Elsinore Valley Municipal Water District

SEWER SYSTEM MASTER PLAN

FINAL | April 2024

ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

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Abbreviations

AAF	average annual flow
ABS	Acrylonitrile-Butadiene-Styrene
ACP	asbestos cement pipe
ADD	average day demand
ADWF	average dry weather flow
BWF	base wastewater flow
Carollo	Carollo Engineers, Inc.
CCTV	closed circuit television
cfs	cubic feet per second
CIP	capital improvement plan
CLWTP	Canyon Lake Water Treatment Plant
d/D	depth to pipe diameter
DIP	ductile iron pipe
DWF	dry weather flow
DU/acre	dwelling units per acre
EDSA	Elsinore Division Service Area
EDU	equivalent dwelling unit
EUL	end of useful life
EVMWD	Elsinore Valley Municipal Water District
ft msl	feet above mean sea level
fps	feet per second
ft	feet
ft^2	square feet
FY	fiscal year
GIS	geographic information system
gpd/acre	gallons per day per acre
gpd/EDU	gallons per day per equivalent dwelling unit
gpm	gallons per minute
GSP	Groundwater Sustainability Plan
GWI	groundwater infiltration
I/I	infiltration/inflow
ID	identification
IDW	Inverse Distance Weighting
mi	mile
mgd	million gallons per day
N/A	not applicable

NASSCO	National Association of Sewer Service Companies
PACP	Pipeline Assessment and Certification Program
PDWF	peak dry weather flow
PE	polyethylene
PVC	polyvinyl chloride
PWWF	peak wet weather flow
R&R	rehabilitation and replacement
RCP	reinforced concrete pipe
RCWD	Rancho California Water District
RDII	rain-derived infiltration and inflow
RTS	return-to-sewer
RUL	remaining useful life
RWSMP	Recycled Water System Master Plan
SCAG	Southern California Association of Governments
SSMP	Sewer System Master Plan
TBD	to be determined
TIN	total inorganic nitrogen
V&A	V&A Consulting Engineers, Inc.
VCP	vitrified clay pipe
WaPUG	Wastewater Planning Users Group
WDF	Water Duty Factor
WRFs	water reclamation facilities
WSMP	Water System Master Plan
WWF	wet weather flow
WWFF	wastewater flow factor

EXECUTIVE SUMMARY

The most recent Sanitary Sewer Master Plan (SSMP) prepared by Elsinore Valley Municipal Water District (EVMWD or District) was completed in 2016. Since then, there has been significant development within EVMWD's service area, resulting in population growth and increased demands for both potable and non-potable water supplies. However, water conservation and efficiency have also improved, and potable reuse regulations have advanced rapidly over the past decade. These factors have created a need to update the 2016 SSMP.

This SSMP has a planning horizon up to the year 2050 and evaluates EVMWD's wastewater collection system under both existing and future conditions. Concurrently with the development of this SSMP, master plan updates are being prepared for EVMWD's water and recycled water distribution systems. All three plans are based on the same set of growth and flow assumptions.

The purpose of this SSMP is to assist the District in:

- Developing an infrastructure plan that balances reliability and cost.
- Creating an accurate and usable calibrated hydraulic model.
- Evaluating sanitary sewer collection system performance.
- Identifying needed capital improvement projects.
- Transferring knowledge to EVMWD's staff.

ES.1 Existing Sewer Collection System

The EVMWD's existing wastewater collection system consists of approximately 429 miles of sewer pipelines, 36 lift stations, and three water reclamation facilities (WRFs). The EVMWD's wastewater collection system and its facilities are shown on Figure ES.1.

The District's collection system is dissected into four distinct sewersheds. A sewershed is defined as a drainage area in which the generated wastewater flow is conveyed to a common outlet point (i.e., a WRF) via a series of gravity sewers, force mains, and lift stations. The EVMWD's existing wastewater collection system is divided into the following four major sewersheds:

- Regional Sewershed.
- Railroad Canyon (Canyon Lake) Sewershed.

- Horsethief Canyon Sewershed.
- Southern Sewershed.

Each sewershed is distinguished by the WRF that services that sewershed. The Regional, Railroad Canyon, and Horsethief Sewersheds are serviced by the Regional WRF, Railroad Canyon WRF, and Horsethief Canyon WRF, respectively. The Southern Sewershed conveys flow to the Rancho California Water District (RCWD) collection system and is ultimately treated at RCWD's Santa Rosa WRF. The key characteristics of each sewershed are summarized in Table ES.1.

An in-depth review of the collection system area and the existing wastewater collection system are included in Chapter 2 and 4, respectively.

Table ES.1 Existing Sewershed Summary

Parameter	Regional Sewershed	Horsethief Canyon Sewershed	Railroad Canyon Sewershed	Southern Sewershed	Total
Lift Stations	28	2	6	0	36
Gravity Main (Miles)	310.8	18.2	46.2	36.9	412.2
Force Main (Miles)	13.4	0.6	2.9	0.0	16.9
Area Served (Acres)	56,670	940	2,040	1,510	61,160
Area Served (Square Miles)	88.5	1.5	3.2	2.4	95.6

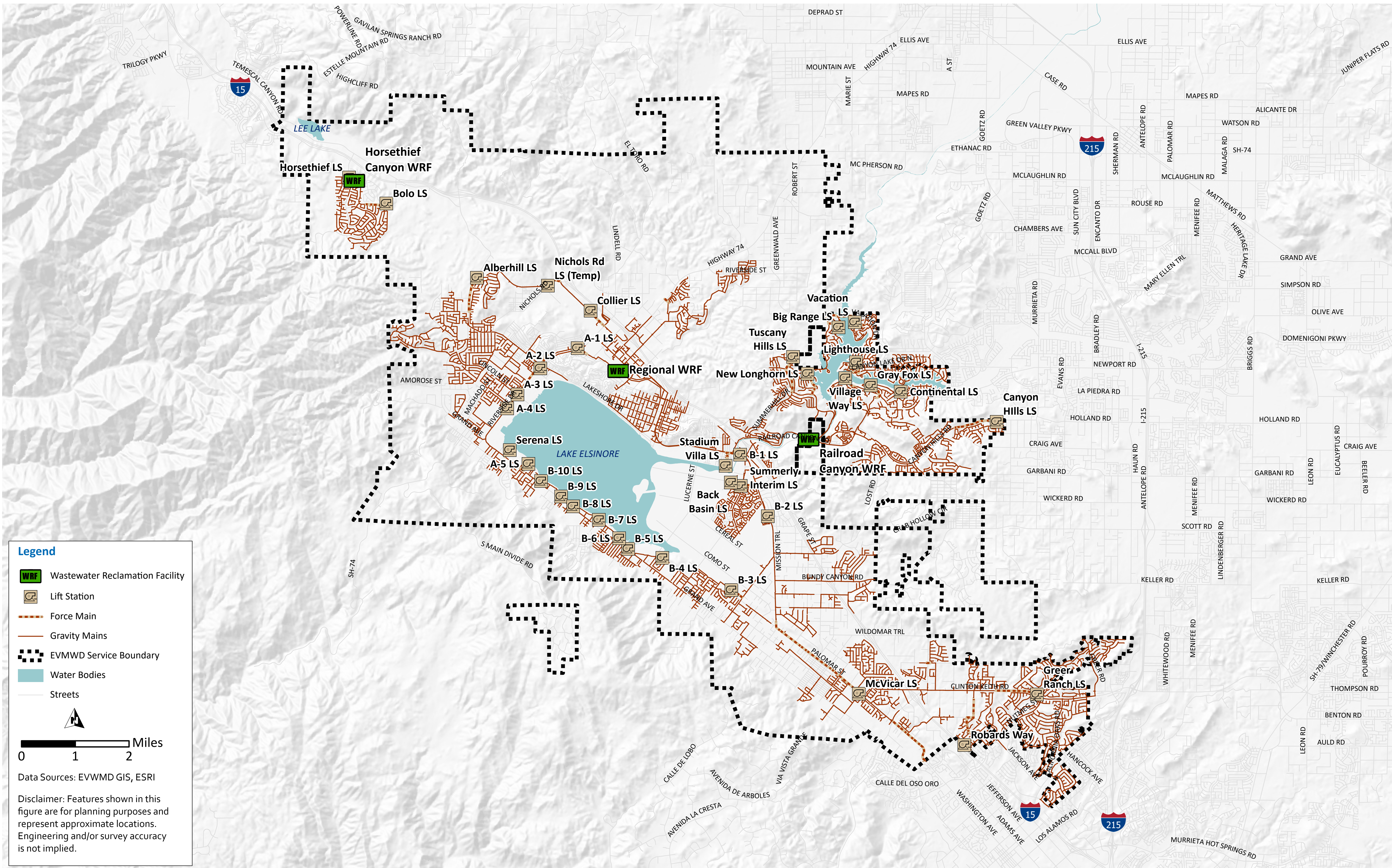

Figure ES.1 Existing Wastewater Collection System

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ES.2 Wastewater Flow Projections

Future wastewater contributions were estimated from planned developments, conversion of existing septic systems to sewer, and infill within the service area. These future contributions were all separately analyzed and summed to estimate the overall new wastewater flows in the system for the 2025, 2030, 2035, 2040, 2045, and 2050 planning horizons. Table ES.2 provides the system-wide average dry weather flow (ADWF) projections categorized by wastewater source.

Table ES.2 System-Wide ADWF Projections

Year	ADWF (mgd)				
	Existing	Known Development	Septic	Infill	Total
Existing	7.70	0.00	0.00	0.00	7.70
2025	8.02(1)	2.57	0.00	0.15	10.73
2030	8.02	3.63	0.22	0.21	12.08
2035	8.02	4.74	0.48	0.27	13.51
2040	8.02	5.98	0.81	0.34	15.14
2045	8.02	7.13	1.09	0.41	16.65
2050	8.02	7.91	1.09	0.46	17.47

Notes:
Abbreviations: gpm - gallons per minute; mgd - million gallons per day.
(1) 0.32 mgd (220 gpm) increase is due to reject water from Canyon Lake Water Treatment Plant (CLWTP).

Peak wet weather flow (PWWF) was derived based on the calibrated hydraulic modeling hourly data. This was accomplished by applying the 10-year, 24-hour design storm to the hydraulic model, which was calibrated to both dry weather and wet weather conditions. Table ES.3 and Table ES.4 contain a comparison of ADWF and PWWF along with peaking factors by sewershed for the existing system and the 2050 planning period, respectively. Flow estimates for Railroad Canyon were provided for two conditions, before the diversion and the flows that continue to the WRF. The Railroad Canyon WRF was set up in the hydraulic model to represent the diversion operation upstream of the WRF; thus, only accepting 0.6 mgd.

Table ES.3 Existing PWWF Estimates by Sewershed

Sewershed	ADWF (mgd)	PWWF (mgd)	Peaking Factor
Regional	5.73	14.46	2.52
Railroad Canyon Before Diversion	0.75	2.07	2.74
Railroad Canyon Into WRF	0.60	0.60	1.0
Horsethief	0.35	1.22	3.50
Southern	1.02	3.86	3.79

Table ES.4 2050 PWWF Estimates by Sewershed

Sewershed	2050 ADWF (mgd)	2050 PWWF (mgd)	Peaking Factor
Regional	14.9	30.2	2.03
Railroad Canyon Before Diversion	0.76	2.09	2.75
Railroad Canyon Into WRF	0.61	0.61	1.0
Horsethief	0.7	1.83	2.77
Southern	1.33	5.32	4.0

It was determined that applying a combination of 250 gallons per day per equivalent dwelling unit (gpd/EDU) with a typical peaking factor of 3.0 for planned residential development was appropriate for future planning.

Further details regarding wastewater flow projections are included in Chapter 3.

ES.3 Existing and Future Collection System Evaluation

The adequacy of EVMWD's system under existing and future wastewater flow projections was evaluated using an updated and calibrated hydraulic model of EVMWD's wastewater collection system. This model was used to evaluate maximum flow depth to pipe diameter for gravity pipes, maximum velocity for force mains, and firm capacity for lift stations. Recommendations were made to address these deficiencies. Closed-circuit television (CCTV) inspection records of gravity pipes, along with their Pipeline Assessment and Certification Program (PACP) scores, were used to help the District identify pipelines that require immediate attention. Additionally to the CCTV PACP scores, the expected remaining useful life of pipelines was analyzed to develop age and condition-based rehabilitation and replacement (R&R) programs.

The hydraulic model update is discussed in Chapter 5, while the evaluation criteria are described in Chapter 6. The hydraulic analyses under existing and future demand conditions are presented in Chapter 7 and 8, respectively.

ES.4 Improvement Recommendations

The wastewater collection system recommendations identified in the system evaluation include both capacity improvements to accommodate growth and R&R improvements to address aging infrastructure. A summary of the number of projects and facilities identified that require improvement, rehabilitation, and/or replacement is listed in Table ES.5.

Table ES.5 Summary of Wastewater Collection System Improvements

Project Type	No. of Projects	Description
Existing Gravity Main Capacity Upgrades	16	4.1 Miles Total
New Gravity Trunk Sewers	14	16.7 Miles Total
Existing Force Main Capacity Upgrades	2	5,000 Feet Total
New Force Mains	10	11.2 Miles Total
Existing Lift Station Upgrades	8	8 Projects To Increase Lift Station Capacity
New Lift Stations	8	8 New Lift Stations
Pipeline R&R	TBD(1)	Replace 5.4 Miles of Gravity Mains With Structural Scores Less Than 4 Replace 0.7 Miles of Gravity Mains That Have Less Than 20-Years of Useful Life

Notes:
Abbreviations: TBD - to be determined.
(1) The number of pipeline replacement projects depends on future contracting and phasing.

ES.5 Capital Improvement Plan

The purpose of the Capital Improvement Plan (CIP) presented in this SSMP is to help guide EVMWD with the implementation of wastewater collection system improvements identified to meet increasing wastewater flows projected through year 2050.

All projects identified during the existing and future system analyses, as well as during the age-based R&R analysis, are phased based on the following considerations:

- Anticipated construction of future land developments.
- The need to meet existing system deficiencies.
- Improvement of the wastewater collection system reliability.
- Replacement of aging infrastructure.
- Combined cost of existing system improvements for each phase to approximately match the projected annual revenues to fund the projects.

The CIP projects have been phased in 6 planning periods from 2023 through 2050. The first phase starts in fiscal year (FY) 2023/2024 (hereafter 2023) and ends in FY 2025/2026 (hereafter 2025). The remaining projects are separated into 5 additional phases, each spanning five FYs from 2025-2030, 2030-2035, 2035-2040, 2040-2045, and 2045-2050.

The capacity-based improvement projects consist of capital projects required to address future hydraulic deficiencies in the distribution system. In the CIP the capacity improvement projects are grouped into the following categories:

- Existing gravity main improvements.
- New gravity main installation.
- Existing force main improvements.
- New force main installation.
- Existing lift station rehabilitation.
- New lift stations.
- Flow monitoring.
- R&R.

The R&R projects consist of capital projects required to replace existing aging infrastructure that is already beyond its anticipated end of useful life (EUL) or will be beyond its EUL by the planning horizon of this SSMP, namely year 2050. These projects are based upon CCTV scores that were provided to Carollo Engineers, Inc. (Carollo) by EVMWD.

In the CIP the recommended projects are given an alphanumeric project identification (ID) code referred to CIP ID to easily identify them in the model and in figures throughout this SSMP. CIP IDs are separated based on the project improvements type as follows:

- WW-EG = Existing gravity main replacement projections.
- WW-NG = New gravity main installation projections.
- WW-EF = Existing force main replacement projects.
- WW-NF = New force main installation projects.
- WW-EL = Existing lift station rehabilitation project.
- WW-NL = New lift station installation project.
- WW-RR = R&R project.
- WW-FM = Flow monitoring project.

A summary of the CIP projects is presented in Table ES.6.

Table ES.6 CIP Project Summary

Project	Existing Size/Type	Proposed Size/Type	Proposed Amount	CIP Cost Estimate[1,2,3,4] ($)	Existing User Cost ($)	Future User Cost ($)	CIP Phasing ($)					
							Near-Term					
							2023-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
Capacity Improvements				$298,942,000	$118,772,000	$180,170,000	$8,039,000	$7,867,000	$221,517,000	$41,383,000	$-	$20,136,000
Existing Gravity Main Improvements	Diameter (inches)	Diameter (inches)	Length (feet)	$23,247,000	$7,515,000	$15,732,000	$-	$6,699,000	$2,830,000	$10,080,000	$-	$3,638,000
WW-EG-01 Riverside - Eisenhower Trunk Sewer Capacity Improvement	10	18	3,250	$3,212,000	$1,162,000	$2,050,000	$-	$3,212,000	$-	$-	$-	$-
WW-EG-02 Escavera Street Trunk Sewer Capacity Improvement	8	12	138	$91,000	$48,000	$43,000	$-	$91,000	$-	$-	$-	$-
WW-EG-03 Riverside - Palm Trunk Sewer Capacity Improvement	10	18	337	$333,000	$183,000	$150,000	$-	$333,000	$-	$-	$-	$-
WW-EG-04 Franklin Street Trunk Sewer Capacity Improvement	8	12	425	$277,000	$138,000	$139,000	$-	$277,000	$-	$-	$-	$-
WW-EG-05 Redwood Road Trunk Sewer Capacity Improvement	8	15	475	$405,000	$384,000	$21,000	$-	$405,000	$-	$-	$-	$-
WW-EG-06 Jackson Road Trunk Sewer Capacity Improvement	12	18	1,480	$1,463,000	$1,267,000	$196,000	$-	$1,463,000	$-	$-	$-	$-
WW-EG-07 Colony Drive Trunk Sewer Capacity Improvement	10	15	416	$354,000	$229,000	$125,000	$-	$354,000	$-	$-	$-	$-
WW-EG-08 Via Grazina Trunk Sewer Capacity Improvement	8	15	413	$353,000	$349,000	$4,000	$-	$353,000	$-	$-	$-	$-
WW-EG-09 Palomar Street Trunk Sewer Capacity Improvement	8	18	215	$211,000	$51,000	$160,000	$-	$211,000	$-	$-	$-	$-
WW-EG-10 Strickland Avenue Trunk Sewer Capacity Improvement	24	36	1,175	$2,120,000	$586,000	$1,534,000	$-	$-	$2,120,000	$-	$-	$-
WW-EG-11 Grand Avenue Trunk Sewer Capacity Improvement	10	15	1,415	$1,207,000	$353,000	$854,000	$-	$-	$-	$-	$-	$1,207,000
WW-EG-12 Camino Aspirante Trunk Sewer Capacity Improvement	10	15	260	$221,000	$119,000	$102,000	$-	$-	$221,000	$-	$-	$-
WW-EG-13 Tassel Way Trunk Sewer Capacity Improvement	8	12	750	$489,000	$237,000	$252,000	$-	$-	$489,000	$-	$-	$-
WW-EG-14 Nichols Road Trunk Sewer Capacity Improvement	10	18	5,150	$5,090,000	$91,000	$4,999,000	$-	$-	$-	$5,090,000	$-	$-
WW-EG-15 Illinois Street Trunk Sewer Capacity Improvement	24	30	3,200	$4,990,000	$1,380,000	$3,610,000	$-	$-	$-	$4,990,000	$-	$-
WW-EG-16 B-5 and B-4 Gravity Main Improvements	12 to 15	15 to 18	2,505	$2,431,000	$938,000	$1,493,000	$-	$-	$-	$-	$-	$2,431,000
New Gravity Mains Recommendations	Diameter (inches)	Diameter (inches)	Length (feet)	$79,156,000	$20,824,000	$58,332,000	$8,039,000	$1,103,000	$59,063,000	$6,121,000	$-	$4,830,000
WW-NG-01 Oak Street	-	12	8,500	$5,550,000	$-	$5,550,000	$-	$-	$5,550,000	$-	$-	$-
WW-NG-02 Canyon Hills Trunk Sewer Extension	-	12	8,500	$5,550,000	$-	$5,550,000	$-	$-	$5,550,000	$-	$-	$-
WW-NG-03 Wildomar Trunk Sewer Extension	-	12	3,350	$2,187,000	$-	$2,187,000	$-	$-	$-	$2,187,000	$-	$-
WW-NG-04 North Ramsgate 1 Trunk Sewer	-	8	4,200	$1,981,000	$-	$1,981,000	$-	$-	$1,981,000	$-	$-	$-
WW-NG-05 North Ramsgate 1 Trunk Sewer	-	15	9,350	$7,969,000	$-	$7,969,000	$-	$-	$7,969,000	$-	$-	$-
WW-NG-06 New Tuscany Hills Trunk Sewer Extension	-	15	1,950	$1,662,000	$-	$1,662,000	$-	$-	$1,662,000	$-	$-	$-
WW-NG-07 El Toro Road Trunk Sewer Extension	-	12	7,800	$5,092,000	$-	$5,092,000	$-	$-	$5,092,000	$-	$-	$-
WW-NG-08 Alberhill Development Area Trunk Sewer	-	18	6,500	$6,425,000	$-	$6,425,000	$-	$-	$6,425,000	$-	$-	$-
WW-NG-09 Nichols Lift Station Trunk Sewer Extension	-	24	3,200	$3,858,000	$-	$3,858,000	$-	$-	$3,858,000	$-	$-	$-
WW-NG-10 B-1/Stadium Villa Trunk Sewer Bypass	-	18	3,981	$3,934,000	$3,499,000	$435,000	$-	$-	$-	$3,934,000	$-	$-
WW-NG-11 Sunset Lift Station Trunk Sewer	-	12	7,400	$4,830,000	$-	$4,830,000	$-	$-	$-	$-	$-	$4,830,000
WW-NG-12 B-2 Bypass	-	8 to 36	5,982	$8,039,000	$4,800,000	$3,239,000	$8,039,000	$-	$-	$-	$-	$-
WW-NG-13 Mission Trail Trunk Improvement	-	24	12,314	$20,976,000	$12,525,000	$8,451,000	$-	$-	$20,976,000	$-	$-	$-
WW-NG-14 A-3 Bypass	-	12	1,691	$1,103,000	$-	$1,103,000	$-	$1,103,000	$-	$-	$-	$-
Existing Force Main Improvements	Diameter (inches)	Diameter (inches)	Length (feet)	$4,121,000	$2,244,000	$1,877,000	$-	$-	$1,859,000	$2,262,000	$-	$-
WW-EF-01 A-2 Force Main Capacity Improvement	14	20	1,800	$1,859,000	$936,000	$923,000	$-	$-	$1,859,000	$-	$-	$-
WW-EF-02 B-3 Force Main Capacity Improvement	10	12	3,200	$2,262,000	$1,308,000	$954,000	$-	$-	$-	$2,262,000	$-	$-

Project		Existing Size/Type	Proposed Size/Type	Proposed Amount	CIP Cost Estimate[1,2,3,4] ($)	Existing User Cost ($)	Future User Cost ($)	CIP Phasing ($)					
								Near-Term					
								2023-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
New Force Main Recommendations		Diameter (inches)	Diameter (inches)	Length (feet)	$49,727,000	$11,473,000	$38,254,000	$-	$-	$34,968,000	$12,872,000	$-	$1,887,000
WW-NF-01	Diamond Lift Station Force Main	-	24	6,500	$12,793,000	$11,473,000	$1,320,000	$-	$-	$12,793,000	$-	$-	$-
WW-NF-02	Oak Street Lift Station Force Main	-	6	1,600	$1,588,000	$-	$1,588,000	$-	$-	$1,588,000	$-	$-	$-
WW-NF-03	North Ramsgate 1 Force Main	-	8	5,900	$3,478,000	$-	$3,478,000	$-	$-	$3,478,000	$-	$-	$-
WW-NF-04	North Ramsgate 2 Force Main	-	8	1,800	$1,060,000	$-	$1,060,000	$-	$-	$1,060,000	$-	$-	$-
WW-NF-05	New Tuscany Hills Force Main	-	16	3,800	$3,240,000	$-	$3,240,000	$-	$-	$3,240,000	$-	$-	$-
WW-NF-06	Temescal Lift Station Force Main 1	-	12	10,000	$7,073,000	$-	$7,073,000	$-	$-	$7,073,000	$-	$-	$-
WW-NF-07	Nichols Lift Station Force Main	-	16	3,750	$5,736,000	$-	$5,736,000	$-	$-	$5,736,000	$-	$-	$-
WW-NF-08	New Alberhill Force Main	-	12	8,200	$5,799,000	$-	$5,799,000	$-	$-	$-	$5,799,000	$-	$-
WW-NF-09	Temescal Lift Station Force Main 2	-	12	10,000	$7,073,000	$-	$7,073,000	$-	$-	$-	$7,073,000	$-	$-
WW-NF-10	Sunset Lift Station Force Main	-	8	3,200	$1,887,000	$-	$1,887,000	$-	$-	$-	$-	$-	$1,887,000
New Lift Stations		Capacity (gpm)	Capacity (gpm)	-	$64,678,000	$23,606,000	$41,072,000	$-	$-	$59,343,000	$1,778,000	$-	$3,557,000
WW-NL-01	Diamond Lift Station Installation	-	13,820	-	$40,965,000	$22,709,000	$18,256,000	$-	$-	$40,965,000	$-	$-	$-
WW-NL-02	Oak Street Lift Station Installation	-	100	-	$592,000	$-	$592,000	$-	$-	$592,000	$-	$-	$-
WW-NL-03	North Ramsgate 2 Lift Station Installation	-	200	-	$1,186,000	$-	$1,186,000	$-	$-	$1,186,000	$-	$-	$-
WW-NL-04	North Ramsgate 1 Lift Station Installation	-	200	-	$1,186,000	$-	$1,186,000	$-	$-	$1,186,000	$-	$-	$-
WW-NL-05	Temescal Lift Station Installation	-	2,400	-	$10,671,000	$-	$10,671,000	$-	$-	$10,671,000	$-	$-	$-
WW-NL-06	New Tuscany Hills Lift Station Installation	-	800	-	$4,743,000	$897,000	$3,846,000	$-	$-	$4,743,000	$-	$-	$-
WW-NL-07	New Alberhill Lift Station Installation	-	300	-	$1,778,000	$-	$1,778,000	$-	$-	$-	$1,778,000	$-	$-
WW-NL-08	Sunset Lift Station Installation	-	600	-	$3,557,000	$-	$3,557,000	$-	$-	$-	$-	$-	$3,557,000
Existing Lift Stations		Capacity (gpm)	Capacity (gpm)	-	$77,948,000	$53,045,000	$24,903,000	$-	$-	$63,454,000	$8,270,000	$-	$6,224,000
WW-EL-01	A-2 Lift Station Capacity Improvement	2,400	5,180	-	$20,474,000	$15,790,000	$4,684,000	$-	$-	$20,474,000	$-	$-	$-
WW-EL-02	A-4 Lift Station Capacity Improvement	1,780	2,900	-	$12,894,000	$8,891,000	$4,003,000	$-	$-	$12,894,000	$-	$-	$-
WW-EL-03	B-3 Lift Station Capacity Improvement	1,400	1,860	-	$8,270,000	$6,145,000	$2,125,000	$-	$-	$-	$8,270,000	$-	$-
WW-EL-04	B-9 Lift Station Capacity Improvement	350	500	-	$2,964,000	$1,077,000	$1,887,000	$-	$-	$2,964,000	$-	$-	$-
WW-EL-05	Horsethief Lift Station Capacity Improvement	200	300	-	$1,778,000	$60,000	$1,718,000	$-	$-	$1,778,000	$-	$-	$-
WW-EL-06	McVicar Lift Station Capacity Improvement	1,400	2,800	-	$12,450,000	$12,450,000	$-	$-	$-	$12,450,000	$-	$-	$-
WW-EL-07	Nichols Lift Station Capacity Improvement	280	2,900	-	$12,894,000	$6,477,000	$6,417,000	$-	$-	$12,894,000	$-	$-	$-
WW-EL-08	B-4 Lift Station Capacity Improvement	1,200	1,400	-	$6,224,000	$2,155,000	$4,069,000	$-	$-	$-	$-	$-	$6,224,000
Flow Monitoring[5]		Number of Flowmeters			$65,000	$65,000	$-	$-	$65,000	$-	$-	$-	$-
WW-FM-01	Canyon Lake infiltration and Inflow Monitoring	8			65,000	$65,000	$-	$-	$65,000	$-	$-	$-	$-
R&R Projects					$16,419,000	$16,419,000	$-	$-	$14,598,000	$-	$-	$-	$1,821,000
Pipelines		Diameter (inches)	Diameter (inches)	Length (feet)	$16,419,000	$16,419,000	$-	$-	$14,598,000	$-	$-	$-	$1,821,000
WW-RR-01	Gravity Pipeline R&R Program (Condition Based)	Varies	Varies	28,356	$14,598,000	$14,598,000	$-	$-	$14,598,000	$-	$-	$-	$-
WW-RR-02	Gravity Pipeline R&R Program (Age Based)	Varies	Varies	3,569	$1,821,000	$1,821,000	$-	$-	$-	$-	$-	$-	$1,821,000
CIP Total					$315,361,000	$135,191,000	$180,170,000	$8,039,000	$22,465,000	$221,517,000	$41,383,000	$-	$21,957,000
Annual Cost					$11,680,037[6]	N/A	N/A	$4,019,500	$4,493,000	$44,303,400	$8,276,600	$-	$4,391,400

Notes:
(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.
(2) Estimated construction cost includes a 20 percent contingency of the baseline construction cost.
(3) Total project costs include a 40 percent markup for engineering, construction management and environmental and legal services.
(4) Total markup is 68 percent of the baseline construction costs.
(5) Costs associated with flow monitoring are subject to change.
(6) Calculated by dividing the CIP total cost by total number of years in planning horizon (27).

The cost allocation between existing and future rate payers was determined by multiplying the future cost by the ratio of existing wastewater flow and future flow. The ratio of flow was determined within the hydraulic model by dividing the existing wastewater flow rate by the future wastewater flowrate of a future infrastructure project. A summary of the CIP that dissects cost by project type and ratepayer class is shown in Table ES.7. A summary of the cost allocation by ratepayer class phase (existing or future) is shown on Figure ES.2. Figure ES.3 is a visual summary of the size and total cost percentage associated with each project category.

Table ES.7 CIP Costs by Project Type and Ratepayer Class

Project Type	Existing Users ($ million)	Future Users ($ million)	Total ($ million)	Percent of Total
Existing Gravity Main Improvements	$7.5	$15.7	$23.2	7.4%
New Gravity Mains Recommendations	$20.8	$58.3	$79.2	25.1%
Existing Force Main Improvements	$2.2	$1.9	$4.1	1.3%
New Force Main Recommendations	$11.5	$38.3	$49.7	15.8%
New Lift Stations	$23.6	$41.1	$64.7	20.5%
Existing Lift Stations	$53.0	$24.9	$77.9	24.7%
Flow Monitoring	$0.07	$0.0	$0.07	0.02%
Capacity Improvements	$118.8	$180.2	$298.9	94.8%
Pipelines (R&R)	$16.4	$0.0	$16.4	5.2%
R&R Projects	$16.4	$0.0	$16.4	5.2%
Total	$135.2	$180.2	$315.4	100.0%

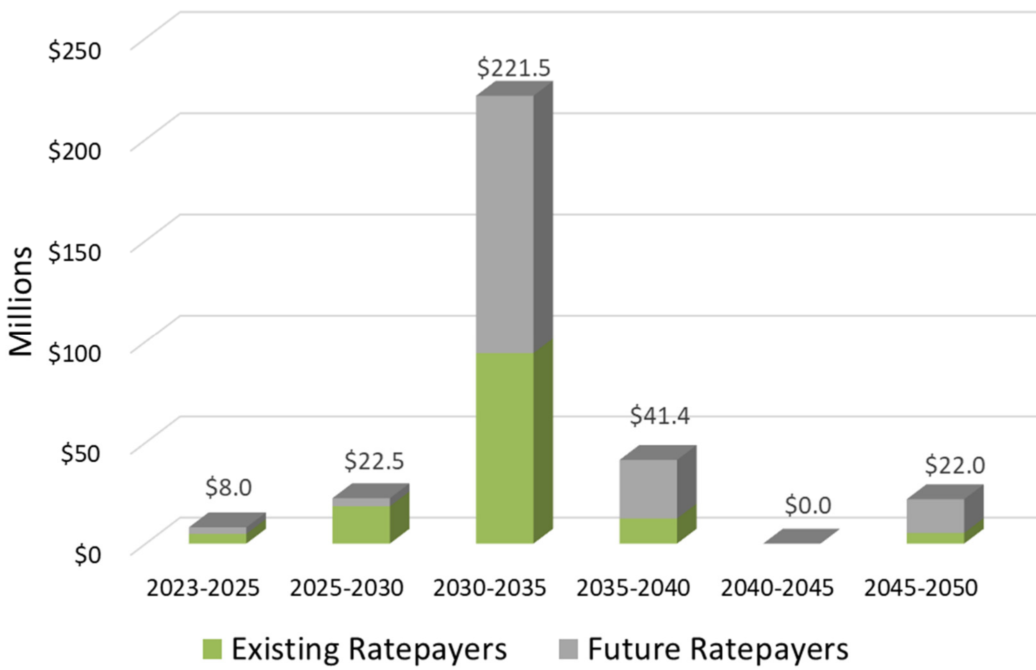

Figure ES.2 Capital Improvement Program Costs by Phase and Ratepayer Class

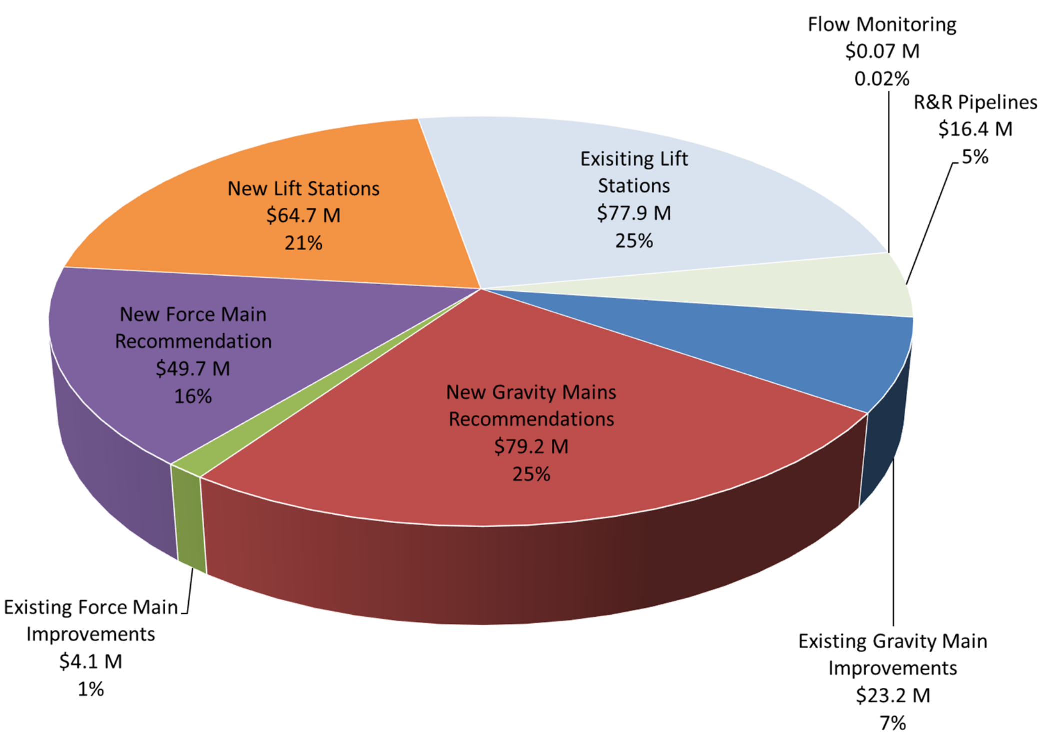

Figure ES.3 Capital Improvement Projects by Project Type

Figure ES.4 provides the location of each CIP project except for projects WW-RR-01 and WW-RR-02.

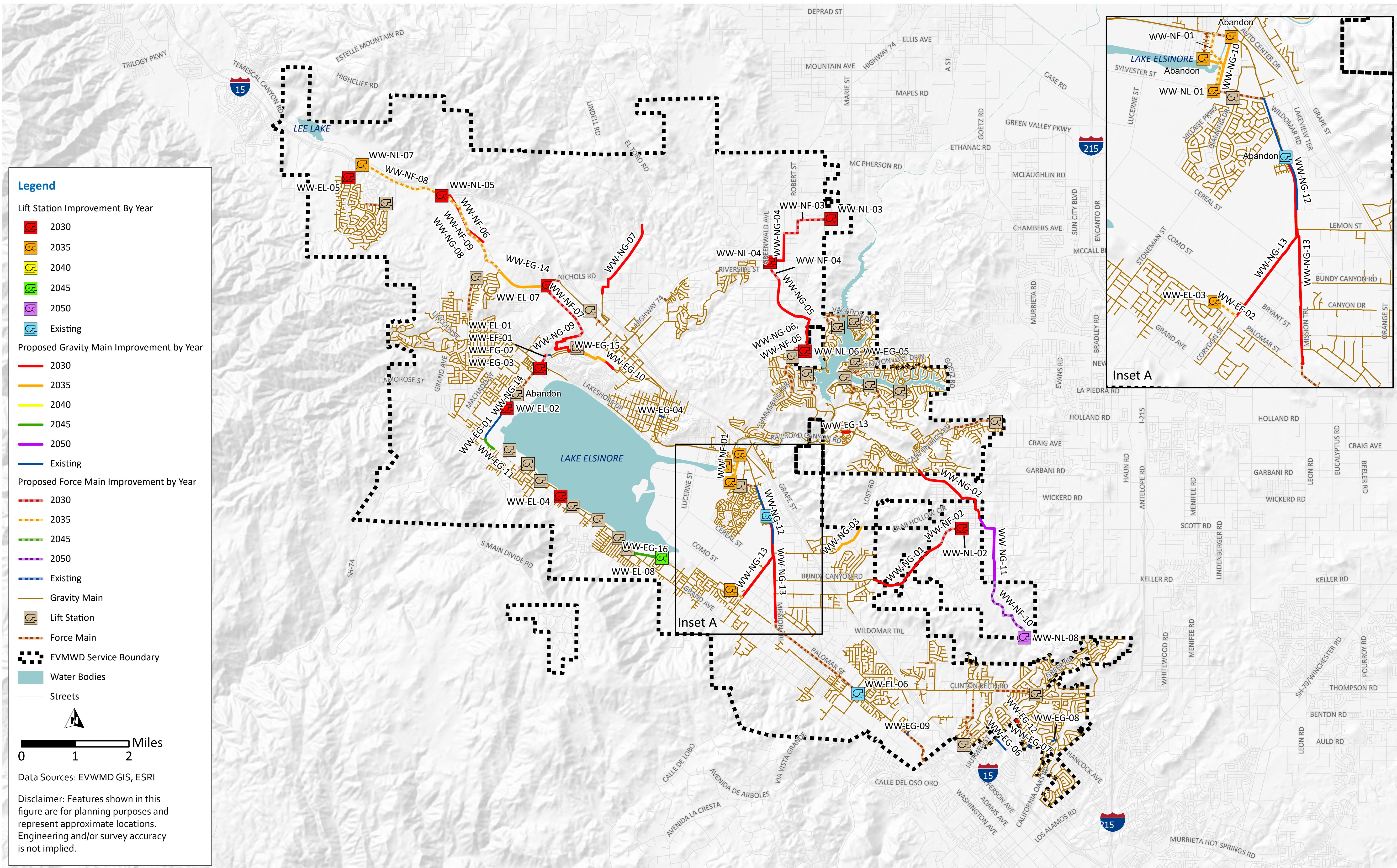

Figure ES.4 Wastewater CIP Projects

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Chapter 1

INTRODUCTION

This chapter provides an introduction to the Sewer System Master Plan (SSMP) for the Elsinore Valley Municipal Water District (EVMWD/District), beginning with the project background. The project objectives are presented, followed by a concise overview of the scope of work, team involvement and acknowledgements. This chapter concludes with a description of the organization of the SSMP report.

1.1 Project Background

The last SSMP for EVMWD was completed by MWH in 2016. Since then, there has been significant development within EVMWD's service area, resulting in population growth and increased wastewater flows. However, water conservation and efficiency have also improved; thus, reducing the amount of wastewater entering the collection system. These factors have created a need to update the 2016 SSMP.

The aim of the current SSMP is to develop a document that will serve as a guideline for planning EVMWD's wastewater collection system. This SSMP has a planning horizon up to the year 2050 and assesses EVMWD's wastewater collection system under both existing and future conditions.

This SSMP covers EVMWD's four sewershed areas:

- Railroad Canyon (Canyon Lake) Sewershed.
- Horsethief Sewershed.
- Regional Sewershed.
- Southern Sewershed.

The proposed developments within EVMWD's service area represent a significant opportunity for growth. Accordingly, the planning and sizing of new infrastructure to serve the new developments are a key focus of this SSMP. The objective is to evaluate the District's sewer collection system using existing and projected future wastewater flows, identify system deficiencies, and recommend improvements.

Concurrently with the development of this SSMP, Carollo Engineers, Inc. (Carollo) is updating the Water System Master Plan (WSMP) and the Recycled Water System Master Plan (RWSMP). All three plans are based on the same set of growth and flow assumptions.

1.2 Project Objectives

The District's mission is to "manage its natural resources to provide reliable, cost-efficient, high-quality water and wastewater services for the communities they serve, while promoting conservation, environmental responsibility, education, community interaction, ethical behavior, and recognizing employees as highly valuable assets."

This SSMP is developed to assist the District in achieving these objectives by meeting the following goals:

- Developing an infrastructure plan that balances reliability and cost.
- Creating an accurate and usable calibrated hydraulic model.
- Evaluating wastewater collection system performance.
- Identifying needed capital improvement projects.
- Transferring knowledge to EVMWD's staff.

The ultimate objective of this SSMP is to provide EVMWD with a phased sanitary sewer capital improvement plan (CIP) that EVMWD staff can use as a planning road map for future wastewater investment decisions.

1.3 Scope of Work

The Scope of Work (SOW) of this SSMP consists of the following tasks:

- Update EVMWD's wastewater collection system hydraulic model.
- Project wastewater flows in the service area through year 2050.
- Analyze the wastewater collection system under existing conditions.
- Analyze the wastewater collection system under future conditions.
- Identify wastewater system improvements.
- Prepare a CIP for the wastewater system.
- Consult EVMWD Staff on the needs of the system.

As part of this SSMP, an updated hydraulic model of the wastewater collection system has been developed. The updated hydraulic model incorporates future system elements that will be required to meet the service conditions through 2050. The purpose of the model is to analyze the system under existing and future demand conditions, identify constraints and deficiencies in existing infrastructure, recommend mitigation measures, and develop conceptual infrastructure to serve future flows.

A comprehensive CIP has been prepared that includes all necessary system improvements required to meet the wastewater collection system needs through the year 2050. The CIP identifies system deficiencies and improvements needed to address these deficiencies and proposes phasing and cost estimates for the recommended improvements. The CIP will provide EVMWD with a roadmap for future wastewater system planning.

During the preparation of this SSMP, EVMWD staff provided numerous reports, maps, studies, and other sources of information. Additionally, pertinent materials were obtained from sources such as United States Geological Survey, ESRI, and others. These materials included wastewater system maps, planning and development information, general plan land use, historical records, billing data, and detailed facility information. Meetings were also held throughout the project with EVMWD's engineering and planning, management, and operational staff to utilize their knowledge and information during the hydraulic model development and calibration stages.

1.4 Authorization

This SSMP has been developed in accordance with the agreement between the EVWMD and Carollo dated December 16, 2021.

1.5 Acknowledgements

Carollo wishes to acknowledge and thank all of EVMWD's staff for their assistance and support in completing this project. Carollo would especially like to thank the following individuals:

- Parag Kalaria, Director of Water Resources and Project Manager.
- Jason Dafforn, Engineering and Water Resources Director (former).
- Sudhir Mohleji, Principal Engineer Wastewater Systems Engineering.
- Jesus Gastelum, Principal Water Resources Planner/Engineer.
- Shane Sibbett, Associate - Water Resources Planner/Engineer.
- Matthew Bates, Engineering Manager (former).
- Mayra Cabrera, Principal Engineer - Development Services.
- Jase Warner, Director of Operations.
- Tim Collie, Water Operations Manager.
- Shawn Gray, Water Production Superintendent.

1.6 Project Staff

The following Carollo staff was principally involved in the preparation of this SSMP:

- Principal-in-Charge: Eric Mills, P.E.
- Project Manager: Inge Wiersema, P.E.
- Assistant Project Manager: Tim Loper, P.E.
- Project Engineer: Ryan Orgill, P.E.
- Hydraulic Modeling and Analysis: Brett O'Hair.
- EDU Tool Developer: Andy Baldwin, P.E.
- GIS Specialists: Jackie Silber, GISP and Kevin Christensen.

1.7 Master Plan Outline

This document is divided into eight chapters. Chapter 1 serves as the introduction of the master plan. Chapter 2 discusses the study area and the land use. Chapter 3 focuses on the wastewater flow projections for existing and future use. Chapter 4 provides an overview of the existing system, while Chapter 5 delves into the wastewater collection system model. The planning and evaluation criteria used for this master plan is described in Chapter 6. Chapter 7 and Chapter 8 present the existing system analysis and the future system analysis, respectively. Based on these evaluations, Chapter 9 provides recommendations for the capital improvement program, along with associated costs. Supporting documents are included in appendices, while acronyms used in this SSMP are listed at the end of the Table of Contents.

Chapter 2

STUDY AREA AND LAND USE

This chapter describes the Elsinore Valley Municipal Water District (EVMWD/District) service area and the spatial boundaries of this study as well as land use within the District's service area.

2.1 Study Area

EVMWD is a public non-profit agency that was created on December 23, 1950. EVMWD is a special district that provides public water service, water supply development and planning, wastewater treatment and disposal, and recycling.

The study area for this Sewer System Master Plan (SSMP) is EVMWD's service area, which is located in southwestern Riverside County and eastern Orange County. EVMWD is located approximately 18 miles northwest from the City of Temecula, 25 miles west of the City of Hemet, and 22 miles southeast of the City of Corona. EVMWD provides water services to approximately 165,000 people in the Cities of Lake Elsinore and Canyon Lake, and portions of the City of Wildomar, City of Murrieta and unincorporated Riverside County and Orange County land, as shown on Figure 2.1. The unincorporated communities within EVMWD's service area include The Farm, Lakeland Village, Cleveland Ridge, Rancho Capistrano, El Cariso Village, Horsethief Canyon, Sedco Canyon, and Temescal Canyon.

The size of the EVMWD service area is approximately 98.5 square miles. The EVMWD service area has a high elevation of over 3,000 feet above mean sea level (ft msl) and a low elevation of roughly 1,250 ft msl. EVMWD is bordered by the Cleveland National Forest to the southwest, which is a part of the Santa Ana Mountains. Because the Santa Ana Mountains surround EVMWD, as well as flat areas surrounding the lake, EVMWD has a large amount of pump stations, as well as many pipes with minimal or very steep slopes.

The most prominent geographic feature of the EVMWD service area is Lake Elsinore, a roughly 3,000-acre natural freshwater lake that is fed by the San Jacinto River and can overflow to the Santa Ana River and eventually to the Pacific Ocean. Lake Elsinore sits in the Center of the EVMWD service area.

EVMWD's service area is divided into two separate divisions: the Elsinore Division and Temescal Division. The Temescal Division Service Area is located northwest of the Elsinore Division Service Area (EDSA) and EVMWD does not currently provide wastewater services to this area. Thus the study area of this SSMP is the EDSA.

EVMWD provides collection system services to approximately 35,000 sewer service accounts within the EDSA. EVMWD operates and maintains three water reclamation facilities (WRFs): Regional WRF, Horsethief Canyon WRF, and Railroad Canyon WRF. In addition, some of EVMWD's sewer pipes collect flow and deliver flow to the Santa Rosa WRF, which is owned and operated by the Rancho California Water District (RCWD).

2.1.1 Service Area Population

Current population served and future population projections for the service area developed in support of EVMWD's 2020 Urban Water Management Plan were adopted for the SSMP.

For the 2020 Urban Water Management Plan, the Department of Water Resources Population Tool, the Southern California Association of Governments' (SCAG) 2020-2045 Regional Transportation Plan, and staff input were considered for the current and projected population estimates. Population estimates within the service area are based off of potable water customers. In recent years, the number of potable water service connections within EVMWD's service area has grown at a rate of 1.5 percent per year and this growth is expected to continue through 2050. Table 2.1 shows the current and projected population for the EVMWD service area. Note that EVMWD does not collect wastewater from as many customers, as some potable water customers have private septic systems. Thus, wastewater customers served is a smaller subset of total potable customers served. It is assumed that the number of wastewater customers served will grow at the same rate as EVMWD's total potable service area population.

Table 2.1 EVMWD Service Area Population Projection(1)

Year	EVMWD Population Served
2020	163,984
2025	176,657
2030	190,310
2035	205,018
2040	220,863
2045	237,932
2050	256,320

Notes:
(1) Source: 2020-2045 population estimates from EVMWD's 2020 Urban Water Management Plan (WSC, 2021), and the 2050 estimate was calculated using a continued growth rate of 1.5 percent.

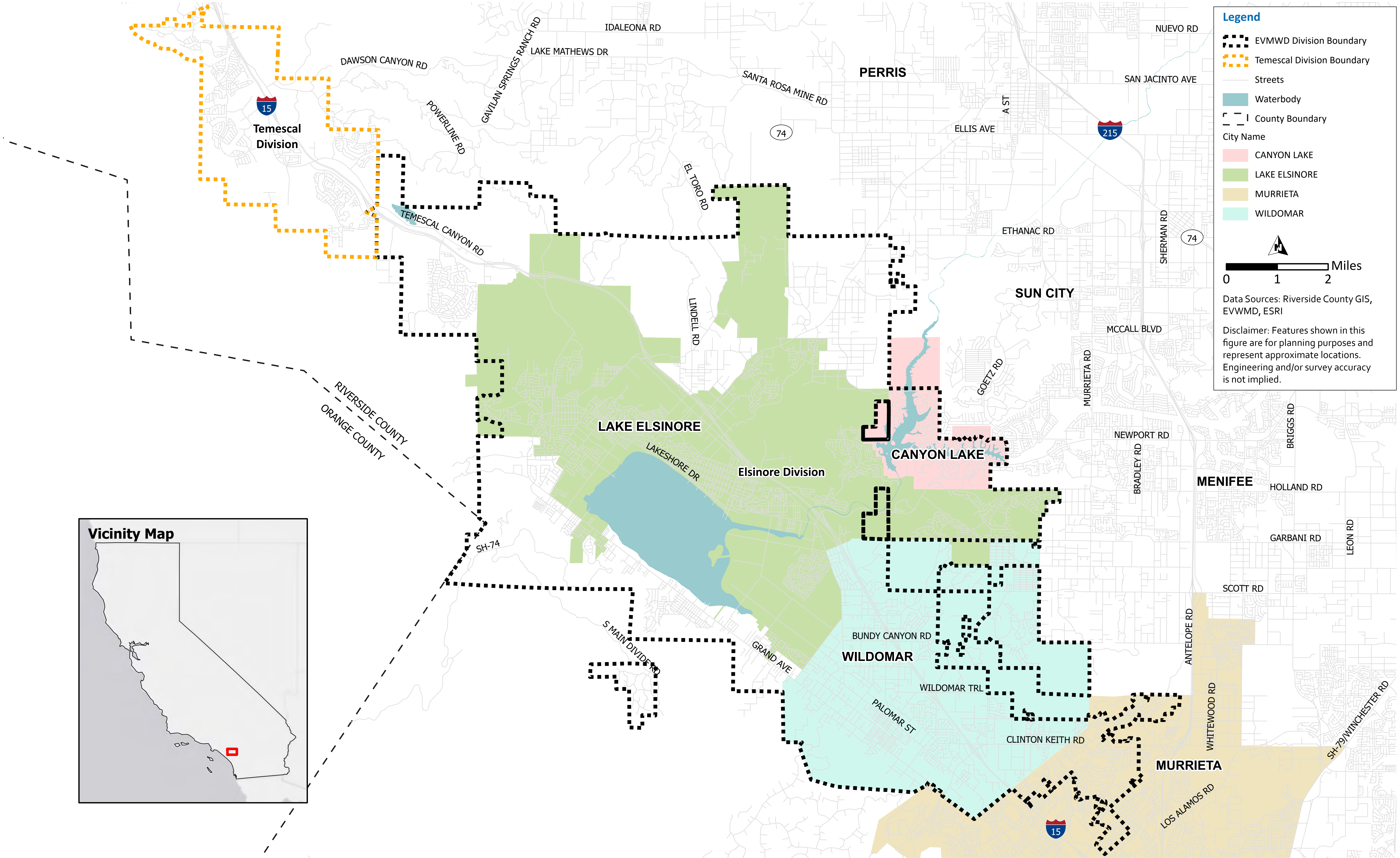

Figure 2.1 EVMWD Service Area

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2.2 Land Use

The general plans of the Cities of Lake Elsinore, Canyon Lake, Wildomar, and Murrieta as well as Riverside and Orange County guide development and establish long-range development policies within their jurisdictions that overlap with EVMWD's service area. Land use information is an integral component in determining the amount of future potable and recycled water use and wastewater generation within the District's boundaries. The type of land use in an area will affect the volume and timing of water use as well as the volume, timing, and water quality characteristics of the wastewater generation. Adequately estimating the water use and generation of wastewater from various land use types is important in sizing and maintaining effective water and sewer system facilities.

Figure 2.2 shows the land uses within the District's service area. Each land use category is defined, and the approximate percentage of the District's service area comprised of that land use type is shown, in Table 2.2. Low density residential is the largest land use category in the District's service area, with significant amounts of medium density residential, industrial, and open space land uses as well. A large portion of the service area is categorized is vacant, under construction, or undevelopable, indicating a significant potential for growth.

Table 2.2 Land Use Designations

Land Use Category(1)	Percentage of EVMWD Service Area(2)	Definition
Low Density Residential	31%	This designation provides for single-family detached homes, secondary residential units, hobby farming and keeping of animals, public and quasi-public uses, and similar and compatible uses. Clustered single-family development may also be encouraged within this designation to minimize grading requirements and impacts to environmentally sensitive areas. Residential densities shall be between 1 and 6 dwelling units per net acre.
Medium Density Residential	17%	This designation provides for typical single family detached and attached homes, duplexes, triplexes, fourplexes, multi-family residential units, group quarters, public and quasi-public uses, and similar and compatible uses. Residential densities shall be between 7 and 18 dwelling units per net acre.

Land Use Category[(1)]	Percentage of EVMWD Service Area[(2)]	Definition
High Density Residential	1%	This designation provides for single-family attached homes, multi-family residential units, group quarters, public and quasi-public uses, and similar and compatible uses. Residential densities shall be between 19 and 24 units per net acre.
Commercial	2%	This designation provides for retail, services, restaurants, professional and administrative offices, hotels and motels, mixed-use projects, public and quasi-public uses, and similar and compatible uses.
Mixed Use	3%	This designation provides for a mix of residential and non-residential uses within a single proposed development area.
Industrial	6%	This designation provides for office and administrative uses, light industrial, research and development, industrial parks, warehouses, manufacturing, office-based firms, including office support facilities, restaurants, medical clinics, public and quasi-public uses, and similar and compatible uses.
Open Space/Recreational	9%	These designations provide for public and private areas of permanent open space and allows for passive and/or active private and public recreation. Open Space and passive recreation areas include State and local parks, Bureau of Land Management lands, the Cleveland National Forest and/or private undeveloped lands. Active recreation includes uses such as golf courses and also allows for commercial recreation facilities such as water-oriented recreational uses.
Public/Institutional	3%	This designation indicates areas owned and maintained by public agencies such as school districts, water districts, utility companies, the County of Riverside, and the City. Appropriate uses for this designation include schools, roads, drainage facilities, utility substations, sewage treatment plants, civic facilities and cemeteries, and similar and compatible uses.
Other[(3)]	29%	Includes land that is vacant, under construction, undevelopable, unknown zoning, floodways, and a small amount of agriculture.

Notes:
(1) Land use categories adapted from the City of Lake Elsinore's General Plan (2011).
(2) Percentages are rounded to the nearest whole number.
(3) Not an officially-designated land use category but used to capture land use types across jurisdictions that don't fit into another category.

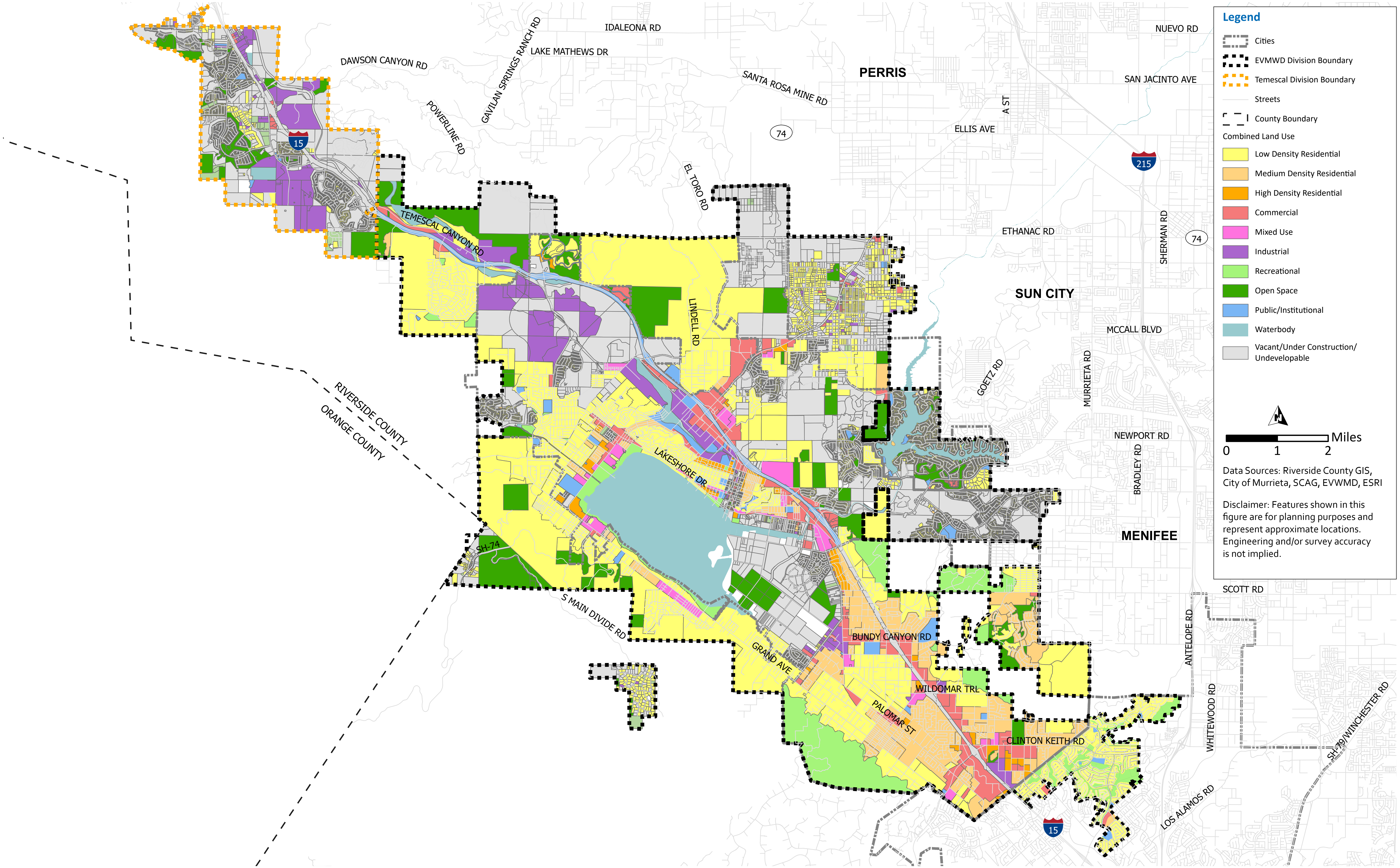

Figure 2.2 Service Area Land Use

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2.2.1 Planned Developments

Since the District's service area has a significant potential for additional growth, EVMWD tracks planned developments within each of the cities and unincorporated county areas within its boundaries in order to plan for their potential future water demand and wastewater collection needs. EVMWD is currently tracking approximately 321 planned developments. Over half of these developments are within the City of Lake Elsinore with a large number planned in the City of Wildomar and unincorporated Riverside County as well. The cities of Canyon Lake and Murrieta have relatively few planned developments within EVMWD's service area.

The full list of planned developments tracked by EVMWD is included in Appendix A. Some of the 321 developments are broken into phases that take place in different plan years; reference numbers were assigned to each phase for each development so that each entry has a unique reference number. The size, character, and location of the planned developments contributes to the spatial allocation of projected future potable and recycled water demands and wastewater flows, as described in Chapters 3 and 8.

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Chapter 3

WASTEWATER FLOW PROJECTIONS

This section presents the wastewater flow projections for the Elsinore Valley Municipal Water District (EVMWD) system. Included in this section is a presentation of historical flows. Future flows are projected and presented in this section for each of the six planning horizons (2025, 2030, 2035, 2040, 2045, and 2050). In addition, a projected flow for wet weather conditions is presented. Due to the nature of the project - a multiple system master plan (water, wastewater, and recycled water) - the wastewater flow projections are developed closely with the water and recycled water flow projections. This ensures consistency between the different planning documents and allows engineers to do independent calculations for each system and compare them as verification of projected flows. Some portions of the water flow projections are presented in this section as the basis for portions of the projected wastewater flows.

3.1 Wastewater Flow Components

This section describes the terminology used for the hydraulic analysis of the wastewater collection system. Wastewater flows vary according to season and generally consist of dry weather flow (DWF) and wet weather flow (WWF).

Another component of DWF is the contribution of dry weather groundwater infiltration (GWI) into the collection system. Dry weather GWI will enter the sewer system when the relative depth of the groundwater table is higher than the depth of the pipeline and when the susceptibility of the sanitary sewer pipe allows infiltration through defects such as cracks, misaligned joints, and broken pipelines. Such defects may be prevalent in EVMWD's sewer lines and the privately owned sanitary sewer laterals that are connected to the sewer system. Due to the proximity of Lake Elsinore, Canyon Lake, Temescal Creek and its tributaries, these defects can contribute to increases in infiltration.

WWF includes stormwater inflow, trench infiltration, and rainfall derived GWI. The stormwater inflow and trench infiltration comprise the WWF component termed infiltration/inflow (I/I). The response in the sewer system to rainfall is seen immediately (as with inflow) or within hours after the storm (as with infiltration).

- **Base Wastewater Flow.** The base wastewater flow (BWF) is the flow generated by the EVMWD's customers independent of wet weather influences. BWF is estimated by measuring flows during dry weather conditions. The flow has a diurnal pattern that varies depending on the type of use. Commercial and industrial patterns, though they vary depending on the type of use, typically have more consistent higher flows during business hours and lower flows at night. Furthermore, the diurnal flow pattern experienced during a weekend may vary from the diurnal flow experienced during a weekday.

- **Average Annual Flow (AAF).** The AAF is the average flow that occurs on a daily basis throughout the year, including both periods of dry and wet weather conditions.
- **Average Dry Weather Flow (ADWF).** The ADWF is the flow that occurs on a daily basis during the dry weather season. The ADWF includes the BWF generated by EVMWD's residential, commercial, and industrial users, plus the dry weather GWI component.
- **Peak Dry Weather Flow (PDWF).** PDWF is the maximum flow that occurs during the dry weather season.
- **Peak Wet Weather Flow (PWWF).** PWWF is the highest observed flow that occurs following a design storm event. Wet weather I/I causes flows in the collection system to increase. PWWF is typically used for designing sewers, pump stations, and some unit processes in a treatment plant. Therefore, the PWWF and the "Design Flow" are synonymous and will be used interchangeably throughout this report.
- **Groundwater Infiltration.** GWI is the result of extraneous water entering the sewer system through defects in pipes and manholes. GWI is related to the condition of the sewer pipes, manholes, and groundwater levels. GWI may occur throughout the year, although rates are typically higher in the late winter and early spring. Dry weather GWI (or base infiltration) cannot easily be separated from BWF by flow measurement techniques. Therefore, dry weather GWI is typically grouped with BWF.
- **Rain-Derived Infiltration and Inflow (RDII).** Infiltration is defined as stormwater flows that enter the sewer system by percolating through the soil and then through defects in pipelines, manholes, and joints. Examples of infiltration entry points are cracks in pipelines, misaligned joints, and root penetration. Inflow is defined as stormwater that enters the sewer system via storm drain cross connections, leaky manhole covers, or cleanouts. Examples of inflow entry points are roof drain and downspout connections, leaky manhole covers, and illegal storm drain connections.

3.2 Historical Wastewater Flow Analysis

Records of historical flows at EVMWD's three wastewater treatment plants and the Southern Sewershed discharge locations were provided for analysis and comparison to existing flows. Table 3.1 provides a summary of the historical flows, based on available data provided by EVMWD.

Table 3.1 Historical Flow Summary

Month	Regional WRF (mgd)		Railroad Canyon WRF (mgd)		Horsethief Canyon WRF (mgd)		Southern (mgd)		Total (mgd)	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
January	6.41	6.50	0.60	0.65	0.37	0.37	0.81	0.89	8.19	8.40
February	5.97	6.54	0.53	0.64	0.38	0.34	0.83	0.88	7.70	8.41
March	6.64	6.74	0.51	0.65	0.43	0.37	0.93	0.94	8.51	8.69
April	6.47	6.21	0.52	0.63	0.47	0.36	1.18	0.93	8.64	8.14
May	6.19	5.70	0.80	0.64	0.46	0.36	0.97	0.92	8.43	7.62
June	6.13	5.60	0.85	0.63	0.44	0.35	0.84	0.90	8.26	7.48
July	6.08	5.77	0.81	0.59	0.40	0.35	0.87	0.82	8.16	7.54
August	5.80	6.02	0.80	0.57	0.36	0.36	0.88	0.81	7.84	7.76
September	5.83	6.02	0.76	0.59	0.37	0.37	0.87	0.87	7.83	7.84
October	6.10	6.05	0.69	0.70	0.35	0.36	1.05	0.90	8.19	8.00
November	6.21	6.12	0.71	0.63	0.35	0.42	1.20	0.90	8.46	8.06
December	5.88	6.51	0.64	0.52	0.36	0.38	0.92	0.92	5.03	7.48
AAF	**6.14**	**6.15**	**0.68**	**0.62**	**0.40**	**0.36**	**0.95**	**0.89**	**8.16**	**8.02**
ADWF	**6.00**	**5.80**	**0.82**	**0.60**	**0.40**	**0.35**	**0.86**	**0.85**	**8.14**	**7.59**

Notes:
Abbreviations: mgd - million gallons per day; WRF - water reclamation facility.

3.3 Temporary Flow Monitoring Program

Carollo Engineers, Inc. (Carollo) contracted with V&A Consulting Engineers, Inc. (V&A) to conduct a temporary flow monitoring program within EVMWD's wastewater collection system. Flow monitoring was performed over a three-month period from February 21, 2022, to May 22, 2022, at 34 flow monitoring sites. V&A is also conducted supplemental wet weather flow (WWF) monitoring program for the Southern Sewershed, to obtain additional WWF data during the 2022-2023 wet weather season. The results from this flow monitoring program can be found in the Southern Section I/I Study.

The temporary flow monitoring program helped develop design flow criteria and correlate actual collection system flows to the hydraulic model predicted flows. The flow monitoring data was also used to calibrate the collection system hydraulic model for DWF and WWF and to help to identify areas of the system with the highest rates of I/I (see Chapter 5 for further detail on the model calibration process).

3.3.1 Flow Monitoring Sites

A total of 34 open-channel flowmeters were installed at locations selected by Carollo and EVMWD. The meter sites were selected to best isolate and model critical areas and subareas within the sewer system. Table 3.2 lists the flow monitoring locations and the sewer diameters where the meters were installed. The 34 flow monitoring locations, as well as the tributary area to each site, are shown on Figure 3.1. It should be noted that Washington Avenue Lift Station is included as an active lift station within Figure 3.1 because it was active during the flow monitoring period, however this facility has since been inactivated to allow flows from Washington Avenue Lift Station to be conveyed to the Southern Sewershed. The calibration scenarios in the hydraulic model are the only scenarios where Washington Avenue Lift Station is active. Figure 3.2 provides a schematic illustration of the flow monitoring locations and the associated water reclamation facilities.

3.3.2 Flowmeter Installation and Flow Calculation

Teledyne Isco 2150 flowmeters were used for this project. Isco 2150 meters use a pressure transducer to collect depth readings and ultrasonic Doppler sensors on the probe to determine the average fluid velocity. The ultrasonic sensor emits high-frequency sound waves, which are reflected by air bubbles and suspended particles in the flow. The sensor receives the reflected signal and determines the Doppler frequency shift, which indicates the estimated average flow velocity. The sensor is typically mounted at a manhole inlet to take advantage of smoother upstream flow conditions. The sensor may be offset to one side to lessen the chances of fouling and sedimentation where these problems are expected to occur. Manual level and velocity measurements were taken during installation of the flowmeters and again when they were removed and were compared to simultaneous level and velocity readings from the flowmeters to verify proper calibration and accuracy. The pipeline diameter was also verified in order to accurately calculate the flow cross-section. The continuous depth and velocity readings were recorded by the flowmeters on five-minute intervals. The flow at each meter was calculated at five-minute intervals based on the continuity equation:

$$Q = V \times A$$

where:

Q = Pipeline flow rate, cubic feet per second (cfs).

V = Average velocity, feet per second (fps).

A = Cross sectional flow area, square feet (ft^2).

Table 3.2 Flow Monitoring Sites

Site Number	Manhole (Maximo ID)	Field Measured Pipe Diameter (inches)	Measured Sediment Depth (inches)
Site 01	MH-58	14.75	none
Site 02	MH-703	12	none
Site 03	MH-955	14.75	none
Site 04	MH-1432	17.75	none
Site 05	MH-1018	29.75	none
Site 06	MH-1035	24	1.5
Site 07	MH-8697	14.75	none
Site 08	MH-8708	15	none
Site 09	MH-10055	54	none
Site 10	MH-1465	11.75	none
Site 11	MH-1444	26.75	none
Site 12	MH-1463	24	none
Site 13	MH-2755	36	none
Site 14	MH-2866	20.75	none
Site 15	MH-2869	17.75	none
Site 16	MH-2545	20.75	none
Site 17	MH-2613	14.75	none
Site 18	MH-2239	15	none
Site 19	MH-1125	12	1.25
Site 20	MH-3330	21	none
Site 21	MH-3460	11.75	none
Site 22	MH-3446	18	2
Site 23	MH-3677	12	none
Site 24	MH-4236	23.75	none
Site 25	MH-5031	23.75	none
Site 26	MH-7177	20.75	none
Site 27	MH-4513	14.75	none
Site 28	MH-4735	11.75	none
Site 29	MH-4626	9.75	none
Site 30	MH-4752	9.75	none
Site 31	MH-4344	10	none
Site 32	MH-4711	9.75	none
Site 33	MH-4877	11.75	none
Site 34	MH-4954	9.75	none

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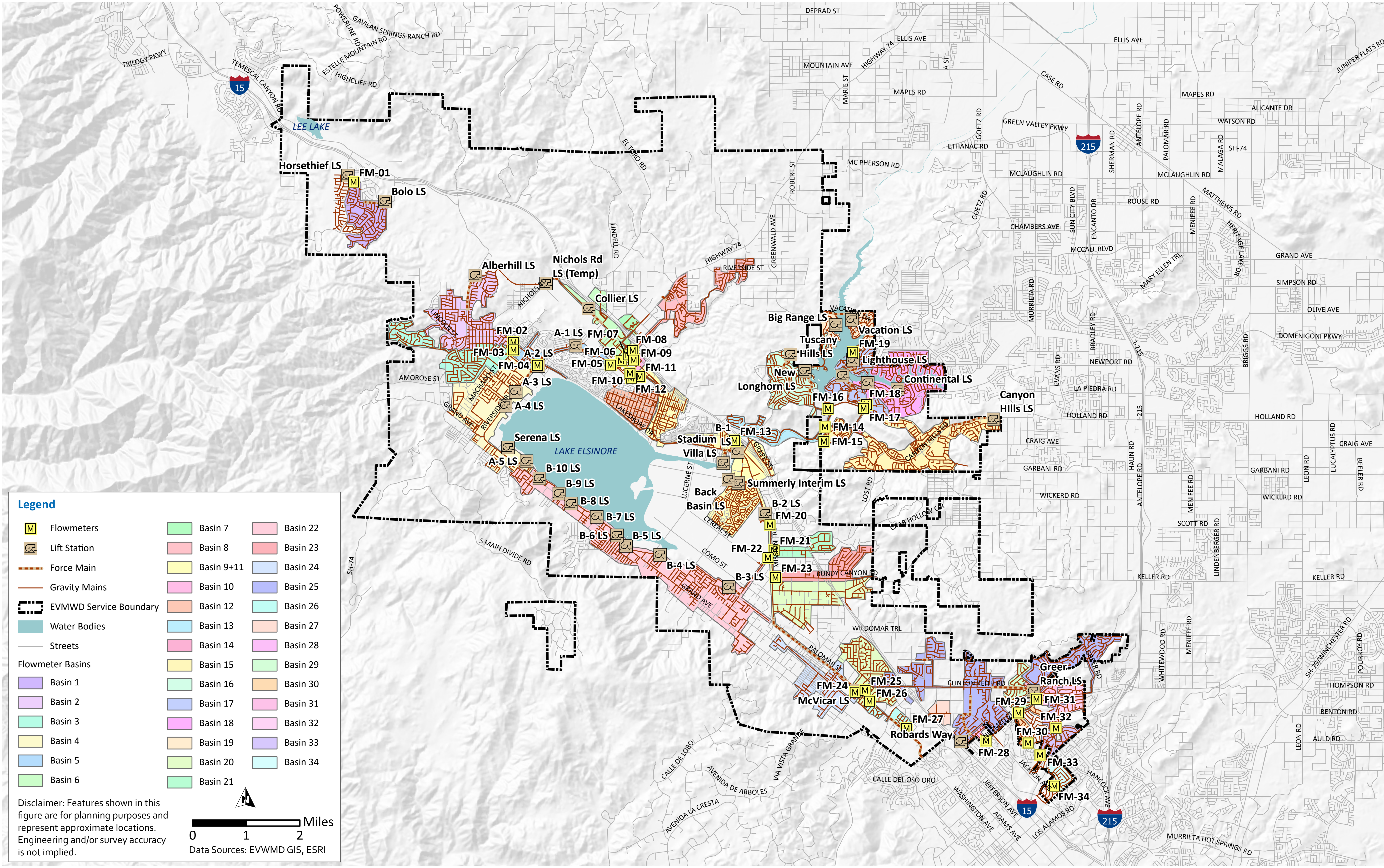

Figure 3.1 Flowmeter and Flowmeter Basin Locations

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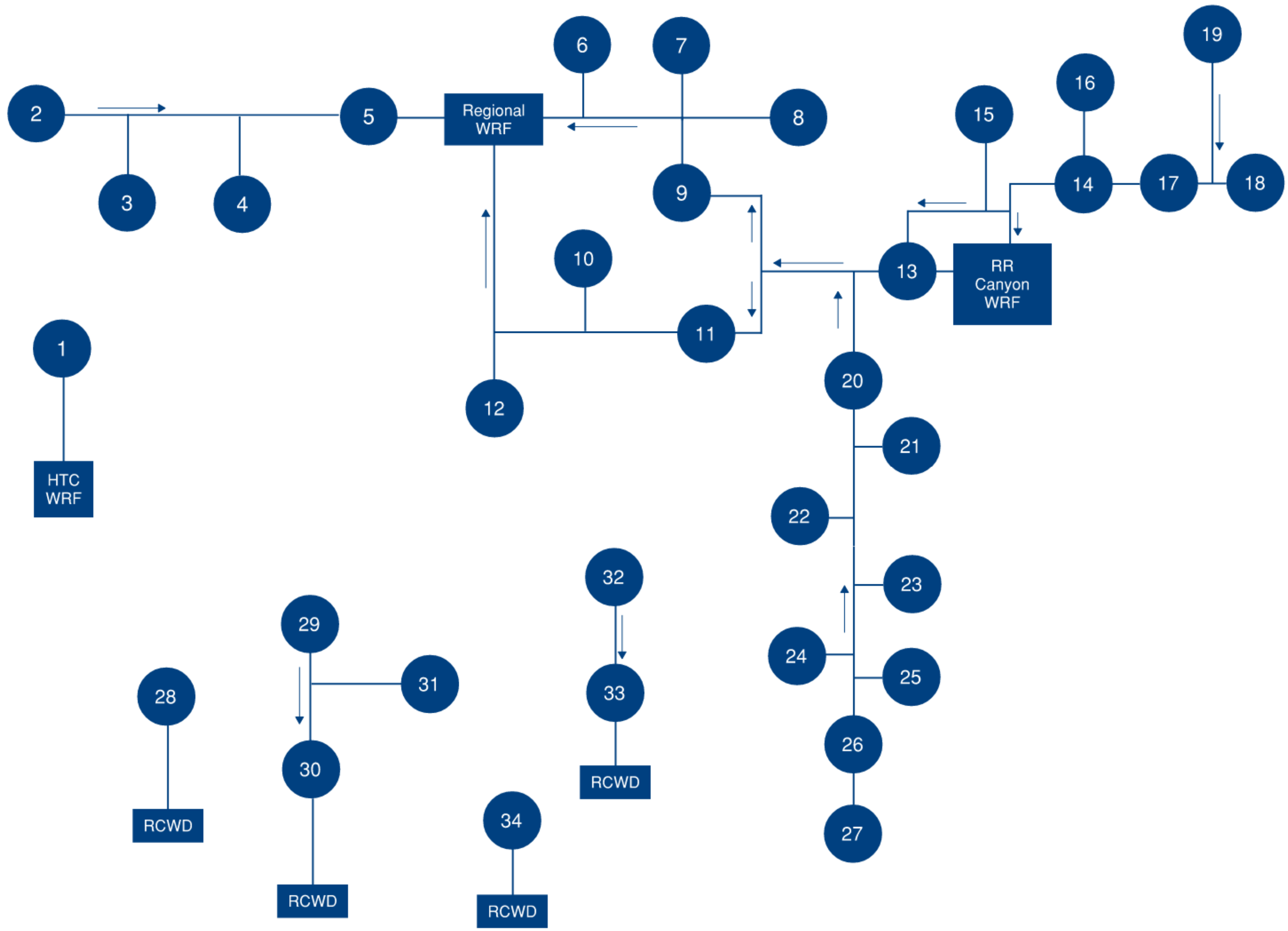

Figure 3.2 Temporary Flow Monitoring Locations Schematic

3.3.3 Flow Monitoring Results

This section summarizes the results of the flow monitoring program. Flow monitoring Site 12 is presented throughout this chapter as an example.

3.3.3.1 Dry Weather Flow Data

Characteristic dry weather 24-hour diurnal flow patterns for each site were developed based on the hourly data. DWF data is taken from days without noticeable inflow or infiltration response. This hourly flow data was then used to calibrate the hydraulic model for the observed DWFs during the flow monitoring period.

Hourly patterns for weekday and weekend flows were analyzed separately to better understand DWF. V&A provided estimates for the average weekday and weekend levels and velocities at each site, which are used in DWF calibration. Table 3.3 summarizes the DWFs at each meter. Figure 3.3 illustrates a typical variation of wastewater flows in EVMWD, which is based on the data collected from Site 12. Similar graphics associated with the remaining sites are included in Appendix E. Appendix E contains the 2022 Sanitary Sewer Master Plan Update Flow Monitoring Report provided by V&A.

As shown on Figure 3.3, flow patterns differ according to the day of the week. DWF for Monday through Thursday experienced the greatest peak during evening hours, while Saturday and Sunday show peaks later at midday.

3.3.3.2 Rainfall Data

V&A installed three rain gauges throughout the EVMWD service area. The three rain gauges were located at the Regional Water Reclamation Facility, near Canyon Lake along Lighthouse Drive, and at Wildomar Pump Station. Rainfall affecting wastewater collection basins was determined by the basins proximity to the installed rain gauges using the Inverse Distance Weighting (IDW) method. The influence of each rain gauge was determined for a select number of sewer basins that characterized the entire collection system. The locations of IDW rain gauges can be seen in Table 3.4. V&A performed a quality assurance of the rainfall data, and the entire V&A report can be seen in Appendix E.

The rainfall data collected was used to correlate the I/I response observed in the collection system to specific storm recurrence intervals. Minor rainfall events occurred during the flow monitoring period. The March 28 to March 29, 2022, rainfall event was the largest event captured and elicited the greatest I/I response throughout the collection system. Table 3.4 summarizes the rainfall amount for each rain gauge for the March 28 to March 29, 2022, storm event along with the total rainfall captured during the flow monitoring program.

Table 3.3 DWF Summary

Site Number	Manhole (Maximo ID)	Field Measured Pipe Diameter (inches)	Measured DWF[(1)] (mgd)
Site 01	MH-58	14.75	0.199
Site 02	MH-703	12	0.253
Site 03	MH-955	14.75	0.179
Site 04	MH-1432	17.75	0.738
Site 05	MH-1018	29.75	1.293
Site 06	MH-1035	24	0.085
Site 07	MH-8697	14.75	0.048
Site 08	MH-8708	15	0.419
Site 09	MH-10055	54	3.458
Site 10	MH-1465	11.75	0.003
Site 11	MH-1444	26.75	0.061
Site 12	MH-1463	24	0.116
Site 13	MH-2755	36	0.720
Site 14	MH-2866	20.75	0.702
Site 15	MH-2869	17.75	0.556
Site 16	MH-2545	20.75	0.177
Site 17	MH-2613	14.75	0.507
Site 18	MH-2239	15	0.275
Site 19	MH-1125	12	0.100
Site 20	MH-3330	21	1.730
Site 21	MH-3460	11.75	0.024
Site 22	MH-3446	18	0.413
Site 23	MH-3677	12	0.096
Site 24	MH-4236	23.75	0.165
Site 25	MH-5031	23.75	0.570
Site 26	MH-7177	20.75	0.179
Site 27	MH-4513	14.75	0.148
Site 28	MH-4735	11.75	0.025
Site 29	MH-4626	9.75	0.138
Site 30	MH-4752	9.75	0.194
Site 31	MH-4344	10	0.046
Site 32	MH-4711	9.75	0.095
Site 33	MH-4877	11.75	0.273
Site 34	MH-4954	9.75	0.047

Notes:
(1) Source: Appendix E V&A Consulting Engineers, *Sanitary Sewer Master Plan Update Flow Monitoring*, November 9, 2022.

Table 3.4 Summary of IDW Rain Gauge Locations

Rain Gauge[(1)]	Approximate Rain Gauge Location	Rain Event 1 (inches) March 28-29, 2022	Total Over Monitoring Period[(2)] (inches)
A	Pacos Ridge and Coyote Mesa Drive	0.86	1.70
B	Walaham Place and Lakeridge Road	0.58	1.70
C	Bell Avenue and Dwan Drive	0.62	1.27
D	Wood Mesa Court	0.79	1.15
E	Del Fiore and Bella Vista	0.83	1.43
F	Normandy Road and La Ladera Road	0.65	1.47
G	Village Parkway and Hidden Trail	0.51	1.16
H	Palomar Street and Batson Lane	0.52	1.66
I	Charles Street and Woshka Lane	0.65	2.08
J	Spring Meadow Drive and Bunchberry Lane	0.60	1.83
K	Arron Court	0.62	2.18
L	Vence Drive and Mandelieu Drive	0.81	2.40
M	Via Tonada and Colony Drive	0.57	1.90

Notes:
(1) Rain Gauge data was determined by V&A through the IDW method, as described in Appendix E.
(2) Flow monitoring program took place from February 21, 2022 to May 22, 2022.

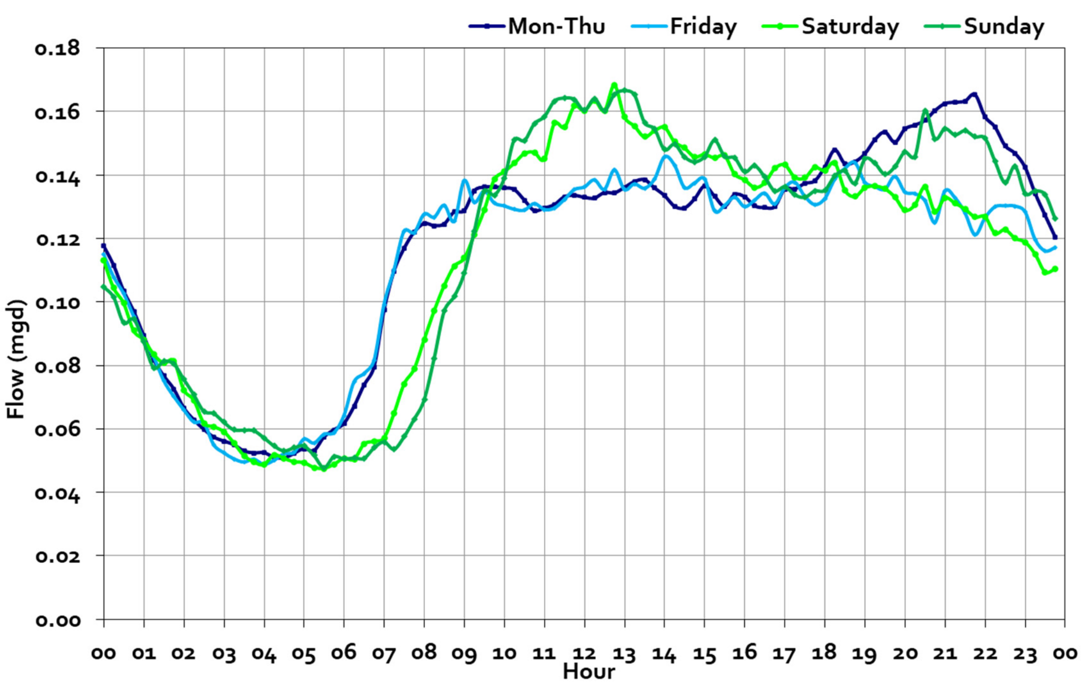

Figure 3.3 Typical Dry Weather Flow Variation (Site 12)

3.3.3.3 Wet Weather Flow Data

The flow monitoring data was also evaluated to determine how the collection system responds to wet weather events. The most significant rainfall event that occurred during the flow monitoring program was on March 28 to March 29, 2022, and was used for model calibration.

Figure 3.4 shows an example of the wet weather response at flowmeter Site 12 during the March 28 to March 29, 2022, storm event. The dashed line is the calculated BWF (baseline flow), while the solid blue line is the measured flow from the flow monitoring period (real-time flow). The calculated I/I flow rate is shown in red. As shown on Figure 3.4, there is a discernible I/I response in the system associated with WWF events.

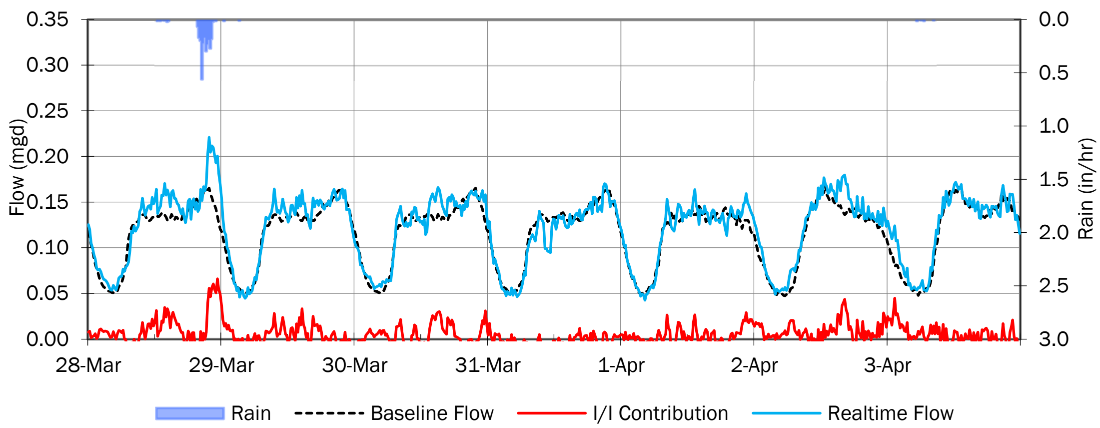

Figure 3.4 Example Wet Weather Flow Response (Site 12)

3.3.3.4 Peak Flow Summary

Table 3.5 summarizes the measured peak flows at each flow monitoring site. In many cases, the measured peak flows are associated with the March 28 to March 29, 2022, storm event, whereas others are a result of anomalous flow spikes during dry weather conditions (Example sites: Site 6, Site 7, Site 13, Site 21, Site 28, Site 30, Site 31). The previous flow monitoring report performed by V&A in 2014 was used to review peaking factors from the previous master plan. The 2014 V&A flow monitoring report can be found in Appendix G.

Table 3.5 Peak Measured Flow During Flow Monitoring Period (February 21, 2022 to May 22, 2022)

Site Number	Measured ADWF[1,3] (mgd)	Peak Measured Flow[2,3] (mgd)	Peaking Factor[4]
Site 01	0.20	0.46	2.32
Site 02	0.25	0.57	2.27
Site 03	0.18	0.37	2.08
Site 04	0.74	1.57	2.13
Site 05	1.29	2.64	2.05
Site 06	0.09	0.36	4.19
Site 07[5]	0.05	0.54	11.42
Site 08	0.42	0.75	1.79
Site 09	3.46	5.89	1.70
Site 10	<0.01	0.02	6.68
Site 11	0.06	0.13	2.10
Site 12	0.12	0.22	1.90
Site 13	0.72	2.27	3.15
Site 14	0.70	1.57	2.24
Site 15	0.56	1.15	2.06
Site 16	0.18	0.49	2.75
Site 17	0.51	1.07	2.12
Site 18	0.28	0.62	2.26
Site 19	0.10	0.21	2.14
Site 20	1.73	2.94	1.70
Site 21	0.02	0.23	9.76
Site 22	0.41	0.85	2.06
Site 23	0.10	0.29	3.06
Site 24	0.16	0.79	4.79
Site 25	0.57	1.31	2.30
Site 26	0.18	0.38	2.13
Site 27	0.15	0.31	2.13
Site 28	0.03	0.25	9.97
Site 29	0.14	0.35	2.52
Site 30	0.19	0.60	3.10
Site 31	0.05	0.27	5.85
Site 32	0.10	0.21	2.19
Site 33	0.27	0.56	2.05
Site 34	0.05	0.13	2.67

Notes:
(1) ADWF is the ADWF rate or pattern from days without noticeable inflow or infiltration response.
(2) Peak measured flow is the maximum flow rate measured at a site throughout the entire flow monitoring period.
(3) Appendix E V&A Consulting Engineers, Sanitary Sewer Master Plan Update Flow Monitoring, November 9, 2022.
(4) Peaking factor represents peak flow measured during flow monitoring and should not be equated with the design flow.
(5) The peak measured flow at Site 7 is associated with an anomalous flow spike on March 21, 2022.

3.4 Projected Wastewater Flows

For future flows in the EVMWD system, it is necessary to estimate the future wastewater contributions from planned developments, conversion of existing septic systems to sewer, and infill within the service area. These future contributions were all separately analyzed and summed to estimate the overall new wastewater flows in the system for the 2025, 2030, 2035, 2040, 2045, and 2050 planning horizons.

3.4.1 Flow Projection Methodology

As part of the Water System Master Plan (WSMP), future demand projections for the water system were estimated using population and land use, as described in Chapter 3 of the WSMP. From these projections, return-to-sewer (RTS) ratios were used to estimate the wastewater contribution that would be generated as a percentage of anticipated water demands. This value can vary greatly depending on the locality, due to factors such as amount of irrigation. Carollo developed the RTS ratios using a similar methodology to what was used in the 2016 Sewer System Master Plan (SSMP). Carollo utilized the model calibrated RTS ratios (see Chapter 5 and Appendix F for more detailed information regarding the DWF calibration process) from the EVMWD sewer system hydraulic model and summarized the average calibrated RTS ratios by land use type. Table 3.6 summarizes the model calibrated RTS ratios summarized by land use type, as well as the calculated Water Duty Factor (WDF) and Wastewater Flow Factor (WWFF) associated with each land use type, in the units of gallons per day per acre (gpd/acre).

Weighted averages of the RTS ratios from Table 3.6 were calculated for more general land use classifications for use in the development of future flow projections (similar to the approach used in the 2016 SSMP). Supporting information for Table 3.6 can be found in Appendix F. Table 3.7 summarizes the recommended RTS ratios by general land use type. The recommended RTS ratios varied from a low of 5 percent for open space/recreation land uses up to 75 percent for industrial land uses.

Table 3.6 RTS Ratios and Wastewater Flow Factors by Land Use

Land Use Category	2022 WDF (gpd/acre)	Modeled RTS	2022 WWFF, Rounded (gpd/acre)
Business Park	800	60%	500
General Commercial	2,300	63%	1,400
Limited Industrial	700	73%	500
Open Space - Recreation	2,300	4%	100
Public Institutional	1,300	42%	500
Hillside Residential	1,400	36%	500
Very Low Density Residential (0.1 – 0.5 DU/acre)	700	44%	300
Low Density Residential (0.5-2 DU/acre)	1,200	53%	600
Low Medium Density Residential (2-4 DU/acre)	2,000	44%	900
Medium Density Residential (4-6 DU/acre)	2,200	45%	1,000
Medium High Density Residential (6-12 DU/acre)	2,400	45%	1,100
High Density Residential (12-24 DU/acre)	2,600	79%	2,100
Mixed Use (24 DU/acre maximum)	1,700	40%	700

Notes:
Abbreviations: DU/acre - dwelling units per acre.

Table 3.7 Recommended RTS Ratios

Land Use Category	Modeled RTS Ratio	Recommended RTS Ratio
Residential	46%	45%
Commercial	59%	60%
Industrial	73%	75%
Mixed Use	40%	40%
Open Space/Recreational	4%	5%
Public/Institutional	42%	45%

3.4.2 Planned Development Average Dry Weather Flow Projections

ADWF projections for the planned development areas were developed by applying a unit flow of 250 gallons per day per equivalent dwelling unit (gpd/EDU) for residential planned developments, or the recommended RTS ratios from Table 3.7 to the projected water demands summarized in Chapter 3 of the WSMP for non-residential planned developments. Figure 3.5 shows the planned development areas for reference, including the planned development reference number on each project polygon that corresponds to Appendix A. Appendix A contains a detailed summary of the projected ADWF by planned development, including the projected water demand, the RTS ratio assumed, the projected ADWF (with timing), and the sewershed associated with the planned development. Table 3.8 summarizes the total projected ADWF increase by sewershed and phase. As shown in Table 3.8, planned developments are projected to add approximately 7.91 mgd of new flow within the EVMWD service area by 2050.

Table 3.8 Projected ADWF Associated With Planned Developments

Year	Cumulative Sum of ADWF Added (mgd)				
	Regional	Railroad	Horsethief	Southern	Total
Existing	0.00	0.00	0.00	0.00	0.00
2025	2.33	0.01	0.06	0.17	2.57
2030	3.26	0.01	0.20	0.17	3.63
2035	4.32	0.01	0.22	0.19	4.74
2040	5.49	0.01	0.29	0.19	5.98
2045	6.61	0.01	0.29	0.22	7.13
2050	7.39	0.01	0.29	0.22	7.91

3.4.3 ADWF Increases Due to Septic Customer Conversion

The second component of future wastewater flow was customers with septic tanks connecting to EVMWD's sewer system. Because current septic customers are already receiving potable water from EVMWD, their demands to the water system are already accounted for in the existing water system. However, the contribution to wastewater flow from these customers is not accounted for in the existing system. Therefore, an independent method of quantifying and assigning these flows in the future had to be developed separate from the future water demand projections.

The first step in assigning this flow to future scenarios was to develop a phasing plan for different areas where there are septic customers. EVMWD is currently working on a project to plan for the conversion of certain customers within the Sedco Hills and Avenues areas to the sewer system. These areas were assumed to be converted by 2030. The remaining areas were assumed to connect in a time frame consistent with the EVMWD Groundwater Sustainability Plan (GSP). Table 3.9 shows the phasing assumptions for septic customers and the number of parcels in each septic area and Figure 3.6 shows the location of each septic area as well as phasing.

Table 3.9 Septic Area Conversion Assumptions

Septic Area	Connection Year	Parcels in Septic Area
Sedco Hills	2030	641
Avenues	2030	242
Palomar	2035	306
Wildomar	2035	735
North Basin	2040	1,301
Lakeland	2045	733
Northeast Lakeshore	2045	399
Alberhill	2050	21
Not Considered	Post 2050	2,971

ADWF projections for the septic customers were developed by applying a unit flow of 250 gpd/EDU to each septic customer. Table 3.10 summarizes the projected increase in ADWF associated with the connection of septic customers. As shown in Table 3.10, this SSMP estimates that an additional 1.09 mgd of ADWF could be added to the system by 2050 from septic conversions. It should be noted that all the septic conversions considered in this SSMP would be located within the Regional Sewershed.

Table 3.10 Cumulative ADWF Added Associated with Septic Conversions

Year	Cumulative Sum of ADWF Added (mgd)	
	Regional	Total
Existing	0.00	0.00
2025	0.00	0.00
2030	0.22	0.22
2035	0.48	0.48
2040	0.81	0.81
2045	1.09	1.09
2050	1.09	1.09

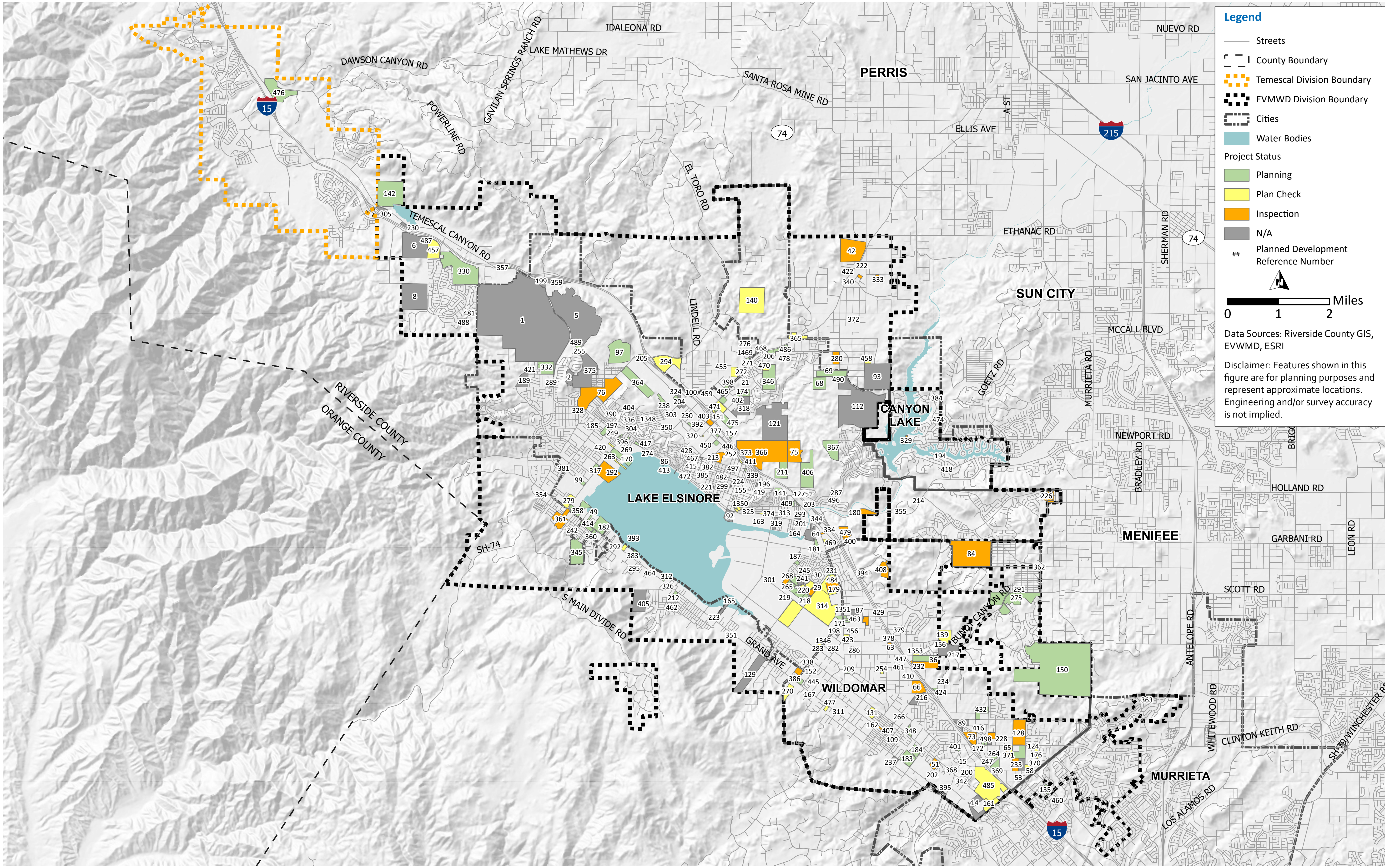

Figure 3.5 Planned Developments

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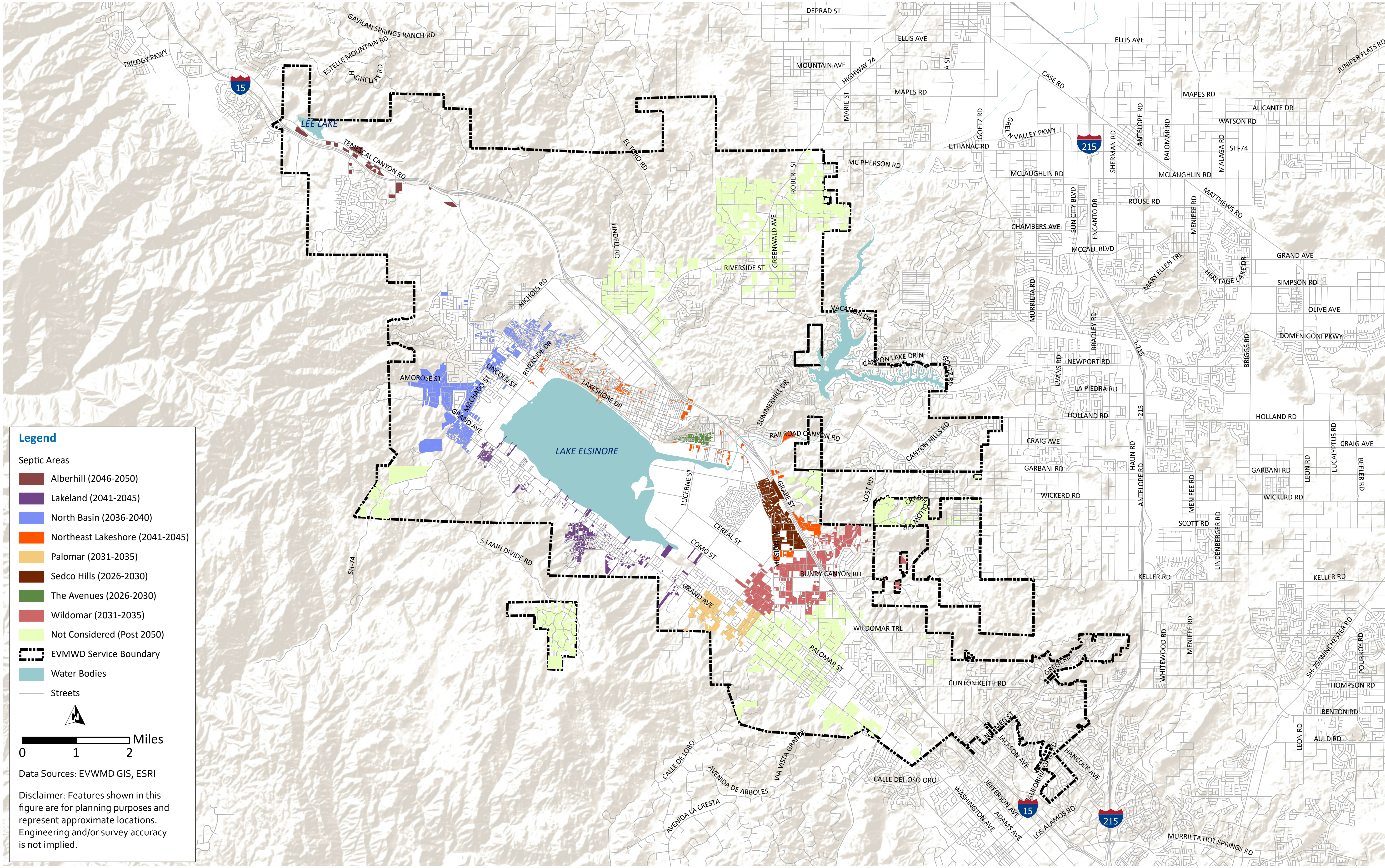

Figure 3.6 Septic Areas

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3.4.4 Infill ADWF Projections

The final component of the projected ADWF is associated with infill areas within the current service area. The 2022 WSMP projected a total infill average day demand of 1.01 mgd by 2050. An RTS ratio of 45 percent was applied to this project infill average day demand to develop an estimated 0.46 mgd ADWF increase system-wide. Due to the unknown nature of the infill development, this flow was allocated by planning year and sewershed in similar proportions to the planned developments.

3.4.5 Total Projected ADWF

Tables 3.11 through 3.14 summarize the total projected ADWF by sewershed, and Table 3.15 summarizes the total projected ADWF system-wide. It should be noted that the abandonment of the Washington Avenue Lift Station has redirected flows away from the Regional Sewershed to the Southern Sewershed, as of 2023. The addition of reject water flows from the Canyon Lake Water Treatment Plant (CLWTP) of 220 gallons per minute (gpm) on average is also included in 2025. Table 3.11 and Table 3.14 reflect these changes. The flow values shown in Table 3.12 reflect current operating strategies at the Railroad Canyon WRF, as this is a conservative approach for collection system planning. With process improvements, the Railroad Canyon WRF could treat more wastewater in the future. As shown in Table 3.15, the total ADWF is projected to increase from 7.70 mgd to 17.47 mgd by 2050.

Table 3.11 Regional ADWF Projections

Year	ADWF (mgd)				
	Existing	Planned Development	Septic	Infill	Total
Existing	5.73	0.00	0.00	0.00	5.73
2025	6.05	2.33	0.00	0.13	8.52
2030	6.05	3.18	0.22	0.18	9.63
2035	6.05	4.25	0.48	0.25	11.02
2040	6.05	5.41	0.81	0.31	12.58
2045	6.05	6.53	1.09	0.38	14.05
2050	6.05	7.31	1.09	0.42	14.87

Table 3.12 Railroad Canyon ADWF Projections

Year	ADWF (mgd)				
	Existing	Planned Development	Septic	Infill	Total
Existing	0.60	0.00	0.00	0.00	0.60
2025	0.60	0.01	0.00	0.00	0.61
2030	0.60	0.01	0.00	0.00	0.61
2035	0.60	0.01	0.00	0.00	0.61
2040	0.60	0.01	0.00	0.00	0.61
2045	0.60	0.01	0.00	0.00	0.61
2050	0.60	0.01	0.00	0.00	0.61

Table 3.13 Horsethief ADWF Projections

Year	ADWF (mgd)				
	Existing	Planned Development	Septic	Infill	Total
Existing	0.35	0.00	0.00	0.00	0.35
2025	0.35	0.06	0.00	0.00	0.41
2030	0.35	0.20	0.00	0.01	0.56
2035	0.35	0.22	0.00	0.01	0.58
2040	0.35	0.29	0.00	0.02	0.65
2045	0.35	0.29	0.00	0.02	0.65
2050	0.35	0.29	0.00	0.02	0.65

Table 3.14 Southern ADWF Projections

Year	ADWF (mgd)				
	Existing	Planned Development	Septic	Infill	Total
Existing	1.02	0.00	0.00	0.00	1.02
2025	1.02	0.17	0.00	0.01	1.20
2030	1.02	0.24	0.00	0.01	1.28
2035	1.02	0.27	0.00	0.02	1.30
2040	1.02	0.27	0.00	0.02	1.30
2045	1.02	0.30	0.00	0.02	1.33
2050	1.02	0.30	0.00	0.02	1.33

Table 3.15 System-Wide ADWF Projections

Year	ADWF (mgd)				
	Existing	Known Development	Septic	Infill	Total
Existing	7.70	0.00	0.00	0.00	7.70
2025	8.02[(1)]	2.57	0.00	0.15	10.73
2030	8.02	3.63	0.22	0.21	12.08
2035	8.02	4.74	0.48	0.27	13.51
2040	8.02	5.98	0.81	0.34	15.14
2045	8.02	7.13	1.09	0.41	16.65
2050	8.02	7.91	1.09	0.46	17.47

Notes:
(1) 0.32 mgd (220 gpm) increase is due to reject water from Canyon Lake Water Treatment Plant (CLWTP).

3.4.6 Peak Wet Weather Flow Projections

The existing PWWF was derived based on the calibrated hydraulic modeling hourly data. This was accomplished by applying the 10-year, 24-hour design storm to the hydraulic model, which was calibrated to both dry weather and wet weather conditions. The 10-year, 24-hour design storm volume is approximately 4.2 inches. Figure 3.7 shows the design storm used for the analysis.

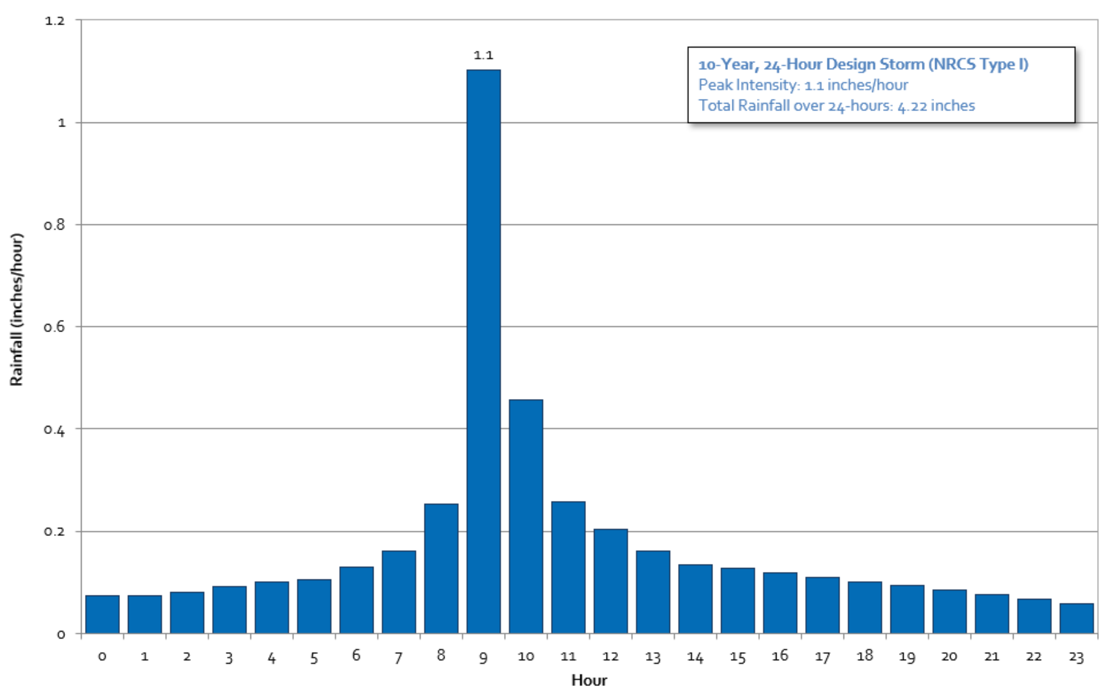

Figure 3.7 10-Year, 24-Hour Design Storm

The resulting PWWF into each treatment plant was summarized based on the hydraulic modeling results, as shown in Table 3.16. The flows for the Railroad Canyon WRF are shown before the flow diversion, as well as the estimated flow to the WRF itself. The Railroad Canyon WRF was set up in the hydraulic model to represent the diversion operation of the plant; thus, only accepting 0.6 mgd. The excess flow bypasses Railroad Canyon WRF to Regional WRF. In addition, a peak reject water flow of 460 gpm was assumed for CLWTP for the estimation of the PWWFs.

Table 3.16 Existing PWWF Estimates by Sewershed

Sewershed	ADWF (mgd)	PWWF (mgd)	Peaking Factor
Regional	5.73	14.46	2.52
Railroad Canyon Before Diversion	0.75	2.07	2.74
Railroad Canyon Into WRF	0.60	0.60	1.0
Horsethief	0.35	1.22	3.50
Southern	1.02	3.86	3.79

The future PWWFs were estimated using the hydraulic model. The values presented in Table 3.17 are the results from the 2050 scenario from the hydraulic model. Flow projections presented in this chapter were considered in the 2050 scenario.

Table 3.17 2050 PWWF Estimates by Sewershed

Sewershed	2050 ADWF (mgd)	2050 PWWF (mgd)	Peaking Factor
Regional	14.9	30.2	2.03
Railroad Canyon Before Diversion	0.76	2.09	2.75
Railroad Canyon Into WRF	0.61	0.61	1.0
Horsethief	0.7	1.83	2.77
Southern	1.33	5.32	4.0

3.5 Recommended Design Flow Factors

It was determined that applying a combination of 250 gpd/EDU with a typical peaking factor of 3.0 for planned residential development is sufficient for future planning. For specific WDF by land use types, refer to Table 3.6.

Chapter 4

EXISTING SYSTEM DESCRIPTION

This chapter provides a general overview of the existing Elsinore Valley Municipal Water District (EVMWD) wastewater collection system and treatment facilities. The EVMWD's existing wastewater collection system consists of approximately 429 miles of sewer pipelines, 36 lift stations, and three water reclamation facilities (WRFs). The EVMWD's wastewater collection system and its facilities are shown on Figure 4.1.

Information analyzed in this section of the Sewer System Master Plan is primarily based on the EVMWD's geographic information system (GIS) database received in January 2022, the EVMWD's previous collection system master plan, and other relevant sources.

4.1 Wastewater Collection System Facilities

The EVMWD's existing wastewater collection systems are described in this section. An overview of the EVMWD's lift stations, gravity sewers, and force mains are provided.

4.1.1 Gravity Mains

Gravity sewers are any pipes in the collection system that convey flow without any added force other than gravity. Gravity sewers in the EVMWD system range in size from 54 inches to less than 4 inches in diameter. The majority of gravity sewer pipes are composed of polyvinyl chloride (PVC), while some of the older pipelines in the system comprise vitrified clay pipe (VCP). The following sections describe the gravity mains in the EVMWD's system.

4.1.1.1 Gravity Mains by Diameter

The EVMWD's existing gravity collection systems consist of approximately 412 miles of pipelines up to 54 inches in diameter, with approximately 81 percent being 8 inches in diameter and smaller. A summary of the gravity pipeline length by diameter is provided in Table 4.1. Figure 4.2 shows the EVMWD's collection system, color coded by pipe diameter.

Table 4.1 Gravity Main Pipe Length by Diameter

Diameter (inches)	Length (feet)	Length (miles)	Percent of System
4 and Smaller	9,847	1.9	0.5%
6	68,352	12.9	3.1%
8	1,685,801	319.3	77.5%

Diameter (inches)	Length (feet)	Length (miles)	Percent of System
10	69,735	13.2	3.2%
12	105,488	20.0	4.8%
14	292	0.1	<0.1%
15	69,512	13.2	3.2%
16	10,111	1.9	0.5%
18	40,108	7.6	1.8%
21	34,506	6.5	1.6%
24	41,590	7.9	1.9%
27	6,149	1.2	0.3%
30	6,713	1.3	0.3%
36	5,563	1.1	0.3%
42	58	0.0	<0.1%
48	2,582	0.5	0.1%
54	19,766	3.7	0.9%
Total	2,176,174	412.2	100.0%

Notes:
(1) Based on GIS database as of January 2022. Does not include inactive or proposed infrastructure.

4.1.1.2 Gravity Mains by Installation Year

The EVMWD's GIS data contains information related to the installation date of the wastewater collection system facilities. Figure 4.3 shows the EVMWD's collection system by pipe installation period. Table 4.2, Figure 4.4, and Figure 4.5 provide summaries of the length of gravity mains by installation period. As shown on Table 4.2, approximately 41 percent of the EVMWD's gravity mains were installed since the year 2000. It should be noted that roughly 105,000 feet (5 percent) of gravity pipes provided in the EVMWD's GIS database did not contain an installation year in their metadata. Since there is no information available as to the year in which these pipes were installed, a conservative estimate was applied to these pipes. It is assumed that any pipes without a listed install year are the oldest pipes in the system and thus are listed as "pre-1970" in the analysis below.

Table 4.2 Gravity Main Pipe Length by Installation Period

Installation Period	Length (feet)	Length (miles)	Percent of System
Pre 1970	162,581	30.8	7.5%
1970-1979	223,116	42.3	10.3%
1980-1989	507,054	96.0	23.3%
1990-1999	395,628	74.9	18.2%
2000-2009	715,716	135.6	32.9%
2010-2019	155,240	29.4	7.1%
2020-2021	16,839	3.2	0.8%
Total	2,176,174	412.2	100.0%

Notes:
(1) Based on GIS database as of January 2022. Does not include inactive or proposed infrastructure.

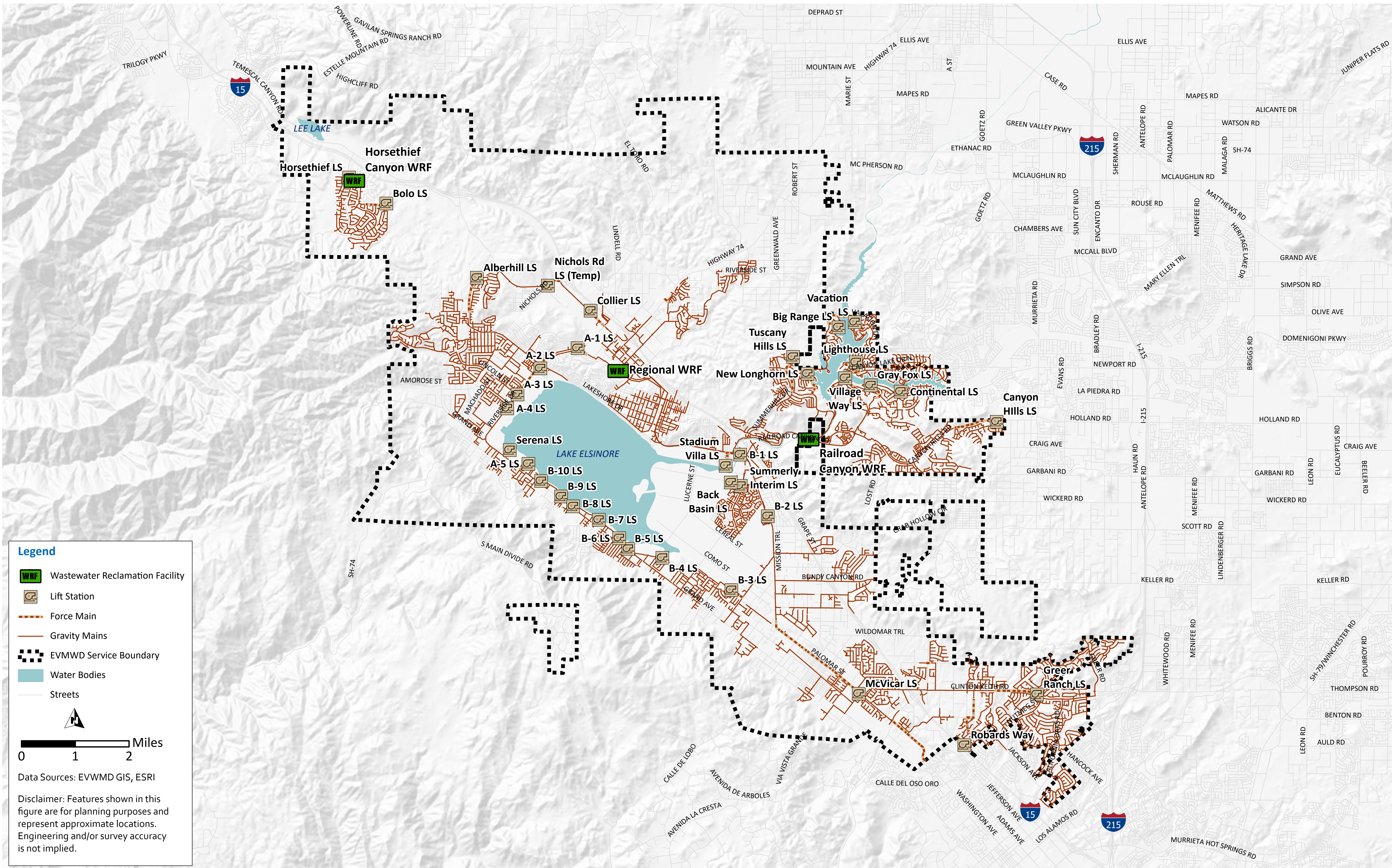

Figure 4.1 Existing Wastewater Collection System

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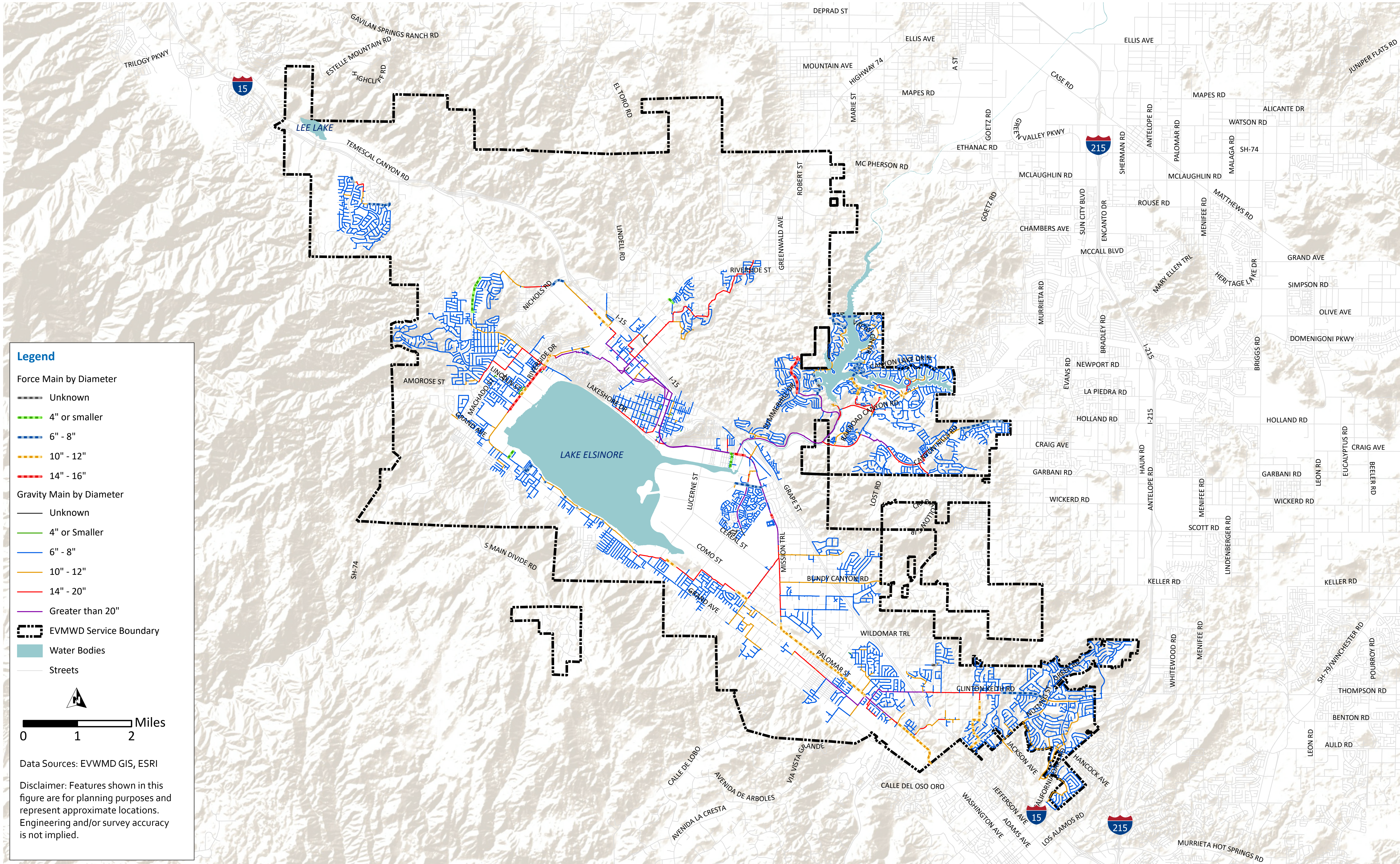

Figure 4.2 Collection System Pipelines by Diameter

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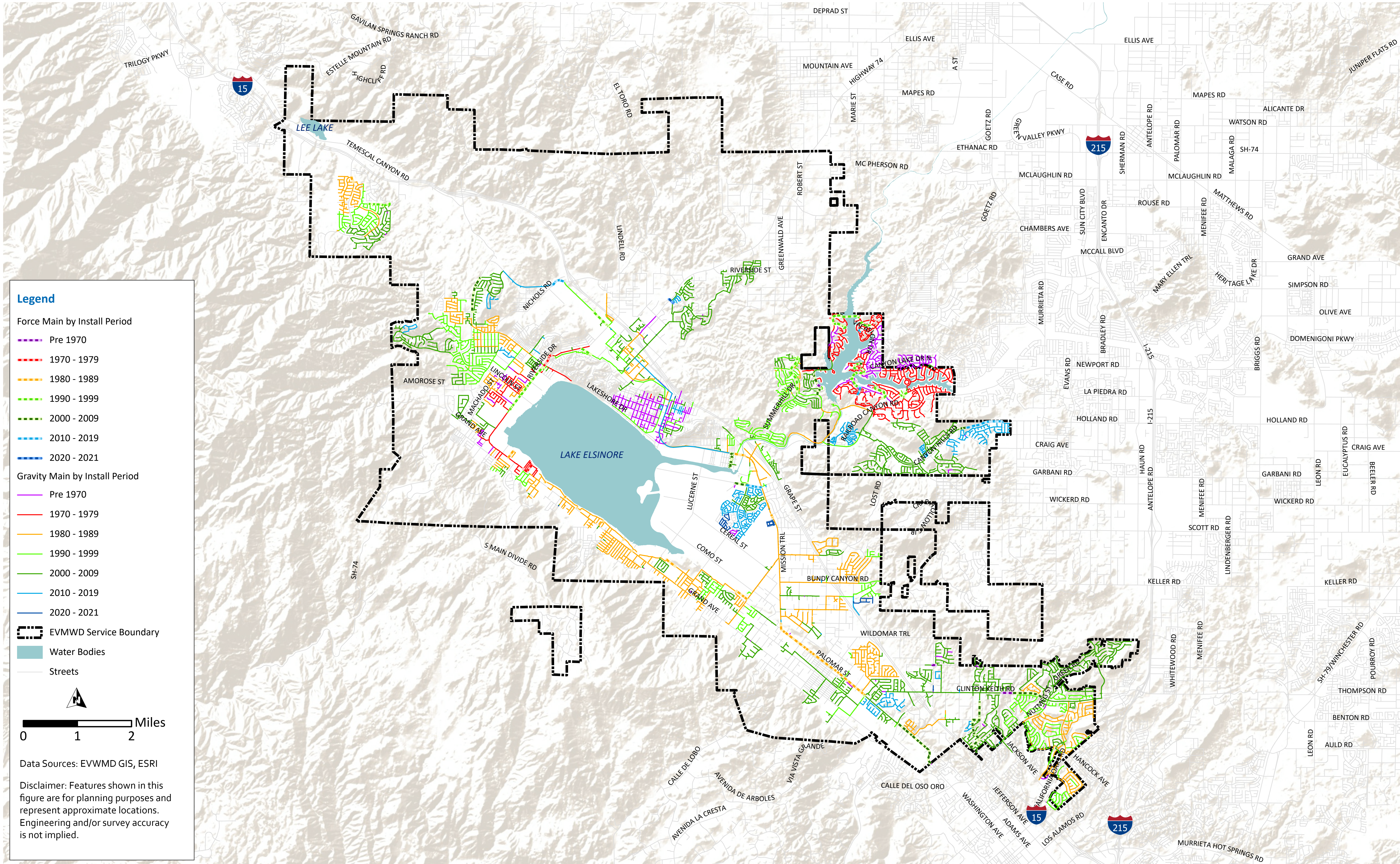

Figure 4.3 Collection System Pipelines by Installation Period

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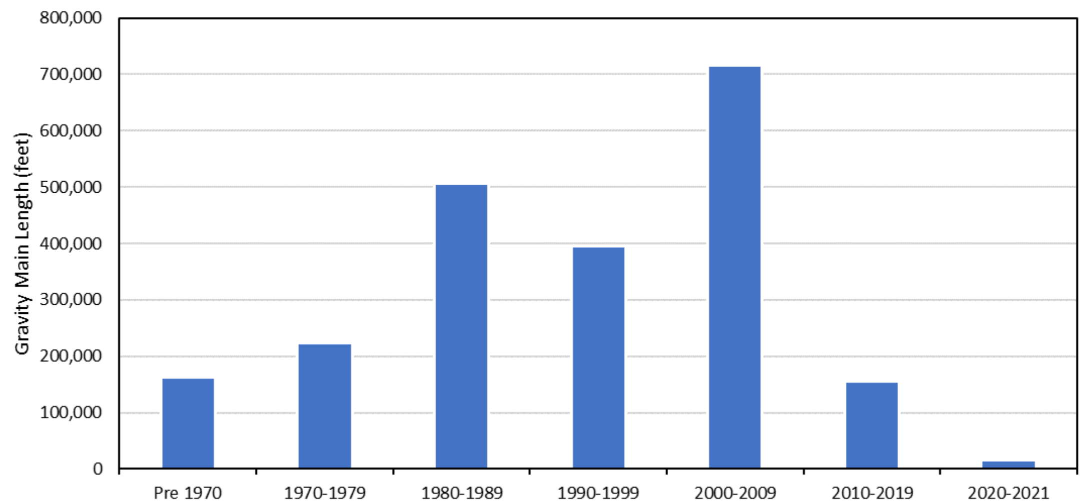

Figure 4.4 Gravity Main Length by Installation Period

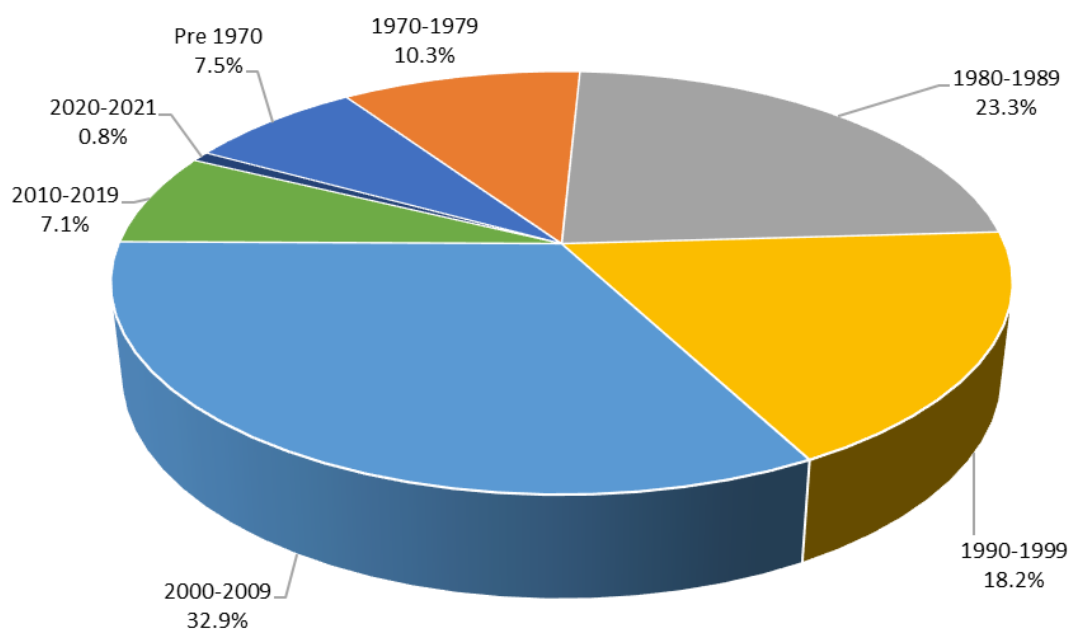

Figure 4.5 Gravity Main Length Distribution by Installation Period

4.1.1.3 Gravity Mains by Material

The EVMWD GIS database contains information on pipe material for gravity mains. As with the pipeline installation year, some of the gravity mains have no given abbreviation for material or were given an otherwise unknown abbreviation. For the EVMWD system, 97.2 percent of the pipes (by length) contain material information. Figure 4.6 shows the pipes in the EVMWD system color coded by material. Table 4.3 and Figure 4.7 show the distribution of gravity main material by length in the EVMWD system. As shown in Table 4.3, the majority of the EVMWD gravity mains are PVC pipe, which makes up nearly 70 percent of the system. The next most common material is VCP, which comprises roughly 26 percent of the system. Of the remaining materials, none make up more than 1 percent of the total system by length.

Table 4.3 Gravity Main Pipe Length by Material

Material Abbreviation	Name	Length (feet)	Length (miles)	Percent of System
ABS and ACP	Asbestos Cement	3,393	0.6	0.2%
CIP	Cast Iron Pipe	2,023	0.4	0.1%
DIP	Ductile Iron Pipe	2,283	0.4	0.1%
PE	Polyethylene Pipe	58	<0.1	<0.1%
PVC	Polyvinyl Chloride	1,520,725	288.0	69.9%
RCP	Reinforced Concrete Pipe	22,247	4.2	1.0%
UNK	Unknown	61,062	11.6	2.8%
VCP	Vitrified Clay Pipe	564,384	106.9	25.9%
Total	**--**	**2,176,174**	**412.2**	**100.0%**

Notes:
(1) Based on GIS database as of January 2022. Does not include inactive or proposed infrastructure.

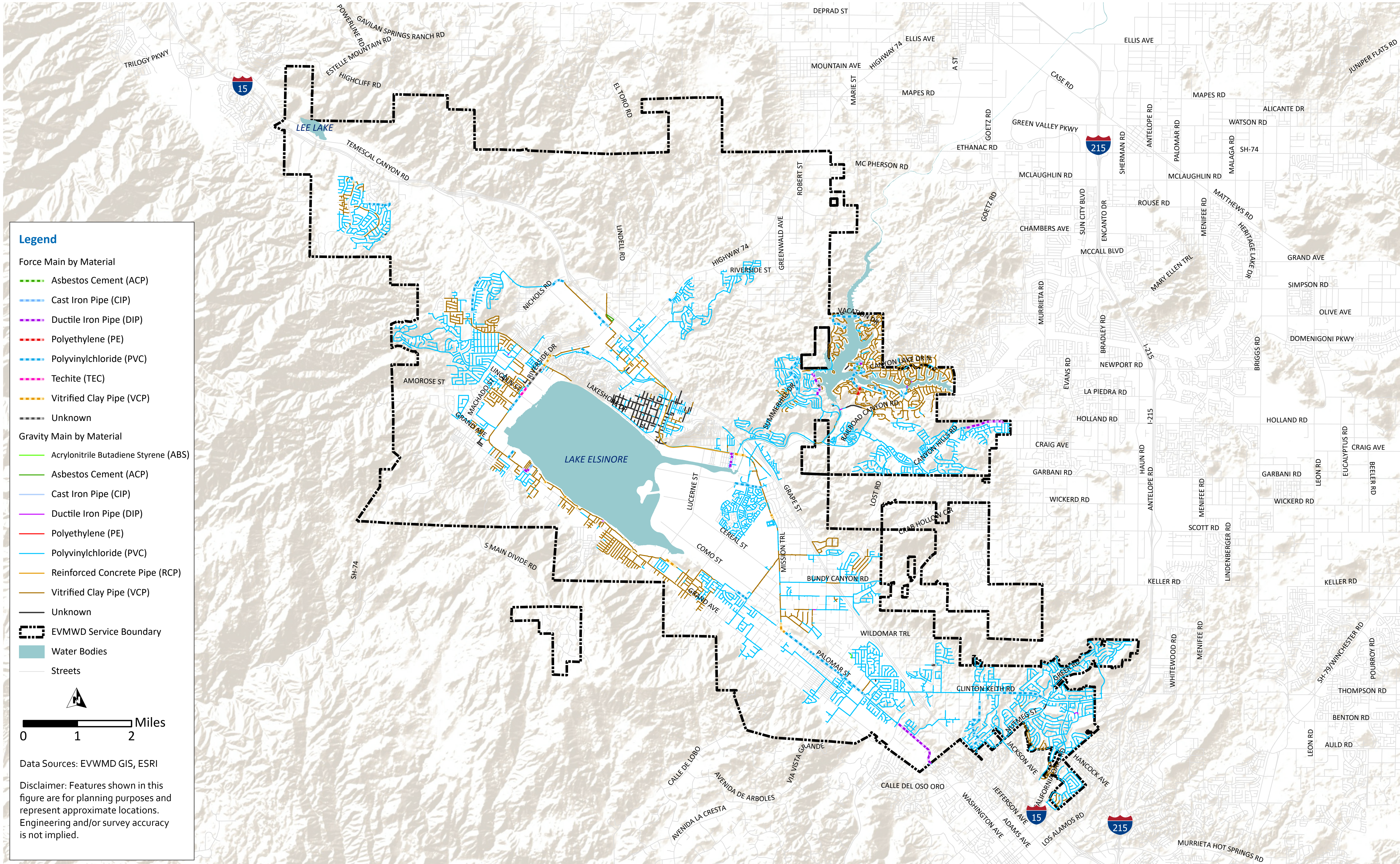

Figure 4.6 Collection System Pipelines by Material

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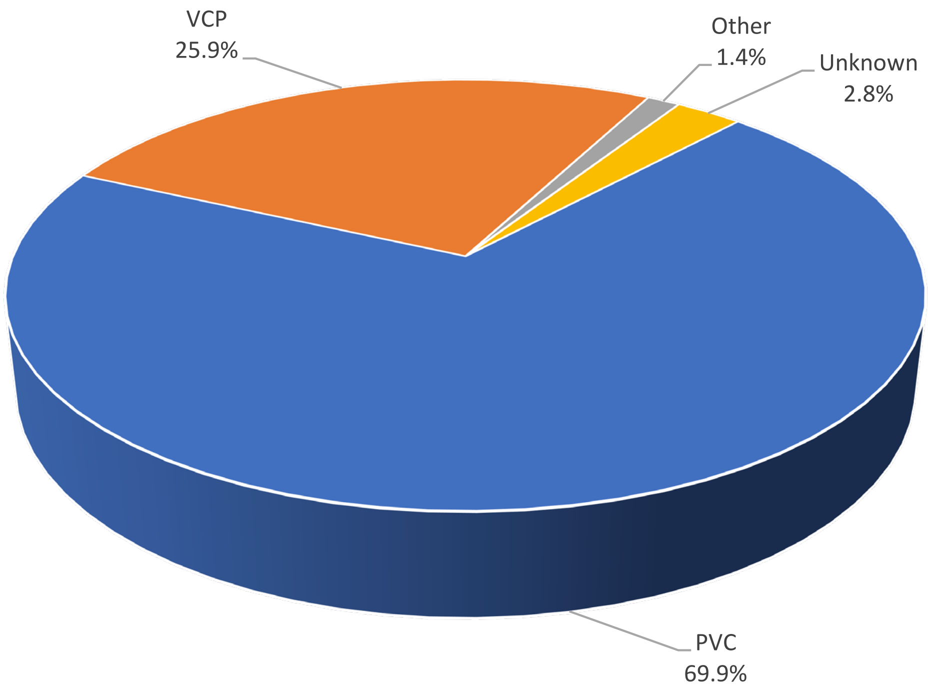

Figure 4.7 Gravity Main Length Distribution by Material

4.1.2 Force Mains

Force mains are pressurized pipes that carry flow from a lift station to a discharge point, usually a gravity sewer manhole. The following sections describe the force mains in the EVMWD system.

4.1.2.1 Force Mains by Diameter

The EVMWD collection system includes nearly 17 miles of force mains up to 16 inches in diameter. A summary of the force main pipeline length by diameter is provided in Table 4.4. Figure 4.2 shows the EVMWD force mains, color coded by pipe diameter.

Table 4.4 Force Main Pipe Length by Diameter

Diameter (inches)	Length (feet)	Length (miles)	Percent of System
4	7,110	1.3	8.0%
6	27,219	5.2	30.6%
8	4,122	0.8	4.6%
10	16,493	3.1	18.5%
12	17,955	3.4	20.2%
14	15,142	2.9	17.0%
16	1,013	0.2	1.1%
Total	**89,055**	**16.9**	**100.0%**

4.1.2.2 Force Mains by Installation Period

Figure 4.3 shows the EVMWD collection system force mains by pipe installation period. Table 4.5, Figure 4.8, and Figure 4.9 provide summaries of the length of force mains by installation period. As shown on Table 4.5, approximately 38 percent of the EVMWD gravity mains were installed since the year 2000.

Table 4.5 Force Main Pipe Length by Installation Period

Installation Period	Length (feet)	Length (miles)	Percent of System
Pre 1970	1,562	0.3	1.8%
1970-1979	3,296	0.6	3.7%
1980-1989	16,780	3.2	18.8%
1990-1999	34,893	6.6	39.2%
2000-2009	24,269	4.6	27.3%
2010-2019	7,666	1.5	8.6%
2020-2021	588	0.1	0.7%
Total	**89,055**	**16.9**	**100.0%**

Notes:
(1) Based on GIS database as of January 2022. Does not include inactive or proposed infrastructure.

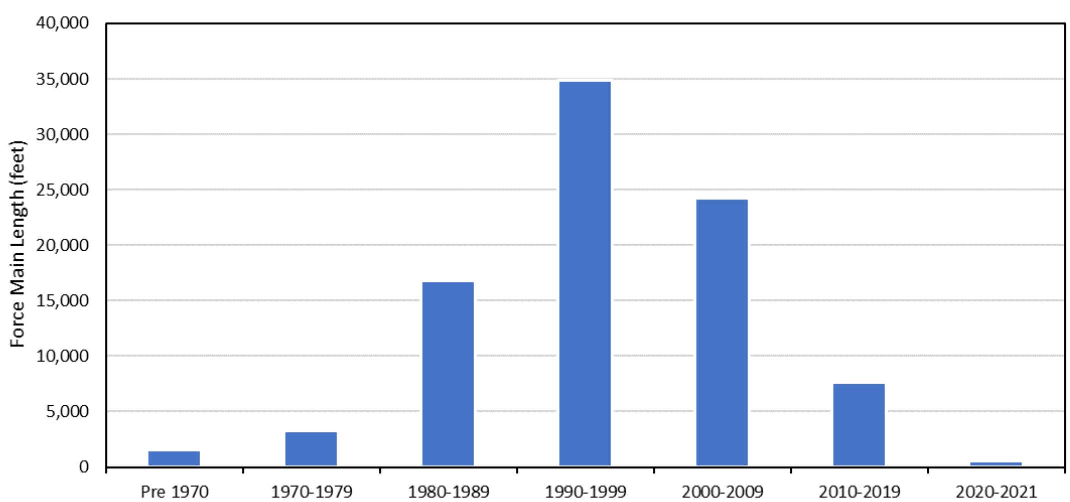

Figure 4.8 Force Main Length by Installation Period

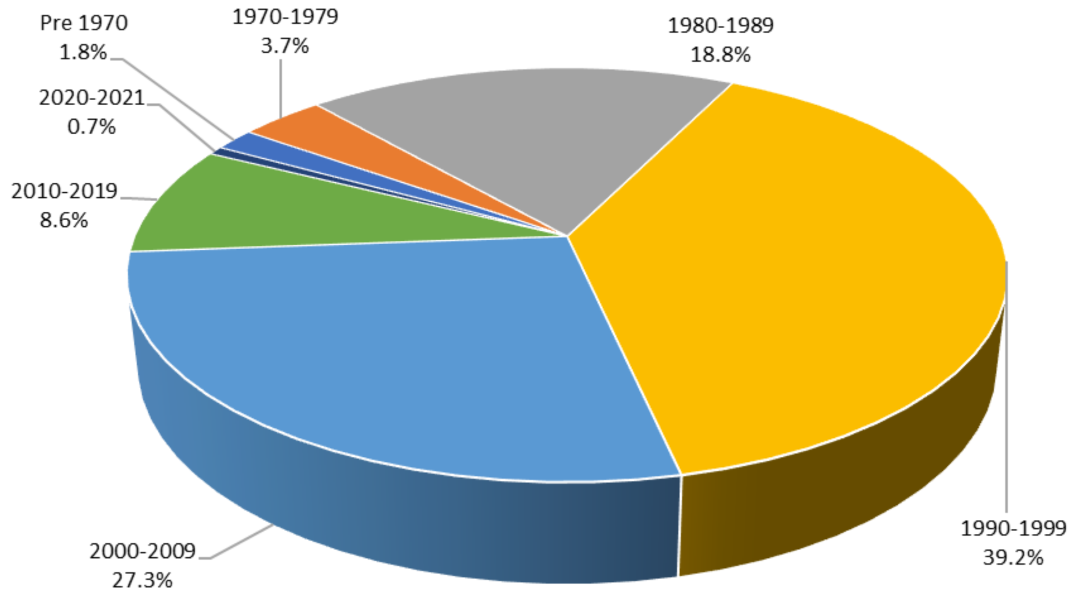

Figure 4.9 Force Main Length Distribution by Installation Period

4.1.2.3 Force Mains by Material

The EVMWD GIS database contains information on pipe material for force mains. Figure 4.6 shows the force mains in the EVMWD system color coded by material. Table 4.6 and Figure 4.10 show the distribution of force main material by length in the EVMWD system. As shown in Table 4.6, the majority of the EVMWD force mains are PVC pipe, which makes up nearly 72 percent of the system. The next most common material is ductile iron pipe, which comprises roughly 16 percent of the system.

Table 4.6 Force Main Pipe Length by Material

Material Abbreviation	Name	Length (feet)	Length (miles)	Percent of System
ABS and ACP	Asbestos Cement	512	0.1	0.6%
CIP	Cast Iron Pipe	607	0.1	0.7%
DIP	Ductile Iron Pipe	14,030	2.7	15.8%
PE	Polyethylene Pipe	948	0.2	1.1%
PVC	Polyvinyl Chloride	63,724	12.1	71.6%
RCP	Techite	846	0.2	0.9%
UNK	Unknown	2,823	0.5	3.2%
VCP	Vitrified Clay Pipe	5,565	1.1	6.2%
Total		**89,055**	**16.9**	**100.0%**

Notes:
(1) Based on GIS database as of January 2022. Does not include inactive or proposed infrastructure.

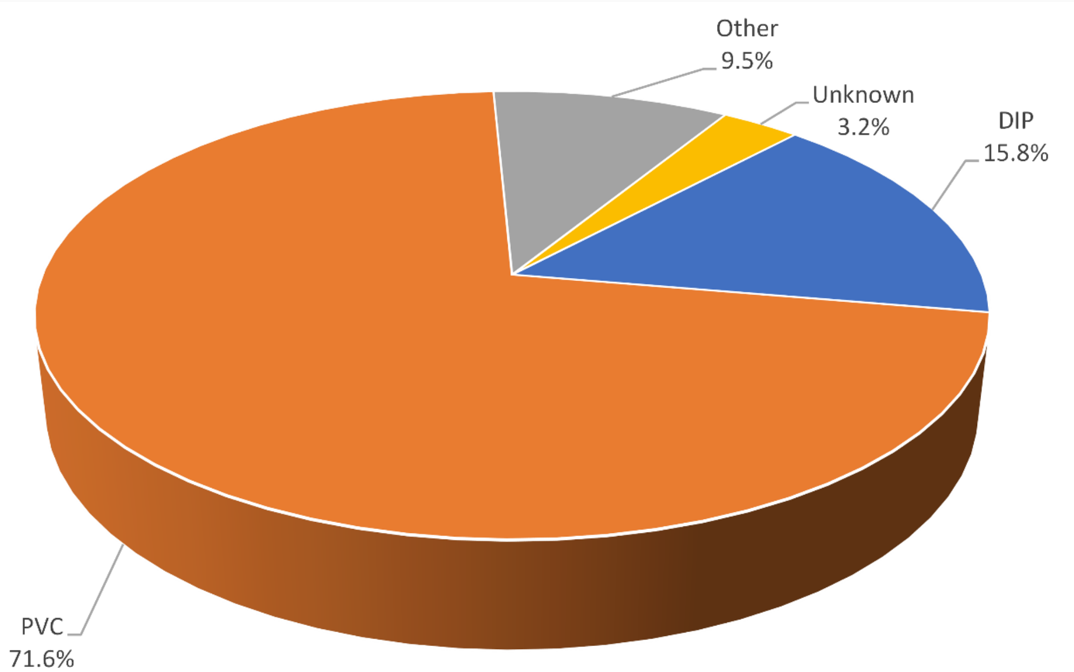

Figure 4.10 Force Main Length Distribution by Material

4.1.3 Lift Stations

The EVMWD currently operates 36 wastewater lift stations within its service area. A summary of the EVMWD existing lift stations is provided in Table 4.7. This table includes the lift station location, capacity, installation year, and the number of pumps. As shown in Table 4.7, the EVMWD lift stations range in capacity from 120 gallons per minute (gpm) to 2,400 gpm.

There are two major groups of lift stations within the Regional Sewershed. These are the "A-Series" and "B-Series" lift stations. There are currently five lift stations within the A Series (A-1 through A-5), which convey flow from the western and northwestern portion of the City of Lake Elsinore to the Regional WRF. These are shown on Figure 4.1. The B Series currently contains 10 lift stations (B-1 through B-10) that convey flow from the eastern and southeastern portion of the City of Lake Elsinore to the Regional WRF. There are also 15 lift stations in the Regional Sewershed that do not belong to the A-Series or B-Series group. Additionally, there are currently six lift stations in the Railroad Canyon Sewershed and two lift stations in the Horsethief Canyon Sewershed.

Table 4.7 Lift Station Summary

Lift Station Name	Installation Year	Firm Capacity (gpm)	Location	Sewershed
A-1	1998	255	17505 Strickland Avenue	Regional
A-2	1992	2,400	31071 Wisconsin Street	Regional
A-3	1970	1,125	77 Lincoln Street & Riverside Drive	Regional
A-4	1997	1,780	32390 Riverside Drive	Regional
A-5	1970	400	32850 Oleander Drive	Regional
Alberhill	2006	120	Lake Street and Alberhill Ranch Road	Regional
B-1	1984	1,400	31702 Mission Trail	Regional
B-2	1984	1,200	32741 Mission Trail	Regional
B-3	1984	1,400	32533 Corydon Street	Regional
B-4	1984	1,200	18566 Grand Avenue	Regional
B-5	1984	1,000	18098 Grand Avenue	Regional
B-6	1984	1,000	17752 Grand Avenue	Regional
B-7	1984	650	32942 Maiden Lane	Regional
B-8	1984	650	17010 Grand Avenue	Regional
B-9	1984	350	32990 Garner Road	Regional
B-10	1984	350	16240 Grand Avenue	Regional
Back Basin	2009	150	18505 Malaga Road	Regional
Big Range	1970	335	29161 Big Range Road	Railroad Canyon
Bolo	1998	200	27017 Bolo Ct	Horsethief Canyon
Canyon Hills	2016	Unknown	36705 Hermosa Drive	Regional
Collier	1990	800	17602 Collier Street	Regional
Continental	2009	2,100	77 Continental Drive	Railroad Canyon
Gray Fox	1993	1,396	22750 Gray Fox Drive	Railroad Canyon
Greer Ranch	2004	350	23696 Clinton Keith Road	Regional
Horsethief	1989	200	26600 Horsethief Canyon Road	Horsethief Canyon
Lighthouse	2007	1,500	22656 Lighthouse Drive	Railroad Canyon
McVicar	1995	1,160	32575 McVicar Street	Regional

Lift Station Name	Installation Year	Firm Capacity (gpm)	Location	Sewershed
New Longhorn	2006	275	30327 Longhorn Drive	Regional
Nichols Road	2012	285	Nichols Road and Coal Avenue	Regional
Robards Way	2001	1,000	23623 Madison Street	Regional
Serena	1986	150	32865 Serena Way	Regional
Stadium Villa	2005	120	1800 Lakeshore Boulevard, Building O	Regional
Summerly Interim	2008	250	18750 Malaga Road	Regional
Tuscany Hills	1991	1,000	2 Villa Ravena	Regional
Vacation	1970	626	28932 Vacation Drive	Railroad Canyon
Village Way	1969	931	22380 Village Way Drive	Railroad Canyon

4.1.4 Sewersheds

A sewershed is defined as a drainage area in which the generated wastewater flow is conveyed to a common outlet point (i.e., an WRF) via a series of gravity sewers and lift stations. The EVMWD existing wastewater collection system is divided into the following four major sewersheds:

- Regional Sewershed.
- Railroad Canyon (Canyon Lake) Sewershed.
- Horsethief Canyon Sewershed.
- Southern Sewershed.

These four sewersheds are shown on Figure 4.11, Figure 4.12, Figure 4.13, and Figure 4.14. Each sewershed is distinguished by the WRF that services that sewershed. The Regional, Railroad Canyon, and Horsethief Sewersheds are serviced by the Regional WRF, Railroad Canyon WRF, and Horsethief Canyon WRF, respectively. The Southern Sewershed conveys flow to the Rancho California Water District (RCWD) collection system and is ultimately treated at RCWD's Santa Rosa WRF. The key characteristics of each sewershed are summarized in Table 4.8.

Table 4.8 Existing Sewershed Summary

Parameter	Regional Sewershed	Horsethief Canyon Sewershed	Railroad Canyon Sewershed	Southern Sewershed	Total
Lift Stations	28	2	6	0	36
Gravity Main (miles)	310.8	18.2	46.2	36.9	412.2
Force Main (miles)	13.4	0.6	2.9	0.0	16.9
Area Served (acres)	56,670	940	2,040	1,510	61,160
Area Served (square miles)	88.5	1.5	3.2	2.4	95.6

Figure 4.11 through Figure 4.14 show detail maps of the Regional, Horsethief Canyon, Railroad Canyon, and Southern Sewershed collection system facilities, respectively.

4.2 WRFs

The EVMWD operates three WRFs within the EVMWD service area. In addition, flow from the Southern Sewershed is treated at the RCWD Santa Rosa WRF. Figure 4.1 shows the locations of the EVMWD-operated WRFs.

4.2.1 Regional WRF

The Regional WRF is located near Lake Elsinore, at Chaney Street and Treleven Road. The Regional WRF treats the majority of flow generated in the service area, and primarily treats flows from the city of Lake Elsinore. The plant was constructed in 1986 with a capacity of 2 million gallons per day (mgd). Several expansions and improvements were completed over the years, and currently the plant has an average flow capacity of 8 mgd and a peak flow capacity of 17.6 mgd. It treats flows using an extended aeration process. Treatment processes used in the Regional WRF include an influent lift station, headworks with bar screens and grit removal, oxidation ditches, clarifiers, filter influent lift stations, tertiary filters, ultraviolet disinfection, and biosolids dewatering. The plant does not have any primary clarification or sludge digestion facilities. Dewatered sludge cake is hauled away for composting and ultimate disposal. EVMWD is currently in the process of implementing reliability and redundancy upgrades to the Regional WRF, as well as upgrading the plant capacity as indicated below:

- Average Influent Flow Capacity: 12 mgd.
- Dry Weather Peak Day Flow Capacity: 14.4 mgd.
- Dry Weather Peak Hour Flow Capacity: 16.3 mgd.
- Peak Wet Weather Flow (PWWF) Capacity: 30 to 32 mgd.

4.2.2 Horsethief Canyon WRF

The Horsethief Canyon WRF, which is located on Shotgun Trail in the northeastern portion of the Horsethief Canyon community, is rated to treat 0.5 mgd, but is currently undergoing an expansion to treat up to 0.8 mgd (average annual flow). The existing oxidation ditch, secondary clarifiers and tertiary filtration will be replaced with a membrane bioreactor (MBR) process including denitrification to remove nitrogen. Influent flows are sent into the headworks consisting of grit channels and a mechanical screening facility. Currently from the headworks, flow enters an oxidation ditch and then to two circular clarifiers. From the clarifiers, the effluent is treated with anthracite-sand filters and finally sent through chlorine contact chambers before being pumped to a reclaimed water storage facility for use in landscape spray irrigation. Excess effluent in low demand wet periods is discharged to a percolation pond. Currently, all waste activated sludge is trucked to the Regional WRF for treatment and disposal. Upon the completion of the plant upgrade and expansion, a sludge dewatering facility using screw presses will become operational and online.

4.2.3 Railroad Canyon WRF

Located near the intersection of Railroad Canyon Road and Old Newport Road, the Railroad Canyon WRF is a scalping plant that services the Canyon Lake area. The average design capacity is currently 1.12 mgd. The Railroad Canyon WRF was constructed in 1984 but has since been expanded in 2005 to meet total inorganic nitrogen (TIN) effluent requirements of 10 milligrams per liter. Improvements to yard piping also took place in 2018 to prepare the facility to receive flows from the Tuscany trunk sewer junction and flow control structure as well as to improve the facility's nitrification and denitrification processes, aeration system, and storage ponds. Waste activated sludge produced by this facility is discharged to the Regional WRF via the Regional WRF's collection system.

4.2.4 RCWD Santa Rosa WRF

The Santa Rosa WRF is operated by the RCWD and is not part of the EVMWD system. The WRF was constructed in 1989 and can treat 5 mgd of wastewater. The WRF employs biological treatment followed by clarification, filtration, and disinfection. The treated effluent is ultimately reused. A portion of the EVMWD collection system discharges to the RCWD collection system and is included in the hydraulic model. However, no analysis of the WRF is part of this Sewer System Master Plan.

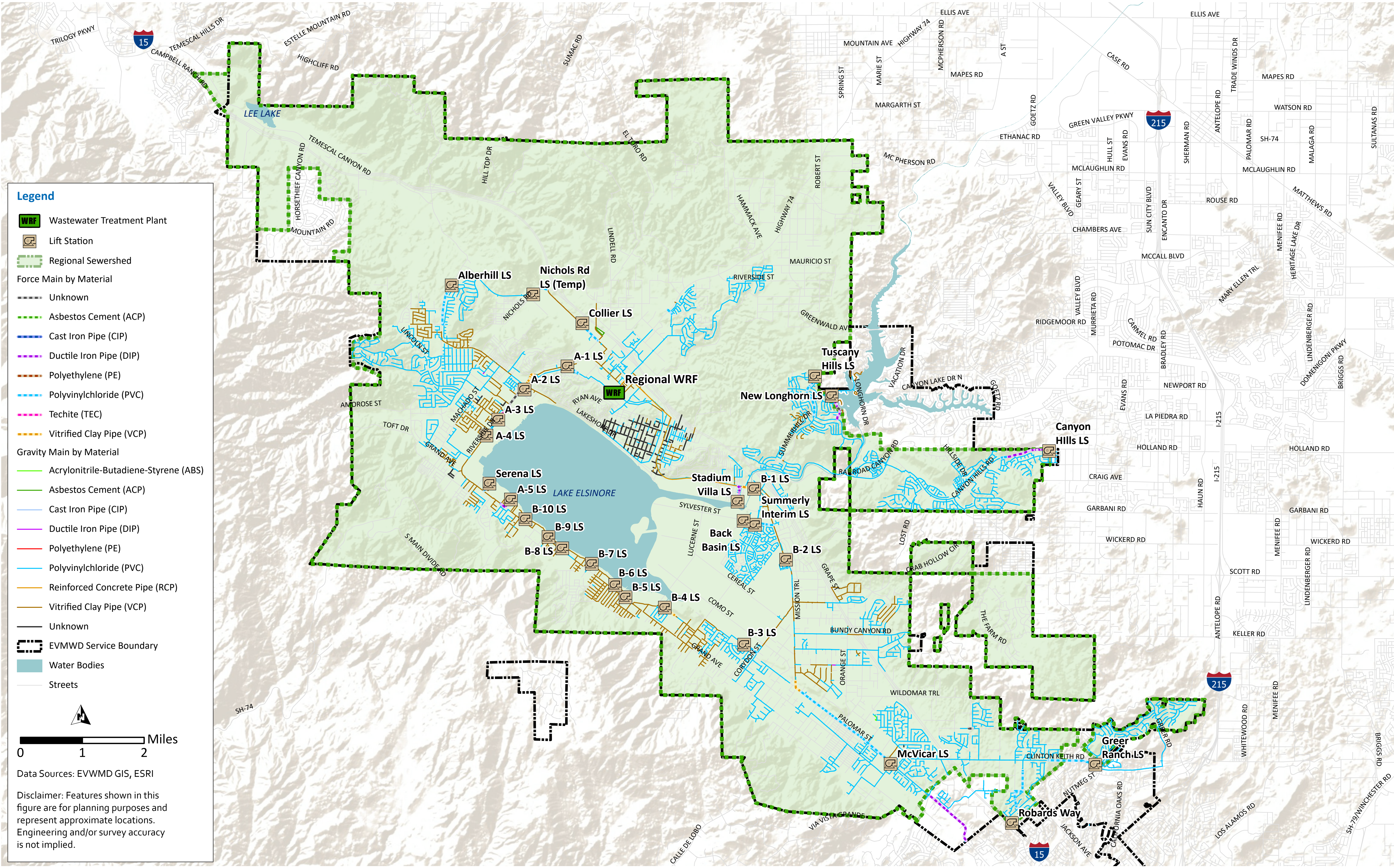

Figure 4.11 Regional Sewershed Facilities

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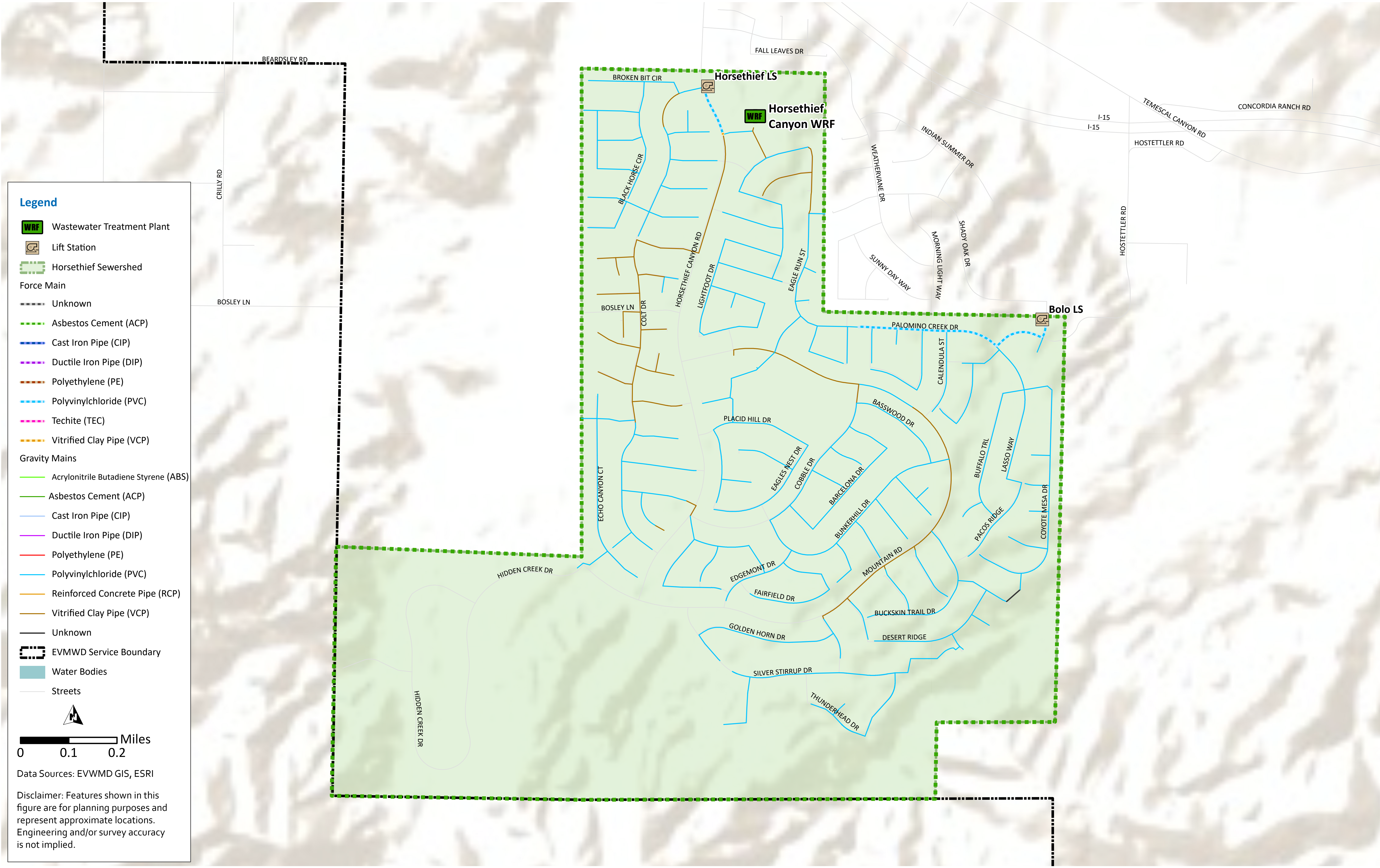

Figure 4.12 Horsethief Canyon Sewershed Facilities

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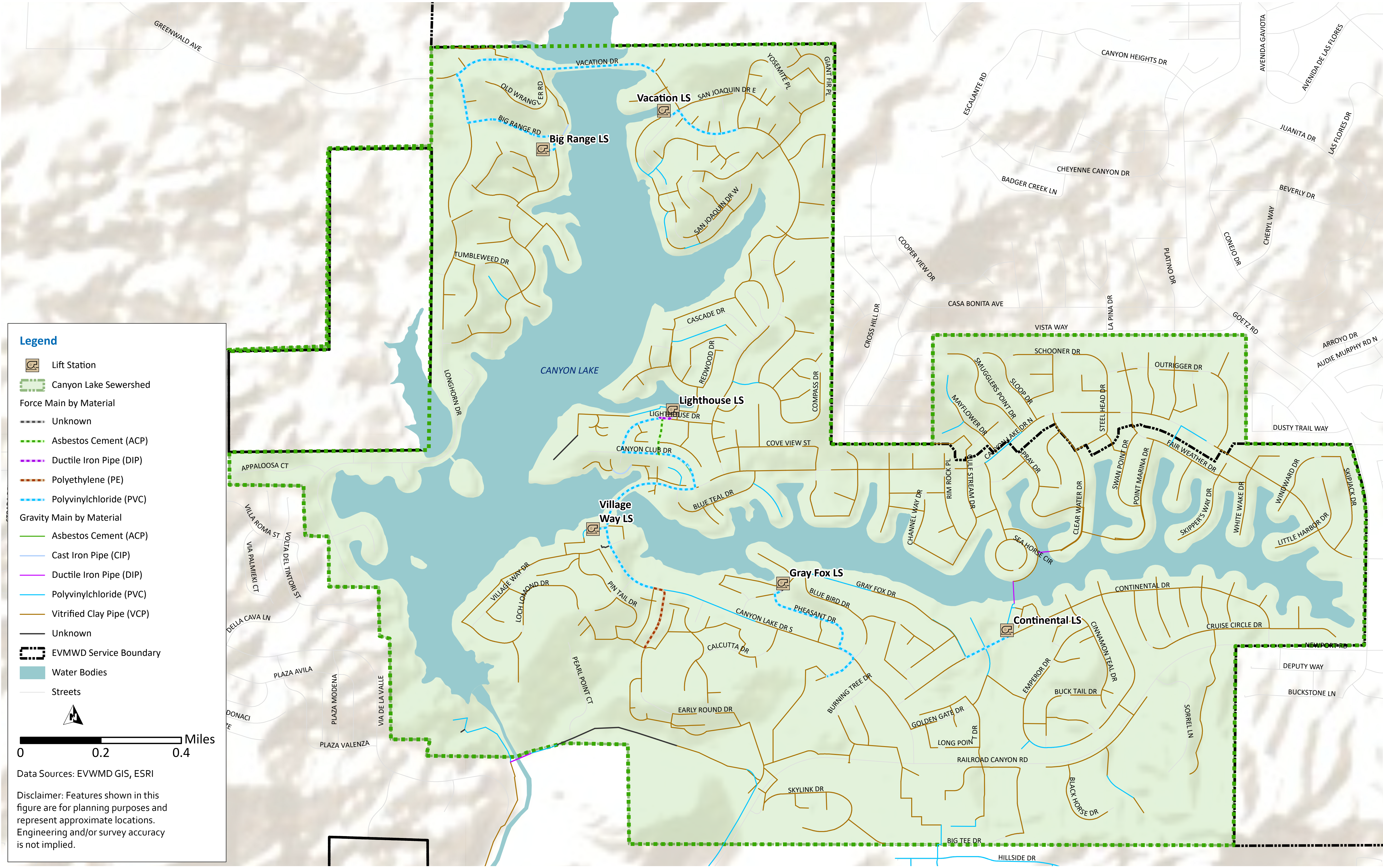

Figure 4.13 Railroad Canyon Sewershed Facilities

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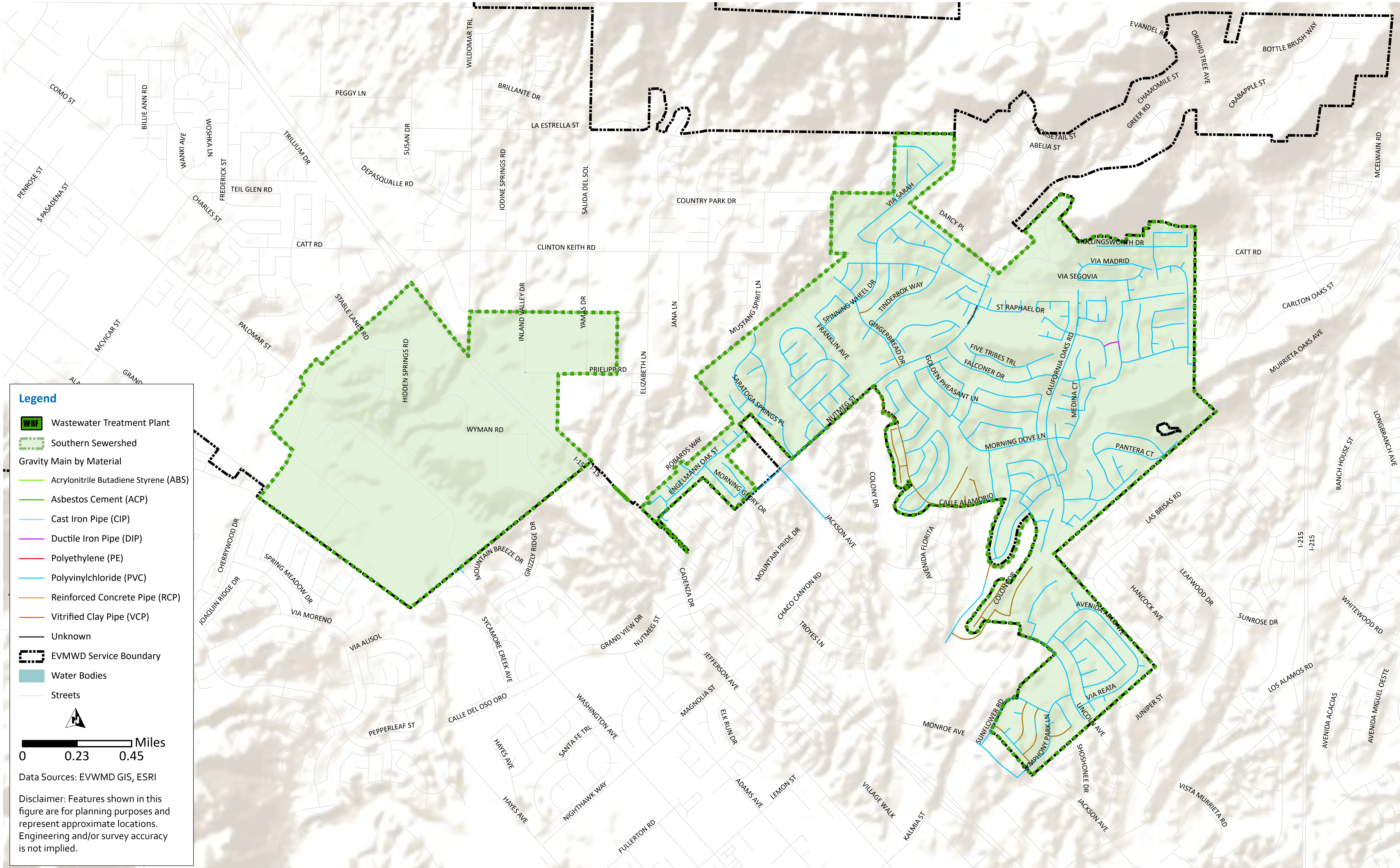

Figure 4.14 Southern Sewershed Facilities

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Chapter 5

SEWER SYSTEM HYDRAULIC MODEL DEVELOPMENT AND CALIBRATION

This chapter describes the steps involved in updating the Elsinore Valley Municipal Water District (EVMWD) model, including data collection, model update, and wastewater flow allocation. The process of creating subsewersheds in the model, which are used in allocating wastewater flow in the existing system and projecting future flows based on land use, is also discussed in this section. This chapter also summarizes the calibration results for both dry and wet weather flow conditions. Appendix I includes additional detail on model construction and calibration.

5.1 Hydraulic Model Development

A sewer collection system model is a simplified representation of the real sewer system. Sewer system models can assess the conveyance capacity for a collection system and can also be used to perform "what if" scenarios to assess the impacts of future developments and land use changes. The collection system hydraulic model was constructed using a multi-step process utilizing data from varying sources. This section summarizes the hydraulic model development process, a description of the modeled collection system, the hydraulic elements and the model review and update process.

5.1.1 Previous Hydraulic Model

EVMWD's previous model was originally created for the November 2008 EVMWD Wastewater Master Plan. As part of the 2016 Sewer System Master Plan, the model was converted to Innovyze's InfoSWMM Suite 12.0 software and updated to include additional infrastructure that had been constructed since 2008.

5.1.2 Software Selection

Innovyze's InfoSWMM Suite 14.5 software was selected to model the EVMWD sewer system for this Sewer System Master Plan (SSMP) Update. InfoSWMM is a fully dynamic geospatial wastewater and stormwater modeling and management software application. The application is fully ArcGIS integrated, which allows for a modeling system that can be fully integrated with geographic information system (GIS) software and permits all the advanced ArcGIS functions to be utilized. InfoSWMM includes several proprietary tools used throughout model development.

It should be noted that Innovyze is planning to sunset the InfoSWMM hydraulic modeling software platform when Esri's ArcMap software application is no longer supported, which is scheduled for 2026. Based on discussions with EVMWD staff, it was agreed that this SSMP Update would continue to utilize Innovyze's InfoSWMM modeling package. During the next round of master plan updates, however, EVWMD should plan on converting their existing hydraulic model to a new software platform.

5.1.3 Data Collection

EVMWD provided detailed information for the update of the model. Key information included:

- 2016 Wastewater Model (InfoSWMM format).
- GIS file of sewer manholes.
- GIS file of gravity mains.
- GIS file of force mains.
- GIS file of lift stations.
- GIS file of parcels.
- Water consumption data by account with septic customers.
- Previous Sewer System Master Plan (2016).
- Drawings of sewer system facilities in design or construction.
- GIS of elevation contours.
- GIS of land use in the service area.
- GIS file of service and sewershed boundaries for each of the water reclamation facility (WRFs) in the EVMWD service area.
- GIS of WRFs.
- Lift station control settings and pump capacity information.

5.1.4 Hydraulic Model Update

One major change in the model developed as part of the SSMP Update versus the 2016 Sewer System Master Plan is that the new hydraulic model has been expanded to an "all-pipe" model rather than the trunk system model (or skeletonized model) that was developed in 2016. GIS data was provided by EVMWD and imported into the model to represent the current wastewater collection system. More detailed information regarding the existing collection system facilities is included in Chapter 4 for reference.

5.1.5 Elements of the Hydraulic Model

The following provides a brief overview of the major elements of the hydraulic model and the required input parameters associated with each:

- Junctions: Sewer manholes, cleanouts, as well as other locations where pipe sizes change or where pipelines intersect are represented by junctions in the hydraulic model. Junctions are also used to represent locations where flows are split or diverted between two or more downstream links. Required inputs for junctions include rim elevation, invert elevation, and surcharge depth (used to represent pressurized systems).

- Pipes: Gravity sewers and force mains are represented as pipes in the hydraulic model. Input parameters for pipes include length, friction factor (e.g., Manning's n for gravity mains, Hazen Williams C for force mains), invert elevations, diameter, and whether or not the pipe is a force main.
- Storage Nodes: For sewer system modeling, storage nodes typically are used to represent lift station wet wells (although other types of storage basins would be modeled as storage nodes). Input parameters for storage nodes include invert elevation, maximum depth, and cross sectional area.
- Pumps: Pumps are included in the hydraulic model as links. Input parameters for pumps include pump curves and operational controls.
- Outfalls: Outfalls represent areas where flow leaves the system. For sewer system modeling, an outfall typically represents the connection to the influent pump station or headworks of a wastewater treatment plant. Input parameters for outfalls include ground elevation and outfall type (free fall, fixed head, etc.).
- Rain Gauges: Rain gauges are input into the hydraulic model to simulate historical or theoretical rainfall events.
- Inflows: The following are the three types of wastewater flow sources that can be applied to individual model junctions (and storage nodes):
  - Dry Weather: Dry weather inflows simulate base sanitary wastewater flows and represent the average flow. The dry weather flows (DWFs) can be multiplied by up to four patterns that vary the flow by month, day, hour, and day of the week (e.g., weekday or weekend). The dry weather diurnal patterns are adjusted during the dry weather calibration process.
  - External: External inflows can represent any number of flows into the collection system, such as backwash flow from a wellhead treatment facility. Typically, external inflows are used for loads other than base sanitary flows. External inflows are applied to a specific model junction by applying a baseline flow value and a pattern that varies the flow by hour, day, or month of the year. This option was used to simulate future infiltration and inflow (I/I).
  - Rainfall Derived Infiltration and Inflow (RDII): RDII flows are applied in the model by assigning a unit hydrograph and a corresponding tributary area to a given junction. The unit hydrographs consist of several parameters that are used to adjust the volume of RDII that enters the system at a given location. These parameters are adjusted during the wet weather calibration process.

5.1.6 Wastewater Load Allocation

Determining the quantity of dry weather wastewater flows generated by a municipality and how they are distributed throughout the collection system is an important component of the hydraulic modeling process. Various techniques can be used to assign wastewater flows to individual model junctions, depending on the type of data that is available. Adequate estimates of the volume of wastewater are important in maintaining and sizing wastewater collection system facilities, both for existing and future conditions. Baseline wastewater flows were allocated (assigned to specific nodes) in the hydraulic model based on parcels with water billing data provided by District and wastewater flow factors developed by Carollo Engineers, Inc. Wastewater RTS ratios were calculated for general land use classifications and applied with water billing data to determine wastewater contribution. RTS ratios used in this Master Plan can be found in Figure 3.6. The following steps outline the wastewater load allocation process:

- Step 1: EVMWD's sewer service area was broken up into individual loading polygon areas. Each loading polygon represents the geographic area that contributes flows into a single model node (i.e., manhole). Sewersheds were developed using GIS, based on EVMWD's parcel and sewer pipeline shapefiles. The polygons were developed on a parcel level.
- Step 2: Geocoded water billing data were used in conjunction with the loading polygons discussed in step one to allocate DWFs into the hydraulic model. January/February 2021 water consumption data were used to allocate sewer flows into the model. This method is widely considered to be the most accurate method of allocating base wastewater flows into collection system models.
- Step 3: The allocated loads were adjusted as necessary during the DWF calibration process to closely match the actual measured DWFs recorded during the flow monitoring period (see Chapter 3).

5.2 Hydraulic Model Calibration

Hydraulic model calibration is a crucial component of the hydraulic modeling effort. Calibrating the model to match data collected during the flow monitoring program provides confidence in the modeling results. The calibration process consists of calibrating to both dry and wet weather conditions. This section summarizes the overall methodology employed to calibrate EVMWD's wastewater collection system hydraulic model and the calibration results, including a detailed description of each of the major components of the model calibration process.

For this project, a temporary flow monitoring program was conducted at 34 flowmeter sites from February 22, 2022 through May 22, 2022. DWF calibration provides an accurate depiction of base wastewater flow generated within the study area. The wet weather flow (WWF) calibration consists of calibrating the hydraulic model to a specific storm event(s) to accurately simulate the peak and total I/I volume entering the sewer system. The amount of I/I is essentially the difference between the WWF and DWF components.

5.2.1 Calibration Standards

The hydraulic model was calibrated in accordance with international modeling standards. The Wastewater Planning Users Group (WaPUG), a section of the Chartered Institution of Water and Environmental Management, has established generally agreed upon principles for model verification. The dry weather and wet weather calibration focused on meeting the recommendations on model verification contained in the "Code of Practice for the Hydraulic Modeling of Sewer Systems," published by the WaPUG (WaPUG 2002), as summarized below:

- Dry Weather Calibration Standards: Dry weather calibration should be carried out for two dry weather days and the modeled flows and depths should be compared to the field measured flows and depths. Both the modeled and field measured flow hydrographs should closely follow each other in both shape and magnitude.
  In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:
  - The timing of flow peaks and troughs should be within 1 hour.
  - The peak flow rate should be within the range of ±10 percent.
  - The volume of flow (or the average rate of flow) should be within the range of ±10 percent. If applicable, care should be taken to exclude periods of missing or inaccurate data.
- Wet Weather Calibration Standards: The model simulated flows should be compared to the field measured flows. The flow hydrographs for both events should closely follow each other in both shape and magnitude, until the flow has substantially returned to DWF rates. In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:
  - The timing of the peaks and troughs should be similar with regard to the duration of the events.
  - The peak flow rates at significant peaks should be in the range of +25 percent to -15 percent and should be generally similar throughout.
  - The volume of flow (or the average flow rate) should be within the range of +20 percent to -10 percent.

WaPUG does not specify standards for level and velocity calibration.

5.2.2 Dry Weather Calibration

The DWF calibration process consists of several elements, as outlined below:

- Divide the system into areas tributary to each flowmeter. The first step in the calibration process was to divide EVMWD's sewer service area into flowmeter tributary areas, one for each flow monitoring site. A map showing the locations of each flow monitoring site is provided in Chapter 3 along with a schematic of the flowmeters.
- Define flow volumes within each area. The next step was to define the flow volumes within each area, which was accomplished in the flow allocation step during model developing.
- Create diurnal patterns to match the temporal distribution of flow. A diurnal curve is a pattern of hourly multipliers that are applied to the base flow to simulate the variation in flow that occurs throughout the day. Two diurnal curves were developed for each flow monitoring tributary area, one representing weekday flow and one representing weekend flow. The diurnal patterns were initially developed based on the flow monitoring data and adjusted as part of the calibration process until the model simulated flows matched the field measured flows as closely as possible. Figure 5.1 shows the calibrated weekday and weekend diurnal pattern for Site 12. Additional diurnal patterns were developed for all flowmeter tributary areas, and are included in the DWF calibration sheets, provided in Appendix B.
- Adjust model variables to match field measured velocity and flow depths. Once the model simulated flows acceptably matched the field measured flows, the model simulated velocity and flow depth were compared to the field measured velocity and flow depth. Adjustments were made to various model parameters until the modeled and measured velocity and depth closely matched one another. The primary adjusted parameters for this process are pipeline roughness (Manning's n) and sediment buildup in the pipe, although other parameters can also be adjusted as calibration results are generated.
  - Manning's roughness coefficients, or n values, have industry accepted ranges based on several variables. Roughness coefficients increase over time depending on the construction methods, installation quality, system maintenance, and other environmental factors. There can be certain factors within EVMWD's collection system that can result in roughness coefficients that differ from the typical range. For example, pipeline bellies, joint misalignment, cracks, and debris (e.g., root intrusion, etc.) lead to increased turbulence in a pipe, as well as the apparent Manning's n factor. In general, the model simulated roughness coefficients were

initially set to a typical value of 0.013 and then adjusted within a specified range (typically 0.01 to 0.02).

- If the model is unable to reasonably match the field measured flow depth and velocity without leaving the acceptable range of manning's roughness coefficients, further investigation is needed to help determine the cause of the discrepancy. Some issues that could cause such a discrepancy can include errors in the slope or diameter of a pipeline, downstream blockages, pipeline sags, and, in some cases, influences from downstream lift station operations.

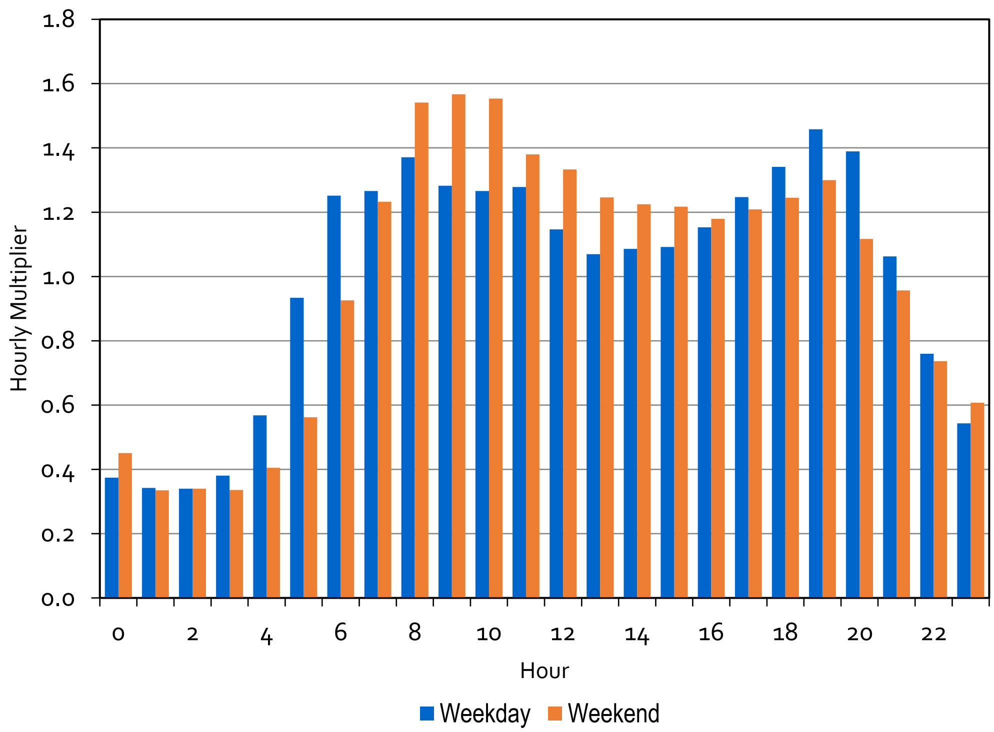


Figure 5.1 Example Weekday and Weekend Diurnal Patterns (Site 12)

Figure 5.2 is an example DWF calibration sheet for flowmeter Site 12. Calibration sheets provide graphs and tables that compare model results with the field measured flow, velocity, and level during the calibration period. Appendix B contains detailed DWF calibrations sheets for all meter locations. The model simulated measured flows for weekday and weekend DWF were all within 10 percent with the exception of site 11. Site 11 is downstream of a diversion structure, modeled using as-built drawings, intended to divert flows away from site 11 and towards site 9. The modeled flow was low compared to the measured flow, but the flows at site 11 are relatively low and don't impact the model calibration in a significant way. The flows at site 11 are 0.06 and 0.02 million gallons per day for measured and modeled flow, respectively.

As shown in Appendix B, the model simulated levels and velocities matched well compared to the field measured data. The modeled levels/velocities in a few sites (2, 6, 11, 19, and 22) differed somewhat from the measured data. Further investigation into these sites, including a detailed review of as-built drawings, operational records, etc. could help to further refine the modeling results for these sites.

Aside from the few discrepancies noted above, the hydraulic model met the established dry weather calibration standards and accurately simulates DWF conditions. Therefore, the model is considered calibrated for DWF conditions.

5.2.3 Wet Weather Flow Calibration

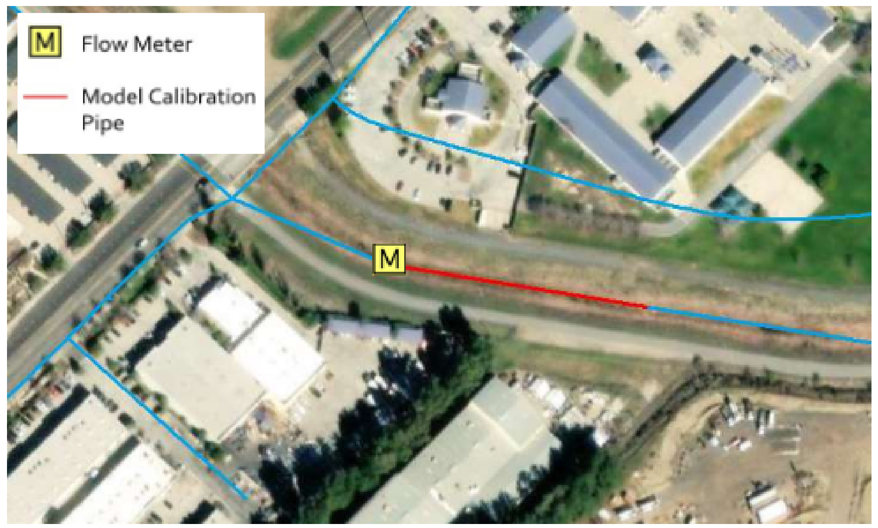
The wet weather calibration enables the hydraulic model to accurately simulate I/I entering the collection system during a historical rainfall event. As outlined below, the WWF calibration process consists of several elements:

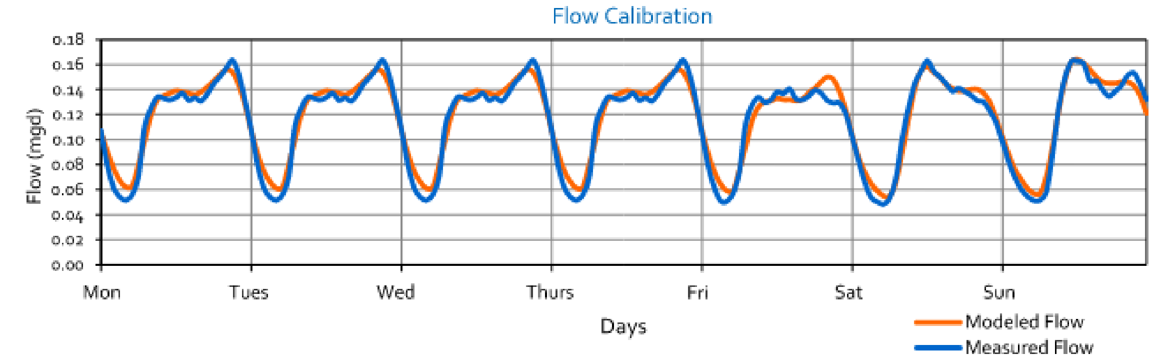
- Identify calibration rainfall events. For this project, the WWF calibration process consists of running model simulations of a historical rainfall event. The goal of any WWF calibration is to capture and characterize a system's response to a significant rainfall event, preferably during wet antecedent moisture conditions. The most significant wet weather event captured during the flow monitoring program occurred on March 29, 2022.
- Define RDII tributary areas. For the WWF calibration, RDII flows are superimposed on top of the DWF. The model calculates RDII by assigning "RDII Inflows" to each node in the model. RDII inflows consist of both a unit hydrograph and the total area that is tributary to the model node. The RDII tributary areas were calculated in GIS using the area of developed parcels within each sewershed. The tributary area provides a means to transform hourly rainfall depth from the rainfall hyetographs into a rainfall volume. The rainfall volume is transformed into actual RDII flows using the unit hydrograph, as described in the next step.
- Create I/I parameter database and modify to match field measured flows. The main step in the WWF calibration process involved creating a custom unit hydrograph for the service area using the "RTK Method," which is widely used in collection system master planning. Using the RTK Method, the RDII unit hydrograph is the summation of three separate triangular hydrographs (short term, medium term, and long term), which are each defined by three parameters: R, T, and K. R represents the fraction of rainfall over the sewer basin that enters the collection system; T represents the time to peak of the of the hydrograph; and K represents the ratio of time to recession to the time to peak. Therefore, there are a total of nine separate variables associated with a unit hydrograph. Figure 5.3 shows an example unit hydrograph.

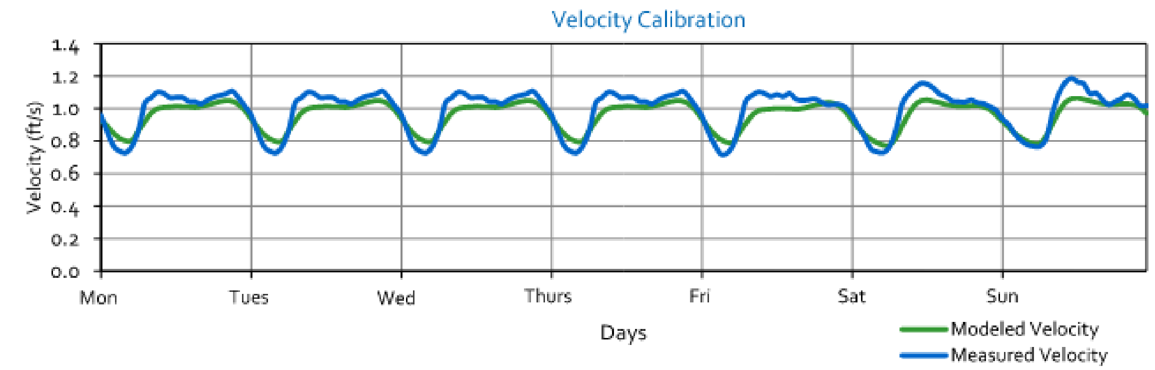
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

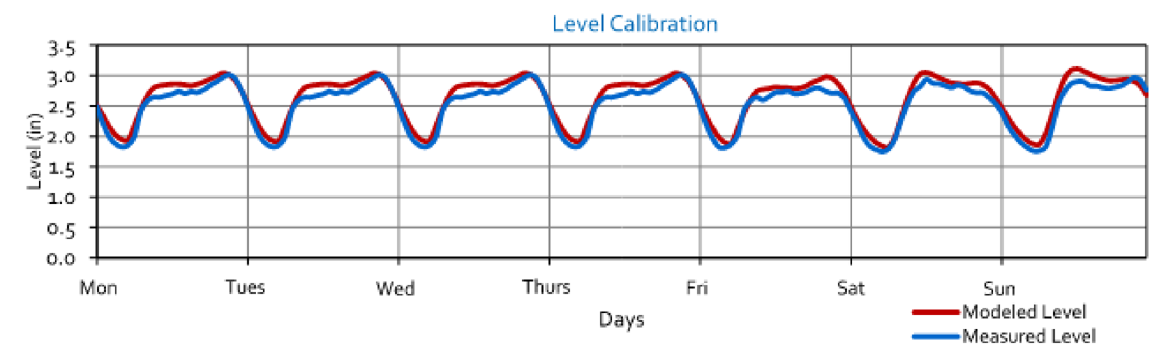
Flow Monitoring Site 12, Dry Weather Flow Calibration
Location: Easement off Chaney St
Pipeline Diameter: 24"
City Manhole ID: Easement off Chaney St
Model Pipe ID: GM-1665

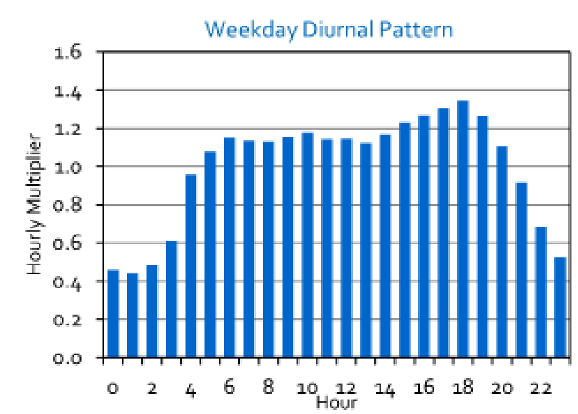
Flow Monitor Location

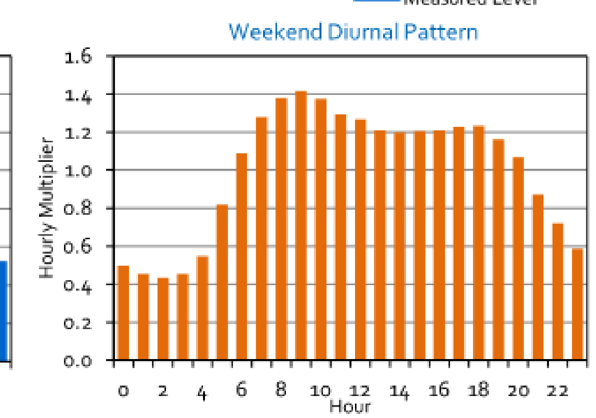












Model Calibration Summary

Day	Measured Data[1]				Modeled Data				Percent Error[3]			
	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Tues.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Wed.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Thur.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Fri.	0.11	0.14	2.5	0.99	0.12	0.15	2.6	0.95	1.9%	6.7%	4.4%	-3.5%
Sat.	0.11	0.16	2.5	0.98	0.11	0.16	2.6	0.95	1.5%	-3.2%	4.1%	-3.7%
Sun.	0.12	0.16	2.5	1.00	0.12	0.16	2.6	0.96	2.2%	0.9%	4.8%	-3.7%
Summary												
Weekday	0.12	--	2.5	0.99	0.12	--	2.6	0.96	2.0%	--	4.1%	-3.0%
Weekend	0.11	--	2.5	0.99	0.12	--	2.6	0.95	1.8%	--	4.5%	-3.7%
ADWF[4]	0.12	--	2.5	0.99	0.12	--	2.6	0.96	2.0%	--	4.2%	-3.2%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Figure 5.2 Example Weekday and Weekend Average DWF Diurnal Patterns (Site 12)

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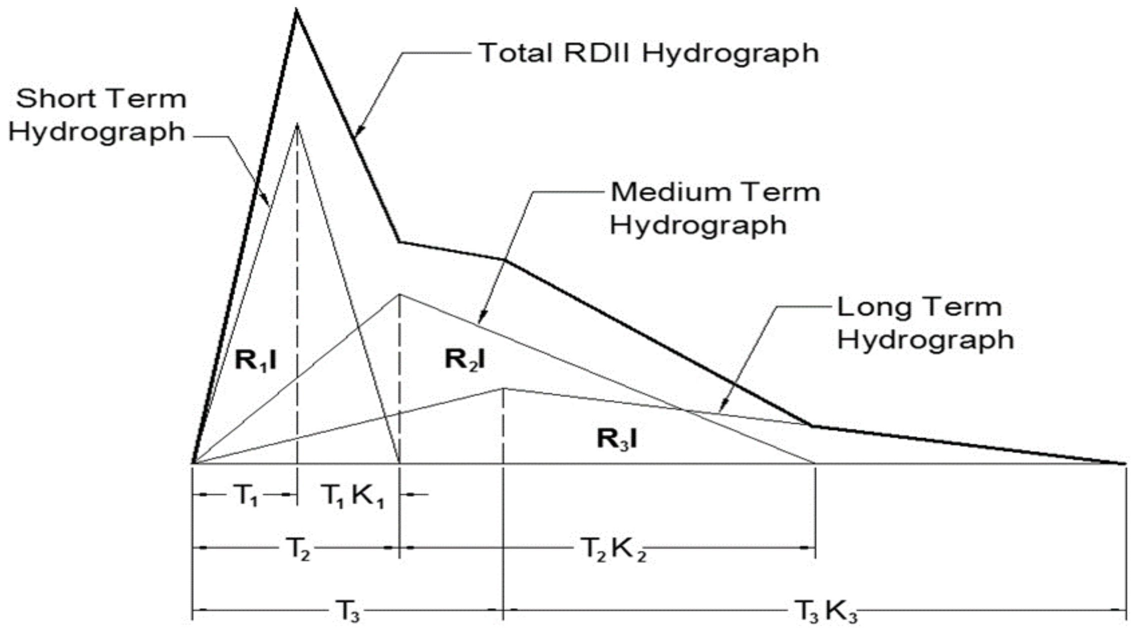

Figure 5.3 Example RDII Unit Hydrograph

The hydrograph utilizes the R-values (percent of rainfall that enters the collection system) calculated for each flowmeter basin to simulate I/I. The nine variables in each unit hydrograph were initially set based on engineering judgment and then adjusted until the model simulated flows (both peak flows and average flows) matched closely with the field measured flows.

As with the dry weather calibration, the wet weather calibration process compared the measured flow, velocity, and level data with the model output. Comparisons were made for average and peak flows as well as the temporal distribution of flow until flows returned to their baseline levels.

Figure 5.4 is an example WWF calibration sheet for flowmeter Site 12. The WWF calibration sheets show figures comparing the measured data and model results for flow, velocity, and level in response to the March 2022 rain event. The WWF calibrations sheets for all sites are provided in Appendix B. There is good correlation between the model-simulated flows and the flows that were measured at each flowmeter location. The velocity and level discrepancies noted in the DWF calibration also translated to the WWF calibration, but overall, the model accurately simulated the effects of wet weather events and was considered calibrated and ready to use for capacity analysis purposes.

5.2.4 Collection System Hydraulic Model Calibration Summary

In summary, the calibration results indicate that the model predicts conditions like those observed in the field. Based on the results presented in this chapter, it can be concluded that the model is calibrated to dry and wet weather flow conditions. The model provides an accurate representation of EVMWD's wastewater collection system to a level suitable for this Master Plan and for EVMWD's future hydraulic modeling needs.

5.2.5 Additional Model Calibration Efforts

As noted in Chapter 3, V&A Consulting Engineers conducted a supplemental flow monitoring effort in the Southern Sewershed to further refine the I/I response in this area and to develop recommendations to reduce the rates of I/I observed in the system. The data obtained from the 2022-23 wet weather season flow monitoring effort was utilized to further refine the wet weather calibration in the Southern Sewershed, however, the majority of the system (Regional, Railroad Canyon, and Horsethief) were not monitored as part of the 2022-23 wet weather flow monitoring effort.

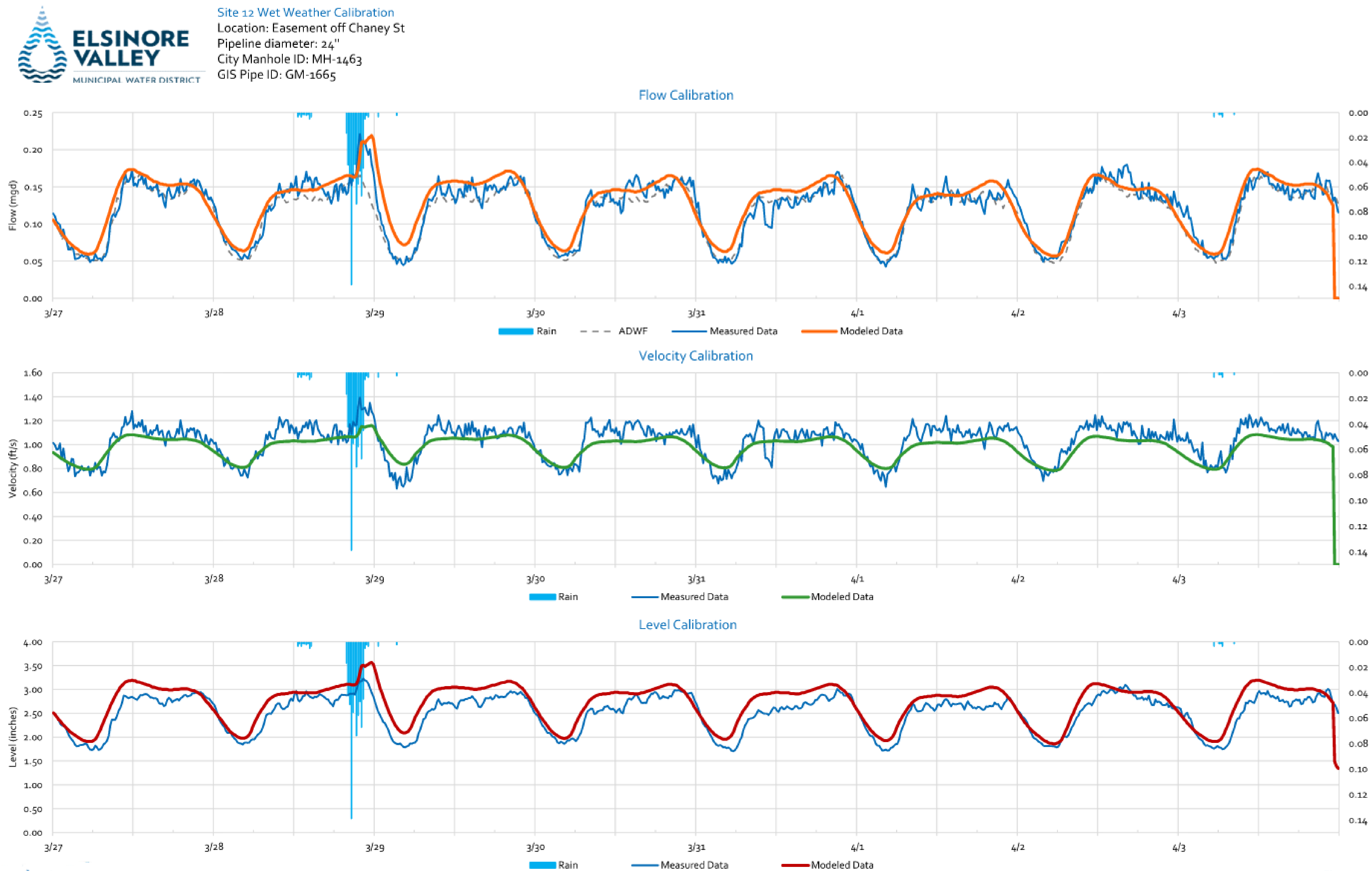

Figure 5.4 Example Wet Weather Flow Monitoring Calibration (Site 12)

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Chapter 6

PLANNING AND EVALUATION CRITERIA

This chapter presents the design criteria and methodologies for analysis used to evaluate the existing collection system and its facilities, and to size future improvements.

6.1 Design Criteria

Planning criteria are established for the evaluation of the Elsinore Valley Municipal Water District (EVMWD) sewer collection system. The criteria are developed using the typical planning criteria used in the systems of similar utilities, local codes, engineering judgment, and commonly accepted industry standards. The "industry standards" are typically ranges of values that are acceptable for the criteria in question and, therefore, are used more as a check to confirm that the values being developed are reasonable.

Deviations from the recommended guidelines may be necessary in defining specific improvement projects for an existing sewer collection system due to the restrictions posed by existing upstream and downstream conditions. In these special circumstances, design criteria will need to be determined on a case-by-case basis.

6.2 Recommended Design Criteria for Gravity Sewers

This section provides recommended design criteria for sewer mains in the EVMWD system.

6.2.1 Peak Design Flow

It is recommended that the EVMWD sewer system be capable of conveying the greater of either the peak dry weather flow (PDWF) or peak wet weather flow (PWWF) condition based on the varying criteria for both conditions described in Section 6.2.4. The criteria used to develop PDWF and PWWF estimates are described in detail in Chapter 3 - Wastewater Flow Projections.

6.2.2 Coefficients of Pipe Friction

A Manning's 'n' value of 0.013 will be used to analyze hydraulic conditions in gravity sewers for all pipe materials in the EVMWD system. This value is typical for sanitary sewer systems with similar materials and pipe sizes as the EVMWD collection system. If instances of sediment deposition, obstructions or other impeding factors are known, a higher value will be used to represent those conditions. Similar to the selected Manning's value, a Hazen-William's "C" factor of 120 will be used to analyze hydraulic conditions for all force mains in the system.

6.2.3 Minimum Collection Sewer Size

No sewer shall be less than 8 inches in diameter.

6.2.4 Flow Depth Ratio (d/D)

Sewer systems are designed to have a maximum flow depth to pipe diameter (d/D) ratio under the peak design flow condition. The d/D ratios recommended for the sewer conveyance system vary for existing sewers and new/proposed sewers, as indicated below:

- New/Proposed Sewers:
  - Maximum d/D ratio for all sewers that are less than 18 inches in diameter shall be 0.50 under all peak flow conditions.
  - Maximum d/D ratio for all sewers that are greater than or equal to 18 inches in diameter shall be 0.75 under all peak flow conditions.
- Existing Sewers:
  - Maximum d/D ratio for all sewers under PDWF conditions shall be 0.75.
  - Maximum d/D ratio for all sewers under PWWF conditions shall be 0.92.

6.2.5 Slopes and Velocity

To minimize potential for grit and debris accumulation in the conveyance system, all trunk and collector sewers shall be designed with hydraulic slopes sufficient to result in mean velocities at the annual dry weather flow (ADWF) of not less than 2 feet per second (fps). To minimize potential for scouring and pipe erosion, the maximum allowable velocity in the sewer shall not be greater than 10 fps. Table 6.1 summarizes the recommended pipe diameters from EVMWD's standard design requirements.

Table 6.1 Minimum Pipe Slope

Sewer Size (inches)	Minimum Pipe Slope (feet/feet)
6	0.0100
8	0.0040
10	0.0032
12	0.0024
15	0.0015
18	0.0012
21	0.0009
24	0.0008
27	0.0006

6.2.6 Manholes

Manholes shall be installed on sewers at all changes in slope, size of pipe, changes in vertical or horizontal alignment and at all intersections of main line sewers. The EVMWD has indicated the maximum spacing allowable between manholes is 500 feet unless otherwise approved. The average friction loss for manholes should be 0.1 foot, while the peak loss through a manhole should not exceed 0.5 foot, as listed in Table 6.2.

Table 6.2 Gravity Sewer Design Criteria

Design Criteria	Value
Per-Capita Flow	
Flow Generation Rate	Based on Population and Land Use
Velocity	
Minimum Velocity	2 fps
Maximum Velocity	10 fps
d/D Ratio	
For all Sewers That are Less Than 18 Inches in Diameter	0.5
For all Sewers That are Greater Than or Equal to 18 inches in Diameter	0.75
Manning's n (Gravity Mains)	0.013
Hazen-Williams C-factor (Force Mains)	120
Average Manhole Friction Head Losses	0.1 feet
Peak Manhole Friction Head Losses	0.5 feet

6.3 Recommended Design Criteria for Special Projects

In addition to the recommended design criteria for gravity sewers, the recommended design criteria for non-gravity sewer improvement projects are discussed in this section. Special projects are defined in this master plan as projects other than gravity mains, and include such facilities as lift stations, force mains, weirs, etc. Recommended design criteria for special projects are summarized in Table 6.3.

Table 6.3 Design Criteria for Specific Projects

Item	Recommended Value
Lift Stations and Force Mains	• Lift stations and force mains will be avoided whenever possible. • ADWF (existing conditions) velocity = 3.0 fps minimum. • Hazen-William's "C" factor of 120 will be used to analyze hydraulic conditions for all force mains in the system. • Force mains shall be sized to provide a design velocity no less than 4 fps with all pumps running and 2.5 fps during normal operations. • Maximum velocity shall be 7 fps.
Diversion Structures	• New diversion structures will be avoided whenever possible. • Maintain existing diversion structures open with no control setting whenever possible. • If a gate/stop-log setting is required for a diversion structure, maintain a fixed setting for all flow conditions whenever possible.

Chapter 7

EXISTING SYSTEM CAPACITY ANALYSIS

This chapter summarizes the results of the model predicted performance evaluation of the Elsinore Valley Municipal Water District (EVMWD) collection system under existing peak flow condition based on the performance criteria described in Chapter 6. The results of the future system capacity analysis, and the recommended capital improvements to address existing and future system deficiencies, are provided in Chapter 8.

7.1 Existing Sewer System Capacity Analysis

The existing sewer analysis involved identifying areas within the collection system where pipe capacity is inadequate to convey design flows. Sewers that lack sufficient capacity create bottlenecks in the system and potentially contribute to sanitary sewer overflows. EVMWD's sewer system was evaluated with a hydraulic computer model which was calibrated for dry and wet weather flow conditions against flow monitoring data collected in early 2022, as described in Chapter 5. The calibrated hydraulic model provides a platform for effectively identifying and managing capacity deficiencies within the sewer system.

This section discusses the locations of hydraulic deficiencies resulting from flows exceeding the maximum allowable flow depth criteria. The system evaluation was performed under peak dry and wet weather flow conditions. The peak wet weather flow (PWWF), or design flow, was evaluated by routing a 10-year, 24-hour design storm through the model and identifying capacity deficiencies based on the evaluation criteria established in Chapter 6.

7.1.1 Existing Gravity System Capacity Analysis

In accordance with the established flow depth criteria for existing sewers, pipelines with a maximum flow depth to pipe diameter (d/D) ratio greater than 0.75 under peak dry weather flow (PDWF) conditions were flagged. Figure 7.1 shows the locations of gravity sewers with a maximum d/D greater than 0.75.

Similarly, the model was run under PWWF conditions to identify pipelines exceeding the maximum allowable d/D ratio of 0.92. It is important to understand, however, that not all of the existing pipelines with a d/D greater than 0.92 under PWWF conditions are necessarily capacity deficient. In some cases, a surcharged condition within a given pipeline segment is due to backwater effects created by a downstream bottleneck (i.e., upstream surcharging is caused by downstream pipeline deficiencies). These capacity deficient sewers are shown on Figure 7.2.

Table 7.1 provides a summary of the number and length of capacity deficiencies that were identified. As shown in Table 7.1, the system generally performs well under existing PDWF conditions, with 1.9 miles of pipelines being flagged as exceeding the established d/D criteria of 0.75. Under PWWF conditions, the length of gravity mains flagged increased to 4 miles.

Table 7.1 Existing Gravity Main Evaluation Summary

Flow Condition/Criteria	Number of Deficient Pipes	Length of Deficient Pipes (miles)	Percent of System, by Length(1)
Existing PDWF, d/D>0.75	38	1.9	0.5-percent
Existing PWWF, d/D>0.92(1)	75	4.0	1.0-percent

Notes:
(1) Lengths presented exclude backwater pipelines (i.e., pipelines that are not actually capacity deficient).

The most significant capacity limitations noted on the existing trunk sewer were located on Mission Trail between the McVicar Lift Station force main discharge and the B-1 Lift Station. This reach of pipeline was also flagged in the 2016 Sewer Master Plan. Gravity main surcharging along Mission Trail is a result of flows from the B-3 Lift Station and McVicar Lift Station converging at the intersection of Corydon Road and Mission Trail. The hydraulic profile downstream of the intersection becomes surcharged in PWWF conditions. As the areas tributary and upstream to the B-3 and McVicar Lift Stations grow, the capacity issue will be exacerbated. Multiple Capital Improvement Plan (CIP) projects are proposed in Chapter 9 to reduce gravity pipe surcharging along Mission Trail by diverting flow at multiple locations before and after the Corydon Road intersection. The most significant CIP project intended to deal with this is the Diamond Regional Lift Station; this lift station will divert flow away from Mission Trail and B-1 Lift Station.

The next most significant deficiency was identified on Riverside Drive upstream of the A-4 Lift Station. This reach of pipeline was also flagged in the 2016 Sewer Master Plan. This section of 10-inch gravity pipe is currently undersized and will continue to be surcharged in PWWF conditions as growth in the area continues. Future CIP projects detailed in Chapter 9 include diverting the B-9 and B-10 Lift Stations into the A-Train, which would cause further surcharging in this location. Projects to upsize this section of gravity pipe can be seen in Chapter 9.

Other relatively minor capacity deficiencies were flagged throughout the collection system and are a result of isolated capacity limitations. Hydraulic grade line plots for the capacity deficient sewers are provided in Appendix C for reference.

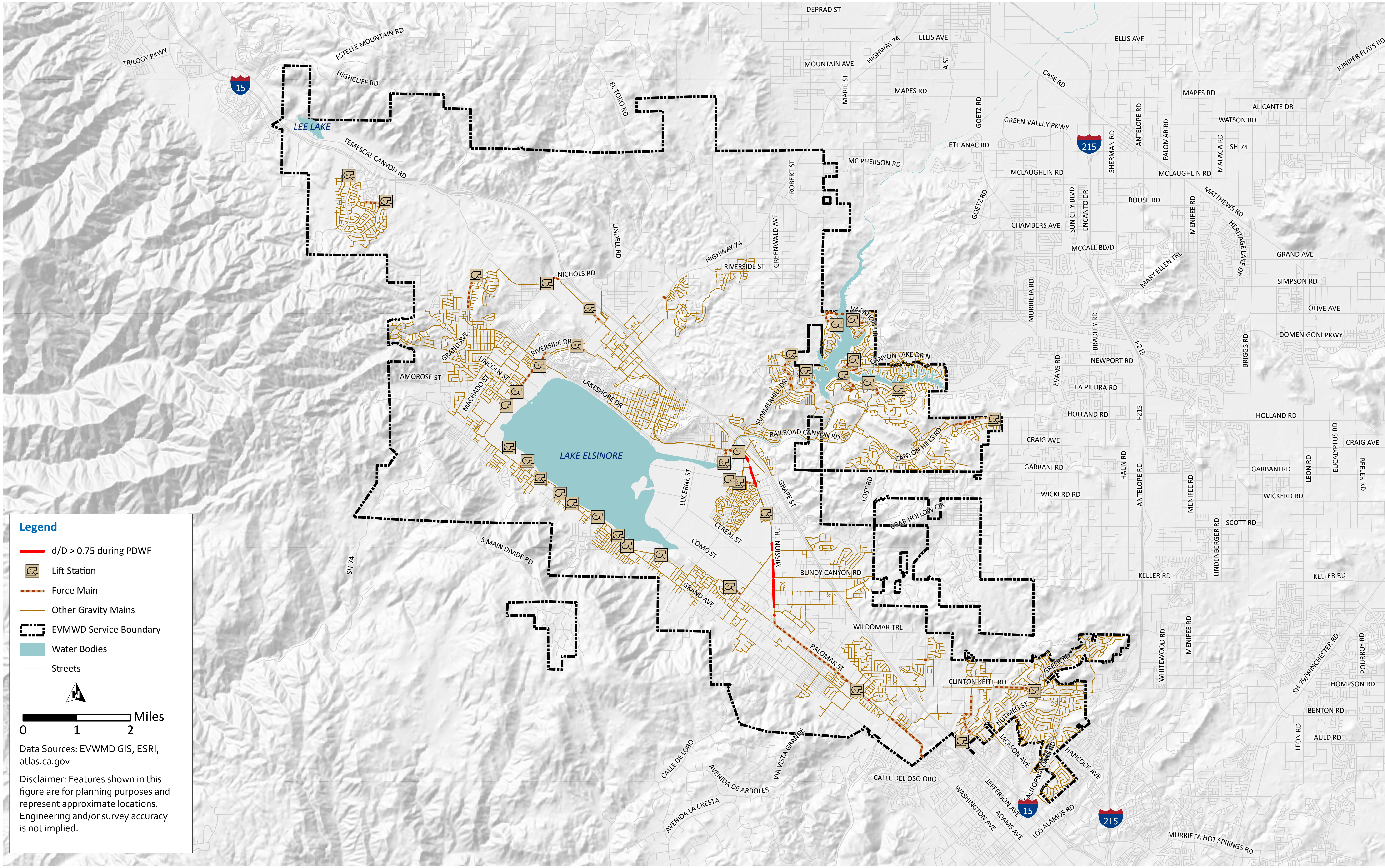

Figure 7.1 Existing Gravity Main PDWF Evaluation Results

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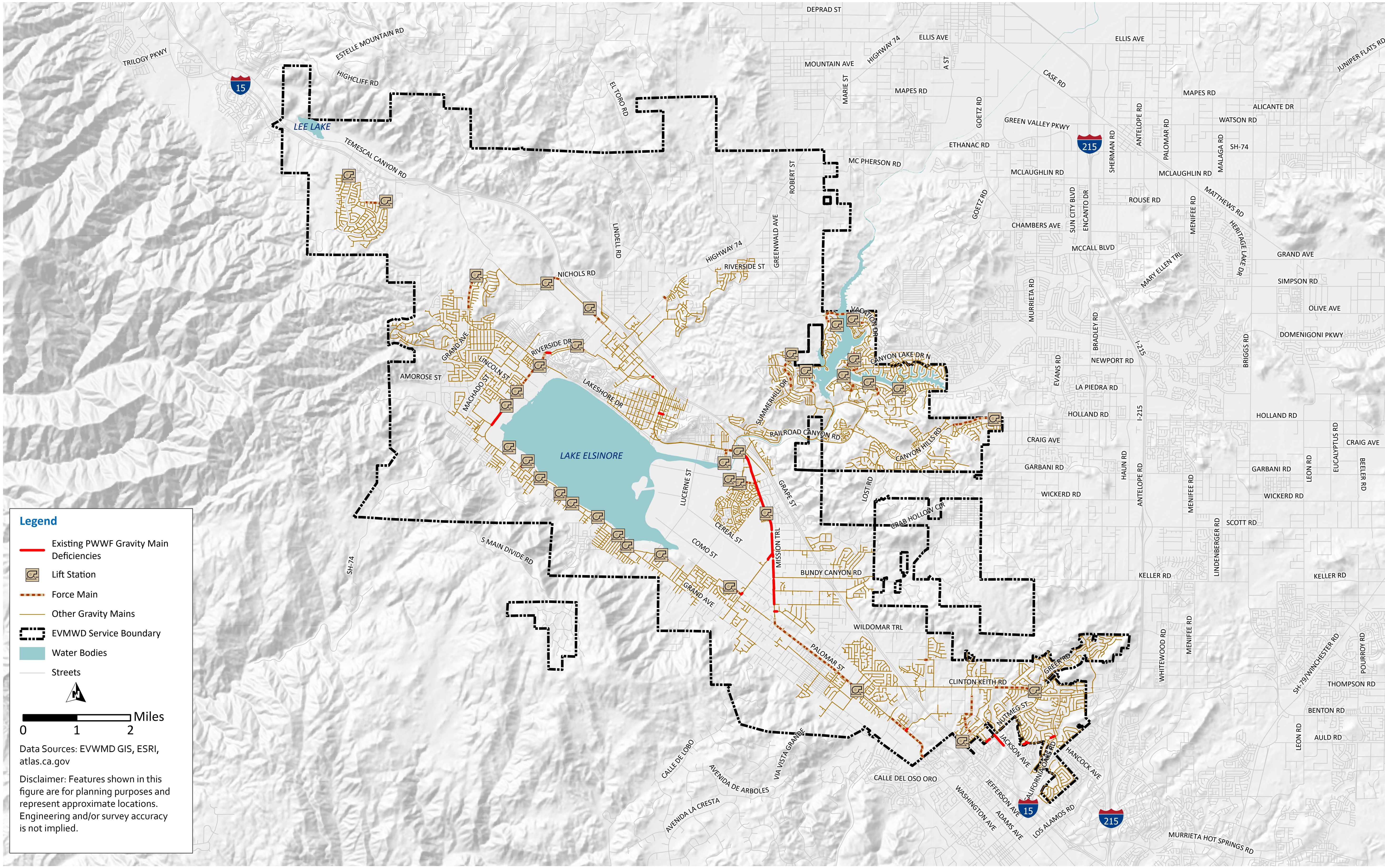

Figure 7.2 Existing PWWF Gravity Main Deficiencies

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7.1.2 Lift System Capacity Analysis and Force Main Evaluation

EVMWD's hydraulic model includes all currently operational lift stations in the service area, as described in Chapter 4. Each of the modeled lift stations were evaluated to determine if they have capacity to convey peak flow. Lift stations with an influent peak flow above the existing firm capacity were flagged.

The A-2, B-1, B-2, and McVicar Lift Stations were all found to be deficient under existing conditions. Lift station A-2 is to be improved with a future CIP project that increases its firm capacity. The stress on the B-1 and B-2 Lift Stations will be alleviated with the future CIP projects that divert flow away from Mission Trail, as described in Section 7.1.1. The firm capacity of the McVicar Lift Station was set at 1,400 gallons per minute (gpm), which was based on operational information provided by EVMWD staff. This capacity is lower than the design point because the pumps at this station operate at a rate significantly lower than the original design flow rates. McVicar Lift Station is also included in a future CIP project to increase its firm capacity.

Table 7.2 shows the results of the existing lift station evaluation. As shown in Table 7.2, four existing lift stations (A-2, B-1, B-2, and McVicar) were flagged as capacity deficient. For two additional lift stations (B-9 and Stadium Villa), the modeled PWWF was nominally higher than the existing firm capacity, however, due to the minor nature of the exceedances, these lift stations weren't flagged as deficient under existing conditions. However, any significant additional flows into these lift stations would trigger the need for a capacity upgrade.

The A-3 Lift Station will be abandoned in the future and wastewater flow will be directed to the A-4 Lift Station via gravity sewer. Under existing conditions without the A-3 Lift Station, PWWF into the A-4 Lift Station would be 1,938 gpm. Therefore, the A-4 Lift Station would be operating over its firm capacity by 158 gpm. Similarly, to the B-9 and Stadium Villa Lift Stations, this would be considered a minor exceedance of firm capacity and not flagged as deficient under existing conditions. Future developments within the A-3 and A-4 sewerbasins should be closely monitored; this topic will be discussed in detail in Chapter 8.

Table 7.2 Lift Station and Force Main Evaluation

Lift Station Name	Number of Pumps	PDWF (gpm)	PWWF (gpm)	Firm Capacity (gpm)	Surplus/ Deficit(1) (gpm)	Force Main Deficient?
A-1	2	3	35	255	220	No
A-2	3	1,390	3,857	2,400	***-1,457***	***Yes***
A-3	2	186	579	1,125	546	No
A-4	2	428	1,359	1,780	421	No

Lift Station Name	Number of Pumps	PDWF (gpm)	PWWF (gpm)	Firm Capacity (gpm)	Surplus/ Deficit(1) (gpm)	Force Main Deficient?
A-5	2	21	85	N/A	N/A	No
Alberhill	2	30	49	N/A	N/A	No
B-1	3	2,684	3,648	2,800	***-848***	No
B-2	3	1,970	3,369	2,400	***-969***	***Yes***
B-3	2	353	1,351	1,400	49	No
B-4	2	238	1,003	1,200	197	No
B-5	2	94	621	1,000	379	No
B-6	2	97	577	1,000	423	No
B-7	2	103	452	650	198	No
B-8	2	91	448	650	202	No
B-9	2	58	432	350	-82	No
B-10	3	42	293	350	57	No
Backbasin	2	0	0	N/A	N/A	No
Big Range	2	61	177	335	158	No
Bolo	2	63	173	200	27	No
Canyon Hills	2	127	371	N/A	N/A	No
Collier	2	40	147	800	653	No
Continental	3	551	607	2,100	1,493	No
Gray Fox	3	385	629	1,396	767	No
Greer Ranch	2	131	303	350	47	No
Horsethief	2	62	108	200	92	No
Lighthouse	3	187	416	1,500	1,084	No
McVicar(2)	3	1,400	2,742	1,400	***-1,342***	No
New Longhorn	2	48	83	275	192	No
Nichols	2	42	129	285	156	No
Robards Way	2	98	244	1,000	756	No
Serena	2	10	19	N/A	N/A	No
Stadium Villa	2	14	185	120	-65	No
Summerly	2	527	422	N/A	N/A	No
Tuscany Hills	2	76	128	1,000	872	No
Vacation	2	84	203	626	423	No
Village Way	3	232	529	2,060	1,531	No

Notes:
Abbreviations: N/A - not applicable.
(1) Capacity deficiencies highlighted in ***Bold Italic.***
(2) McVicar Lift Station operates at a rate lower than the design pumping rate.

7.2 Gravity Main Condition Assessment

Closed circuit television (CCTV) inspection records form the foundation of the gravity main condition assessment provided in this study. CCTV equipment crawlers deployed across a discrete section of pipe provides images of pipe defects and operational concerns from which qualitative observations can be recorded and later standardized to quantitative measures that provide a snapshot of pipe condition, potential failure, and operational considerations.

EVMWD provided inspection record summaries for historical inspections that were performed between 2010 and early 2023. The National Association of Sewer Service Companies' (NASSCO) Pipeline Assessment and Certification Program (PACP) is used by EVMWD to document defects in their gravity system. EVMWD staff provided Carollo Engineers, Inc. (Carollo) with the structural "Quick Rating" for each pipeline segment that has been inspected since 2010. Table 7.3 summarizes the total length of gravity mains that have been inspected by EVWMD, by year, since 2010. As shown in Table 7.3, the average length of pipeline that has been inspected per year between 2010 and 2022 (the last full year) was about 33 miles per year. At this rate, it would take approximately 13 years to inspect the entire system, on average.

Table 7.3 Historical Length of Pipe CCTV Inspected by Year(1)

Year	Total Length of Pipe Inspected (miles)
2010	13.1
2011	29.3
2012	64.5
2013	45.6
2014	52.0
2015	25.0
2016	35.8
2017	27.8
2018	43.7
2019	14.5
2020	10.1
2021	22.6
2022	44.2
2023	1.5
2010-2023 Total	**429.7**
2010-2022 Average	**32.9**

Notes:
(1) Source: PACP quick rating summary provided by EVMWD staff.

Each pipeline segment with a NASSCO PACP quick rating was tabulated and the most recent inspection record was used to identify the most recent PACP quick rating that was applied to each gravity main segment. For simplicity, the most severe defect rating from the PACP Quick Rating was used to rate each pipe segment against the scoring summary provided in Table 7.4. For the Grade 4 and 5 defect codes, EVMWD's geographic information system database was used to identify if that pipe segment has been lined/replaced since the last CCTV inspection was performed. If so, a new score of 0 was applied to that pipeline segment.

Table 7.4 PACP Scoring Summary

Score/Garde	General Description	Detailed Description
1	Excellent	Minor defects. RUL: Failure unlikely in the foreseeable future.
2	Good	Defects that have not begun to deteriorate. RUL: Pipe unlikely to fail for at least 20 years.
3	Fair	Moderate defects that will continue to deteriorate. RUL: Pipe may fail in 10 to 20 years.
4	Poor	Severe defects that will become Grade 5 defects within the foreseeable future. RUL: Pipe could fail in 5 to 10 years.
5	Immediate Attention	Defects requiring immediate attention. RUL: Pipe has failed or will likely fail within the next 5 years.

Notes:
Abbreviation: RUL - remaining useful life.

Figure 7.3 shows the locations of pipelines that had inspections records associated with them, as well as the PACP rating of each pipeline. Table 7.5 summarizes the results of the evaluation of the historical CCTV inspection data. As shown in Table 7.5, roughly 40-percent of the system did not have an associated CCTV record. Only 100 pipeline segments were flagged as showing a pipe score of 4 or 5 (approximately 0.8 percent of the total pipeline segments within the service area).

Table 7.5 Summary of Pipeline Inspection Score

Score/Grade	Number of Pipe Segments	Percent of Total Pipe Segments	Length of Pipe (miles)
No Inspection Record	4,253	40.3%	142.8
0/1	6,039	57.2%	256.7
2	113	1.1%	5.5
3	53	0.5%	2.6
4	36	0.3%	1.9
5	64	0.6%	3.5

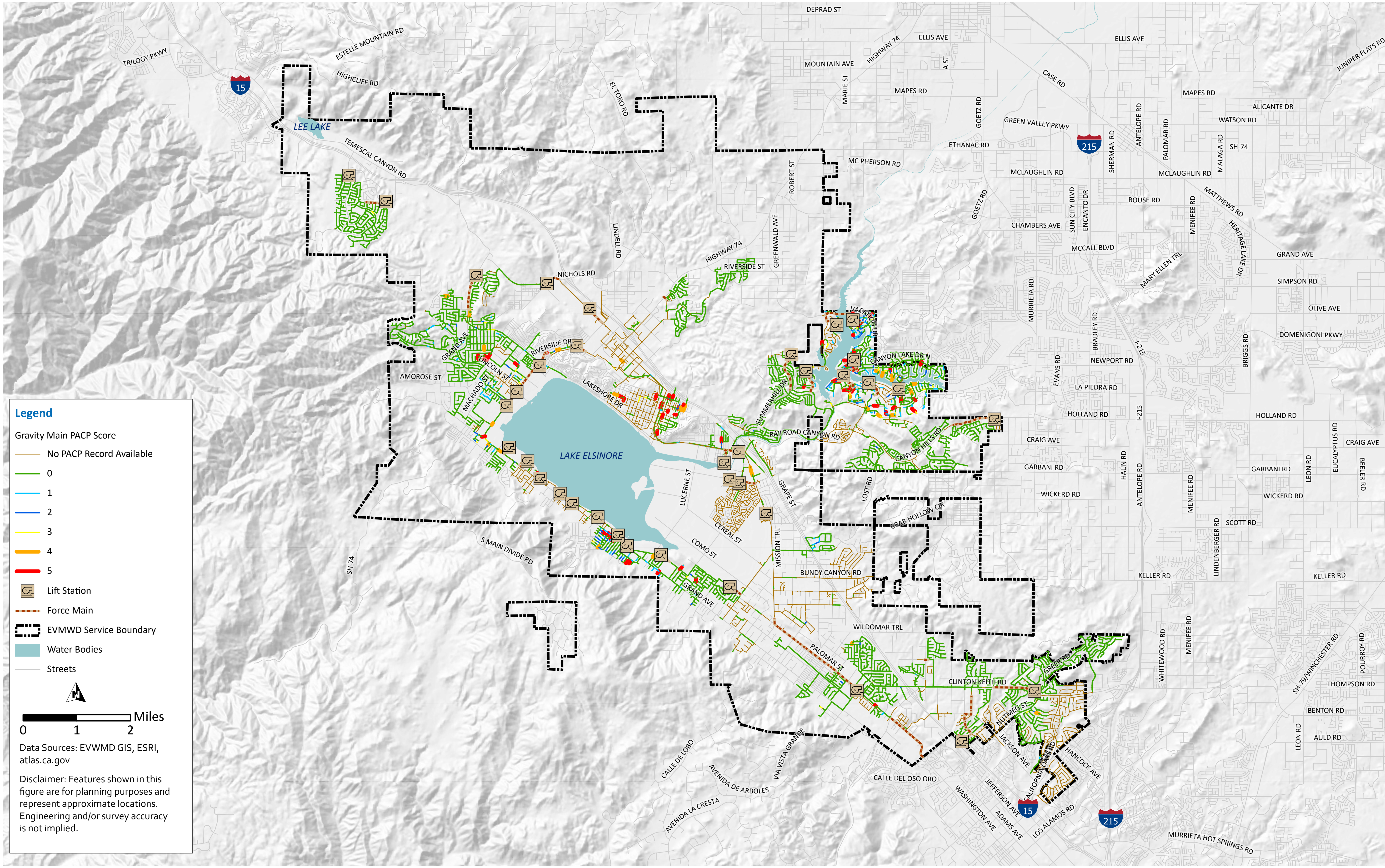

Figure 7.3 Gravity Main PACP Score

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An estimate of the RUL was developed for the gravity mains without an available inspection record. The RUL was calculated as the estimate useful life minus the age of the pipe segment. The RUL was assigned by pipe material as shown on Table 7.6. In the geographic information systems, pipelines with no installation year were assumed to have an installation year of 1969.

Table 7.6 Useful Life Assumptions

Pipe Material	Assumed Useful Life
Asbestos Cement Pipe (ACP)	50
Cast Iron Pipe (CIP)	50
Ductile Iron Pipe (DIP)	50
Polyethylene Pipe (PE)	75
Polyvinyl Chloride Pipe (PVC)	75
Reinforced Concrete Pipe (RCP)	75
Vitrified Clay Pipe (VCP)	75
Unknown	75

Figure 7.4 color codes pipelines without inspections records by their respective RUL. Table 7.7 summarizes the results of the evaluation of the estimated RUL for those pipe segments. As shown in Table 7.7, 27 pipe segments were flagged as exceeding the estimate RUL within the next 20-years.

Table 7.7 Summary of RUL for Pipelines Without a PACP Record

RUL (Years)	Number of Pipe Segments	Length of Pipe (miles)	Percent of Total Pipe Segments
PACP Record Available	6,305	0.4	60.3 percent
Less than 0	6	0.7	0.1 percent
0-20	21	21.7	0.2 percent
21-30	546	119.7	5.2 percent
More than 30	3,580	270.1	34.2 percent

7.2.1 Condition Assessment Recommendations

Carollo reviewed historical CCTV records from the year 2010 through 2023 to identify pipelines in need of replacement and repair. Approximately 60-percent of the system had at least one CCTV inspection record during that time period, although many pipes had multiple records. For the gravity mains without a PACP inspection record, a RUL calculation was performed to indicate generally when each pipeline segment may need to be replaced. A summary of all pipes that have PACP scores greater than or equal to 4 and RUL less than 20 can be found in Appendix H. The following summarizes the general findings and recommendations of this analysis:

- Since 2010, EVMWD has inspected an average of 33 miles of gravity mains per year. It is recommended that the District increase the annual rate of CCTV inspections to roughly 40 miles per year in order to maintain a 10-year inspection cycle systemwide.
- 100 individual pipelines were scored with a Grade 4 or 5 as part of the CCTV analysis. It is recommended that EVMWD budget for rehabilitation/repair projects for these pipelines within the next five years.
- It is recommended that pipelines with a PACP score of 3 be re-inspected within the next five years.
- It is recommended that the pipelines without a PACP score be inspected by EVMWD as soon as is practical, so that a better indication of pipeline condition can be assessed for these pipelines.
- A simple RUL calculation indicated that 27 individual pipeline segments could potentially reach their RUL within the next 20 years. It is recommended that the Sewer System Master Plan CIP includes costs of replacing these lines, however, further analysis would be required before moving forward with any rehabilitation or replacement projects.

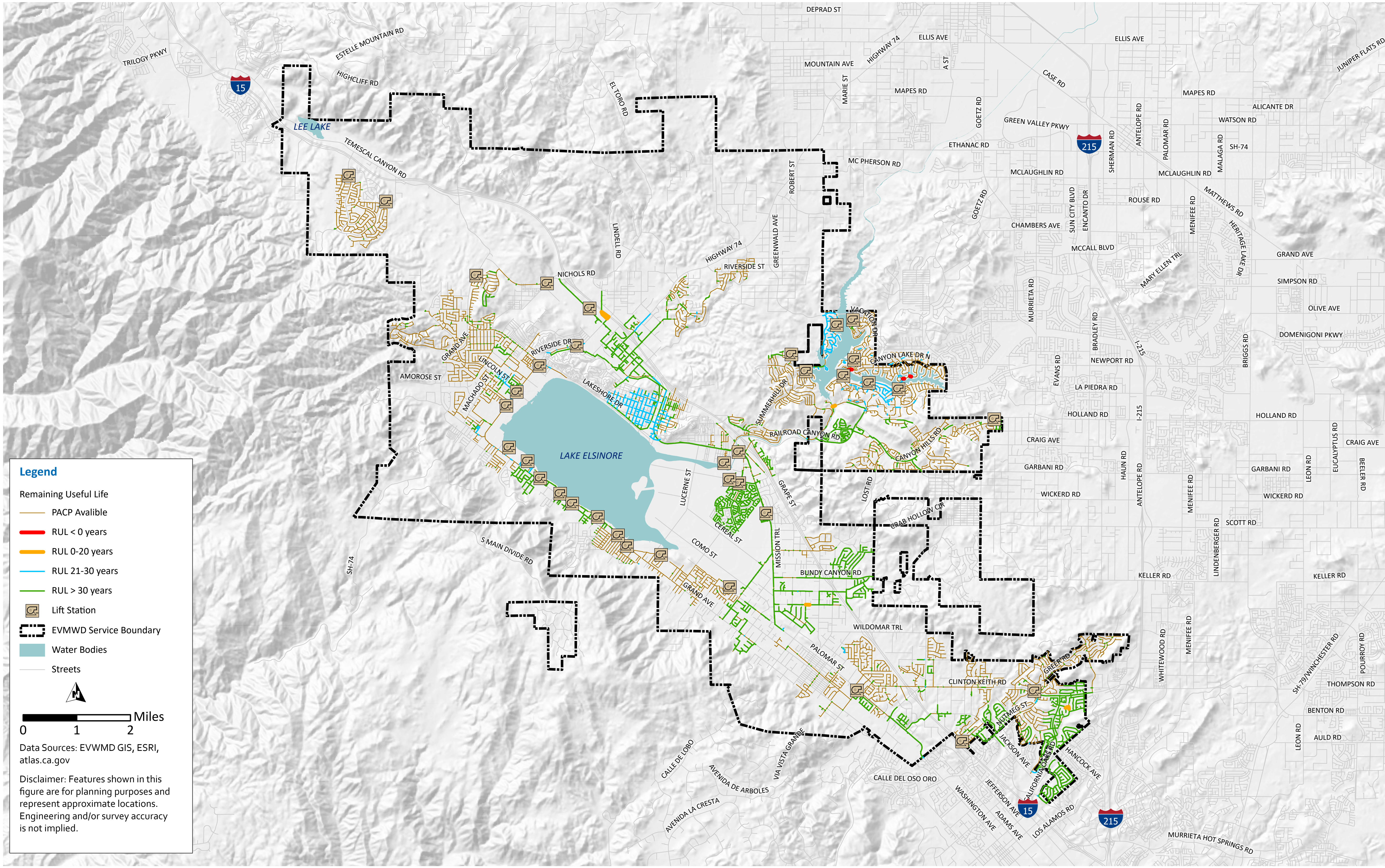

Figure 7.4 RUL for Pipelines Without an Inspection Record

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Chapter 8

FUTURE SYSTEM ANALYSIS

This chapter describes the evaluation of the Elsinore Valley Municipal Water District's (EVMWD) sewer collection system. Hydraulic deficiencies within the sewer collection system are identified and infrastructure improvements are recommended based upon design criteria from Chapter 6. The hydraulic model was used to create scenarios in five-year increments starting from 2030 and ending in 2050. Gravity mains, force mains, and lift stations were evaluated at each planning horizon. Recommended improvements to the sewer collection system discussed in this chapter are summarized in the Capital Improvement Plan. Prior to any future system analysis, it was assumed that all existing improvements would be implemented in future scenarios. The proposed existing system improvements are identified in Section 8.2.

8.1 Future System Analysis

All future scenarios were simulated under peak dry weather flow (PDWF) and peak wet weather flow (PWWF) conditions. Gravity mains, force mains, and lift stations were then evaluated with the design criteria established in Chapter 6.

Notable improvements that were assumed to be implemented before the year 2030 include:

- A-3 Lift Station bypass.
- McVicar Lift Station capacity upgrade.
- The B-2 Lift Station bypass.
- The Diamond Regional Lift Station.

8.1.1 Gravity System Capacity Analysis

Deficient gravity mains were identified and listed by the planning horizon in which the deficiency was triggered. In PDWF conditions, gravity mains were flagged if maximum flow depth to pipe diameter ratio (d/D) exceeded 0.75. In PWWF conditions, gravity mains were flagged if d/D exceeded 0.92. It is important to understand that not all the existing pipelines with a d/D greater than 0.92 under PWWF conditions are necessarily capacity deficient. In some cases, a surcharged condition within a given pipeline segment is due to backwater effects created by a downstream bottleneck (i.e., upstream surcharging is caused by downstream pipeline deficiencies).

8.1.1.1 2030 Scenario

During the 2030 PWWF and PDWF conditions, there were approximately 6,530 feet of deficient gravity pipe. During the PDWF condition only 30 feet of gravity pipes were flagged as deficient, while PWWF conditions resulted in nearly 6,500 feet of deficient gravity pipe. It should be noted that some pipes were flagged as deficient in both PDWF and PWWF conditions. The location of deficient pipes in the 2030 scenarios can be seen on Figure 8.1.

8.1.1.2 2035 Scenario

During the 2035 PWWF and PDWF conditions, there were a total of 3,145 feet of deficient gravity pipe. The PDWF conditions caused approximately 2,870 feet of gravity pipe to be flagged as deficient, while PWWF conditions resulted in 1,382 feet of gravity pipe to be flagged as deficient. It should be noted that some pipes were flagged as deficient in both PDWF and PWWF conditions. The location of deficient pipes in the 2035 scenarios can be seen on Figure 8.2.

8.1.1.3 2040 Scenario

A total of 3,599 feet of gravity pipe were flagged as deficient in the 2040 scenario. Approximately 1,633 feet of pipe were flagged as deficient under PDWF conditions, while approximately 2,131 feet of pipe were flagged deficient under PWWF conditions. It should be noted that some pipes were flagged as deficient in both PDWF and PWWF conditions. All flagged deficiencies in the 2040 scenario can be seen on Figure 8.3.

8.1.1.4 2045 Scenario

There were only 3,604 feet of pipe that were flagged as deficient in the 2045 scenario. In the PDWF scenario there were 1,434 feet of deficient pipe and 2,706 feet in the PWWF scenario. All flagged deficiencies in the 2045 scenario can be seen on Figure 8.4.

8.1.1.5 2050 Scenario

There were no deficiencies observed in the 2050 PDWF or PWWF scenarios.

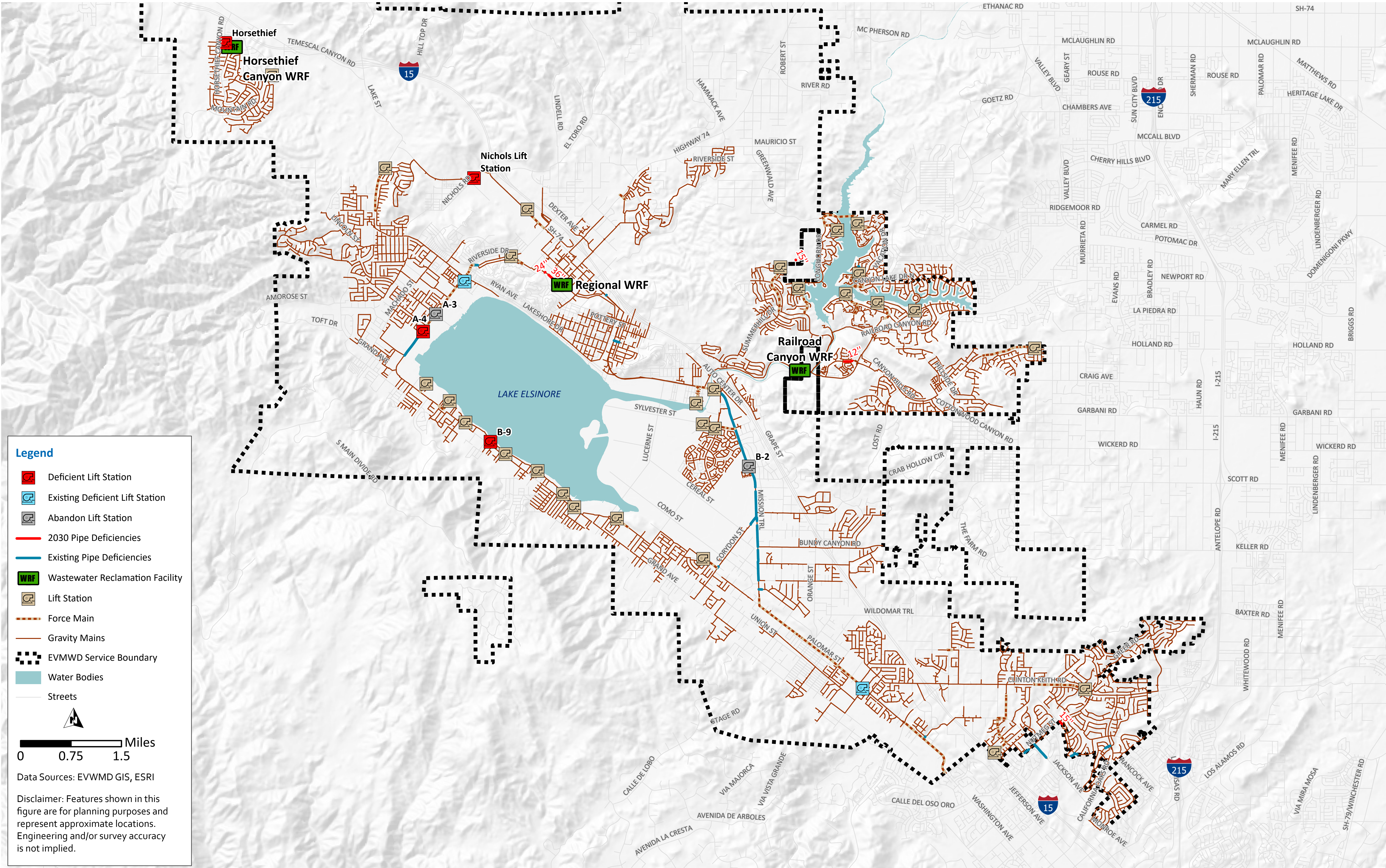

Figure 8.1 2030 Wastewater Deficiencies

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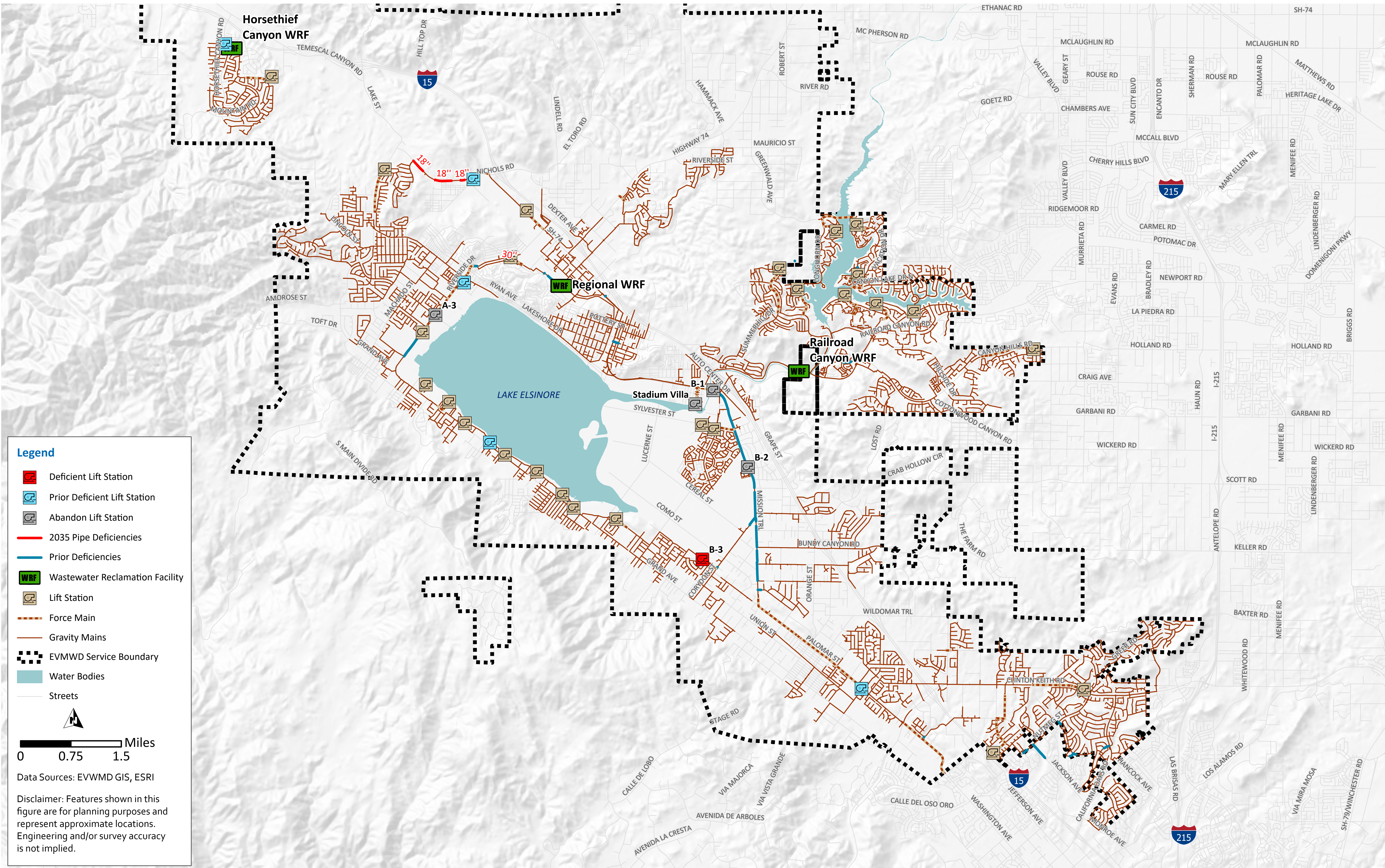

Figure 8.2 2035 Wastewater Deficiencies

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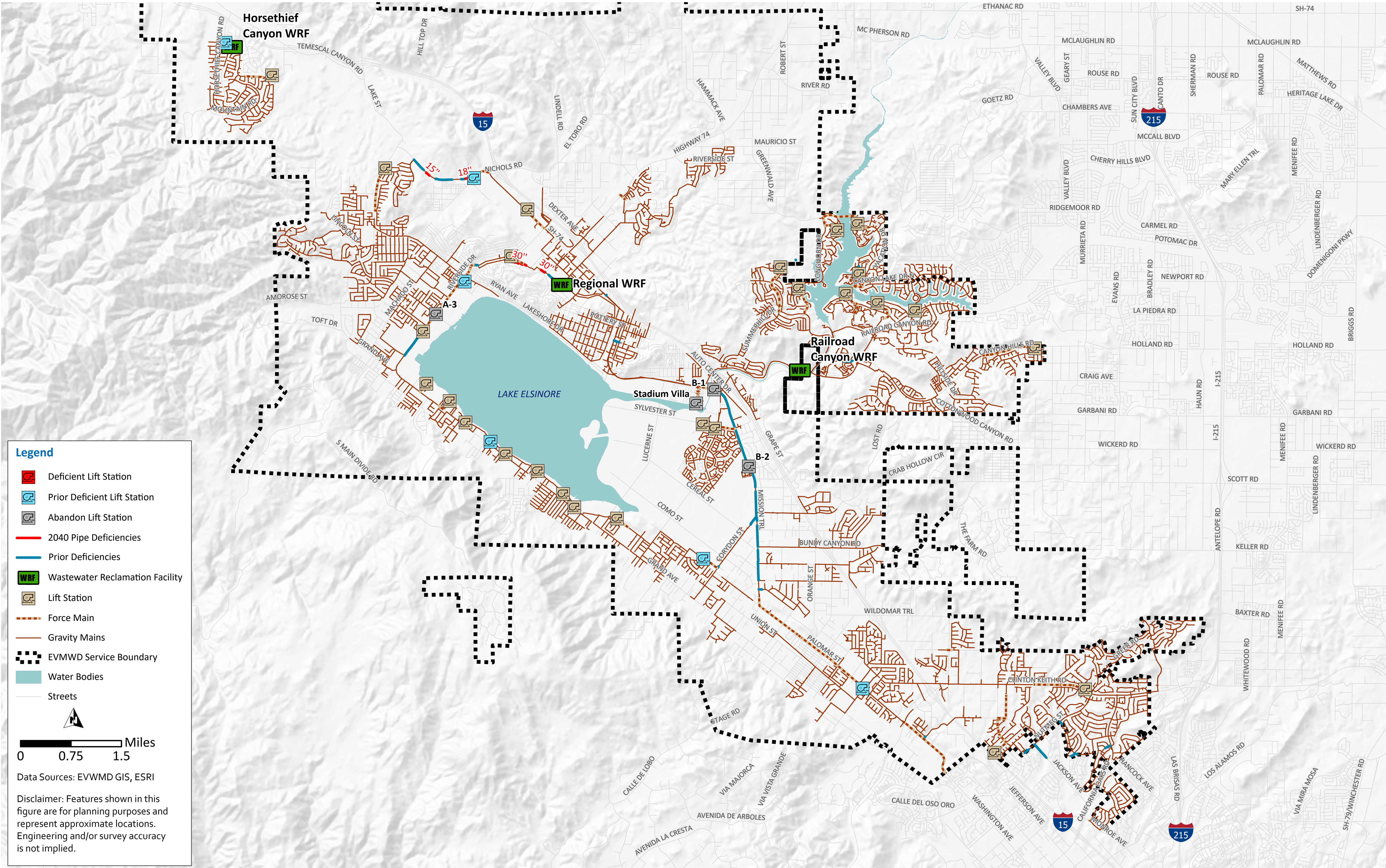

Figure 8.3 2040 Wastewater Deficiencies

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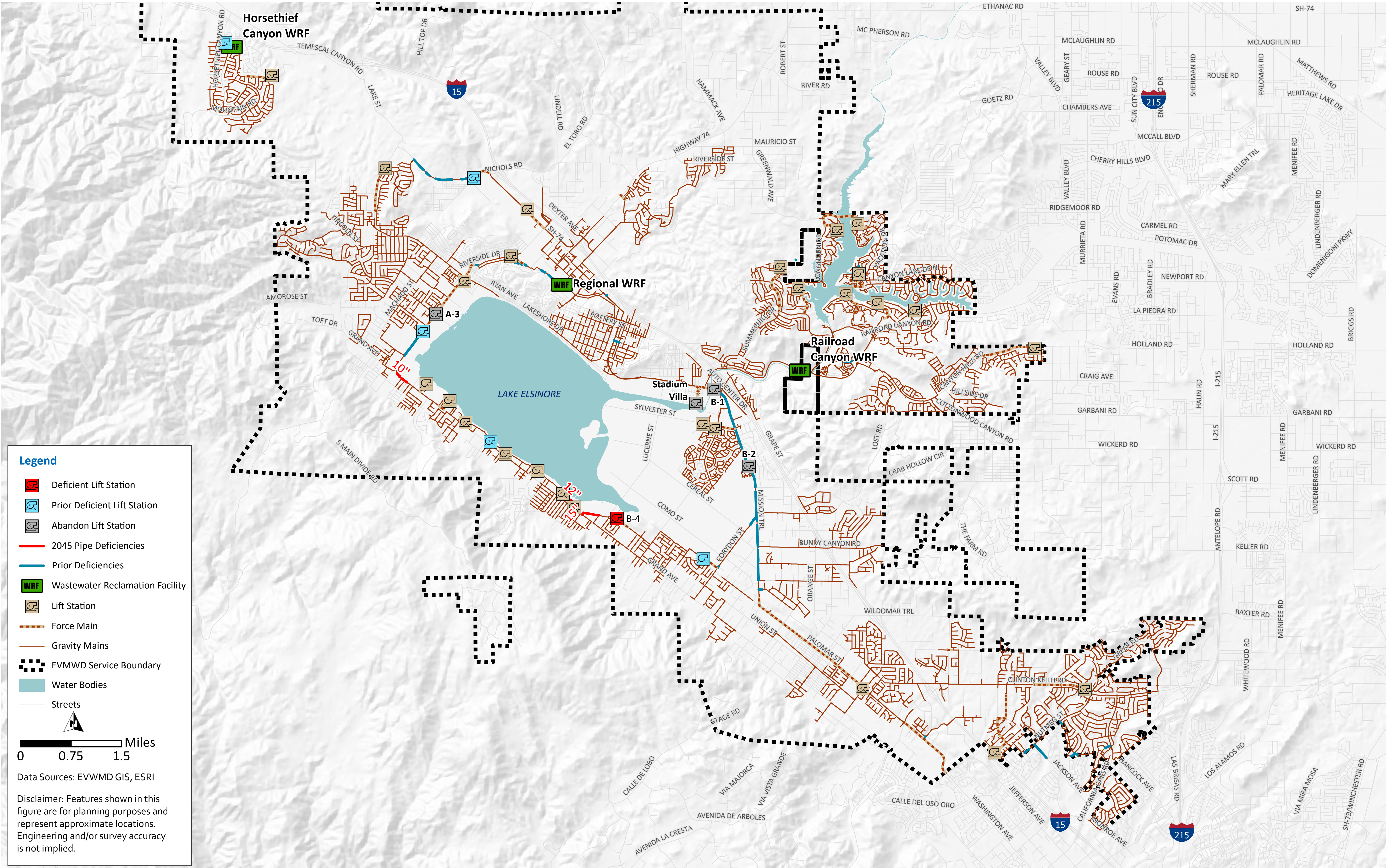

Figure 8.4 2045 Wastewater Deficiencies

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8.1.2 Lift Station Capacity Analysis and Force Main Evaluation

Lift stations and force mains were evaluated, and deficiencies were flagged in each planning horizon. Lift stations were flagged if firm capacity was exceeded in PWWF conditions. Force mains were flagged in each scenario if velocity exceeded 7 feet per second (fps). Table 8.1 provides an overview of firm capacity, inflow during PWWF conditions, flow surplus or deficit, and the condition of the respective force main for every lift station in each planning horizon. Lift stations A-2 and B-3 are the only two lift stations with deficient force mains; the deficiencies occur in the 2030 and 2035 scenarios, respectively. It should be noted that lift stations B-1, B-2, and Stadium Villa were taken offline, and their flows diverted by gravity to Diamond Lift Station by 2035. McVicar Lift Station is listed as an existing improvement; however, it is also shown as deficient in Table 8.1 to display its flow deficit if no improvements were made by 2030.

The A-3 Lift Station was taken offline and flow was redirected to the A-4 Lift Station via gravity main. The A-4 Lift Station was flagged as deficient by 2030 due to the increased wastewater flows.

The seven lift stations that exceed their firm capacity by 2050 are as follows:

- A-2.
- A-4.
- B-3.
- B-4.
- B-9.
- Horsethief.
- Nichols.

Of the listed lift stations, only A-2 and B-3 had undersized force mains that need to be upsized to maintain velocity below 7 fps.

8.2 Future System Infrastructure Recommendations

This section summarizes the recommended capacity upgrades and the estimated time of improvement based upon the existing planning horizon. For newly proposed sewer pipes that are less than 18 inches in diameter, the maximum d/D must be 0.50 for all peak flow conditions. Newly proposed sewer pipes that are greater than or equal to 18 inches in diameter can have a maximum d/D of 0.75 for all peak flow conditions.

Future projects were recommended to EVMWD to improve the existing collection system or to create new infrastructure to alleviate the existing collection system of stress incurred from growth. Recommendations to the collection system were based upon observed deficiencies from the hydraulic model. The description of recommended improvements and new infrastructure for the future system can be seen in Table 8.2. The CIP projects can also be seen on Figure 8.5. The CIP ID is coded to include all improvements to existing infrastructure and recommendations for new infrastructure. The CIP ID's first two letters "WW" stand for wastewater, and the subsequent letters stand for the following:

- "EG" - Existing gravity main improvement recommendation.
- "NG" - New gravity main recommendation.
- "EF" - Existing force main improvement recommendation.
- "NF" - New force main recommendation.
- "EL" - Existing lift station improvement recommendation.
- "NL" - New lift station recommendation.

It is Important to note that the recommendations in the future systems have various degrees of certainty and are greatly dependent on the timing of future development in comparison to the demand projections described in Chapter 3.

Table 8.1 Lift Station Firm Capacity Summary

Lift Station Name	Number of Pumps	Firm Capacity (gpm)	PWWF (gpm)					Surplus/Deficit[1] (gpm)					Force Main Deficient?				
			2030	2035	2040	2045	2050	2030	2035	2040	2045	2050	2030	2035	2040	2045	2050
A-1	2	255	40	40	40	40	40	220	210	210	210	210	No	No	No	No	No
A-2	3	2,400	4,260	4,370	4,920	5,120	5,180	-1,860	-1,970	-2,520	-2,720	-2,730	Yes	No	No	No	No
A-3	2	1,125	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
A-4	2	1,780	2,250	2,280	2,650	2,780	2,860	-470	-500	-870	-1,000	-1,080	No	No	No	No	No
A-5	2	N/A	90	90	90	90	90	OFF	OFF	OFF	OFF	OFF	No	No	No	No	No
Alberhill	2	N/A	50	50	50	50	50	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
B-1	3	N/A	1,420	OFF	OFF	OFF	OFF	N/A	OFF	OFF	OFF	OFF	No	OFF	OFF	OFF	OFF
B-2	3	2,400	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
B-3	2	1,400	1,400	1,420	1,430	1,670	1,860	0	-20	-30	-270	-410	No	No	No	Yes	No
B-4	2	1,200	1,050	1,030	1,030	1,280	1,330	150	170	170	-80	-80	No	No	No	No	No
B-5	2	1,000	650	670	650	720	780	350	330	350	280	230	No	No	No	No	No
B-6	2	1,000	610	620	600	670	730	390	380	400	330	300	No	No	No	No	No
B-7	2	650	470	470	470	540	590	180	180	180	110	70	No	No	No	No	No
B-8	1	650	420	470	460	500	420	230	180	190	150	160	No	No	No	No	No
B-9	2	350	450	450	450	460	460	-100	-100	-100	-110	-110	No	No	No	No	No
B-10	3	350	300	300	300	310	310	50	50	50	40	40	No	No	No	No	No
Big Range	2	N/A	180	180	180	180	180	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Bolo	2	200	180	180	180	180	180	30	30	20	30	20	No	No	No	No	No
Canyon Hills	2	N/A	400	400	400	400	400	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Collier	2	800	40	40	40	40	40	760	760	760	760	760	No	No	No	No	No
Continental	3	2,100	540	540	560	660	540	1,560	1,560	1,540	1,440	1,490	No	No	No	No	No
Diamond	4	N/A	6,060	6,900	7,140	7,610	7,930	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Gray Fox	3	1,396	650	650	650	650	650	750	750	750	750	750	No	No	No	No	No
Greer Ranch	2	350	330	330	330	330	330	30	30	30	30	30	No	No	No	No	No
Horsethief	2	200	270	270	270	270	270	-70	-70	-70	-70	-70	No	No	No	No	No
Lighthouse	3	1,500	430	430	430	430	430	1,070	1,070	1,070	1,070	1,070	No	No	No	No	No
McVicar	3	1,400	2,440	2,510	2,600	2,730	2,780	-1,040	-1,110	-1,200	-1,330	-1,360	No	No	No	No	No

Lift Station Name	Number of Pumps	Firm Capacity (gpm)	PWWF (gpm)					Surplus/Deficit[1] (gpm)					Force Main Deficient?				
			2030	2035	2040	2045	2050	2030	2035	2040	2045	2050	2030	2035	2040	2045	2050
New Alberhill	2	N/A	N/A	0	180	190	230	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
New Longhorn	2	275	90	90	90	90	90	190	190	190	190	190	No	No	No	No	No
New Tuscany	3	N/A	260	260	380	380	750	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Nichols	2	285	1,350	2,270	2,610	2,790	2,830	-1,060	-1,980	-2,320	-2,500	-2,550	No	No	No	No	No
N. Ramsgate	2	N/A	150	150	150	160	160	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
N. Ramsgate 2	2	N/A	160	160	160	160	160	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Oak Street	2	N/A	40	40	40	40	40	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Robards Way	2	1,000	250	250	250	250	250	750	750	750	750	750	No	No	No	No	No
Serena	2	N/A	20	20	20	20	20	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Stadium Villa	2	N/A	170	OFF	OFF	OFF	OFF	N/A	OFF	OFF	OFF	OFF	No	OFF	OFF	OFF	OFF
Sunset	2	N/A	OFF	OFF	OFF	OFF	590	OFF	OFF	OFF	OFF	N/A	OFF	OFF	OFF	OFF	No
Temescal	3	N/A	850	1,770	2,120	2,300	2,340	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No
Vacation	2	626	210	210	210	210	210	410	410	410	410	410	No	No	No	No	No
Village Way	3	2,060	540	540	540	550	550	1,520	1,520	1,520	1,510	1,510	No	No	No	No	No

Notes:
Abbreviations: gpm - gallons per minute.
(1) Red text indicates a deficit in PWWF conditions.

Table 8.2 CIP Project Summary(1)

CIP ID	Project Year	Sewershed	Project Name	Description
Existing Gravity Main Improvements				
WW-EG-01	2025-2030	Regional	Riverside - Eisenhower Trunk Sewer Capacity Improvement	Upsize 3,250 feet of existing 10-inch gravity main to 18-inch gravity main due to existing undersized gravity pipe.
WW-EG-02	2025-2030	Regional	Escavera Street Trunk Sewer Capacity Improvement	Upsize 138 feet of existing 8-inch gravity pipe to 12 inches.
WW-EG-03	2025-2030	Regional	Riverside - Palm Trunk Sewer Capacity Improvement	Upsize 337 feet of 10-inch gravity pipe to 18 inches. Deficiency was triggered by B-9 and B-10 redirecting flow into the A-Train.
WW-EG-04	2025-2030	Regional	Franklin Street Trunk Sewer Capacity Improvement	Upsize 425 feet of 8-inch gravity pipe to 12 inches.
WW-EG-05	2025-2030	Railroad Canyon	Redwood Road Trunk Sewer Capacity Improvement	Upsize 475 feet of 8-inch gravity pipe to 15 inches.
WW-EG-06	2025-2030	Southern Section	Jackson Road Trunk Sewer Capacity Improvement	Upsize 1,480 feet of existing 12-inch pipe to 18-inch gravity pipe.
WW-EG-07	2025-2030	Southern Section	Colony Drive Trunk Sewer Capacity Improvement	Upsize 416 feet of existing 10-inch gravity pipe to 15-inch pipe.
WW-EG-08	2025-2030	Southern Section	Via Grazina Trunk Sewer Capacity Improvement	Upsize 413 feet of existing 8-inch gravity pipe to 15-inch pipe.
WW-EG-09	2025-2030	Southern Section	Palomar Street Trunk Sewer Capacity Improvement	Upsize 215 feet of existing 8-inch gravity pipe to 18-inch pipe.
WW-EG-10	2030-2035	Regional	Strickland Avenue Trunk Sewer Capacity Improvement	Upsize 1,175 feet of existing 24-inch gravity main to 36-inch.
WW-EG-11	2045-2050	Regional	Grand Avenue Trunk Sewer Capacity Improvement	Upsize 1,415 feet of 12-inch pipe to 15-inch.
WW-EG-12	2030-2035	Southern Section	Camino Aspirante Trunk Sewer Capacity Improvement	Upsize approximately 260 feet of 10-inch pipe to 15-inch.
WW-EG-13	2030-2035	Regional	Tassel Way Trunk Sewer Capacity Improvement	Replace 750 feet of 8-inch pipe with 12-inche pipe.
WW-EG-14	2035-2040	Regional	Nichols Road Trunk Sewer Capacity Improvement	Upsize 5,150 feet of 10-inch pipe with 18-inch pipe to alleviate existing over capacity gravity pipe due to the Alberhill Ridge and Alberhill Villages development.
WW-EG-15	2035-2040	Regional	Illinois Street Trunk Sewer Capacity Improvement	Replace 4,050 feet of existing 24-inch gravity main with 30-inch gravity main.
WW-EG-16	2045-2050	Regional	B-5 and B-4 Gravity Main Improvements	Upstream of LS-B5, upsize 335 feet of 12-inch gravity sewer to 15-inch. Upstream of LS-B4, upsize 2,170 feet of 15-inch pipe to 18-inch pipe.
New Gravity Mains Recommendations				
WW-NG-01	2030-2035	Regional	Oak Street	Install approximately 8,500 feet of 12-inch force main to convey flow from the Oak Street force main to the existing collection system.
WW-NG-02	2030-2035	Regional	Canyon Hills Trunk Sewer Extension	Install approximately 8,500 feet of 12-inch gravity main to extend service to the Canyon Hills Estates and single-family residence manufactured homes developments.
WW-NG-03	2035-2040	Regional	Wildomar Trunk Sewer Extension	Install approximately 3,350 feet of 12-inch pipe to extend service to extend service to the Wildomar septic area.
WW-NG-04	2030-2035	Railroad Canyon	North Ramsgate 1 Trunk Sewer	Install approximately 4,200 feet of 8-inch gravity main to convey flow from North Ramsgate 1 Lift Station.
WW-NG-05	2030-2035	Railroad Canyon	North Ramsgate 1 Trunk Sewer	Install approximately 9,350 feet of 15-inch gravity main to convey flow from the North Ramsgate 2 Lift Station.
WW-NG-06	2030-2035	Railroad Canyon	New Tuscany Hills Trunk Sewer Extension	Install approximately 1,950 feet of 15-inch gravity main to divert flow from the old Tuscany Hills Lift Station to the new Tuscany Hills Lift Station.
WW-NG-07	2030-2035	Regional	El Toro Road Trunk Sewer Extension	Install approximately 7,800 feet of 12-inch gravity main to service a 440 equivalent dwelling unit development (unnamed).

CIP ID	Project Year	Sewershed	Project Name	Description
WW-NG-08	2030-2035	Regional	Alberhill Development Area Trunk Sewer	Install approximately 6,500 feet of 18-inch gravity main to service the Alberhill Ridge and Alberhill Villages development.
WW-NG-09	2030-2035	Regional	Nichols LS Trunk Sewer Extension	Install approximately 5,650 feet of 24-inch gravity main to service the new Nichols force main.
WW-NG-10	2035-2040	Regional	B-1/Stadium Villa Trunk Sewer Bypass	Install approximately 3,980 feet of 18-inch gravity main to bypass the Stadium Villa Lift Station and B-1 Lift Station.
WW-NG-11	2045-2050	Regional	Sunset Lift Station Trunk Sewer	Install 7,400 feet of 12-inch gravity pipe to service the Sunset Lift Station force main.
WW-NG-12	2025-2030	Regional	B-2 Bypass	Bypass B-2 and create side-sewer for Sedco Hills septic conversion. Install 8-inch and 10-inch sewer from Lemon Street to the B-2 Lift Station. Install 36-inch pipe from B-2 to Malaga Road.
WW-NG-13	2030-2035	Regional	Mission Trail Trunk Improvement	Improve the trunk sewer along Mission Trail and Corydon Road by installing 12,314 feet of 24-inch pipe and 3,396 feet of 36-inch pipe.
WW-NG-14	2025-2030	Regional	A-3 Bypass	Bypass the A-3 Lift Station by redirecting flow to the A-4 Lift Station via gravity main. The 1,691-feet of 12-inch gravity pipe will begin at the A-3 Lift Station near Lincoln Street, run southwest along CA-74 to the A-4 Lift Station near Eisenhower Drive
Existing Force Main Improvements				
WW-EF-01	2030	Regional	A-2 Force Main Capacity Improvement	Upsize 1,800 feet of existing 14-inch force main to 18-inch force main to reduce velocity below 7 fps.
WW-EF-02	2045	Regional	B-3 Force Main Capacity Improvement	Upsize 1,350 feet of existing 10-inch force main to 12-inch force main to reduce velocity below 7 fps.
New Force Main Recommendations				
WW-NF-01	2030-2035	Regional	Diamond Lift Station Force Main	Install dual force mains, each approximately 3,250 feet in length and 24-inch in diameter, to convey flow from the new Diamond Lift Station.
WW-NF-02	2030-2035	Regional	Oak Street Lift Station Force Main	Install approximately 2,825 feet of 6-inch force main to convey flow from the Oak Street Lift Station to the existing collection system.
WW-NF-03	2030-2035	Railroad Canyon	North Ramsgate 1 Force Main	Install approximately 5,900 feet of 8-inch force main to convey flow from North Ramsgate 1 Lift Station.
WW-NF-04	2030-2035	Railroad Canyon	North Ramsgate 2 Force Main	Install approximately 1,800 feet of 8-inch force main to convey flow from North Ramsgate 2 Lift Station.
WW-NF-05	2030-2035	Railroad Canyon	New Tuscany Hills Force Main	Install dual force mains to convey flows from the new Tuscany Hills Lift Station to the existing collection system. Total length of force main is approximately 3,800 feet of 16-inch pipe.
WW-NF-06	2030-2035	Regional	Temescal Lift Station Force Main 1	Install approximately 10,000 feet of 10-inch force main to convey flow from the Temescal Lift Station to the existing collection system.
WW-NF-07	2030-2035	Regional	Nichols Lift Station Force Main	Install approximately 6,730 feet of 16-inch force main to convey flow from Nichols Lift Station along a new alignment.
WW-NF-08	2035-2040	Regional	New Alberhill Force Main	Install approximately 8,200 feet of 12-inch force main to service flows from the new Alberhill Lift Station.
WW-NF-09	2035-2040	Regional	Temescal Lift Station Force Main 2	Install another 12-inch force main to run parallel with WW-NF-10.
WW-NF-10	2045-2050	Regional	Sunset Lift Station Force Main	Install 7,500 feet of 8-inch force main to service the Sunset Lift Station.

CIP ID	Project Year	Sewershed	Project Name	Description
Existing Lift Station Improvements				
WW-EL-01	2030-2035	Regional	A-2 Lift Station Capacity Improvement	Firm capacity at A-2 needs to be increased to 5,200 gpm. Previous firm capacity was 2,400 gpm.
WW-EL-02	2040-2045	Regional	A-4 Lift Station Capacity Improvement	Firm capacity at A-4 needs to be increased to 2,200 gpm. Previous firm capacity was 1,780 gpm.
WW-EL-03	2035-2040	Regional	B-3 Lift Station Capacity Improvement	Firm capacity at B-3 needs to be increased to 1,900 gpm. Previous firm capacity was 1,400 gpm.
WW-EL-04	2030-2035	Regional	B-9 Lift Station Capacity Improvement	Firm capacity at B-9 needs to be increased to 500 gpm. Previous firm capacity was 350 gpm.
WW-EL-05	2030-2035	Horsethief Canyon	Horsethief Lift Station Capacity Improvement	Firm Capacity at Horsethief needs to be increased to 300 gpm. Previous firm capacity was 200 gpm.
WW-EL-06	2030-2035	Regional	McVicar Lift Station Capacity Improvement	Firm capacity at McVicar needs to be increased to 2,800 gpm to satisfy existing PWWF inflow. Previous firm capacity was 1,400 gpm.
WW-EL-07	2030-2035	Regional	Nichols Lift Station Capacity Improvement	Firm capacity at Nichols needs to be increased to 2,900 gpm. Previous firm capacity was 285 gpm.
WW-EL-08	2045-2050	Regional	B-4 Lift Station Capacity Improvement	Firm capacity at the B-4 Lift Station needs to be increased to 1,400 gpm.
New Lift Station Recommendations				
WW-NL-01	2030-2035	Regional	Diamond Lift Station Installation	Install Diamond Lift Station to alleviate the B-Train, namely the B-2 Lift Stations.
WW-NL-02	2030-2035	Regional	Oak Street Lift Station Installation	Install Oak Street Lift Station to service the Oak Creek Canyon development.
WW-NL-03	2030-2035	Railroad Canyon	North Ramsgate 2 Lift Station Installation	Install North Ramsgate 2 Lift Station to convey flow primarily from the Colinas Del Oro development.
WW-NL-04	2030-2035	Railroad Canyon	North Ramsgate 1 Lift Station Installation	Install North Ramsgate 1 Lift Station to convey flow primarily from the Colinas Del Oro development.
WW-NL-05	2030-2035	Regional	Temescal Lift Station Installation	Install the Temescal Lift Station to service the Alberhill area developments.
WW-NL-06	2030-2035	Railroad Canyon	New Tuscany Hills Lift Station Installation	Install the new Tuscany Hills Lift Station.
WW-NL-07	2035-2040	Regional	New Alberhill Lift Station Installation	Install the new Alberhill Lift Station.
WW-NL-08	2045-2050	Regional	Sunset Lift Station Installation	Install Sunset Lift Station to service the Wildomar Meadows development.

Notes:
(1) See detailed project summary sheets in Appendix D.

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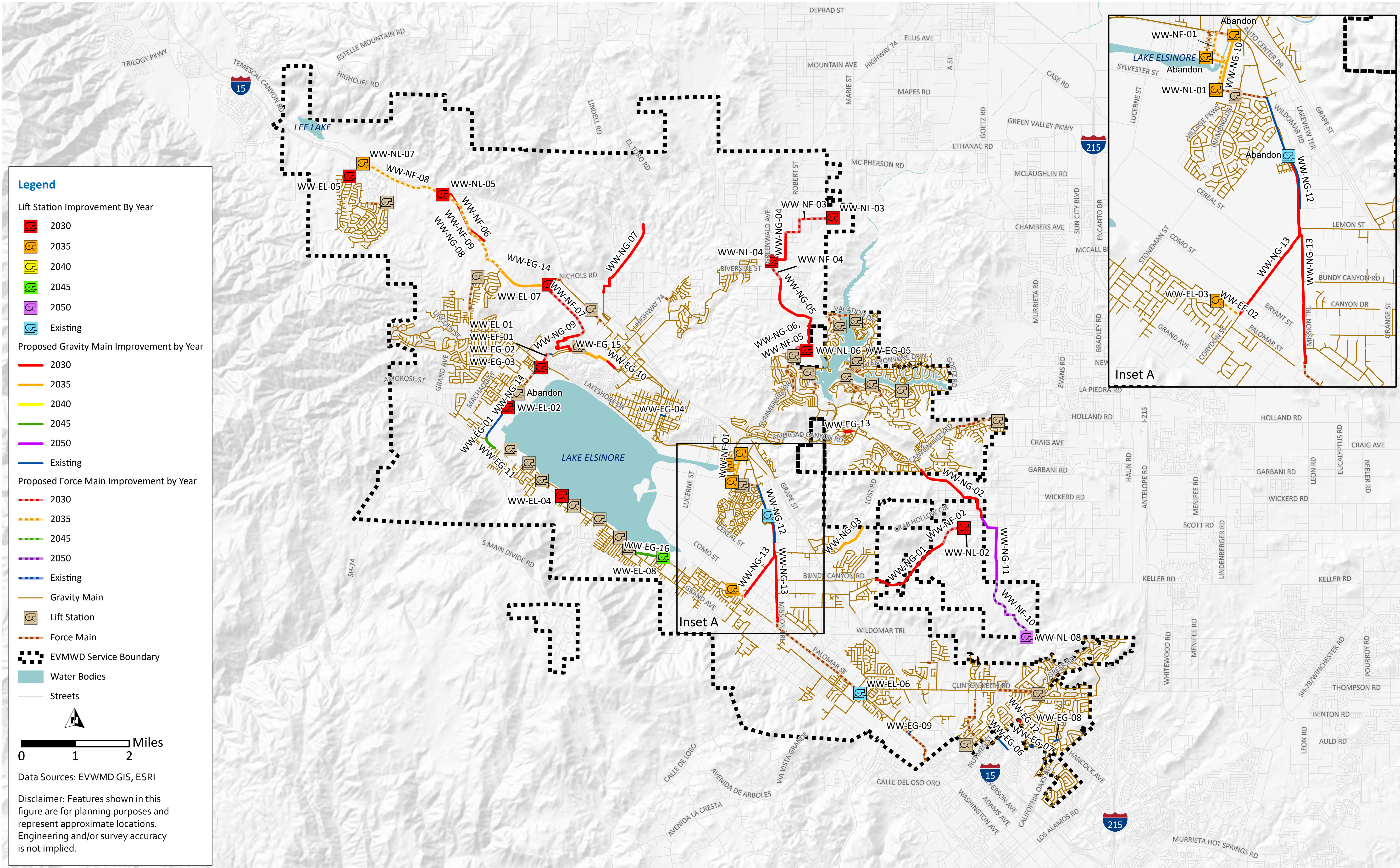
Legend
Lift Station Improvement By Year
2030
2035
2040
2045
2050
Existing
Proposed Gravity Main Improvement by Year
2030
2035
2040
2045
2050
Existing
Proposed Force Main Improvement by Year
2030
2035
2045
2050
Existing
Gravity Main
Lift Station
Force Main
EVMWD Service Boundary
Water Bodies
Streets
Miles
0
1
2
Data Sources: EVMWD GIS, ESRI
Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.
LAKE ELSINORE
LEE LAKE
Inset A
Abandon
WW-NL-07
WW-NF-08
WW-EL-05
WW-NL-05
WW-NF-06
WW-NF-09
WW-NG-08
WW-EG-14
WW-EL-07
WW-NG-07
WW-EL-01
WW-EF-01
WW-EG-02
WW-EG-03
WW-NG-09
WW-EG-15
WW-EG-10
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WW-EL-02
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WW-EL-04
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WW-EG-16
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WW-EG-07
WW-EG-06
WW-NG-10
WW-NL-01
WW-EL-03
WW-EF-02

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8.3 Future System Capacity Improvement Summary

8.3.1 Regional

Table 8.3 summarizes the future system capacity upgrades for the Regional Sewershed. As shown in Table 8.3, a total of 17.2 miles of gravity sewer improvements are recommended, including new gravity mains and gravity capacity upgrades. There are also 9.9 miles of force main improvement recommendations and a total of 15 lift station improvement recommendations.

The most notable capacity project recommendations in the Regional Sewershed are described below:

- Diamond Regional Lift Station and Trunk Sewers (WW-NL-01, WW-NF-01, WW-NG-10, WW-NG-12, and WW-NG-13). These projects alleviate the B-train trunk sewer along Mission Trail and bypass the B-1 and B-2 lift stations. The Diamond Lift station is to be online by 2030 along with the B-2 Bypass which installs a 36-inch sewer line along Mission Trail. In 2035 the B-1/Stadium Villa Trunk Sewer Bypass will be installed which will take B-1 and Stadium Villa Lift Stations offline. The trunk sewer south of B-2 along Mission Trail and Corydon Road will be improved by 2030.
- Alberhill Development Area: Temescal Lift Station, New Alberhill Lift Station, and Trunk Sewers (WW-NG-08, WW-NF-06, WW-NF-08, WW-NF-09, WW-NL-05, WW-NL-07). The previous master plan had the new Alberhill Lift Station as the only lift station to service this development. One notable change since the previous master plan was completed is that EVMWD opted to upgrade the capacity of the Horsethief Water Reclamation Facility rather than abandoning it. Therefore, the future collection system infrastructure backbone was reevaluated in the Alberhill area to identify the optimal approach to extend service to the area. After this analysis, it was determined that two lift stations would better service this development. Temescal Lift Station is recommended to be online by 2030 along with an 18-inch trunk sewer to collect wastewater into the lift station and a 10-inch force main to connect to the Nichols Road trunk sewer. By 2035, the new Alberhill Lift Station is recommended to be online along with its 10-inch force main that feeds into Temescal Lift Station, as well as a new parallel 10-inch force main out of Temescal Lift Station.
- Nichols Lift Station, Trunk Sewer, and Force Mains (WW-EG-14, WW-NF-07, WW-EL-07). The Temescal Lift Station triggers a series of necessary improvements along the Nichols Road trunk sewer by 2030. At the same time, the Nichols Lift Station will need to undergo capacity improvements and a new Nichols Lift Station force main will be redirected along Baker Street to bypass Collier Lift Station.

- New Tuscany Hills and North Ramsgate Lift Stations (WW-NG-04, WW-NG-05, WW-NF-07, WW-NF-06, WW-NF-07, WW-NL-03, WW-NL-04, WW-NL-06). This project creates a new and larger lift station to service the previous Tuscany Hills Lift Station Service area. The two North Ramsgate Lift Stations extend service to the Colinas Del Oro development. All infrastructure is to be online by 2030.

Table 8.3 Regional Sewershed Improvement Summary

Improvement Category	Length (miles)
Gravity Main Capacity Upgrades	3.5
New Gravity Trunk Sewers	13.8
All Gravity Main Improvements	**17.6**
Force Main Capacity Upgrades	0.9
New Force Mains	9.0
All Force Main Improvements	**9.9**
Lift Station Upgrades	7
New Lift Station	8
Total Lift Station Improvements	**15**

8.3.2 Railroad Canyon

Table 8.4 summarizes the future system capacity upgrades for the Railroad Canyon Sewershed. As shown in Table 8.4, a total of 3 miles of gravity sewer improvements are recommended, including new gravity mains and gravity capacity upgrades. There are also 2.2 miles of force main improvement recommendations. There are no lift station improvement recommendations or any notable capacity projects that take place in this sewershed.

Table 8.4 Railroad Canyon Sewershed Improvement Summary

Improvement Category	Length (miles)
Gravity Main Capacity Upgrades	0.1
New Gravity Trunk Sewers	2.9
All Gravity Main Improvements	**3.0**
Force Main Capacity Upgrades	0.0
New Force Mains	2.2
All Force Main Improvements	**2.2**
Lift Station Upgrades	0
New Lift Station	0
Total Lift Station Improvements	**0**

8.3.3 Southern Section

Table 8.5 summarizes the future system capacity upgrades for the Southern Section Sewershed. As shown in Table 8.5, a total of 0.5 mile of gravity sewer improvements are recommended, including new gravity mains and gravity capacity upgrades. There is no force main or lift station improvements recommended for this area.

Table 8.5 Southern Section Sewershed Improvement Summary

Improvement Category	Length (miles)
Gravity Main Capacity Upgrades	0.5
New Gravity Trunk Sewers	0
All Gravity Main Improvements	**0.5**
Force Main Capacity Upgrades	0
New Force Mains	0
All Force Main Improvements	**0**
Lift Station Upgrades	0
New Lift Station	0
Total Lift Station Improvements	**0**

8.3.4 Horsethief Canyon

There are no notable improvements in the Horsethief Canyon Sewershed beyond the Horsethief Lift Station Capacity Improvement (WW-EL-05), which is estimated to be required by 2030.

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Chapter 9

CAPITAL IMPROVEMENT PLAN

9.1 Introduction

This chapter presents the recommended Capital Improvement Plan (CIP) for Elsinore Valley Municipal Water District's (EVMWD or District) sewer collection system through the year 2050. The recommended projects allow EVMWD to address existing system deficiencies, replace aging infrastructure, and provide the facilities necessary to meet future growth. The major categories of facilities associated with the sewer collection system consist of gravity pipes, lift stations, and force mains.

It should be noted that this Sewer System Master Plan (SSMP) does not include the evaluation of EVMWD's wastewater treatment plants. Hence, treatment related projects are not included in this sewer system CIP.

9.2 Phasing

The phasing of system improvements is based upon the following considerations:

- Anticipated construction of future land developments.
- The need to meet existing system deficiencies.
- Improvement of the sewer system reliability.
- Replacement of aging infrastructure.
- Combined cost of existing system improvements for each phase to approximately match the projected annual revenues to fund the projects.

All projects identified during the existing and future system analyses, as well as during the facility assessment, are phased based on system needs and the considerations listed above. Projects are categorized into six planning horizons starting in fiscal year (FY) 2023/2024 (hereafter 2023). The first near-term phase includes the most urgent projects and system improvements to serve near-term developments planned in 2023-2025. The remaining projects are separated into five additional phases, each spanning five years from 2025-2030, 2030-2035, 2035-2040, 2040-2045, and 2045-2050.

Improvements to address existing system deficiencies that affect the ability of EVMWD to provide a reliable wastewater collection and conveyance system for its customers are the highest priority and are assigned to the 2023-2025 planning horizon. Improvements that address existing system deficiencies that are considered less critical are placed in later phasing periods. The prioritization of projects provides

EVMWD with a practical and cost-balanced CIP that focuses on the most urgent projects first. The phasing of existing system projects is presented as a planning guideline and is subject to the availability of funds. The phasing of infrastructure that addresses future growth up to year 2050 is based on information provided by EVMWD for planned developments within the service area and expected dates of construction. The actual timing of future facilities will be dependent upon the actual rate of growth and the timing of new developments expected in the service area.

9.3 Cost Estimating Basis

The opinion of probable construction cost is developed based on costs obtained from industry manufacturers, Carollo Engineers, Inc.'s (Carollo) experience on similar sewer master planning projects and from comparable projects implemented by EVMWD. Some key cost assumptions are as follows:

- All costs are in 2023 United States dollars and are consistent with the AACE International guidelines for developing planning-level estimates (Class 4). Due to significant uncertainties related to the development of future construction costs, cost escalation is not included in this CIP.
- Costs are adjusted to the *Engineering News-Record* (ENR) Greater Los Angeles Construction Cost Index of July 2023 is 15,147.
- The cost estimates do not include costs for land acquisition, easements, permits, and/or right-of-way acquisition.
- Twenty percent of construction costs are added to the baseline construction cost estimate as a construction cost contingency.
- Forty percent of additional markups are included in the cost estimate for engineering, construction management, planning, administration, and environmental and legal services. This markup is added to the total of the baseline construction cost plus the construction cost contingency.

An example calculation of these markups for a hypothetical $1 million project is shown below. As shown, the combined multiplier for construction cost to derive the capital cost of each project is 1.68.

Baseline Construction Cost	**$1,000,000**
Construction Cost Contingency (20%)	$200,000
Construction Cost Subtotal	***$1,200,000***
Engineering (10%)	$120,000
Construction Management (10%)	$120,000
Permitting and Administration (10%)	$120,000
Environmental and Legal Services (10%)	$120,000
Capital Cost	**$1,680,000**

The unit construction costs for different assets used for the sewer system CIP are summarized in Table 9.1 and Table 9.2. A comparison of costs from historical bid tabs and the opinion of probable construction cost from the Diamond Regional Sewer Lift Station was conducted. The previous cost estimates for lift stations were adjusted to 2023 dollars using the Greater Los Angeles Area ENR Construction Cost Index of 15,147. This process yielded a unit cost of $1.23 per gallon per day for lift stations.

Table 9.1 Gravity Pipeline Cost

Diameter (inches)	Baseline Construction Cost ($/linear-feet)(1)	Unit Construction Cost ($/diameter-inches/feet)
8	$260	$33
10	$330	$33
12	$360	$30
15	$470	$31
18	$545	$30
21	$585	$28
24	$665	$28
27	$760	$28
30	$860	$29
32	$930	$28
36	$995	$28
42	$1,125	$27
48	$1,395	$29
54	$1,505	$28
60	$1,615	$27

Notes:
(1) All unit construction costs are in 2023 dollars and based on adjustments for the Greater Los Angeles Area ENR Construction Cost Index of 15,147. (July 2023).

Table 9.2 Force Main Pipeline Cost

Diameter (inches)	Unit Construction Cost ($/linear-feet)(1)
4	$259
6	$335
8	$351
12	$421
16	$507
20	$615
24	$680
30	$810
36	$917
42	$1,079
48	$1,241

Notes:
(1) All unit construction costs are in 2023 dollars and based on adjustments for the Greater Los Angeles Area ENR Construction Cost Index of 15,147. (July 2023).

9.4 Recommended Improvement Program

The CIP costs were developed using the unit costs from Table 9.1 and Table 9.2 along with the required project sizing, such as length of pipelines; lift station pumping capacities; and sizing of other improvements identified during the system analyses. The CIP was created for assets required to meet existing hydraulic deficiencies and planned future growth within the defined planning horizons up until the year 2050. The CIP projects are categorized as capacity-based improvement projects and rehabilitation and replacement (R&R) projects.

The capacity-based improvement projects consist of capital projects required to address future hydraulic deficiencies in the distribution system. In the CIP the capacity improvement projects are grouped into the following categories:

- Existing gravity main improvements.
- New gravity main installation.
- Existing force main improvements.
- New force main installation.
- Existing lift station rehabilitation.
- New lift stations.
- Flow monitoring.
- R&R.

The R&R projects consist of capital projects required to replace existing aging infrastructure that is already beyond its anticipated end of useful life (EUL) or will be beyond its EUL by the planning horizon of this SSMP, namely year 2050. These projects are based upon closed-circuit television (CCTV) scores that were provided to Carollo by EVMWD.

In the CIP the recommended projects are given an alphanumeric project identification (ID) code referred to CIP ID to easily identify them in the model and in figures throughout this SSMP. CIP IDs are separated based on the project improvements type as follows:

- WW-EG = Existing gravity main replacement projections.
- WW-NG = New gravity main installation projections.
- WW-EF = Existing force main replacement projects.
- WW-NF = New force main installation projects.
- WW-EL = Existing lift station rehabilitation project.
- WW-NL = New lift station installation project.
- WW-RR = R&R project.
- WW-FM = Flow monitoring project.

As noted in the Introduction, CIP projects were defined in Chapter 7 and Chapter 8 of this SSMP and are grouped by the improvement types previously presented in this section. A summary of the CIP projects is presented in Table 9.3.

Each project listed in Table 9.3 has a detailed project sheet which is provided in Appendix D. The project information sheets have specific information about the capital project which includes the following:

- CIP ID.
- Project name.
- Project map which shows the location of the projects.
- System type which is wastewater for the projects in this SSMP.
- Description of the project need.
- Details that list the project elements as well as the cost and phasing of each project element.
- Cost allocation between existing and future ratepayers.

The cost allocation between existing and future rate payers was determined by multiplying the future cost by the ratio of existing wastewater flow and future flow. The ratio of flow was determined within the hydraulic model by dividing the existing wastewater flow rate by the future wastewater flow rate of a future infrastructure project.

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Table 9.3 CIP Project Summary

Project		Existing Size/Type	Proposed Size/Type	Proposed Amount	CIP Cost Estimate[1,2,3,4] ($)	Existing User Cost ($)	Future User Cost ($)	CIP Phasing ($)					
								Near-Term					
								2023-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
Capacity Improvements					$298,942,000	$118,772,000	$180,170,000	$8,039,000	$7,867,000	$221,517,000	$41,383,000	$-	$20,136,000
Existing Gravity Main Improvements		Diameter (inches)	Diameter (inches)	Length (feet)	$23,247,000	$7,515,000	$15,732,000	$-	$6,699,000	$2,830,000	$10,080,000	$-	$3,638,000
WW-EG-01	Riverside - Eisenhower Trunk Sewer Capacity Improvement	10	18	3,250	$3,212,000	$1,162,000	$2,050,000	$-	$3,212,000	$-	$-	$-	$-
WW-EG-02	Escavera Street Trunk Sewer Capacity Improvement	8	12	138	$91,000	$48,000	$43,000	$-	$91,000	$-	$-	$-	$-
WW-EG-03	Riverside - Palm Trunk Sewer Capacity Improvement	10	18	337	$333,000	$183,000	$150,000	$-	$333,000	$-	$-	$-	$-
WW-EG-04	Franklin Street Trunk Sewer Capacity Improvement	8	12	425	$277,000	$138,000	$139,000	$-	$277,000	$-	$-	$-	$-
WW-EG-05	Redwood Road Trunk Sewer Capacity Improvement	8	15	475	$405,000	$384,000	$21,000	$-	$405,000	$-	$-	$-	$-
WW-EG-06	Jackson Road Trunk Sewer Capacity Improvement	12	18	1,480	$1,463,000	$1,267,000	$196,000	$-	$1,463,000	$-	$-	$-	$-
WW-EG-07	Colony Drive Trunk Sewer Capacity Improvement	10	15	416	$354,000	$229,000	$125,000	$-	$354,000	$-	$-	$-	$-
WW-EG-08	Via Grazina Trunk Sewer Capacity Improvement	8	15	413	$353,000	$349,000	$4,000	$-	$353,000	$-	$-	$-	$-
WW-EG-09	Palomar Street Trunk Sewer Capacity Improvement	8	18	215	$211,000	$51,000	$160,000	$-	$211,000	$-	$-	$-	$-
WW-EG-10	Strickland Avenue Trunk Sewer Capacity Improvement	24	36	1,175	$2,120,000	$586,000	$1,534,000	$-	$-	$2,120,000	$-	$-	$-
WW-EG-11	Grand Avenue Trunk Sewer Capacity Improvement	10	15	1,415	$1,207,000	$353,000	$854,000	$-	$-	$-	$-	$-	$1,207,000
WW-EG-12	Camino Aspirante Trunk Sewer Capacity Improvement	10	15	260	$221,000	$119,000	$102,000	$-	$-	$221,000	$-	$-	$-
WW-EG-13	Tassel Way Trunk Sewer Capacity Improvement	8	12	750	$489,000	$237,000	$252,000	$-	$-	$489,000	$-	$-	$-
WW-EG-14	Nichols Road Trunk Sewer Capacity Improvement	10	18	5,150	$5,090,000	$91,000	$4,999,000	$-	$-	$-	$5,090,000	$-	$-
WW-EG-15	Illinois Street Trunk Sewer Capacity Improvement	24	30	3,200	$4,990,000	$1,380,000	$3,610,000	$-	$-	$-	$4,990,000	$-	$-
WW-EG-16	B-5 and B-4 Gravity Main Improvements	12 to 15	15 to 18	2,505	$2,431,000	$938,000	$1,493,000	$-	$-	$-	$-	$-	$2,431,000
New Gravity Mains Recommendations		Diameter (inches)	Diameter (inches)	Length (feet)	$79,156,000	$20,824,000	$58,332,000	$8,039,000	$1,103,000	$59,063,000	$6,121,000	$-	$4,830,000
WW-NG-01	Oak Street	-	12	8,500	$5,550,000	$-	$5,550,000	$-	$-	$5,550,000	$-	$-	$-
WW-NG-02	Canyon Hills Trunk Sewer Extension	-	12	8,500	$5,550,000	$-	$5,550,000	$-	$-	$5,550,000	$-	$-	$-
WW-NG-03	Wildomar Trunk Sewer Extension	-	12	3,350	$2,187,000	$-	$2,187,000	$-	$-	$-	$2,187,000	$-	$-
WW-NG-04	North Ramsgate 1 Trunk Sewer	-	8	4,200	$1,981,000	$-	$1,981,000	$-	$-	$1,981,000	$-	$-	$-
WW-NG-05	North Ramsgate 1 Trunk Sewer	-	15	9,350	$7,969,000	$-	$7,969,000	$-	$-	$7,969,000	$-	$-	$-
WW-NG-06	New Tuscany Hills Trunk Sewer Extension	-	15	1,950	$1,662,000	$-	$1,662,000	$-	$-	$1,662,000	$-	$-	$-
WW-NG-07	El Toro Road Trunk Sewer Extension	-	12	7,800	$5,092,000	$-	$5,092,000	$-	$-	$5,092,000	$-	$-	$-
WW-NG-08	Alberhill Development Area Trunk Sewer	-	18	6,500	$6,425,000	$-	$6,425,000	$-	$-	$6,425,000	$-	$-	$-
WW-NG-09	Nichols Lift Station Trunk Sewer Extension	-	24	3,200	$3,858,000	$-	$3,858,000	$-	$-	$3,858,000	$-	$-	$-
WW-NG-10	B-1/Stadium Villa Trunk Sewer Bypass	-	18	3,981	$3,934,000	$3,499,000	$435,000	$-	$-	$-	$3,934,000	$-	$-
WW-NG-11	Sunset Lift Station Trunk Sewer	-	12	7,400	$4,830,000	$-	$4,830,000	$-	$-	$-	$-	$-	$4,830,000
WW-NG-12	B-2 Bypass	-	8 to 36	5,982	$8,039,000	$4,800,000	$3,239,000	$8,039,000	$-	$-	$-	$-	$-
WW-NG-13	Mission Trail Trunk Improvement	-	24	12,314	$20,976,000	$12,525,000	$8,451,000	$-	$-	$20,976,000	$-	$-	$-
WW-NG-14	A-3 Bypass	-	12	1,691	$1,103,000	$-	$1,103,000	$-	$1,103,000	$-	$-	$-	$-
Existing Force Main Improvements		Diameter (inches)	Diameter (inches)	Length (feet)	$4,121,000	$2,244,000	$1,877,000	$-	$-	$1,859,000	$2,262,000	$-	$-
WW-EF-01	A-2 Force Main Capacity Improvement	14	20	1,800	$1,859,000	$936,000	$923,000	$-	$-	$1,859,000	$-	$-	$-
WW-EF-02	B-3 Force Main Capacity Improvement	10	12	3,200	$2,262,000	$1,308,000	$954,000	$-	$-	$-	$2,262,000	$-	$-

Project		Existing Size/Type	Proposed Size/Type	Proposed Amount	CIP Cost Estimate[1,2,3,4] ($)	Existing User Cost ($)	Future User Cost ($)	CIP Phasing ($)					
								Near-Term					
								2023-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
New Force Main Recommendations		Diameter (inches)	Diameter (inches)	Length (feet)	$49,727,000	$11,473,000	$38,254,000	$-	$-	$34,968,000	$12,872,000	$-	$1,887,000
WW-NF-01	Diamond Lift Station Force Main	-	24	6,500	$12,793,000	$11,473,000	$1,320,000	$-	$-	$12,793,000	$-	$-	$-
WW-NF-02	Oak Street Lift Station Force Main	-	6	1,600	$1,588,000	$-	$1,588,000	$-	$-	$1,588,000	$-	$-	$-
WW-NF-03	North Ramsgate 1 Force Main	-	8	5,900	$3,478,000	$-	$3,478,000	$-	$-	$3,478,000	$-	$-	$-
WW-NF-04	North Ramsgate 2 Force Main	-	8	1,800	$1,060,000	$-	$1,060,000	$-	$-	$1,060,000	$-	$-	$-
WW-NF-05	New Tuscany Hills Force Main	-	16	3,800	$3,240,000	$-	$3,240,000	$-	$-	$3,240,000	$-	$-	$-
WW-NF-06	Temescal Lift Station Force Main 1	-	12	10,000	$7,073,000	$-	$7,073,000	$-	$-	$7,073,000	$-	$-	$-
WW-NF-07	Nichols Lift Station Force Main	-	16	3,750	$5,736,000	$-	$5,736,000	$-	$-	$5,736,000	$-	$-	$-
WW-NF-08	New Alberhill Force Main	-	12	8,200	$5,799,000	$-	$5,799,000	$-	$-	$-	$5,799,000	$-	$-
WW-NF-09	Temescal Lift Station Force Main 2	-	12	10,000	$7,073,000	$-	$7,073,000	$-	$-	$-	$7,073,000	$-	$-
WW-NF-10	Sunset Lift Station Force Main	-	8	3,200	$1,887,000	$-	$1,887,000	$-	$-	$-	$-	$-	$1,887,000
New Lift Stations		Capacity (gpm)	Capacity (gpm)	-	$64,678,000	$23,606,000	$41,072,000	$-	$-	$59,343,000	$1,778,000	$-	$3,557,000
WW-NL-01	Diamond Lift Station Installation	-	13,820	-	$40,965,000	$22,709,000	$18,256,000	$-	$-	$40,965,000	$-	$-	$-
WW-NL-02	Oak Street Lift Station Installation	-	100	-	$592,000	$-	$592,000	$-	$-	$592,000	$-	$-	$-
WW-NL-03	North Ramsgate 2 Lift Station Installation	-	200	-	$1,186,000	$-	$1,186,000	$-	$-	$1,186,000	$-	$-	$-
WW-NL-04	North Ramsgate 1 Lift Station Installation	-	200	-	$1,186,000	$-	$1,186,000	$-	$-	$1,186,000	$-	$-	$-
WW-NL-05	Temescal Lift Station Installation	-	2,400	-	$10,671,000	$-	$10,671,000	$-	$-	$10,671,000	$-	$-	$-
WW-NL-06	New Tuscany Hills Lift Station Installation	-	800	-	$4,743,000	$897,000	$3,846,000	$-	$-	$4,743,000	$-	$-	$-
WW-NL-07	New Alberhill Lift Station Installation	-	300	-	$1,778,000	$-	$1,778,000	$-	$-	$-	$1,778,000	$-	$-
WW-NL-08	Sunset Lift Station Installation	-	600	-	$3,557,000	$-	$3,557,000	$-	$-	$-	$-	$-	$3,557,000
Existing Lift Stations		Capacity (gpm)	Capacity (gpm)	-	$77,948,000	$53,045,000	$24,903,000	$-	$-	$63,454,000	$8,270,000	$-	$6,224,000
WW-EL-01	A-2 Lift Station Capacity Improvement	2,400	5,180	-	$20,474,000	$15,790,000	$4,684,000	$-	$-	$20,474,000	$-	$-	$-
WW-EL-02	A-4 Lift Station Capacity Improvement	1,780	2,900	-	$12,894,000	$8,891,000	$4,003,000	$-	$-	$12,894,000	$-	$-	$-
WW-EL-03	B-3 Lift Station Capacity Improvement	1,400	1,860	-	$8,270,000	$6,145,000	$2,125,000	$-	$-	$-	$8,270,000	$-	$-
WW-EL-04	B-9 Lift Station Capacity Improvement	350	500	-	$2,964,000	$1,077,000	$1,887,000	$-	$-	$2,964,000	$-	$-	$-
WW-EL-05	Horsethief Lift Station Capacity Improvement	200	300	-	$1,778,000	$60,000	$1,718,000	$-	$-	$1,778,000	$-	$-	$-
WW-EL-06	McVicar Lift Station Capacity Improvement	1,400	2,800	-	$12,450,000	$12,450,000	$-	$-	$-	$12,450,000	$-	$-	$-
WW-EL-07	Nichols Lift Station Capacity Improvement	280	2,900	-	$12,894,000	$6,477,000	$6,417,000	$-	$-	$12,894,000	$-	$-	$-
WW-EL-08	B-4 Lift Station Capacity Improvement	1,200	1,400	-	$6,224,000	$2,155,000	$4,069,000	$-	$-	$-	$-	$-	$6,224,000
Flow Monitoring[5]			Number of Flowmeters		$65,000	$65,000	$-	$-	$65,000	$-	$-	$-	$-
WW-FM-01	Canyon Lake infiltration and Inflow Monitoring		8		65,000	$65,000	$-	$-	$65,000	$-	$-	$-	$-
R&R Projects					$16,419,000	$16,419,000	$-	$-	$14,598,000	$-	$-	$-	$1,821,000
Pipelines		Diameter (inches)	Diameter (inches)	Length (feet)	$16,419,000	$16,419,000	$-	$-	$14,598,000	$-	$-	$-	$1,821,000
WW-RR-01	Gravity Pipeline R&R Program (Condition Based)	Varies	Varies	28,356	$14,598,000	$14,598,000	$-	$-	$14,598,000	$-	$-	$-	$-
WW-RR-02	Gravity Pipeline R&R Program (Age Based)	Varies	Varies	3,569	$1,821,000	$1,821,000	$-	$-	$-	$-	$-	$-	$1,821,000
CIP Total					$315,361,000	$135,191,000	$180,170,000	$8,039,000	$22,465,000	$221,517,000	$41,383,000	$-	$21,957,000
Annual Cost					$11,680,037[6]	N/A	N/A	$4,019,500	$4,493,000	$44,303,400	$8,276,600	$-	$4,391,400

Notes:
Abbreviations: gpm - gallons per minute.
(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.
(2) Estimated construction cost includes a 20 percent contingency of the baseline construction cost.
(3) Total project costs include a 40 percent markup for engineering, construction management and environmental and legal services.
(4) Total markup is 68 percent of the baseline construction costs.
(5) Costs associated with flow monitoring are subject to change.
(6) Calculated by dividing the CIP total cost by total number of years in planning horizon (27).

9.4.1 Capacity Based Capital Improvement Projects

The capacity-based portion of the CIP is grouped by gravity main, force mains, and lift stations and the year that the improvement is recommended to come online. The existing hydraulic deficiencies in EVMWD's wastewater collection system that need to be addressed in the CIP are described in the existing system evaluation section (Chapter 7). Additionally, Chapter 8 identified the future projects needed to address the anticipated future deficiencies based on growth.

The total cost to address the existing and planned capacity deficiencies in EVMWD is approximately $299 million. $118.7 million, approximately 40 percent, is due to existing capacity deficiencies and is to be funded by existing users. The remaining 60 percent, or $180.2 million, is attributed to future growth and the cost is allocated to future users. This breakdown only applies to Capital Improvements, as summarized in the top of Table 9.3, and does not include R&R project costs.

9.4.1.1 Gravity Mains

There are a total of 30 projects to address future and existing capacity deficiencies associated with gravity mains. There are 16 projects to address 4.1 miles of existing gravity main and 14 projects to install 16.7 miles of new gravity main.

9.4.1.2 Force Mains

There are a total of 12 projects to address force main capacity improvements and there are only 2 projects that improve an existing force main. These two projects replace 5,000 feet of pipe which accounts for approximately 1-percent of the total CIP cost. The remaining force main projects are new pipelines to extend service to new growth areas or new alignments to relieve the existing collection system of deficiencies. Approximately 11.2 miles of new force main is recommended to be installed by 2050; approximately 64-percent of which is recommended to be installed by 2035.

9.4.1.3 Lift Stations

There are 8 projects to improve existing lift stations and 8 projects to install new lift stations at new locations. It was determined that extensive work is needed at all existing lift station sites except for McVicar Lift Station and Horsethief Lift Station; these two lift stations only require an upsizing of pumps.

9.4.1.4 Canyon Lake Infiltration and Inflow Monitoring

Based on information presented by District operations staff, in wet years (such as the winter of 2022/2023) water flows over the dam at Canyon Lake and a high volume of flow reaches the San Jacinto River in Railroad Canyon. This high flow rate submerges the manhole covers of the sewer that flows to the Regional Water Reclamation Facility. A high rate of infiltration and inflow enters the system during these events. This project was created to fund additional flow monitoring during these high flow times. This project was allocated to Phase 2 (2025 to 2030).

9.4.2 Replacement and Rehabilitation Capital Improvement Projects

An R&R component was included in the CIP to implement CCTV scores and remaining useful life (RUL) of pipelines based upon age. The Pipeline Condition Assessment Certification Program assigns a score from one to five, five being the highest severity defect of a pipe inspected via CCTV. For this CIP, all pipes that scored four or five were flagged for an R&R project recommended for 2030. These projects were grouped together into one project under the code "WW-RR-01"; the details of the length and diameter of the pipe included in this R&R project are included in Appendix D. An estimate of the RUL was developed for the gravity mains without an available inspection record. The RUL was calculated as the estimate useful life minus the age of the pipe segment. In the geographic information systems, pipelines with no installation year were assumed to have an installation year of 1969. All pipelines flagged as deficient under RUL criteria were grouped together in "WW-RR-02". The list of each individual pipe recommended for R&R can be found in Appendix H. Costs of all R&R projects are allocated to the existing users.

9.4.3 CIP Project Summary

The CIP projects are phased in 6 planning periods from 2023 through 2050 and categorized by ratepayer class (existing or future), project category (capacity improvement or rehabilitation and repair), and by project type (gravity main, force main, and lift station).

The CIP summary is presented in Table 9.4. A summary of the cost allocation by ratepayer class (existing or future) by phase is shown on Figure 9.1.

As shown in Table 9.4 the total CIP cost is estimated at $315.4 million with $135.2 million (43 percent) for existing system improvements to be paid by existing rate payers and the remaining $180.2 million (57 percent) for projects needed to accommodate future growth to be paid by future rate payers. The cost difference between existing and future ratepayers is largely due to new gravity main improvements which accounts for $58.3 million of the future user cost, as shown in Table 9.4. Figure 9.1 provides a visual summary of the size and total cost percentage associated with each project category. Figure 9.2 shows how CIP projects are categorized by project type and their respective cost.

Table 9.4 CIP Costs by Project Type, and Ratepayer Class

Project Type	Existing Users ($ million)	Future Users ($ million)	Total ($ million)	Percent of Total
Existing Gravity Main Improvements	$7.5	$15.7	$23.2	7.4%
New Gravity Mains Recommendations	$20.8	$58.3	$79.2	25.1%
Existing Force Main Improvements	$2.2	$1.9	$4.1	1.3%
New Force Main Recommendations	$11.5	$38.3	$49.7	15.8%
New Lift Stations	$23.6	$41.1	$64.7	20.5%
Existing Lift Stations	$53.0	$24.9	$77.9	24.7%
Flow Monitoring	$0.07	$0.0	$0.07	0.02%
Capacity Improvements	$118.8	$180.2	$298.9	94.8%
Pipelines (R&R)	$16.4	$0.0	$16.4	5.2%
R&R Projects	$16.4	$0.0	$16.4	5.2%
Total	$135.2	$180.2	$315.4	100.0%

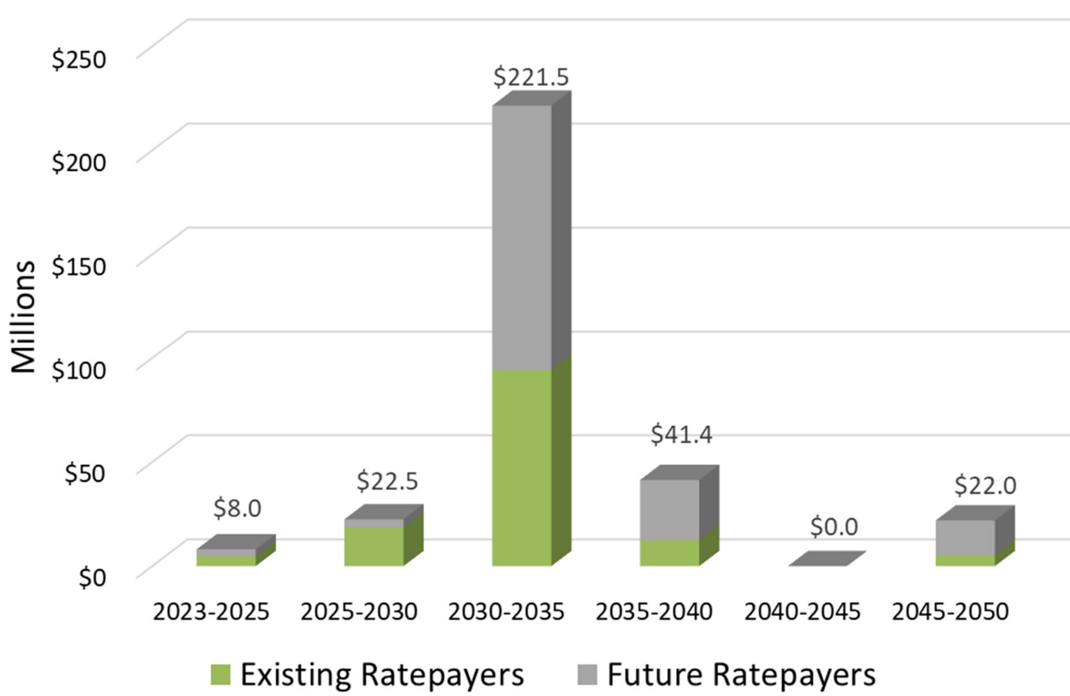

Figure 9.1 Capital Improvement Program Costs by Phase and Ratepayer Class

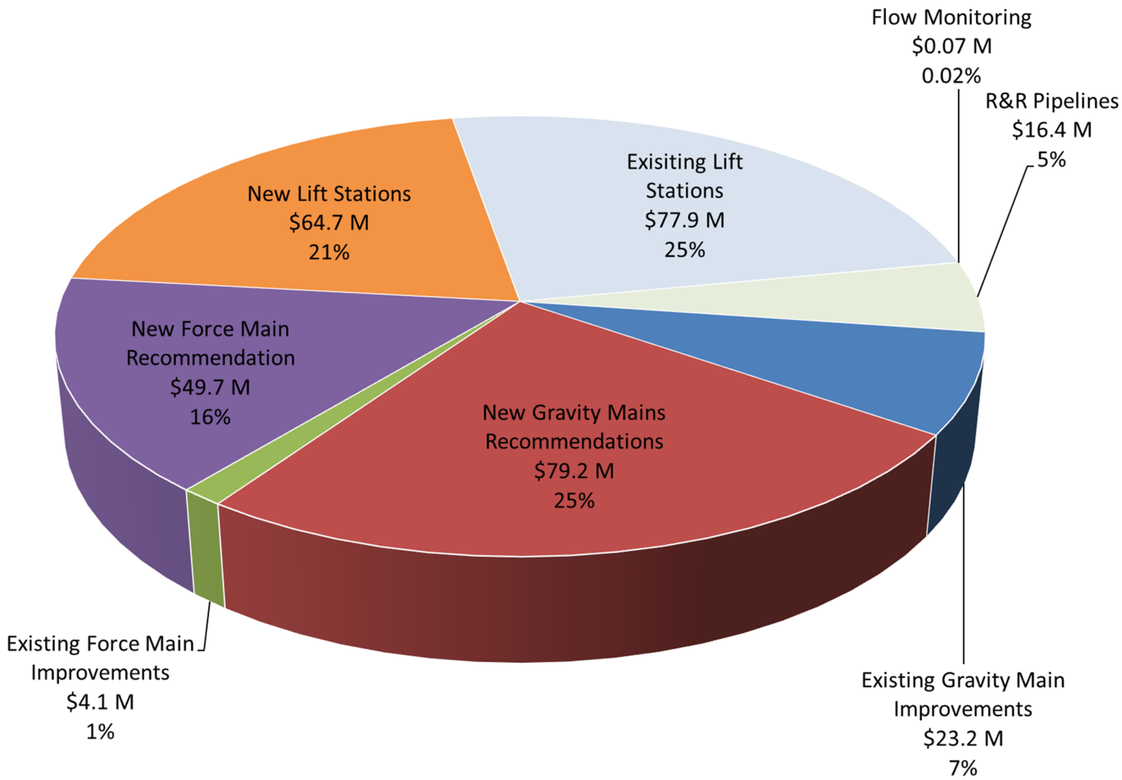

Figure 9.2 Capital Improvement Projects by Project Type

Figure 9.3 provides the location of each CIP project except for projects WW-RR-01 and WW-RR-02. These two projects can be seen in Figure 9.4, and Figure 9.5, respectively.

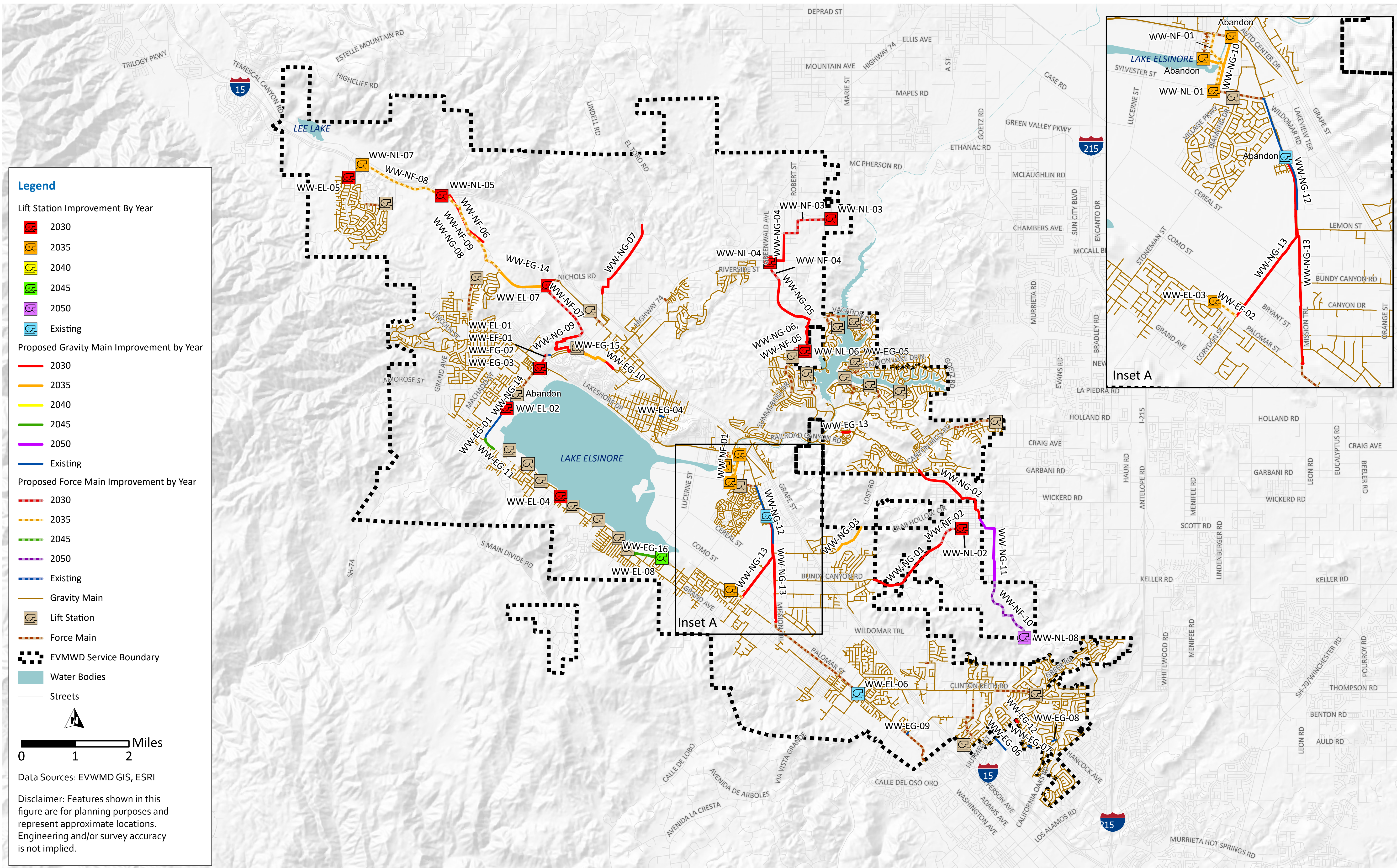

Figure 9.3 Wastewater CIP Projects

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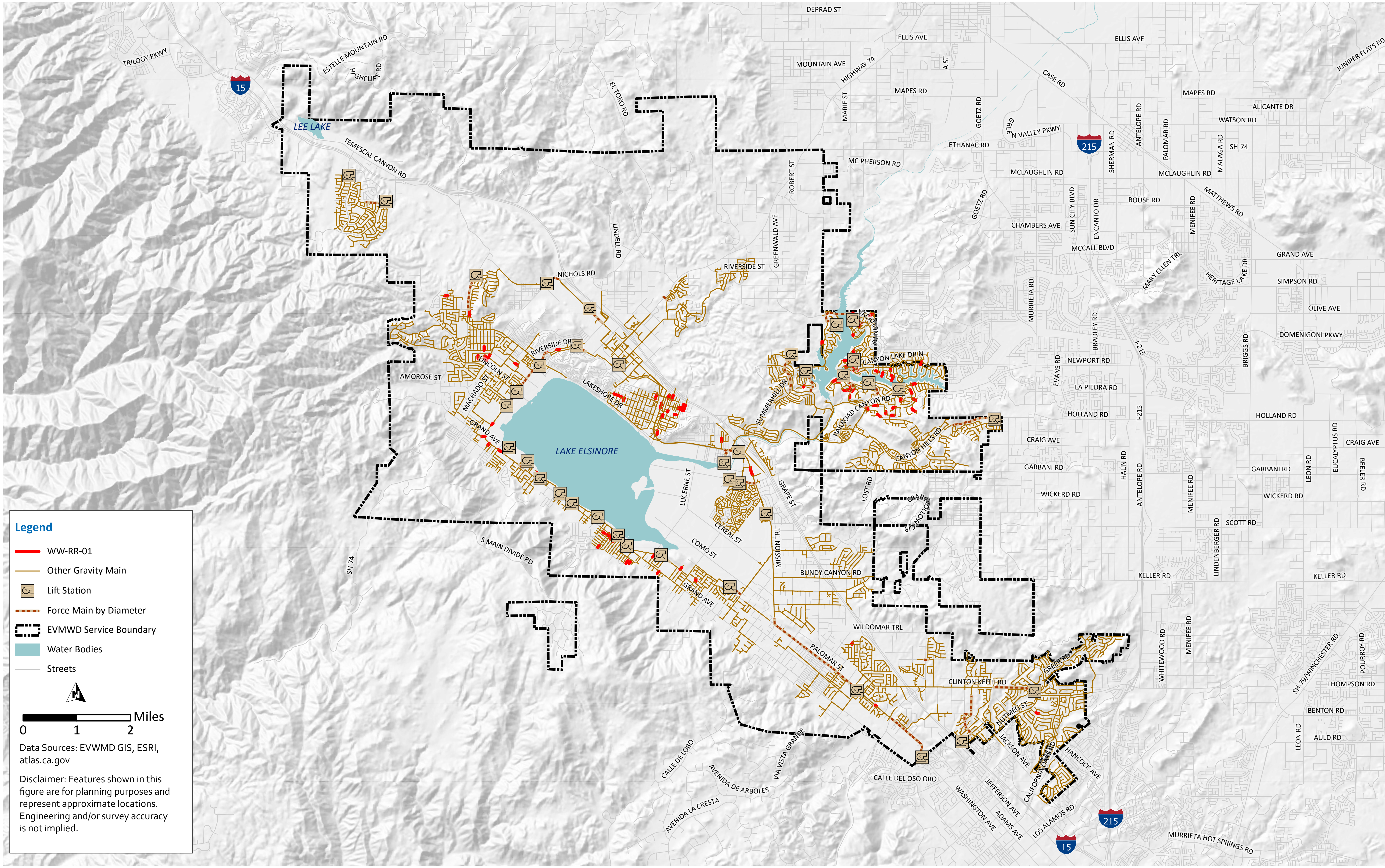

Figure 9.4 CIP Project WW-RR-01

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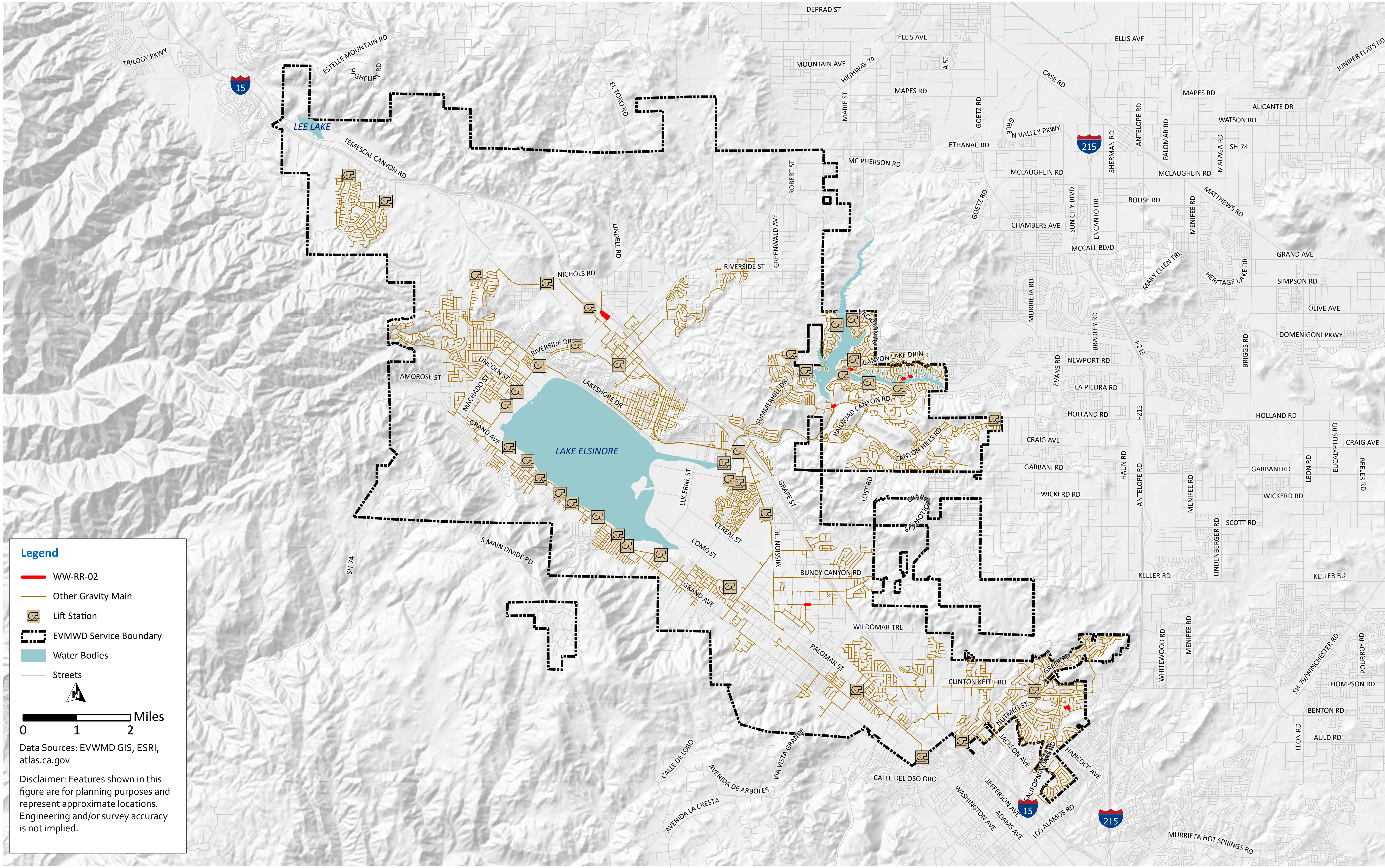

Figure 9.5 CIP Project WW-RR-02

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Appendix A

PLANNED DEVELOPMENTS

Appendix A

PLANNED DEVELOPMENT

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
1	Alberhill Ranch Master Plan Review	2030	N/A	Medium Density Residential	Residential	761.5	426.47	0.38	N/A	250	0.19	Regional
1	Alberhill Ranch Master Plan Review	2030	N/A	Medium Density Residential	Residential	975.1	546.15	0.49	N/A	250	0.24	Regional
1	Alberhill Ranch Master Plan Review	2035	N/A	Medium Density Residential	Residential	3088.0	1729.48	1.54	N/A	250	0.77	Regional
1	Alberhill Ranch Master Plan Review	2040	N/A	Medium Density Residential	Residential	572.6	320.70	0.29	N/A	250	0.14	Regional
1	Alberhill Ranch Master Plan Review	2045	N/A	Medium Density Residential	Residential	481.2	269.53	0.24	N/A	250	0.12	Regional
2	Alberhill Ranch	2025	N/A	Low Medium Density Residential	Residential	61.5	34.44	0.03	N/A	250	0.02	Regional
2	Alberhill Ranch	2025	N/A	Low Medium Density Residential	Residential	20.5	11.48	0.01	N/A	250	0.01	Regional
5	Alberhill Ridge	2030	N/A	Low Medium Density Residential	Residential	686.4	384.43	0.34	N/A	250	0.17	Regional
5	Alberhill Ridge	2030	N/A	Low Medium Density Residential	Residential	369.6	207.00	0.18	N/A	250	0.09	Regional
6	Saddleback Estates	2030	N/A	Low Medium Density Residential	Residential	18.0	10.09	0.01	N/A	250	0.00	Horsethief
6	Saddleback Estates	2030	N/A	Low Medium Density Residential	Residential	180.9	101.30	0.09	N/A	250	0.05	Horsethief
6	Saddleback Estates	2030	N/A	Low Medium Density Residential	Residential	62.1	34.79	0.03	N/A	250	0.02	Horsethief
8	JBJ Ranch	2030	N/A	Low Density Residential	Residential	239.3	134.04	0.12	N/A	250	0.06	Horsethief
8	JBJ Ranch	2030	N/A	Low Density Residential	Residential	70.7	39.59	0.04	N/A	250	0.02	Horsethief
14	Murrieta Creek Estates - Trail 31896	2045	N/A	Low Medium Density Residential	Residential	117.0	65.53	0.06	N/A	250	0.03	Southern
15	Wildomar Crossing at Clinton Keith & Stable Lane	2025	Planning	Commercial	Commercial	16.3	9.15	0.01	60%	N/A	0.00	Regional
21	Highway 74 Car Wash and Retail Center	2023	Inspection	Commercial	Commercial	4.3	2.39	0.00	60%	N/A	0.00	Regional
29	Northeast Corner Diamond Drive and Village Parkway	2023	Inspection	Medium Density Residential	Residential	53.8	30.11	0.03	N/A	250	0.01	Regional
30	Summerly Trail 31920-15	2024	Plan Check	Medium Density Residential	Residential	65.0	36.40	0.03	N/A	250	0.02	Regional
36	Monte Vista Ranch	2040	Planning	Medium Density Residential	Residential	170.4	95.43	0.09	N/A	250	0.04	Regional
42	Colinas Del Oro	2023	Inspection	Low Medium Density Residential	Residential	488.0	273.31	0.24	N/A	250	0.12	Regional
49	Livable Communities	2025	Planning	Mixed Use	Mixed Use	17.7	9.92	0.01	40%	N/A	0.00	Regional
51	Rancho Fortunado II	2023	Inspection	Low Medium Density Residential	Residential	55.0	30.80	0.03	N/A	250	0.01	Regional
53	Horizon Condos Trail 36672	2045	N/A	High Density Residential	Residential	104.5	58.54	0.05	N/A	250	0.03	Regional
58	Villa Siena	2024	Plan Check	High Density Residential	Residential	48.2	26.97	0.02	N/A	250	0.01	Regional
63	Orange Street Water and Sewer Improvements	2023	Inspection	Commercial	Commercial	47.5	26.62	0.02	60%	N/A	0.01	Regional
64	Diamond Professional Plaza	2025	Planning	Mixed Use	Mixed Use	1.7	0.93	0.00	40%	N/A	0.00	Regional
65	Grove Park	2024	Plan Check	Mixed Use	Mixed Use	65.9	36.88	0.03	40%	N/A	0.01	Regional
66	Baxter Village	2023	Inspection	Mixed Use	Mixed Use	123.2	69.01	0.06	40%	N/A	0.02	Regional
68	Tuscany Valley TTM 25475	2040	Planning	Medium Density Residential	Residential	169.2	94.77	0.08	N/A	250	0.04	Regional
69	Tuscany Crest TTM 33725	2040	Planning	Low Density Residential	Residential	115.6	64.73	0.06	N/A	250	0.03	Regional
73	Westpark	2023	Inspection	Mixed Use	Mixed Use	97.0	54.32	0.05	40%	N/A	0.02	Regional
75	South Shore II Tract 36567	2023	Inspection	Low Medium Density Residential	Residential	128.8	72.12	0.06	N/A	250	0.03	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
75	South Shore II Tract 36567	2023	Inspection	Low Medium Density Residential	Residential	158.0	88.50	0.08	N/A	250	0.04	Regional
76	Terracina Tract 36557	2023	Inspection	Low Medium Density Residential	Residential	453.2	253.84	0.23	N/A	250	0.11	Regional
76	Terracina Tract 36557	2023	Inspection	Low Medium Density Residential	Residential	124.6	69.81	0.06	N/A	250	0.03	Regional
84	Canyon Hills Estates TTM 34249	2023	Inspection	Low Density Residential	Residential	302.0	169.14	0.15	N/A	250	0.08	Regional
86	Fisherman's Wharf	2045	N/A	Low Density Residential	Residential	50.0	28.00	0.02	N/A	250	0.01	Regional
87	33401 Orchard Street 3 Lot Subdivision	2023	Inspection	Medium Density Residential	Residential	3.0	1.68	0.00	N/A	250	0.00	Regional
89	Faith Bible Church	2045	N/A	Public/Institutional	Public/ Institutional	64.3	36.03	0.03	45%	N/A	0.01	Regional
92	Lake Elsinore Town Center	2045	N/A	Mixed Use	Mixed Use	77.8	43.57	0.04	40%	N/A	0.02	Regional
93	The Summit	2050	N/A	Low Medium Density Residential	Residential	350.0	196.03	0.17	N/A	250	0.09	Regional
97	Hoist Industrial	2030	Planning	Industrial	Industrial	70.1	39.28	0.04	75%	N/A	0.03	Regional
97	Hoist Industrial	2030	Planning	Industrial	Industrial	81.7	45.74	0.04	75%	N/A	0.03	Regional
99	Lakeside Pointe Apartments	2040	Planning	High Density Residential	Residential	150.0	84.01	0.07	N/A	250	0.04	Regional
100	Steven's Gardens No. 2	2025	Planning	Commercial	Commercial	5.4	3.00	0.00	60%	N/A	0.00	Regional
109	Tract 33840	2023	Inspection	Low Medium Density Residential	Residential	15.0	8.40	0.01	N/A	250	0.00	Regional
110	Walmart Shopping Center, Inc.	2024	Plan Check	Commercial	Commercial	81.0	45.39	0.04	60%	N/A	0.02	Regional
112	Tuscany Hills North	2050	N/A	Low Medium Density Residential	Residential	807.0	451.98	0.40	N/A	250	0.20	Regional
113	Circle K Riverside & Joy	2025	Planning	Commercial	Commercial	6.0	3.35	0.00	60%	N/A	0.00	Regional
121	South Shore I Tract 31593	2050	N/A	Low Medium Density Residential	Residential	596.7	334.21	0.30	N/A	250	0.15	Regional
121	South Shore I Tract 31593	2050	N/A	Low Medium Density Residential	Residential	310.1	173.71	0.16	N/A	250	0.08	Regional
124	Kasiri Commercial Center	2023	Inspection	Commercial	Commercial	5.7	3.20	0.00	60%	N/A	0.00	Regional
128	Clinton Keith Mount San Jacinto College Campus	2023	Inspection	Public/Institutional	Public/ Institutional	200.5	112.29	0.10	45%	N/A	0.05	Regional
129	Tract 32026 Water and Sewer Improvements	2050	N/A	Low Medium Density Residential	Residential	341.5	191.24	0.17	N/A	250	0.09	Regional
131	Bridlewood Trail 32206	2024	Plan Check	Medium Density Residential	Residential	60.0	33.60	0.03	N/A	250	0.01	Regional
135	Palmilla Commercial Center	2025	Planning	Commercial	Commercial	16.3	9.15	0.01	60%	N/A	0.00	Southern
139		2024	Plan Check	Medium High Density Residential	Residential	288.0	161.30	0.14	N/A	250	0.07	Regional
140		2024	Plan Check	Hillside Residential	Residential	440.0	246.42	0.22	N/A	250	0.11	Regional
141	Tessera Project	2035	Planning	Medium Density Residential	Residential	40.6	22.71	0.02	N/A	250	0.01	Regional
142		2040	Planning	Hillside Residential	Residential	347.0	194.34	0.17	N/A	250	0.09	Regional
150	Wildomar Meadows	2045	Planning	Mixed Use	Mixed Use	2064.0	1155.99	1.03	40%	N/A	0.41	Regional
151	La Quinta Hotel on Dexter Avenue	2035	Planning	High Density Residential	Residential	63.0	35.28	0.03	N/A	250	0.02	Regional
152	94 Unit Apartments on Corydon and Sheets Lane	2045	N/A	High Density Residential	Residential	94.0	52.65	0.05	N/A	250	0.02	Regional
155	Heald Street Apartment Complex - 8 Units - Sewer and Water	2025	Planning	High Density Residential	Residential	8.0	4.48	0.00	N/A	250	0.00	Regional
156	Darling-Bundy Canyon Apartments Project	2050	N/A	Medium Density Residential	Residential	128.2	71.81	0.06	N/A	250	0.03	Regional
157	Airstream RV Dealership	2025	Planning	Commercial	Commercial	26.8	15.03	0.01	60%	N/A	0.01	Regional
159	North Main Street Hotel Water and Sewer	2040	Planning	High Density Residential	Residential	156.0	87.37	0.08	N/A	250	0.04	Regional
161	Camelia Townhomes	2024	Plan Check	Medium High Density Residential	Residential	164.0	91.85	0.08	N/A	250	0.04	Southern
162		2045	N/A	Low Density Residential	Residential	5.4	3.04	0.00	N/A	250	0.00	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
163	Lakeshore Senior Apartments	2024	Plan Check	High Density Residential	Residential	121.0	67.77	0.06	N/A	250	0.03	Regional
164	Diamond Indoor Sports Center	2045	N/A	Industrial	Industrial	17.1	9.60	0.01	75%	N/A	0.01	Regional
164	Diamond Indoor Sports Center	2045	N/A	Industrial	Industrial	23.7	13.25	0.01	75%	N/A	0.01	Regional
165	Rome Hills Commercial	2045	N/A	Mixed Use	Mixed Use	126.0	70.57	0.06	40%	N/A	0.03	Regional
167	Tract 32726 - 7 lots	2024	Plan Check	Low Density Residential	Residential	7.0	3.92	0.00	N/A	250	0.00	Regional
170	Riverside Drive Lake Front Hotel - Mixed Use	2040	Planning	Mixed Use	Mixed Use	101.0	56.57	0.05	40%	N/A	0.02	Regional
171	Triangle ExpResidentials Car Wash	2045	N/A	Commercial	Commercial	5.3	2.95	0.00	60%	N/A	0.00	Regional
172	Wildomar Shopping Mall	2045	N/A	Commercial	Commercial	3.5	1.96	0.00	60%	N/A	0.00	Regional
174	Wasson Canyon Tract 37381	2035	Planning	Low Medium Density Residential	Residential	75.3	42.17	0.04	N/A	250	0.02	Regional
176	Smith Ranch Self Storage	2024	Plan Check	Industrial	Industrial	13.1	7.34	0.01	75%	N/A	0.00	Regional
178	Sunbelt Rentals	2025	Planning	Industrial	Industrial	4.1	2.28	0.00	75%	N/A	0.00	Regional
179	The Cottages at Mission	2023	Inspection	Medium Density Residential	Residential	143.0	80.09	0.07	N/A	250	0.04	Regional
180	Railroad Canyon Mixed-Use	2023	Inspection	Mixed Use	Mixed Use	70.5	39.49	0.04	40%	N/A	0.01	Regional
181	Artisan Alley	2035	Planning	Commercial	Commercial	51.3	28.73	0.03	60%	N/A	0.02	Regional
182	Lake Front Village Mixed-Use Project	2045	Planning	Mixed Use	Mixed Use	460.0	257.63	0.23	40%	N/A	0.09	Regional
183	Starlight Meadows	2040	Planning	Low Medium Density Residential	Residential	108.0	60.49	0.05	N/A	250	0.03	Regional
184	Tract 32035	2035	Planning	Low Medium Density Residential	Residential	49.0	27.44	0.02	N/A	250	0.01	Regional
185	Lakeview Manor	2040	Planning	High Density Residential	Residential	104.0	58.25	0.05	N/A	250	0.03	Regional
187	Greenspring Hotel	2040	Planning	High Density Residential	Residential	87.0	48.73	0.04	N/A	250	0.02	Regional
188	RV Ready RV sales	2025	Planning	Industrial	Industrial	4.4	2.49	0.00	75%	N/A	0.00	Regional
189	Running Deer	2045	N/A	Low Medium Density Residential	Residential	96.0	53.77	0.05	N/A	250	0.02	Regional
192	La Laguna RV Residentialort	2023	Inspection	Open Space	Residential	328.3	183.87	0.16	N/A	250	0.08	Regional
194	Roadrunner Park Bathroom	2025	Planning	Open Space	Open Space/ Recreational	2.4	1.37	0.00	5%	N/A	0.00	Railroad
196	Lake Elsinore Assisted Living	2045	N/A	High Density Residential	Residential	66.0	36.96	0.03	N/A	250	0.02	Regional
197	Atshan Residentialidence	2023	Inspection	Low Density Residential	Residential	0.3	0.19	0.00	N/A	250	0.00	Regional
198	Brent Industrial Building	2045	N/A	Industrial	Industrial	6.5	3.64	0.00	75%	N/A	0.00	Regional
199	Lake and I-15 Gas Station	2045	N/A	Industrial	Industrial	13.5	7.54	0.01	75%	N/A	0.01	Regional
200	Markou Palomar Condo (12-15 Unit)	2024	Plan Check	High Density Residential	Residential	15.0	8.40	0.01	N/A	250	0.00	Southern
201	Elm Street Container Home	2045	N/A	High Density Residential	Residential	5.0	2.80	0.00	N/A	250	0.00	Regional
202	Grand Avenue Subdivision - 11 Lots (City of Wildomar)	2024	Plan Check	Low Density Residential	Residential	11.0	6.16	0.01	N/A	250	0.00	Regional
203	Silverleaf Motors	2045	N/A	Commercial	Commercial	5.8	3.26	0.00	60%	N/A	0.00	Regional
204	Lake Elsinore Travel Center	2025	Planning	Commercial	Commercial	9.1	5.11	0.00	60%	N/A	0.00	Regional
205	Circle K (Nichols Town Center)	2035	Planning	Commercial	Commercial	27.6	15.46	0.01	60%	N/A	0.01	Regional
206	Lake Elsinore Commercial	2035	Planning	Mixed Use	Mixed Use	44.4	24.87	0.02	40%	N/A	0.01	Regional
207	Sky Memorial Center	2024	Plan Check	Commercial	Commercial	23.7	13.25	0.01	60%	N/A	0.01	Regional
209	Wildomar Sites	2025	Planning	Low Medium Density Residential	Residential	9.0	5.04	0.00	N/A	250	0.00	Regional
211	Commercial Mixed-Use - New Elsinore 43	2040	Planning	Mixed Use	Mixed Use	148.3	83.08	0.07	40%	N/A	0.03	Regional
212	Home Sweet Home M-HD Residential	2035	Planning	Medium High Density Residential	Residential	59.0	33.04	0.03	N/A	250	0.01	Regional
213	Vantage Auctions	2023	Inspection	Industrial	Industrial	37.0	20.72	0.02	75%	N/A	0.01	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
214	Canyon Hills Marketplace, Pad 8	2045	N/A	Commercial	Commercial	3.8	2.13	0.00	60%	N/A	0.00	Regional
215	Collier Honda Dealership	2023	Inspection	Commercial	Commercial	33.2	18.58	0.02	60%	N/A	0.01	Regional
216	Baxter and I-15 Mixed Use Project	2045	N/A	Mixed Use	Mixed Use	83.8	46.93	0.04	40%	N/A	0.02	Regional
217	Bundy Canyon Subdivision	2045	N/A	Low Medium Density Residential	Residential	63.0	35.28	0.03	N/A	250	0.02	Regional
218	Summerly Tract 31920-17	2035	Planning	Medium Density Residential	Residential	65.0	36.40	0.03	N/A	250	0.02	Regional
219	Summerly Tract 31920-18	2035	Planning	Medium Density Residential	Residential	57.0	31.92	0.03	N/A	250	0.01	Regional
220	Summerly Tract 31920-19	2024	Plan Check	Medium Density Residential	Residential	53.0	29.68	0.03	N/A	250	0.01	Regional
221	Ortiz Apartments	2045	N/A	High Density Residential	Residential	5.0	2.80	0.00	N/A	250	0.00	Regional
222	Dollar General - Highway 74 and Richard Street	2045	N/A	Commercial	Commercial	12.3	6.89	0.01	60%	N/A	0.00	Regional
223	Dollar General - Grand Avenue	2025	Planning	Commercial	Commercial	9.3	5.20	0.00	60%	N/A	0.00	Regional
224	Kumar Convenience Center	2023	Inspection	Commercial	Commercial	3.7	2.10	0.00	60%	N/A	0.00	Regional
226	Tract 36115-1 PA 32	2023	Inspection	Low Medium Density Residential	Residential	78.0	43.69	0.04	N/A	250	0.02	Regional
228	Clinton Keith Village Grocery Outlet	2045	N/A	Commercial	Commercial	25.0	14.00	0.01	60%	N/A	0.01	Regional
230	Temescal Valley Project	2050	N/A	Medium High Density Residential	Residential	142.0	79.53	0.07	N/A	250	0.04	Regional
231	Lake Elsinore Travel Center	2040	Planning	High Density Residential	Residential	81.0	45.37	0.04	N/A	250	0.02	Regional
232	Monte Vista II	2023	Inspection	Mixed Use	Mixed Use	128.2	71.82	0.06	40%	N/A	0.03	Regional
233	Prielipp Apartments	2023	Inspection	Mixed Use	Mixed Use	68.6	38.44	0.03	40%	N/A	0.01	Regional
234	Kumar Commercial Center	2025	Planning	Commercial	Commercial	13.1	7.32	0.01	60%	N/A	0.00	Regional
236	Imperial Stations	2023	Inspection	Commercial	Commercial	8.1	4.52	0.00	60%	N/A	0.00	Regional
237	Wild Omar's Zoo	2045	N/A	Mixed Use	Mixed Use	38.7	21.67	0.02	40%	N/A	0.01	Regional
238	Marriott Hotel	2040	Planning	High Density Residential	Residential	135.0	75.61	0.07	N/A	250	0.03	Regional
240	New VentuResidential Apartments	2025	Planning	High Density Residential	Residential	6.0	3.36	0.00	N/A	250	0.00	Regional
241	Summerly Trail 31920-21 Water and Sewer	2045	N/A	Medium Density Residential	Residential	57.2	32.04	0.03	N/A	250	0.01	Regional
242	Ortega Avenue and Grand Avenue Mixed-Use Project	2035	Planning	Mixed Use	Mixed Use	42.7	23.92	0.02	40%	N/A	0.01	Regional
244	Highway 74 Self Storage	2025	Planning	Industrial	Industrial	6.7	3.75	0.00	75%	N/A	0.00	Regional
245	Summerly Trail 31920-22	2035	Planning	Medium Density Residential	Residential	47.5	26.61	0.02	N/A	250	0.01	Regional
247	Hotel at Oak Creek Shopping Center	2045	N/A	High Density Residential	Residential	102.0	57.13	0.05	N/A	250	0.03	Regional
249	Viscaya Trail 32008	2025	Planning	High Density Residential	Residential	8.0	4.48	0.00	N/A	250	0.00	Regional
250	Simple Simon, LLC	2025	Planning	Commercial	Commercial	11.8	6.63	0.01	60%	N/A	0.00	Regional
252	Harvest of Lake Elsinore	2025	Planning	Industrial	Industrial	0.6	0.32	0.00	75%	N/A	0.00	Regional
253	Summerly1	2040	Planning	Medium High Density Residential	Residential	101.0	56.57	0.05	N/A	250	0.0252 499	Regional
254	NexxGen Project	2024	Plan Check	Low Density Residential	Residential	8.0	4.48	0.00	N/A	250	0.00	Regional
255	Alberhill Elementary School	2025	Planning	Public/Institutional	Public/ Institutional	26.4	14.76	0.01	45%	N/A	0.01	Regional
263	Vista Ortega Apartments	2024	Plan Check	Low Medium Density Residential	Residential	16.0	8.96	0.01	N/A	250	0.00	Regional
264	Oak Springs Ranch Phase 2	2035	Planning	High Density Residential	Residential	65.4	36.63	0.03	N/A	250	0.02	Regional
265	Summerly2	2035	Planning	Medium High Density Residential	Residential	60.0	33.60	0.03	N/A	250	0.01	Regional
266	Central Street Plot Plan	2024	Plan Check	Business Park	Commercial	0.4	0.22	0.00	60%	N/A	0.00	Regional
268	Summerly Tract 31920-23	2023	Inspection	Medium High Density Residential	Residential	77.0	43.13	0.04	N/A	250	0.02	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
269	Silverleaf Motors	2025	Planning	Commercial	Commercial	1.3	0.74	0.00	60%	N/A	0.00	Regional
270	Won Meditation/Retreat Center	2024	Plan Check	Commercial	Commercial	101.3	56.75	0.05	60%	N/A	0.03	Regional
271	Jack in the Box El Toro	2045	N/A	Commercial	Commercial	8.3	4.65	0.00	60%	N/A	0.00	Regional
272	Central Avenue and Ardenwood Way Gas Station and Convenience Store	2025	Planning	Commercial	Commercial	7.4	4.15	0.00	60%	N/A	0.00	Regional
273	Tru-Sports 17938 Collier Avenue	2025	Planning	Industrial	Industrial	5.0	2.81	0.00	75%	N/A	0.00	Regional
274	The Lakeview Plaza	2025	Planning	Commercial	Commercial	19.1	10.68	0.01	60%	N/A	0.01	Regional
275	Oak Creek Canyon1	2025	Planning	Mixed Use	Mixed Use	4.3	2.41	0.00	40%	N/A	0.00	Regional
276	Highway 74 Business Park	2045	N/A	Business Park	Commercial	6.6	3.67	0.00	60%	N/A	0.00	Regional
279	Westlake Offsite Water	2024	Plan Check	Medium Density Residential	Residential	89.9	50.33	0.04	N/A	250	0.02	Regional
280	21-115 - SFR Waterline Extension	2023	Inspection	Low Density Residential	Residential	50.0	27.99	0.02	N/A	250	0.01	Regional
282	Corydon II	2045	N/A	Industrial	Industrial	4.5	2.54	0.00	75%	N/A	0.00	Regional
283	Hadley's Place	2025	Planning	Industrial	Industrial	2.6	1.43	0.00	75%	N/A	0.00	Regional
284	Jean Hayman Site Phase I	2045	N/A	Medium Density Residential	Residential	49.6	27.77	0.02	N/A	250	0.01	Regional
286	Wildomar Shooting Range	2045	N/A	Industrial	Industrial	3.3	1.83	0.00	75%	N/A	0.00	Regional
287	Ramiro Residentialidence	2025	Planning	Medium Density Residential	Residential	1.4	0.81	0.00	N/A	250	0.00	Regional
288	Mosqueda Residentialidence	2025	Planning	High Density Residential	Residential	0.9	0.49	0.00	N/A	250	0.00	Regional
289	Mountain and Lake Street	2035	Planning	Commercial	Commercial	27.5	15.42	0.01	60%	N/A	0.01	Regional
291	Leicester Waterline	2024	Plan Check	Low Density Residential	Residential	0.6	0.32	0.00	N/A	250	0.00	Regional
292	DG- Lake Elsinore	2023	Inspection	Commercial	Commercial	5.8	3.25	0.00	60%	N/A	0.00	Regional
293	Canyon Hills Phase 7 Landscape	2045	N/A	Open Space	Open Space/ Recreational	37.8	21.15	0.02	5%	N/A	0.00	Regional
294	Nichols Ranch Tract 37305	2024	Plan Check	Low Density Residential	Residential	172.8	96.76	0.09	N/A	250	0.04	Regional
295	Garner Road	2025	Planning	Medium Density Residential	Residential	0.6	0.35	0.00	N/A	250	0.00	Regional
299	Cordero Residence	2025	Planning	High Density Residential	Residential	1.0	0.56	0.00	N/A	250	0.00	Regional
300	Perris Senior Apartments	2045	N/A	High Density Residential	Residential	5.4	3.01	0.00	N/A	250	0.00	Regional
301	Summerly Storm Water Pump Station	2025	Planning	Vacant	Public/ Institutional	0.0	0.00	0.00	45%	N/A	0.00	Regional
303	TPM 37773	2045	N/A	Industrial	Industrial	11.8	6.64	0.01	75%	N/A	0.00	Regional
304	Chevron Gas Station Remodel	2025	Planning	Commercial	Commercial	3.1	1.76	0.00	60%	N/A	0.00	Regional
305	Sycamore Creek Marketplace	2045	N/A	Commercial	Commercial	51.1	28.62	0.03	60%	N/A	0.02	Regional
310	Gas Station, Convenience Store and Carwash	2025	Planning	Commercial	Commercial	4.7	2.63	0.00	60%	N/A	0.00	Regional
311	Arturo and Nathan Luna	2024	Plan Check	Low Density Residential	Residential	8.9	4.96	0.00	N/A	250	0.00	Regional
312	Wagners Run	2025	Planning	Low Medium Density Residential	Residential	7.0	3.90	0.00	N/A	250	0.00	Regional
313	1589 Mill Street	2025	Planning	Medium Density Residential	Residential	18.6	10.40	0.01	N/A	250	0.00	Regional
314	Lake Elsinore Commerce Center	2024	Plan Check	Commercial	Commercial	1181.5	661.72	0.59	60%	N/A	0.35	Regional
317	Golcheh Group Commercial Use	2035	Planning	Commercial	Commercial	28.9	16.20	0.01	60%	N/A	0.01	Regional
318	Wasson Canyon Tract 37382	2050	N/A	Low Medium Density Residential	Residential	220.5	123.48	0.11	N/A	250	0.06	Regional
319	East Lake Villas	2045	N/A	Mixed Use	Mixed Use	37.0	20.72	0.02	40%	N/A	0.01	Regional
320	Cannabis Property1	2024	Plan Check	Commercial	Commercial	3.3	1.83	0.00	60%	N/A	0.00	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
322	Los Compadres	2025	Planning	Commercial	Commercial	1.8	0.99	0.00	60%	N/A	0.00	Regional
324	North Elsinore Industrial Park	2045	N/A	Industrial	Industrial	9.4	5.29	0.00	75%	N/A	0.00	Regional
325	187 Chestnut Avenue	2025	Planning	Medium Density Residential	Residential	3.5	1.93	0.00	N/A	250	0.00	Regional
326	17393 Grand Avenue Cannabis Retail	2025	Planning	Mixed Use	Mixed Use	0.9	0.52	0.00	40%	N/A	0.00	Regional
328	143 South Terra Cotta Road	2024	Plan Check	Low Medium Density Residential	Residential	0.7	0.37	0.00	N/A	250	0.00	Regional
329	22200 Canyon Club Drive	2023	Inspection	Public/Institutional	Public/ Institutional	21.9	12.28	0.01	45%	N/A	0.00	Railroad
330	Renaissance Ranch Commerce Center	2040	Planning	Business Park	Commercial	221.5	124.06	0.11	60%	N/A	0.07	Horsethief
330	Renaissance Ranch Commerce Center	2035	Planning	Business Park	Commercial	67.7	37.90	0.03	60%	N/A	0.02	Horsethief
331	407 West Sumner Avenue	2025	Planning	Low Medium Density Residential	Residential	0.8	0.44	0.00	N/A	250	0.00	Regional
332	Pacific Coral	2040	Planning	Low Medium Density Residential	Residential	174.3	97.63	0.09	N/A	250	0.04	Regional
333	Herbert Nursery	2023	Inspection	Commercial	Commercial	22.6	12.68	0.01	60%	N/A	0.01	Regional
334	Tommy's Car Wash	2045	N/A	Commercial	Commercial	5.4	3.04	0.00	60%	N/A	0.00	Regional
335	APN 374-101-003 Water Line Extension	2025	Planning	Low Medium Density Residential	Residential	1.4	0.76	0.00	N/A	250	0.00	Regional
336	APN 378-183-024 Single Family Home	2025	Planning	Low Density Residential	Residential	0.5	0.29	0.00	N/A	250	0.00	Regional
338	Bahia Village	2023	Inspection	Low Medium Density Residential	Residential	38.2	21.41	0.02	N/A	250	0.01	Regional
339	Granite Street - Sewer Line Extension	2025	Planning	Medium Density Residential	Residential	1.5	0.82	0.00	N/A	250	0.00	Regional
340	APN 345-220-067 - Water Line Extension	2025	Planning	Medium Density Residential	Residential	4.5	2.51	0.00	N/A	250	0.00	Regional
341	SEC Dexter and Allan	2025	Planning	Commercial	Commercial	12.4	6.97	0.01	60%	N/A	0.00	Regional
342	Palomar Road Single Family Residence	2024	Plan Check	Medium High Density Residential	Residential	4.5	2.53	0.00	N/A	250	0.00	Southern
343	APN 347-130-025 - Cannabis Facility	2025	Planning	Commercial	Commercial	5.5	3.06	0.00	60%	N/A	0.00	Regional
344	Mi Familia Tattoo Shop	2024	Plan Check	Commercial	Commercial	3.4	1.88	0.00	60%	N/A	0.00	Regional
345	Trail 33140	2025	Planning	Low Medium Density Residential	Residential	26.0	14.54	0.01	N/A	250	0.01	Regional
345	Trail 33140	2025	Planning	Low Medium Density Residential	Residential	17.9	10.05	0.01	N/A	250	0.00	Regional
345	Trail 33140	2040	Planning	Low Medium Density Residential	Residential	247.8	138.80	0.12	N/A	250	0.06	Regional
346	PAR APN 370-080-024 Modular Offices	2025	Planning	Business Park	Commercial	1.3	0.73	0.00	60%	N/A	0.00	Regional
347	Starbucks	2025	Planning	Commercial	Commercial	6.1	3.39	0.00	60%	N/A	0.00	Regional
348	CAFH Order of Wildomar	2025	Planning	Low Density Residential	Residential	0.3	0.16	0.00	N/A	250	0.00	Regional
349	Pennington Industrial	2025	Planning	Industrial	Industrial	6.6	3.72	0.00	75%	N/A	0.00	Regional
350	183 S Chestnut Street APN 373-152-016	2023	Inspection	Medium Density Residential	Residential	0.9	0.48	0.00	N/A	250	0.00	Regional
351	18565 Grand Avenue	2025	Planning	Low Medium Density Residential	Residential	4.2	2.33	0.00	N/A	250	0.00	Regional
352	1515 West Sumner Avenue Sewer Extension	2025	Planning	Low Medium Density Residential	Residential	0.8	0.44	0.00	N/A	250	0.00	Regional
353	Store America Self Storage	2024	Plan Check	Industrial	Industrial	5.7	3.21	0.00	75%	N/A	0.00	Regional
354	Sunny Lane SFR APN 387-060-004	2025	Planning	Low Medium Density Residential	Residential	1.1	0.61	0.00	N/A	250	0.00	Regional
355	Westridge Condos	2035	Planning	Medium Density Residential	Residential	60.0	33.60	0.03	N/A	250	0.01	Regional
356	Rivera Towing Flint Street Waterline Extension	2045	N/A	High Density Residential	Residential	2.4	1.34	0.00	N/A	250	0.00	Regional
357	Temescal Canyon Mini Storage	2025	Planning	Industrial	Industrial	9.8	5.50	0.00	75%	N/A	0.00	Regional
358	Lakeside (TriPoint Homes)	2040	Planning	Medium High Density Residential	Residential	167.9	94.02	0.08	N/A	250	0.04	Regional
359	Lake Street RV Storage	2045	N/A	Industrial	Industrial	26.8	15.00	0.01	75%	N/A	0.01	Regional
360	Ortega Plaza	2025	Planning	Commercial	Commercial	27.1	15.16	0.01	60%	N/A	0.01	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
361	Echo Highland Tract 32585	2023	Inspection	Low Medium Density Residential	Residential	163.0	91.29	0.08	N/A	250	0.04	Regional
362	Single Family Residence Manufactured Homes	2025	Planning	Low Density Residential	Residential	6.0	3.36	0.00	N/A	250	0.00	Regional
363	TTM 37916 Single Family Residence	2025	Planning	Low Density Residential	Residential	5.0	2.80	0.00	N/A	250	0.00	Regional
364	Nichols Industrial Center	2030	Planning	Industrial	Industrial	34.9	19.54	0.02	75%	N/A	0.01	Regional
364	Nichols Industrial Center	2030	Planning	Industrial	Industrial	69.2	38.78	0.03	75%	N/A	0.03	Regional
365	Pacific Hydrotech Corporation	2024	Plan Check	Industrial	Industrial	27.5	15.43	0.01	75%	N/A	0.01	Regional
366	Spyglass Tract 35337	2023	Inspection	Low Medium Density Residential	Residential	163.4	91.49	0.08	N/A	250	0.04	Regional
366	Spyglass Tract 35337	2023	Inspection	Low Medium Density Residential	Residential	680.3	381.01	0.34	N/A	250	0.17	Regional
366	Spyglass Tract 35337	2023	Inspection	Low Medium Density Residential	Residential	190.2	106.54	0.10	N/A	250	0.05	Regional
367	La Strata Tract 32077	2040	Planning	Low Medium Density Residential	Residential	128.0	71.69	0.06	N/A	250	0.03	Regional
368	ProWest Main	2024	Plan Check	Commercial	Commercial	12.9	7.25	0.01	60%	N/A	0.00	Southern
369	Inland Valley Medical Center	2035	Planning	Public/Institutional	Public/ Institutional	50.6	28.36	0.03	45%	N/A	0.01	Southern
370	Rancon Medical & Education Center	2040	Planning	Commercial	Commercial	135.7	76.02	0.07	60%	N/A	0.04	Regional
371	The Grove (T36673)	2023	Inspection	High Density Residential	Residential	38.7	21.68	0.02	N/A	250	0.01	Regional
372	Cholico Residence	2025	Planning	Low Density Residential	Residential	1.0	0.56	0.00	N/A	250	0.00	Regional
373	Cannabis Property2	2024	Plan Check	Commercial	Commercial	6.8	3.82	0.00	60%	N/A	0.00	Regional
374	760 Park Avenue Waterline Extension	2023	Inspection	Medium Density Residential	Residential	0.7	0.37	0.00	N/A	250	0.00	Regional
375	Alberhill Ranch Tract 28214-9 to 17	2030	N/A	Low Medium Density Residential	Residential	464.1	259.92	0.23	N/A	250	0.12	Regional
375	Alberhill Ranch Tract 28214-9 to 17	2030	N/A	Low Medium Density Residential	Residential	54.0	30.24	0.03	N/A	250	0.01	Regional
376	Sunny Express Carwash	2024	Plan Check	Commercial	Commercial	11.0	6.18	0.01	60%	N/A	0.00	Regional
377	Commercial Remodel 18570 Collier	2025	Planning	Commercial	Commercial	3.0	1.67	0.00	60%	N/A	0.00	Regional
378	Popeyes	2023	Inspection	Commercial	Commercial	5.7	3.18	0.00	60%	N/A	0.00	Regional
379	10 Single Family Homes	2025	Planning	Medium Density Residential	Residential	10.4	5.84	0.01	N/A	250	0.00	Regional
380	Sage/Investco Mixed-Use	2035	Planning	Mixed Use	Mixed Use	34.3	19.23	0.02	40%	N/A	0.01	Regional
381	Espinoza Residential	2025	Planning	Low Medium Density Residential	Residential	1.8	1.02	0.00	N/A	250	0.00	Regional
382	374-081-002 Line Extension	2045	N/A	Low Medium Density Residential	Residential	0.8	0.45	0.00	N/A	250	0.00	Regional
383	381-100-021 Parcel Subdivision	2025	Planning	Low Medium Density Residential	Residential	17.4	9.76	0.01	N/A	250	0.00	Regional
384	Sierra Park North Development	2045	N/A	Medium Density Residential	Residential	23.1	12.96	0.01	N/A	250	0.01	Railroad
385	315 North Lewis Street Sewer Lateral	2045	N/A	Low Medium Density Residential	Residential	0.8	0.46	0.00	N/A	250	0.00	Regional
386	Cannabis Cultivation Distribution Retail	2025	Planning	Commercial	Commercial	13.6	7.62	0.01	60%	N/A	0.00	Regional
387	Riley Apartments	2045	N/A	High Density Residential	Residential	2.1	1.19	0.00	N/A	250	0.00	Regional
388	Flint Street 4 Plex	2025	Planning	High Density Residential	Residential	4.0	2.24	0.00	N/A	250	0.00	Regional
389	18492 Dexter Building Division	2024	Plan Check	Commercial	Commercial	5.2	2.94	0.00	60%	N/A	0.00	Regional
390	Brown Street New Single Family Residence	2025	Planning	Low Density Residential	Residential	0.3	0.18	0.00	N/A	250	0.00	Regional
391	Coffee and Bakery	2025	Planning	Commercial	Commercial	8.1	4.55	0.00	60%	N/A	0.00	Regional
392	Cannabis Cultivation and Retail Facility	2024	Plan Check	Commercial	Commercial	1.8	1.01	0.00	60%	N/A	0.00	Regional
393	Lakeland Village Senior Complex	2024	Plan Check	Low Medium Density Residential	Residential	20.6	11.52	0.01	N/A	250	0.01	Regional
394	PAR - 21-0119 - TPM 36476 Proposal	2045	N/A	Medium Density Residential	Residential	46.5	26.04	0.02	N/A	250	0.01	Regional
395	PAR - 21-0108 - Chiquito Battery Storage Facility	2025	Planning	Industrial	Industrial	2.5	1.42	0.00	75%	N/A	0.00	Southern

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
396	Single Family Residence 379-202-001 31131 Illinois Street	2024	Plan Check	Medium Density Residential	Residential	0.5	0.28	0.00	N/A	250	0.00	Regional
397	Pottery Apartments	2045	N/A	Medium Density Residential	Residential	5.8	3.27	0.00	N/A	250	0.00	Regional
398	Commercial Retail Center	2023	Inspection	Commercial	Commercial	11.2	6.29	0.01	60%	N/A	0.00	Regional
400	Reyes Single Family Residence	2025	Planning	Low Medium Density Residential	Residential	1.1	0.60	0.00	N/A	250	0.00	Regional
401	Tres Lagos Apartments	2035	Planning	High Density Residential	Residential	52.7	29.50	0.03	N/A	250	0.01	Regional
402	Central Grocery and Retail	2035	Planning	Commercial	Commercial	41.2	23.08	0.02	60%	N/A	0.01	Regional
403	Miguels Jr DCDA Service Removal	2024	Plan Check	Commercial	Commercial	3.0	1.69	0.00	60%	N/A	0.00	Regional
404	Single Family Residence APN 378-181-080	2023	Inspection	Low Density Residential	Residential	0.3	0.18	0.00	N/A	250	0.00	Regional
405	Single Family Residence APN 383-020-001	2050	N/A	Low Medium Density Residential	Residential	213.0	119.27	0.11	N/A	250	0.05	Regional
405	Single Family Residence APN 383-020-001	2045	N/A	Low Medium Density Residential	Residential	54.2	30.38	0.03	N/A	250	0.01	Regional
406	350-Home Single Family Development	2040	Planning	Hillside Residential	Residential	249.2	139.56	0.12	N/A	250	0.06	Regional
407	Single Family Residence 32657 Wildomar Trail 376-042-011	2025	Planning	Medium Density Residential	Residential	0.9	0.51	0.00	N/A	250	0.00	Regional
408	Single Family Residence 365-270-053	2023	Inspection	Open Space	Residential	135.7	76.02	0.07	N/A	250	0.03	Regional
409	373-082-037 Townhomes	2023	Inspection	Mixed Use	Mixed Use	0.4	0.22	0.00	40%	N/A	0.00	Regional
410	22261 Walnut Street Sewer Lateral	2023	Inspection	Low Density Residential	Residential	1.6	0.91	0.00	N/A	250	0.00	Regional
411	Empire Design Group Backflow Upgrade	2023	Inspection	Commercial	Commercial	1.0	0.53	0.00	60%	N/A	0.00	Regional
412	Graham Street Sewer Lateral Repair	2023	Inspection	Mixed Use	Mixed Use	0.7	0.40	0.00	40%	N/A	0.00	Regional
413	375-250-024 Line Extension	2023	Inspection	Medium Density Residential	Residential	2.3	1.29	0.00	N/A	250	0.00	Regional
414	32985 Serena Way	2023	Inspection	Mixed Use	Mixed Use	1.1	0.62	0.00	40%	N/A	0.00	Regional
415	1505 West Sumner Avenue Sewer Lateral	2023	Inspection	Low Medium Density Residential	Residential	0.7	0.41	0.00	N/A	250	0.00	Regional
416	Trail 36952, Wildomar Ridge	2023	Inspection	Medium Density Residential	Residential	49.3	27.61	0.02	N/A	250	0.01	Regional
417	Manning Street Water Line Extension	2023	Inspection	Hillside Residential	Residential	0.2	0.11	0.00	N/A	250	0.00	Regional
418	Sierra Park North Bathroom	2025	Planning	Low Density Residential	Residential	0.4	0.23	0.00	N/A	250	0.00	Railroad
419	Franklin and Miramar Single Family Residence	2025	Planning	Very Low Density Residential	Residential	0.7	0.37	0.00	N/A	250	0.00	Regional
420	16465 Joy Street 6-Inch Sewer Lateral Repair	2025	Planning	Medium Density Residential	Residential	5.0	2.80	0.00	N/A	250	0.00	Regional
421	389-290-028 Water Line Extension	2025	Planning	Low Medium Density Residential	Residential	9.0	5.03	0.00	N/A	250	0.00	Regional
422	Single Family Residence - APN - 345-220-044	2023	Inspection	Low Density Residential	Residential	8.1	4.55	0.00	N/A	250	0.00	Regional
423	North Wildomar Retail Center	2025	Planning	Commercial	Commercial	6.6	3.72	0.00	60%	N/A	0.00	Regional
424	Central Wildomar Retail Center	2045	N/A	Commercial	Commercial	3.9	2.21	0.00	60%	N/A	0.00	Regional
427	Corydon 3	2024	Plan Check	Low Density Residential	Residential	7.8	4.34	0.00	N/A	250	0.00	Regional
428	Single Family Residence - 375-323-006	2023	Inspection	Low Medium Density Residential	Residential	0.3	0.17	0.00	N/A	250	0.00	Regional
429	Saint Frances of Rome Recycled Water	2023	Inspection	Outside	Public/ Institutional	0.0	0.00	0.00	45%	N/A	0.00	Regional
432	City of Wildomar 27 Acre Park	2040	Planning	Medium Density Residential	Residential	119.9	67.14	0.06	N/A	250	0.03	Regional
433	317 North Lewis Street Sewer Lateral Connection	2025	Planning	Low Medium Density Residential	Residential	0.8	0.46	0.00	N/A	250	0.00	Regional
445	Corydon and Grand Mixed Use - APN 370-171-015	2035	Planning	Commercial	Commercial	37.0	20.71	0.02	60%	N/A	0.01	Regional
446	PA 2021-22 APN 377-190-002	2045	N/A	Commercial	Commercial	4.1	2.27	0.00	60%	N/A	0.00	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
447	Summer Sage Way PAR APN 367-130-036	2023	Inspection	Open Space	Open Space/ Recreational	4.6	2.58	0.00	5%	N/A	0.00	Regional
449	PAR - Ou Residence - APN - 374-112-019	2025	Planning	Low Medium Density Residential	Residential	0.8	0.44	0.00	N/A	250	0.00	Regional
450	PA 2021-29 Industrial Project APN 377-140-028	2025	Planning	Industrial	Industrial	12.3	6.91	0.01	75%	N/A	0.00	Regional
454	Catt Road Retail Center	2025	Planning	Commercial	Commercial	12.8	7.15	0.01	60%	N/A	0.00	Regional
455	Highway 74 Contractor Yard	2024	Plan Check	Commercial	Commercial	71.0	39.74	0.04	60%	N/A	0.02	Regional
456	Mission Trail Animal Shelter	2025	Planning	Commercial	Commercial	12.9	7.23	0.01	60%	N/A	0.00	Regional
457	Horsethief Ridge Trail 37002	2024	Plan Check	Medium Density Residential	Residential	229.0	128.26	0.11	N/A	250	0.06	Horsethief
458	Water and Sewer Extension APN 349-330-007	2024	Plan Check	Hillside Residential	Residential	26.8	14.99	0.01	N/A	250	0.01	Regional
459	LE Costco Car Wash	2024	Plan Check	Commercial	Commercial	12.3	6.87	0.01	60%	N/A	0.00	Regional
460	Palmilla Bungalows Apartments	2035	Planning	High Density Residential	Residential	54.4	30.46	0.03	N/A	250	0.01	Southern
461	34497 Cherry Street Sewer Lateral	2045	N/A	Low Density Residential	Residential	0.5	0.29	0.00	N/A	250	0.00	Regional
462	Single Family Residence APN 383-091-001	2045	N/A	Low Medium Density Residential	Residential	0.5	0.26	0.00	N/A	250	0.00	Regional
463	Water Line Ext 366-130-041	2025	Planning	Medium Density Residential	Residential	3.4	1.90	0.00	N/A	250	0.00	Regional
464	33016 Evergreen Street Sewer Lateral	2025	Planning	Medium Density Residential	Residential	0.5	0.29	0.00	N/A	250	0.00	Regional
465	America's Tire Lake Elsinore	2025	Planning	Commercial	Commercial	10.2	5.72	0.01	60%	N/A	0.00	Regional
466	Single Family Residence APN 379-090-029 and 030	2024	Plan Check	Low Medium Density Residential	Residential	1.7	0.94	0.00	N/A	250	0.00	Regional
467	Single Family Residence Sewer Extension APN - 375-322-020	2024	Plan Check	Low Medium Density Residential	Residential	0.3	0.15	0.00	N/A	250	0.00	Regional
468	28603 Highway 74 Contractor Yard	2045	N/A	Business Park	Commercial	6.9	3.84	0.00	60%	N/A	0.00	Regional
469	Dutch Brothers Coffee	2024	Plan Check	Business Park	Commercial	1.2	0.67	0.00	60%	N/A	0.00	Regional
470	Rosetta View Estates	2024	Plan Check	Low Medium Density Residential	Residential	39.9	22.35	0.02	N/A	250	0.01	Regional
471	Fire Hydrant Relocation 29280 Central Avenue	2025	Planning	Public/Institutional	Public/Institutio nal	2.5	1.40	0.00	45%	N/A	0.00	Regional
472	Lakeshore Dock Installation	2025	Planning	Vacant	Public/ Institutional	0.0	0.00	0.00	45%	N/A	0.00	Regional
473	Aguinaga Green	2025	Planning	Commercial	Commercial	17.7	9.92	0.01	60%	N/A	0.01	Regional
474	Trail 3720 Verizon Cell Tower - Cross Hill	2023	Inspection	Industrial	Industrial	2.9	1.62	0.00	75%	N/A	0.00	Railroad
475	The Cove Apartments	2045	Planning	High Density Residential	Residential	456.0	255.39	0.23	N/A	250	0.11	Regional
476	Temescal Valley Commerce Center	2040	Planning	Industrial	Industrial	123.8	69.31	0.06	75%	N/A	0.05	Regional
477	Grand Avenue 6	2025	Planning	Low Density Residential	Residential	5.0	2.80	0.00	N/A	250	0.00	Regional
478	Rosetta Ridge	2035	Planning	Low Medium Density Residential	Residential	77.7	43.50	0.04	N/A	250	0.02	Regional
479	Lakeview Apartments	2023	Inspection	High Density Residential	Residential	117.9	66.02	0.06	N/A	250	0.03	Regional
479	Lakeview Apartments	2023	Inspection	High Density Residential	Residential	26.1	14.59	0.01	N/A	250	0.01	Regional
481	Horsethief 5G LSub6	2025	Planning	Industrial	Industrial	1.2	0.7	0.00	0.75	N/A	0.00	Horsethief
482	Lindsay Street	2023	Inspection	Low Medium Density Residential	Residential	0.7	0.4	0.00	N/A	250	0.00	Regional
483	30433 Chaney Street	2045	N/A	Low Medium Density Residential	Residential	0.5	0.3	0.00	N/A	250	0.00	Regional
484	Mission Trail Tract 043001/1	2024	Plan Check	Medium Density Residential	Residential	135.6	75.9	0.07	N/A	250	0.03	Regional
485	Hidden Springs Mixed Use	2024	Plan Check	Mixed Use	Mixed Use	558.4	312.7	0.28	0.40	N/A	0.11	Southern
486	Rosetta Canyon Apartments	2040	Planning	High Density Residential	Residential	268.0	150.1	0.13	N/A	250	0.07	Regional

Reference Number	Title	Plan Year	Status	Land Use	Type	EDUs	Projected Water Demand (AFY)	Projected ADD (mgd)	RTS	WWFF (gpd)	ADWF (mgd)	WRF
487	De Palma Regional Lift Station	2024	Plan Check	Low Medium Density Residential	Residential	12.0	6.7	0.01	N/A	250	0.00	Regional
488	Horsethief Zone 1601 Reservoir No. 2	2025	N/A	Low Density Residential	Residential	1.5	0.8	0.00	N/A	250	0.00	Horsethief
489	Alberhill Ridge Zone 1601/1676 Pump Station	2025	N/A	Vacant	Public/ Institutional	0.0	0.0	0.00	0.45	N/A	0.00	Regional
490	Tuscany Crest Temporary Sewer Lift Station	2025	Planning	Vacant	Public/ Institutional	0.0	0.0	0.00	0.45	N/A	0.00	Regional
496	Single Family Residence - APN 363-273-025	2025	Planning	Low Medium Density Residential	Residential	1.0	0.6	0.00	N/A	250	0.00	Regional
497	420 North Langstaff Street Multi Family	2025	Planning	High Density Residential	Residential	4.0	2.2	0.00	N/A	250	0.00	Regional
498	Wildomar Crossings Commercial Mixed-Use	2025	Planning	Commercial	Commercial	21.2	11.9	0.01	0.60	N/A	0.01	Regional
499	Industrial Building APN 377-430-016	2025	Planning	Industrial	Industrial	2.1	1.2	0.00	0.75	N/A	0.00	Regional
1275	Oak Creek Canyon2	2040	Planning	Mixed Use	Residential	275.0	154.0	0.14	N/A	250	0.07	Regional
1346	Rosetta Hills Trail 30698	2040	Planning	Low Medium Density Residential	Residential	198.6	111.3	0.10	N/A	250	0.05	Regional
1348	Single Family Residence Olivas APN 378-156-038, 039	2035	Planning	Medium Density Residential	Residential	44.4	24.9	0.02	N/A	250	0.01	Regional
1350	Thomas Residence	2025	Planning	Industrial	Residential	0.9	0.5	0.00	N/A	250	0.00	Regional
1351	Corydon Gateway Commercial	2025	Planning	Commercial	Commercial	26.3	14.7	0.01	0.60	N/A	0.01	Regional
1353	Wildomar MDP Lateral C, Stage 3 Sewer Relocation	2024	Plan Check	Medium Density Residential	Residential	42.2	23.6	0.02	N/A	250	0.01	Regional
1469	Mermack Avenue Street Improvements	2024	Plan Check	Commercial	Commercial	42.0	23.5	0.02	0.60	N/A	0.01	Regional

Appendix B

DWF AND WWF CALIBRATION SHEETS

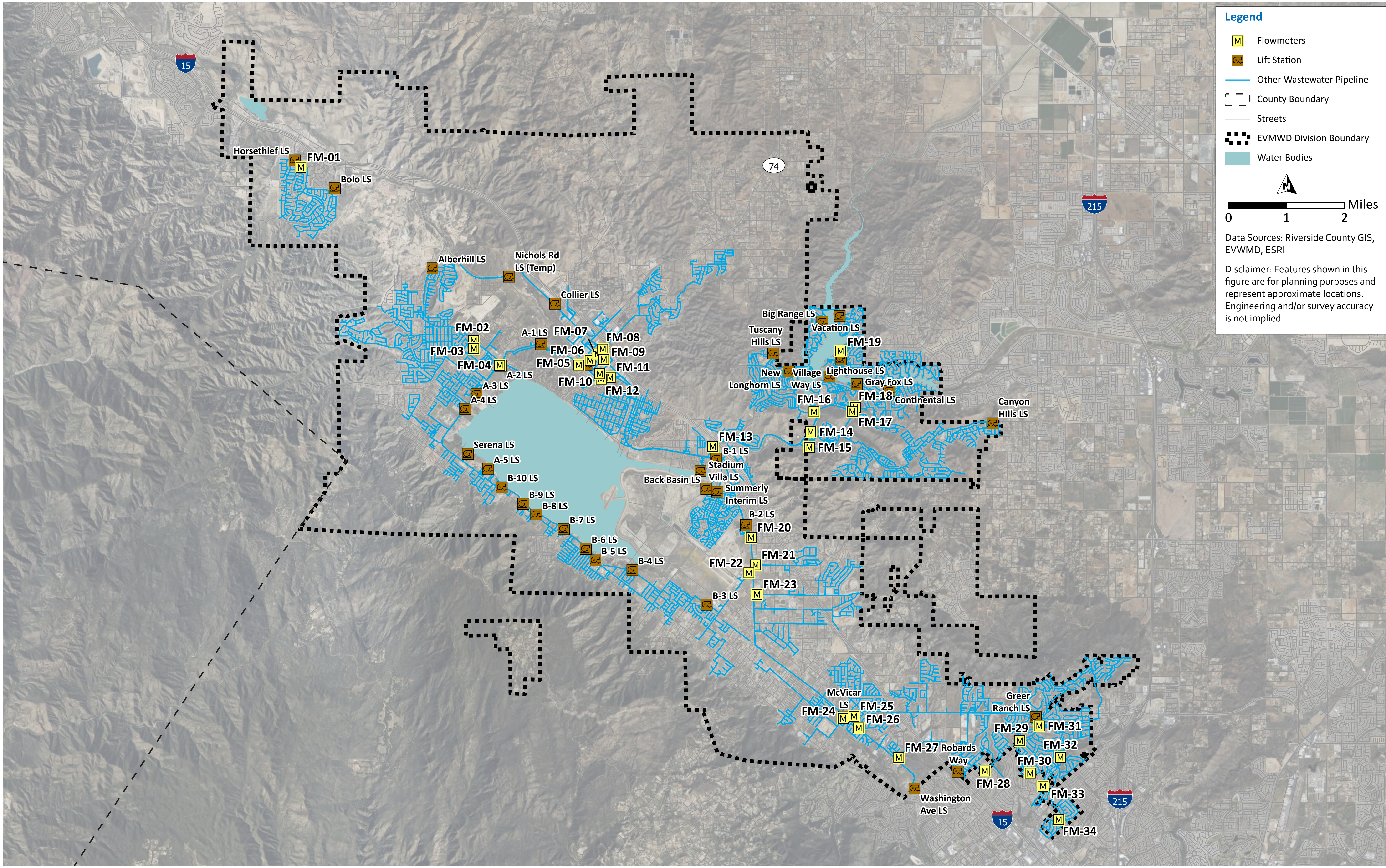


Figure 1 Flow Meter Locations

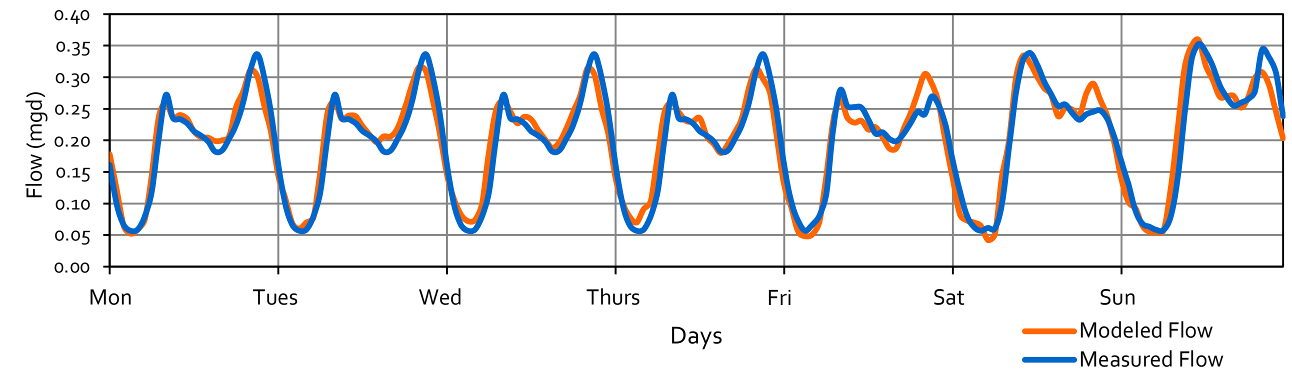
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 01, Dry Weather Flow Calibration

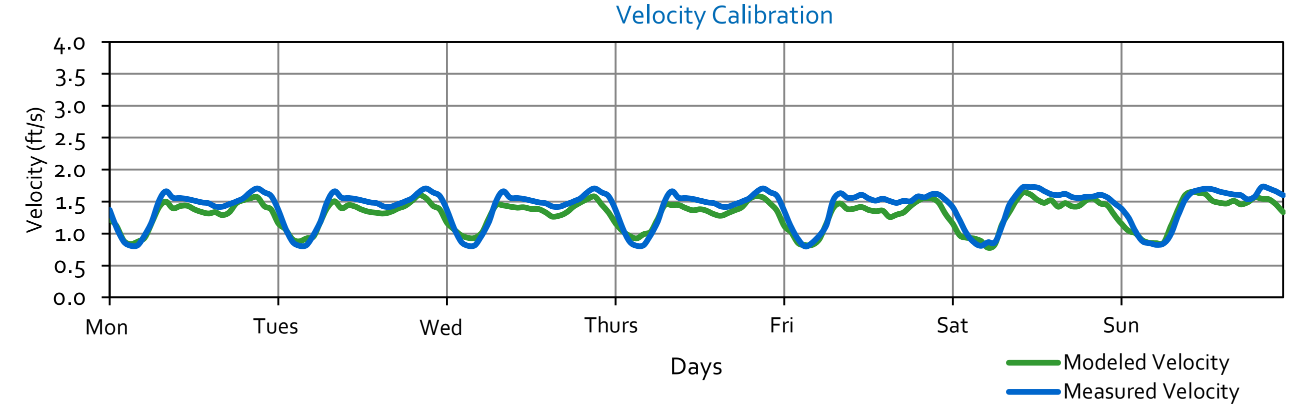
Location: Kicking Horse Drive, west of Caravan Circle
Pipeline Diameter: 14.75"
City Manhole ID: MH-58
Model Pipe ID: GM-70

Flow Monitor Location

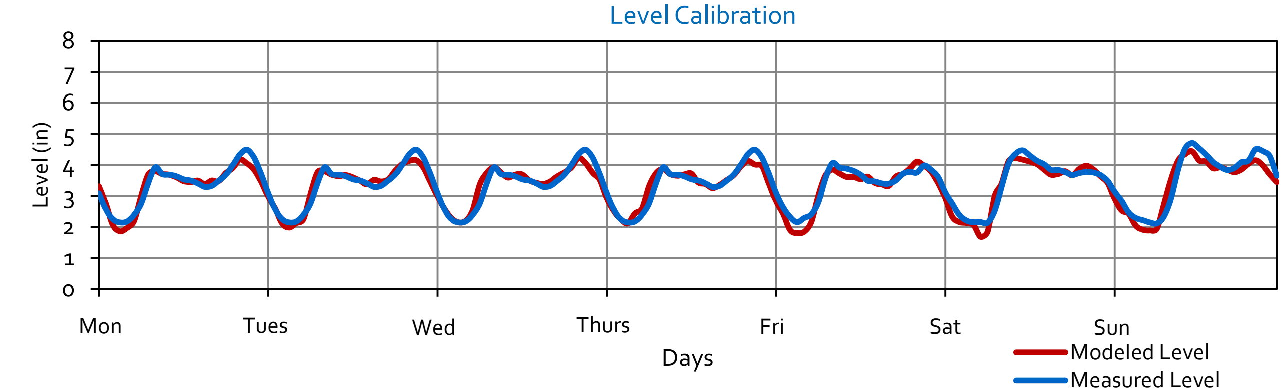
Flow Calibration



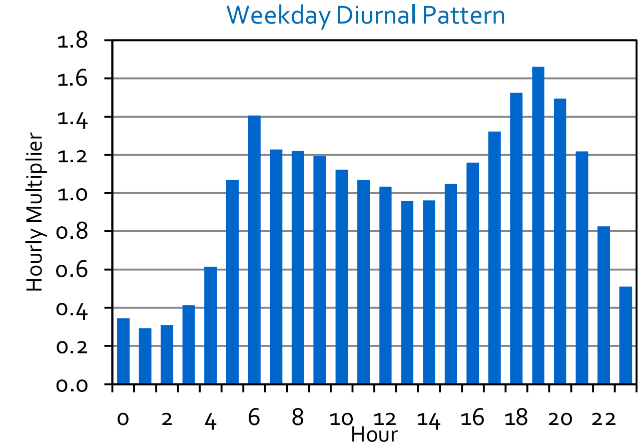
Velocity Calibration



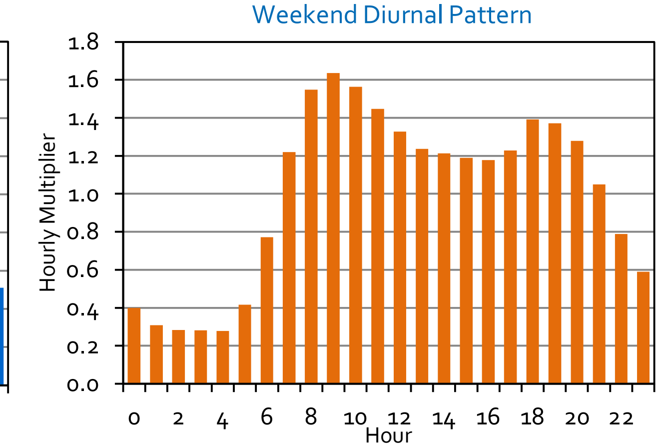
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.19	0.34	3.4	1.39	0.20	0.32	3.3	1.30	2.6%	-6.2%	-0.5%	-6.4%
Tues.	0.19	0.34	3.4	1.39	0.20	0.32	3.3	1.30	2.6%	-6.2%	-0.5%	-6.4%
Wed.	0.19	0.34	3.4	1.39	0.20	0.32	3.3	1.30	2.6%	-6.2%	-0.5%	-6.4%
Thur.	0.19	0.34	3.4	1.39	0.20	0.32	3.3	1.30	2.6%	-6.2%	-0.5%	-6.4%
Fri.	0.19	0.28	3.4	1.40	0.19	0.31	3.3	1.27	-1.2%	9.0%	-2.9%	-8.9%
Sat.	0.20	0.34	3.4	1.41	0.20	0.33	3.3	1.30	0.6%	-1.3%	-2.4%	-7.4%
Sun.	0.22	0.35	3.6	1.41	0.22	0.36	3.4	1.33	-0.9%	1.8%	-4.2%	-5.5%
Summary												
Weekday	0.19	--	3.4	1.39	0.20	--	3.3	1.30	1.8%	--	-1.0%	-6.9%
Weekend	0.21	--	3.5	1.41	0.21	--	3.4	1.32	-0.2%	--	-3.3%	-6.5%
ADWF[4]	0.20	--	3.4	1.40	0.20	--	3.3	1.30	1.2%	--	-1.7%	-6.8%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

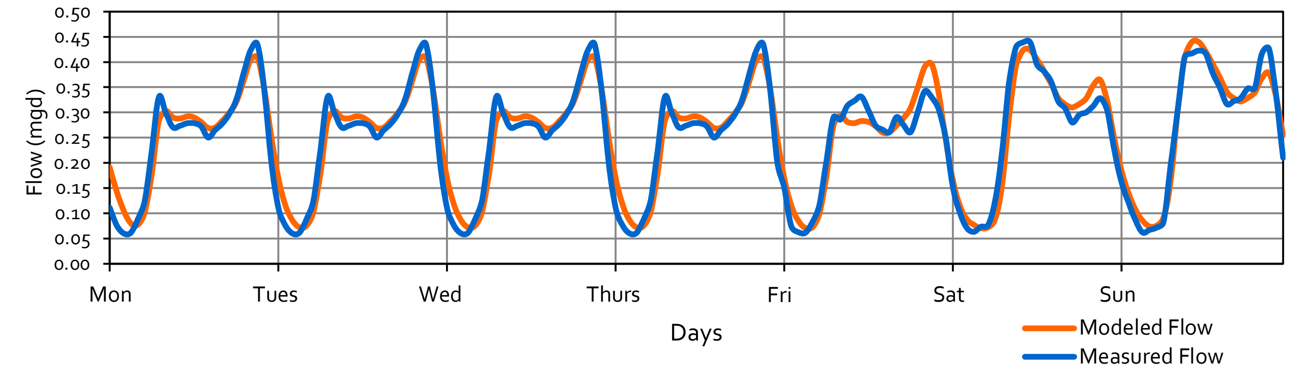
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 02, Dry Weather Flow Calibration

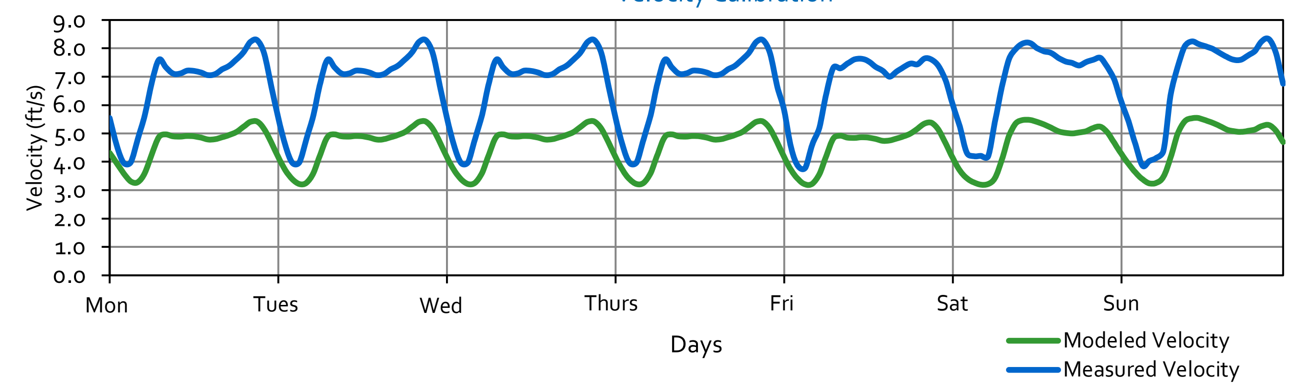
Location: Lakeshore Drive, north of Machado Street
Pipeline Diameter: 12"
City Manhole ID: Lakeshore Drive, north of Machado Street
Model Pipe ID: GM-801

Flow Monitor Location

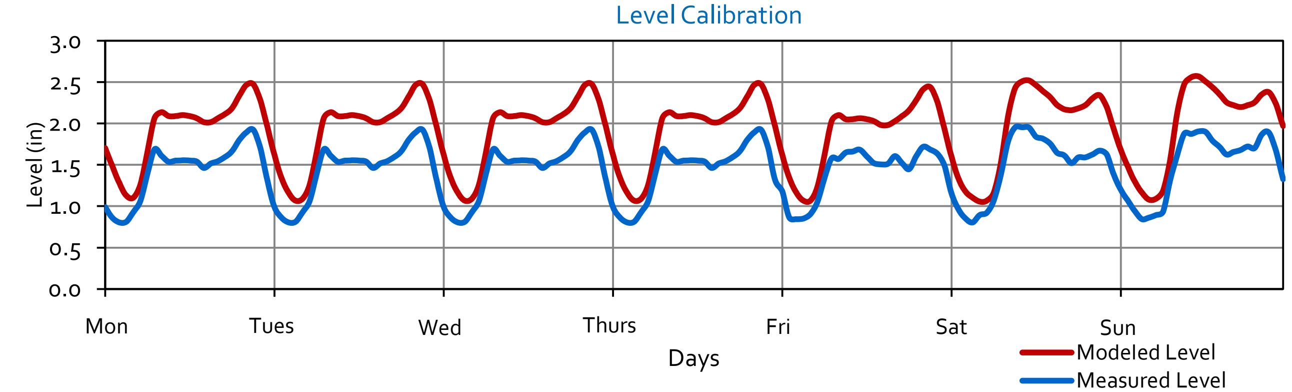
Flow Calibration



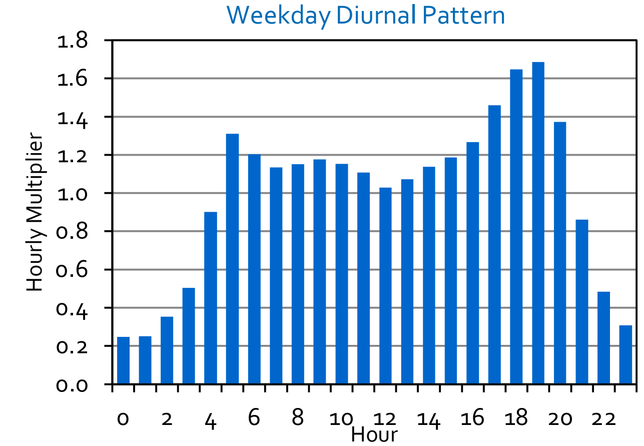
Velocity Calibration



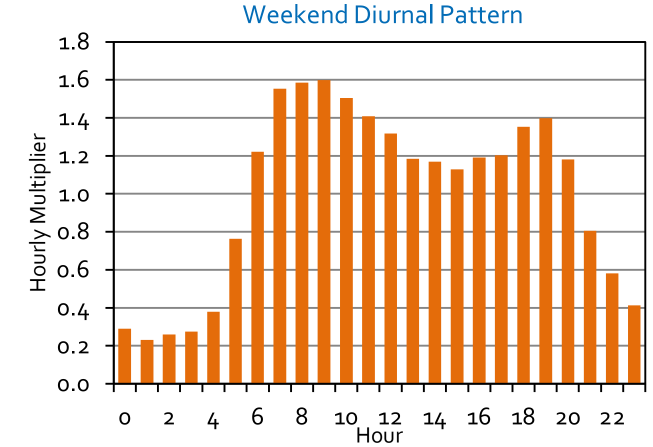
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



Model Calibration Summary

	Measured Data[(1)]				Modeled Data				Percent Error[(3)]			
Day	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.25	0.44	1.4	6.72	0.25	0.41	1.9	4.60	2.0%	-6.2%	33.7%	-31.5%
Tues.	0.25	0.44	1.4	6.72	0.25	0.41	1.9	4.60	2.0%	-6.2%	33.7%	-31.5%
Wed.	0.25	0.44	1.4	6.72	0.25	0.41	1.9	4.60	2.0%	-6.2%	33.7%	-31.5%
Thur.	0.25	0.44	1.4	6.72	0.25	0.41	1.9	4.60	2.0%	-6.2%	33.7%	-31.5%
Fri.	0.24	0.34	1.4	6.64	0.24	0.40	1.9	4.55	1.9%	15.8%	32.4%	-31.5%
Sat.	0.26	0.44	1.5	6.79	0.27	0.42	1.9	4.62	0.5%	-3.5%	31.4%	-31.9%
Sun.	0.27	0.43	1.5	6.84	0.28	0.44	2.0	4.70	1.4%	3.2%	32.8%	-31.4%
Summary												
Weekday	0.25	--	1.4	6.70	0.25	--	1.9	4.59	2.0%	--	33.4%	-31.5%
Weekend	0.27	--	1.5	6.81	0.27	--	2.0	4.66	1.0%	--	32.1%	-31.6%
ADWF[(4)]	0.25	--	1.4	6.73	0.26	--	1.9	4.61	1.7%	--	33.0%	-31.6%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

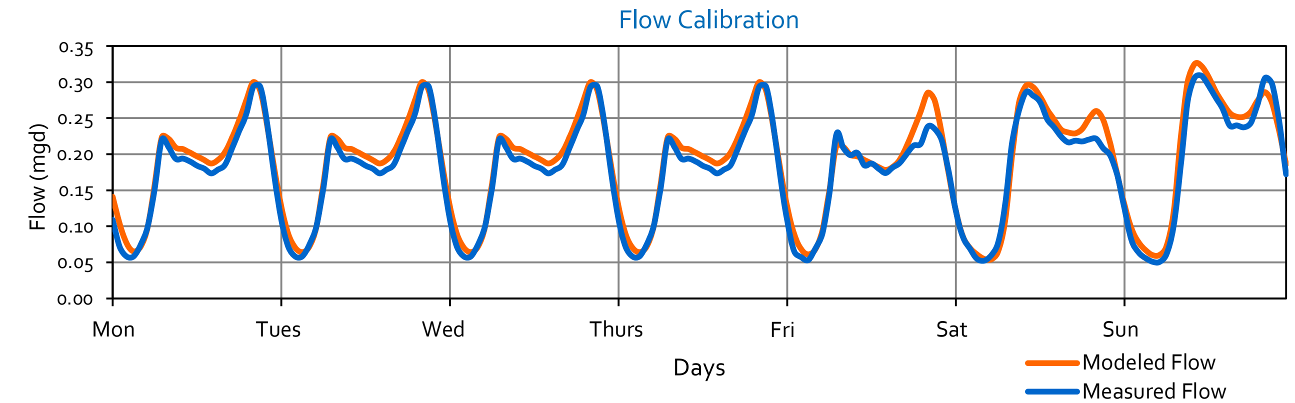
(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

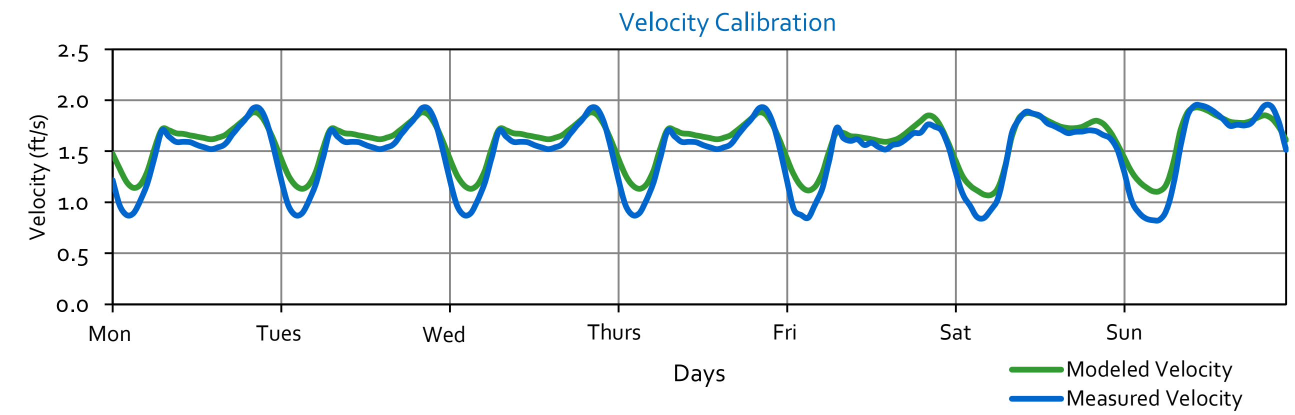
ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

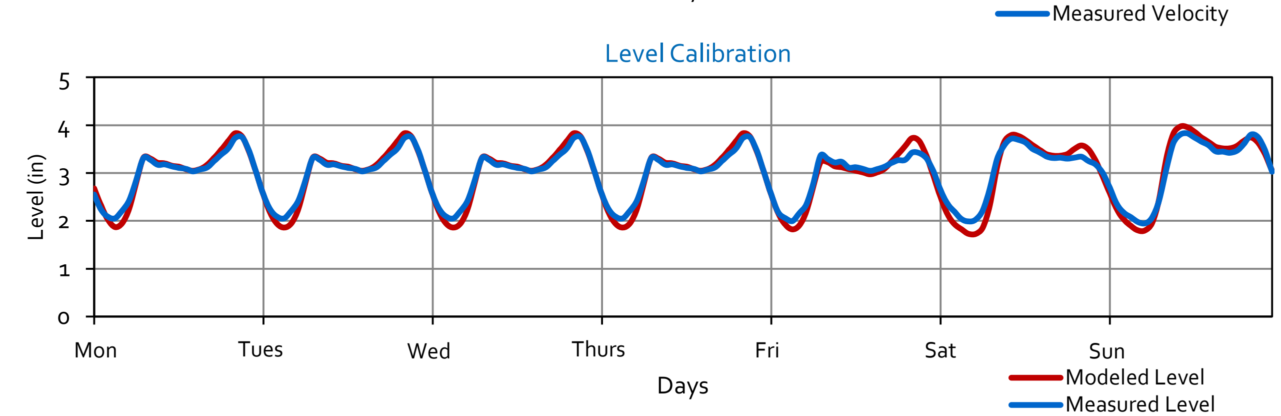
Flow Monitoring Site 03, Dry Weather Flow Calibration

Location: Machado Street, west of Lakeshore Drive
Pipeline Diameter: 14.75"
City Manhole ID: Machado Street, west of Lakeshore Drive
Model Pipe ID: GM-1099

Flow Monitor Location







Model Calibration Summary

Day	Measured Data[1]				Modeled Data				Percent Error[3]			
	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.18	0.29	3.0	1.49	0.19	0.30	3.0	1.59	5.9%	2.2%	-0.3%	6.2%
Tues.	0.18	0.29	3.0	1.49	0.19	0.30	3.0	1.59	5.9%	2.2%	-0.3%	6.2%
Wed.	0.18	0.29	3.0	1.49	0.19	0.30	3.0	1.59	5.9%	2.2%	-0.3%	6.2%
Thur.	0.18	0.29	3.0	1.49	0.19	0.30	3.0	1.59	5.9%	2.2%	-0.3%	6.2%
Fri.	0.17	0.24	2.9	1.46	0.18	0.29	2.9	1.56	5.9%	19.6%	-0.9%	6.9%
Sat.	0.18	0.29	3.0	1.50	0.19	0.30	3.0	1.57	4.4%	3.1%	-1.4%	5.0%
Sun.	0.20	0.31	3.1	1.53	0.21	0.33	3.1	1.62	5.1%	5.3%	0.3%	5.7%
Summary												
Weekday	0.17	--	3.0	1.49	0.18	--	3.0	1.58	5.9%	--	-0.4%	6.4%
Weekend	0.19	--	3.1	1.51	0.20	--	3.0	1.60	4.8%	--	-0.5%	5.4%
ADWF[4]	0.18	--	3.0	1.49	0.19	--	3.0	1.59	5.5%	--	-0.4%	6.1%

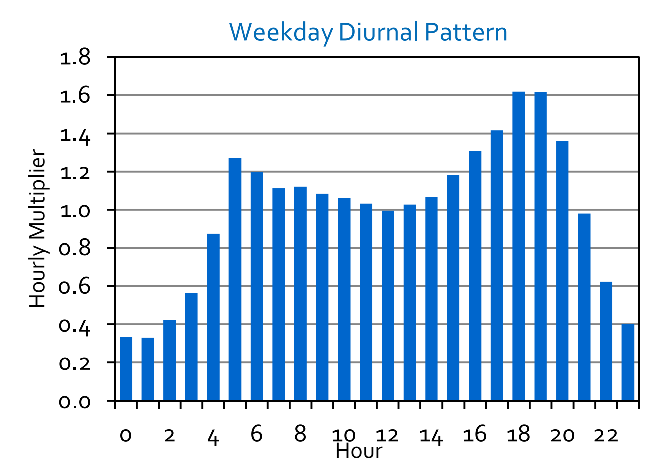
Notes:

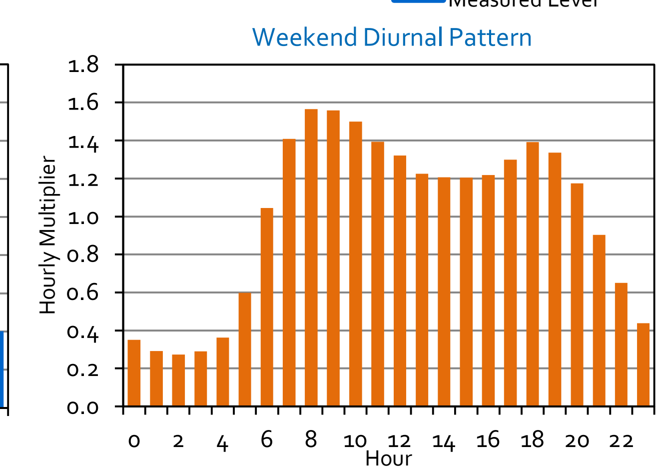
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7





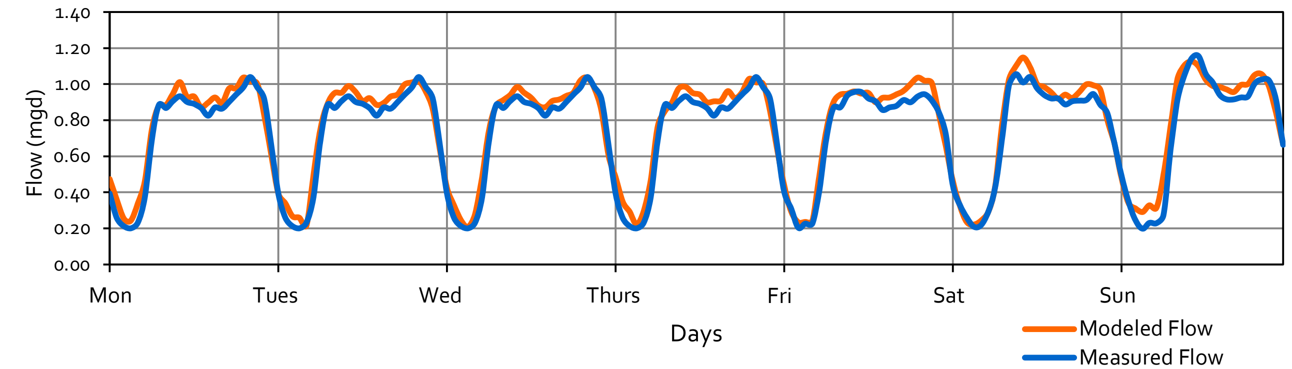
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 04, Dry Weather Flow Calibration

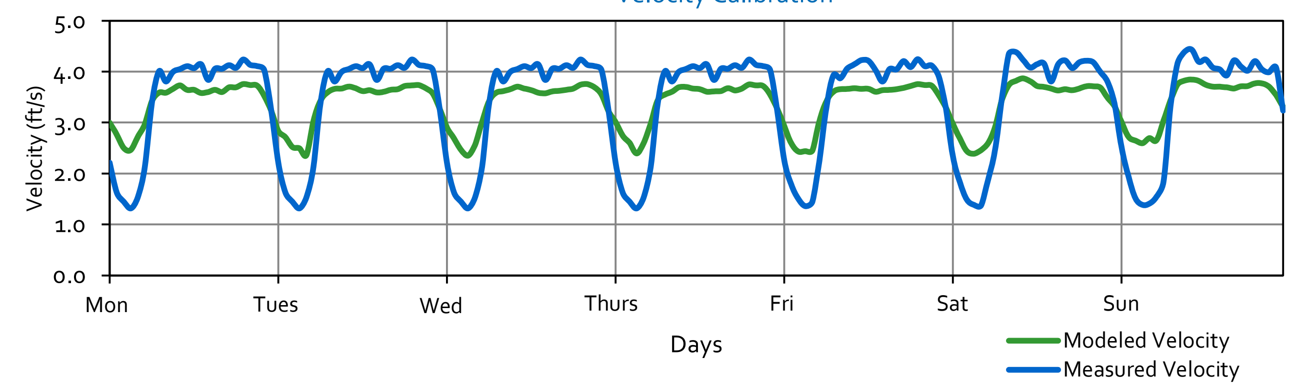
Location: Riverside Dr, Lake Elsinore, CA 92530
Pipeline Diameter: 17.75"
City Manhole ID: Riverside Dr, Lake Elsinore, CA 92530
Model Pipe ID: GM-1636

Flow Monitor Location

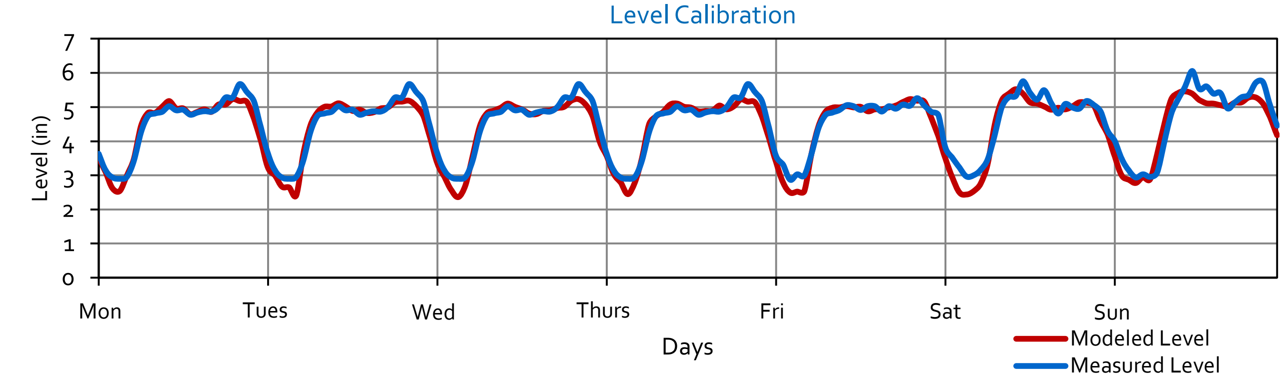
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.73	1.04	4.5	3.41	0.77	1.04	4.4	3.39	4.8%	-0.3%	-2.0%	-0.6%
Tues.	0.73	1.04	4.5	3.41	0.77	1.04	4.4	3.39	4.8%	-0.3%	-2.0%	-0.6%
Wed.	0.73	1.04	4.5	3.41	0.77	1.04	4.4	3.39	4.8%	-0.3%	-2.0%	-0.6%
Thur.	0.73	1.04	4.5	3.41	0.77	1.04	4.4	3.39	4.8%	-0.3%	-2.0%	-0.6%
Fri.	0.74	0.96	4.5	3.43	0.77	1.04	4.4	3.38	4.9%	8.4%	-2.1%	-1.2%
Sat.	0.74	1.06	4.5	3.40	0.77	1.15	4.4	3.36	4.4%	8.8%	-3.7%	-1.0%
Sun.	0.76	1.16	4.7	3.37	0.80	1.13	4.5	3.42	5.3%	-2.5%	-3.6%	1.5%
Summary												
Weekday	0.73	--	4.5	3.41	0.77	--	4.4	3.39	4.8%	--	-2.0%	-0.7%
Weekend	0.75	--	4.6	3.38	0.78	--	4.4	3.39	4.9%	--	-3.6%	0.3%
ADWF[4]	0.74	--	4.5	3.40	0.77	--	4.4	3.39	4.8%	--	-2.5%	-0.4%

Notes:

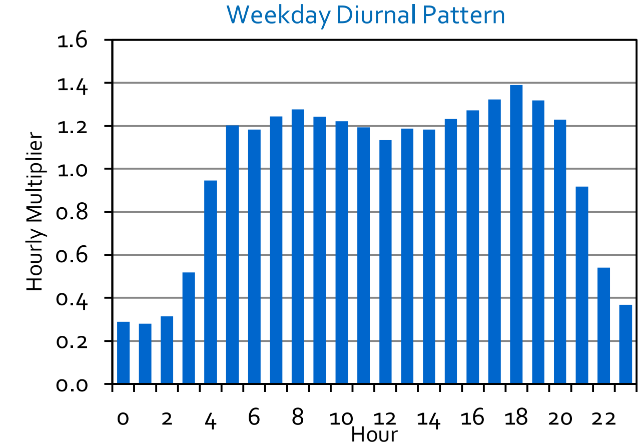
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

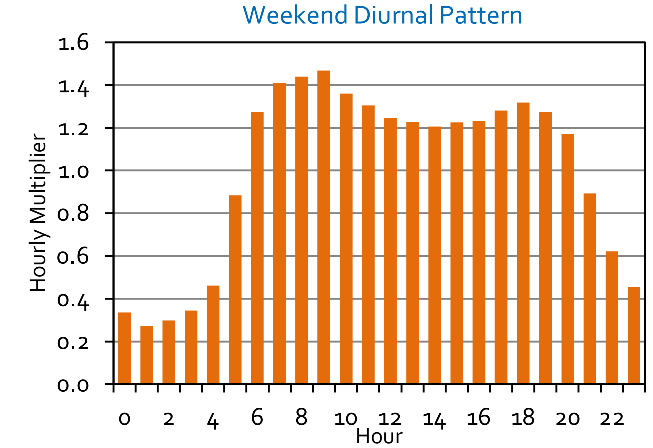
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

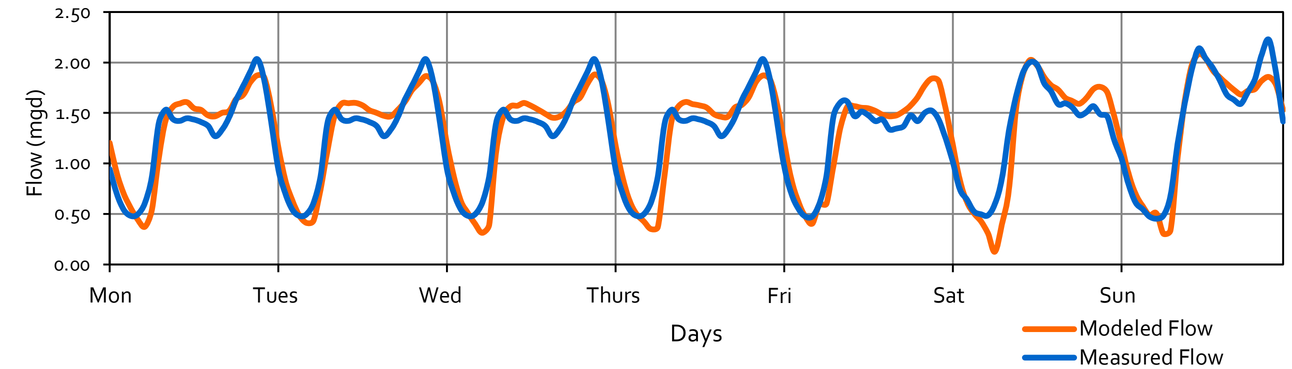
Flow Monitoring Site 05, Dry Weather Flow Calibration

Location: Regional WRF
Pipeline Diameter: 29.75"
City Manhole ID: Regional WRF
Model Pipe ID: GM-1236

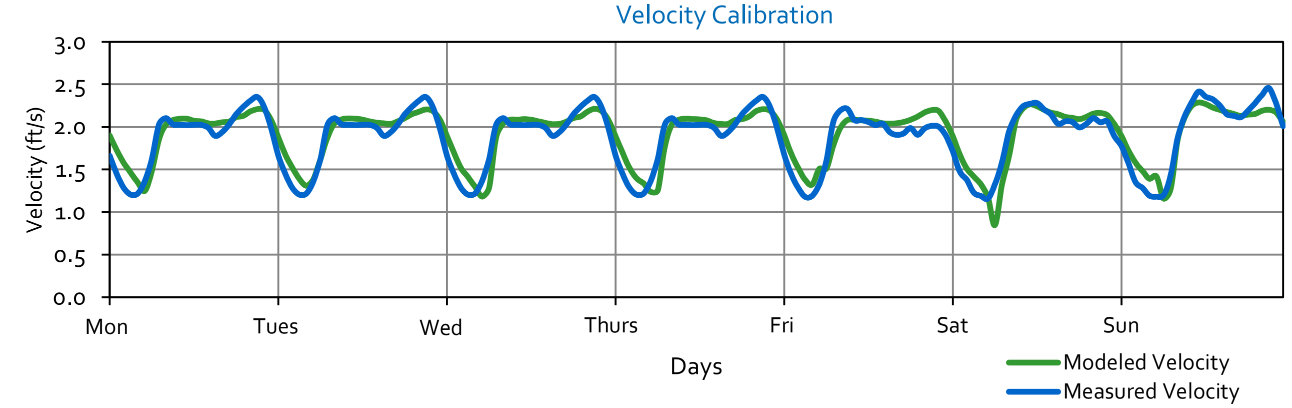
Flow Monitor Location

GM-1236
Previously GM-1646

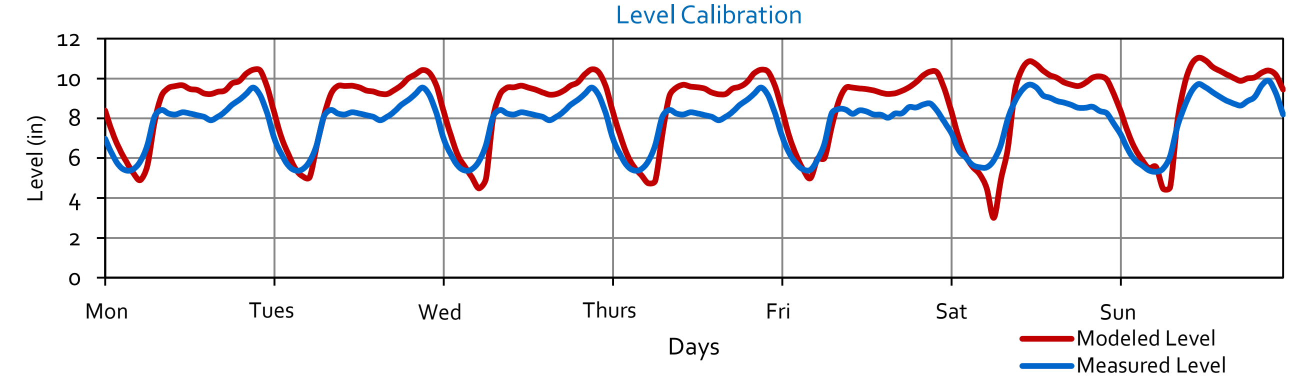
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	1.28	2.03	7.7	1.88	1.30	1.88	8.5	1.91	1.5%	-7.5%	10.2%	1.6%
Tues.	1.28	2.03	7.7	1.88	1.30	1.88	8.5	1.91	1.5%	-7.5%	10.2%	1.6%
Wed.	1.28	2.03	7.7	1.88	1.30	1.88	8.5	1.91	1.5%	-7.5%	10.2%	1.6%
Thur.	1.28	2.03	7.7	1.88	1.30	1.88	8.5	1.91	1.5%	-7.5%	10.2%	1.6%
Fri.	1.22	1.61	7.7	1.83	1.29	1.84	8.5	1.92	5.7%	14.2%	11.0%	4.5%
Sat.	1.30	2.00	7.9	1.86	1.29	2.02	8.4	1.88	-0.4%	1.0%	6.6%	1.1%
Sun.	1.41	2.23	8.0	1.94	1.38	2.09	8.7	1.94	-1.9%	-6.3%	9.3%	-0.3%
Summary												
Weekday	1.27	--	7.7	1.87	1.30	--	8.5	1.91	2.3%	--	10.3%	2.2%
Weekend	1.35	--	7.9	1.90	1.34	--	8.6	1.91	-1.2%	--	7.9%	0.4%
ADWF[4]	1.29	--	7.8	1.88	1.31	--	8.5	1.91	1.3%	--	9.6%	1.7%

Notes:

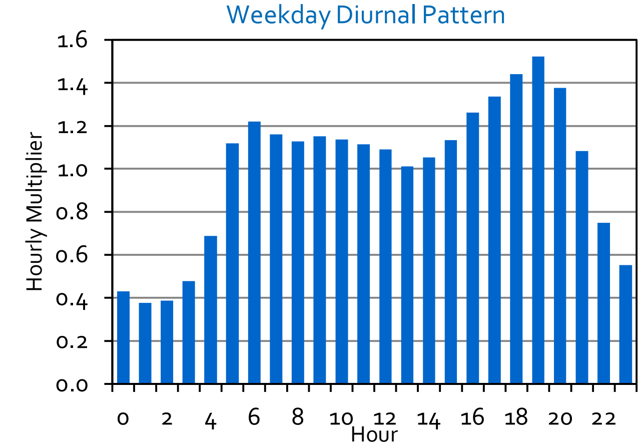
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

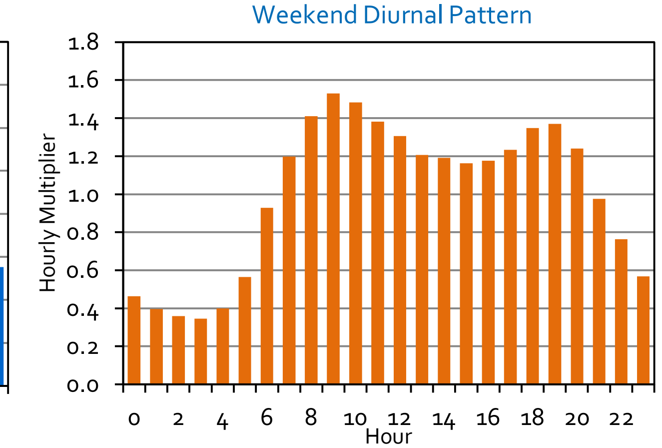
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern

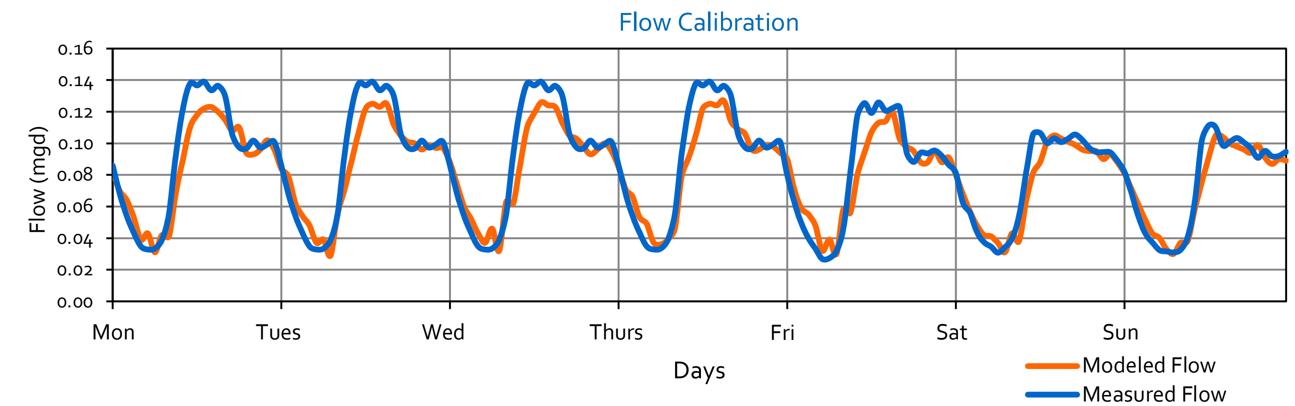


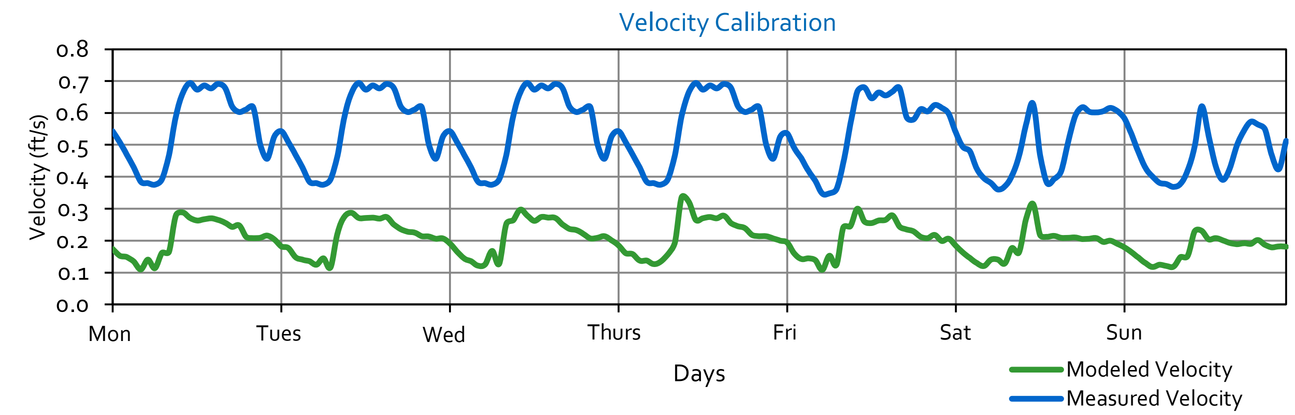
ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

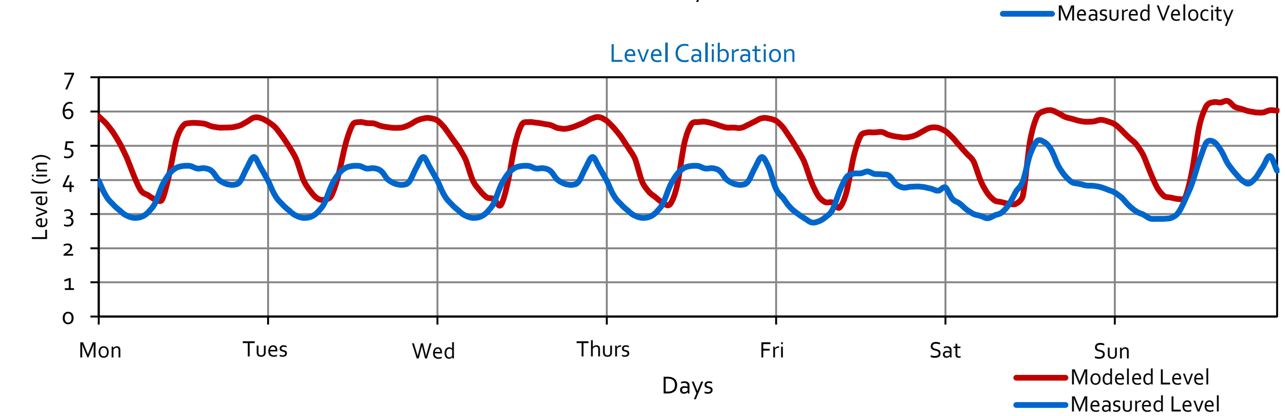
Flow Monitoring Site 06, Dry Weather Flow Calibration

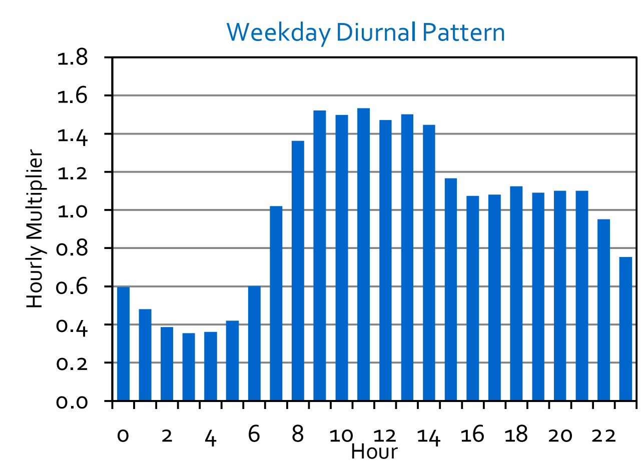
Location: Pasadena Street, west of 3rd Street
Pipeline Diameter: 24"
City Manhole ID: Pasadena Street, west of 3rd Street
Model Pipe ID: GM-1211

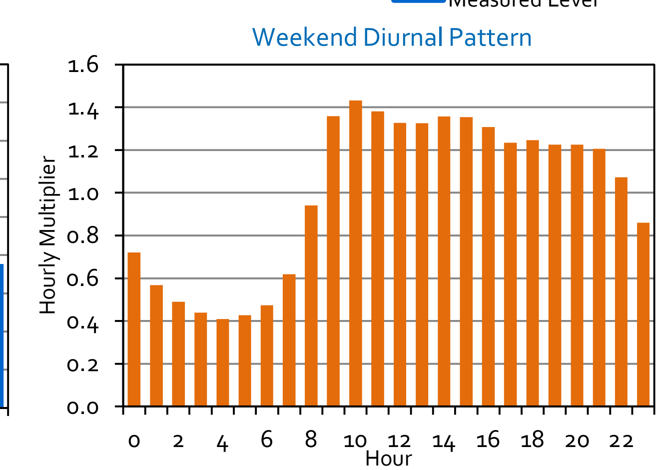
Flow Monitor Location











Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.09	0.14	3.8	0.55	0.09	0.13	5.0	0.21	-5.7%	-8.7%	31.2%	-61.5%
Tues.	0.09	0.14	3.8	0.55	0.09	0.13	5.0	0.21	-5.7%	-8.7%	31.2%	-61.5%
Wed.	0.09	0.14	3.8	0.55	0.09	0.13	5.0	0.21	-5.7%	-8.7%	31.2%	-61.5%
Thur.	0.09	0.14	3.8	0.55	0.09	0.13	5.0	0.21	-5.7%	-8.7%	31.2%	-61.5%
Fri.	0.08	0.13	3.6	0.55	0.08	0.12	4.8	0.21	-3.3%	-4.6%	33.1%	-62.0%
Sat.	0.08	0.11	3.8	0.50	0.07	0.11	4.9	0.19	-3.7%	-1.5%	30.7%	-61.8%
Sun.	0.08	0.11	3.8	0.47	0.07	0.11	5.2	0.17	-2.2%	-5.6%	36.1%	-63.4%
Summary												
Weekday	0.09	--	3.8	0.55	0.08	--	5.0	0.21	-5.3%	--	31.6%	-61.6%
Weekend	0.08	--	3.8	0.49	0.07	--	5.1	0.18	-3.0%	--	33.4%	-62.6%
ADWF[4]	0.09	--	3.8	0.53	0.08	--	5.0	0.20	-4.7%	--	32.1%	-61.9%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 07, Dry Weather Flow Calibration

Location: 3rd Street, south of Collier Street
Pipeline Diameter: 14.75"
City Manhole ID: 3rd Street, south of Collier Street
Model Pipe ID: GM-7908

Flow Monitor Location

Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.05	0.0736	1.6222	0.9498	0.0473	0.0710	1.5151	1.0360	-1.8%	-3.6%	-6.6%	9.1%
Tues.	0.05	0.0736	1.6222	0.9498	0.0473	0.0710	1.5151	1.0360	-1.8%	-3.6%	-6.6%	9.1%
Wed.	0.05	0.0736	1.6222	0.9498	0.0473	0.0710	1.5151	1.0360	-1.8%	-3.6%	-6.6%	9.1%
Thur.	0.05	0.0736	1.6222	0.9498	0.0473	0.0710	1.5151	1.0360	-1.8%	-3.6%	-6.6%	9.1%
Fri.	0.05	0.0769	1.6351	0.9601	0.0488	0.0730	1.5335	1.0462	-1.5%	-5.1%	-6.2%	9.0%
Sat.	0.05	0.0826	1.5884	0.9236	0.0458	0.0780	1.4825	1.0166	-0.7%	-5.6%	-6.7%	10.1%
Sun.	0.04	0.0789	1.5697	0.9103	0.0443	0.0760	1.4595	1.0051	-1.7%	-3.7%	-7.0%	10.4%
Summary												
Weekday	0.05	--	1.6	0.95	0.05	--	1.5	1.04	-1.7%	--	-6.5%	9.1%
Weekend	0.05	--	1.6	0.92	0.05	--	1.5	1.01	-1.2%	--	-6.8%	10.2%
ADWF[4]	0.05	--	1.6	0.94	0.05	--	1.5	1.03	-1.6%	--	-6.6%	9.4%

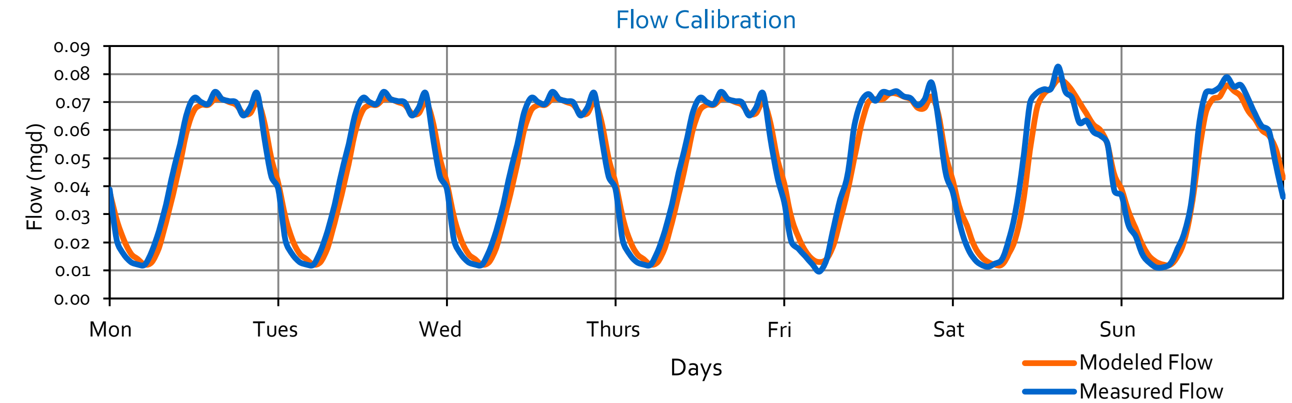
Notes:

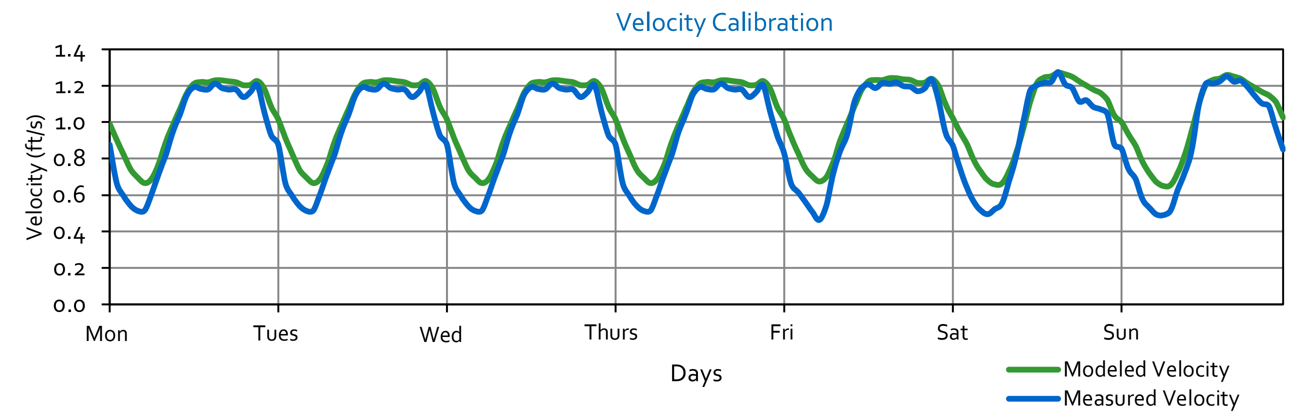
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

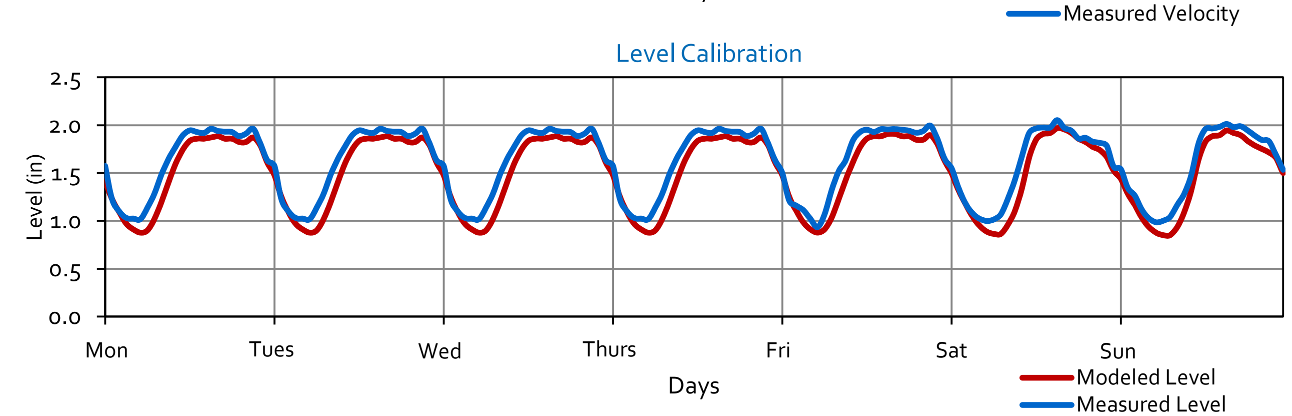
(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

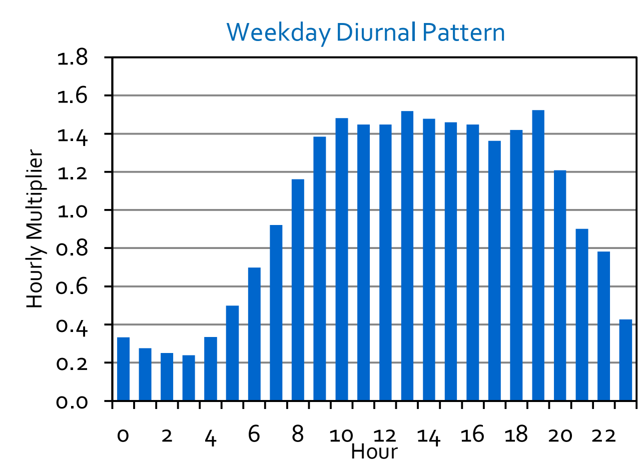
(3) Percent Error = (Modeled - Measured) /Measured x 100

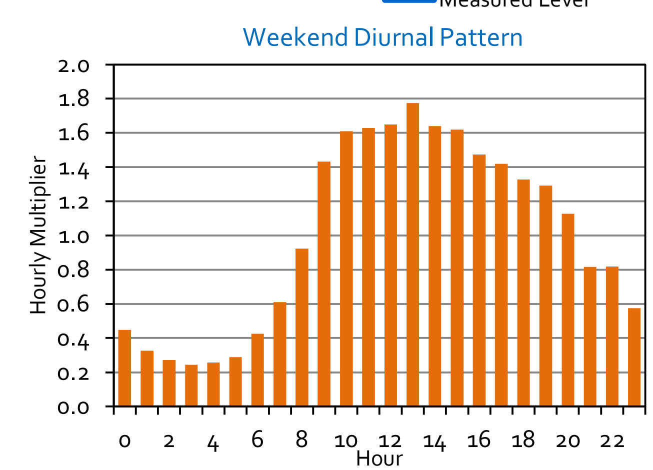
(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7











ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 08, Dry Weather Flow Calibration

Location: 3rd Street, south of Collier Street
Pipeline Diameter: 15"
City Manhole ID: 3rd Street, south of Collier Street
Model Pipe ID: GM-7912

Flow Monitor Location

Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.42	0.59	2.9	3.76	0.43	0.57	3.0	3.78	1.8%	-3.4%	1.1%	0.6%
Tues.	0.42	0.59	2.9	3.76	0.43	0.57	3.0	3.78	1.8%	-3.4%	1.1%	0.6%
Wed.	0.42	0.59	2.9	3.76	0.43	0.57	3.0	3.78	1.8%	-3.4%	1.1%	0.6%
Thur.	0.42	0.59	2.9	3.76	0.43	0.57	3.0	3.78	1.8%	-3.4%	1.1%	0.6%
Fri.	0.41	0.50	2.9	3.76	0.42	0.57	3.0	3.77	2.1%	12.5%	1.3%	0.3%
Sat.	0.41	0.56	2.9	3.72	0.42	0.55	2.9	3.74	1.5%	-2.5%	0.6%	0.7%
Sun.	0.43	0.60	3.0	3.74	0.44	0.58	3.0	3.79	1.3%	-3.4%	0.3%	1.5%
Summary												
Weekday	0.42	--	2.9	3.76	0.43	--	3.0	3.78	1.8%	--	1.1%	0.6%
Weekend	0.42	--	2.9	3.73	0.43	--	3.0	3.77	1.4%	--	0.5%	1.1%
ADWF[4]	0.42	--	2.9	3.75	0.43	--	3.0	3.78	1.7%	--	0.9%	0.7%

Notes:

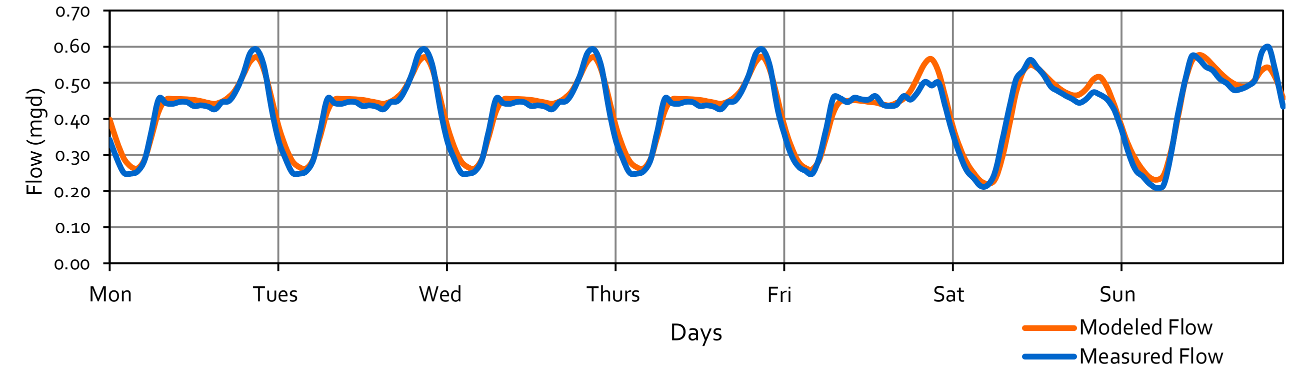
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

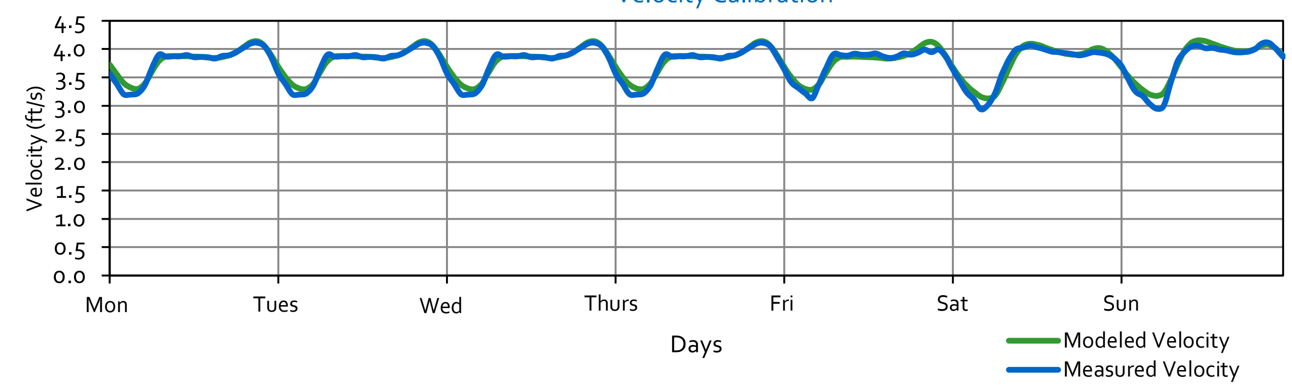
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

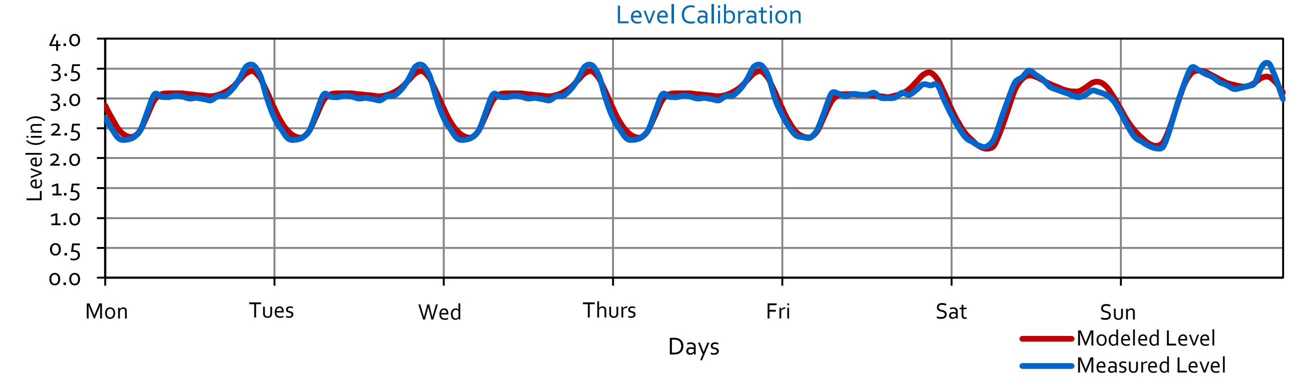
Flow Calibration



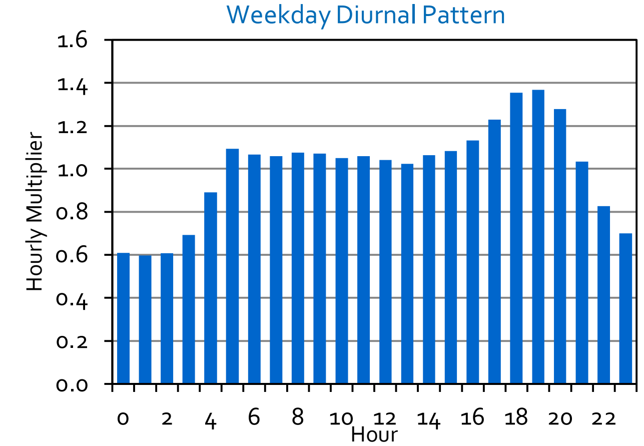
Velocity Calibration



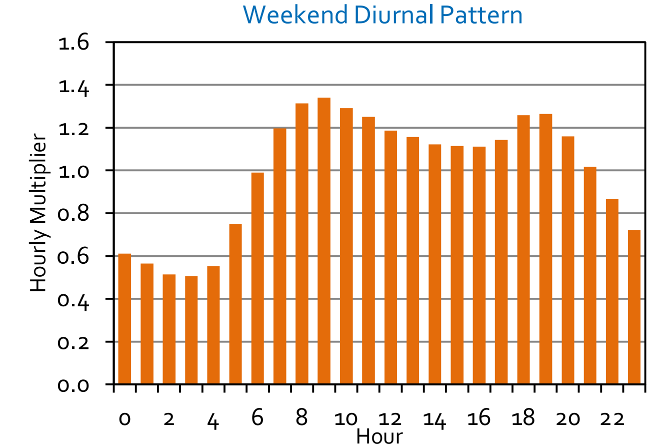
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern

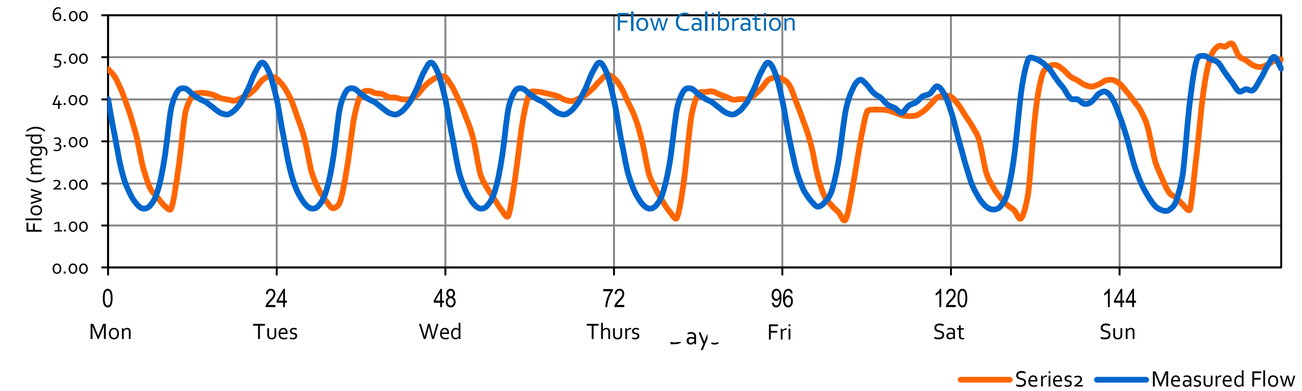


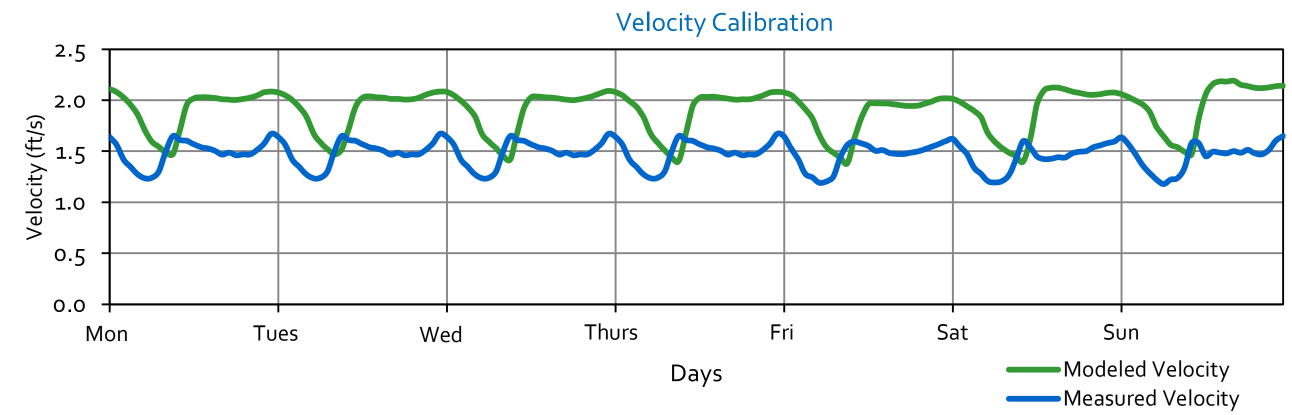
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

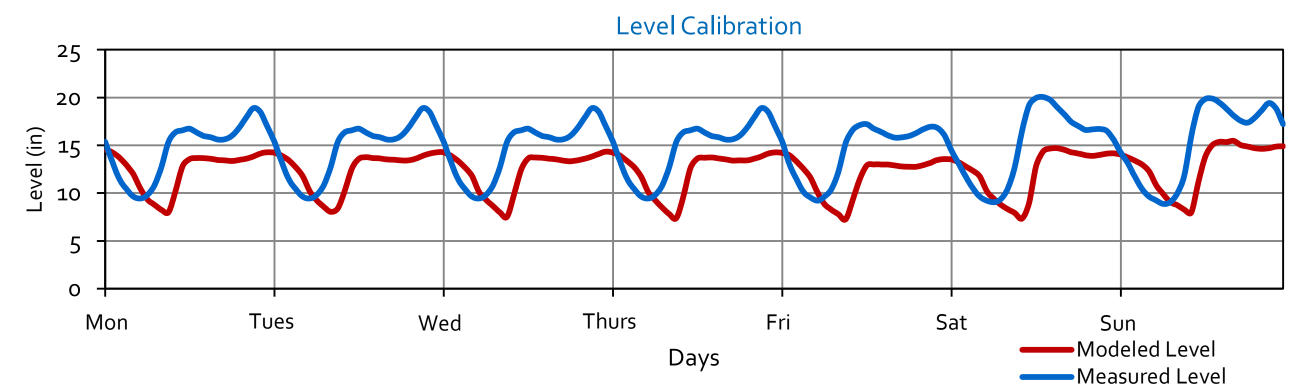
Flow Monitoring Site 09, Dry Weather Flow Calibration

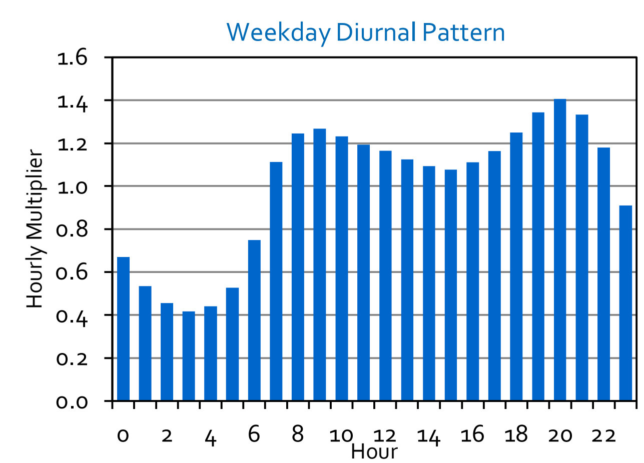
Location: Minthorn Street, west of Birch Street
Pipeline Diameter: 54"
City Manhole ID: Minthorn Street, west of Birch Street
Model Pipe ID: GM-9341

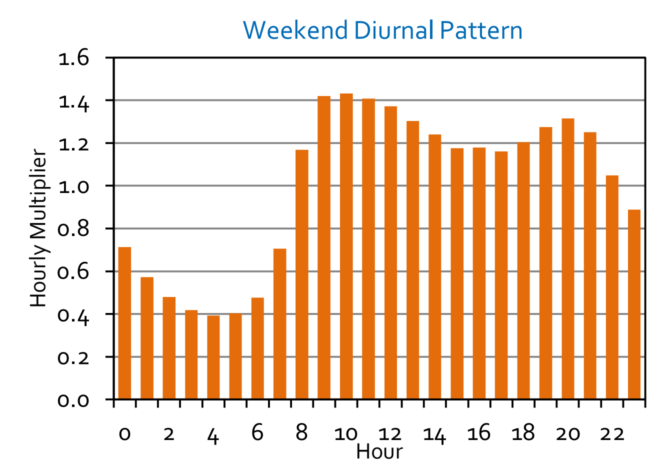
Flow Monitor Location











Model Calibration Summary

	Measured Data[1]				Modeled Data				Percent Error[3]			
Day	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	3.39	4.88	14.7	1.48	3.50	4.72	12.4	1.90	3.1%	-3.1%	-15.7%	28.1%
Tues.	3.39	4.88	14.7	1.48	3.50	4.72	12.4	1.90	3.1%	-3.1%	-15.7%	28.1%
Wed.	3.39	4.88	14.7	1.48	3.50	4.72	12.4	1.90	3.1%	-3.1%	-15.7%	28.1%
Thur.	3.39	4.88	14.7	1.48	3.50	4.72	12.4	1.90	3.1%	-3.1%	-15.7%	28.1%
Fri.	3.37	4.46	14.5	1.46	3.21	4.49	11.9	1.85	-4.8%	0.5%	-17.9%	26.5%
Sat.	3.43	4.97	15.0	1.44	3.46	4.81	12.3	1.89	1.0%	-3.1%	-18.2%	30.8%
Sun.	3.56	5.03	15.3	1.45	3.86	5.32	13.0	1.95	8.6%	5.8%	-15.0%	34.7%
Summary												
Weekday	3.39	--	14.6	1.48	3.44	--	12.3	1.89	1.5%	--	-16.1%	27.8%
Weekend	3.49	--	15.1	1.45	3.66	--	12.6	1.92	4.9%	--	-16.6%	32.8%
ADWF[4]	3.42	--	14.8	1.47	3.50	--	12.4	1.90	2.5%	--	-16.3%	29.2%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

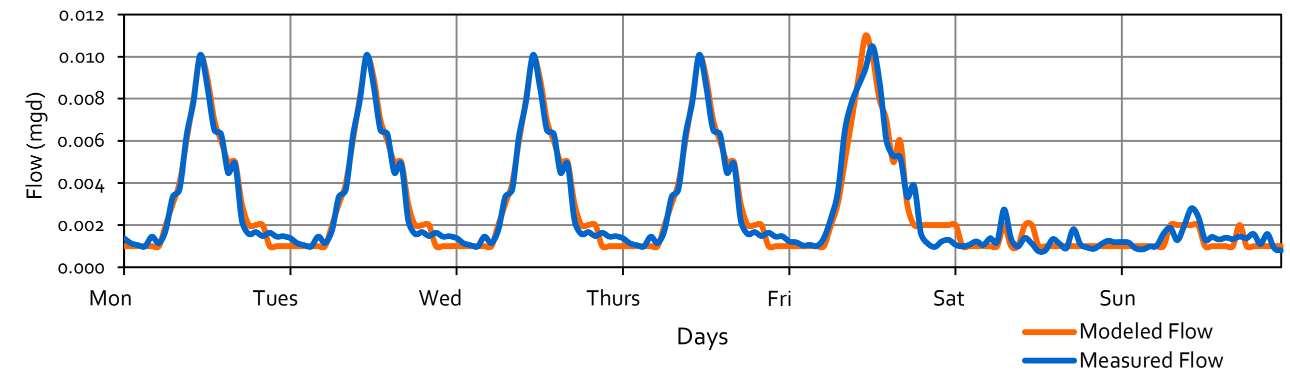
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 10, Dry Weather Flow Calibration

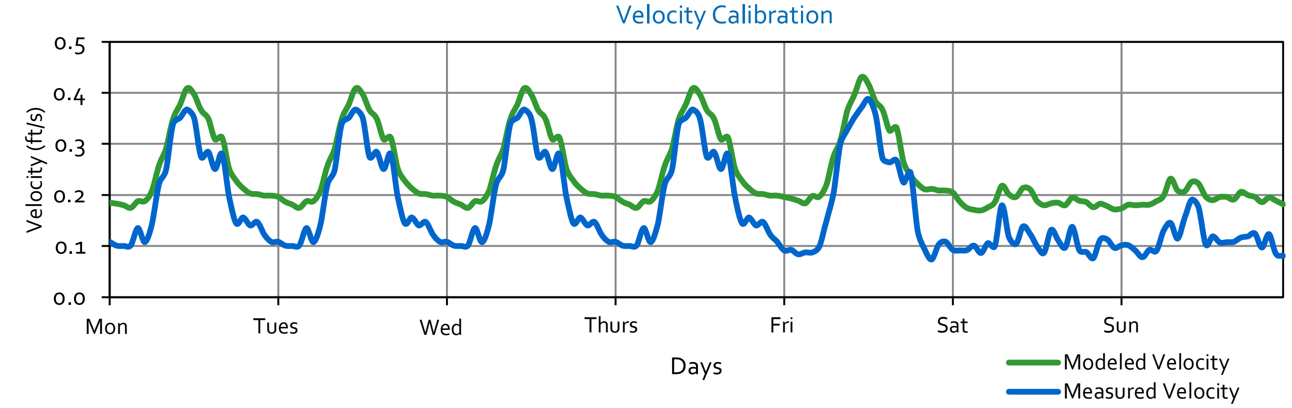
Location: Chaney Street, north of Pasadena Street
Pipeline Diameter: 11.75"
City Manhole ID: Chaney Street, north of Pasadena Street
Model Pipe ID: GM-1666

Flow Monitor Location

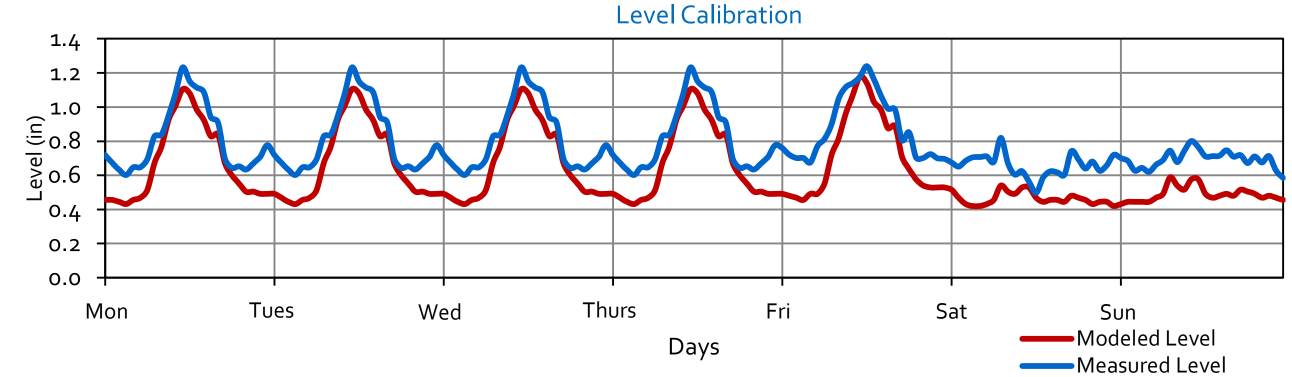
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.0034	0.0101	0.8139	0.1993	0.0035	0.0100	0.6755	0.2597	0.7%	-0.8%	-17.0%	30.3%
Tues.	0.0034	0.0101	0.8139	0.1993	0.0035	0.0100	0.6755	0.2597	0.7%	-0.8%	-17.0%	30.3%
Wed.	0.0034	0.0101	0.8139	0.1993	0.0035	0.0100	0.6755	0.2597	0.7%	-0.8%	-17.0%	30.3%
Thur.	0.0034	0.0101	0.8139	0.1993	0.0035	0.0100	0.6755	0.2597	0.7%	-0.8%	-17.0%	30.3%
Fri.	0.0039	0.0105	0.8811	0.1989	0.0039	0.0110	0.7140	0.2725	-0.5%	4.8%	-19.0%	37.0%
Sat.	0.0012	0.0027	0.6576	0.1075	0.0012	0.0020	0.4645	0.1878	-2.6%	-27.1%	-29.4%	74.7%
Sun.	0.0014	0.0028	0.6938	0.1151	0.0013	0.0020	0.4900	0.1960	-10.7%	-28.3%	-29.4%	70.3%
Summary												
Weekday	0.00	--	0.8	0.20	0.00	--	0.7	0.26	-2.2%	--	-18.4%	30.4%
Weekend	0.00	--	0.7	0.11	0.00	--	0.5	0.19	-7.0%	--	-29.4%	72.4%
ADWF[4]	0.00	--	0.8	0.17	0.00	--	0.6	0.24	-2.8%	--	-21.1%	38.1%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

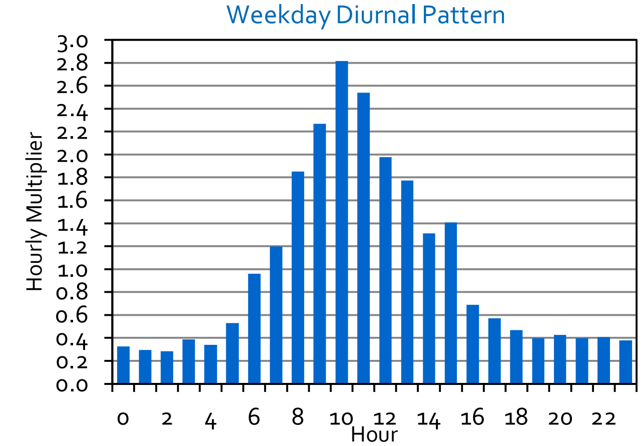
0.900

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

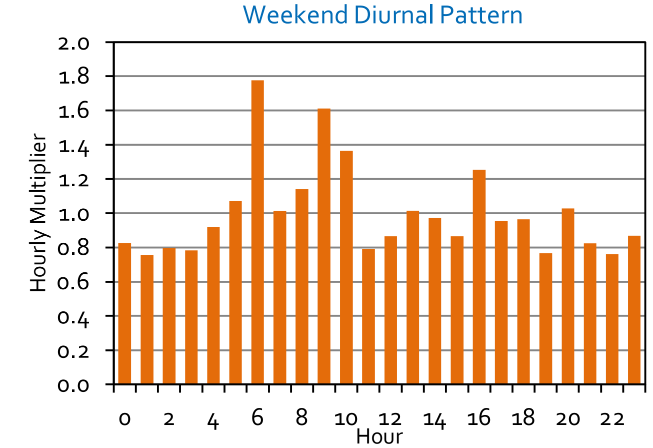
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern

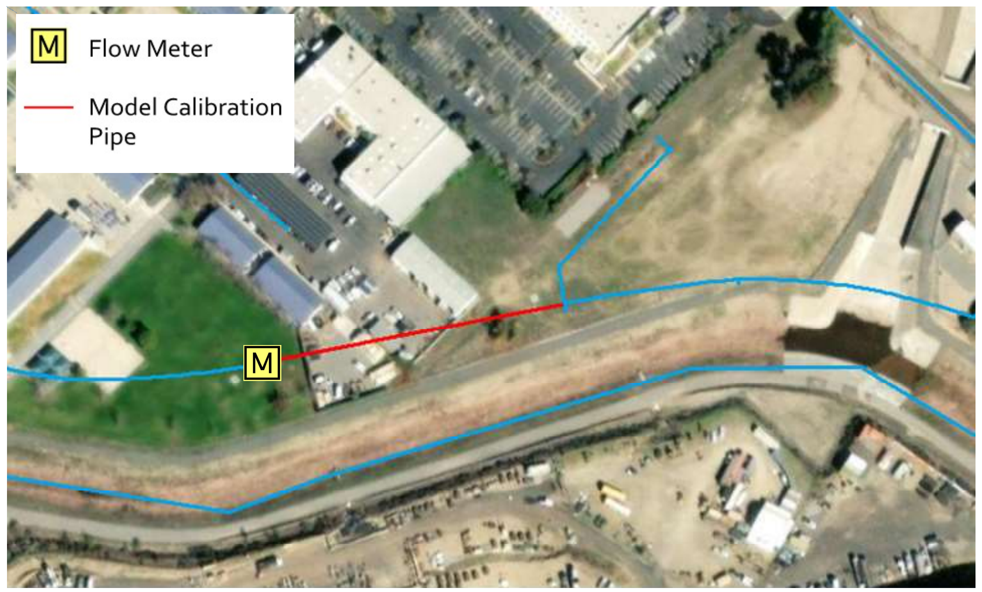


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

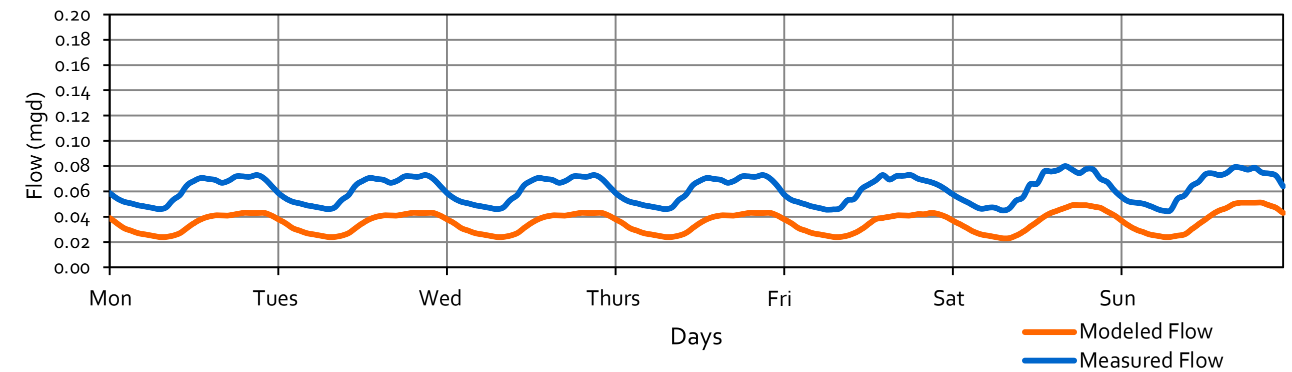
Flow Monitoring Site 11, Dry Weather Flow Calibration

Location: Easement off Chaney St
Pipeline Diameter: 26.75"
City Manhole ID: Easement off Chaney St
Model Pipe ID: GM-1658

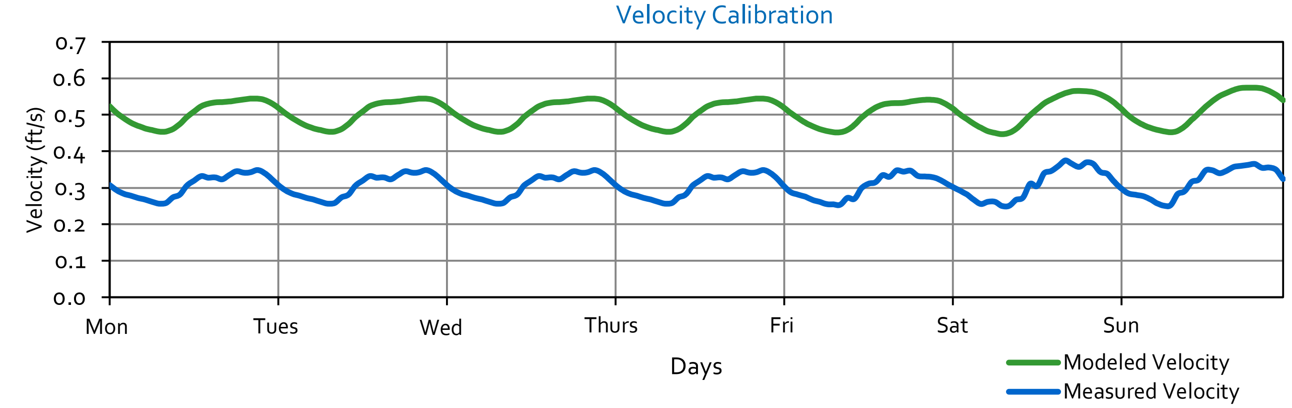
Flow Monitor Location



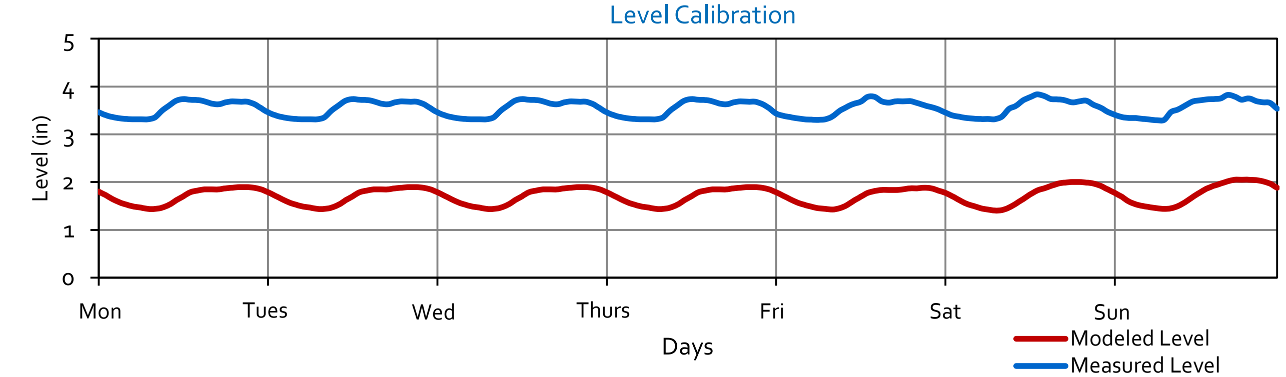
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.06	0.07	3.5	0.31	0.03	0.04	1.7	0.51	-43.1%	-41.1%	-52.0%	65.1%
Tues.	0.06	0.07	3.5	0.31	0.03	0.04	1.7	0.51	-43.1%	-41.1%	-52.0%	65.1%
Wed.	0.06	0.07	3.5	0.31	0.03	0.04	1.7	0.51	-43.1%	-41.1%	-52.0%	65.1%
Thur.	0.06	0.07	3.5	0.31	0.03	0.04	1.7	0.51	-43.1%	-41.1%	-52.0%	65.1%
Fri.	0.06	0.07	3.5	0.30	0.03	0.04	1.7	0.50	-42.8%	-41.1%	-52.2%	66.9%
Sat.	0.06	0.08	3.6	0.31	0.04	0.05	1.7	0.51	-41.6%	-38.8%	-51.3%	64.8%
Sun.	0.06	0.08	3.6	0.32	0.04	0.05	1.8	0.52	-40.8%	-35.4%	-50.6%	63.5%
Summary												
Weekday	0.06	--	3.5	0.31	0.03	--	1.7	0.51	-43.1%	--	-52.0%	65.4%
Weekend	0.06	--	3.6	0.31	0.04	--	1.7	0.51	-41.2%	--	-50.9%	64.1%
ADWF[4]	0.06	--	3.5	0.31	0.04	--	1.7	0.51	-42.5%	--	-51.7%	65.1%

Notes:

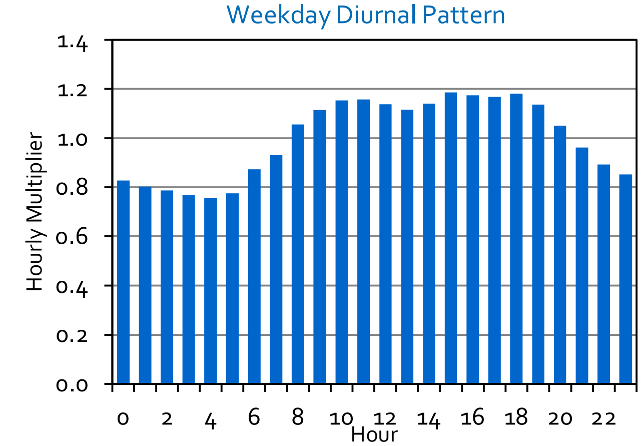
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

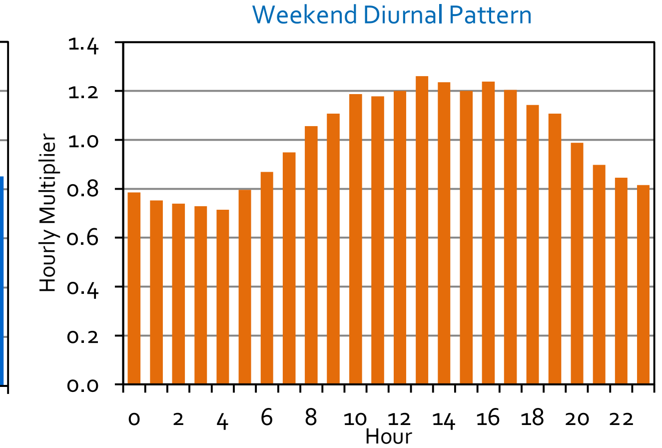
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern

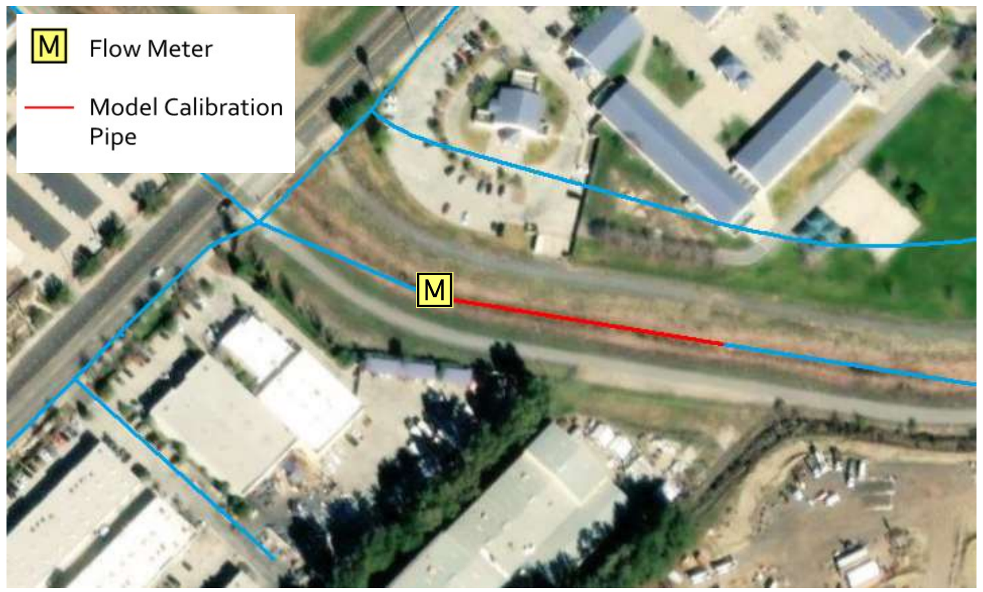


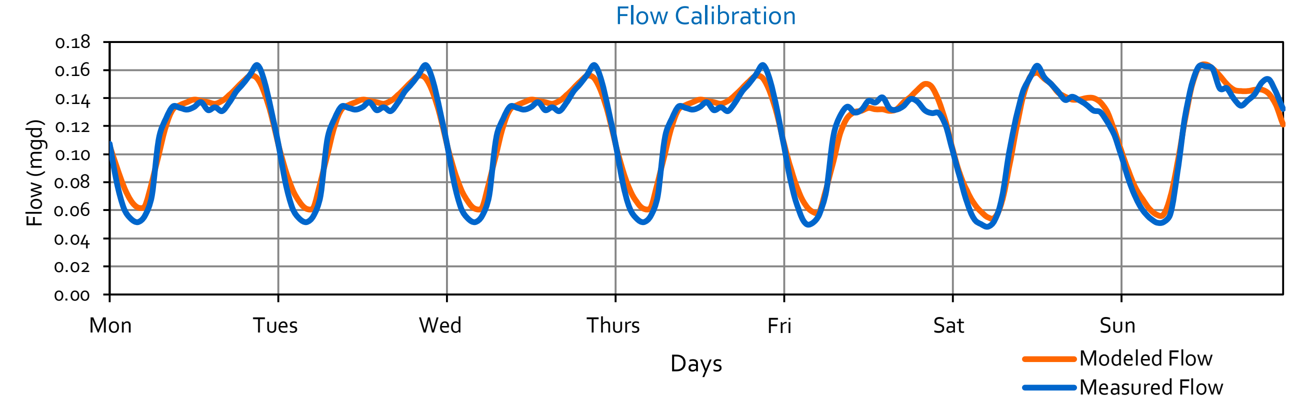
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

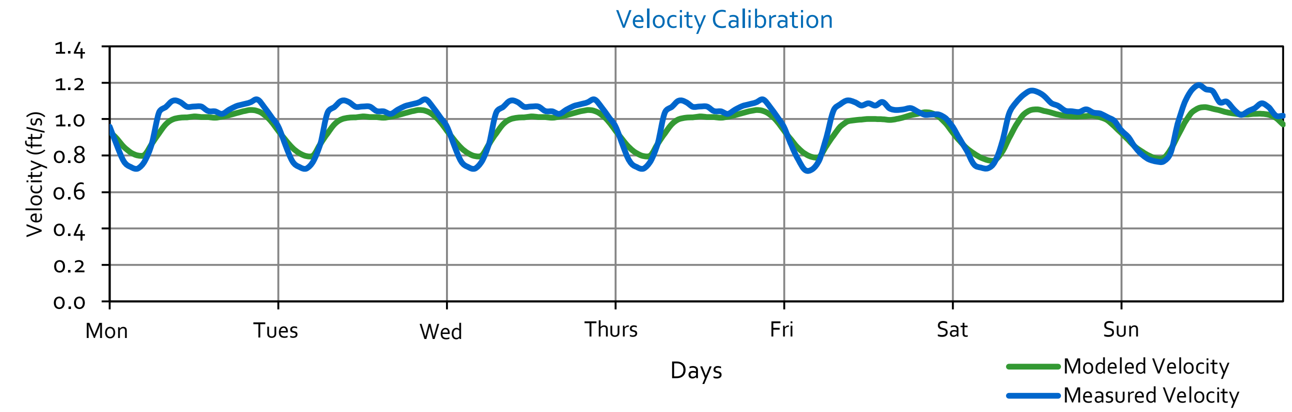
Flow Monitoring Site 12, Dry Weather Flow Calibration

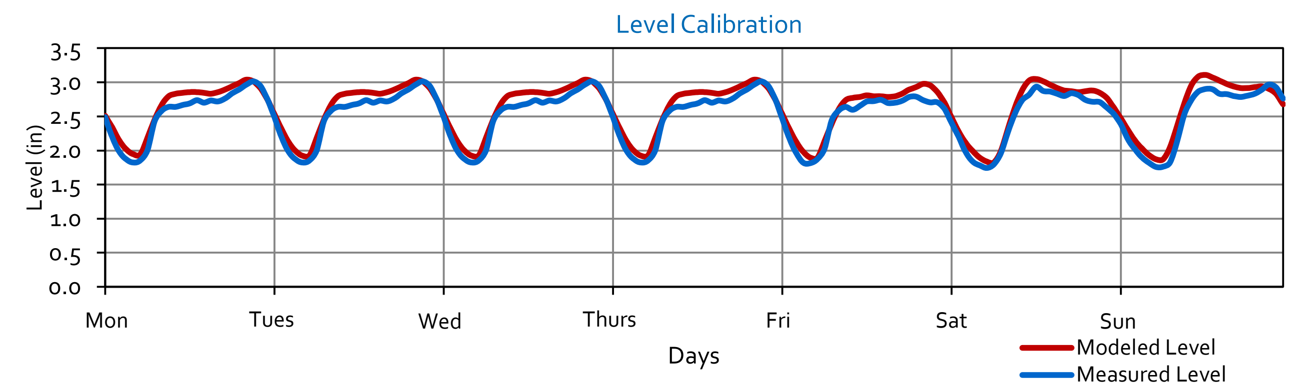
Location: Easement off Chaney St
Pipeline Diameter: 24"
City Manhole ID: Easement off Chaney St
Model Pipe ID: GM-1665

Flow Monitor Location









Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Tues.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Wed.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Thur.	0.12	0.16	2.5	0.99	0.12	0.16	2.6	0.96	2.1%	-4.6%	4.1%	-2.8%
Fri.	0.11	0.14	2.5	0.99	0.12	0.15	2.6	0.95	1.9%	6.7%	4.4%	-3.5%
Sat.	0.11	0.16	2.5	0.98	0.11	0.16	2.6	0.95	1.5%	-3.2%	4.1%	-3.7%
Sun.	0.12	0.16	2.5	1.00	0.12	0.16	2.6	0.96	2.2%	0.9%	4.8%	-3.7%
Summary												
Weekday	0.12	--	2.5	0.99	0.12	--	2.6	0.96	2.0%	--	4.1%	-3.0%
Weekend	0.11	--	2.5	0.99	0.12	--	2.6	0.95	1.8%	--	4.5%	-3.7%
ADWF[4]	0.12	--	2.5	0.99	0.12	--	2.6	0.96	2.0%	--	4.2%	-3.2%

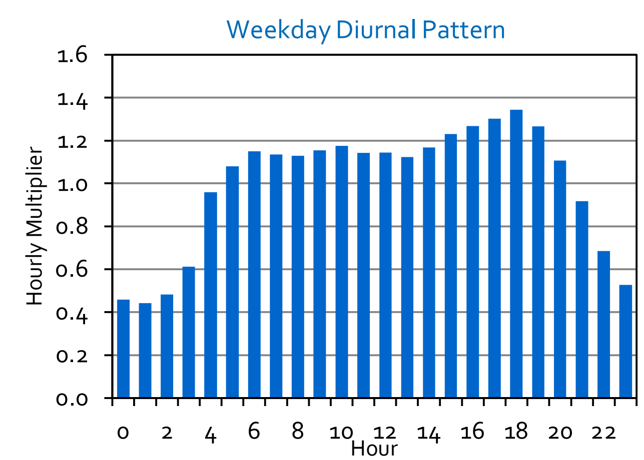
Notes:

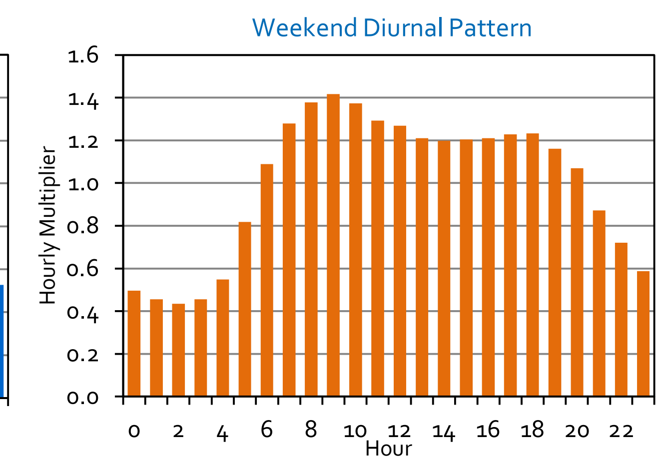
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7





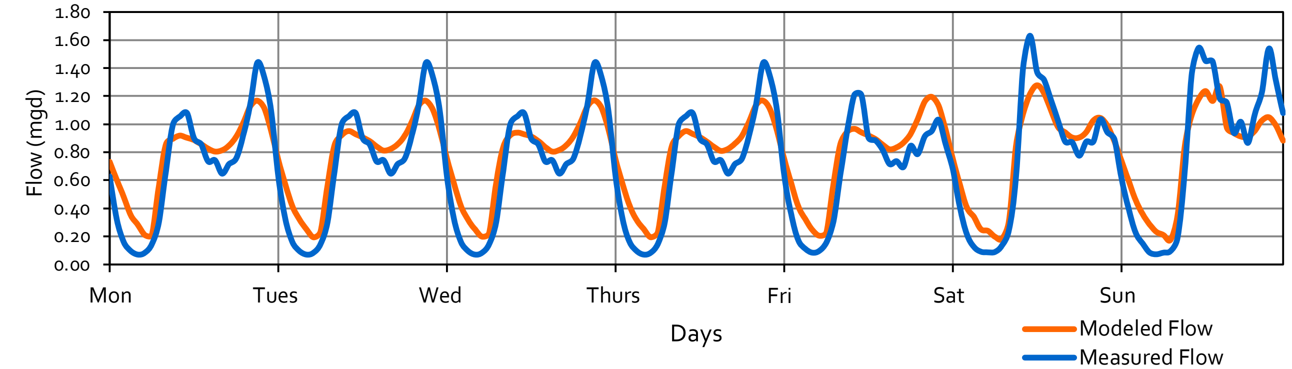
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 13, Dry Weather Flow Calibration

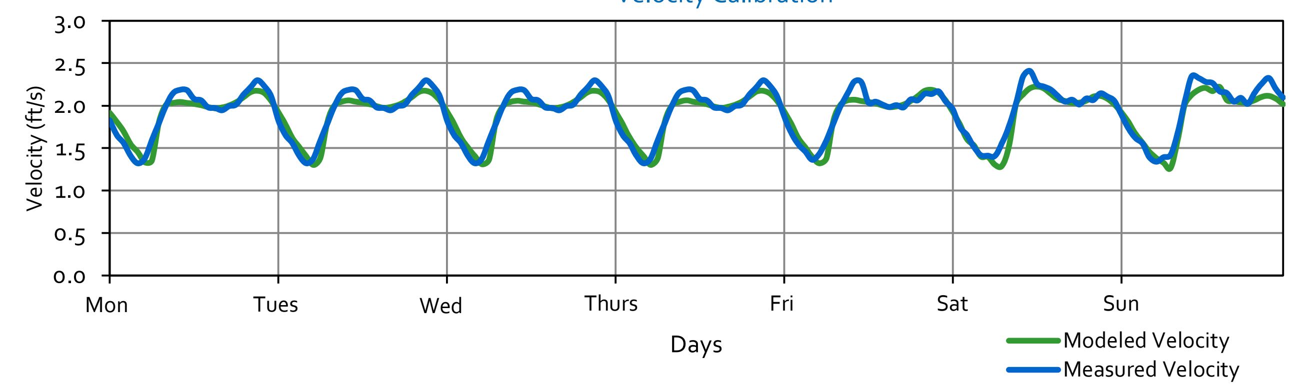
Location: Casino Drive, east of Avenue 12
Pipeline Diameter: 36"
City Manhole ID: Casino Drive, east of Avenue 12
Model Pipe ID: GM-3072

Flow Monitor Location

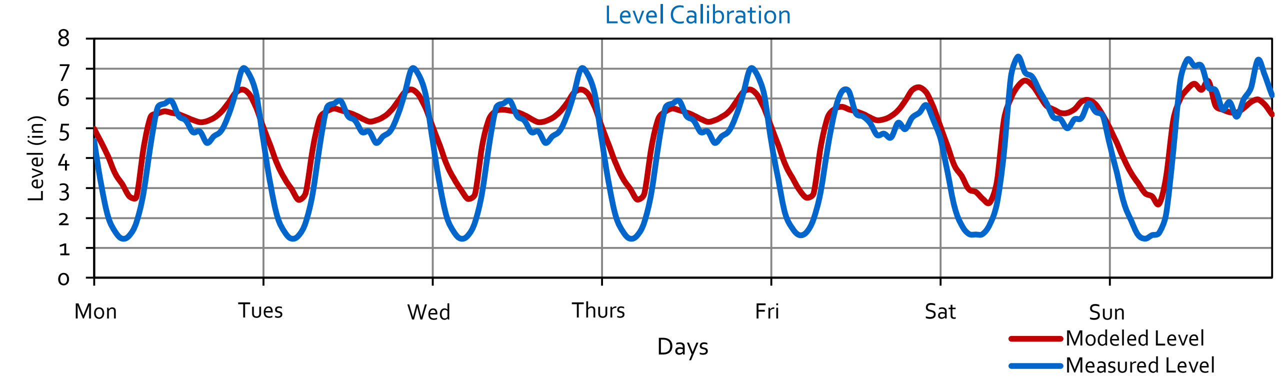
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.70	1.44	4.4	1.92	0.76	1.17	5.0	1.90	8.7%	-18.6%	12.0%	-1.0%
Tues.	0.70	1.44	4.4	1.92	0.76	1.17	5.0	1.90	8.7%	-18.6%	12.0%	-1.0%
Wed.	0.70	1.44	4.4	1.92	0.76	1.17	5.0	1.90	8.7%	-18.6%	12.0%	-1.0%
Thur.	0.70	1.44	4.4	1.92	0.76	1.17	5.0	1.90	8.7%	-18.6%	12.0%	-1.0%
Fri.	0.67	1.21	4.3	1.92	0.78	1.19	5.0	1.91	15.9%	-1.2%	15.3%	-0.8%
Sat.	0.74	1.63	4.5	1.94	0.77	1.28	5.0	1.88	4.7%	-21.7%	9.9%	-2.8%
Sun.	0.82	1.55	4.8	1.95	0.78	1.27	5.0	1.89	-4.8%	-17.9%	4.5%	-2.8%
Summary												
Weekday	0.70	--	4.4	1.92	0.77	--	5.0	1.90	10.1%	--	12.7%	-1.0%
Weekend	0.78	--	4.6	1.94	0.78	--	5.0	1.89	-0.3%	--	7.1%	-2.8%
ADWF[4]	0.72	--	4.5	1.93	0.77	--	5.0	1.90	6.9%	--	11.0%	-1.5%

Notes:

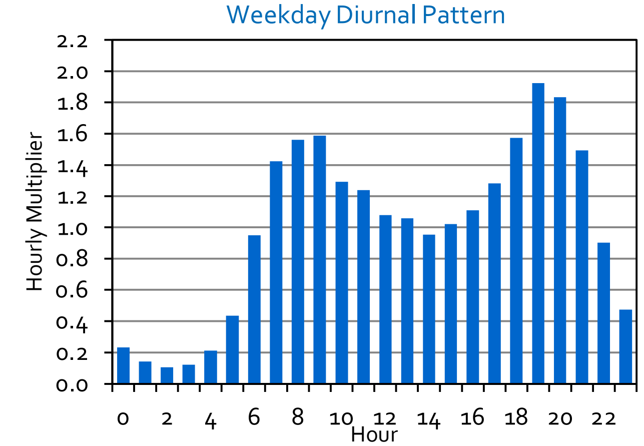
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

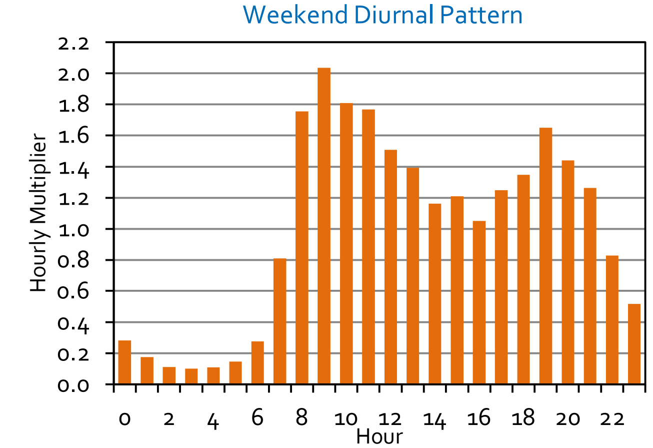
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern



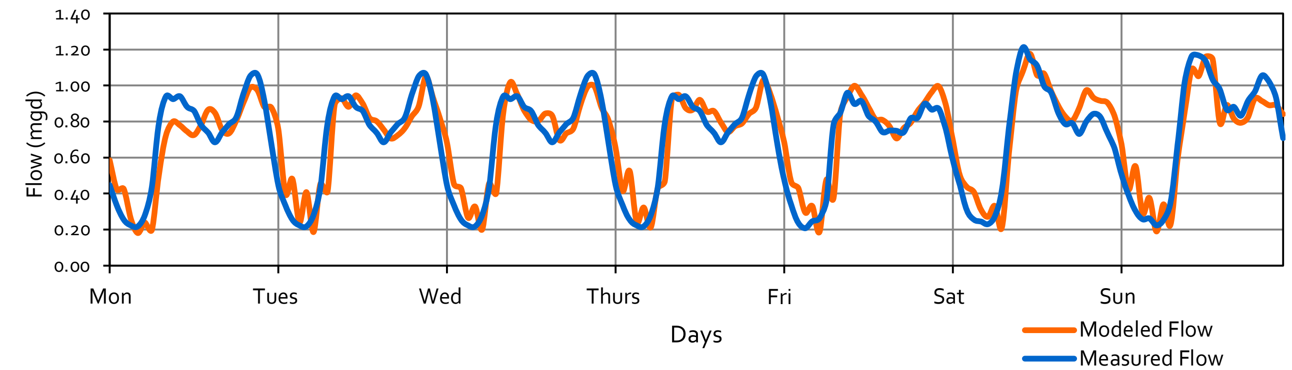
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 14, Dry Weather Flow Calibration

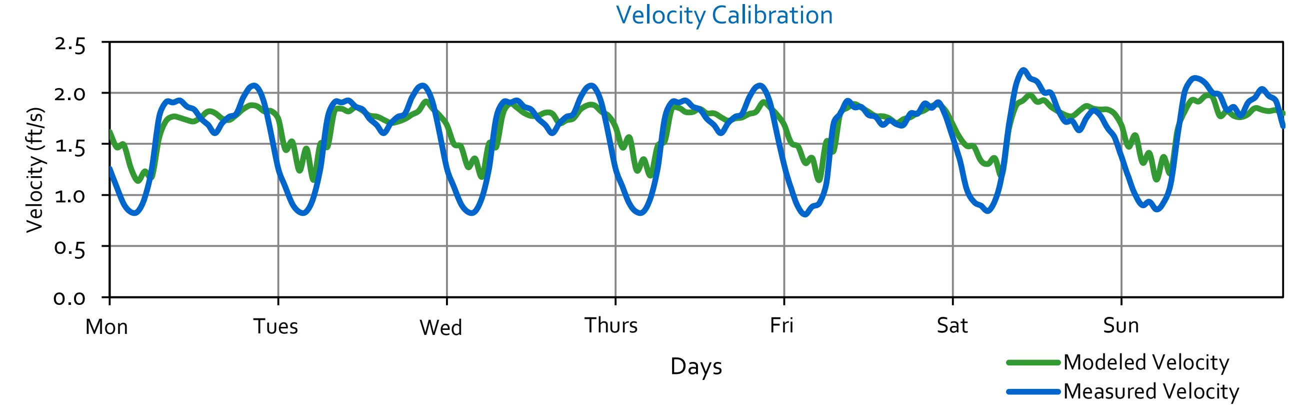
Location: Old Newport Road
Pipeline Diameter: 20.75"
City Manhole ID: Old Newport Road
Model Pipe ID: GM-3204

Flow Monitor Location

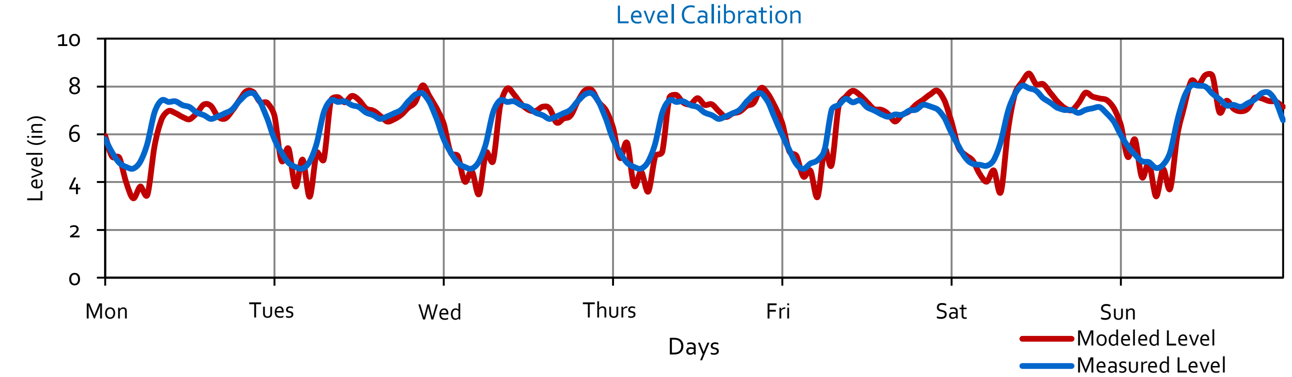
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[(1)]				Modeled Data				Percent Error[(3)]			
	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.70	1.06	6.5	1.59	0.70	1.05	6.4	1.67	0.2%	-1.2%	-2.0%	5.0%
Tues.	0.70	1.06	6.5	1.59	0.70	1.05	6.4	1.67	0.2%	-1.2%	-2.0%	5.0%
Wed.	0.70	1.06	6.5	1.59	0.70	1.05	6.4	1.67	0.2%	-1.2%	-2.0%	5.0%
Thur.	0.70	1.06	6.5	1.59	0.70	1.05	6.4	1.67	0.2%	-1.2%	-2.0%	5.0%
Fri.	0.67	0.96	6.5	1.56	0.71	1.00	6.5	1.68	5.9%	4.1%	-0.1%	7.7%
Sat.	0.71	1.21	6.6	1.60	0.75	1.18	6.6	1.70	6.1%	-2.9%	1.1%	6.3%
Sun.	0.74	1.17	6.7	1.63	0.73	1.16	6.5	1.69	-1.9%	-0.5%	-2.2%	3.5%
Summary												
Weekday	0.69	--	6.5	1.59	0.70	--	6.4	1.67	1.3%	--	-1.7%	5.6%
Weekend	0.73	--	6.6	1.62	0.74	--	6.6	1.70	2.0%	--	-0.6%	4.9%
ADWF[(4)]	0.70	--	6.5	1.59	0.71	--	6.5	1.68	1.5%	--	-1.3%	5.4%

Notes:

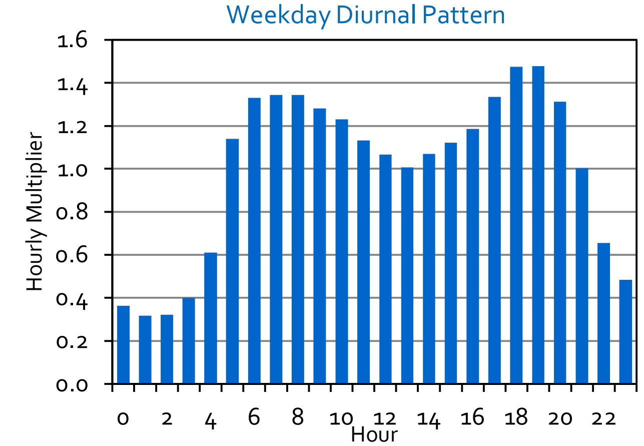
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

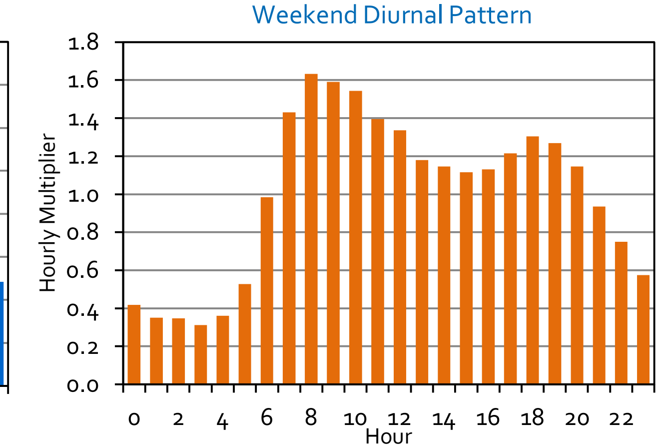
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern

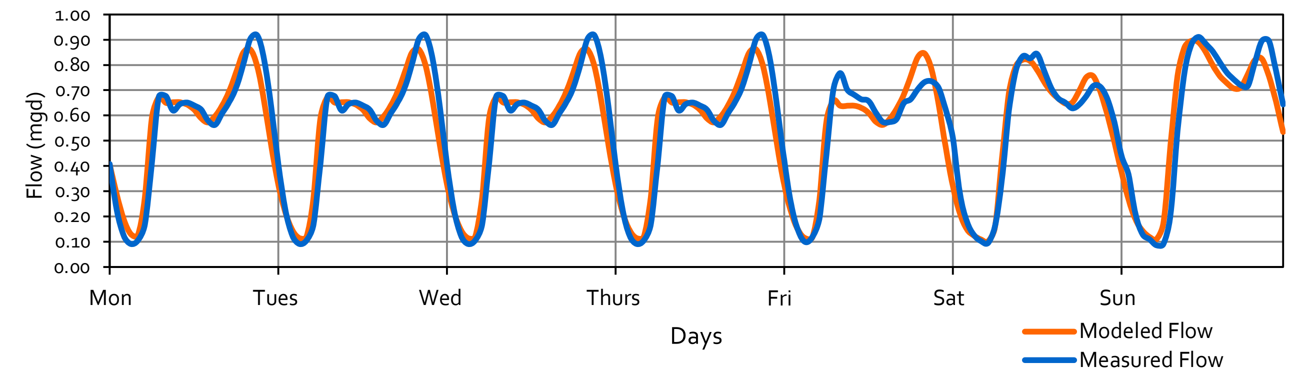


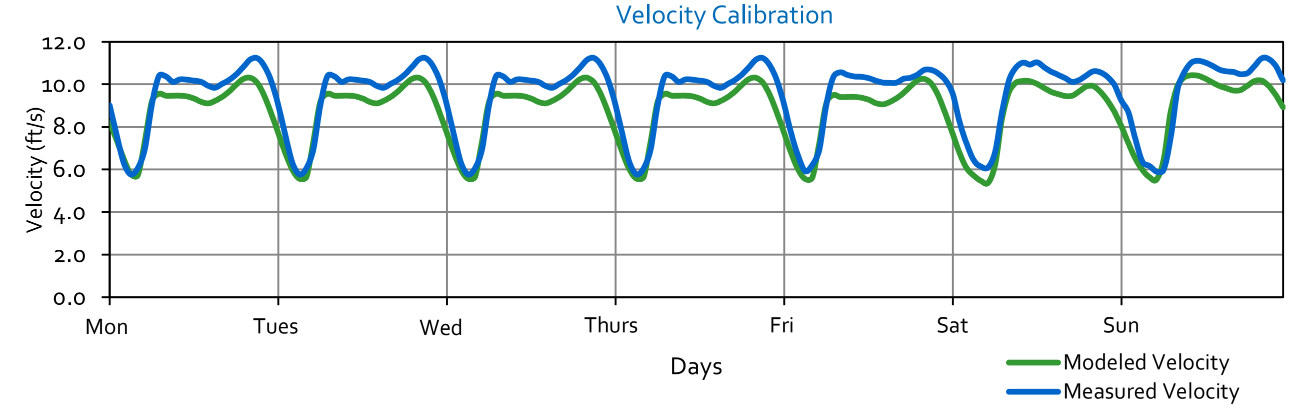
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

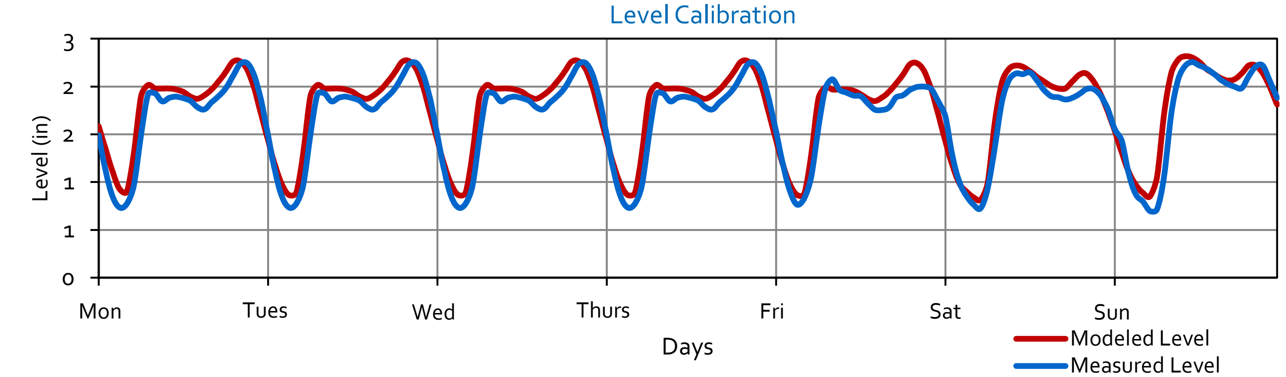
Flow Monitoring Site 15, Dry Weather Flow Calibration

Location: Railroad Canyon Road, 1 MH down stream on easement
Pipeline Diameter: 17.75"
City Manhole ID: Railroad Canyon Road, 1 MH down stream on easement
Model Pipe ID: GM-7891

Flow Monitor Location







Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.55	0.92	1.7	9.46	0.55	0.86	1.8	8.78	-0.1%	-6.1%	5.9%	-7.2%
Tues.	0.55	0.92	1.7	9.46	0.55	0.86	1.8	8.78	-0.1%	-6.1%	5.9%	-7.2%
Wed.	0.55	0.92	1.7	9.46	0.55	0.86	1.8	8.78	-0.1%	-6.1%	5.9%	-7.2%
Thur.	0.55	0.92	1.7	9.46	0.55	0.86	1.8	8.78	-0.1%	-6.1%	5.9%	-7.2%
Fri.	0.54	0.77	1.7	9.47	0.54	0.85	1.8	8.71	-0.6%	10.0%	5.0%	-8.0%
Sat.	0.55	0.84	1.7	9.47	0.54	0.82	1.7	8.61	-1.9%	-2.7%	4.3%	-9.1%
Sun.	0.59	0.91	1.7	9.53	0.59	0.90	1.8	8.88	-0.6%	-1.7%	5.3%	-6.8%
Summary												
Weekday	0.55	--	1.7	9.46	0.55	--	1.8	8.77	-0.2%	--	5.7%	-7.4%
Weekend	0.57	--	1.7	9.50	0.56	--	1.8	8.74	-1.2%	--	4.8%	-8.0%
ADWF[4]	0.56	--	1.7	9.47	0.55	--	1.8	8.76	-0.5%	--	5.4%	-7.5%

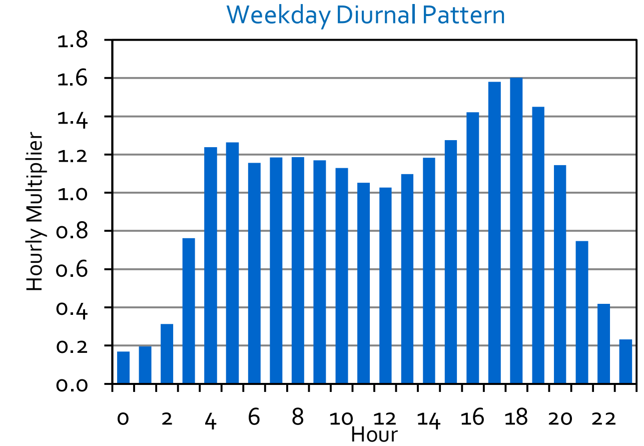
Notes:

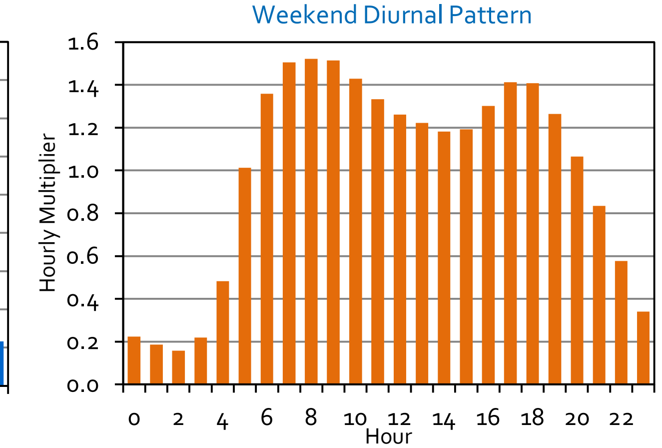
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7



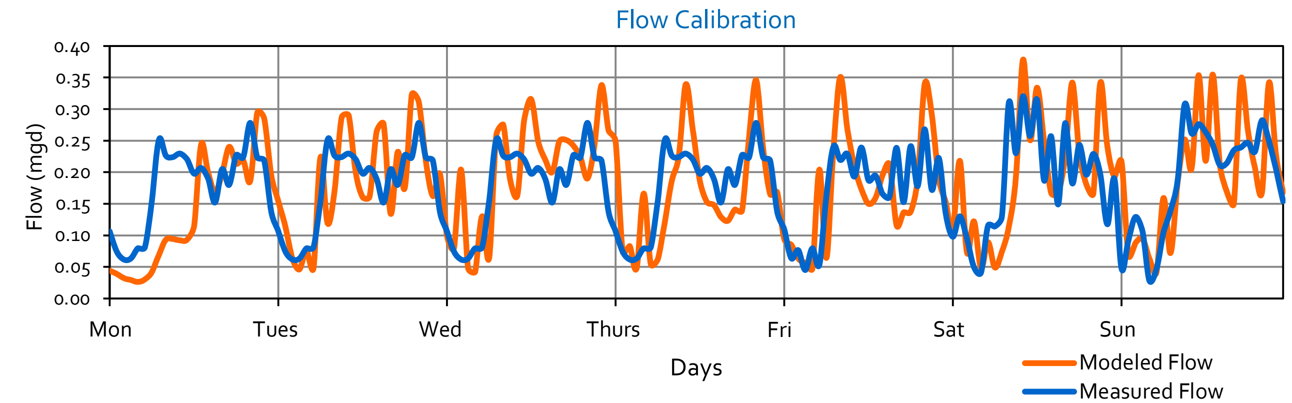


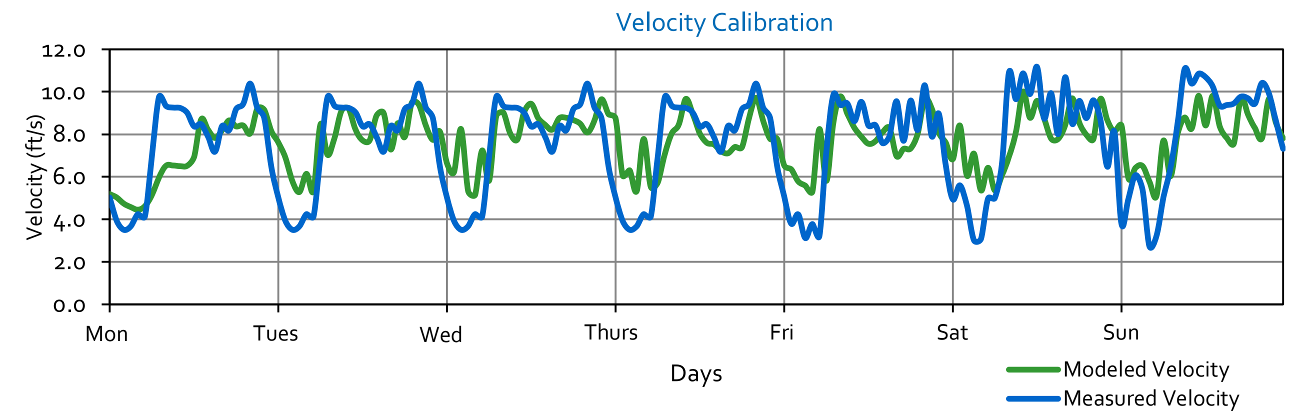
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

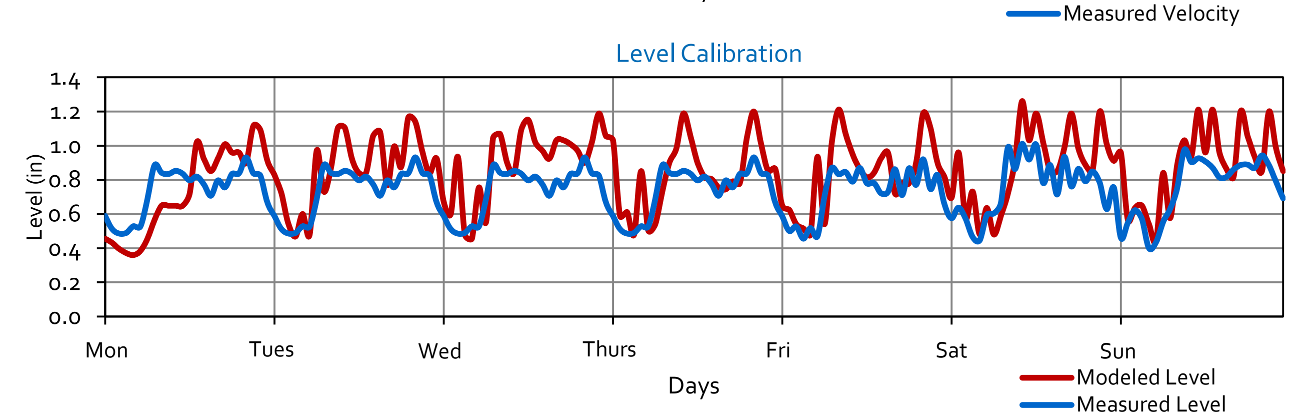
Flow Monitoring Site 16, Dry Weather Flow Calibration

Location: Via De La Valle, east of Via De La Luna
Pipeline Diameter: 20.75"
City Manhole ID: Via De La Valle, east of Via De La Luna
Model Pipe ID: GM-2893

Flow Monitor Location







Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data Peak Flow[2] (mgd)	Measured Data Avg. Level (in)	Measured Data Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error Peak Flow (%)	Percent Error Avg. Level (%)	Percent Error Avg. Vel. (%)
Mon.	0.18	0.28	0.7	7.50	0.17	0.35	0.8	7.58	-1.8%	24.3%	13.2%	1.0%
Tues.	0.18	0.28	0.7	7.50	0.17	0.35	0.8	7.58	-1.8%	24.3%	13.2%	1.0%
Wed.	0.18	0.28	0.7	7.50	0.17	0.35	0.8	7.58	-1.8%	24.3%	13.2%	1.0%
Thur.	0.18	0.28	0.7	7.50	0.17	0.35	0.8	7.58	-1.8%	24.3%	13.2%	1.0%
Fri.	0.17	0.27	0.7	7.43	0.17	0.35	0.8	7.62	2.3%	30.9%	15.9%	2.6%
Sat.	0.18	0.32	0.8	7.81	0.19	0.38	0.9	7.84	2.8%	18.1%	16.0%	0.5%
Sun.	0.19	0.31	0.8	8.03	0.19	0.36	0.9	7.89	2.9%	15.5%	17.5%	-1.7%
Summary												
Weekday	0.17	--	0.7	7.49	0.17	--	0.8	7.59	-1.0%	--	13.7%	1.3%
Weekend	0.19	--	0.8	7.92	0.19	--	0.9	7.87	2.8%	--	16.8%	-0.6%
ADWF[4]	0.18	--	0.7	7.61	0.18	--	0.8	7.67	0.1%	--	14.6%	0.8%

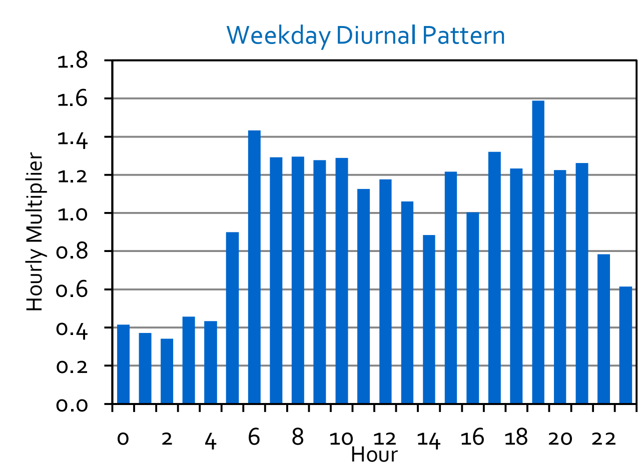
Notes:

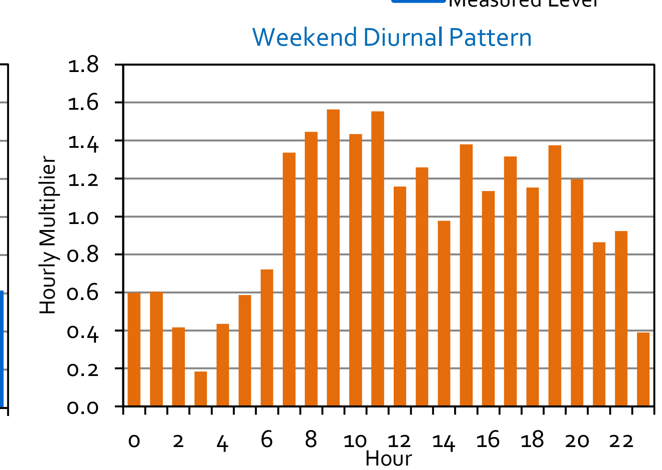
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7



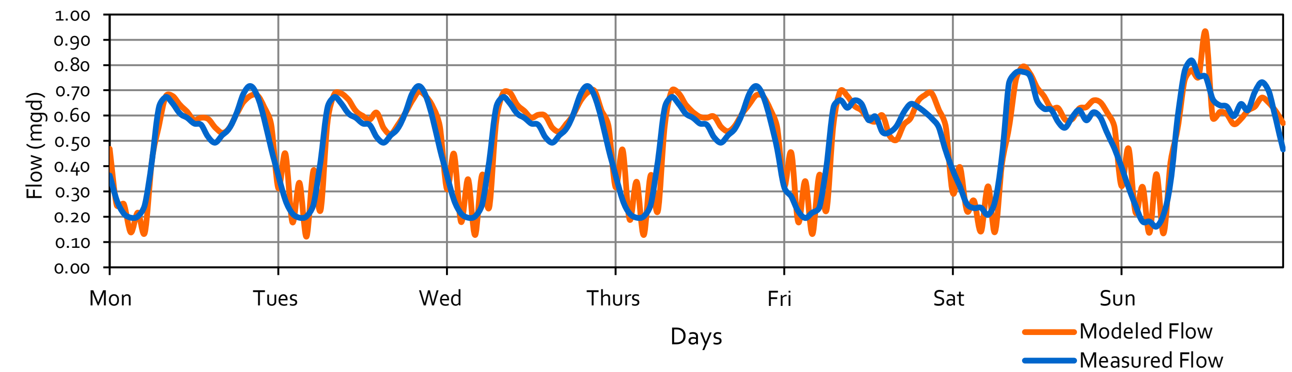


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

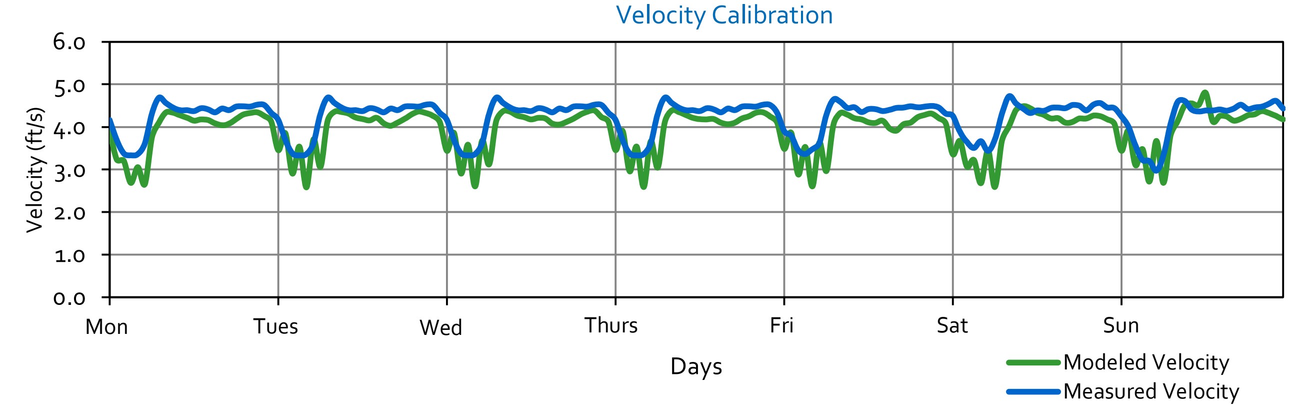
Flow Monitoring Site 17, Dry Weather Flow Calibration
Location: Railroad Canyon Road, near Skylink
Pipeline Diameter: 14.75"
City Manhole ID: Railroad Canyon Road, near Skylink
Model Pipe ID: GM-2931

Flow Monitor Location

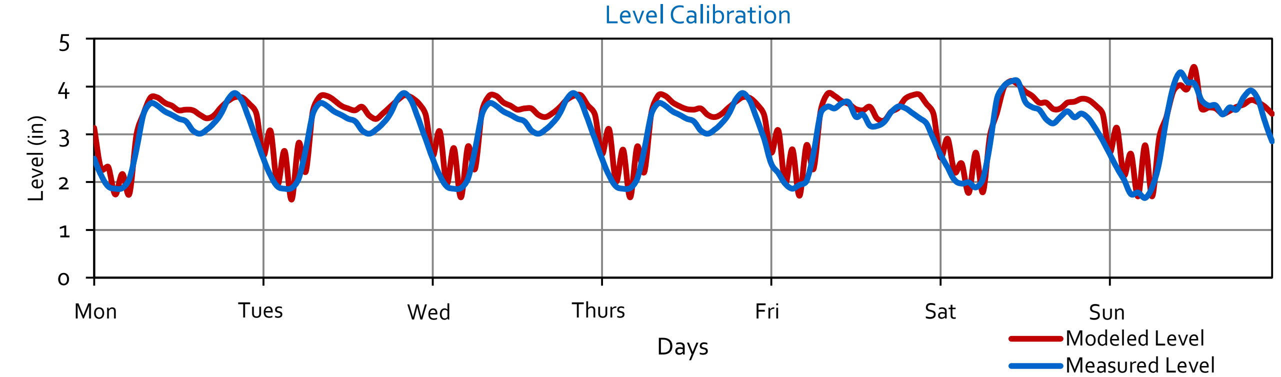
Flow Calibration



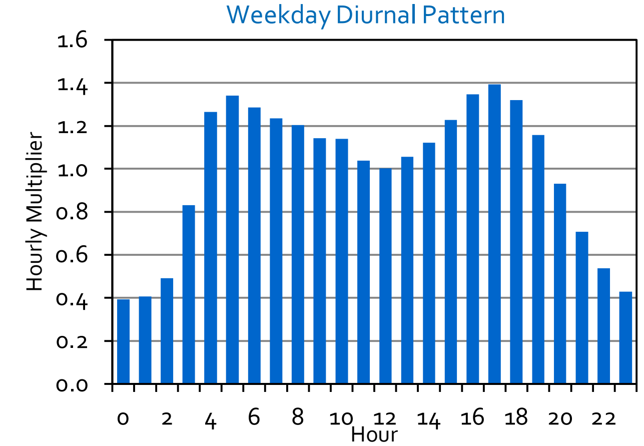
Velocity Calibration



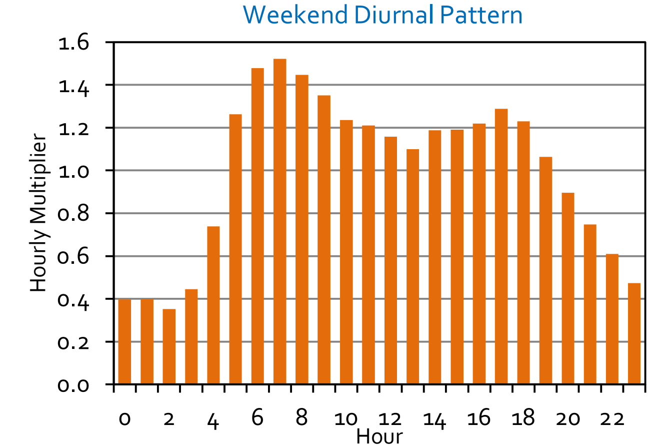
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



Model Calibration Summary

	Measured Data[1]				Modeled Data				Percent Error[3]			
Day	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.50	0.72	3.0	4.23	0.52	0.70	3.2	3.94	3.5%	-2.6%	7.3%	-6.8%
Tues.	0.50	0.72	3.0	4.23	0.52	0.70	3.2	3.94	3.5%	-2.6%	7.3%	-6.8%
Wed.	0.50	0.72	3.0	4.23	0.52	0.70	3.2	3.94	3.5%	-2.6%	7.3%	-6.8%
Thur.	0.50	0.72	3.0	4.23	0.52	0.70	3.2	3.94	3.5%	-2.6%	7.3%	-6.8%
Fri.	0.50	0.66	3.0	4.23	0.52	0.70	3.3	3.90	2.9%	5.4%	7.6%	-7.9%
Sat.	0.52	0.77	3.1	4.25	0.52	0.79	3.3	3.89	1.6%	2.7%	6.5%	-8.3%
Sun.	0.53	0.82	3.1	4.17	0.54	0.93	3.3	4.00	1.3%	13.8%	4.3%	-4.1%
Summary												
Weekday	0.50	--	3.0	4.23	0.52	--	3.2	3.93	3.4%	--	7.3%	-7.0%
Weekend	0.52	--	3.1	4.21	0.53	--	3.3	3.95	1.4%	--	5.4%	-6.2%
ADWF[4]	0.51	--	3.0	4.22	0.52	--	3.3	3.94	2.8%	--	6.8%	-6.8%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

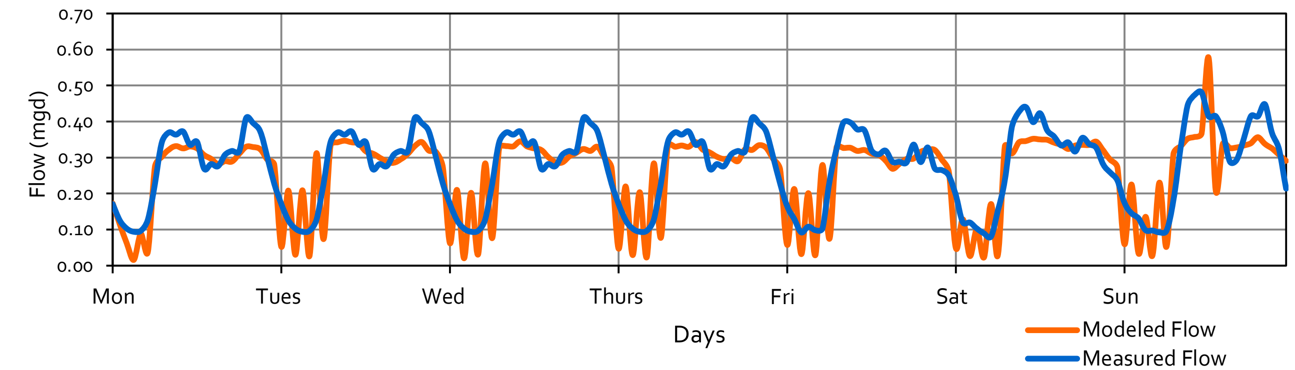
(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Flow Monitoring Site 18, Dry Weather Flow Calibration

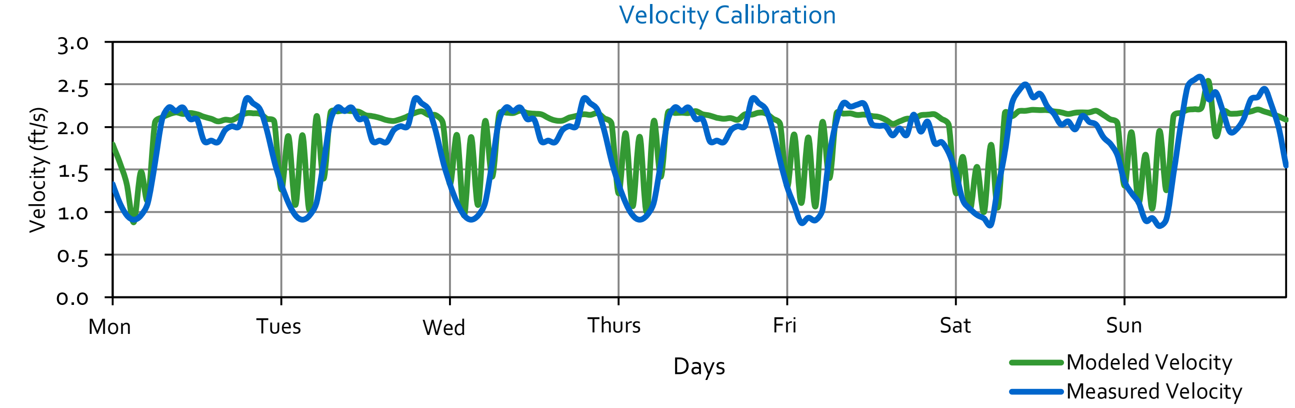
Location: Canyon Lake Country Club
Pipeline Diameter: 15"
City Manhole ID: Canyon Lake Country Club
Model Pipe ID: GM-2551

Flow Monitor Location

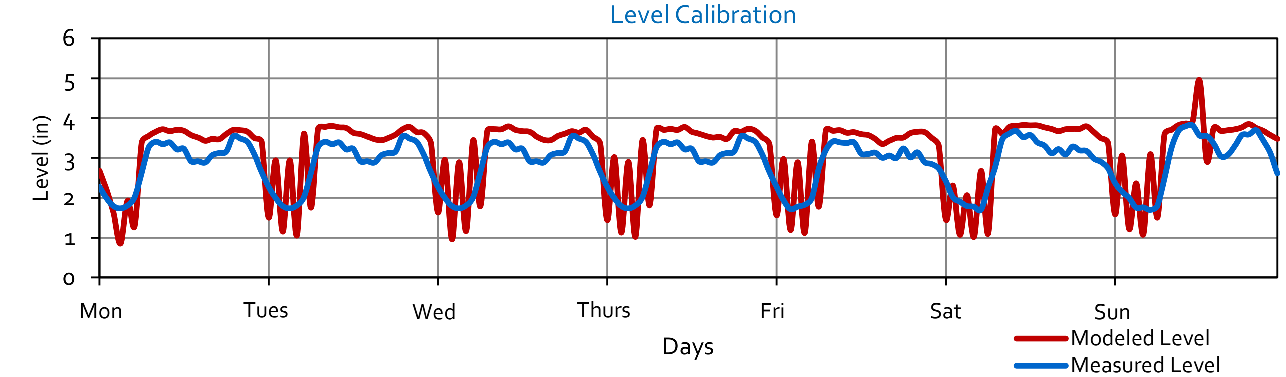
Flow Calibration



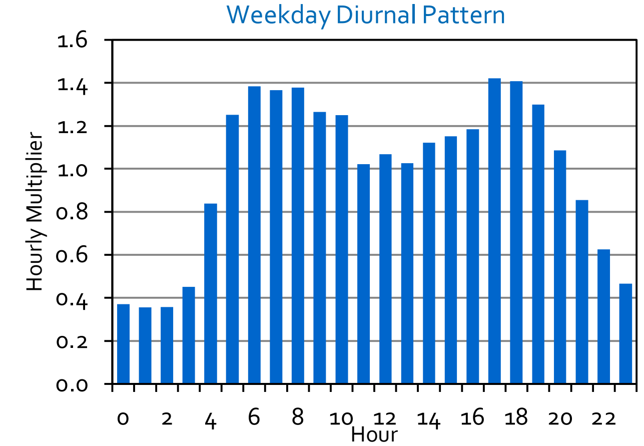
Velocity Calibration



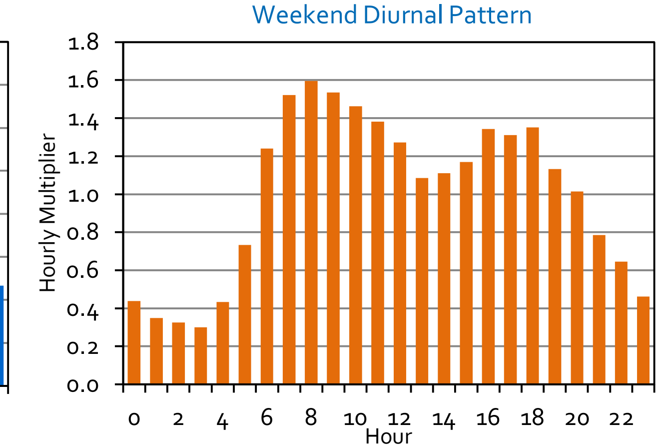
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



Model Calibration Summary

Day	Measured Data[1]				Modeled Data				Percent Error[3]			
	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.27	0.41	2.8	1.78	0.26	0.35	3.2	1.95	-5.2%	-15.3%	11.3%	9.6%
Tues.	0.27	0.41	2.8	1.78	0.26	0.35	3.2	1.95	-5.2%	-15.3%	11.3%	9.6%
Wed.	0.27	0.41	2.8	1.78	0.26	0.35	3.2	1.95	-5.2%	-15.3%	11.3%	9.6%
Thur.	0.27	0.41	2.8	1.78	0.26	0.35	3.2	1.95	-5.2%	-15.3%	11.3%	9.6%
Fri.	0.26	0.40	2.8	1.76	0.25	0.33	3.1	1.94	-4.3%	-17.5%	12.1%	10.5%
Sat.	0.28	0.44	2.9	1.81	0.26	0.35	3.1	1.92	-8.2%	-20.0%	8.4%	6.2%
Sun.	0.29	0.48	2.9	1.84	0.27	0.58	3.2	1.97	-7.2%	20.1%	10.1%	6.9%
Summary												
Weekday	0.27	--	2.8	1.77	0.26	--	3.2	1.95	-5.0%	--	11.5%	9.8%
Weekend	0.29	--	2.9	1.82	0.26	--	3.2	1.94	-7.7%	--	9.3%	6.5%
ADWF[4]	0.28	--	2.9	1.79	0.26	--	3.2	1.95	-5.8%	--	10.9%	8.8%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

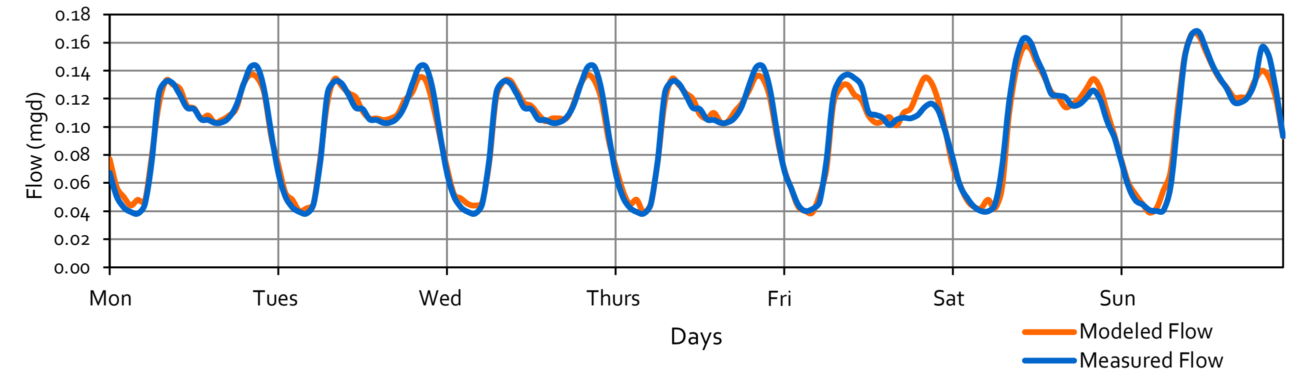
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 19, Dry Weather Flow Calibration

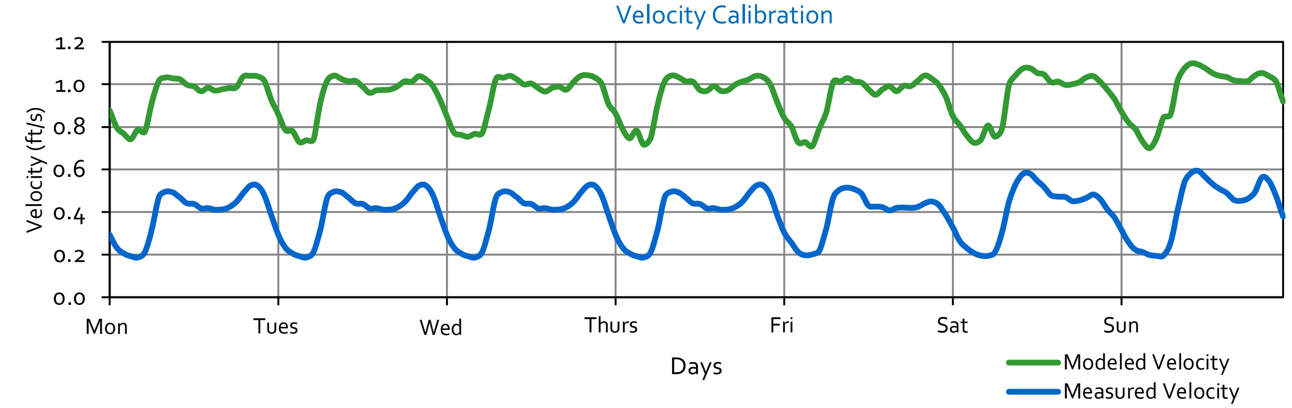
Location: Redwood Drive and Boating Way
Pipeline Diameter: 12"
City Manhole ID: Redwood Drive and Boating Way
Model Pipe ID: GM-1305

Flow Monitor Location

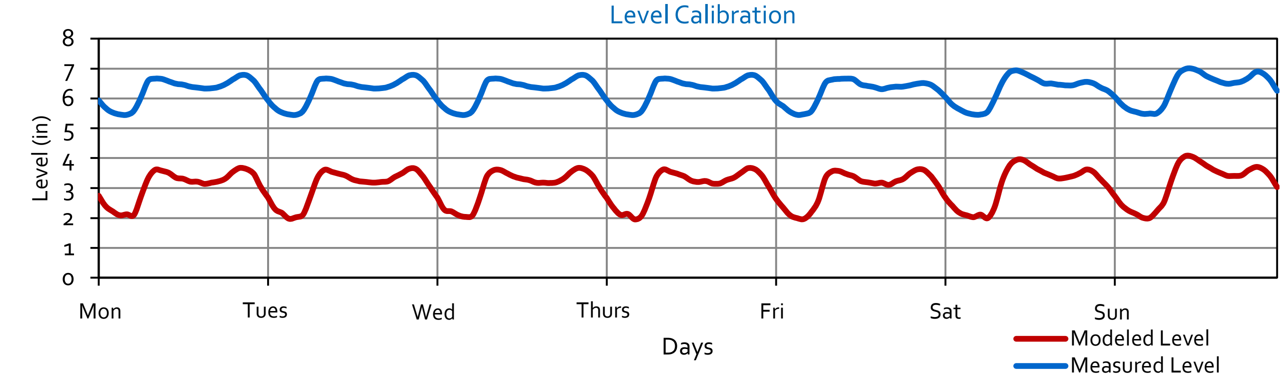
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data(1)				Modeled Data				Percent Error(3)			
	Avg. Flow (mgd)	Peak Flow(2) (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow(2) (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.10	0.14	6.3	0.39	0.10	0.14	3.1	0.94	0.5%	-4.0%	-51.2%	140.9%
Tues.	0.10	0.14	6.3	0.39	0.10	0.14	3.1	0.94	0.5%	-4.0%	-51.2%	140.9%
Wed.	0.10	0.14	6.3	0.39	0.10	0.14	3.1	0.94	0.5%	-4.0%	-51.2%	140.9%
Thur.	0.10	0.14	6.3	0.39	0.10	0.14	3.1	0.94	0.5%	-4.0%	-51.2%	140.9%
Fri.	0.10	0.14	6.2	0.39	0.10	0.14	3.0	0.93	0.6%	-1.6%	-51.4%	141.4%
Sat.	0.10	0.16	6.3	0.40	0.10	0.16	3.1	0.94	-0.7%	-4.0%	-50.8%	133.2%
Sun.	0.11	0.17	6.3	0.41	0.11	0.17	3.2	0.96	0.4%	-1.1%	-50.1%	131.8%
Summary												
Weekday	0.10	--	6.3	0.39	0.10	--	3.1	0.94	0.5%	--	-51.3%	141.0%
Weekend	0.10	--	6.3	0.41	0.10	--	3.1	0.95	-0.2%	--	-50.4%	132.5%
ADWF(4)	0.10	--	6.3	0.40	0.10	--	3.1	0.94	0.3%	--	-51.0%	138.5%

Notes:

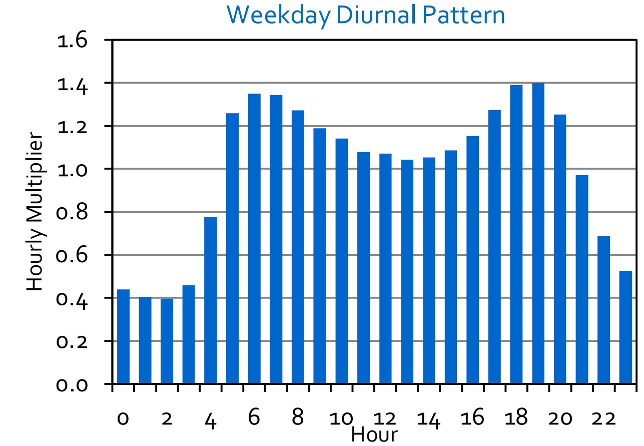
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

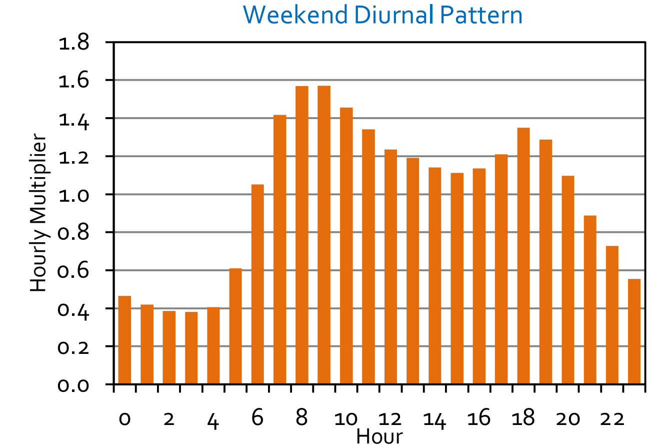
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern

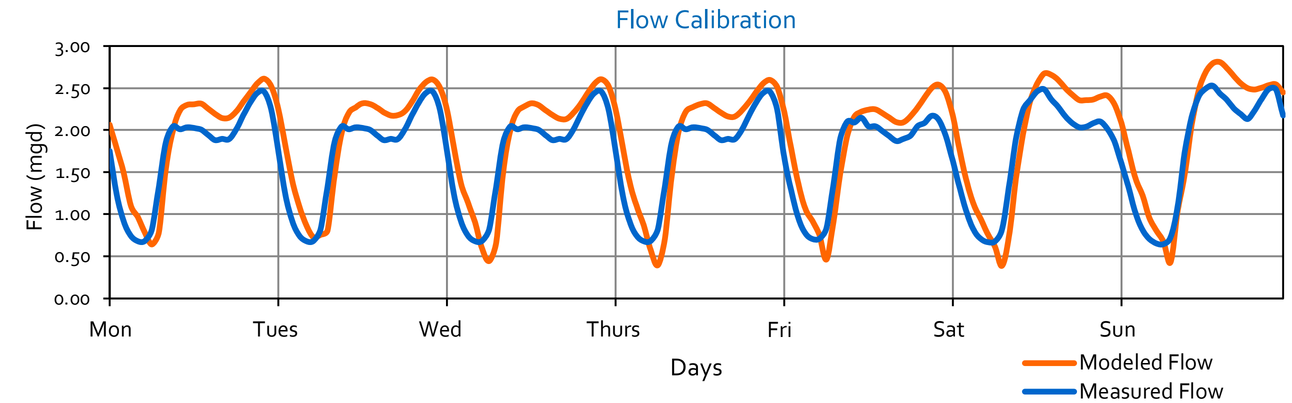


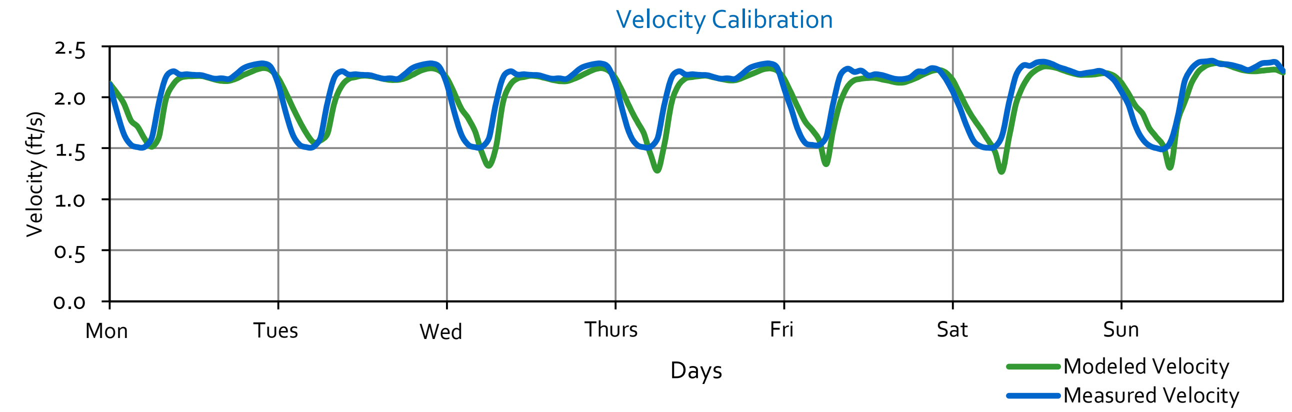
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

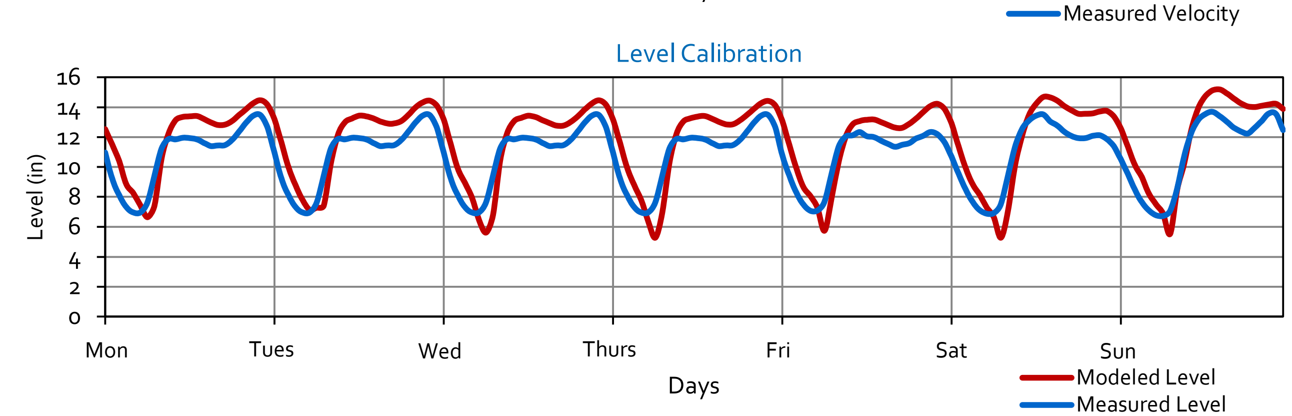
Flow Monitoring Site 20, Dry Weather Flow Calibration

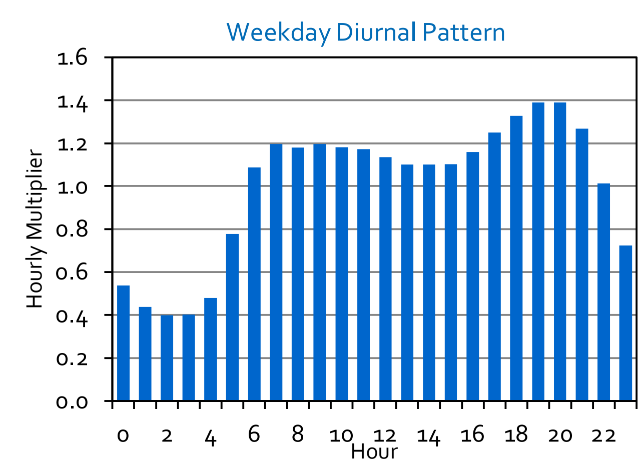
Location: Mission Trail and Olive Street
Pipeline Diameter: 21"
City Manhole ID: Mission Trail and Olive Street
Model Pipe ID: GM-3680

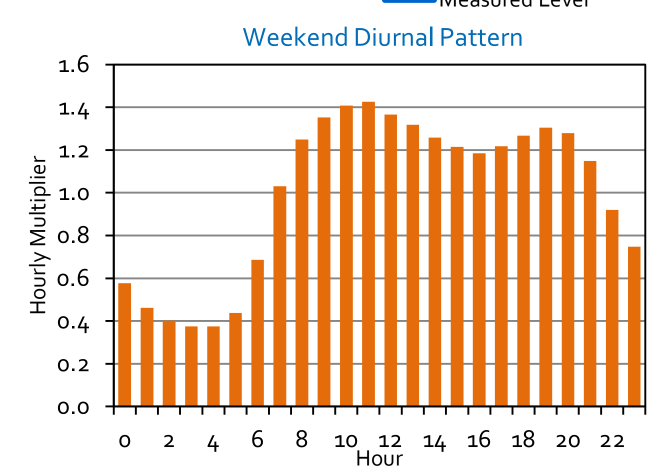
Flow Monitor Location











Model Calibration Summary

	Measured Data[1]				Modeled Data				Percent Error[3]			
Day	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	1.73	2.46	10.8	2.07	1.89	2.61	11.8	2.05	9.7%	6.3%	8.7%	-0.9%
Tues.	1.73	2.46	10.8	2.07	1.89	2.61	11.8	2.05	9.7%	6.3%	8.7%	-0.9%
Wed.	1.73	2.46	10.8	2.07	1.89	2.61	11.8	2.05	9.7%	6.3%	8.7%	-0.9%
Thur.	1.73	2.46	10.8	2.07	1.89	2.61	11.8	2.05	9.7%	6.3%	8.7%	-0.9%
Fri.	1.69	2.17	10.7	2.06	1.86	2.54	11.7	2.04	9.9%	17.0%	8.8%	-1.1%
Sat.	1.73	2.49	10.8	2.06	1.88	2.67	11.7	2.03	9.0%	7.5%	8.0%	-1.3%
Sun.	1.79	2.53	11.0	2.07	1.98	2.81	12.1	2.07	10.7%	11.1%	9.5%	-0.3%
Summary												
Weekday	1.72	--	10.8	2.07	1.89	--	11.8	2.05	9.8%	--	8.7%	-1.0%
Weekend	1.76	--	10.9	2.06	1.93	--	11.9	2.05	9.9%	--	8.7%	-0.8%
ADWF[4]	1.73	--	10.8	2.07	1.90	--	11.8	2.05	9.8%	--	8.7%	-0.9%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

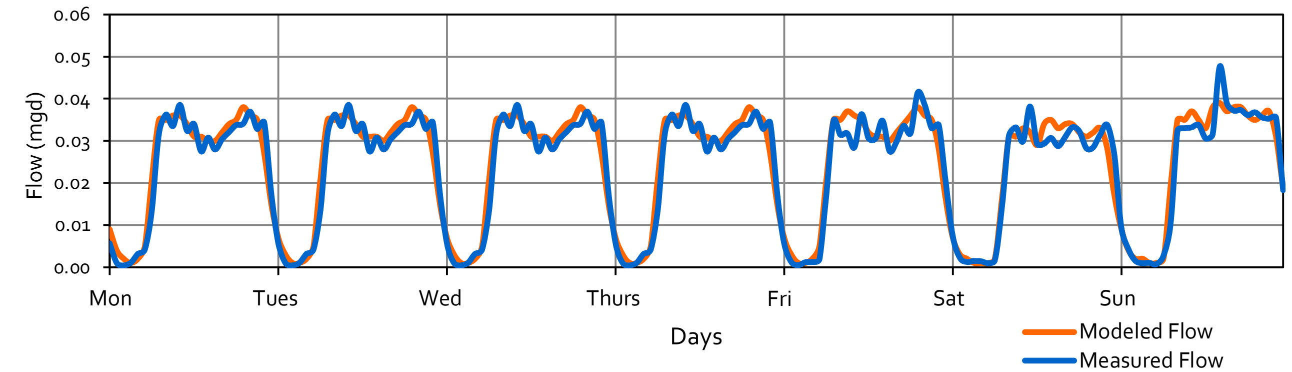
(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Flow Monitoring Site 21, Dry Weather Flow Calibration

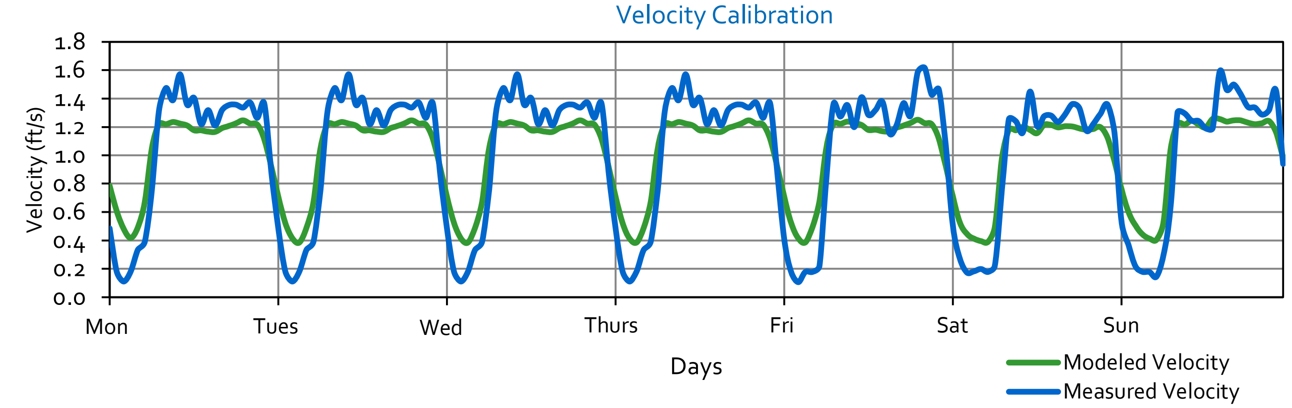
Location: Lemon Street and Mission Trail
Pipeline Diameter: 11.75"
City Manhole ID: Lemon Street and Mission Trail
Model Pipe ID: GM-3927

Flow Monitor Location

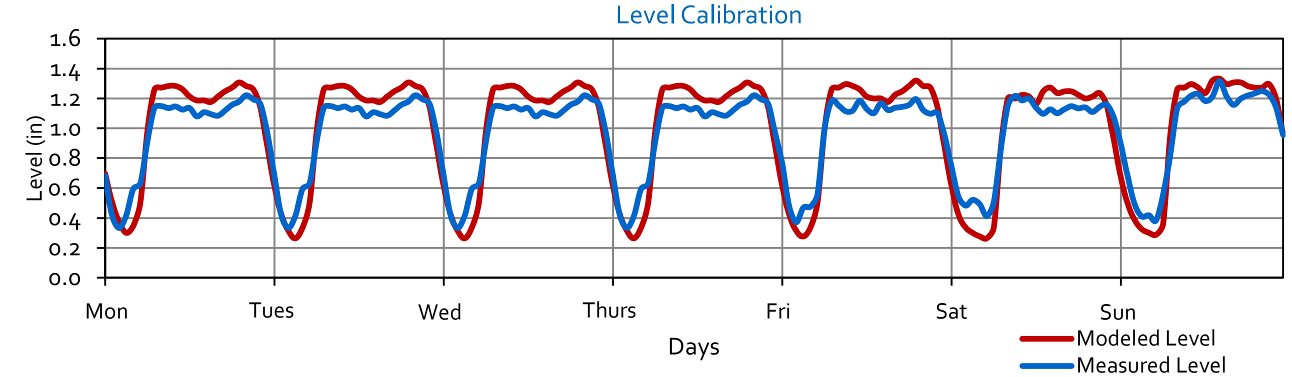
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.02	0.04	1.0	1.04	0.02	0.04	1.0	1.02	3.1%	-1.4%	4.5%	-2.0%
Tues.	0.02	0.04	1.0	1.04	0.02	0.04	1.0	1.02	3.1%	-1.4%	4.5%	-2.0%
Wed.	0.02	0.04	1.0	1.04	0.02	0.04	1.0	1.02	3.1%	-1.4%	4.5%	-2.0%
Thur.	0.02	0.04	1.0	1.04	0.02	0.04	1.0	1.02	3.1%	-1.4%	4.5%	-2.0%
Fri.	0.02	0.04	1.0	1.04	0.02	0.04	1.0	1.02	3.4%	-8.2%	4.2%	-1.6%
Sat.	0.02	0.04	1.0	0.95	0.02	0.04	0.9	0.96	1.2%	-8.4%	-0.9%	1.5%
Sun.	0.02	0.05	1.0	0.99	0.02	0.04	1.0	1.00	2.6%	-18.2%	1.0%	1.8%
Summary												
Weekday	0.02	--	1.0	1.04	0.02	--	1.0	1.02	3.2%	--	4.4%	-1.9%
Weekend	0.02	--	1.0	0.97	0.02	--	1.0	0.98	1.9%	--	0.1%	1.7%
ADWF[4]	0.02	--	1.0	1.02	0.02	--	1.0	1.01	2.8%	--	3.2%	-1.0%

Notes:

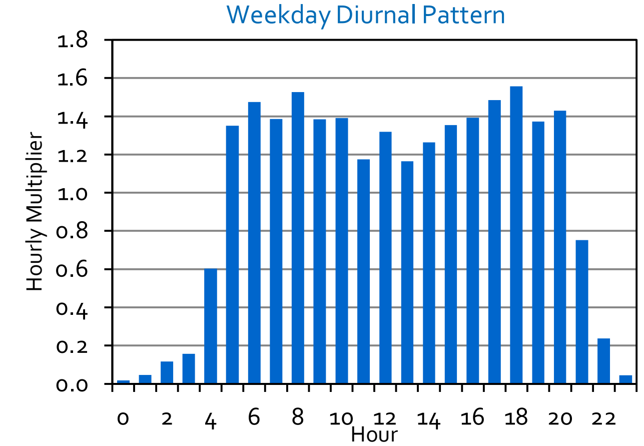
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

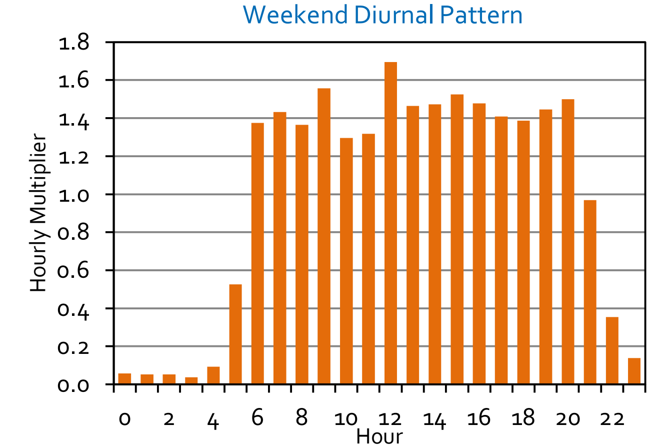
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern

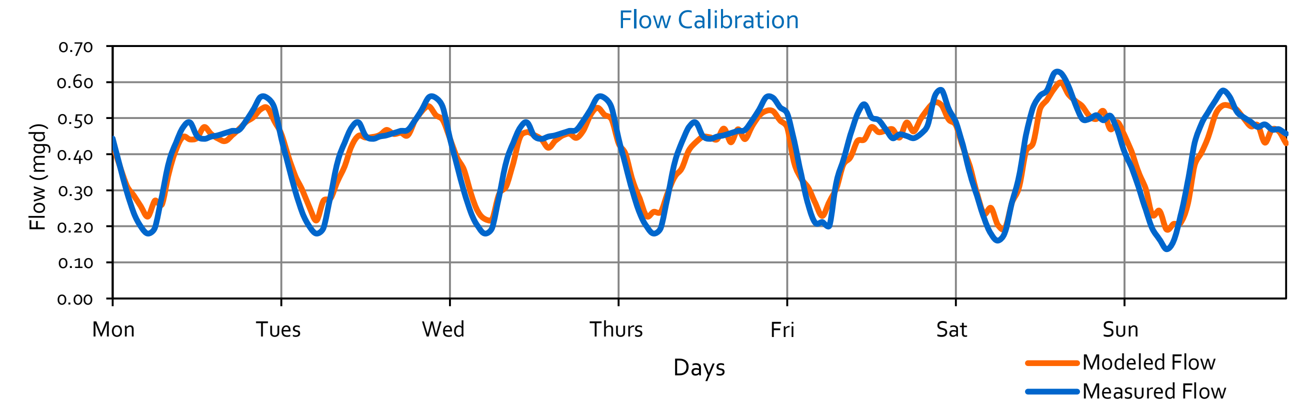


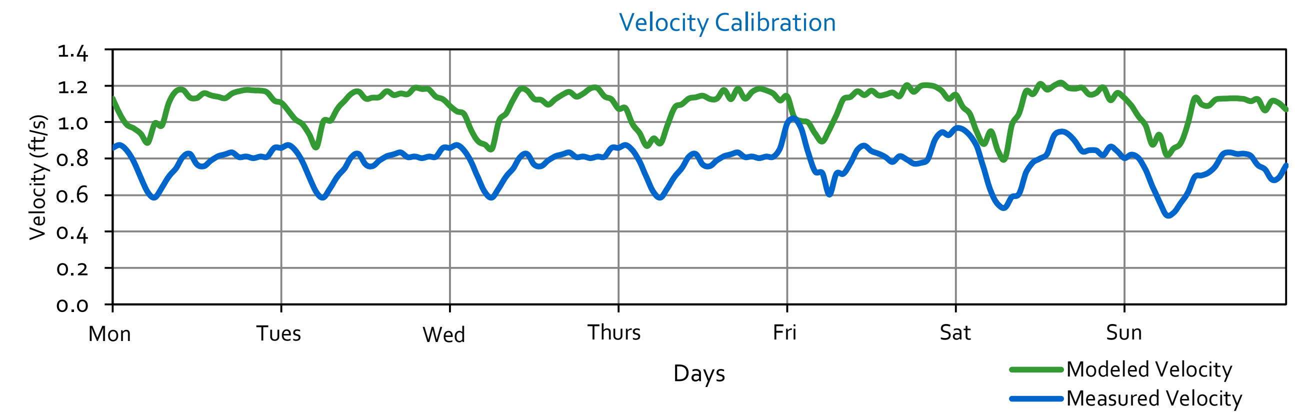
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

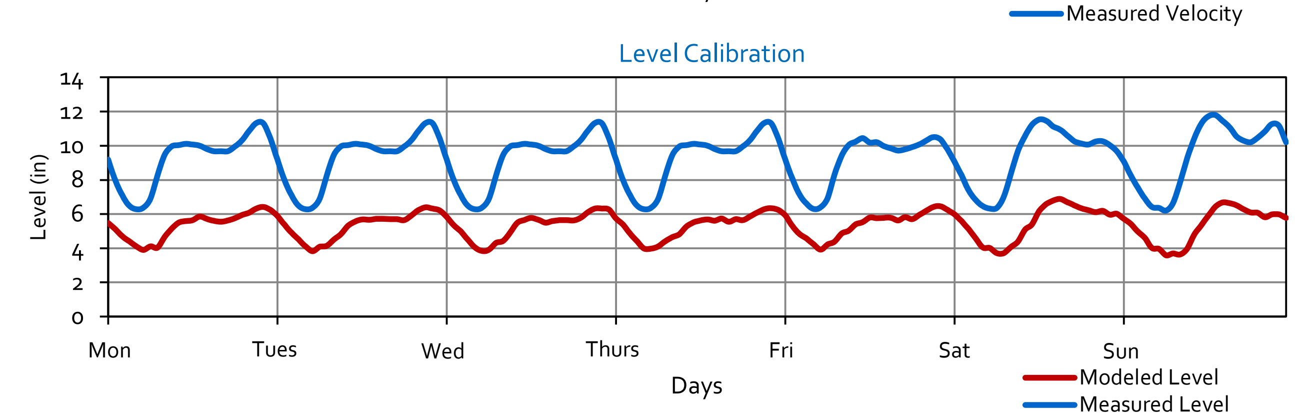
Flow Monitoring Site 22, Dry Weather Flow Calibration

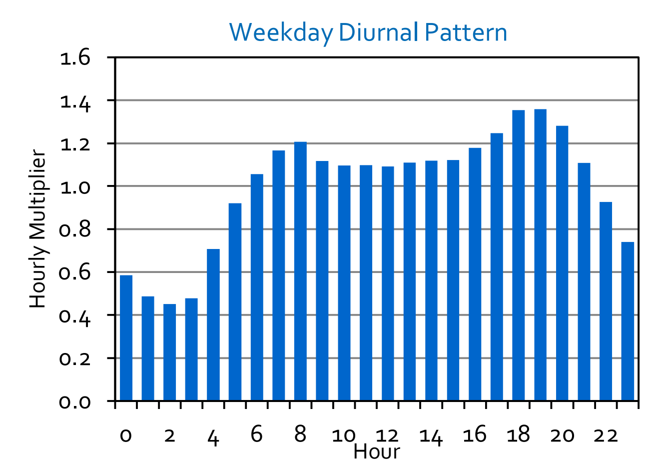
Location: Mission Trail Road, shoulder
Pipeline Diameter: 18"
City Manhole ID: Mission Trail Road, shoulder
Model Pipe ID: GM-3974

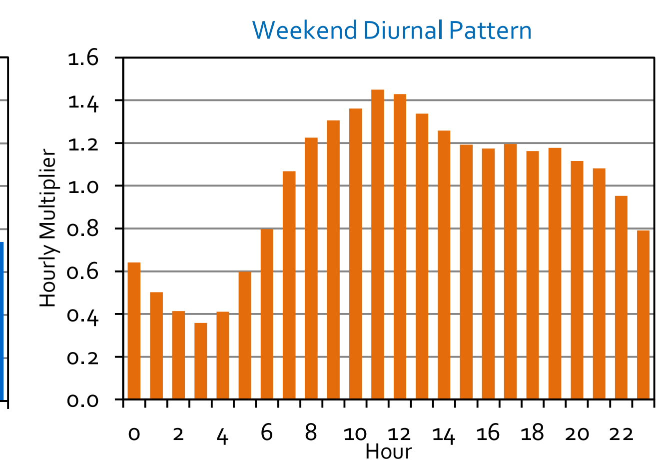
Flow Monitor Location











Model Calibration Summary

Day	Measured Data[1]				Modeled Data				Percent Error[3]			
	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.41	0.56	9.2	0.78	0.40	0.53	5.3	1.09	-1.1%	-4.5%	-42.3%	40.2%
Tues.	0.41	0.56	9.2	0.78	0.40	0.53	5.3	1.09	-1.1%	-4.5%	-42.3%	40.2%
Wed.	0.41	0.56	9.2	0.78	0.40	0.53	5.3	1.09	-1.1%	-4.5%	-42.3%	40.2%
Thur.	0.41	0.56	9.2	0.78	0.40	0.53	5.3	1.09	-1.1%	-4.5%	-42.3%	40.2%
Fri.	0.43	0.58	9.2	0.82	0.42	0.54	5.4	1.11	-1.8%	-5.8%	-41.0%	34.7%
Sat.	0.43	0.62	9.3	0.80	0.43	0.60	5.5	1.09	-1.2%	-4.0%	-41.0%	36.2%
Sun.	0.40	0.58	9.5	0.72	0.39	0.54	5.3	1.05	-0.8%	-7.1%	-43.7%	46.2%
Summary												
Weekday	0.41	--	9.2	0.79	0.41	--	5.3	1.09	-1.2%	--	-42.1%	39.1%
Weekend	0.41	--	9.4	0.76	0.41	--	5.4	1.07	-1.0%	--	-42.4%	40.9%
ADWF[4]	0.41	--	9.3	0.78	0.41	--	5.4	1.09	-1.2%	--	-42.1%	39.6%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

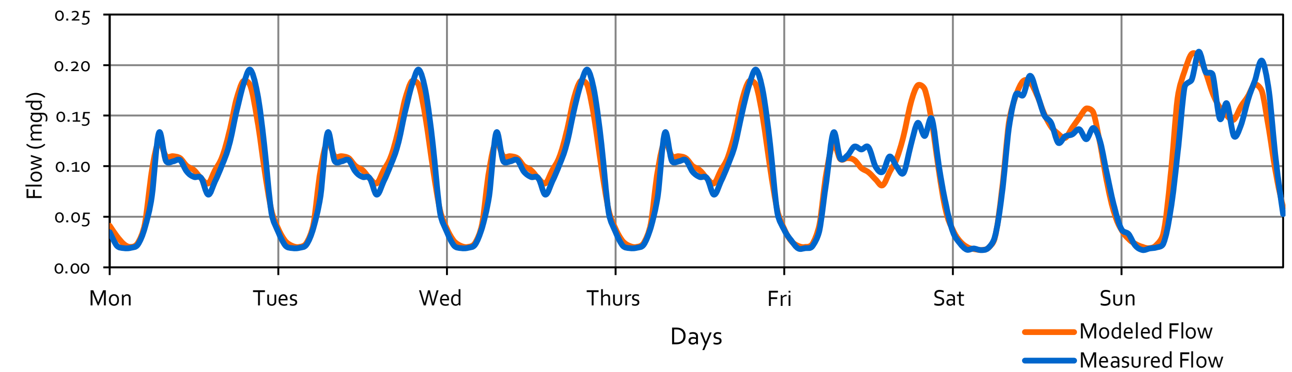
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 23, Dry Weather Flow Calibration

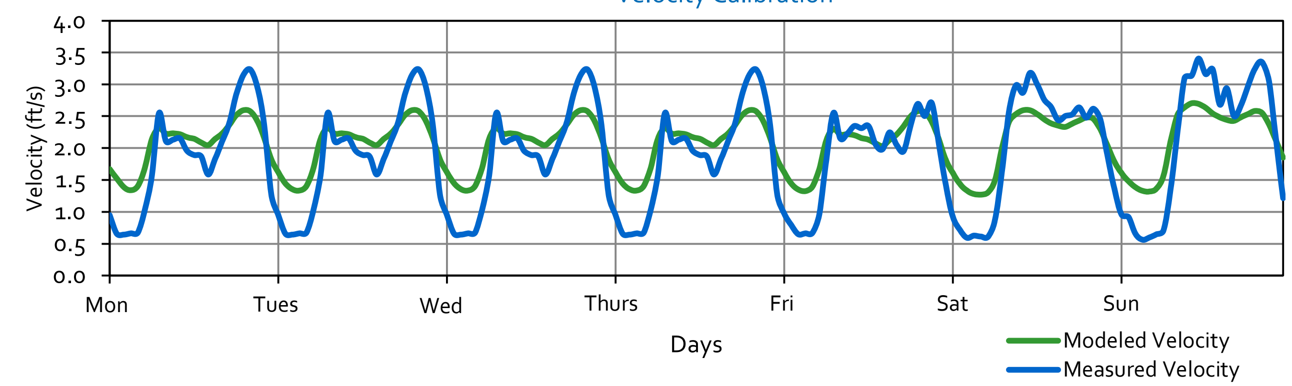
Location: Bundy Canyon Road and Mission Trail
Pipeline Diameter: 12"
City Manhole ID: Bundy Canyon Road and Mission Trail
Model Pipe ID: GM-4193

Flow Monitor Location

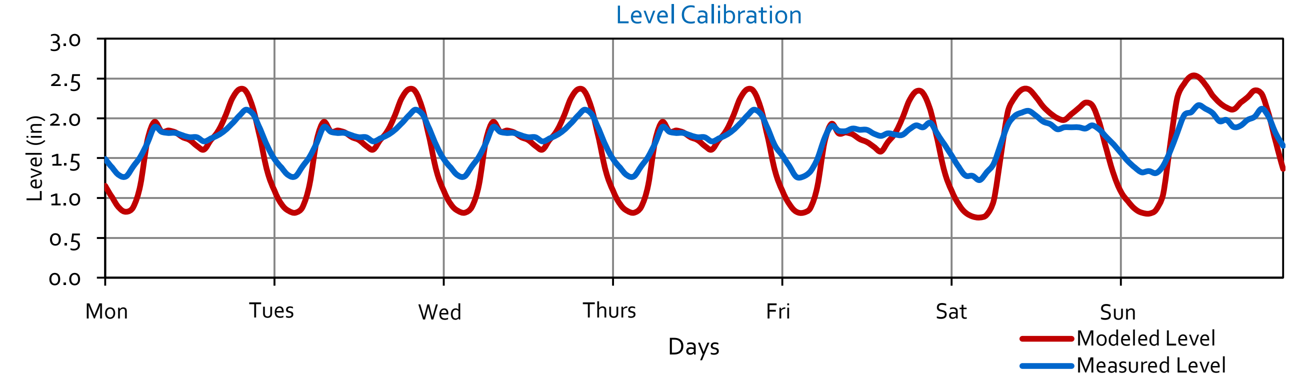
Flow Calibration



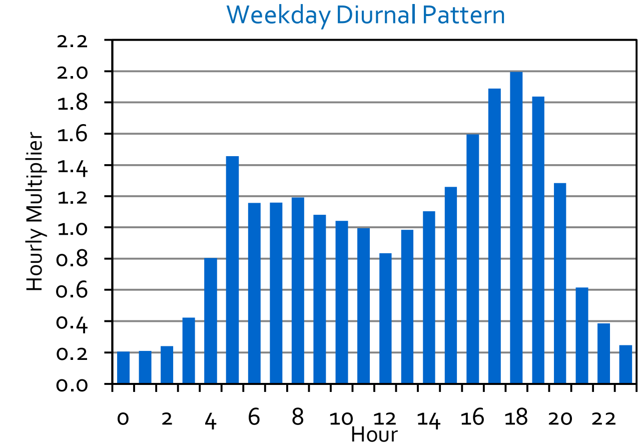
Velocity Calibration



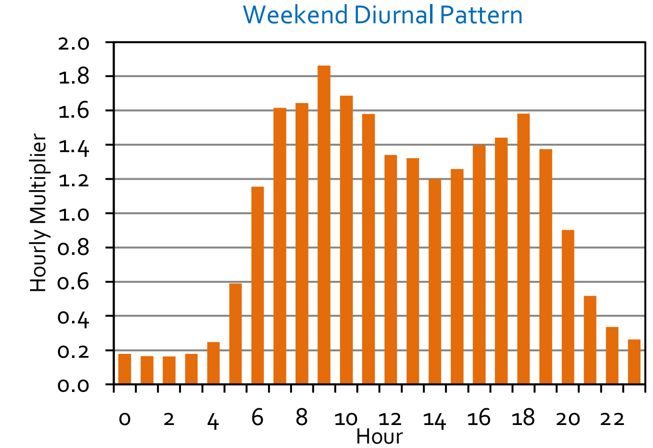
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



Model Calibration Summary

Day	Measured Data[(1)]				Modeled Data				Percent Error[(3)]			
	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.09	0.20	1.7	1.86	0.09	0.18	1.6	2.05	2.5%	-5.8%	-4.8%	10.7%
Tues.	0.09	0.20	1.7	1.86	0.09	0.18	1.6	2.05	2.5%	-5.8%	-4.8%	10.7%
Wed.	0.09	0.20	1.7	1.86	0.09	0.18	1.6	2.05	2.5%	-5.8%	-4.8%	10.7%
Thur.	0.09	0.20	1.7	1.86	0.09	0.18	1.6	2.05	2.5%	-5.8%	-4.8%	10.7%
Fri.	0.09	0.15	1.7	1.86	0.09	0.18	1.6	2.04	2.9%	22.5%	-5.6%	9.9%
Sat.	0.10	0.19	1.7	1.98	0.10	0.18	1.7	2.07	2.9%	-2.9%	-3.0%	4.9%
Sun.	0.12	0.21	1.8	2.14	0.12	0.21	1.8	2.16	2.9%	-1.0%	0.4%	0.6%
Summary												
Weekday	0.09	--	1.7	1.86	0.09	--	1.6	2.05	2.6%	--	-5.0%	10.5%
Weekend	0.11	--	1.8	2.06	0.11	--	1.7	2.11	2.9%	--	-1.2%	2.7%
ADWF[(4)]	0.10	--	1.7	1.91	0.10	--	1.7	2.07	2.7%	--	-3.9%	8.1%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

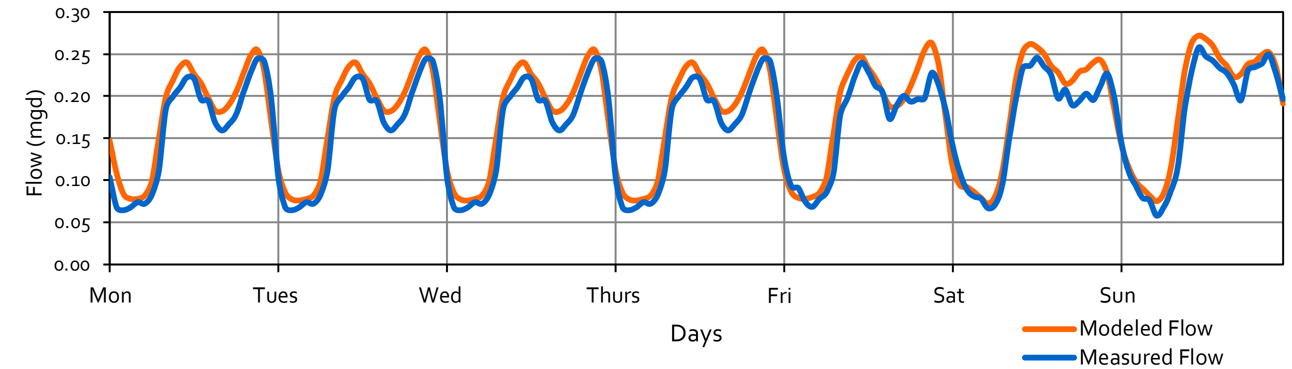
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 24, Dry Weather Flow Calibration

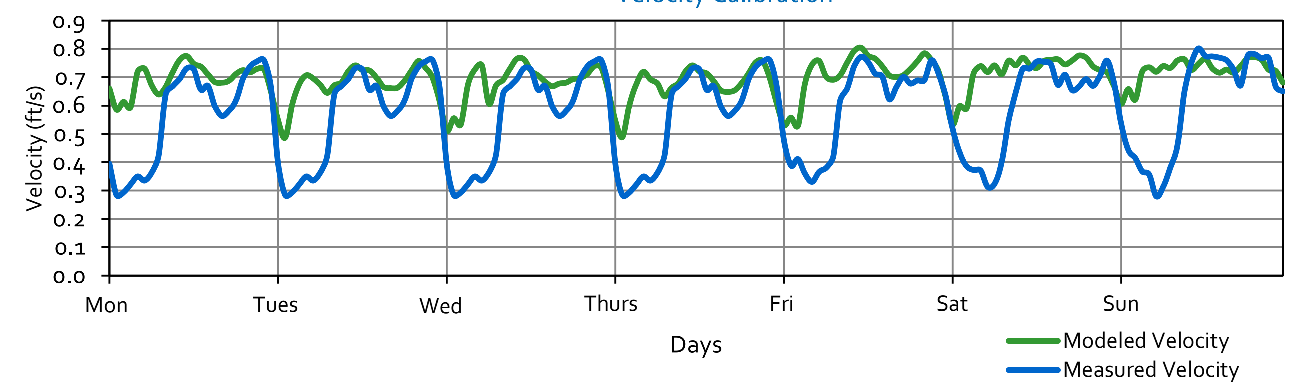
Location: McVicar Street 32555
Pipeline Diameter: 23.75"
City Manhole ID: McVicar Street 32555
Model Pipe ID: GM-4818

Flow Monitor Location

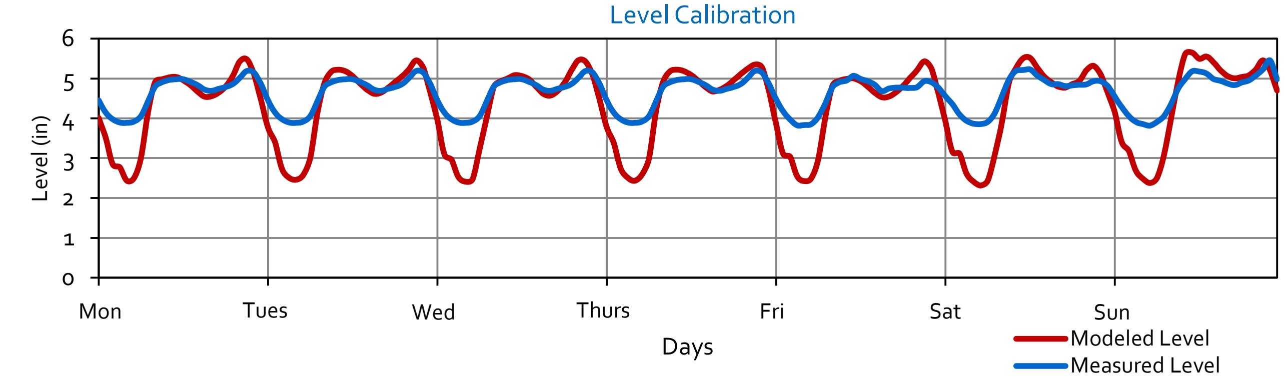
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.16	0.24	4.6	0.56	0.17	0.26	4.3	0.68	8.7%	4.4%	-6.3%	20.7%
Tues.	0.16	0.24	4.6	0.56	0.17	0.26	4.3	0.68	8.7%	4.4%	-6.3%	20.7%
Wed.	0.16	0.24	4.6	0.56	0.17	0.26	4.3	0.68	8.7%	4.4%	-6.3%	20.7%
Thur.	0.16	0.24	4.6	0.56	0.17	0.26	4.3	0.68	8.7%	4.4%	-6.3%	20.7%
Fri.	0.17	0.24	4.6	0.59	0.18	0.26	4.3	0.71	8.1%	9.7%	-6.8%	19.5%
Sat.	0.17	0.25	4.7	0.59	0.18	0.26	4.3	0.72	7.7%	6.7%	-7.7%	21.3%
Sun.	0.18	0.26	4.7	0.61	0.19	0.27	4.4	0.72	8.5%	5.6%	-5.1%	18.6%
Summary												
Weekday	0.16	--	4.6	0.57	0.17	--	4.3	0.69	8.1%	--	-6.3%	20.4%
Weekend	0.17	--	4.7	0.60	0.19	--	4.4	0.72	8.1%	--	-6.4%	19.9%
ADWF[4]	0.16	--	4.6	0.58	0.18	--	4.3	0.70	8.1%	--	-6.4%	20.3%

Notes:

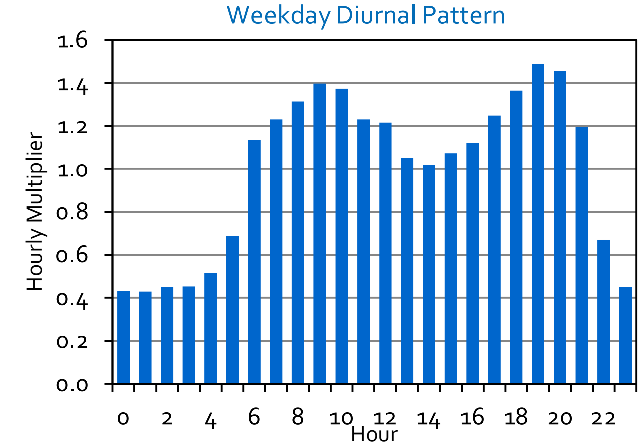
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

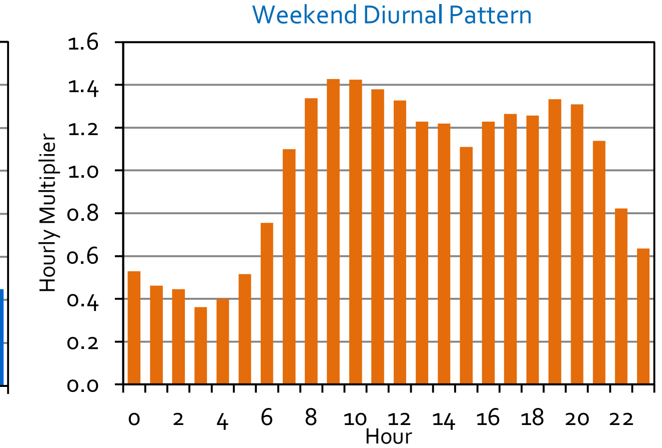
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern



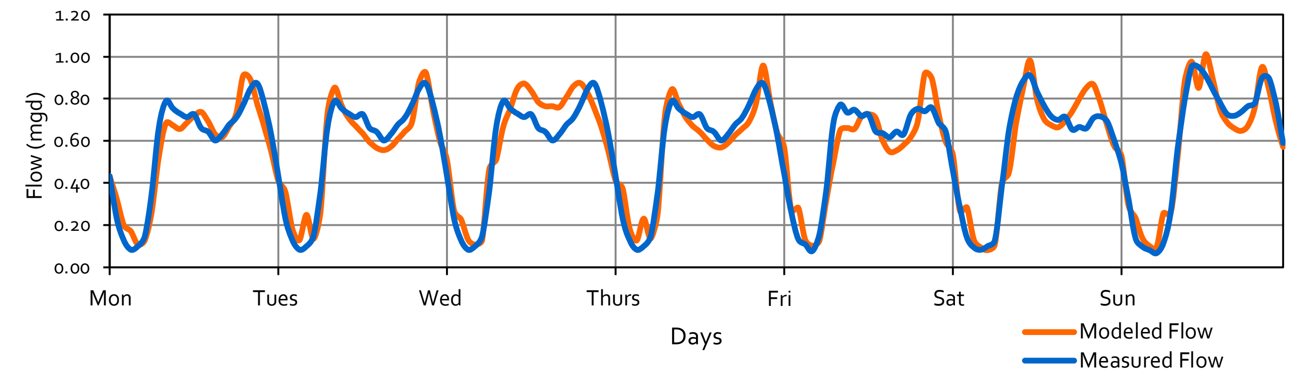
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 25, Dry Weather Flow Calibration

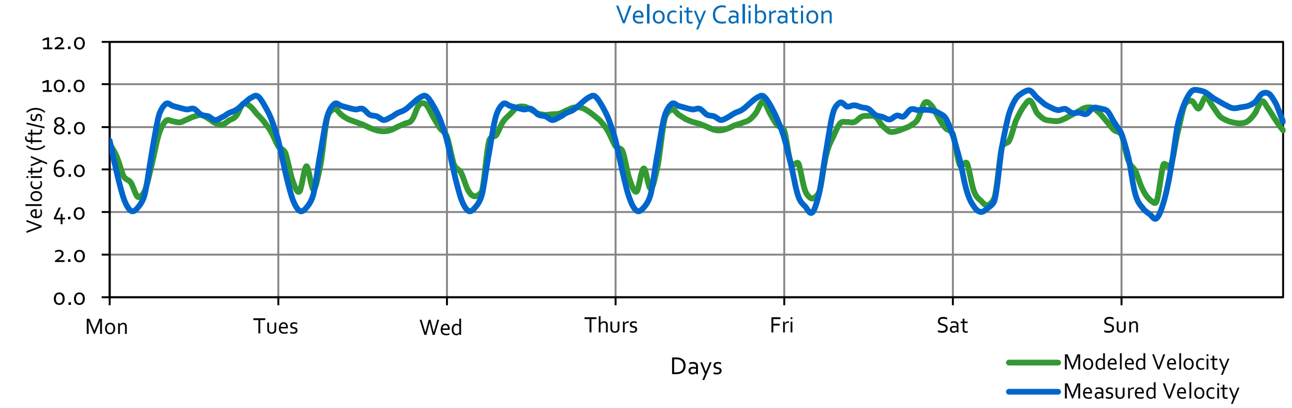
Location: Catt Road and Nan Street
Pipeline Diameter: 23.75"
City Manhole ID: Catt Road and Nan Street
Model Pipe ID: GM-5705

Flow Monitor Location

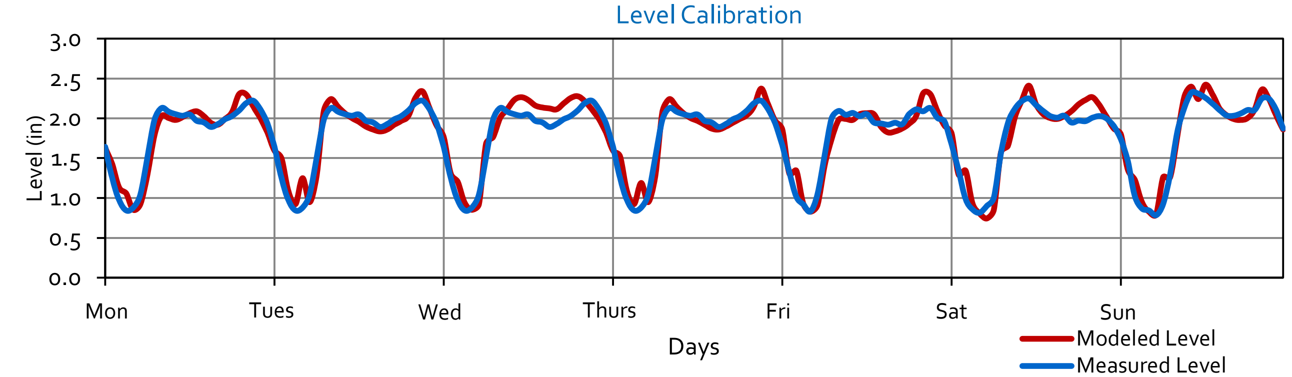
Flow Calibration



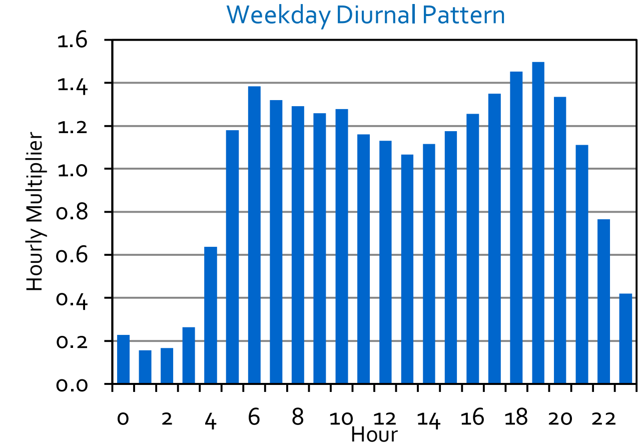
Velocity Calibration



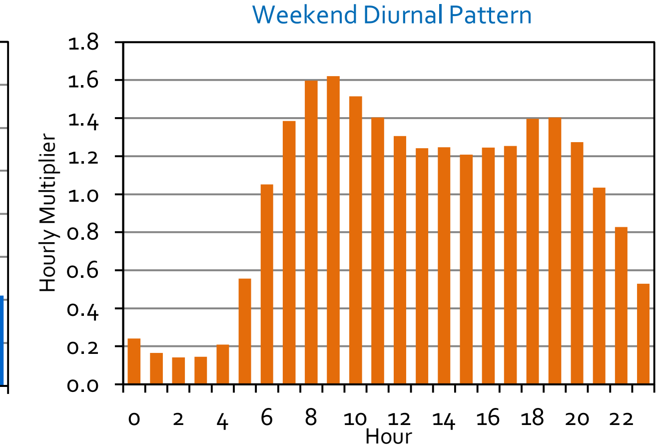
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



Model Calibration Summary

	Measured Data[1]				Modeled Data				Percent Error[3]			
Day	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.57	0.87	1.8	7.82	0.58	0.96	1.8	7.67	0.9%	9.7%	1.5%	-1.9%
Tues.	0.57	0.87	1.8	7.82	0.58	0.96	1.8	7.67	0.9%	9.7%	1.5%	-1.9%
Wed.	0.57	0.87	1.8	7.82	0.58	0.96	1.8	7.67	0.9%	9.7%	1.5%	-1.9%
Thur.	0.57	0.87	1.8	7.82	0.58	0.96	1.8	7.67	0.9%	9.7%	1.5%	-1.9%
Fri.	0.56	0.77	1.8	7.78	0.55	0.92	1.8	7.57	-2.0%	18.8%	-0.5%	-2.7%
Sat.	0.56	0.91	1.7	7.75	0.57	0.98	1.8	7.55	2.5%	7.7%	2.1%	-2.5%
Sun.	0.59	0.95	1.8	7.80	0.59	1.01	1.8	7.66	0.1%	6.1%	1.7%	-1.8%
Summary												
Weekday	0.57	--	1.8	7.81	0.57	--	1.8	7.65	0.4%	--	1.1%	-2.1%
Weekend	0.57	--	1.8	7.78	0.58	--	1.8	7.61	1.3%	--	1.9%	-2.2%
ADWF[4]	0.57	--	1.8	7.80	0.57	--	1.8	7.64	0.6%	--	1.4%	-2.1%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

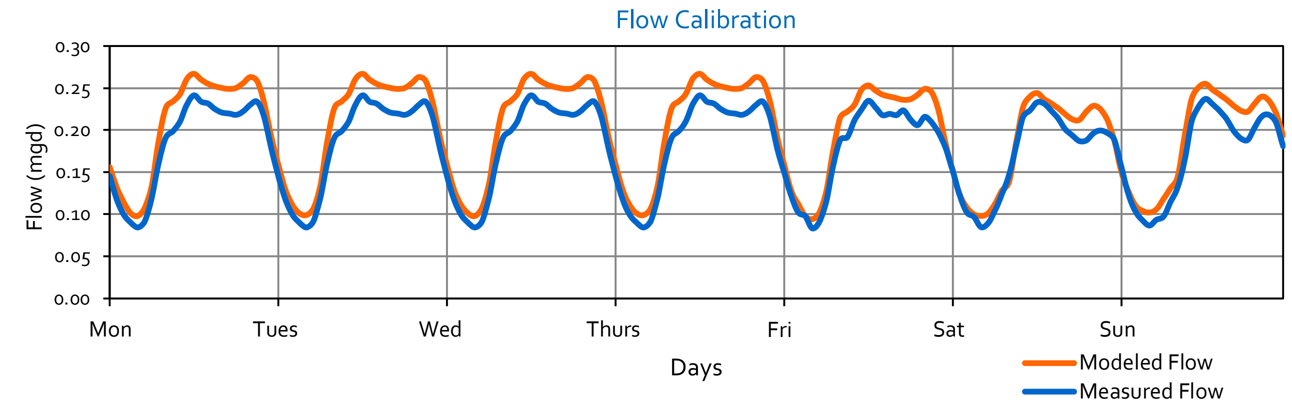
(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

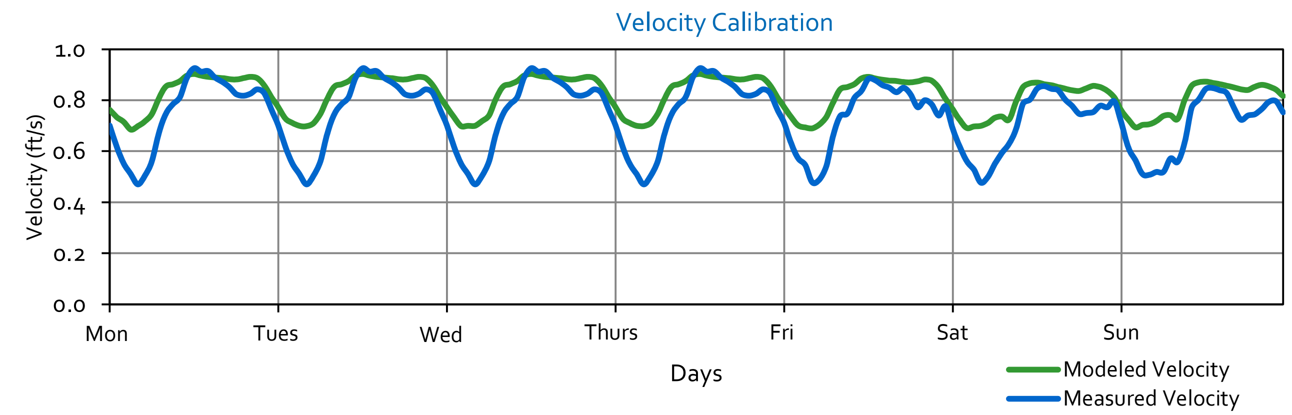
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

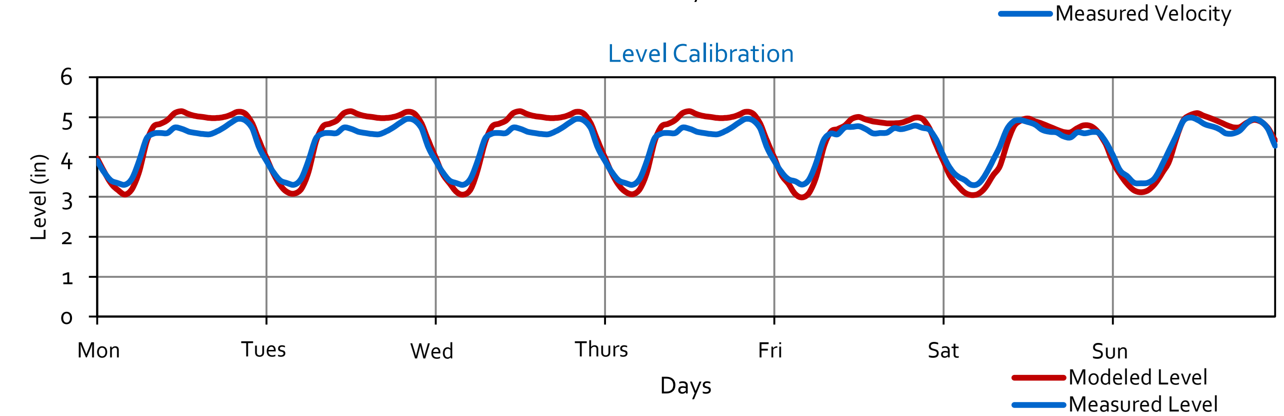
Flow Monitoring Site 26, Dry Weather Flow Calibration

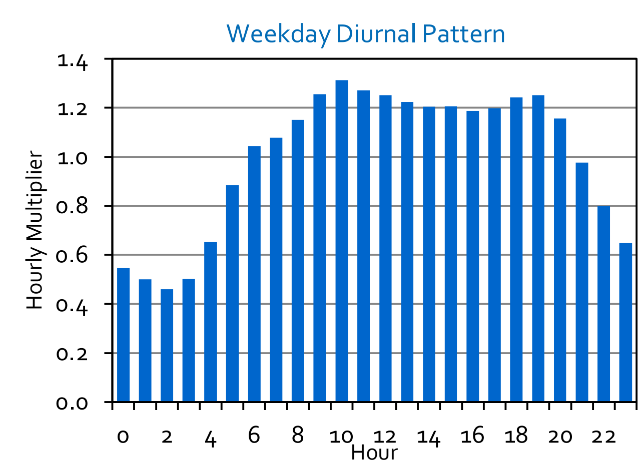
Location: Palomar Street and Delca Lane
Pipeline Diameter: 20.75"
City Manhole ID: Palomar Street and Delca Lane
Model Pipe ID: GM-7136

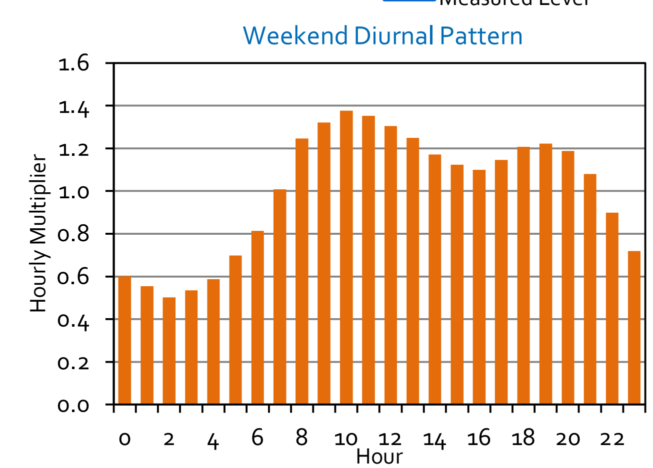
Flow Monitor Location











Model Calibration Summary

	Measured Data[1]				Modeled Data				Percent Error[3]			
Day	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.18	0.24	4.3	0.75	0.21	0.27	4.5	0.83	12.9%	10.6%	3.4%	10.1%
Tues.	0.18	0.24	4.3	0.75	0.21	0.27	4.5	0.83	12.9%	10.6%	3.4%	10.1%
Wed.	0.18	0.24	4.3	0.75	0.21	0.27	4.5	0.83	12.9%	10.6%	3.4%	10.1%
Thur.	0.18	0.24	4.3	0.75	0.21	0.27	4.5	0.83	12.9%	10.6%	3.4%	10.1%
Fri.	0.18	0.23	4.3	0.73	0.20	0.25	4.4	0.82	10.5%	7.7%	0.8%	11.9%
Sat.	0.17	0.23	4.3	0.71	0.18	0.24	4.2	0.80	6.8%	4.7%	-1.9%	12.8%
Sun.	0.17	0.24	4.3	0.70	0.19	0.26	4.3	0.80	10.7%	7.5%	-0.3%	15.1%
Summary												
Weekday	0.18	--	4.3	0.75	0.21	--	4.5	0.83	12.4%	--	2.9%	10.5%
Weekend	0.17	--	4.3	0.70	0.19	--	4.3	0.80	8.7%	--	-1.1%	14.0%
ADWF[4]	0.18	--	4.3	0.74	0.20	--	4.4	0.82	11.4%	--	1.8%	11.4%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

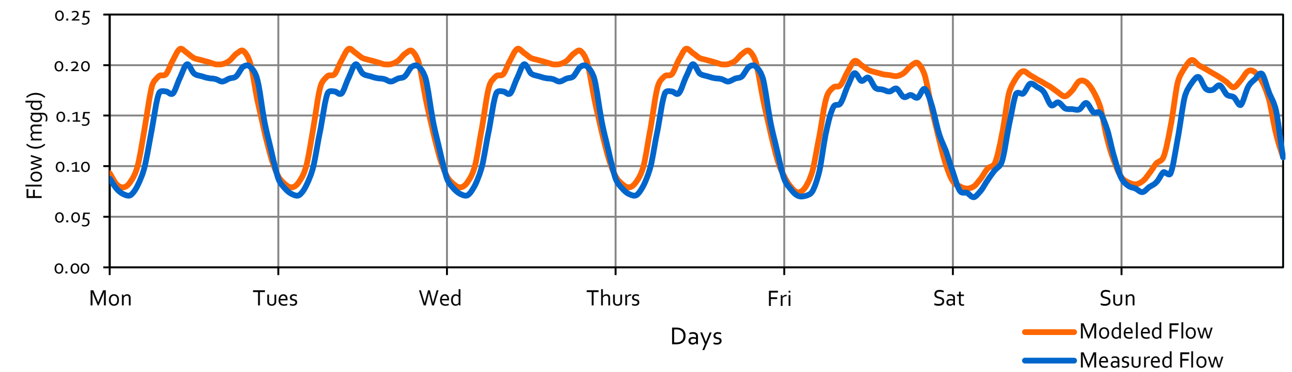
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 27, Dry Weather Flow Calibration

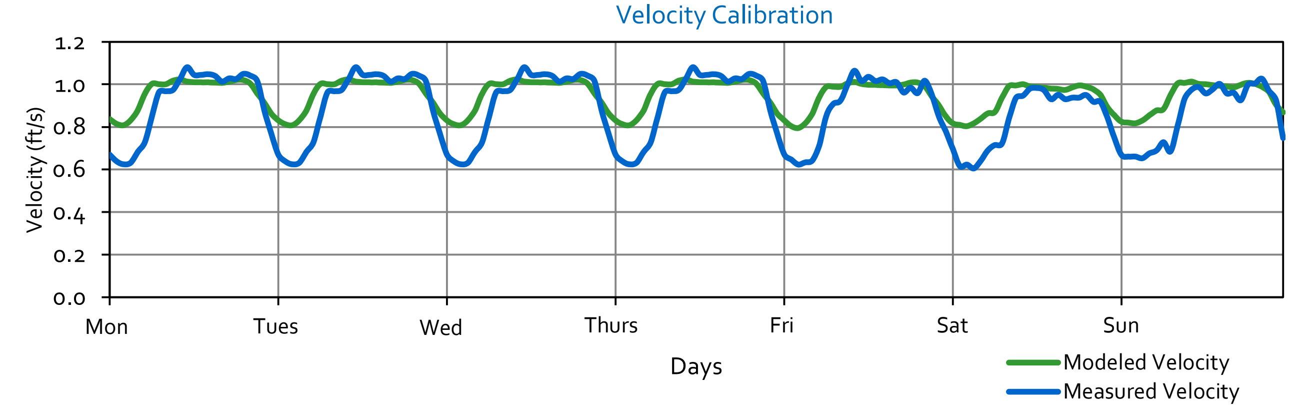
Location: Hardwood Lane and Wing Elm Circle
Pipeline Diameter: 14.75"
City Manhole ID: Hardwood Lane and Wing Elm Circle
Model Pipe ID: GM-5116

Flow Monitor Location

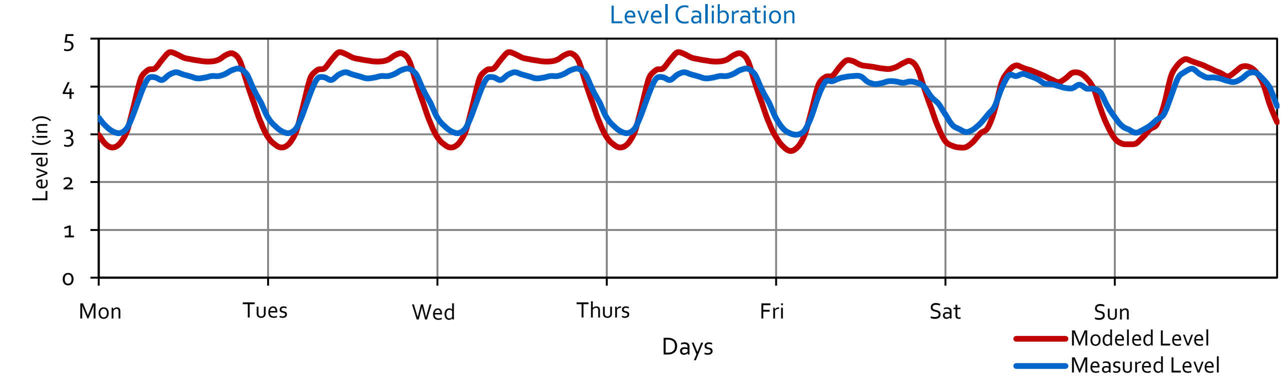
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data Peak Flow[2] (mgd)	Measured Data Avg. Level (in)	Measured Data Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error Peak Flow (%)	Percent Error Avg. Level (%)	Percent Error Avg. Vel. (%)
Mon.	0.15	0.20	3.9	0.91	0.17	0.22	4.0	0.96	9.1%	7.5%	3.0%	5.4%
Tues.	0.15	0.20	3.9	0.91	0.17	0.22	4.0	0.96	9.1%	7.5%	3.0%	5.4%
Wed.	0.15	0.20	3.9	0.91	0.17	0.22	4.0	0.96	9.1%	7.5%	3.0%	5.4%
Thur.	0.15	0.20	3.9	0.91	0.17	0.22	4.0	0.96	9.1%	7.5%	3.0%	5.4%
Fri.	0.14	0.19	3.8	0.89	0.16	0.20	3.9	0.95	9.5%	6.3%	2.2%	6.7%
Sat.	0.13	0.18	3.8	0.83	0.14	0.19	3.7	0.93	8.8%	7.0%	-1.2%	11.2%
Sun.	0.14	0.19	3.8	0.86	0.15	0.21	3.8	0.94	9.2%	7.2%	0.3%	9.8%
Summary												
Weekday	0.15	--	3.9	0.91	0.17	--	4.0	0.96	9.2%	--	2.9%	5.7%
Weekend	0.14	--	3.8	0.85	0.15	--	3.8	0.93	9.0%	--	-0.5%	10.5%
ADWF[4]	0.15	--	3.9	0.89	0.16	--	3.9	0.95	9.1%	--	1.9%	7.0%

Notes:

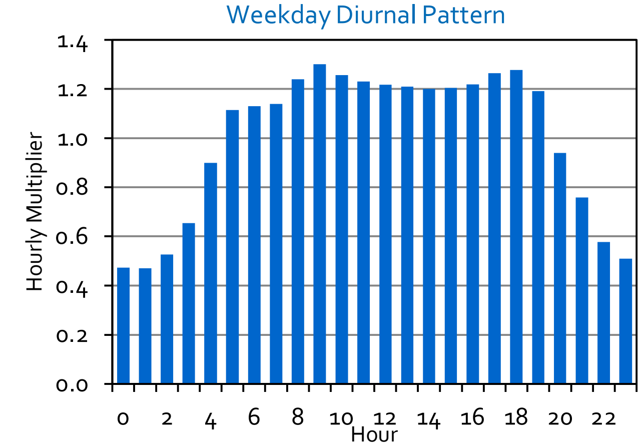
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

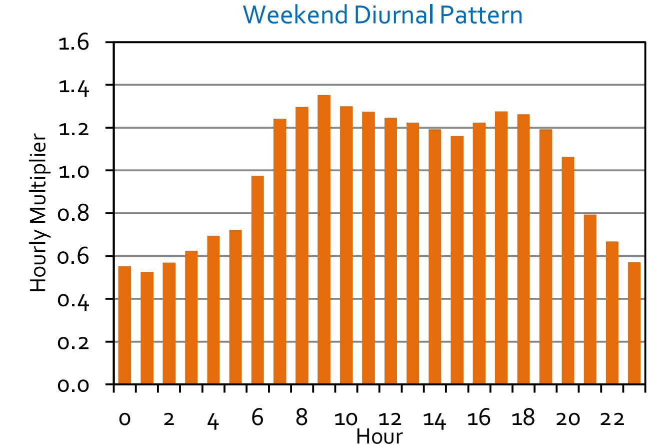
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern



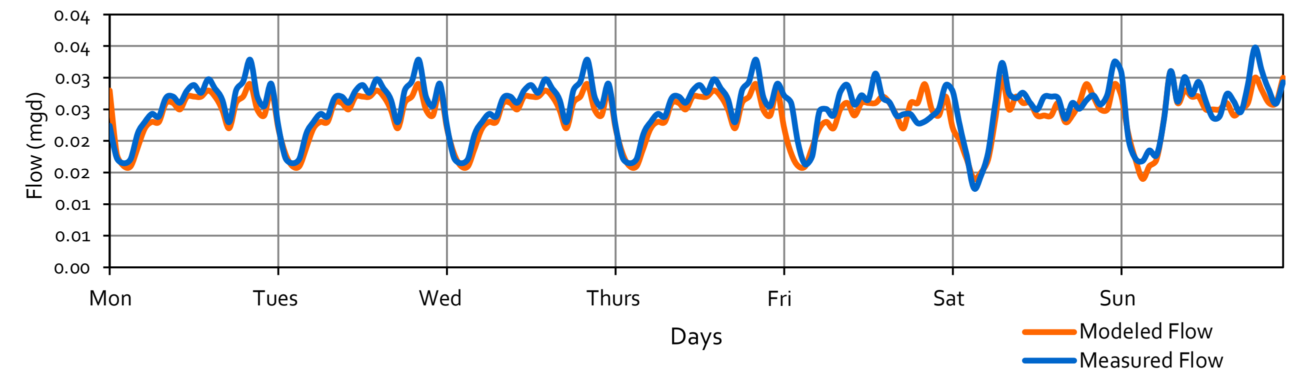
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 28, Dry Weather Flow Calibration

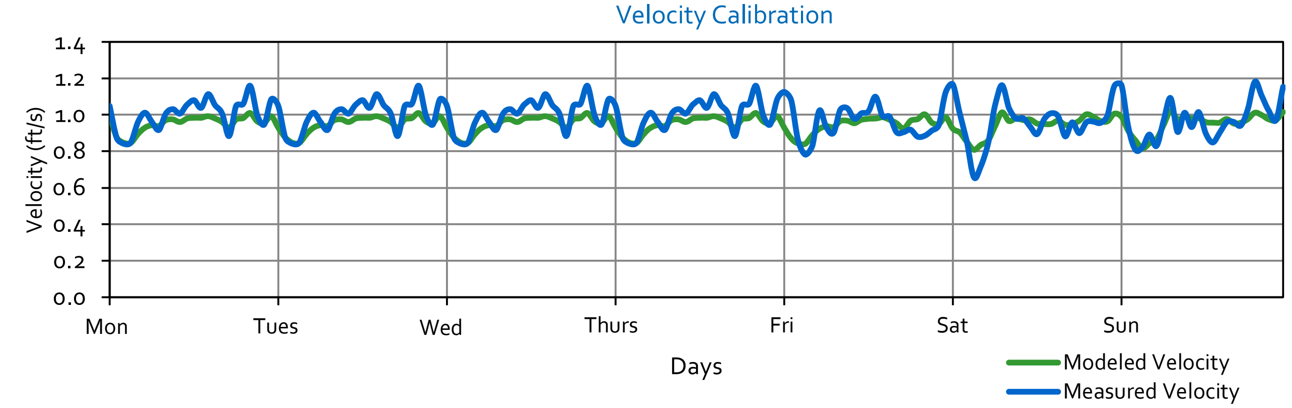
Location: Nutmeg Street, west of Jackson Avenue
Pipeline Diameter: 11.75"
City Manhole ID: Nutmeg Street, west of Jackson Avenue
Model Pipe ID: GM-6218

Flow Monitor Location

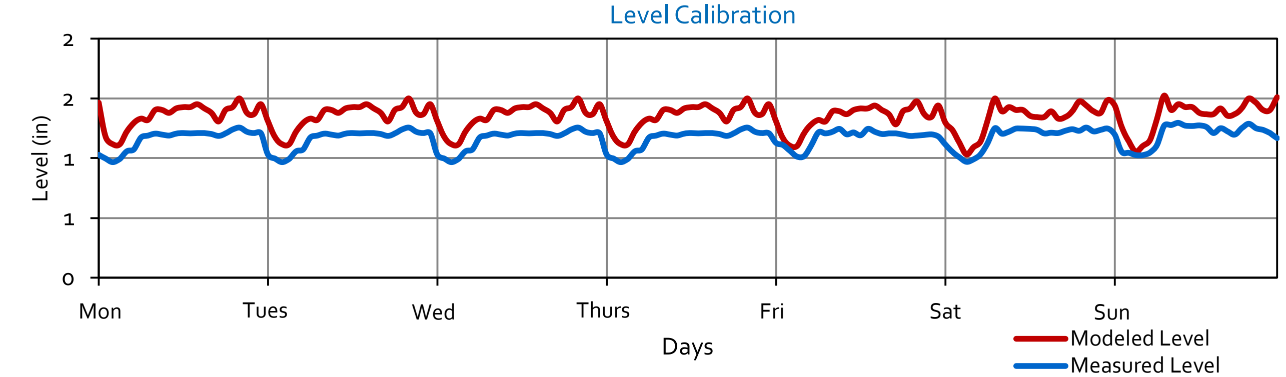
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.03	0.03	1.16	1.00	0.02	0.03	1.35	0.95	-4.9%	-11.7%	16.6%	-5.1%
Tues.	0.03	0.03	1.16	1.00	0.02	0.03	1.35	0.95	-4.9%	-11.7%	16.6%	-5.1%
Wed.	0.03	0.03	1.16	1.00	0.02	0.03	1.35	0.95	-4.9%	-11.7%	16.6%	-5.1%
Thur.	0.03	0.03	1.16	1.00	0.02	0.03	1.35	0.95	-4.9%	-11.7%	16.6%	-5.1%
Fri.	0.02	0.03	1.17	0.96	0.02	0.03	1.34	0.94	-4.9%	-5.4%	14.0%	-2.1%
Sat.	0.02	0.03	1.18	0.96	0.02	0.03	1.34	0.94	-5.0%	-7.9%	13.4%	-1.7%
Sun.	0.03	0.03	1.20	0.97	0.02	0.03	1.36	0.95	-4.6%	-10.8%	13.8%	-1.9%
Summary												
Weekday	0.03	--	1.2	0.99	0.02	--	1.4	0.95	-4.9%	--	16.1%	-4.5%
Weekend	0.03	--	1.2	0.97	0.02	--	1.3	0.95	-4.8%	--	13.6%	-1.8%
ADWF[4]	0.03	--	1.2	0.99	0.02	--	1.3	0.95	-4.9%	--	15.4%	-3.8%

Notes:

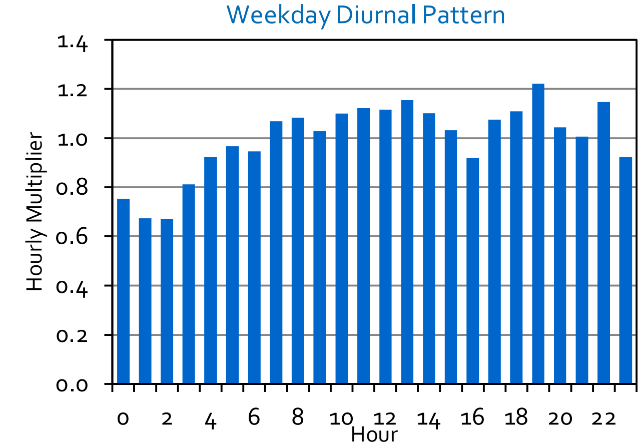
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

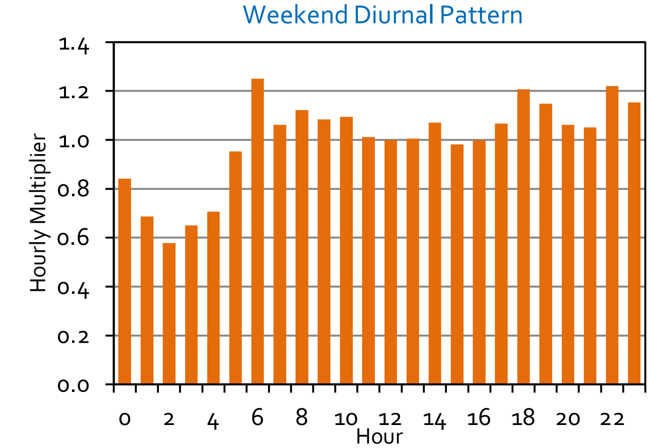
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern



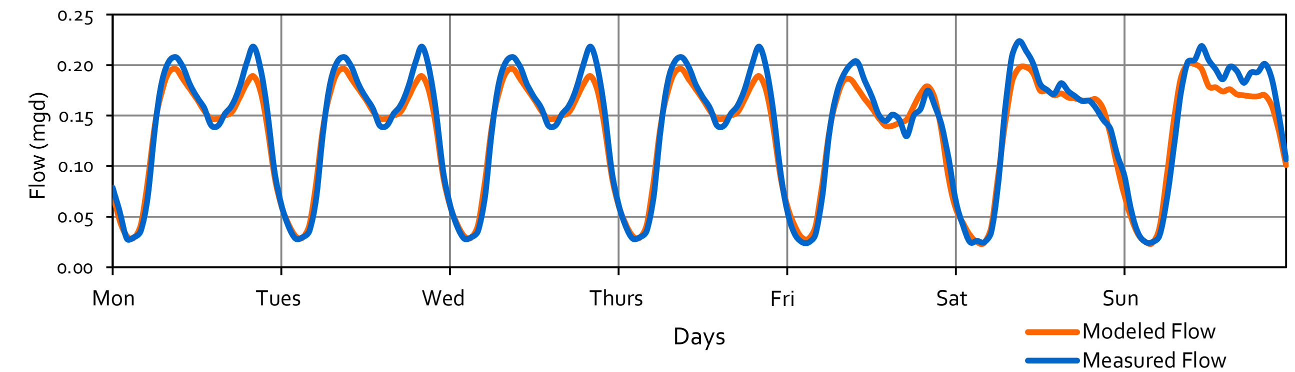
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 29, Dry Weather Flow Calibration

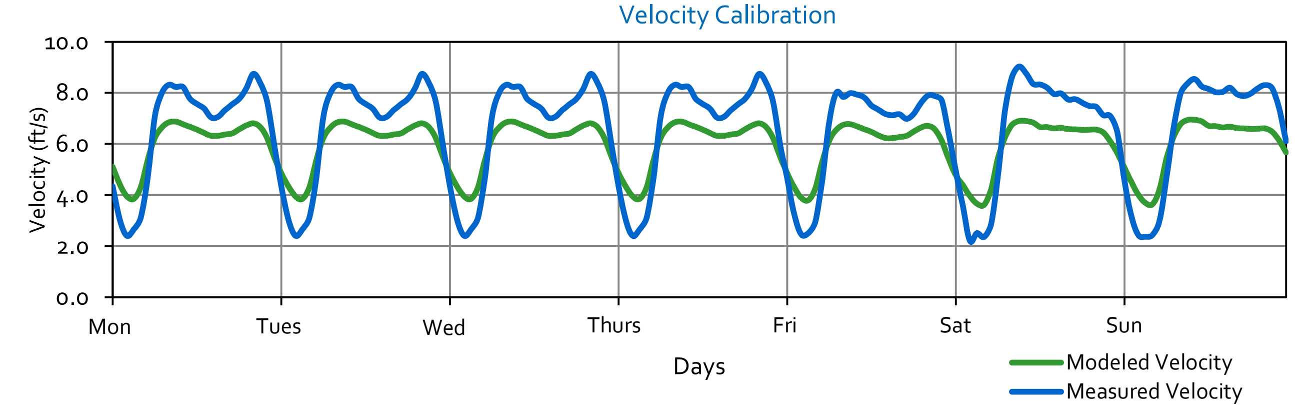
Location: Nutmeg Street, we of Gingerbread Drive
Pipeline Diameter: 9.75"
City Manhole ID: Nutmeg Street, we of Gingerbread Drive
Model Pipe ID: GM-5276

Flow Monitor Location

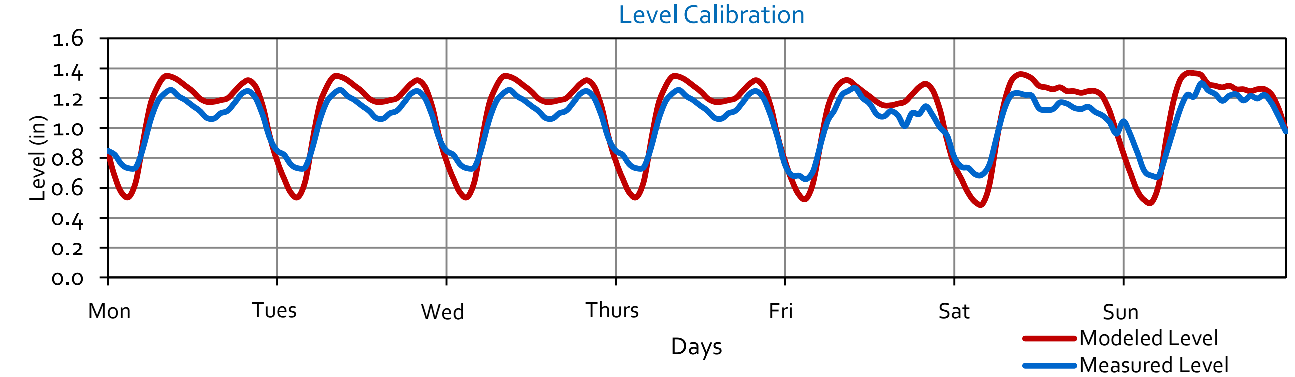
Flow Calibration



Velocity Calibration



Level Calibration



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.14	0.22	1.1	6.60	0.13	0.20	1.1	5.99	-3.8%	-10.3%	3.6%	-9.3%
Tues.	0.14	0.22	1.1	6.60	0.13	0.20	1.1	5.99	-3.8%	-10.3%	3.6%	-9.3%
Wed.	0.14	0.22	1.1	6.60	0.13	0.20	1.1	5.99	-3.8%	-10.3%	3.6%	-9.3%
Thur.	0.14	0.22	1.1	6.60	0.13	0.20	1.1	5.99	-3.8%	-10.3%	3.6%	-9.3%
Fri.	0.13	0.20	1.0	6.45	0.13	0.19	1.1	5.90	-1.1%	-8.4%	5.2%	-8.5%
Sat.	0.13	0.22	1.0	6.51	0.13	0.20	1.1	5.88	-3.2%	-11.5%	3.9%	-9.6%
Sun.	0.14	0.22	1.1	6.53	0.13	0.20	1.1	5.93	-6.5%	-8.2%	1.1%	-9.2%
Summary												
Weekday	0.14	--	1.0	6.57	0.13	--	1.1	5.97	-3.3%	--	3.9%	-9.2%
Weekend	0.14	--	1.0	6.52	0.13	--	1.1	5.91	-4.9%	--	2.5%	-9.4%
ADWF[4]	0.14	--	1.0	6.56	0.13	--	1.1	5.95	-3.7%	--	3.5%	-9.2%

Notes:

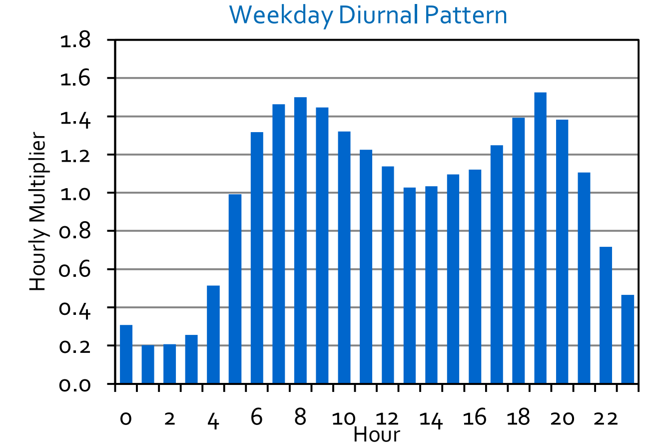
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

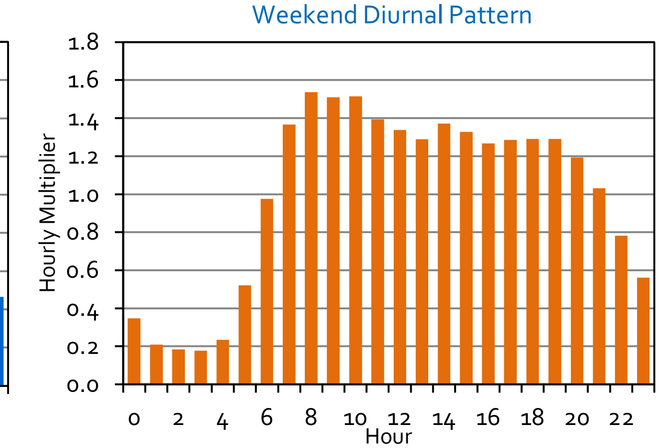
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Weekday Diurnal Pattern



Weekend Diurnal Pattern

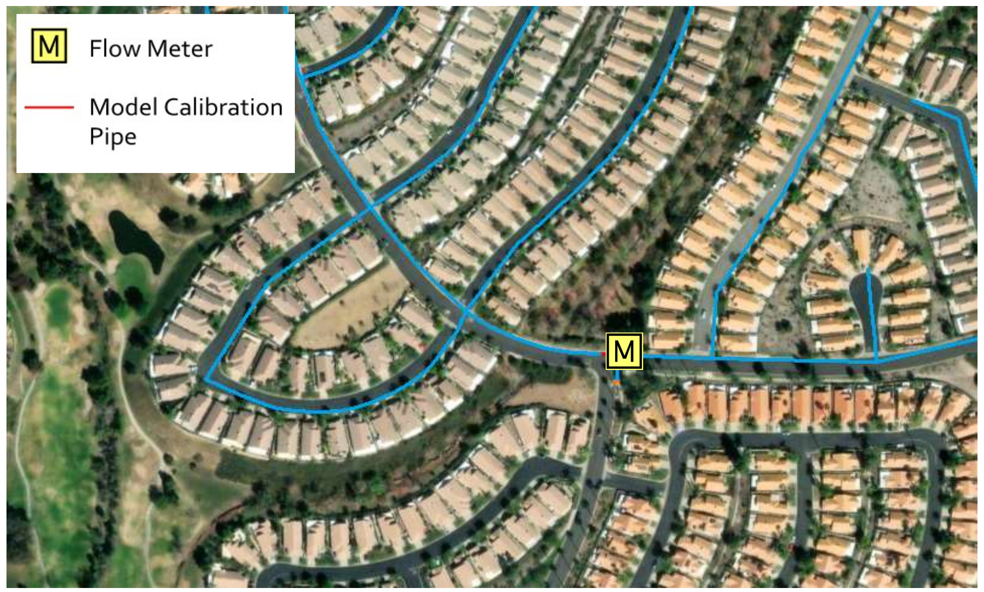


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 30, Dry Weather Flow Calibration

Location: Colony Drive, west of Avenida Florita
Pipeline Diameter: 9.75"
City Manhole ID: Colony Drive, west of Avenida Florita
Model Pipe ID: GM-5404

Flow Monitor Location



Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data Peak Flow[2] (mgd)	Measured Data Avg. Level (in)	Measured Data Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error Peak Flow (%)	Percent Error Avg. Level (%)	Percent Error Avg. Vel. (%)
Mon.	0.19	0.31	2.5	2.64	0.19	0.28	2.3	2.86	-1.3%	-11.5%	-7.7%	8.2%
Tues.	0.19	0.31	2.5	2.64	0.19	0.28	2.3	2.86	-1.3%	-11.5%	-7.7%	8.2%
Wed.	0.19	0.31	2.5	2.64	0.19	0.28	2.3	2.86	-1.3%	-11.5%	-7.7%	8.2%
Thur.	0.19	0.31	2.5	2.64	0.19	0.28	2.3	2.86	-1.3%	-11.5%	-7.7%	8.2%
Fri.	0.19	0.36	2.5	2.74	0.18	0.27	2.3	2.82	-5.7%	-26.3%	-7.1%	2.7%
Sat.	0.21	0.39	2.5	2.78	0.19	0.30	2.3	2.80	-9.7%	-24.2%	-9.1%	0.7%
Sun.	0.21	0.35	2.6	2.68	0.19	0.30	2.3	2.83	-7.7%	-13.4%	-10.2%	5.4%
Summary												
Weekday	0.19	--	2.5	2.66	0.19	--	2.3	2.85	-2.2%	--	-7.6%	7.1%
Weekend	0.21	--	2.6	2.73	0.19	--	2.3	2.81	-8.7%	--	-9.7%	3.0%
ADWF[4]	0.19	--	2.5	2.68	0.19	--	2.3	2.84	-4.2%	--	-8.2%	5.9%

Notes:

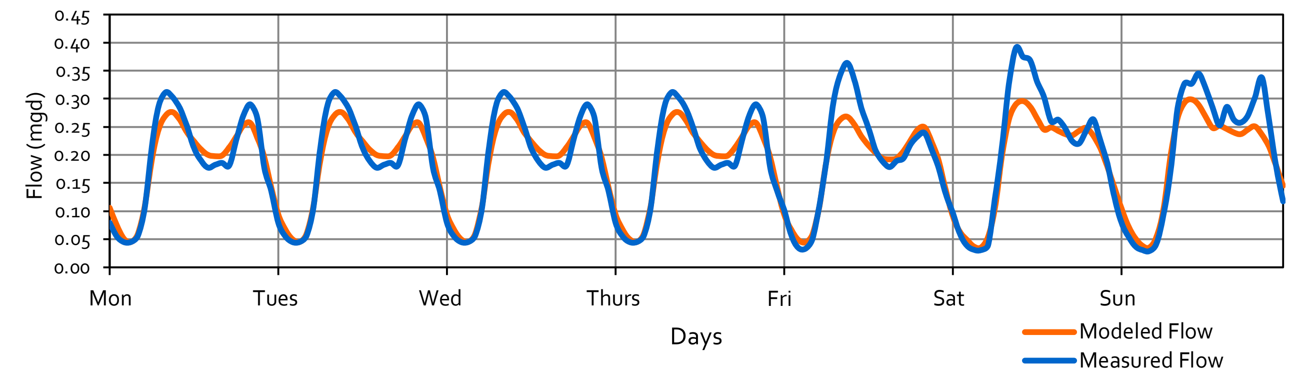
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

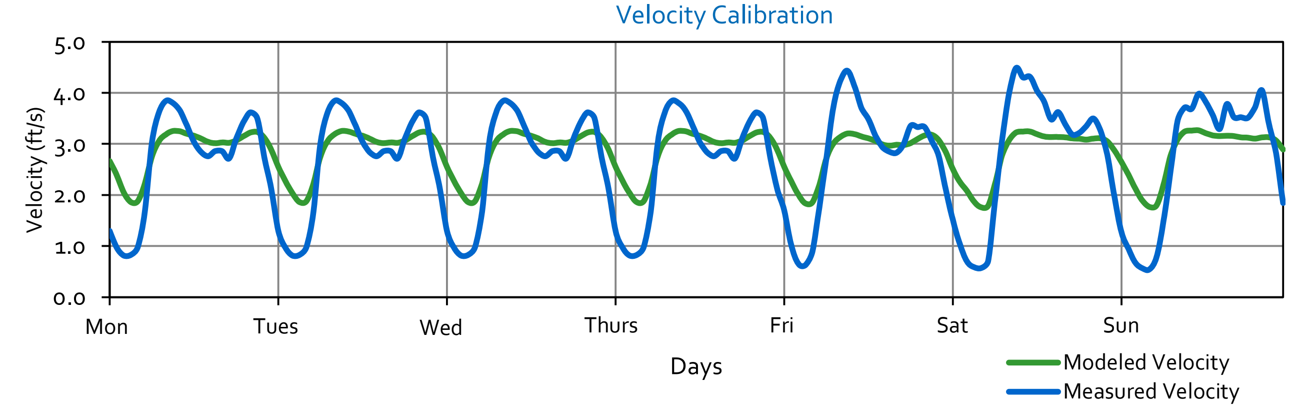
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

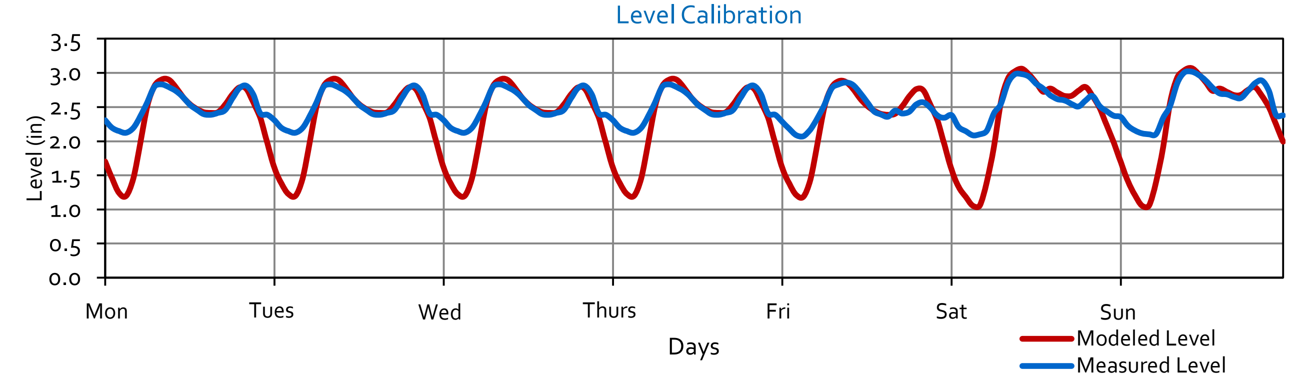
Flow Calibration



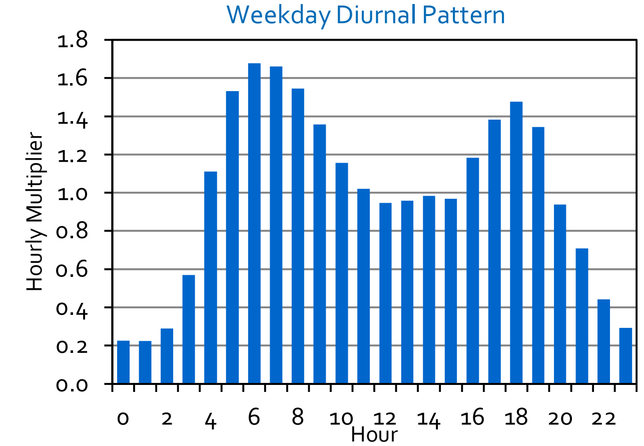
Velocity Calibration



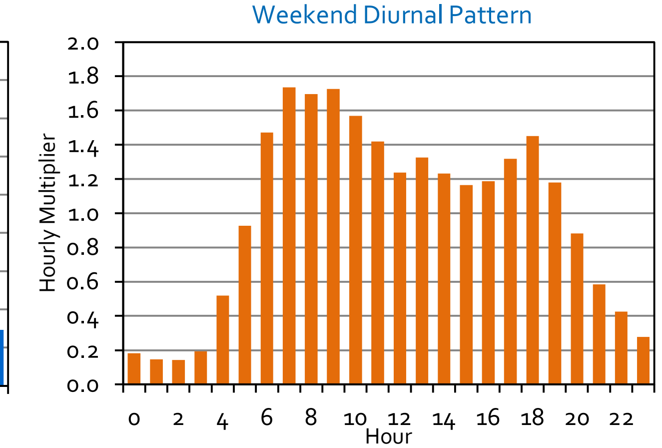
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern

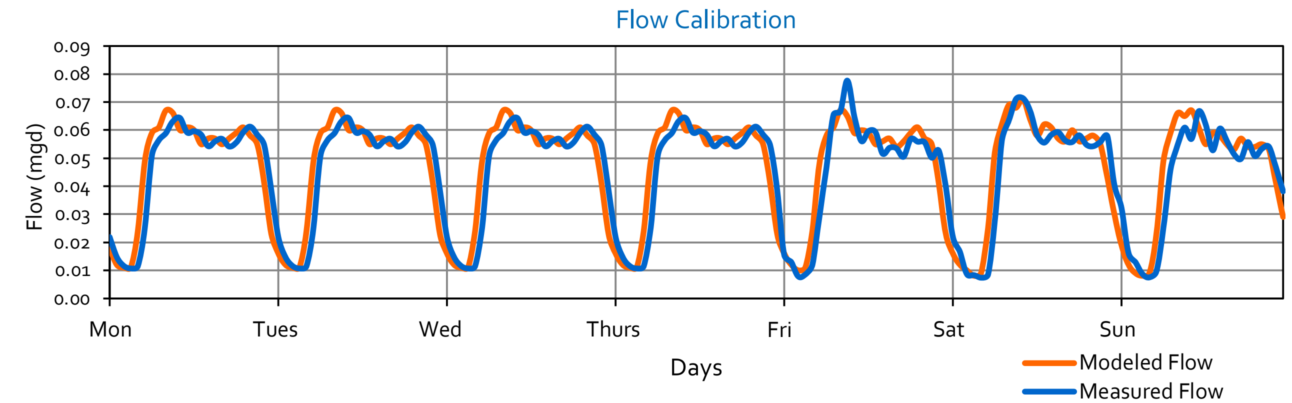


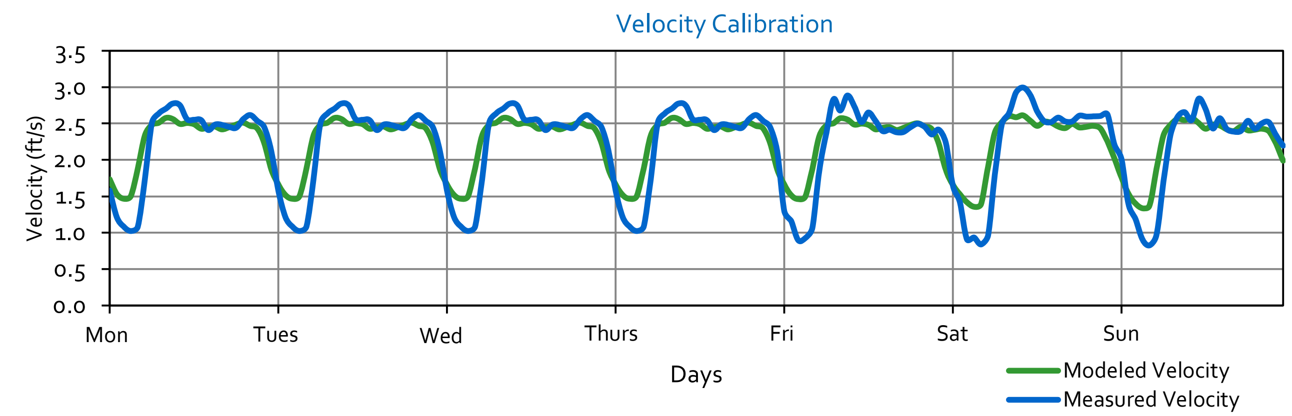
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

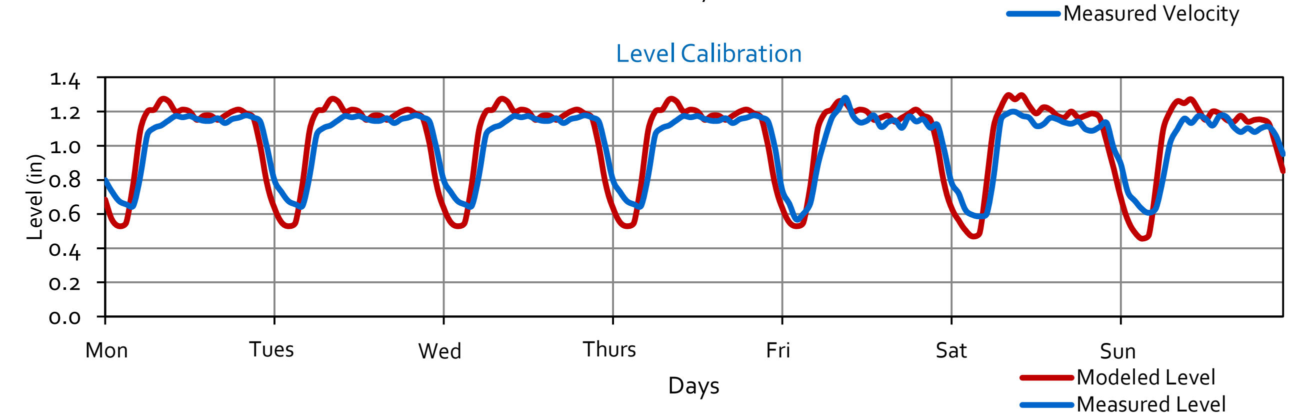
Flow Monitoring Site 31, Dry Weather Flow Calibration

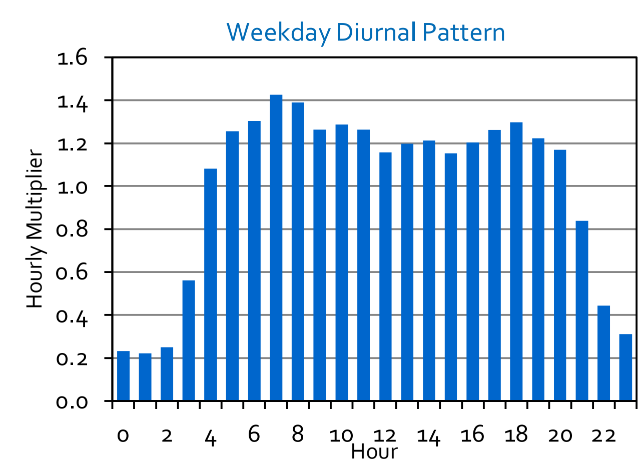
Location: Nutmeg Street, south of Saint Rafael Drive
Pipeline Diameter: 10"
City Manhole ID: Nutmeg Street, south of Saint Rafael Drive
Model Pipe ID: GM-4965

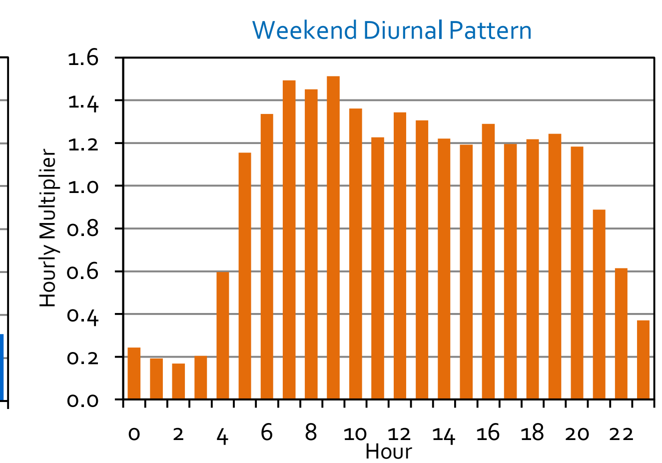
Flow Monitor Location











Model Calibration Summary

Day	Measured Data[(1)]				Modeled Data				Percent Error[(3)]			
	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[(2)] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.05	0.06	1.0	2.22	0.05	0.07	1.0	2.26	1.8%	4.2%	1.1%	1.7%
Tues.	0.05	0.06	1.0	2.22	0.05	0.07	1.0	2.26	1.8%	4.2%	1.1%	1.7%
Wed.	0.05	0.06	1.0	2.22	0.05	0.07	1.0	2.26	1.8%	4.2%	1.1%	1.7%
Thur.	0.05	0.06	1.0	2.22	0.05	0.07	1.0	2.26	1.8%	4.2%	1.1%	1.7%
Fri.	0.05	0.08	1.0	2.18	0.05	0.07	1.0	2.25	2.0%	-13.8%	1.4%	3.1%
Sat.	0.05	0.07	1.0	2.21	0.05	0.07	1.0	2.23	2.4%	-0.5%	2.7%	0.8%
Sun.	0.04	0.07	1.0	2.14	0.04	0.07	1.0	2.20	4.0%	0.5%	1.7%	2.7%
Summary												
Weekday	0.05	--	1.0	2.21	0.05	--	1.0	2.26	1.8%	--	1.1%	2.0%
Weekend	0.04	--	1.0	2.17	0.05	--	1.0	2.21	3.2%	--	2.2%	1.7%
ADWF[(4)]	0.05	--	1.0	2.20	0.05	--	1.0	2.24	2.2%	--	1.4%	1.9%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 32, Dry Weather Flow Calibration

Location: Tarragona Drive, east of Almansa Court
Pipeline Diameter: 9.75"
City Manhole ID: Tarragona Drive, east of Almansa Court
Model Pipe ID: GM-5323

Flow Monitor Location

Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data Peak Flow[2] (mgd)	Measured Data Avg. Level (in)	Measured Data Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error Peak Flow (%)	Percent Error Avg. Level (%)	Percent Error Avg. Vel. (%)
Mon.	0.09	0.15	2.6	1.27	0.10	0.14	2.5	1.39	3.2%	-3.6%	-4.2%	9.0%
Tues.	0.09	0.15	2.6	1.27	0.10	0.14	2.5	1.39	3.2%	-3.6%	-4.2%	9.0%
Wed.	0.09	0.15	2.6	1.27	0.10	0.14	2.5	1.39	3.2%	-3.6%	-4.2%	9.0%
Thur.	0.09	0.15	2.6	1.27	0.10	0.14	2.5	1.39	3.2%	-3.6%	-4.2%	9.0%
Fri.	0.09	0.13	2.6	1.25	0.09	0.14	2.4	1.38	2.9%	4.2%	-5.1%	9.8%
Sat.	0.10	0.16	2.6	1.27	0.10	0.15	2.5	1.38	2.4%	-3.7%	-4.9%	8.8%
Sun.	0.10	0.16	2.7	1.31	0.11	0.16	2.6	1.41	2.5%	0.7%	-3.6%	7.7%
Summary												
Weekday	0.09	--	2.6	1.27	0.10	--	2.5	1.38	3.2%	--	-4.3%	9.1%
Weekend	0.10	--	2.6	1.29	0.10	--	2.5	1.39	2.4%	--	-4.2%	8.3%
ADWF[4]	0.10	--	2.6	1.27	0.10	--	2.5	1.39	2.9%	--	-4.3%	8.9%

Notes:

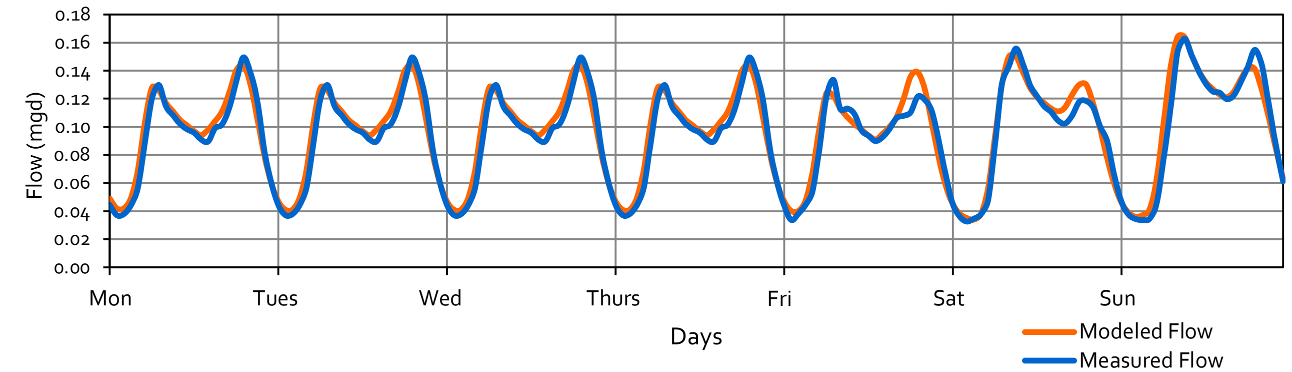
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

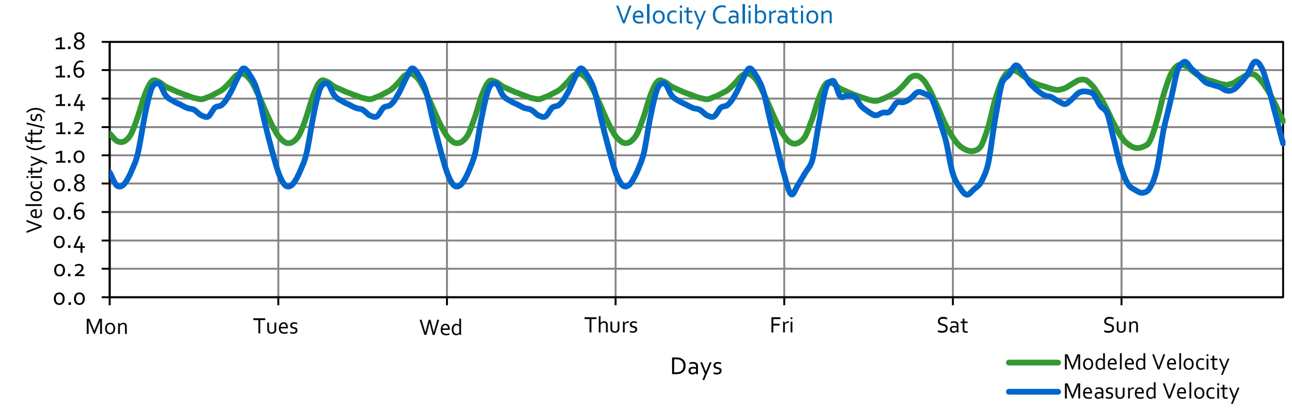
(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

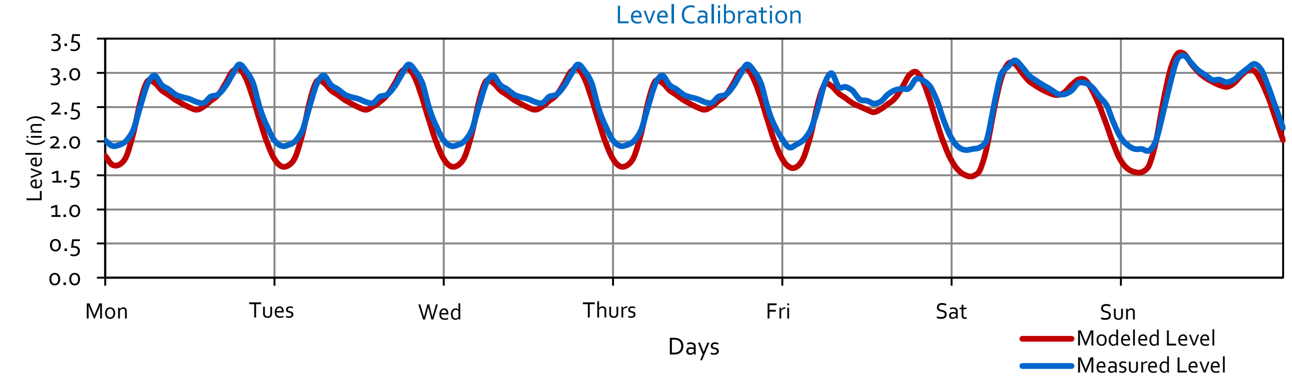
Flow Calibration



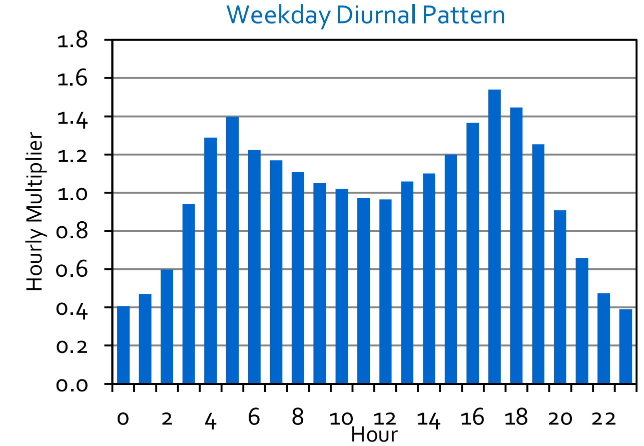
Velocity Calibration



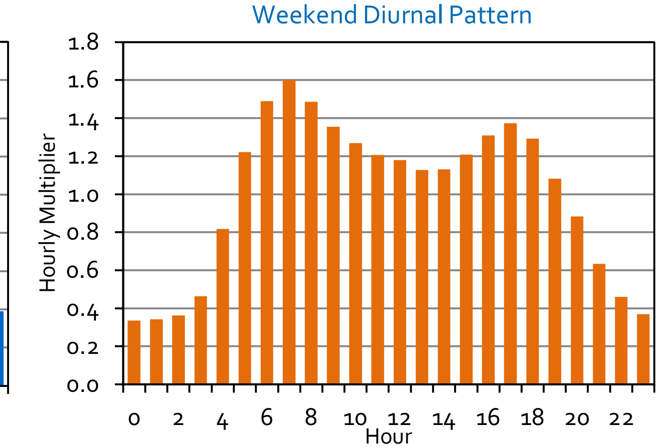
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



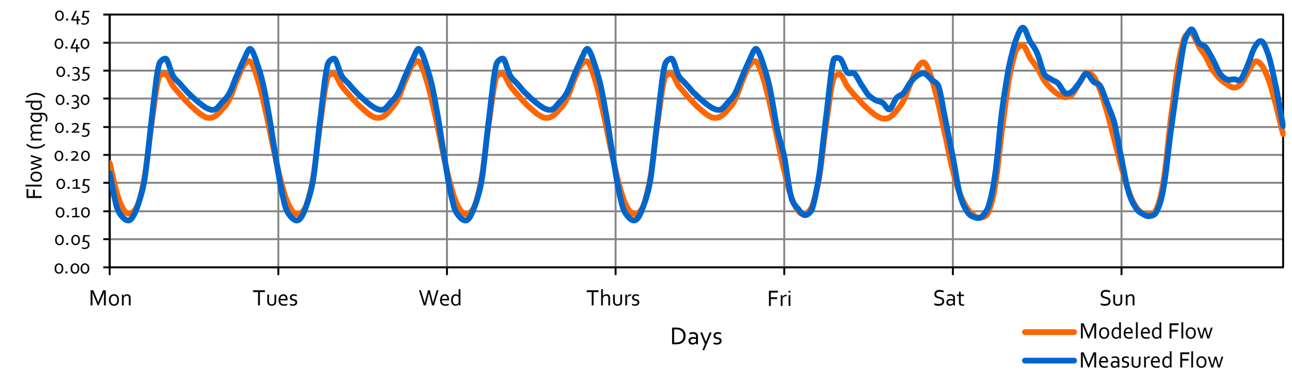
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 33, Dry Weather Flow Calibration

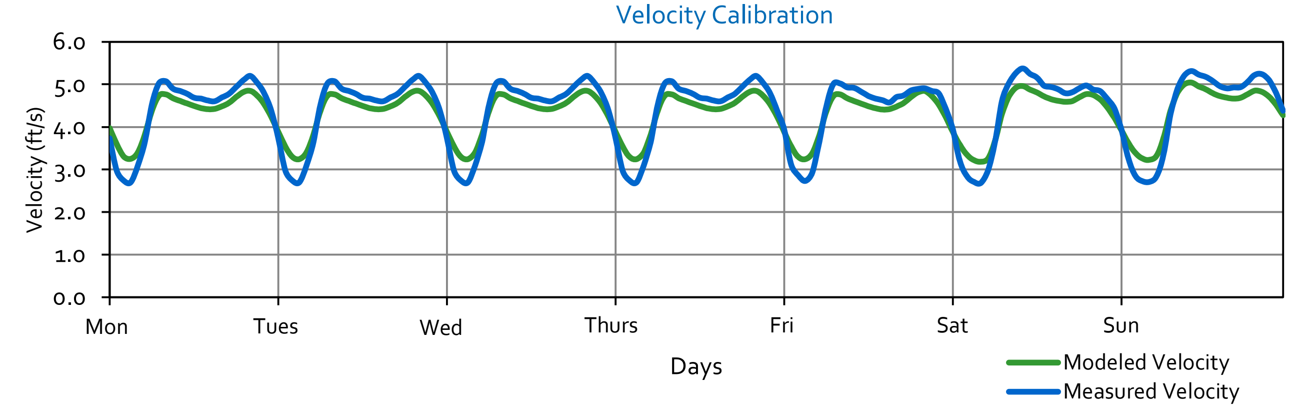
Location: Behind Via Tonada in California Oaks Golf Course
Pipeline Diameter: 11.75"
City Manhole ID: Behind Via Tonada in California Oaks Golf Course
Model Pipe ID: GM-5555

Flow Monitor Location

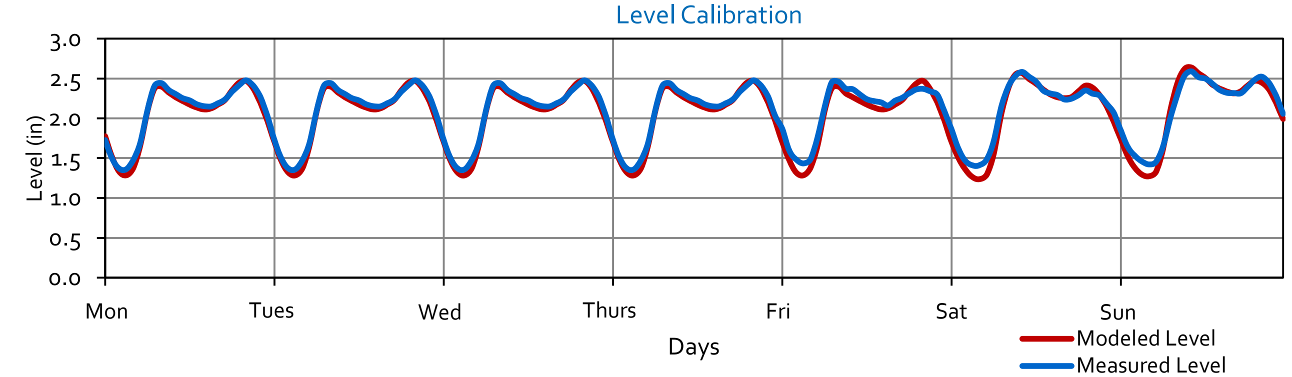
Flow Calibration



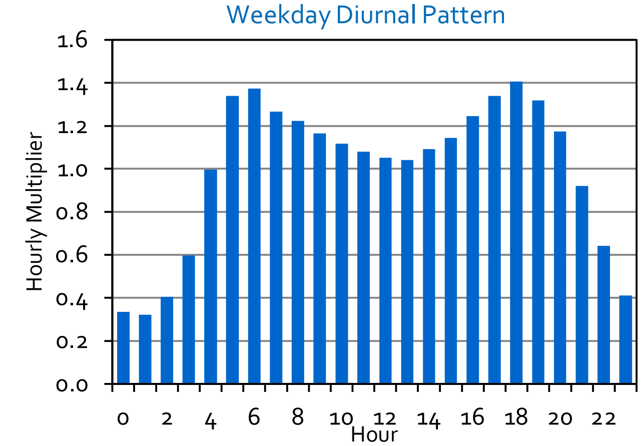
Velocity Calibration



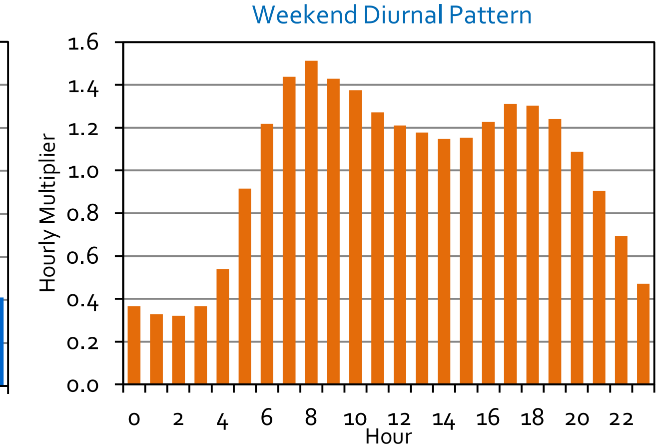
Level Calibration



Weekday Diurnal Pattern



Weekend Diurnal Pattern



Model Calibration Summary

Day	Measured Data[1]				Modeled Data				Percent Error[3]			
	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.27	0.39	2.1	4.40	0.26	0.37	2.1	4.32	-3.9%	-5.9%	-1.5%	-1.8%
Tues.	0.27	0.39	2.1	4.40	0.26	0.37	2.1	4.32	-3.9%	-5.9%	-1.5%	-1.8%
Wed.	0.27	0.39	2.1	4.40	0.26	0.37	2.1	4.32	-3.9%	-5.9%	-1.5%	-1.8%
Thur.	0.27	0.39	2.1	4.40	0.26	0.37	2.1	4.32	-3.9%	-5.9%	-1.5%	-1.8%
Fri.	0.27	0.37	2.1	4.38	0.26	0.36	2.1	4.31	-5.4%	-1.9%	-3.1%	-1.6%
Sat.	0.28	0.43	2.1	4.41	0.26	0.40	2.1	4.31	-4.7%	-7.4%	-2.3%	-2.2%
Sun.	0.29	0.42	2.1	4.43	0.28	0.42	2.1	4.38	-2.9%	-1.6%	-1.3%	-1.3%
Summary												
Weekday	0.27	--	2.1	4.39	0.26	--	2.1	4.32	-4.2%	--	-1.9%	-1.7%
Weekend	0.28	--	2.1	4.42	0.27	--	2.1	4.34	-3.8%	--	-1.8%	-1.7%
ADWF[4]	0.27	--	2.1	4.40	0.26	--	2.1	4.32	-4.1%	--	-1.8%	-1.7%

Notes:

(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

(3) Percent Error = (Modeled - Measured) /Measured x 100

(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Flow Monitoring Site 34, Dry Weather Flow Calibration

Location: Symphony Park Lane and Chalone Drive
Pipeline Diameter: 9.75"
City Manhole ID: Symphony Park Lane and Chalone Drive
Model Pipe ID: GM-5624

Flow Monitor Location

Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Measured Data[1] Peak Flow[2] (mgd)	Measured Data[1] Avg. Level (in)	Measured Data[1] Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Modeled Data Peak Flow[2] (mgd)	Modeled Data Avg. Level (in)	Modeled Data Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Percent Error[3] Peak Flow (%)	Percent Error[3] Avg. Level (%)	Percent Error[3] Avg. Vel. (%)
Mon.	0.05	0.07	2.0	0.96	0.04	0.06	1.8	0.96	-1.8%	-6.9%	-11.0%	0.7%
Tues.	0.05	0.07	2.0	0.96	0.04	0.06	1.8	0.96	-1.8%	-6.9%	-11.0%	0.7%
Wed.	0.05	0.07	2.0	0.96	0.04	0.06	1.8	0.96	-1.8%	-6.9%	-11.0%	0.7%
Thur.	0.05	0.07	2.0	0.96	0.04	0.06	1.8	0.96	-1.8%	-6.9%	-11.0%	0.7%
Fri.	0.05	0.07	2.1	0.90	0.05	0.07	1.9	0.99	-1.4%	-1.0%	-7.7%	9.6%
Sat.	0.05	0.09	2.1	0.93	0.05	0.08	1.9	1.00	-1.6%	-7.1%	-6.9%	7.8%
Sun.	0.05	0.07	2.1	0.88	0.05	0.08	1.9	0.99	-1.6%	4.9%	-10.0%	12.9%
Summary												
Weekday	0.05	--	2.0	0.95	0.05	--	1.8	0.97	-1.7%	--	-10.3%	2.4%
Weekend	0.05	--	2.1	0.90	0.05	--	1.9	1.00	-1.6%	--	-8.5%	10.3%
ADWF[4]	0.05	--	2.1	0.93	0.05	--	1.9	0.98	-1.7%	--	-9.8%	4.6%

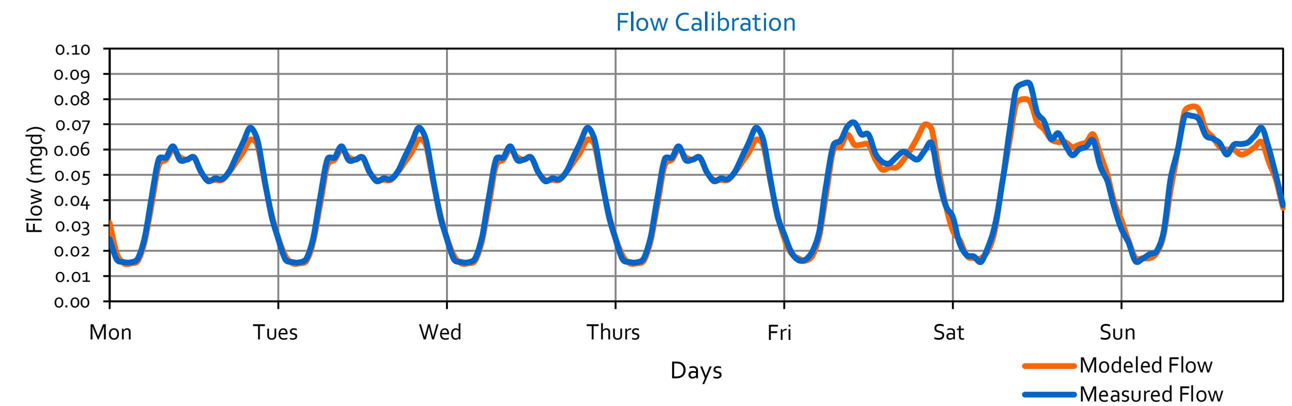
Notes:

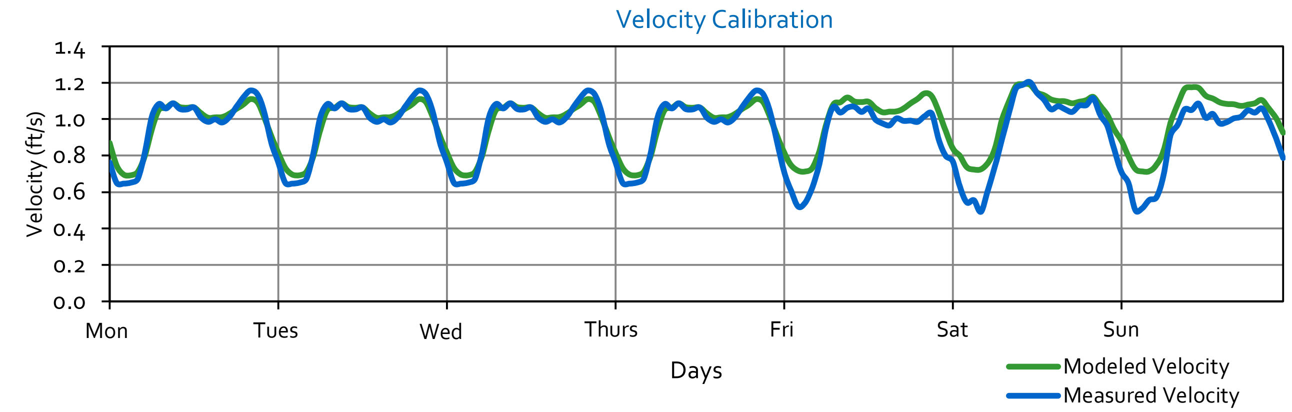
(1) Source: V&A Temporary Flow Monitoring Program (December 11, 2021 through January 10, 2022)

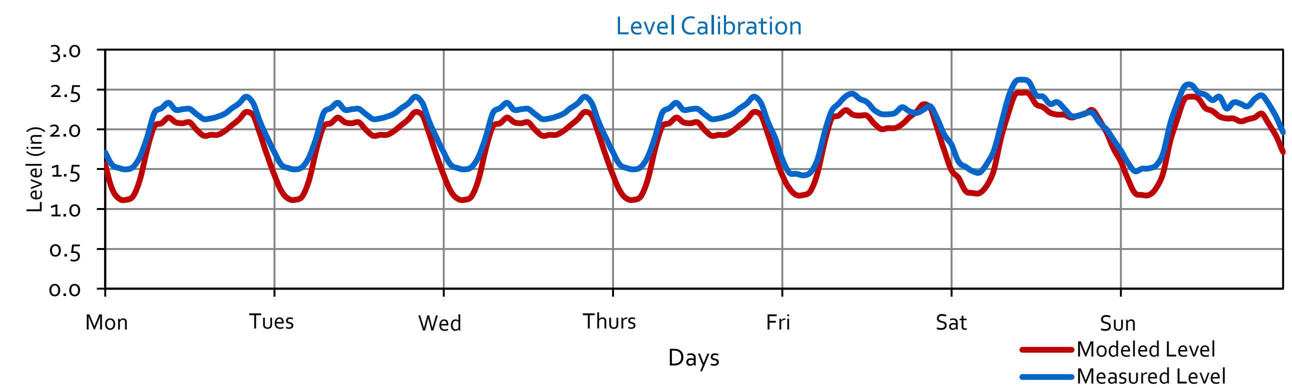
(2) Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

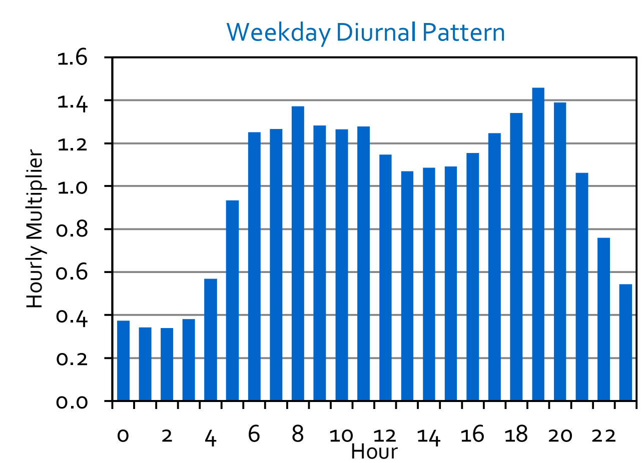
(3) Percent Error = (Modeled - Measured) /Measured x 100

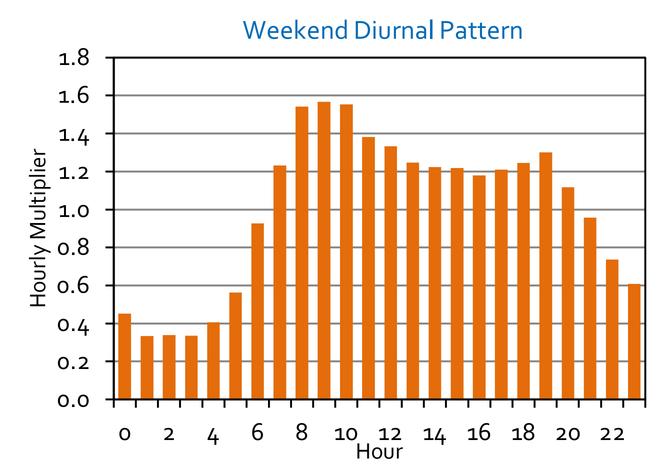
(4) ADWF = (5xWeekday Average + 2xWeekend Average)/7







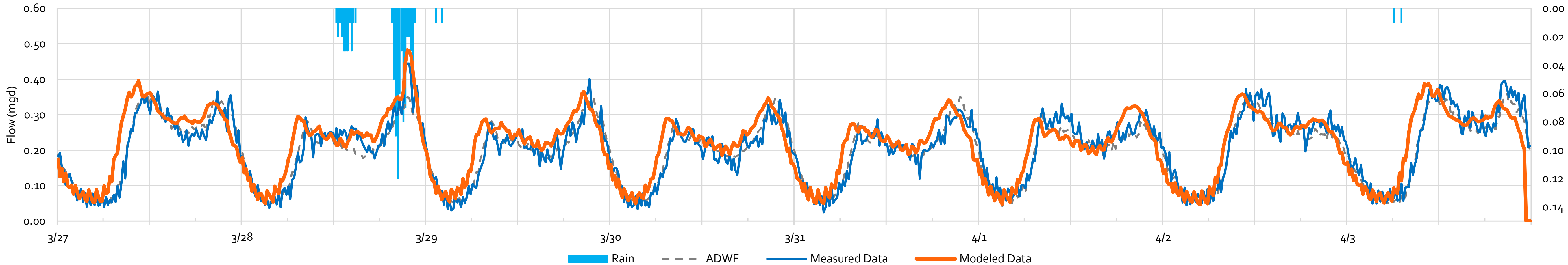




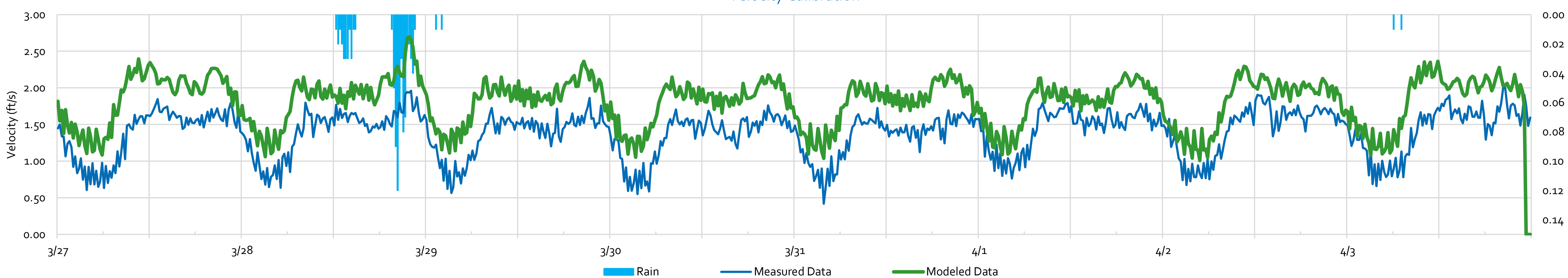
ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

Site 01 Wet Weather Calibration
Location: Kicking Horse Drive, west of Caravan Circle
Pipeline diameter: 14.75"
City Manhole ID: MH-58
GIS Pipe ID: GM-70

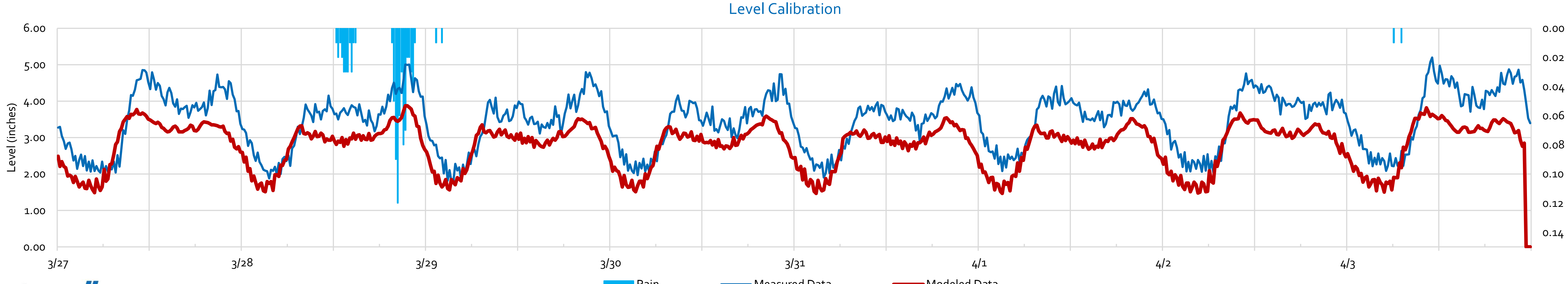
Flow Calibration



Velocity Calibration



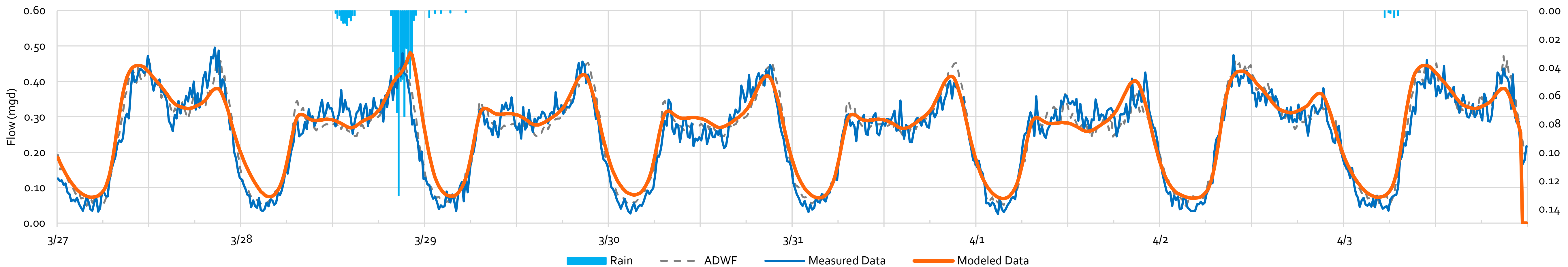
Level Calibration



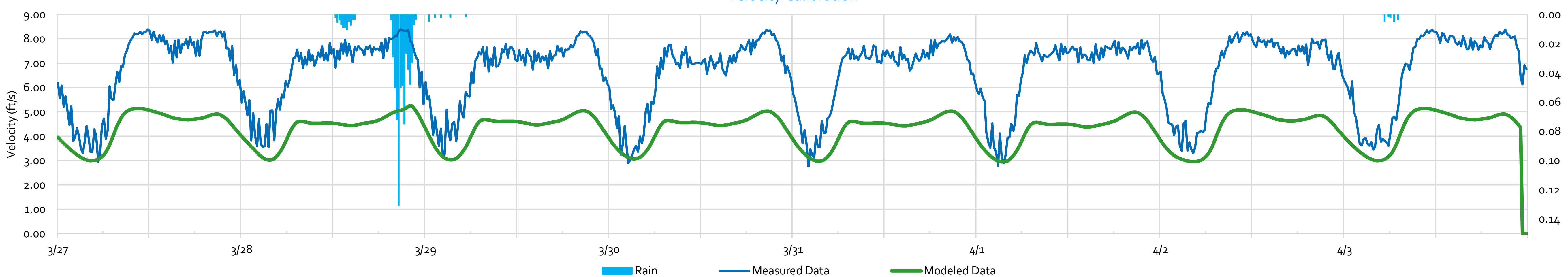
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 02 Wet Weather Calibration
Location: Lakeshore Drive, north of Machado Street
Pipeline diameter: 12"
City Manhole ID: MH-703
GIS Pipe ID: GM-801

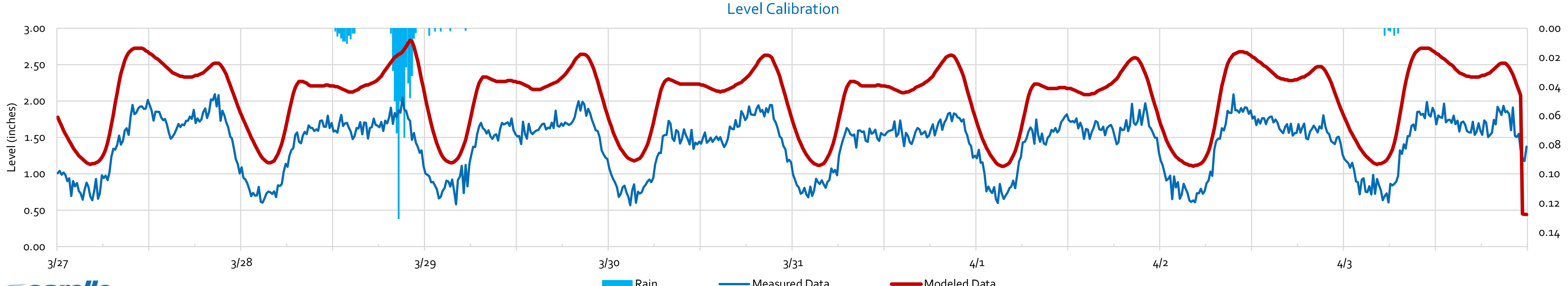
Flow Calibration



Velocity Calibration

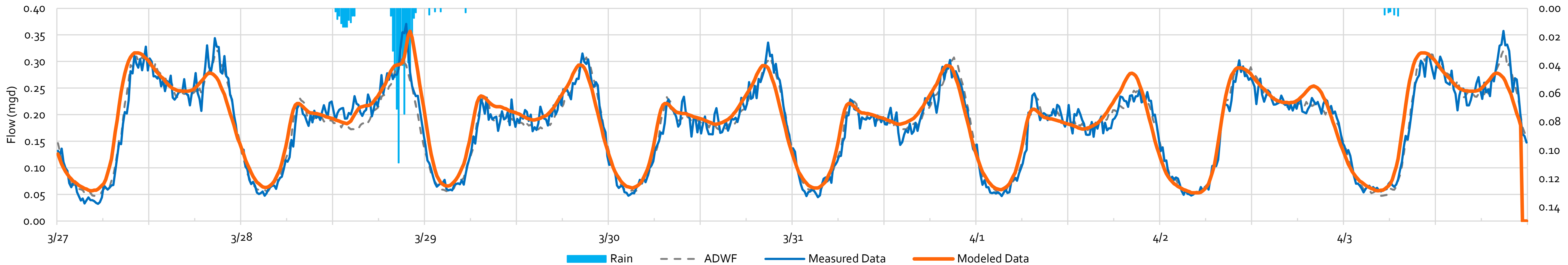


Level Calibration

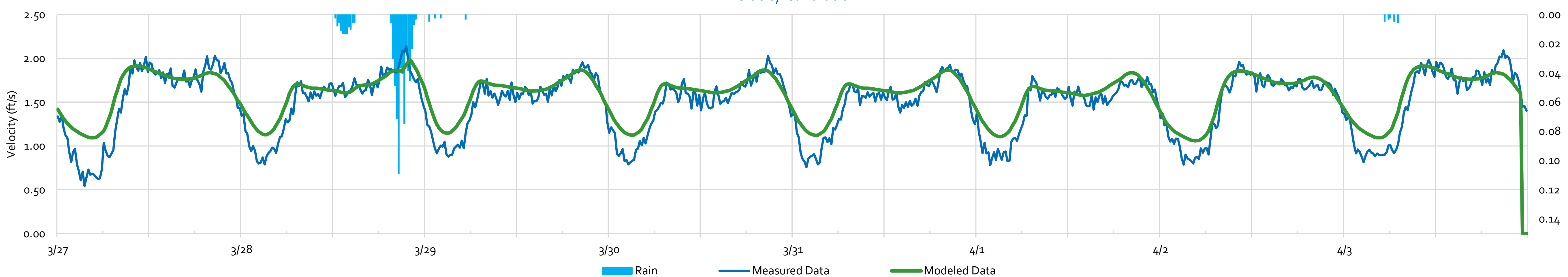


Site 03 Wet Weather Calibration
Location: Machado Street, west of Lakeshore Drive
Pipeline diameter: 14.75"
City Manhole ID: MH-955
GIS Pipe ID: GM-1099

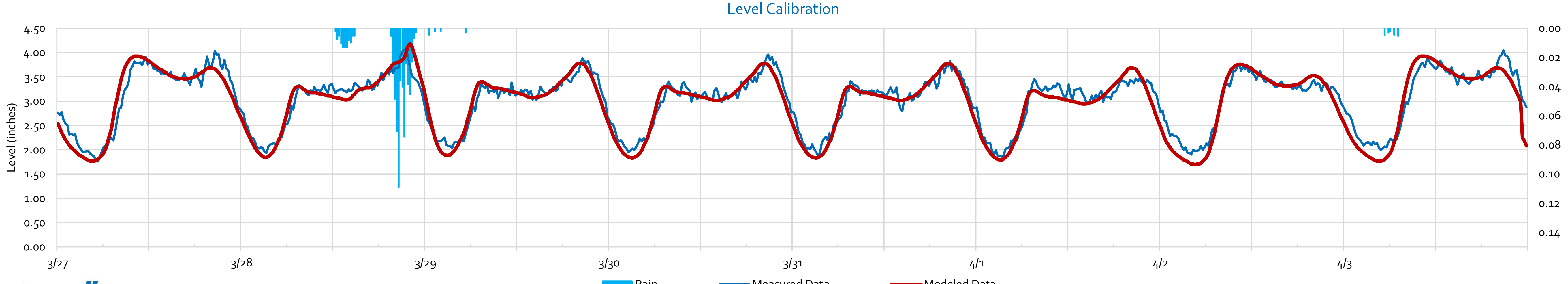
Flow Calibration



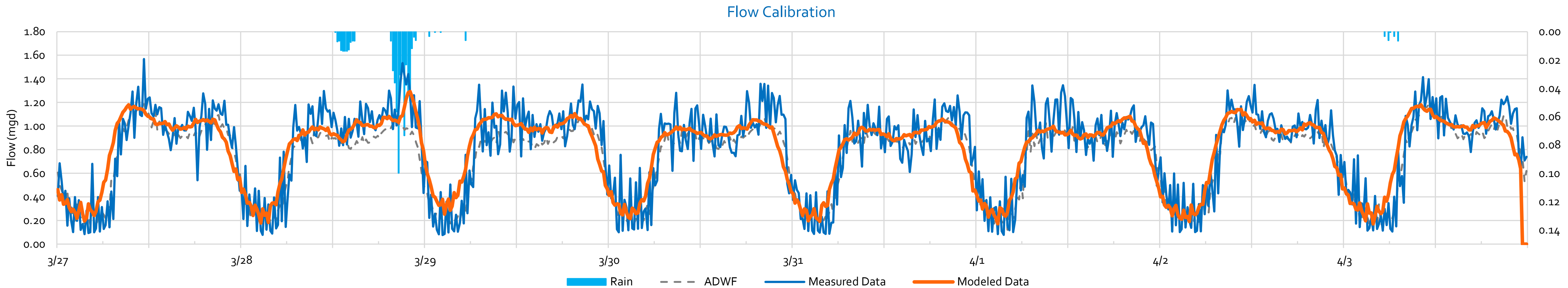
Velocity Calibration

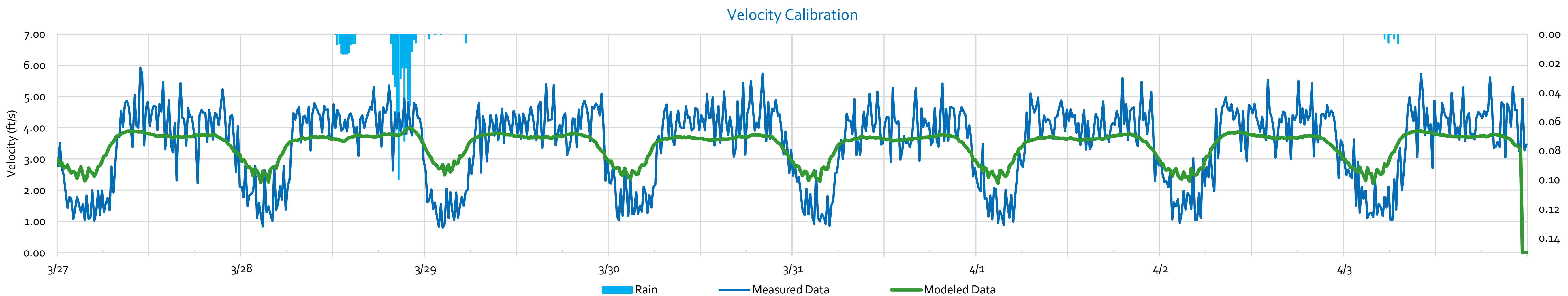


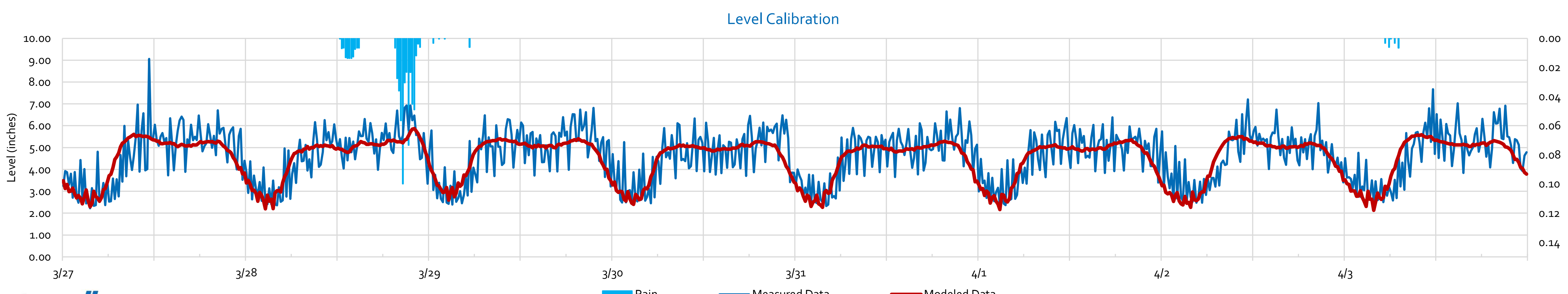
Level Calibration



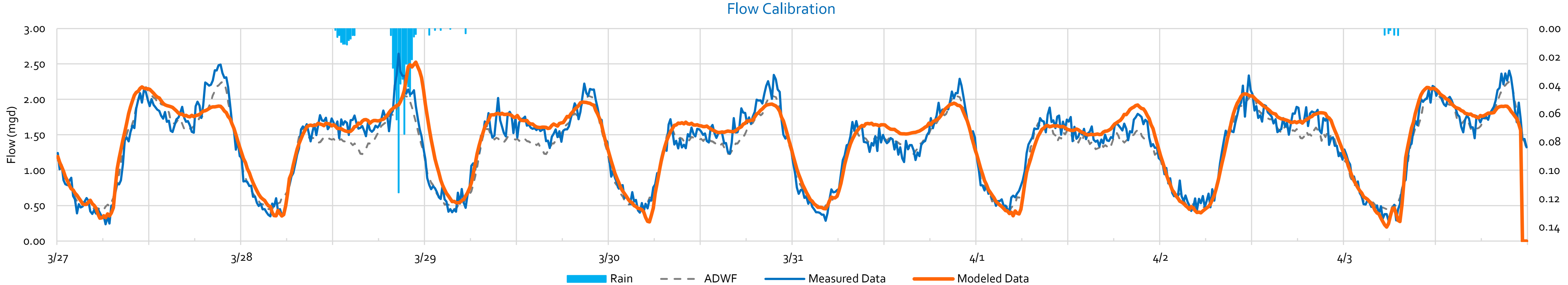
Site 04 Wet Weather Calibration
Location: Riverside Dr, Lake Elsinore, CA 92530
Pipeline diameter: 17.75"
City Manhole ID: MH-1432
GIS Pipe ID: GM-1636

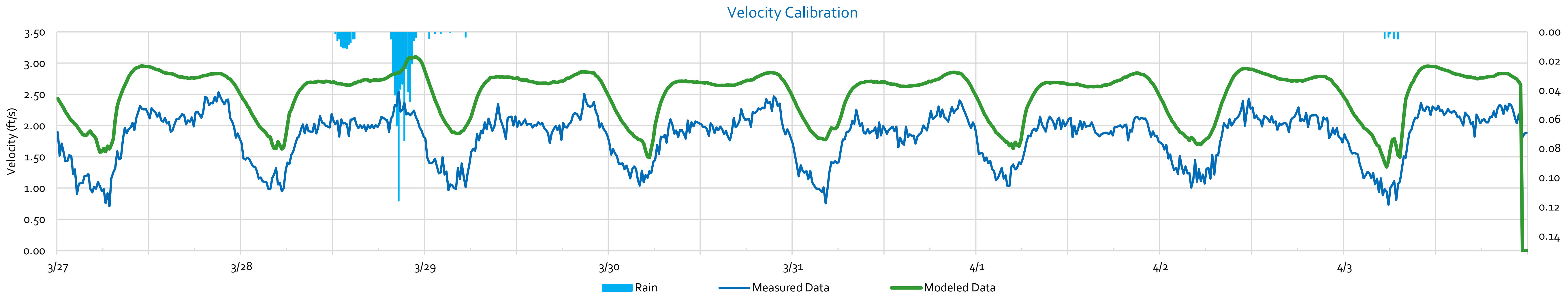


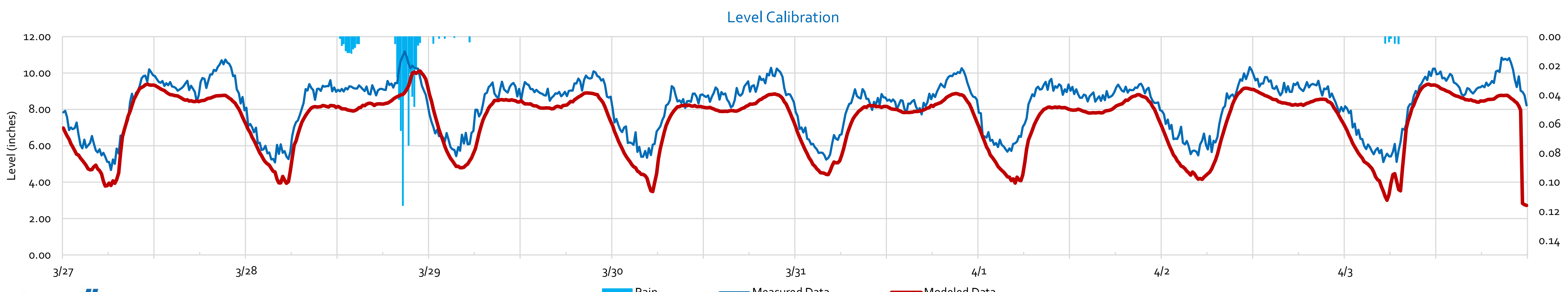




Site 05 Wet Weather Calibration
Location: Regional WRF
Pipeline diameter: 29.75"
City Manhole ID: MH-1018
GIS Pipe ID: GM-1646



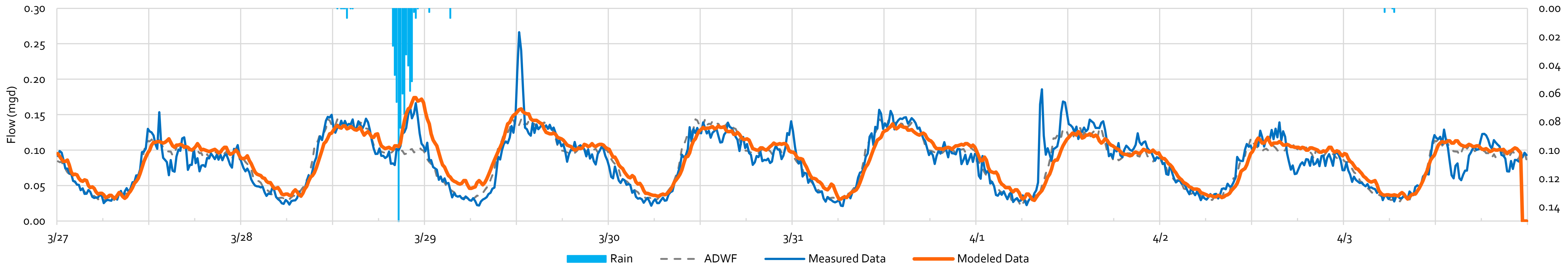




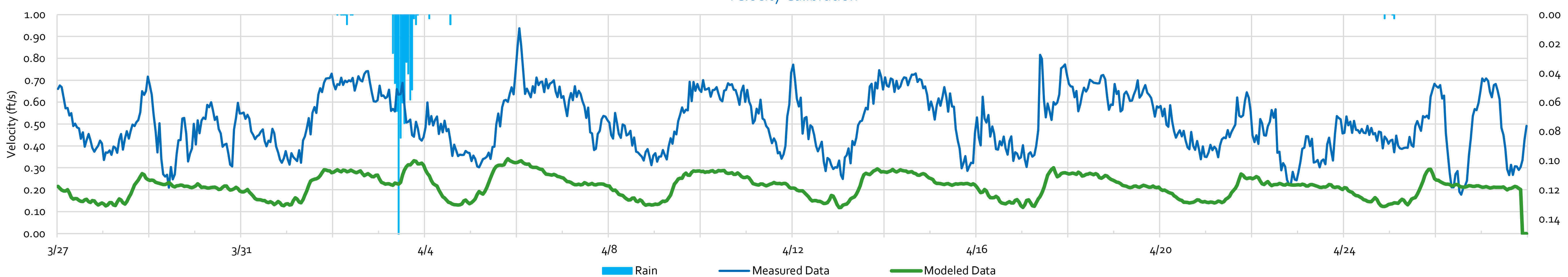
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 06 Wet Weather Calibration
Location: Pasadena Street, west of 3rd Street
Pipeline diameter: 24"
City Manhole ID: MH-1035
GIS Pipe ID: GM-1211

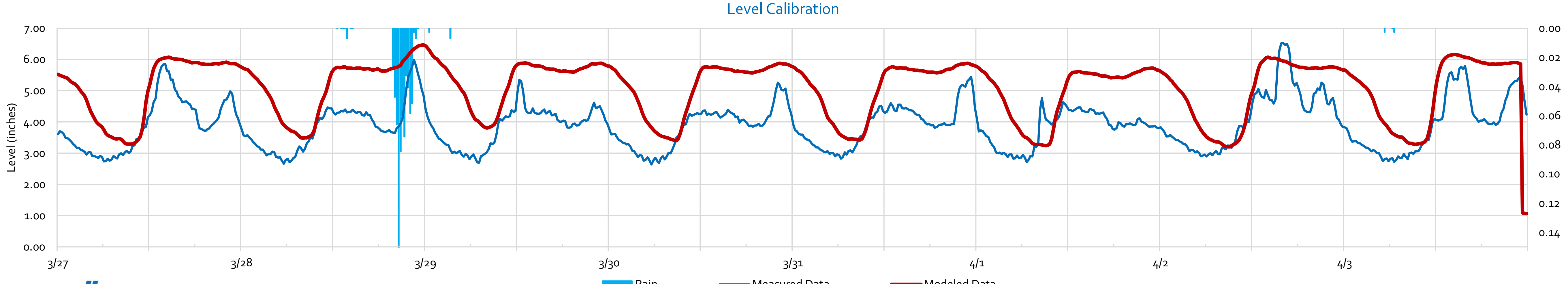
Flow Calibration



Velocity Calibration



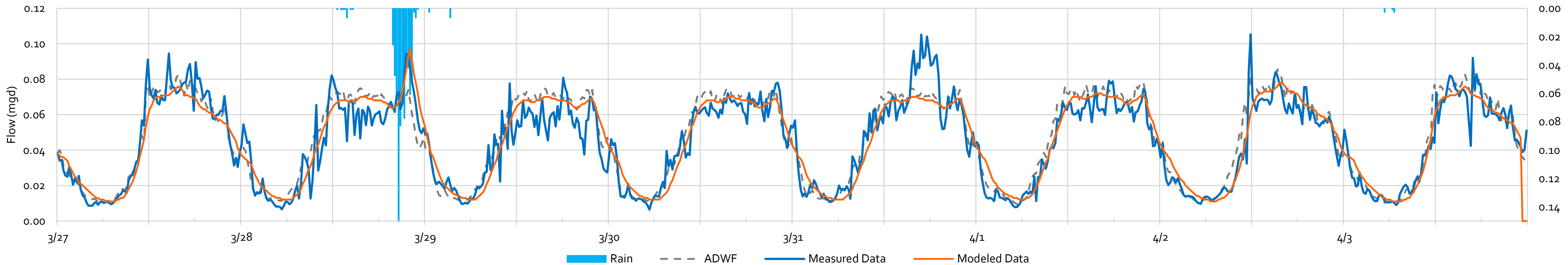
Level Calibration



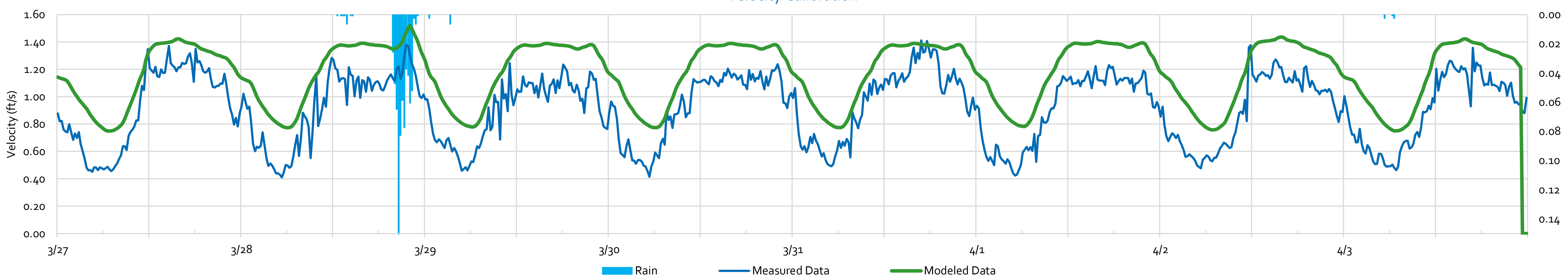
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 07 Wet Weather Calibration
Location: 3rd Street, south of Collier Street
Pipeline diameter: 14.75"
City Manhole ID: MH-8697
GIS Pipe ID: GM-7908

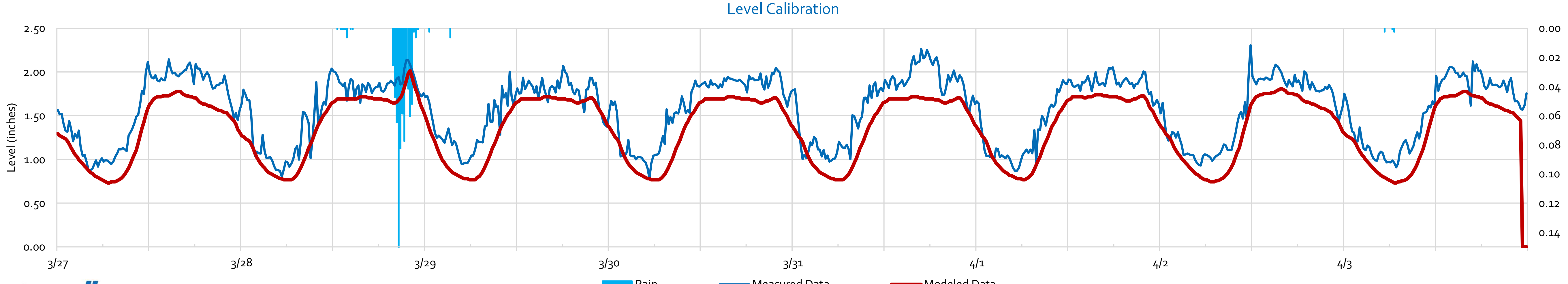
Flow Calibration



Velocity Calibration

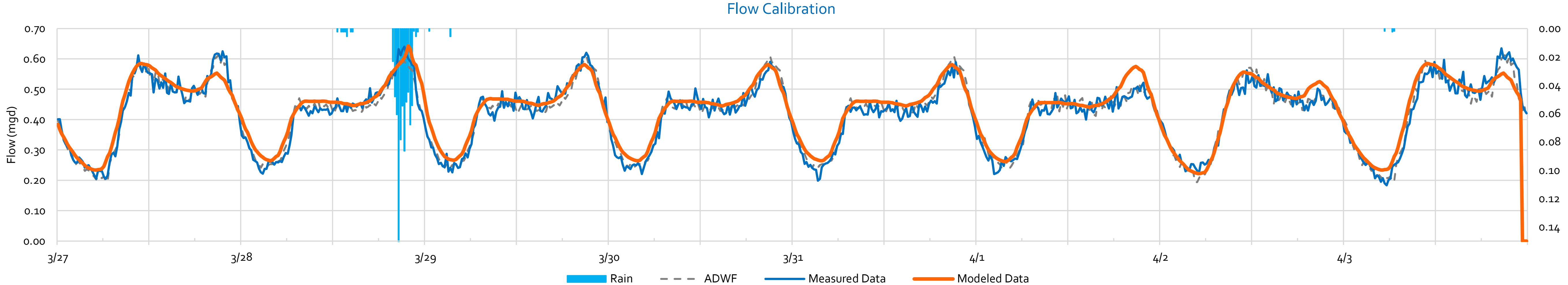


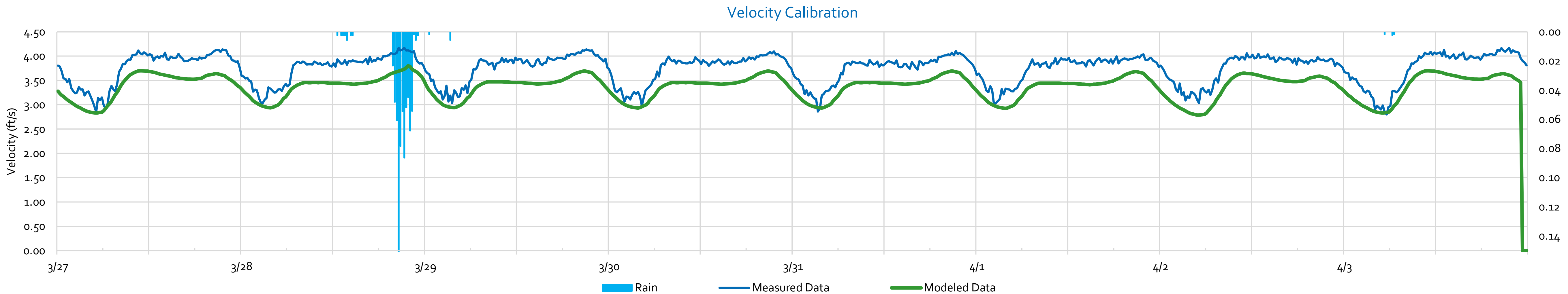
Level Calibration

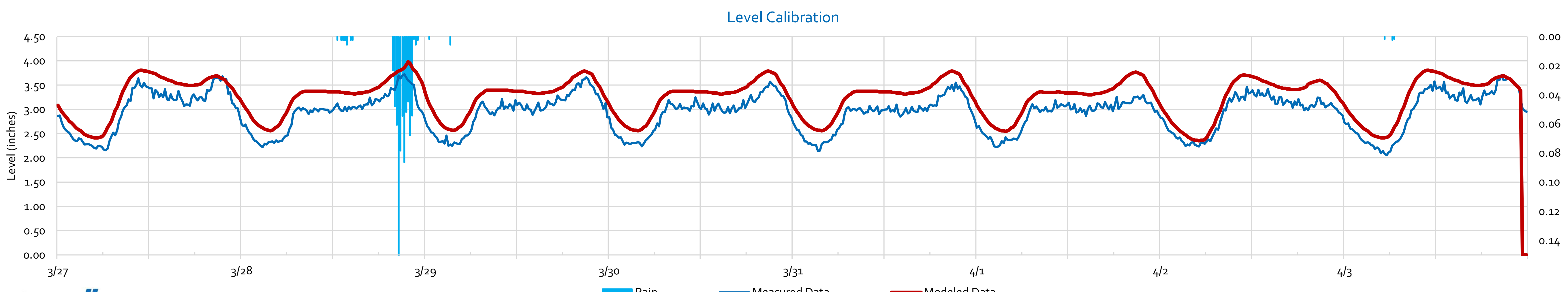


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 08 Wet Weather Calibration
Location: 3rd Street, south of Collier Street
Pipeline diameter: 15"
City Manhole ID: MH-8708
GIS Pipe ID: GM-7912

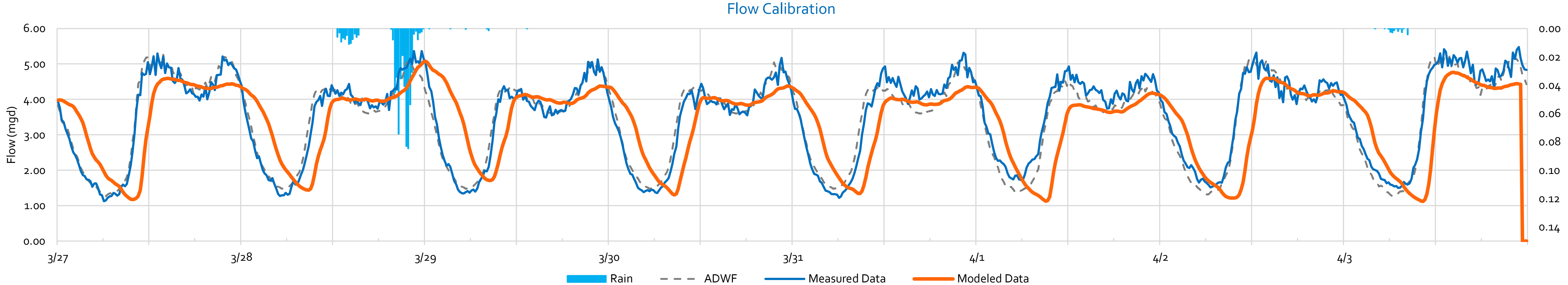


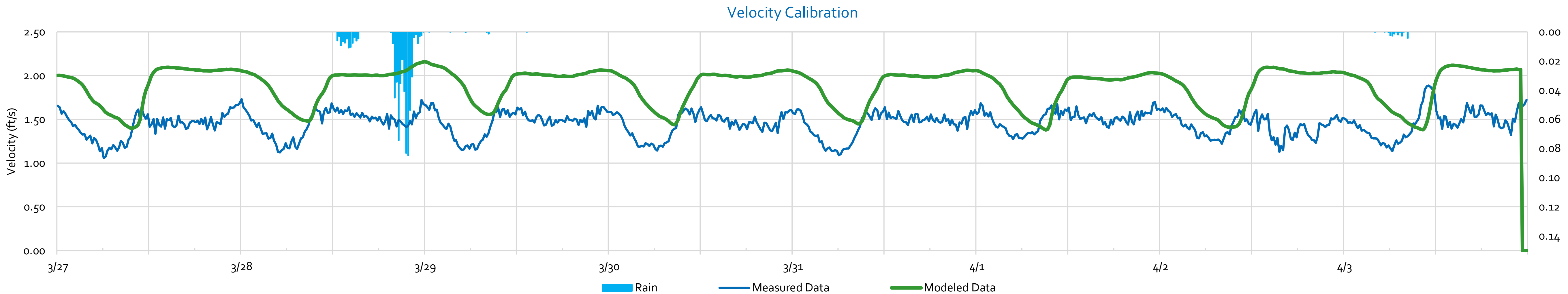


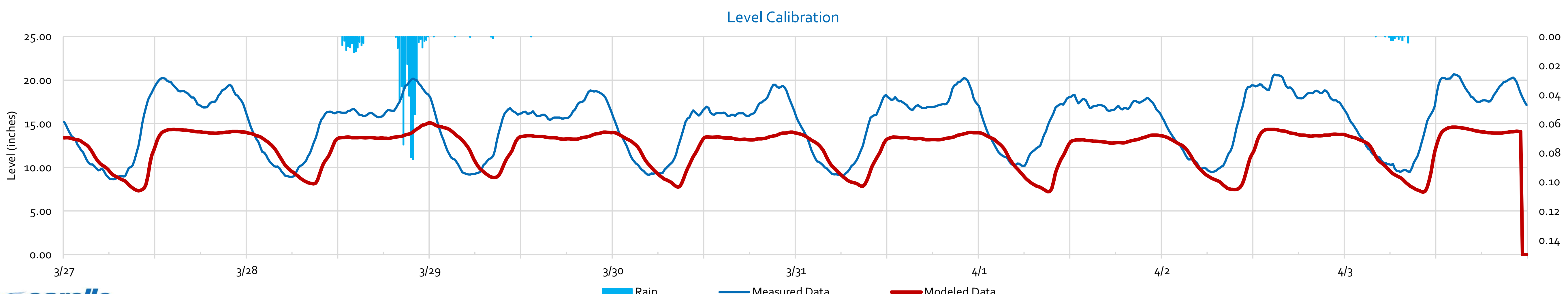


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 09 Wet Weather Calibration
Location: Minthorn Street, west of Birch Street
Pipeline diameter: 54"
City Manhole ID: MH-10055
GIS Pipe ID: GM-9341



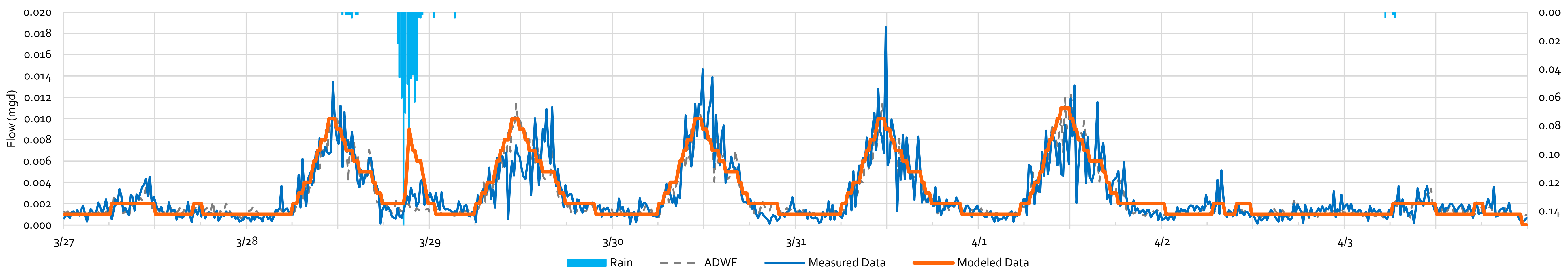




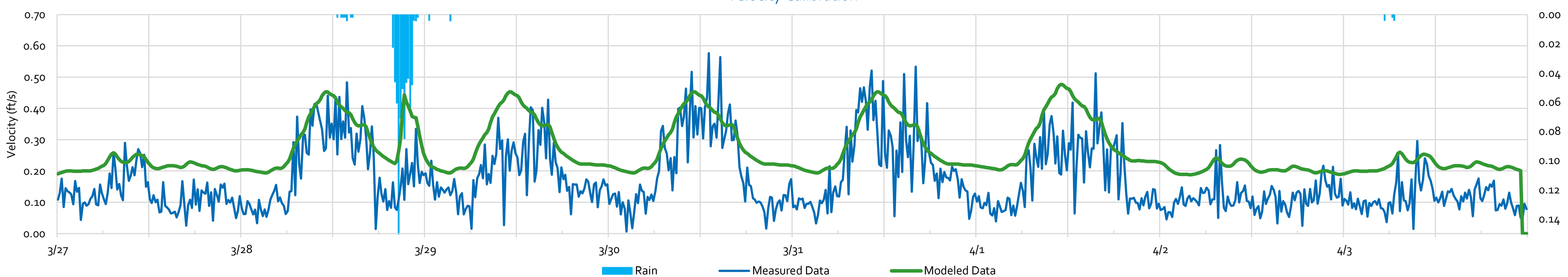
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 10 Wet Weather Calibration
Location: Chaney Street, north of Pasadena Street
Pipeline diameter: 11.75"
City Manhole ID: MH-1465
GIS Pipe ID: GM-1666

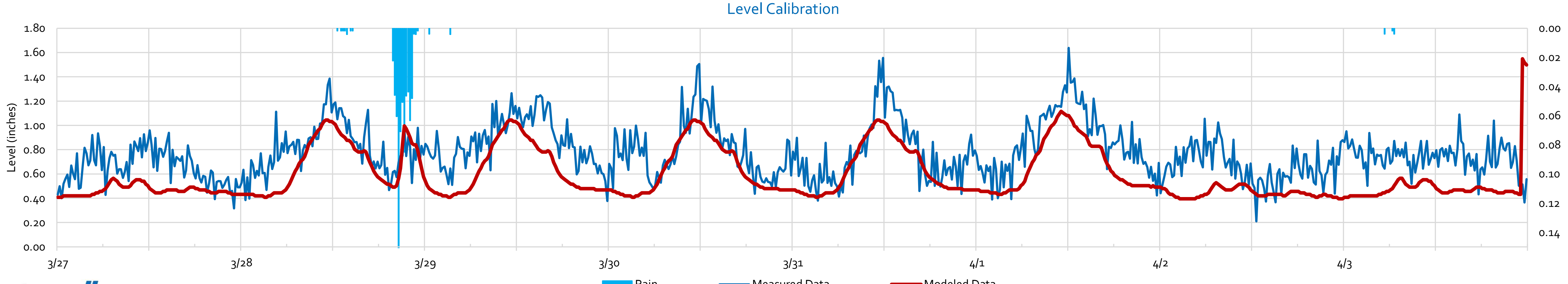
Flow Calibration



Velocity Calibration

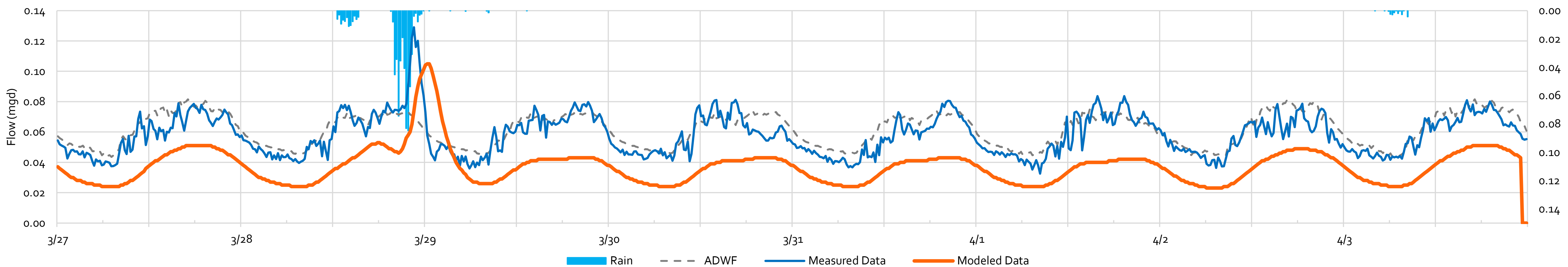


Level Calibration

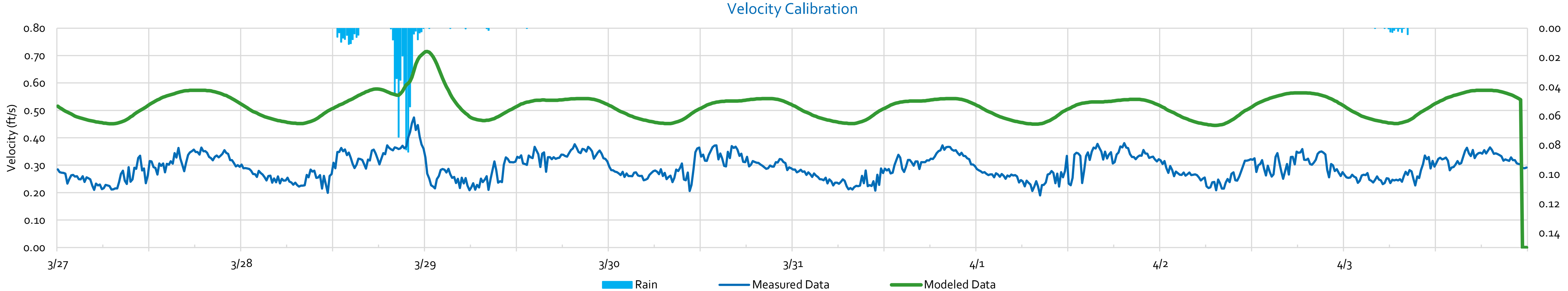


Site 11 Wet Weather Calibration
Location: Easement off Chaney St
Pipeline diameter: 26.75"
City Manhole ID: MH-1444
GIS Pipe ID: GM-1658

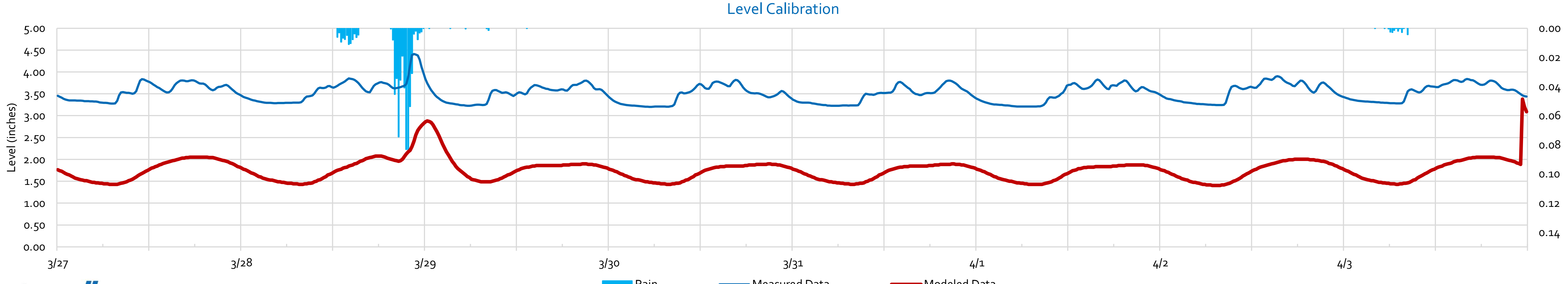
Flow Calibration



Velocity Calibration



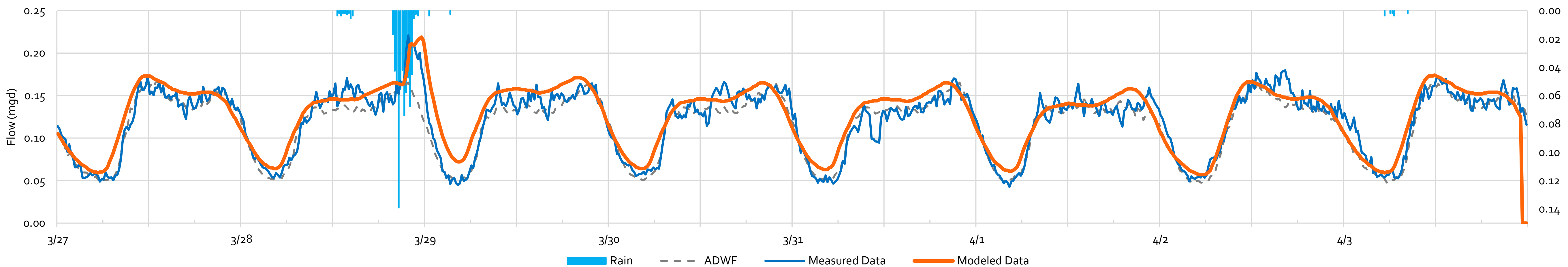
Level Calibration



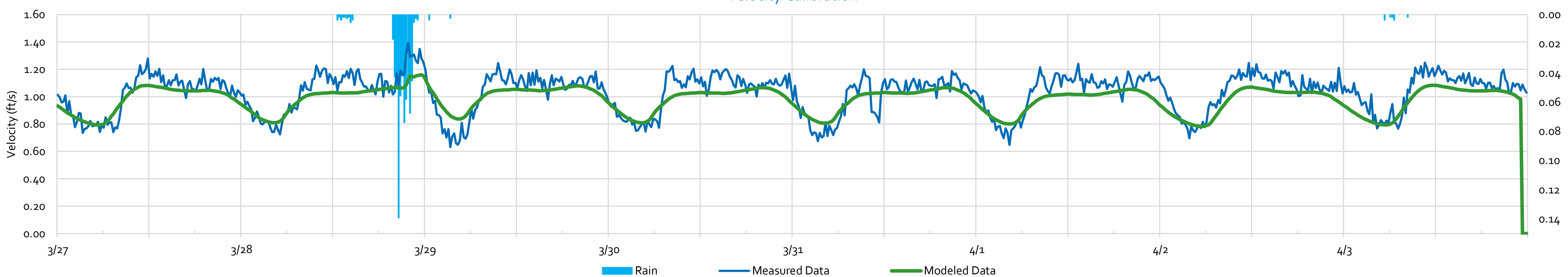
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 12 Wet Weather Calibration
Location: Easement off Chaney St
Pipeline diameter: 24"
City Manhole ID: MH-1463
GIS Pipe ID: GM-1665

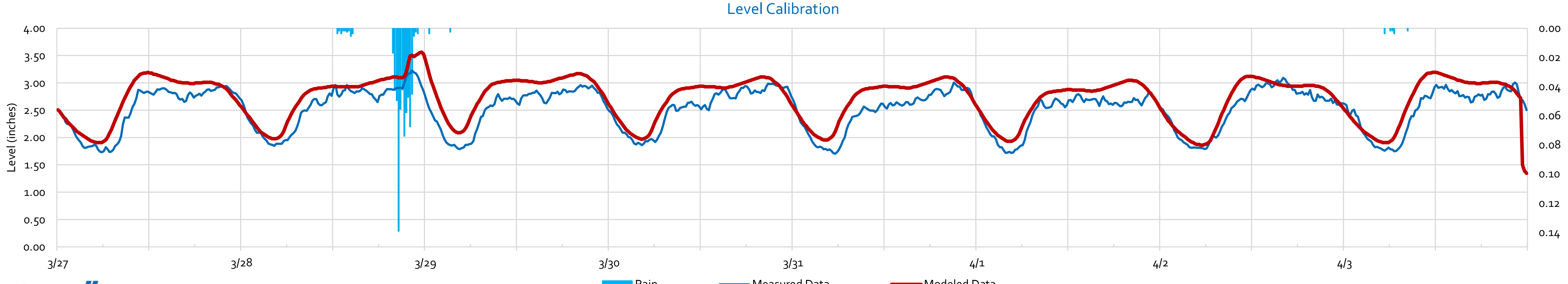
Flow Calibration



Velocity Calibration

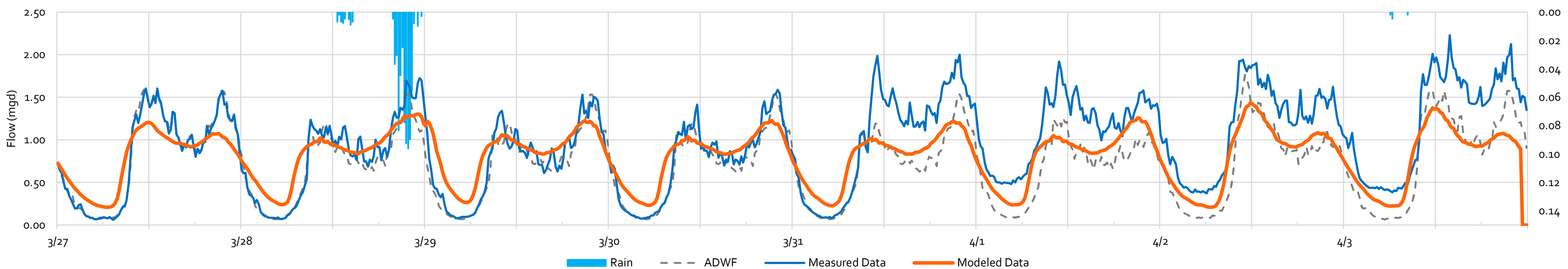


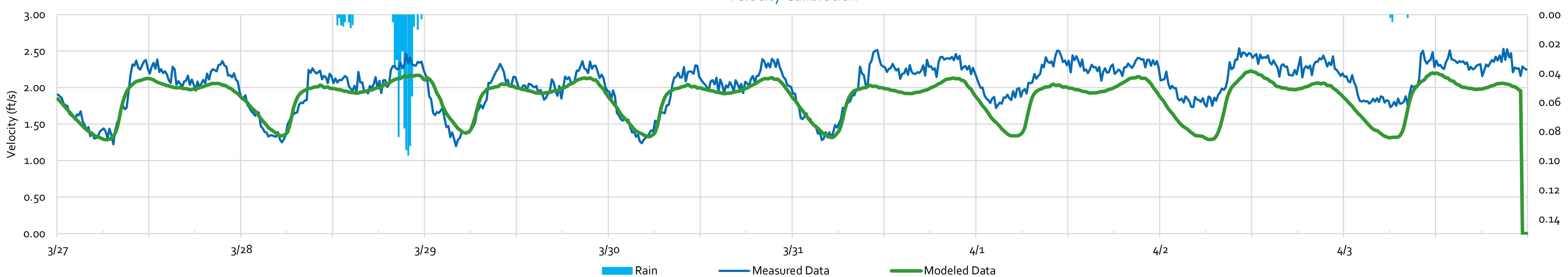
Level Calibration

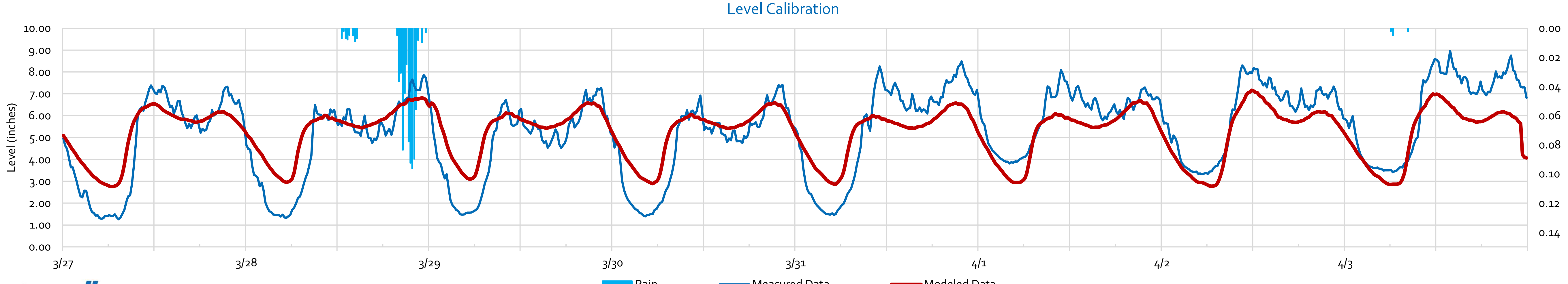


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 13 Wet Weather Calibration
Location: Casino Drive, east of Avenue 12
Pipeline diameter: 36"
City Manhole ID: MH-2755
GIS Pipe ID: GM-3072

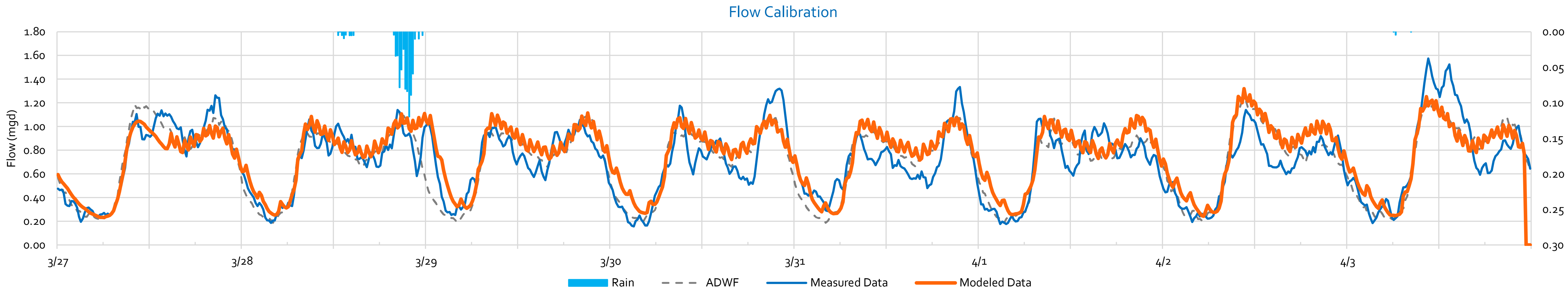


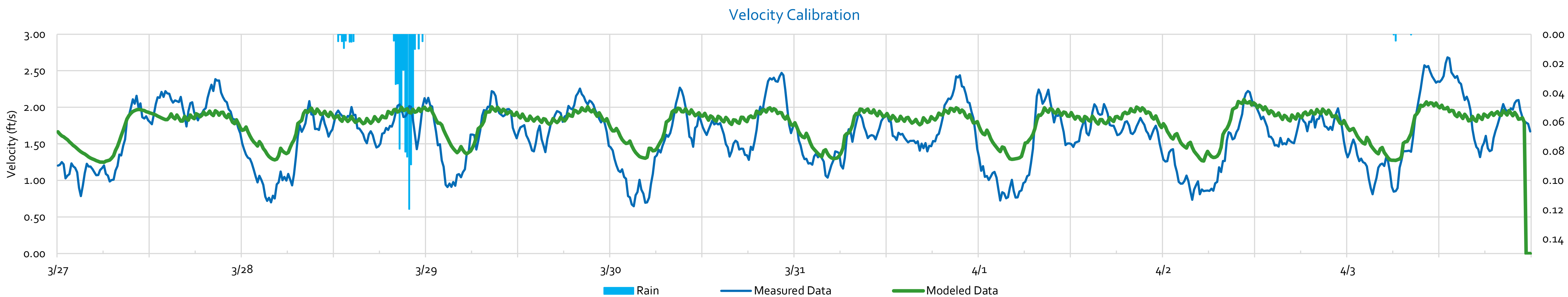


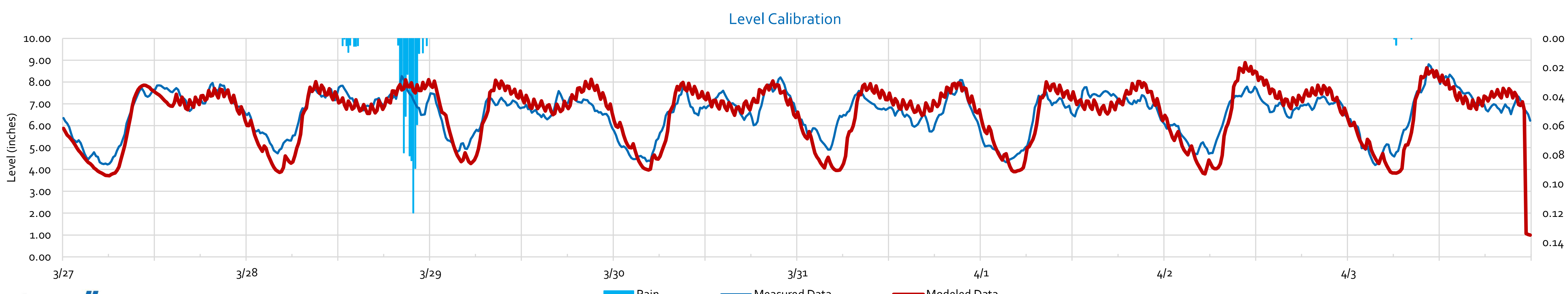


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 14 Wet Weather Calibration
Location: Old Newport Road
Pipeline diameter: 20.75"
City Manhole ID: MH-2866
GIS Pipe ID: GM-3204



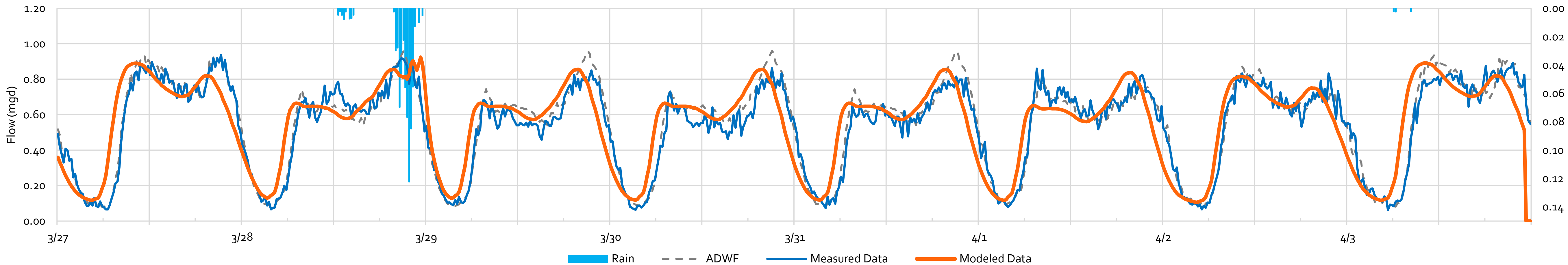




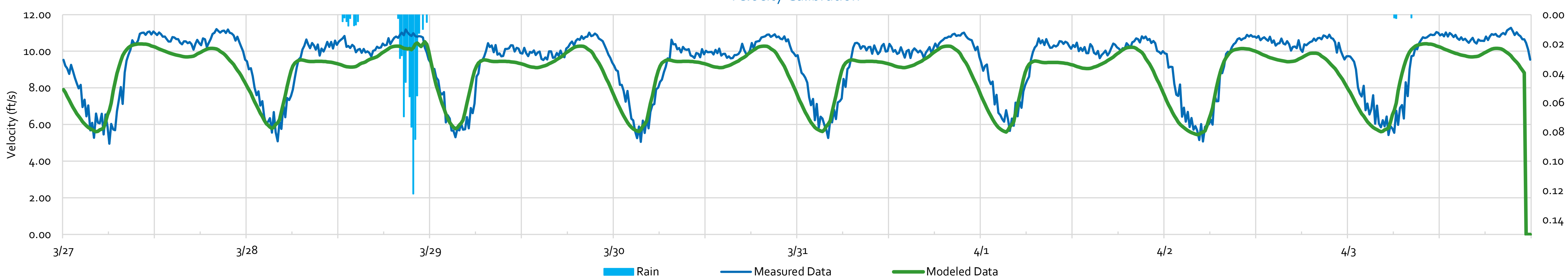
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 15 Wet Weather Calibration
Location: Railroad Canyon Road, 1 MH down stream on easement
Pipeline diameter: 17.75"
City Manhole ID: MH-2869
GIS Pipe ID: GM-7891

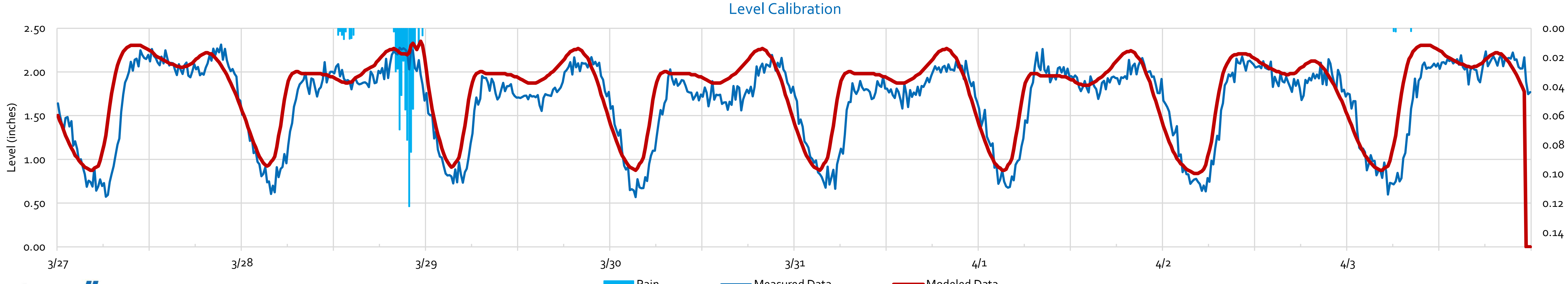
Flow Calibration



Velocity Calibration

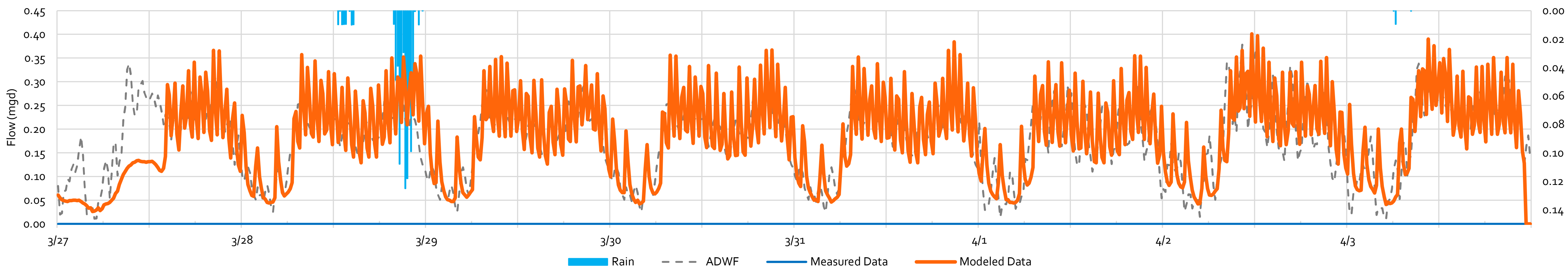


Level Calibration

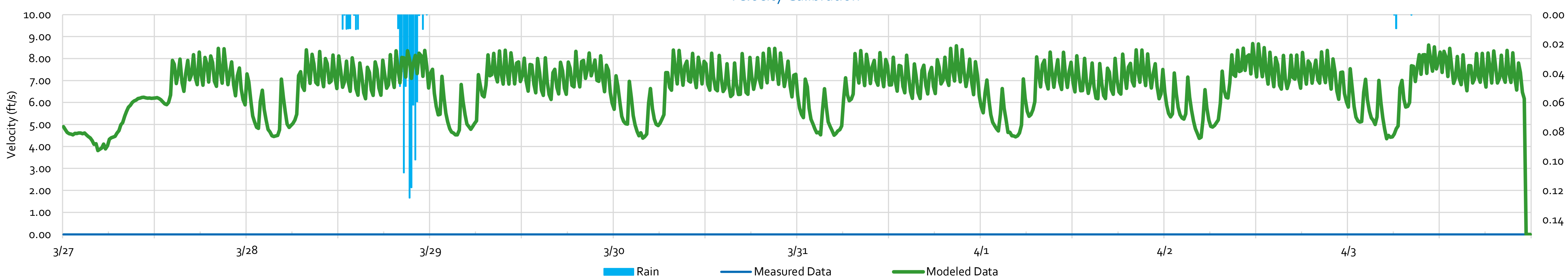


Site 16 Wet Weather Calibration
Location: Via De La Valle, east of Via De La Luna
Pipeline diameter: 20.75"
City Manhole ID: MH-2545
GIS Pipe ID: GM-2893

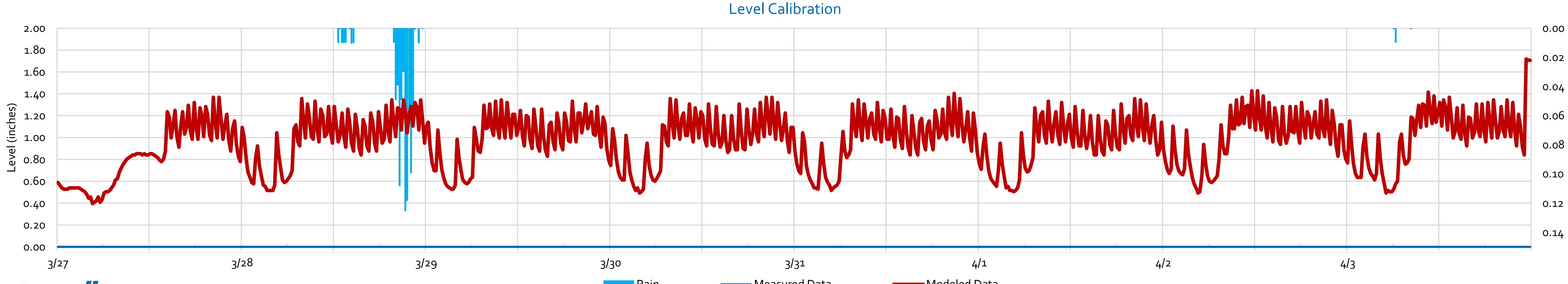
Flow Calibration



Velocity Calibration



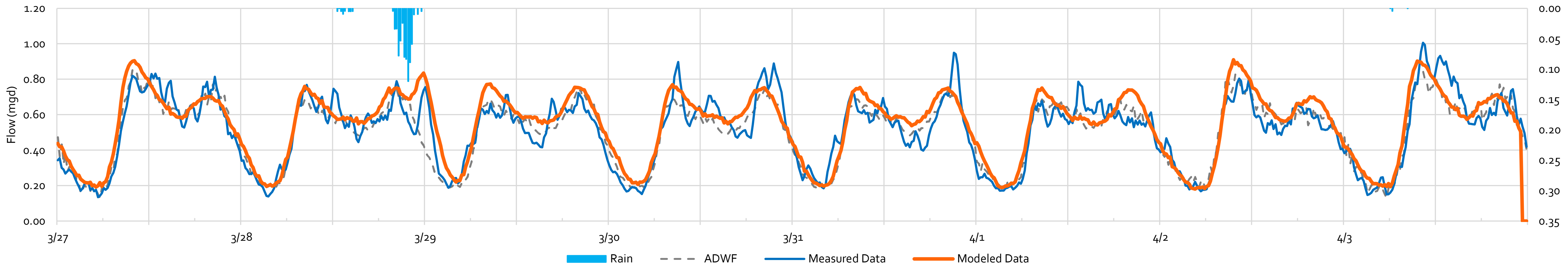
Level Calibration



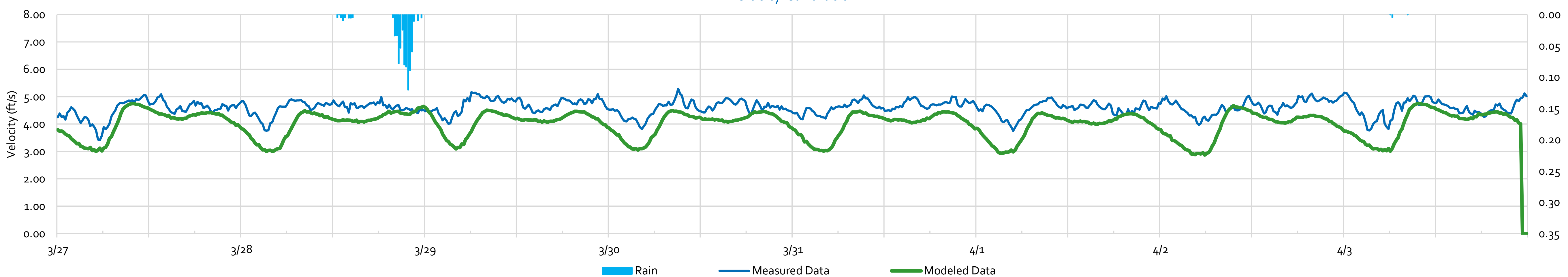
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 17 Wet Weather Calibration
Location: Railroad Canyon Road, near Skylink
Pipeline diameter: 14.75"
City Manhole ID: MH-2613
GIS Pipe ID: GM-2931

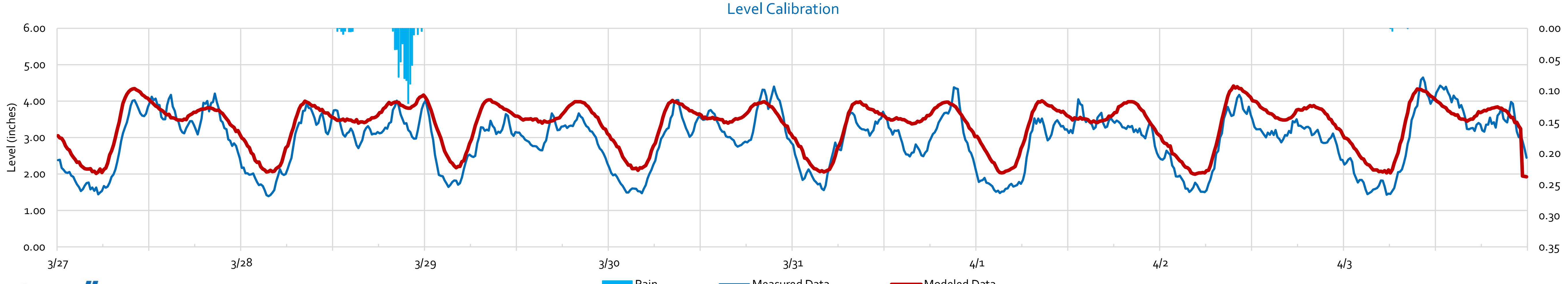
Flow Calibration



Velocity Calibration

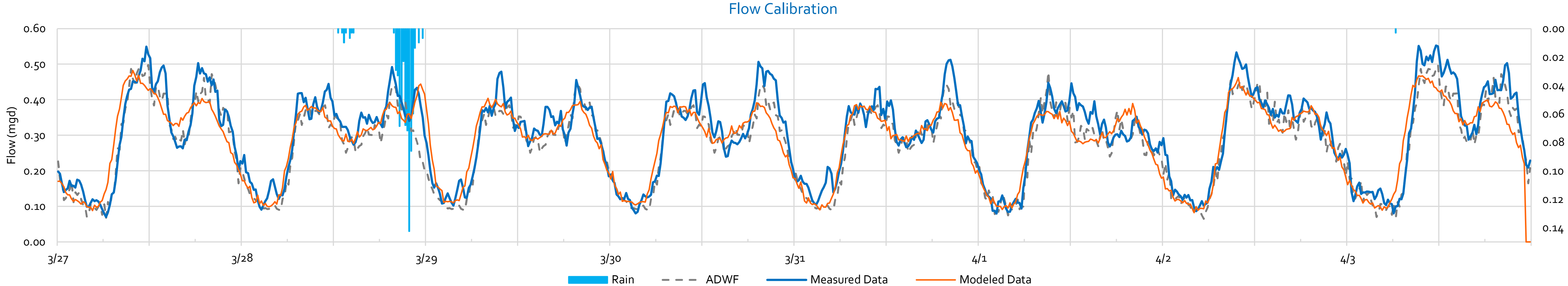


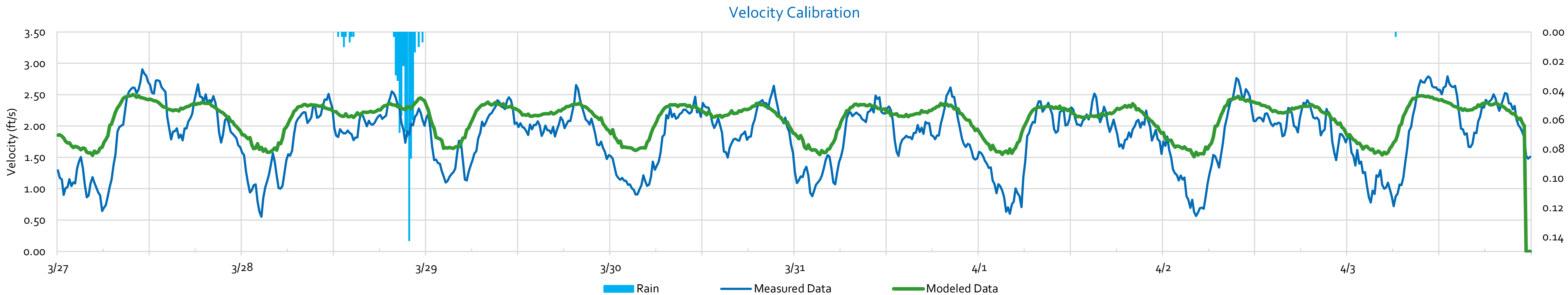
Level Calibration

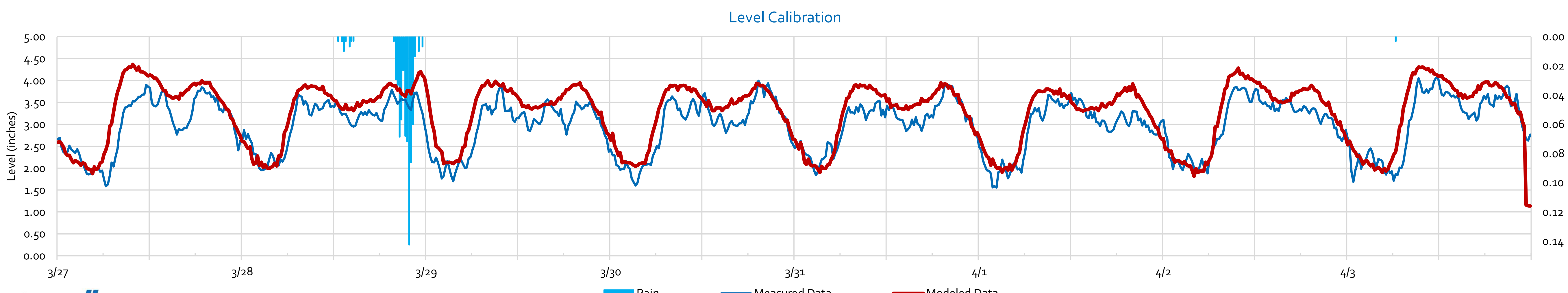


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 18 Wet Weather Calibration
Location: Canyon Lake Country Club
Pipeline diameter: 15"
City Manhole ID: MH-2239
GIS Pipe ID: GM-2551

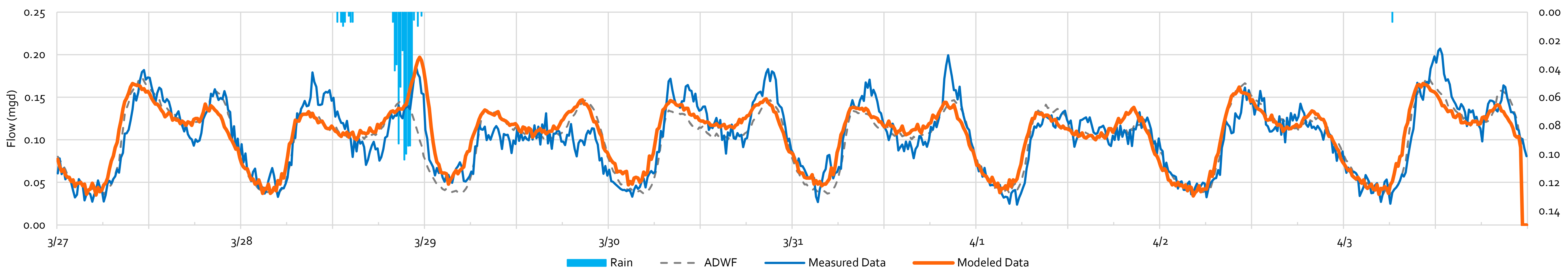




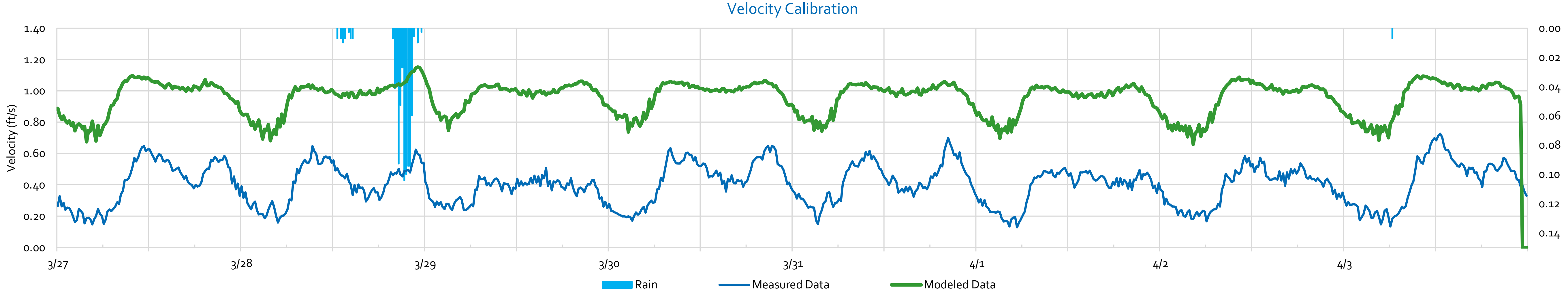


Site 19 Wet Weather Calibration
Location: Redwood Drive and Boating Way
Pipeline diameter: 12"
City Manhole ID: MH-1125
GIS Pipe ID: GM-1305

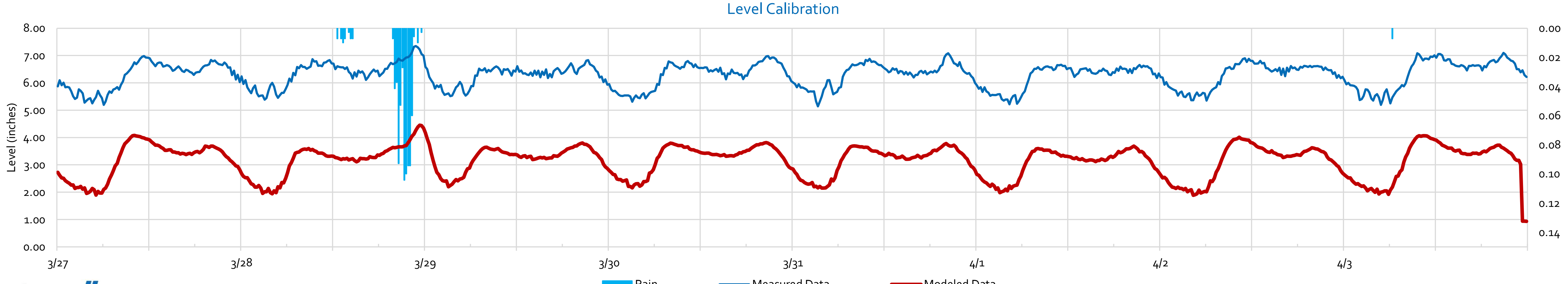
Flow Calibration



Velocity Calibration



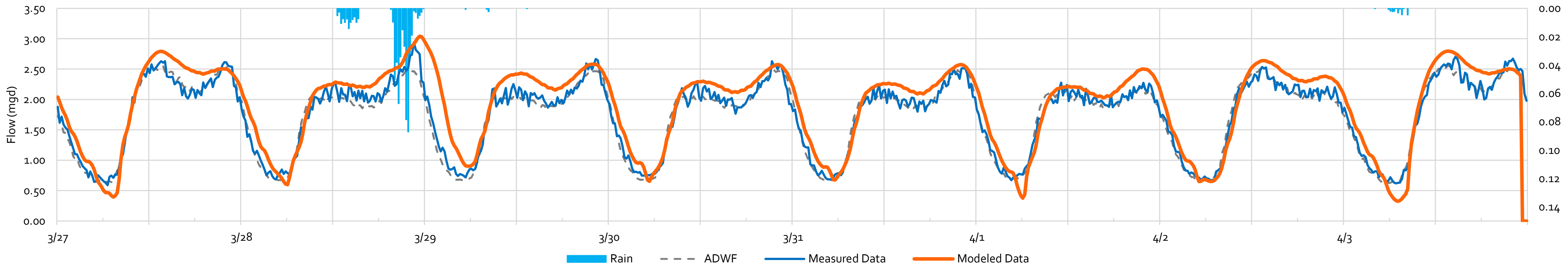
Level Calibration



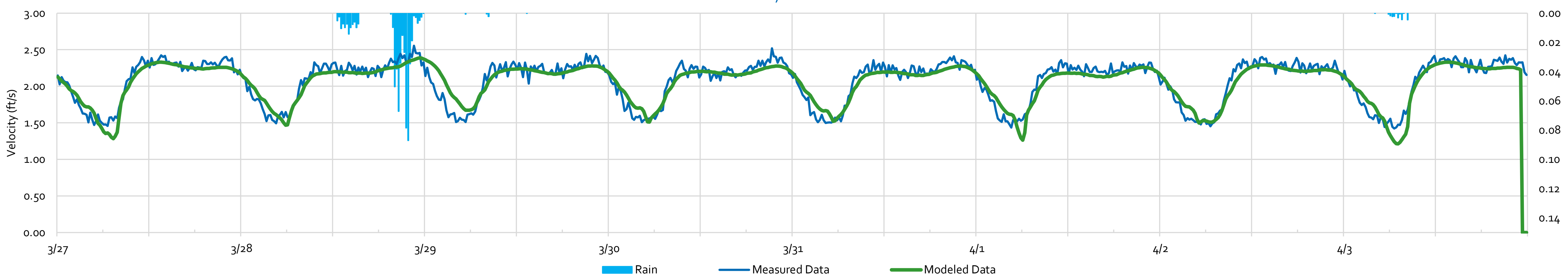
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 20 Wet Weather Calibration
Location: Mission Trail and Olive Street
Pipeline diameter: 21"
City Manhole ID: MH-3330
GIS Pipe ID: GM-3680

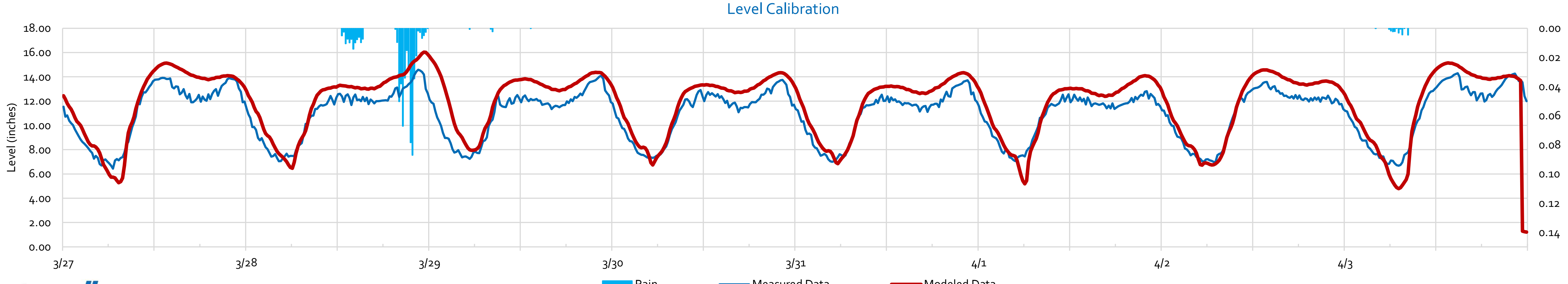
Flow Calibration



Velocity Calibration

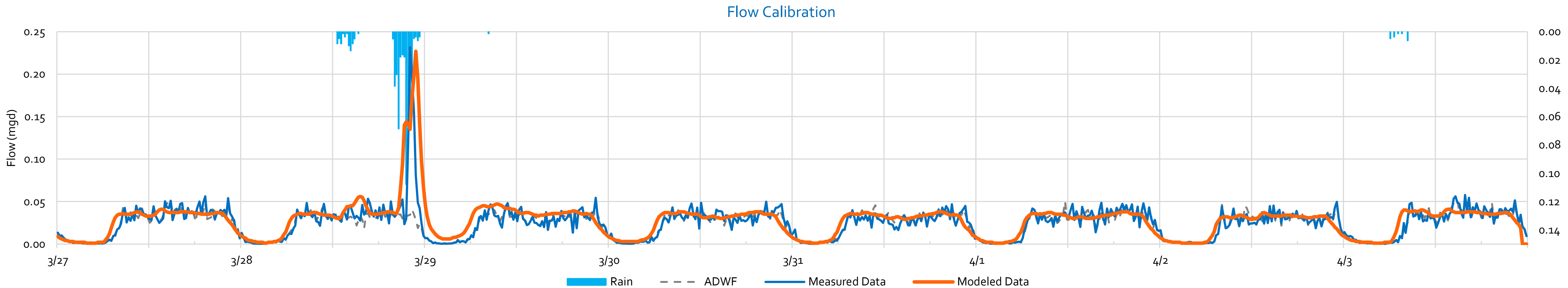


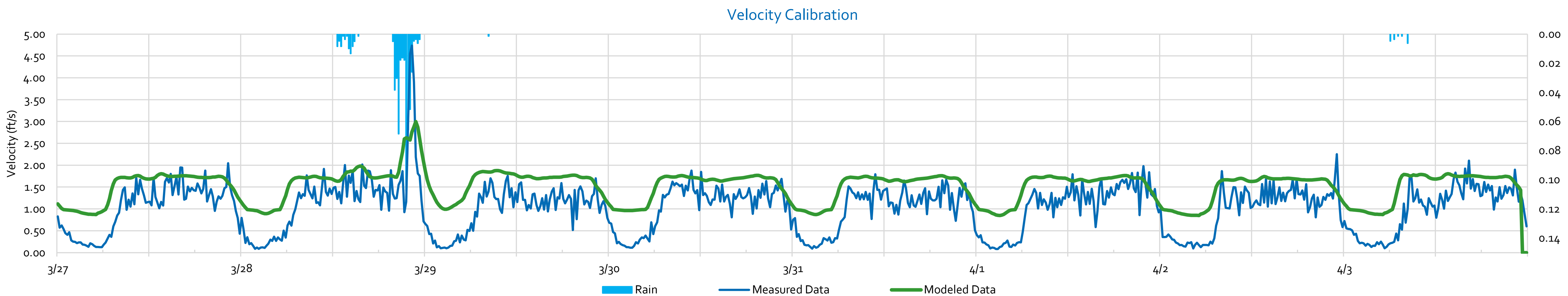
Level Calibration

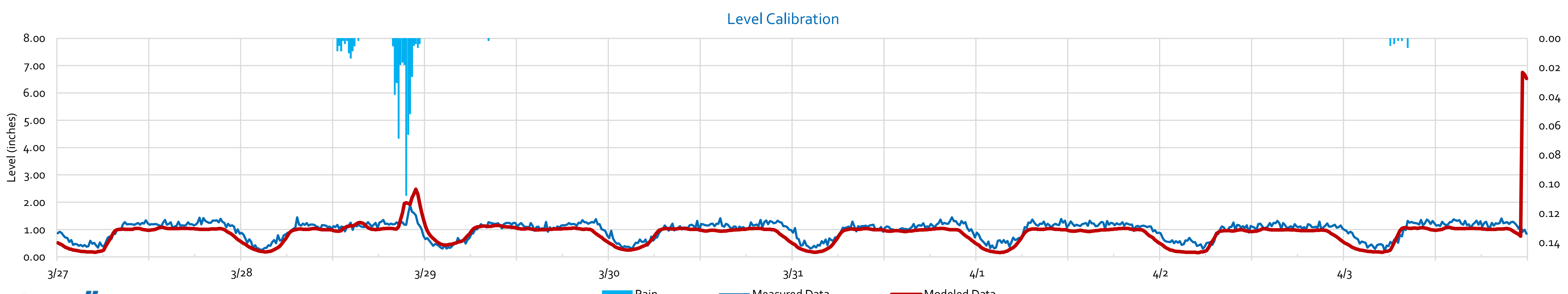


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 21 Wet Weather Calibration
Location: Lemon Street and Mission Trail
Pipeline diameter: 11.75"
City Manhole ID: MH-3460
GIS Pipe ID: GM-3927



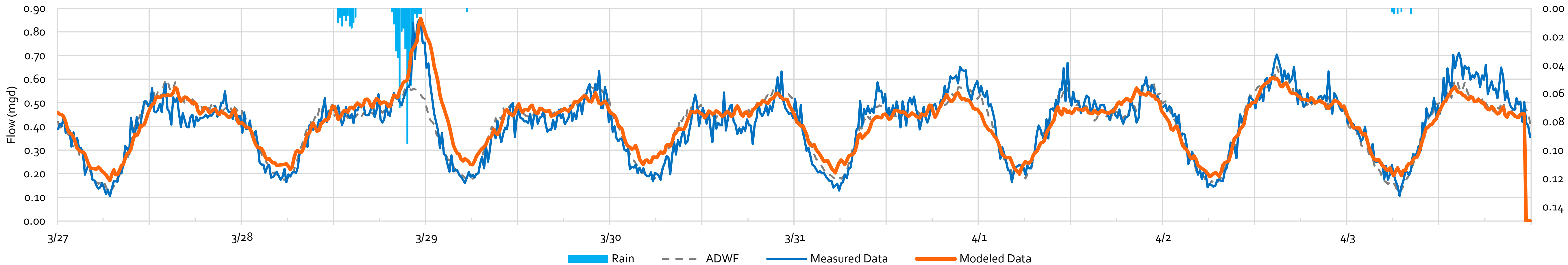




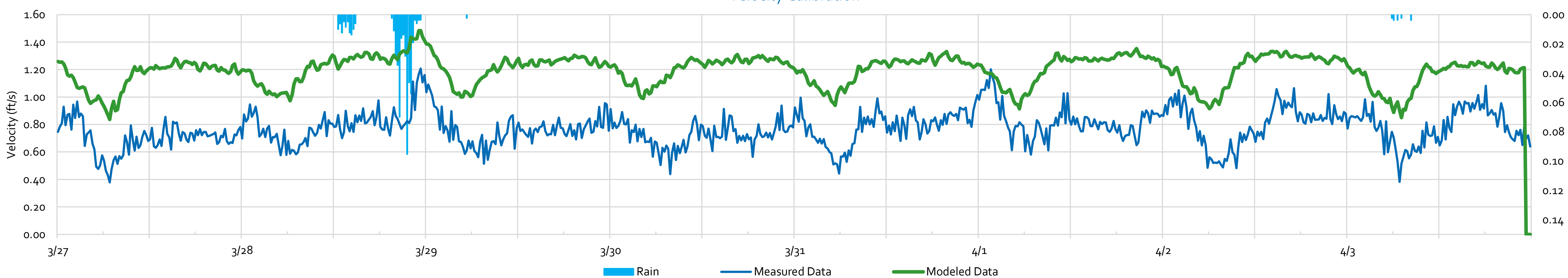
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 22 Wet Weather Calibration
Location: Mission Trail Road, shoulder
Pipeline diameter: 18"
City Manhole ID: MH-3446
GIS Pipe ID: GM-3974

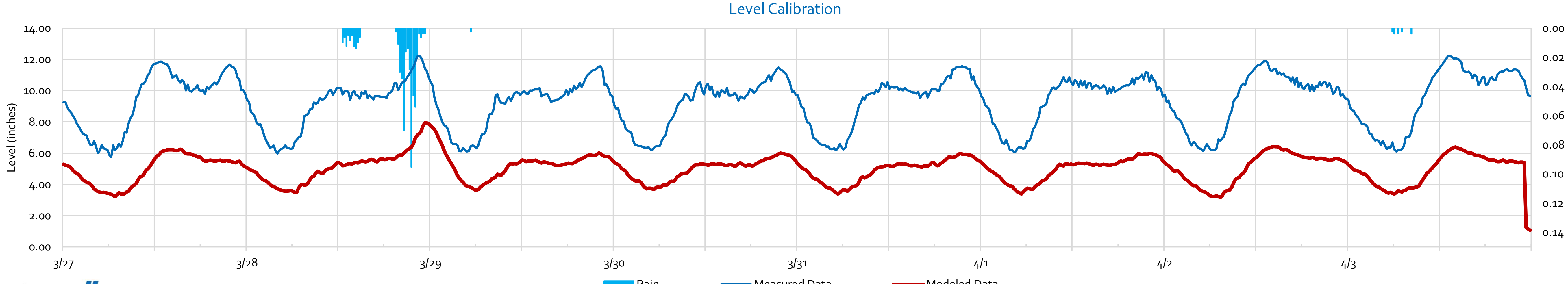
Flow Calibration



Velocity Calibration



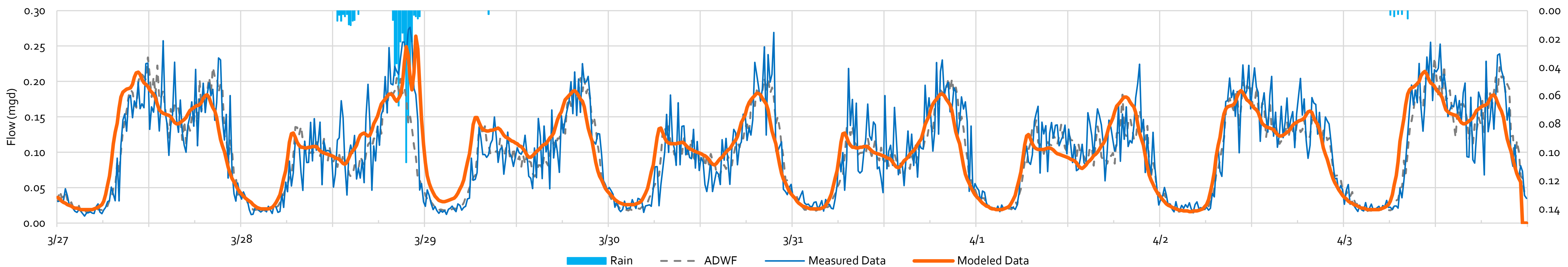
Level Calibration



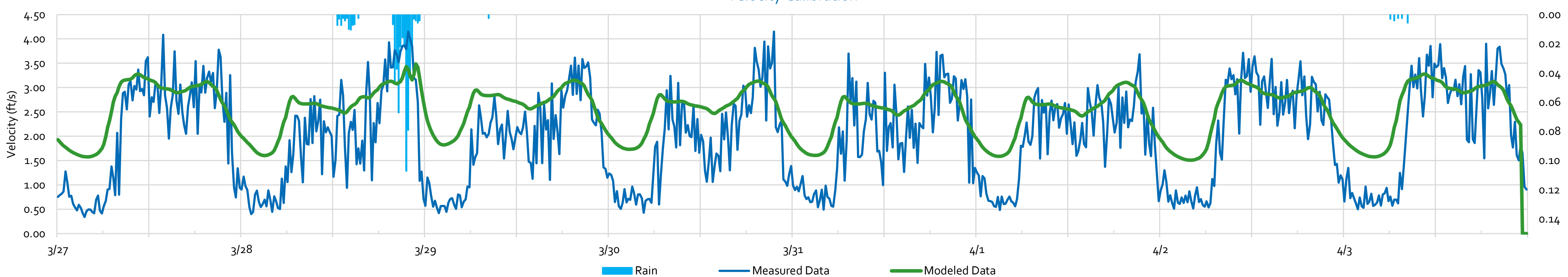
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 23 Wet Weather Calibration
Location: Bundy Canyon Road and Mission Trail
Pipeline diameter: 12"
City Manhole ID: MH-3677
GIS Pipe ID: GM-4193

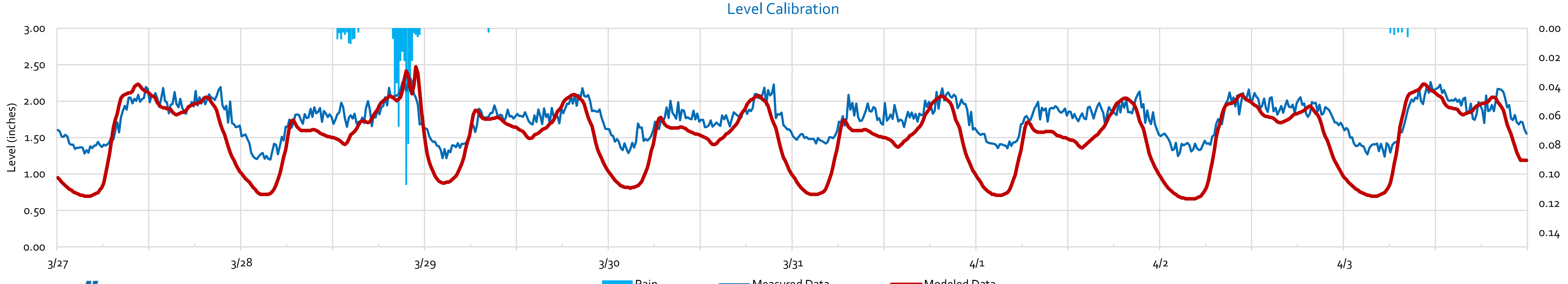
Flow Calibration



Velocity Calibration

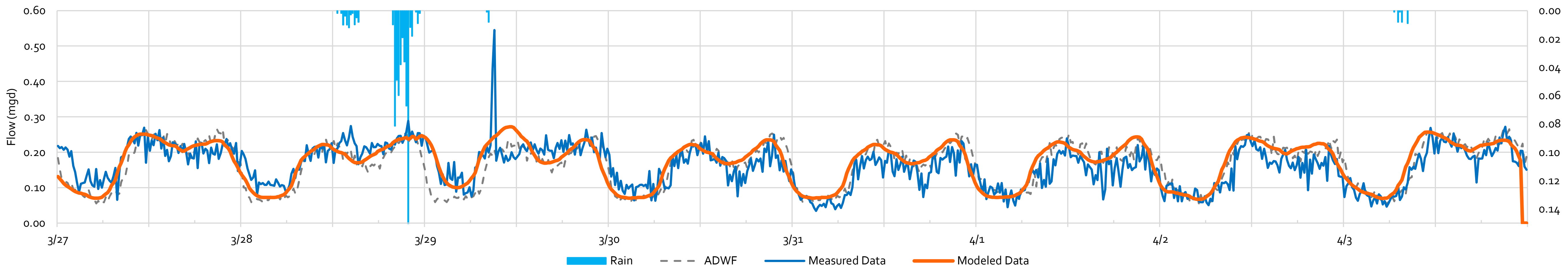


Level Calibration

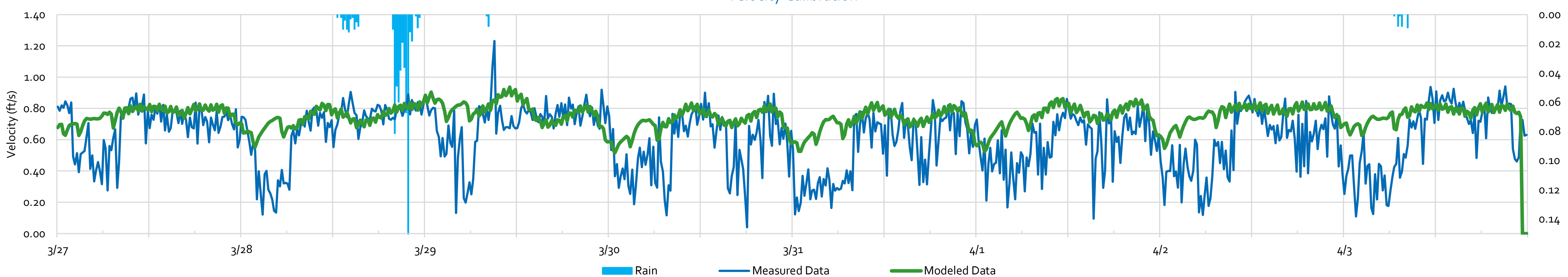


Site 24 Wet Weather Calibration
Location: McVicar Street 32555
Pipeline diameter: 23.75"
City Manhole ID: MH-4236
GIS Pipe ID: GM-4818

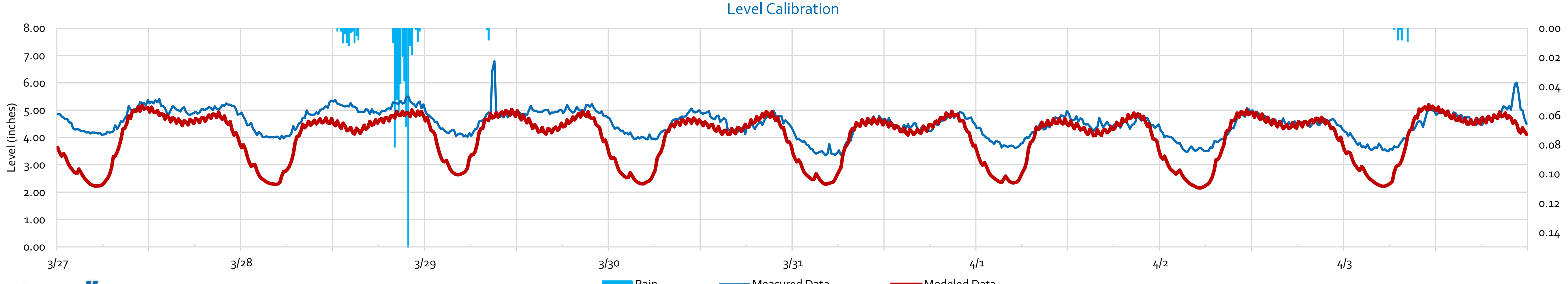
Flow Calibration



Velocity Calibration



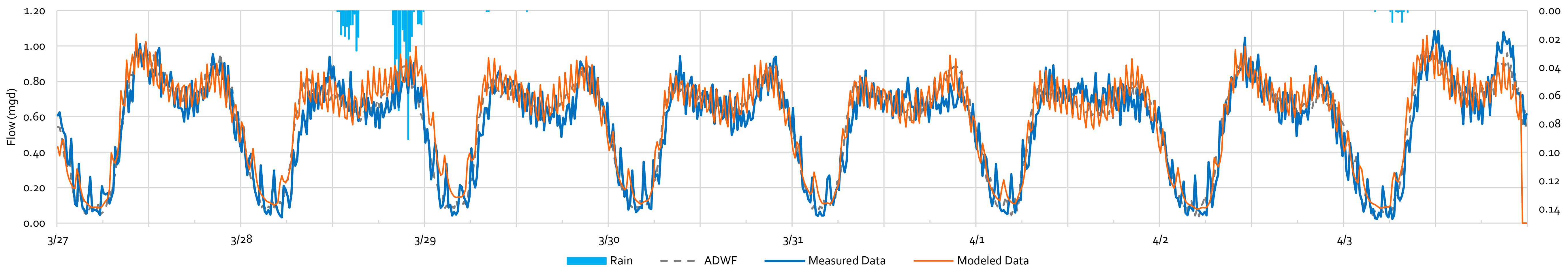
Level Calibration



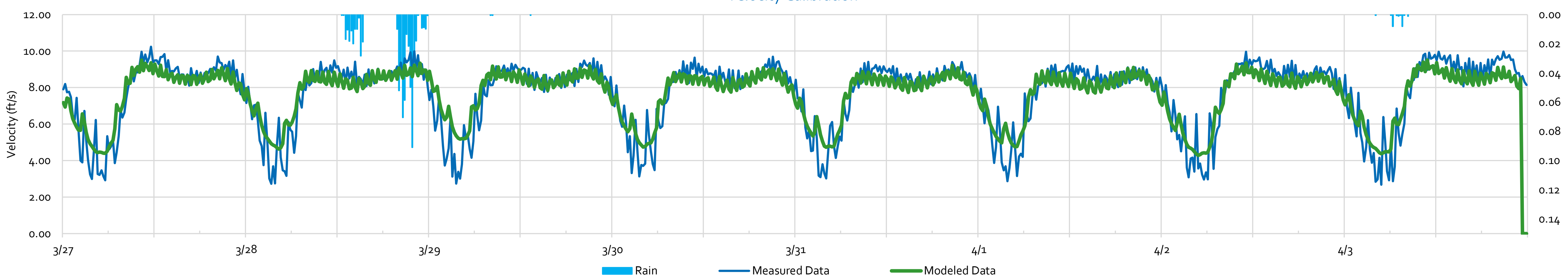
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 25 Wet Weather Calibration
Location: Catt Road and Nan Street
Pipeline diameter: 23.75"
City Manhole ID: MH-5031
GIS Pipe ID: GM-5705

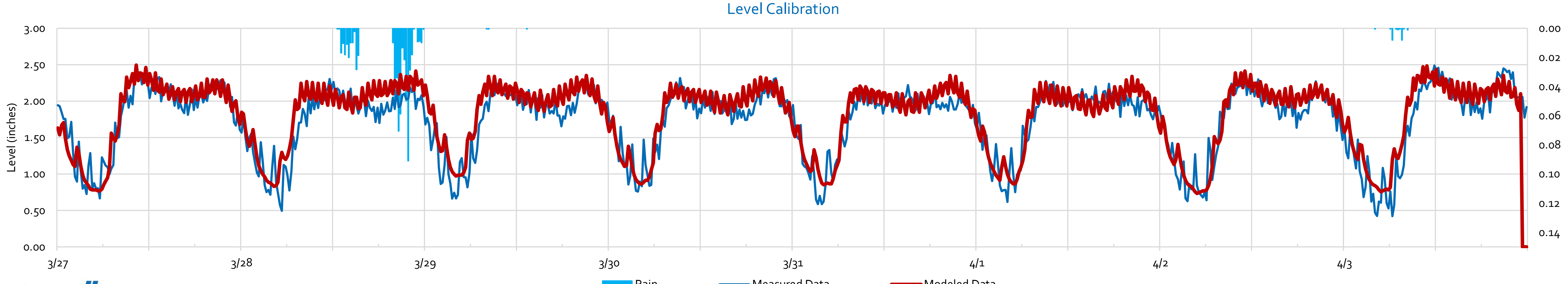
Flow Calibration



Velocity Calibration



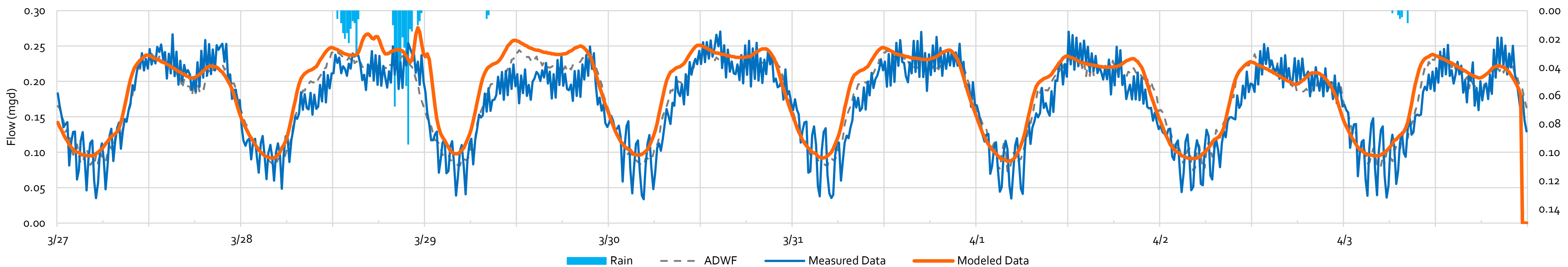
Level Calibration



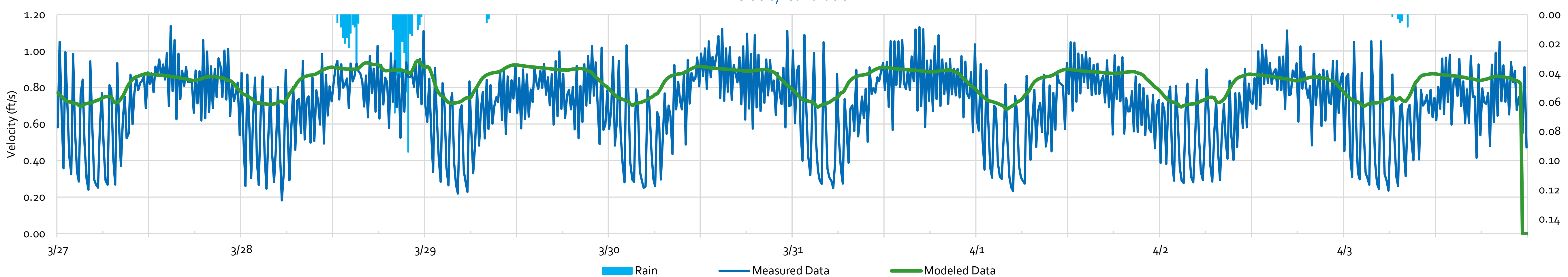
ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

Site 26 Wet Weather Calibration
Location: Palomar Street and Delca Lane
Pipeline diameter: 20.75"
City Manhole ID: MH-7177
GIS Pipe ID: GM-7136

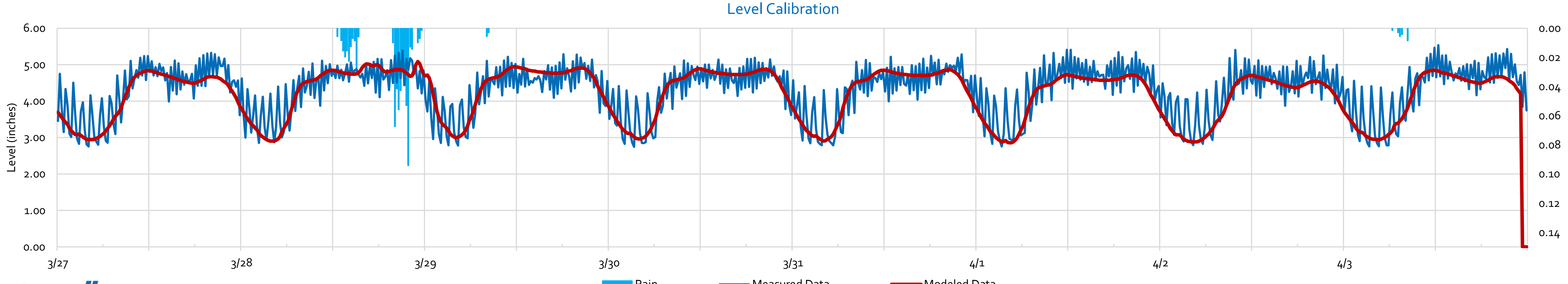
Flow Calibration



Velocity Calibration



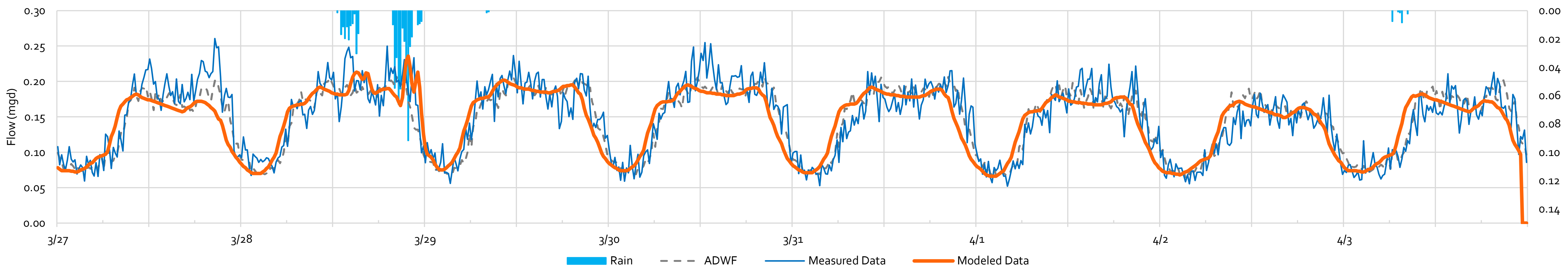
Level Calibration



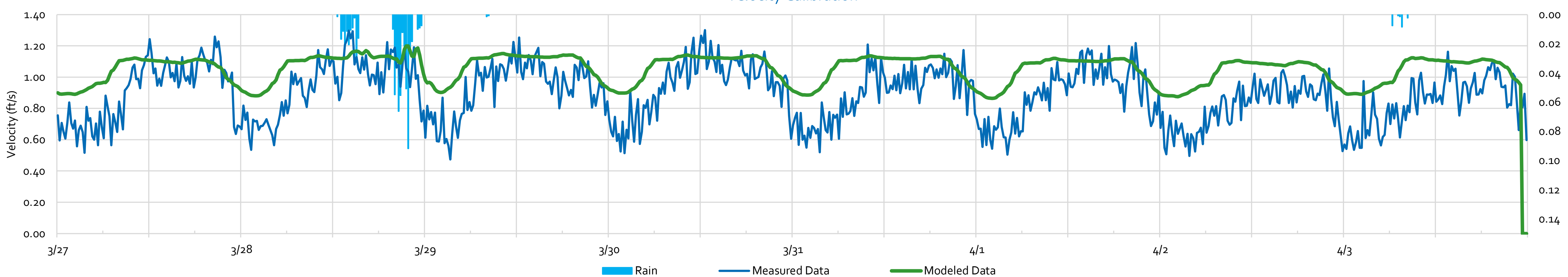
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 27 Wet Weather Calibration
Location: Hardwood Lane and Wing Elm Circle
Pipeline diameter: 14.75"
City Manhole ID: MH-4513
GIS Pipe ID: GM-5116

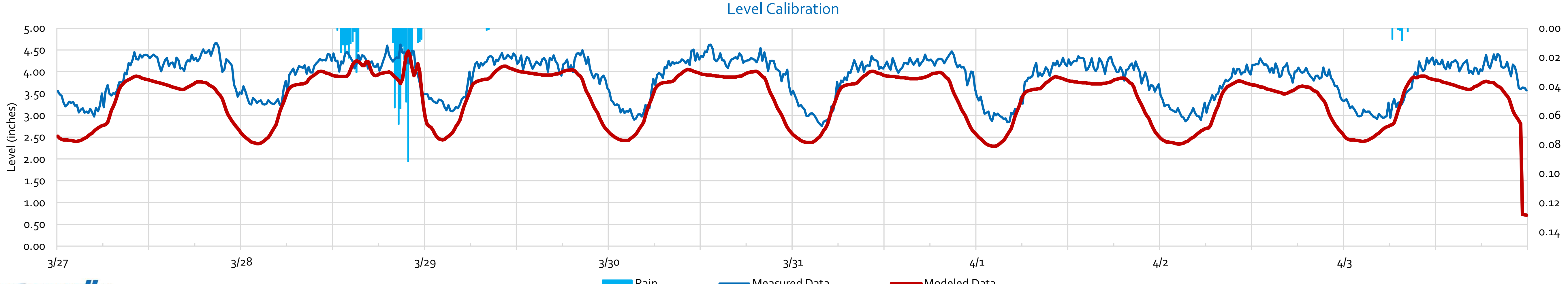
Flow Calibration



Velocity Calibration



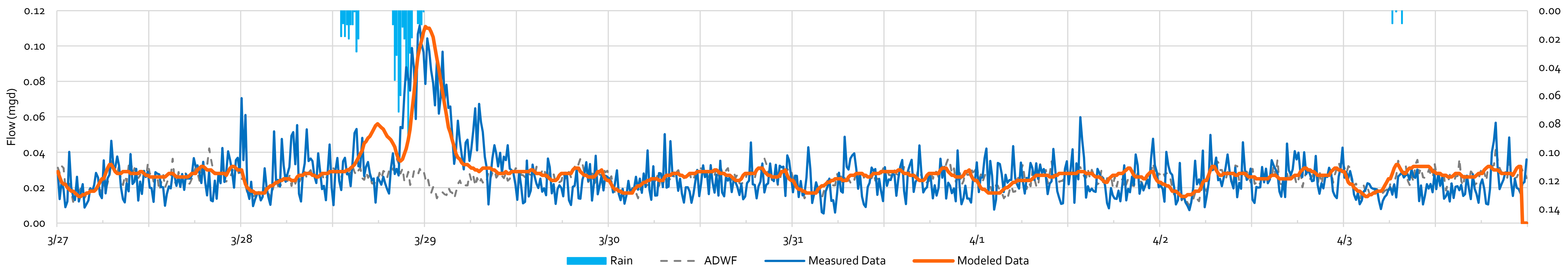
Level Calibration



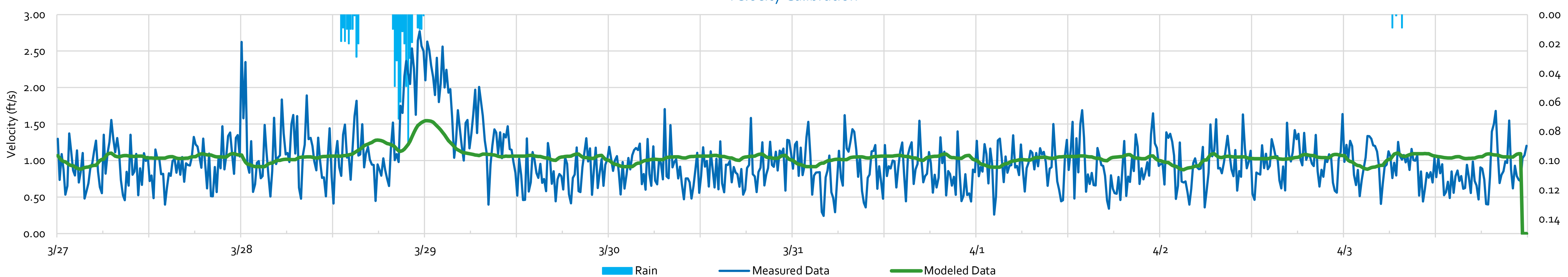
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 28 Wet Weather Calibration
Location: Nutmeg Street, west of Jackson Avenue
Pipeline diameter: 11.75"
City Manhole ID: MH-4735
GIS Pipe ID: GM-6218

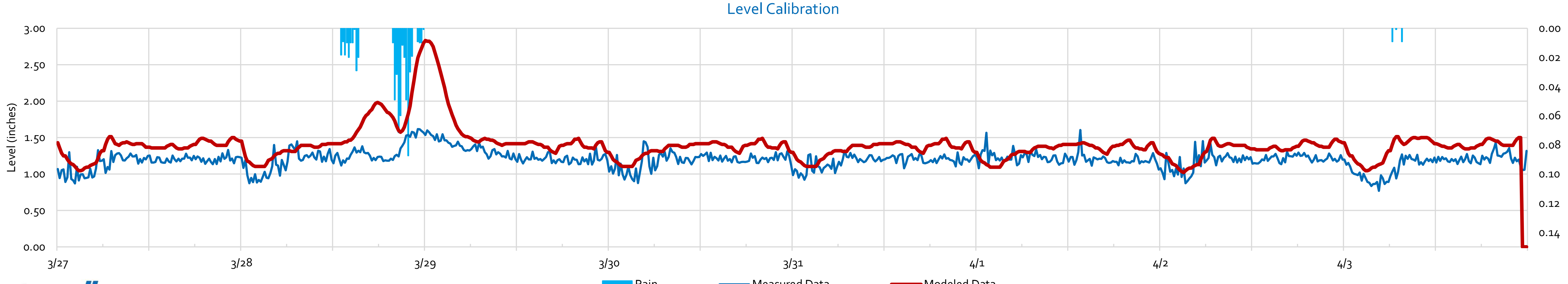
Flow Calibration



Velocity Calibration



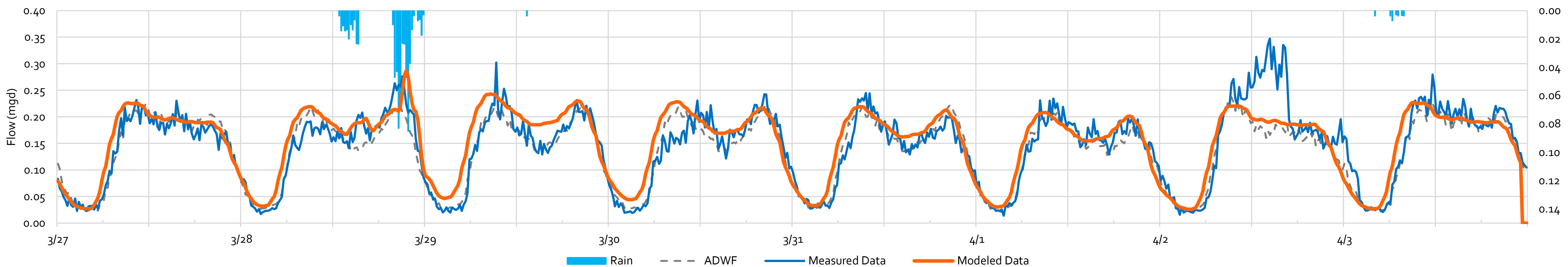
Level Calibration



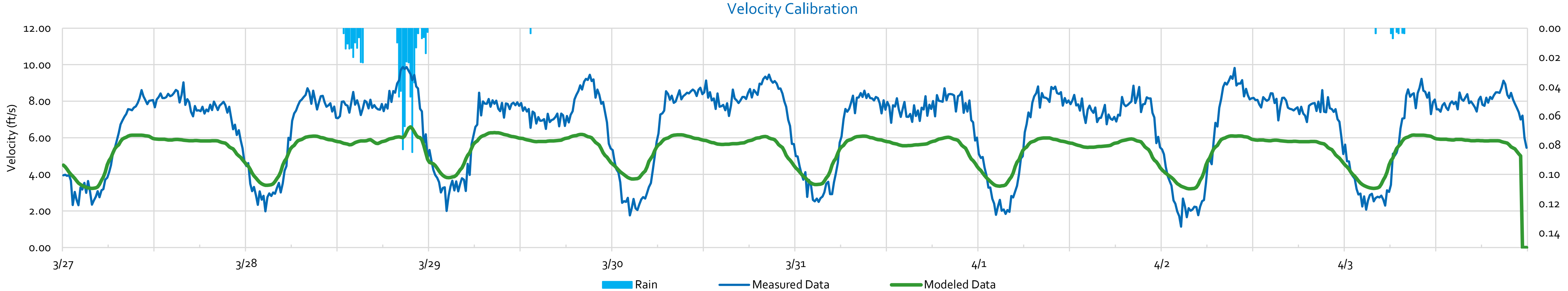
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 29 Wet Weather Calibration
Location: Nutmeg Street, we of Gingerbread Drive
Pipeline diameter: 9.75"
City Manhole ID: MH-4626
GIS Pipe ID: GM-5276

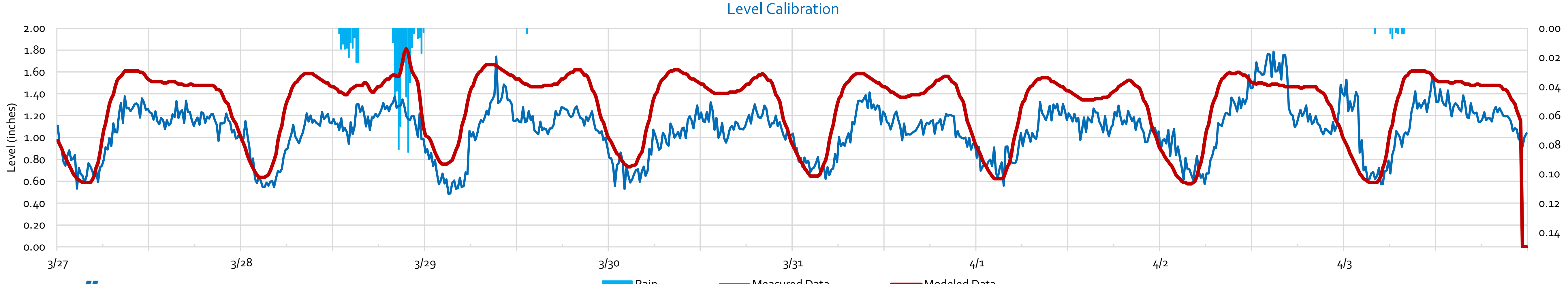
Flow Calibration



Velocity Calibration



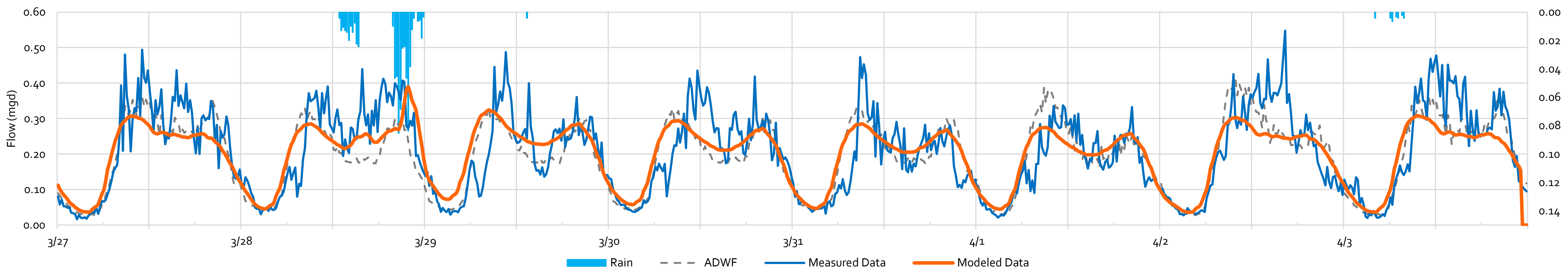
Level Calibration



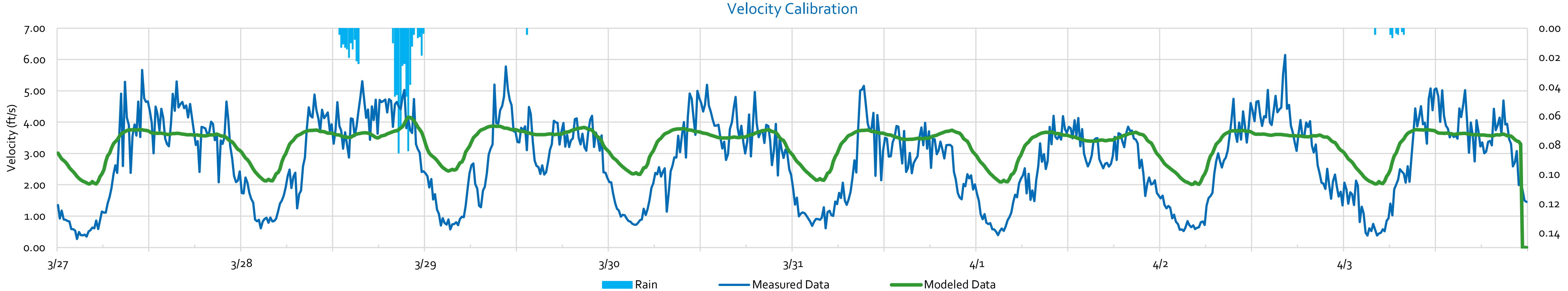
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 30 Wet Weather Calibration
Location: Colony Drive, west of Avenida Florita
Pipeline diameter: 9.75"
City Manhole ID: MH-4752
GIS Pipe ID: GM-5404

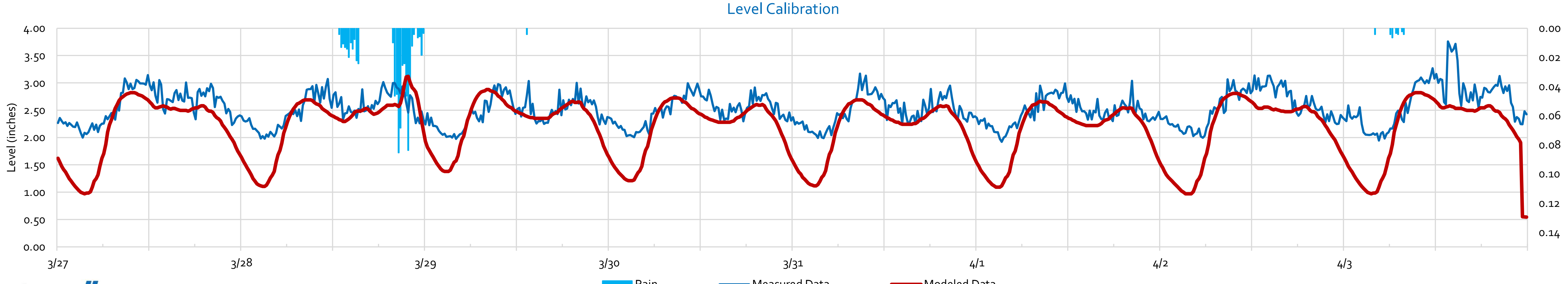
Flow Calibration



Velocity Calibration



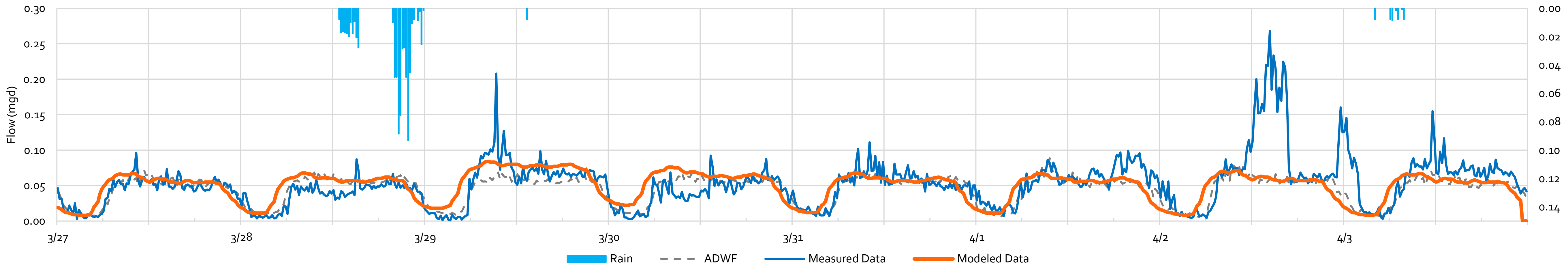
Level Calibration



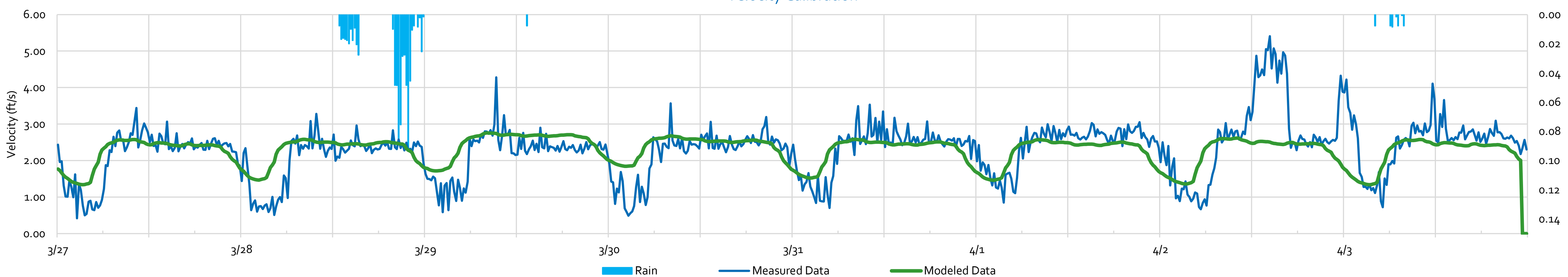
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 31 Wet Weather Calibration
Location: Nutmeg Street, south of Saint Rafael Drive
Pipeline diameter: 10"
City Manhole ID: MH-4344
GIS Pipe ID: GM-4965

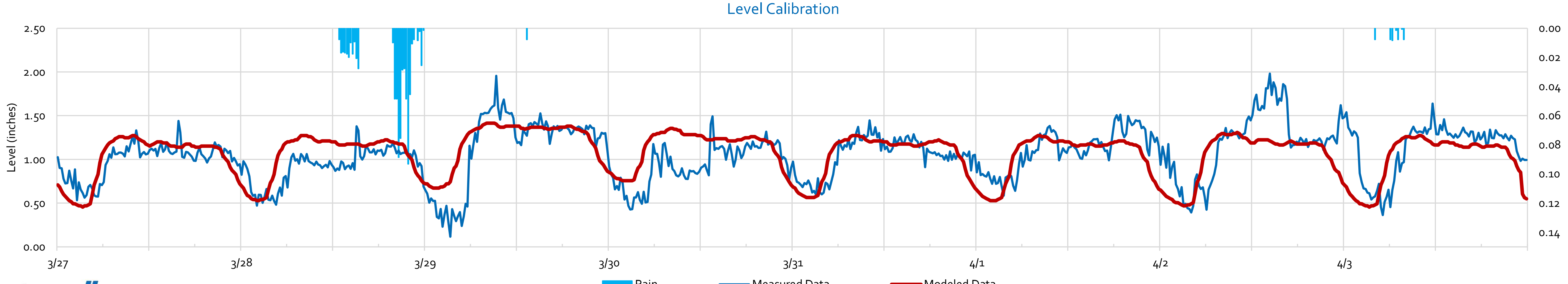
Flow Calibration



Velocity Calibration



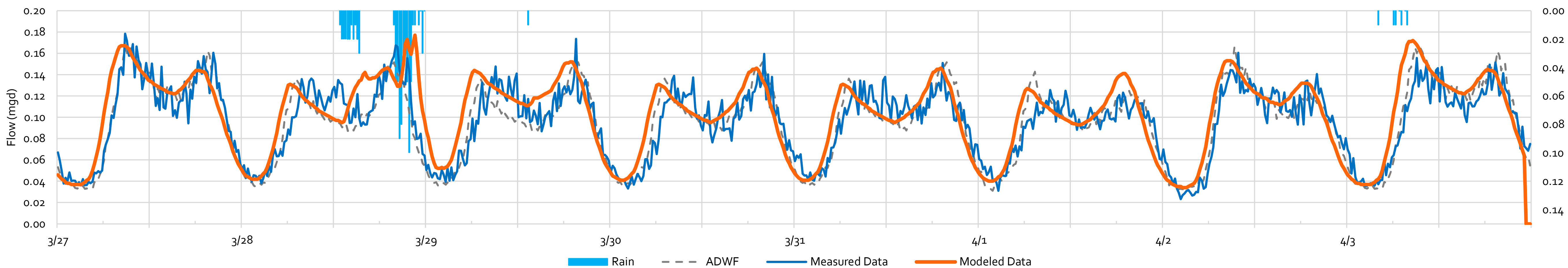
Level Calibration



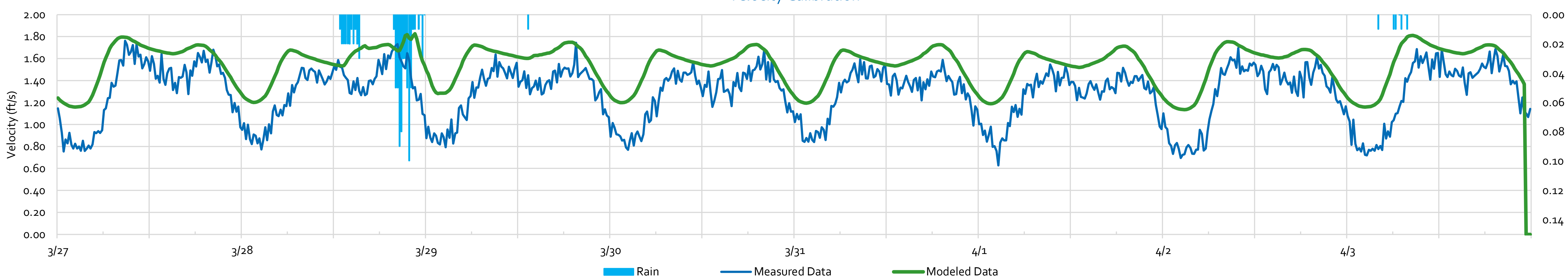
ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

Site 32 Wet Weather Calibration
Location: Tarragona Drive, east of Almansa Court
Pipeline diameter: 9.75"
City Manhole ID: MH-4711
GIS Pipe ID: GM-5323

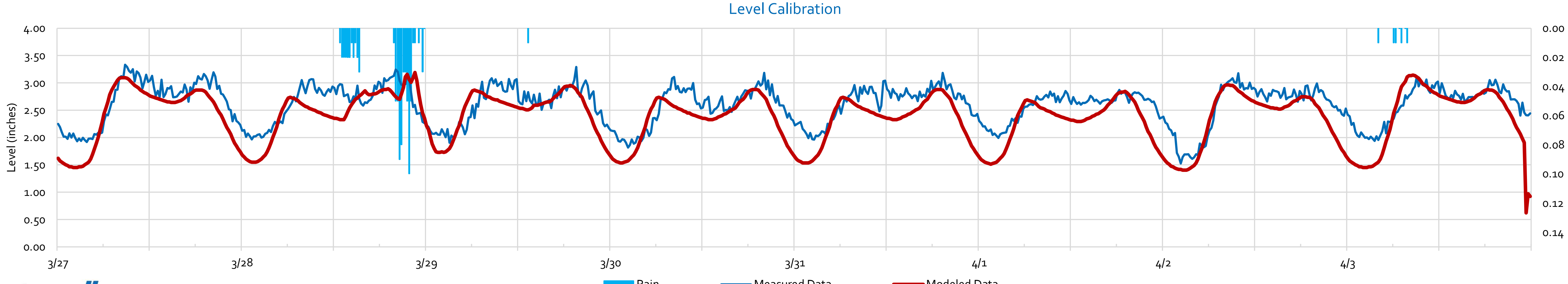
Flow Calibration



Velocity Calibration

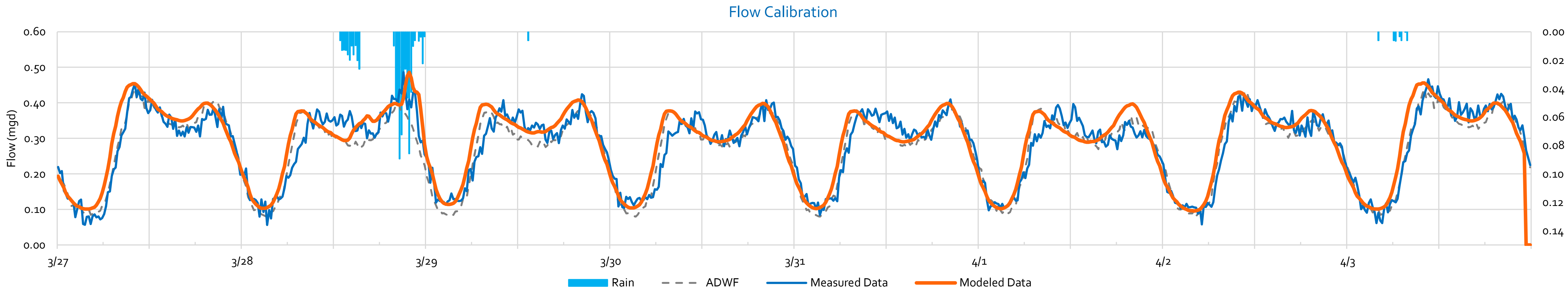


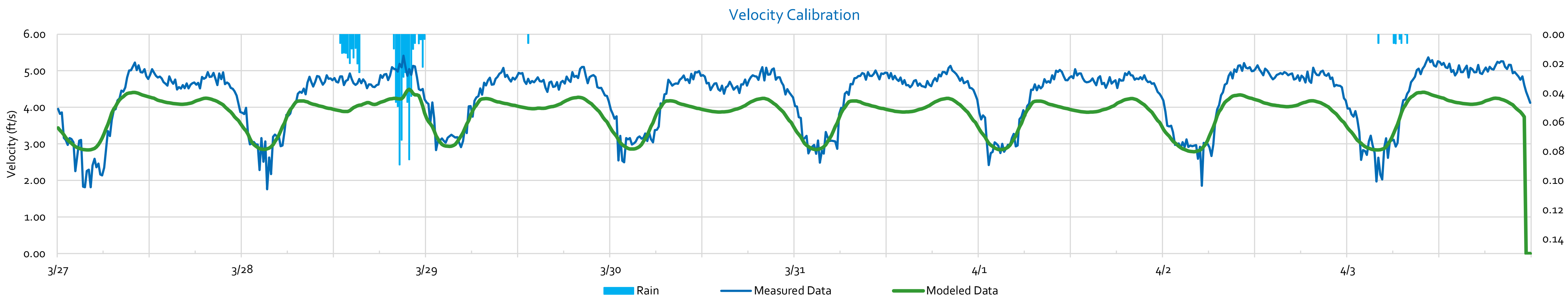
Level Calibration

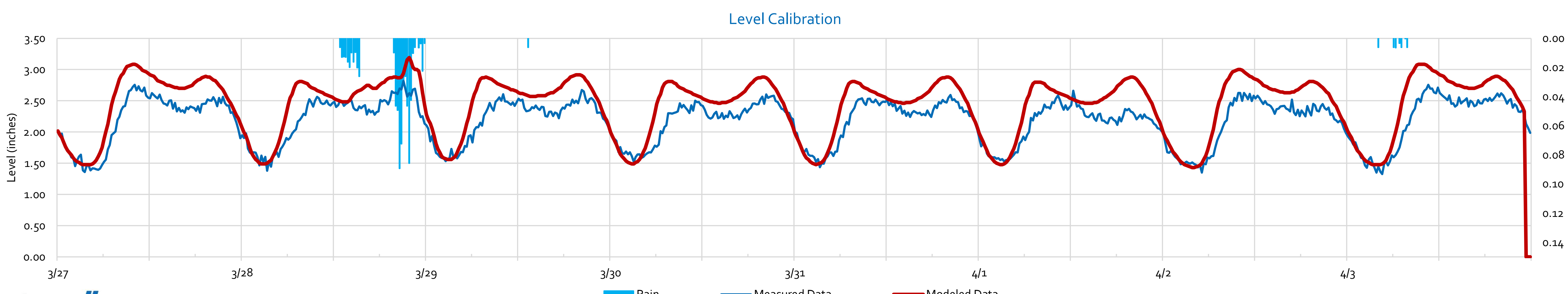


ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 33 Wet Weather Calibration
Location: Behind Via Tonada in California Oaks Golf Course
Pipeline diameter: 11.75"
City Manhole ID: MH-4877
GIS Pipe ID: GM-5555



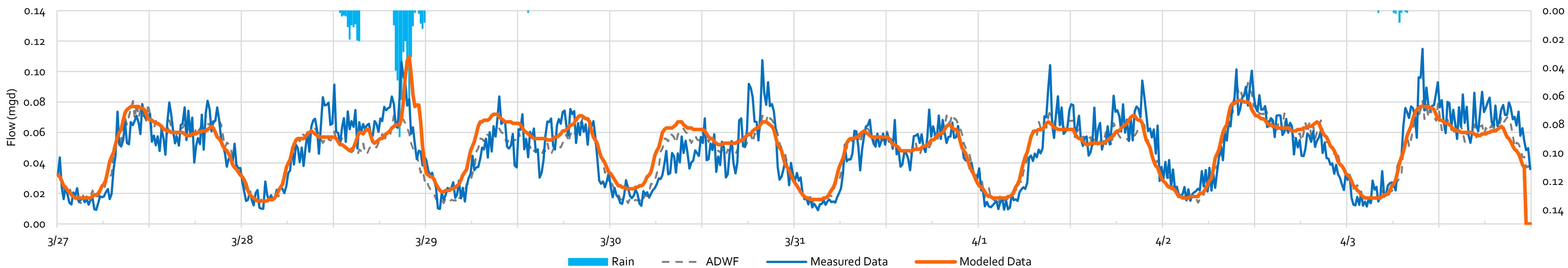




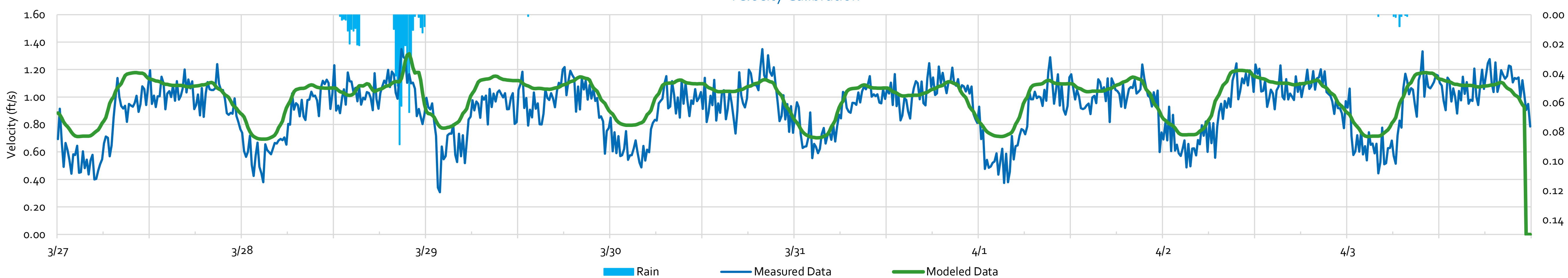
ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Site 34 Wet Weather Calibration
Location: Symphony Park Lane and Chalone Drive
Pipeline diameter: 9.75"
City Manhole ID: MH-4954
GIS Pipe ID: GM-5624

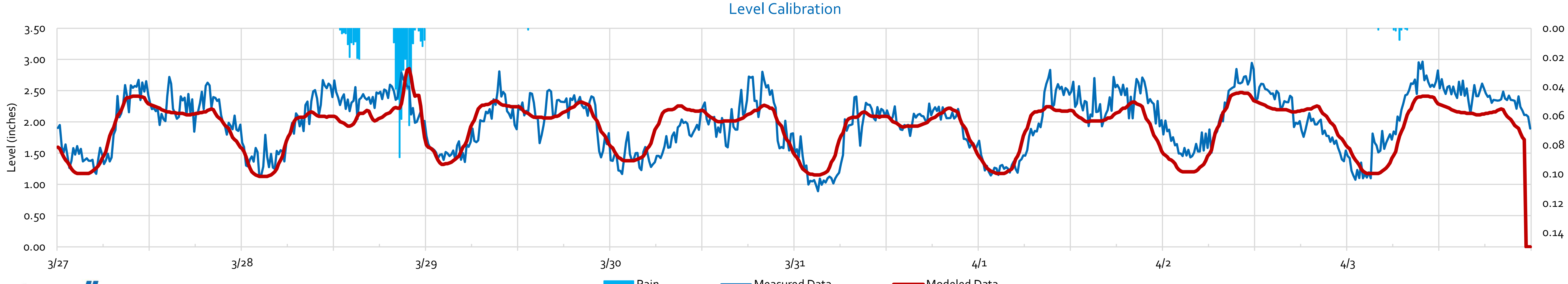
Flow Calibration



Velocity Calibration



Level Calibration



Appendix C

HYDRAULIC GRADE LINES

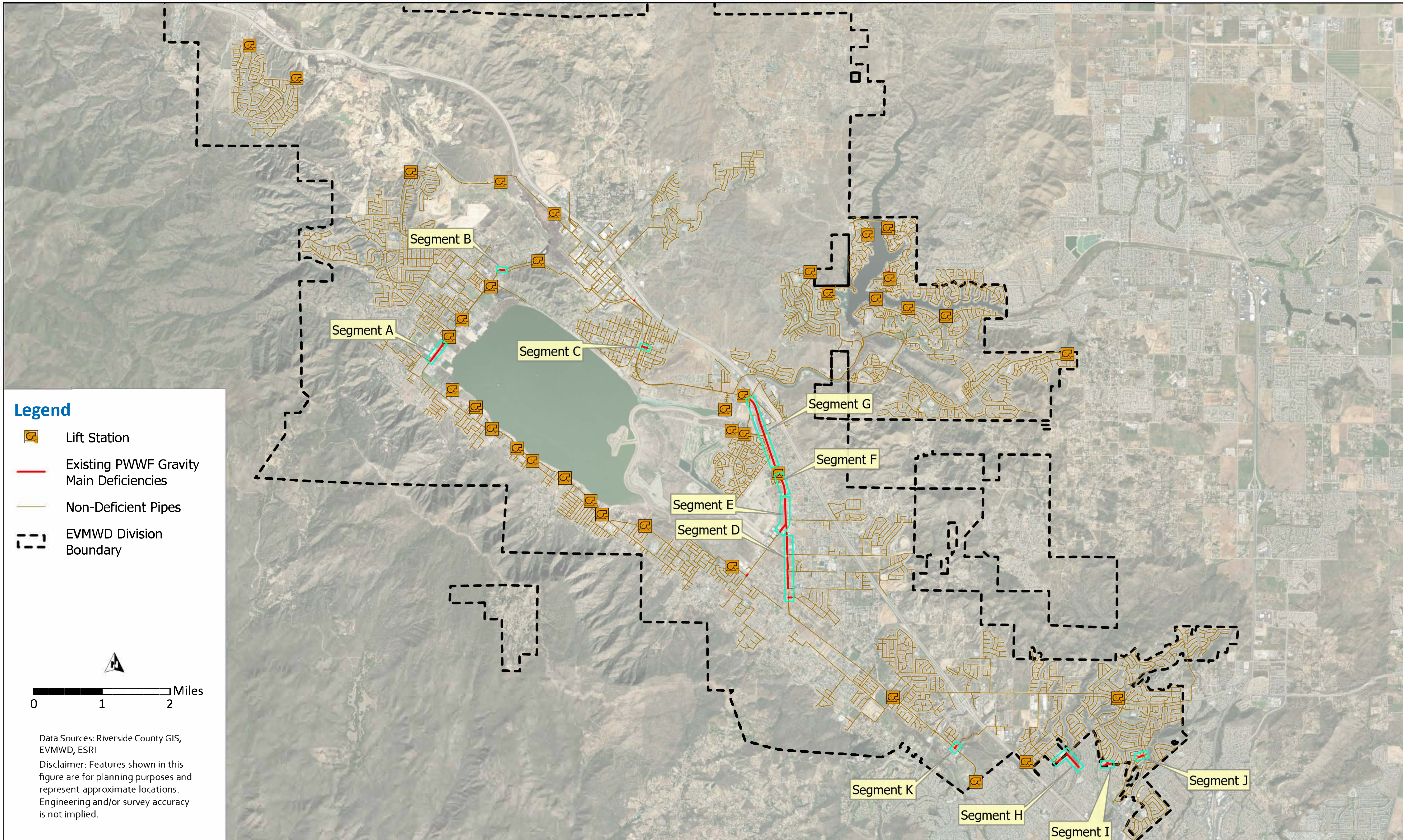


Figure 1 Existing PWWF Gravity Main Deficiencies

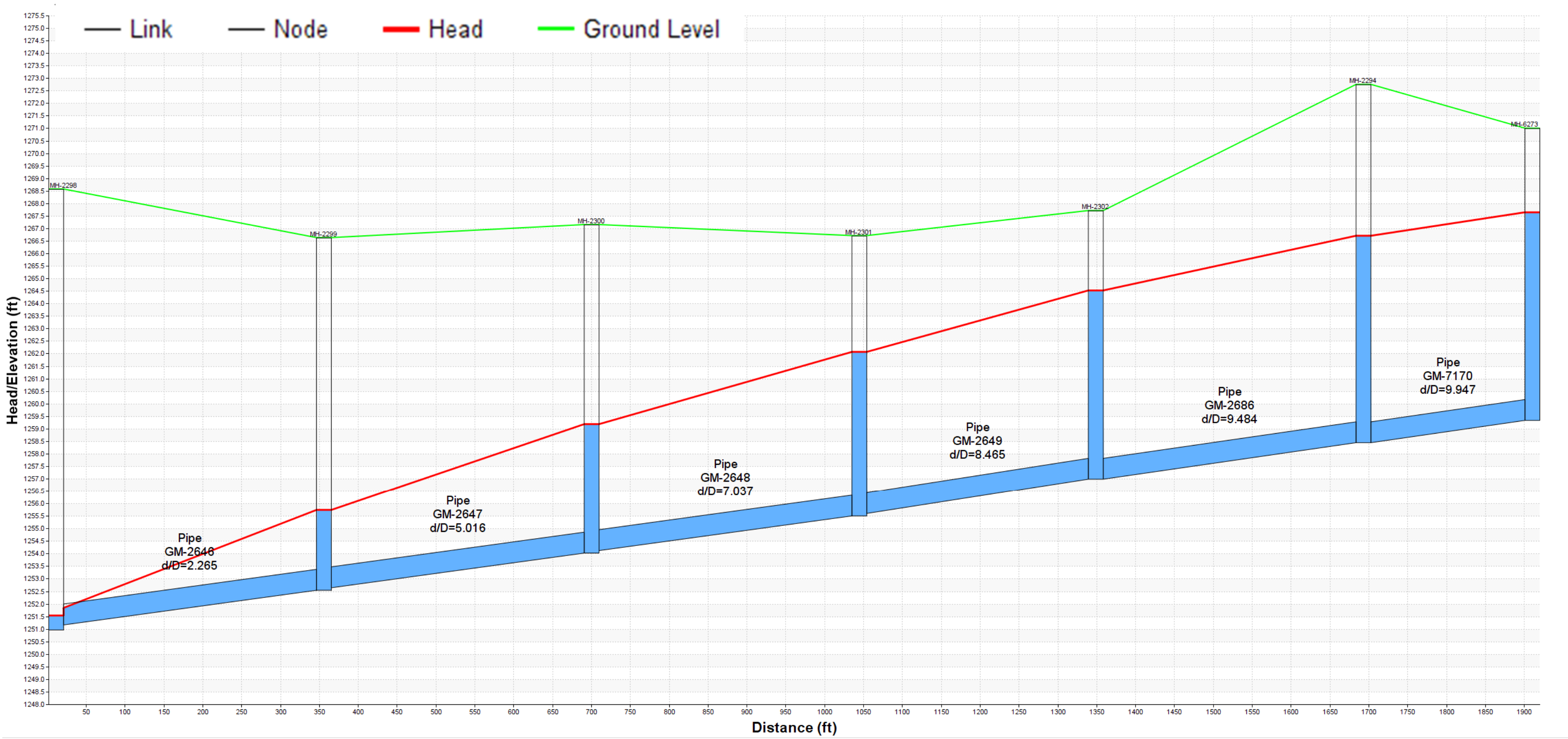


Figure 2 Segment A

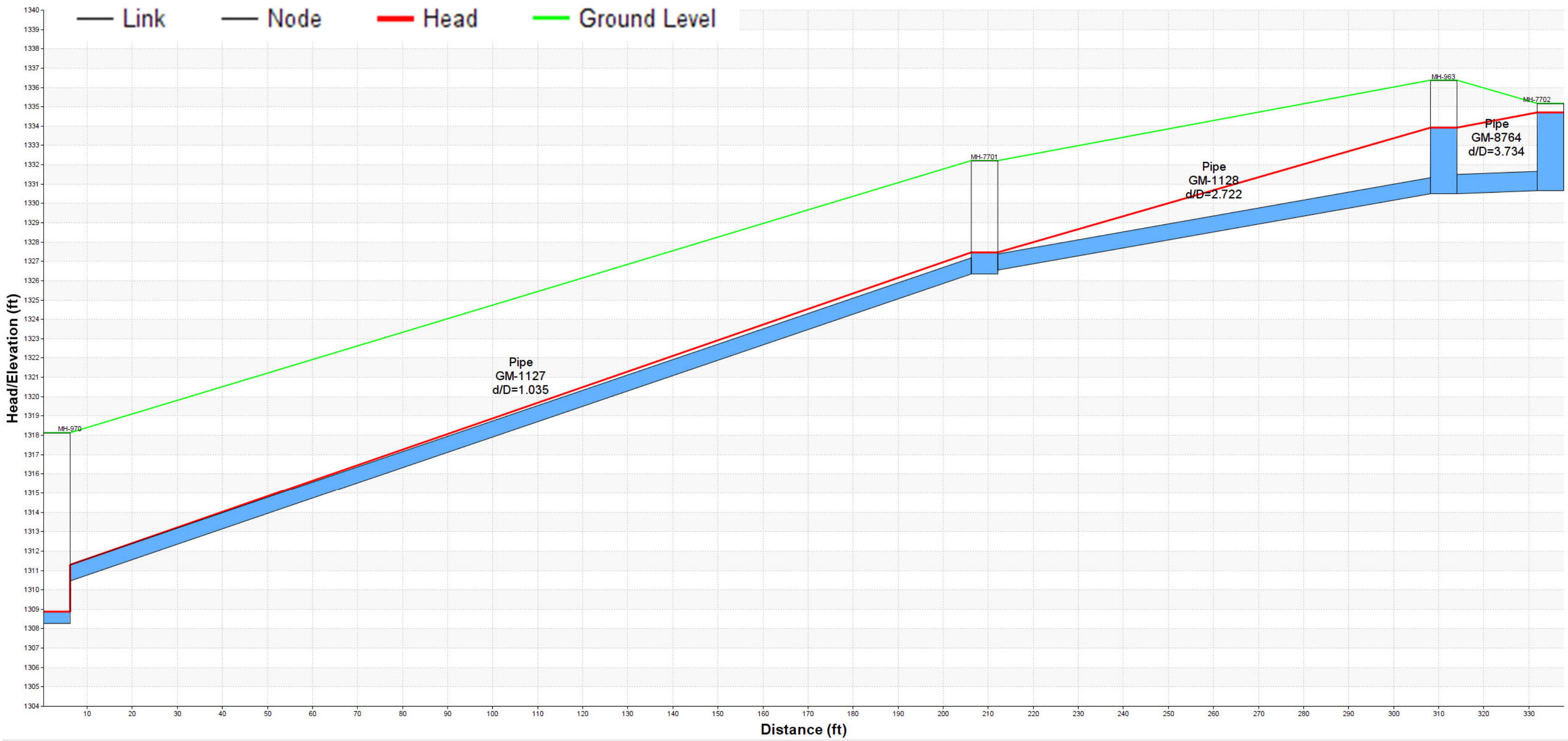


Figure 3 Segment B

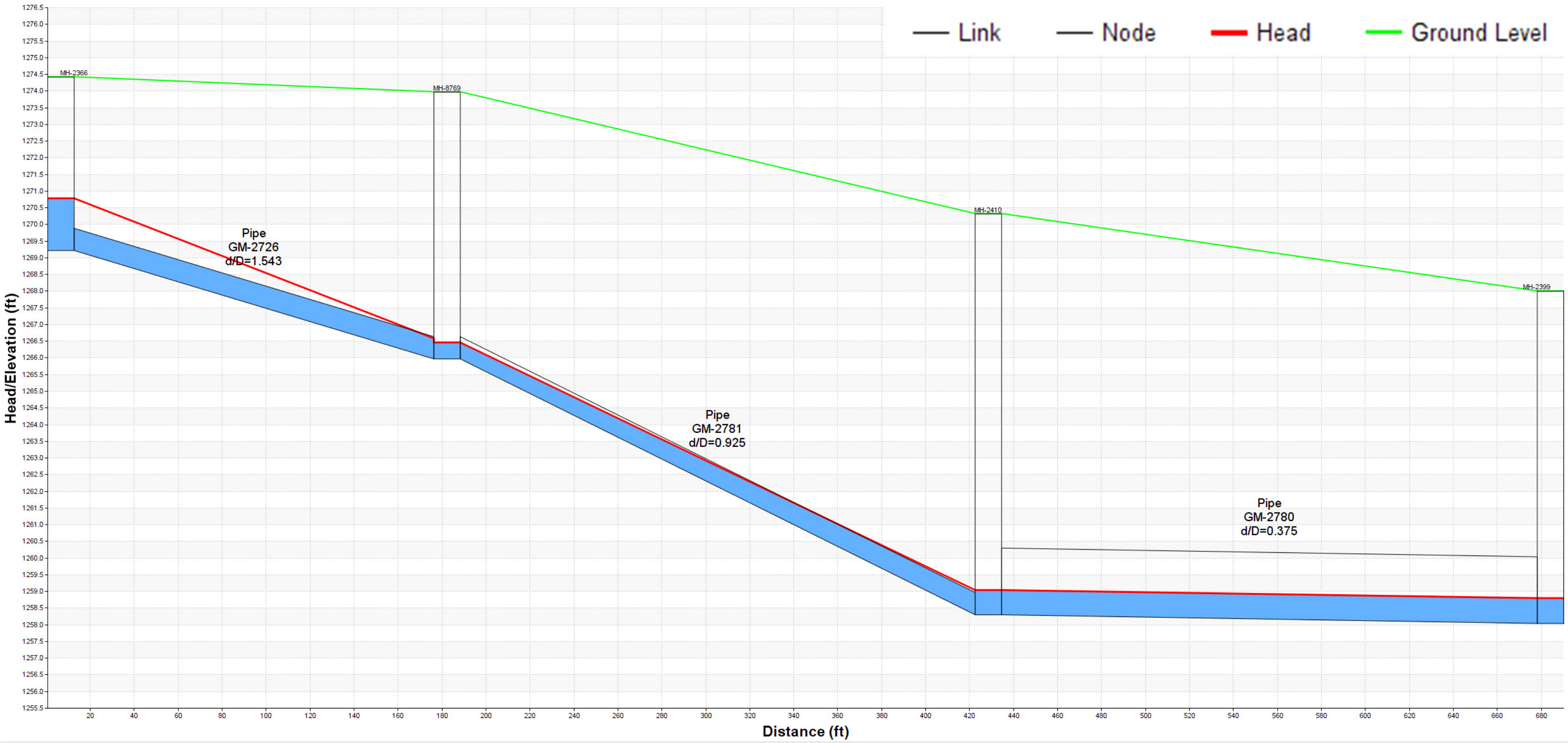


Figure 4 Segment C

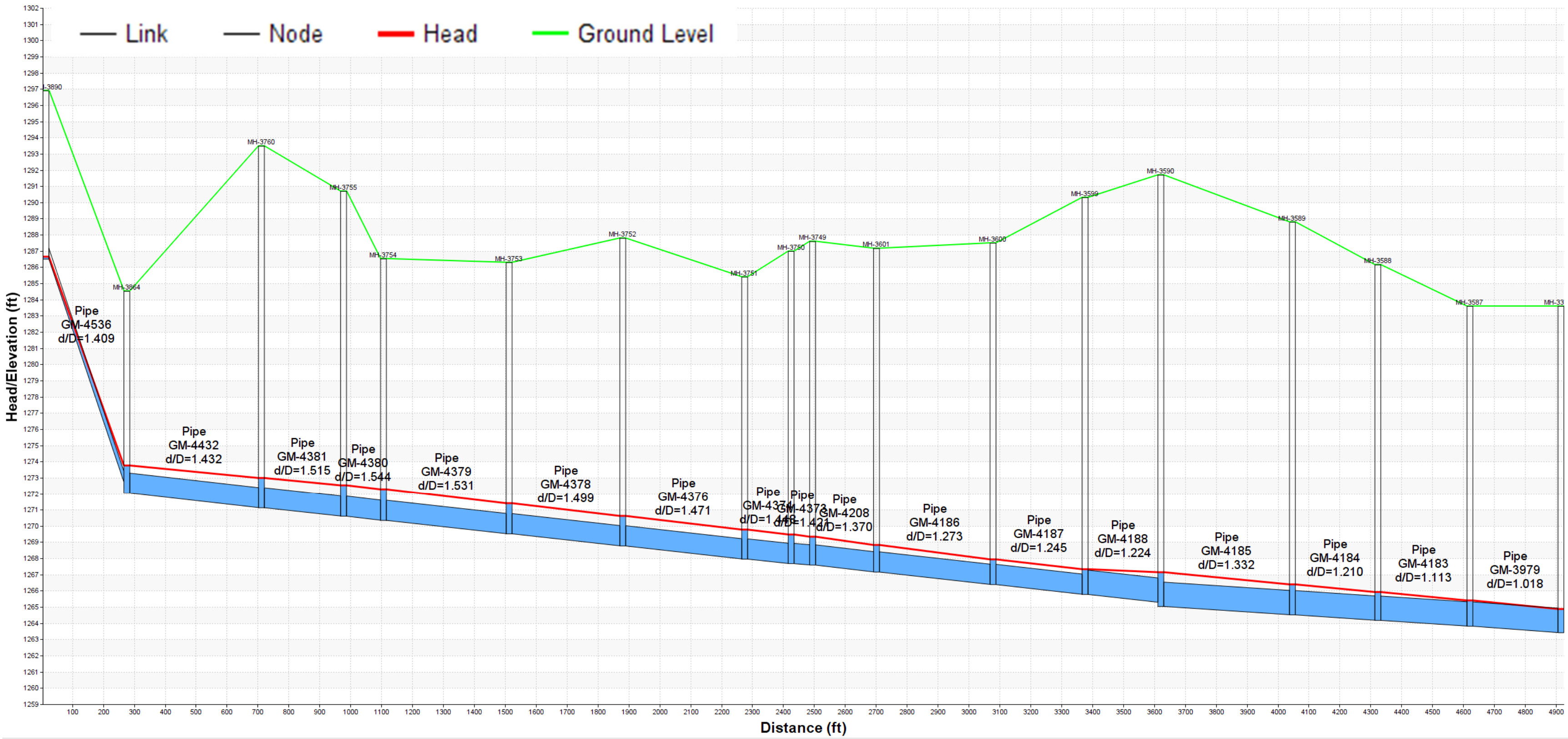


Figure 5 Segment D

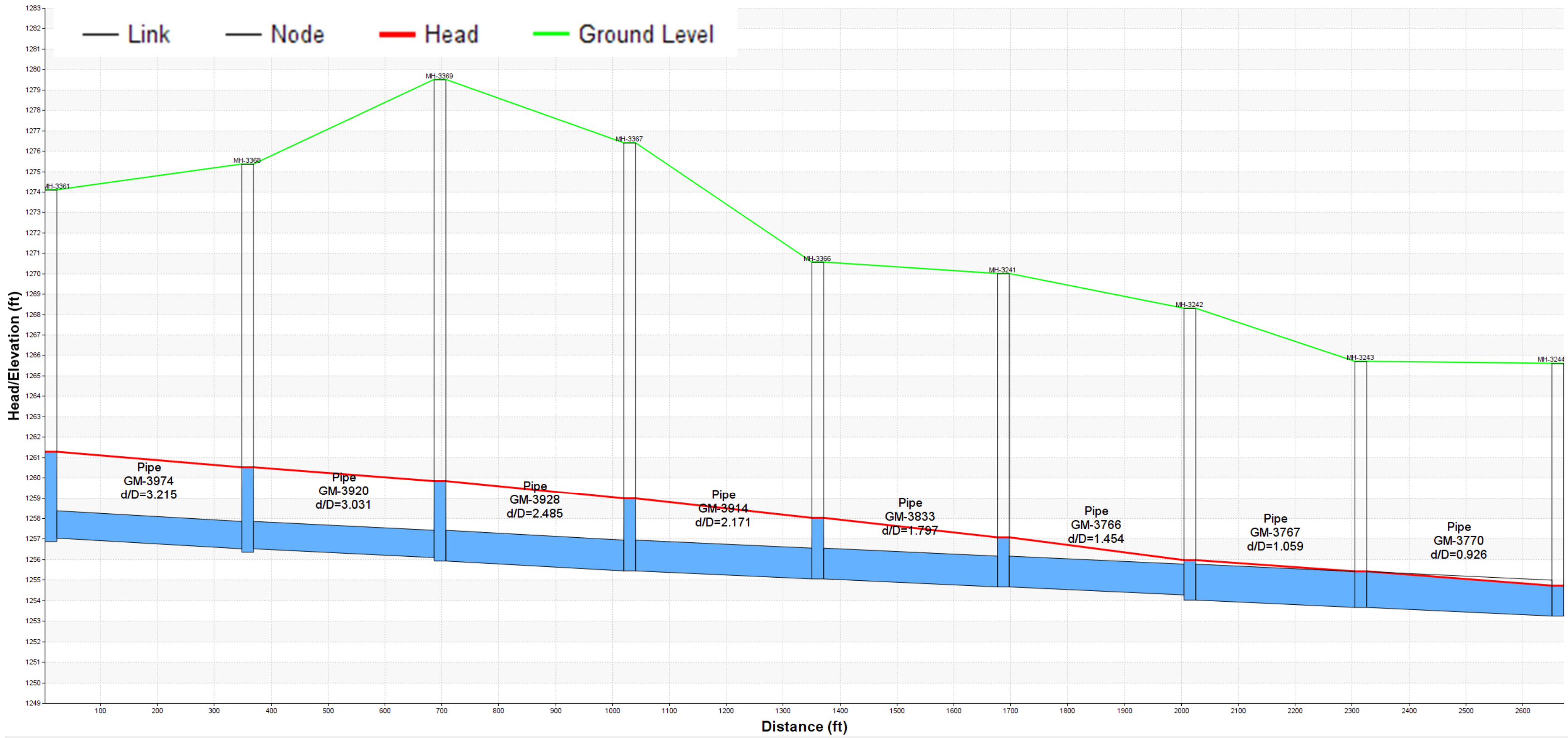


Figure 6 Segment E

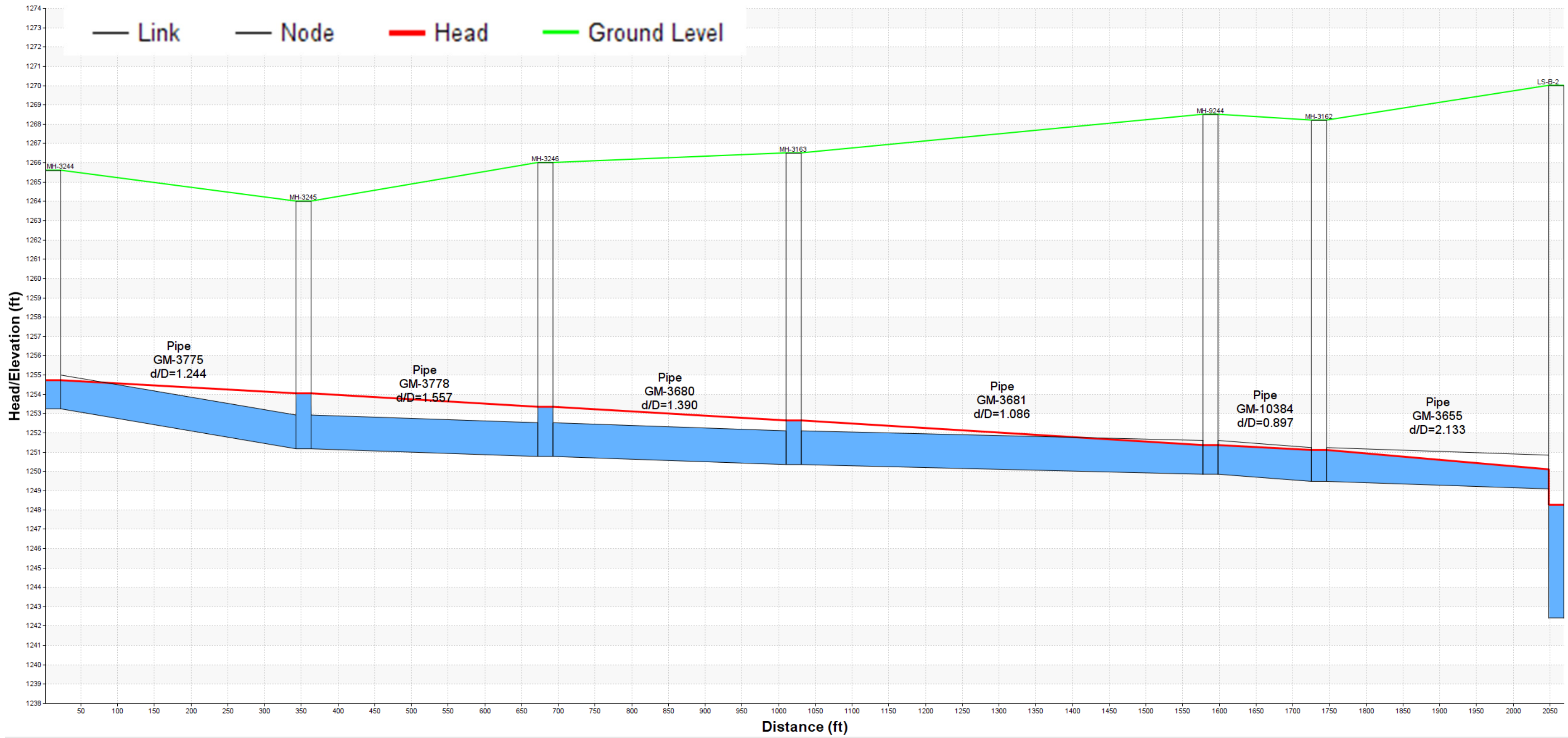


Figure 7 Segment F

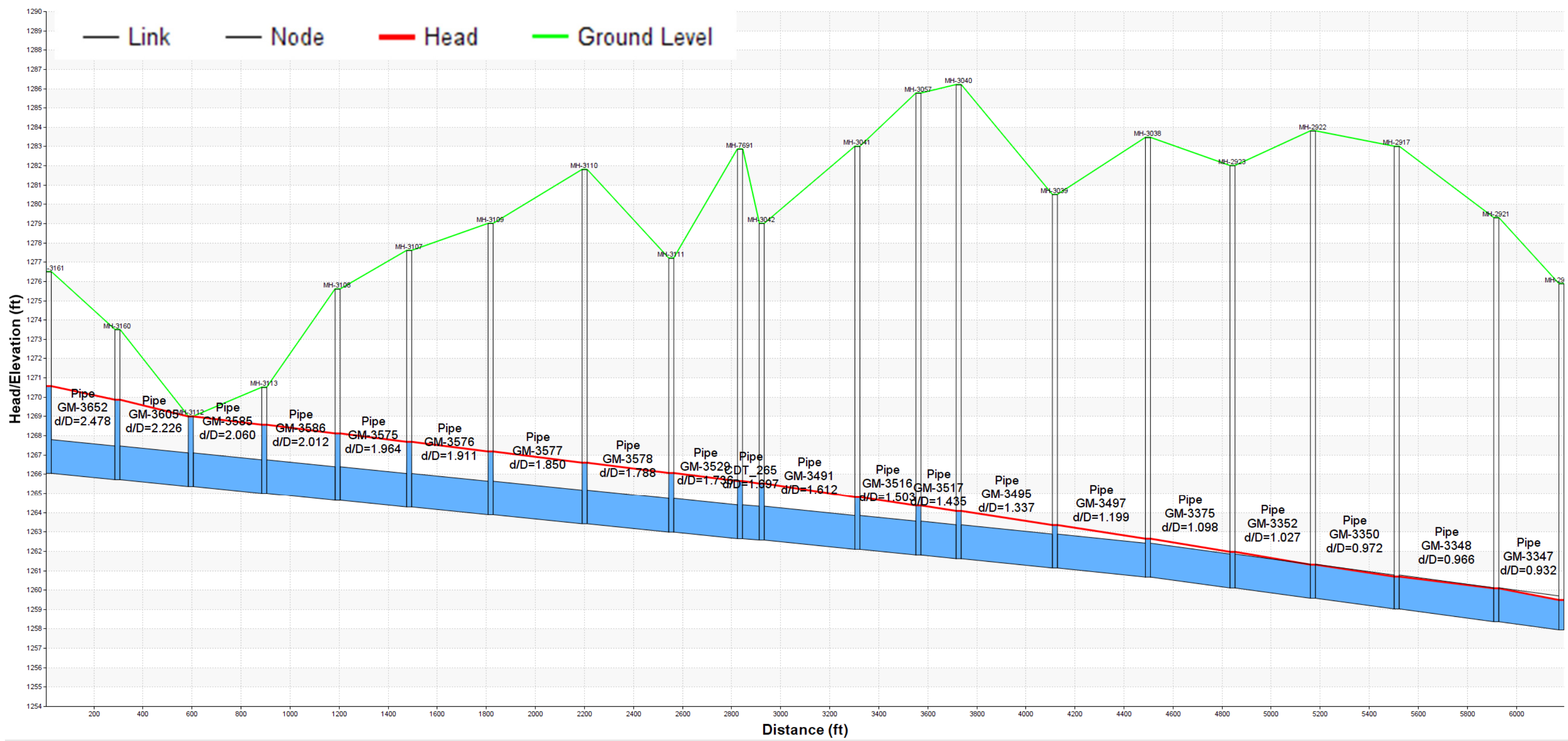


Figure 8 Segment G

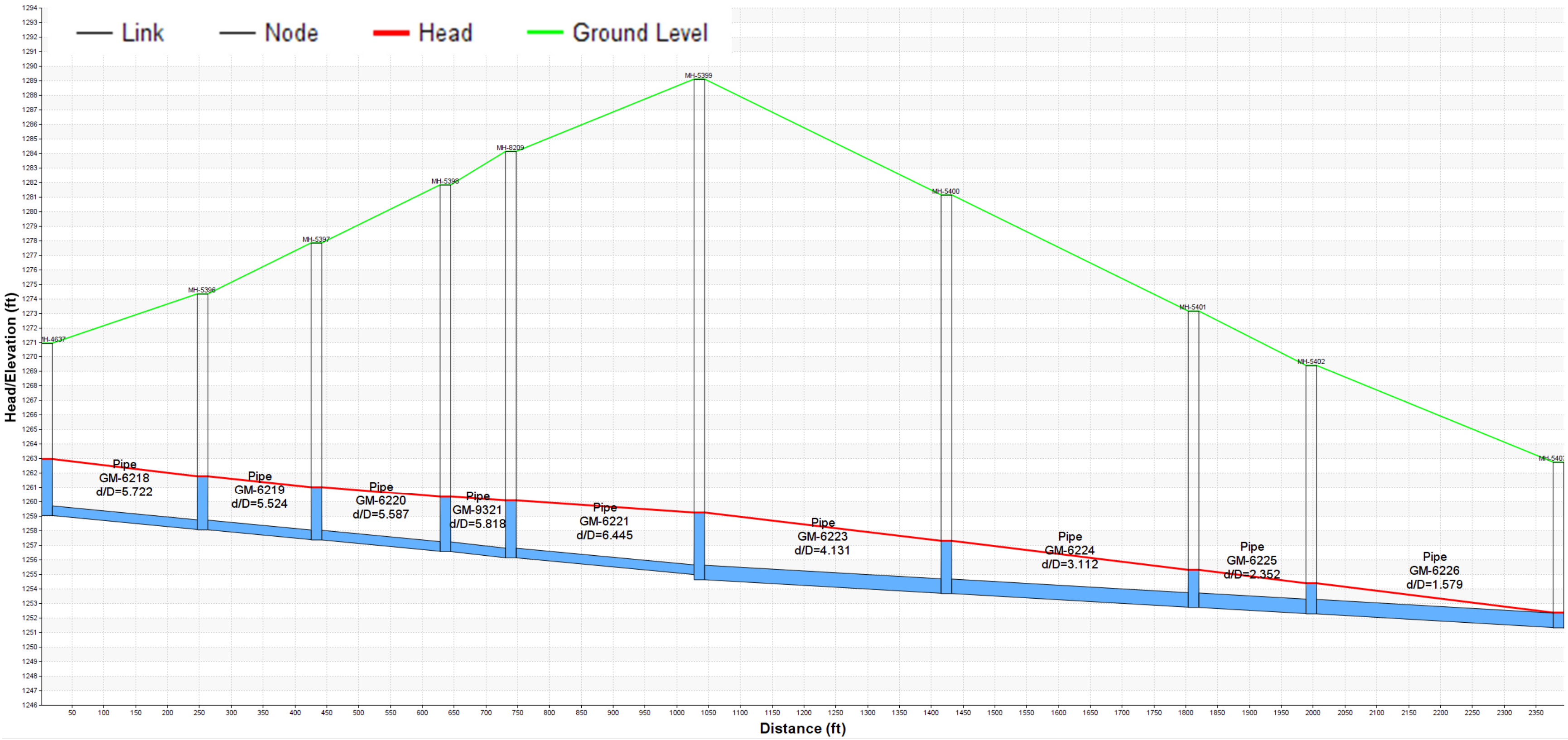


Figure 9 Segment H

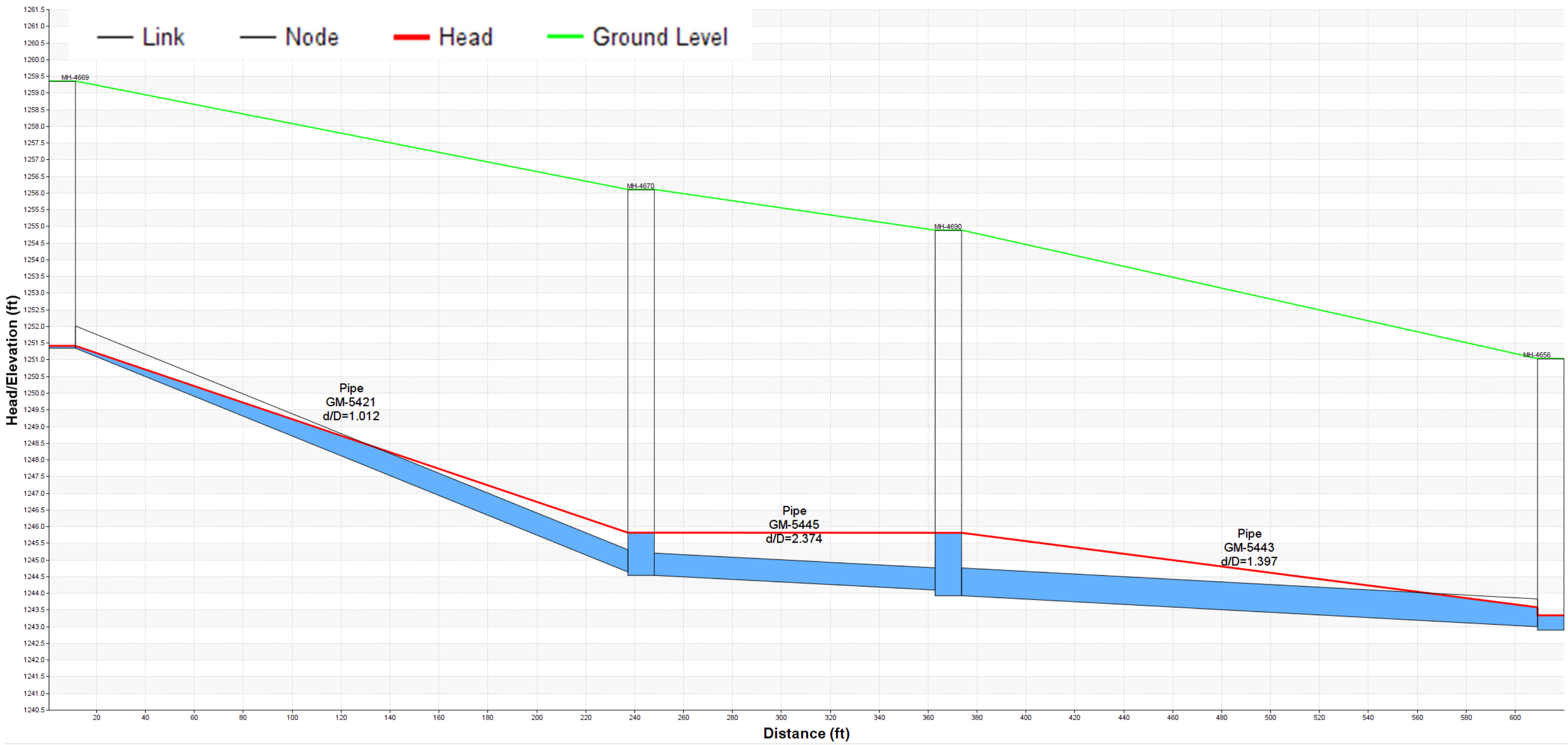


Figure 10 Segment I

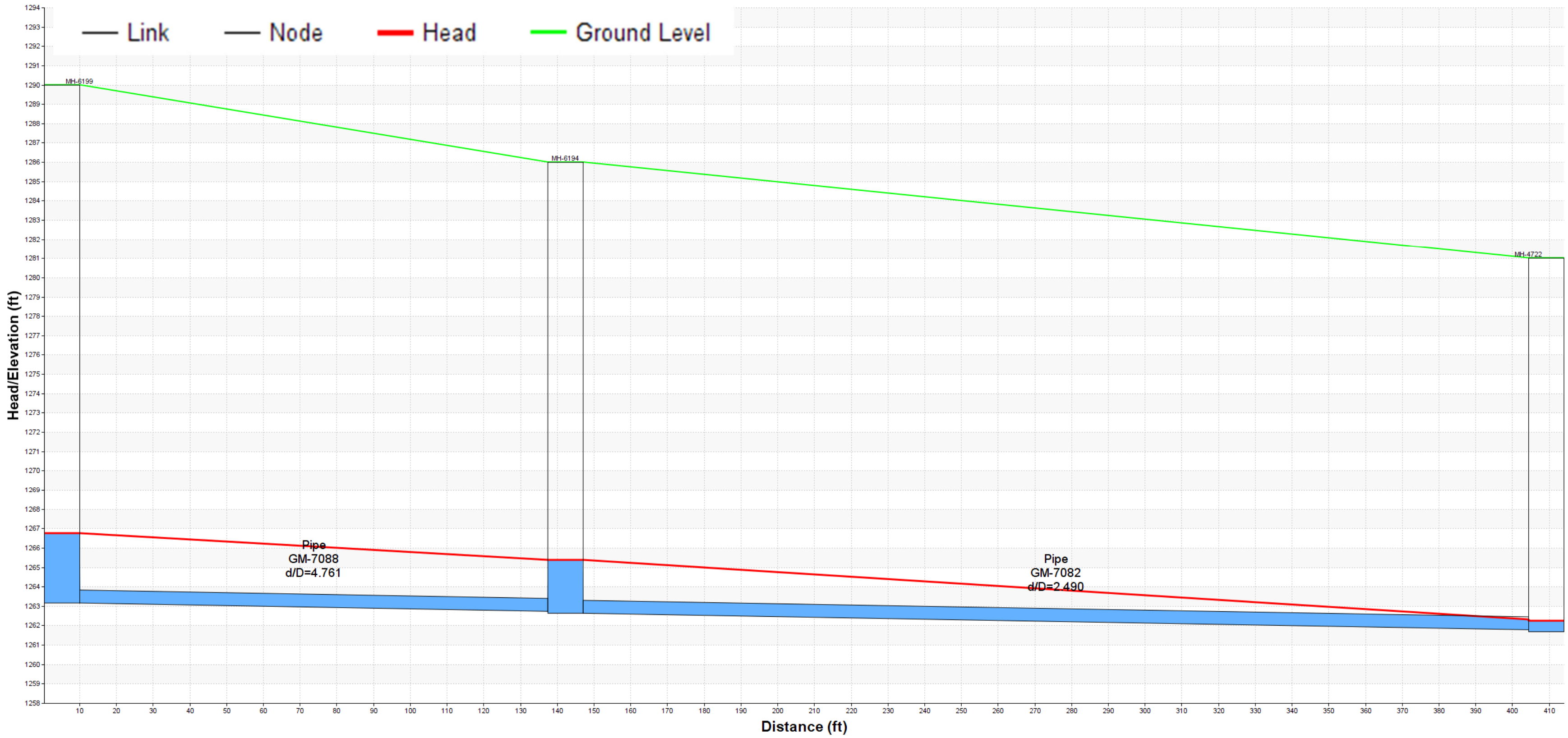


Figure 11 Segment J

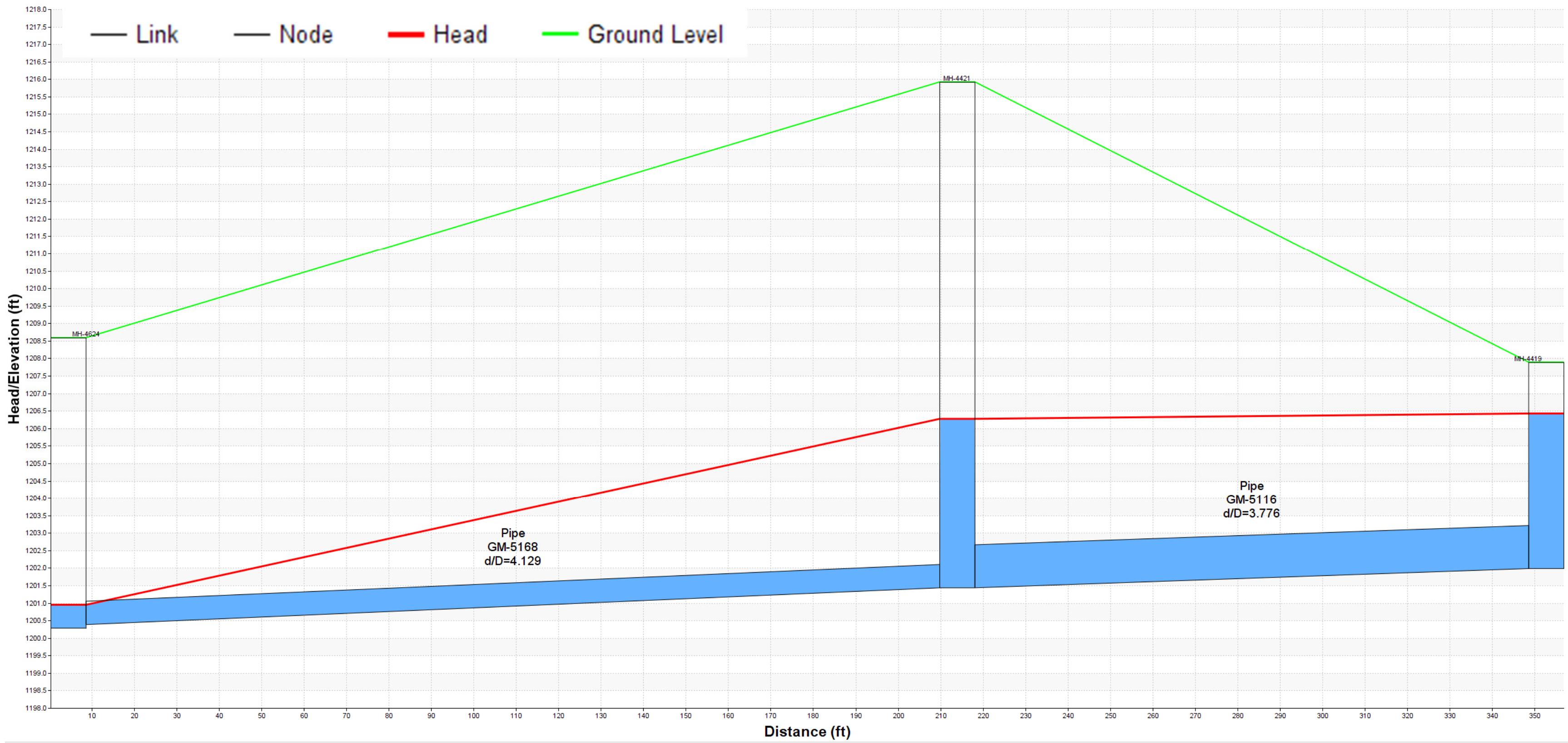


Figure 12 Segment K

Appendix D
CAPITAL IMPROVEMENT PLAN DETAIL SHEETS

Project Number: WW-EG-01
Project Name: Riverside - Eisenhower Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 3,250 feet of existing 10-inch gravity main to 18-inch gravity main due to existing undersized gravity pipe.Starting at Grand Avenue and Riverside drive, extending to Riverside and Eisenhower.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	10	18	Replace	3,250	$ 588	$ 1,912,000	$ 2,294,000	$ 3,212,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	36%	$ 1,162,000
Future Users	64%	$ 2,050,000
Total	100%	$ 3,212,000

Project Detail:

ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-EG-02
Project Name: Escavera Street Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 138 feet of existing 8-inch gravity pipe to 12-inches.Along Escavera Street.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	8	12	Replace	138	$ 389	$ 54,000	$ 65,000	$ 91,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	53%	$ 48,000
Future Users	47%	$ 43,000
Total	100%	$ 91,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number:	WW-EG-03
Project Name:	Riverside - Palm Trunk Sewer Capacity Improvement
System Type:	Wastewater

Project Description:

Upsize 337 feet of 10-inch gravity pipe to 18-inches.Downstream of A-2 force main starting at the intersection of Riverside and Lash Street and terminating at Riverside and Palm Street.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	10	18	Replace	337	$ 588	$ 198,000	$ 238,000	$ 333,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	55%	$ 183,000
Future Users	45%	$ 150,000
Total	100%	$ 333,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-EG-04
Project Name: Franklin Street Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 425 feet of 8-inch gravity pipe to 12-inches.Pipe starting at Franklin and Main Street and ending at North Spring Street.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	8	12	Replace	425	$ 389	$ 165,000	$ 198,000	$ 277,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

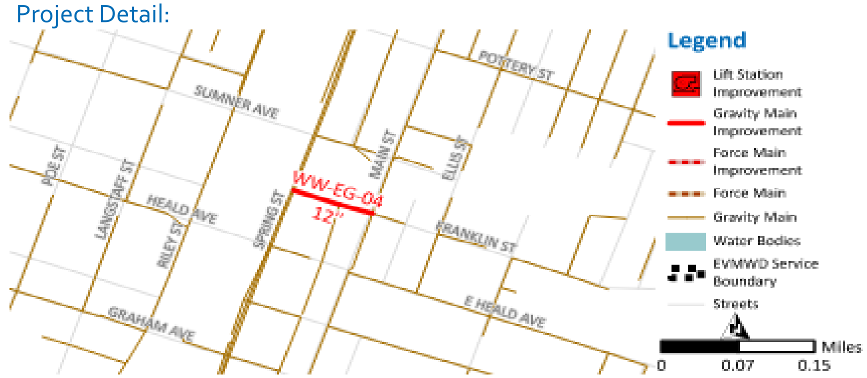
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	50%	$ 138,000
Future Users	50%	$ 139,000
Total	100%	$ 277,000

Project Detail:



Project Number: WW-EG-05
Project Name: Redwood Road Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 475 feet of 8-inch gravity pipe to 15-inches.Pipe starting at intersection of Boating Way and ending at Redwood Road.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	8	15	Replace	475	$ 507	$ 241,000	$ 289,000	$ 405,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	95%	$ 384,000
Future Users	5%	$ 21,000
Total	100%	$ 405,000

Project Detail:

Project Number: WW-EG-06
Project Name: Jackson Road Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 1,480 feet of existing 12-inch pipe to 18-inch gravity pipe.Pipe starting at Nutmeg and Jackson and ending at Jackson and Via Diamante.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	18	Replace	1,480	$ 588	$ 871,000	$ 1,045,000	$ 1,463,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

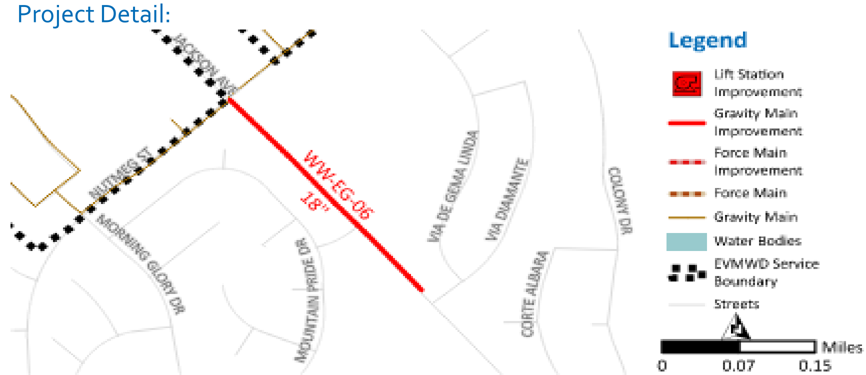
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	87%	$ 1,267,000
Future Users	13%	$ 196,000
Total	100%	$ 1,463,000

Project Detail:



Project Number: WW-EG-07
Project Name: Colony Drive Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 416 feet of existing 10-inch gravity pipe to 15-inch pipe.Pipe starts at Via Tapader and Colony Drive and terminates at Colony Drive and Avenida Florita.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	10	15	Replace	416	$ 507	$ 211,000	$ 253,000	$ 354,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

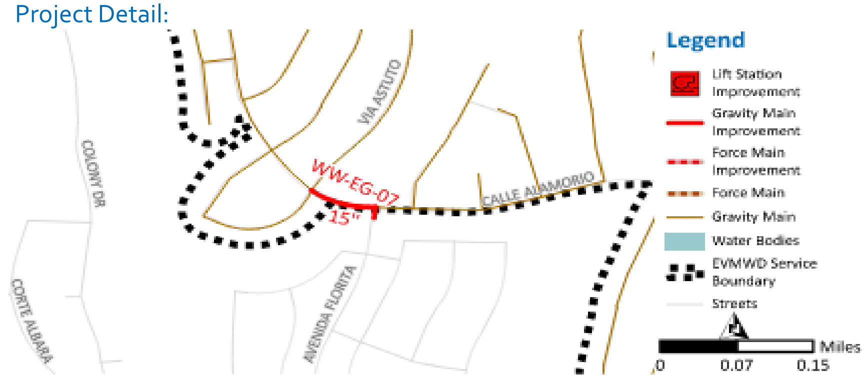
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	65%	$ 229,000
Future Users	35%	$ 125,000
Total	100%	$ 354,000

Project Detail:



Project Number: WW-EG-08
Project Name: Via Grazina Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 413 feet of existing 8-inch gravity pipe to 15-inch pipe.Along Via Grazina.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	8	15	Replace	413	$ 507	$ 210,000	$ 252,000	$ 353,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	99%	$ 349,000
Future Users	1%	$ 4,000
Total	100%	$ 353,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-EG-09
Project Name: Palomar Street Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 215 feet of existing 8-inch gravity pipe to 18-inch pipe.Starting at Wing Elm Circle and ending on Palomar Street.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	8	18	Replace	215	$ 588	$ 126,000	$ 151,000	$ 211,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

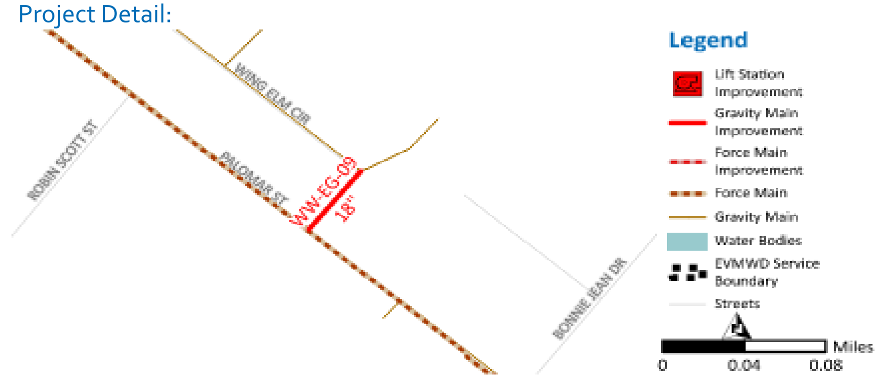
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	24%	$ 51,000
Future Users	76%	$ 160,000
Total	100%	$ 211,000

Project Detail:



ELSINORE VALLEY
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Project Number: WW-EG-10
Project Name: Strickland Avenue Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:

Upsize 1,175 feet of existing 24-inch gravity main to 36-inch.Starting near the intersection of Foster Street and Strickland Ave, ending near the Regional WRF outfall.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	24	36	Replace	1,175	$ 1,074	$ 1,262,000	$ 1,514,000	$ 2,120,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

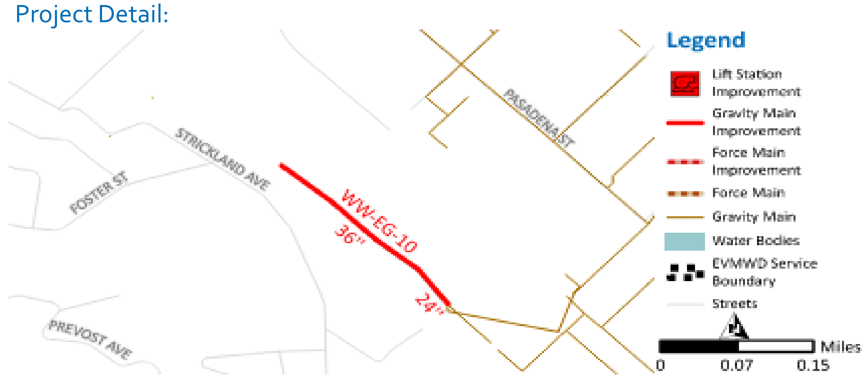
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	28%	$ 586,000
Future Users	72%	$ 1,534,000
Total	100%	$ 2,120,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-EG-11
Project Name: Grand Avenue Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 1,415 feet of 12-inch pipe to 15-inch.Starting from Hill Street and Grande Ave to Grand Ave and Riverside Drive.

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Baseline Construction Cost	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	10	15	Replace	1,415	$ 507	$ 718,000	$ 862,000	$ 1,207,000	2045-2050

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	29%	$ 353,000
Future Users	71%	$ 854,000
Total	100%	$ 1,207,000

Project Number: WW-EG-12
Project Name: Camino Aspirante Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize approximately 260 feet of 10-inch pipe to 15-inch.At the intersection of Nutmeg Street and Camino Aspirante along Camino Aspirante.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	10	15	Replace	260	$ 507	$ 132,000	$ 158,000	$ 221,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	54%	$ 119,000
Future Users	46%	$ 102,000
Total	100%	$ 221,000

Project Detail:

Project Number: WW-EG-13
Project Name: Tassel Way Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Replace 750 feet of 8-inch pipe with 12-inche pipe.Starting at the intersection of Westridge Way and Tassel Way, east along Tassle Way.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	8	12	Replace	750	$ 389	$ 291,000	$ 349,000	$ 489,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

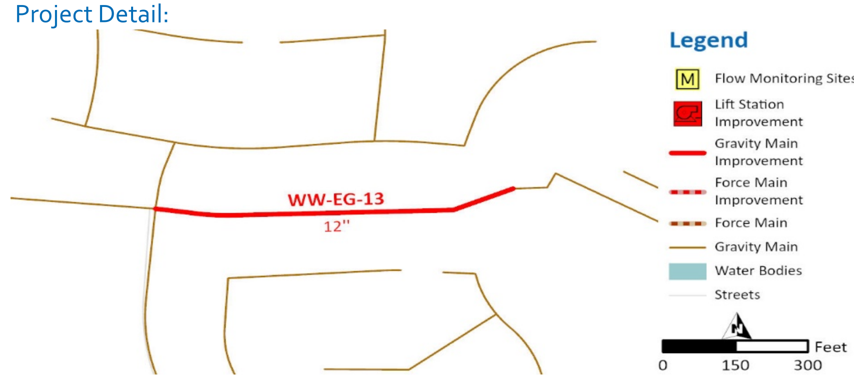
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	48%	$ 237,000
Future Users	52%	$ 252,000
Total	100%	$ 489,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-EG-14
Project Name: Nichols Road Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 5,150-feet of 10-inch pipe with 18-inch pipe to alleviate existing over capacity gravity pipe due to the Alberhill Ridge and Alberhill Villages development.Pipe starting at Nichols Road and Alberhill Ranch Road and extending southeast to Nichols Lift Station.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	10	18	Replace	5,150	$ 588	$ 3,030,000	$ 3,636,000	$ 5,090,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

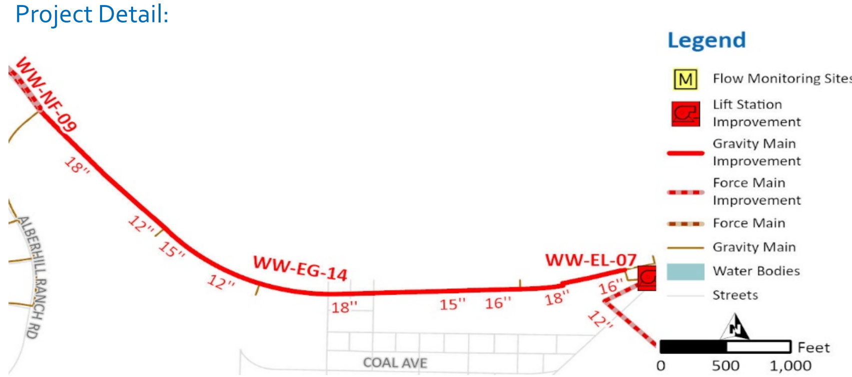
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	2%	$ 91,000
Future Users	98%	$ 4,999,000
Total	100%	$ 5,090,000

Project Detail:



Project Number: WW-EG-15
Project Name: Illinois Street Trunk Sewer Capacity Improvement
System Type: Wastewater

Project Description:
Replace 4,050-feet of existing 24-inch gravity main with 30-inch gravity main.Starting at Illinois Street along Strickland Avenue ending near the intersection of Foster Street and Strickland Ave.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	24	30	Replace	3,200	$ 928	$ 2,970,000	$ 3,564,000	$ 4,990,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

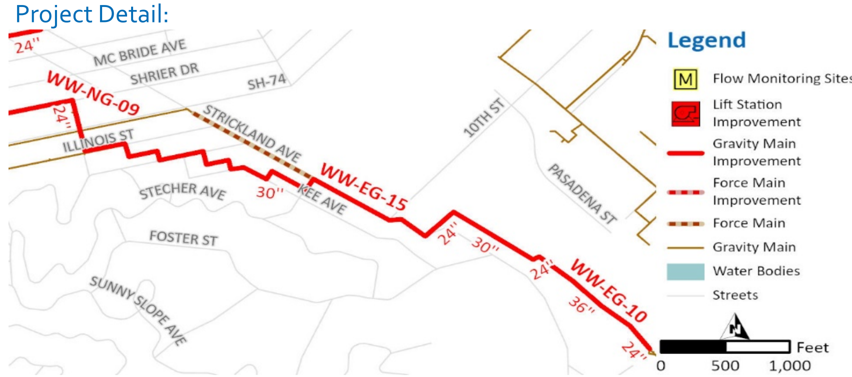
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	28%	$ 1,380,000
Future Users	72%	$ 3,610,000
Total	100%	$ 4,990,000

Project Detail:



Project Number: WW-EG-16
Project Name: B-5 and B-4 Gravity Main Imrovements
System Type: Wastewater

Project Description:
Upstream of LS-B5, upsize 335-feet of 12-inch gravity sewer to 15-inch. Upstream of LS-B4, upsize 2,170-feet of 15-inch pipe to 18-inch pipe.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	15	Replace	335	$ 507	$ 170,000	$ 204,000	$ 286,000	2045-2050
Gravity Main	15	18	Replace	2,170	$ 588	$ 1,277,000	$ 1,532,000	$ 2,145,000	2045-2050
Gravity Main	12 to 15	15 to 18	Replace	2,505	-	$ 1,447,000	$ 1,736,000	$ 2,431,000	2045-2050

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	39%	$ 938,000
Future Users	61%	$ 1,493,000
Total	100%	$ 2,431,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-NG-01
Project Name: Oak Street
System Type: Wastewater

Project Description:
Install approximately 8,500 feet of 12-inch force main to convey flow from the Oak Street force main to the existing collection systemPipe starts on Bundy Canyon Road at Harvest Way and extends down near Tulip Lane.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	New	8,500	$ 389	$ 3,303,000	$ 3,964,000	$ 5,550,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 5,550,000
Total	100%	$ 5,550,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NG-02
Project Name: Canyon Hills Trunk Sewer Extension
System Type: Wastewater

Project Description:
Install approximately 8,500 feet of 12-inch gravity main to extend service to the Canyon Hills Estates and single-family residence manufactured homes developments.Pipe starts at Bundy Canyon Road and Sunset Avenue and extends north along Cottonwood Canyon Road until the intersection of Cottonwood Canyon Road and Cedar Mesa Drive.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	New	8,500	$ 389	$ 3,303,000	$ 3,964,000	$ 5,550,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 5,550,000
Total	100%	$ 5,550,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-NG-03
Project Name: Wildomar Trunk Sewer Extension
System Type: Wastewater

Project Description:
Install approximately 3,350 feet of 12-inch pipe to extend service to extend service to the Wildomar septic area.Pipe starts at Lost Road and Crab Hollow Circle and continues southwest along Lost Road to Lemon Street near Cherry Street and Lemon Street.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	New	3,350	$ 389	$ 1,302,000	$ 1,562,000	$ 2,187,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 2,187,000
Total	100%	$ 2,187,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-NG-04
Project Name: North Ramsgate 1 Trunk Sewer
System Type: Wastewater

Project Description:
Install approximately 4,200 feet of 8-inch gravity main to convey flow from North Ramsgate 1 Lift Station.Starts at the intersection of Wallace Street and Read Street and extends south to Mauricio Street and Greenwald Avenue.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	8	New	4,200	$ 281	$ 1,179,000	$ 1,415,000	$ 1,981,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

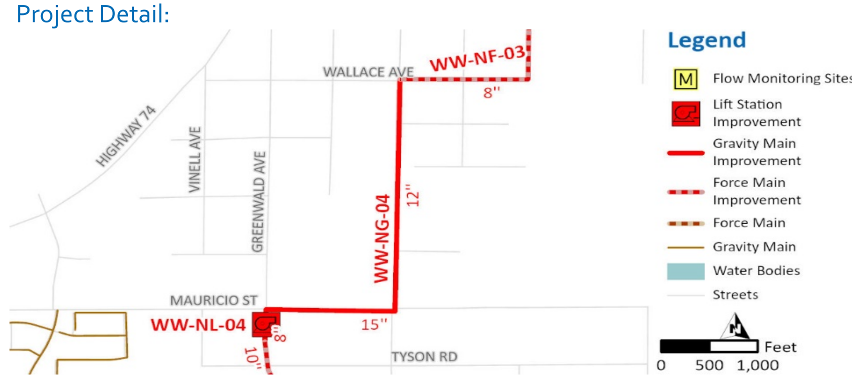
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,981,000
Total	100%	$ 1,981,000

Project Detail:



Project Number: WW-NG-05
Project Name: North Ramsgate 1 Trunk Sewer
System Type: Wastewater

Project Description:
Install approximately 9,350 feet of 15-inch gravity main to convey flow from the North Ramsgate 2 Lift Station.Starts near the intersection of Greenwald Avenue to Hyatt Road and extends south along Greenwald Avenue.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	15	New	9,350	$ 507	$ 4,743,000	$ 5,692,000	$ 7,969,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 7,969,000
Total	100%	$ 7,969,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-NG-06
Project Name: New Tuscany Hills Trunk Sewer Extension
System Type: Wastewater

Project Description:
Install approximately 1,950 feet of 15-inch gravity main to divert flow from the old Tuscany Hills Lift Station to the new Tuscany Hills Lift Station.Starts near the intersection of Ponte Russo and Summerhill Drive and extends North to the New Tuscany Hills Lift Station.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	15	New	1,950	$ 507	$ 989,000	$ 1,187,000	$ 1,662,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

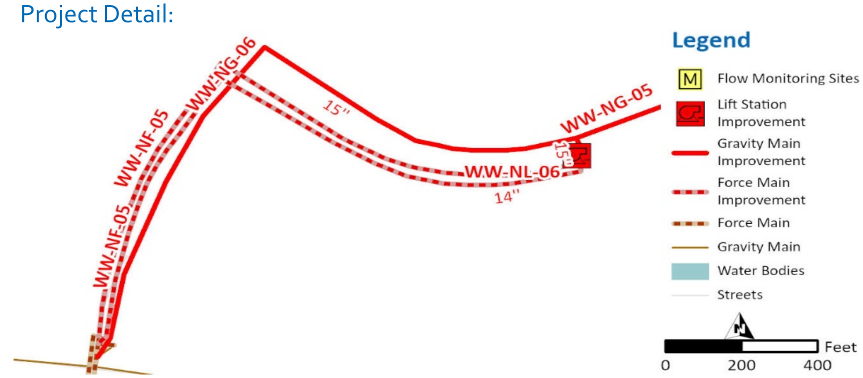
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,662,000
Total	100%	$ 1,662,000

Project Detail:



Project Number: WW-NG-07
Project Name: El Toro Road Trunk Sewer Extension
System Type: Wastewater

Project Description:
Install approximately 7,800 feet of 12-inch gravity main to service a 440 equivalent dwelling unit development (unnamed).Starts on El Toro Road, north of Green Mountain Drive and extends south along El Toro Road to the existing collection system at Wood Mesa Road.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	New	7,800	$ 389	$ 3,031,000	$ 3,637,000	$ 5,092,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

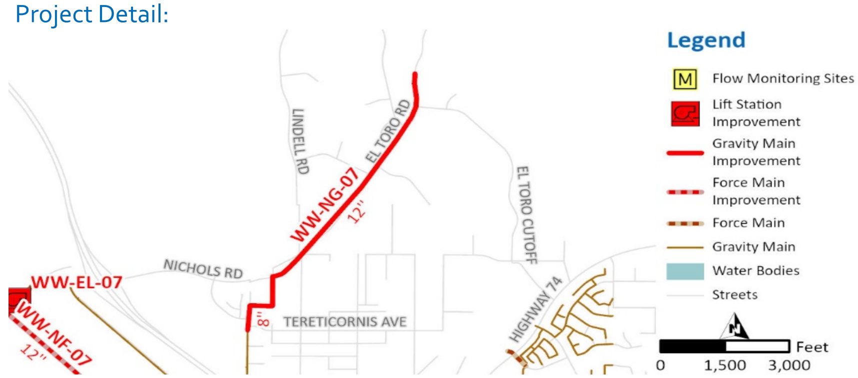
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 5,092,000
Total	100%	$ 5,092,000

Project Detail:



Project Number: WW-NG-08
Project Name: Alberhill Development Area Trunk Sewer
System Type: Wastewater

Project Description:
Install approximately 6,500 feet of 18-inch gravity main to service the Alberhill Ridge and Alberhill Villages development.Pipe starts near Lake Street and Nichols Road and extends north to Temescal Canyon Road.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	18	New	6,500	$ 588	$ 3,824,000	$ 4,589,000	$ 6,425,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 6,425,000
Total	100%	$ 6,425,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-NG-09
Project Name: Nichols LS Trunk Sewer Extension
System Type: Wastewater

Project Description:
Install approximately 5,650 feet of 24-inch gravity main to service the new Nichols force main.Pipe starts at the intersection of Turnbull Ave and Bunker Street extending along Turnbull Avenue and Bromley Avenue. Termination at the existing 24-inch gravity main on Illinois Street.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	24	5,650	3,200	$ 718	$ 2,297,000	$ 2,756,000	$ 3,858,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 3,858,000
Total	100%	$ 3,858,000

Project Detail:

Project Number:	WW-NG-10
Project Name:	B-1/Stadium Villa Trunk Sewer Bypass
System Type:	Wastewater

Project Description:

Install approximately 3,980-feet of 18-inch gravity main to bypass the Stadium Villa Lift Station and B-1 Lift StationStarting at the Stadium Villa Lift Station and B-1 Lift Stations, 18-inch pipe will extend towards Pete Lehr Drive and converge. Upon convergence, an 18-inch gravity pipe will commute flow along Diamond Circle to Diamond Lift Station.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	18	New	3,981	$ 588	$ 2,342,000	$ 2,810,000	$ 3,934,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	89%	$ 3,499,000
Future Users	11%	$ 435,000
Total	100%	$ 3,934,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NG-11
Project Name: Sunset Lift Station Trunk Sewer
System Type: Wastewater

Project Description:
Install 7,400 feet of 12-inch gravity pipe to service the Sunset Lift Station force main.Pipe starts at Keller Road and extends to Mullbery Street.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	New	7,400	$ 389	$ 2,875,000	$ 3,450,000	$ 4,830,000	2045-2050

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 4,830,000
Total	100%	$ 4,830,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NG-12
Project Name: B-2 Bypass
System Type: Wastewater

Project Description:
Two new gravity mains that run parallel to the Mission Trail trunk sewer starting at Lewis Street and ending at Malaga Road.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	8	New	996	$ 281	$ 280,000	$ 336,000	$ 470,000	2023-2025
Gravity Main	15	New	1,499	$ 507	$ 760,000	$ 912,000	$ 1,277,000	2023-2025
Gravity Main	36	New	3,487	$ 1,074	$ 3,745,000	$ 4,494,000	$ 6,292,000	2023-2025
Gravity Main	8 to 36	New	5,982	-	$ 4,785,000	$ 5,742,000	$ 8,039,000	2023-2025

Notes:
(1) ENR 20 City Average Construction Cost Index for June 2023 is 15,147.
(2) Estimated Construction Cost includes a 30% contingency of the baseline construction cost.
(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	60%	$ 4,800,000
Future Users	40%	$ 3,239,000
Total	100%	$ 8,039,000

Project Detail:

Project Number: WW-NG-13
Project Name: Mission Trail Trunk Improvement
System Type: Wastewater

Project Description:
Two new gravity mains that run parallel to the Mission Trail trunk sewer starting at Lewis Street and ending at Malaga Road.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	24	New	12,314	$ 718	$ 8,839,000	$ 10,607,000	$ 14,850,000	2030-2035
Gravity Main	36	New	3,396	$ 1,074	$ 3,647,000	$ 4,376,000	$ 6,126,000	2030-2035
Gravity Main	24 to 36	New	15,710	-	$ 12,486,000	$ 14,983,000	$ 20,976,000	2030-2035

Notes:
(1) ENR 20 City Average Construction Cost Index for June 2023 is 15,147.
(2) Estimated Construction Cost includes a 30% contingency of the baseline construction cost.
(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	60%	$ 12,525,000
Future Users	40%	$ 8,451,000
Total	100%	$ 20,976,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NG-14
Project Name: A-3 Bypass
System Type: Wastewater

Project Description:
Bypass the A-3 Lift Station by redirecting flow to the A-4 Lift Station via 1,691-feet of 12-inch gravity pipe. The project will begin at the A-3 Lift Station near Lincoln Street, run southwest along CA-74 to the A-4 Lift Station near Eisenhower Drive

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Gravity Main	12	New	1,691	$ 389	$ 657,000	$ 788,000	$ 1,103,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,103,000
Total	100%	$ 1,103,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-EF-01
Project Name: A-2 Force Main Capacity Improvement
System Type: Wastewater

Project Description:
Upsize 1,800 feet of existing 14-inch force main to 20-inch force main to reduce velocity below 7 fps.Starting at the A-2 lift station, extending along Riverside Drive and termination at Riverside and Lash Street.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Force Main	14	20	Replace	1,800	$ 615	$ 1,107,000	$ 1,328,000	$ 1,859,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

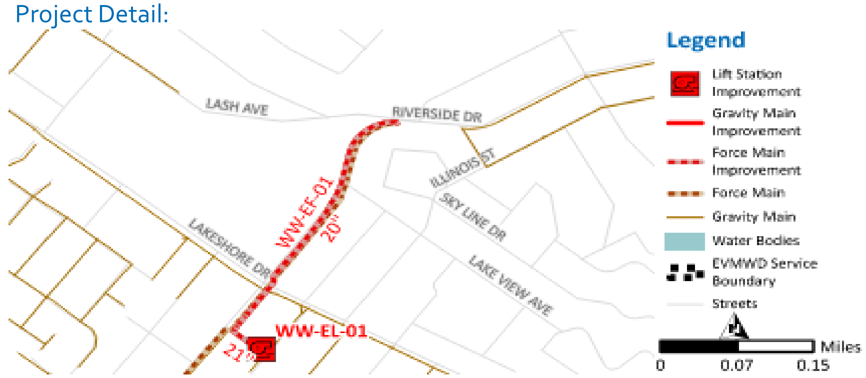
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	50%	$ 936,000
Future Users	50%	$ 923,000
Total	100%	$ 1,859,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number:	WW-EF-02
Project Name:	B-3 Force Main Capacity Improvement
System Type:	Wastewater

Project Description:

Upsize 1,350 feet of existing 10-inch force main to 12-inch force main to reduce velocity below 7 fps.Starting at the B-3 Lift Station and extending to the intersection of Cathy Lane and Corydon Road.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Force Main	10	12	Replace	3,200	$ 421	$ 1,347,000	$ 1,616,000	$ 2,262,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	58%	$ 1,308,000
Future Users	42%	$ 954,000
Total	100%	$ 2,262,000

Project Detail:

Project Number: WW-NF-01
Project Name: Diamond Lift Station Force Main
System Type: Wastewater

Project Description:
Install dual force mains, each approximately 3,250 feet in length and 24-inch in diameter, to convey flow from the new Diamond Lift Station.Starting at Diamond Circle at the southwest end of the Lake Elsinore Diamond Stadium. Pipe runs north to Elm street and connects to the 54-inch gravity main on East Lakeshore Drive.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Force Main	24	New	6,500	$ 1,172	$ 7,615,000	$ 9,138,000	$ 12,793,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	90%	$ 11,473,000
Future Users	10%	$ 1,320,000
Total	100%	$ 12,793,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NF-02
Project Name: Oak Street Lift Station Force Main
System Type: Wastewater

Project Description:
Install approximately 2,825 feet of 6-inch force main to convey flow from the Oak Street Lift Station to the existing collection system.Pipe starts on Bundy Canyon Road at the Oak Street Lift Station and extends south west to Harvest Way.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Force Main	6	New	2,825	$ 335	$ 945,000	$ 1,134,000	$ 1,588,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,588,000
Total	100%	$ 1,588,000

Project Detail:

Project Number: WW-NF-03
Project Name: North Ramsgate 1 Force Main
System Type: Wastewater

Project Description:
Install approximately 5,900 feet of 8-inch force main to convey flow from North Ramsgate 1 Lift Station.Pipe starts new River Road and extends to the intersection of Wallace Street and Read Street

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Force Main	8	New	5,900	$ 351	$ 2,070,000	$ 2,484,000	$ 3,478,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

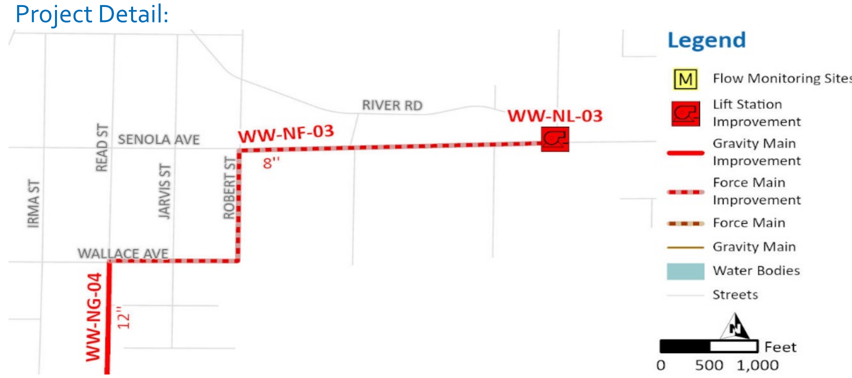
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 3,478,000
Total	100%	$ 3,478,000

Project Detail:



Project Number: WW-NF-04
Project Name: North Ramsgate 2 Force Main
System Type: Wastewater

Project Description:
Install approximately 1,800 feet of 8-inch force main to convey flow from North Ramsgate 2 Lift Station.Starts near the intersection of Mauricio and Greenwald Avenue and extends south along Greenwald Avenue to Hyatt Road.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Force Main	8	New	1,800	$ 351	$ 631,000	$ 757,000	$ 1,060,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

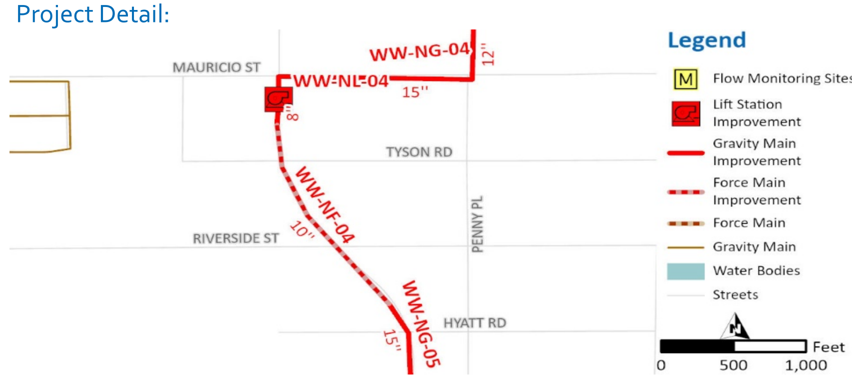
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,060,000
Total	100%	$ 1,060,000

Project Detail:



Project Number: WW-NF-05
Project Name: New Tuscany Hills Force Main
System Type: Wastewater

Project Description:
Install dual force mains to convey flows from the new Tuscany Hills Lift Station to the existing collection system. Total length of force main is approximately 3,800 feet of 16-inch pipe.Starts at the New Tuscany Hills Lift station and extends to the old Tuscany Hills Lift Station

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Force Main	16	New	3,800	$ 507	$ 1,928,000	$ 2,314,000	$ 3,240,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

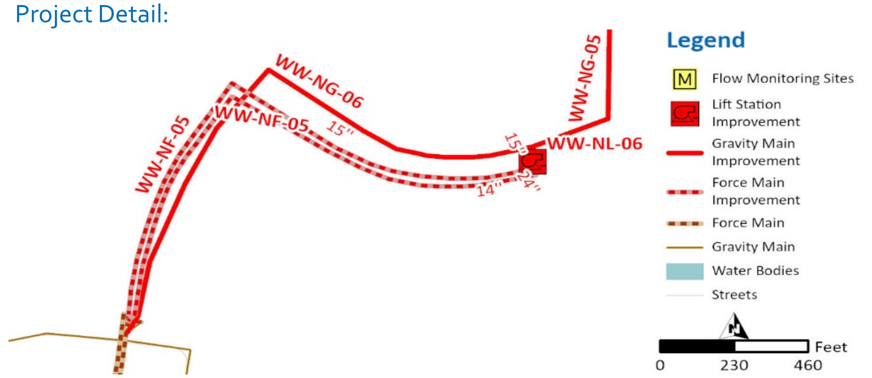
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 3,240,000
Total	100%	$ 3,240,000

Project Detail:



Project Number: WW-NF-06
Project Name: Temescal Lift Station Force Main 1
System Type: Wastewater

Project Description:

Install approximately 10,000 feet of 10-inch force main to convey flow from the Temescal Lift Station to the existing collection system.Pipe starts at the Temescal Lift Station and extends south to the intersection of Lake Street and Nichols Road

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Force Main	12	New	10,000	$ 421	$ 4,210,000	$ 5,052,000	$ 7,073,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

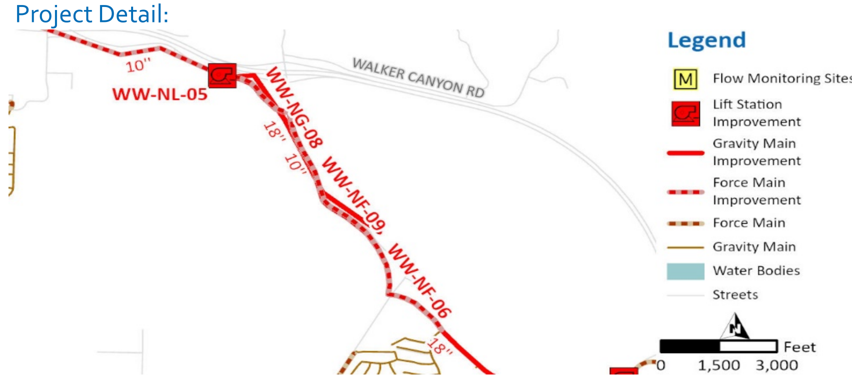
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 7,073,000
Total	100%	$ 7,073,000

Project Detail:



Project Number: WW-NF-07
Project Name: Nichols Lift Station Force Main
System Type: Wastewater

Project Description:
Install approximately 6,730 feet of 16-inch force main to convey flow from Nichols Lift Station along a new alignment.Starting at Nichols Lift Station and extending southeast down Baker Street. Terminating near the intersection of Turnbull Ave and Bunker Street

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Force Main	16	New	6,730	$ 507	$ 3,414,000	$ 4,097,000	$ 5,736,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

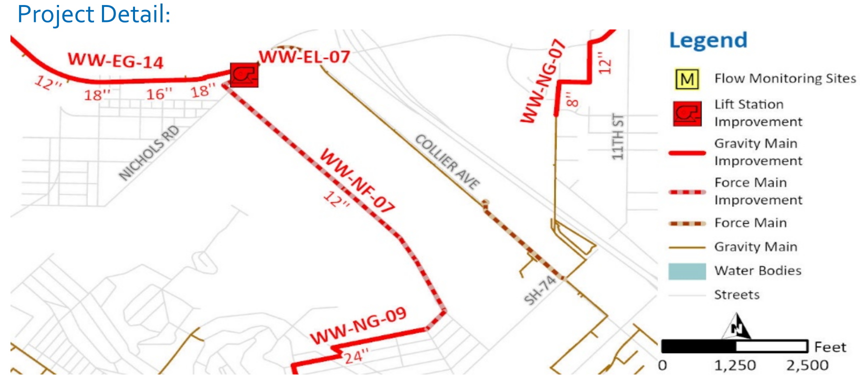
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 5,736,000
Total	100%	$ 5,736,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NF-08
Project Name: New Alberhill Force Main
System Type: Wastewater

Project Description:

Install approximately 8,200 feet of 12-inch force main to service flows from the new Alberhill Lift Station.Starting at the New Alberhill Lift Station, extending southeast along Temescal Canyon Road to the Temescal Lift Station.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Force Main	12	New	8,200	$ 421	$ 3,452,000	$ 4,142,000	$ 5,799,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

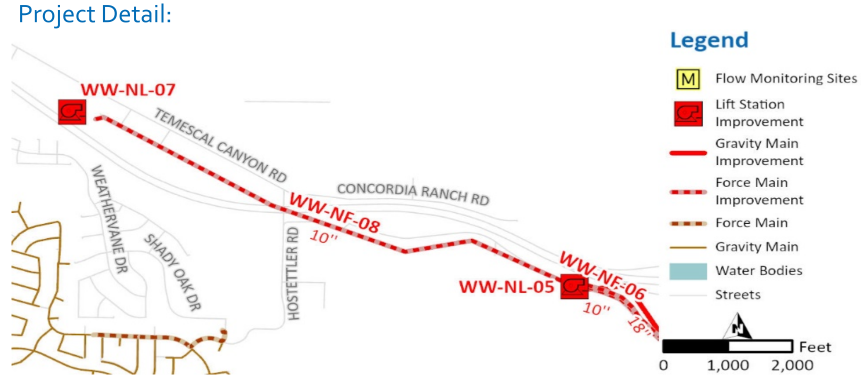
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 5,799,000
Total	100%	$ 5,799,000

Project Detail:



Project Number: WW-NF-09
Project Name: Temescal Lift Station Force Main 2
System Type: Wastewater

Project Description:

Install another 12-inch force main to run parallel with WW-NF-06.Pipe starts at the Temescal Lift Station and extends south to the intersection of Lake Street and Nichols Road

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost(1) ($/ft)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
Force Main	12	New	10,000	$ 421	$ 4,210,000	$ 5,052,000	$ 7,073,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

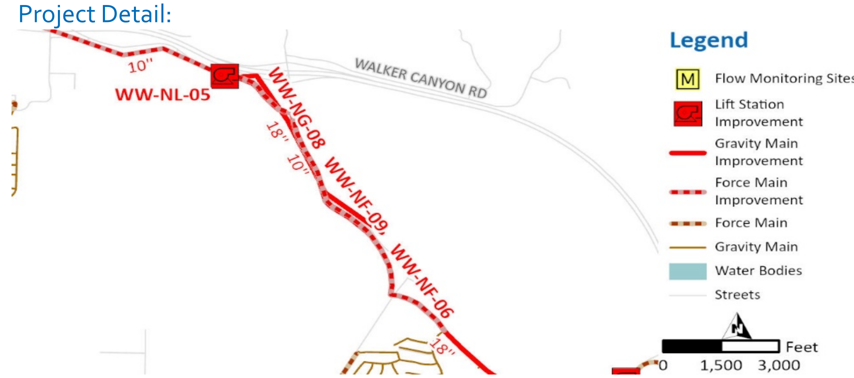
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 7,073,000
Total	100%	$ 7,073,000

Project Detail:



Project Number: WW-NF-10
Project Name: Sunset Lift Station Force Main
System Type: Wastewater

Project Description:
Install 7,500 feet of 8-inch force main to service the Sunset Lift Station.Extending from the Sunset Lift Station to Keller Road.

Project Details:

Project Element	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[(1)] ($/ft)	Construction Cost ($)	Estimated Construction Cost[(2)]	Capital Improvement Cost[(3)]	Project Schedule
Force Main	8	New	3,200	$ 351	$ 1,123,000	$ 1,348,000	$ 1,887,000	2045-2050

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,887,000
Total	100%	$ 1,887,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-EL-01
Project Name: A-2 Lift Station Capacity Improvement
System Type: Wastewater

Project Description:
Firm capacity at A-2 needs to be increased to 5,200 gpm. Previous firm capacity was 2,400 gpm.Located along Wisconsin Street.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost(1) ($)	Baseline Construction Cost ($)	Estimated Construction Cost(2) ($)	Capital Improvement Cost(3) ($)	Project Schedule
Lift Station Pump Replacement	2,400	5,180	Replace	6,907	$1.23	$ 12,186,270	$ 14,624,000	$ 20,474,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	77%	$ 15,790,000
Future Users	23%	$ 4,684,000
Total	100%	$ 20,474,000

Project Detail:

Project Number: WW-EL-02
Project Name: A-4 Lift Station Capacity Improvement
System Type: Wastewater

Project Description:
Firm capacity at A-4 needs to be increased to 2,900 gpm. Previous firm capacity was 1,780 gpm.Located near the intersection of Eisenhower Drive and Riverside Drive.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost(1) ($)	Baseline Construction Cost ($)	Estimated Construction Cost(2) ($)	Capital Improvement Cost(3) ($)	Project Schedule
Lift Station Pump Replacement	1,780	2,900	Replace	4,350	$ 1.23	$ 7,675,233	$ 9,210,000	$ 12,894,000	2030-2035

Notes:
(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.
(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	69%	$ 8,891,000
Future Users	31%	$ 4,003,000
Total	100%	$ 12,894,000

Project Detail:

Project Number: WW-EL-03
Project Name: B-3 Lift Station Capacity Improvement
System Type: Wastewater

Project Description:

Firm capacity at B-3 needs to be increased to 1,900 gpm. Previous firm capacity was 1,400 gpm.Located along Cathy Lane.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[(1)] ($)	Baseline Construction Cost ($)	Estimated Construction Cost[(2)] ($)	Capital Improvement Cost[(3)] ($)	Project Schedule
Lift Station Pump Replacement	1,400	1,860	Replace	2,790	$ 1.23	$ 4,922,735	$ 5,907,000	$ 8,270,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	74%	$ 6,145,000
Future Users	26%	$ 2,125,000
Total	100%	$ 8,270,000

Project Detail:

ELSINORE VALLEY
MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-EL-04
Project Name: B-9 Lift Station Capacity Improvement
System Type: Wastewater

Project Description:
Firm capacity at B-9 needs to be increased to 500 gpm. Previous firm capacity was 350 gpm.Located at the B-9 Lift Station along Grand Avenue, near Garner Road.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[(1)] ($)	Baseline Construction Cost ($)	Estimated Construction Cost[(2)] ($)	Capital Improvement Cost[(3)] ($)	Project Schedule
Lift Station Pump Replacement	350	500	Replace	1,000	$ 1.23	$ 1,764,421	$ 2,117,000	$ 2,964,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	36%	$ 1,077,000
Future Users	64%	$ 1,887,000
Total	100%	$ 2,964,000

Project Detail:

Project Number: WW-EL-05
Project Name: Horsethief Lift Station Capacity Improvement
System Type: Wastewater

Project Description:
Firm Capacity at Horsethief needs to be increased to 300 gpm. Previous firm capacity was 200 gpm.Located at the intersection of Horsethief Canyon Road and Colt Drive.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost(1) ($)	Baseline Construction Cost ($)	Estimated Construction Cost(2) ($)	Capital Improvement Cost(3) ($)	Project Schedule
Lift Station Pump Replacement	200	300	Replace	600	$ 1.23	$ 1,058,653	$ 1,270,000	$ 1,778,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	3%	$ 60,000
Future Users	97%	$ 1,718,000
Total	100%	$ 1,778,000

Project Detail:

Project Number:	WW-EL-06
Project Name:	McVicar Lift Station Capacity Improvement
System Type:	Wastewater

Project Description:

Firm capacity at McVicar needs to be increased to 2,800 gpm to satisfy existing PWWF inflow.
Previous firm capacity was 1,400 gpm.Located near the intersection of Palomar and McVicar Street.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[(1)] ($)	Baseline Construction Cost ($)	Estimated Construction Cost[(2)] ($)	Capital Improvement Cost[(3)] ($)	Project Schedule
Lift Station Pump Replacement	1,400	2,800	Replace	4,200	$1.23	$ 7,410,569	$ 8,893,000	$ 12,450,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	100%	$ 12,450,000
Future Users	0%	$ -
Total	100%	$ 12,450,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-EL-07
Project Name: Nichols Lift Station Capacity Improvement
System Type: Wastewater

Project Description:
Firm capacity at Nichols needs to be increased to 2,900 gpm. Previous firm capacity was 285 gpm.Located near the intersection of Nichols Road and Coal Avenue.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[(1)] ($)	Baseline Construction Cost ($)	Estimated Construction Cost[(2)] ($)	Capital Improvement Cost[(3)] ($)	Project Schedule
Lift Station Pump Replacement	280	2,900	Replace	4,350	$ 1.23	$ 7,675,233	$ 9,210,000	$ 12,894,000	2030-2035

Notes:
(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.
(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	50%	$ 6,477,000
Future Users	50%	$ 6,417,000
Total	100%	$ 12,894,000

Project Detail:

Project Number: WW-EL-08
Project Name: B-4 Lift Station Capacity Improvement
System Type: Wastewater

Project Description:
Firm capacity at the B-4 Lift Station needs to be increased to 1,400 gpm.

Project Details:

Project Element	Existing Firm Capacity (gpm)	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[(1)] ($)	Baseline Construction Cost ($)	Estimated Construction Cost[(2)] ($)	Capital Improvement Cost[(3)] ($)	Project Schedule
Lift Station Pump Replacement	1,200	1,400	Replace	2,100	$ 1.23	$ 3,705,285	$ 4,446,000	$ 6,224,000	2045-2050

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

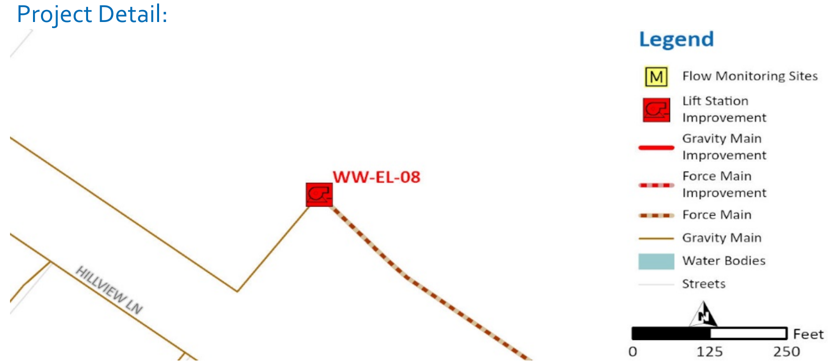
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	35%	$ 2,155,000
Future Users	65%	$ 4,069,000
Total	100%	$ 6,224,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-NL-01
Project Name: Diamond Lift Station Installation
System Type: Wastewater

Project Description:
Install Diamond Lift Station to alleviate the B-Train, namely the B-2 Lift Stations. Firm capacity of 6,400 gpm required.On Diamond Circle at the southwest end of the Lake Elsinore Diamond Stadium.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[1] ($)	Baseline Construction Cost ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[3] ($)	Project Schedule
New Lift Station	13,820	New	13,820	$ 1.23	$ 24,384,302	$ 29,261,000	$ 40,965,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	55%	$ 22,709,000
Future Users	45%	$ 18,256,000
Total	100%	$ 40,965,000

Project Detail:

Project Number: WW-NL-02
Project Name: Oak Street Lift Station Installation
System Type: Wastewater

Project Description:
Install Oak Street Lift Station to service the Oak Creek Canyon development. Firm capacity of 100 gpm required.Located Near the intersection of Club Avenue and Bundy Canyon Road.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[1] ($/gallon/day)	Baseline Construction Cost ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[3] ($)	Project Schedule
New Lift Station	100	New	200	$ 1.23	$ 352,884	$ 423,000	$ 592,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

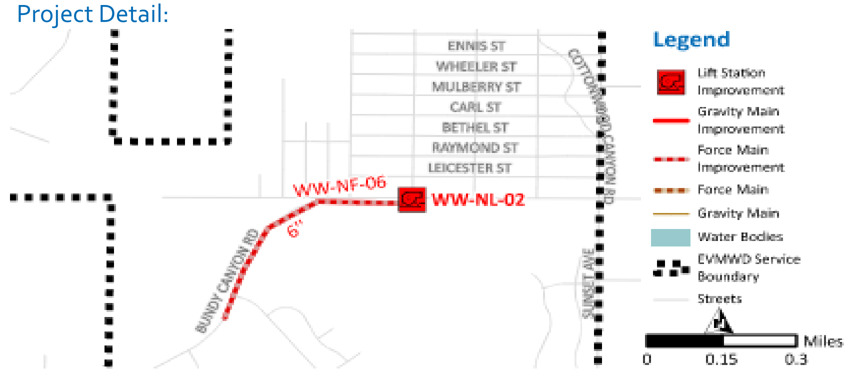
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 592,000
Total	100%	$ 592,000

Project Detail:



Project Number: WW-NL-03
Project Name: North Ramsgate 2 Lift Station Installation
System Type: Wastewater

Project Description:
Install North Ramsgate 2 Lift Station to convey flow primarily from the Colinas Del Oro development. Firm capacity of 200 gpm required.Near the intersection of River Road and Stonyhill Drive.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost(1) ($/gallon/day)	Baseline Construction Cost ($)	Estimated Construction Cost(2) ($)	Capital Improvement Cost(3) ($)	Project Schedule
New Lift Station	200	New	400	$ 1.23	$ 705,769	$ 847,000	$ 1,186,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

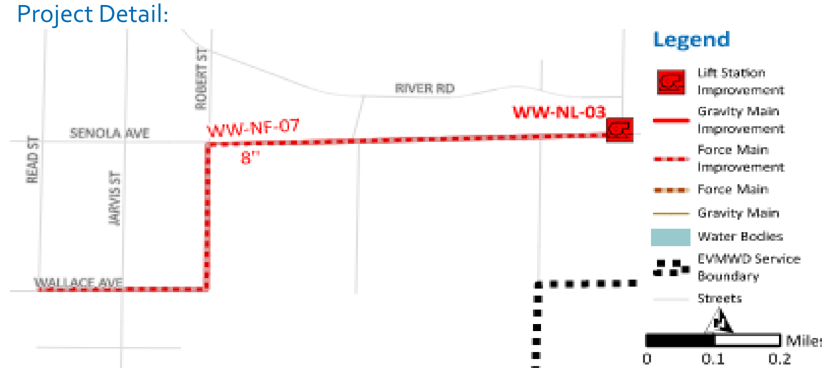
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,186,000
Total	100%	$ 1,186,000

Project Detail:



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Project Number: WW-NL-04
Project Name: North Ramsgate 1 Lift Station Installation
System Type: Wastewater

Project Description:
Install North Ramsgate 1 Lift Station to convey flow primarily from the Colinas Del Oro development. Firm capacity of 200 gpm required.Near the intersection of Mauricio and Greenwald Avenue.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[1] ($/gallon/day)	Baseline Construction Cost ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[3] ($)	Project Schedule
New Lift Station	200	New	400	$ 1.23	$ 705,769	$ 847,000	$ 1,186,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

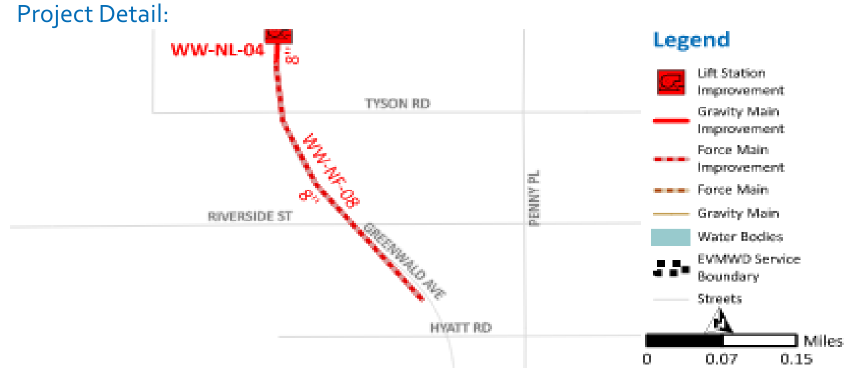
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,186,000
Total	100%	$ 1,186,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

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Project Number: WW-NL-05
Project Name: Temescal Lift Station Installation
System Type: Wastewater

Project Description:
Install the Temescal Lift Station to service the Alberhill area developments. Firm capacity of 2,400 gpm required.Near the intersection of Temescal Canyon Road and Lake Street.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[(1)] ($/gallon/day)	Baseline Construction Cost ($)	Estimated Construction Cost[(2)] ($)	Capital Improvement Cost[(3)] ($)	Project Schedule
New Lift Station	2,400	New	3,600	$1.23	$ 6,351,917	$ 7,622,000	$ 10,671,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

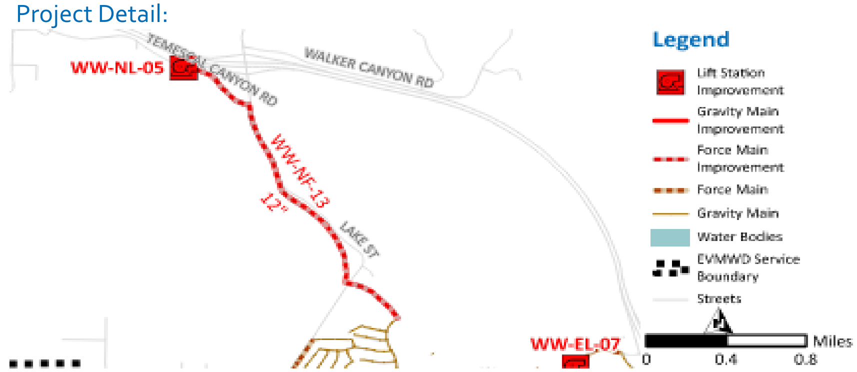
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 10,671,000
Total	100%	$ 10,671,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NL-06
Project Name: New Tuscany Hills Lift Station Installation
System Type: Wastewater

Project Description:

Install the new Tuscany Hills Lift Station. Firm capacity of 800 gpm required.Near the intersection of Ponte Russon and Summerhill Drive.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[1] ($/gallon/day)	Baseline Construction Cost ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[3] ($)	Project Schedule
New Lift Station	800	New	1,600	$ 1.23	$ 2,823,074	$ 3,388,000	$ 4,743,000	2030-2035

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

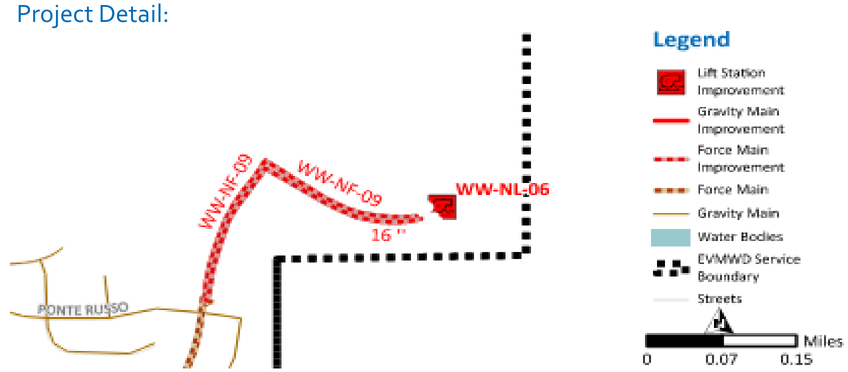
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	19%	$ 897,000
Future Users	81%	$ 3,846,000
Total	100%	$ 4,743,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-NL-07
Project Name: New Alberhill Lift Station Installation
System Type: Wastewater

Project Description:
Install the new Alberhill Lift Station. Firm capacity of 300 gpm required.Near the intersection of De Palma Road and Horsethief Canyon Road.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[(1)] ($/gallon/day)	Baseline Construction Cost ($)	Estimated Construction Cost[(2)] ($)	Capital Improvement Cost[(3)] ($)	Project Schedule
New Lift Station	300	New	600	$ 1.23	$ 1,058,653	$ 1,270,000	$ 1,778,000	2035-2040

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 1,778,000
Total	100%	$ 1,778,000

Project Detail:

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number:	WW-NL-08
Project Name:	Sunset Lift Station Installation
System Type:	Wastewater

Project Description:

Install Sunset Lift Station to service the Wildomar Meadows development. Firm capacity of 600 gpm required.Located near Wright Road and The Farm Road.

Project Details:

Project Element	Proposed Firm Capacity (gpm)	Replace/ New	Total Capacity (gpm)	Unit Cost[1] ($/gallon/day)	Baseline Construction Cost ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[3] ($)	Project Schedule
New Lift Station	600	New	1,200	$ 1.23	$ 2,117,306	$ 2,541,000	$ 3,557,000	2045-2050

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

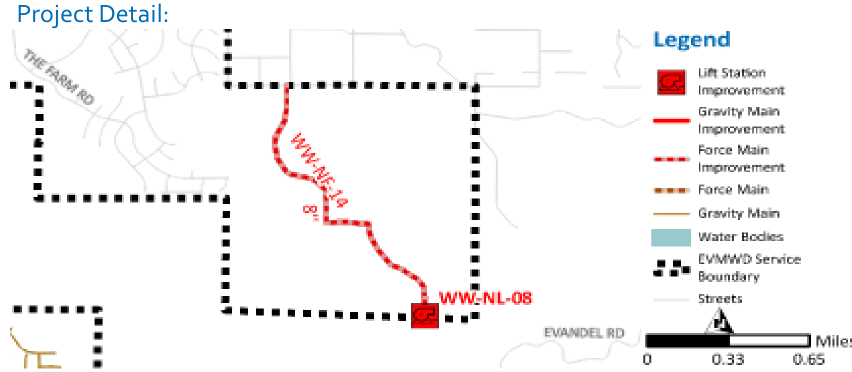
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	0%	$ -
Future Users	100%	$ 3,557,000
Total	100%	$ 3,557,000

Project Detail:



Project Number: WW-RR-01
Project Name: Gravity Pipeline R&R Program
System Type: Wastewater

Project Description:
Replcace all gravity mains that were scored a 4 or 5 during CCTV inspection. See Appendix H for list of individual pipes.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Baseline Construction Cost	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	6	8	Replace	5,367	281	$ 1,506,000	$ 1,807,000	$ 2,530,000	2025-2030
Gravity Main	8	8	Replace	19,318	281	$ 5,421,000	$ 6,505,000	$ 9,107,000	2025-2030
Gravity Main	10	10	Replace	933	356	$ 332,000	$ 398,000	$ 557,000	2025-2030
Gravity Main	12	12	Replace	1,138	389	$ 442,000	$ 530,000	$ 742,000	2025-2030
Gravity Main	15	15	Replace	372	507	$ 189,000	$ 227,000	$ 318,000	2025-2030
Gravity Main	21	21	Replace	936	631	$ 591,000	$ 709,000	$ 993,000	2025-2030
Gravity Main	24	24	Replace	291	718	$ 209,000	$ 251,000	$ 351,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

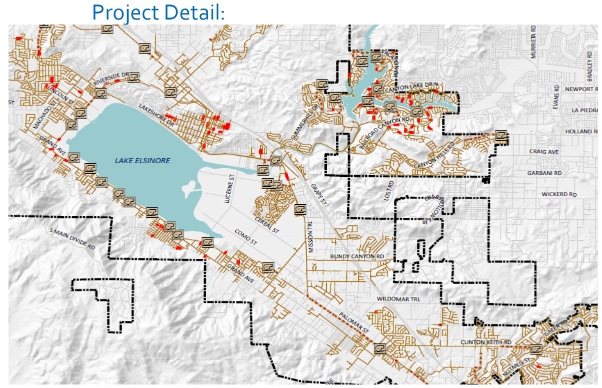
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	100%	$ 14,598,000
Future Users	0%	$ -
Total	100%	$ 14,598,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-RR-02
Project Name: Gravity Pipeline R&R Program
System Type: Wastewater

Project Description:
Replcace all gravity mains with less than 20 years of remaining useful life. See Appendix H for list of individual pipes.

Project Details:

Project Element	Existing Diameter (in)	Proposed Diameter (in)	Replace/ New	Length (ft)	Unit Cost[1] ($/ft)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
Gravity Main	8	8	Replace	3,055	$ 281	$ 857,000	$ 1,028,000	$ 1,439,000	2045-2050
Gravity Main	10	10	Replace	222	$ 356	$ 79,000	$ 95,000	$ 133,000	2045-2050
Gravity Main	14	15	Replace	292	$ 507	$ 148,000	$ 178,000	$ 249,000	2045-2050

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

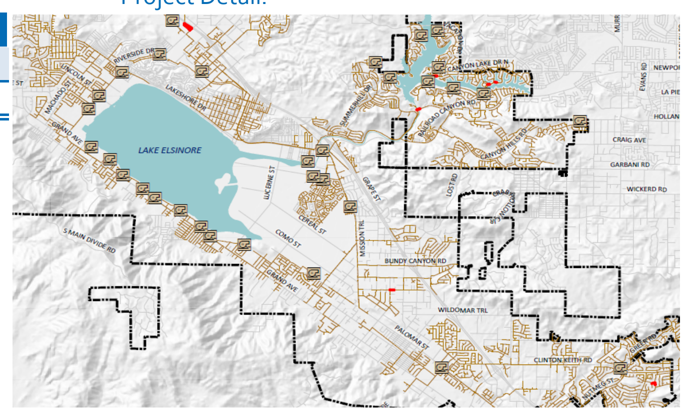
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	100%	$ 1,821,000
Future Users	0%	$ -
Total	100%	$ 1,821,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-FM-01 (1)
Project Name: Canyon Lake Infiltration and Inflow Monitoring
System Type: Wastewater

Project Description:
Install flow monitors downstream of the Canyon Lake to capture inflow into the wastewater collection system from high water levels resulting from water releasing from Canyon Lake. This project is in response to high rates of I/I entering the collection system following previous water releases from the Canyon Lake spillway. Install 8 flow meters along Old Newport Road near the San Jacinto River. WW-FM-01 (1) through WW-FM-01(4) show the location of six proposed meter sites. The remaining two sites will be determined at the time of the flow monitoring program.

Project Details:

Project Element	Number of Flow Meters	Unit Cost(1) ($/meter)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
I/I Flow Monitoring	8	$ 8,125	-	-	$ 65,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

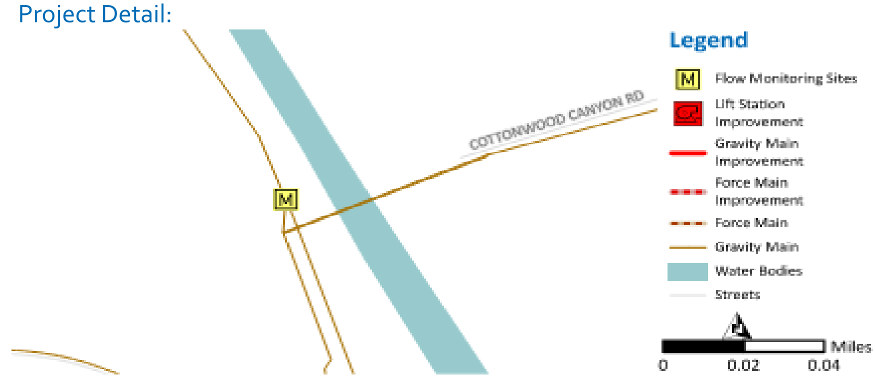
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	100%	$ 65,000
Future Users	0%	$ -
Total	100%	$ 65,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number:	WW-FM-01 (2)
Project Name:	Canyon Lake Infiltration and Inflow Monitoring
System Type:	Wastewater

Project Description:

Install flow monitors downstream of the Canyon Lake to capture inflow into the wastewater collection system from high water levels resulting from water releasing from Canyon Lake. This project is in response to high rates of I/I entering the collection system following previous water releases from the Canyon Lake spillway. Install 8 flow meters along Old Newport Road near the San Jacinto River. WW-FM-01 (1) through WW-FM-01(4) show the location of six proposed meter sites. The remaining two sites will be determined at the time of the flow monitoring program.

Project Details:

Project Element	Number of Flow Meters	Unit Cost(1) ($/meter)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
I/I Flow Monitoring	8	$ 8,125	-	-	$ 65,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

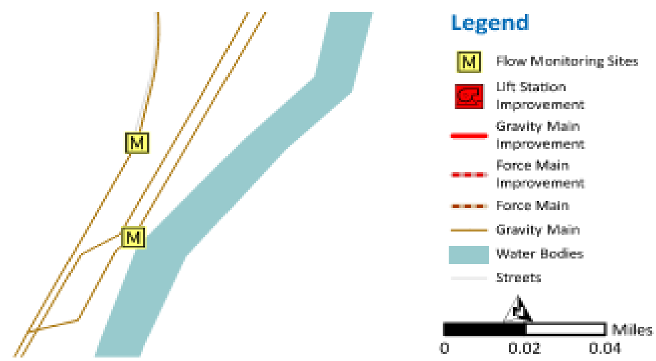
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	100%	$ 65,000
Future Users	0%	$ -
Total	100%	$ 65,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number:	WW-FM-01 (3)
Project Name:	Canyon Lake Infiltration and Inflow Monitoring
System Type:	Wastewater

Project Description:

Install flow monitors downstream of the Canyon Lake to capture inflow into the wastewater collection system from high water levels resulting from water releasing from Canyon Lake. This project is in response to high rates of I/I entering the collection system following previous water releases from the Canyon Lake spillway. Install 8 flow meters along Old Newport Road near the San Jacinto River. WW-FM-01 (1) through WW-FM-01(4) show the location of six proposed meter sites. The remaining two sites will be determined at the time of the flow monitoring program.

Project Details:

Project Element	Number of Flow Meters	Unit Cost[1] ($/meter)	Construction Cost ($)	Estimated Construction Cost[2]	Capital Improvement Cost[3]	Project Schedule
I/I Flow Monitoring	8	$ 8,125	-	-	$ 65,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

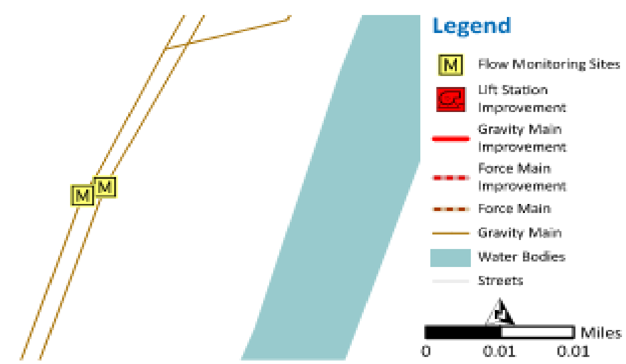
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	100%	$ 65,000
Future Users	0%	$ -
Total	100%	$ 65,000

Project Detail:



ELSINORE VALLEY MUNICIPAL WATER DISTRICT

carollo

Project Number: WW-FM-01 (4)
Project Name: Canyon Lake Infiltration and Inflow Monitoring
System Type: Wastewater

Project Description:

Install flow monitors downstream of the Canyon Lake to capture inflow into the wastewater collection system from high water levels resulting from water releasing from Canyon Lake. This project is in response to high rates of I/I entering the collection system following previous water releases from the Canyon Lake spillway. Install 8 flow meters along Old Newport Road near the San Jacinto River. WW-FM-01 (1) through WW-FM-01(4) show the location of six proposed meter sites. The remaining two sites will be determined at the time of the flow monitoring program.

Project Details:

Project Element	Number of Flow Meters	Unit Cost(1) ($/meter)	Construction Cost ($)	Estimated Construction Cost(2)	Capital Improvement Cost(3)	Project Schedule
I/I Flow Monitoring	8	$ 8,125	-	-	$ 65,000	2025-2030

Notes:

(1) ENR 20 City Average Construction Cost Index for July 2023 is 15,147.

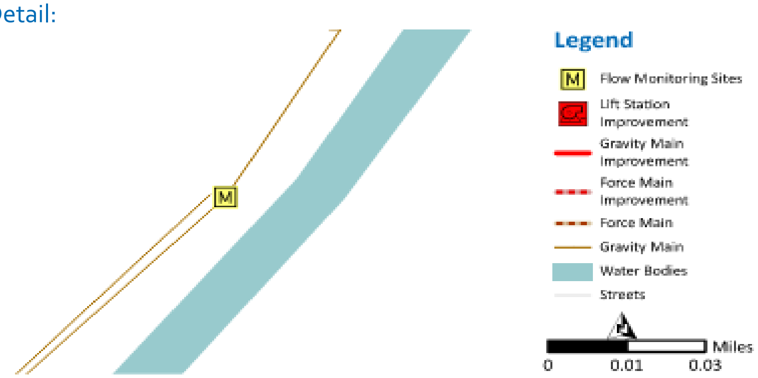
(2) Estimated Construction Cost includes a 20% contingency of the baseline construction cost.

(3) Total project costs includes a 40% markup for engineering, construction management and environmental & legal and a 8% markup for project administration of the estimated construction cost.

Project Cost Allocation:

Reimbursement Category	Percent	Cost ($)
Existing Users	100%	$ 65,000
Future Users	0%	$ -
Total	100%	$ 65,000

Project Detail:



Appendix E

FLOW MONITORING REPORT

Elsinore Valley Municipal Water District

Sanitary Sewer Master Plan Update Flow Monitoring

Prepared for:

Tim Loper, P.E.
Carollo Engineers, Inc.
100 West Liberty Street, Suite 740
Reno, NV 89501

November 9, 2022

Prepared by:

V&A consulting engineers

V&A Project No. 21-0345

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Abbreviations and Acronyms

Abbreviations/Acronyms	Definition
ADWF	Average Dry Weather Flow
AVG.	Average
CCTV	Closed-Circuit Television
CDEC	California Data Exchange Center
CIP	Capital Improvement Plan
CO	Carbon Monoxide
DIA.	Diameter
d/D	Depth/Diameter Ratio
EVMWD	Elsinore Valley Municipal Water District
FPS	Feet/Second
FT.	Feet
FM	Flow Monitor
GPD	Gallons per Day
GPM	Gallons per Minute
GWI	Groundwater Infiltration
H2S	Hydrogen Sulfide
IN.	Inch
I/I	Inflow and Infiltration
IDM	Inch-Diameter Mile
IDW	Inverse Distance Weighting
LEL	Lower Explosive Limit
MAX.	Maximum
MGD	Million Gallons per Day
MIN.	Minimum
NOAA	National Oceanic and Atmospheric Administration
N/A	Not applicable
PF	Peaking Factor
PS	Pump Station
PWS	Personal Weather Station

Q ....Flow Rate

QAQC...Quality Assurance Quality Control

RDI..Rainfall-Dependent Infiltration

RG...Rain Gauge

SSO...Sanitary Sewer Overflow

V&A...V&A Consulting Engineers, Inc.

WEF...Water Environment Federation

WRCC..Western Regional Climate Center

WRF ....Water Reclamation Facility

WU ....Weather Underground

Terms and Definitions

Term	Definition
Average dry weather flow (ADWF)	The average flow rate or pattern from days without noticeable inflow or infiltration response. ADWF usage patterns for weekdays and weekends differ and must be computed separately. ADWF is expressed as a numeric average and may include the influence of normal groundwater infiltration (not related to a rain event).
Basin	Sanitary sewer collection system upstream of a given location (often a flow meter), including all pipelines, inlets, and appurtenances. Also refers to the ground surface area near and enclosed by pipelines. A basin may refer to the entire collection system upstream from a flow meter or exclude separately monitored basins upstream.
Depth/diameter (*d*/*D*) ratio	Depth of water in a pipe as a fraction of the pipe's diameter. A measure of the fullness of the pipe used in the capacity analysis.
Infiltration and inflow	**Infiltration and inflow (I/I)** rates are calculated by subtracting the ADWF flow curve from the instantaneous flow measurements taken during and after a storm event. Flow in excess of the baseline consists of inflow, rainfall-responsive infiltration, and rainfall-dependent infiltration. **Combined I/I** is the total sum in gallons of additional flow attributable to a storm event.
Infiltration, groundwater	**Groundwater infiltration (GWI)** is groundwater that enters the collection system through pipe defects. GWI depends on the depth of the groundwater table above the pipelines as well as the percentage of the system that is submerged. The variation of groundwater levels and subsequent groundwater infiltration rates are seasonal by nature. On a day-to-day basis, groundwater infiltration rates are relatively steady and will not fluctuate greatly.
Infiltration, rainfall-dependent	**Rainfall-dependent infiltration (RDI)** is similar to groundwater infiltration but occurs as a result of storm water. The storm water percolates into the soil, submerges more of the pipe system, and enters through pipe defects. RDI is the slowest component of storm-related infiltration and inflow, beginning gradually and often lasting 24 hours or longer. The response time depends on the soil permeability and saturation levels.
Inflow	Inflow is defined as water discharged into the sewer system, including private sewer laterals, from direct connections such as downspouts, yard, and area drains, holes in manhole covers, cross-connections from storm drains, or catch basins. Inflow creates a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows. Overflows are often attributable to high inflow rates.
Peak Wet Weather Flow	The highest daily flow during and immediately after a significant storm event. Includes sanitary flow, infiltration, and inflow.
Peaking factor (PF)	PF is the ratio of peak measured flow to average dry weather flow. This ratio expresses the degree of fluctuation in flow rate over the monitoring period and is used in the capacity analysis.
Surcharge	When the flow level is higher than the crown of the pipe, then the pipeline is said to be in a **surcharged** condition. The pipeline is surcharged when the *d*/*D* ratio is greater than 1.0.

Executive Summary

Scope and Purpose

V&A Consulting Engineers (V&A) was retained by Carollo Engineers (Carollo) to perform flow monitoring at 34 locations in the Elsinore Valley Municipal Water District (District). The project was intended to be split into two components: (1) system-wide hydraulic calibration flow monitoring at 27 locations for one month; (2) flow monitoring in the southern section at 7 locations for 10 weeks, with a focus on isolating inflow and infiltration (I/I). Due to the lack of rainfall during duration of the flow monitoring, the I/I portion of this project was postponed for a future project.

The purpose of this work was to provide flow monitoring data with capacity analysis. Though I/I analysis was removed from the scope, some I/I observations were included in this report, to be utilized at the discretion of the reviewing Engineer. Flow and rainfall monitoring were conducted from February 23, 2022, to May 17, 2022.The following is our detailed scope of work for the subject services.

1. Establish the baseline sanitary sewer flows at the flow monitoring sites
2. Establish the peak flow condition during rainfall events and indicate relative available sewer capacity at the flow monitoring nodes.

Monitoring Sites and Basins

The flow monitoring site locations were selected and approved by Carollo and the District and are listed in Table ES-1 and shown in Figure ES-1.

Table ES-1. List of Monitoring Sites

Monitoring Site	Manhole No.	Monitored Inlet Pipe	Pipe Diameter (in)	Location	Install Date	Removal Date	Monitored Length (Days)
Site01	MH-77	E	14.75	Kicking Horse Drive, west of Caravan Circle	25-Feb	17-May	81
Site02	MH-719	W	12	Lakeshore Drive, north of Machado Street	1-Mar	18-May	78
Site03	MH-957	S	14.75	Machado Street, west of Lakeshore Drive	1-Mar	21-Apr	51
Site04	MH-1398	W	17.75	Riverside Drive and Washington Street	24-Feb	19-May	84
Site05	MH-1420	N	29.75	Regional Water Reclamation Facility (WRF)	24-Feb	19-May	84
Site06	MH-1035	NW	24	Pasadena Street, west of 3rd Street	3-Mar	18-May	76
Site07	MH-7014	NW	14.75	3rd Street, south of Collier Street	22-Feb	22-May	89
Site08	MH-7016	NE	15	3rd Street, south of Collier Street	28-Feb	18-May	79
Site09	MH-1040	SE	54	Minthorn Street, west of Birch Street	1-Mar	17-May	77
Site10	MH-1445	W	11.75	Chaney Street, north of Pasadena Street	28-Feb	18-Apr	49
Site11	MH-1431	NE	26.75	Tri Valley Community School	24-Feb	20-May	85
Site12	MH-1443	E	24	Easement off Chaney St	22-Feb	22-May	89
Site13	MH-2706	NE	36	Casino Drive, east of Avenue 12	28-Feb	18-May	79
Site14	MH-2825	NE	20.75	Old Newport Road	24-Feb	19-May	84
Site15	MH-6994	E	17.75	Railroad Canyon Road	24-Feb	18-May	83
Site16	MH-2518	W	20.75	Via De La Valle, east of Via De La Luna	1-Mar	19-May	79
Site17	MH-2577	E	14.75	Railroad Canyon Road, near Skylink	24-Feb	19-May	84
Site18	MH-2559	N	15	Canyon Lake Country Club	22-Feb	18-May	85
Site19	MH-1126	NW	12	Redwood Drive and Boating Way	2-Mar	18-May	77
Site20	MH-3157	S	21	Mission Trail and Olive Street	22-Feb	22-May	89
Site21	MH-3368	E	11.75	Lemon Street and Mission Trail	28-Feb	8-May	69
Site22	MH-3356	SE	18	Mission Trail Road, shoulder	28-Feb	18-May	79
Site23	MH-3577	E	12	Bundy Canyon Road and Mission Trail	28-Feb	18-May	79
Site24	MH-4135	S	23.75	McVicar Street	25-Feb	22-May	86
Site25	MH-4921	NE	23.75	Catt Road and Nan Street	25-Feb	9-May	73

Monitoring Site	Manhole No.	Monitored Inlet Pipe	Pipe Diameter (in)	Location	Install Date	Removal Date	Monitored Length (Days)
Site26	MH-6272	SE	20.75	Palomar Street and Delca Lane	28-Feb	17-May	78
Site27	MH-4413	NW	14.75	Hardwood Lane and Wing Elm Circle	25-Feb	20-May	84
Site28	MH-5401	NE	11.75	Nutmeg Street, west of Jackson Avenue	1-Mar	21-Apr	51
Site29	MH-4521	E	9.75	Nutmeg Street, west of Gingerbread Drive	3-Mar	18-May	76
Site30	MH-4647	W	9.75	Colony Drive, west of Avenida Florita	2-Mar	17-May	76
Site31	MH-4228	N	10	Nutmeg Street, south of Saint Rafael Drive	3-Mar	18-Apr	46
Site32	MH-4602	E	9.75	Tarragona Drive, east of Almansa Court	2-Mar	17-May	76
Site33	MH-4768	E	11.75	Behind Via Tonada in California Oaks Golf Course	24-Feb	9-May	74
Site34	MH-4829	N	9.75	Symphony Park Lane and Chalone Drive	2-Mar	17-May	76

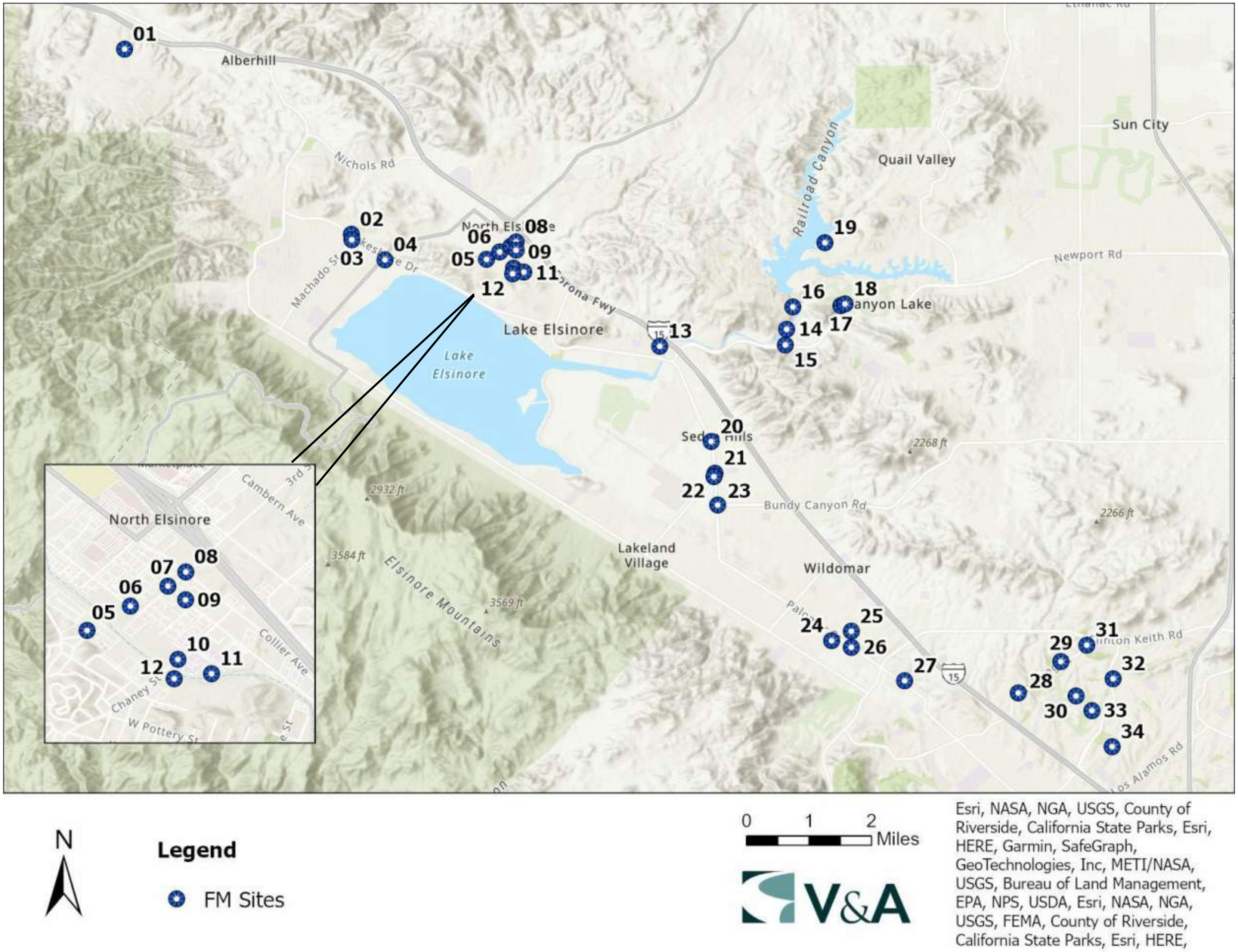

Figure ES-1. Map of Flow Monitoring Sites

Rainfall Monitoring

There was one main rain event that elicited an I/I response at some locations within the system over the flow monitoring period, illustrated in Figure ES-2. This work took place during a 'drought' wet weather season; the cumulative precipitation (triangulated) was approximately at 37% of historical precipitation averages over the specific duration of the flow monitoring and the following classification notes regarding the rain event are identified (refer to Figure ES-3 and Table ES-2):

1. Rain event 1 (3/27 – 3/29) was the only identified rain event
2. Rain event 1 was classified as a < 1 Yr. event by most of the rain gauges

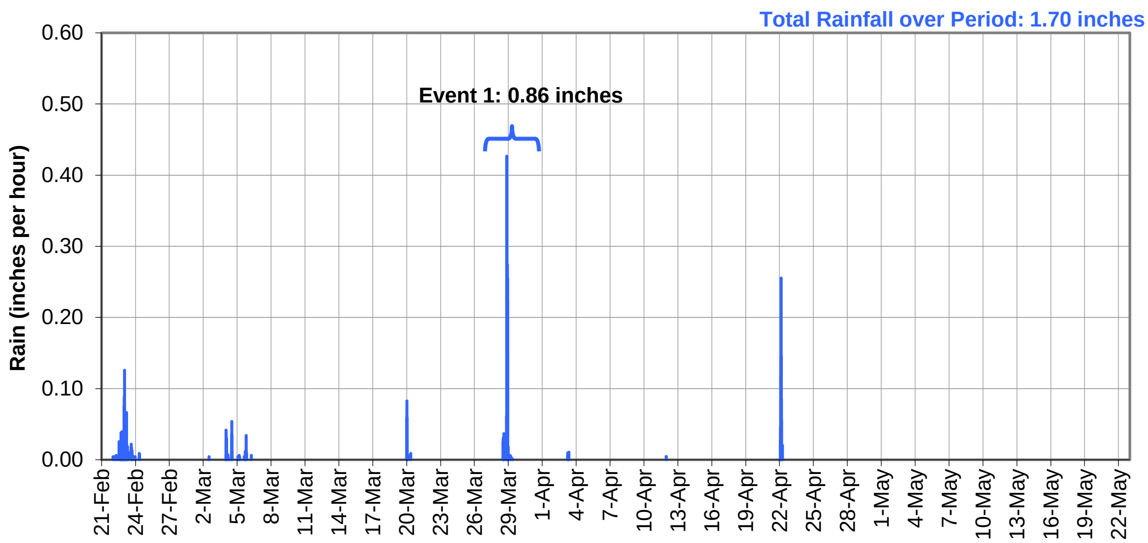

Figure ES-2. Rainfall Monitoring (triangulated to Historical Station Elsinore)

Table ES-2. Rain Event Classification

Rain Gauge	Rain Event 1 3/27/22 - 3/30/22
A	< 1-Yr
B	< 1-Yr
C	< 1-Yr
D	1.5-Yr, 30-Min
E	1.5-Yr, 2-Hr
F	1.5-Yr, 15-Min
G	< 1-Yr
H	1-Yr, 15-Min
I	1.5-Yr, 15-Min
J	< 1-Yr
K	< 1-Yr
L	< 1-Yr
M	< 1-Yr

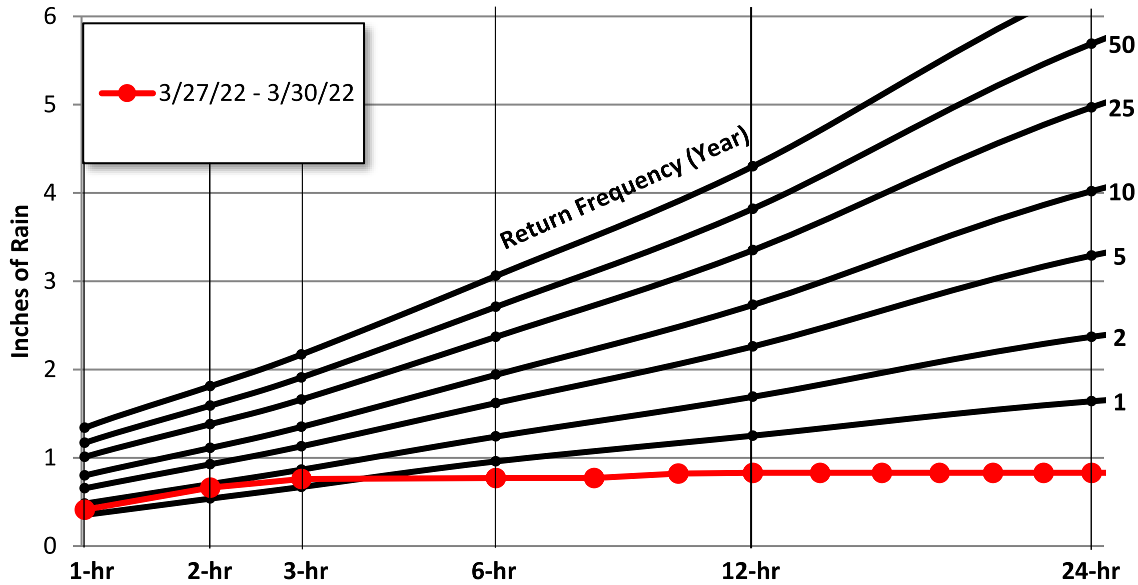

Figure ES-3. Rainfall Event Classification – 24-Hour Period (RG E)

Site Flow Monitoring and Capacity Results

The flow monitoring program was successful in capturing both dry and wet weather flow data. Average dry weather flow (ADWF) curves were established during dry days when I/I had the least impact on the baseline flow. The following dry weather item relating to capacity is noted:

- Sites 6, 19, and 22 had 1.25 to 2.0 inches of sediment measured in the pipe channel. Sites 6, 19, 20, 24, and 34 had an average flow level greater than 50% pipe full conditions (greater than 0.5 d/D).

Peak measured flows and the hydraulic grade line data (flow depths) are important to understanding the capacity limitations of a collection system. The peak flows and flow levels are the peak measurements as taken across the entirety of the flow monitoring period. For this study, peak flows and peak levels corresponded to rainfall events. The following capacity analysis definitions will be used:

- **Peaking Factor (PF)** is defined as the peak measured flow divided by the average dry weather flow (ADWF). Peaking factors are influenced by many factors, including size and topography of tributary area, flow attenuation, flow restrictions, characteristics of I/I entering the collection system, and hydraulic features such as pump stations.
  - For this report, PF > 5 are highlighted in RED[1]; however, the District should refer to District standards when evaluating peaking factors. Peaking factor data should be used at the discretion of the District Engineer.
- **d/D Ratio** is the peak measured depth of flow (d) divided by the pipe diameter (D). The d/D ratio for each site is computed based on the maximum depth of flow for the study. Standards for d/D ratio vary from agency to agency, but typically range between d/D ≤ 0.5 and d/D ≤ 0.75
  - For this report, d/D ratios > 0.75 are highlighted in RED; however, the District should refer to District standards when evaluating d/D ratios, to be used at the discretion of the District Engineer.

Table ES-3 summarizes the peak recorded flows, depths, *d/D* ratios, and peaking factors per site during the flow monitoring period. Capacity analysis data are presented on a site-by-site basis and represents the hydraulic conditions only at the site locations; hydraulic conditions in other areas of the collection system will differ. Figure ES-4 and Figure ES-5 show bar graph summaries of the peaking factors and d/D ratios, respectively. Figure ES-6 shows the schematic diagram of the peak measured flows in each section with peak flow levels.

The following capacity analysis results are noted:

- Peaking Factors
  - Sites 7, 10, 21, 28 and 31 had peaking factors greater than 5.
- d/D Ratio:
  - d/D > 1.0: Site 24 reached a surcharge condition during this study. Peak flow depth was 0.8 feet above the pipe crown. Site 34 had d/D ratio between 0.75 and 1.0.

[1] WEF Manual of Practice FD-6 and ASCE Manual No. 62 suggests typical peaking factor ratios range between 3 and 4, with higher values possibly indicative of pronounced I/I flows.

Table ES-3. Capacity Analysis Summary

Site	ADWF (MGD)	Peak Measured Flow (MGD)	Peaking Factor	Pipe Diameter, *D* (IN)	Max Depth, *d* (IN)	Max, d/D	Surcharge above pipe crown (FT)
Site 01	0.199	0.46	2.3	14.75	5.20	0.35	-
Site 02	0.253	0.57	2.3	12	2.26	0.19	-
Site 03	0.179	0.37	2.1	14.75	4.09	0.28	-
Site 04	0.738	1.57	2.1	17.75	9.07	0.51	-
Site 05	1.293	2.64	2.0	29.75	11.19	0.38	-
Site 06	0.085	0.36	4.2	24	12.80	0.53	-
Site 07	0.048	0.54	11.4	14.75	3.17	0.22	-
Site 08	0.419	0.75	1.8	15	4.22	0.28	-
Site 09	3.458	5.89	1.7	54	25.14	0.47	-
Site 10	0.003	0.02	6.7	11.75	1.70	0.14	-
Site 11	0.061	0.13	2.1	26.75	4.41	0.16	-
Site 12	0.116	0.22	1.9	24	3.28	0.14	-
Site 13	0.720	2.27	3.1	36	9.11	0.25	-
Site 14	0.702	1.57	2.2	20.75	9.05	0.44	-
Site 15	0.556	1.15	2.1	17.75	2.55	0.14	-
Site 16	0.177	0.49	2.7	20.75	1.29	0.06	-
Site 17	0.507	1.07	2.1	14.75	5.03	0.34	-
Site 18	0.275	0.62	2.3	15	4.50	0.30	-
Site 19	0.100	0.21	2.1	12	7.35	0.61	-
Site 20	1.730	2.94	1.7	21	14.58	0.69	-
Site 21	0.024	0.23	9.8	11.75	1.90	0.16	-
Site 22	0.413	0.85	2.1	18	12.46	0.69	-
Site 23	0.096	0.29	3.1	12	2.41	0.20	-
Site 24	0.165	0.79	4.8	23.75	33.64	1.42	0.8
Site 25	0.570	1.31	2.3	23.75	2.62	0.11	-
Site 26	0.179	0.38	2.1	20.75	8.39	0.40	-
Site 27	0.148	0.31	2.1	14.75	4.85	0.33	-
Site 28	0.025	0.25	10.0	11.75	2.25	0.19	-
Site 29	0.138	0.35	2.5	9.75	1.78	0.18	-
Site 30	0.194	0.60	3.1	9.75	4.12	0.42	-
Site 31	0.046	0.27	5.9	10	1.98	0.20	-
Site 32	0.095	0.21	2.2	9.75	3.56	0.36	-
Site 33	0.273	0.56	2.0	11.75	3.08	0.26	-
Site 34	0.047	0.13	2.7	9.75	7.40	0.76	-

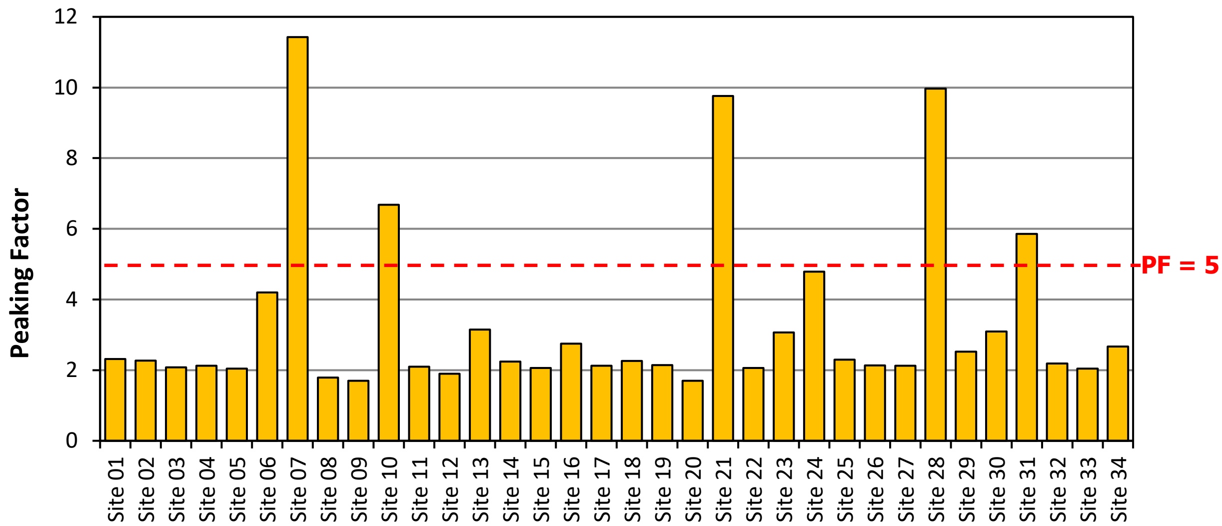

Figure ES-4. Peaking Factors

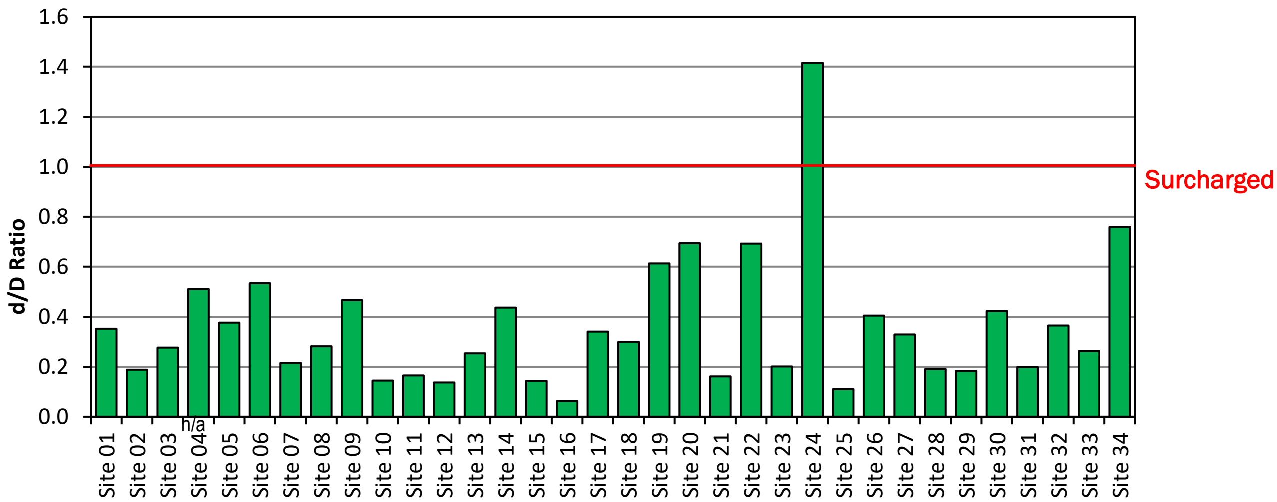

Figure ES-5. Capacity Summary: Max d/D Ratios

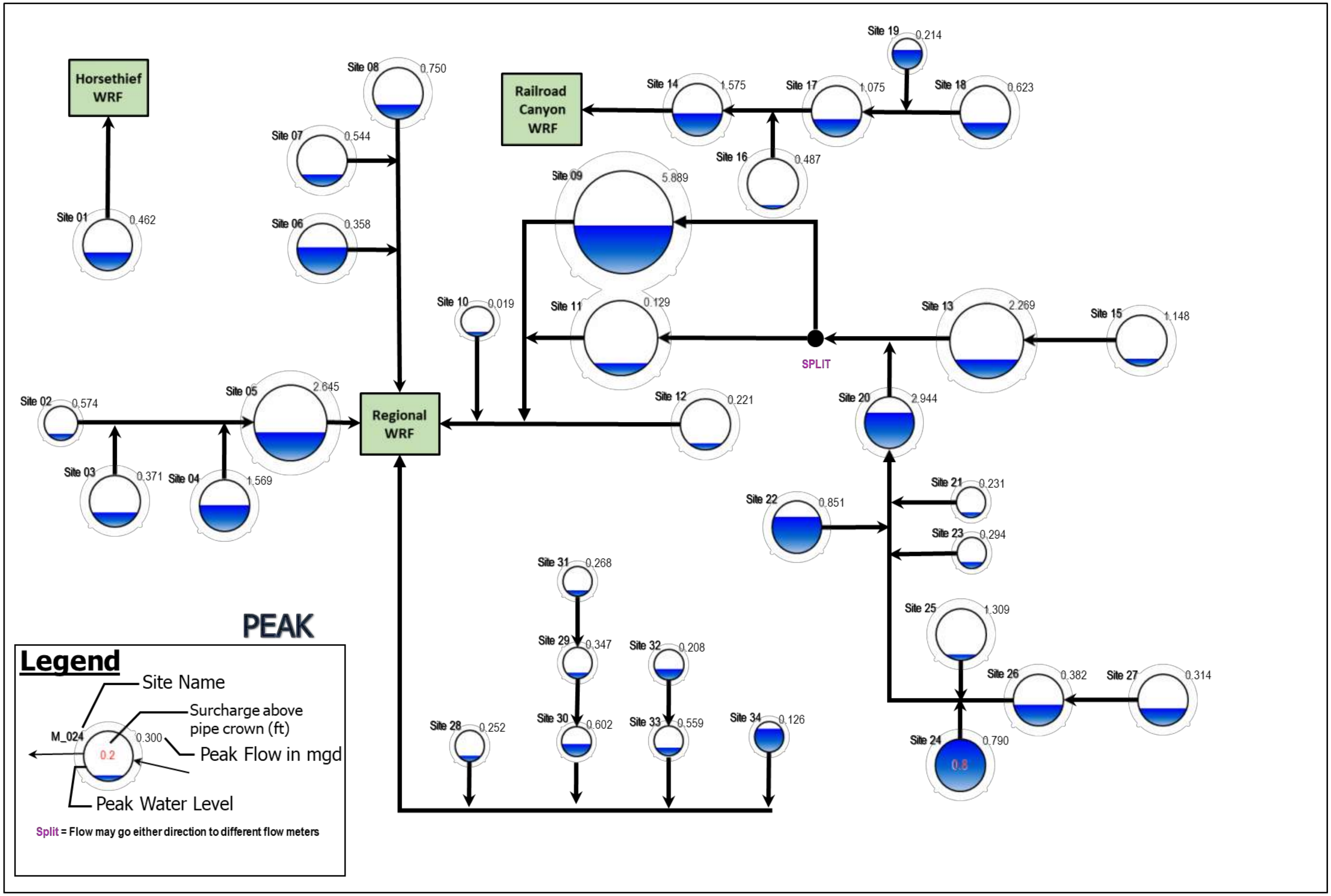

Figure ES-6. Peak Measured Flow (Flow Schematic)

Infiltration and Inflow Analysis

Please note that the rainfall intensity varied significantly across the region during the study, which contributed to some of the unexpected results showcased in the report, i.e., Basin 29-34's I/I response rank were lower than expected. Therefore, this report should be taken with some level of caution.

It is noted and understood that the I/I analysis for this study was removed as a scope item. There was minimal rainfall during the flow monitoring period, and the rain event that did occur had sometimes severely different magnitudes across the collection system. The data provided is for informational purposes only and should be evaluated appropriately by the reviewing Engineer.

Table ES-4 summarizes the I/I result for this study. The "Top 5" basins for each category have been shaded in RED. Please refer to the I/I Methods section for more information on inflow and infiltration analysis methods and ranking methods. Due to the low RDI response obtained from this study, no RDI analysis would be included in this report. Basins 9 and 11 were combined for I/I analysis due to cross-connections upstream. Basins 14 and 16 were combined for I/I analysis as Site 16 (upstream of Site 14) did not capture flow data during the rain event due to meter failure. Temperature maps for the ranked Inflow and Total I/I response metrics are shown in Figure ES-7 and Figure ES-8. The following infiltration and inflow results are noted:

- **Inflow**: Basins 5, 13, 21, 23, and 28 had the highest weighted, normalized peak I/I rates, an indicator of high inflow upstream from the flow monitoring basin.
- **Combined I/I**: Basins 5, 13, 28, 30, and 34 had the highest weighted, normalized combined rates, an indicator of high combined total I/I upstream from the flow monitoring basin.
- **Groundwater Infiltration**: Sites 8 and 11 had GWI rates higher-than typical standards, indicating possible high groundwater infiltration rates.

Table ES-4. I/I Analysis Summary

Monitoring Basin	ADWF (mgd)	Basin Acreage	Peak Inflow Rate (mgd)	Combined I/I (gallons)	Inflow Rank	Combined I/I Rank	Possible high GWI?
Basin 01	0.199	390	0.106	15,100	19	19	-
Basin 02	0.253	767	0.111	3,700	25	28	-
Basin 03	0.179	597	0.078	14,300	27	16	-
Basin 04	0.738	1088	0.375	76,900	17	10	-
Basin 05	0.124	231	0.177	24,400	4	4	-
Basin 06	0.085	310	0.068	4,100	13	23	-
Basin 07	0.048	80	0.029	4,300	12	13	-
Basin 08	0.419	328	0.055	6,300	28	25	-
Basin 10	0.003	31	0.003	200	20	22	-
Basin 12	0.116	345	0.066	10,400	21	15	-
Basin 13	0.164	260	0.324	59,000	3	3	Yes
Basin 15	0.556	1090	0.102	14,800	29	24	-
Basin 17	0.131	397	0.135	Negligible	8	29	-
Basin 18	0.275	880	0.158	21,600	22	18	-
Basin 19	0.1	312	0.074	8,500	14	21	-
Basin 20	0.283	1187	Negligible	Negligible	31	29	-
Basin 21	0.024	208	0.197	7,400	2	7	-
Basin 22	0.413	1677	0.306	25,900	18	17	-
Basin 23	0.096	343	0.132	9,800	5	12	-
Basin 24	0.165	475	0.136	22,200	10	9	-
Basin 25	0.57	1431	0.242	10,600	26	26	-
Basin 26	0.032	121	Negligible	Negligible	31	29	-
Basin 27	0.148	104	0.087	8,900	9	14	-
Basin 28	0.025	31	0.061	18,400	1	1	Yes
Basin 29	0.092	171	0.052	10,700	16	11	-
Basin 30	0.057	121	0.054	23,400	7	2	-
Basin 31	0.046	86.4	0.016	900	24	27	-
Basin 32	0.095	179	0.04	6,600	23	20	-
Basin 33	0.178	221	0.085	22,500	15	6	-
Basin 34	0.047	121	0.037	7,700	11	5	-
Basin 9+11	1.069	1274	0.156	Negligible	30	29	-
Basin 14+16	0.196	575	0.243	33,300	6	8	-

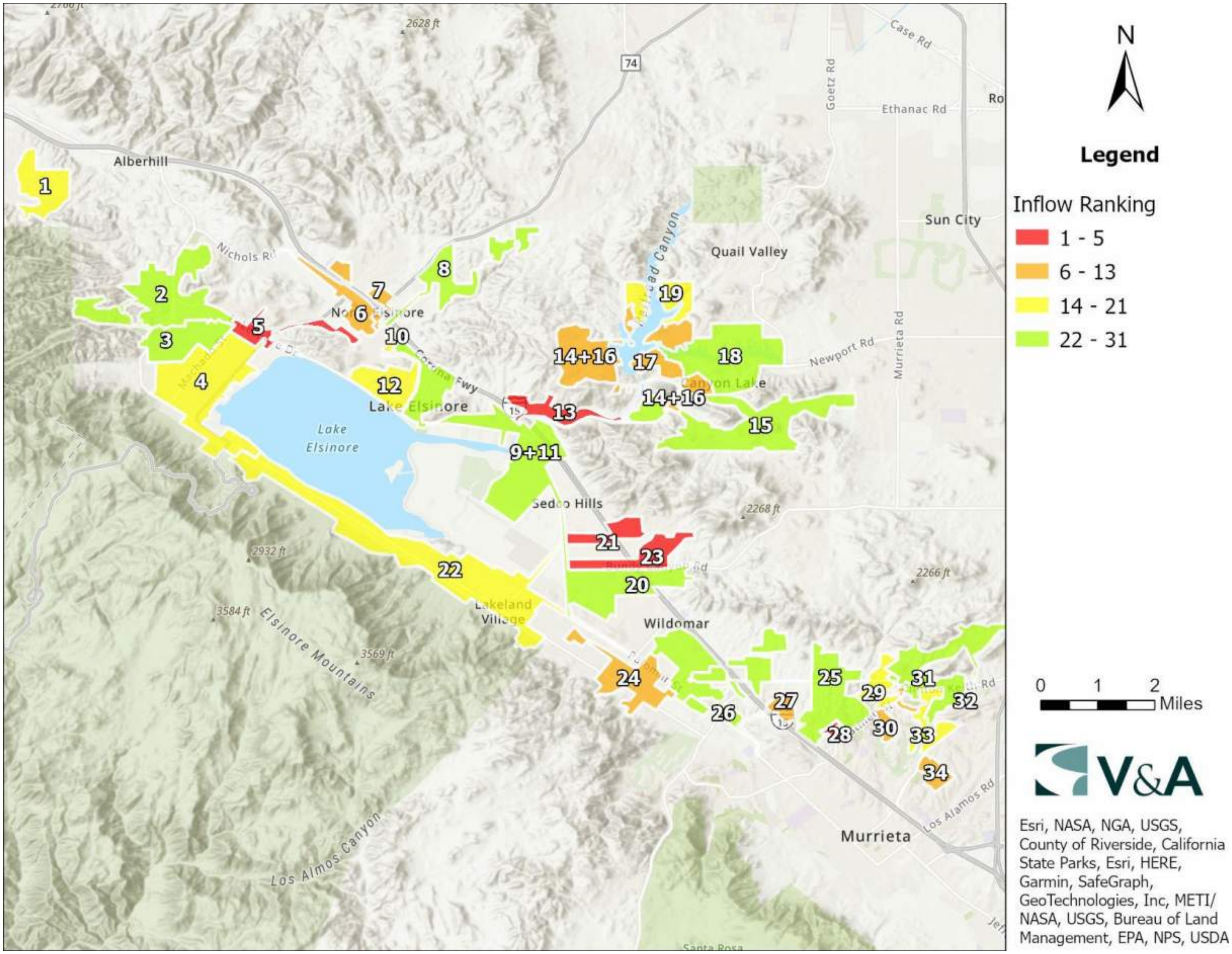

Figure ES-7. Temperature Map: Inflow Final Basin Rankings

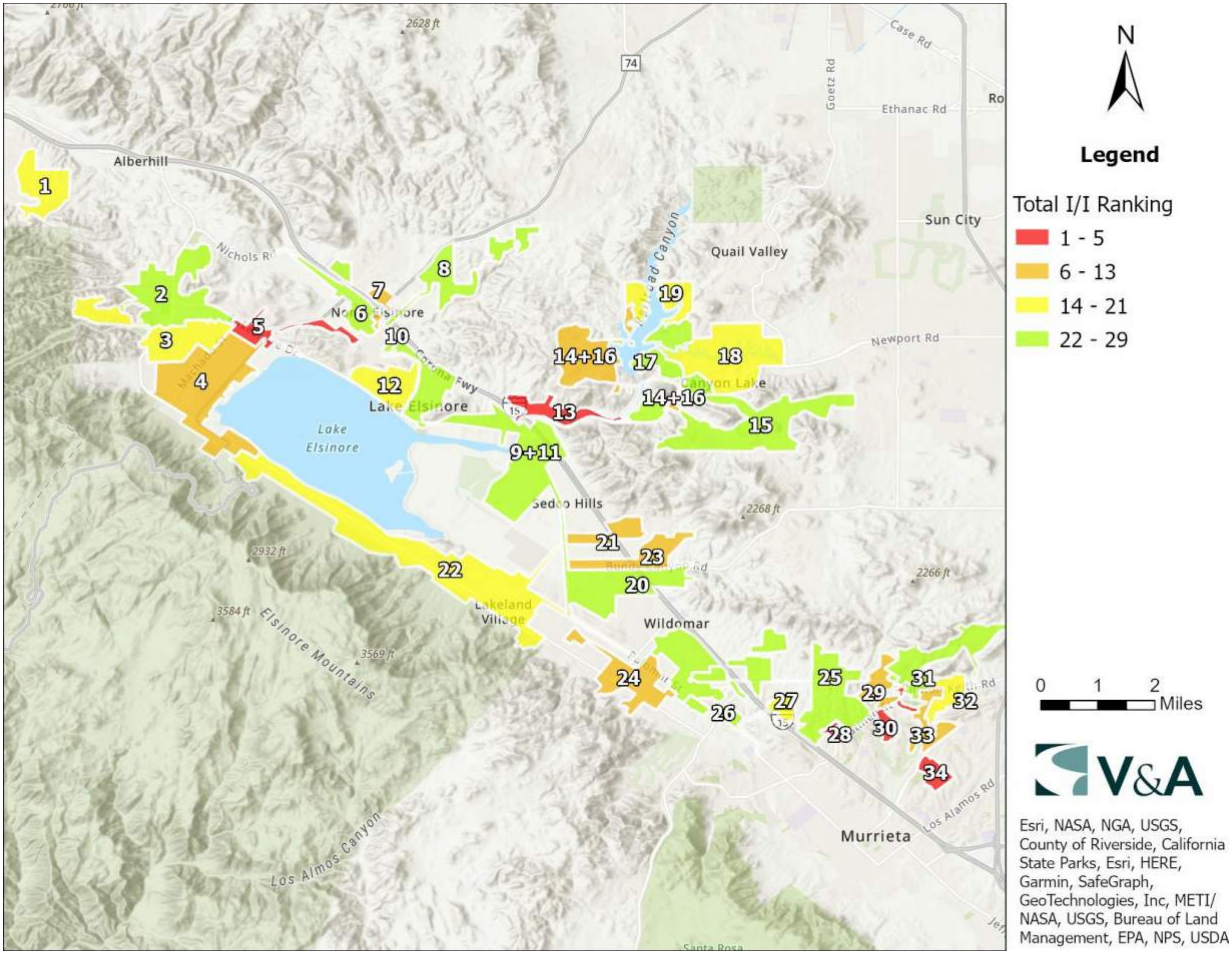

Figure ES-8. Temperature Map: Combined I/I Final Basin Rankings

Recommendations

V&A advises that future I/I reduction plans consider the following recommendations:

1. **Master Plan and Model Implementation**: This study focuses on inflow and infiltration generation; the study results can be used to update the master plan and compare with previous model assumptions and flow monitoring results.
    a. **Verify Interconnections and Overflows**: understanding the interconnections and overflows can help with the master plan, basin isolation, and I/I analysis.
2. **Capacity Analysis**: Global capacity constraints will be addressed in the updated master plan. The following possible capacity concerns are noted:
    a. **Dry weather**: Sites 6, 19, 20, 22, 24, and 34 exceeded 0.5 d/D Dry Weather. Sites 6, 19 and 22 had 1.25 to 2 inches of sediment measured in the pipe channel.
    b. **Wet Weather**: Site 24 reached a surcharge condition during this study. Peak flow depth was 0.8 feet above the pipe crown. Site 34 had d/D ratio between 0.75 and 1.0.
3. **Determine I/I Reduction Program**: The District should examine its I/I reduction needs to determine their needs and goals for a future I/I reduction program.
    a. If peak flows, sanitary sewer overflows, and pipeline capacity issues are of greater concern, then priority can be given to investigate and reduce sources of inflow within the basins with the greatest inflow problems.
    b. If total infiltration and general pipeline deterioration are of greater concern, then the program can be weighted to investigate and reduce sources of infiltration within the basins with the greatest infiltration problems.
4. **I/I Reduction Cost Effective Analysis**: The District should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow/infiltration and systematically rehabilitating or replacing the faulty pipelines; or (2) continued treatment of the additional rainfall dependent I/I flow.

1 Introduction

1.1 Scope and Purpose

V&A Consulting Engineers (V&A) was retained by Carollo Engineers (Carollo) to perform flow monitoring at 34 locations in the Elsinore Valley Municipal Water District (District). The project was intended to be split into two components: (1) system-wide hydraulic calibration flow monitoring at 27 locations for one month; (2) flow monitoring in the southern section at 7 locations for 10 weeks, with a focus on isolating inflow and infiltration (I/I). Due to the lack of rainfall during duration of the flow monitoring, the I/I portion of this project was postponed for a future project.

The purpose of this work was to provide flow monitoring data with capacity analysis. Though I/I analysis was removed from the scope, some I/I observations were included in this report, to be utilized at the discretion of the reviewing Engineer. Flow and rainfall monitoring were conducted from February 23, 2022, to May 17, 2022.The following is our detailed scope of work for the subject services.

1. Establish the baseline sanitary sewer flows at the flow monitoring sites
2. Establish the peak flow condition during rainfall events and indicate relative available sewer capacity at the flow monitoring nodes

1.2 Flow Monitoring Sites and Isolated Sewerage Basins

Flow monitoring sites are defined as the manholes where flow monitors are secured and the pipelines in which flow sensors are placed. Capacity analysis and flow rate information is presented on a site-by-site basis. The flow monitoring sites were selected and approved by Carollo and the District. Information regarding the flow monitoring locations are listed in Table 1-1 and illustrated in Figure 1-1. Detailed descriptions of the individual flow monitoring sites, including photographs, are included in Appendix A.

Flow monitoring site data may include the flows of one or many drainage basins. Flow monitoring basins are localized areas of a sanitary sewer collection system upstream of a given location (often a flow meter), including all pipelines, inlets, and appurtenances. The basin refers to the ground surface area near and enclosed by the pipelines. A basin may refer to the entire collection system upstream from a flow meter or may exclude separately monitored basins upstream, requiring basin isolation (subtraction of upstream flows). The I/I analysis results will be presented on an isolated basin basis. The basins, basin attributes, and basin isolation equations are listed in Table 1-2 and shown in Figure 1-2. The following notes regarding basin isolations are noted:

- Basin 9+11: Due to cross-connections, Sites 9 and 11 were combined (summed) to define Basin 9+11.
- Basin 14+16: Site 16 (upstream of Site 14) did not capture flow data during the rain event due to meter failure. Basins 14 and 16 had to be combined and Site 14 did not subtract upstream Site 16 flows.

Table 1-1. List of Monitoring Locations

Monitoring Site	Manhole No.	Monitored Inlet Pipe	Pipe Diameter (in)	Location	Install Date	Removal Date	Monitored Length (Days)
Site01	MH-77	E	14.75	Kicking Horse Drive, west of Caravan Circle	25-Feb	17-May	81
Site02	MH-719	W	12	Lakeshore Drive, north of Machado Street	1-Mar	18-May	78
Site03	MH-957	S	14.75	Machado Street, west of Lakeshore Drive	1-Mar	21-Apr	51
Site04	MH-1398	W	17.75	Riverside Drive and Washington Street	24-Feb	19-May	84
Site05	MH-1420	N	29.75	Regional Water Reclamation Facility (WRF)	24-Feb	19-May	84
Site06	MH-1035	NW	24	Pasadena Street, west of 3rd Street	3-Mar	18-May	76
Site07	MH-7014	NW	14.75	3rd Street, south of Collier Street	22-Feb	22-May	89
Site08	MH-7016	NE	15	3rd Street, south of Collier Street	28-Feb	18-May	79
Site09	MH-1040	SE	54	Minthorn Street, west of Birch Street	1-Mar	17-May	77
Site10	MH-1445	W	11.75	Chaney Street, north of Pasadena Street	28-Feb	18-Apr	49
Site11	MH-1431	NE	26.75	Tri Valley Community School	24-Feb	20-May	85
Site12	MH-1443	E	24	Easement off Chaney St	22-Feb	22-May	89
Site13	MH-2706	NE	36	Casino Drive, east of Avenue 12	28-Feb	18-May	79
Site14	MH-2825	NE	20.75	Old Newport Road	24-Feb	19-May	84
Site15	MH-6994	E	17.75	Railroad Canyon Road	24-Feb	18-May	83
Site16	MH-2518	W	20.75	Via De La Valle, east of Via De La Luna	1-Mar	19-May	79
Site17	MH-2577	E	14.75	Railroad Canyon Road, near Skylink	24-Feb	19-May	84
Site18	MH-2559	N	15	Canyon Lake Country Club	22-Feb	18-May	85
Site19	MH-1126	NW	12	Redwood Drive and Boating Way	2-Mar	18-May	77
Site20	MH-3157	S	21	Mission Trail and Olive Street	22-Feb	22-May	89
Site21	MH-3368	E	11.75	Lemon Street and Mission Trail	28-Feb	8-May	69
Site22	MH-3356	SE	18	Mission Trail Road, shoulder	28-Feb	18-May	79
Site23	MH-3577	E	12	Bundy Canyon Road and Mission Trail	28-Feb	18-May	79
Site24	MH-4135	S	23.75	McVicar Street	25-Feb	22-May	86

Monitoring Site	Manhole No.	Monitored Inlet Pipe	Pipe Diameter (in)	Location	Install Date	Removal Date	Monitored Length (Days)
Site25	MH-4921	NE	23.75	Catt Road and Nan Street	25-Feb	9-May	73
Site26	MH-6272	SE	20.75	Palomar Street and Delca Lane	28-Feb	17-May	78
Site27	MH-4413	NW	14.75	Hardwood Lane and Wing Elm Circle	25-Feb	20-May	84
Site28	MH-5401	NE	11.75	Nutmeg Street, west of Jackson Avenue	1-Mar	21-Apr	51
Site29	MH-4521	E	9.75	Nutmeg Street, we of Gingerbread Drive	3-Mar	18-May	76
Site30	MH-4647	W	9.75	Colony Drive, west of Avenida Florita	2-Mar	17-May	76
Site31	MH-4228	N	10	Nutmeg Street, south of Saint Rafael Drive	3-Mar	18-Apr	46
Site32	MH-4602	E	9.75	Tarragona Drive, east of Almansa Court	2-Mar	17-May	76
Site33	MH-4768	E	11.75	Behind Via Tonada in California Oaks Golf Course	24-Feb	9-May	74
Site34	MH-4829	N	9.75	Symphony Park Lane and Chalone Drive	2-Mar	17-May	76

Table 1-2. Isolated Flow Monitoring Basin Characteristics

Isolated Basin	Flow Isolation Calculation	Area (Acres)
Basin 1	$= Q_1$	390
Basin 2	$= Q_2$	767
Basin 3	$= Q_3$	597
Basin 4	$= Q_4$	1088
Basin 5	$= Q_5 - Q_2 - Q_3 - Q_4$	231
Basin 6	$= Q_6$	310
Basin 7	$= Q_7$	80
Basin 8	$= Q_8$	328
Basins 9+11	$= Q_9 + Q_{11} - Q_{13} - Q_{20}$	1274
Basin 10	$= Q_{10}$	31.4
Basin 12	$= Q_{12}$	345
Basin 13	$= Q_{13} - Q_{15}$	260
Basin 14+16	$= Q_{14} - Q_{17}$	575
Basin 15	$= Q_{15}$	1090
Basin 17	$= Q_{17} - Q_{18}$	397
Basin 18	$= Q_{18}$	880
Basin 19	$= Q_{19}$	312
Basin 20	$= Q_{20} - Q_{21} - Q_{22} - Q_{23} - Q_{24} - Q_{25} - Q_{26}$	1187
Basin 21	$= Q_{21}$	208
Basin 22	$= Q_{22}$	1677
Basin 23	$= Q_{23}$	343
Basin 24	$= Q_{24}$	475
Basin 25	$= Q_{25}$	1431
Basin 26	$= Q_{26} - Q_{27}$	121
Basin 27	$= Q_{27}$	104
Basin 28	$= Q_{28}$	31
Basin 29	$= Q_{29} - Q_{31}$	171
Basin 30	$= Q_{30} - Q_{29}$	121
Basin 31	$= Q_{31}$	86.4
Basin 32	$= Q_{32}$	179
Basin 33	$= Q_{33} - Q_{32}$	221
Basin 34	$= Q_{34}$	121

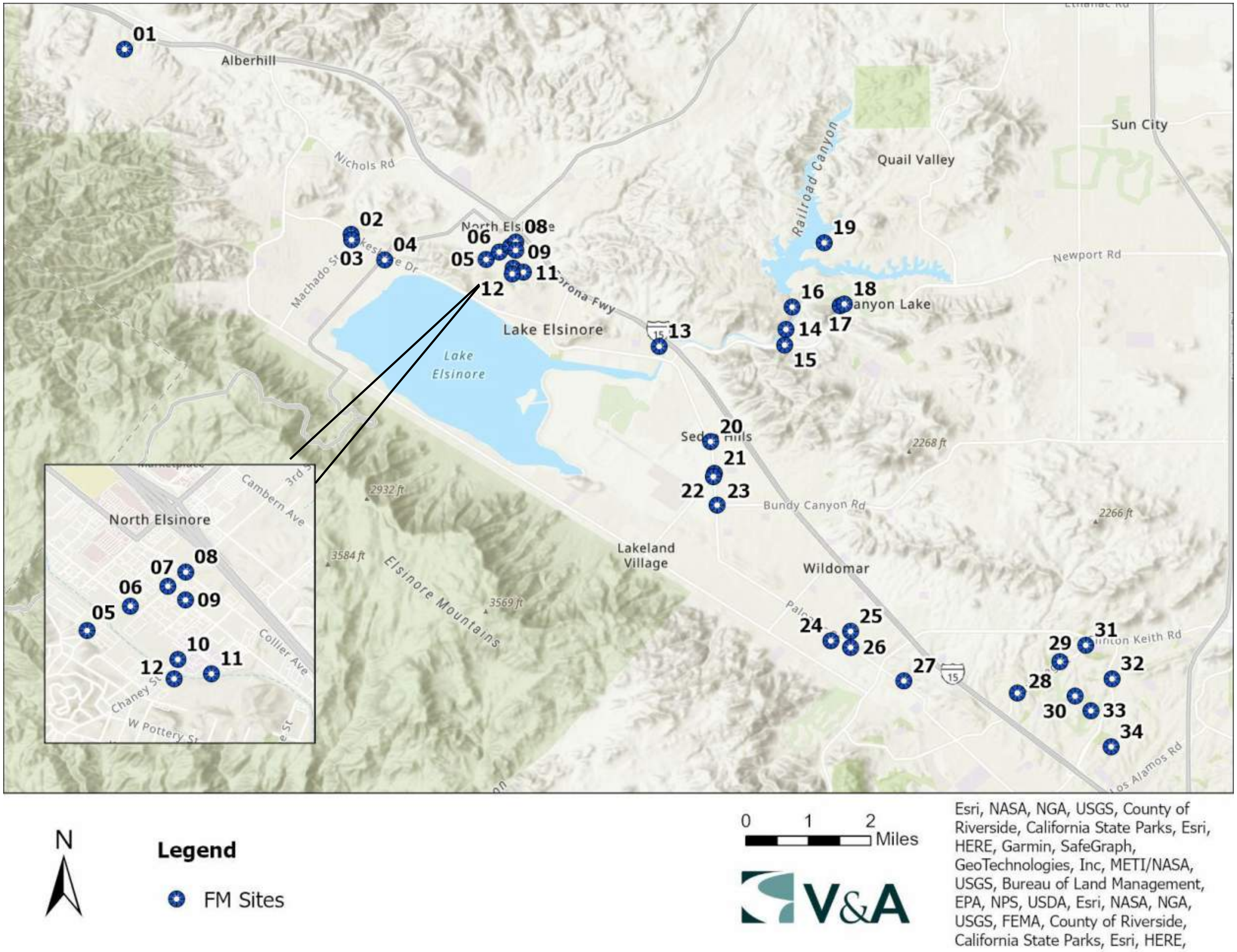

Figure 1-1. Map of Flow Monitoring Sites – Overall

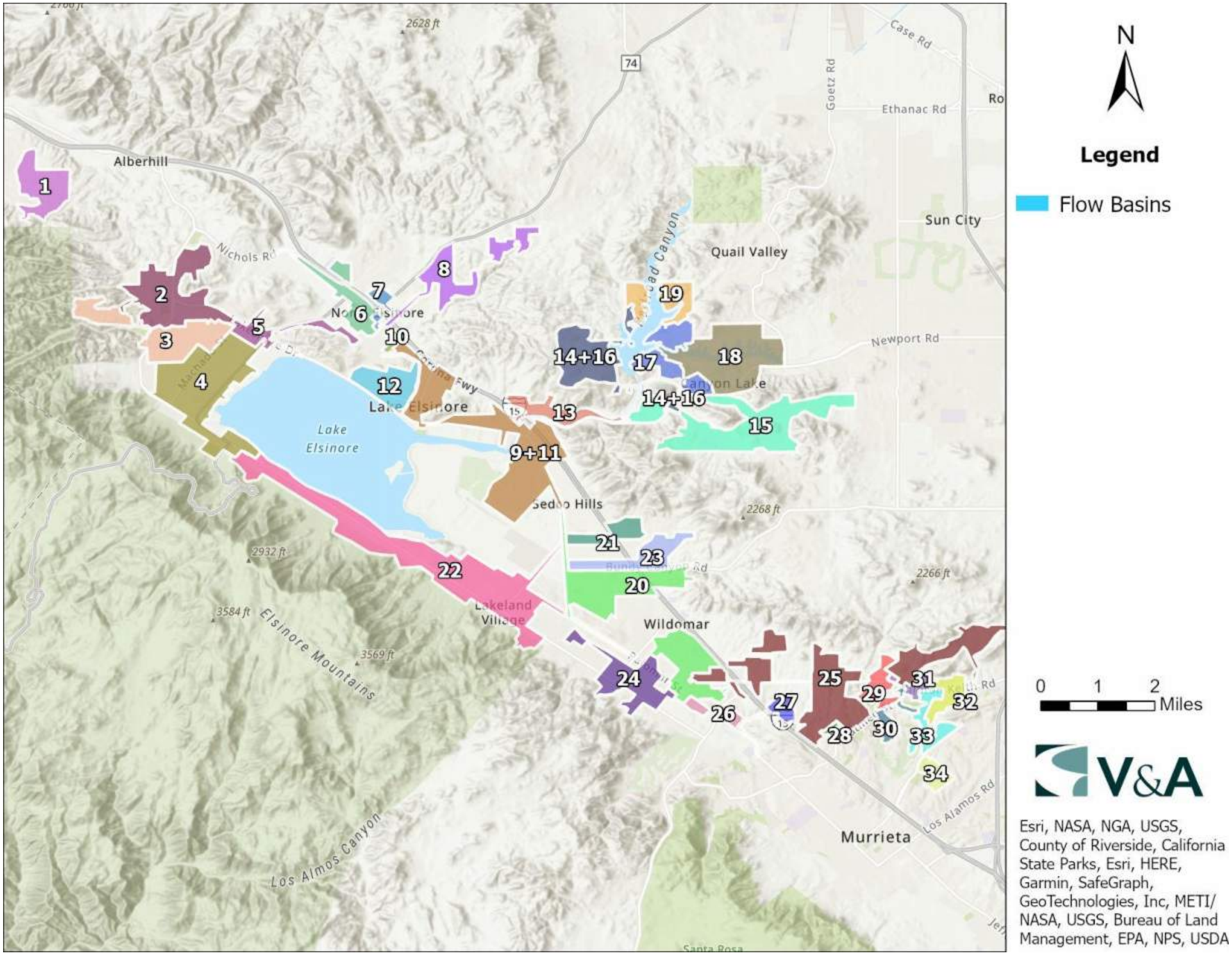

Figure 1-2. Map of Flow Monitoring Basins

2 Methods and Procedures

2.1 Confined Space Entry

A confined space (Photo 2-1) is defined as any space that is large enough and so configured that a person can bodily enter and perform assigned work, has limited or restricted means for entry or exit, and is not designed for continuous employee occupancy. In general, the atmosphere must be constantly monitored for sufficient levels of oxygen (19.5% to 23.5%) and the presence of hydrogen sulfide (H_2S) gas, carbon monoxide (CO) gas, and lower explosive limit (LEL) levels. A typical confined space entry crew has members with OSHA-defined responsibilities of Entrant, Attendant, and Supervisor. The Entrant is the individual performing the work. He or she is equipped with the necessary personal protective equipment needed to perform the job safely, including a personal four-gas monitor (Photo 2-2). If it is not possible to maintain line-of-sight with the Entrant, then more Entrants are required until line-of-sight can be maintained. The Attendant is responsible for maintaining contact with the Entrants to monitor the atmosphere using another four-gas monitor and maintaining records of all Entrants if there is more than one. The Supervisor is responsible for developing the safe work plan for the job at hand prior to entering.

Photo 2-1. Confined Space Entry

Photo 2-2. Typical Personal Four-Gas Monitor

2.2 Flow Meter Installation

V&A installed 34 area-velocity flow meters for temporary monitoring within the collection system using Sigma FL904 manufactured equipment. Sigma FL904 meters use submerged sensors with a pressure transducer to collect depth readings, and an ultrasonic Doppler sensor to determine the average fluid velocity. The ultrasonic sensor emits high-frequency sound waves, which are reflected by air bubbles and suspended particles in the flow. The sensor receives the reflected signal and determines the Doppler frequency shift, which indicates the estimated average flow velocity. The sensor is typically mounted at a manhole inlet to take advantage of smoother upstream flow conditions. The sensor may be offset to one side of the pipe to lessen the chances of fouling and sedimentation where these problems are expected to occur. Manual level and velocity measurements were taken during the installation of the flow meters, and again when they were removed and compared to simultaneous level and velocity readings from the flow meters to ensure proper calibration and accuracy. Figure 2-1 shows a typical installation for a flow meter with a submerged sensor.

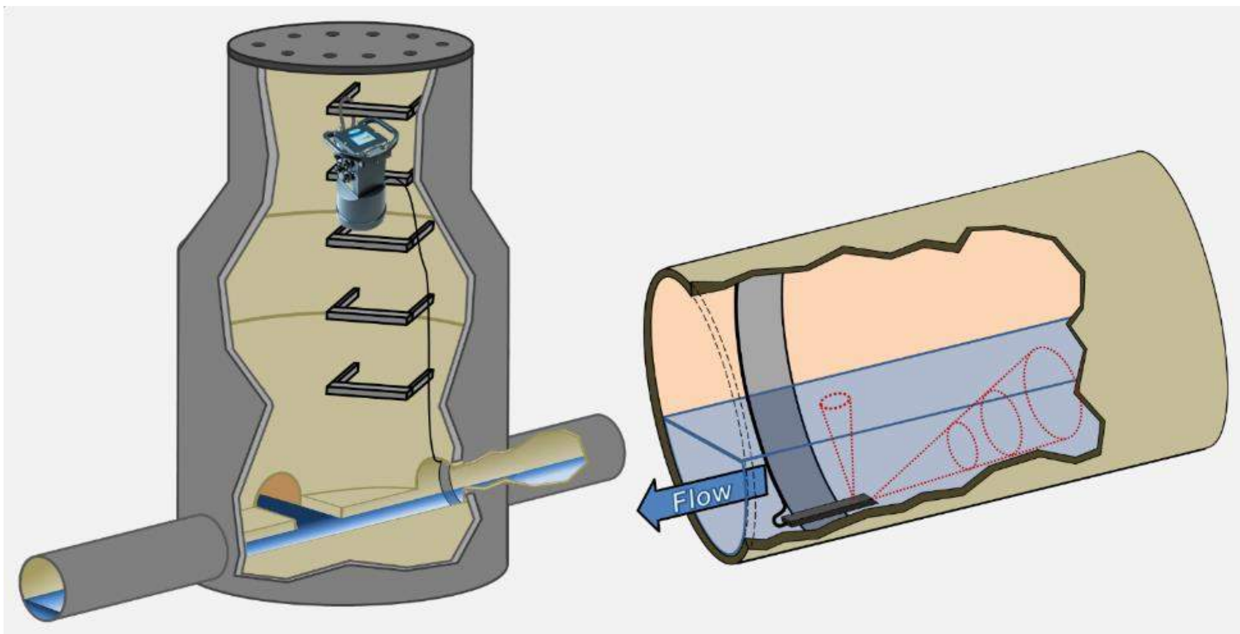

Figure 2-1. Typical Installation for Sigma FL904 Flow Meter with Submerged Sensor

2.3 Flow Calculation

Data retrieved from the flow meters is placed into a spreadsheet program for analysis. Data analysis includes comparison to field calibration measurements as well as necessary geometric adjustments as required for sediment (sediment reduces the pipe's wetted cross-sectional area available to carry flow). Area-velocity flow metering uses the continuity equation,

$$Q = v \cdot A = v \cdot (A_T - A_S)$$

where *Q*: volume flow rate

v: average velocity as determined by the ultrasonic sensor

A: cross-sectional area available to carry the flow

A_T: total cross-sectional area with both wastewater and sediment

A_S: cross-sectional area of sediment

For circular pipe,

$$A_T = \left[\frac{D^2}{4}\cos^{-1}\left(1 - \frac{2d_W}{D}\right)\right] - \left[\left(\frac{D}{2} - d_W\right)\left(\frac{D}{2}\right)\sin\left(\cos^{-1}\left(1 - \frac{2d_W}{D}\right)\right)\right]$$

$$A_S = \left[\frac{D^2}{4}\cos^{-1}\left(1 - \frac{2d_S}{D}\right)\right] - \left[\left(\frac{D}{2} - d_S\right)\left(\frac{D}{2}\right)\sin\left(\cos^{-1}\left(1 - \frac{2d_S}{D}\right)\right)\right]$$

where d_W: distance between wastewater level and pipe invert

d_S: depth of sediment

D: pipe diameter

2.4 Measurement Error and Uncertainty

For traditional engineering applications, measurement "error" is explained as a difference between a computed, estimated, or measured value and the generally accepted true or theoretically correct value. It can also be thought of as a difference between the desired and the actual performance of equipment. For equipment, an error is usually expressed as a percentage relative to accuracy (i.e., "…the velocity sensor has an accuracy of ±2% of the reading…").

However, for this study and flow monitoring applications, the cause of the measurement difference is important, and a distinction will be made between the equipment not performing to industry standards ("error") and expected inaccuracies ("uncertainty") associated with monitoring technology limitations.

Gauging **"error"** occurs when the equipment is not performing to industry standards. This can occur as a result of the following common categories of conditions that can be encountered at a wastewater monitoring site.

- Malfunctioning equipment (i.e., a sensor is damaged, battery life ends, or a desiccant canister becomes saturated)
- Improper equipment choice or maintenance (i.e., the selected gauging equipment technologies are incompatible with hydraulic conditions within the sewer, or excessive gravel deposits are allowed to accumulate around the sensors without being removed)
- Improper equipment calibration (i.e., depth and/or velocity measurements are incorrectly taken within the sewer, or equipment is allowed to drift out of calibration)
- Field conditions within the sewer (i.e., foaming at the water surface that "blinds" an ultrasonic depth sensor, or toilet paper catching and accumulating on a combination sensor, blinding the acoustic Doppler velocity meter)

For flow monitoring applications, gauging **"uncertainty"** is used to describe and quantify the expected inaccuracies that result from the limitations of the technologies that utilize indirect measurements to quantify wastewater flow.

It is important to try and install flow meters in "ideal" flow conditions. Ideal flow conditions are generally defined as laminar flow in a straight-through, constant-slope pipeline with no disturbances (elbows, tees, hydraulic shifts, etc.) 10 diameters upstream and five (5) diameters downstream from the flow monitoring location. If ideal flow conditions are met, then an expected uncertainty of final flow calculation from an open-channel flow meter may be approximately ±5%. For many situations, ideal flow conditions cannot be met, and uncertainties increase.

2.4.1 Flow Addition versus Flow Subtraction

Due to the uncertainties involved in subtracting flows of similar magnitudes, the addition of flows at multiple monitoring sites is usually preferred over subtraction of flows. Subtraction becomes an issue, especially when the flow difference from the subtraction falls within the measurement uncertainty range of the two larger flow data sets (i.e., subtracting a large flow from another large flow to obtain a small difference).

This concept is best demonstrated by the following example:

1. Meter A measures 2.00 MGD of flow and has an expected uncertainty of ±5%; thus the uncertainty range of the flow measurement is ±0.10 MGD.

2. Meter B measures 2.50 MGD of flow and has an expected uncertainty of ±6%, thus the uncertainty range of the flow measurement is ±0.15 MGD.
3. Meter C measures 0.50 MGD of flow and has an expected uncertainty of ±8%, thus the uncertainty range of the flow measurement is ±0.04 MGD.

Scenario 1 – Flow Addition

- Meter A + Meter B = 2.00 MGD (±0.10) + 2.50 MGD (±0.15) = 4.50 MGD (±0.25)
- Overall uncertainty = ±0.25 / 4.50 = ±5.6%
- For flow addition, the final uncertainty is essentially a weighted average of the component uncertainties.

Scenario 2 – Flow Subtraction, Large Flow less Small Flow

- Meter B - Meter C = 2.50 MGD (±0.15) - 0.50 MGD (±0.04) = 2.00 MGD (±0.19)
- Overall uncertainty = ±0.19 / 2.00 = ±9.5%
- For flow subtraction, the final uncertainty will always be greater than the component uncertainties.
- When subtracting a small flow from a large flow, the resulting uncertainties can still be manageable.

Scenario 3 – Flow Subtraction, Large Flow less a similarly Large Flow

- Meter B - Meter A = 2.50 MGD (±0.15) – 2.00 MGD (±0.10) = 0.50 MGD (±0.25)
- Overall uncertainty = ±0.25 / 0.50 = ±50%
- When subtracting similarly sized flow rates, the resulting uncertainties may not be manageable. In this example, an uncertainty of ±50% may be considered unacceptable for confident analyses.

Scenario 3 is a very "real-world" situation. The uncertainties for Meter A and Meter B are extremely reasonable (indeed, most flow monitoring service providers would be extremely pleased with true meter uncertainties of ±5% to ±6%). However, the reality of the math is clear, and the above example demonstrates the concept of flow subtraction and compounding or inflating uncertainty ranges.

The following points are emphasized in relation to the items of this section:

- For subtraction of flows, the overall uncertainty can be an inflated value that far exceeds the component uncertainties.
- The smaller the resultant flow from the subtraction equation, the larger the percentage uncertainty.
- Whenever possible, basins flows should be directly measured, rather than calculated as a subtraction of two or more flow meters.
- If flow subtraction cannot be avoided, it is better to have the magnitudes of the component flows be as dissimilar as possible.

2.5 Average Dry Weather Flow Determination

For this study, four distinct average dry weather flow curves were established for each site location:

- Mondays – Thursdays
- Fridays
- Saturdays
- Sundays

Flows for many sites differ on Friday evenings compared to Mondays through Thursdays. Starting around seven (7) pm, the flows are often decreased (compared to Monday through Thursday). Similarly, flow patterns for Saturday and Sunday were also separated due to their unique evening flow pattern. This type of differentiation can be important when determining I/I response, especially if a rain event occurs on a Friday, Saturday, or Sunday evening.

Figure 2-2 illustrates a sample of varying flow patterns within a typical dry week[2].

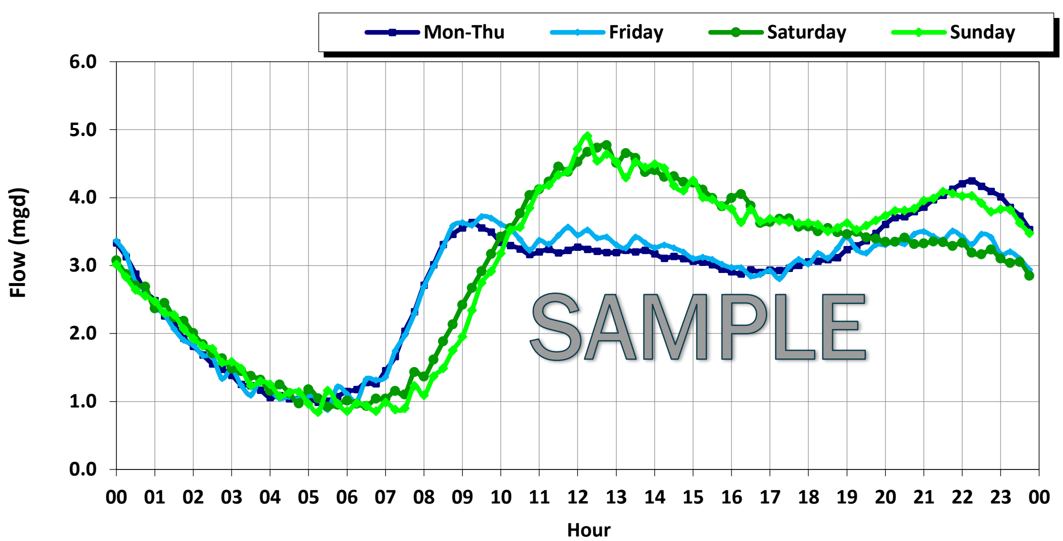

Figure 2-2. Sample ADWF Diurnal Flow Patterns

ADWF curves are taken from "Dry Days" when RDI had the least impact on the baseline flow. The overall average dry weather flow (ADWF) is calculated using the following equation:

$$ADWF = \left(ADWF_{Mon-Thu} \times \frac{4}{7} \right) + \left(ADWF_{Fri} \times \frac{1}{7} \right) + \left(ADWF_{Sat} \times \frac{1}{7} \right) + \left(ADWF_{Sun} \times \frac{1}{7} \right)$$

[2] Holiday flows can be extremely variable. Christmas flows are different from Thanksgiving flows and different from MLK Day flows. See Section 3.3 for details on whether holiday ADWF curves were established for this project's I/I analysis.

2.6 Flow Attenuation

Flow attenuation in a sewer collection system is the natural process of the reduction of the peak flow rate through redistribution of the same volume of flow over a longer period of time. This occurs as a result of friction (resistance), internal storage, and diffusion along the sewer pipes. Fluids are constantly working towards equilibrium. For example, a volume of fluid poured into a static vessel with no outside turbulence will eventually stabilize to a static state, with a smooth fluid surface without peaks and valleys. Attenuation within a sanitary sewer collection system is based upon this concept. A flow profile with a strong peak will tend to stabilize towards equilibrium, as shown in Figure 2-3.

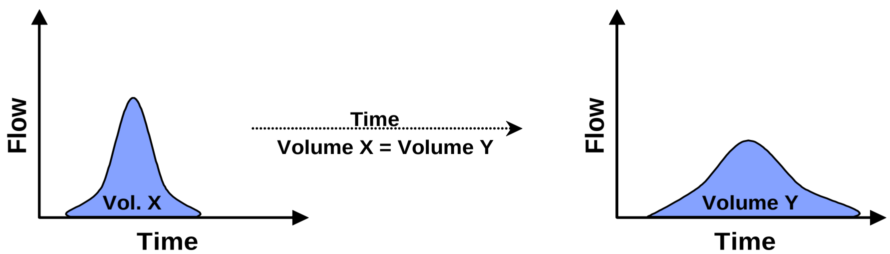

Figure 2-3. Attenuation Illustration

Within a sanitary sewer collection system, each individual basin will have a specific flow profile. As the flows from the basins combine within the trunk sewer lines, the peaks from each basin will not necessarily coincide at the same time, and peak flows may attenuate prior to reaching the treatment facility due to the length and time of travel through the trunk sewers. The sum of the peak flows of the individual basins within a collection system will usually be greater than the peak flows observed at the treatment facility.

2.7 Inflow / Infiltration Analysis: Definitions and Identification

Inflow and infiltration (I/I) consists of storm water and groundwater that enters the sewer system through pipe defects and improper storm drainage connections and is defined as follows:

- **Inflow**: Storm water inflow is defined as water discharged into the sewer system, including private sewer laterals, from direct connections such as downspouts, yard and area drains, holes in manhole covers, cross-connections from storm drains, or catch basins.
- **Infiltration**: Infiltration is defined as water entering the sanitary sewer system through defects in pipes, pipe joints, and manhole walls, which may include cracks, offset joints, root intrusion points, and broken pipes.

Figure 2-4 illustrates the possible sources and components of I/I.

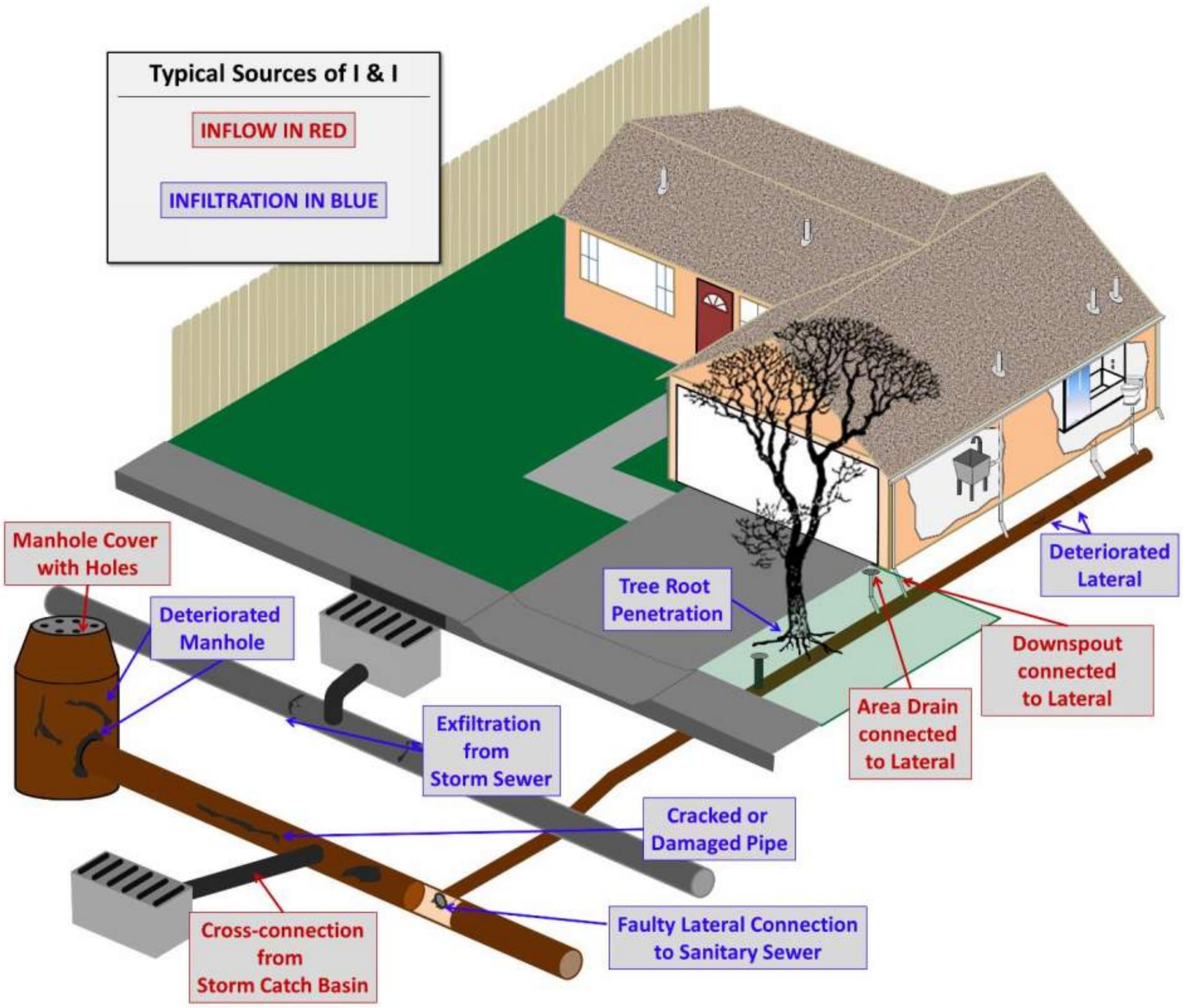

Figure 2-4. Typical Sources of Infiltration and Inflow

2.7.1 Infiltration Components

Infiltration can be further subdivided into components as follows:

- **Groundwater Infiltration**: Groundwater infiltration depends on the depth of the groundwater table above the pipelines as well as the percentage of the system submerged. The variation of groundwater levels and subsequent groundwater infiltration rates are seasonal by nature. On a day-to-day basis, groundwater infiltration rates are relatively steady and will not fluctuate greatly.
- **Rainfall-Dependent Infiltration**: This component occurs as a result of storm water and enters the sewer system through pipe defects, as with groundwater infiltration. The storm water first percolates directly into the soil and then migrates to an infiltration point. Typically, the time of concentration for rainfall-related infiltration may be 24 hours or longer, but this depends on the soil permeability and saturation levels.
- **Rainfall-Responsive Infiltration** is storm water which enters the collection system indirectly through pipe defects, but normally in sewers constructed close to the ground surface, such as private laterals. Rainfall-responsive infiltration is independent of the groundwater table and reaches defective sewers via the pipe trench in which the sewer is constructed, particularly if the pipe is placed in impermeable soil and is bedded and backfilled with a granular material. In this case, the pipe trench serves as a conduit similar to a French drain, conveying storm drainage to defective joints and other openings in the system. This type of infiltration can have a quick response and graphically can look very similar to inflow.

2.7.2 Impact and Cost of Source Detection and Removal

- **Inflow**:
  - Impact: Inflow creates a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows. Because the response and magnitude of inflow are tied closely to the intensity of the storm event, the short-term peak instantaneous flows may result in surcharging and overflows within a collection system. Severe inflow may result in sewage dilution, resulting in upsetting the biological treatment (secondary treatment) at the treatment facility.
  - Cost of Source Identification and Removal: Inflow locations are usually less difficult to find and less expensive to correct. These sources include direct and indirect cross-connections with storm drainage systems, roof downspouts, and various types of surface drains. Generally, the costs to identify and remove sources of inflow are low compared to potential benefits to public health and safety or the costs of building new facilities to convey and treat the resulting peak flows.
- **Infiltration**:
  - Impact: Infiltration typically creates long-term annual volumetric problems. The major impact is the cost of pumping and treating the additional volume of water, and of paying for treatment (for municipalities that are billed strictly on flow volume).
  - Cost of Source Detection and Removal: Infiltration sources are usually harder to find and more expensive to correct than inflow sources. Infiltration sources include defects in deteriorated sewer pipes or manholes that may be widespread throughout a sanitary sewer system.

2.7.3 Graphical Identification of I/I

Inflow is usually recognized graphically by large-magnitude, short-duration spikes immediately following a rain event. Infiltration is often recognized graphically by a gradual increase in flow after a wet-weather event. The increased flow typically sustains for a period after rainfall has stopped and then gradually drops off as soils become less saturated and as groundwater levels recede to normal levels. Real-time flows are plotted against ADWF to analyze the I/I response to rainfall events. Figure 2-5 illustrates a sample of how this analysis is conducted and some of the measurements that are used to distinguish infiltration and inflow. Similar graphs have been generated for the individual flow monitoring sites and can be found in Appendix A.

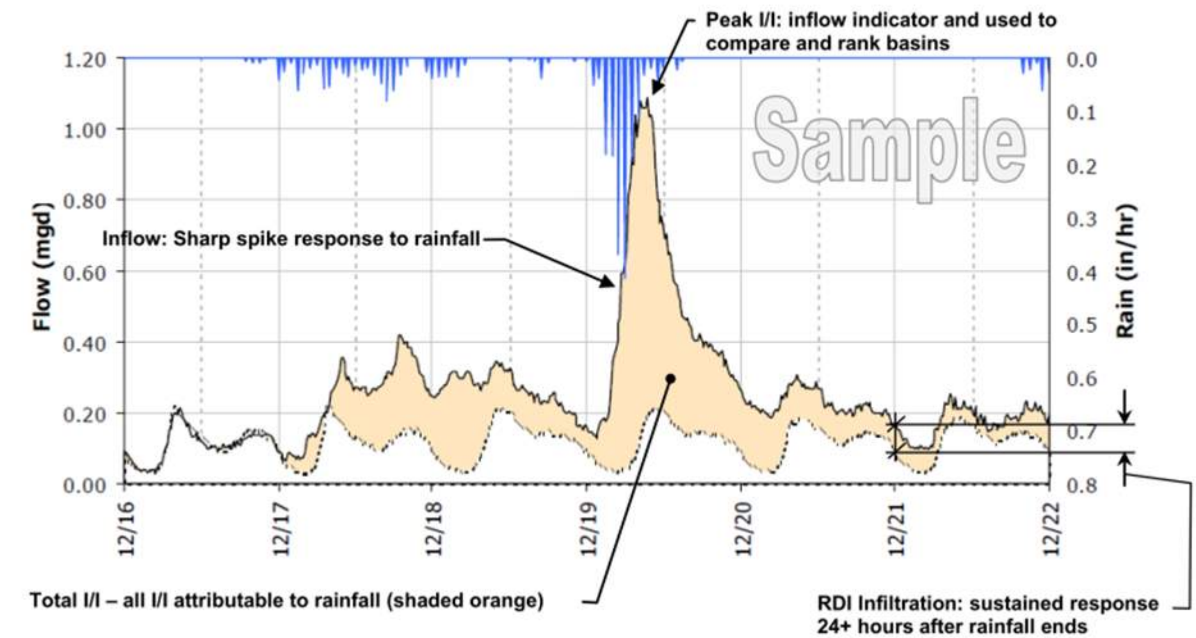

Figure 2-5. Sample Infiltration and Inflow Isolation Graph

2.7.4 Analysis Metrics

After differentiating I/I flows from ADWF flows, various calculations can be made to determine which I/I component (inflow or infiltration) is more prevalent at a particular site and to compare the relative magnitudes of the I/I components between drainage basins and between storm events:

- Inflow – Peak I/I Flow Rate: Inflow is characterized by sharp, direct spikes occurring during a rainfall event. Peak I/I rates are used for inflow analysis. 3
- Groundwater Infiltration (GWI): GWI analysis is conducted by looking at minimum dry weather flow to average dry weather flow ratios and comparing them to established standards to quantify the rate of excess groundwater infiltration.
- Rainfall-Dependent Infiltration (RDI): RDI Analysis is conducted by looking at the infiltration rates at set periods after the conclusion of a storm event. Depending on the particular collection system and the time required for flows to return to ADWF levels, different periods may be examined to determine the basins with the greatest or most sustained rainfall-dependent infiltration rates.
- Combined I/I: The combined inflow and infiltration is measured in gallons per site and per storm event. Because it is based on combined I/I volume, it is used to identify the overall volumetric influence of I/I within the monitoring basin.

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3 I/I flow rate is the real time flow less the estimated average dry weather flow rate. It is an estimate of flows attributable to rainfall. By using peak measured flow rates (inclusive of ADWF), the I/I flow rate would be skewed higher or lower depending on whether the storm event I/I response occurs during low-flow or high-flow hours.

2.7.5 Normalization Methods

There are three ways to *normalize* the I/I analysis metrics for an “apples-to-apples” comparison among the different drainage basins:

- **per-ADWF**: The metric is divided by the established average dry weather flow rate and typically expressed as a ratio. Peaking Factors are examples of using ADWF to normalize data from different sites.
- **per-IDM**: The metric is divided by the length of pipe (IDM [inch-diameter mile]) contained within the upstream basin. Final units typically are gallons per day (gpd) per IDM.
- **per-ACRE**: The metric is divided by the acreage of the upstream basin. Final units typically are gallons per day (gpd) per ACRE.

The infiltration and inflow indicators were normalized by the per-ADWF and per-ACRE methods in this report and these results will be shown in the following I/I analysis results sections. For the purposes of basin rankings, the following weighting decisions are given:

- **per-ADWF:** Per-ADWF metrics were assigned 51% weighting towards final rankings. It is noted that abnormal waste usage could result in low ADWF values, which could skew results and lend for possible misinterpretation of data.
- **per-ACRE:** Per-ACRE values were assigned 49% weighting towards final rankings. The topography known and should result in valid per-ACRE analyses. However, there are areas of new development and non-residential land use.

3 Results and Analysis

3.1 Rainfall Monitoring

3.1.1 Rain Gauge Locations

V&A analyzed rainfall data over 20 publicly available private weather stations (PWS) on Weather Underground[4], choosing the best 13 locations, allowing for solid coverage over the collection system which has a diverse range of topographical features. Figure 3-1 illustrates the locations and labeling convention used for the 13 rain gauges.

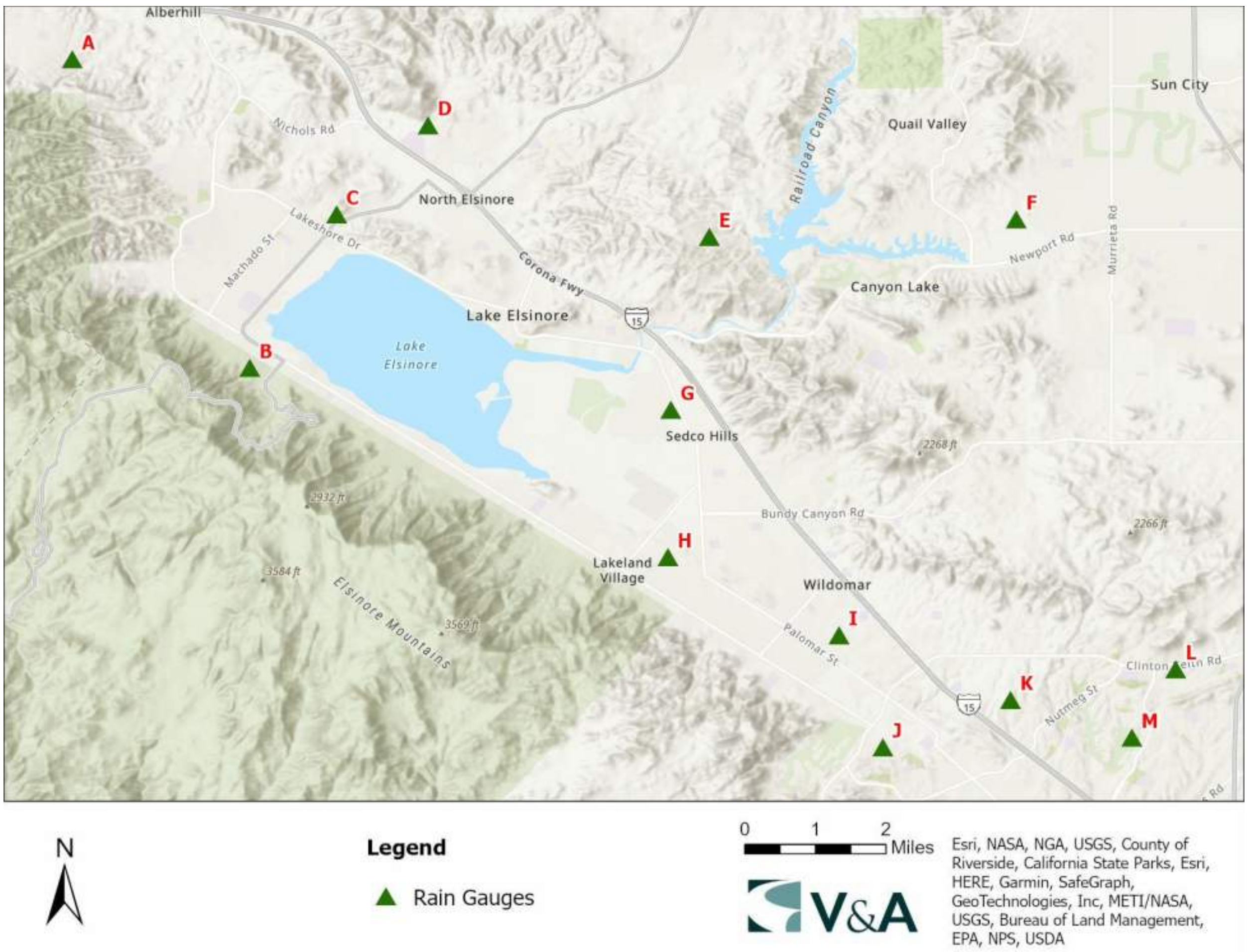

Figure 3-1. Location of Rain Gauges

[4] Weather Underground (wunderground.com) collects data from 180,000+ weather stations across the country, including Automated Surface Observation System (ASOS) at airports, personal weather stations (PWS), and Meteorological Assimilation Data Ingest System (MADIS) managed by the National Oceanic and Atmospheric Administration (NOAA). While V&A has no direct control over the rain gauges, V&A performs additional QA/QC on the data to assure its suitability for use.

3.1.2 Flow Study Rainfall Data

There was one main rainfall event that elicited an I/I response for some locations in the system over the flow monitoring period, summarized in Table 3-1 and illustrated in Figure 3-2. Figure 3-3 shows the rain accumulation plot of the period rainfall, as well as the historical average rainfall[5] (triangulated to Historical Station Elsinore) over the project duration. This work took place during a 'drought' wet weather season; the cumulative precipitation (triangulated) was approximately at 37% of historical precipitation averages over the specific duration of the flow monitoring.

Table 3-1. Summary of Rainfall Data

Rain Gauge	Rain Event 1 3/27/22 - 3/30/22 (in)	Monitoring Period Total (in)
A	0.86	1.70
B	0.58	1.70
C	0.62	1.27
D	0.79	1.15
E	0.83	1.43
F	0.65	1.47
G	0.51	1.16
H	0.52	1.66
I	0.65	2.08
J	0.6	1.83
K	0.62	2.18
L	0.81	2.40
M	0.57	1.90

[5] Historical data taken from the Elsinore (Station 042805): http://www.wrcc.dri.edu/summary/climsmnca.html

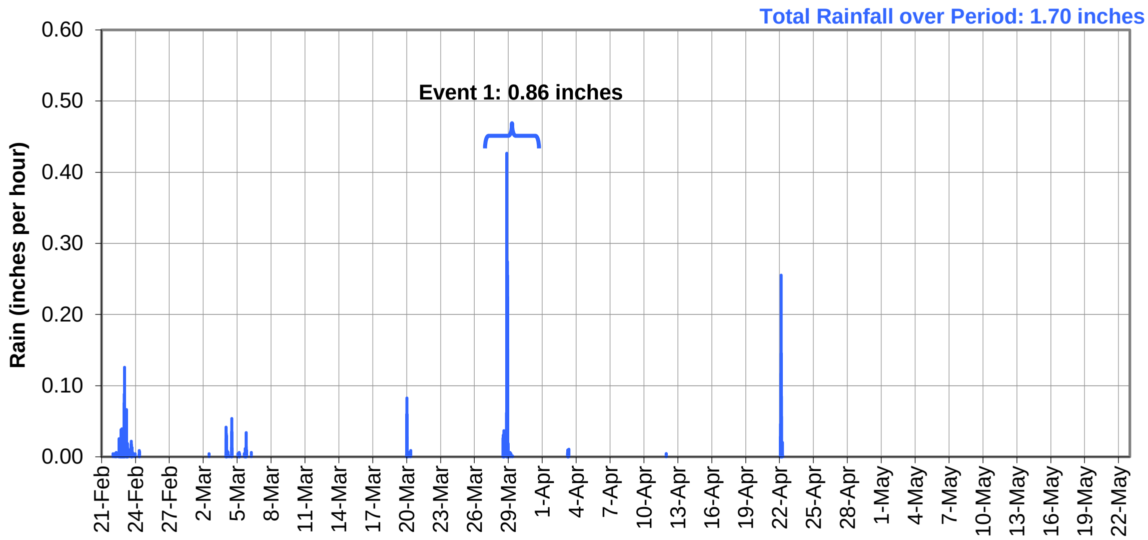

Figure 3-2. Rainfall Monitoring (triangulated to Historical Station Elsinore)

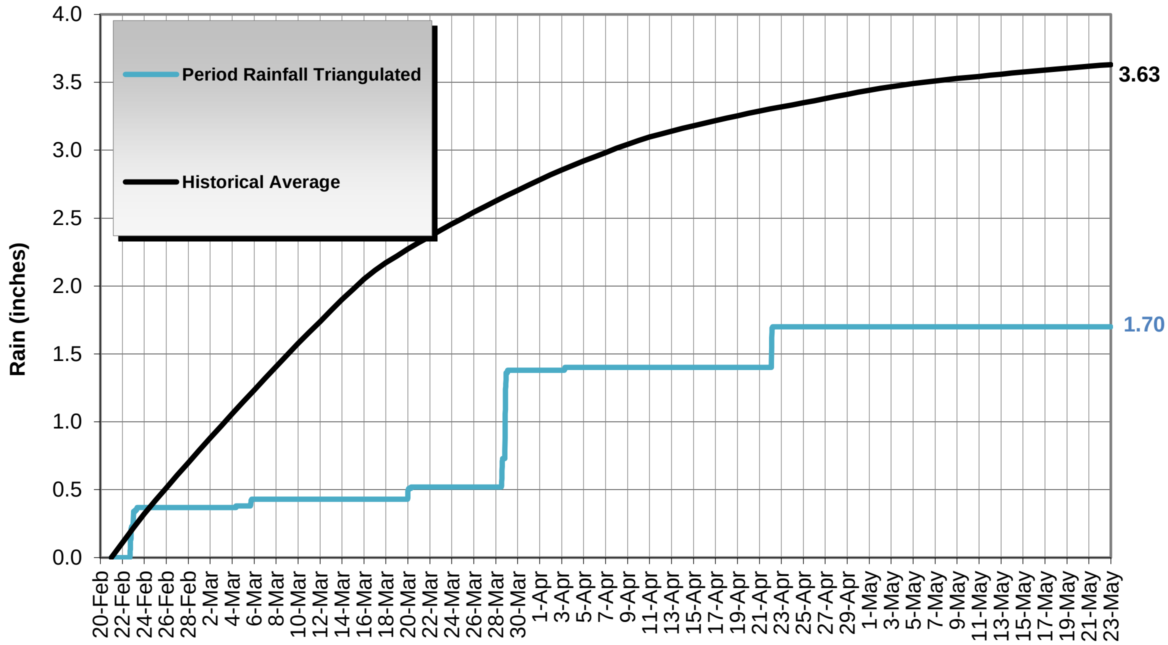

Figure 3-3. Rainfall Accumulation Plot (triangulated to Historical Station Elsinore)

3.1.3 Regional Rainfall Event Classification

It is important to classify the relative size of a major storm event that occurs over the course of a flow monitoring period[6]. Rainfall events are classified by intensity and duration. Based on historical data, frequency contour maps for storm events of given intensity and duration have been developed by the NOAA for all areas within the continental United States (Figure 3-4).

For example, the NOAA Rainfall Frequency Atlas[7] classifies a 10-year, 24-hour storm event at rain gauge A location as **3.6** inches. This means that in any given year, at this specific location, there is a 10% chance that 3.6 inches of rain will fall in any 24-hour period.

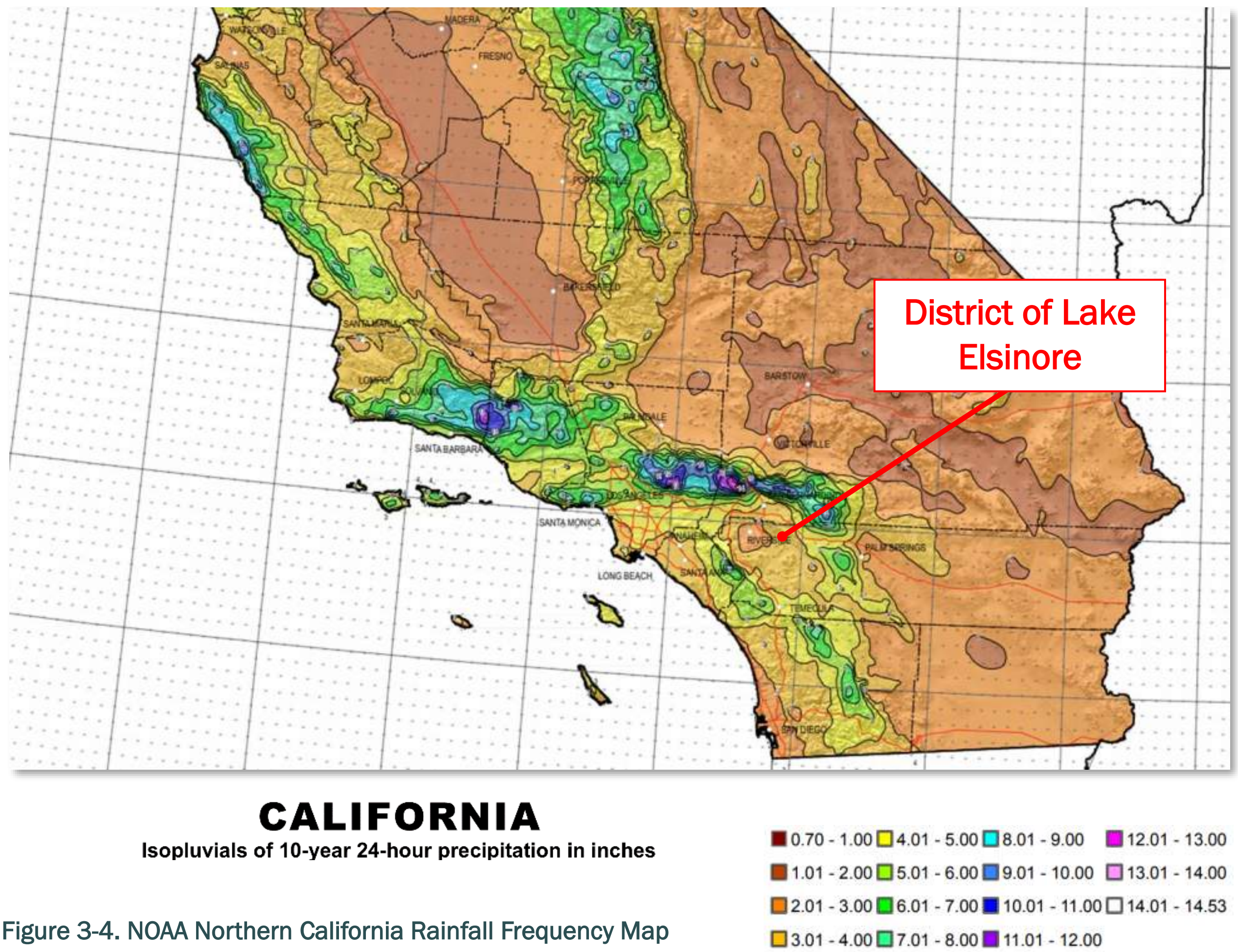

Figure 3-4. NOAA Northern California Rainfall Frequency Map

From the NOAA frequency maps, for a specific latitude and longitude, the rainfall densities for period durations ranging from one (1) hour to 20 days are known for rain events ranging from 1-year to 10-year intensities. These are plotted to develop a rain event frequency map specific to each rainfall monitoring site. Superimposing the peak measured densities for the rainfall events on the rain event frequency plot determines the classification of the rainfall event.

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[6] Sanitary sewers are often designed to withstand I/I contribution to sanitary flows for specific-sized "design" storm events.

[7] NOAA Western U.S. Precipitation Frequency Maps Atlas 14, Volume 6, 2011: ftp://hdsc.nws.noaa.gov/pub/hdsc/data/sw/ca10y24h.pdf

Table 3-2 shows the peak classifications for the rain event at each rain gauge location. Figure 3-5 shows the peak classification plot for rain gauge E.

Table 3-2. Rainfall Events Classification

Rain Gauge	Rain Event 1 3/27/22 - 3/30/22
A	< 1-Yr
B	< 1-Yr
C	< 1-Yr
D	1.5-Yr, 30-Min
E	1.5-Yr, 2-Hr
F	1.5-Yr, 15-Min
G	< 1-Yr
H	1-Yr, 15-Min
I	1.5-Yr, 15-Min
J	< 1-Yr
K	< 1-Yr
L	< 1-Yr
M	< 1-Yr

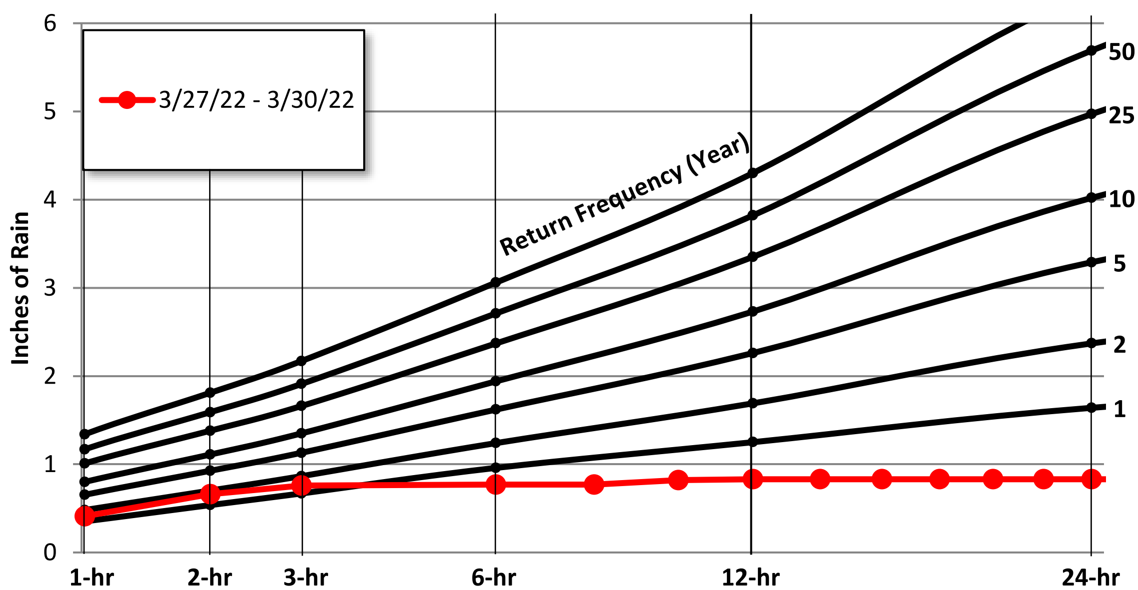


Figure 3-5. Rainfall Event Classification – 24-Hour Period (RG E)

3.1.4 Rain Gauge Triangulation Distribution

The rainfall affecting the sanitary sewer collection system basins must be calculated based on the proximity to the rain gauge locations. The mean precipitation for each site's upstream basin was calculated by taking data from the rain gauges and using the inverse distance weighting (IDW) method. IDW is an interpolation method that assumes the influence of each rain gauge location diminishes with distance. The center of an upstream basin[8] is identified, and a weighted triangulated average is taken of the precipitation data from nearby rain gauge locations.

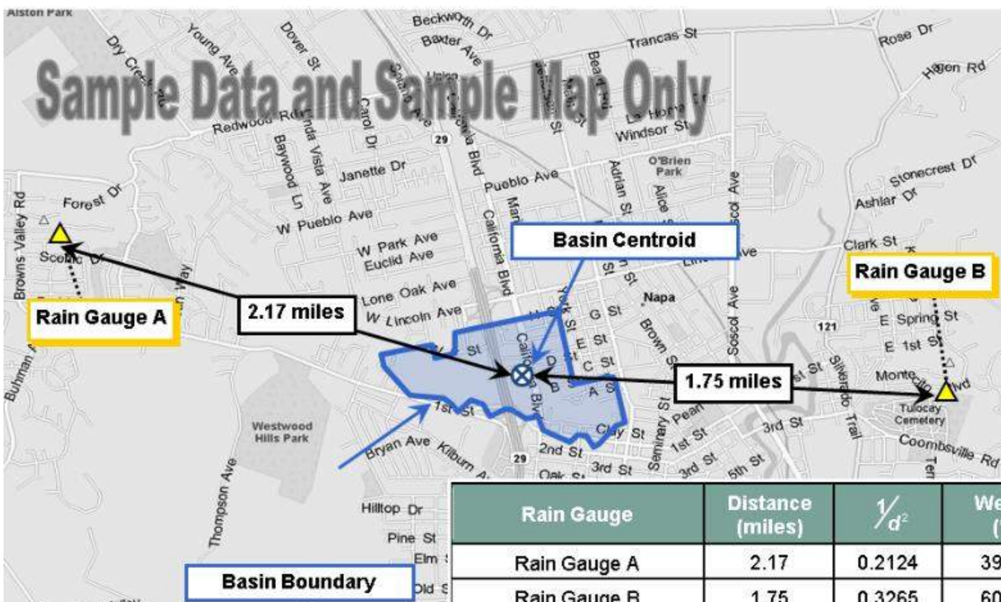
The IDW function is as follows:

$$weight(d) = \frac{1/d^p}{\sum 1/d^p},$$

where: d = distance
p = power ($p > 0$)

The value of p is user defined. The most common choice for hydrological studies of watershed areas is $p = 2$.

Figure 3-6 illustrates the IDW method with sample data. The rain gauge distribution as calculated for each flow monitoring site is shown in Table 3-3.



Rain Gauge	Distance (miles)	$1/d^2$	Weight (%)
Rain Gauge A	2.17	0.2124	39.4%
Rain Gauge B	1.75	0.3265	60.6%
Totals		**0.5389**	**100%**

Figure 3-6. Rainfall Inverse Distance Weighting Method

[8] Note that the full basin upstream of the site was used instead of the isolated basins as the rain data will be compared to the flow at each site

Table 3-3. Rain Gauge Distribution per Monitoring Site

Sites	A	B	C	D	E	F	G	H	I	J	K	L	M
Site 01	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 02	19.4%	14.7%	49.2%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 03	23.5%	30.6%	45.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 04	4.6%	61.7%	33.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 05	12.6%	36.0%	46.3%	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 06	0.0%	0.0%	27.9%	69.1%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 07	0.0%	0.0%	26.4%	65.4%	8.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 08	0.0%	0.0%	18.5%	57.1%	24.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 09	0.0%	4.7%	1.0%	0.9%	14.2%	6.7%	25.1%	13.7%	14.7%	3.4%	13.7%	0.9%	1.1%
Site 10	0.0%	0.0%	39.5%	42.1%	18.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 11	0.0%	4.7%	1.0%	0.9%	14.2%	6.7%	25.1%	13.7%	14.7%	3.4%	13.7%	0.9%	1.1%
Site 12	0.0%	0.0%	37.0%	25.8%	18.9%	0.0%	18.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 13	0.0%	0.0%	0.0%	0.0%	49.0%	30.2%	20.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 14	0.0%	0.0%	0.0%	0.0%	46.4%	49.8%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 15	0.0%	0.0%	0.0%	0.0%	25.3%	52.0%	22.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 16	0.0%	0.0%	0.0%	0.0%	95.7%	1.4%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 17	0.0%	0.0%	0.0%	0.0%	46.1%	50.3%	3.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 18	0.0%	0.0%	0.0%	0.0%	31.2%	68.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 19	0.0%	0.0%	0.0%	0.0%	71.4%	28.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 20	0.0%	7.5%	0.0%	0.0%	0.0%	0.0%	17.3%	21.7%	23.2%	5.5%	21.7%	1.4%	1.7%
Site 21	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	49.1%	36.8%	14.1%	0.0%	0.0%	0.0%	0.0%
Site 22	0.0%	24.3%	0.0%	0.0%	0.0%	0.0%	38.5%	37.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Site 23	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	31.5%	42.0%	26.5%	0.0%	0.0%	0.0%	0.0%
Site 24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.2%	80.8%	10.0%	0.0%	0.0%	0.0%
Site 25	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	6.2%	76.5%	5.4%	6.5%
Site 26	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	29.6%	56.0%	14.4%	0.0%	0.0%
Site 27	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.5%	14.7%	76.9%	0.0%	0.0%
Site 28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	91.8%	0.0%	8.2%
Site 29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	34.4%	36.8%	28.8%
Site 30	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.9%	42.4%	34.6%
Site 31	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.2%	77.6%	15.2%
Site 32	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	99.4%	0.4%
Site 33	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	62.5%	34.7%
Site 34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.3%	12.2%	81.5%

3.2 Flow Monitoring

3.2.1 Average Flow Analysis

Average dry weather flow (ADWF) curves were established during dry days when I/I had the least impact on the baseline flow. Table 3-4 summarizes the dry weather flow data measured for this study. ADWF curves for each site can be found in Appendix A. Figure 3-7 shows a flow schematic of the average daily flows and levels. The following ADWF analysis results are noted:

- Sites 06, 19 and 22 had 1.25 to two (2.0) inches of sediment measured in the pipe channel.
- Sites 19, 20, and 22 showed an average flow level greater than 50% pipe full conditions (greater than 0.5 d/D).

Table 3-4. Dry Weather Flow

Monitored Site	Sediment (in.)	Average d/D Ratio	Mon-Thu ADWF (MGD)	Friday (MGD)	Saturday ADWF (MGD)	Sunday (MGD)	Overall (MGD)
Site 01	none	0.23	0.195	0.194	0.203	0.219	0.199
Site 02	none	0.12	0.248	0.240	0.265	0.275	0.253
Site 03	none	0.20	0.176	0.167	0.181	0.198	0.179
Site 04	none	0.26	0.733	0.736	0.735	0.760	0.738
Site 05	none	0.26	1.280	1.221	1.300	1.409	1.293
Site 06	1.5	0.16	0.091	0.082	0.077	0.075	0.085
Site 07	none	0.11	0.048	0.050	0.046	0.045	0.048
Site 08	none	0.20	0.419	0.413	0.411	0.431	0.419
Site 09	none	0.27	3.450	3.337	3.464	3.603	3.458
Site 10	none	0.07	0.003	0.004	0.001	0.001	0.003
Site 11	none	0.13	0.061	0.060	0.062	0.064	0.061
Site 12	none	0.10	0.117	0.113	0.113	0.117	0.116
Site 13	none	0.12	0.703	0.669	0.739	0.822	0.720
Site 14	none	0.31	0.697	0.674	0.709	0.745	0.702
Site 15	none	0.09	0.552	0.542	0.548	0.594	0.556
Site 16	none	0.04	0.175	0.168	0.184	0.187	0.177
Site 17	none	0.21	0.500	0.501	0.516	0.529	0.507
Site 18	none	0.19	0.273	0.264	0.279	0.294	0.275
Site 19	1.25	0.52	0.099	0.097	0.102	0.107	0.100
Site 20	none	0.52	1.725	1.692	1.726	1.792	1.730
Site 21	none	0.08	0.024	0.024	0.022	0.024	0.024
Site 22	2	0.51	0.409	0.427	0.432	0.396	0.413
Site 23	none	0.14	0.092	0.090	0.101	0.115	0.096
Site 24	none	0.20	0.161	0.166	0.170	0.176	0.165
Site 25	none	0.07	0.570	0.559	0.556	0.594	0.570
Site 26	none	0.21	0.184	0.179	0.171	0.171	0.179

Monitored Site	Sediment (in.)	Average d/D Ratio	Mon-Thu ADWF (MGD)	Friday (MGD)	Saturday ADWF (MGD)	Sunday (MGD)	Overall (MGD)
Site 27	none	0.26	0.154	0.145	0.133	0.140	0.148
Site 28	none	0.10	0.025	0.025	0.025	0.026	0.025
Site 29	none	0.11	0.139	0.129	0.135	0.143	0.138
Site 30	none	0.26	0.189	0.192	0.208	0.206	0.194
Site 31	none	0.10	0.046	0.046	0.046	0.043	0.046
Site 32	none	0.26	0.094	0.091	0.095	0.104	0.095
Site 33	none	0.18	0.270	0.272	0.276	0.286	0.273
Site 34	none	0.21	0.045	0.049	0.052	0.050	0.047

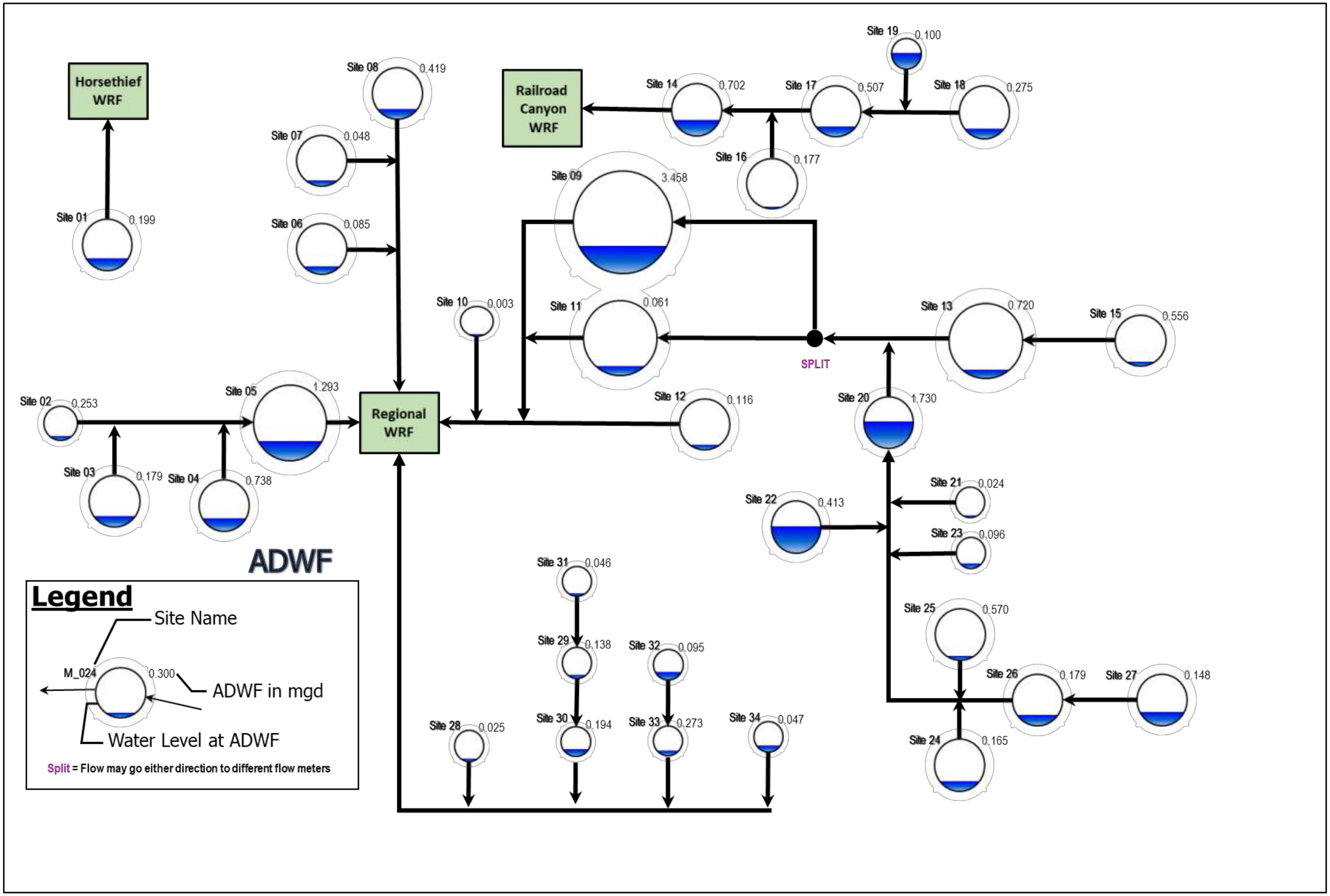


Figure 3-7. Average Dry Weather Flow (Flow Schematic)

3.2.2 Peak Measured Flows and Pipeline Capacity Analysis

Peak measured flows and the hydraulic grade line data (flow depths) are important to understanding the capacity limitations of a collection system. The peak flows and flow levels are the peak measurements as taken across the entirety of the flow monitoring period. For this study, peak flows and peak levels corresponded to rainfall events. The following capacity analysis definitions will be used:

- **Peaking Factor (PF)** is defined as the peak measured flow divided by the average dry weather flow (ADWF). Peaking factors are influenced by many factors, including size and topography of tributary area, flow attenuation, flow restrictions, characteristics of I/I entering the collection system, and hydraulic features such as pump stations.
  - For this report, PF > 5 are highlighted in RED[9]; however, the District should refer to District standards when evaluating peaking factors. Peaking factor data should be used at the discretion of the District Engineer.
- **d/D Ratio** is the peak measured depth of flow (d) divided by the pipe diameter (D). The d/D ratio for each site is computed based on the maximum depth of flow for the study. Standards for d/D ratio vary from agency to agency, but typically range between d/D ≤ 0.5 and d/D ≤ 0.75
  - For this report, d/D ratios > 0.75 are highlighted in RED; however, the District should refer to District standards when evaluating d/D ratios, to be used at the discretion of the District Engineer.

Table 3-5 summarizes the peak recorded flows, depths, *d/D* ratios, and peaking factors per site during the flow monitoring period. Capacity analysis data are presented on a site-by-site basis and represent the hydraulic conditions only at the site locations; hydraulic conditions in other areas of the collection system will differ. Figure 3-8 and Figure 3-9 show bar graph summaries of the peaking factors and d/D ratios, respectively. Figure 3-10 shows the schematic diagram of the peak measured flows in each section with peak flow levels.

The following capacity analysis results are noted:

- Peaking Factors
  - Sites 7, 10, 21, 28 and 31 had peaking factors greater than 5.
- d/D Ratio:
  - d/D > 1.0: Site 24 reached a surcharge condition during this study. Peak flow depth was 0.8 feet above the pipe crown. Site 34 had d/D ratio between 0.75 and 1.0.

[9] WEF Manual of Practice FD-6 and ASCE Manual No. 62 suggests typical peaking factor ratios range between 3 and 4, with higher values possibly indicative of pronounced I/I flows.

Table 3-5. Capacity Analysis Summary

Site	ADWF (MGD)	Peak Measured Flow (MGD)	Peaking Factor	Pipe Diameter, *D* (IN)	Max Depth, *d* (IN)	Max, d/D	Surcharge above pipe crown (FT)
Site 01	0.199	0.462	2.3	14.75	5.2	0.35	-
Site 02	0.253	0.574	2.3	12	2.3	0.19	-
Site 03	0.179	0.371	2.1	14.75	4.1	0.28	-
Site 04	0.738	1.569	2.1	17.75	9.1	0.51	-
Site 05	1.293	2.645	2.0	29.75	11.2	0.38	-
Site 06	0.085	0.358	4.2	24	12.8	0.53	-
Site 07	0.048	0.544	11.4	14.75	3.2	0.22	-
Site 08	0.419	0.750	1.8	15	4.2	0.28	-
Site 09	3.458	5.889	1.7	54	25.1	0.47	-
Site 10	0.003	0.019	6.7	11.75	1.7	0.14	-
Site 11	0.061	0.129	2.1	26.75	4.4	0.16	-
Site 12	0.116	0.221	1.9	24	3.3	0.14	-
Site 13	0.720	2.269	3.1	36	9.1	0.25	-
Site 14	0.702	1.575	2.2	20.75	9.0	0.44	-
Site 15	0.556	1.148	2.1	17.75	2.6	0.14	-
Site 16	0.177	0.487	2.7	20.75	1.3	0.06	-
Site 17	0.507	1.075	2.1	14.75	5.0	0.34	-
Site 18	0.275	0.623	2.3	15	4.5	0.30	-
Site 19	0.100	0.214	2.1	12	7.4	0.61	-
Site 20	1.730	2.944	1.7	21	14.6	0.69	-
Site 21	0.024	0.231	9.8	11.75	1.9	0.16	-
Site 22	0.413	0.851	2.1	18	12.5	0.69	-
Site 23	0.096	0.294	3.1	12	2.4	0.20	-
Site 24	0.165	0.790	4.8	23.75	33.6	1.42	0.8
Site 25	0.570	1.309	2.3	23.75	2.6	0.11	-
Site 26	0.179	0.382	2.1	20.75	8.4	0.40	-
Site 27	0.148	0.314	2.1	14.75	4.8	0.33	-
Site 28	0.025	0.252	10.0	11.75	2.2	0.19	-
Site 29	0.138	0.347	2.5	9.75	1.8	0.18	-
Site 30	0.194	0.602	3.1	9.75	4.1	0.42	-
Site 31	0.046	0.268	5.9	10	2.0	0.20	-
Site 32	0.095	0.208	2.2	9.75	3.6	0.36	-
Site 33	0.273	0.559	2.0	11.75	3.1	0.26	-
Site 34	0.047	0.126	2.7	9.75	7.4	0.76	-

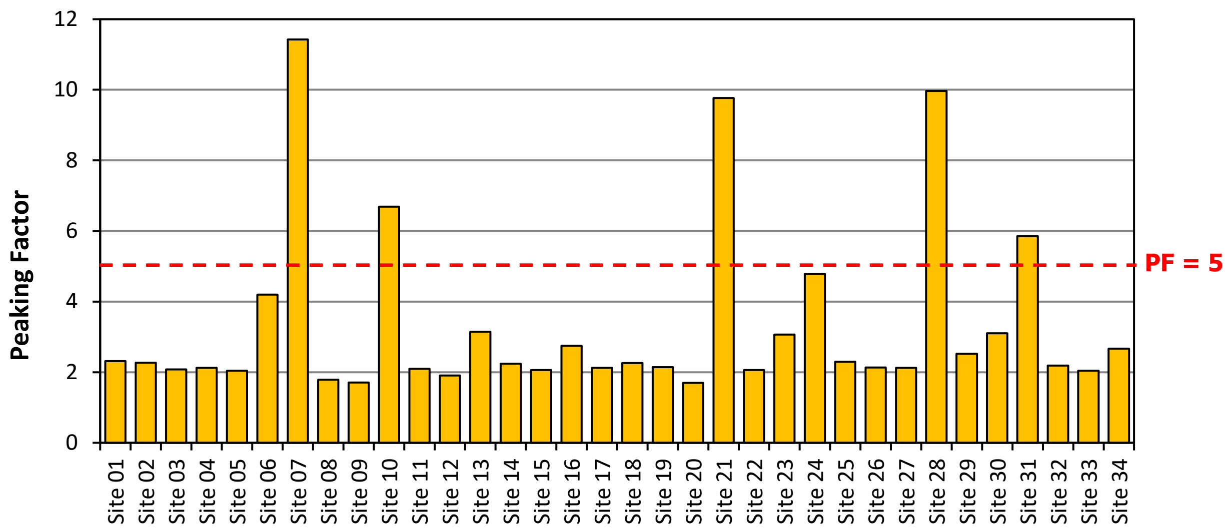


Figure 3-8. Peaking Factors

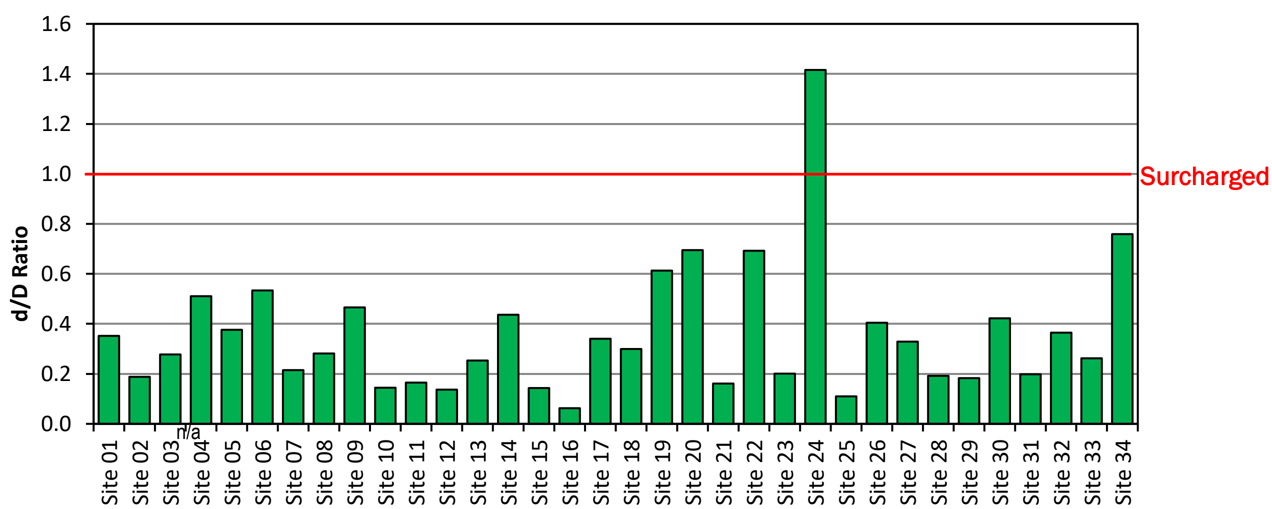


Figure 3-9. Capacity Summary: Max d/D Ratios

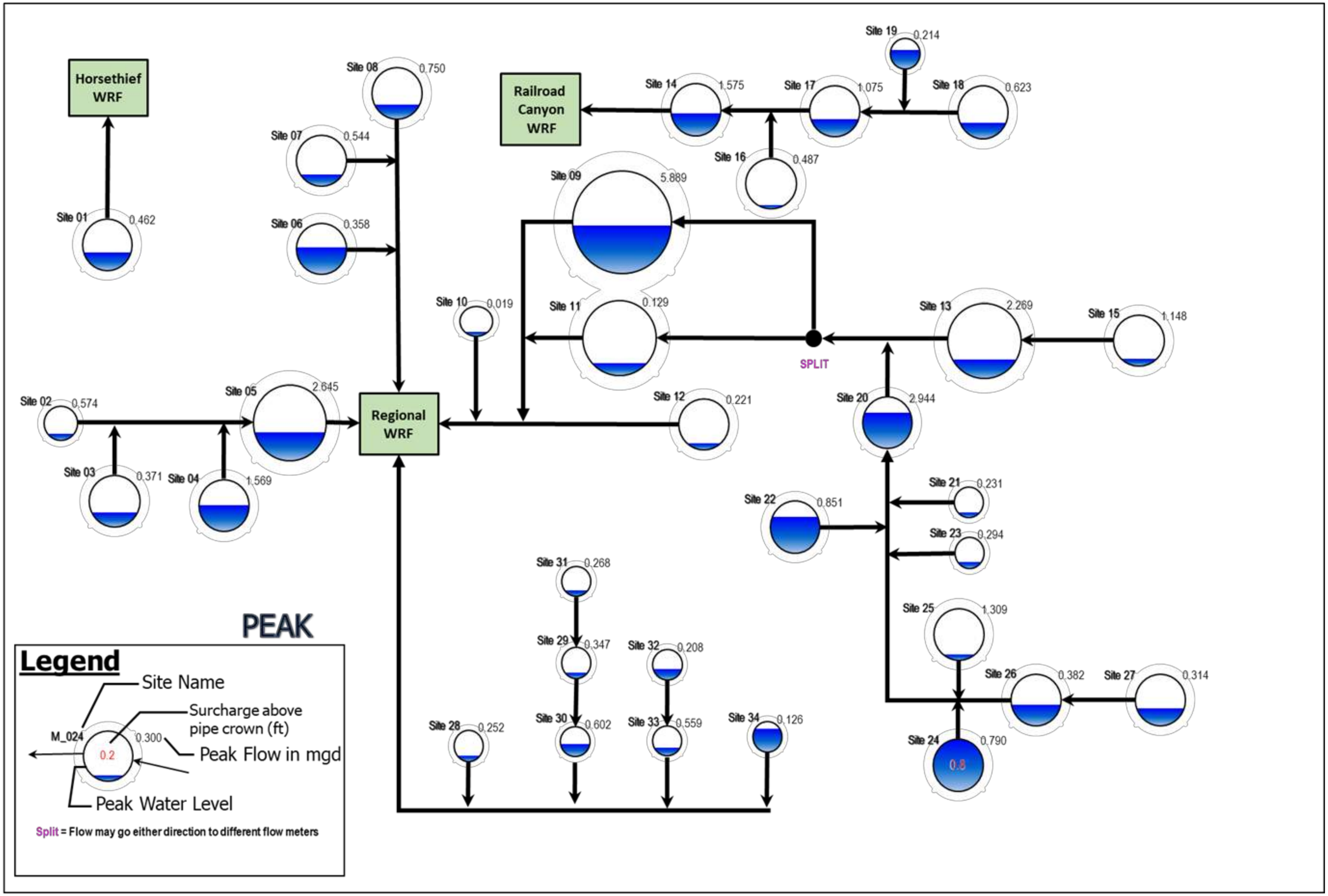


Figure 3-10. Peak Measured Flow (Flow Schematic)

3.3 Inflow and Infiltration: Results

3.3.1 Preface

Please note that the rainfall intensity varied significantly across the region during the study, which contributed to some of the unexpected results showcased in the report, i.e., Basin 29-34's I/I response rank were lower than expected. Therefore, this report should be taken with some level of caution.

I/I analyses are presented on a basin-by-basin basis. Items relevant to the analysis in this study are noted below and referenced in Figure 3-11:

- **I/I Isolation**: The I/I flow rate is the real-time flow less the estimated average dry weather flow rate (shown below as the RED line).
- **Inflow**: Inflow is usually recognized graphically by large-magnitude, short-duration spikes immediately following a rain event. The peak inflow rate is the highest spike in the isolated I/I hydrograph immediately following the evaluated rainfall event.
- **RDI**: RDI is typically taken as the average I/I flow rate measured approximately 24 hours after the rainfall event has concluded. Due to the low RDI response obtained from this study, no RDI analysis would be included in this report
- **Combined I/I**: the totalized volume (in gallons) of both inflow and RDI over the course of a rainfall event (shown below as the shaded orange area).

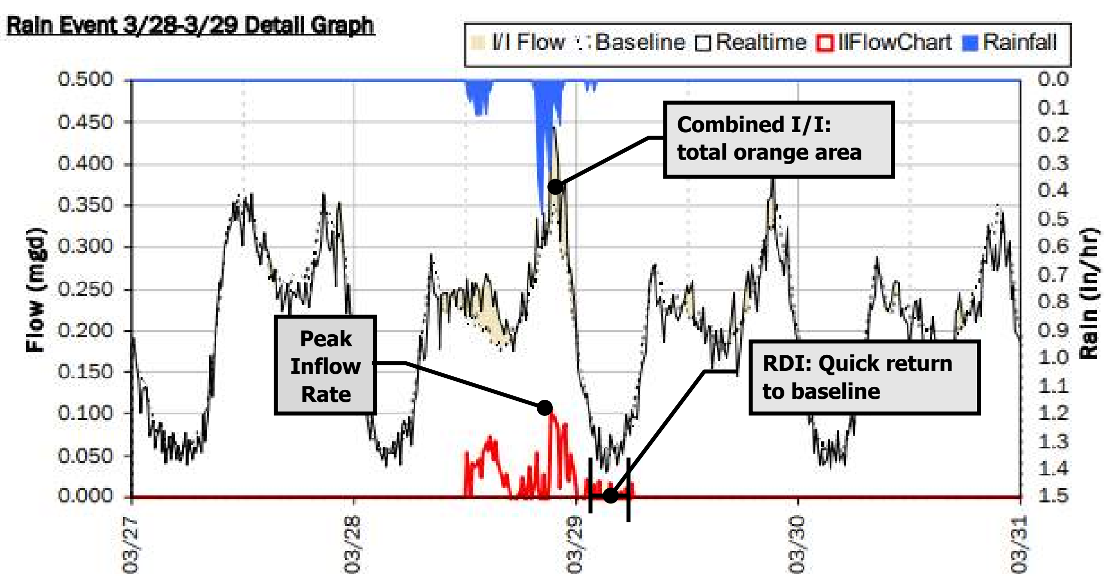


Figure 3-11. I/I Isolation, Site 1

To isolate the sewerage areas of some flow monitoring basins, a subtraction of flow(s) was required (reference Table 1-2). In this study, Site 9 and Site 11 were combined, which resulted in formation of Basin 9+11 due to the split. In addition, the flow monitoring device at Site 16 experienced malfunctioning during the rain event of interest. As a result, Basins 14 and 16 were combined for I/I analysis as Site 16 was upstream of Site 14. Please reference Section 1.2 and Section 2.4 for information on this subject.

3.3.2 Inflow Results Summary

Inflow is storm water discharged into the sewer system through direct connections such as downspouts, area drains, cross-connections to catch basins, etc. These sources transport rainwater directly into the sewer system and the corresponding flow rates are tied closely to the intensity of the storm. This component of I/I often causes a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows.

Table 3-6 summarizes the peak measured inflow and inflow analysis results for the relevant flow monitoring basins. Figure 3-12 shows a temperature map summary of the inflow analysis results per basin. The “Top 5” basins for each category have been shaded in RED. The following inflow results are noted:

- Basins 5, 13, 21, 23, and 28 had the highest weighted, normalized peak I/I rates, an indicator of high inflow upstream from the flow monitoring basin.

Table 3-6. Results and Rankings of Inflow Analysis

Monitoring Basin	ADWF (mgd)	Basin Acreage	Inflow Rate (mgd)	Inflow per-ADWF Ranking	Inflow per-Acre Ranking	Final Inflow Ranking
Basin 01	0.199	390	0.106	20	16	19
Basin 02	0.253	767	0.111	23	26	25
Basin 03	0.179	597	0.078	24	27	27
Basin 04	0.738	1088	0.375	21	11	17
Basin 05	0.124	231	0.177	4	5	4
Basin 06	0.085	310	0.068	11	19	13
Basin 07	0.048	80	0.029	15	10	12
Basin 08	0.419	328	0.055	30	25	28
Basin 10	0.003	31	0.003	8	30	20
Basin 12	0.116	345	0.066	19	20	21
Basin 13	0.164	260	0.324	3	2	3
Basin 15	0.556	1090	0.102	28	29	29
Basin 17	0.131	397	0.135	7	12	8
Basin 18	0.275	880	0.158	17	23	22
Basin 19	0.100	312	0.074	13	17	14
Basin 20	0.283	1187	Negligible	31	31	31
Basin 21	0.024	208	0.197	1	3	2
Basin 22	0.413	1677	0.306	14	22	18
Basin 23	0.096	343	0.132	5	8	5
Basin 24	0.165	475	0.136	10	15	10
Basin 25	0.570	1431	0.242	25	24	26
Basin 26	0.032	121	Negligible	31	31	31
Basin 27	0.148	104	0.087	16	4	9
Basin 28	0.025	31	0.061	2	1	1
Basin 29	0.092	171	0.052	18	14	16
Basin 30	0.057	121	0.054	9	6	7
Basin 31	0.046	86.4	0.016	27	21	24
Basin 32	0.095	179	0.040	26	18	23
Basin 33	0.178	221	0.085	22	9	15
Basin 34	0.047	121	0.037	12	13	11
Basin 9+11	1.069	1274	0.156	29	28	30
Basin 14+16	0.196	575	0.243	6	7	6

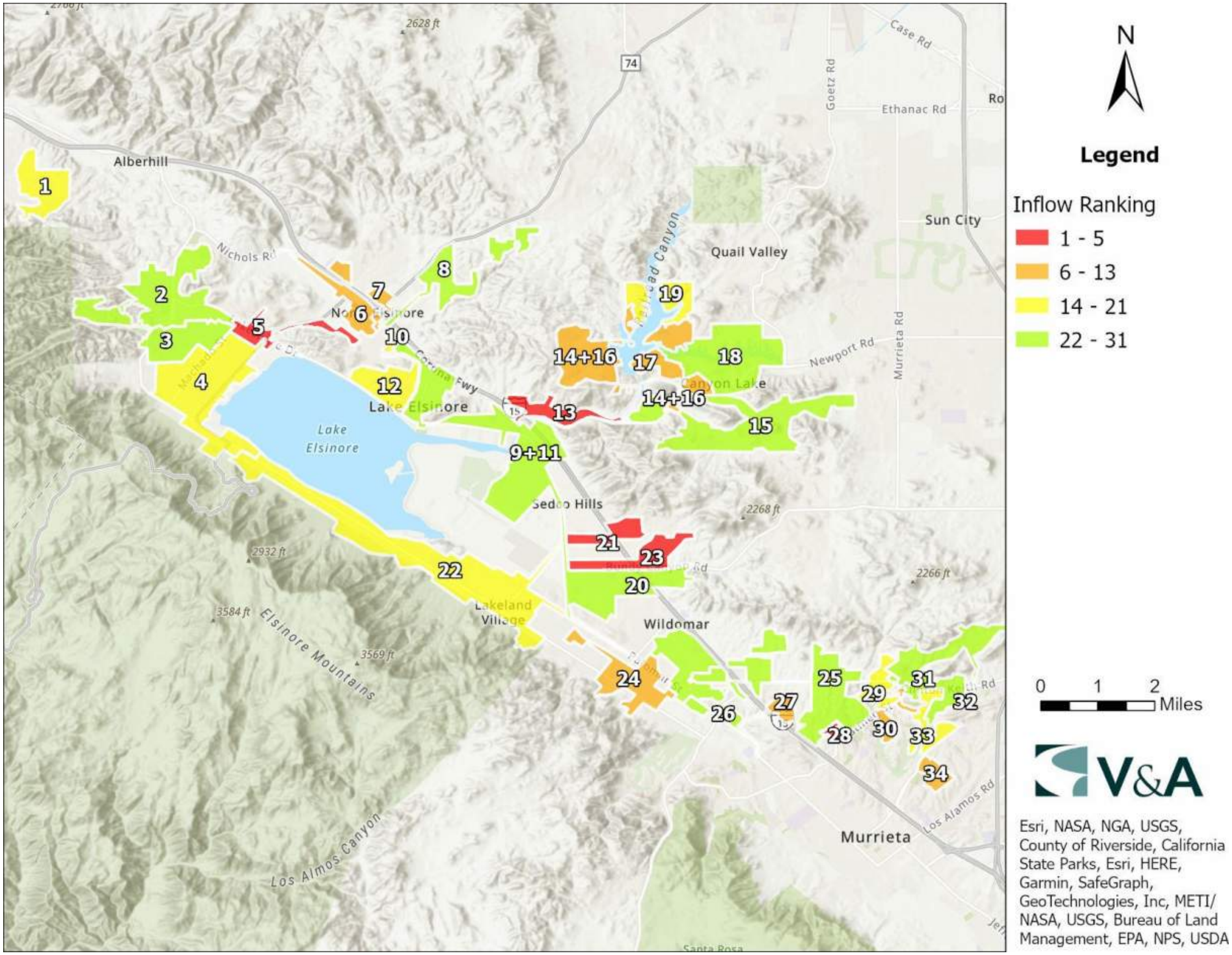


Figure 3-12. Temperature Map: Inflow Final Basin Rankings

3.3.3 Combined I/I Results

Combined I/I analysis considers the totalized volume (in gallons) of both inflow and rainfall-dependent infiltration over the course of a storm event.

Table 3-6 summarizes the combined I/I analysis results for the relevant flow monitoring basins. Figure 3-13 shows a temperature map summary of the combined I/I analysis results per basin. The “Top 5” basins for each category have been shaded in RED. The following inflow results are noted:

- Basins 5, 13, 28, 30, and 34 had the highest weighted, normalized combined rates, an indicator of high combined total I/I upstream from the flow monitoring basin.

Table 3-7. Combined I/I Analysis Summary

Monitoring Basin	ADWF (mgd)	Basin Acreage	Combined I/I (gallons)	R-Value (%)	Total I/I per- Acre Ranking	Total I/I per- ADWF Ranking	Total I/I Final Ranking
Basin 01	0.199	390	15,100	0.17%	16	21	19
Basin 02	0.253	767	3,700	0.03%	28	27	28
Basin 03	0.179	597	14,300	0.13%	18	15	16
Basin 04	0.738	1088	76,900	0.43%	7	12	10
Basin 05	0.124	231	24,400	0.62%	4	5	4
Basin 06	0.085	310	4,100	0.07%	24	23	23
Basin 07	0.048	80	4,300	0.27%	12	14	13
Basin 08	0.419	328	6,300	0.09%	22	28	25
Basin 10	0.003	31	200	0.04%	27	18	22
Basin 12	0.116	345	10,400	0.16%	17	13	15
Basin 13	0.164	260	59,000	1.25%	2	4	3
Basin 15	0.556	1090	14,800	0.08%	23	24	24
Basin 17	0.131	397	Negligible	0.00%	29	29	29
Basin 18	0.275	880	21,600	0.13%	20	17	18
Basin 19	0.100	312	8,500	0.13%	19	19	21
Basin 20	0.283	1187	Negligible	0.00%	29	29	29
Basin 21	0.024	208	7,400	0.25%	13	3	7
Basin 22	0.413	1677	25,900	0.11%	21	16	17
Basin 23	0.096	343	9,800	0.19%	14	10	12
Basin 24	0.165	475	22,200	0.27%	11	8	9
Basin 25	0.570	1431	10,600	0.04%	26	25	26
Basin 26	0.032	121	Negligible	0.00%	29	29	29
Basin 27	0.148	104	8,900	0.51%	6	20	14
Basin 28	0.025	31	18,400	3.55%	1	1	1
Basin 29	0.092	171	10,700	0.34%	9	11	11
Basin 30	0.057	121	23,400	1.12%	3	2	2
Basin 31	0.046	86.4	900	0.05%	25	26	27
Basin 32	0.095	179	6,600	0.17%	15	22	20
Basin 33	0.178	221	22,500	0.58%	5	9	6
Basin 34	0.047	121	7,700	0.39%	8	6	5
Basin 9+11	1.069	1274	Negligible	0.00%	29	29	29
Basin 14+16	0.196	575	33,300	0.27%	10	7	8

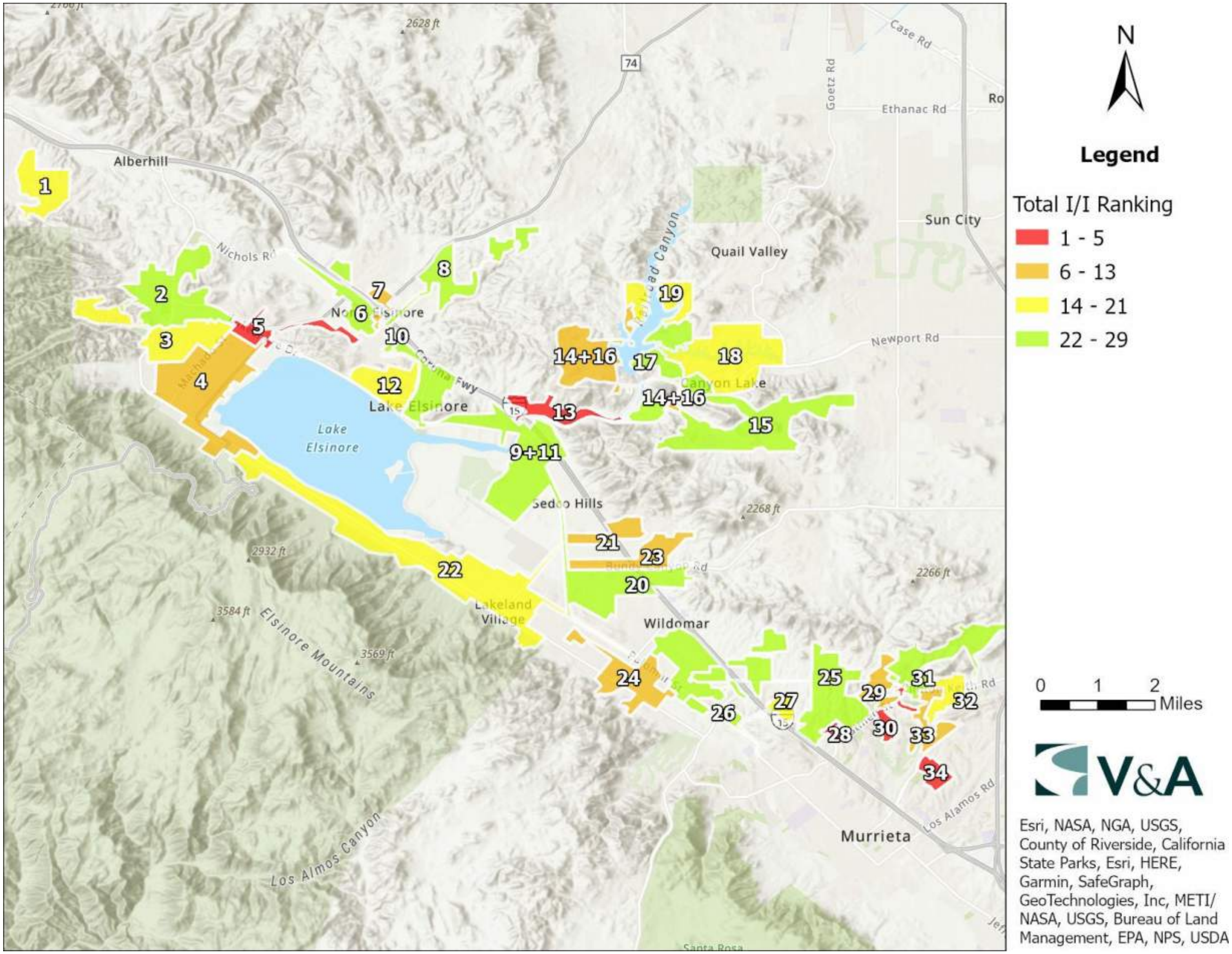


Figure 3-13. Temperature Map: Combined I/I Final Basin Rankings

3.3.4 Groundwater Infiltration Results Summary

Dry weather (ADWF) flow can be expected to have a predictable diurnal flow pattern. While each site is unique, experience has shown that, given a reasonable volume of flow and typical loading conditions, the daily flows fall into a predictable range when compared to the daily average flow. If a site has a large percentage of groundwater infiltration occurring during the periods of dry weather flow measurement, the amplitudes of the peak and low flows will be dampened[10]. Figure 3-14 shows a sample of two flow monitoring sites, both with nearly the same average daily flow, but with considerably different peak and low flows. In this *sample* case, Site B1 may have a considerable volume of groundwater infiltration.

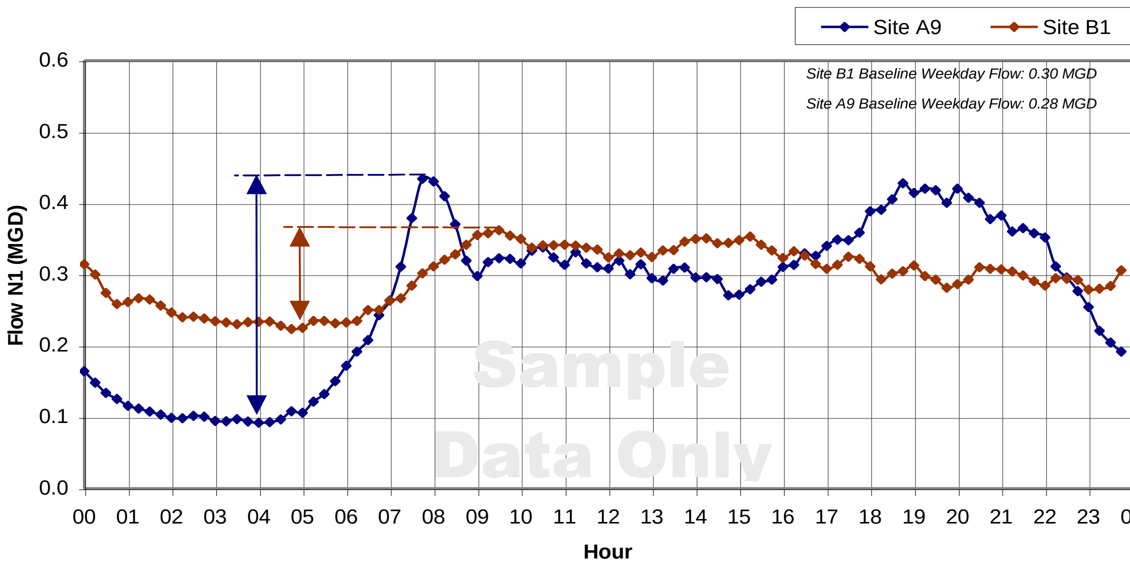


Figure 3-14. Groundwater Infiltration Sample Figure

It can be useful to compare the low-to-ADWF flow ratios for the flow monitoring sites. A site with abnormal ratios, and with no other reasons to suspect abnormal flow patterns (such as proximity to a pump station, treatment facilities, etc.), has a possibility of higher levels of groundwater infiltration in comparison to the rest of the collection system.

Figure 3-15 plots the low-to-ADWF flow ratios[11] against the ADWF flows for the relevant flow monitoring sites. The brown dashed line shows “typical” low-to-ADWF ratios per the Water Environment Federation (WEF).

WEF derived these ratios from residential sanitary sewer data. It is noted that the type of service in this project (airport and shipping) is not residential, and there exists the possibility of excessive early-morning flows due to abnormal working hours. This analysis is presented for reference only. The following GWI results are noted:

- Sites 8 and 11 had GWI rates higher-than typical standards, indicating possible high groundwater infiltration rates.

[10] In an extreme case, perhaps 0.2 mgd of ADWF flow and 2.0 mgd of groundwater infiltration, the peaks and lows would be barely recognizable; the ADWF flow would be nearly a straight line.

[11] The Minimum to Average flow ratio is calculated by taking the minimum flow and dividing by the ADWF value (using the Mon-Thu ADWF curve).

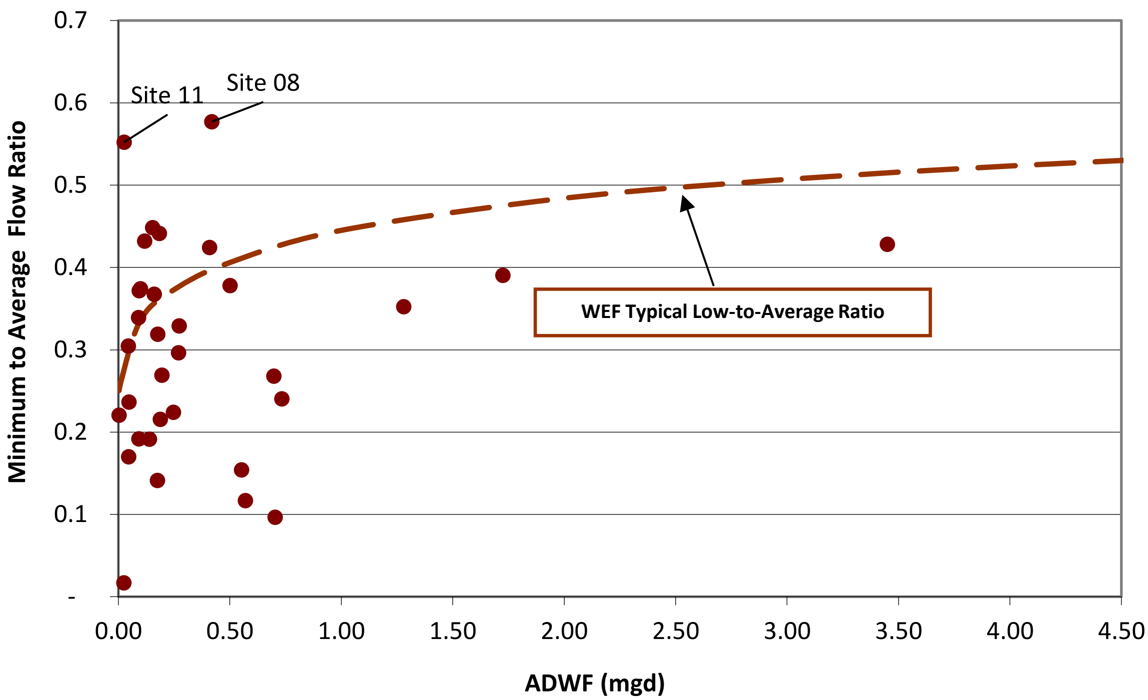


Figure 3-15. Minimum Flow Ratios vs ADWF[12]

[12] Due to attenuation, it should be expected that sites with larger flow volumes should not have quite the peak-to-average and low-to-average flow ratios as sites with lesser flow volumes. This is why the WEF typical trend line's slope is closer to 1.0 as the ADWF increases, as shown in the figure.

4 Recommendations

V&A advises that future I/I reduction plans consider the following recommendations:

1. **Master Plan and Model Implementation**: This study focuses on inflow and infiltration generation; the study results can be used to update the master plan and compare with previous model assumptions and flow monitoring results.
    a. **Verify Interconnections and Overflows**: understanding the interconnections and overflows can help with the master plan, basin isolation, and I/I analysis.
2. **Capacity Analysis**: Global capacity constraints will be addressed in the updated master plan. The following possible capacity concerns are noted:
    a. **Dry weather**: Sites 6, 19, 20, 22, 24, and 34 exceeded 0.5 d/D Dry Weather. Sites 6, 19 and 22 had 1.25 to 2 inches of sediment measured in the pipe channel.
    b. **Wet Weather**: Site 24 reached a surcharge condition during this study. Peak flow depth was 0.8 feet above the pipe crown. Site 34 had d/D ratio between 0.75 and 1.0.
3. **Determine I/I Reduction Program**: The District should examine its I/I reduction needs to determine their needs and goals for a future I/I reduction program.
    a. If peak flows, sanitary sewer overflows, and pipeline capacity issues are of greater concern, then priority can be given to investigate and reduce sources of inflow within the basins with the greatest inflow problems.
    b. If total infiltration and general pipeline deterioration are of greater concern, then the program can be weighted to investigate and reduce sources of infiltration within the basins with the greatest infiltration problems.
4. **I/I Reduction Cost Effective Analysis**: The District should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow/infiltration and systematically rehabilitating or replacing the faulty pipelines; or (2) continued treatment of the additional rainfall dependent I/I flow

Appendix A
Flow Monitoring Sites: Data, Graphs, Information

Monitoring Site: Site 01

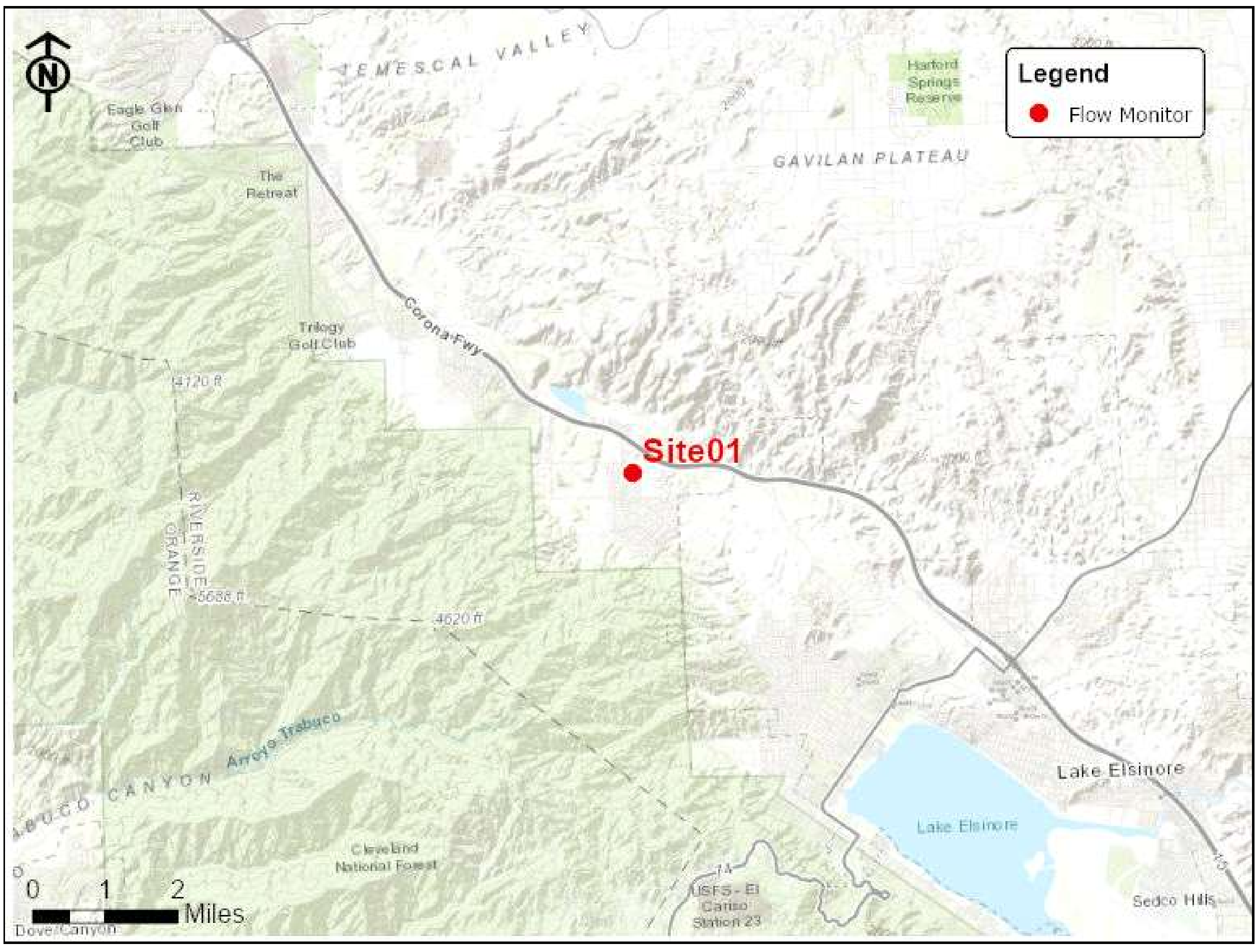
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Kicking Horse Drive, west of Caravan Circle

Data Summary Report



Vicinity Map: Site 01

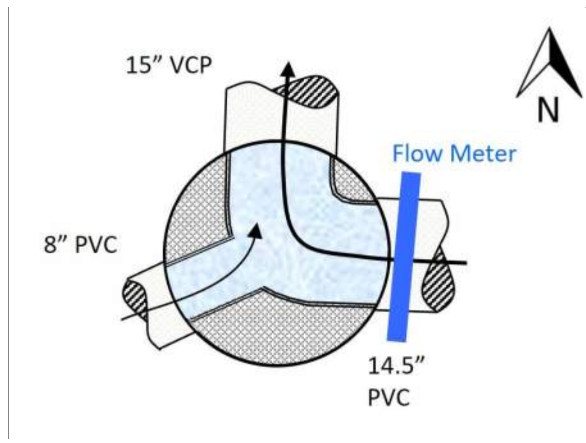
SITE 01

Site Information — MH ID: MH-82

Location:	Kicking Horse Drive, west of Caravan Circle
Coordinates:	117.4269° W, 33.7323° N
Rim Elevation (Earth):	1354 feet
Expected Pipe Diameter:	15 inches
Measured Pipe Diameter:	14.75 inches
ADWF:	0.199 mgd
Peak Measured Flow:	0.462 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 01

Additional Site Photos

Effluent Pipe

Monitored E Influent Pipe

SITE 01

Additional Site Photos

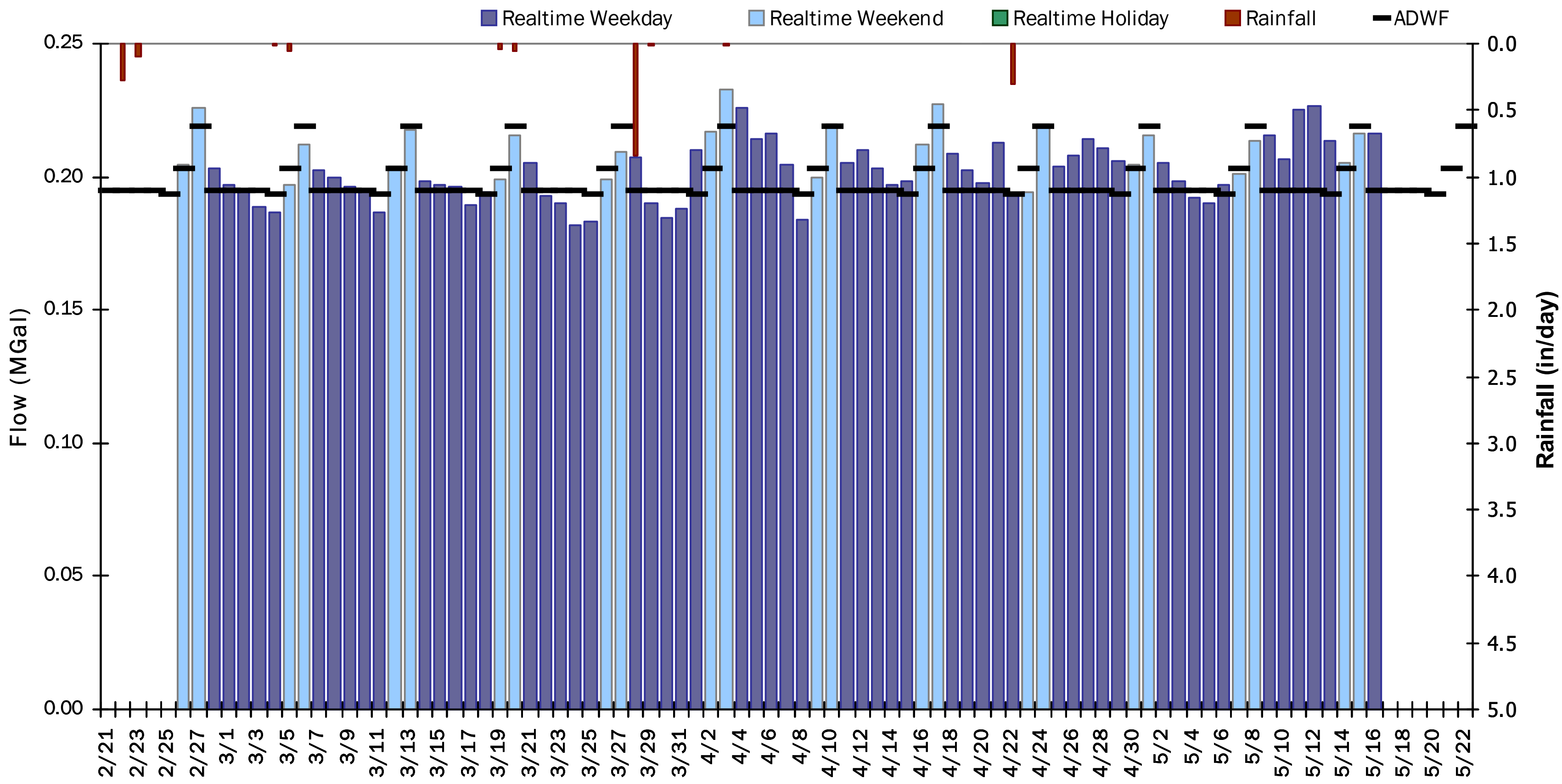
W Influent Pipe

SITE 01

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.204 MGal   Peak Daily Flow: 0.234 MGal   Min Daily Flow: 0.170 MGal

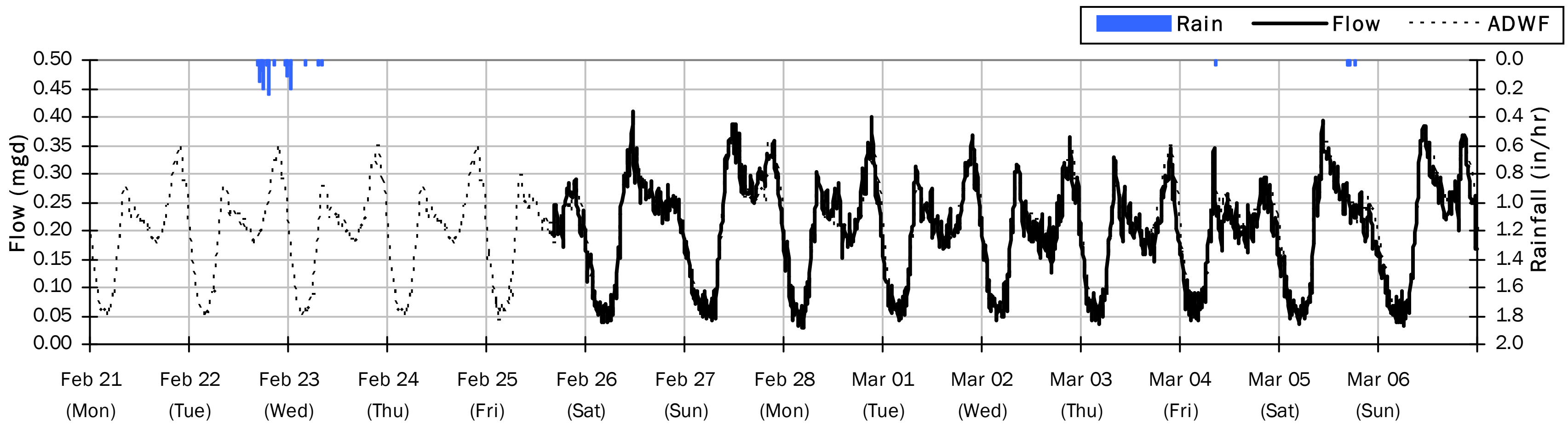
Total Rainfall: 1.33 inches

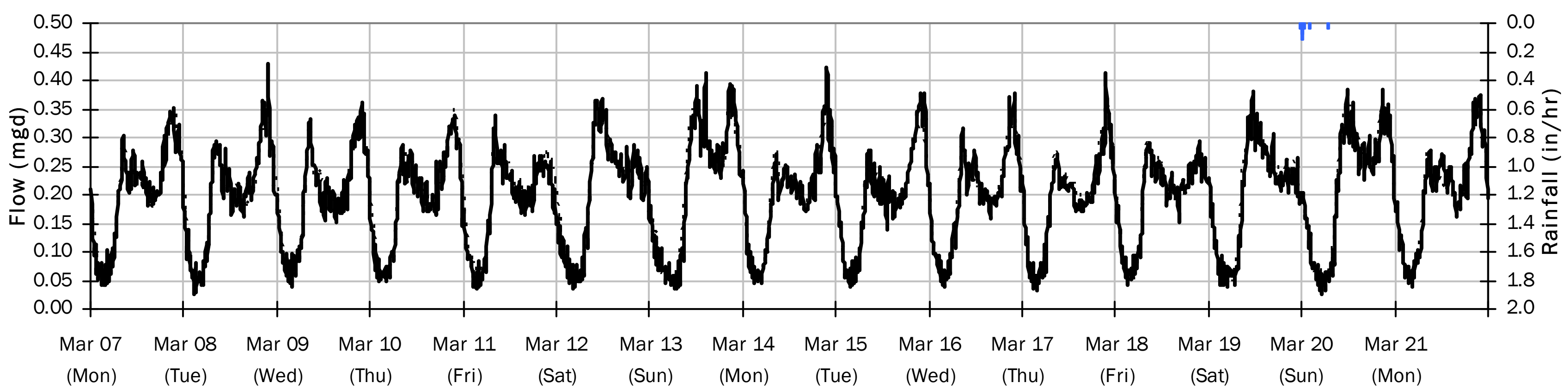


SITE 01
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.52 inches

Period Avg Flow: 0.201 mgd Period Peak Flow: 0.428 mgd Period Min Flow: 0.026 mgd

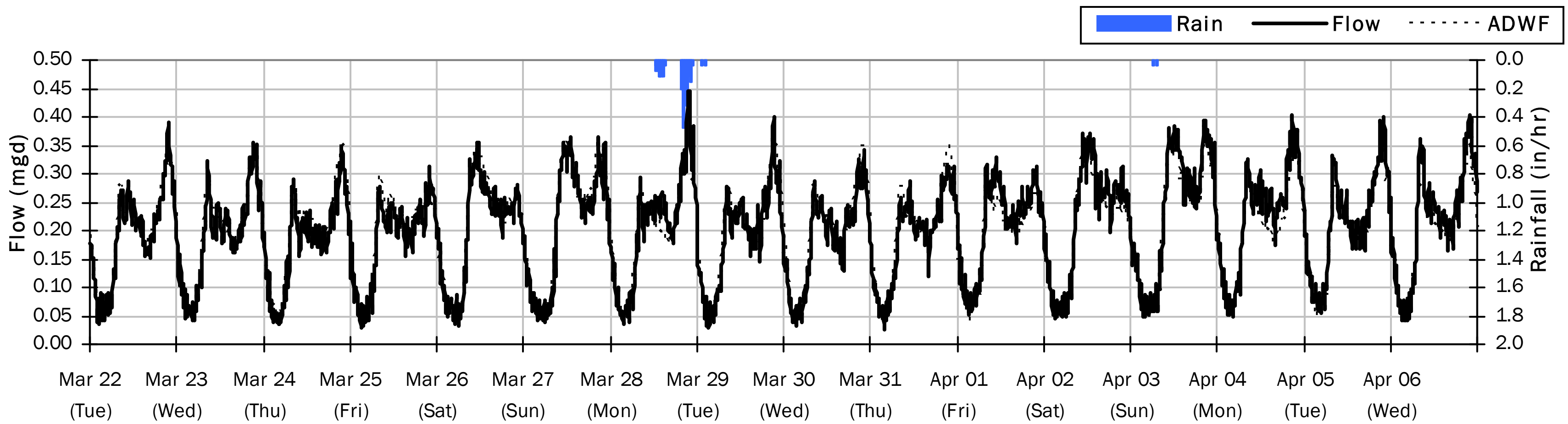


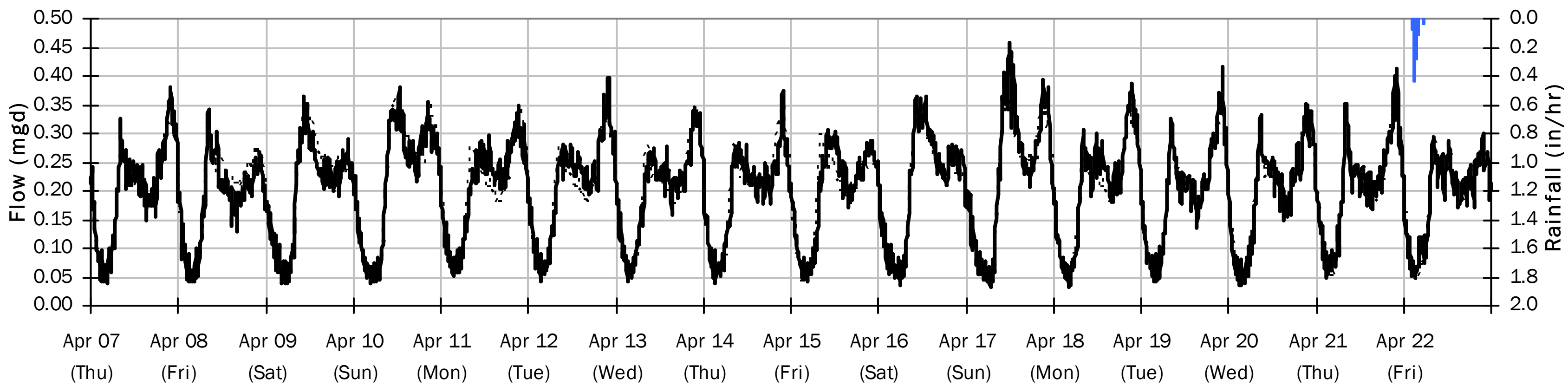


SITE 01

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 1.18 inches Period Avg Flow: 0.204 mgd Period Peak Flow: 0.457 mgd Period Min Flow: 0.024 mgd

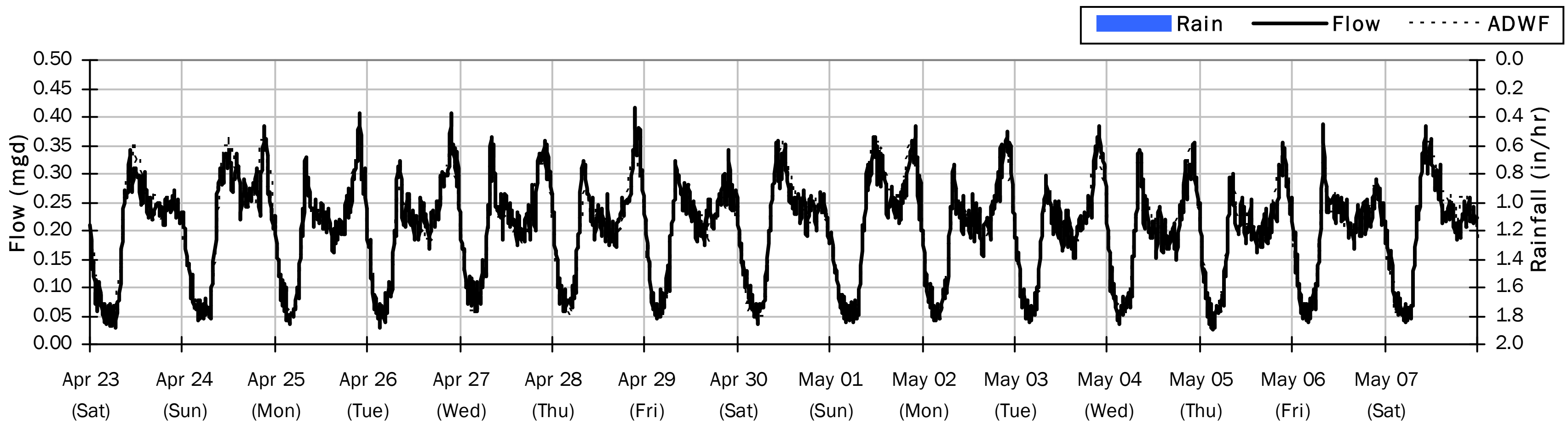


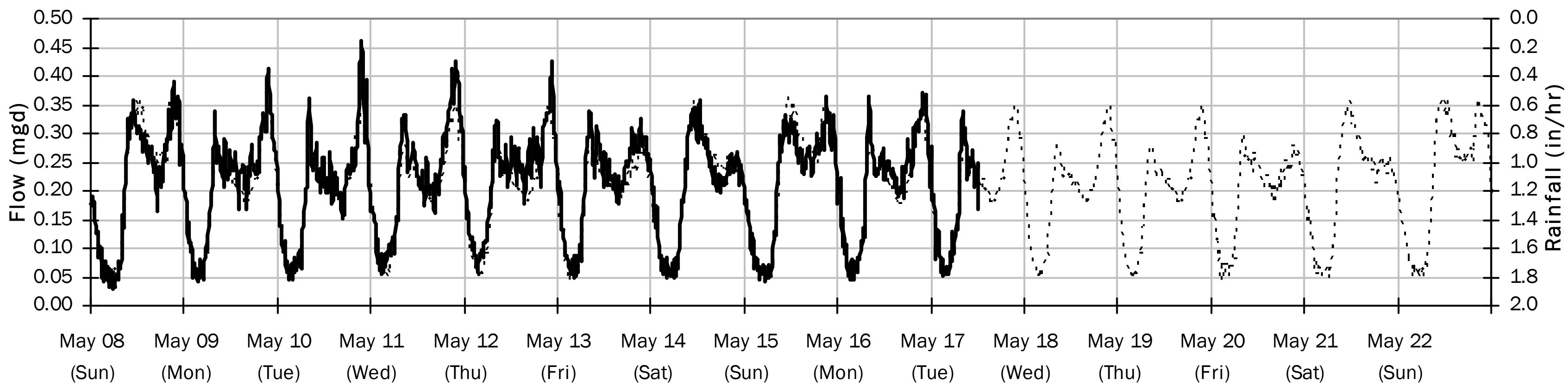


SITE 01

Flow Summary: 4/23/2022 to 5/22/2022

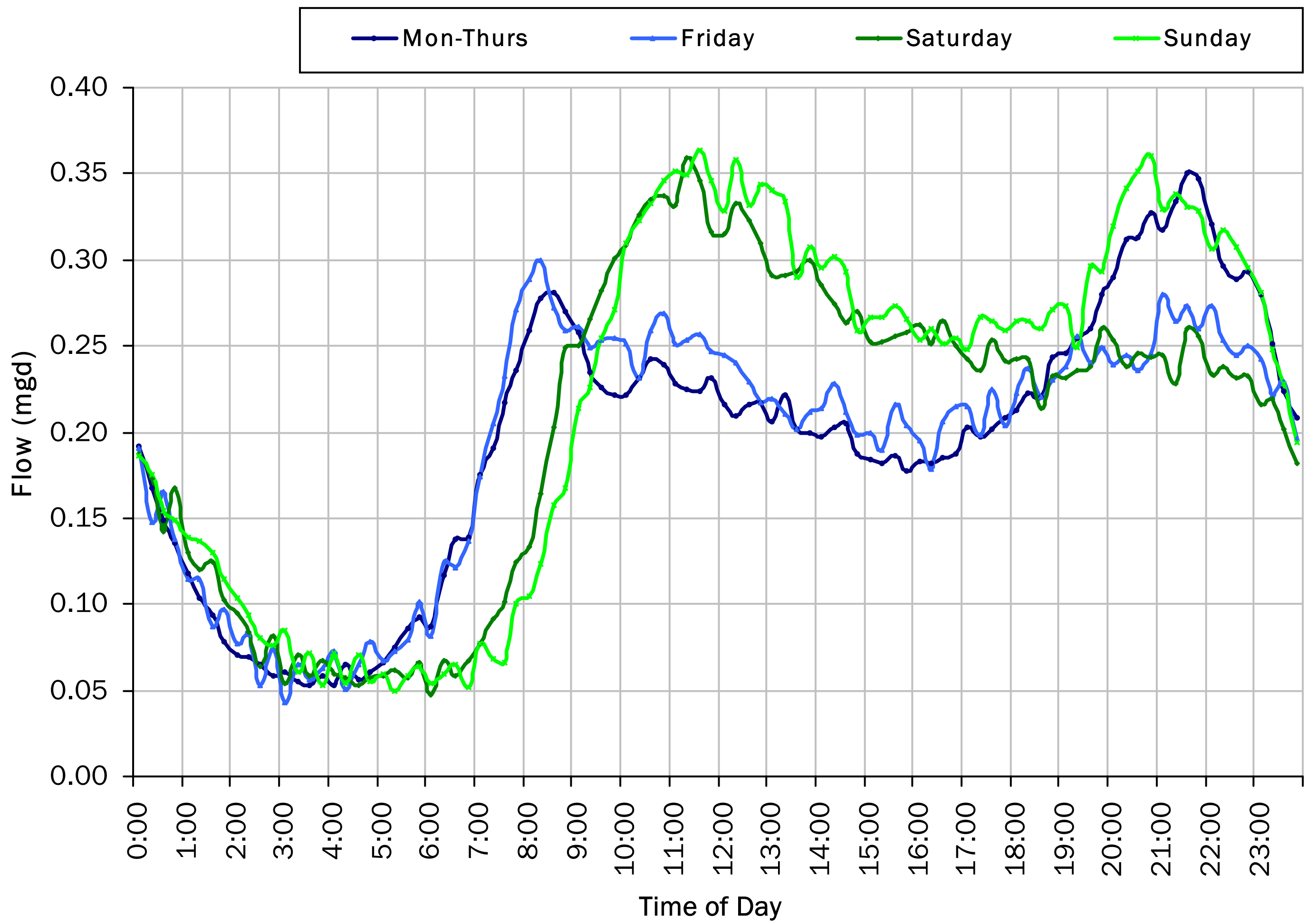
Period Rainfall: 0.00 inches | Period Avg Flow: 0.207 mgd | Period Peak Flow: 0.462 mgd | Period Min Flow: 0.027 mgd





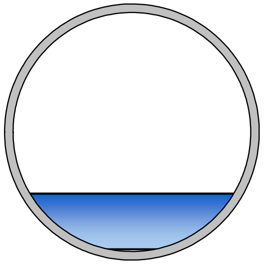
SITE 01

Average Dry Weather Flow Hydrographs



ADWF:

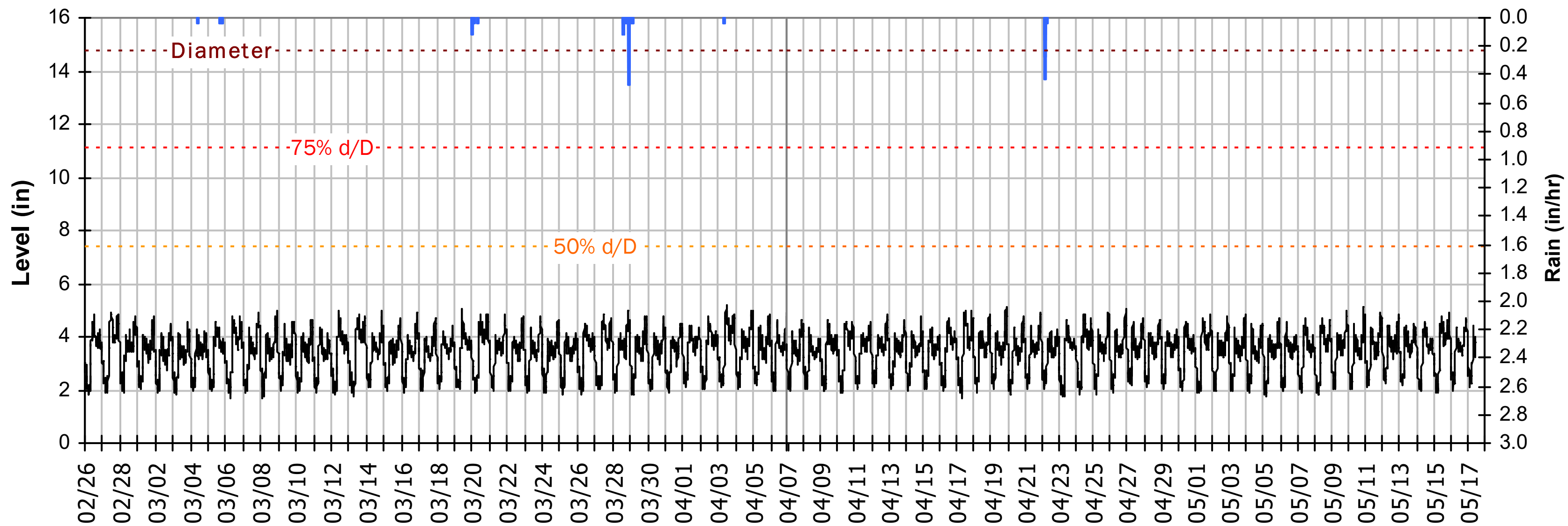
0.199 *mgd*

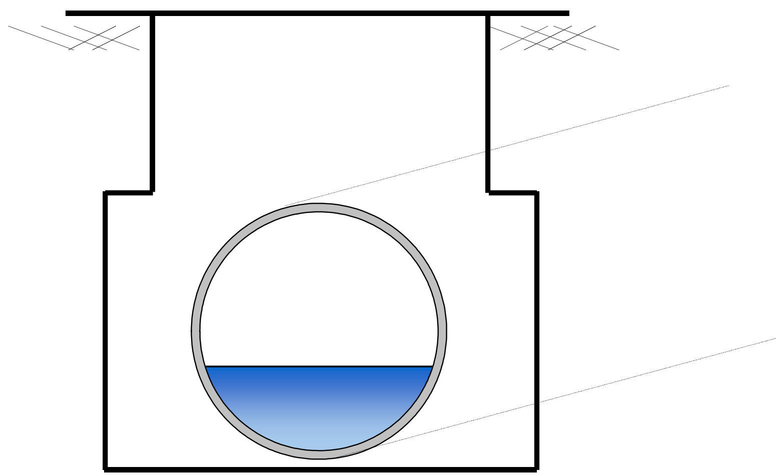


SITE 01

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

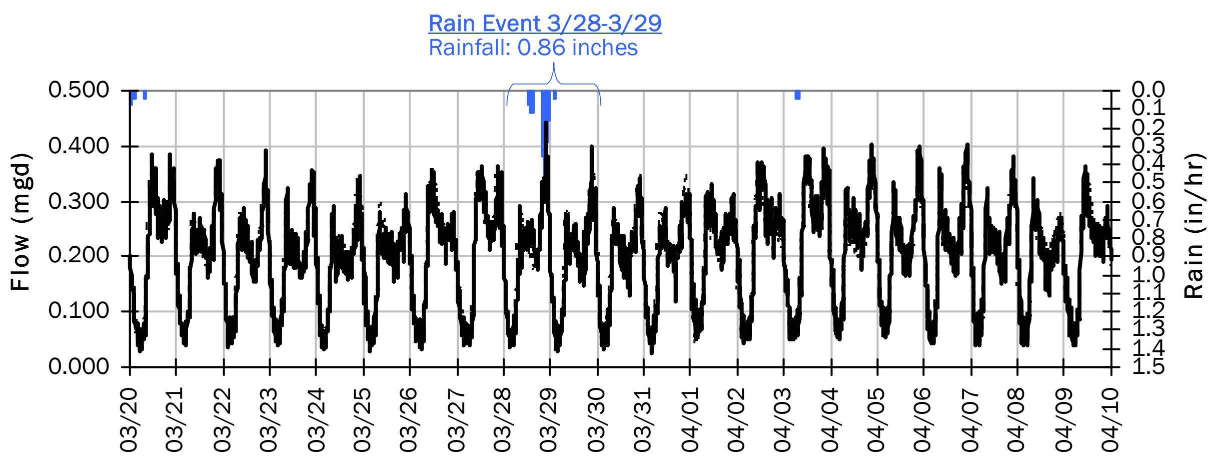




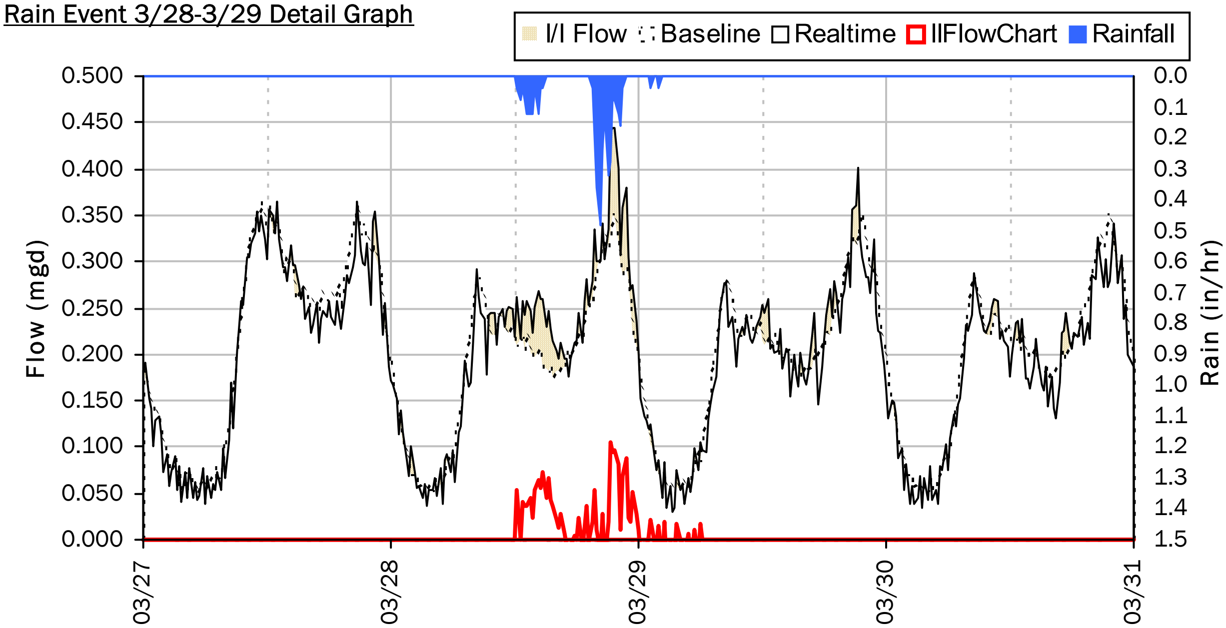
Pipe Diameter:	14.8	*inches*
Peak Measured Level:	5.2	*inches*
Peak d/D Ratio:	0.35	

SITE 01
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



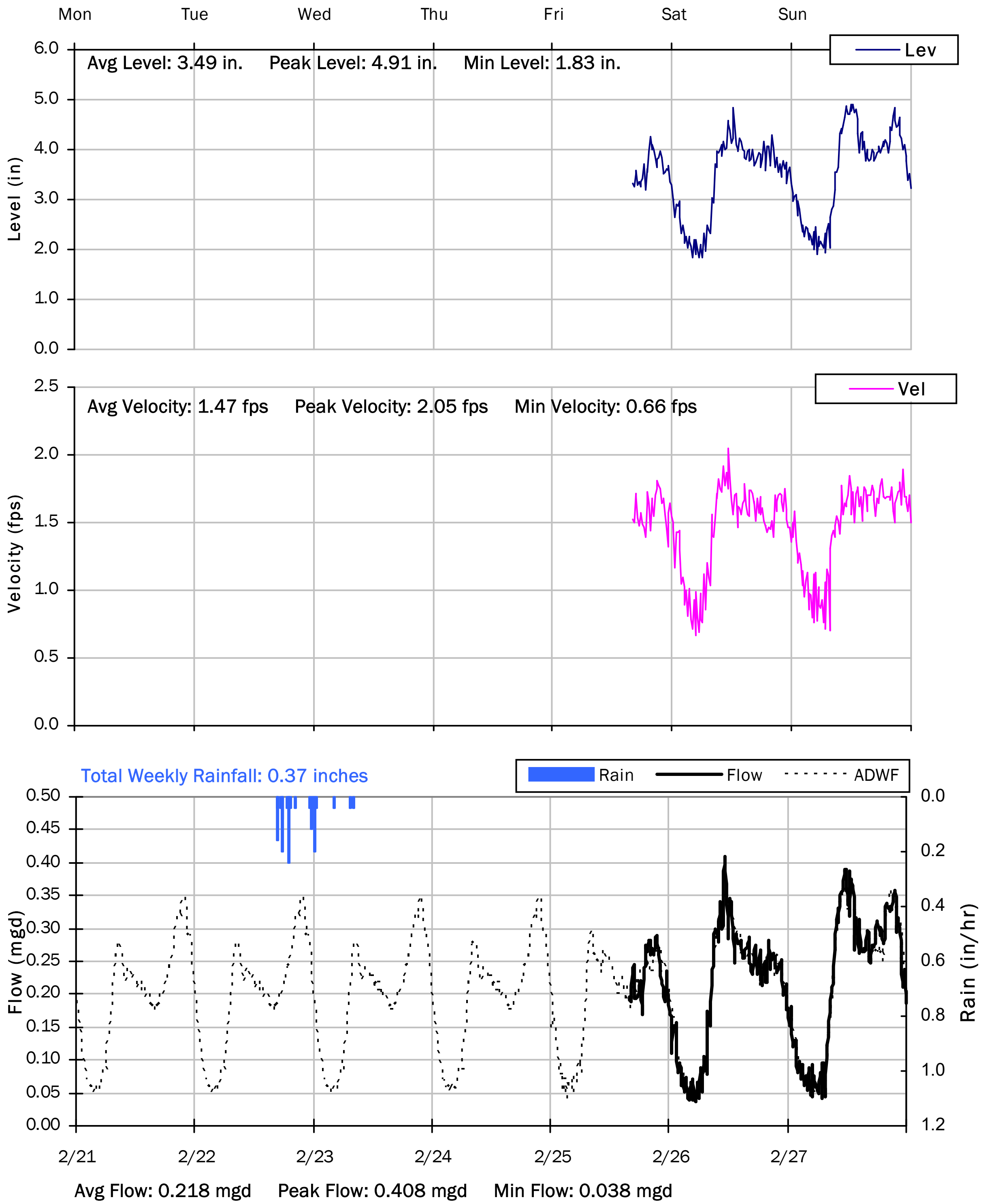
Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.86 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.444 *mgd*	Peak I/I Rate:	0.106 *mgd*
PF:	2.23	Total I/I:	15,000 *gallons*
Peak Level:	5.01 *in*		
d/D Ratio:	0.34		

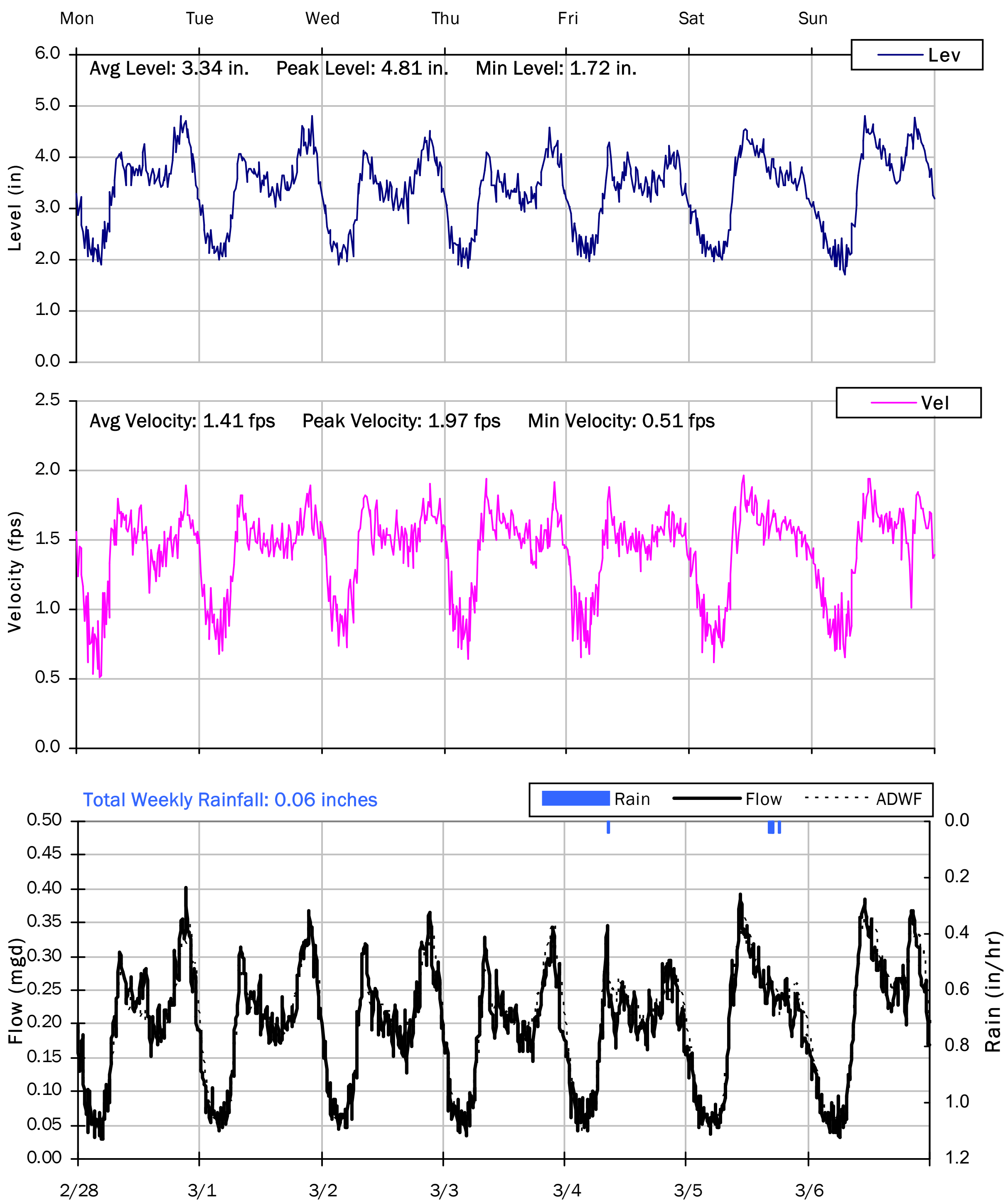
SITE 01
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



SITE 01

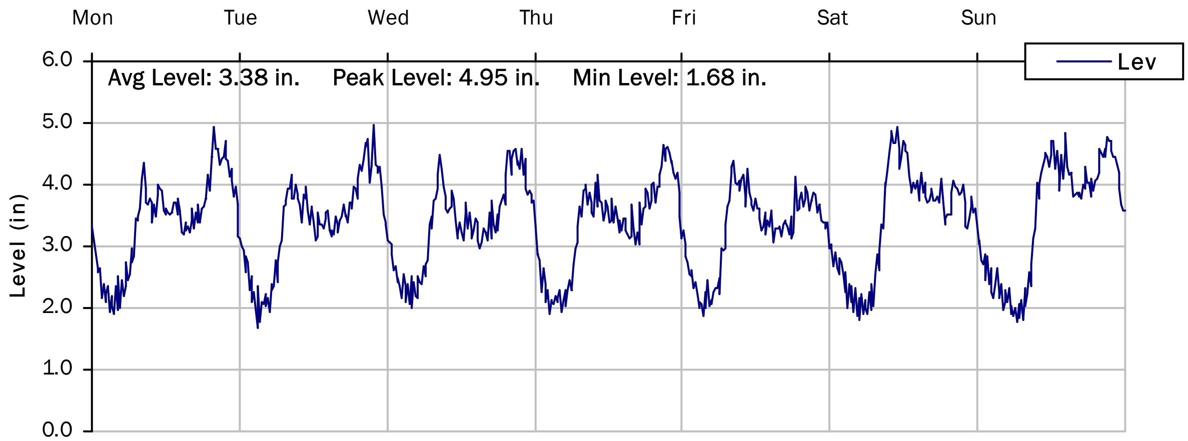
Weekly Level, Velocity and Flow Hydrographs

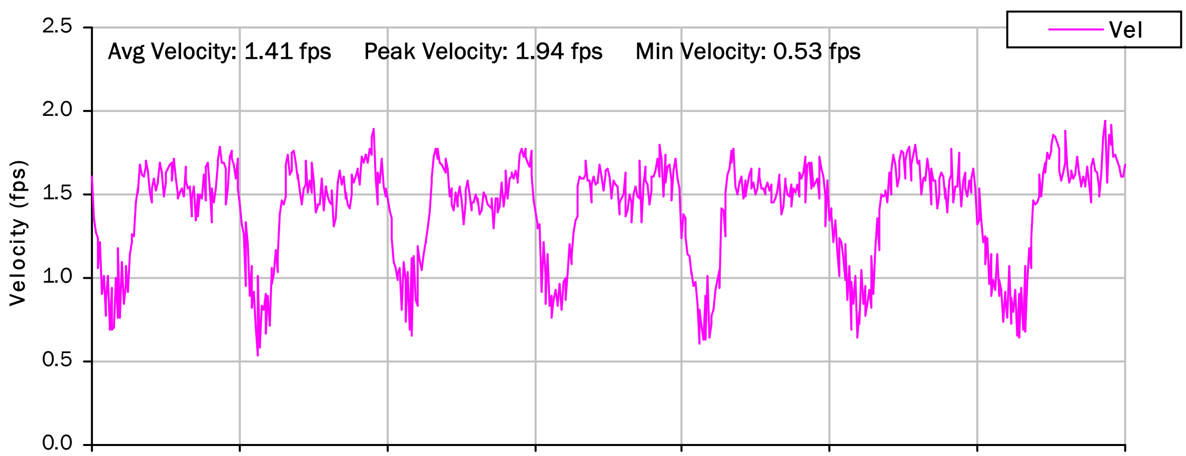
2/28/2022 to 3/7/2022

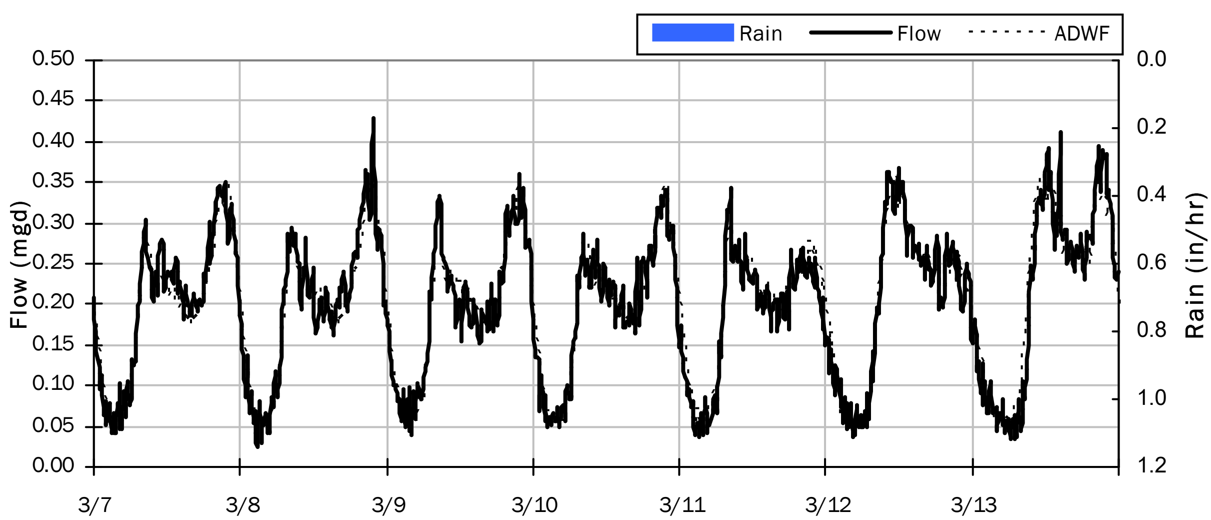


Avg Flow: 0.197 mgd Peak Flow: 0.401 mgd Min Flow: 0.030 mgd

SITE 01
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

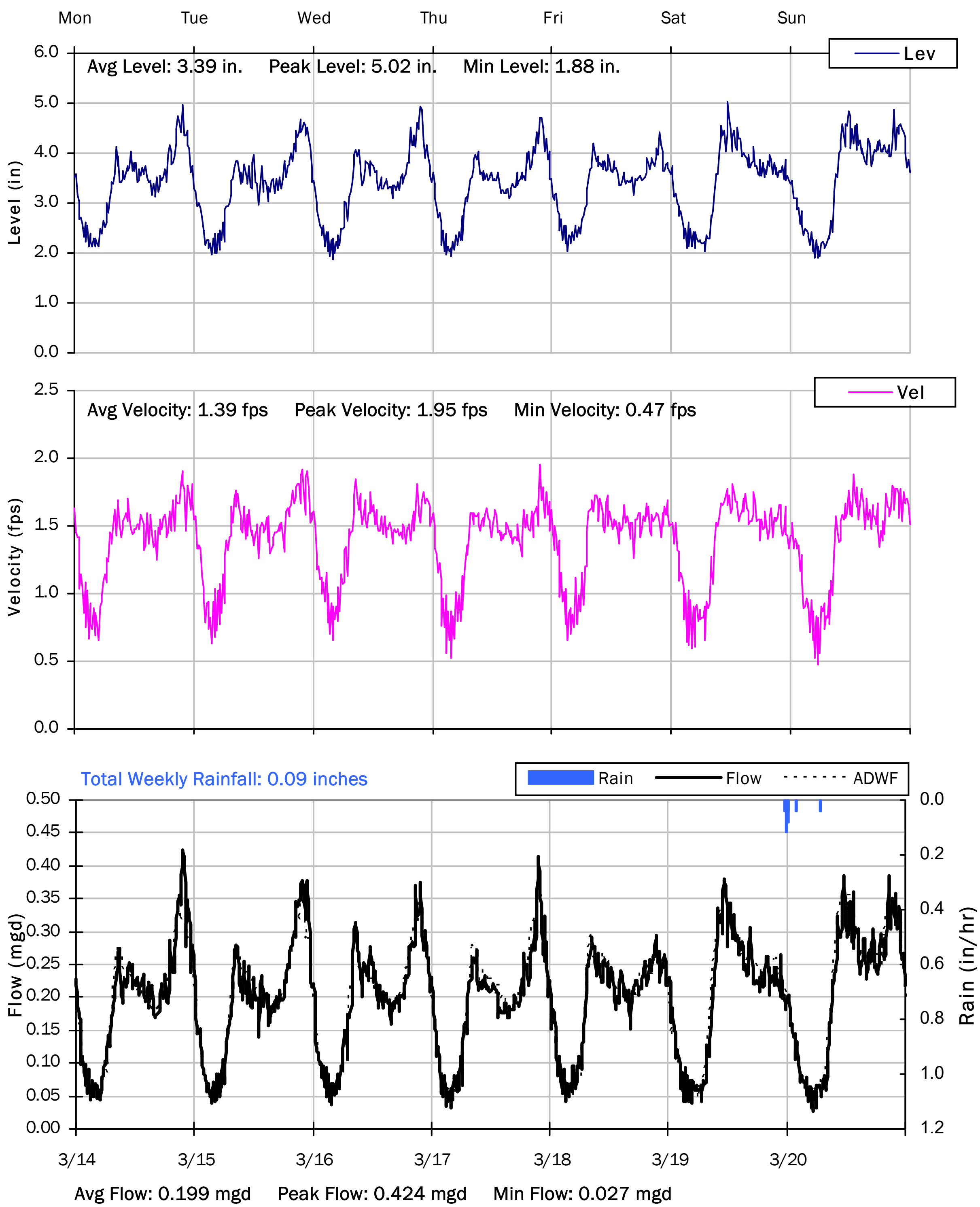




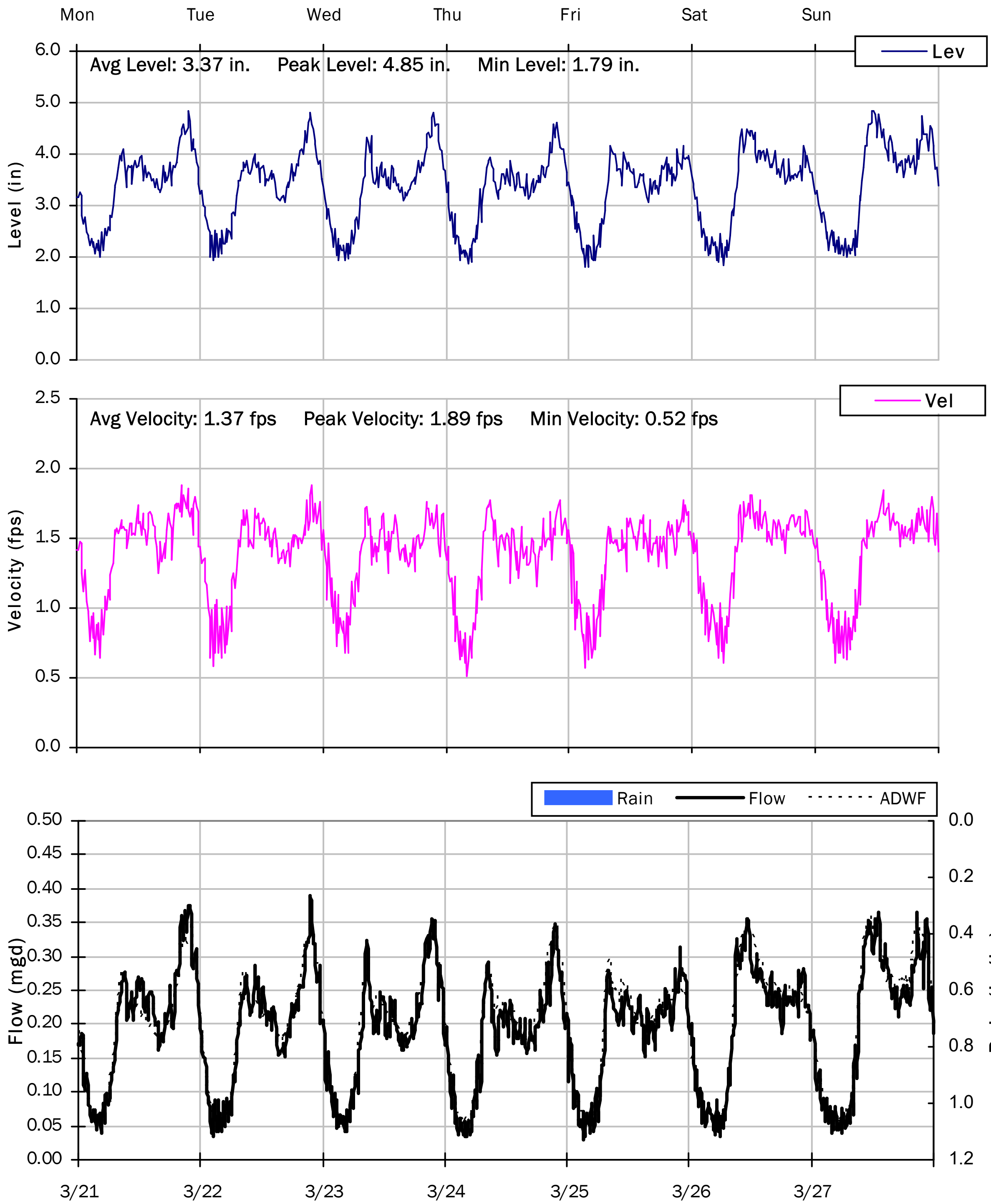


Avg Flow: 0.200 mgd   Peak Flow: 0.428 mgd   Min Flow: 0.026 mgd

SITE 01
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



SITE 01
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

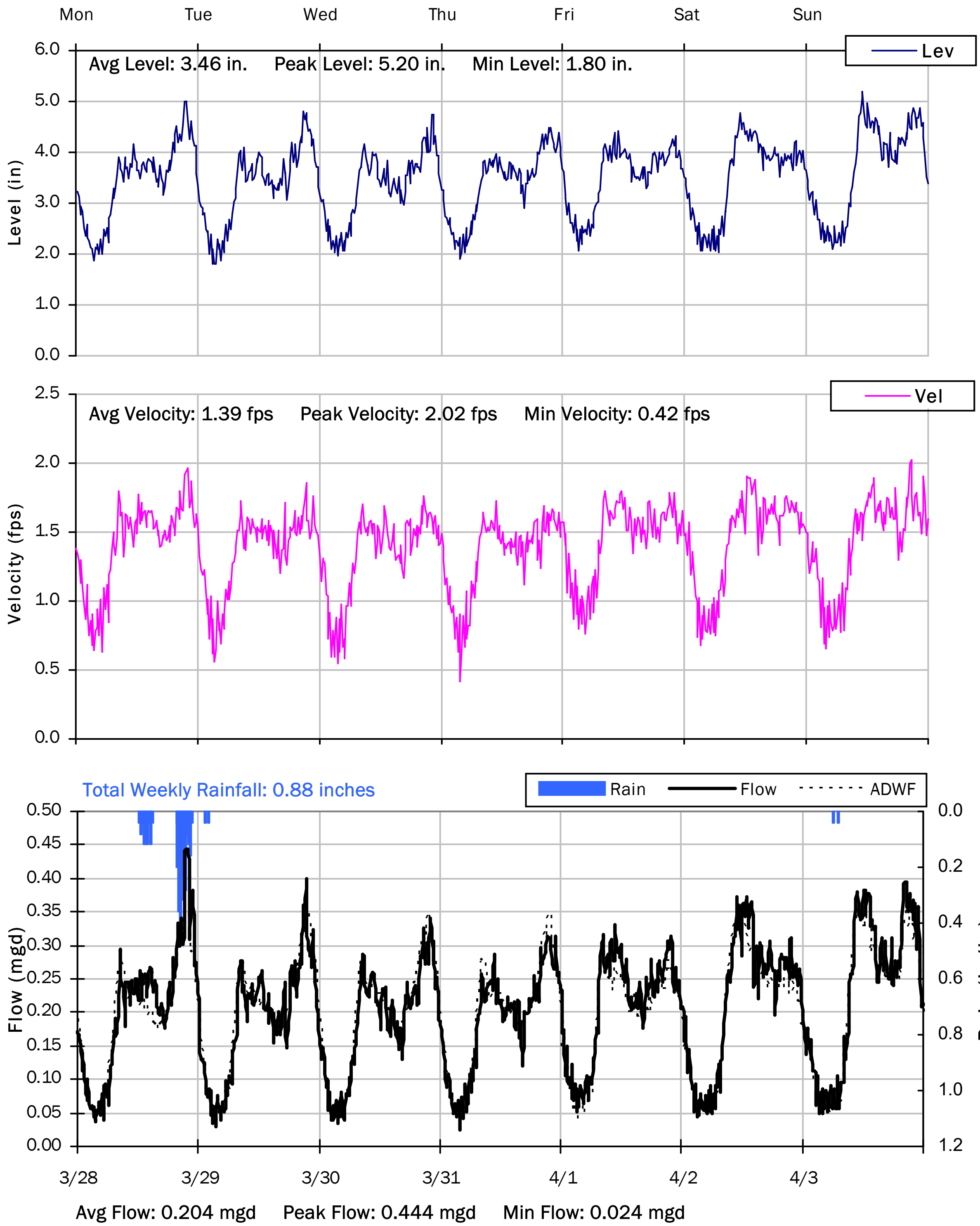


Avg Flow: 0.194 mgd Peak Flow: 0.391 mgd Min Flow: 0.030 mgd

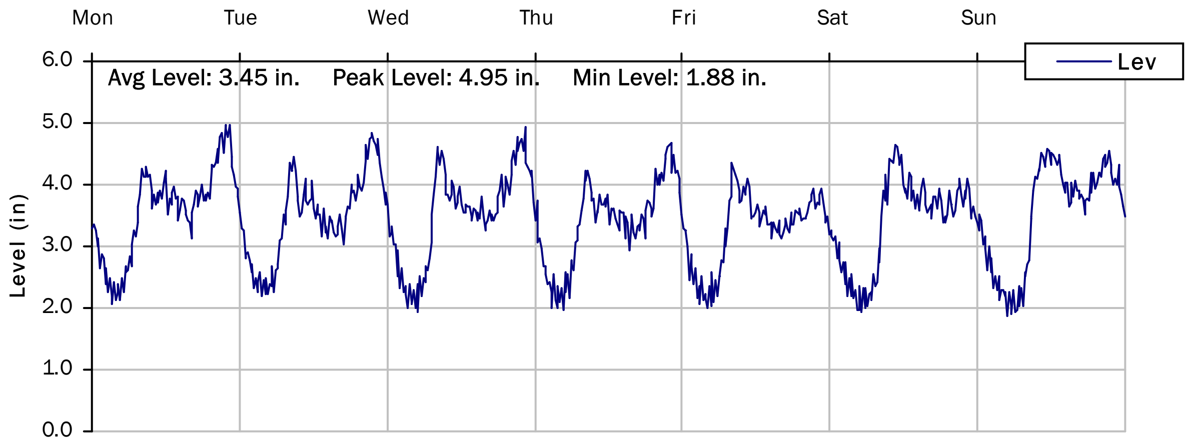
SITE 01

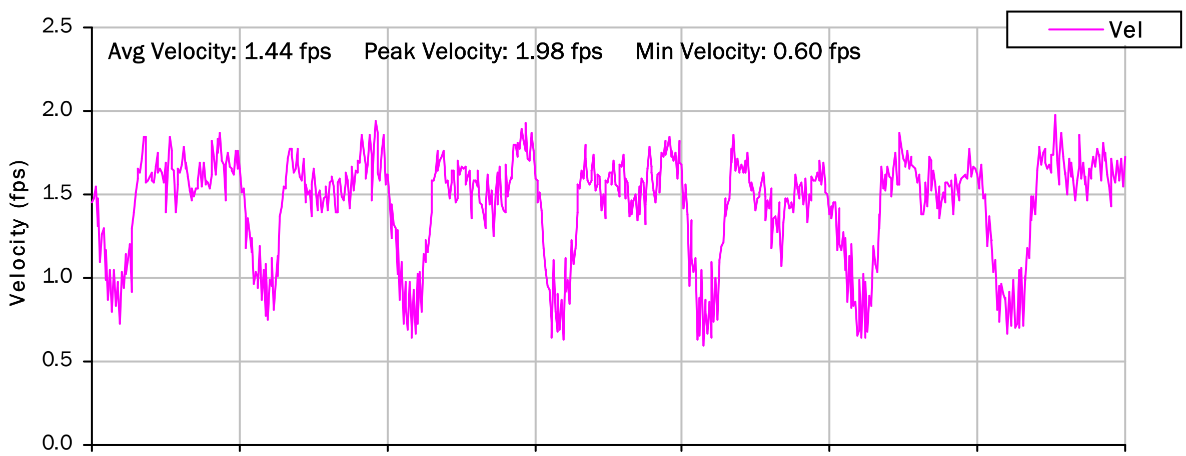
Weekly Level, Velocity and Flow Hydrographs

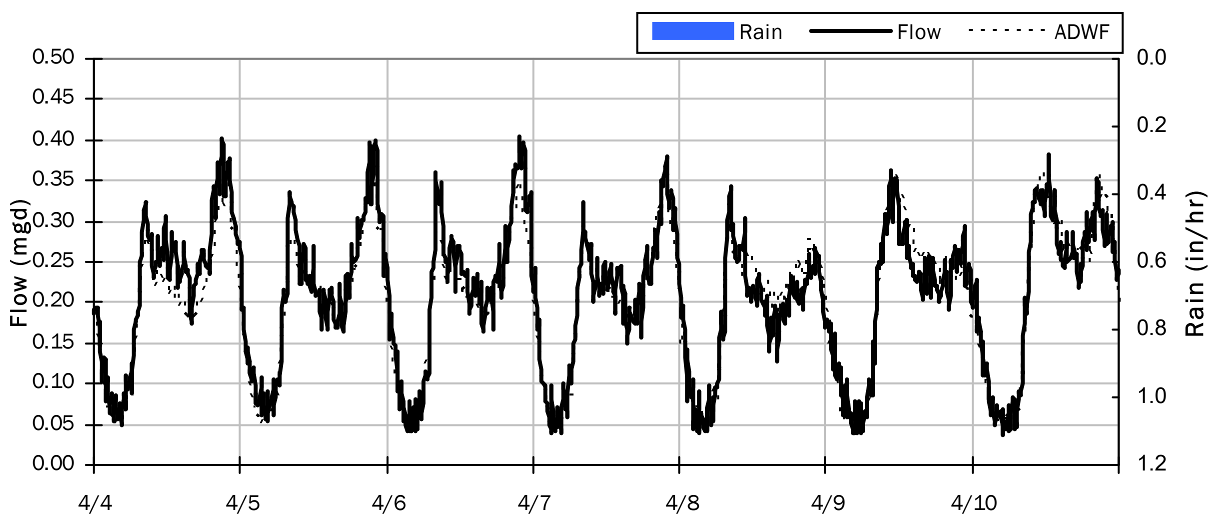
3/28/2022 to 4/4/2022



SITE 01
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

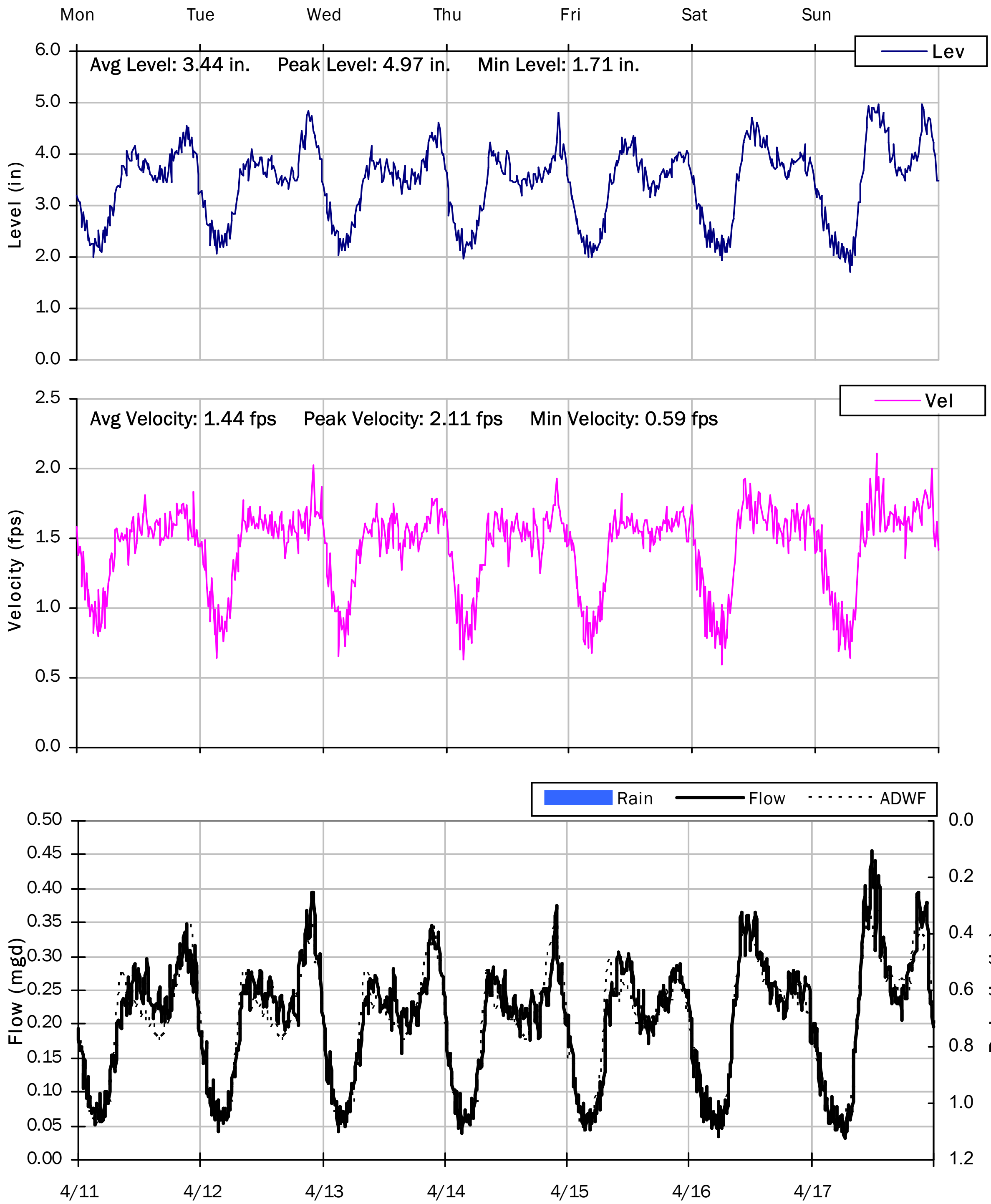






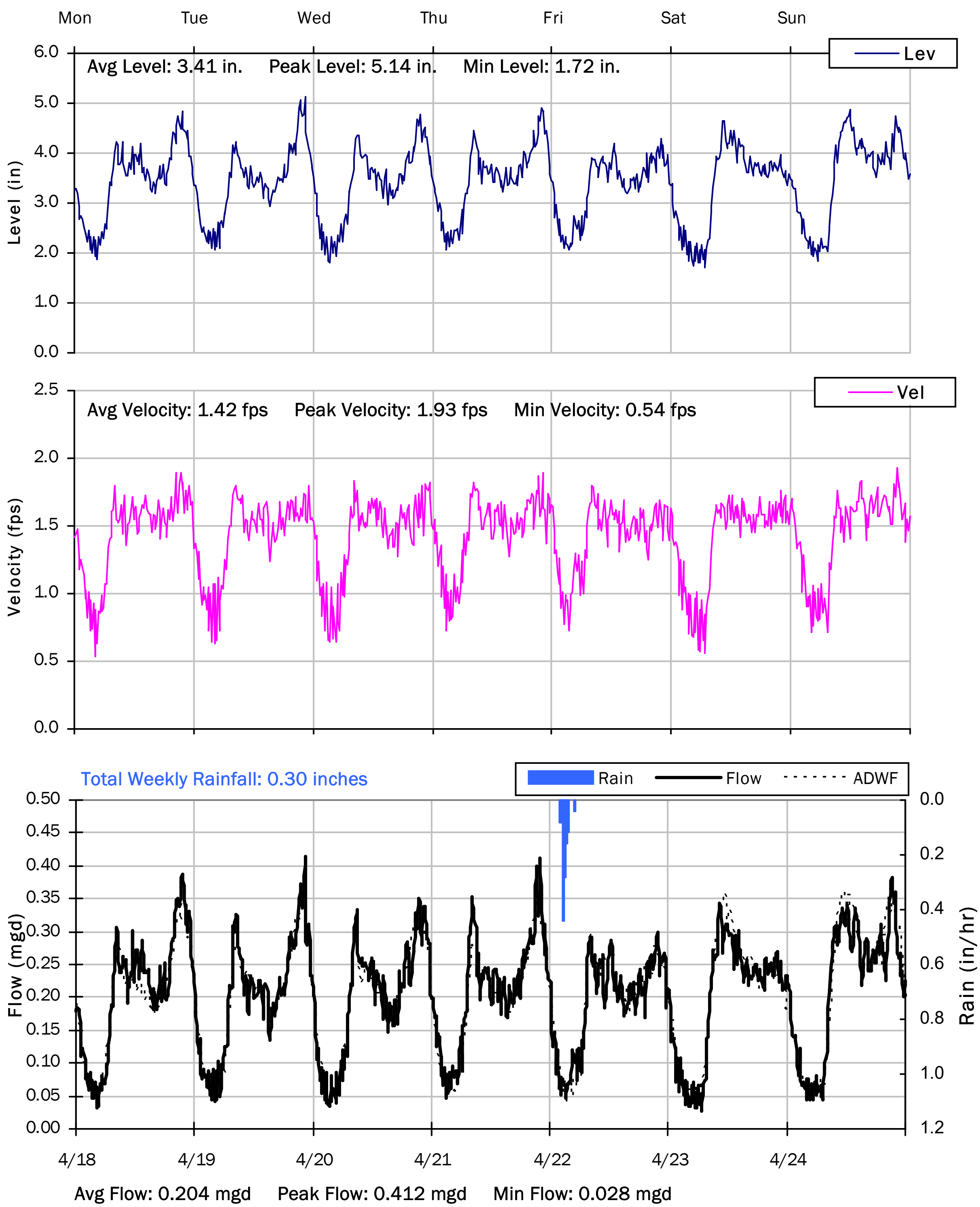
Avg Flow: 0.209 mgd Peak Flow: 0.404 mgd Min Flow: 0.038 mgd

SITE 01
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

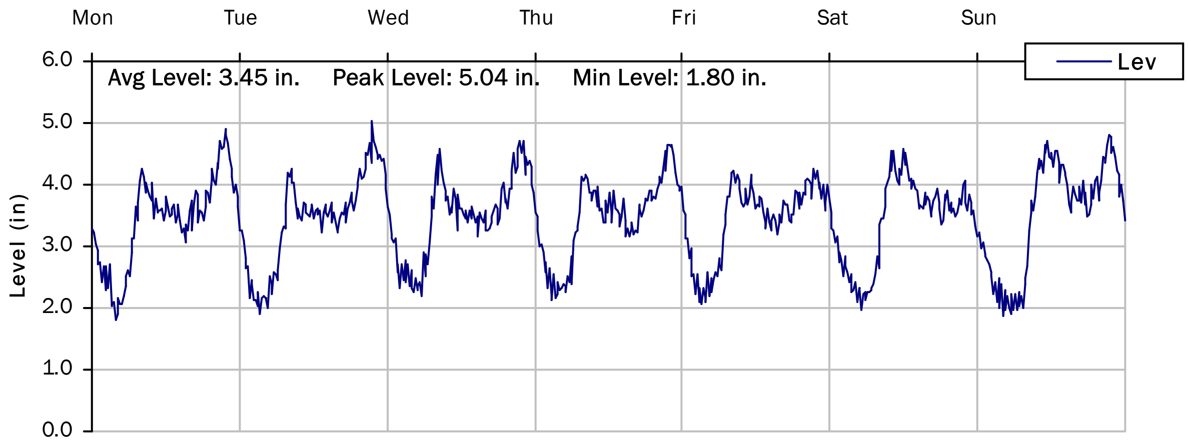


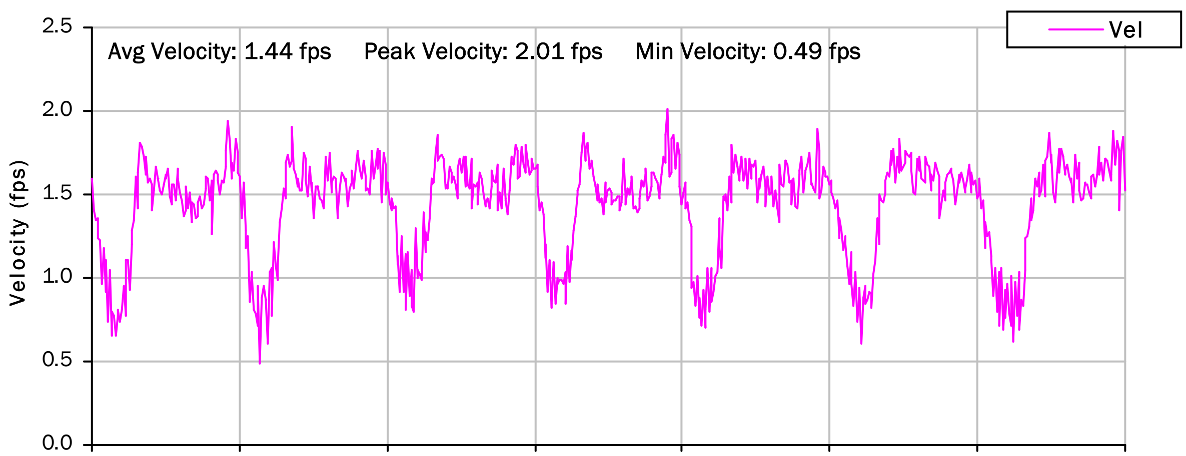
Avg Flow: 0.208 mgd Peak Flow: 0.457 mgd Min Flow: 0.032 mgd

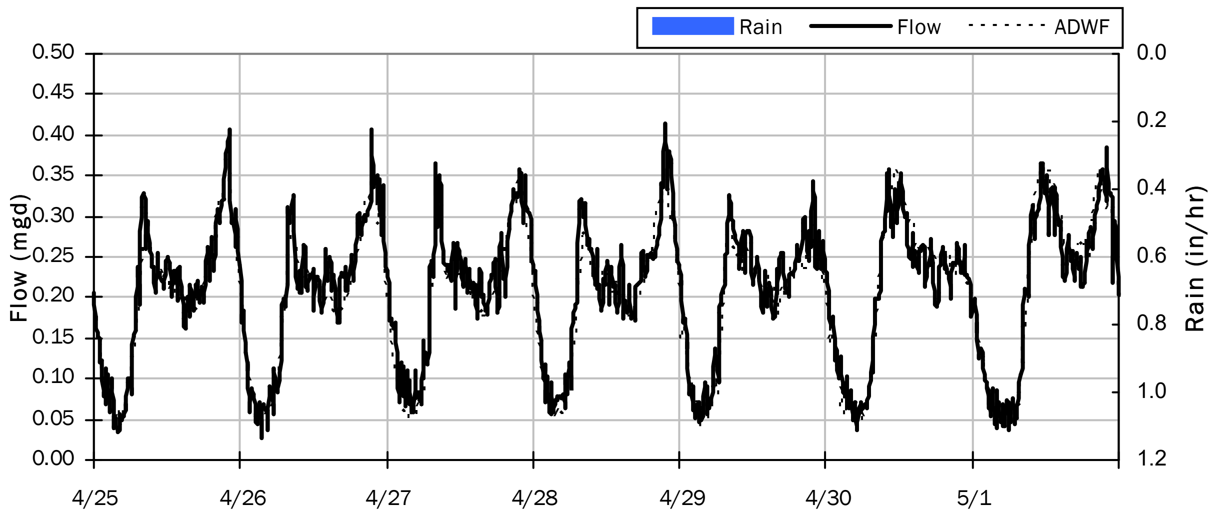
SITE 01
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



SITE 01
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

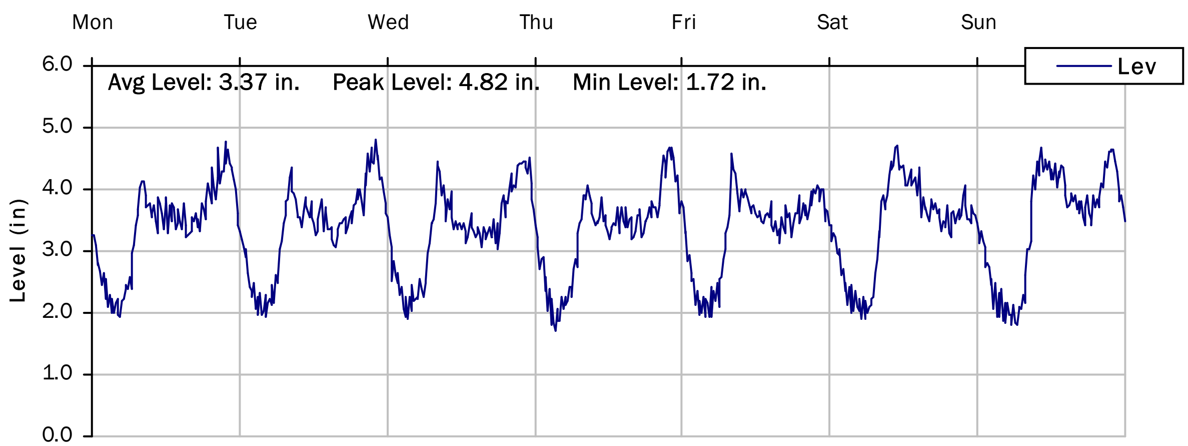


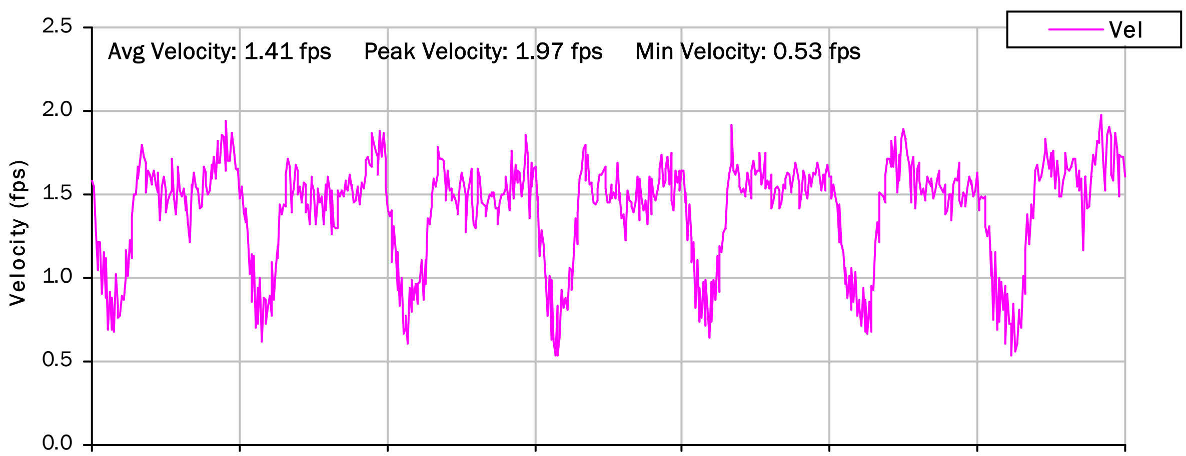


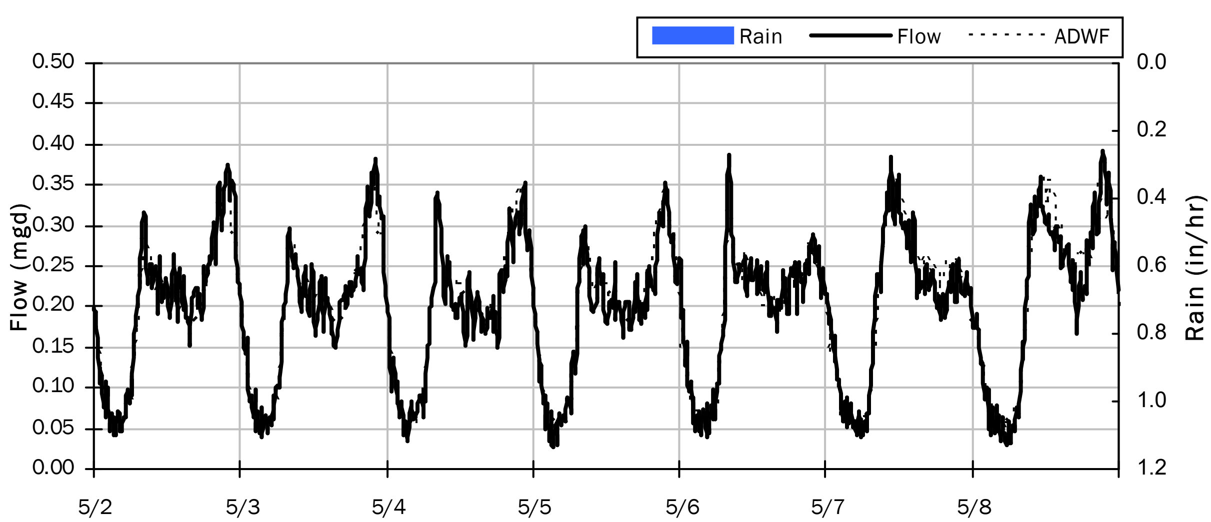


Avg Flow: 0.209 mgd Peak Flow: 0.415 mgd Min Flow: 0.028 mgd

SITE 01
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

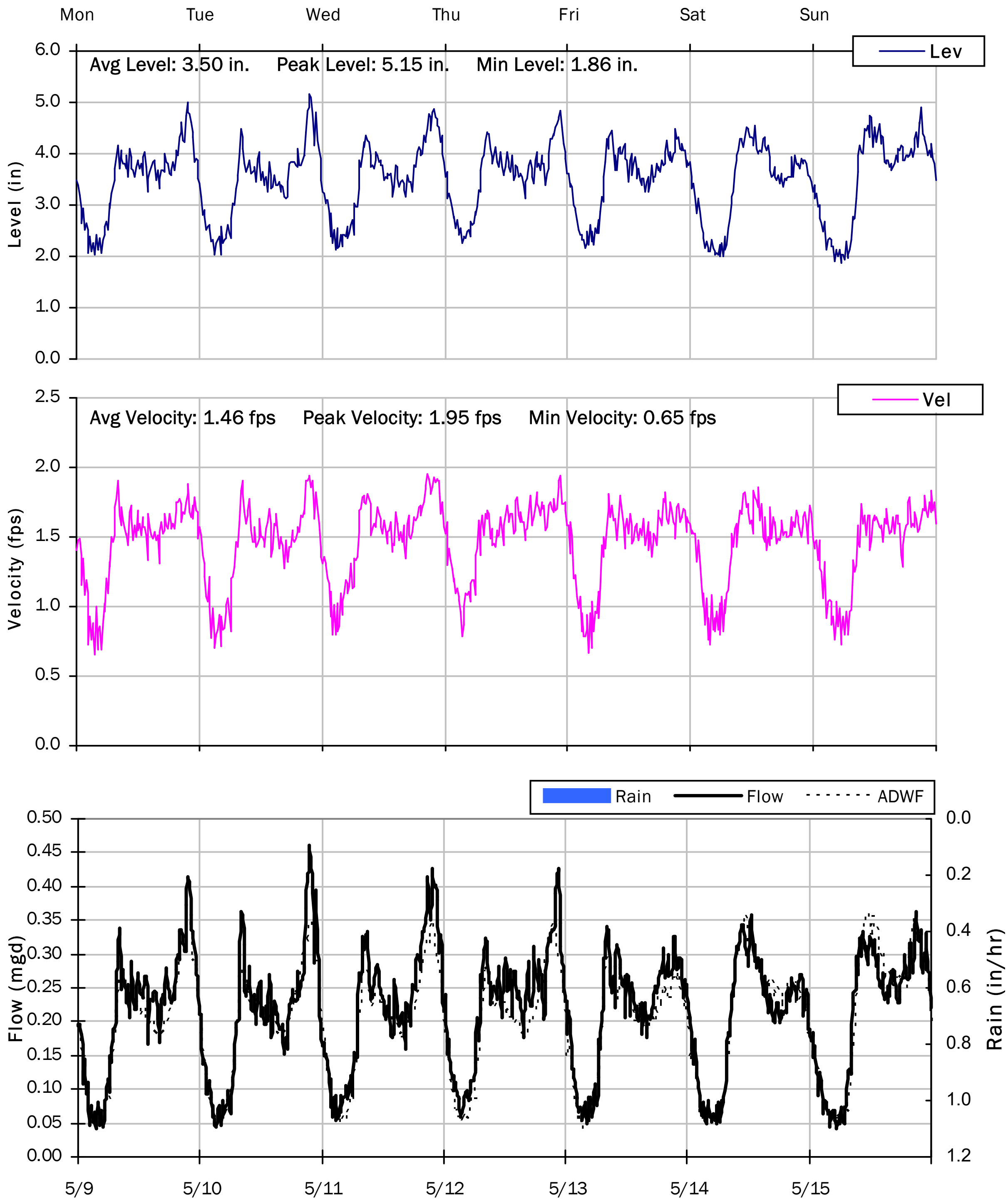






Avg Flow: 0.200 mgd Peak Flow: 0.391 mgd Min Flow: 0.027 mgd

SITE 01
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022

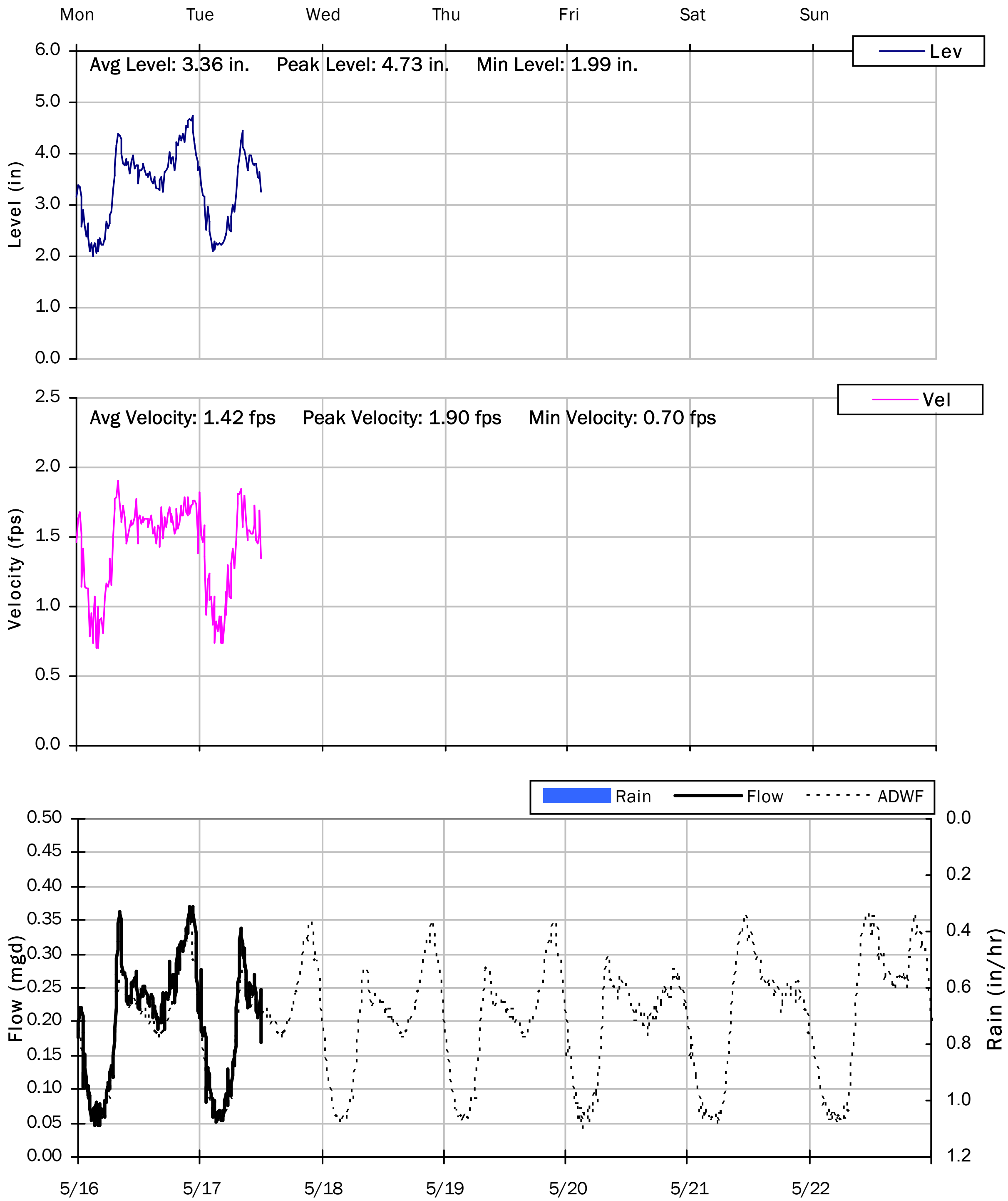


Avg Flow: 0.216 mgd Peak Flow: 0.462 mgd Min Flow: 0.041 mgd

SITE 01

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022



Avg Flow: 0.201 mgd Peak Flow: 0.370 mgd Min Flow: 0.045 mgd

Monitoring Site: Site 02

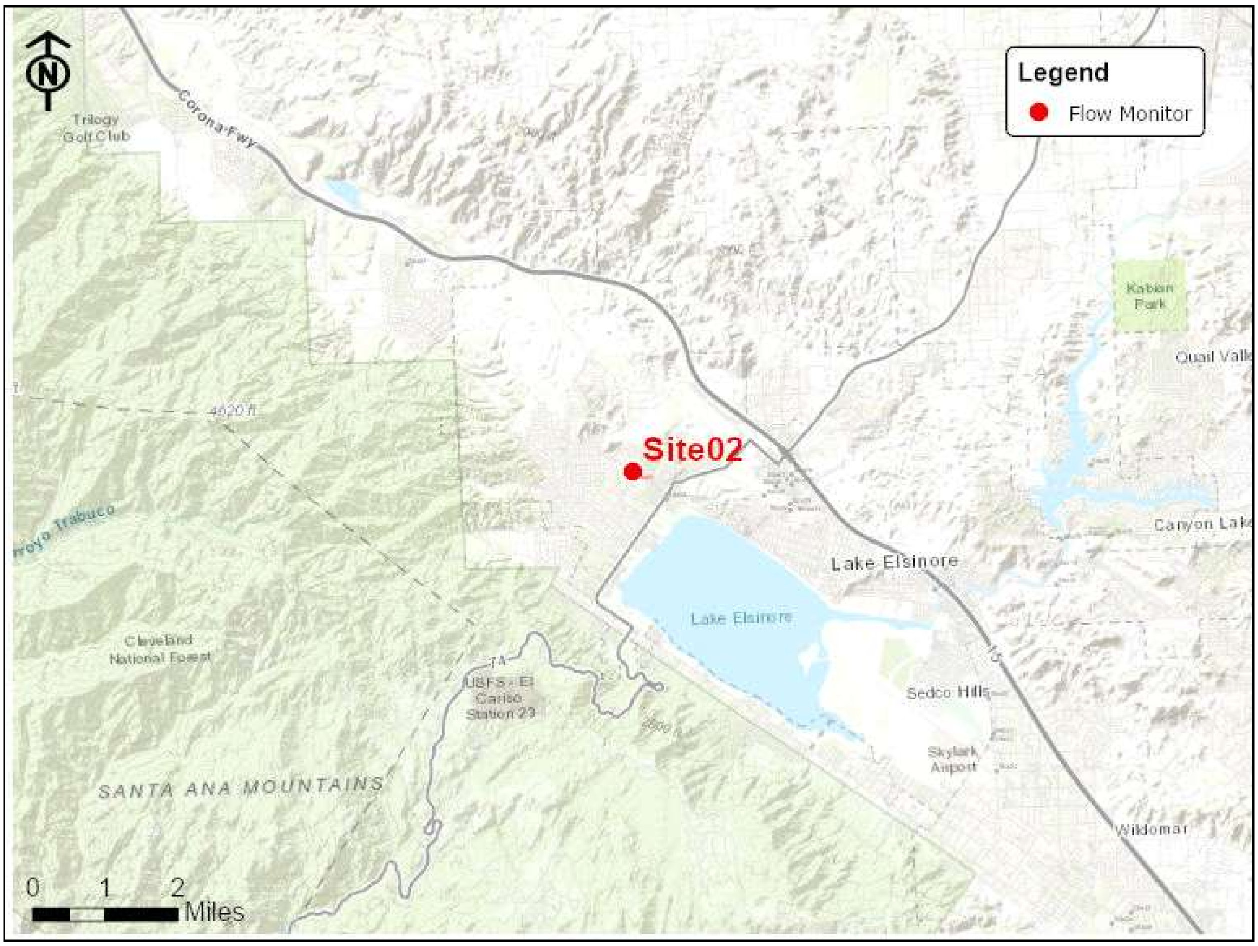
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Lakeshore Drive, north of Machado Street

Data Summary Report



Vicinity Map: Site 02

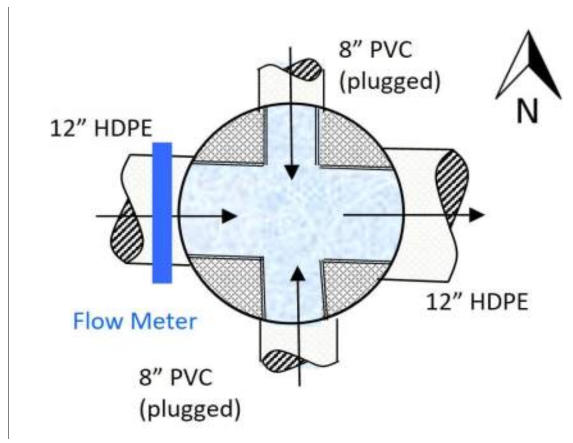
SITE 02

Site Information   MH ID: MH-702

Location:	Lakeshore Drive, north of Machado Street
Coordinates:	117.3746° W, 33.6895° N
Rim Elevation (Earth):	1330 feet
Expected Pipe Diameter:	12 inches
Measured Pipe Diameter:	12 inches
ADWF:	0.253 mgd
Peak Measured Flow:	0.574 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 02

Additional Site Photos

Effluent Pipe

S Influent Pipe

SITE 02

Additional Site Photos

N Influent Pipe

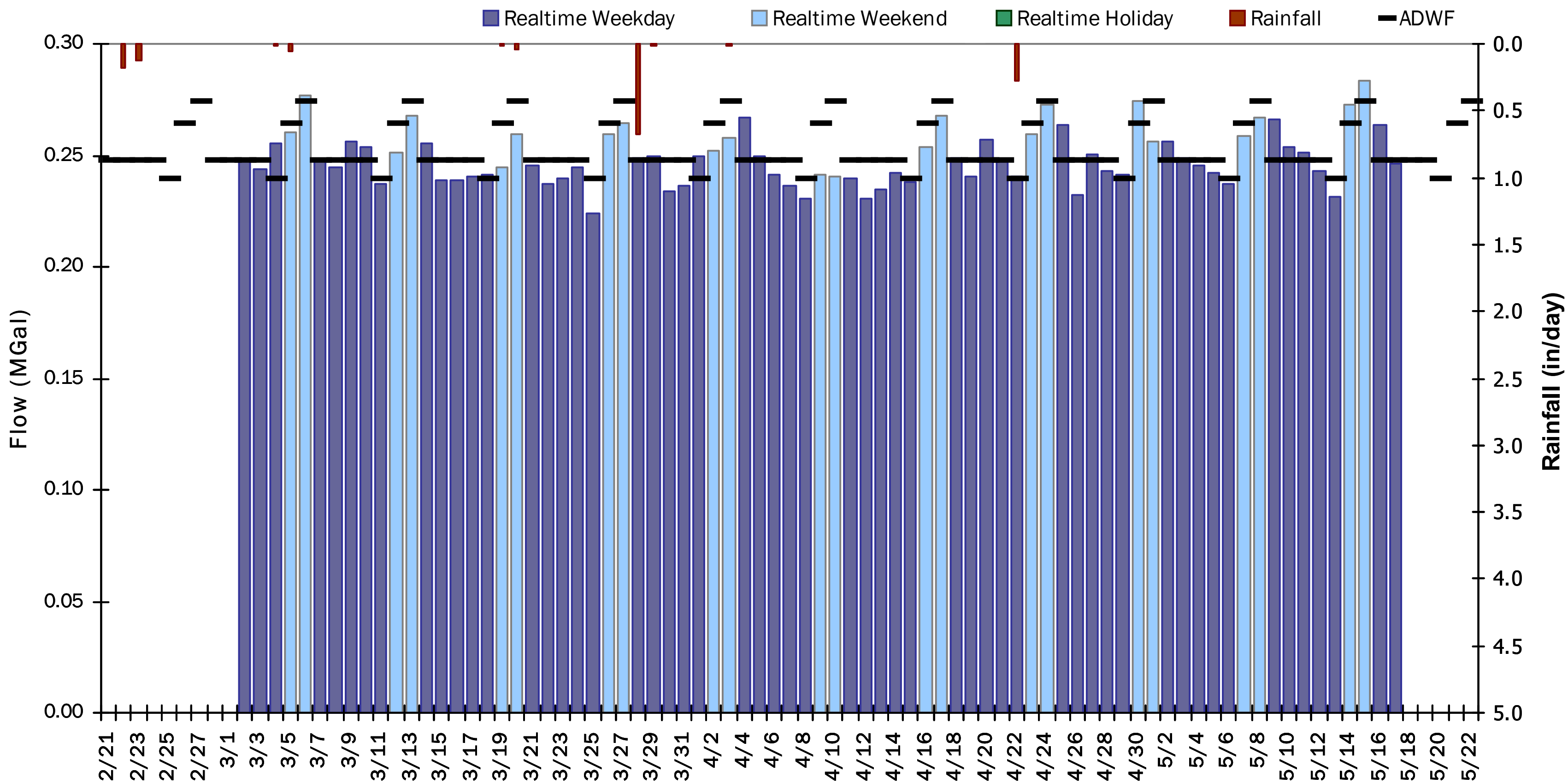
Monitored W Influent Pipe

SITE 02

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.248 MGal Peak Daily Flow: 0.313 MGal Min Daily Flow: 0.068 MGal

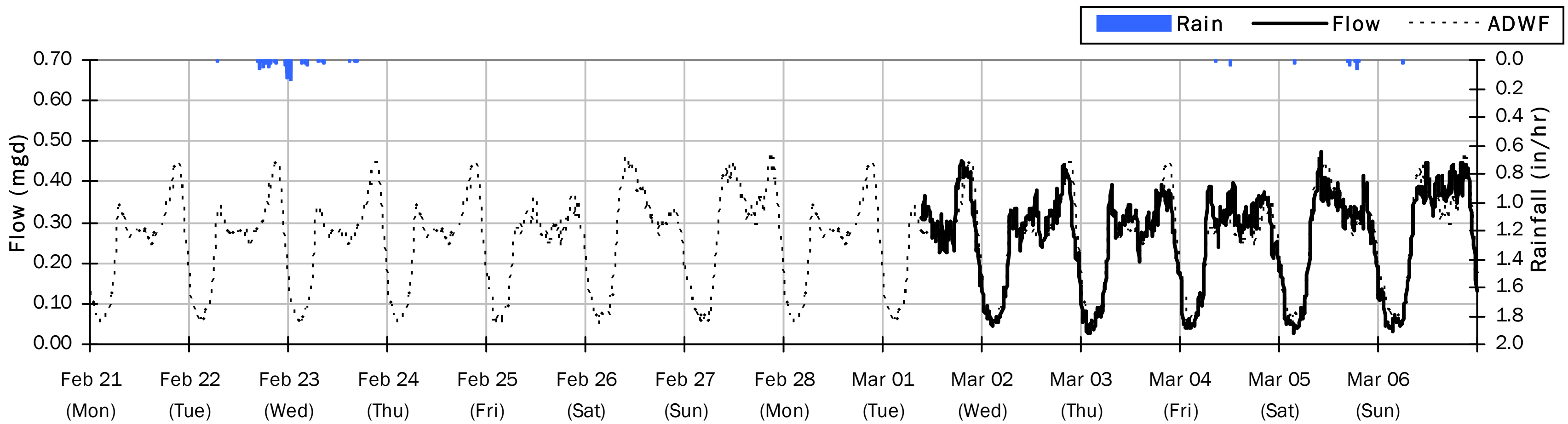
Total Rainfall: 1.10 inches

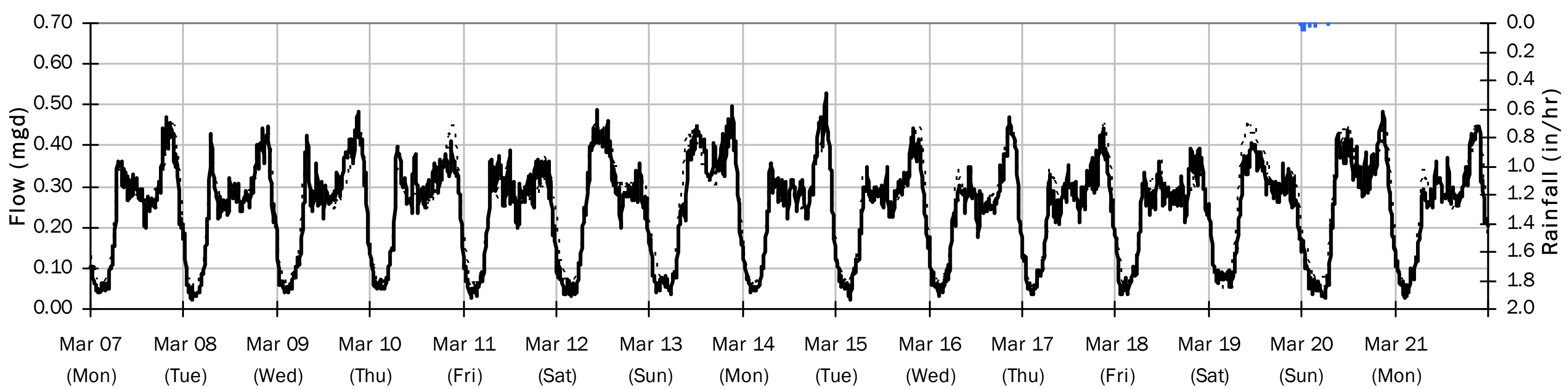


SITE 02

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.42 inches   Period Avg Flow: 0.252 mgd   Period Peak Flow: 0.528 mgd   Period Min Flow: 0.023 mgd



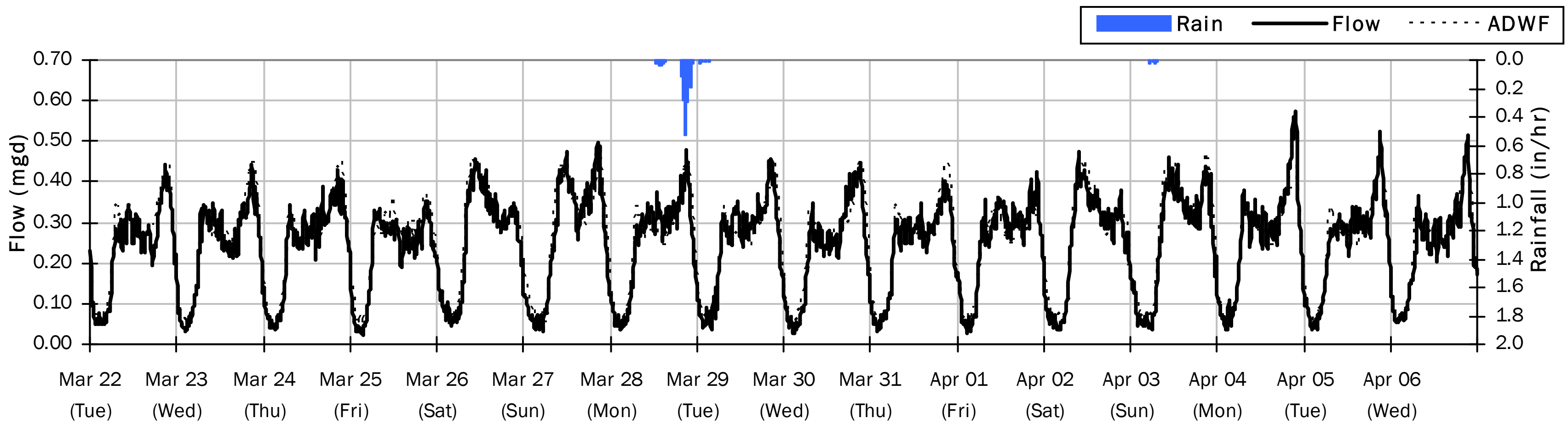


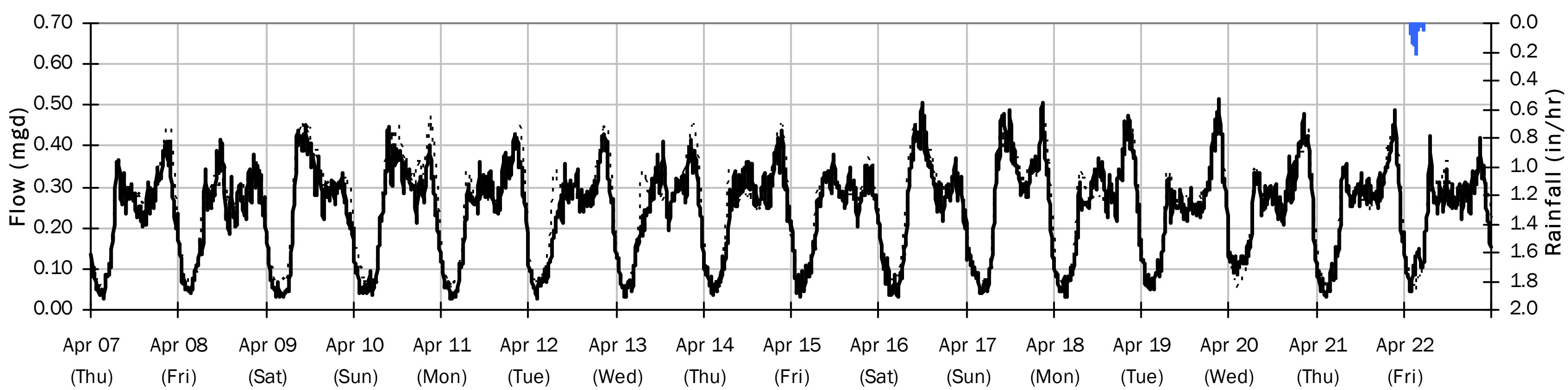
SITE 02

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.98 inches

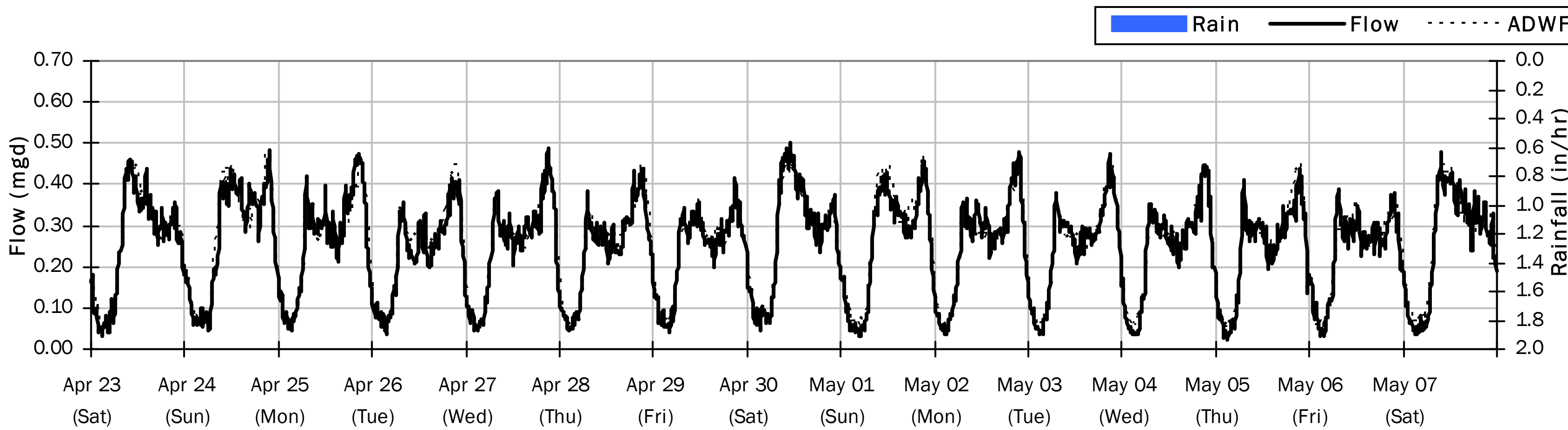
Period Avg Flow: 0.245 mgd   Period Peak Flow: 0.574 mgd   Period Min Flow: 0.023 mgd

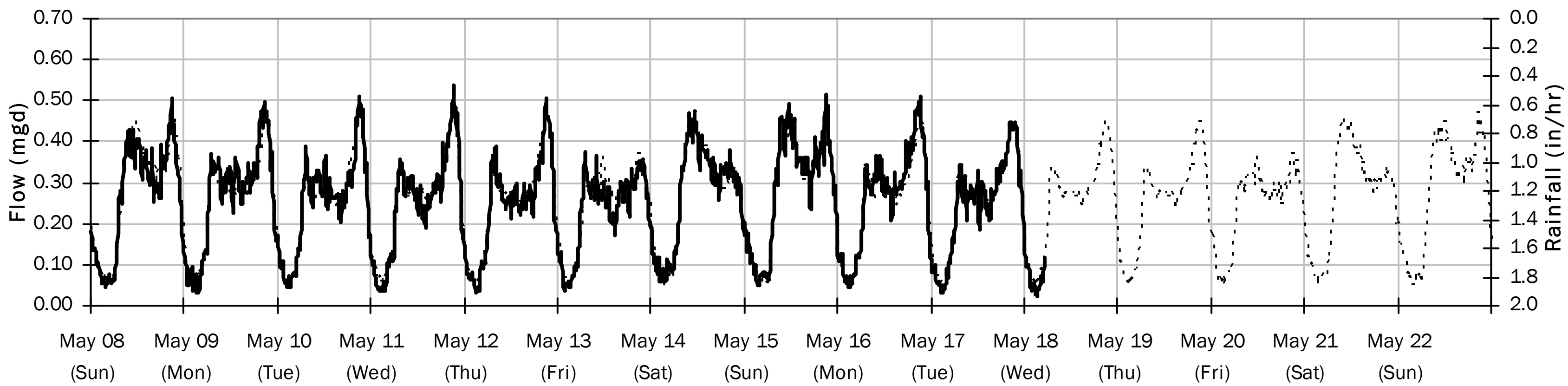




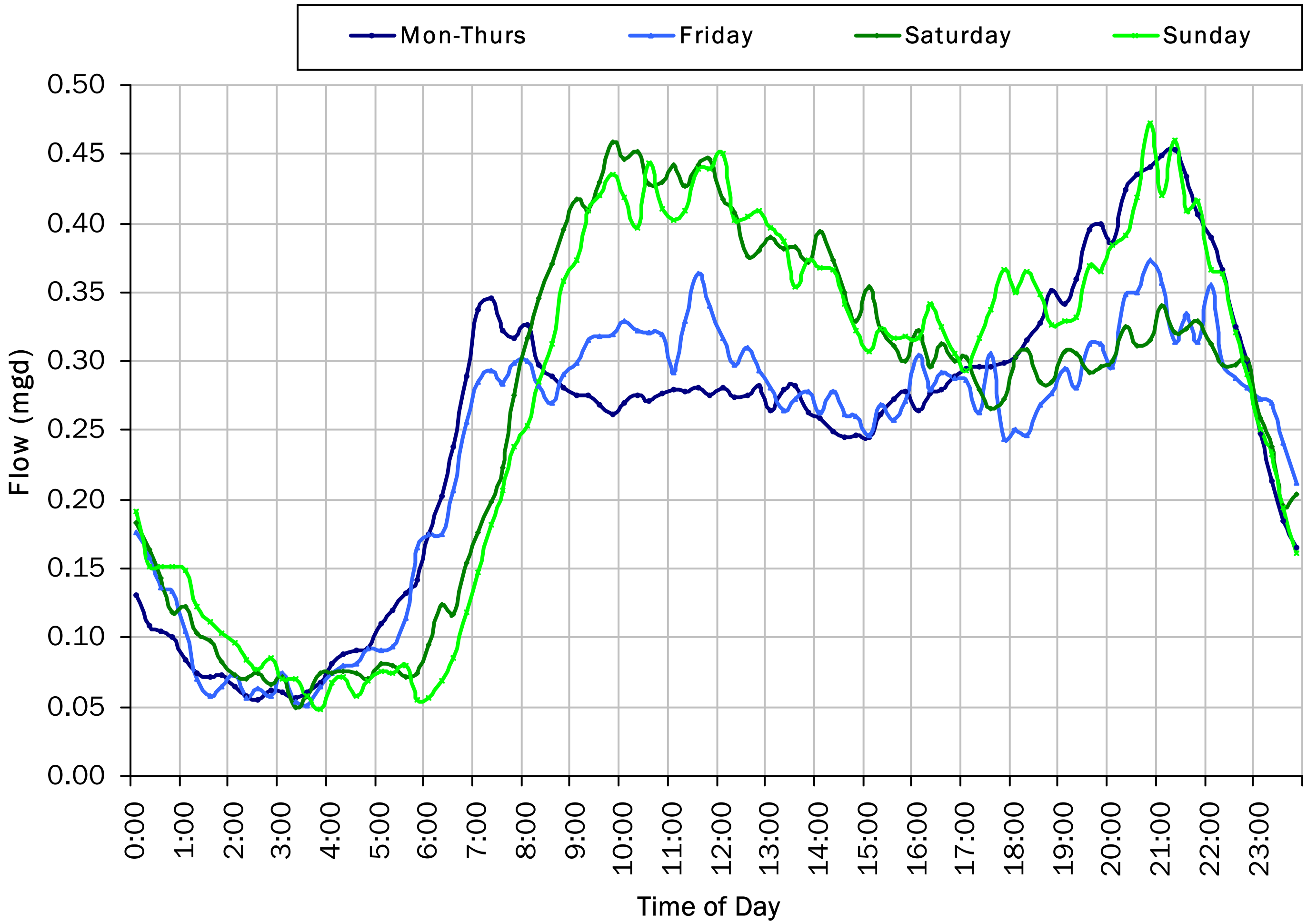
SITE 02
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches   Period Avg Flow: 0.253 mgd   Period Peak Flow: 0.539 mgd   Period Min Flow: 0.023 mgd

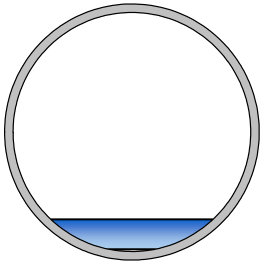




SITE 02
Average Dry Weather Flow Hydrographs



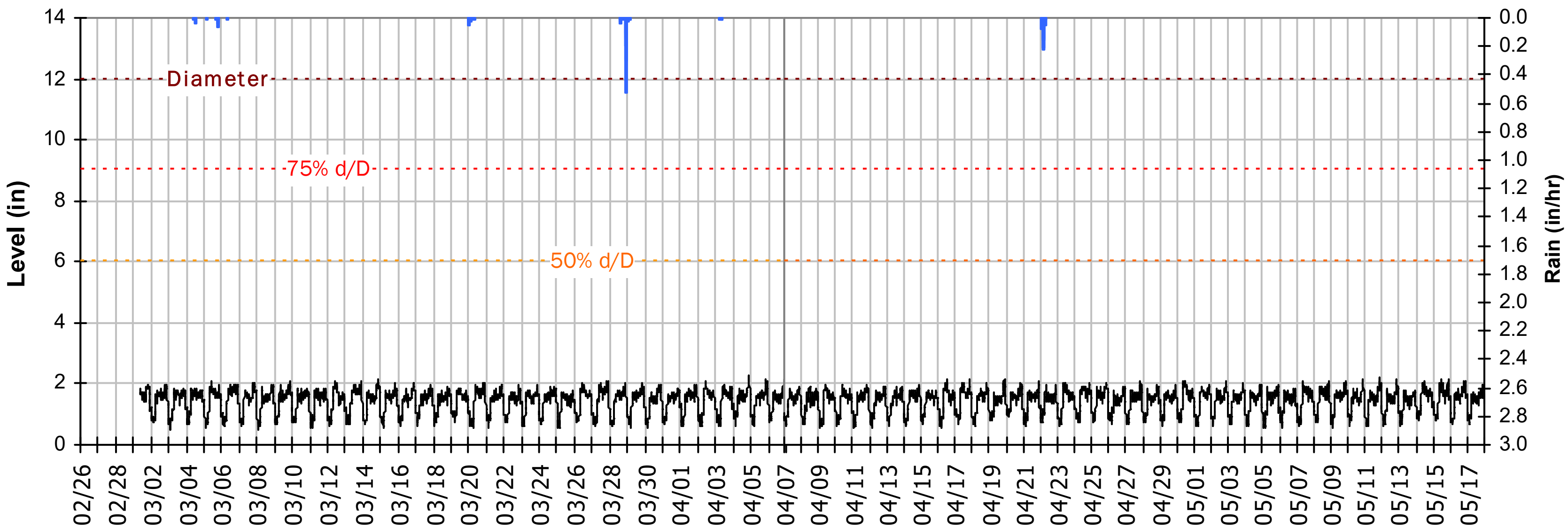
ADWF:
0.253 *mgd*

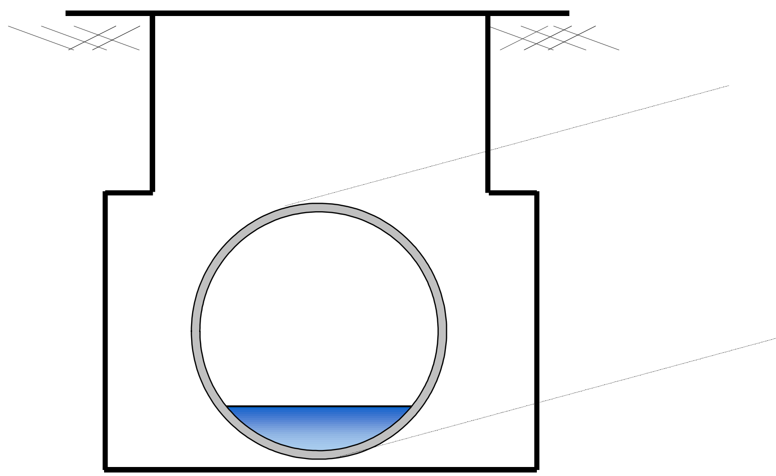


SITE 02

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

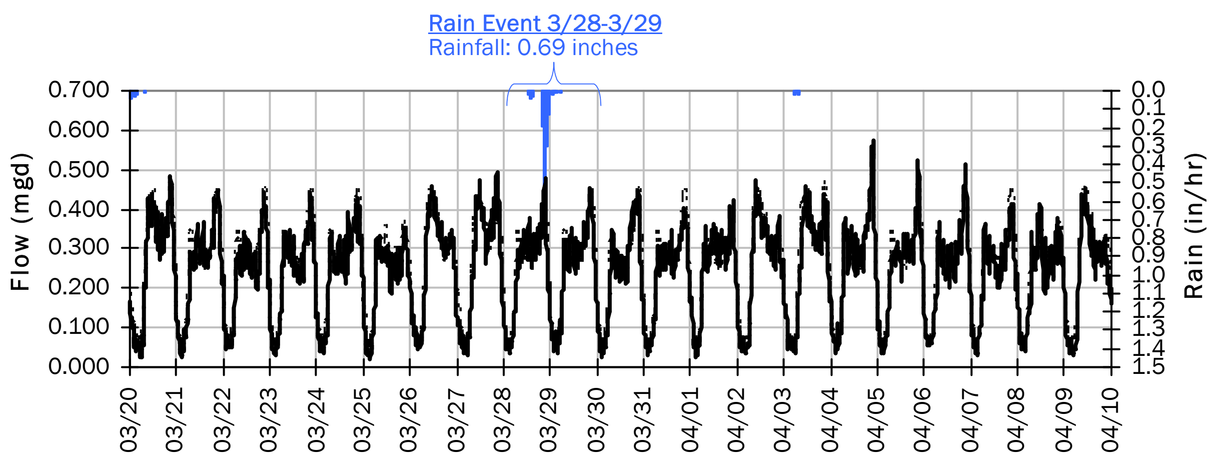




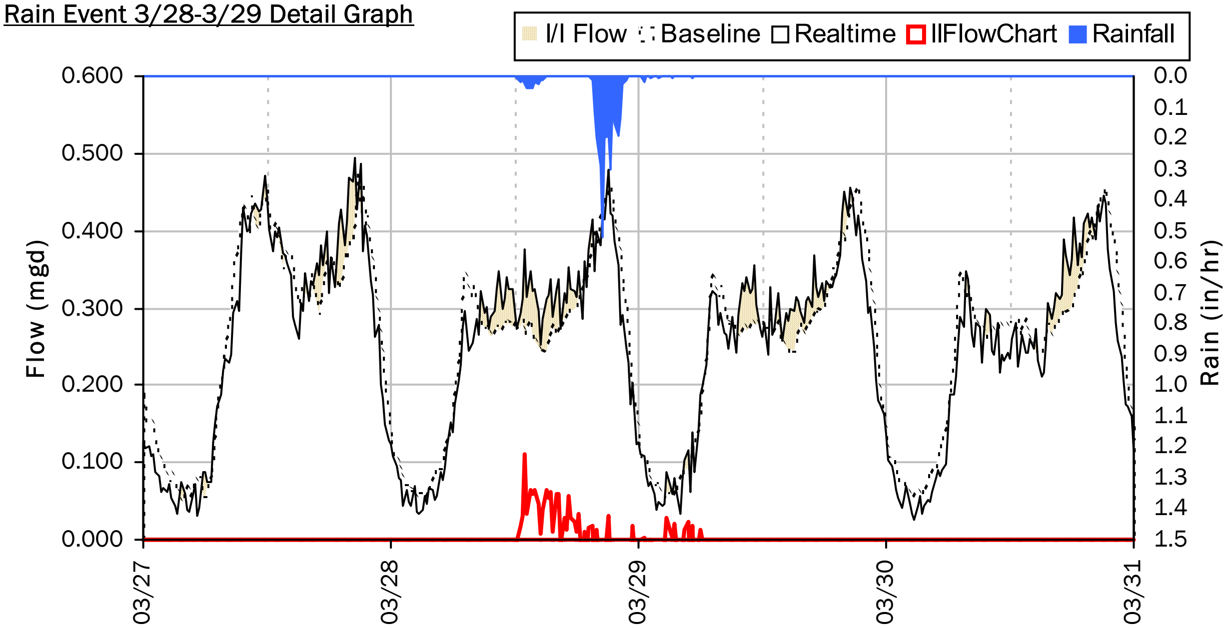
Pipe Diameter:	12	*inches*
Peak Measured Level:	2.26	*inches*
Peak d/D Ratio:	0.19	

SITE 02
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



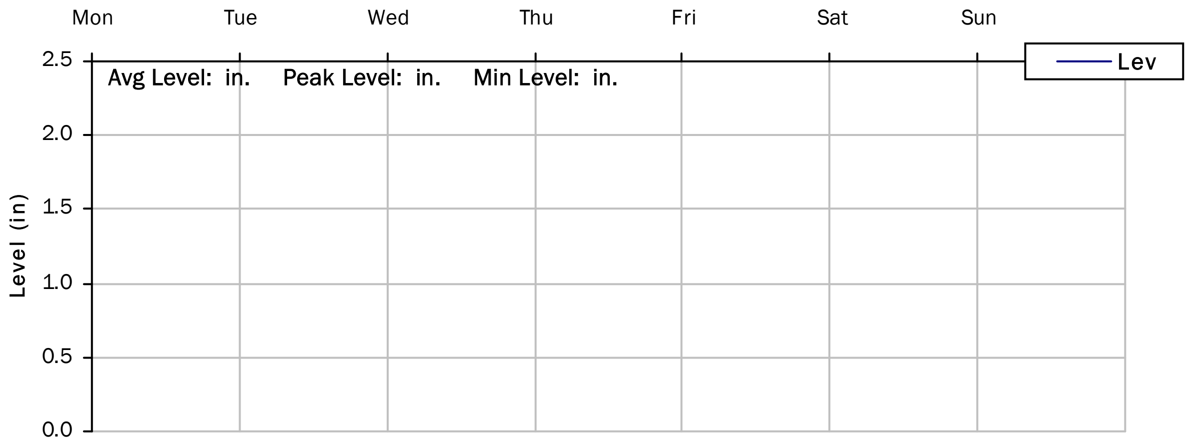
Storm Event I/I Analysis (Rain = 0.69 inches)

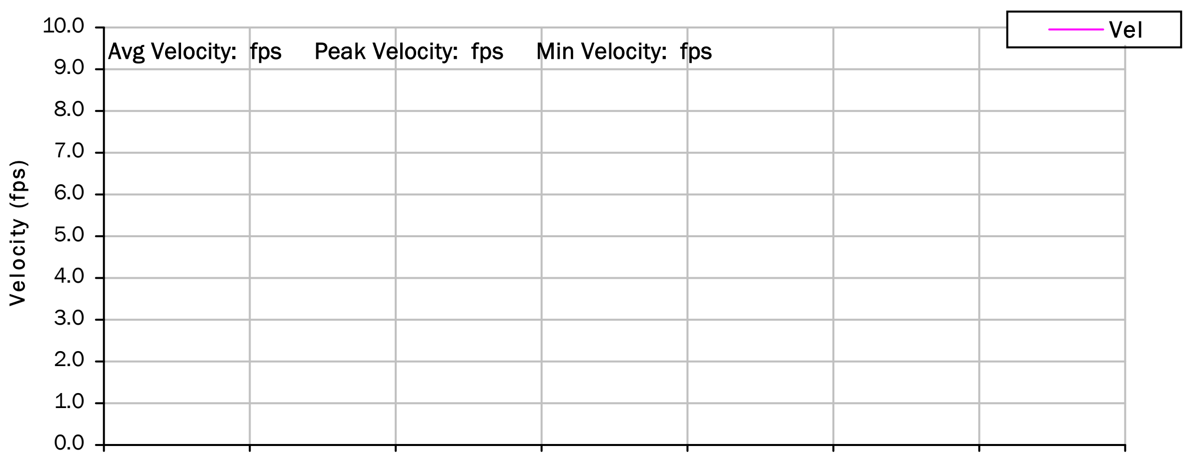
Capacity		Inflow / Infiltration	
Peak Flow:	0.480 *mgd*	Peak I/I Rate:	0.111 *mgd*
PF:	1.90	Total I/I:	4,000 *gallons*
Peak Level:	2.05 *in*		
d/D Ratio:	0.17		

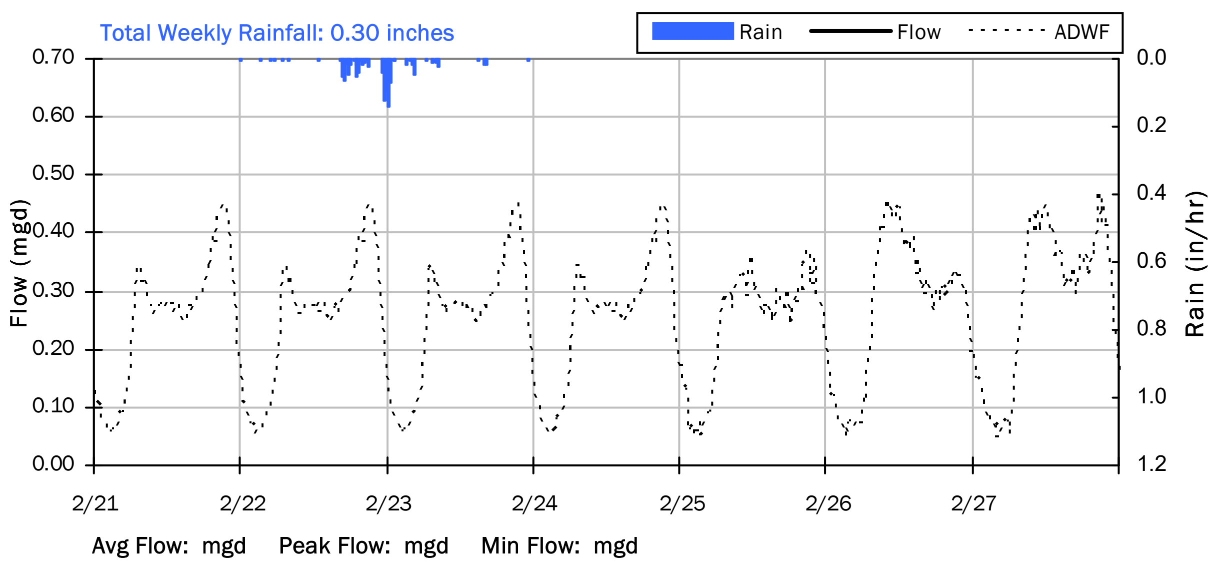
SITE 02

Weekly Level, Velocity and Flow Hydrographs

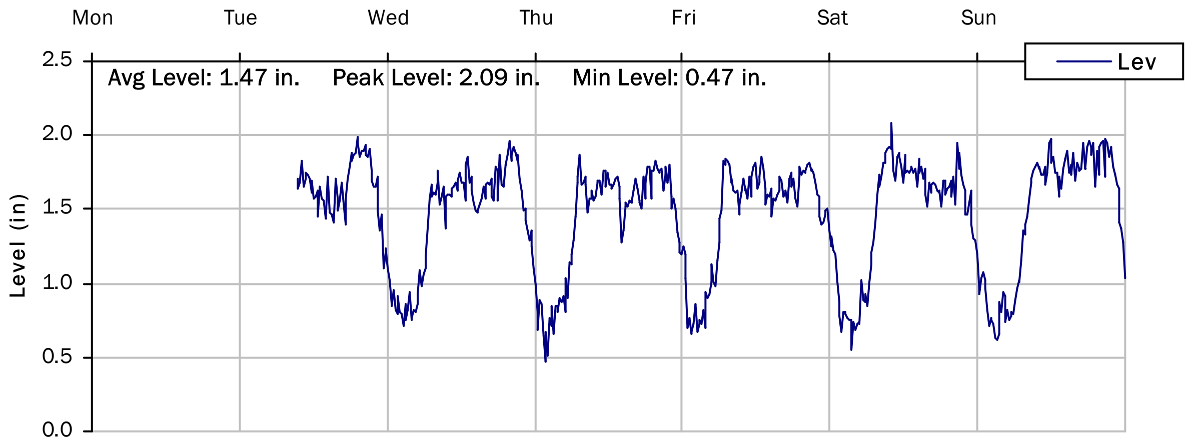
2/21/2022 to 2/28/2022

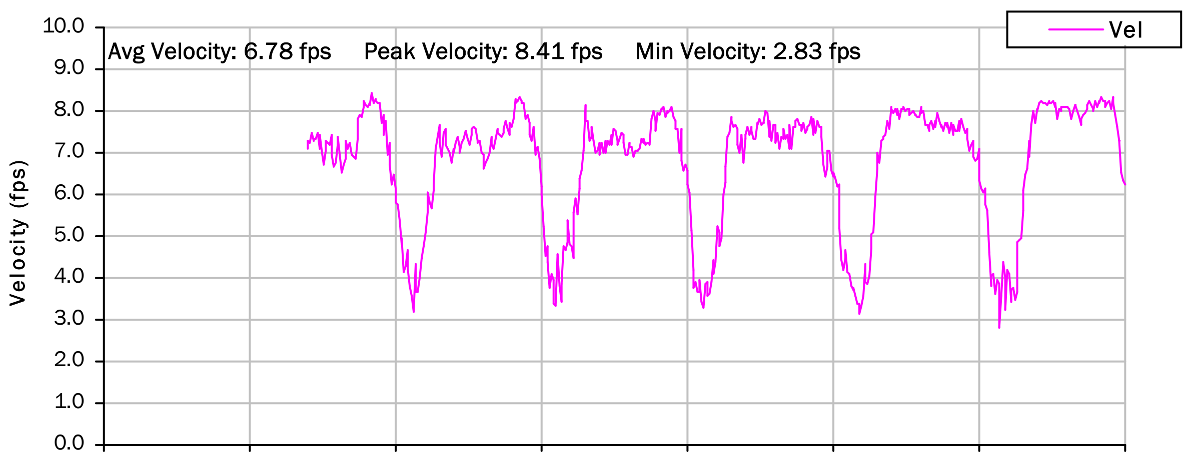


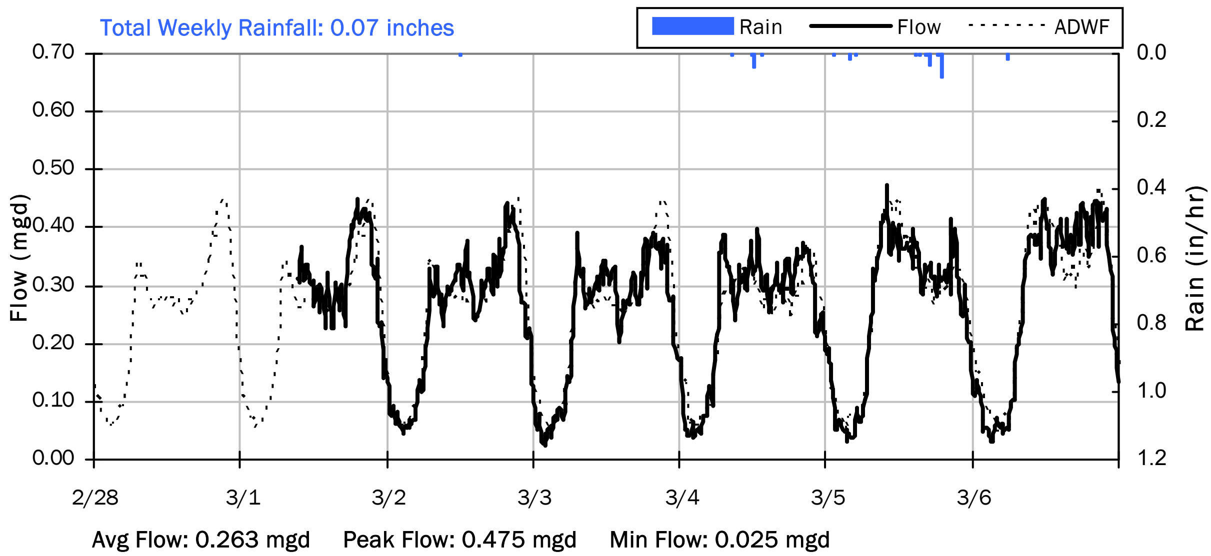




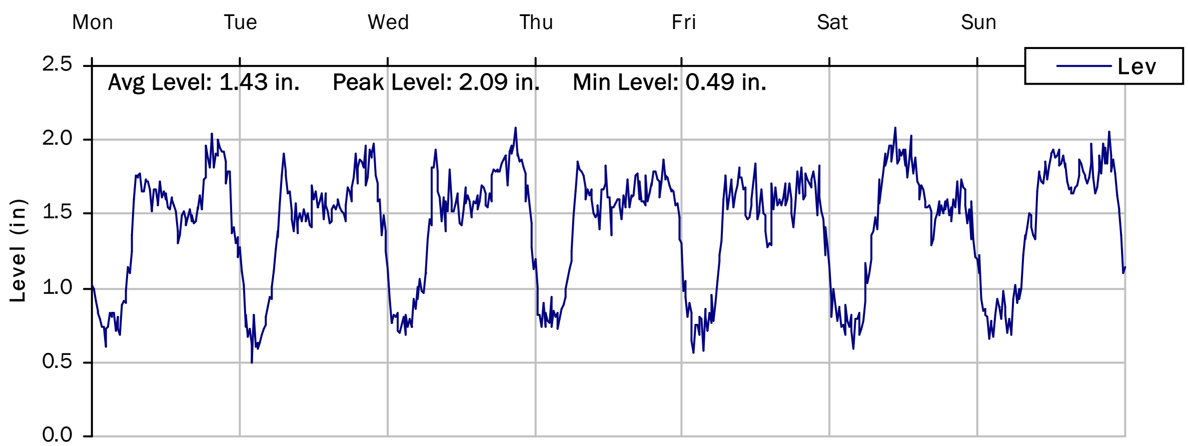
SITE 02
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

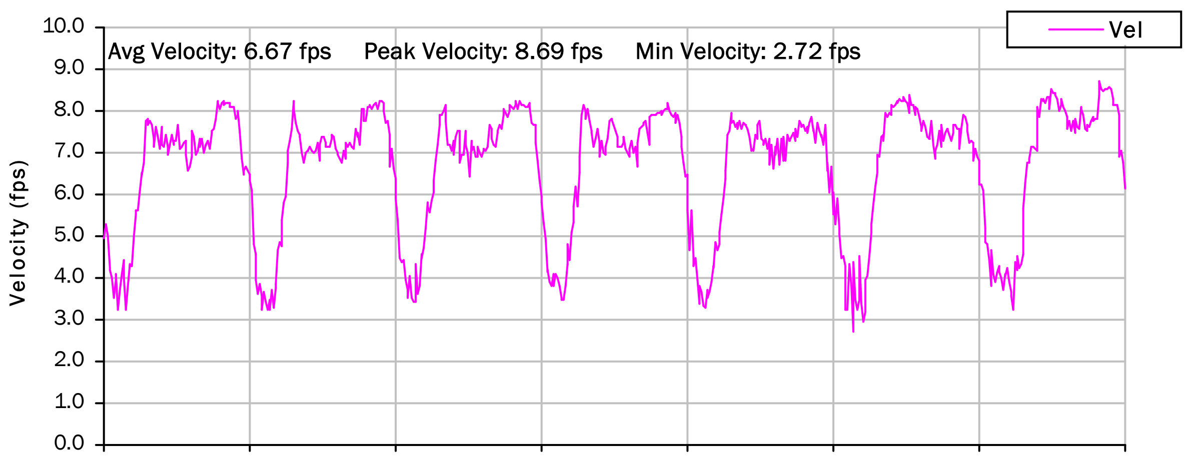


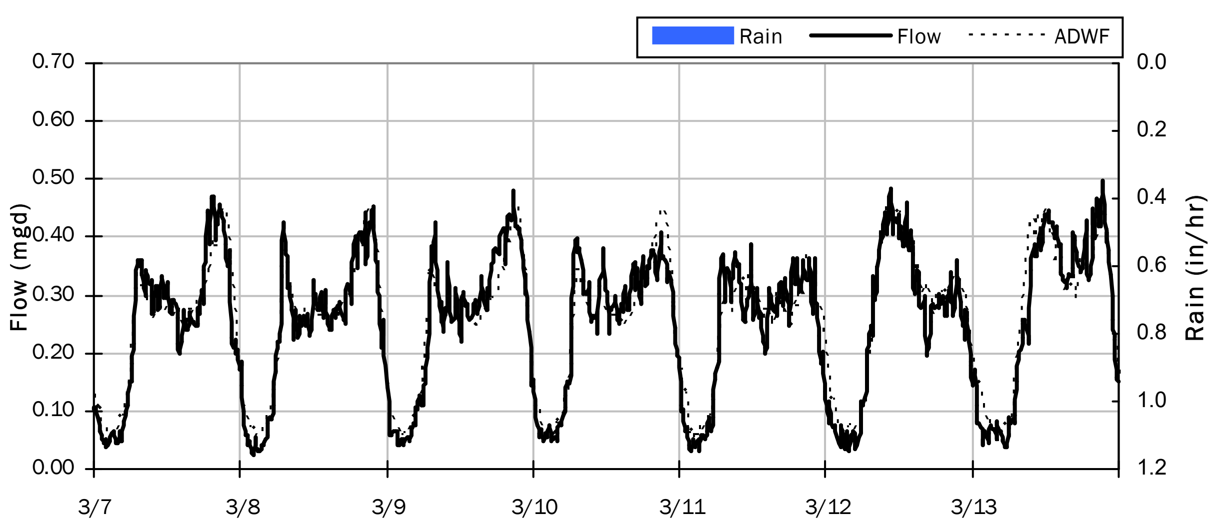




SITE 02
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022



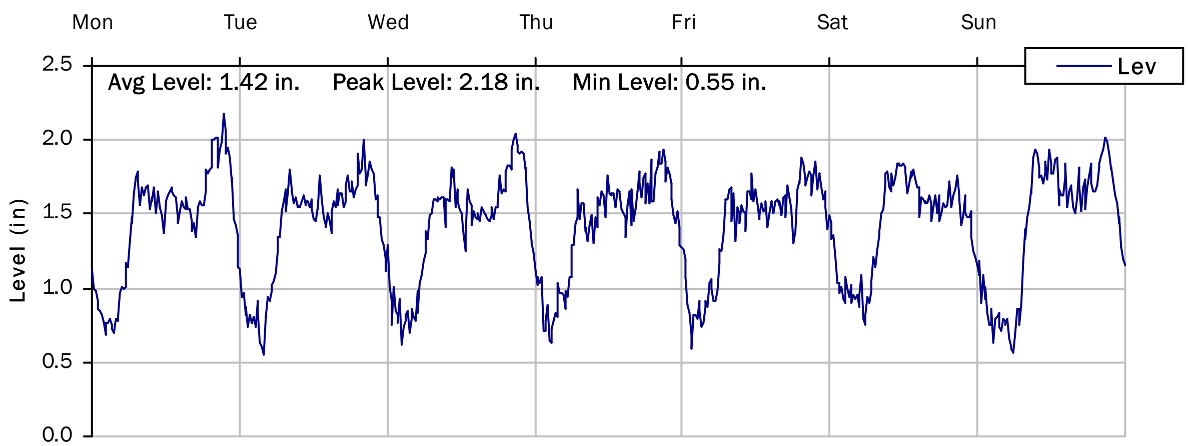


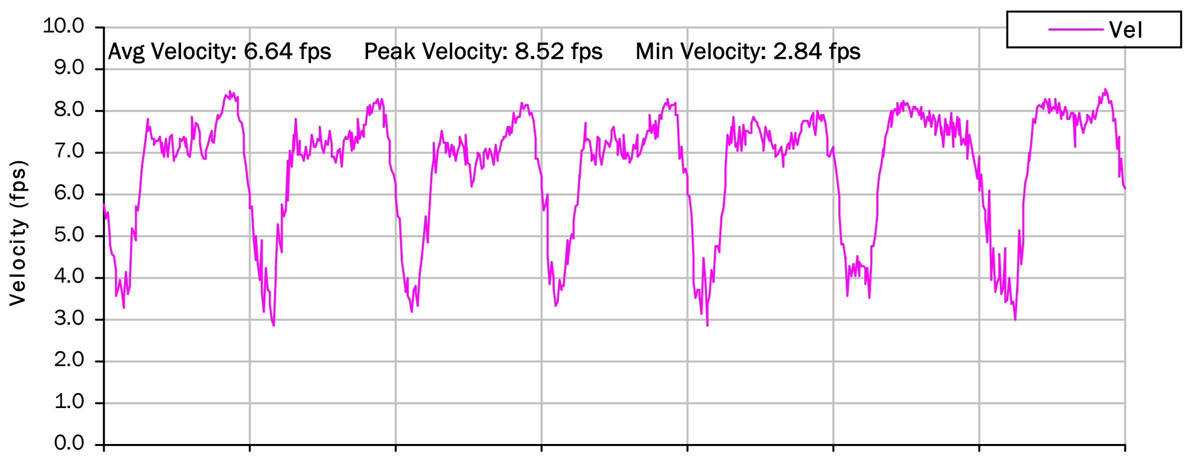


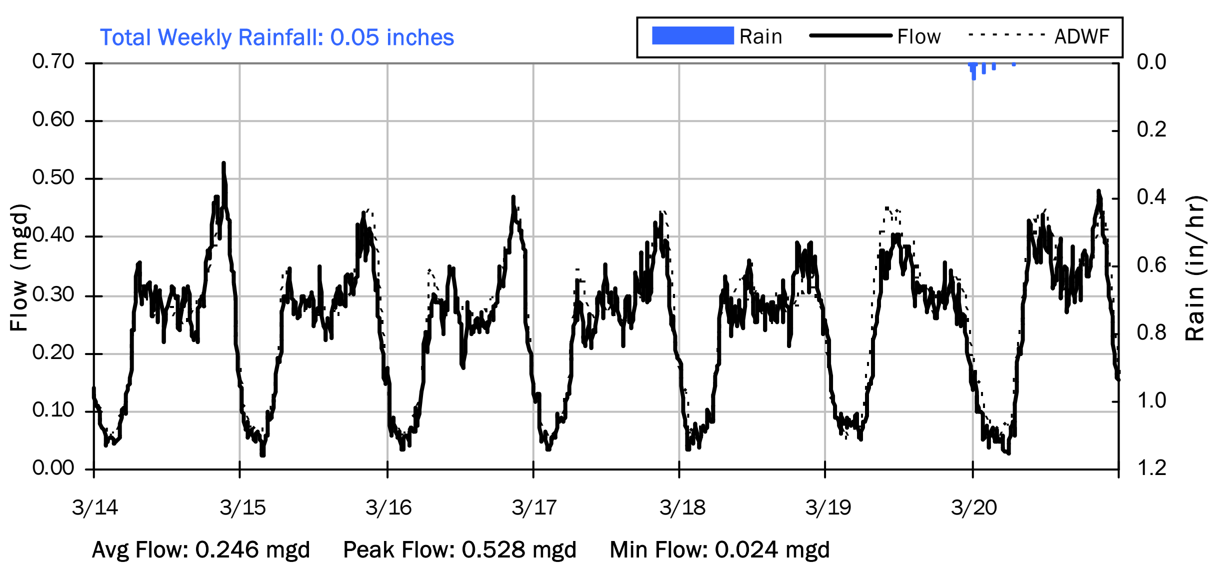
Avg Flow: 0.251 mgd   Peak Flow: 0.498 mgd   Min Flow: 0.023 mgd

SITE 02

Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



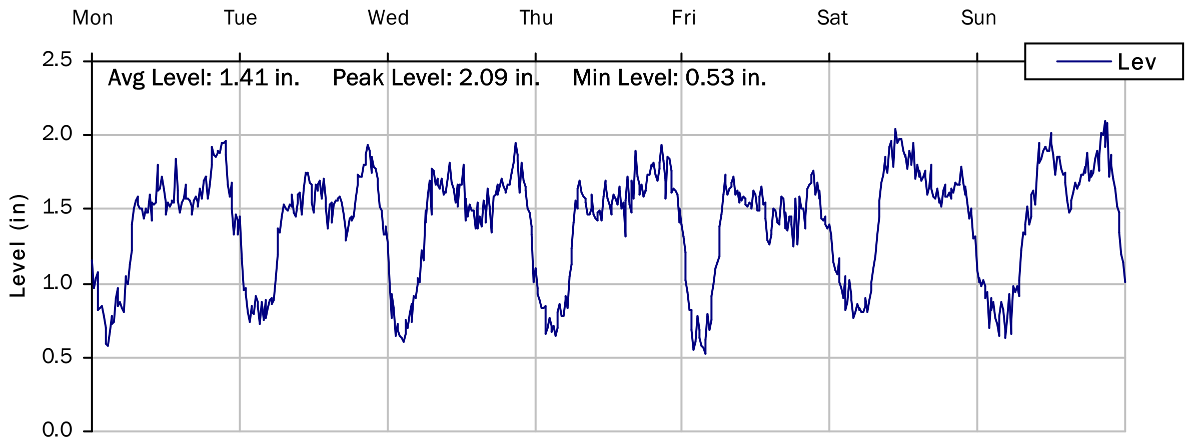


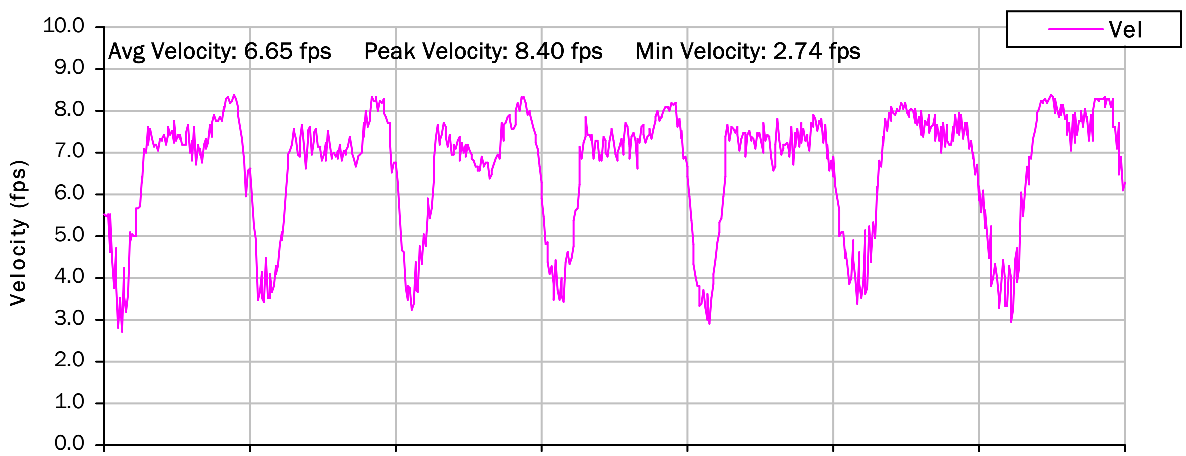


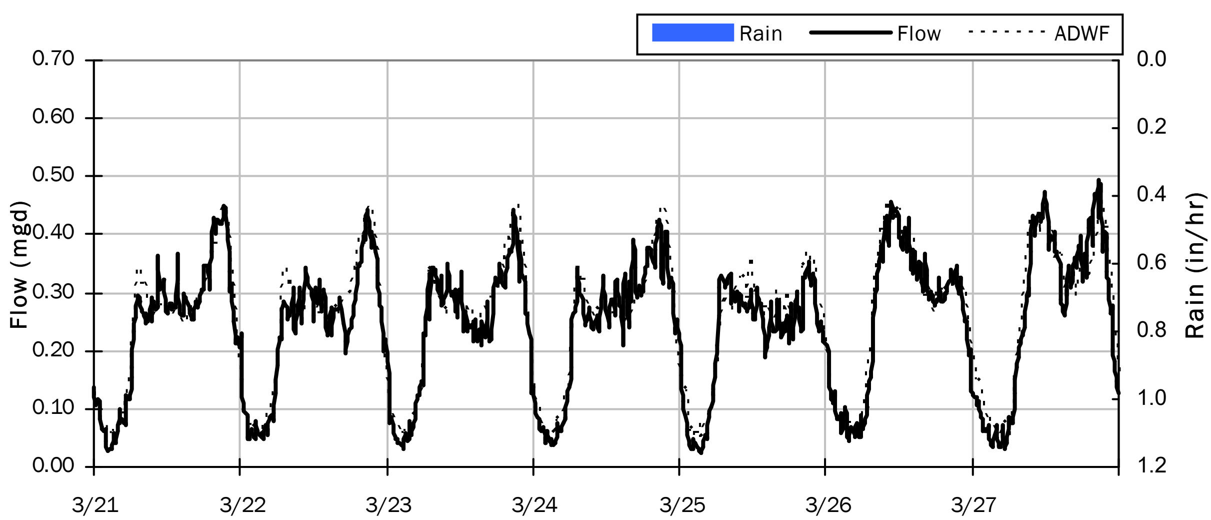
SITE 02

Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022

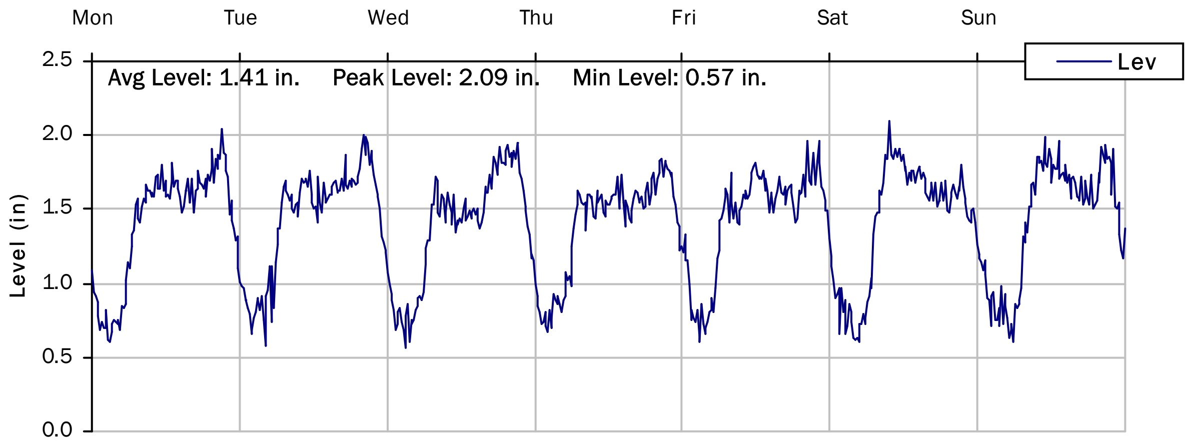


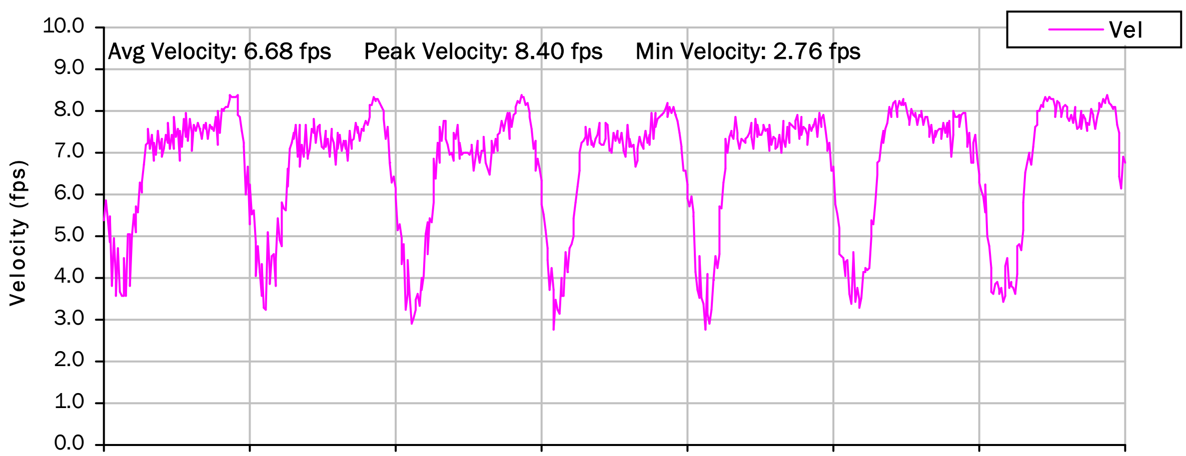


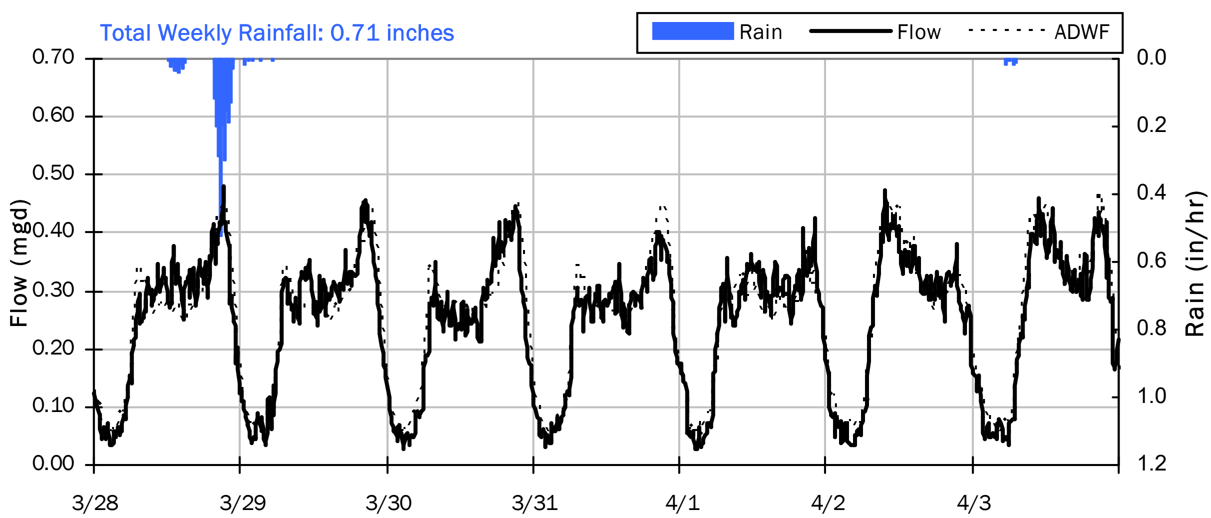


Avg Flow: 0.245 mgd Peak Flow: 0.496 mgd Min Flow: 0.023 mgd

SITE 02
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

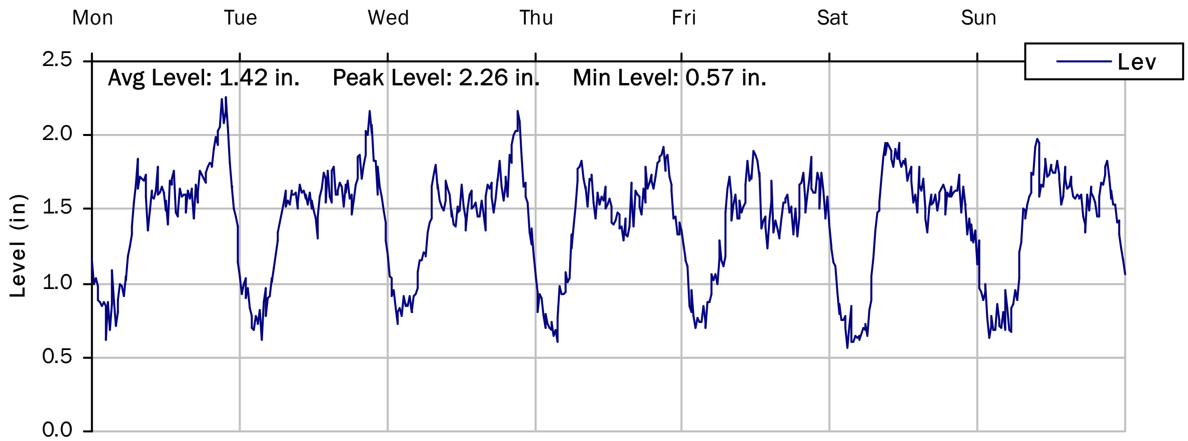


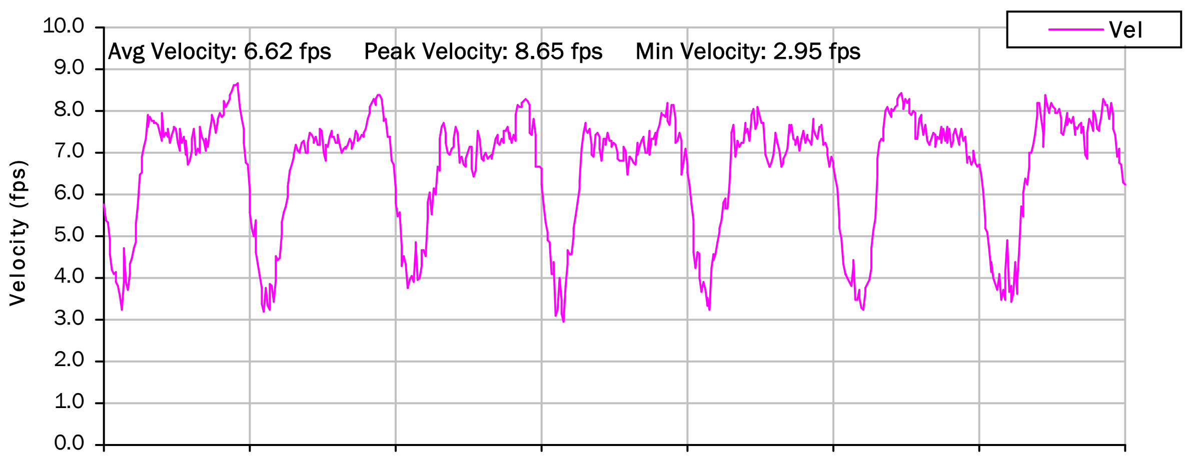


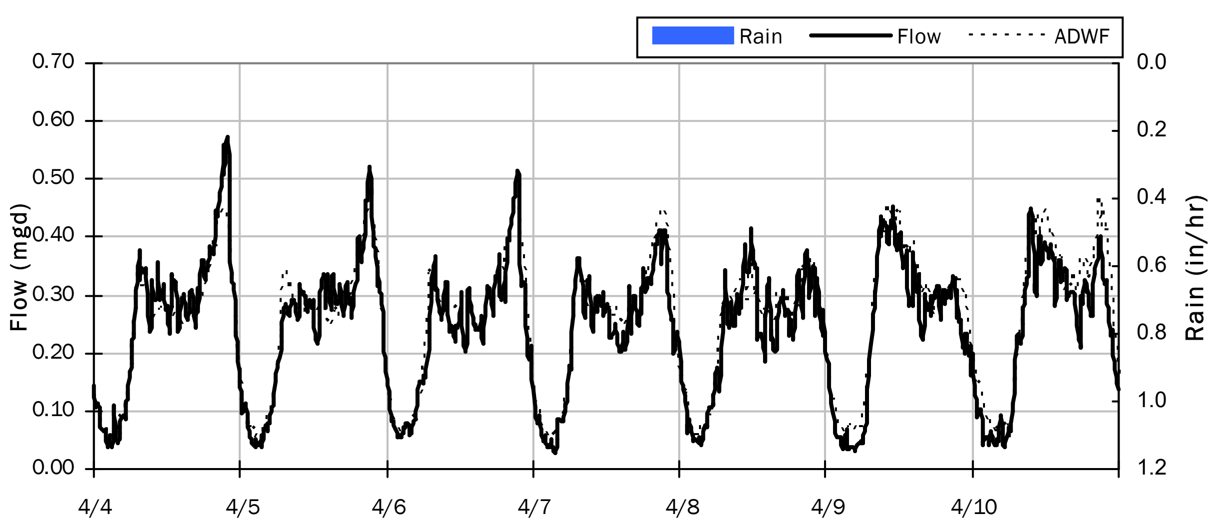


Avg Flow: 0.247 mgd Peak Flow: 0.480 mgd Min Flow: 0.026 mgd

SITE 02
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022





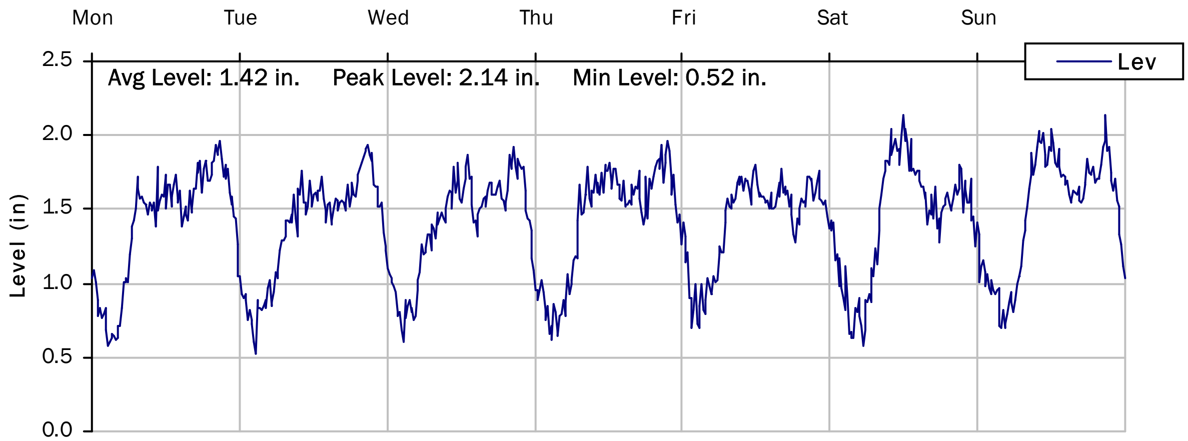


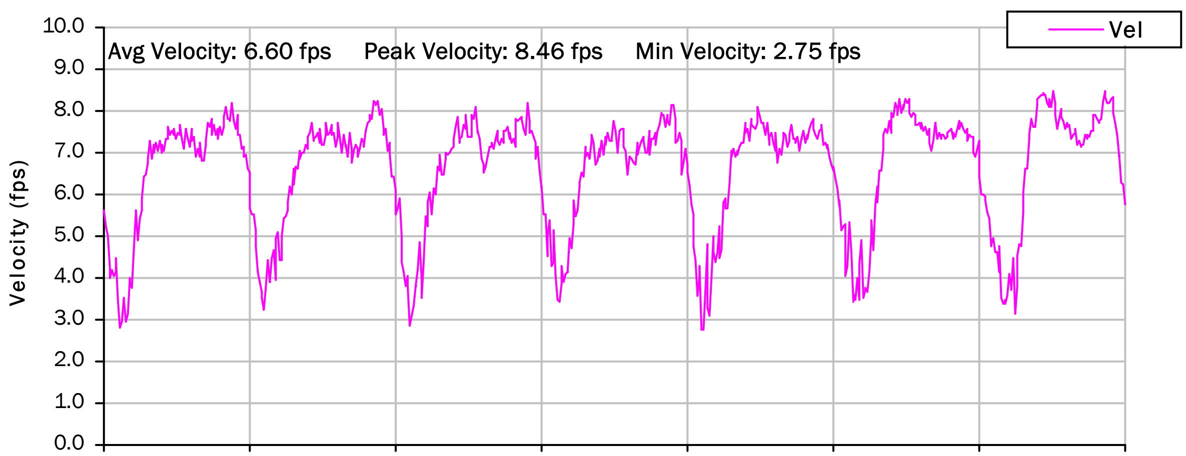
Avg Flow: 0.244 mgd Peak Flow: 0.574 mgd Min Flow: 0.028 mgd

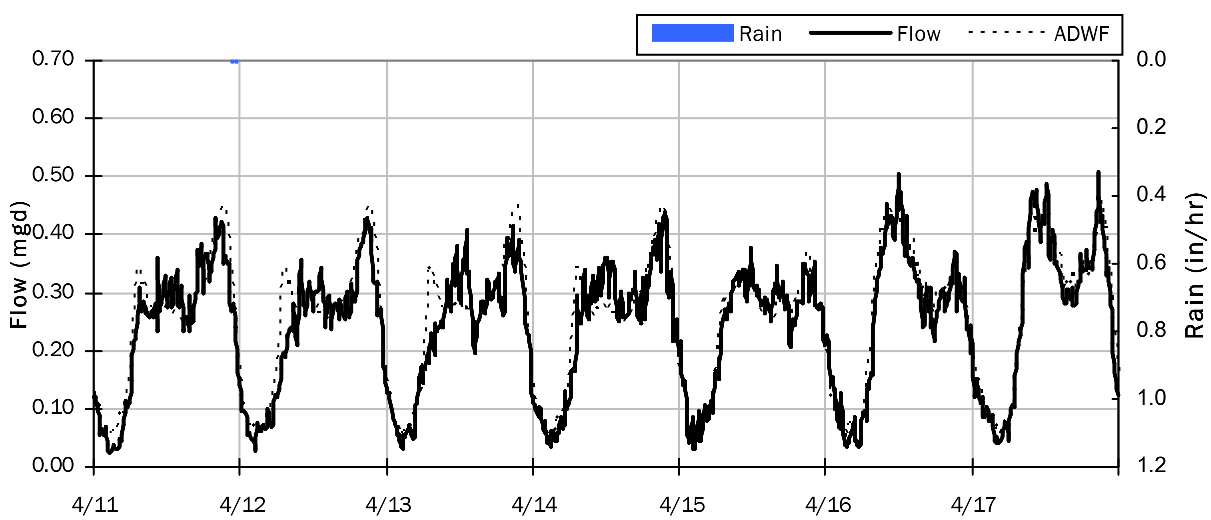
SITE 02

Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022



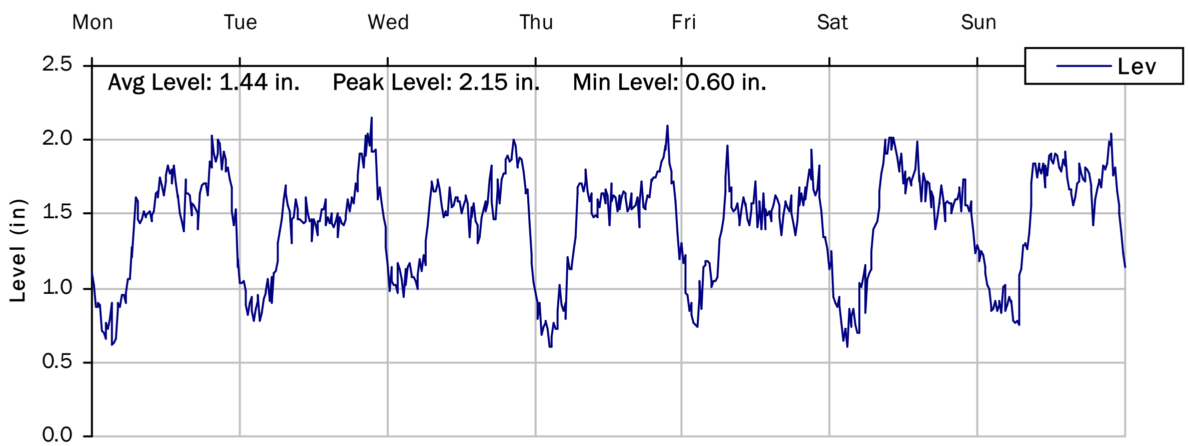


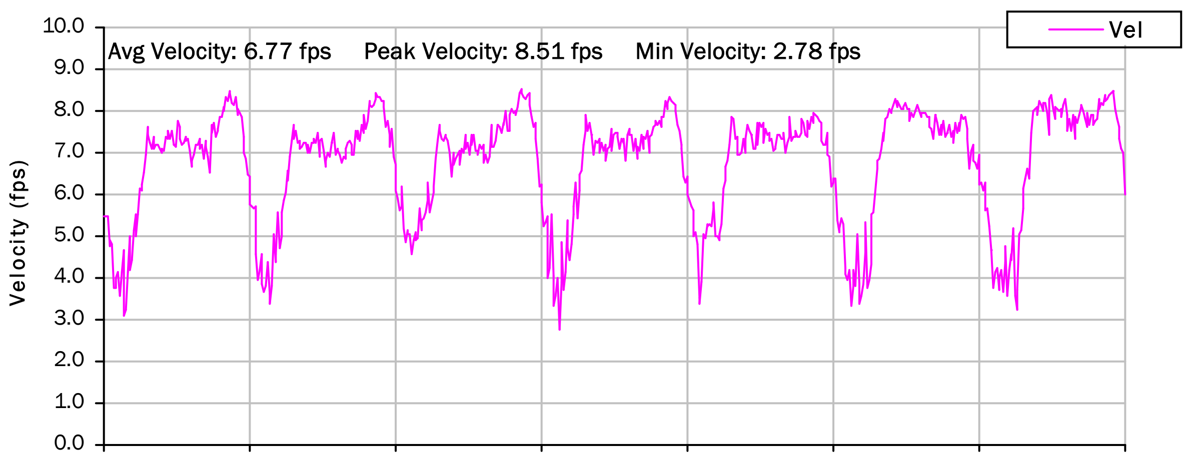


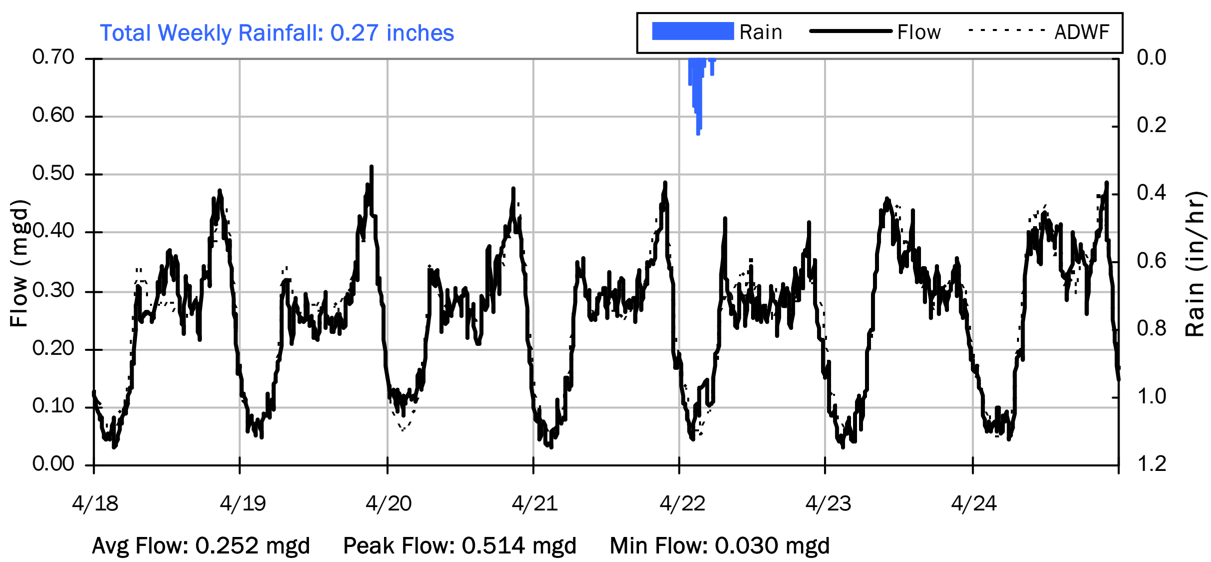
Avg Flow: 0.244 mgd Peak Flow: 0.508 mgd Min Flow: 0.025 mgd

SITE 02

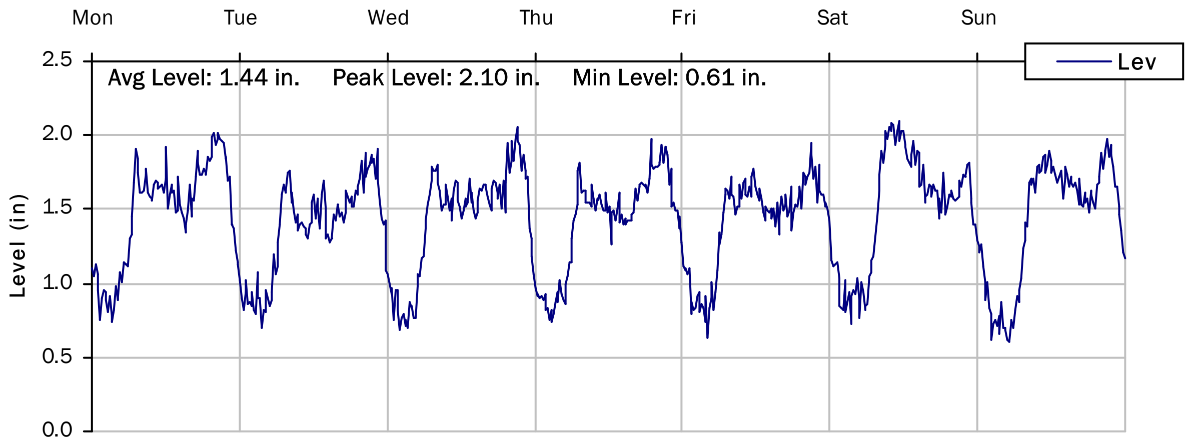
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

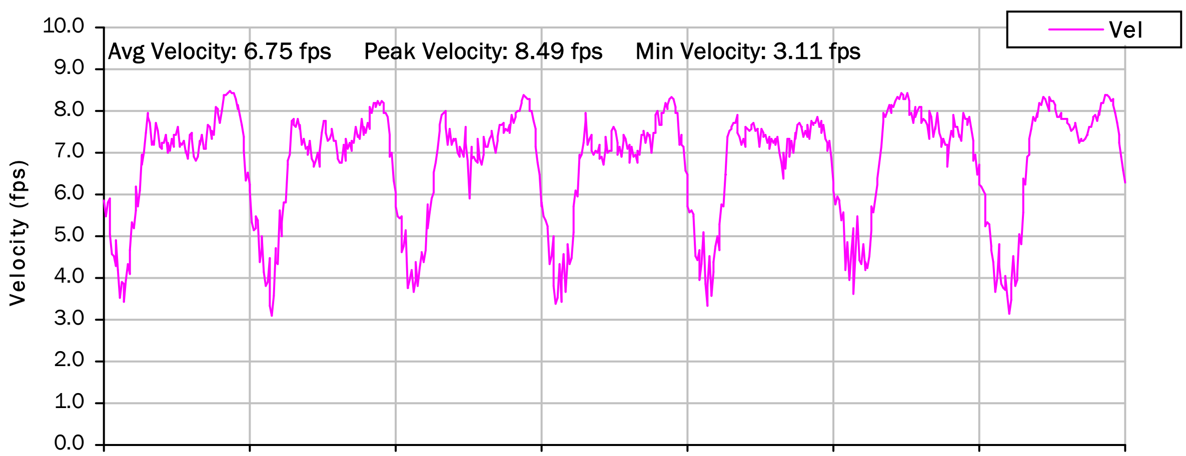


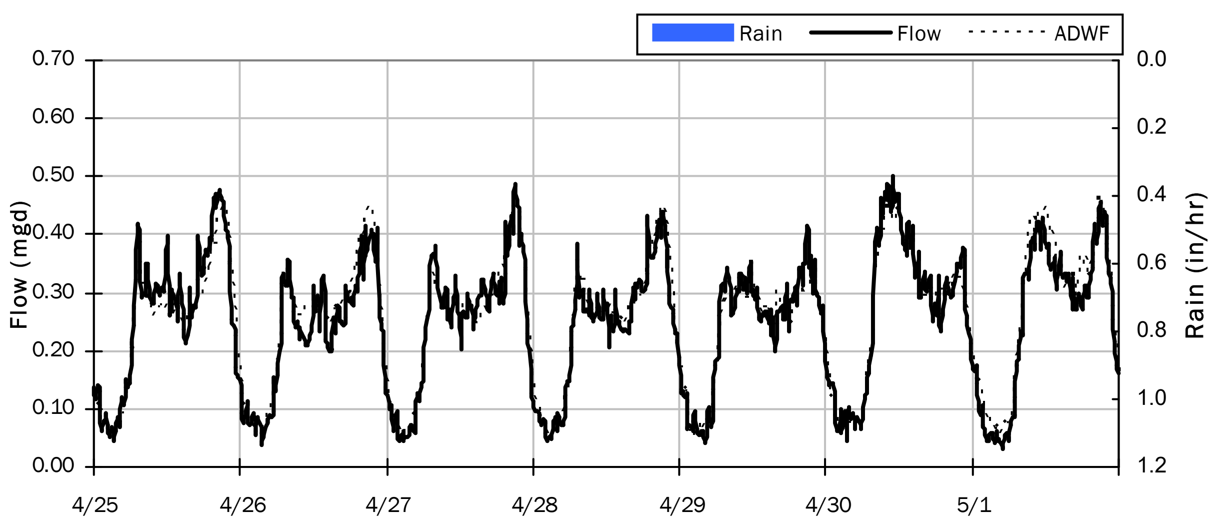




SITE 02
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022





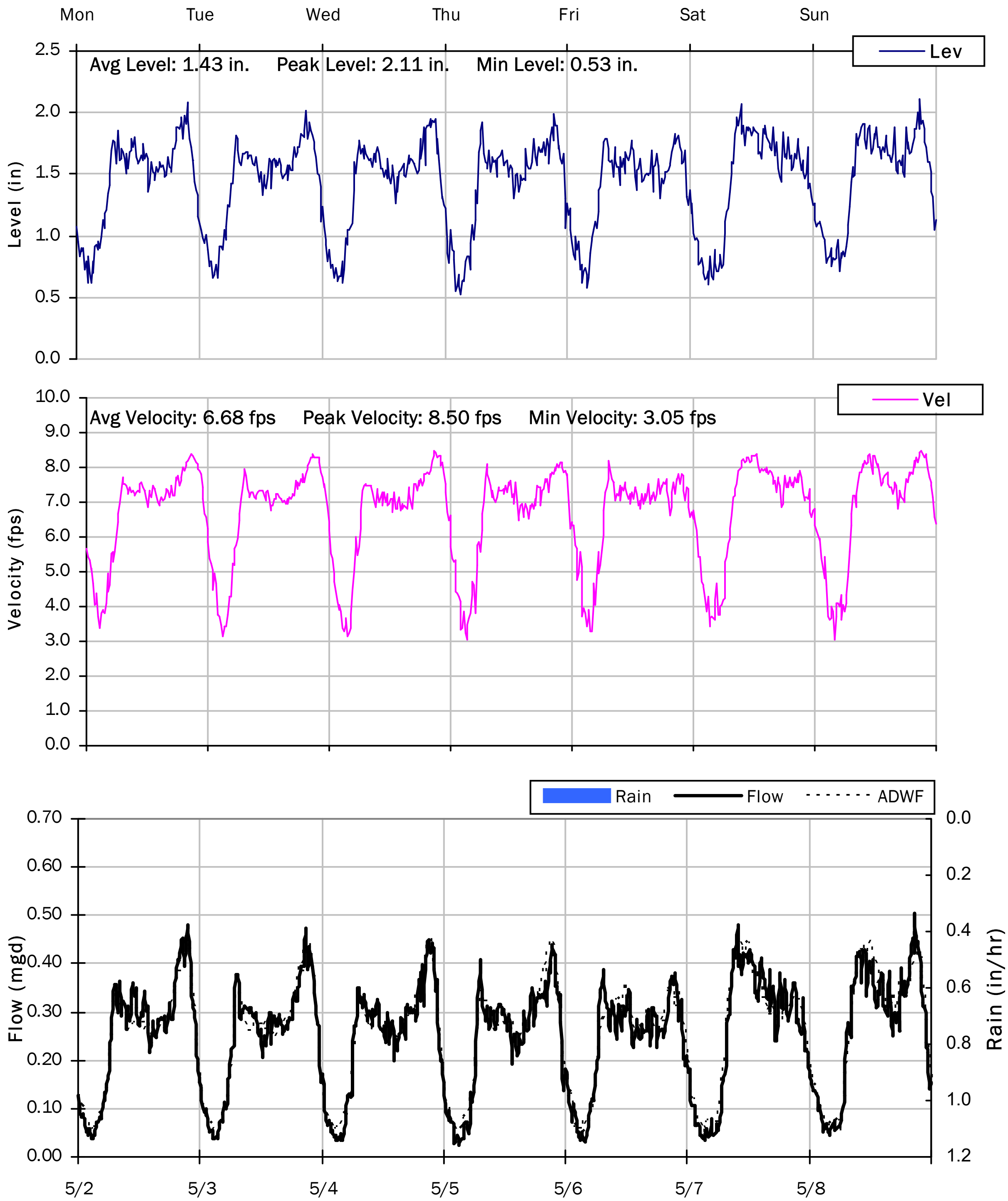


Avg Flow: 0.252 mgd Peak Flow: 0.501 mgd Min Flow: 0.031 mgd

SITE 02

Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022

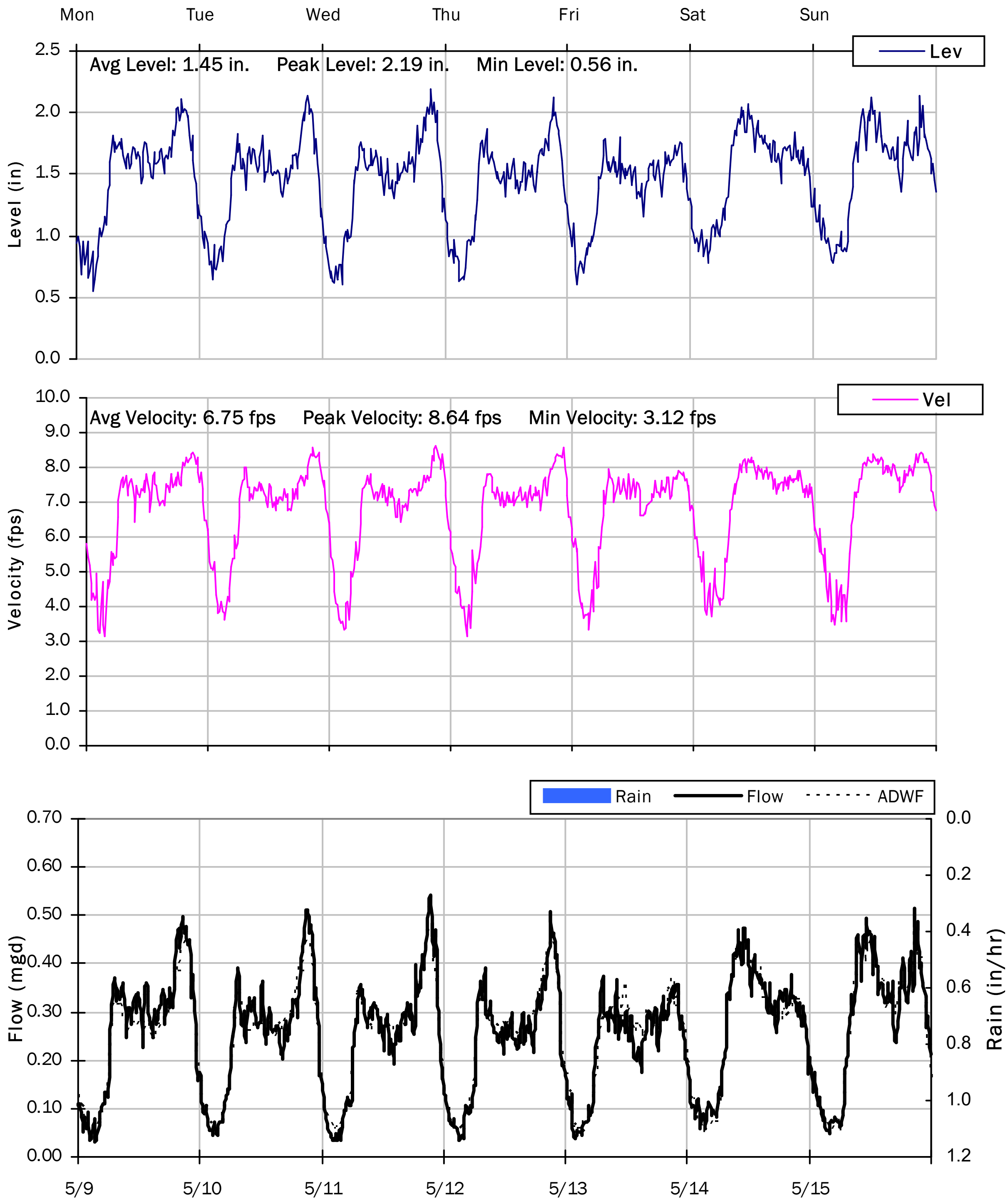


Avg Flow: 0.251 mgd   Peak Flow: 0.506 mgd   Min Flow: 0.024 mgd

SITE 02

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022

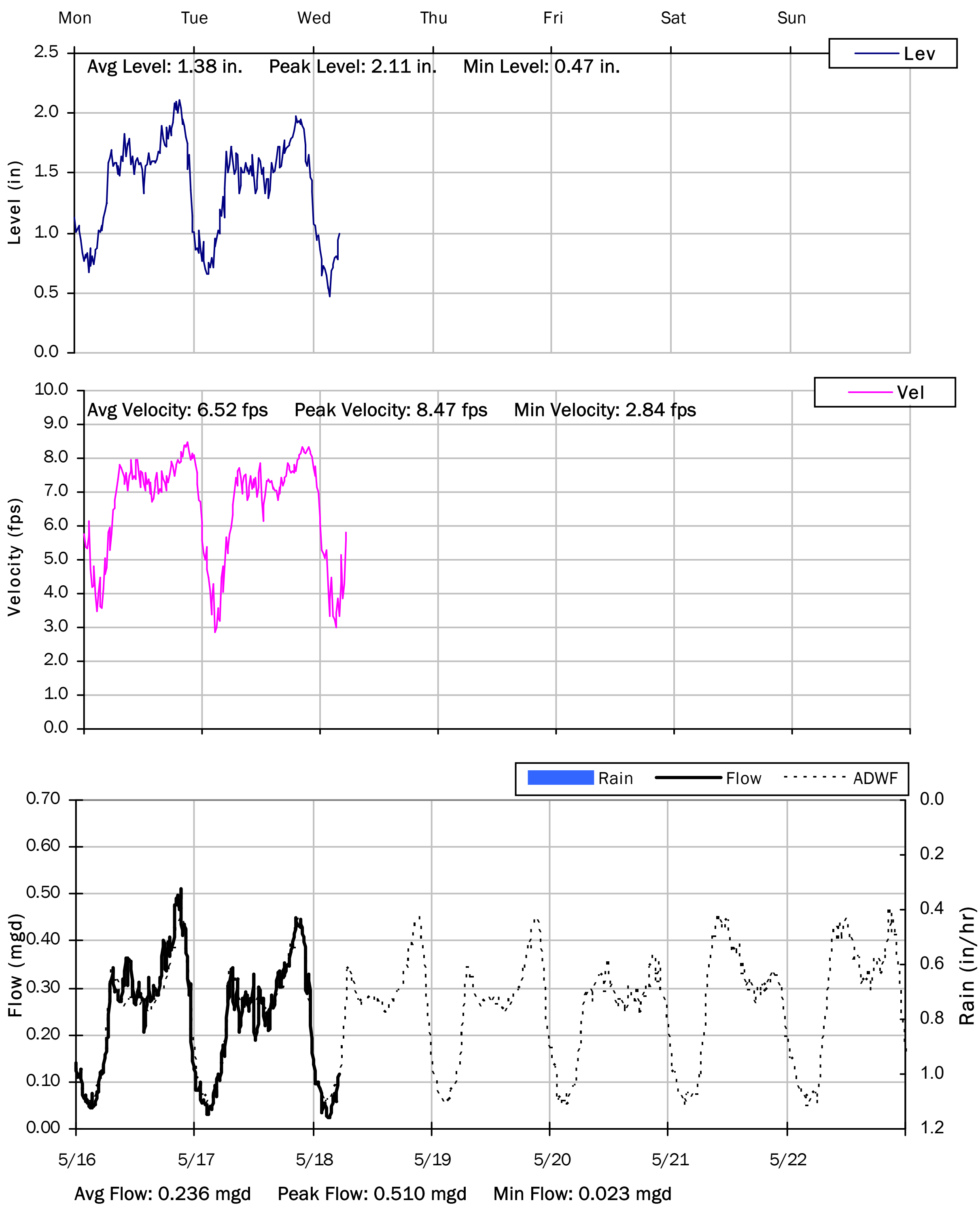


Avg Flow: 0.257 mgd   Peak Flow: 0.539 mgd   Min Flow: 0.030 mgd

SITE 02

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022



Monitoring Site: Site 03

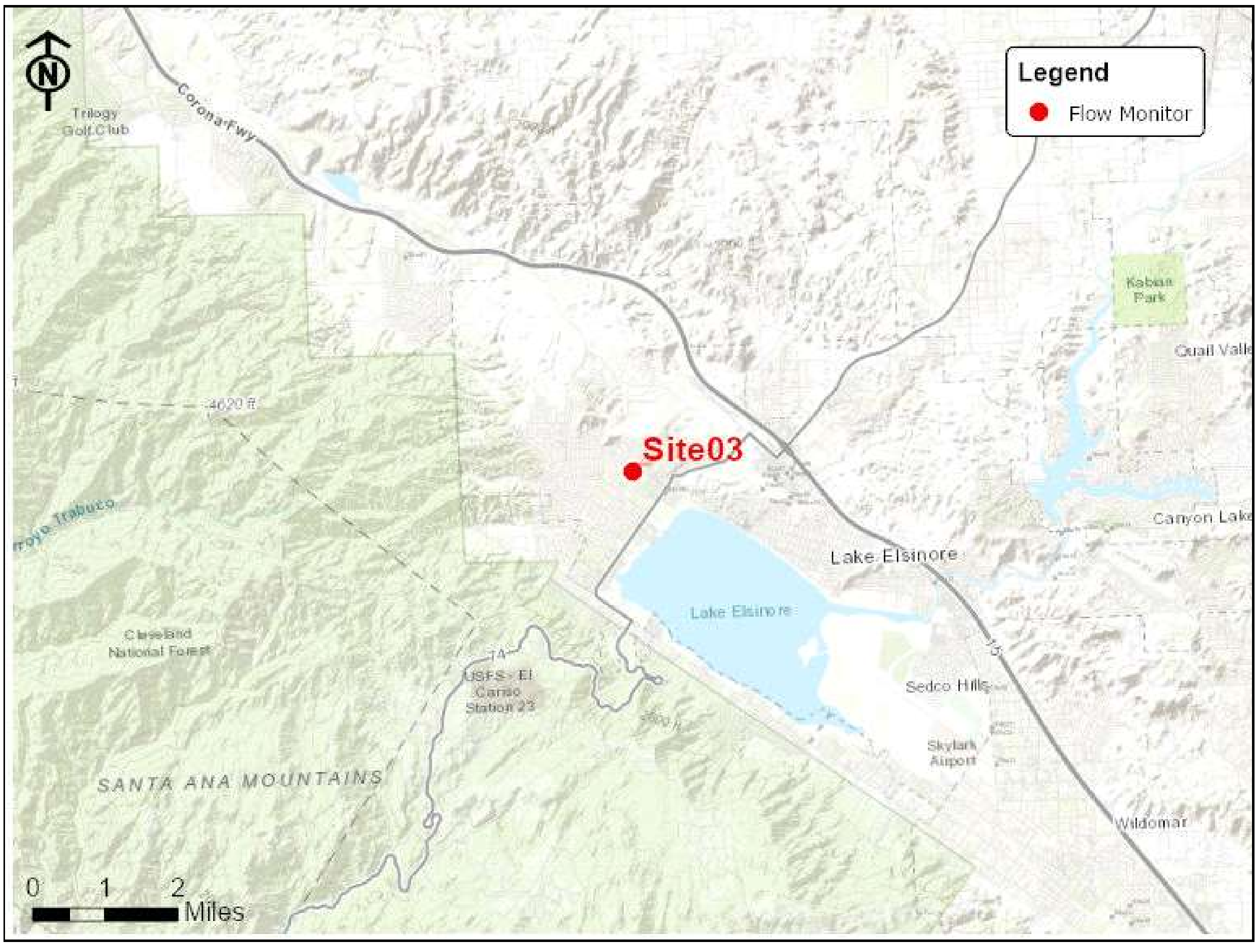
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Machado Street, west of Lakeshore Drive

Data Summary Report



Vicinity Map: Site 03

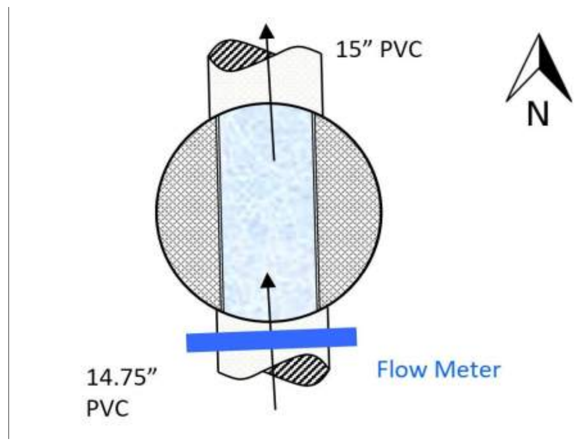
SITE 03

Site Information MH ID: MH-951

Location:	Machado Street, west of Lakeshore Drive
Coordinates:	117.3744° W, 33.6882° N
Rim Elevation (Earth):	1325 feet
Expected Pipe Diameter:	15 inches
Measured Pipe Diameter:	14.75 inches
ADWF:	0.179 mgd
Peak Measured Flow:	0.371 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch

View from Street


Plan View

SITE 03

Additional Site Photos

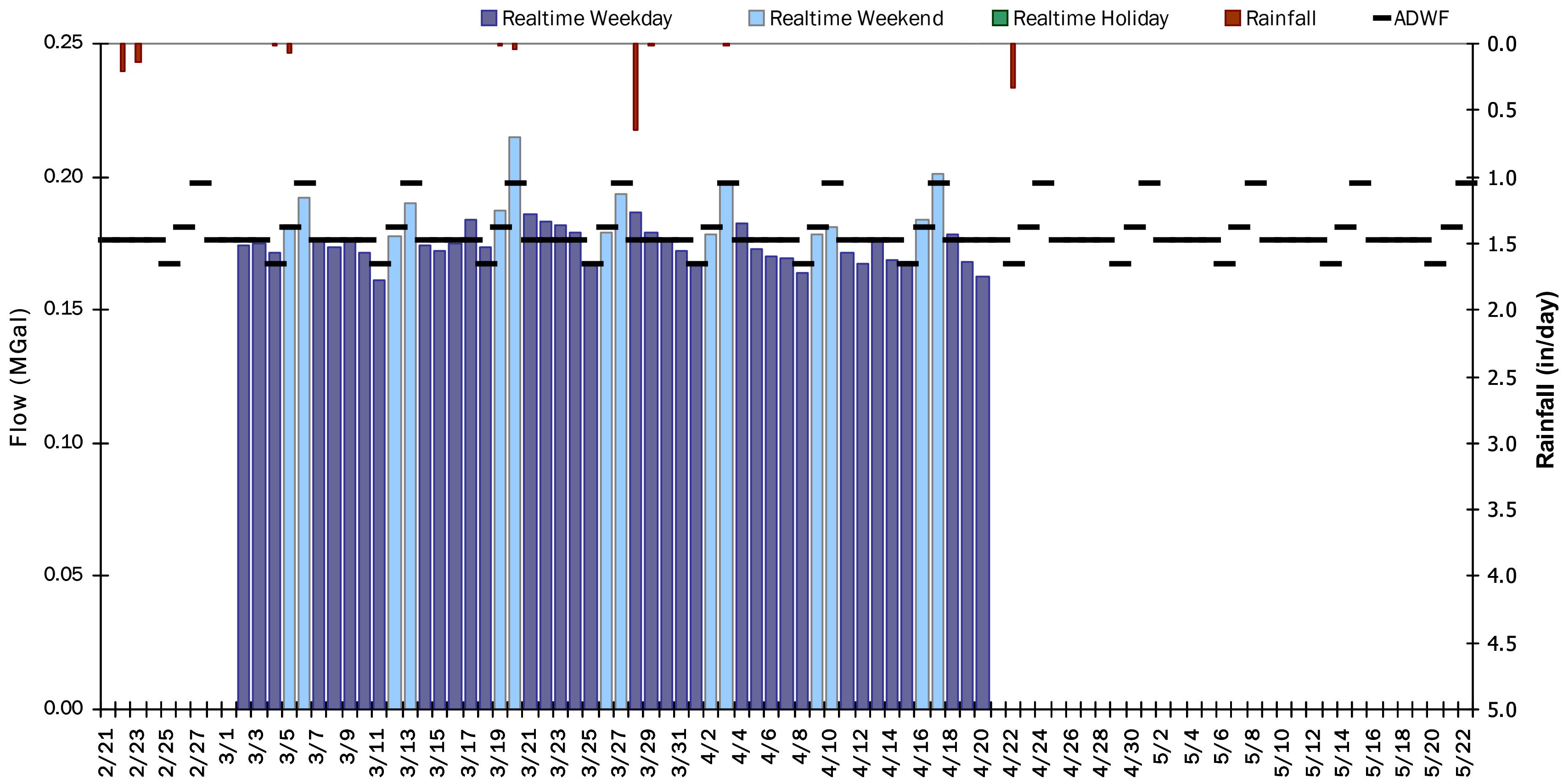
Effluent Pipe

Influent Pipe

SITE 03
Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.177 MGal   Peak Daily Flow: 0.216 MGal   Min Daily Flow: 0.118 MGal

Total Rainfall: 0.82 inches

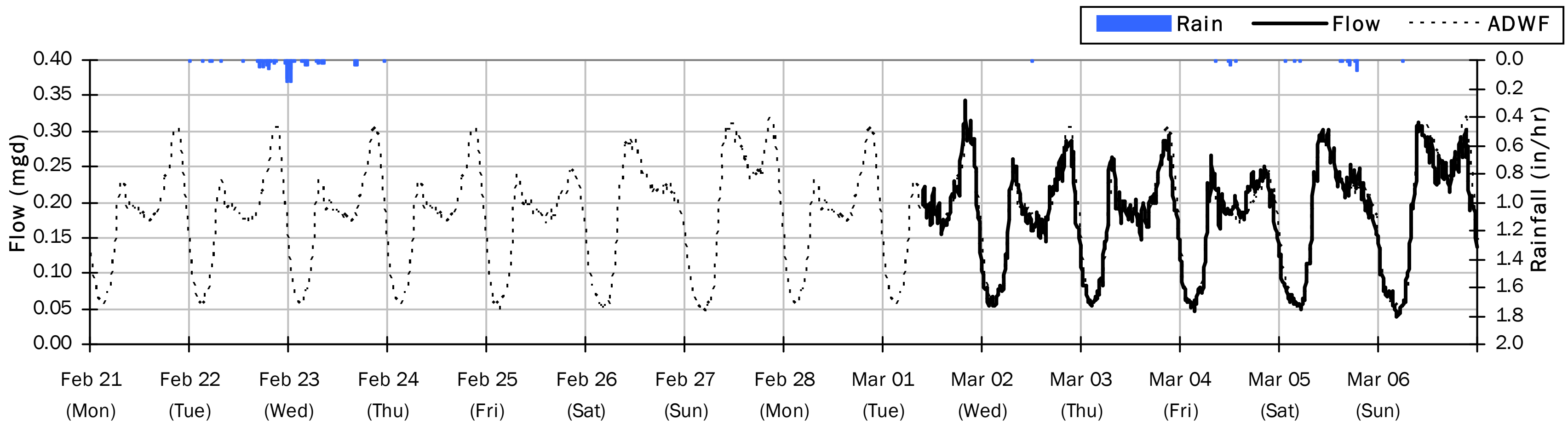


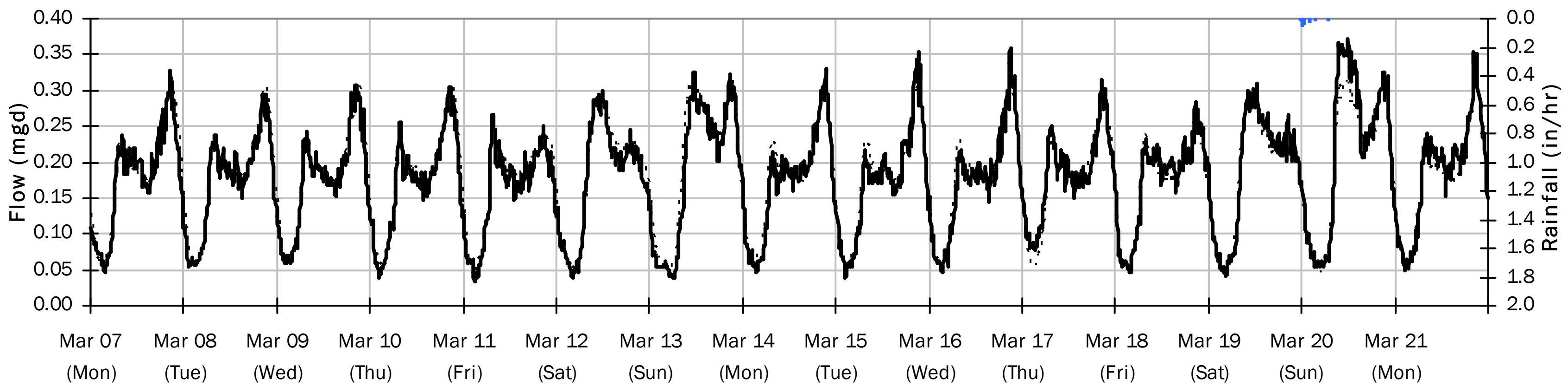
SITE 03

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.49 inches

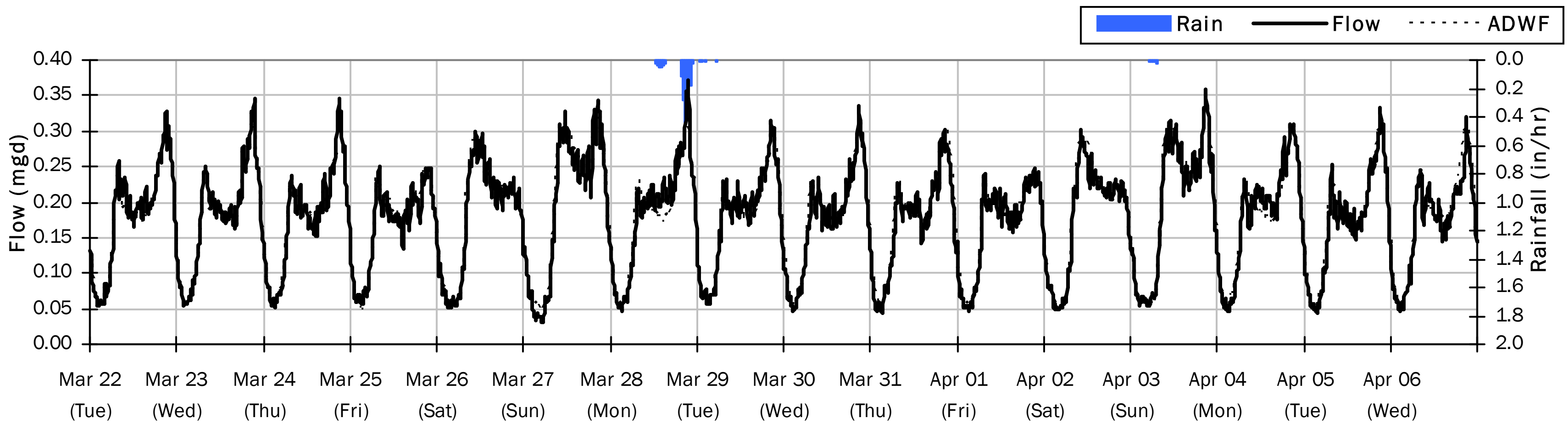
Period Avg Flow: 0.180 mgd Period Peak Flow: 0.370 mgd Period Min Flow: 0.034 mgd

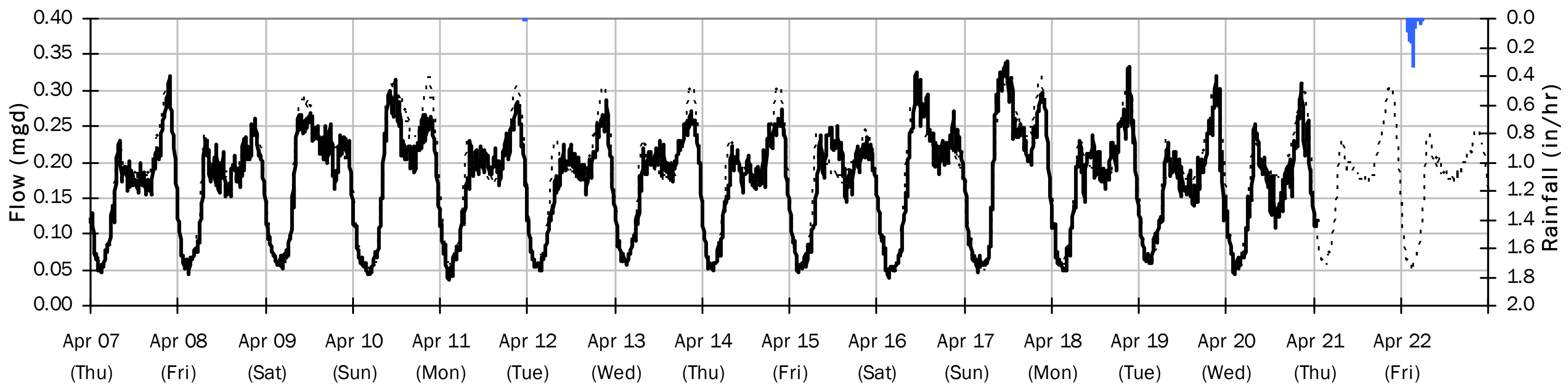




SITE 03
Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 1.01 inches   Period Avg Flow: 0.177 mgd   Period Peak Flow: 0.371 mgd   Period Min Flow: 0.032 mgd



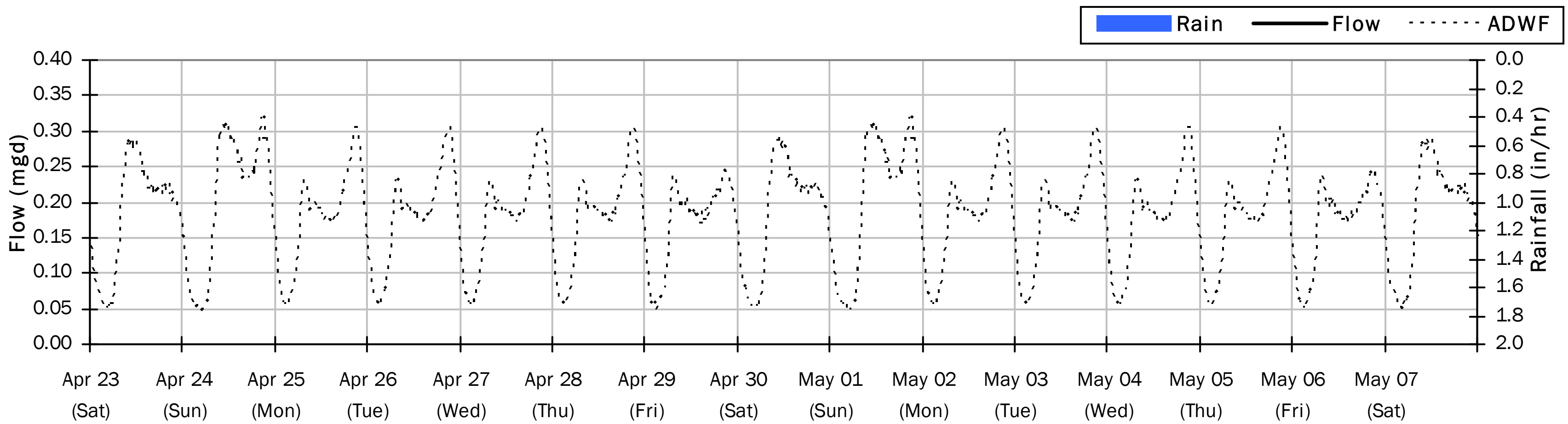


SITE 03

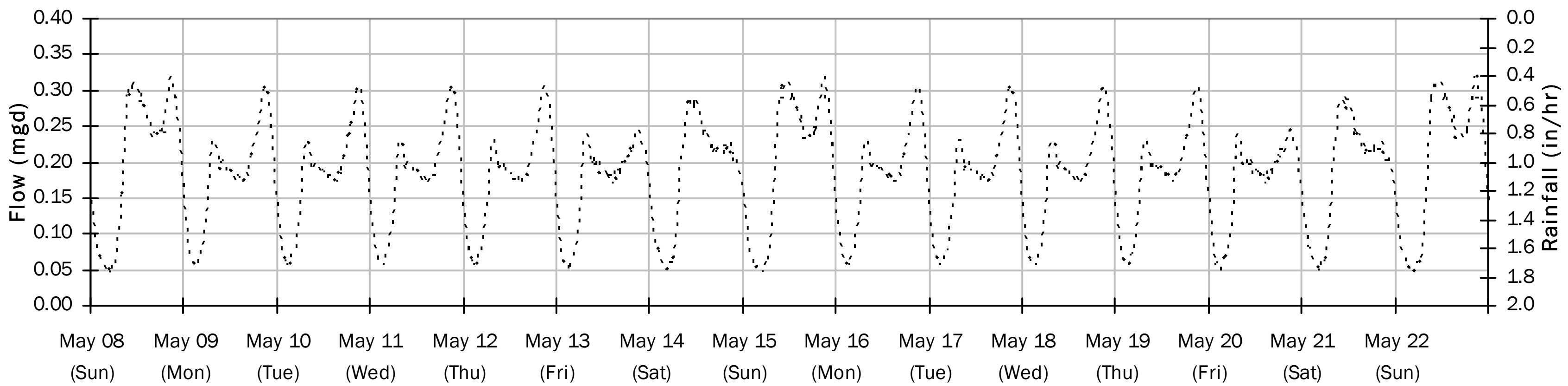
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

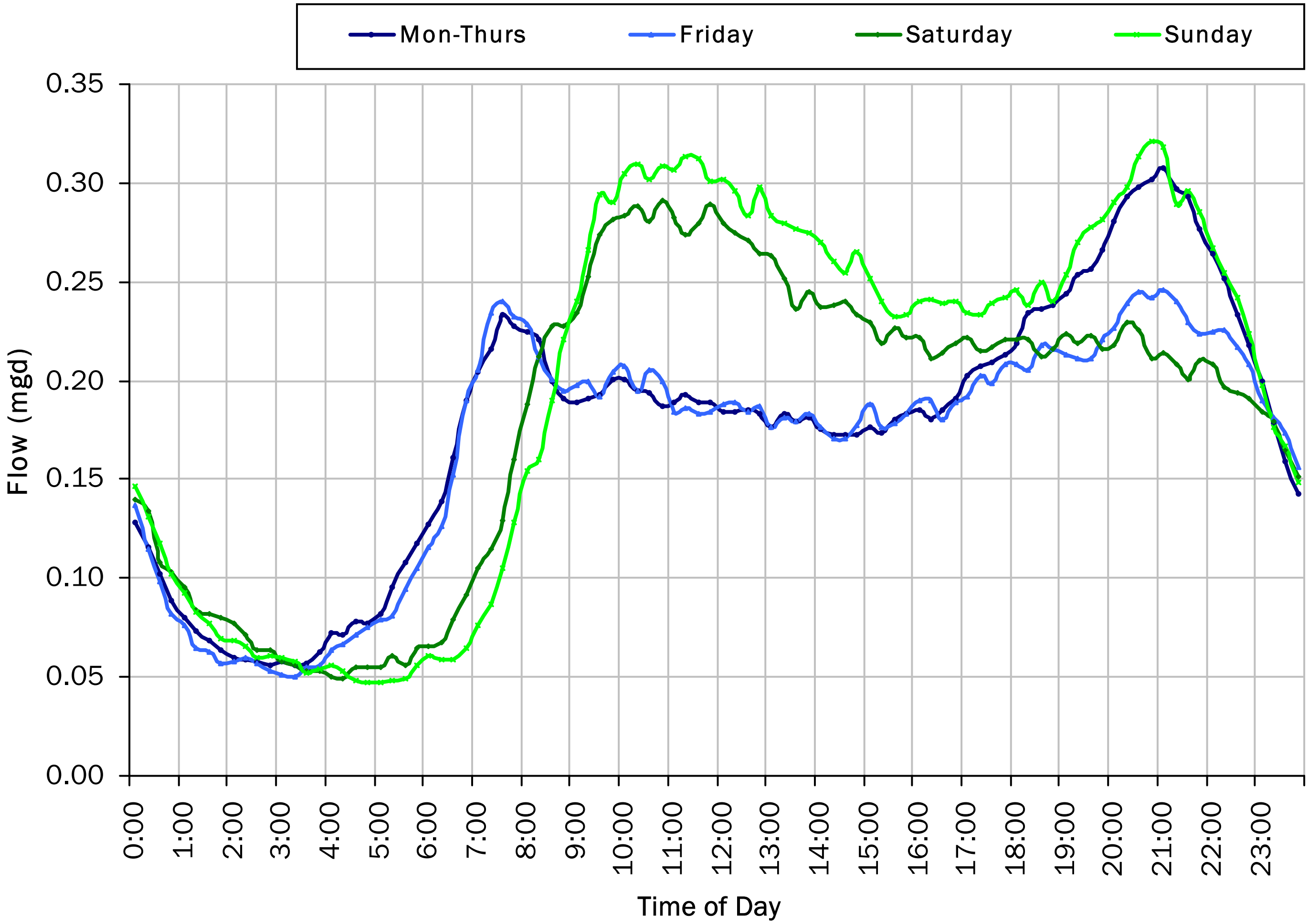
Period Avg Flow: mgd Period Peak Flow: mgd Period Min Flow: mgd



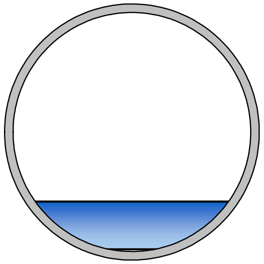
Meter Removed



SITE 03
Average Dry Weather Flow Hydrographs

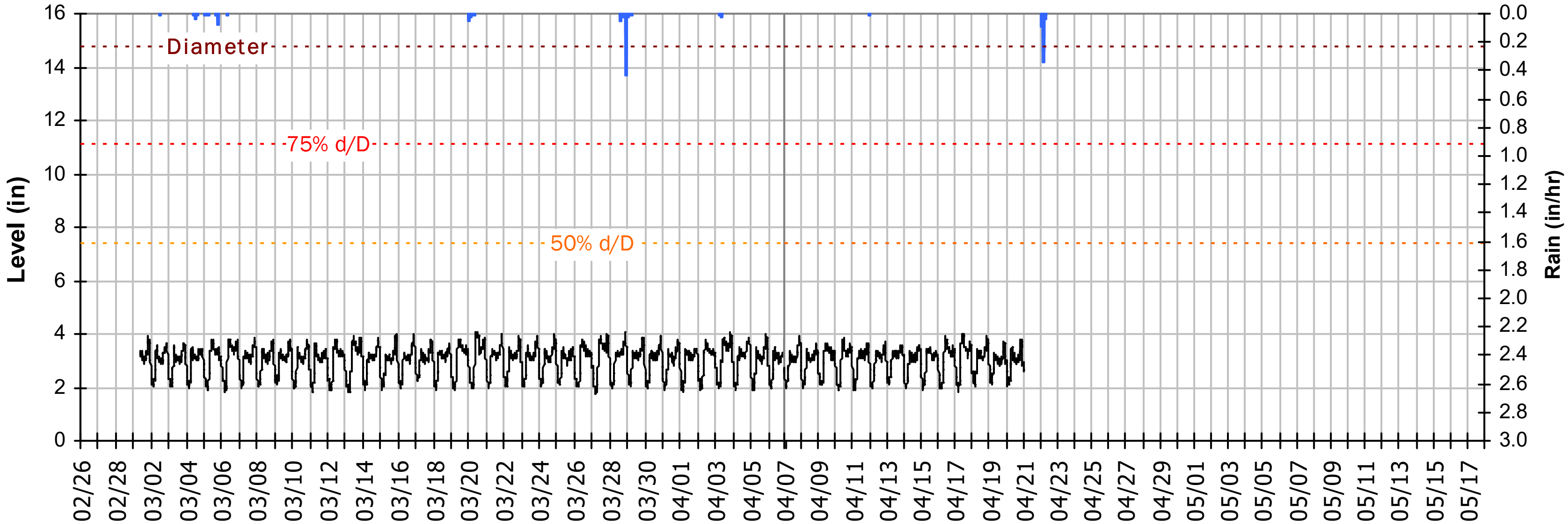


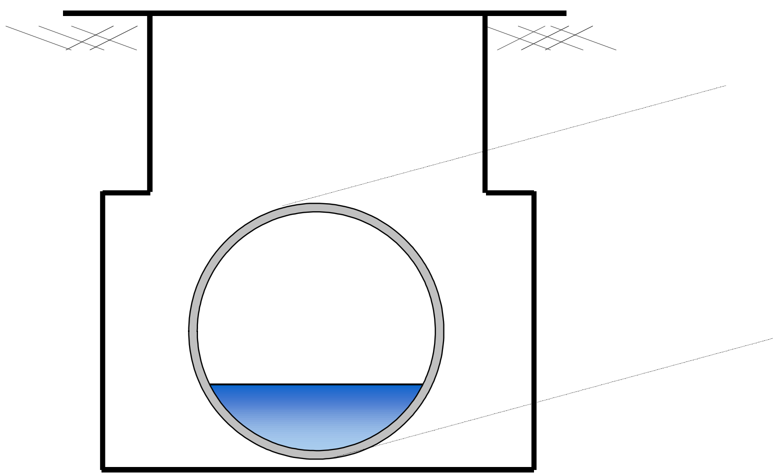
ADWF:
0.179 *mgd*



SITE 03
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

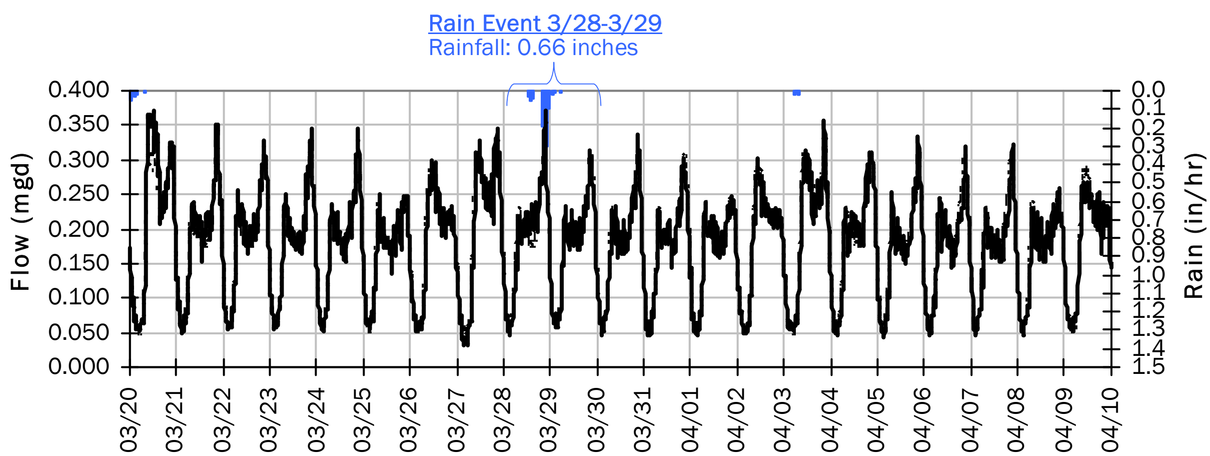




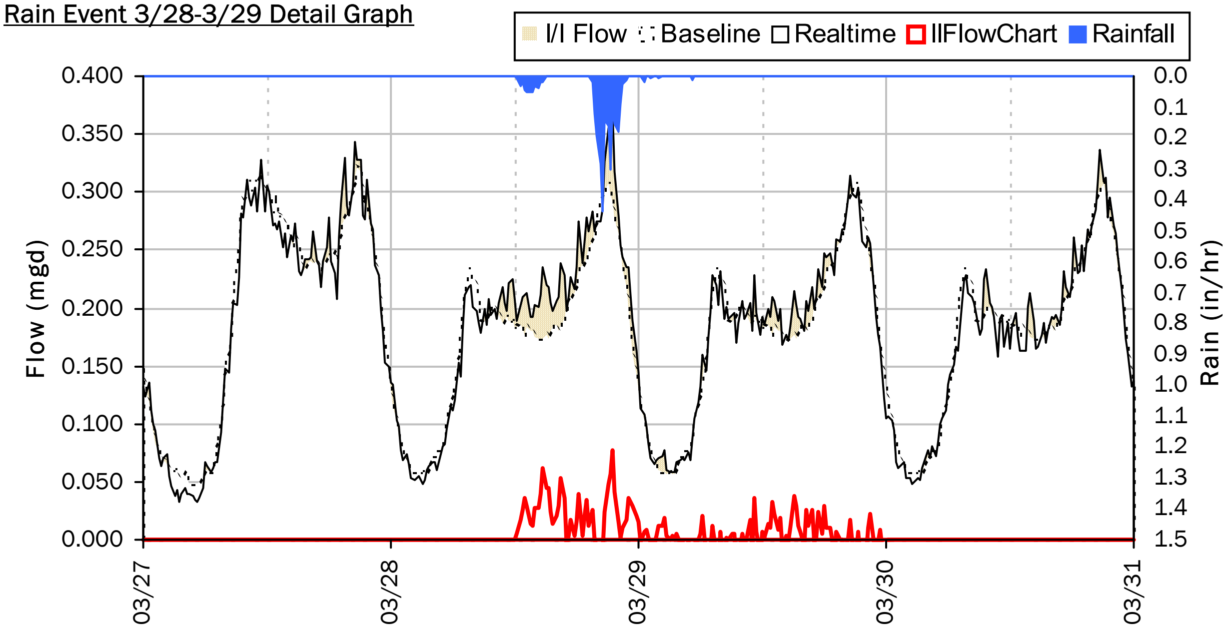
Pipe Diameter:	14.8	*inches*
Peak Measured Level:	4.09	*inches*
Peak d/D Ratio:	0.28	

SITE 03
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



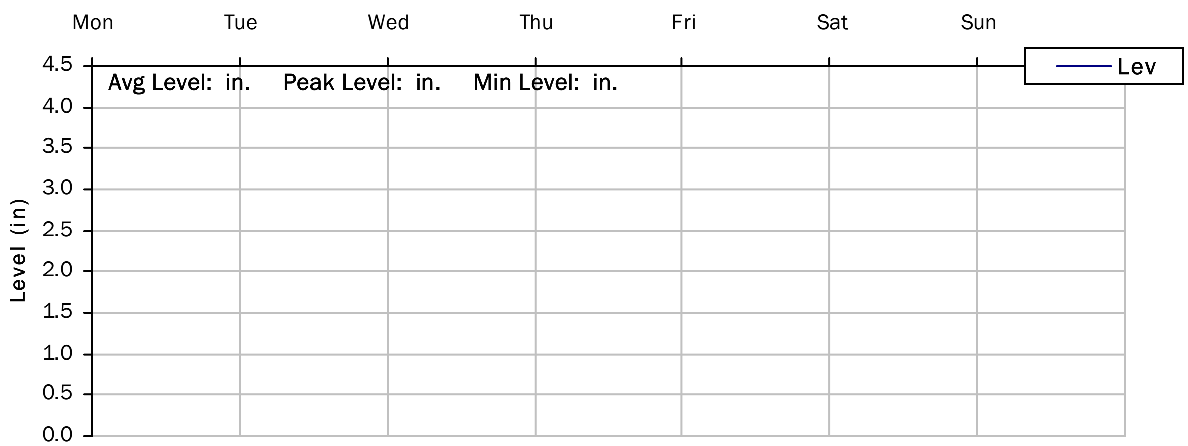
Rain Event 3/28-3/29 Detail Graph

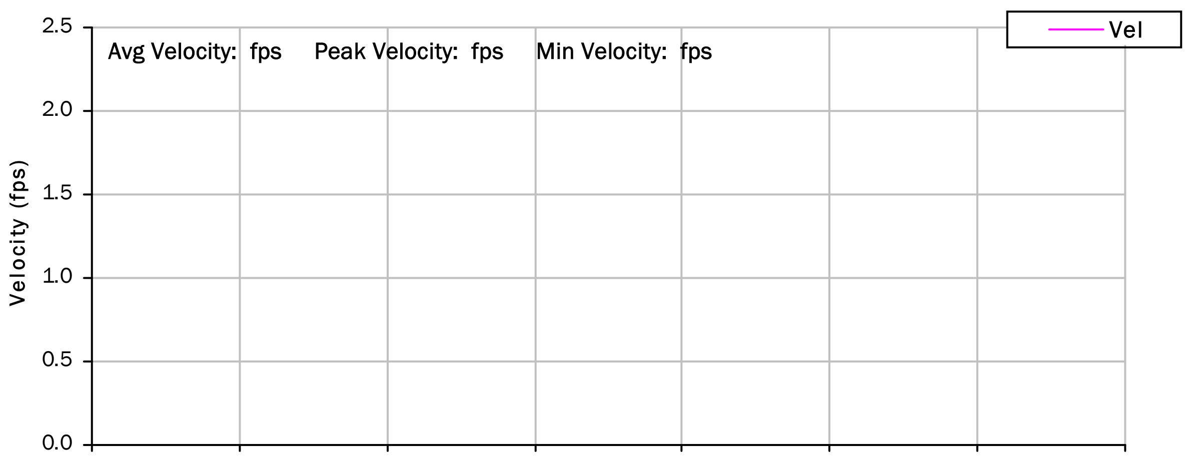


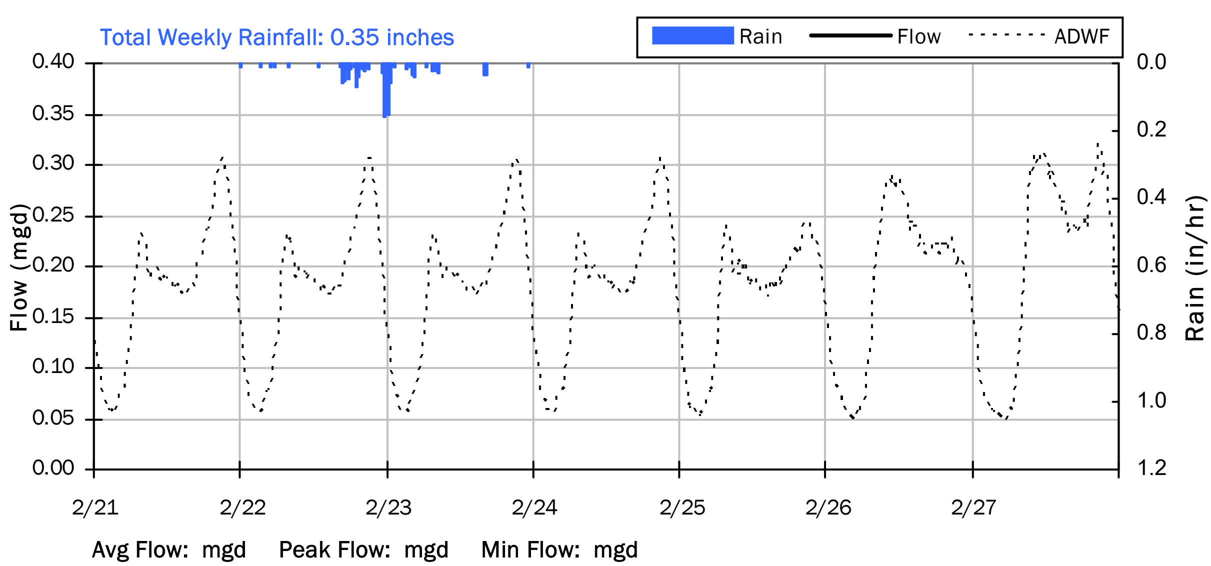
Storm Event I/I Analysis (Rain = 0.66 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.371 *mgd*	Peak I/I Rate:	0.078 *mgd*
PF:	2.08	Total I/I:	14,000 *gallons*
Peak Level:	4.09 *in*		
d/D Ratio:	0.28		

SITE 03
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



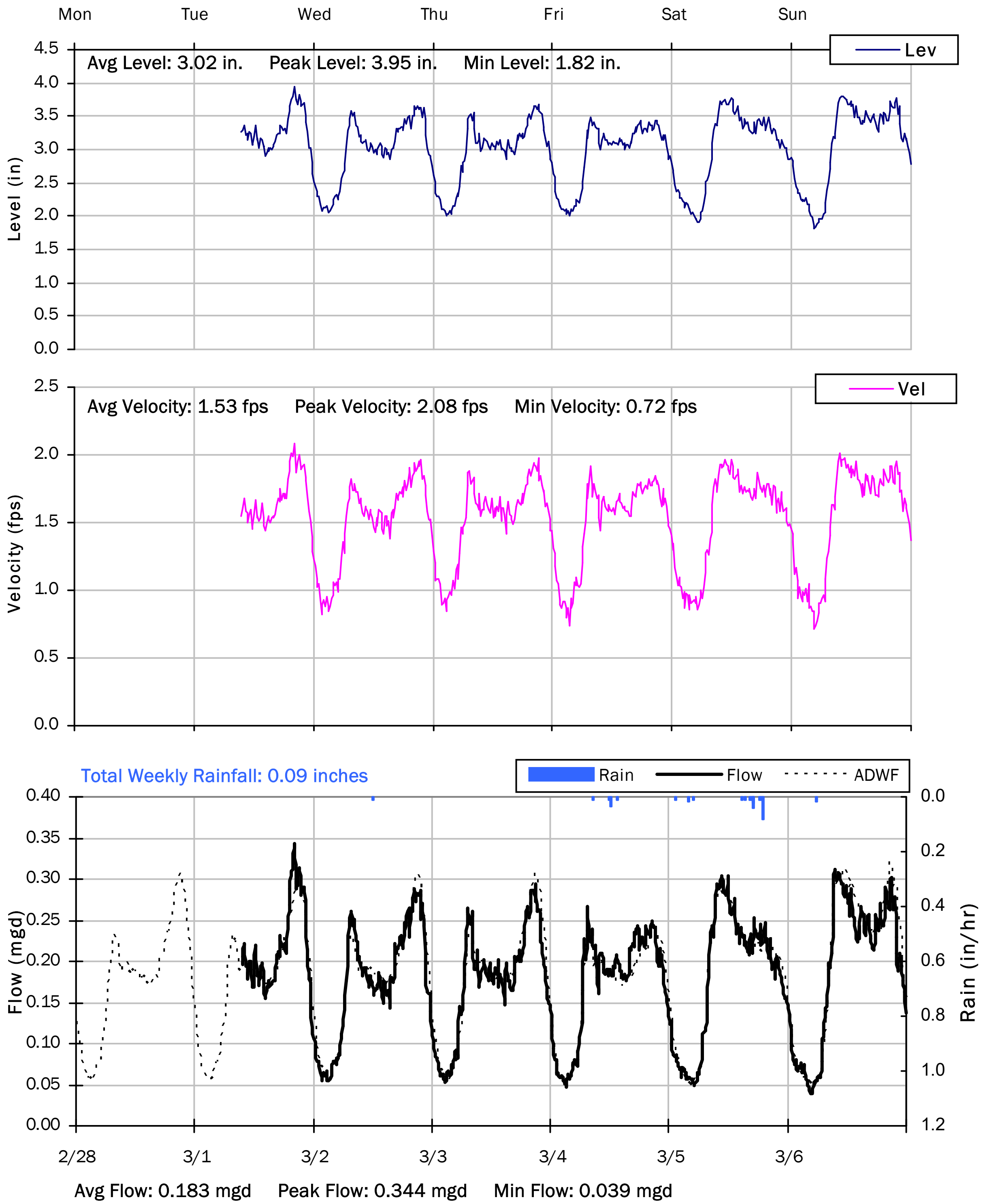




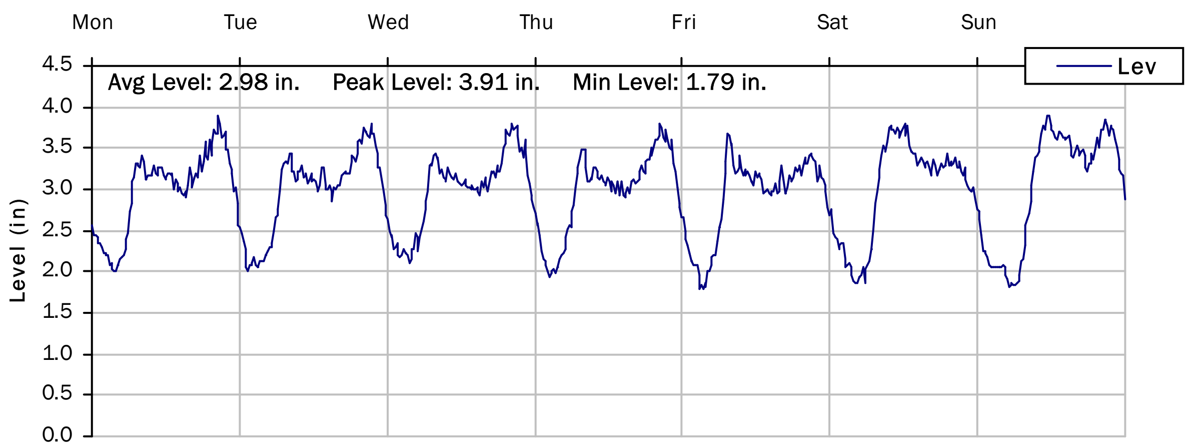
SITE 03

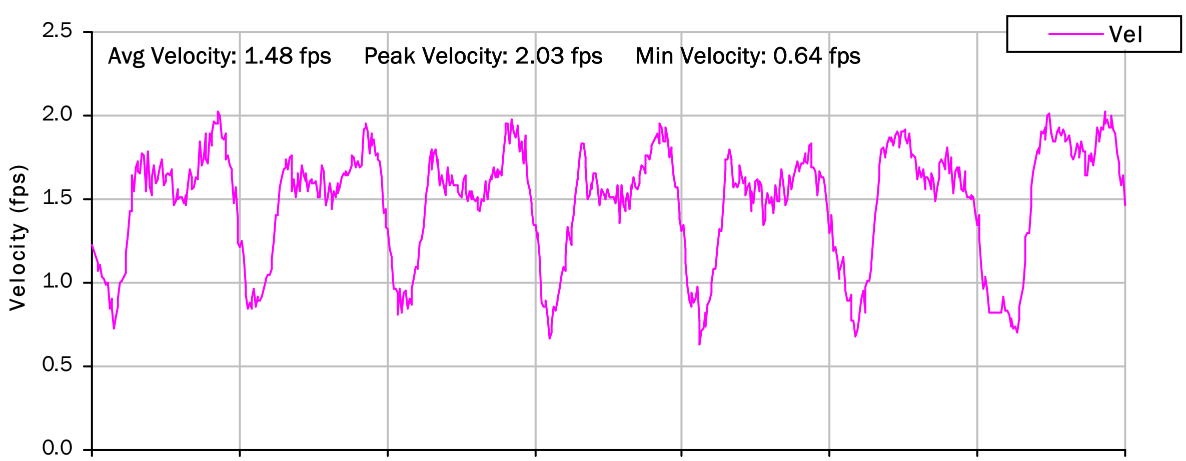
Weekly Level, Velocity and Flow Hydrographs

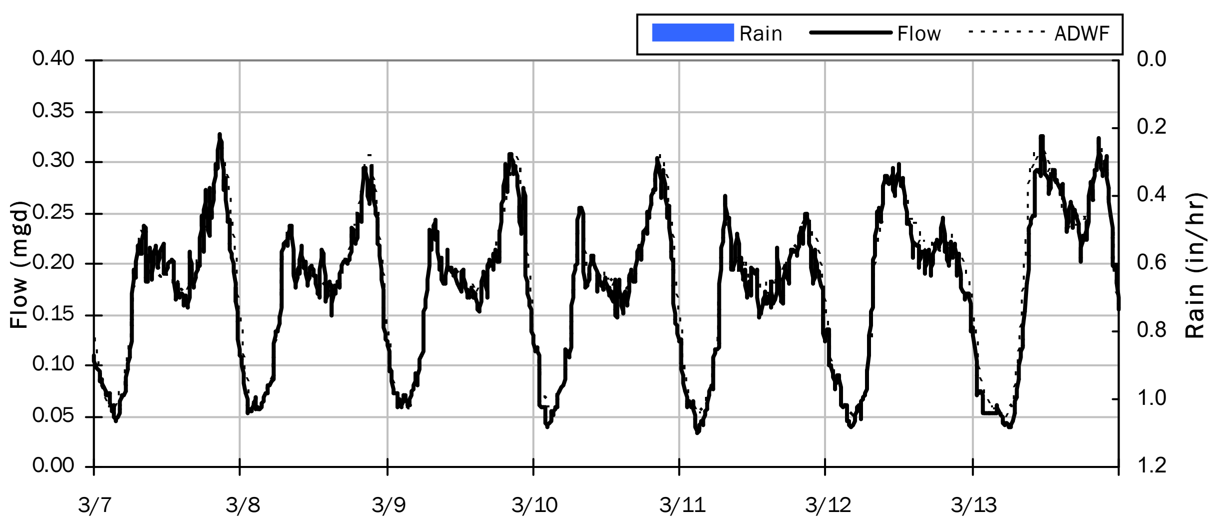
2/28/2022 to 3/7/2022



SITE 03
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

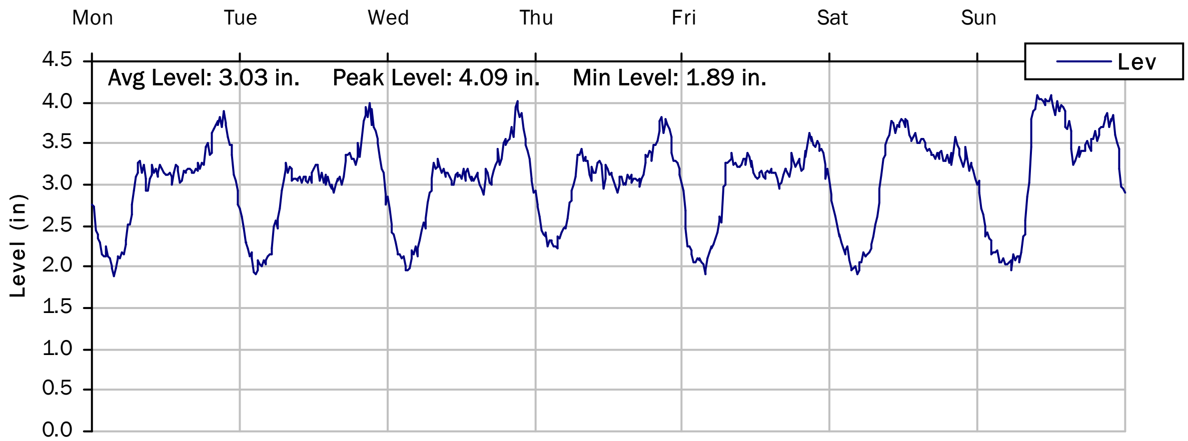


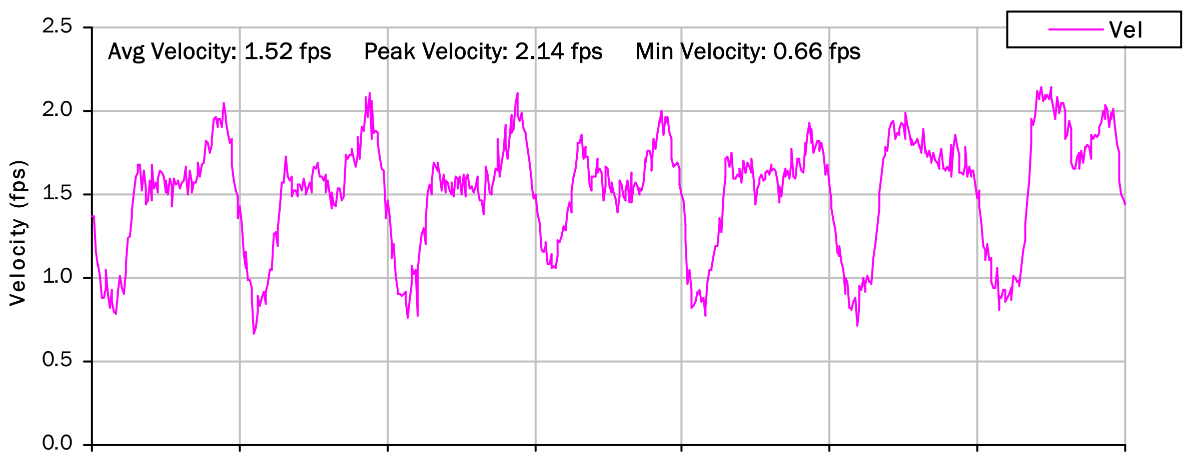


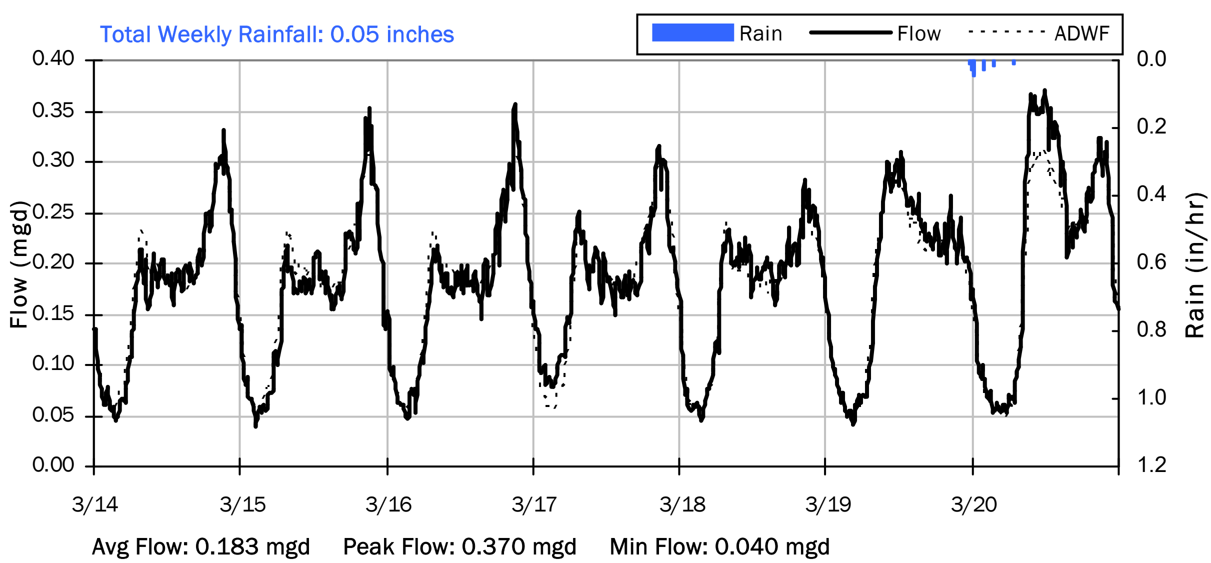


Avg Flow: 0.175 mgd Peak Flow: 0.327 mgd Min Flow: 0.034 mgd

SITE 03
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



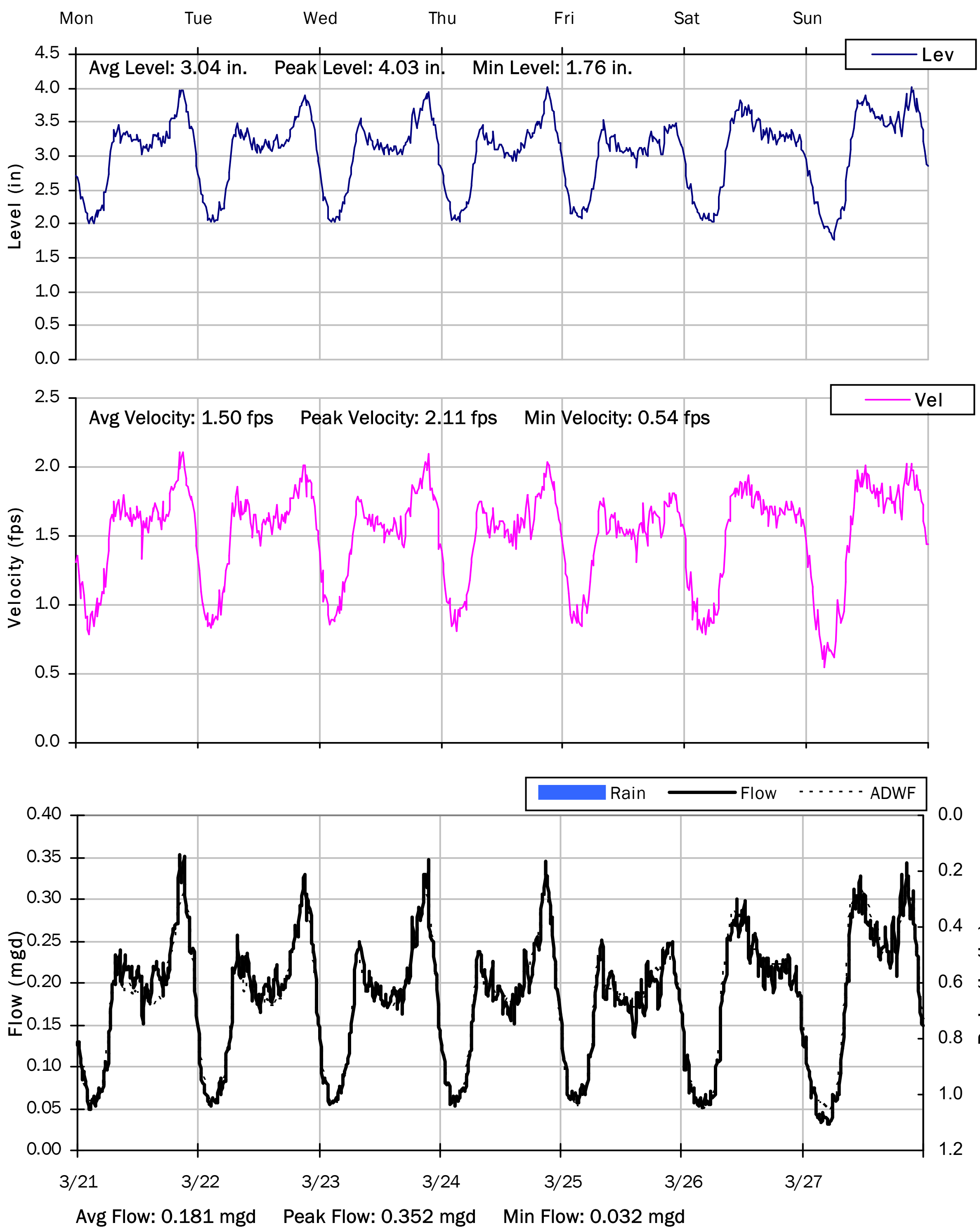




SITE 03

Weekly Level, Velocity and Flow Hydrographs

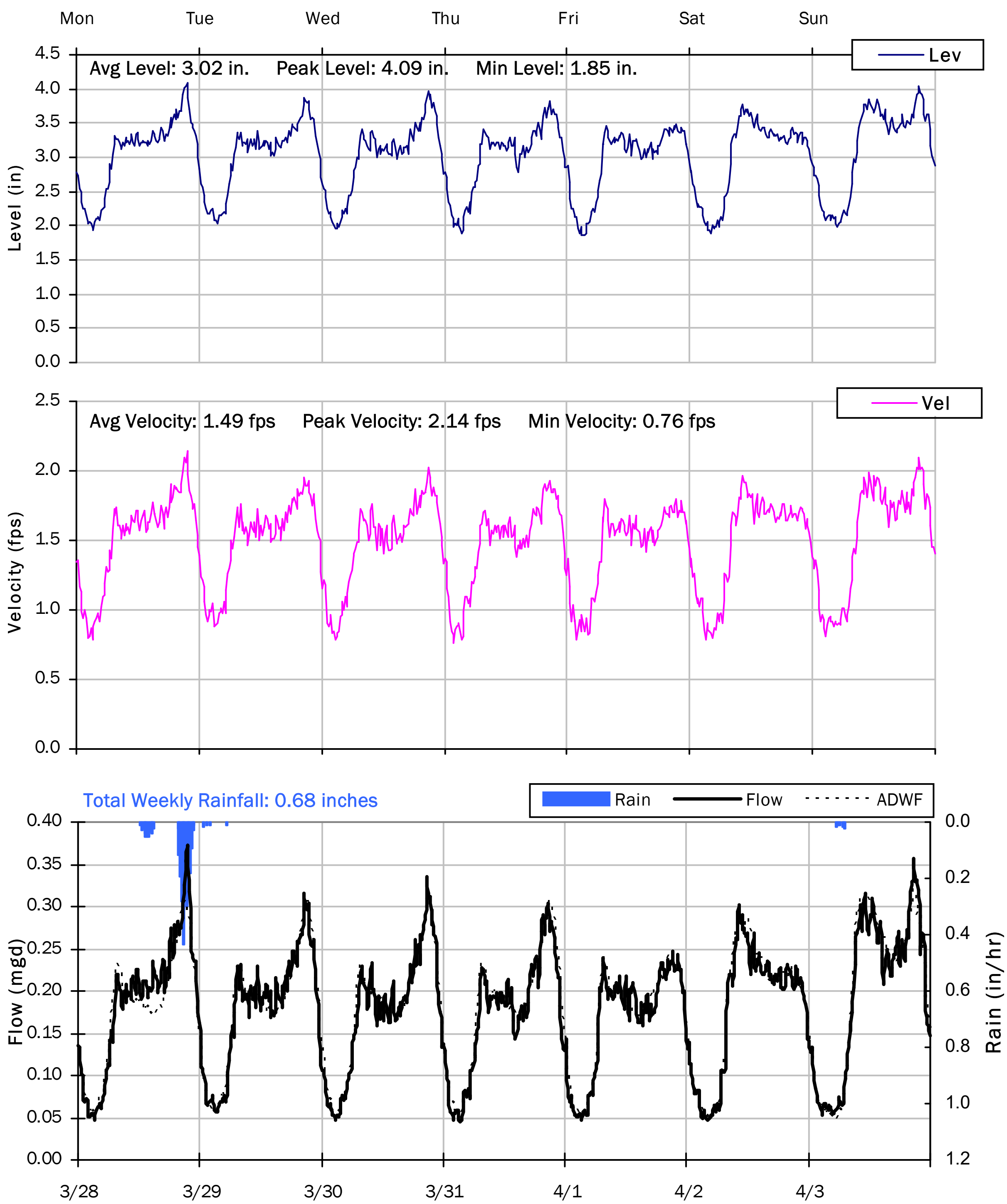
3/21/2022 to 3/28/2022



SITE 03

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

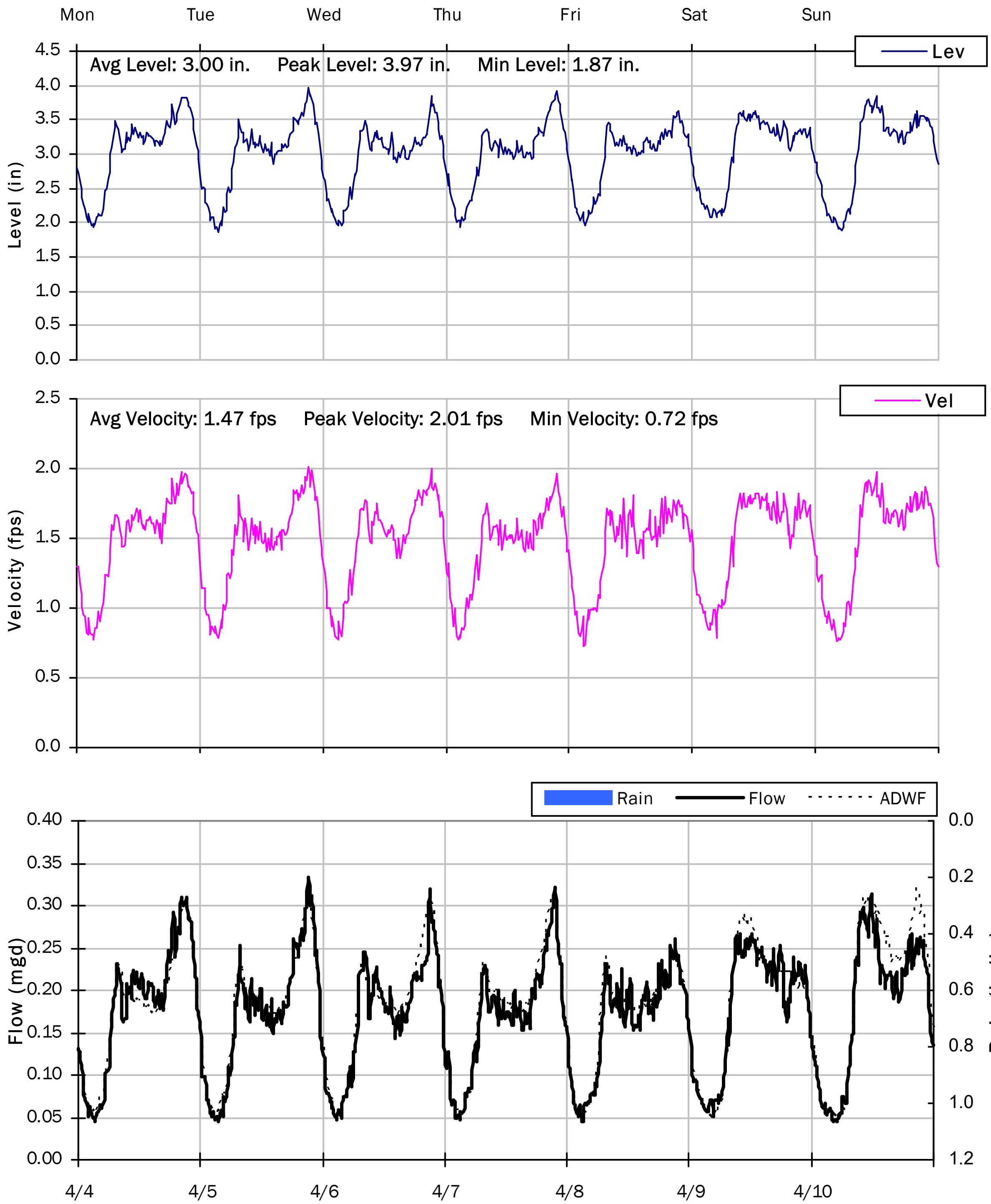


Avg Flow: 0.179 mgd Peak Flow: 0.371 mgd Min Flow: 0.045 mgd

SITE 03

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022

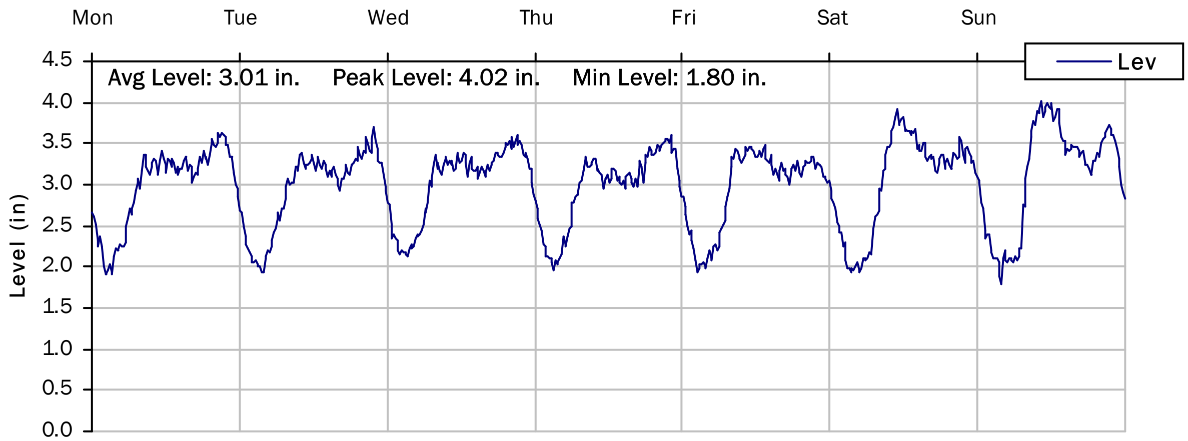


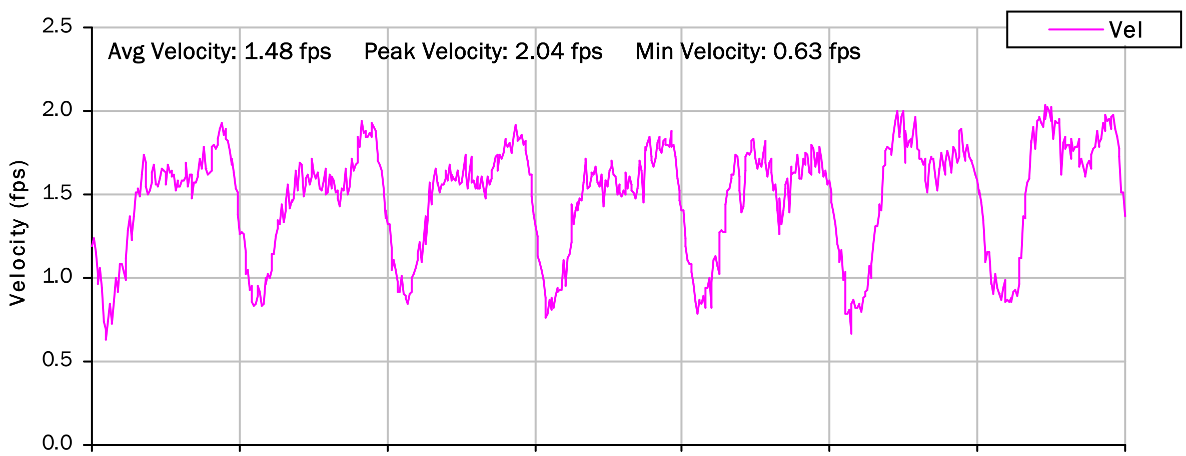
Avg Flow: 0.174 mgd Peak Flow: 0.334 mgd Min Flow: 0.044 mgd

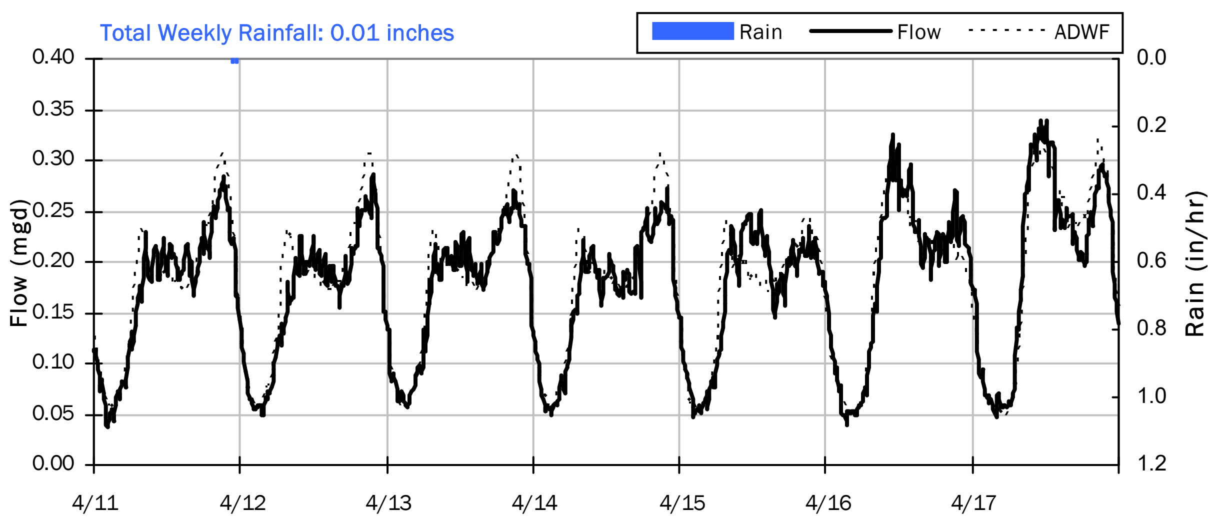
SITE 03

Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022





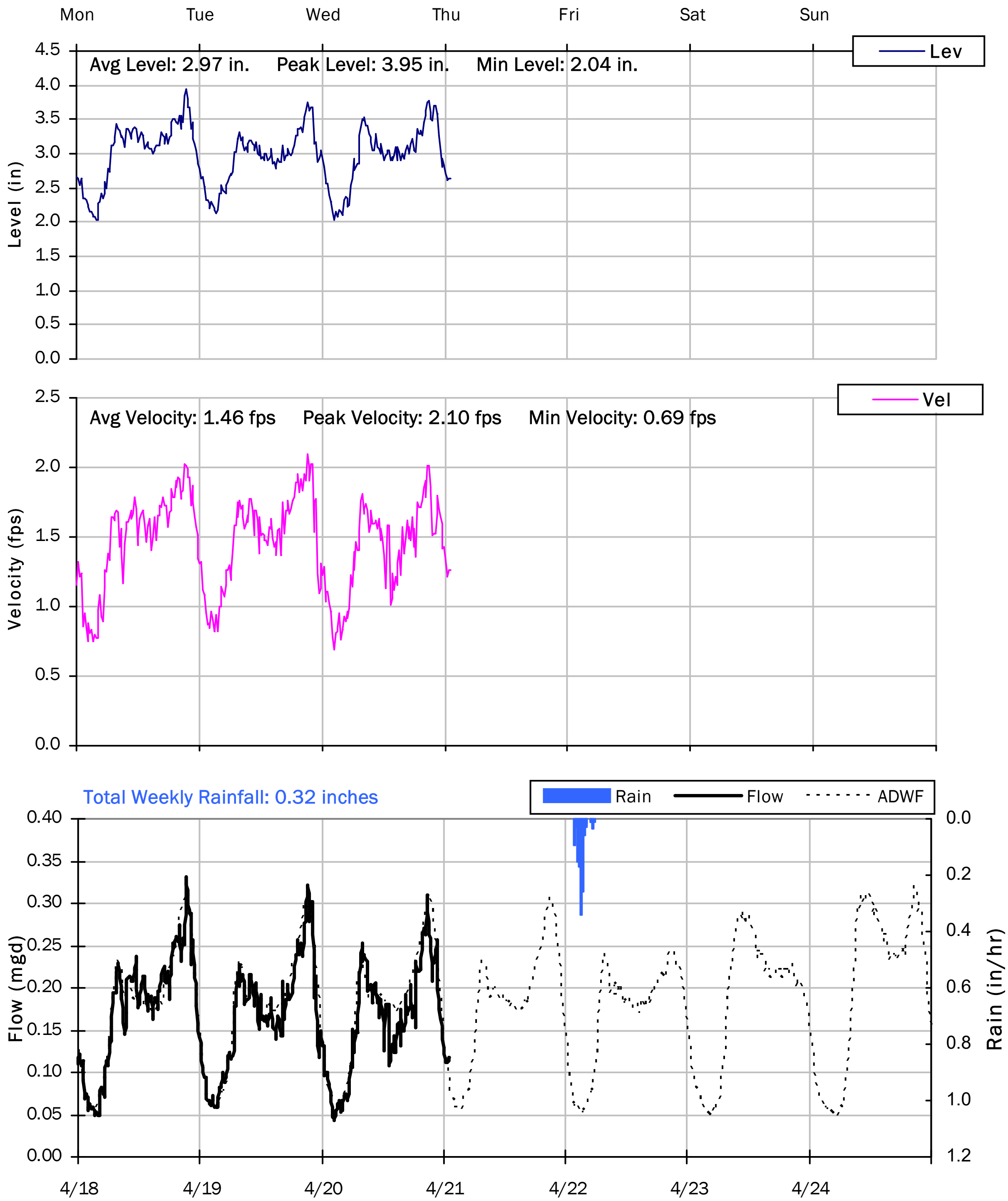


Avg Flow: 0.177 mgd Peak Flow: 0.340 mgd Min Flow: 0.037 mgd

SITE 03

Weekly Level, Velocity and Flow Hydrographs

4/18/2022 to 4/25/2022



Avg Flow: 0.169 mgd Peak Flow: 0.332 mgd Min Flow: 0.044 mgd

Monitoring Site: Site 04

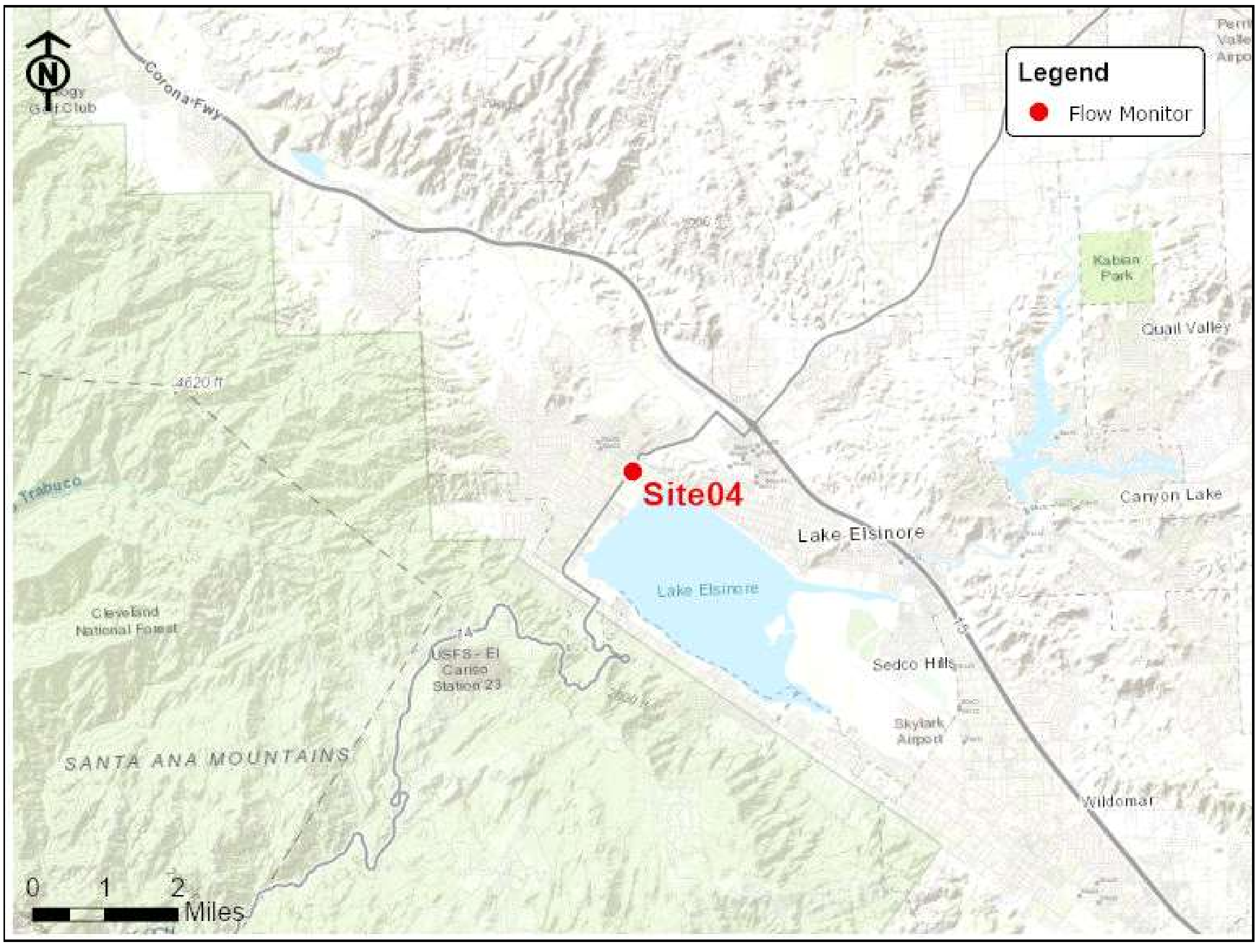
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Riverside Drive and Washington Street

Data Summary Report



Vicinity Map: Site 04

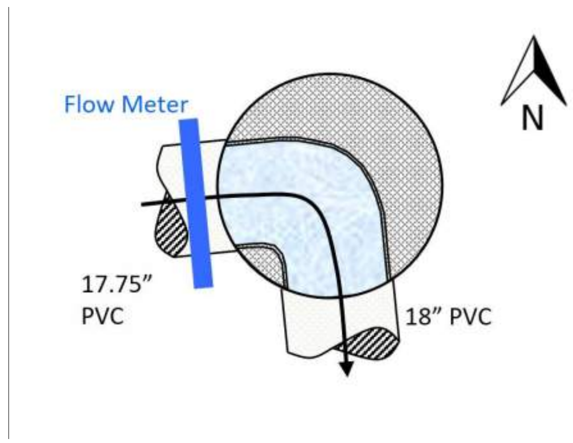
SITE 04

Site Information — MH ID: MH-1430

Location:	Riverside Drive and Washington Street
Coordinates:	117.3667° W, 33.6836° N
Rim Elevation (Earth):	1290 feet
Expected Pipe Diameter:	12 inches
Measured Pipe Diameter:	17.75 inches
ADWF:	0.738 mgd
Peak Measured Flow:	1.569 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 04

Additional Site Photos

Effluent Pipe

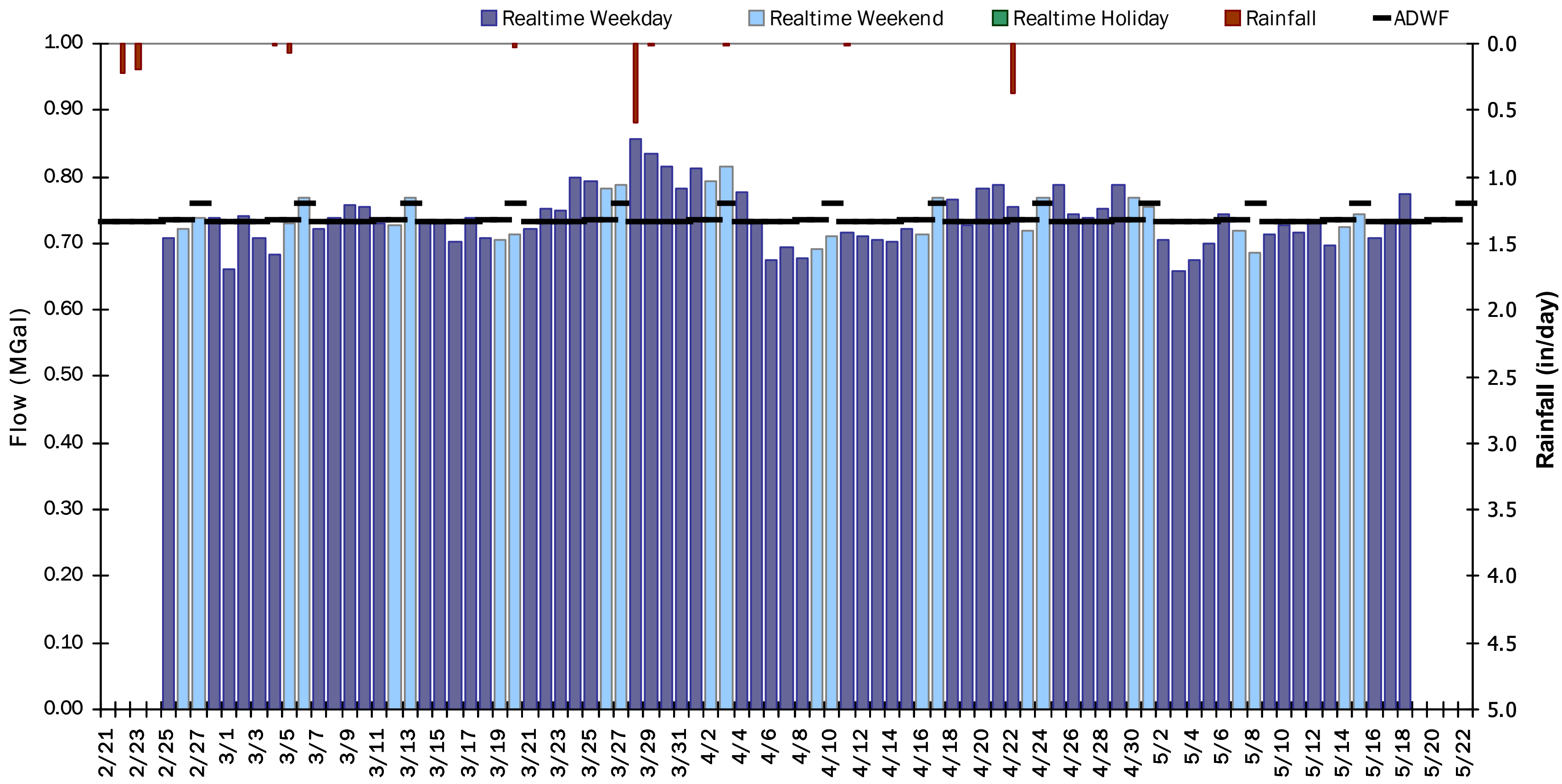
Influent Pipe

SITE 04

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.738 MGal Peak Daily Flow: 0.860 MGal Min Daily Flow: 0.565 MGal

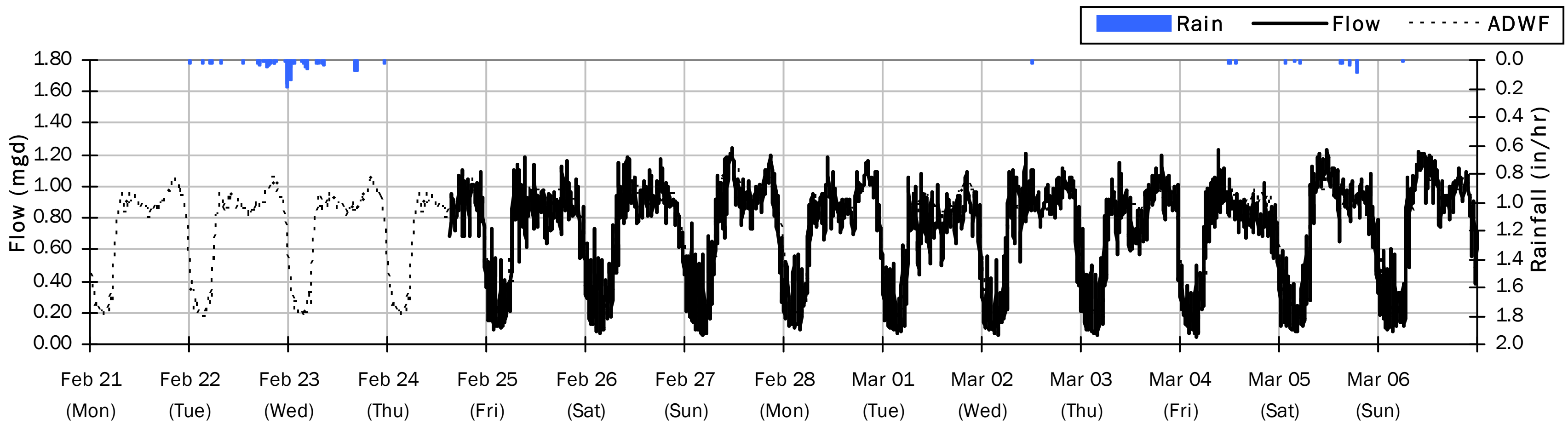
Total Rainfall: 1.15 inches

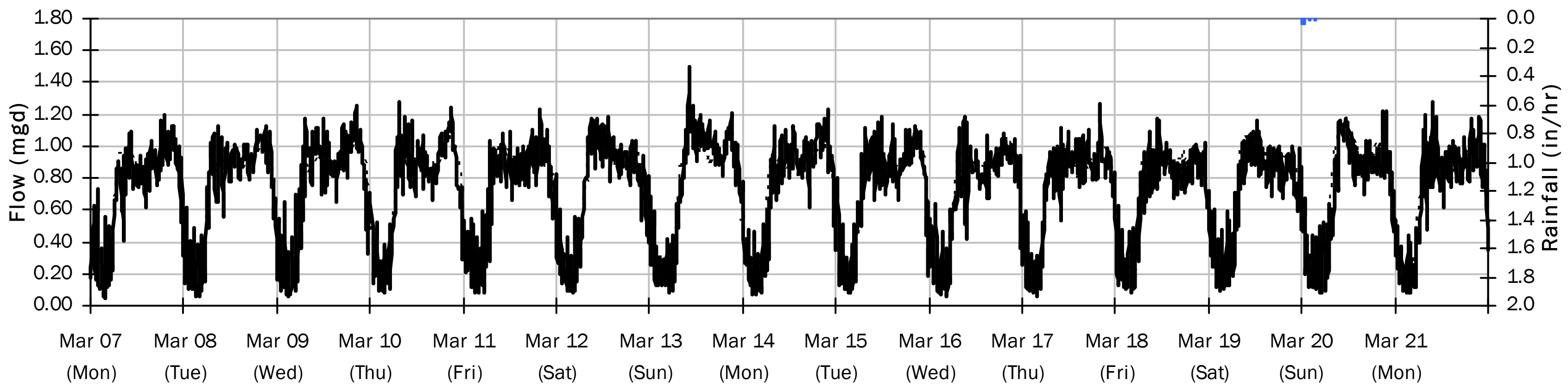


SITE 04

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.54 inches   Period Avg Flow: 0.728 mgd   Period Peak Flow: 1.503 mgd   Period Min Flow: 0.047 mgd



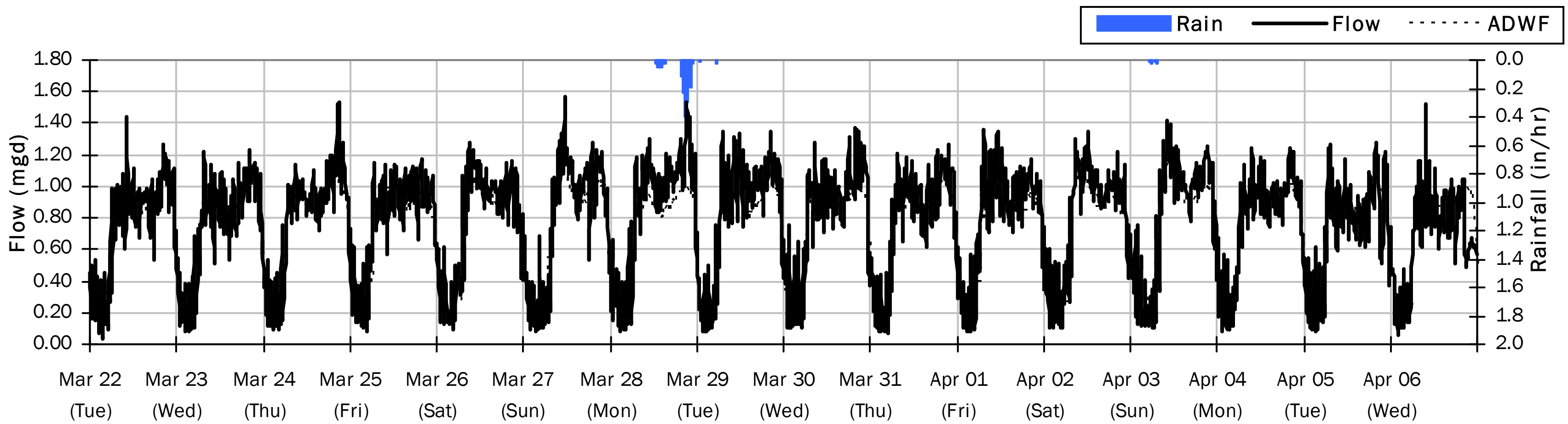


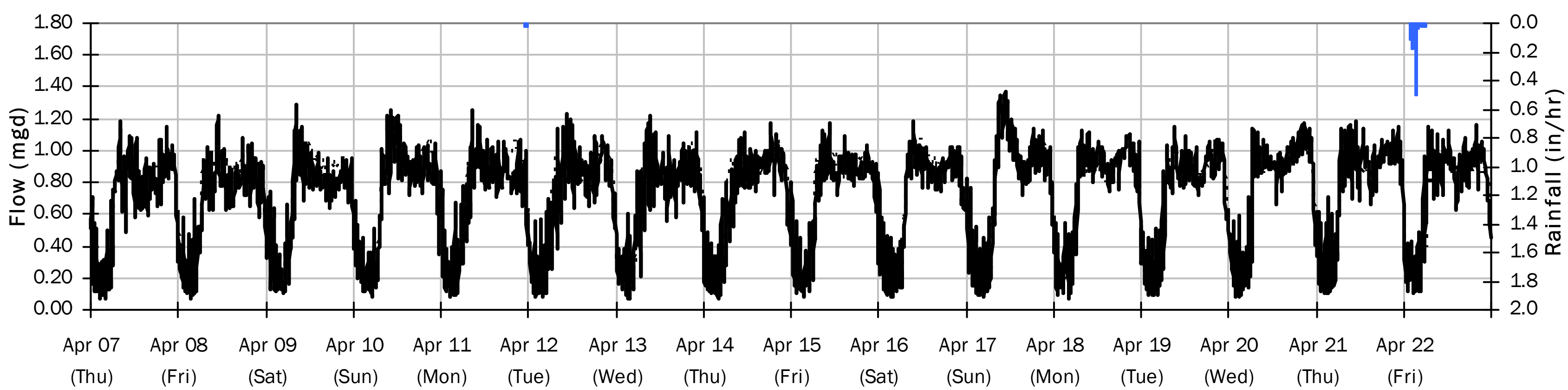
SITE 04

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 1.01 inches

Period Avg Flow: 0.756 mgd Period Peak Flow: 1.569 mgd Period Min Flow: 0.049 mgd

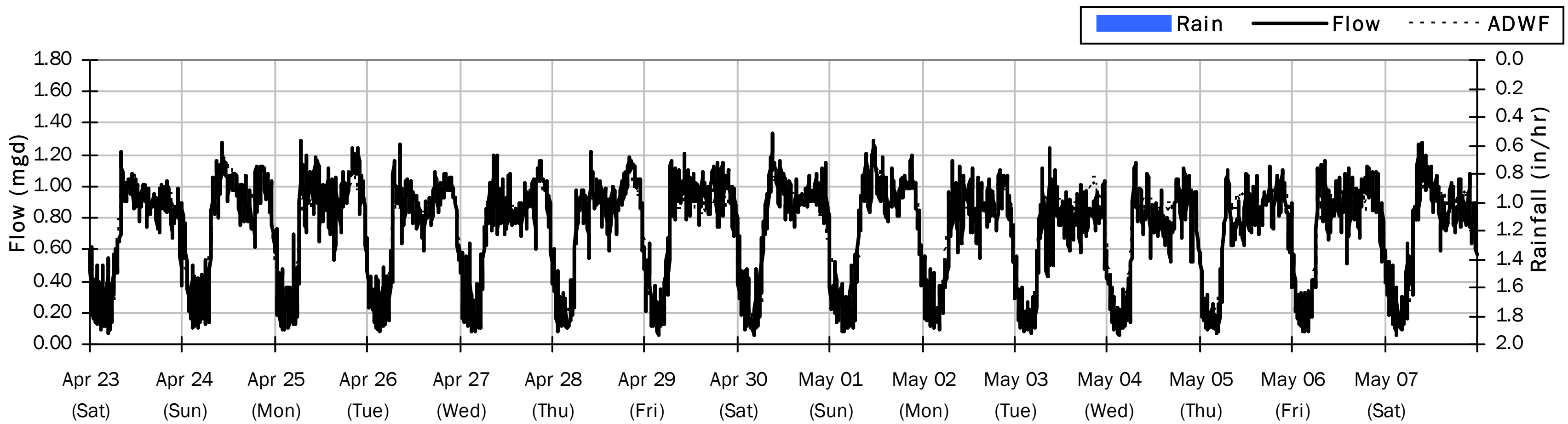


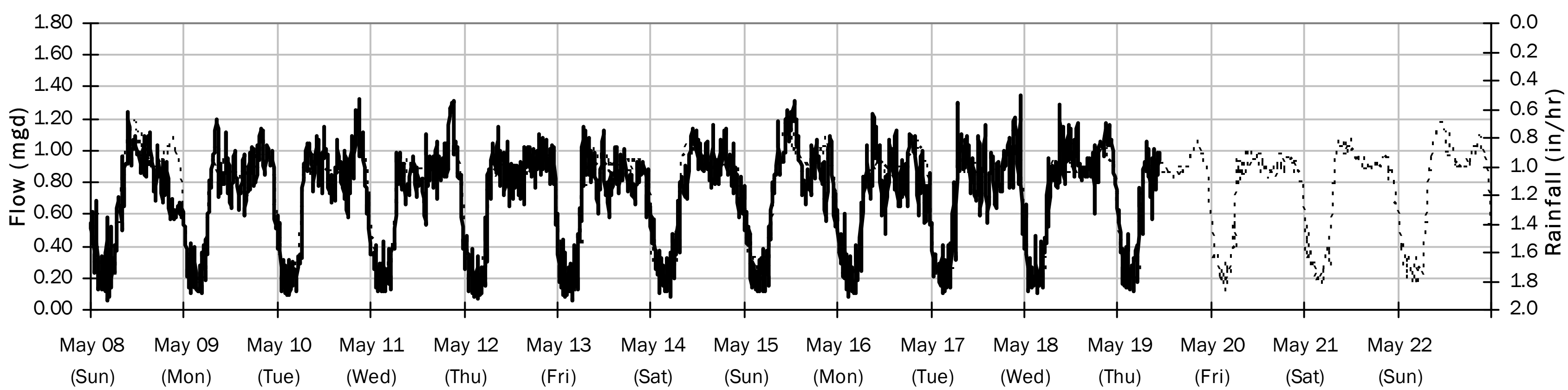


SITE 04
Flow Summary: 4/23/2022 to 5/22/2022

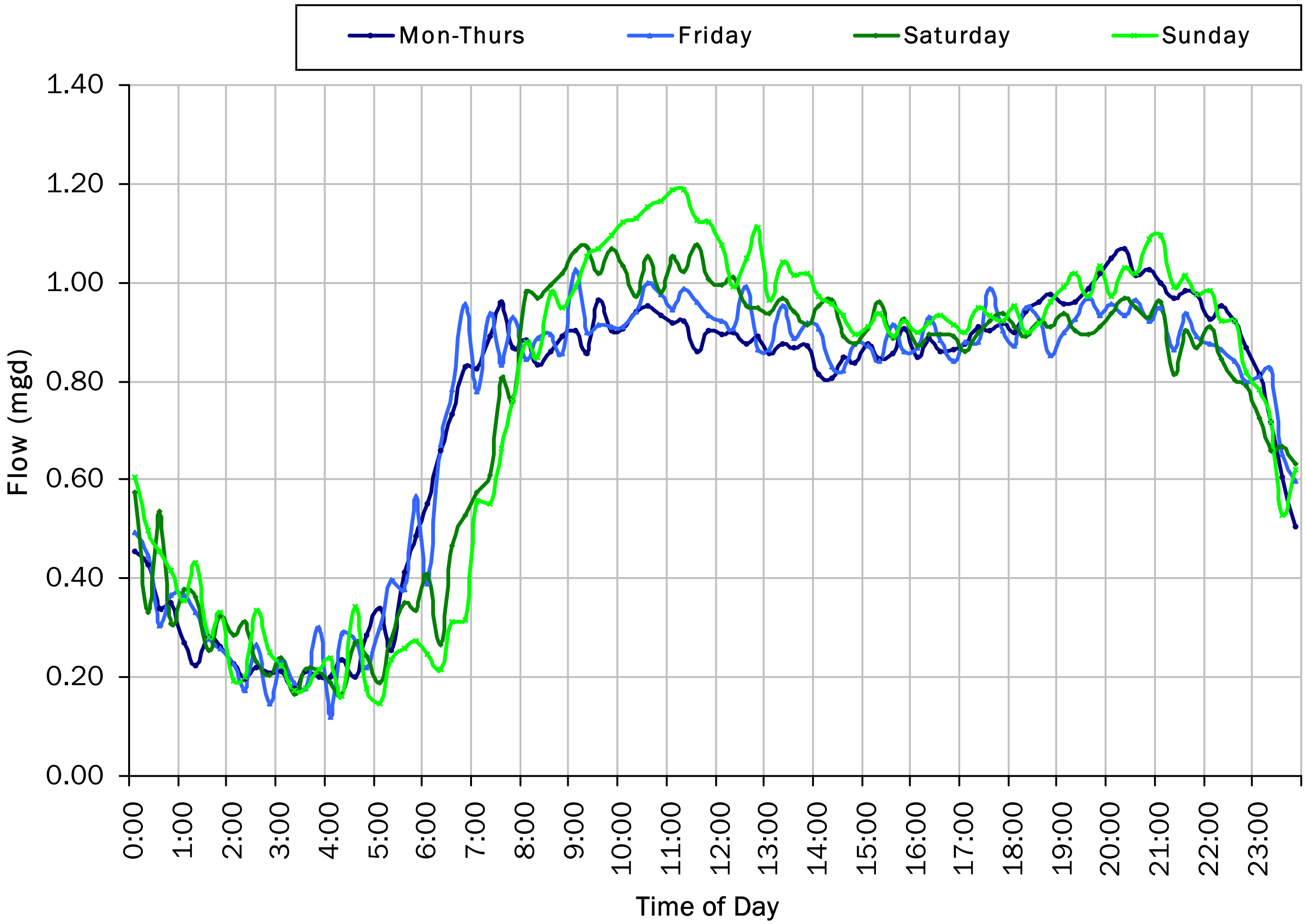
Period Rainfall: 0.00 inches

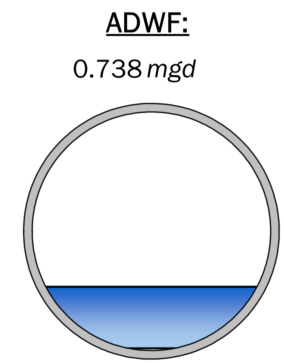
Period Avg Flow: 0.727 mgd   Period Peak Flow: 1.345 mgd   Period Min Flow: 0.053 mgd





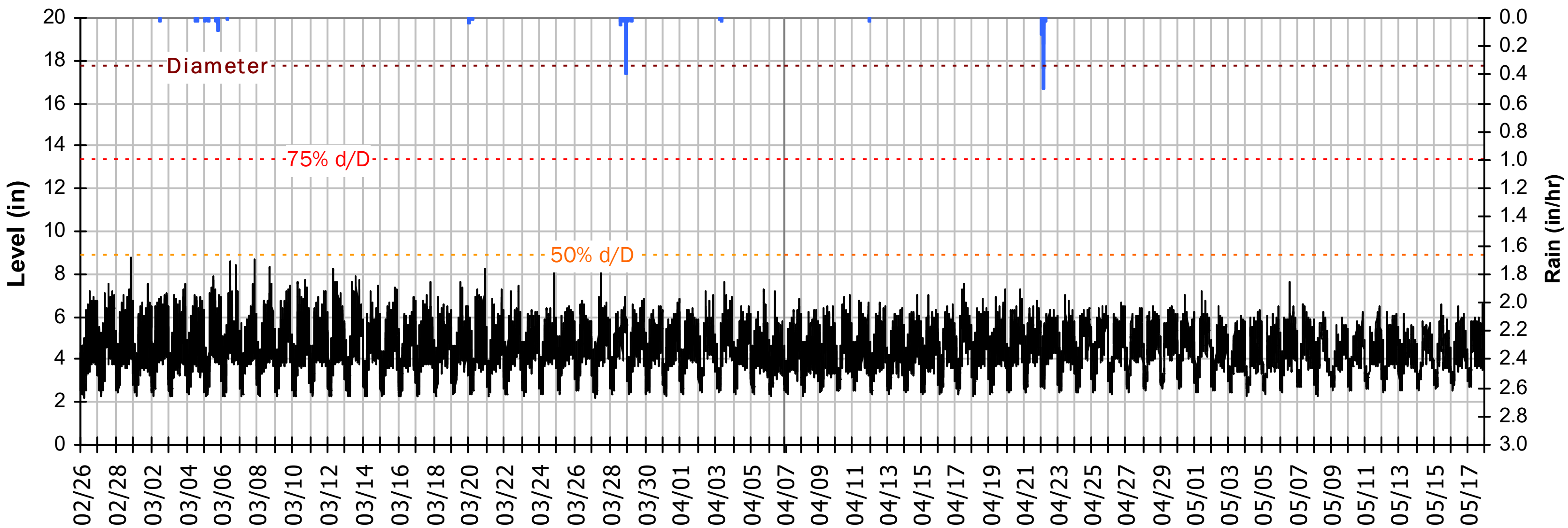
SITE 04
Average Dry Weather Flow Hydrographs

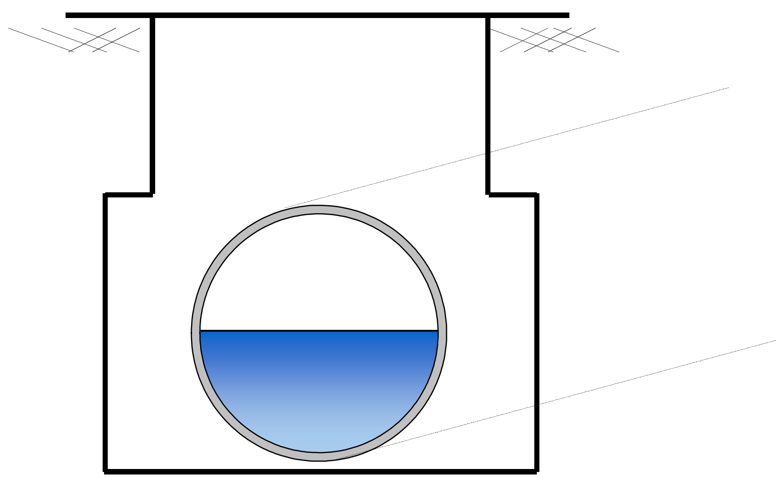




SITE 04
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

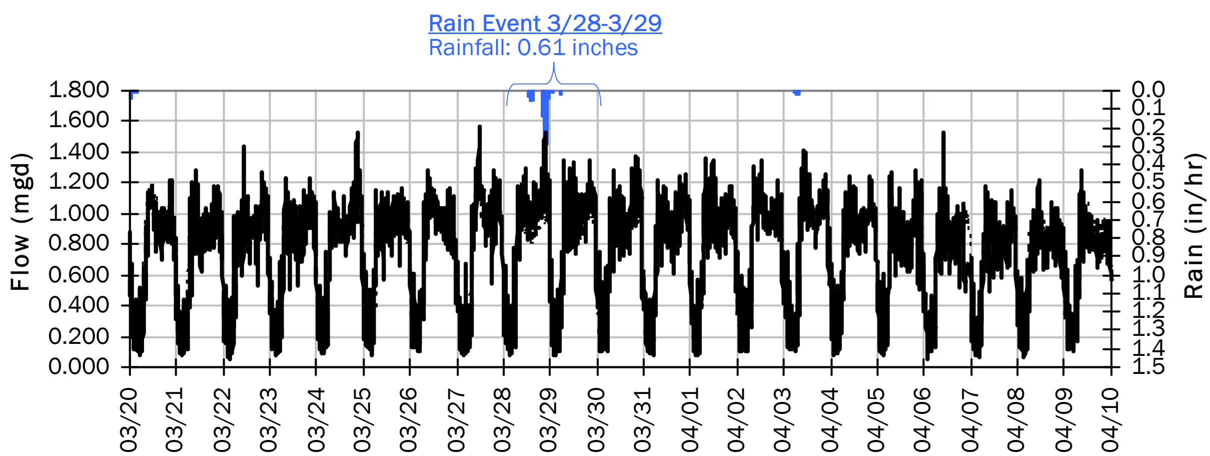




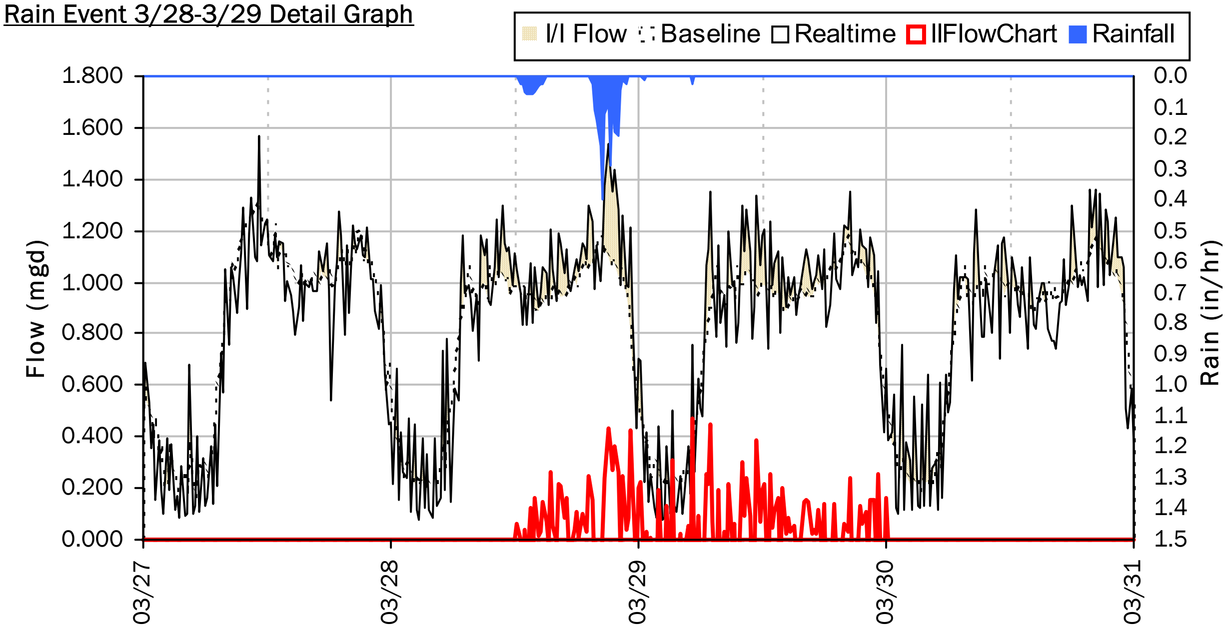
Pipe Diameter:	17.8	*inches*
Peak Measured Level:	9.07	*inches*
Peak d/D Ratio:	0.51	

SITE 04
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



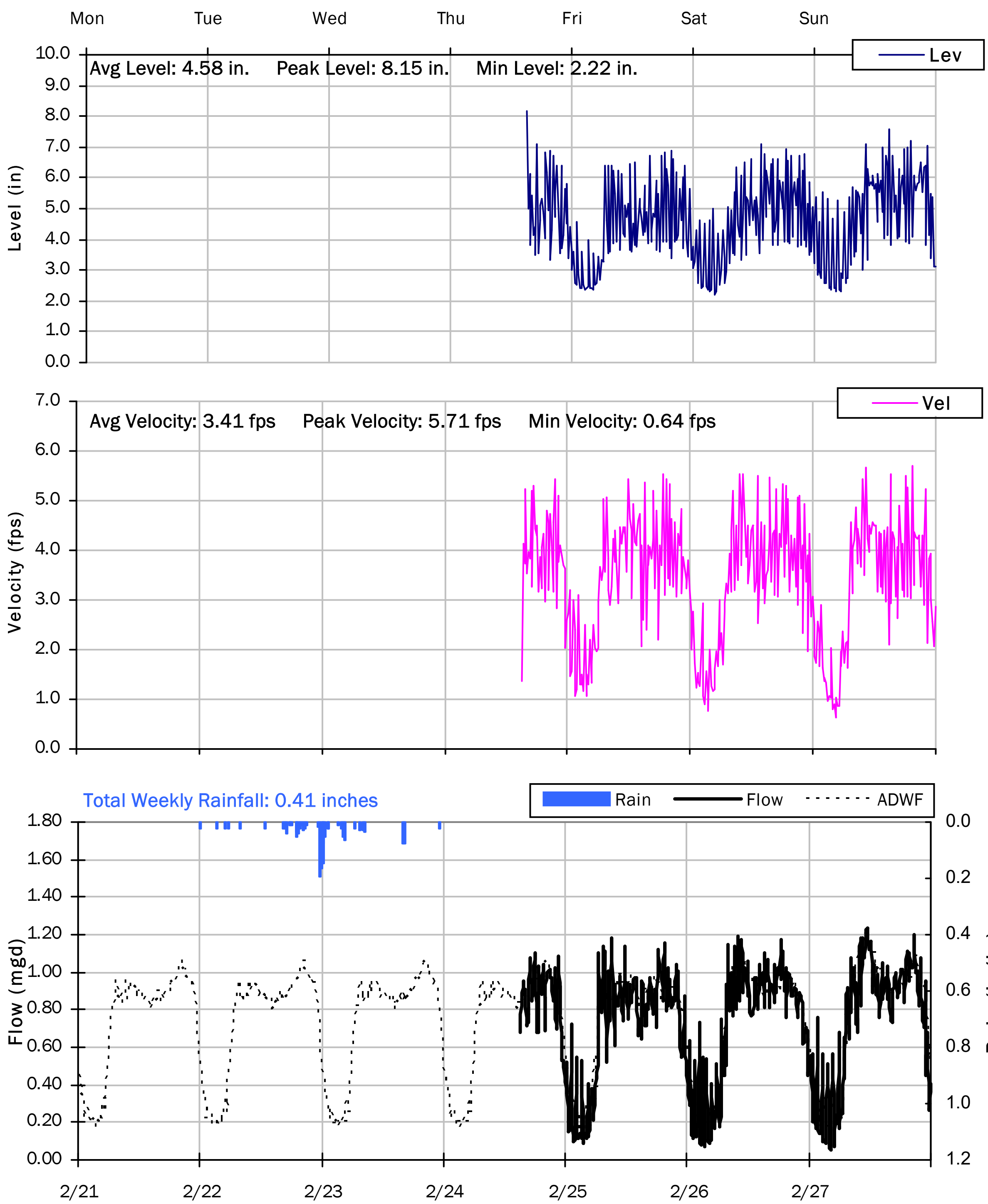
Storm Event I/I Analysis (Rain = 0.61 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	1.534 *mgd*	Peak I/I Rate:	0.475 *mgd*
PF:	2.08	Total I/I:	77,000 *gallons*
Peak Level:	6.93 *in*		
d/D Ratio:	0.39		

SITE 04

Weekly Level, Velocity and Flow Hydrographs

2/21/2022 to 2/28/2022

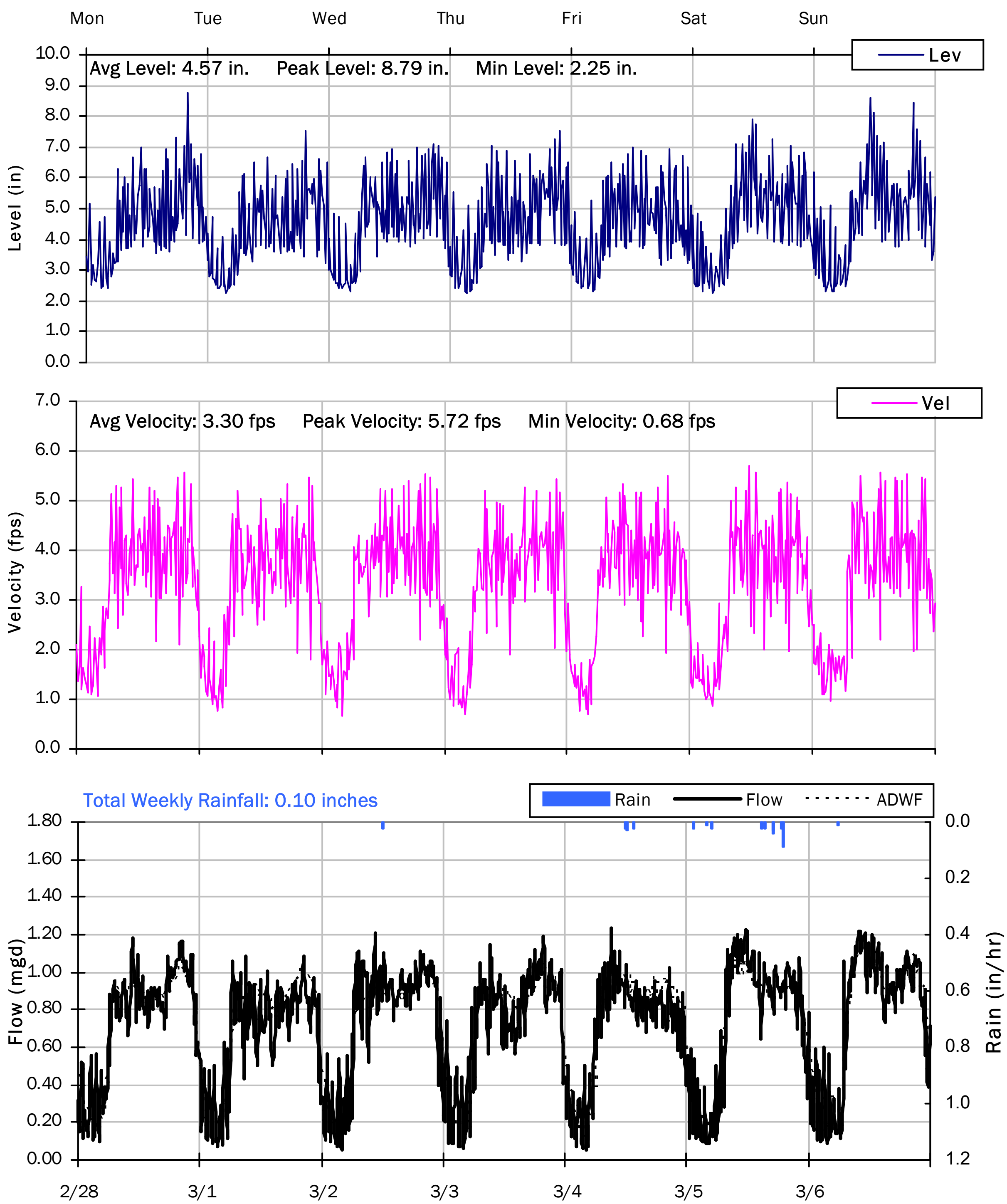


Avg Flow: 0.738 mgd Peak Flow: 1.239 mgd Min Flow: 0.054 mgd

SITE 04

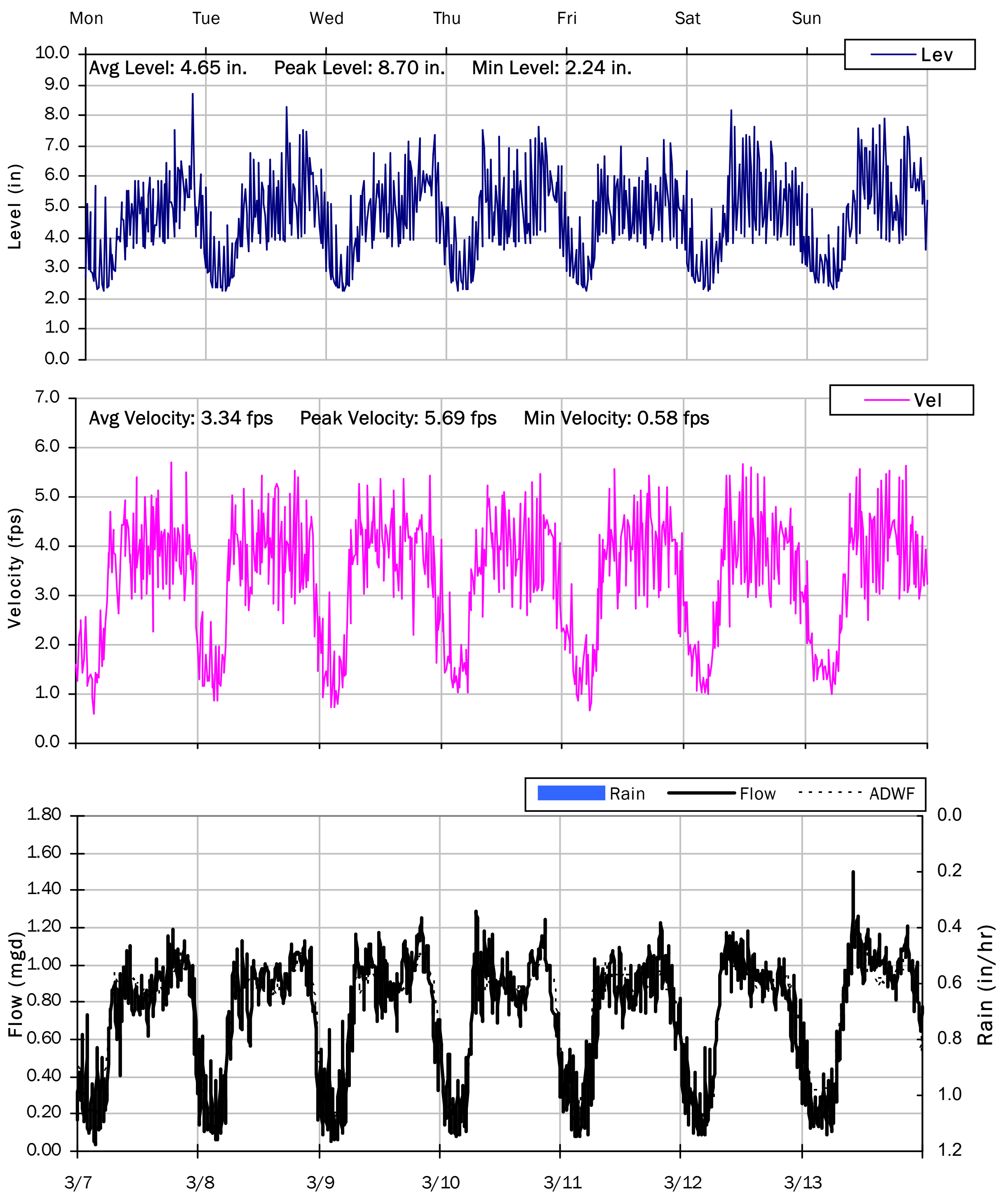
Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022



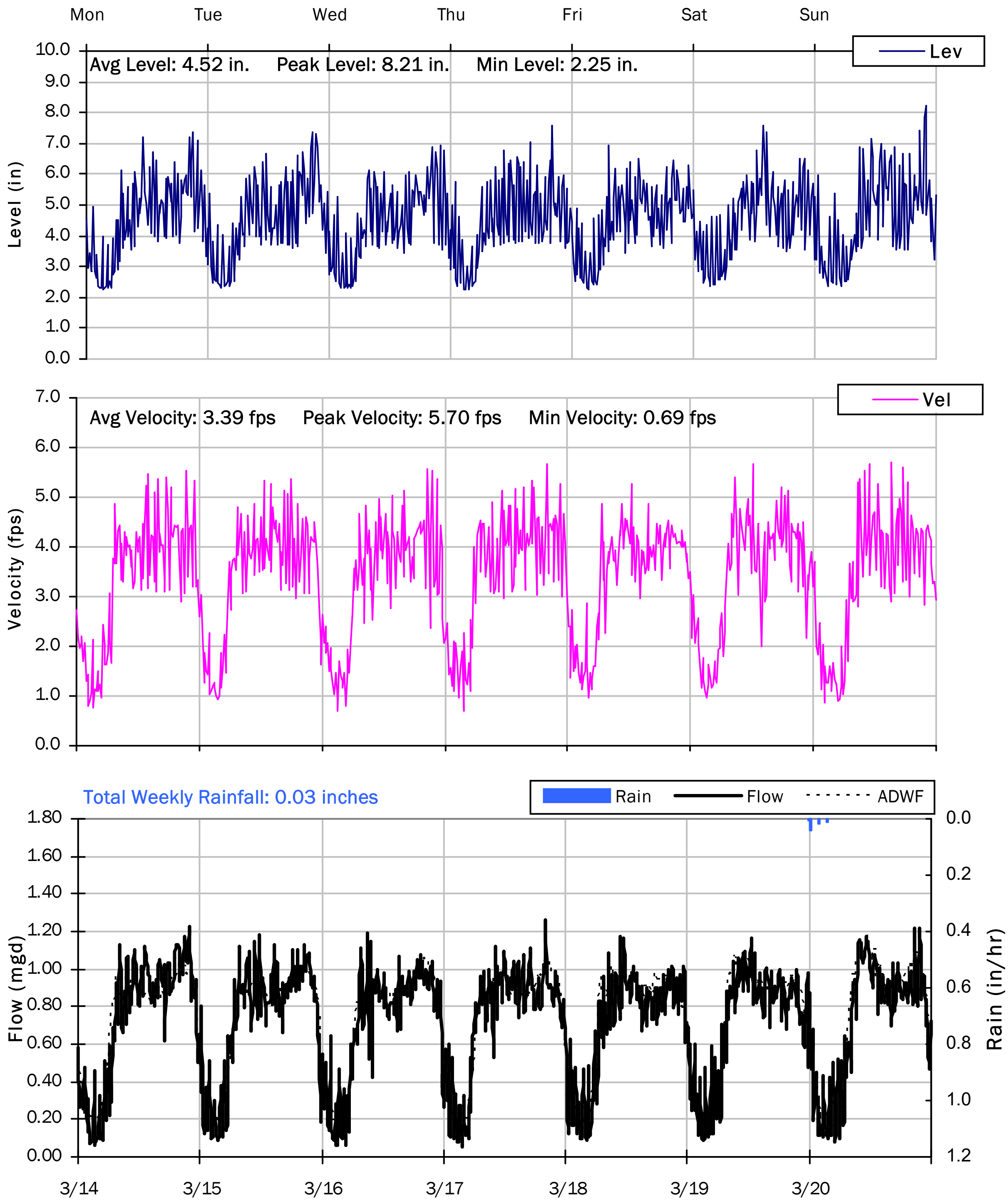
Avg Flow: 0.719 mgd Peak Flow: 1.236 mgd Min Flow: 0.058 mgd

SITE 04
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022



Avg Flow: 0.742 mgd Peak Flow: 1.503 mgd Min Flow: 0.047 mgd

SITE 04
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022

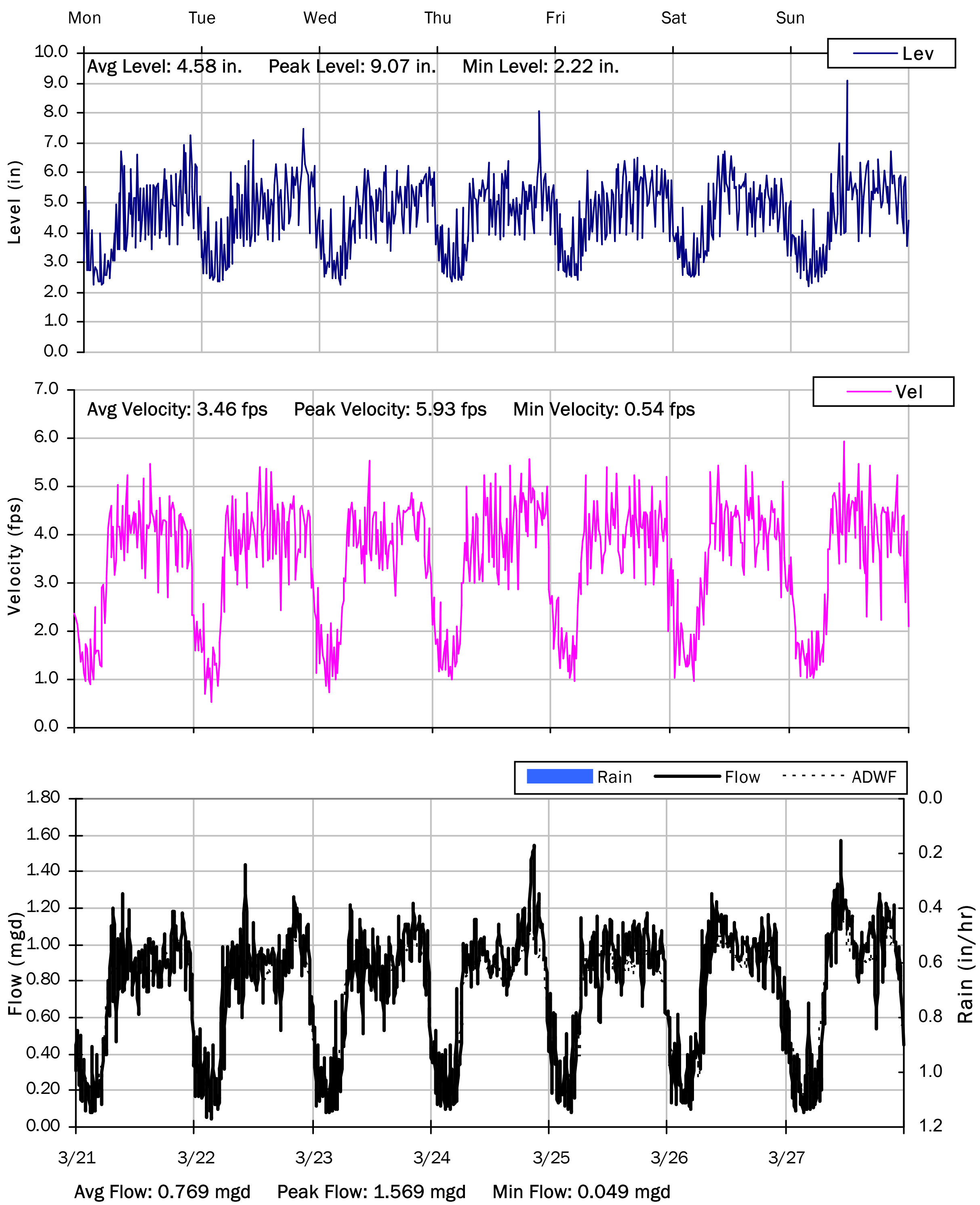


Avg Flow: 0.719 mgd   Peak Flow: 1.264 mgd   Min Flow: 0.057 mgd

SITE 04

Weekly Level, Velocity and Flow Hydrographs

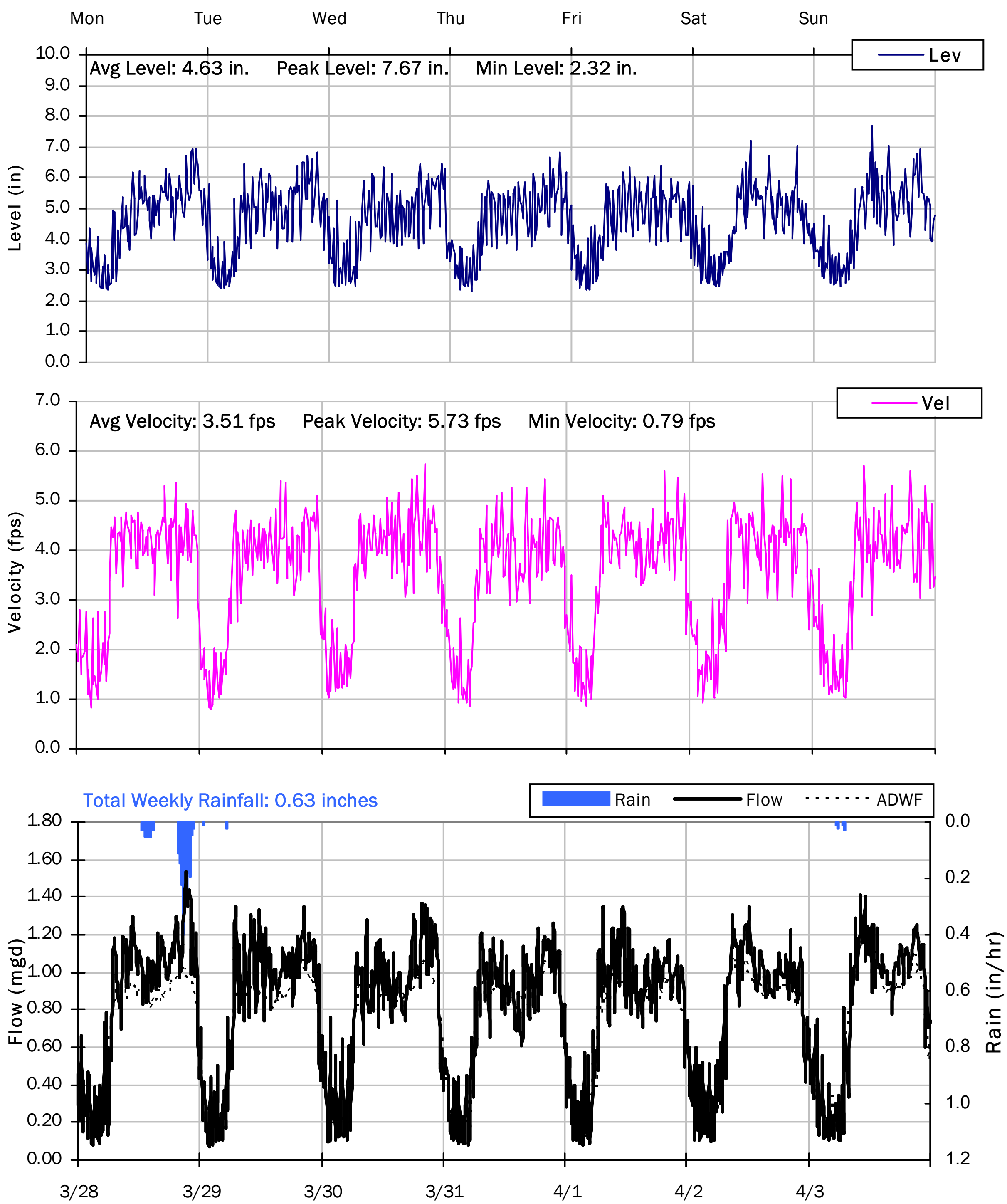
3/21/2022 to 3/28/2022



SITE 04

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

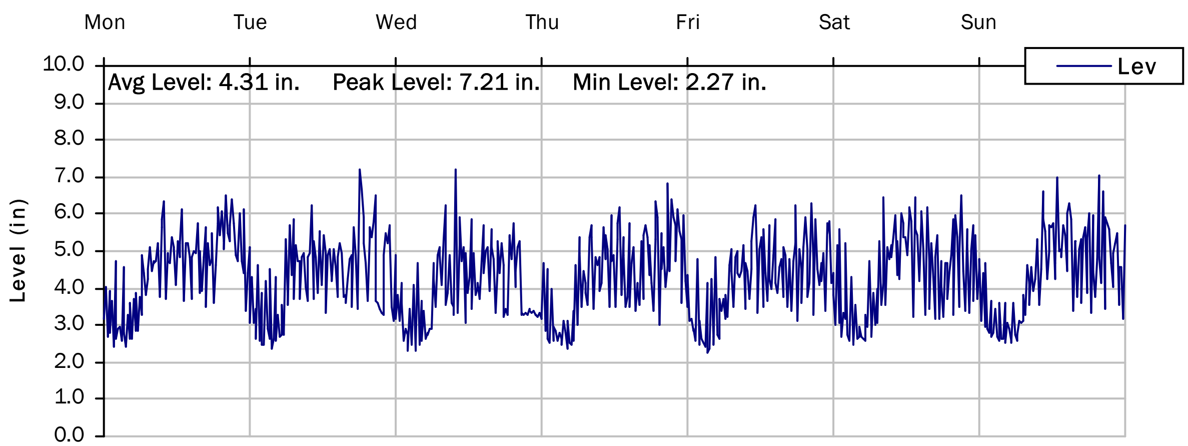


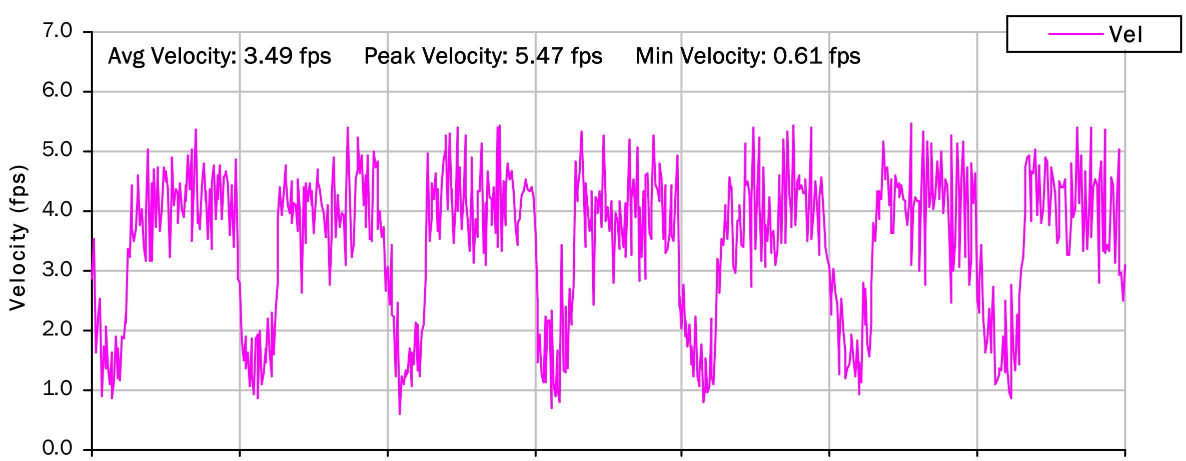
Avg Flow: 0.816 mgd   Peak Flow: 1.534 mgd   Min Flow: 0.076 mgd

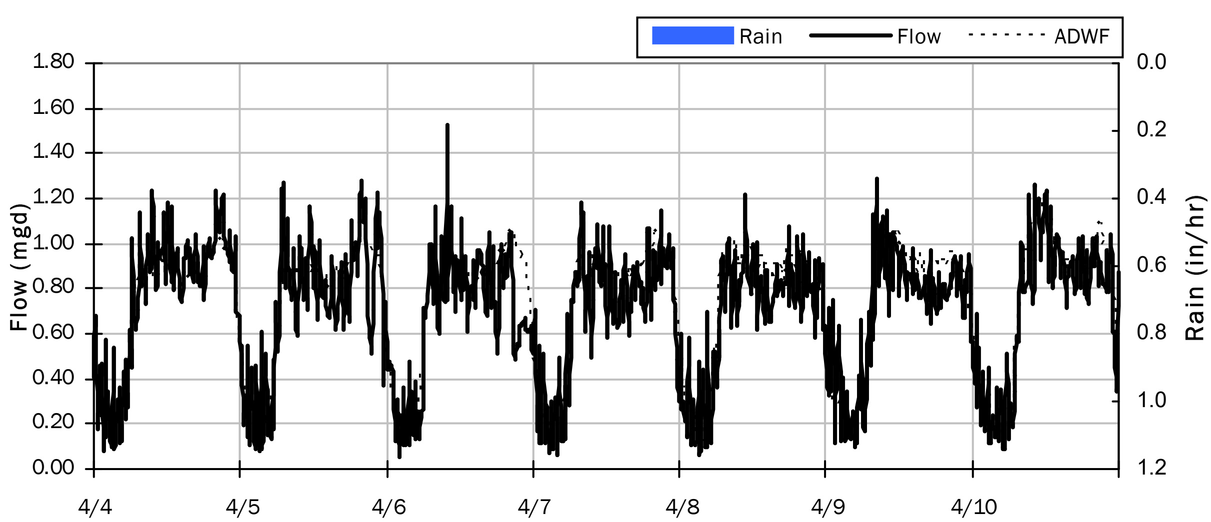
SITE 04

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022





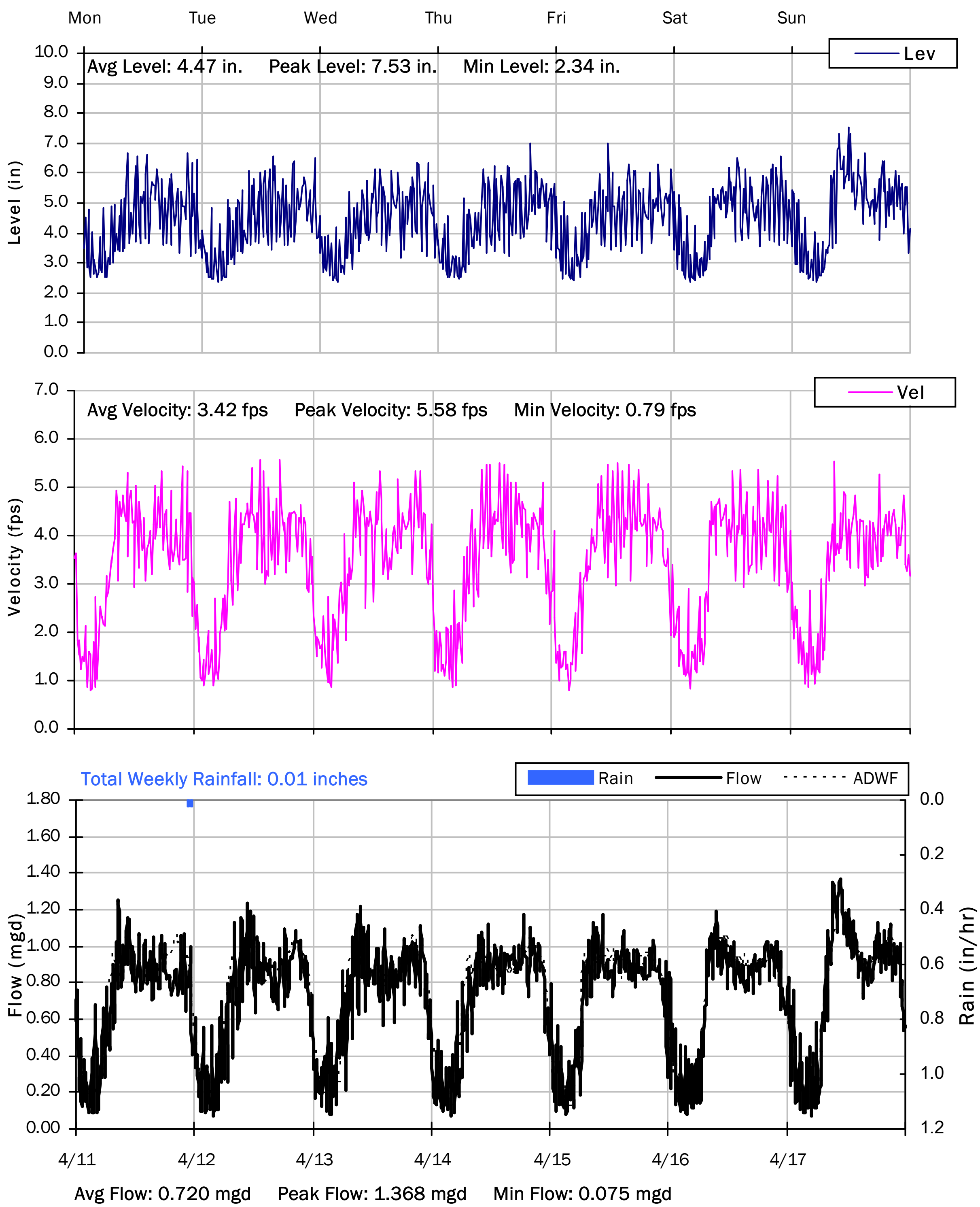


Avg Flow: 0.708 mgd Peak Flow: 1.524 mgd Min Flow: 0.053 mgd

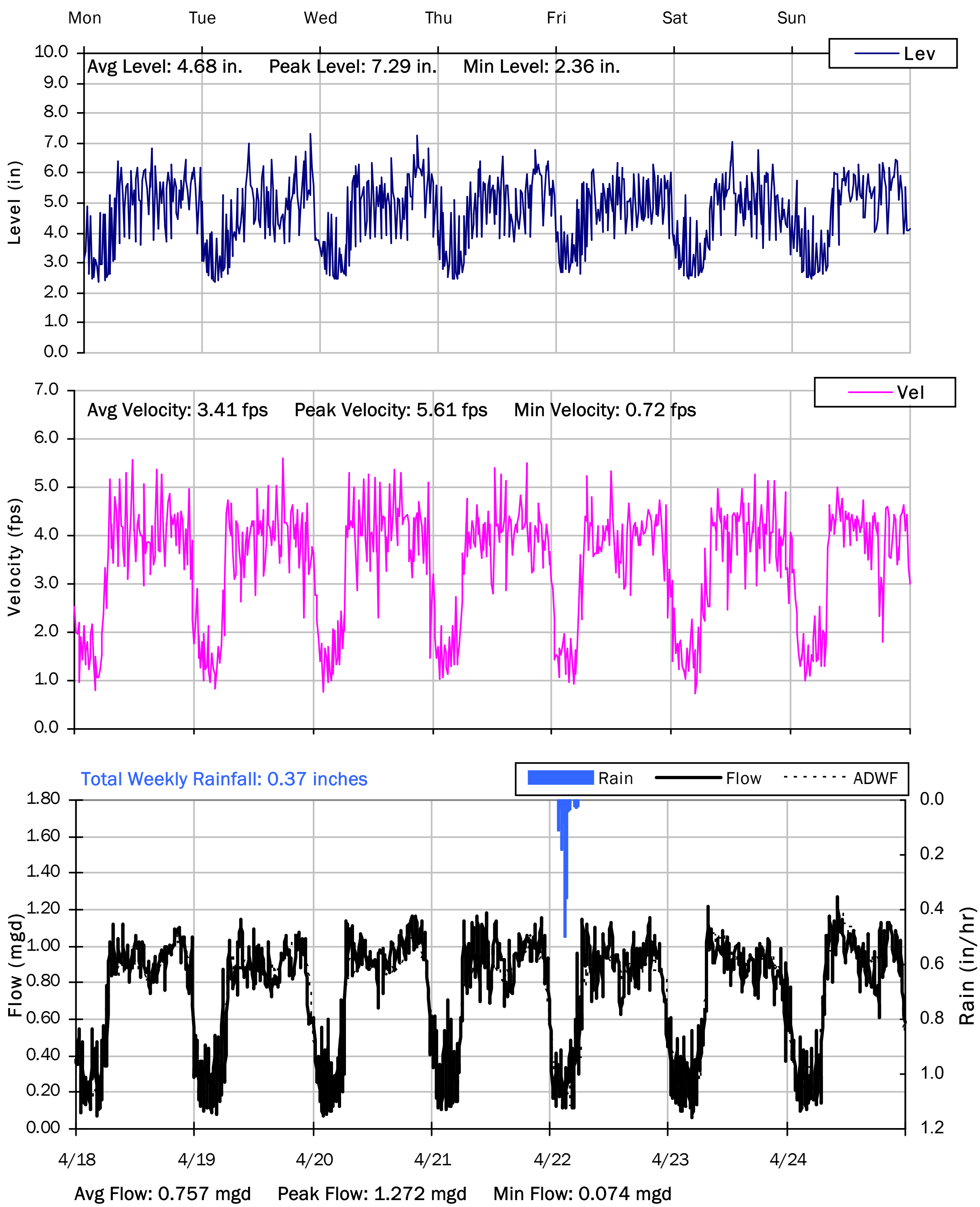
SITE 04

Weekly Level, Velocity and Flow Hydrographs

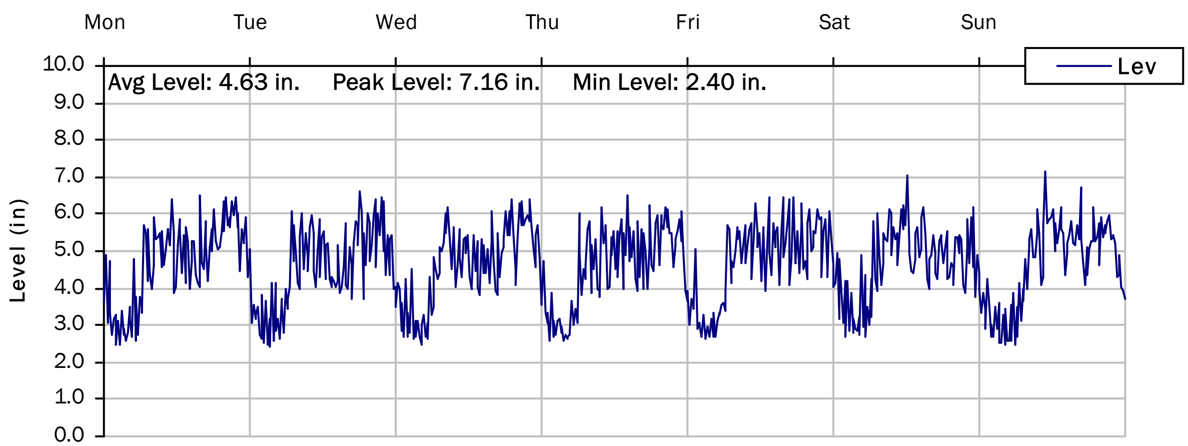
4/11/2022 to 4/18/2022

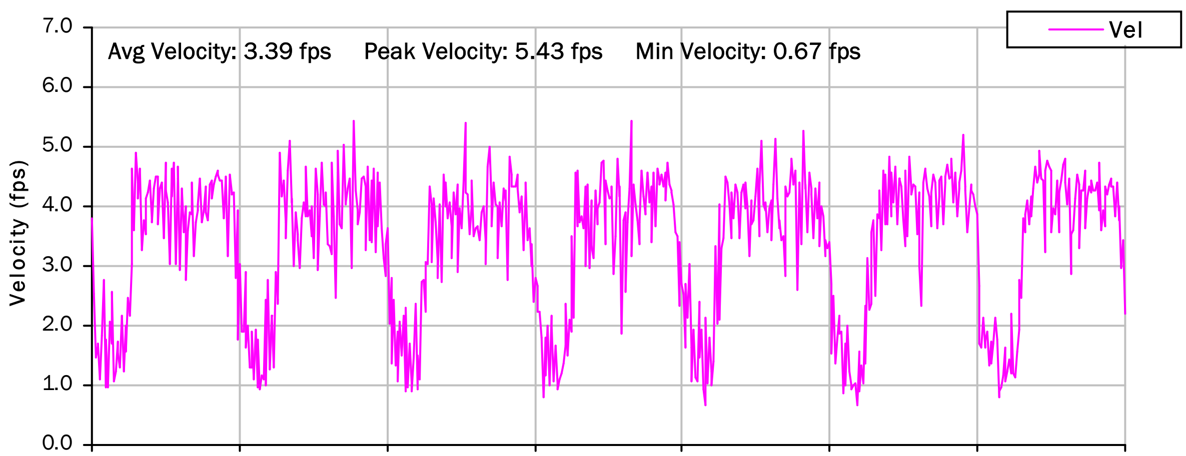


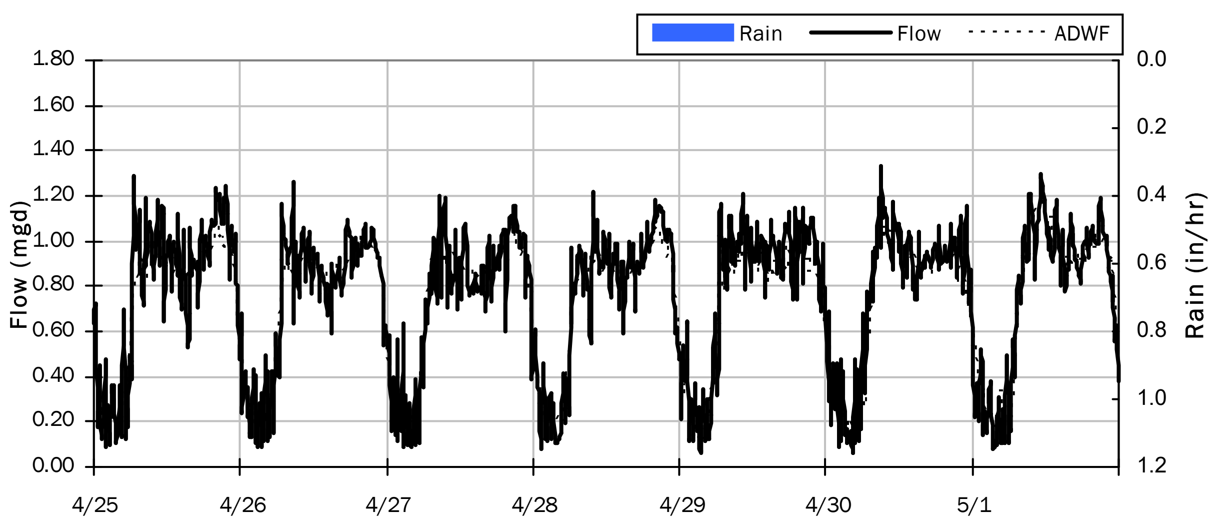
SITE 04
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



SITE 04
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

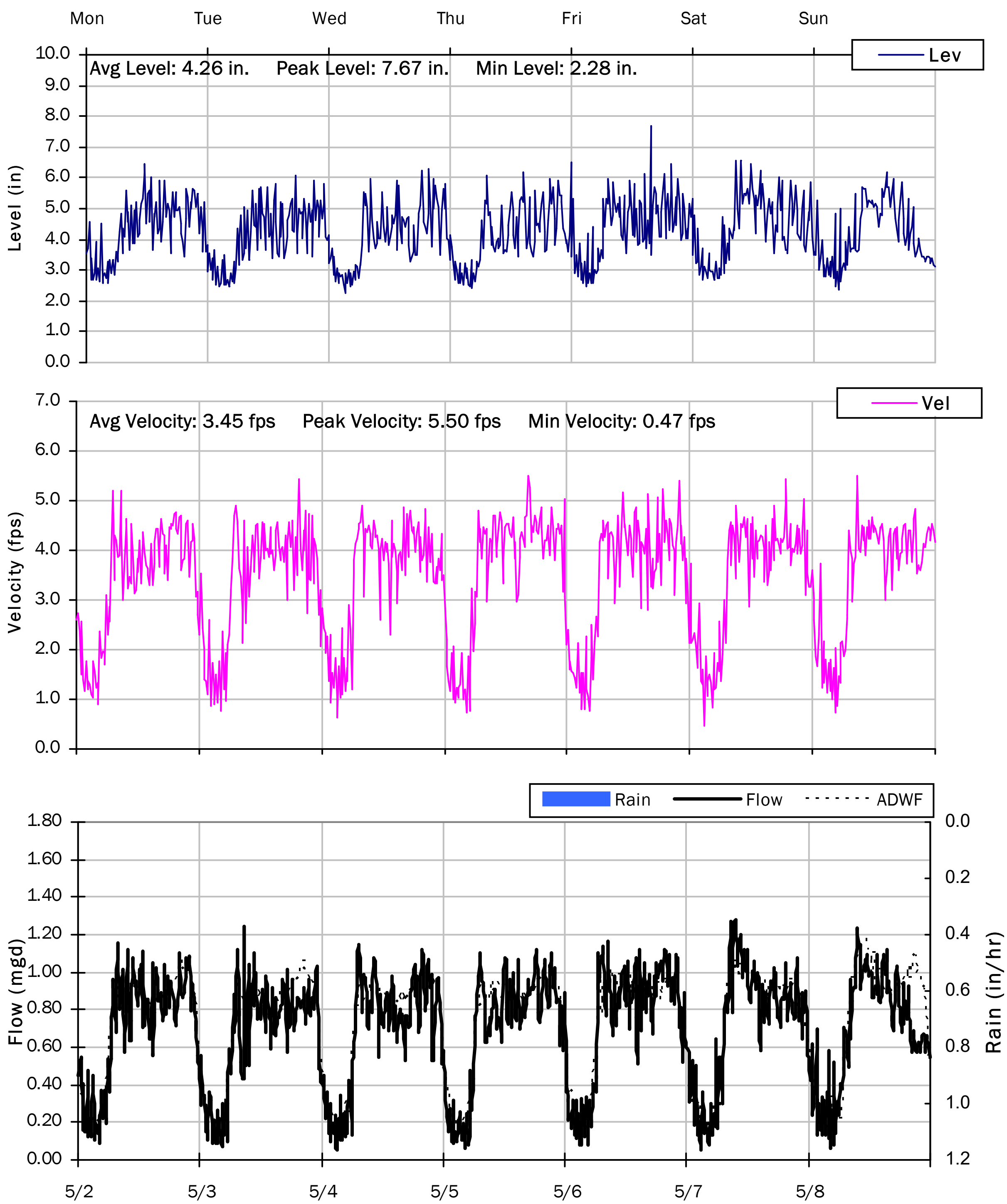






Avg Flow: 0.762 mgd Peak Flow: 1.336 mgd Min Flow: 0.072 mgd

SITE 04
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

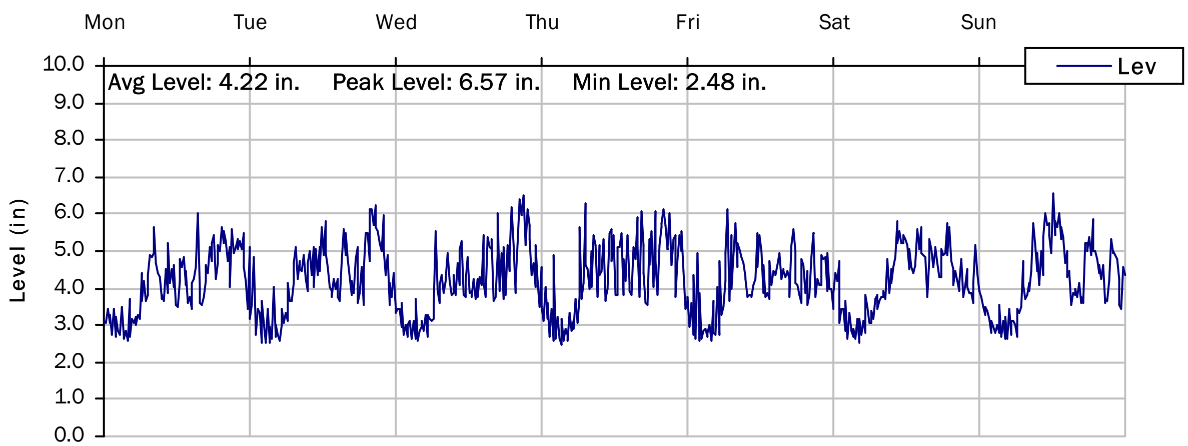


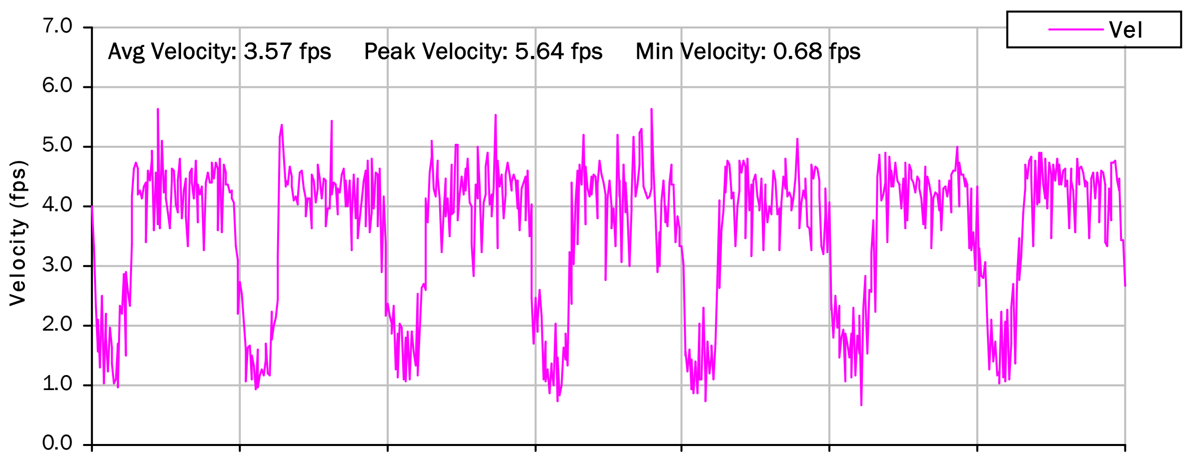
Avg Flow: 0.698 mgd Peak Flow: 1.276 mgd Min Flow: 0.053 mgd

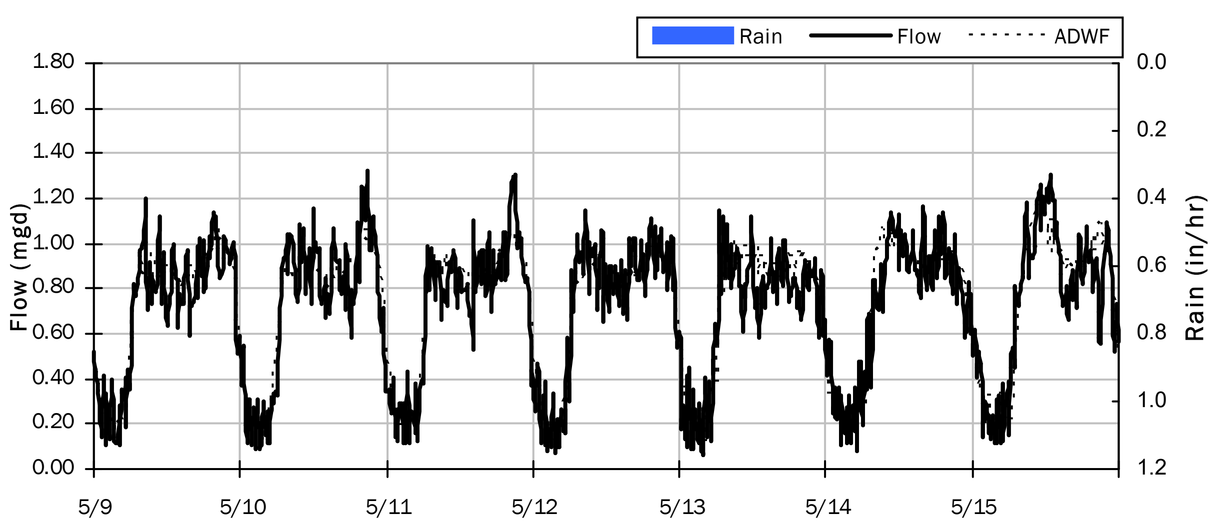
SITE 04

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022

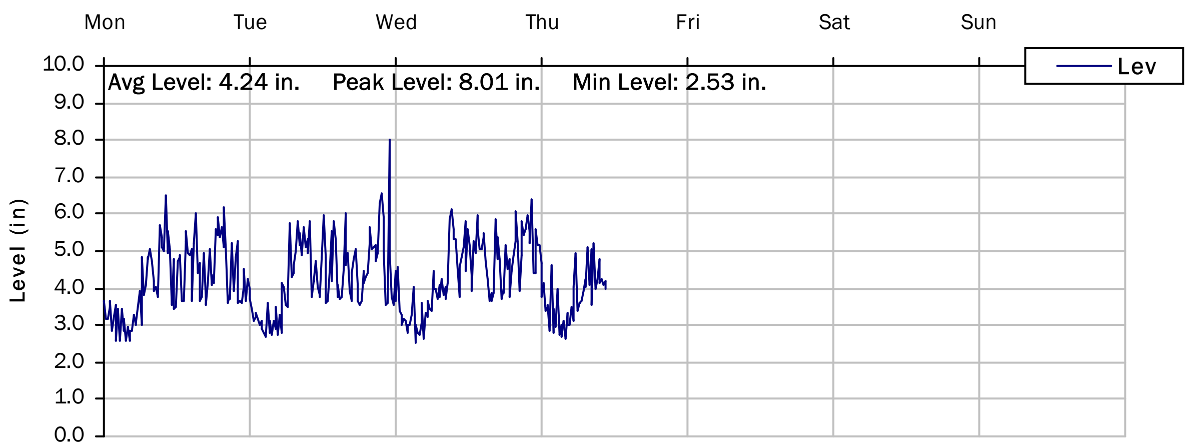


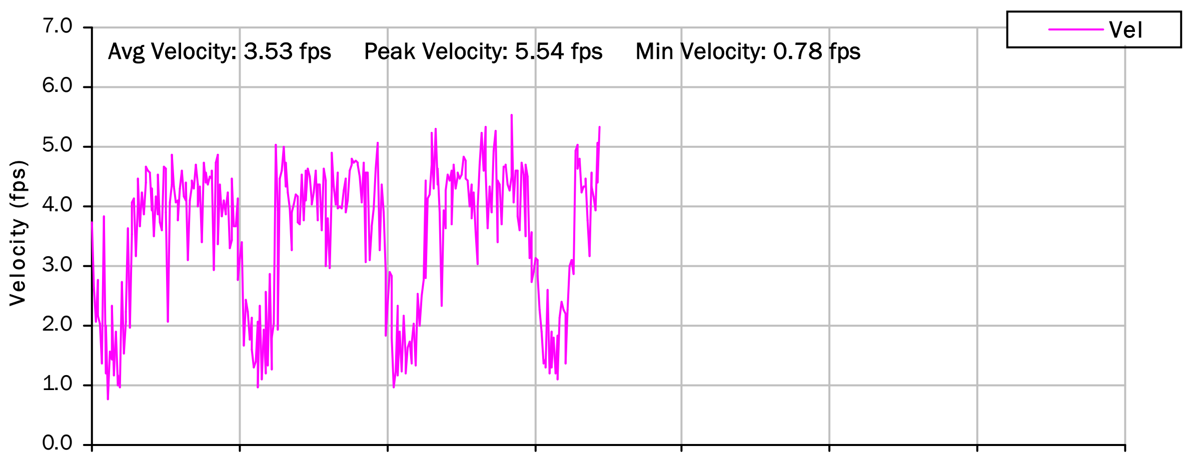


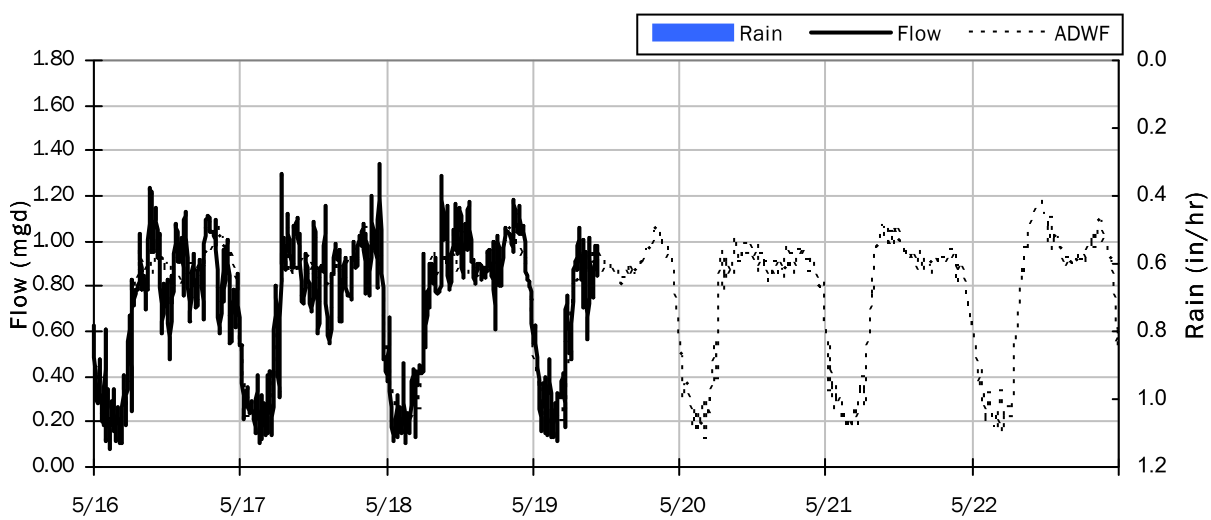


Avg Flow: 0.721 mgd Peak Flow: 1.320 mgd Min Flow: 0.075 mgd

SITE 04
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Avg Flow: 0.717 mgd Peak Flow: 1.345 mgd Min Flow: 0.077 mgd

Monitoring Site: Site 05

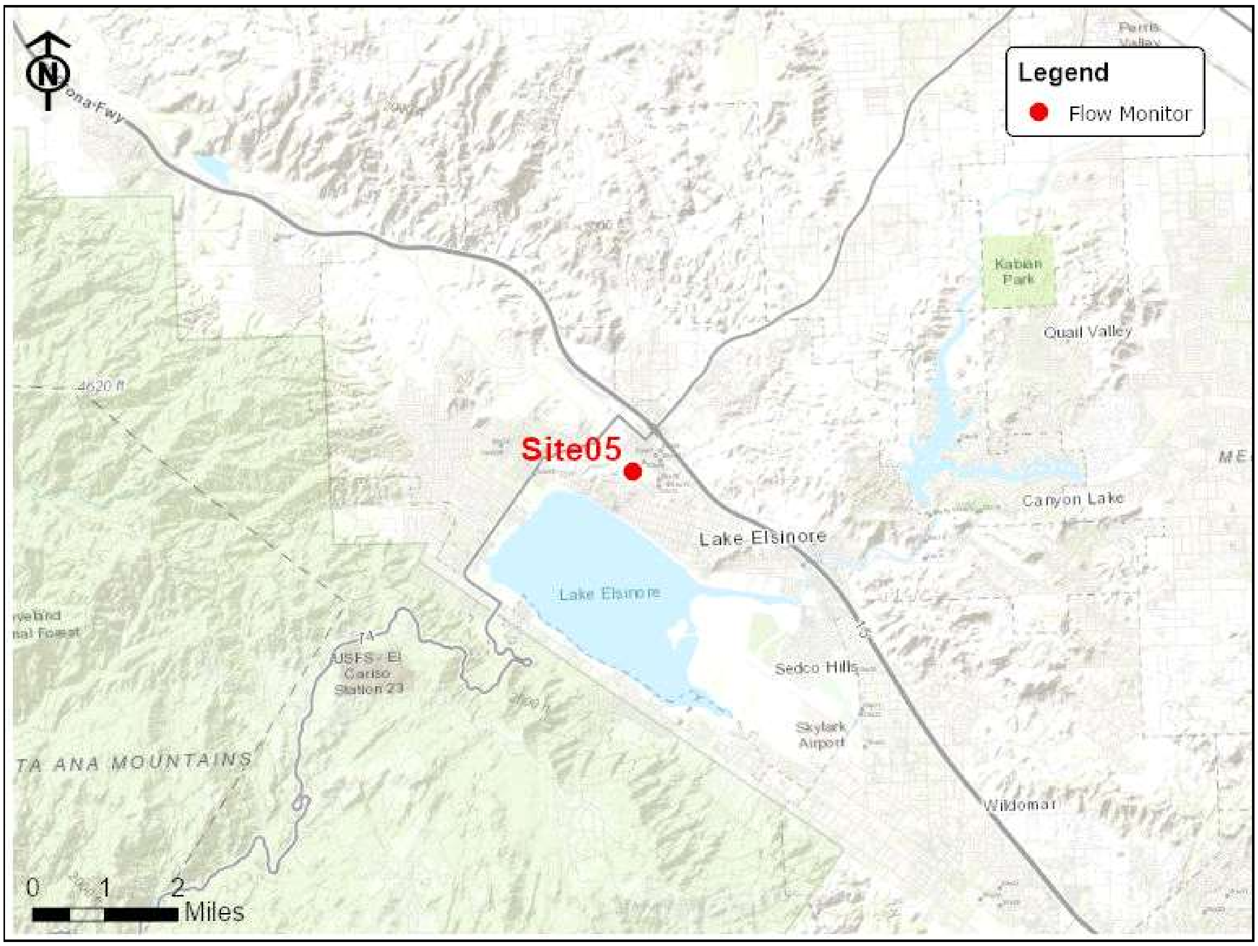
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Regional WRF

Data Summary Report



Vicinity Map: Site 05

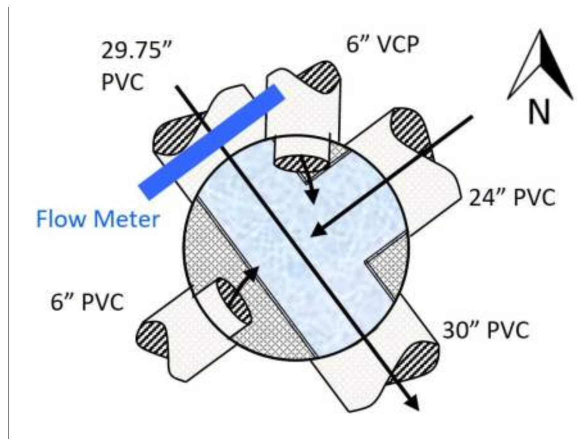
SITE 05

Site Information MH ID: MH-1439

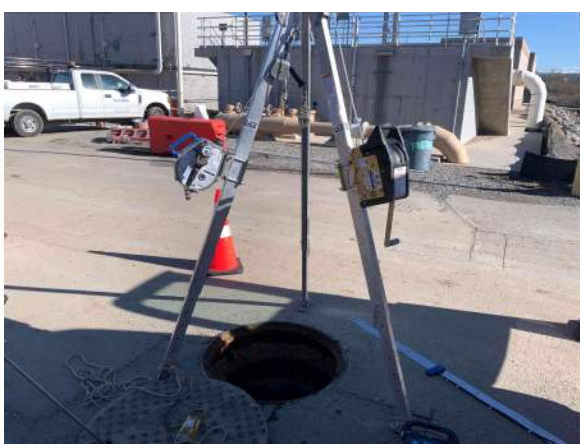
Location:	Regional WRF
Coordinates:	117.3433° W, 33.6837° N
Rim Elevation (Earth):	1271 feet
Expected Pipe Diameter:	24 inches
Measured Pipe Diameter:	29.75 inches
ADWF:	1.293 mgd
Peak Measured Flow:	2.645 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 05

Additional Site Photos

Effluent Pipe

E Influent Pipe

SITE 05

Additional Site Photos

N Influent Pipe

W Influent Pipe

SITE 05

Additional Site Photos

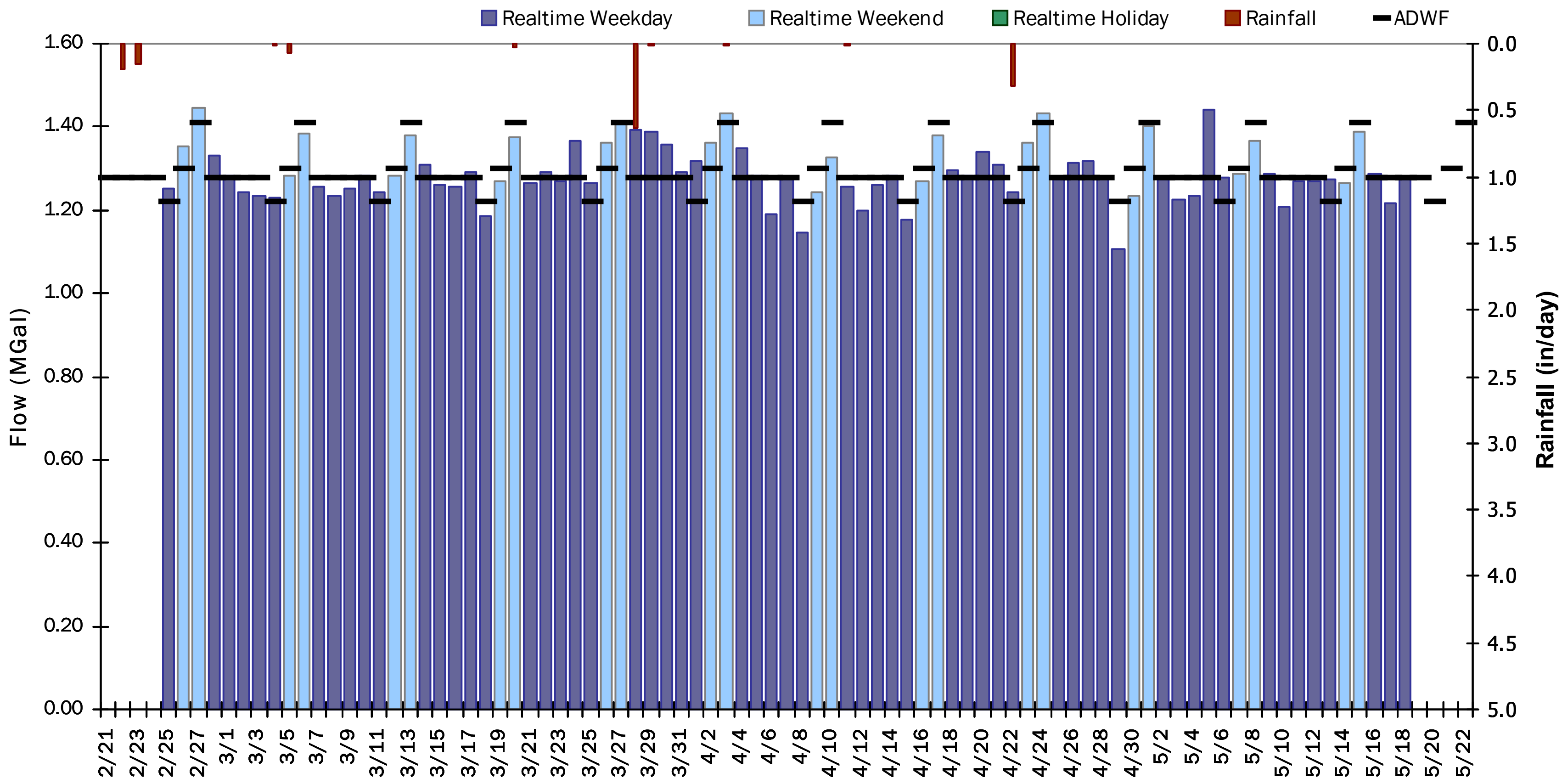
Monitored NW Influent Pipe

SITE 05

Period Flow Summary: Daily Flow Totals

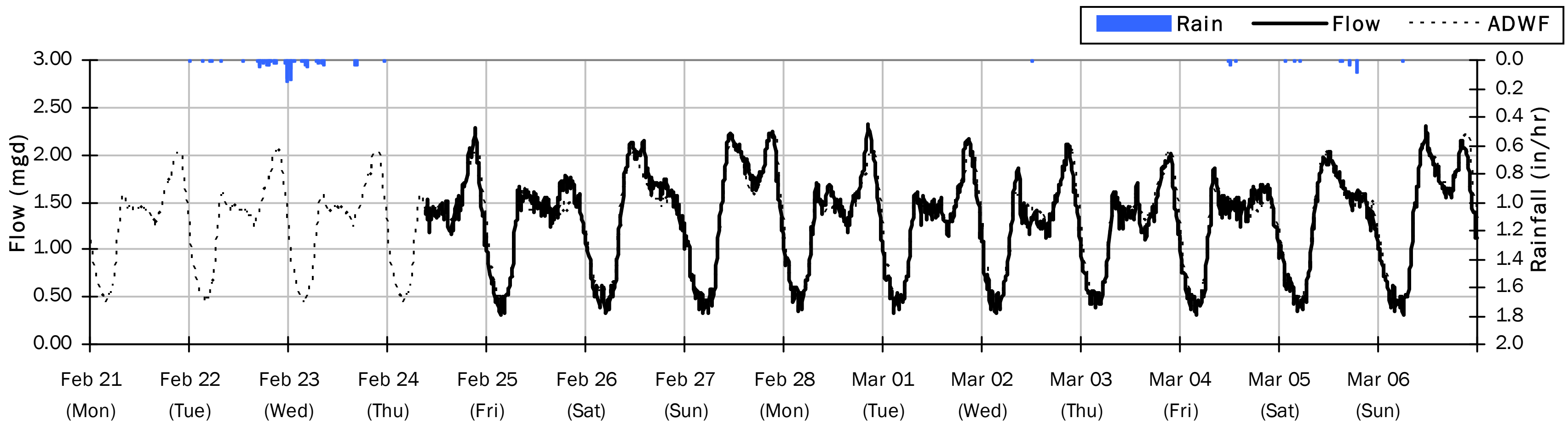
Avg Daily Flow: 1.292 MGal   Peak Daily Flow: 1.536 MGal   Min Daily Flow: 0.937 MGal

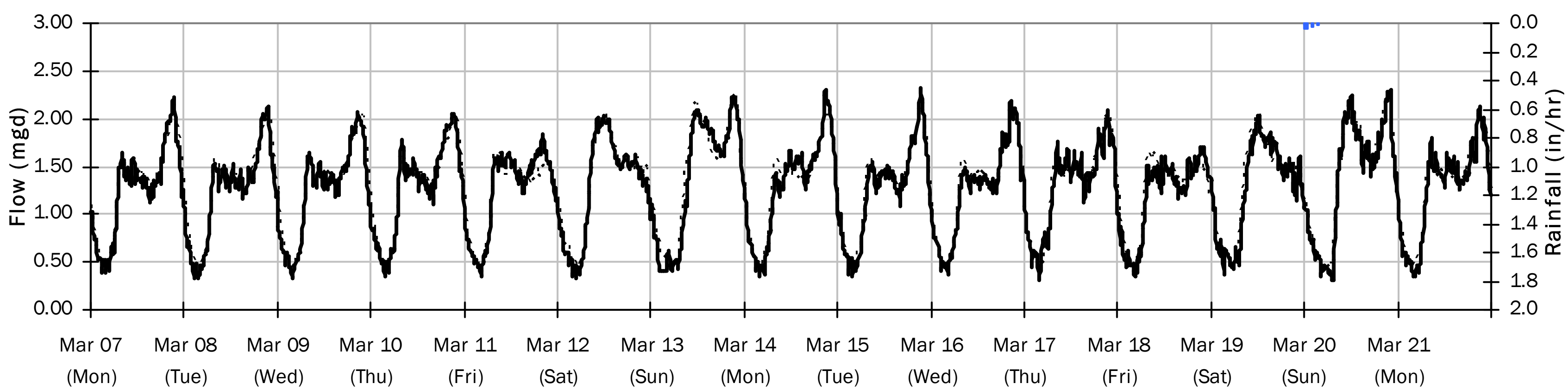
Total Rainfall: 1.12 inches



SITE 05
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.48 inches   Period Avg Flow: 1.293 mgd   Period Peak Flow: 2.332 mgd   Period Min Flow: 0.308 mgd



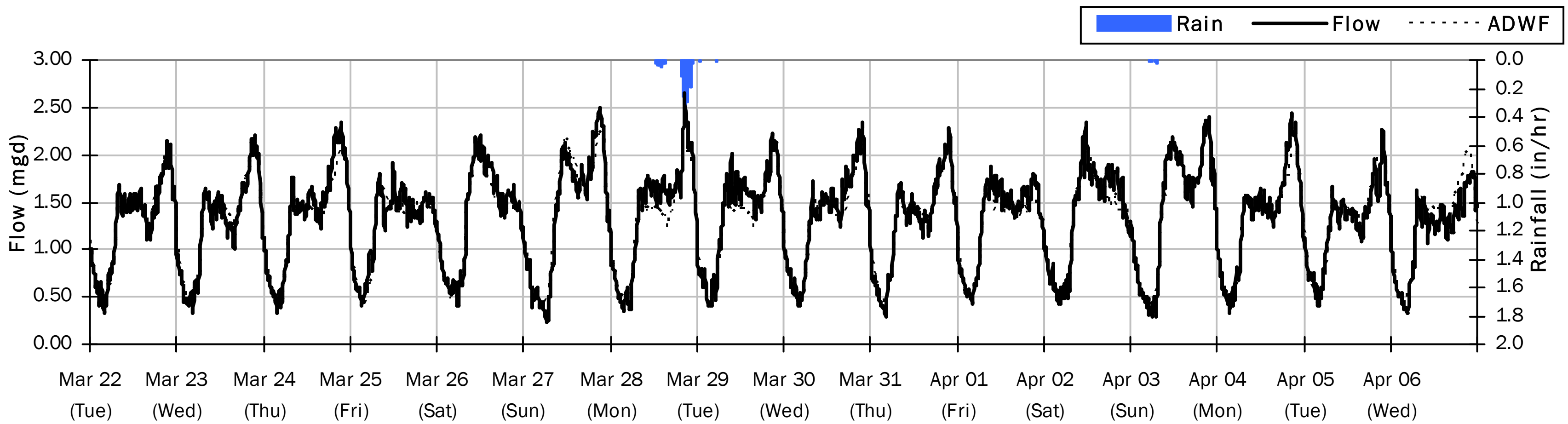


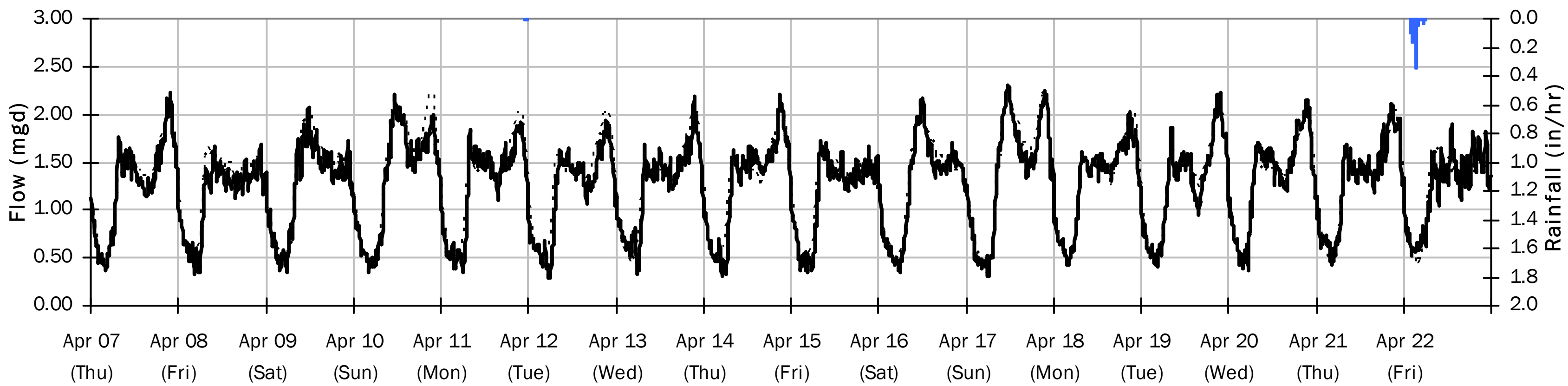
SITE 05

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.99 inches

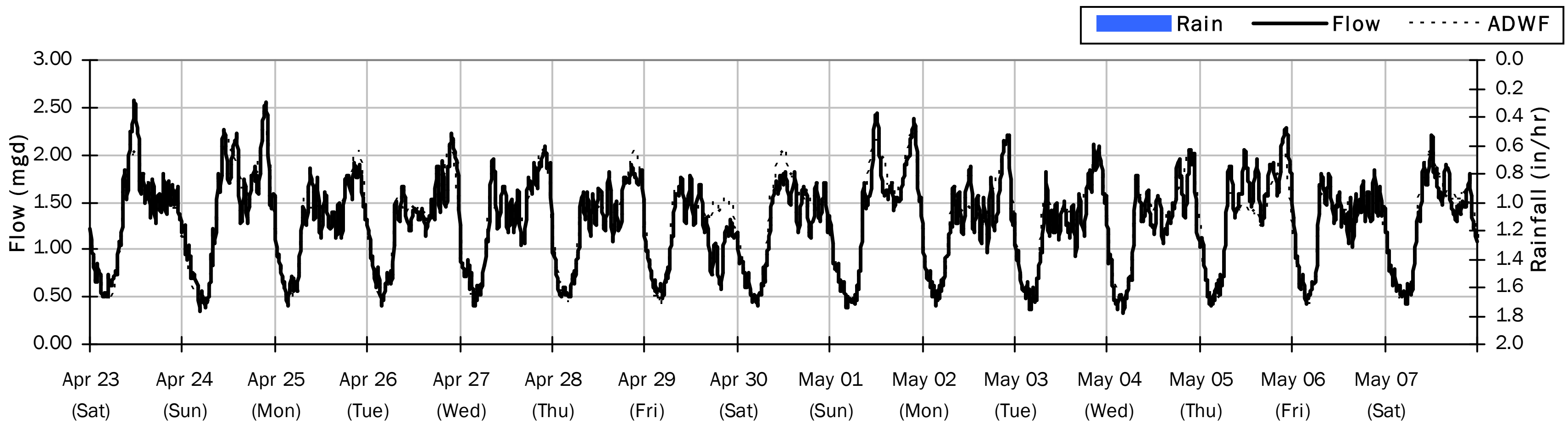
Period Avg Flow: 1.300 mgd Period Peak Flow: 2.645 mgd Period Min Flow: 0.238 mgd

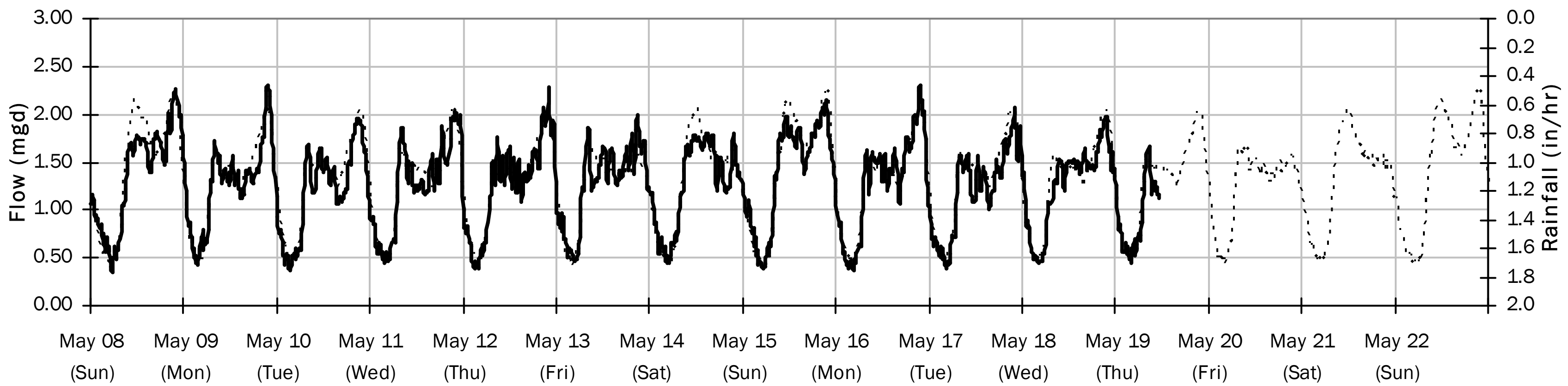




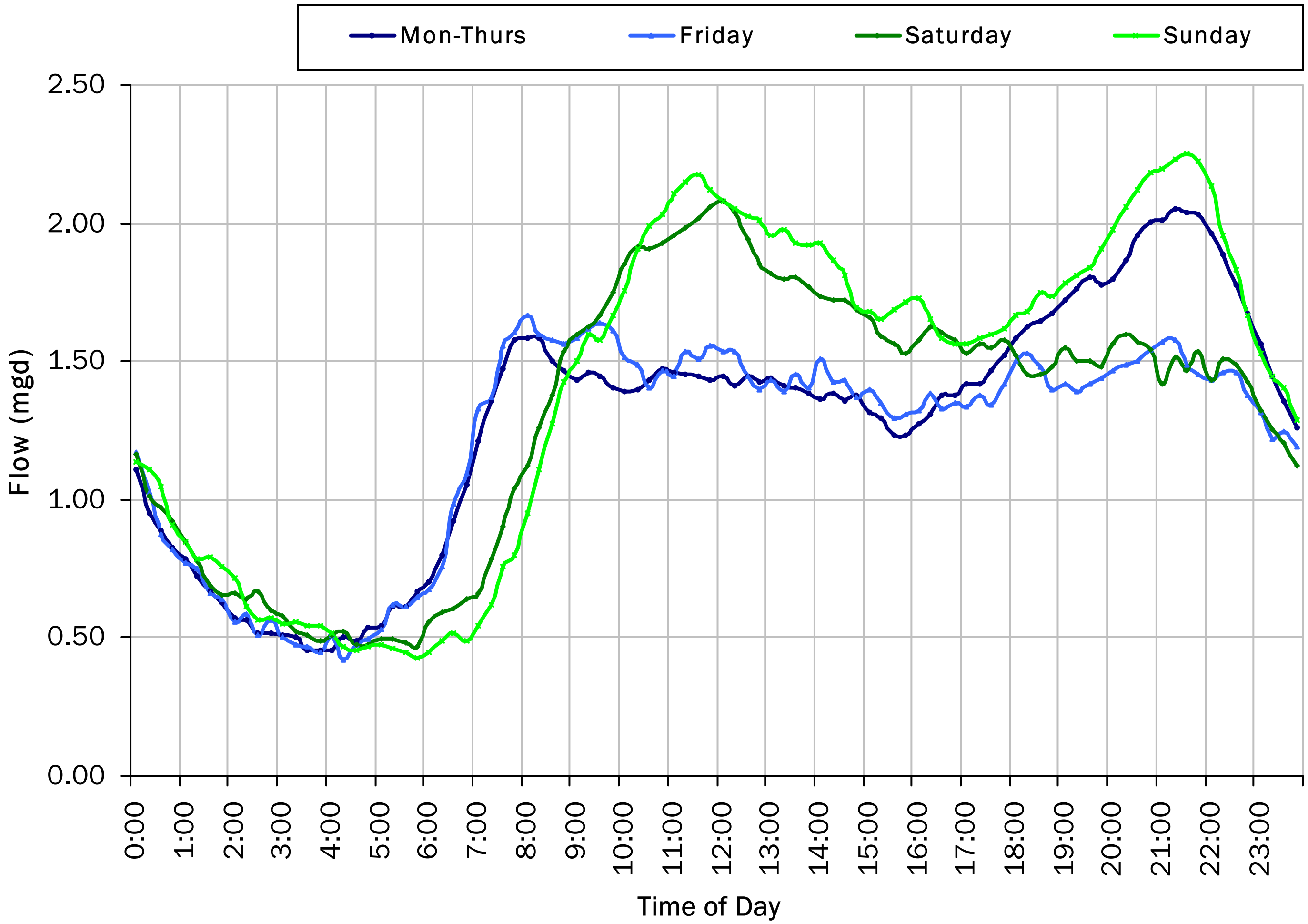
SITE 05
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches   Period Avg Flow: 1.284 mgd   Period Peak Flow: 2.567 mgd   Period Min Flow: 0.325 mgd



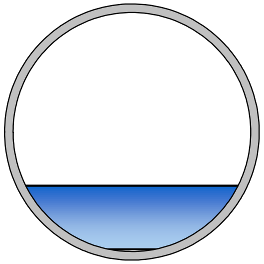


SITE 05
Average Dry Weather Flow Hydrographs



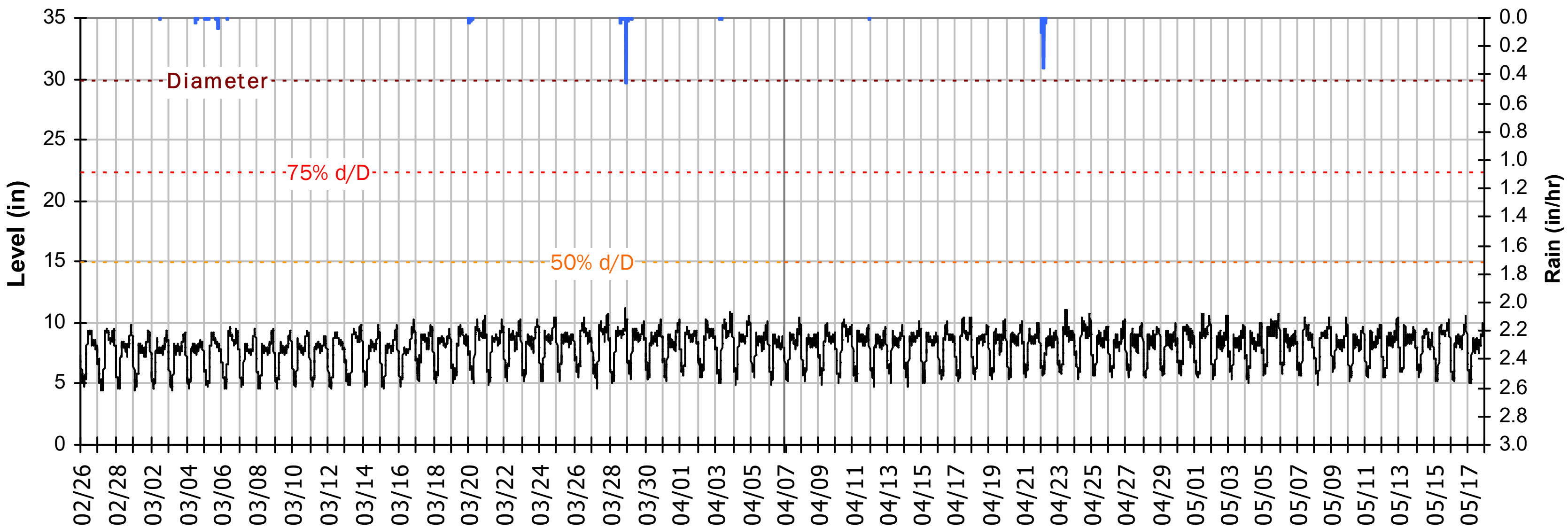
ADWF:

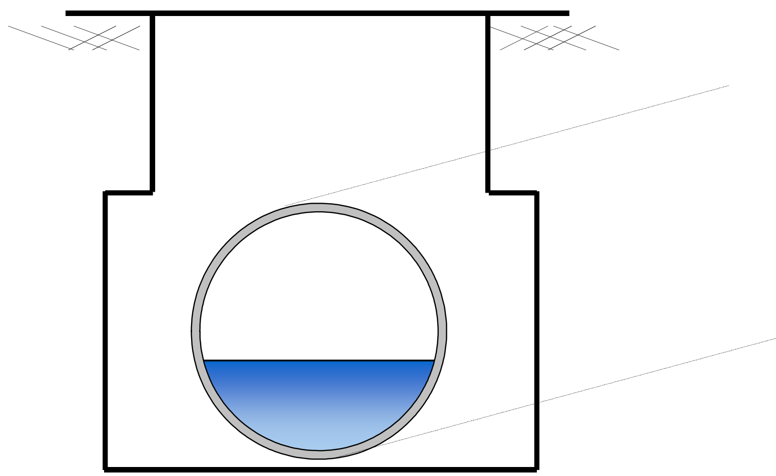
1.293 *mgd*



SITE 05
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



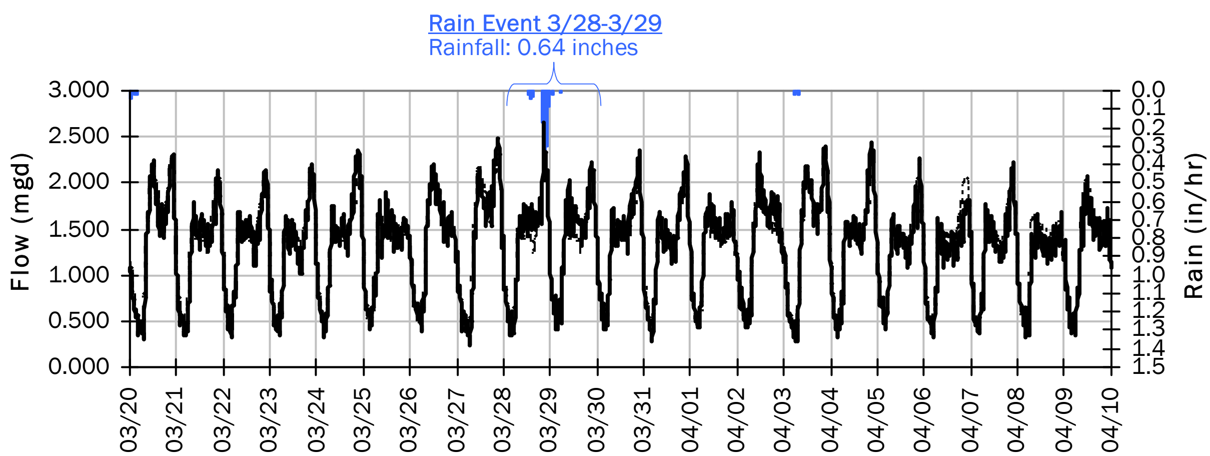


Pipe Diameter:	29.8	*inches*
Peak Measured Level:	11.2	*inches*
Peak d/D Ratio:	0.38	

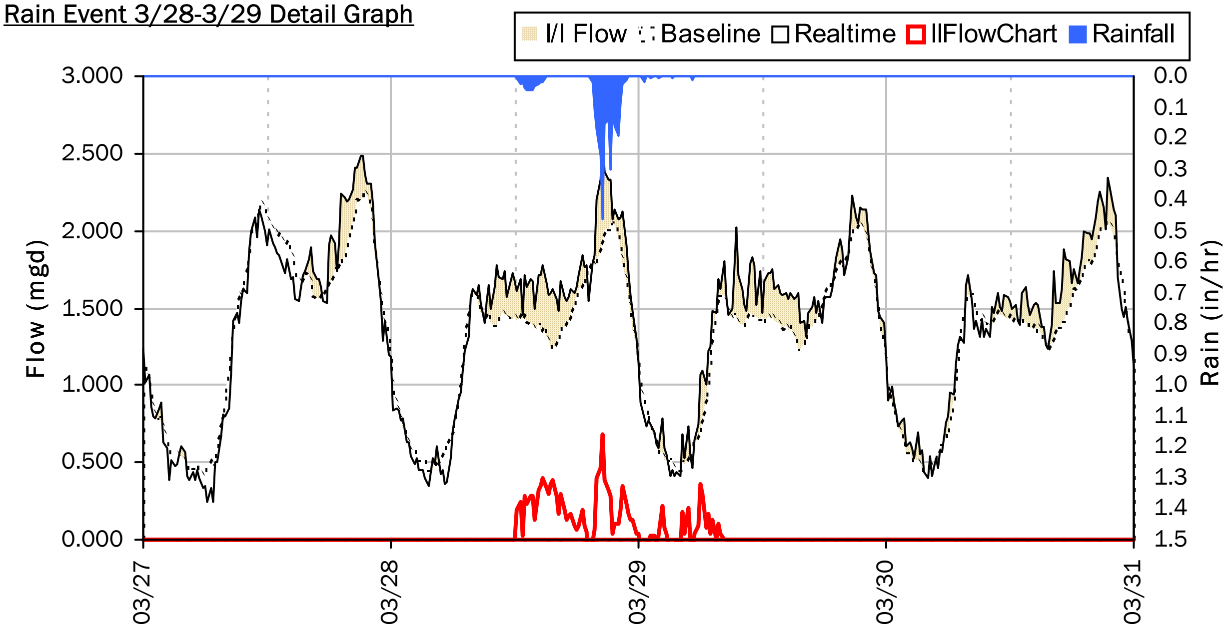
SITE 05

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



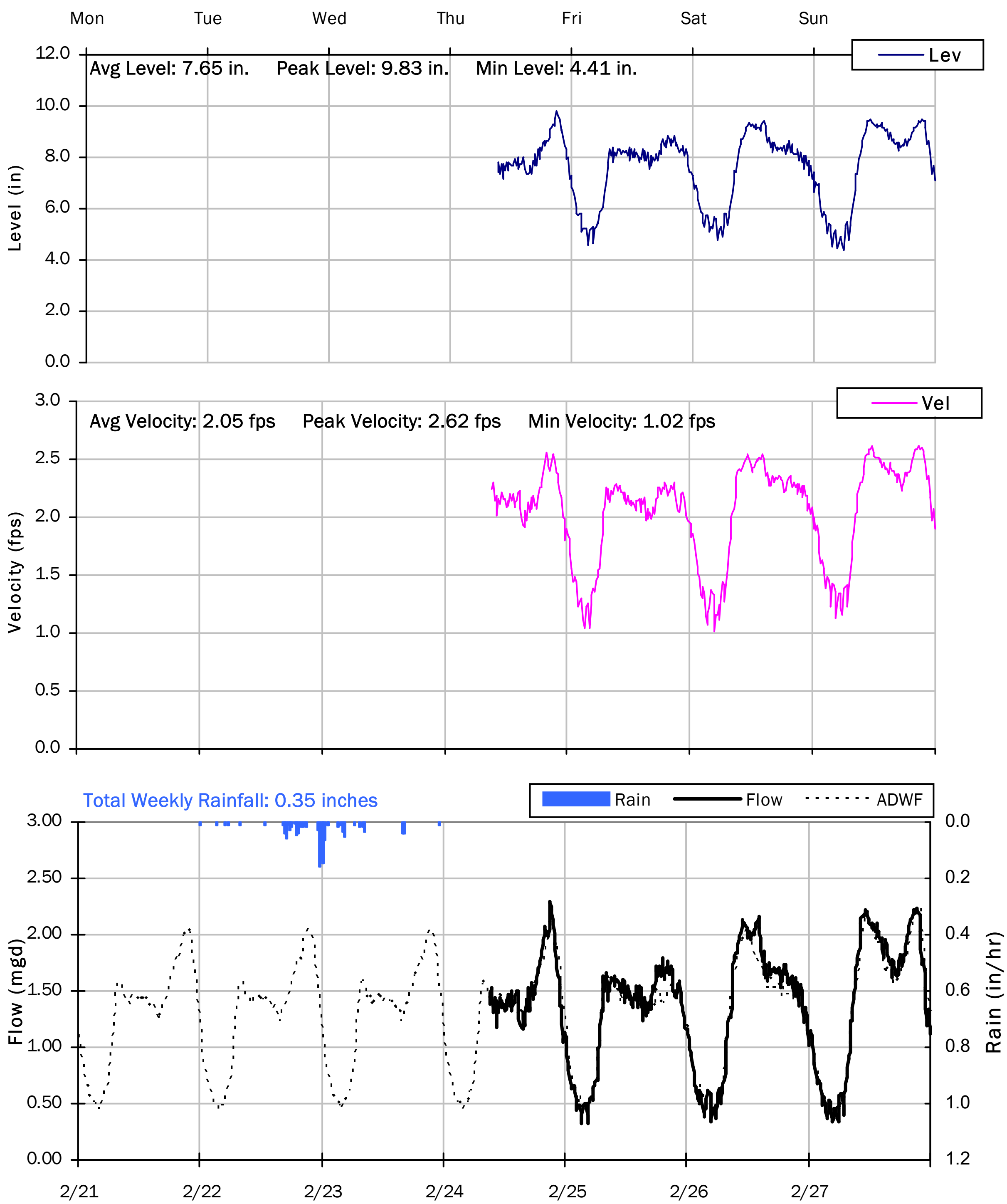
Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.64 inches)

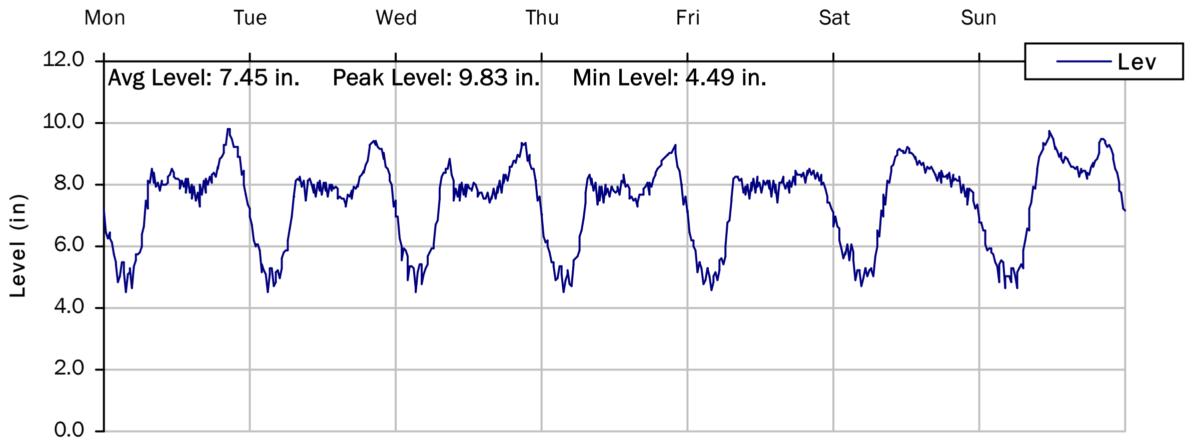
Capacity		Inflow / Infiltration	
Peak Flow:	2.645 *mgd*	Peak I/I Rate:	0.689 *mgd*
PF:	2.05	Total I/I:	119,000 *gallons*
Peak Level:	11.19 *in*		
d/D Ratio:	0.38		

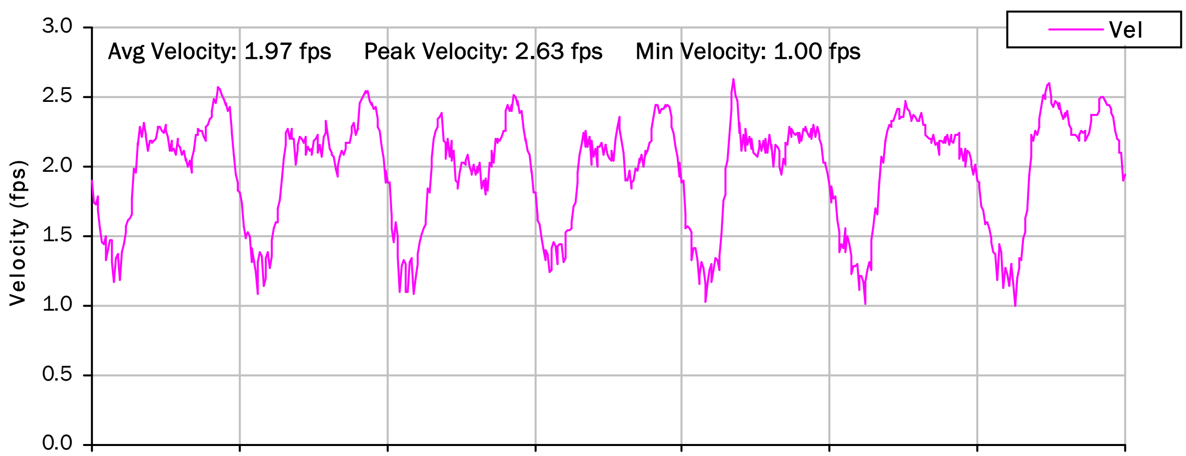
SITE 05
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

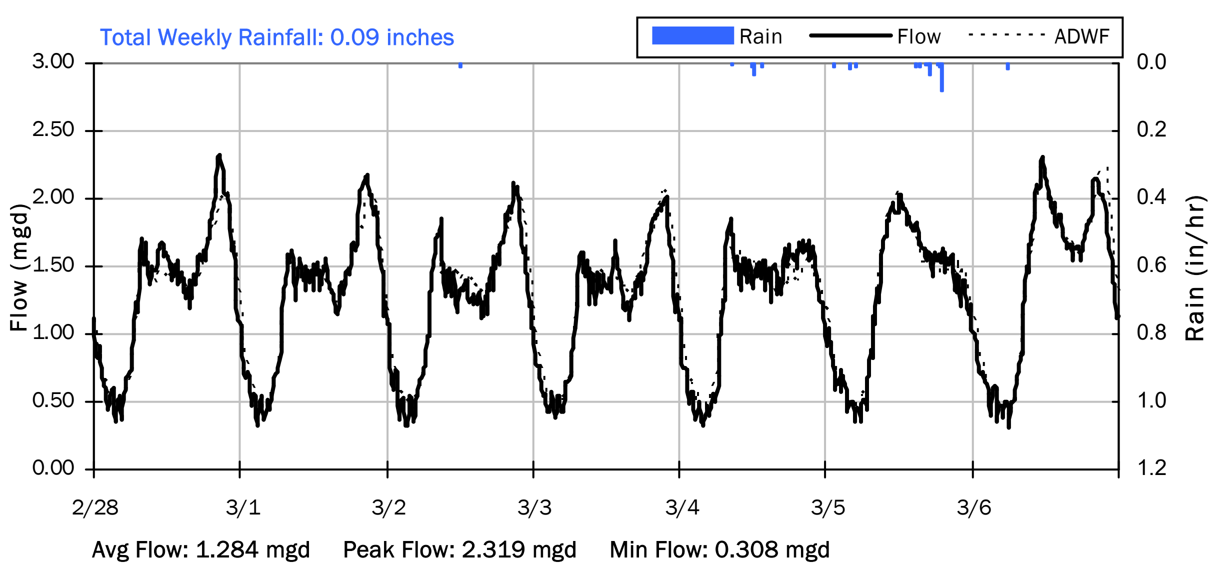


Avg Flow: 1.382 mgd Peak Flow: 2.288 mgd Min Flow: 0.319 mgd

SITE 05
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



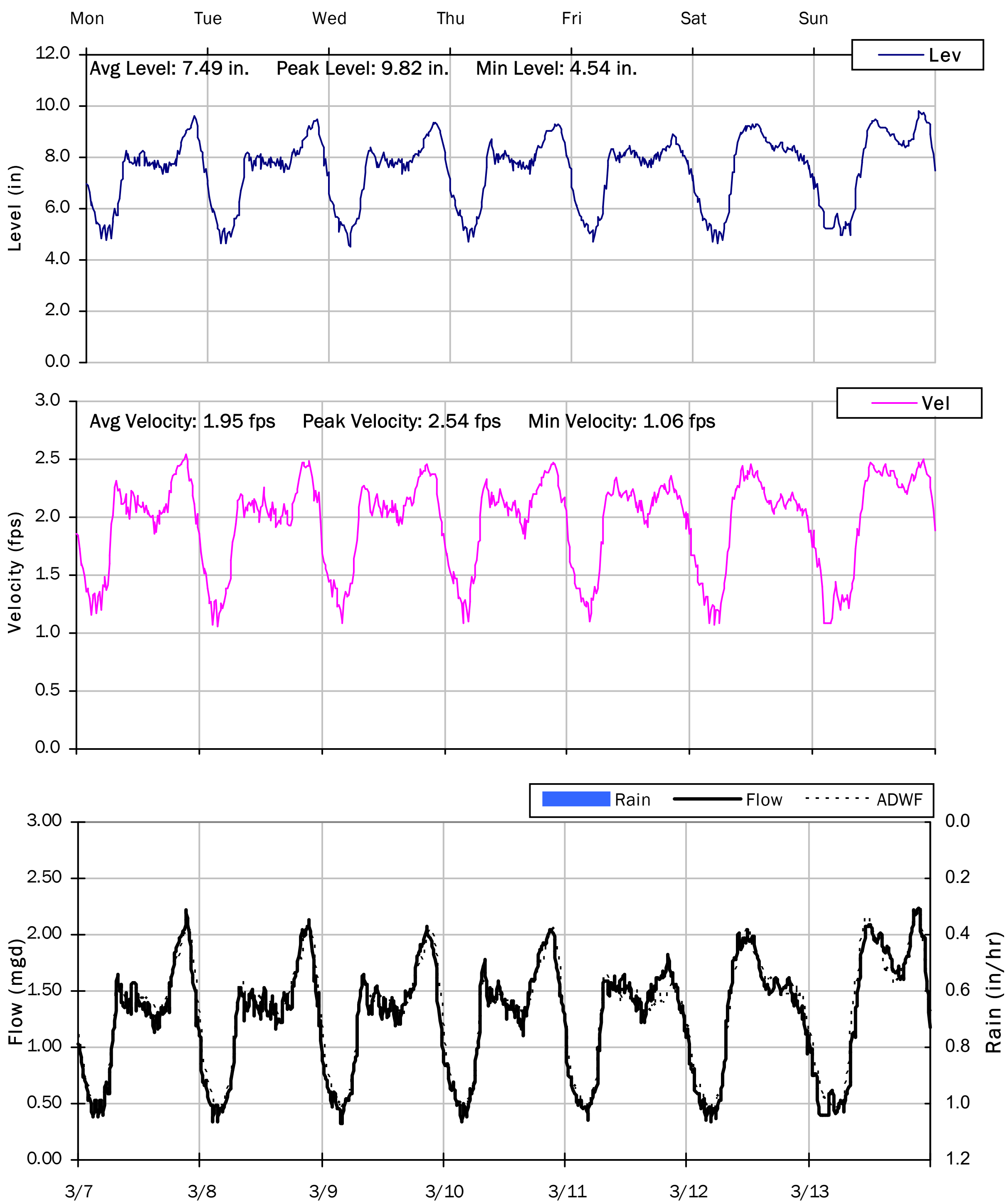




SITE 05

Weekly Level, Velocity and Flow Hydrographs

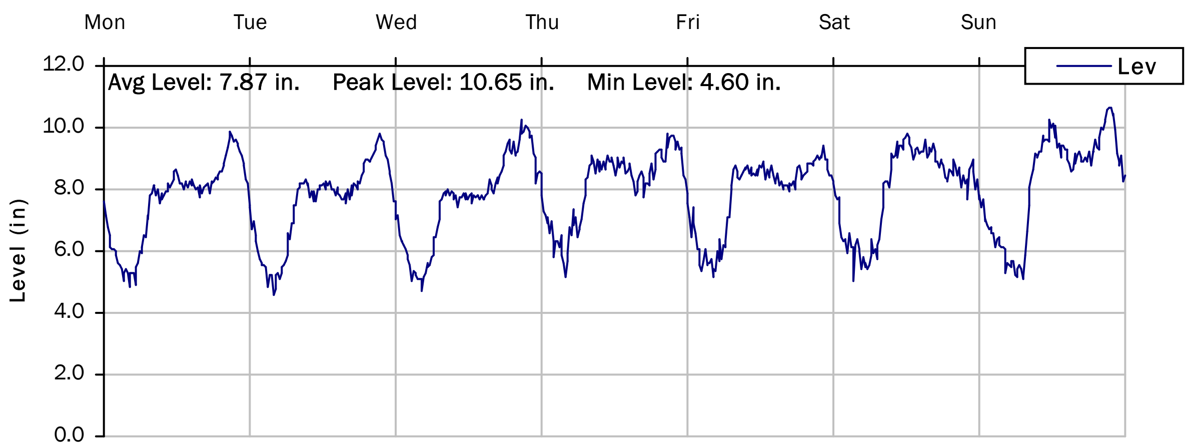
3/7/2022 to 3/14/2022

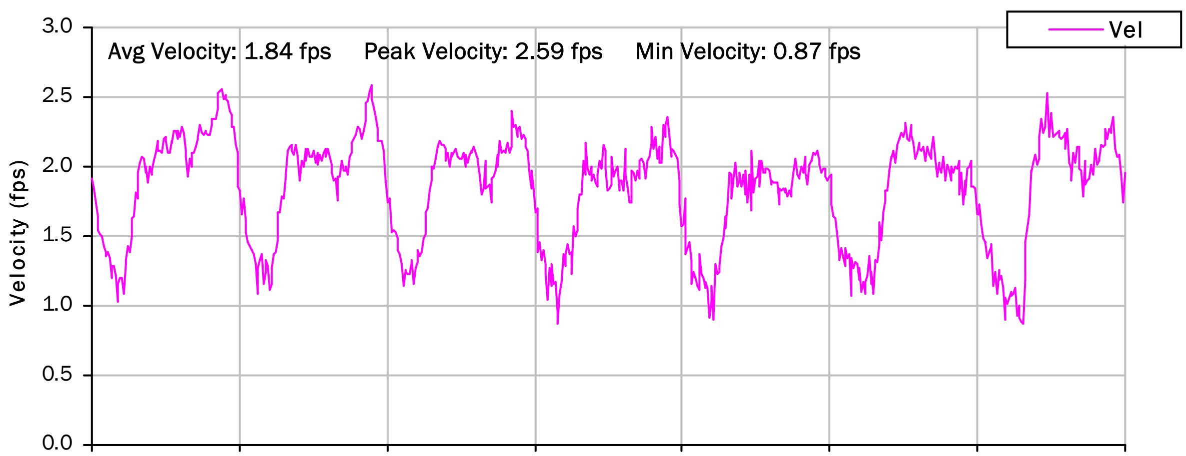


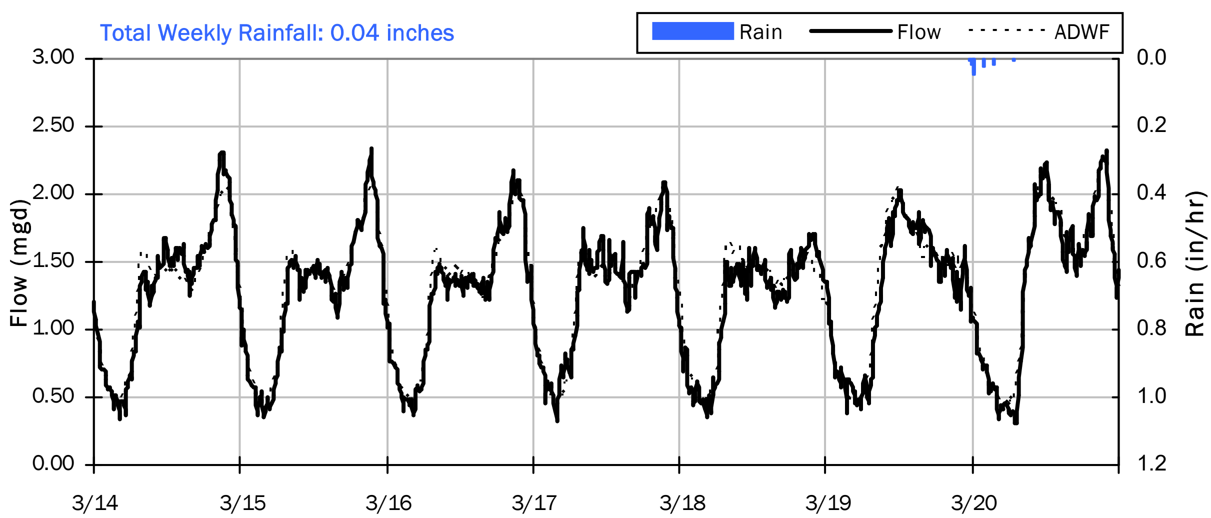
Avg Flow: 1.276 mgd Peak Flow: 2.235 mgd Min Flow: 0.326 mgd

SITE 05

Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022

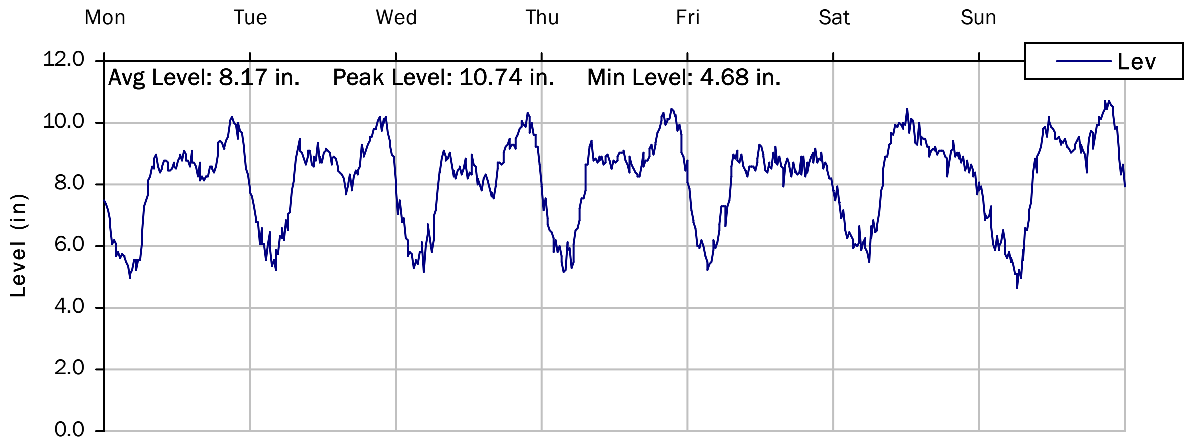


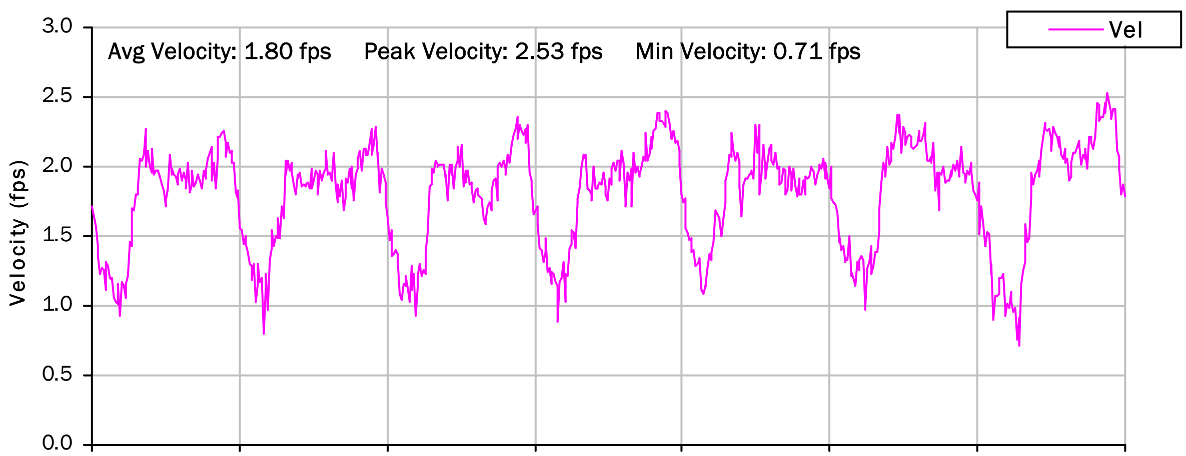


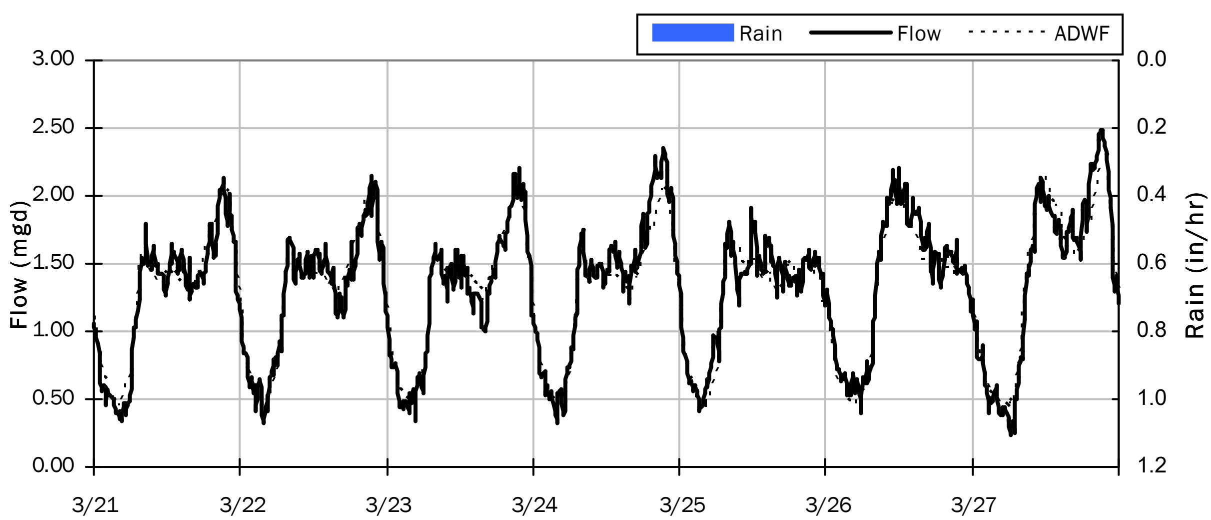


Avg Flow: 1.279 mgd   Peak Flow: 2.332 mgd   Min Flow: 0.310 mgd

SITE 05
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

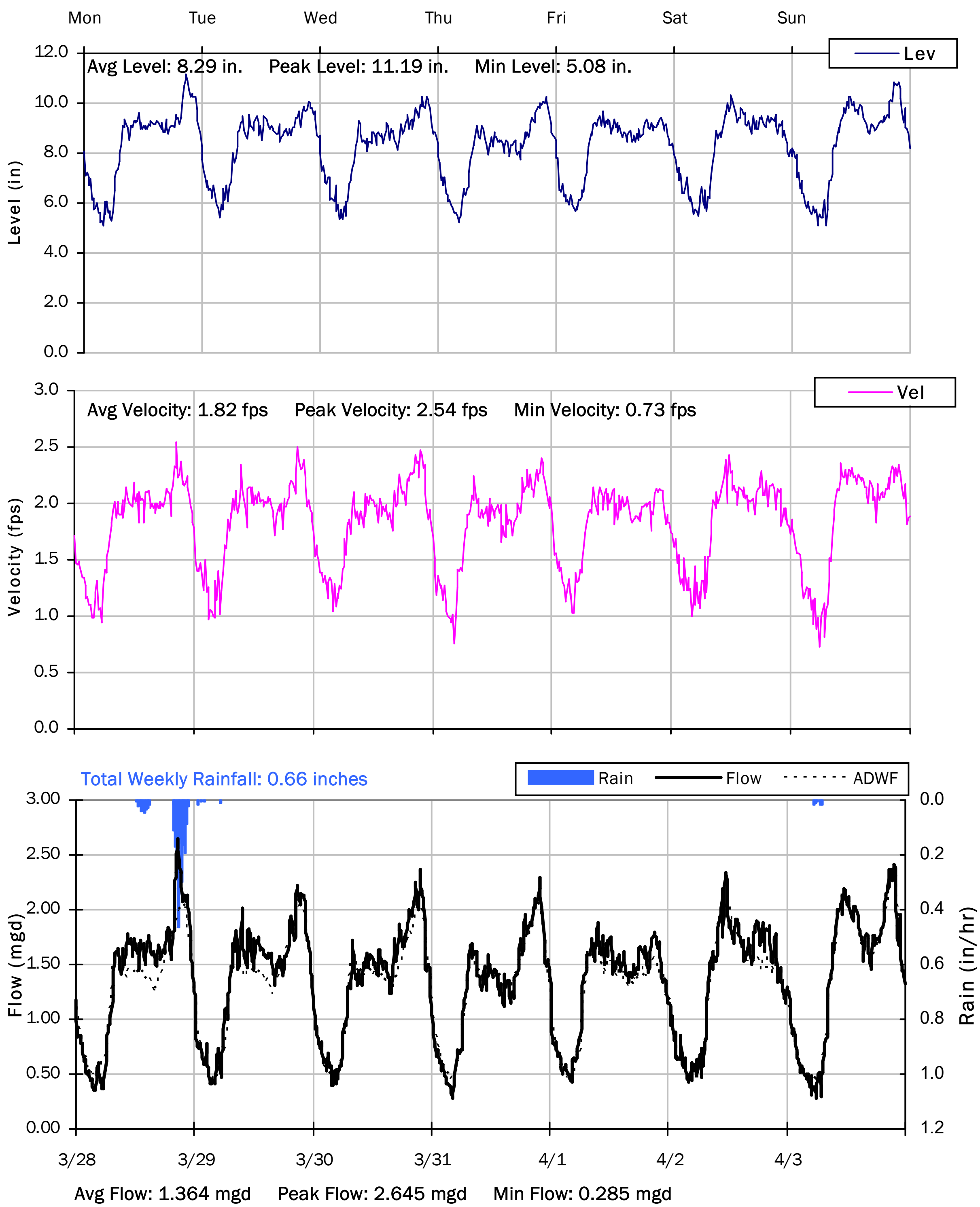




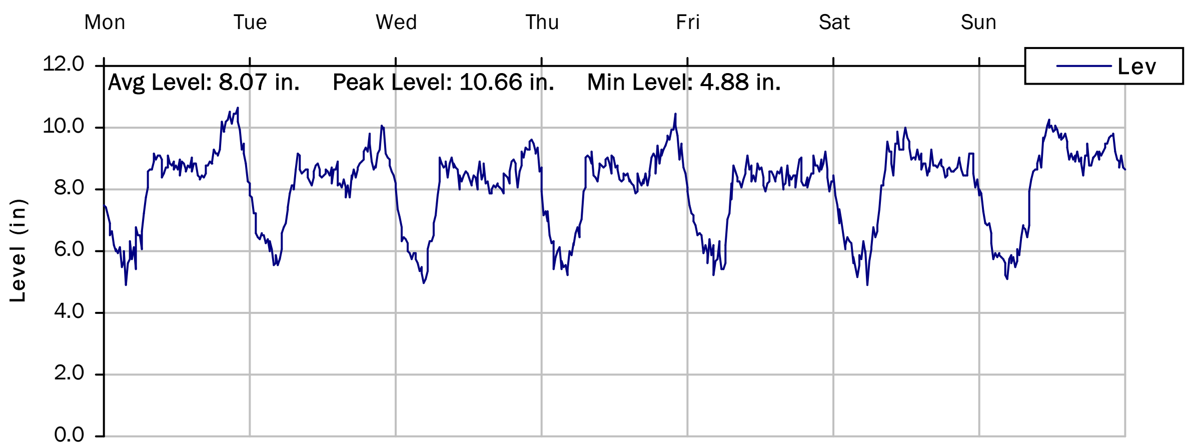


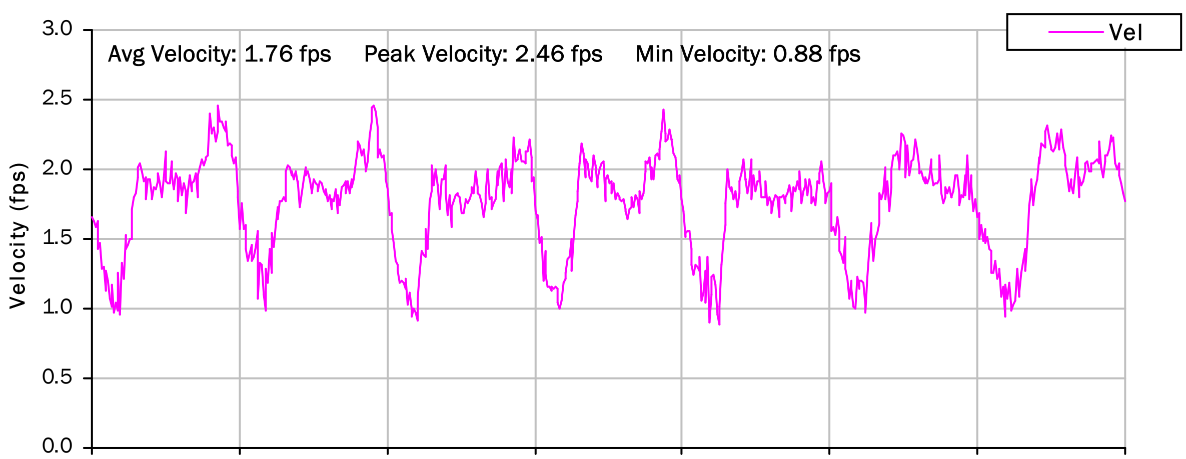
Avg Flow: 1.319 mgd Peak Flow: 2.489 mgd Min Flow: 0.238 mgd

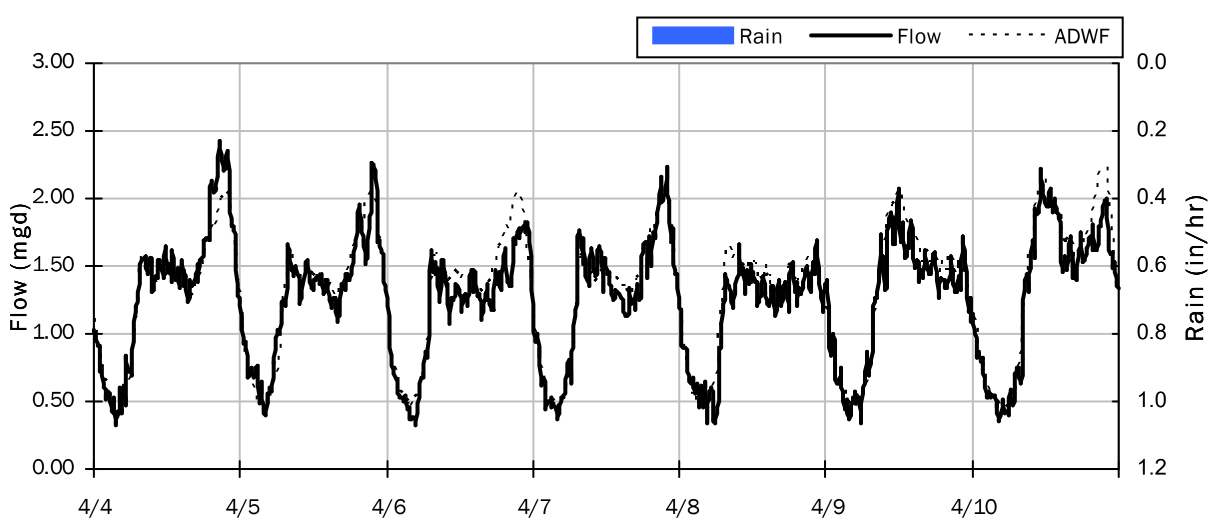
SITE 05
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022



SITE 05
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

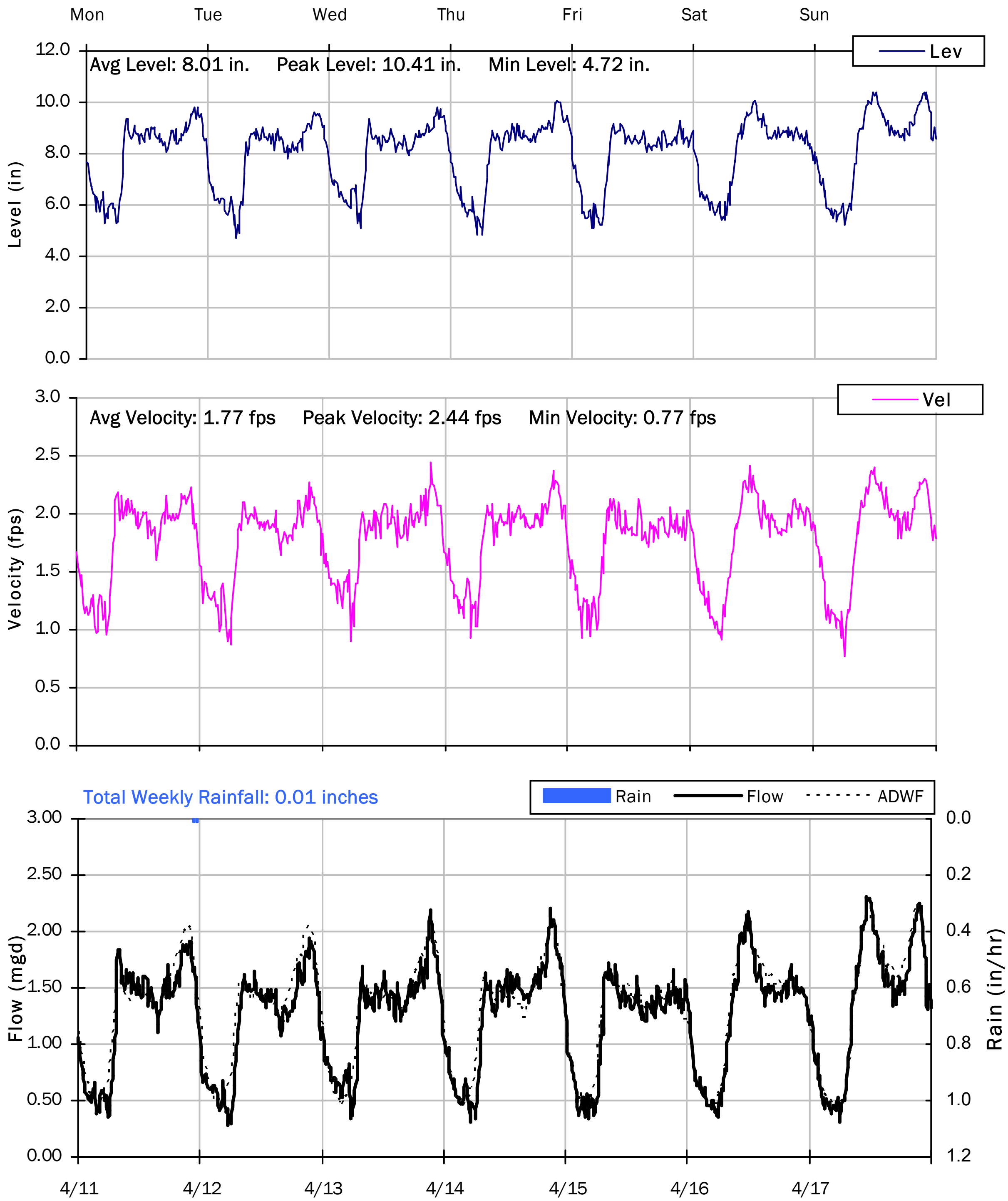






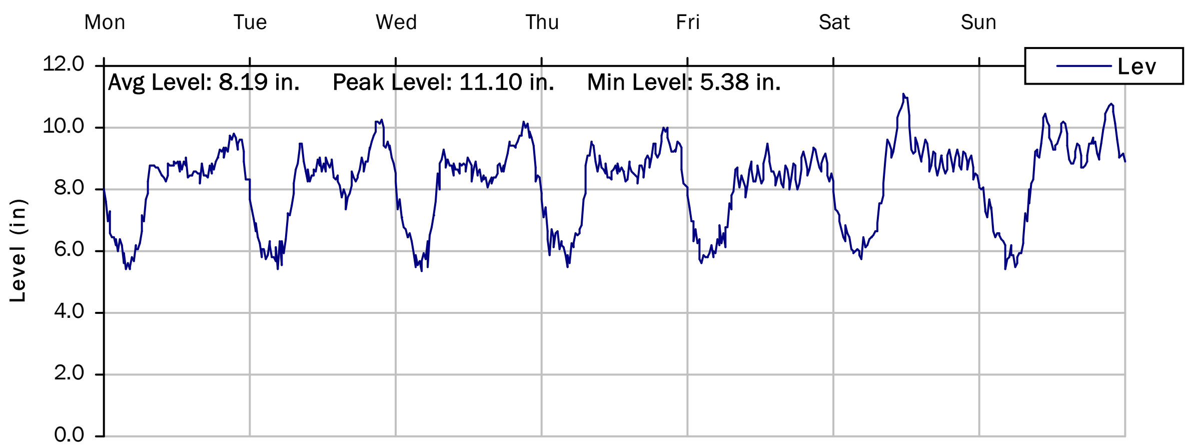
Avg Flow: 1.259 mgd   Peak Flow: 2.430 mgd   Min Flow: 0.324 mgd

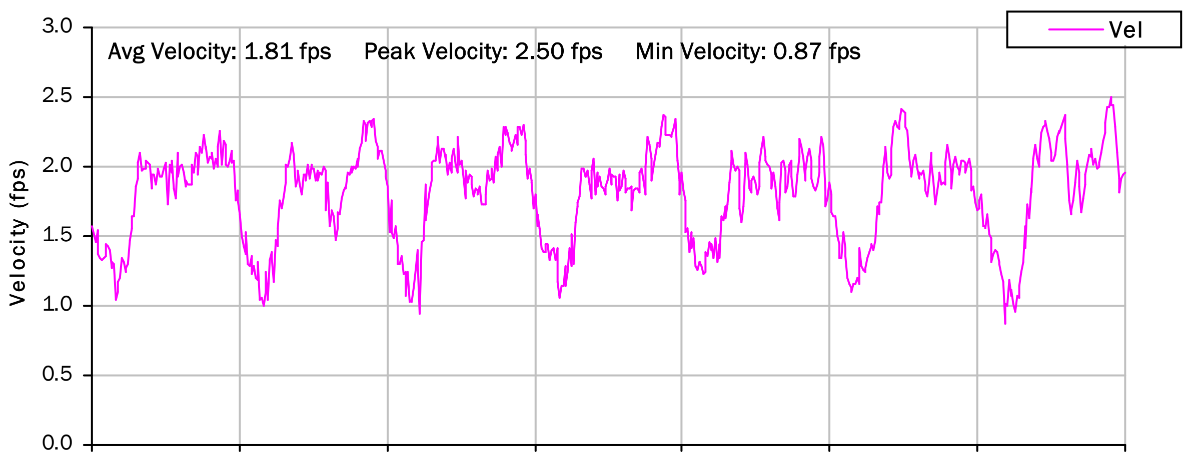
SITE 05
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

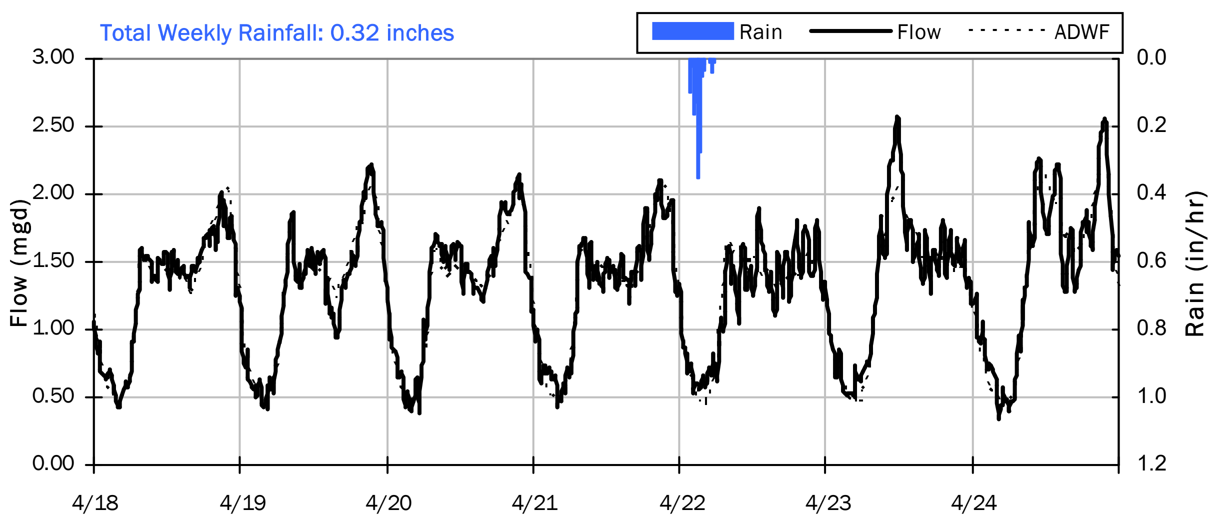


Avg Flow: 1.260 mgd Peak Flow: 2.306 mgd Min Flow: 0.285 mgd

SITE 05
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022





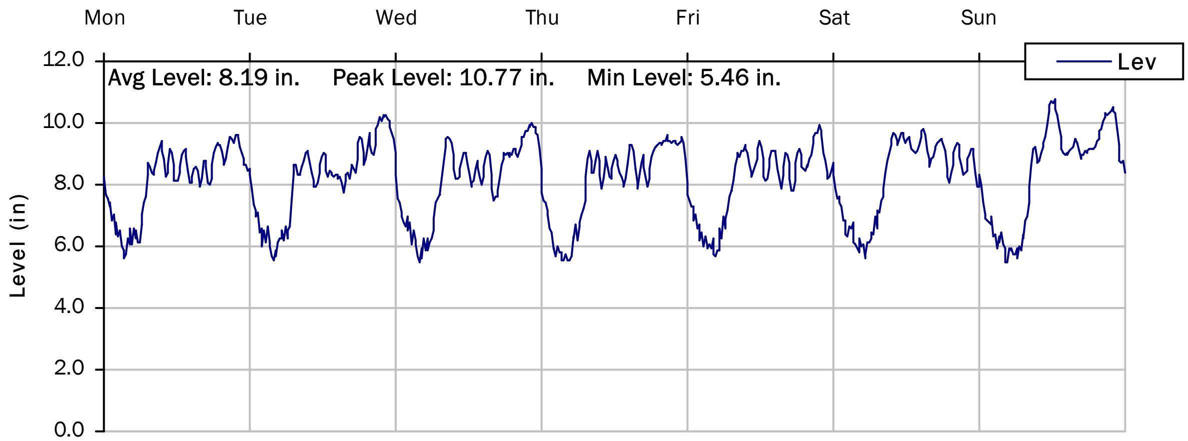


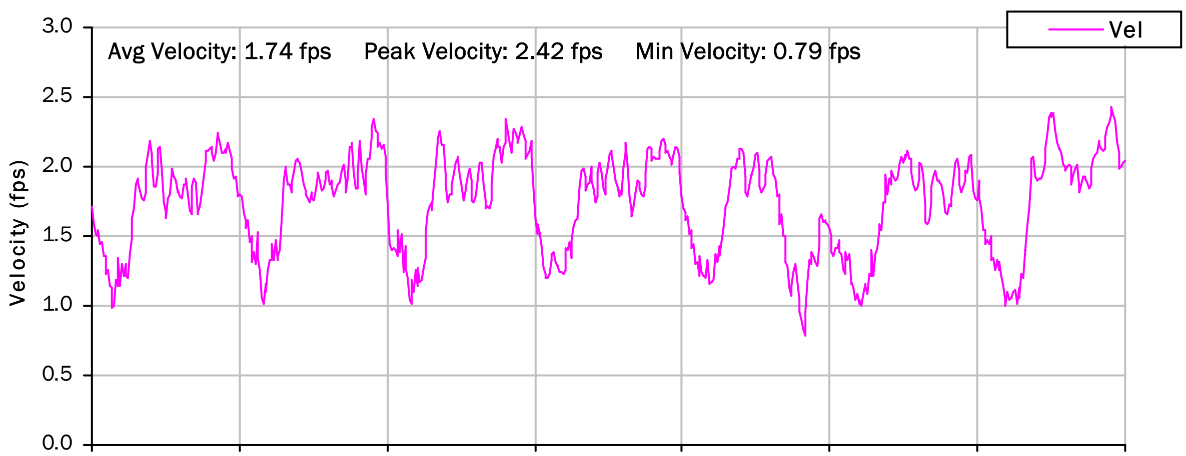
Avg Flow: 1.323 mgd Peak Flow: 2.567 mgd Min Flow: 0.340 mgd

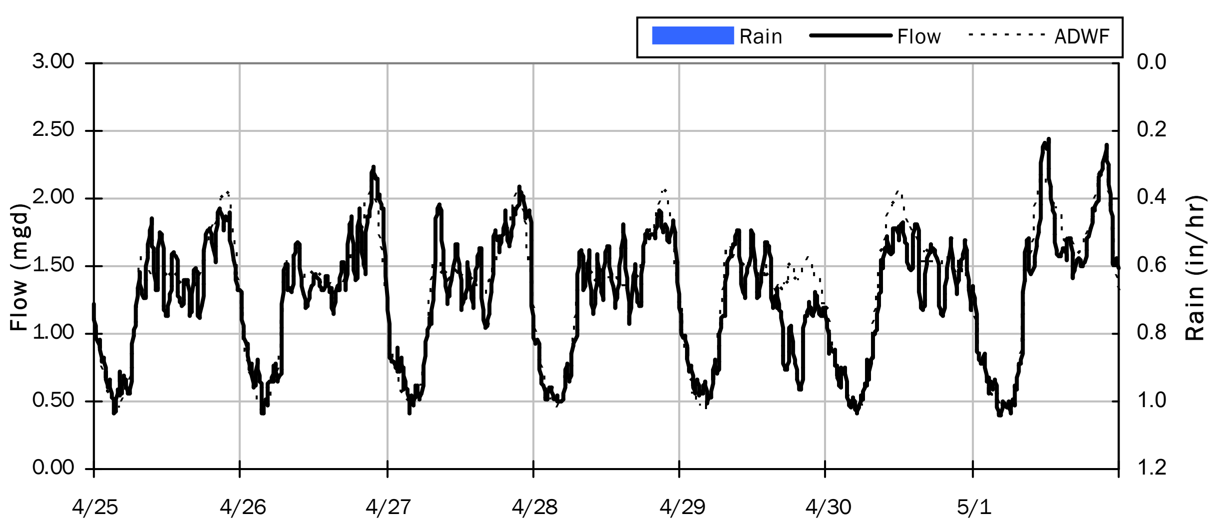
SITE 05

Weekly Level, Velocity and Flow Hydrographs

4/25/2022 to 5/2/2022

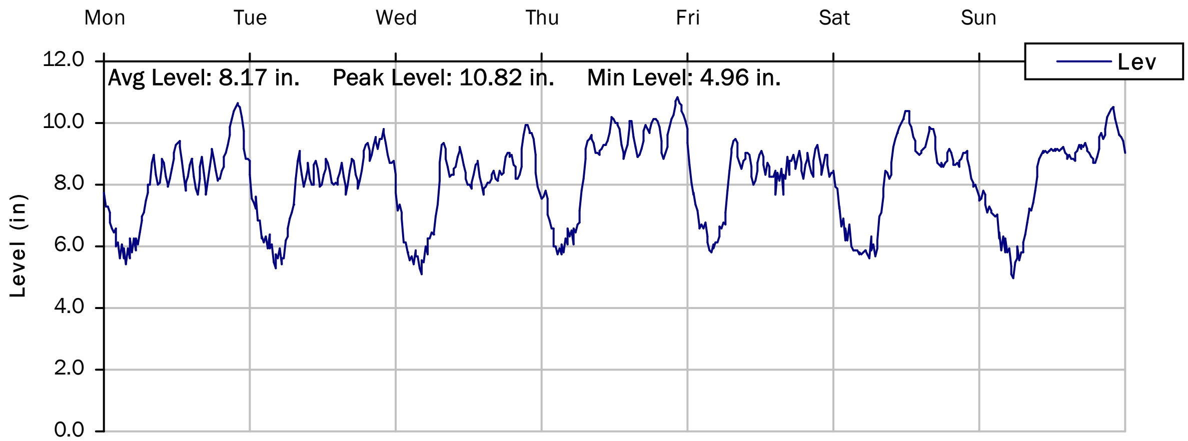


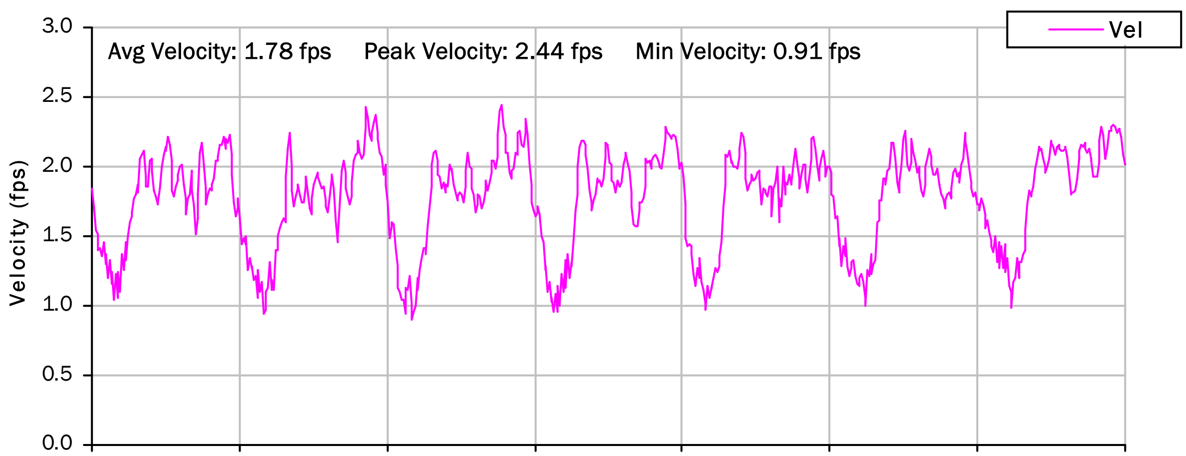


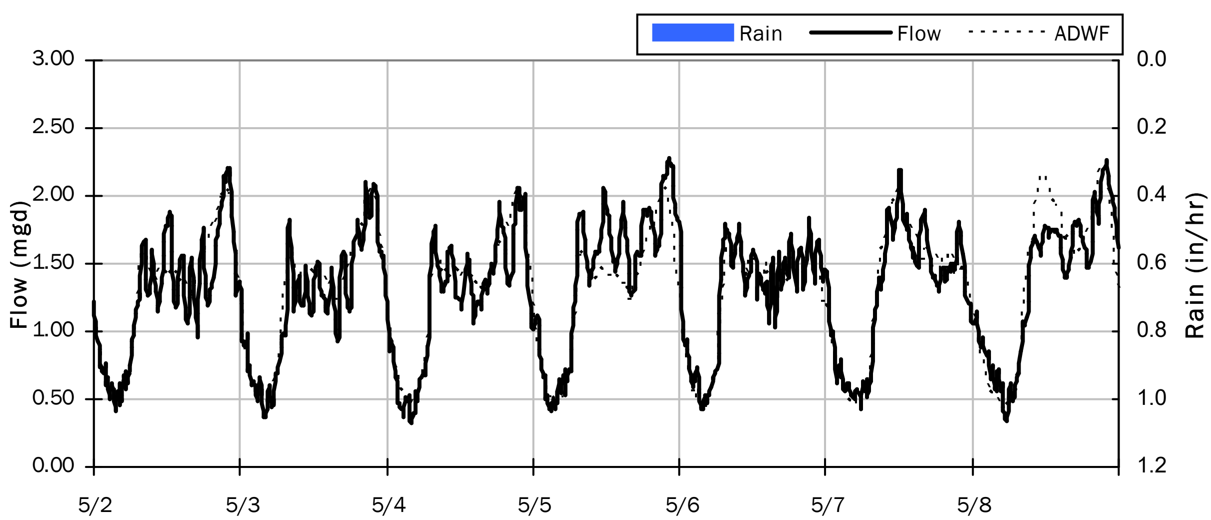


Avg Flow: 1.274 mgd Peak Flow: 2.436 mgd Min Flow: 0.396 mgd

SITE 05
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022





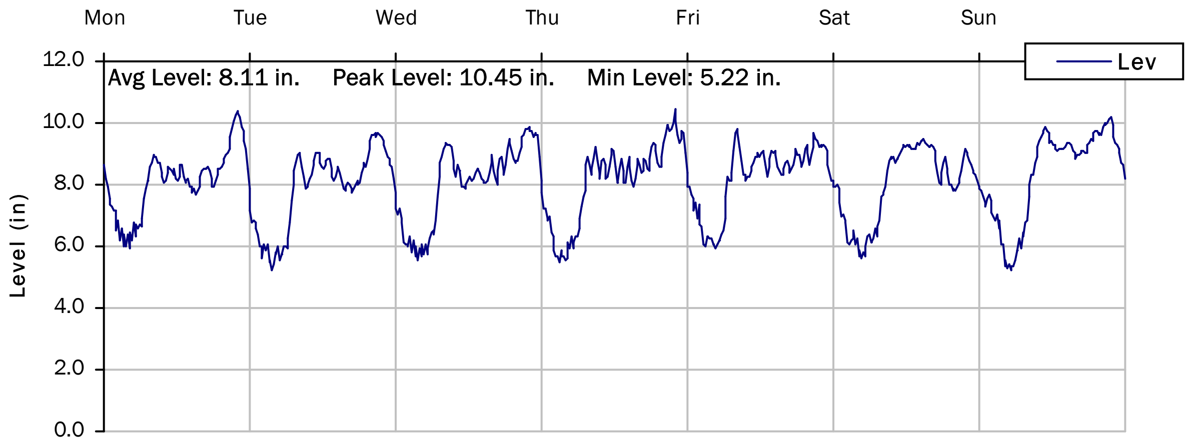


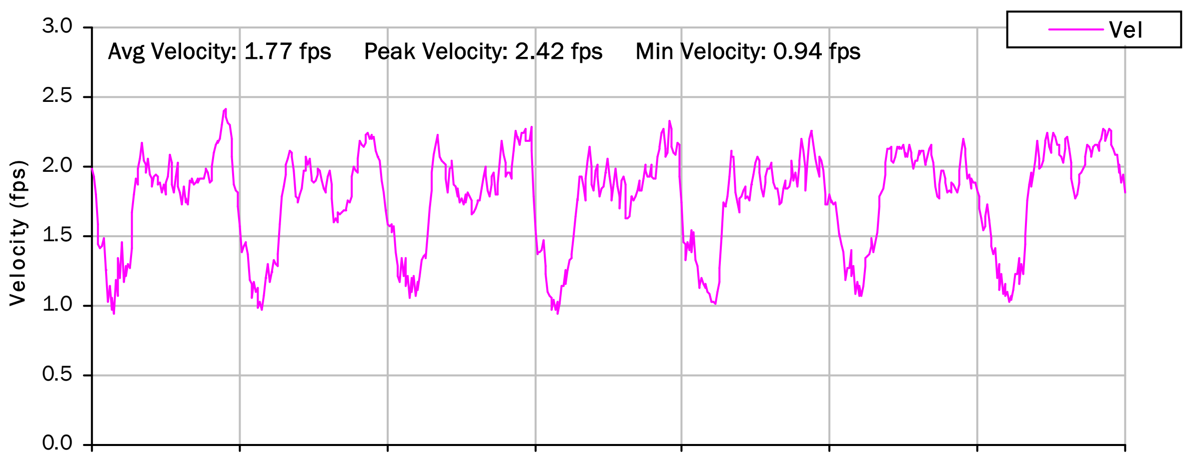
Avg Flow: 1.301 mgd Peak Flow: 2.277 mgd Min Flow: 0.325 mgd

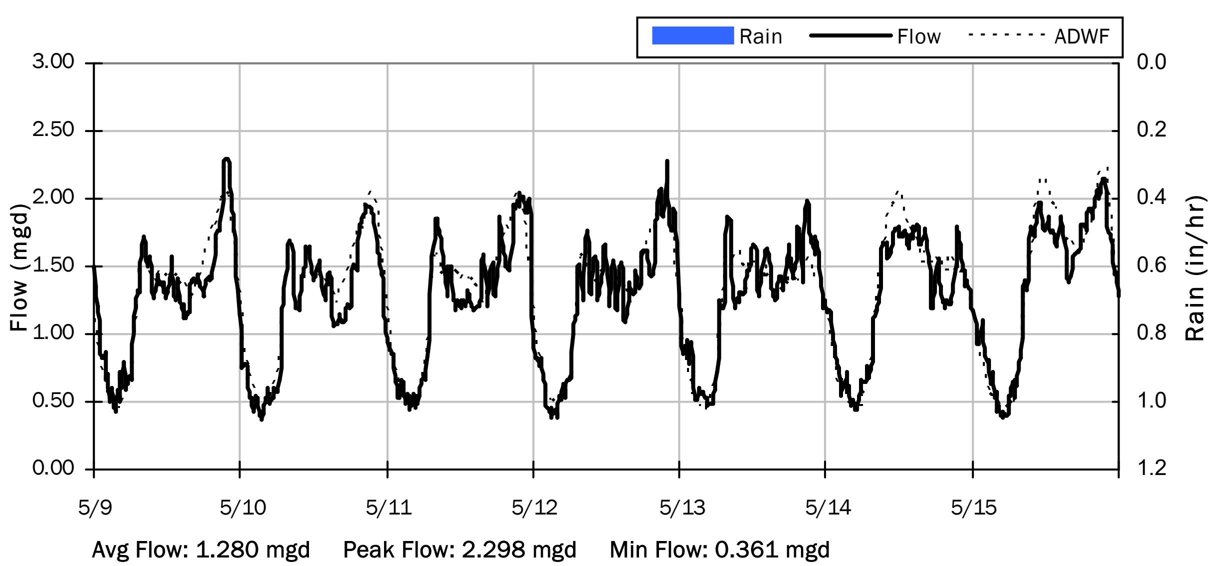
SITE 05

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022



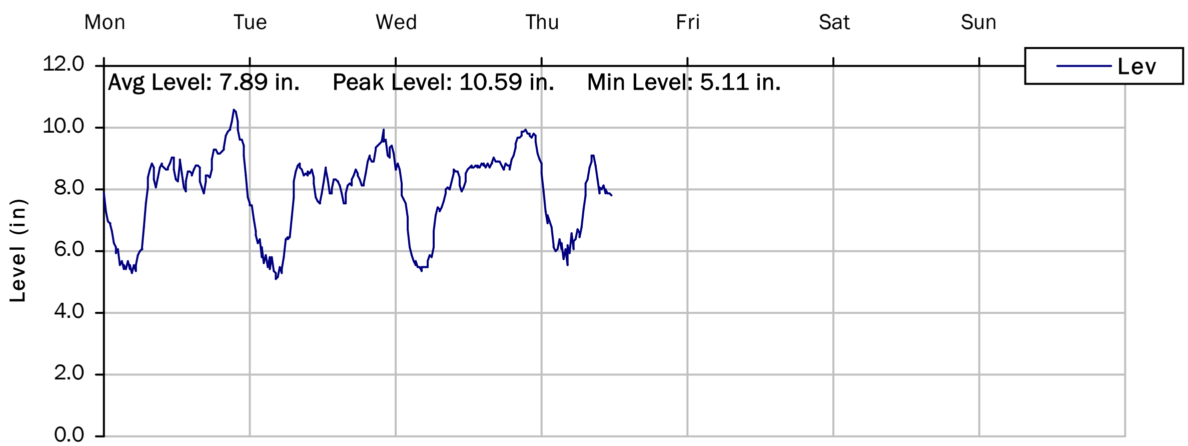


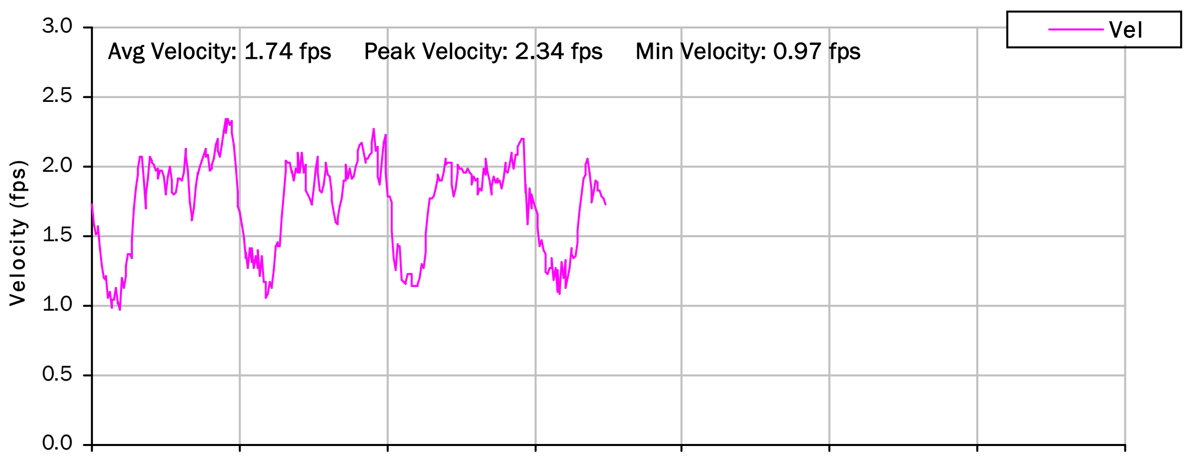


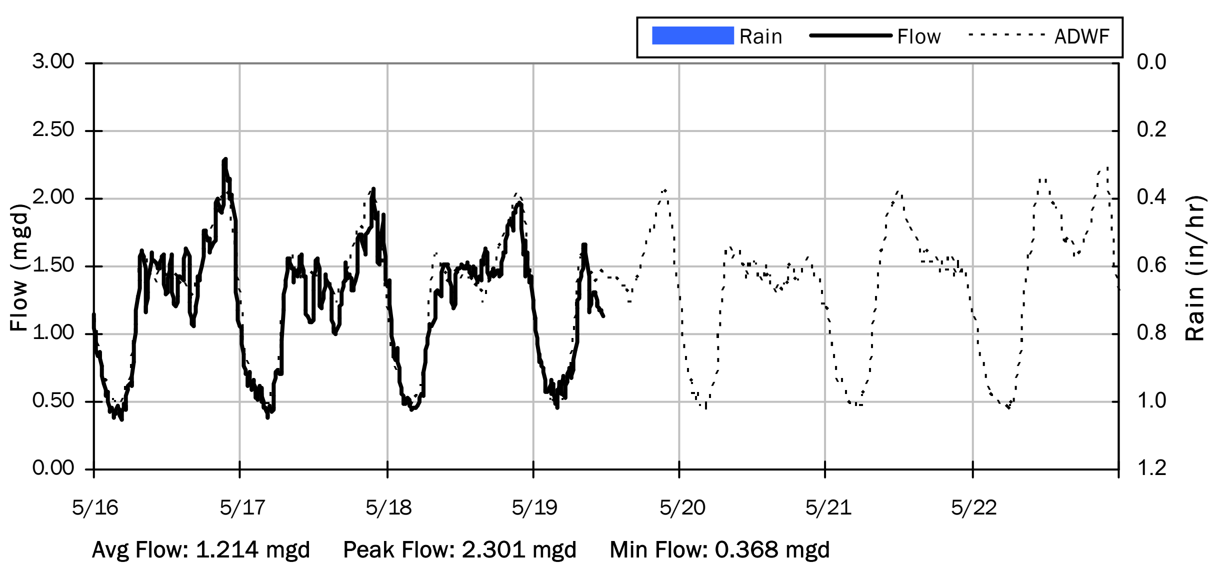
SITE 05

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022







Monitoring Site: Site 06

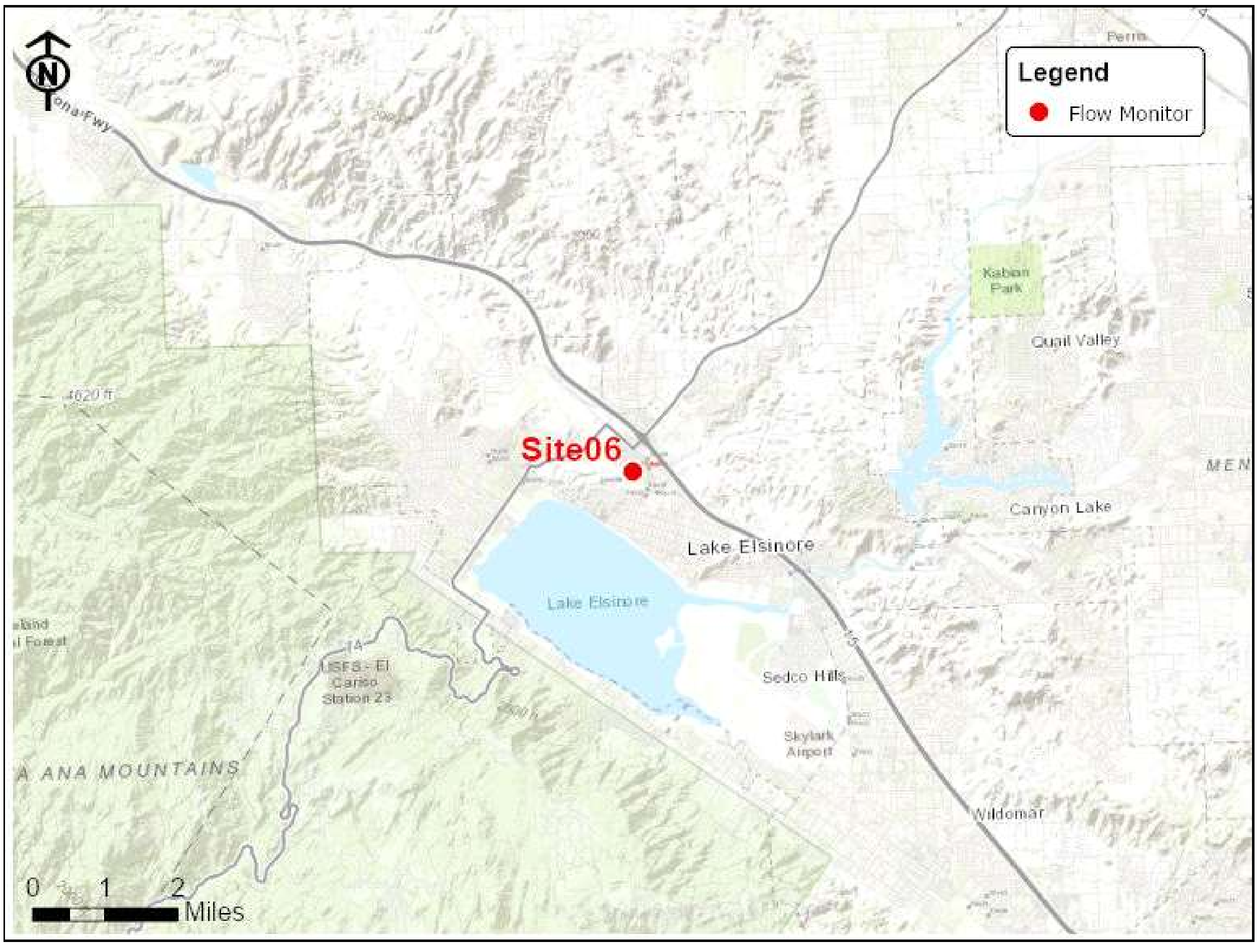
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Pasadena Street, west of 3rd Street

Data Summary Report



Vicinity Map: Site 06

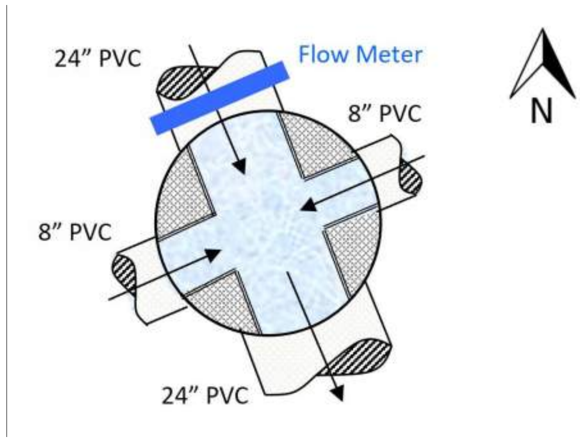
SITE 06

Site Information MH ID: MH-1035

Location:	Pasadena Street, west of 3rd Street
Coordinates:	117.3403° W, 33.6854° N
Rim Elevation (Earth):	1265 feet
Expected Pipe Diameter:	24 inches
Measured Pipe Diameter:	24 inches
ADWF:	0.085 mgd
Peak Measured Flow:	0.358 mgd
Sediment:	1.5 inches

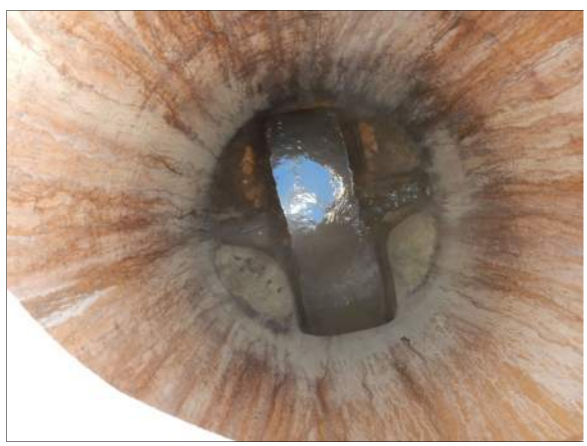
Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 06

Additional Site Photos

Effluent Pipe

E Influent Pipe

SITE 06

Additional Site Photos

Monitored N Influent Pipe

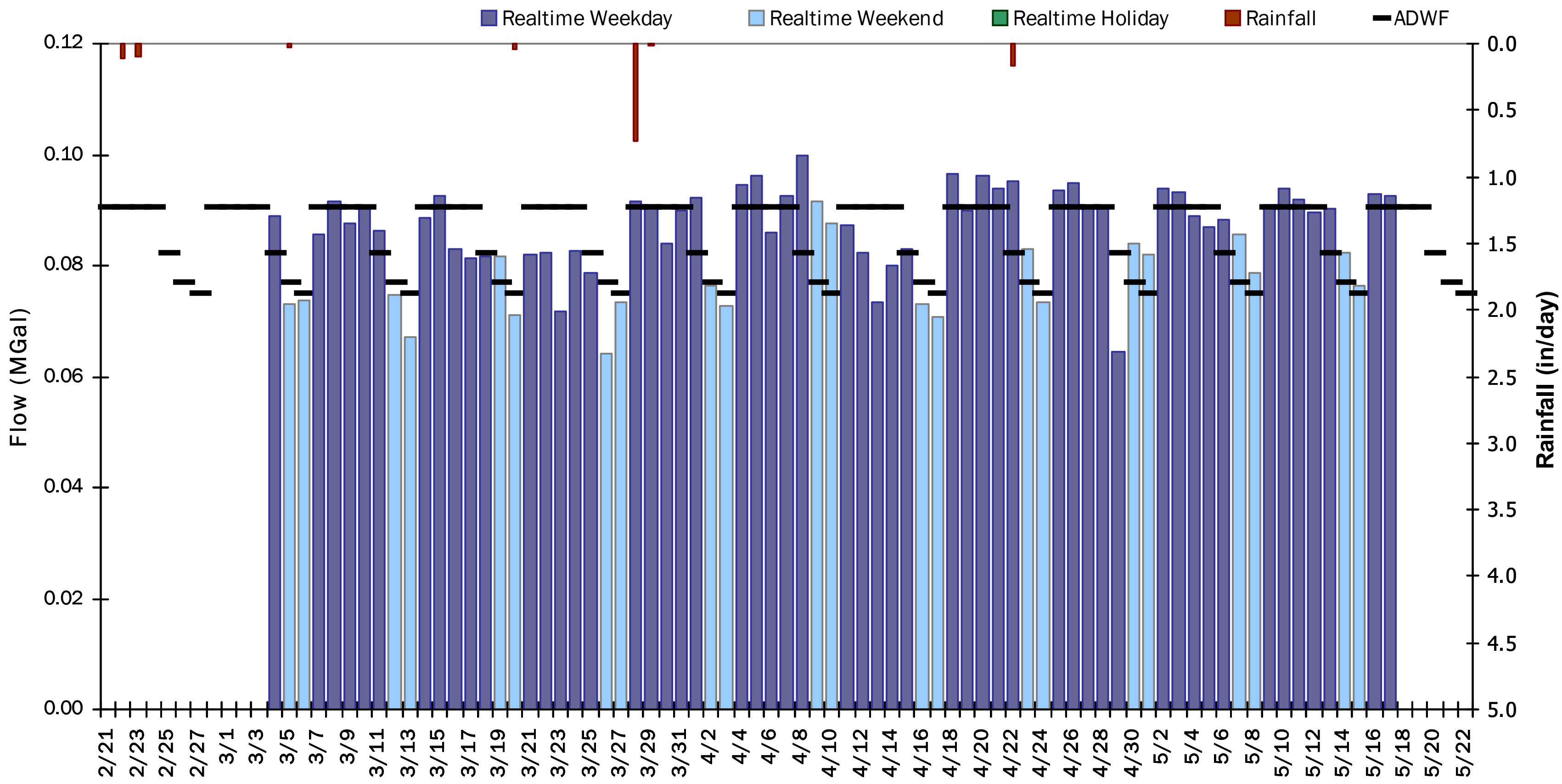
W Influent Pipe

SITE 06

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.085 MGal   Peak Daily Flow: 0.100 MGal   Min Daily Flow: 0.064 MGal

Total Rainfall: 0.98 inches

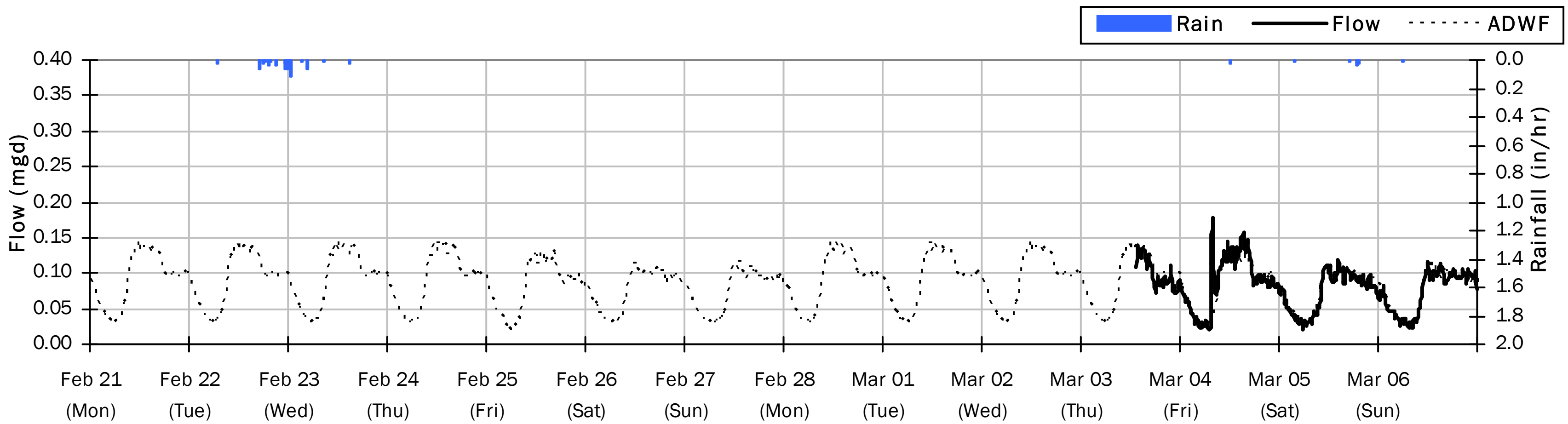


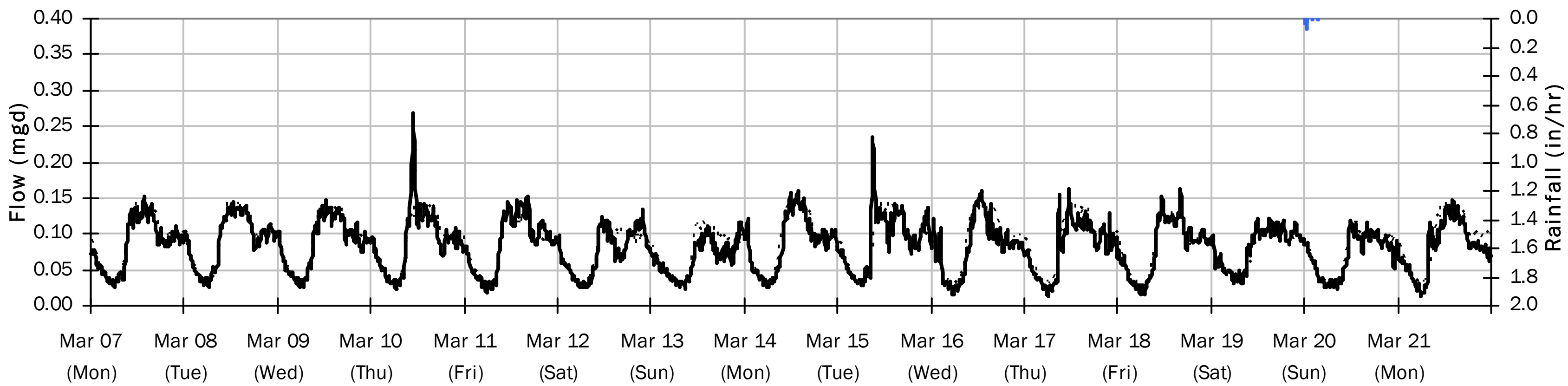
SITE 06

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.28 inches

Period Avg Flow: 0.083 mgd   Period Peak Flow: 0.268 mgd   Period Min Flow: 0.013 mgd

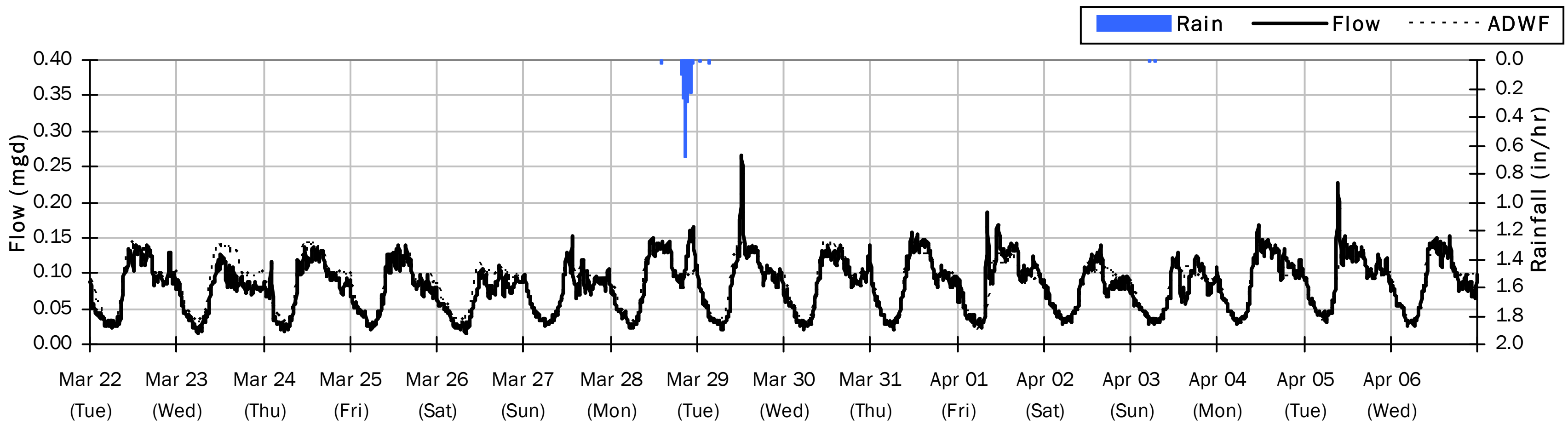


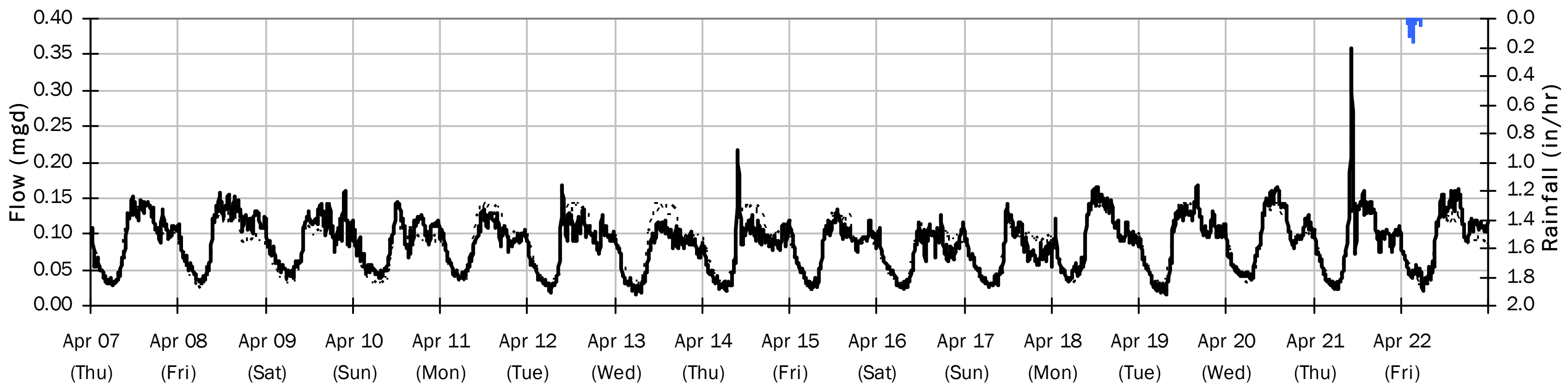


SITE 06

Flow Summary: 3/22/2022 to 4/22/2022

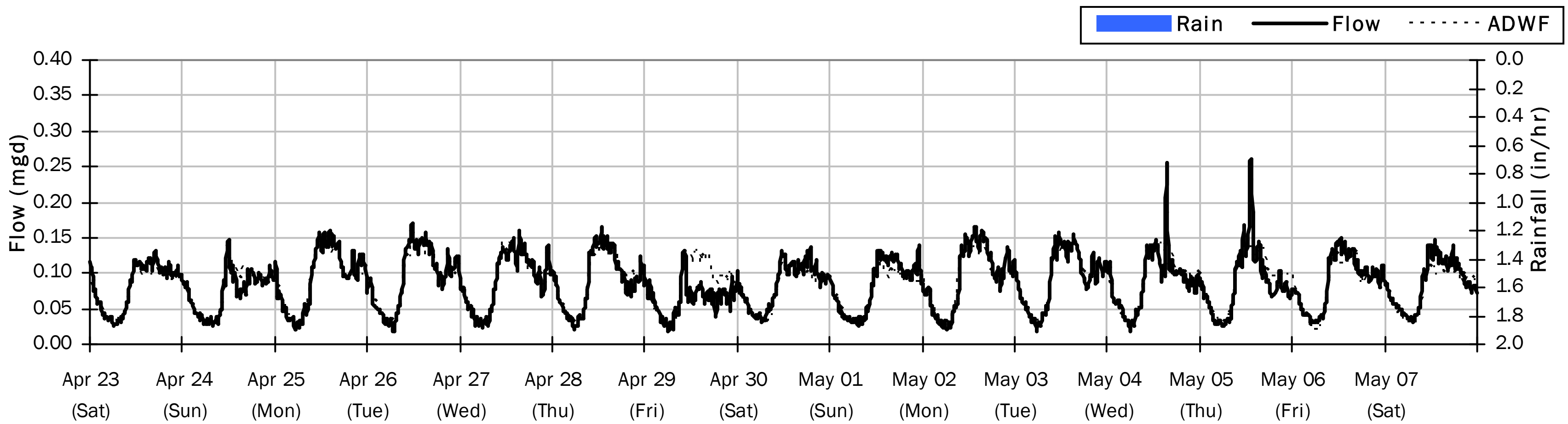
Period Rainfall: 0.91 inches   Period Avg Flow: 0.085 mgd   Period Peak Flow: 0.358 mgd   Period Min Flow: 0.014 mgd

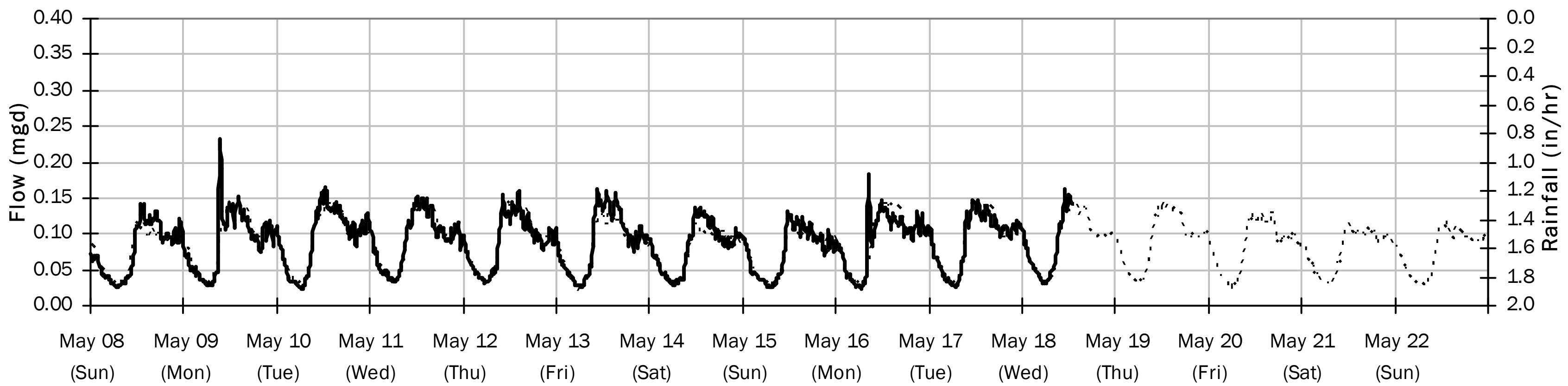




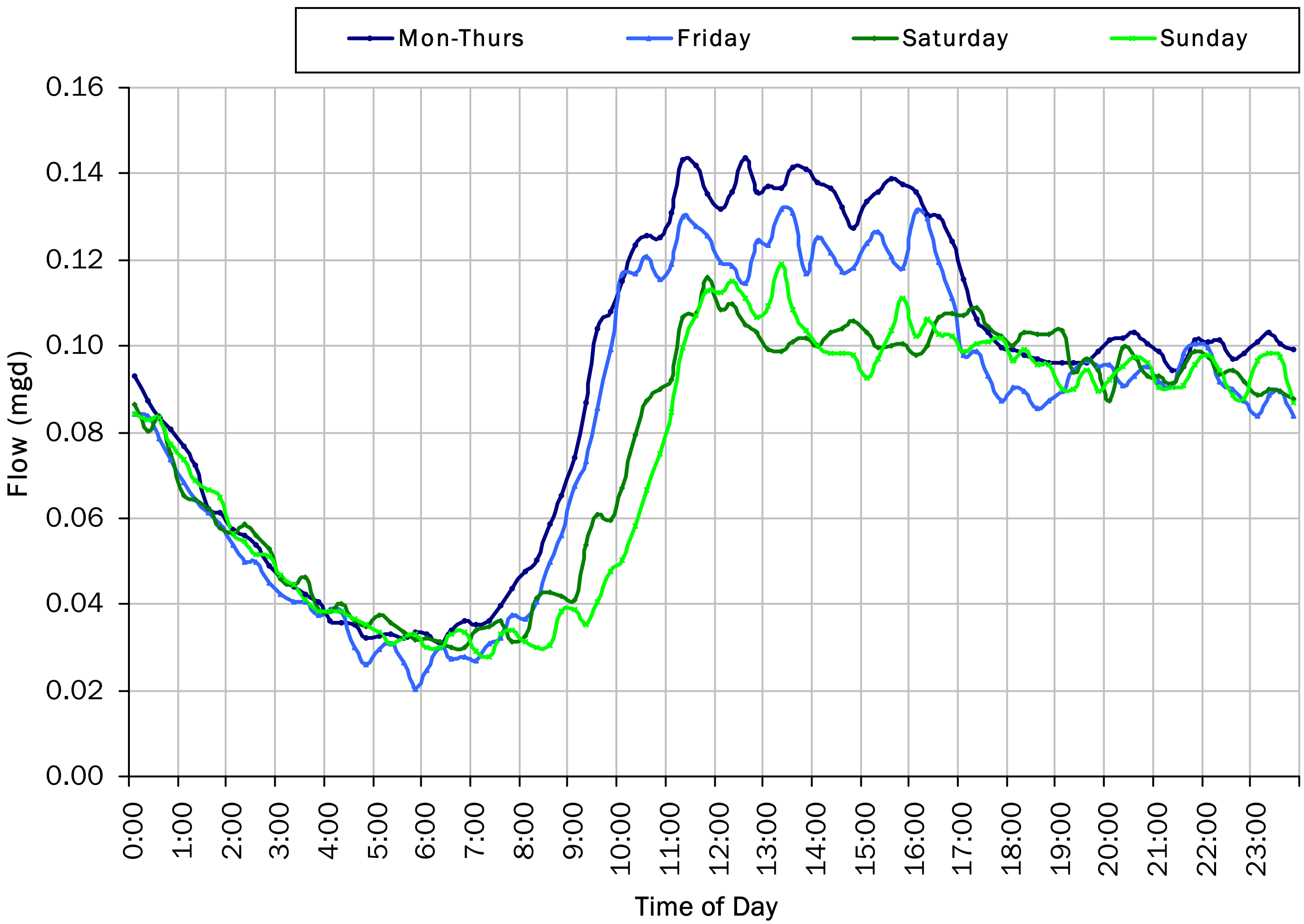
SITE 06
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches   Period Avg Flow: 0.087 mgd   Period Peak Flow: 0.261 mgd   Period Min Flow: 0.018 mgd



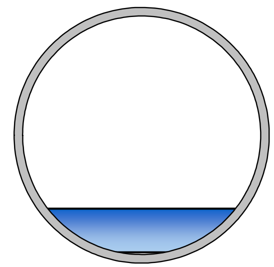


SITE 06
Average Dry Weather Flow Hydrographs



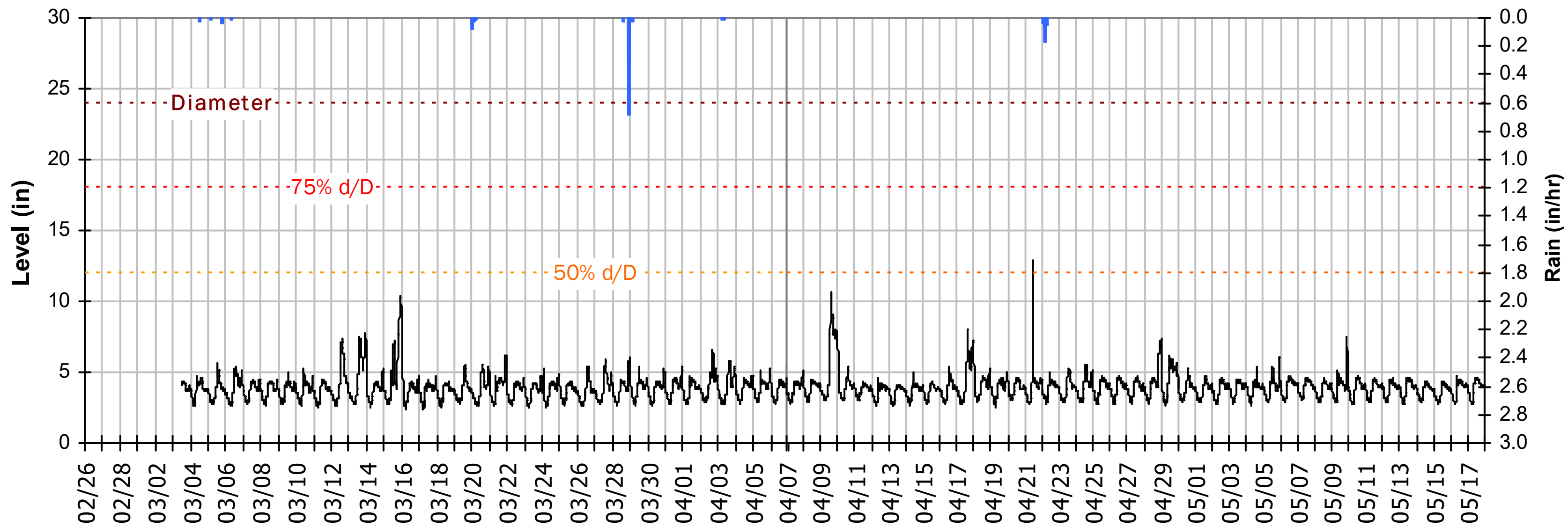
ADWF:

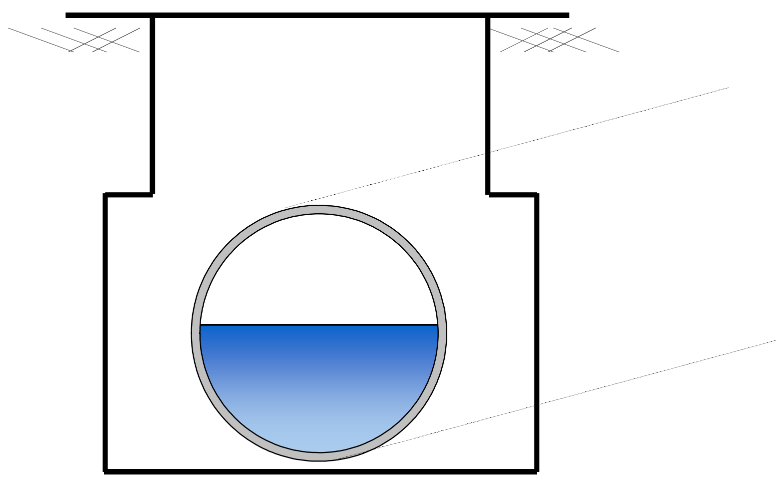
0.085 *mgd*



SITE 06
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

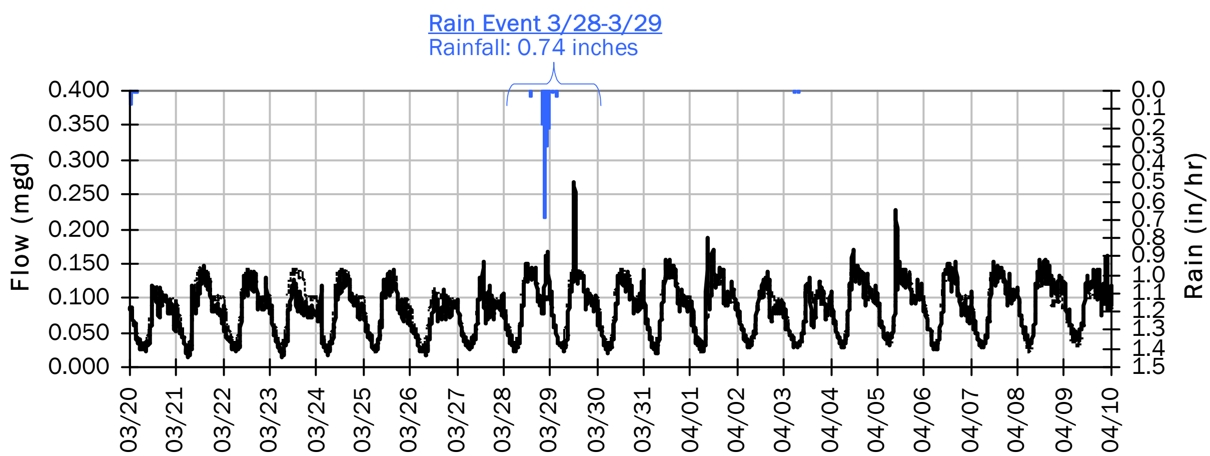




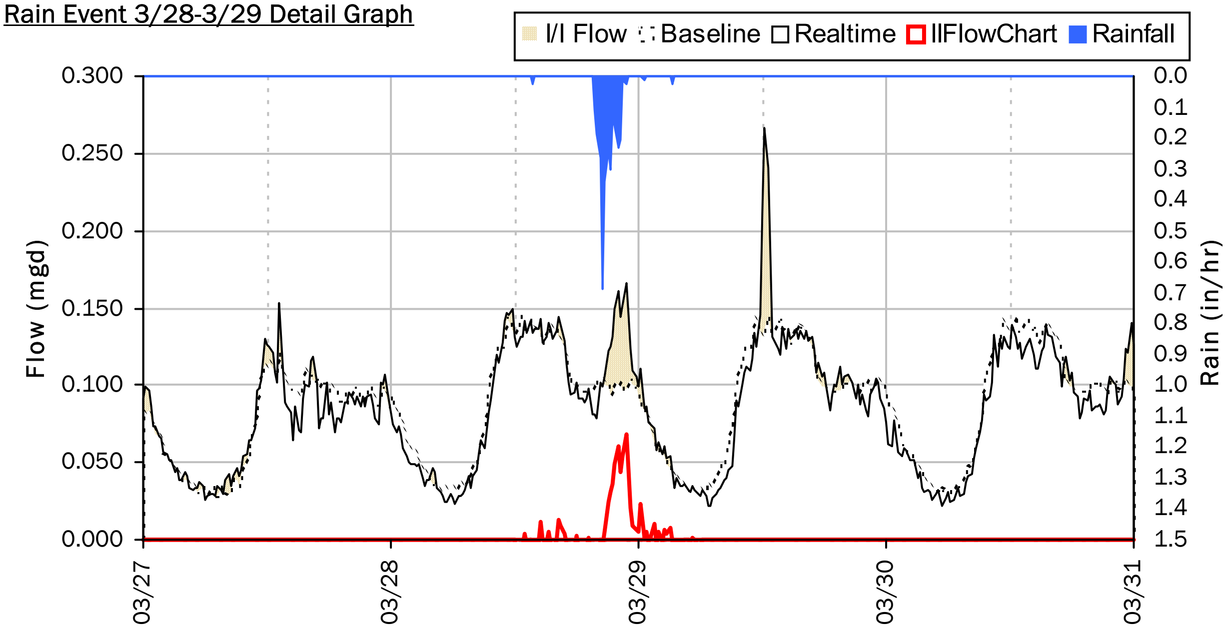
Pipe Diameter:	24	*inches*
Peak Measured Level:	12.8	*inches*
Peak d/D Ratio:	0.53	

SITE 06
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



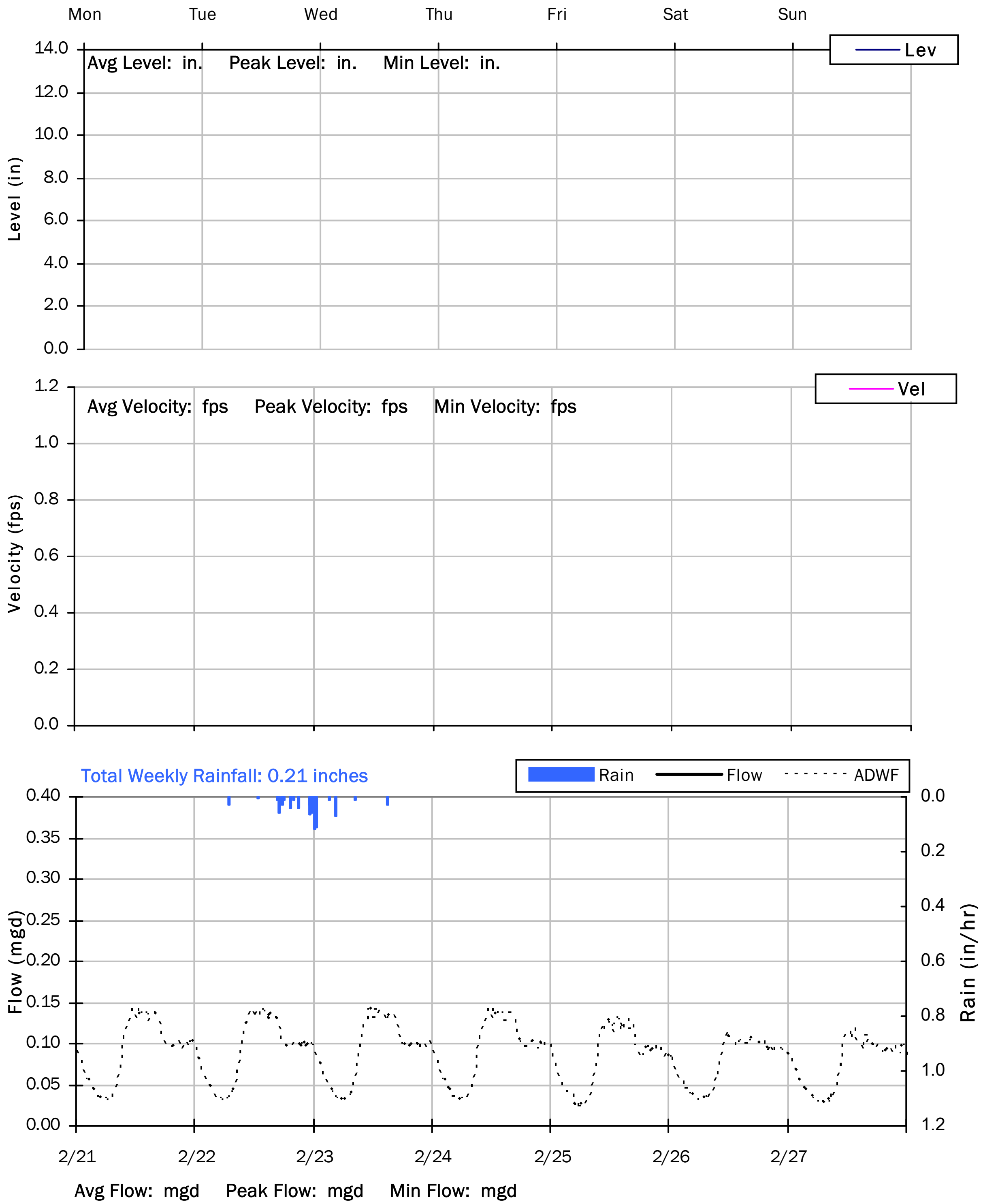
Storm Event I/I Analysis (Rain = 0.74 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.166 *mgd*	Peak I/I Rate:	0.068 *mgd*
PF:	1.95	Total I/I:	4,000 *gallons*
Peak Level:	5.99 *in*		
d/D Ratio:	0.25		

SITE 06

Weekly Level, Velocity and Flow Hydrographs

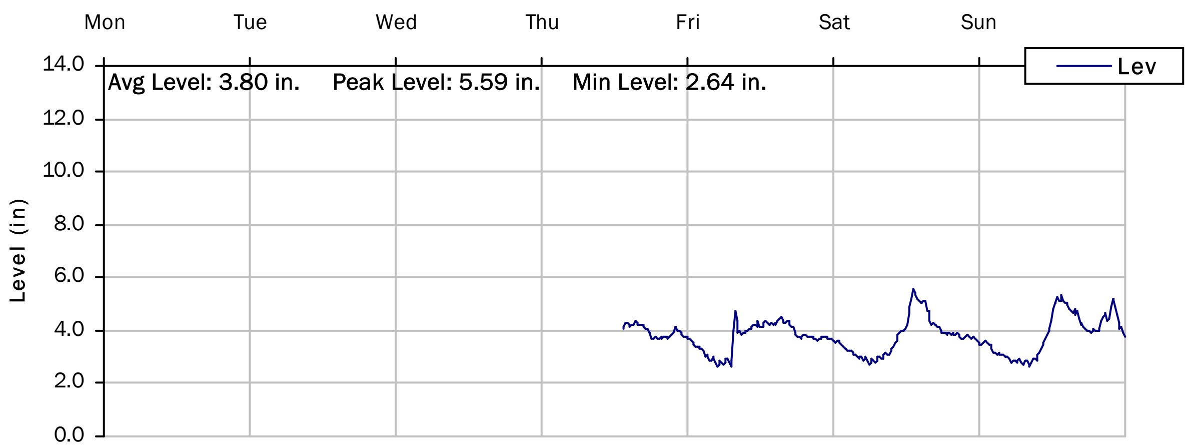
2/21/2022 to 2/28/2022

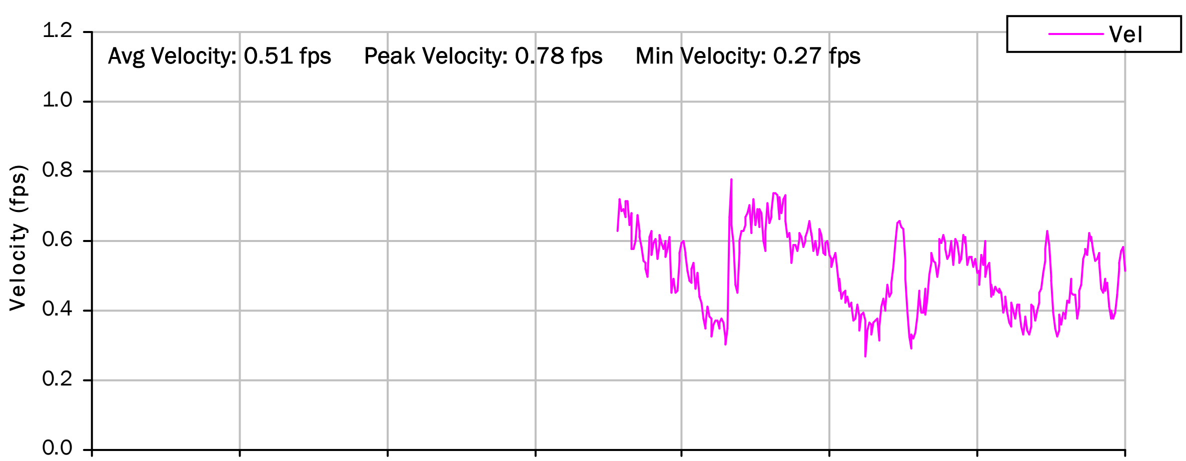


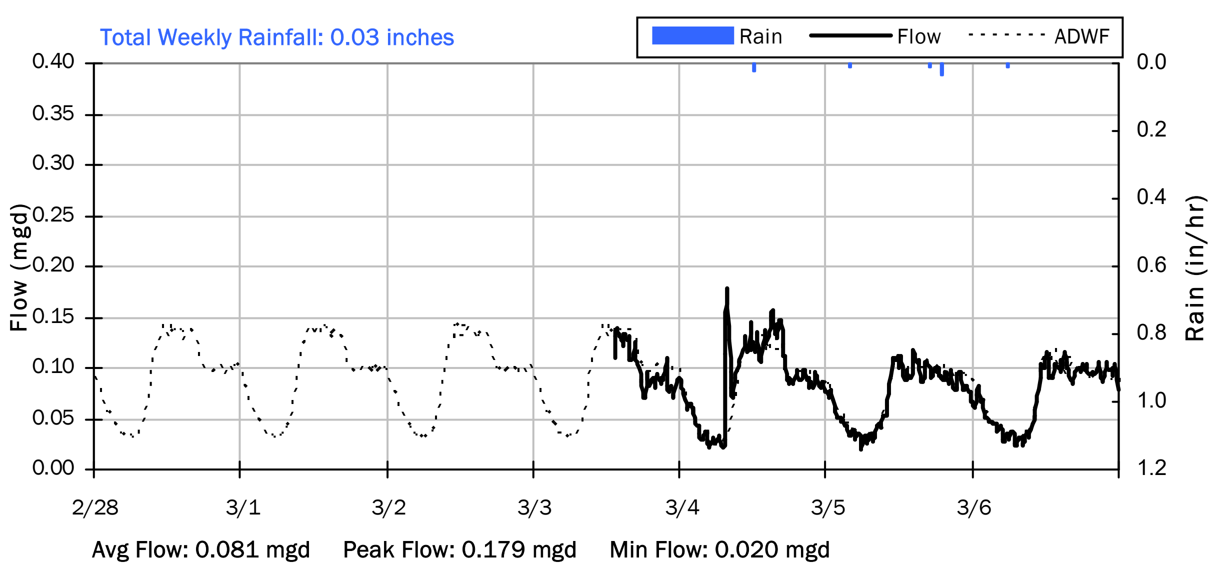
SITE 06

Weekly Level, Velocity and Flow Hydrographs

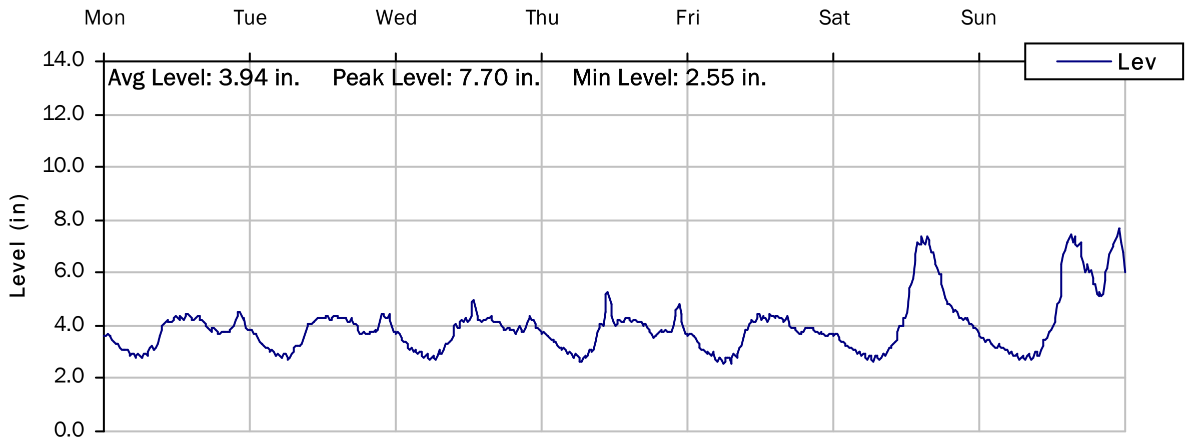
2/28/2022 to 3/7/2022

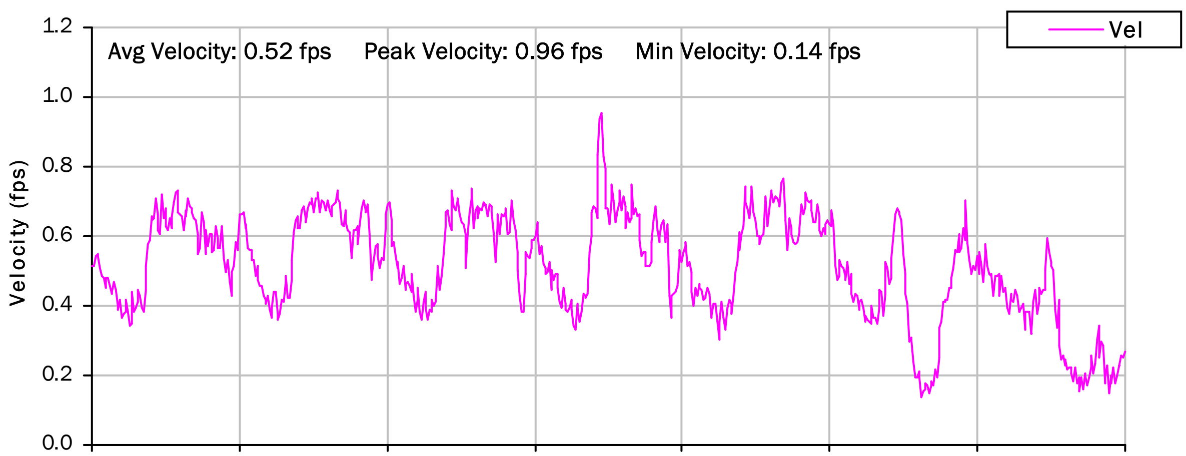


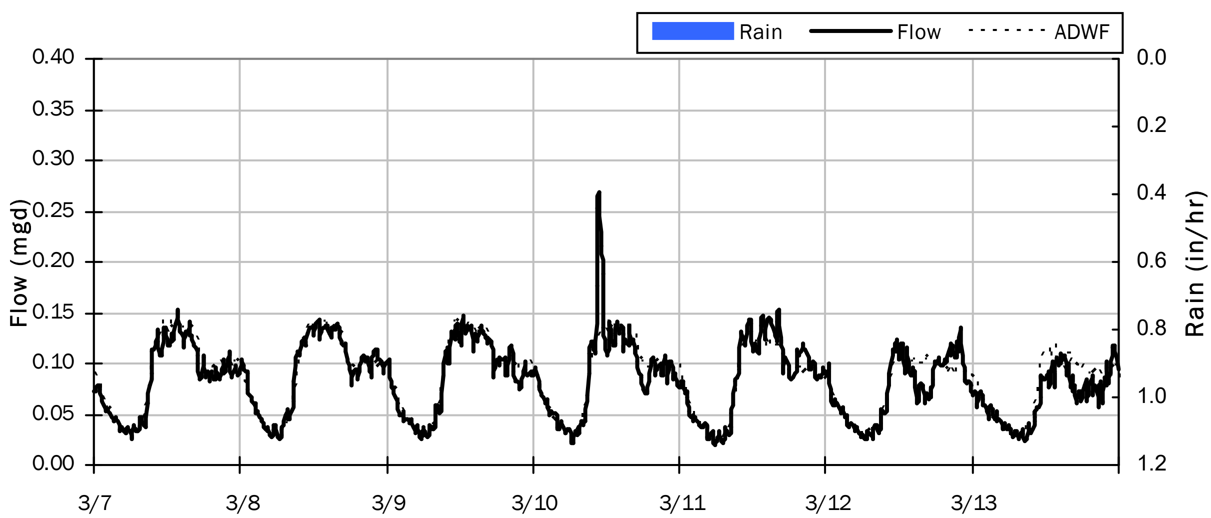




SITE 06
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

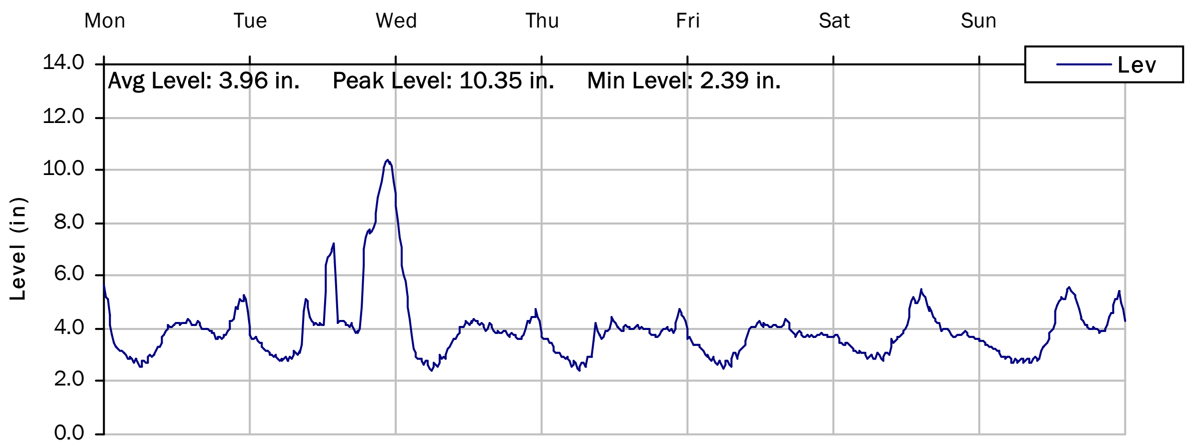


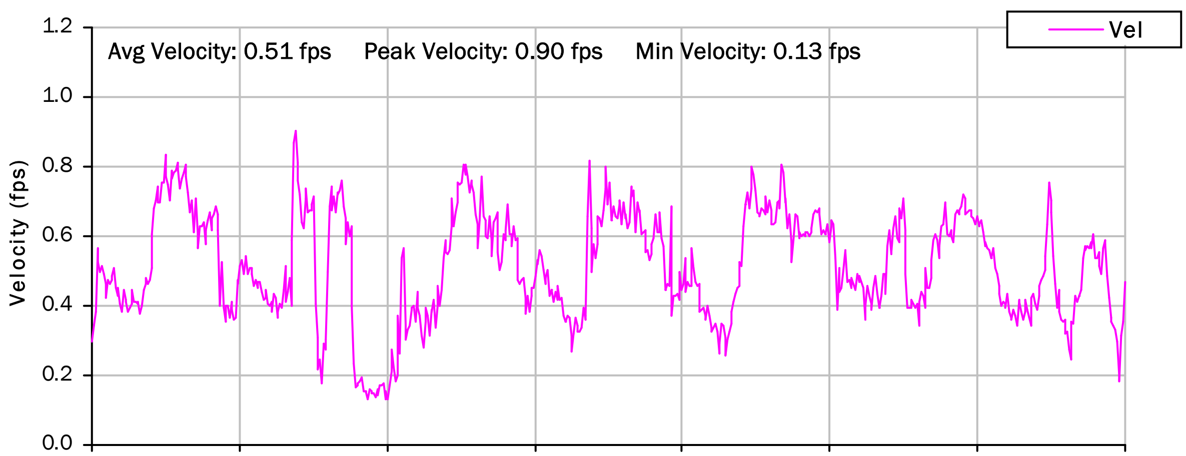


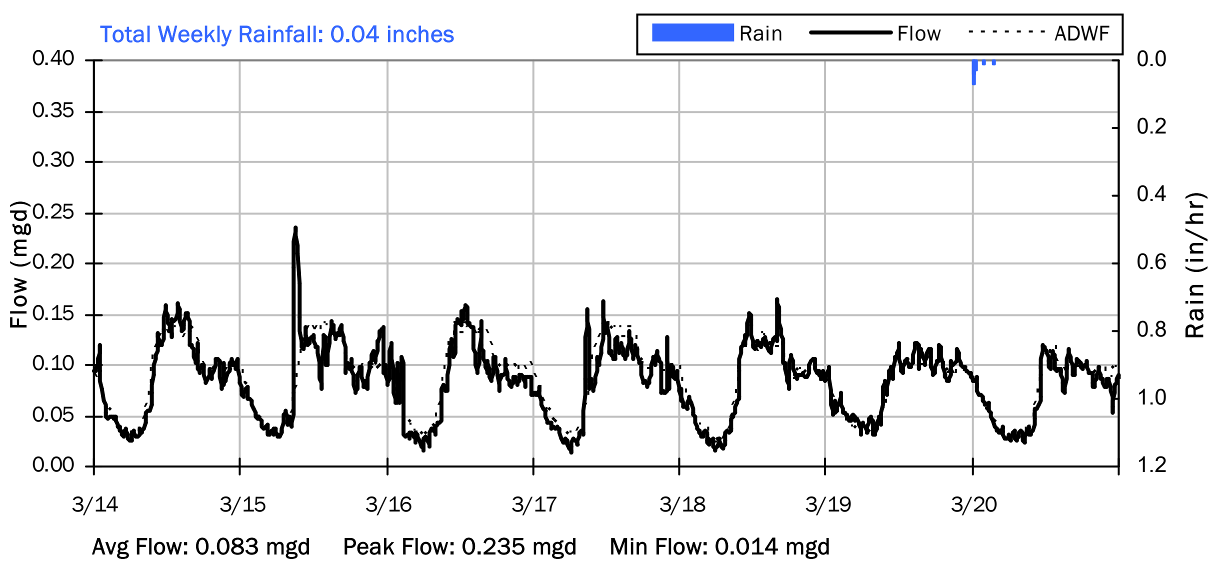


Avg Flow: 0.083 mgd Peak Flow: 0.268 mgd Min Flow: 0.019 mgd

SITE 06
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



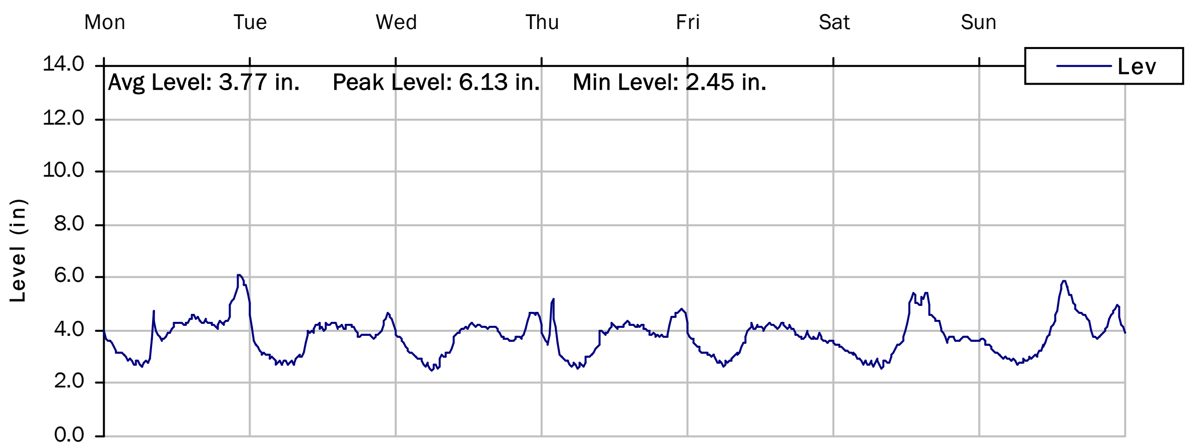


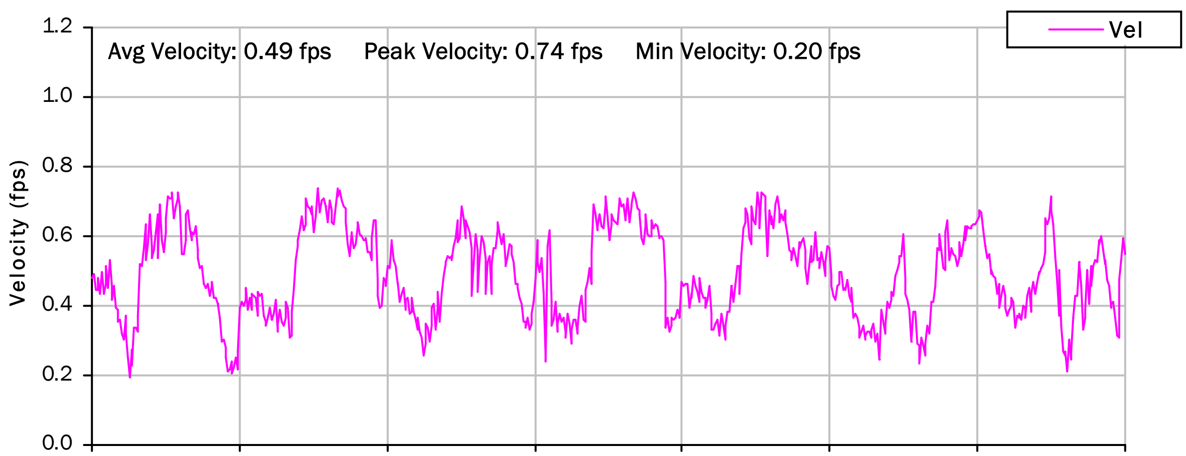


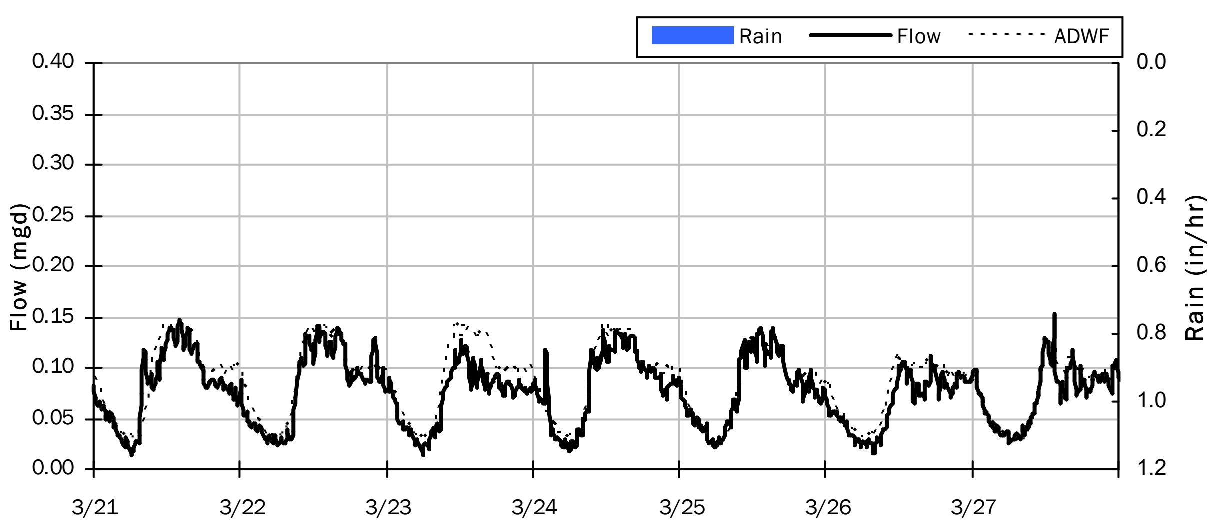
SITE 06

Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022





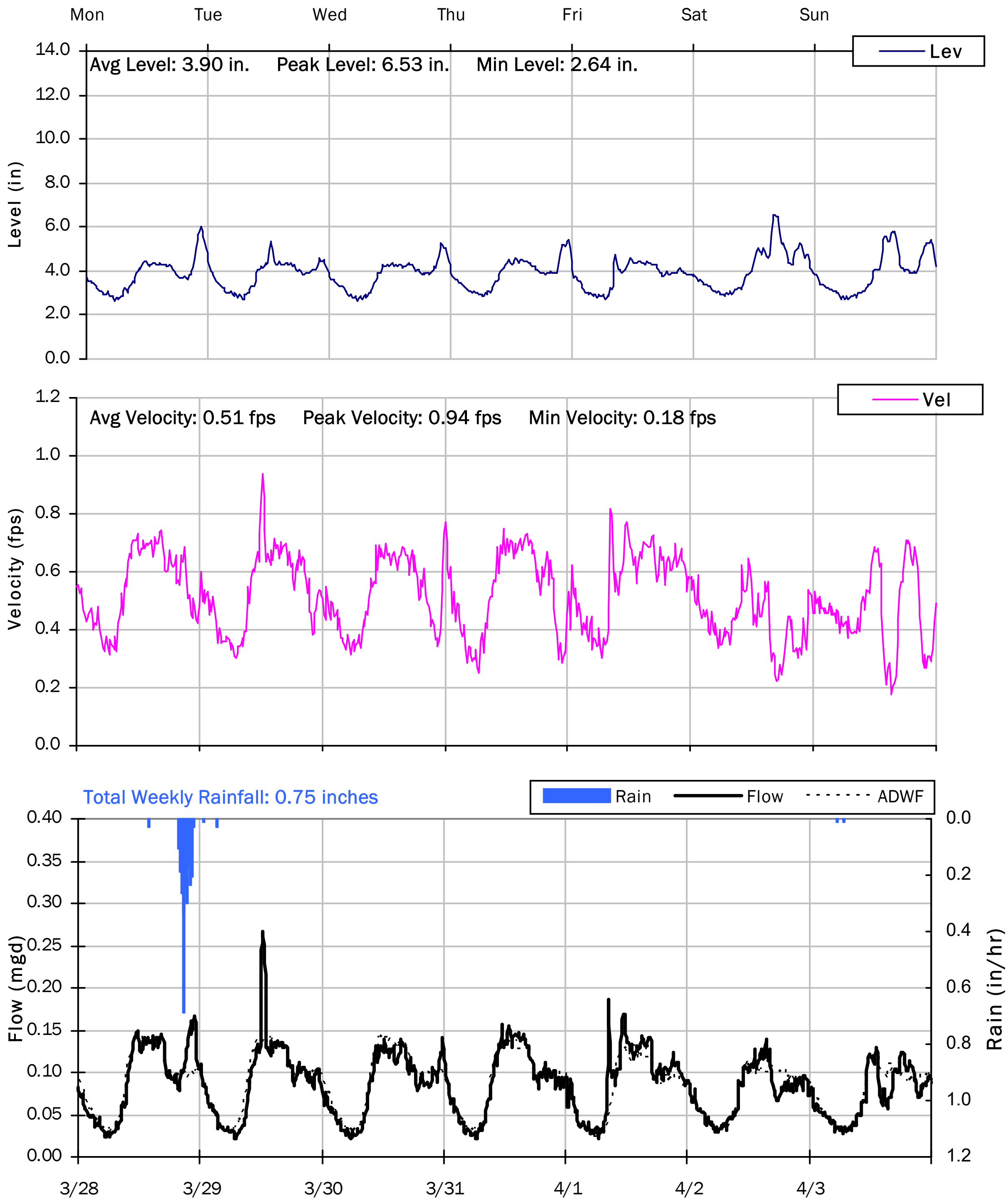


Avg Flow: 0.076 mgd Peak Flow: 0.153 mgd Min Flow: 0.013 mgd

SITE 06

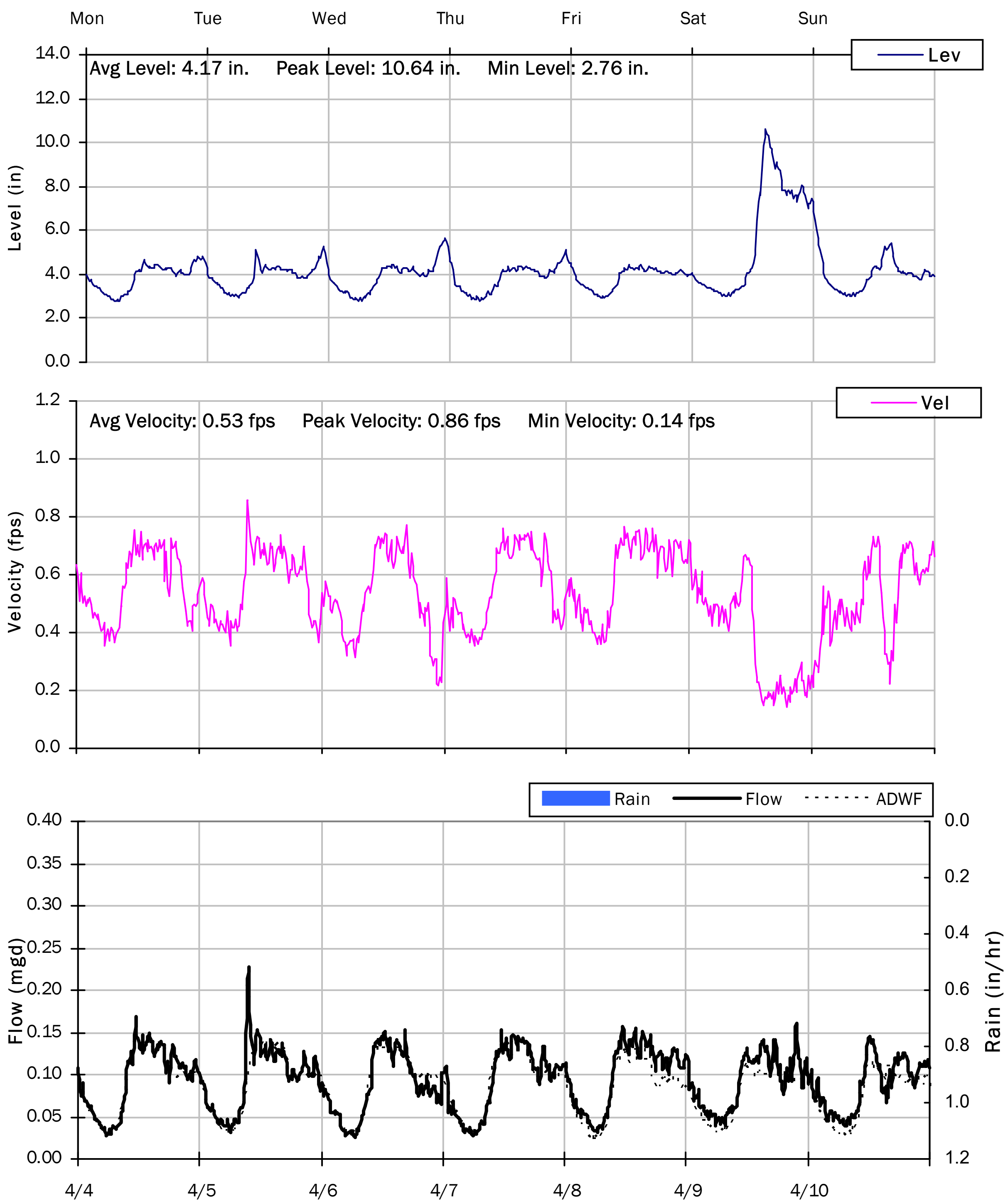
Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022



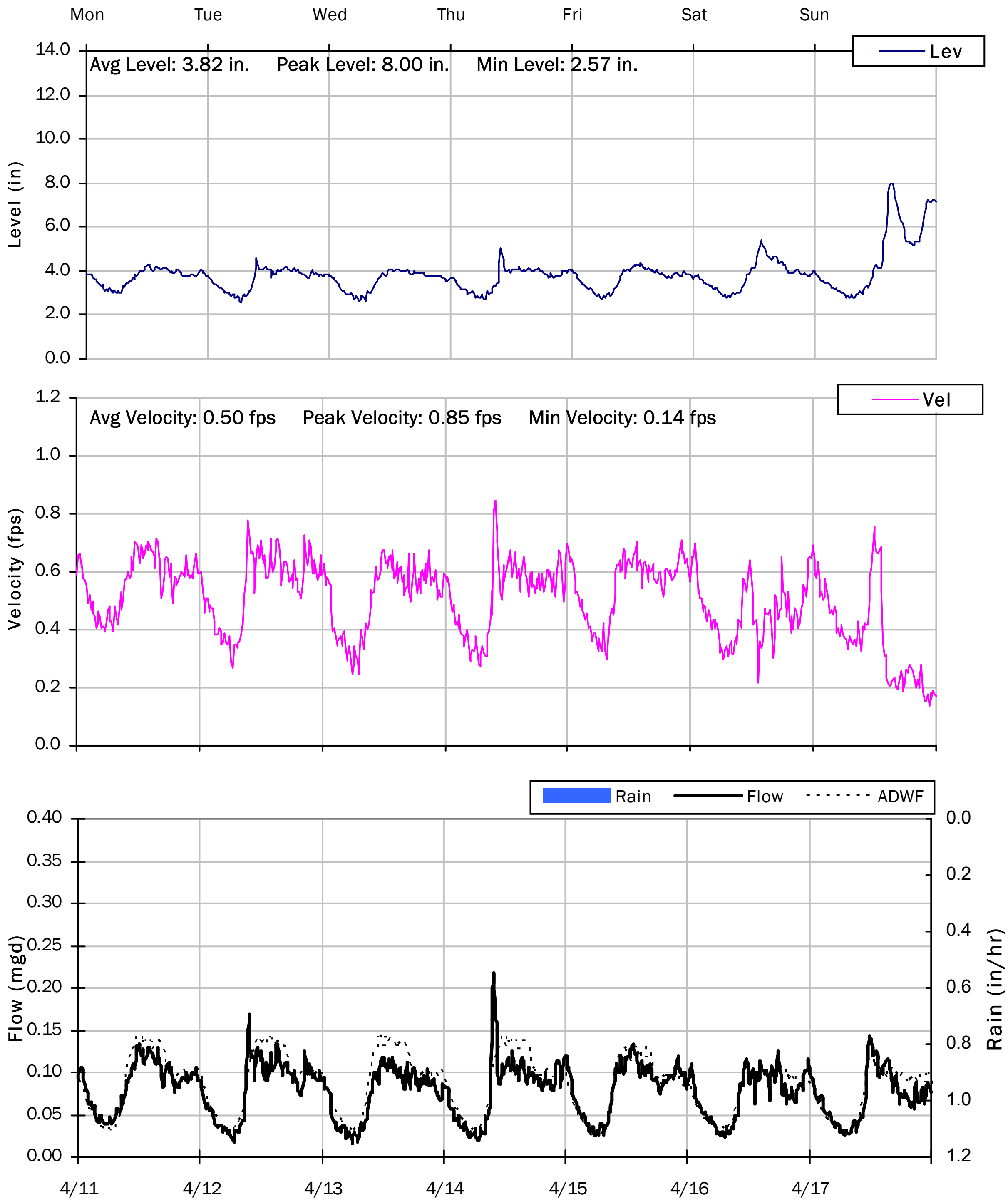
Avg Flow: 0.085 mgd Peak Flow: 0.266 mgd Min Flow: 0.021 mgd

SITE 06
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022



Avg Flow: 0.093 mgd Peak Flow: 0.227 mgd Min Flow: 0.025 mgd

SITE 06
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

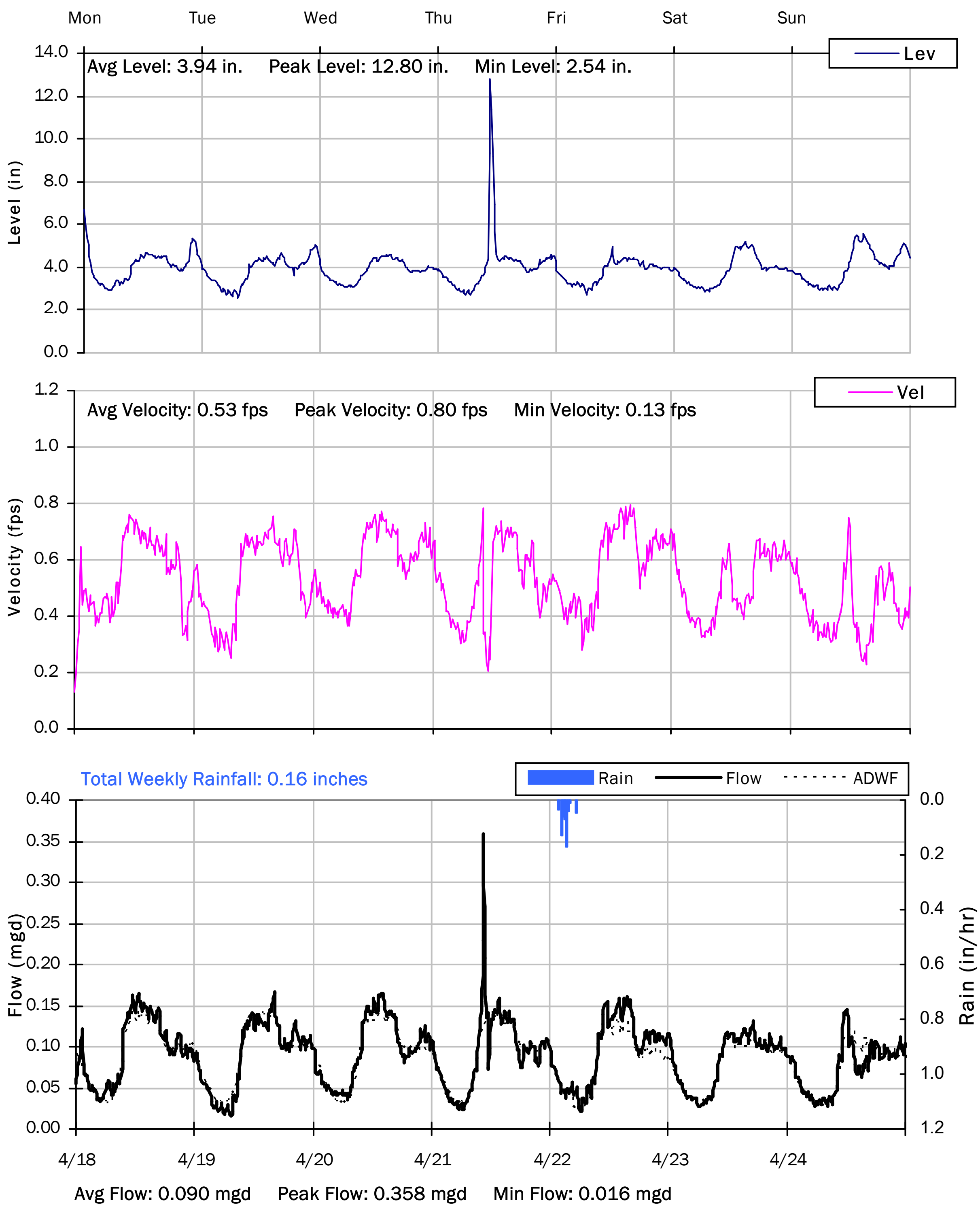


Avg Flow: 0.079 mgd Peak Flow: 0.218 mgd Min Flow: 0.017 mgd

SITE 06

Weekly Level, Velocity and Flow Hydrographs

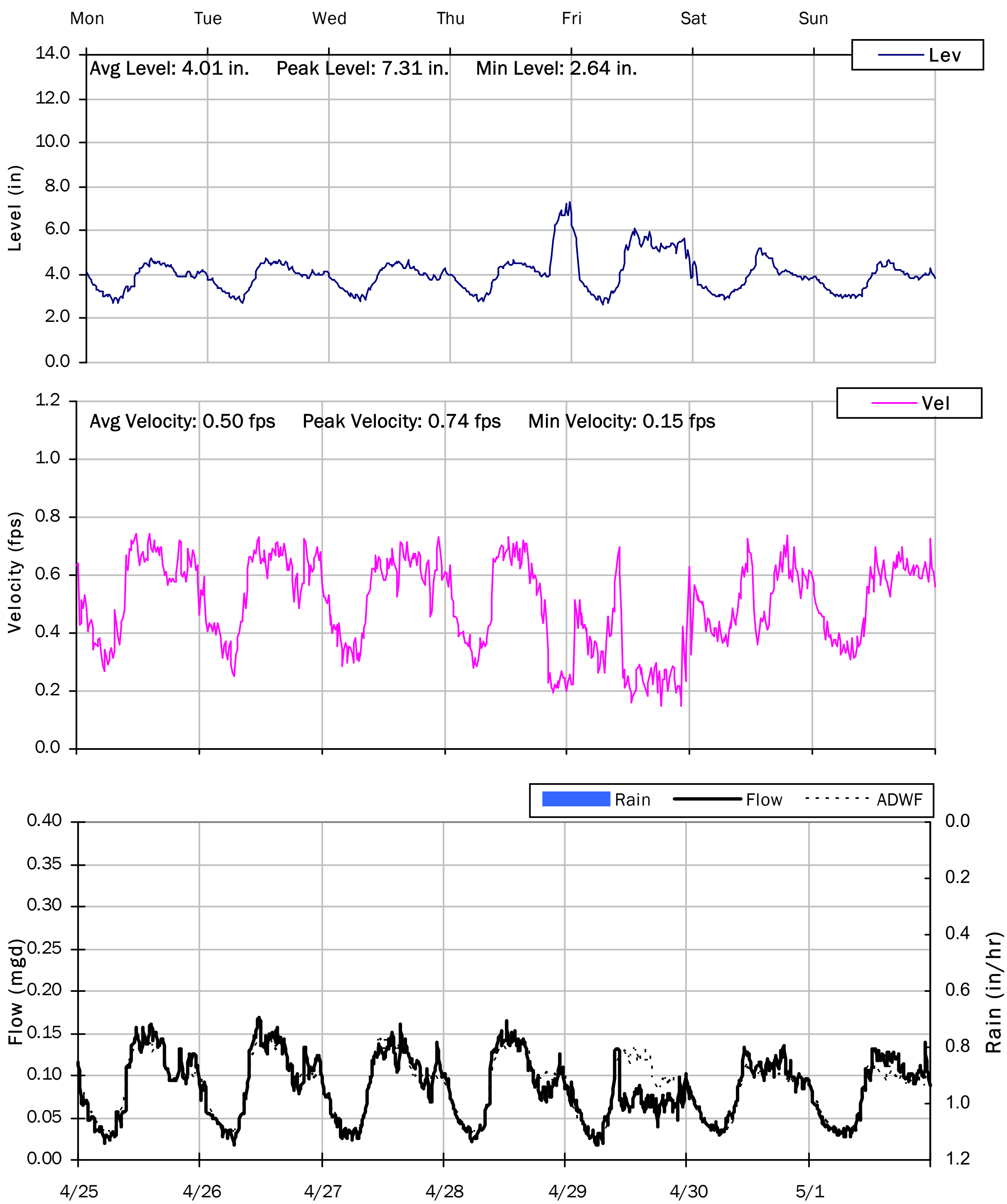
4/18/2022 to 4/25/2022



SITE 06

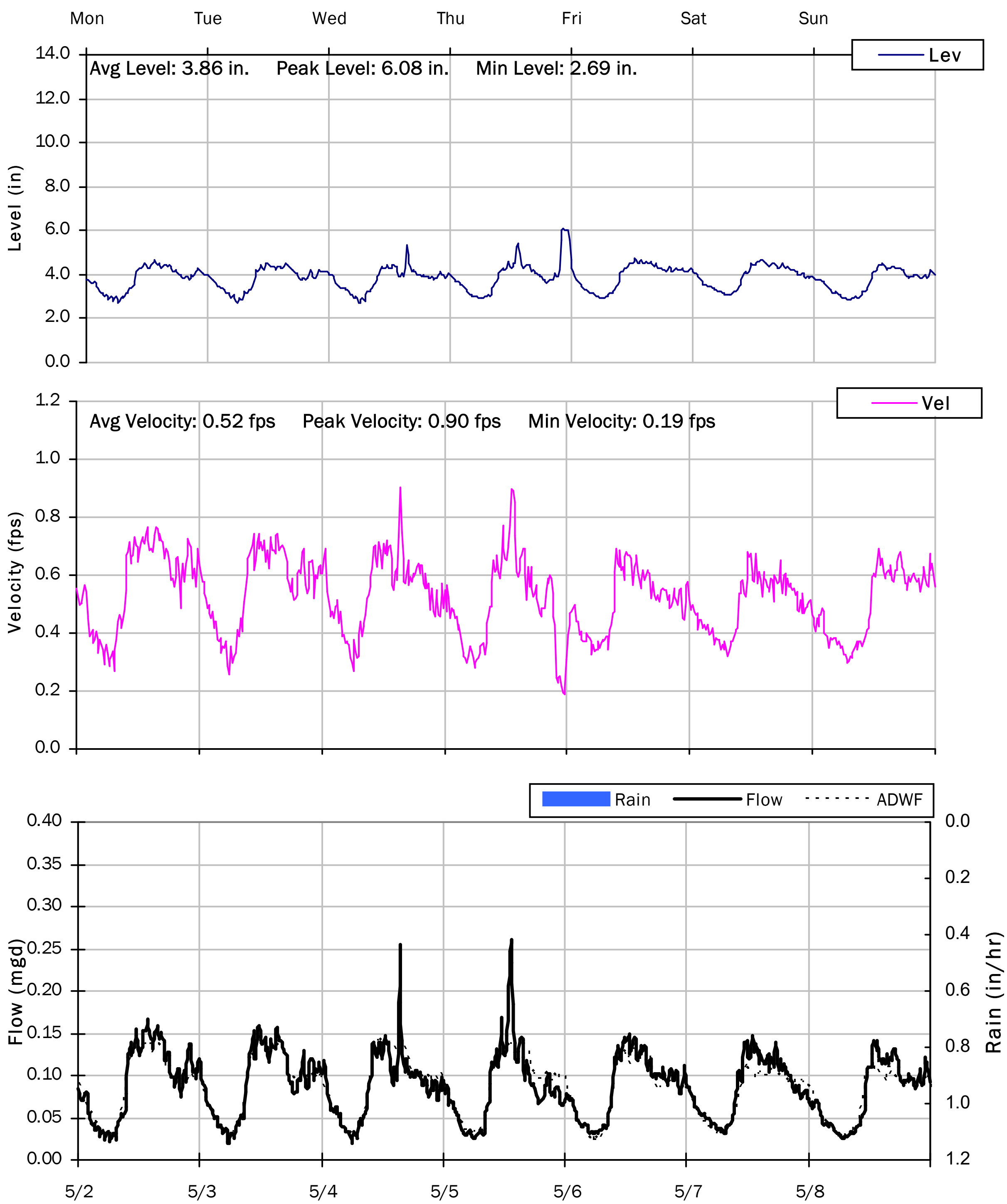
Weekly Level, Velocity and Flow Hydrographs

4/25/2022 to 5/2/2022



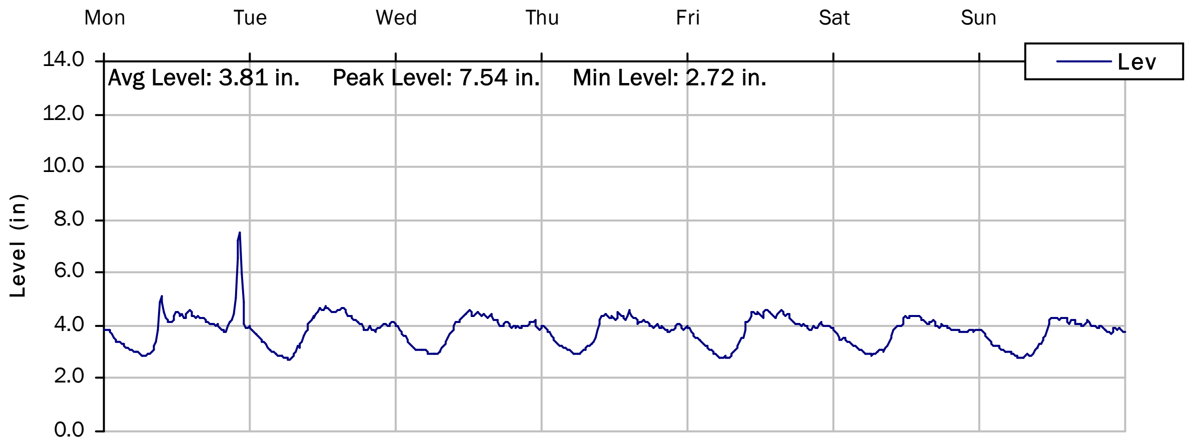
Avg Flow: 0.086 mgd Peak Flow: 0.169 mgd Min Flow: 0.018 mgd

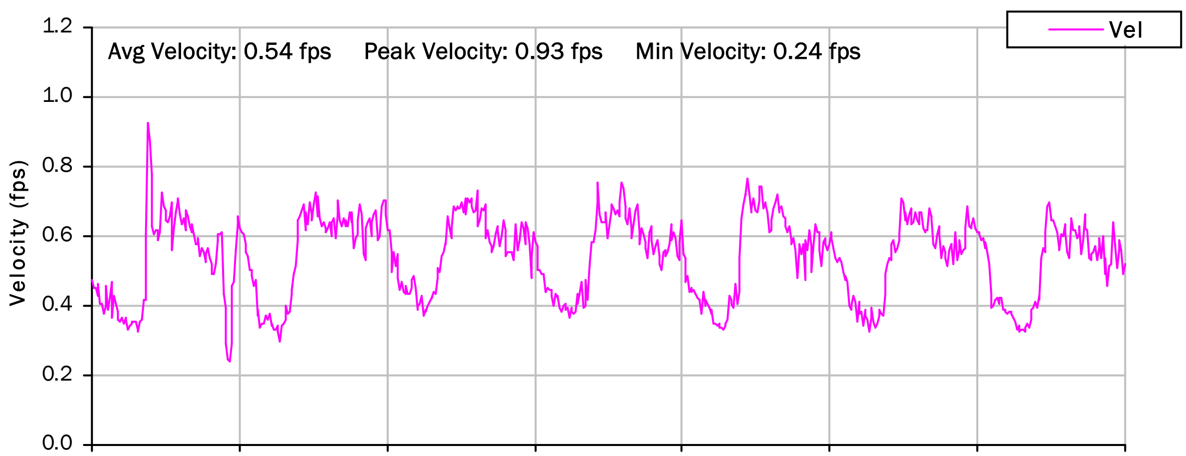
SITE 06
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

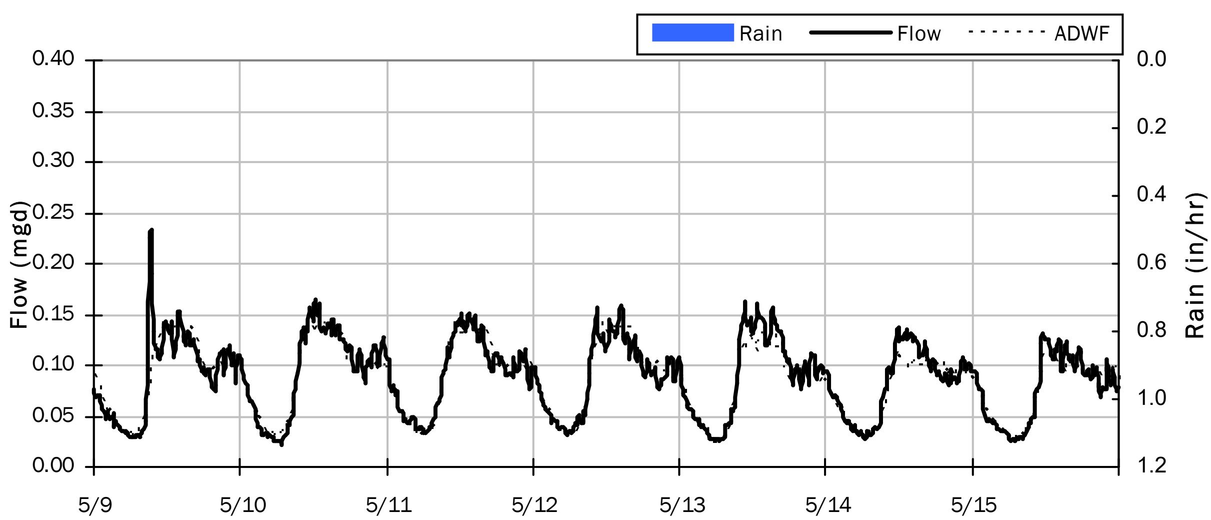


Avg Flow: 0.088 mgd Peak Flow: 0.261 mgd Min Flow: 0.019 mgd

SITE 06
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022





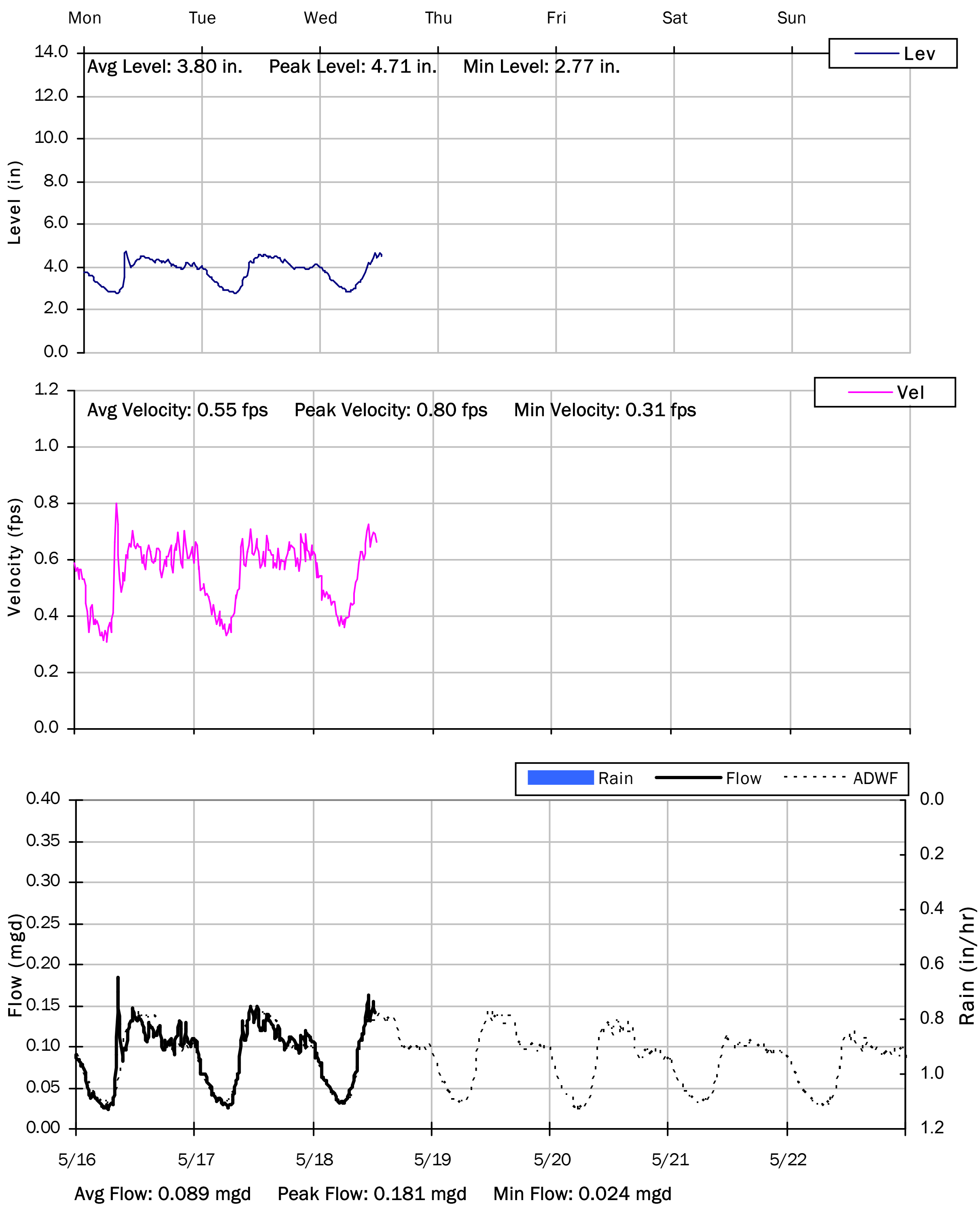


Avg Flow: 0.088 mgd Peak Flow: 0.233 mgd Min Flow: 0.022 mgd

SITE 06

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022



Monitoring Site: Site 07

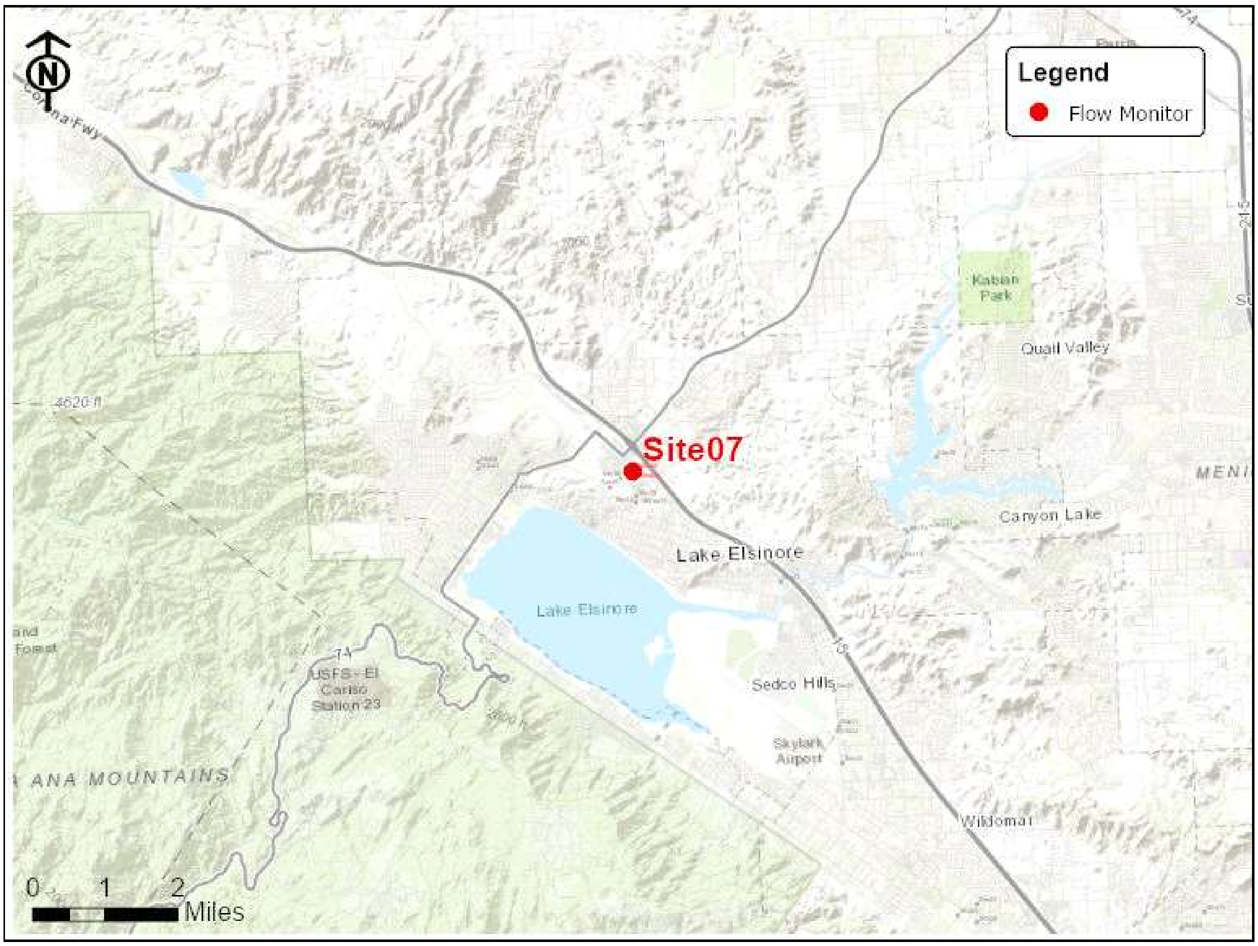
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: 3rd Street, south of Collier Street

Data Summary Report



Vicinity Map: Site 07

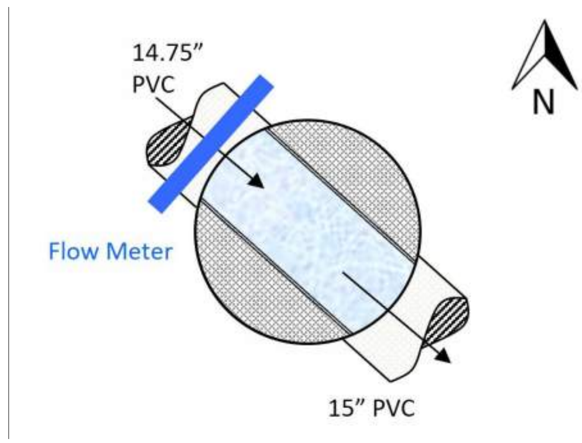
SITE 07

Site Information — MH ID: MH-8697

Location:	3rd Street, south of Collier Street
Coordinates:	117.3377° W, 33.6868° N
Rim Elevation (Earth):	1268 feet
Expected Pipe Diameter:	15 inches
Measured Pipe Diameter:	14.75 inches
ADWF:	0.048 mgd
Peak Measured Flow:	0.544 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 07

Additional Site Photos

Effluent Pipe

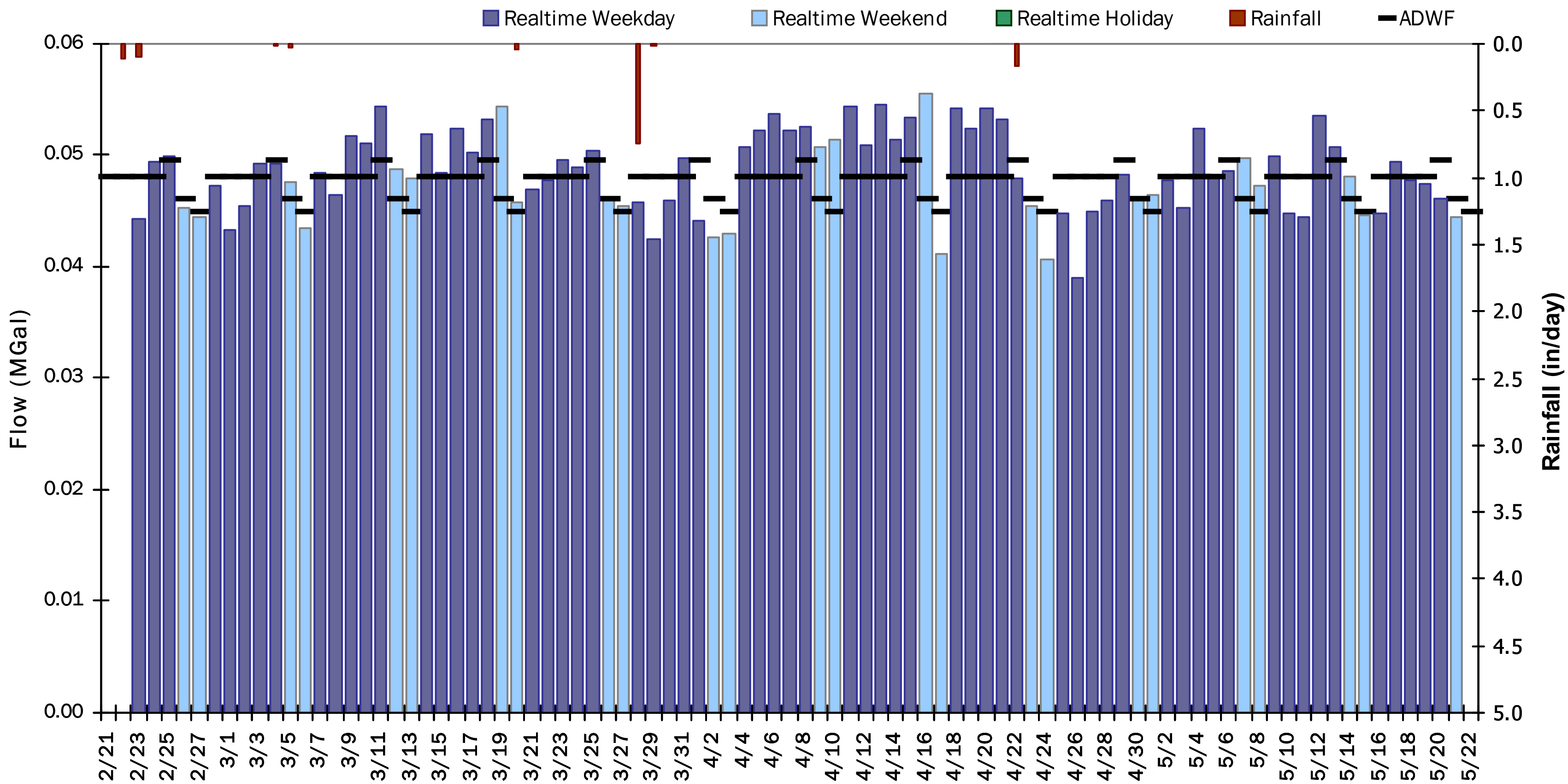
Influent Pipe

SITE 07

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.049 MGal Peak Daily Flow: 0.060 MGal Min Daily Flow: 0.039 MGal

Total Rainfall: 1.20 inches

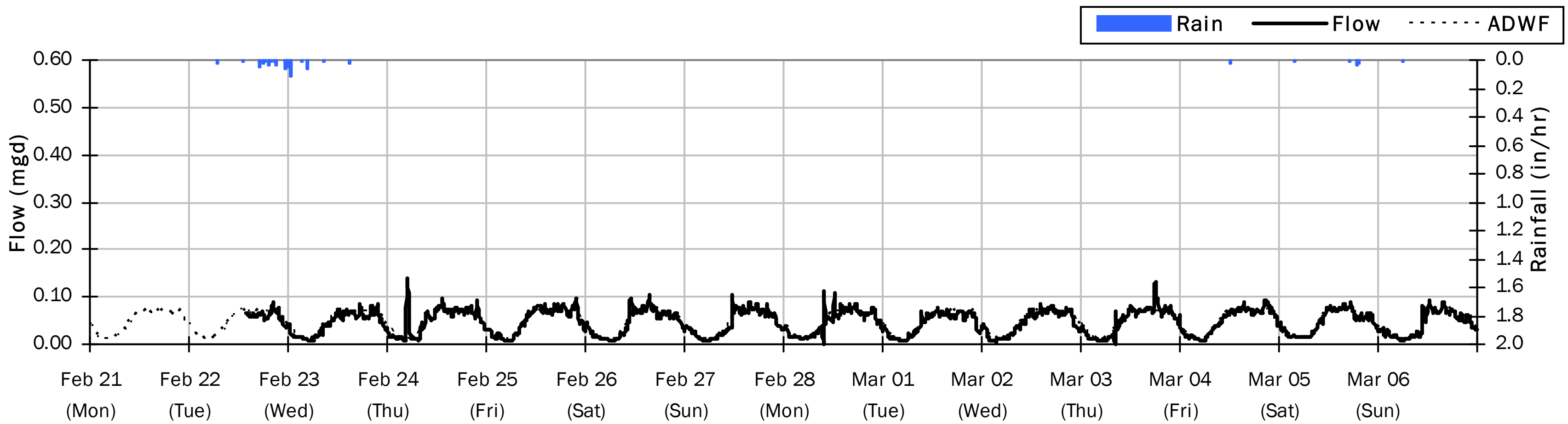


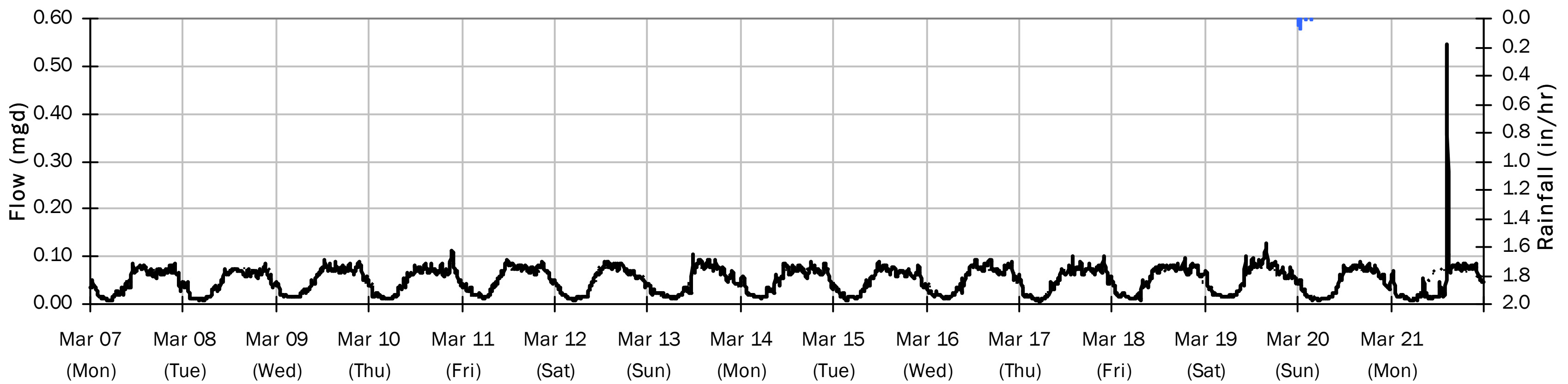
SITE 07

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.28 inches

Period Avg Flow: 0.049 mgd Period Peak Flow: 0.544 mgd Period Min Flow: 0.001 mgd



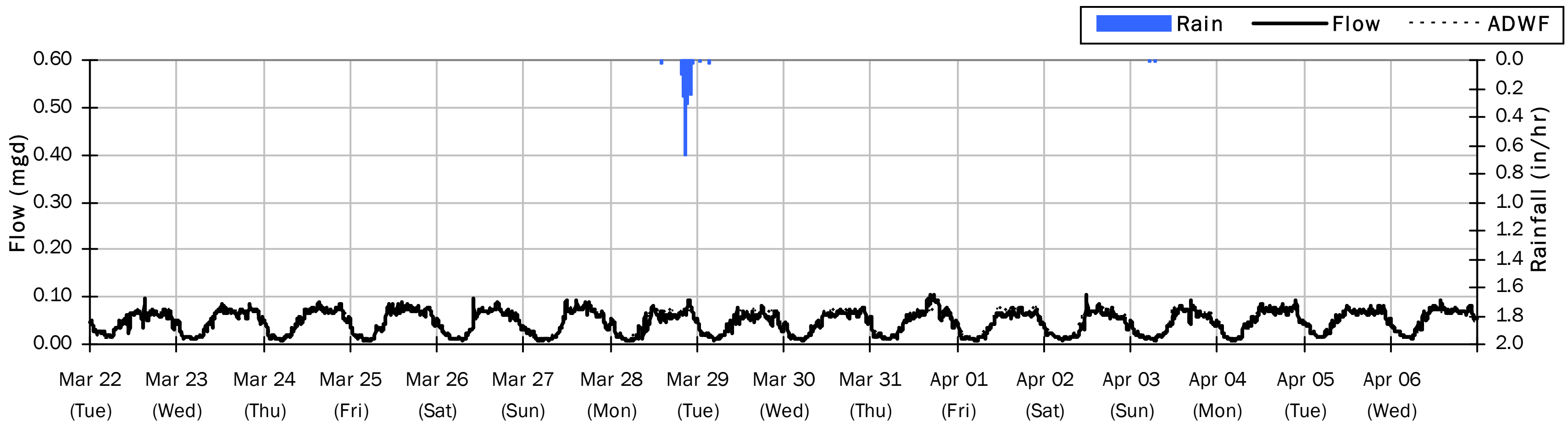


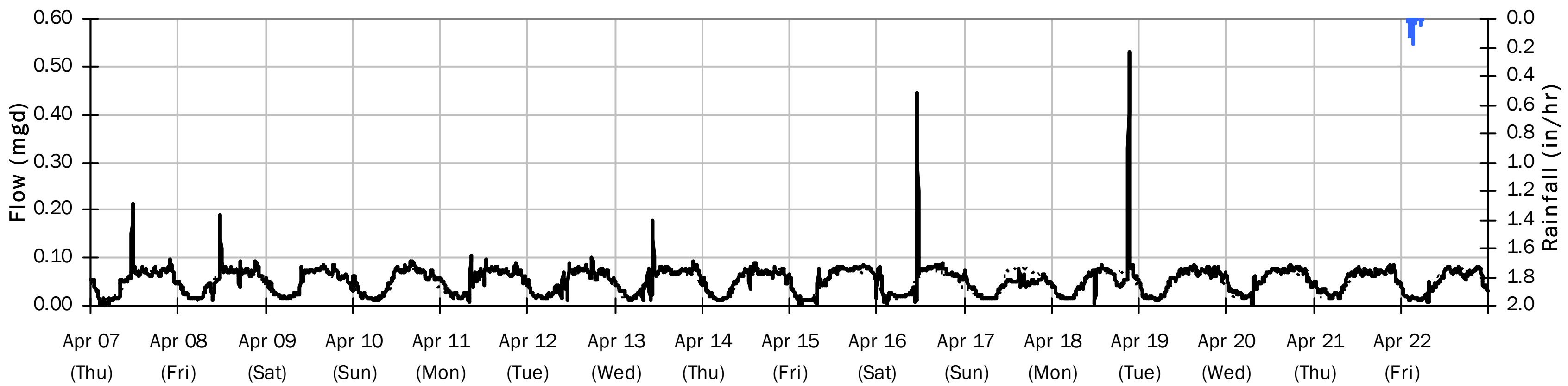
SITE 07

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.92 inches

Period Avg Flow: 0.050 mgd Period Peak Flow: 0.531 mgd Period Min Flow: 0.001 mgd

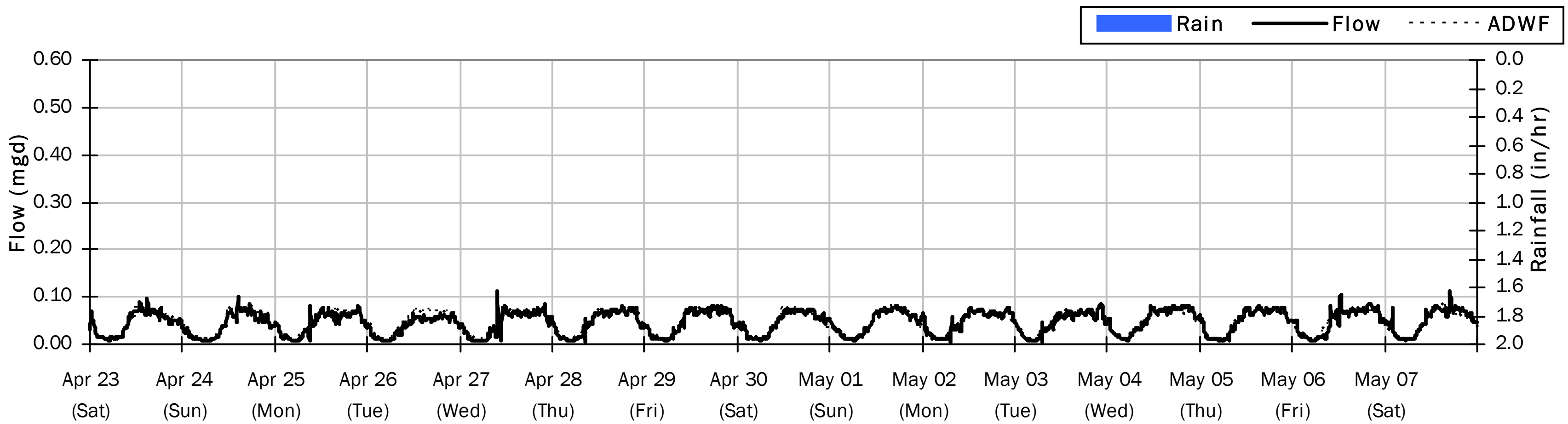


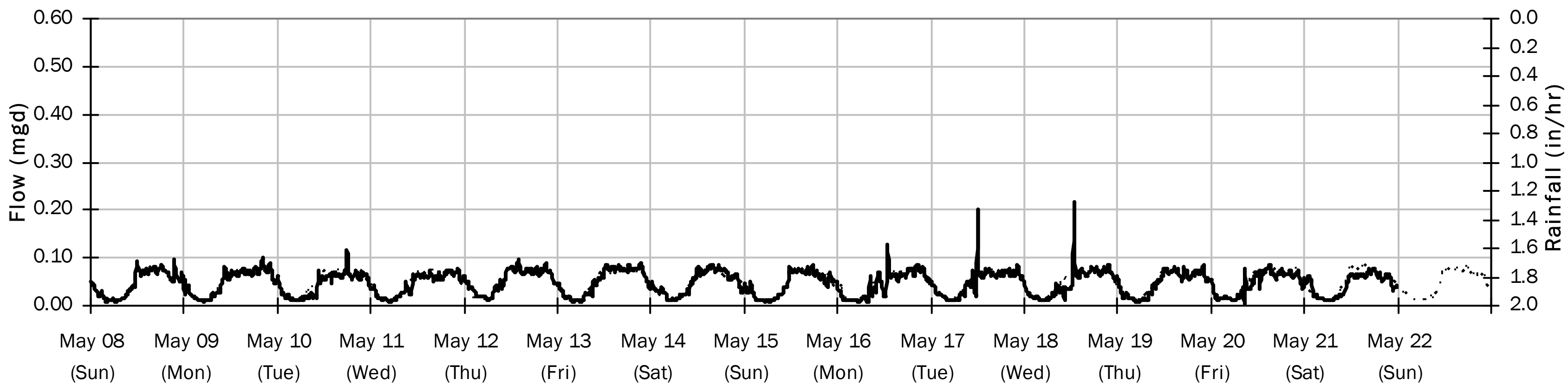


SITE 07

Flow Summary: 4/23/2022 to 5/22/2022

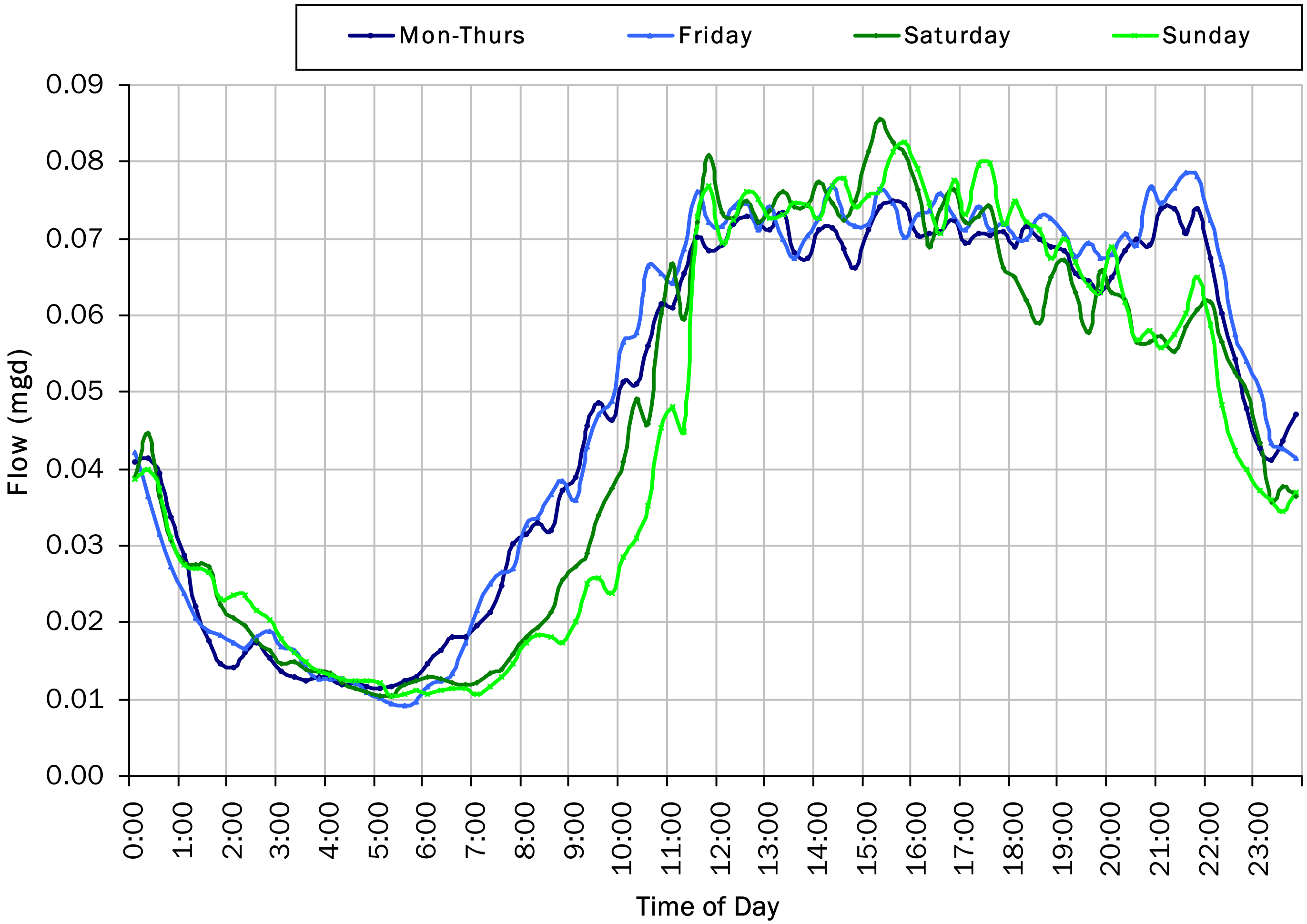
Period Rainfall: 0.00 inches | Period Avg Flow: 0.047 mgd | Period Peak Flow: 0.216 mgd | Period Min Flow: 0.003 mgd





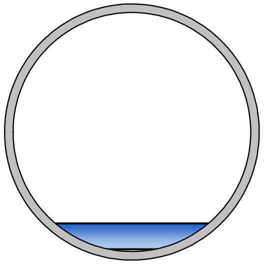
SITE 07

Average Dry Weather Flow Hydrographs



ADWF:

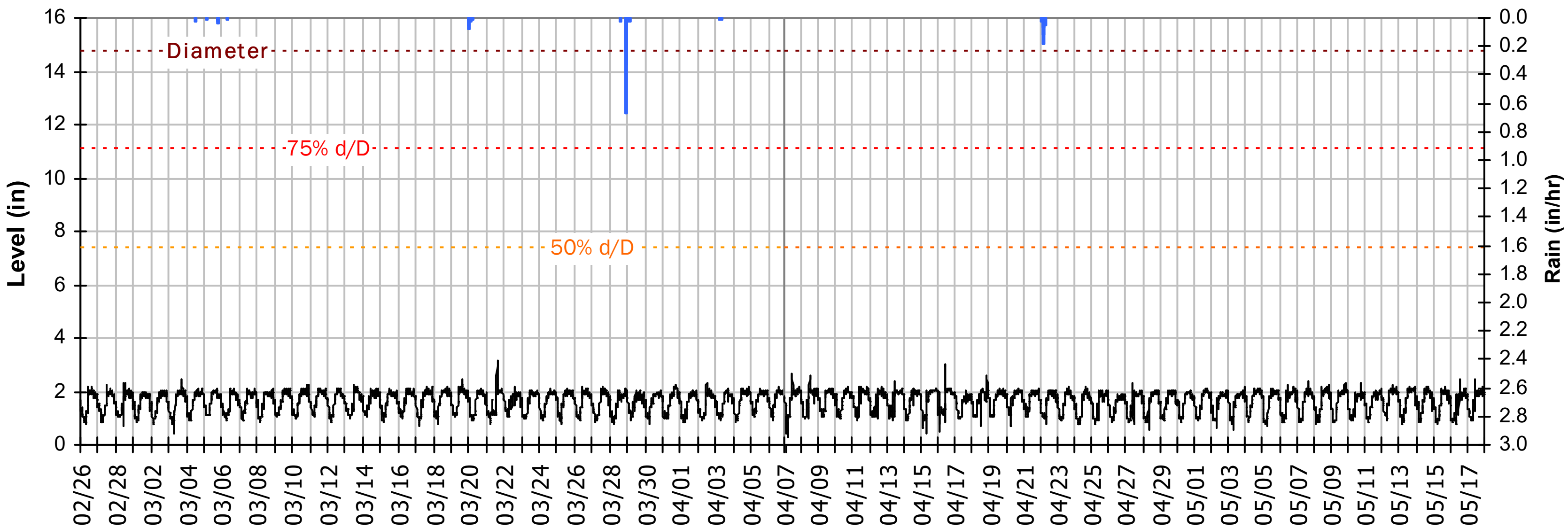
0.048 *mgd*

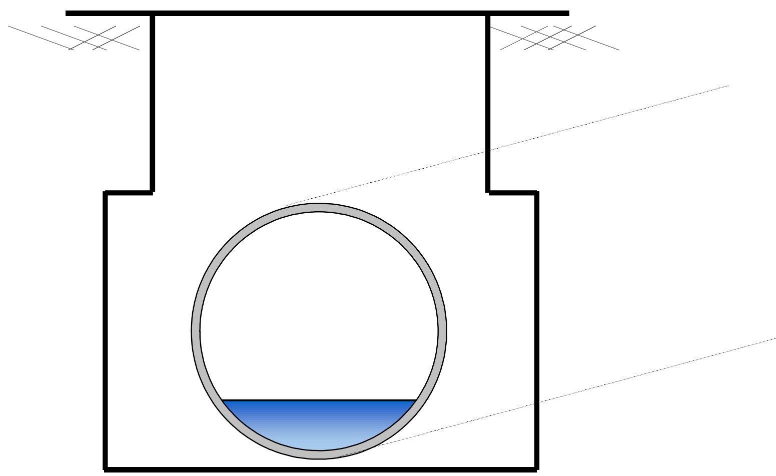


SITE 07

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



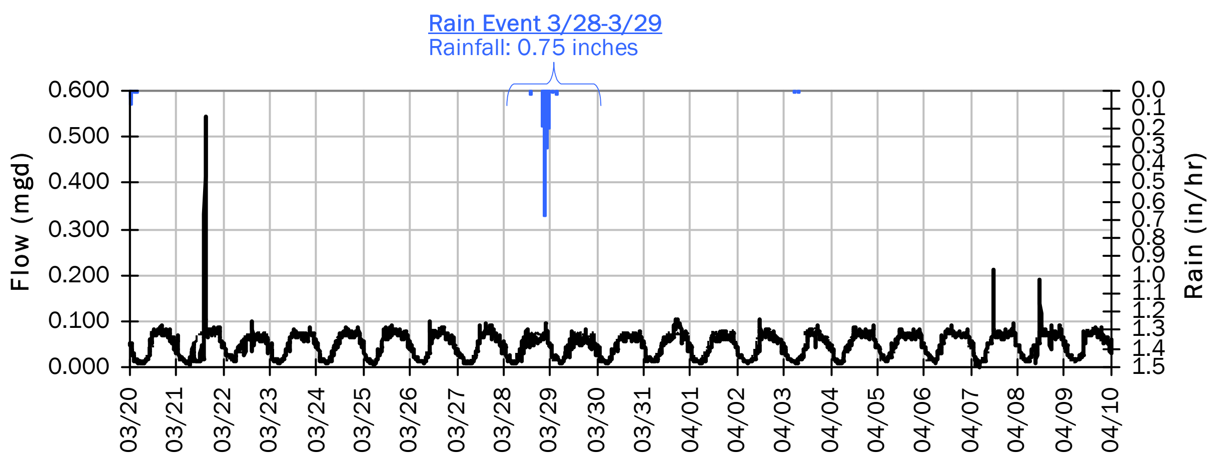


Pipe Diameter:	14.8	*inches*
Peak Measured Level:	3.17	*inches*
Peak d/D Ratio:	0.22	

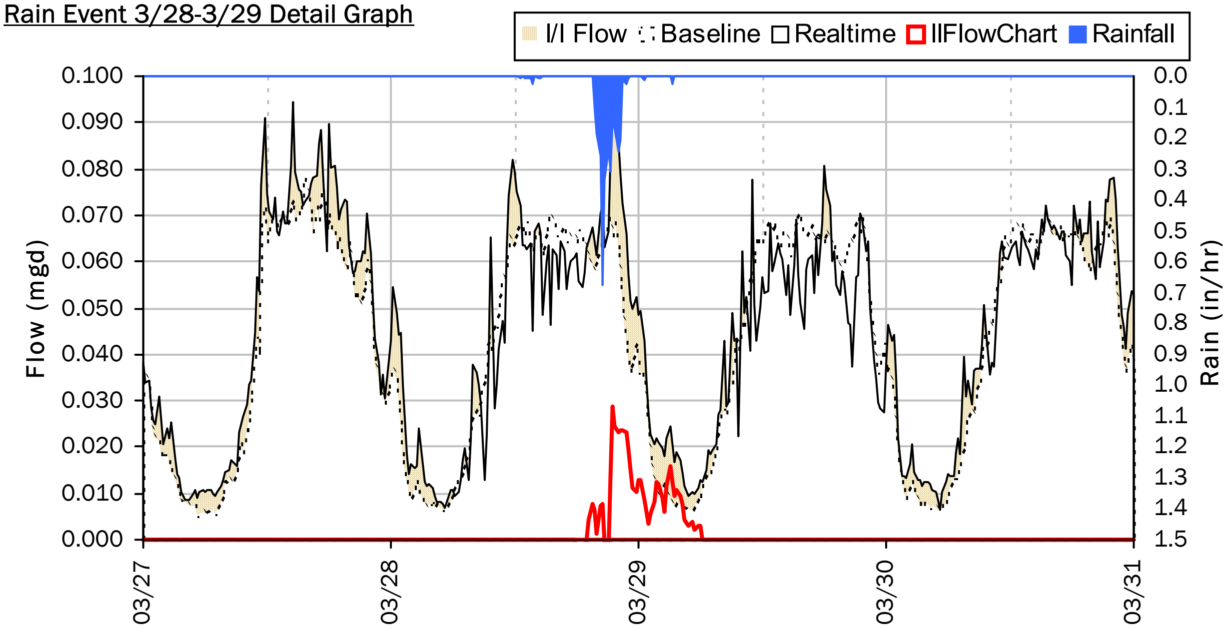
SITE 07

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



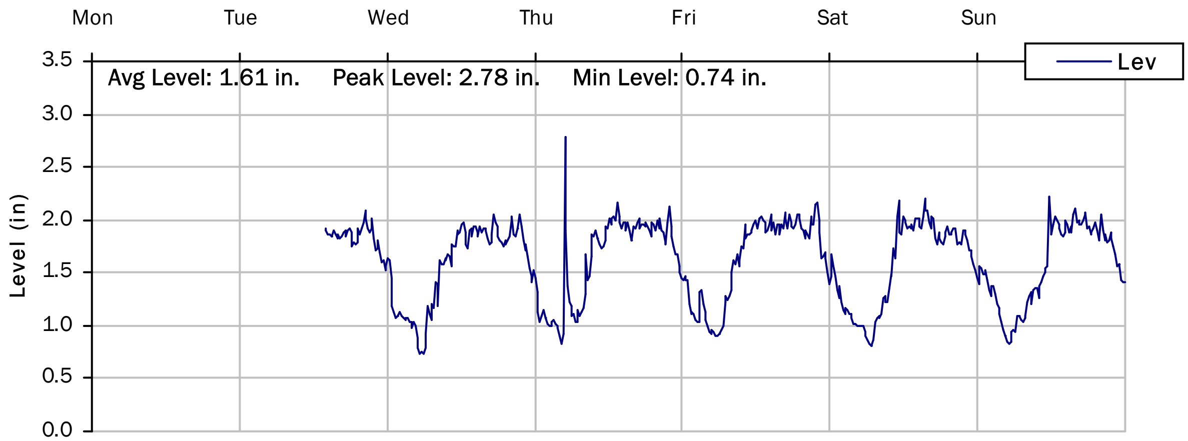
Storm Event I/I Analysis (Rain = 0.75 inches)

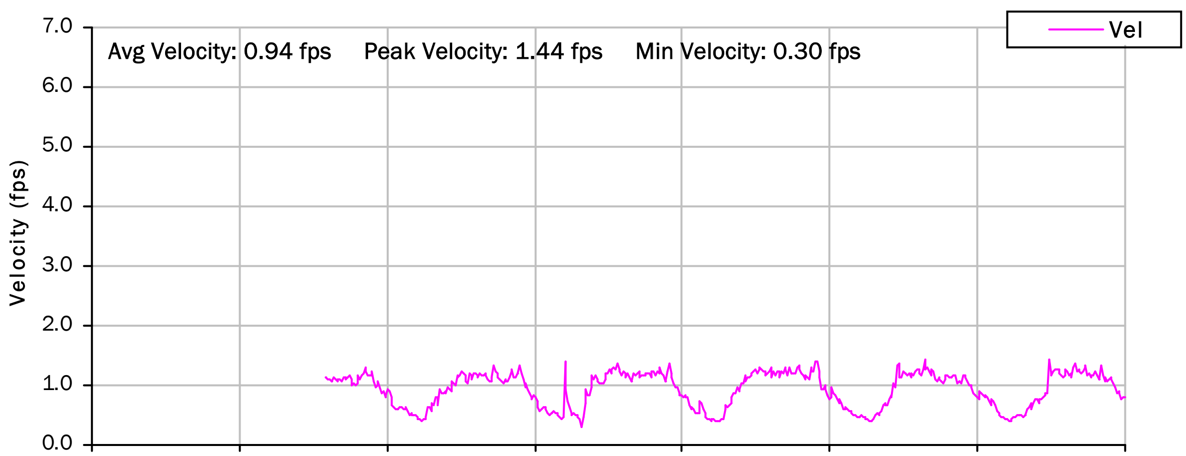
Capacity		Inflow / Infiltration	
Peak Flow:	0.094 *mgd*	Peak I/I Rate:	0.029 *mgd*
PF:	1.98	Total I/I:	4,000 *gallons*
Peak Level:	2.13 *in*		
d/D Ratio:	0.14		

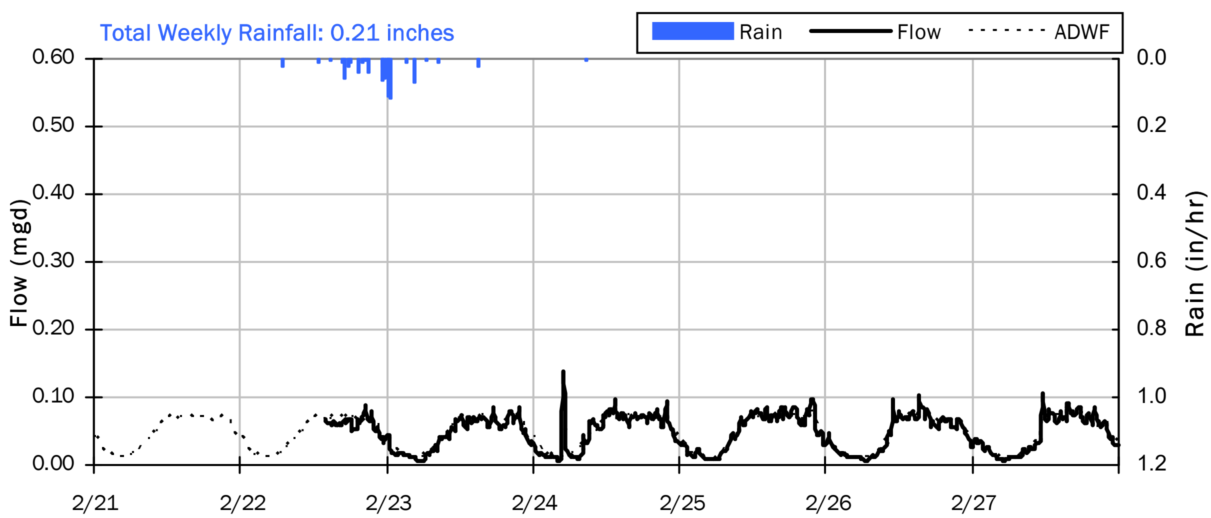
SITE 07

Weekly Level, Velocity and Flow Hydrographs

2/21/2022 to 2/28/2022

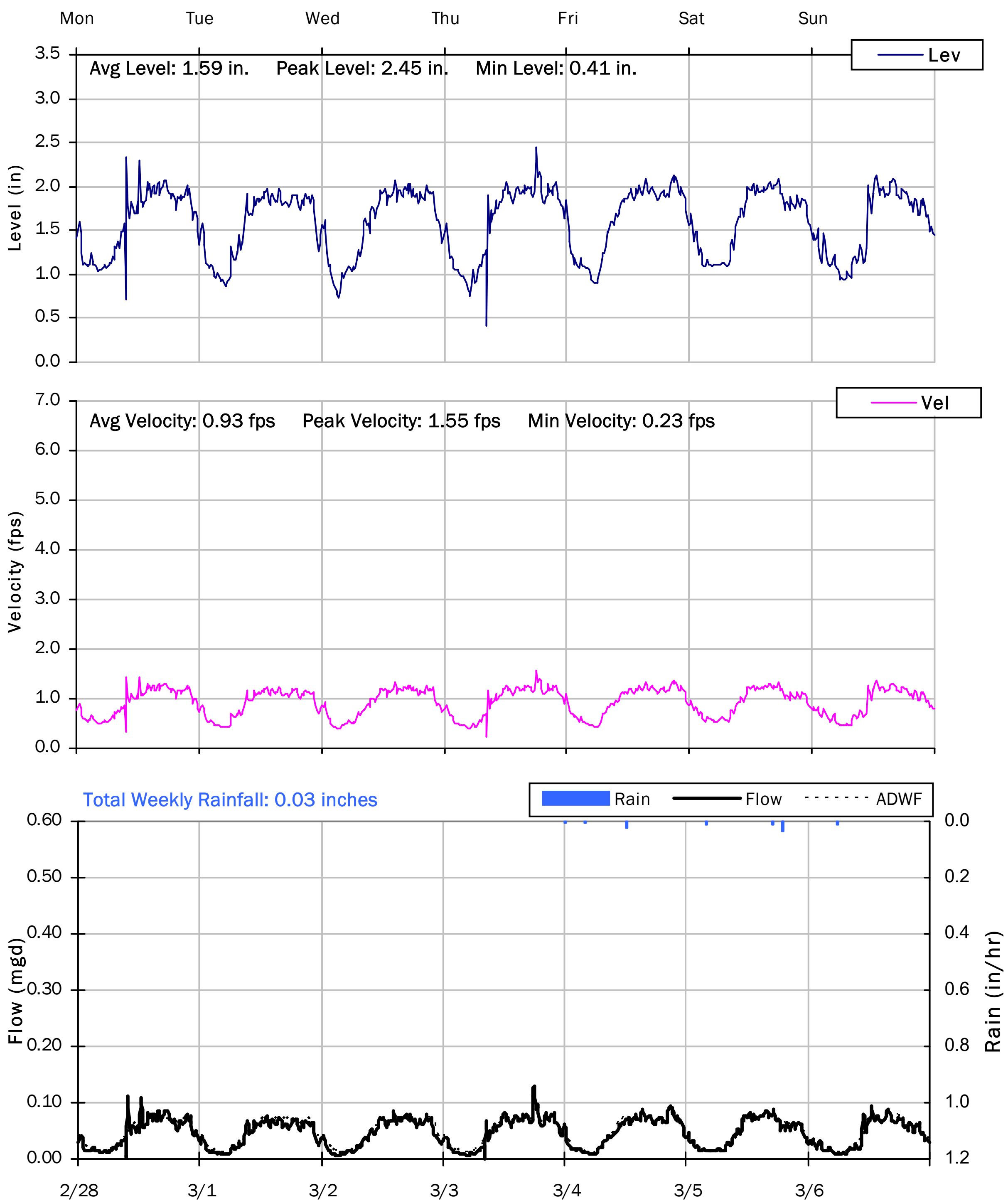






Avg Flow: 0.048 mgd Peak Flow: 0.140 mgd Min Flow: 0.006 mgd

SITE 07
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

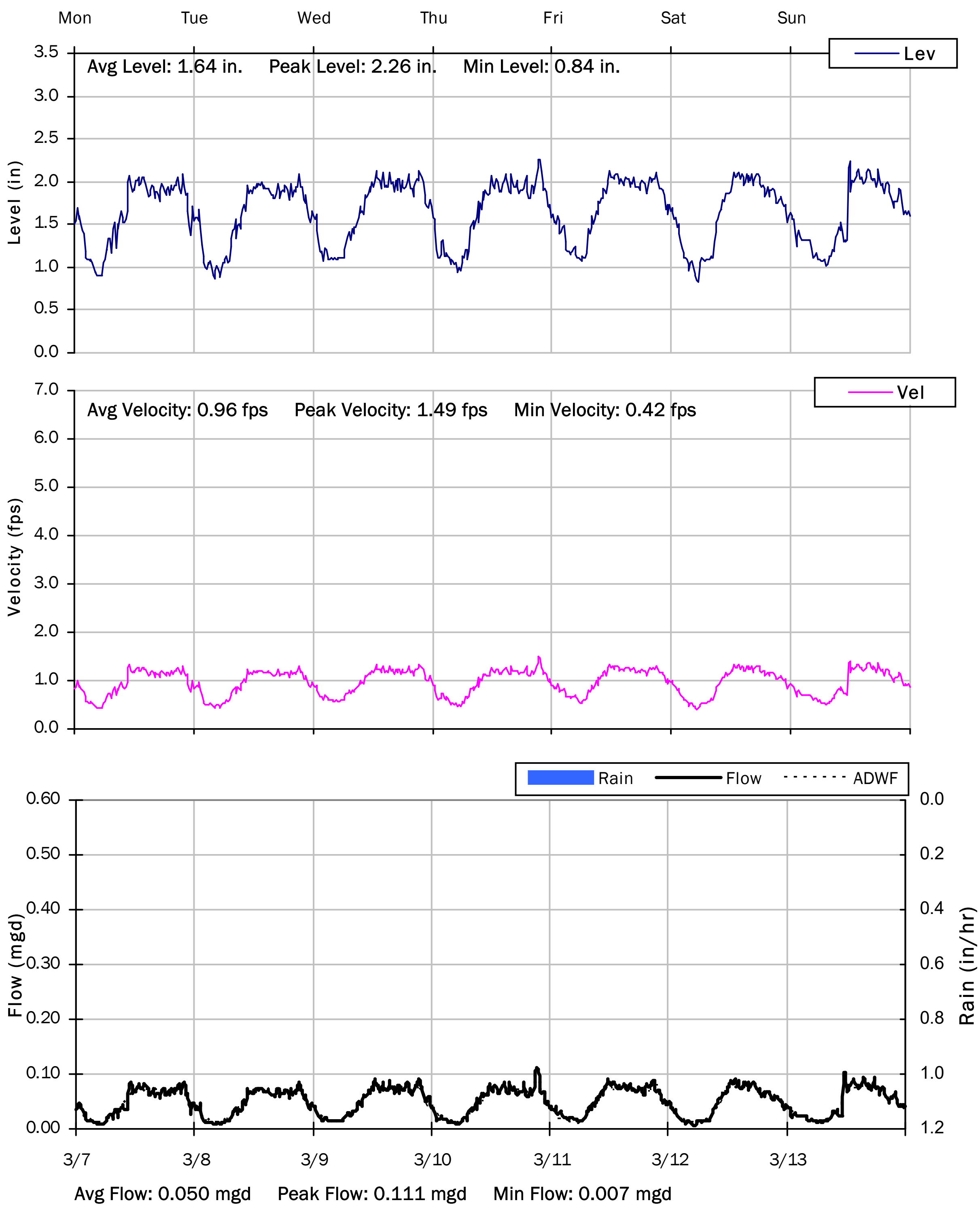


Avg Flow: 0.047 mgd Peak Flow: 0.130 mgd Min Flow: 0.001 mgd

SITE 07

Weekly Level, Velocity and Flow Hydrographs

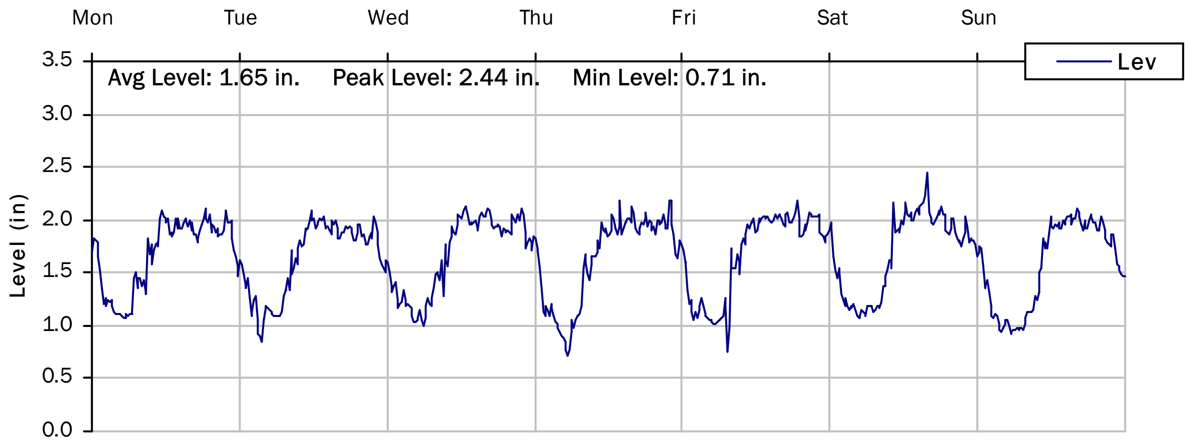
3/7/2022 to 3/14/2022

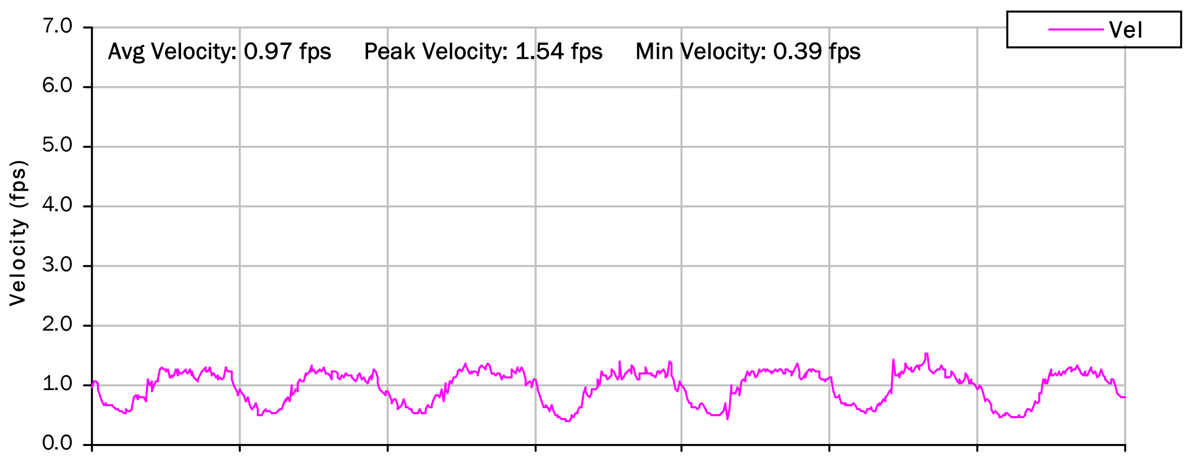


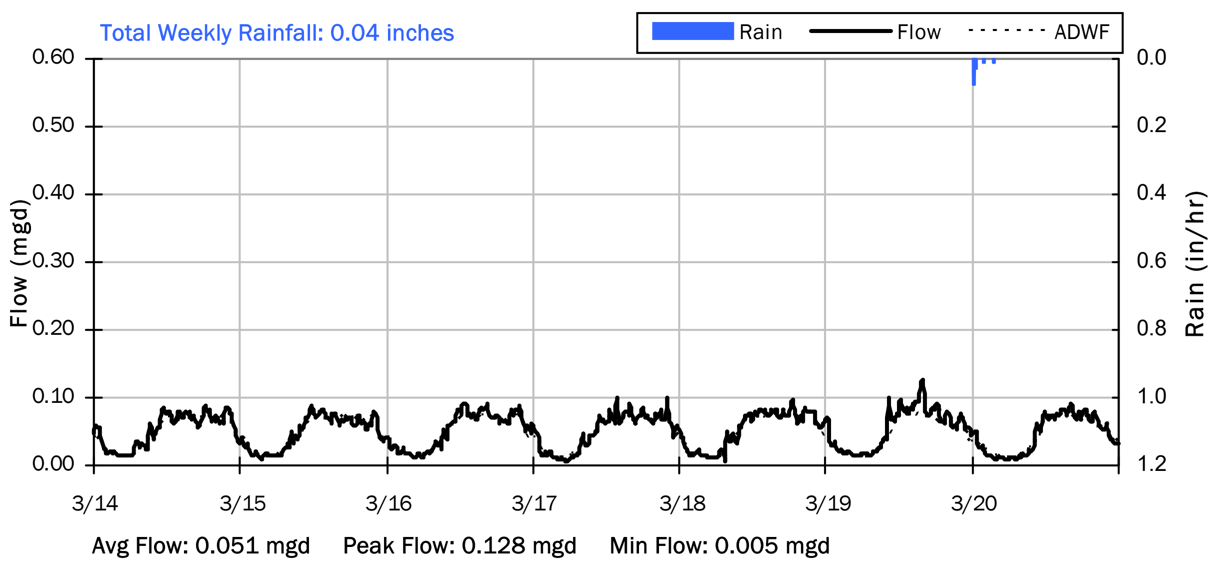
SITE 07

Weekly Level, Velocity and Flow Hydrographs

3/14/2022 to 3/21/2022



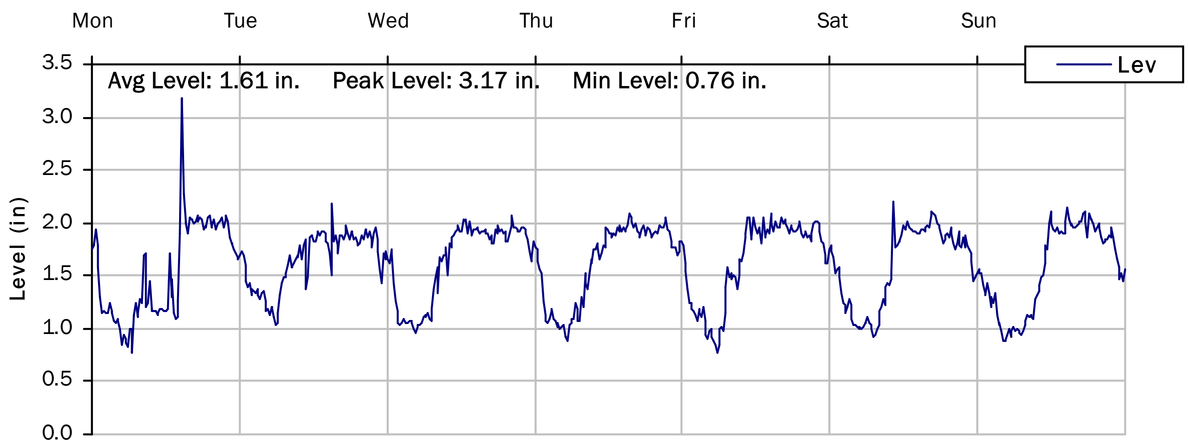


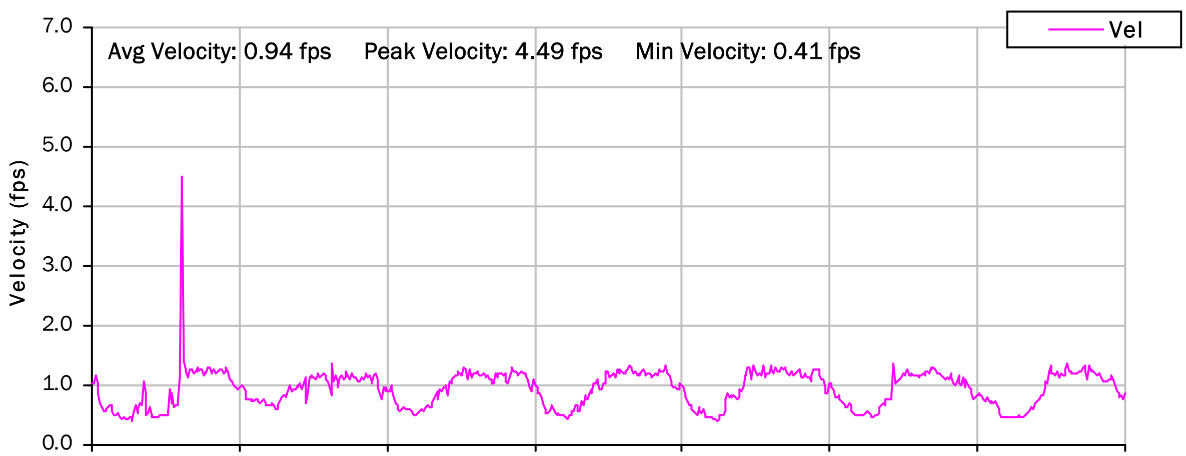


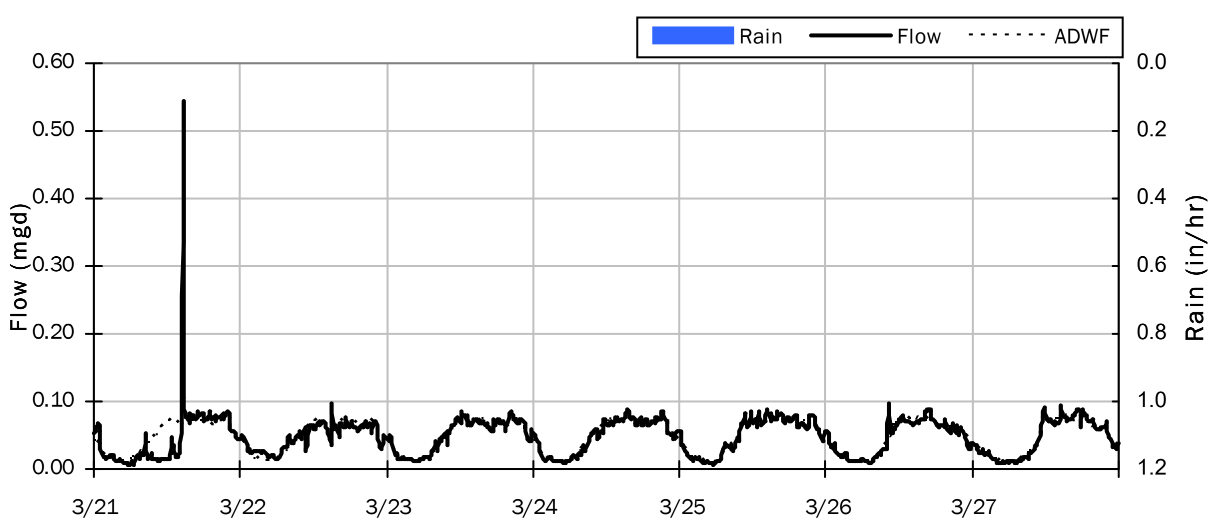
SITE 07

Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022



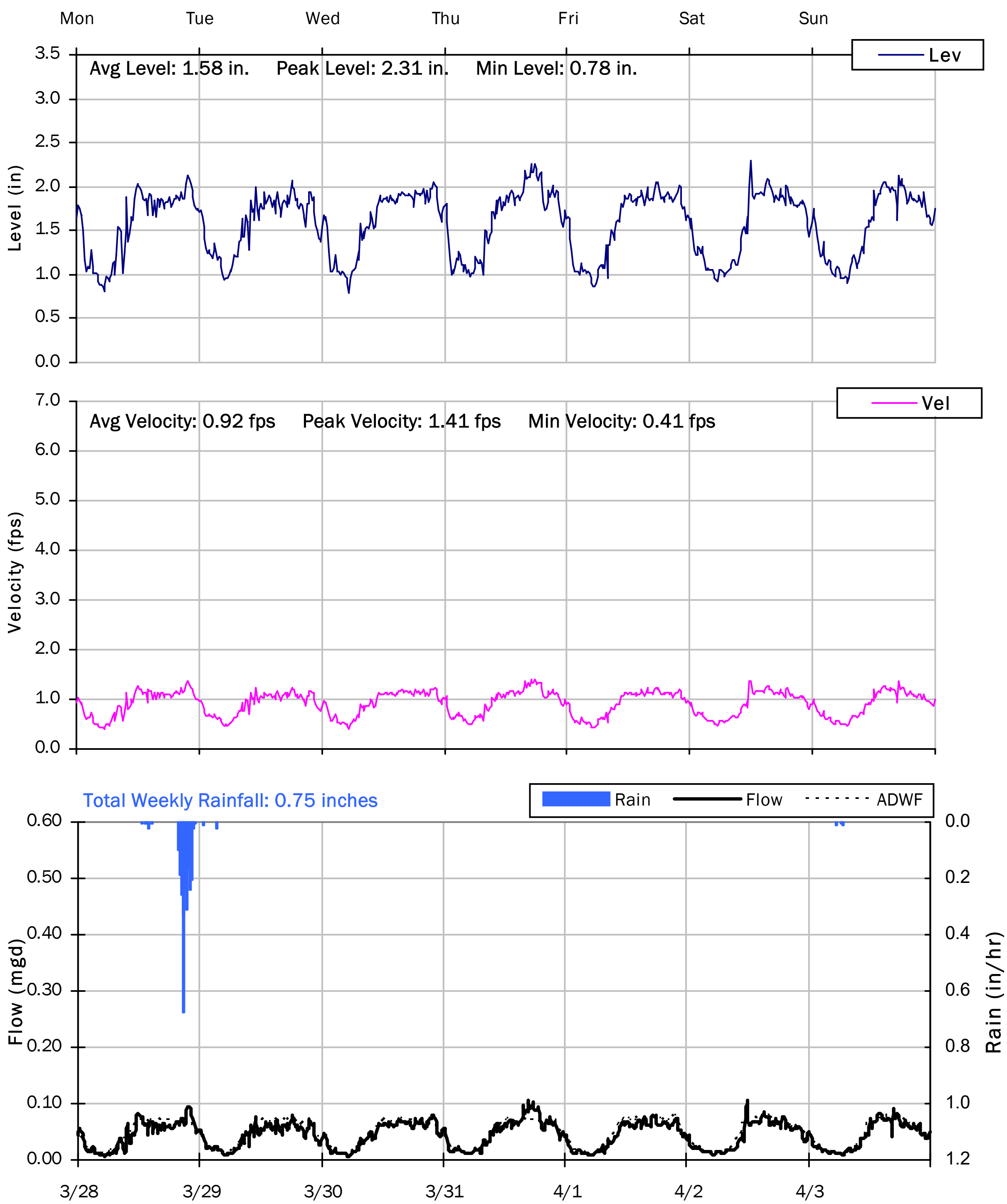




Avg Flow: 0.048 mgd   Peak Flow: 0.544 mgd   Min Flow: 0.006 mgd

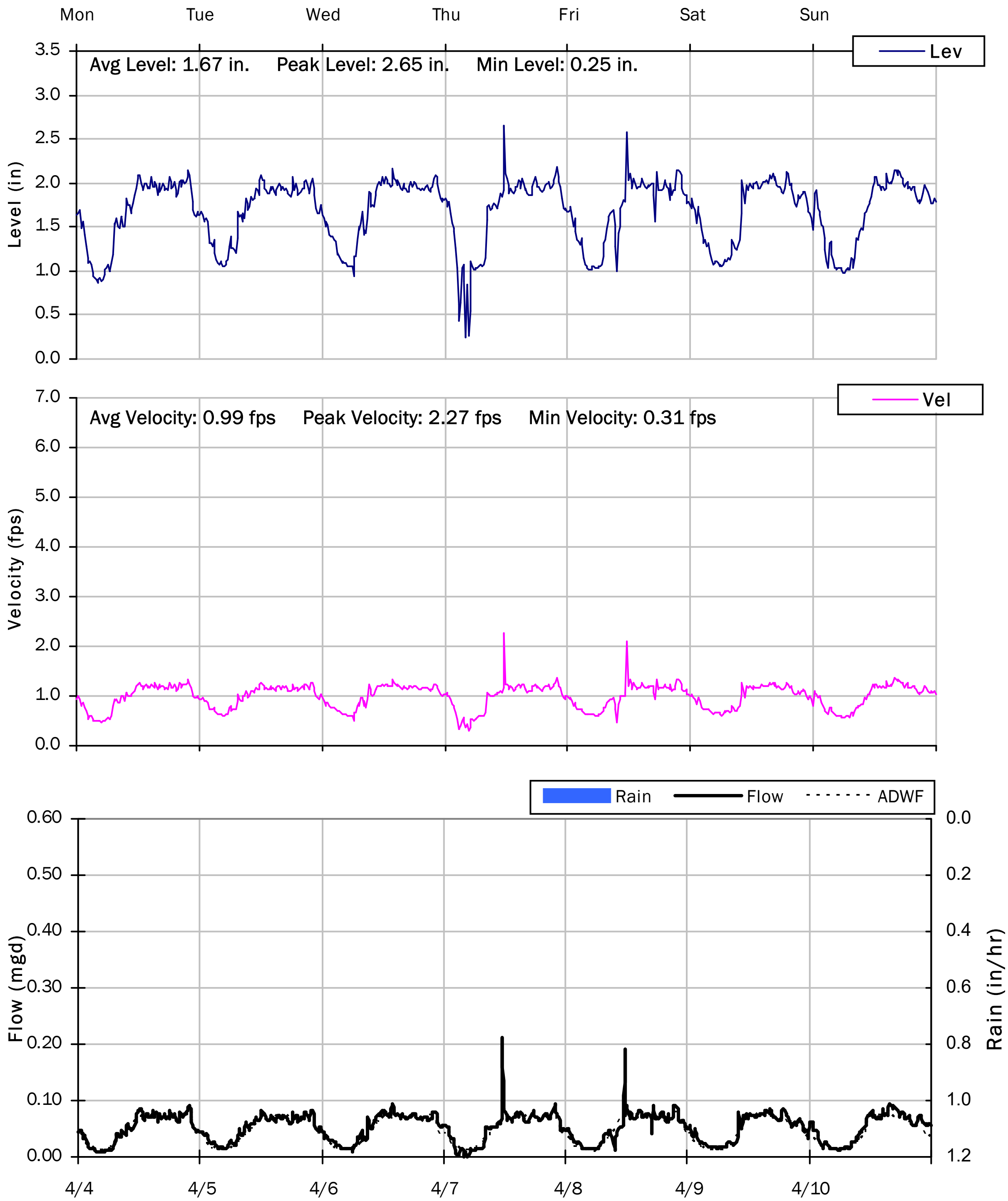
SITE 07

Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022



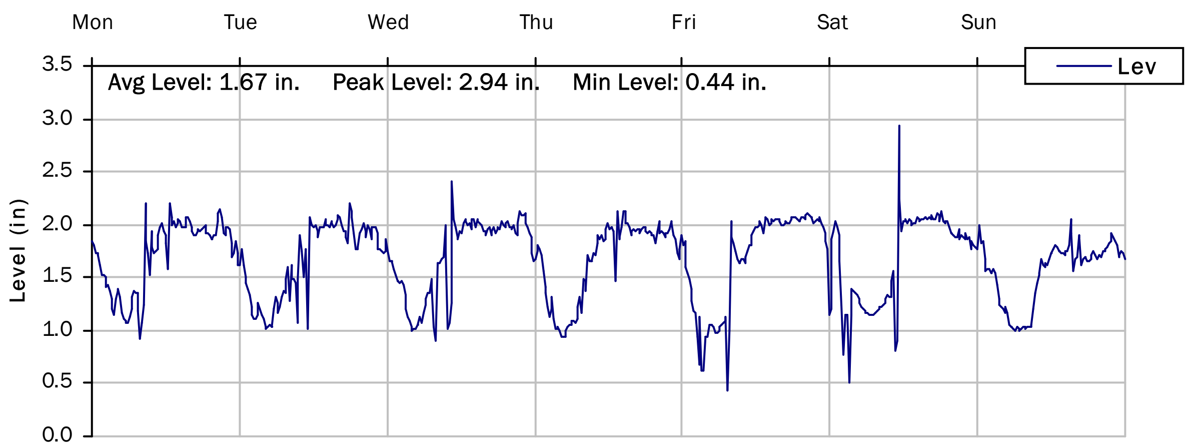
Avg Flow: 0.045 mgd Peak Flow: 0.105 mgd Min Flow: 0.007 mgd

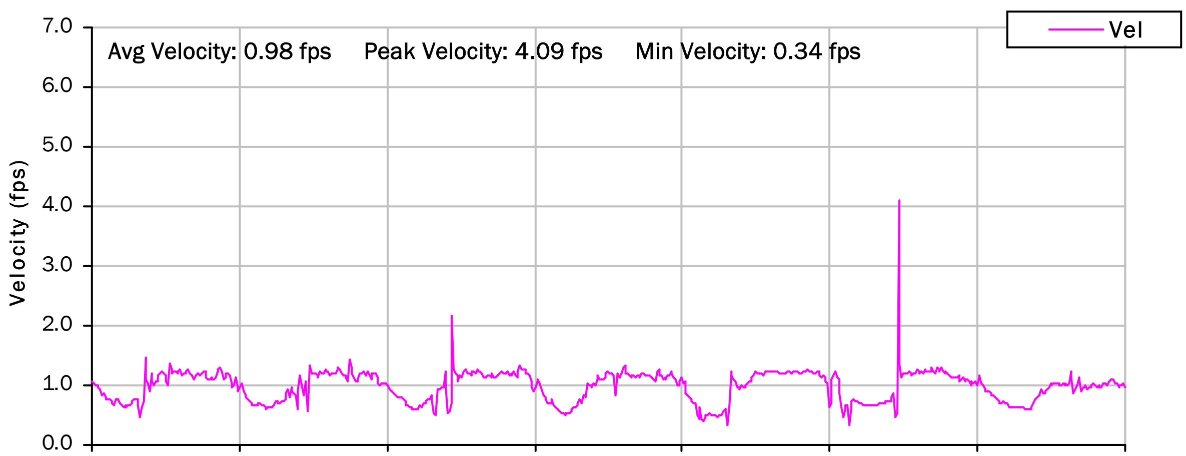
SITE 07
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

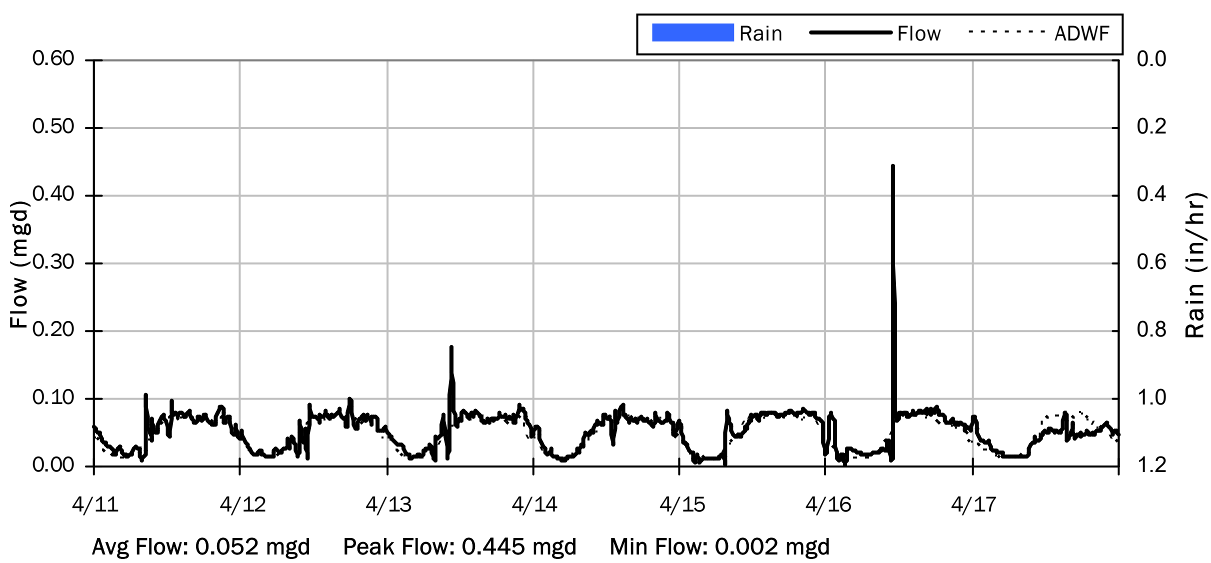


Avg Flow: 0.052 mgd   Peak Flow: 0.213 mgd   Min Flow: 0.001 mgd

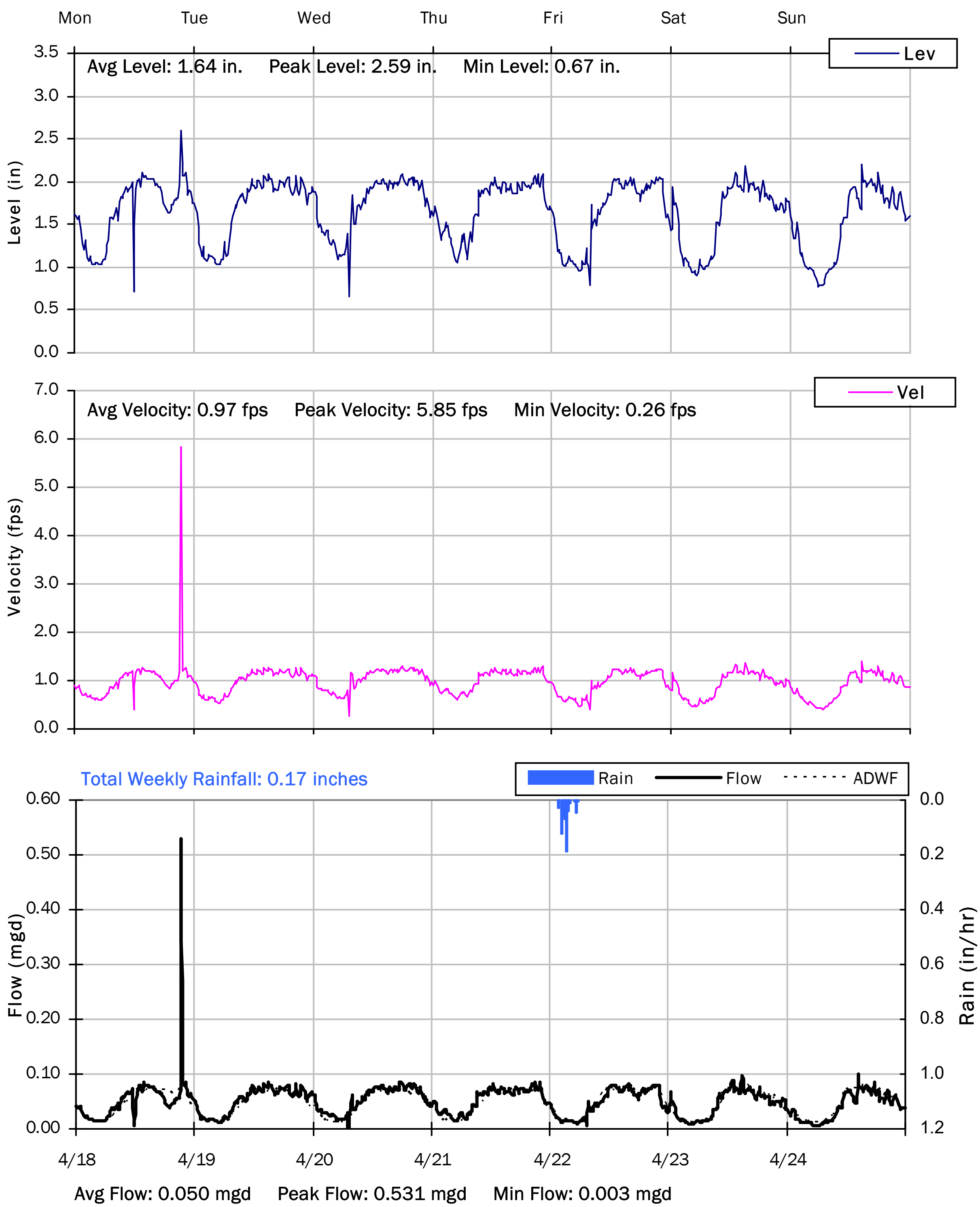
SITE 07
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022



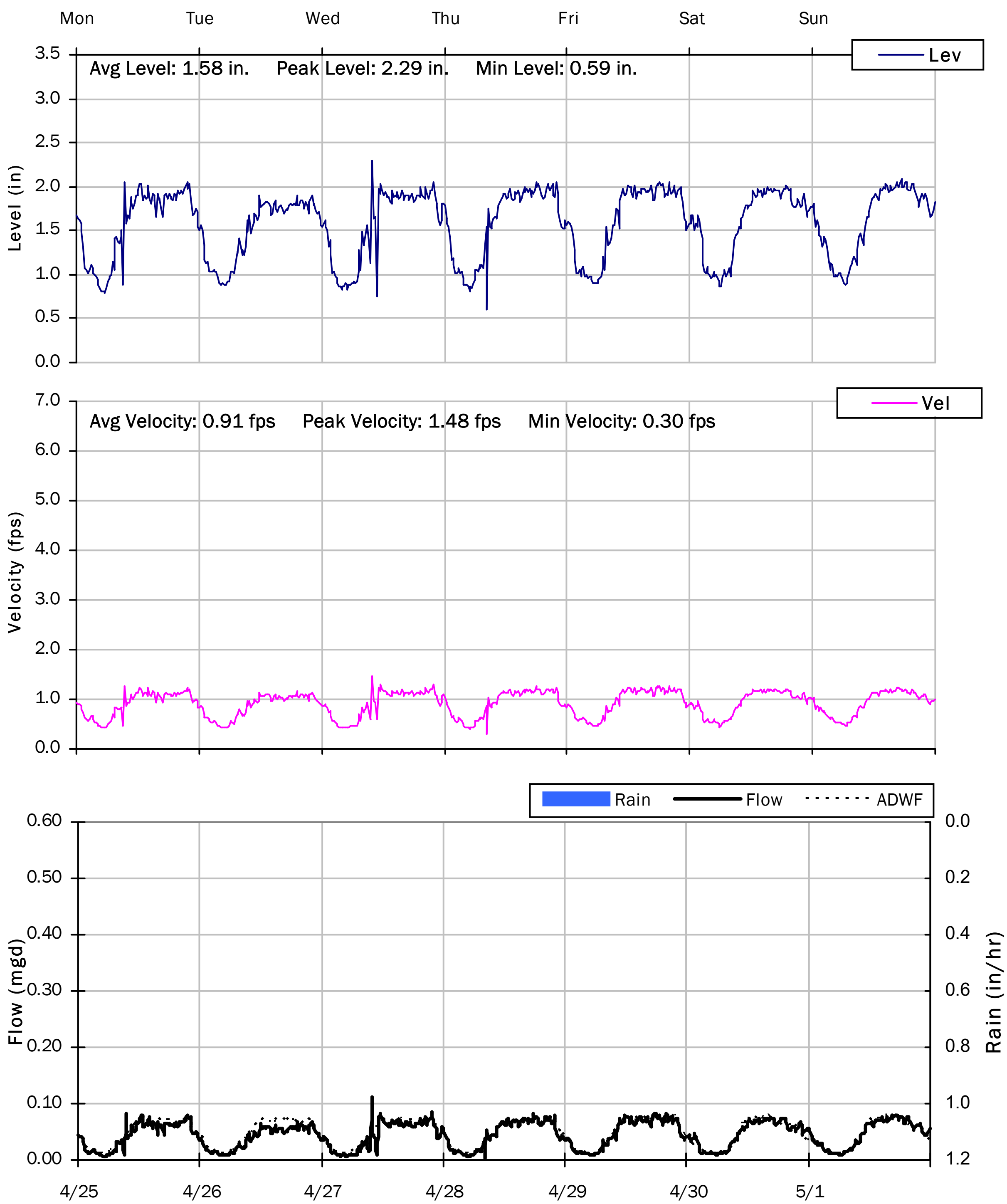




SITE 07
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

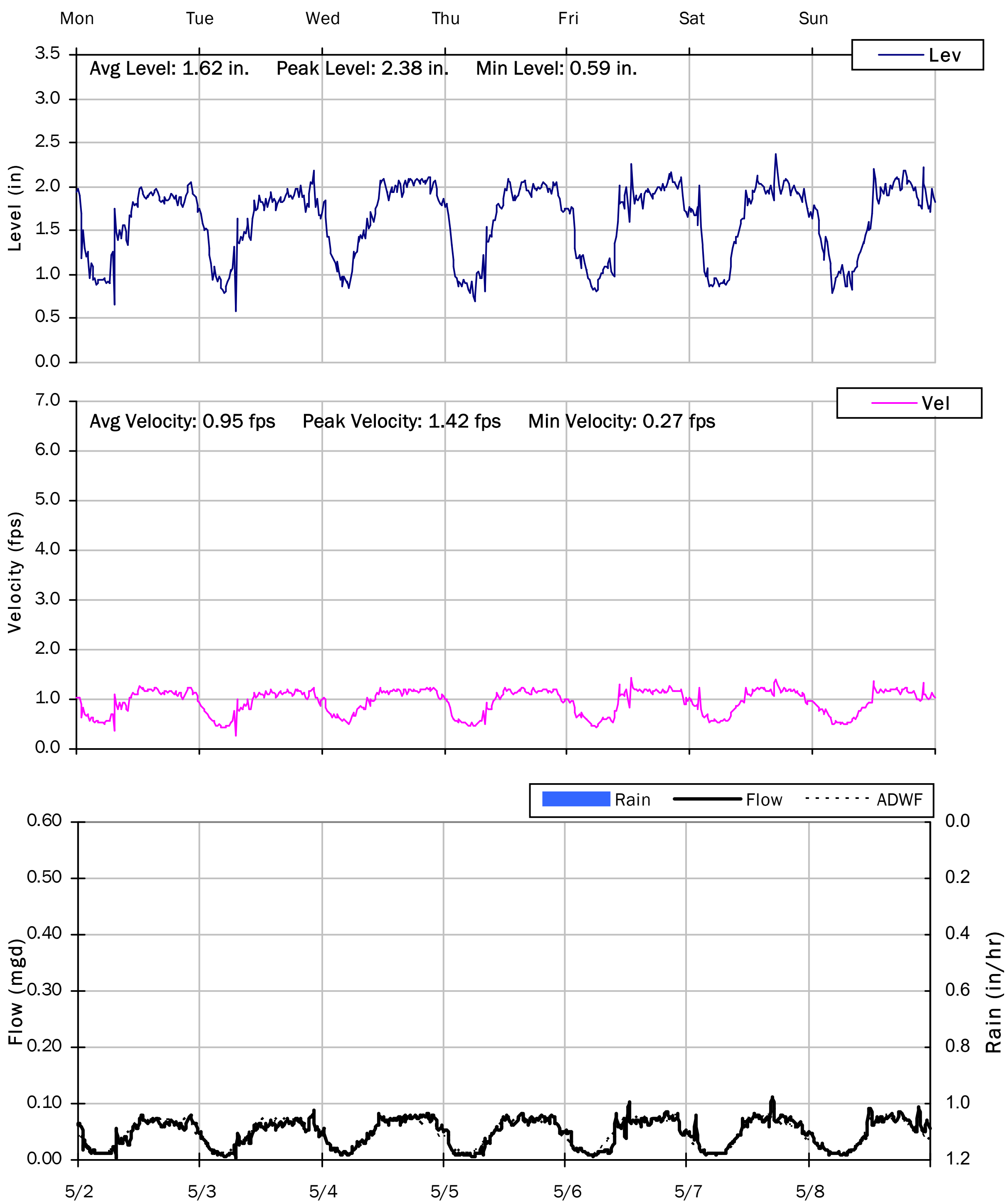


SITE 07
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022



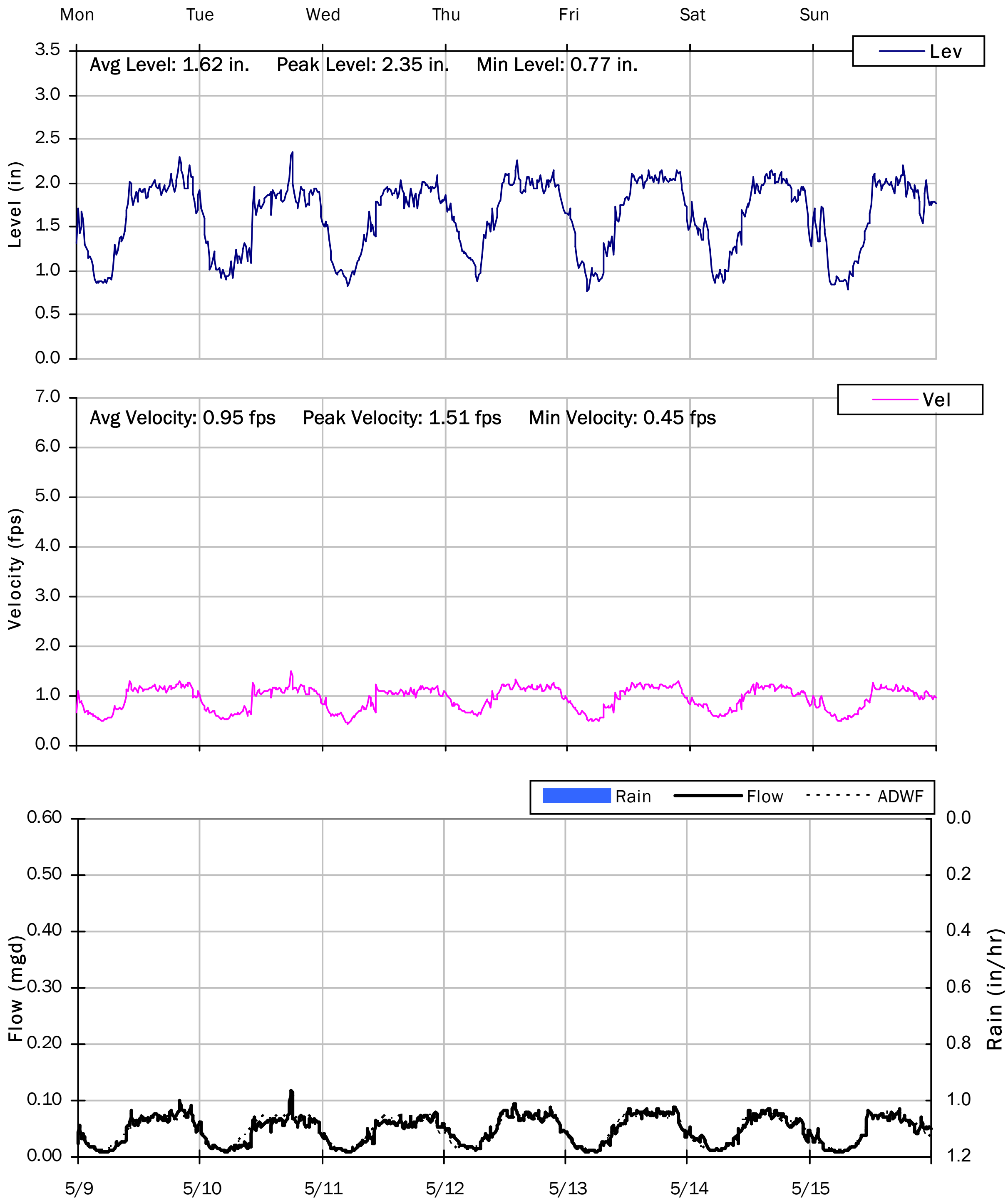
Avg Flow: 0.045 mgd Peak Flow: 0.113 mgd Min Flow: 0.003 mgd

SITE 07
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022



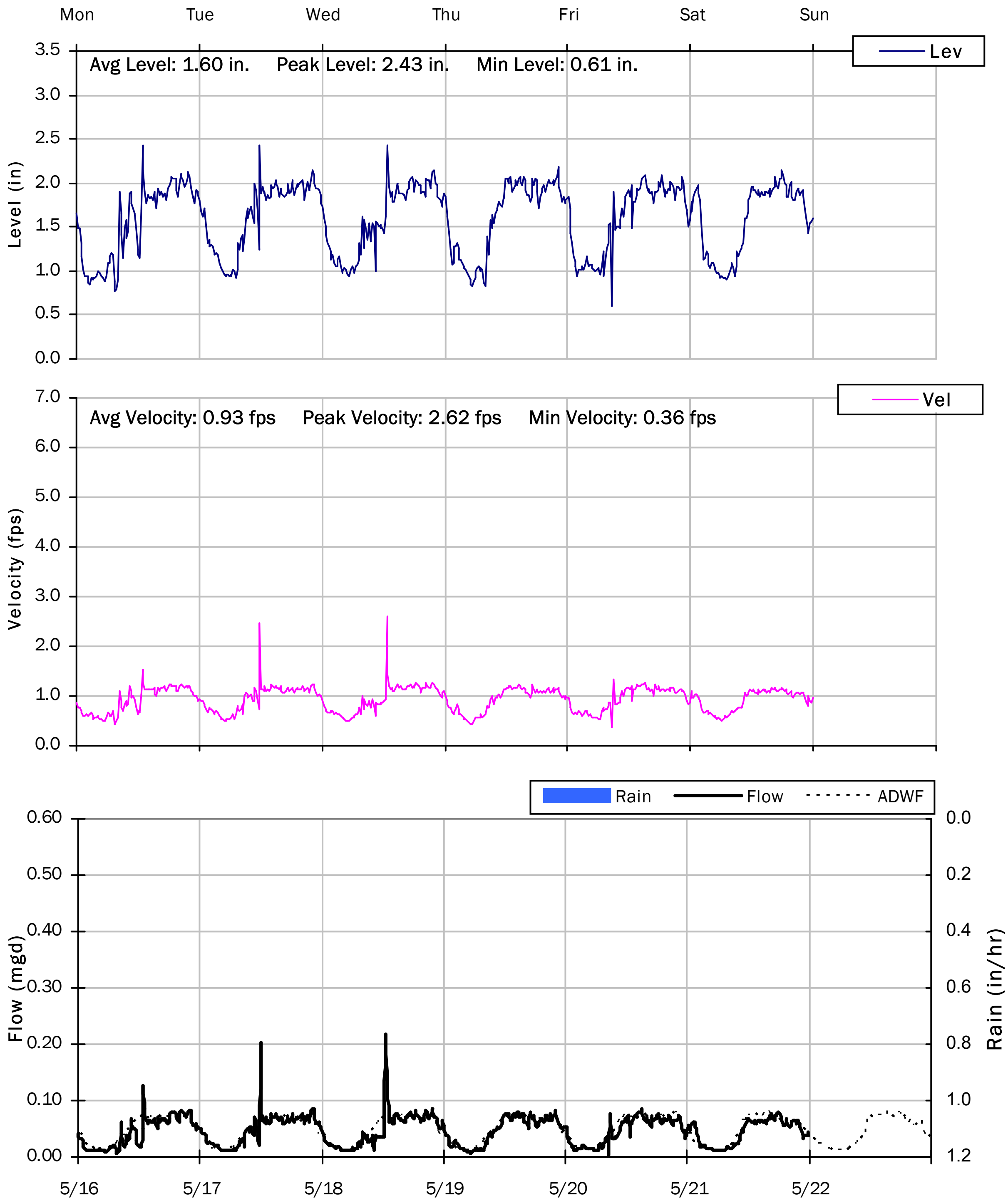
Avg Flow: 0.048 mgd   Peak Flow: 0.111 mgd   Min Flow: 0.003 mgd

SITE 07
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022



Avg Flow: 0.048 mgd Peak Flow: 0.116 mgd Min Flow: 0.008 mgd

SITE 07
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022



Avg Flow: 0.047 mgd   Peak Flow: 0.216 mgd   Min Flow: 0.004 mgd

Monitoring Site: Site 08

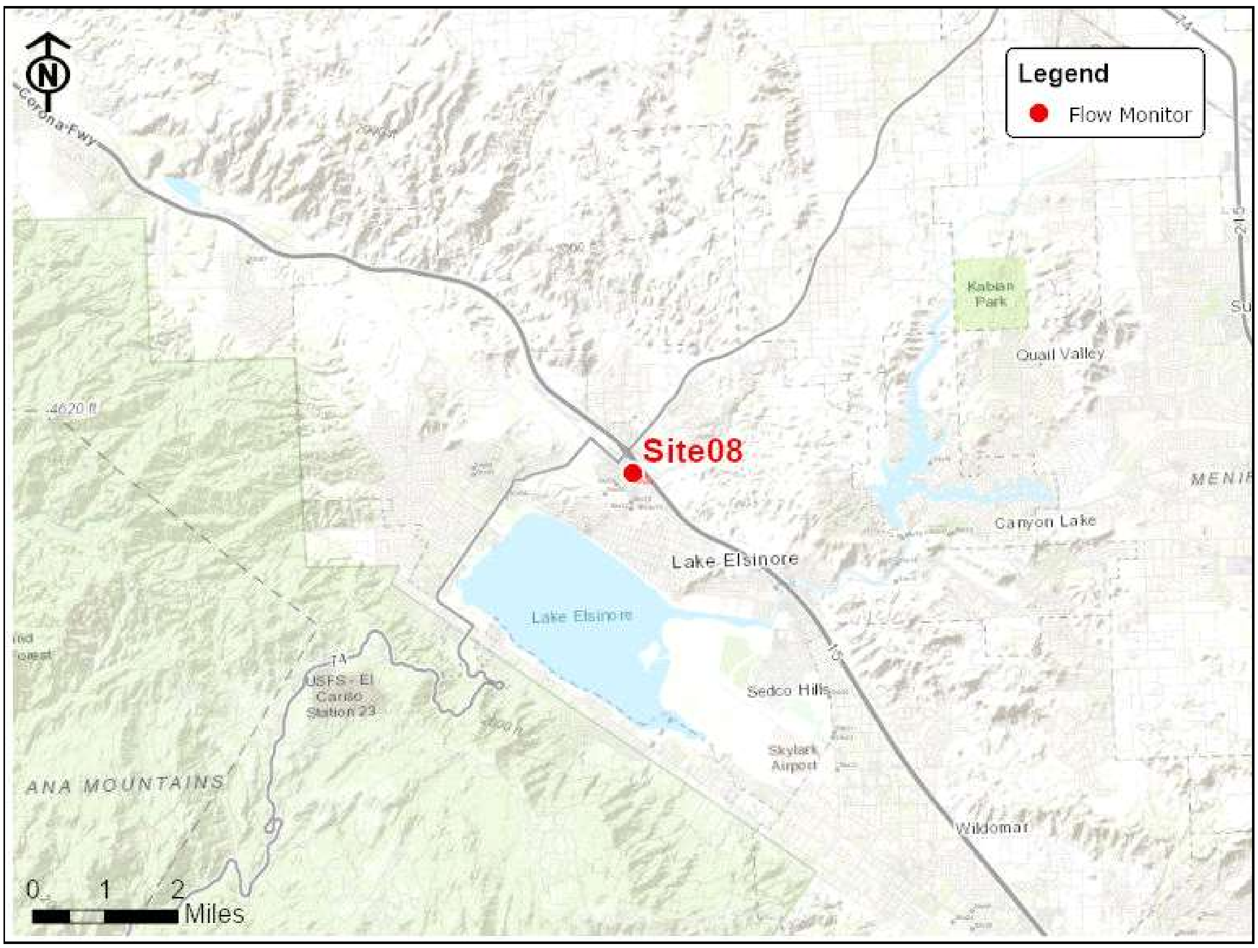
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: 3rd Street, south of Collier Street

Data Summary Report



Vicinity Map: Site 08

SITE 08

Site Information MH ID: MH-8699

Location: 3rd Street, south of Collier Street

Coordinates: 117.3365° W, 33.6877° N

Rim Elevation (Earth): 1276 feet

Expected Pipe Diameter: 15 inches

Measured Pipe Diameter: 15 inches

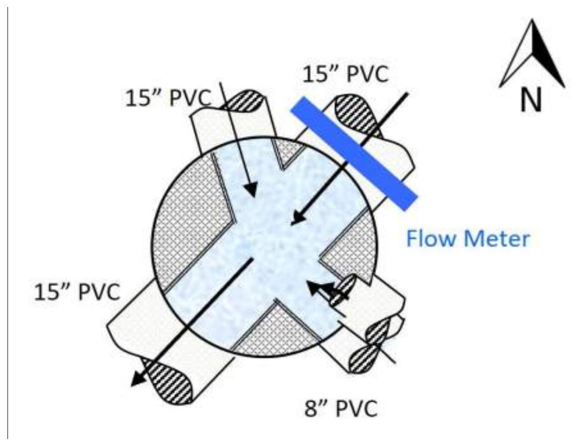
ADWF: 0.419 mgd

Peak Measured Flow: 0.750 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch


View from Street

Photo Not Taken

Plan View

SITE 08

Additional Site Photos

Effluent Pipe

E Low Influent Pipe

SITE 08

Additional Site Photos

E up Influent Pipe

N Influent Pipe

SITE 08

Additional Site Photos

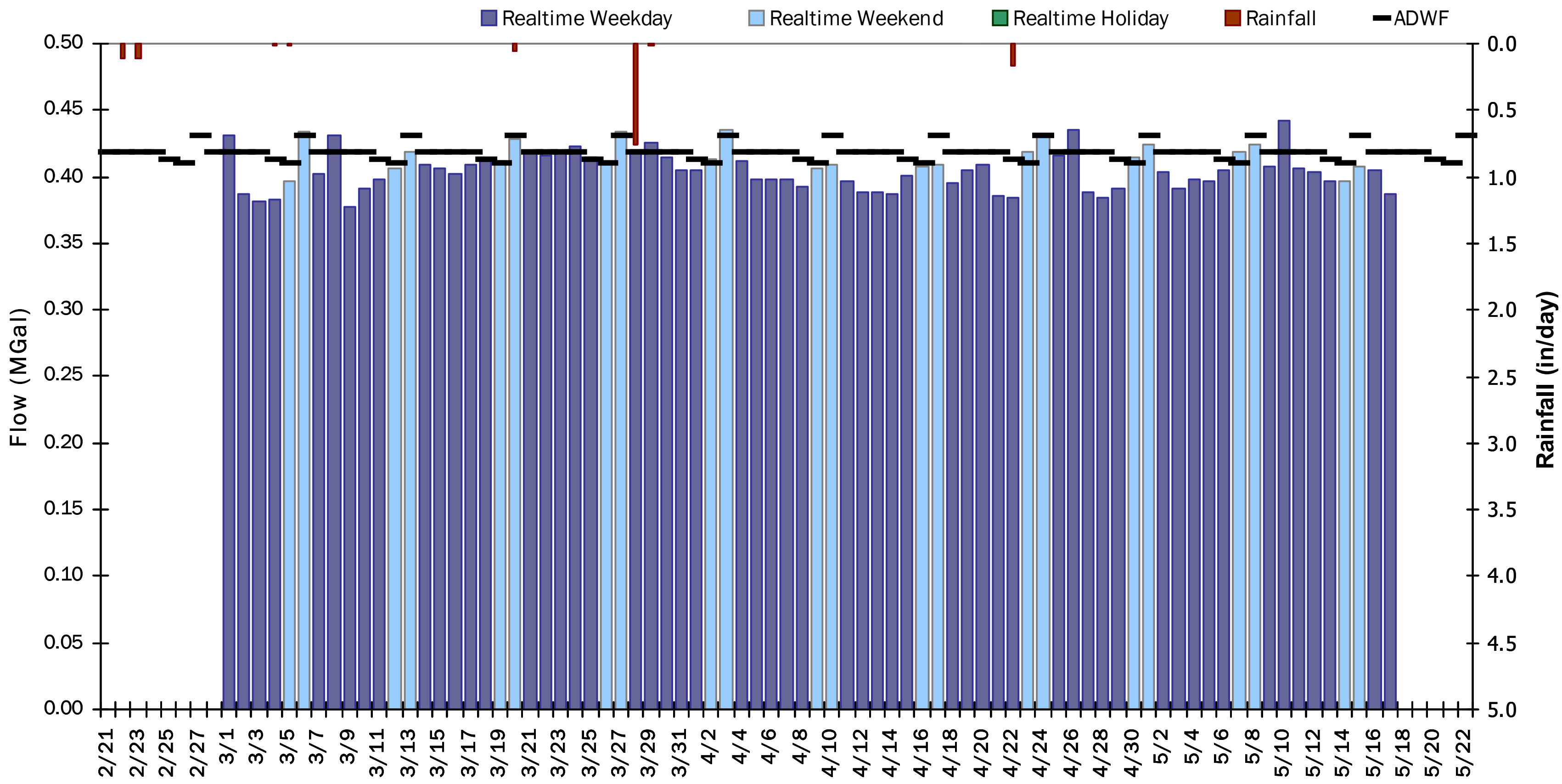
W Influent Pipe

SITE 08

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.405 MGal   Peak Daily Flow: 0.442 MGal   Min Daily Flow: 0.271 MGal

Total Rainfall: 1.03 inches

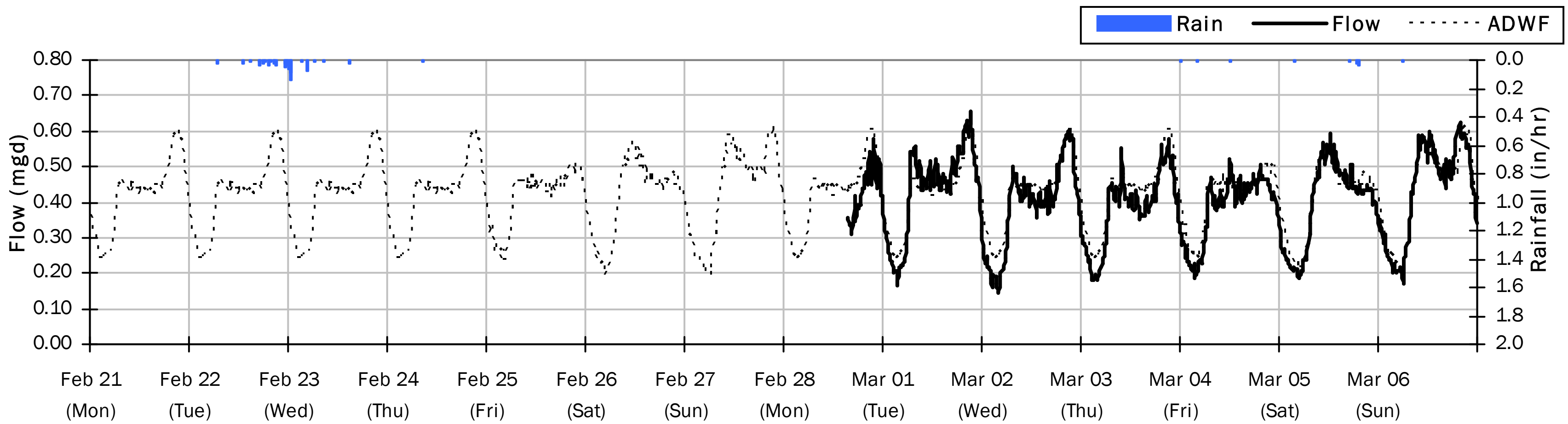


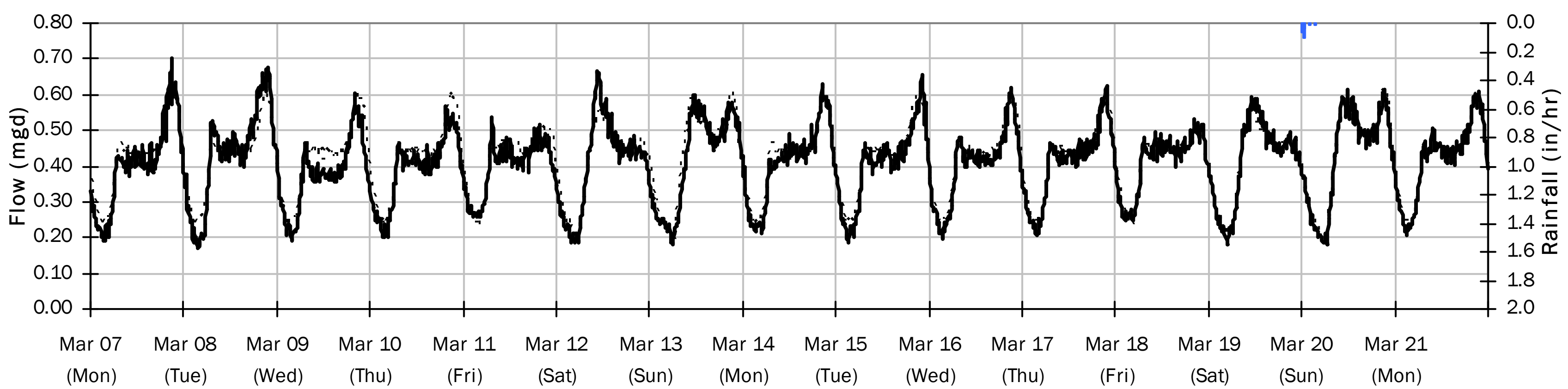
SITE 08

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.30 inches

Period Avg Flow: 0.407 mgd Period Peak Flow: 0.701 mgd Period Min Flow: 0.143 mgd

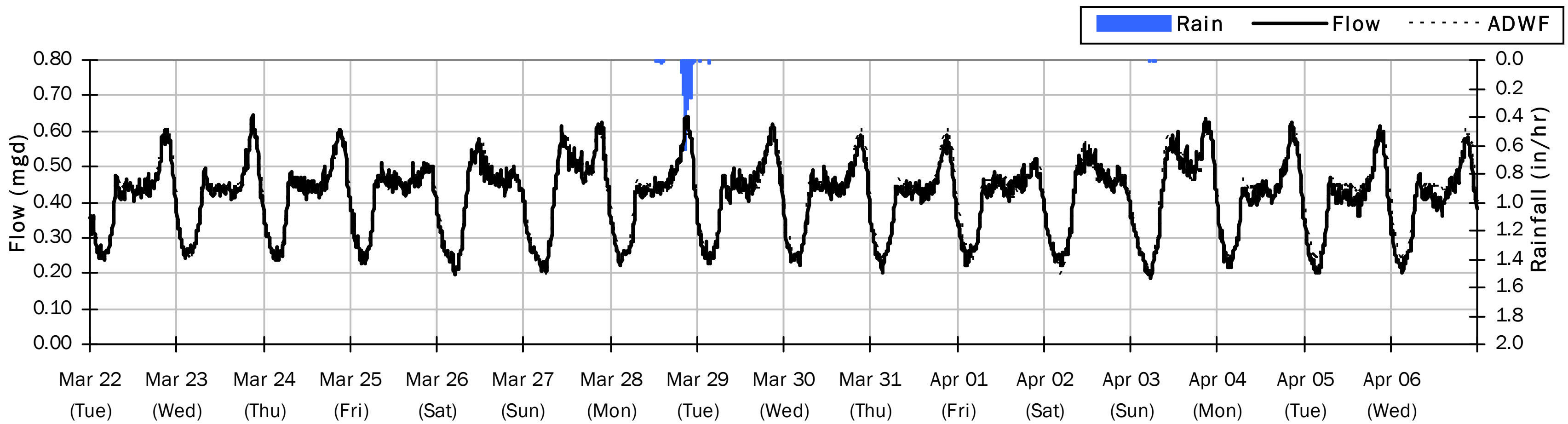


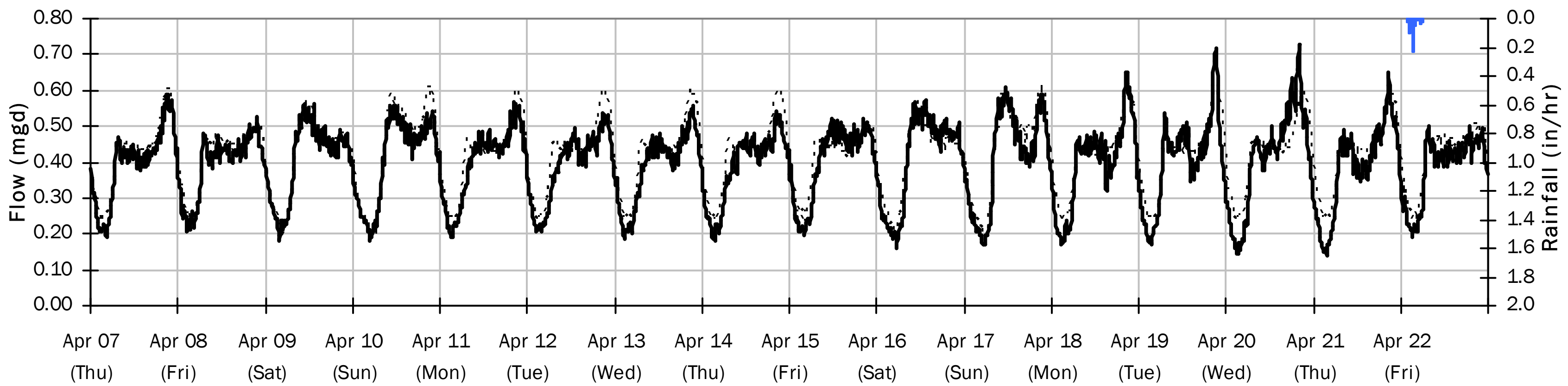


SITE 08

Flow Summary: 3/22/2022 to 4/22/2022

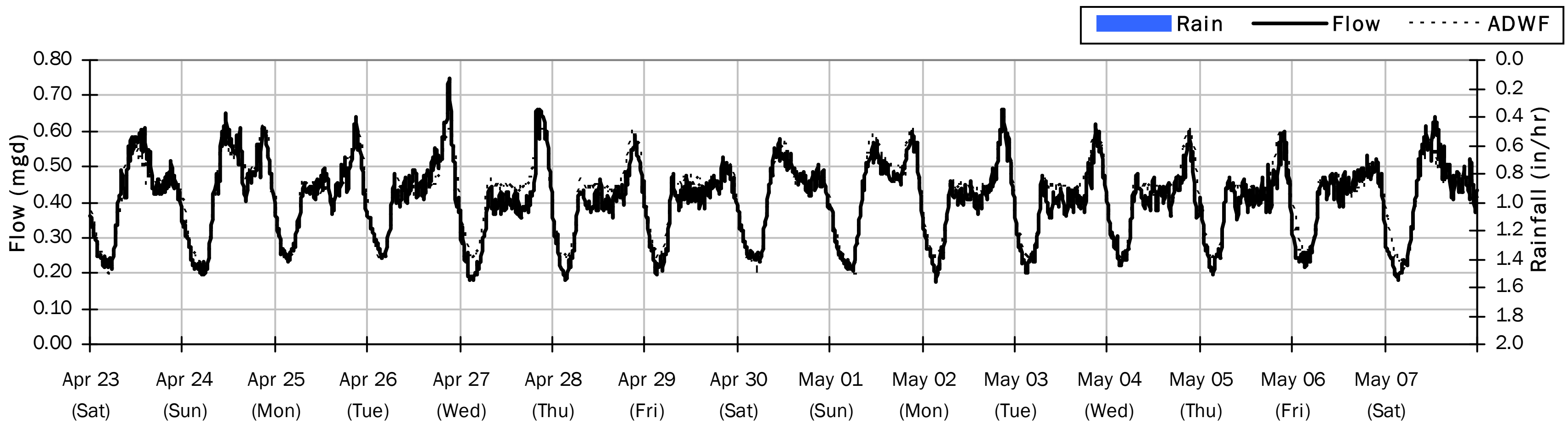
Period Rainfall: 0.94 inches   Period Avg Flow: 0.407 mgd   Period Peak Flow: 0.730 mgd   Period Min Flow: 0.139 mgd

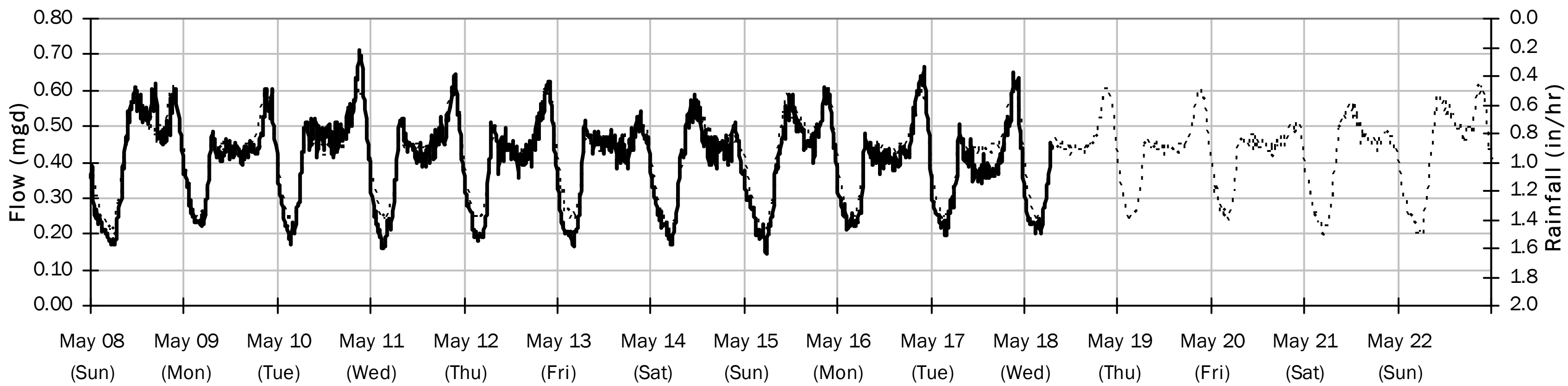




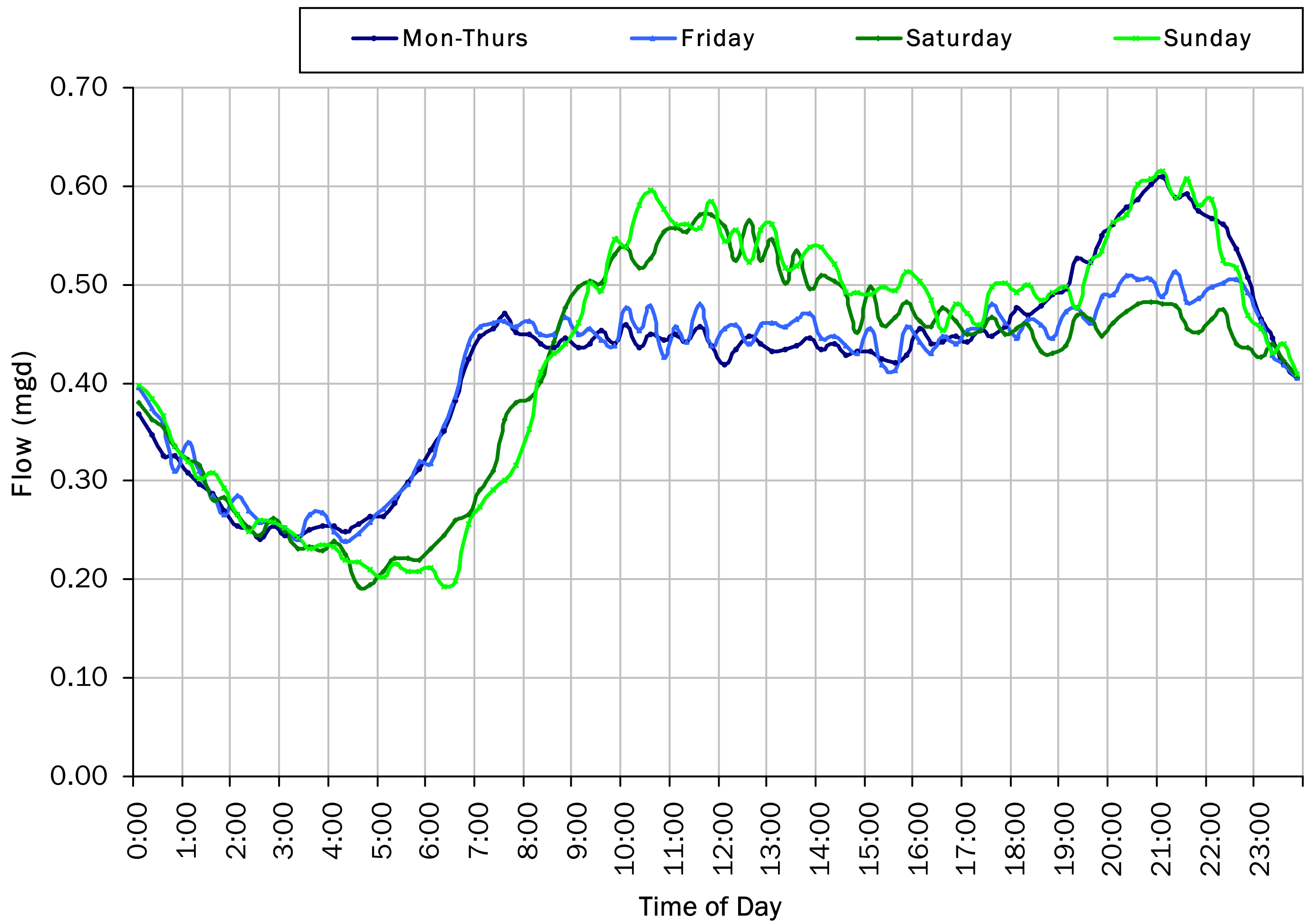
SITE 08
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches   Period Avg Flow: 0.406 mgd   Period Peak Flow: 0.750 mgd   Period Min Flow: 0.145 mgd



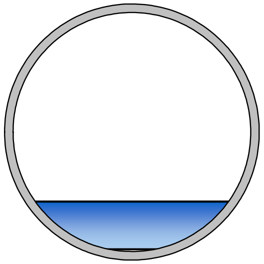


SITE 08
Average Dry Weather Flow Hydrographs



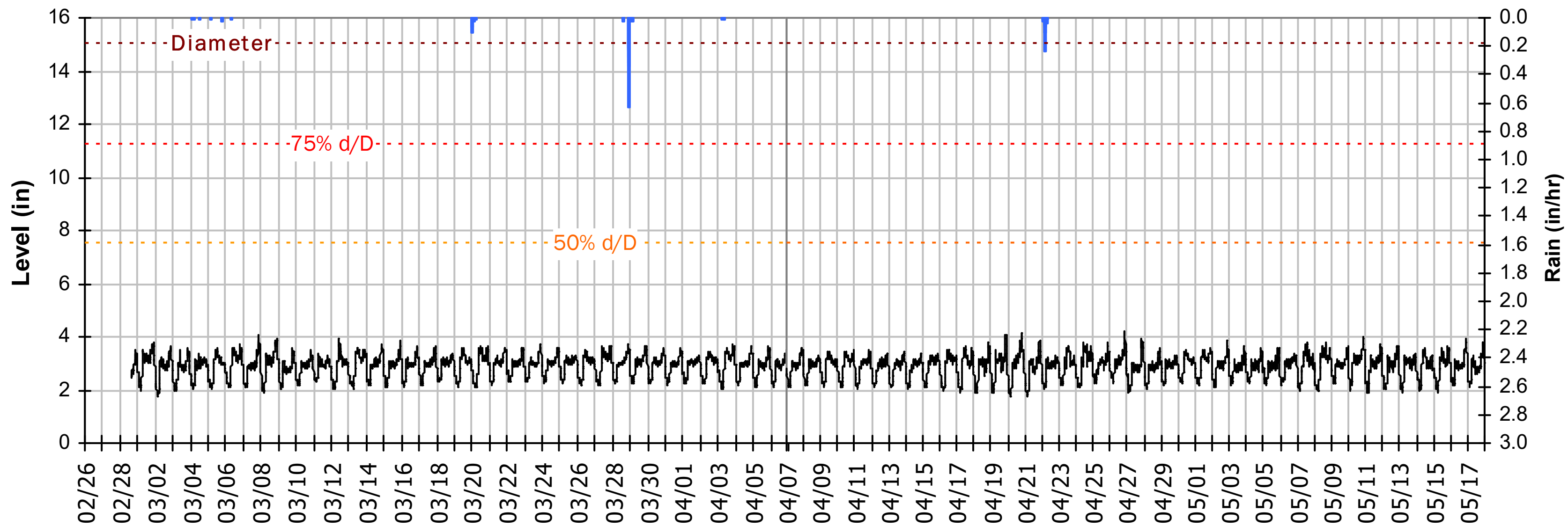
ADWF:

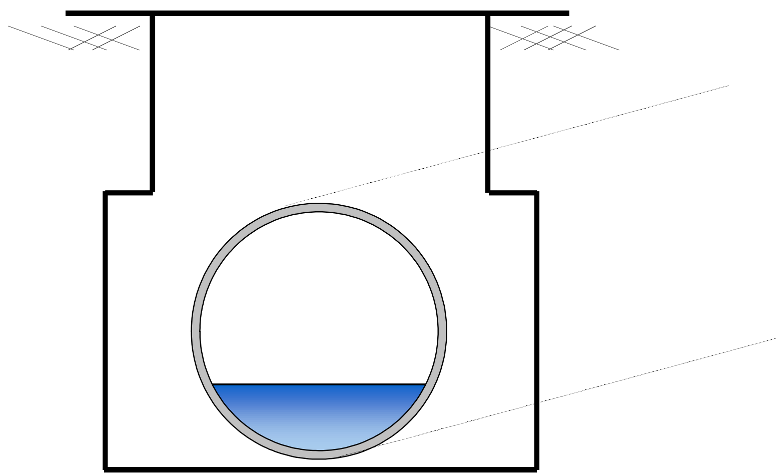
0.419 *mgd*



SITE 08
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



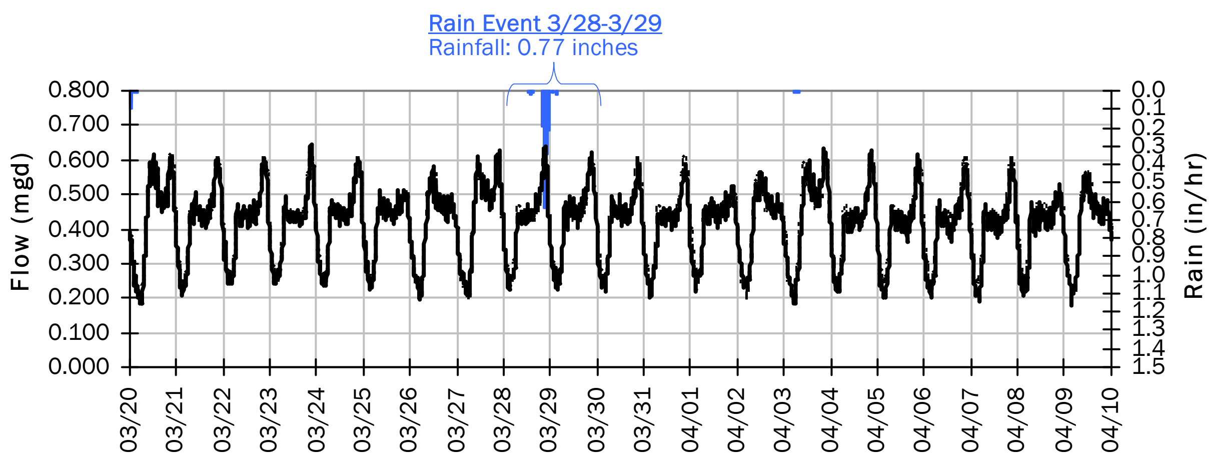


Pipe Diameter:	15	*inches*
Peak Measured Level:	4.22	*inches*
Peak d/D Ratio:	0.28	

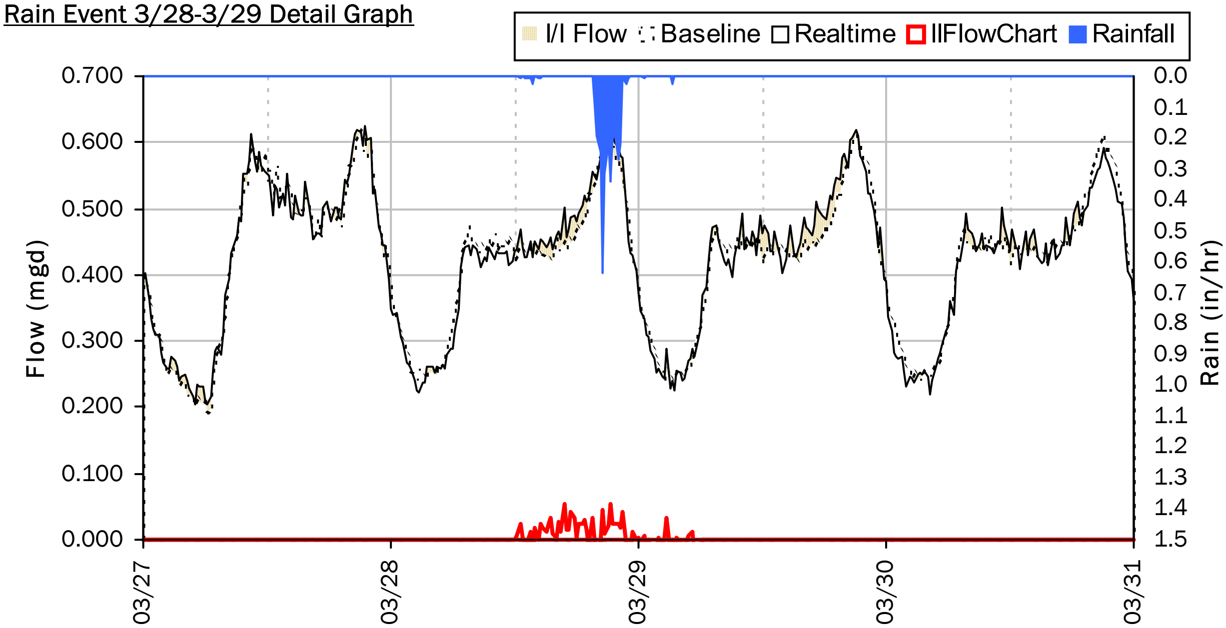
SITE 08

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



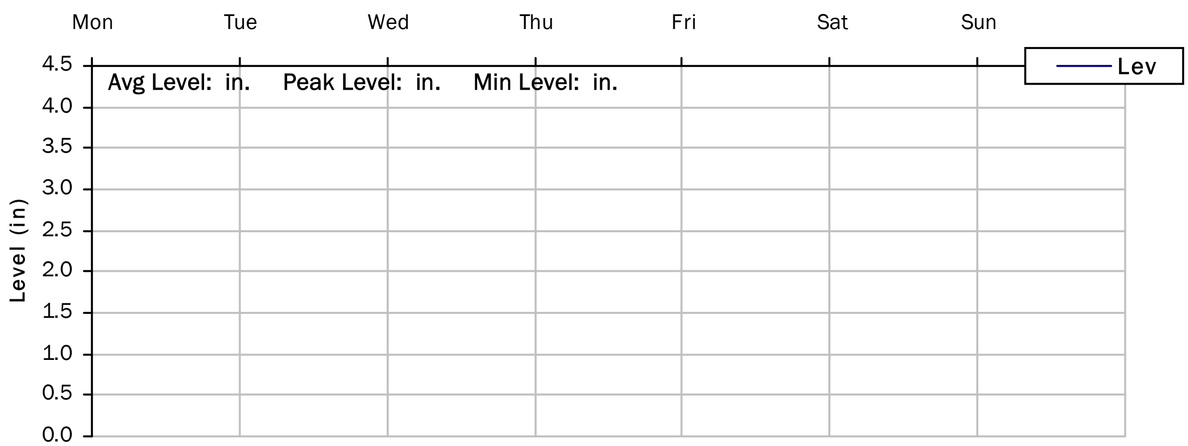
Rain Event 3/28-3/29 Detail Graph

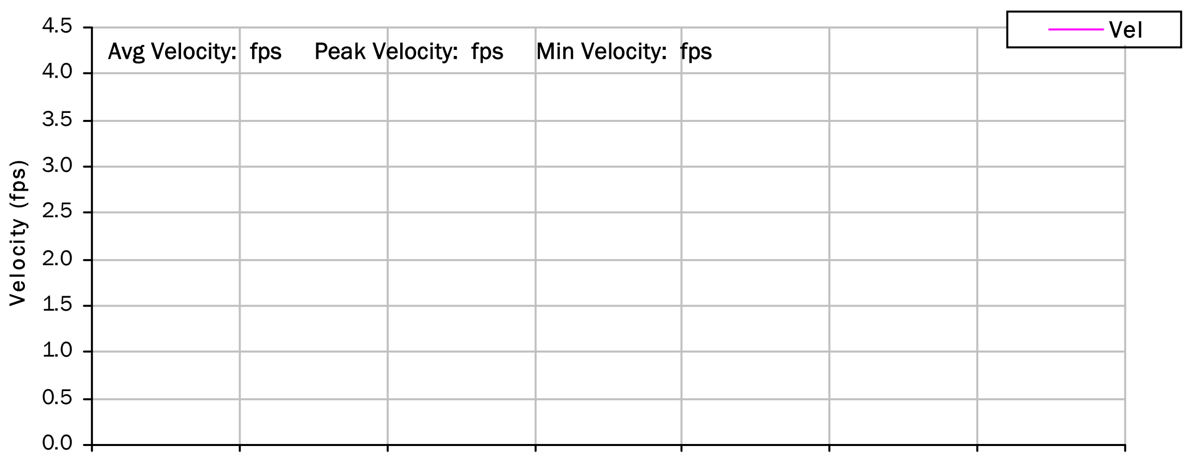


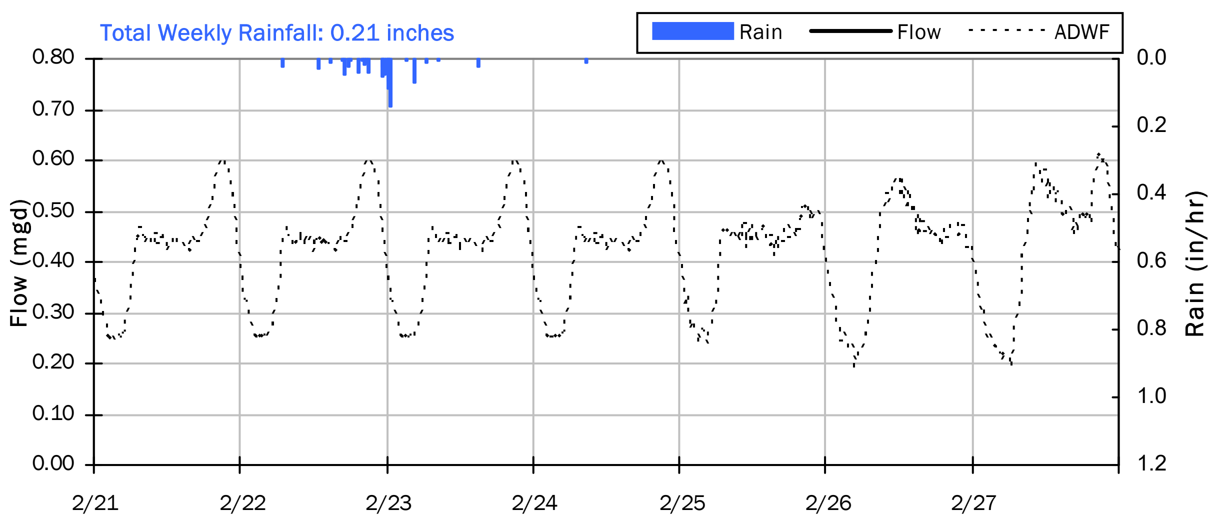
Storm Event I/I Analysis (Rain = 0.77 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.641 *mgd*	Peak I/I Rate:	0.055 *mgd*
PF:	1.53	Total I/I:	6,000 *gallons*
Peak Level:	3.73 *in*		
d/D Ratio:	0.25		

SITE 08
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



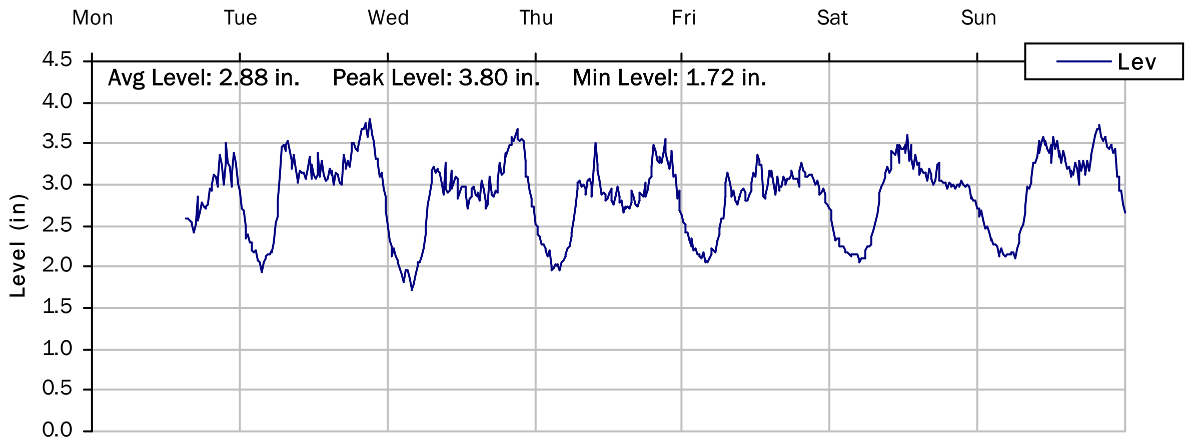


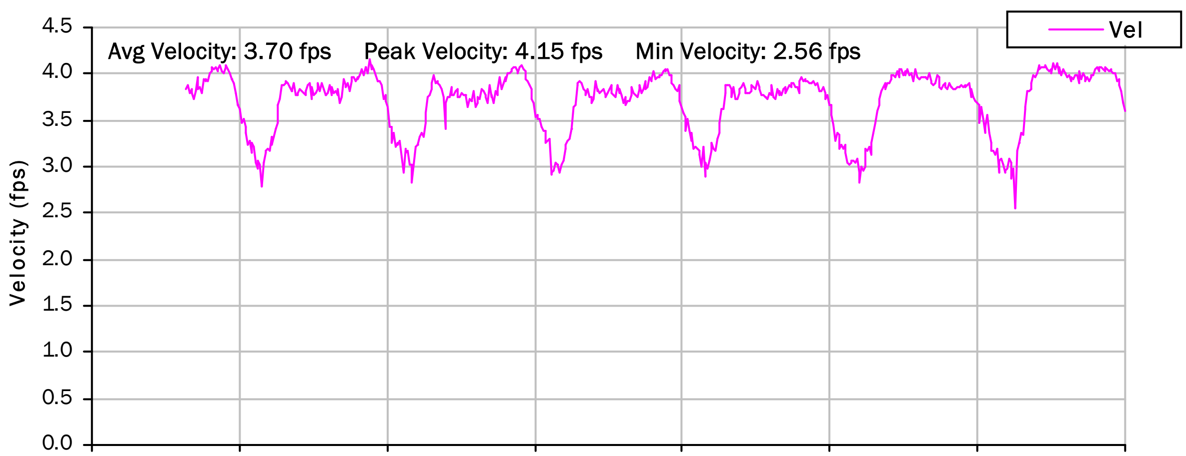


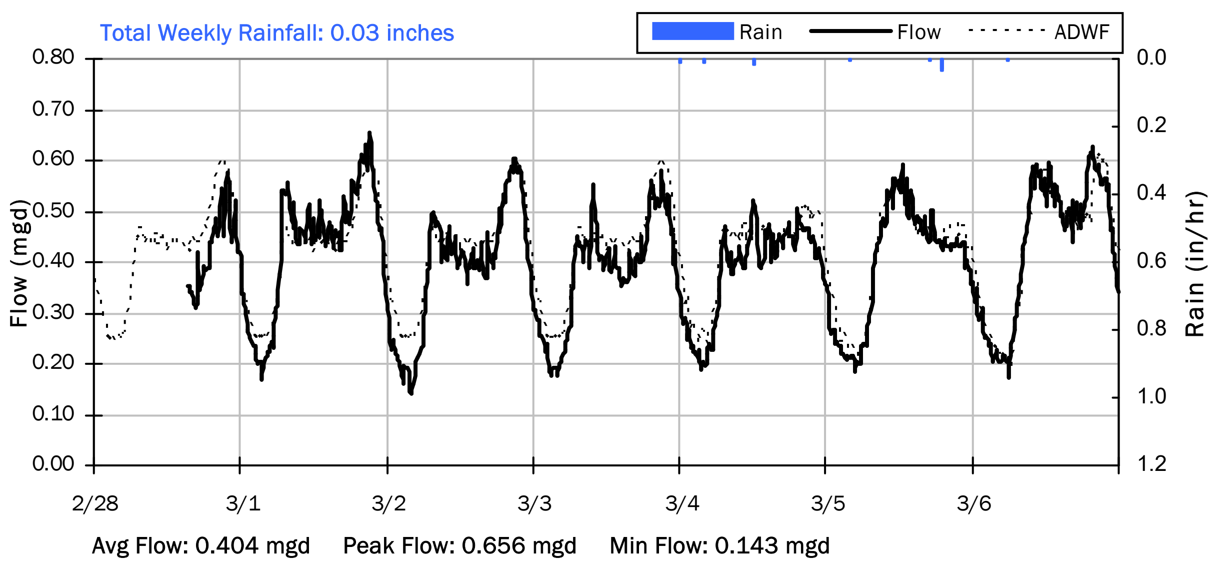
Avg Flow: mgd Peak Flow: mgd Min Flow: mgd

SITE 08

Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

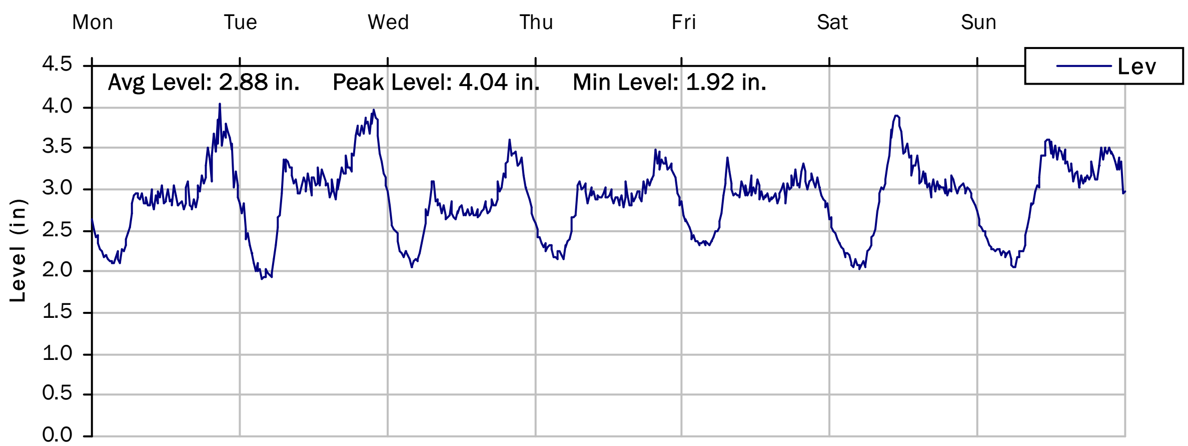


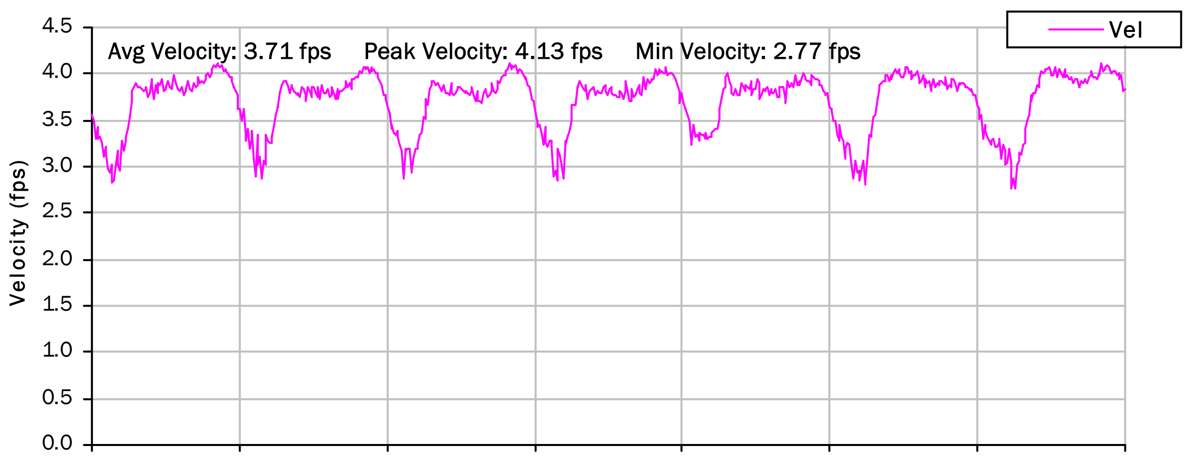


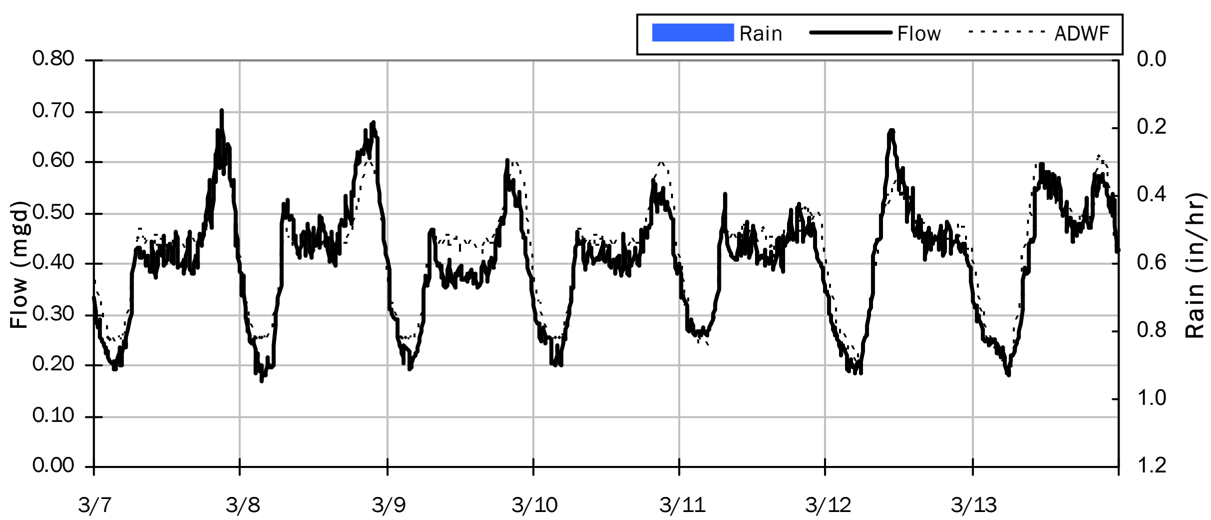


SITE 08

Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022





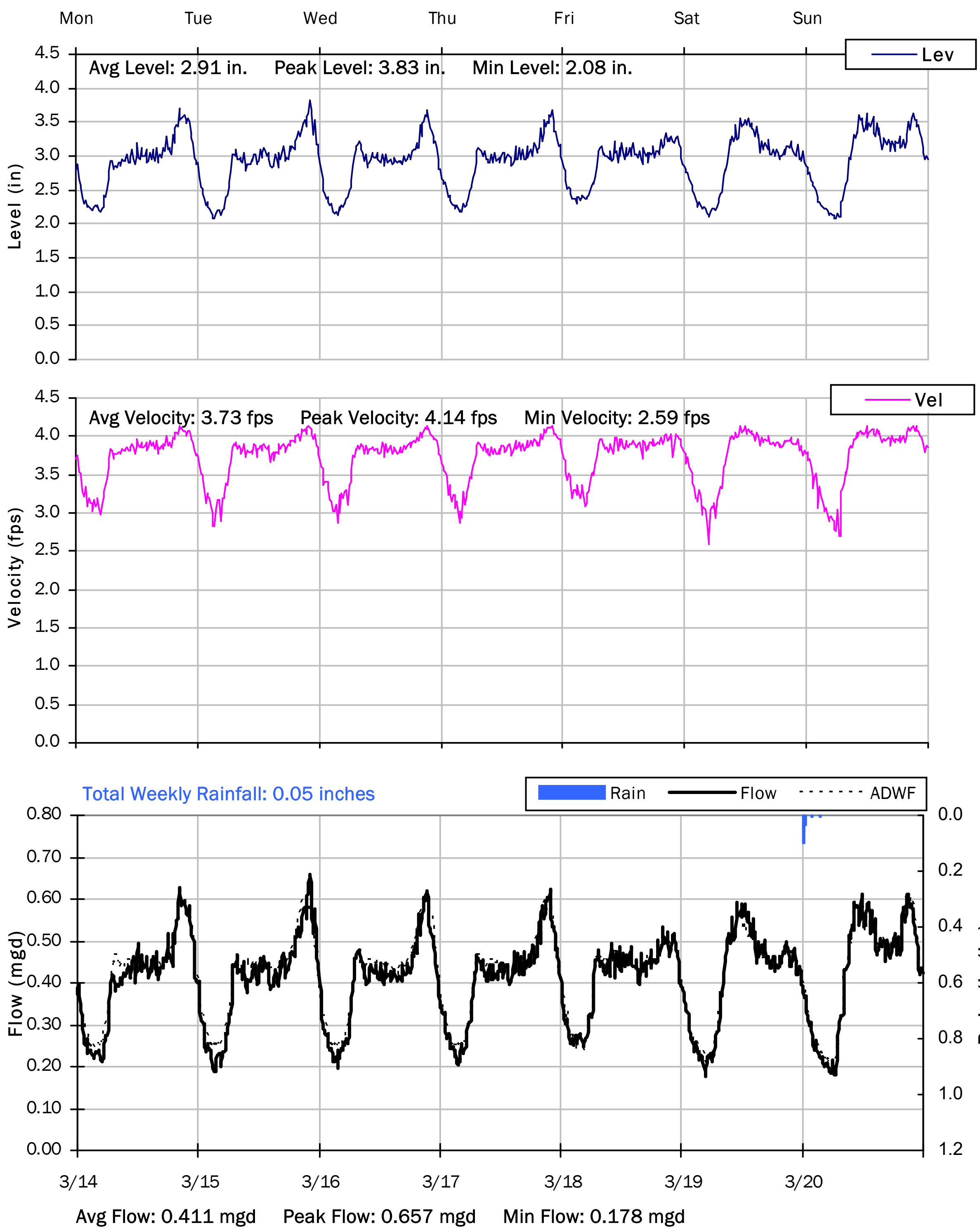


Avg Flow: 0.404 mgd Peak Flow: 0.701 mgd Min Flow: 0.170 mgd

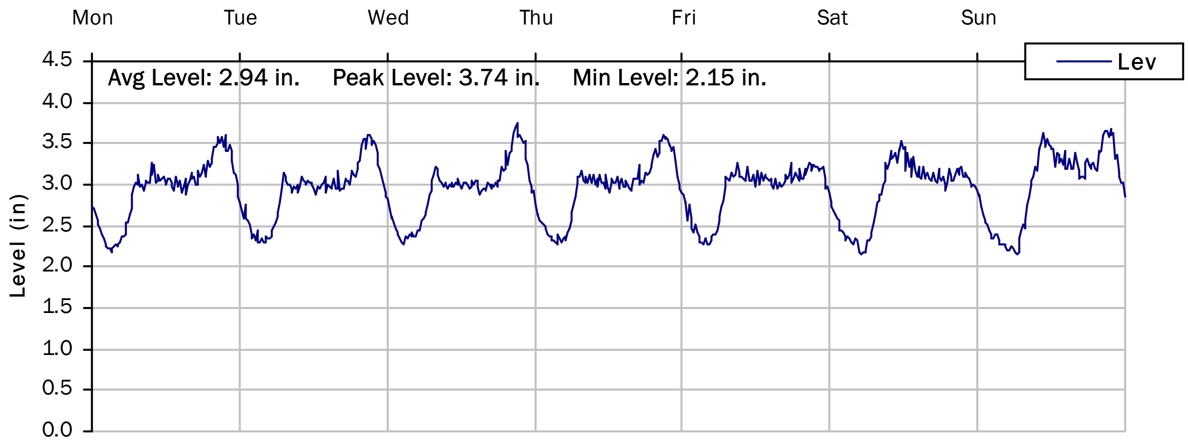
SITE 08

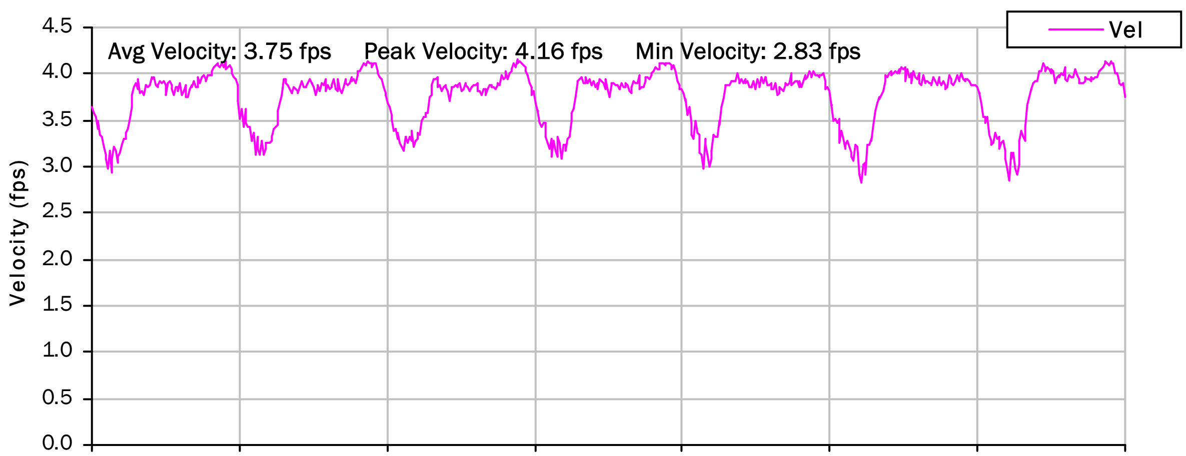
Weekly Level, Velocity and Flow Hydrographs

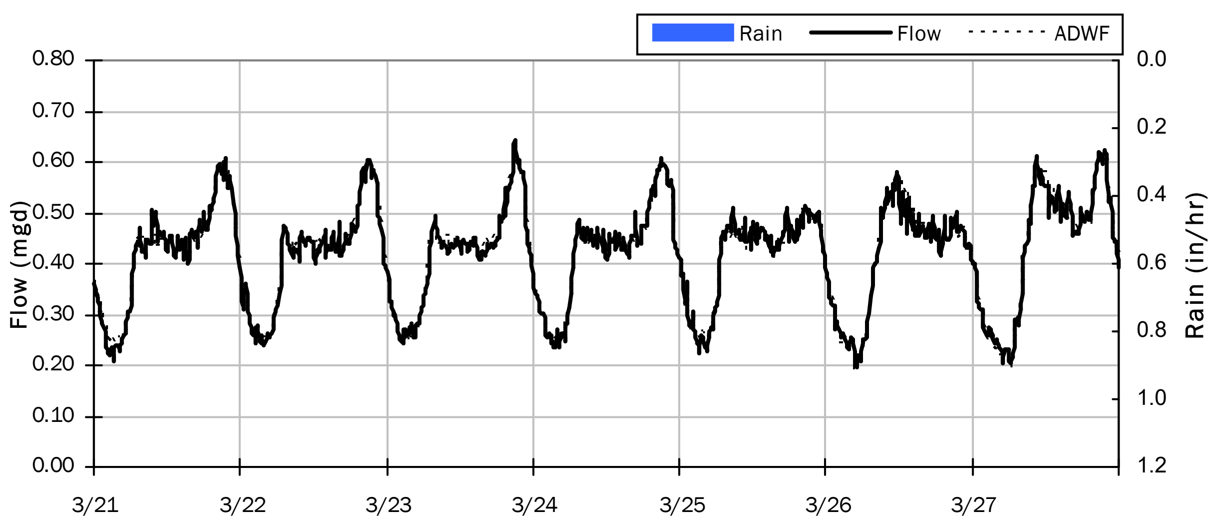
3/14/2022 to 3/21/2022



SITE 08
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022





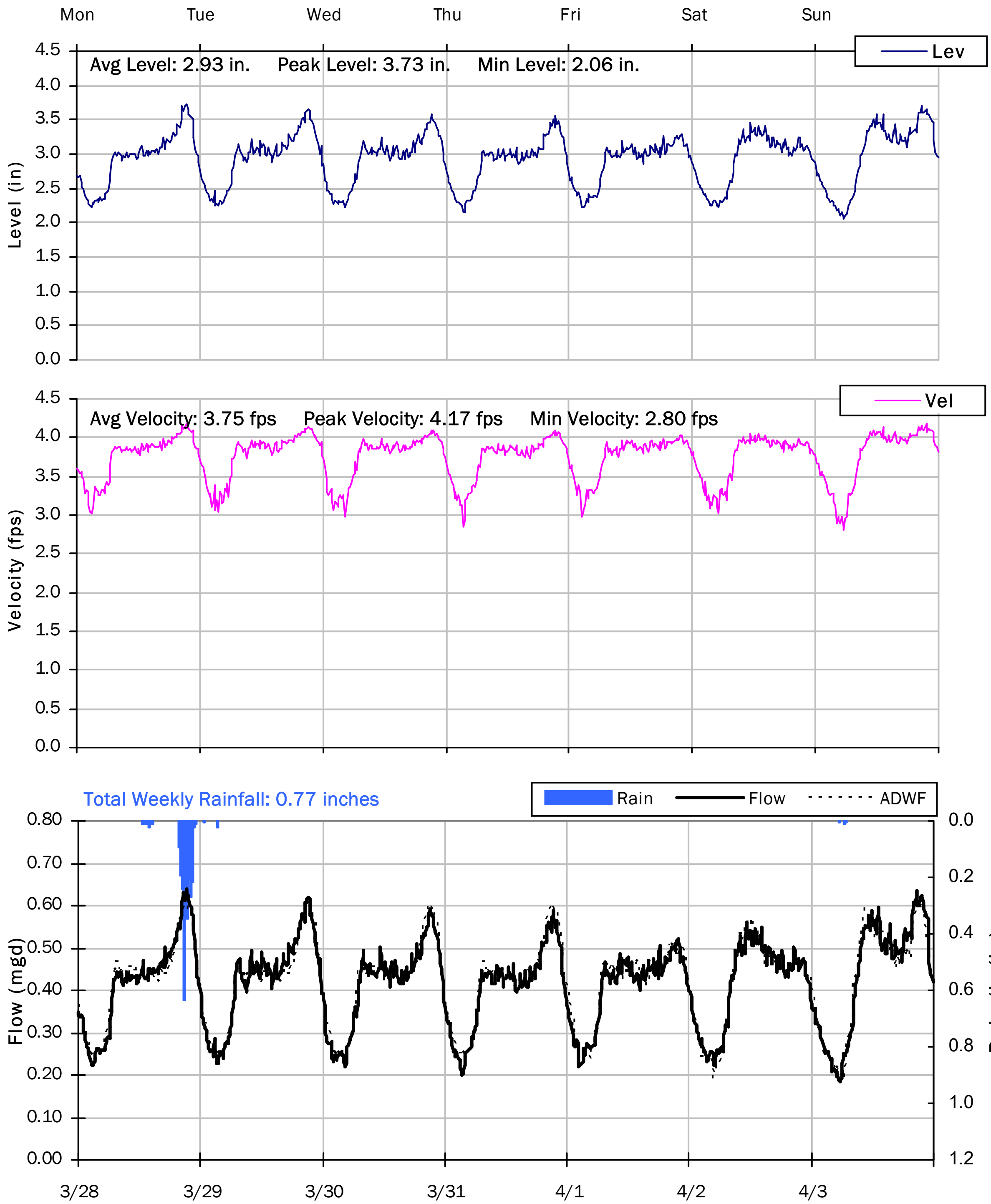


Avg Flow: 0.419 mgd Peak Flow: 0.643 mgd Min Flow: 0.198 mgd

SITE 08

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

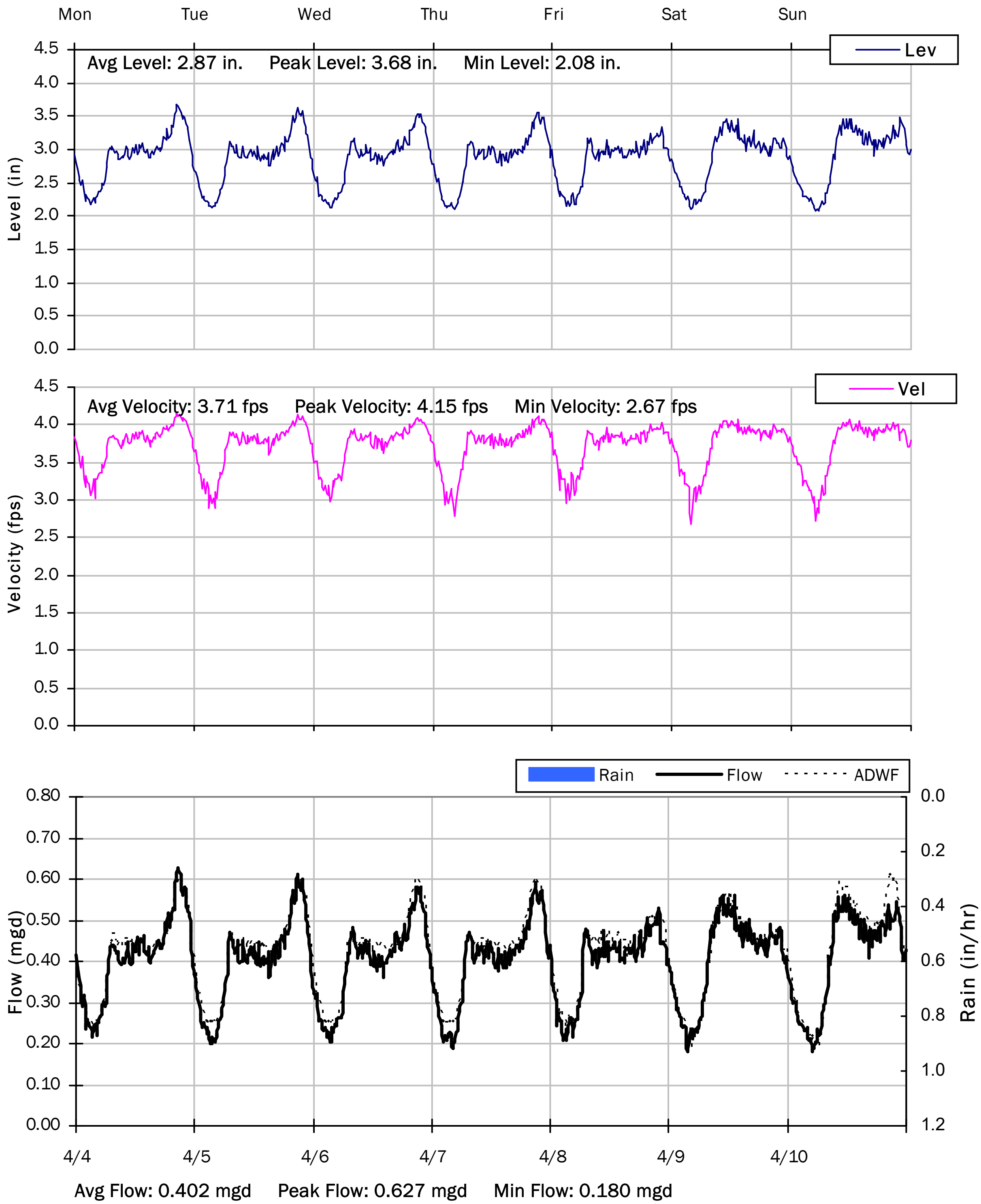


Avg Flow: 0.417 mgd   Peak Flow: 0.641 mgd   Min Flow: 0.184 mgd

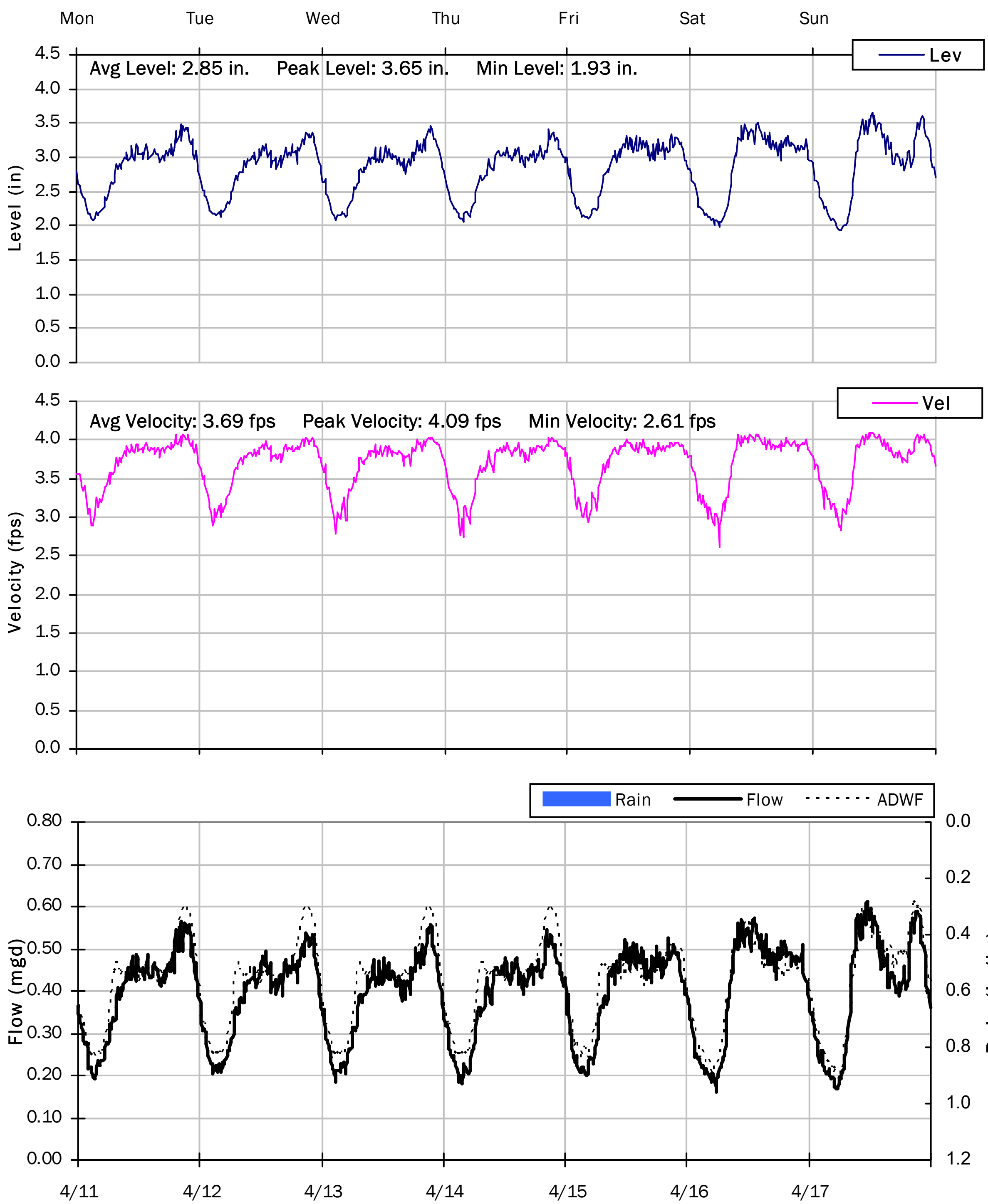
SITE 08

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022



SITE 08
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

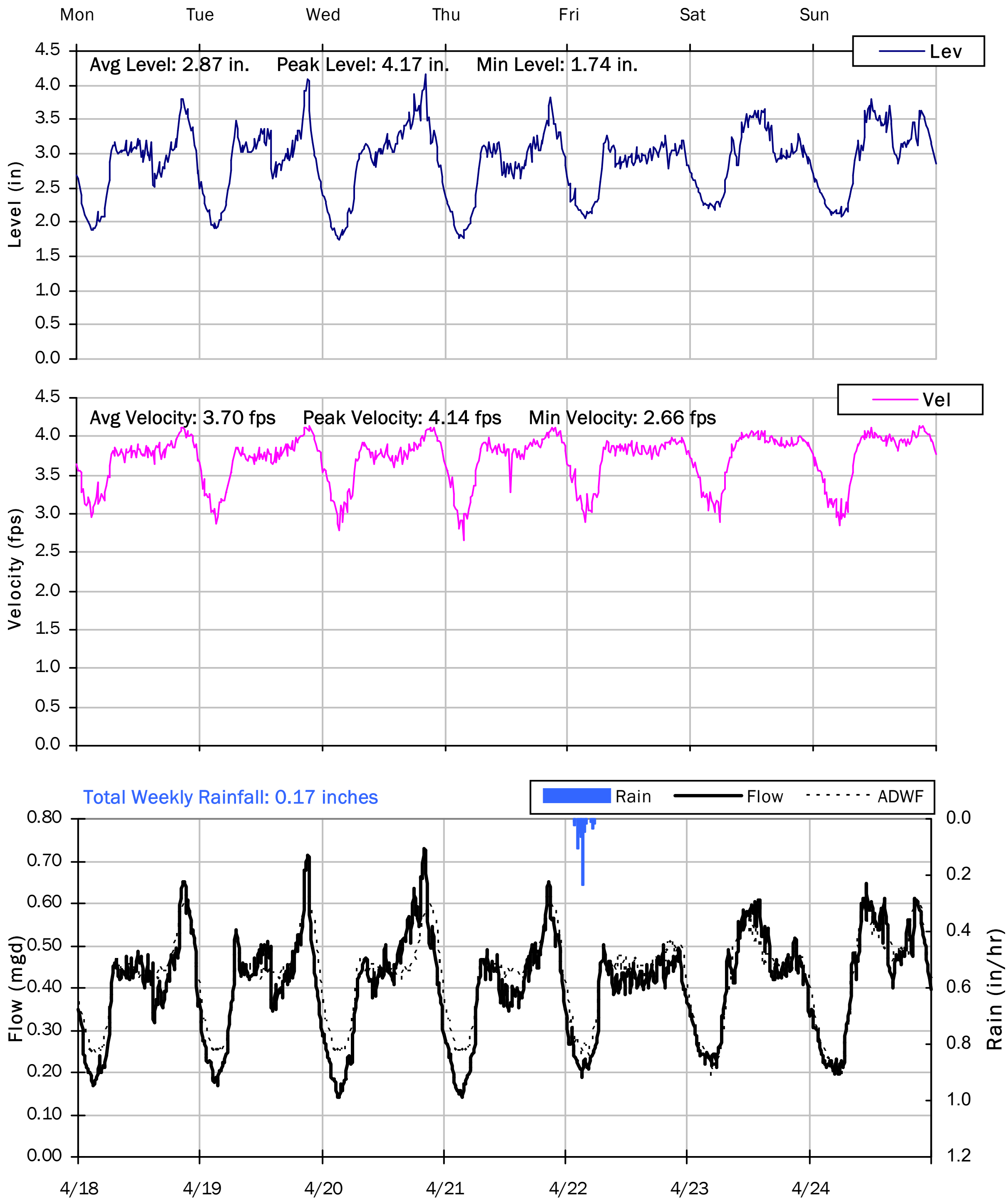


Avg Flow: 0.397 mgd Peak Flow: 0.610 mgd Min Flow: 0.162 mgd

SITE 08

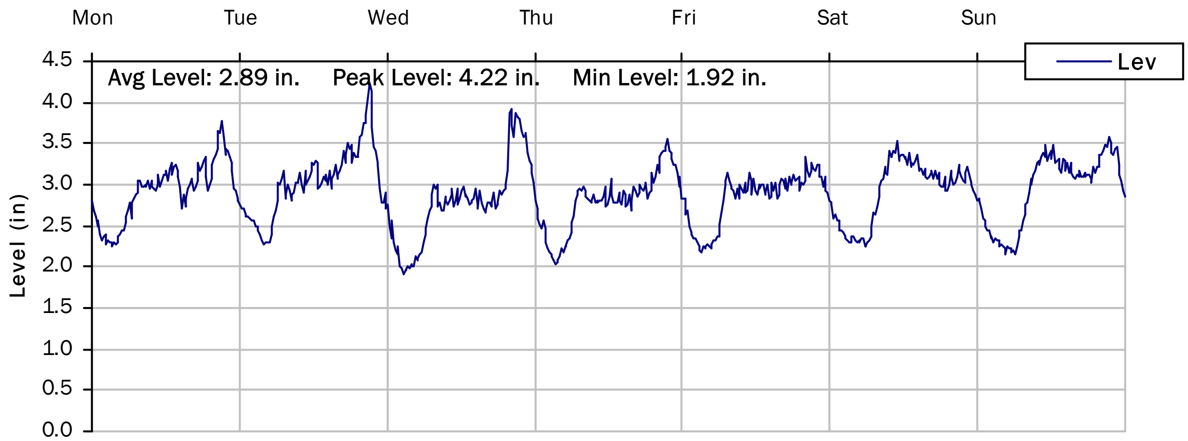
Weekly Level, Velocity and Flow Hydrographs

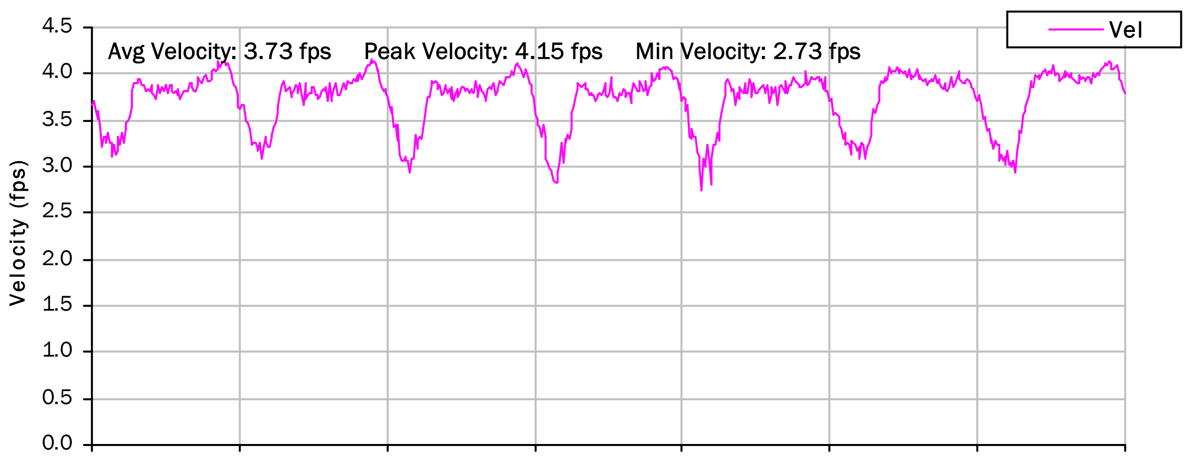
4/18/2022 to 4/25/2022

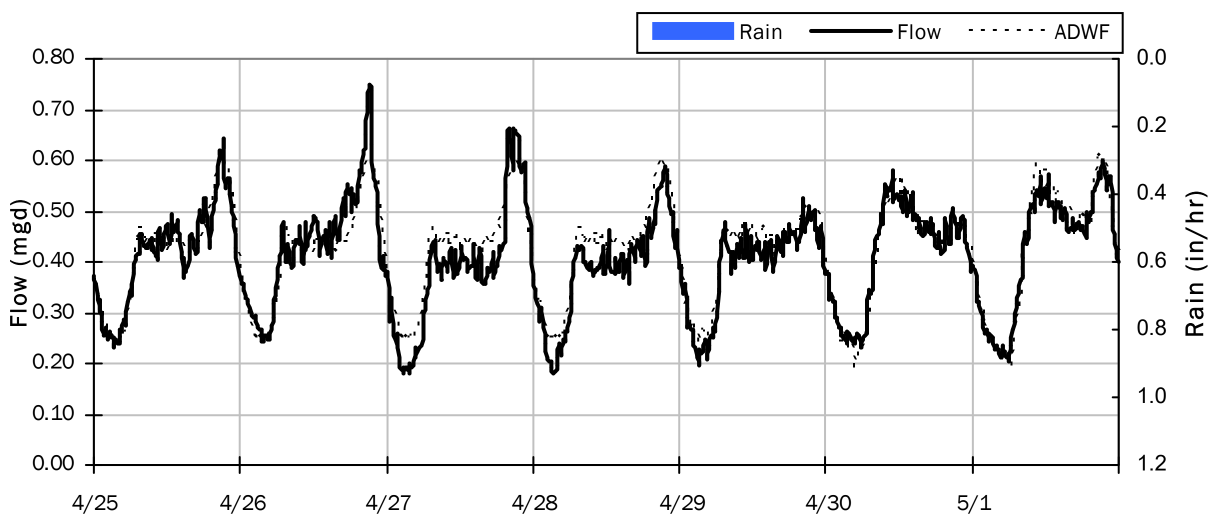


Avg Flow: 0.404 mgd Peak Flow: 0.730 mgd Min Flow: 0.139 mgd

SITE 08
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022





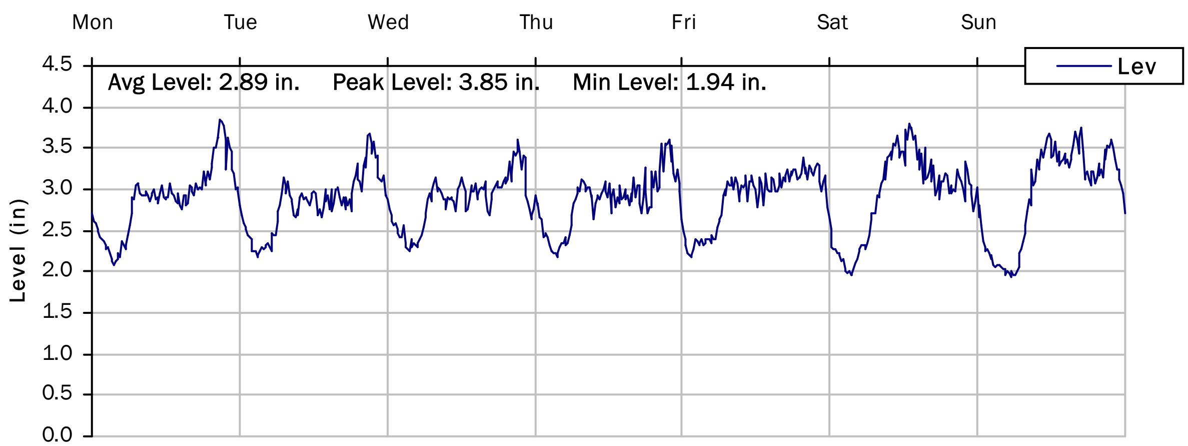


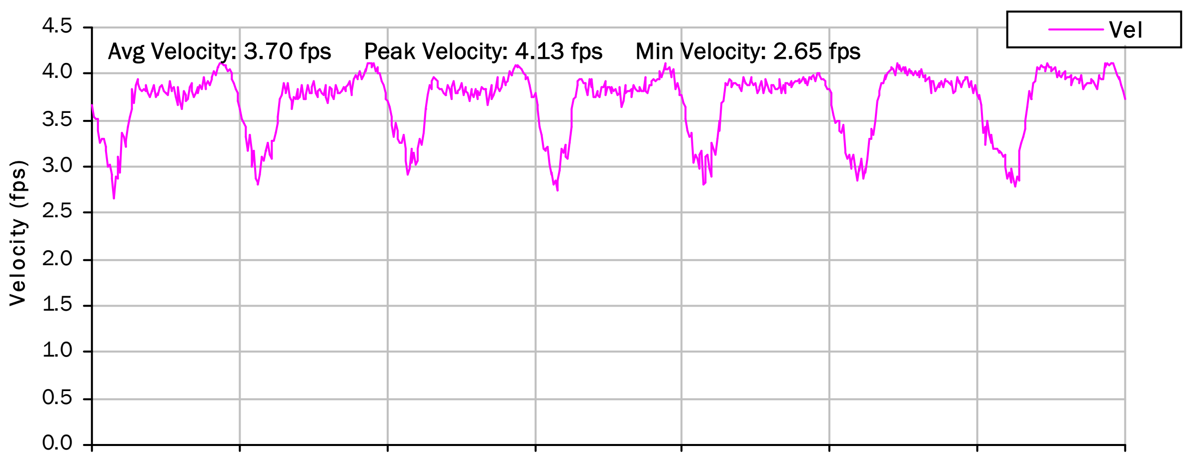
Avg Flow: 0.408 mgd Peak Flow: 0.750 mgd Min Flow: 0.182 mgd

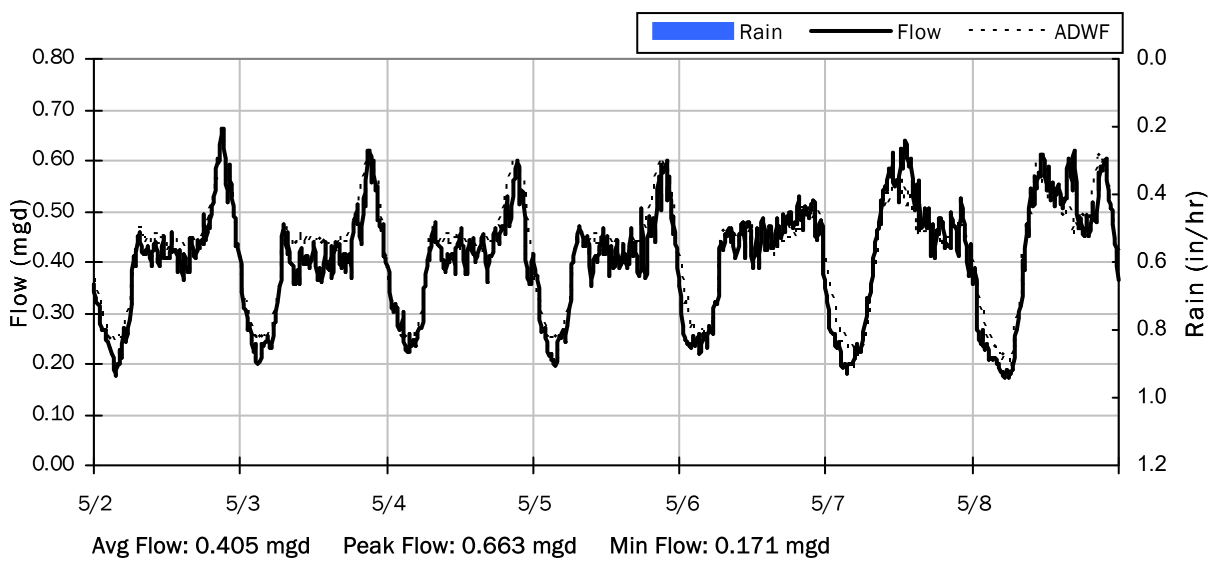
SITE 08

Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022

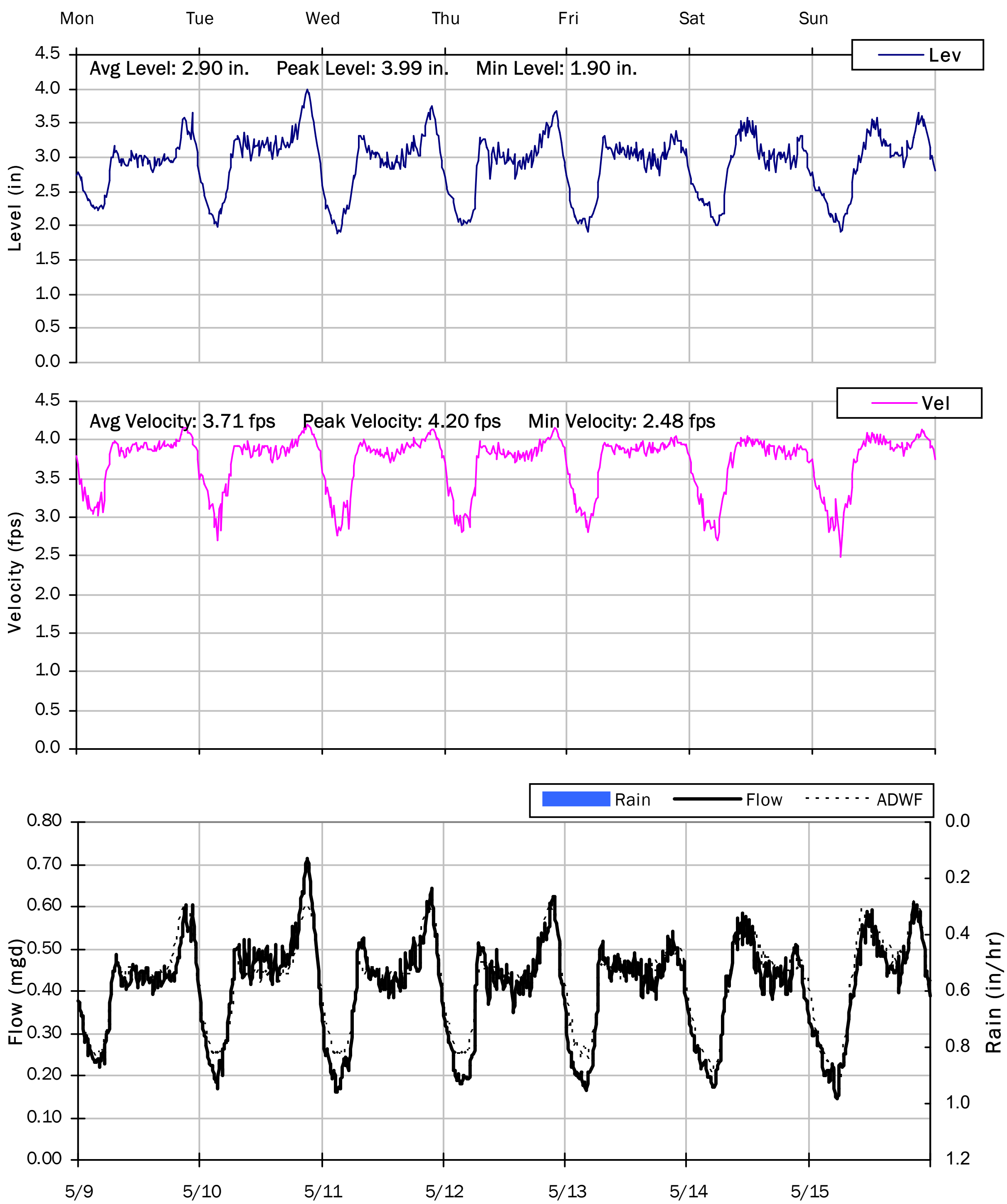






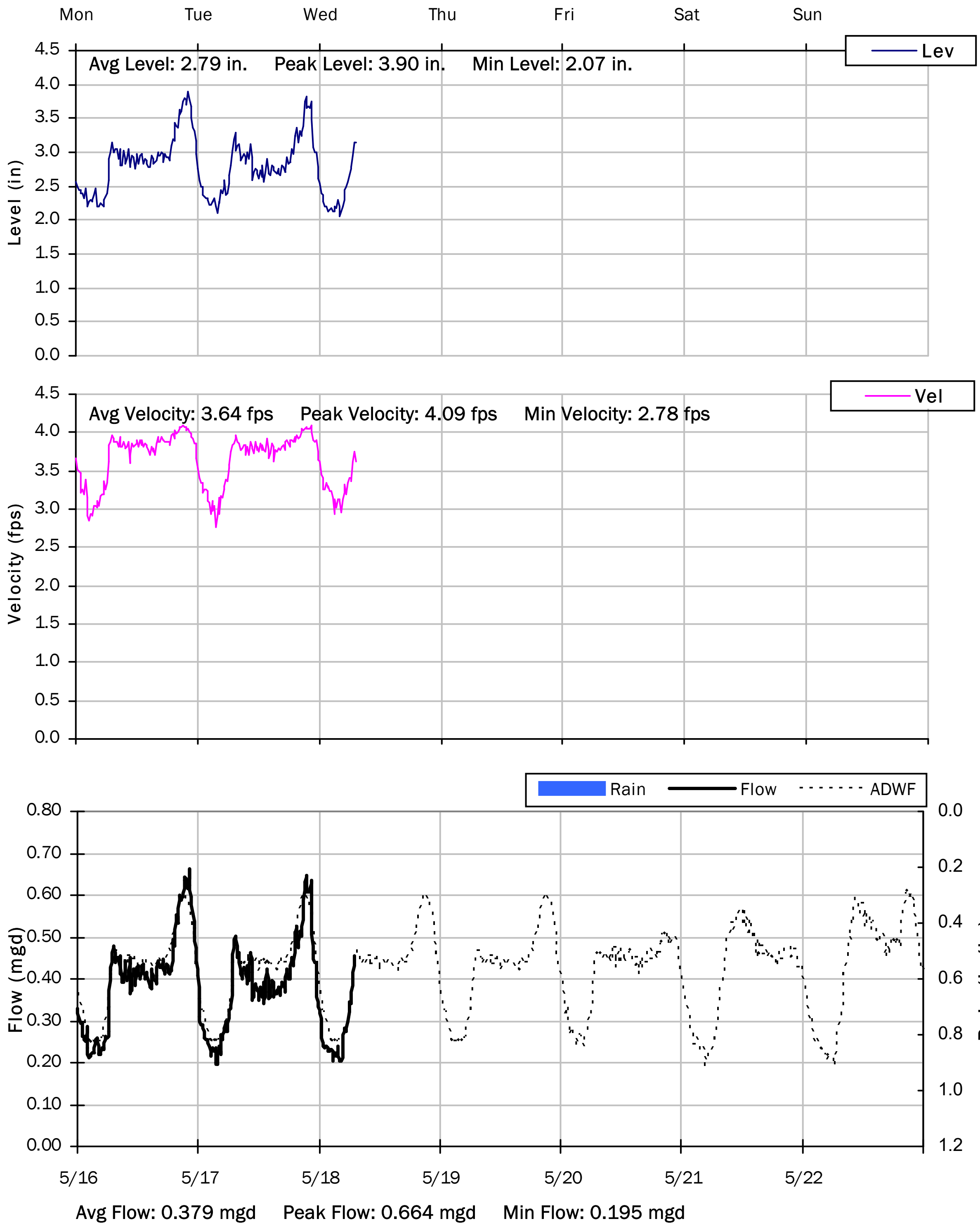
SITE 08

Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022



Avg Flow: 0.409 mgd Peak Flow: 0.712 mgd Min Flow: 0.145 mgd

SITE 08
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022



Monitoring Site: Site 09

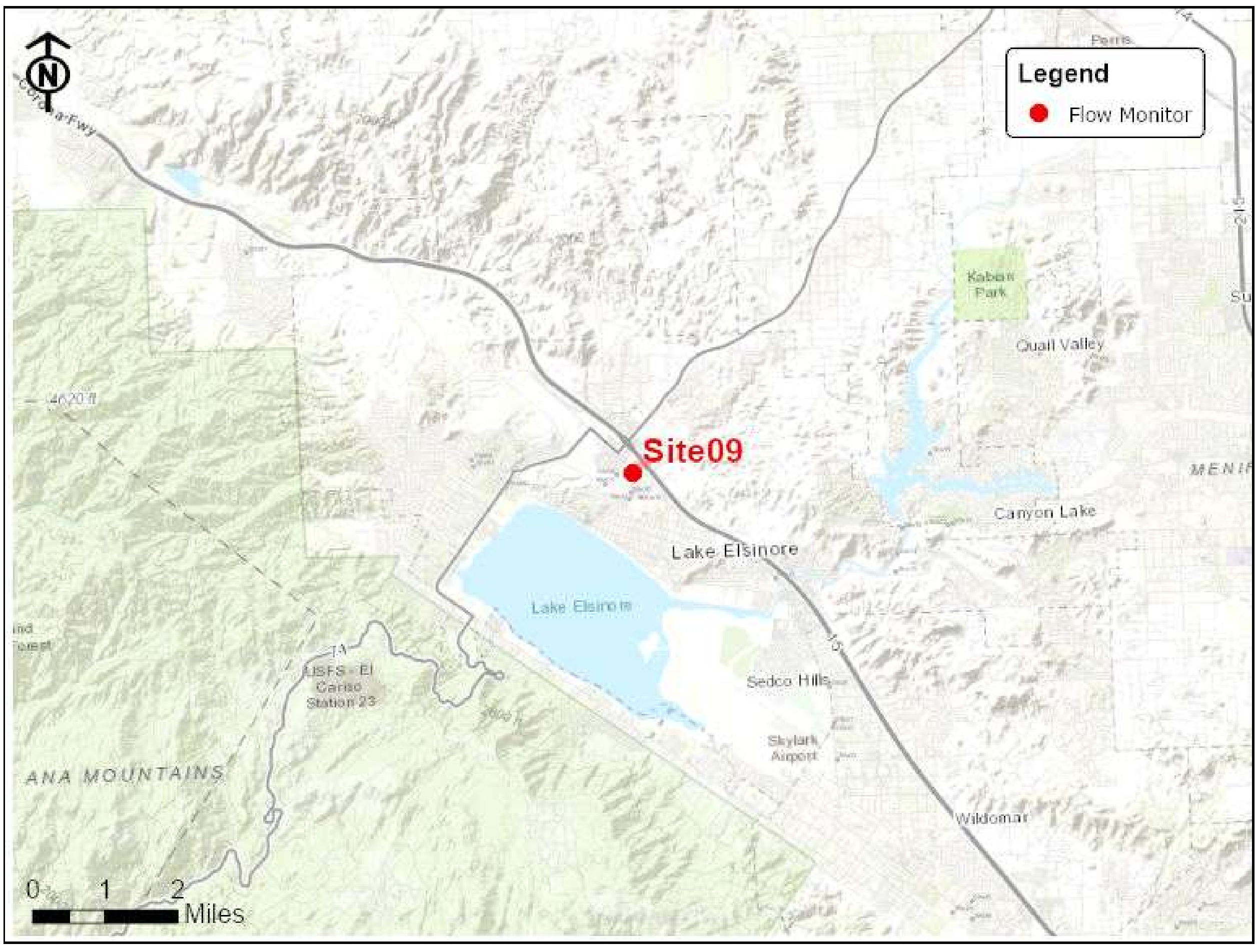
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Minthorn Street, west of Birch Street

Data Summary Report



Vicinity Map: Site 09

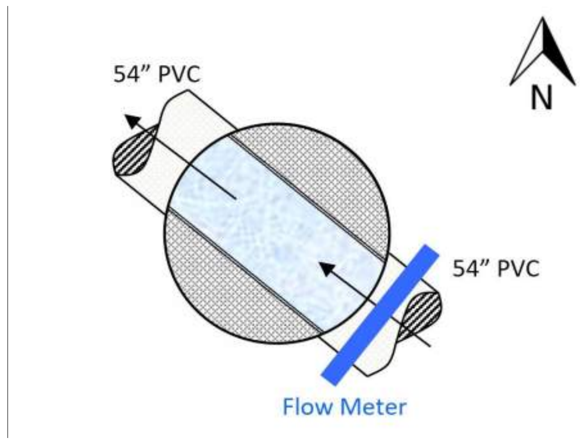
SITE 09

Site Information MH ID: MH-10056

Location:	Minthorn Street, west of Birch Street
Coordinates:	117.3365° W, 33.6858° N
Rim Elevation (Earth):	1272 feet
Expected Pipe Diameter:	54 inches
Measured Pipe Diameter:	54 inches
ADWF:	3.458 mgd
Peak Measured Flow:	5.889 mgd
Sediment:	None

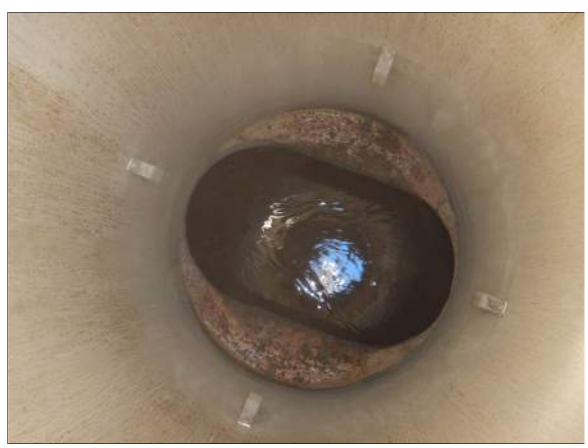
Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 09

Additional Site Photos

Effluent Pipe

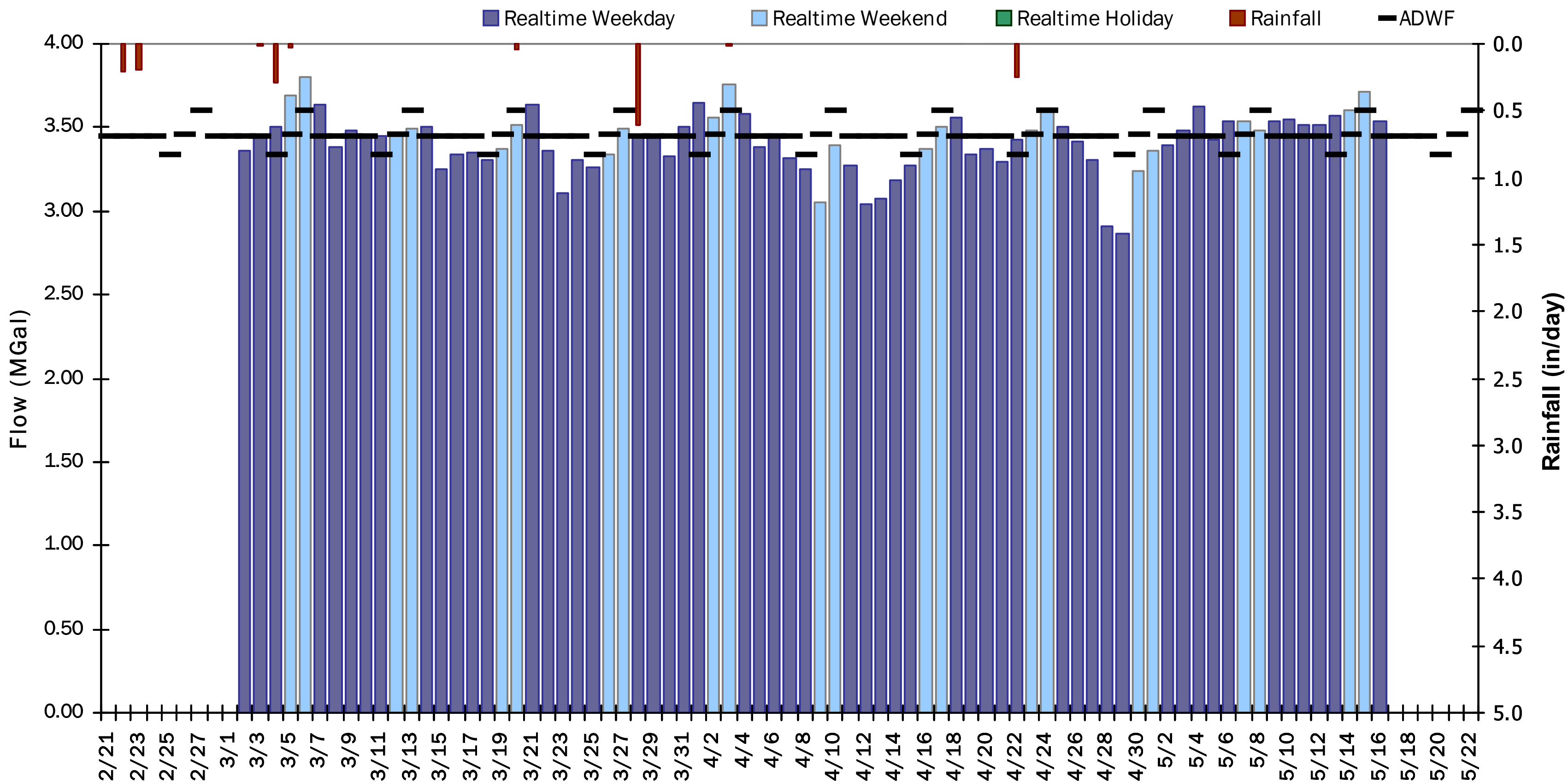
Influent Pipe

SITE 09

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 3.412 MGal   Peak Daily Flow: 4.014 MGal   Min Daily Flow: 2.322 MGal

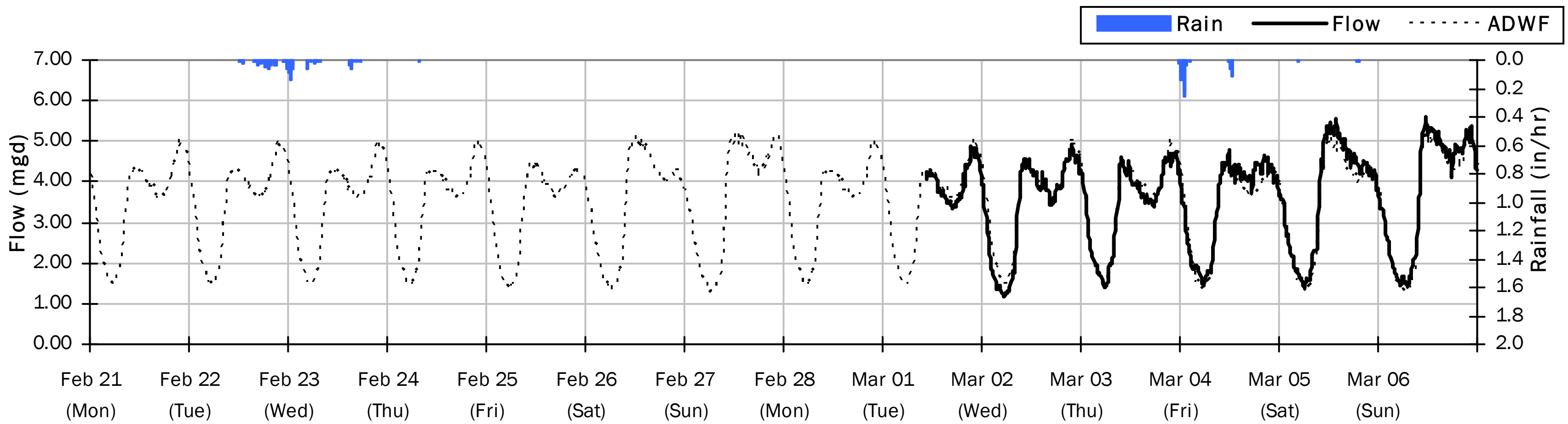
Total Rainfall: 1.23 inches

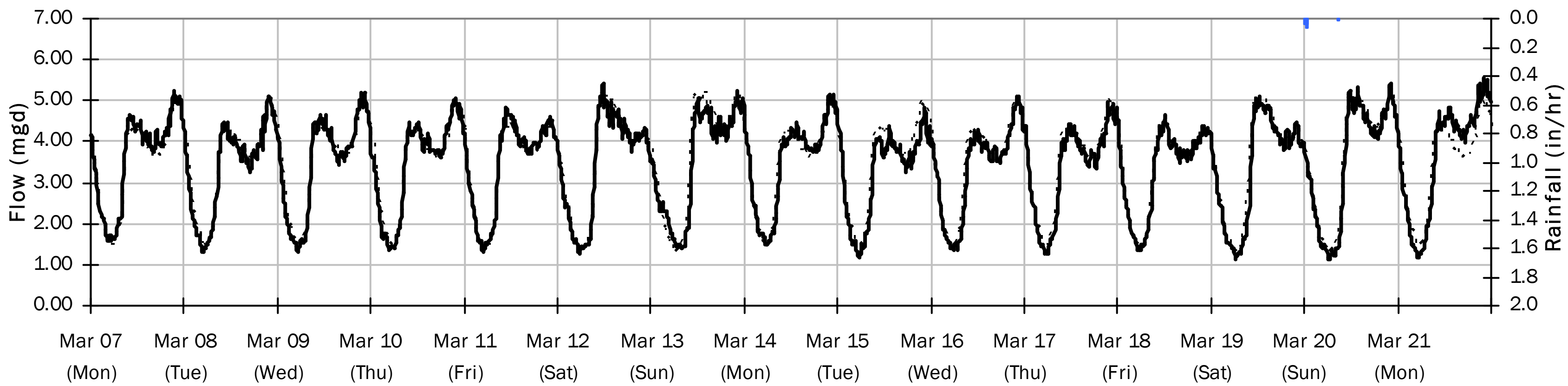


SITE 09

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.75 inches Period Avg Flow: 3.484 mgd Period Peak Flow: 5.591 mgd Period Min Flow: 1.108 mgd

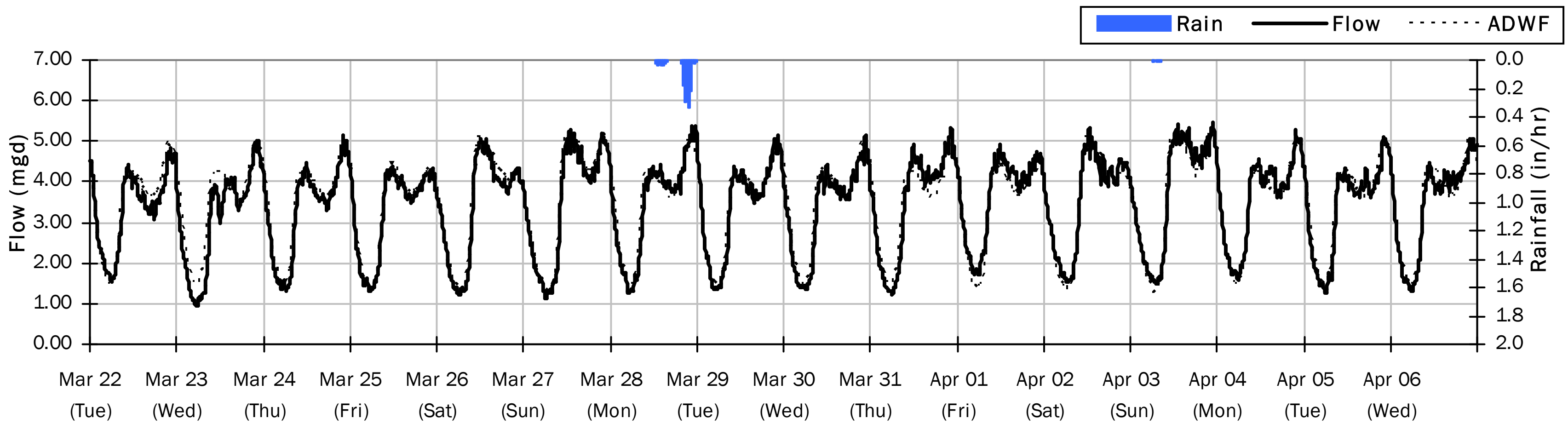


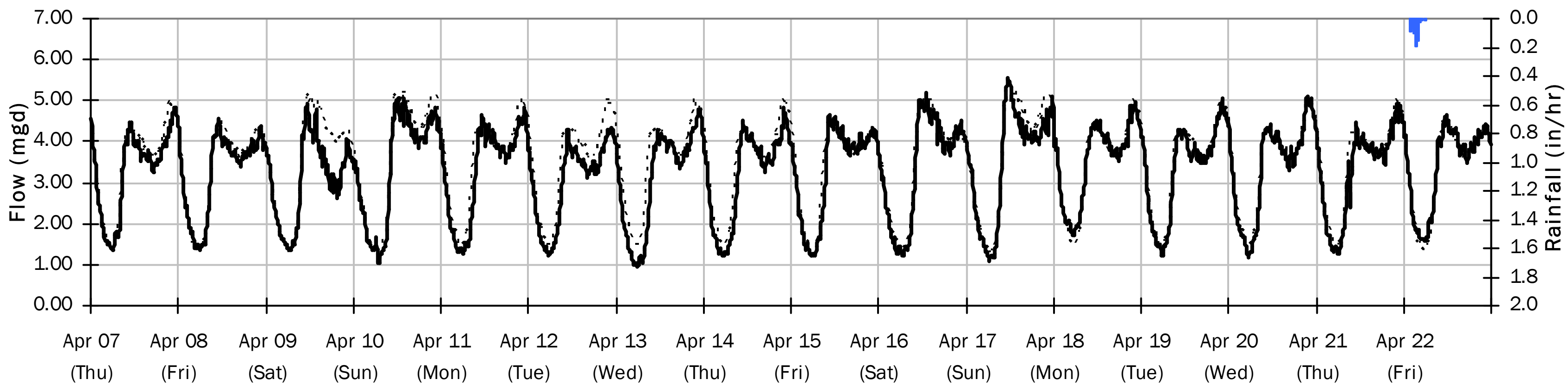


SITE 09
Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.88 inches

Period Avg Flow: 3.366 mgd   Period Peak Flow: 5.560 mgd   Period Min Flow: 0.937 mgd



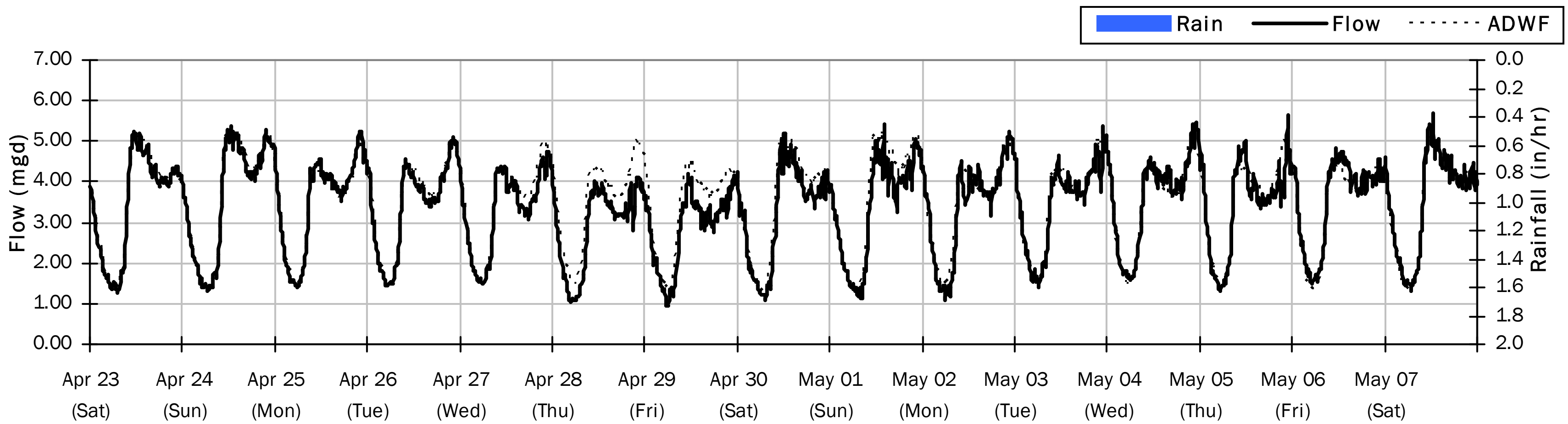


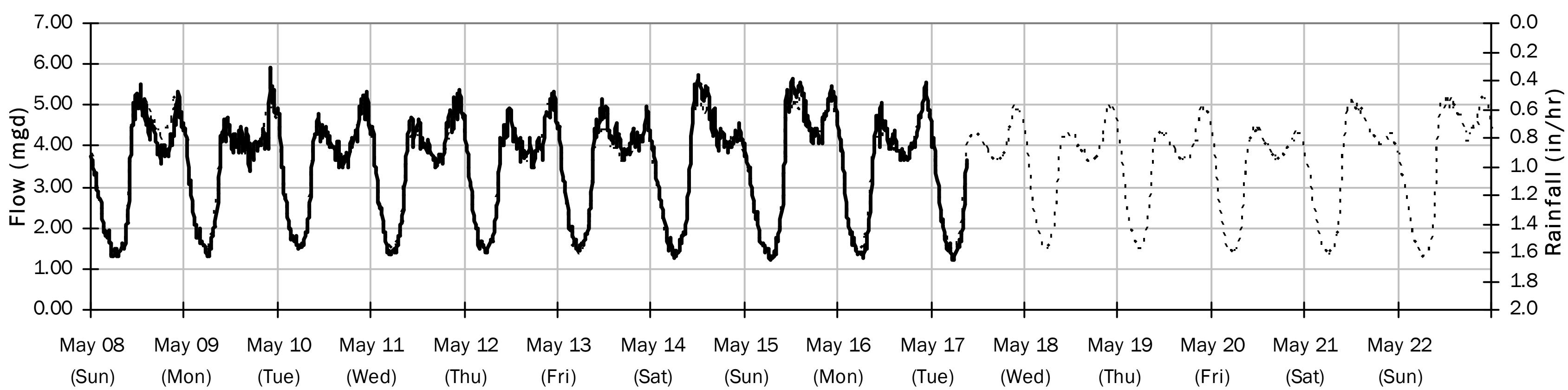
SITE 09

Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

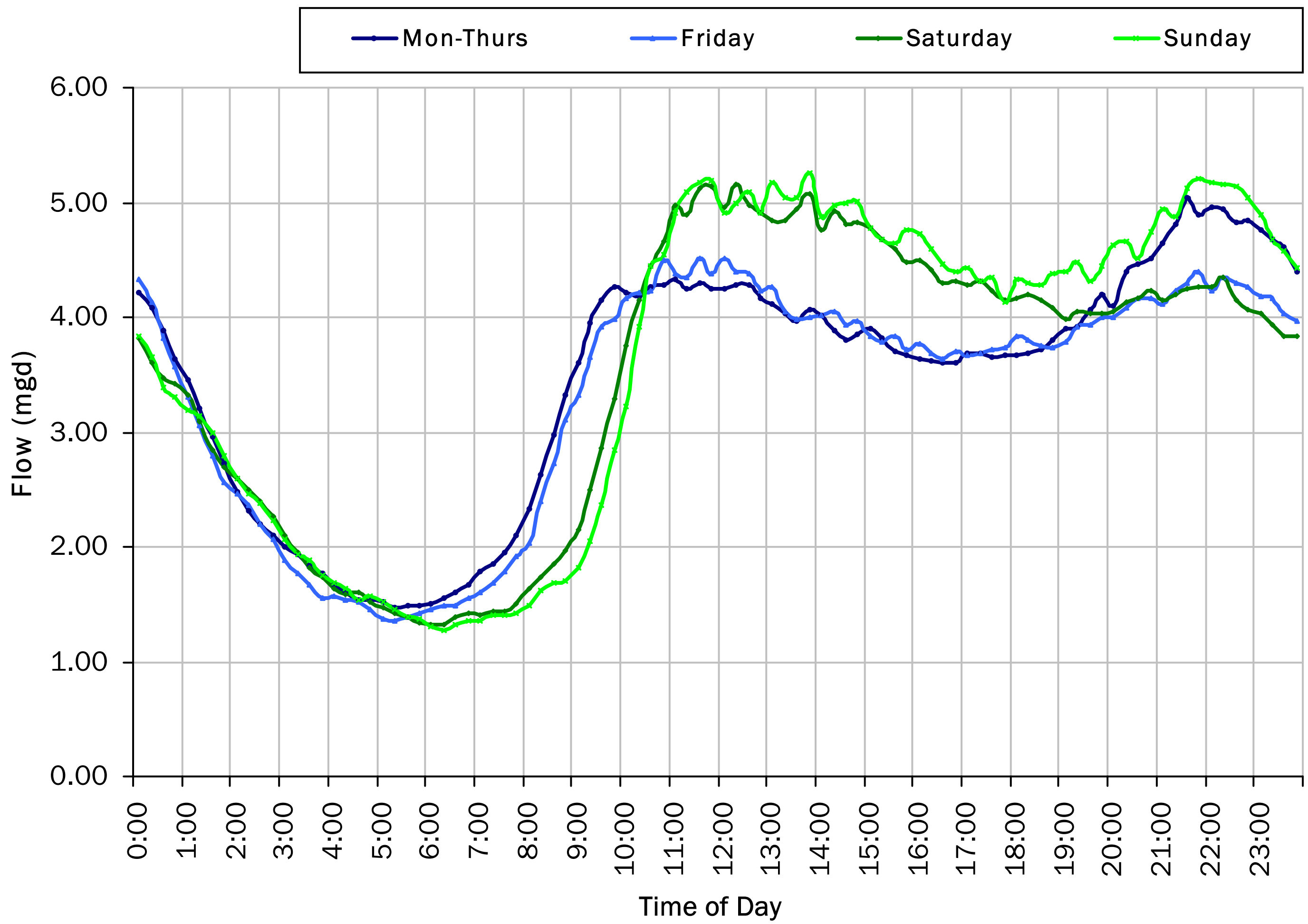
Period Avg Flow: 3.427 mgd Period Peak Flow: 5.889 mgd Period Min Flow: 0.929 mgd





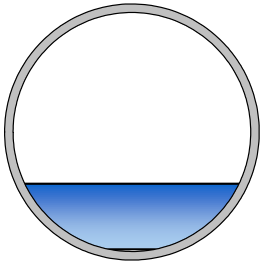
SITE 09

Average Dry Weather Flow Hydrographs



ADWF:

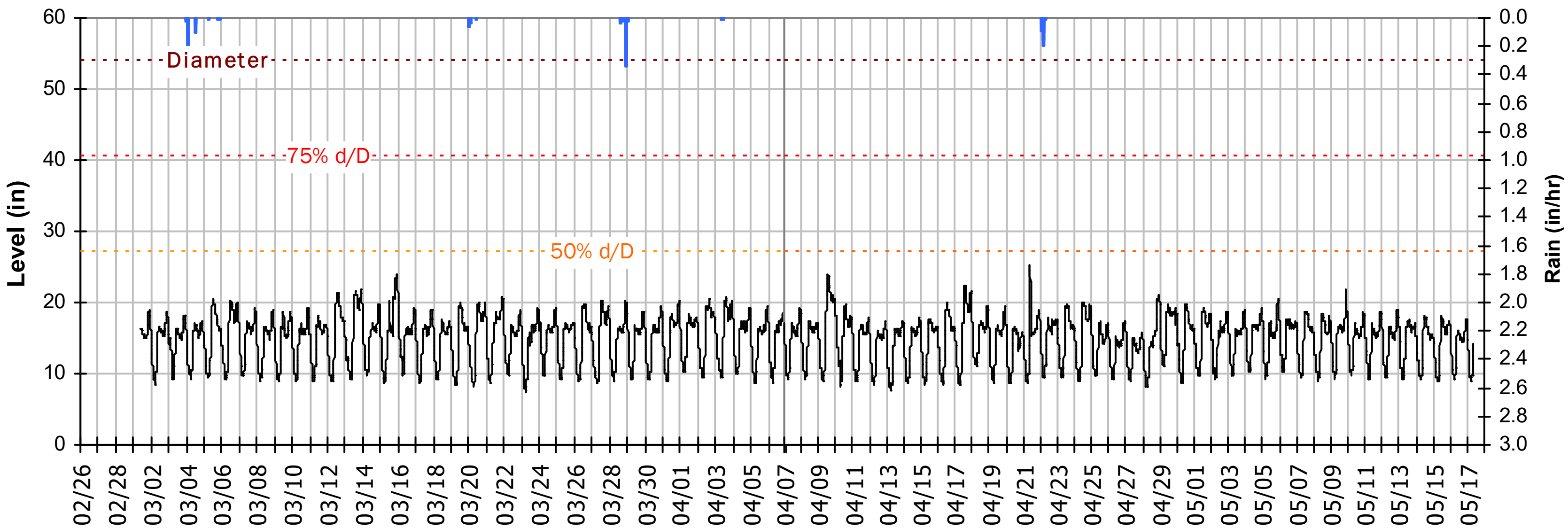
3.458 *mgd*

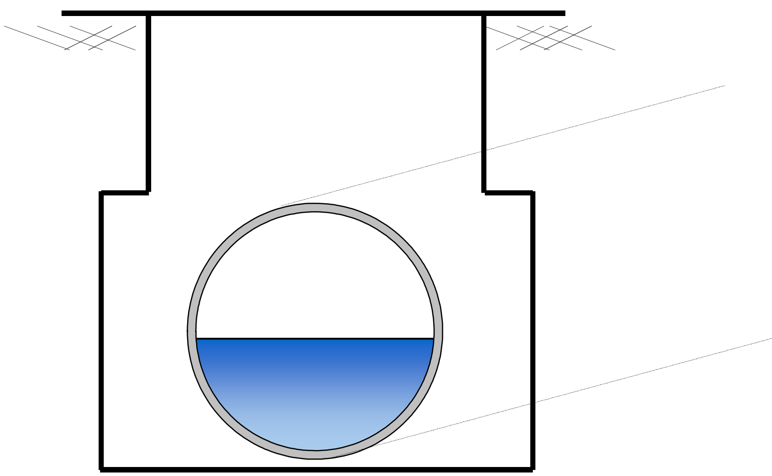


SITE 09

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

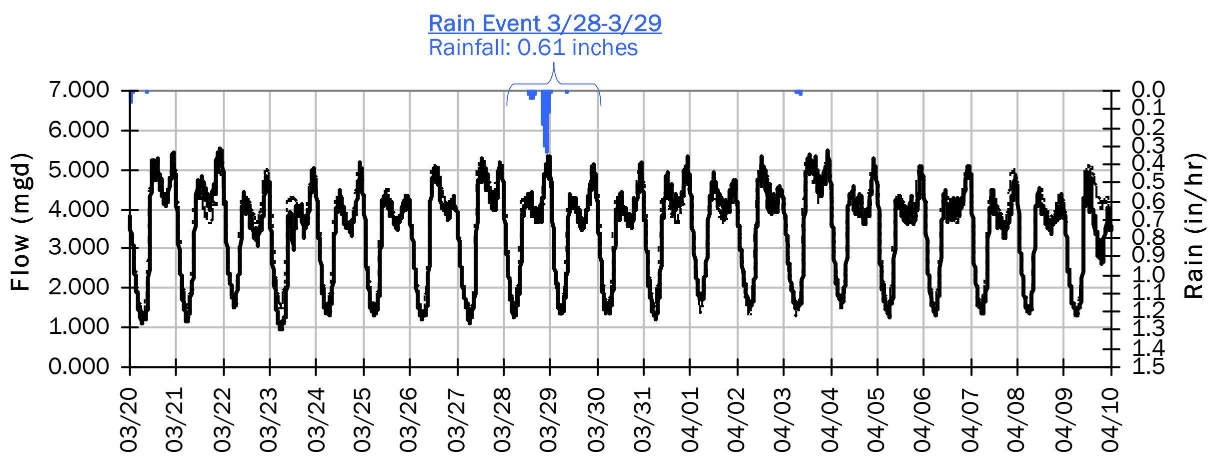




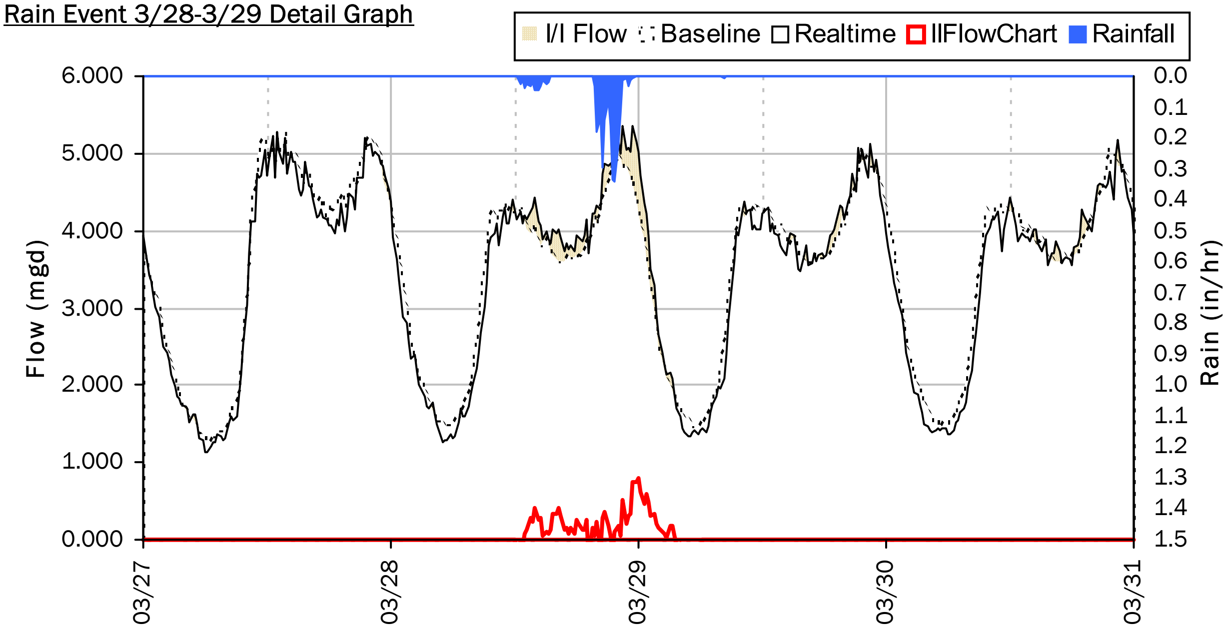
Pipe Diameter:	54	*inches*
Peak Measured Level:	25.1	*inches*
Peak d/D Ratio:	0.47	

SITE 09
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



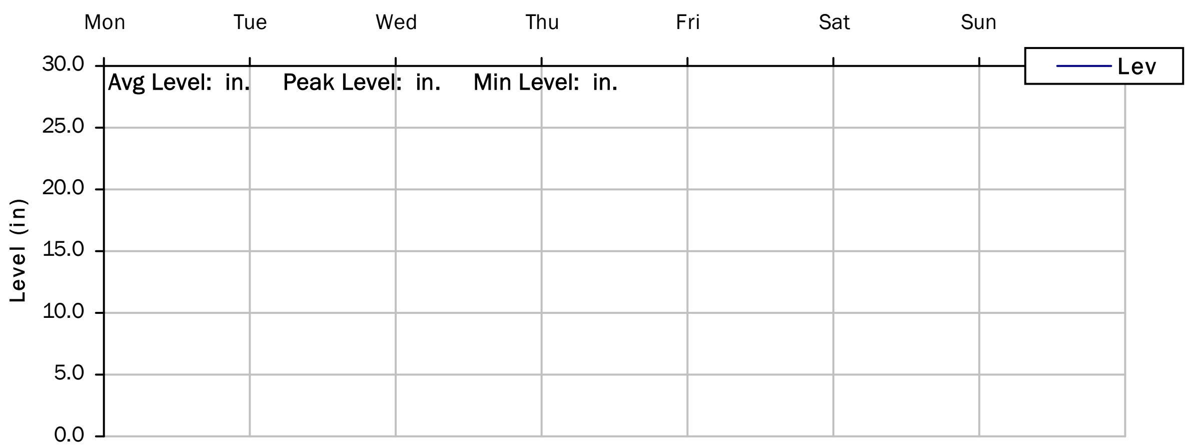
Rain Event 3/28-3/29 Detail Graph

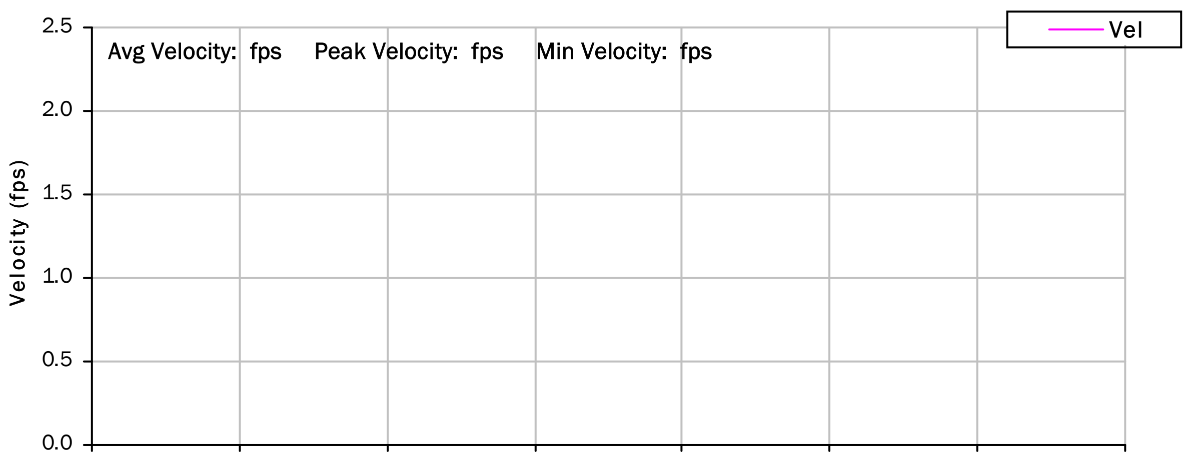


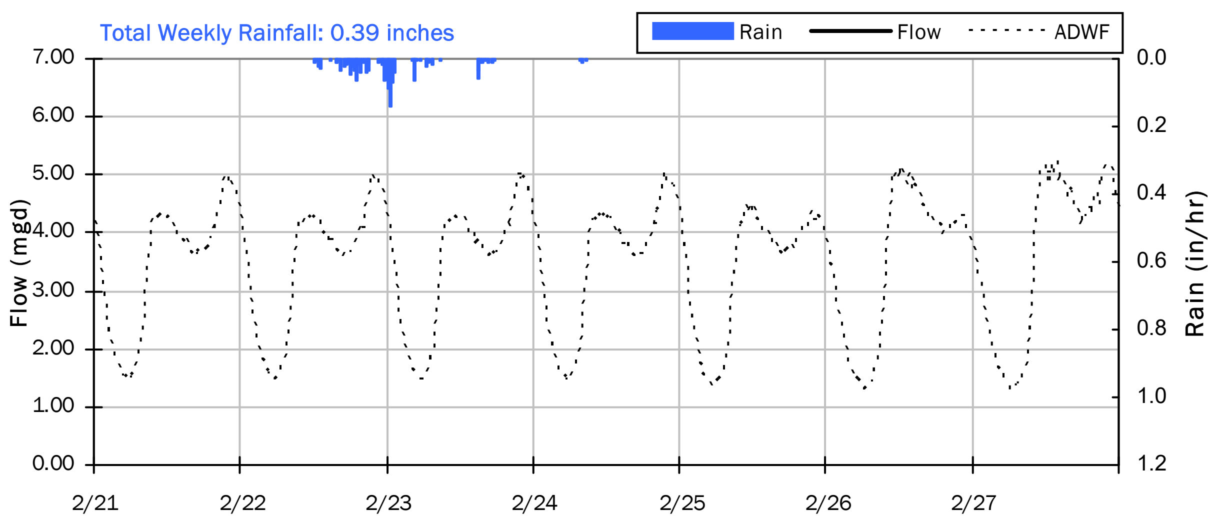
Storm Event I/I Analysis (Rain = 0.61 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	5.359 *mgd*	Peak I/I Rate:	0.806 *mgd*
PF:	1.55	Total I/I:	126,000 *gallons*
Peak Level:	20.16 *in*		
d/D Ratio:	0.37		

SITE 09
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

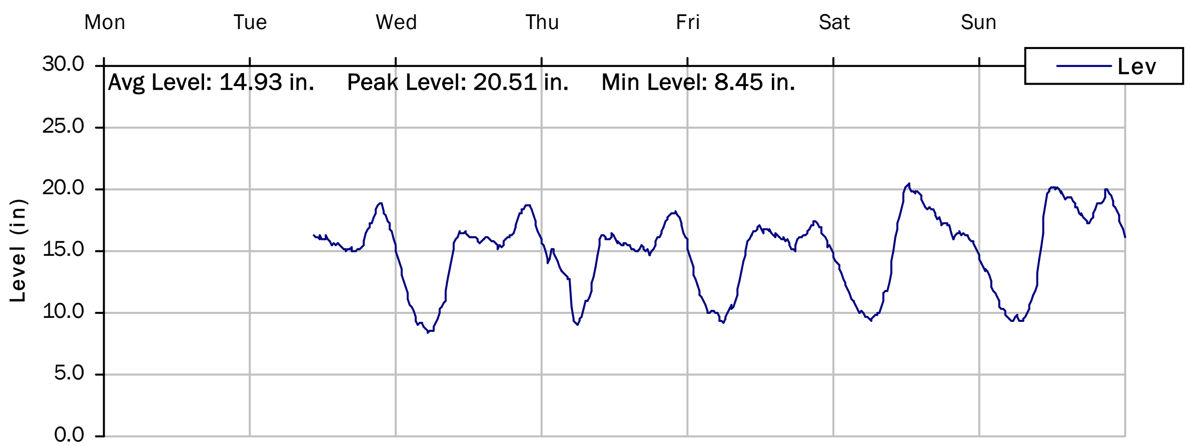


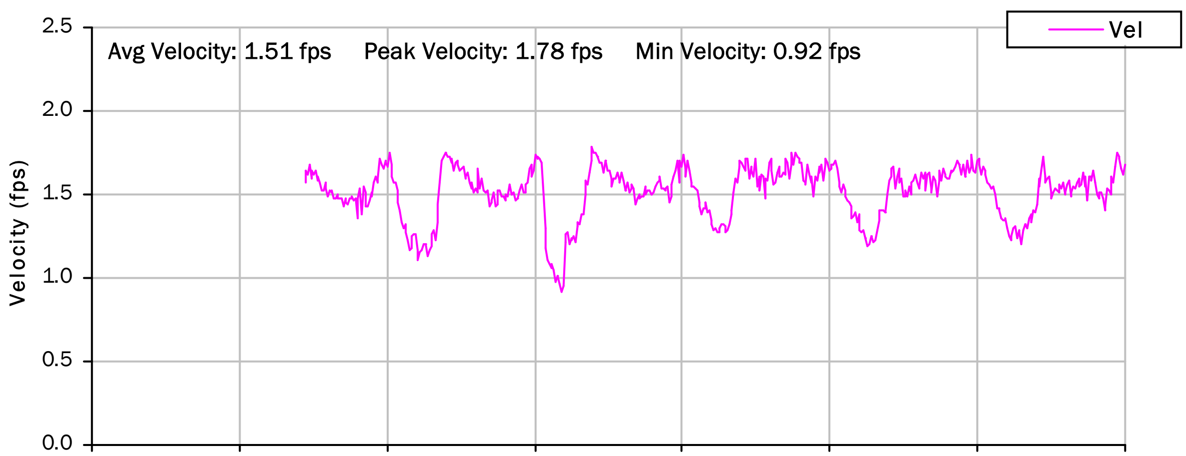


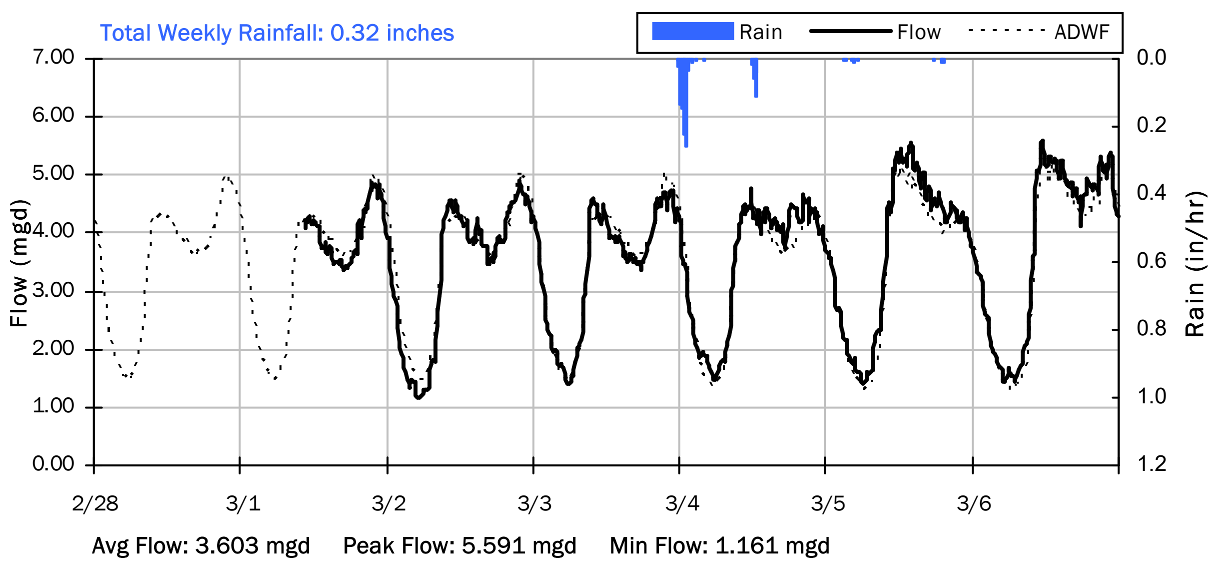


Avg Flow: mgd Peak Flow: mgd Min Flow: mgd

SITE 09
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



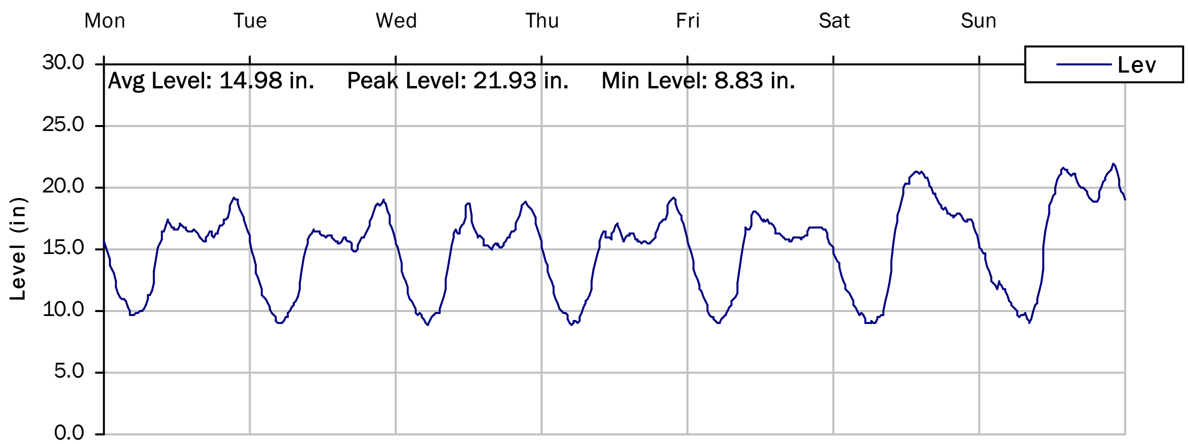


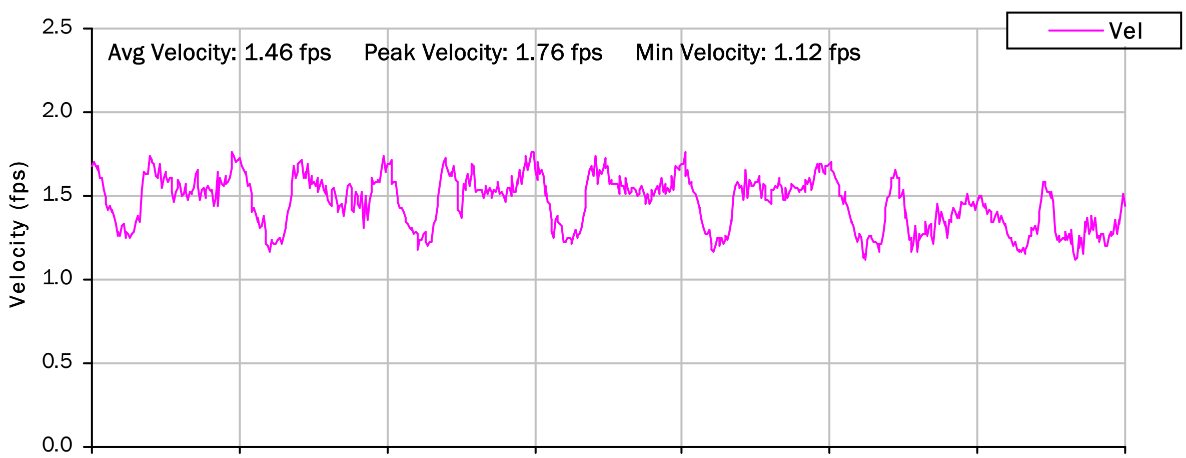


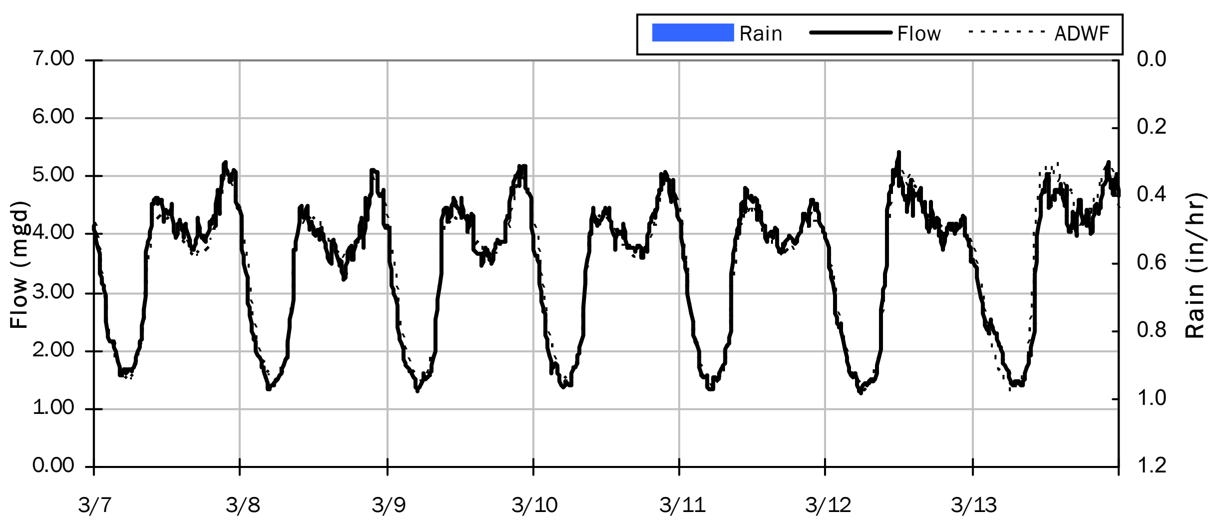
SITE 09

Weekly Level, Velocity and Flow Hydrographs

3/7/2022 to 3/14/2022

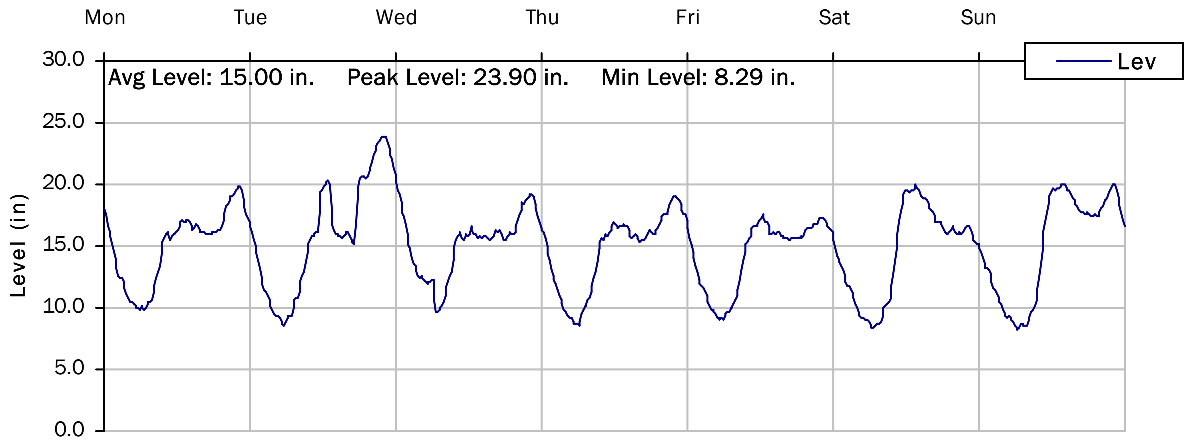


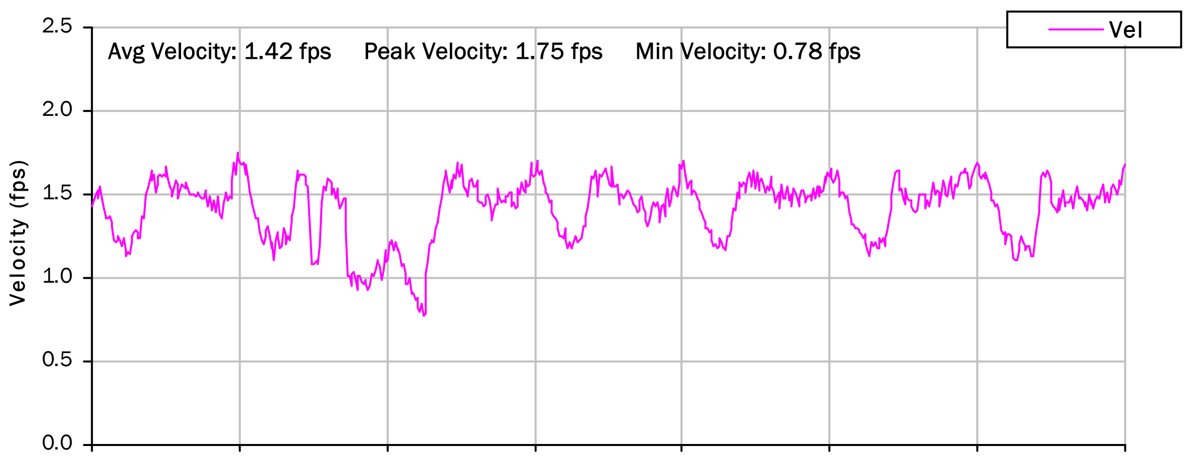


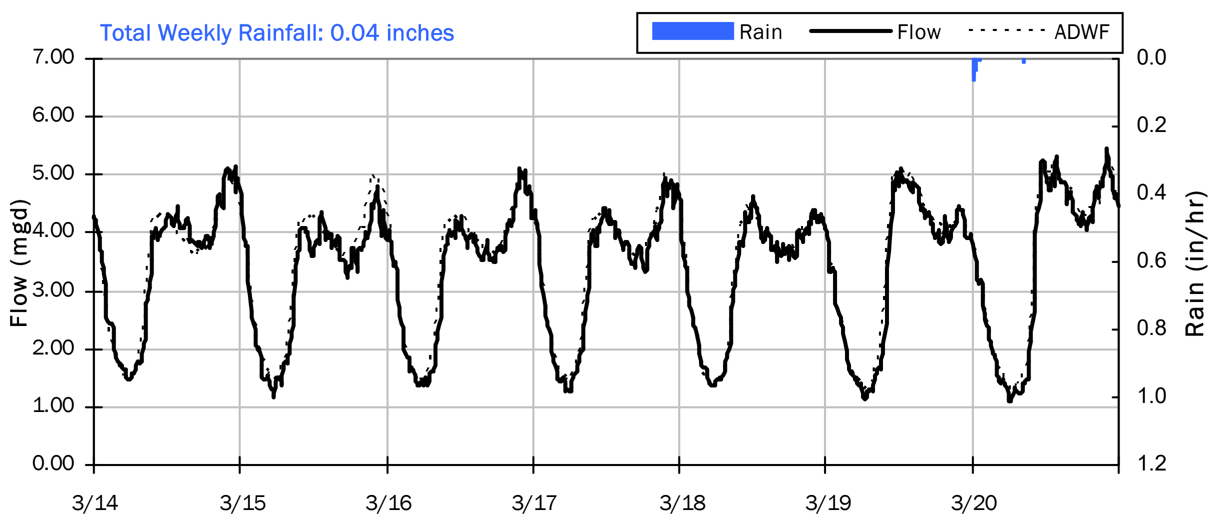


Avg Flow: 3.477 mgd   Peak Flow: 5.423 mgd   Min Flow: 1.259 mgd

SITE 09
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022





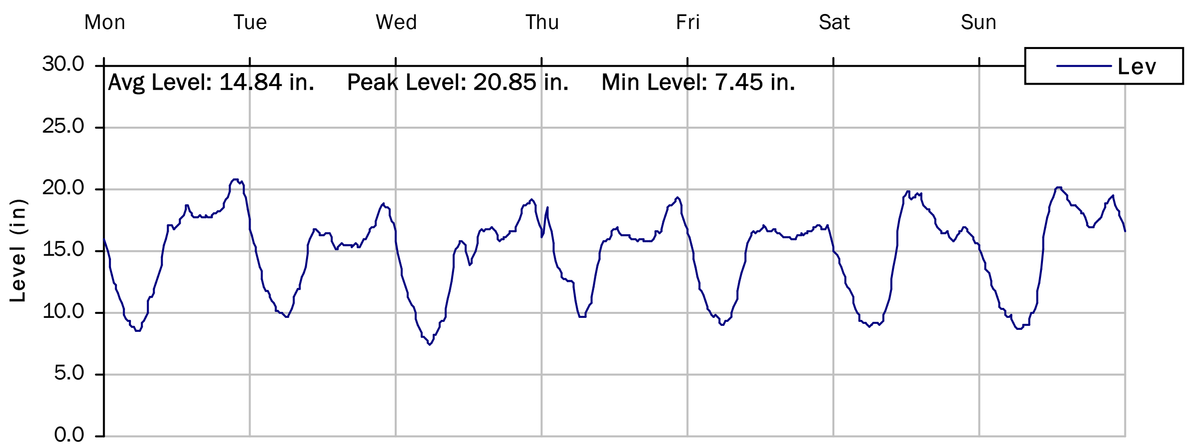


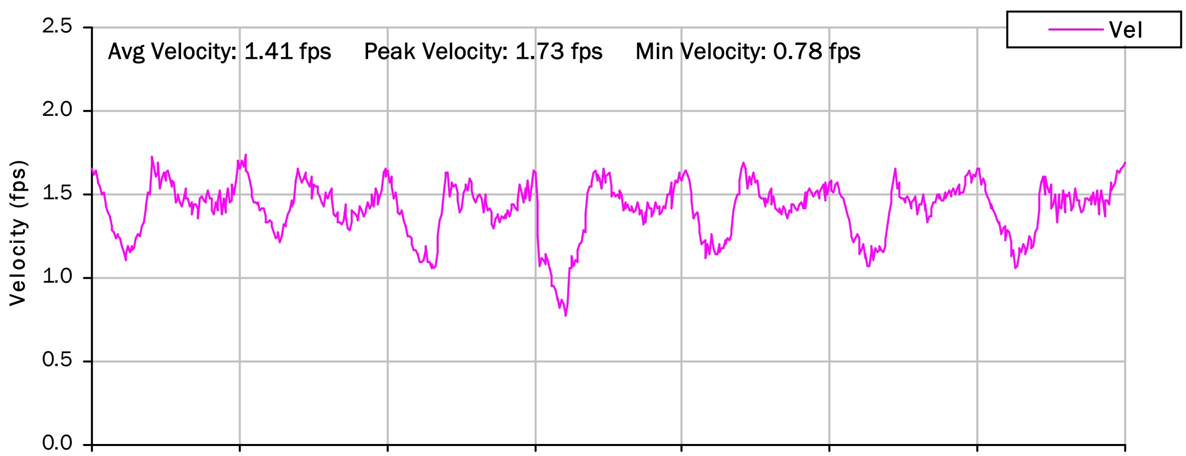
Avg Flow: 3.376 mgd   Peak Flow: 5.439 mgd   Min Flow: 1.108 mgd

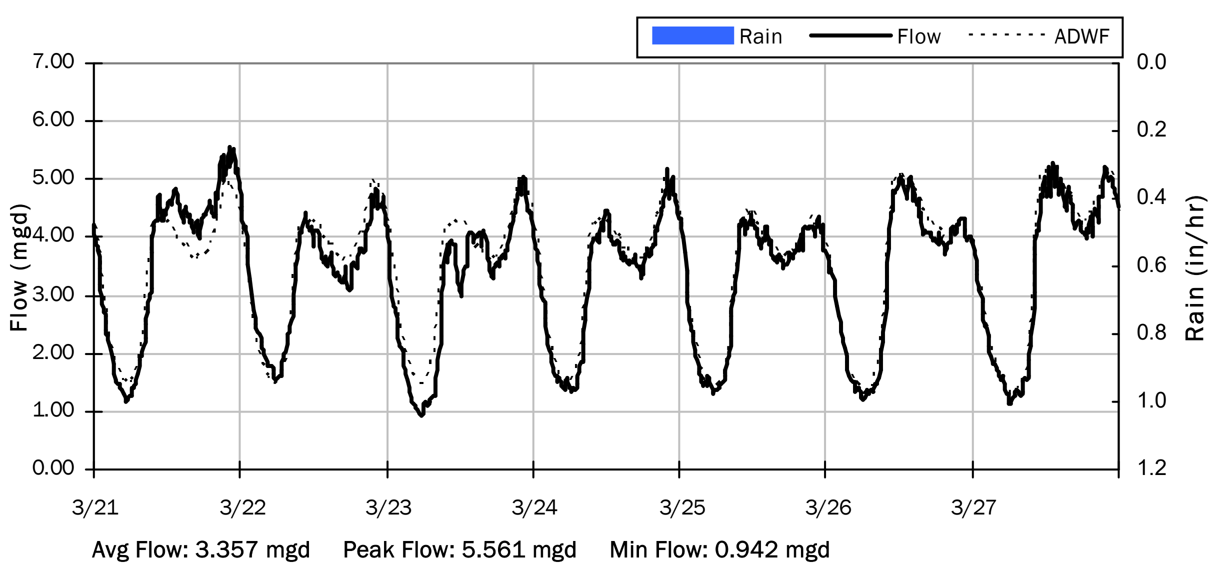
SITE 09

Weekly Level, Velocity and Flow Hydrographs

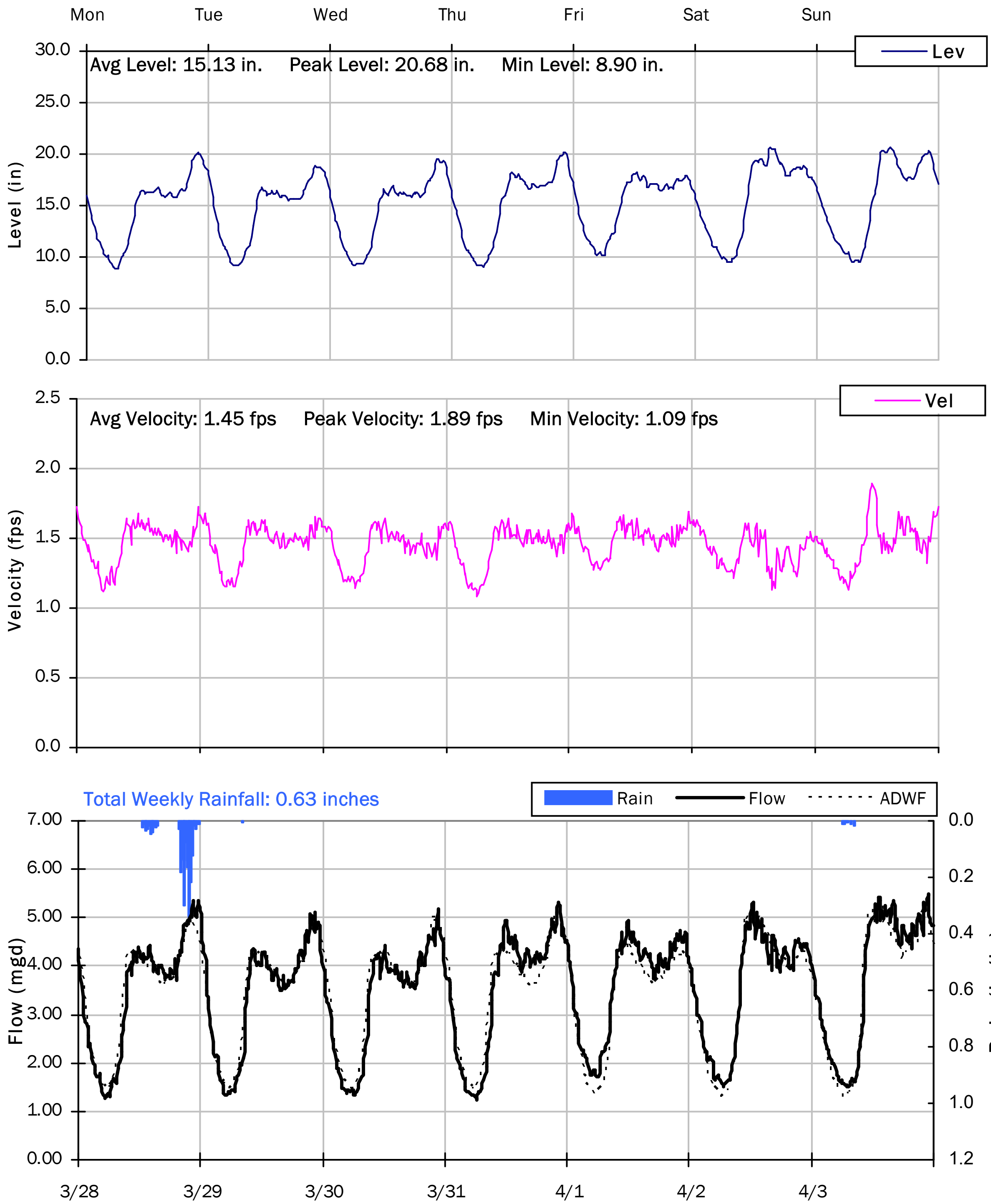
3/21/2022 to 3/28/2022







SITE 09
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

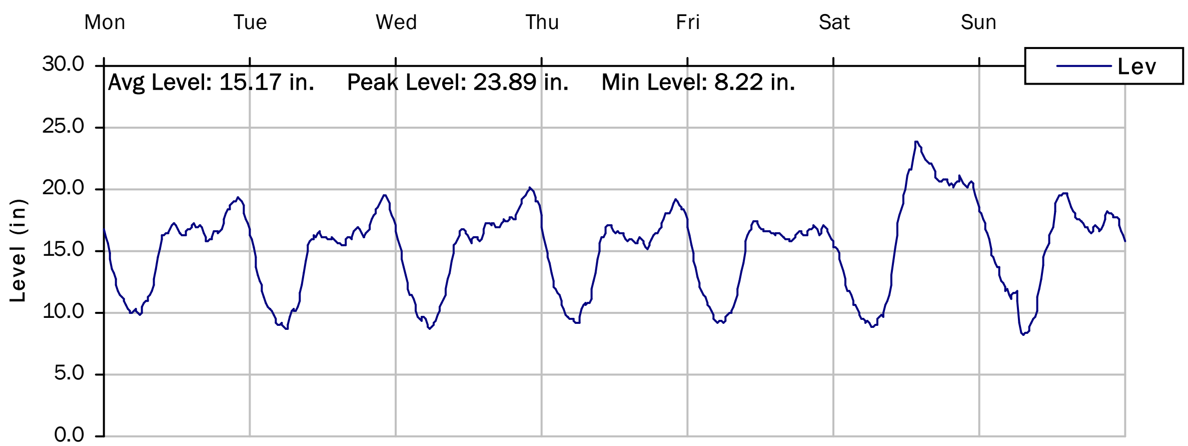


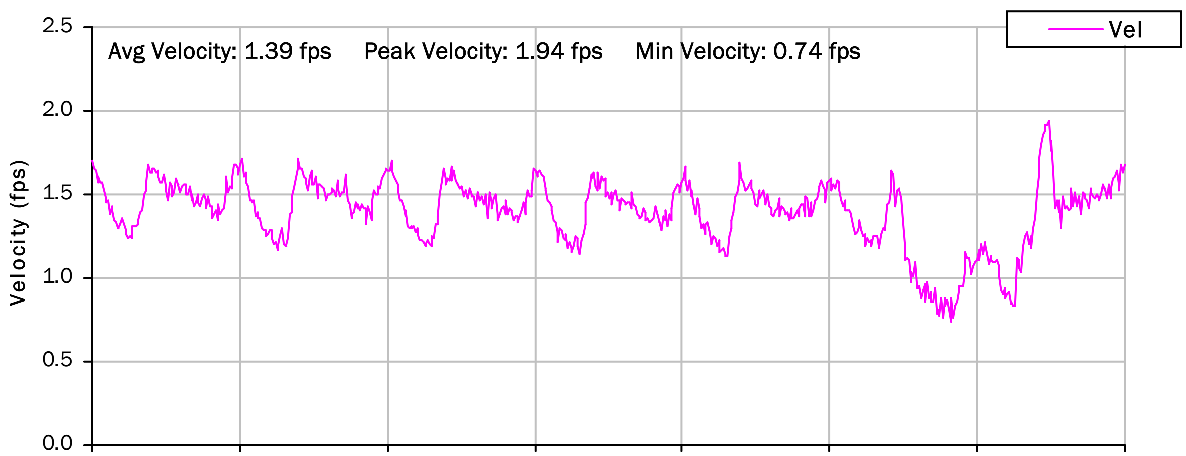
Avg Flow: 3.525 mgd   Peak Flow: 5.478 mgd   Min Flow: 1.219 mgd

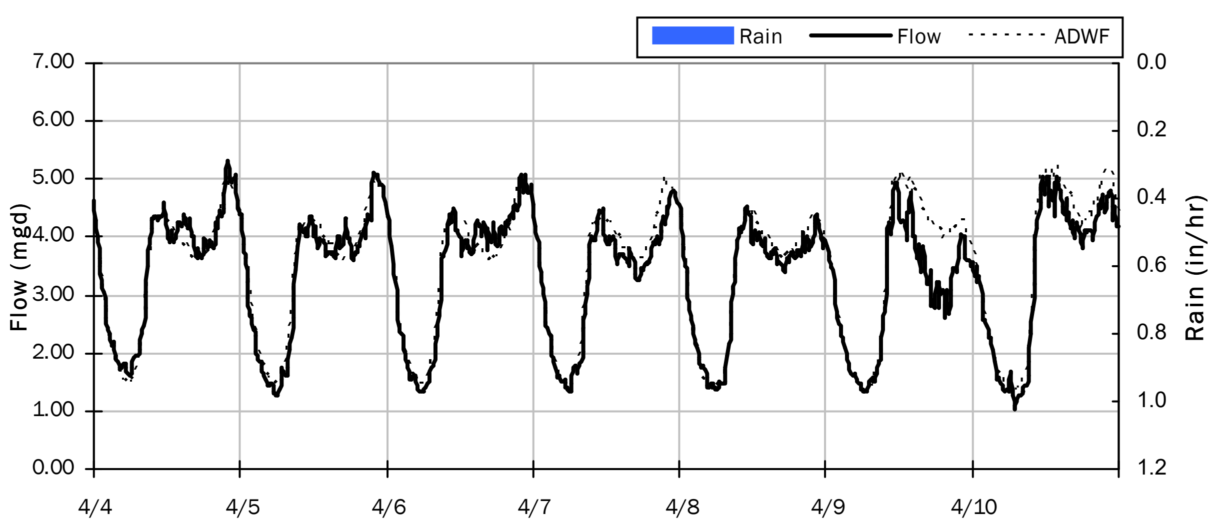
SITE 09

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022

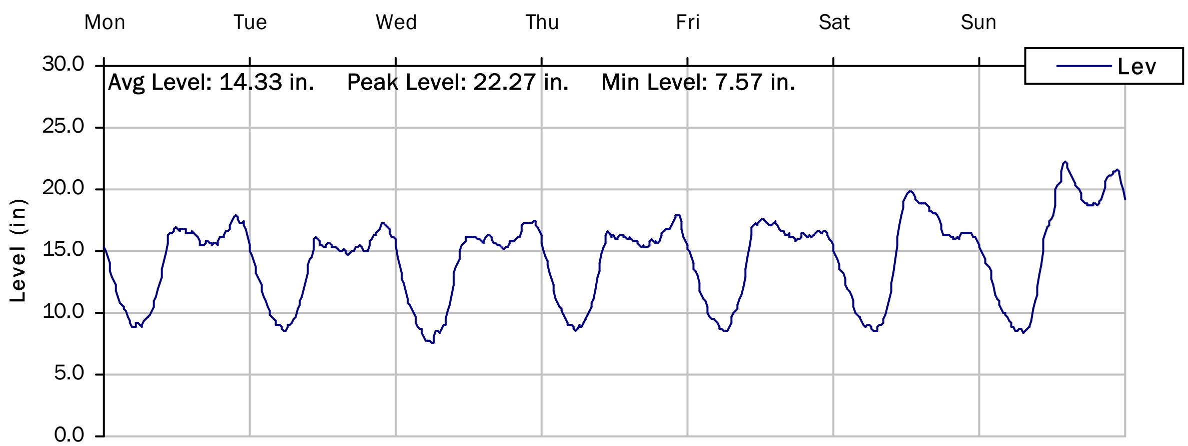


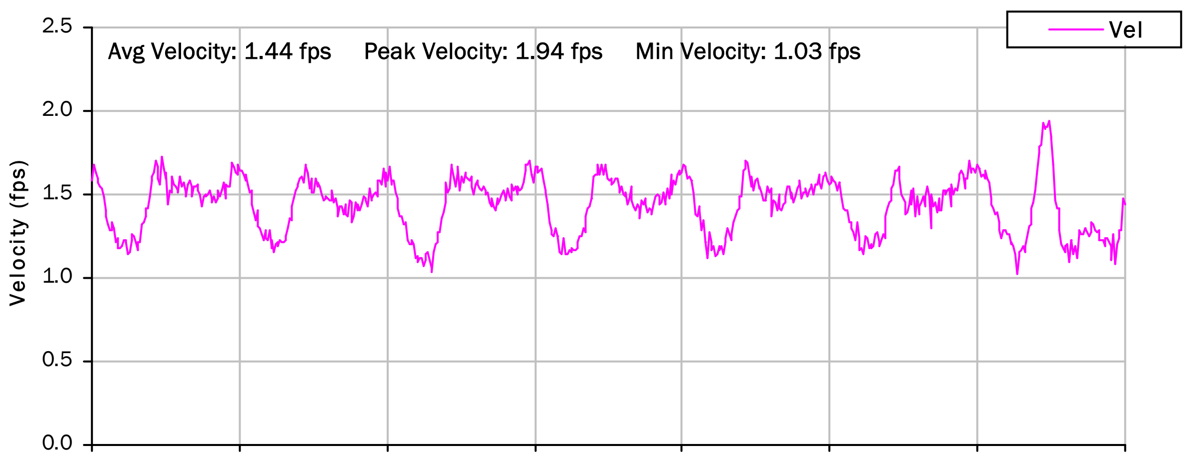


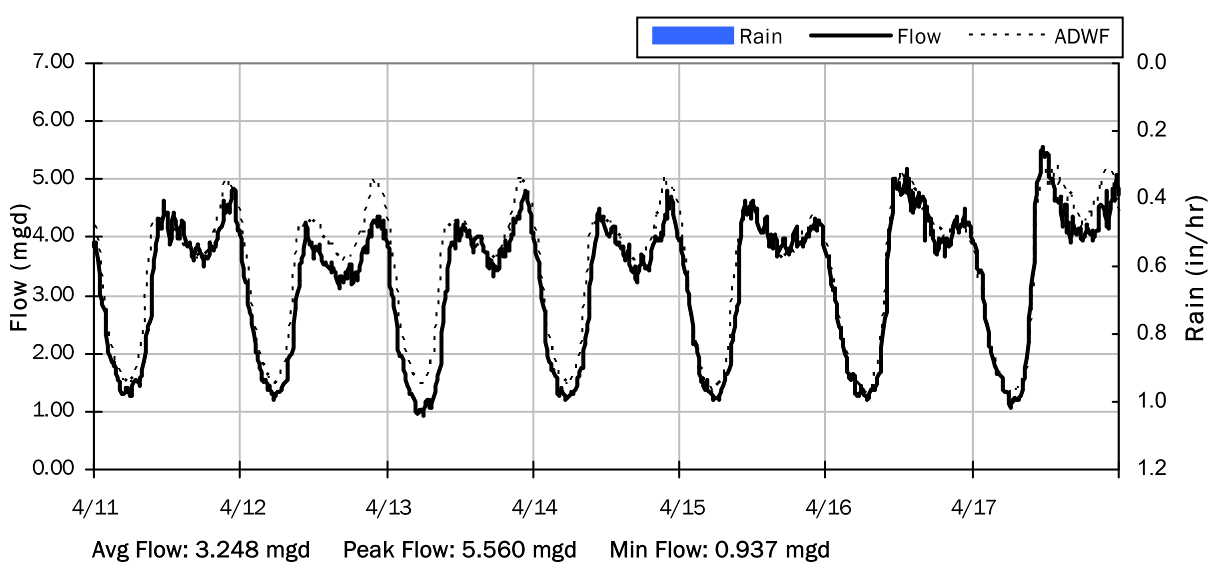


Avg Flow: 3.348 mgd Peak Flow: 5.303 mgd Min Flow: 1.017 mgd

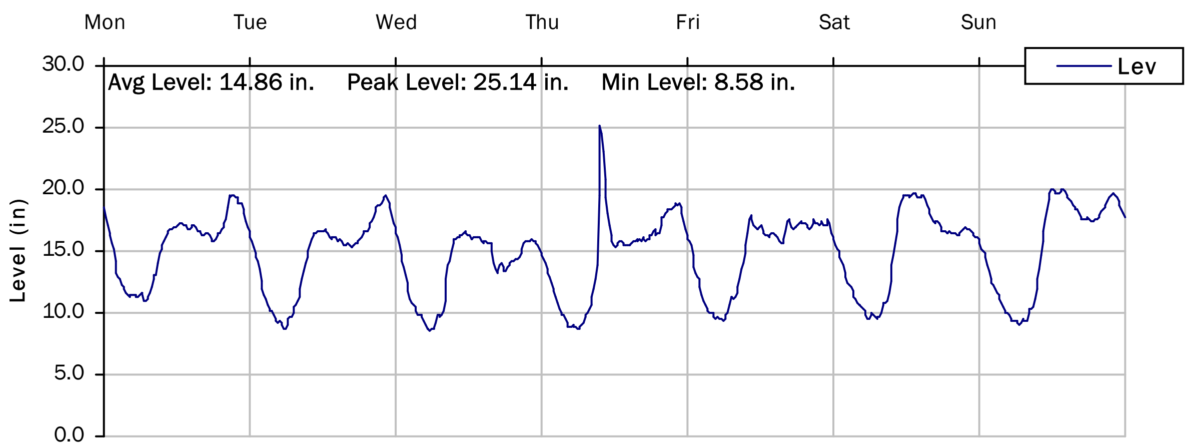
SITE 09
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

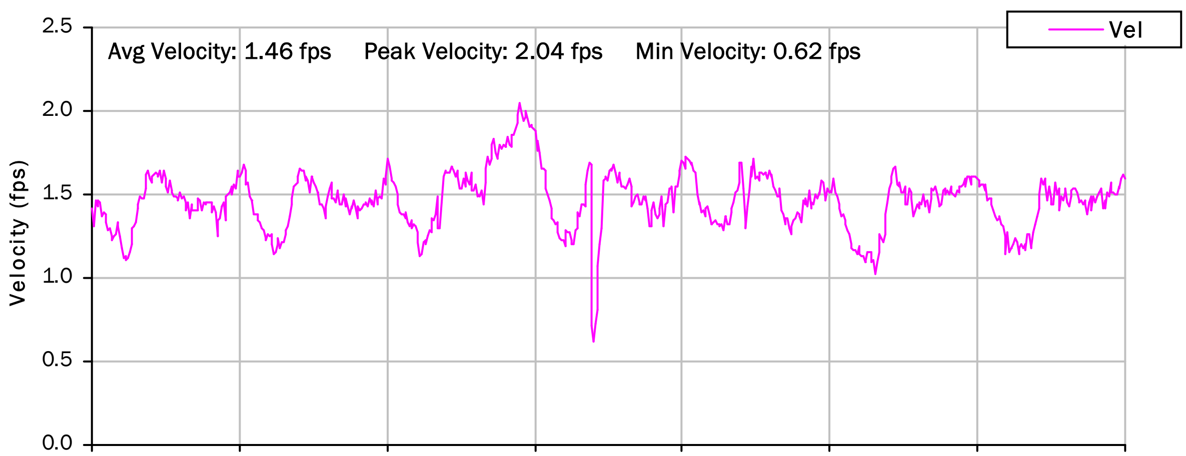


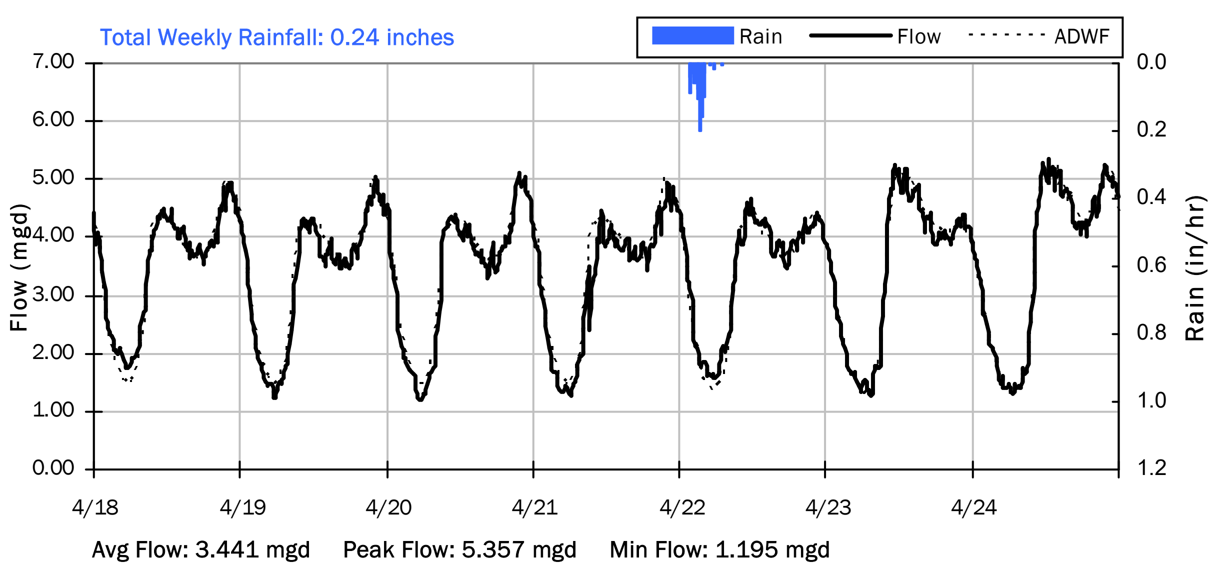




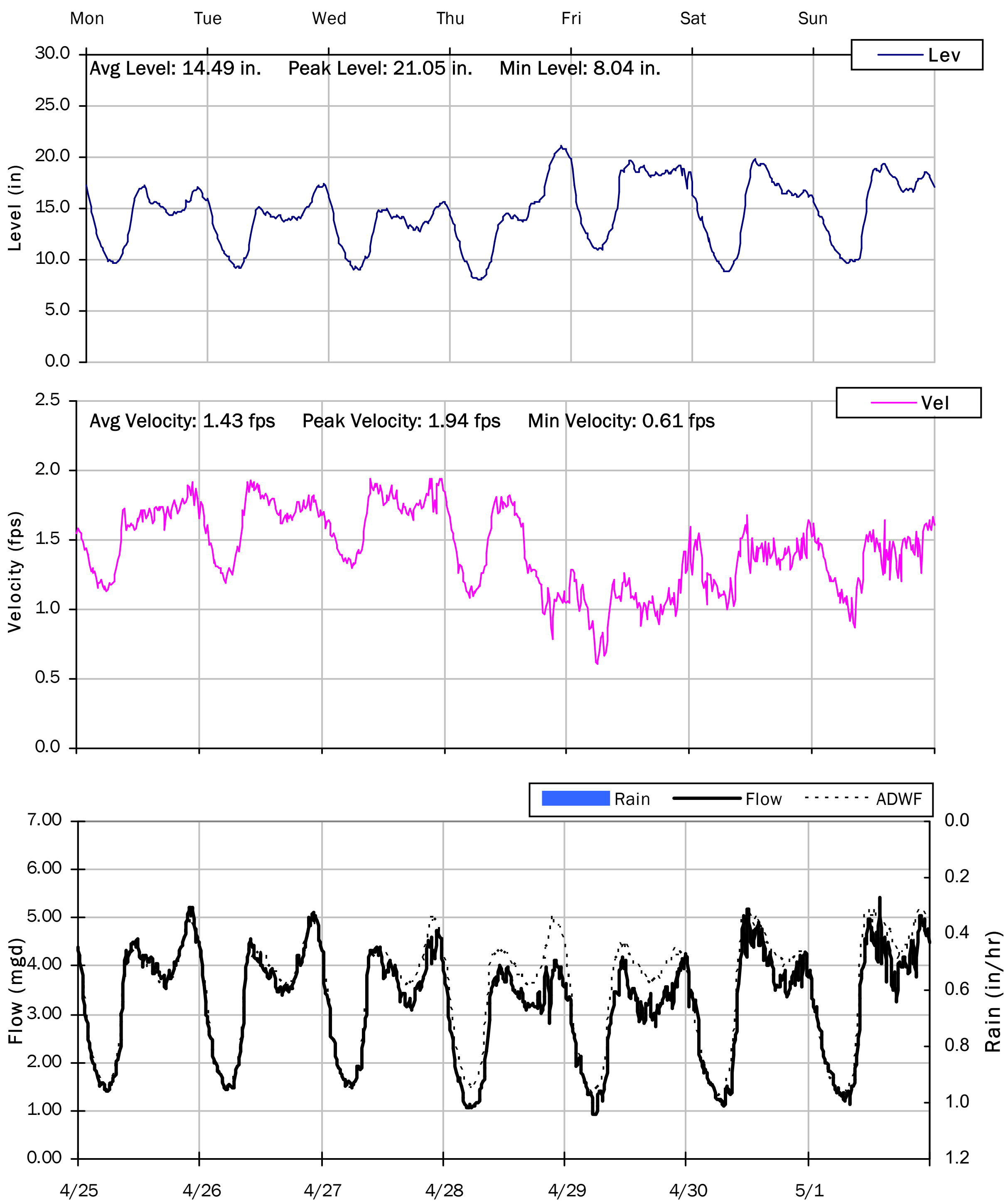
SITE 09
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022





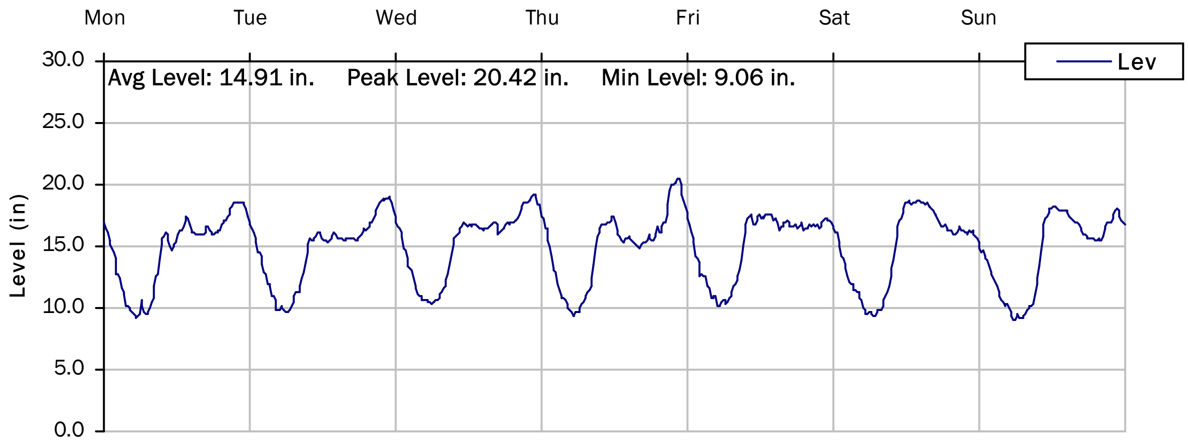


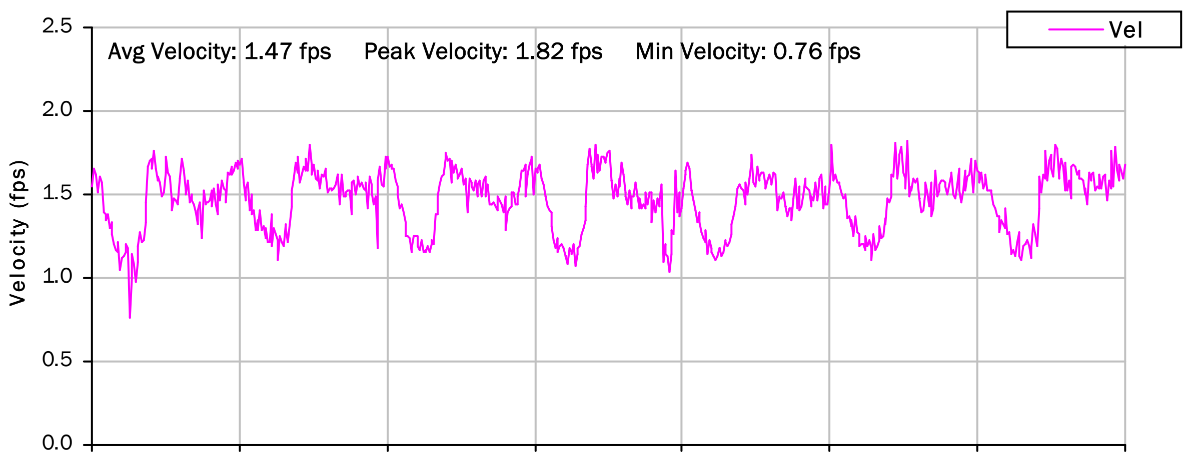
SITE 09
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

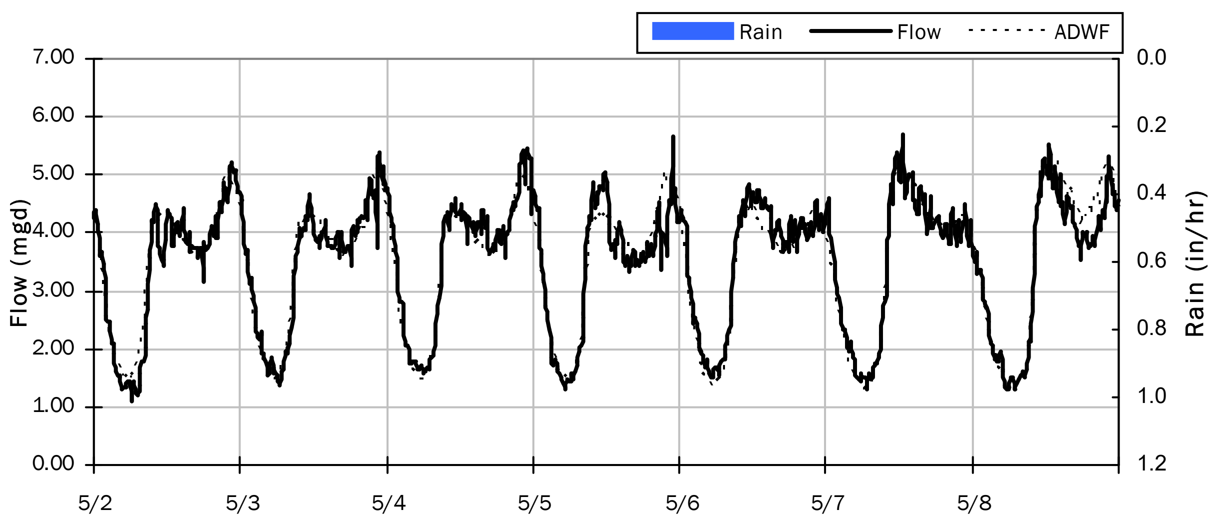


Avg Flow: 3.226 mgd Peak Flow: 5.419 mgd Min Flow: 0.929 mgd

SITE 09
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

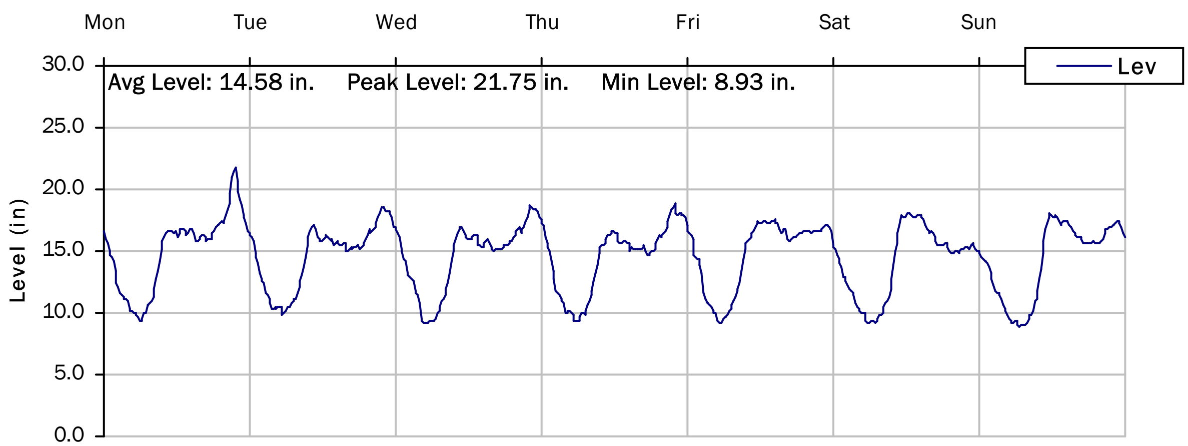


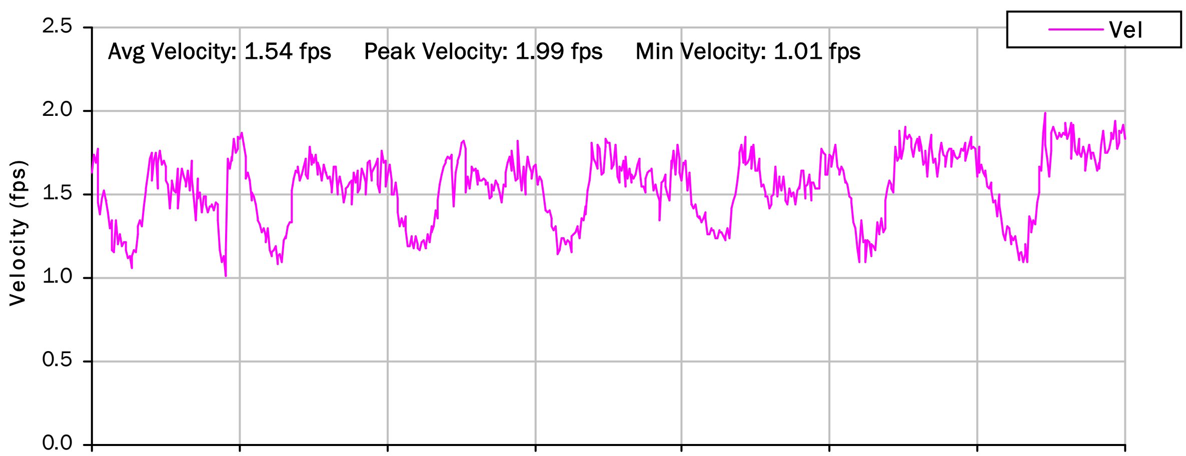


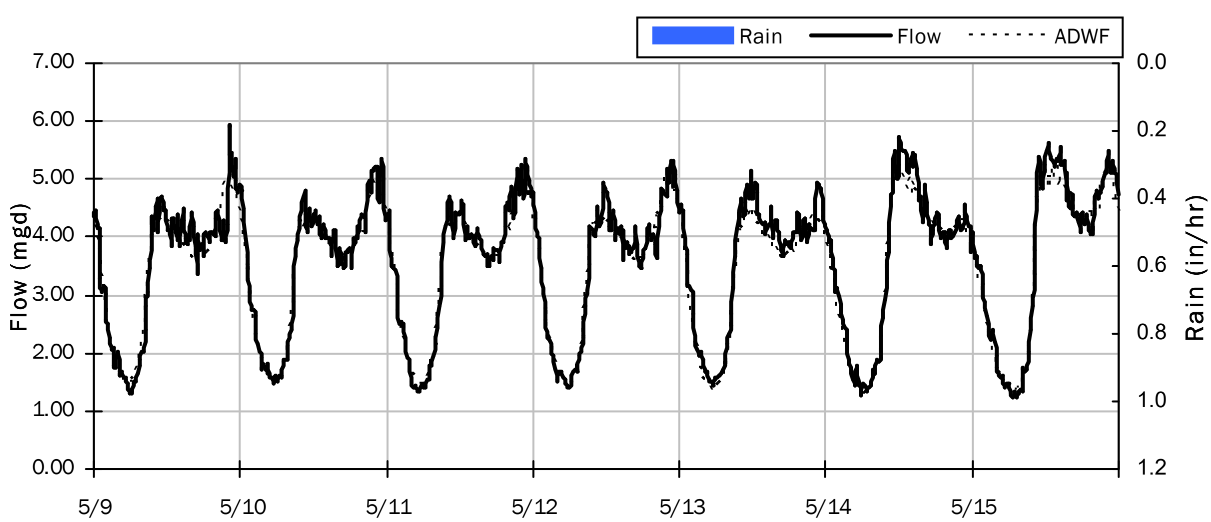


Avg Flow: 3.496 mgd Peak Flow: 5.704 mgd Min Flow: 1.090 mgd

SITE 09
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022

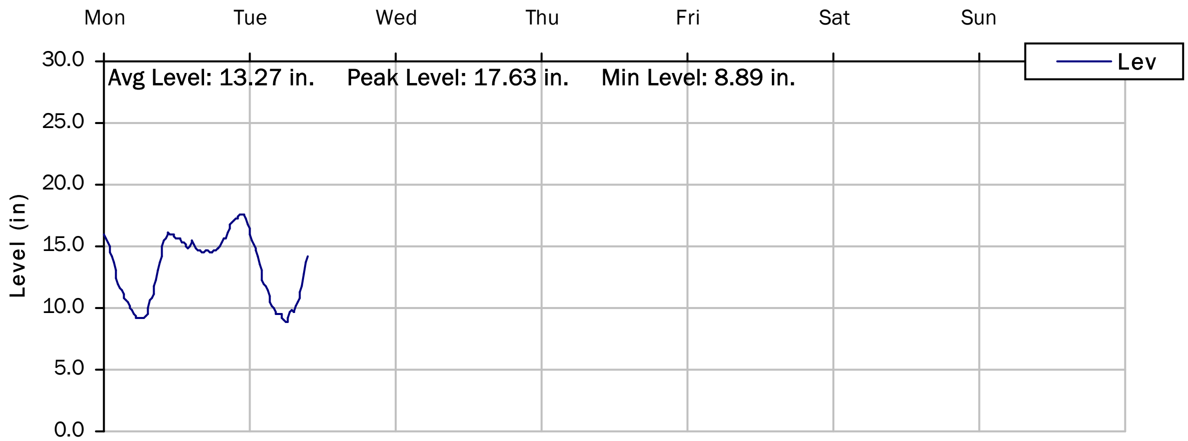


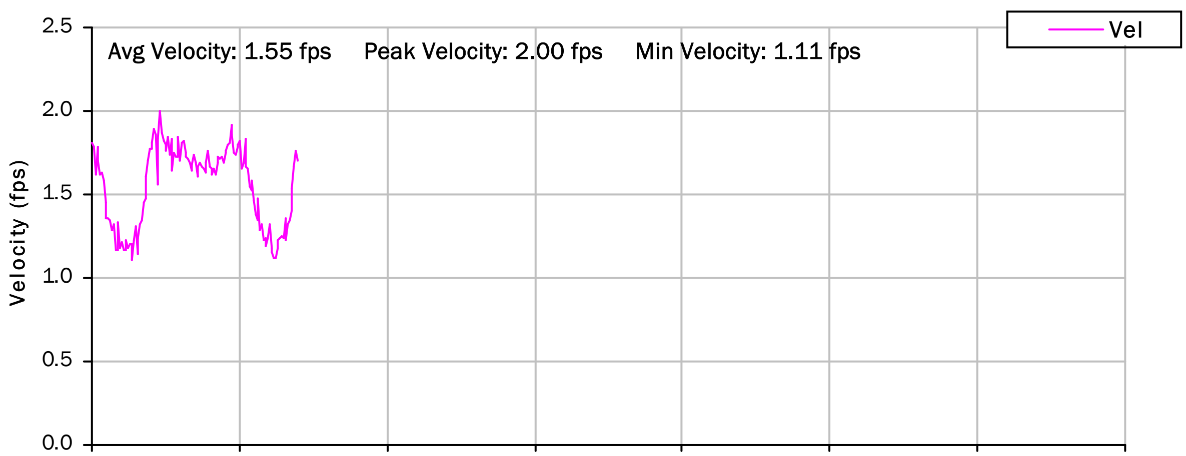


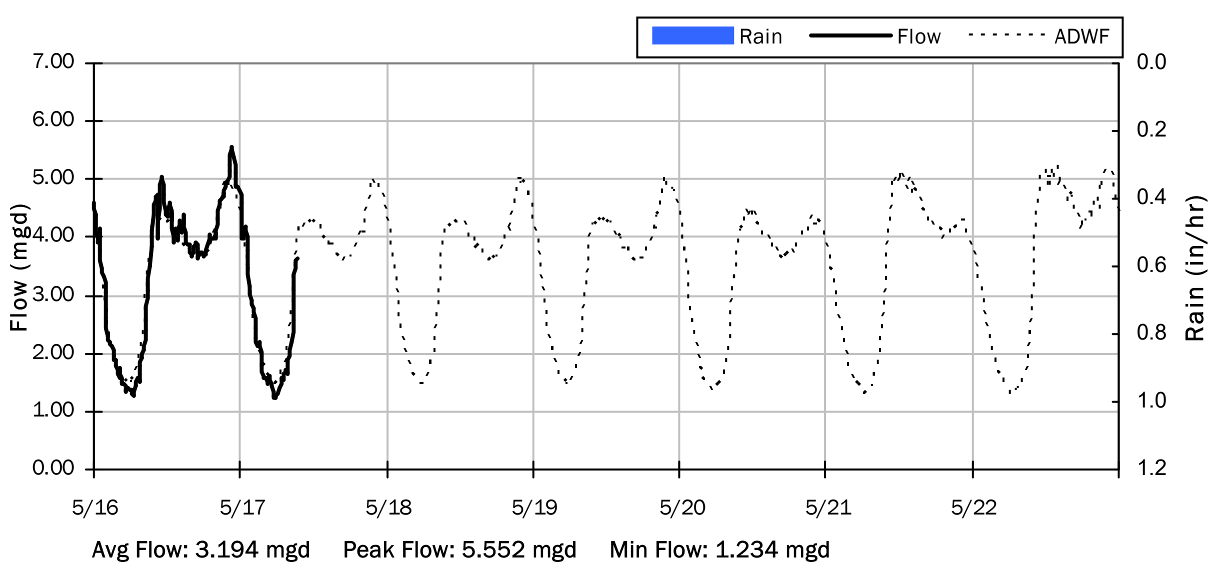


Avg Flow: 3.572 mgd Peak Flow: 5.889 mgd Min Flow: 1.236 mgd

SITE 09
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Monitoring Site: Site 10

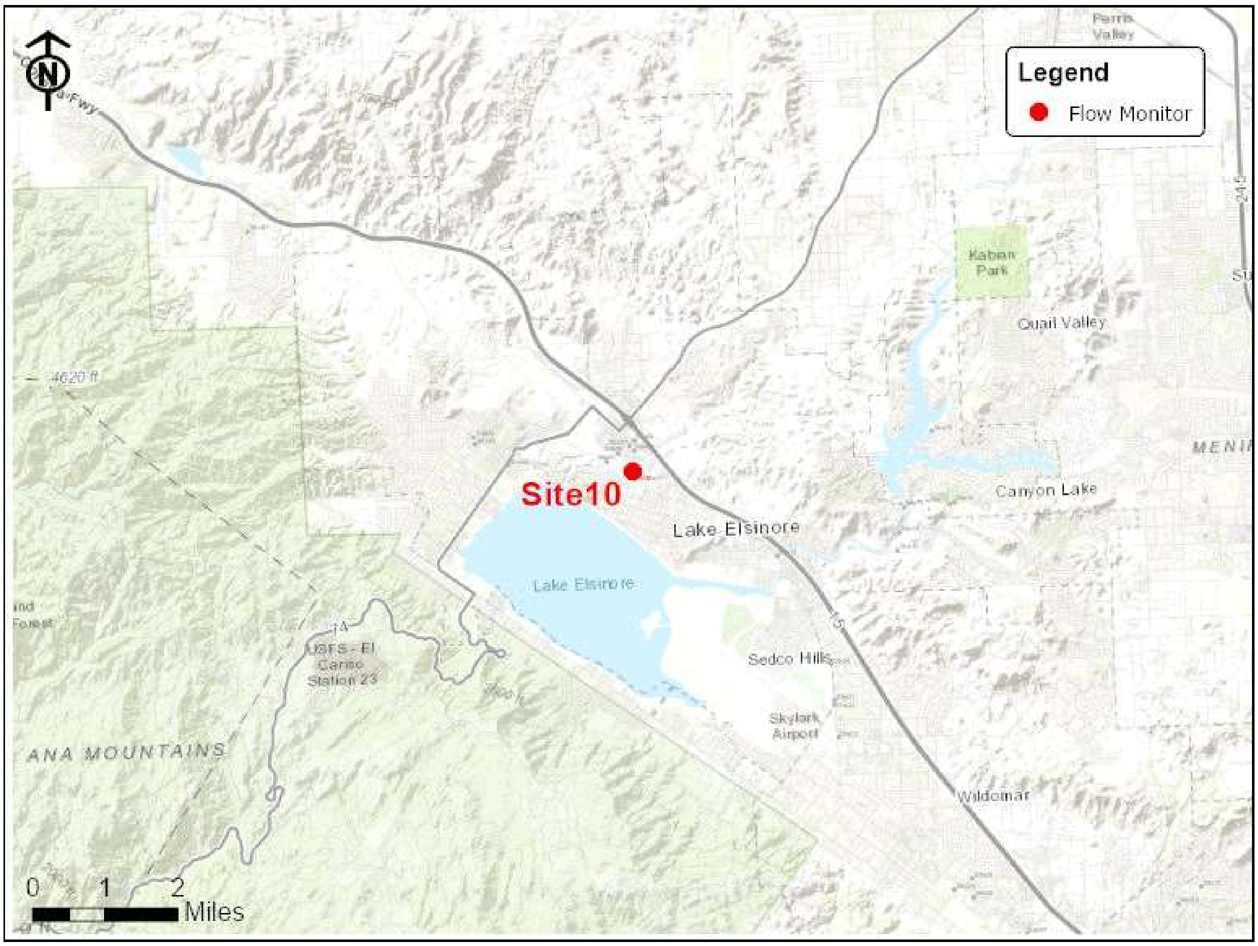
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Chaney Street, north of Pasadena Street

Data Summary Report



Vicinity Map: Site 10

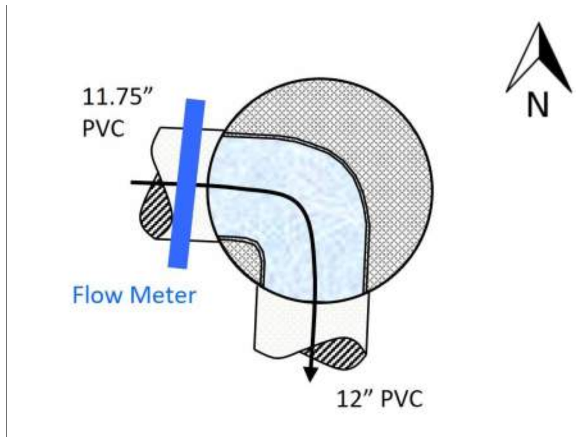
SITE 10

Site Information — MH ID: MH-1466

Location:	Chaney Street, north of Pasadena Street
Coordinates:	117.3370° W, 33.6817° N
Rim Elevation (Earth):	1270 feet
Expected Pipe Diameter:	12 inches
Measured Pipe Diameter:	11.75 inches
ADWF:	0.003 mgd
Peak Measured Flow:	0.019 mgd
Sediment:	None

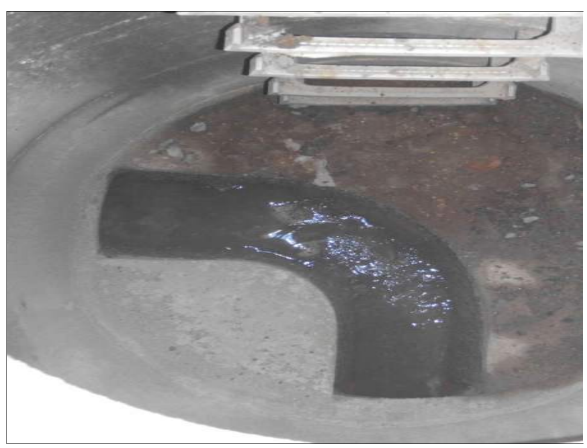
Satellite Map

Sanitary Map



Flow Sketch

View from Street


Plan View

SITE 10

Additional Site Photos

Effluent Pipe

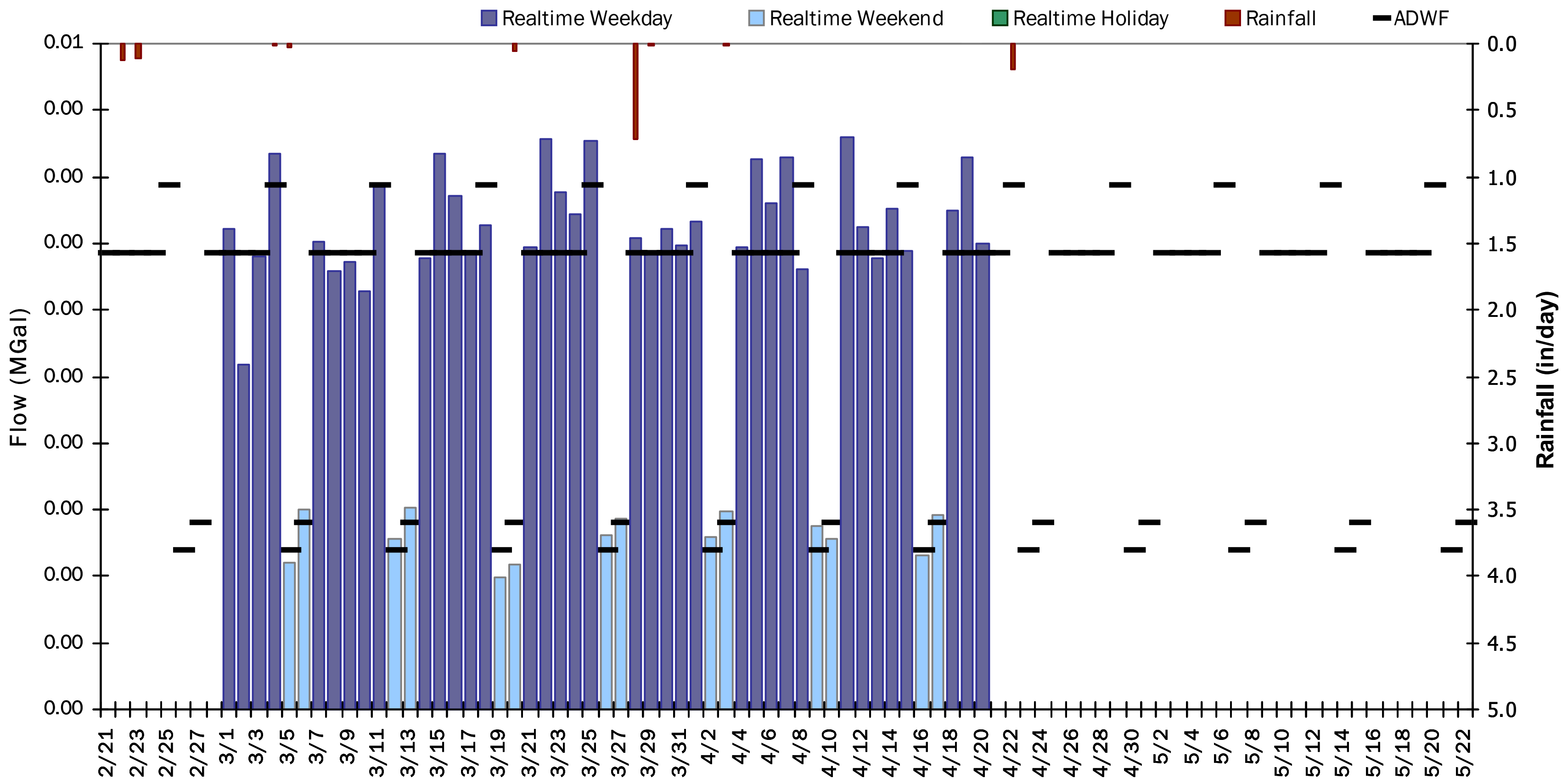
Influent Pipe

SITE 10

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.003 MGal   Peak Daily Flow: 0.004 MGal   Min Daily Flow: 0.001 MGal

Total Rainfall: 0.83 inches

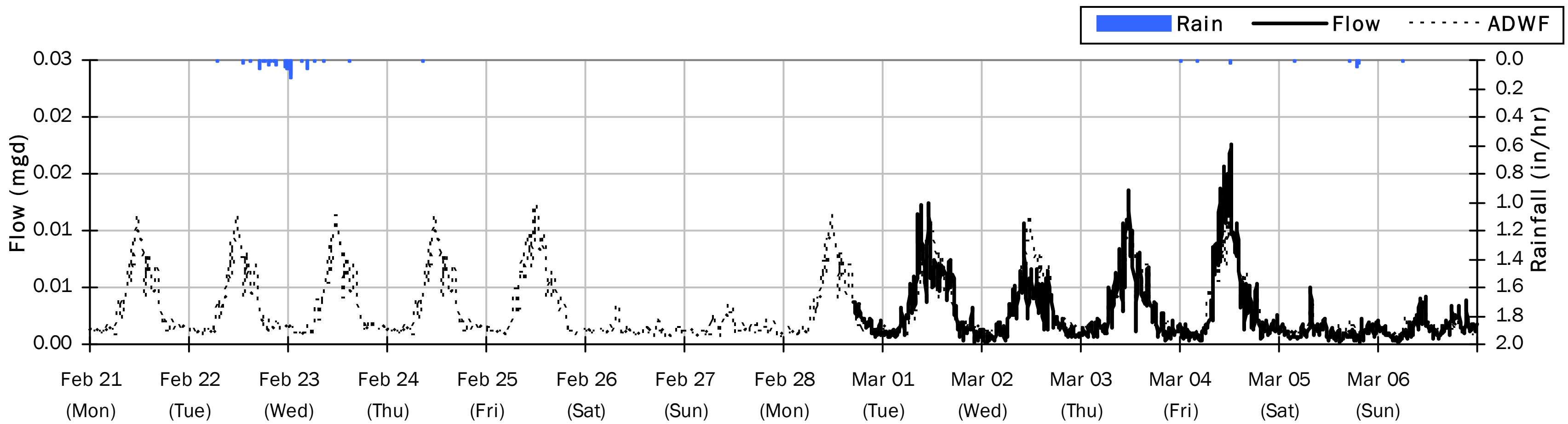


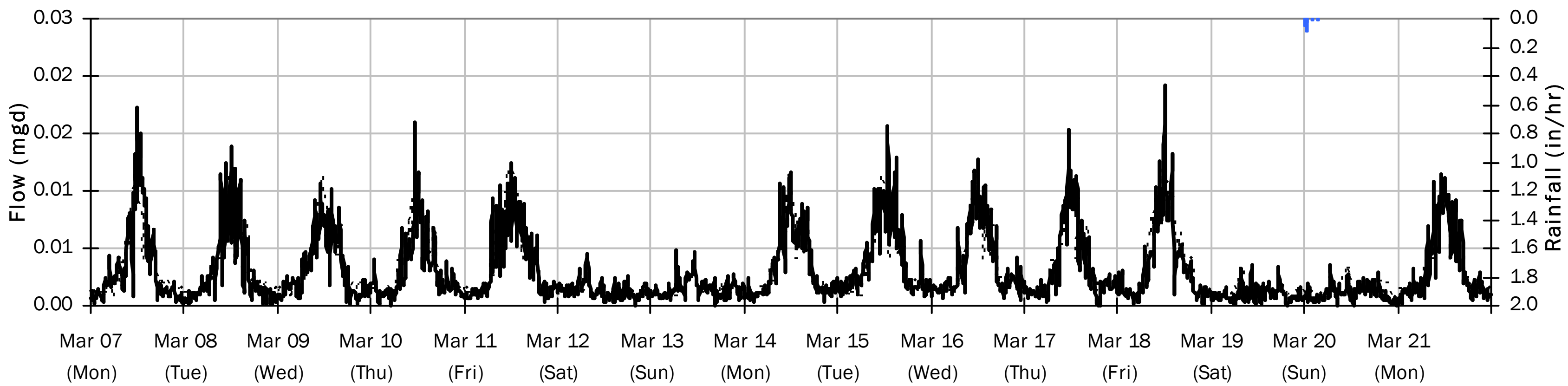
SITE 10

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.32 inches

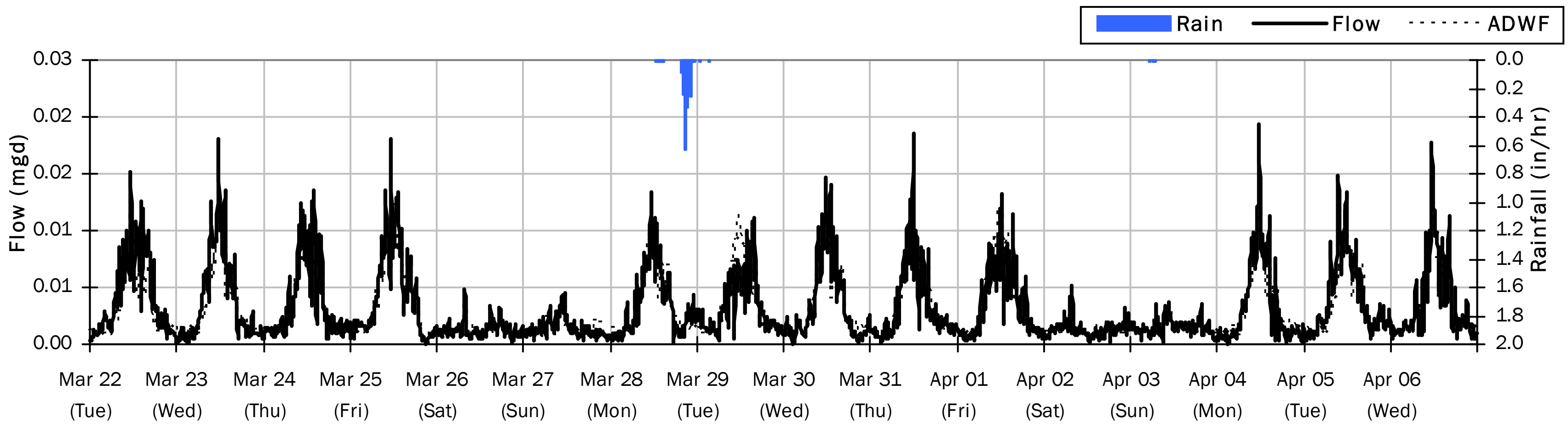
Period Avg Flow: 0.003 mgd Period Peak Flow: 0.019 mgd Period Min Flow: 0.000 mgd

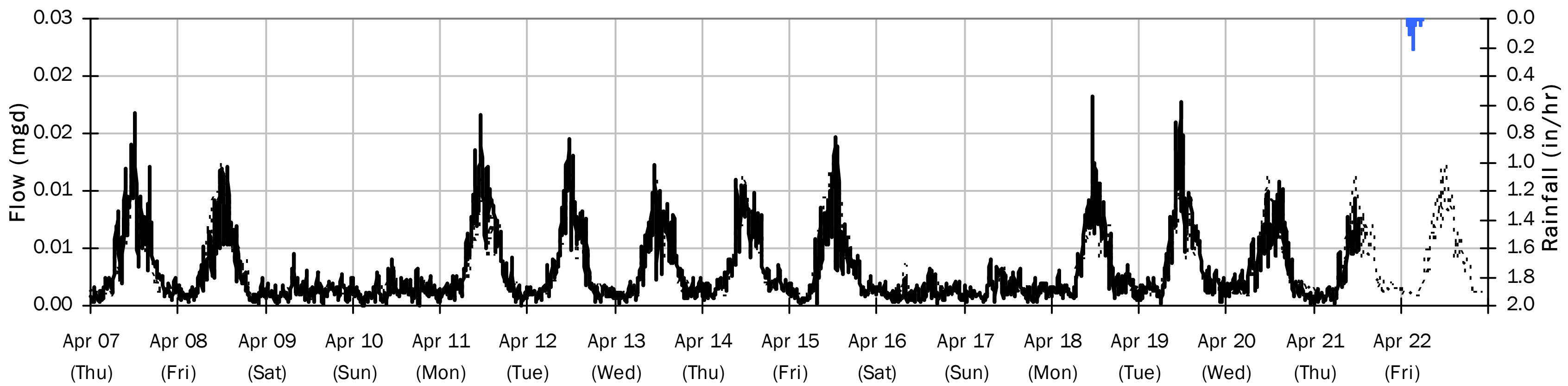




SITE 10
Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.93 inches   Period Avg Flow: 0.003 mgd   Period Peak Flow: 0.019 mgd   Period Min Flow: 0.000 mgd

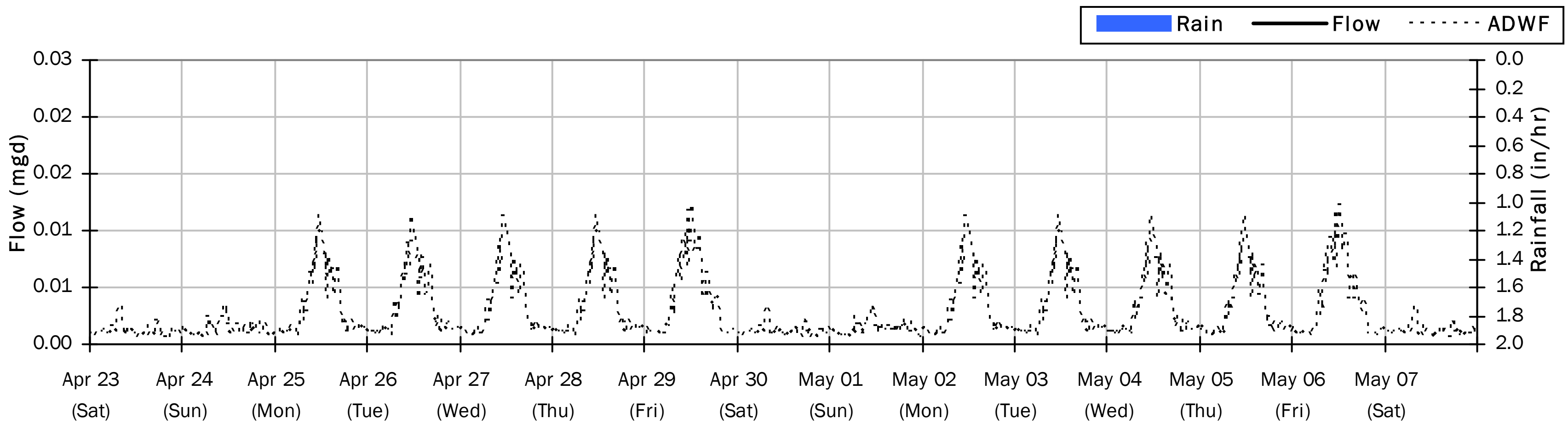




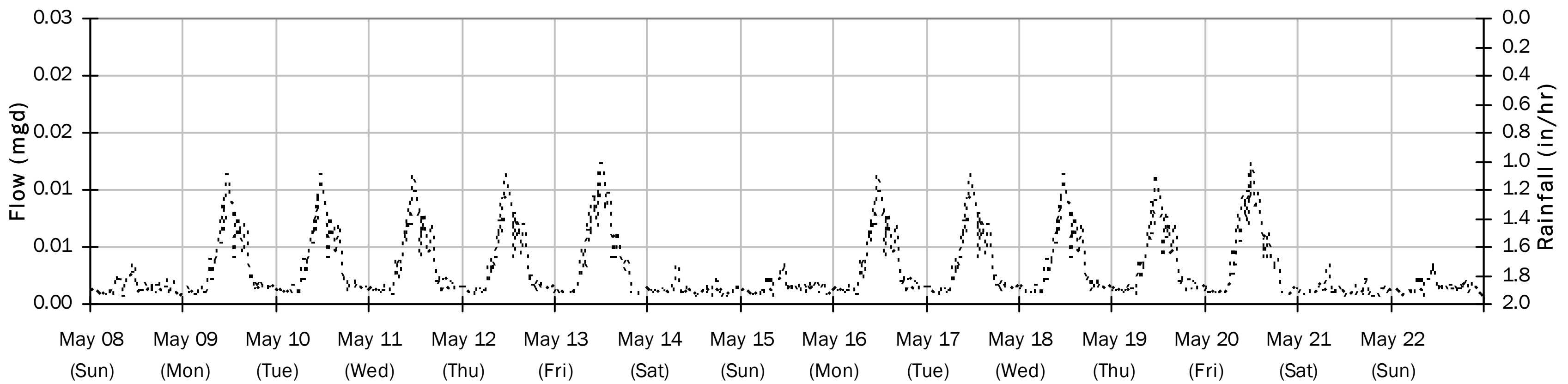
SITE 10

Flow Summary: 4/23/2022 to 5/22/2022

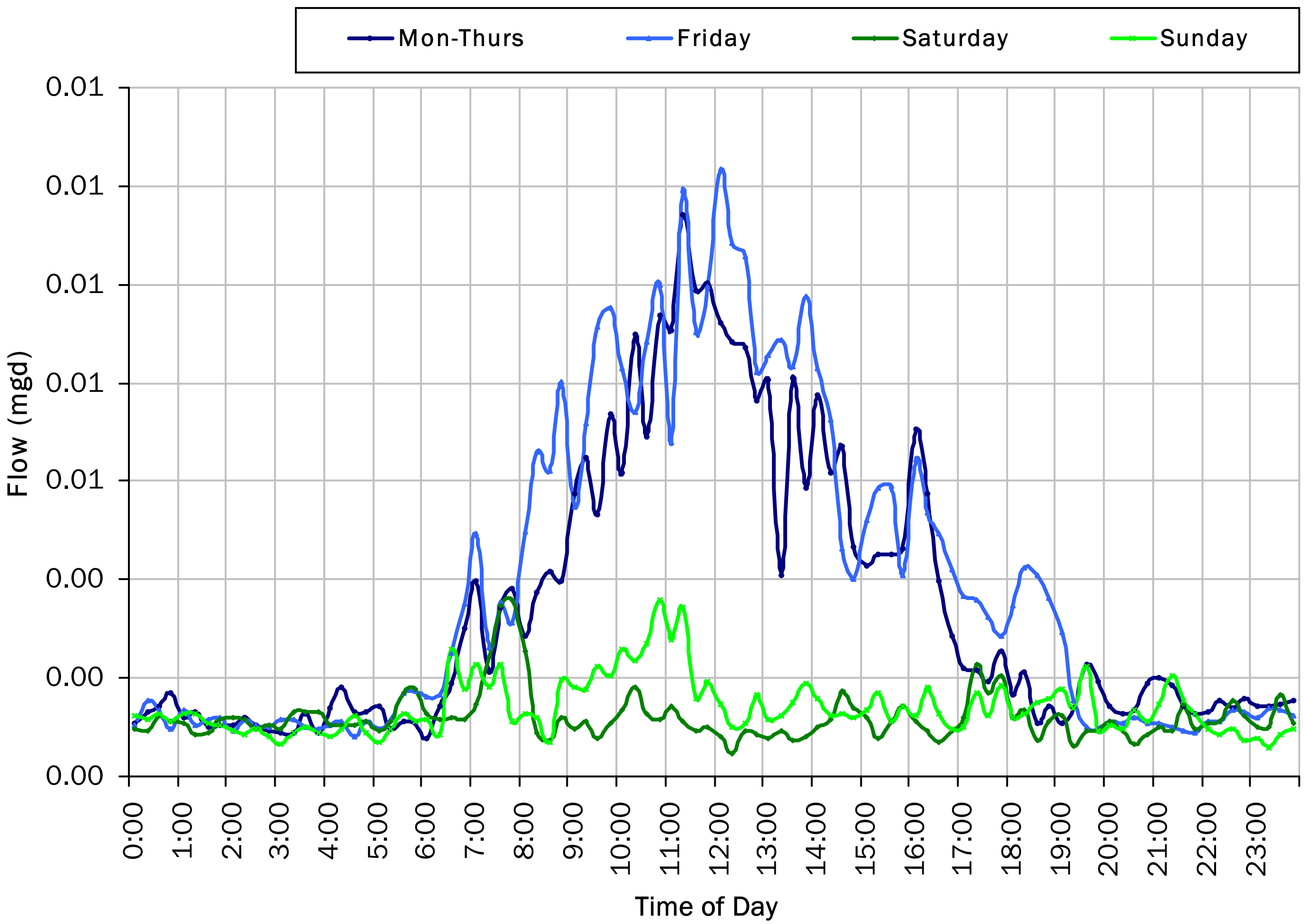
Period Rainfall: 0.00 inches   Period Avg Flow: mgd   Period Peak Flow: mgd   Period Min Flow: mgd

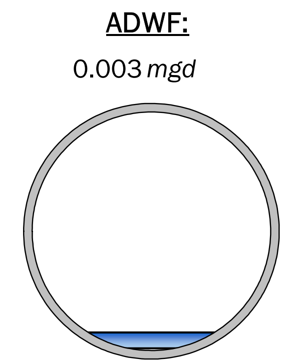


Meter removed



SITE 10
Average Dry Weather Flow Hydrographs

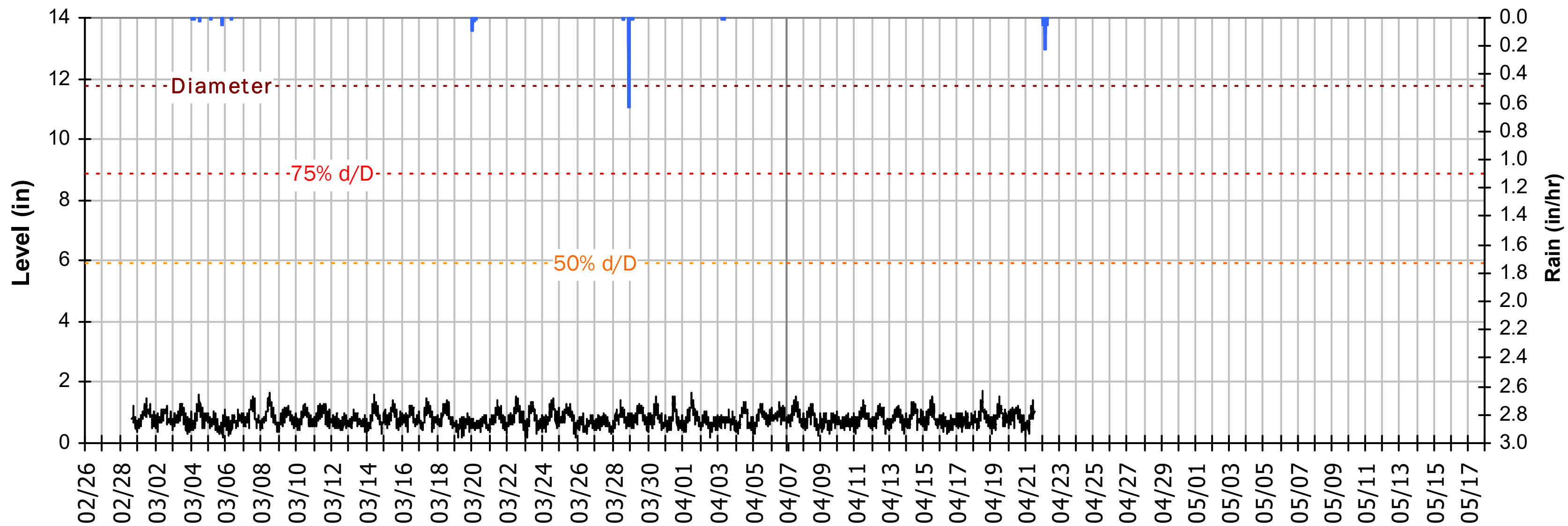


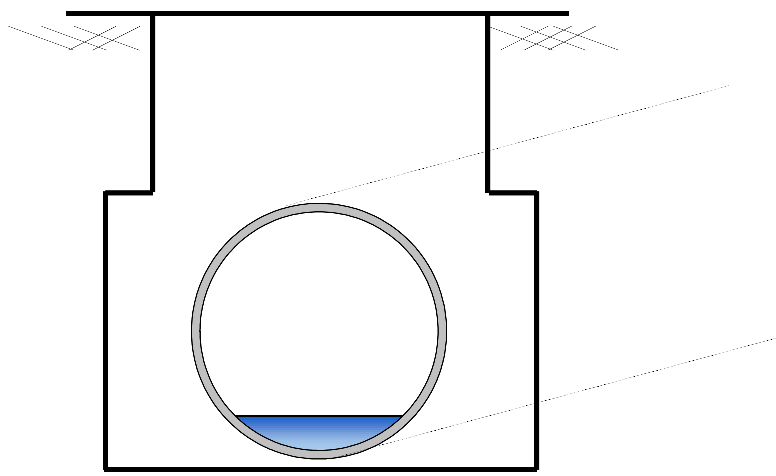


SITE 10

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



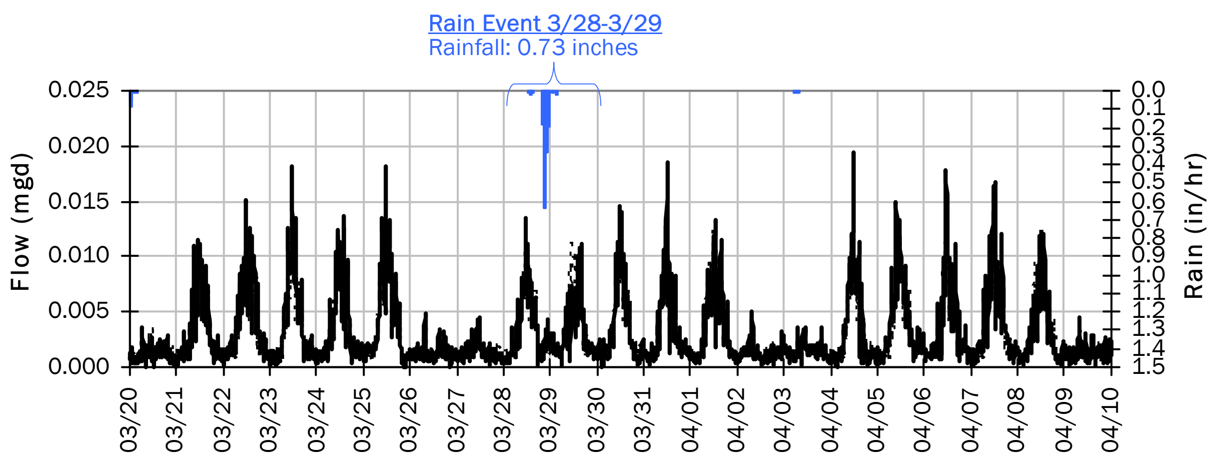


Pipe Diameter:	11.8	*inches*
Peak Measured Level:	1.7	*inches*
Peak d/D Ratio:	0.14	

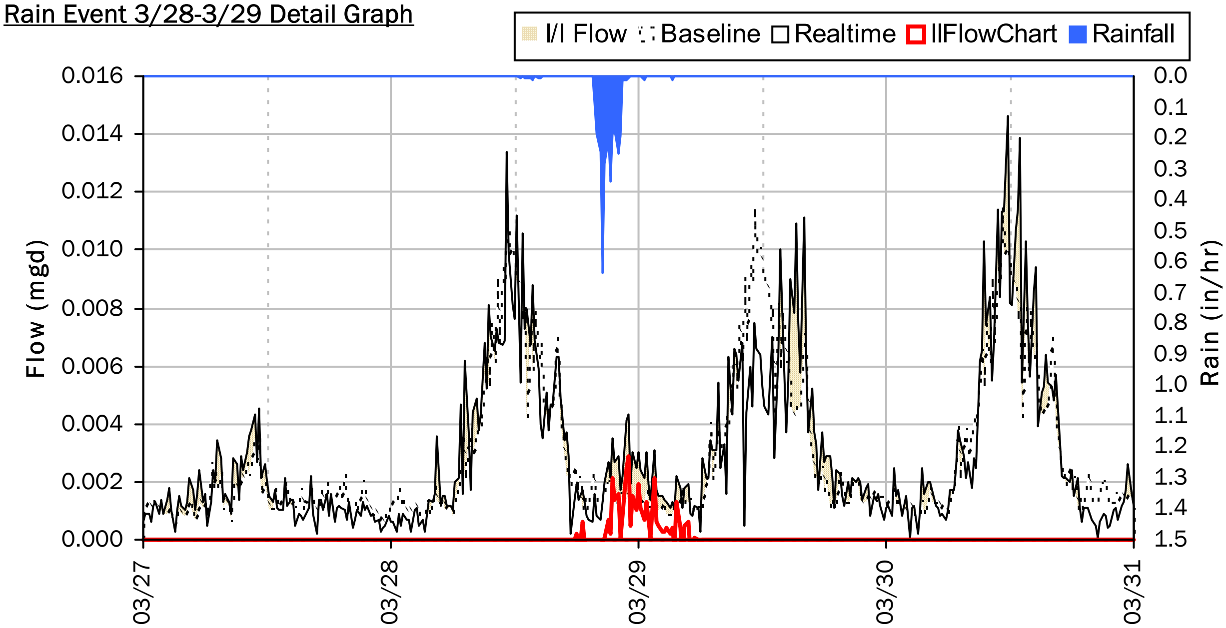
SITE 10

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



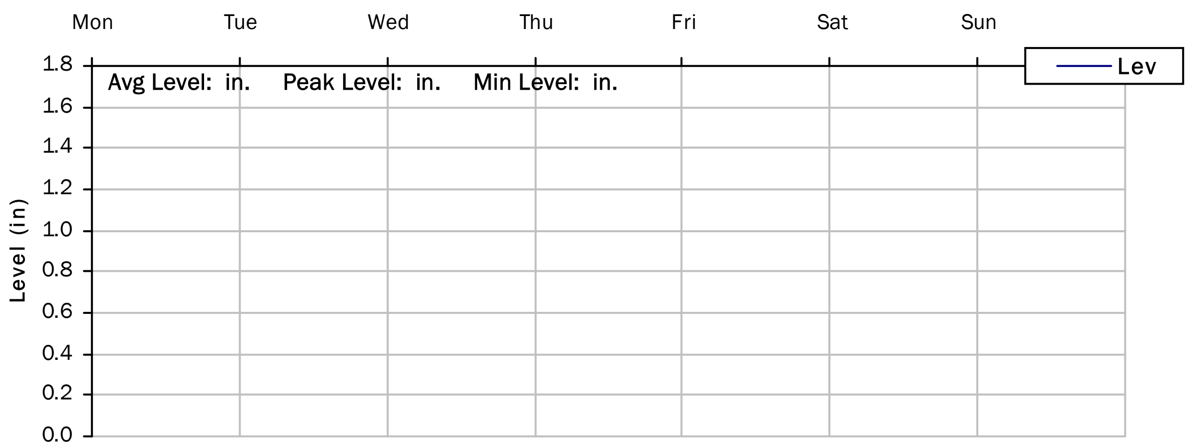
Storm Event I/I Analysis (Rain = 0.73 inches)

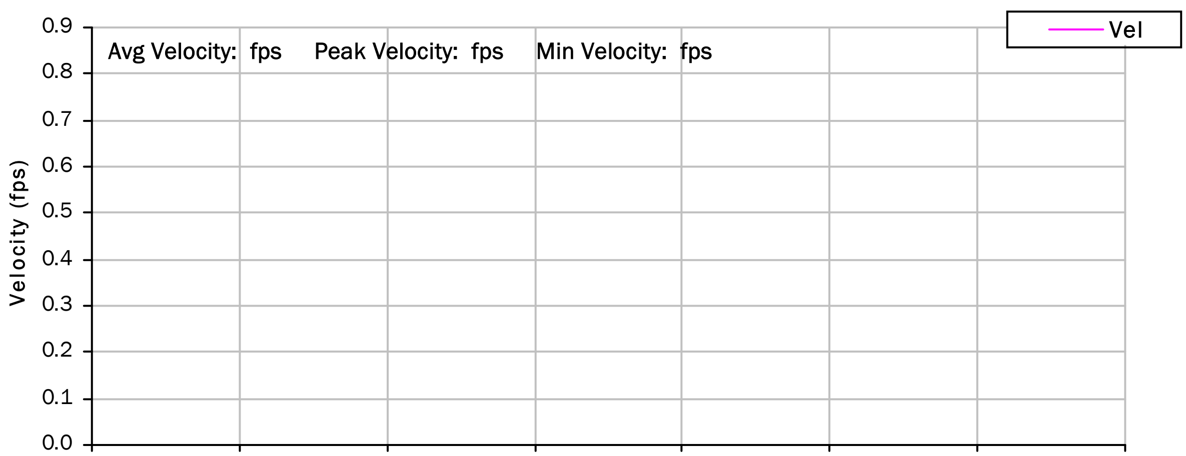
Capacity		Inflow / Infiltration	
Peak Flow:	0.004 *mgd*	Peak I/I Rate:	0.003 *mgd*
PF:	1.48	Total I/I:	0 *gallons*
Peak Level:	0.98 *in*		
d/D Ratio:	0.08		

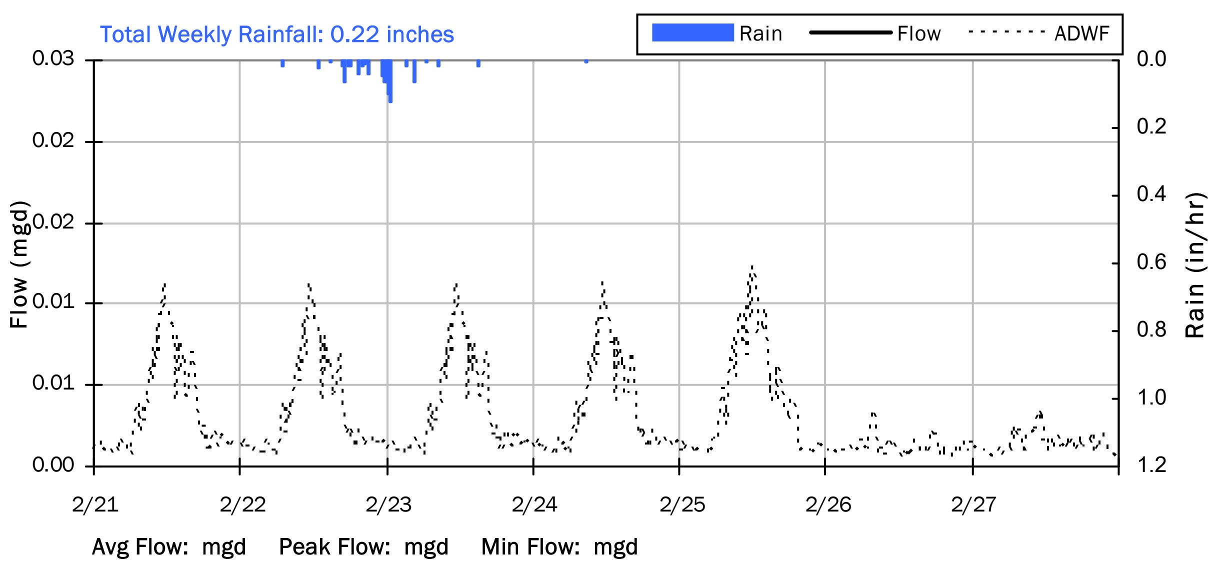
SITE 10

Weekly Level, Velocity and Flow Hydrographs

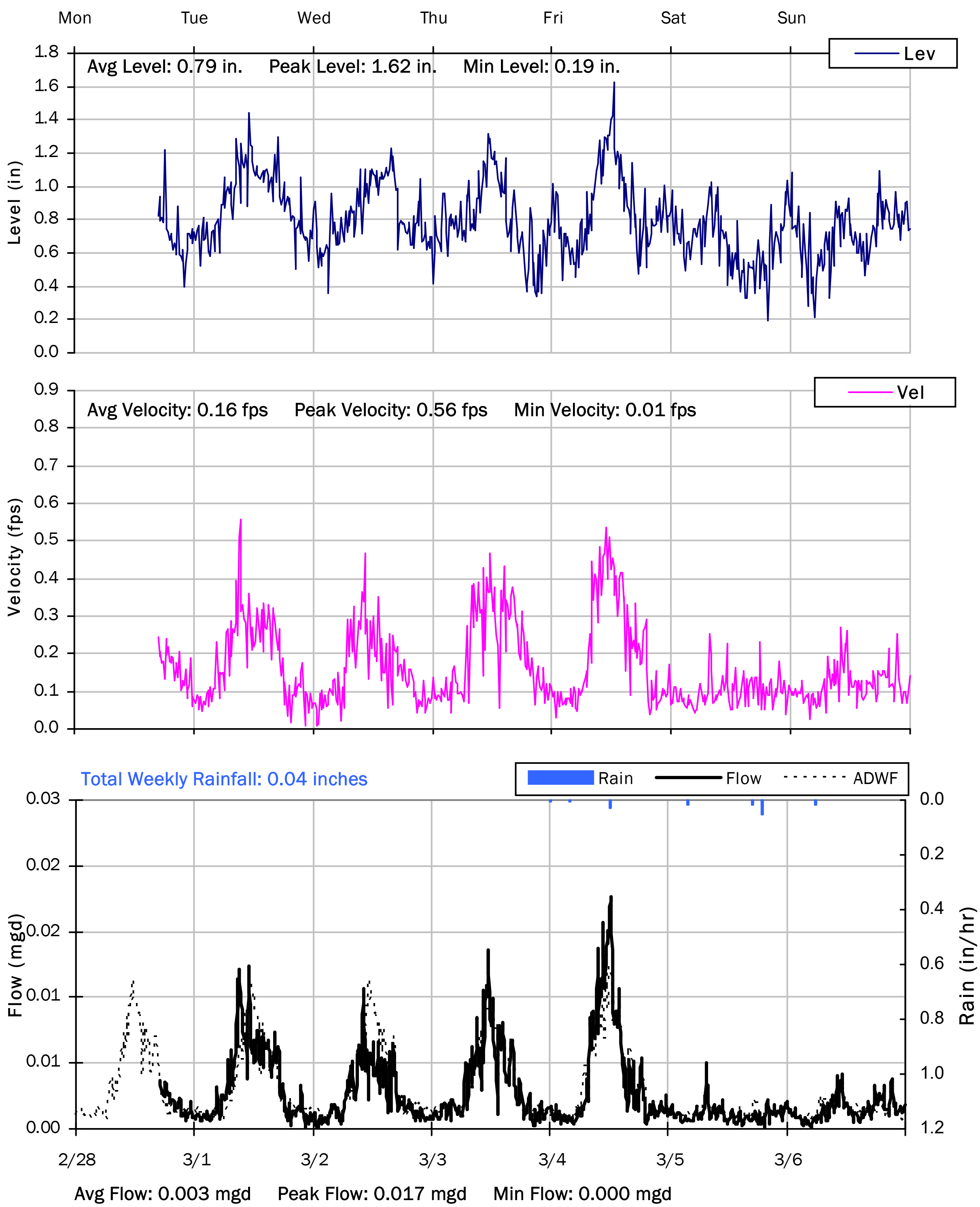
2/21/2022 to 2/28/2022







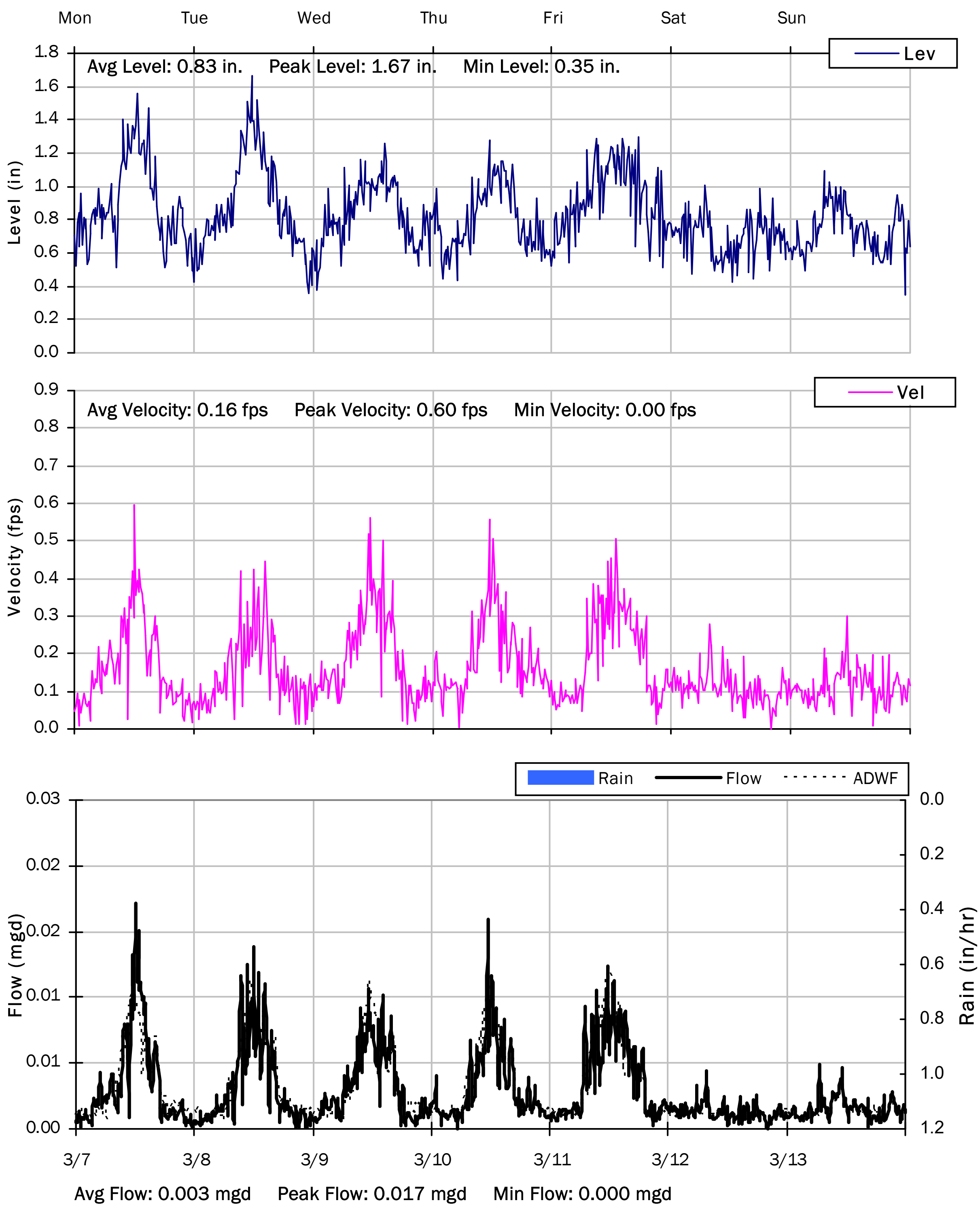
SITE 10
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

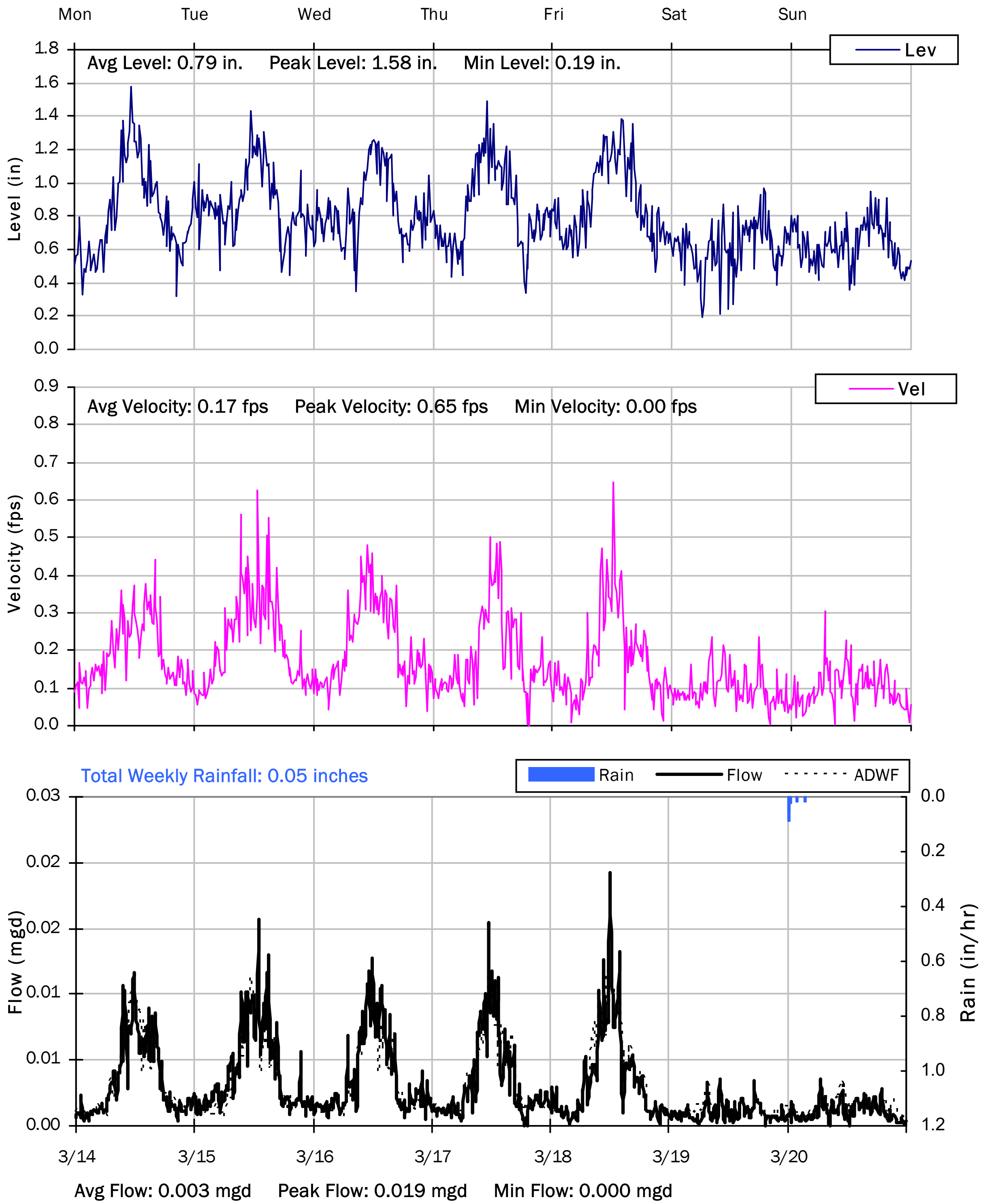
3/7/2022 to 3/14/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

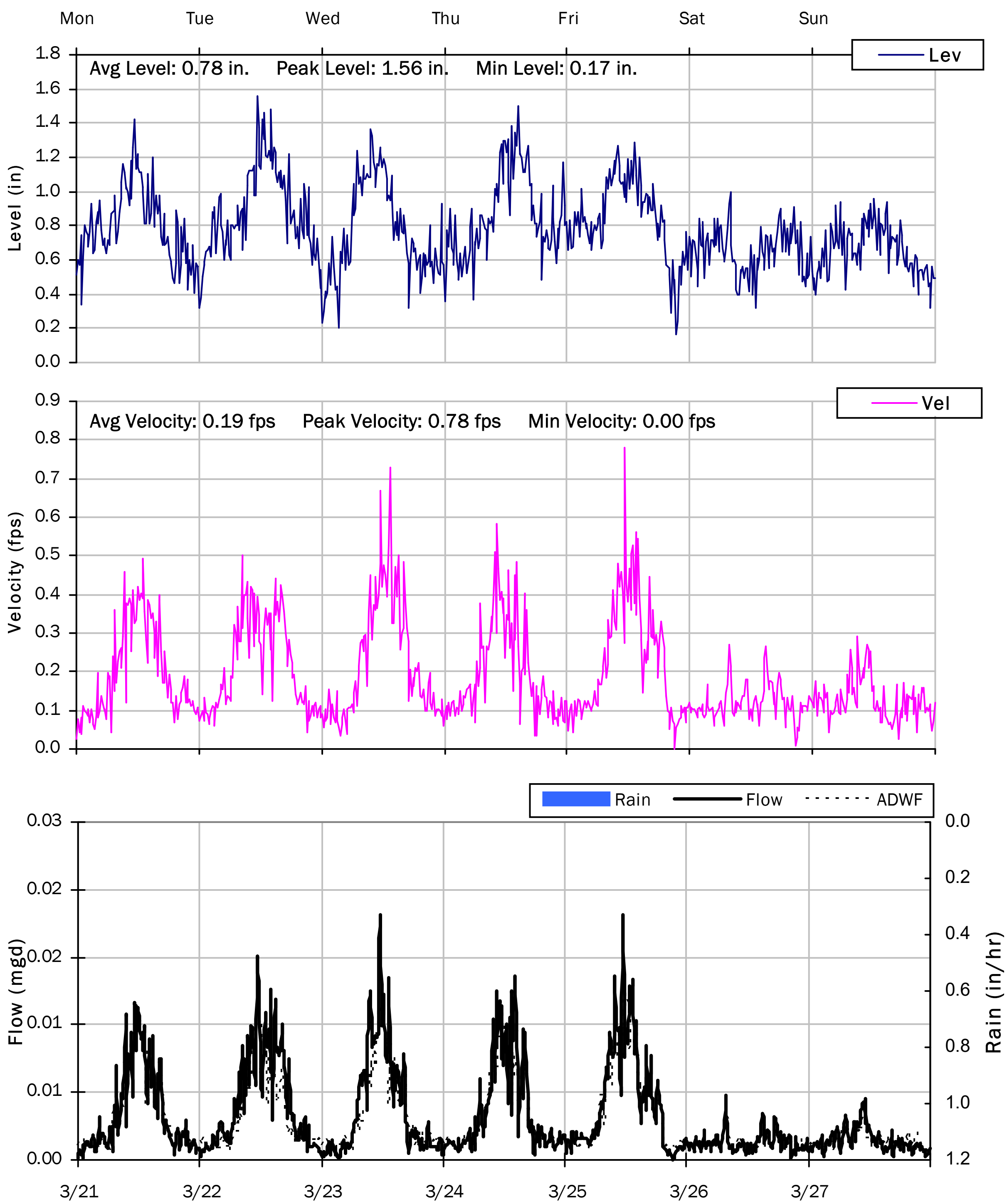
3/14/2022 to 3/21/2022



SITE 10

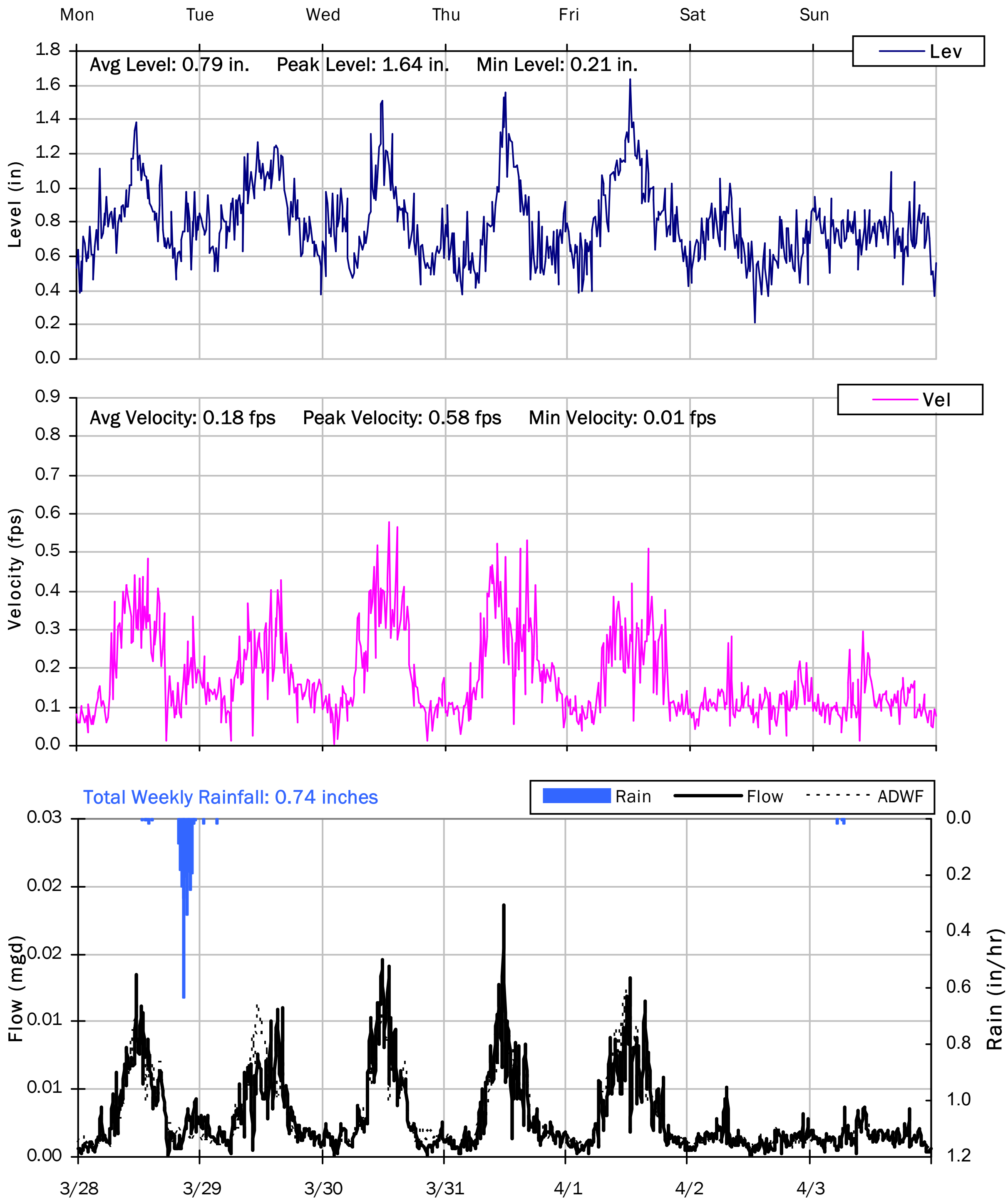
Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022



Avg Flow: 0.003 mgd Peak Flow: 0.018 mgd Min Flow: 0.000 mgd

SITE 10
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

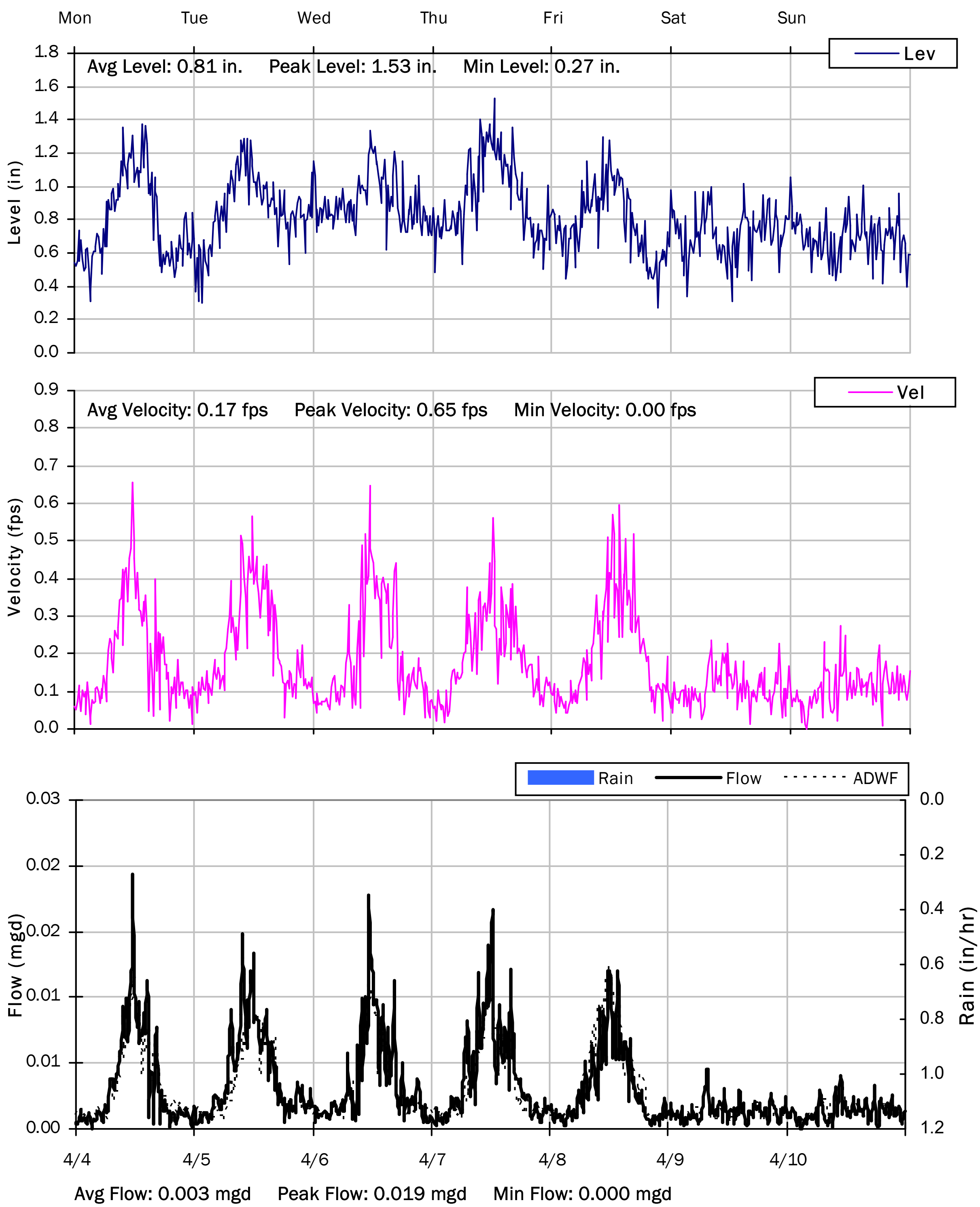


Avg Flow: 0.003 mgd Peak Flow: 0.019 mgd Min Flow: 0.000 mgd

SITE 10

Weekly Level, Velocity and Flow Hydrographs

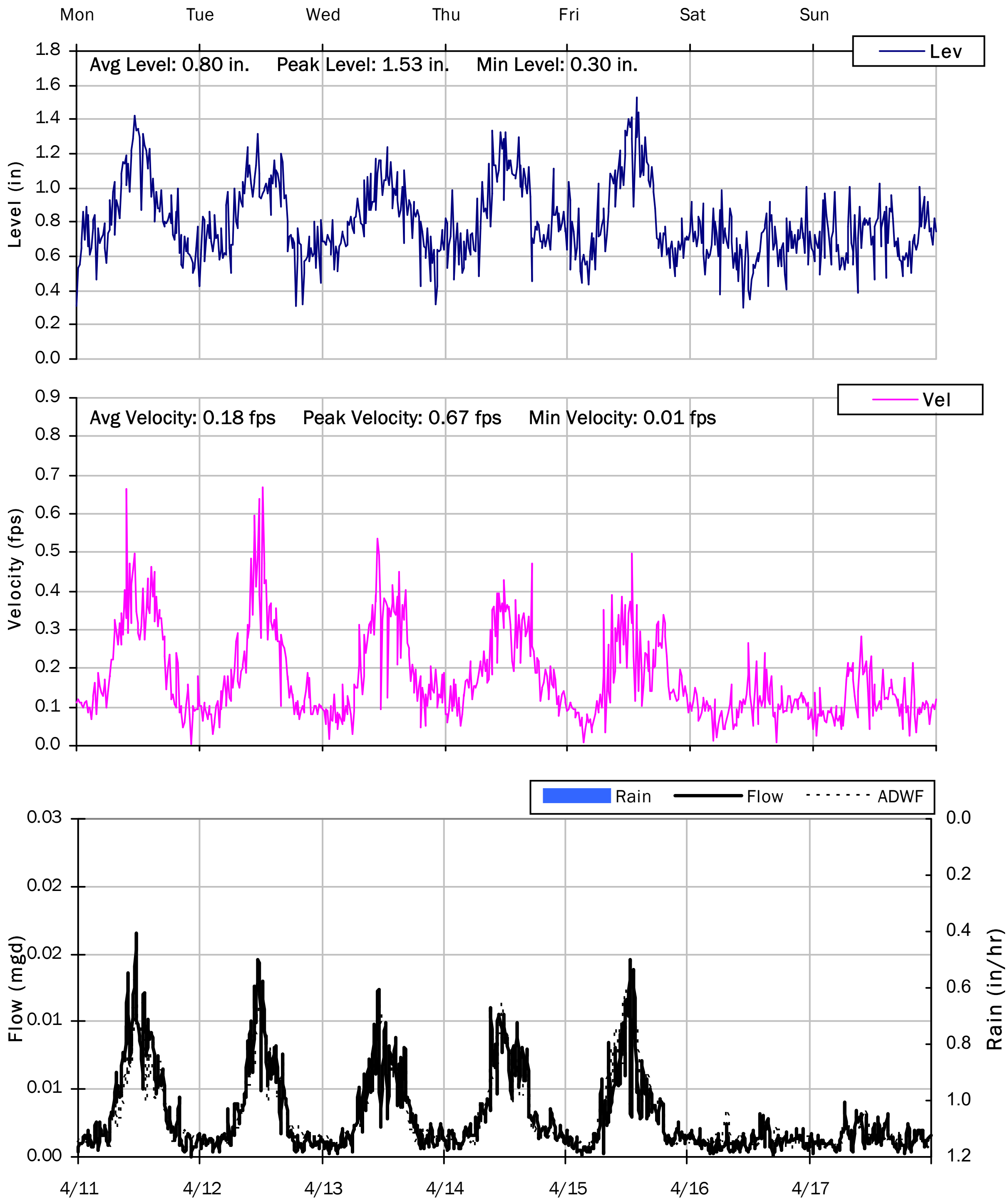
4/4/2022 to 4/11/2022



SITE 10

Weekly Level, Velocity and Flow Hydrographs

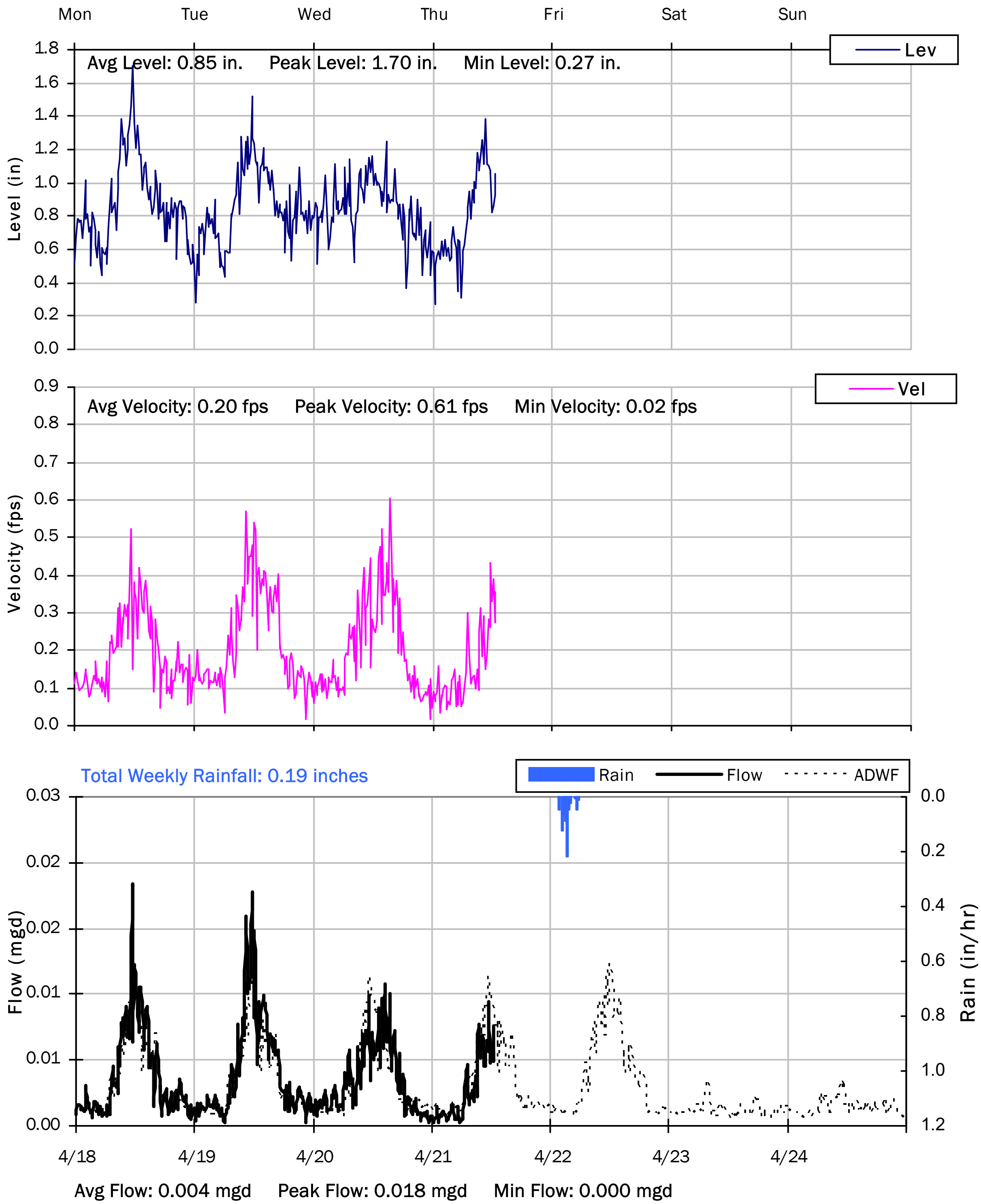
4/11/2022 to 4/18/2022



Avg Flow: 0.003 mgd Peak Flow: 0.017 mgd Min Flow: 0.000 mgd

SITE 10

Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



Monitoring Site: Site 11

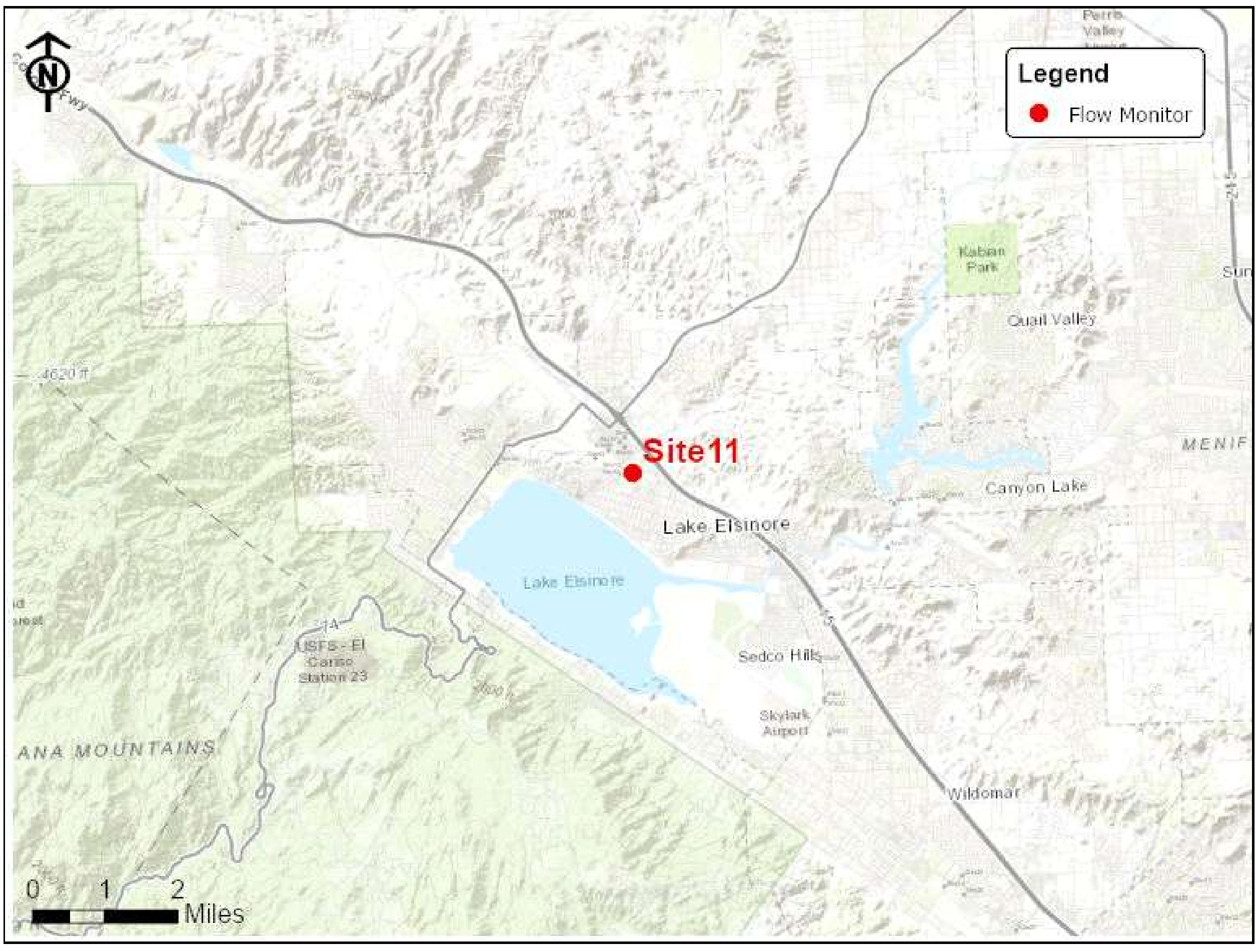
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Tri Valley Community School

Data Summary Report



Vicinity Map: Site 11

SITE 11

Site Information MH ID: MH-1452

Location: Tri Valley Community School

Coordinates: 117.3347° W, 33.6807° N

Rim Elevation (Earth): 1273 feet

Expected Pipe Diameter: 27 inches

Measured Pipe Diameter: 26.75 inches

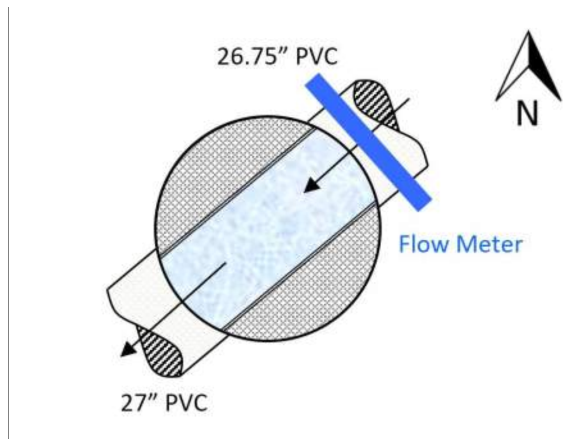
ADWF: 0.061 mgd

Peak Measured Flow: 0.129 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch

View from Street

Plan View

SITE 11

Additional Site Photos

Effluent Pipe

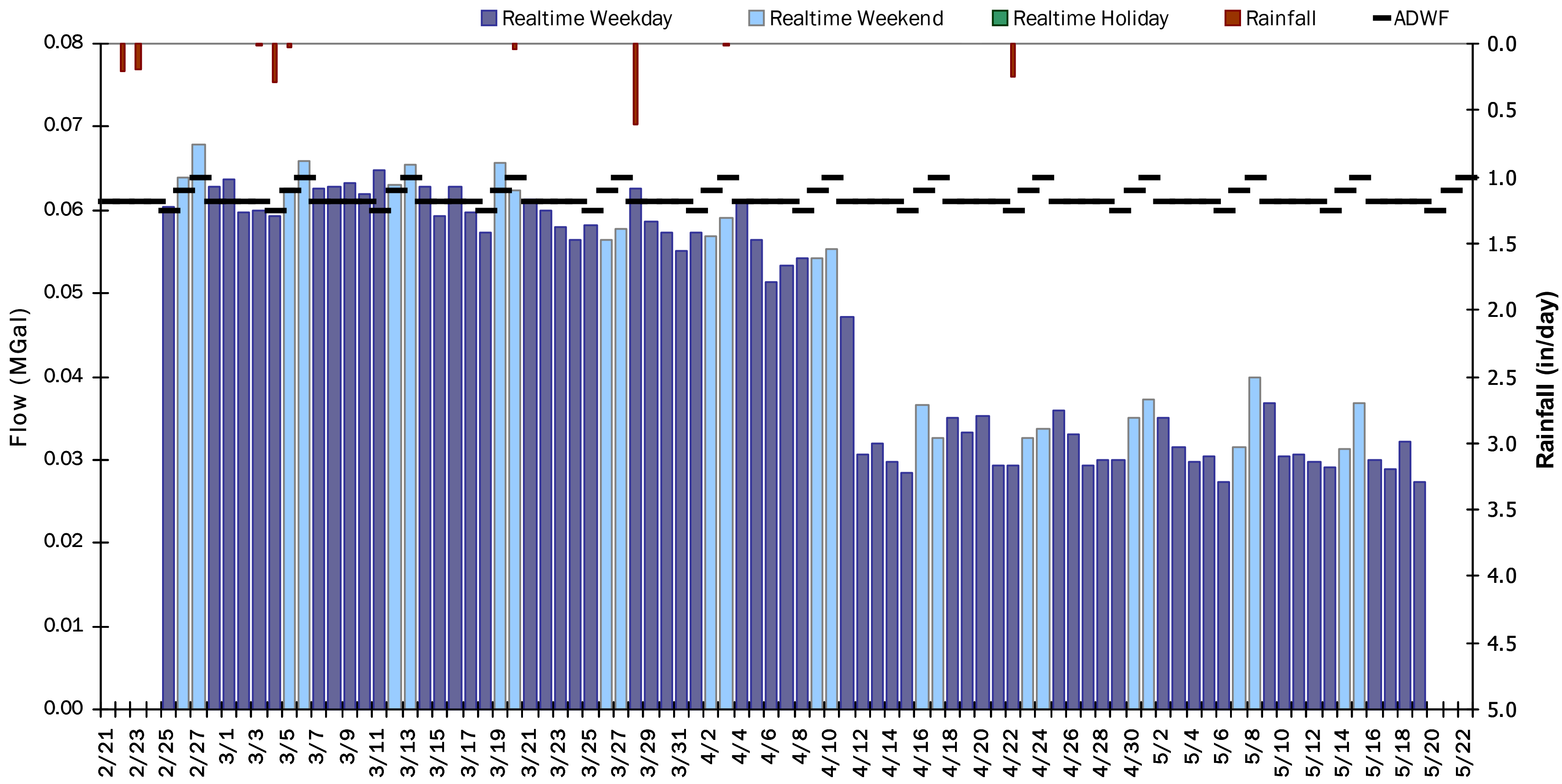
Influent Pipe

SITE 11

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.047 MGal Peak Daily Flow: 0.069 MGal Min Daily Flow: 0.016 MGal

Total Rainfall: 1.23 inches

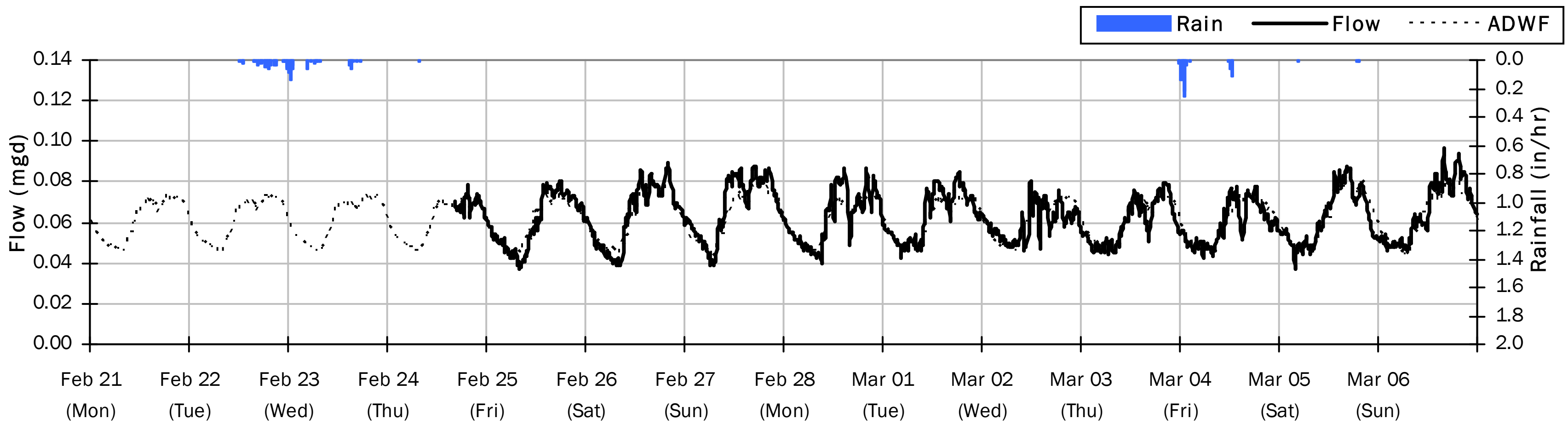


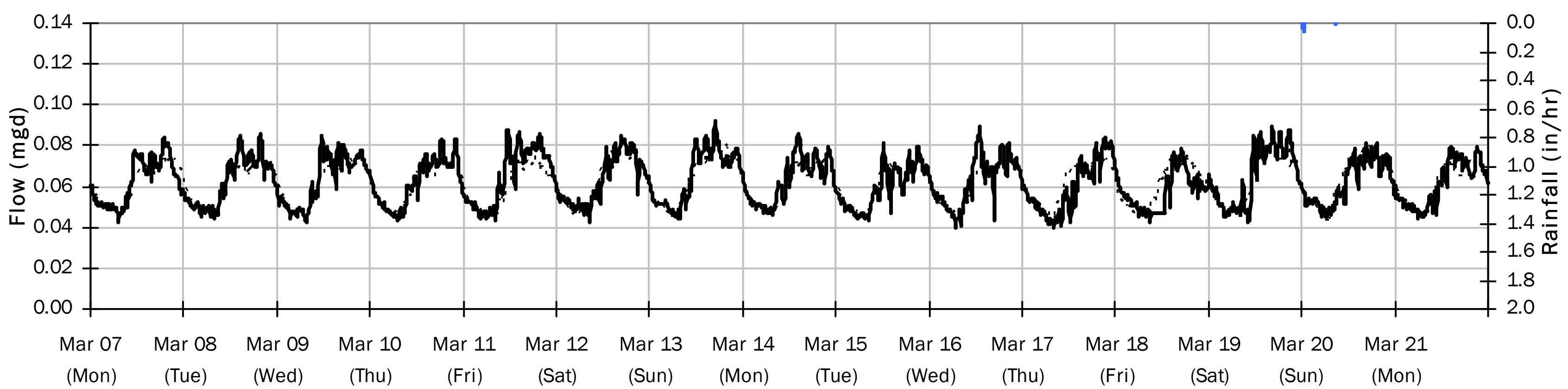
SITE 11

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.75 inches

Period Avg Flow: 0.063 mgd Period Peak Flow: 0.096 mgd Period Min Flow: 0.037 mgd

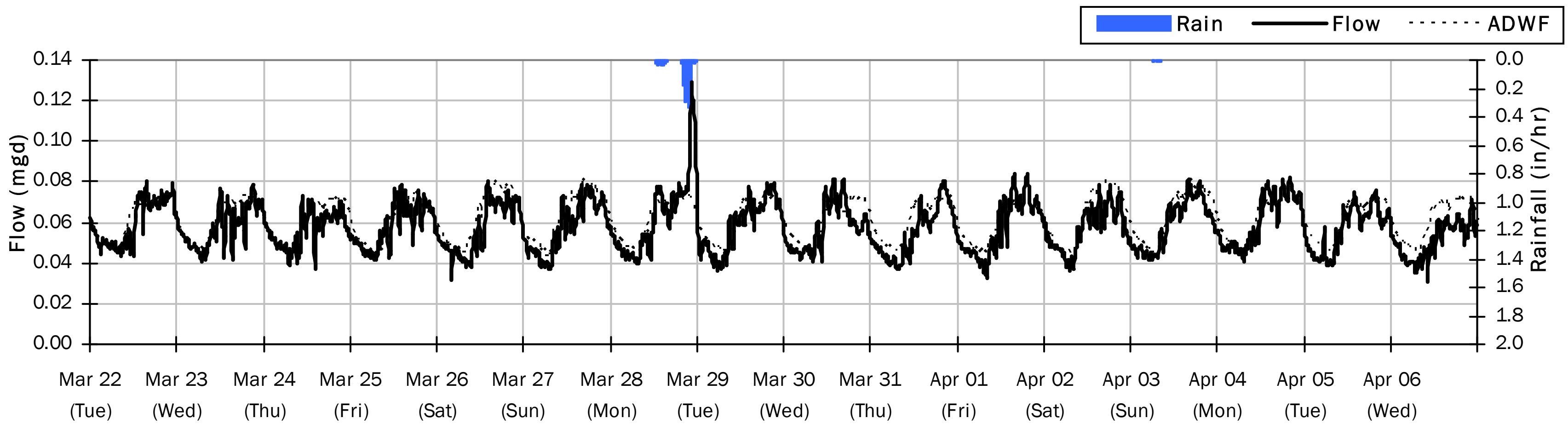


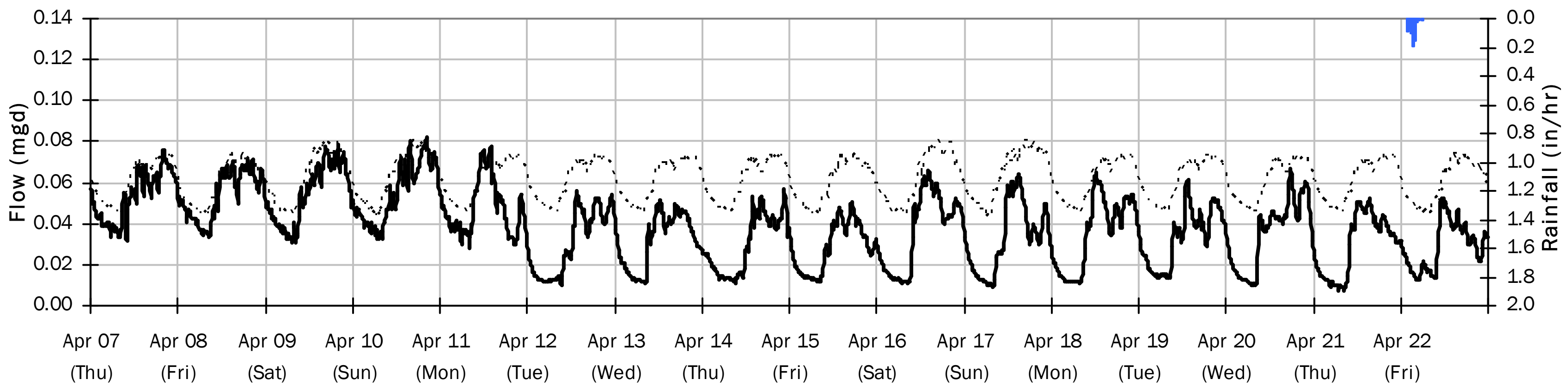


SITE 11

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.88 inches   Period Avg Flow: 0.048 mgd   Period Peak Flow: 0.129 mgd   Period Min Flow: 0.007 mgd

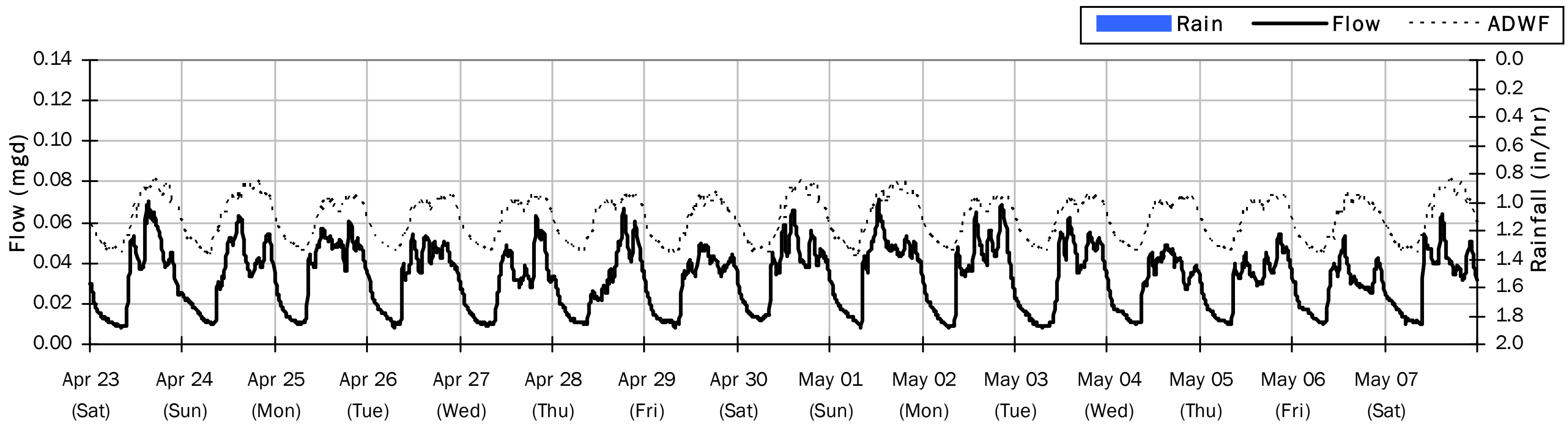


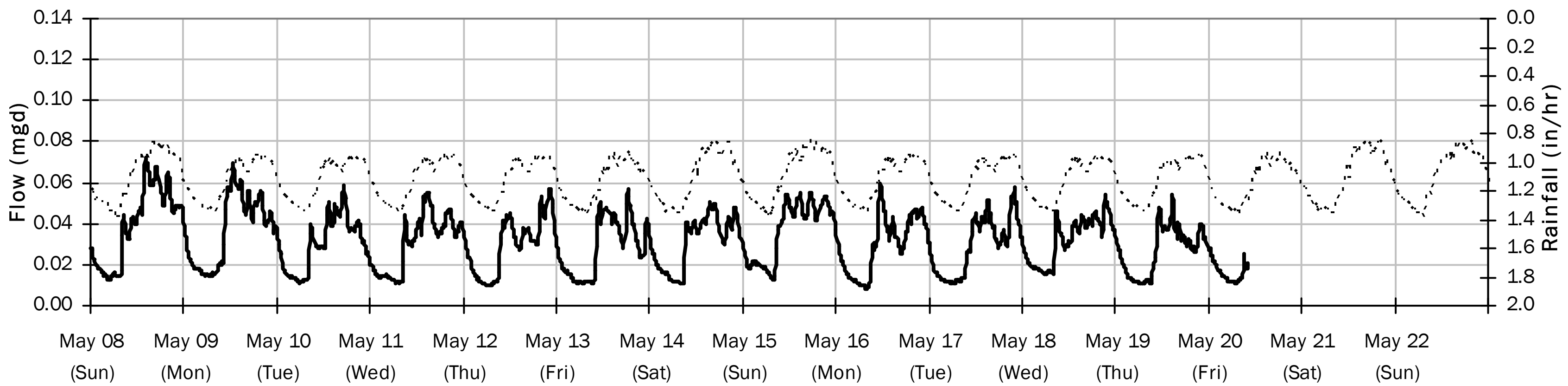


SITE 11
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

Period Avg Flow: 0.032 mgd Period Peak Flow: 0.072 mgd Period Min Flow: 0.008 mgd

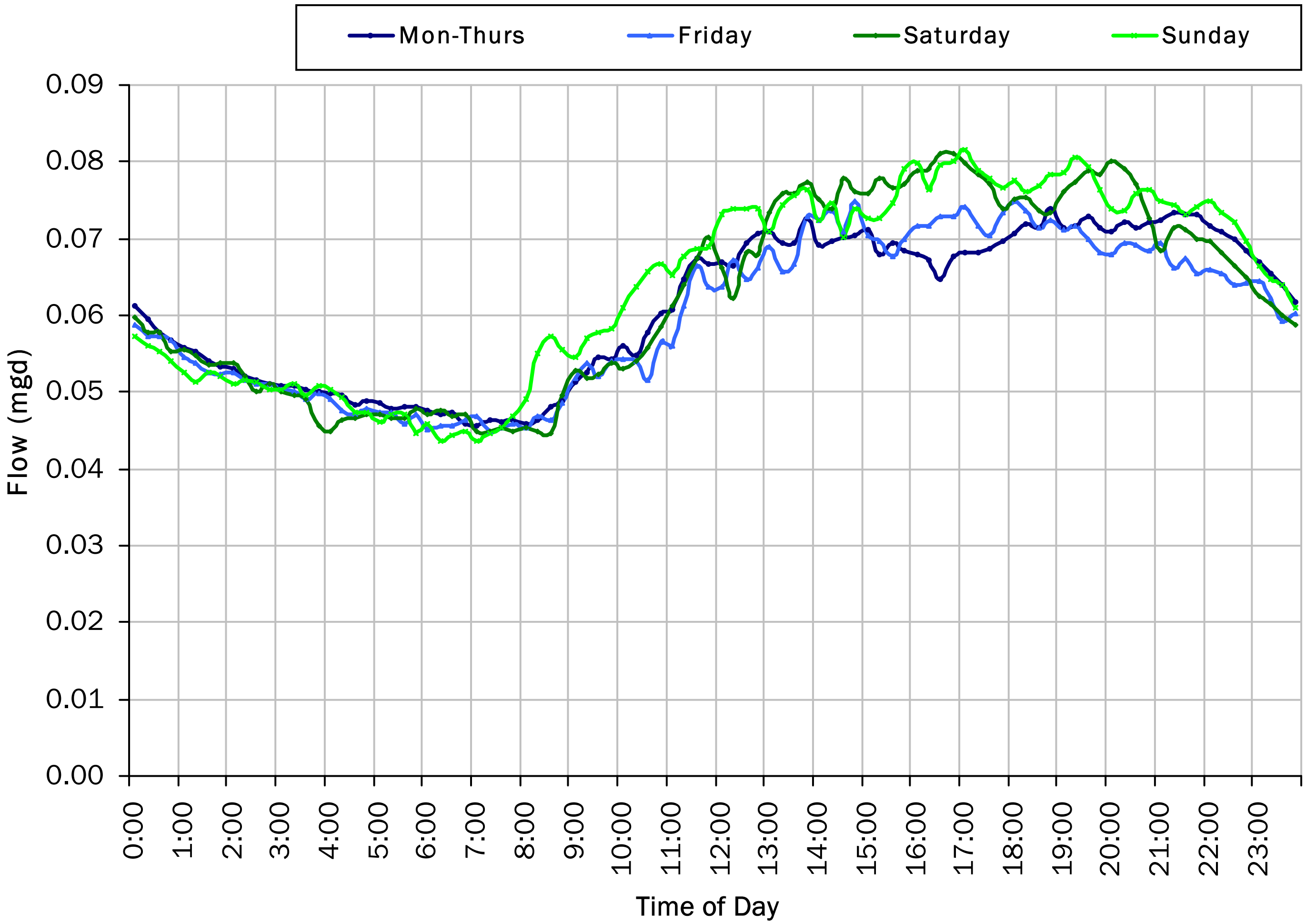




SITE 11

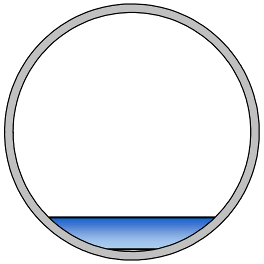
Average Dry Weather Flow Hydrographs

Taken from Pre-April 11, 2022



ADWF:

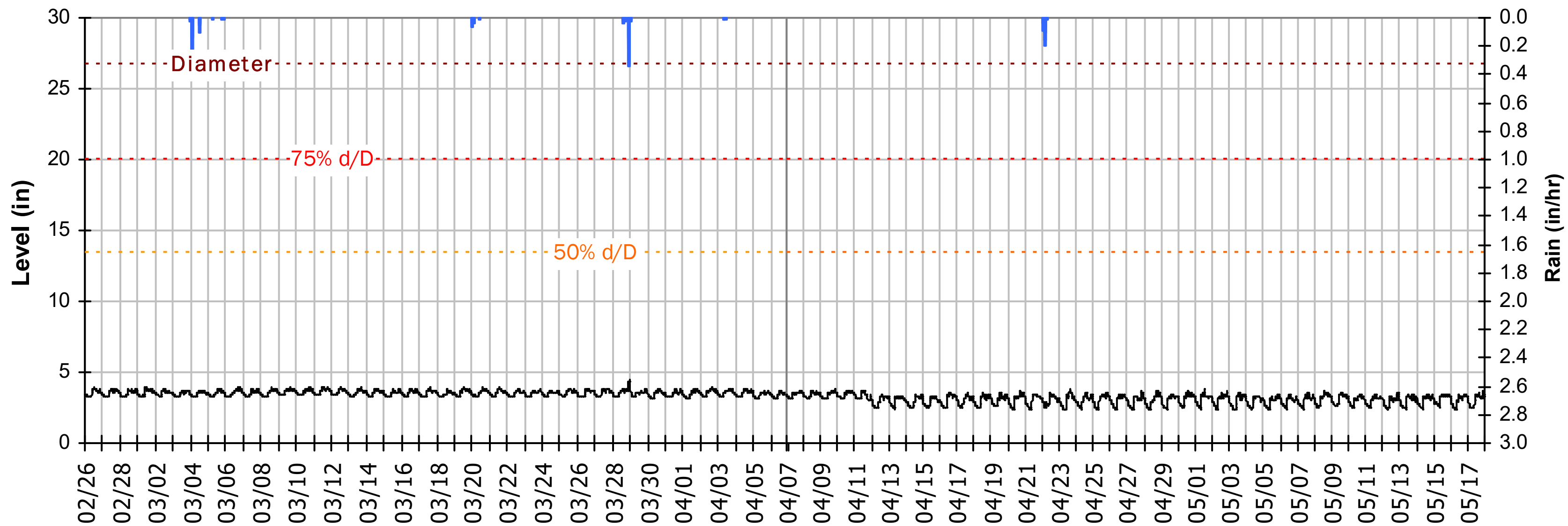
0.061 *mgd*

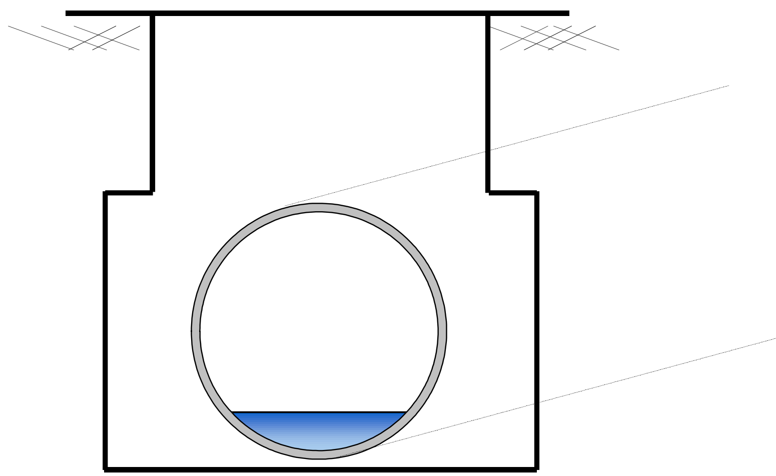


SITE 11

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



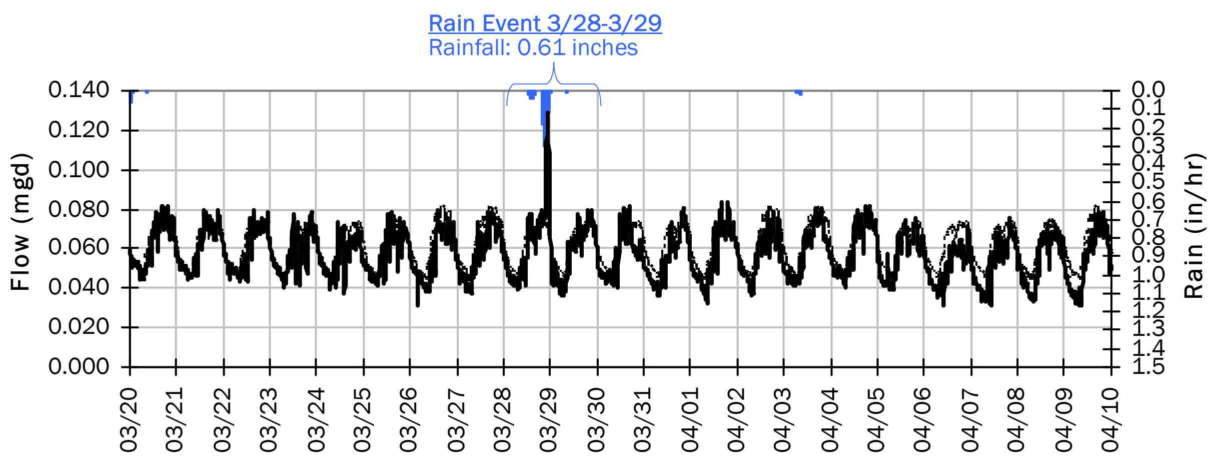


Pipe Diameter:	26.8	*inches*
Peak Measured Level:	4.41	*inches*
Peak d/D Ratio:	0.16	

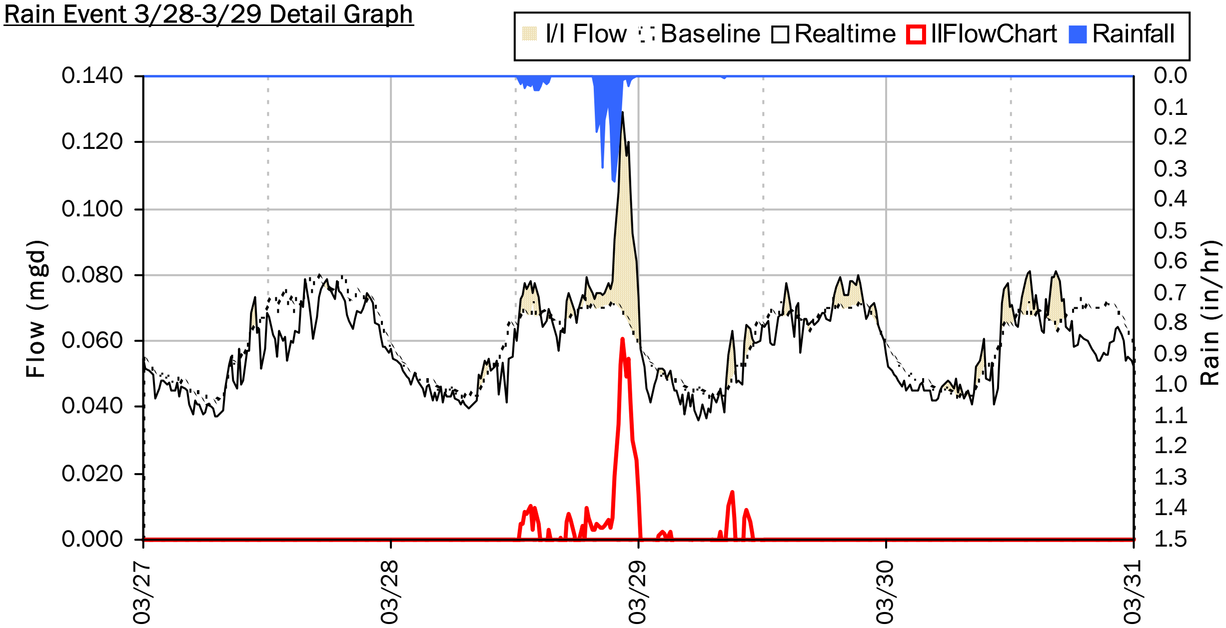
SITE 11

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



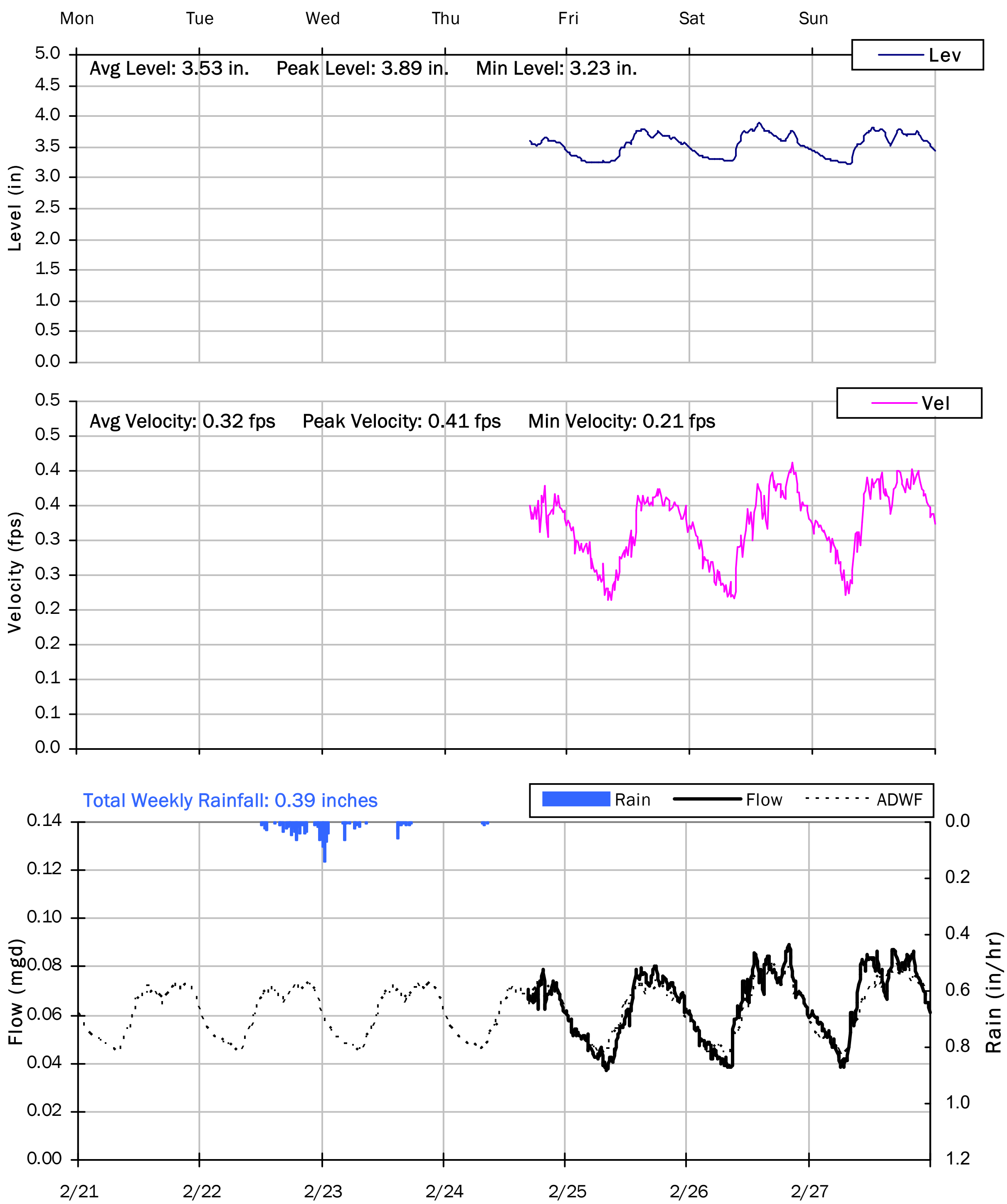
Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.61 inches)

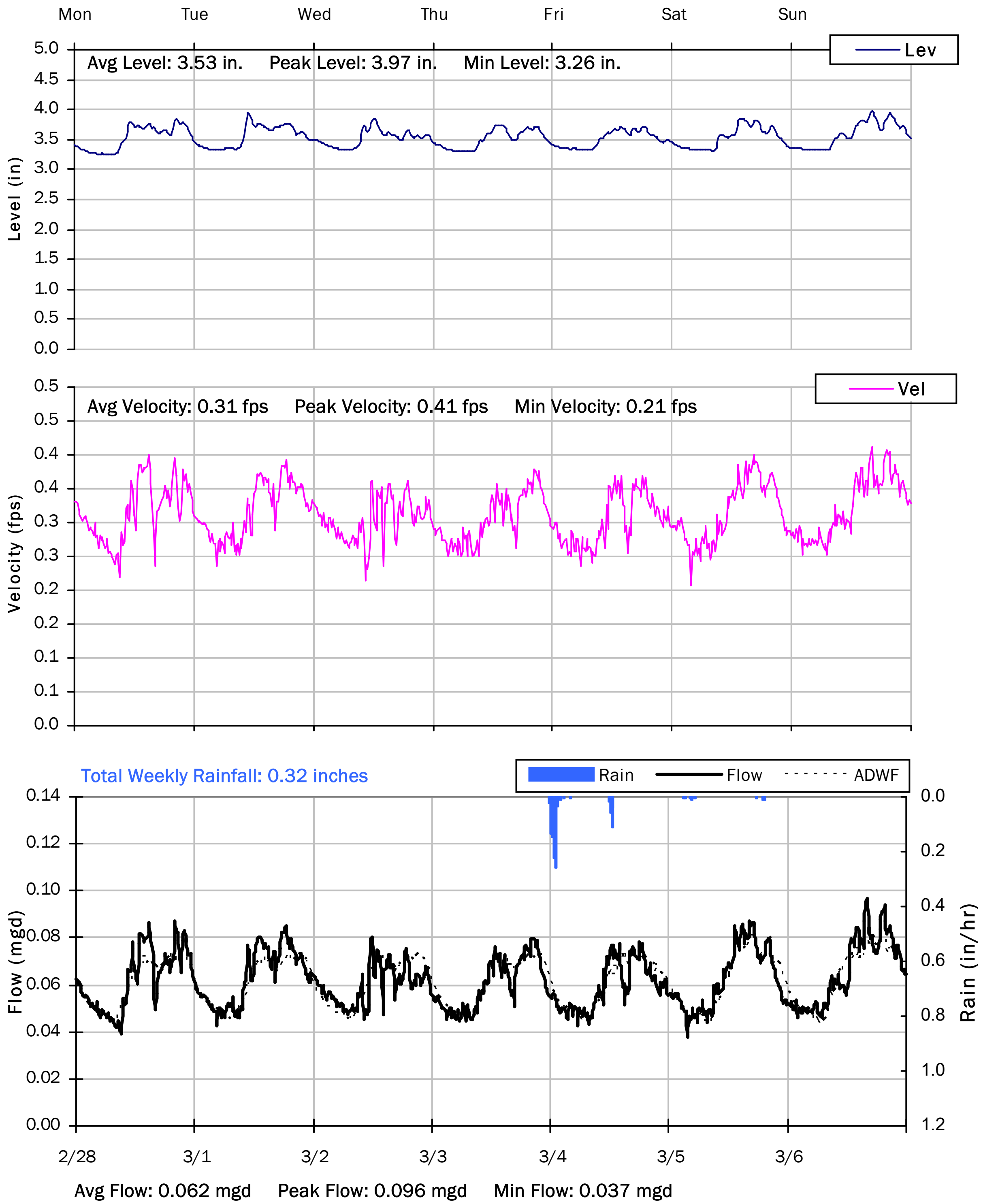
Capacity		Inflow / Infiltration	
Peak Flow:	0.129 *mgd*	Peak I/I Rate:	0.061 *mgd*
PF:	2.10	Total I/I:	4,000 *gallons*
Peak Level:	4.41 *in*		
d/D Ratio:	0.16		

SITE 11
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

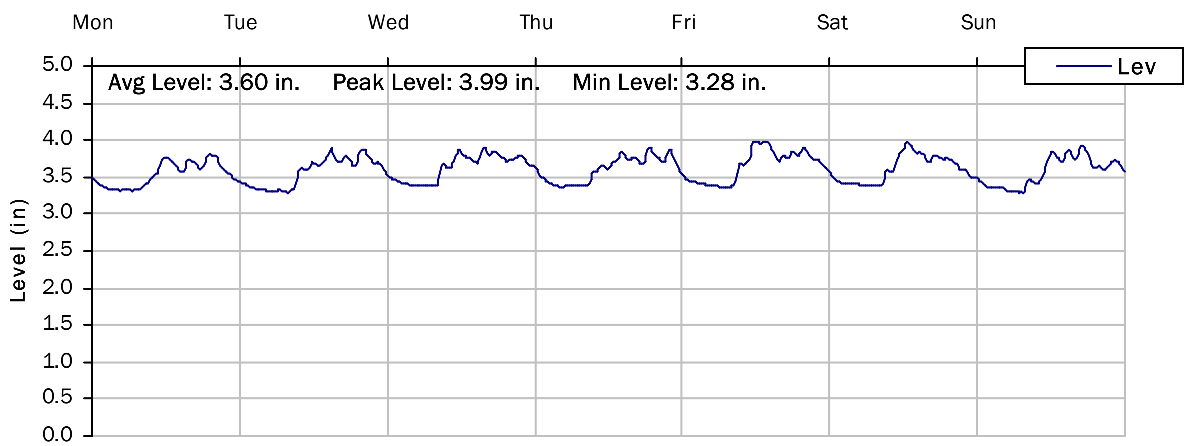


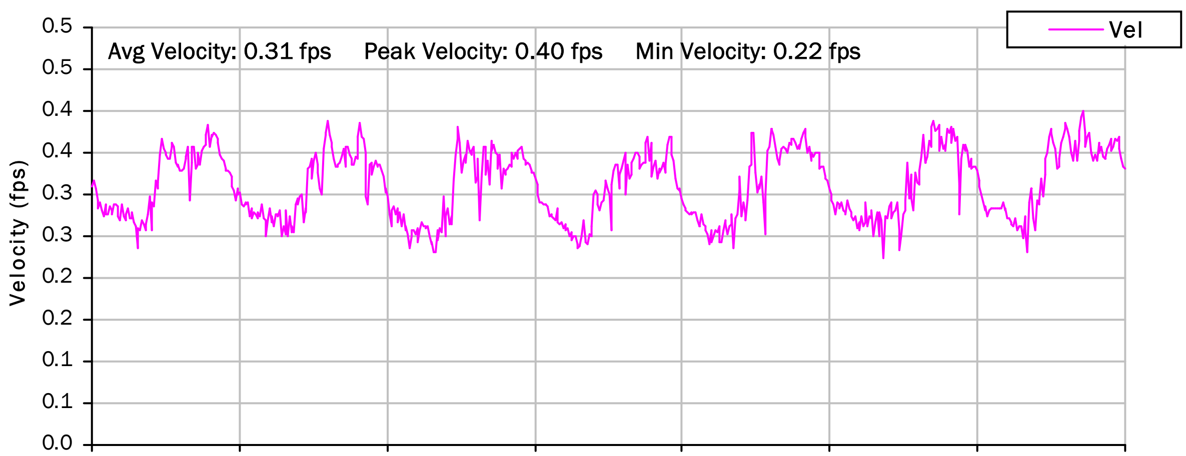
Avg Flow: 0.064 mgd Peak Flow: 0.089 mgd Min Flow: 0.037 mgd

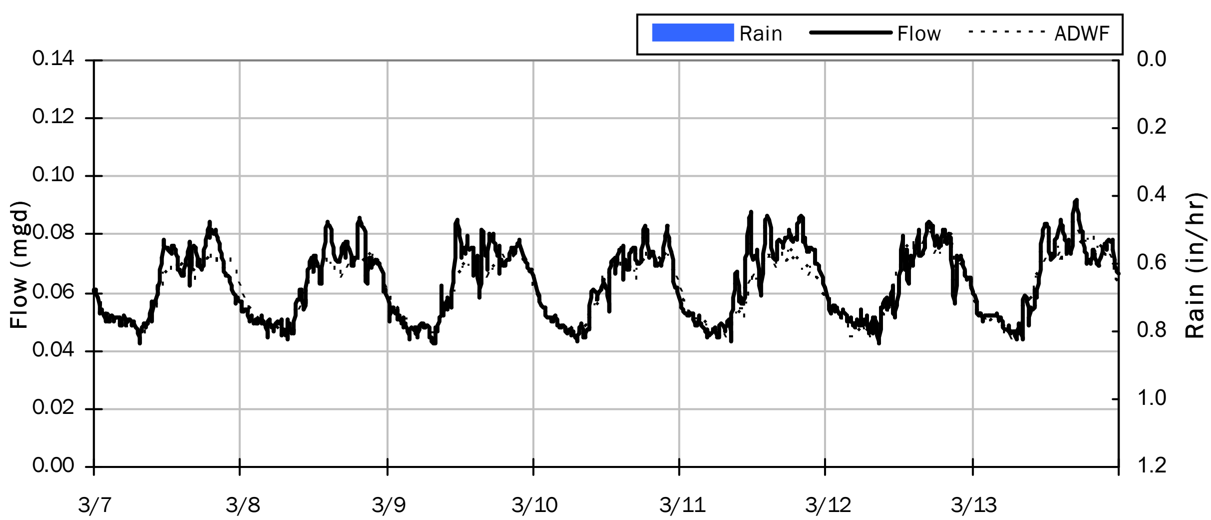
SITE 11
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



SITE 11
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022





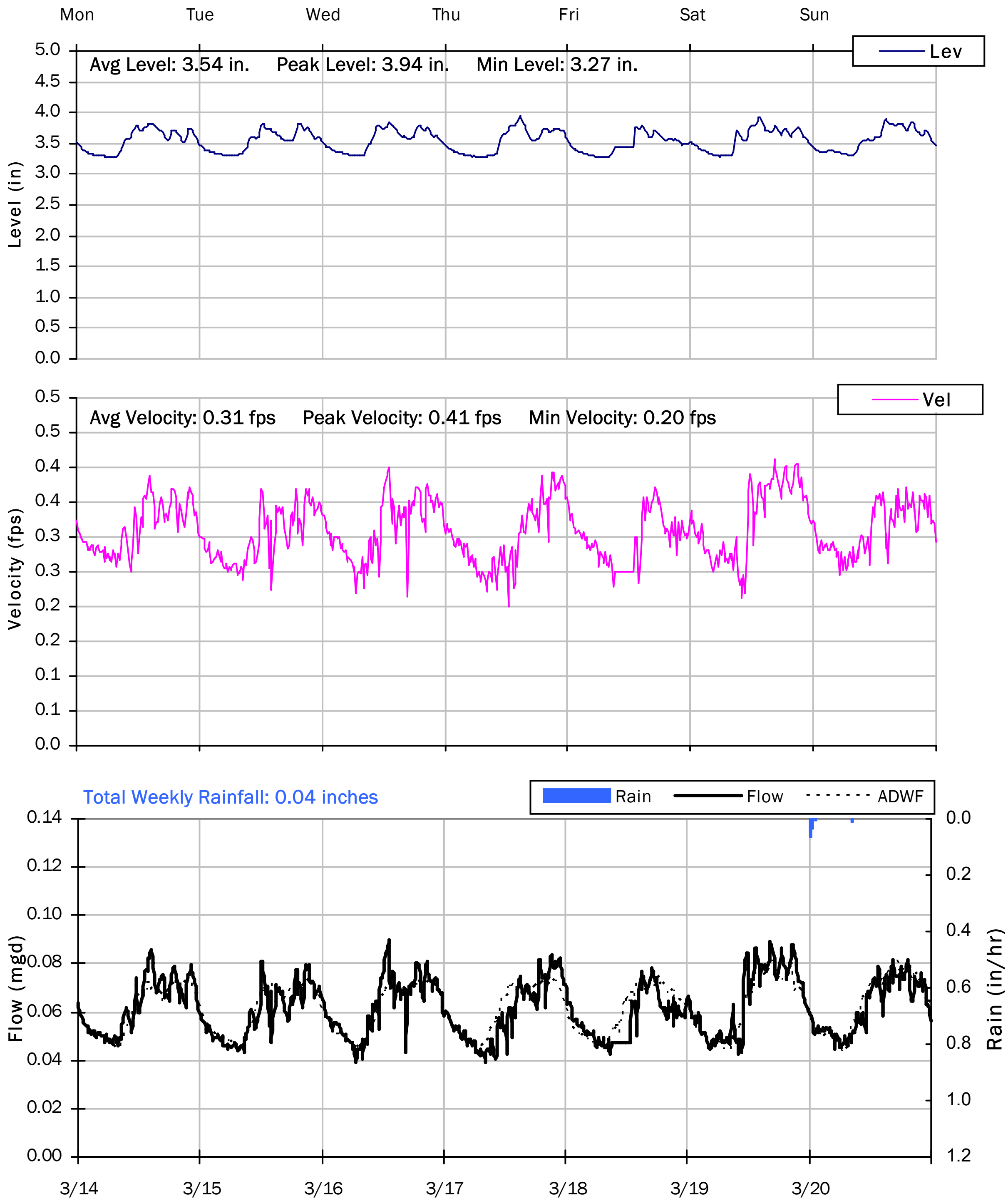


Avg Flow: 0.063 mgd   Peak Flow: 0.092 mgd   Min Flow: 0.042 mgd

SITE 11

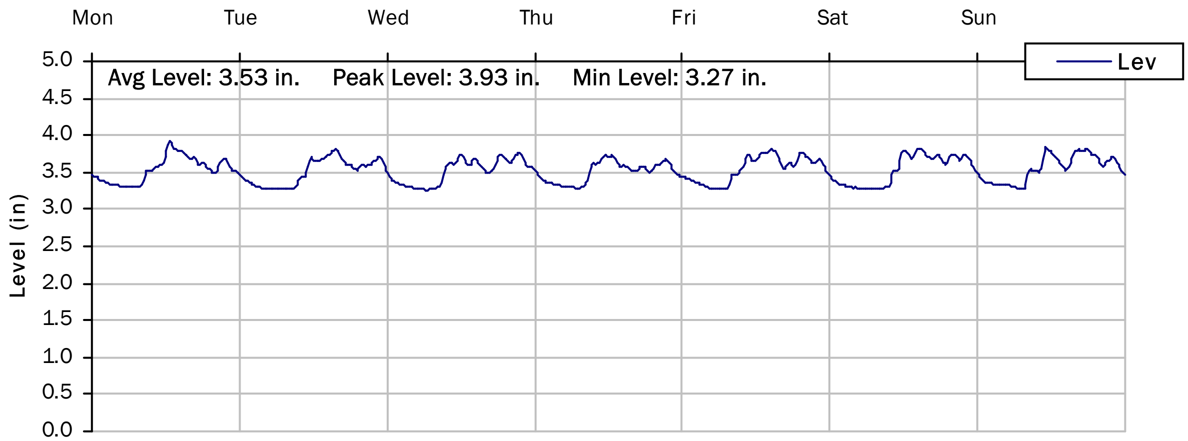
Weekly Level, Velocity and Flow Hydrographs

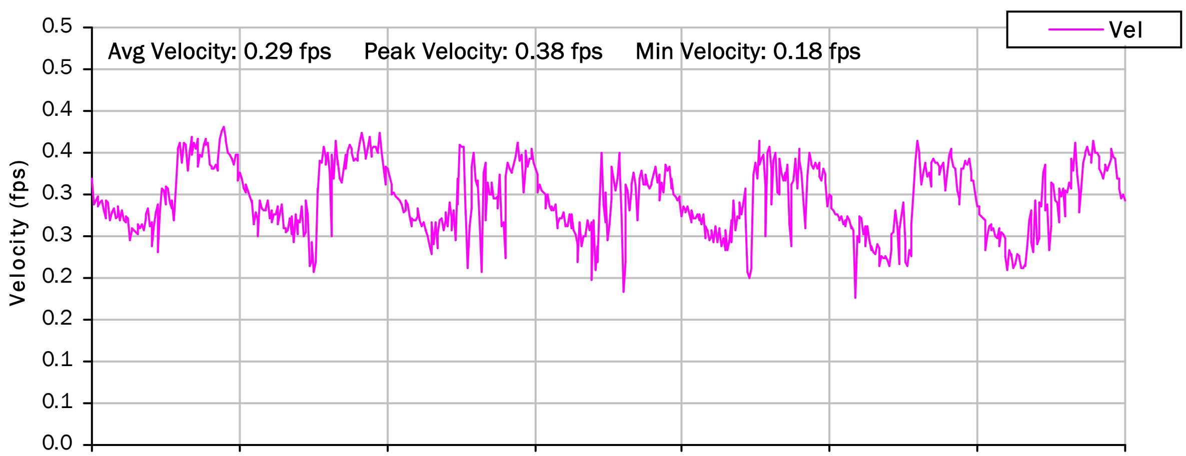
3/14/2022 to 3/21/2022

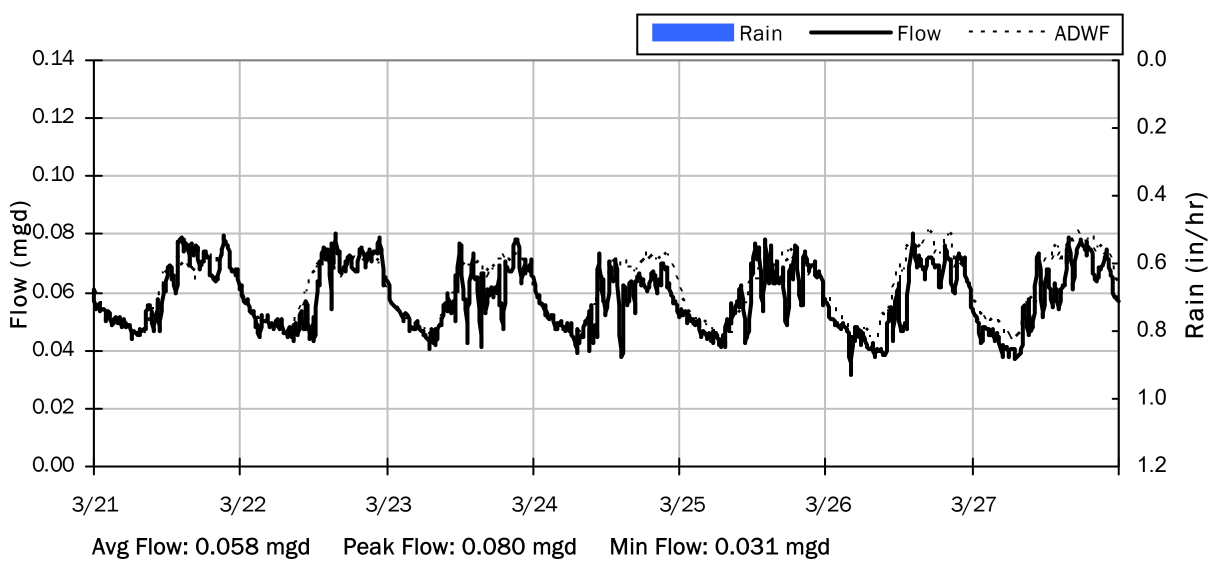


Avg Flow: 0.061 mgd Peak Flow: 0.090 mgd Min Flow: 0.039 mgd

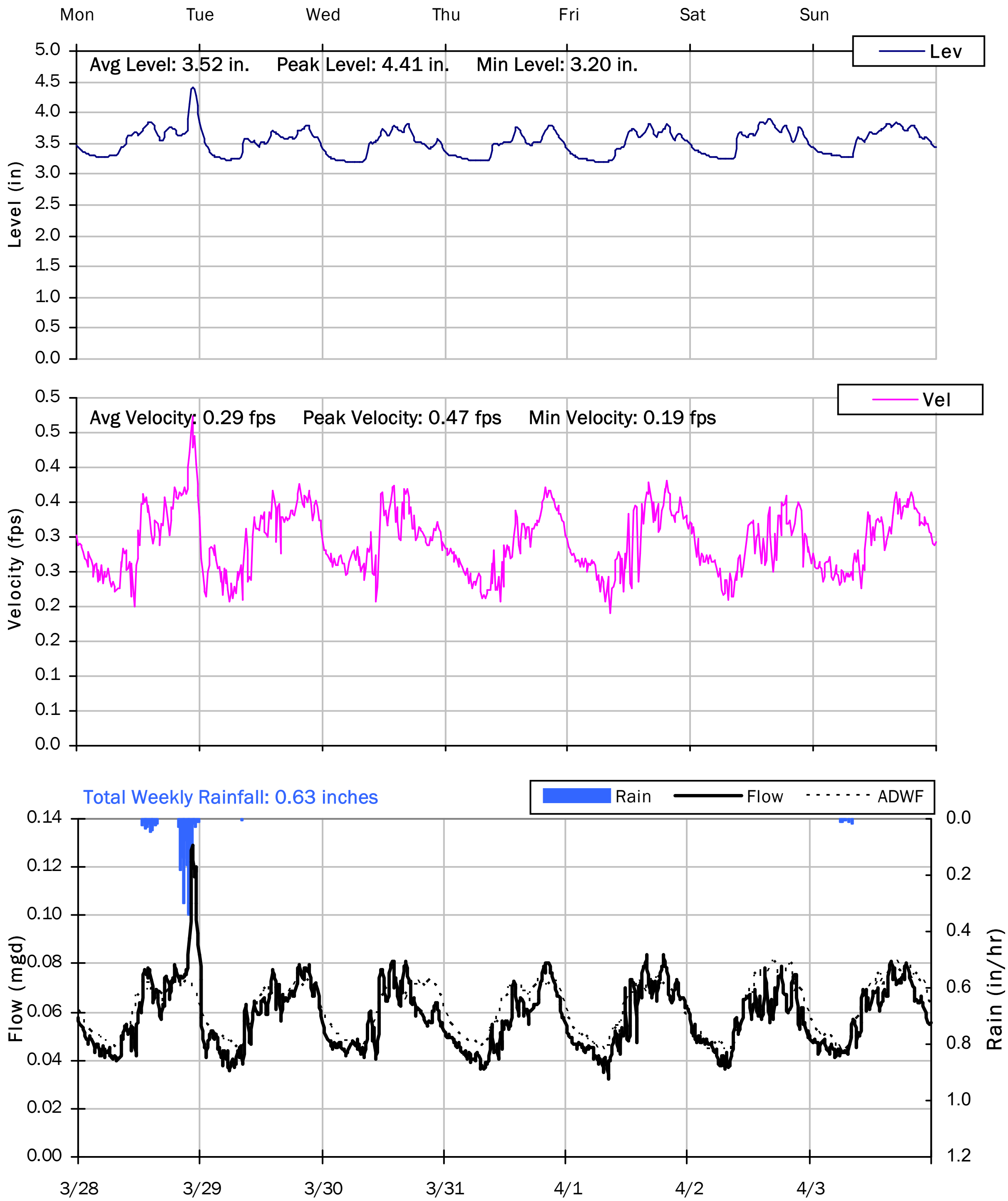
SITE 11
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022







SITE 11
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

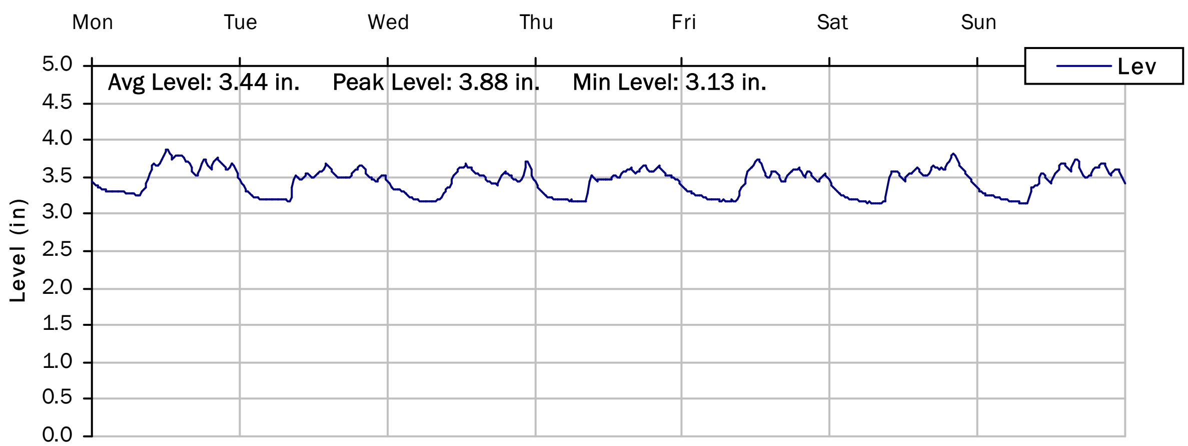


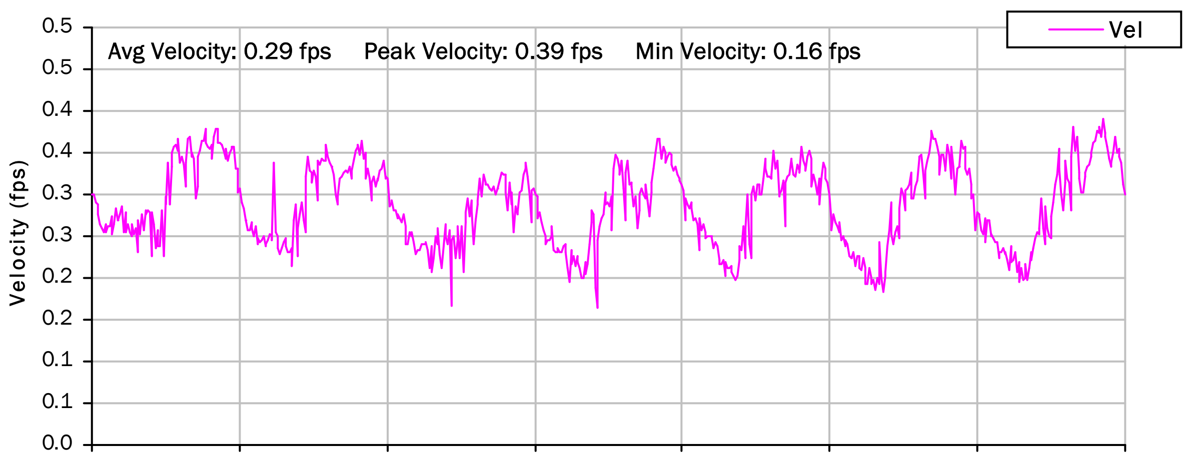
Avg Flow: 0.058 mgd Peak Flow: 0.129 mgd Min Flow: 0.033 mgd

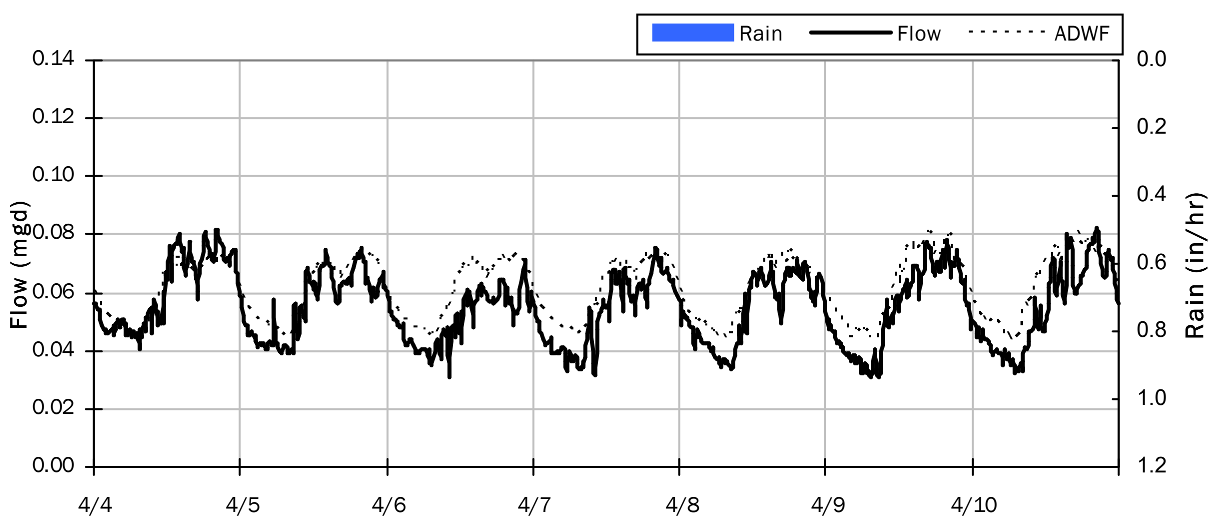
SITE 11

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022

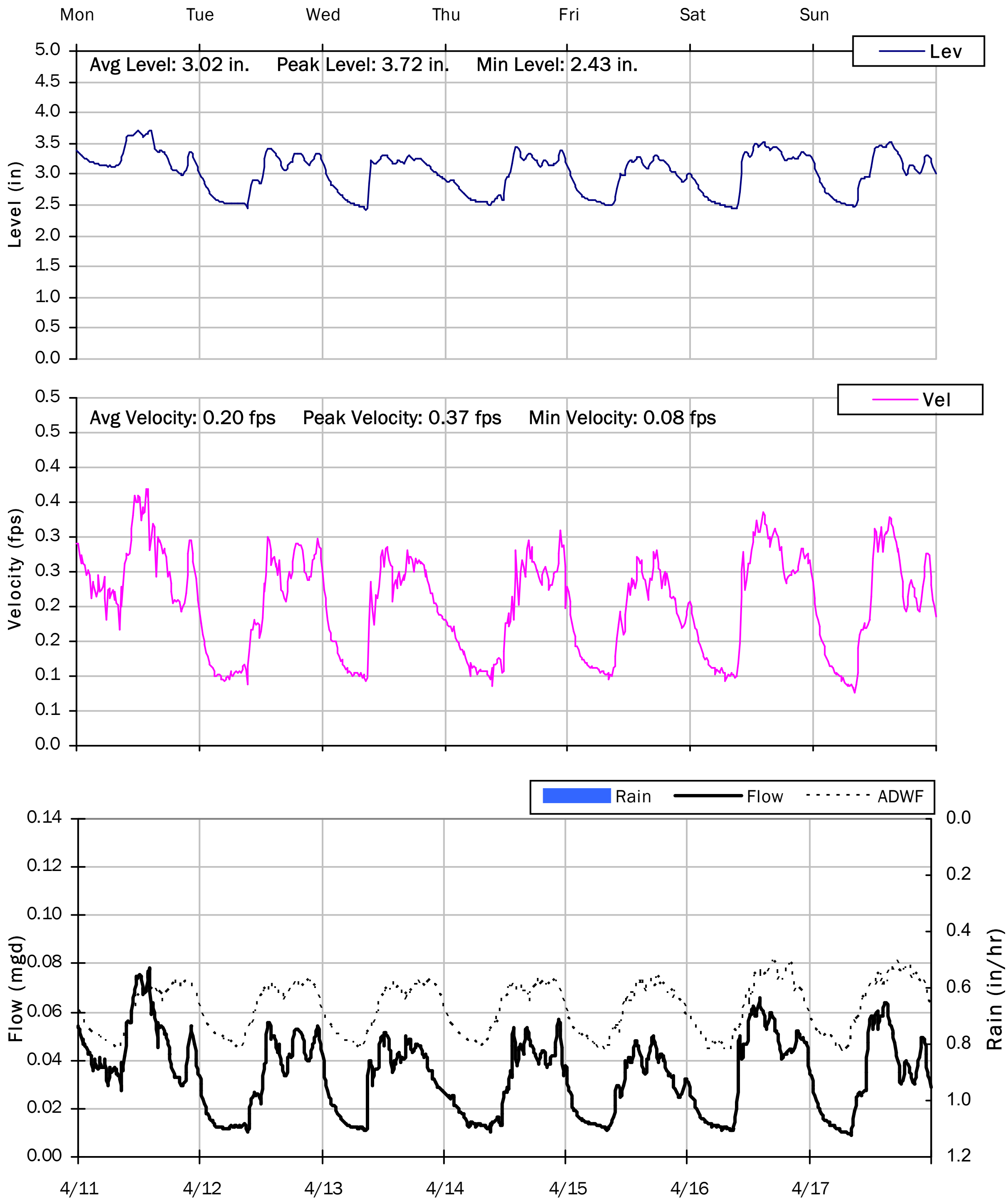






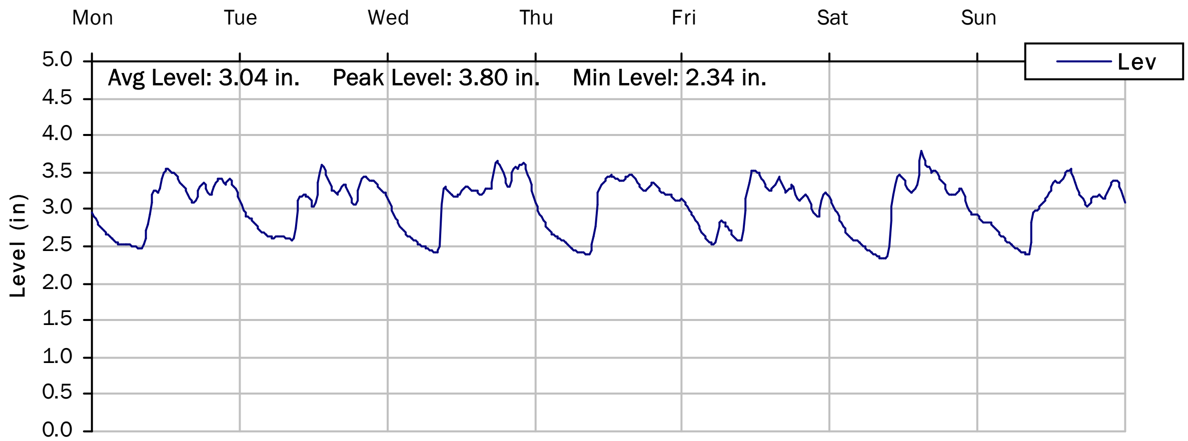
Avg Flow: 0.055 mgd Peak Flow: 0.082 mgd Min Flow: 0.031 mgd

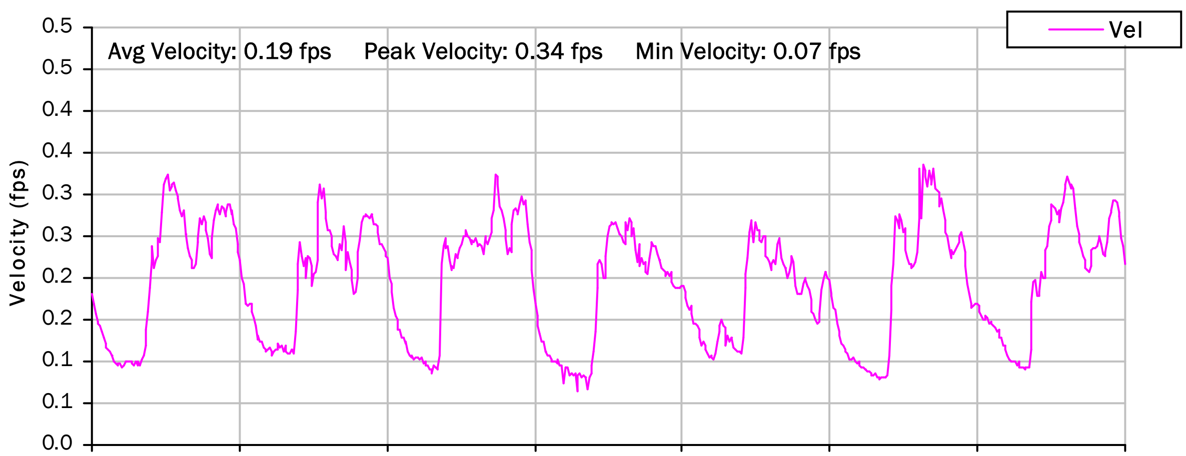
SITE 11
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

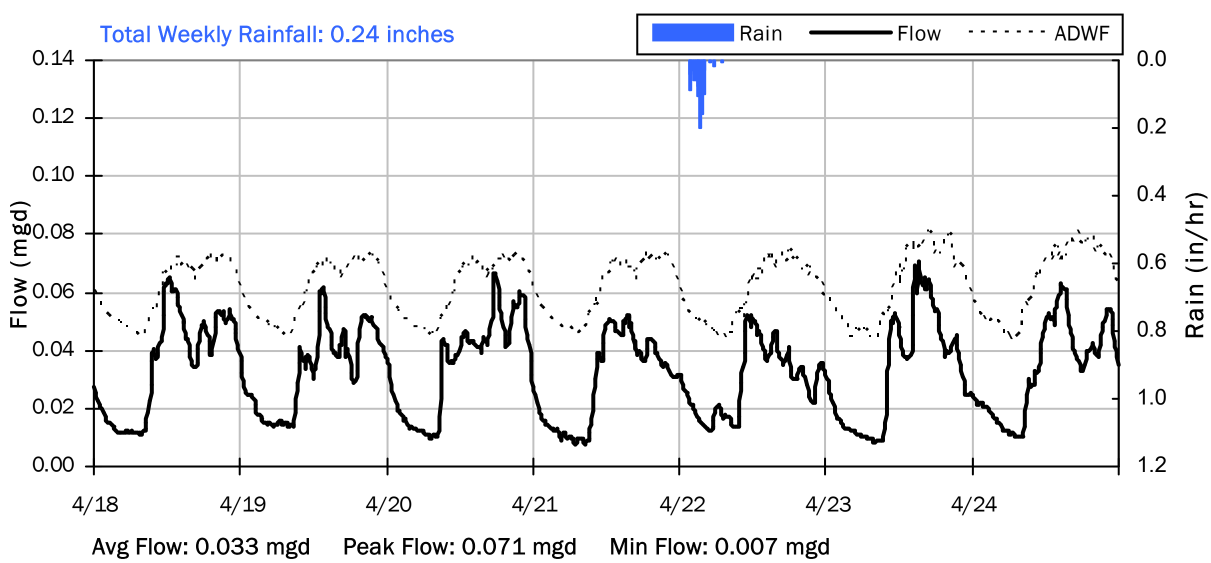


Avg Flow: 0.034 mgd Peak Flow: 0.078 mgd Min Flow: 0.009 mgd

SITE 11
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



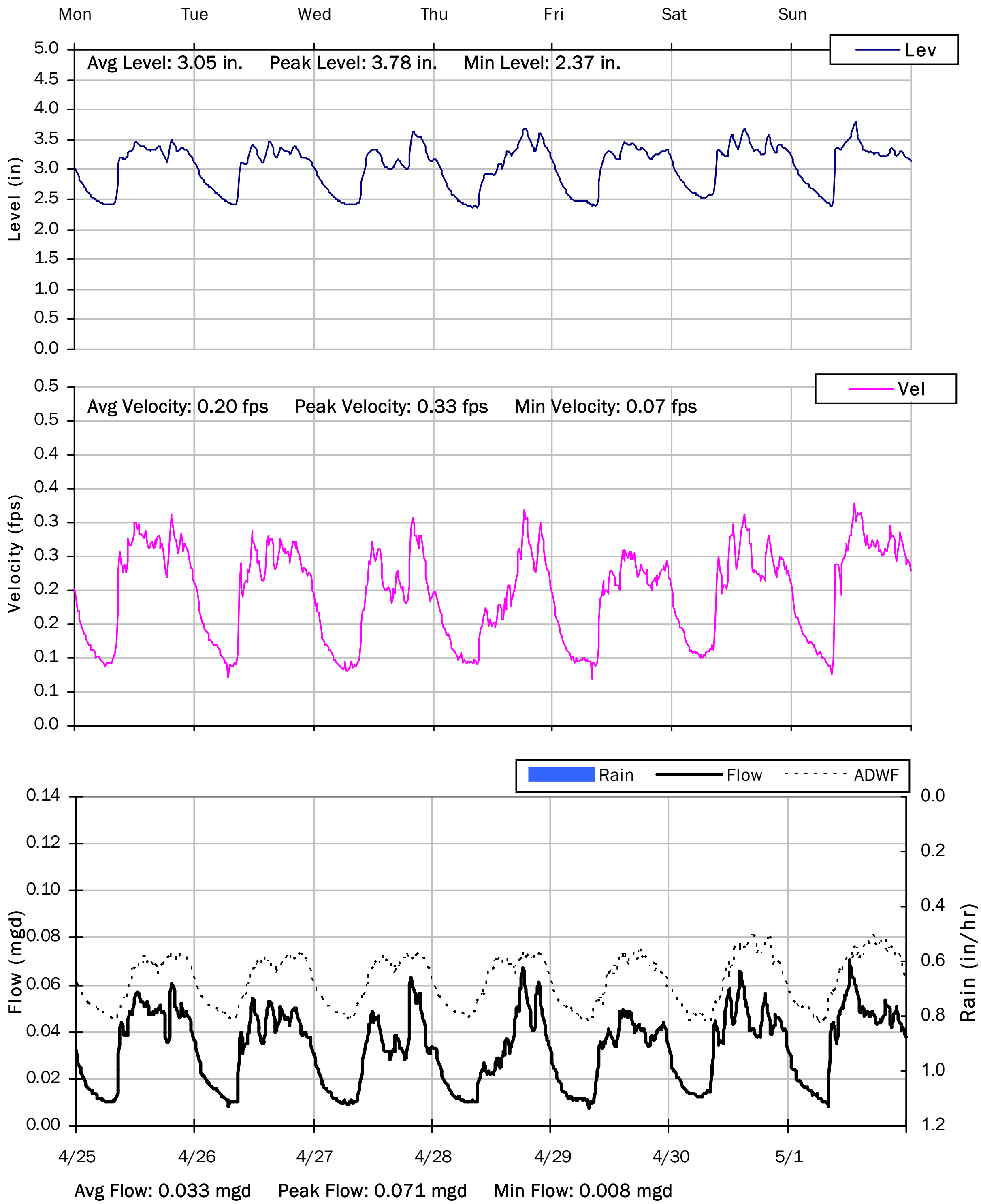




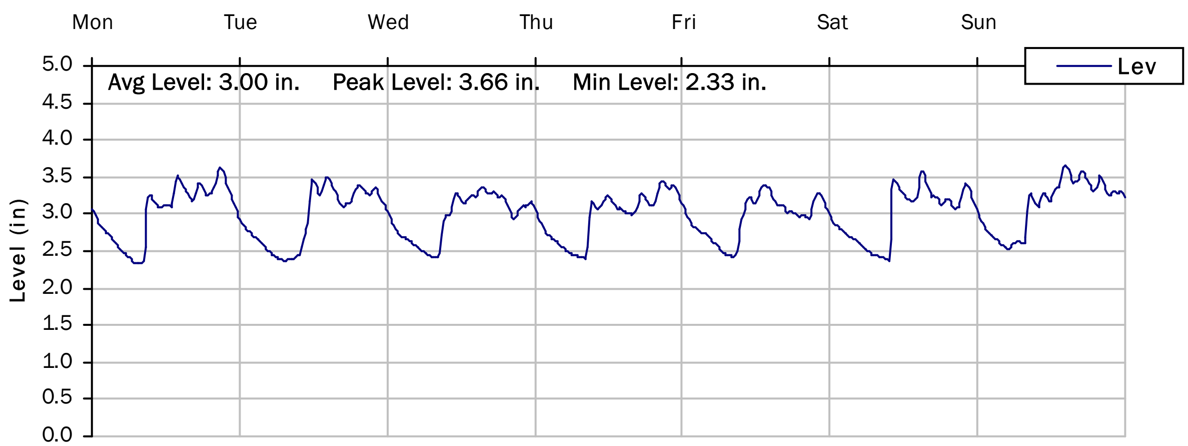
SITE 11

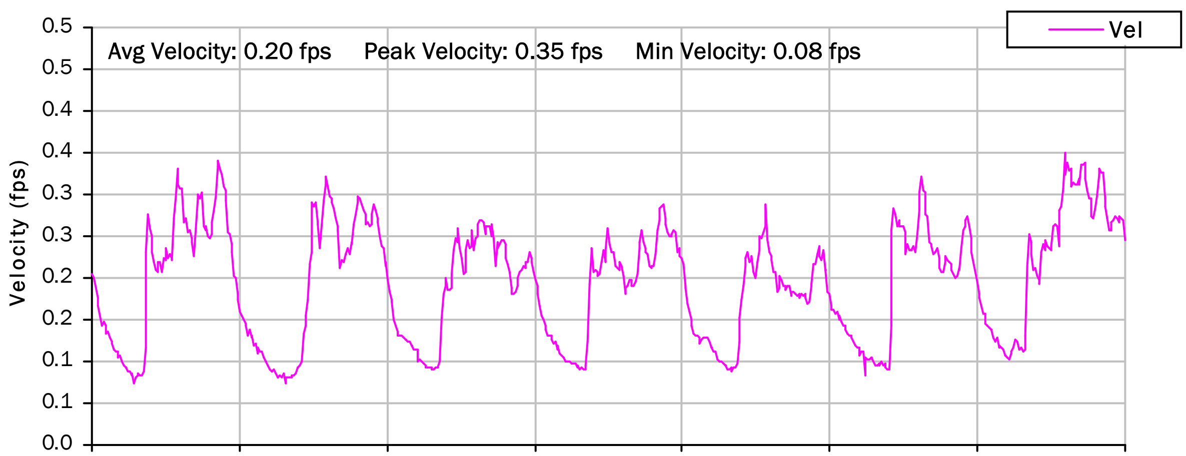
Weekly Level, Velocity and Flow Hydrographs

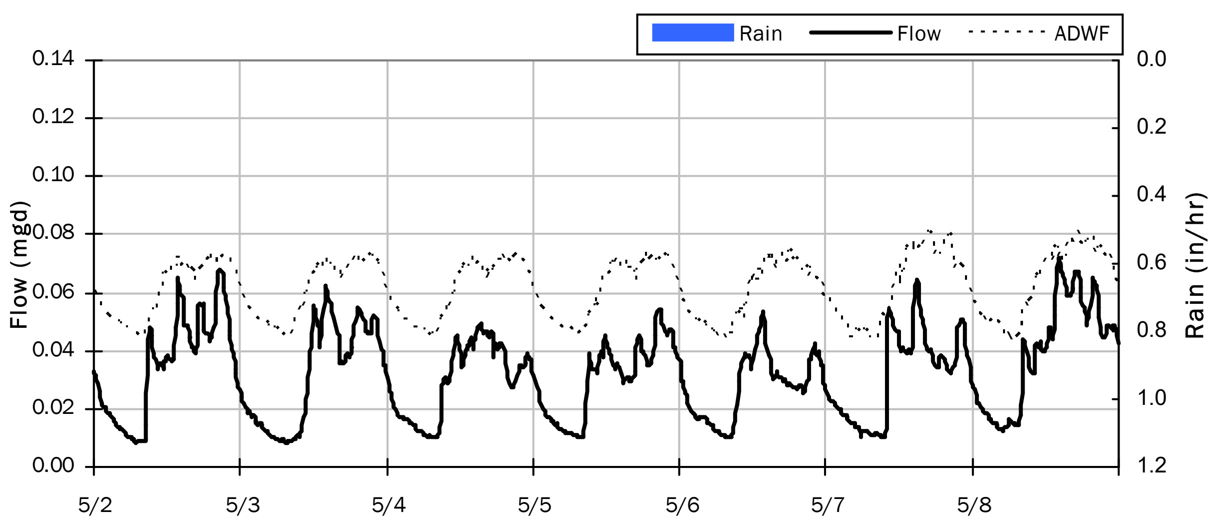
4/25/2022 to 5/2/2022



SITE 11
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022





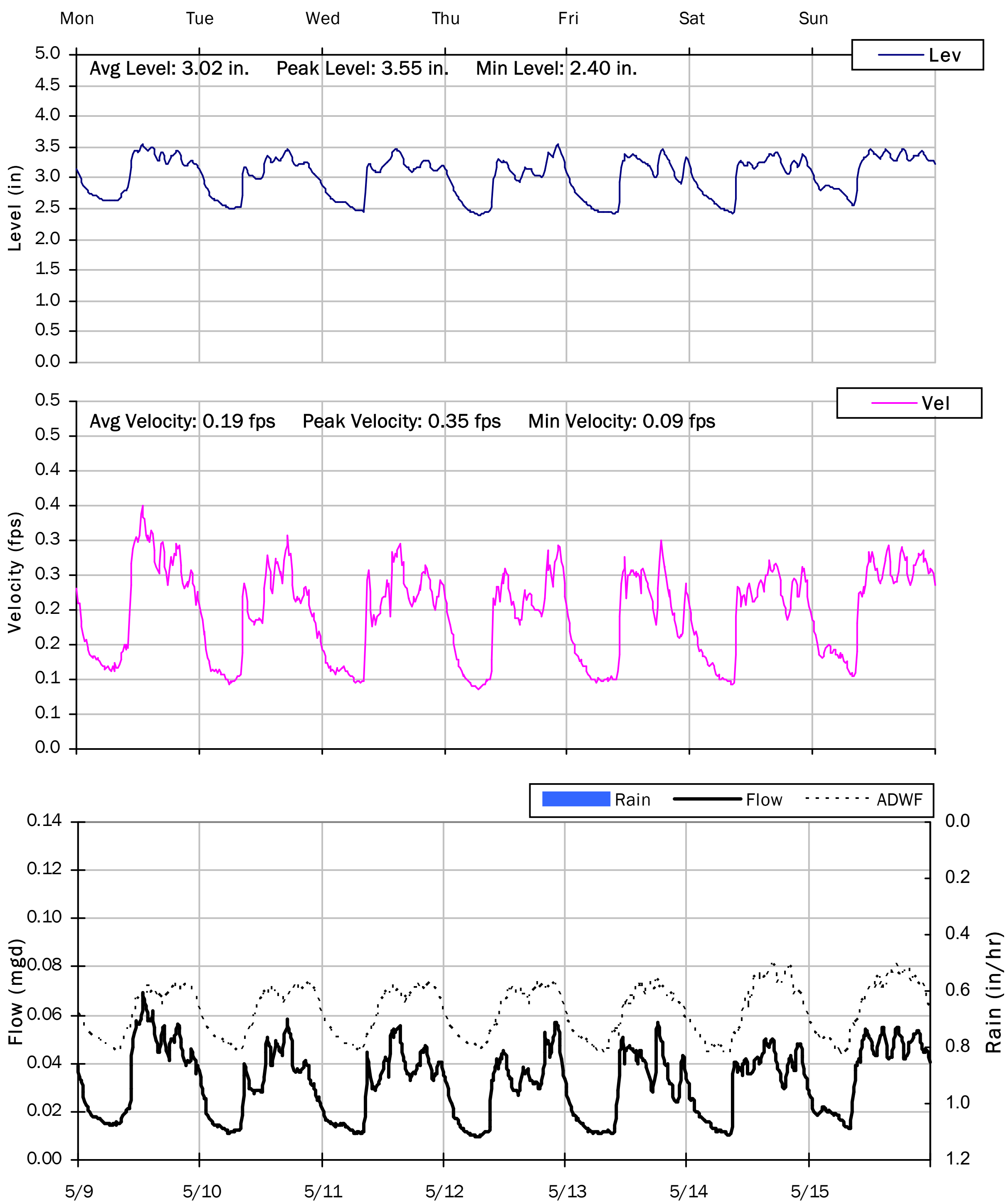


Avg Flow: 0.032 mgd Peak Flow: 0.072 mgd Min Flow: 0.008 mgd

SITE 11

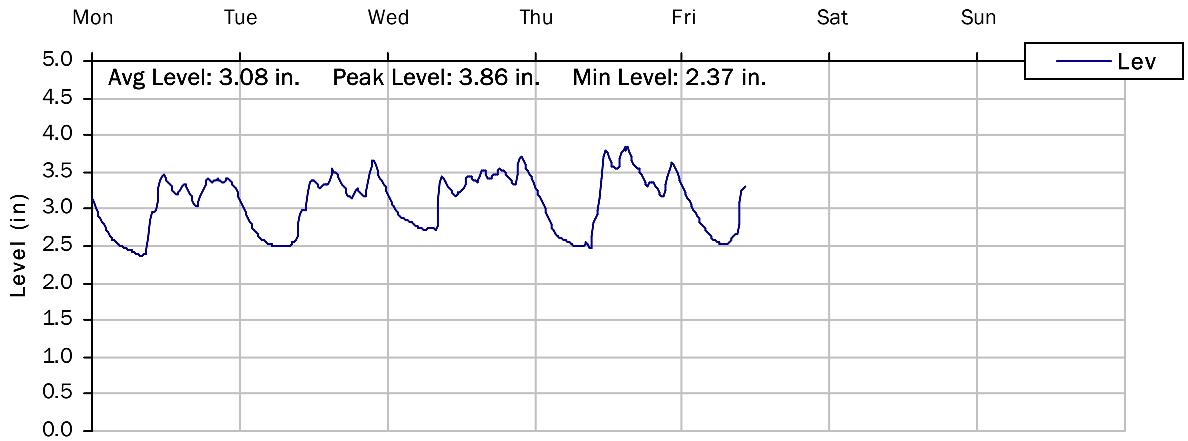
Weekly Level, Velocity and Flow Hydrographs

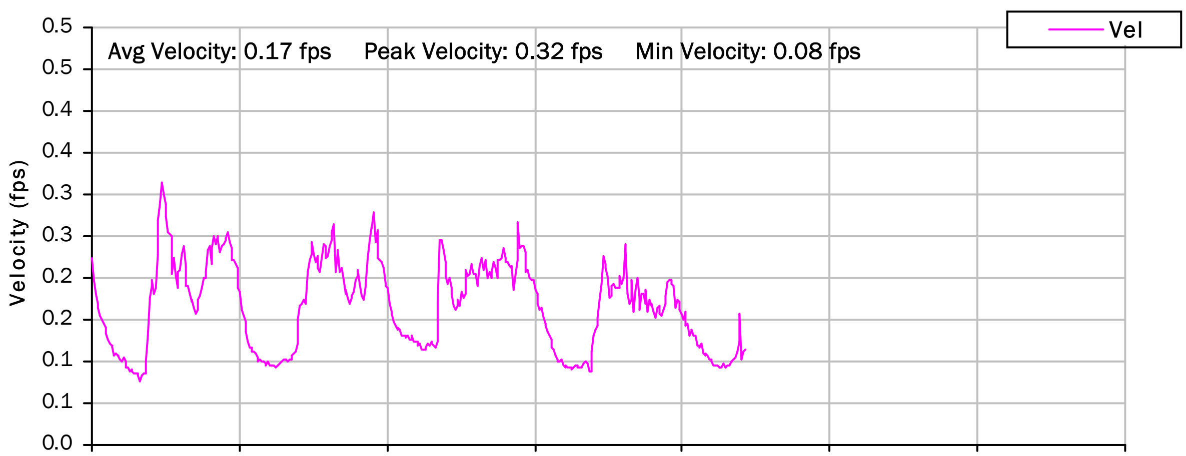
5/9/2022 to 5/16/2022

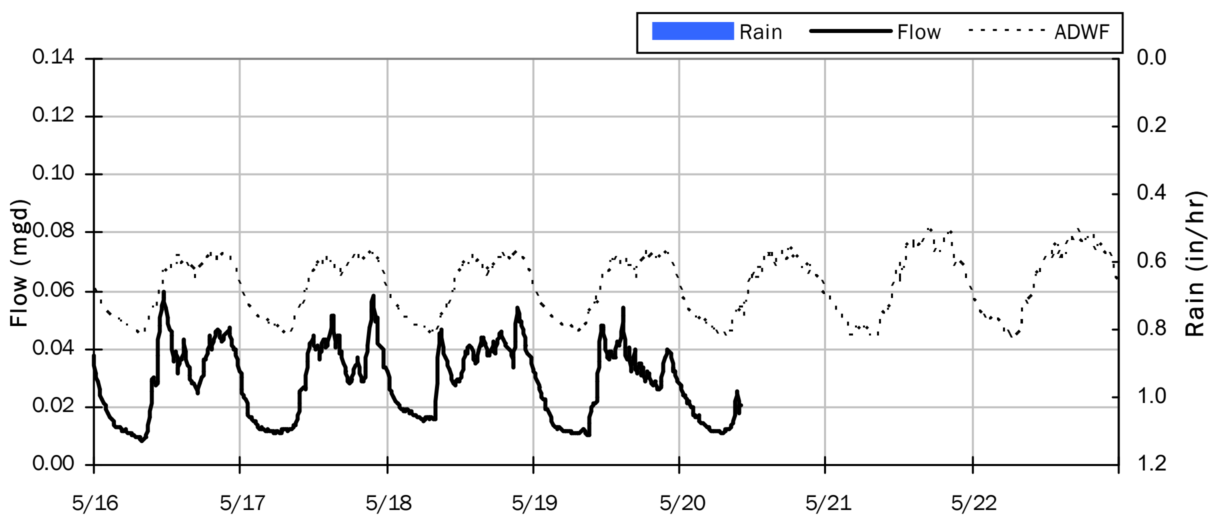


Avg Flow: 0.032 mgd Peak Flow: 0.069 mgd Min Flow: 0.010 mgd

SITE 11
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Avg Flow: 0.028 mgd Peak Flow: 0.060 mgd Min Flow: 0.008 mgd

Monitoring Site: Site 12

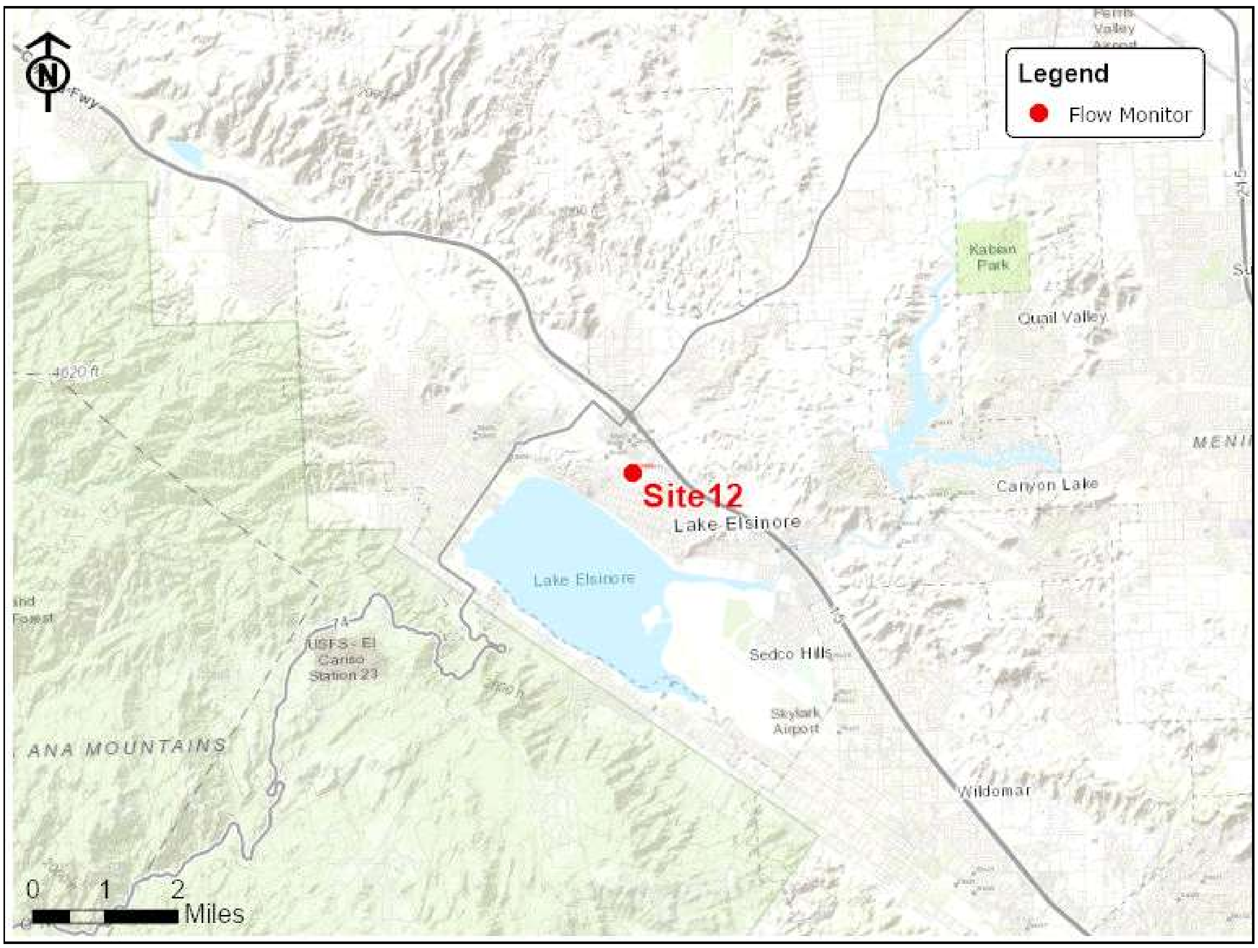
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Easement off Chaney St

Data Summary Report



Vicinity Map: Site 12

SITE 12

Site Information MH ID: MH-1464

Location: Easement off Chaney St

Coordinates: 117.3373° W, 33.6804° N

Rim Elevation (Earth): 1274 feet

Expected Pipe Diameter: 24 inches

Measured Pipe Diameter: 24 inches

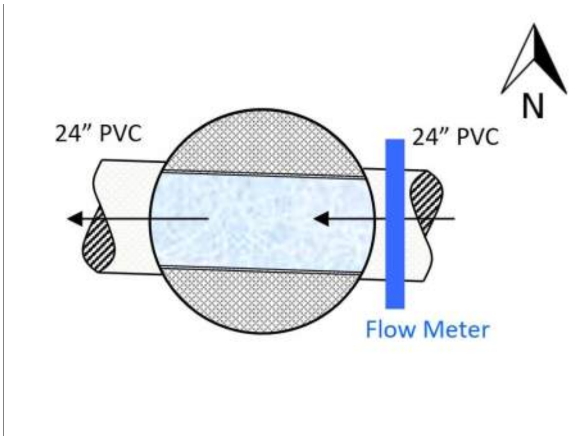
ADWF: 0.116 mgd

Peak Measured Flow: 0.221 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch

View from Street

Plan View

SITE 12

Additional Site Photos

Effluent Pipe

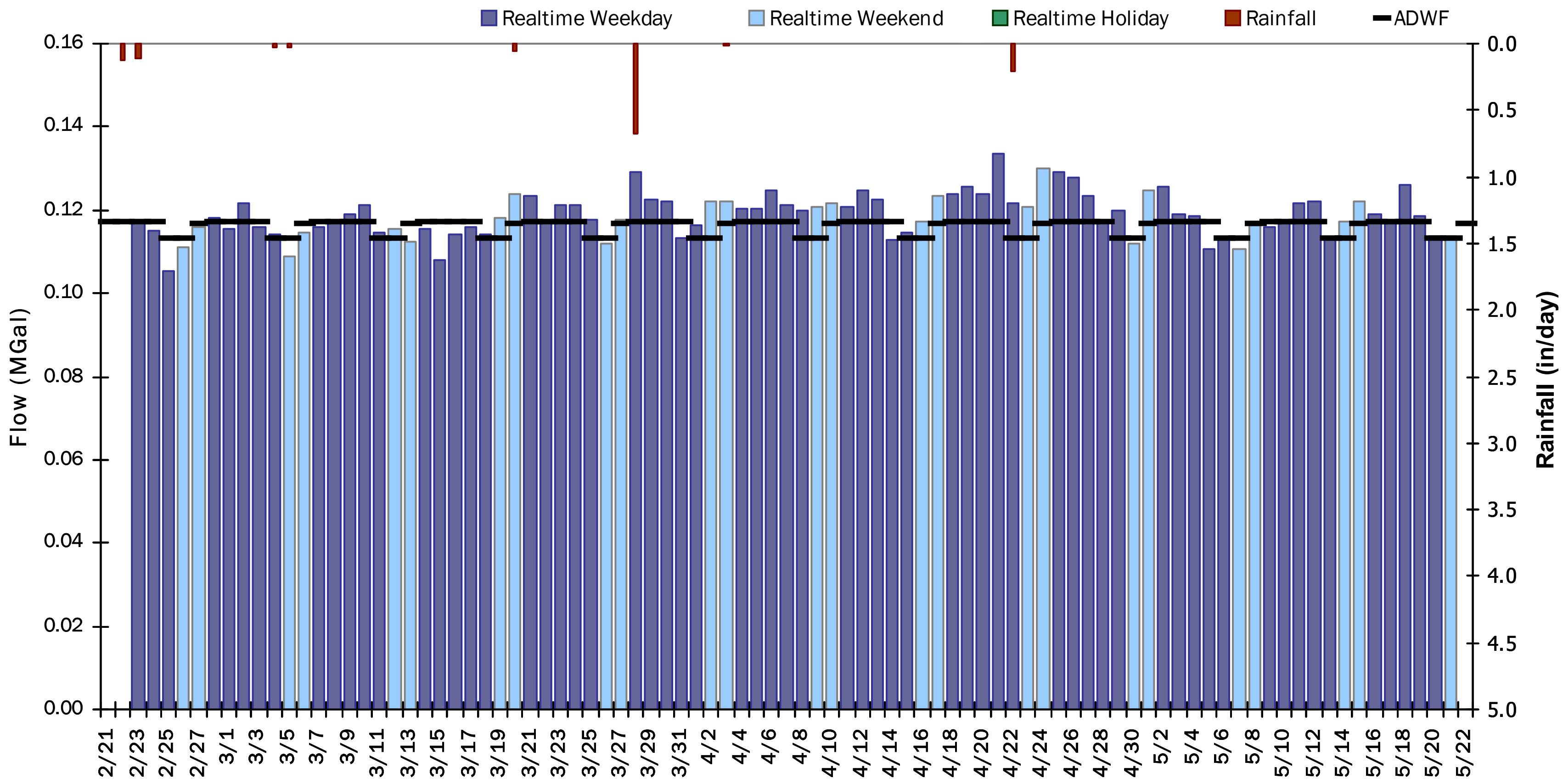
Influent Pipe

SITE 12

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.119 MGal   Peak Daily Flow: 0.141 MGal   Min Daily Flow: 0.105 MGal

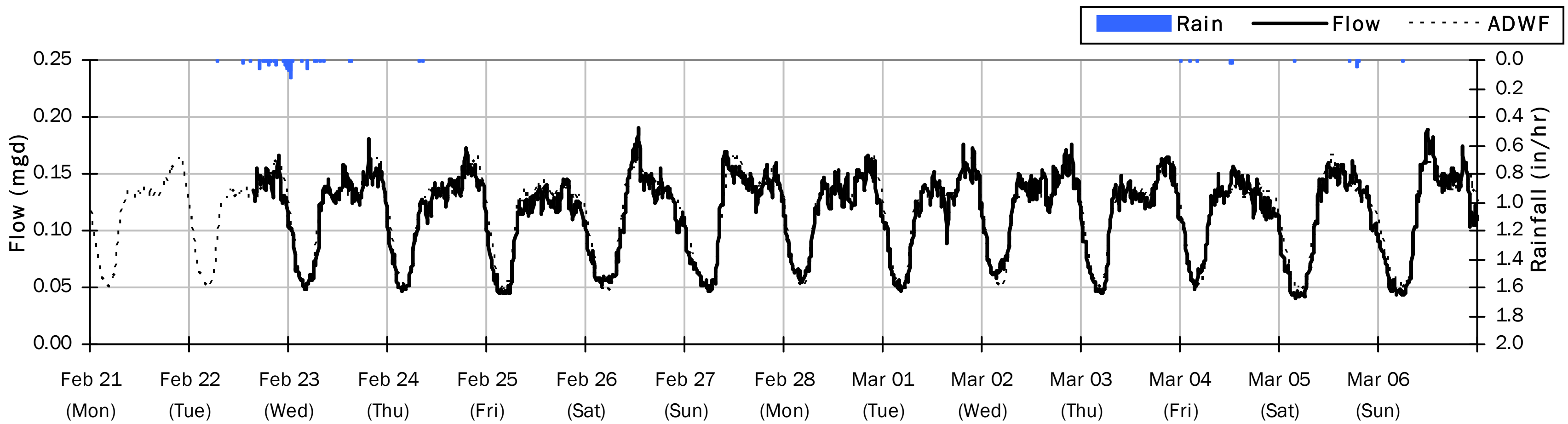
Total Rainfall: 1.23 inches

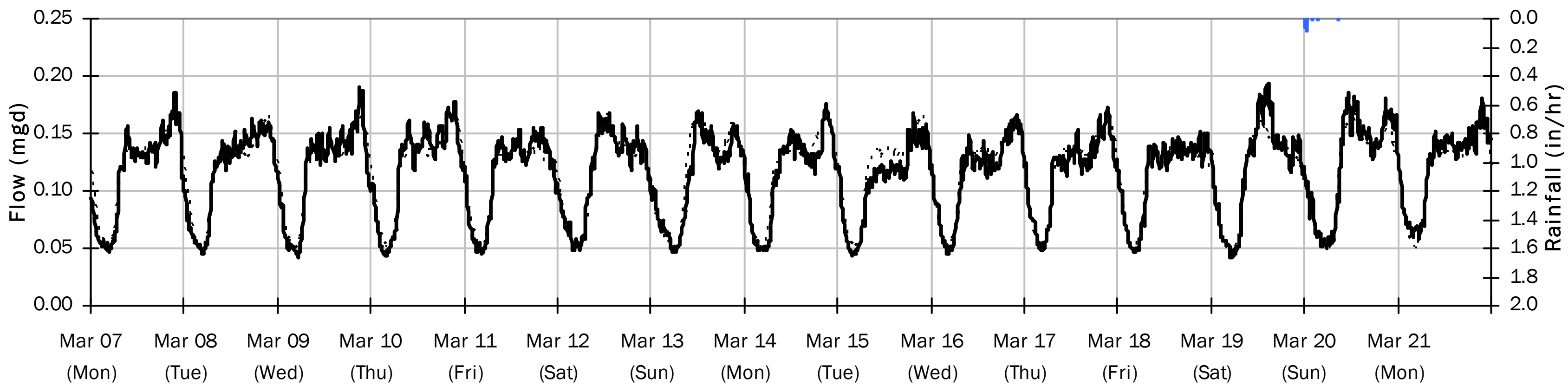


SITE 12

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.34 inches   Period Avg Flow: 0.116 mgd   Period Peak Flow: 0.193 mgd   Period Min Flow: 0.041 mgd

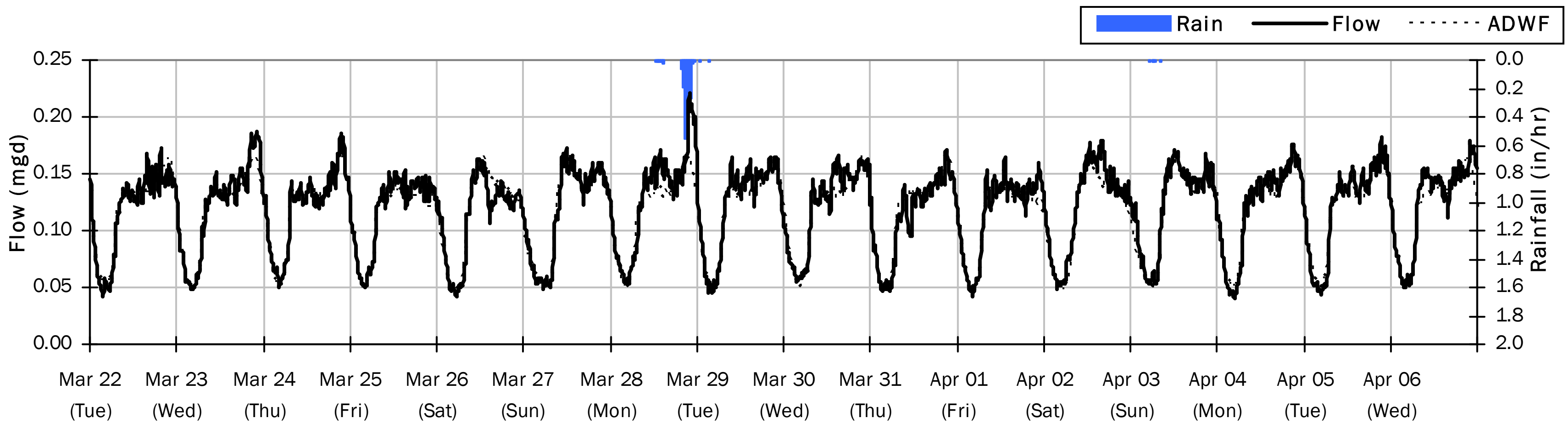


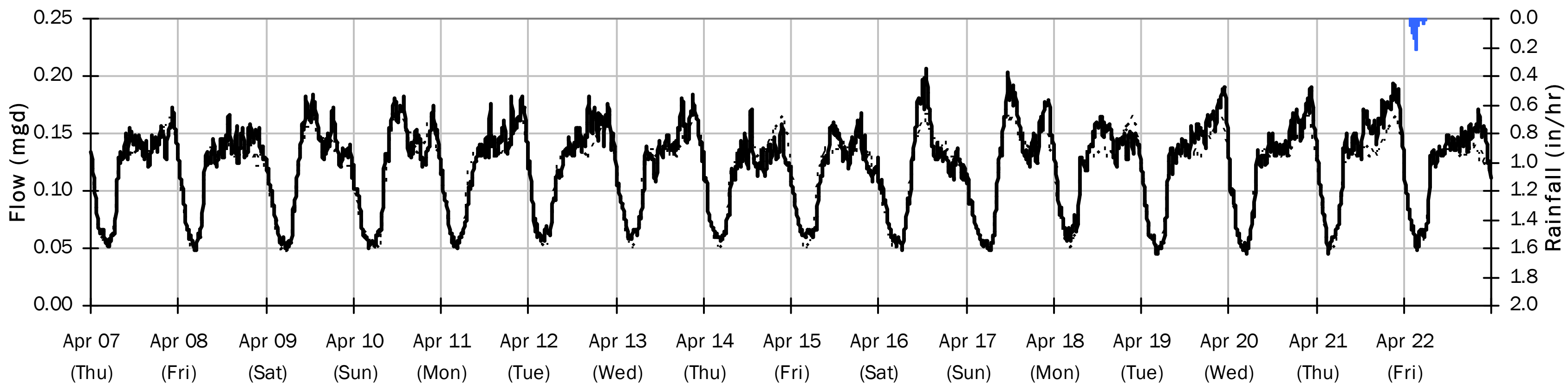


SITE 12
Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.90 inches

Period Avg Flow: 0.121 mgd Period Peak Flow: 0.221 mgd Period Min Flow: 0.041 mgd

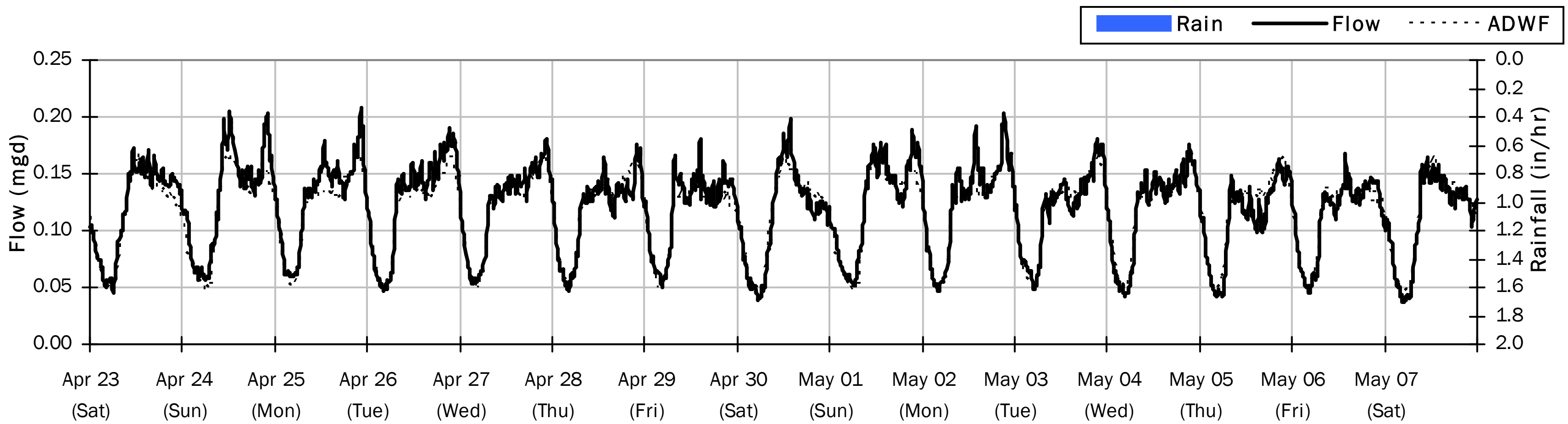


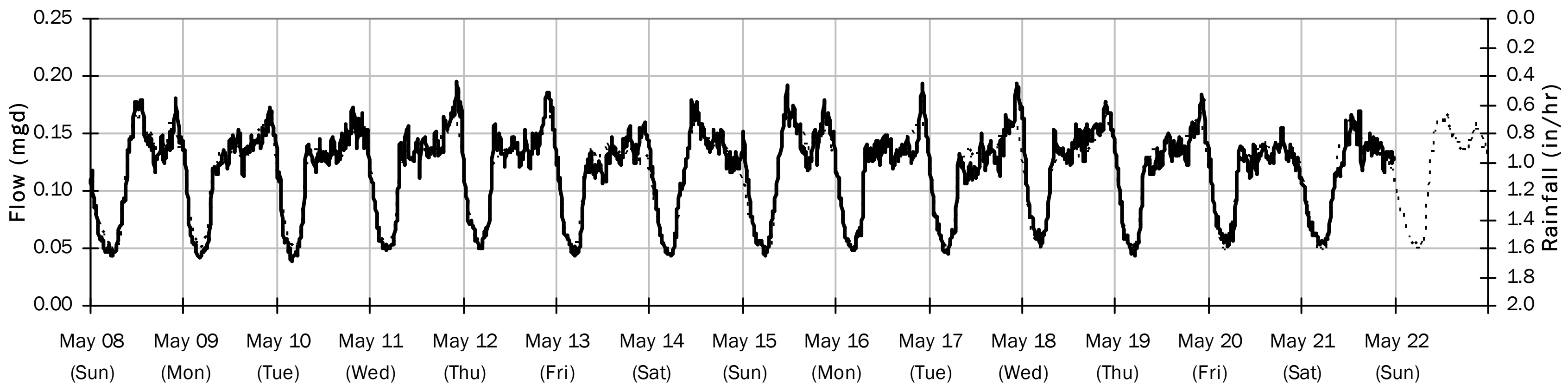


SITE 12

Flow Summary: 4/23/2022 to 5/22/2022

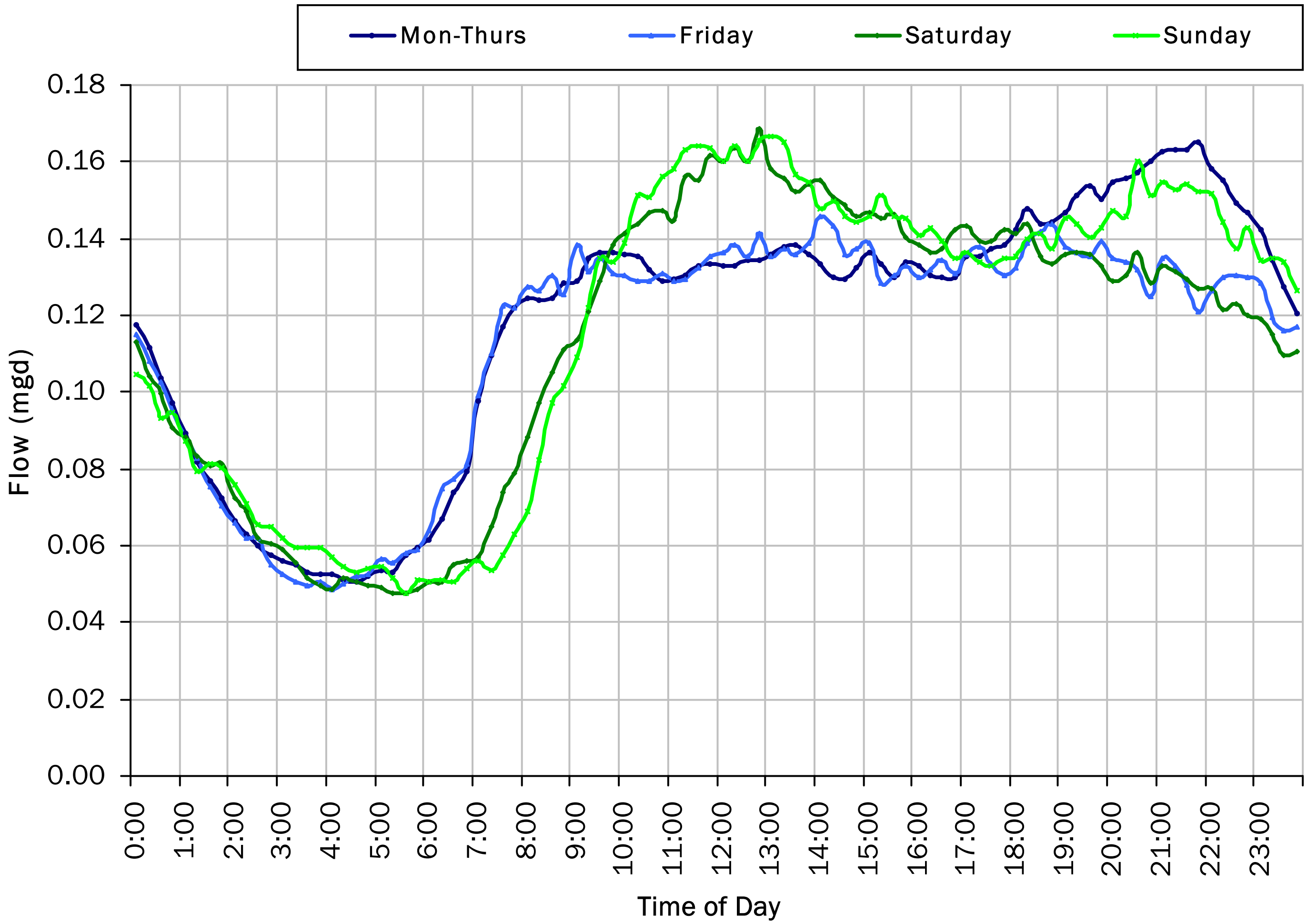
Period Rainfall: 0.00 inches   Period Avg Flow: 0.119 mgd   Period Peak Flow: 0.207 mgd   Period Min Flow: 0.037 mgd





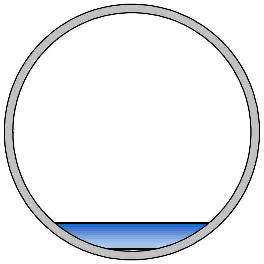
SITE 12

Average Dry Weather Flow Hydrographs



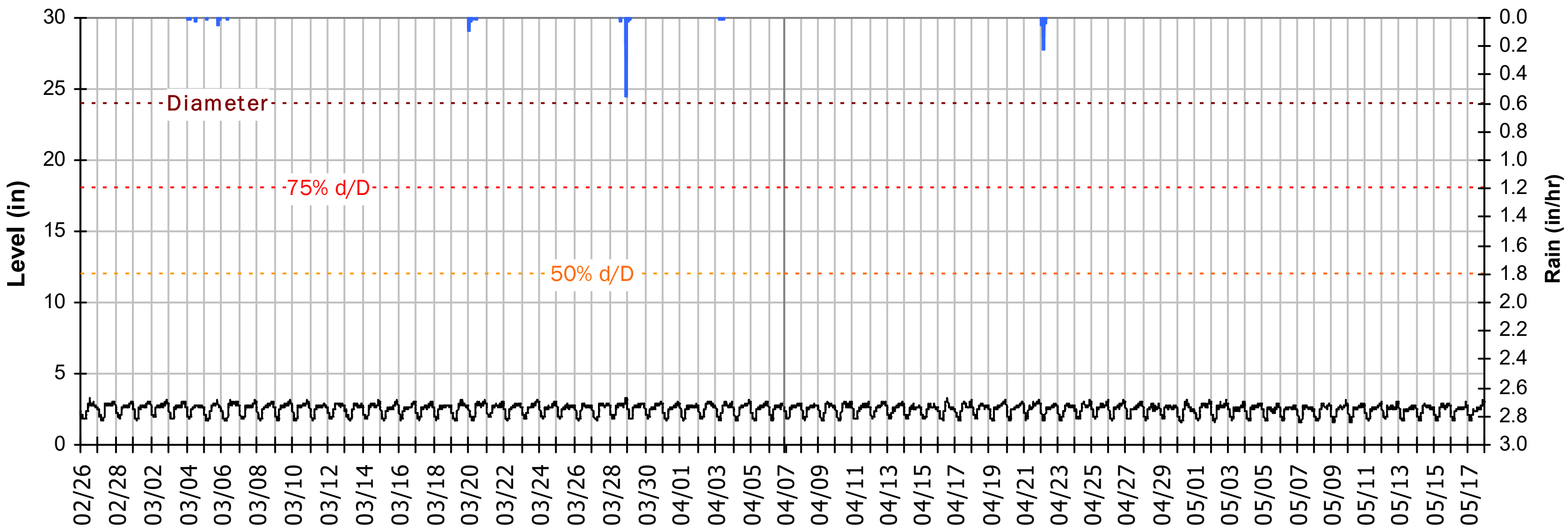
ADWF:

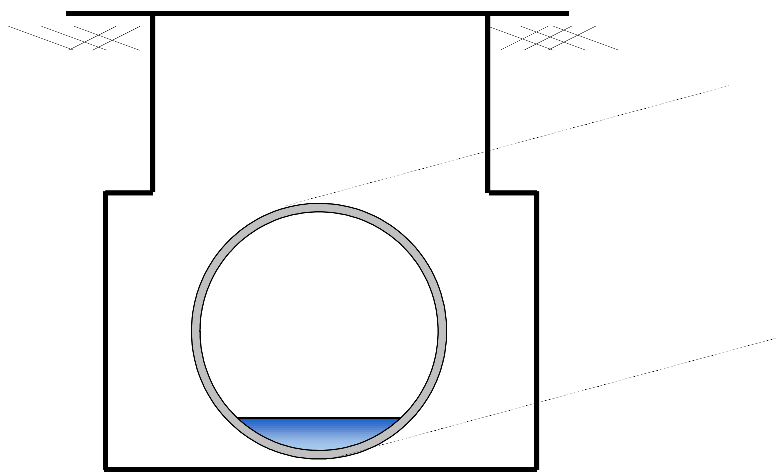
0.116 *mgd*



SITE 12
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

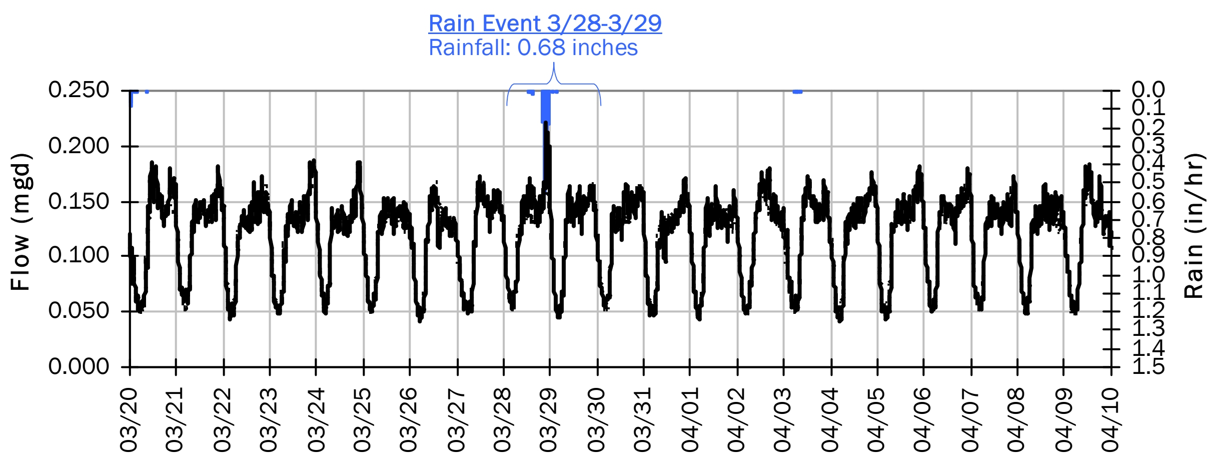




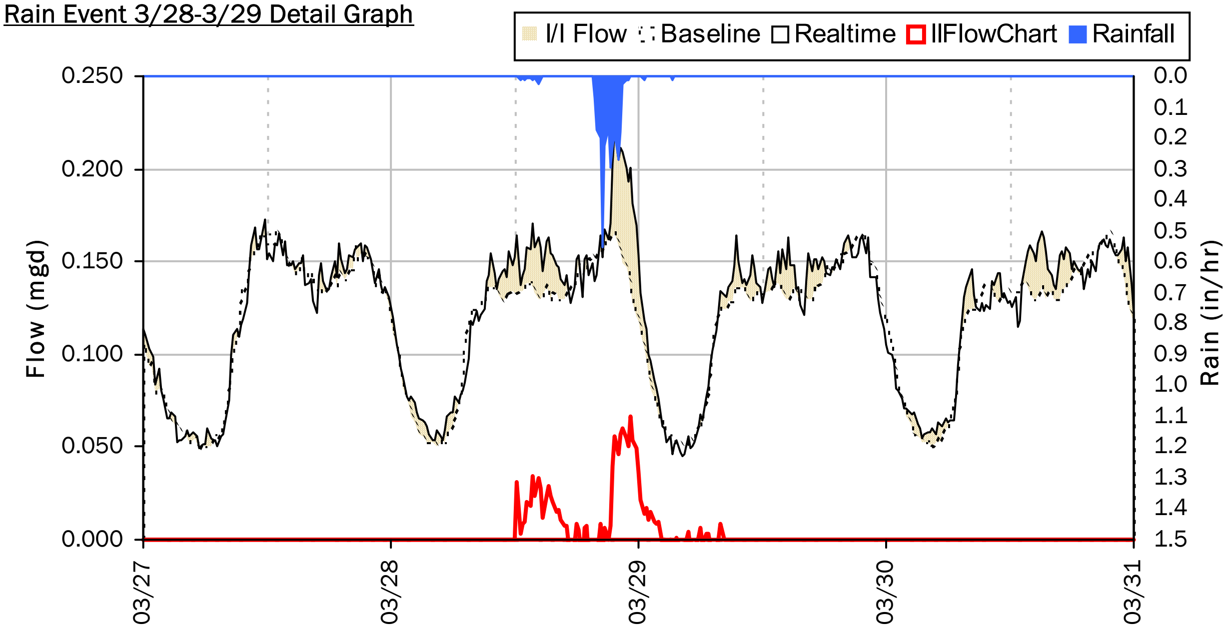
Pipe Diameter:	24	*inches*
Peak Measured Level:	3.28	*inches*
Peak d/D Ratio:	0.14	

SITE 12
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.68 inches)

Capacity

Peak Flow:	0.221 *mgd*
PF:	1.90
Peak Level:	3.23 *in*
d/D Ratio:	0.13

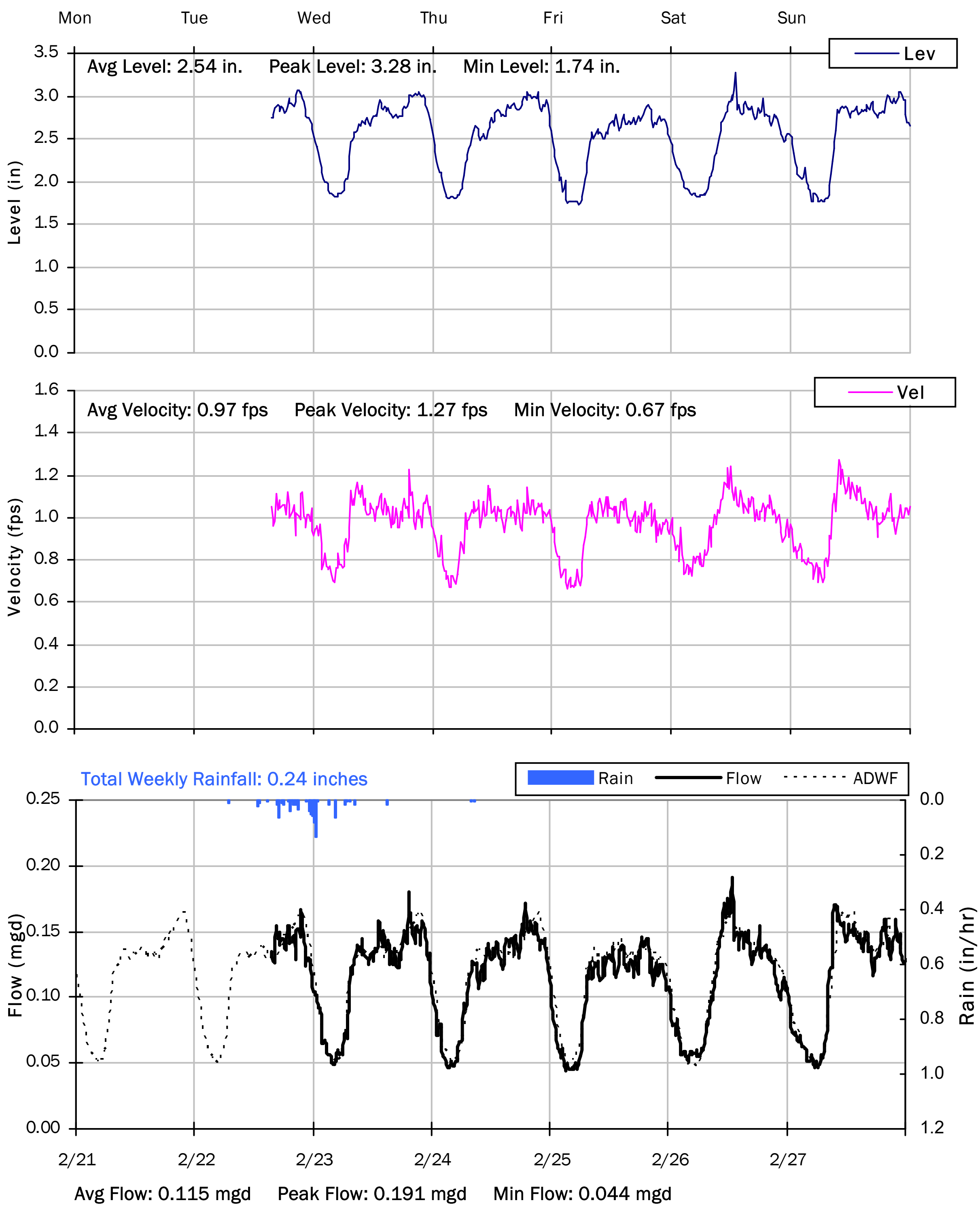
Inflow / Infiltration

Peak I/I Rate:	0.066 *mgd*
Total I/I:	10,000 *gallons*

SITE 12

Weekly Level, Velocity and Flow Hydrographs

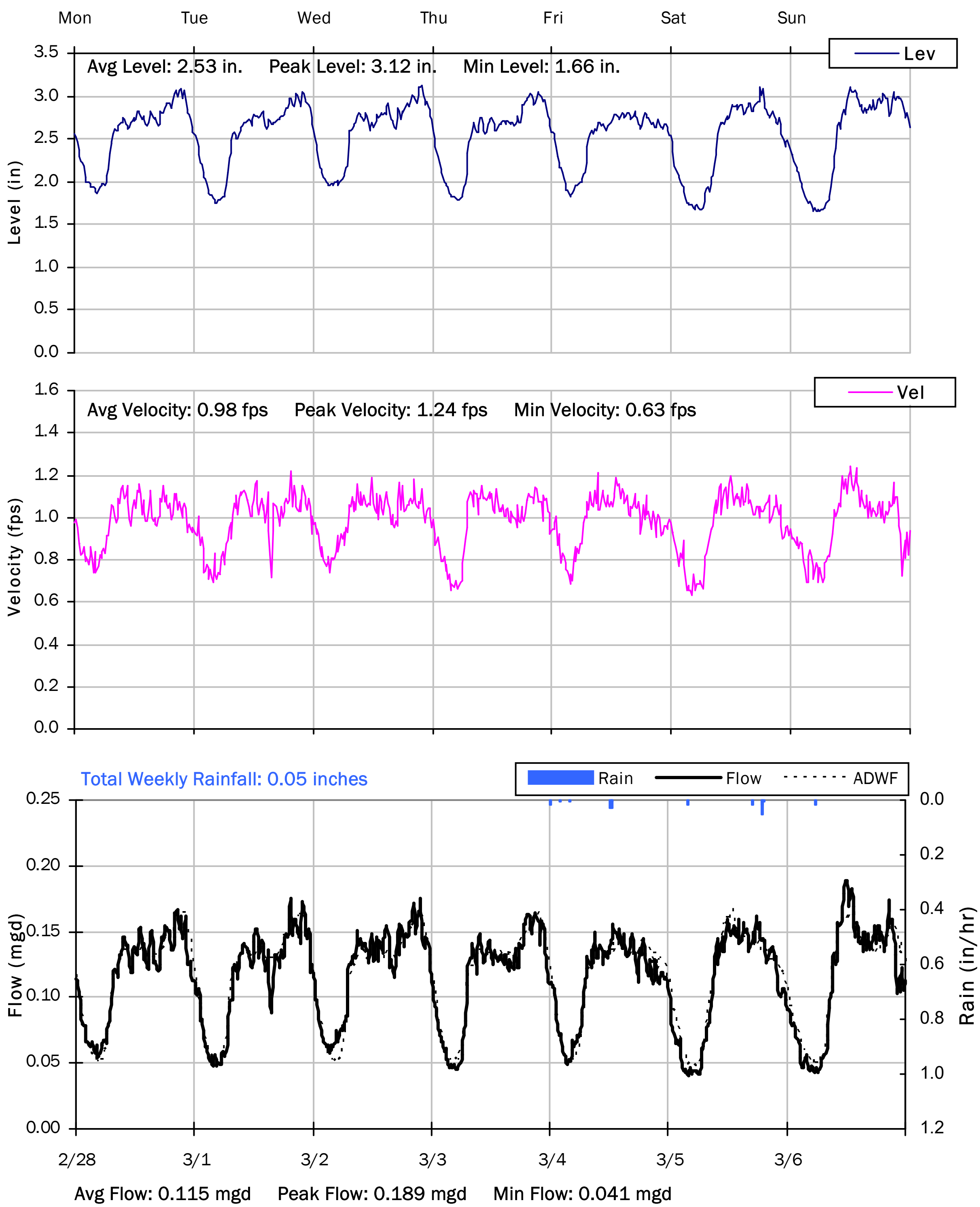
2/21/2022 to 2/28/2022



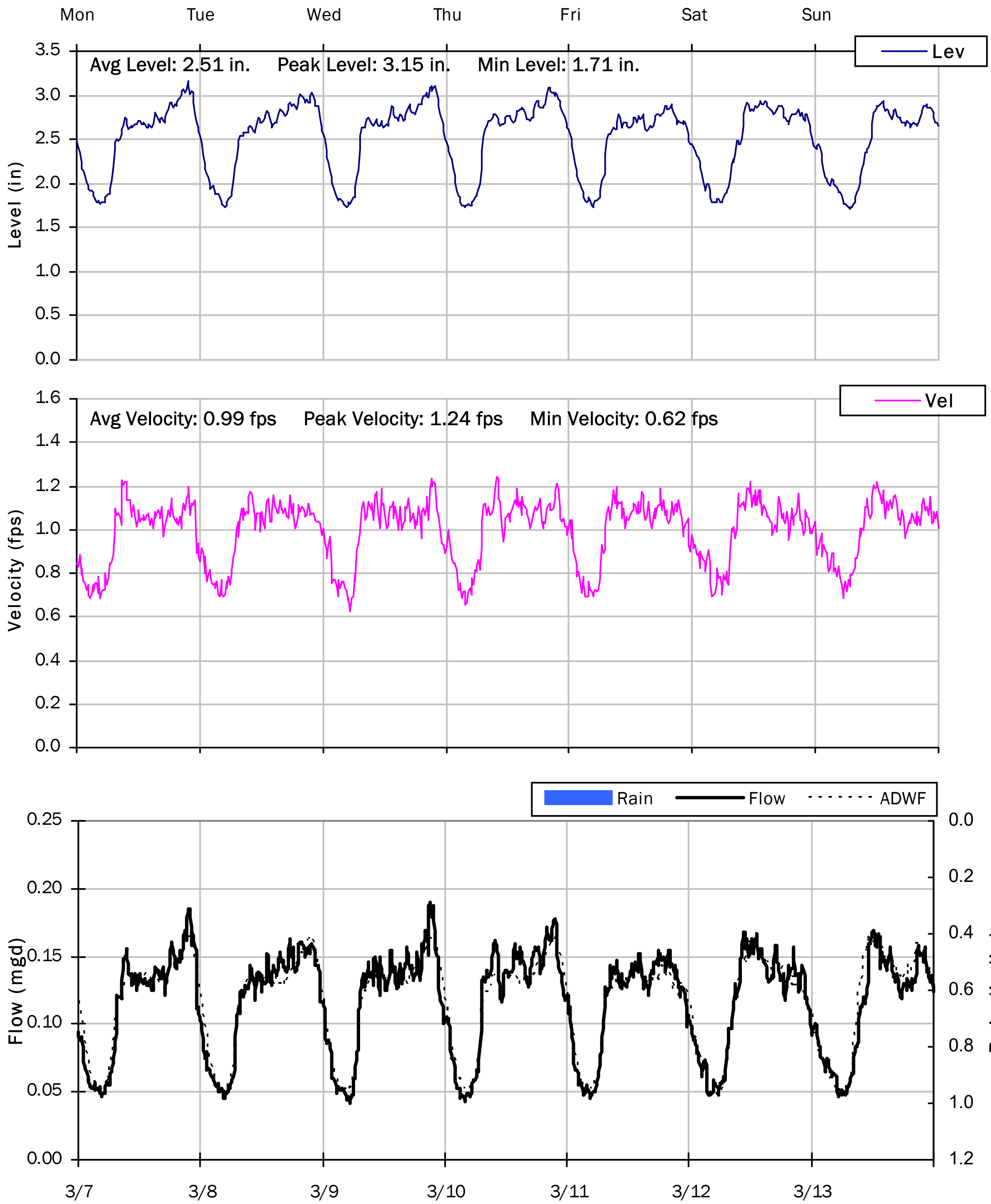
SITE 12

Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022



SITE 12
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

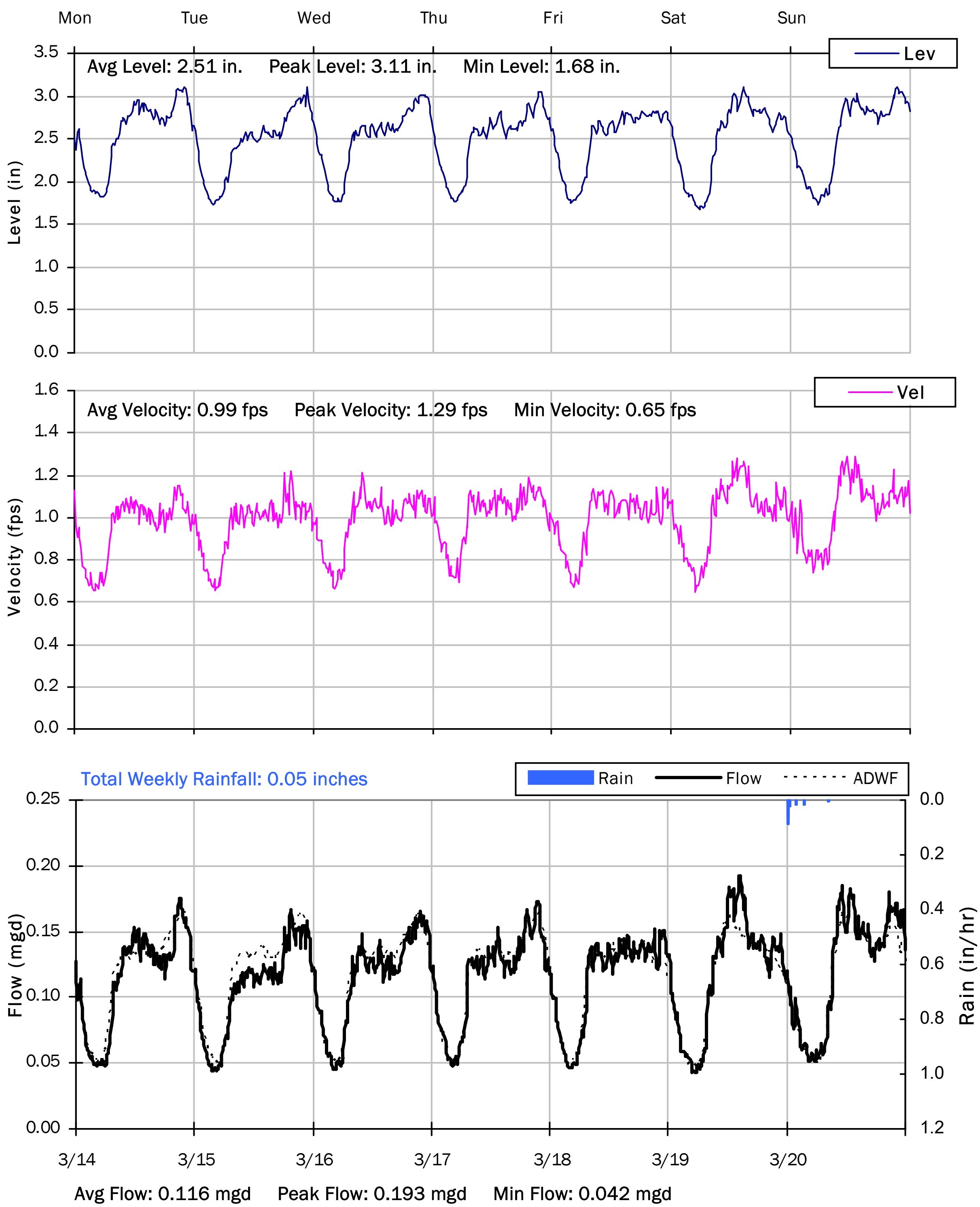


Avg Flow: 0.117 mgd Peak Flow: 0.190 mgd Min Flow: 0.042 mgd

SITE 12

Weekly Level, Velocity and Flow Hydrographs

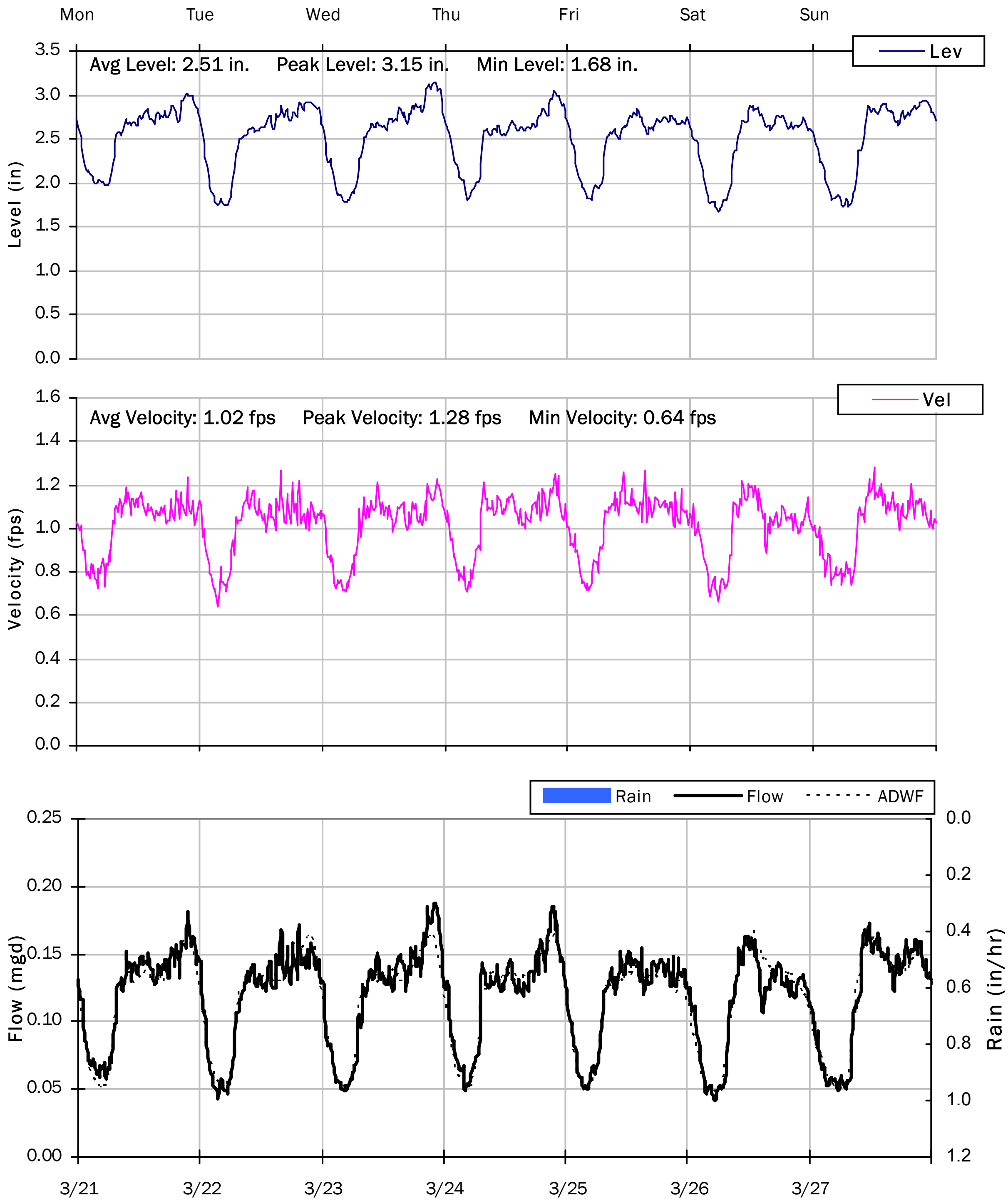
3/14/2022 to 3/21/2022



SITE 12

Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022

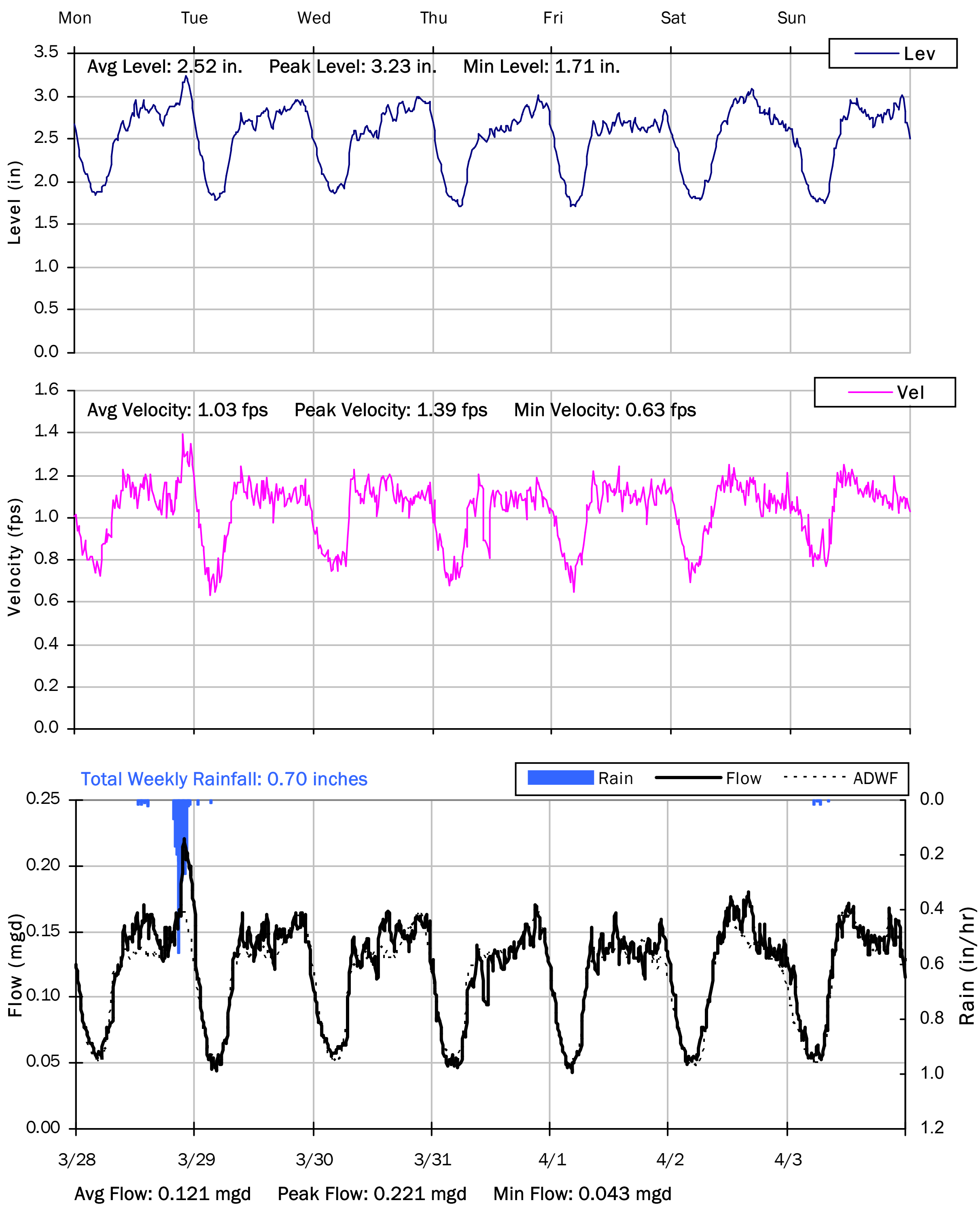


Avg Flow: 0.119 mgd   Peak Flow: 0.188 mgd   Min Flow: 0.041 mgd

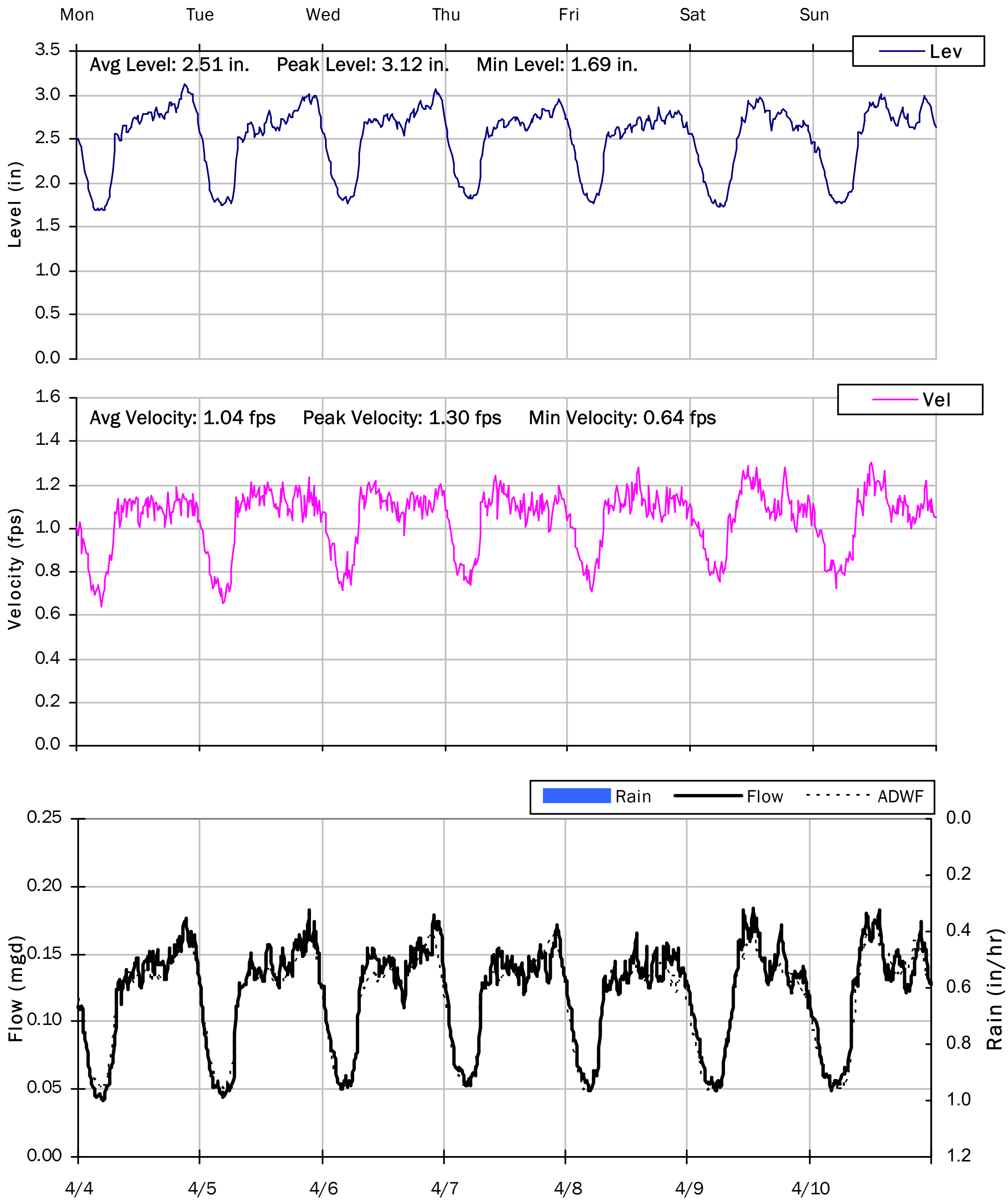
SITE 12

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

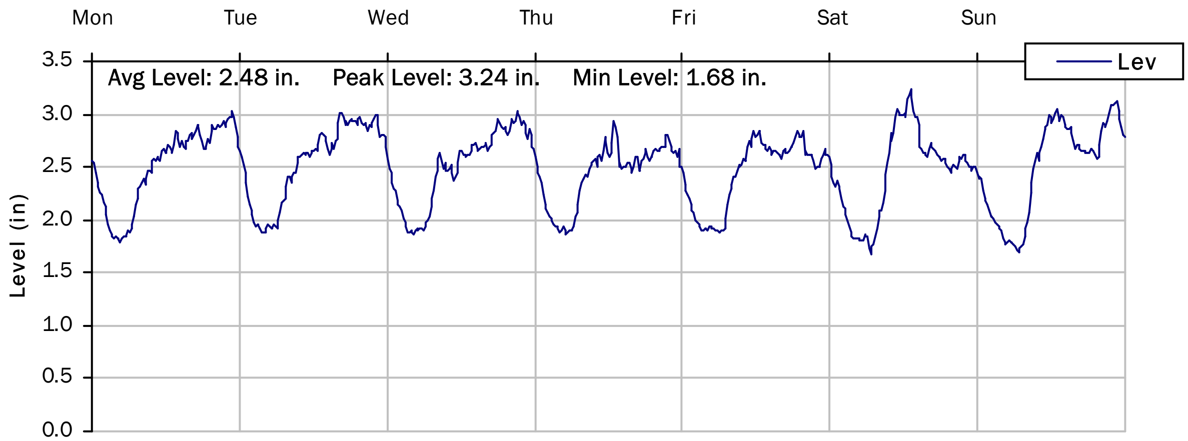


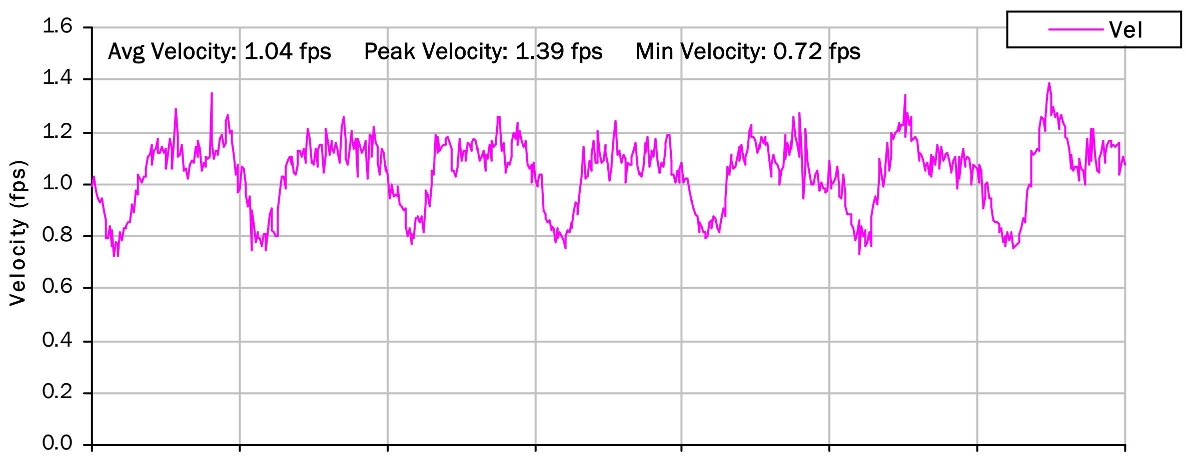
SITE 12
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

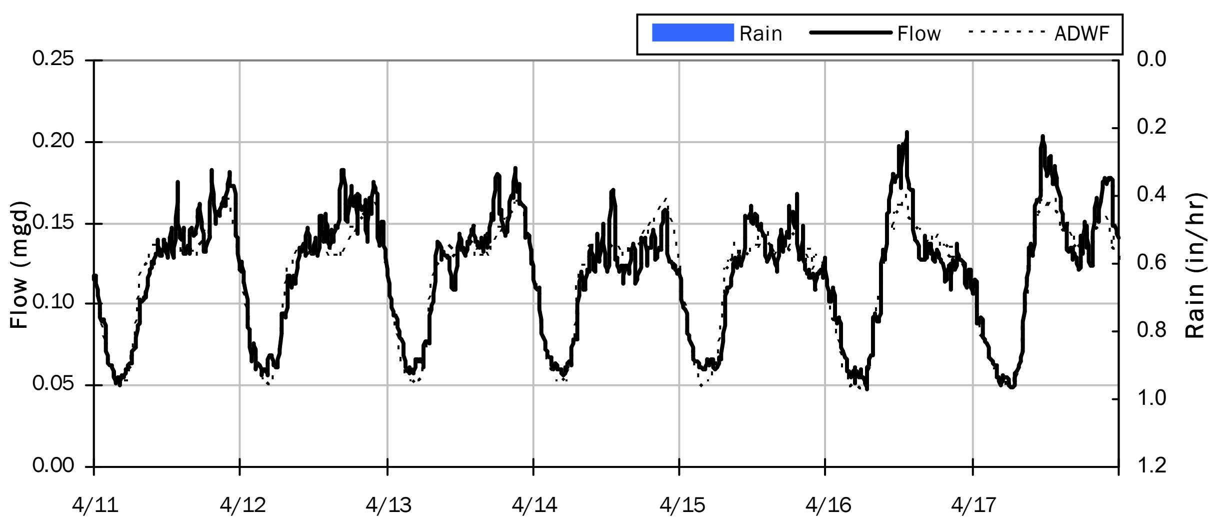


Avg Flow: 0.121 mgd   Peak Flow: 0.183 mgd   Min Flow: 0.041 mgd

SITE 12
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

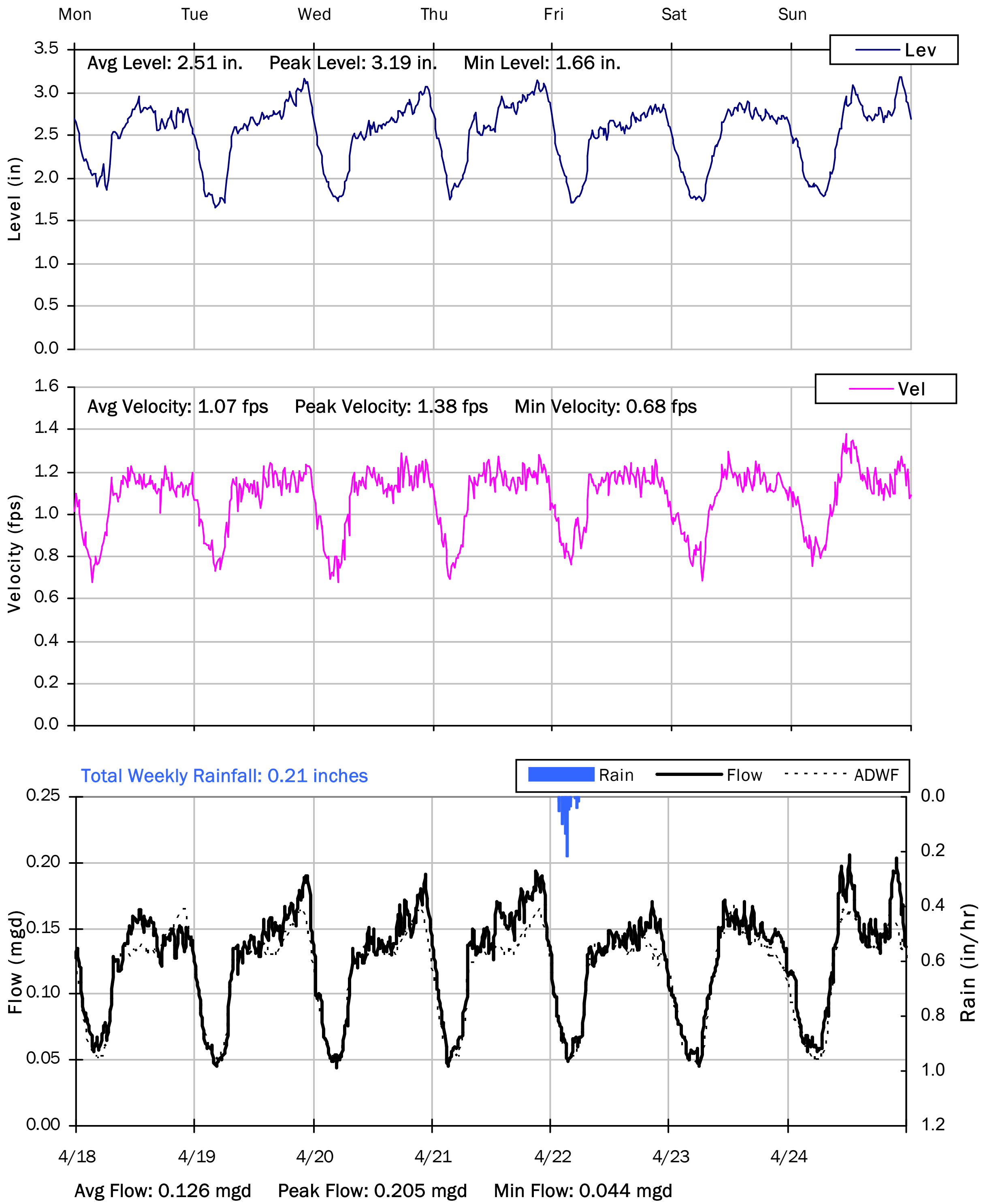






Avg Flow: 0.119 mgd   Peak Flow: 0.206 mgd   Min Flow: 0.048 mgd

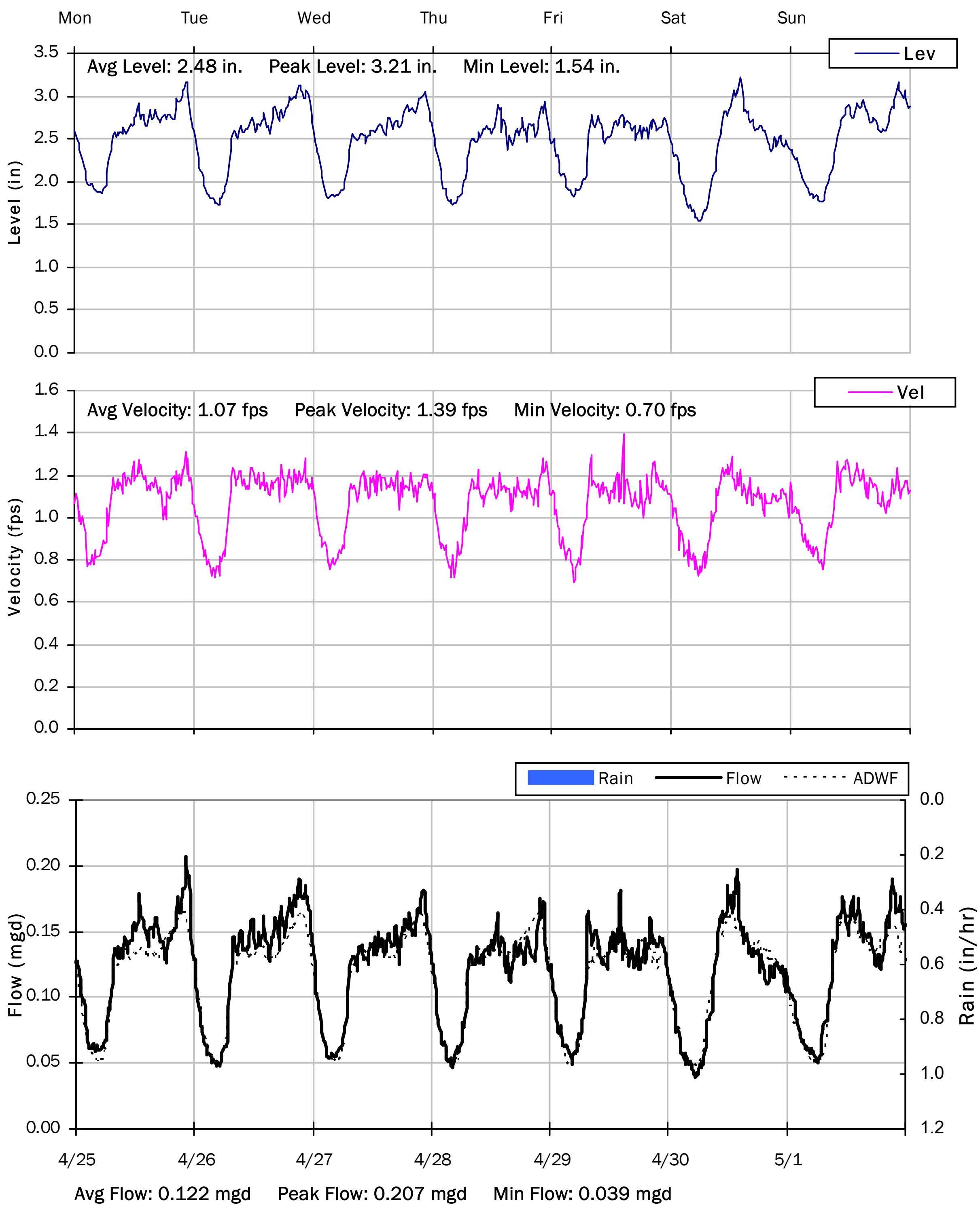
SITE 12
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



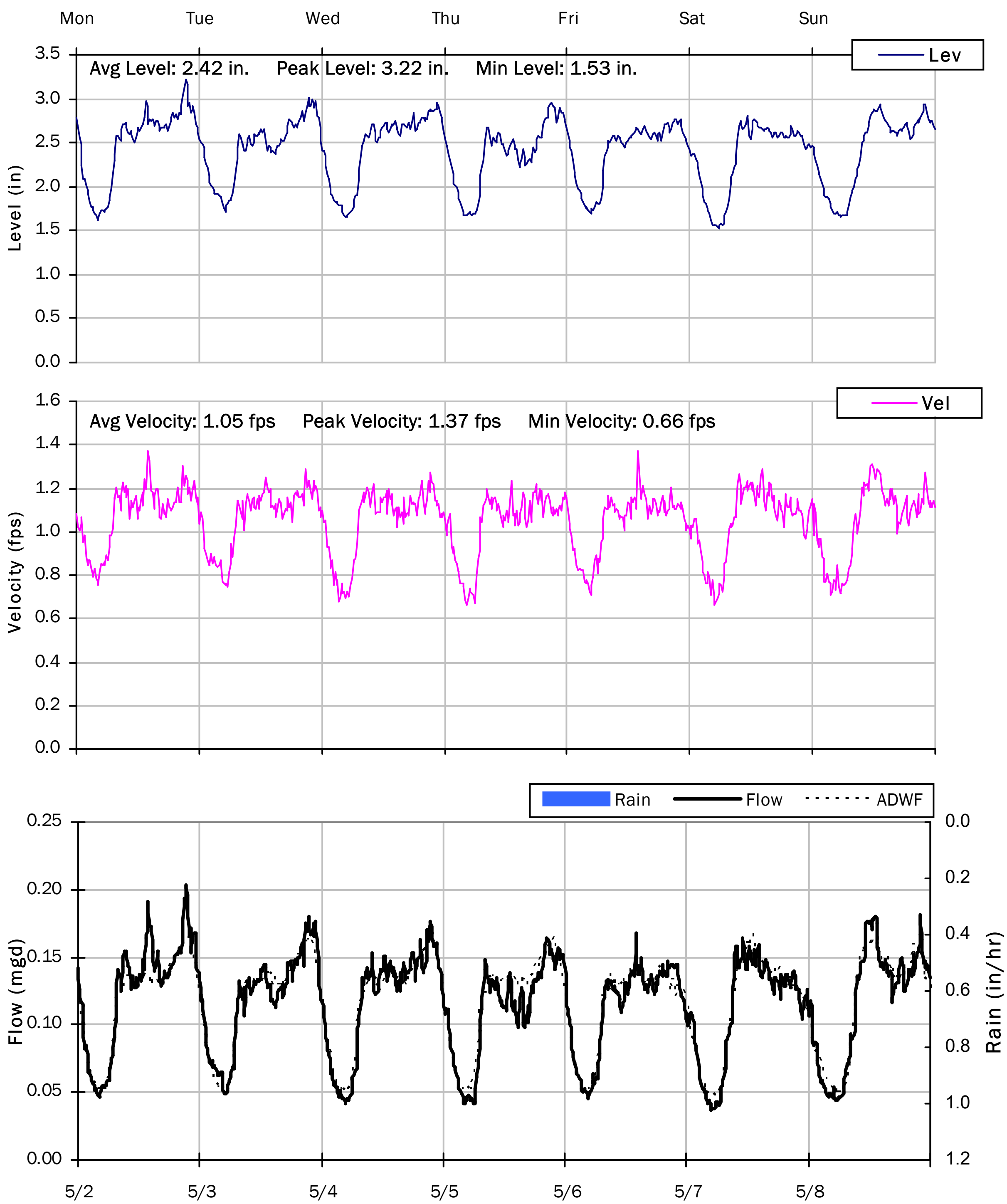
SITE 12

Weekly Level, Velocity and Flow Hydrographs

4/25/2022 to 5/2/2022

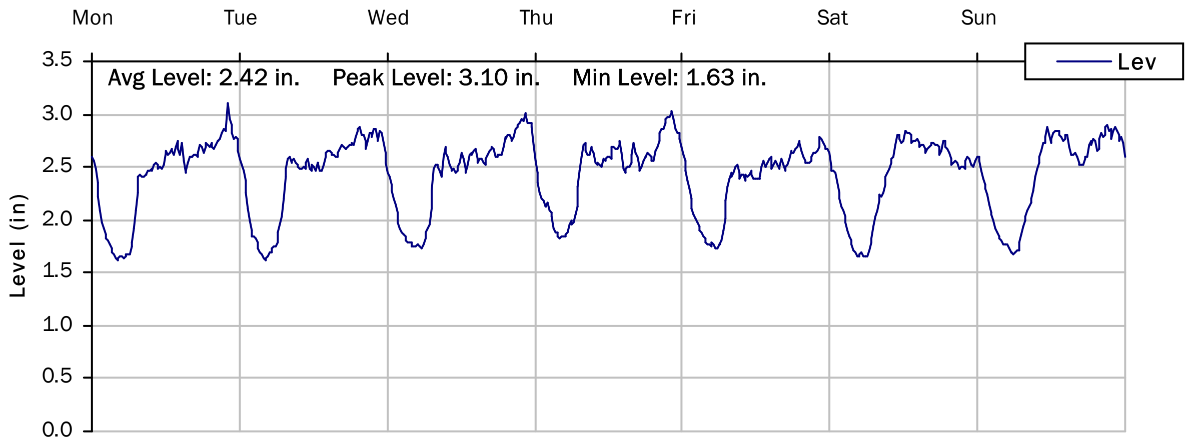


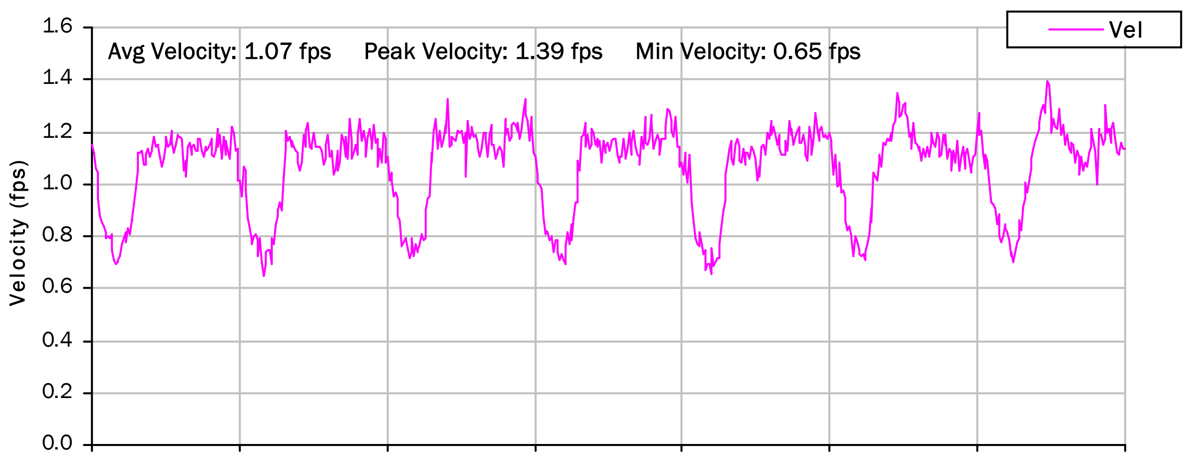
SITE 12
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

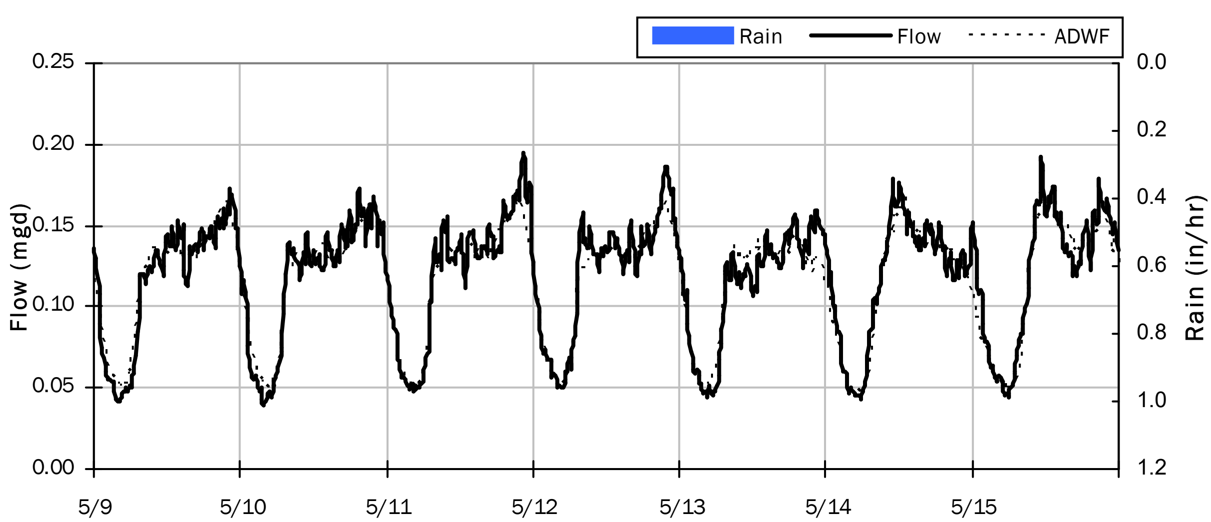


Avg Flow: 0.116 mgd Peak Flow: 0.204 mgd Min Flow: 0.037 mgd

SITE 12
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022

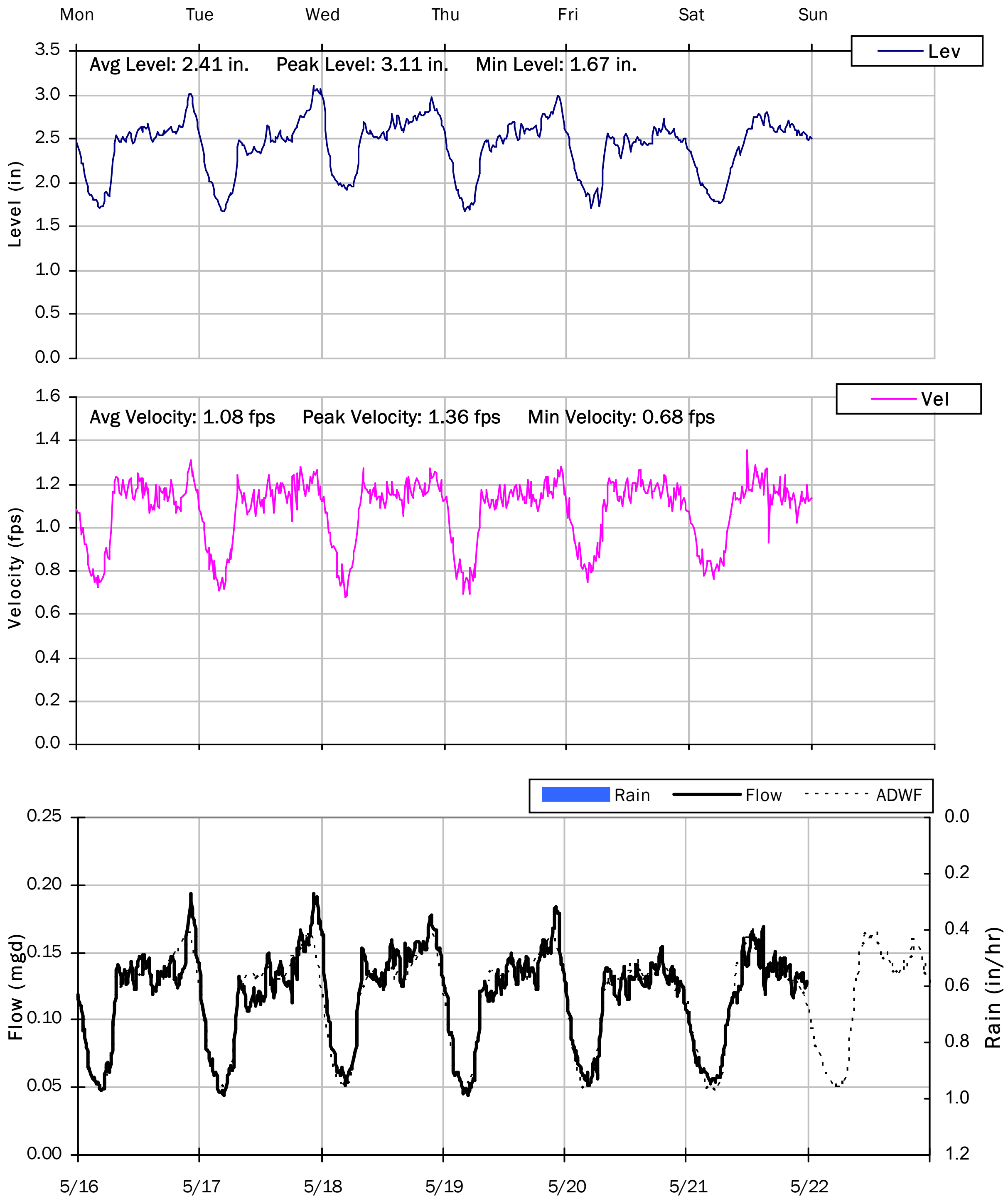






Avg Flow: 0.119 mgd Peak Flow: 0.195 mgd Min Flow: 0.039 mgd

SITE 12
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022



Avg Flow: 0.118 mgd   Peak Flow: 0.194 mgd   Min Flow: 0.044 mgd

Monitoring Site: Site 13

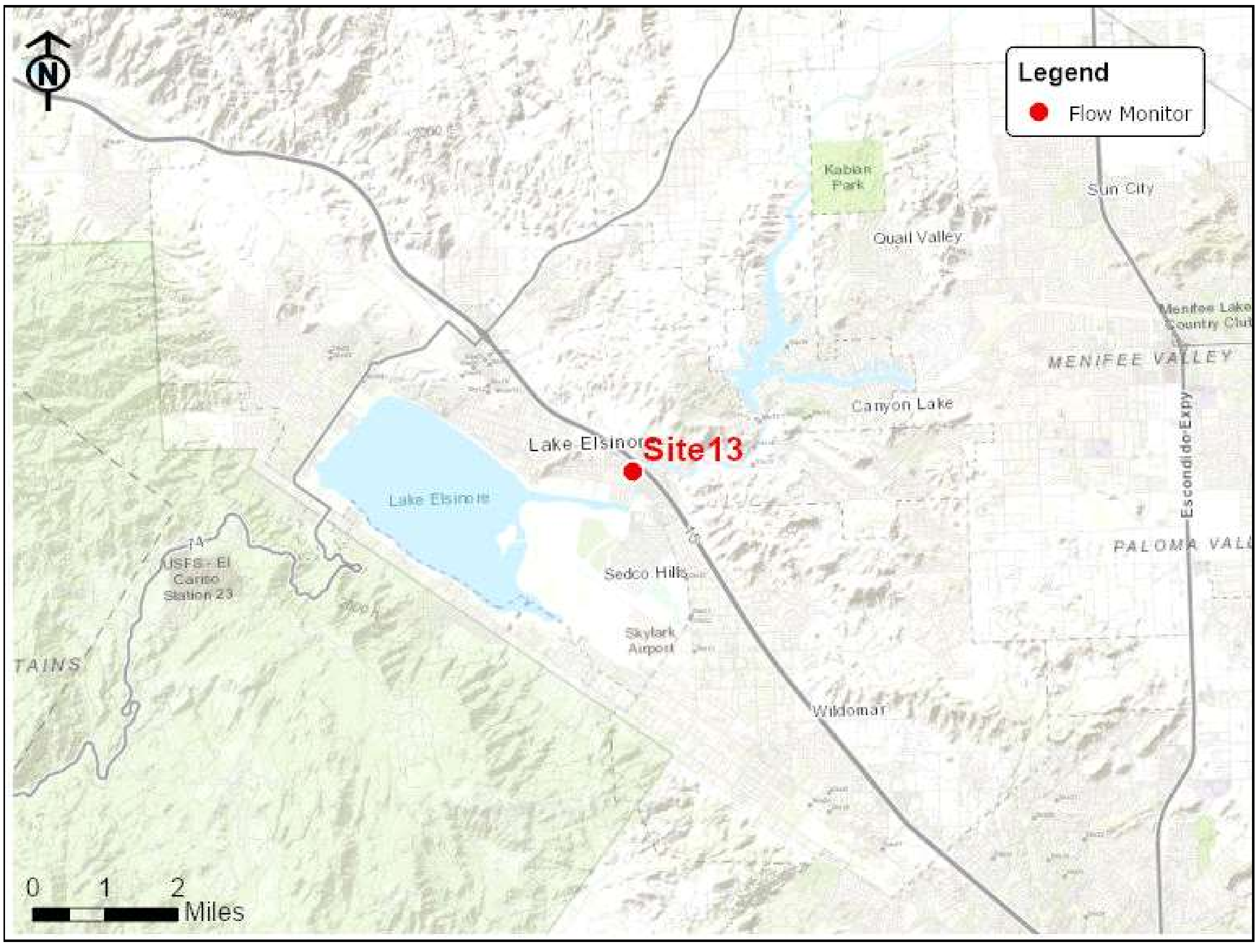
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Casino Drive, east of Avenue 12

Data Summary Report



Vicinity Map: Site 13

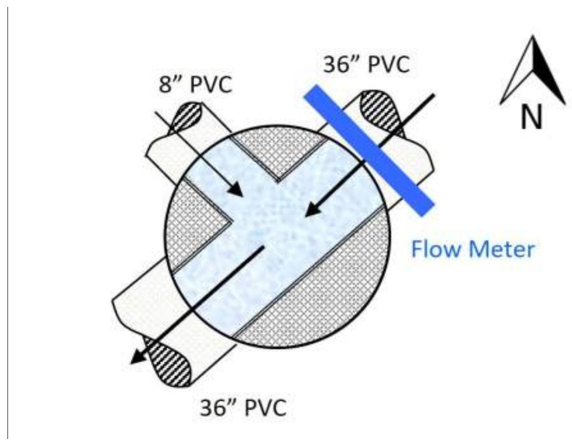
SITE 13

Site Information — MH ID: MH-2756

Location:	Casino Drive, east of Avenue 12
Coordinates:	117.3033° W, 33.6636° N
Rim Elevation (Earth):	1294 feet
Expected Pipe Diameter:	36 inches
Measured Pipe Diameter:	36 inches
ADWF:	0.720 mgd
Peak Measured Flow:	2.269 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street

Photo Not Taken

Plan View

SITE 13

Additional Site Photos

Effluent Pipe

Monitred N Influent Pipe

SITE 13

Additional Site Photos

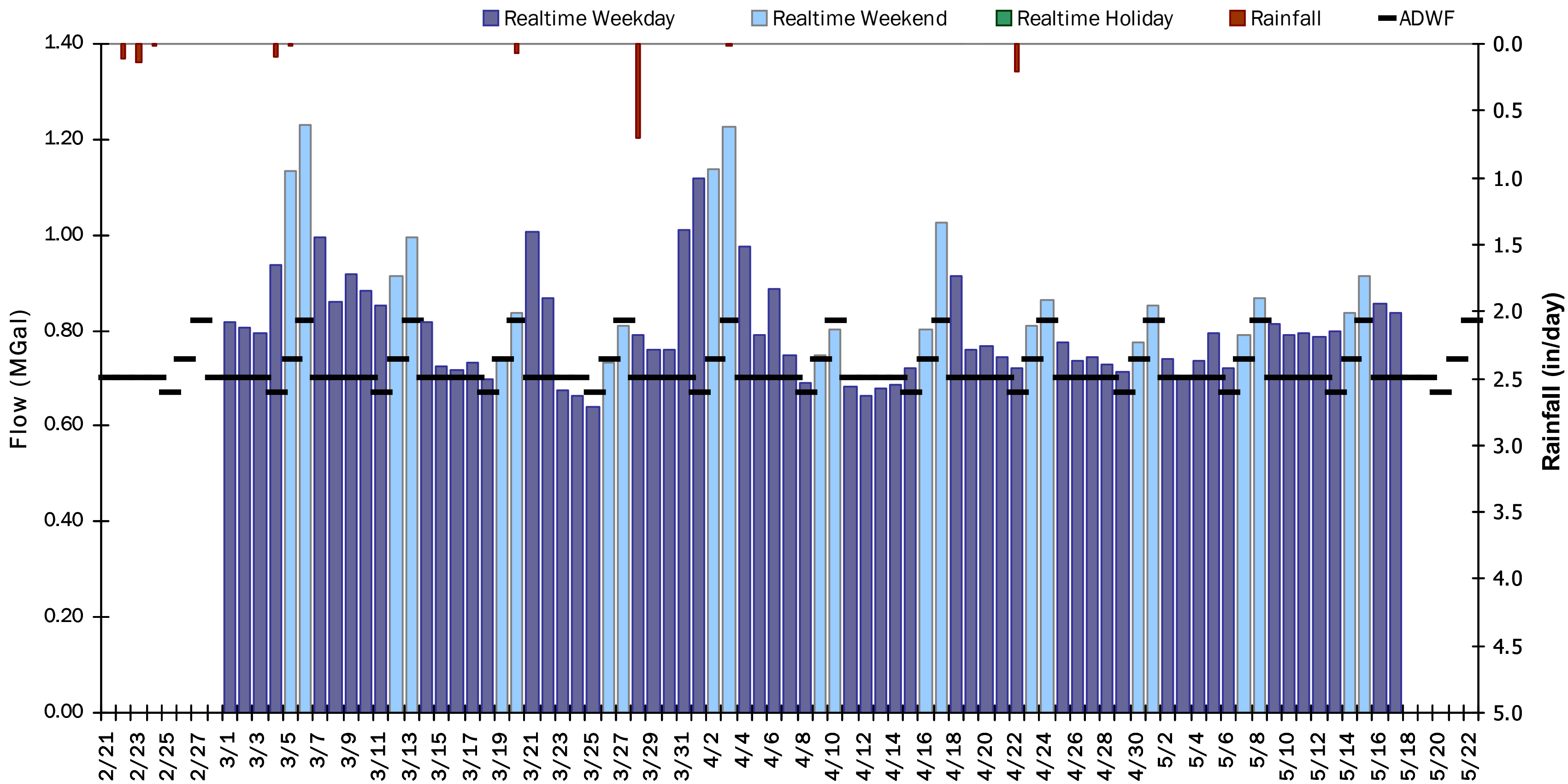
W Influent Pipe

SITE 13

Period Flow Summary: Daily Flow Totals

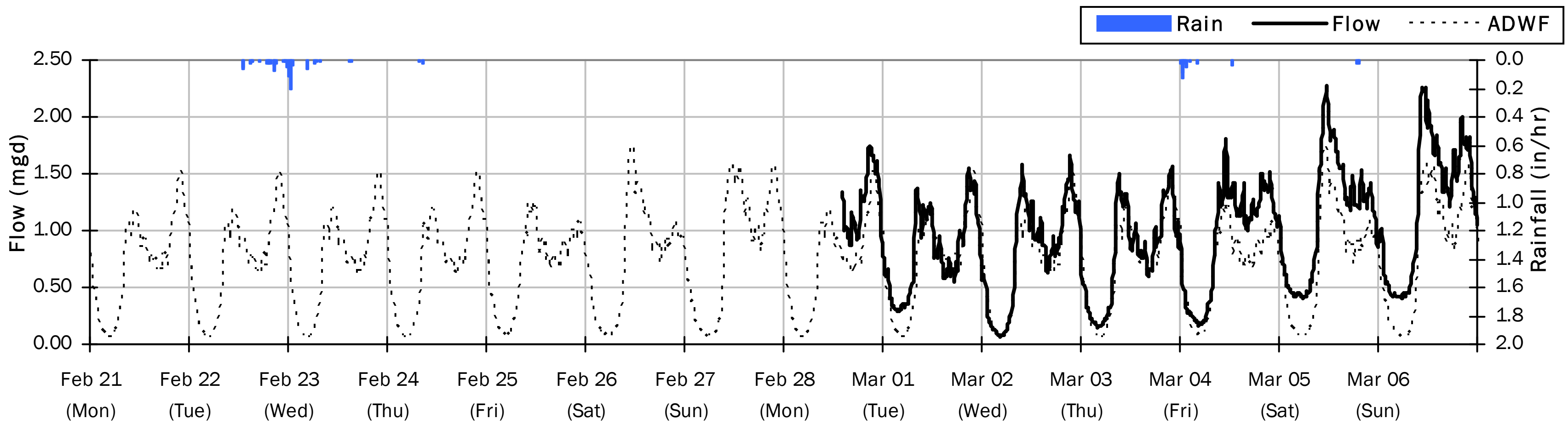
Avg Daily Flow: 0.822 MGal Peak Daily Flow: 1.253 MGal Min Daily Flow: 0.314 MGal

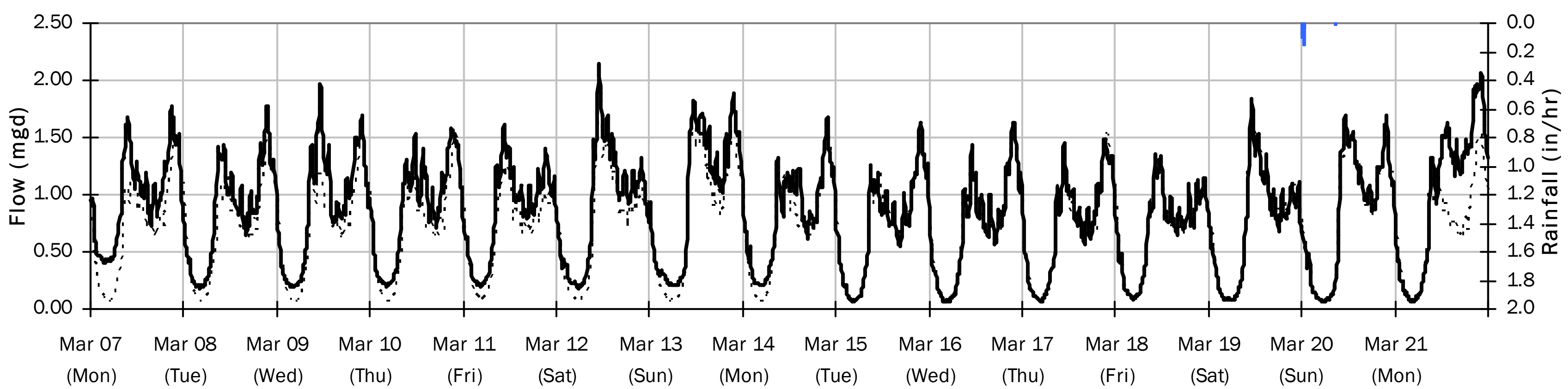
Total Rainfall: 1.12 inches



SITE 13
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.45 inches   Period Avg Flow: 0.884 mgd   Period Peak Flow: 2.269 mgd   Period Min Flow: 0.059 mgd



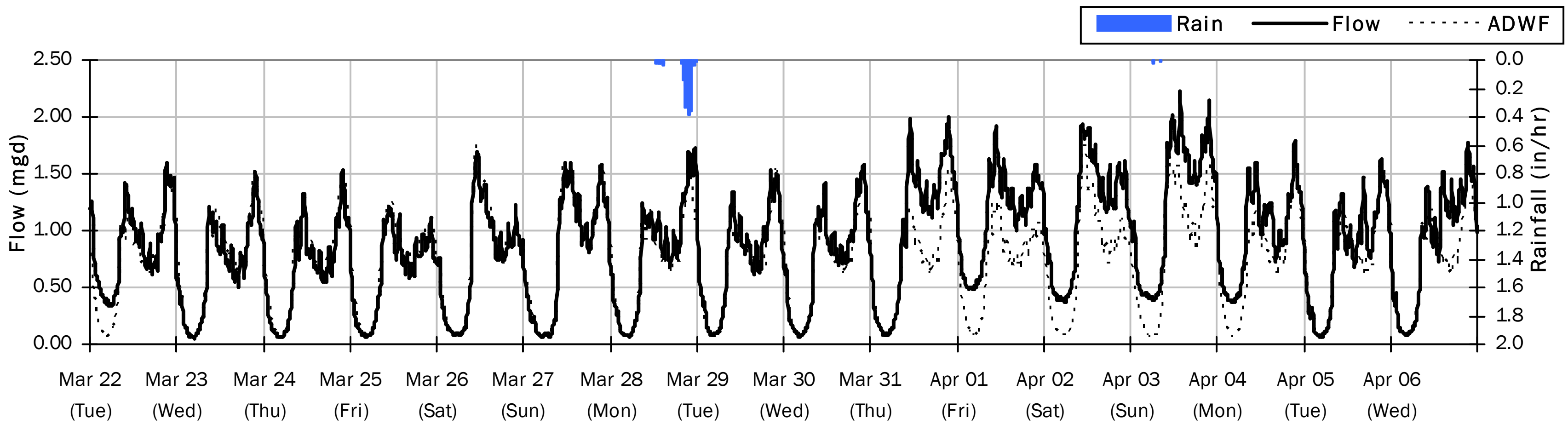


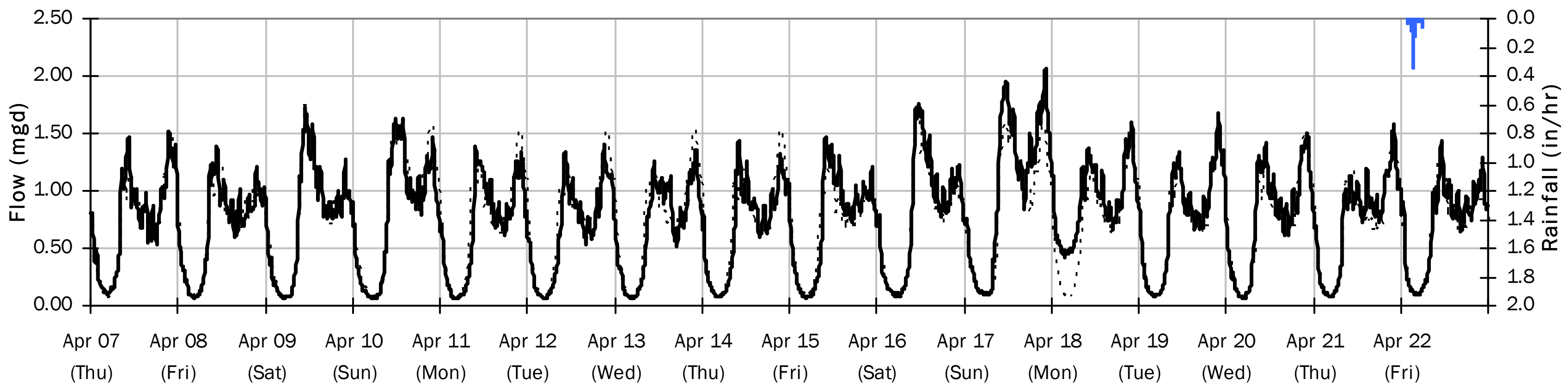
SITE 13

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.93 inches

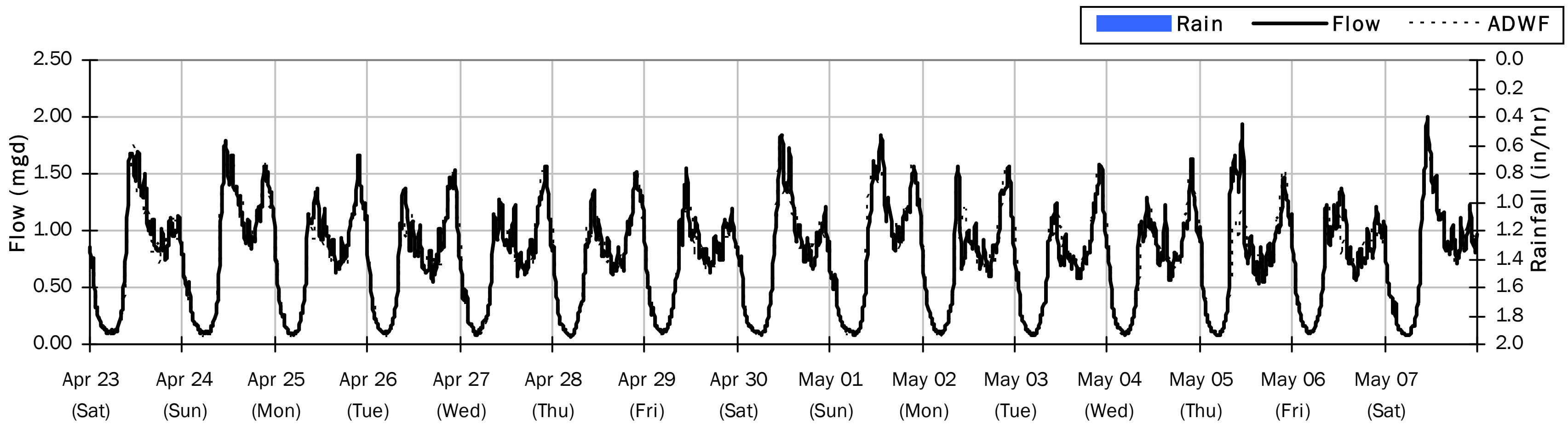
Period Avg Flow: 0.812 mgd Period Peak Flow: 2.229 mgd Period Min Flow: 0.056 mgd

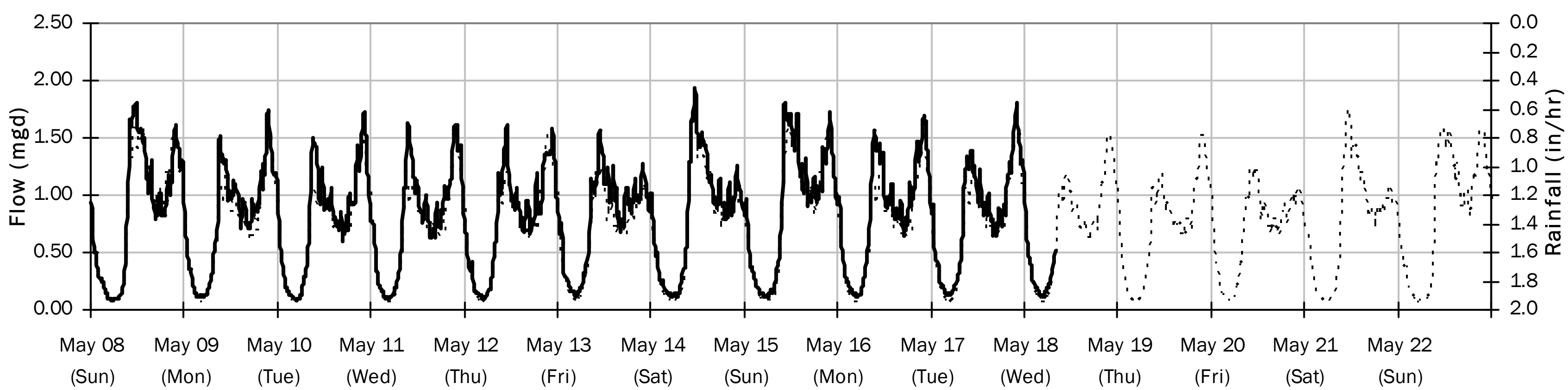




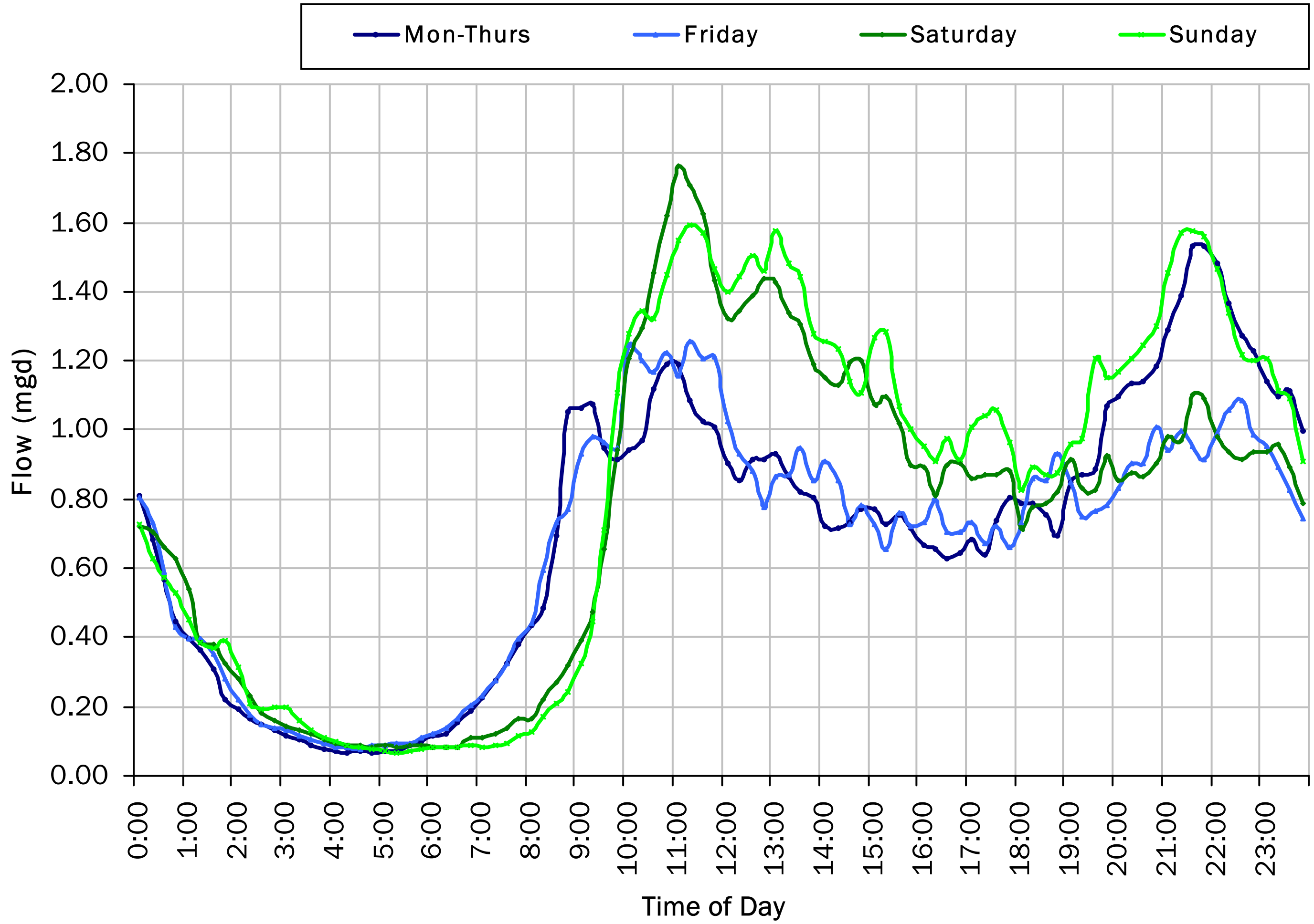
SITE 13
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches   Period Avg Flow: 0.785 mgd   Period Peak Flow: 1.998 mgd   Period Min Flow: 0.072 mgd

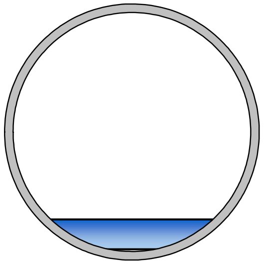




SITE 13
Average Dry Weather Flow Hydrographs



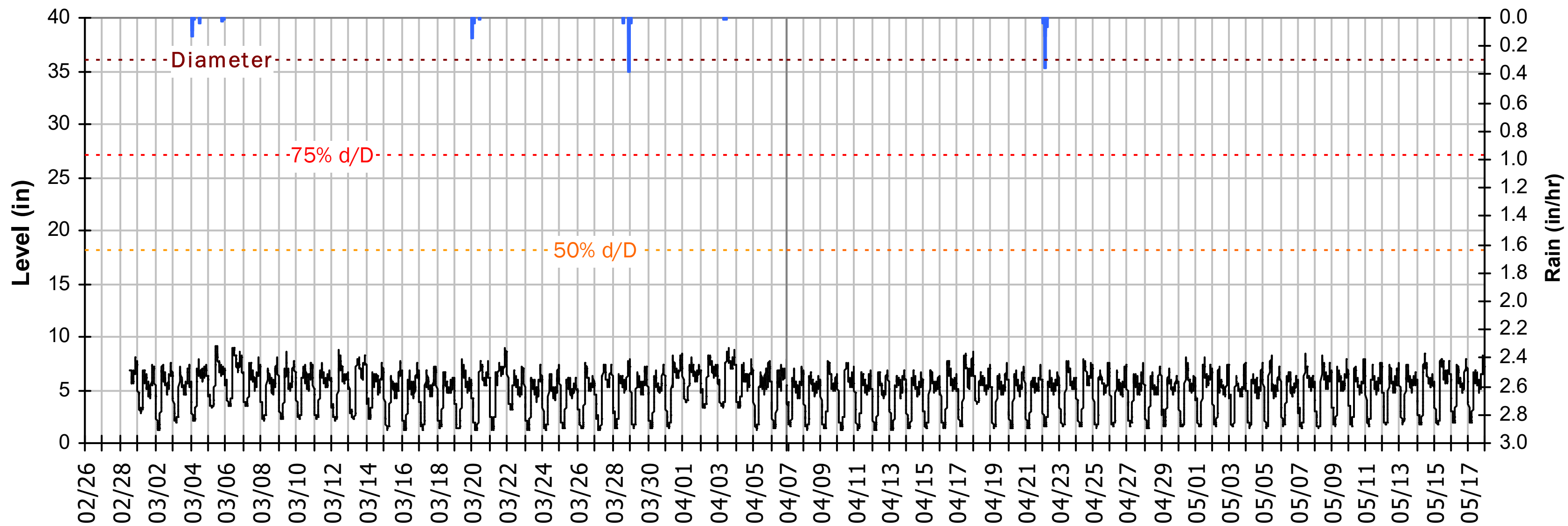
ADWF:
0.720 *mgd*

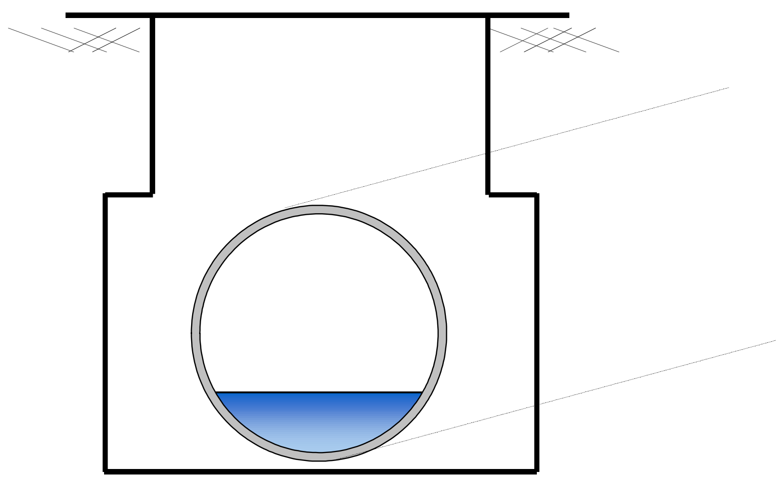


SITE 13

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



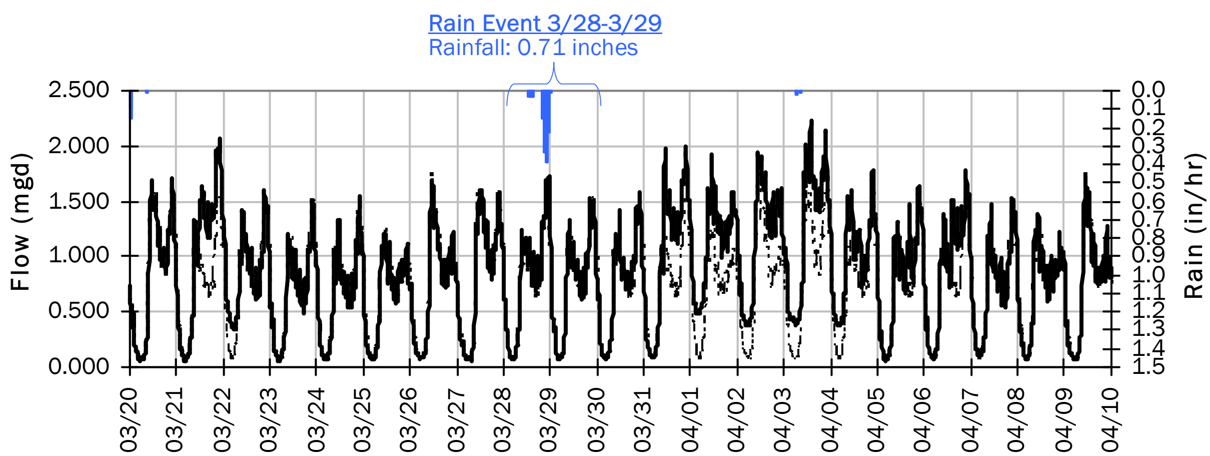


Pipe Diameter:	36	*inches*
Peak Measured Level:	9.11	*inches*
Peak d/D Ratio:	0.25	

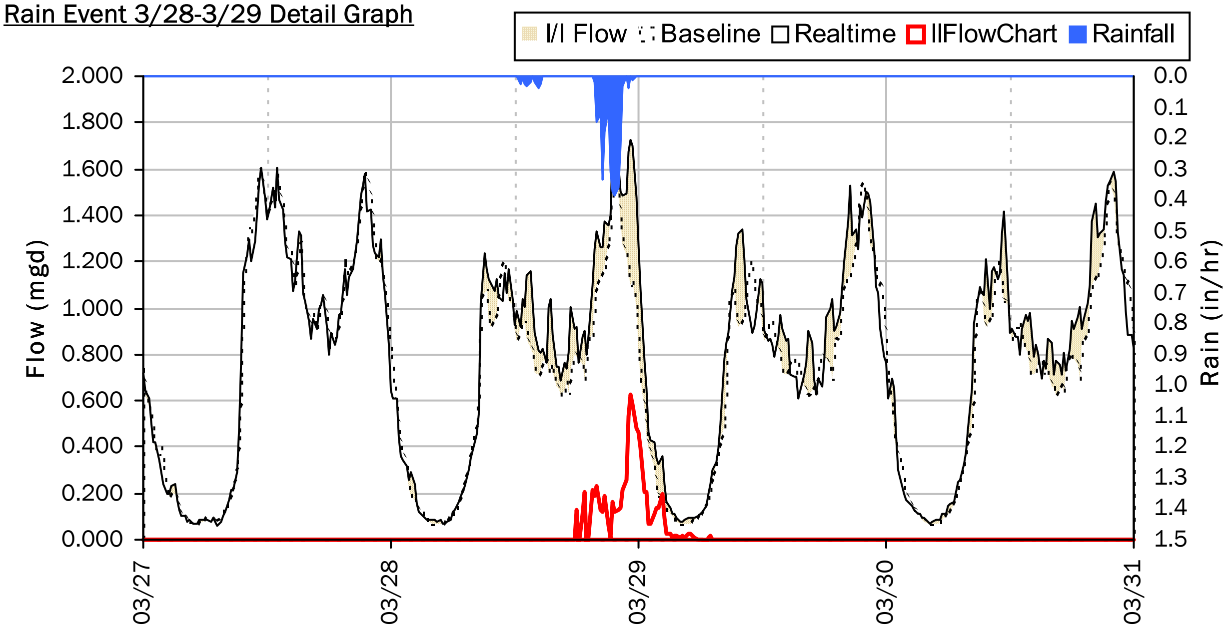
SITE 13

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



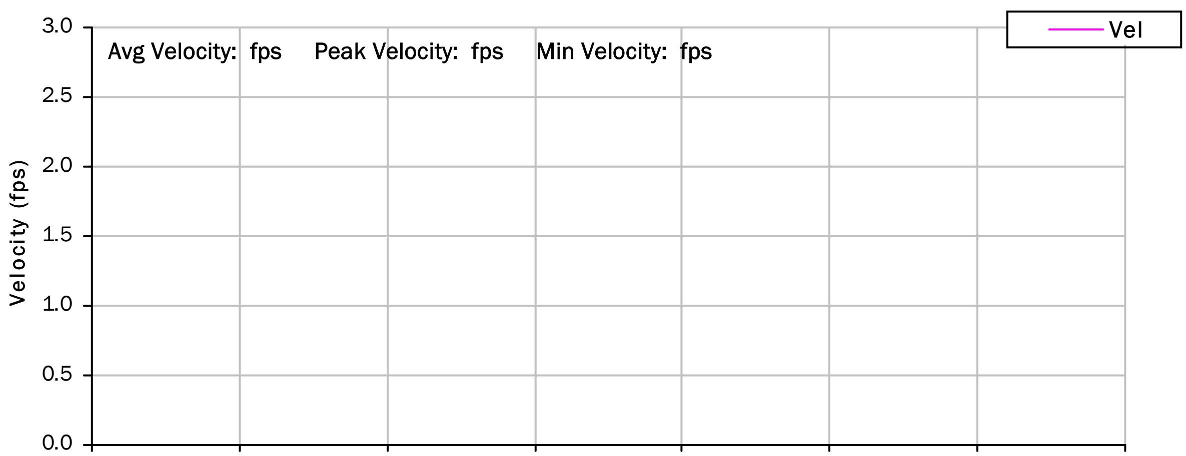
Rain Event 3/28-3/29 Detail Graph

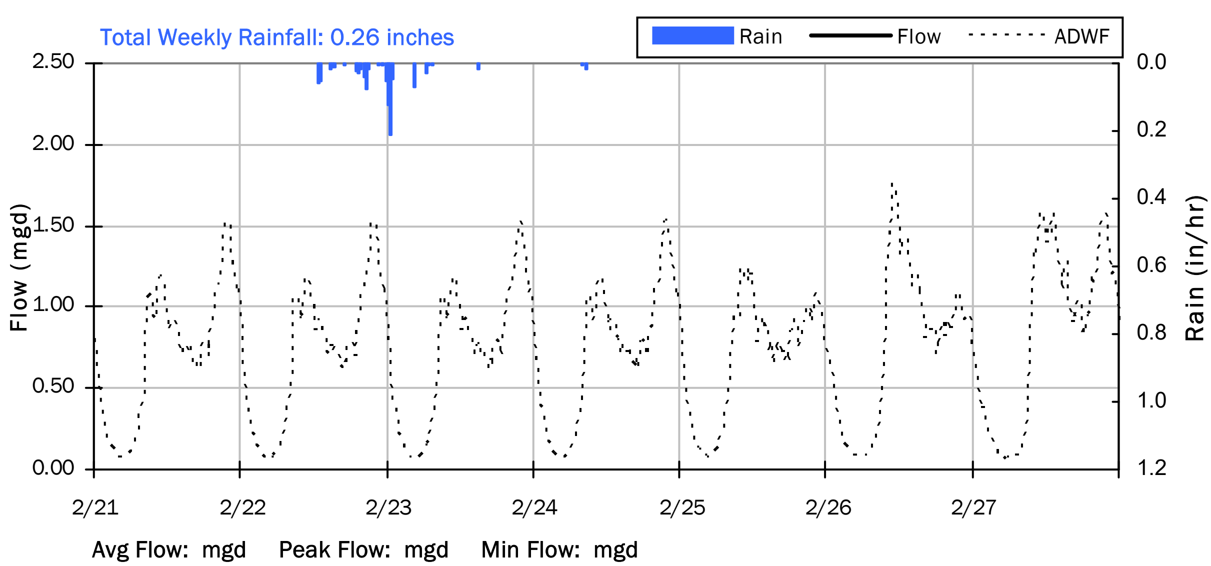


Storm Event I/I Analysis (Rain = 0.71 inches)

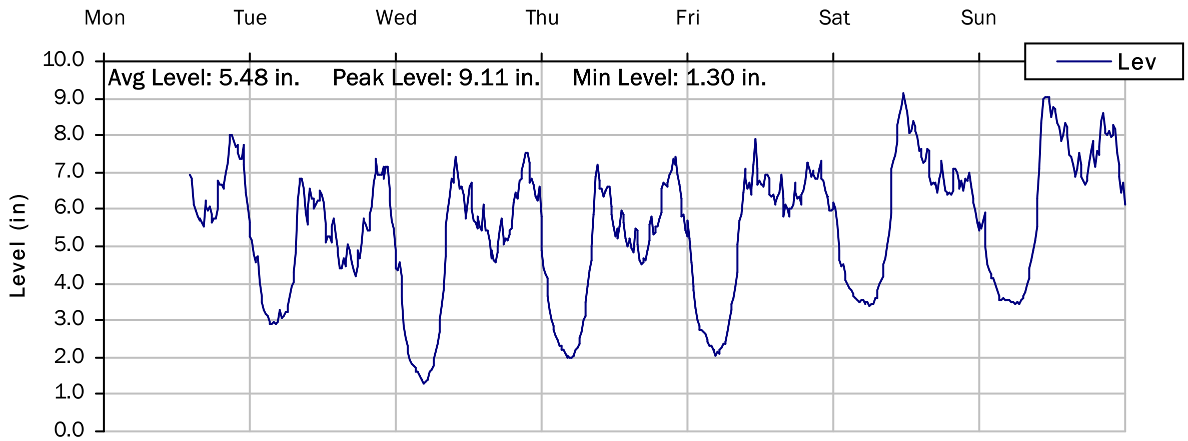
Capacity		Inflow / Infiltration	
Peak Flow:	1.723 *mgd*	Peak I/I Rate:	0.627 *mgd*
PF:	2.39	Total I/I:	74,000 *gallons*
Peak Level:	7.86 *in*		
d/D Ratio:	0.22		

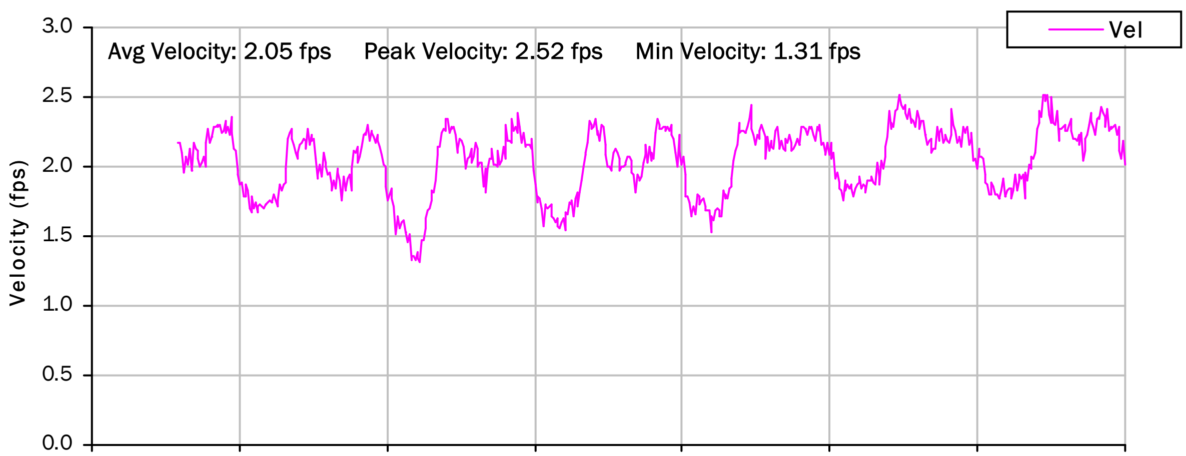
SITE 13
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

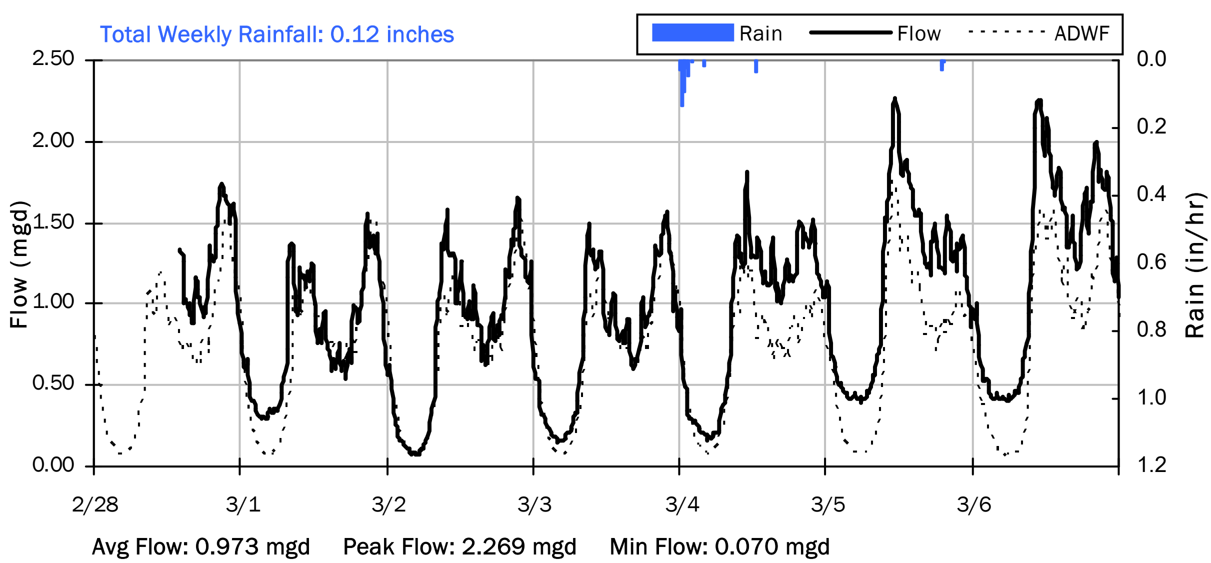




SITE 13
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



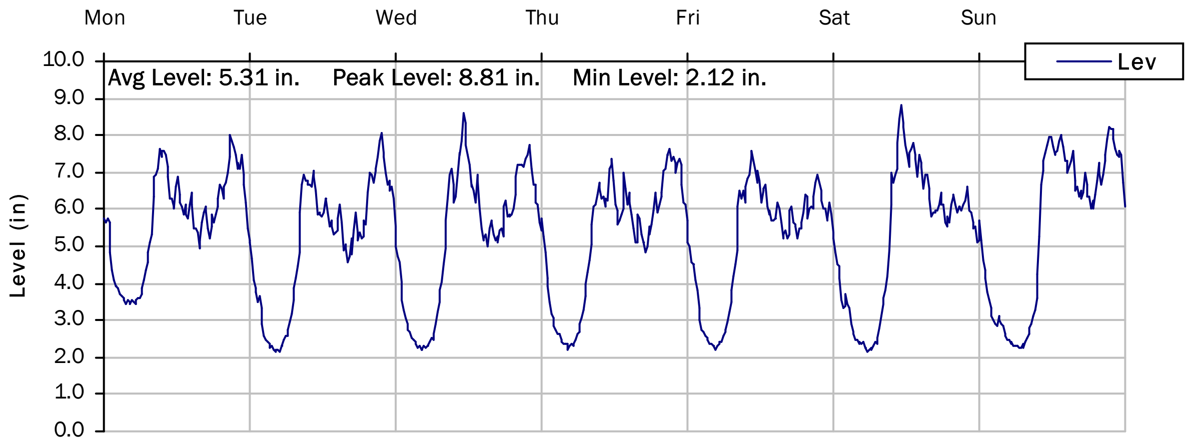


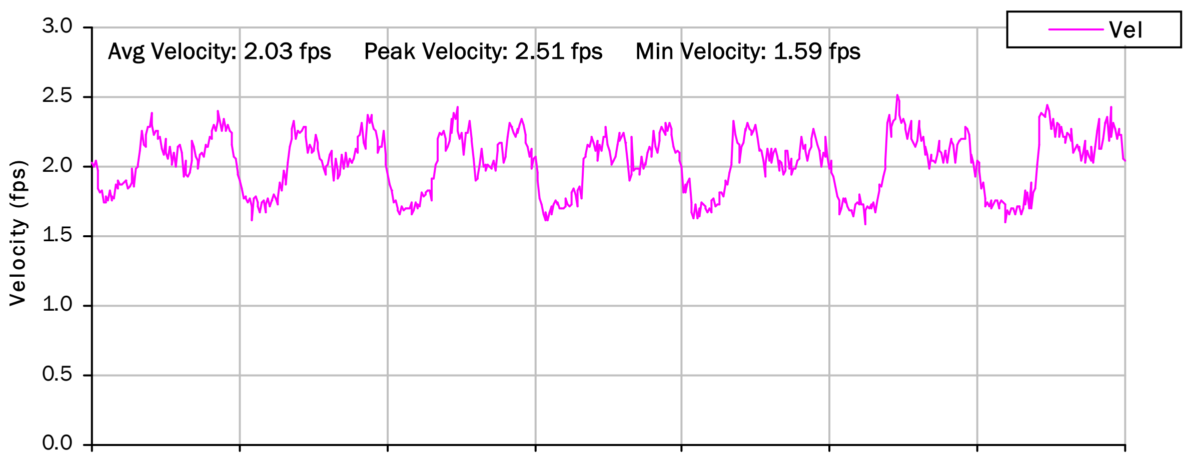


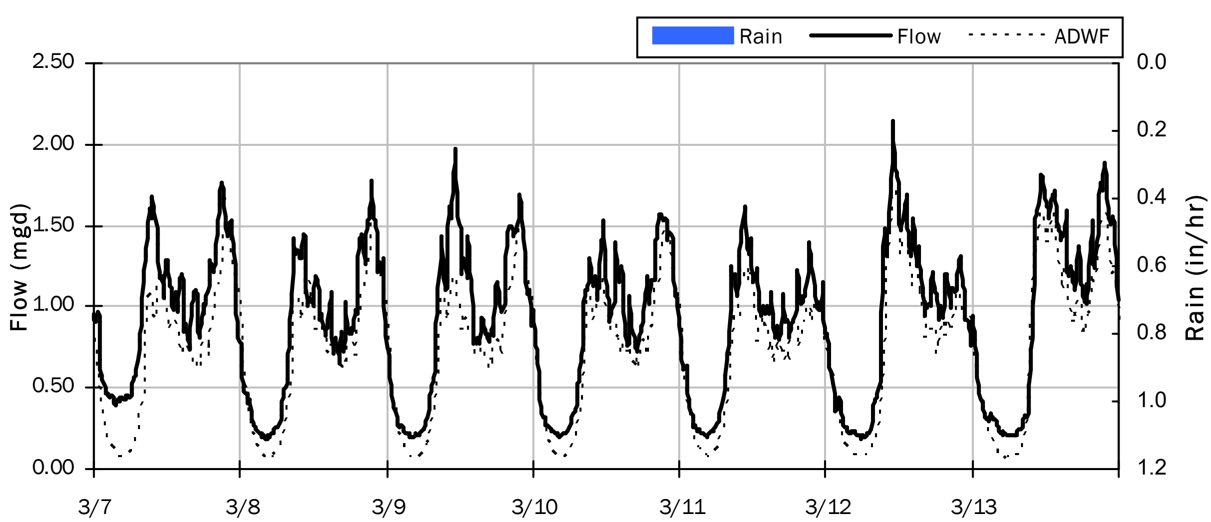
SITE 13

Weekly Level, Velocity and Flow Hydrographs

3/7/2022 to 3/14/2022





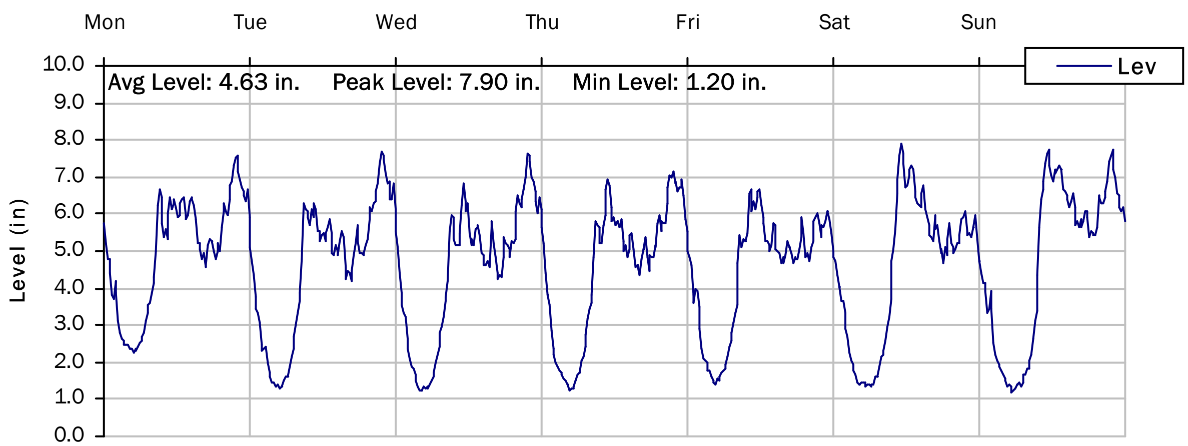


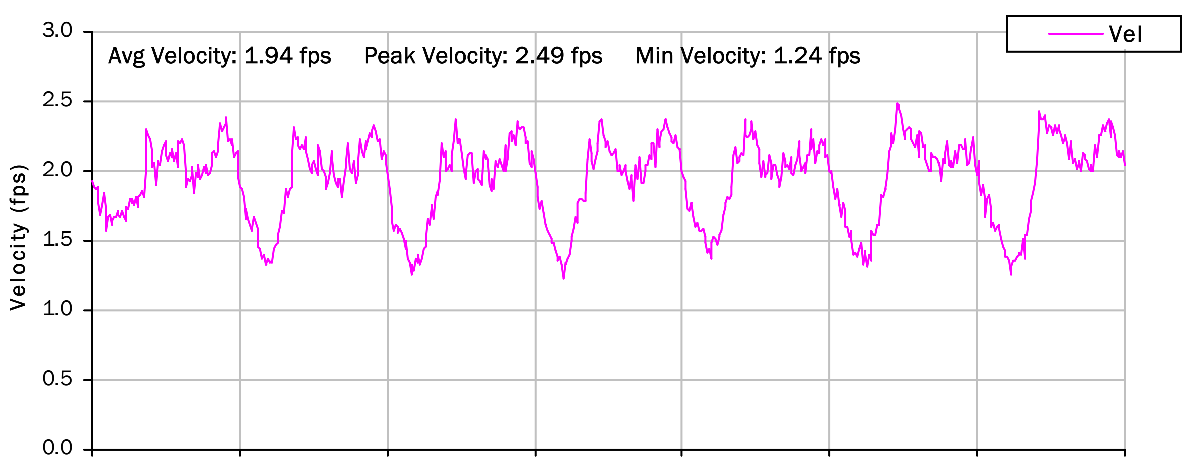
Avg Flow: 0.917 mgd Peak Flow: 2.145 mgd Min Flow: 0.179 mgd

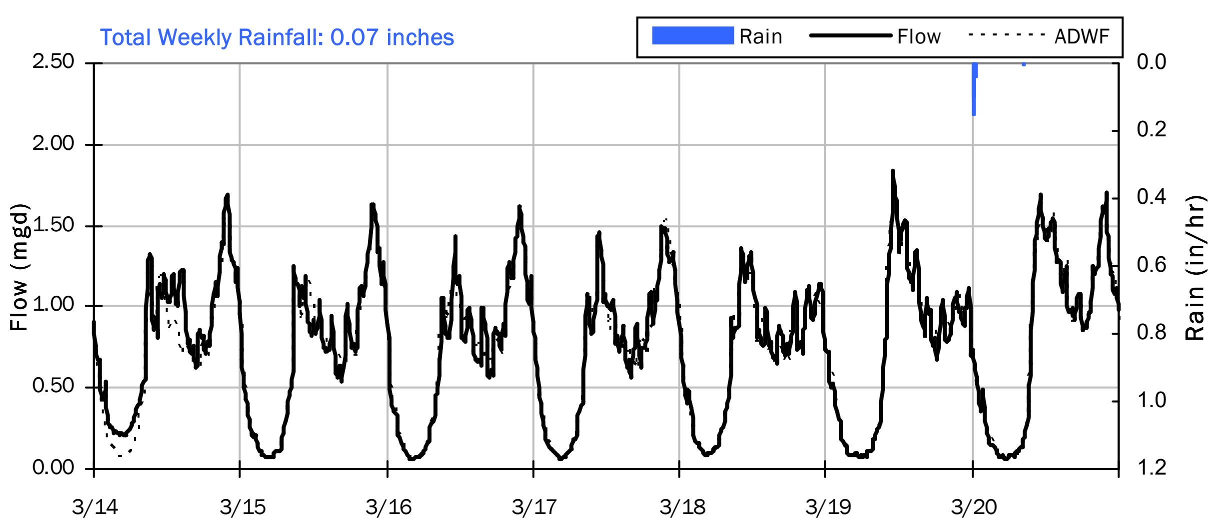
SITE 13

Weekly Level, Velocity and Flow Hydrographs

3/14/2022 to 3/21/2022

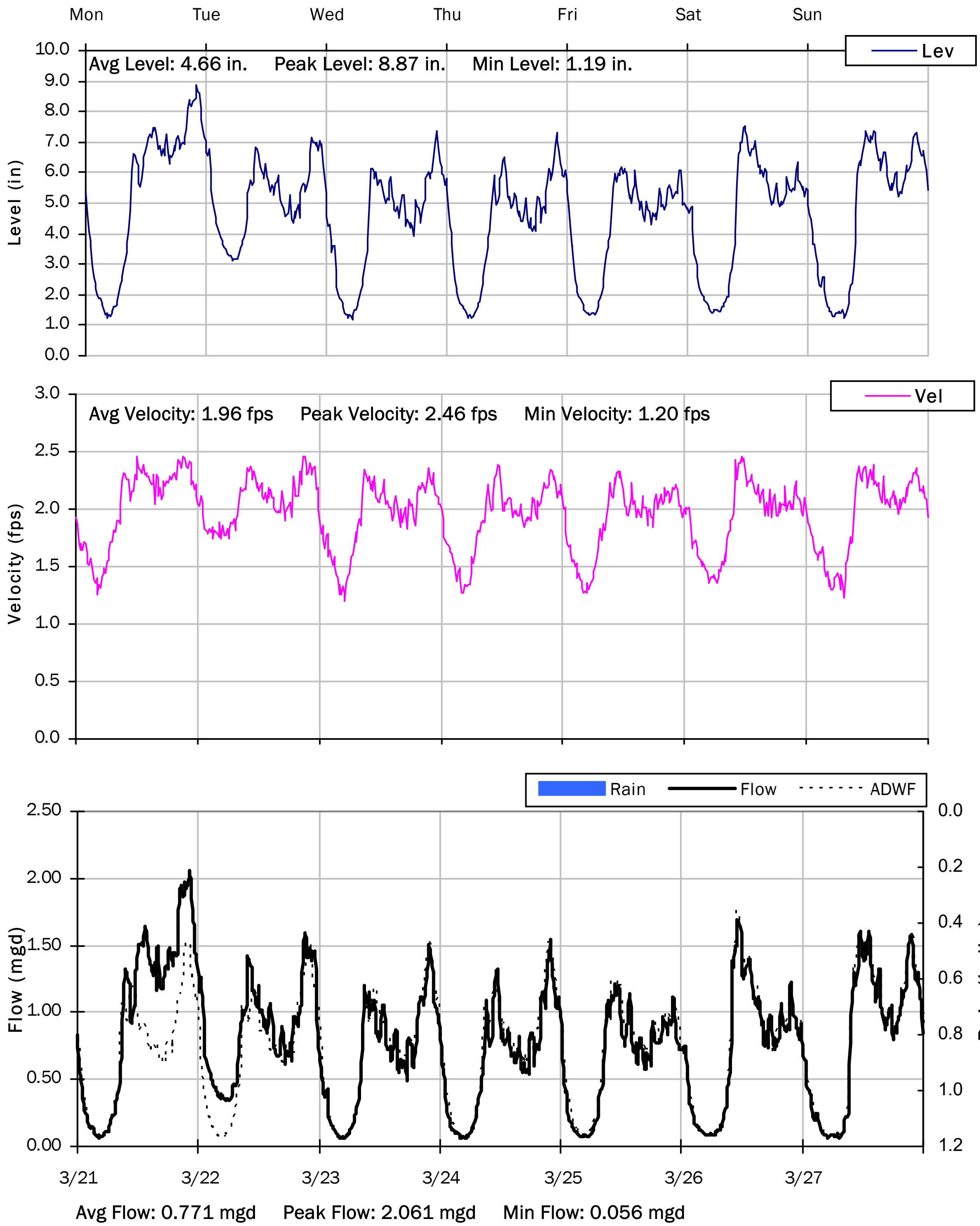






Avg Flow: 0.753 mgd Peak Flow: 1.839 mgd Min Flow: 0.059 mgd

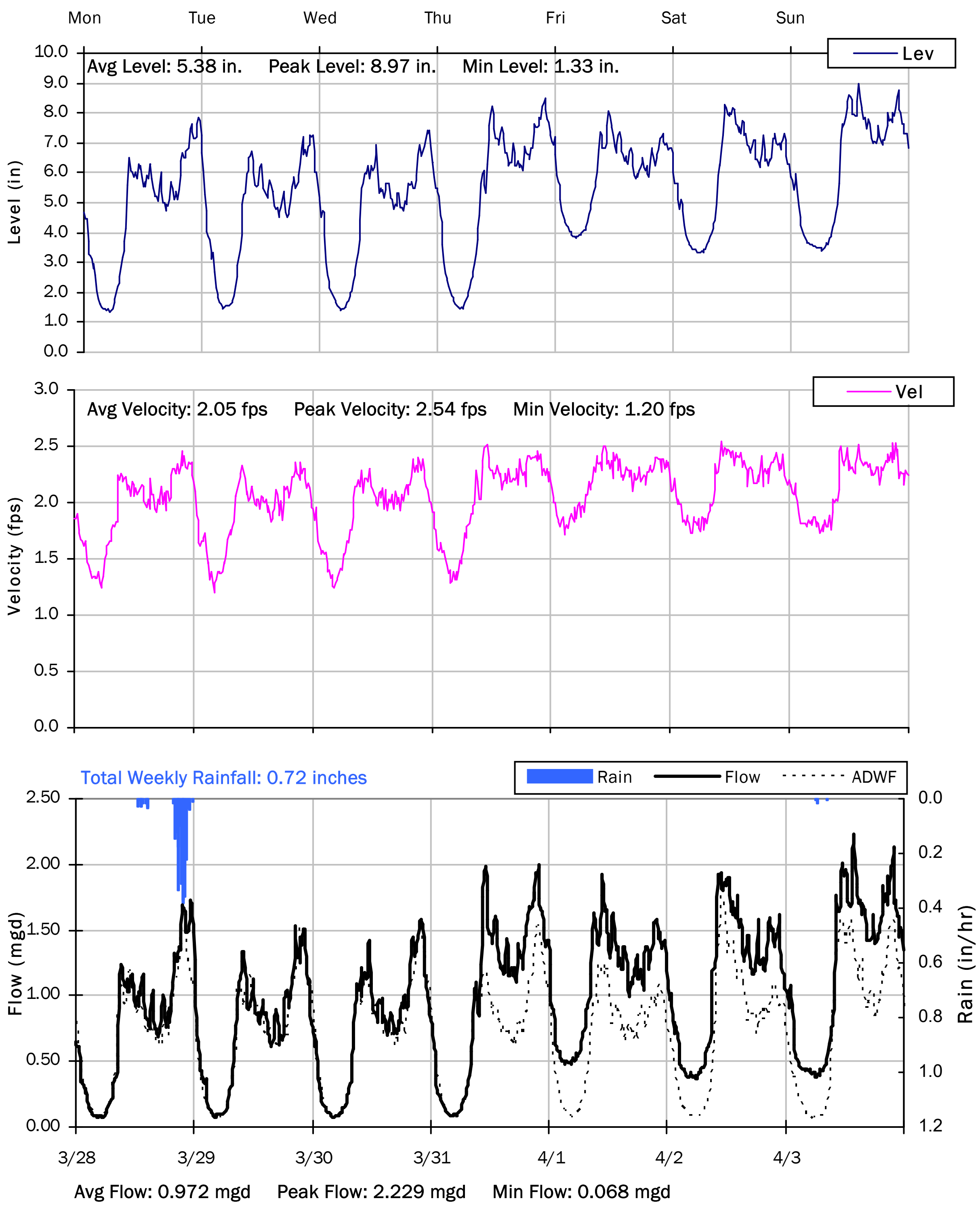
SITE 13
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



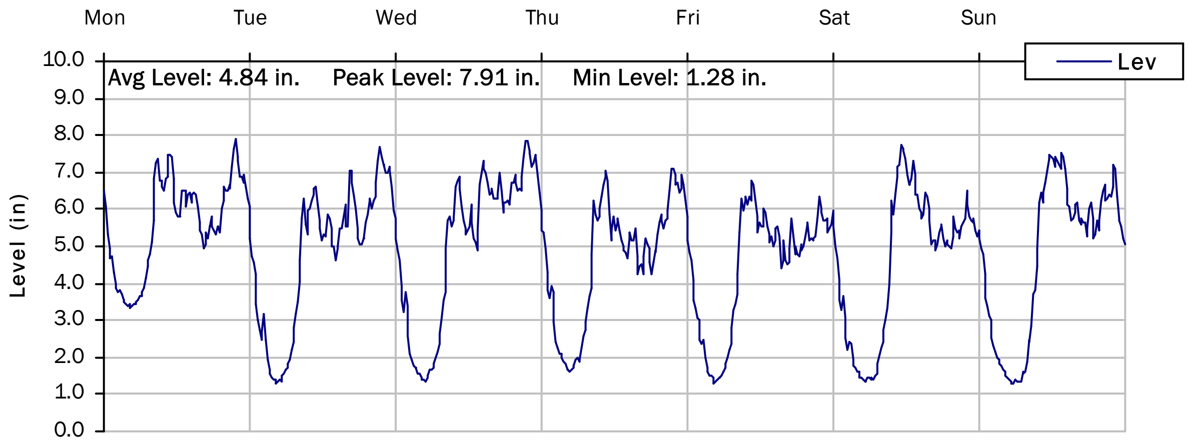
SITE 13

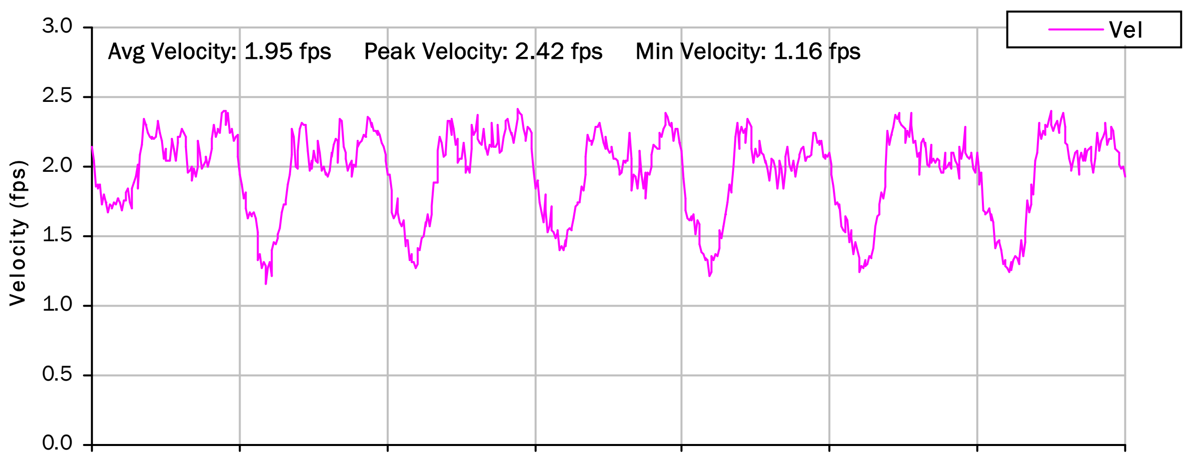
Weekly Level, Velocity and Flow Hydrographs

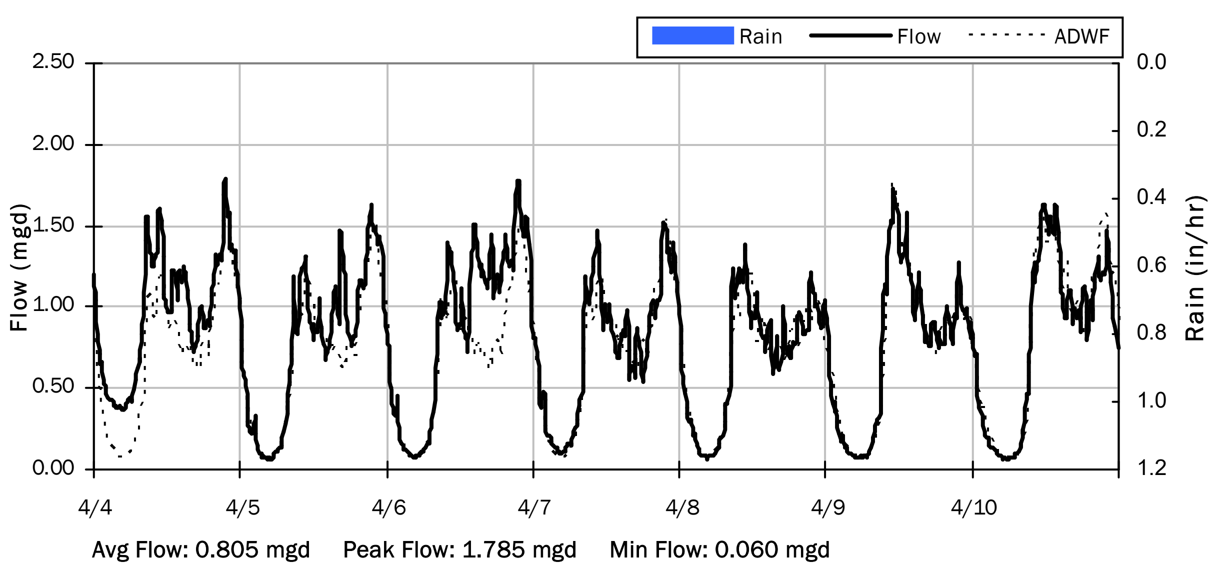
3/28/2022 to 4/4/2022



SITE 13
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022



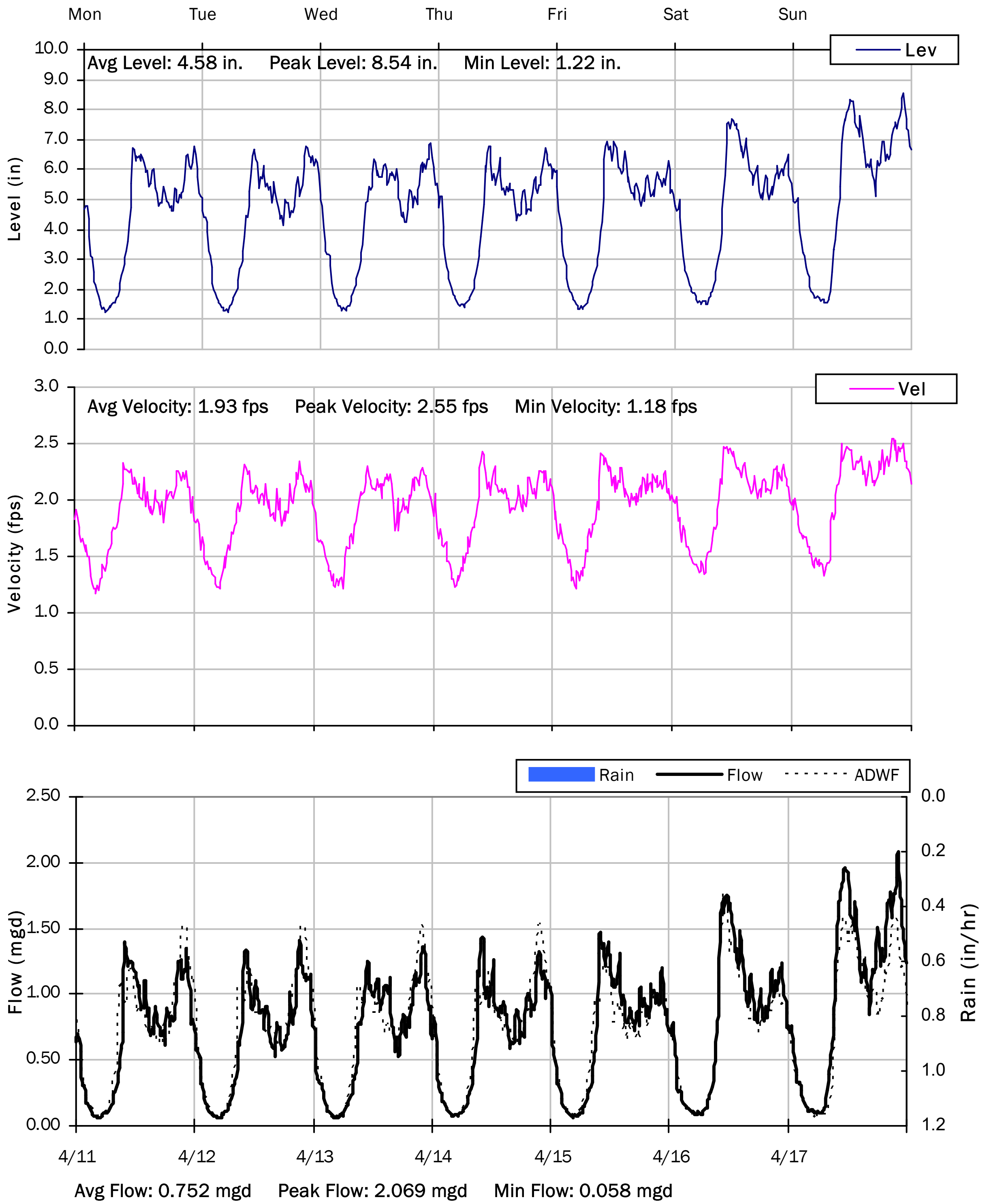




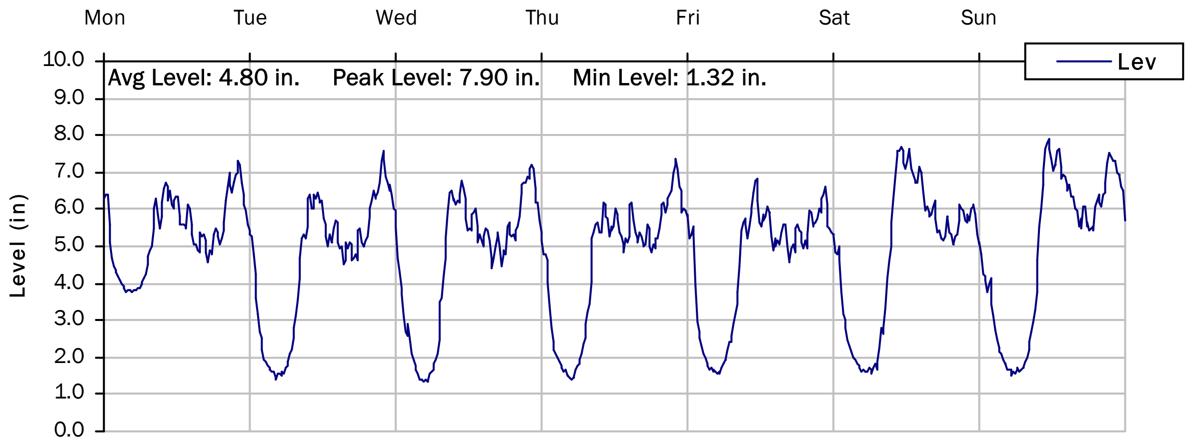
SITE 13

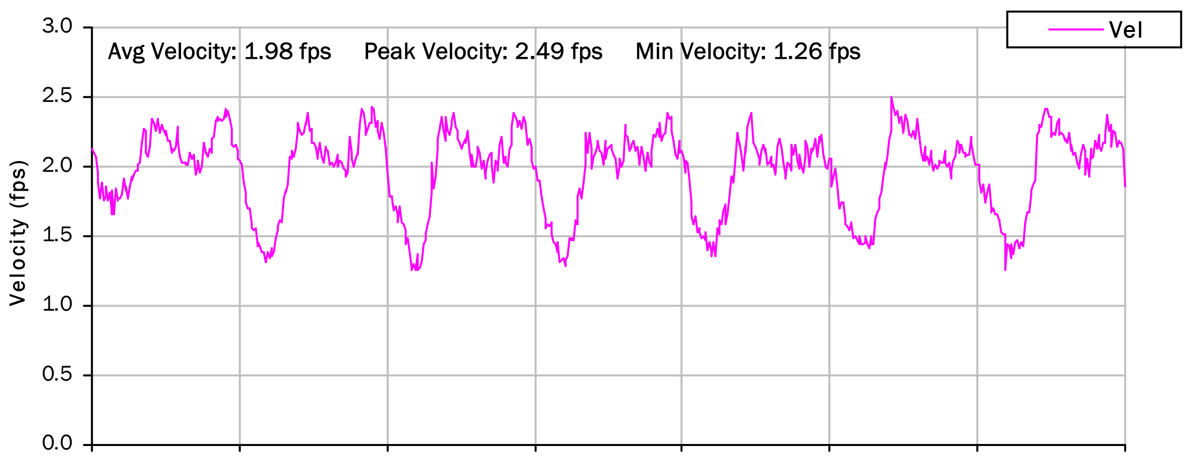
Weekly Level, Velocity and Flow Hydrographs

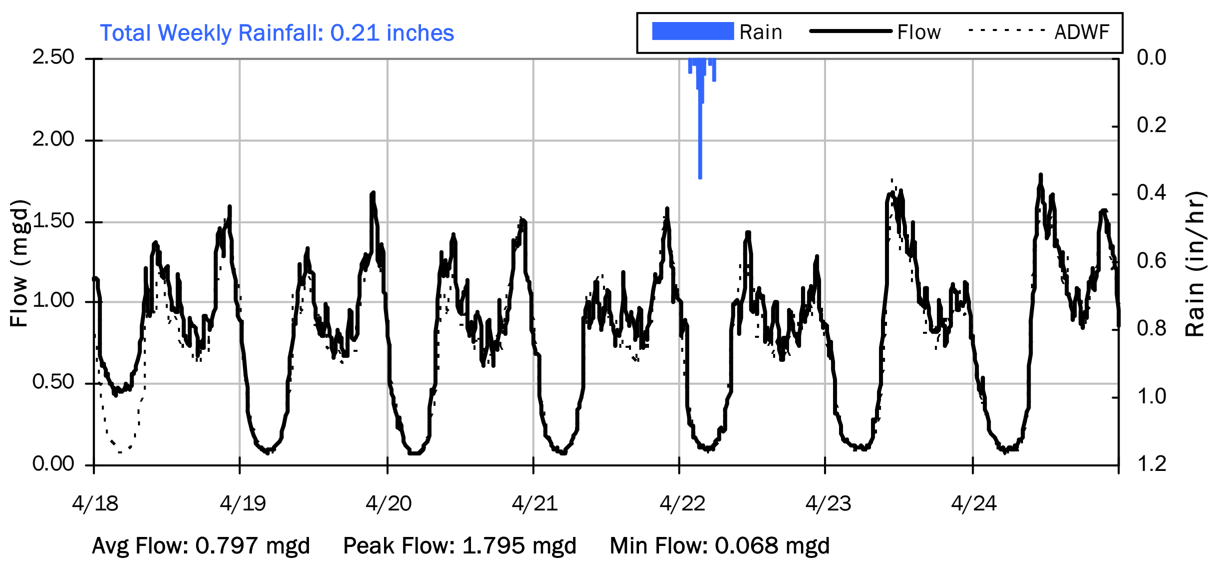
4/11/2022 to 4/18/2022



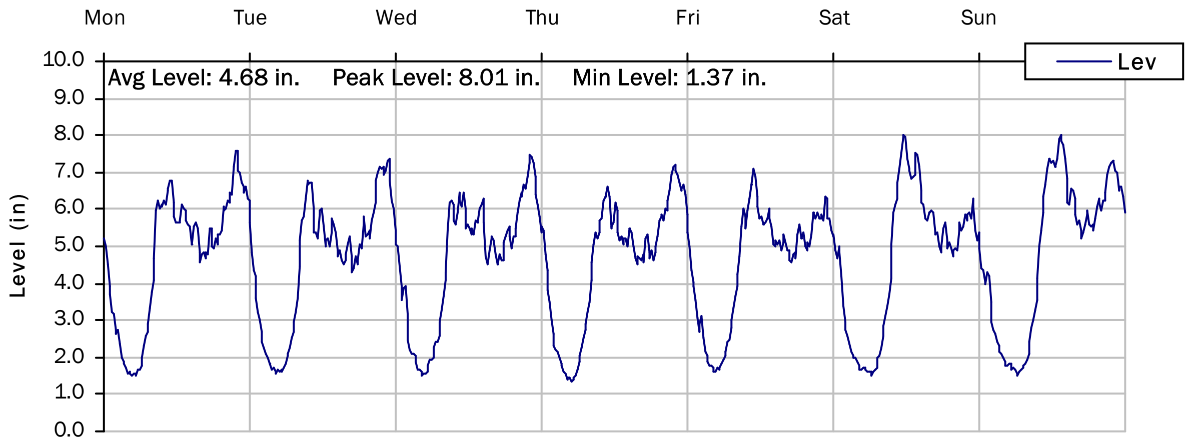
SITE 13
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

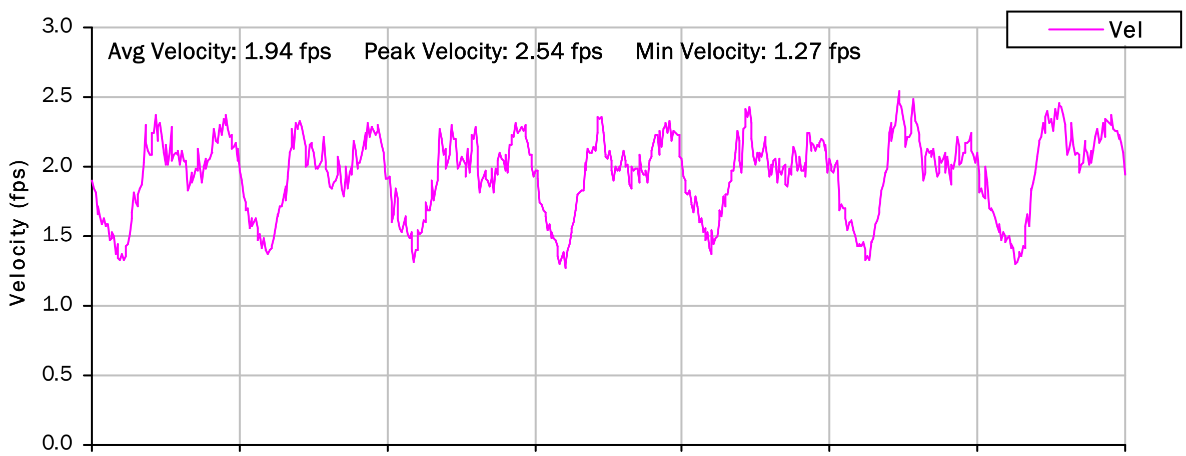


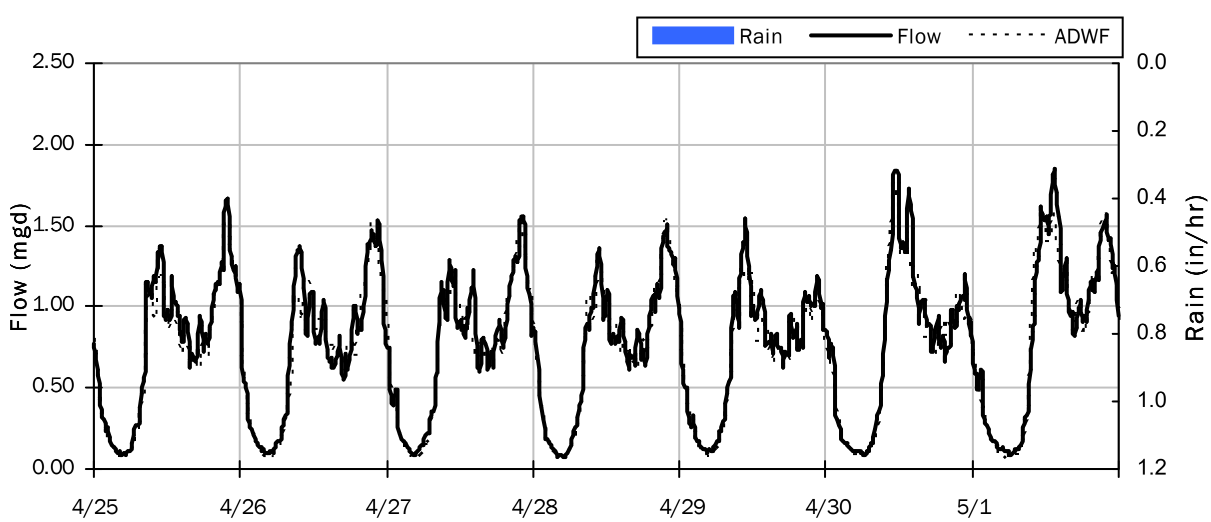




SITE 13
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022





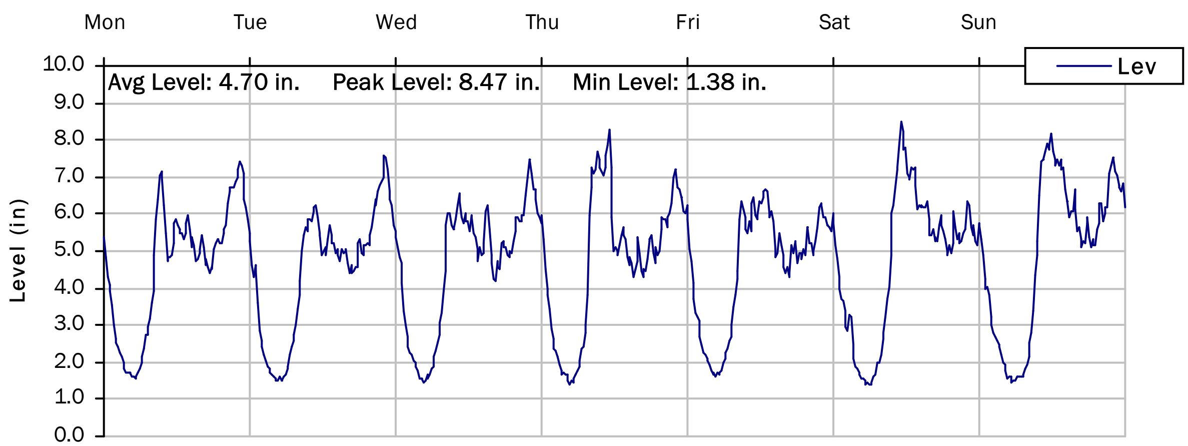


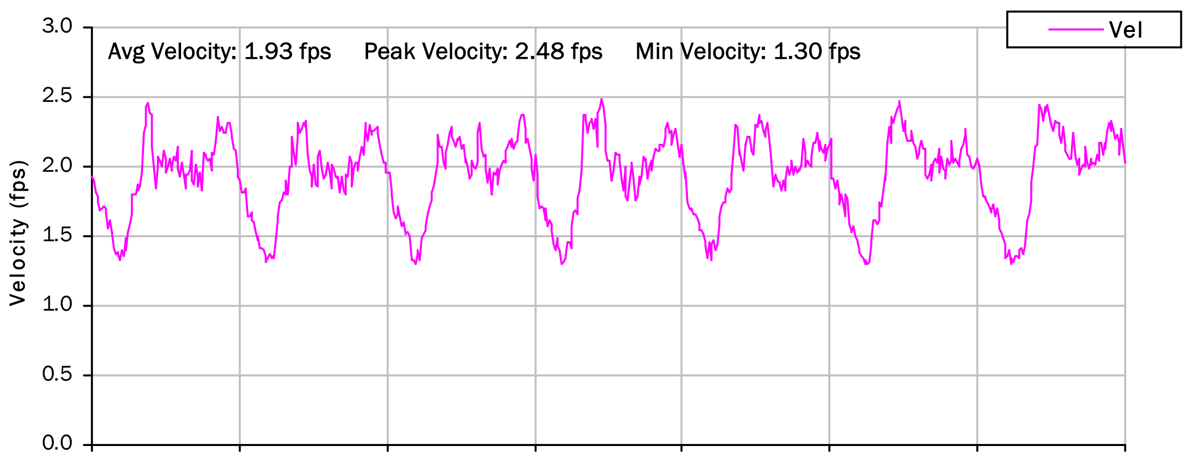
Avg Flow: 0.761 mgd Peak Flow: 1.845 mgd Min Flow: 0.072 mgd

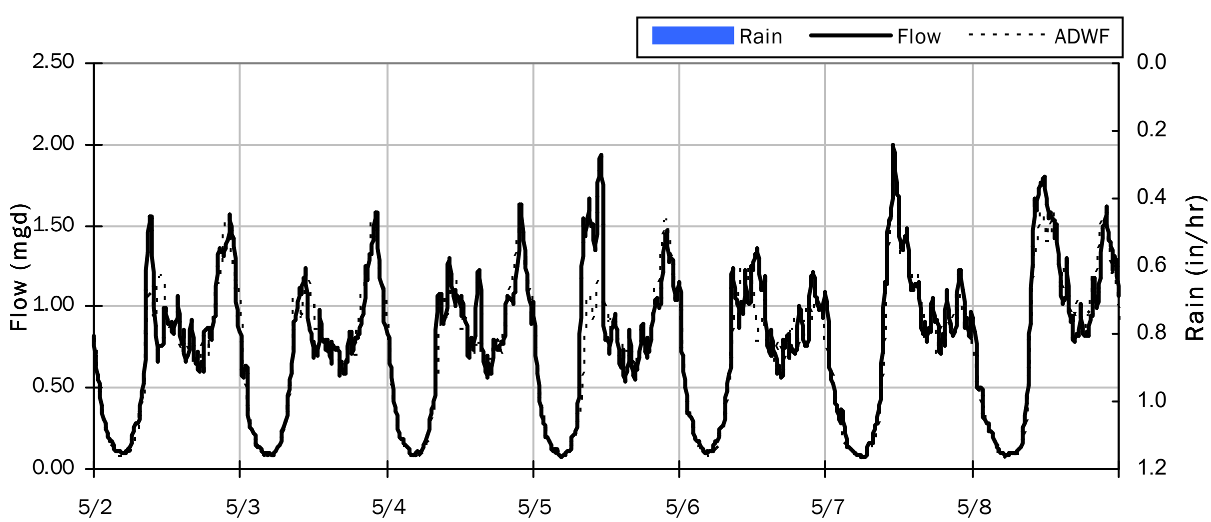
SITE 13

Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022

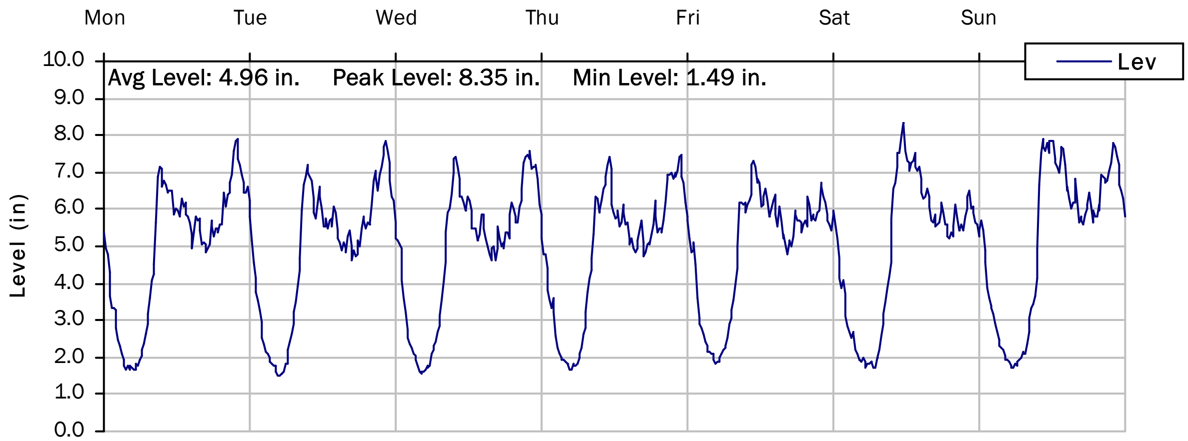


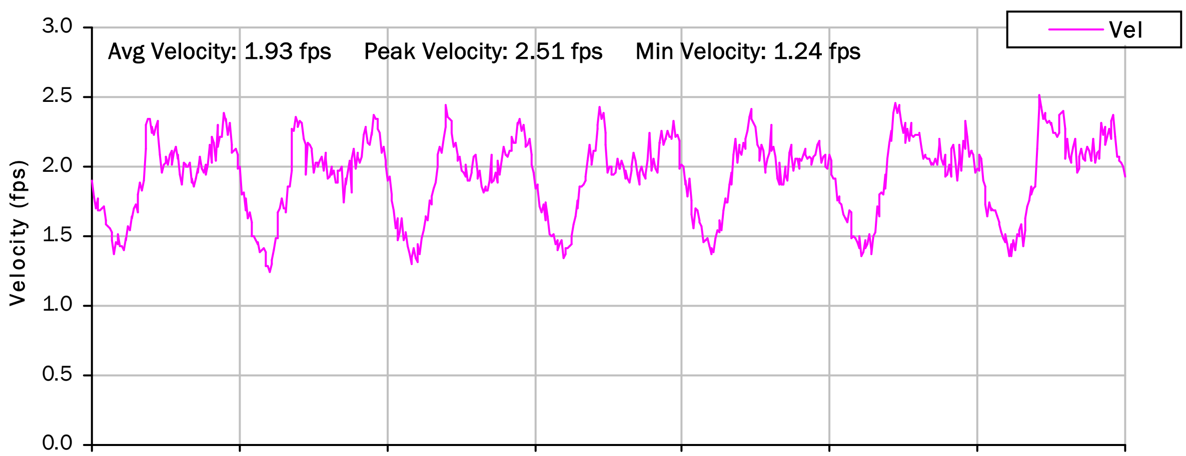


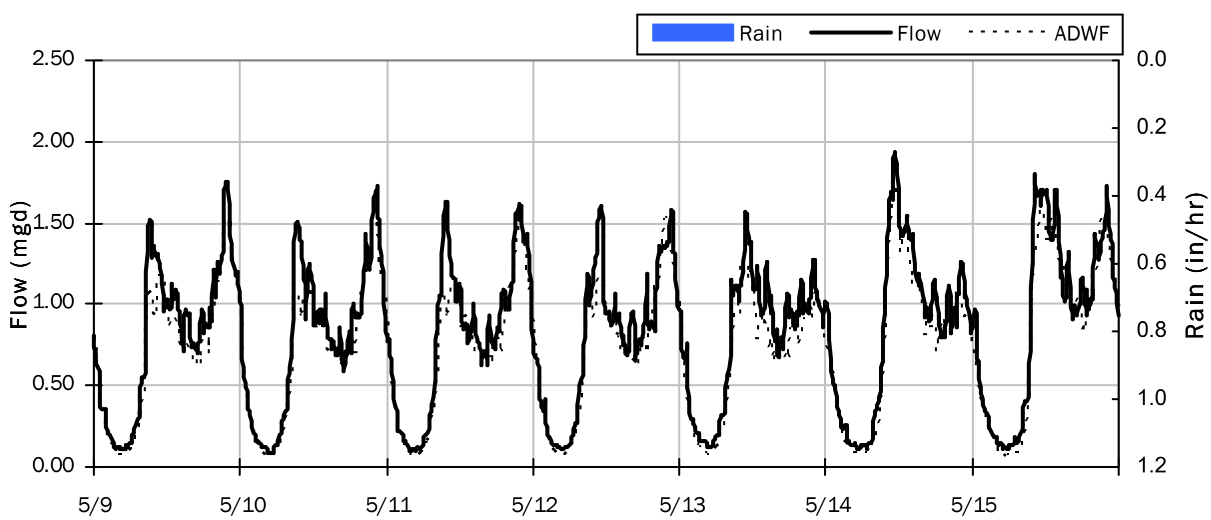


Avg Flow: 0.764 mgd Peak Flow: 1.998 mgd Min Flow: 0.074 mgd

SITE 13
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022

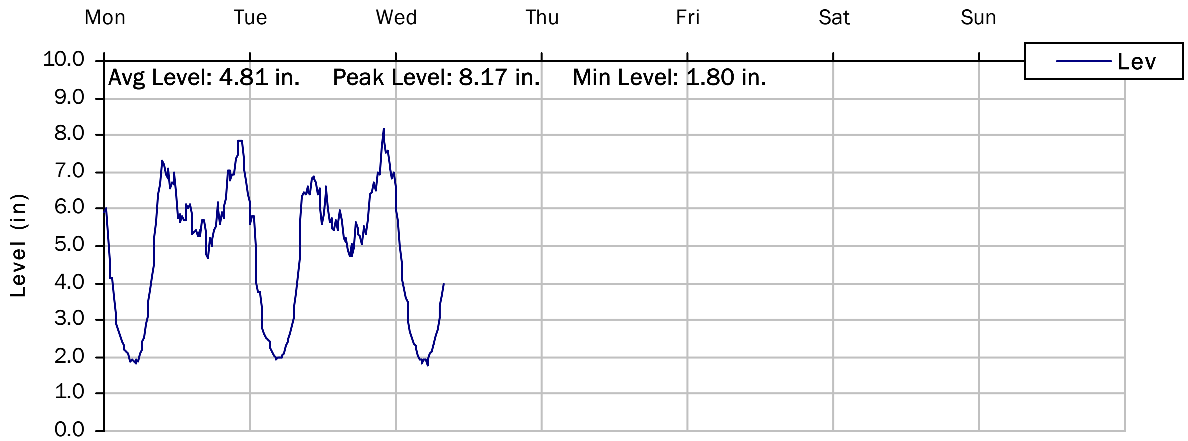


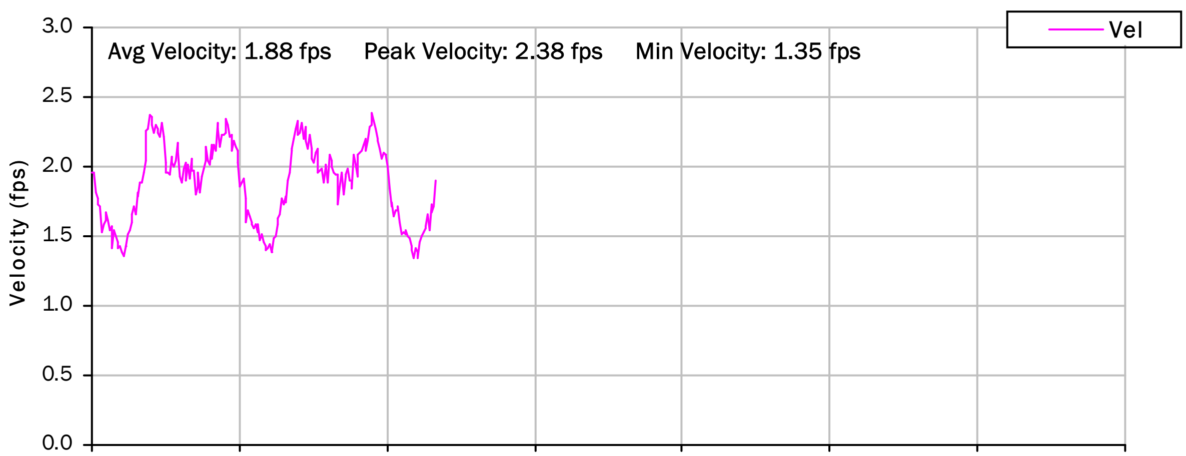


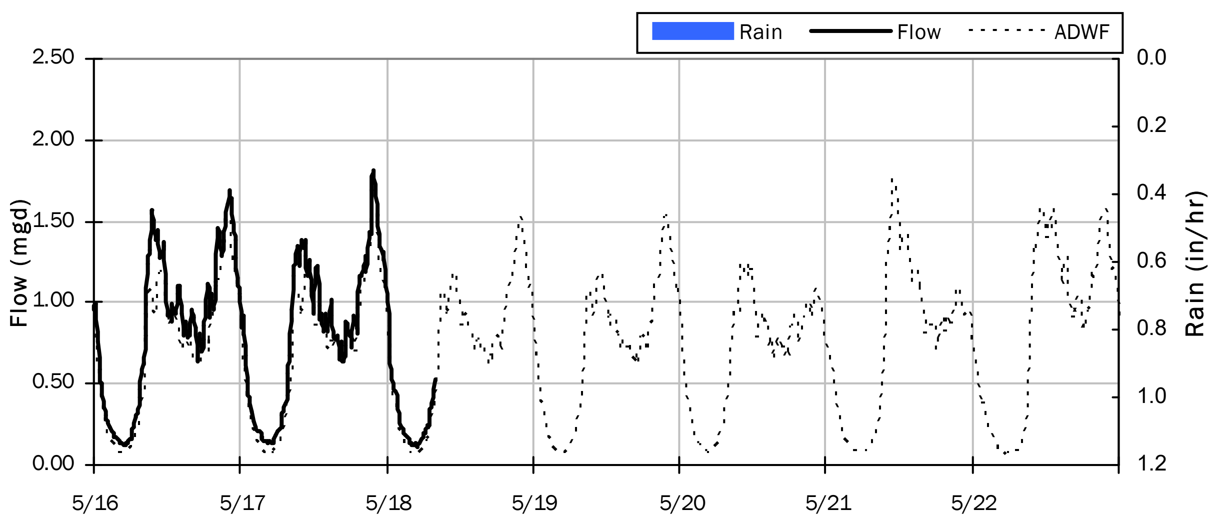


Avg Flow: 0.820 mgd Peak Flow: 1.934 mgd Min Flow: 0.081 mgd

SITE 13
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Avg Flow: 0.769 mgd Peak Flow: 1.815 mgd Min Flow: 0.114 mgd

Monitoring Site: Site 14

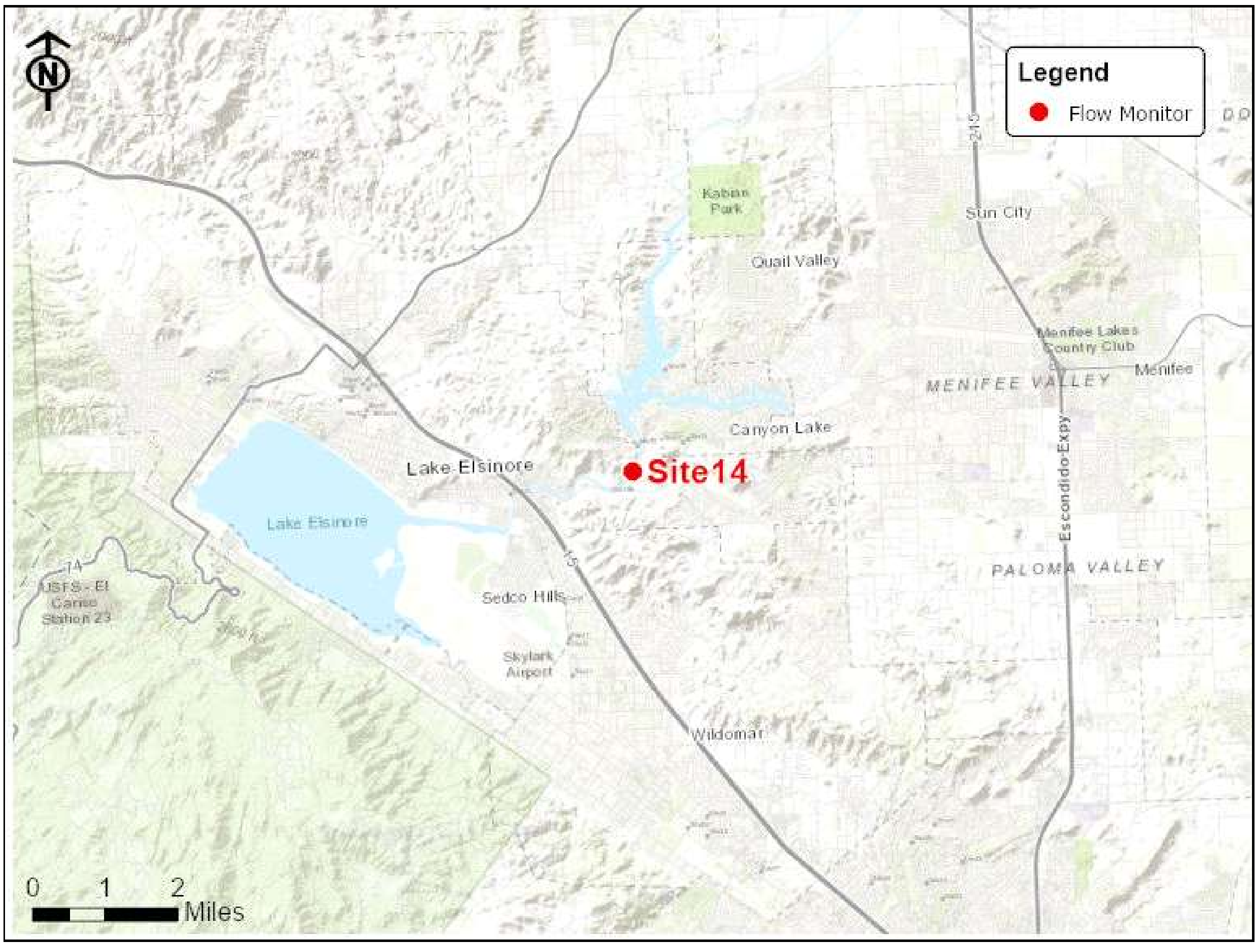
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Old Newport Road

Data Summary Report



Vicinity Map: Site 14

SITE 14

Site Information MH ID: MH-2878

Location: Old Newport Road

Coordinates: 117.2739° W, 33.6675° N

Rim Elevation (Earth): 1325 feet

Expected Pipe Diameter: 21 inches

Measured Pipe Diameter: 20.75 inches

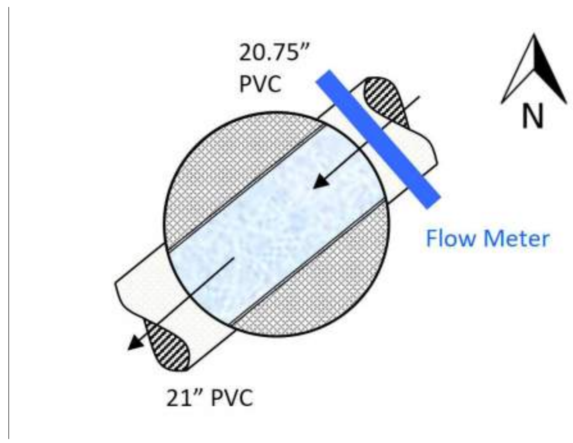
ADWF: 0.702 mgd

Peak Measured Flow: 1.575 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 14

Additional Site Photos

Effluent Pipe

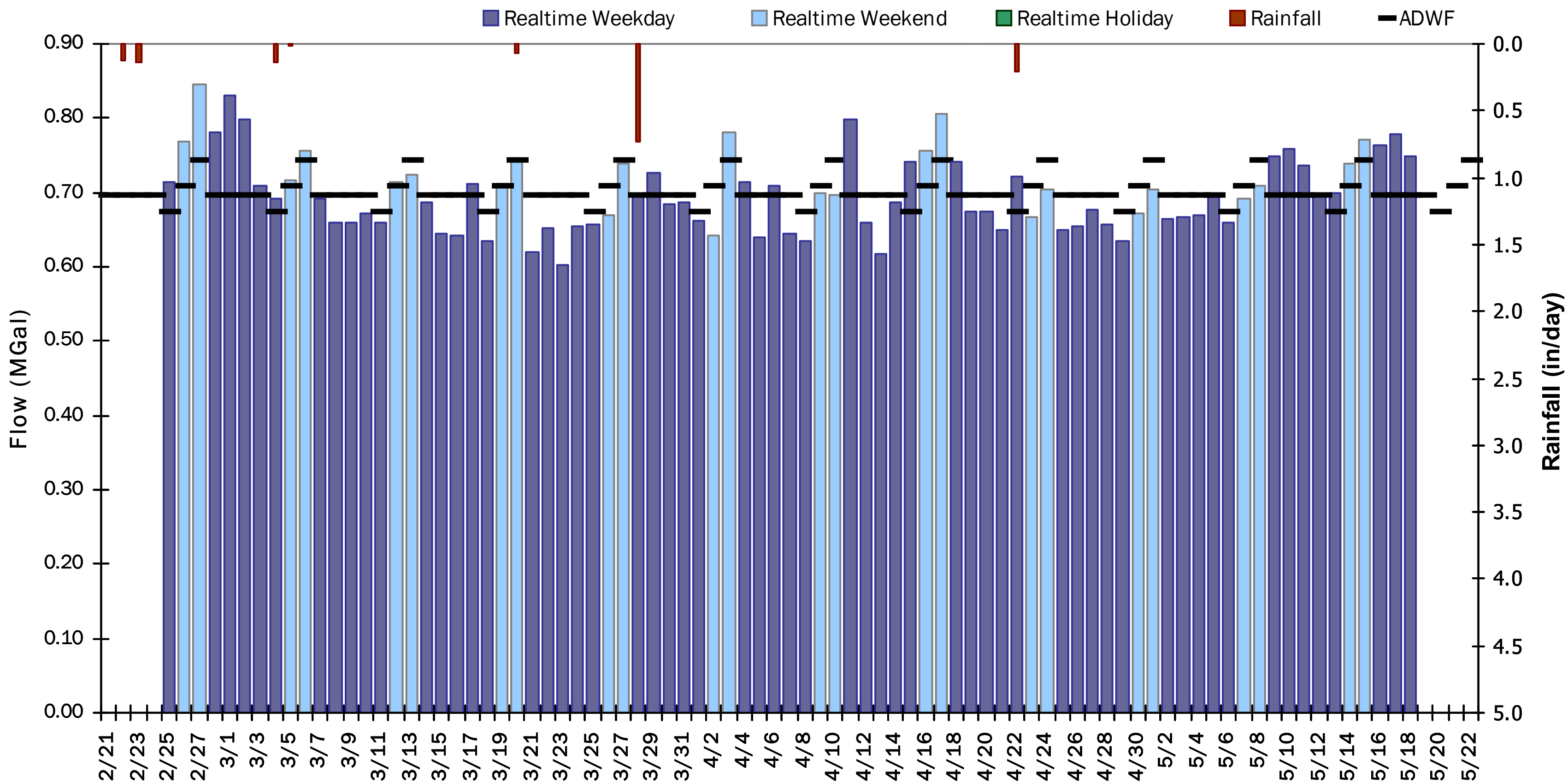
Influent Pipe

SITE 14

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.702 MGal   Peak Daily Flow: 0.845 MGal   Min Daily Flow: 0.603 MGal

Total Rainfall: 1.17 inches

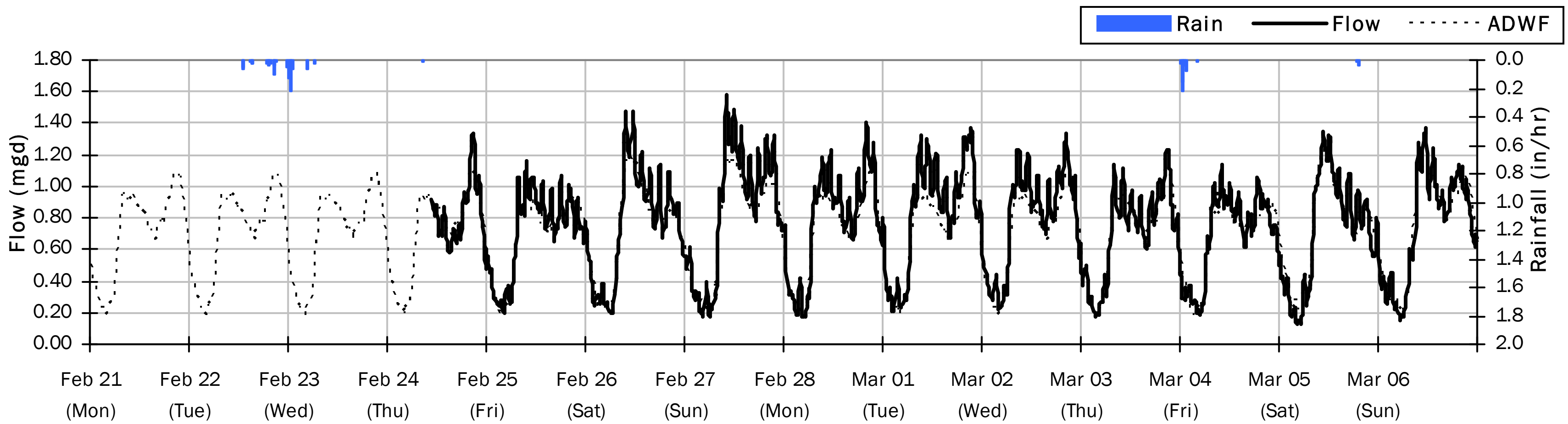


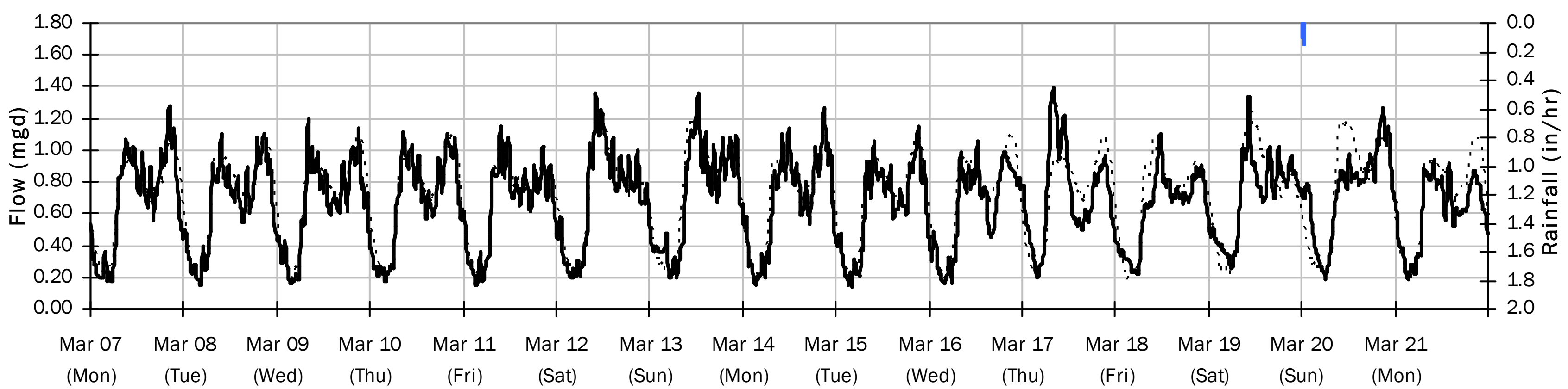
SITE 14

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.49 inches

Period Avg Flow: 0.714 mgd Period Peak Flow: 1.566 mgd Period Min Flow: 0.125 mgd

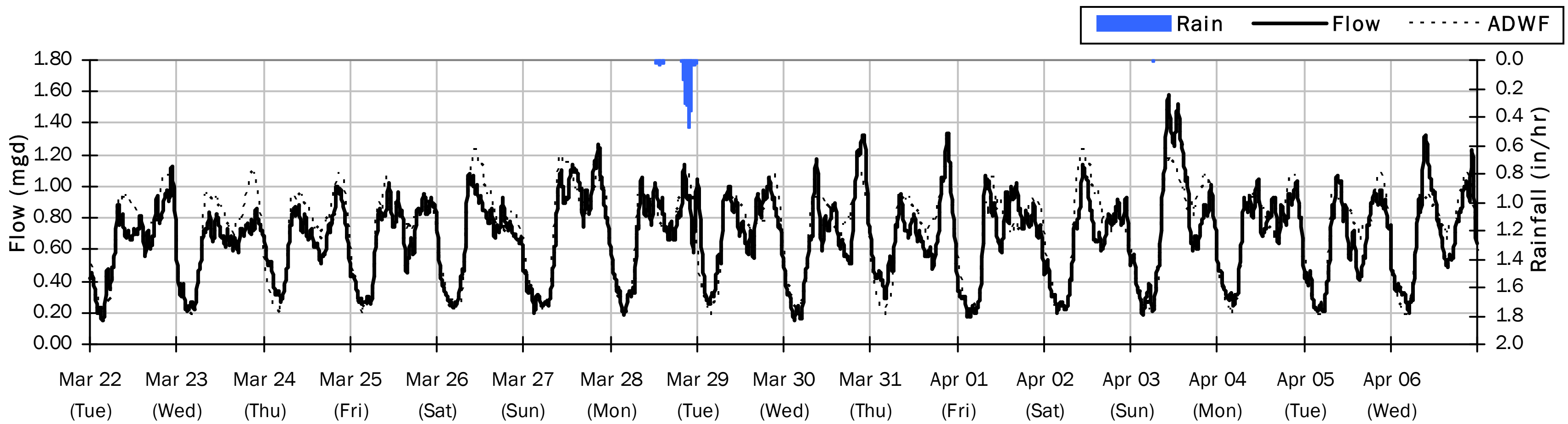


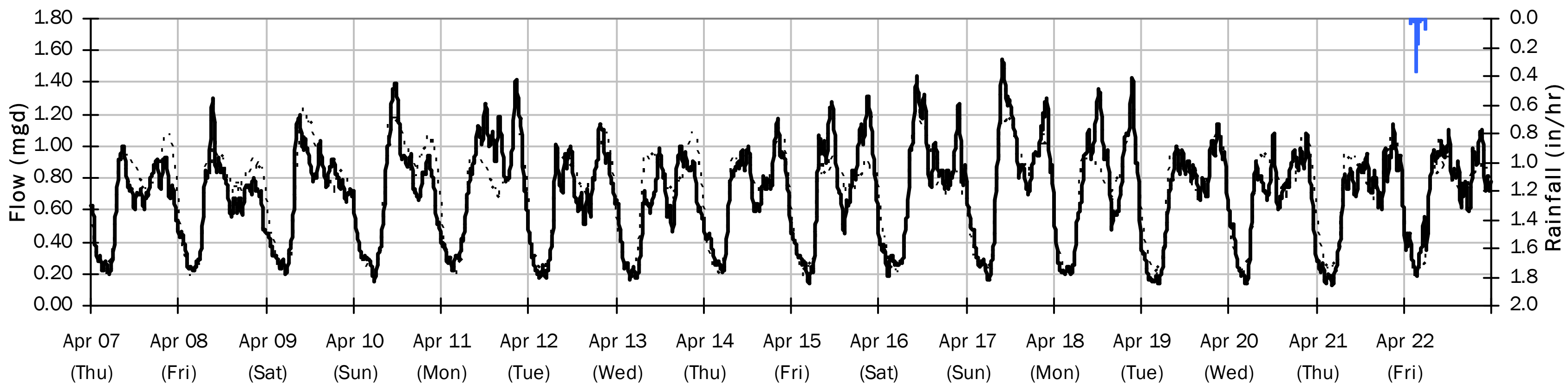


SITE 14

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.94 inches   Period Avg Flow: 0.691 mgd   Period Peak Flow: 1.575 mgd   Period Min Flow: 0.128 mgd



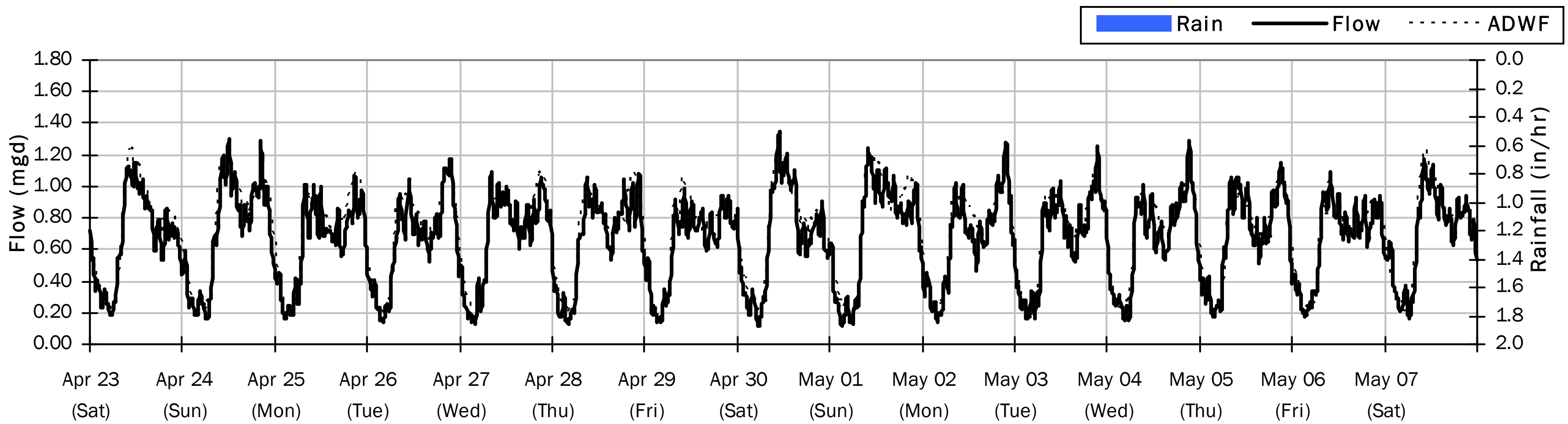


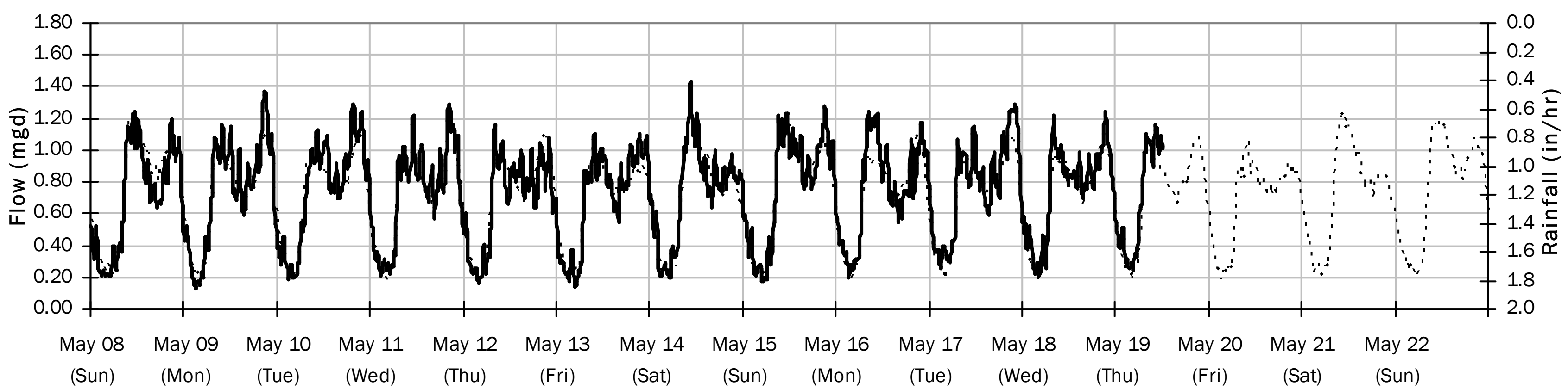
SITE 14

Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

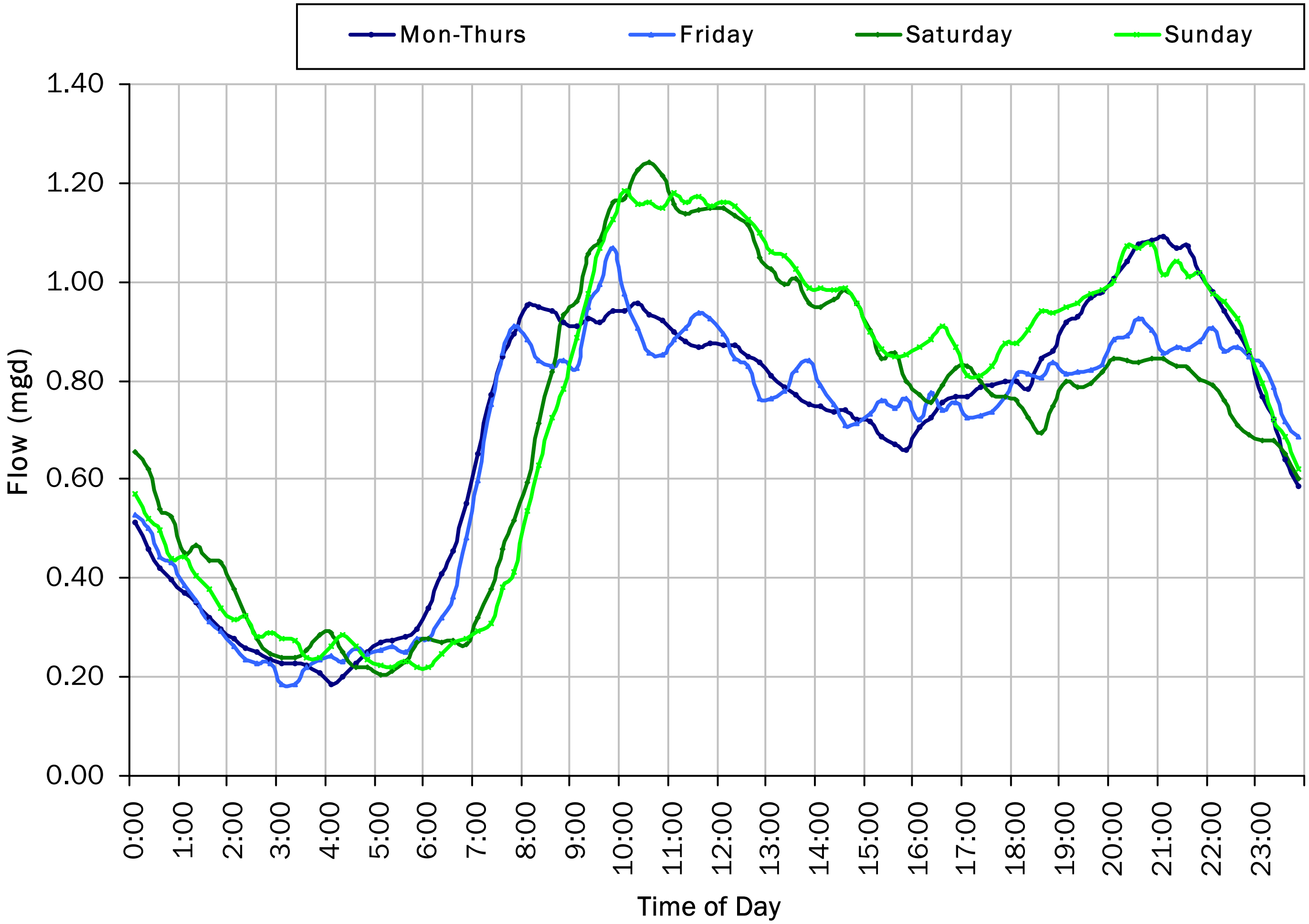
Period Avg Flow: 0.700 mgd Period Peak Flow: 1.431 mgd Period Min Flow: 0.111 mgd





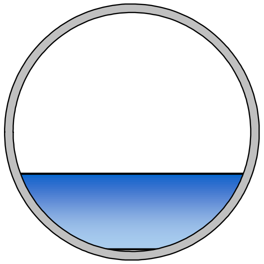
SITE 14

Average Dry Weather Flow Hydrographs



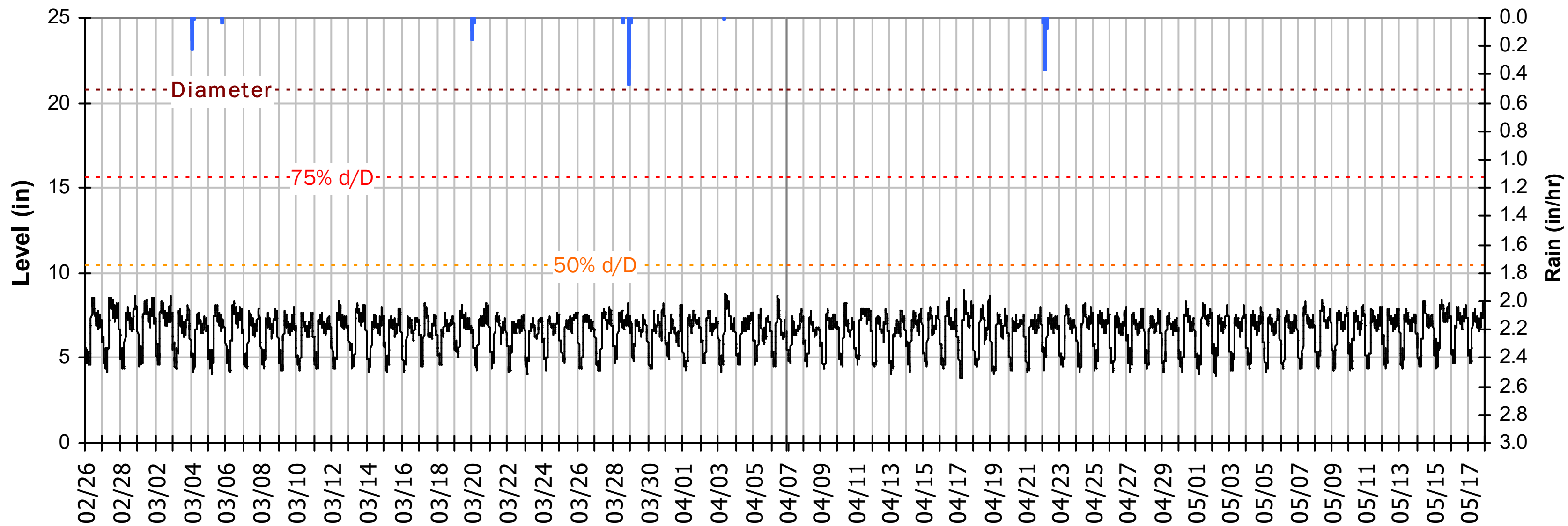
ADWF:

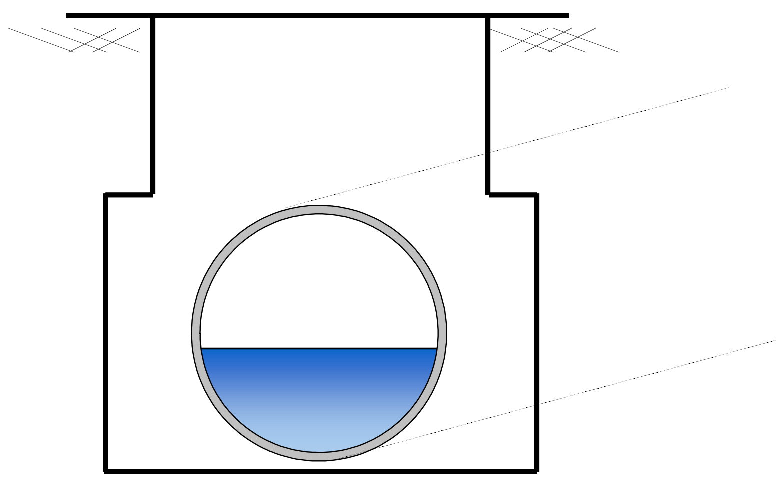
0.702 *mgd*



SITE 14
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

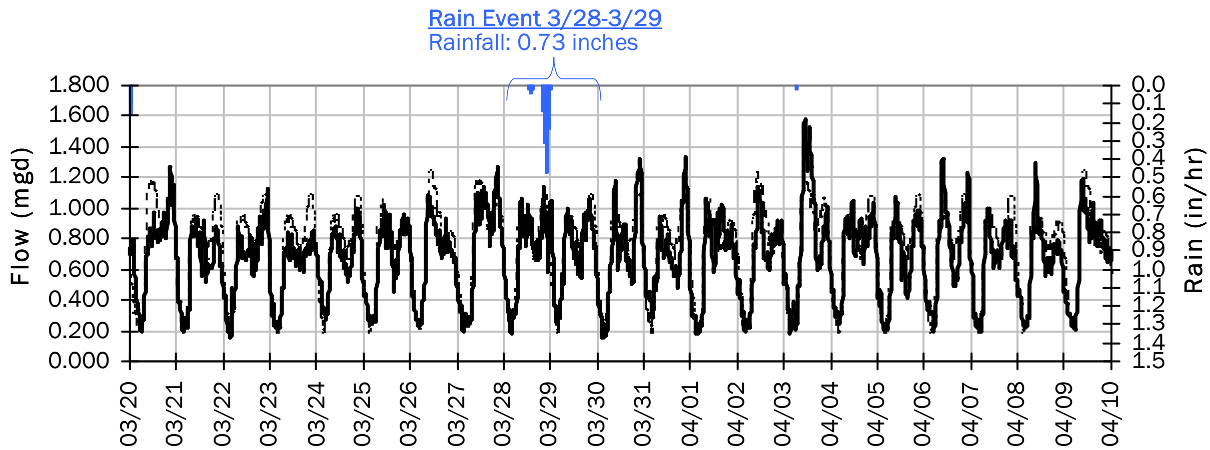




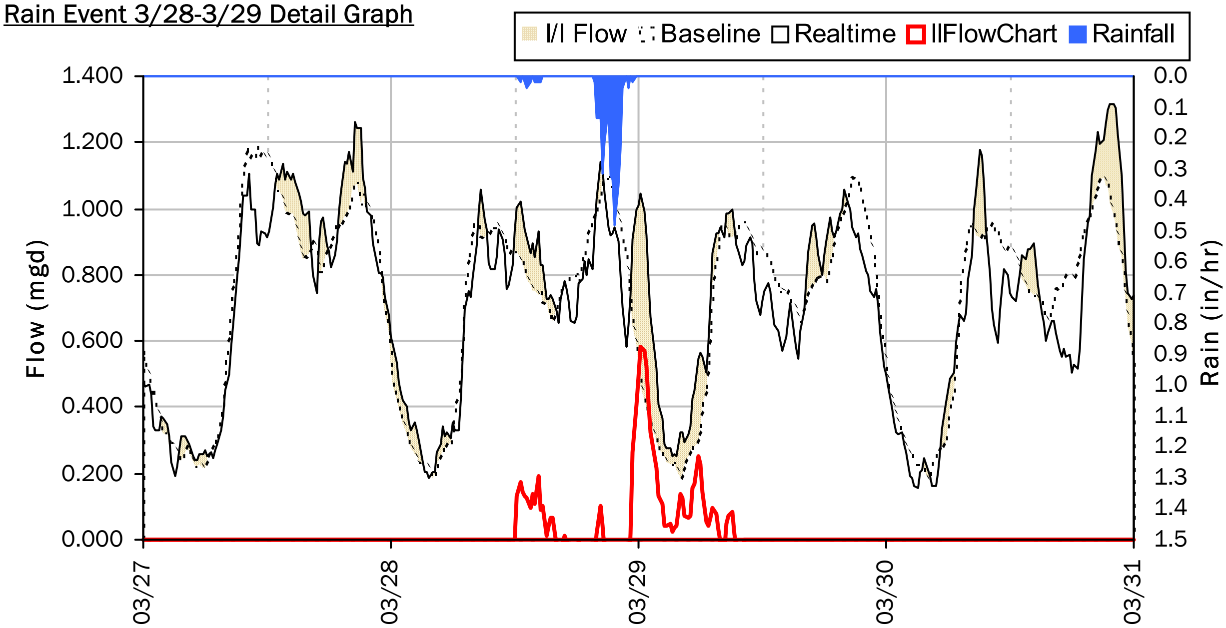
Pipe Diameter:	20.8	*inches*
Peak Measured Level:	9.05	*inches*
Peak d/D Ratio:	0.44	

SITE 14
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



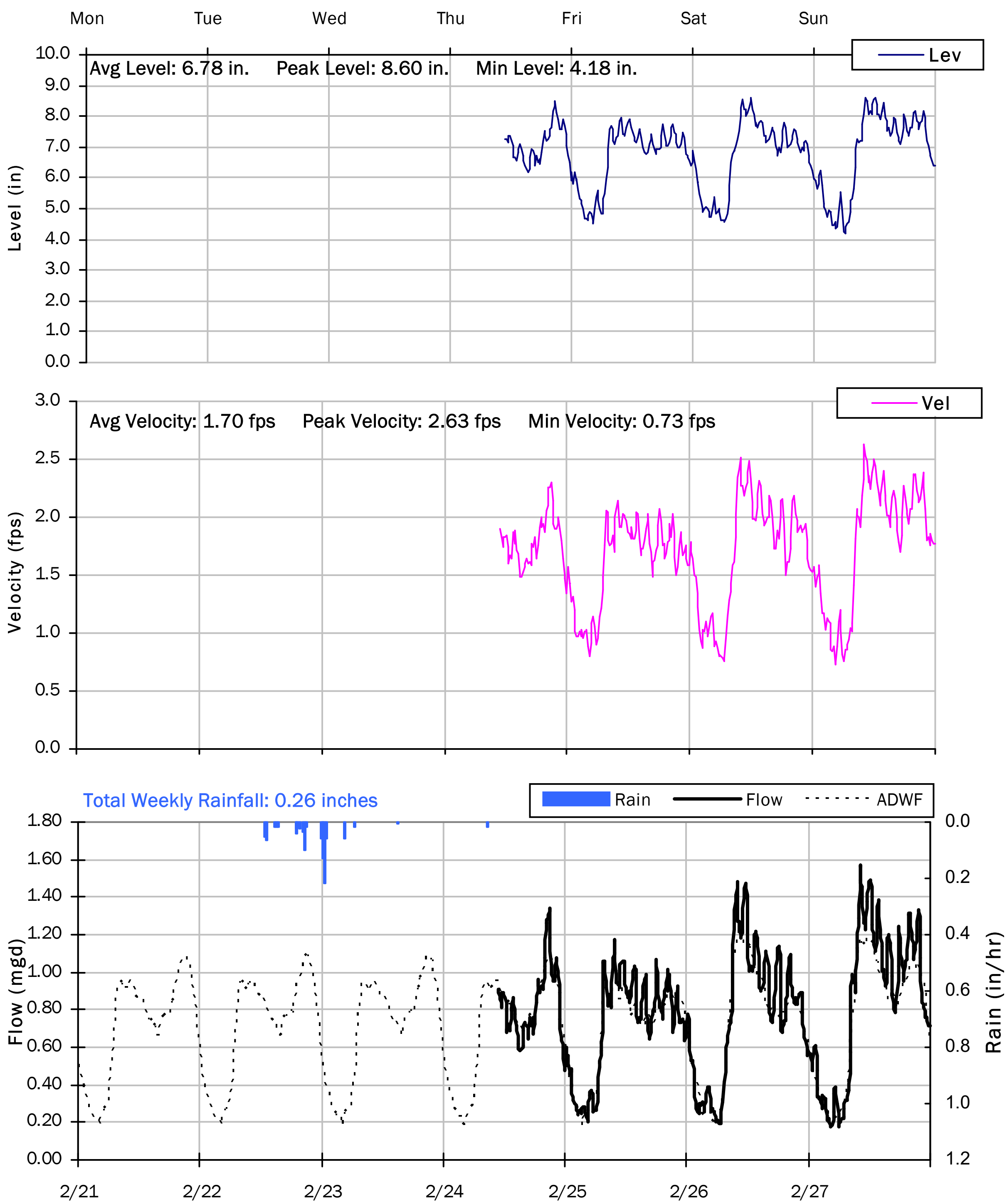
Storm Event I/I Analysis (Rain = 0.73 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	1.140 *mgd*	Peak I/I Rate:	0.584 *mgd*
PF:	1.62	Total I/I:	59,000 *gallons*
Peak Level:	8.27 *in*		
d/D Ratio:	0.40		

SITE 14

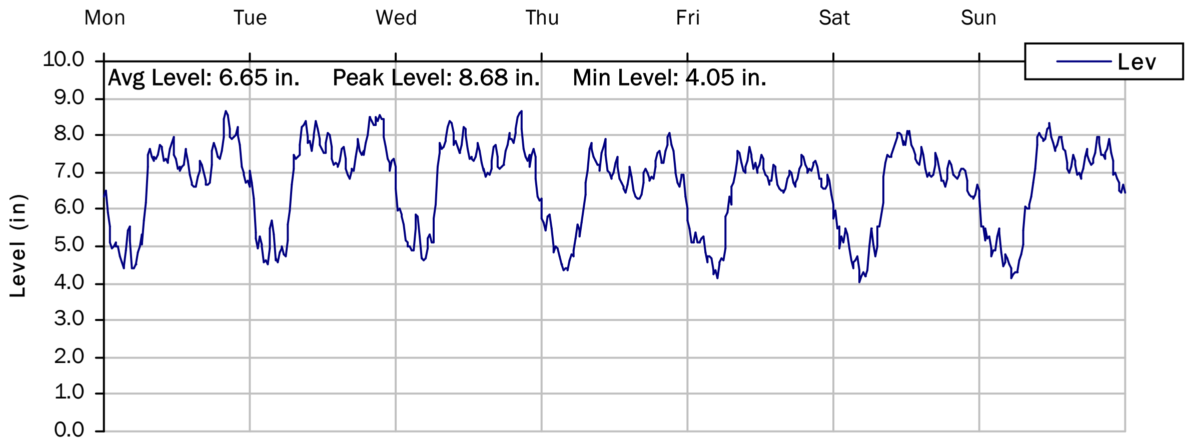
Weekly Level, Velocity and Flow Hydrographs

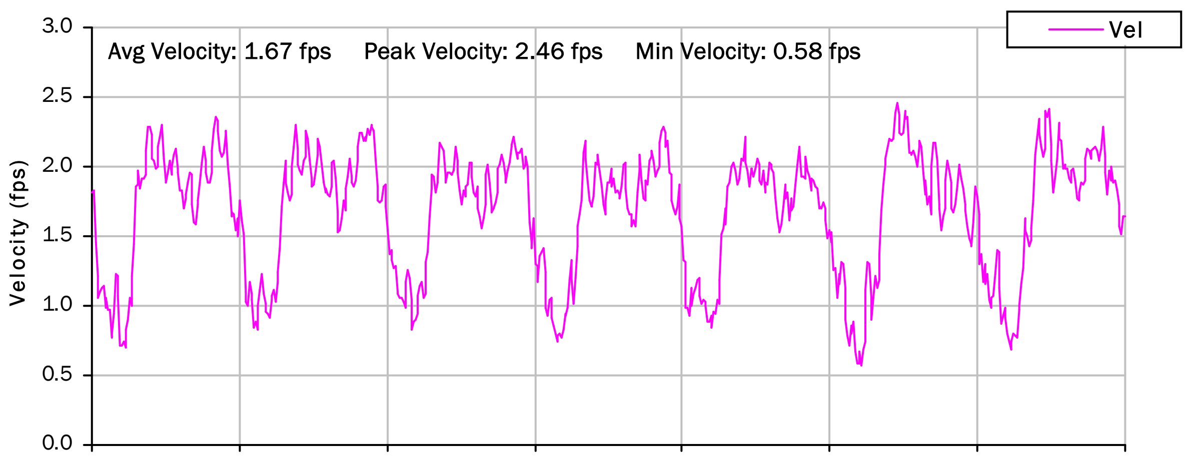
2/21/2022 to 2/28/2022

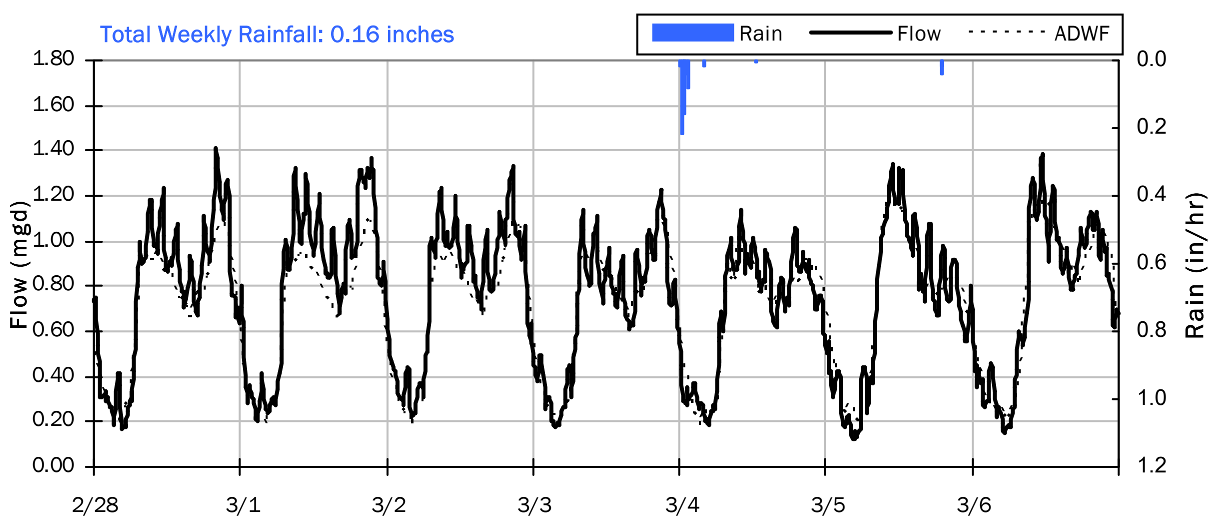


Avg Flow: 0.785 mgd Peak Flow: 1.566 mgd Min Flow: 0.172 mgd

SITE 14
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

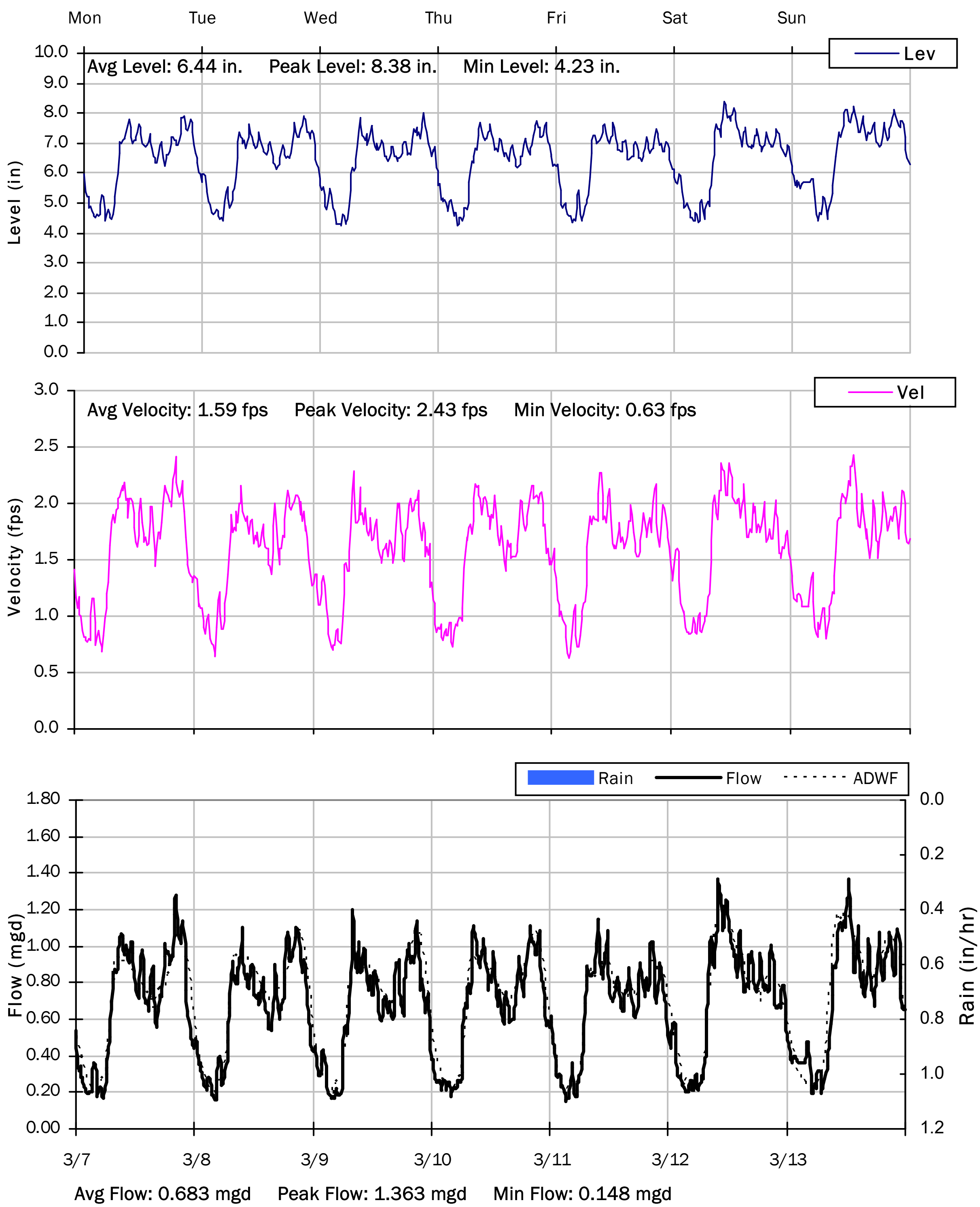




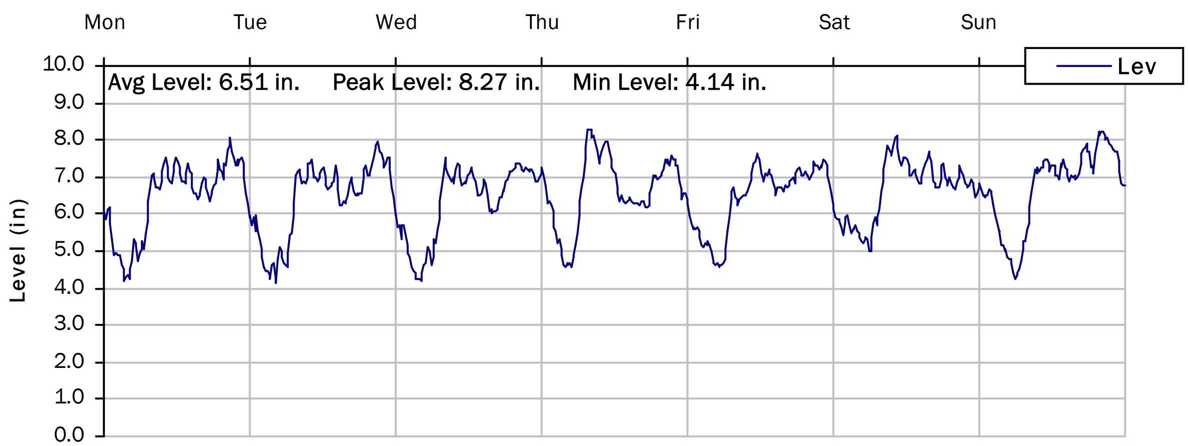


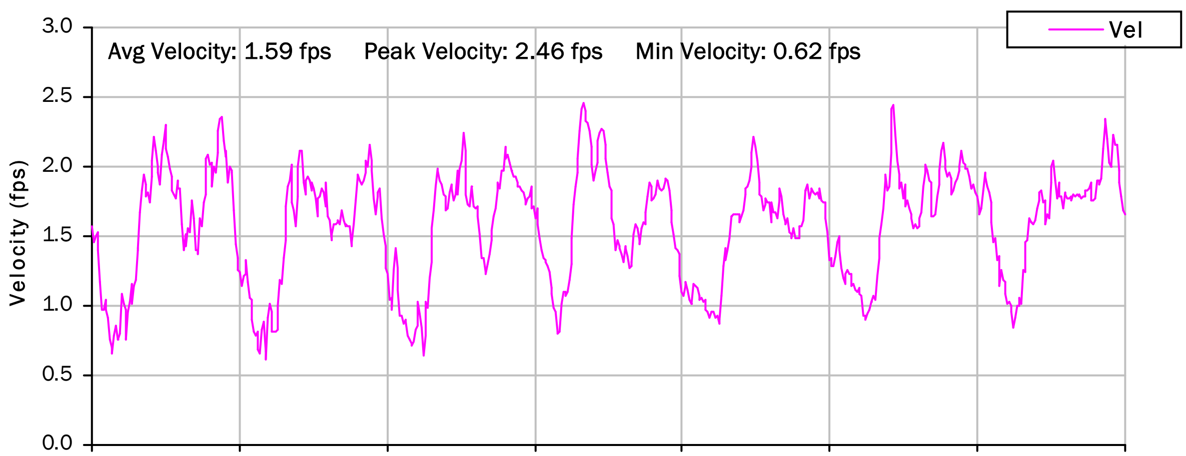
Avg Flow: 0.755 mgd Peak Flow: 1.410 mgd Min Flow: 0.125 mgd

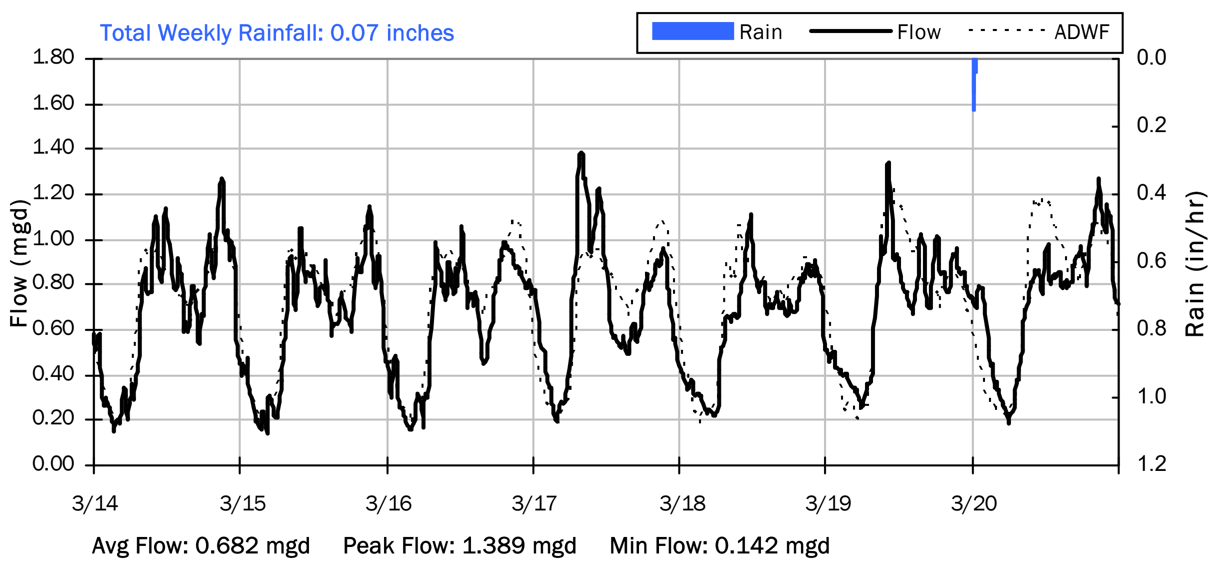
SITE 14
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022



SITE 14
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022

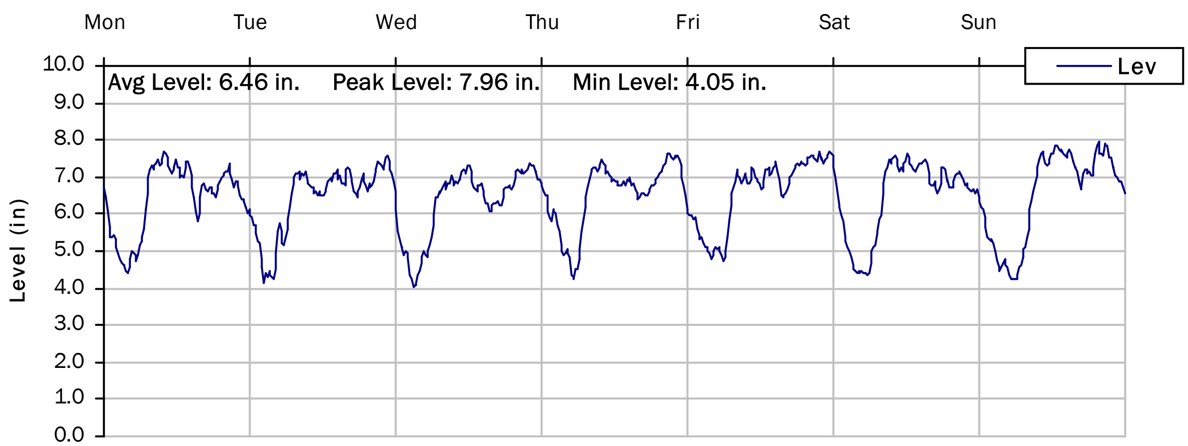


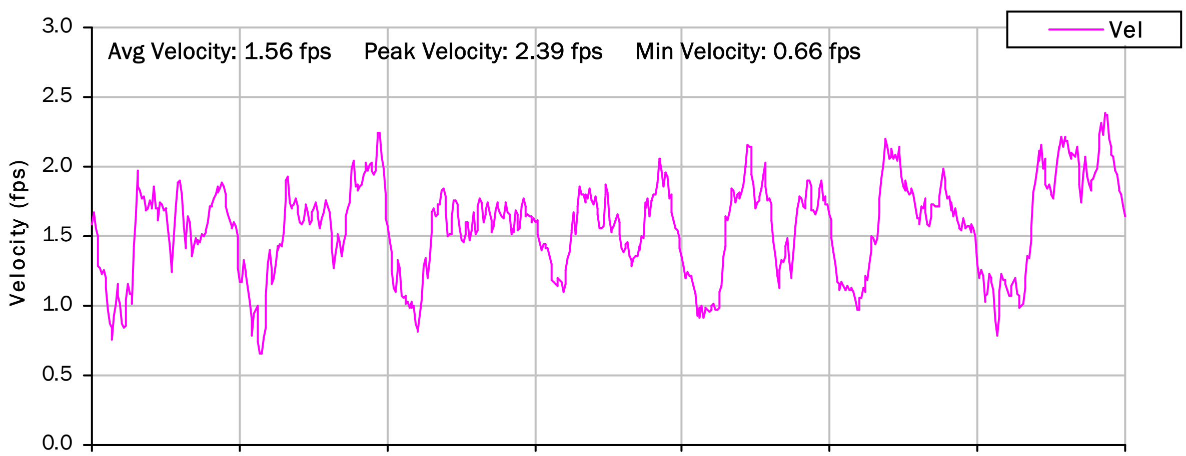


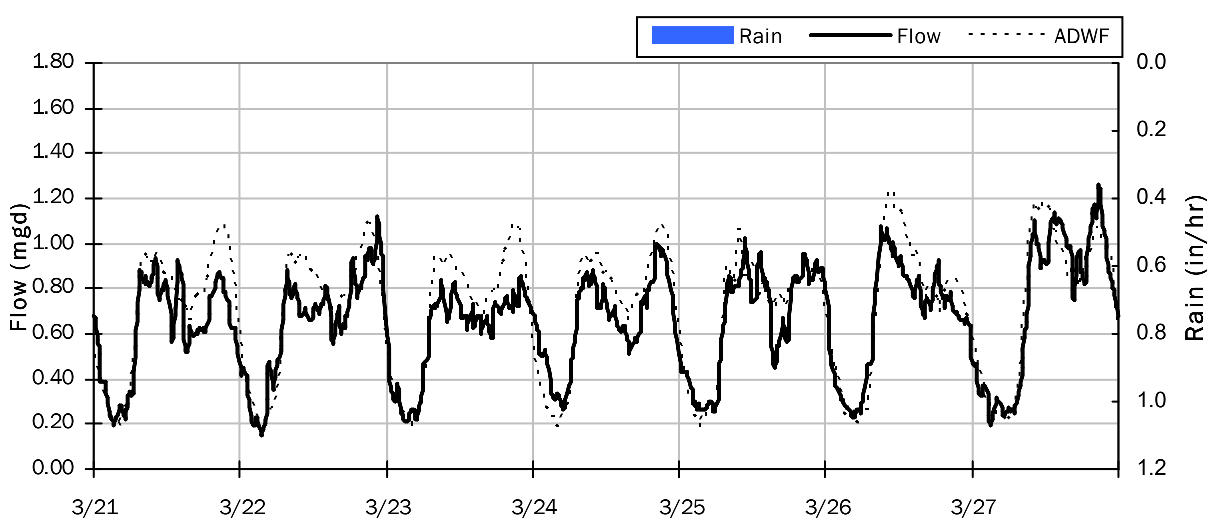


SITE 14

Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

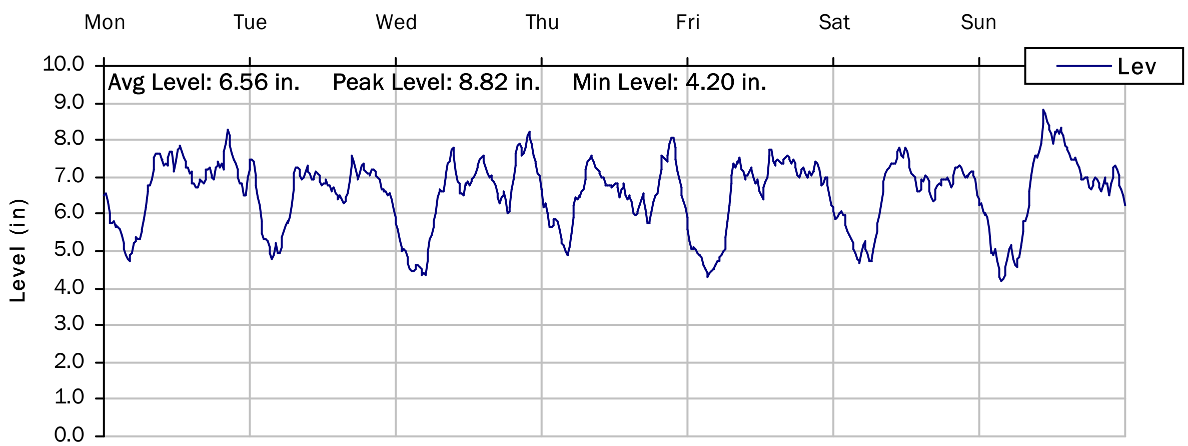


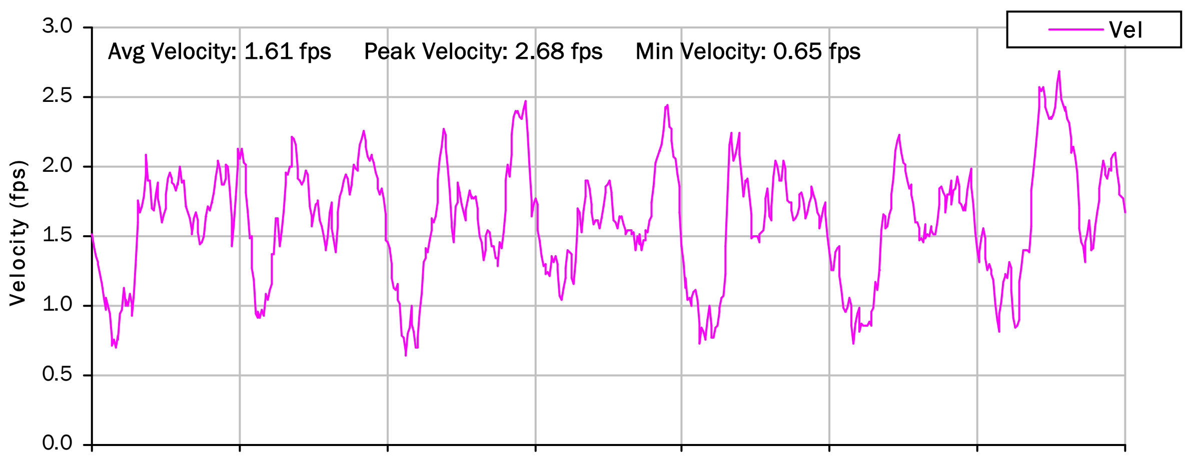


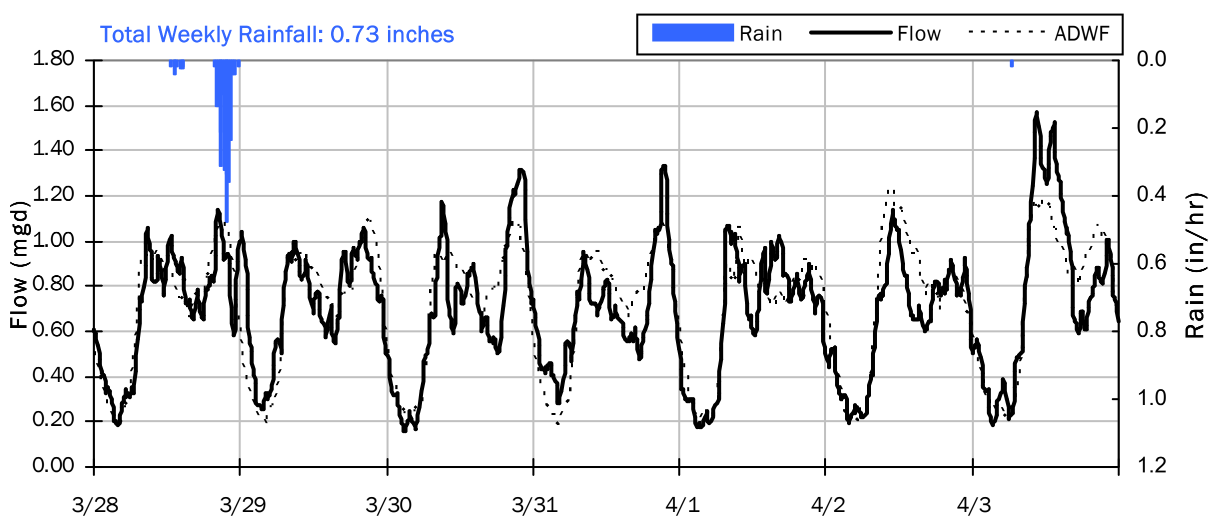


Avg Flow: 0.657 mgd Peak Flow: 1.264 mgd Min Flow: 0.149 mgd

SITE 14
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

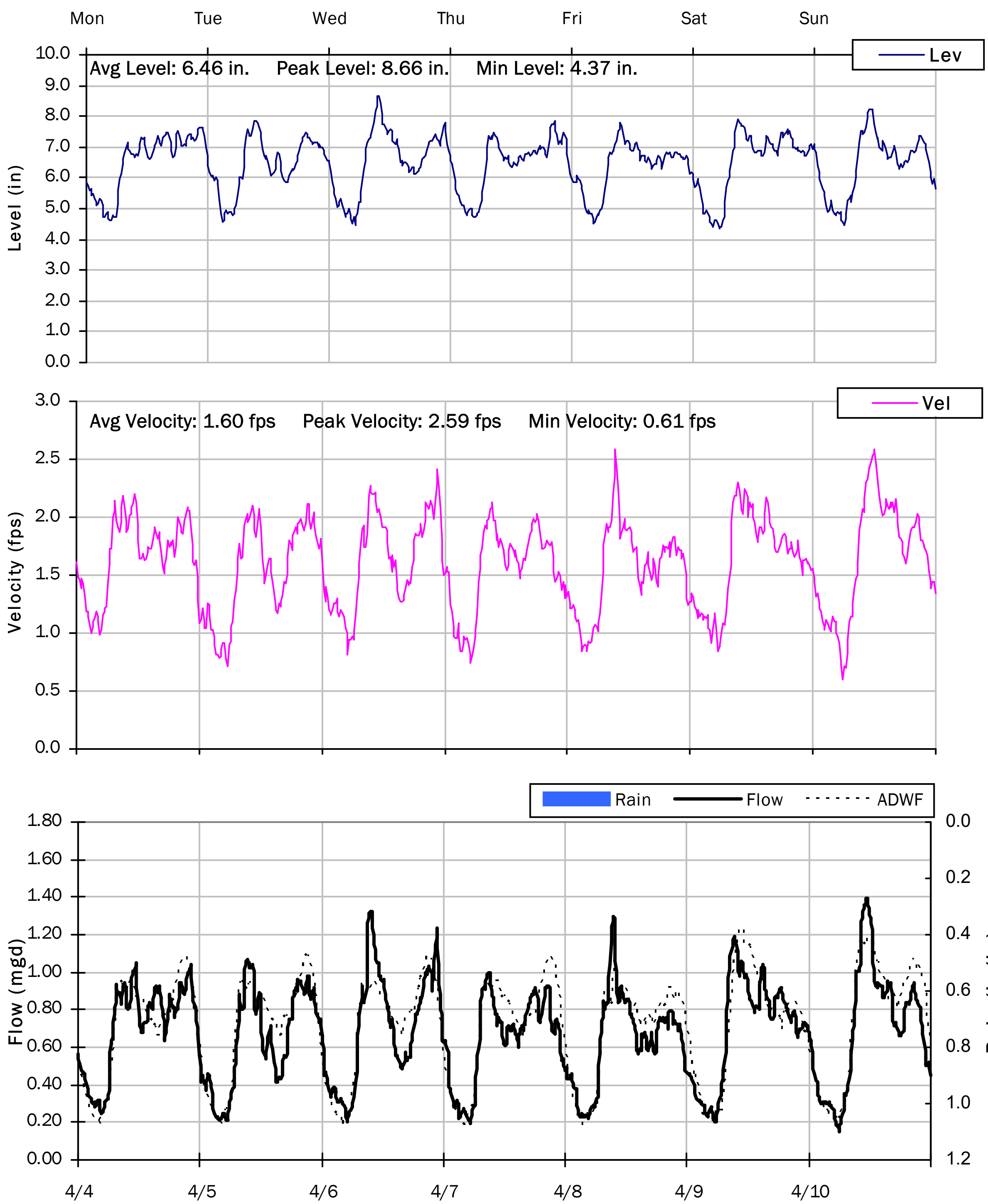






Avg Flow: 0.697 mgd Peak Flow: 1.575 mgd Min Flow: 0.156 mgd

SITE 14
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

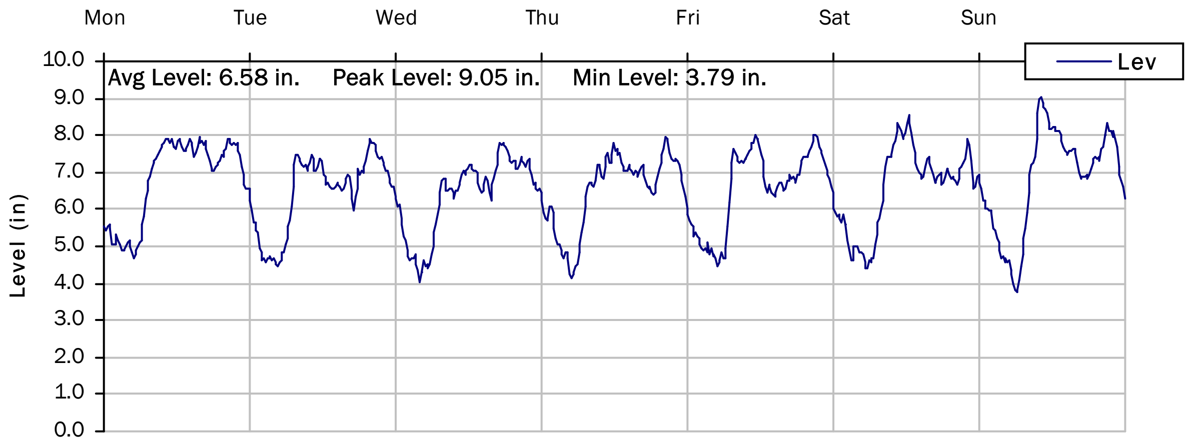


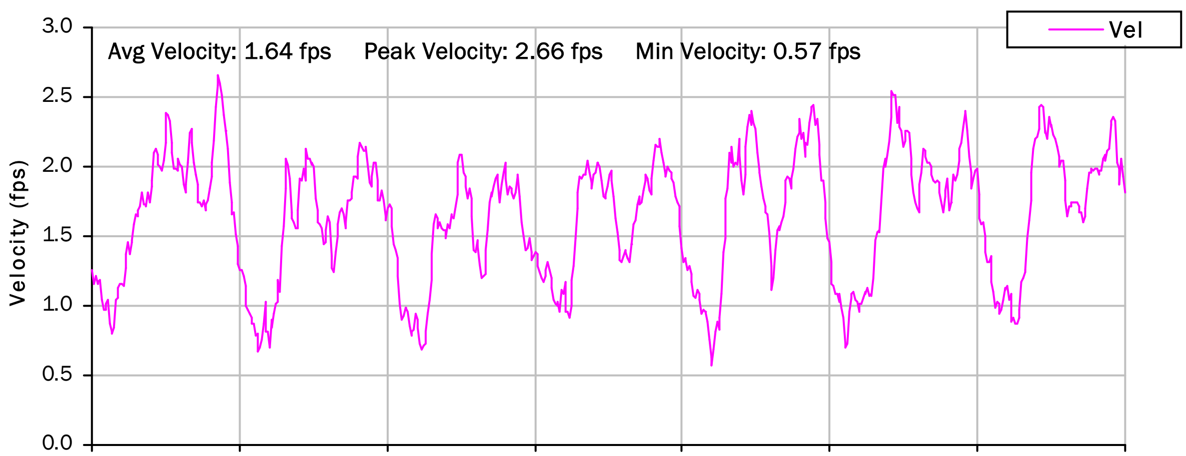
Avg Flow: 0.677 mgd Peak Flow: 1.396 mgd Min Flow: 0.146 mgd

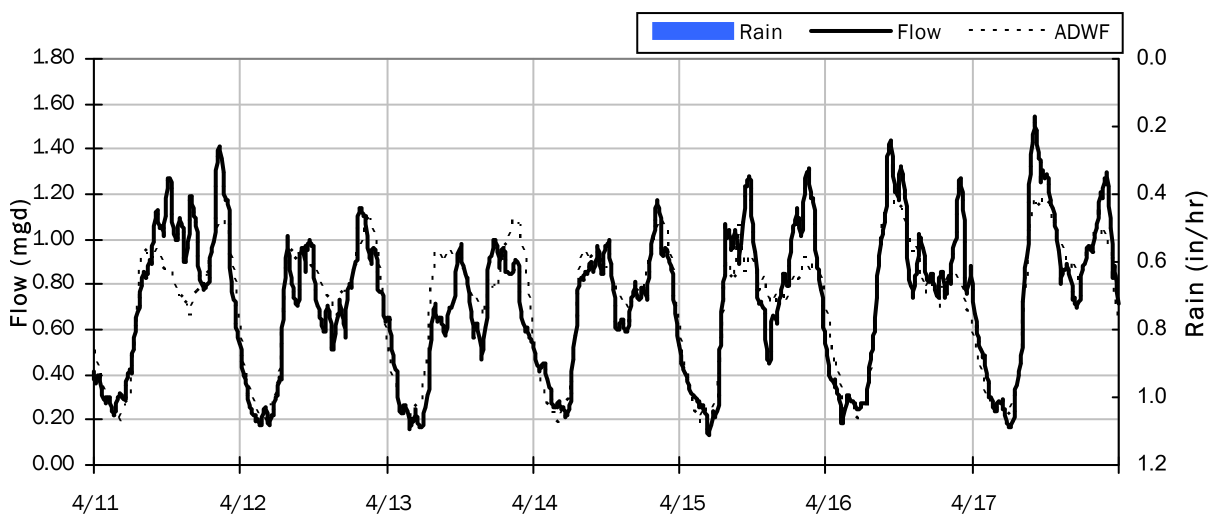
SITE 14

Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022

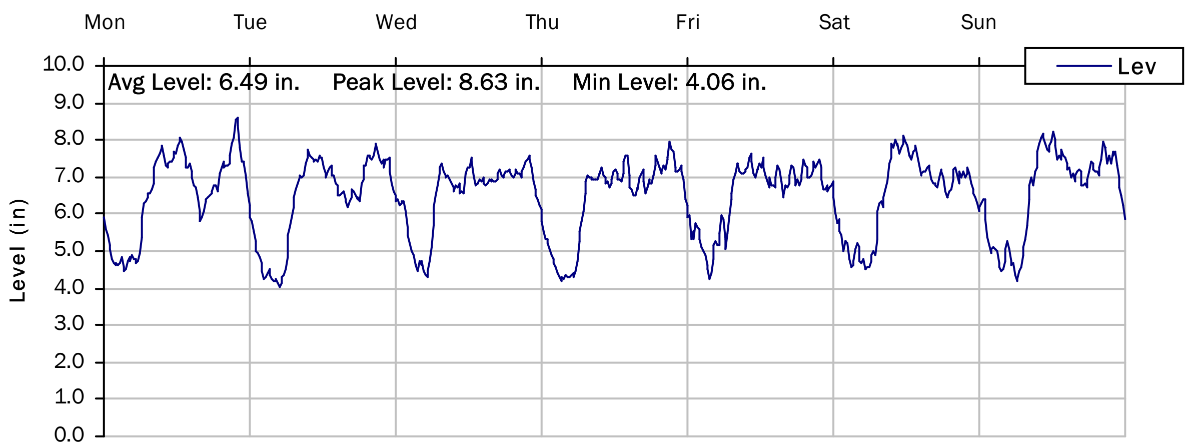


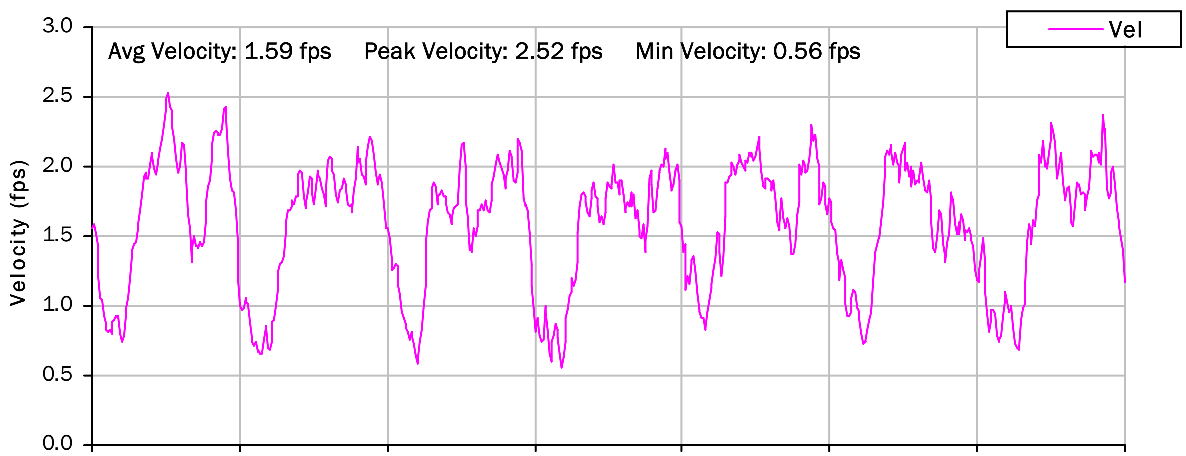


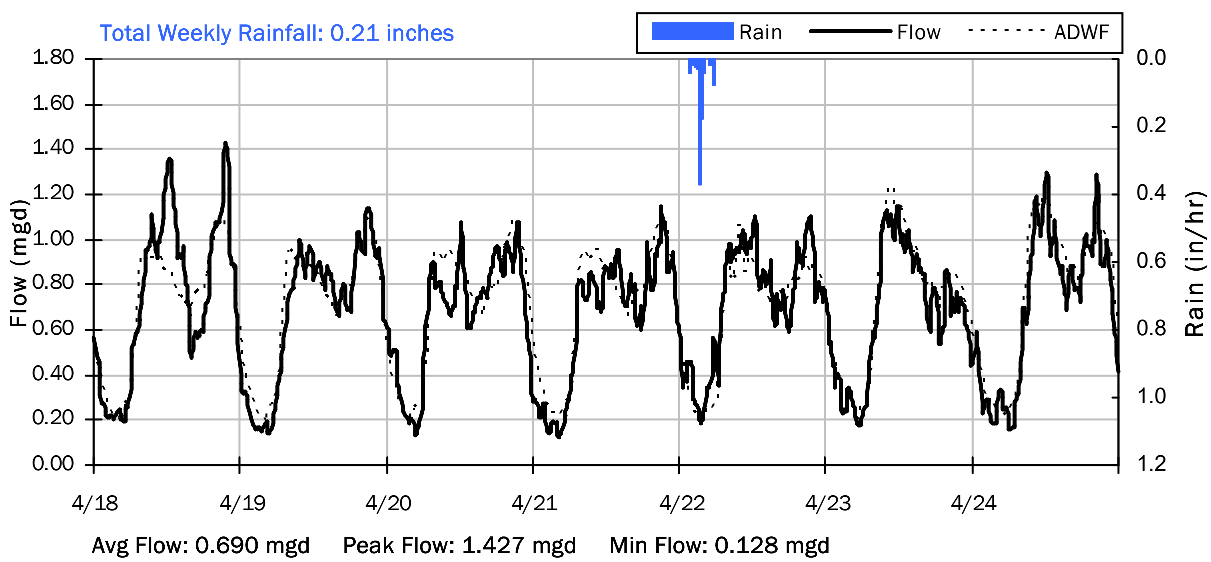


Avg Flow: 0.724 mgd Peak Flow: 1.543 mgd Min Flow: 0.136 mgd

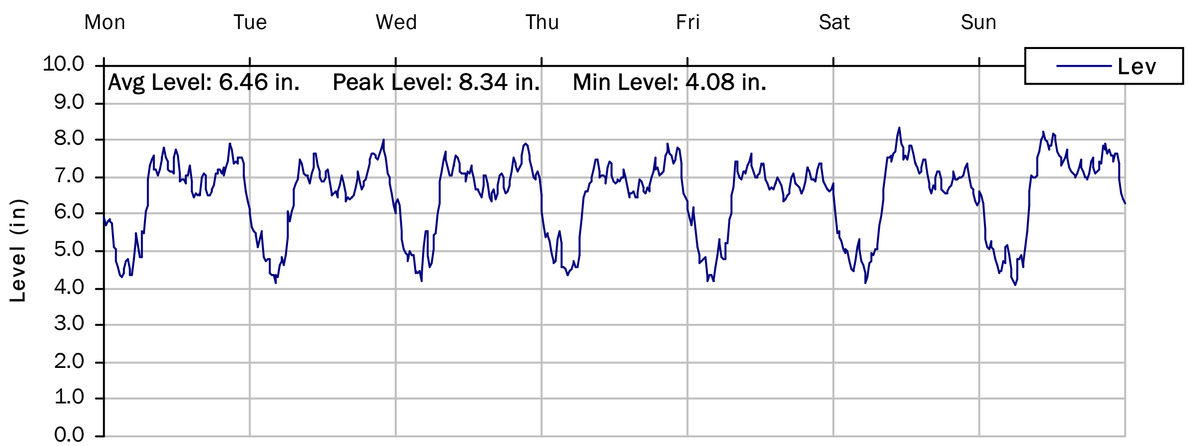
SITE 14
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

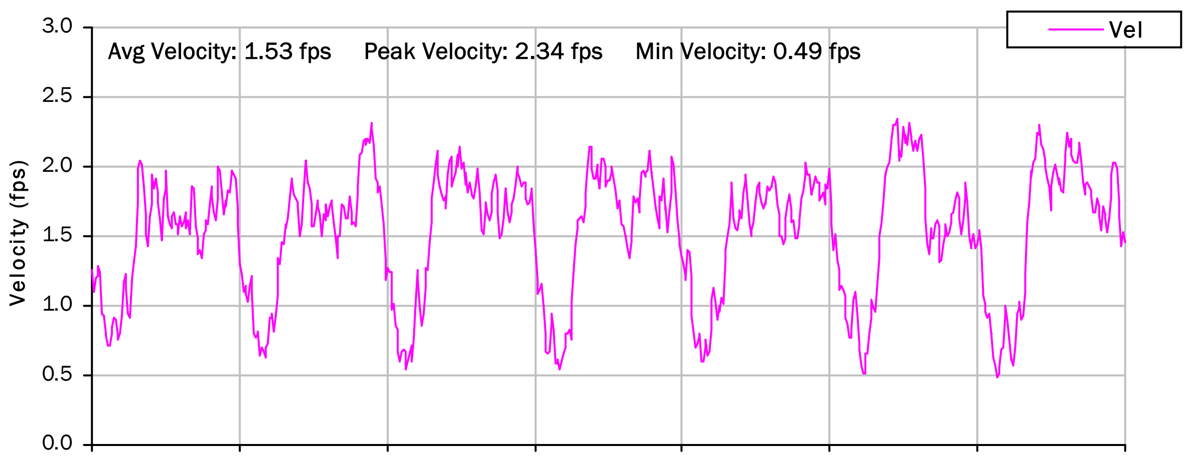


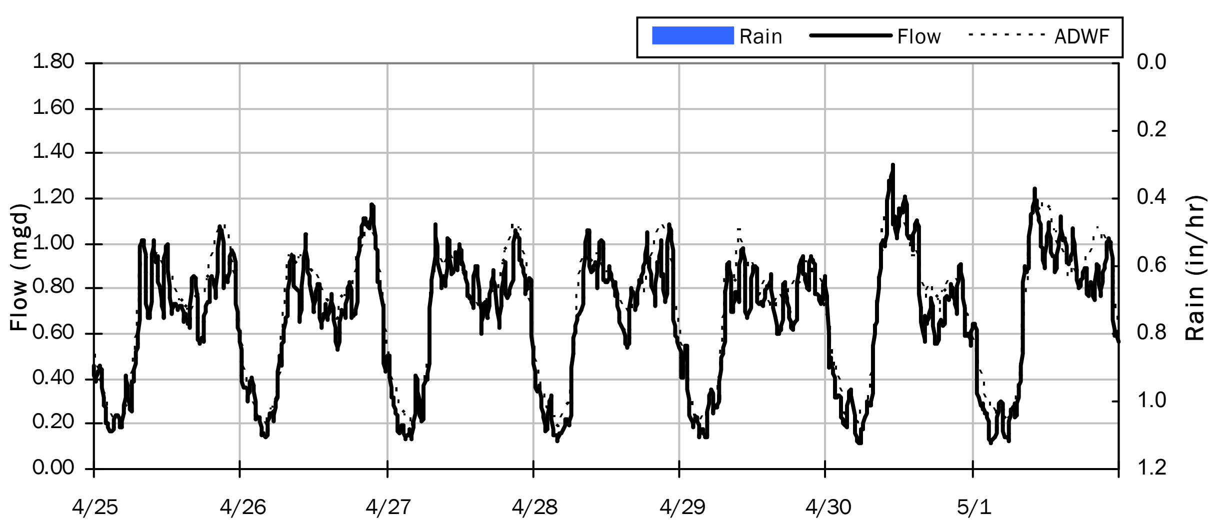




SITE 14
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022





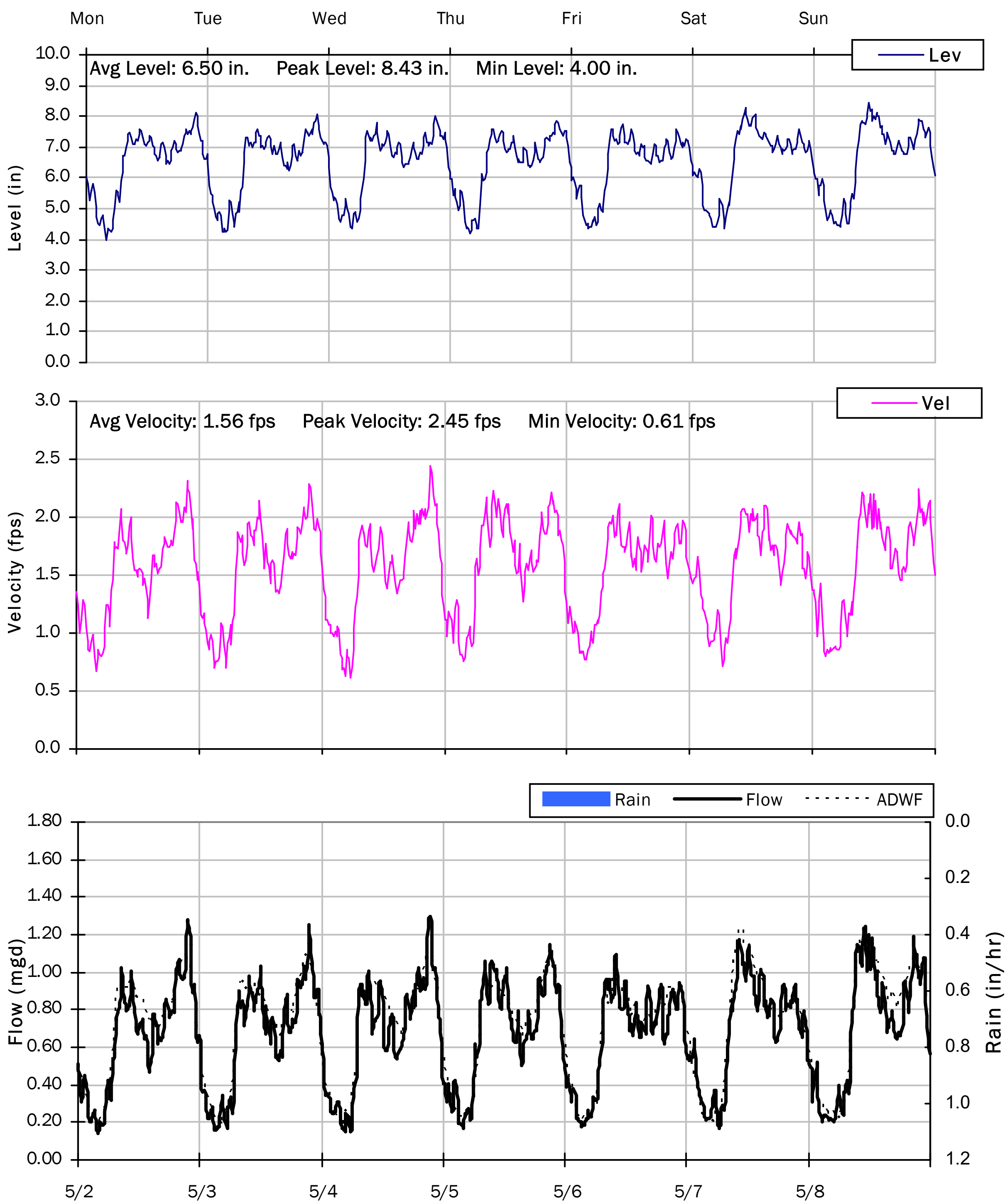


Avg Flow: 0.664 mgd Peak Flow: 1.341 mgd Min Flow: 0.111 mgd

SITE 14

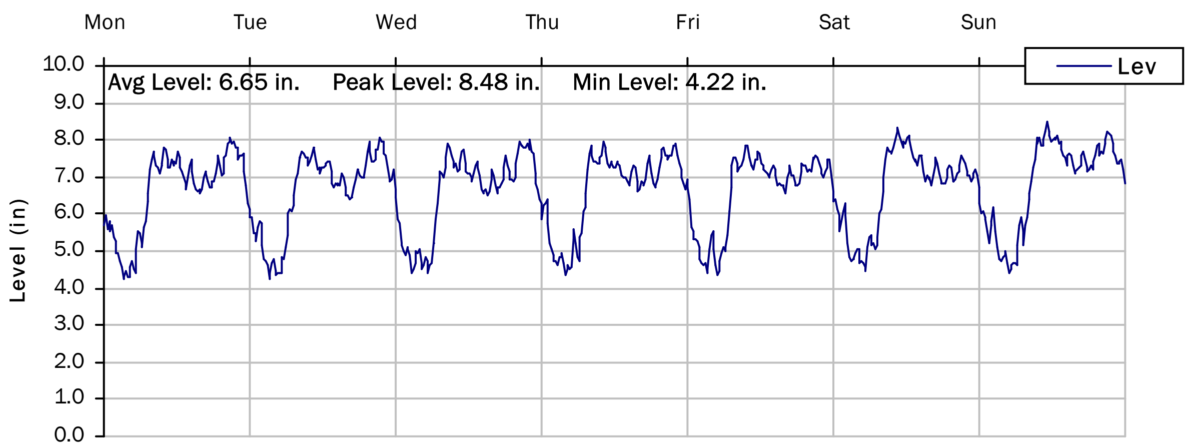
Weekly Level, Velocity and Flow Hydrographs

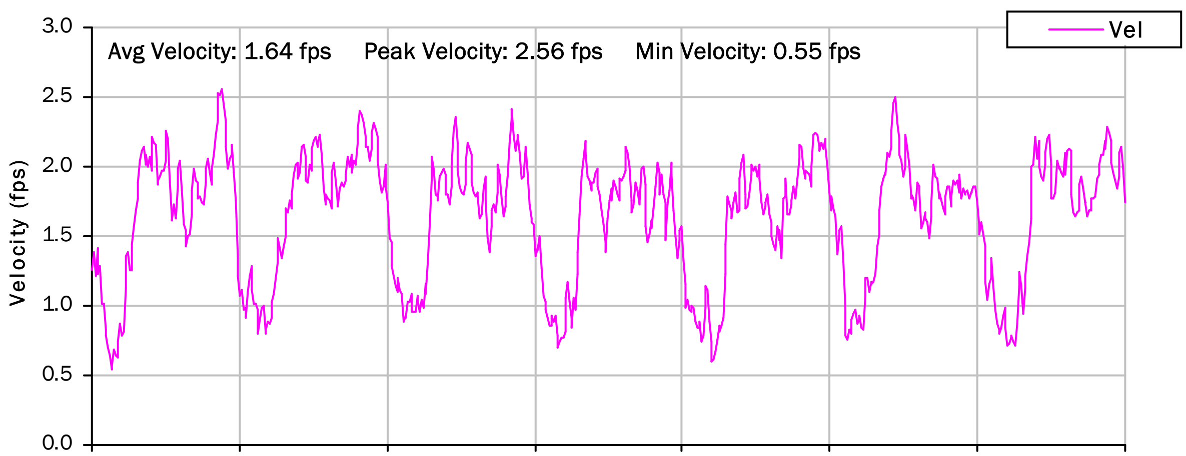
5/2/2022 to 5/9/2022

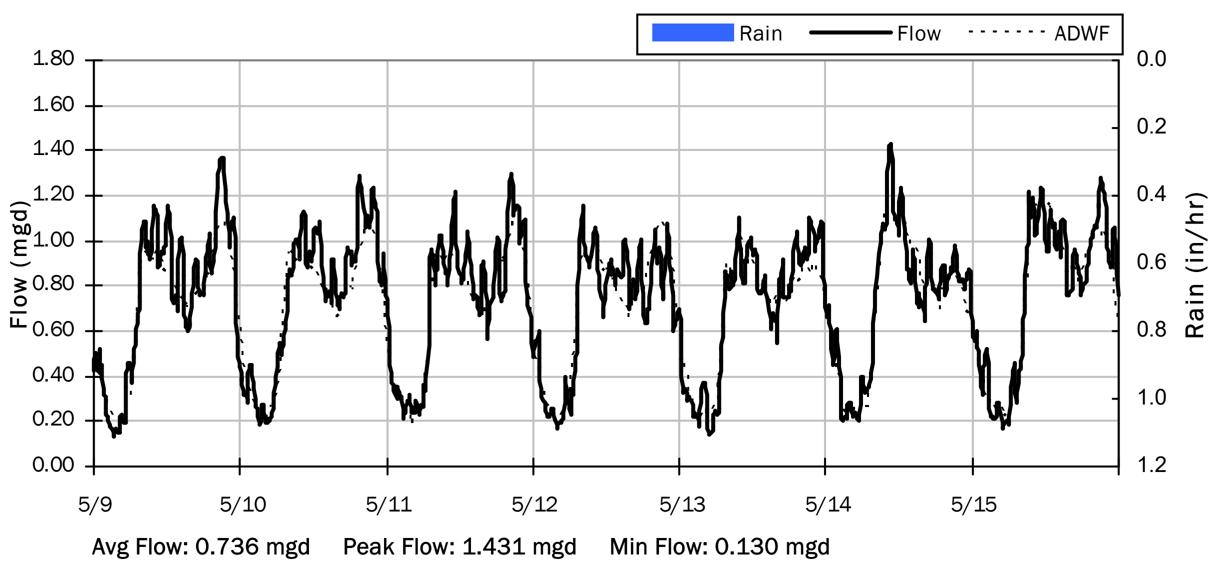


Avg Flow: 0.679 mgd Peak Flow: 1.294 mgd Min Flow: 0.137 mgd

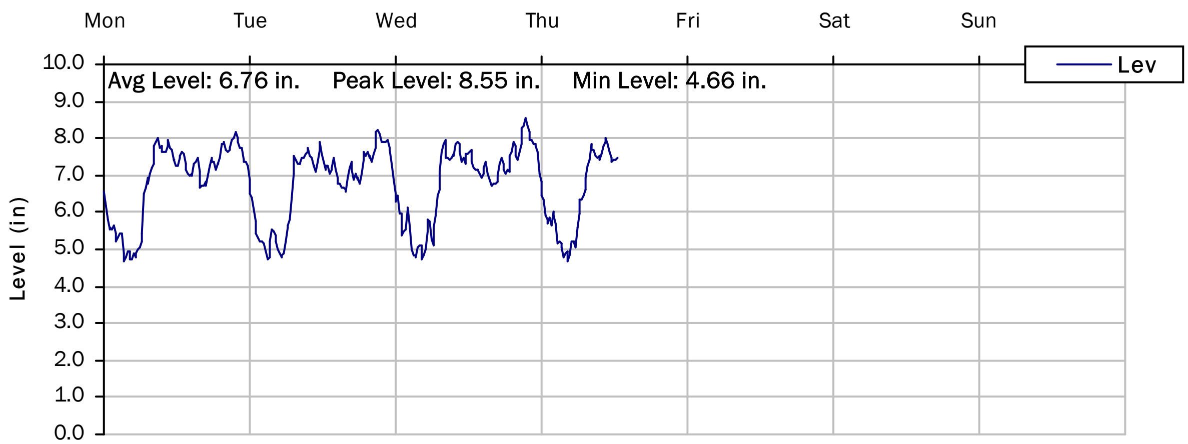
SITE 14
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022

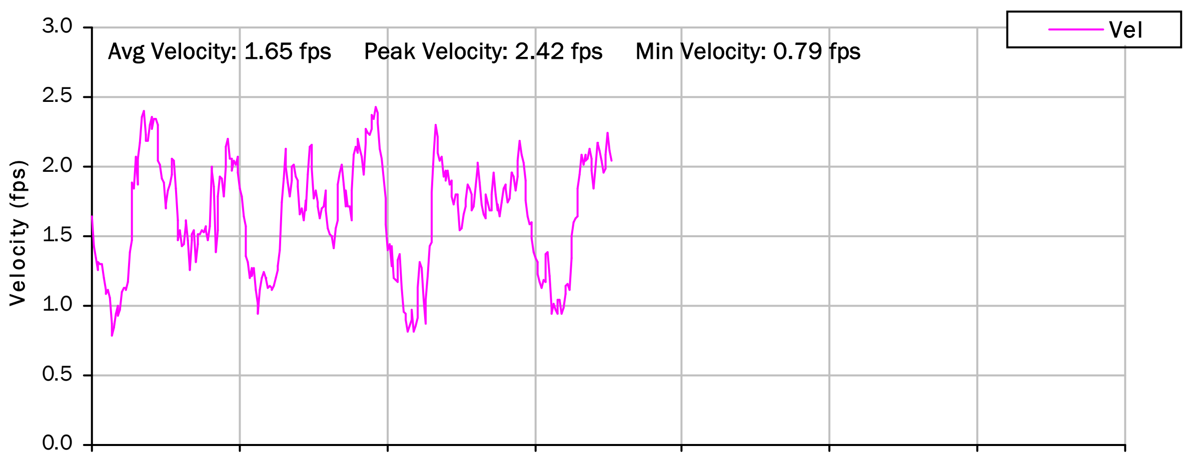


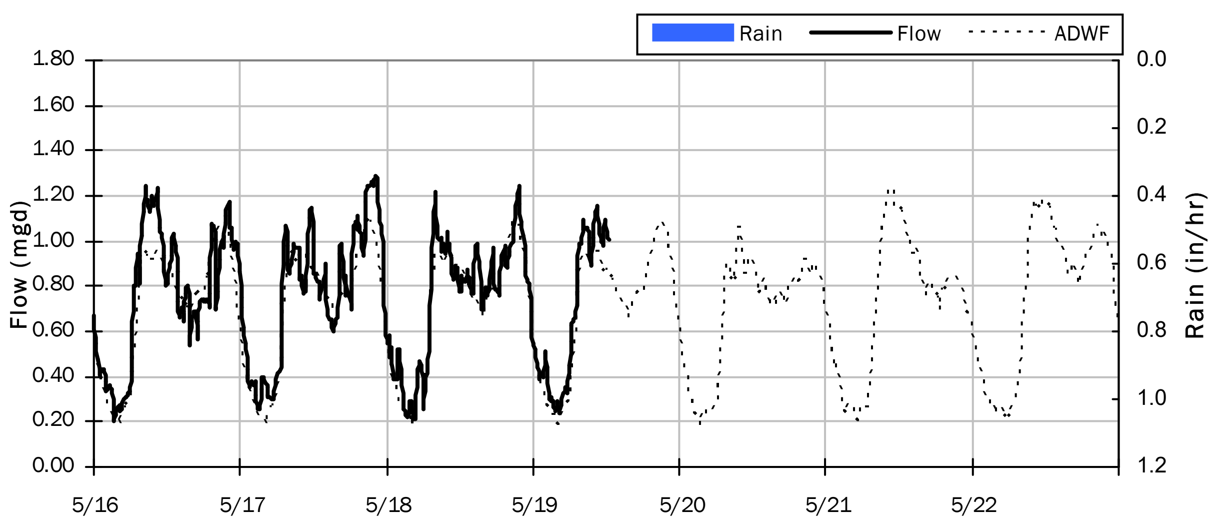




SITE 14
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Avg Flow: 0.750 mgd   Peak Flow: 1.286 mgd   Min Flow: 0.203 mgd

Monitoring Site: Site 15

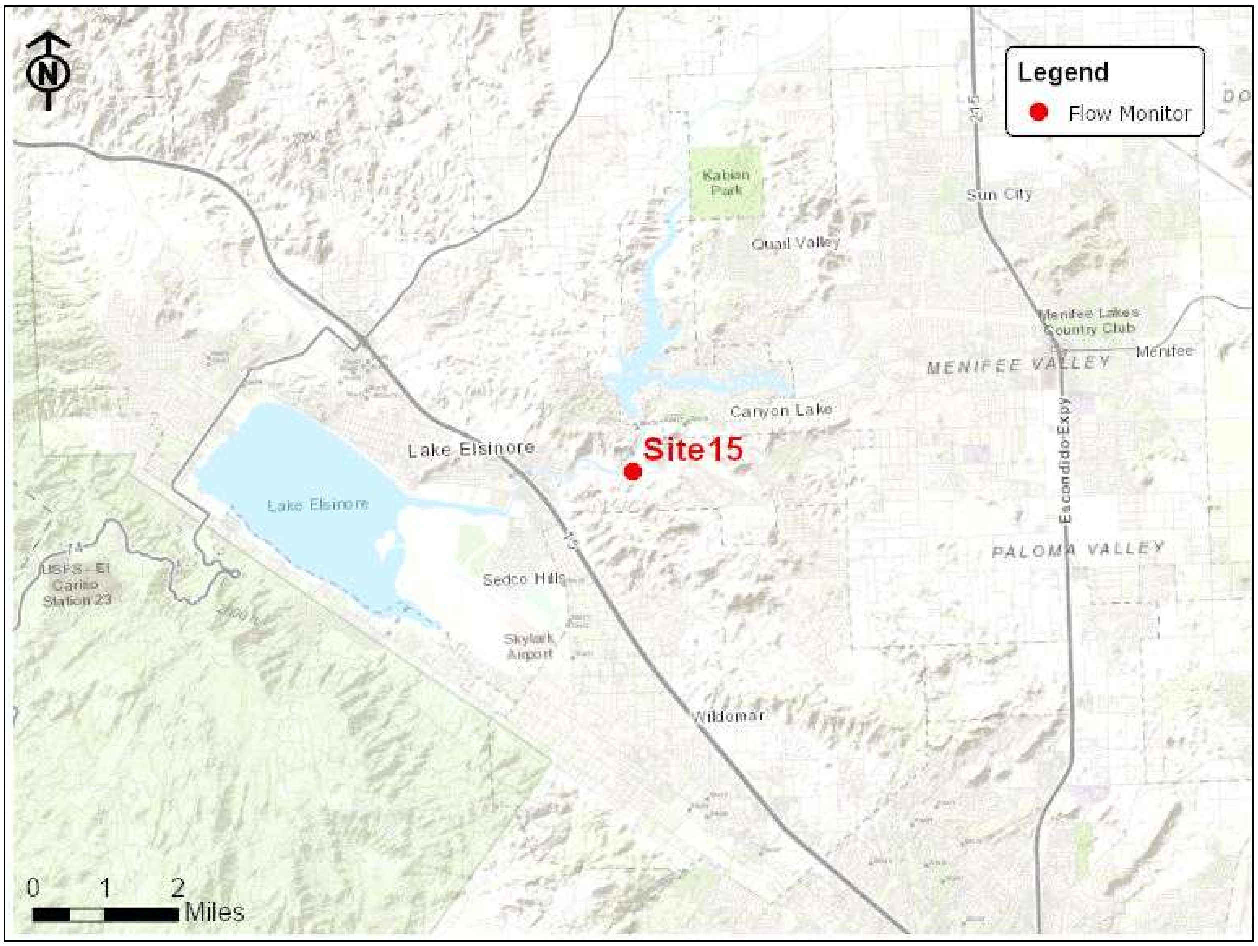
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Railroad Canyon Road

Data Summary Report



Vicinity Map: Site 15

SITE 15

Site Information MH ID: MH-2892

Location: Railroad Canyon Road

Coordinates: 117.2742° W, 33.6639° N

Rim Elevation (Earth): 1380 feet

Expected Pipe Diameter: 18 inches

Measured Pipe Diameter: 17.75 inches

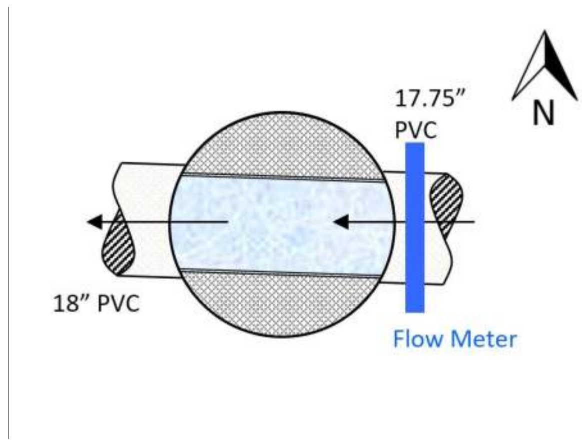
ADWF: 0.556 mgd

Peak Measured Flow: 1.148 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch

View from Street

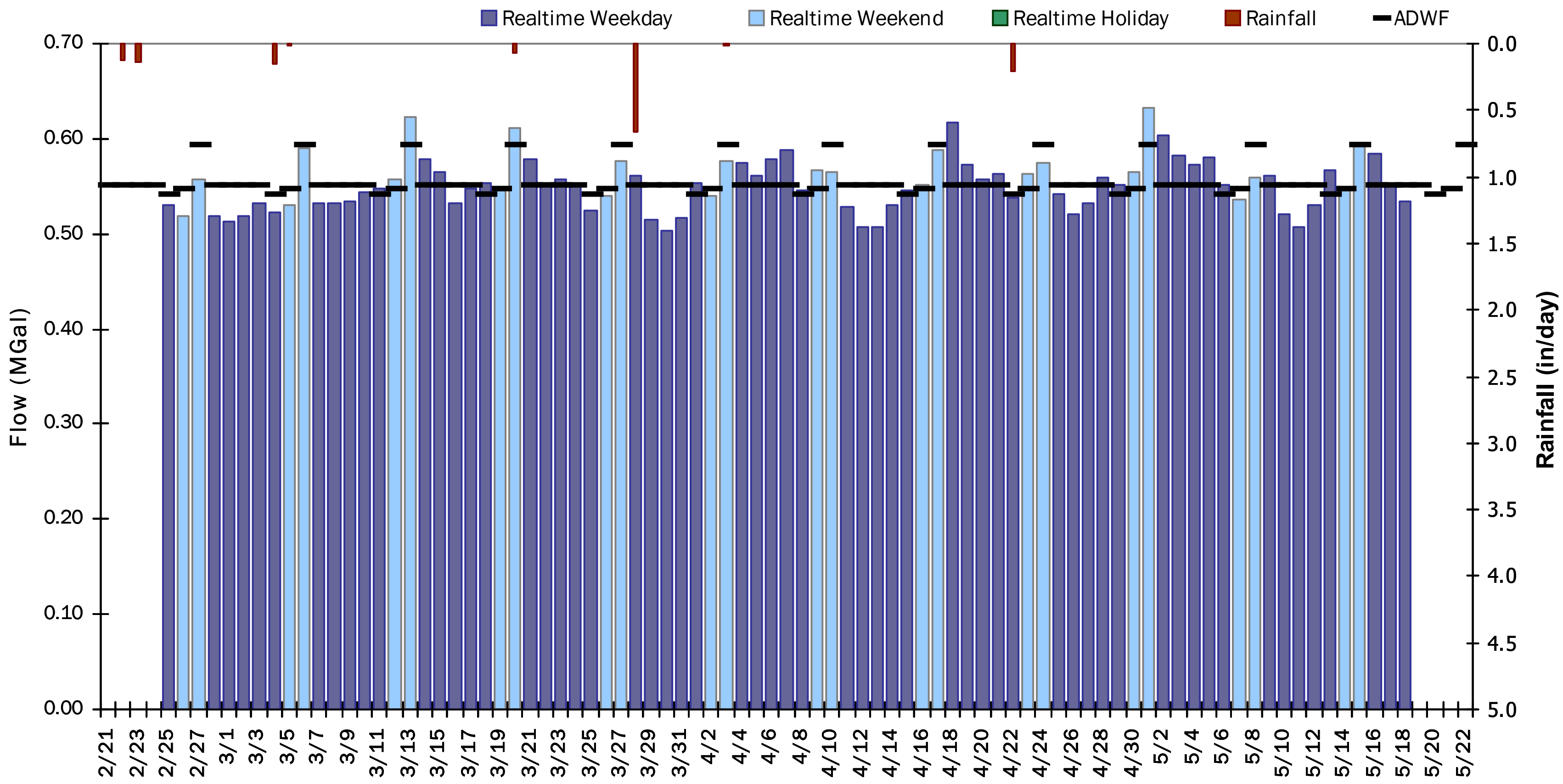
Plan View

SITE 15

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.553 MGal Peak Daily Flow: 0.737 MGal Min Daily Flow: 0.422 MGal

Total Rainfall: 1.11 inches

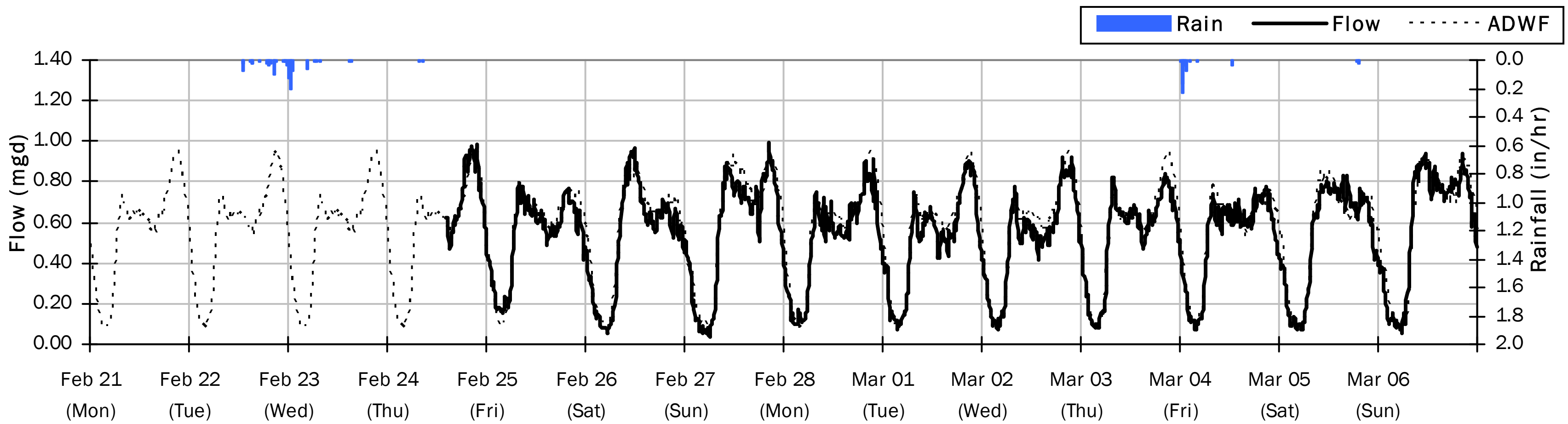


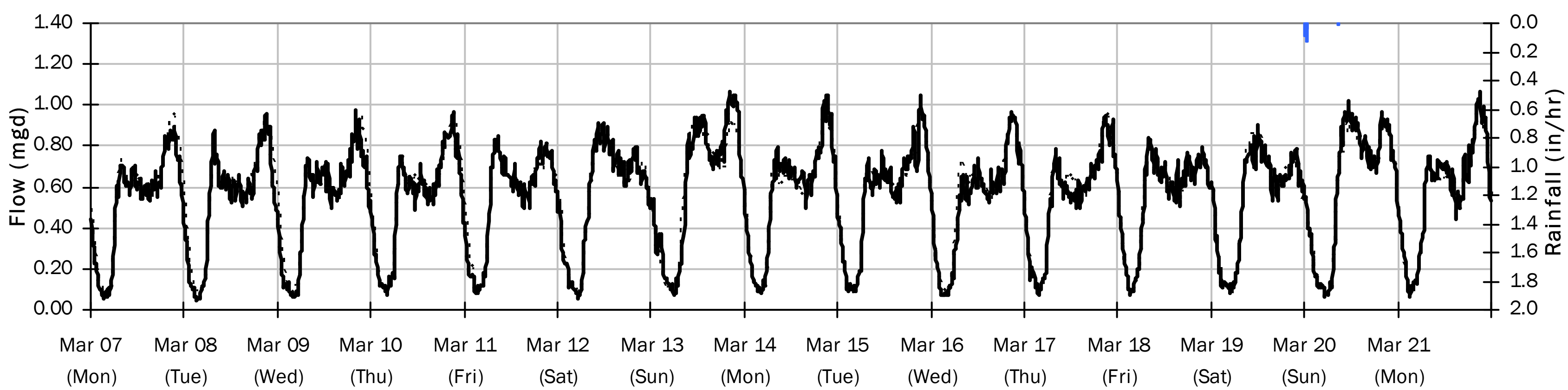
SITE 15

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.51 inches

Period Avg Flow: 0.552 mgd   Period Peak Flow: 1.068 mgd   Period Min Flow: 0.036 mgd

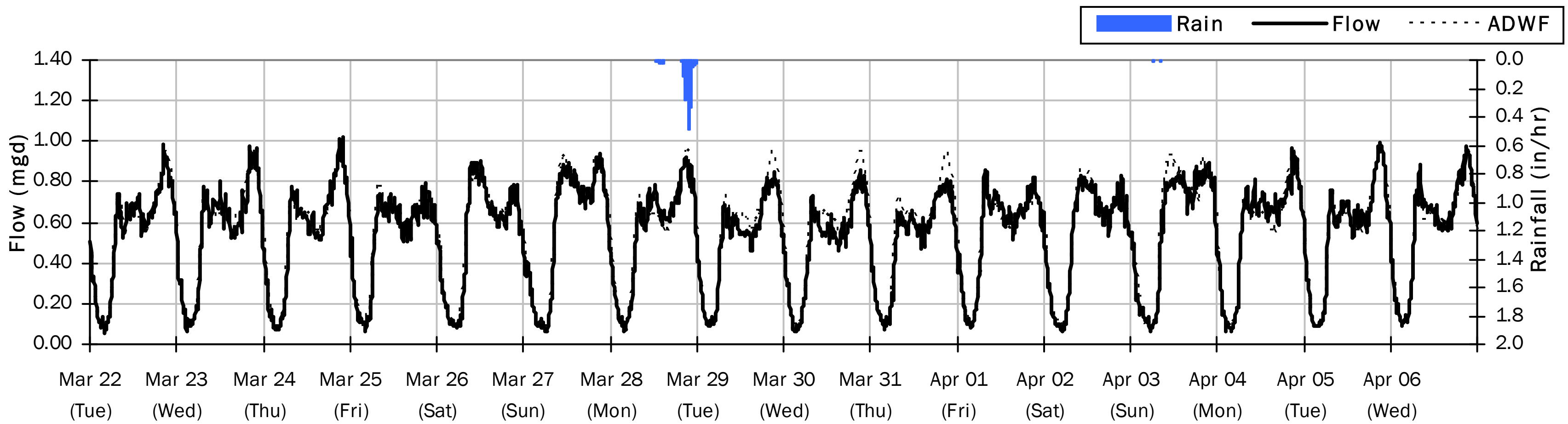


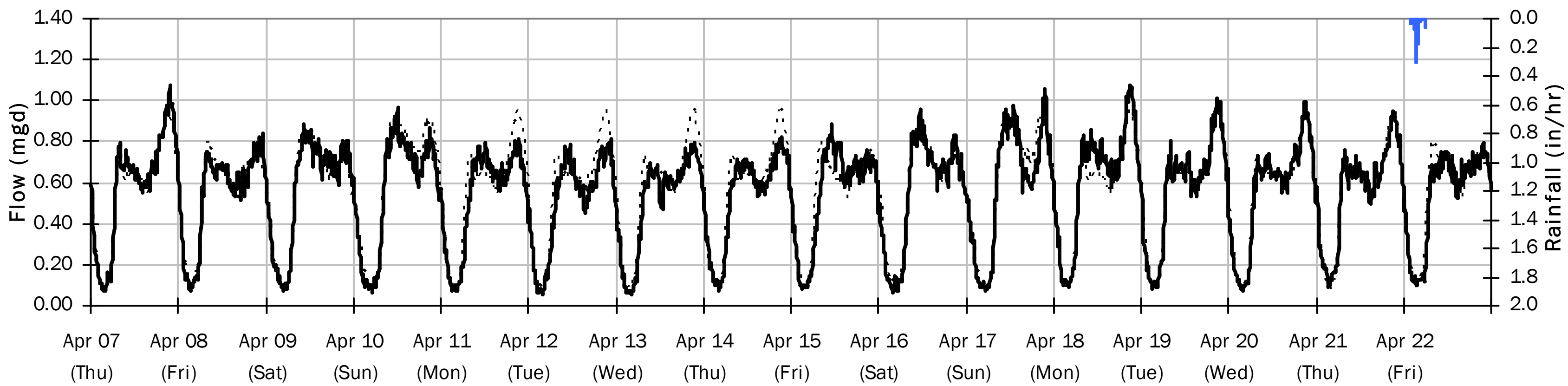


SITE 15

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.88 inches   Period Avg Flow: 0.552 mgd   Period Peak Flow: 1.075 mgd   Period Min Flow: 0.051 mgd



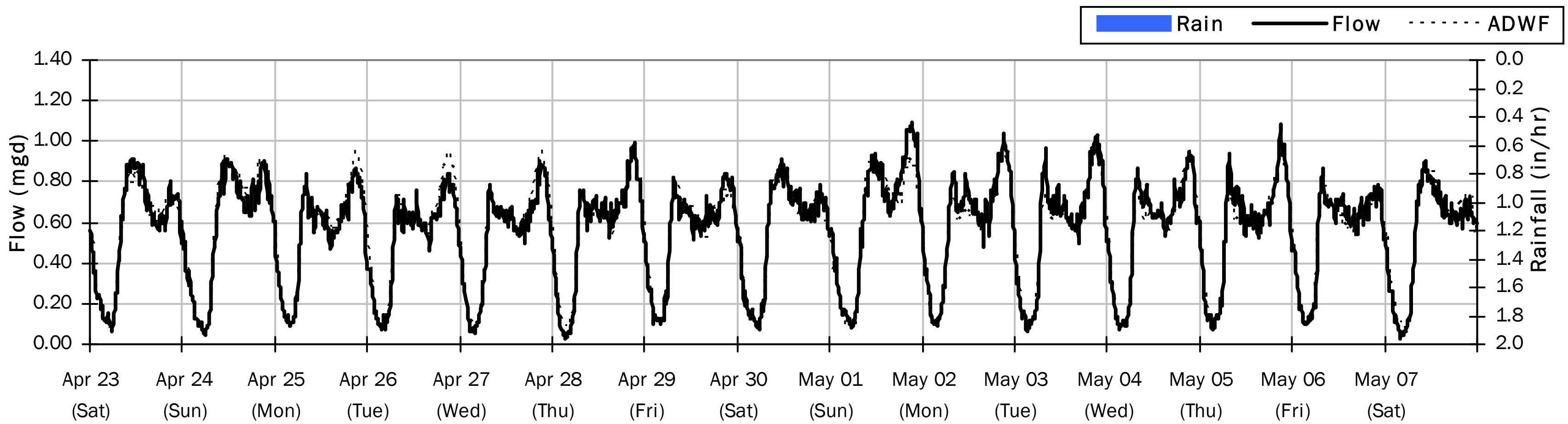


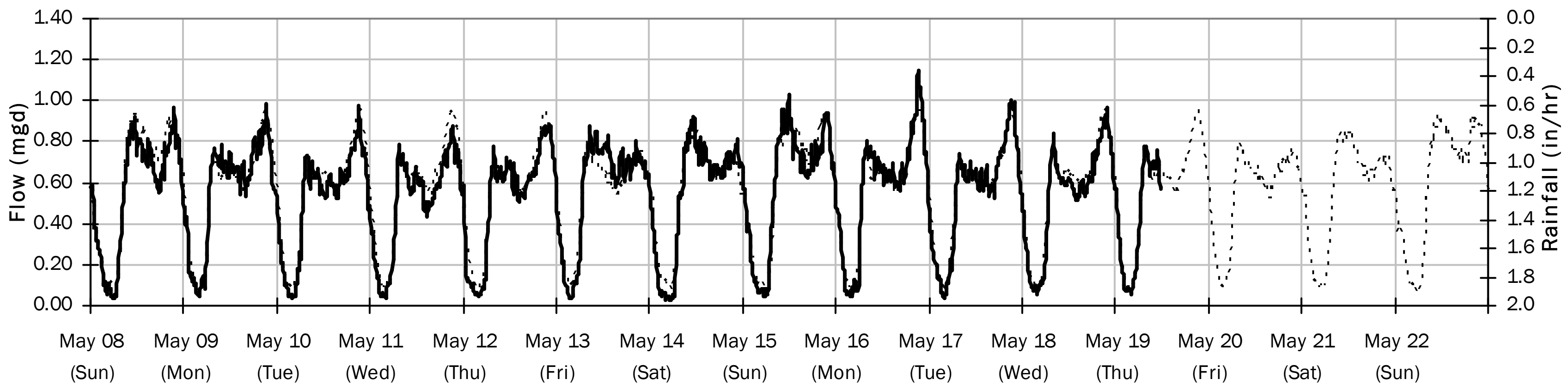
SITE 15

Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

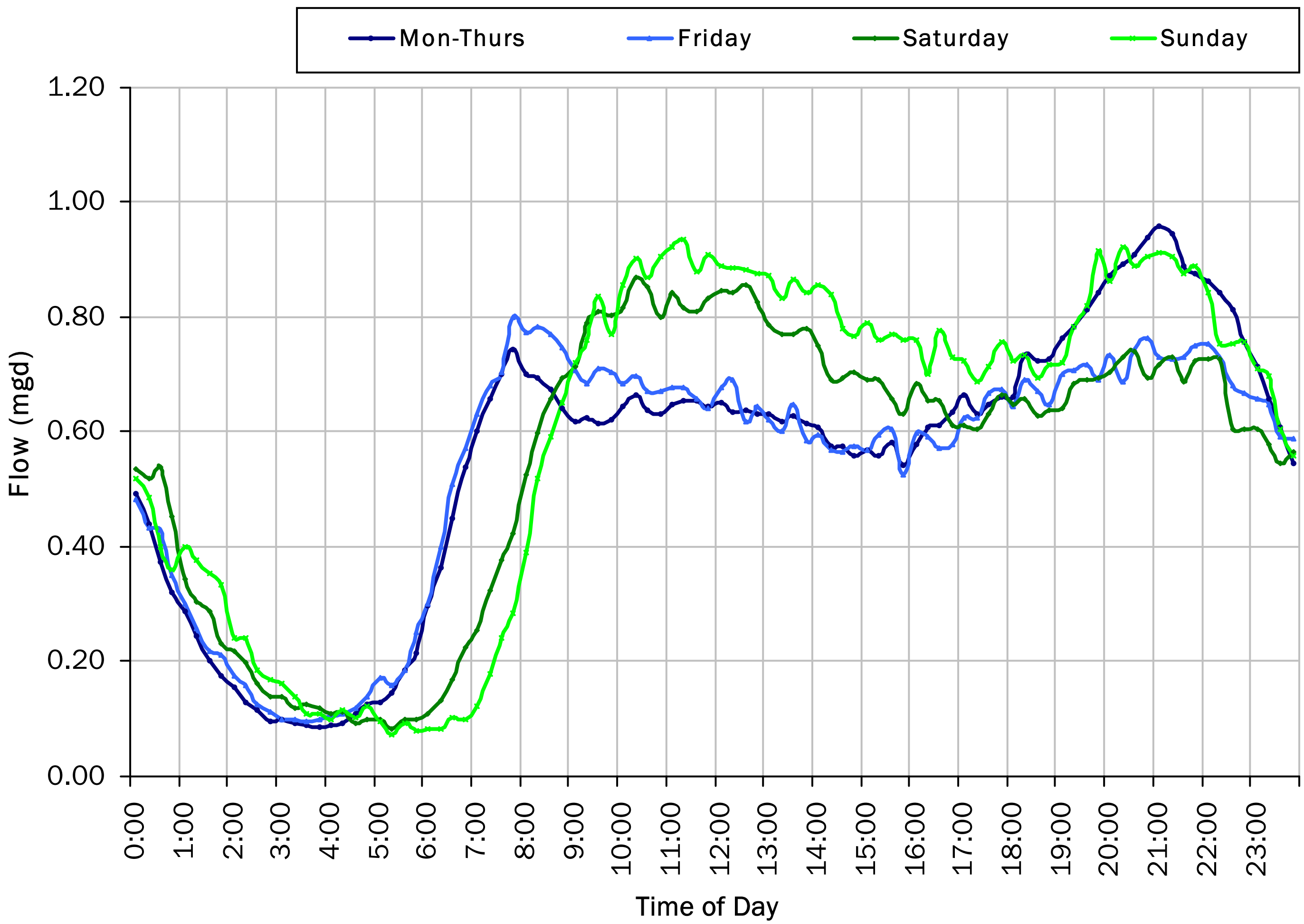
Period Avg Flow: 0.556 mgd   Period Peak Flow: 1.148 mgd   Period Min Flow: 0.027 mgd





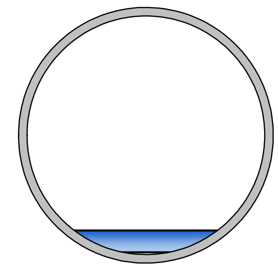
SITE 15

Average Dry Weather Flow Hydrographs



ADWF:

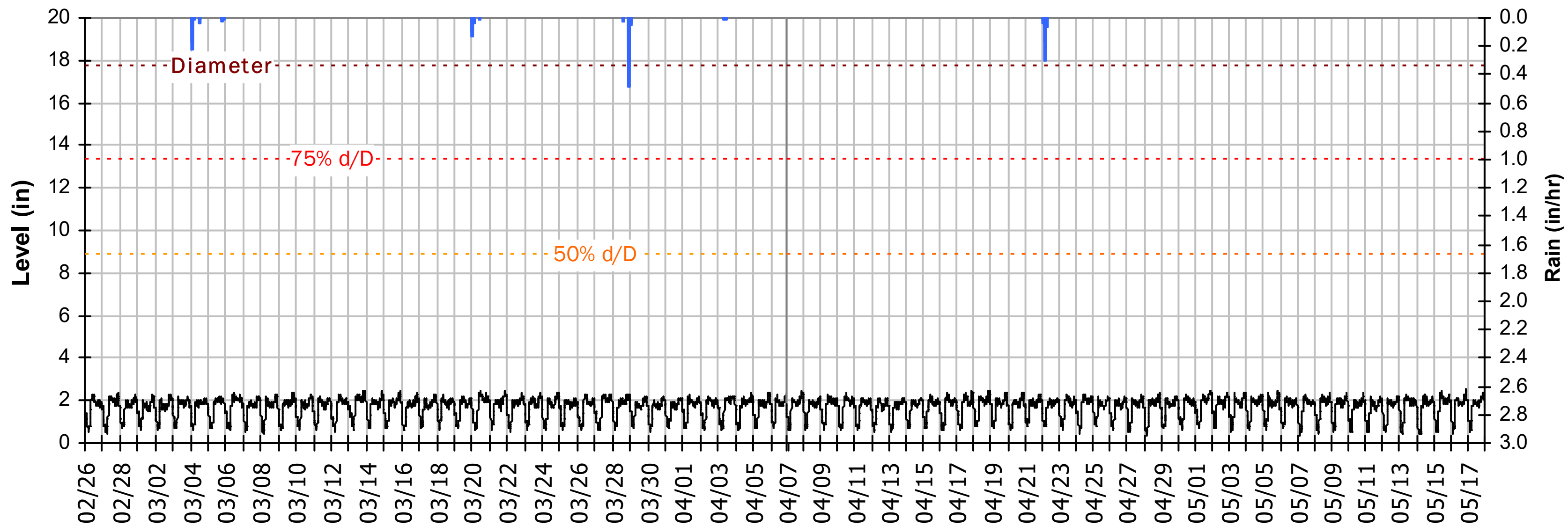
0.556 *mgd*

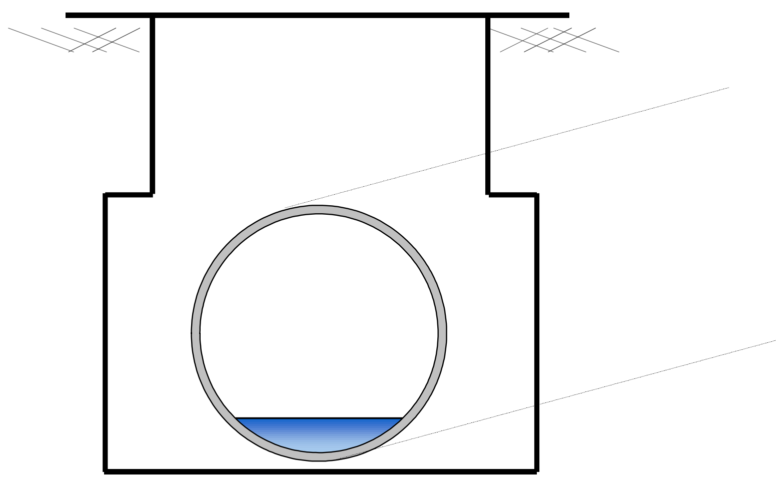


SITE 15

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



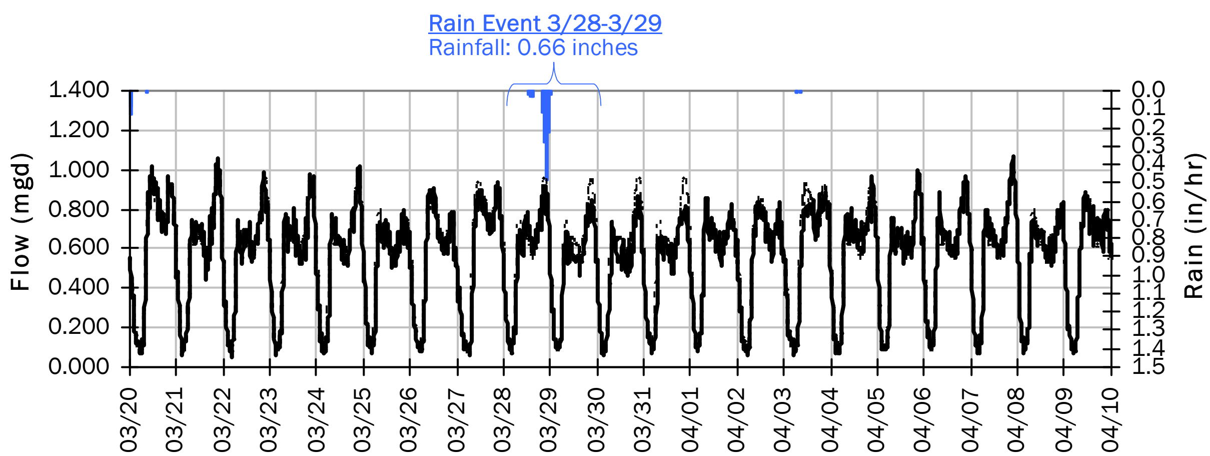


Pipe Diameter:	17.8	*inches*
Peak Measured Level:	2.55	*inches*
Peak d/D Ratio:	0.14	

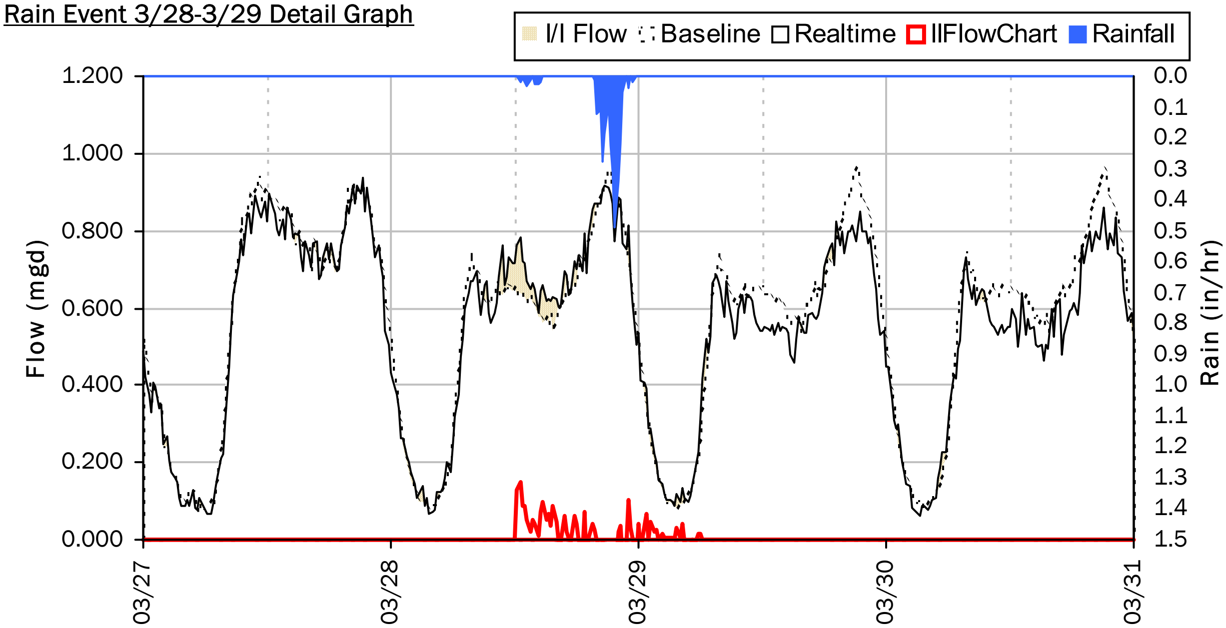
SITE 15

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



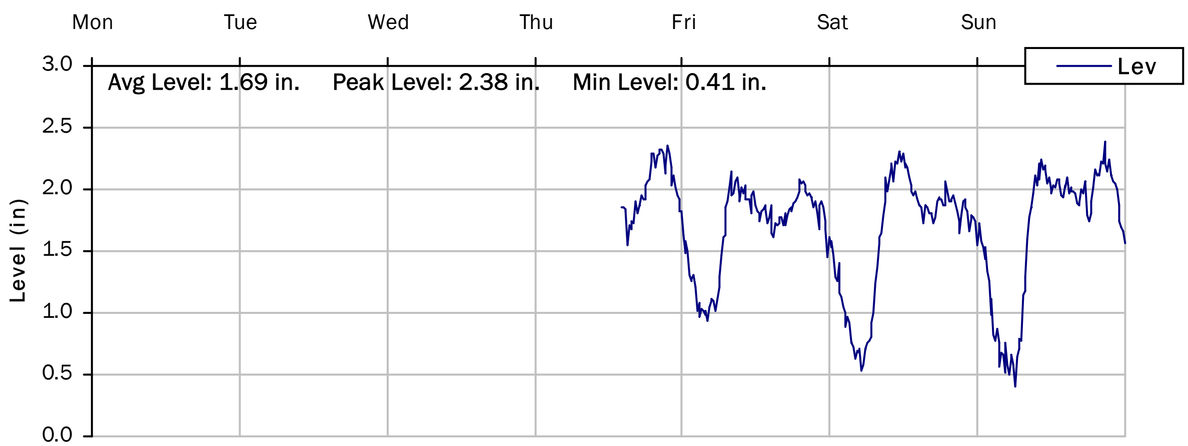
Storm Event I/I Analysis (Rain = 0.66 inches)

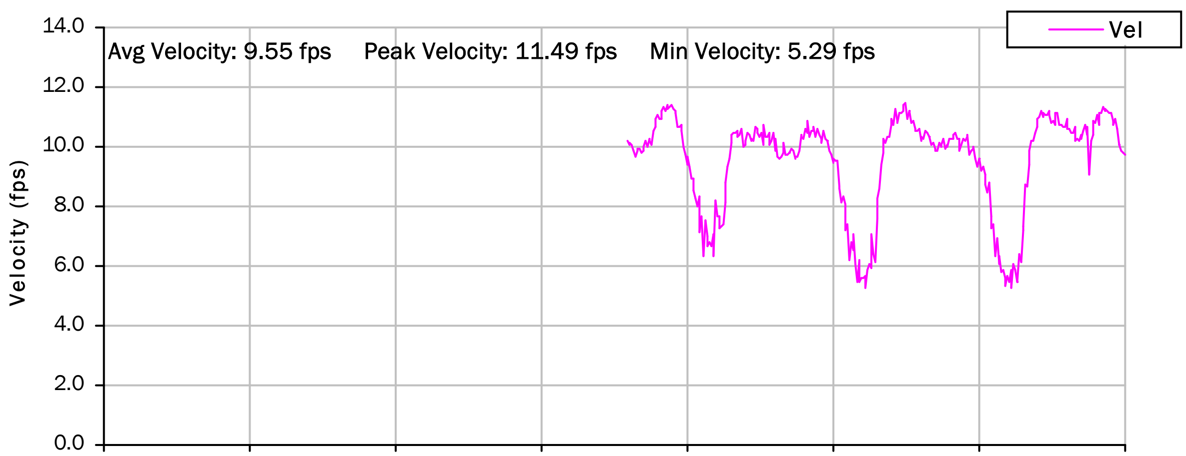
Capacity		Inflow / Infiltration	
Peak Flow:	0.918 *mgd*	Peak I/I Rate:	0.147 *mgd*
PF:	1.65	Total I/I:	15,000 *gallons*
Peak Level:	2.28 *in*		
d/D Ratio:	0.13		

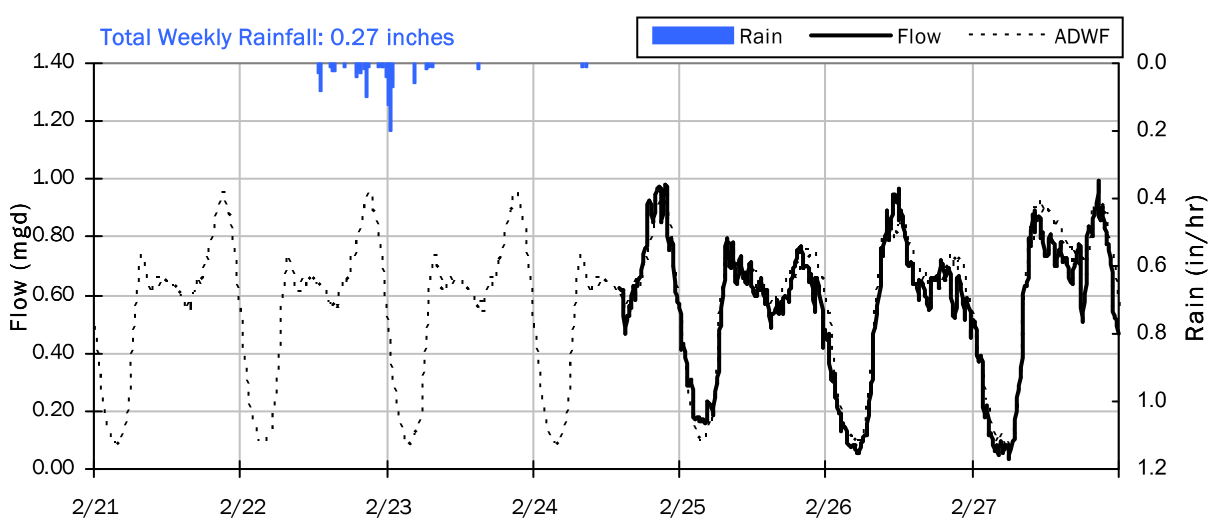
SITE 15

Weekly Level, Velocity and Flow Hydrographs

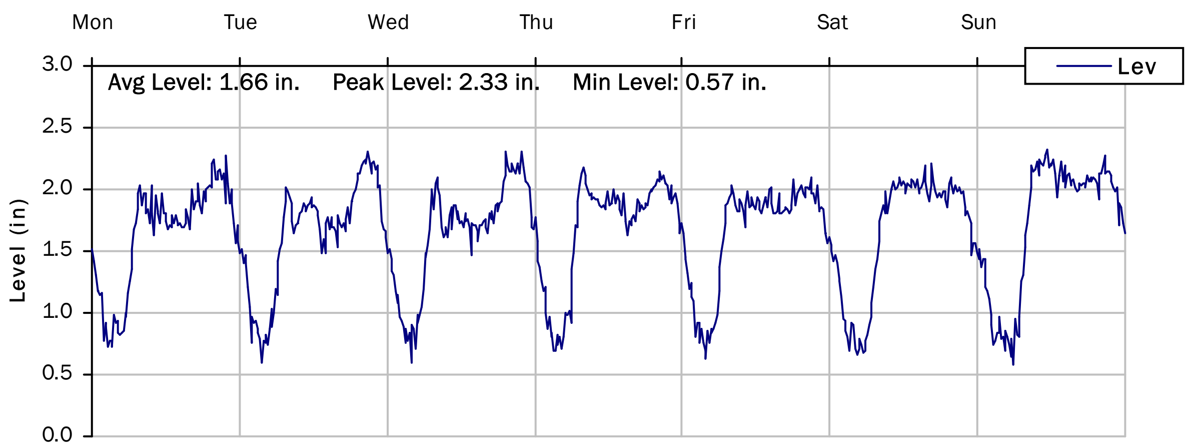
2/21/2022 to 2/28/2022

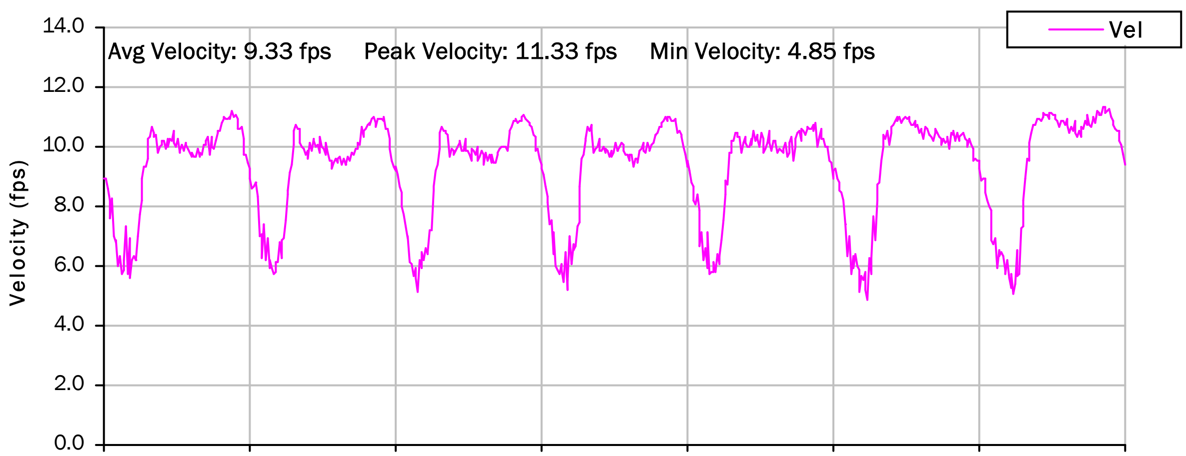


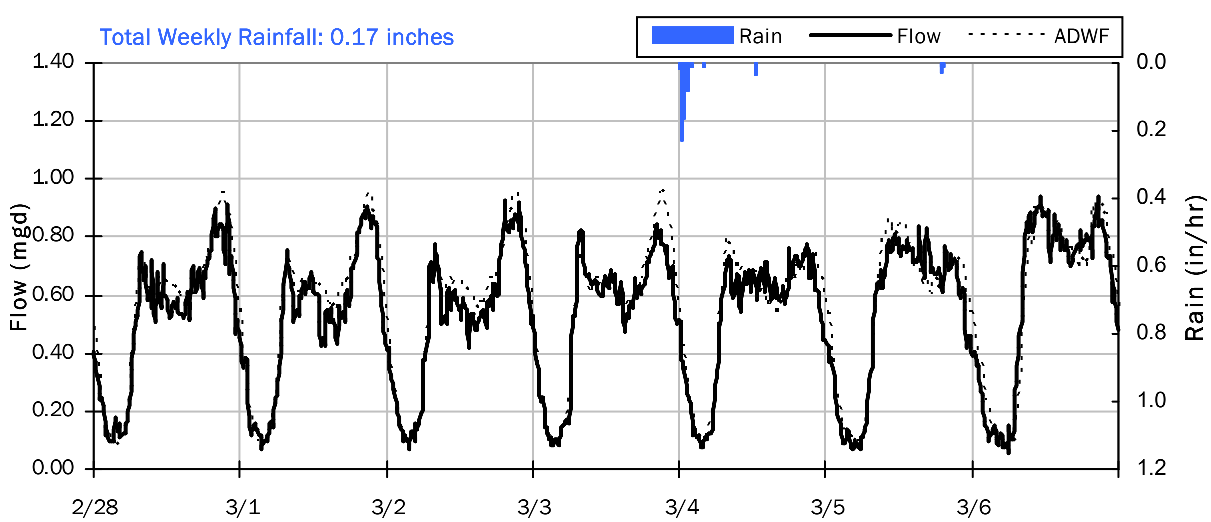




SITE 15
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

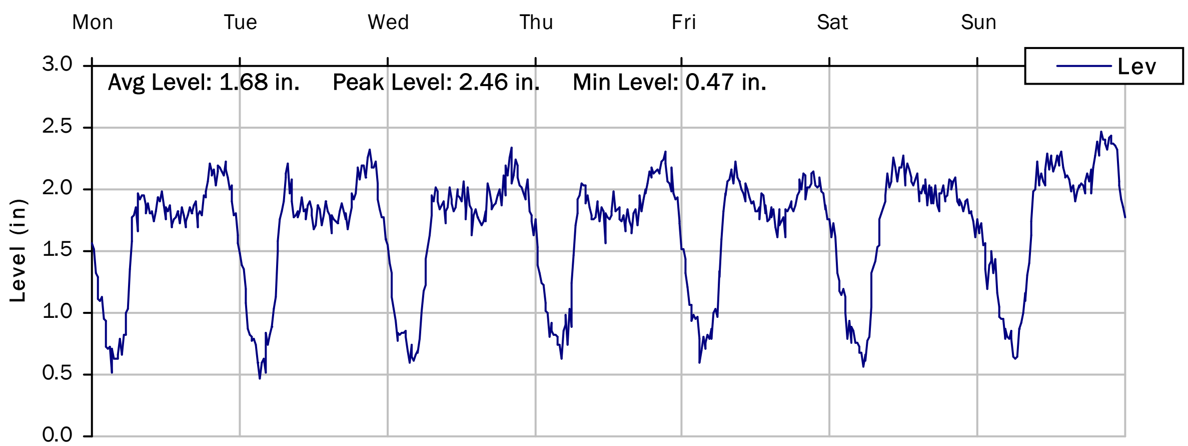


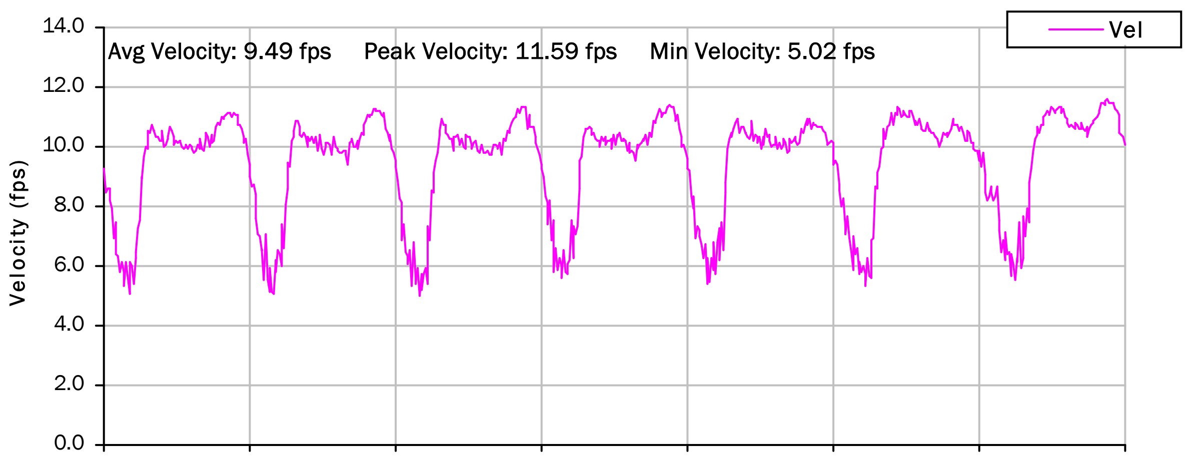


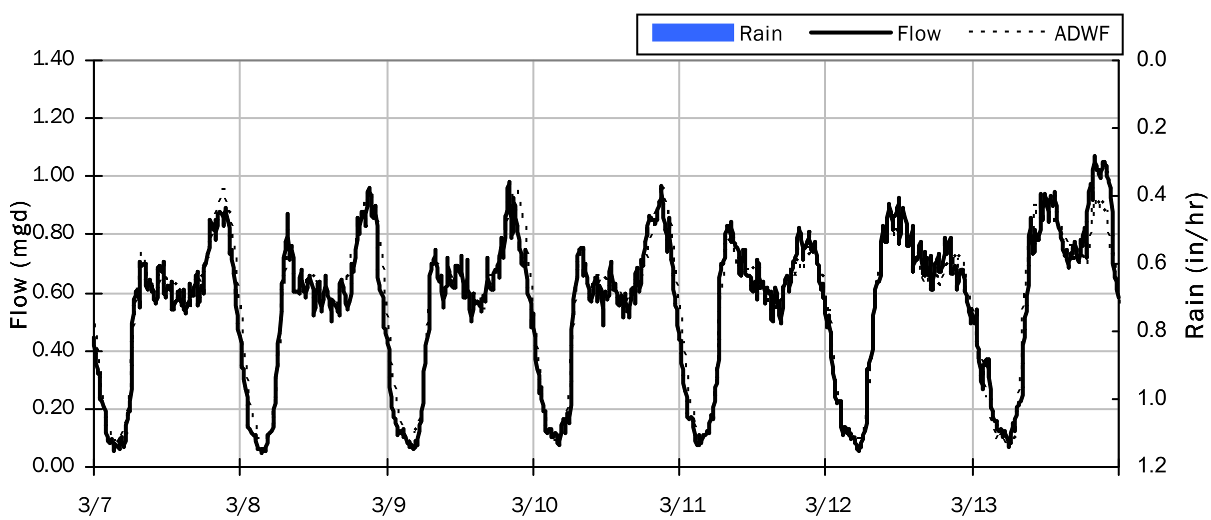


Avg Flow: 0.533 mgd   Peak Flow: 0.941 mgd   Min Flow: 0.058 mgd

SITE 15
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022





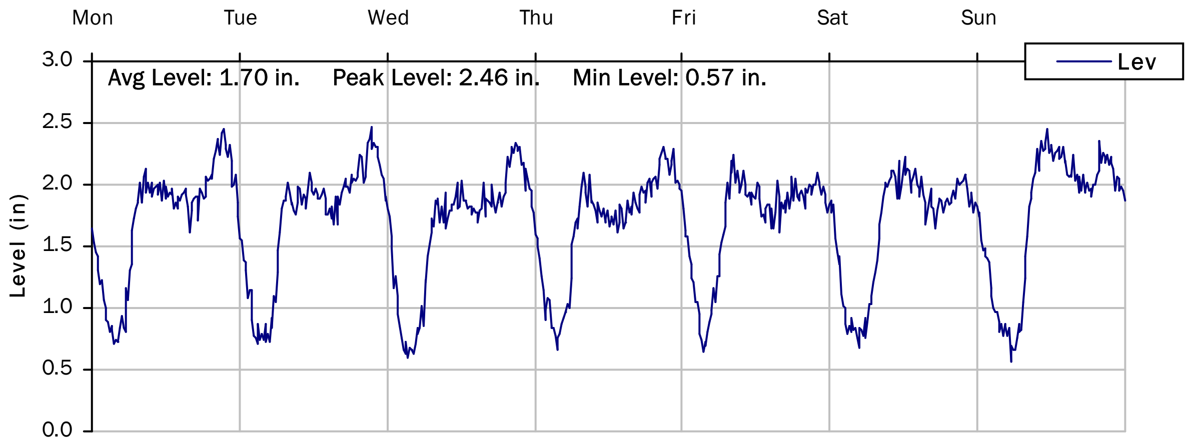


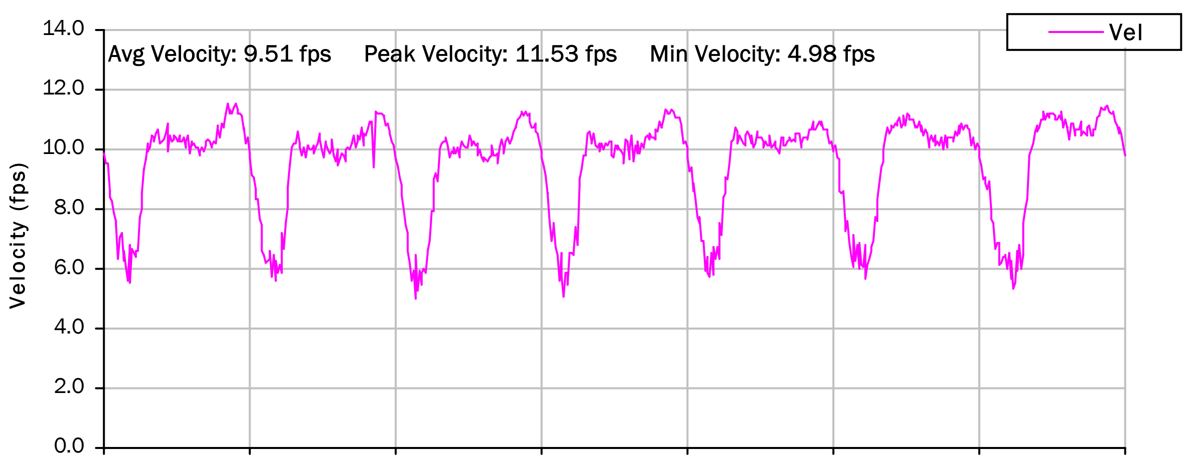
Avg Flow: 0.553 mgd Peak Flow: 1.068 mgd Min Flow: 0.048 mgd

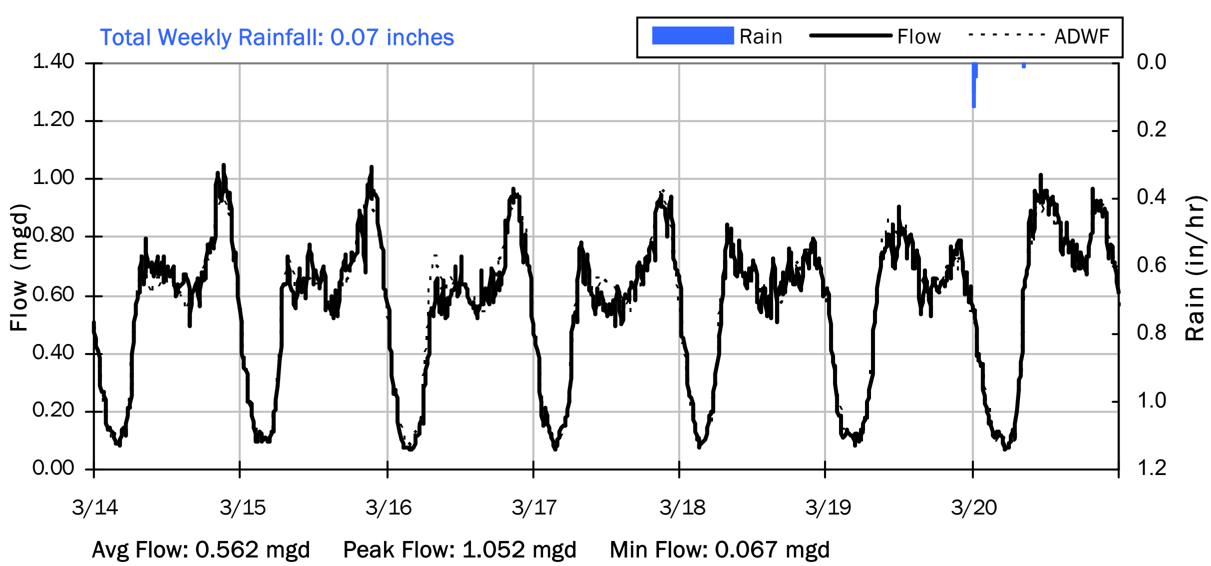
SITE 15

Weekly Level, Velocity and Flow Hydrographs

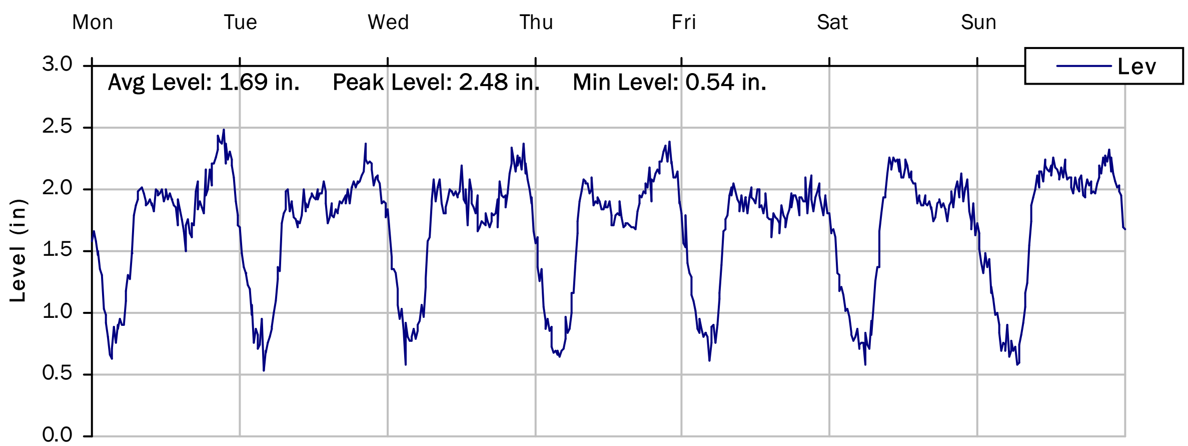
3/14/2022 to 3/21/2022

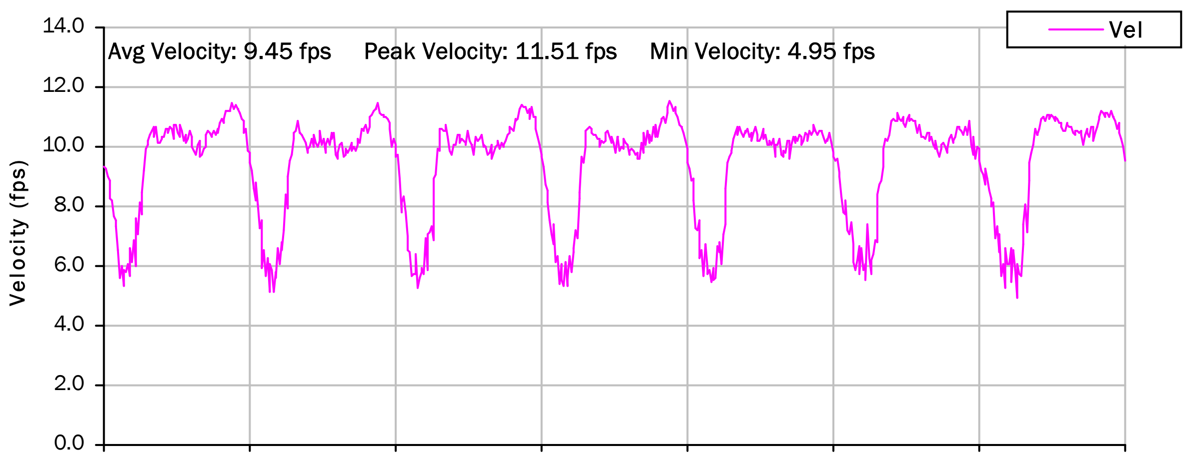


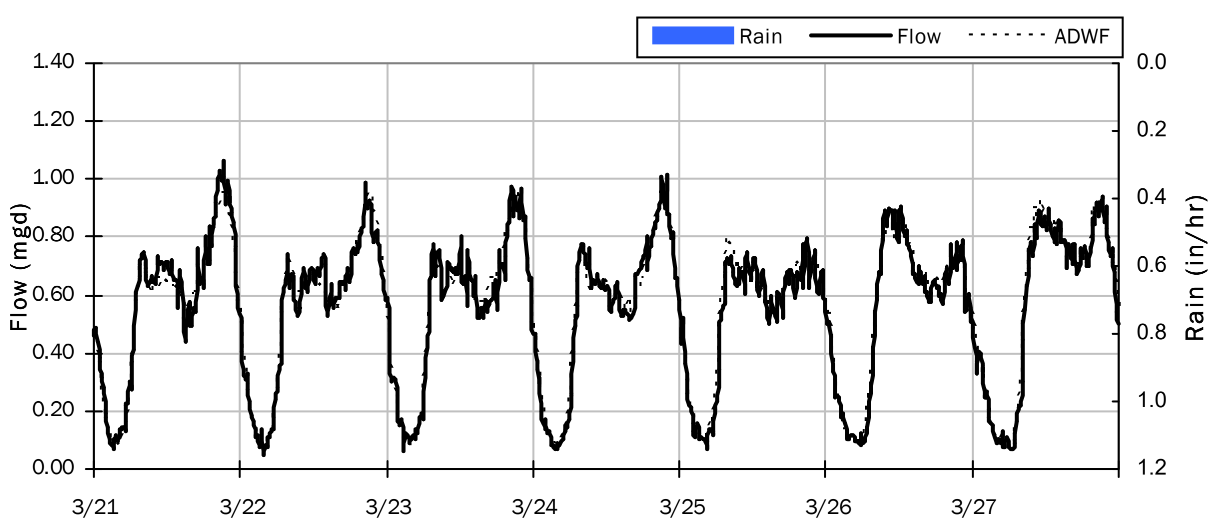




SITE 15
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

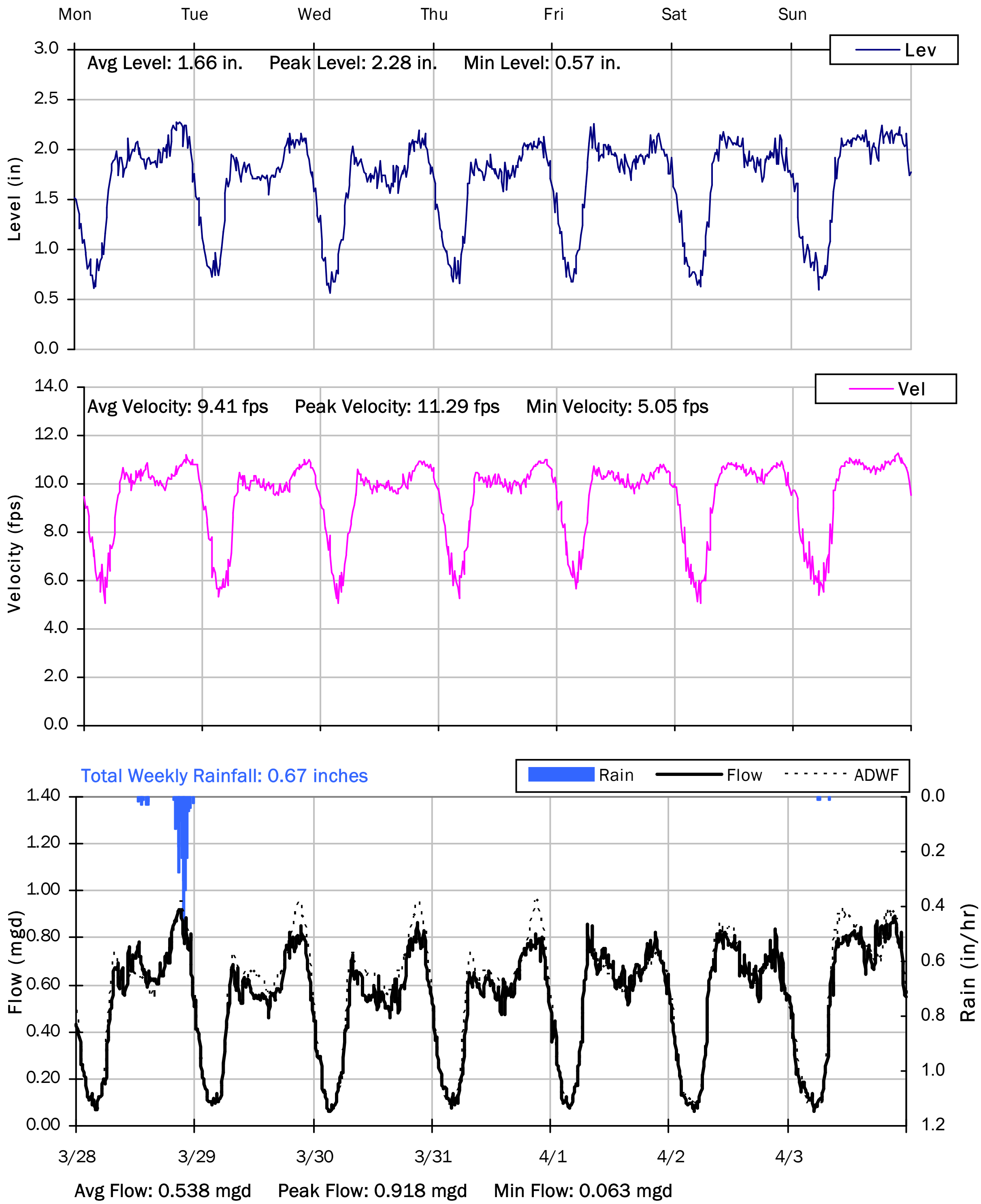




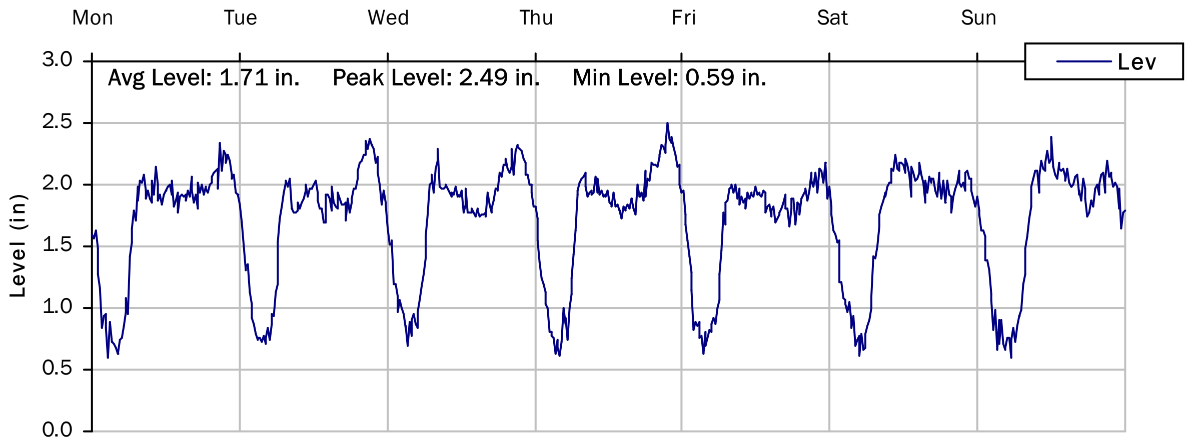


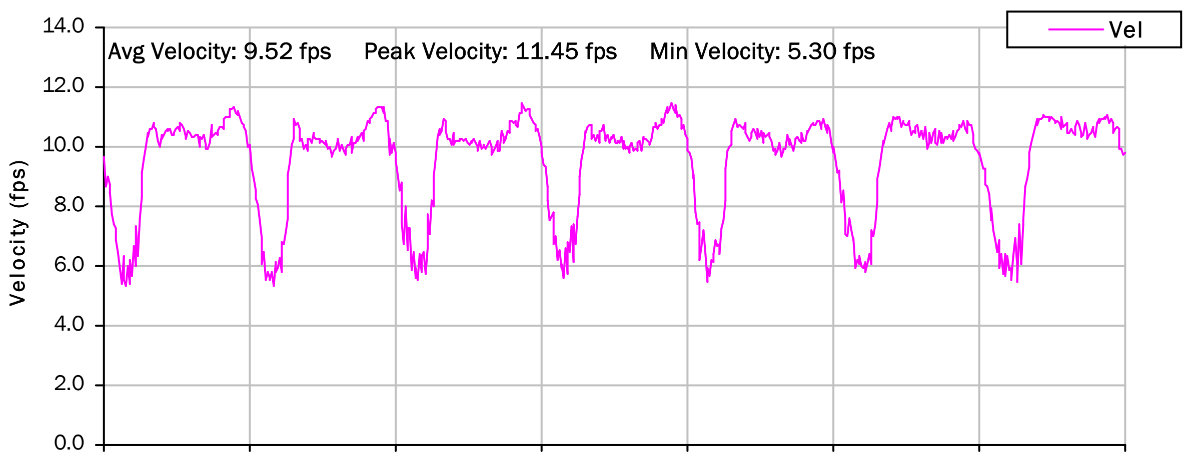
Avg Flow: 0.554 mgd Peak Flow: 1.062 mgd Min Flow: 0.051 mgd

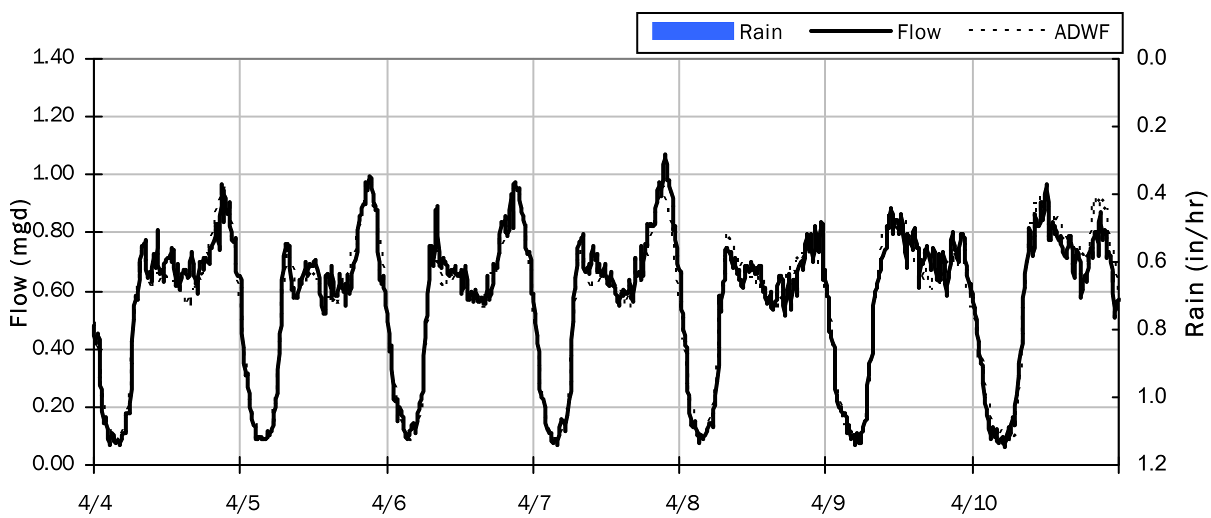
SITE 15
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022



SITE 15
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022





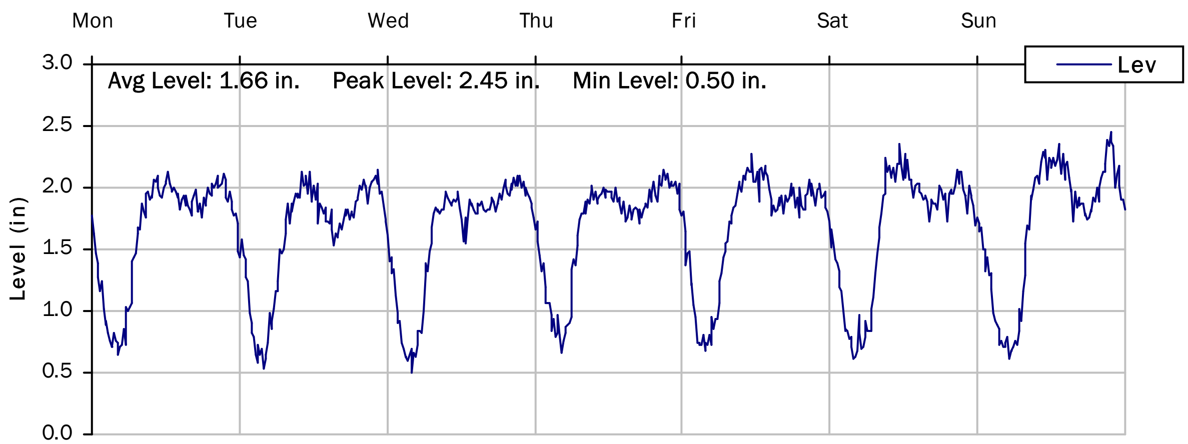


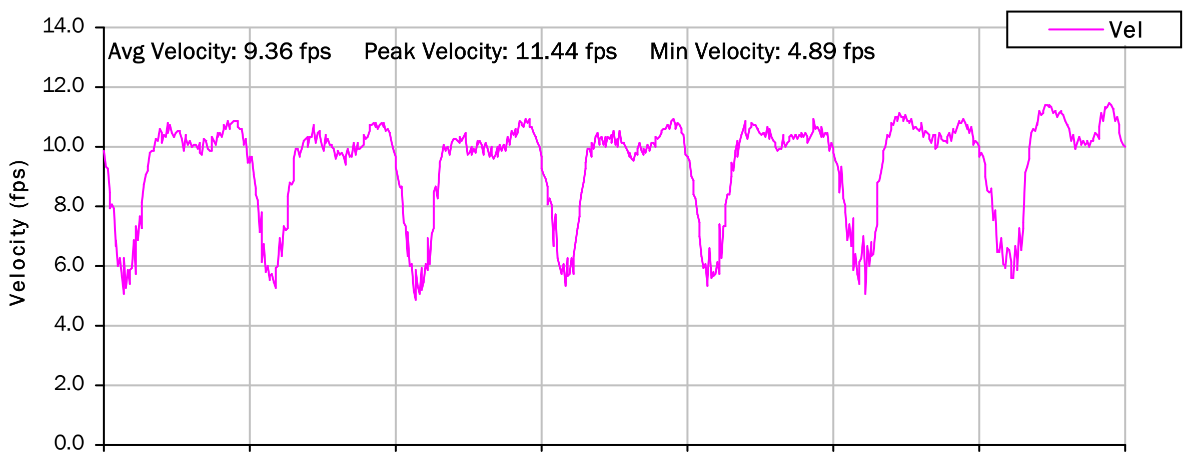
Avg Flow: 0.569 mgd Peak Flow: 1.070 mgd Min Flow: 0.065 mgd

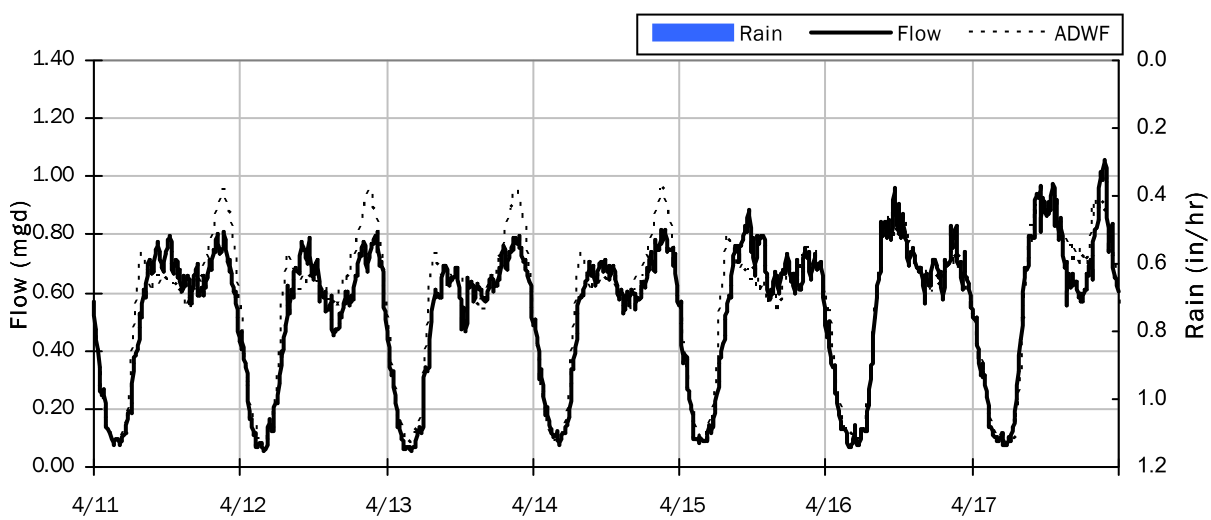
SITE 15

Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022

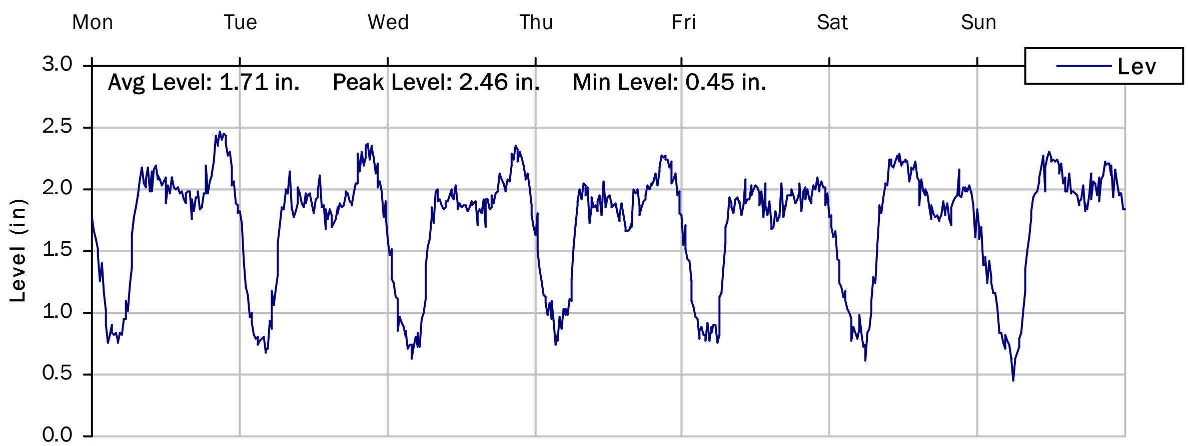


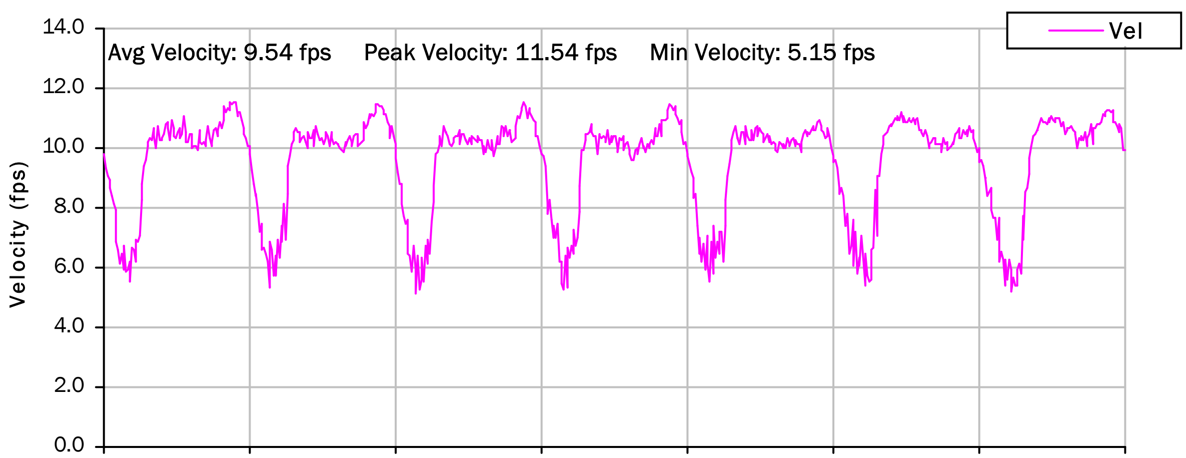


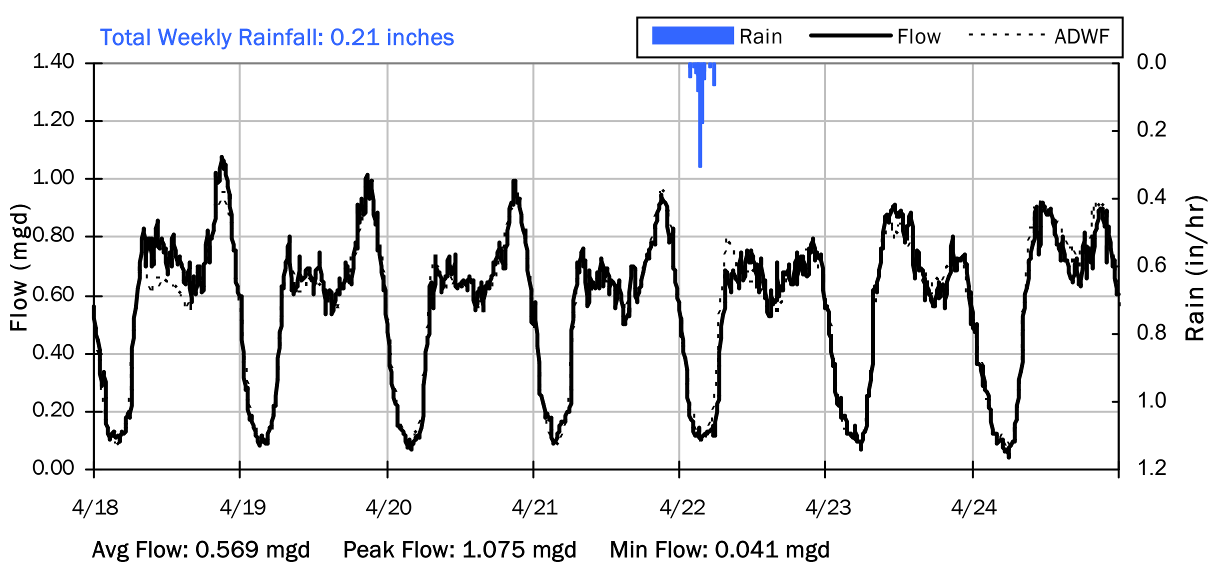


Avg Flow: 0.537 mgd Peak Flow: 1.054 mgd Min Flow: 0.052 mgd

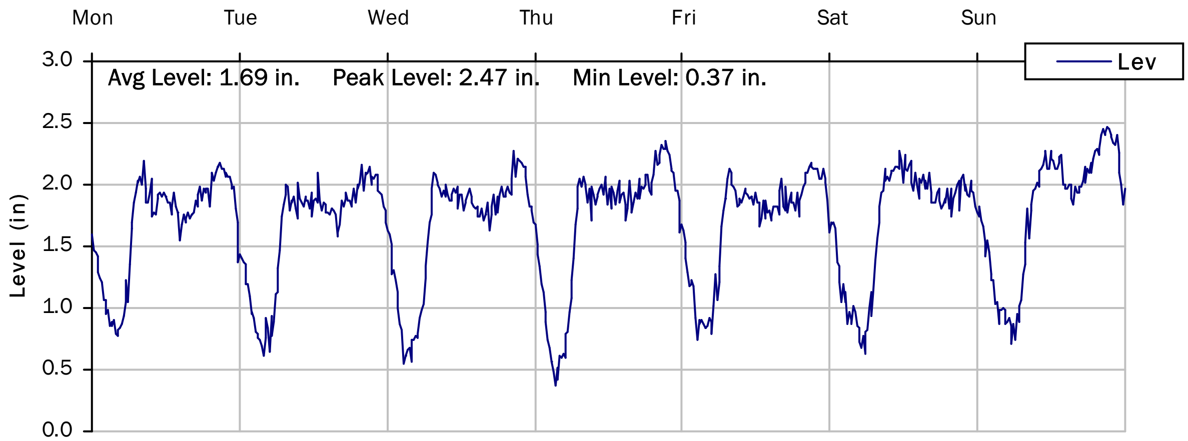
SITE 15
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

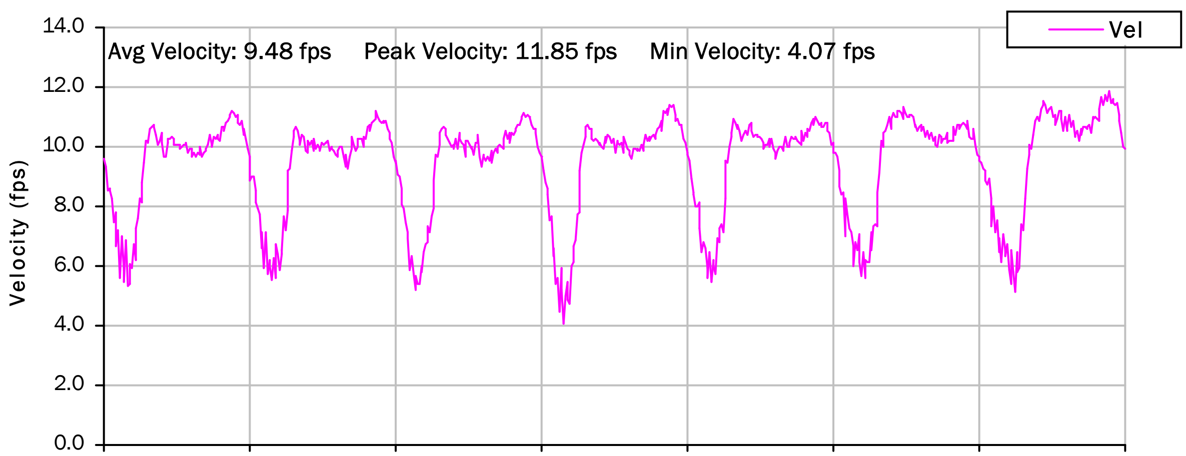


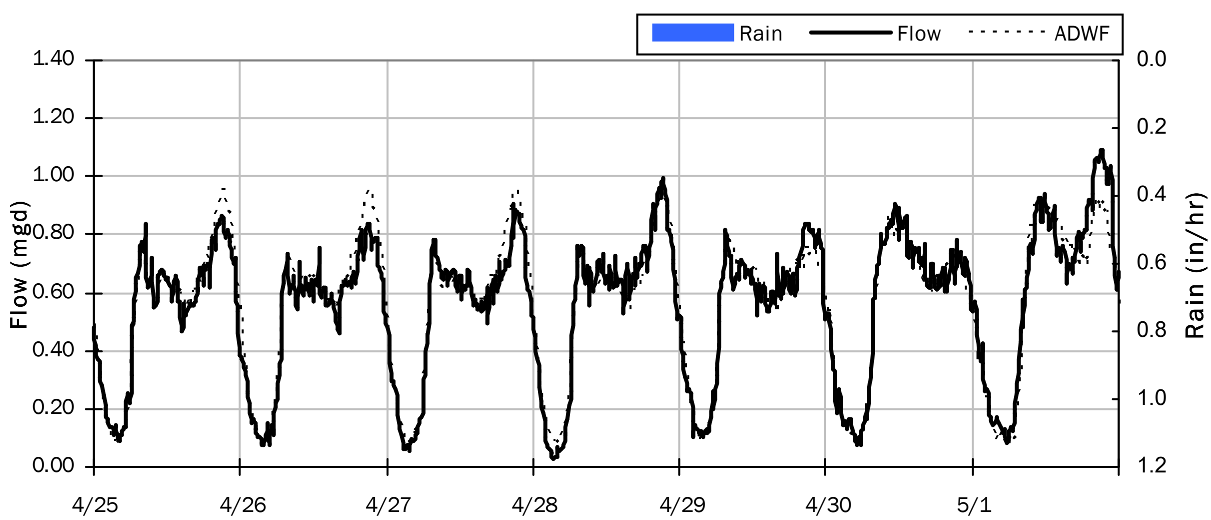




SITE 15
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

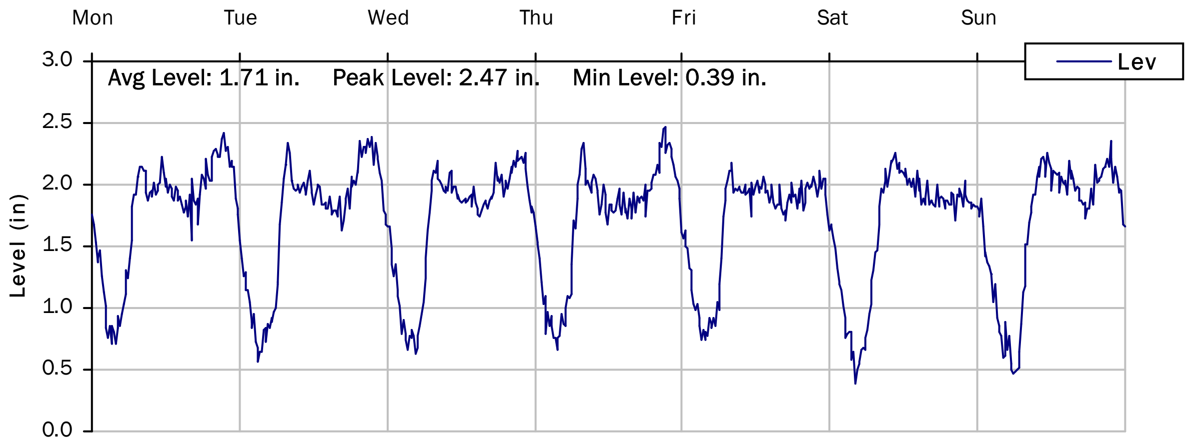


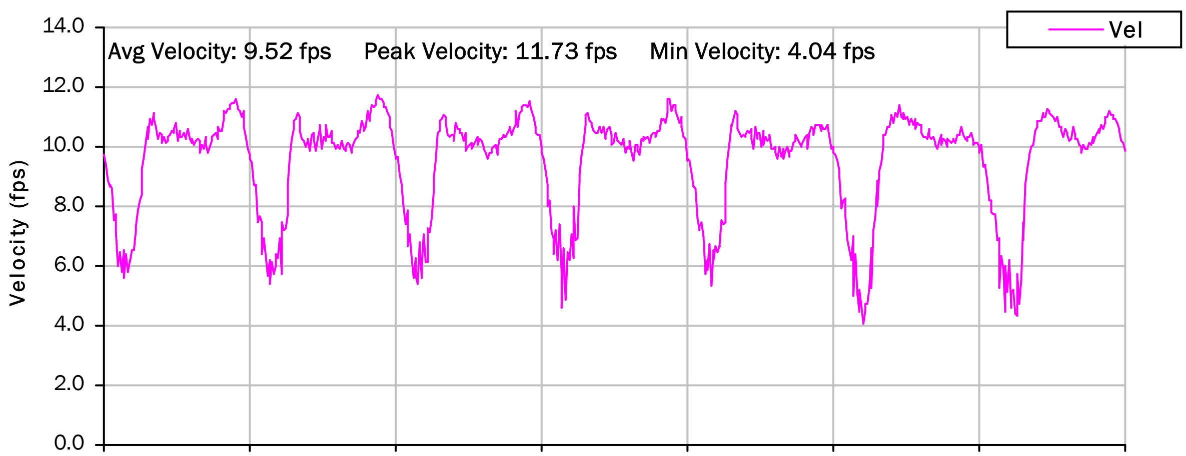


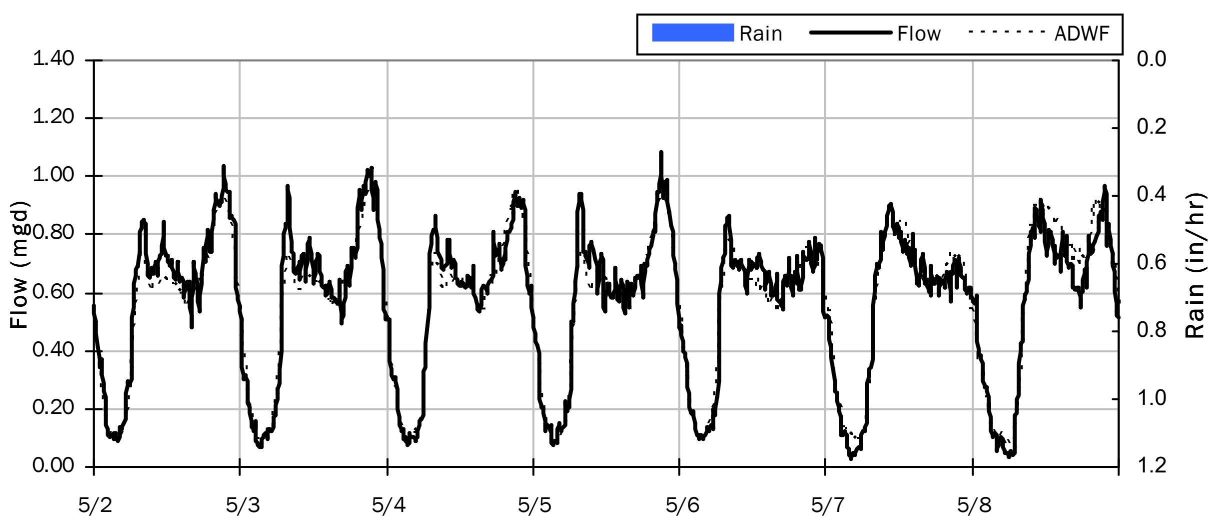


Avg Flow: 0.557 mgd Peak Flow: 1.094 mgd Min Flow: 0.029 mgd

SITE 15
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022





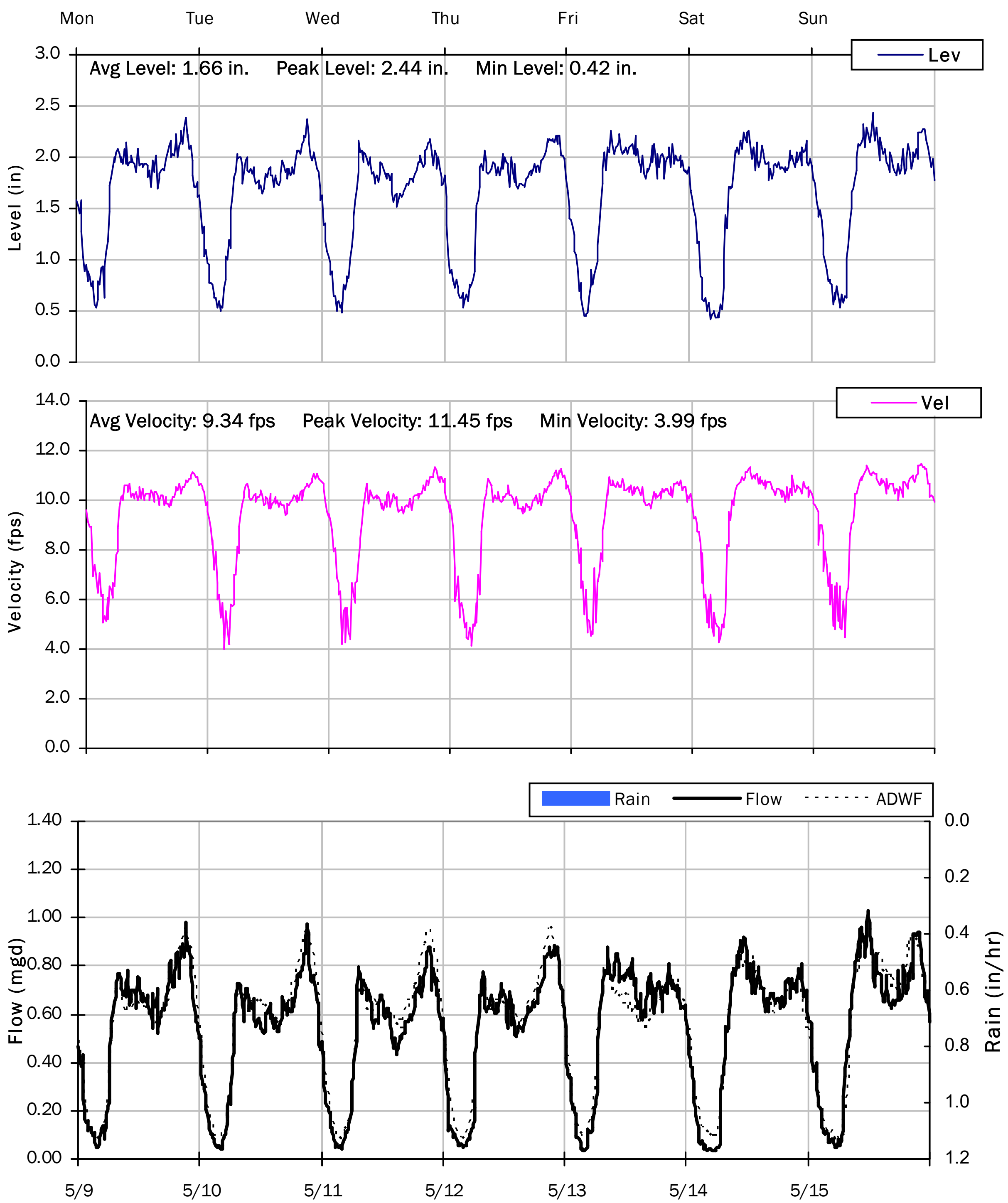


Avg Flow: 0.569 mgd Peak Flow: 1.084 mgd Min Flow: 0.027 mgd

SITE 15

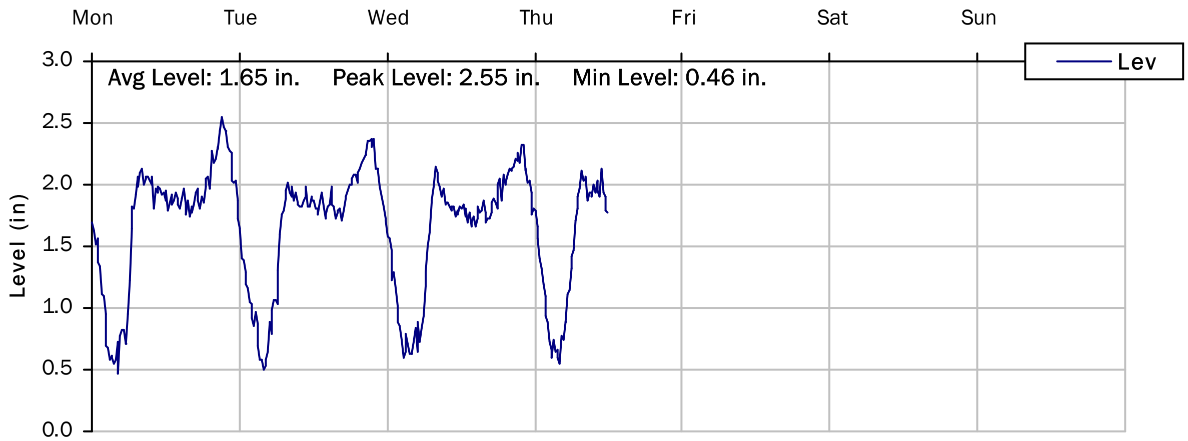
Weekly Level, Velocity and Flow Hydrographs

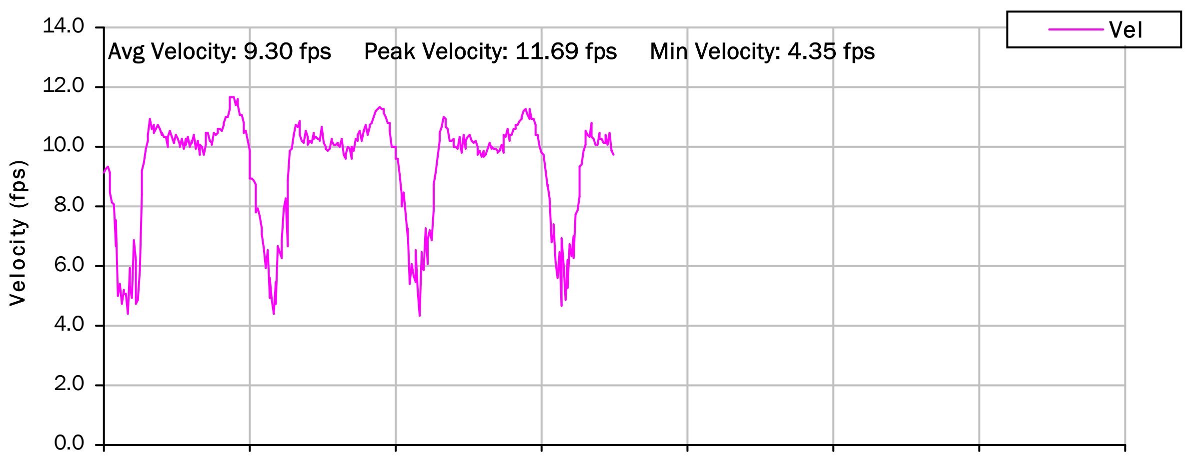
5/9/2022 to 5/16/2022

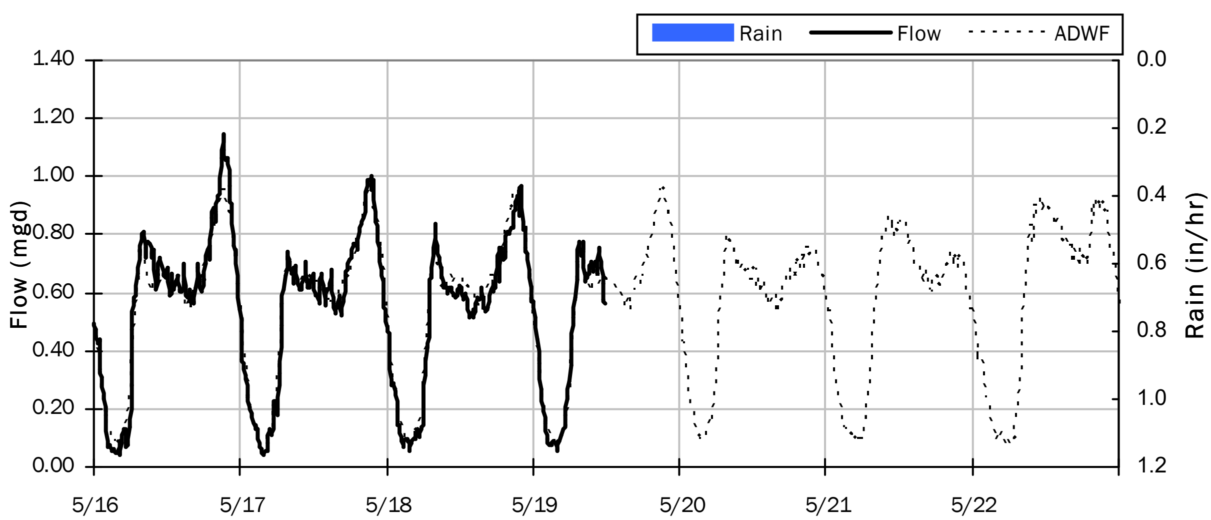


Avg Flow: 0.546 mgd Peak Flow: 1.027 mgd Min Flow: 0.031 mgd

SITE 15
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Avg Flow: 0.537 mgd Peak Flow: 1.148 mgd Min Flow: 0.039 mgd

Monitoring Site: Site 16

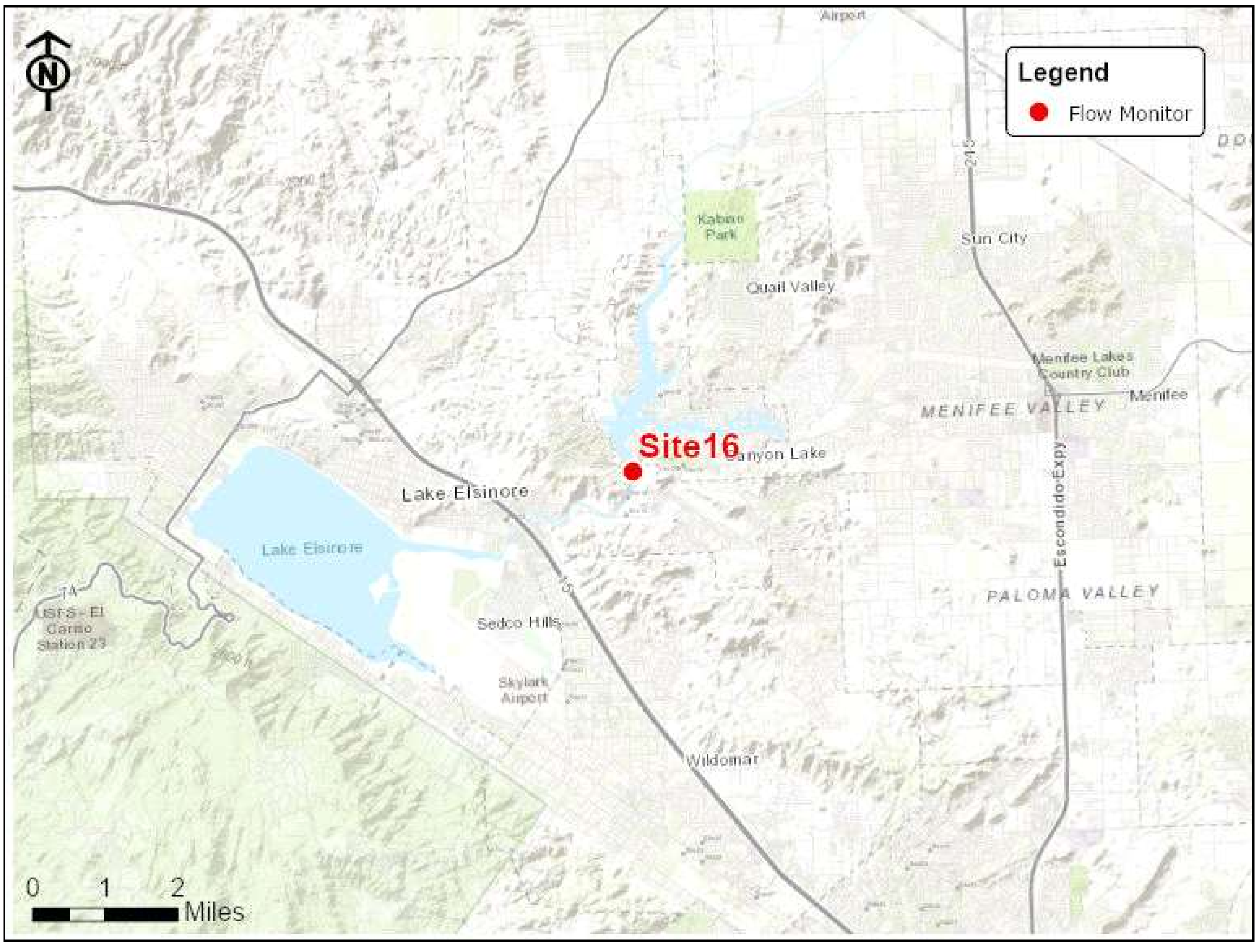
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Via De La Valle, east of Via De La Luna

Data Summary Report



Vicinity Map: Site 16

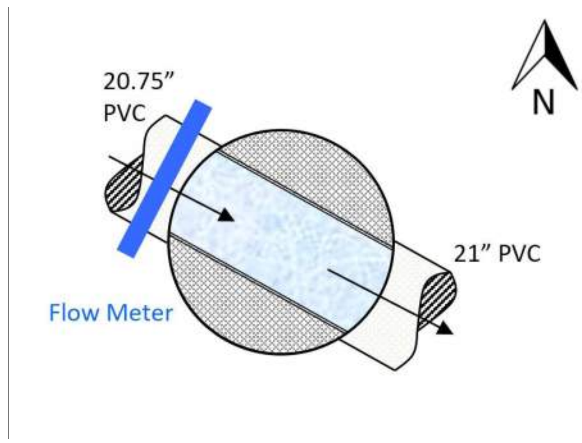
SITE 16

Site Information MH ID: MH-2552

Location:	Via De La Valle, east of Via De La Luna
Coordinates:	117.2725° W, 33.6727° N
Rim Elevation (Earth):	1369 feet
Expected Pipe Diameter:	21 inches
Measured Pipe Diameter:	20.75 inches
ADWF:	0.177 mgd
Peak Measured Flow:	0.487 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 16

Additional Site Photos

Effluent Pipe

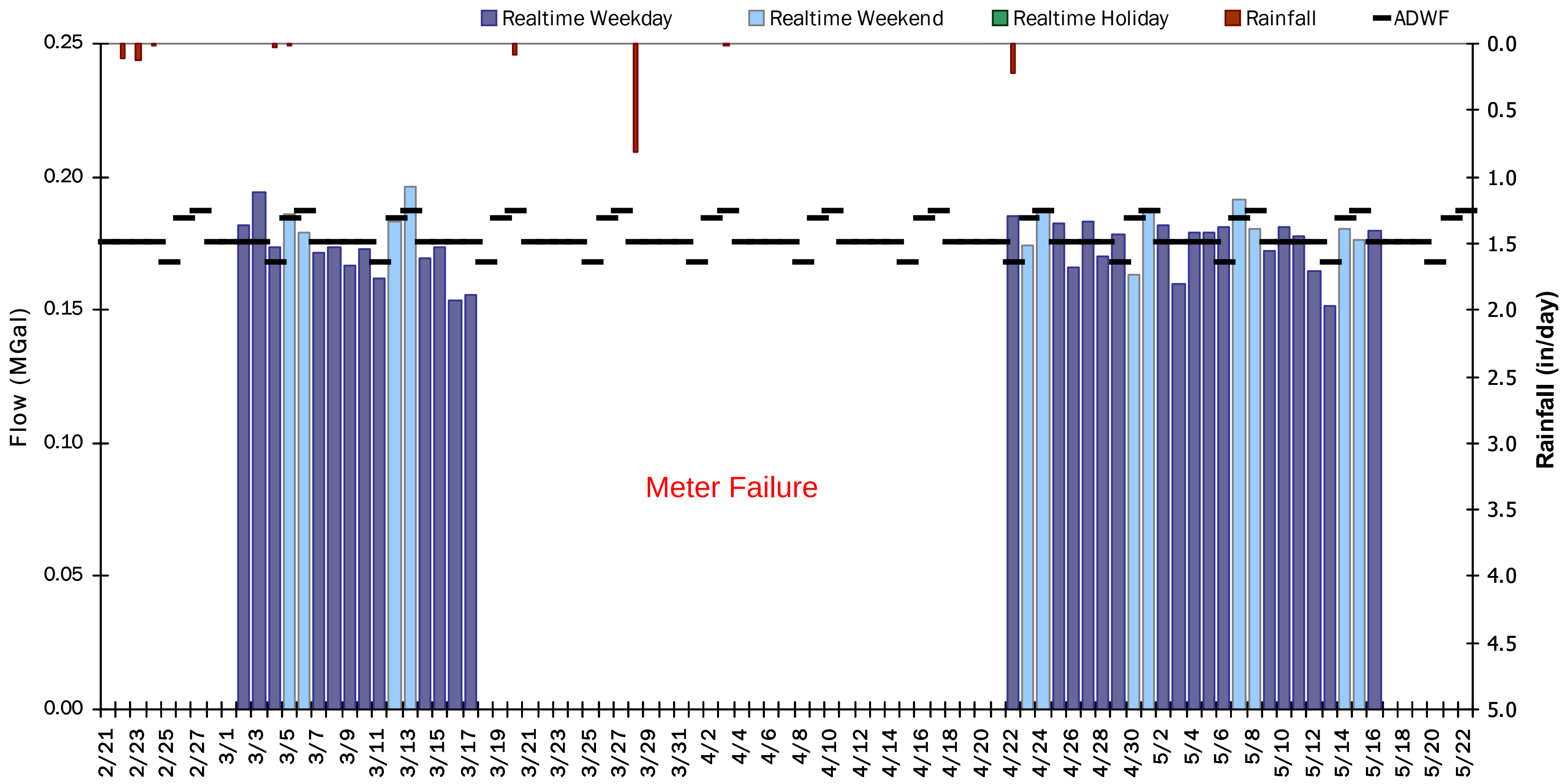
Influent Pipe

SITE 16

Period Flow Summary: Daily Flow Totals

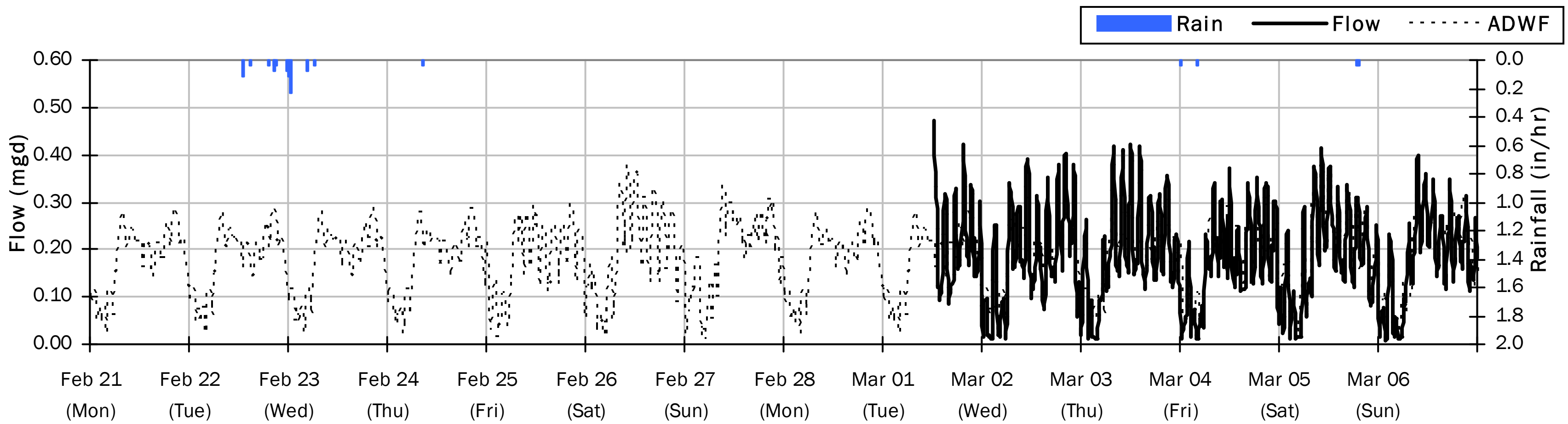
Avg Daily Flow: 0.174 MGal   Peak Daily Flow: 0.216 MGal   Min Daily Flow: 0.124 MGal

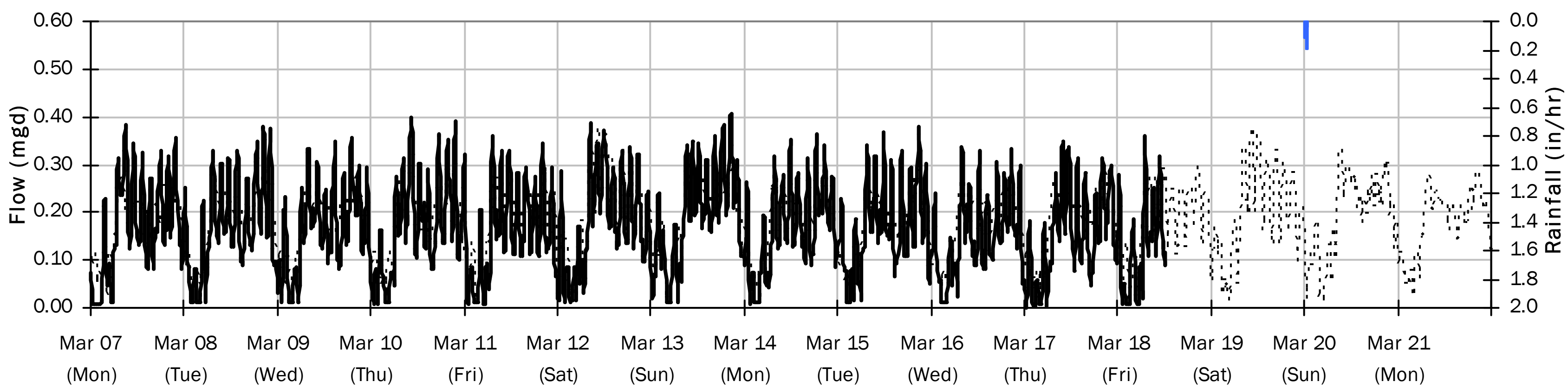
Total Rainfall: 0.26 inches



SITE 16
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.37 inches   Period Avg Flow: 0.174 mgd   Period Peak Flow: 0.473 mgd   Period Min Flow: 0.000 mgd

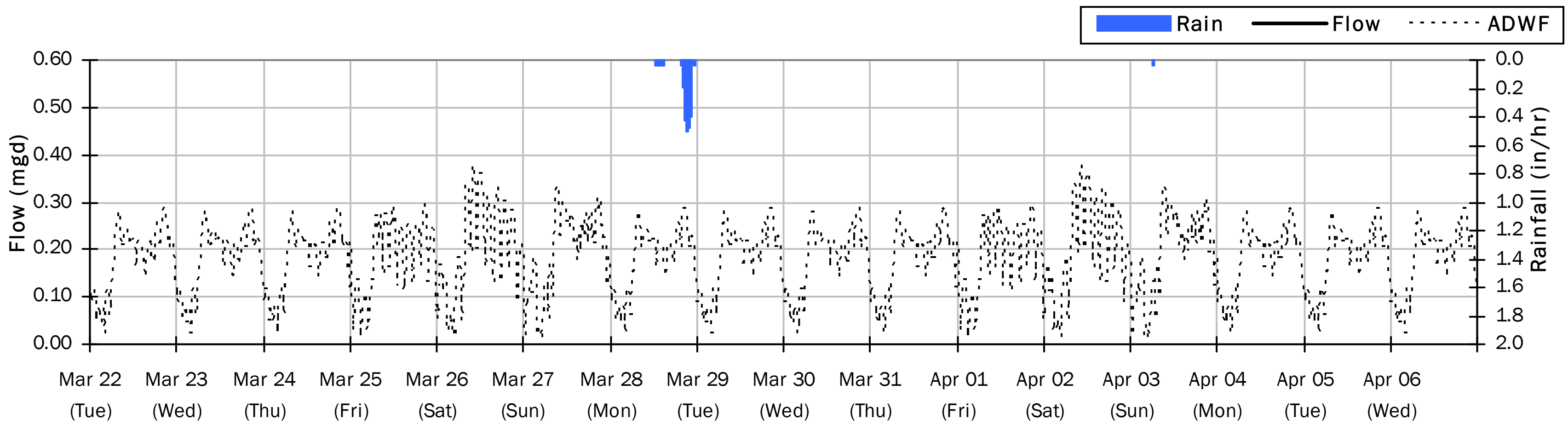


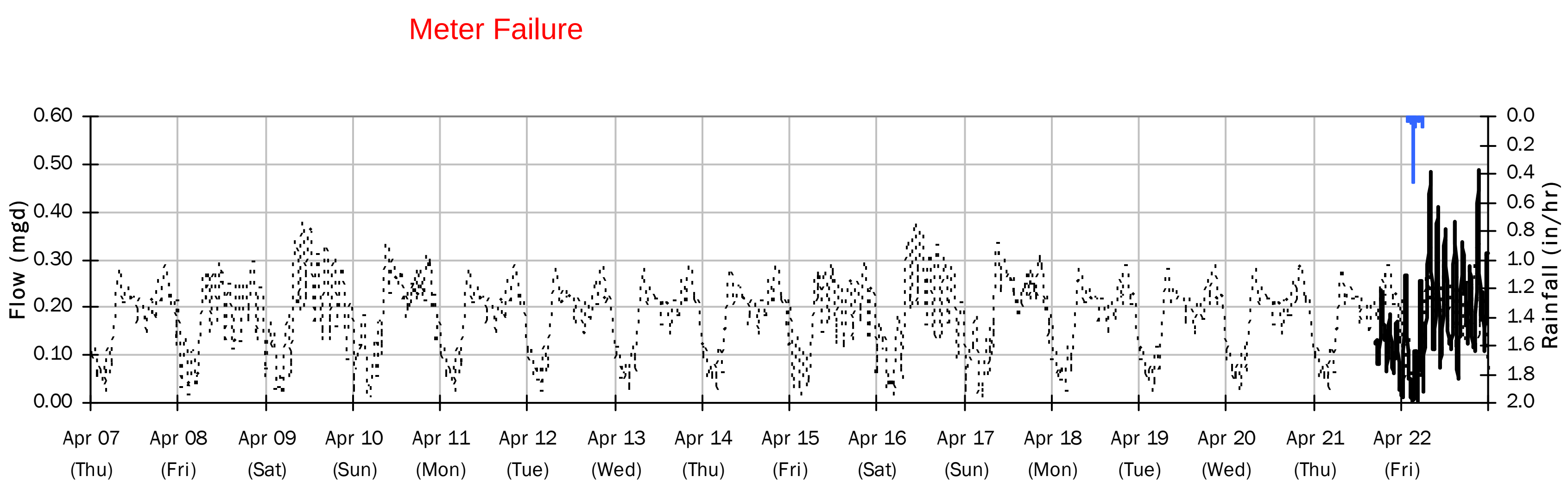


SITE 16

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 1.05 inches　　Period Avg Flow: 0.171 mgd　　Period Peak Flow: 0.487 mgd　　Period Min Flow: 0.005 mgd

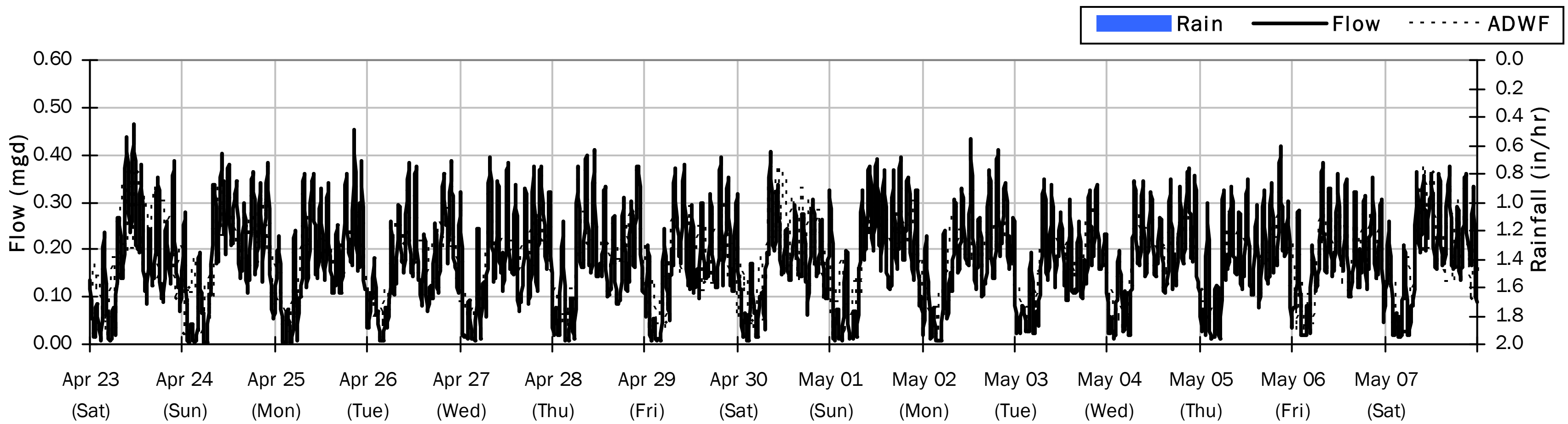


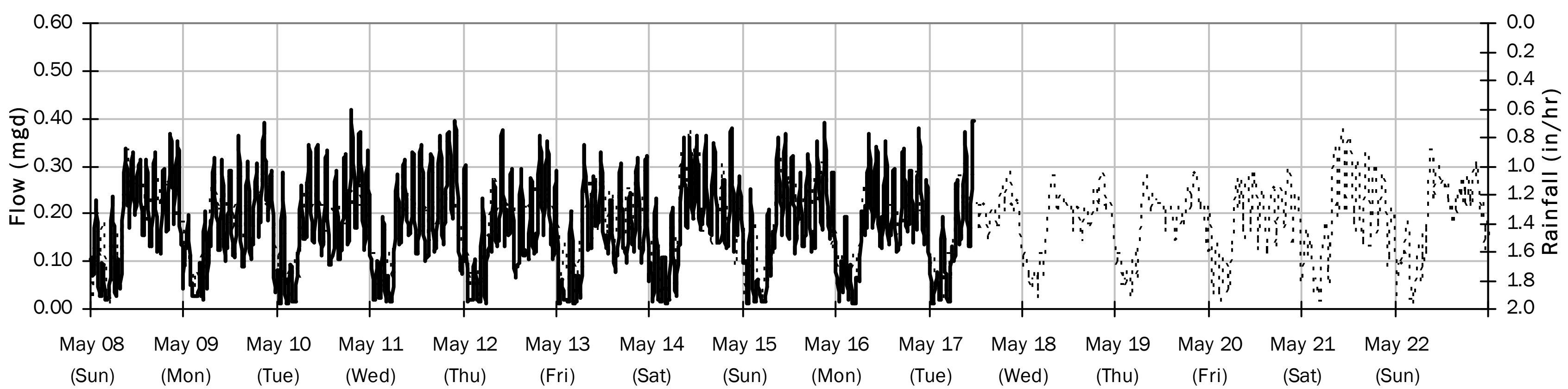


SITE 16

Flow Summary: 4/23/2022 to 5/22/2022

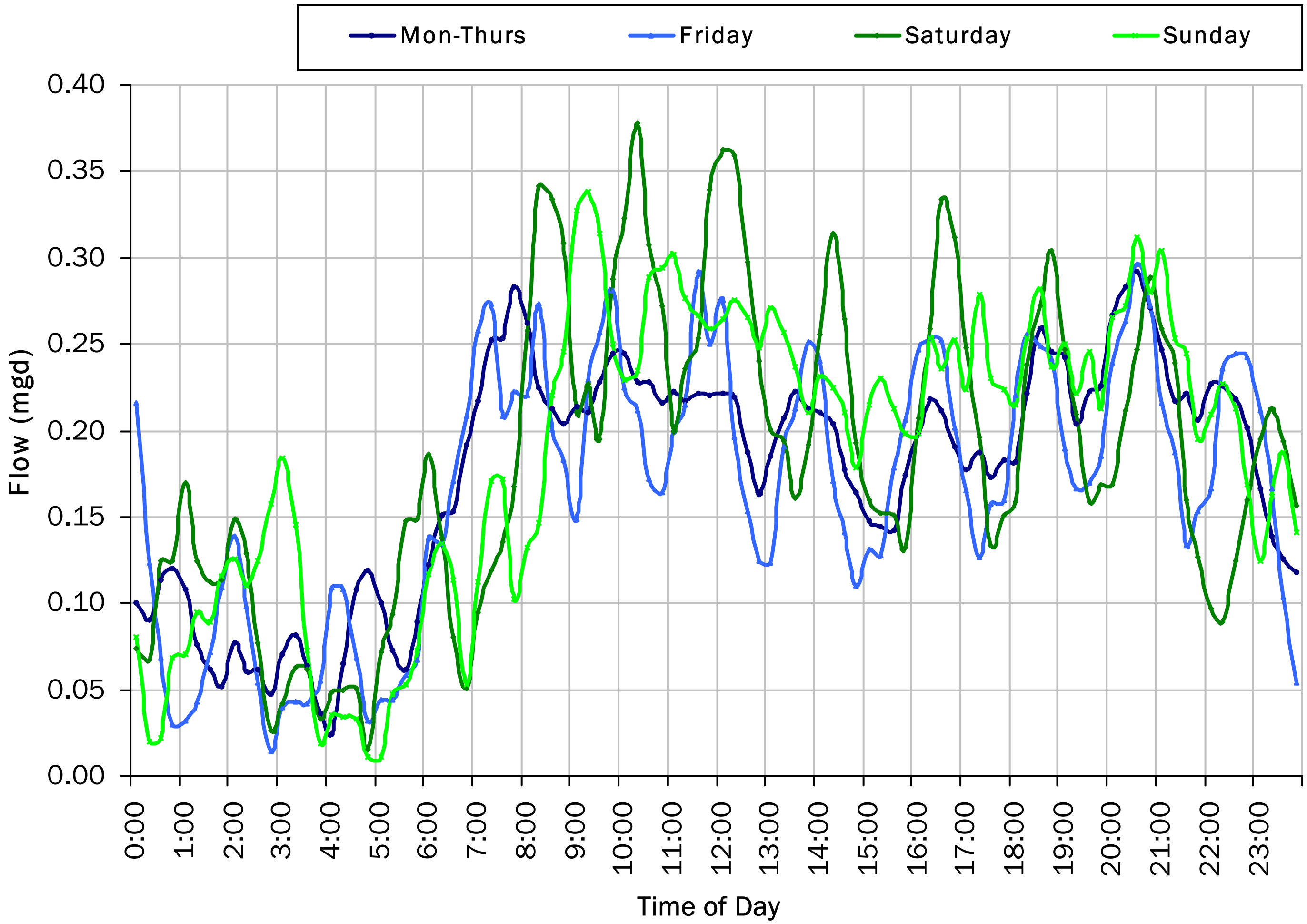
Period Rainfall: 0.00 inches   Period Avg Flow: 0.176 mgd   Period Peak Flow: 0.461 mgd   Period Min Flow: 0.003 mgd





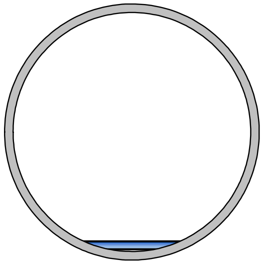
SITE 16

Average Dry Weather Flow Hydrographs



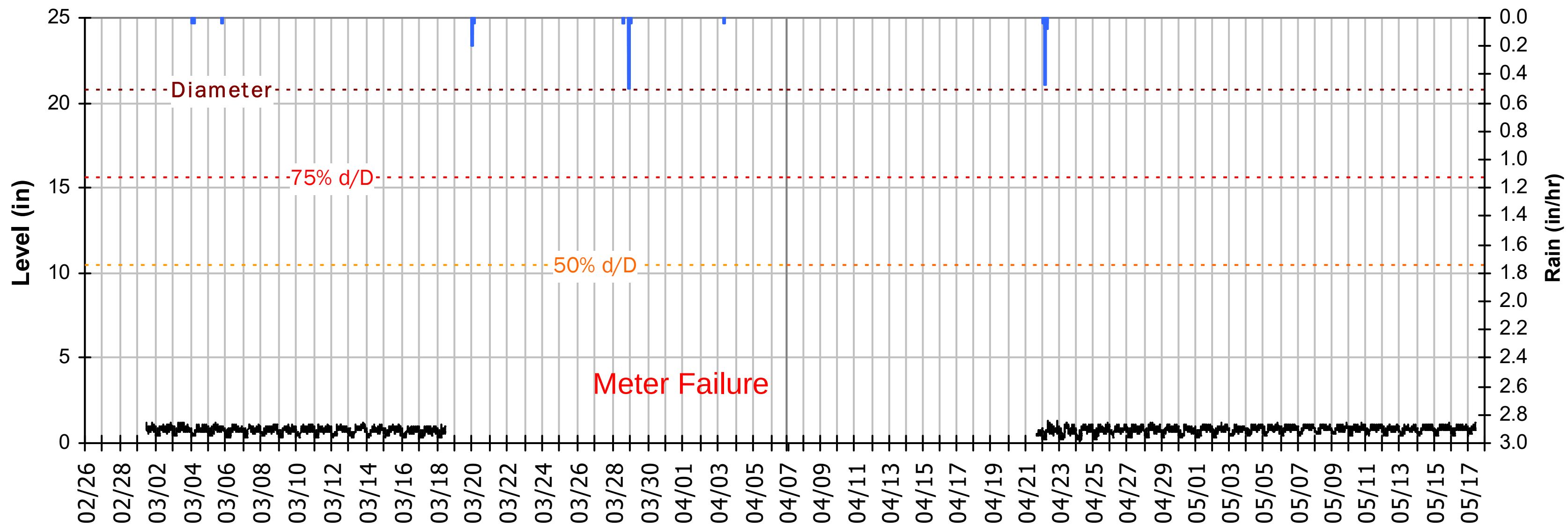
ADWF:

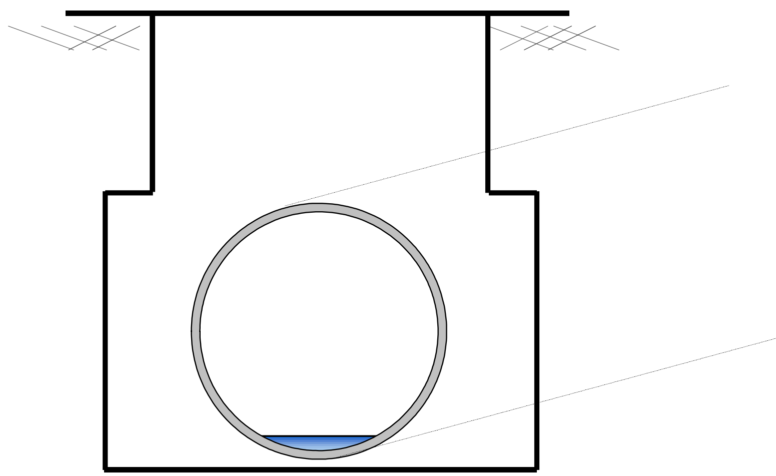
0.177 *mgd*



SITE 16
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



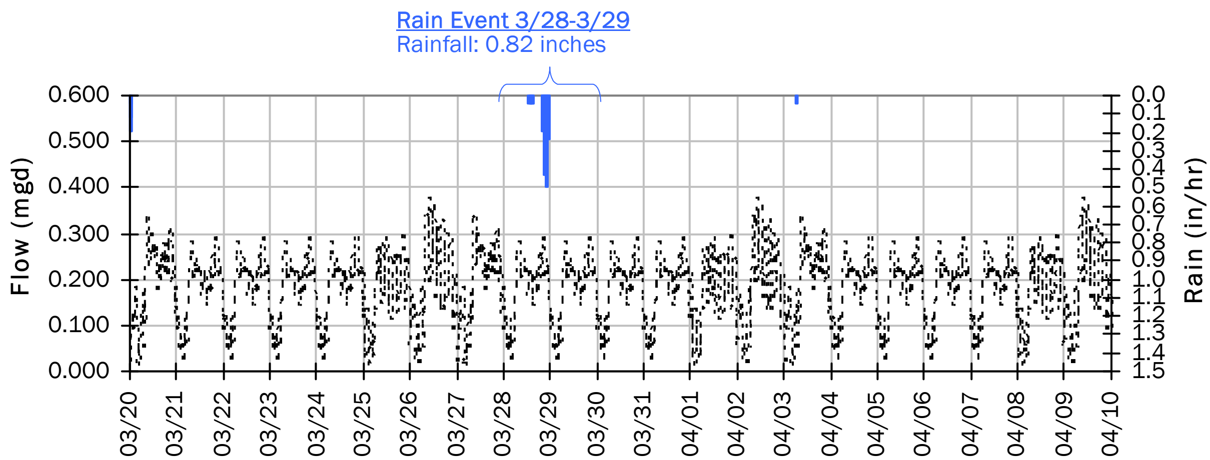


Pipe Diameter:	20.8	*inches*
Peak Measured Level:	1.29	*inches*
Peak d/D Ratio:	0.06	

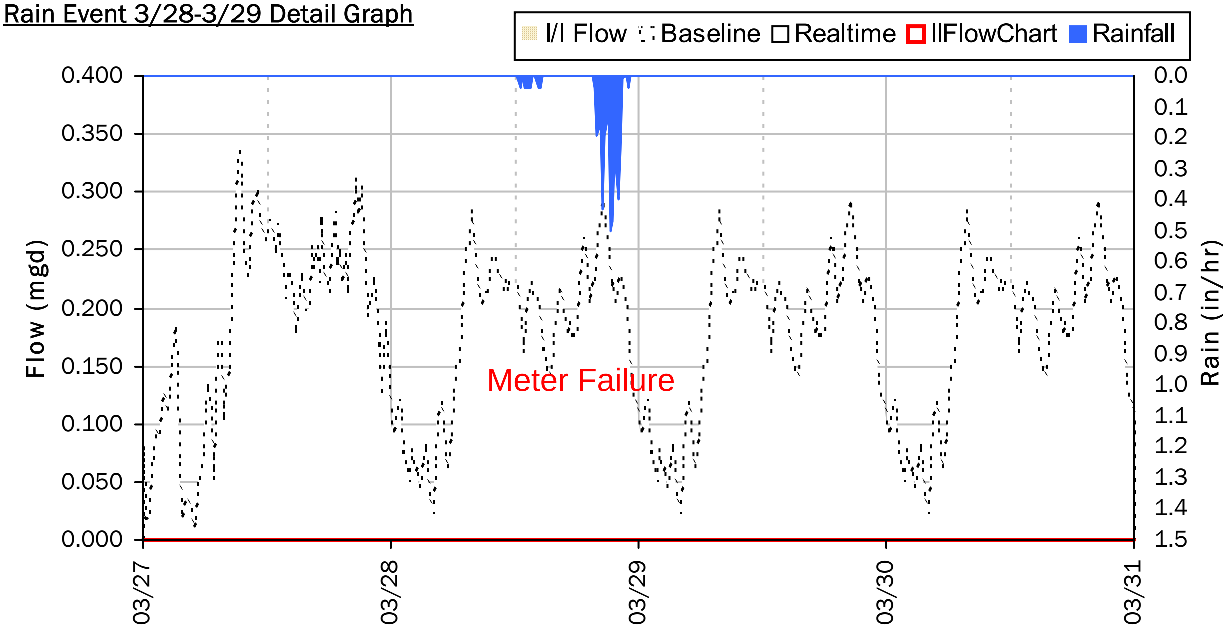
SITE 16

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



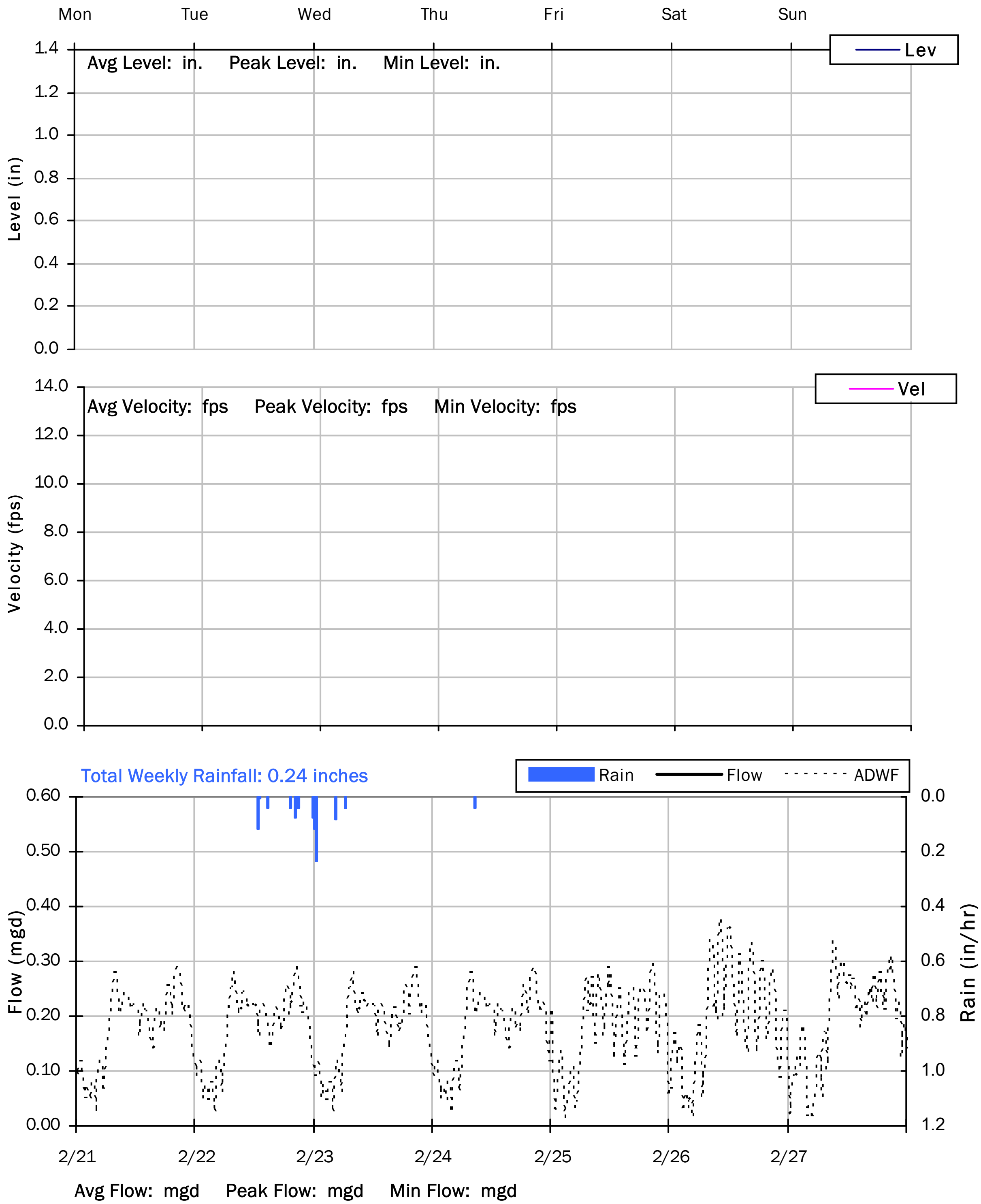
Storm Event I/I Analysis (Rain = 0.82 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	*mgd*	Peak I/I Rate:	*mgd*
PF:		Total I/I:	*gallons*
Peak Level:	*in*		
d/D Ratio:			

SITE 16

Weekly Level, Velocity and Flow Hydrographs

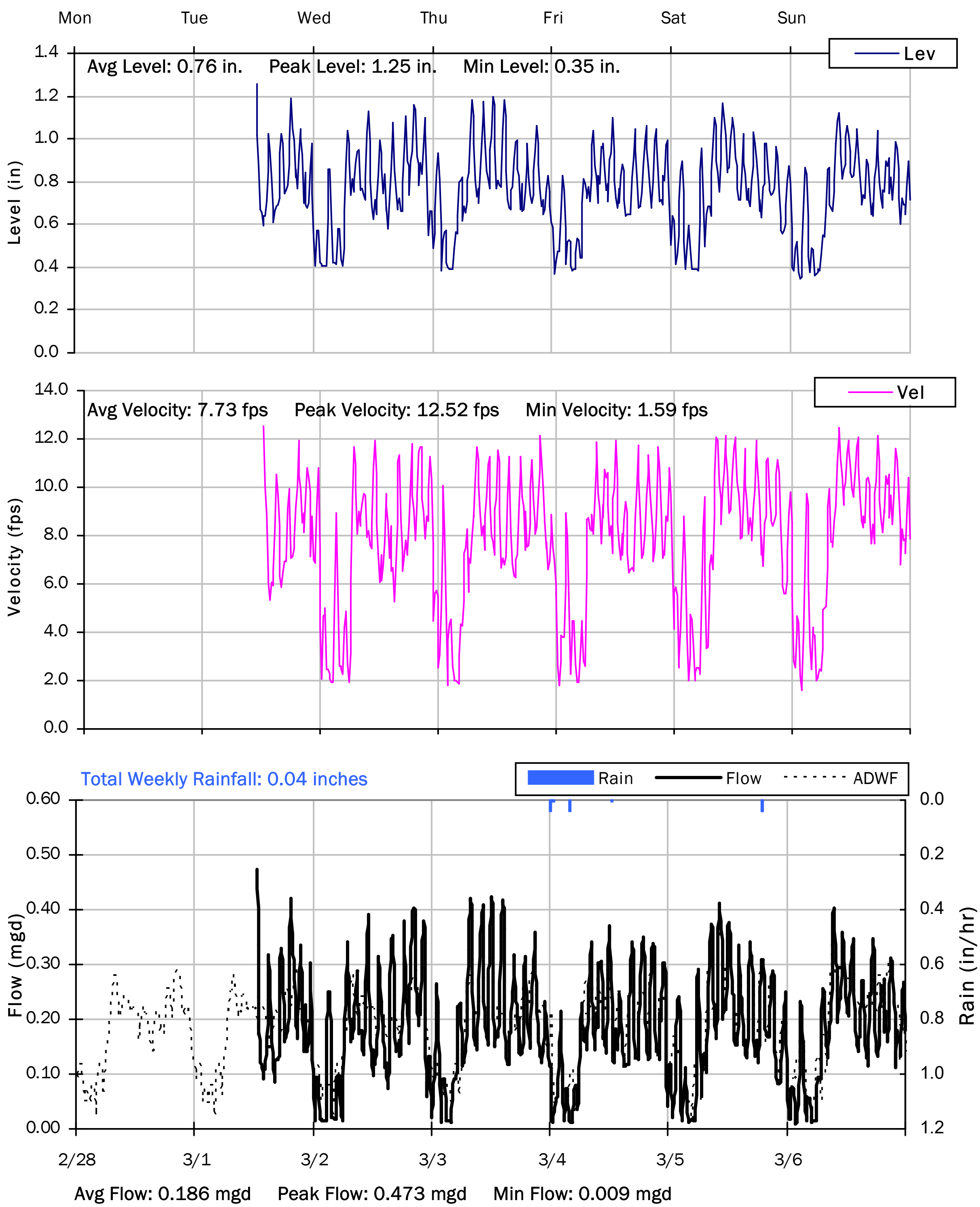
2/21/2022 to 2/28/2022



SITE 16

Weekly Level, Velocity and Flow Hydrographs

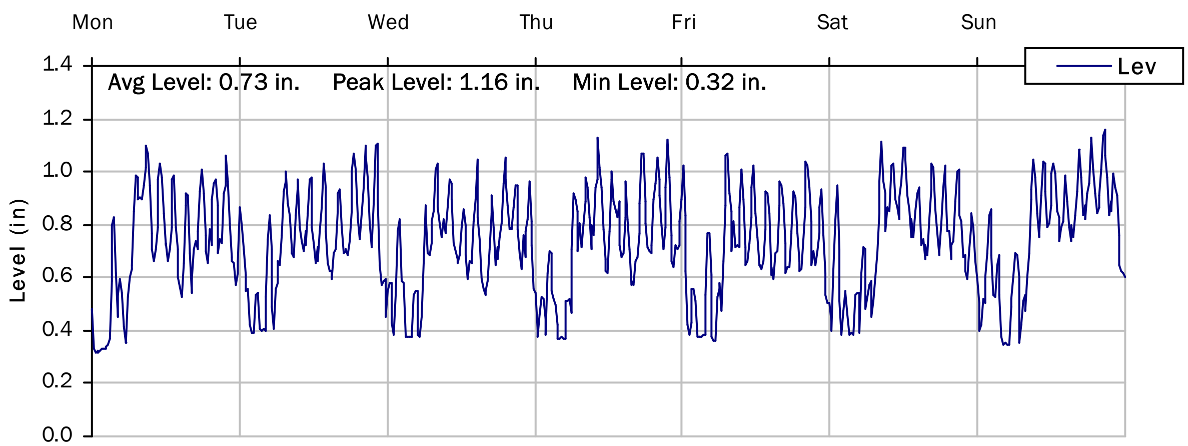
2/28/2022 to 3/7/2022

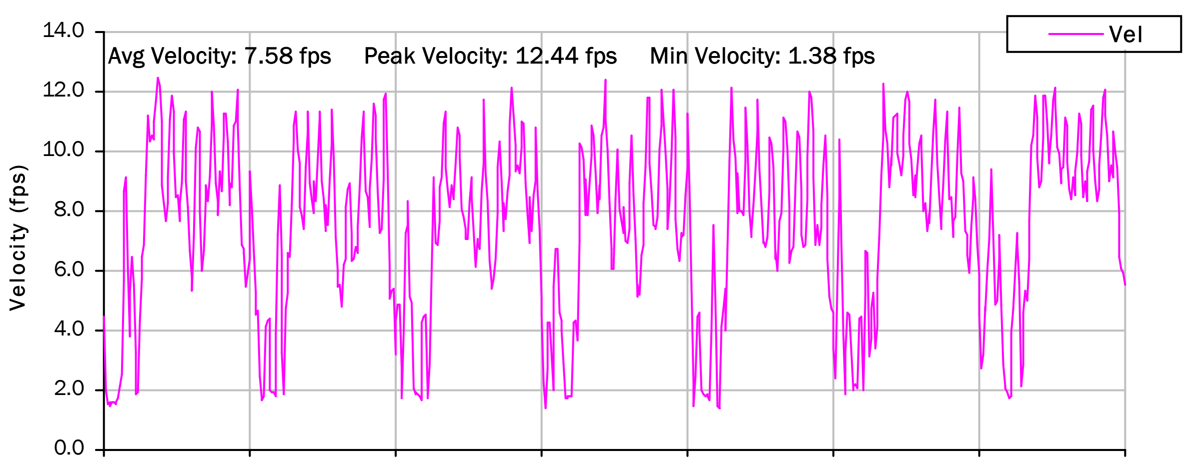


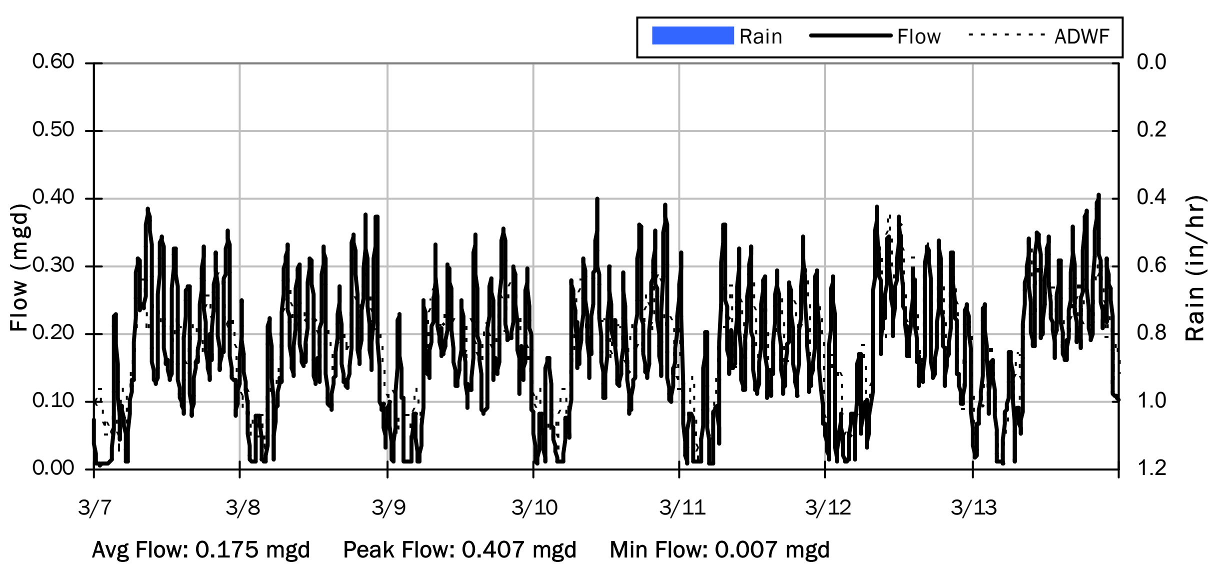
SITE 16

Weekly Level, Velocity and Flow Hydrographs

3/7/2022 to 3/14/2022



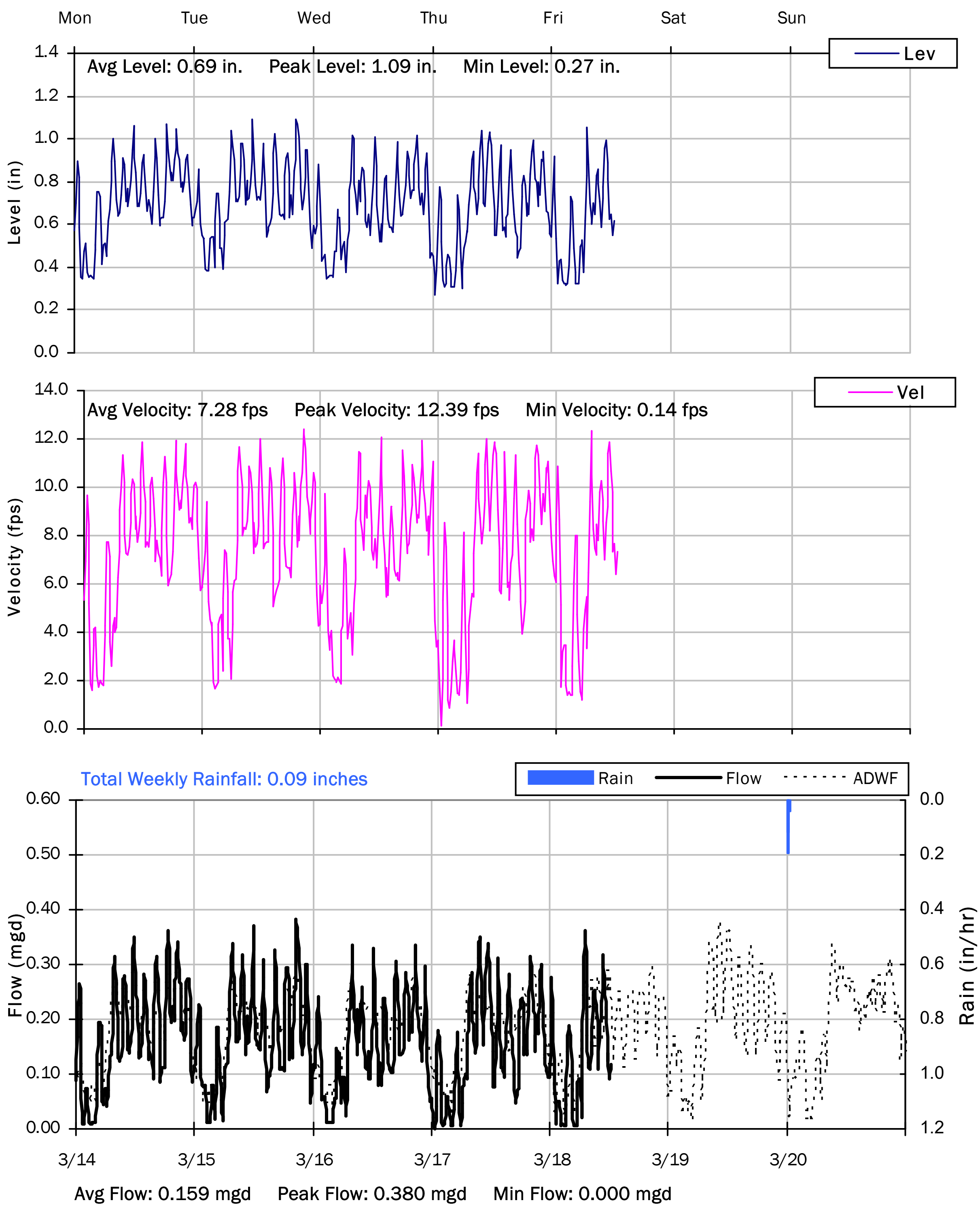




SITE 16

Weekly Level, Velocity and Flow Hydrographs

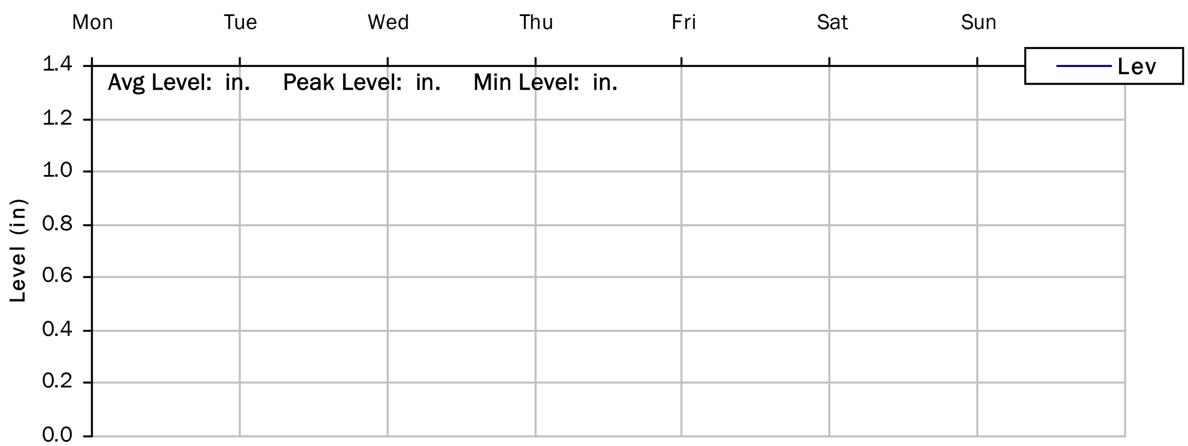
3/14/2022 to 3/21/2022

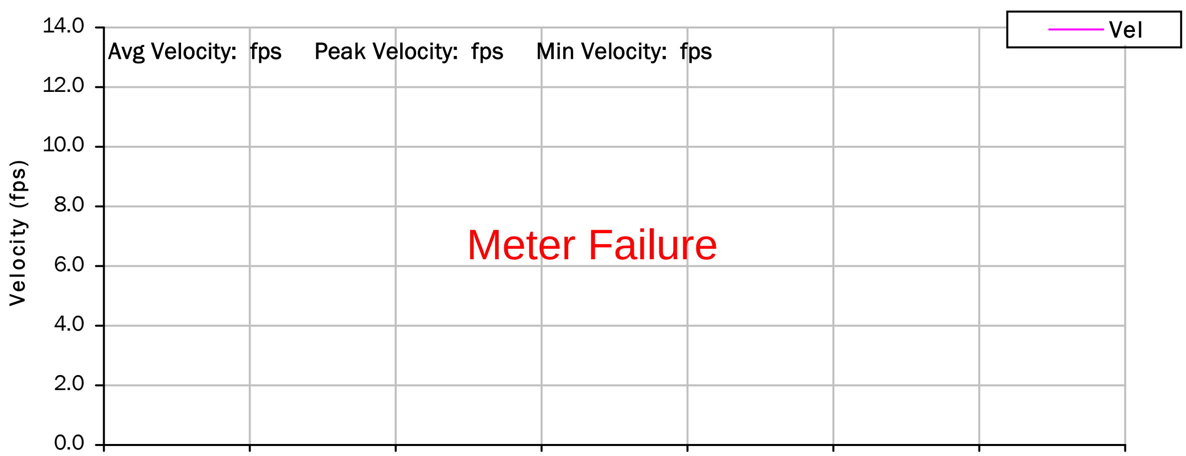


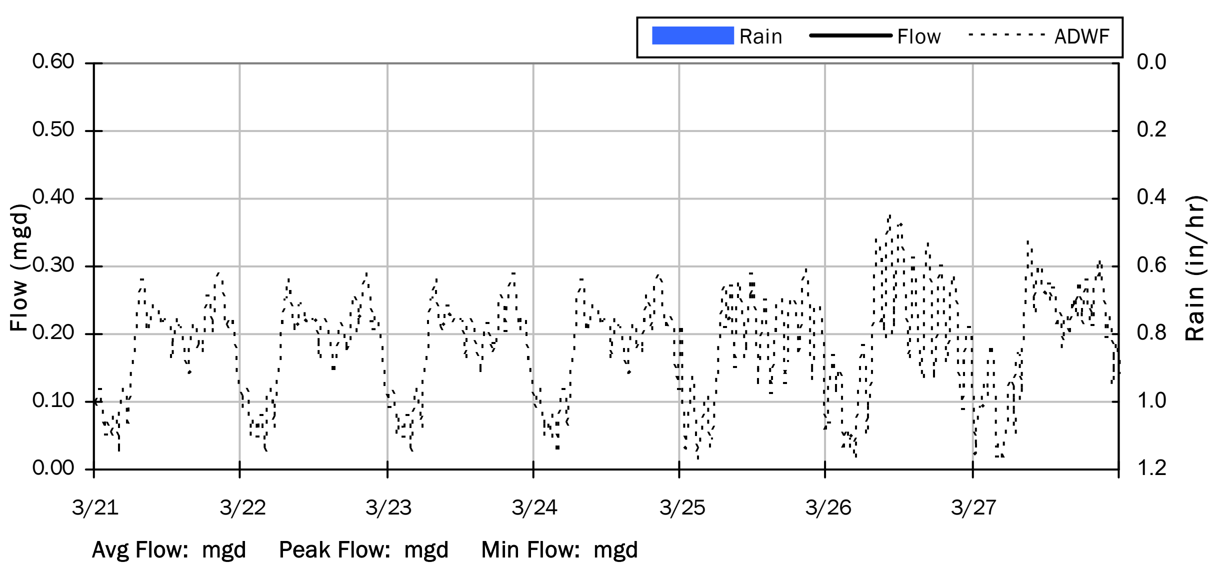
SITE 16

Weekly Level, Velocity and Flow Hydrographs

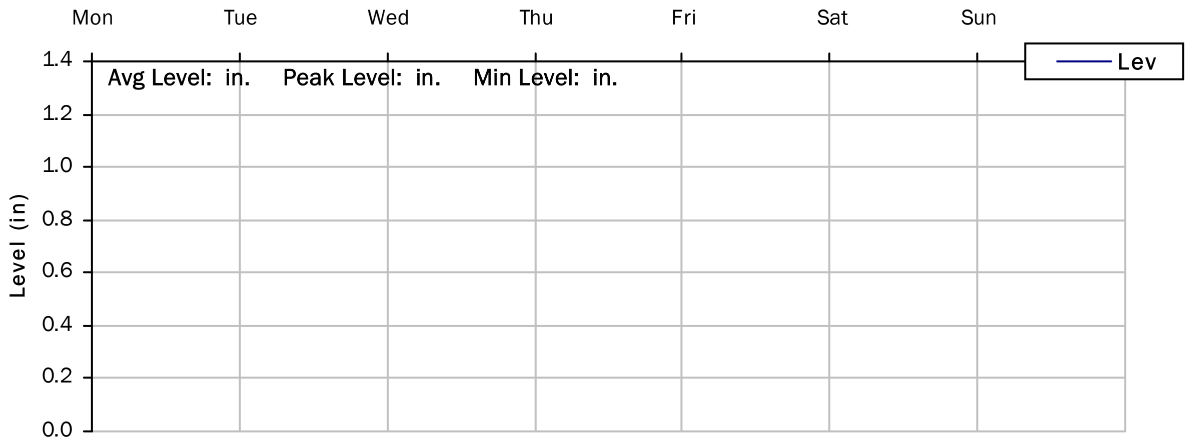
3/21/2022 to 3/28/2022

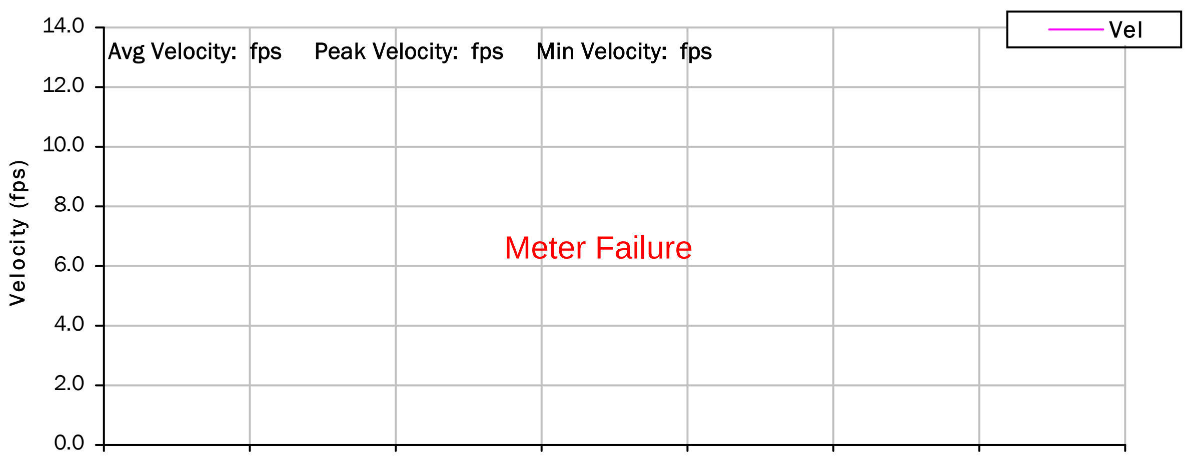


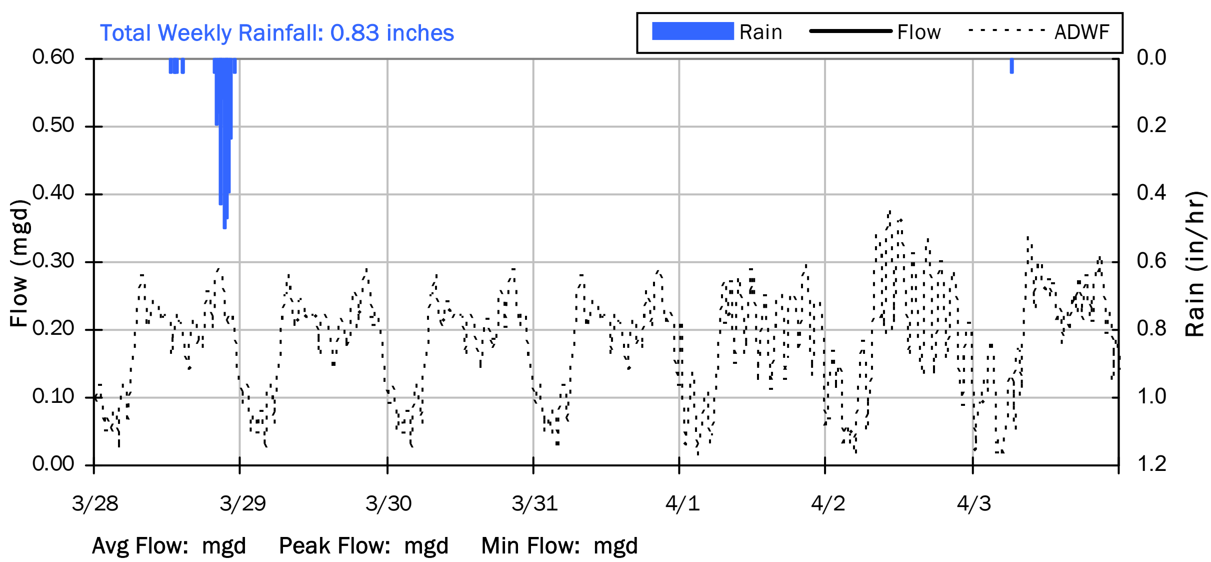




SITE 16
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022



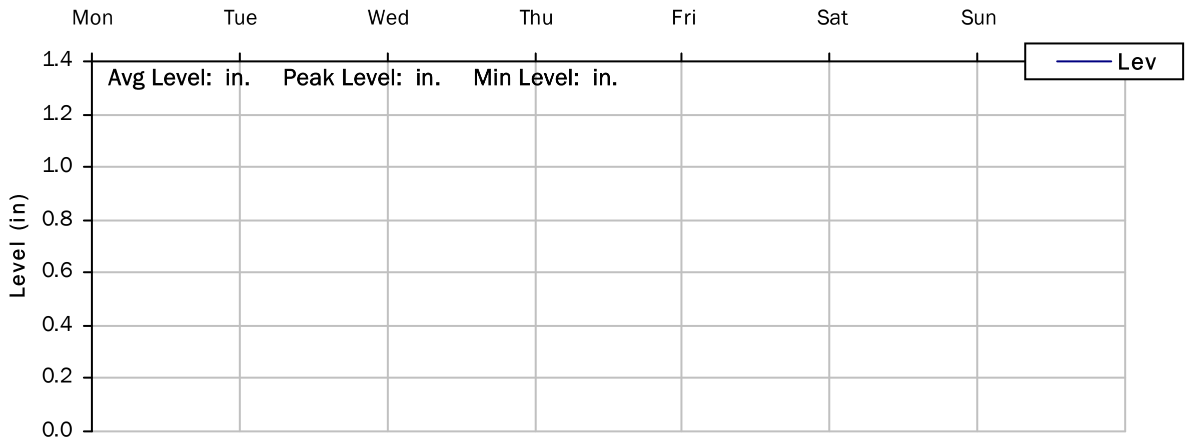


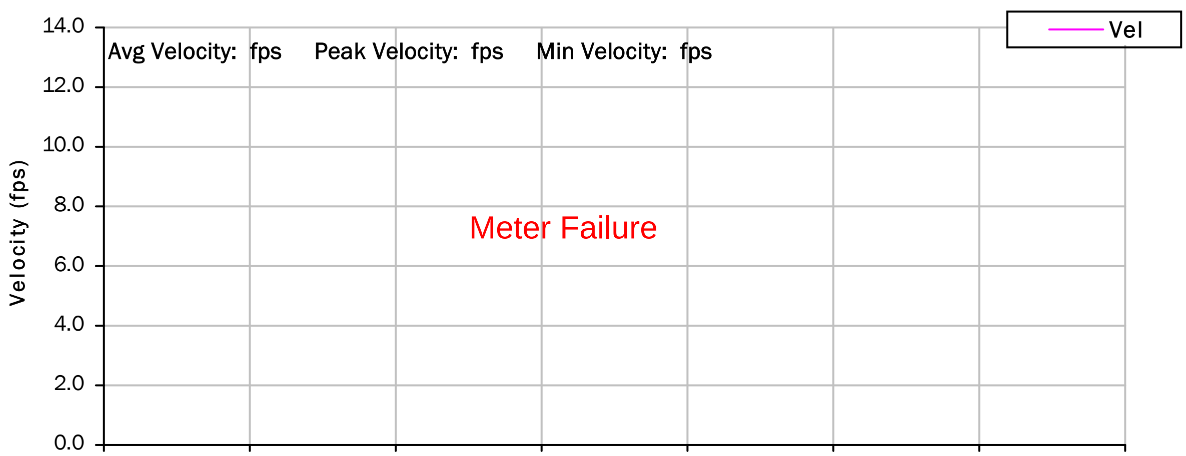


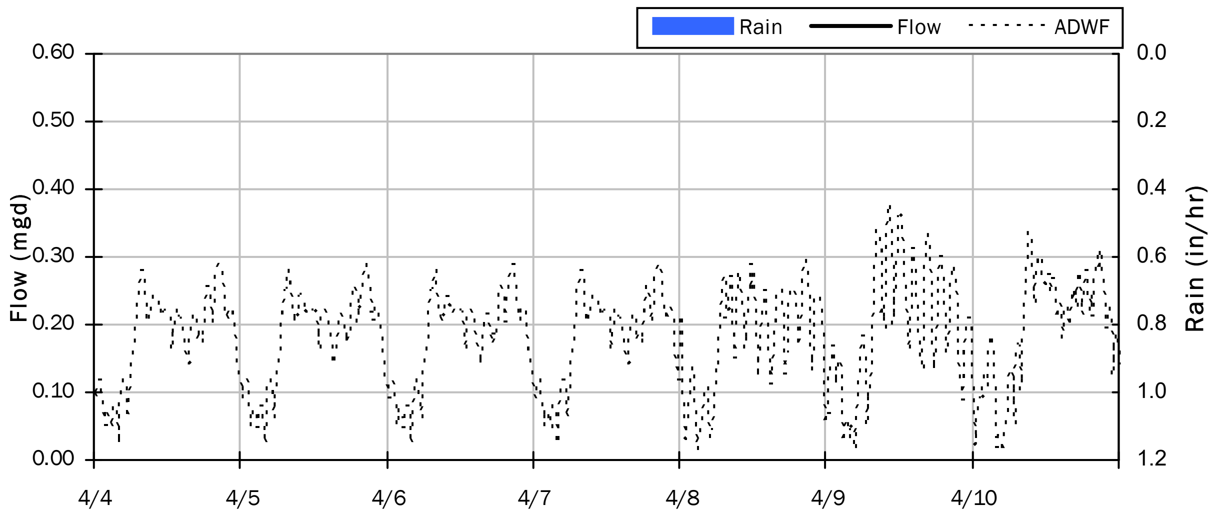
SITE 16

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022

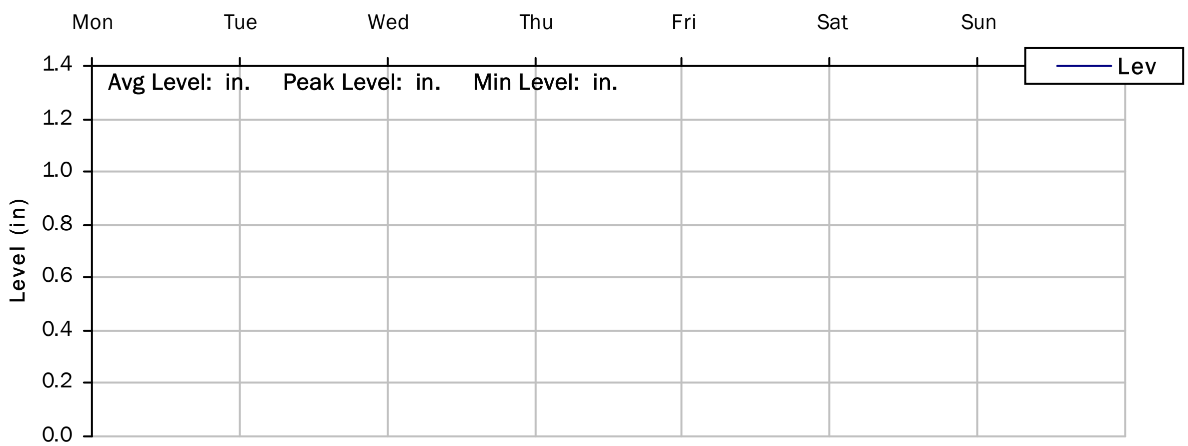


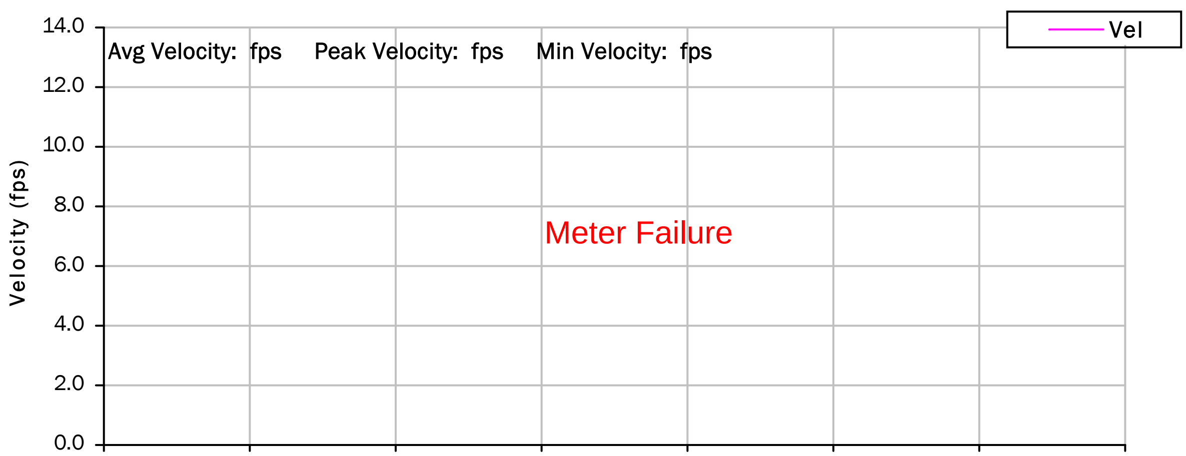


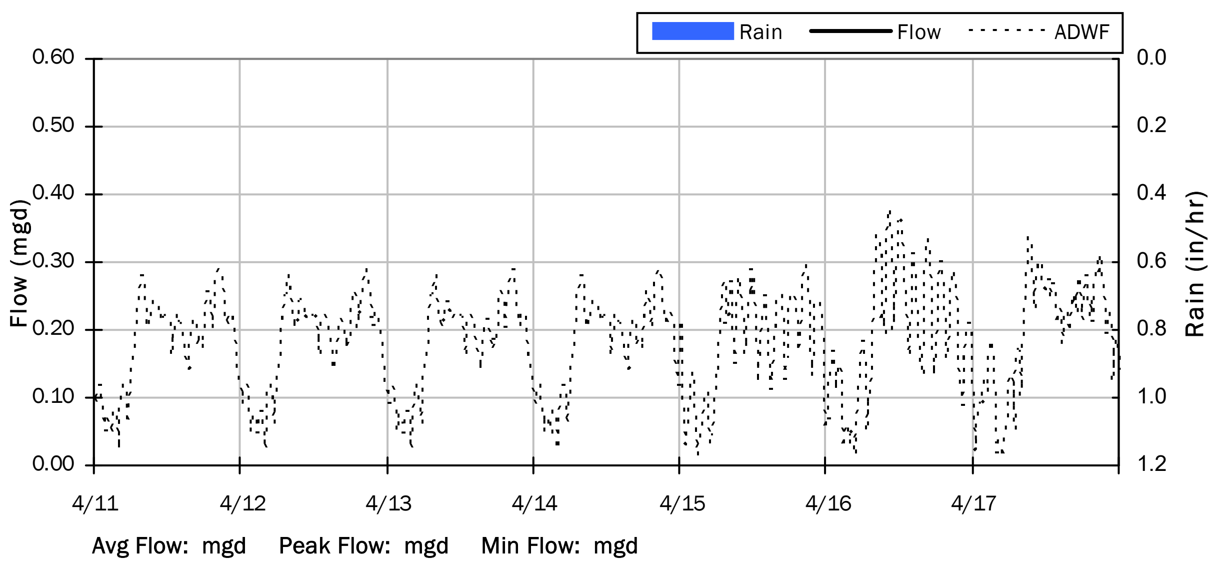


Avg Flow: mgd Peak Flow: mgd Min Flow: mgd

SITE 16
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022



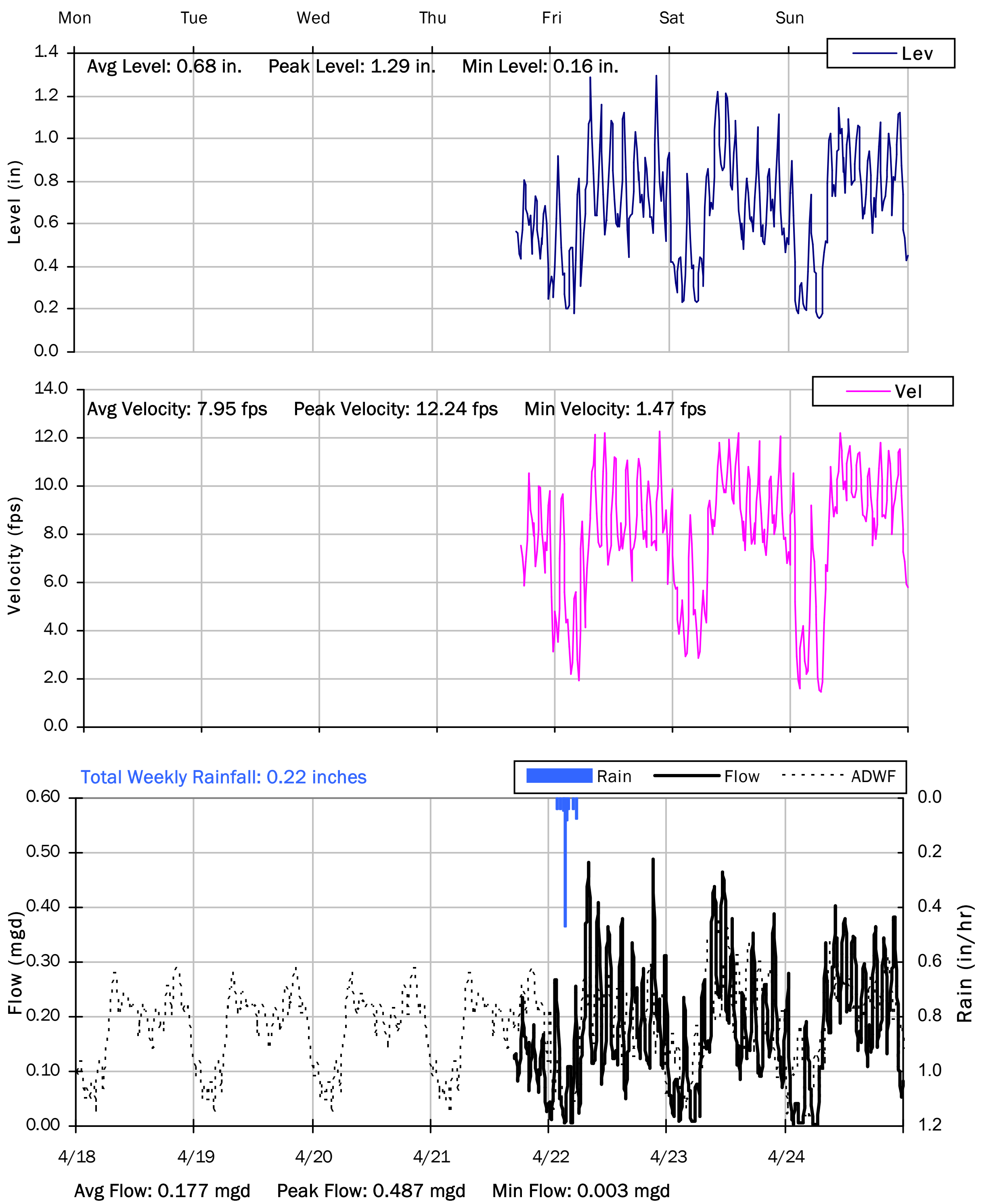




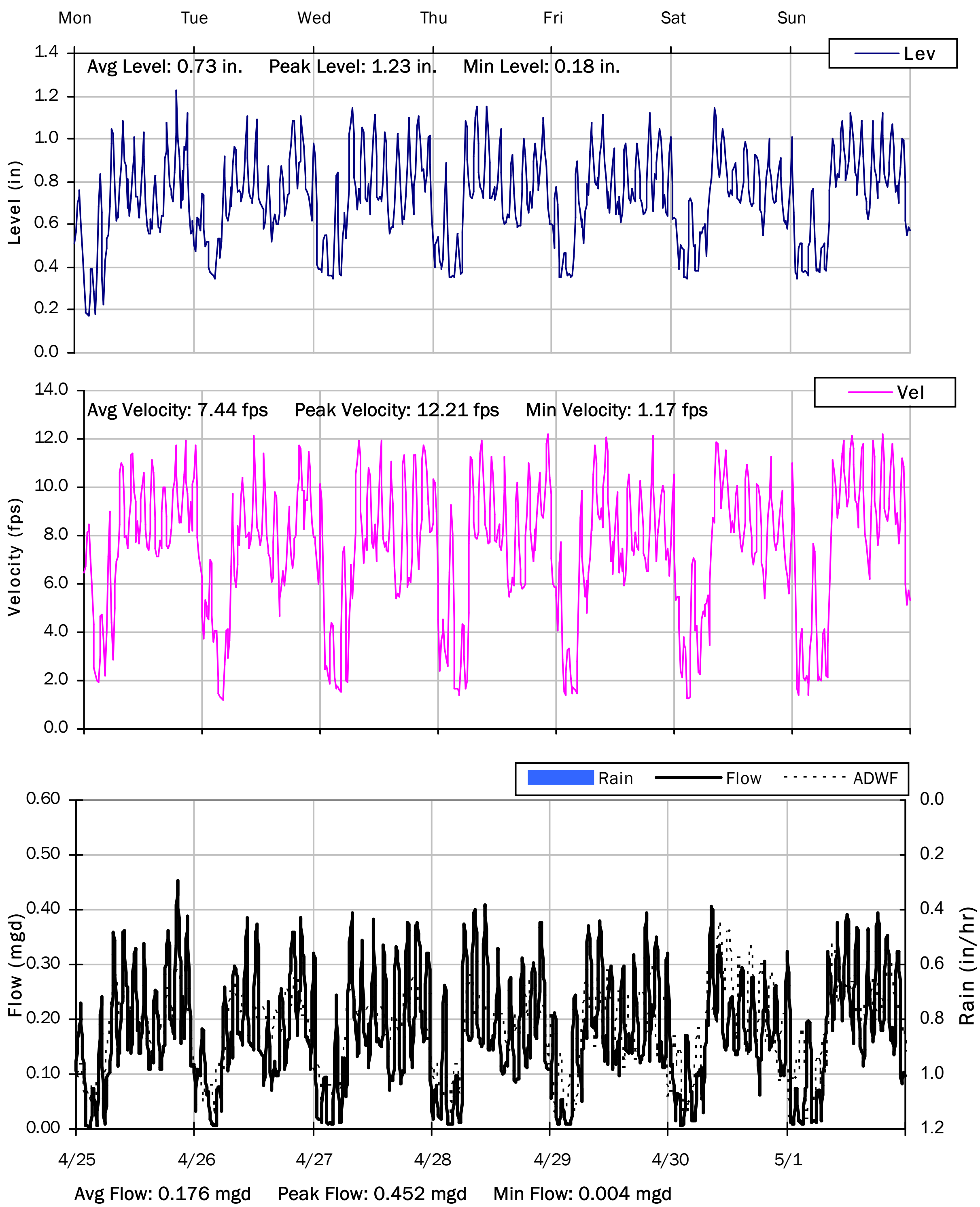
SITE 16

Weekly Level, Velocity and Flow Hydrographs

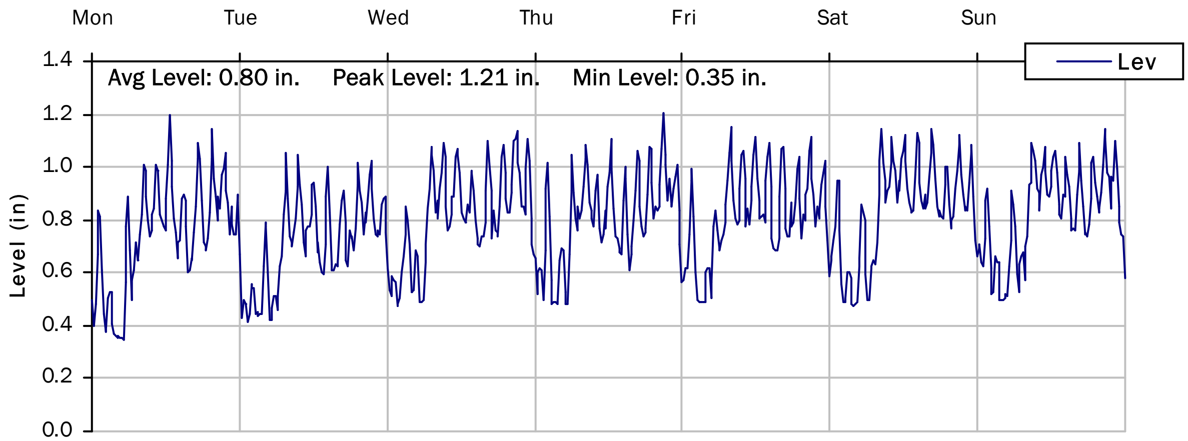
4/18/2022 to 4/25/2022

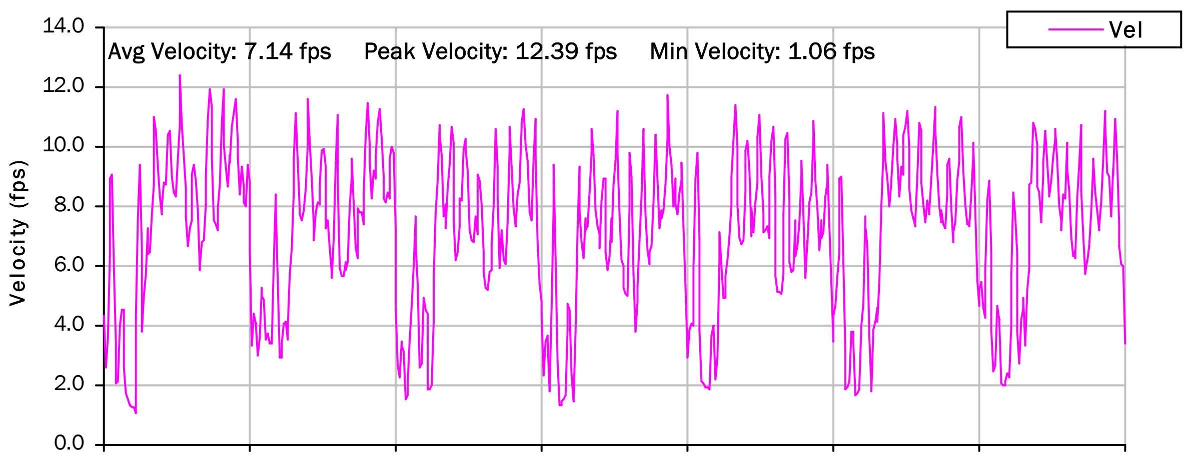


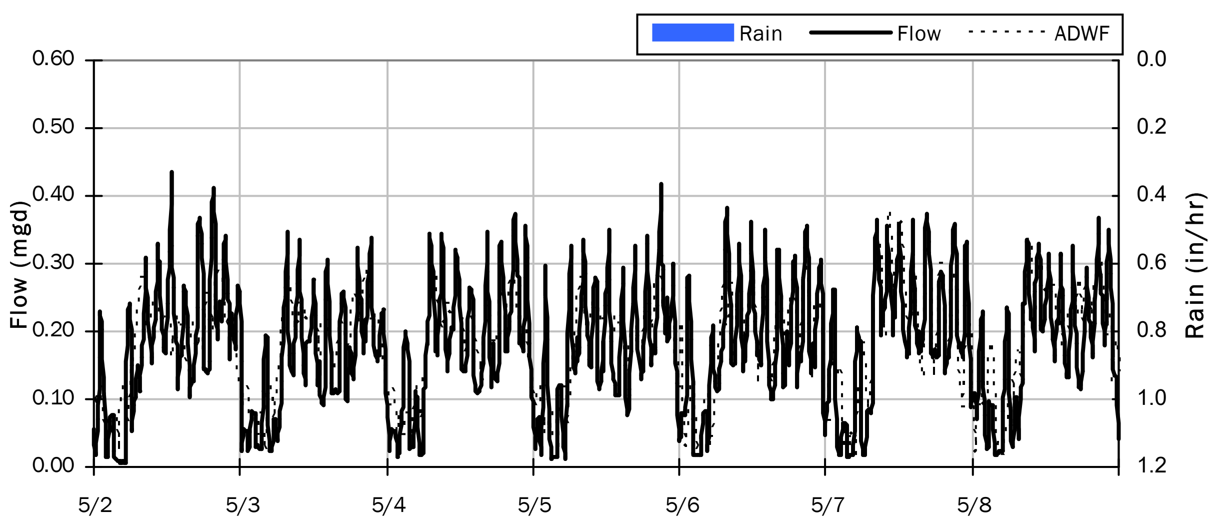
SITE 16
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022



SITE 16
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

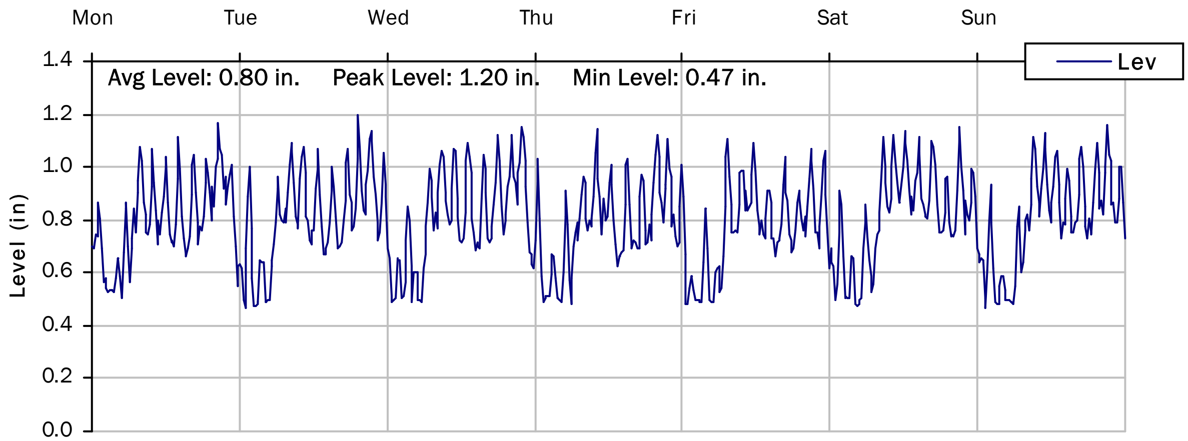


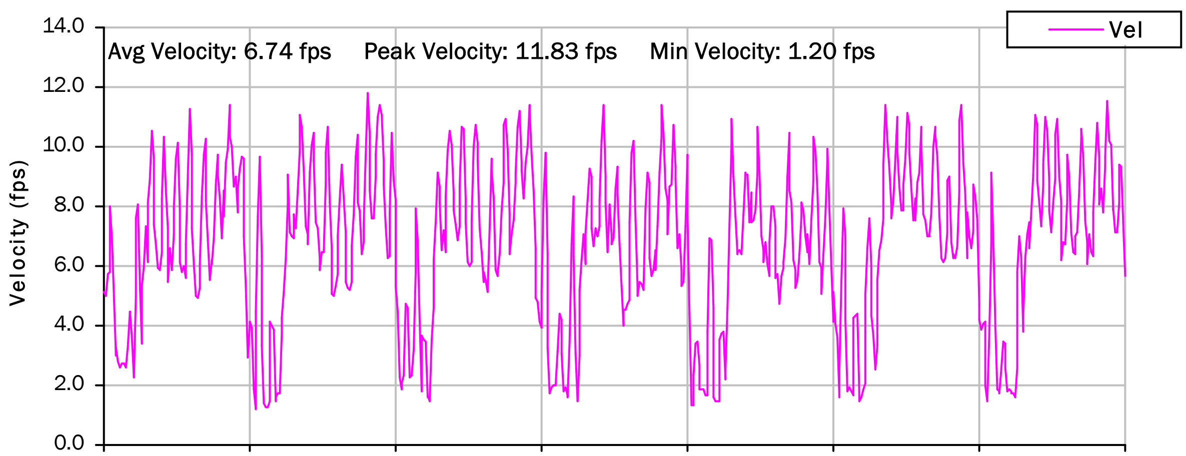


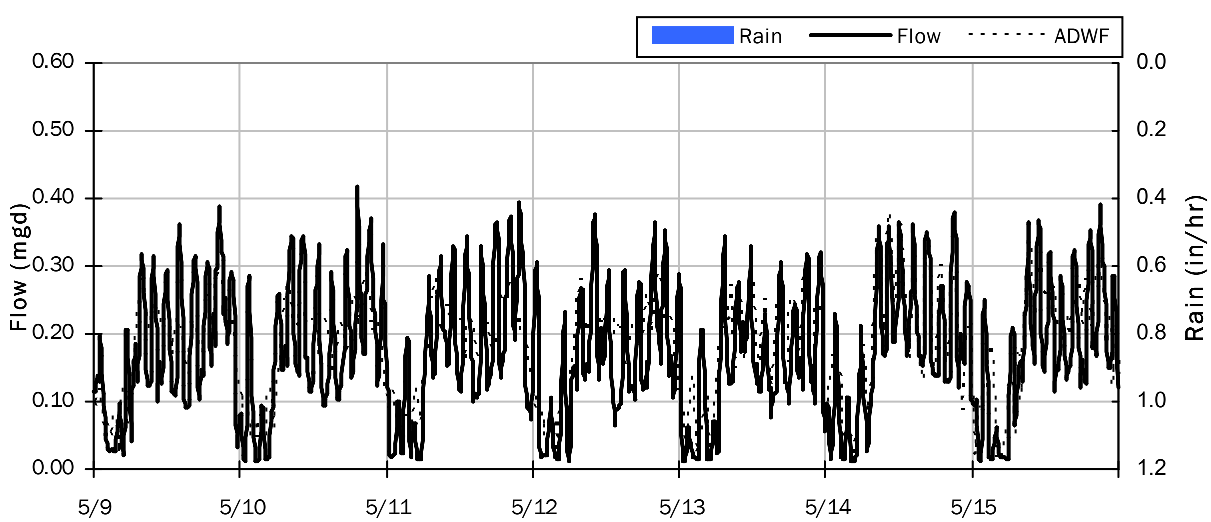


Avg Flow: 0.179 mgd   Peak Flow: 0.435 mgd   Min Flow: 0.006 mgd

SITE 16
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022





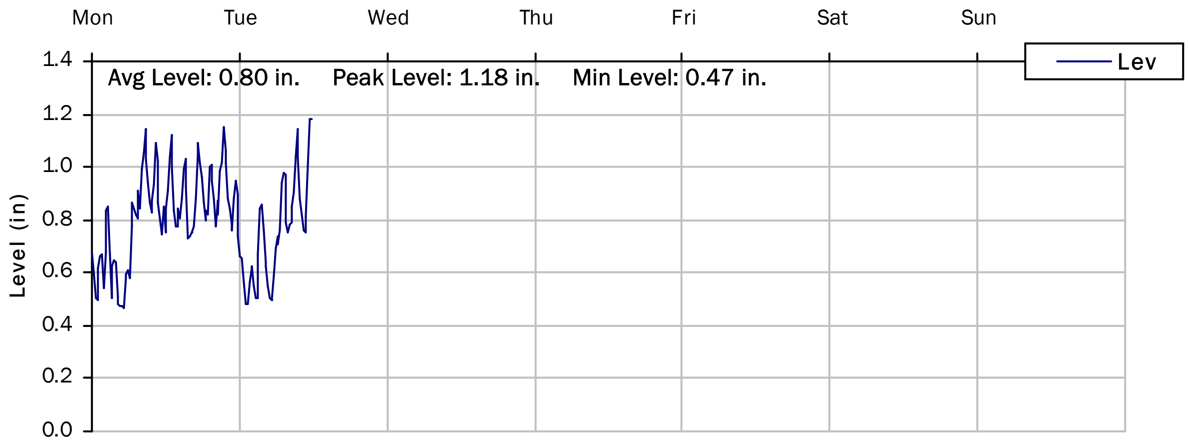


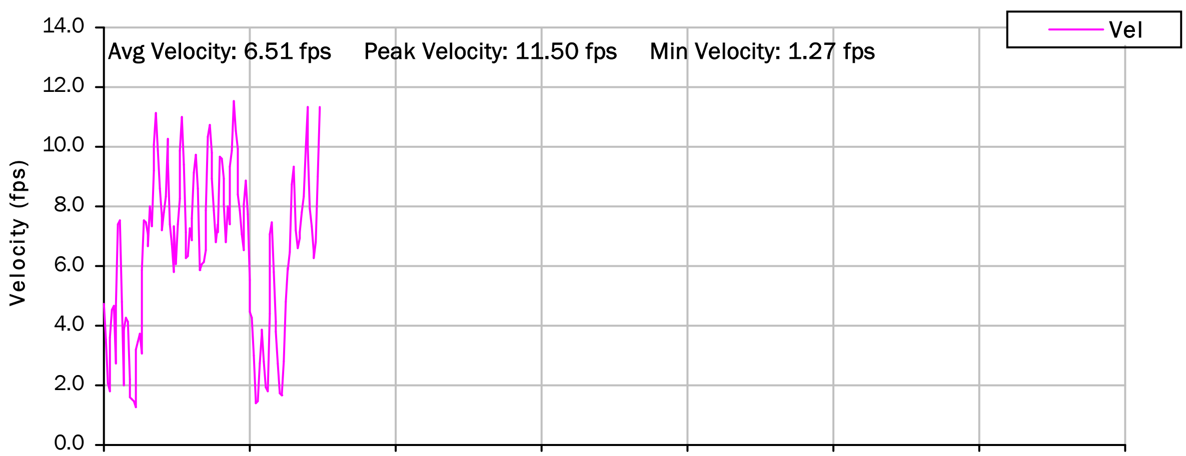
Avg Flow: 0.172 mgd   Peak Flow: 0.418 mgd   Min Flow: 0.010 mgd

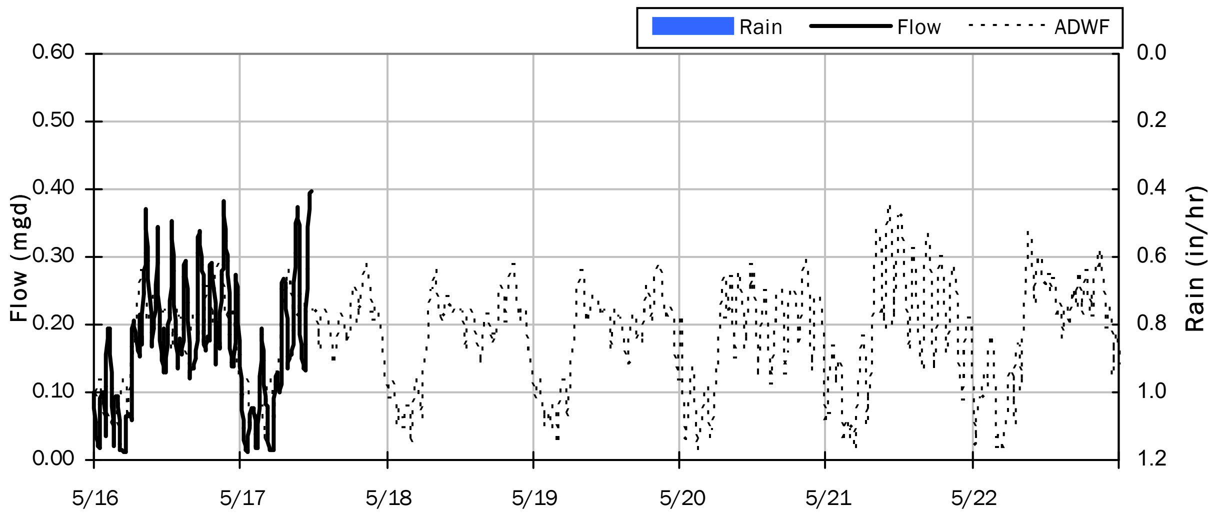
SITE 16

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022







Monitoring Site: Site 17

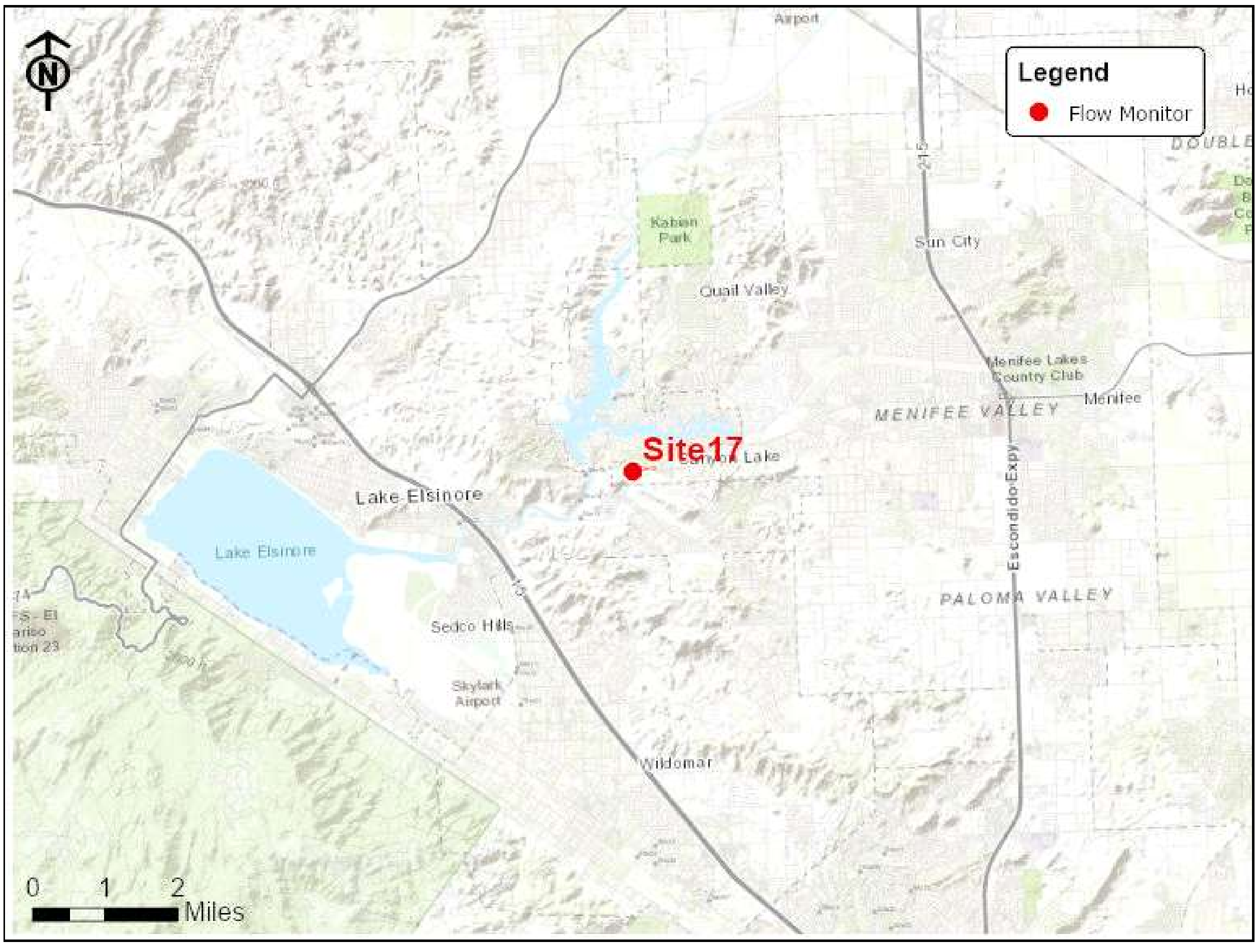
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Railroad Canyon Road, near Skylink

Data Summary Report



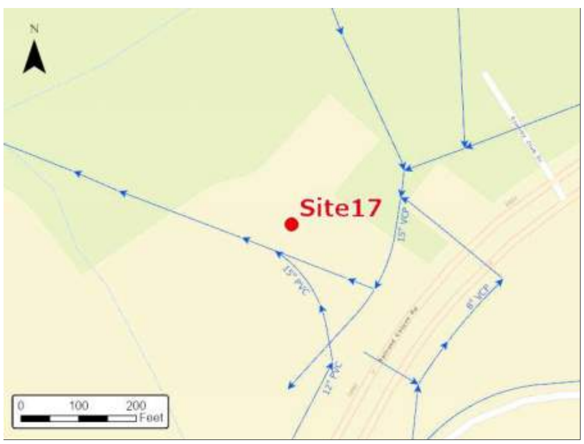
Vicinity Map: Site 17

SITE 17

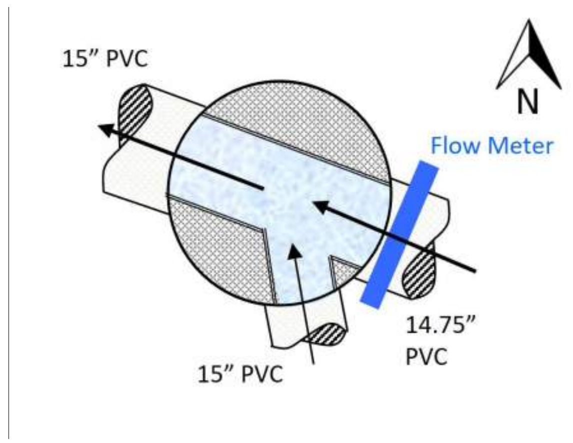
Site Information MH ID: MH-2614

Location:	Railroad Canyon Road, near Skylink
Coordinates:	117.2614° W, 33.6730° N
Rim Elevation (Earth):	1400 feet
Expected Pipe Diameter:	15 inches
Measured Pipe Diameter:	14.75 inches
ADWF:	0.507 mgd
Peak Measured Flow:	1.075 mgd
Sediment:	None

Satellite Map



Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 17

Additional Site Photos

Effluent Pipe

Monitored E Influent Pipe

SITE 17

Additional Site Photos

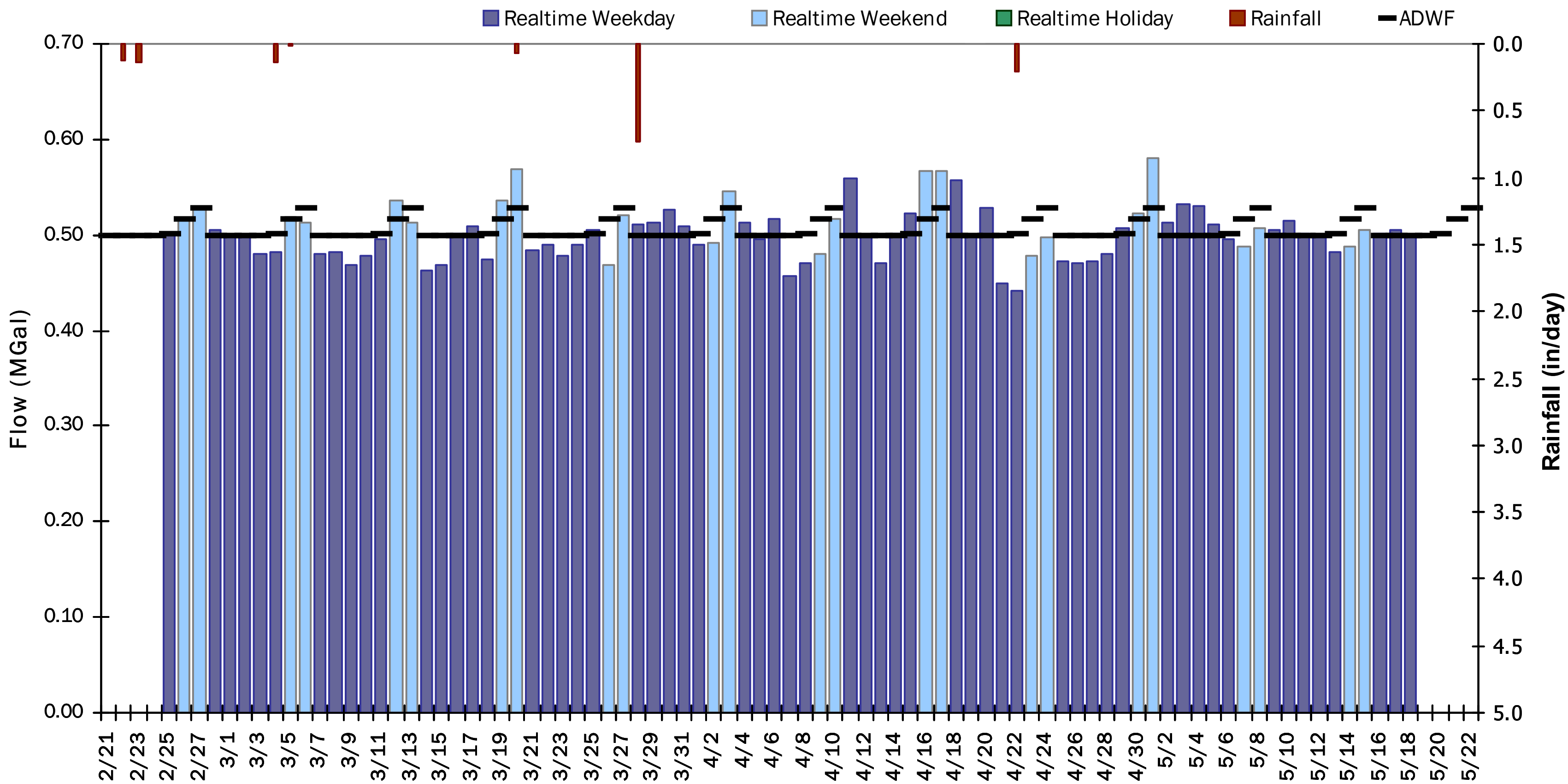
SE Influent Pipe

SITE 17

Period Flow Summary: Daily Flow Totals

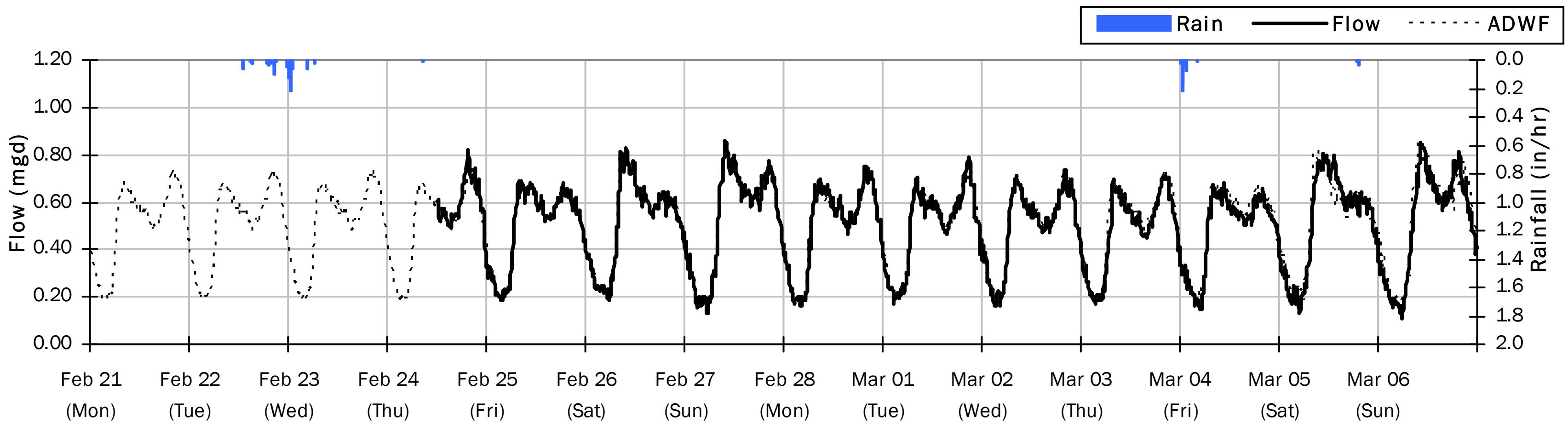
Avg Daily Flow: 0.503 MGal   Peak Daily Flow: 0.604 MGal   Min Daily Flow: 0.427 MGal

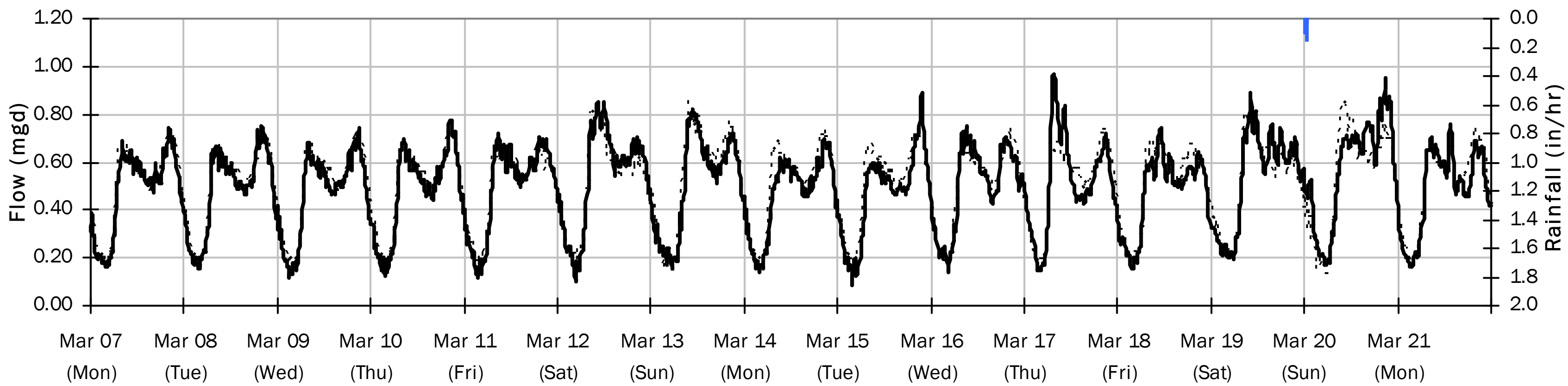
Total Rainfall: 1.17 inches



SITE 17
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.49 inches   Period Avg Flow: 0.502 mgd   Period Peak Flow: 0.967 mgd   Period Min Flow: 0.082 mgd



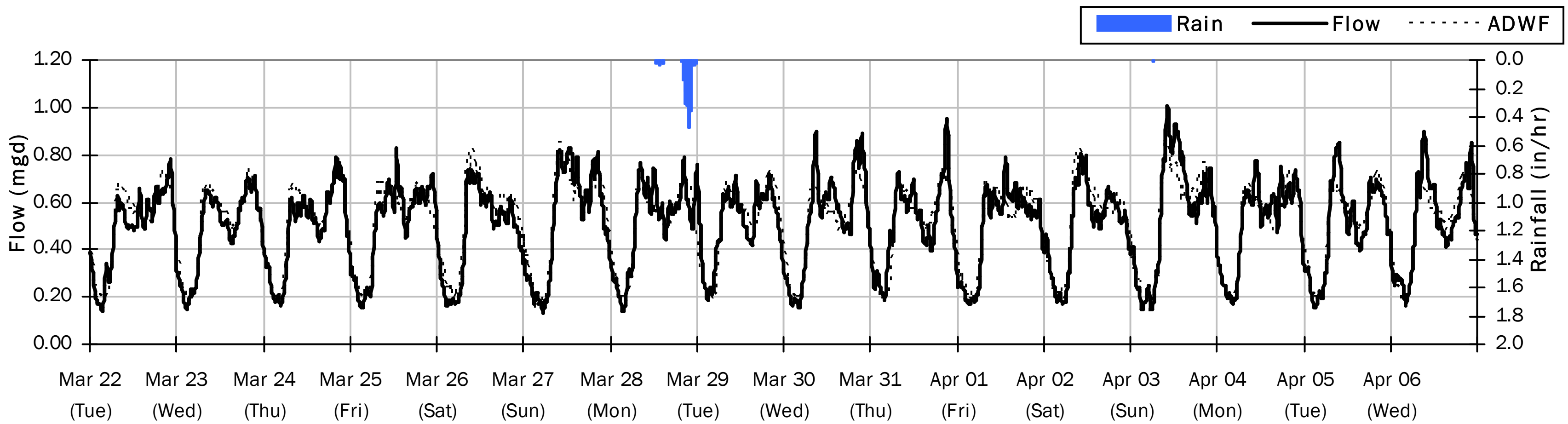


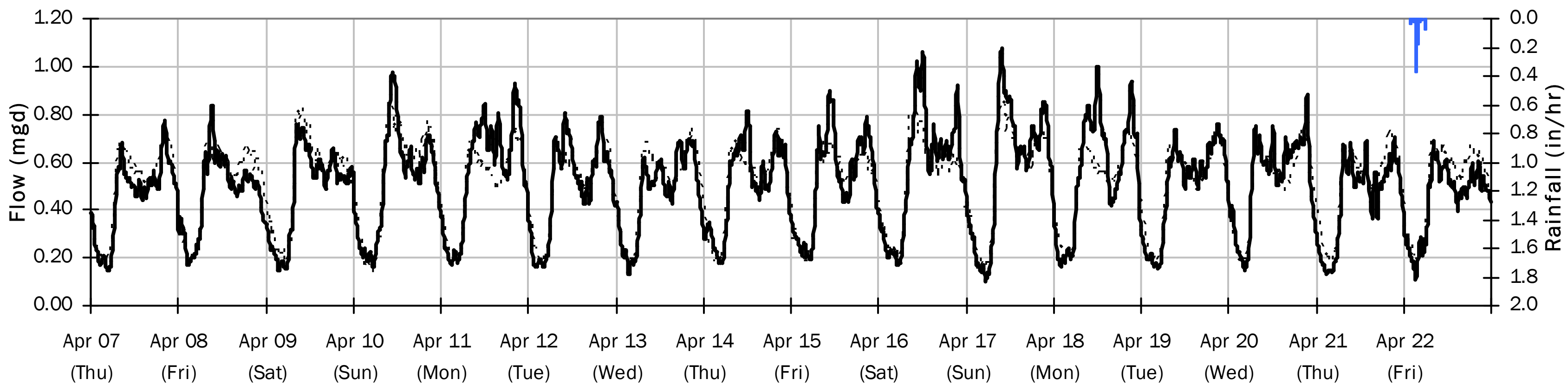
SITE 17

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.94 inches

Period Avg Flow: 0.505 mgd Period Peak Flow: 1.075 mgd Period Min Flow: 0.103 mgd

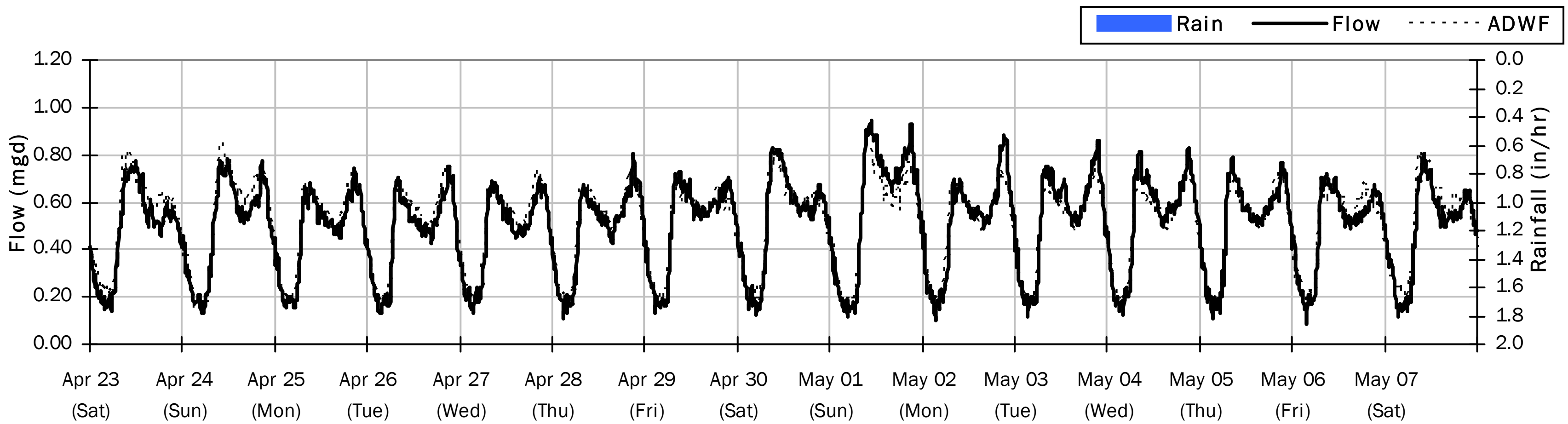


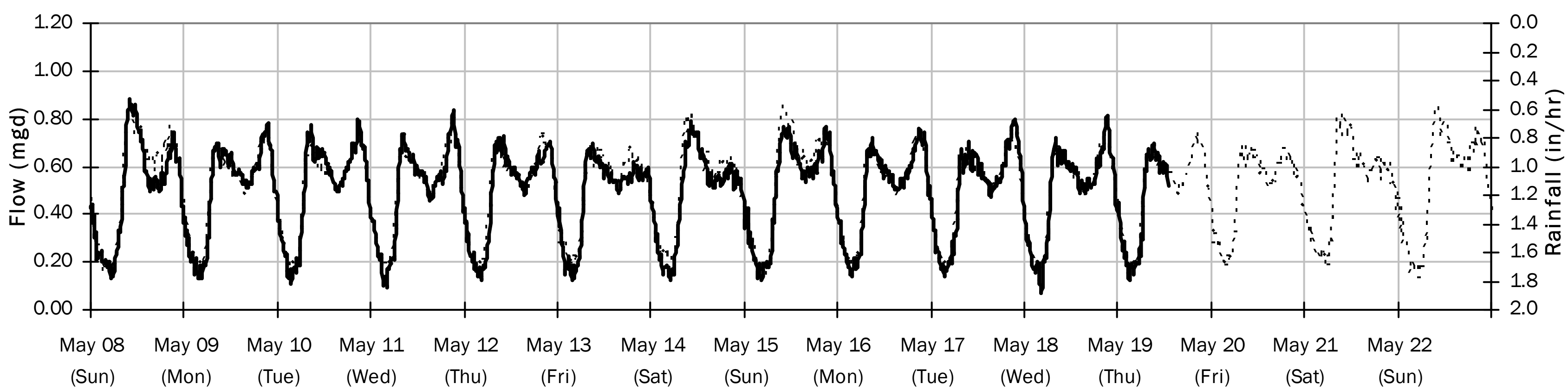


SITE 17
Flow Summary: 4/23/2022 to 5/22/2022

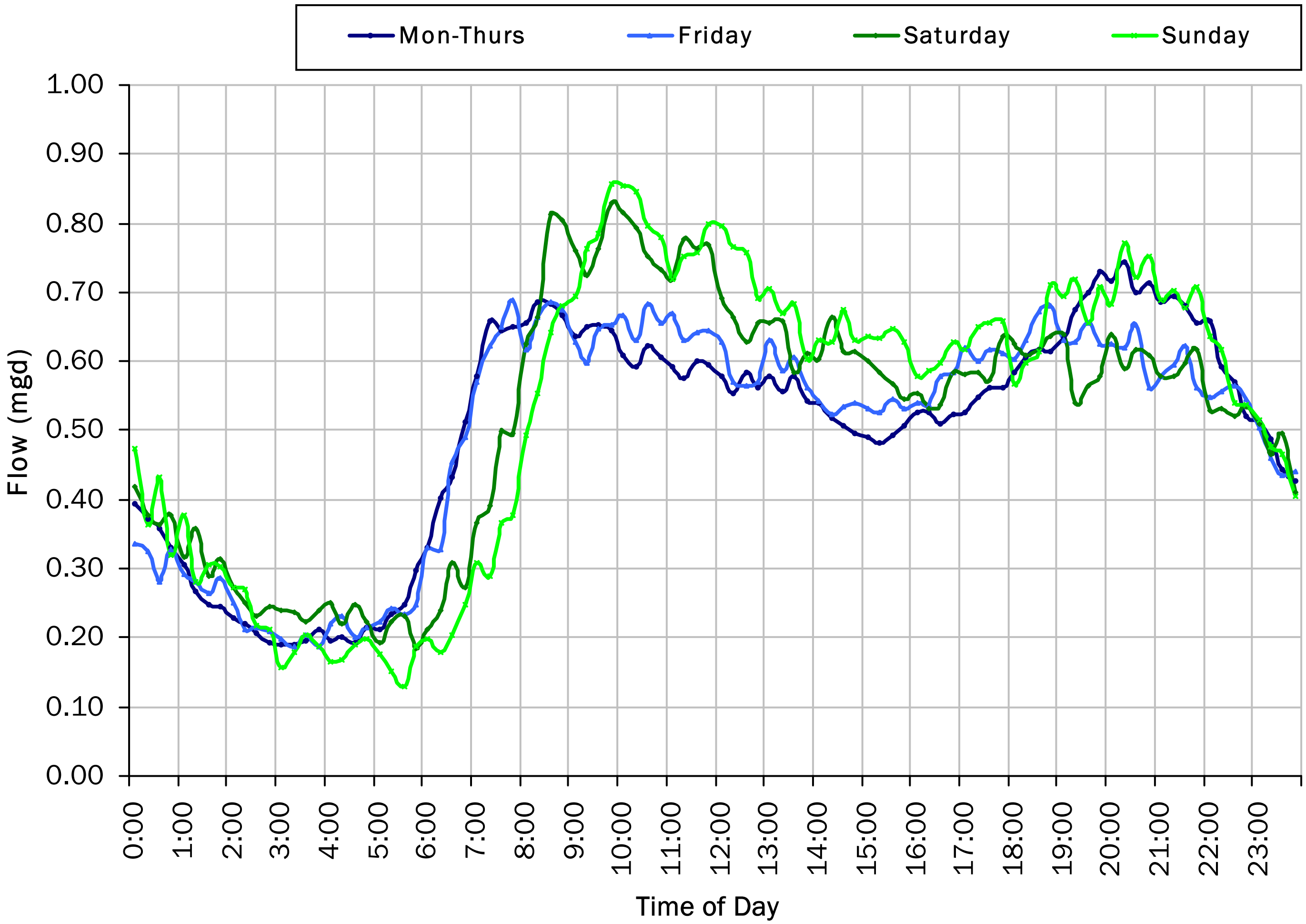
Period Rainfall: 0.00 inches

Period Avg Flow: 0.500 mgd Period Peak Flow: 0.943 mgd Period Min Flow: 0.071 mgd

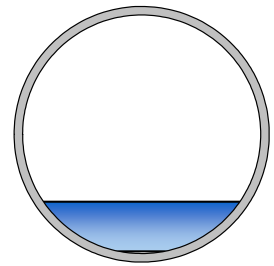




SITE 17
Average Dry Weather Flow Hydrographs



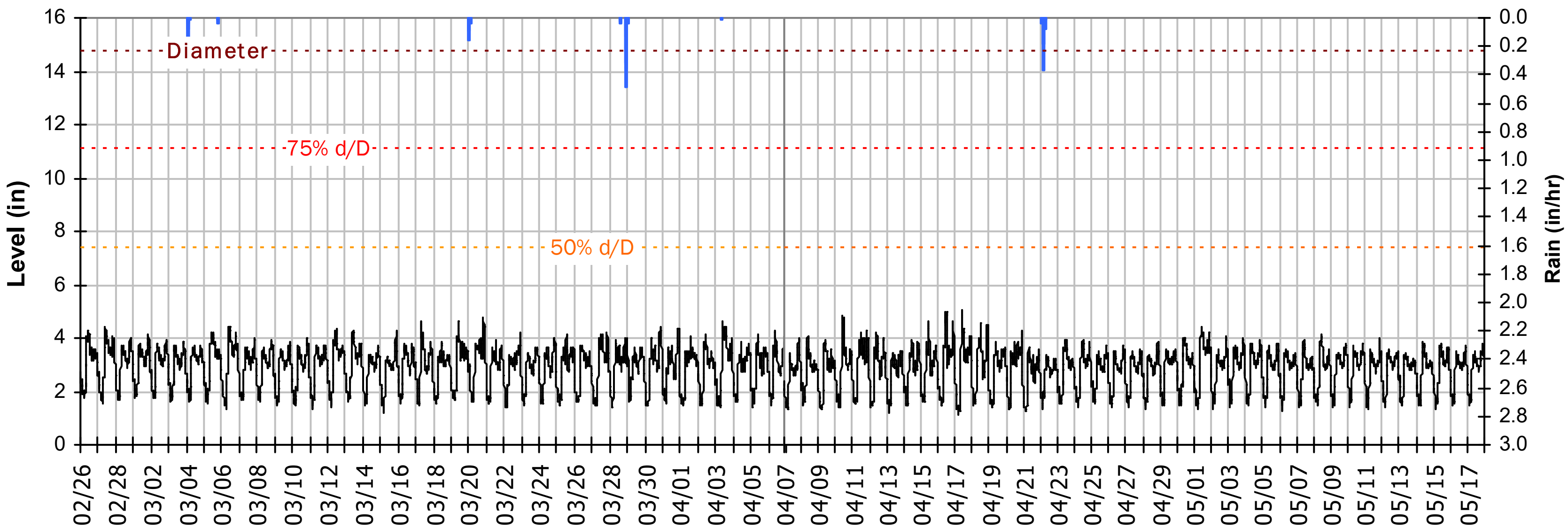
ADWF:
0.507 *mgd*

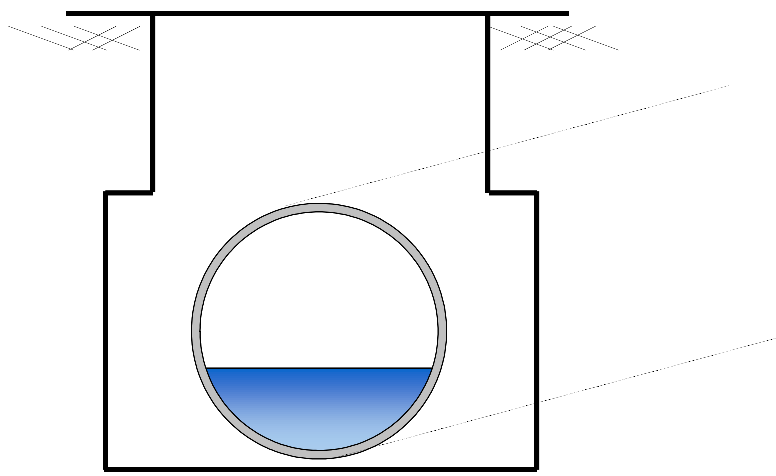


SITE 17

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



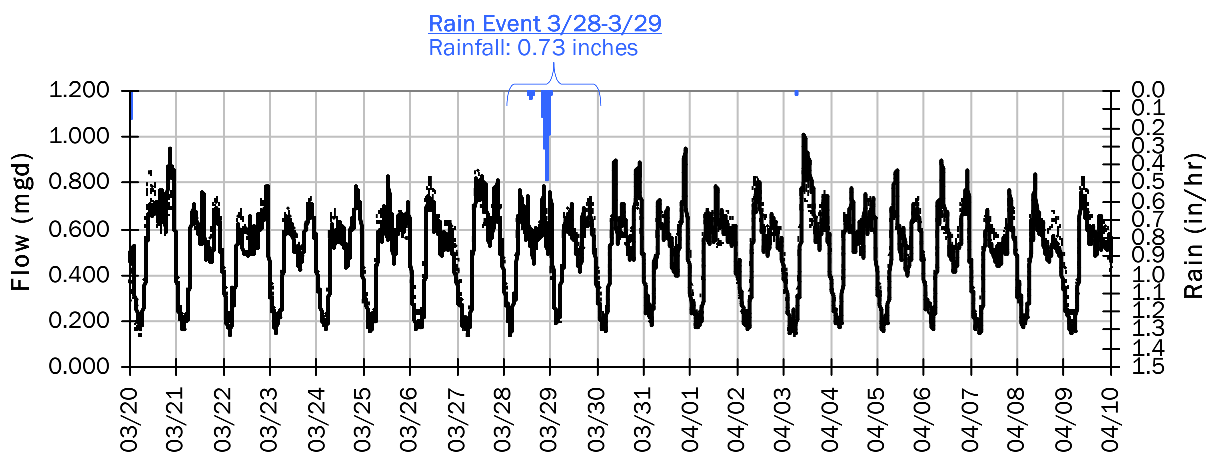


Pipe Diameter:	14.8	*inches*
Peak Measured Level:	5.03	*inches*
Peak d/D Ratio:	0.34	

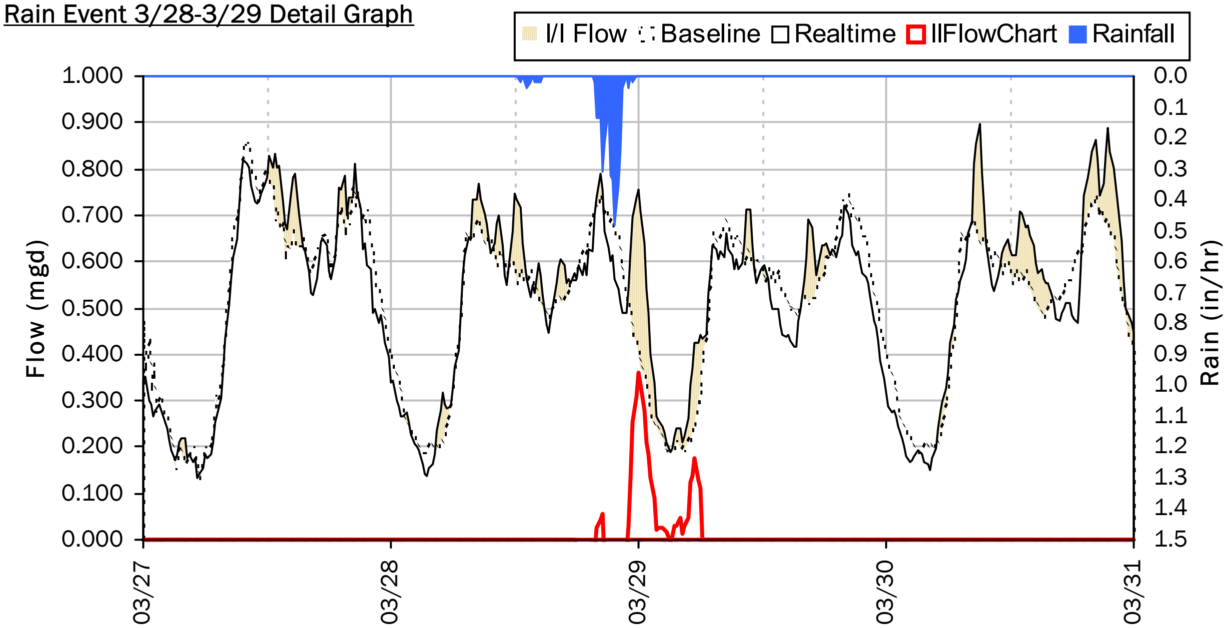
SITE 17

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



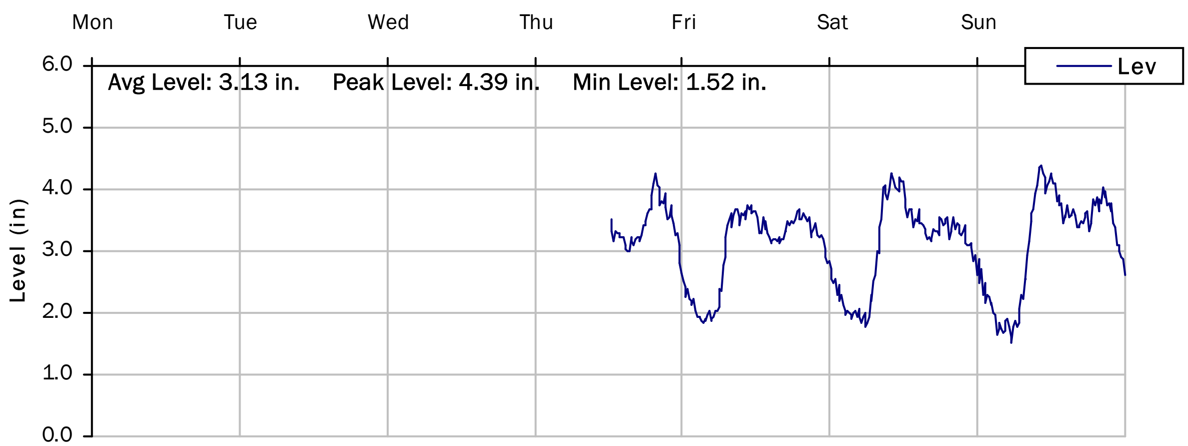
Rain Event 3/28-3/29 Detail Graph

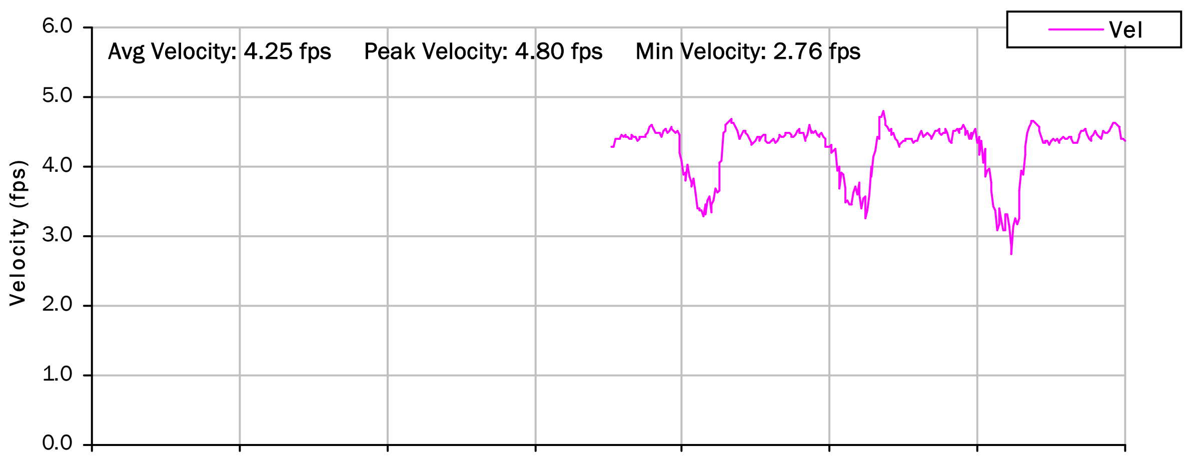


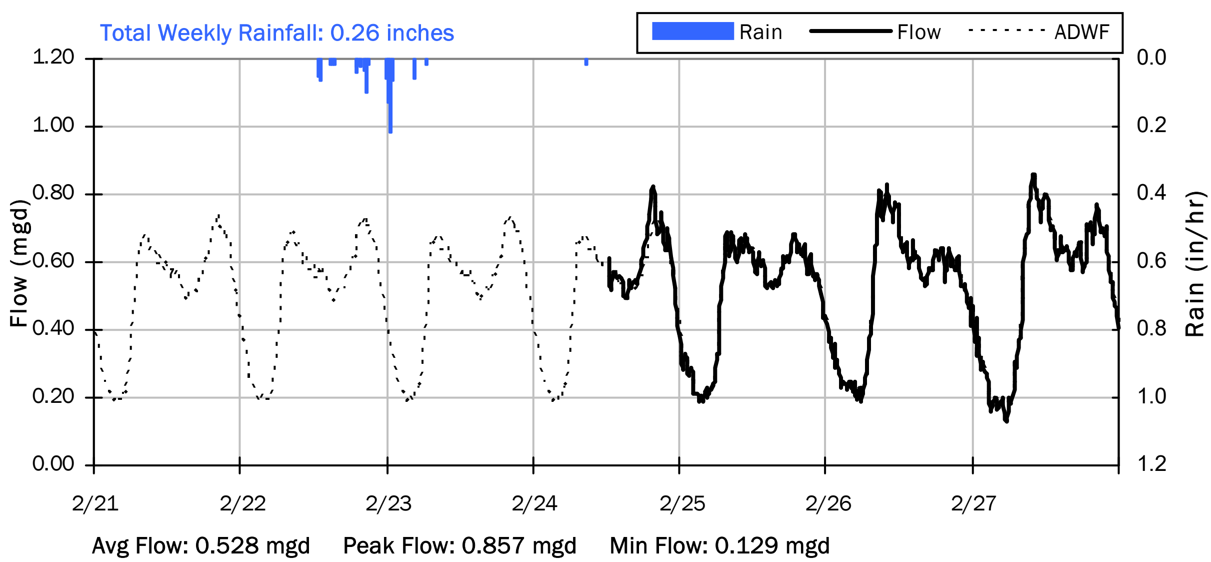
Storm Event I/I Analysis (Rain = 0.73 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.789 *mgd*	Peak I/I Rate:	0.361 *mgd*
PF:	1.56	Total I/I:	26,000 *gallons*
Peak Level:	4.02 *in*		
d/D Ratio:	0.27		

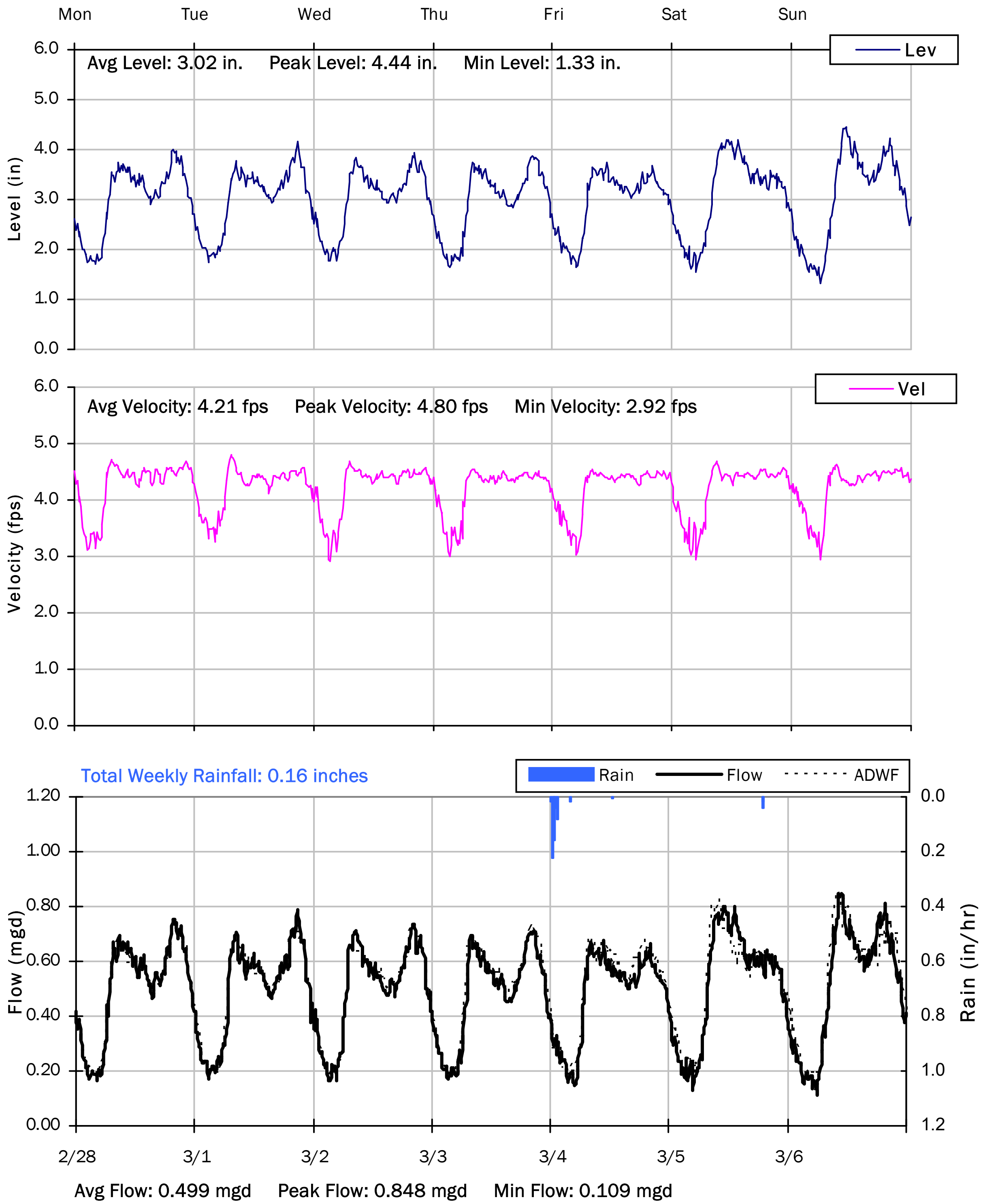
SITE 17
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022







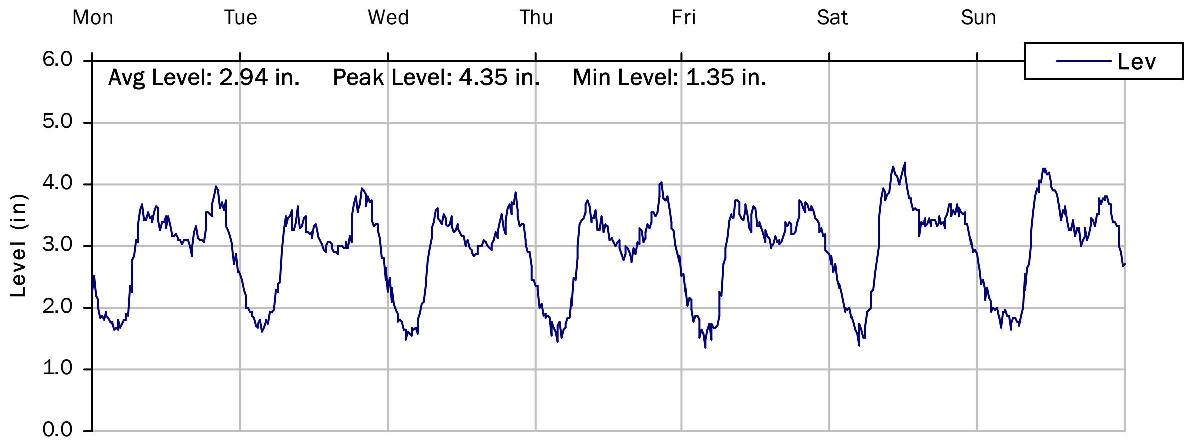
SITE 17
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

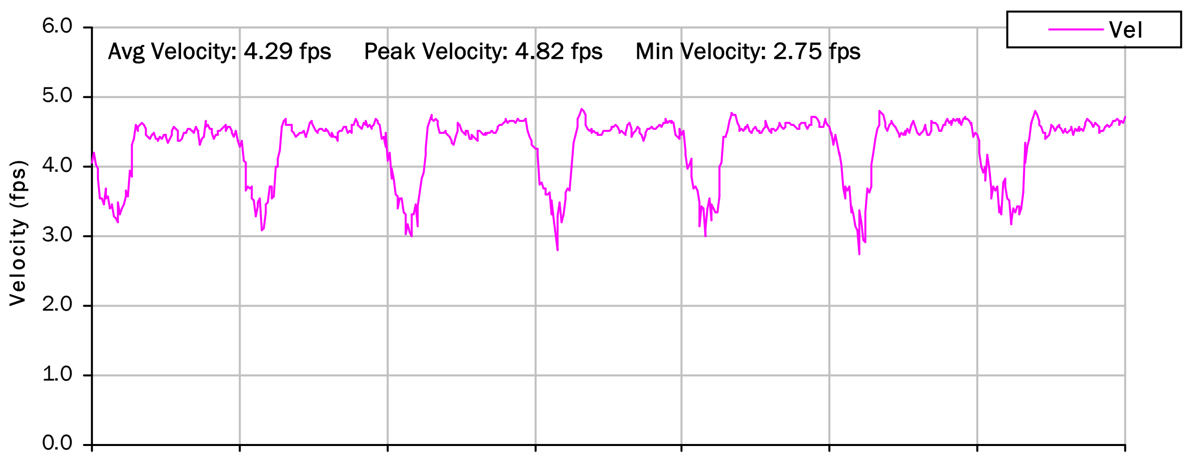


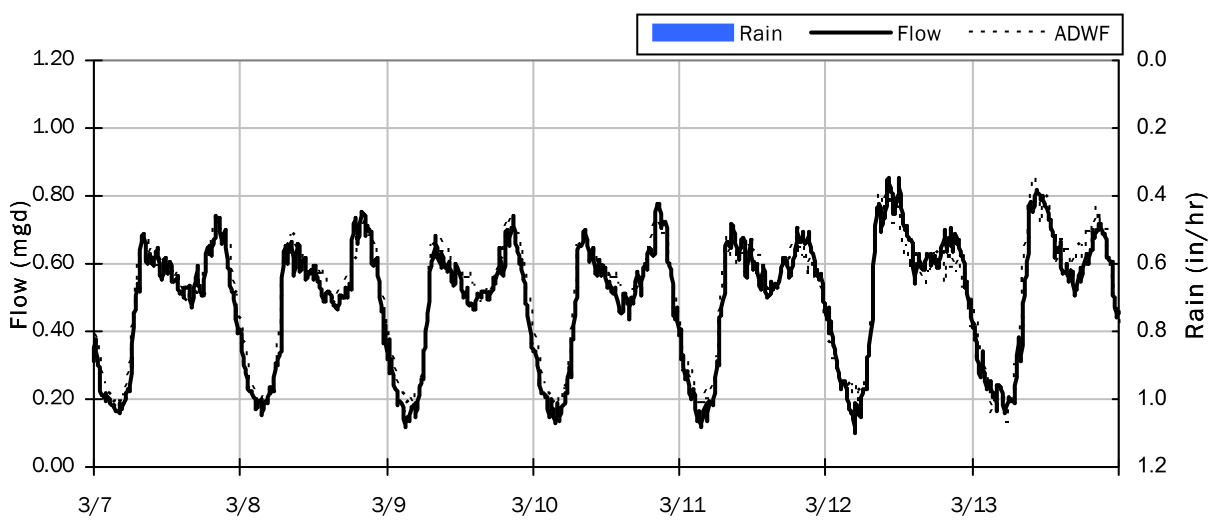
SITE 17

Weekly Level, Velocity and Flow Hydrographs

3/7/2022 to 3/14/2022

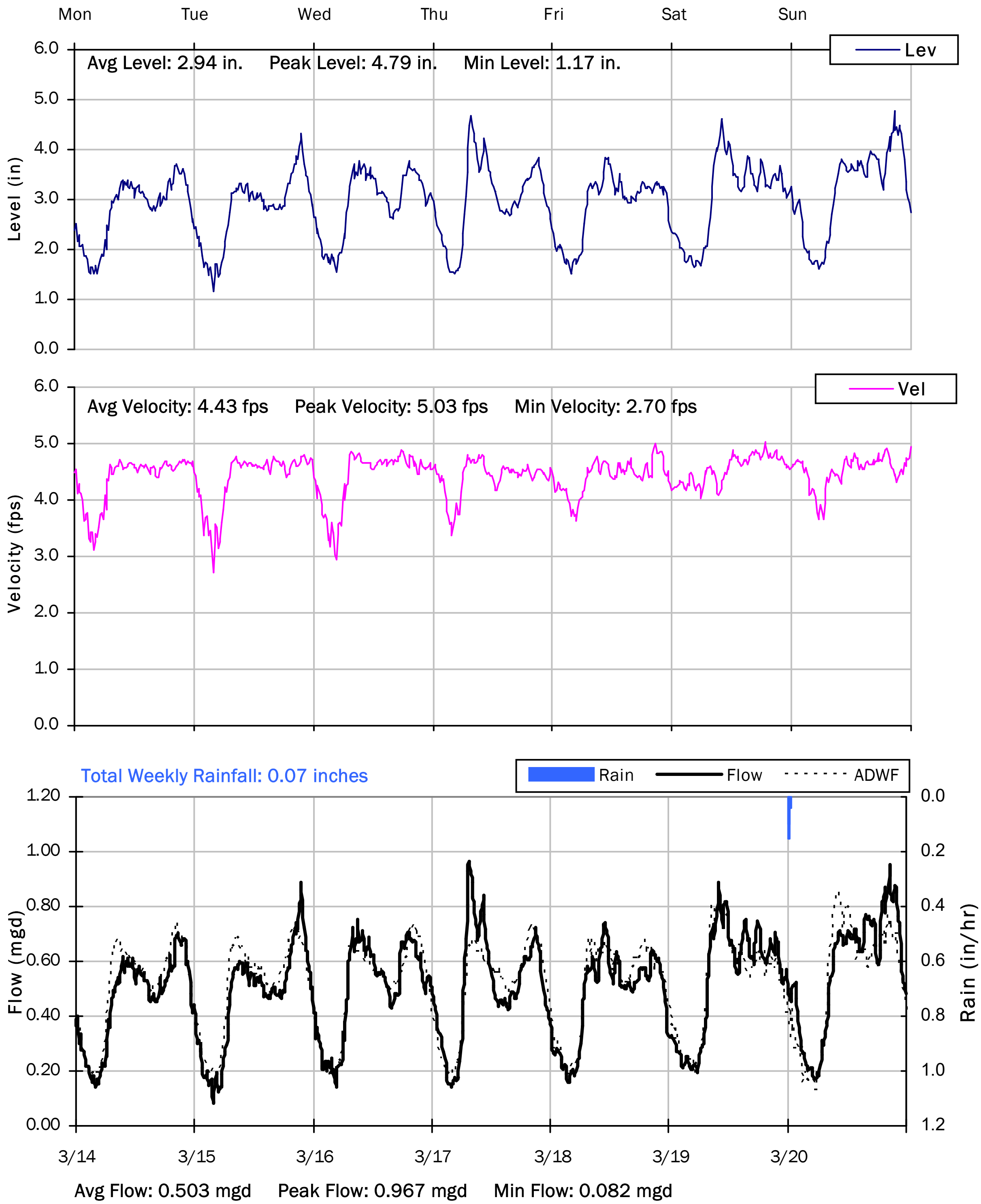




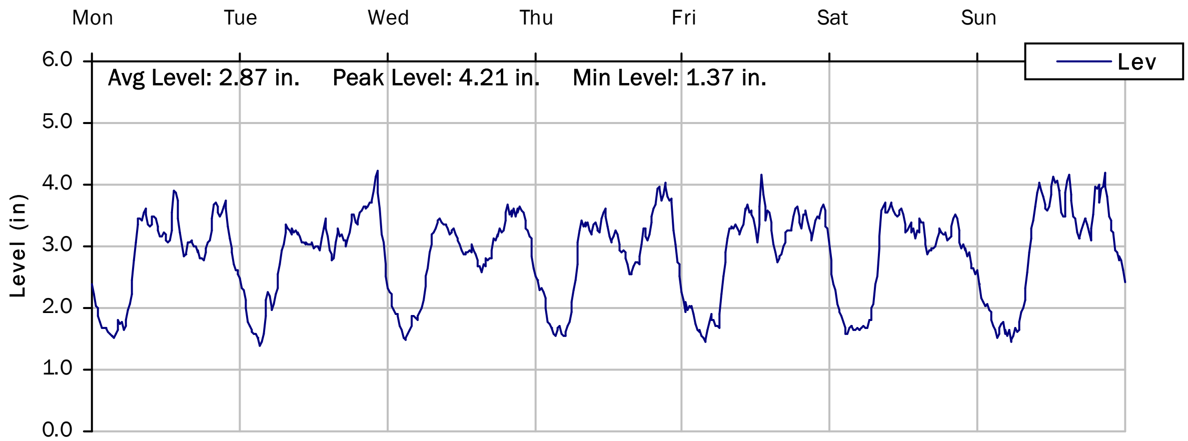


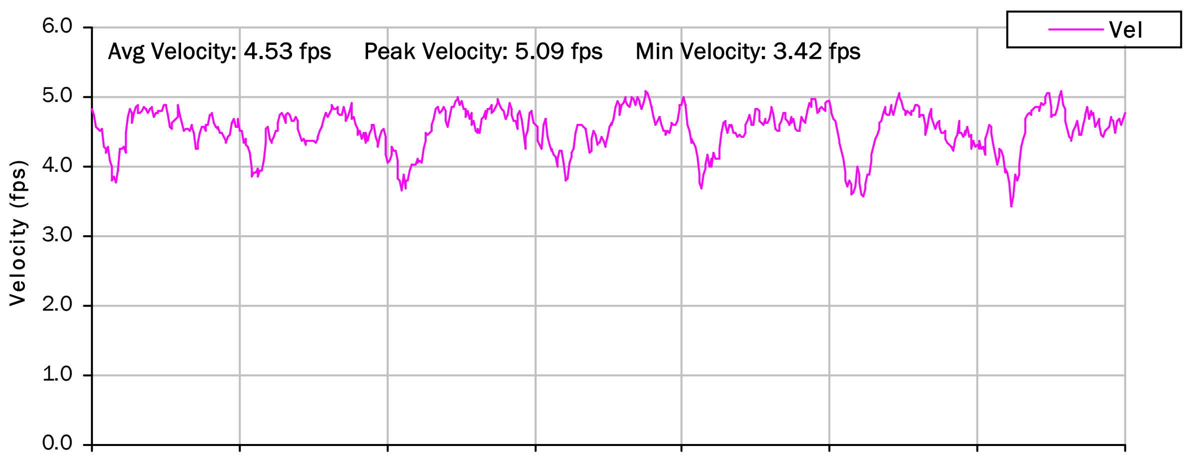
Avg Flow: 0.494 mgd   Peak Flow: 0.855 mgd   Min Flow: 0.103 mgd

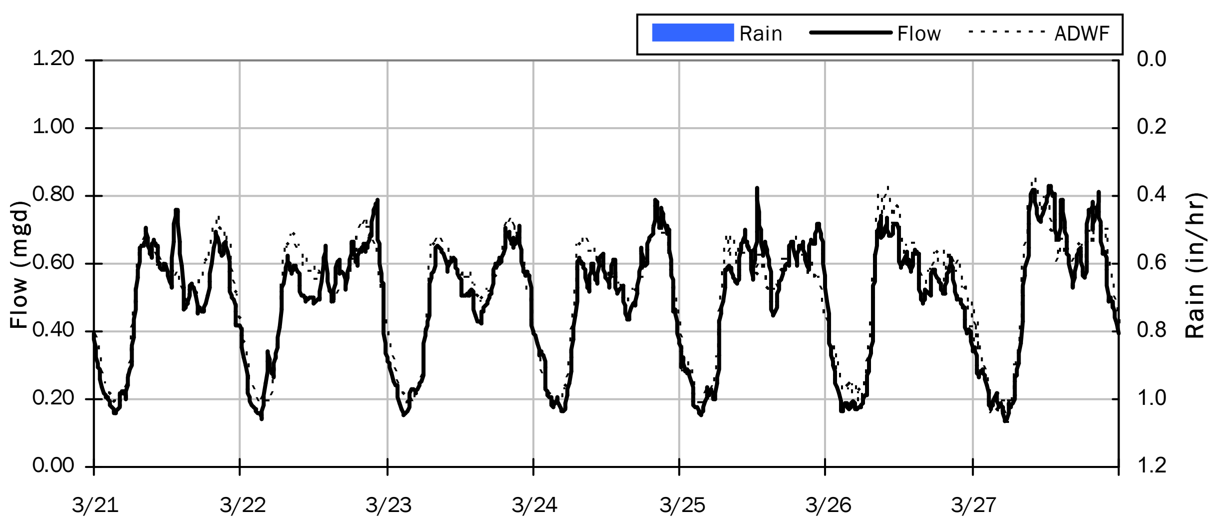
SITE 17
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



SITE 17
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

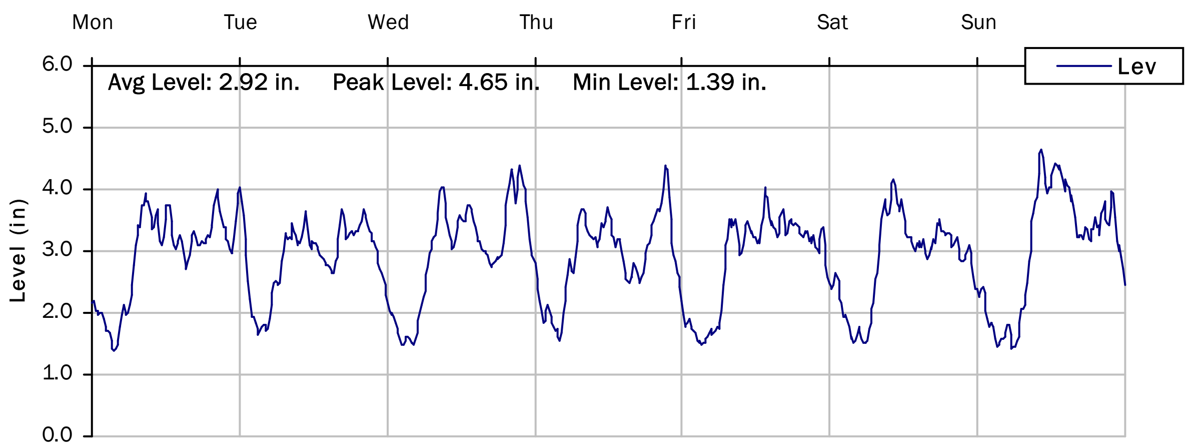


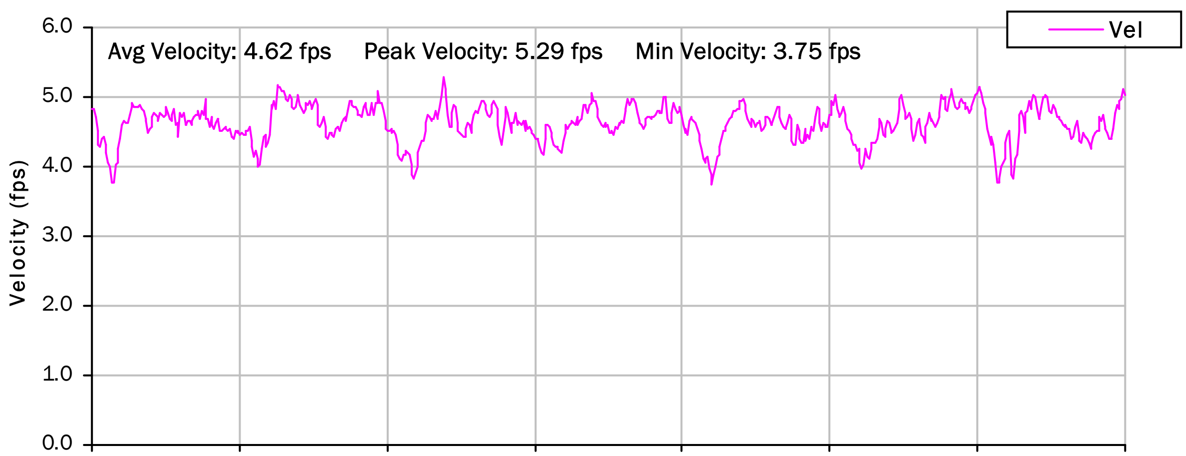


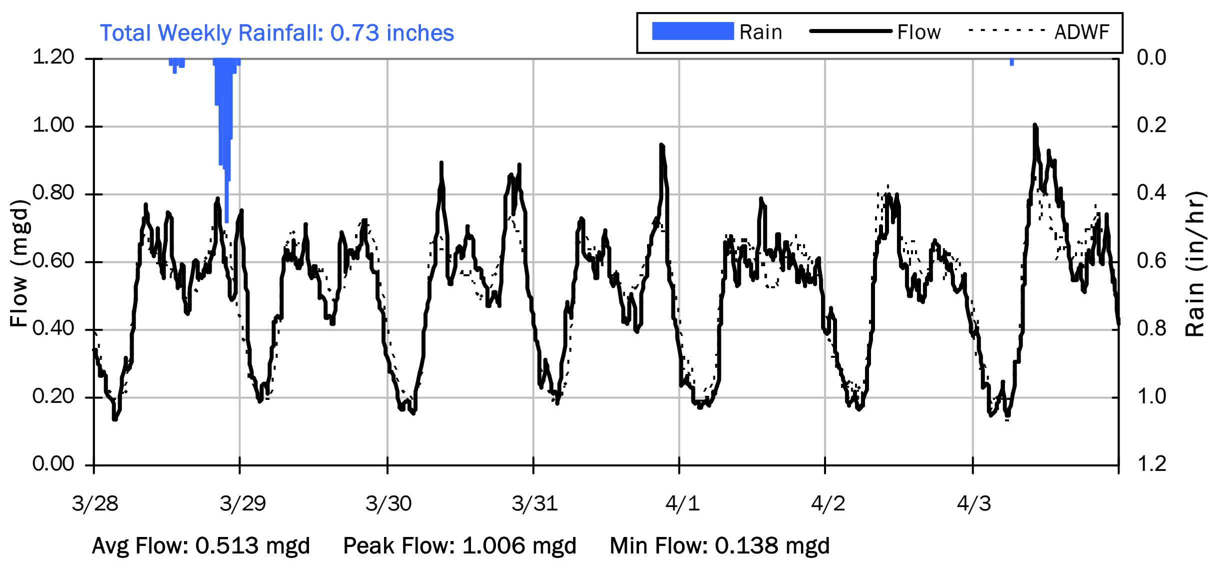


Avg Flow: 0.491 mgd Peak Flow: 0.831 mgd Min Flow: 0.134 mgd

SITE 17
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022



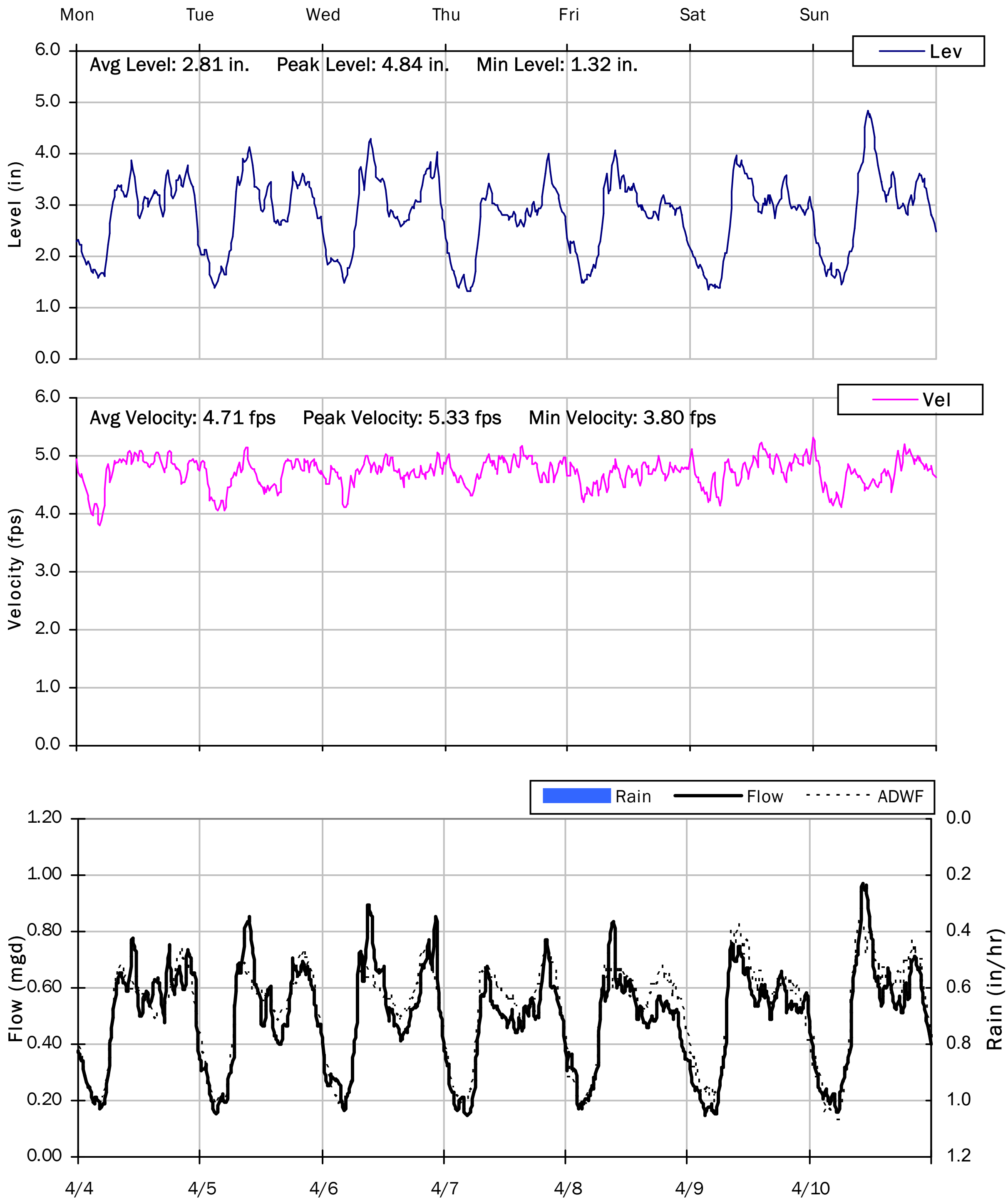




SITE 17

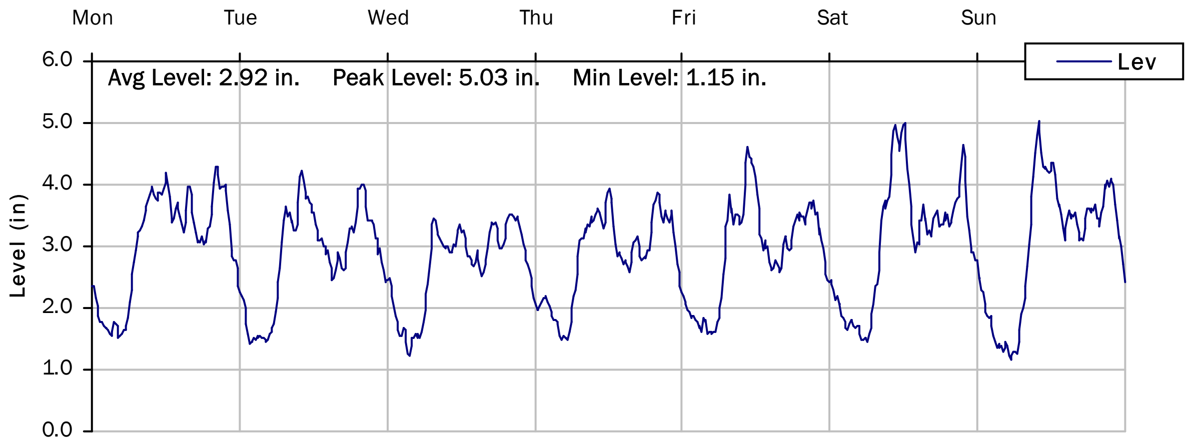
Weekly Level, Velocity and Flow Hydrographs

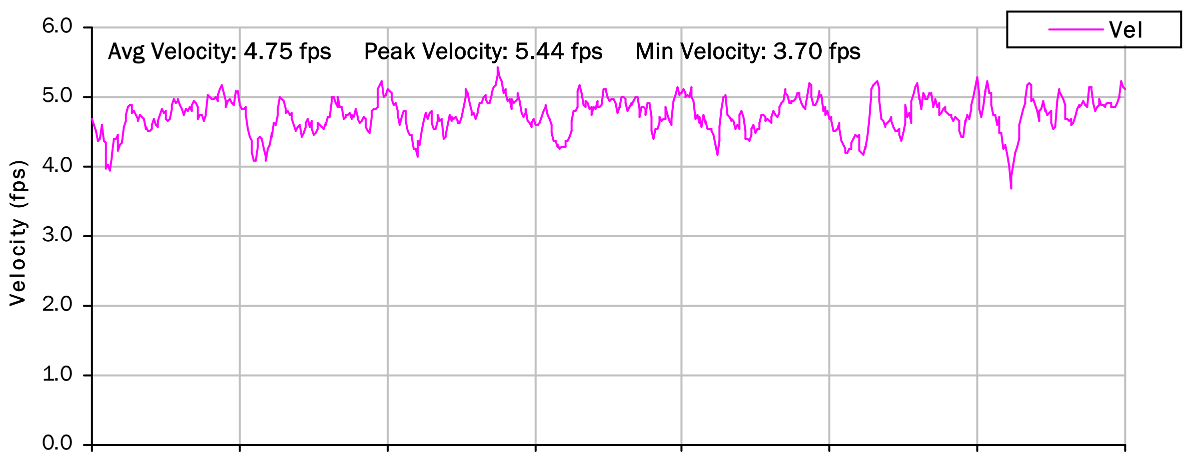
4/4/2022 to 4/11/2022

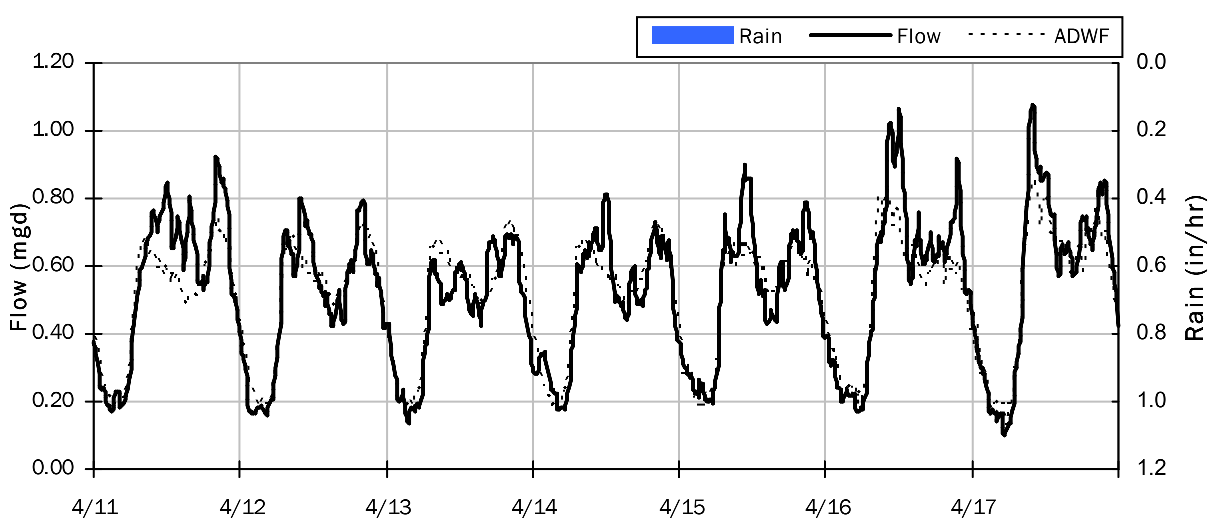


Avg Flow: 0.492 mgd   Peak Flow: 0.972 mgd   Min Flow: 0.149 mgd

SITE 17
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

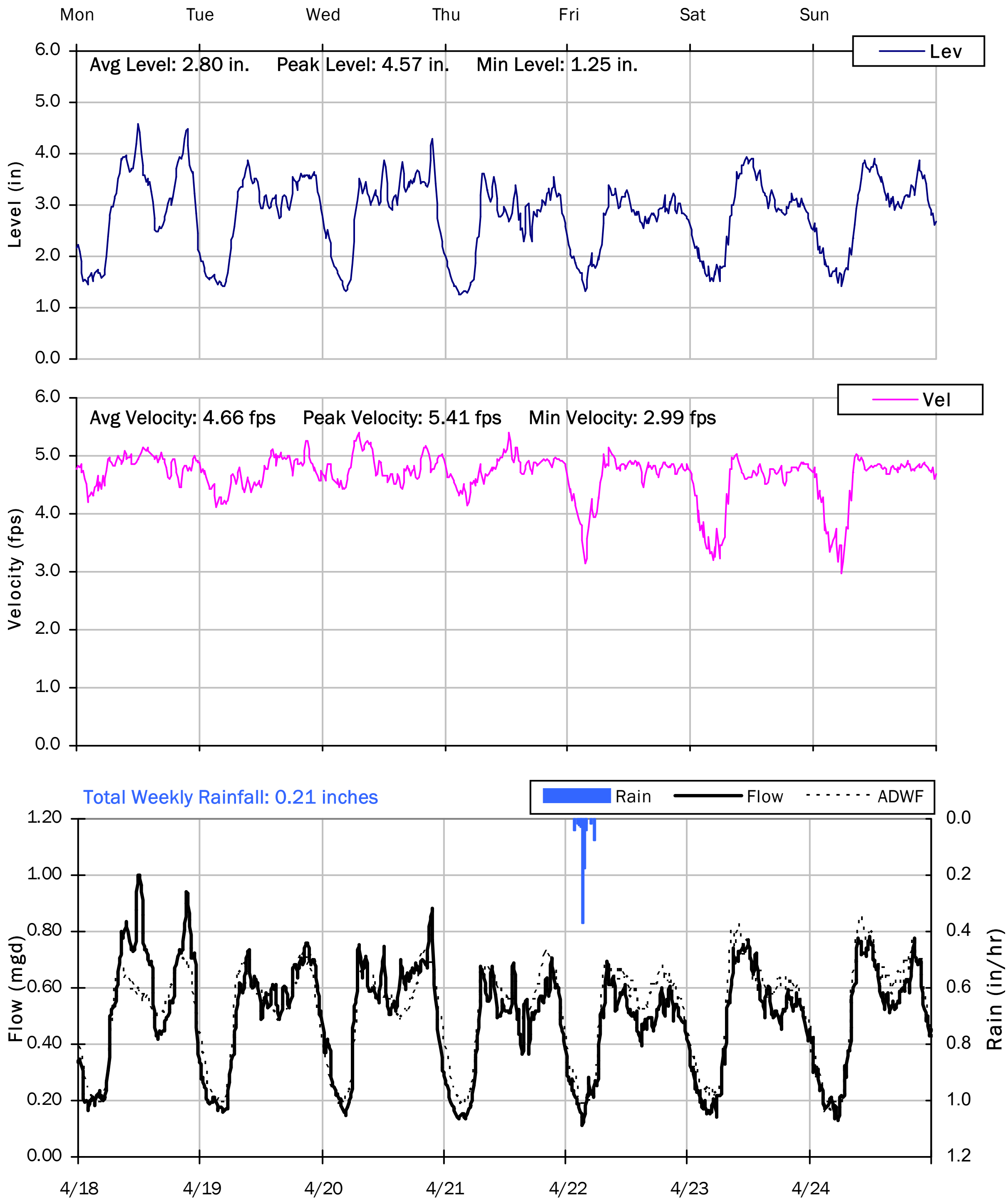






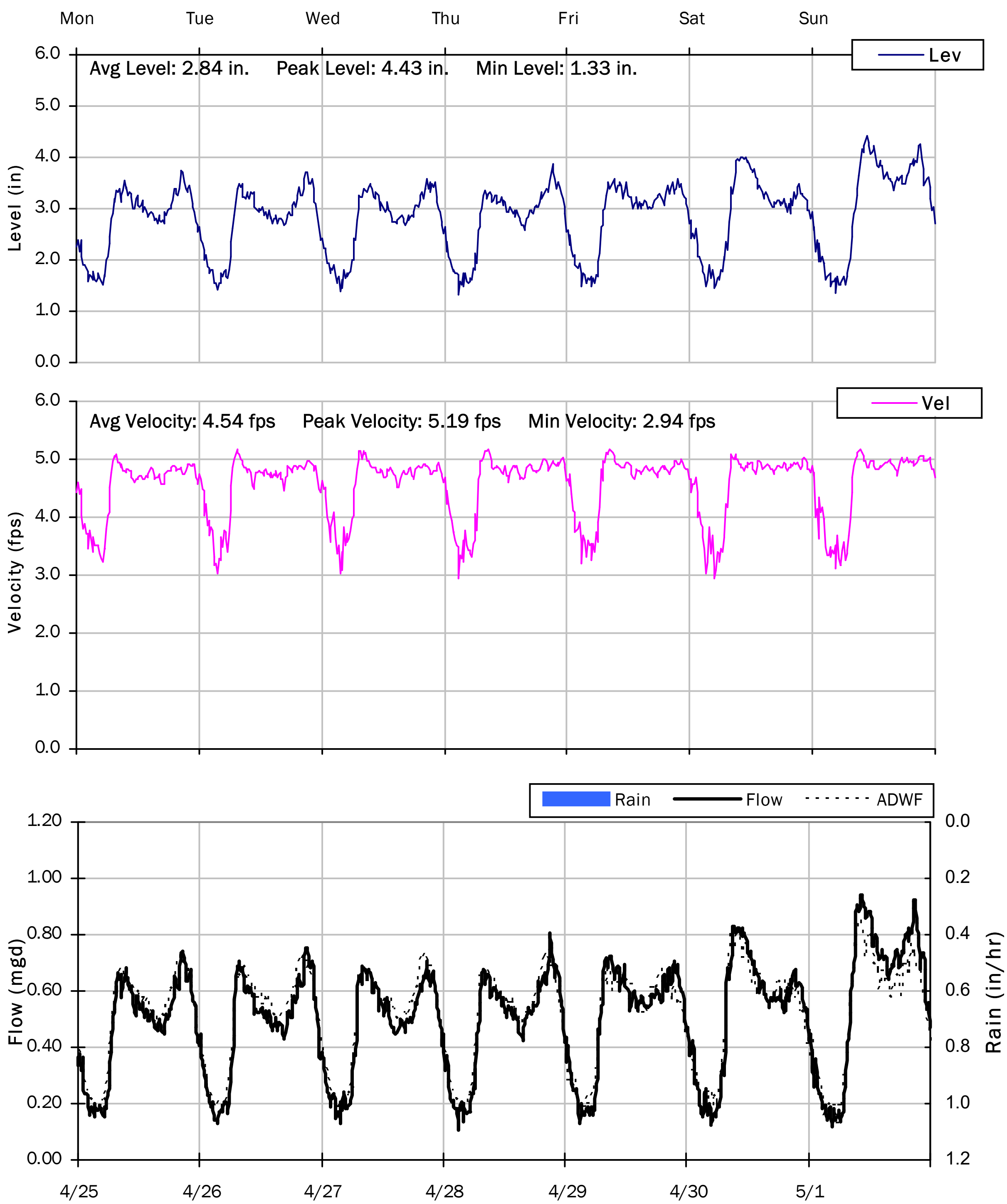
Avg Flow: 0.526 mgd Peak Flow: 1.075 mgd Min Flow: 0.103 mgd

SITE 17
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



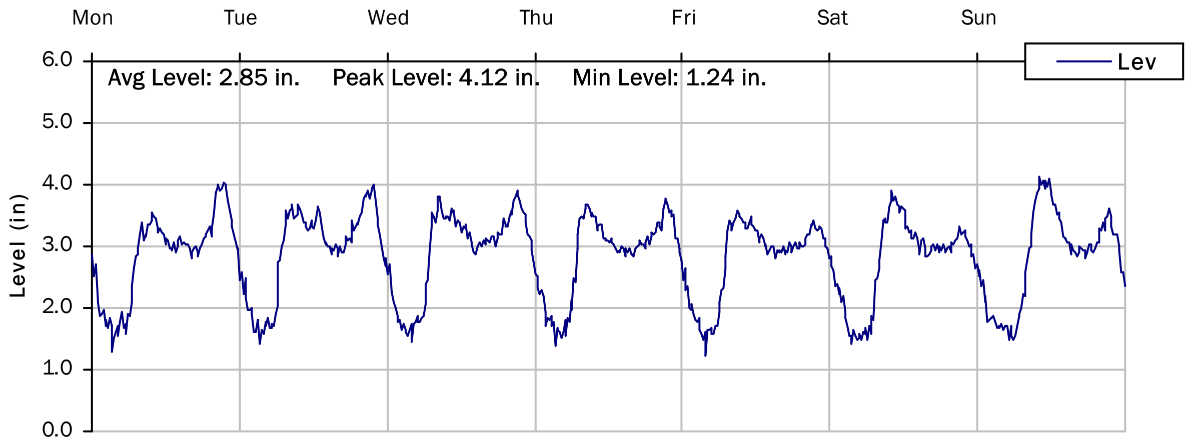
Avg Flow: 0.493 mgd Peak Flow: 1.001 mgd Min Flow: 0.109 mgd

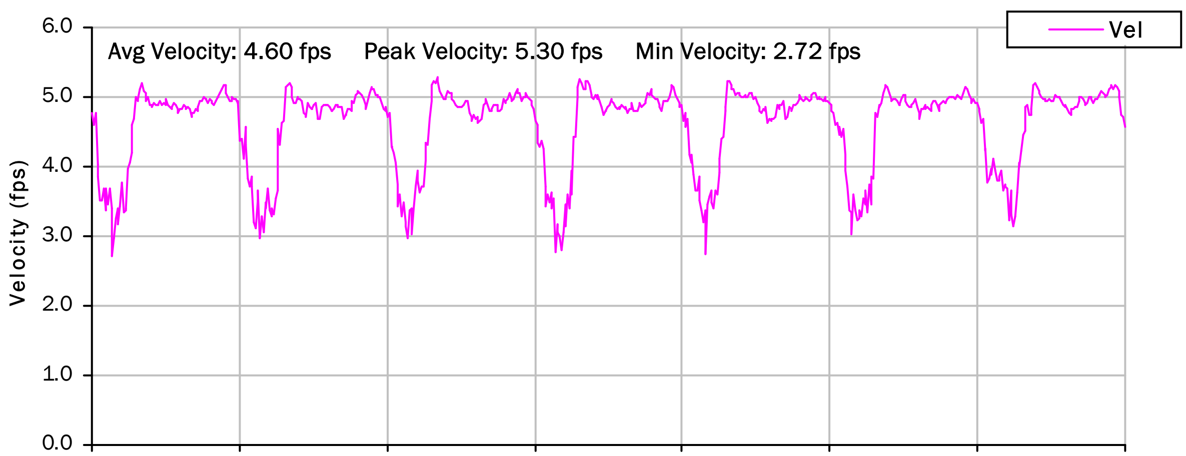
SITE 17
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

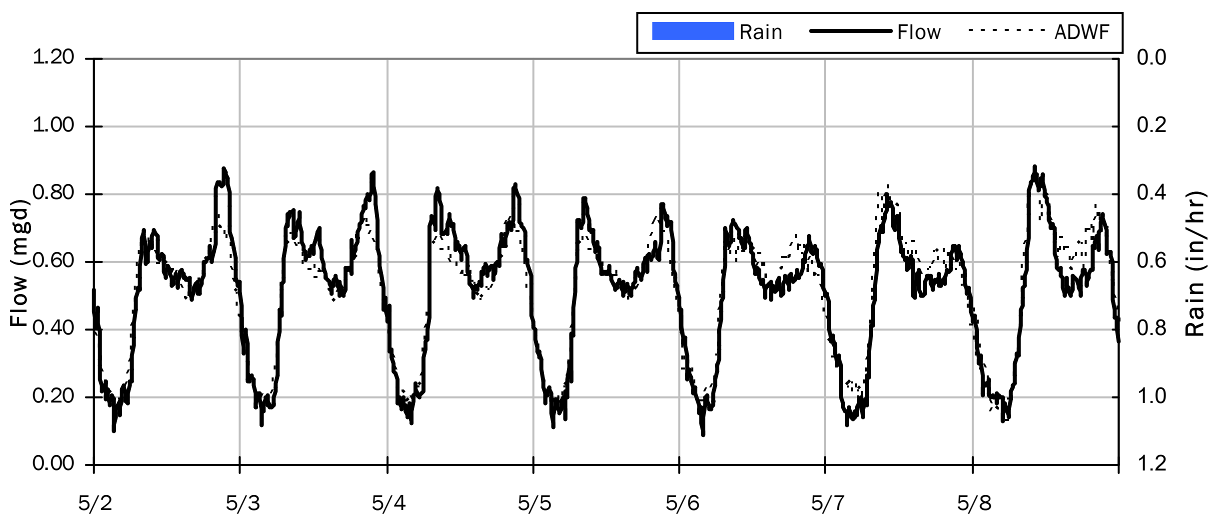


Avg Flow: 0.501 mgd Peak Flow: 0.943 mgd Min Flow: 0.107 mgd

SITE 17
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022





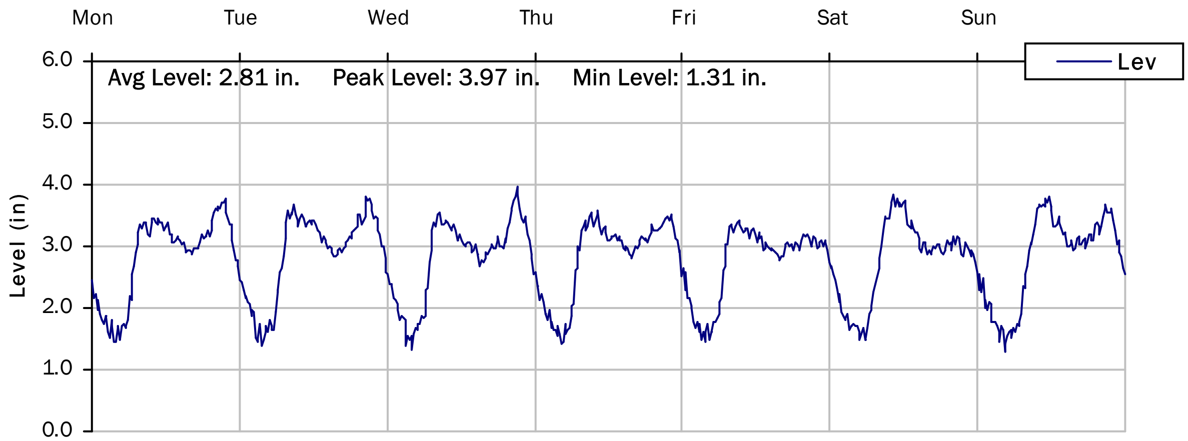


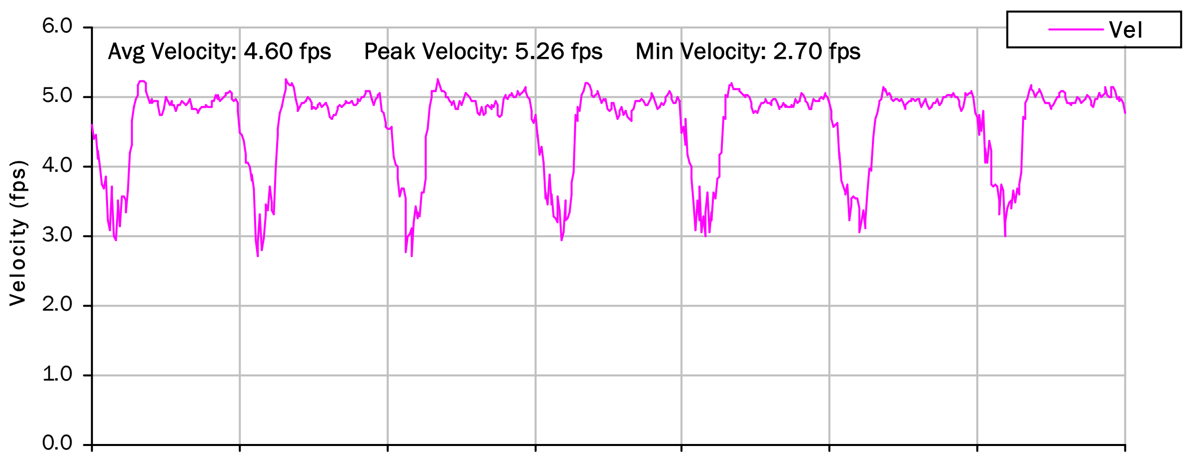
Avg Flow: 0.511 mgd   Peak Flow: 0.884 mgd   Min Flow: 0.087 mgd

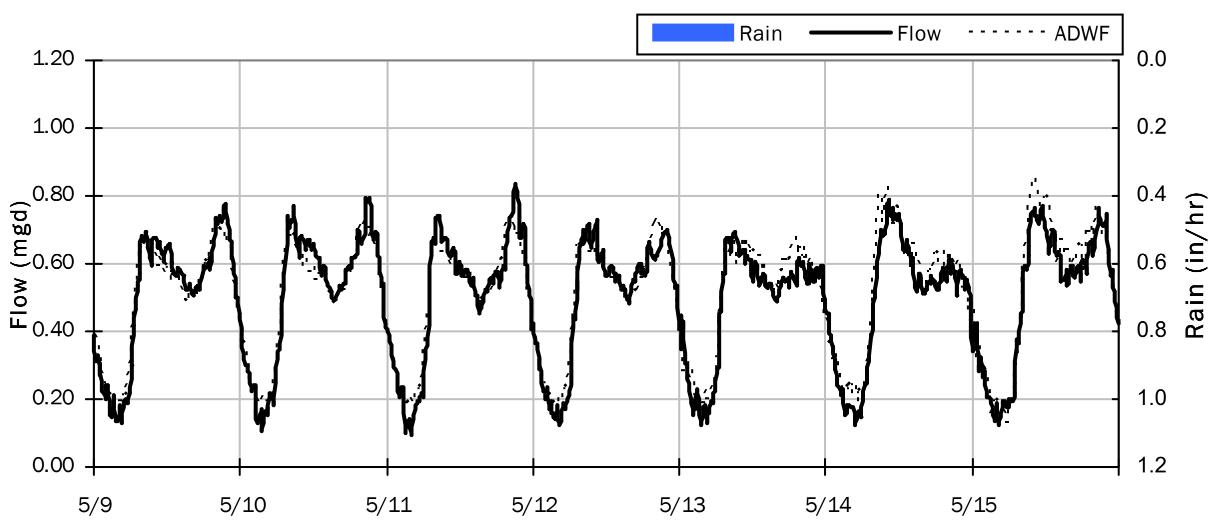
SITE 17

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022





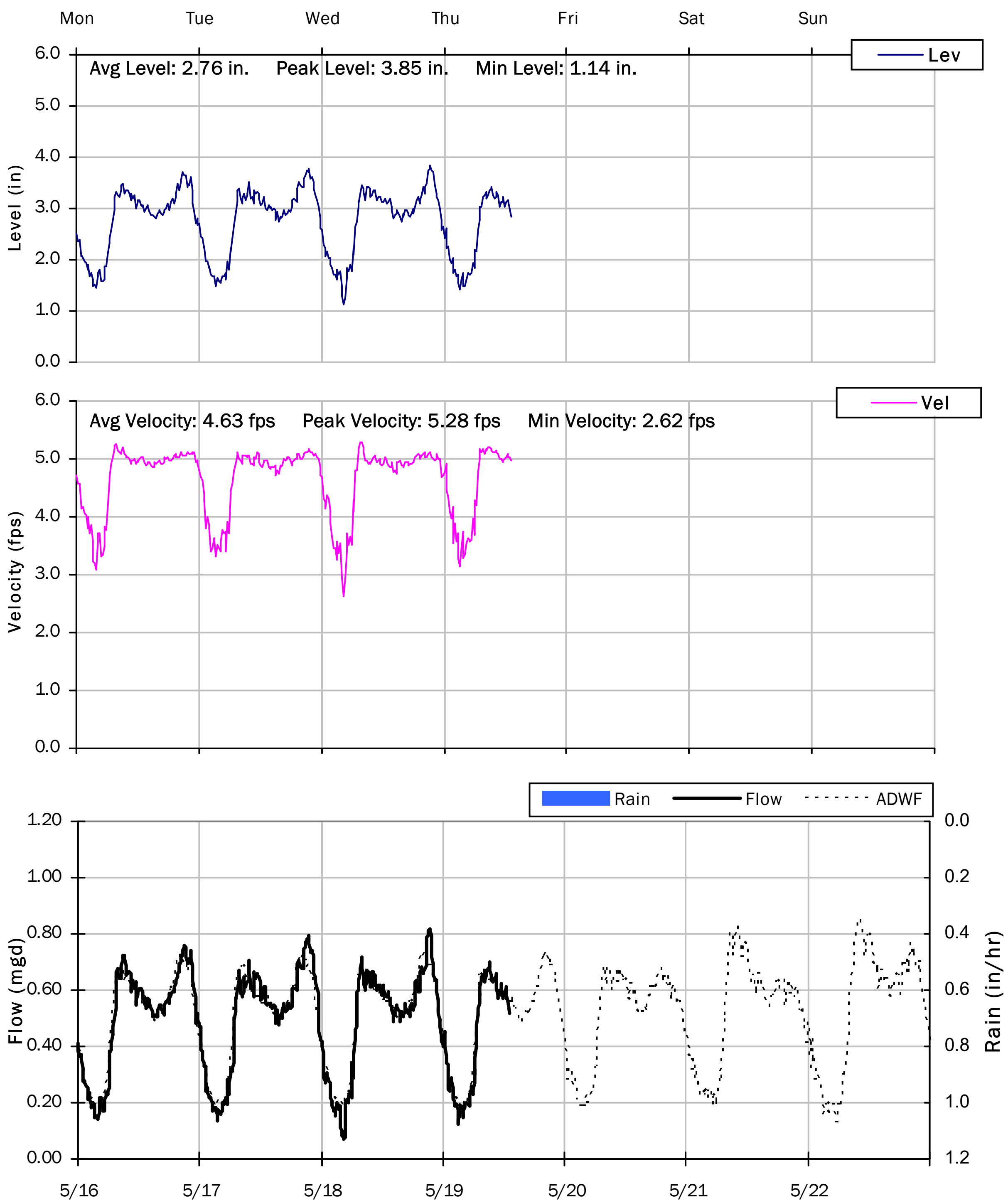


Avg Flow: 0.499 mgd   Peak Flow: 0.837 mgd   Min Flow: 0.094 mgd

SITE 17

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022



Avg Flow: 0.490 mgd Peak Flow: 0.815 mgd Min Flow: 0.071 mgd

Monitoring Site: Site 18

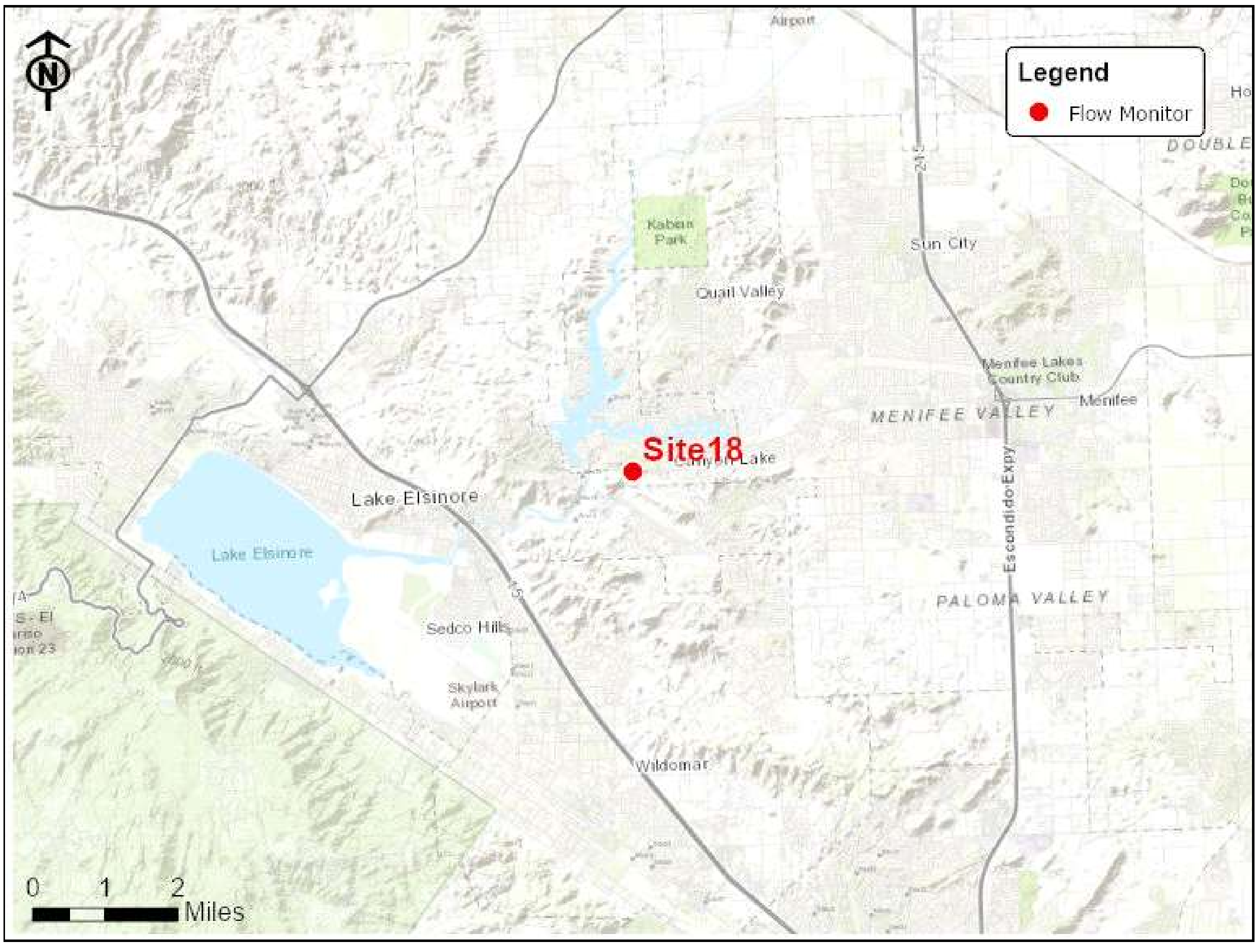
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Canyon Lake Country Club

Data Summary Report



Vicinity Map: Site 18

SITE 18

Site Information MH ID: MH-2590

Location: Canyon Lake Country Club

Coordinates: 117.2604° W, 33.6734° N

Rim Elevation (Earth): 1420 feet

Expected Pipe Diameter: 15 inches

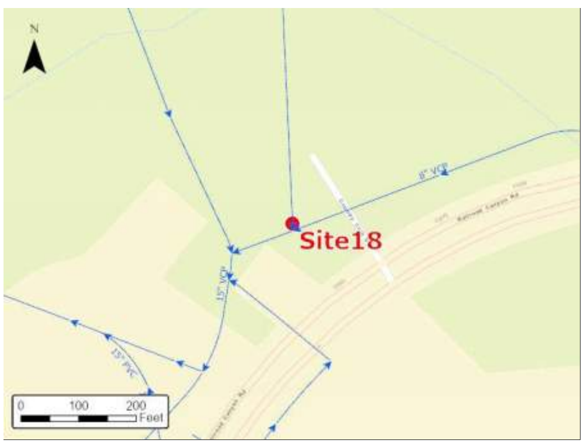
Measured Pipe Diameter: 15 inches

ADWF: 0.275 mgd

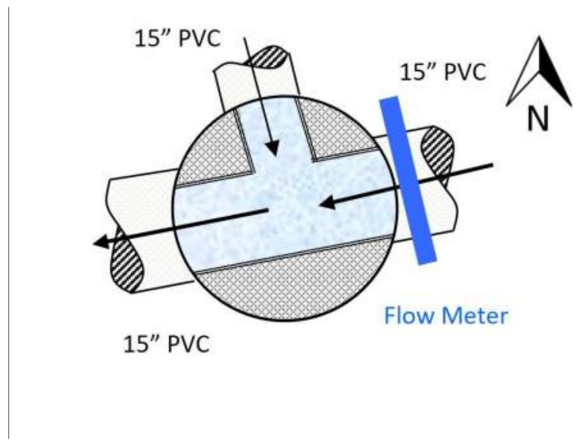
Peak Measured Flow: 0.623 mgd

Sediment: None

Satellite Map



Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 18

Additional Site Photos

Effluent Pipe

N Influent Pipe

SITE 18

Additional Site Photos

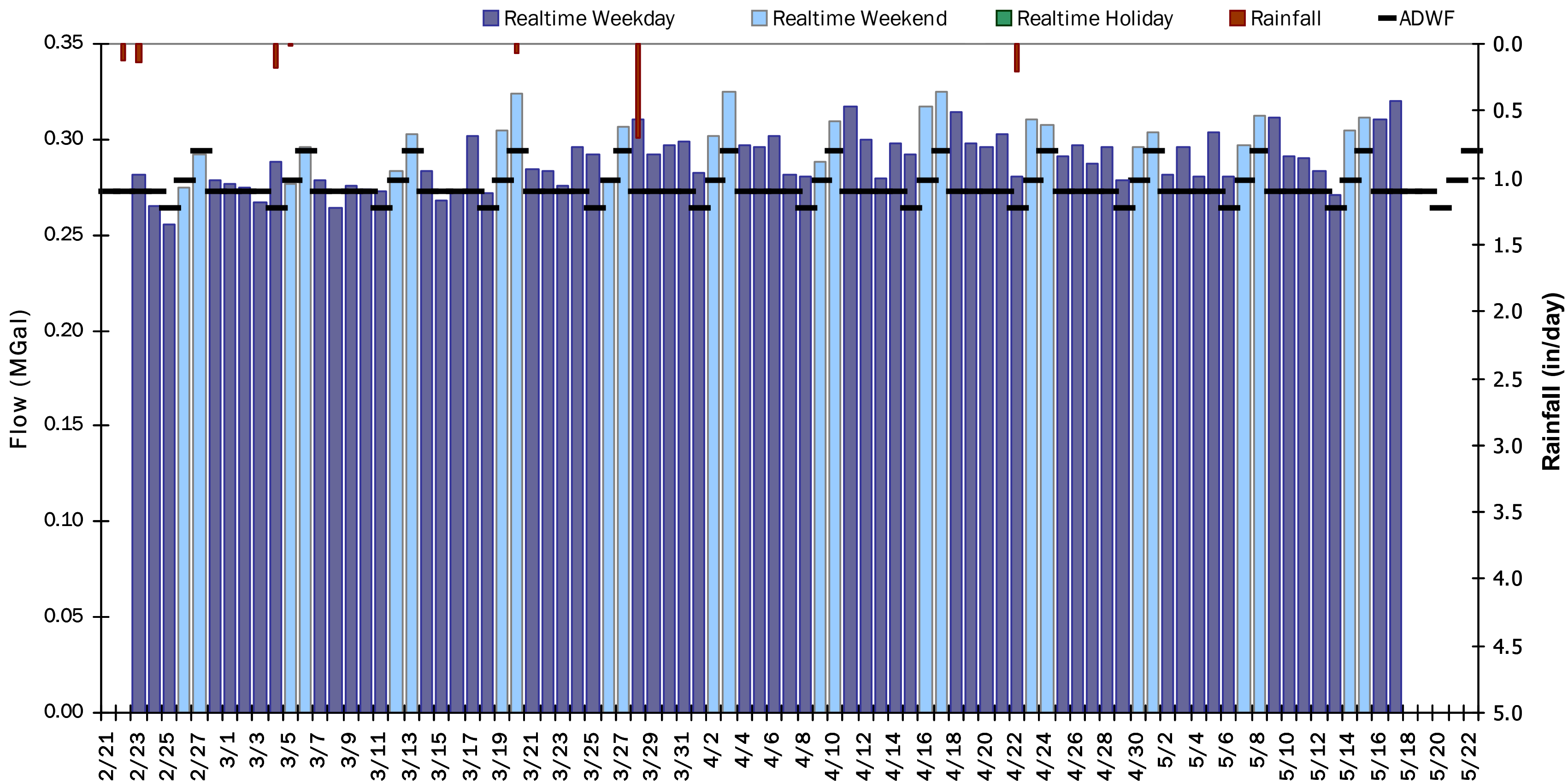
E Influent Pipe

SITE 18

Period Flow Summary: Daily Flow Totals

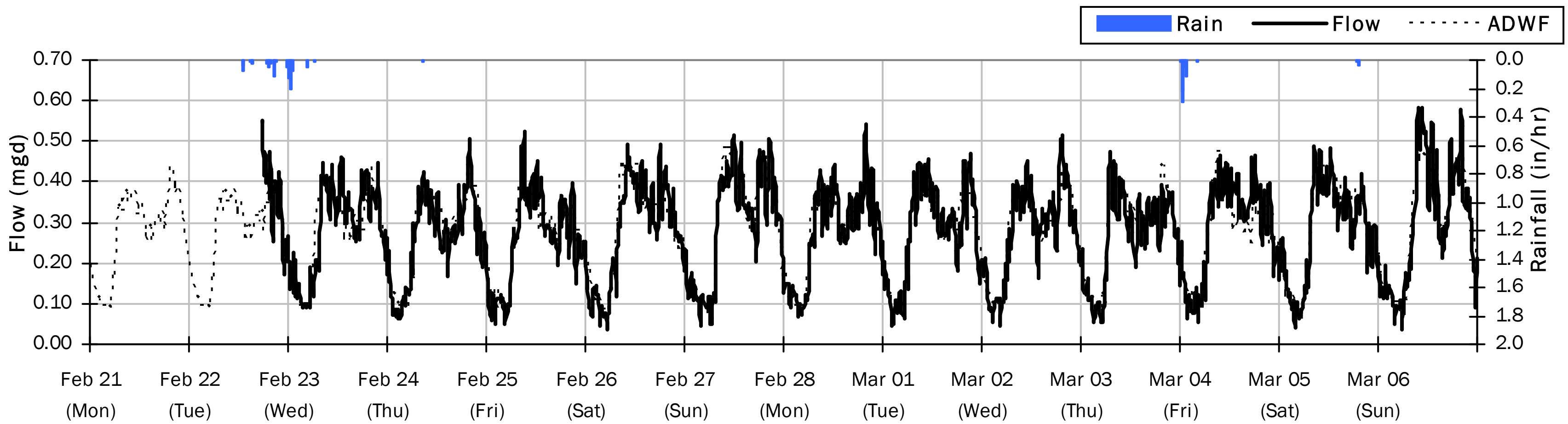
Avg Daily Flow: 0.292 MGal Peak Daily Flow: 0.365 MGal Min Daily Flow: 0.231 MGal

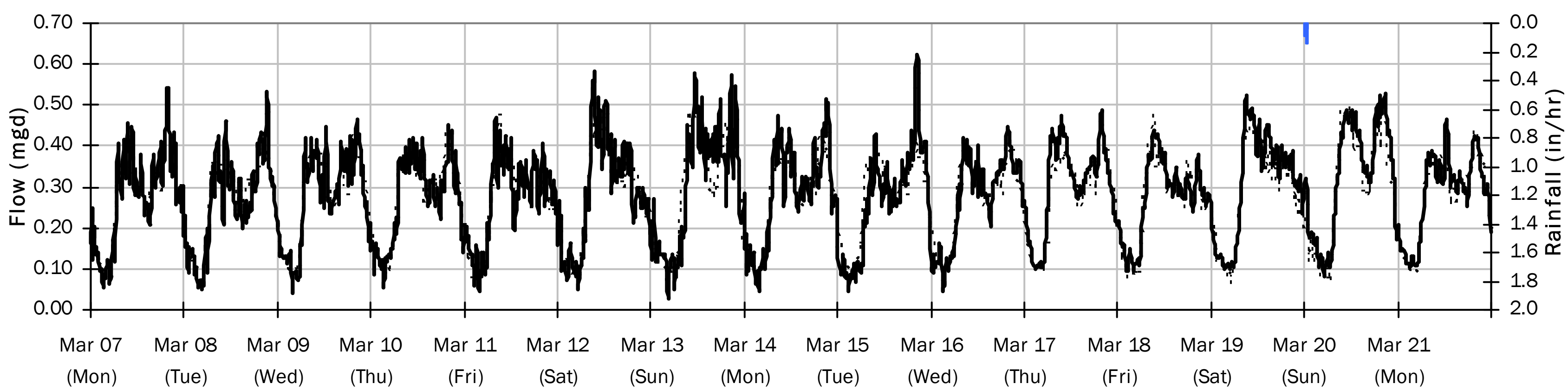
Total Rainfall: 1.41 inches



SITE 18
Flow Summary: 2/21/2022 to 3/21/2022

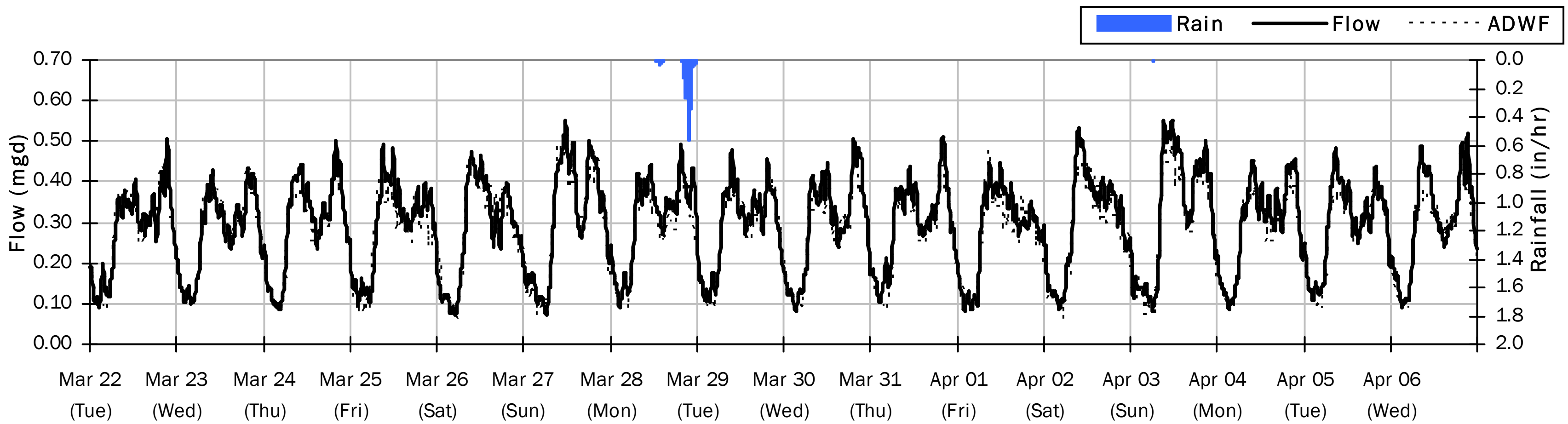
Period Rainfall: 0.54 inches Period Avg Flow: 0.282 mgd Period Peak Flow: 0.623 mgd Period Min Flow: 0.029 mgd

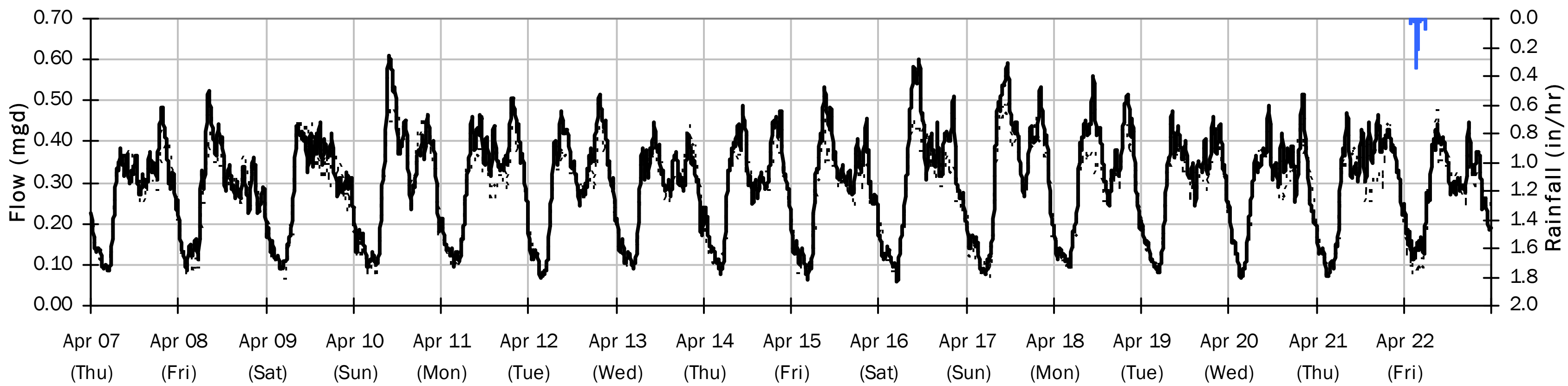




SITE 18
Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.92 inches   Period Avg Flow: 0.297 mgd   Period Peak Flow: 0.608 mgd   Period Min Flow: 0.060 mgd

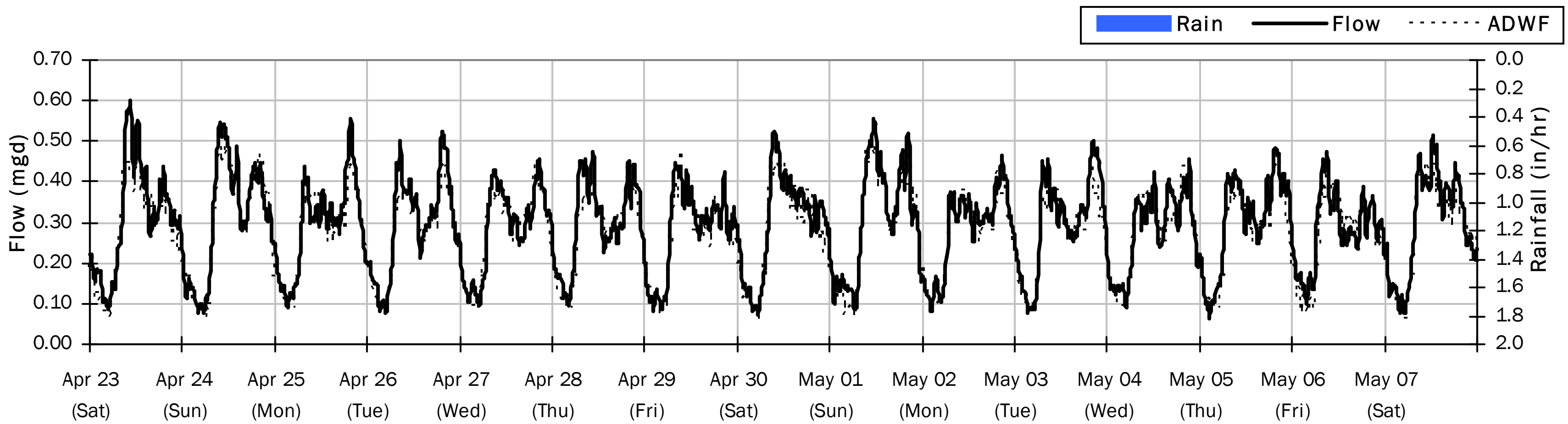


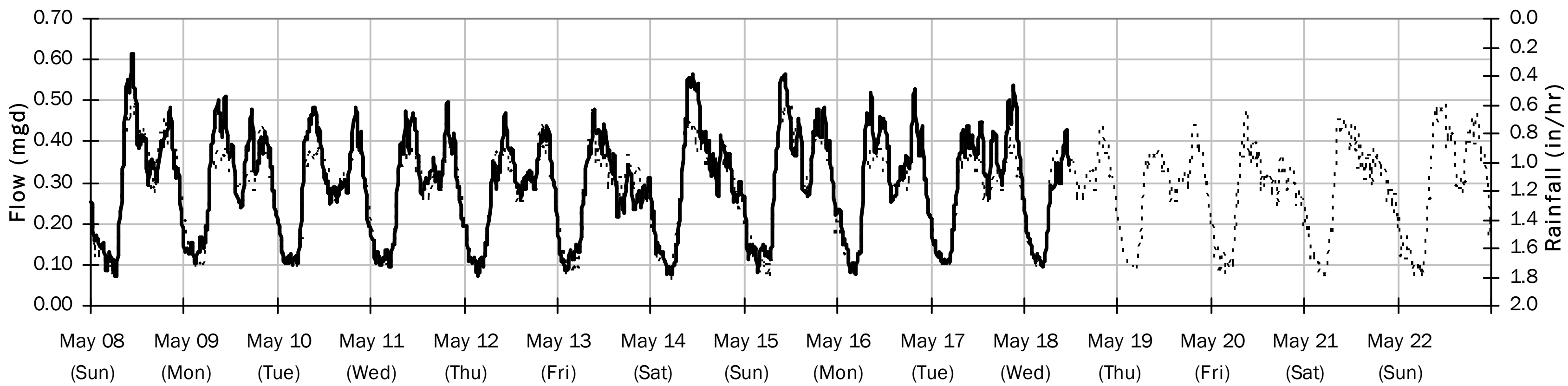


SITE 18

Flow Summary: 4/23/2022 to 5/22/2022

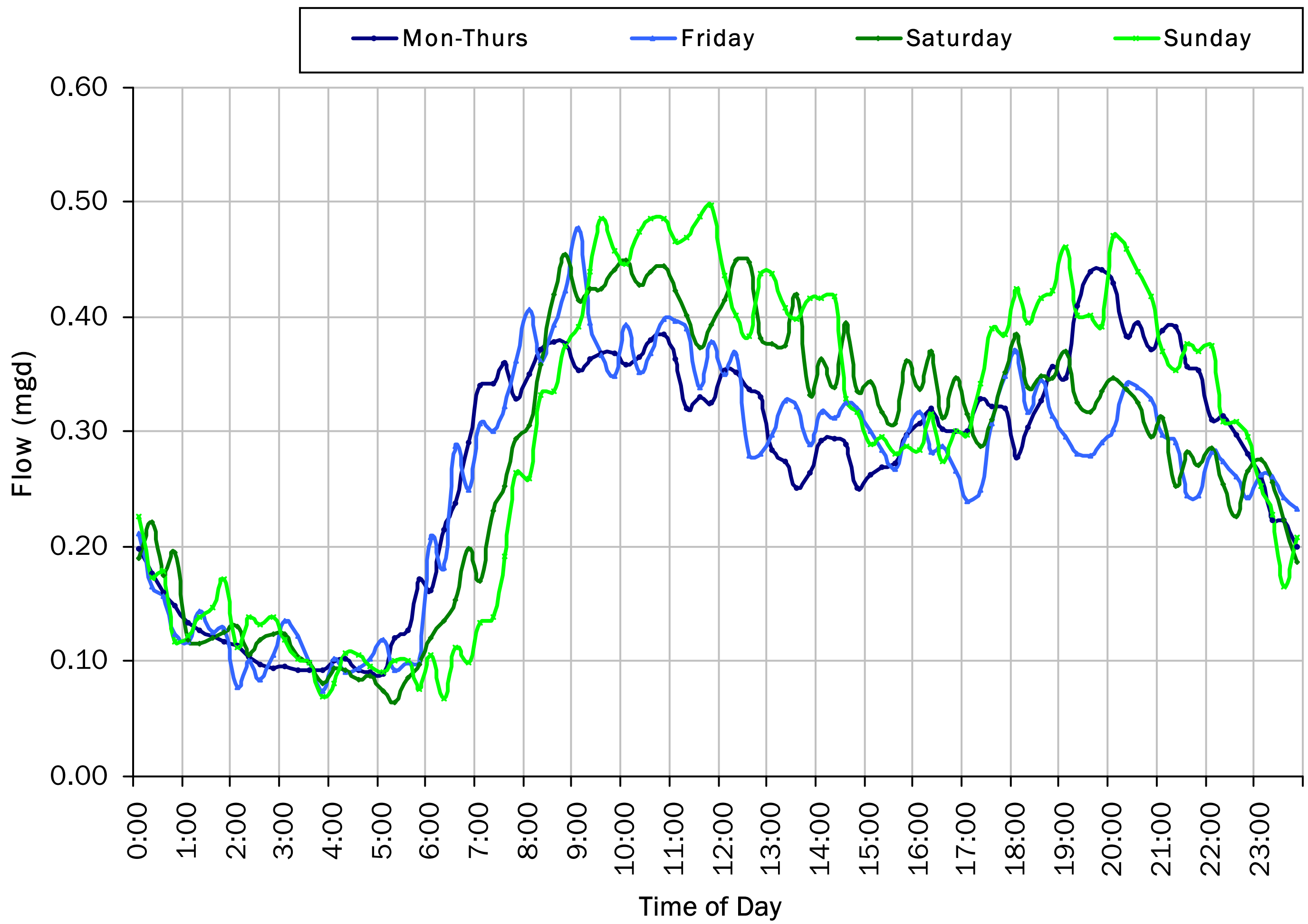
Period Rainfall: 0.00 inches   Period Avg Flow: 0.295 mgd   Period Peak Flow: 0.614 mgd   Period Min Flow: 0.062 mgd

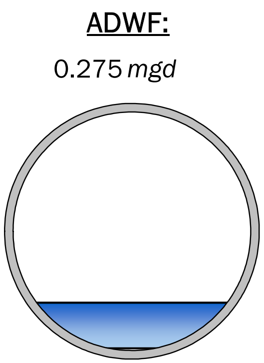




SITE 18

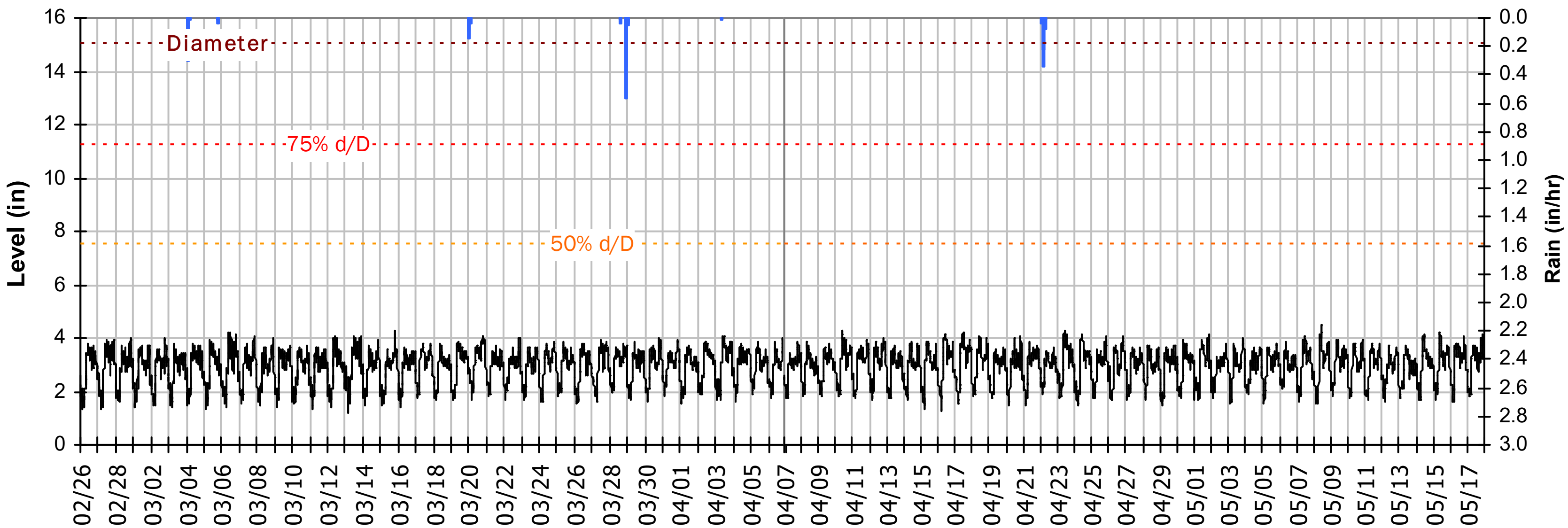
Average Dry Weather Flow Hydrographs

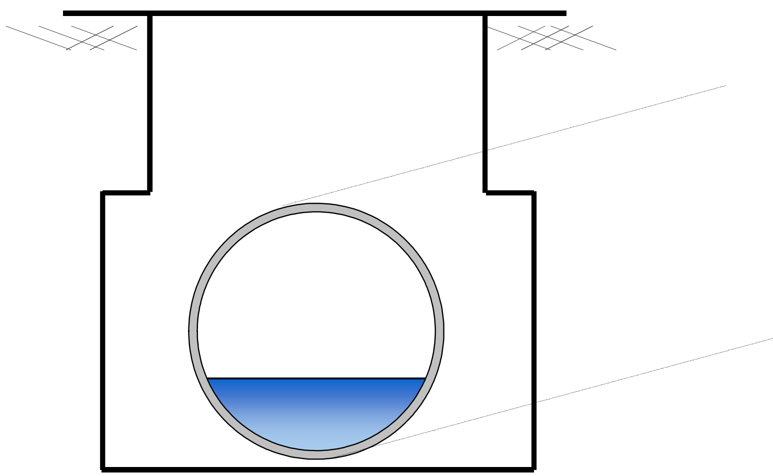




SITE 18
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

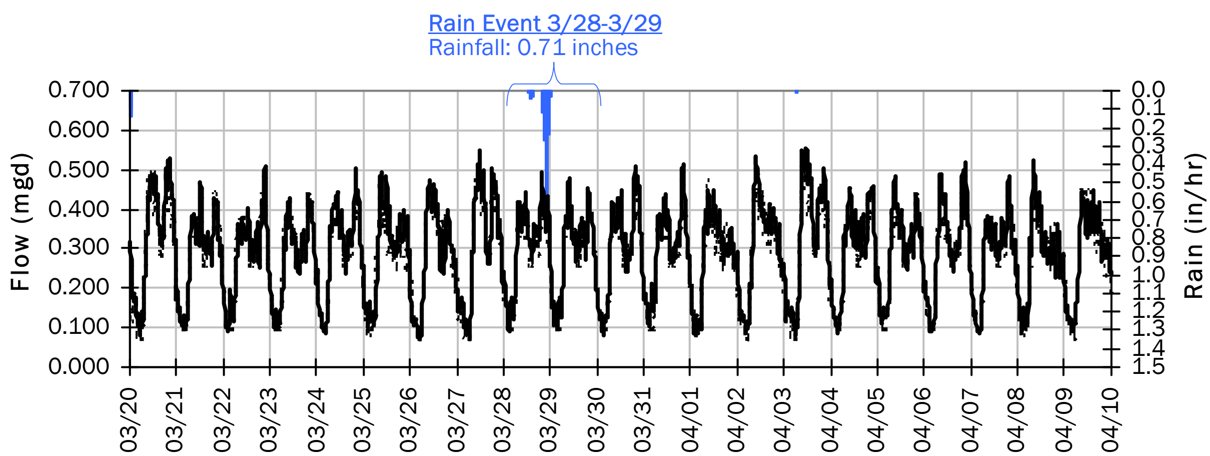




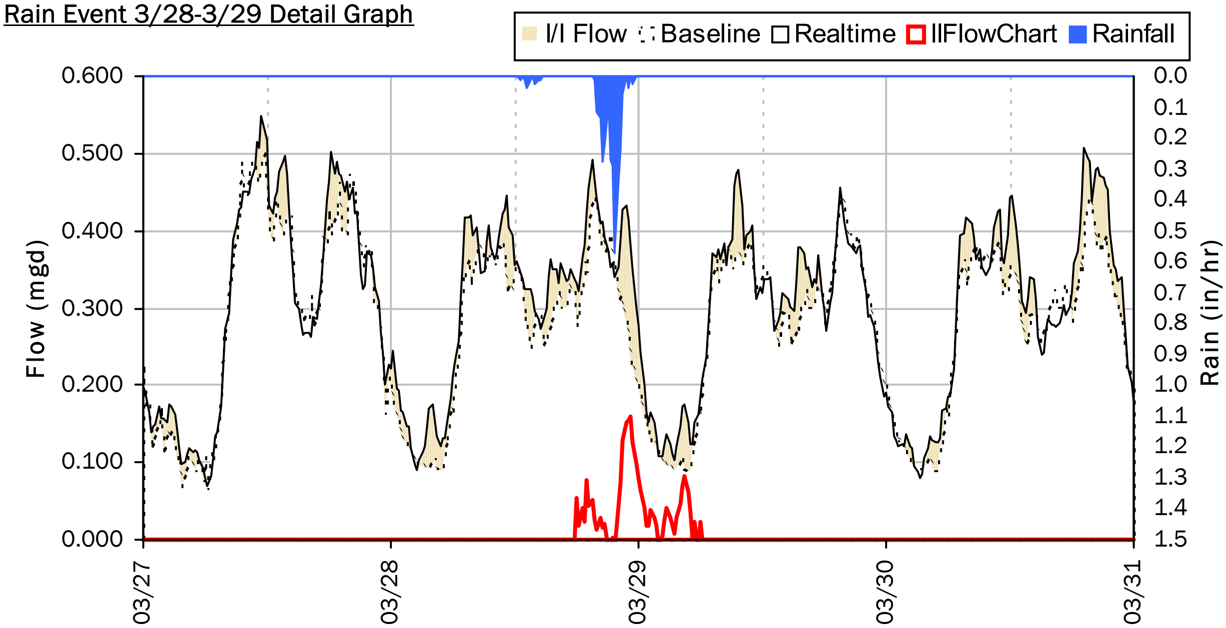
Pipe Diameter:	15	*inches*
Peak Measured Level:	4.5	*inches*
Peak d/D Ratio:	0.30	

SITE 18
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



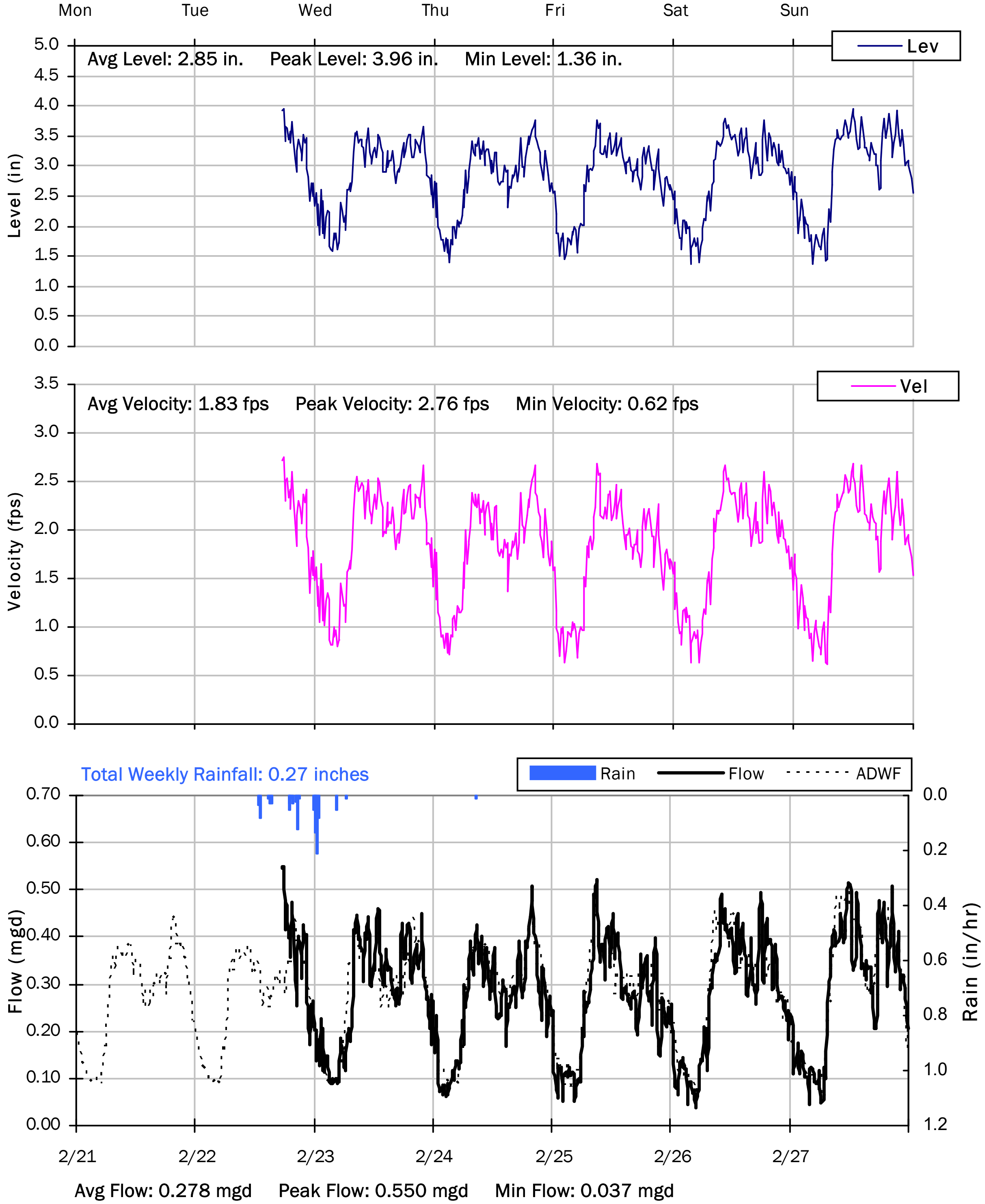
Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.71 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.492 *mgd*	Peak I/I Rate:	0.158 *mgd*
PF:	1.79	Total I/I:	22,000 *gallons*
Peak Level:	3.79 *in*		
d/D Ratio:	0.25		

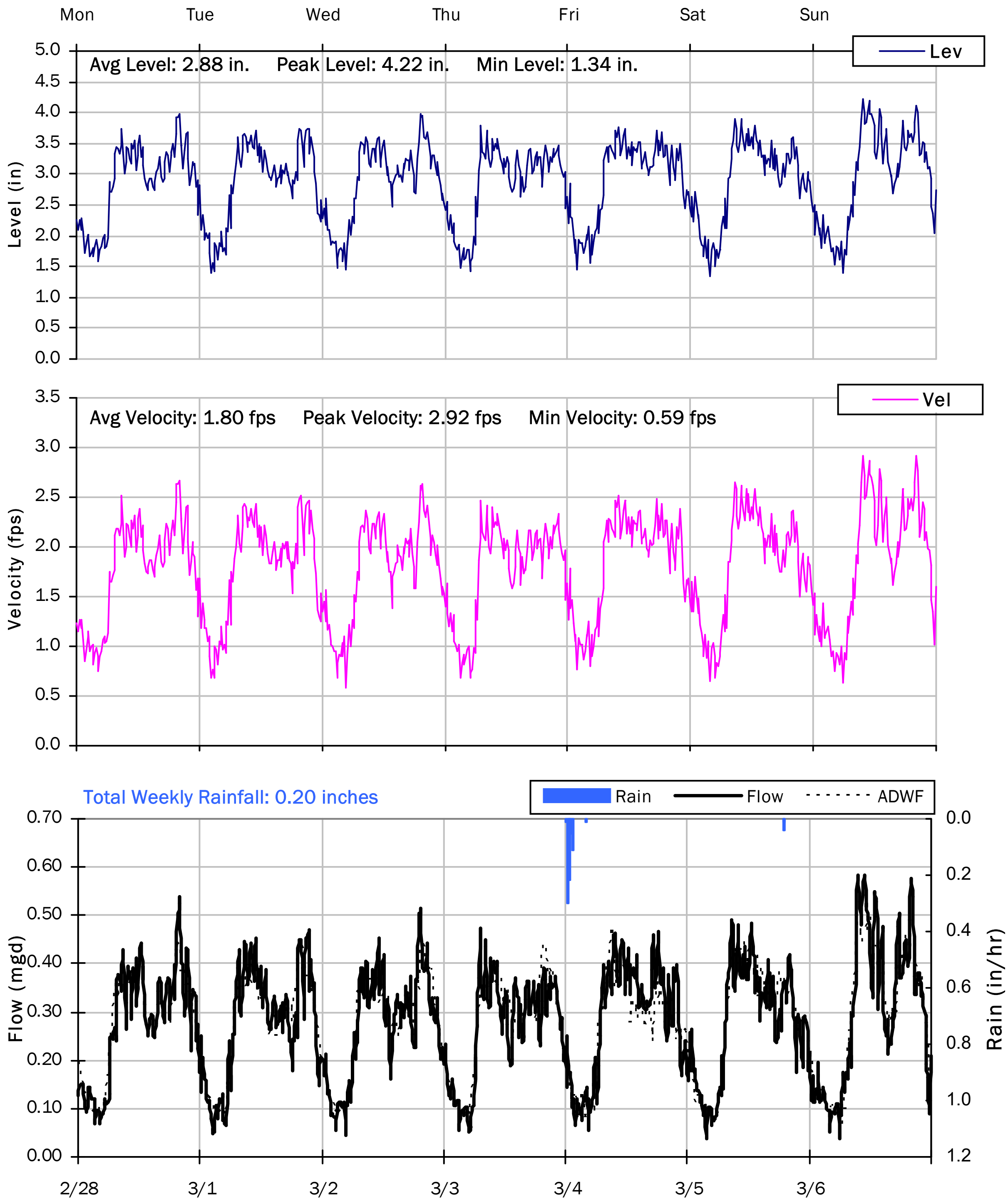
SITE 18
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



SITE 18

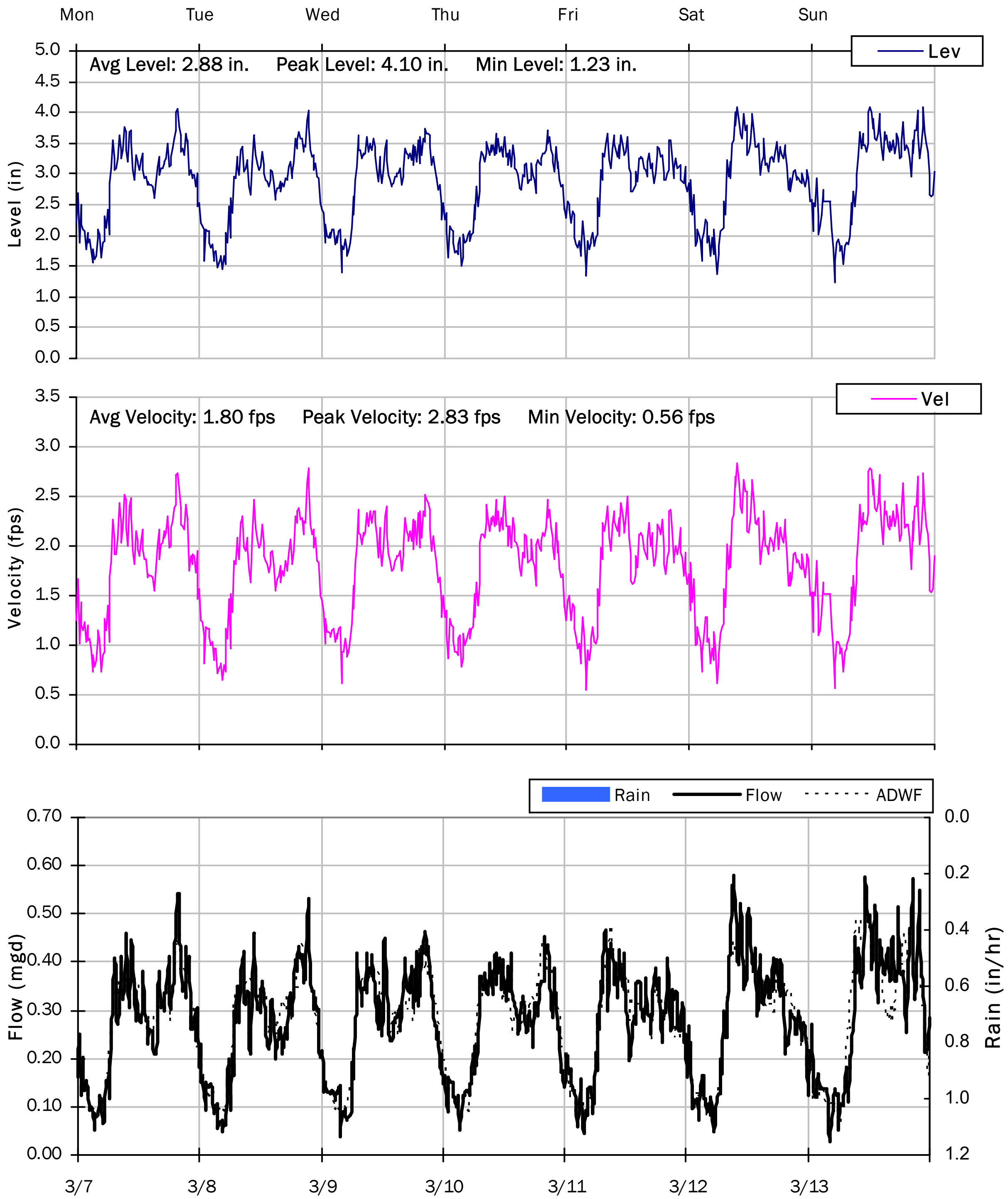
Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022



Avg Flow: 0.280 mgd Peak Flow: 0.584 mgd Min Flow: 0.038 mgd

SITE 18
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

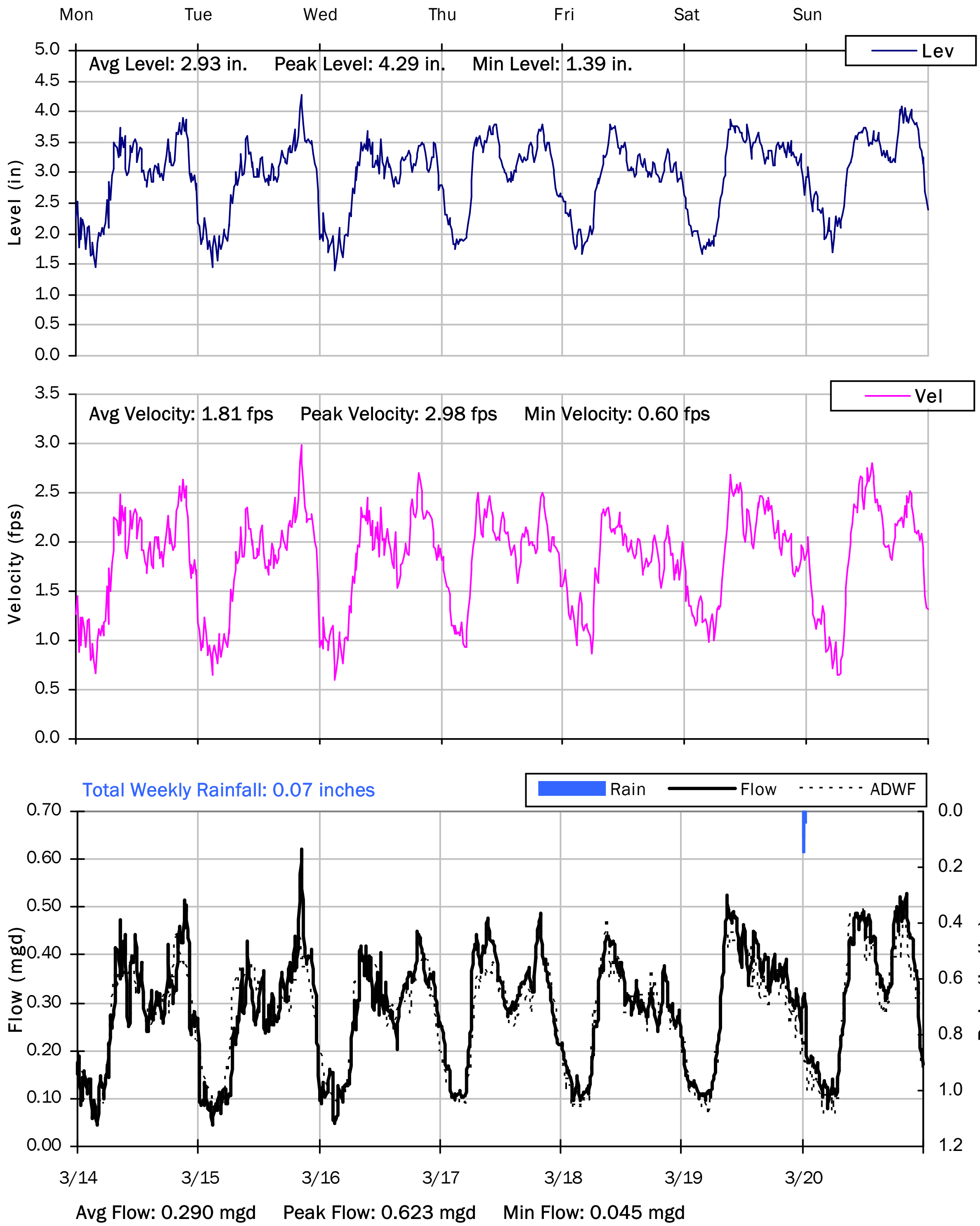


Avg Flow: 0.279 mgd Peak Flow: 0.581 mgd Min Flow: 0.029 mgd

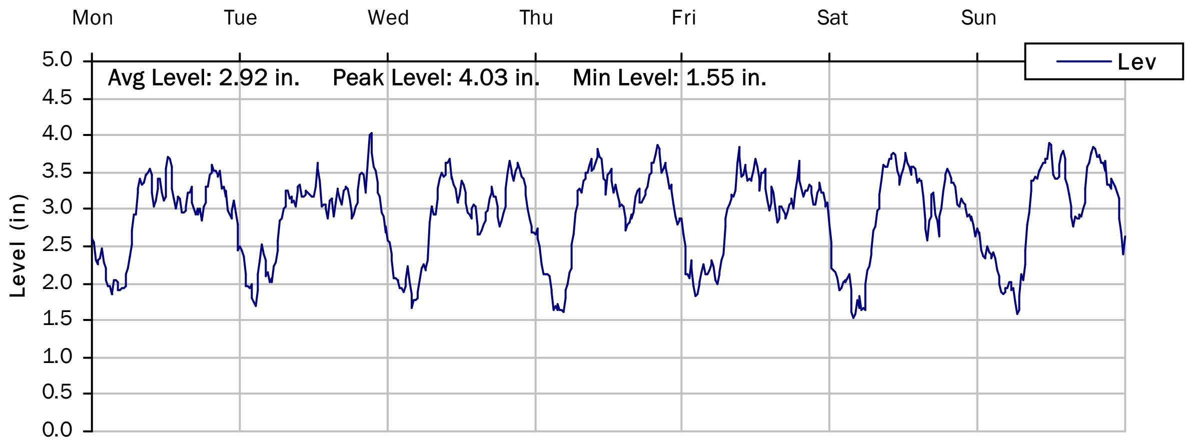
SITE 18

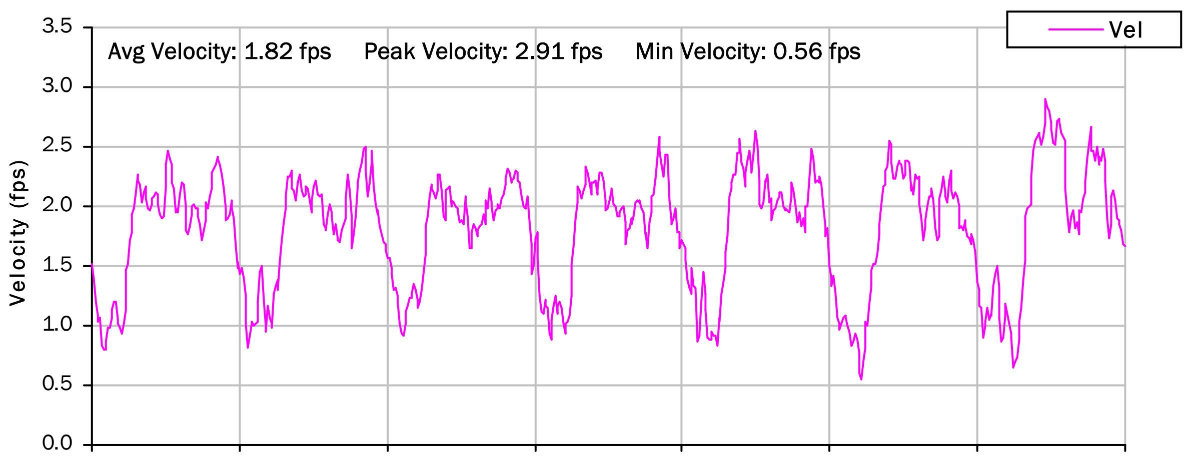
Weekly Level, Velocity and Flow Hydrographs

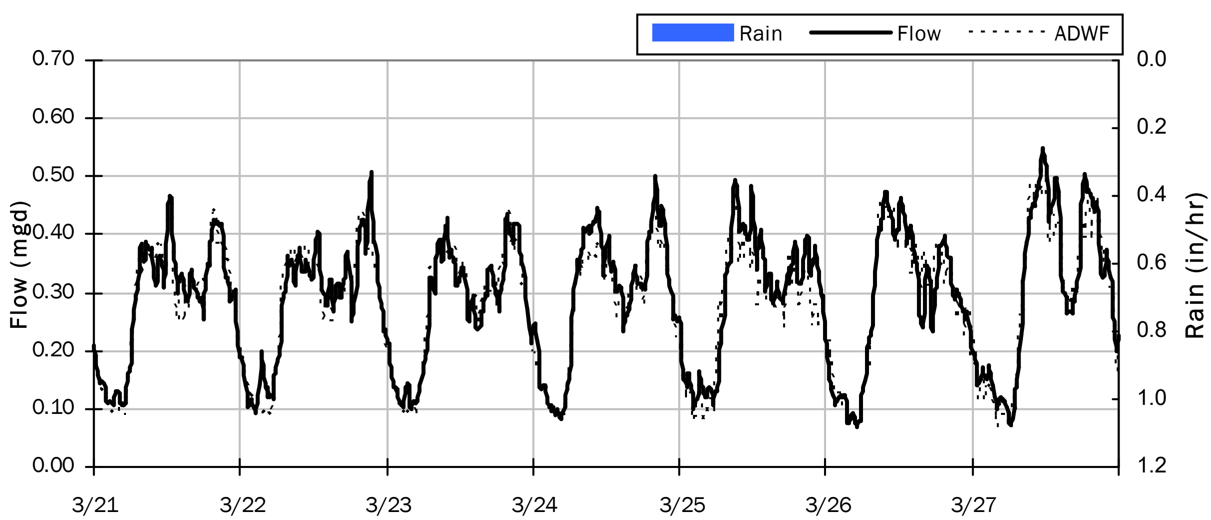
3/14/2022 to 3/21/2022



SITE 18
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

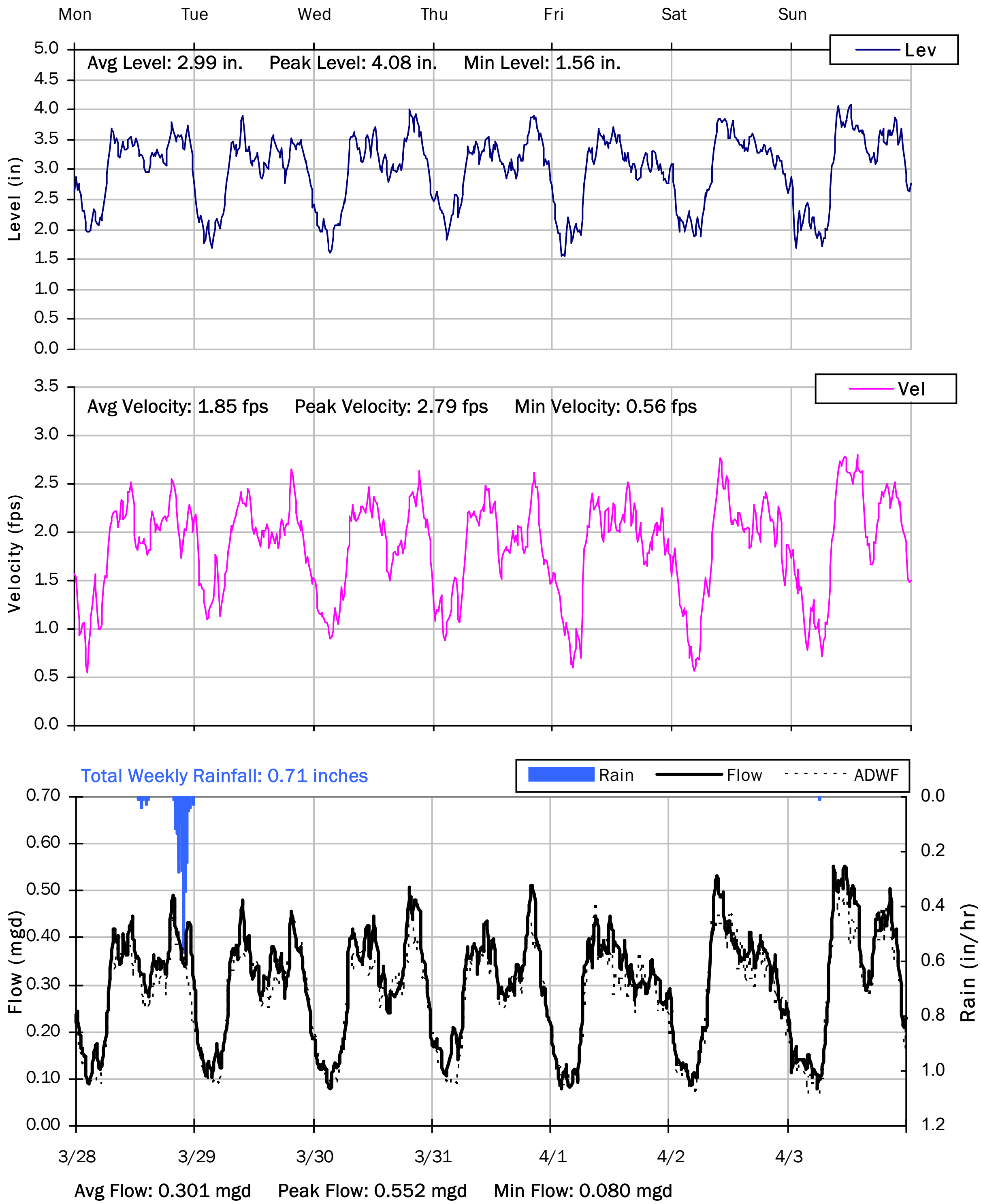






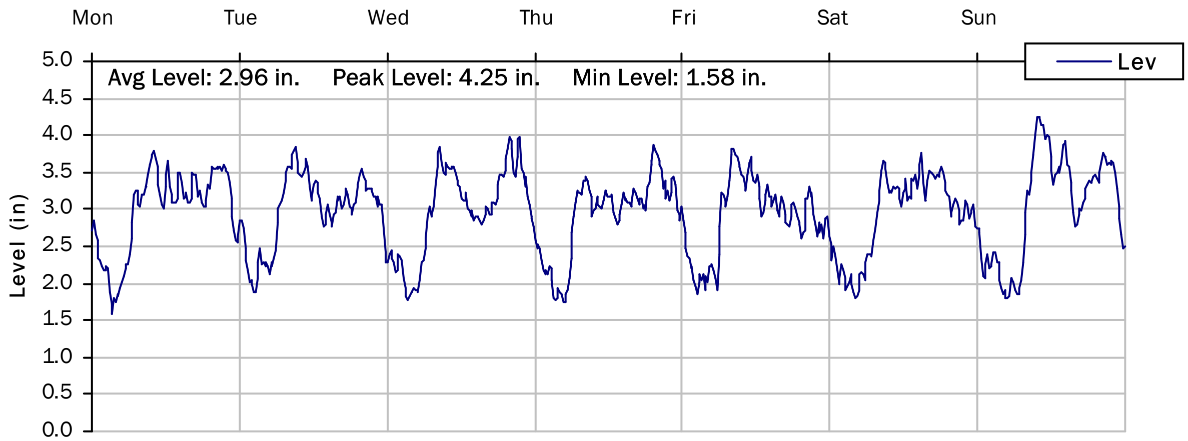
Avg Flow: 0.288 mgd Peak Flow: 0.549 mgd Min Flow: 0.070 mgd

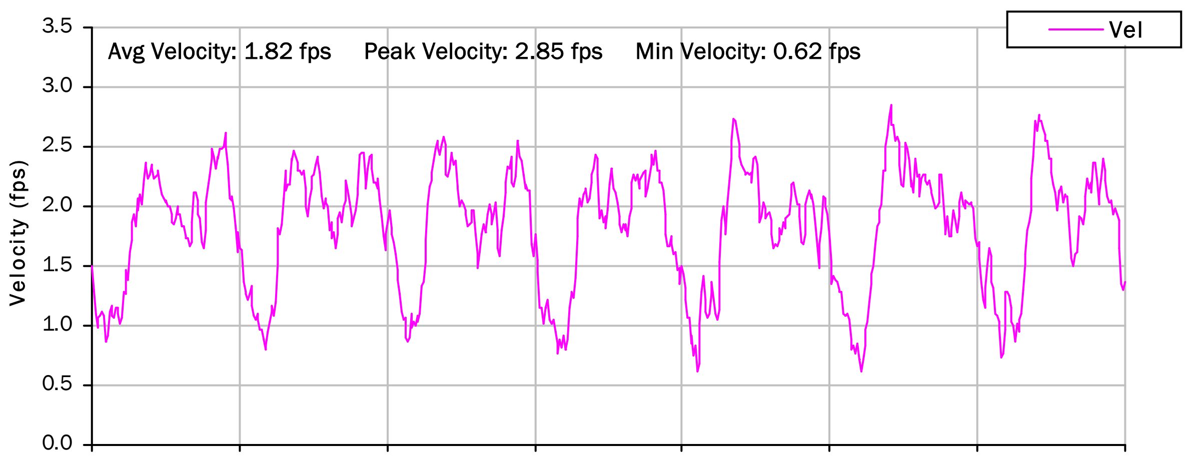
SITE 18
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

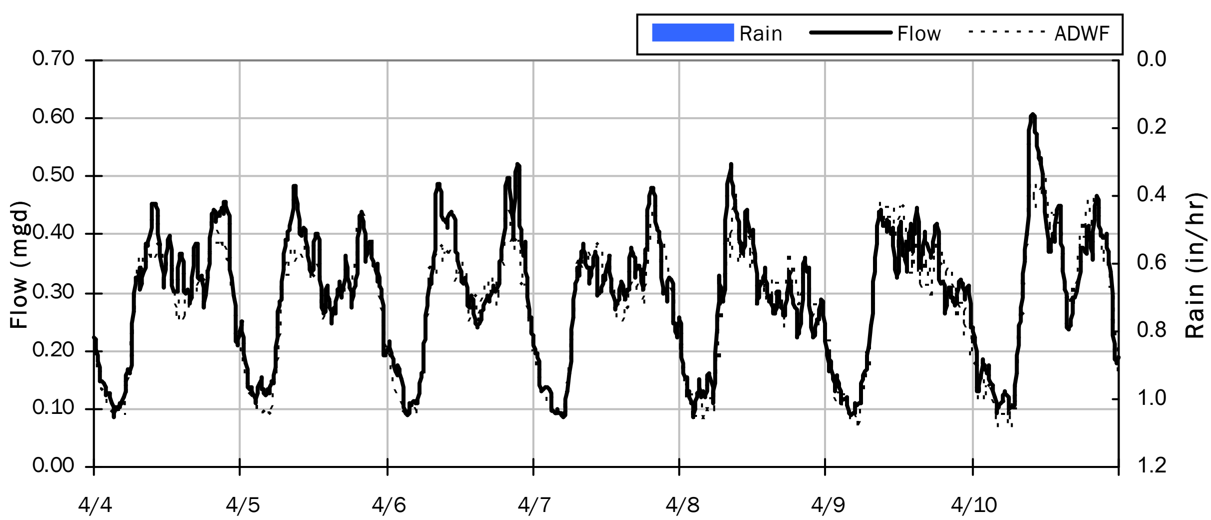


SITE 18

Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022





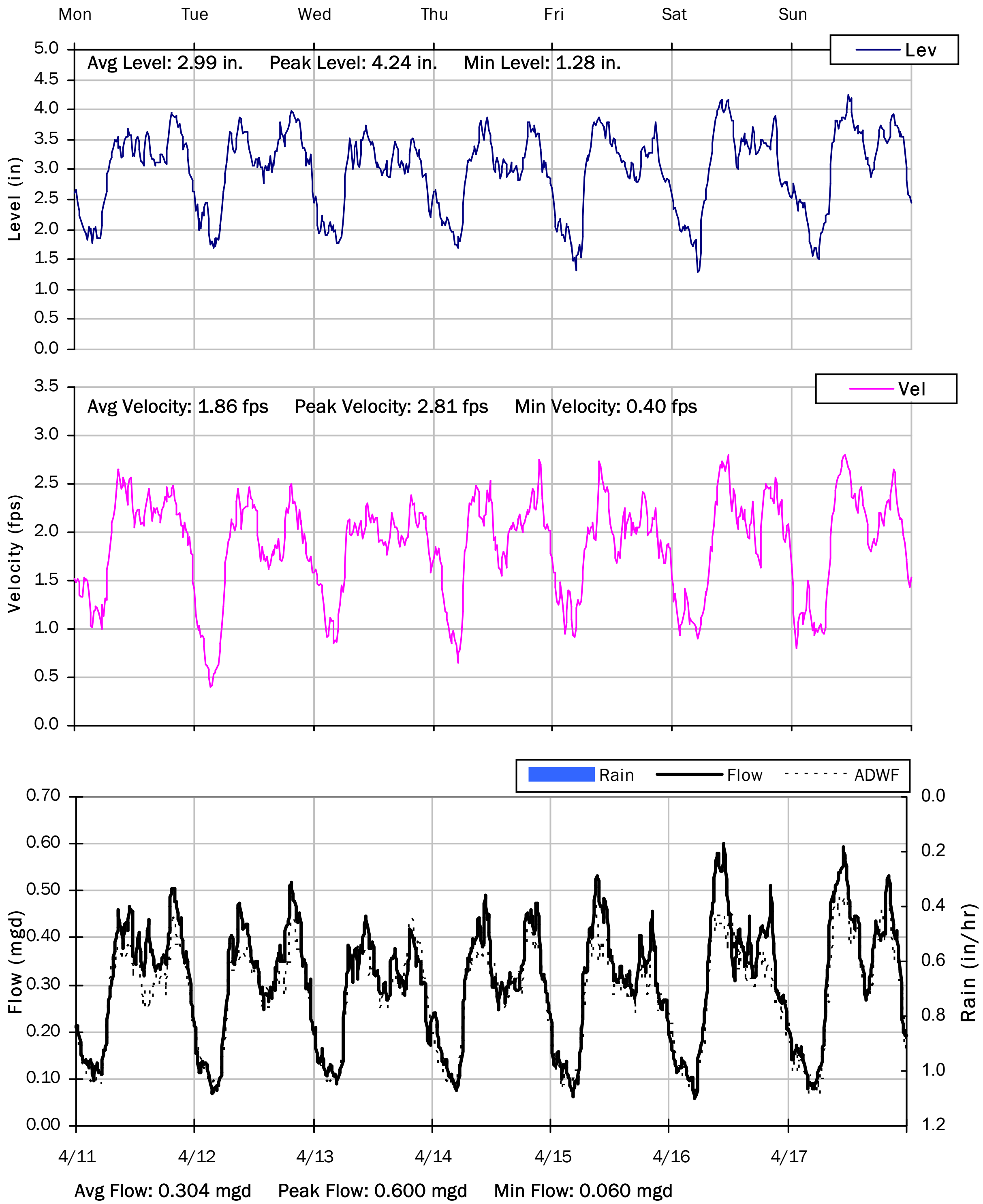


Avg Flow: 0.294 mgd Peak Flow: 0.608 mgd Min Flow: 0.085 mgd

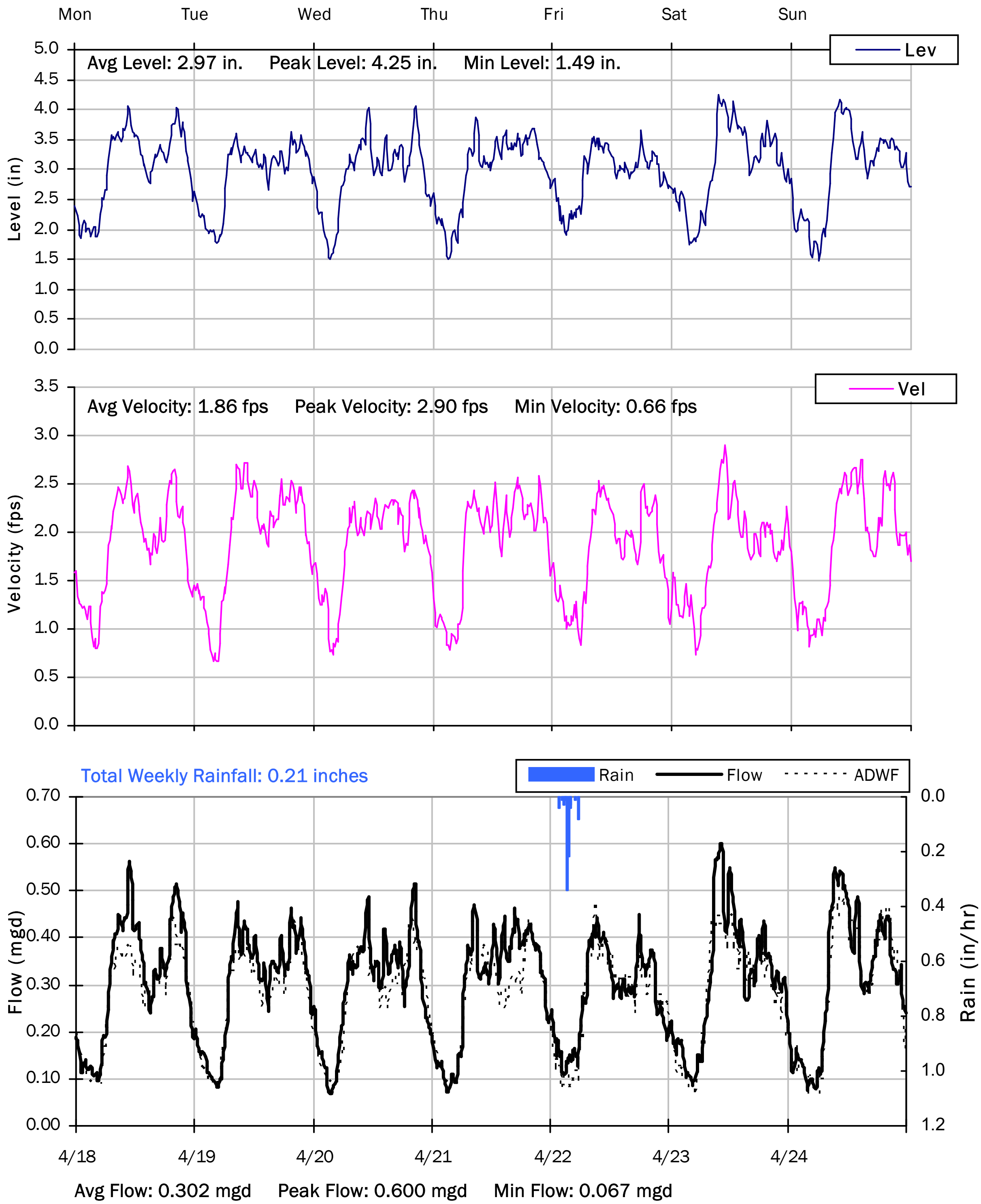
SITE 18

Weekly Level, Velocity and Flow Hydrographs

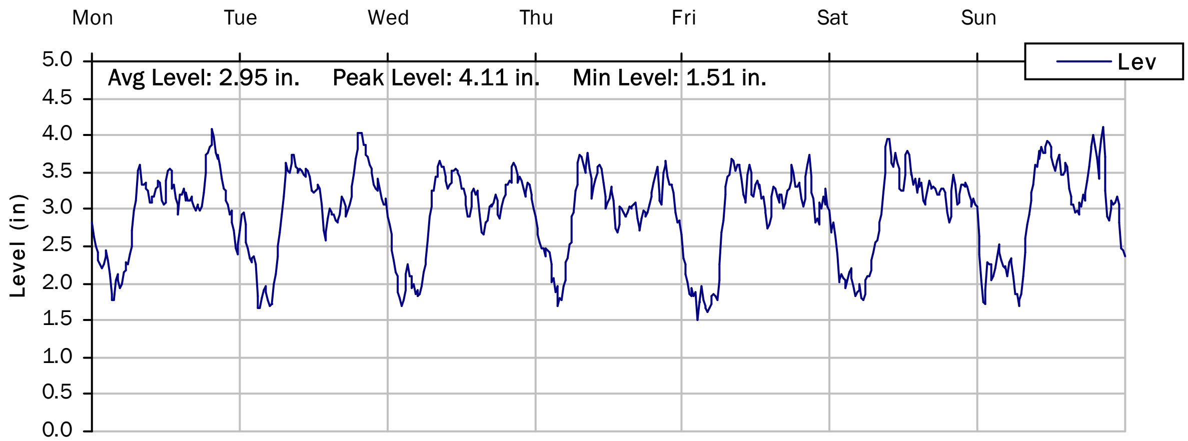
4/11/2022 to 4/18/2022

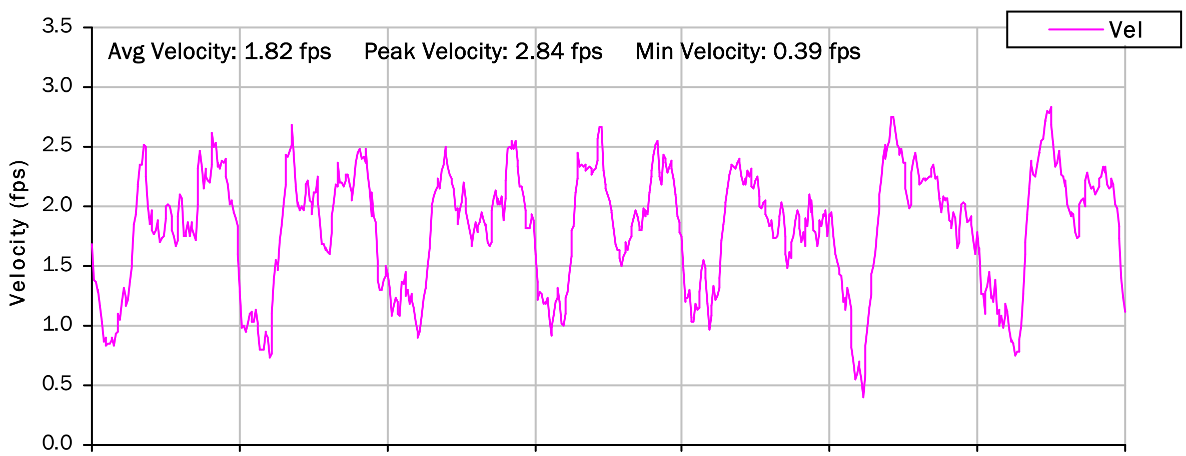


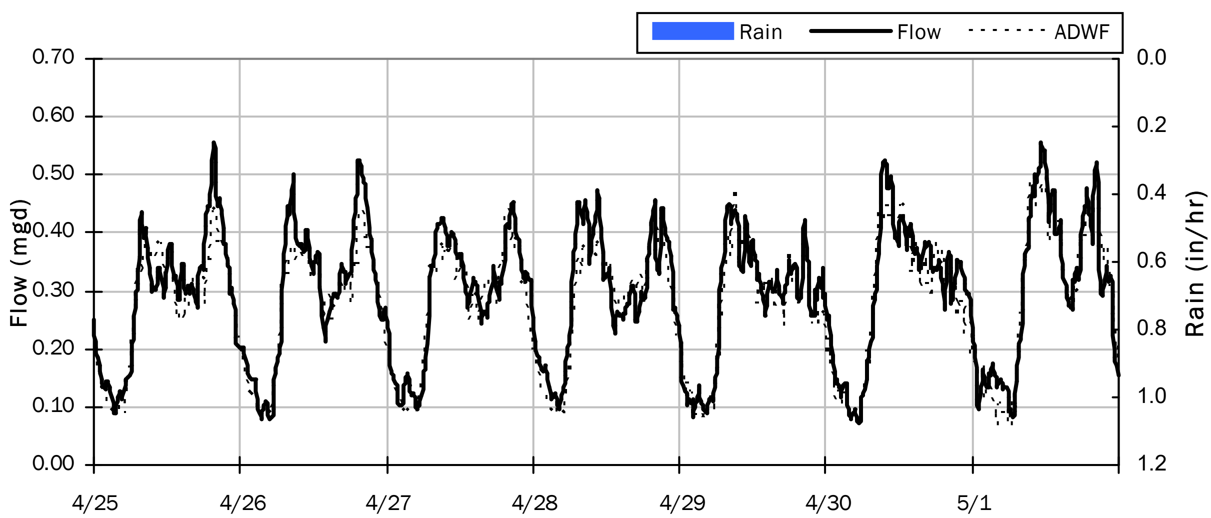
SITE 18
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



SITE 18
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

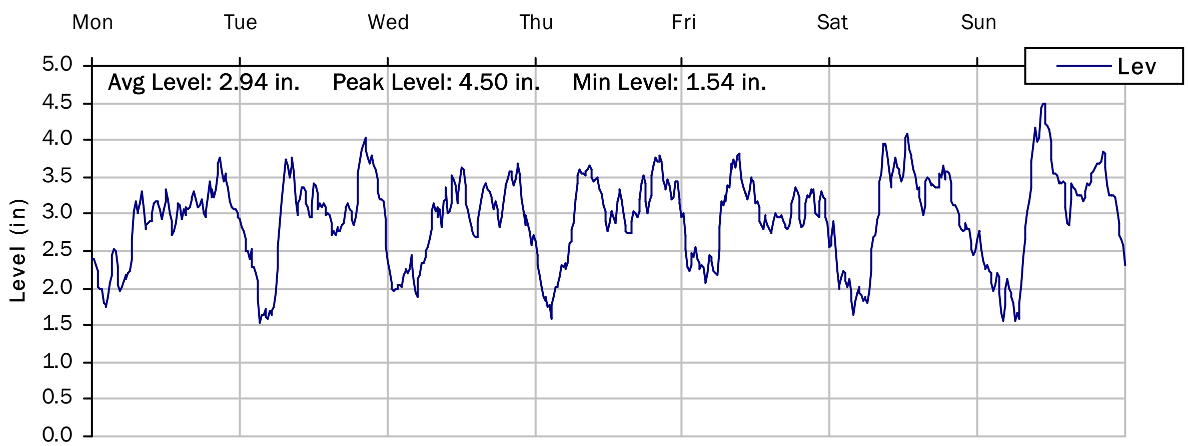


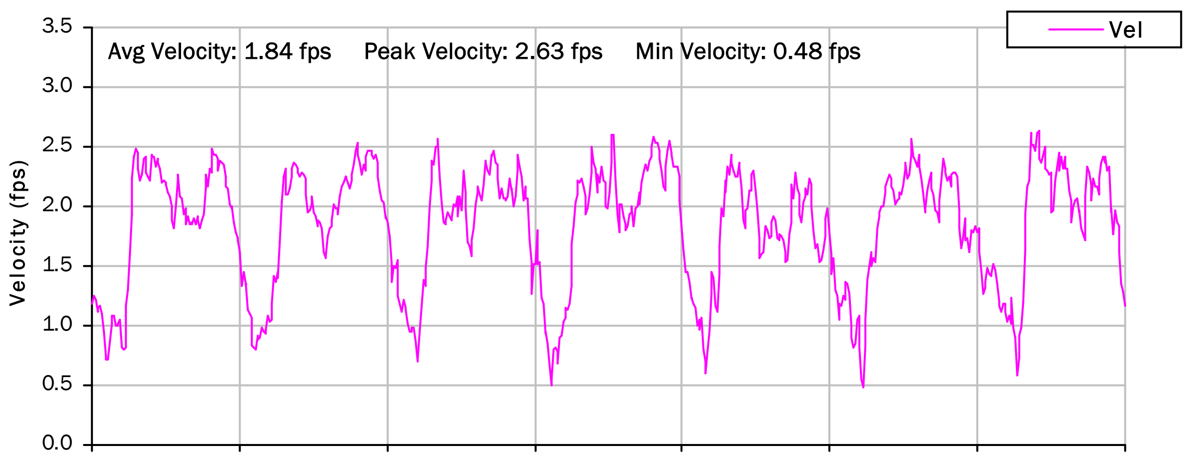


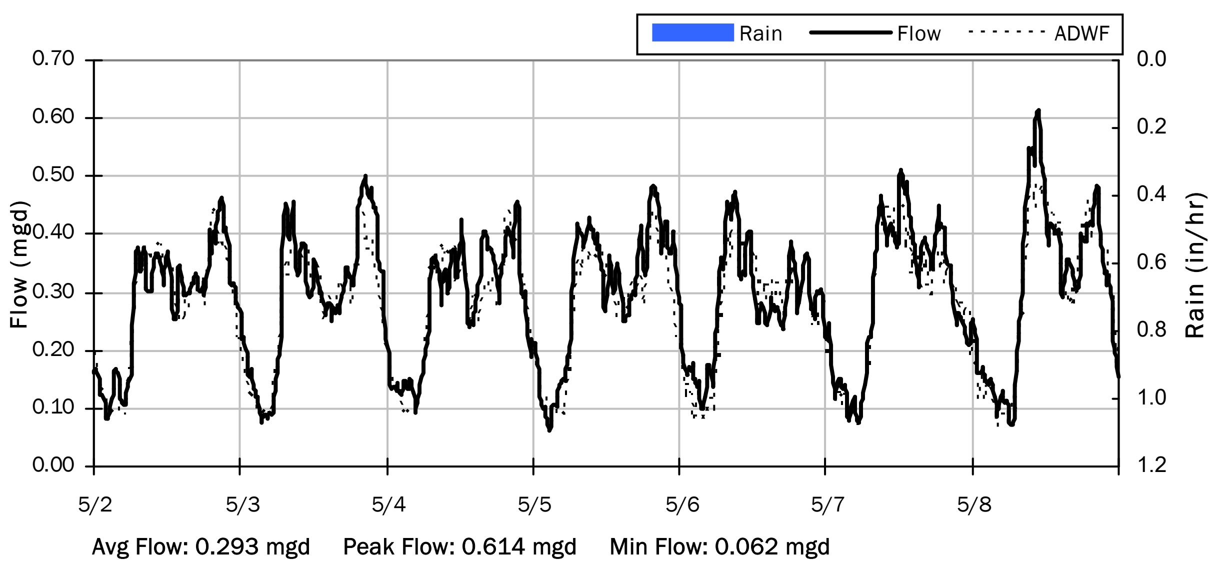


Avg Flow: 0.293 mgd Peak Flow: 0.554 mgd Min Flow: 0.070 mgd

SITE 18
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022



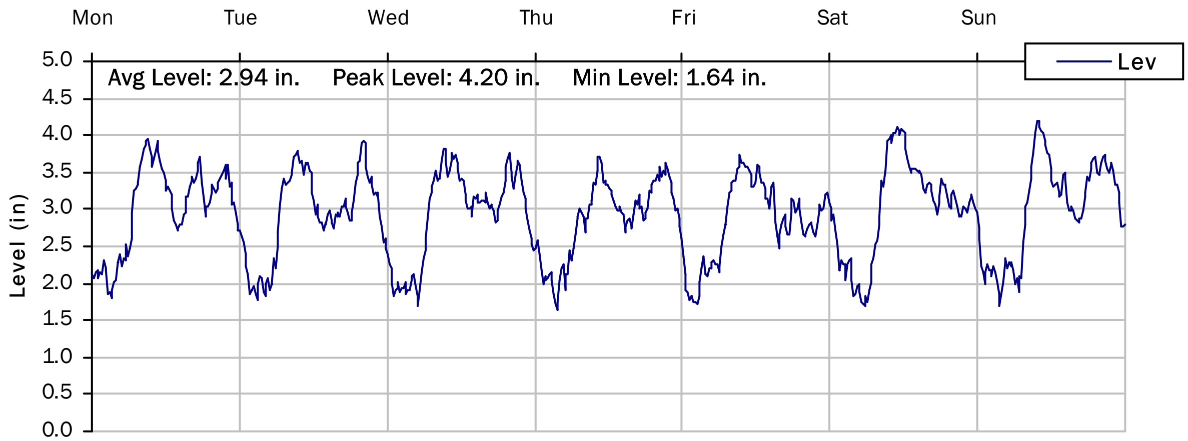


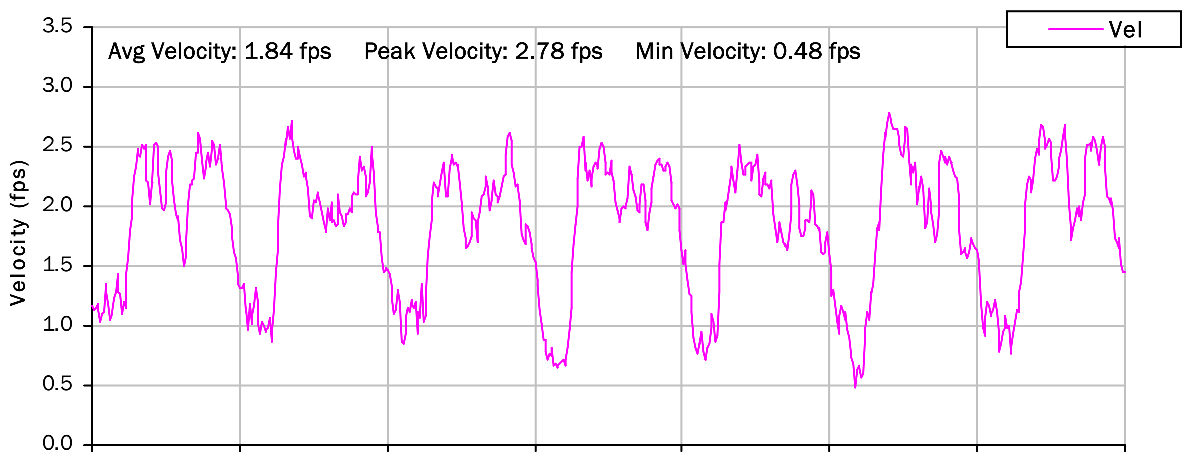


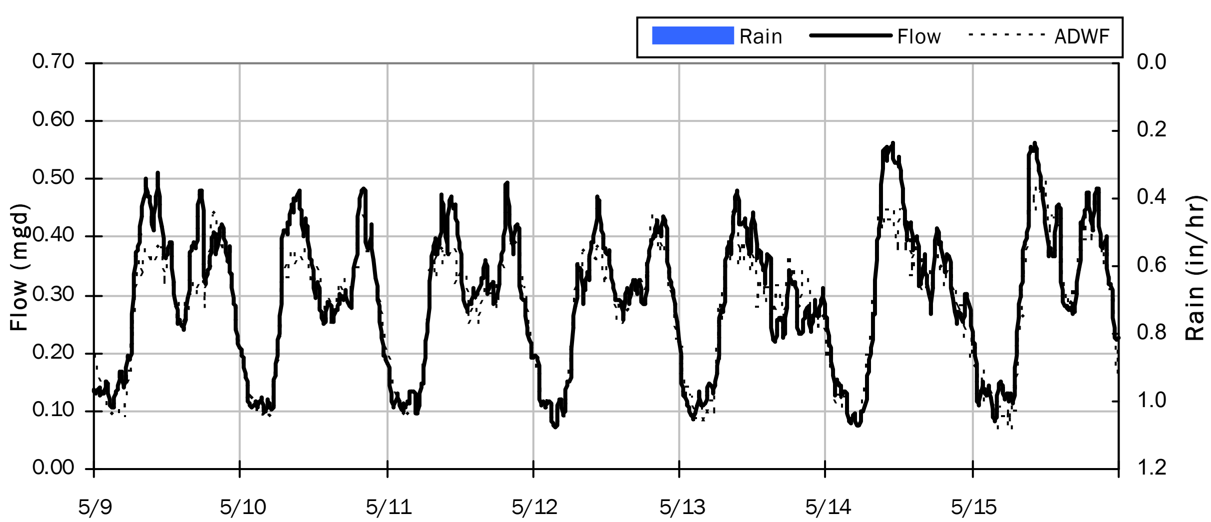
SITE 18

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022

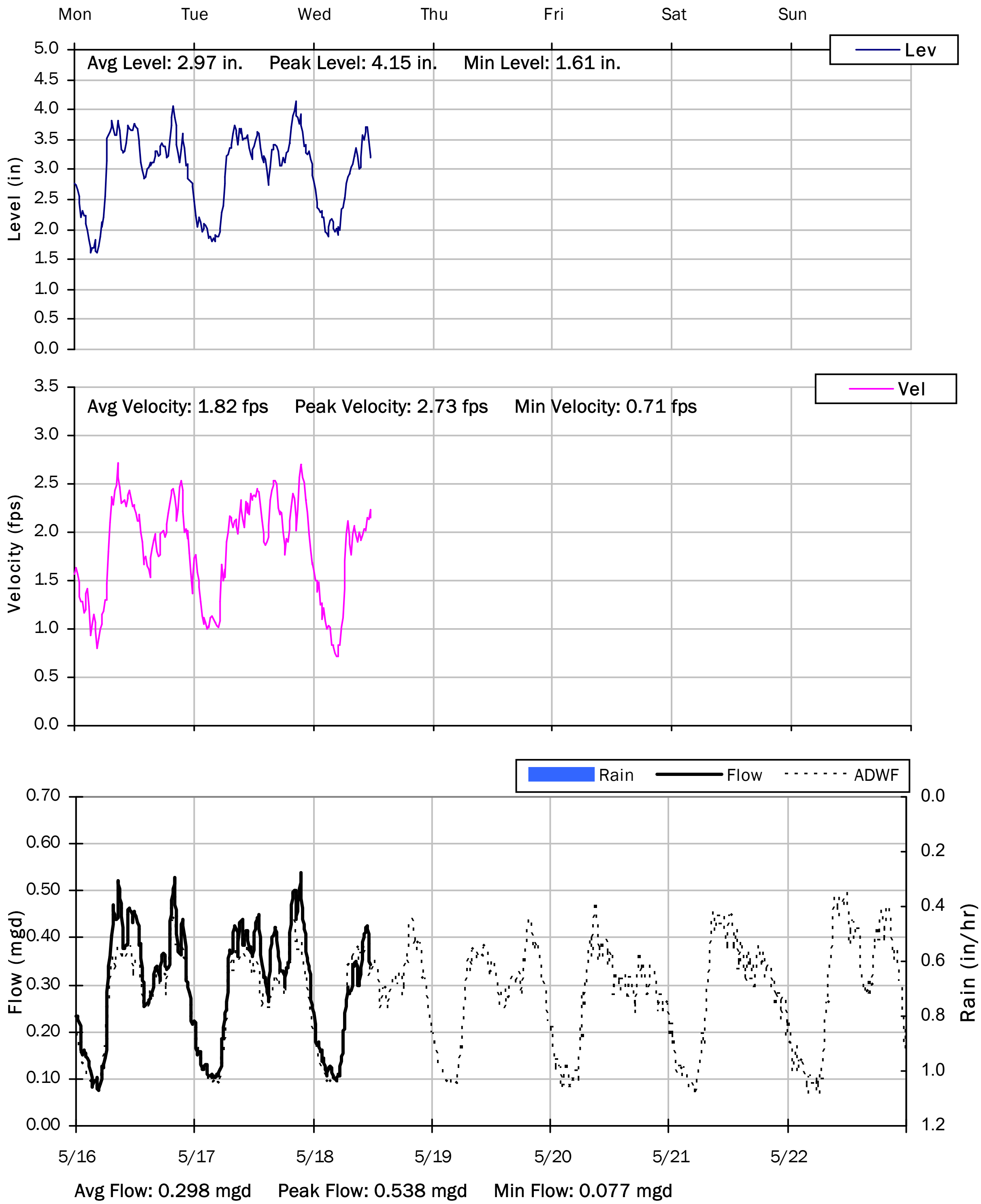






Avg Flow: 0.295 mgd Peak Flow: 0.564 mgd Min Flow: 0.072 mgd

SITE 18
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022



Monitoring Site: Site 19

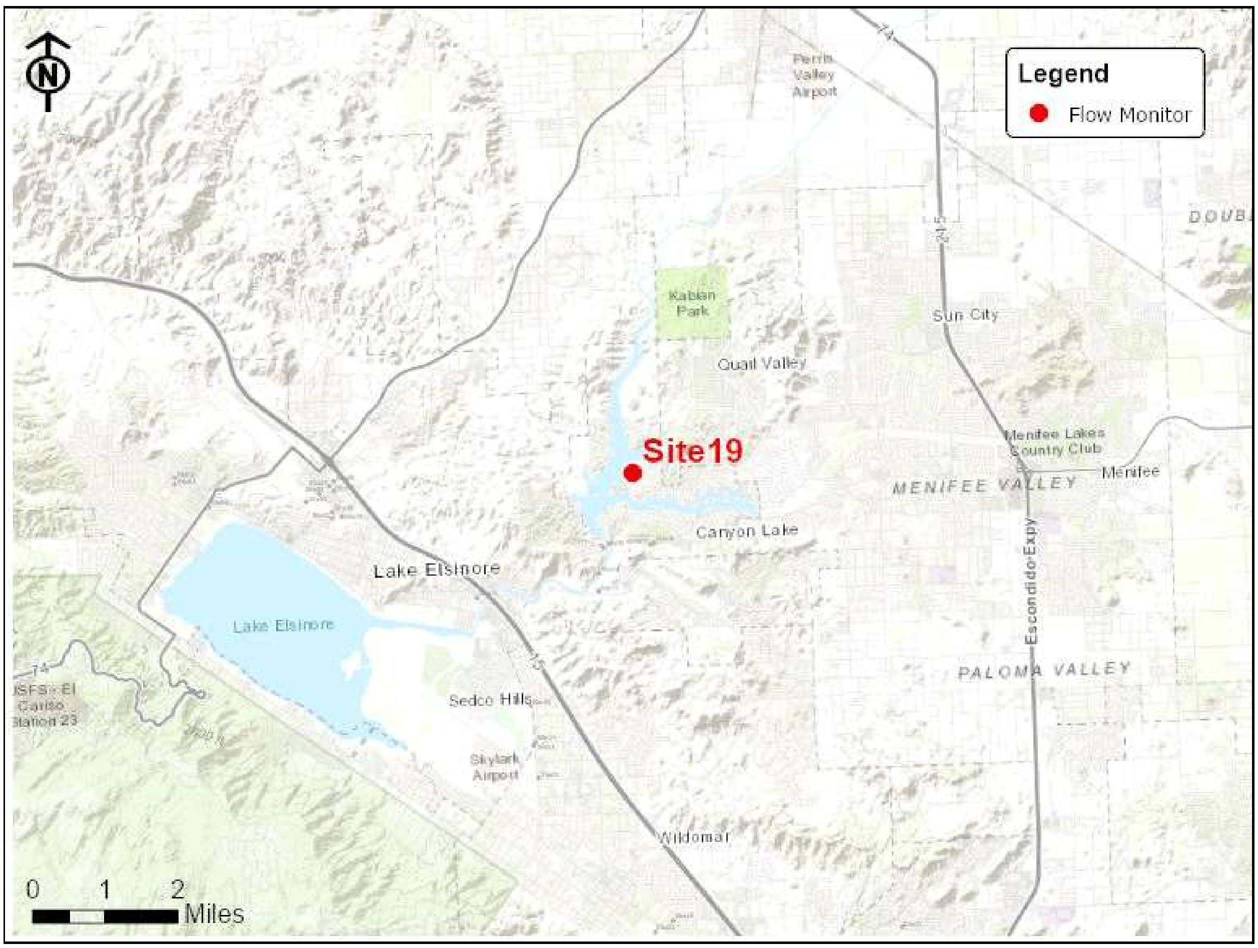
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Redwood Drive and Boating Way

Data Summary Report



Vicinity Map: Site 19

SITE 19

Site Information MH ID: MH-1137

Location: Redwood Drive and Boating Way

Coordinates: 117.2651° W, 33.6876° N

Rim Elevation (Earth): 1418 feet

Expected Pipe Diameter: 12 inches

Measured Pipe Diameter: 12 inches

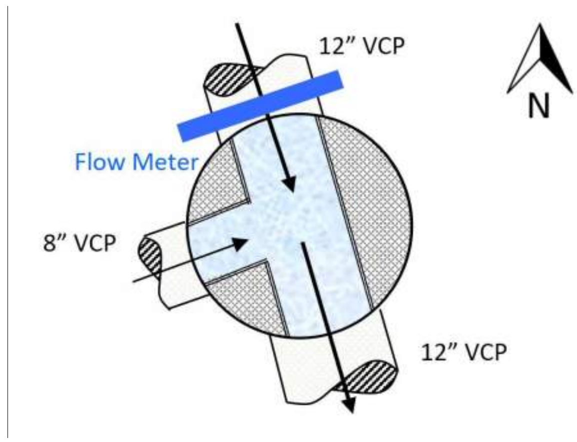
ADWF: 0.100 mgd

Peak Measured Flow: 0.214 mgd

Sediment: 1.75 inches

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 19

Additional Site Photos

Effluent Pipe

Monitored N Influent Pipe

SITE 19

Additional Site Photos

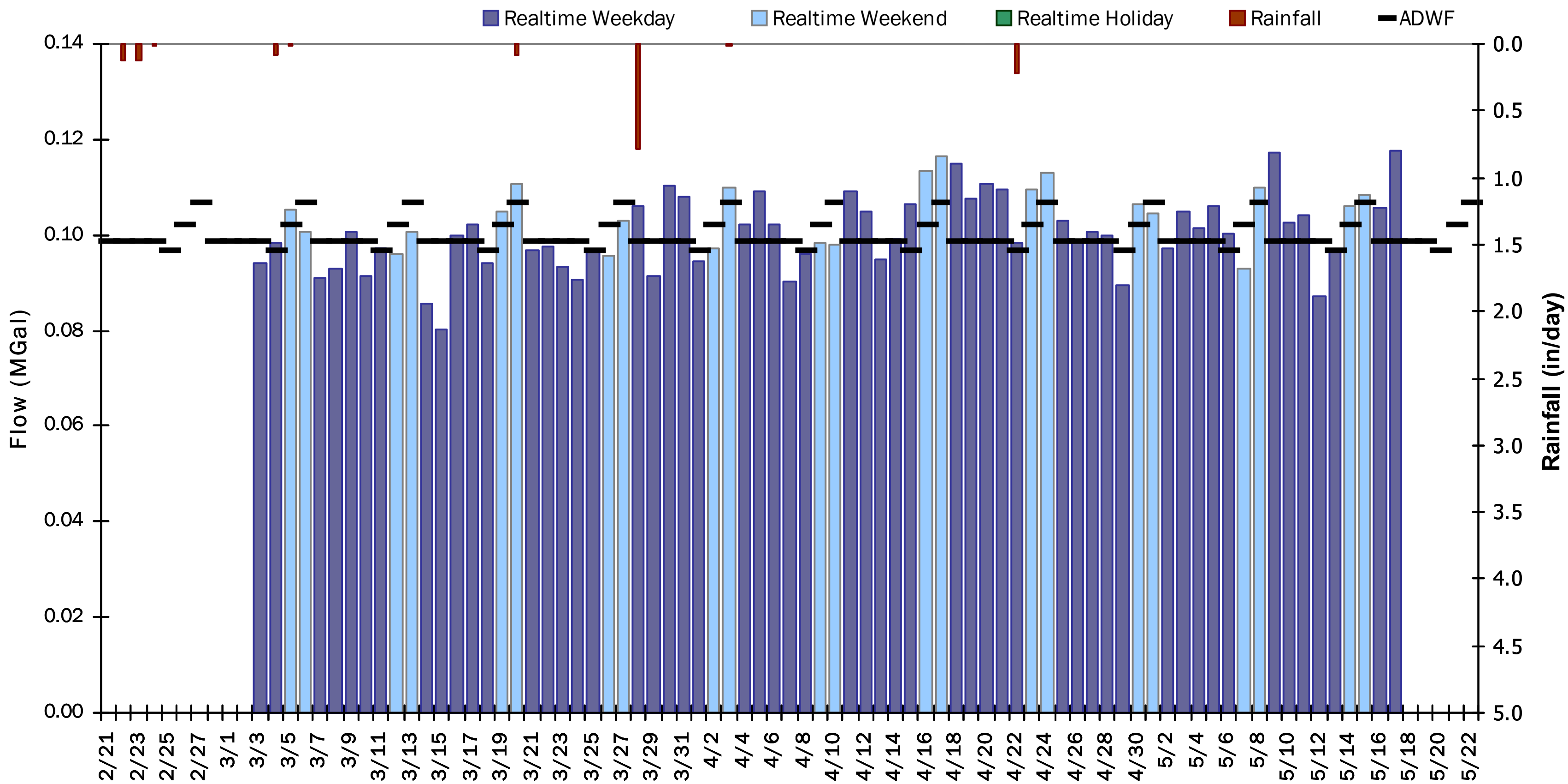
W Influent Pipe

SITE 19

Period Flow Summary: Daily Flow Totals

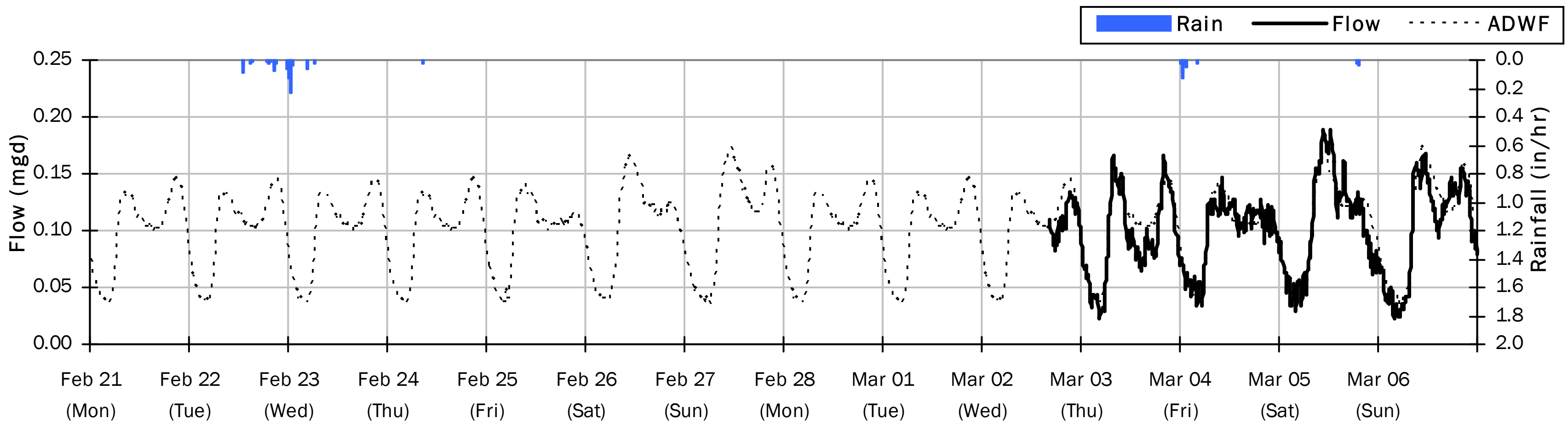
Avg Daily Flow: 0.101 MGal   Peak Daily Flow: 0.118 MGal   Min Daily Flow: 0.080 MGal

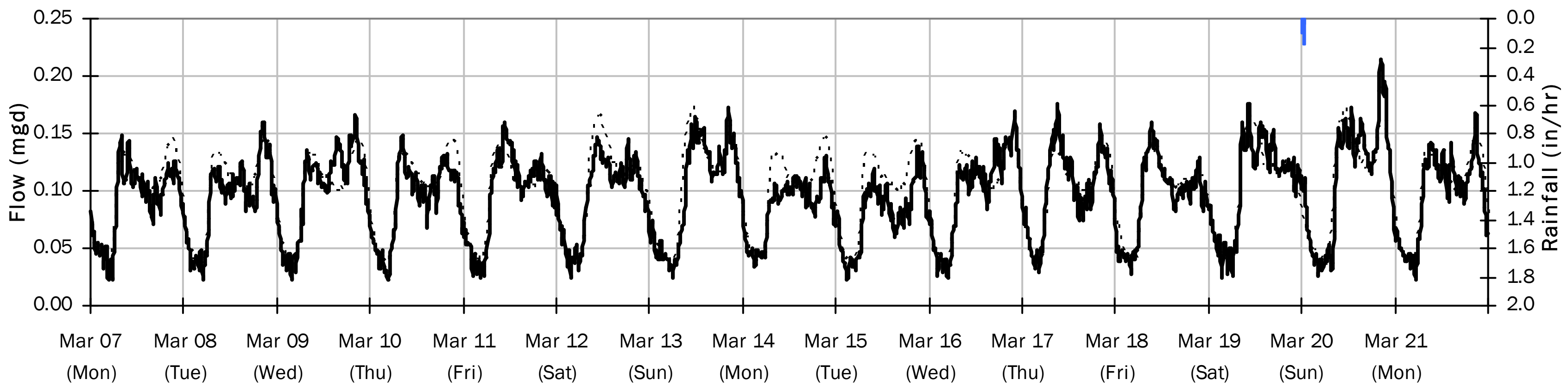
Total Rainfall: 1.19 inches



SITE 19
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.44 inches   Period Avg Flow: 0.097 mgd   Period Peak Flow: 0.214 mgd   Period Min Flow: 0.022 mgd

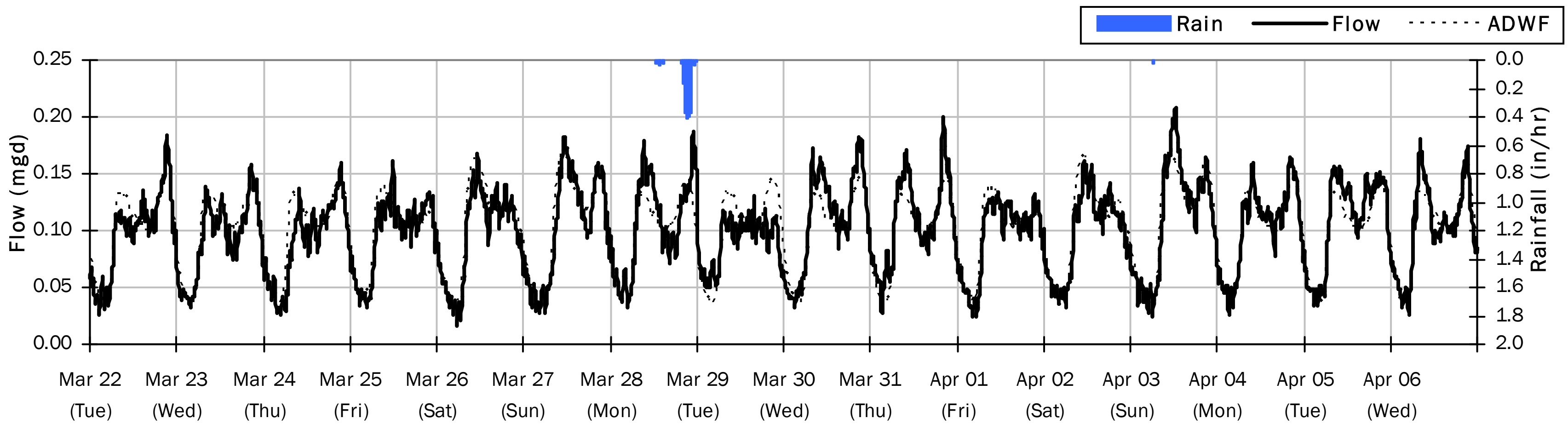


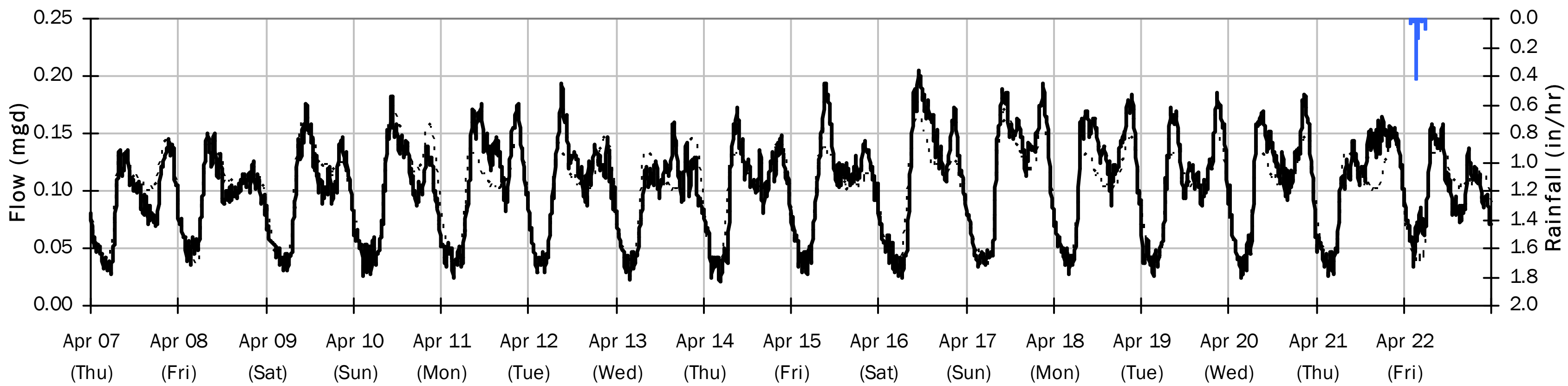


SITE 19

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 1.00 inches   Period Avg Flow: 0.102 mgd   Period Peak Flow: 0.207 mgd   Period Min Flow: 0.016 mgd



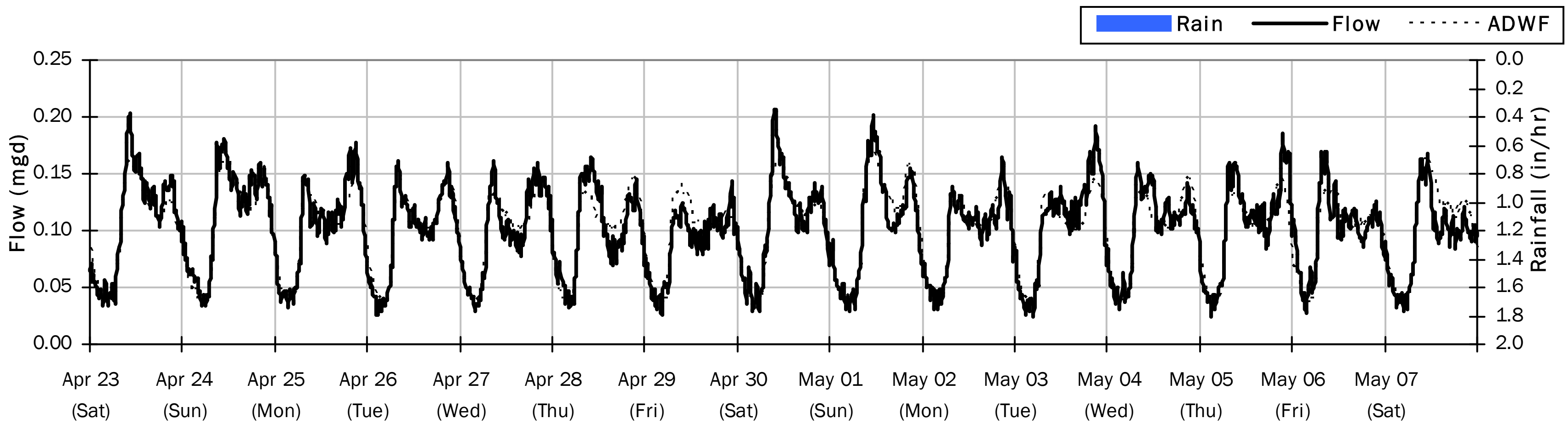


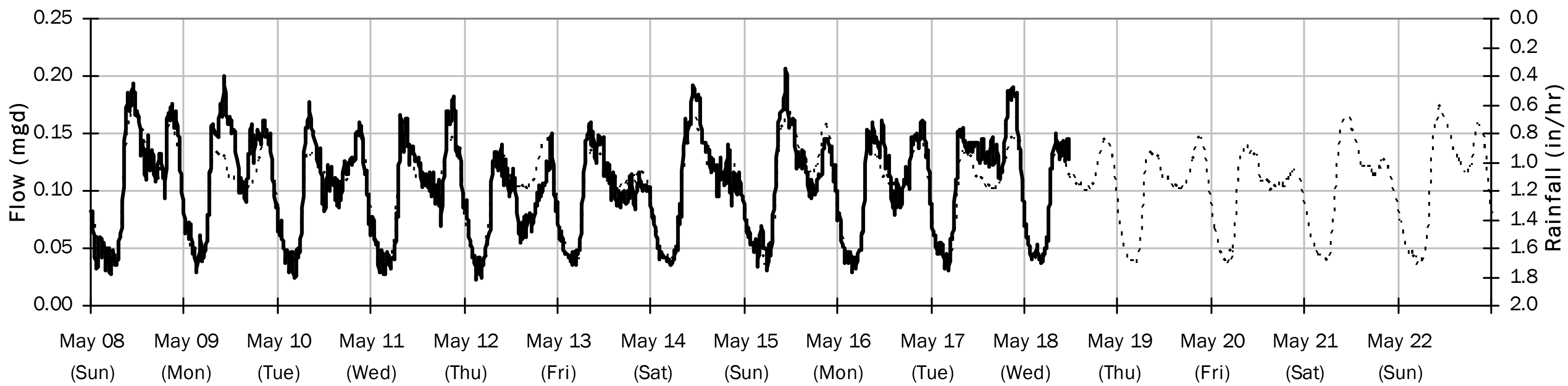
SITE 19

Flow Summary: 4/23/2022 to 5/22/2022

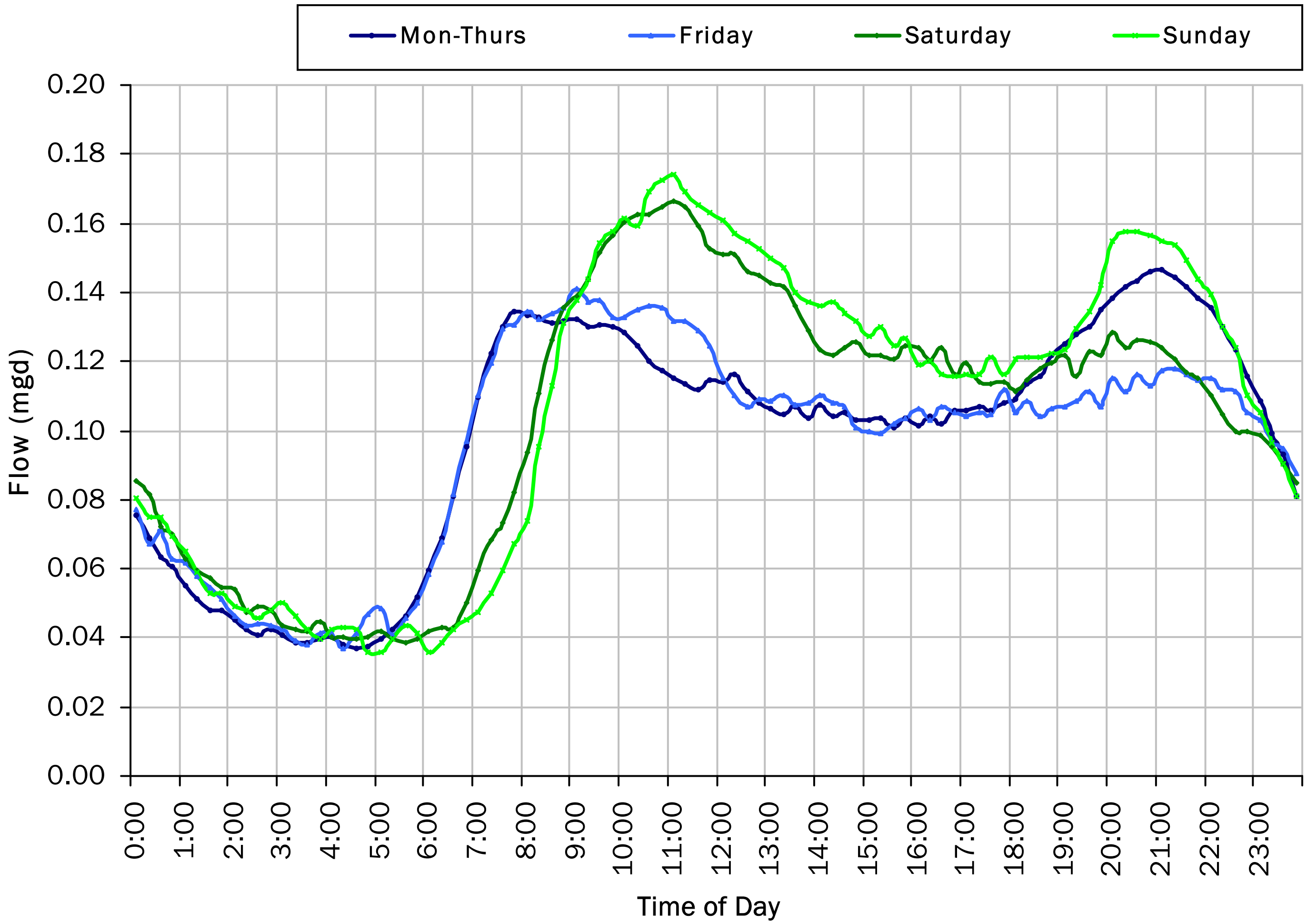
Period Rainfall: 0.00 inches

Period Avg Flow: 0.103 mgd Period Peak Flow: 0.206 mgd Period Min Flow: 0.023 mgd



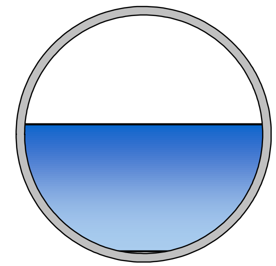


SITE 19
Average Dry Weather Flow Hydrographs



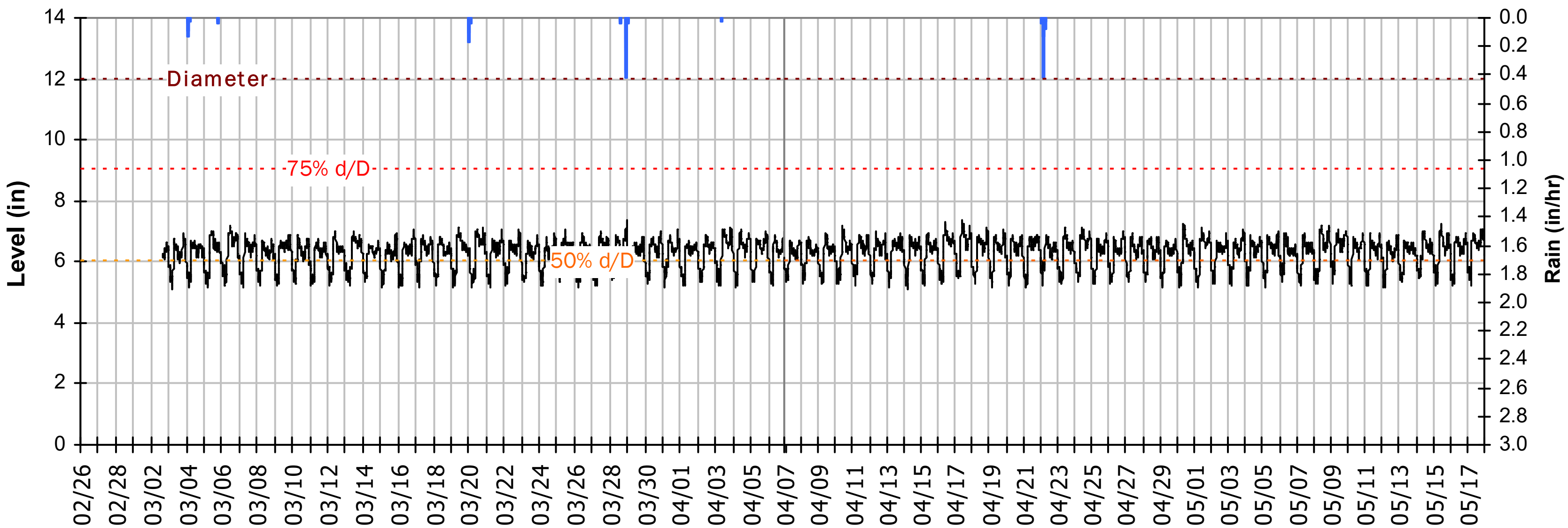
ADWF:

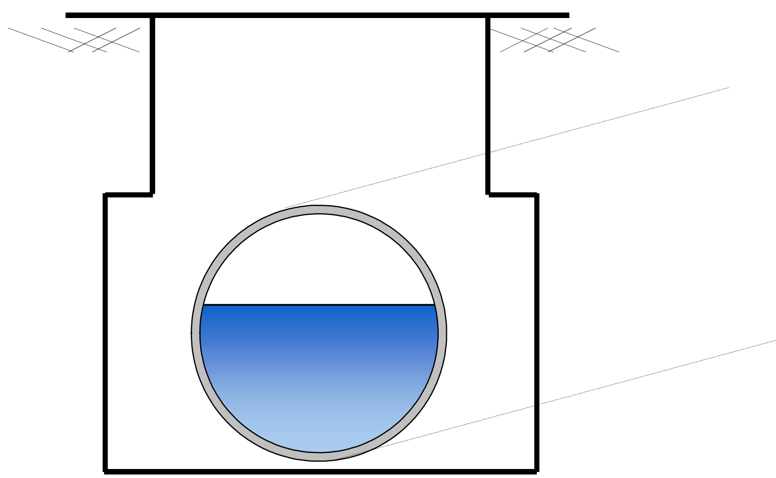
0.100 *mgd*



SITE 19
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

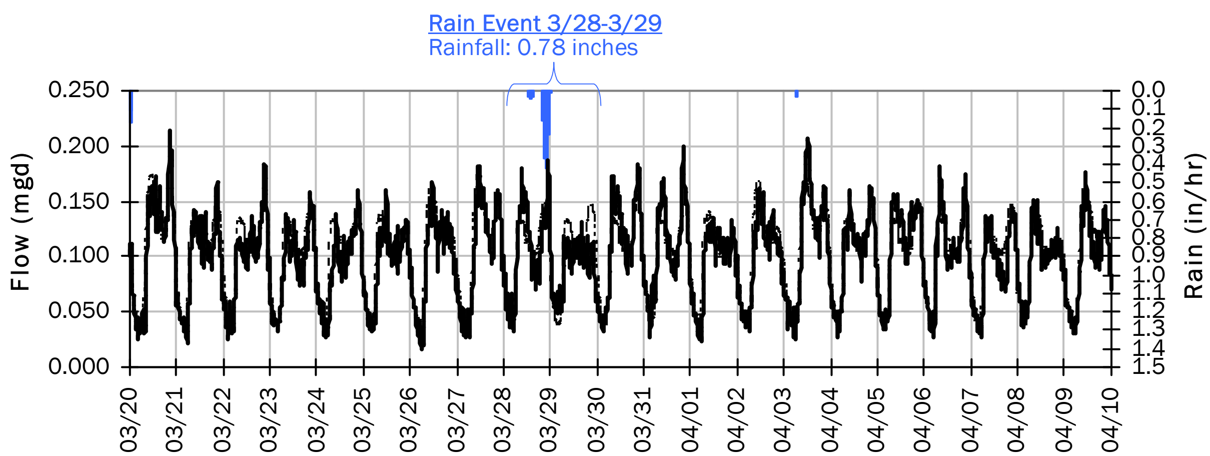




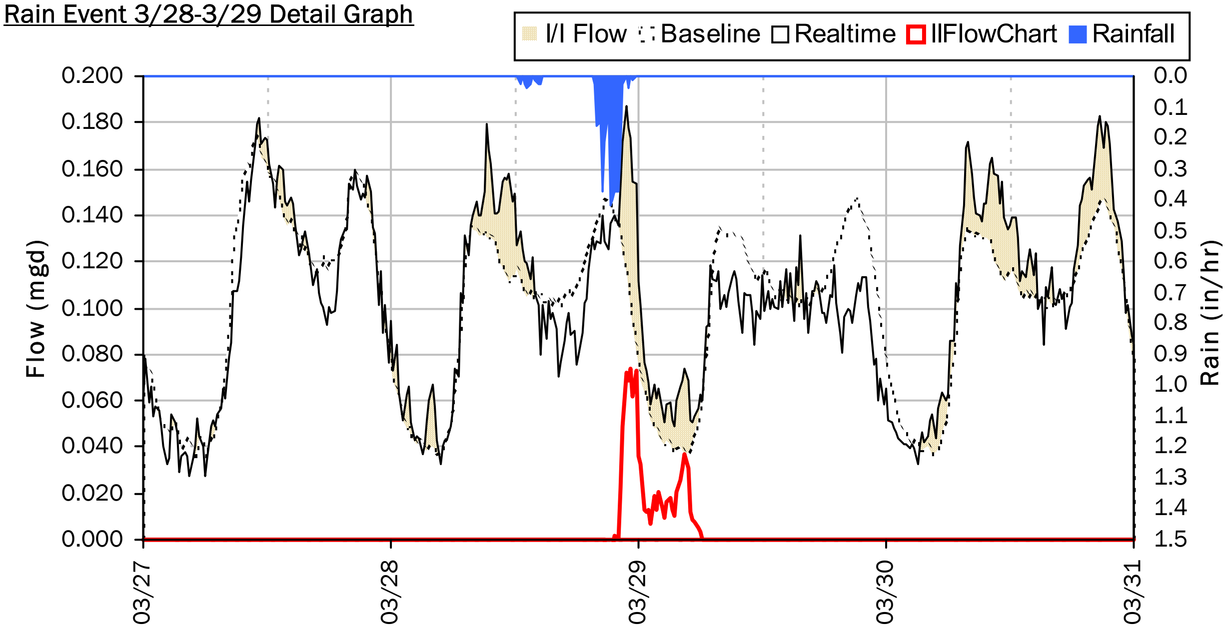
Pipe Diameter:	12	*inches*
Peak Measured Level:	7.35	*inches*
Peak d/D Ratio:	0.61	

SITE 19
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



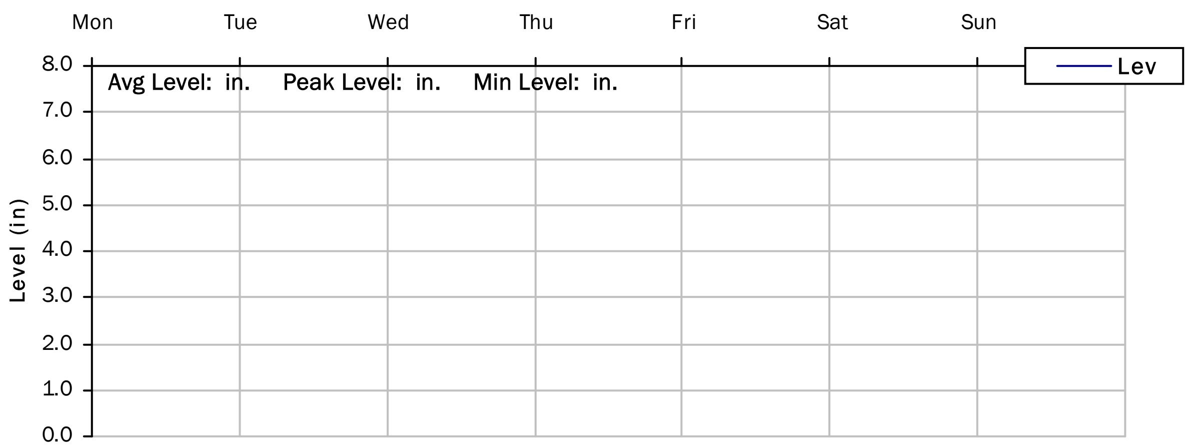
Storm Event I/I Analysis (Rain = 0.78 inches)

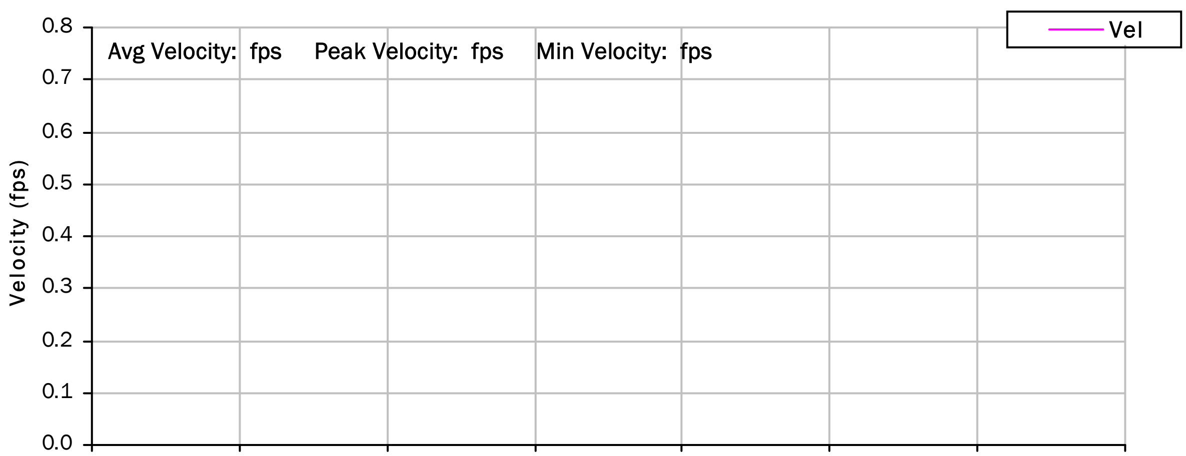
Capacity		Inflow / Infiltration	
Peak Flow:	0.188 *mgd*	Peak I/I Rate:	0.074 *mgd*
PF:	1.87	Total I/I:	9,000 *gallons*
Peak Level:	7.35 *in*		
d/D Ratio:	0.61		

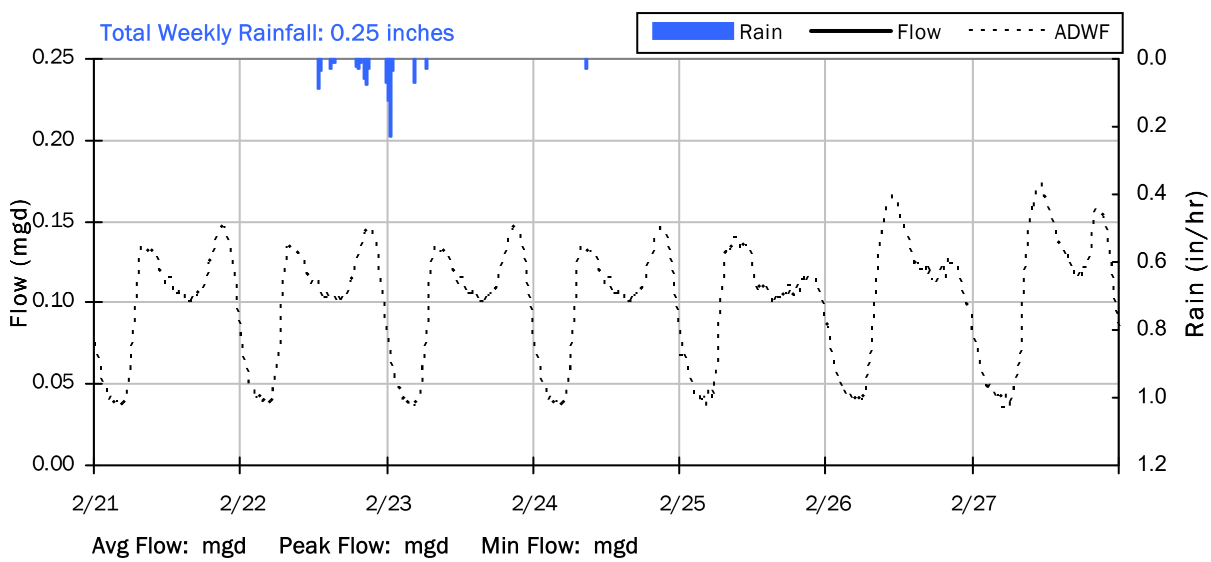
SITE 19

Weekly Level, Velocity and Flow Hydrographs

2/21/2022 to 2/28/2022



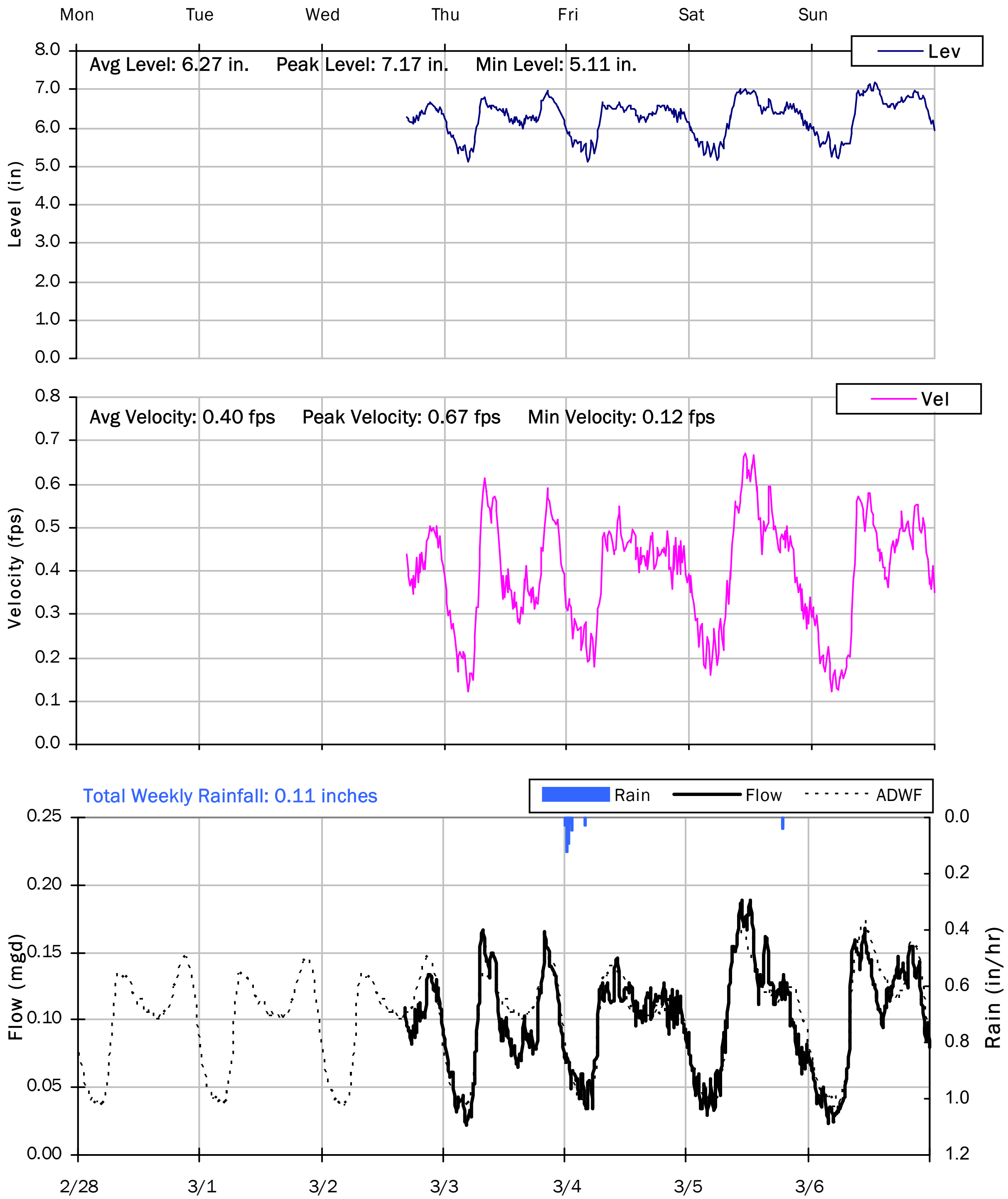




SITE 19

Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022

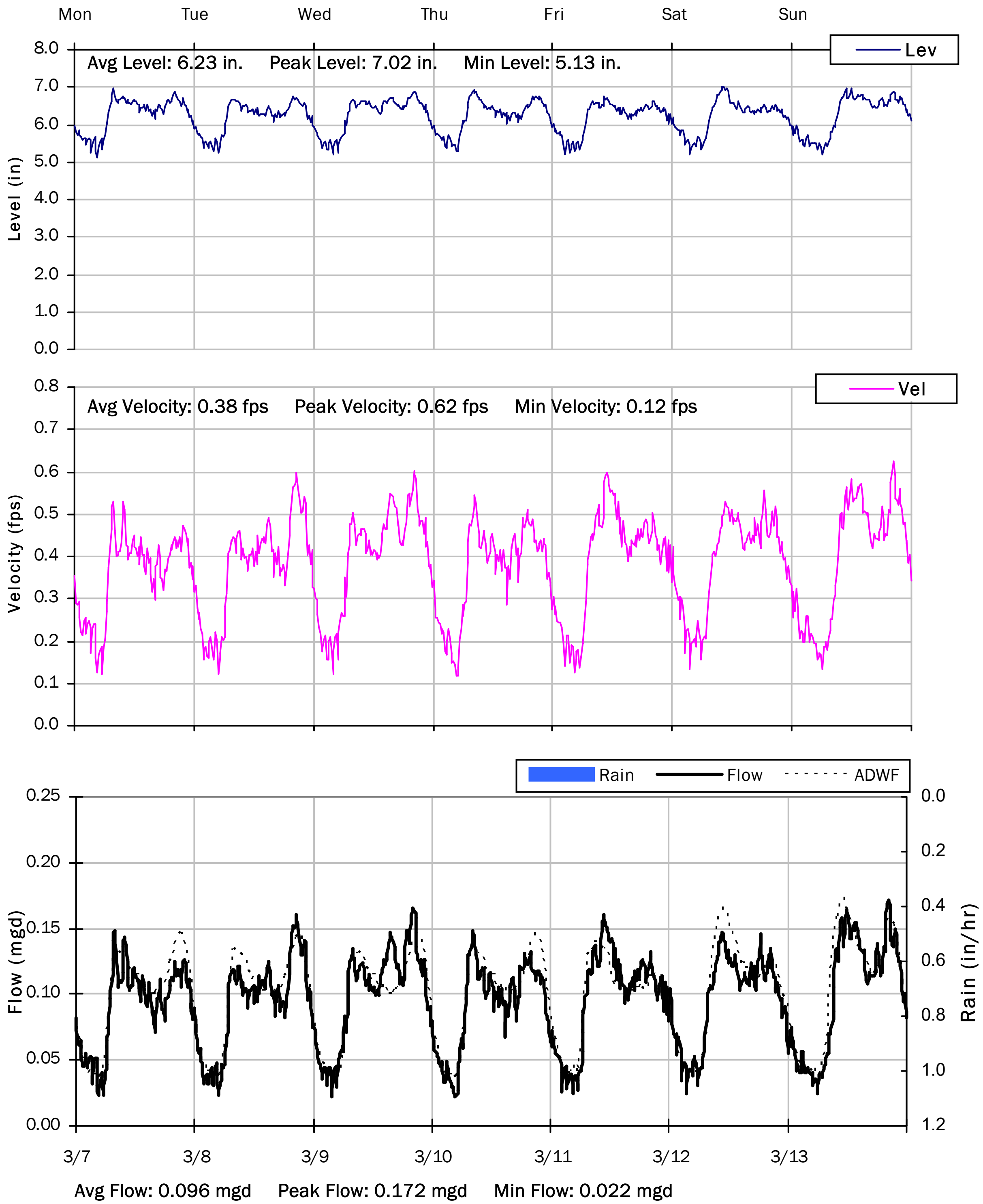


Avg Flow: 0.100 mgd   Peak Flow: 0.189 mgd   Min Flow: 0.022 mgd

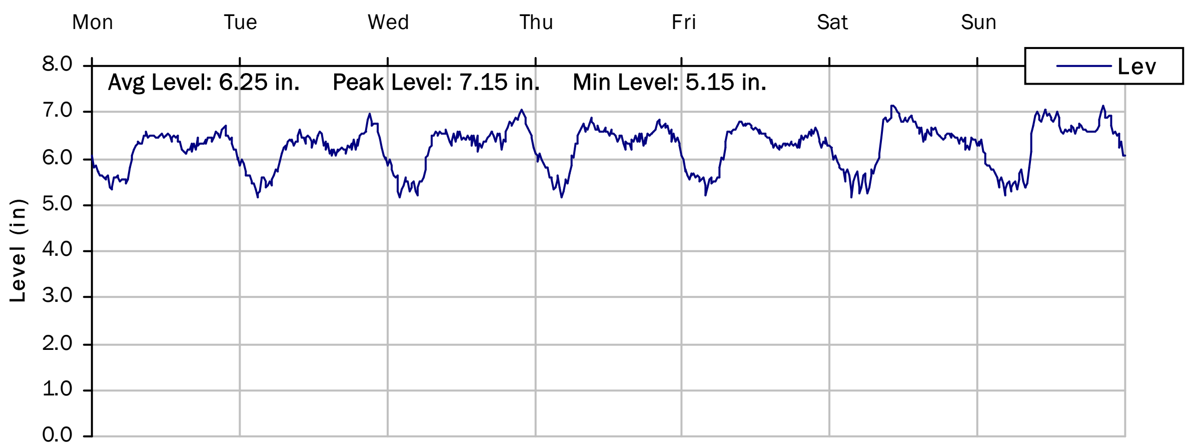
SITE 19

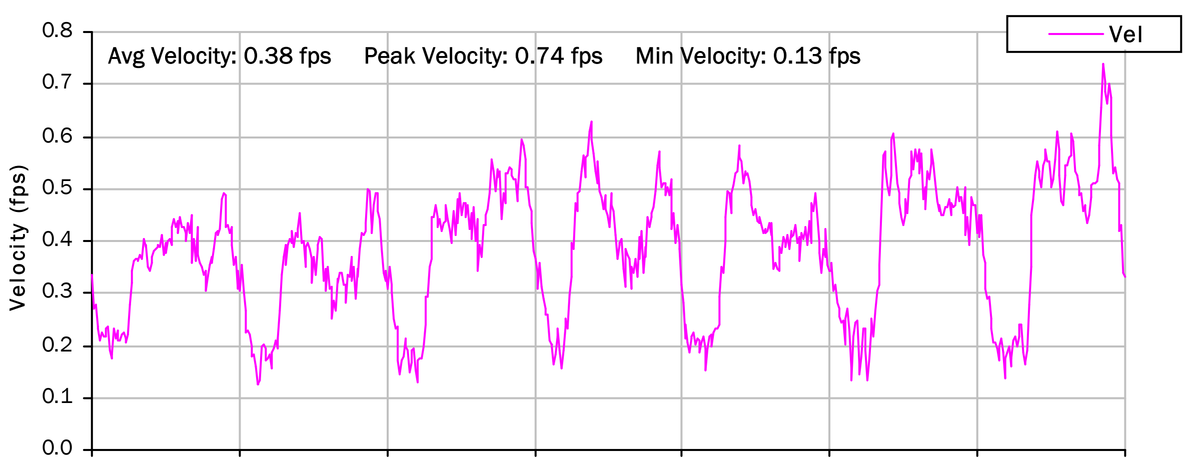
Weekly Level, Velocity and Flow Hydrographs

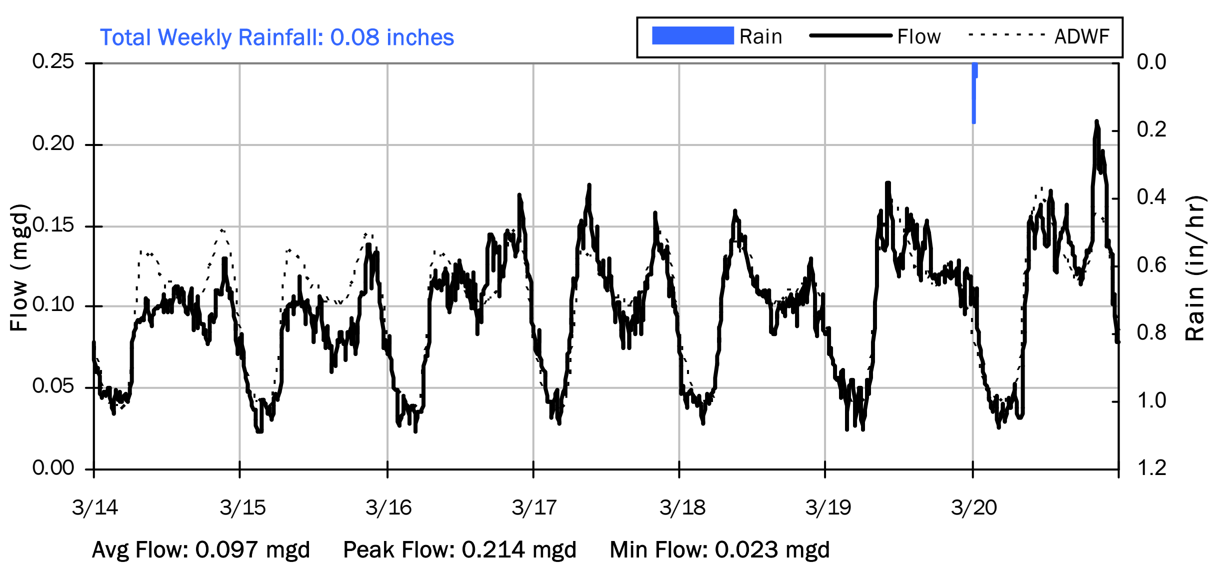
3/7/2022 to 3/14/2022



SITE 19
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



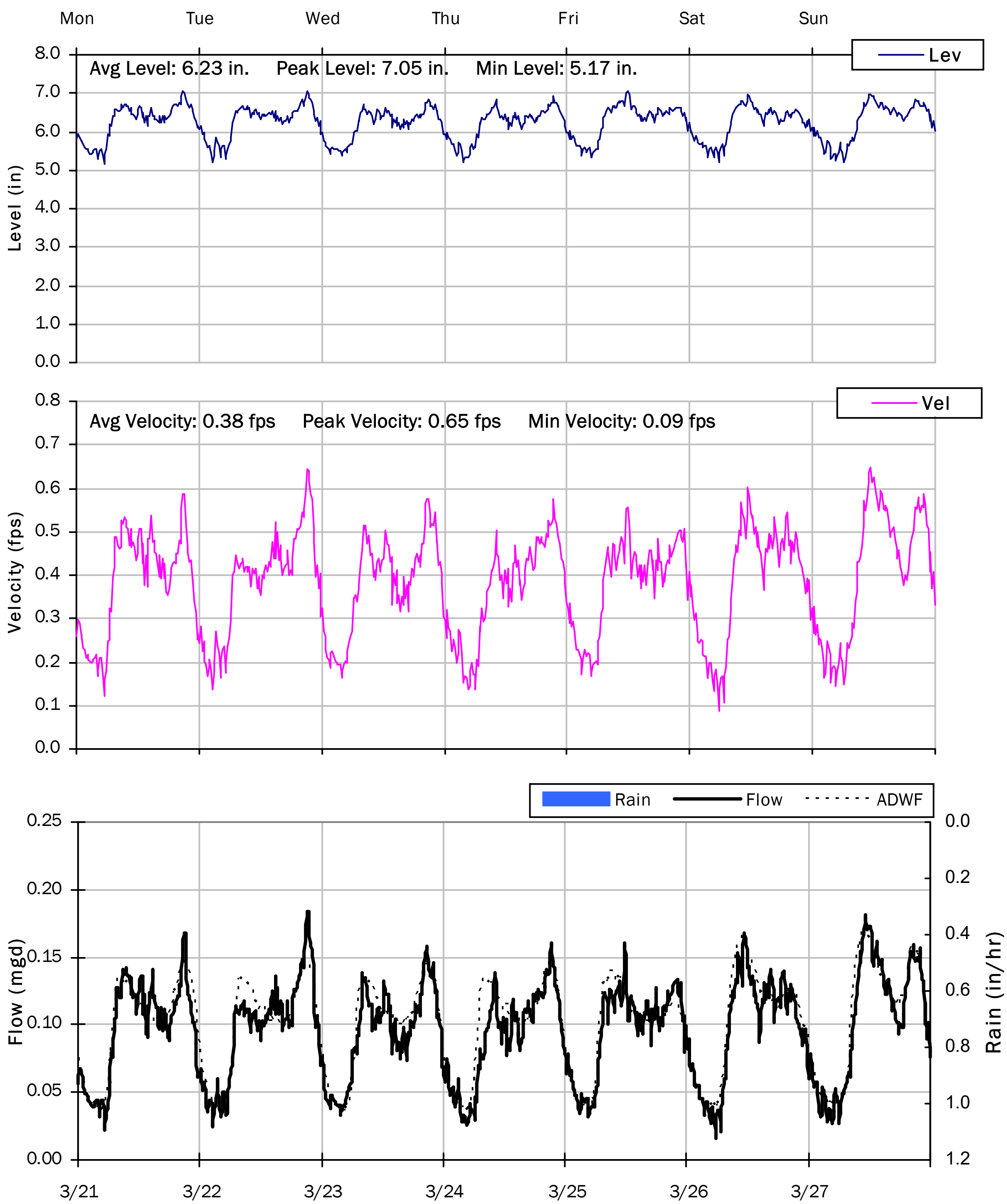




SITE 19

Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022

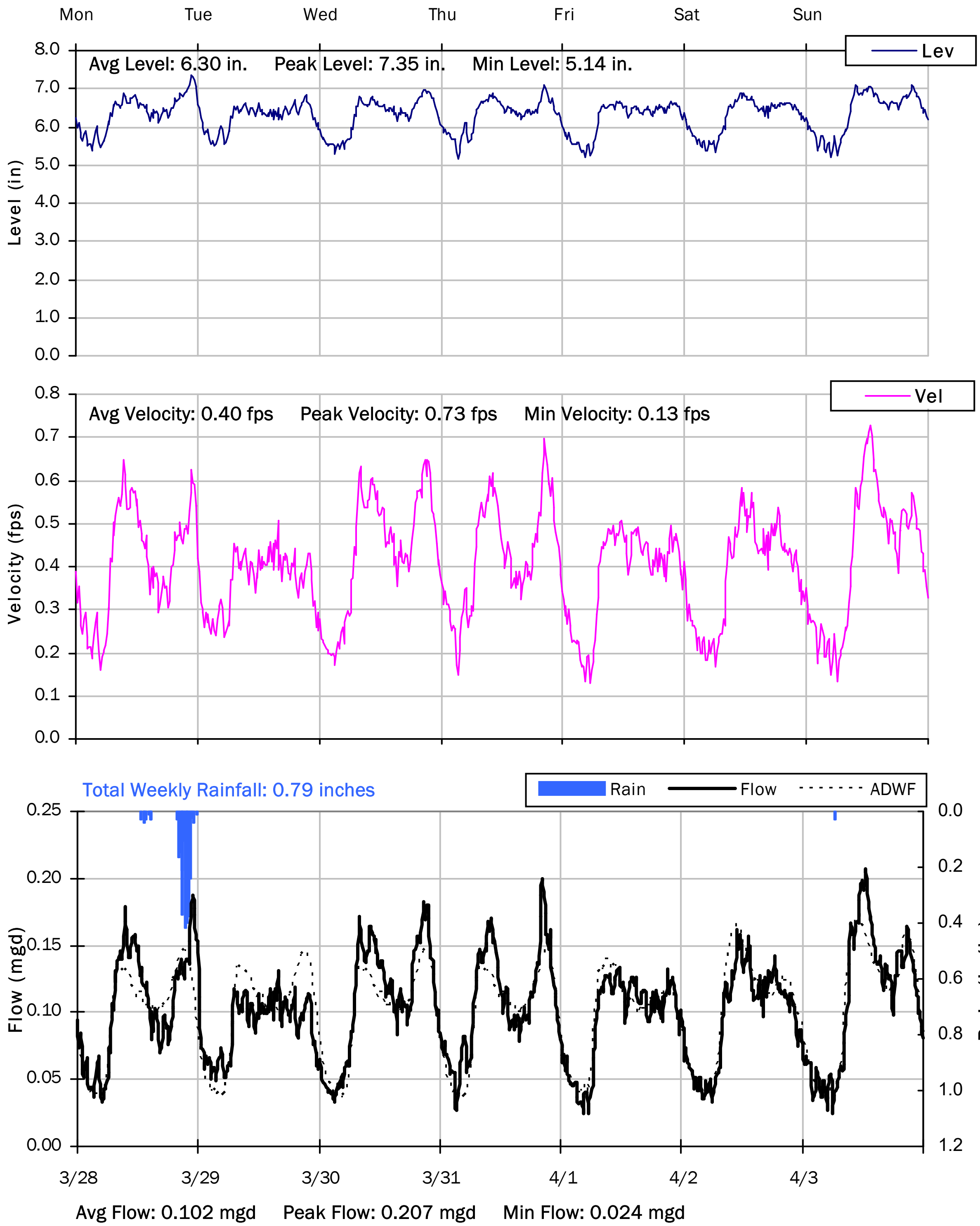


Avg Flow: 0.096 mgd Peak Flow: 0.184 mgd Min Flow: 0.016 mgd

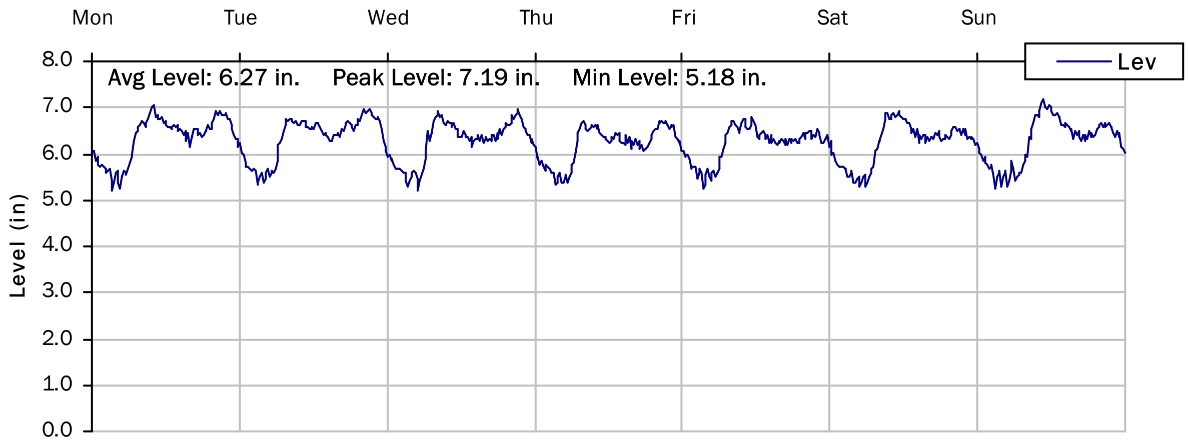
SITE 19

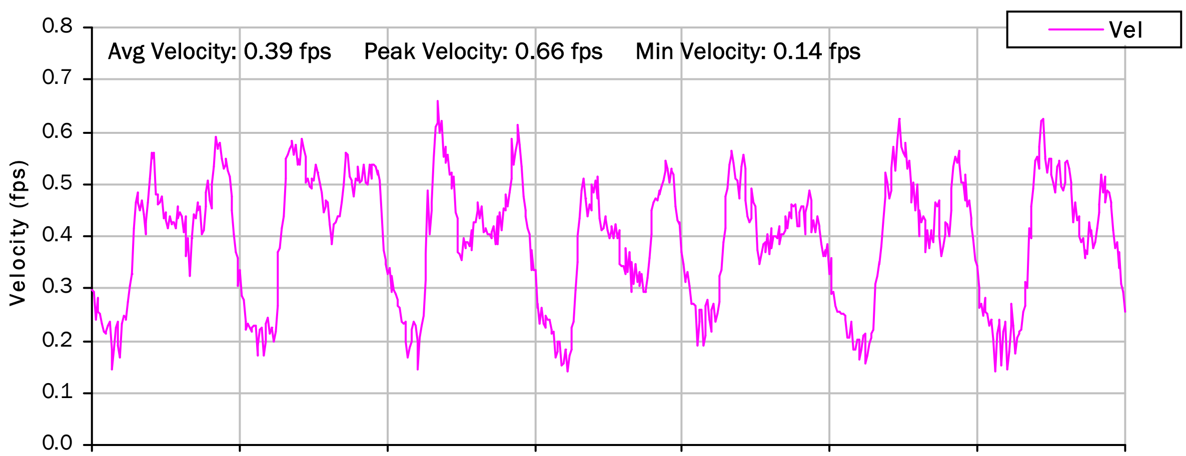
Weekly Level, Velocity and Flow Hydrographs

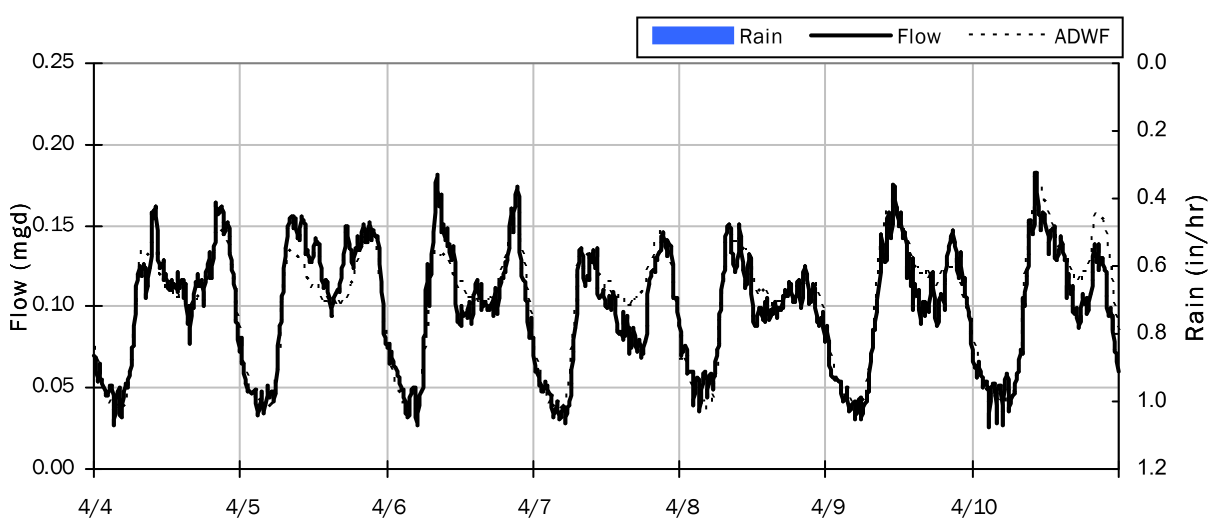
3/28/2022 to 4/4/2022



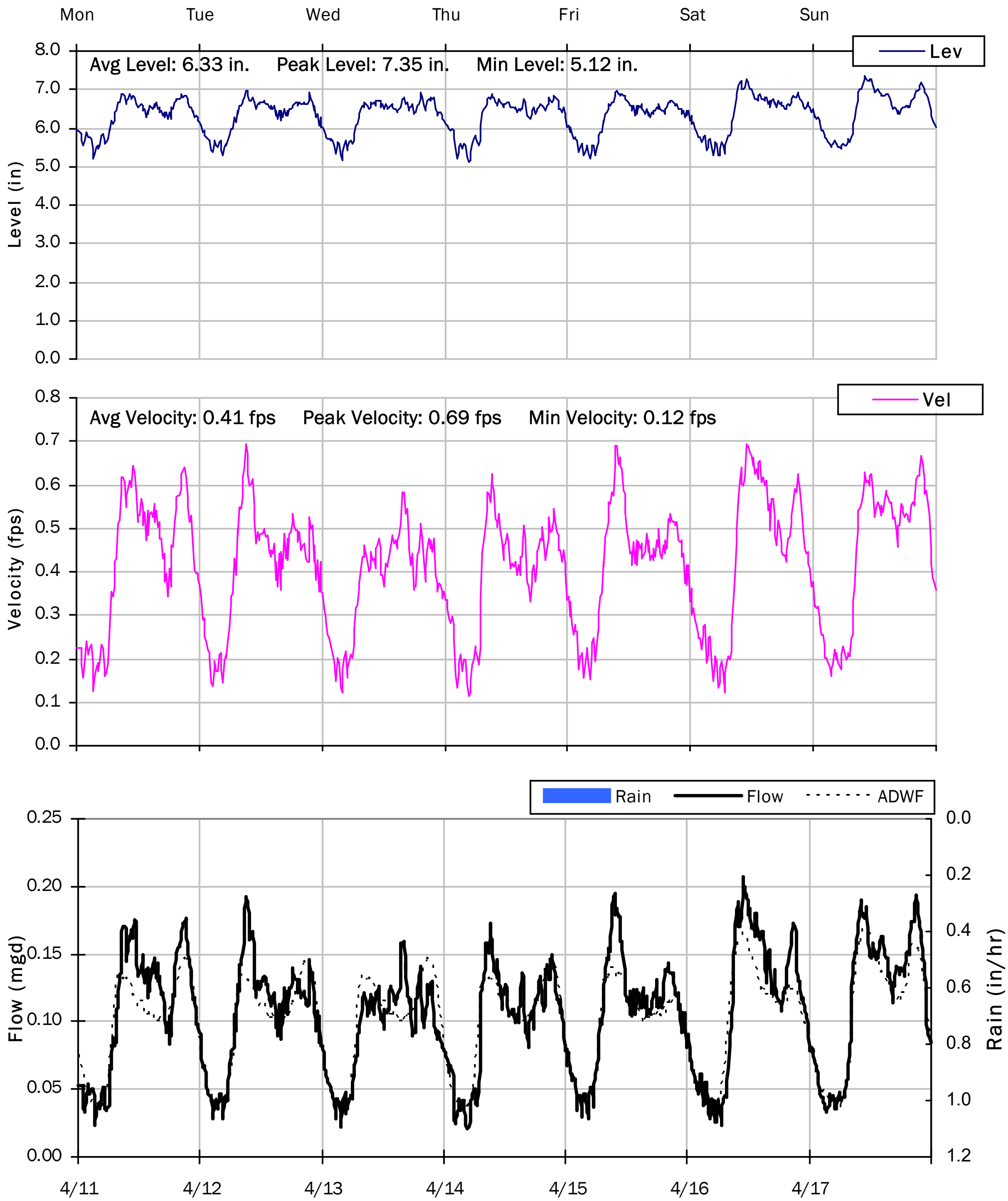
SITE 19
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022







SITE 19
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

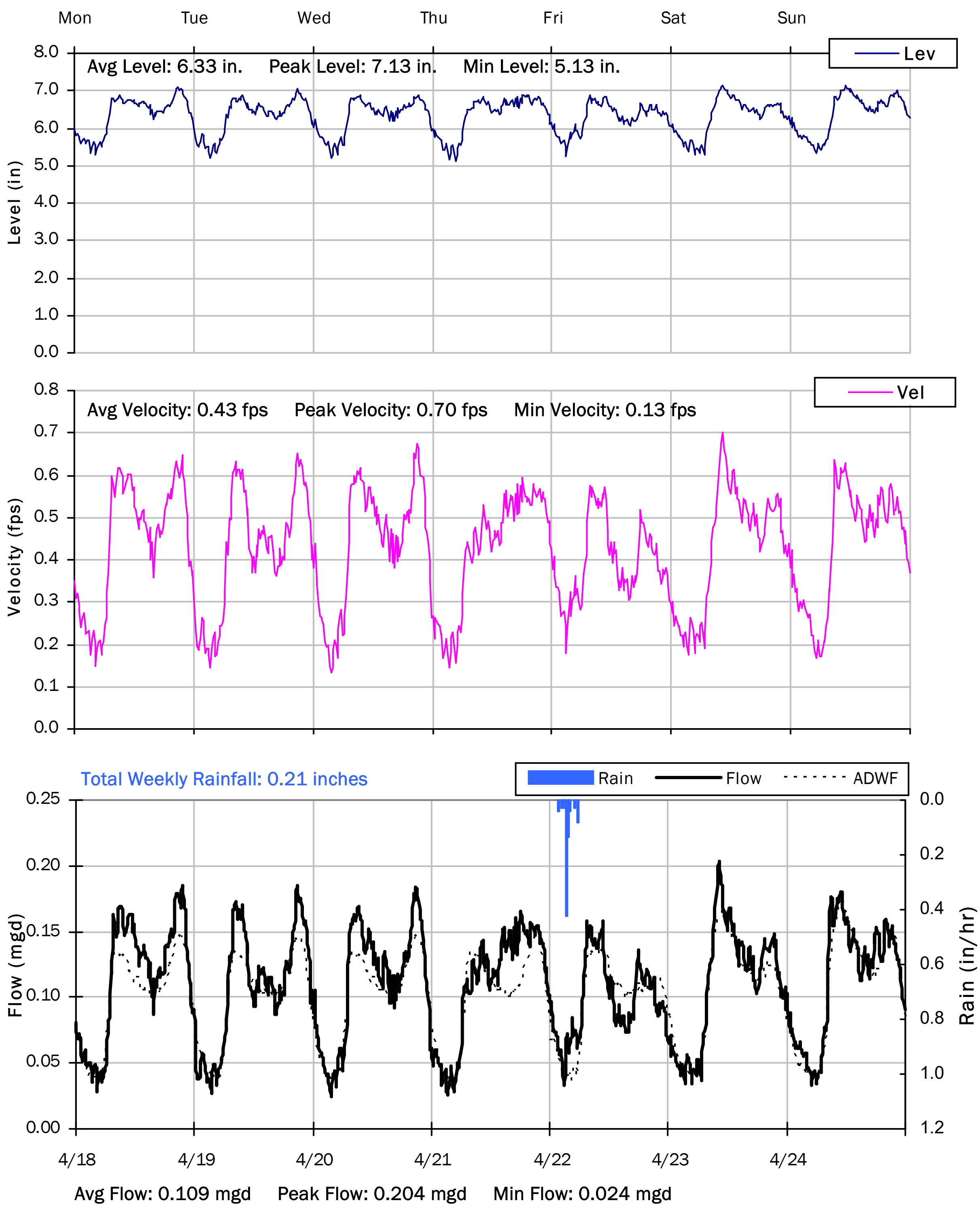


Avg Flow: 0.106 mgd   Peak Flow: 0.206 mgd   Min Flow: 0.021 mgd

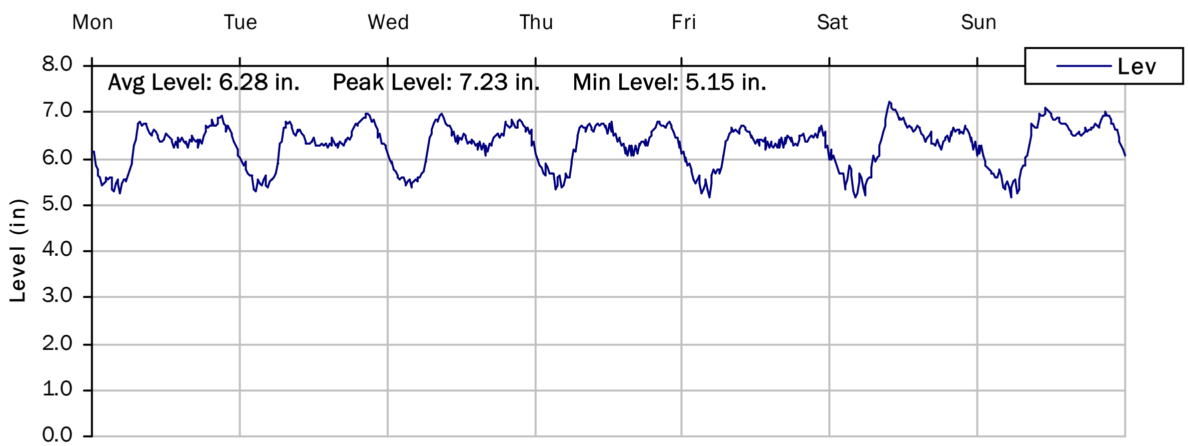
SITE 19

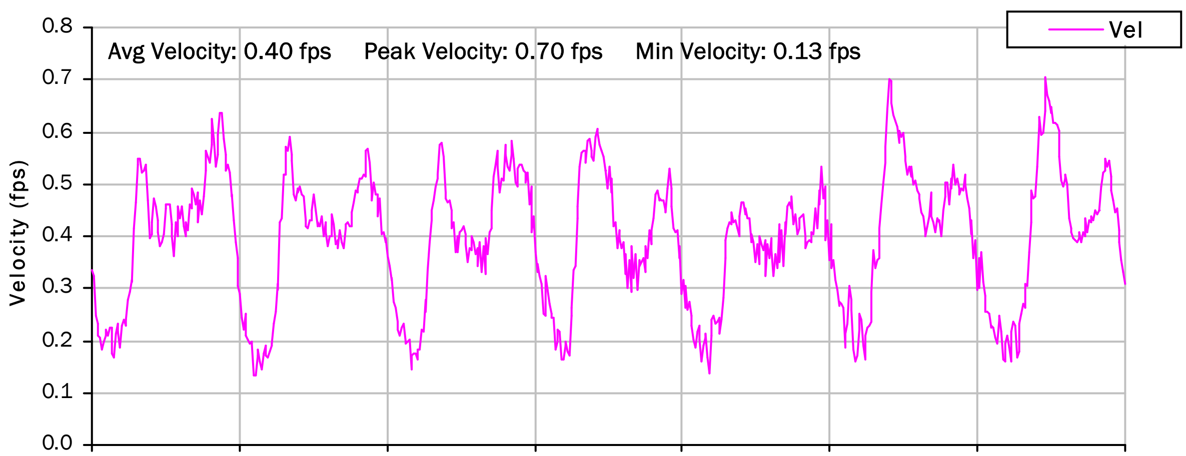
Weekly Level, Velocity and Flow Hydrographs

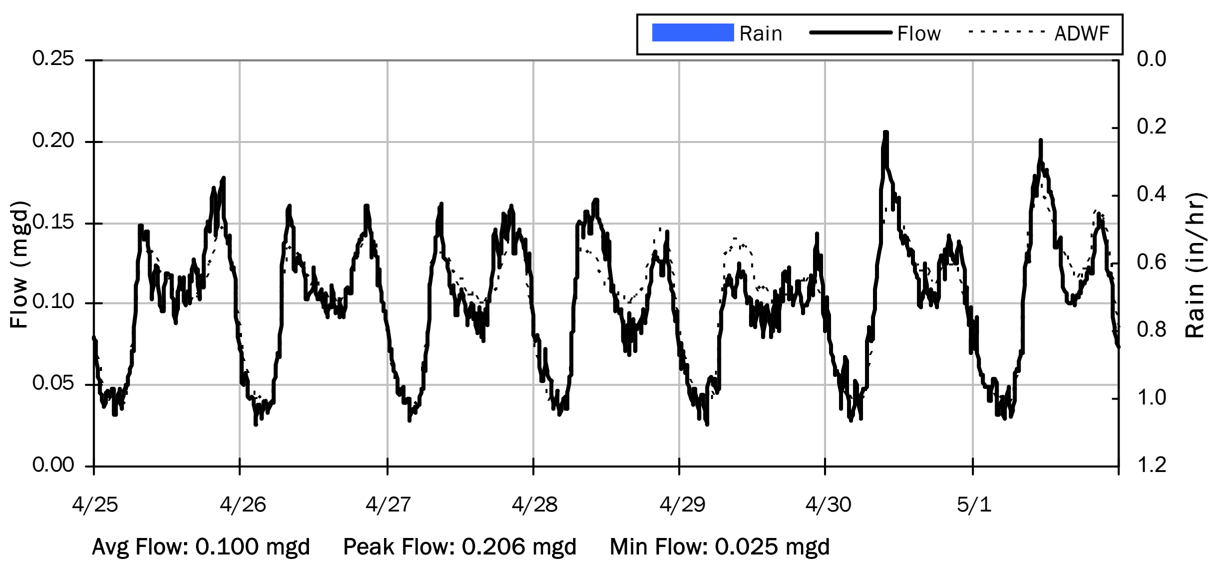
4/18/2022 to 4/25/2022



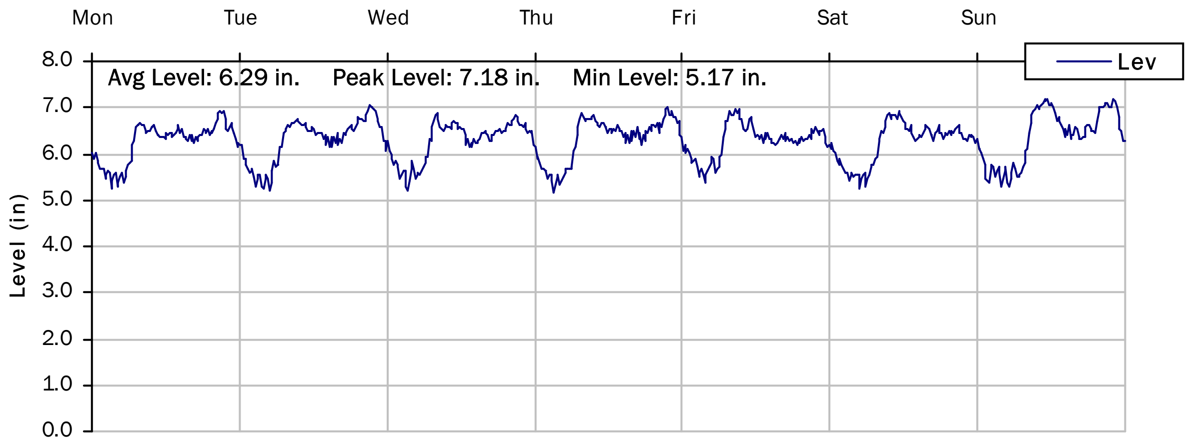
SITE 19
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

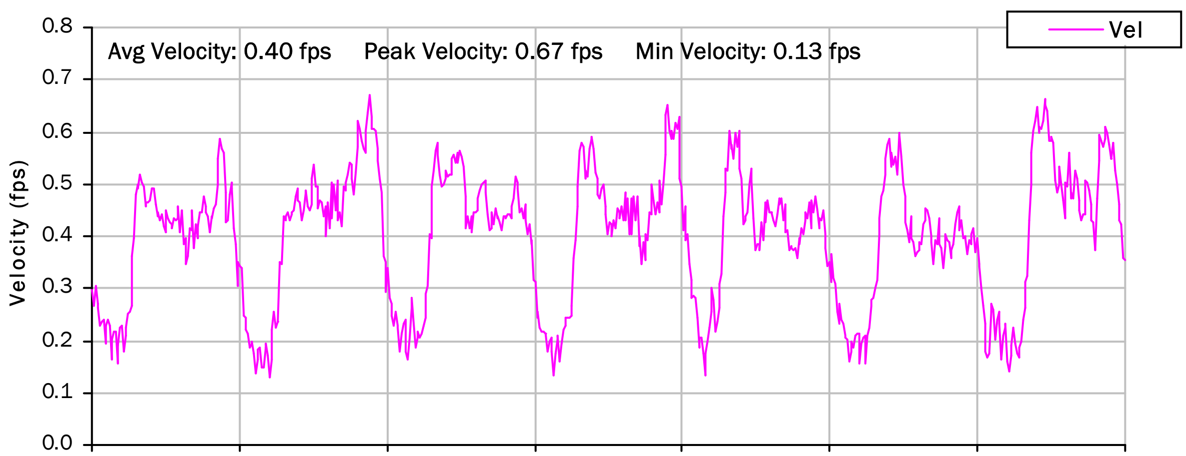


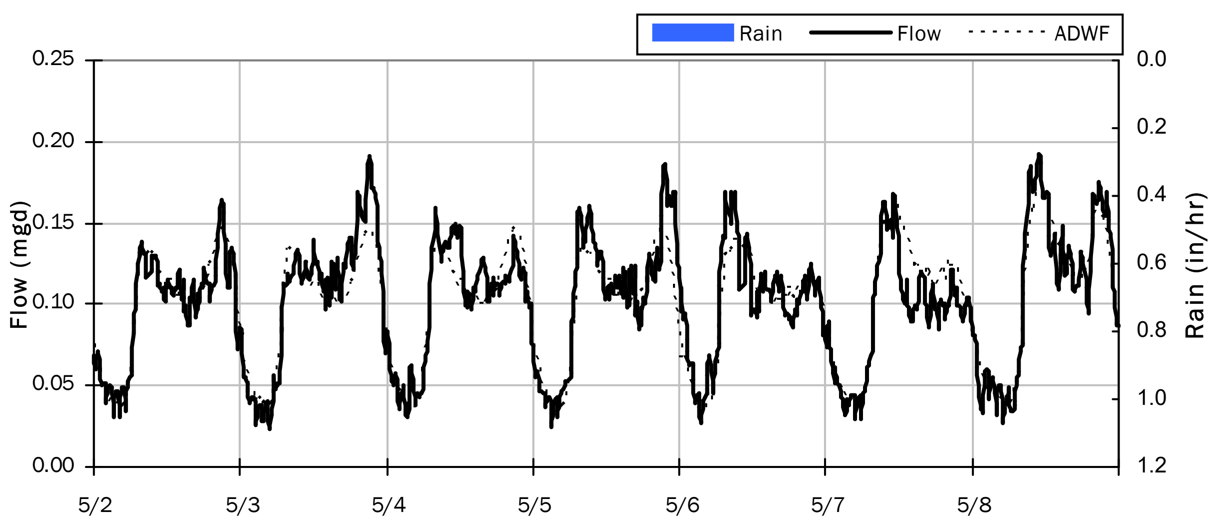




SITE 19
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022





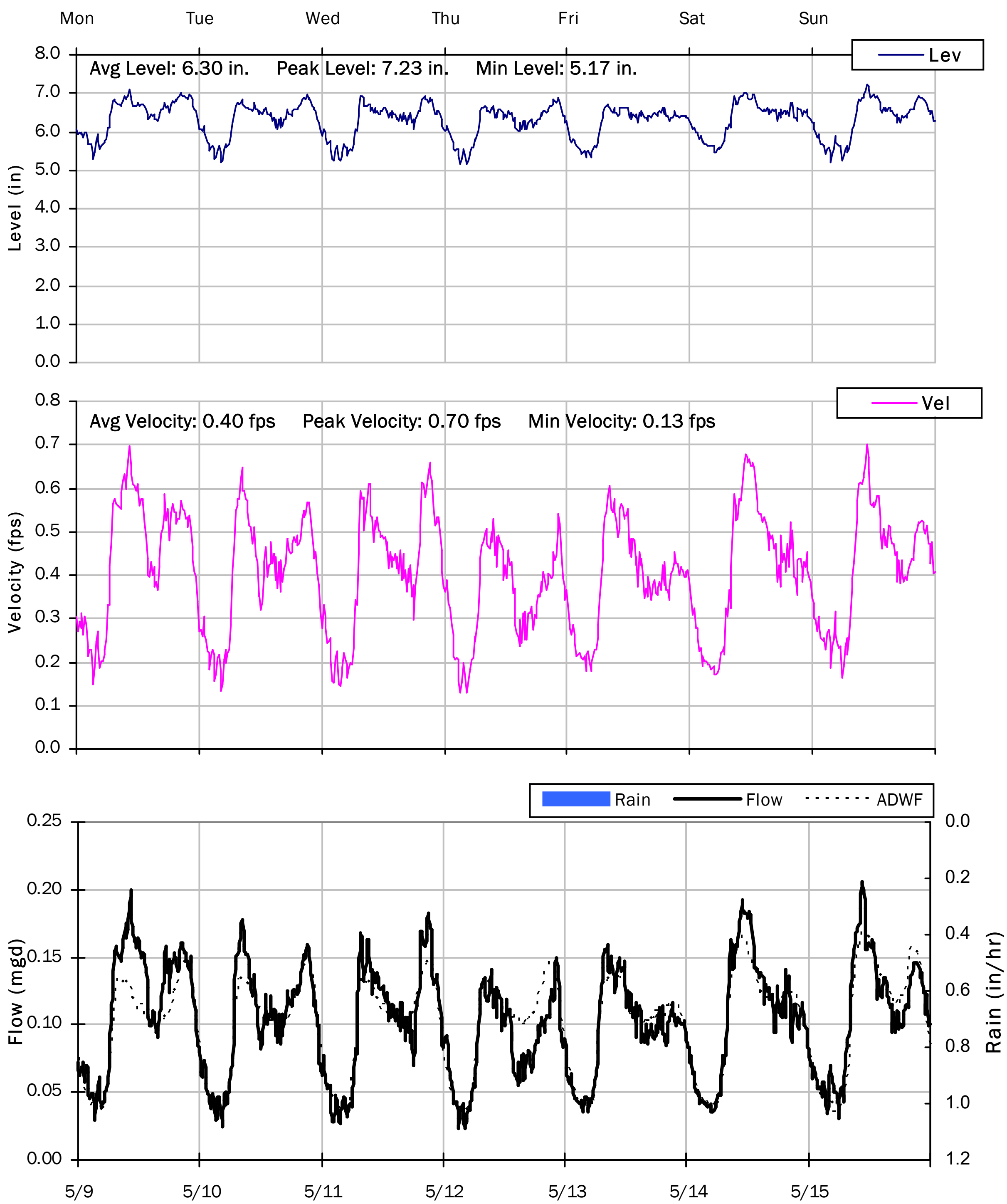


Avg Flow: 0.102 mgd   Peak Flow: 0.193 mgd   Min Flow: 0.024 mgd

SITE 19

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022

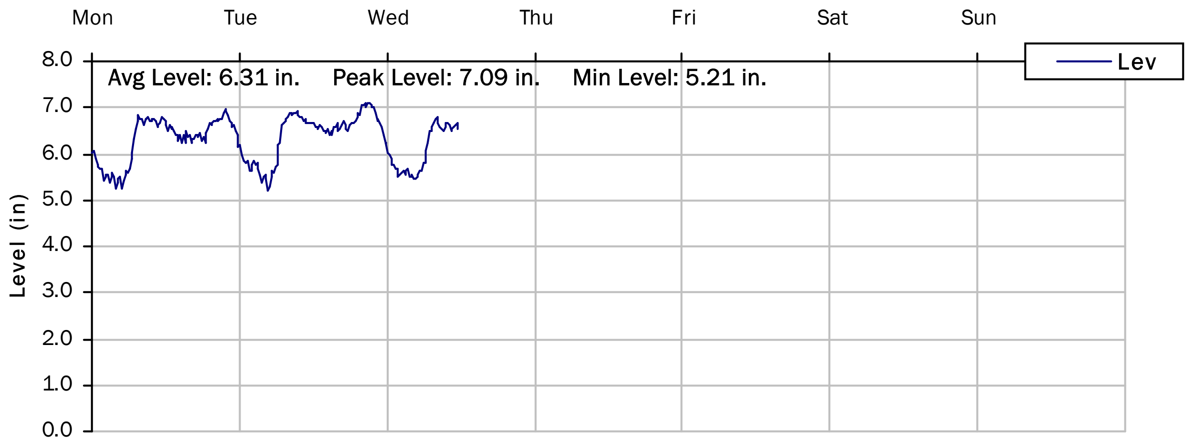


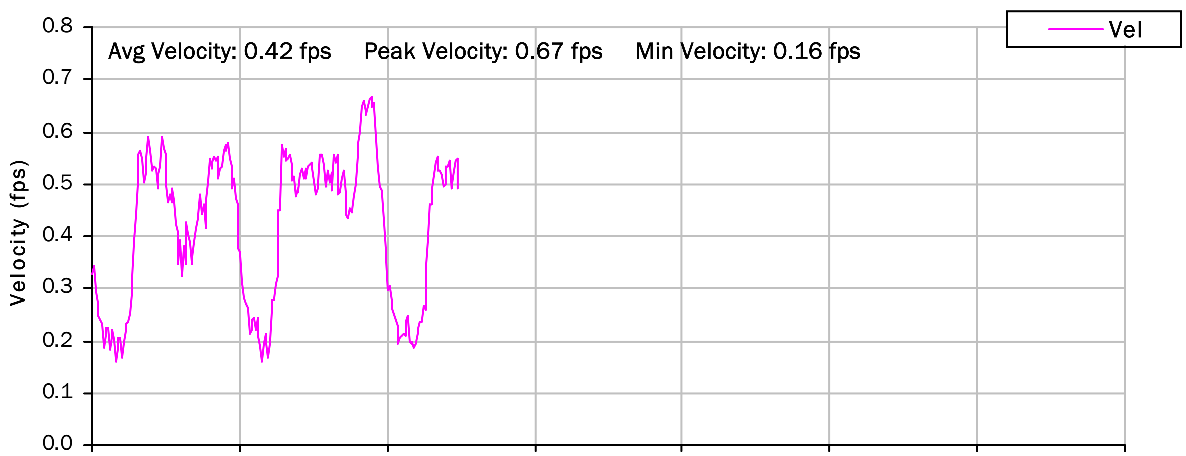
Avg Flow: 0.103 mgd Peak Flow: 0.206 mgd Min Flow: 0.023 mgd

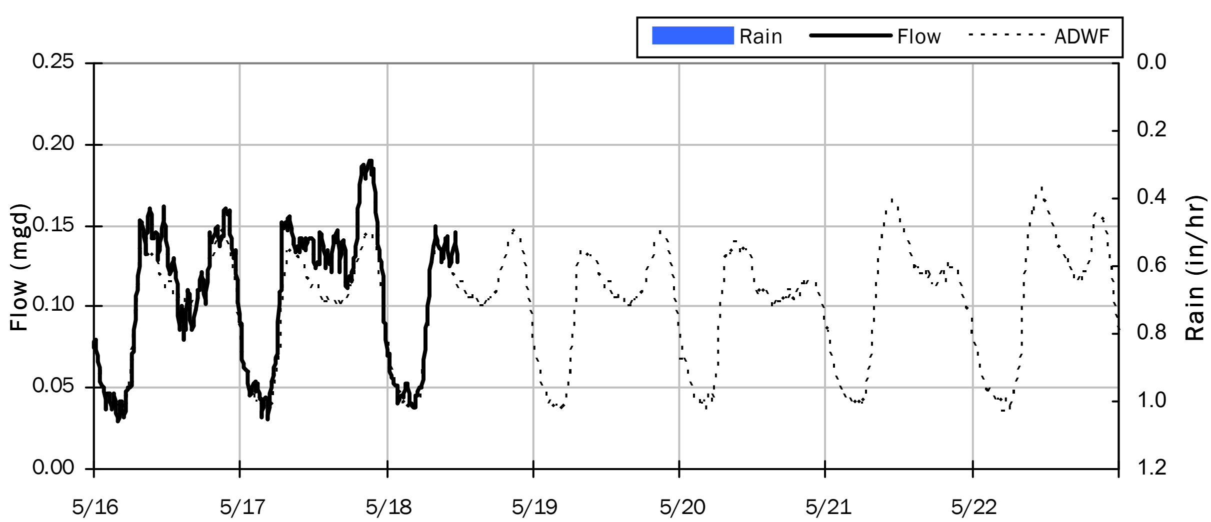
SITE 19

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022







Avg Flow: 0.107 mgd Peak Flow: 0.190 mgd Min Flow: 0.030 mgd

Monitoring Site: Site 20

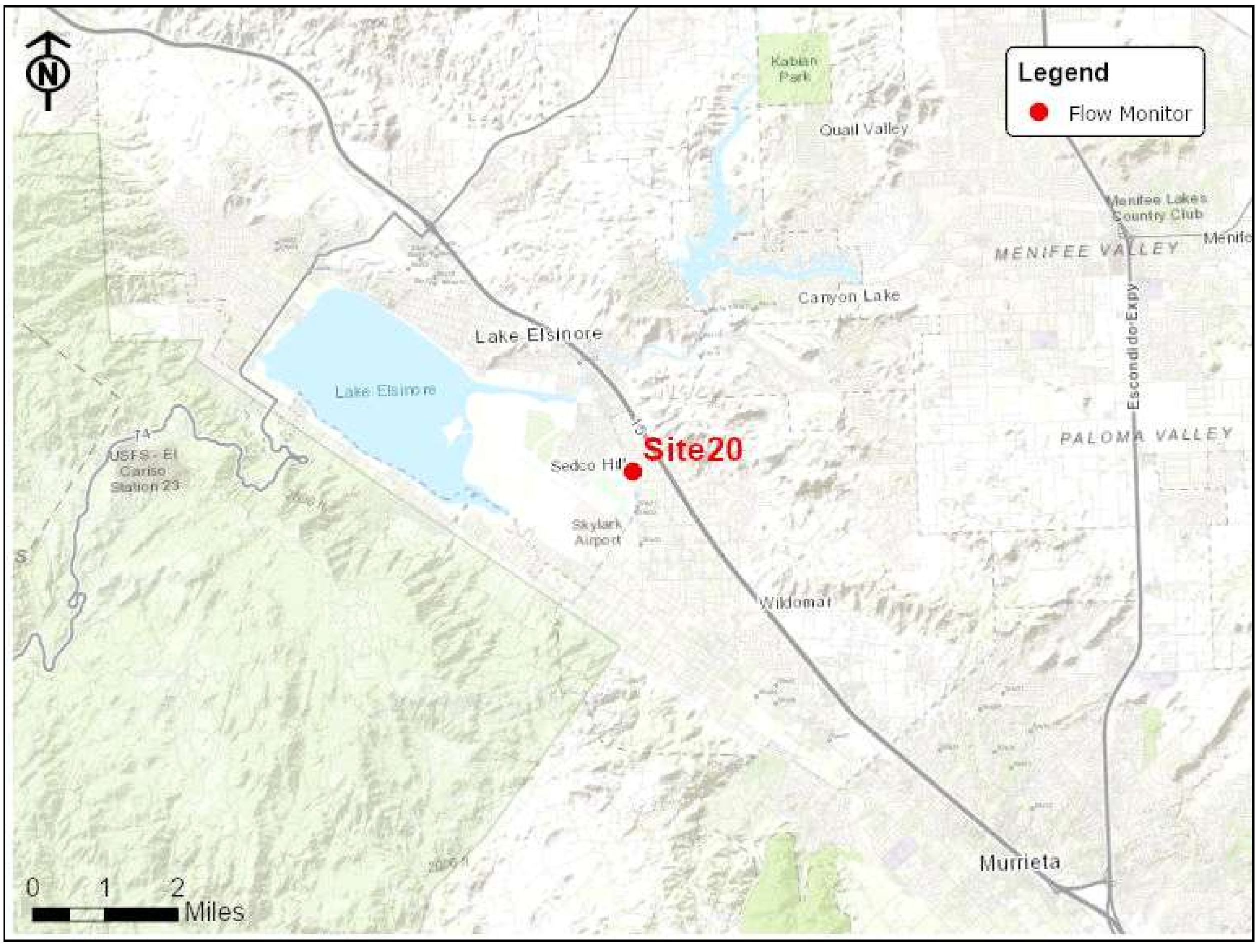
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Mission Trail and Olive Street

Data Summary Report



Vicinity Map: Site 20

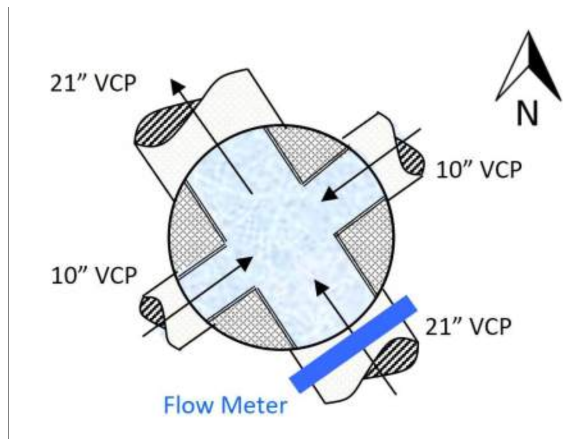
SITE 20

Site Information MH ID: MH-3247

Location:	Mission Trail and Olive Street
Coordinates:	117.2914° W, 33.6416° N
Rim Elevation (Earth):	1270 feet
Expected Pipe Diameter:	21 inches
Measured Pipe Diameter:	21 inches
ADWF:	1.730 mgd
Peak Measured Flow:	2.944 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 20

Additional Site Photos

Effluent Pipe

E Influent Pipe

SITE 20

Additional Site Photos

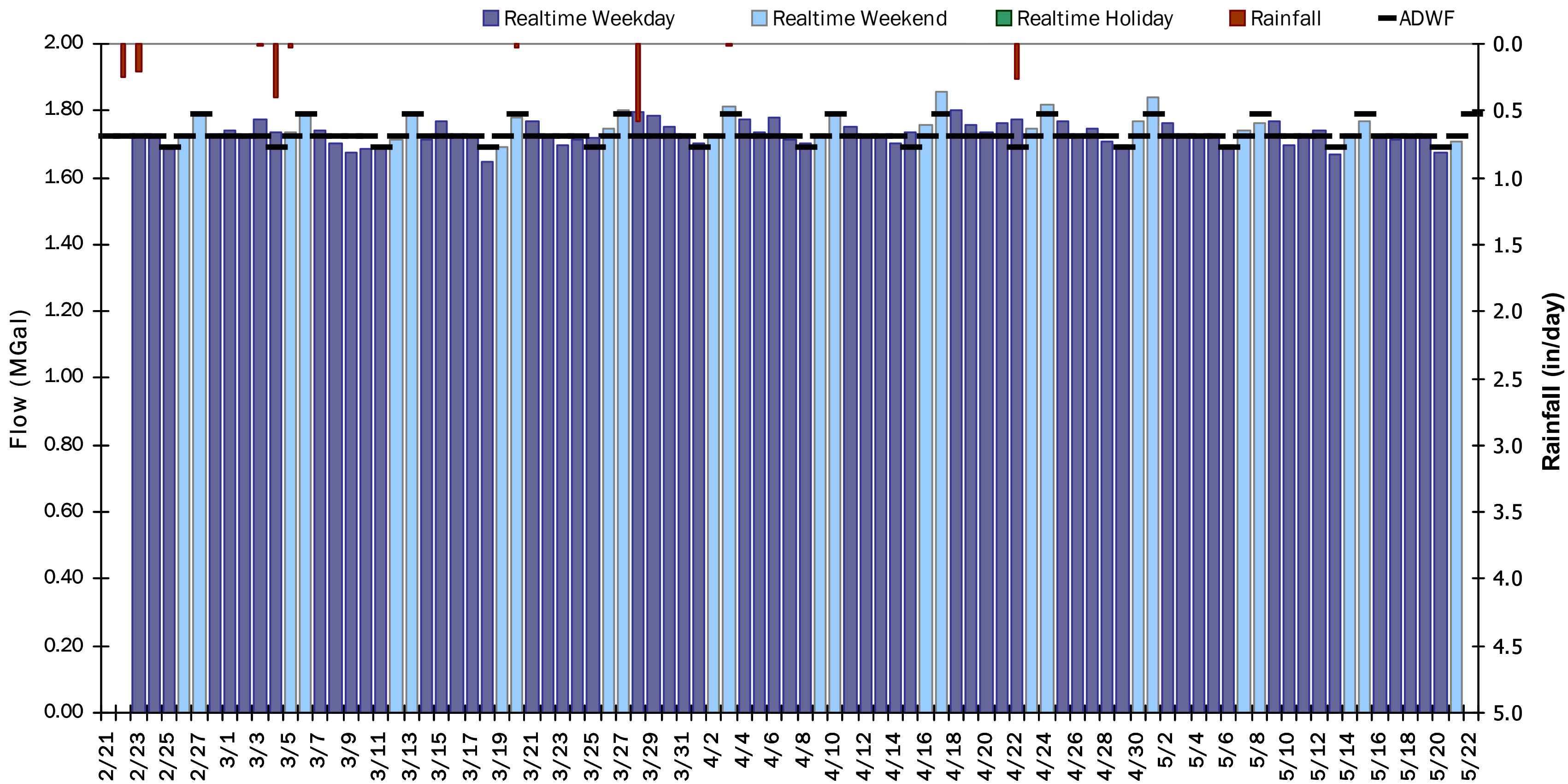
S Influent Pipe

SITE 20

Period Flow Summary: Daily Flow Totals

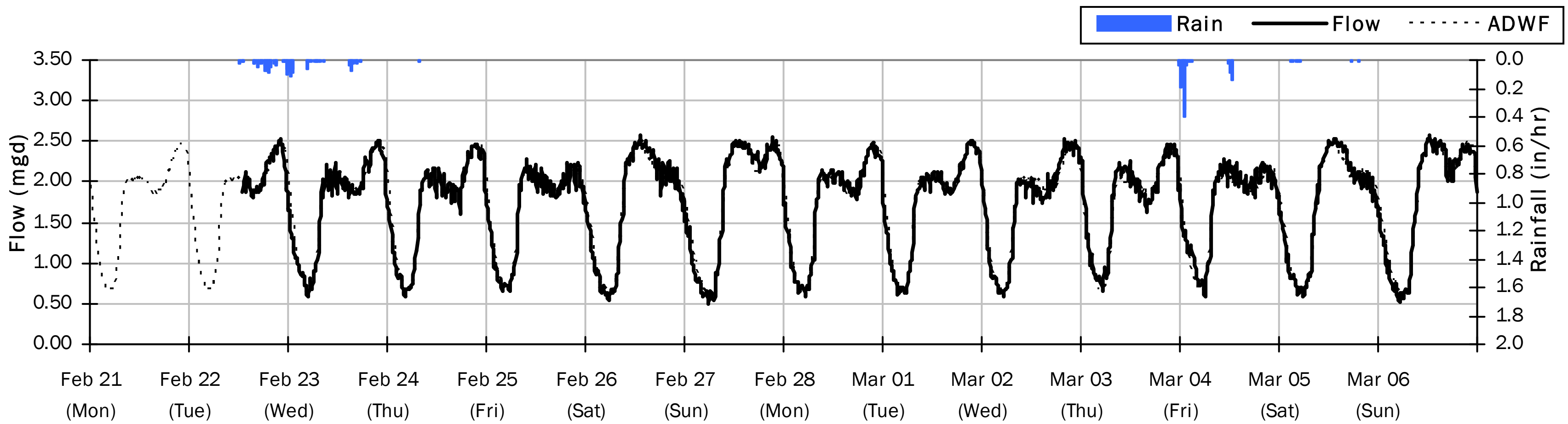
Avg Daily Flow: 1.743 MGal   Peak Daily Flow: 2.115 MGal   Min Daily Flow: 1.647 MGal

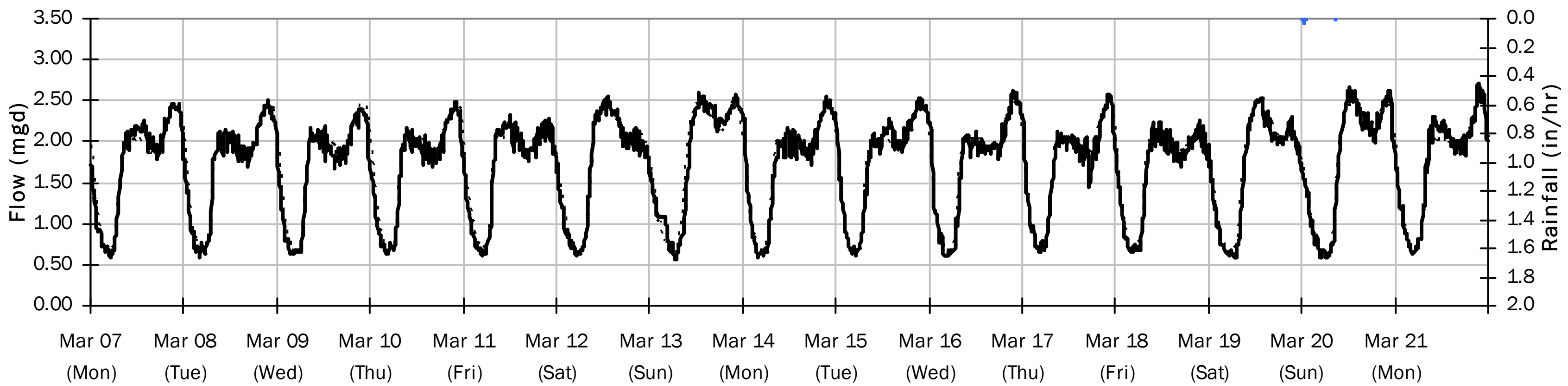
Total Rainfall: 1.79 inches



SITE 20
Flow Summary: 2/21/2022 to 3/21/2022

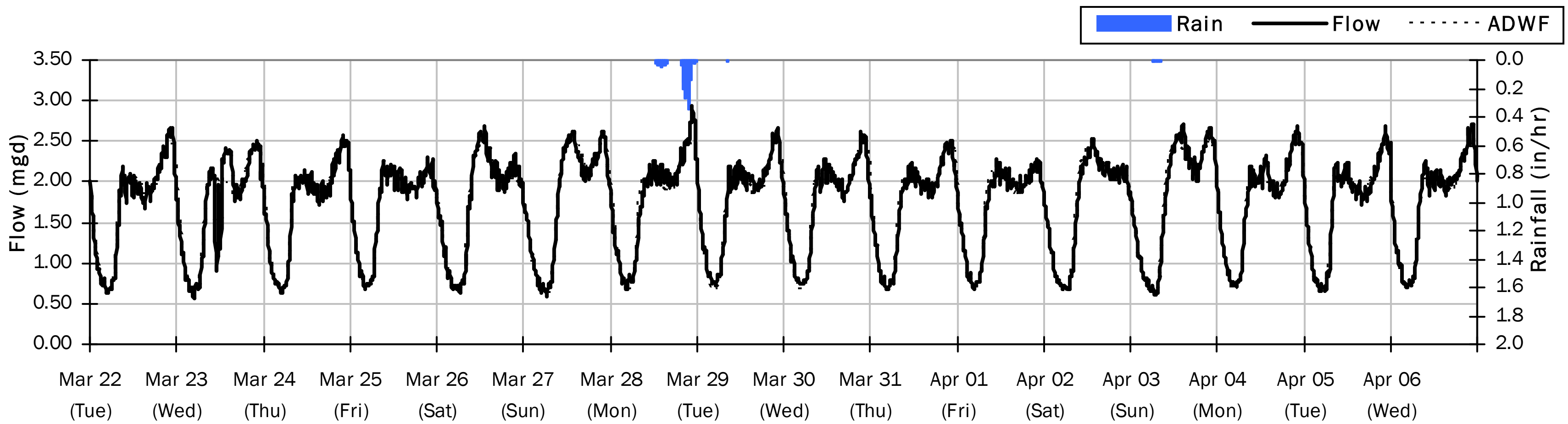
Period Rainfall: 0.94 inches   Period Avg Flow: 1.736 mgd   Period Peak Flow: 2.701 mgd   Period Min Flow: 0.507 mgd

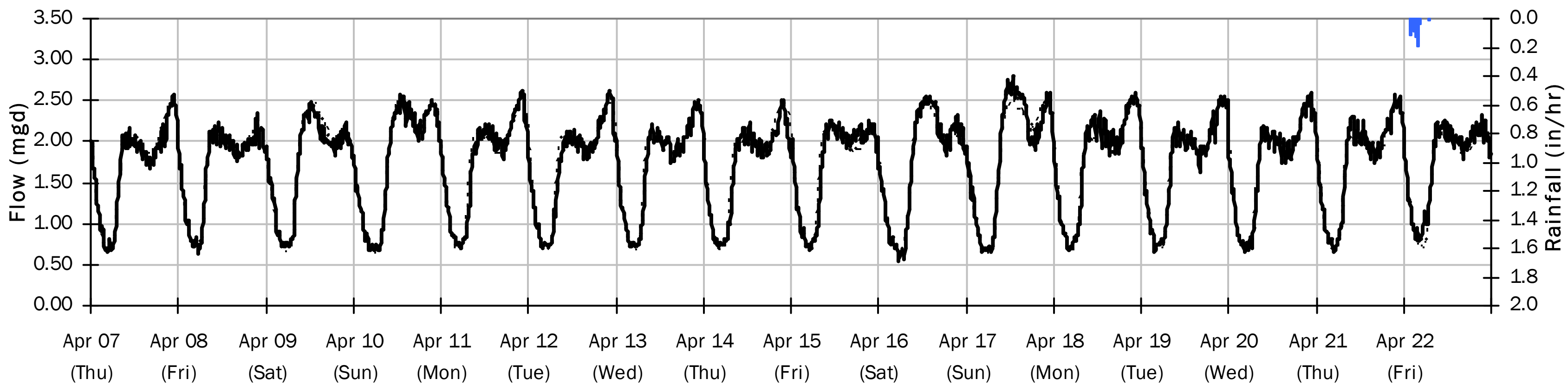




SITE 20
Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.87 inches   Period Avg Flow: 1.750 mgd   Period Peak Flow: 2.944 mgd   Period Min Flow: 0.549 mgd

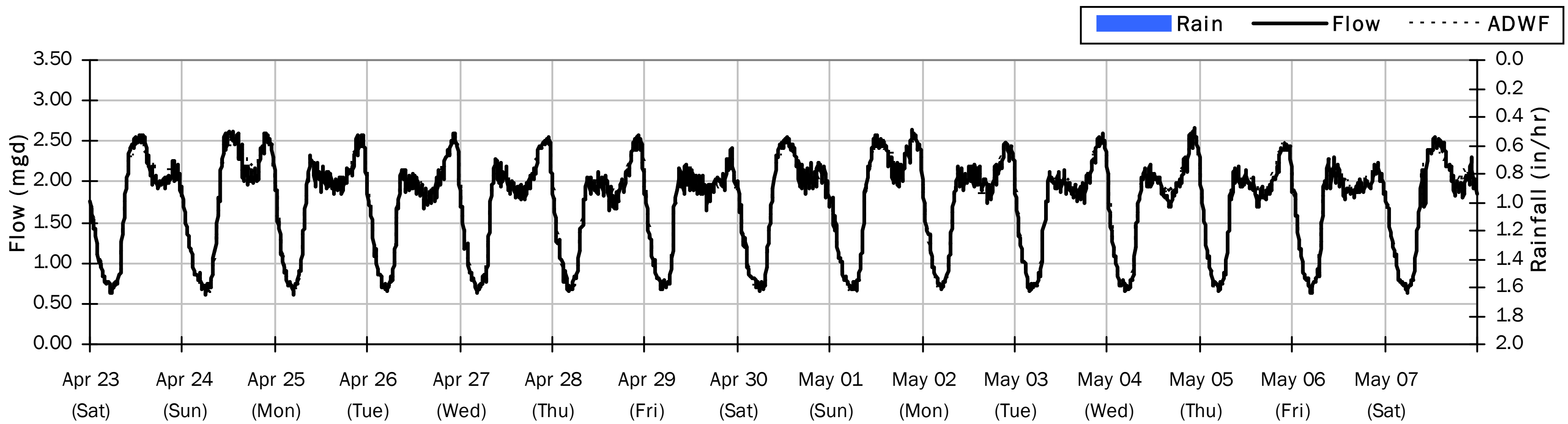


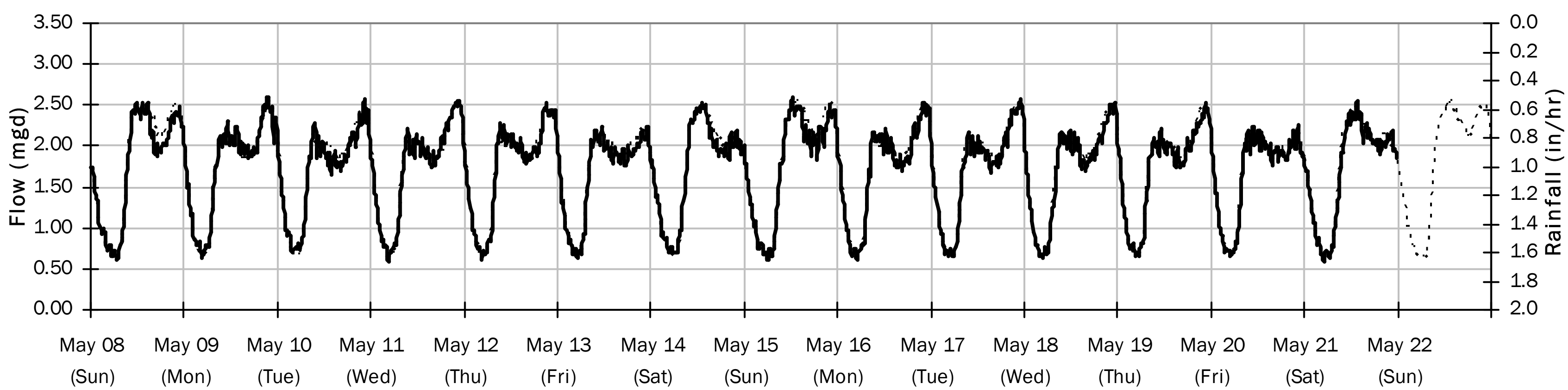


SITE 20
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

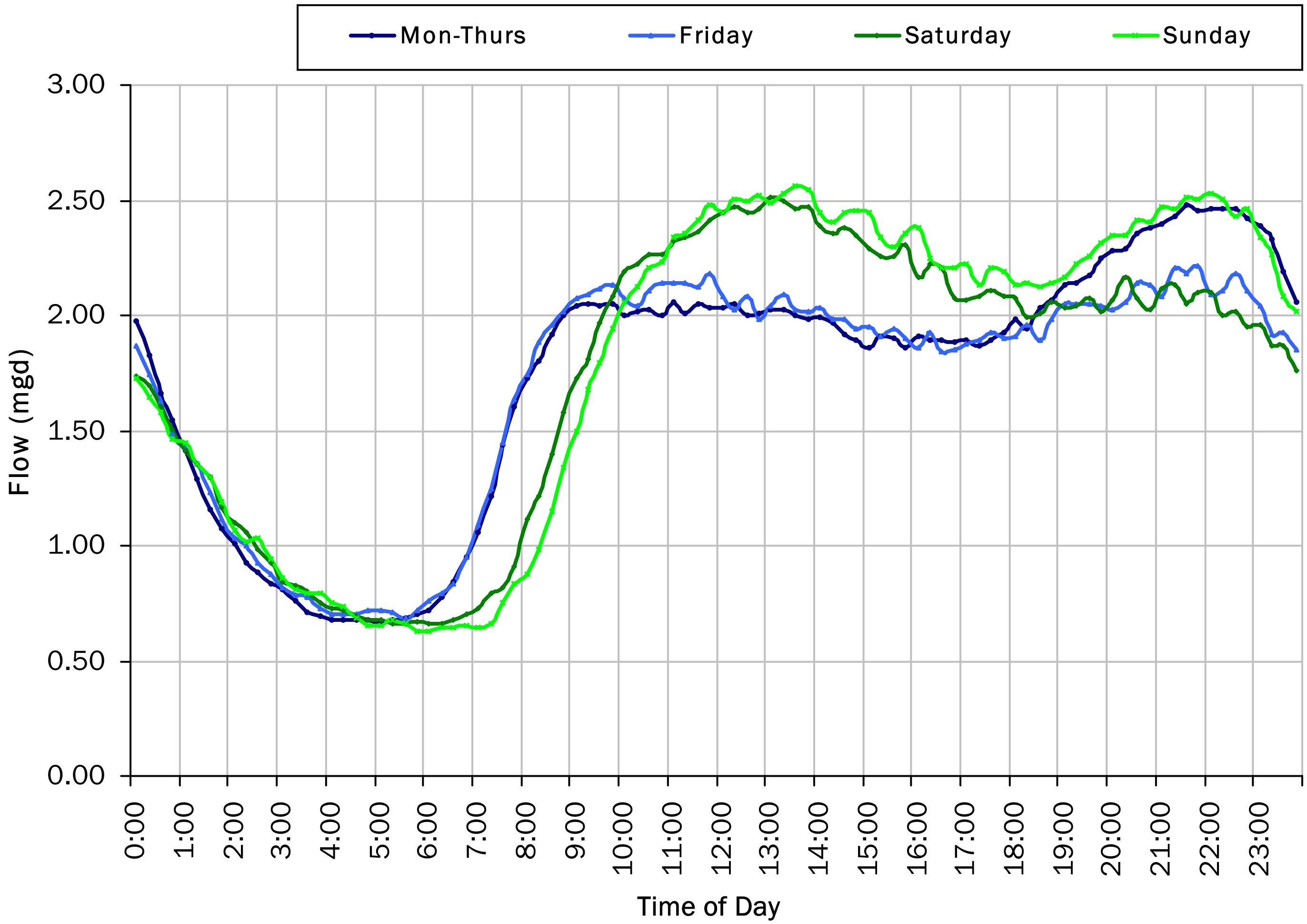
Period Avg Flow: 1.736 mgd   Period Peak Flow: 2.655 mgd   Period Min Flow: 0.583 mgd





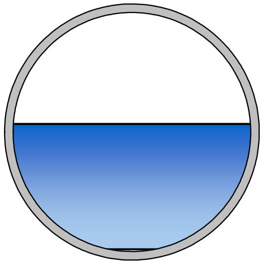
SITE 20

Average Dry Weather Flow Hydrographs



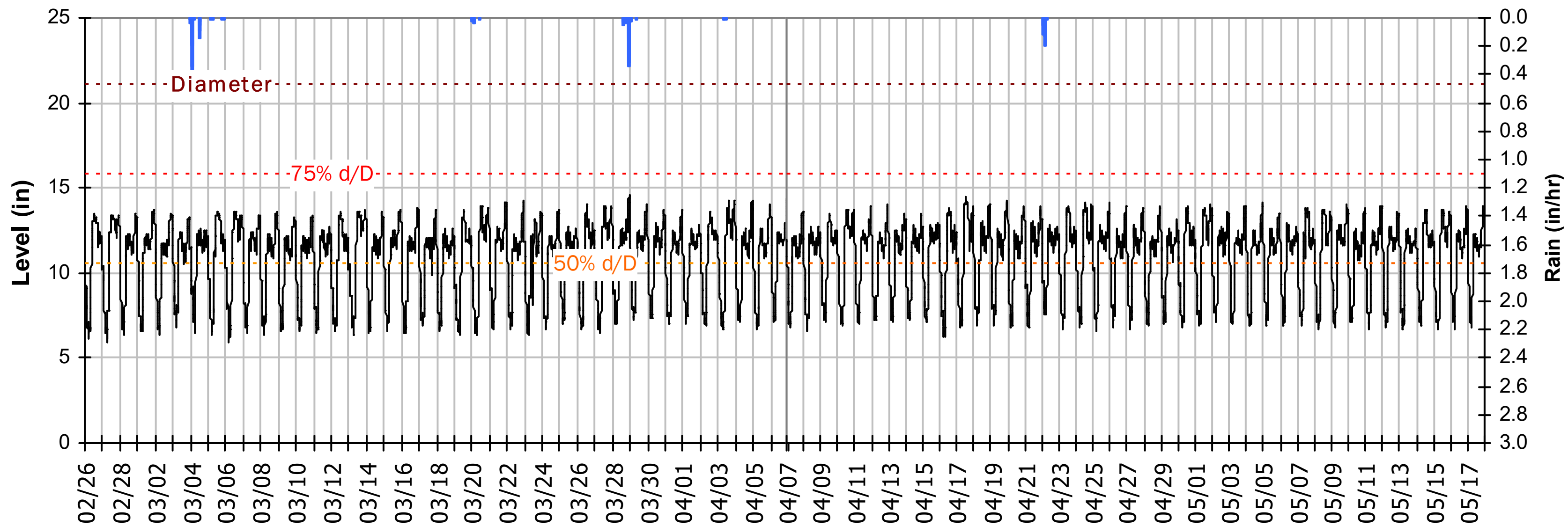
ADWF:

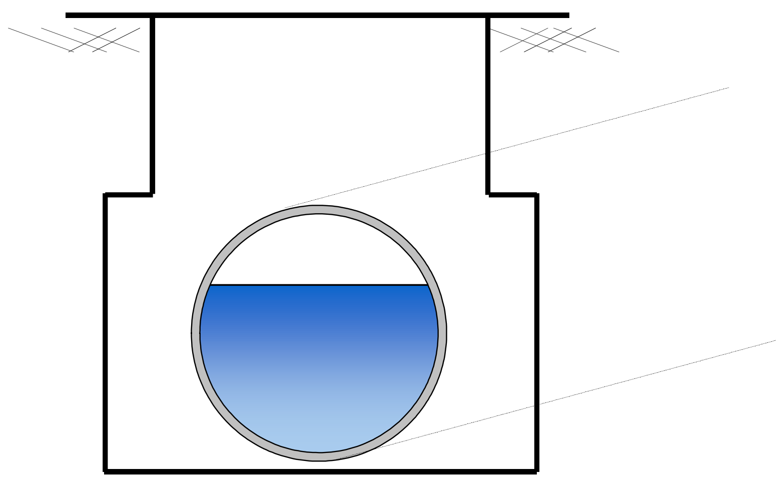
1.730 *mgd*



SITE 20
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



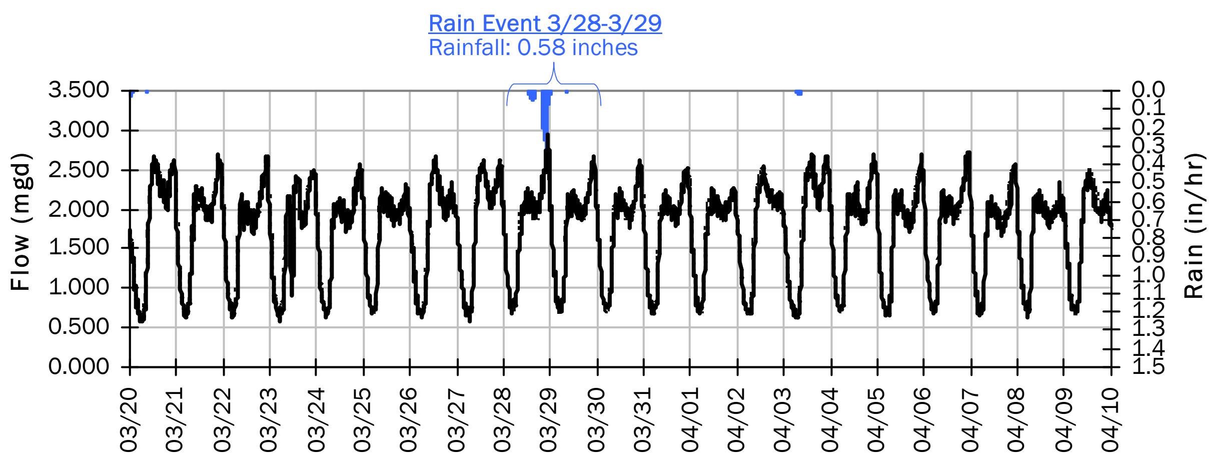


Pipe Diameter:	21	*inches*
Peak Measured Level:	14.6	*inches*
Peak d/D Ratio:	0.69	

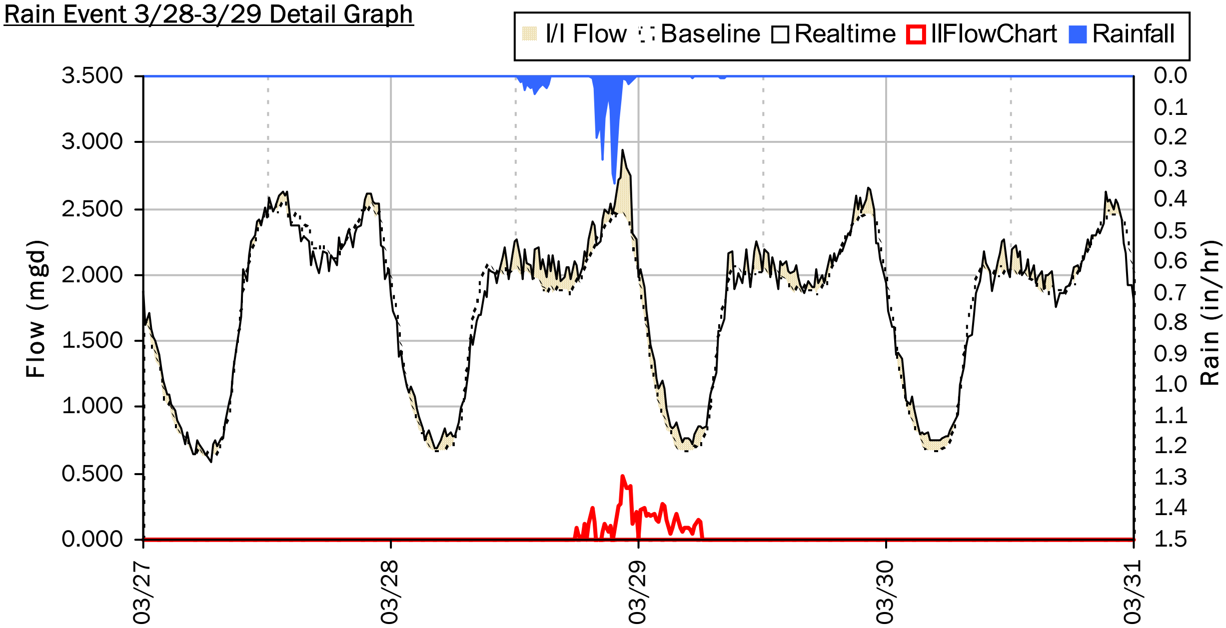
SITE 20

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



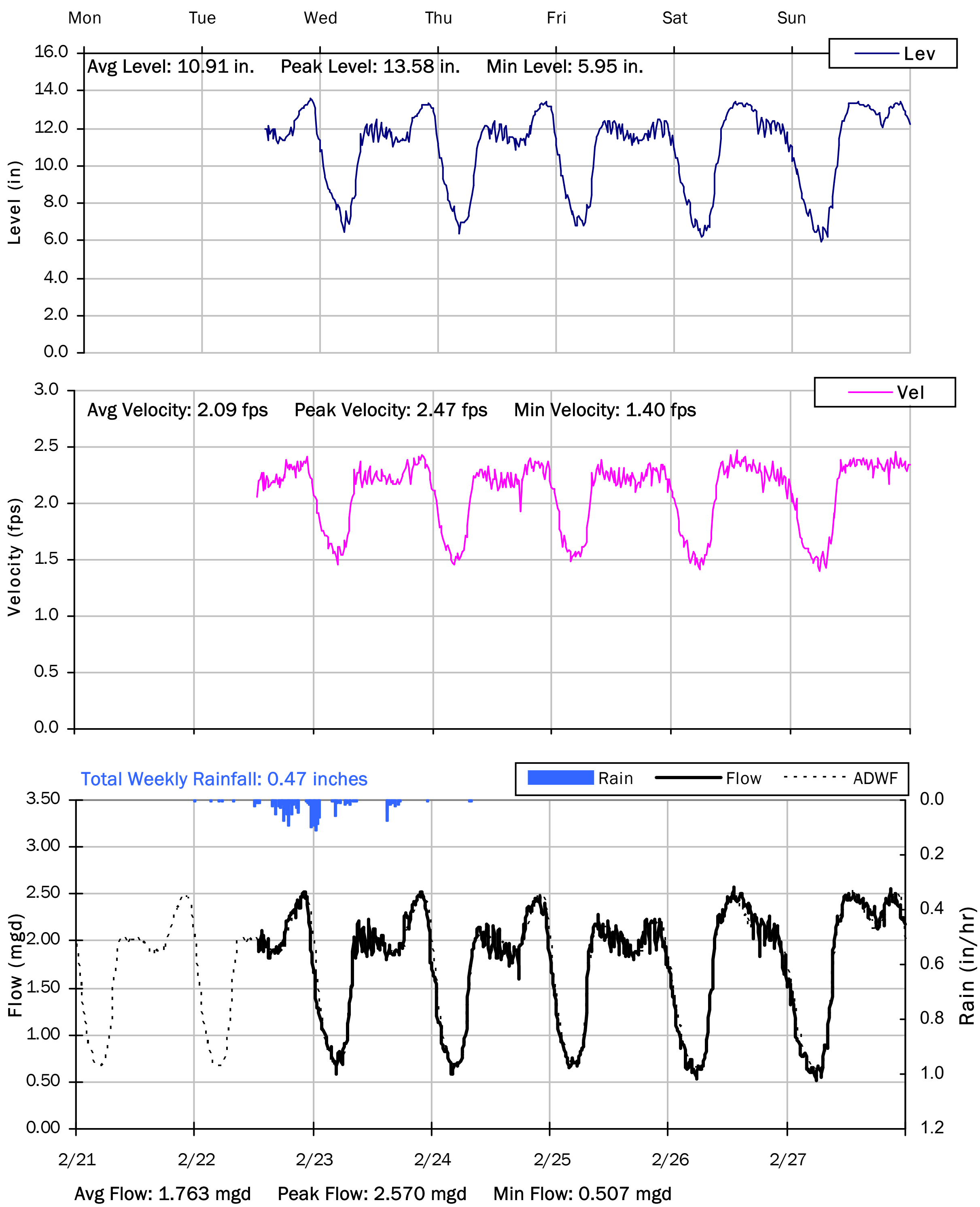
Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.58 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	2.944 *mgd*	Peak I/I Rate:	0.479 *mgd*
PF:	1.70	Total I/I:	74,000 *gallons*
Peak Level:	14.58 *in*		
d/D Ratio:	0.69		

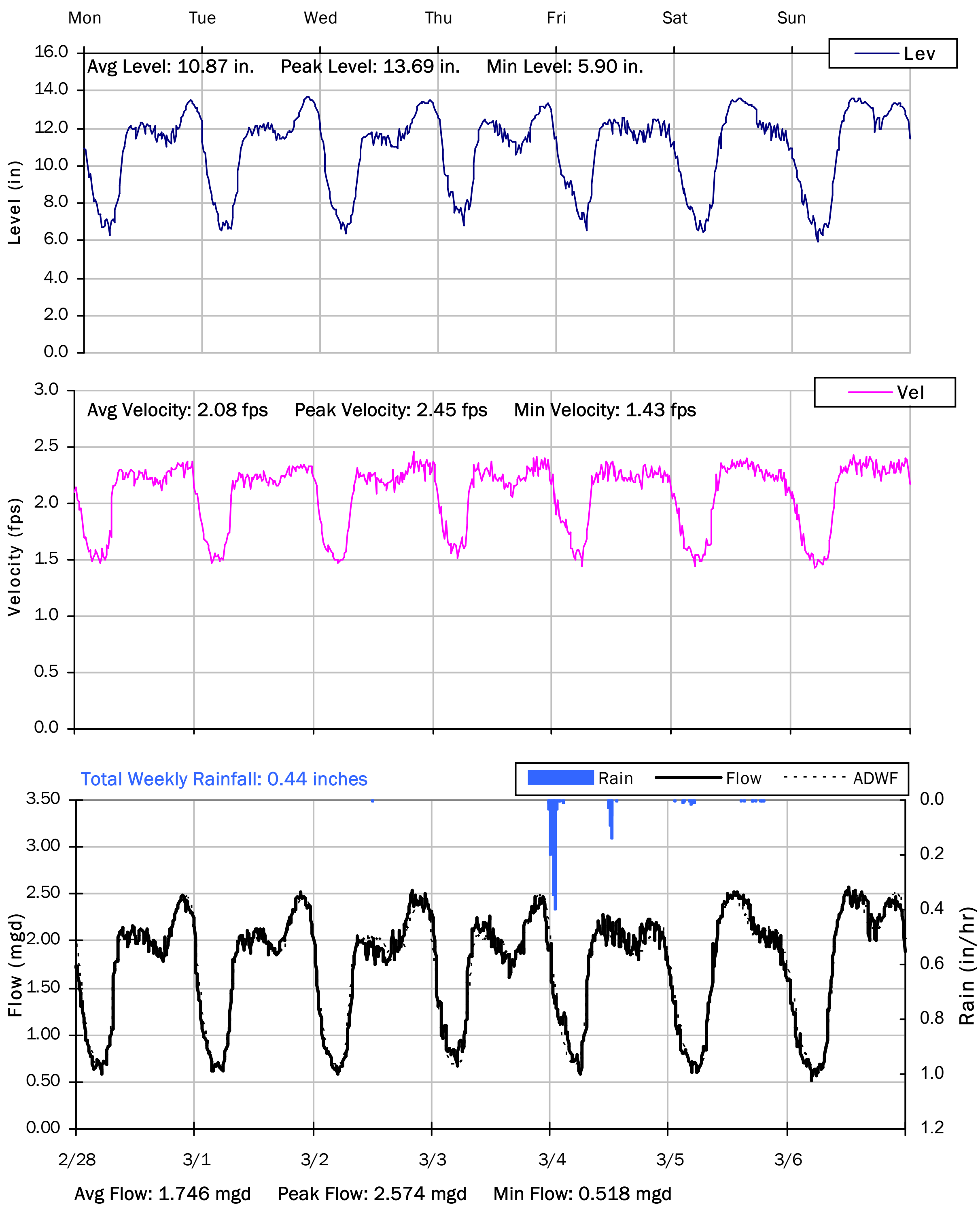
SITE 20
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



SITE 20

Weekly Level, Velocity and Flow Hydrographs

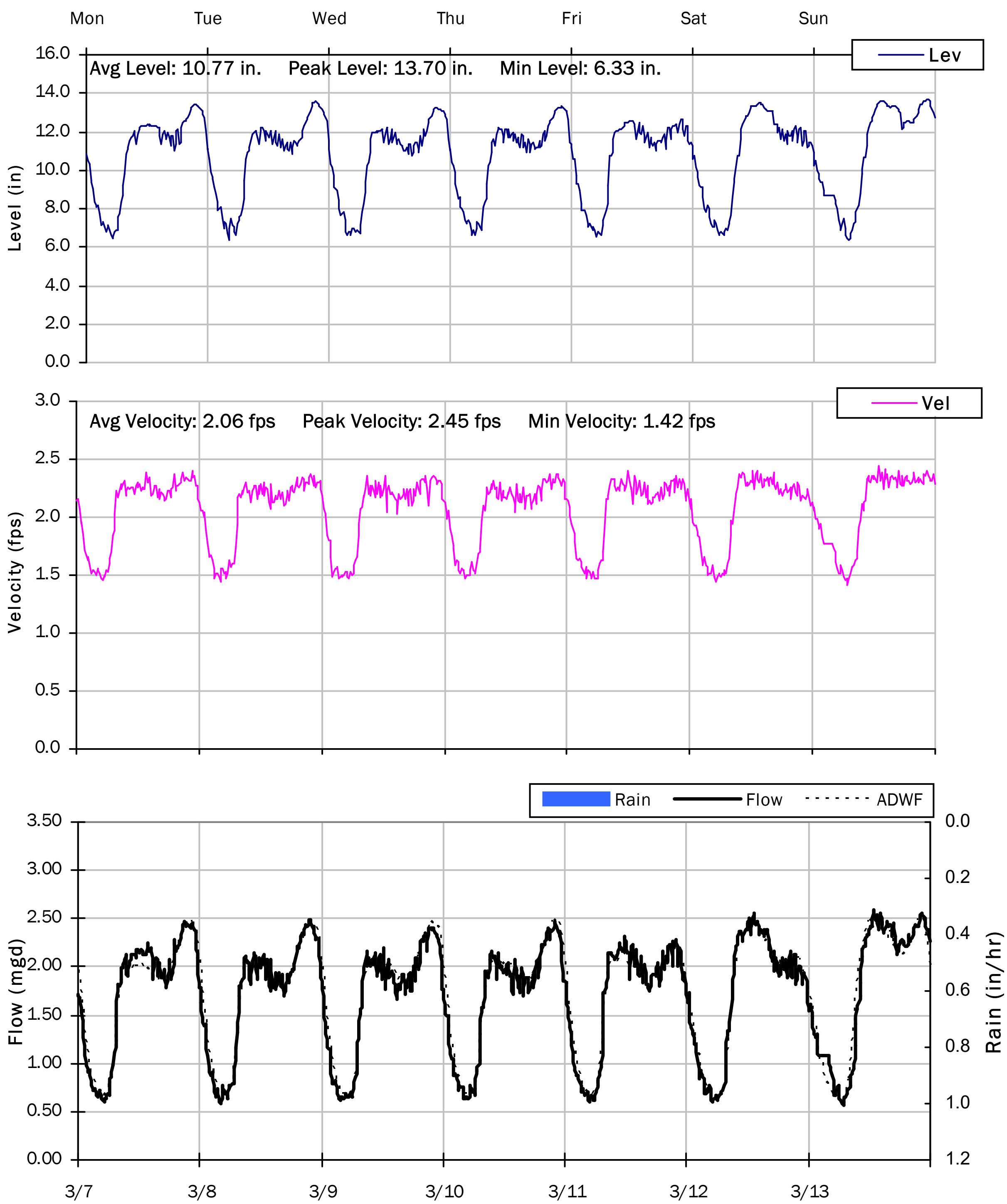
2/28/2022 to 3/7/2022



SITE 20

Weekly Level, Velocity and Flow Hydrographs

3/7/2022 to 3/14/2022

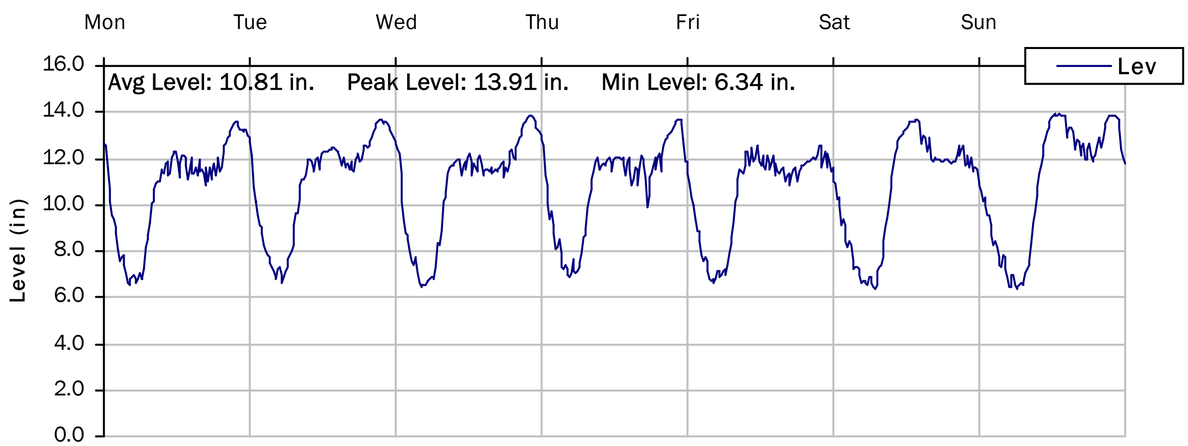


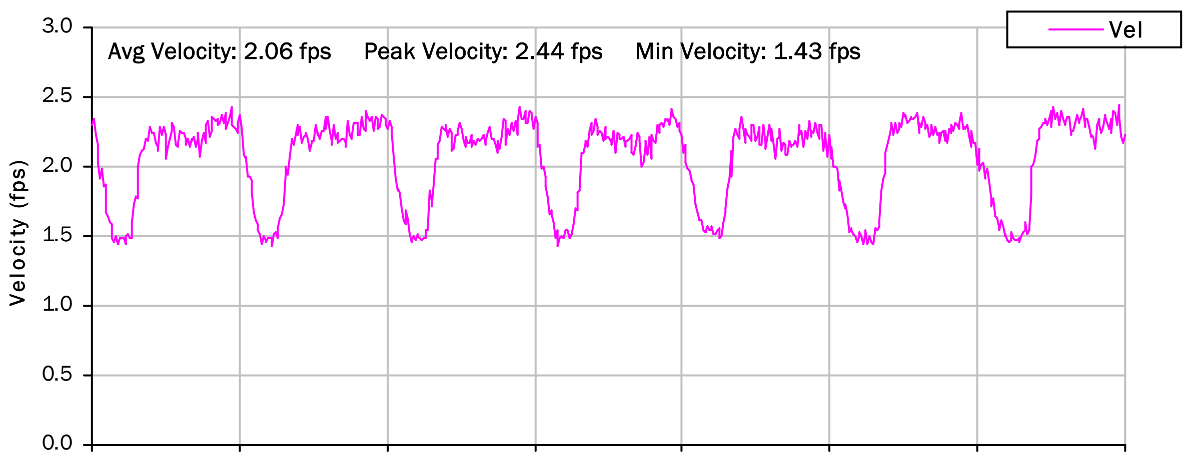
Avg Flow: 1.715 mgd Peak Flow: 2.593 mgd Min Flow: 0.562 mgd

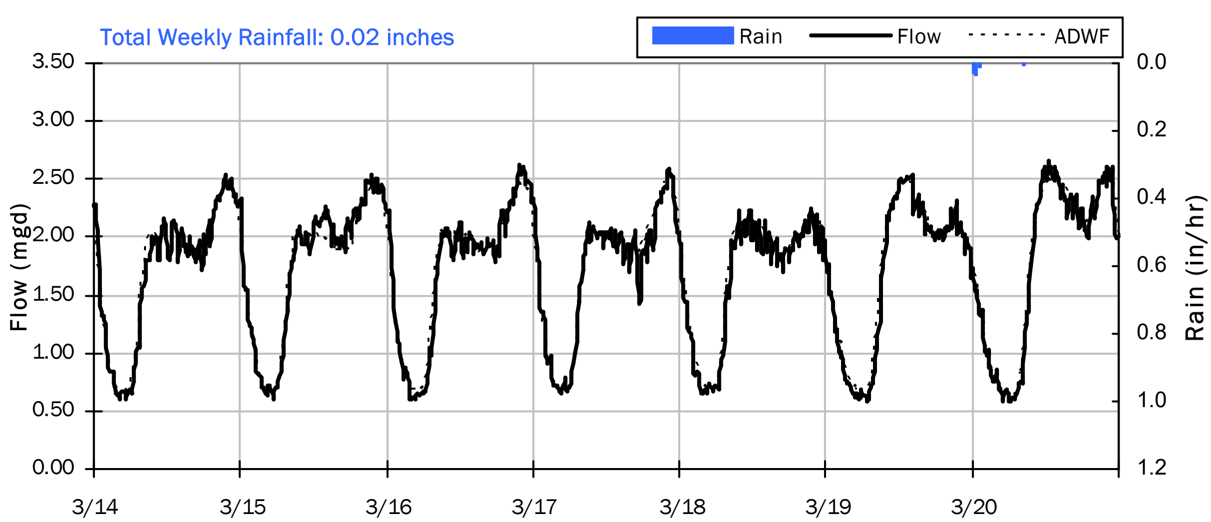
SITE 20

Weekly Level, Velocity and Flow Hydrographs

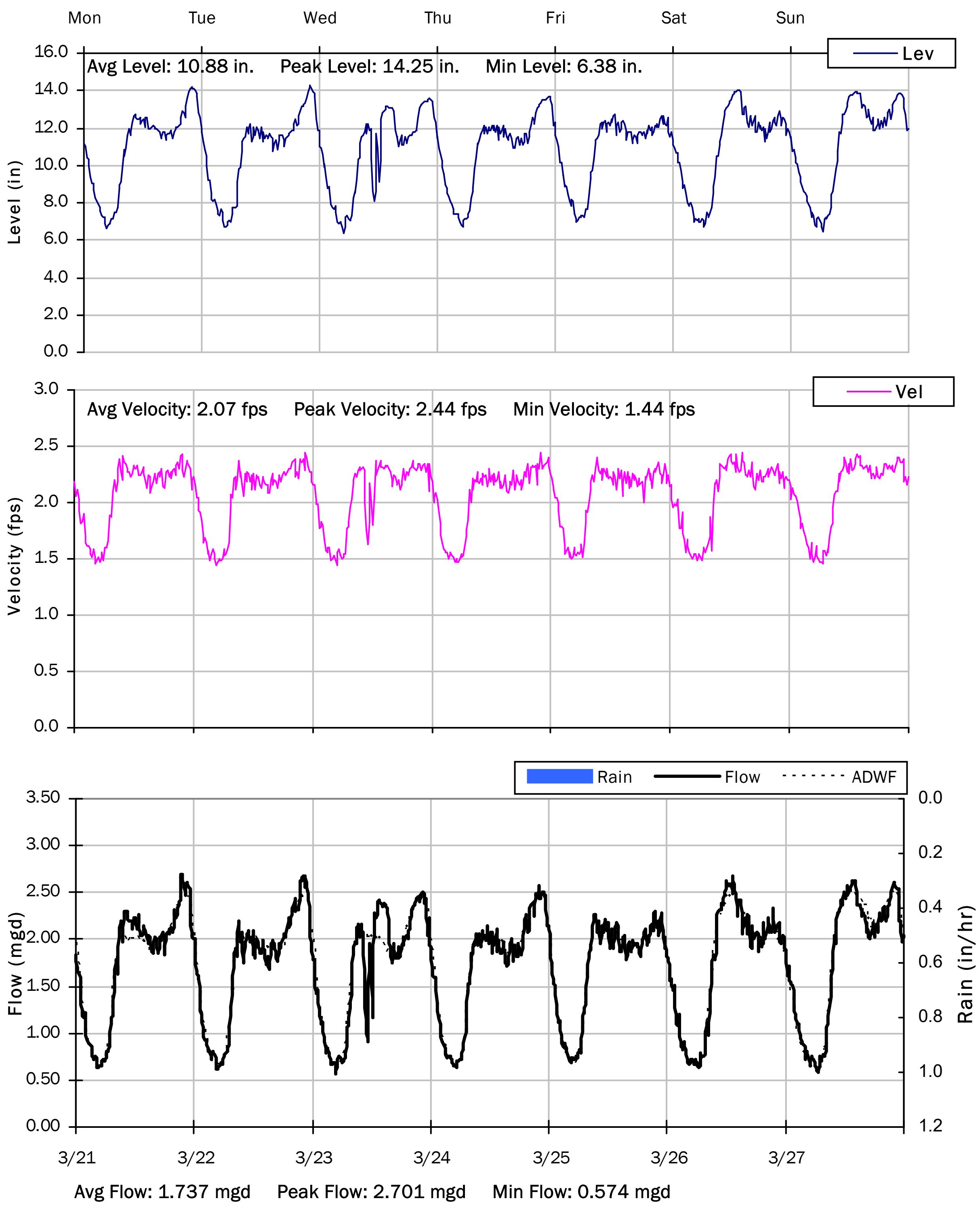
3/14/2022 to 3/21/2022







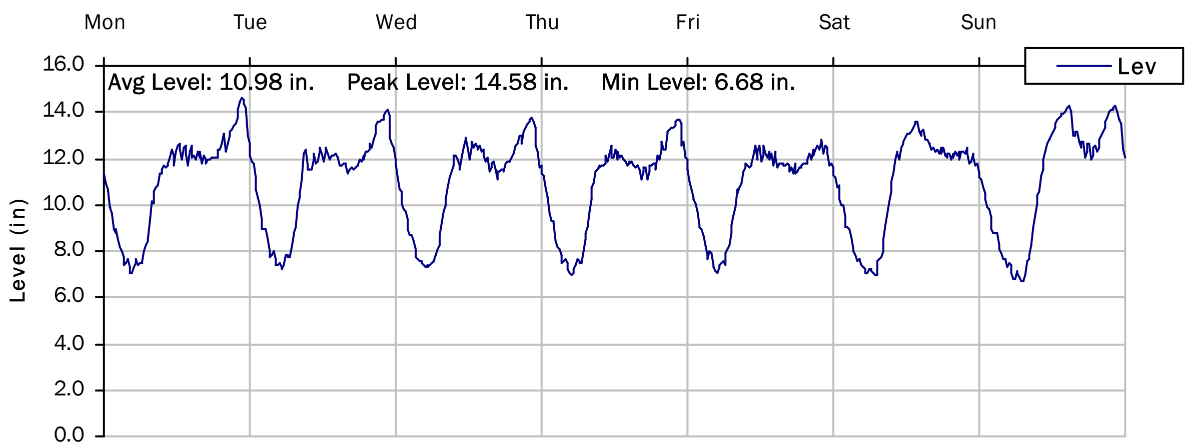
SITE 20
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

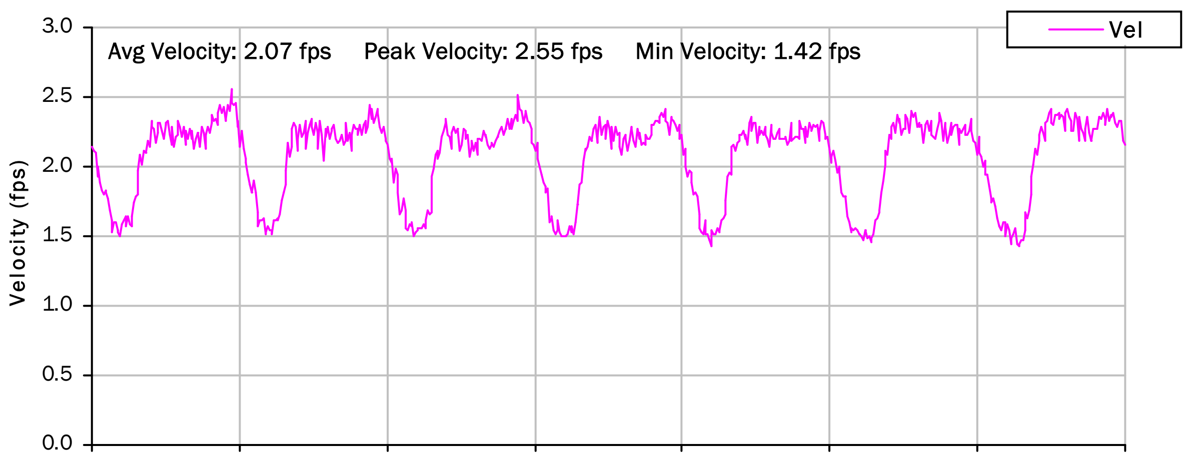


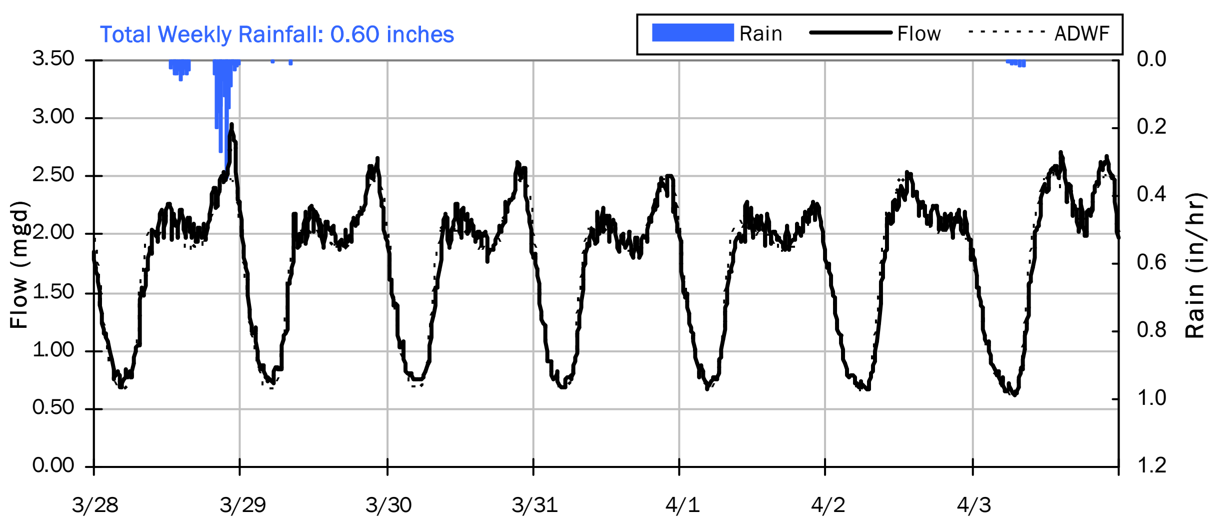
SITE 20

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

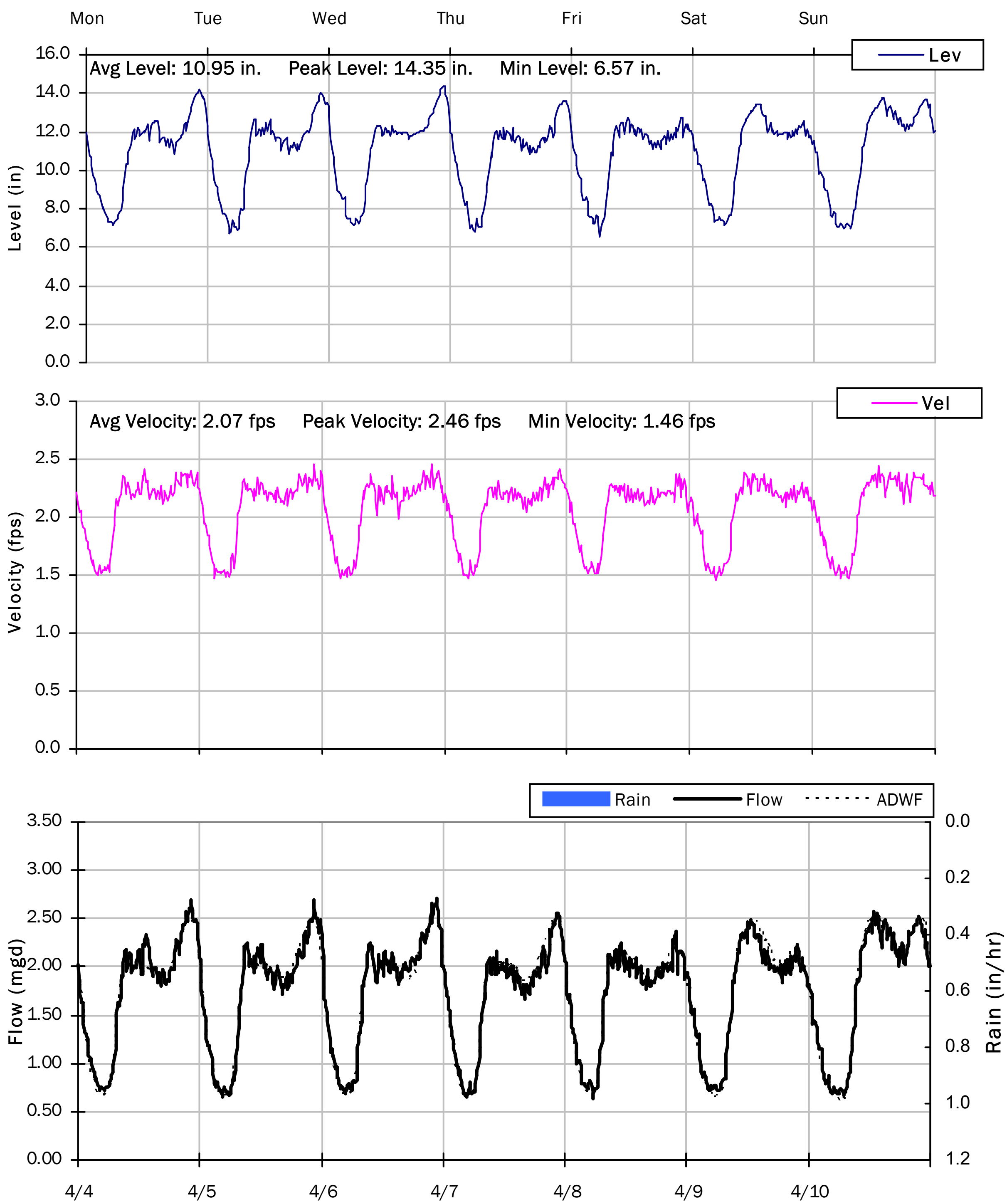






Avg Flow: 1.758 mgd Peak Flow: 2.944 mgd Min Flow: 0.618 mgd

SITE 20
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

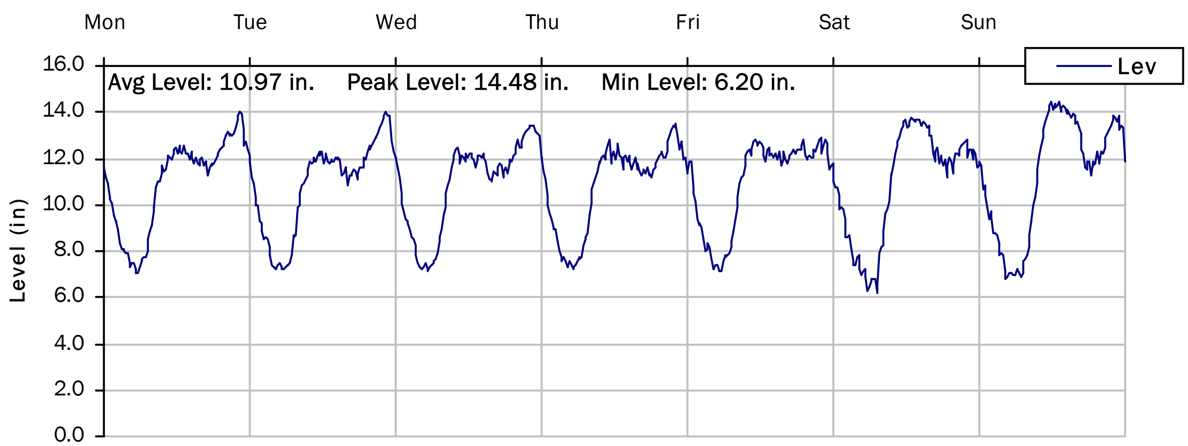


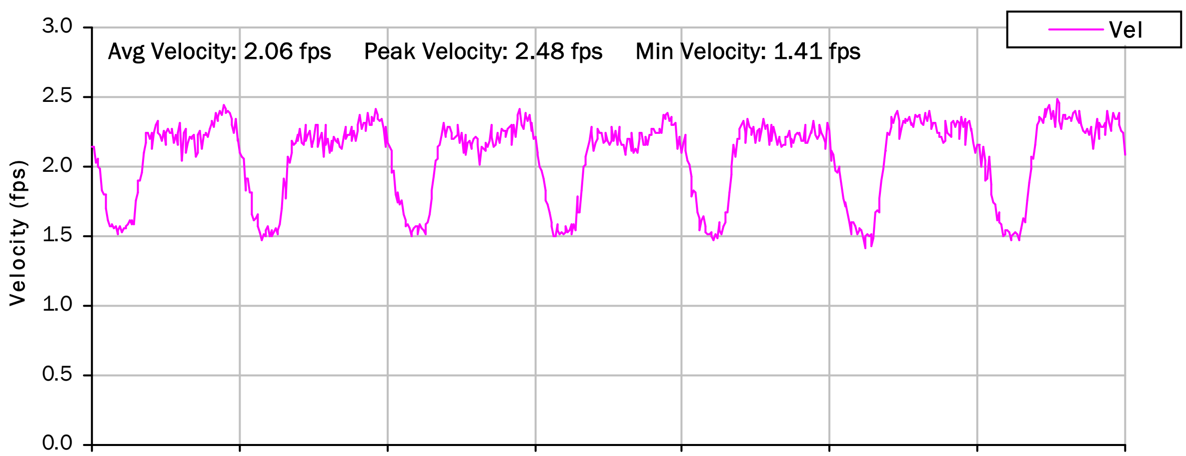
Avg Flow: 1.746 mgd
Peak Flow: 2.712 mgd
Min Flow: 0.632 mgd

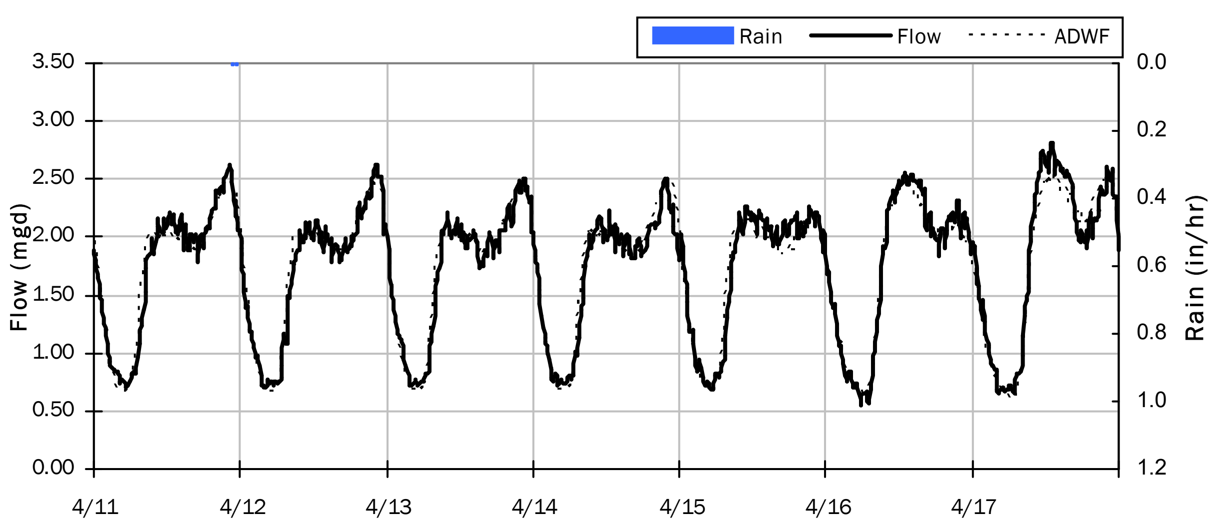
SITE 20

Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022





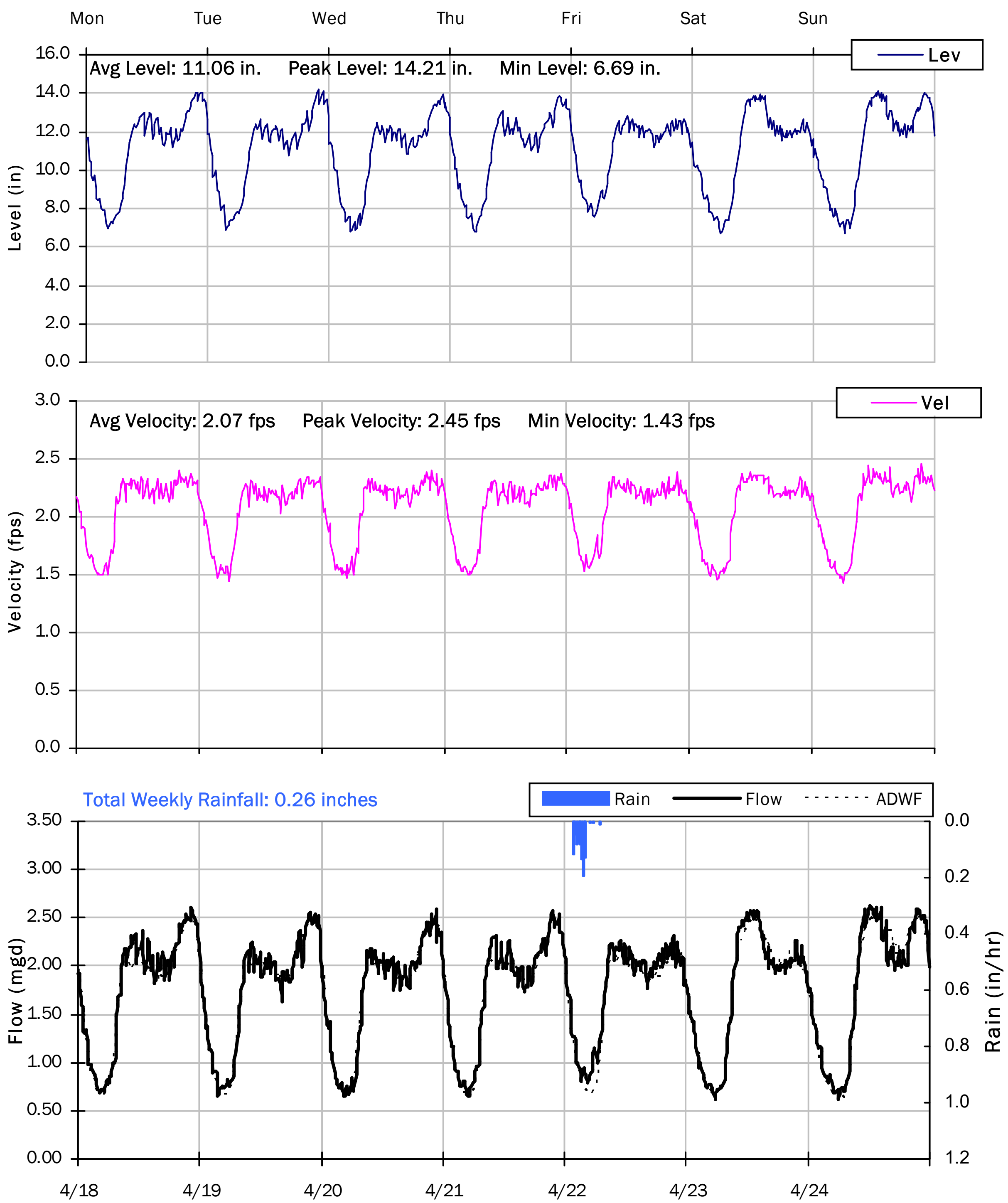


Avg Flow: 1.749 mgd Peak Flow: 2.808 mgd Min Flow: 0.549 mgd

SITE 20

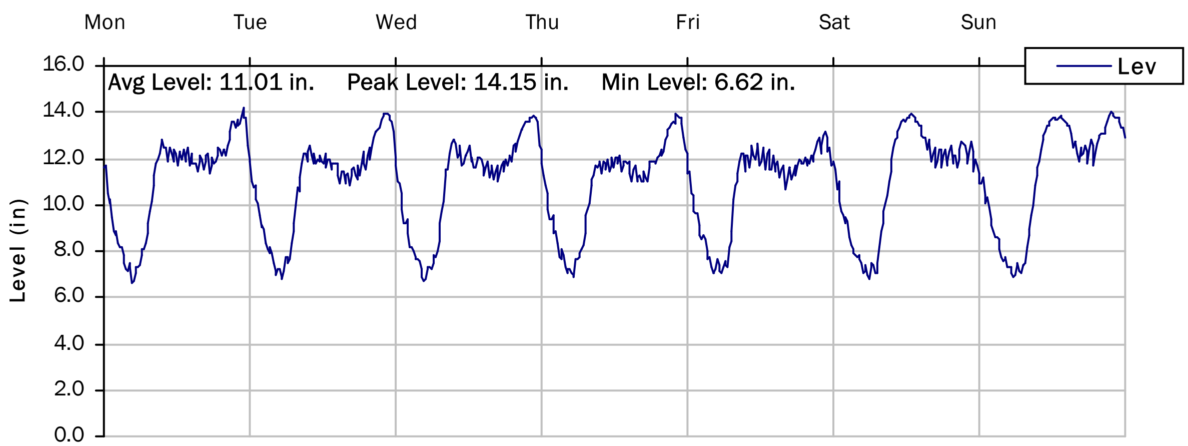
Weekly Level, Velocity and Flow Hydrographs

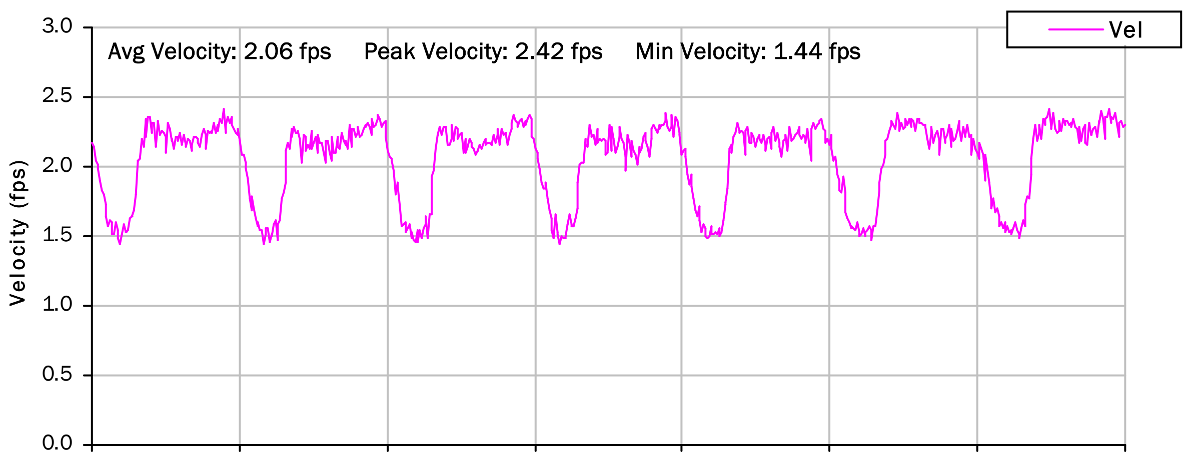
4/18/2022 to 4/25/2022

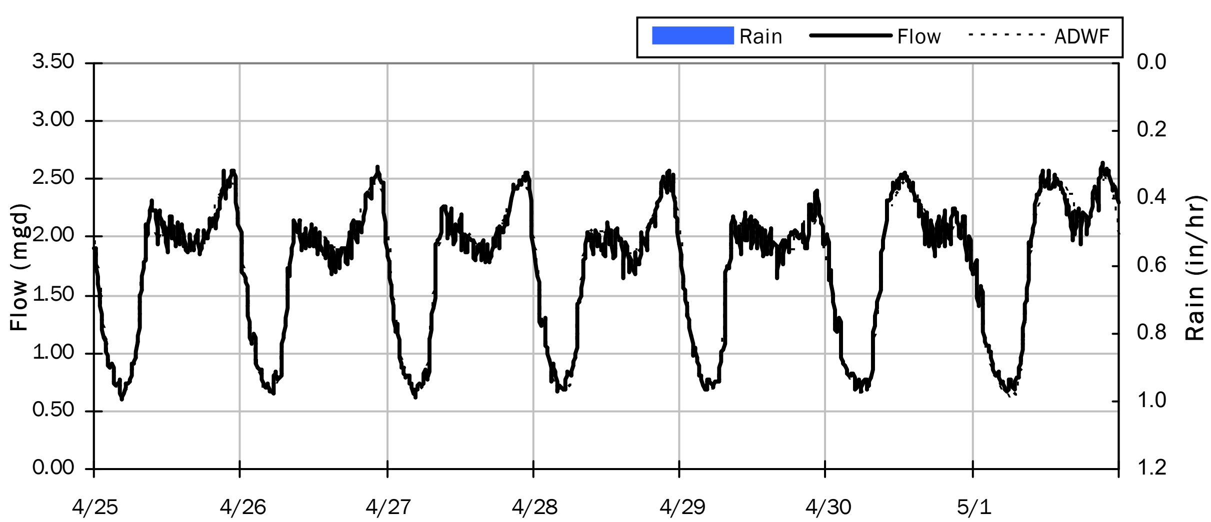


Avg Flow: 1.771 mgd Peak Flow: 2.625 mgd Min Flow: 0.618 mgd

SITE 20
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

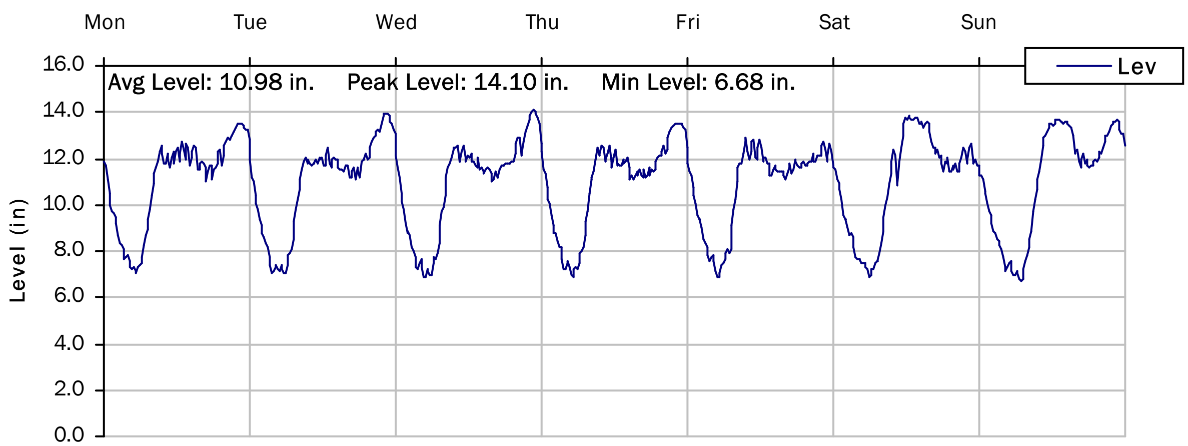


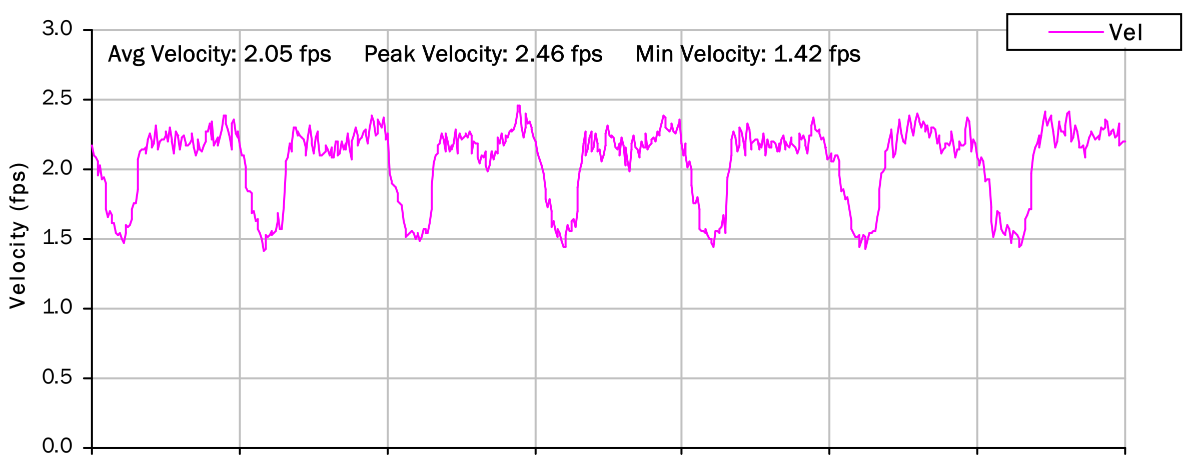


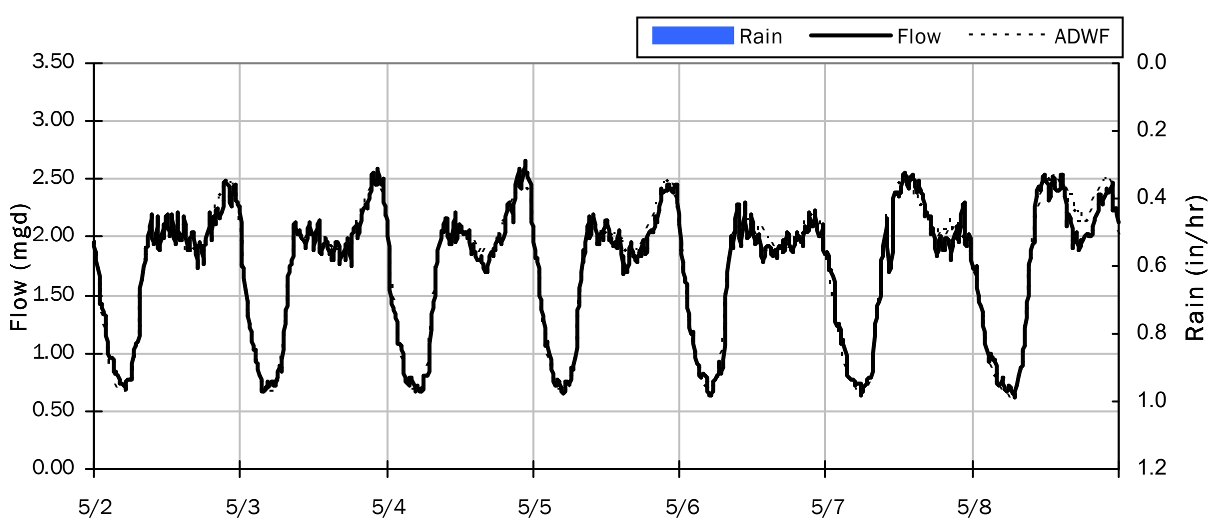


Avg Flow: 1.751 mgd Peak Flow: 2.639 mgd Min Flow: 0.608 mgd

SITE 20
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

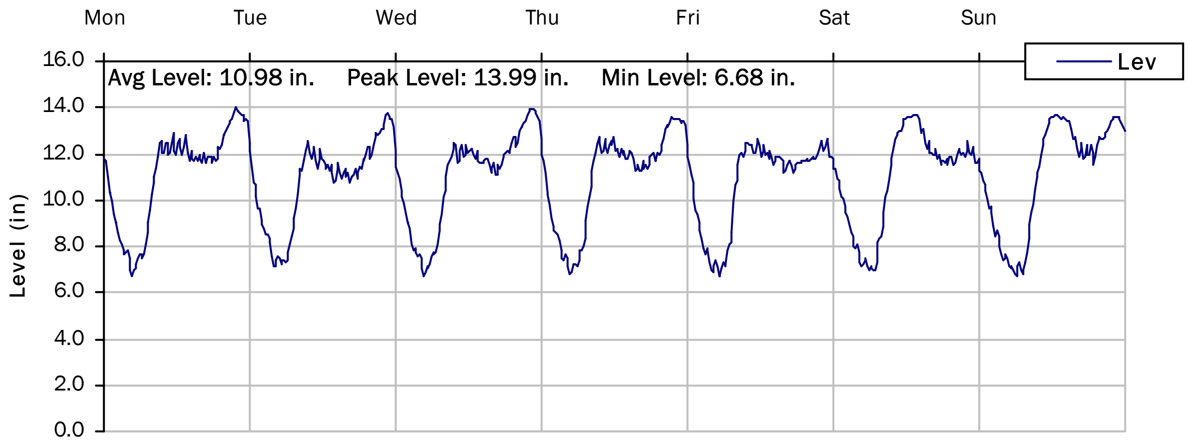


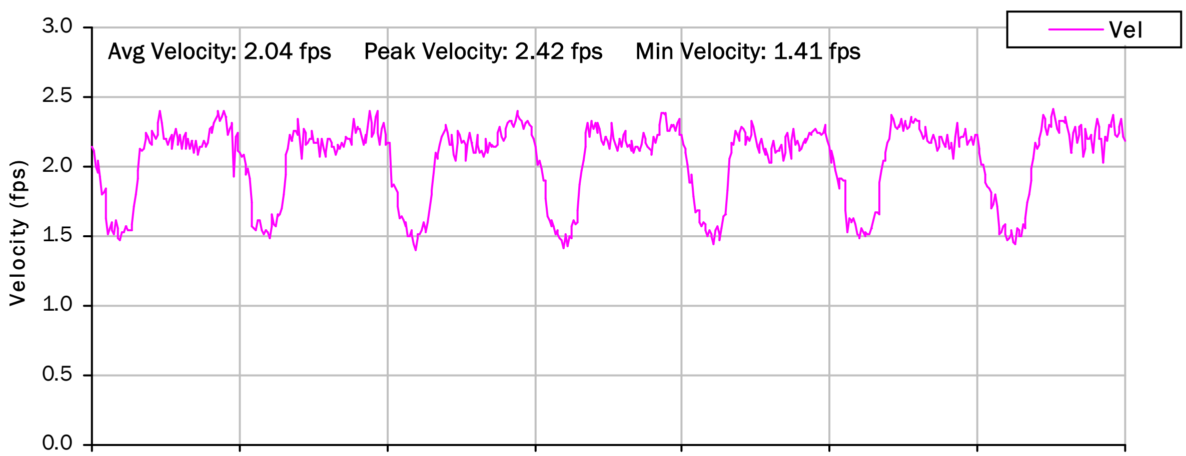


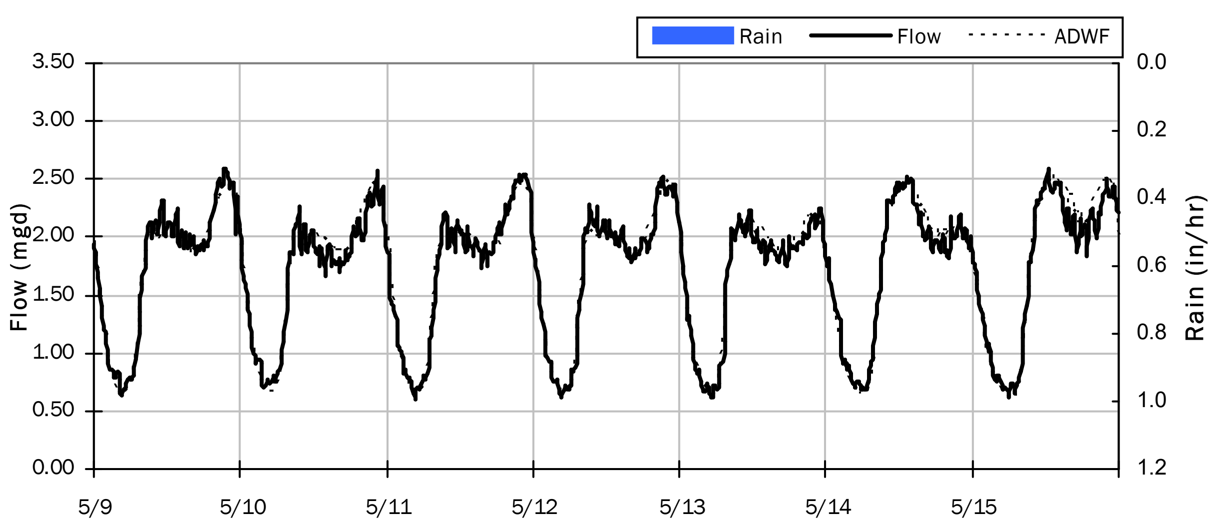


Avg Flow: 1.734 mgd   Peak Flow: 2.655 mgd   Min Flow: 0.615 mgd

SITE 20
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022





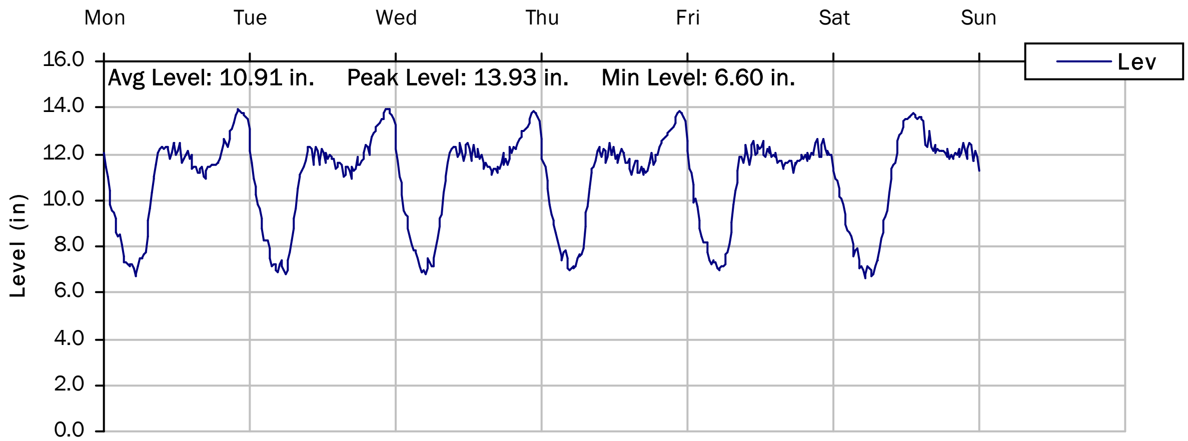


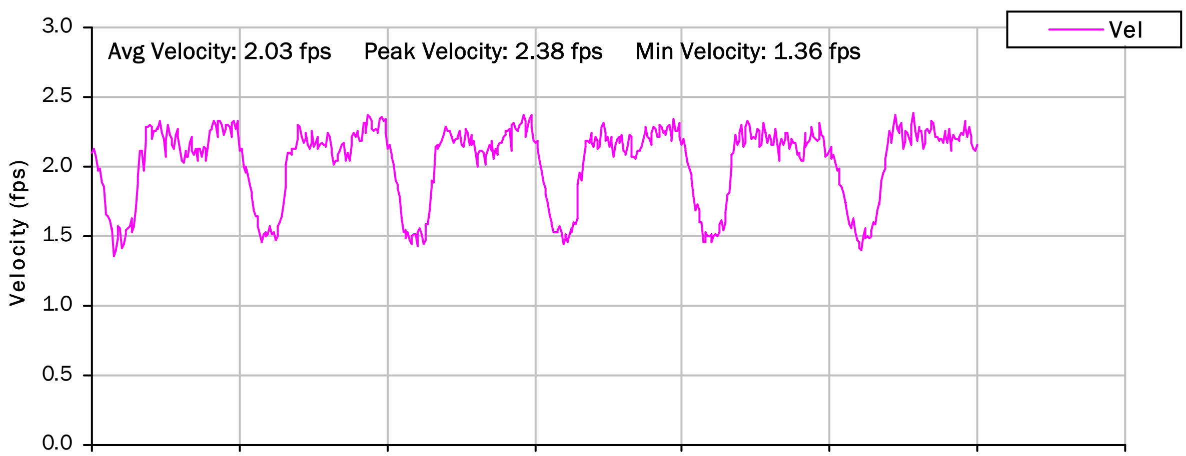
Avg Flow: 1.730 mgd Peak Flow: 2.592 mgd Min Flow: 0.598 mgd

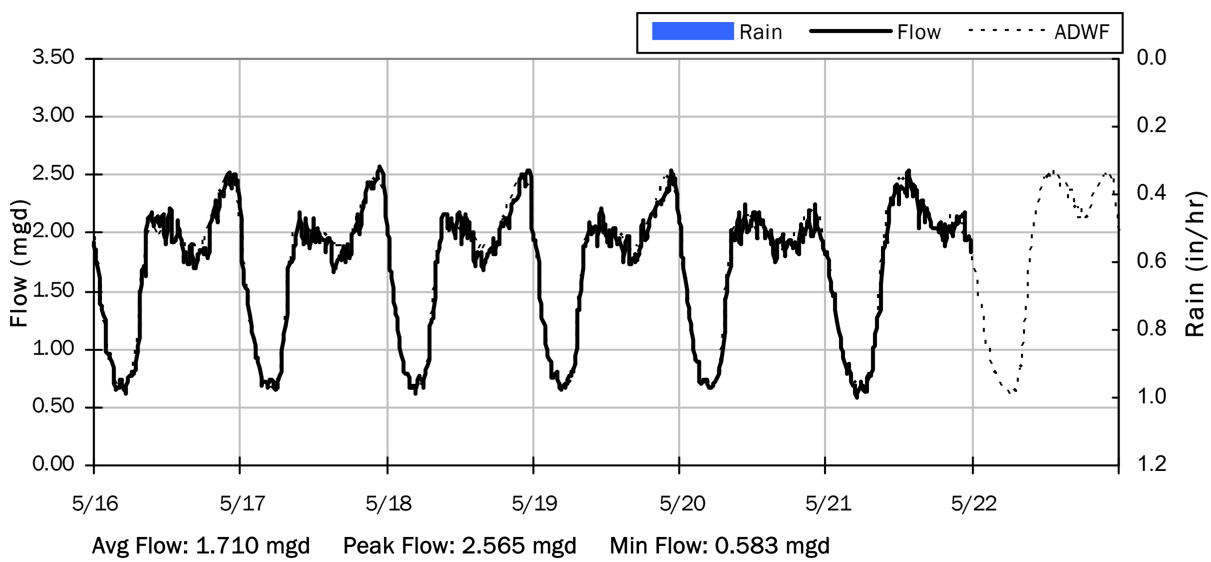
SITE 20

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022







Monitoring Site: Site 21

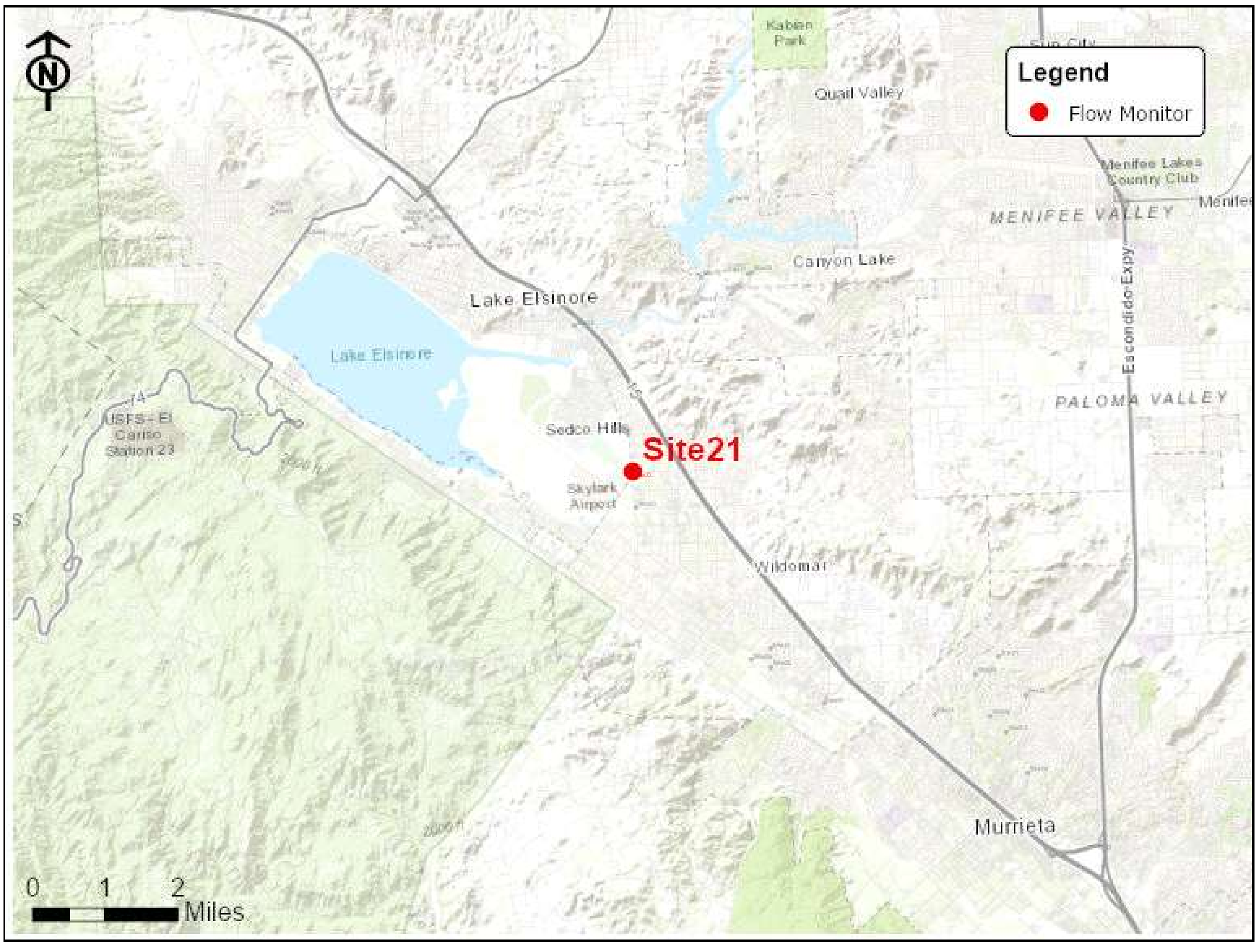
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Lemon Street and Mission Trail

Data Summary Report



Vicinity Map: Site 21

SITE 21

Site Information MH ID: MH-3459

Location: Lemon Street and Mission Trail

Coordinates: 117.2905° W, 33.6343° N

Rim Elevation (Earth): 1280 feet

Expected Pipe Diameter: 12 inches

Measured Pipe Diameter: 11.75 inches

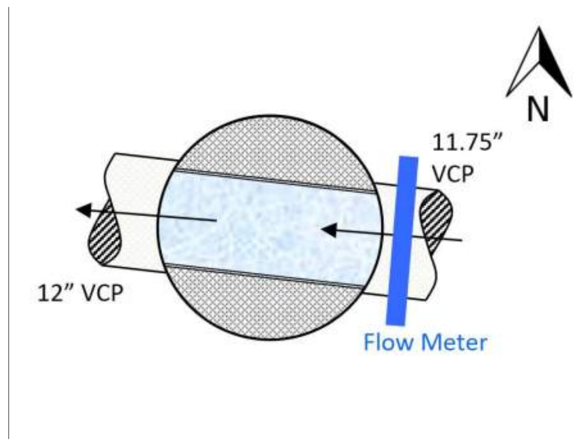
ADWF: 0.024 mgd

Peak Measured Flow: 0.231 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch

View from Street

Plan View

SITE 21

Additional Site Photos

Effluent Pipe

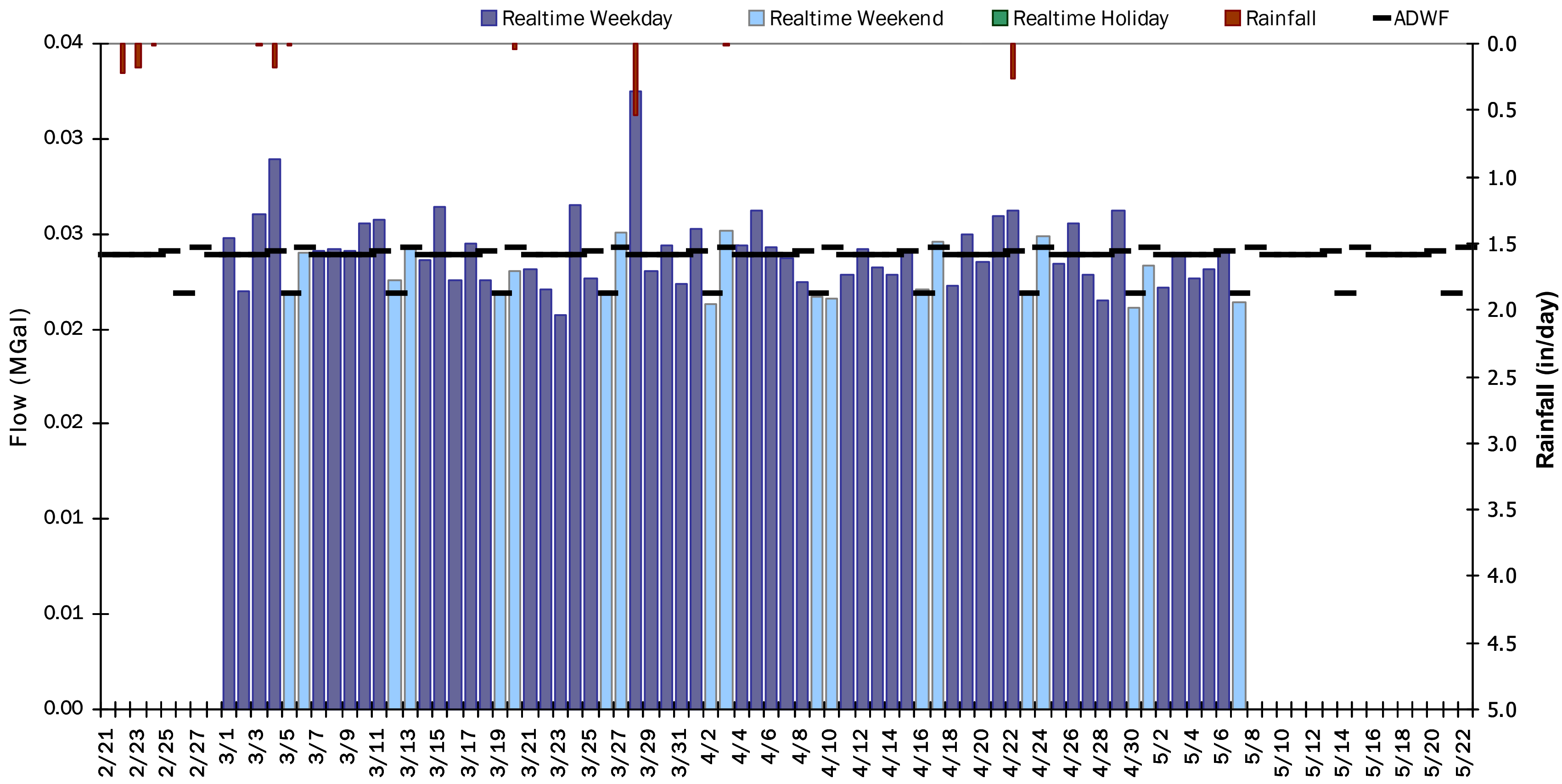
Influent Pipe

SITE 21

Period Flow Summary: Daily Flow Totals

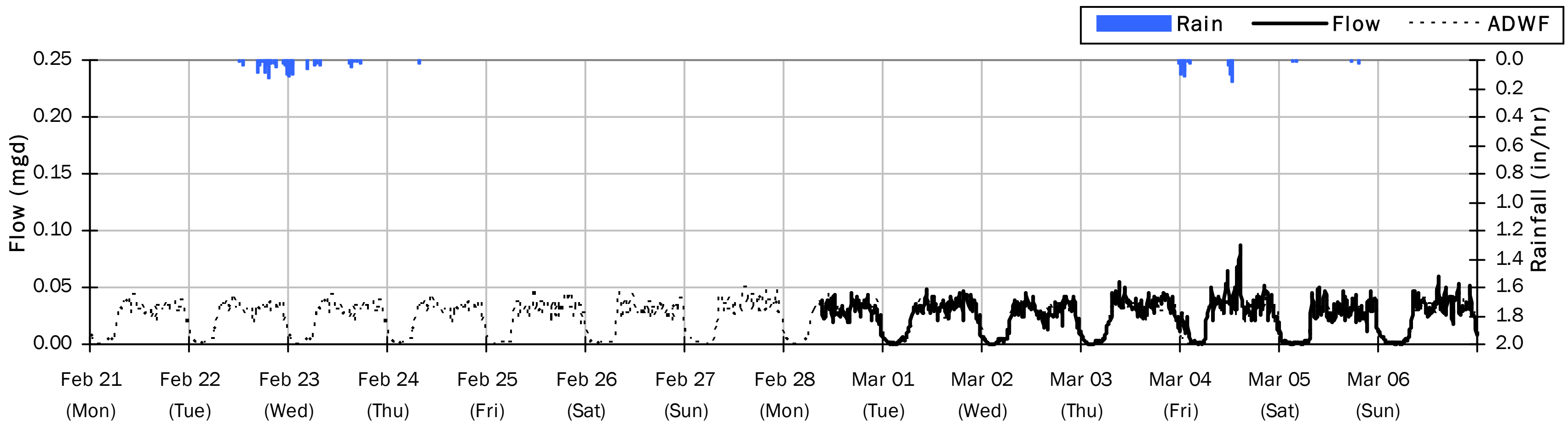
Avg Daily Flow: 0.024 MGal Peak Daily Flow: 0.032 MGal Min Daily Flow: 0.021 MGal

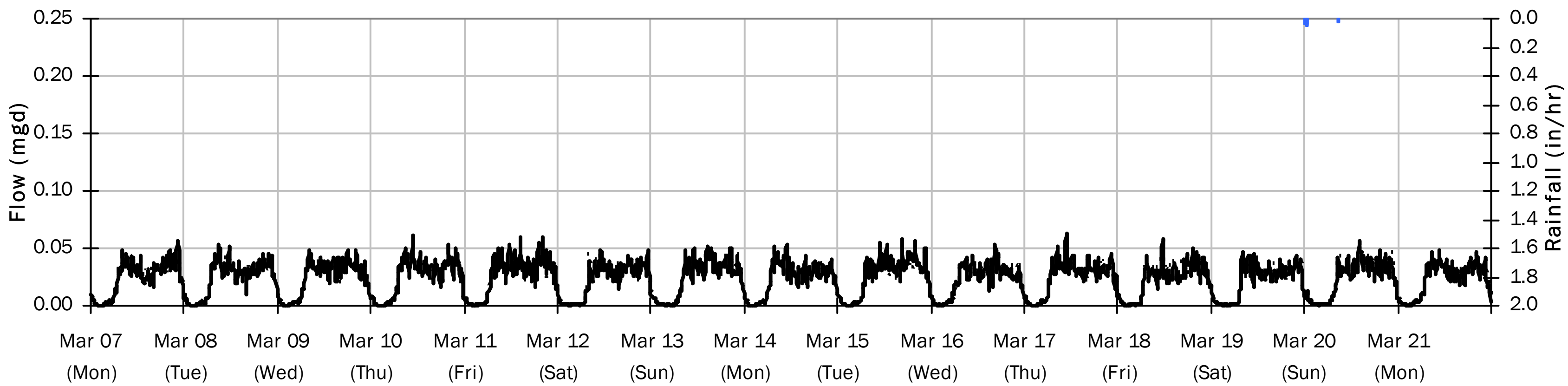
Total Rainfall: 1.06 inches



SITE 21
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.65 inches Period Avg Flow: 0.024 mgd Period Peak Flow: 0.087 mgd Period Min Flow: 0.000 mgd



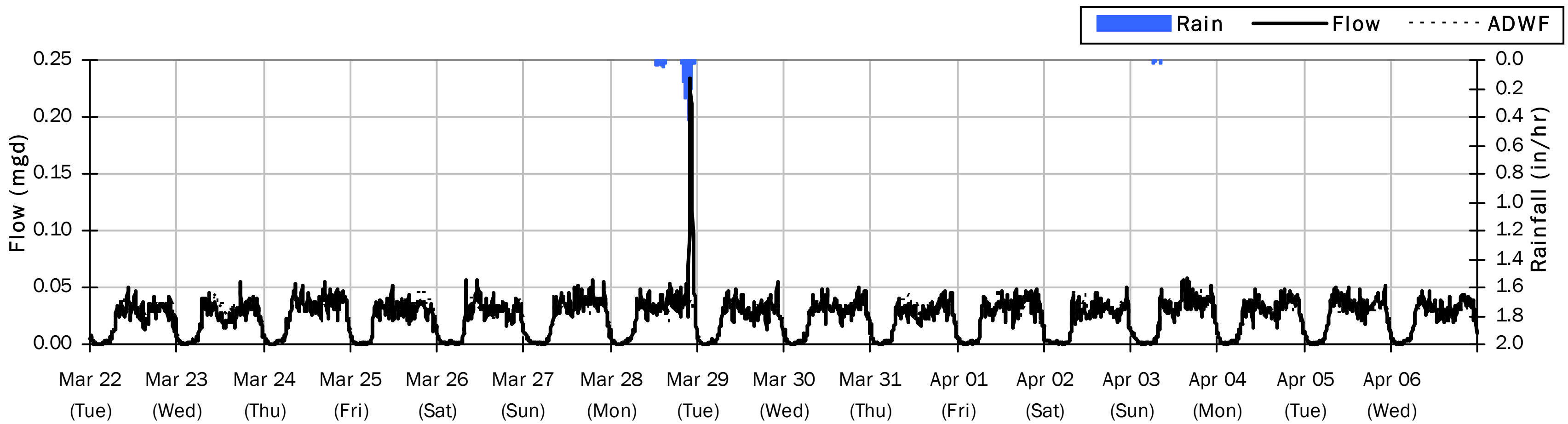


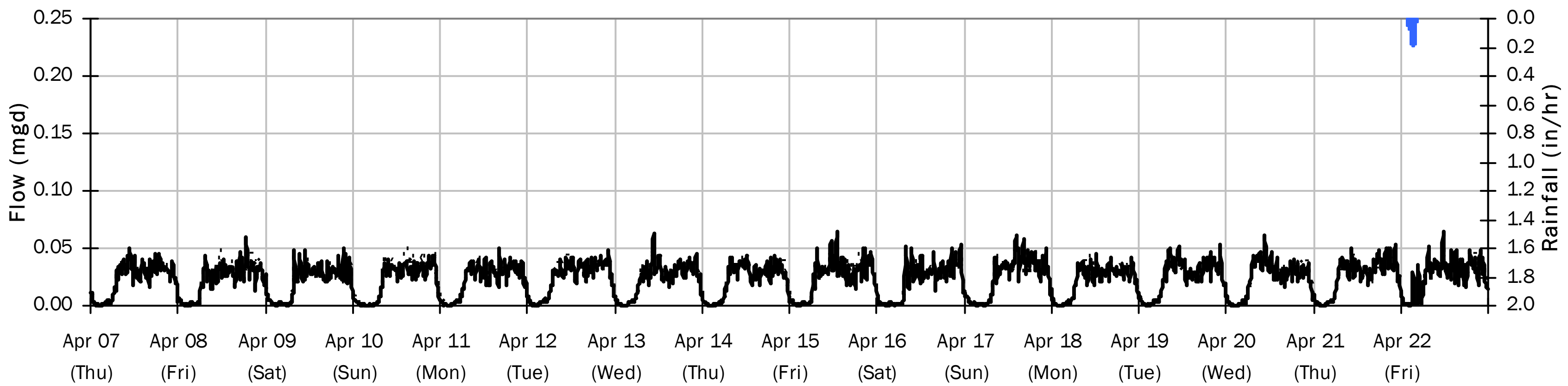
SITE 21

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.82 inches

Period Avg Flow: 0.024 mgd Period Peak Flow: 0.231 mgd Period Min Flow: 0.000 mgd



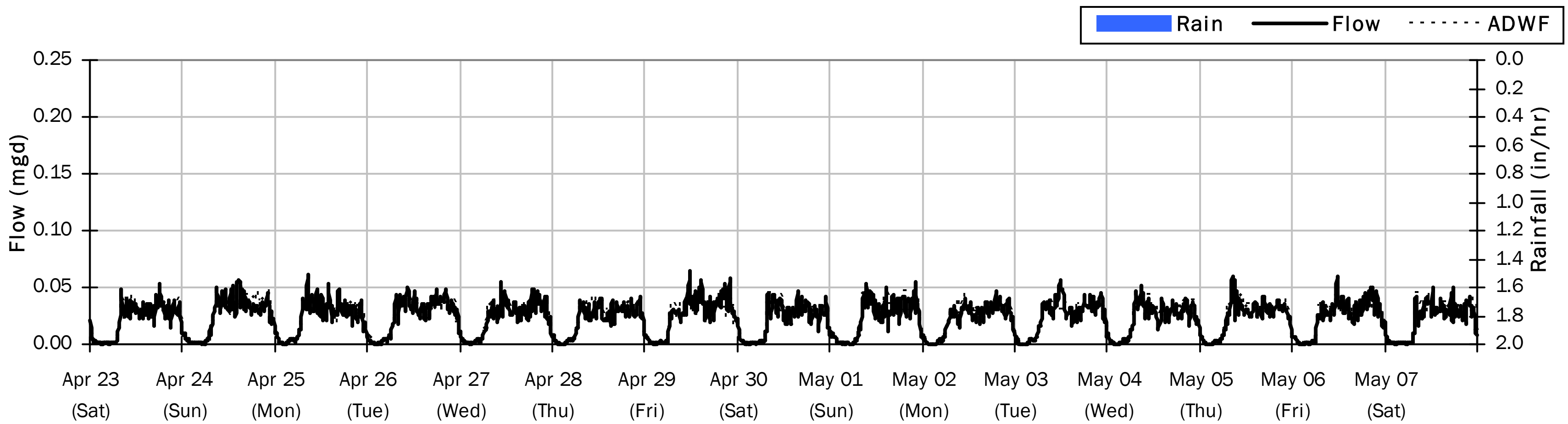


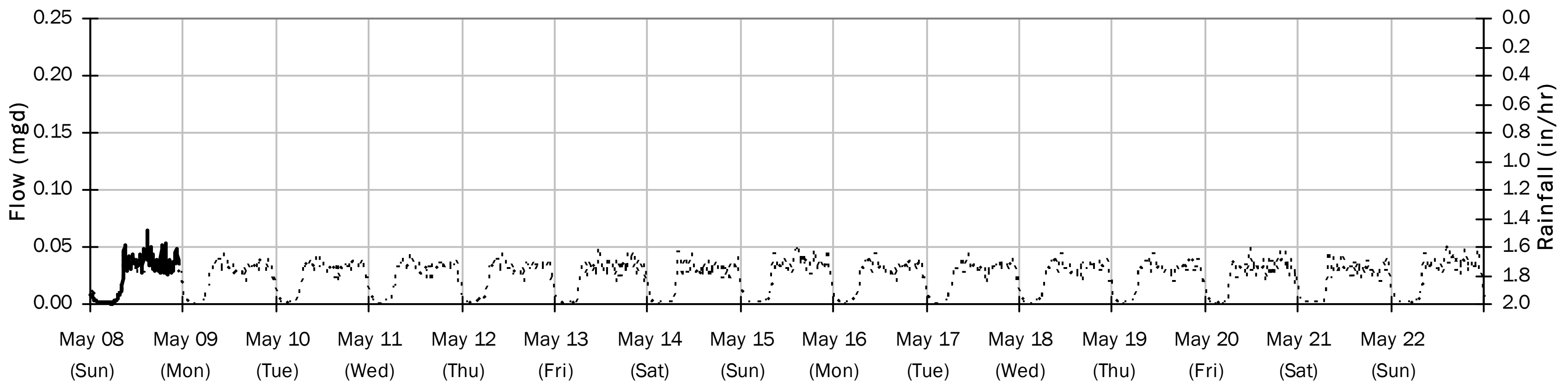
SITE 21

Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

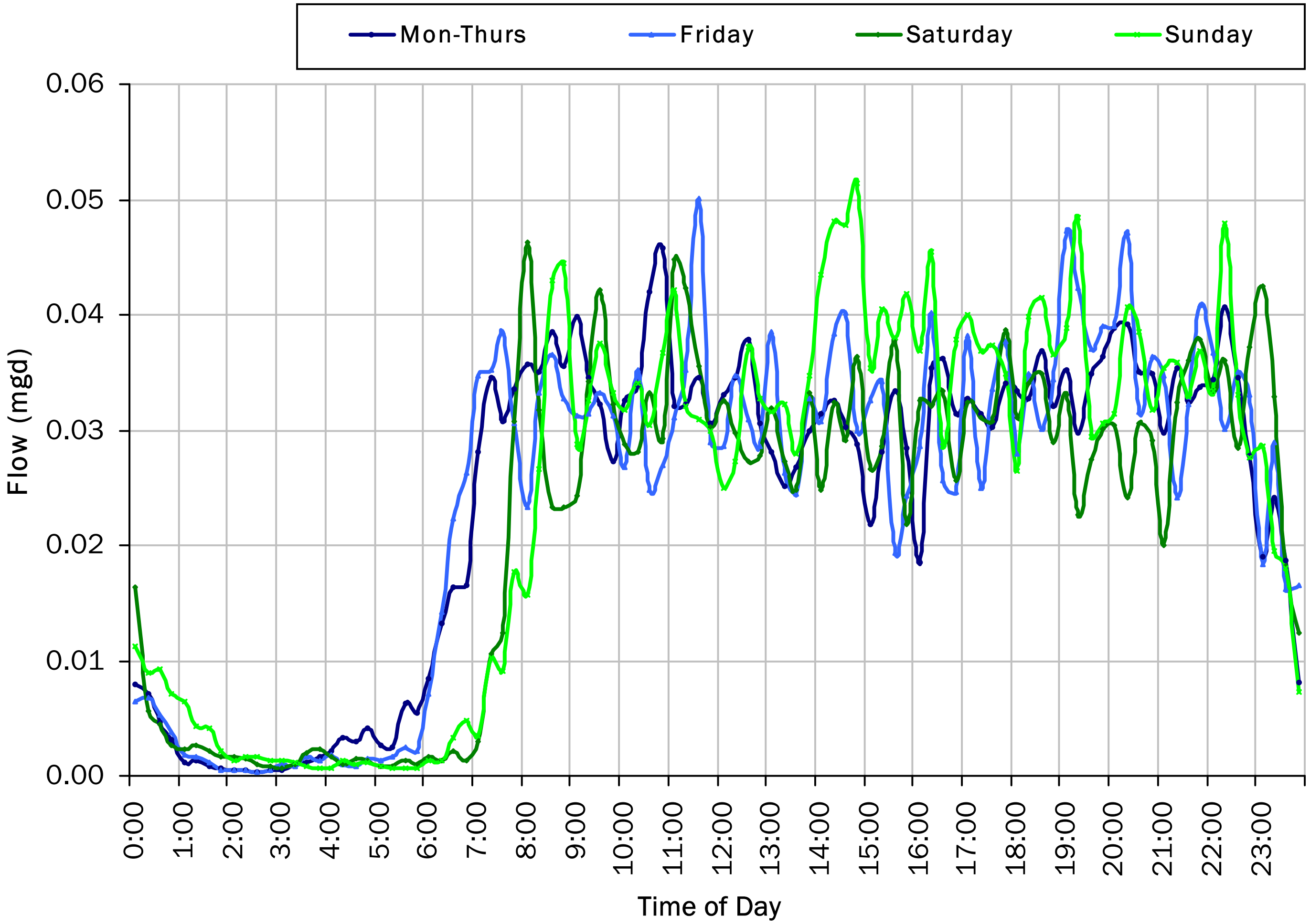
Period Avg Flow: 0.023 mgd Period Peak Flow: 0.064 mgd Period Min Flow: 0.000 mgd





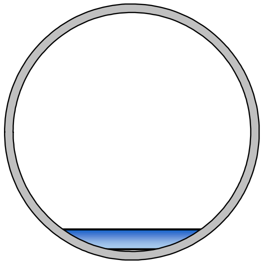
SITE 21

Average Dry Weather Flow Hydrographs



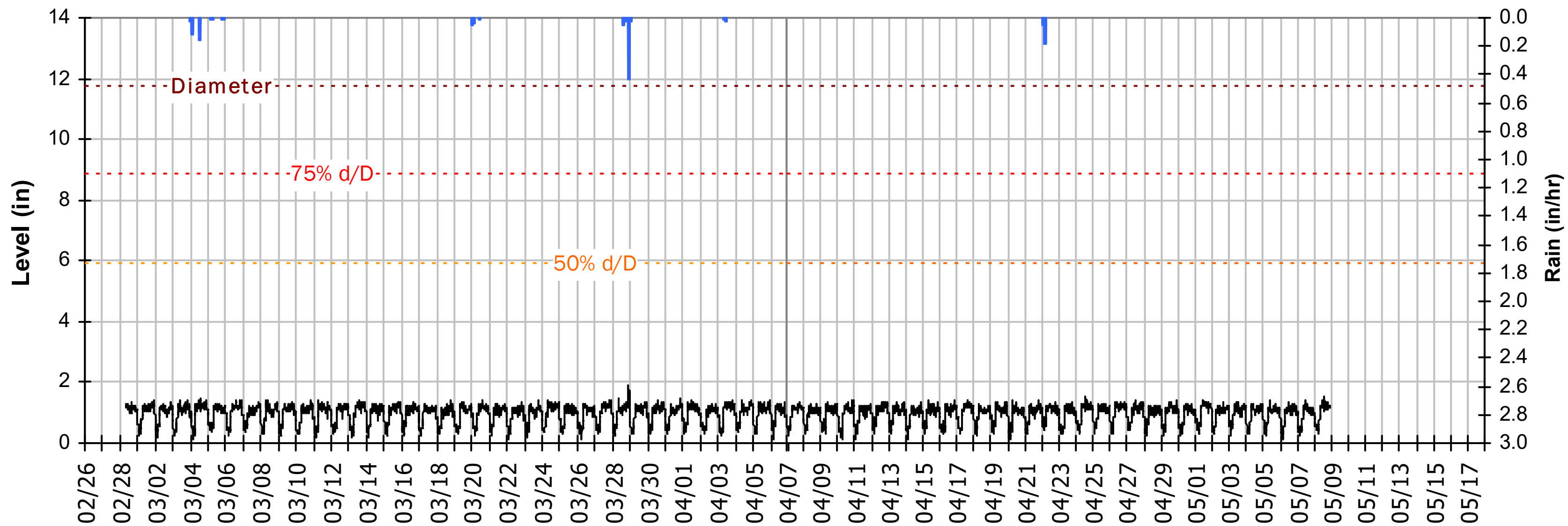
ADWF:

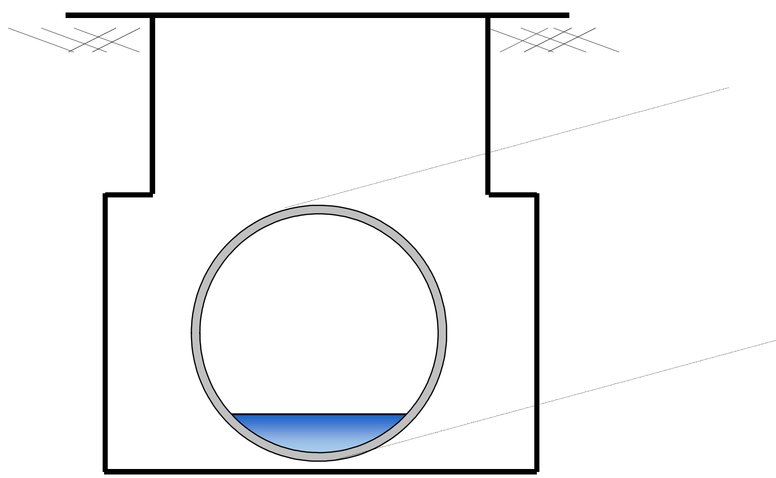
0.024 *mgd*



SITE 21
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

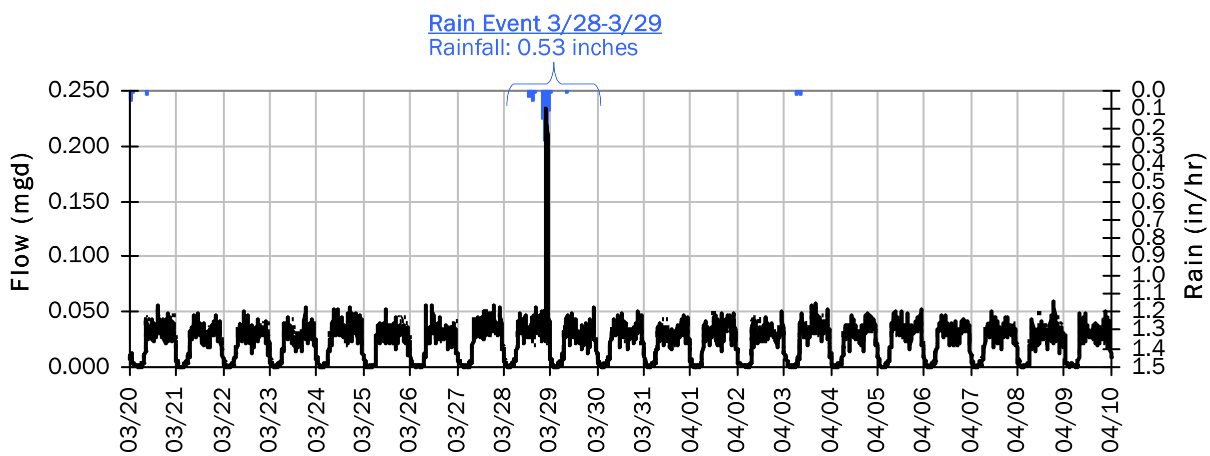




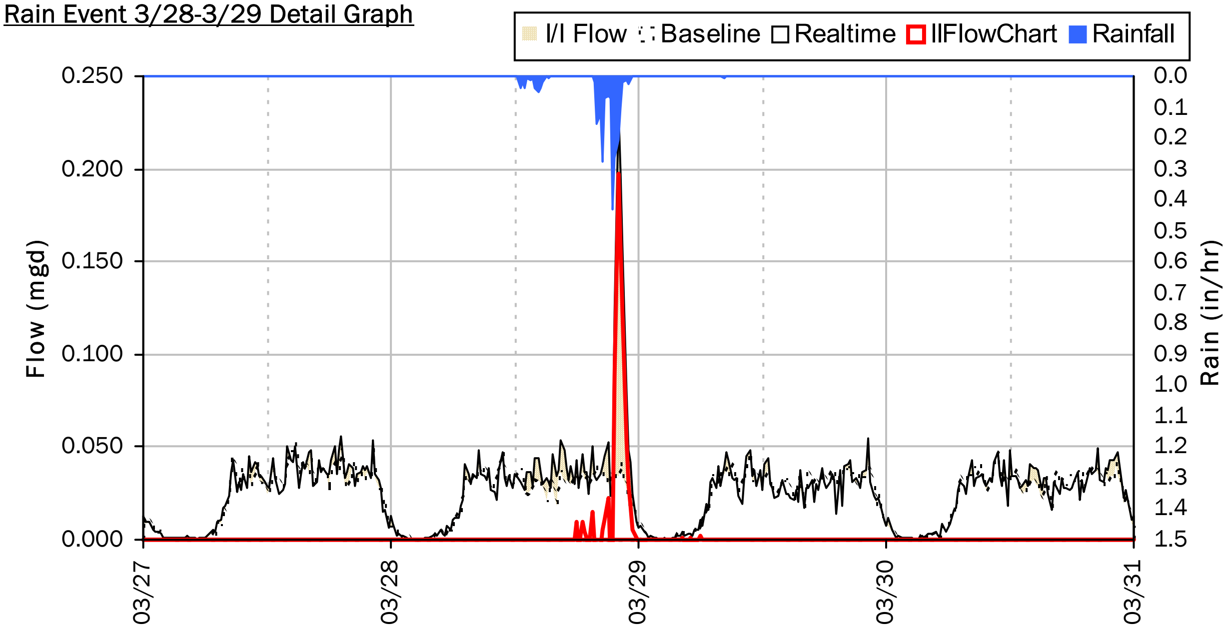
Pipe Diameter:	11.8	*inches*
Peak Measured Level:	1.9	*inches*
Peak d/D Ratio:	0.16	

SITE 21
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



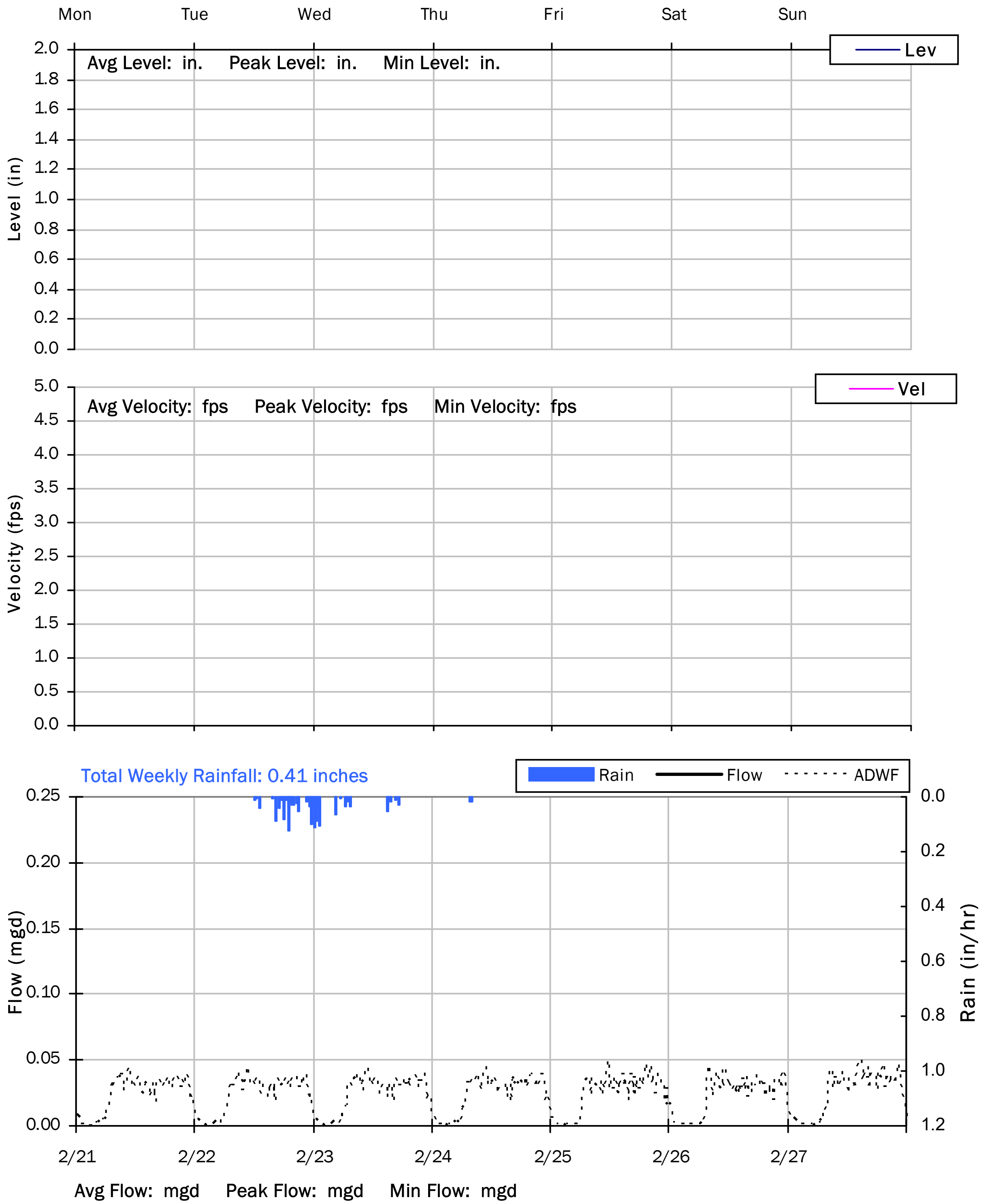
Rain Event 3/28-3/29 Detail Graph



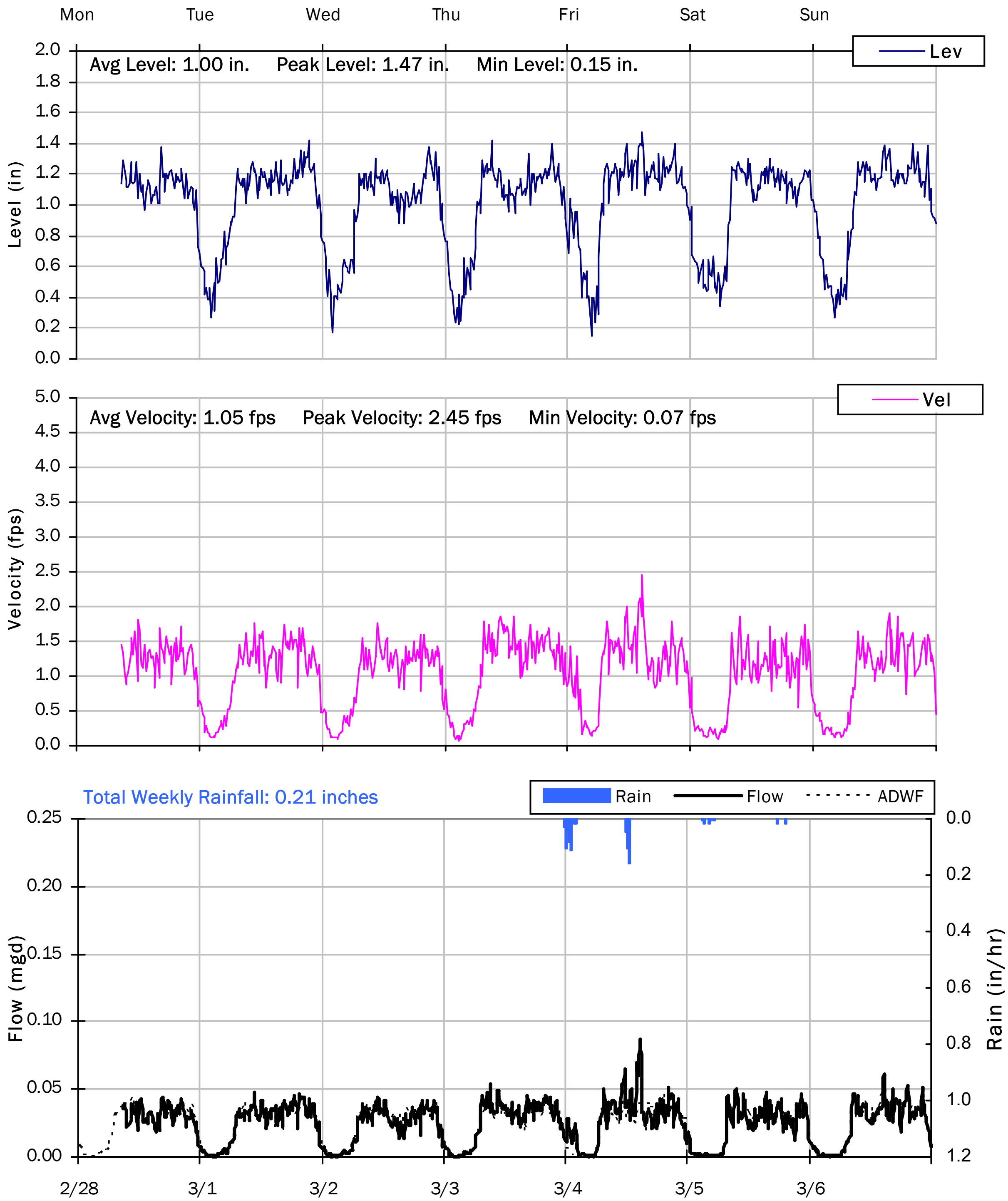
Storm Event I/I Analysis (Rain = 0.53 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.231 *mgd*	Peak I/I Rate:	0.197 *mgd*
PF:	9.76	Total I/I:	7,000 *gallons*
Peak Level:	1.90 *in*		
d/D Ratio:	0.16		

SITE 21
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



SITE 21
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

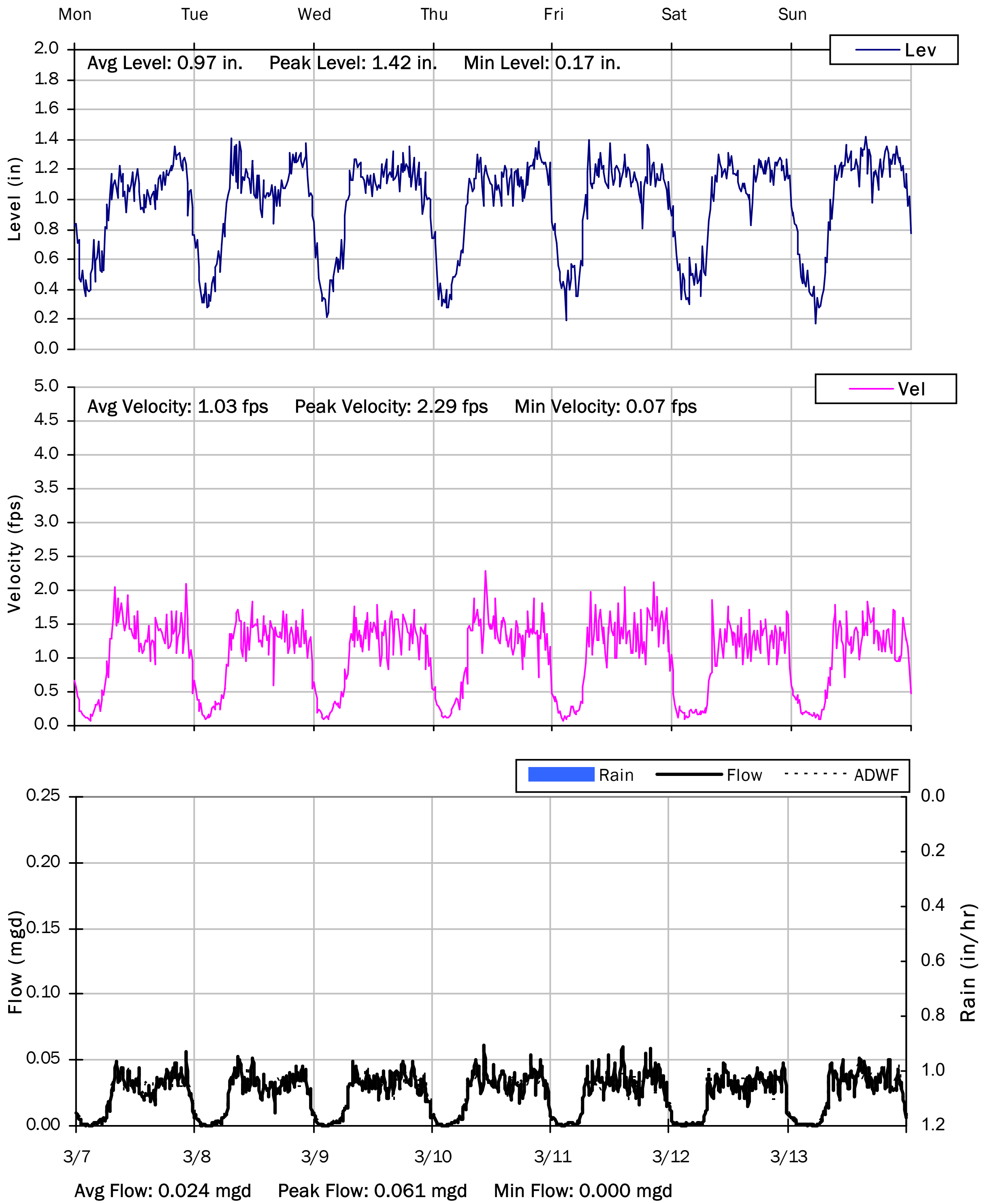


Avg Flow: 0.025 mgd Peak Flow: 0.087 mgd Min Flow: 0.000 mgd

SITE 21

Weekly Level, Velocity and Flow Hydrographs

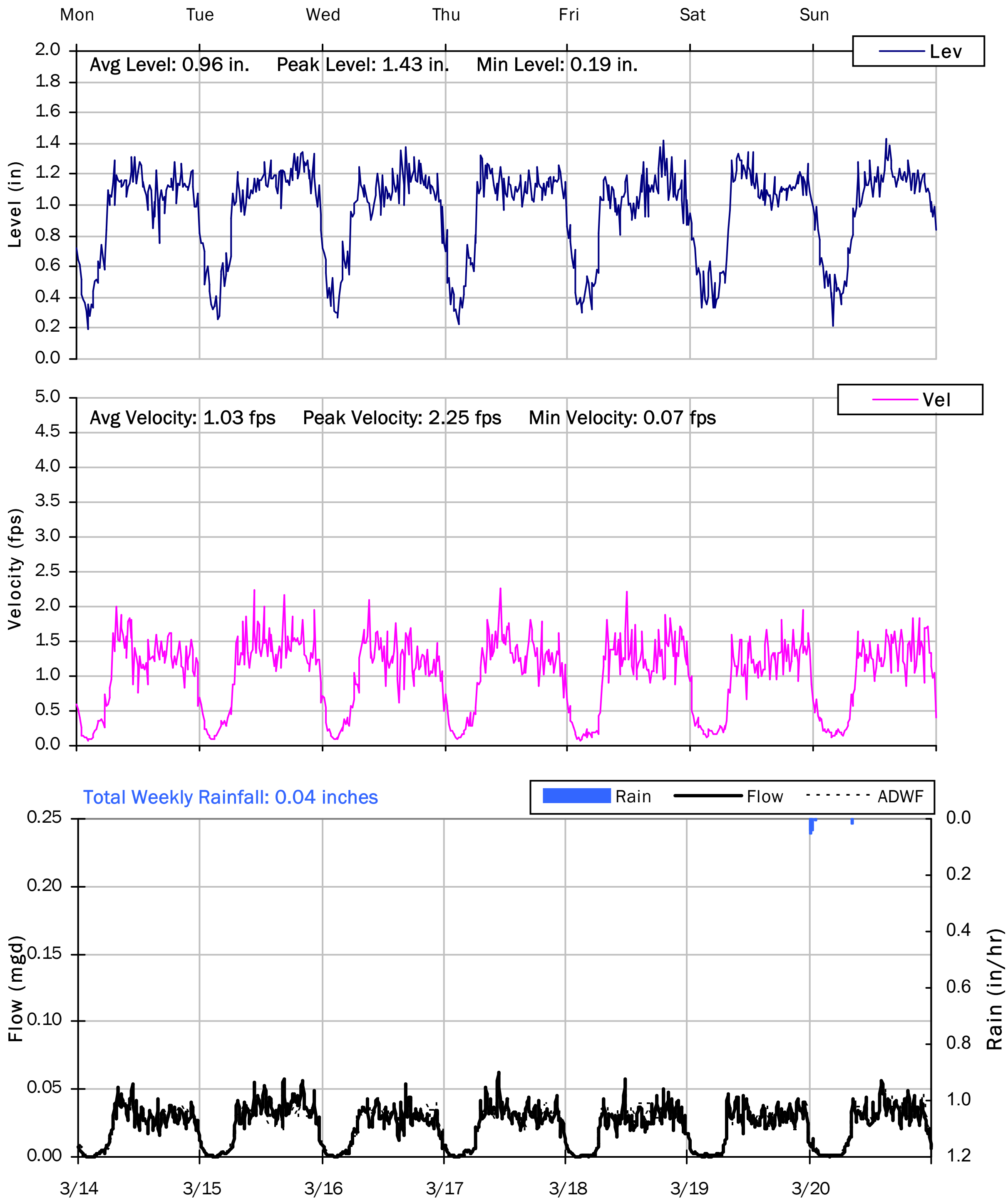
3/7/2022 to 3/14/2022



SITE 21

Weekly Level, Velocity and Flow Hydrographs

3/14/2022 to 3/21/2022

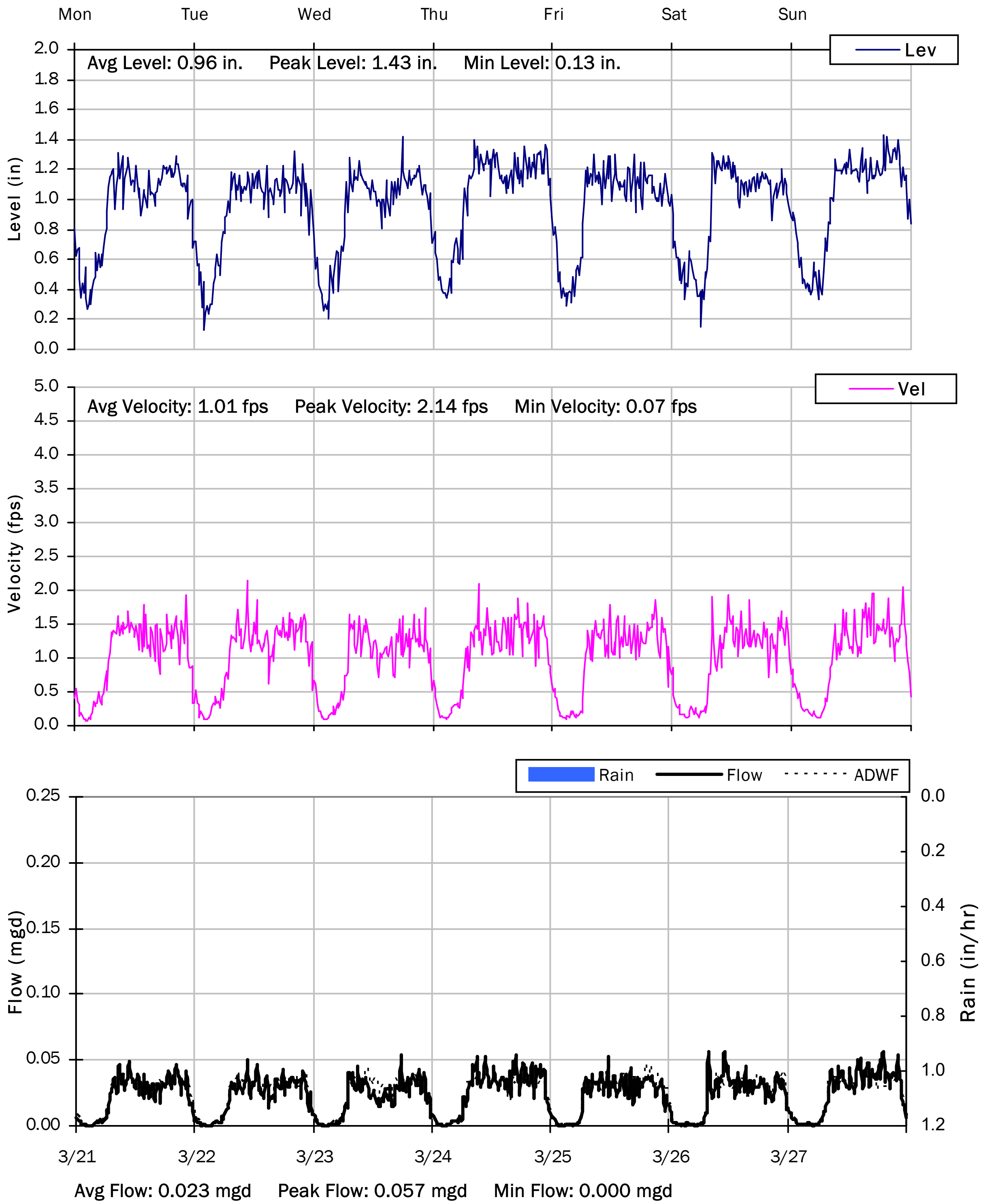


Avg Flow: 0.024 mgd   Peak Flow: 0.062 mgd   Min Flow: 0.000 mgd

SITE 21

Weekly Level, Velocity and Flow Hydrographs

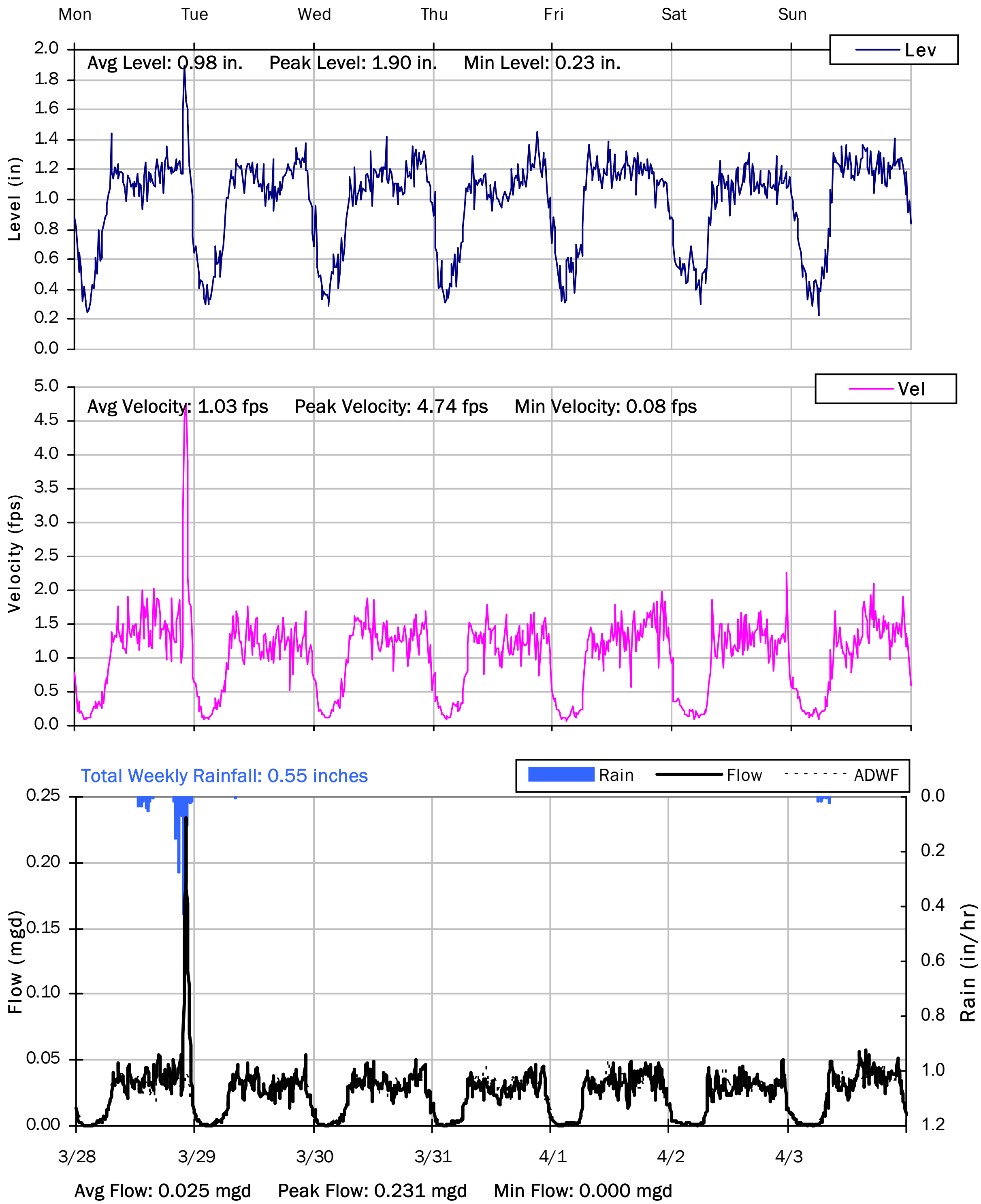
3/21/2022 to 3/28/2022



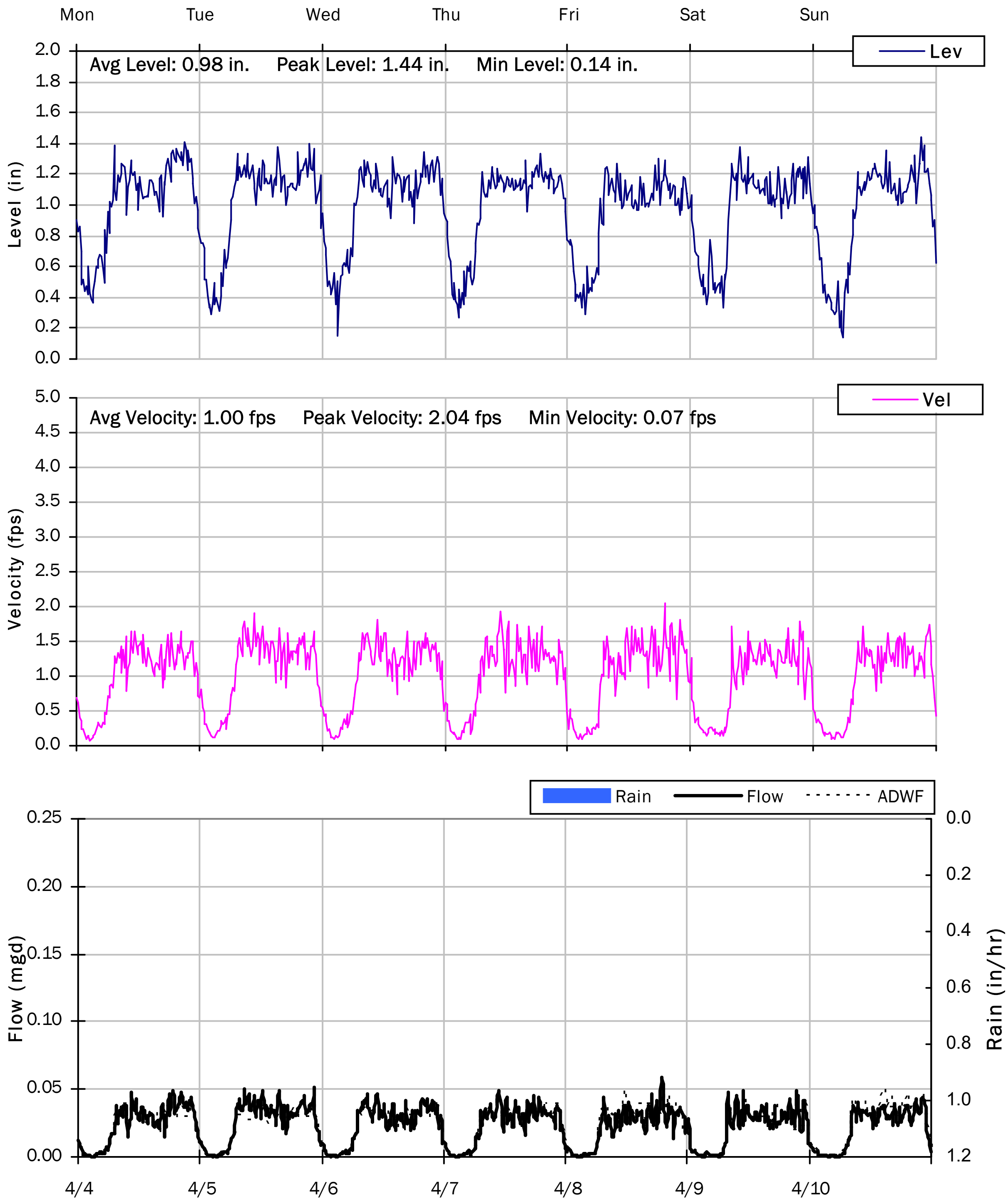
SITE 21

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

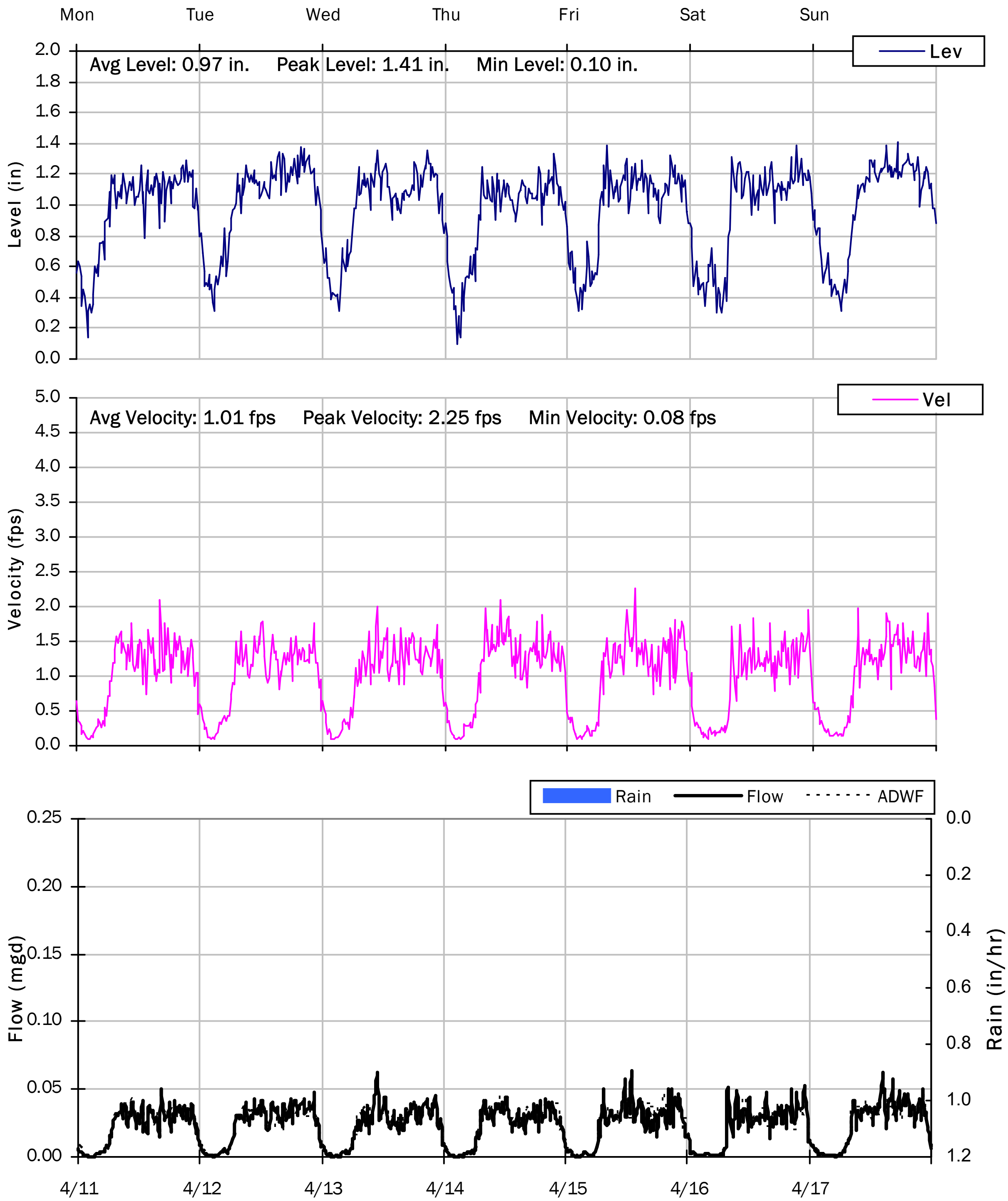


SITE 21
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022



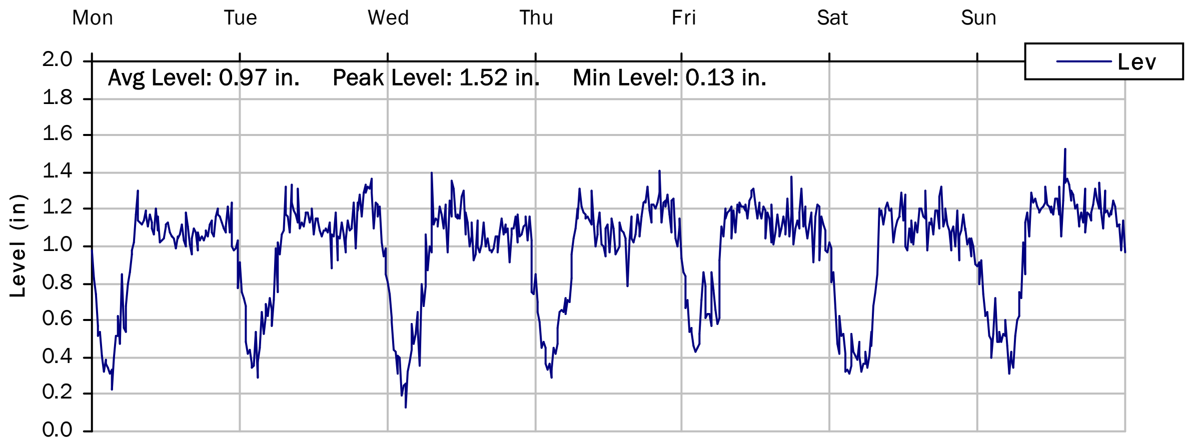
Avg Flow: 0.023 mgd Peak Flow: 0.059 mgd Min Flow: 0.000 mgd

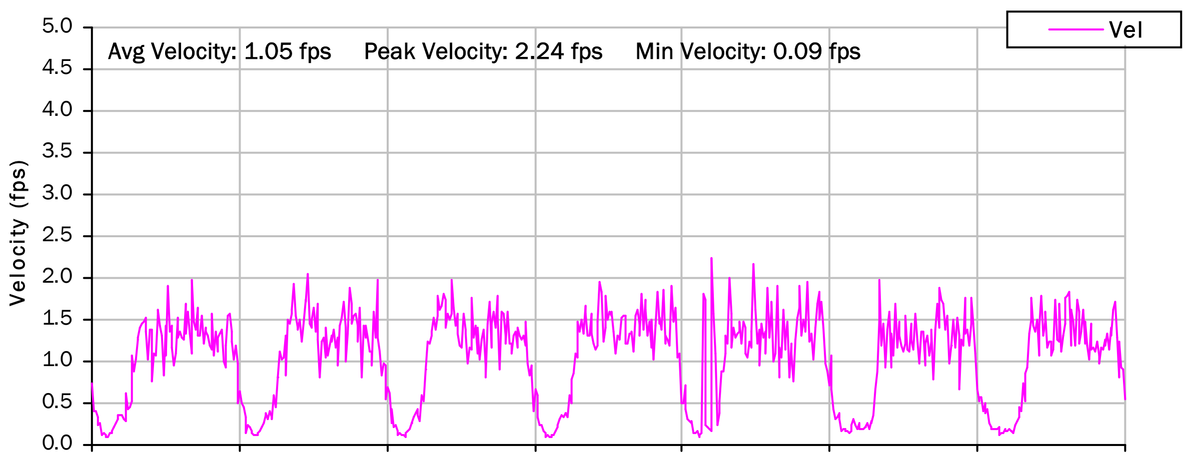
SITE 21
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

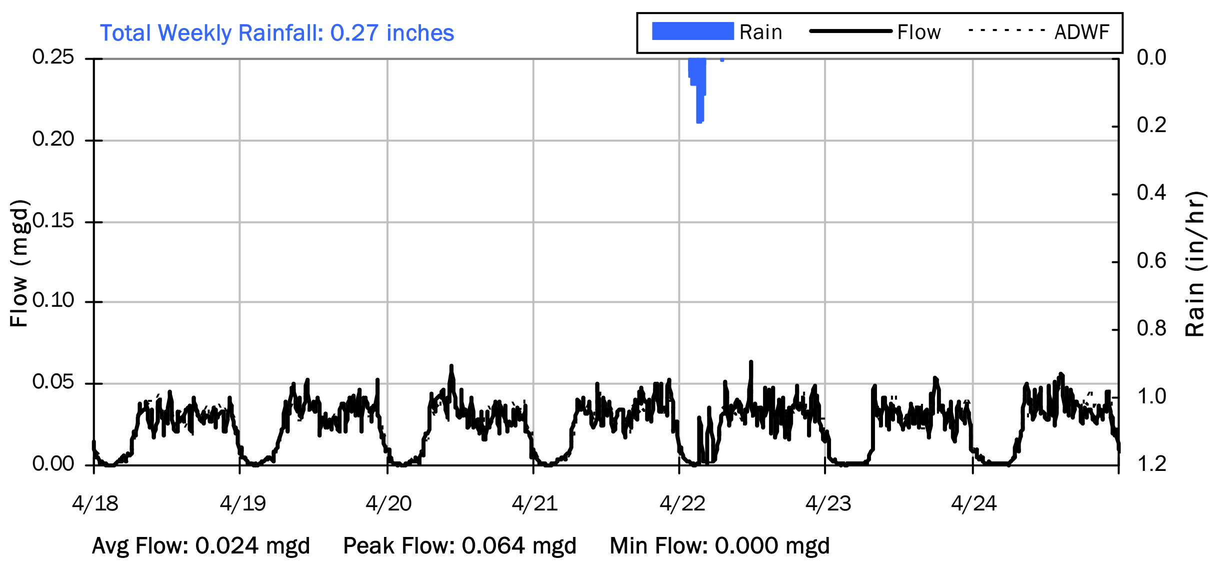


Avg Flow: 0.023 mgd Peak Flow: 0.064 mgd Min Flow: 0.000 mgd

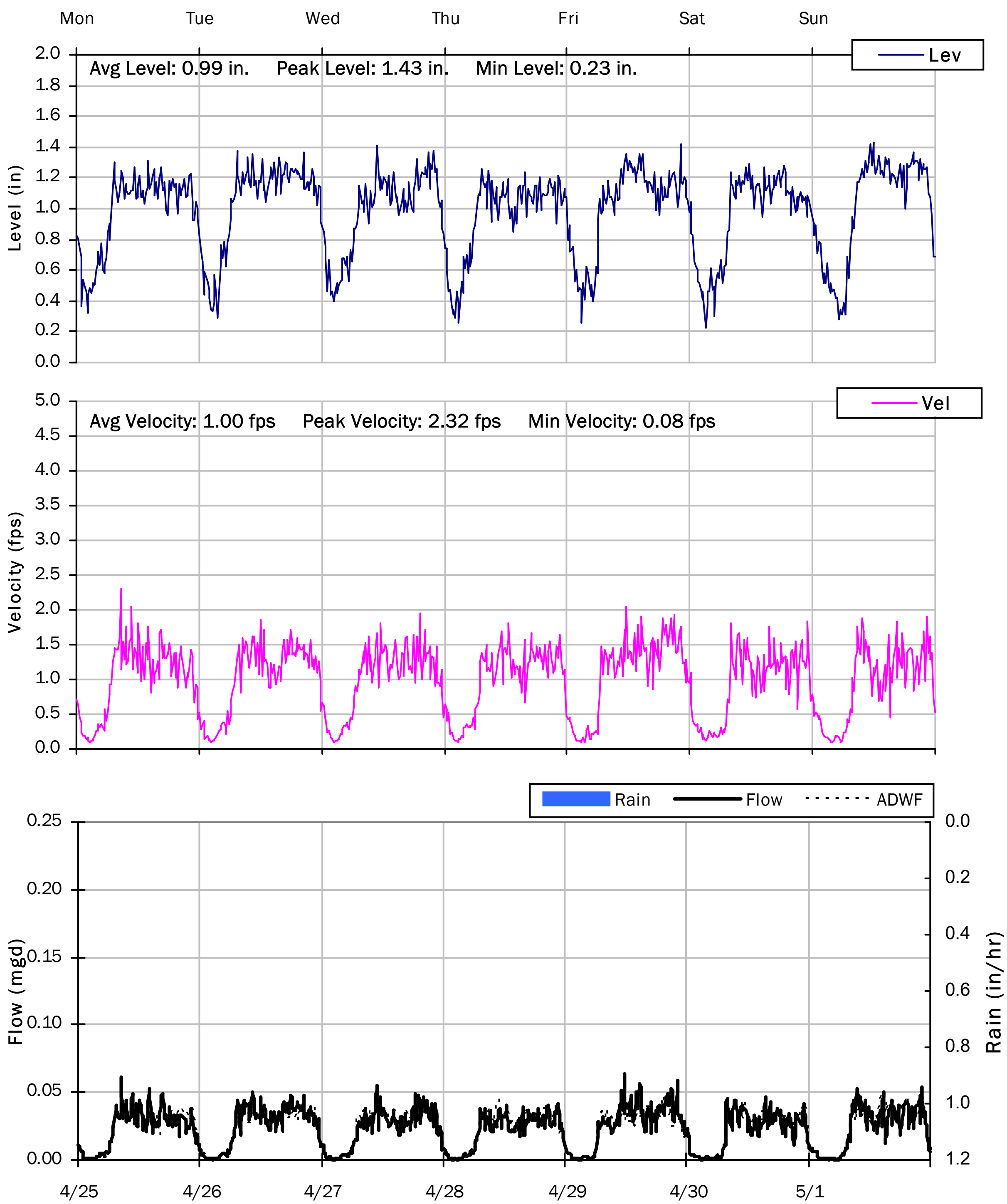
SITE 21
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022





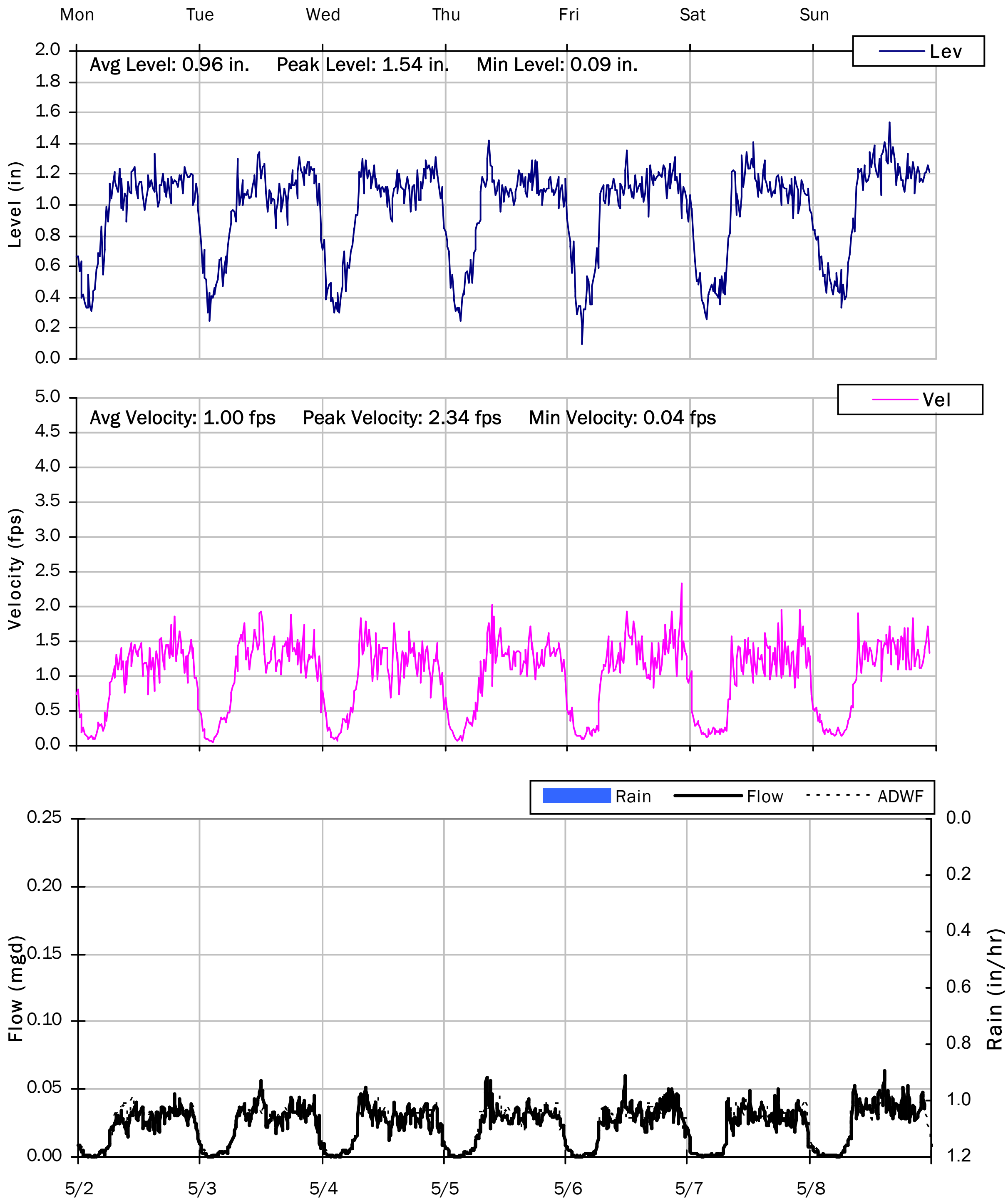


SITE 21
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022



Avg Flow: 0.023 mgd Peak Flow: 0.064 mgd Min Flow: 0.000 mgd

SITE 21
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022



Avg Flow: 0.023 mgd Peak Flow: 0.064 mgd Min Flow: 0.000 mgd

Monitoring Site: Site 22

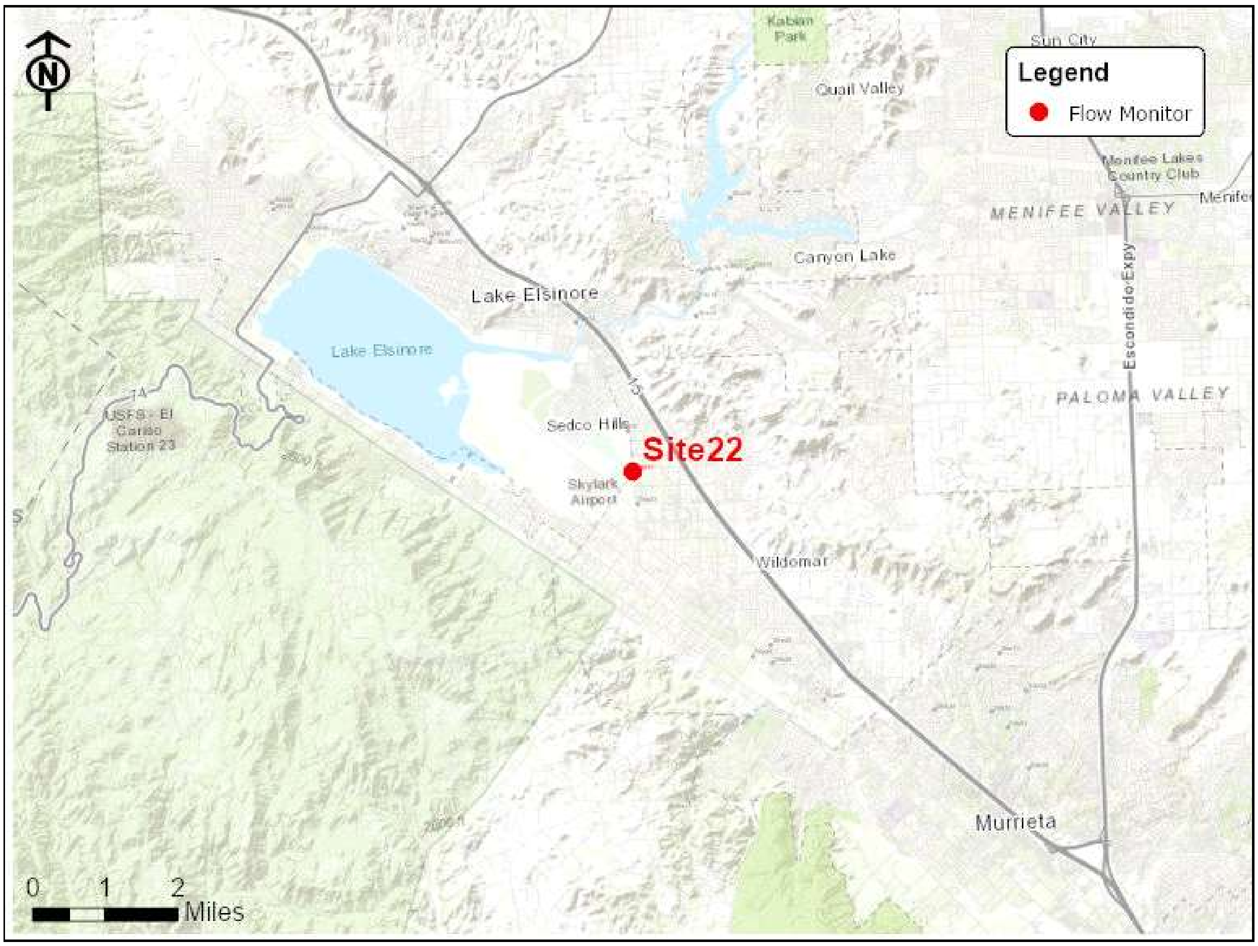
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Mission Trail Road, shoulder

Data Summary Report



Vicinity Map: Site 22

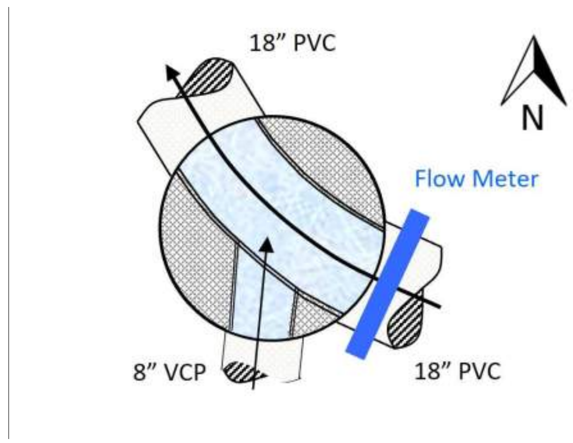
SITE 22

Site Information — MH ID: MH-3454

Location:	Mission Trail Road, shoulder
Coordinates:	117.2908° W, 33.6335° N
Rim Elevation (Earth):	1281 feet
Expected Pipe Diameter:	18 inches
Measured Pipe Diameter:	18 inches
ADWF:	0.413 mgd
Peak Measured Flow:	0.851 mgd
Sediment:	1.5 inches

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 22

Additional Site Photos

Effluent Pipe

S Influent Pipe

SITE 22

Additional Site Photos

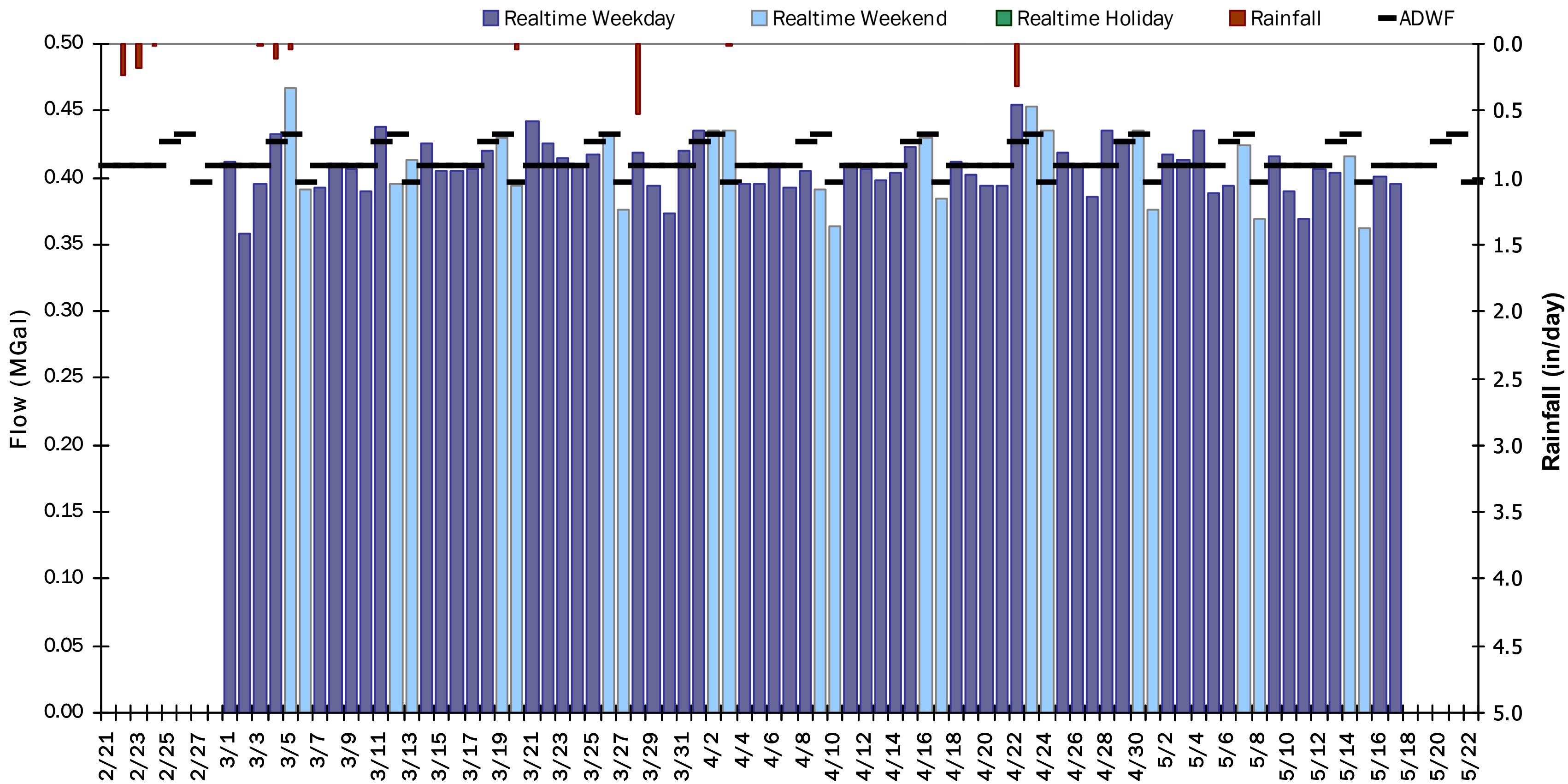
Monitored SE Influent Pipe

SITE 22

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.409 MGal Peak Daily Flow: 0.571 MGal Min Daily Flow: 0.269 MGal

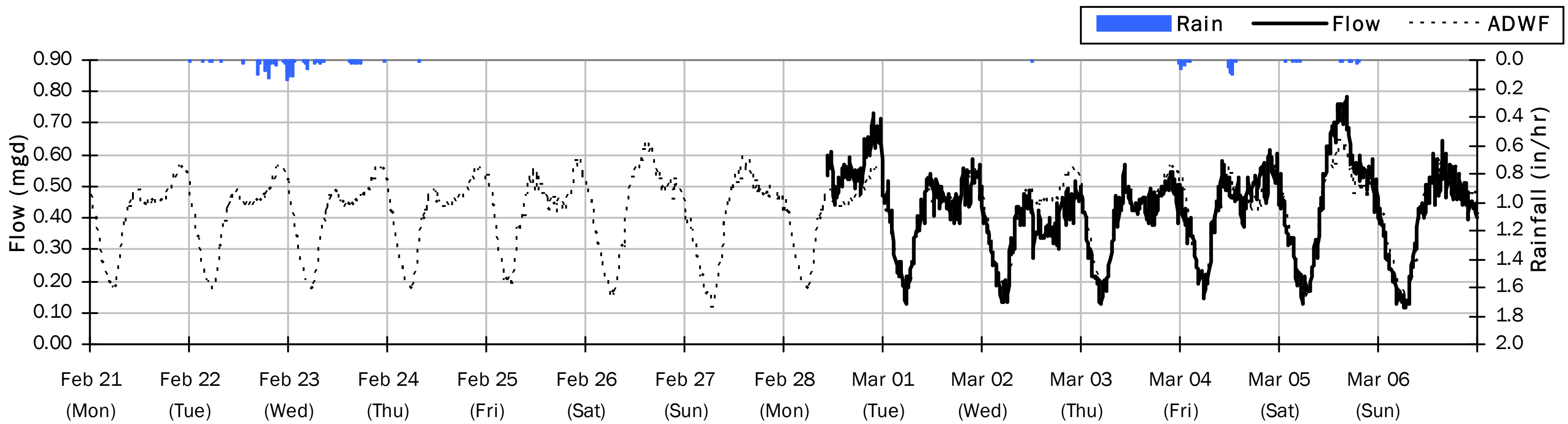
Total Rainfall: 1.05 inches

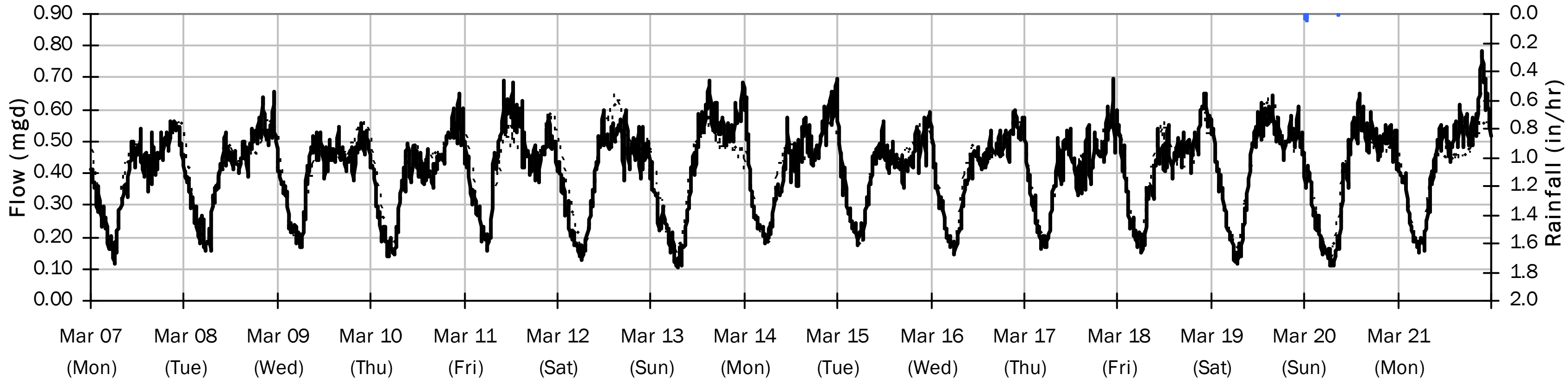


SITE 22

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.61 inches   Period Avg Flow: 0.415 mgd   Period Peak Flow: 0.786 mgd   Period Min Flow: 0.105 mgd

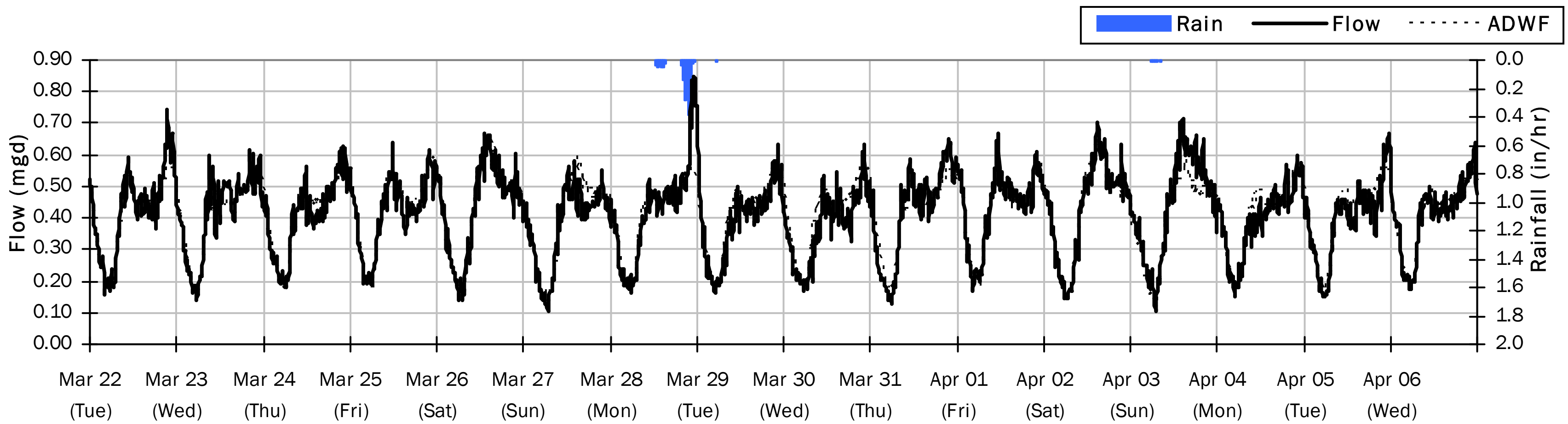


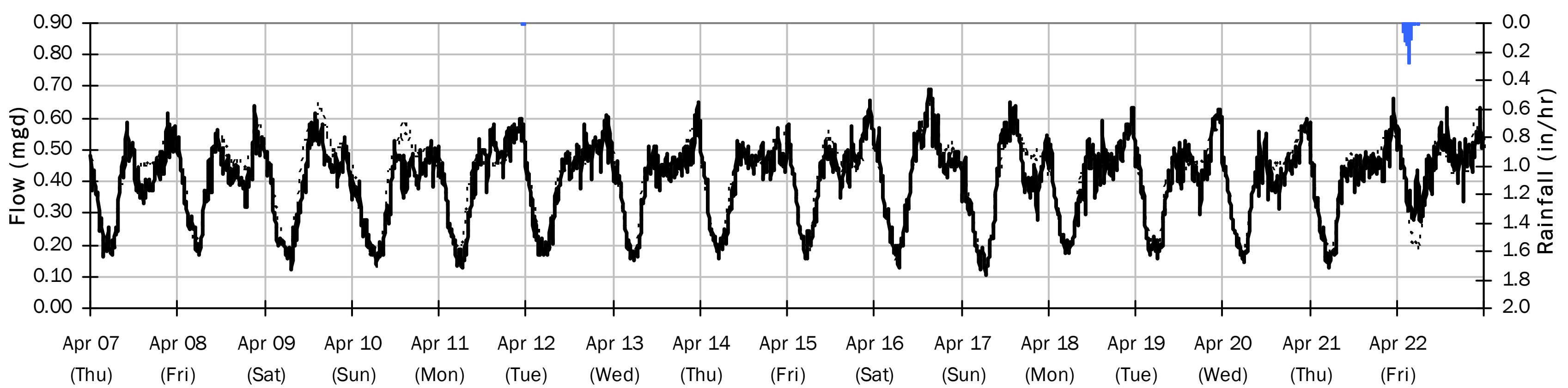


SITE 22

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.86 inches | Period Avg Flow: 0.408 mgd | Period Peak Flow: 0.851 mgd | Period Min Flow: 0.102 mgd

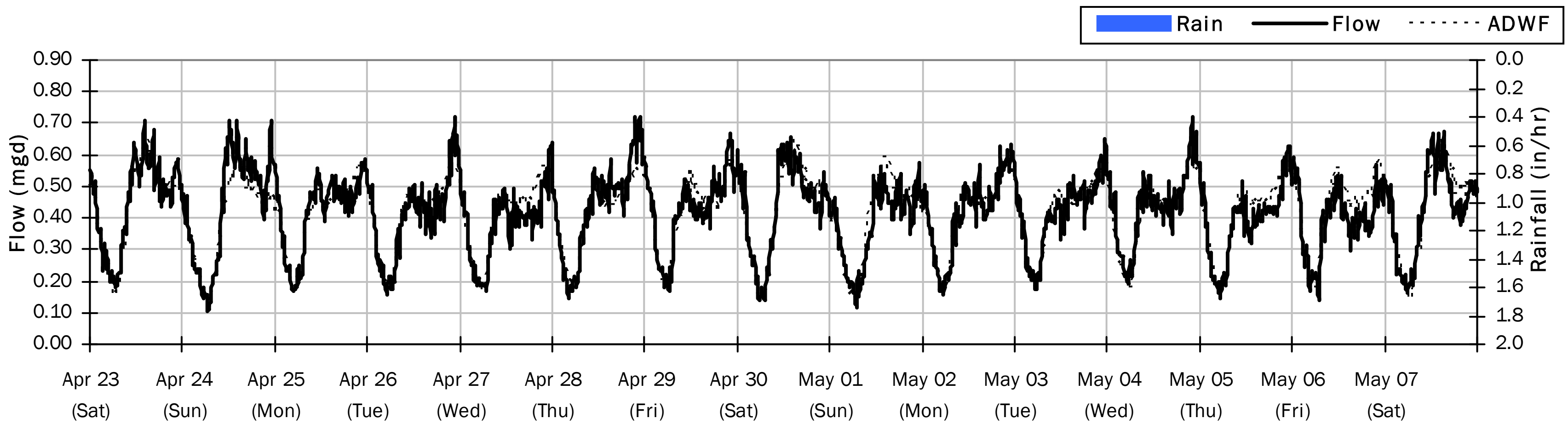


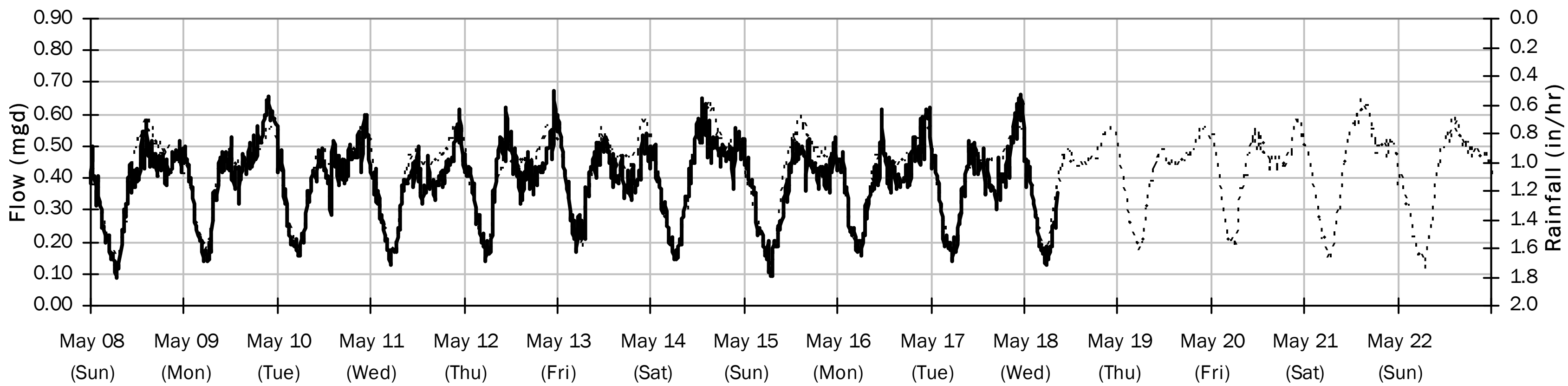


SITE 22
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

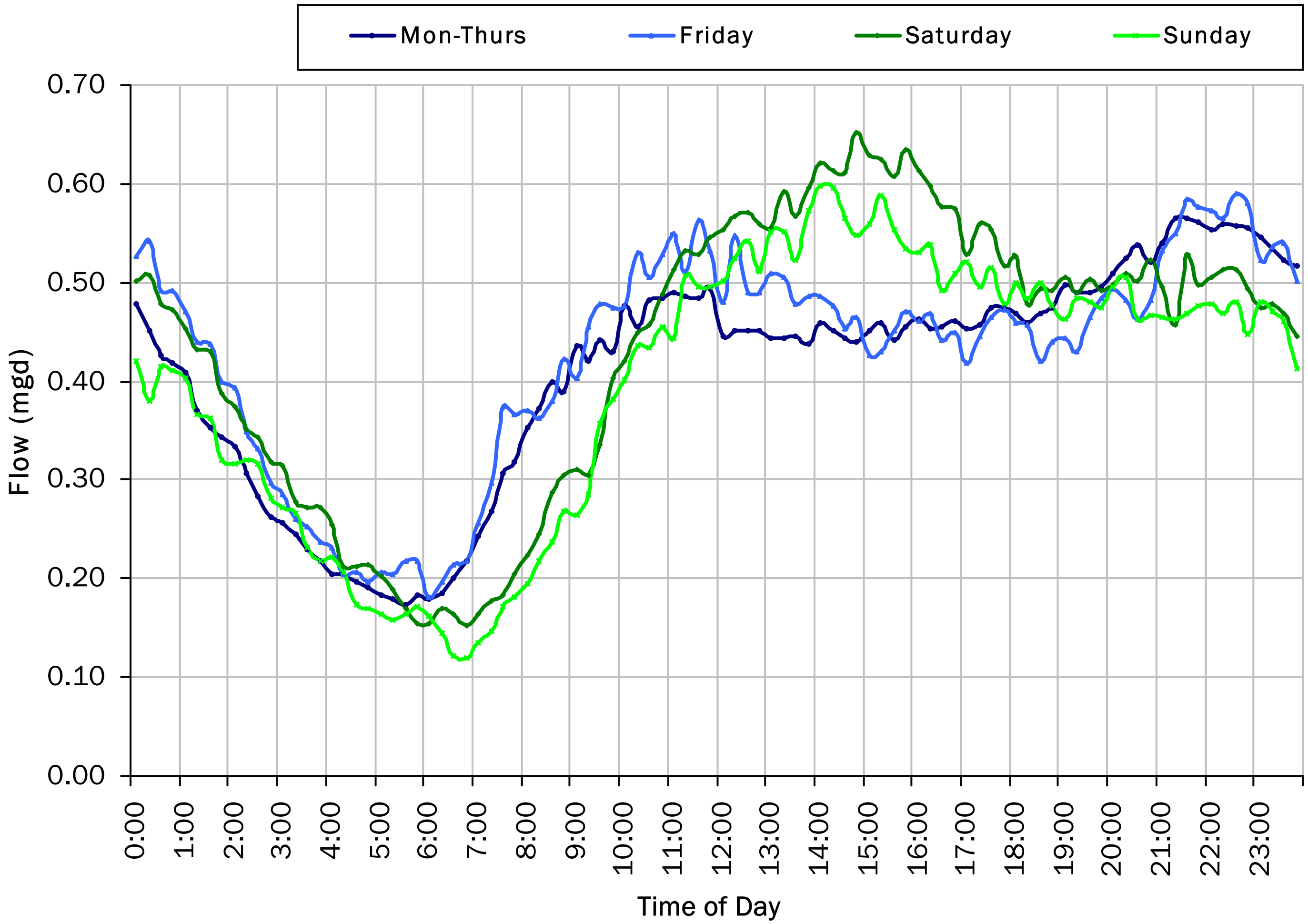
Period Avg Flow: 0.405 mgd Period Peak Flow: 0.720 mgd Period Min Flow: 0.085 mgd





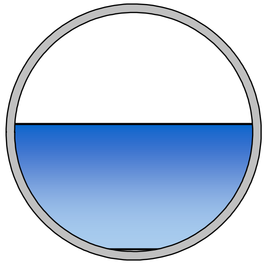
SITE 22

Average Dry Weather Flow Hydrographs



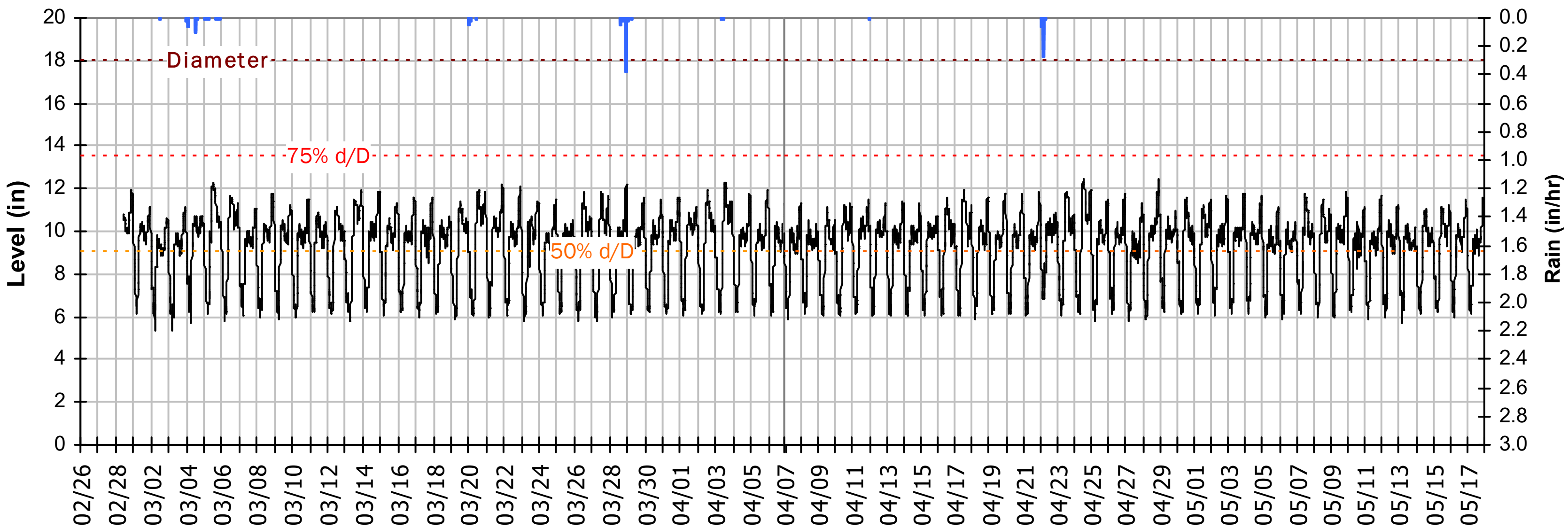
ADWF:

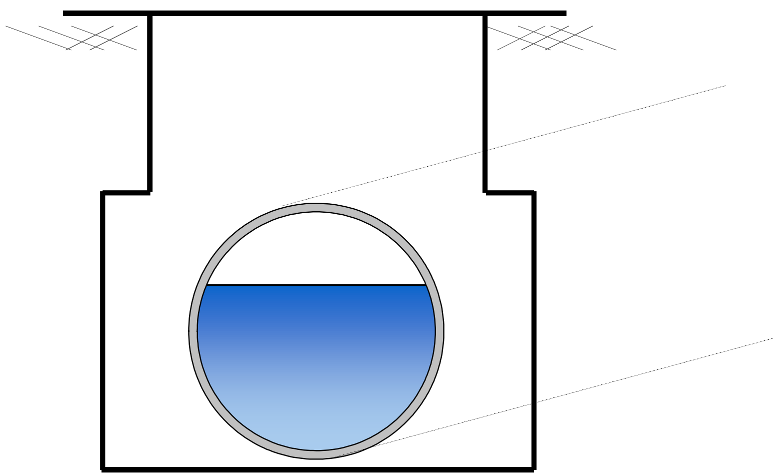
0.413 *mgd*



SITE 22
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



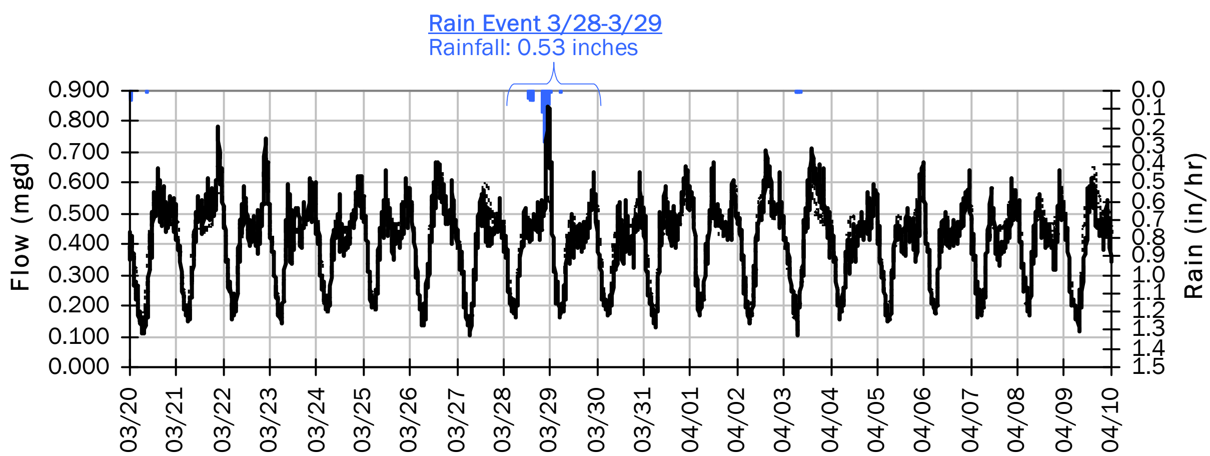


Pipe Diameter:	18	*inches*
Peak Measured Level:	12.5	*inches*
Peak d/D Ratio:	0.69	

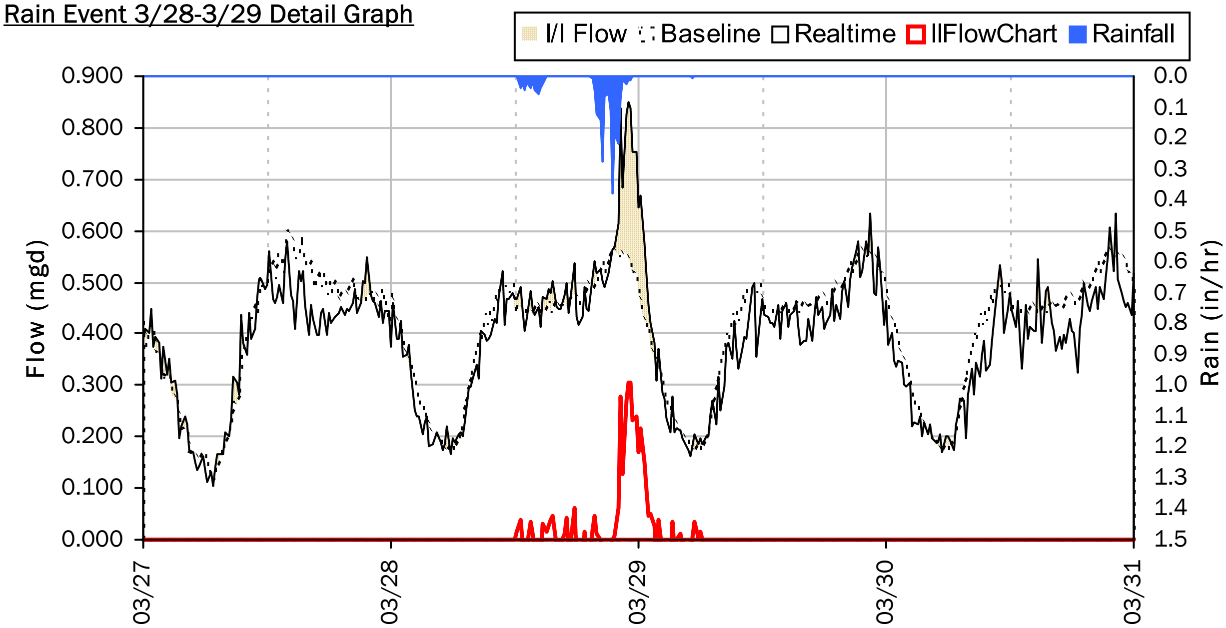
SITE 22

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



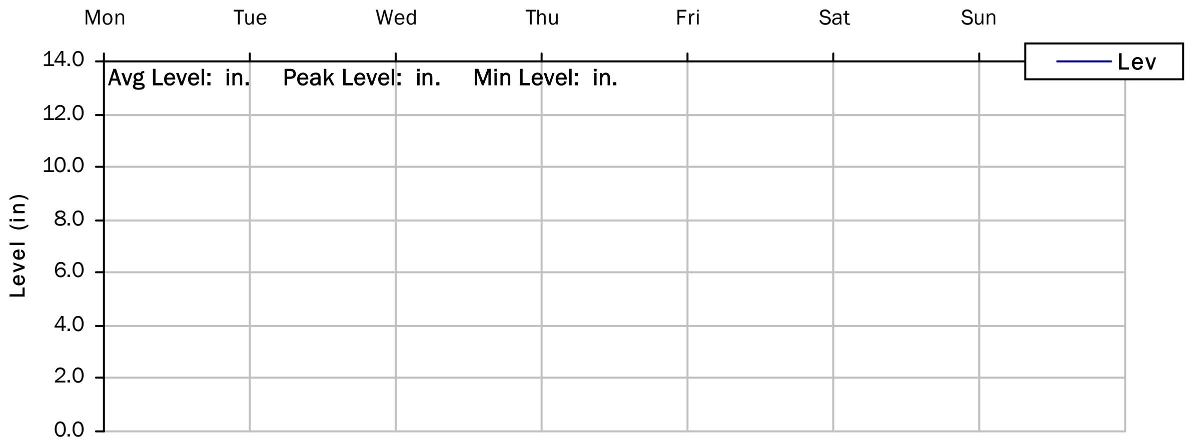
Storm Event I/I Analysis (Rain = 0.53 inches)

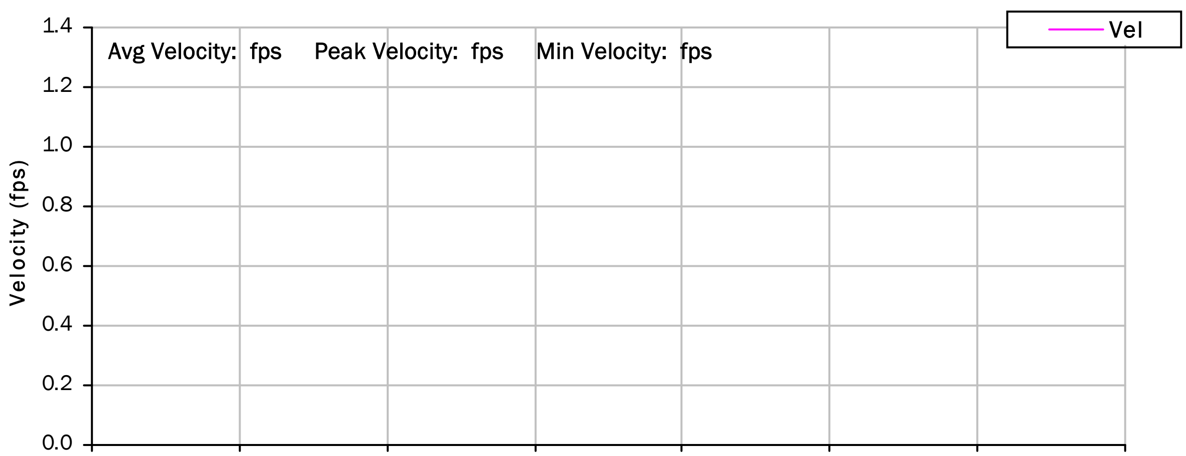
Capacity		Inflow / Infiltration	
Peak Flow:	0.851 *mgd*	Peak I/I Rate:	0.306 *mgd*
PF:	2.06	Total I/I:	26,000 *gallons*
Peak Level:	12.23 *in*		
d/D Ratio:	0.68		

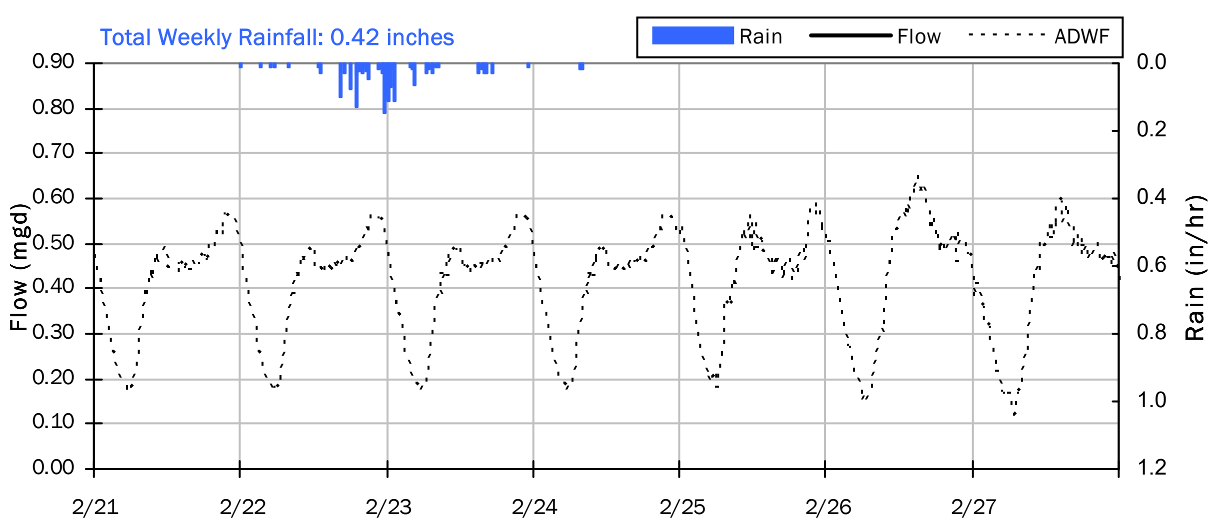
SITE 22

Weekly Level, Velocity and Flow Hydrographs

2/21/2022 to 2/28/2022





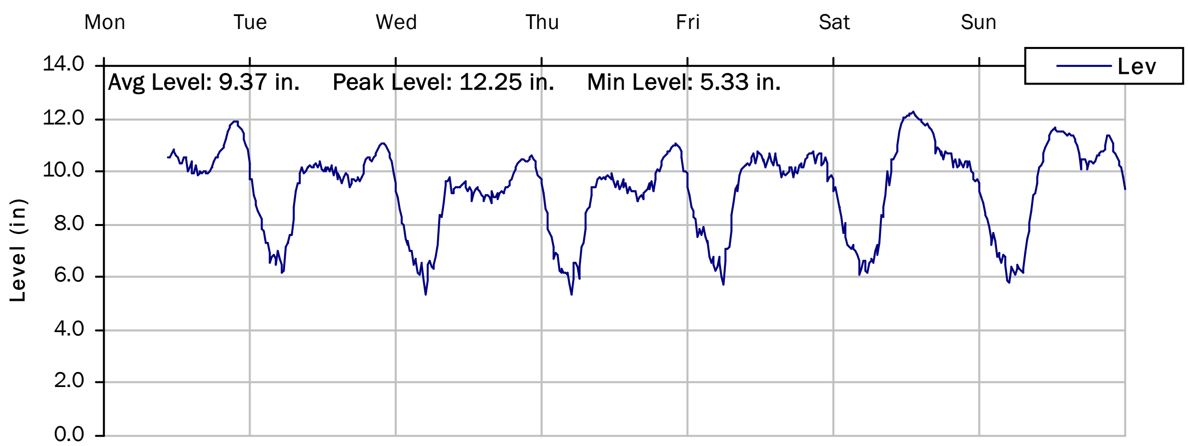


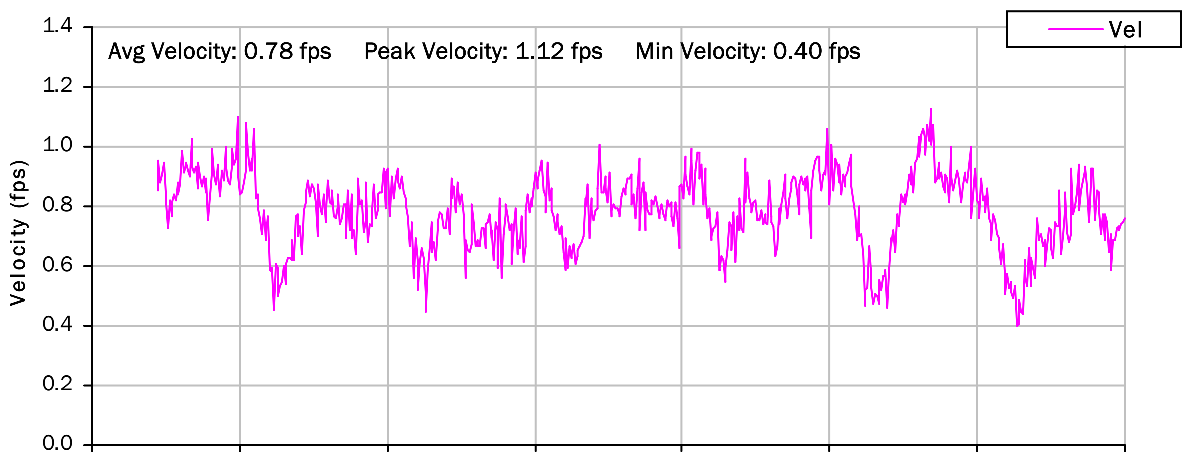
Avg Flow: mgd Peak Flow: mgd Min Flow: mgd

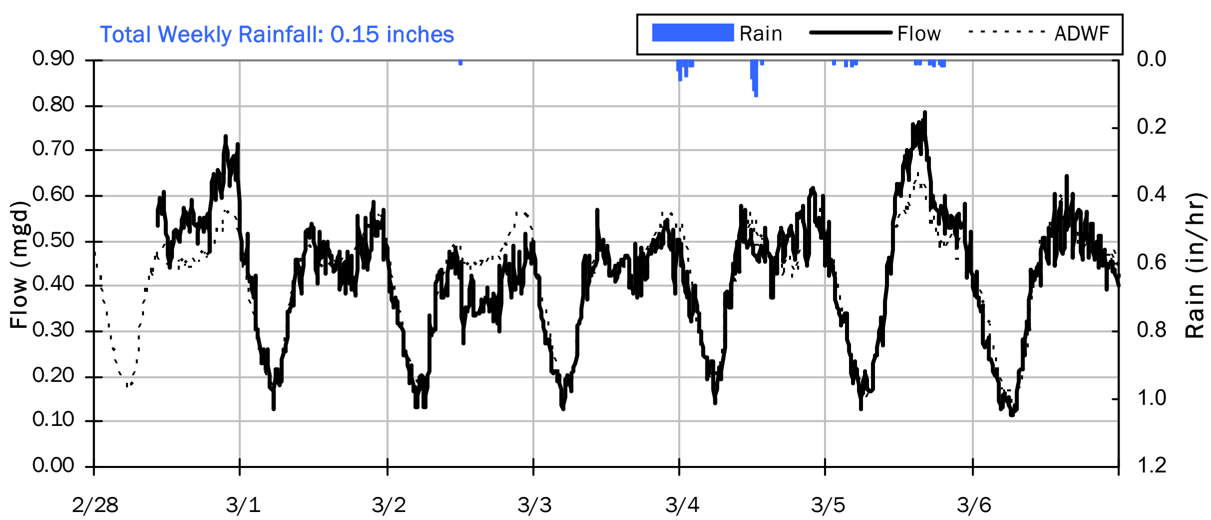
SITE 22

Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022

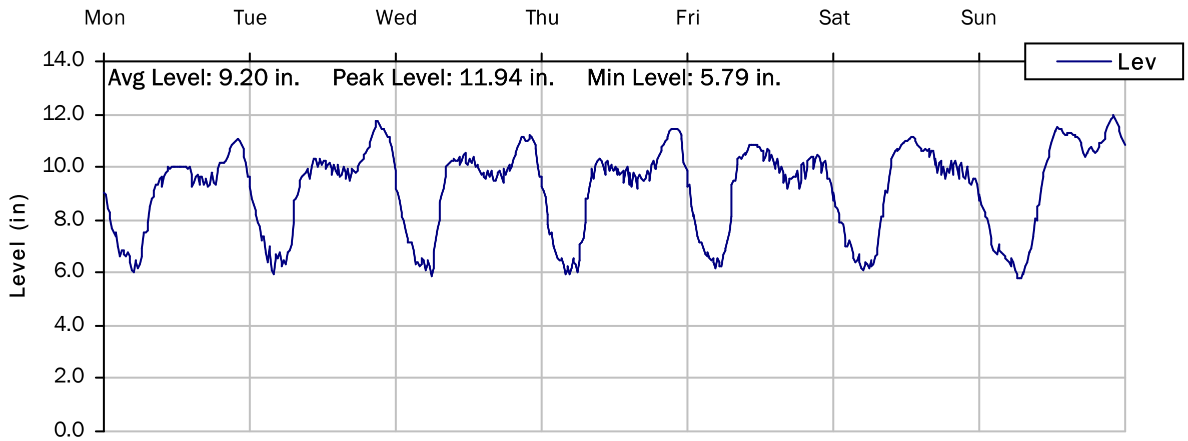


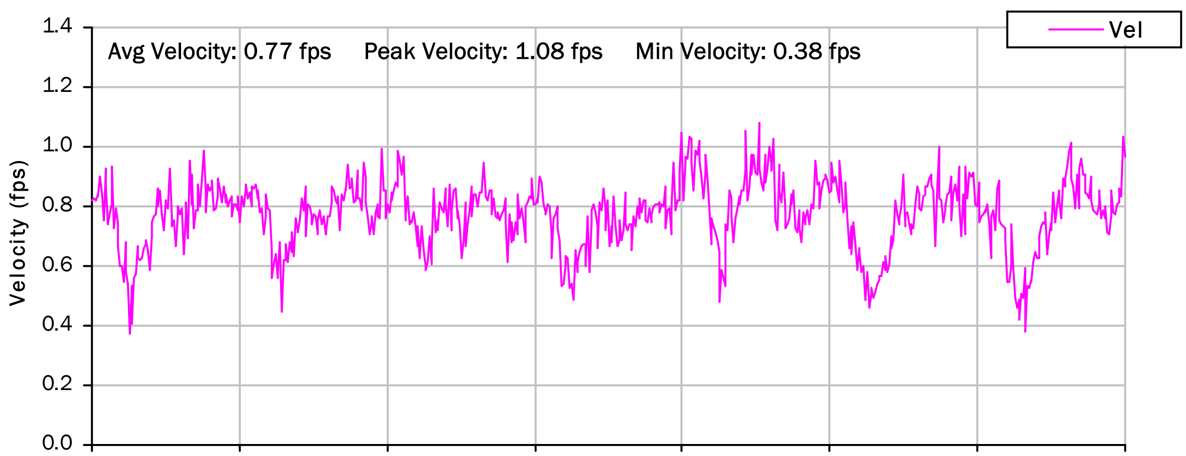


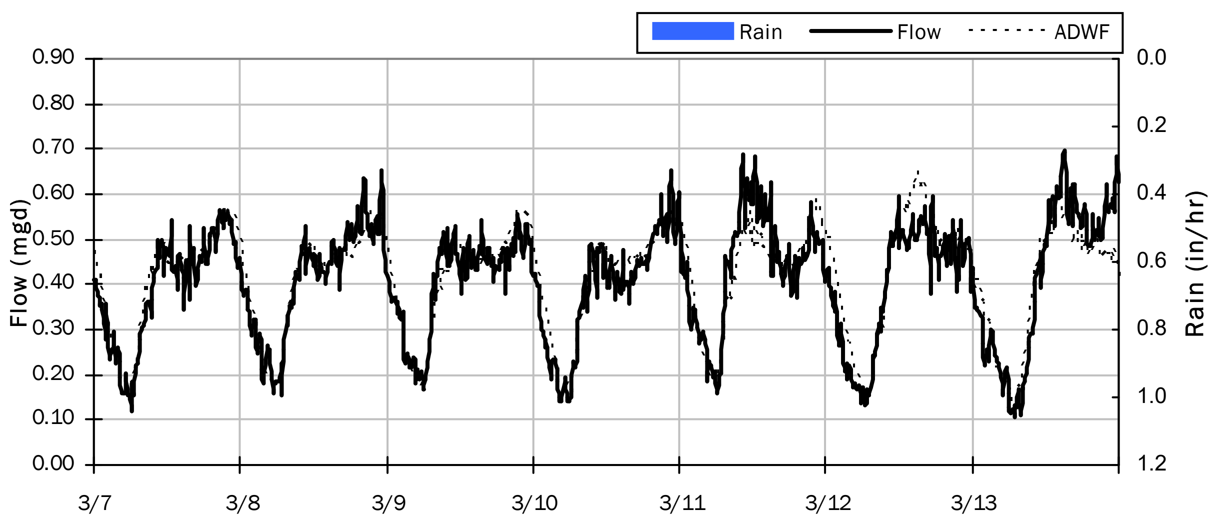


Avg Flow: 0.423 mgd Peak Flow: 0.784 mgd Min Flow: 0.117 mgd

SITE 22
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

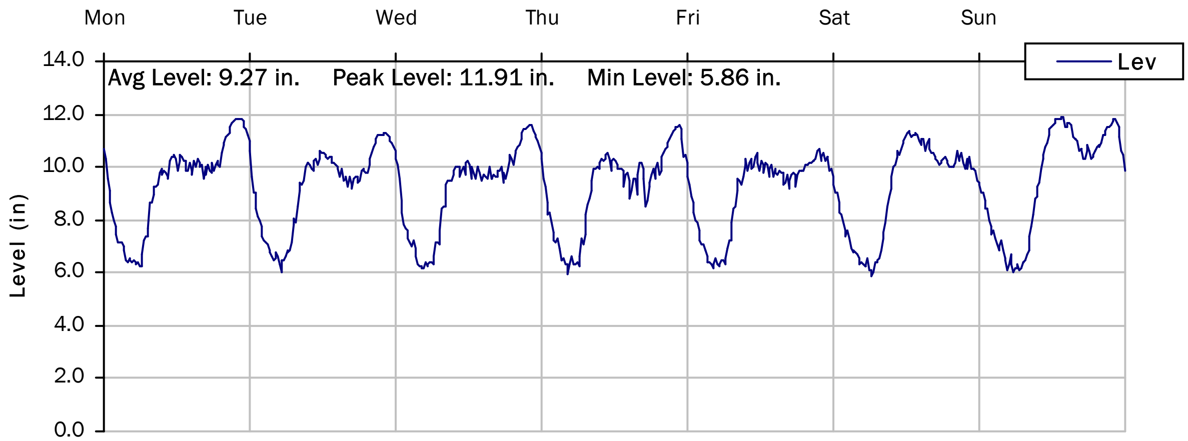


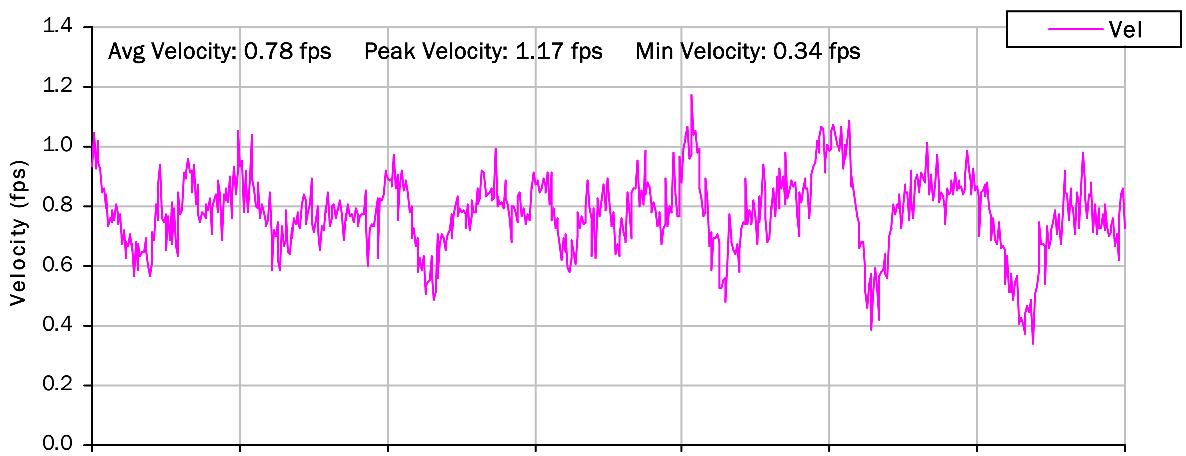


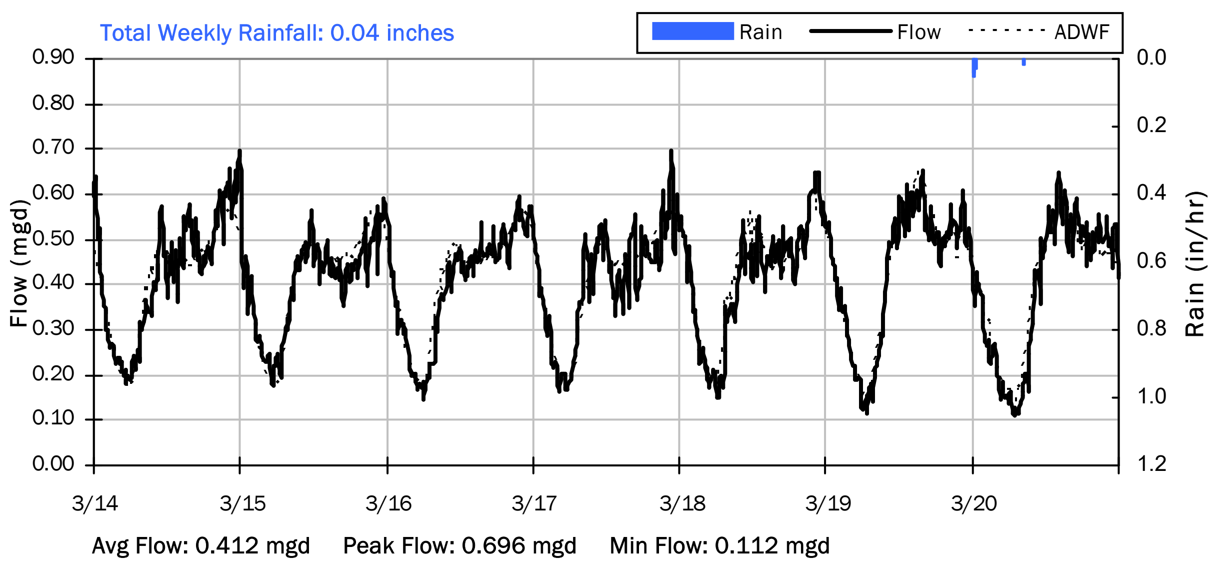


Avg Flow: 0.407 mgd Peak Flow: 0.692 mgd Min Flow: 0.105 mgd

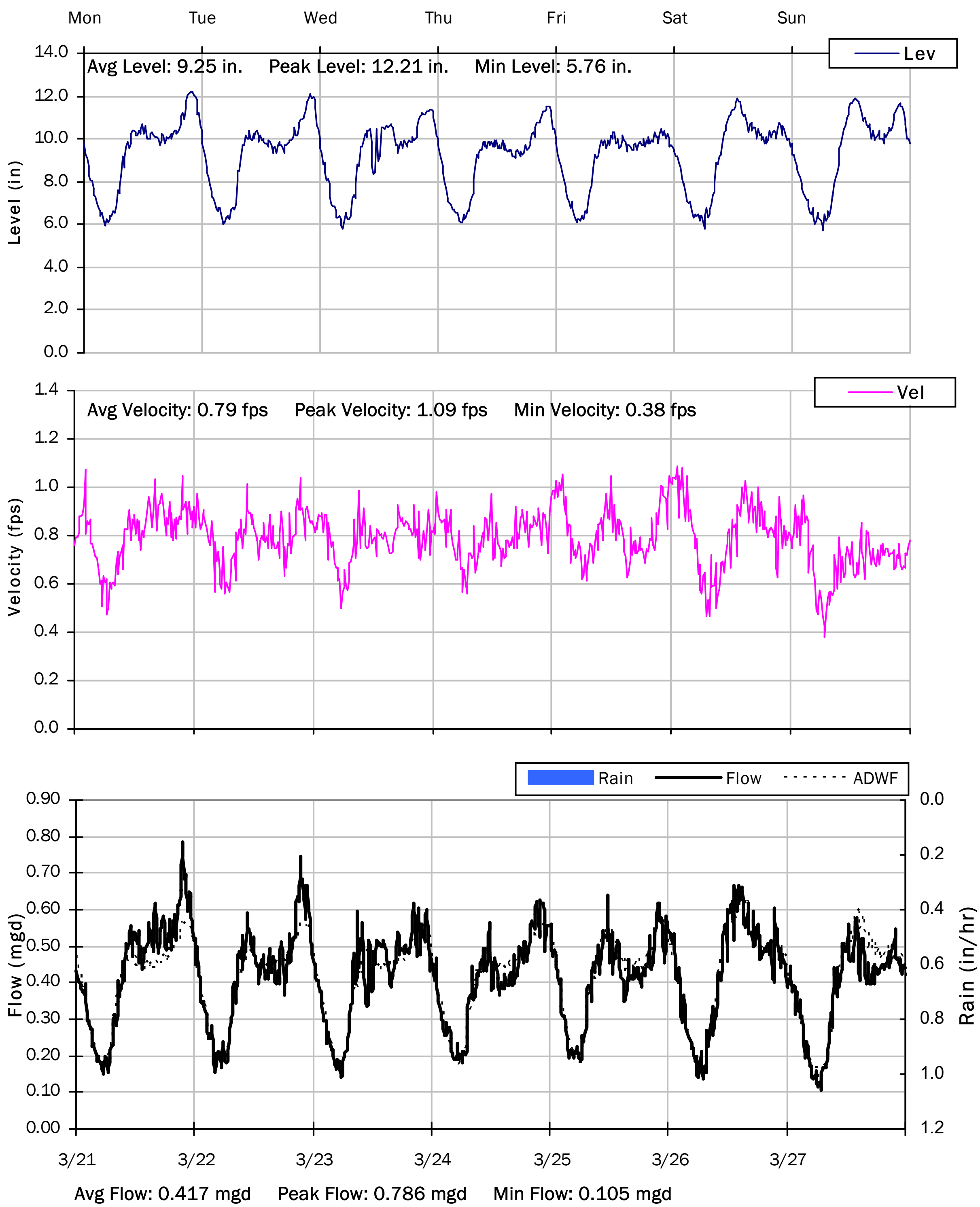
SITE 22
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022







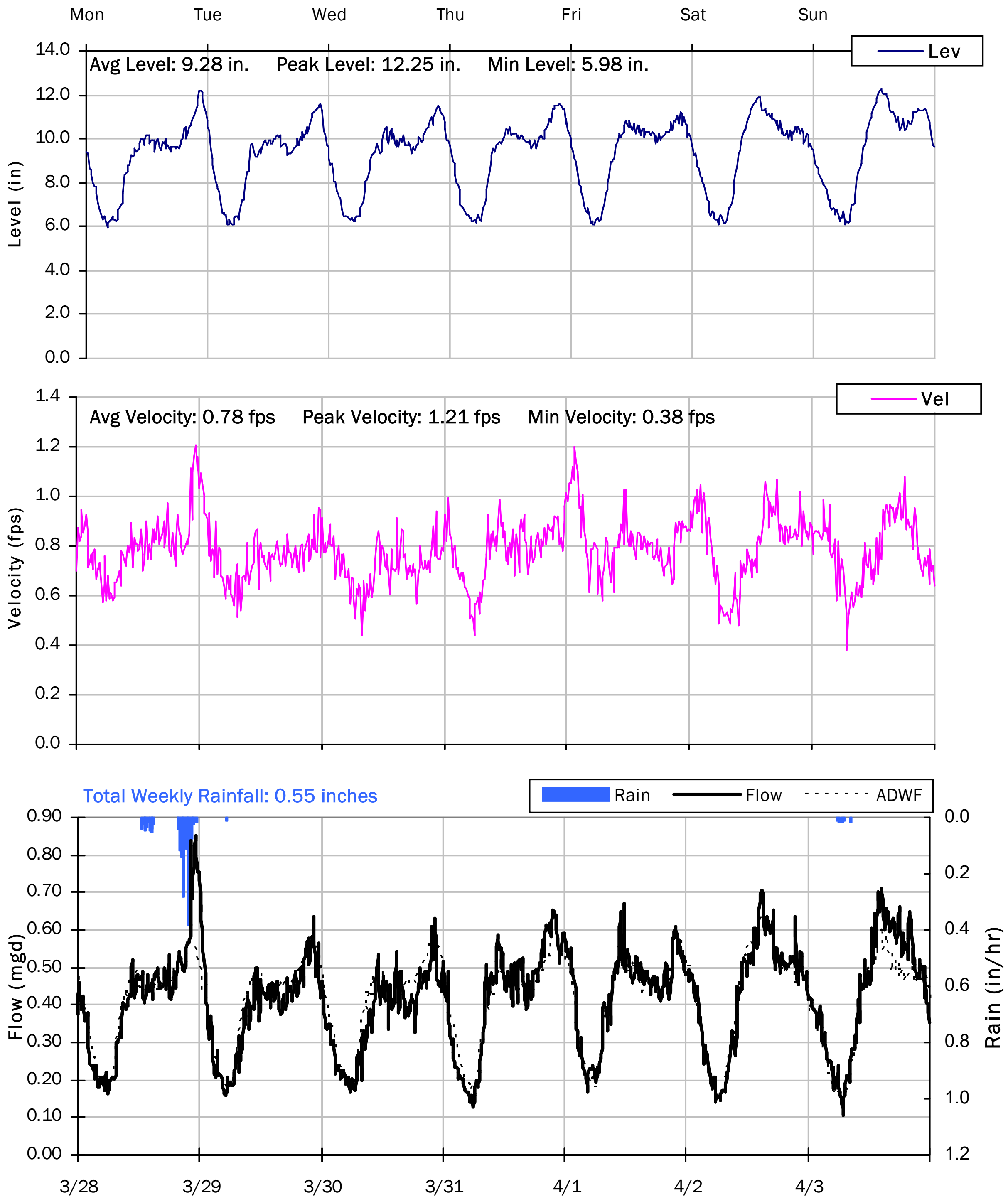
SITE 22
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



SITE 22

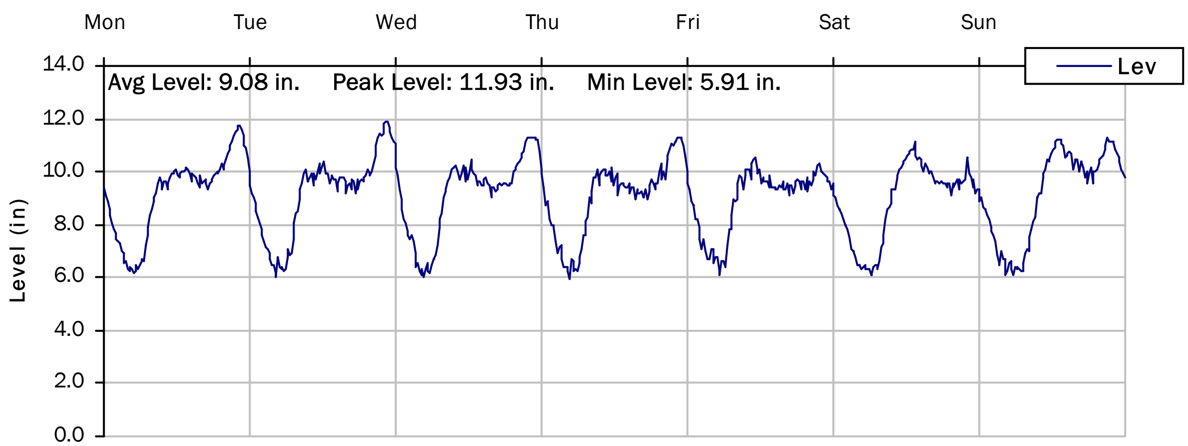
Weekly Level, Velocity and Flow Hydrographs

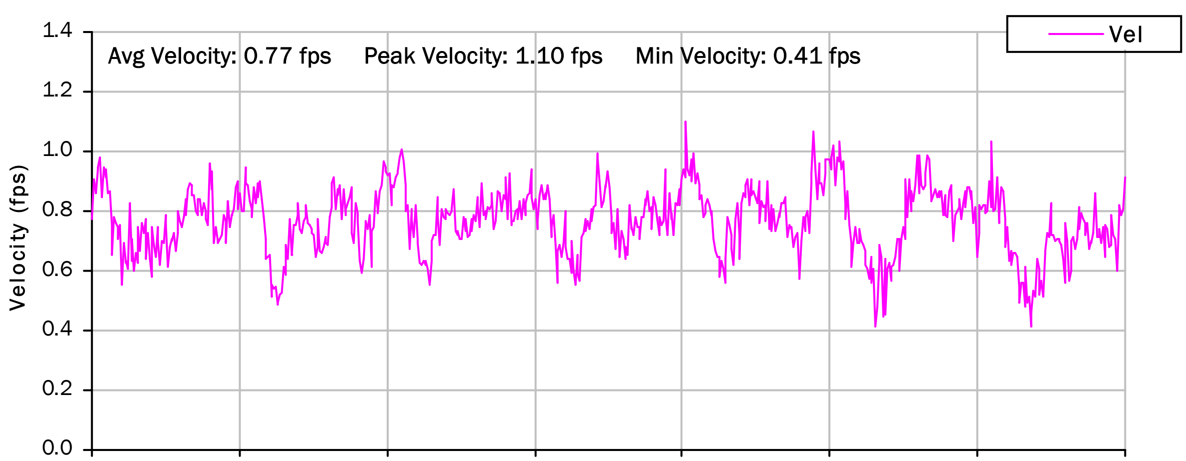
3/28/2022 to 4/4/2022

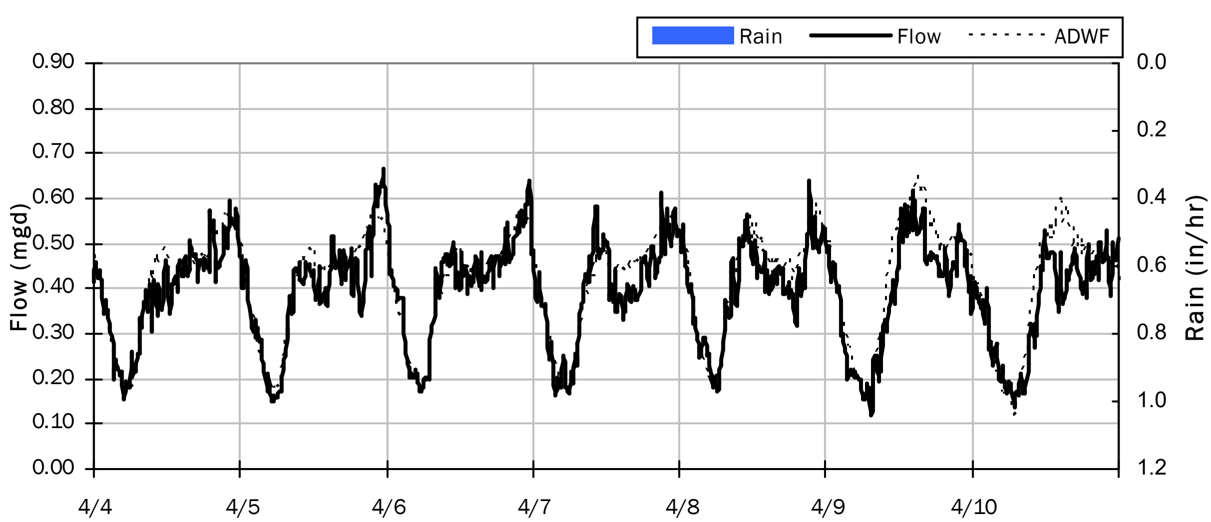


Avg Flow: 0.416 mgd   Peak Flow: 0.851 mgd   Min Flow: 0.106 mgd

SITE 22
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022





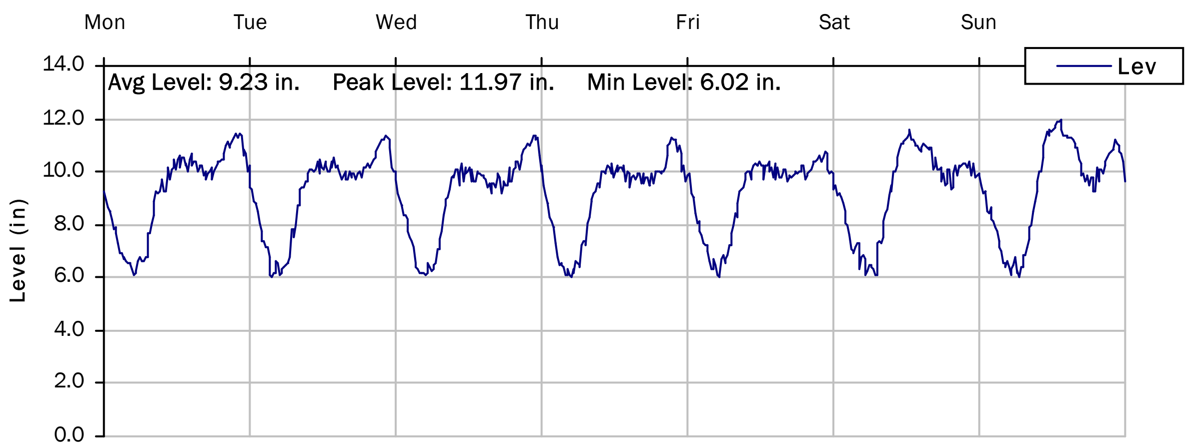


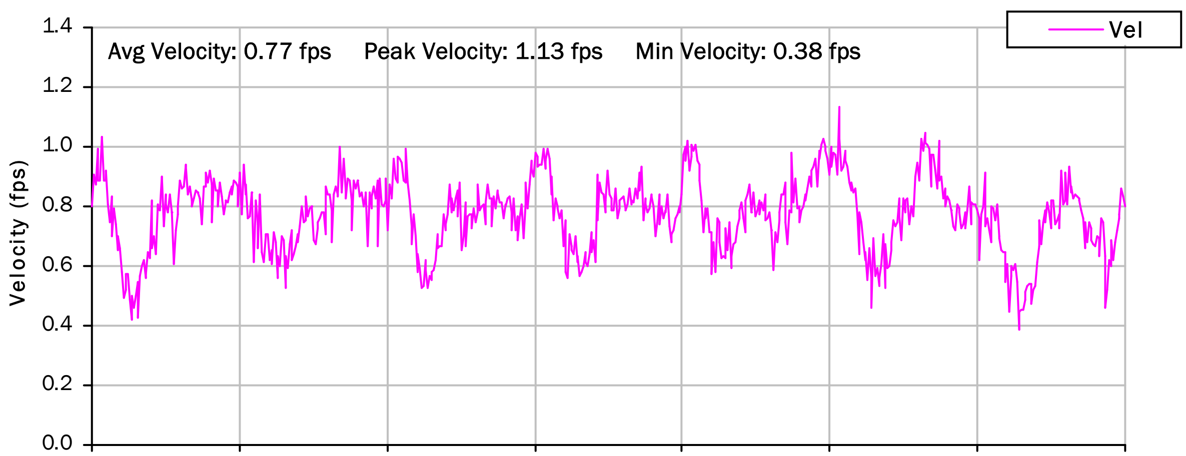
Avg Flow: 0.394 mgd Peak Flow: 0.666 mgd Min Flow: 0.119 mgd

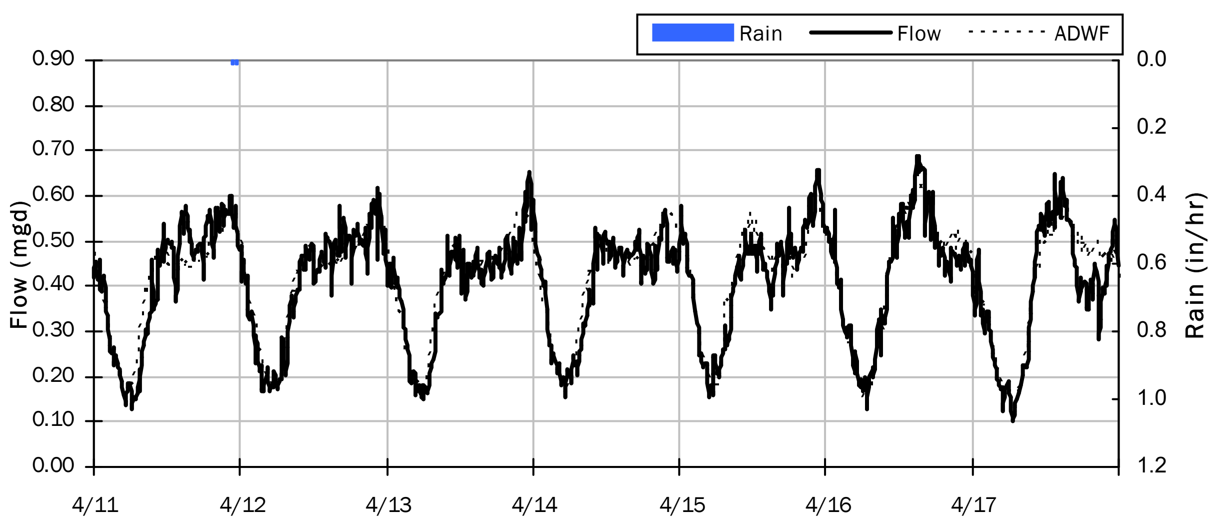
SITE 22

Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022

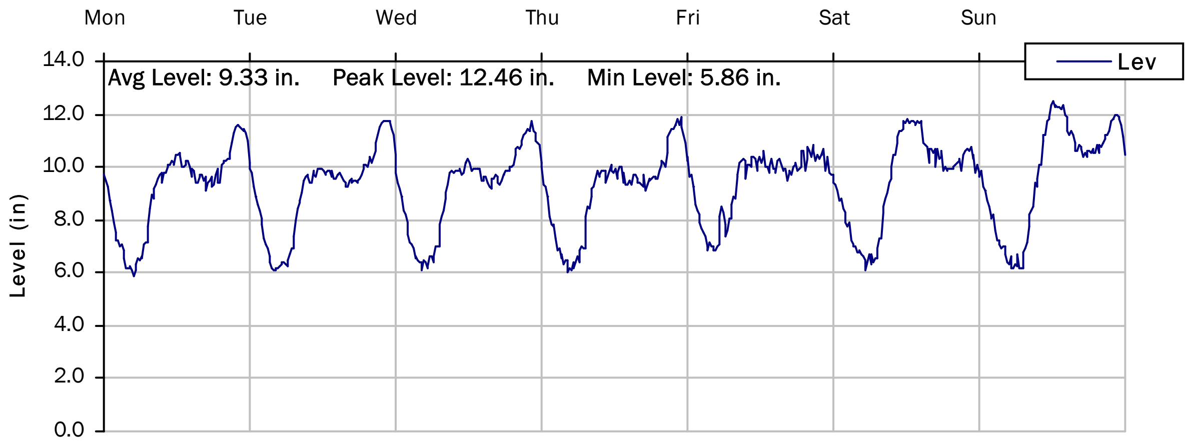


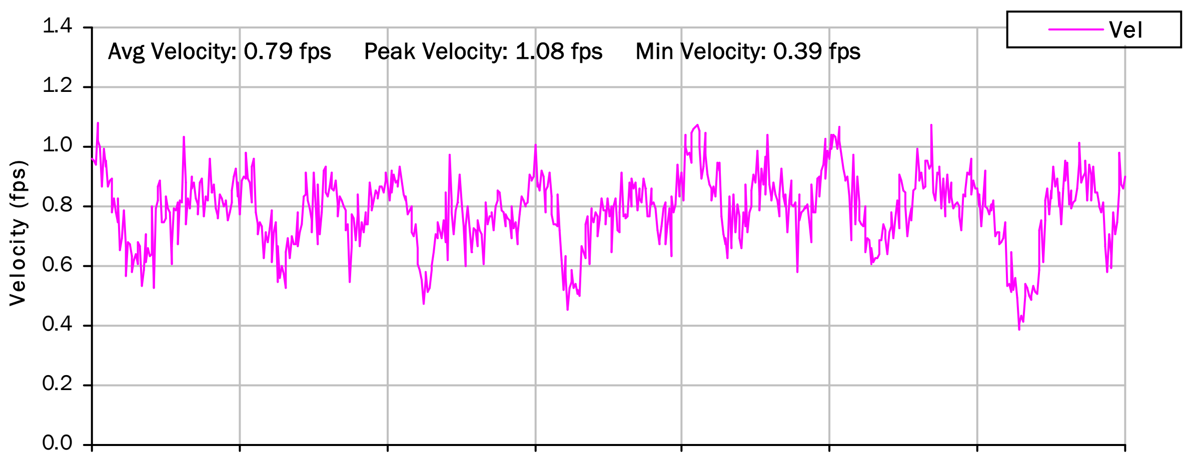


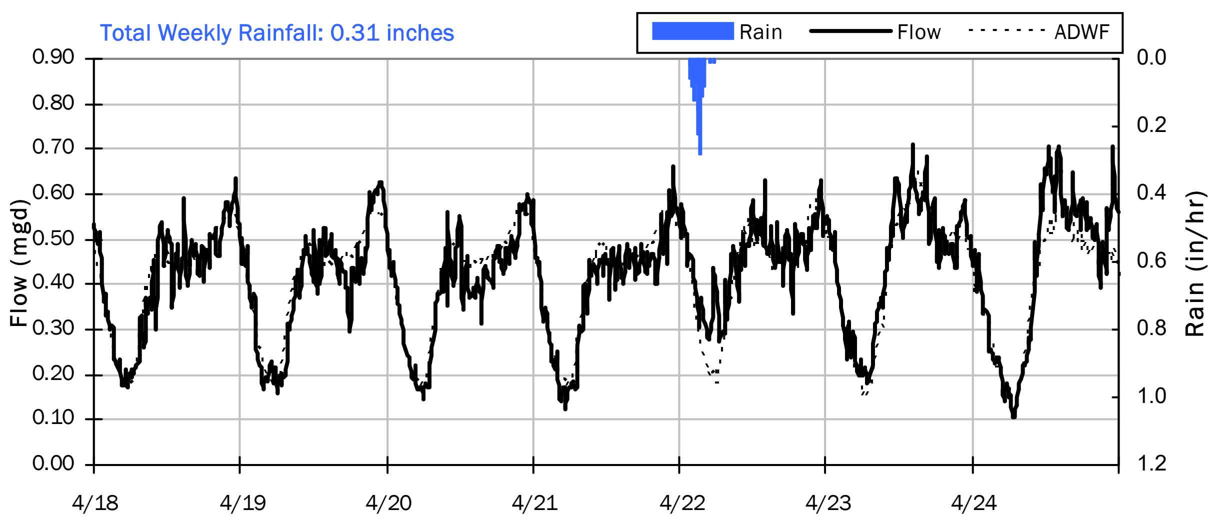


Avg Flow: 0.408 mgd   Peak Flow: 0.689 mgd   Min Flow: 0.102 mgd

SITE 22
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022





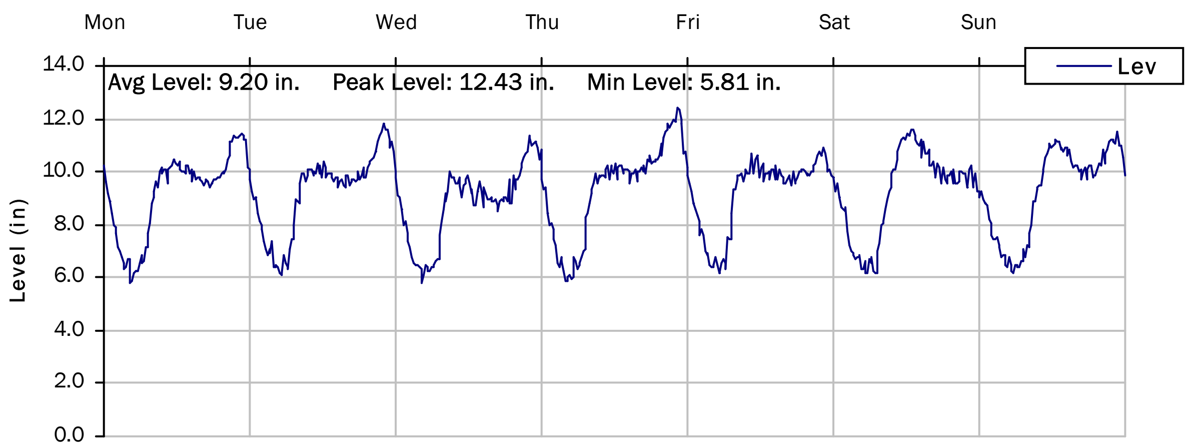


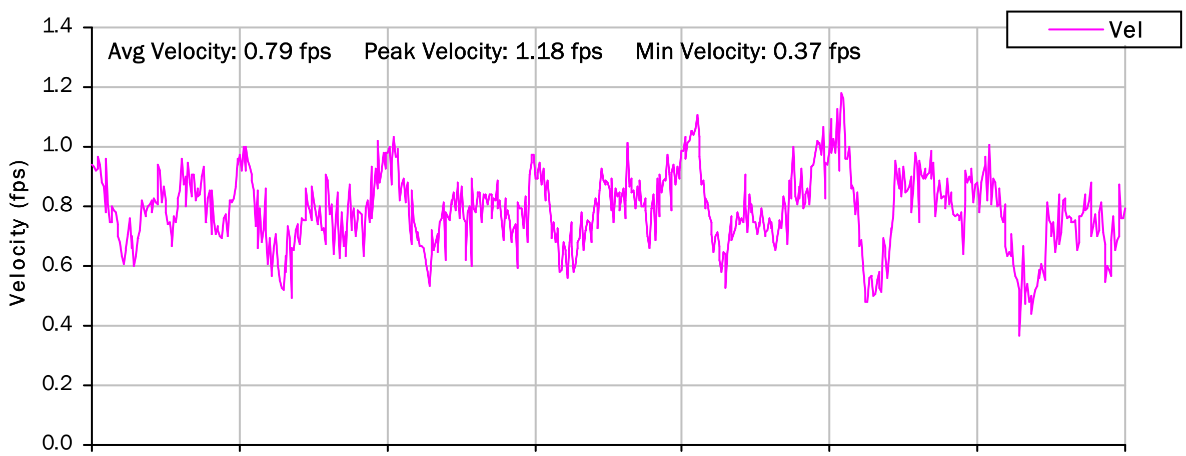
Avg Flow: 0.421 mgd Peak Flow: 0.710 mgd Min Flow: 0.107 mgd

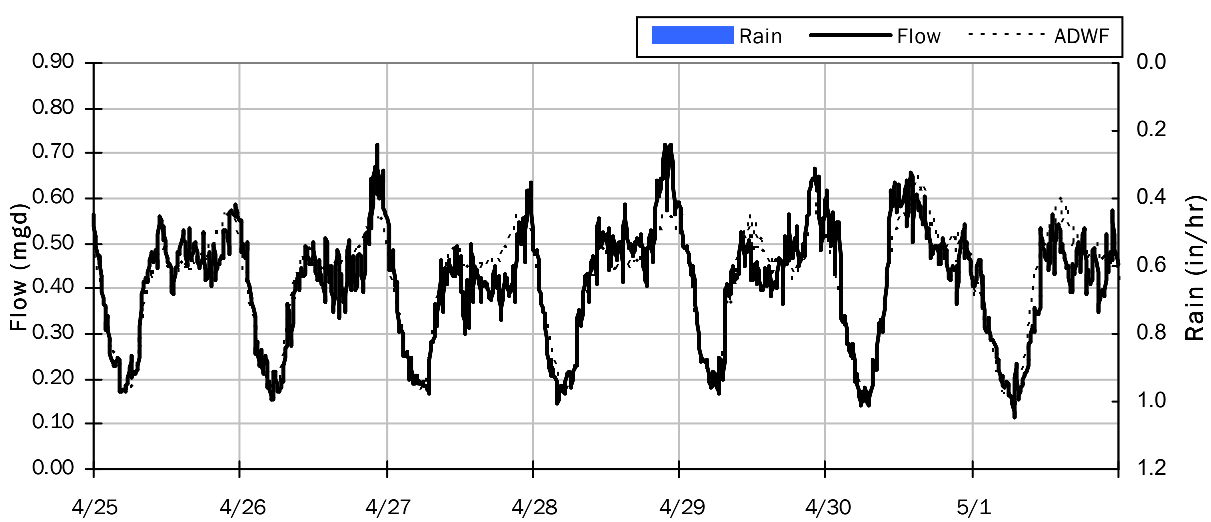
SITE 22

Weekly Level, Velocity and Flow Hydrographs

4/25/2022 to 5/2/2022

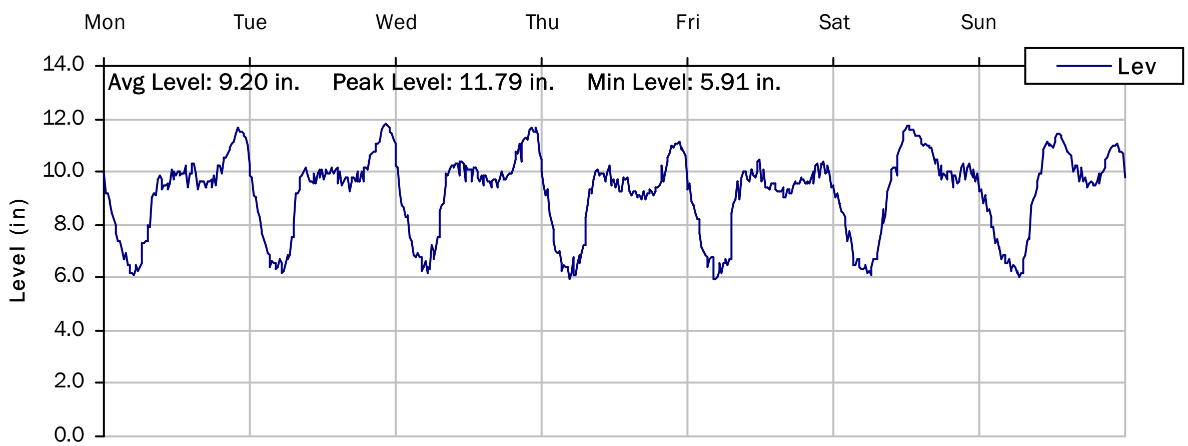


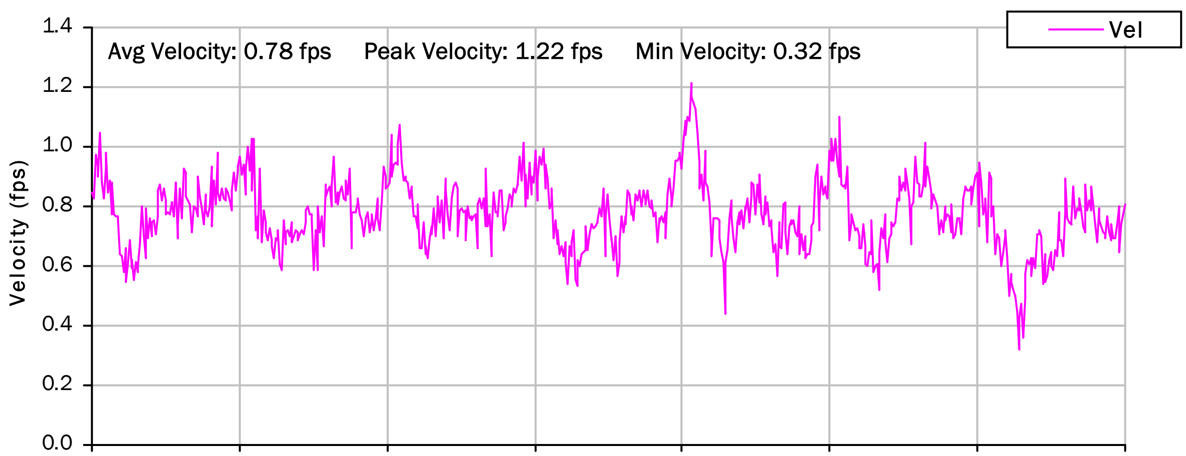


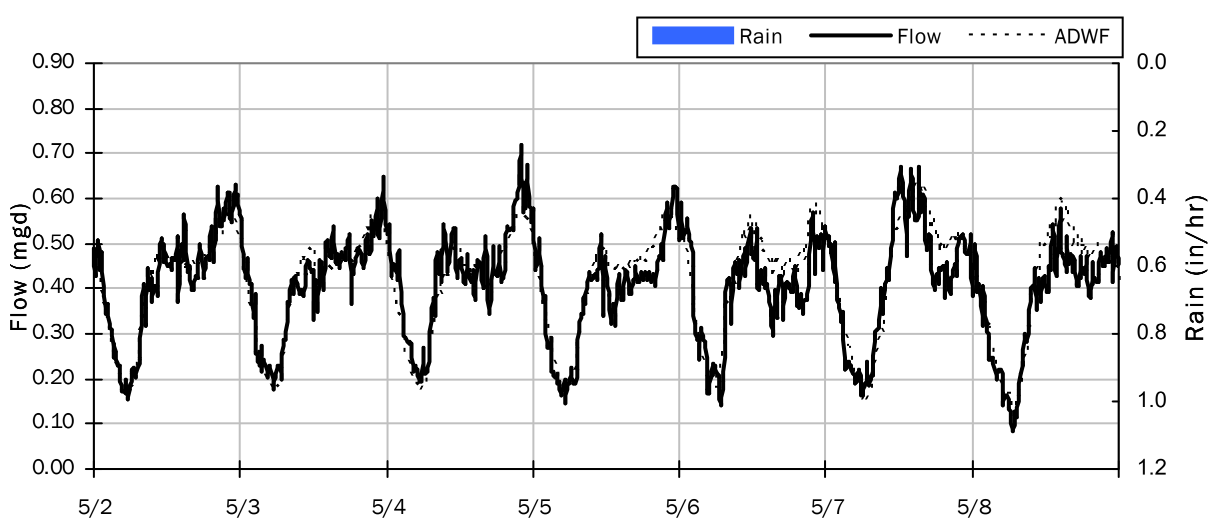


Avg Flow: 0.412 mgd Peak Flow: 0.720 mgd Min Flow: 0.114 mgd

SITE 22
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

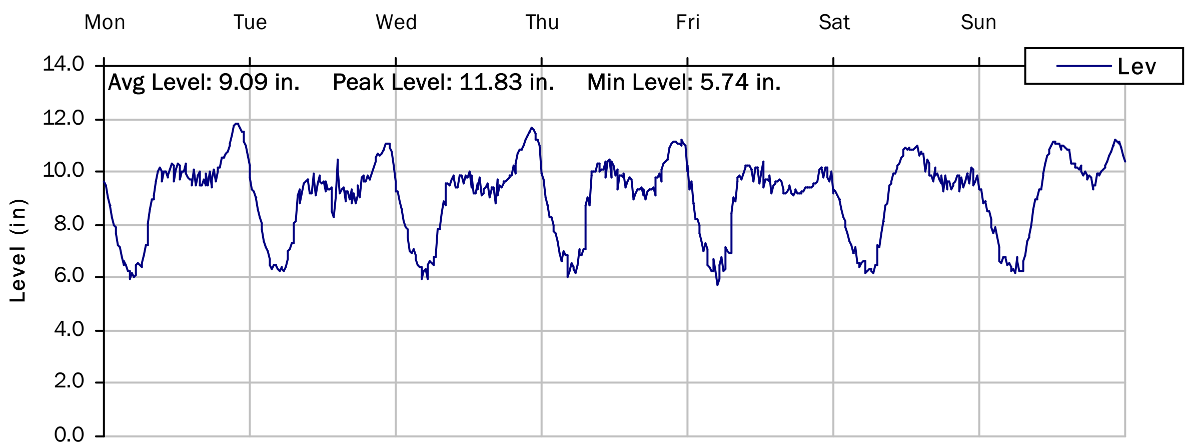


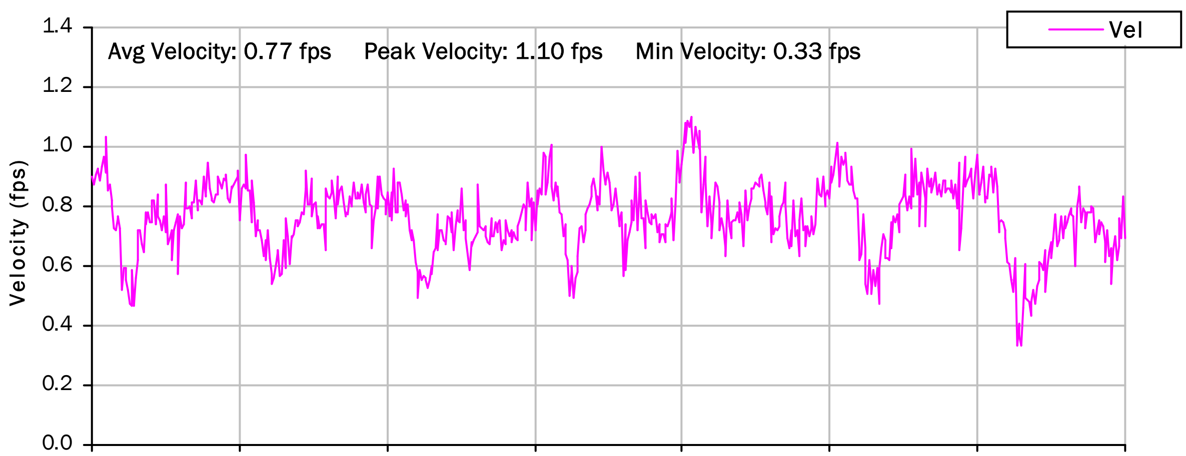


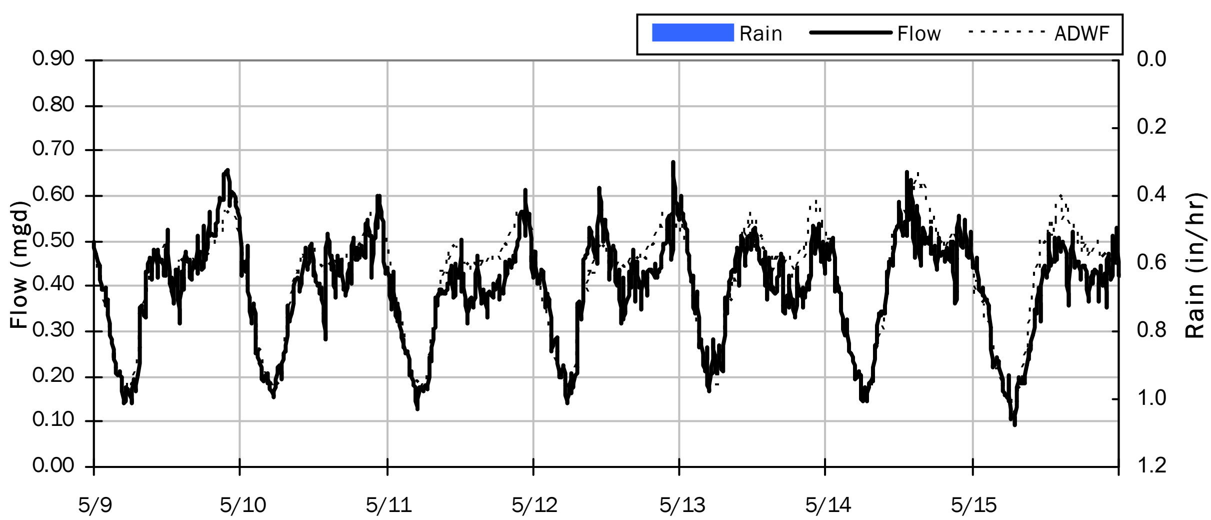


Avg Flow: 0.406 mgd Peak Flow: 0.718 mgd Min Flow: 0.085 mgd

SITE 22
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022





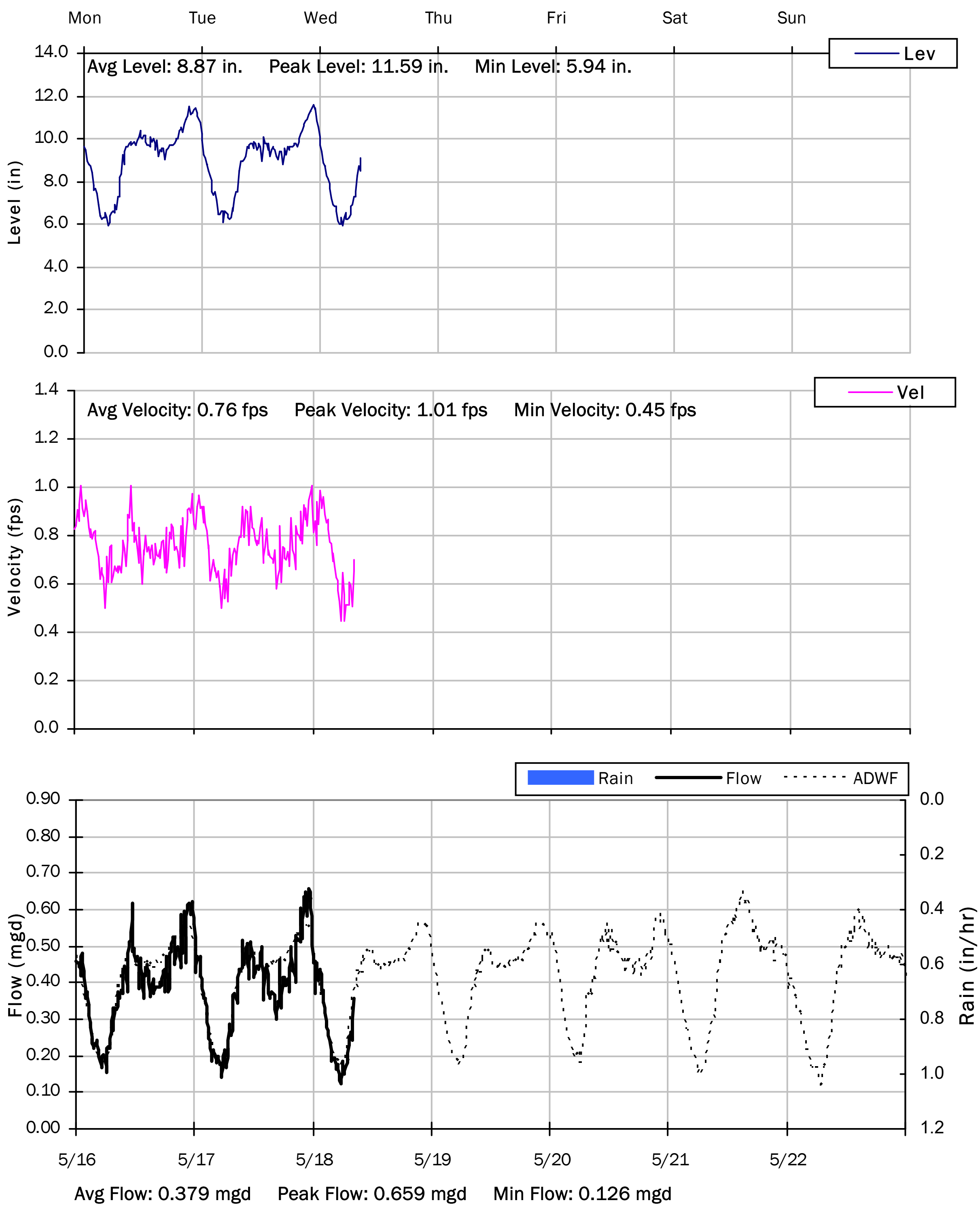


Avg Flow: 0.394 mgd   Peak Flow: 0.673 mgd   Min Flow: 0.094 mgd

SITE 22

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022



Monitoring Site: Site 23

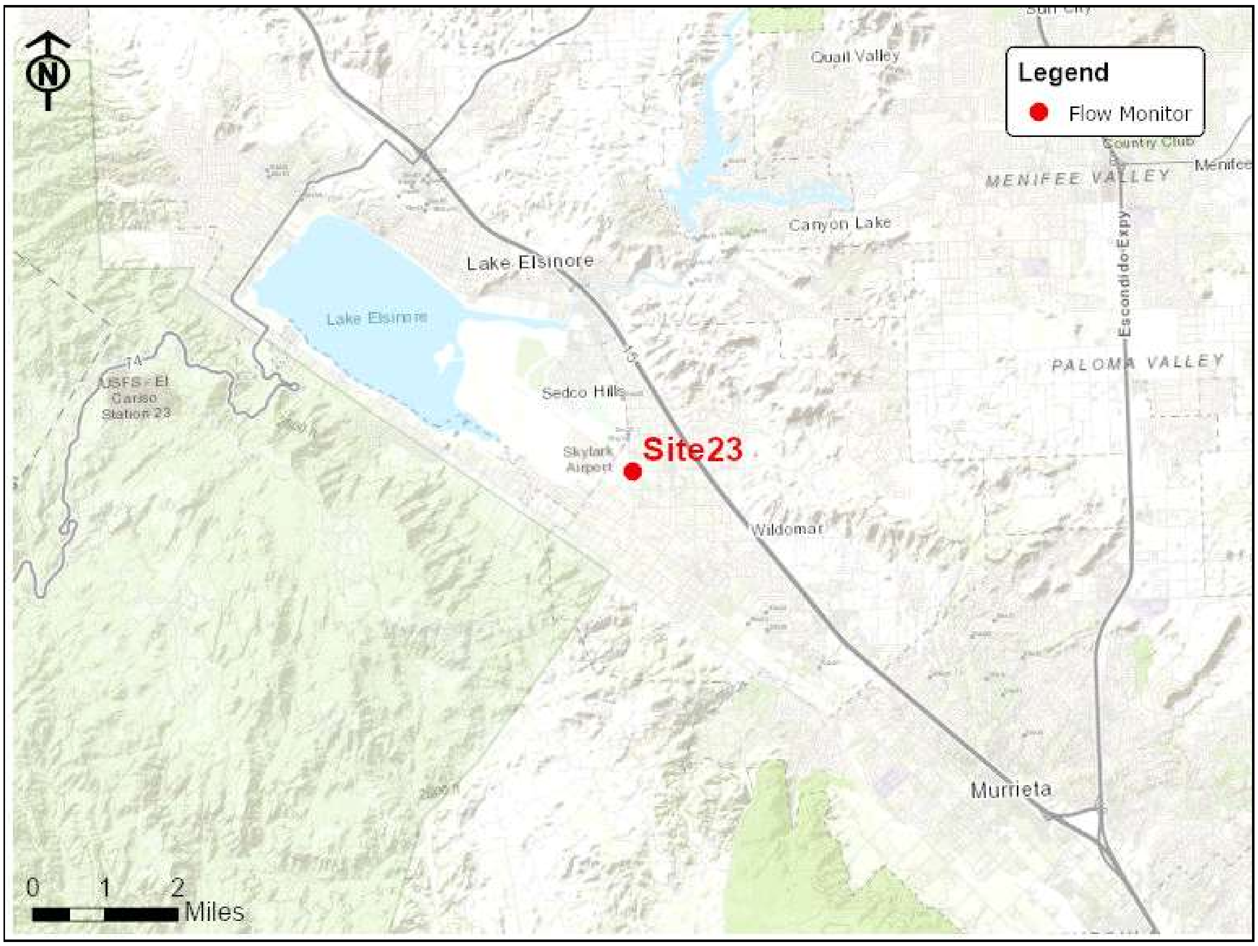
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Bundy Canyon Road and Mission Trail

Data Summary Report



Vicinity Map: Site 23

SITE 23

Site Information MH ID: MH-3676

Location: Bundy Canyon Road and Mission Trail

Coordinates: 117.2899° W, 33.6269° N

Rim Elevation (Earth): 1298 feet

Expected Pipe Diameter: 12 inches

Measured Pipe Diameter: 12 inches

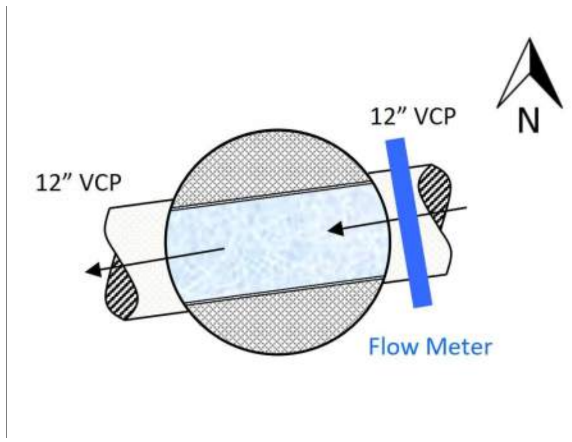
ADWF: 0.096 mgd

Peak Measured Flow: 0.294 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch

View from Street


Plan View

SITE 23

Additional Site Photos

Effluent Pipe

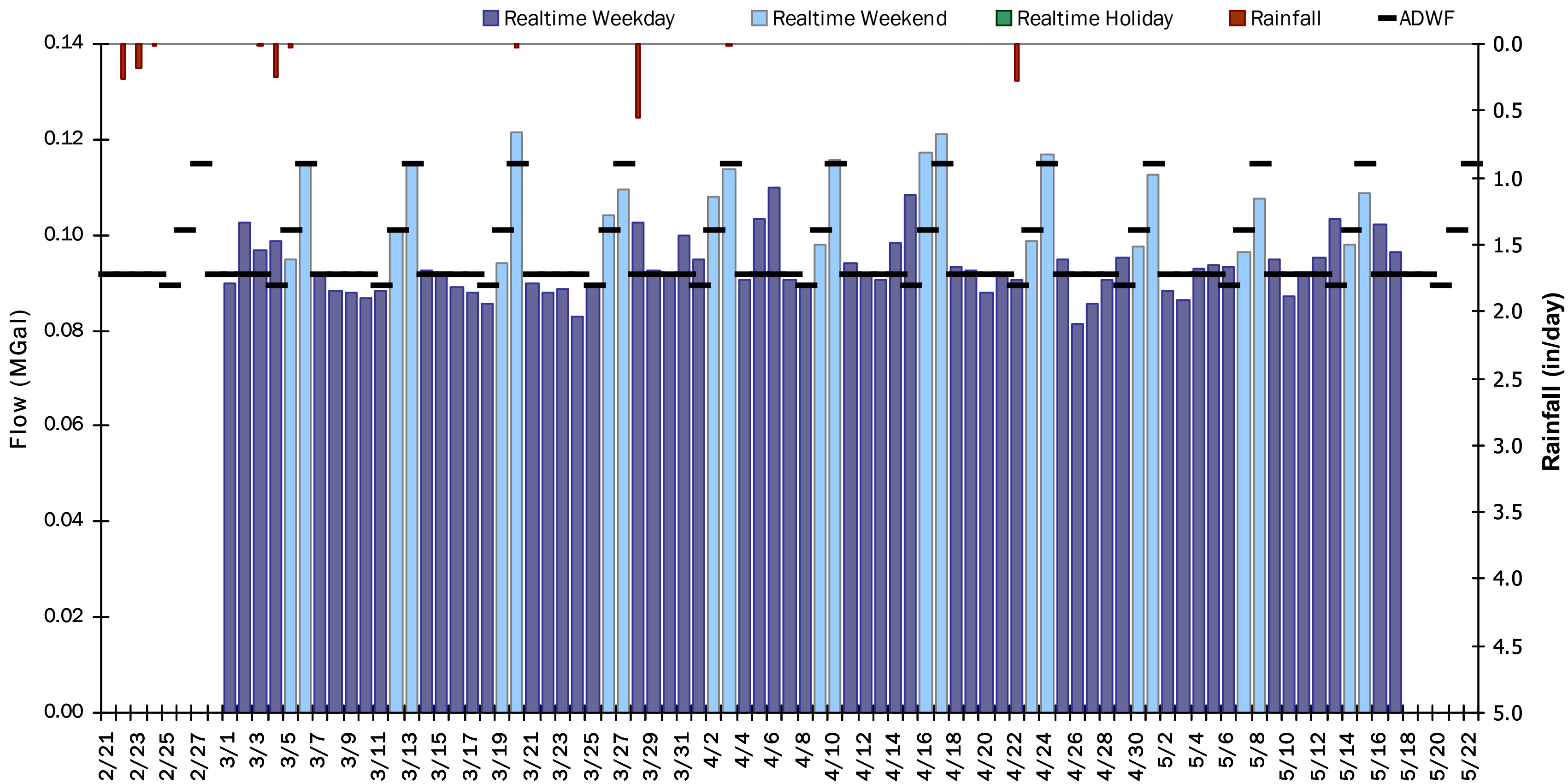
Influent Pipe

SITE 23

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.097 MGal Peak Daily Flow: 0.121 MGal Min Daily Flow: 0.059 MGal

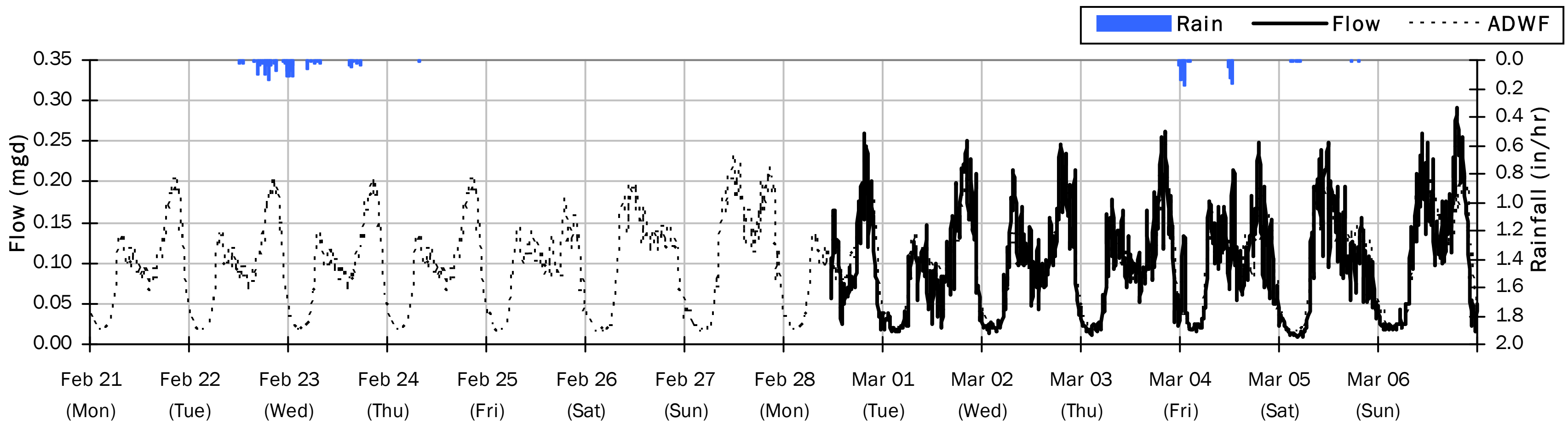
Total Rainfall: 1.16 inches

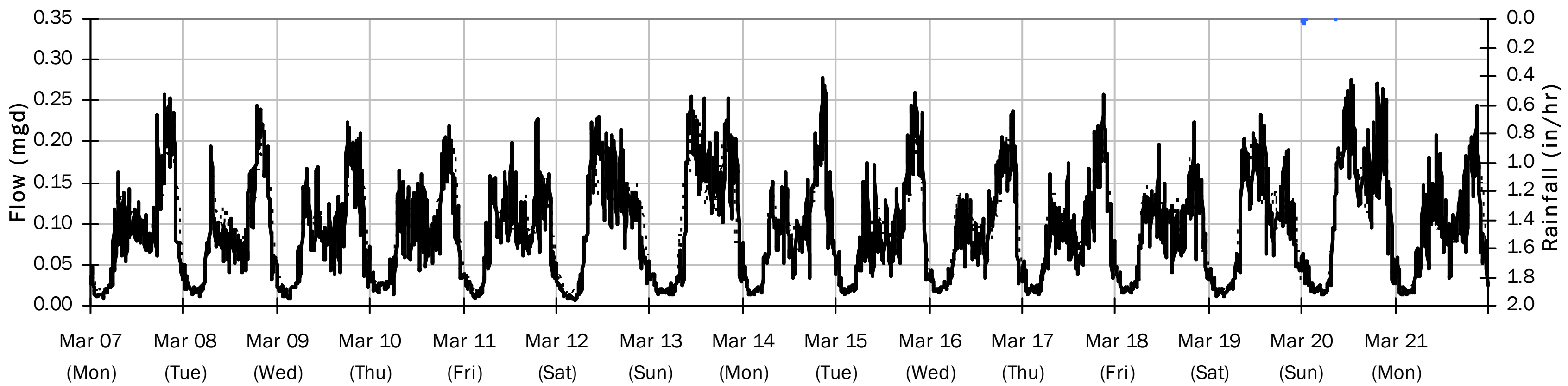


SITE 23

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 0.76 inches Period Avg Flow: 0.096 mgd Period Peak Flow: 0.291 mgd Period Min Flow: 0.007 mgd

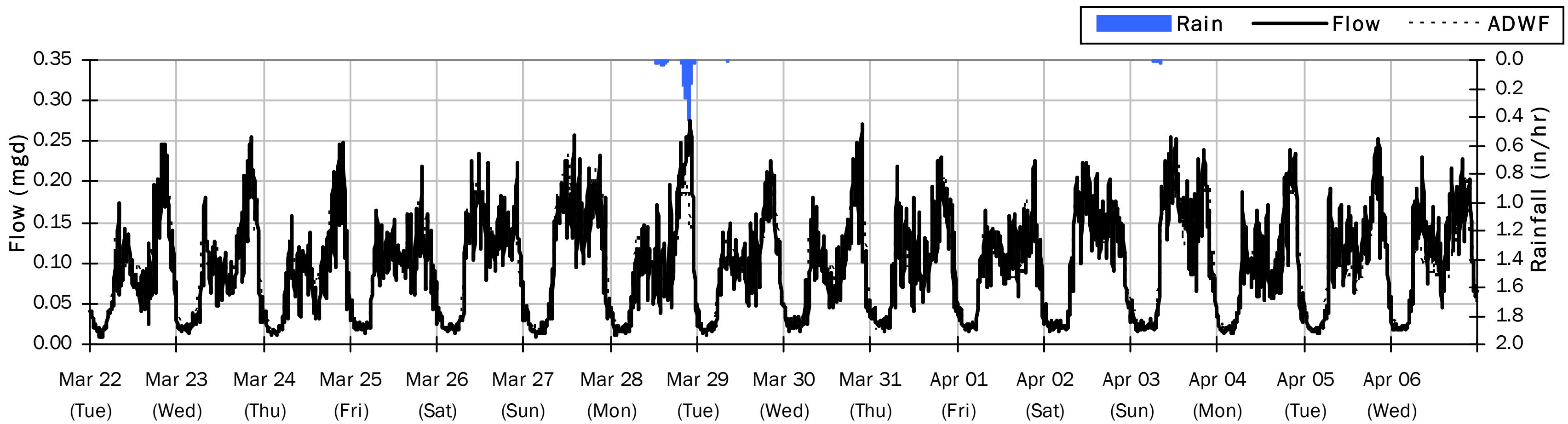


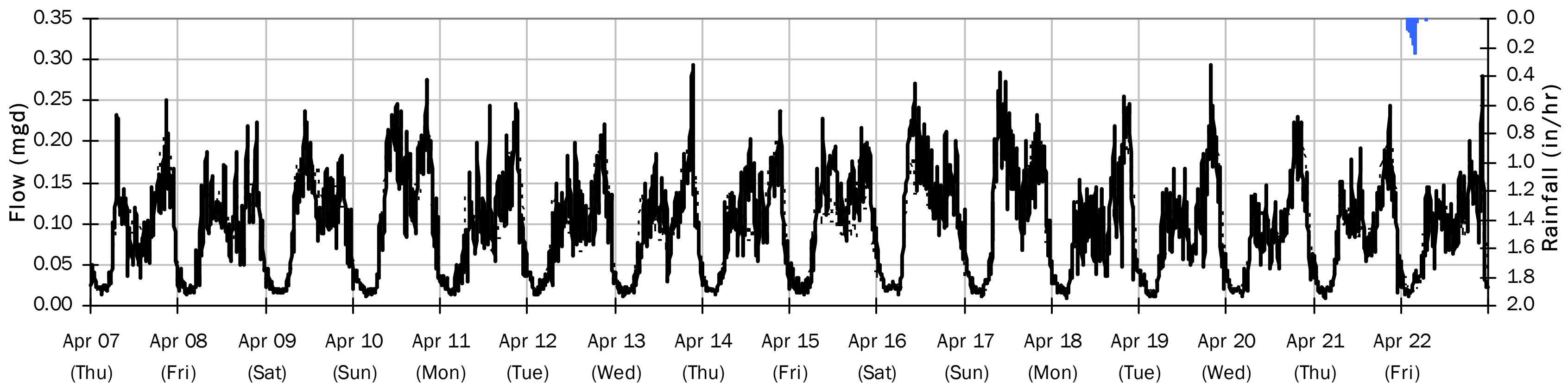


SITE 23

Flow Summary: 3/22/2022 to 4/22/2022

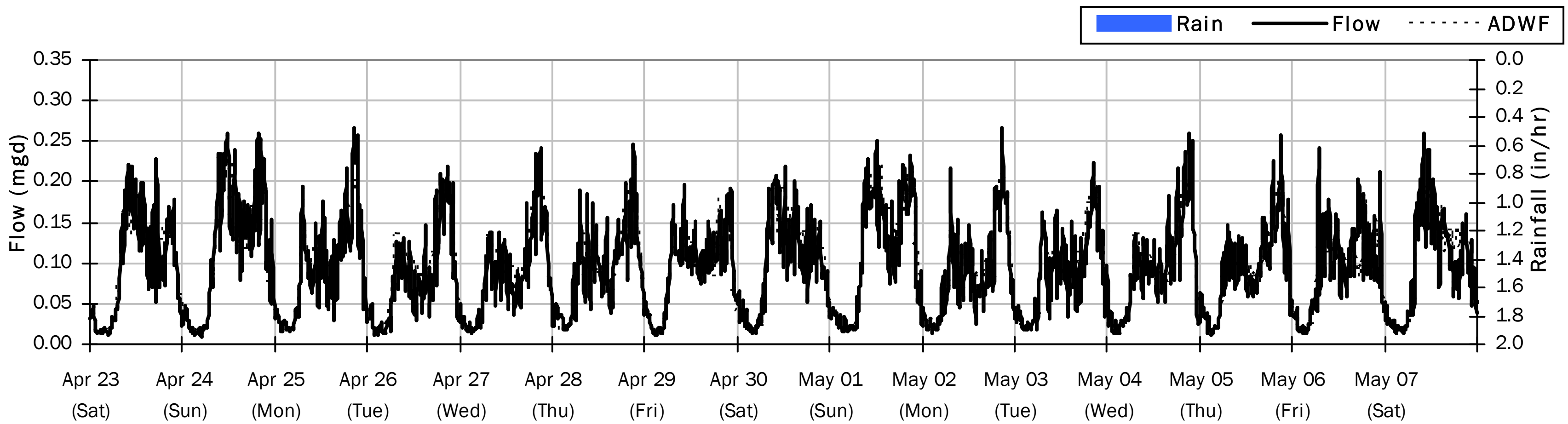
Period Rainfall: 0.85 inches   Period Avg Flow: 0.098 mgd   Period Peak Flow: 0.294 mgd   Period Min Flow: 0.009 mgd

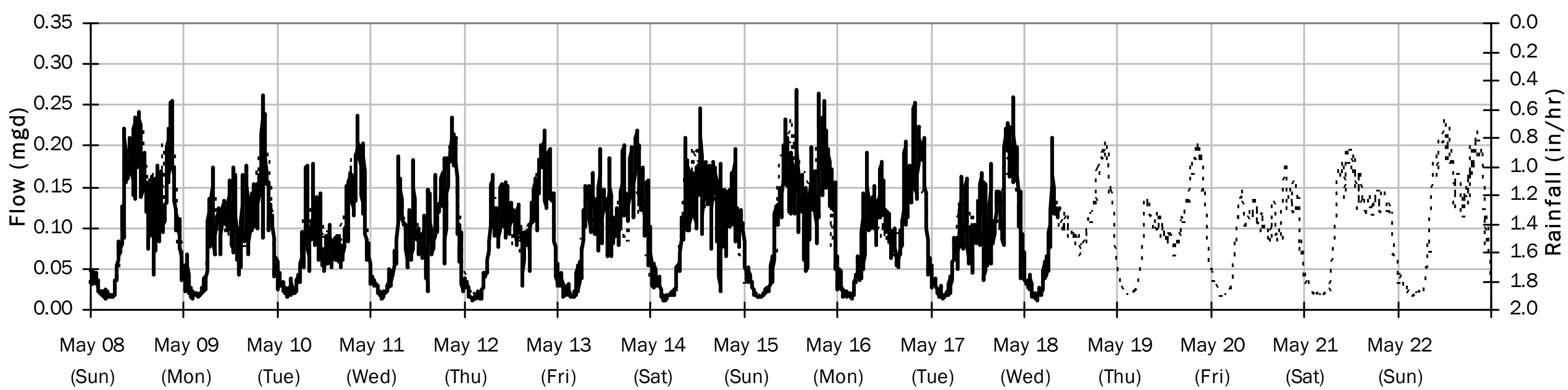




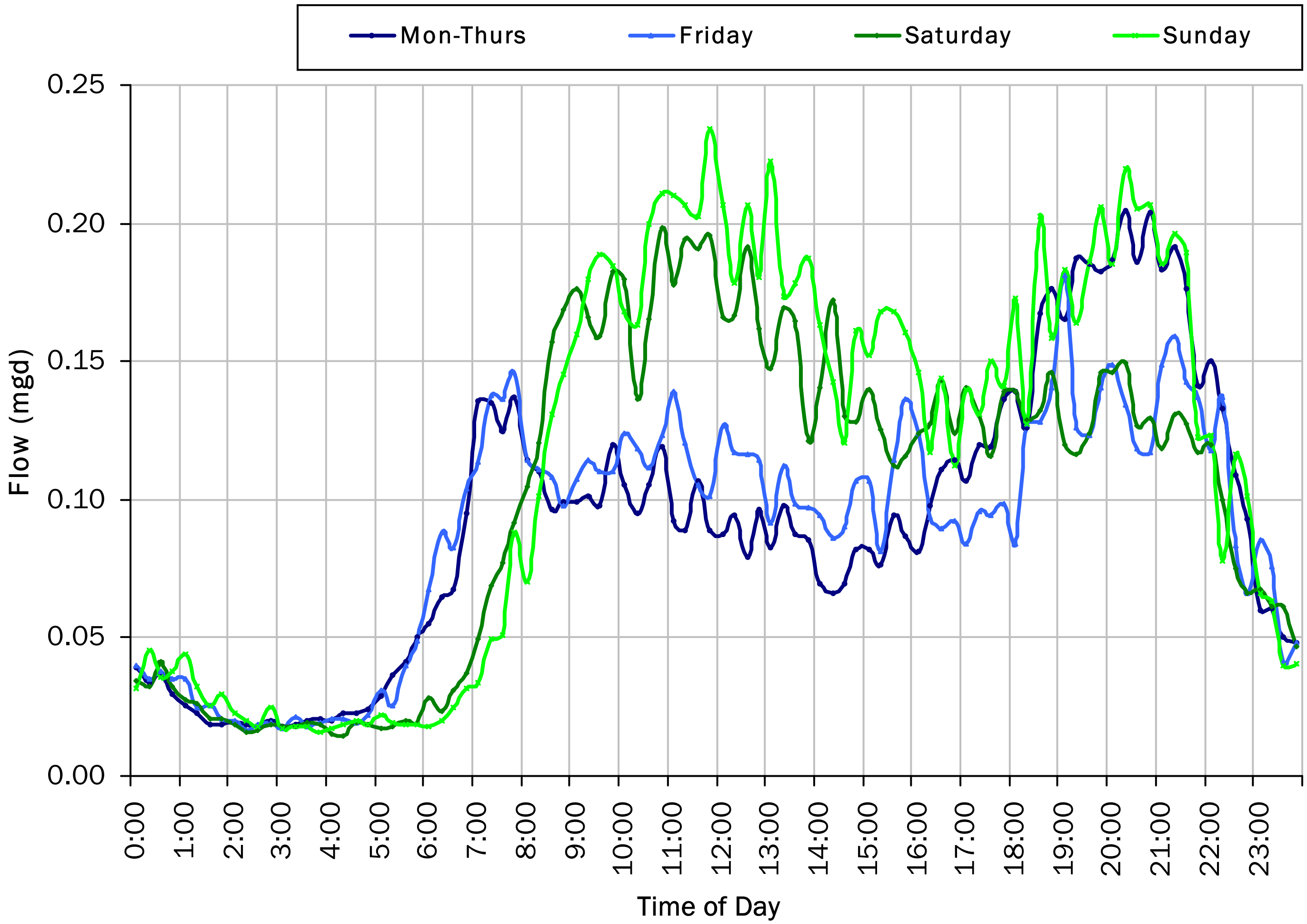
SITE 23
Flow Summary: 4/23/2022 to 5/22/2022

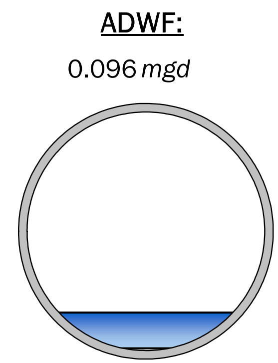
Period Rainfall: 0.00 inches   Period Avg Flow: 0.096 mgd   Period Peak Flow: 0.269 mgd   Period Min Flow: 0.009 mgd





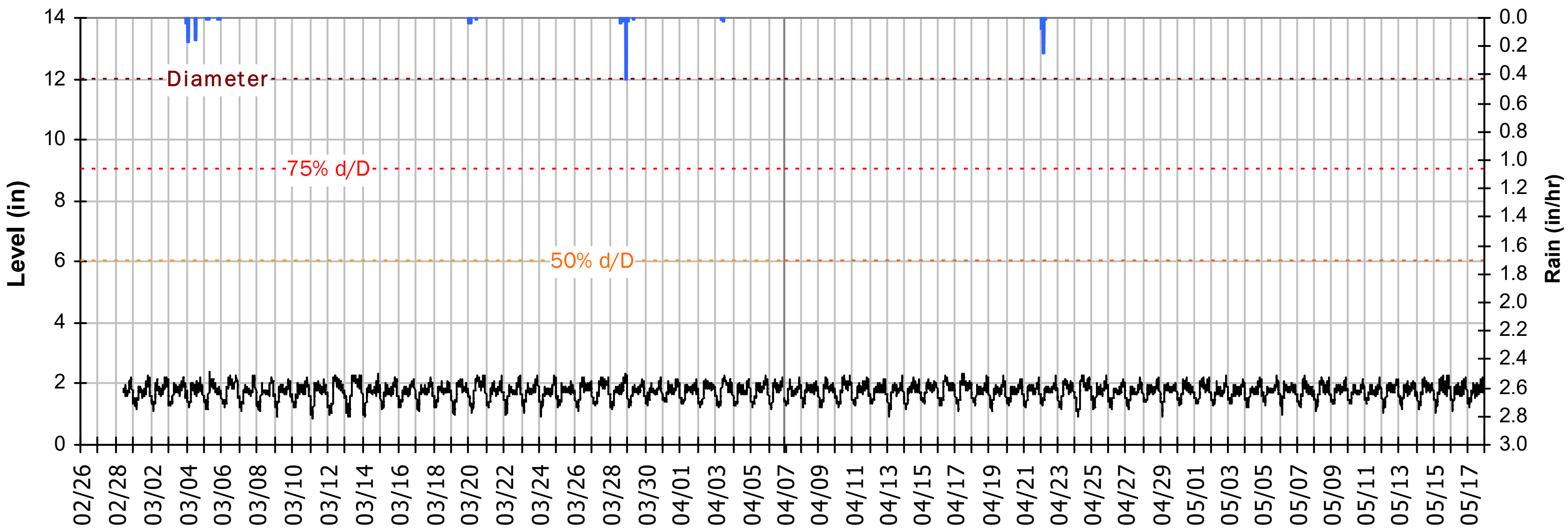
SITE 23
Average Dry Weather Flow Hydrographs

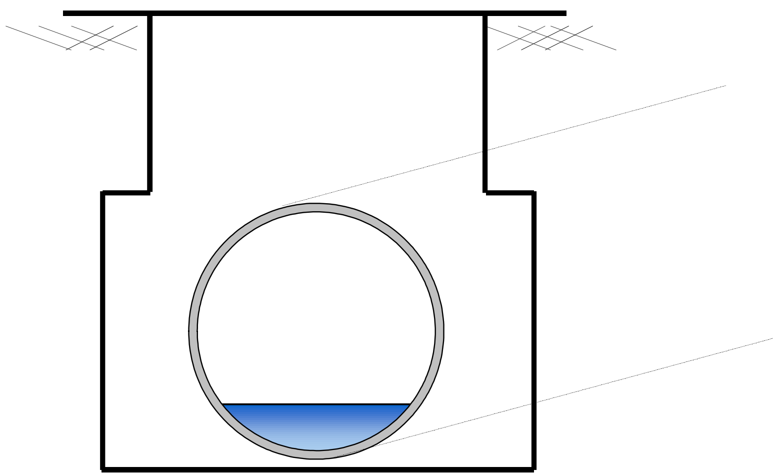




SITE 23
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



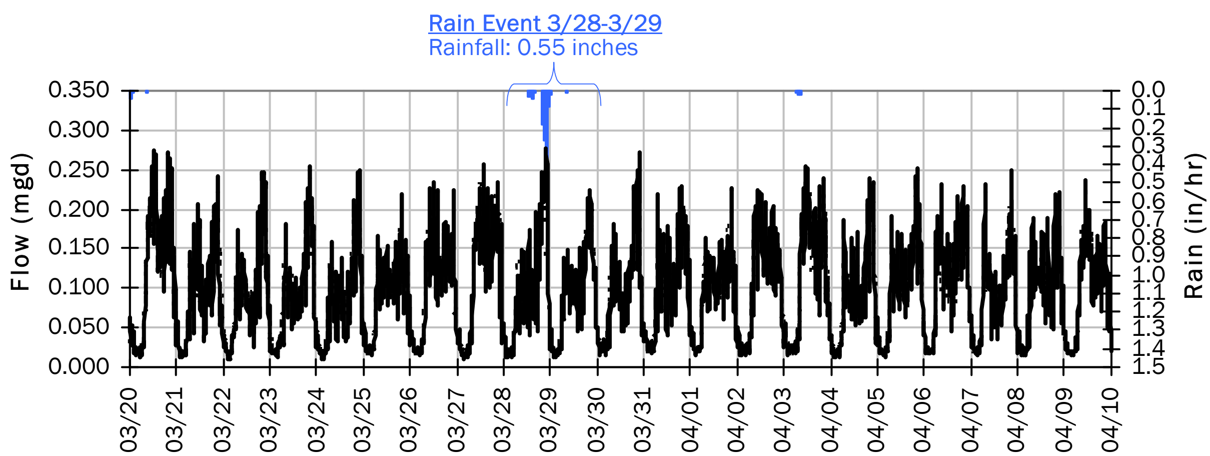


Pipe Diameter:	12	*inches*
Peak Measured Level:	2.41	*inches*
Peak d/D Ratio:	0.20	

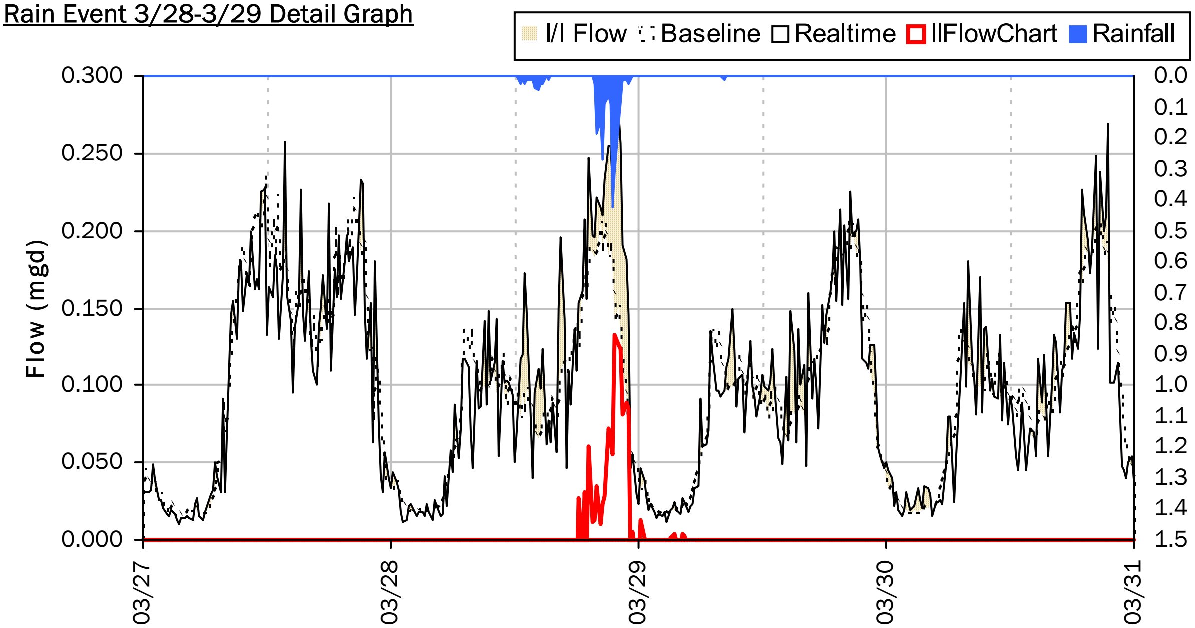
SITE 23

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph

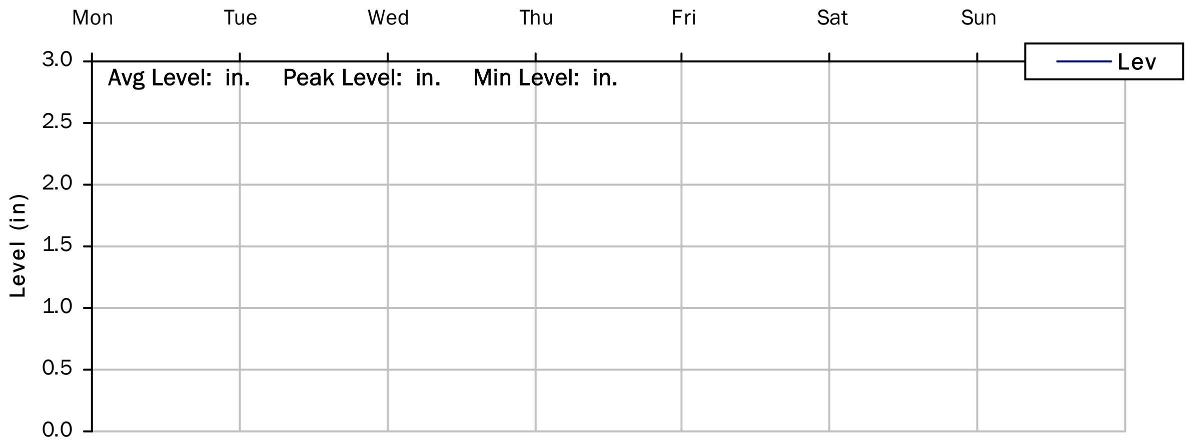


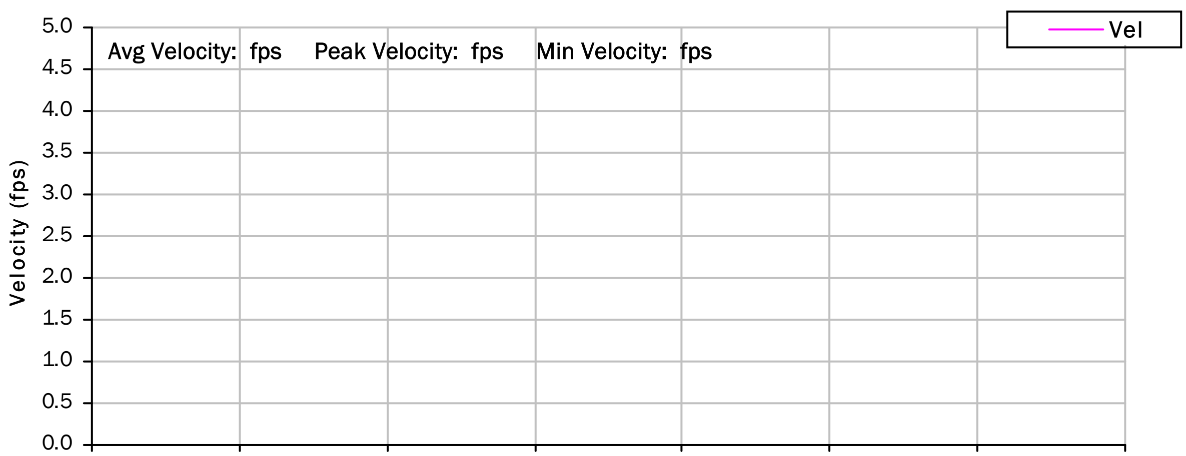
Storm Event I/I Analysis (Rain = 0.55 inches)

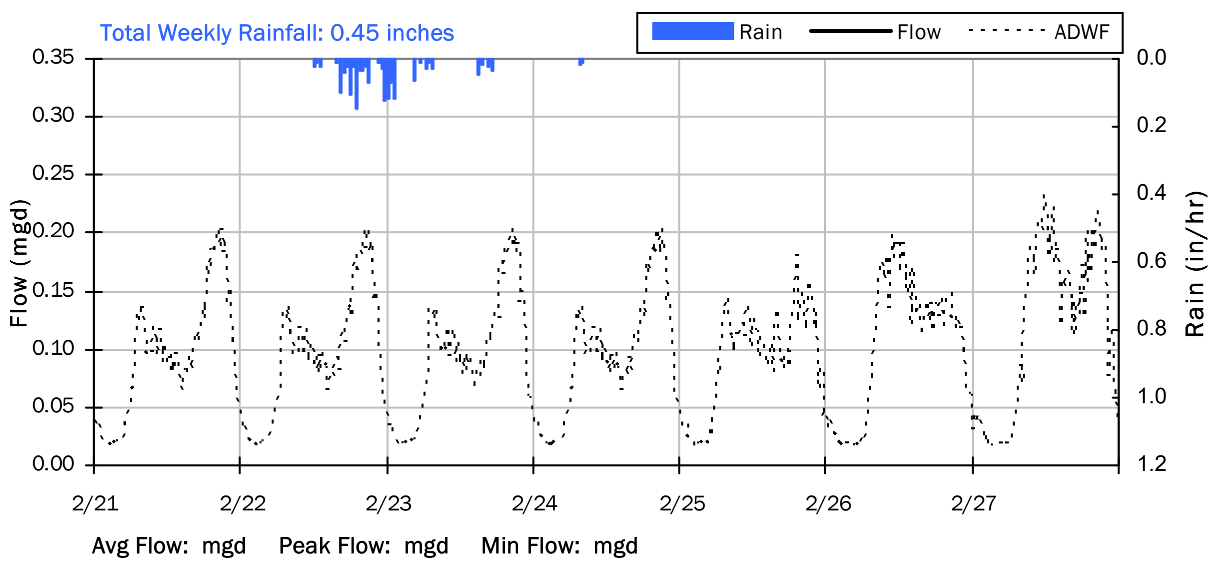
Capacity		Inflow / Infiltration	
Peak Flow:	0.277 *mgd*	Peak I/I Rate:	0.132 *mgd*
PF:	2.88	Total I/I:	10,000 *gallons*
Peak Level:	2.32 *in*		
d/D Ratio:	0.19		

SITE 23

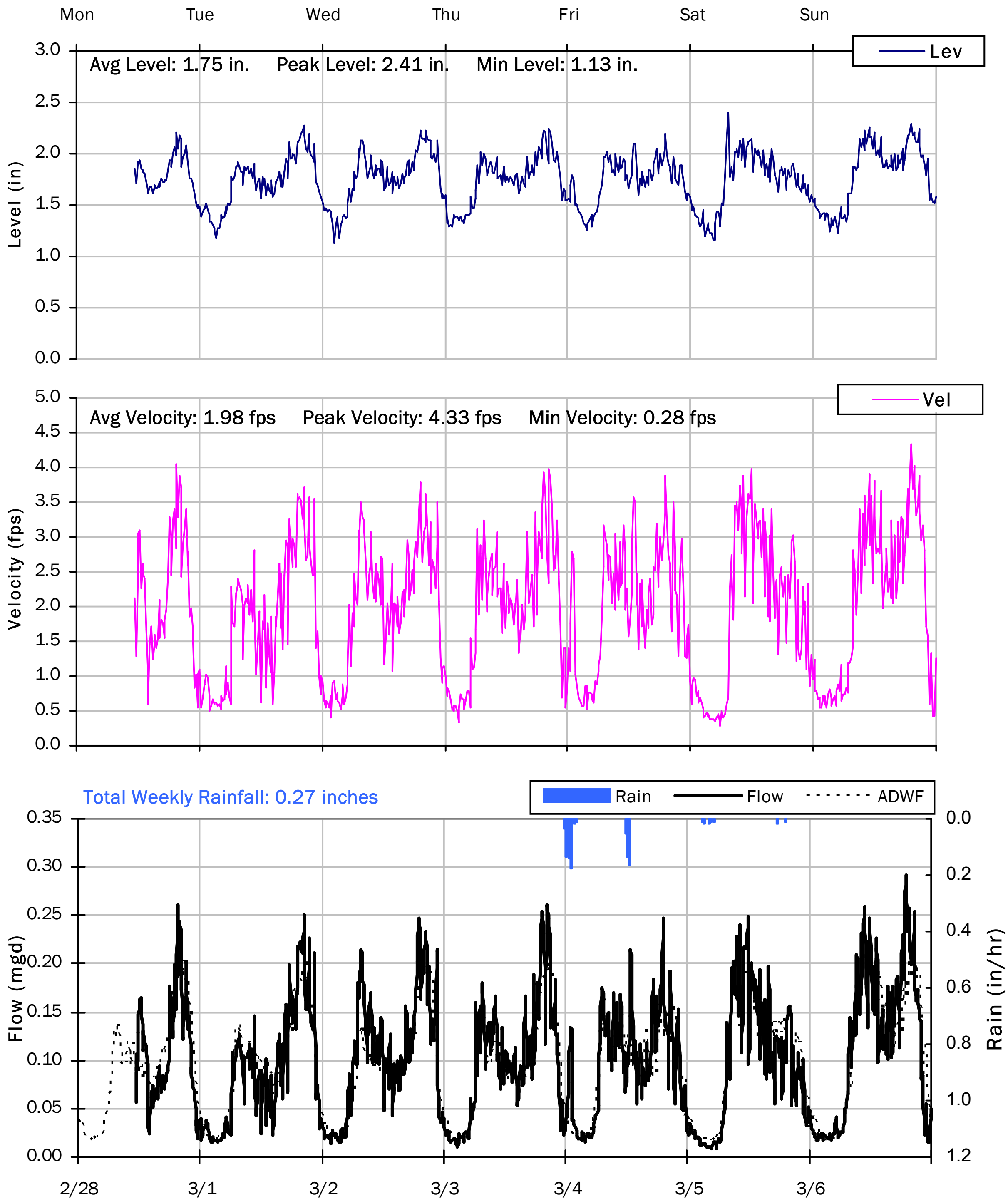
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022







SITE 23
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

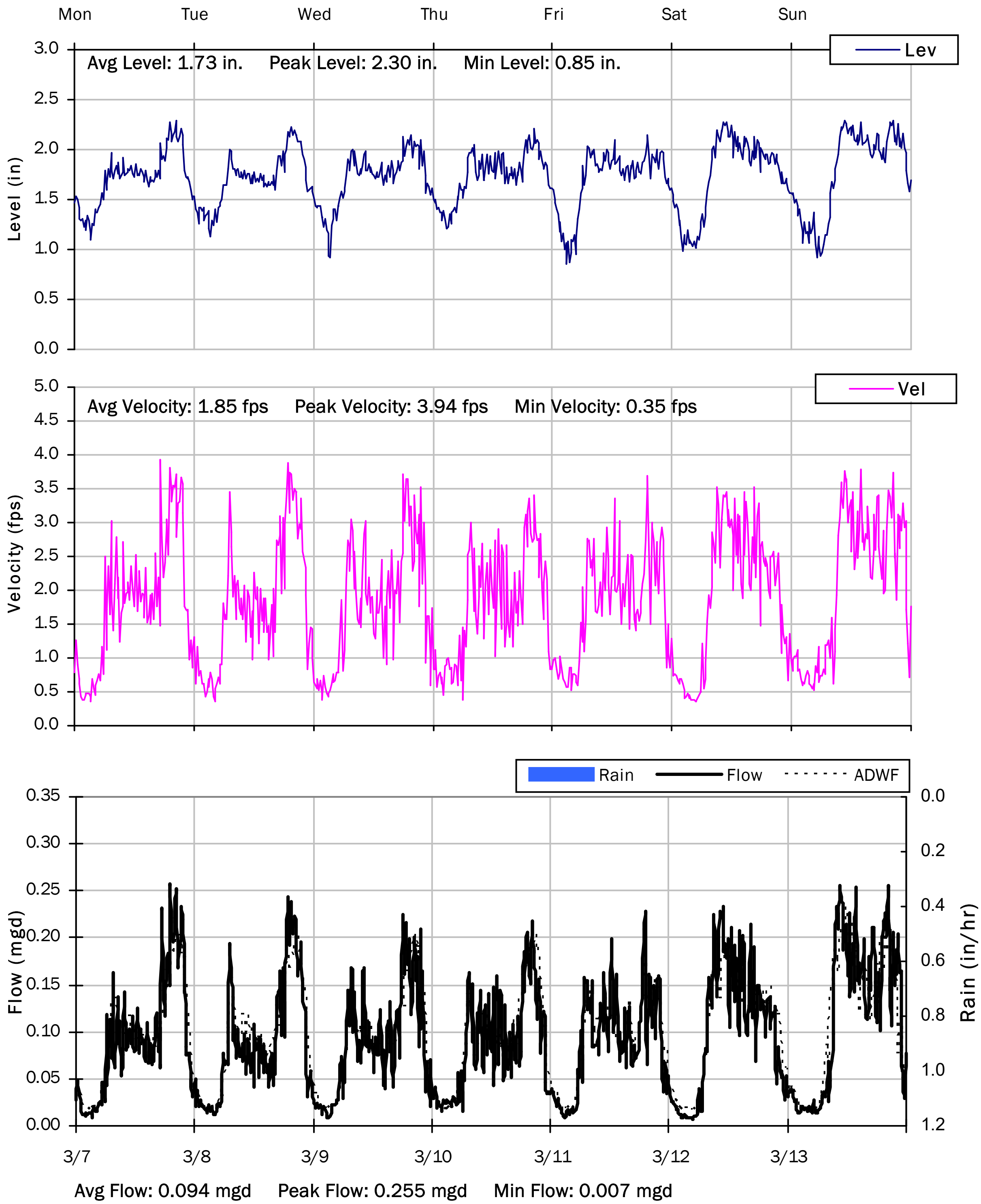


Avg Flow: 0.101 mgd   Peak Flow: 0.291 mgd   Min Flow: 0.008 mgd

SITE 23

Weekly Level, Velocity and Flow Hydrographs

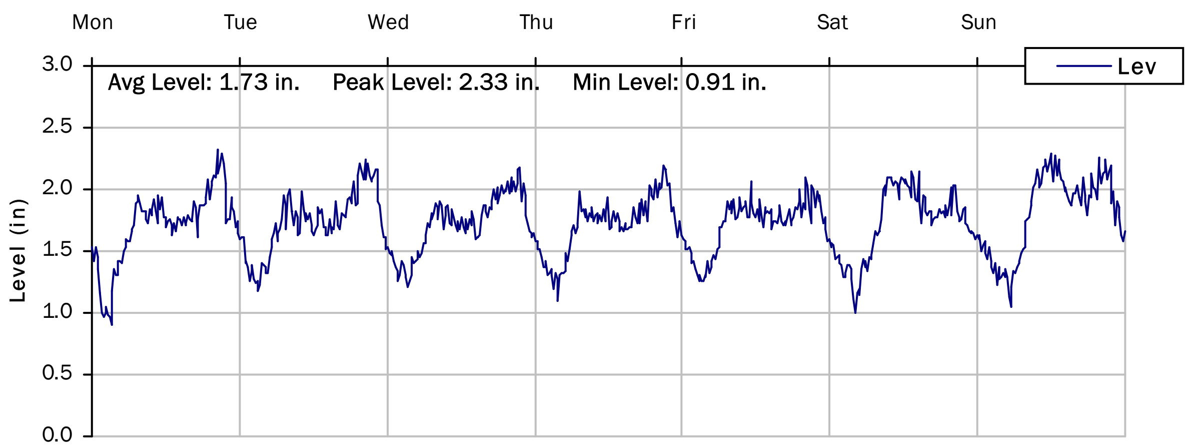
3/7/2022 to 3/14/2022

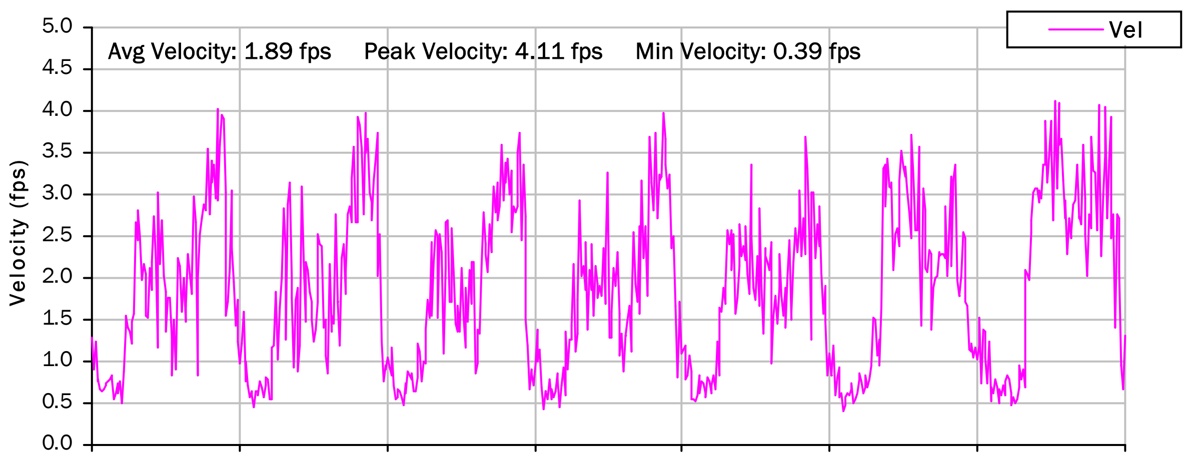


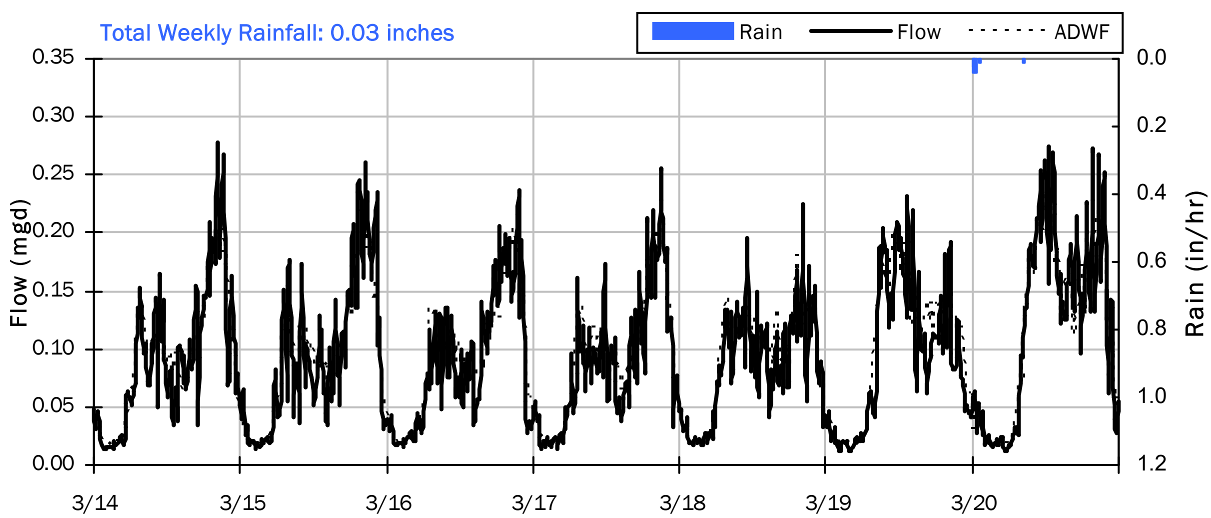
SITE 23

Weekly Level, Velocity and Flow Hydrographs

3/14/2022 to 3/21/2022





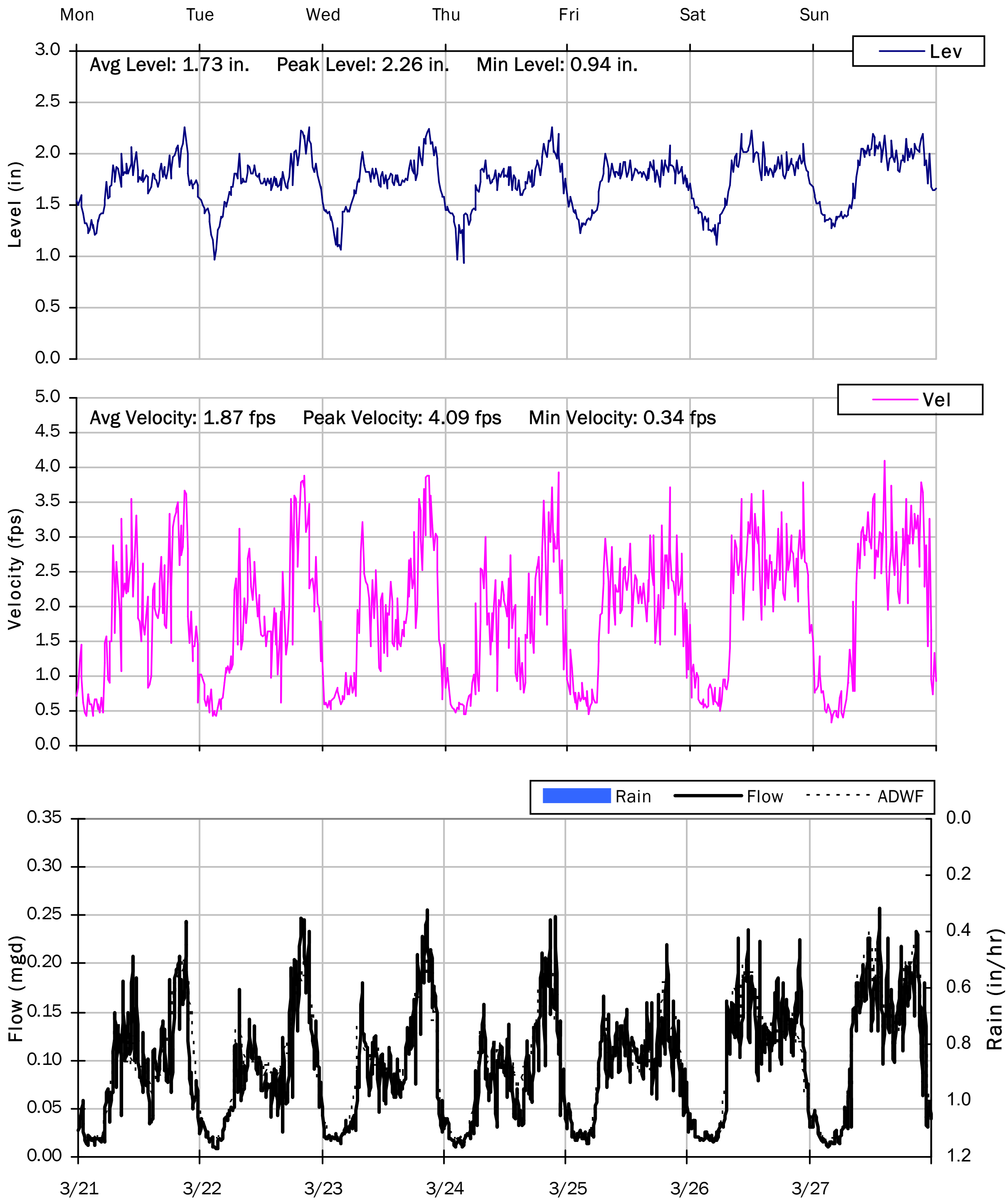


Avg Flow: 0.095 mgd Peak Flow: 0.279 mgd Min Flow: 0.011 mgd

SITE 23

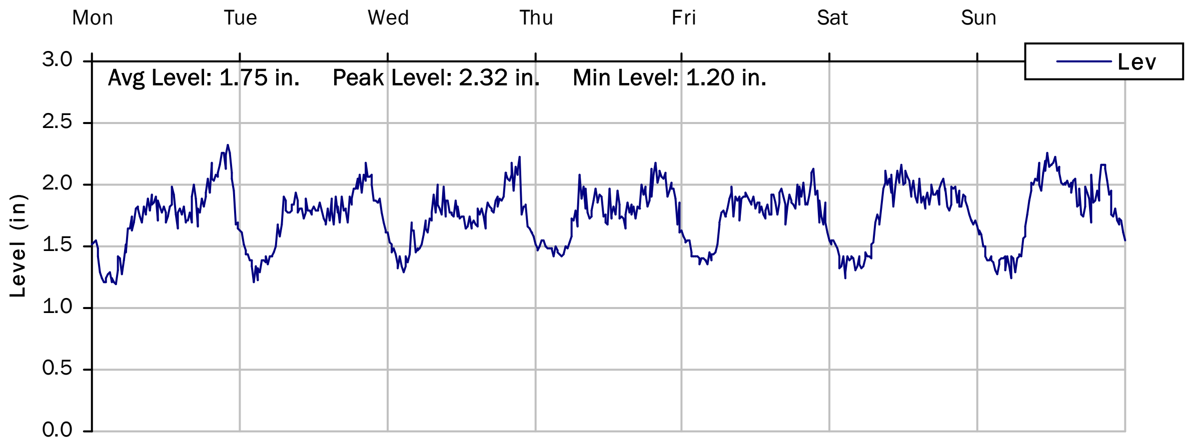
Weekly Level, Velocity and Flow Hydrographs

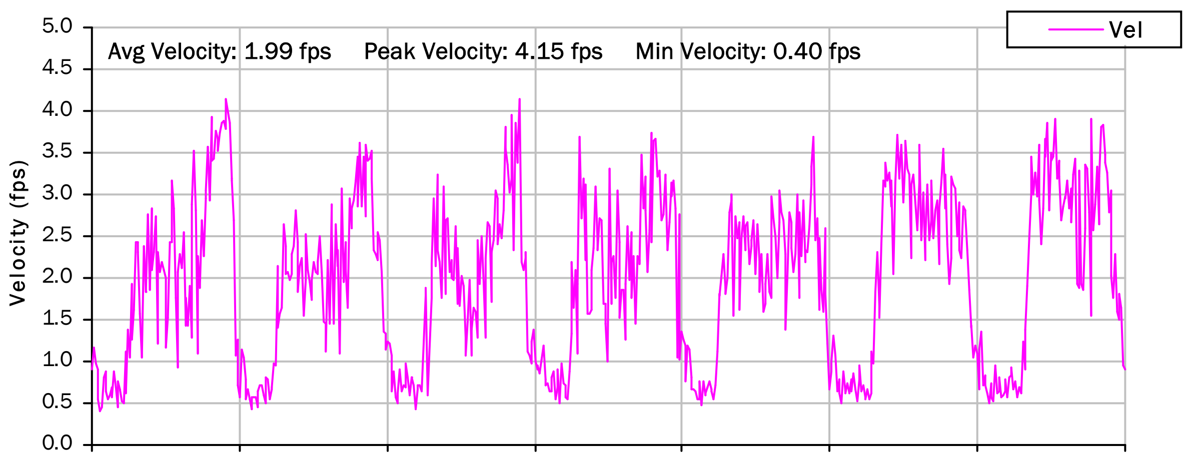
3/21/2022 to 3/28/2022

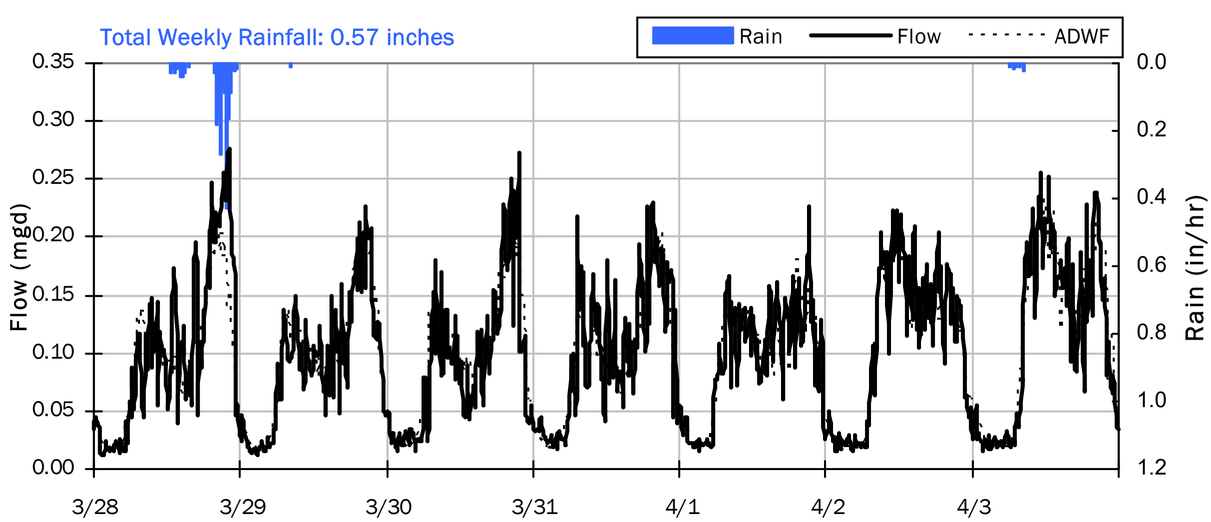


Avg Flow: 0.093 mgd Peak Flow: 0.257 mgd Min Flow: 0.009 mgd

SITE 23
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

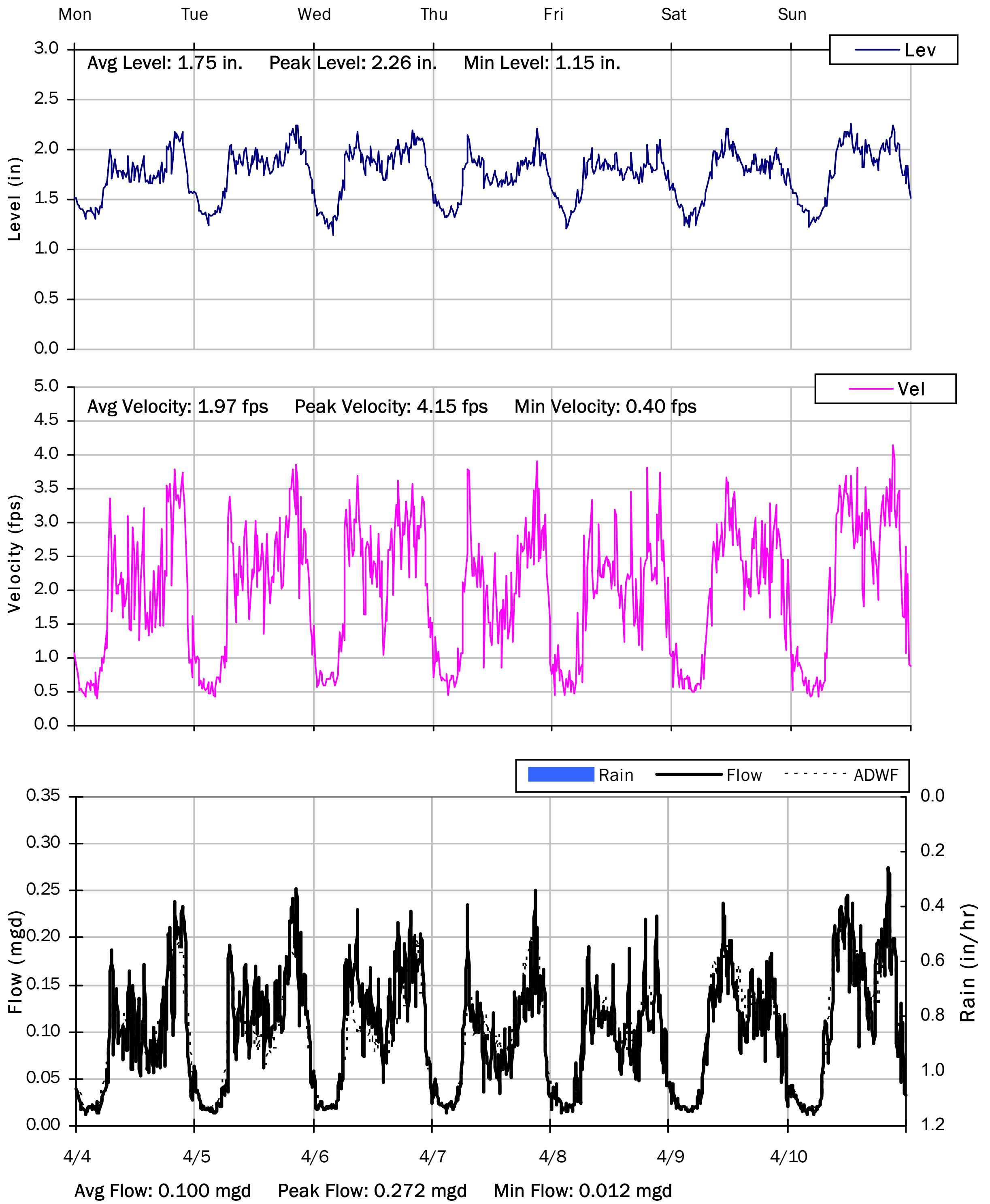




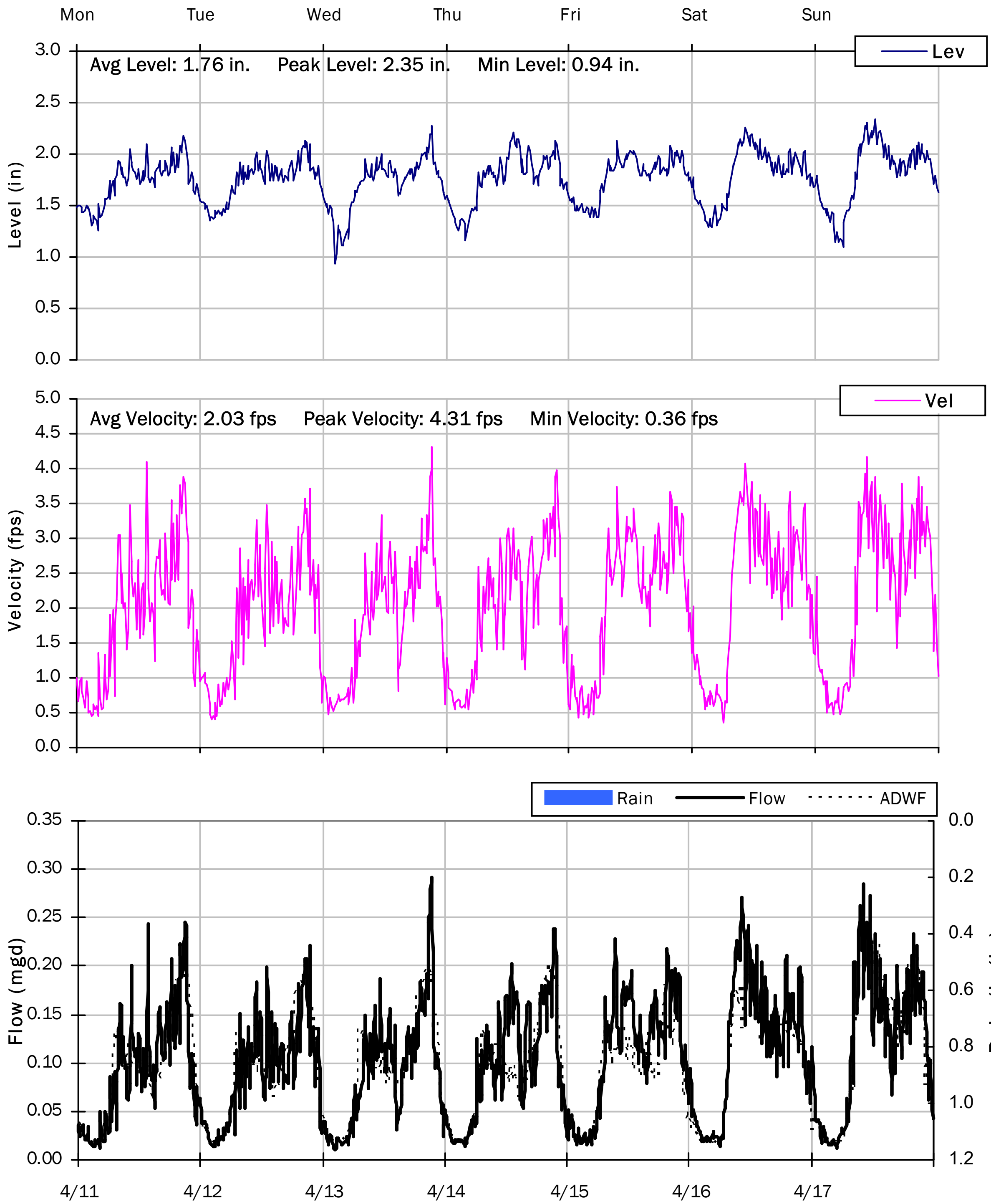


Avg Flow: 0.100 mgd Peak Flow: 0.276 mgd Min Flow: 0.012 mgd

SITE 23
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

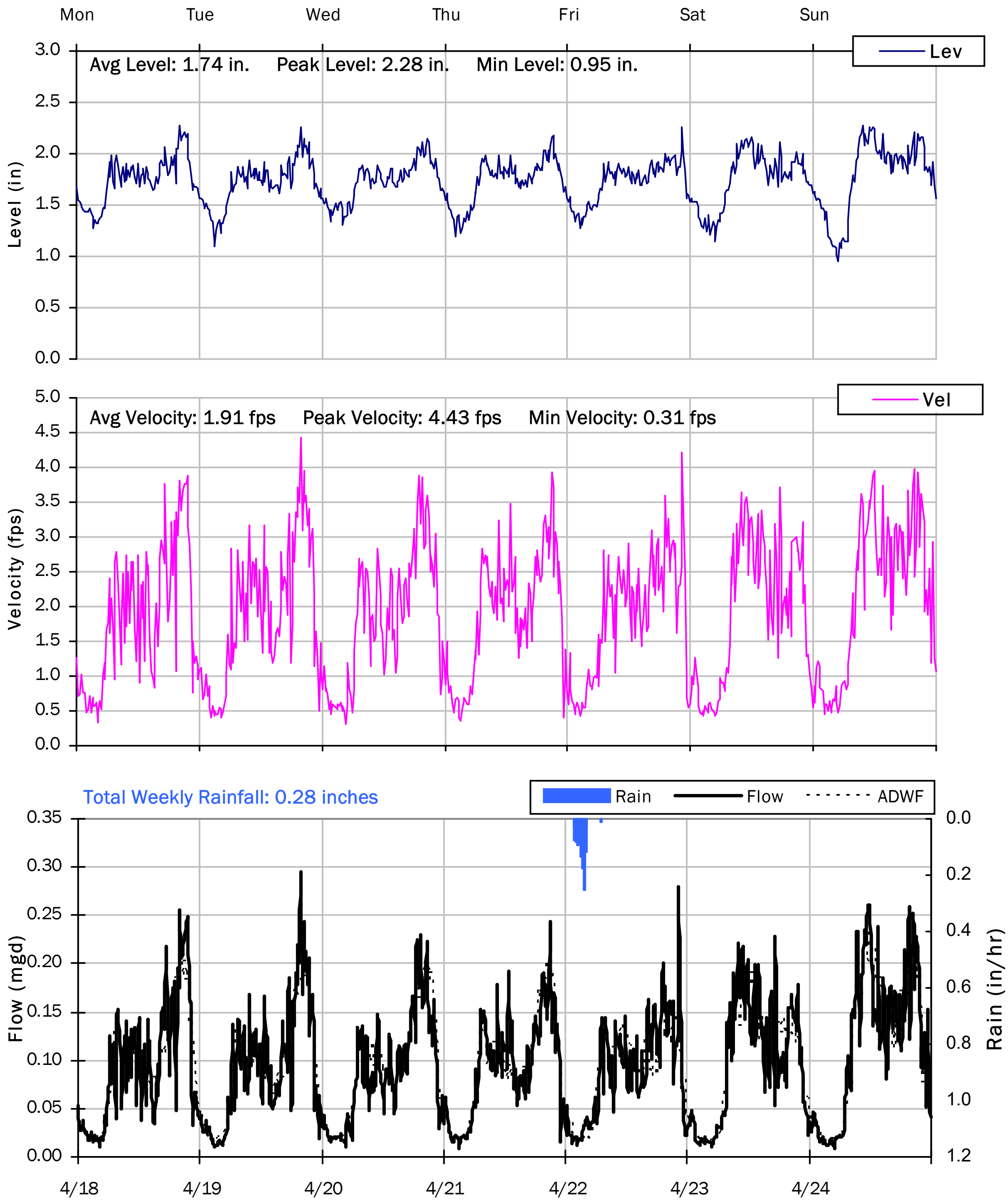


SITE 23
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022



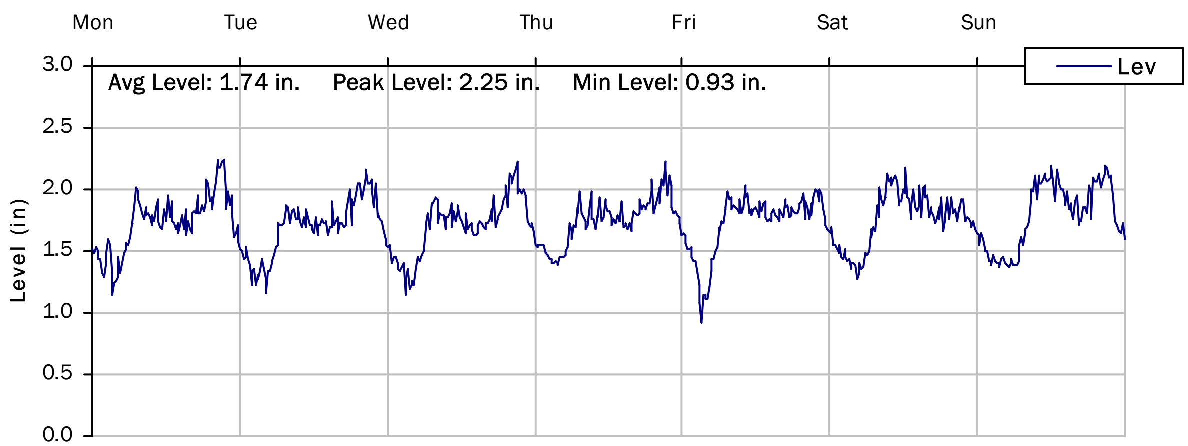
Avg Flow: 0.103 mgd Peak Flow: 0.289 mgd Min Flow: 0.011 mgd

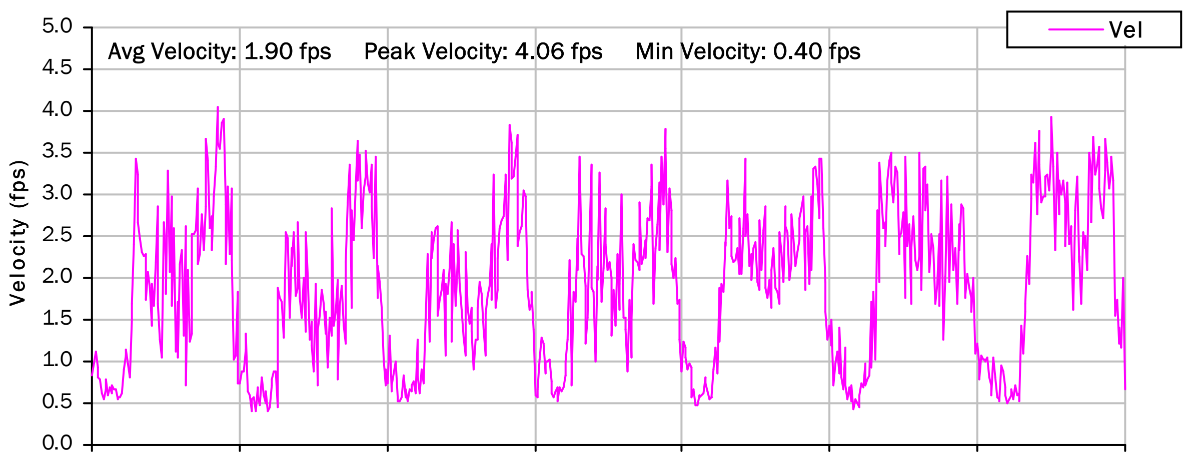
SITE 23
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

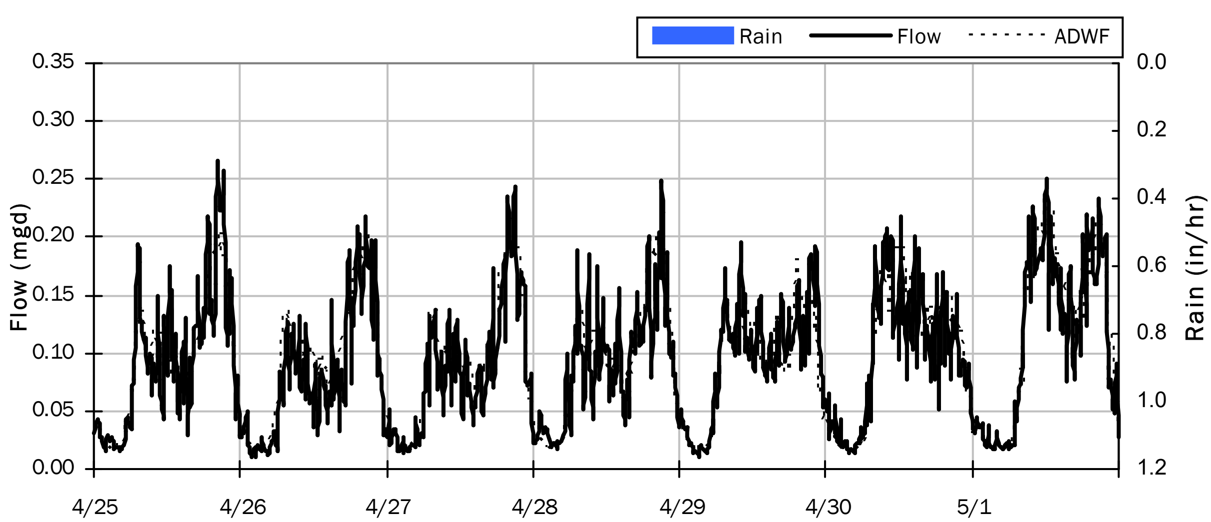


Avg Flow: 0.096 mgd Peak Flow: 0.294 mgd Min Flow: 0.009 mgd

SITE 23
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

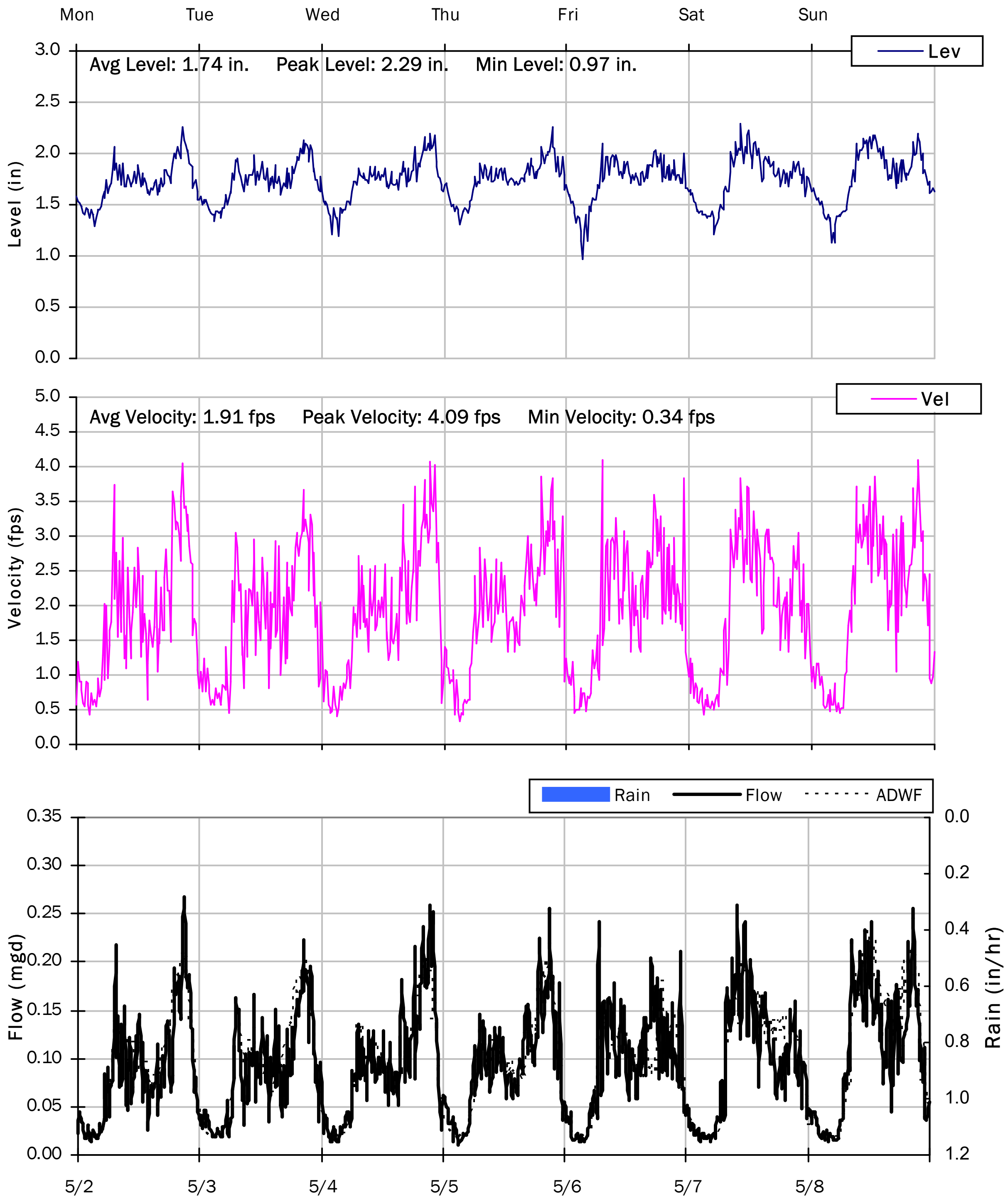






Avg Flow: 0.094 mgd   Peak Flow: 0.267 mgd   Min Flow: 0.011 mgd

SITE 23
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

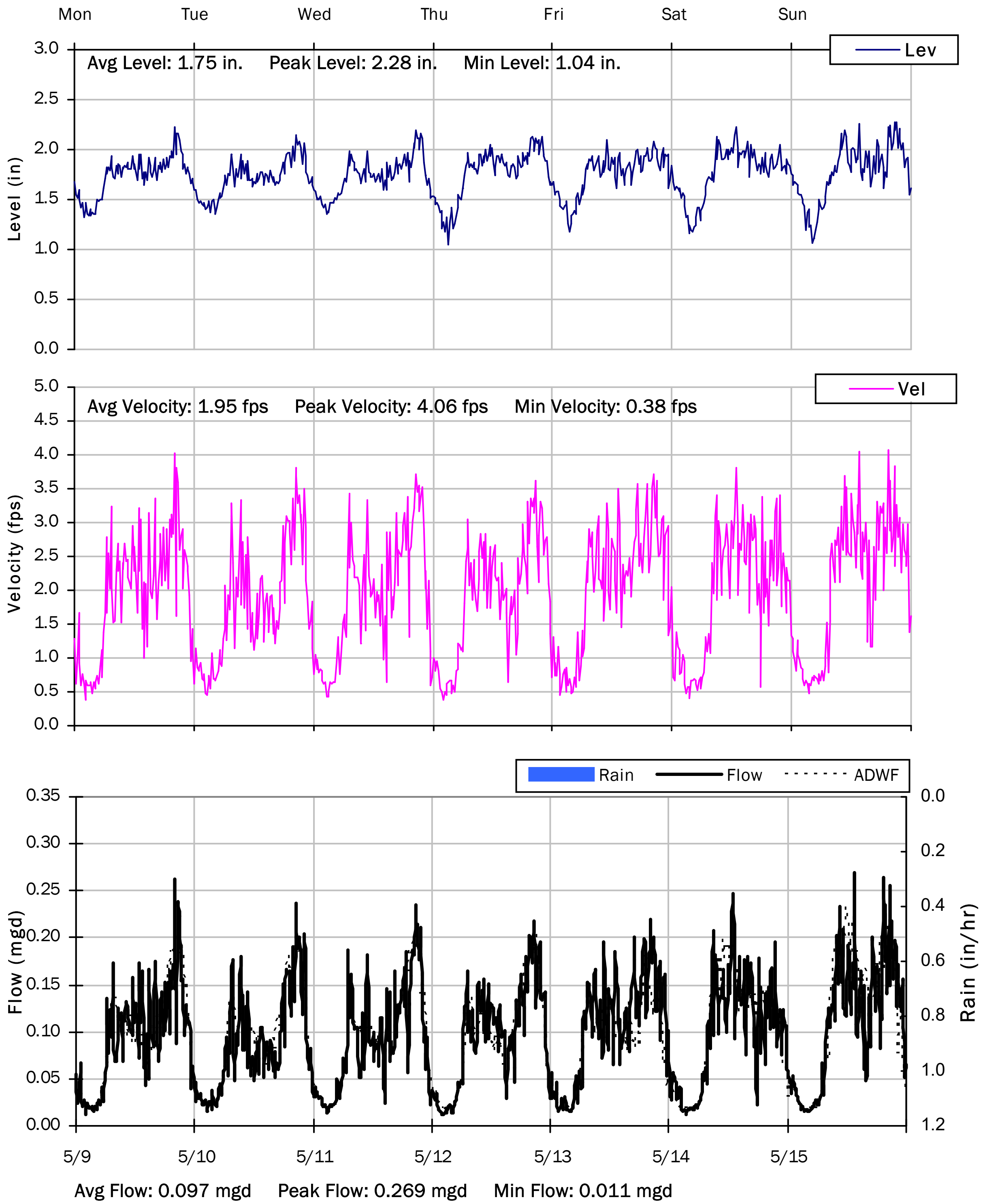


Avg Flow: 0.094 mgd   Peak Flow: 0.268 mgd   Min Flow: 0.010 mgd

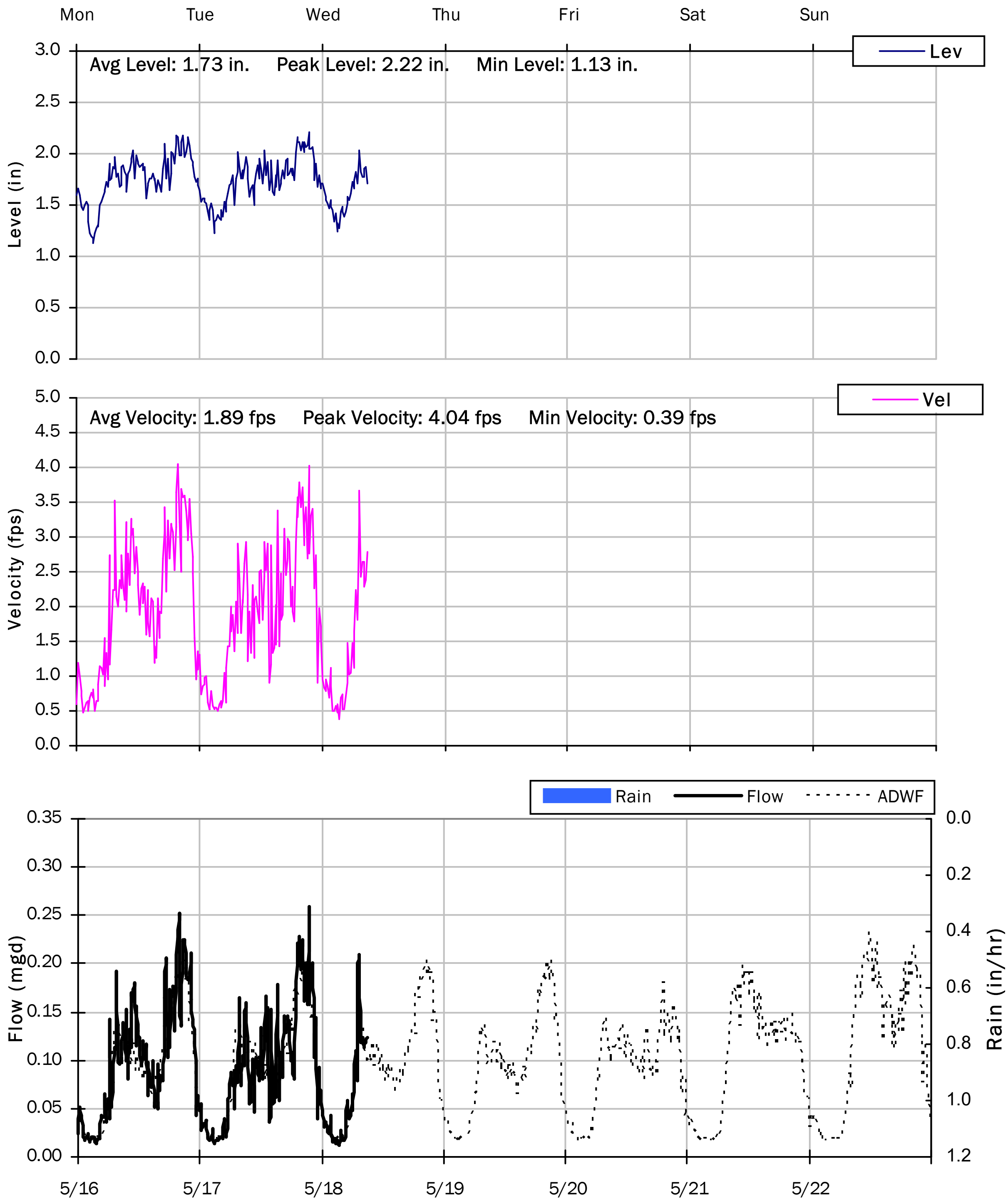
SITE 23

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022



SITE 23
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022



Avg Flow: 0.093 mgd Peak Flow: 0.259 mgd Min Flow: 0.011 mgd

Monitoring Site: Site 24

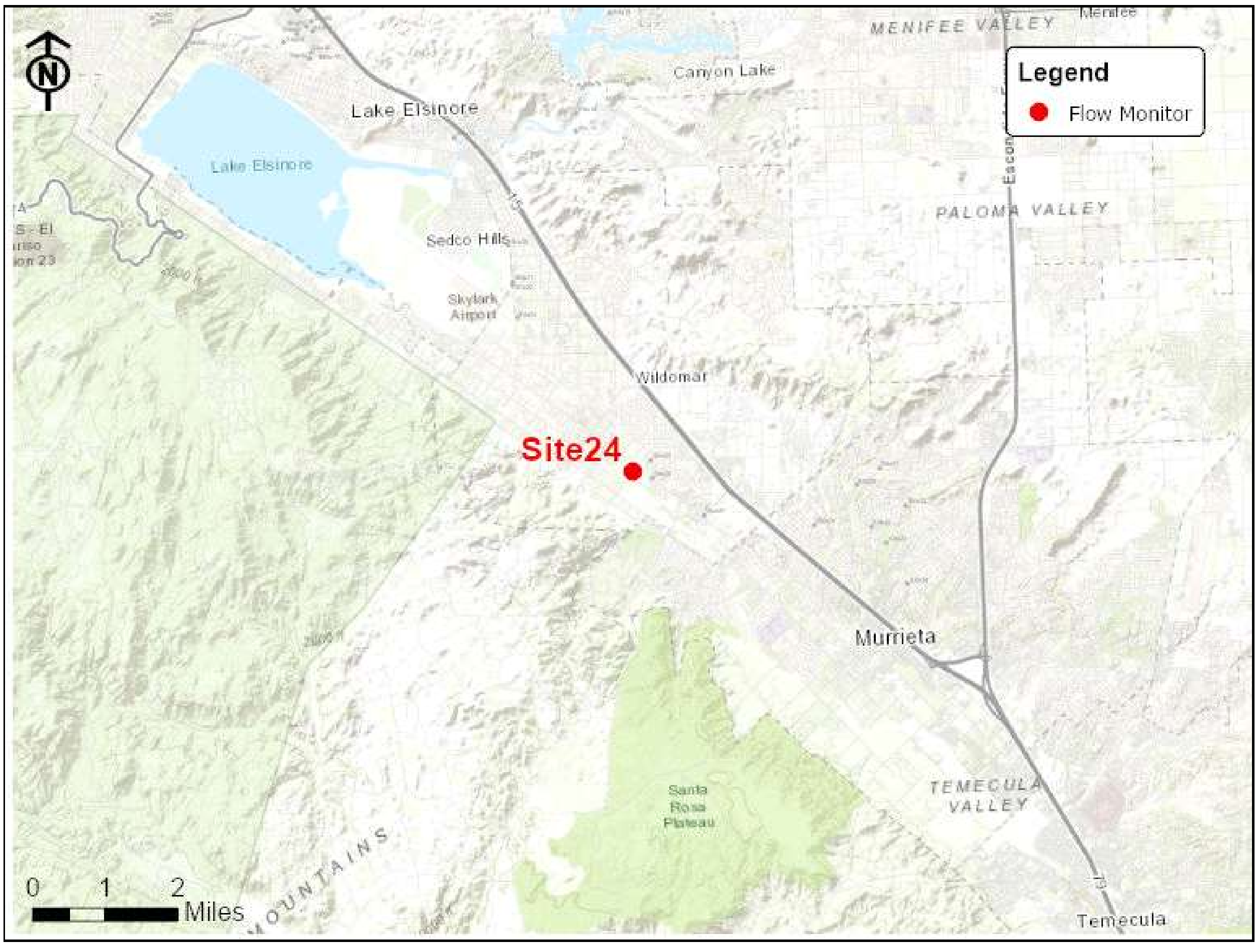
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: McVicar Street

Data Summary Report



Vicinity Map: Site 24

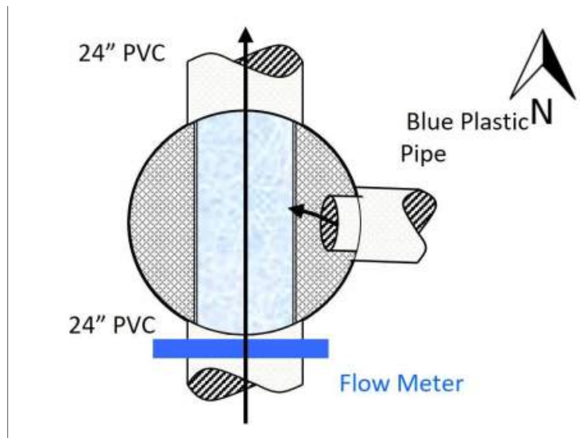
SITE 24

Site Information MH ID: MH-4236

Location:	McVicar Street
Coordinates:	117.2636° W, 33.5956° N
Rim Elevation (Earth):	1220 feet
Expected Pipe Diameter:	24 inches
Measured Pipe Diameter:	23.75 inches
ADWF:	0.165 mgd
Peak Measured Flow:	0.790 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch

View from Street


Plan View

SITE 24

Additional Site Photos

Effluent Pipe

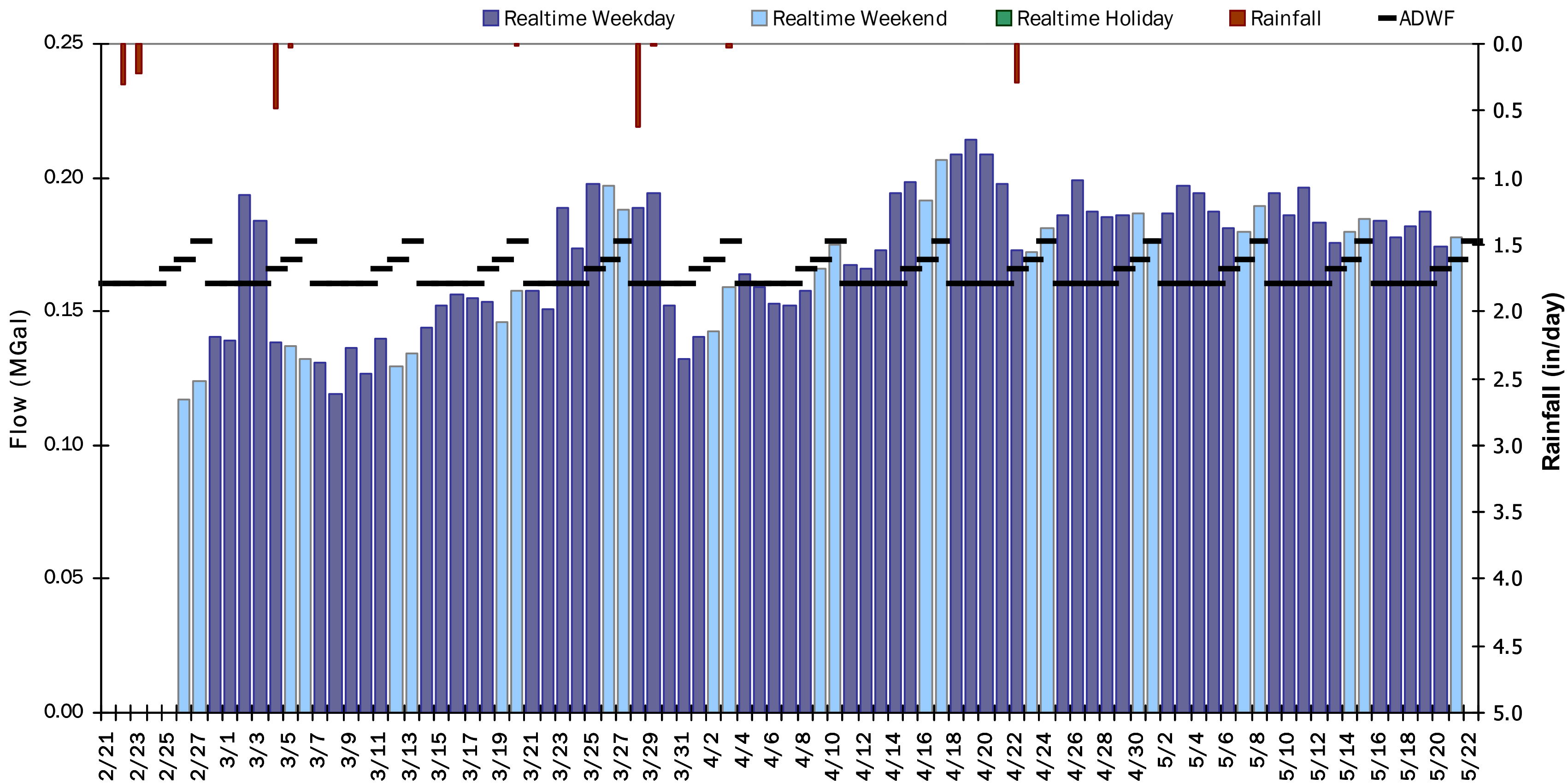
Influent Pipe

SITE 24

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.170 MGal   Peak Daily Flow: 0.214 MGal   Min Daily Flow: 0.117 MGal

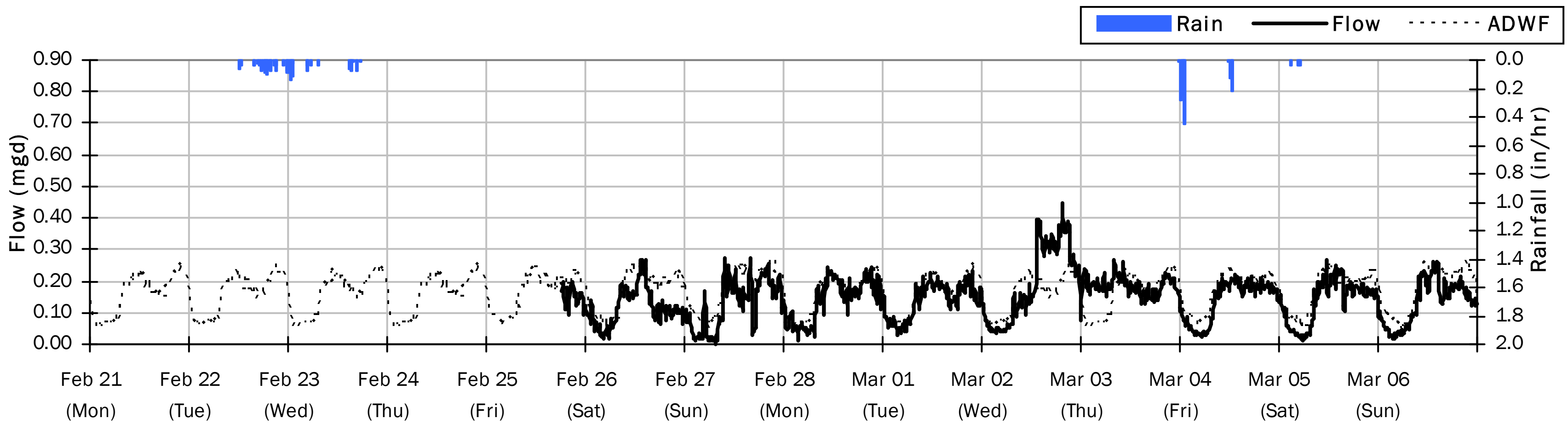
Total Rainfall: 1.48 inches

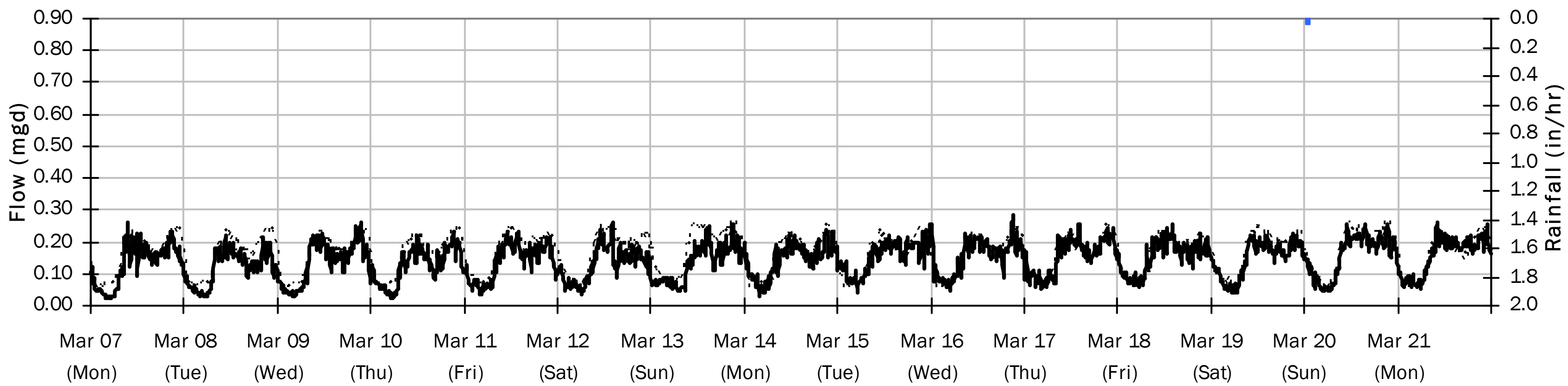


SITE 24

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.06 inches   Period Avg Flow: 0.144 mgd   Period Peak Flow: 0.445 mgd   Period Min Flow: 0.002 mgd

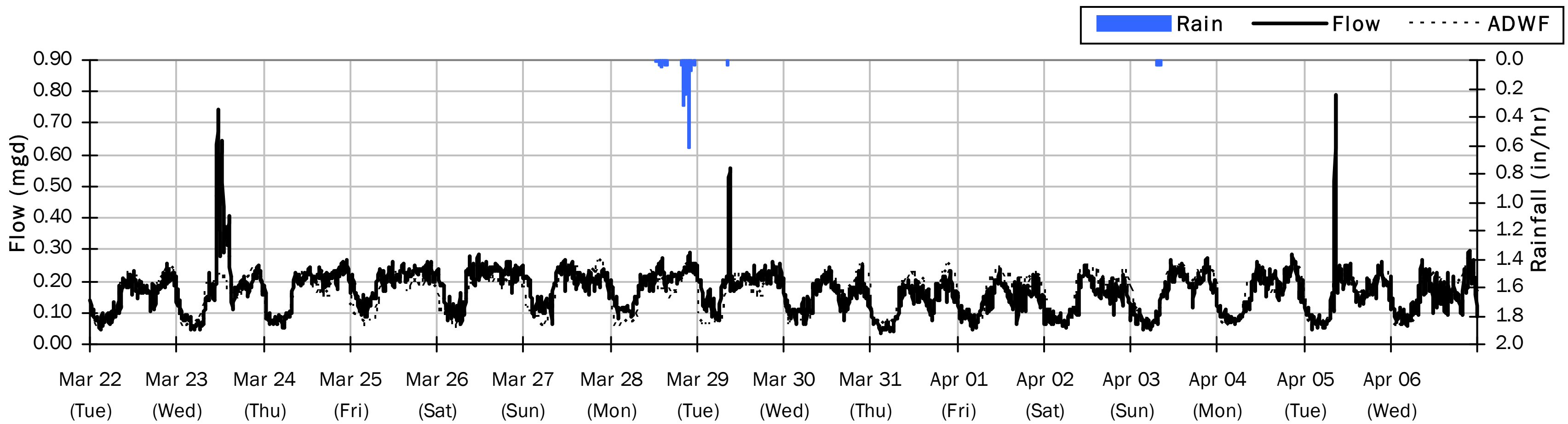


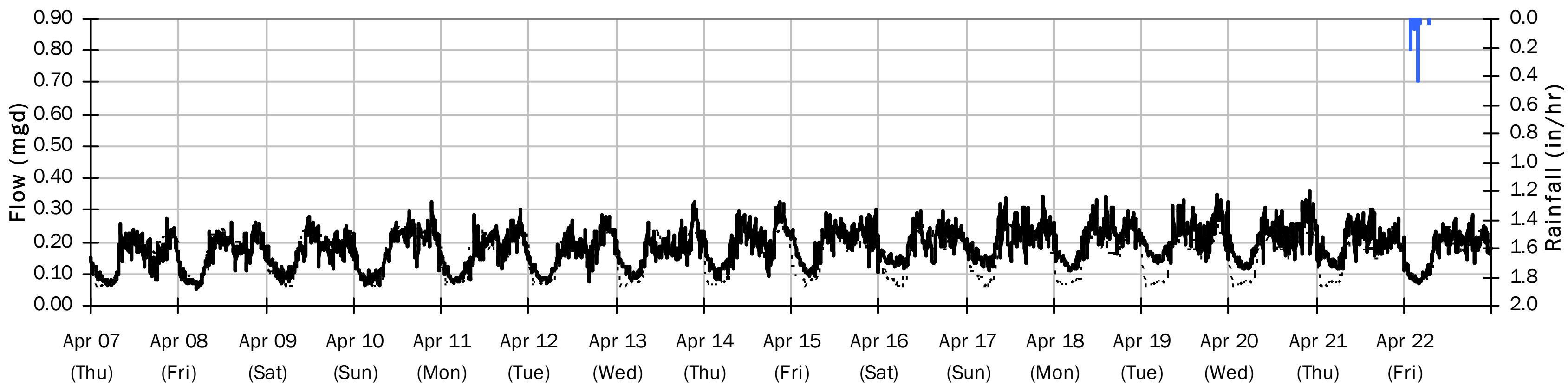


SITE 24

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.95 inches   Period Avg Flow: 0.176 mgd   Period Peak Flow: 0.790 mgd   Period Min Flow: 0.035 mgd

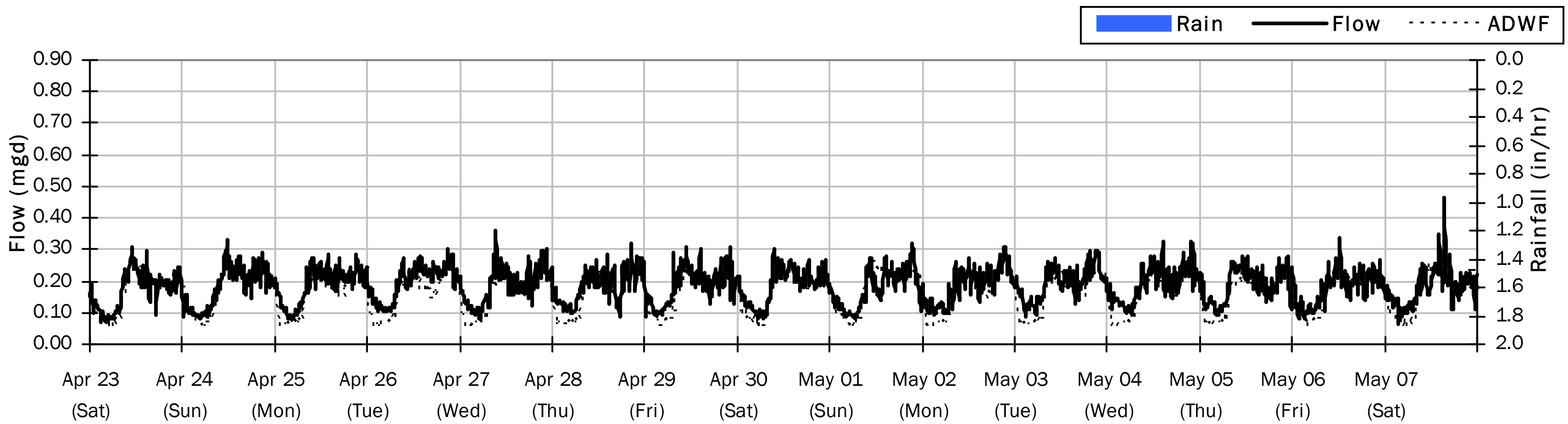


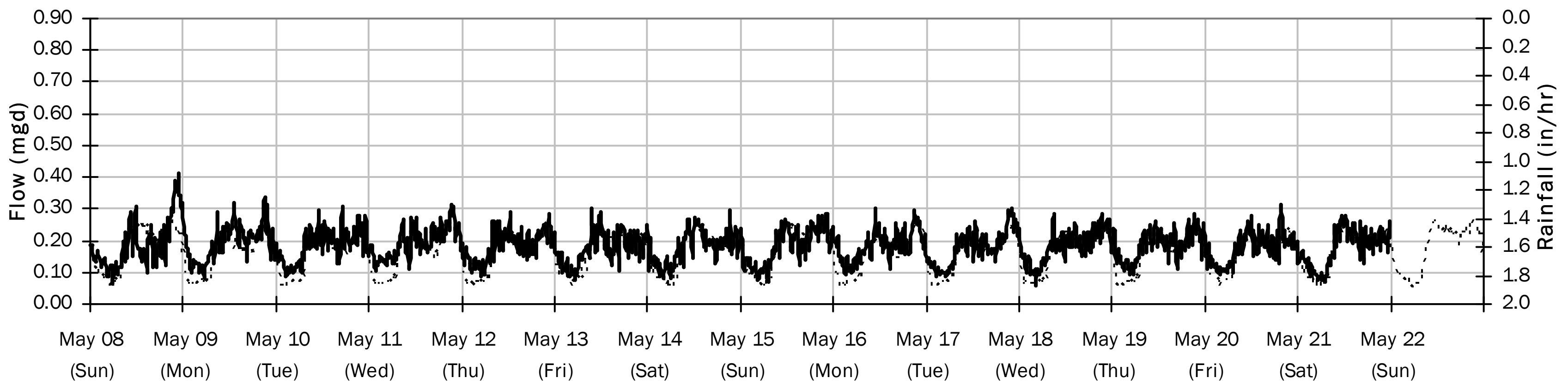


SITE 24
Flow Summary: 4/23/2022 to 5/22/2022

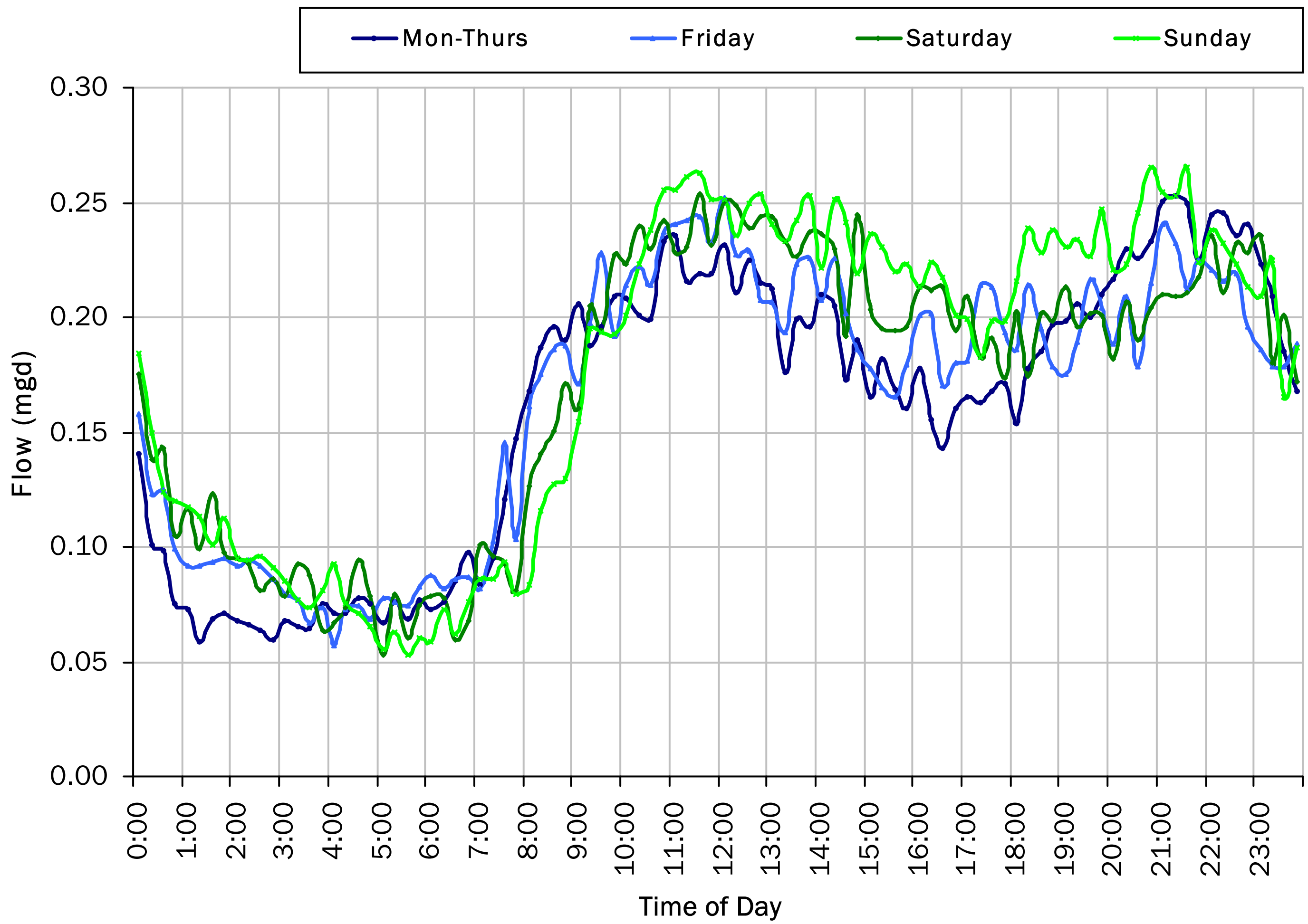
Period Rainfall: 0.00 inches

Period Avg Flow: 0.185 mgd Period Peak Flow: 0.463 mgd Period Min Flow: 0.057 mgd

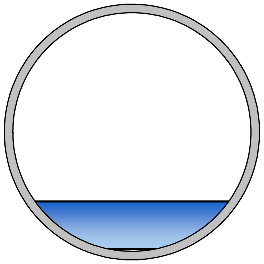




SITE 24
Average Dry Weather Flow Hydrographs

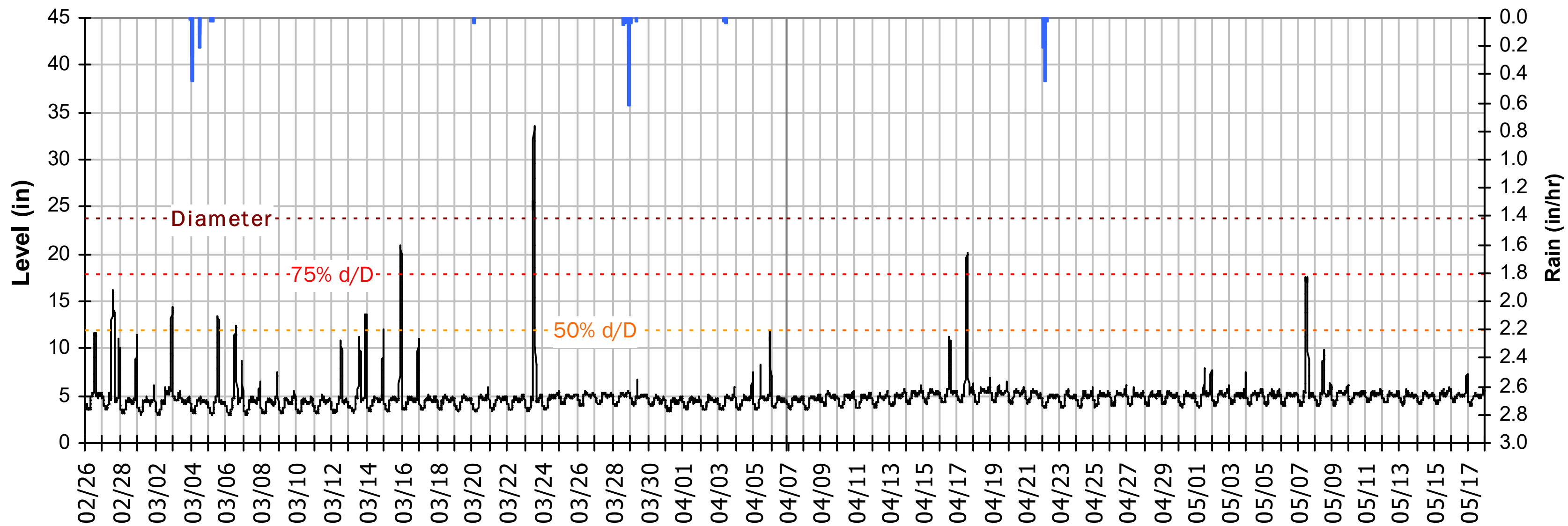


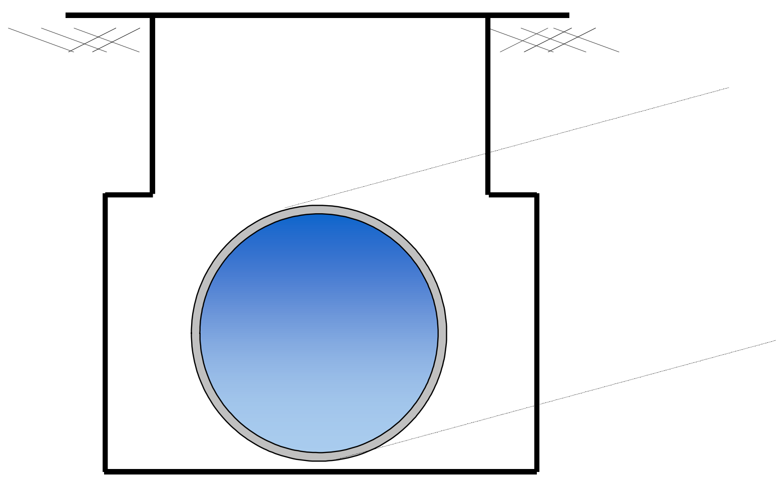
ADWF:
0.165 *mgd*



SITE 24
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period





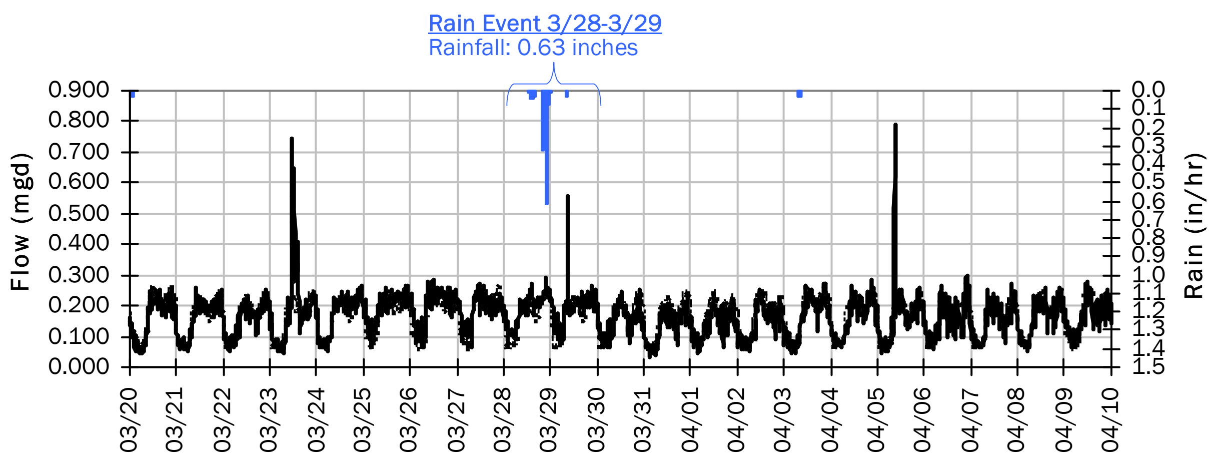
Pipe Diameter:	23.8	*inches*
Peak Measured Level:	33.6	*inches*
Peak d/D Ratio:	1.42	

Surcharged 9.9 inches over crown

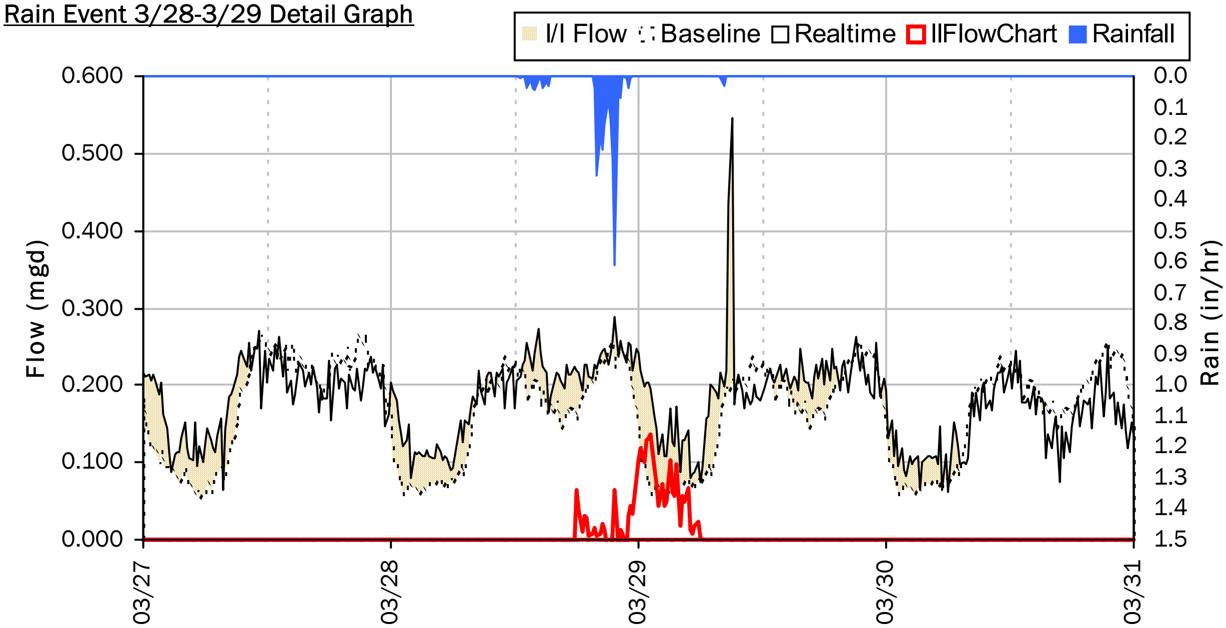
SITE 24

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph

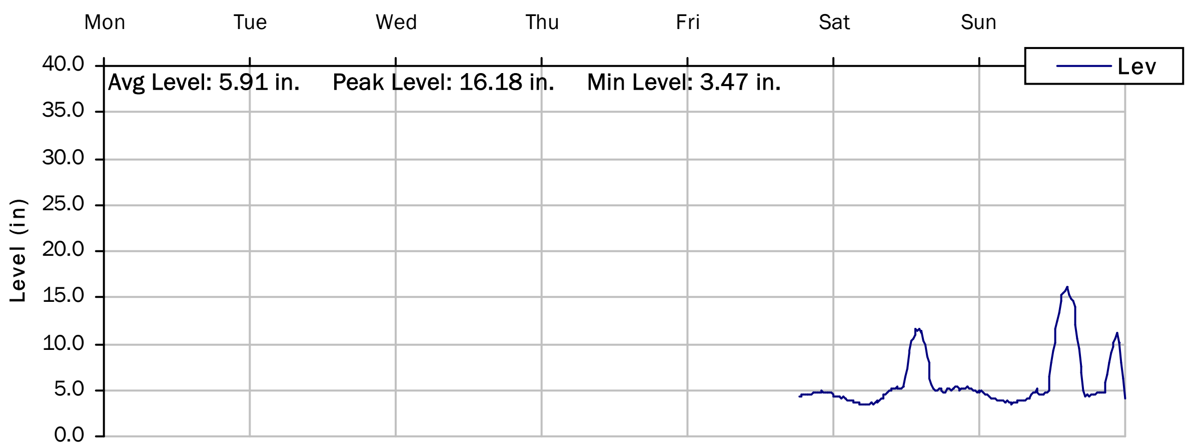


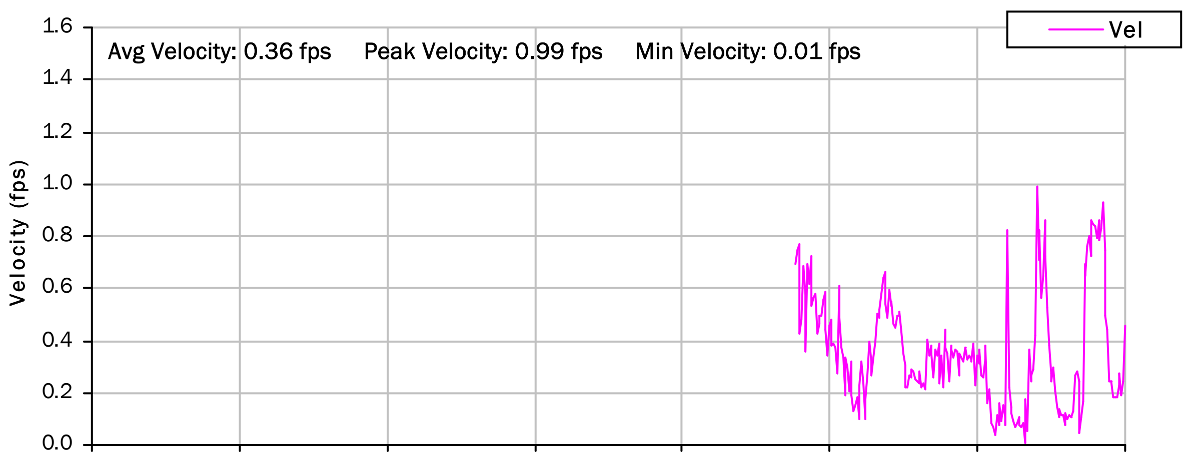
Storm Event I/I Analysis (Rain = 0.63 inches)

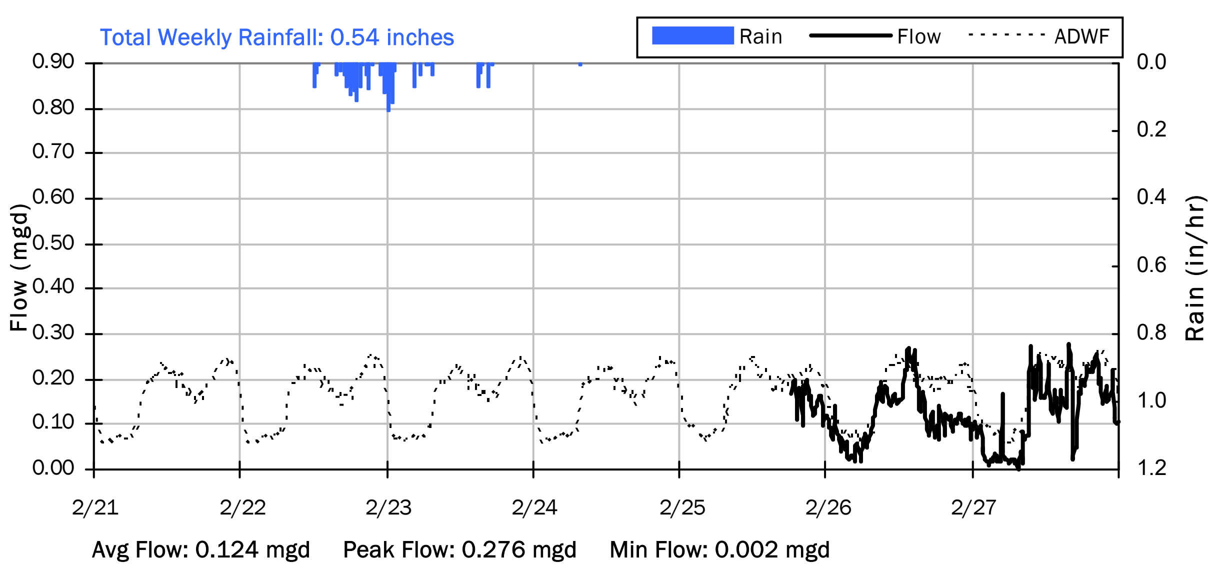
Capacity		Inflow / Infiltration	
Peak Flow:	0.289 *mgd*	Peak I/I Rate:	0.136 *mgd*
PF:	1.75	Total I/I:	22,000 *gallons*
Peak Level:	5.51 *in*		
d/D Ratio:	0.23		

SITE 24

Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



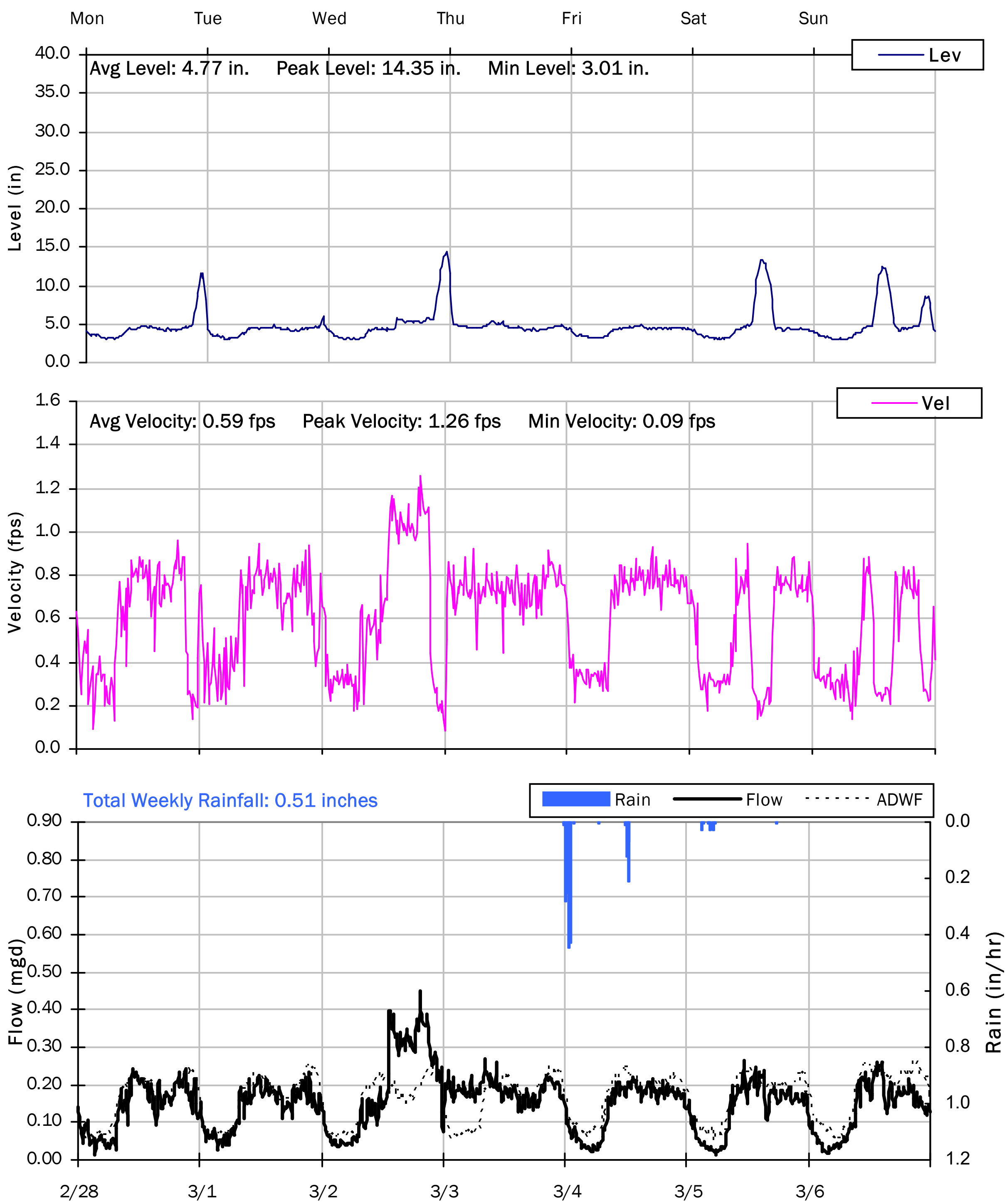




SITE 24

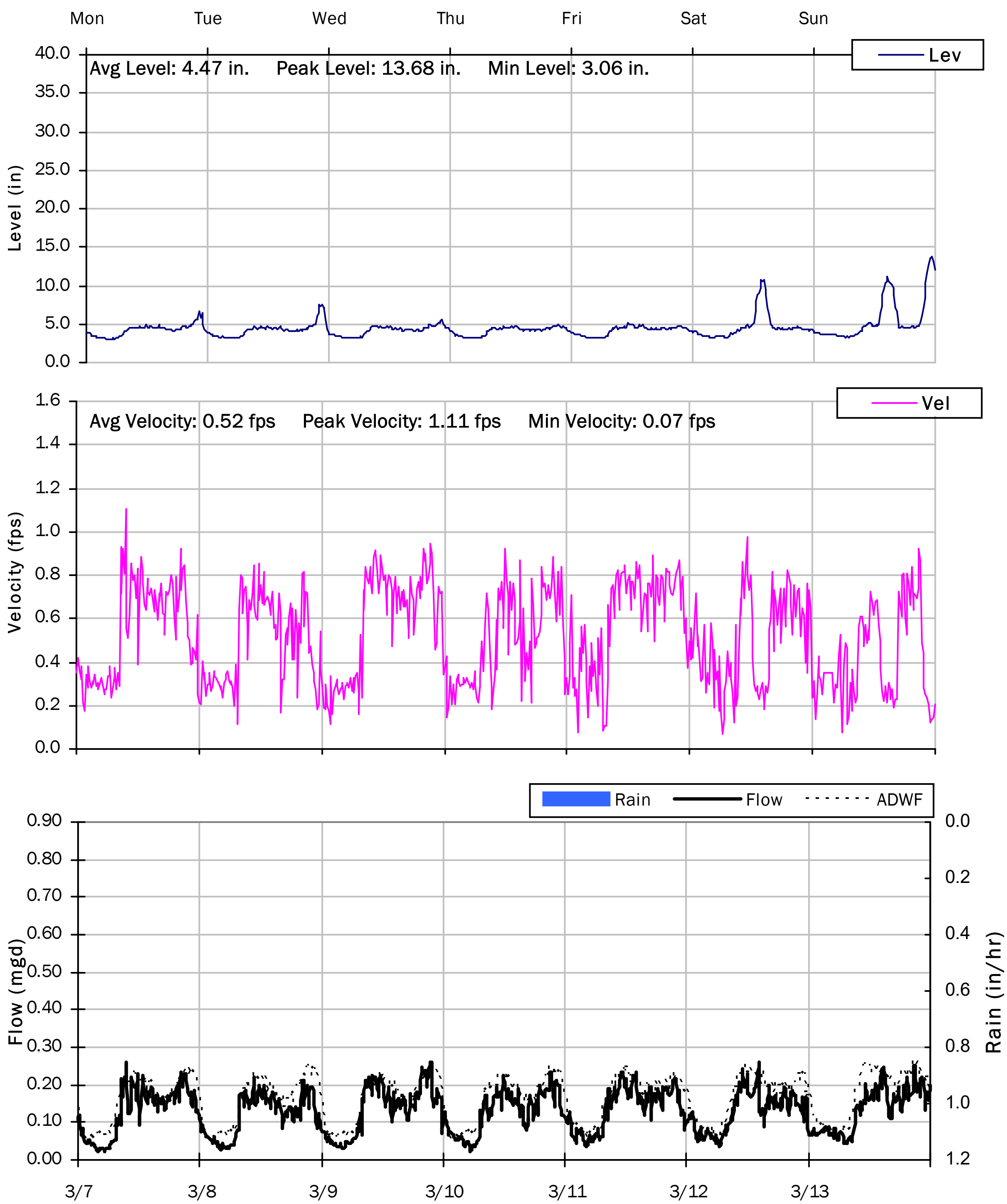
Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022



Avg Flow: 0.152 mgd Peak Flow: 0.445 mgd Min Flow: 0.014 mgd

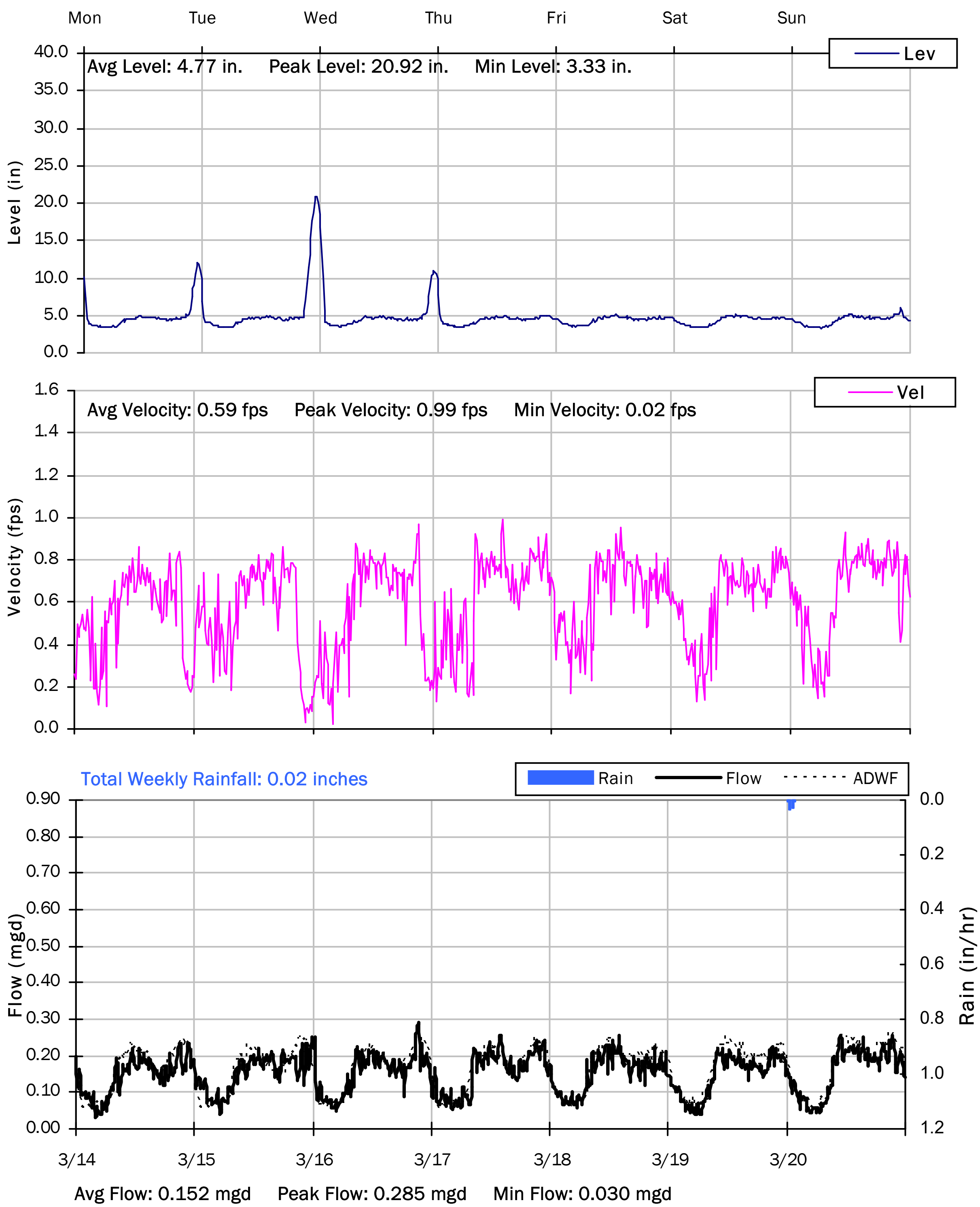
SITE 24
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022



Avg Flow: 0.131 mgd Peak Flow: 0.262 mgd Min Flow: 0.022 mgd

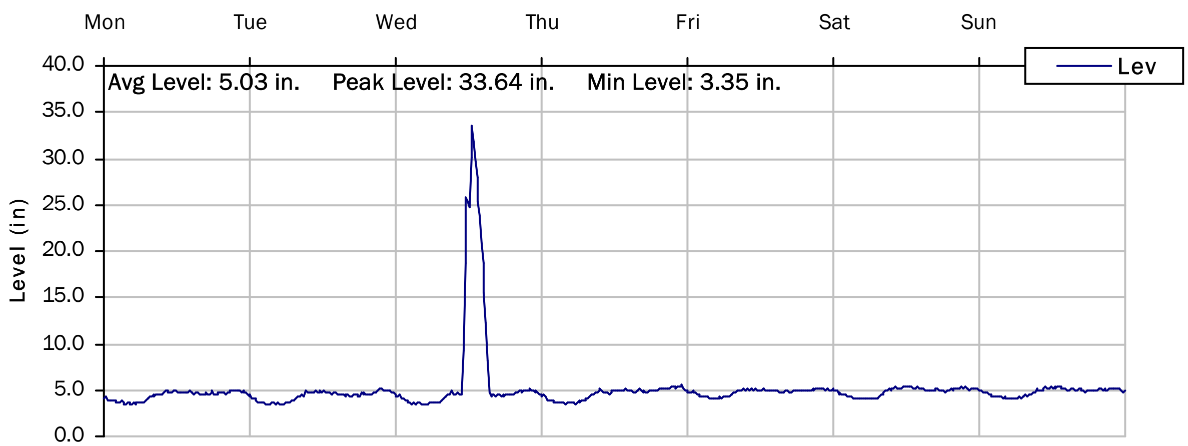
SITE 24

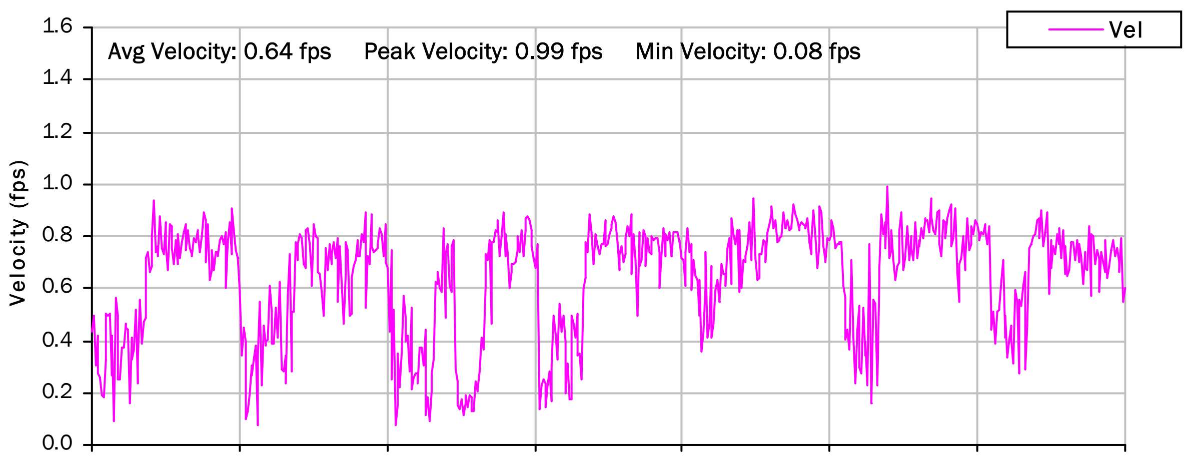
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022

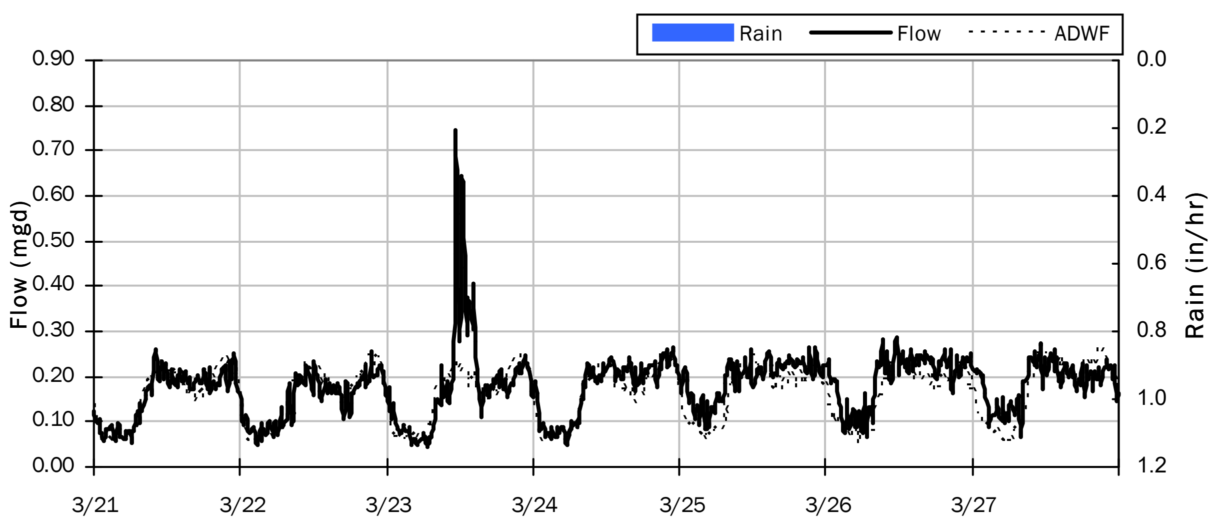


SITE 24

Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

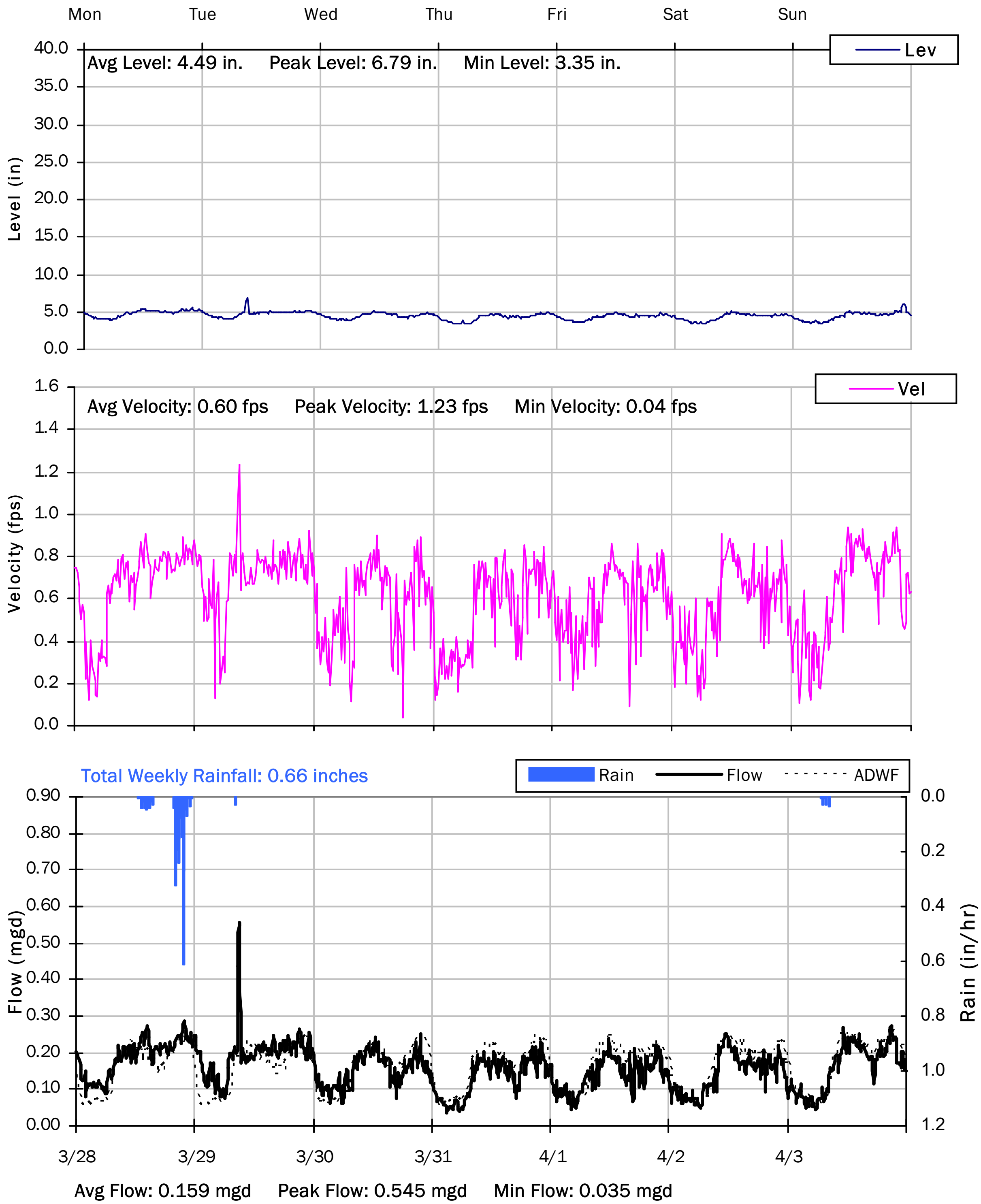




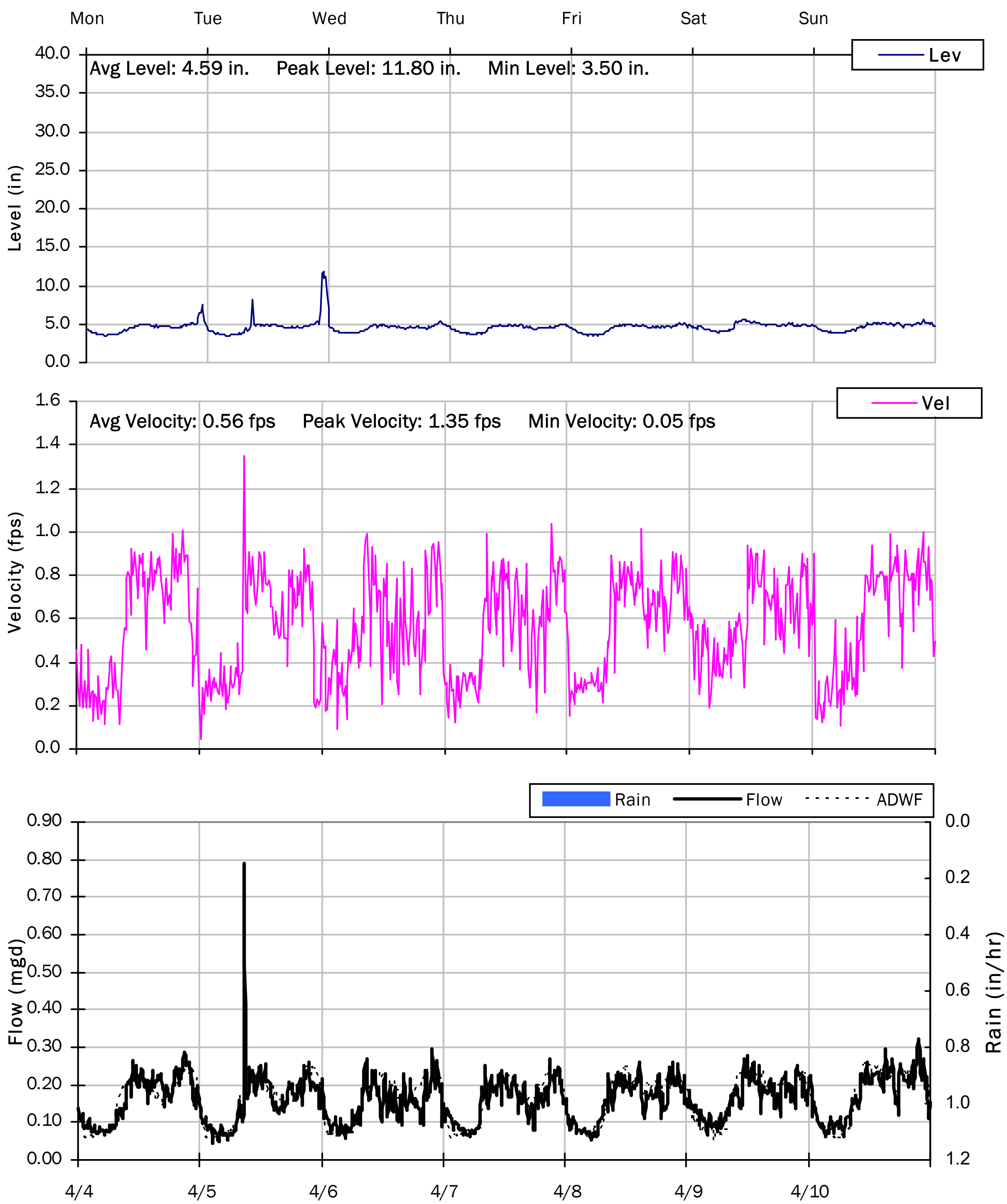


Avg Flow: 0.179 mgd Peak Flow: 0.746 mgd Min Flow: 0.046 mgd

SITE 24
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

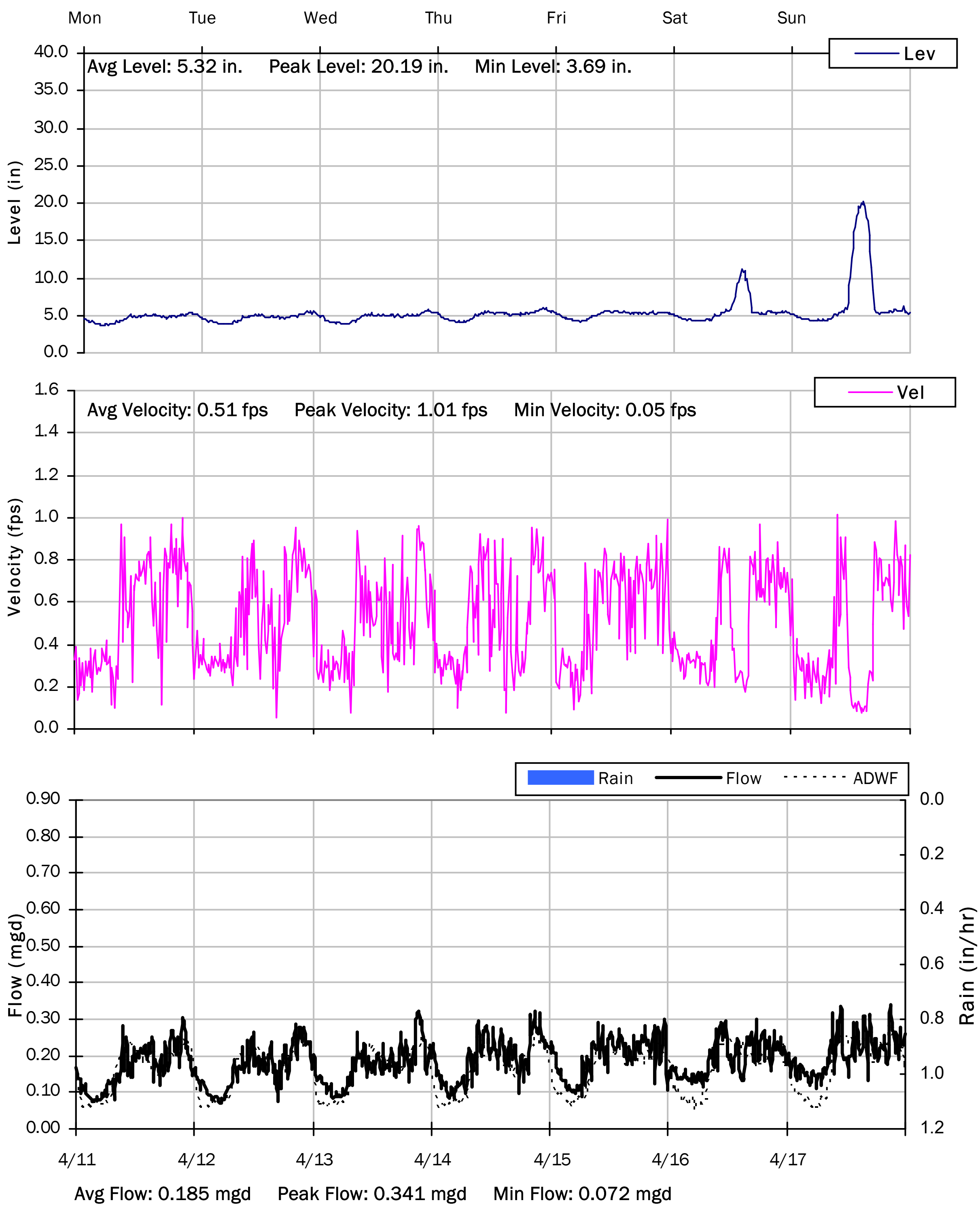


SITE 24
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

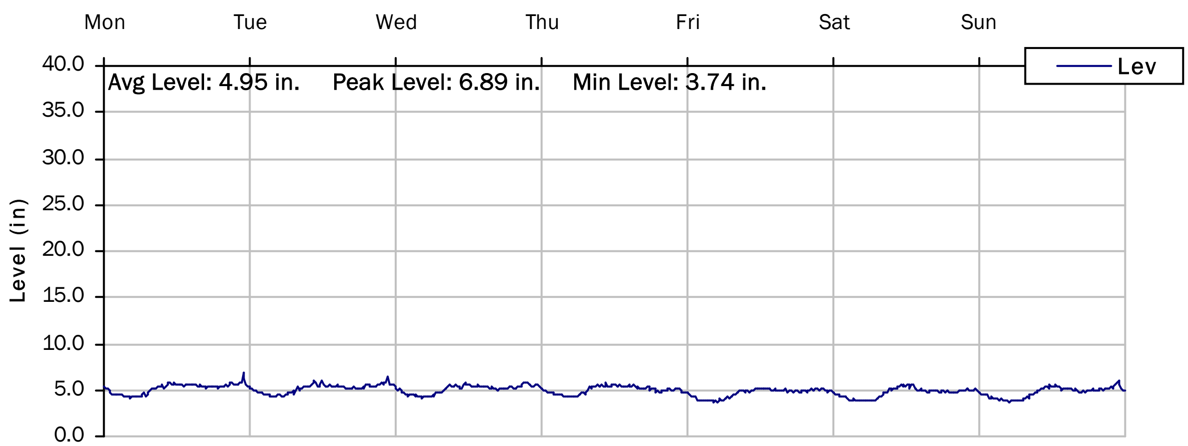


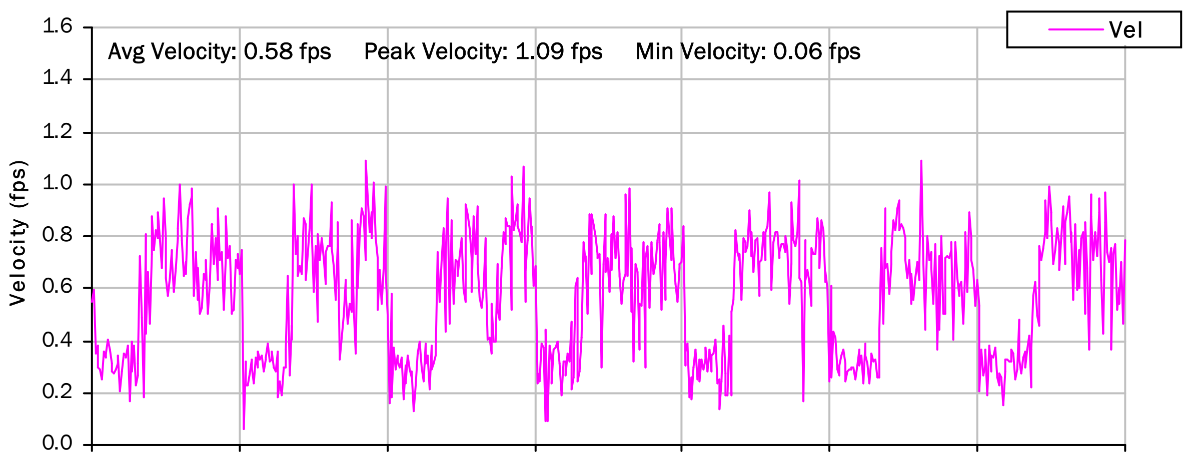
Avg Flow: 0.161 mgd Peak Flow: 0.790 mgd Min Flow: 0.046 mgd

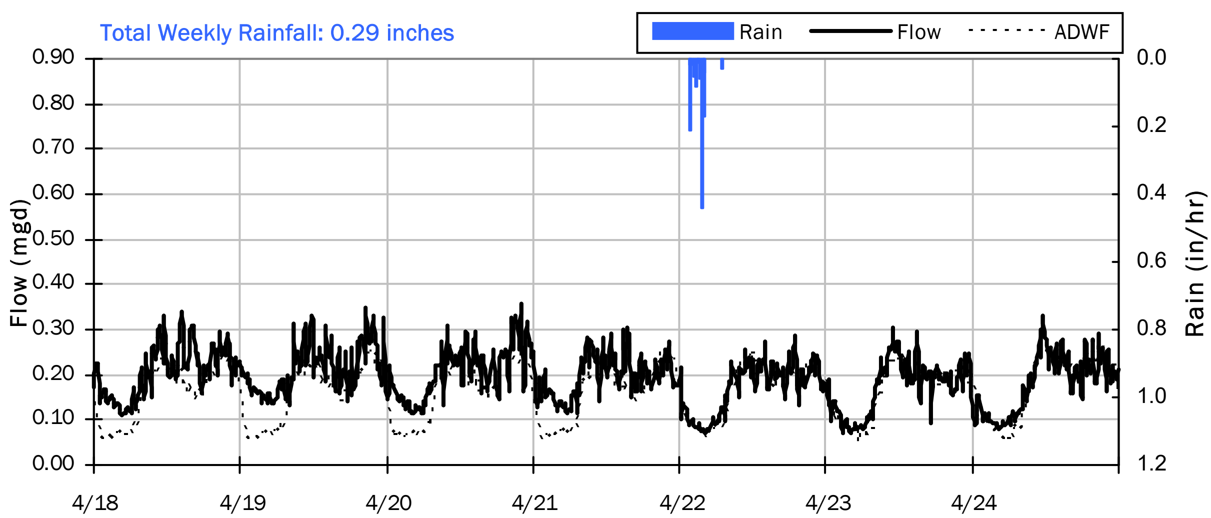
SITE 24
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022



SITE 24
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

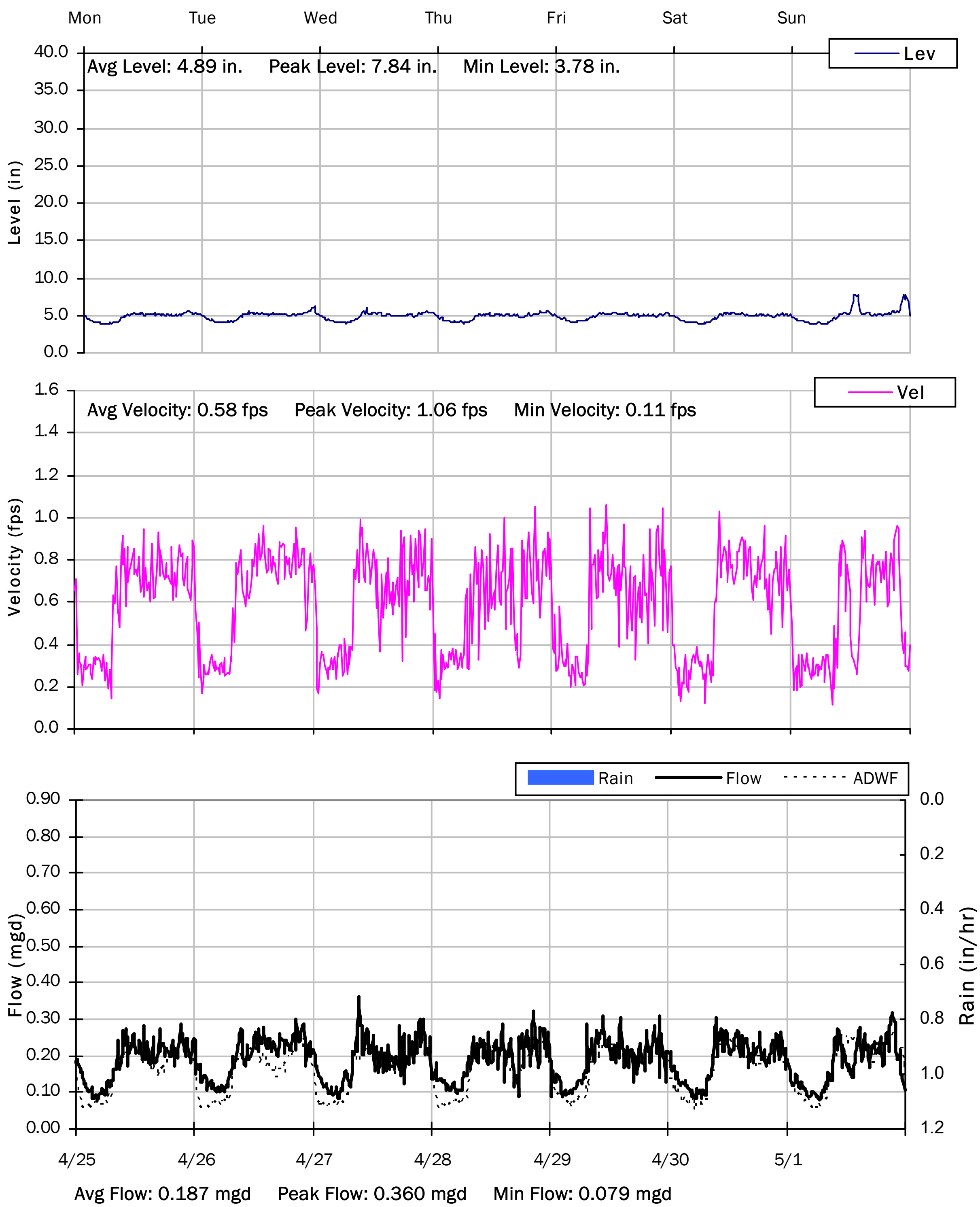




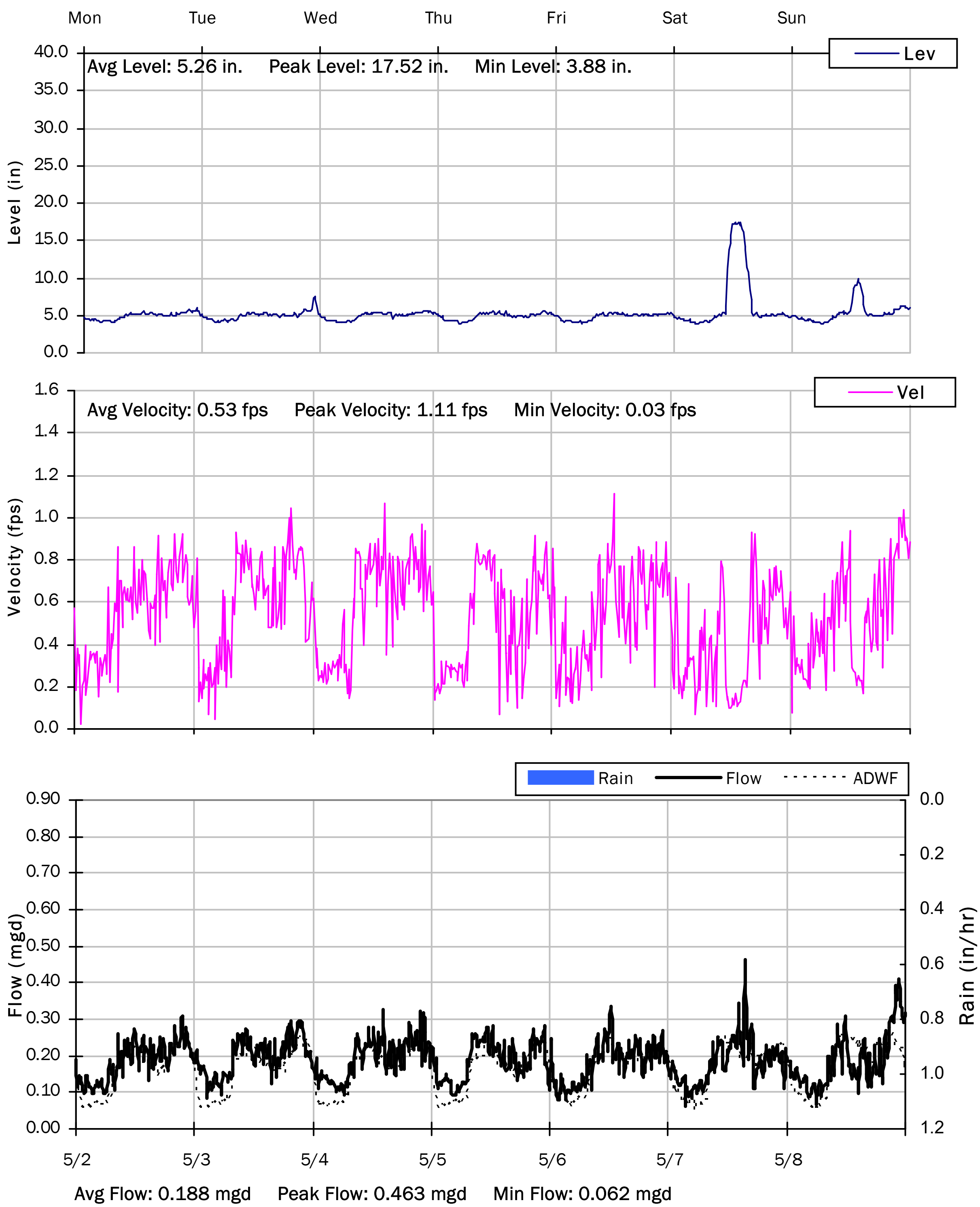


Avg Flow: 0.194 mgd Peak Flow: 0.358 mgd Min Flow: 0.069 mgd

SITE 24
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022



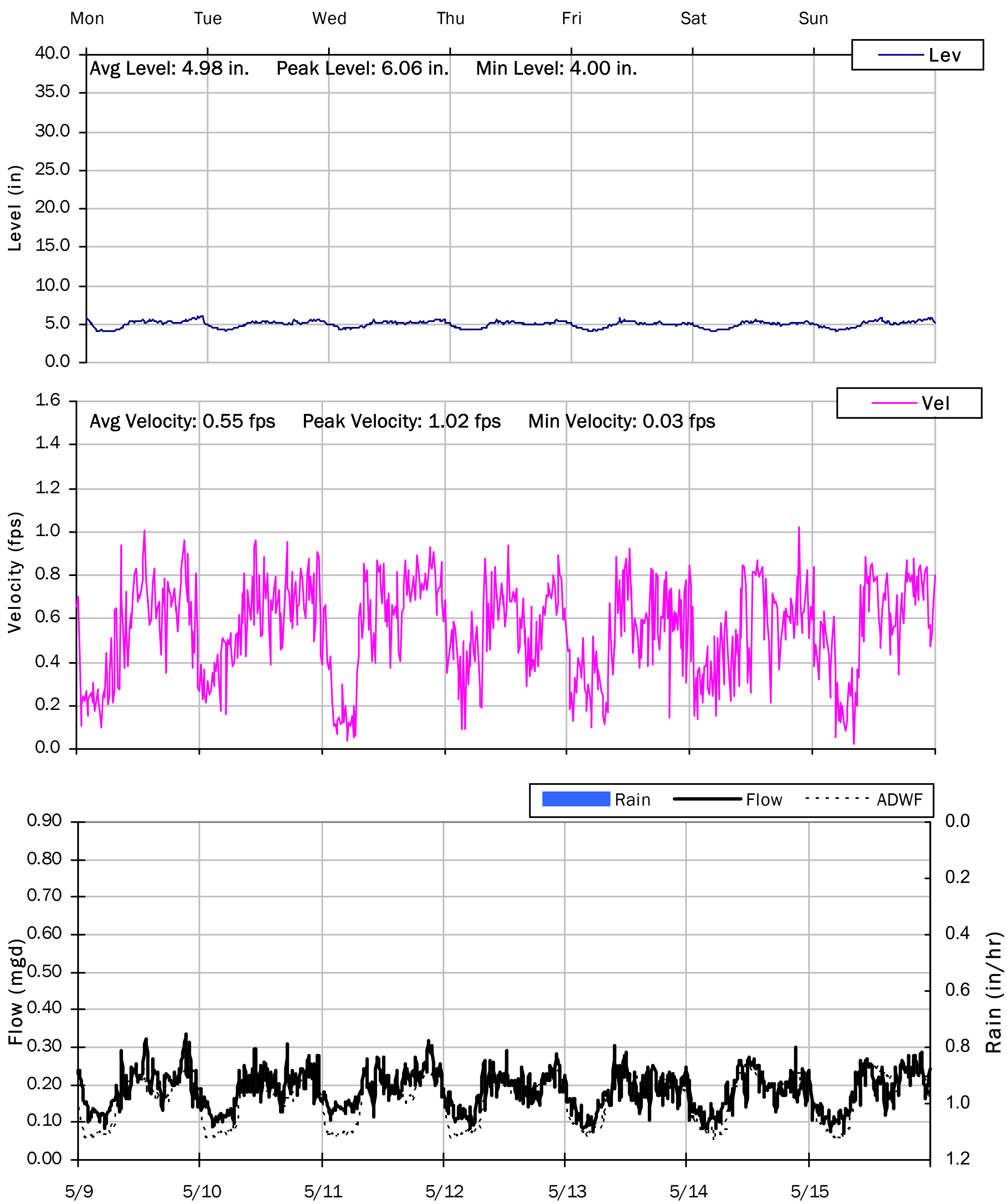
SITE 24
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022



SITE 24

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022

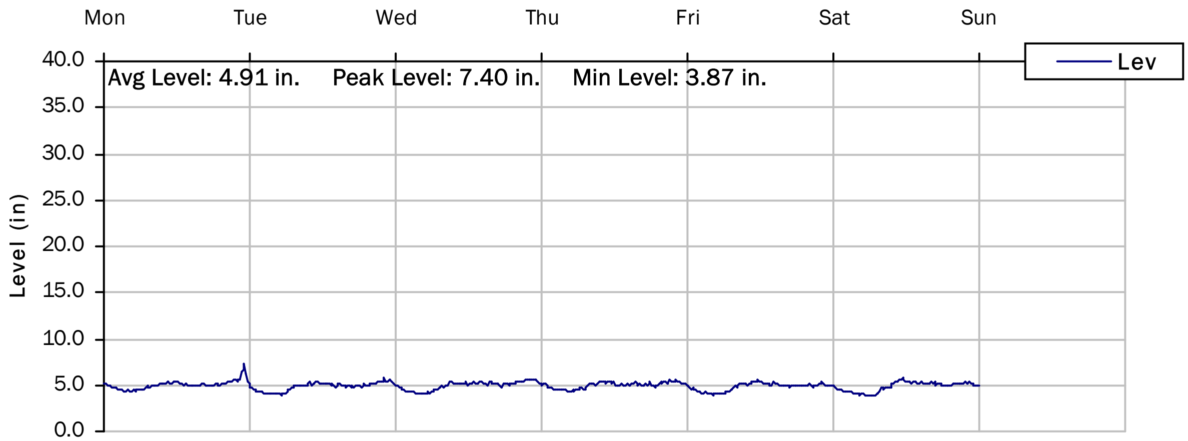


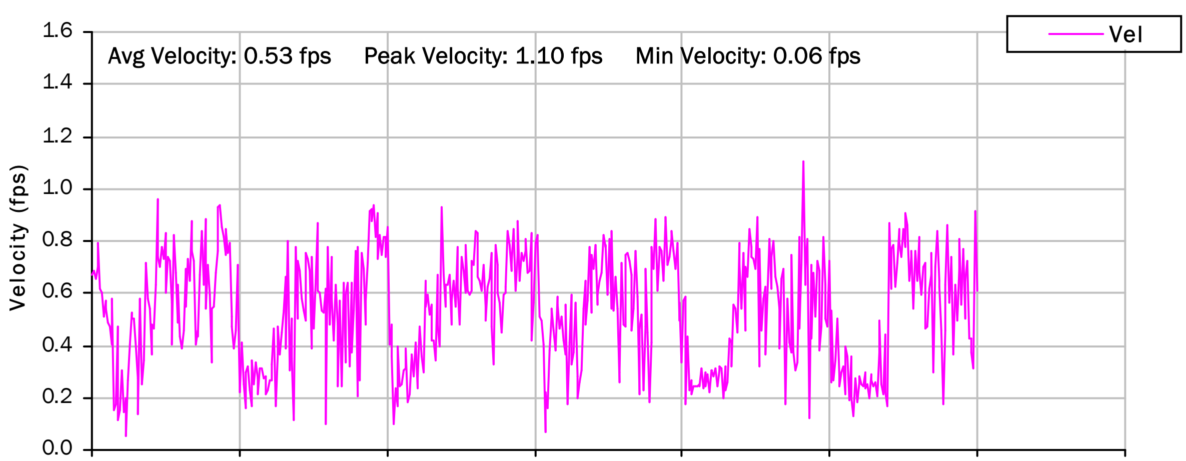
Avg Flow: 0.186 mgd Peak Flow: 0.334 mgd Min Flow: 0.071 mgd

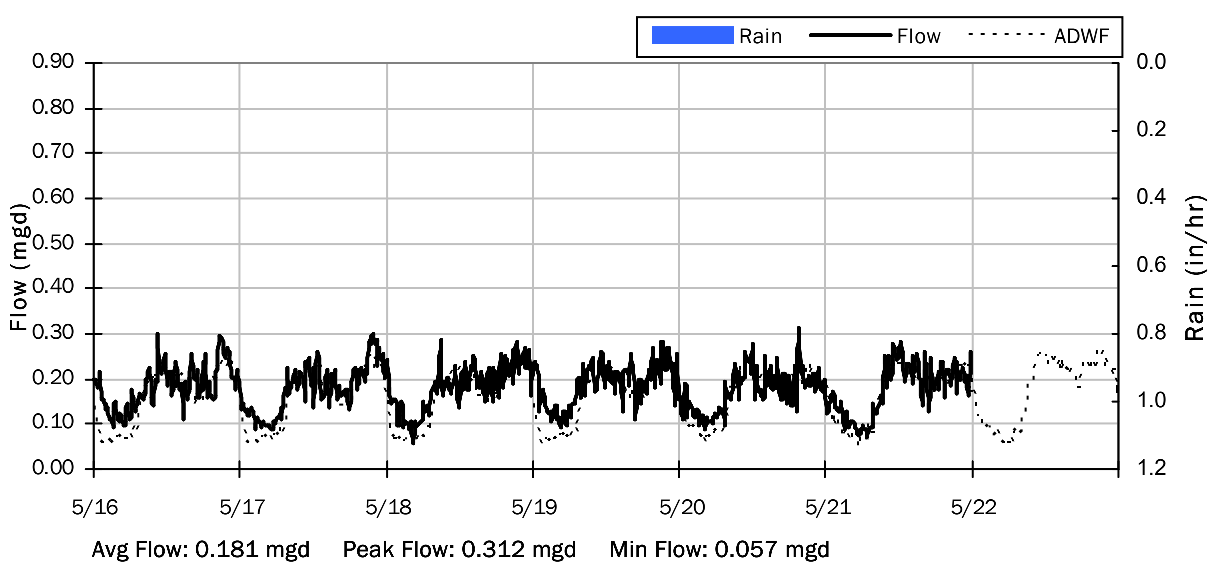
SITE 24

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022







Monitoring Site: Site 25

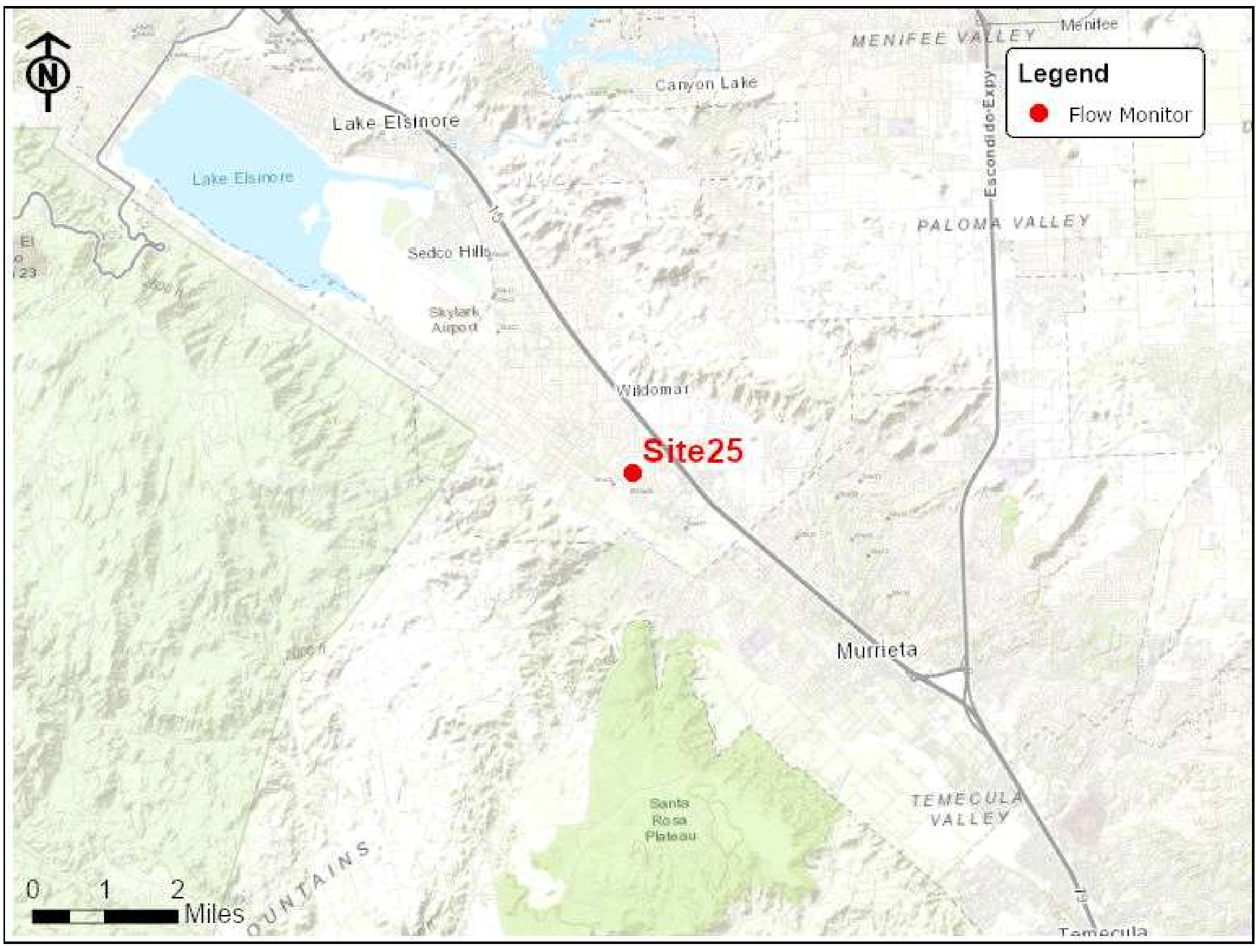
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Catt Road and Nan Street

Data Summary Report



Vicinity Map: Site 25

SITE 25

Site Information   MH ID: MH-5032

Location: Catt Road and Nan Street

Coordinates: 117.2590° W, 33.5977° N

Rim Elevation (Earth): 1265 feet

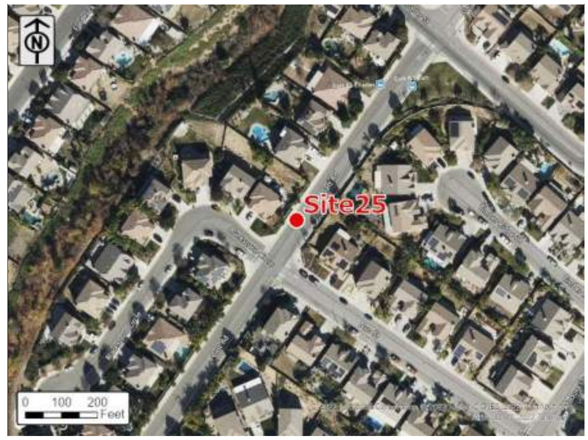
Expected Pipe Diameter: 24 inches

Measured Pipe Diameter: 23.75 inches

ADWF: 0.570 mgd

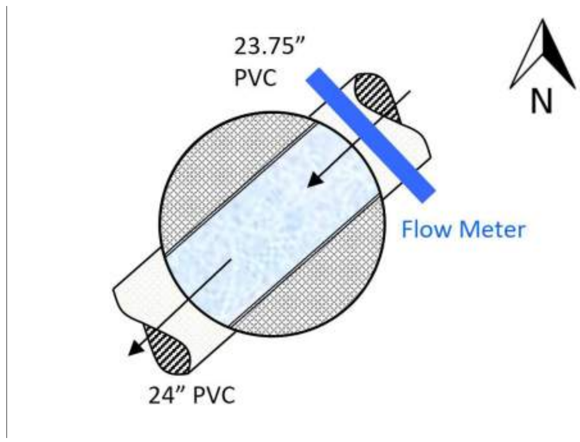
Peak Measured Flow: 1.309 mgd

Sediment: None



Satellite Map

Sanitary Map



Flow Sketch

View from Street

Photo Not Taken

Plan View

SITE 25

Additional Site Photos

Effluent Pipe

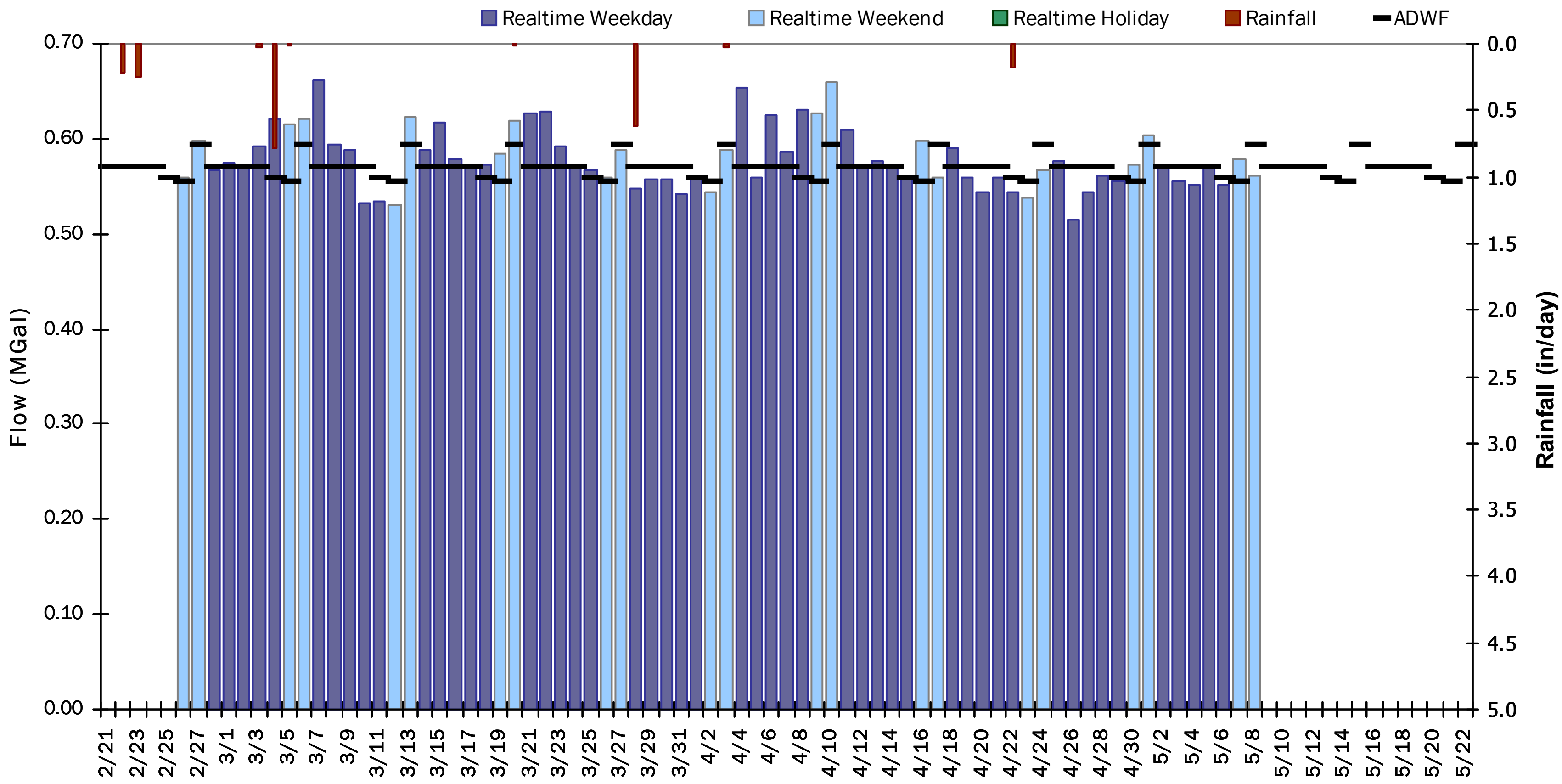
Monitored NE Influent Pipe

SITE 25

Period Flow Summary: Daily Flow Totals

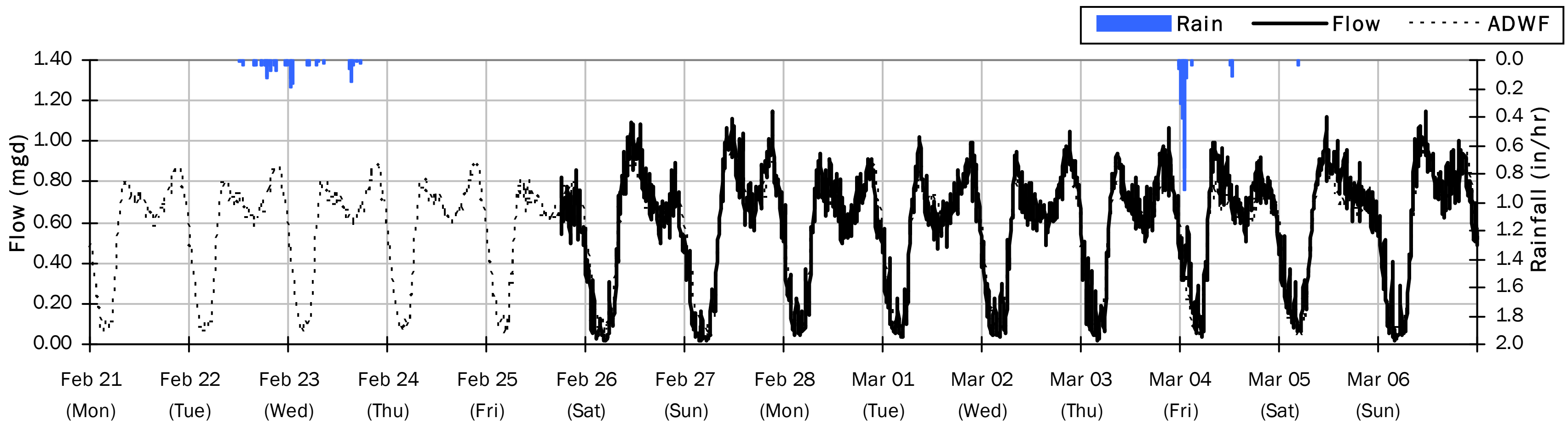
Avg Daily Flow: 0.576 MGal Peak Daily Flow: 0.661 MGal Min Daily Flow: 0.265 MGal

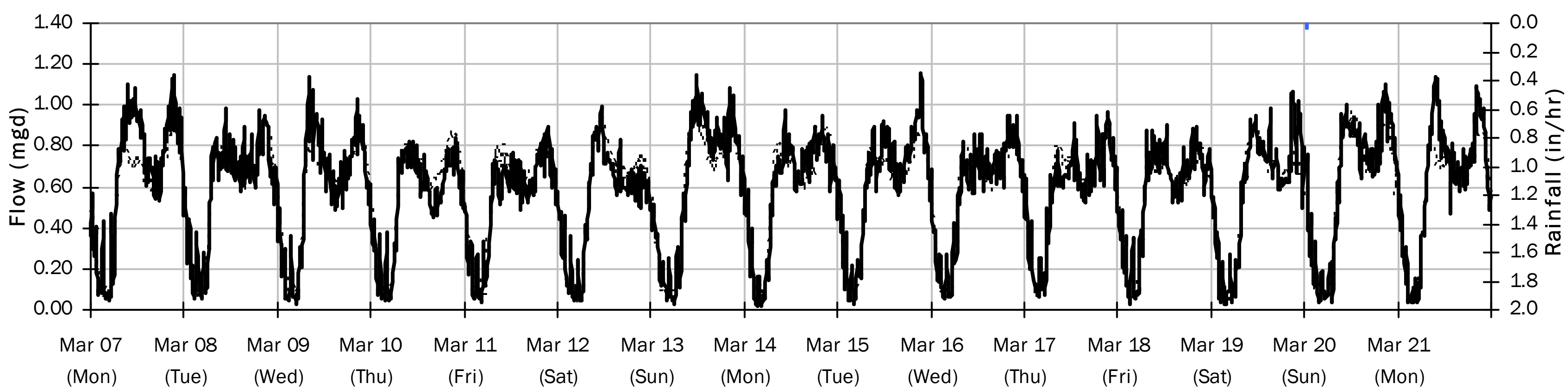
Total Rainfall: 1.66 inches



SITE 25
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.31 inches   Period Avg Flow: 0.590 mgd   Period Peak Flow: 1.158 mgd   Period Min Flow: 0.016 mgd

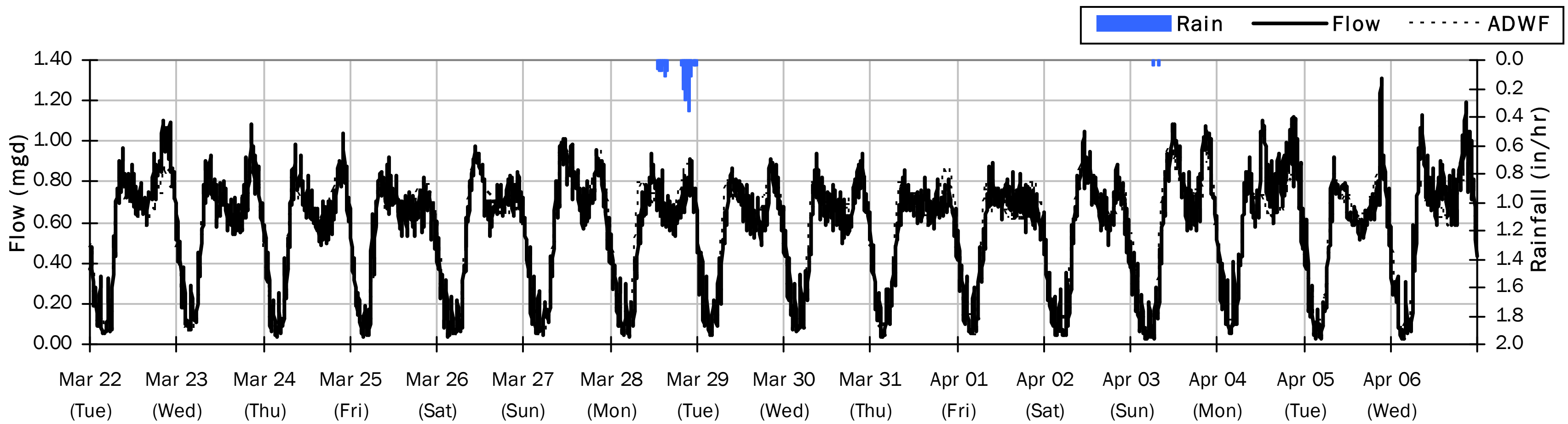


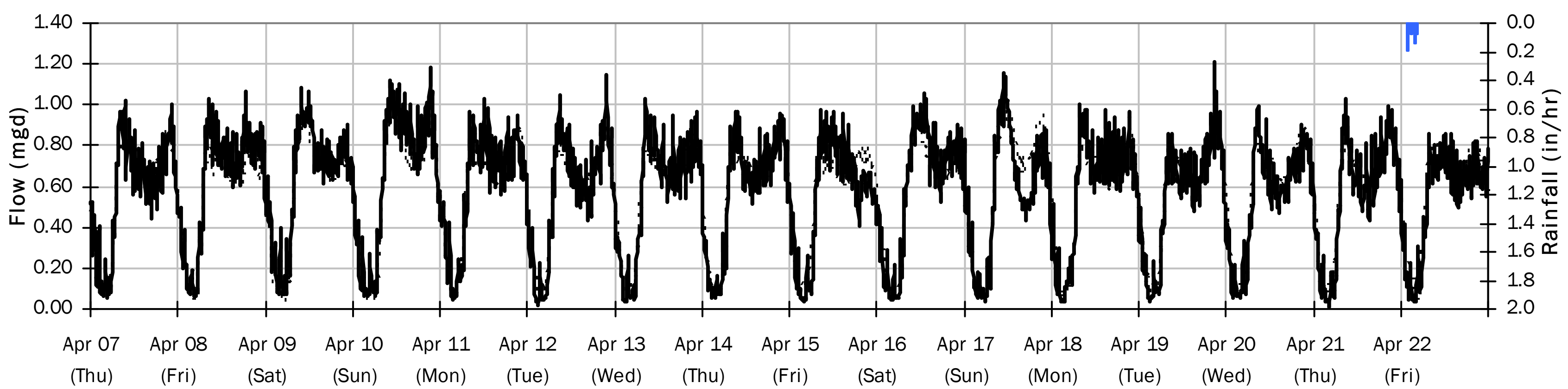


SITE 25

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.83 inches   Period Avg Flow: 0.580 mgd   Period Peak Flow: 1.309 mgd   Period Min Flow: 0.009 mgd



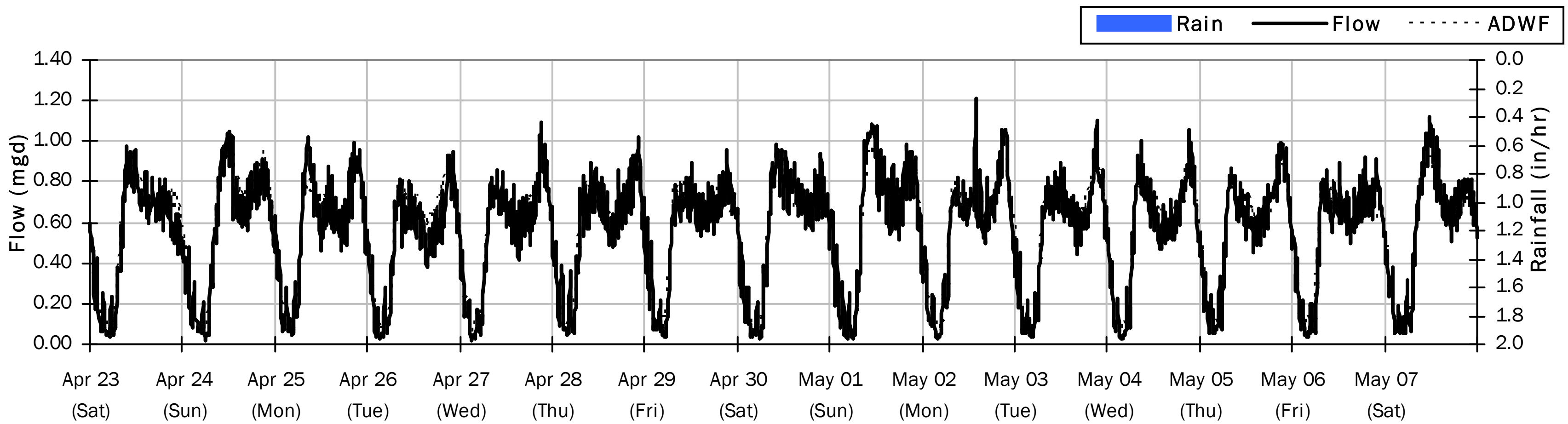


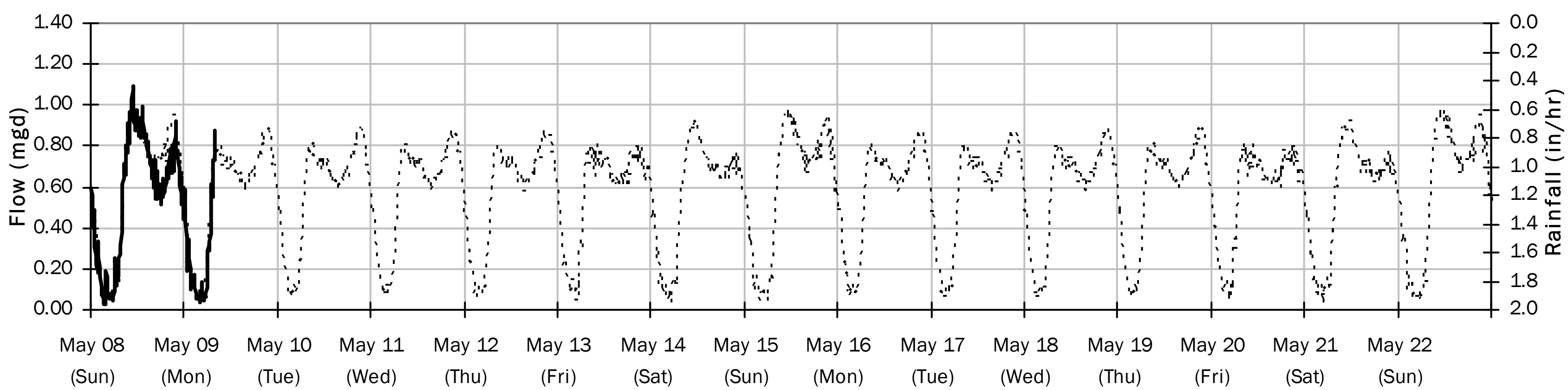
SITE 25

Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

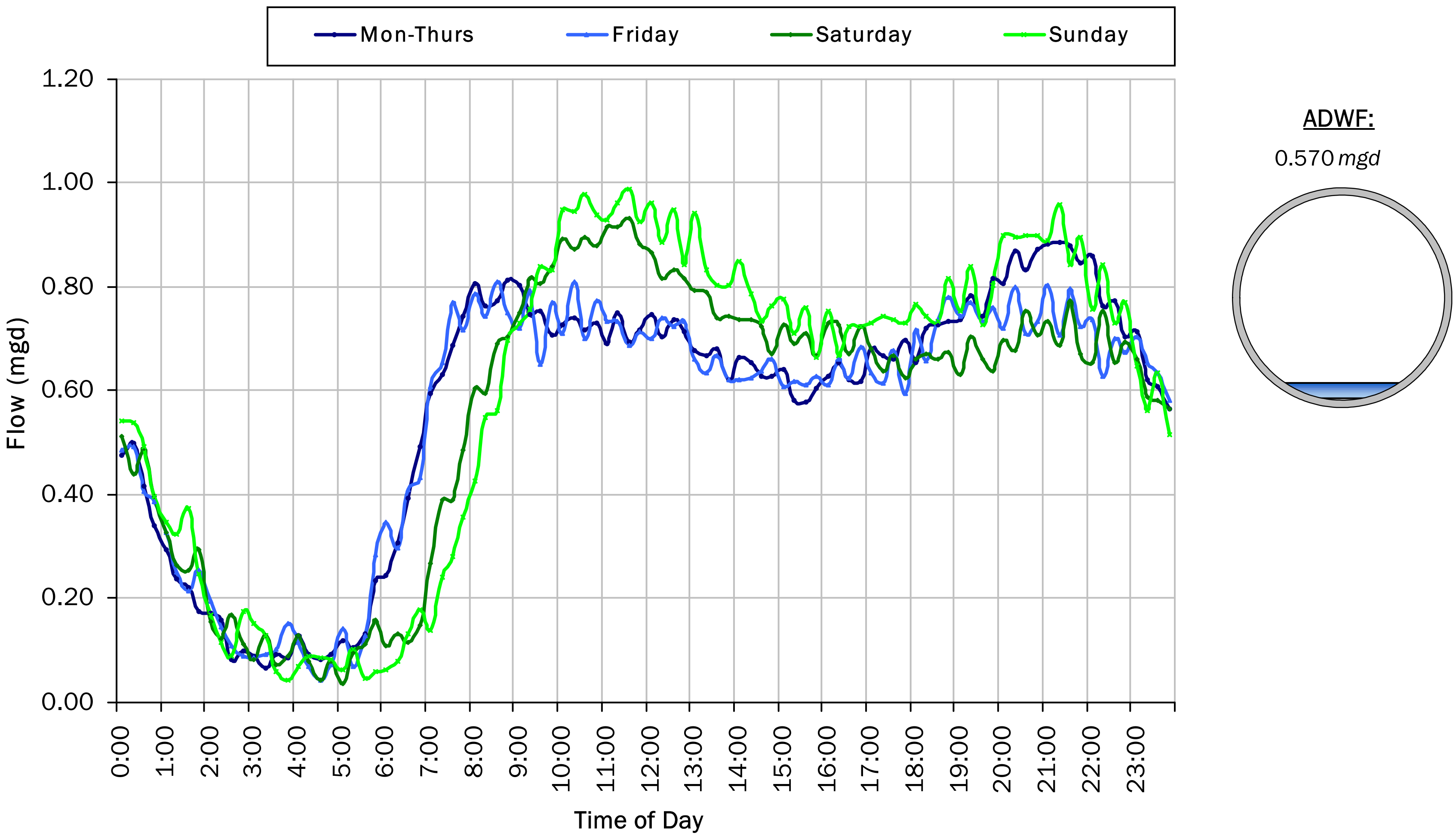
Period Avg Flow: 0.555 mgd   Period Peak Flow: 1.208 mgd   Period Min Flow: 0.020 mgd





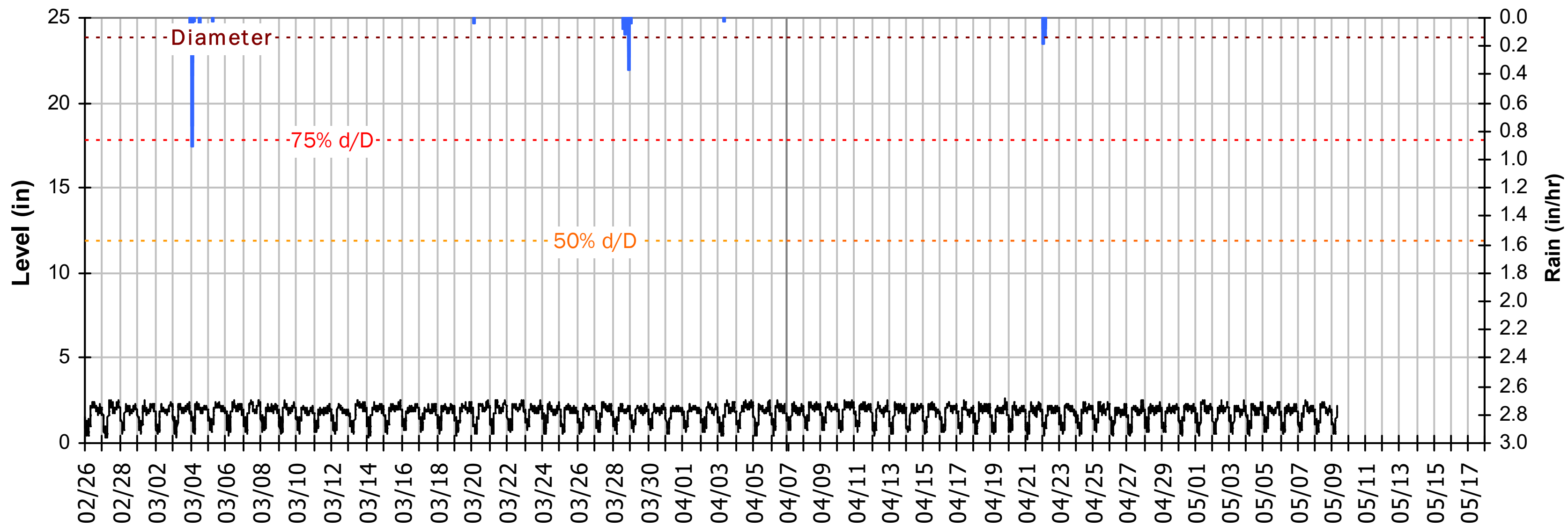
SITE 25

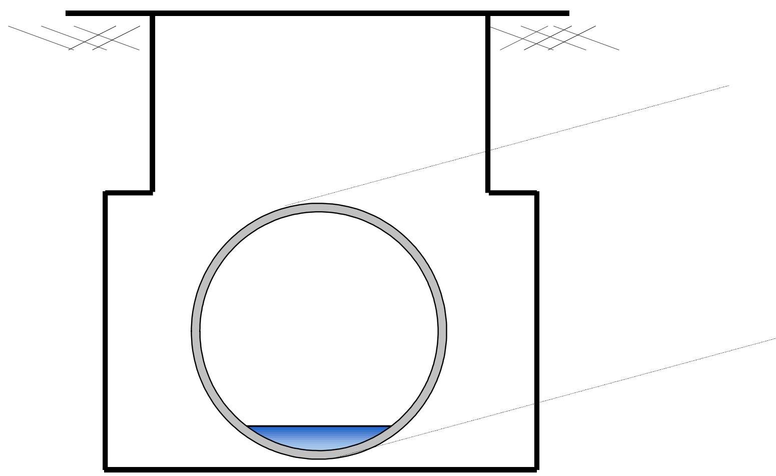
Average Dry Weather Flow Hydrographs



SITE 25
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



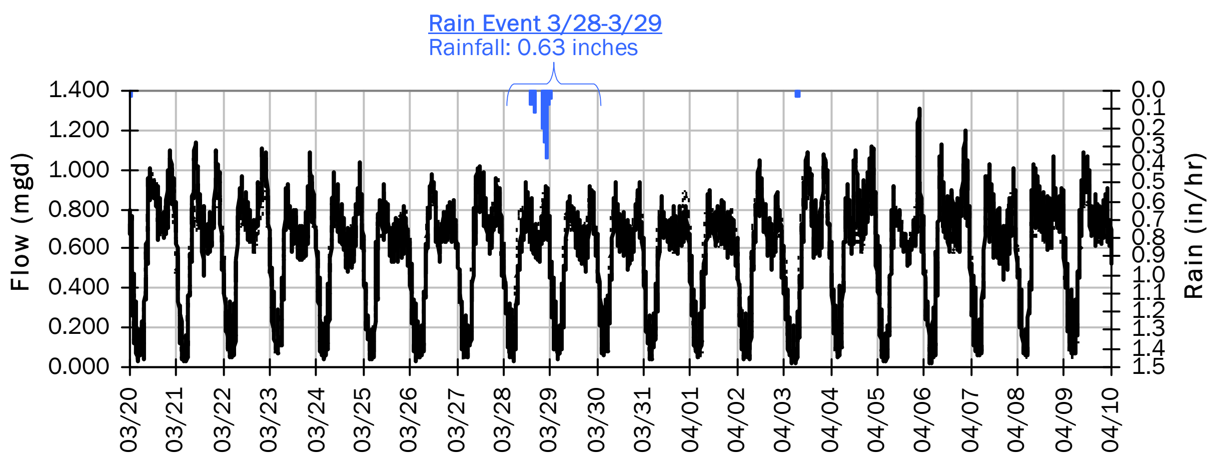


Pipe Diameter:	23.8	*inches*
Peak Measured Level:	2.62	*inches*
Peak d/D Ratio:	0.11	

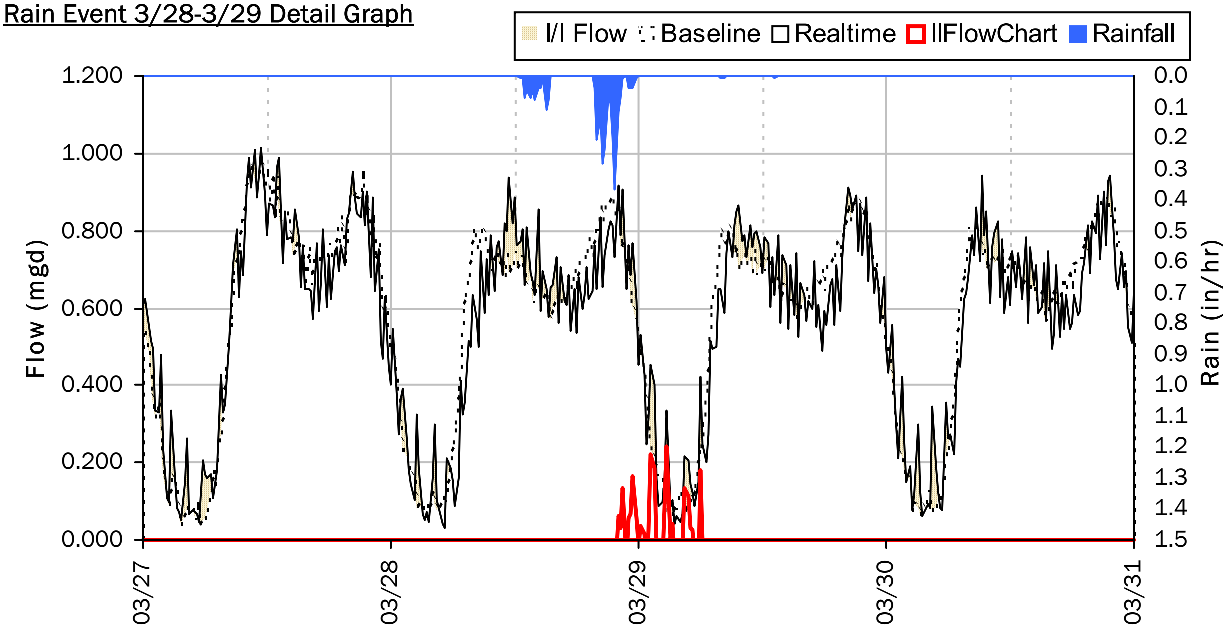
SITE 25

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph

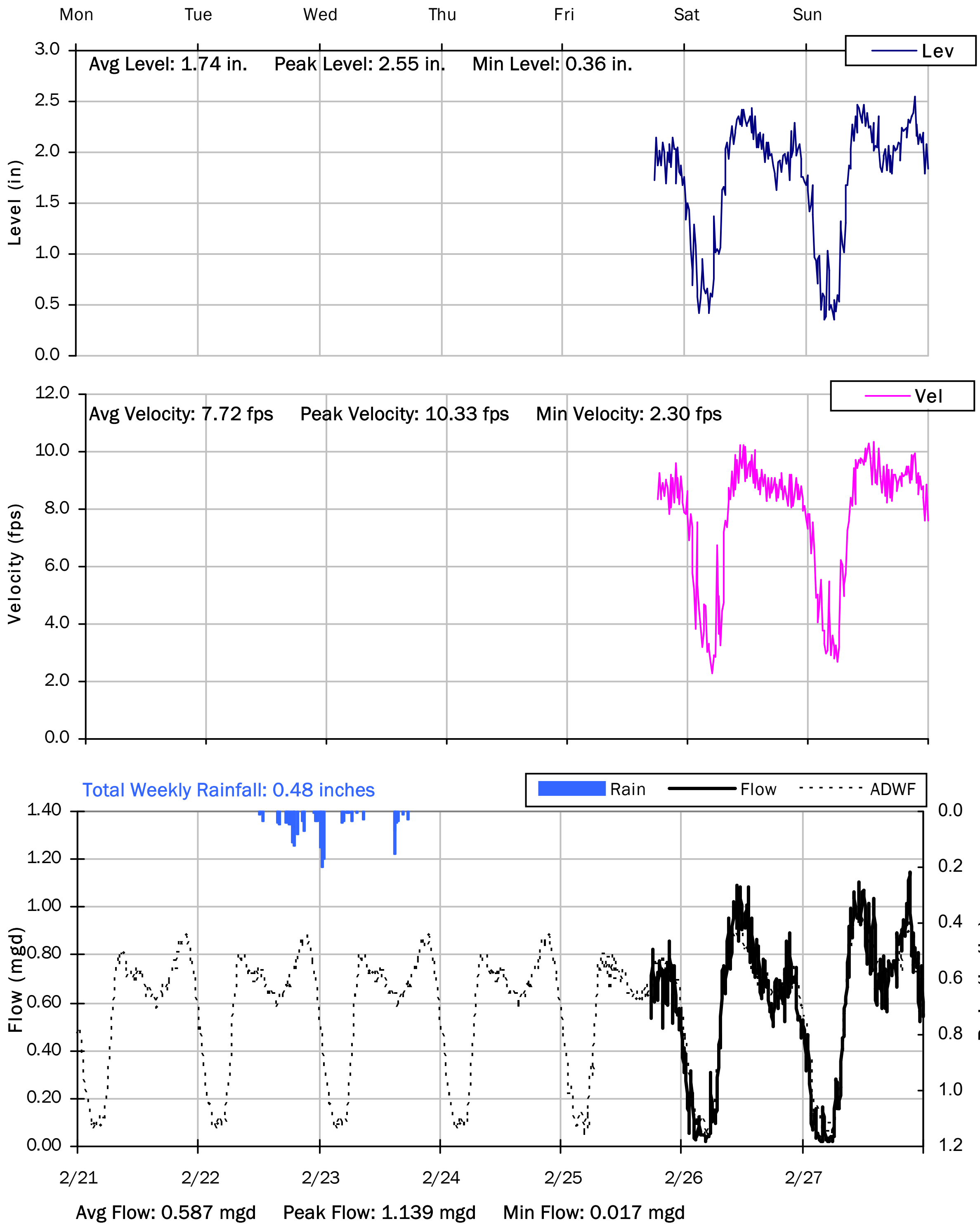


Storm Event I/I Analysis (Rain = 0.63 inches)

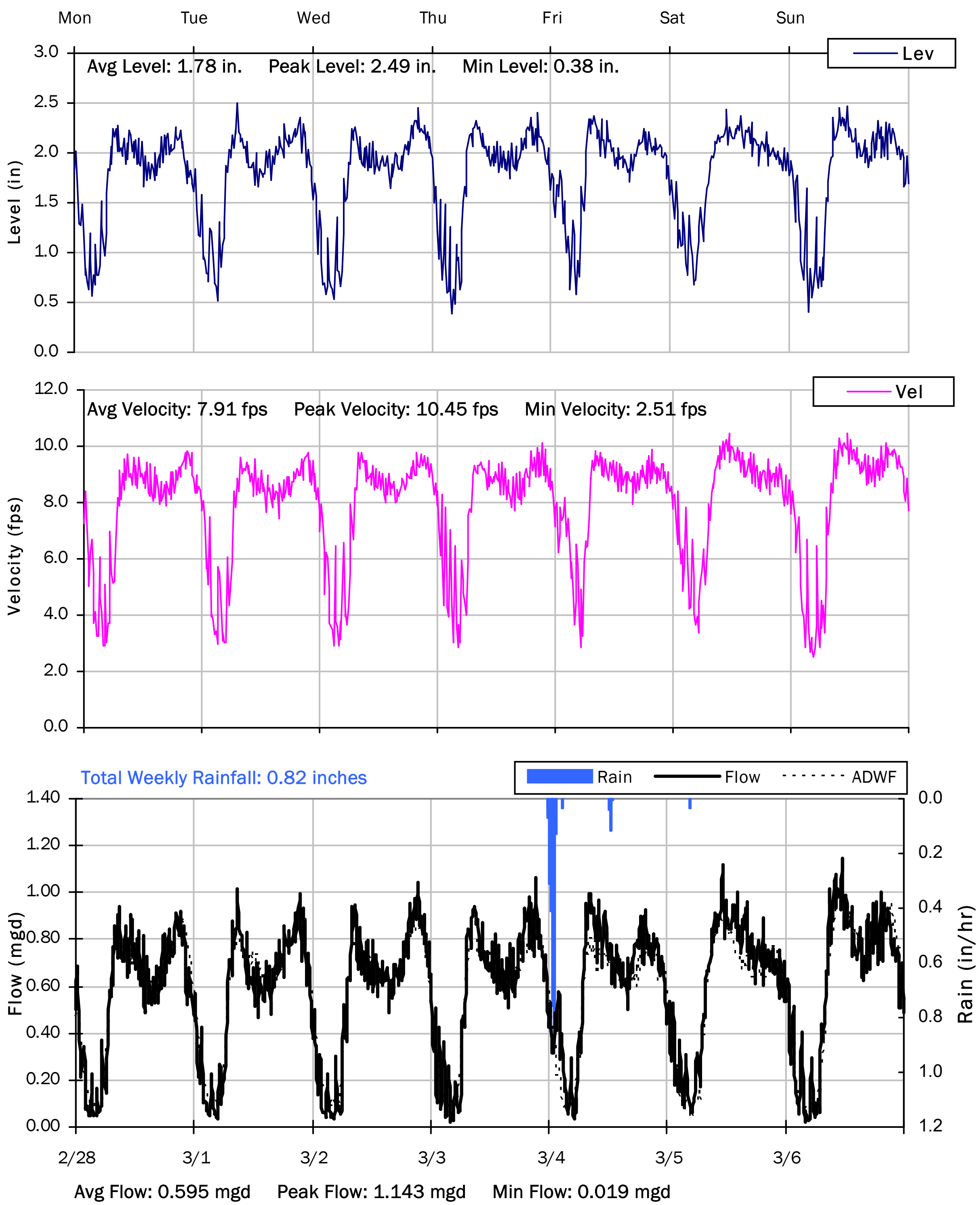
Capacity		Inflow / Infiltration	
Peak Flow:	0.916 *mgd*	Peak I/I Rate:	0.242 *mgd*
PF:	1.61	Total I/I:	11,000 *gallons*
Peak Level:	2.20 *in*		
d/D Ratio:	0.09		

SITE 25

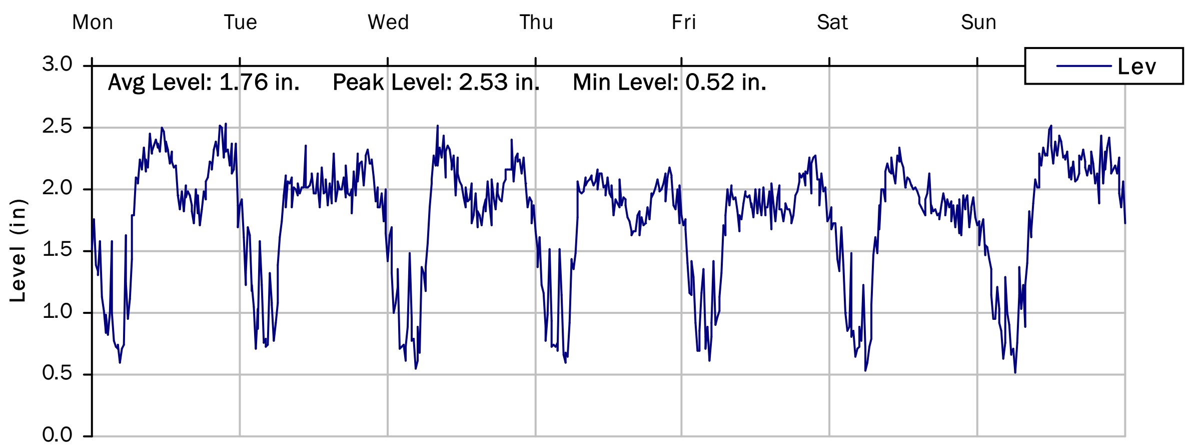
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

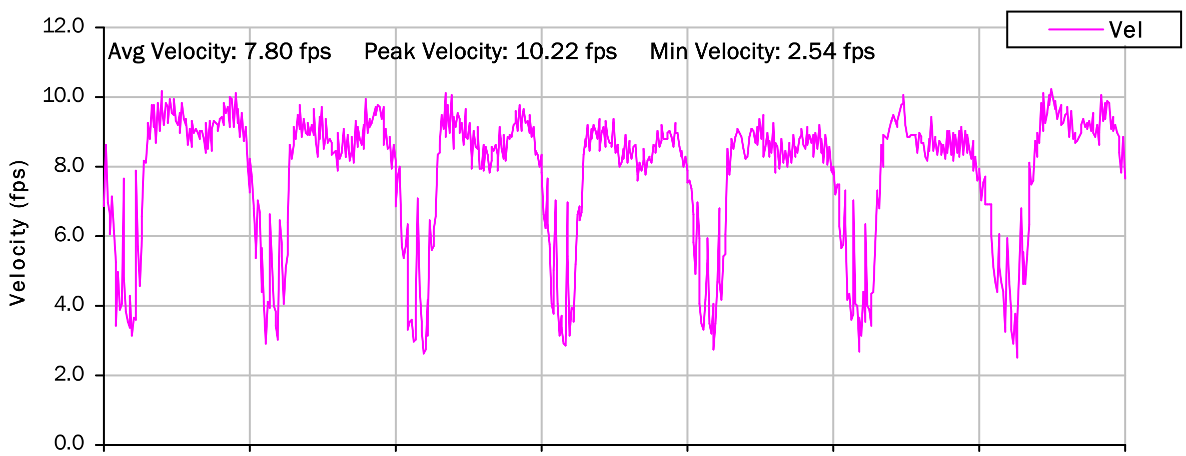


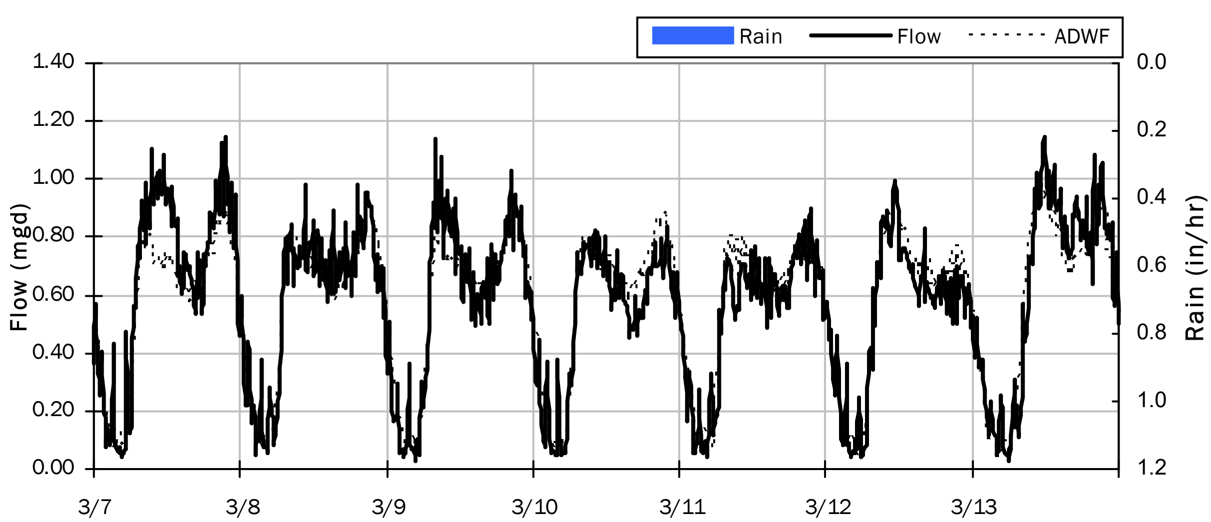
SITE 25
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



SITE 25
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

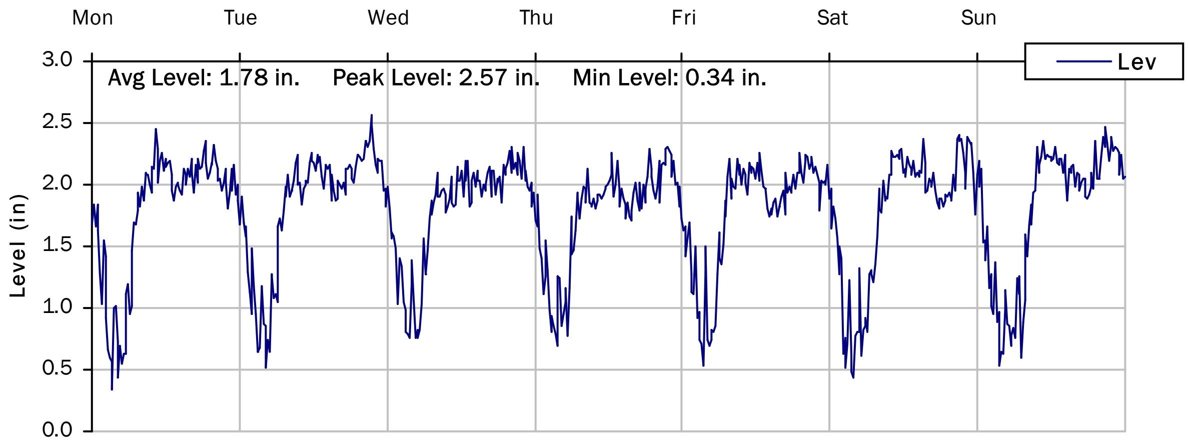


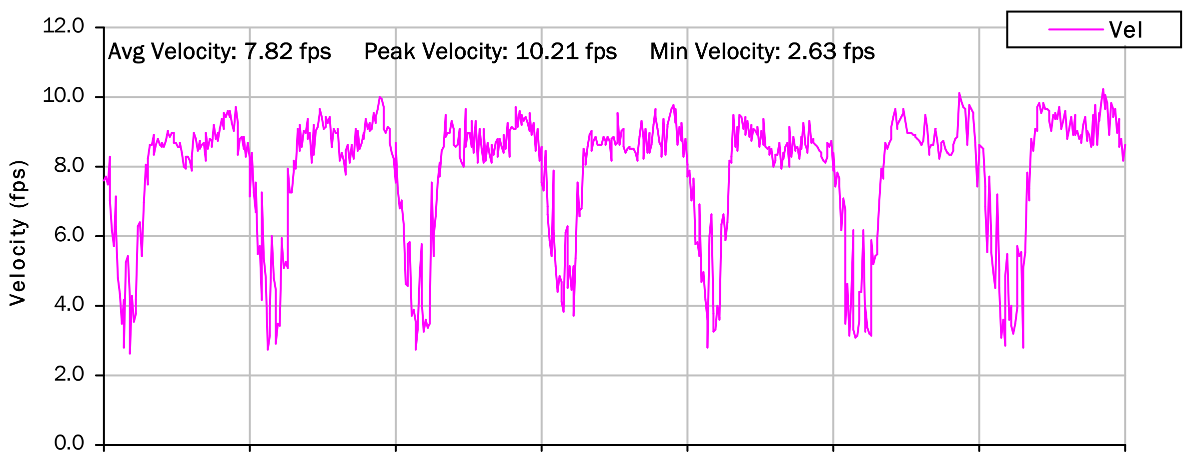


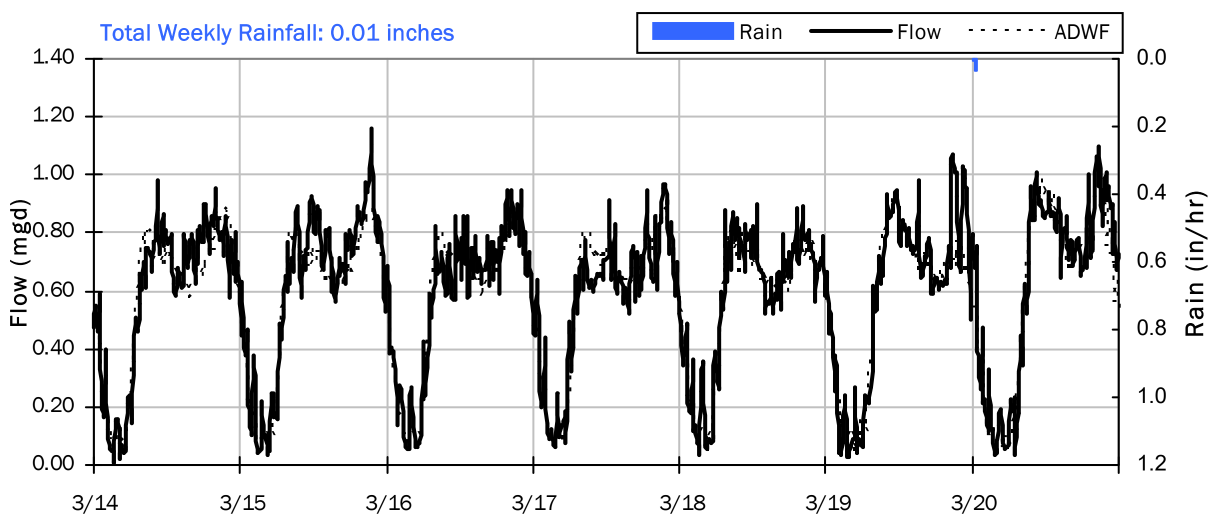


Avg Flow: 0.580 mgd Peak Flow: 1.149 mgd Min Flow: 0.028 mgd

SITE 25
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



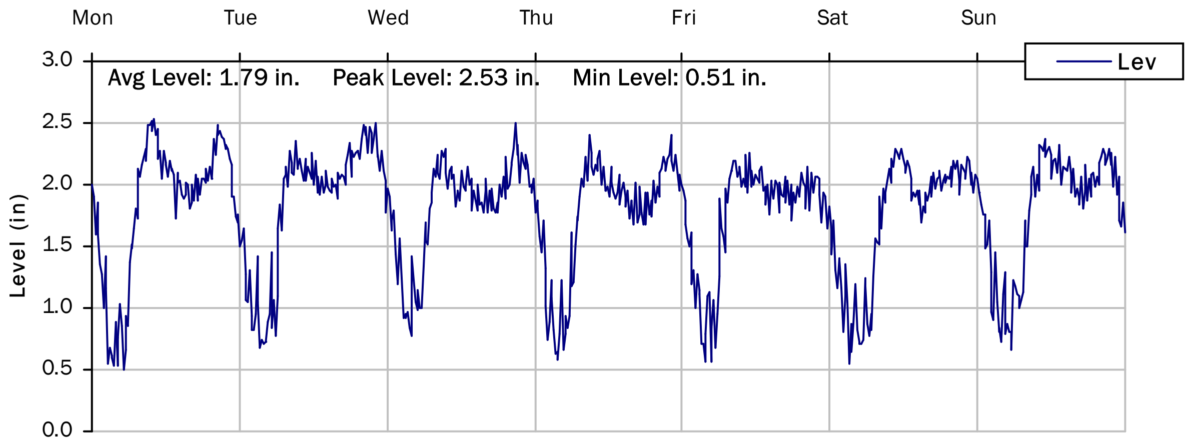


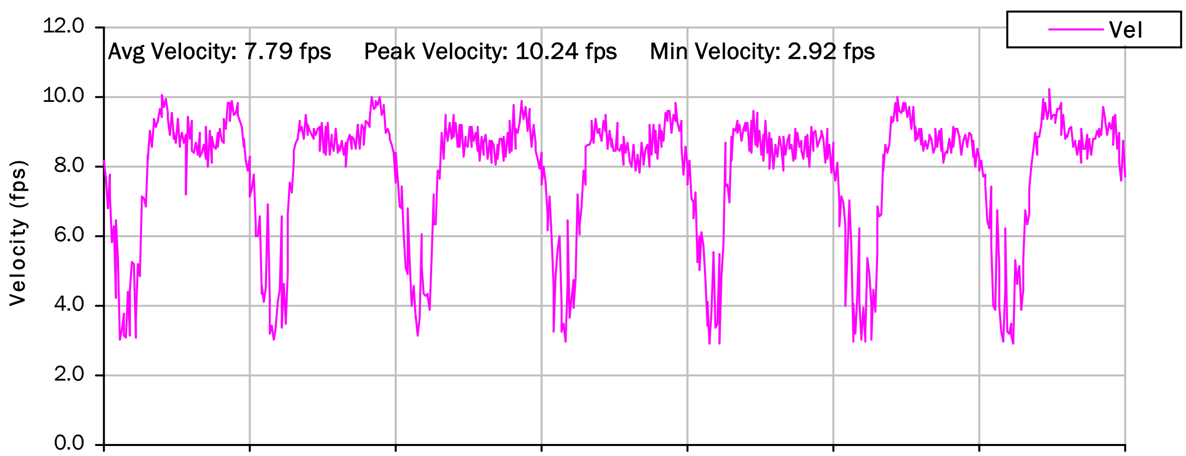


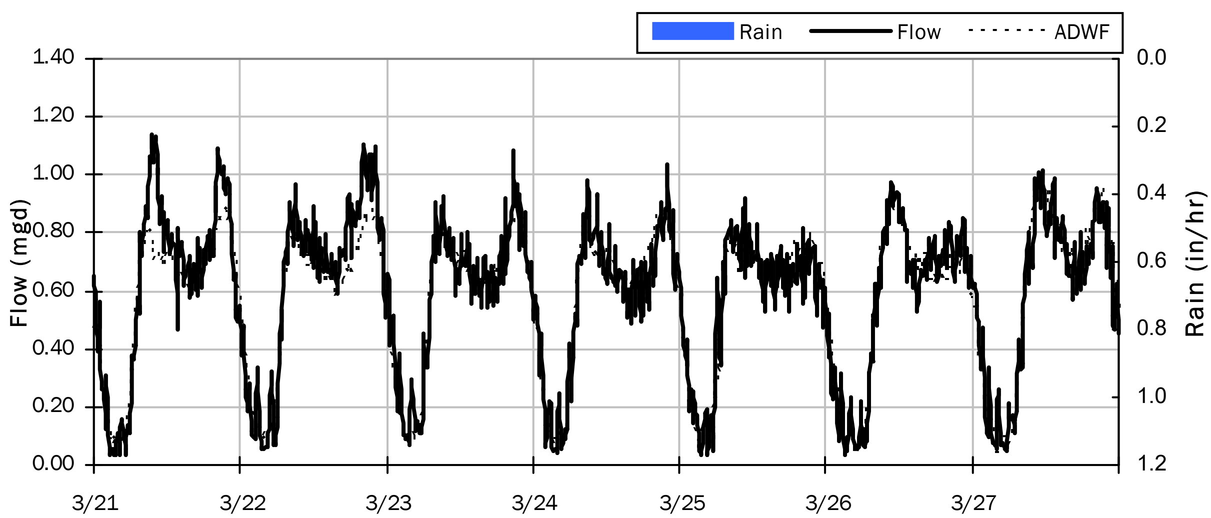
Avg Flow: 0.590 mgd Peak Flow: 1.158 mgd Min Flow: 0.016 mgd

SITE 25

Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

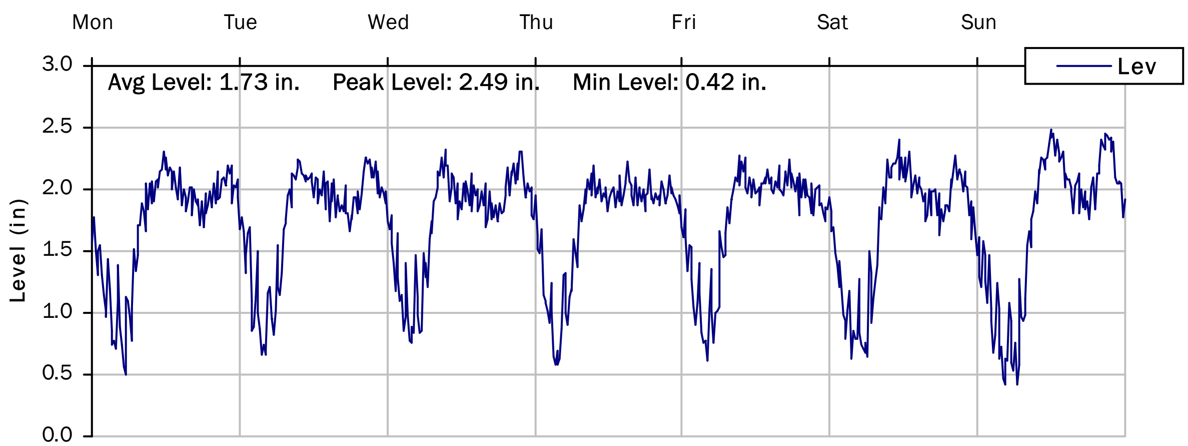


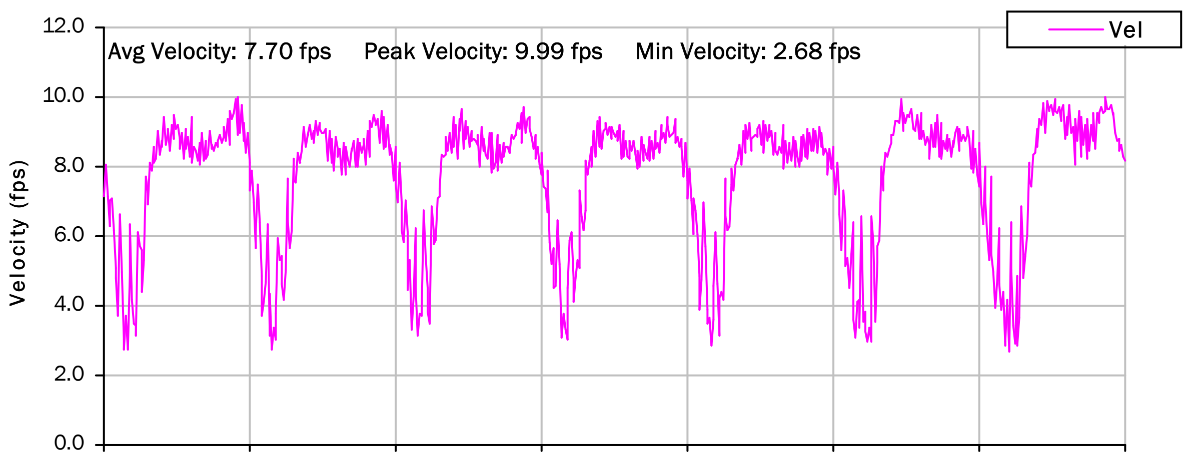


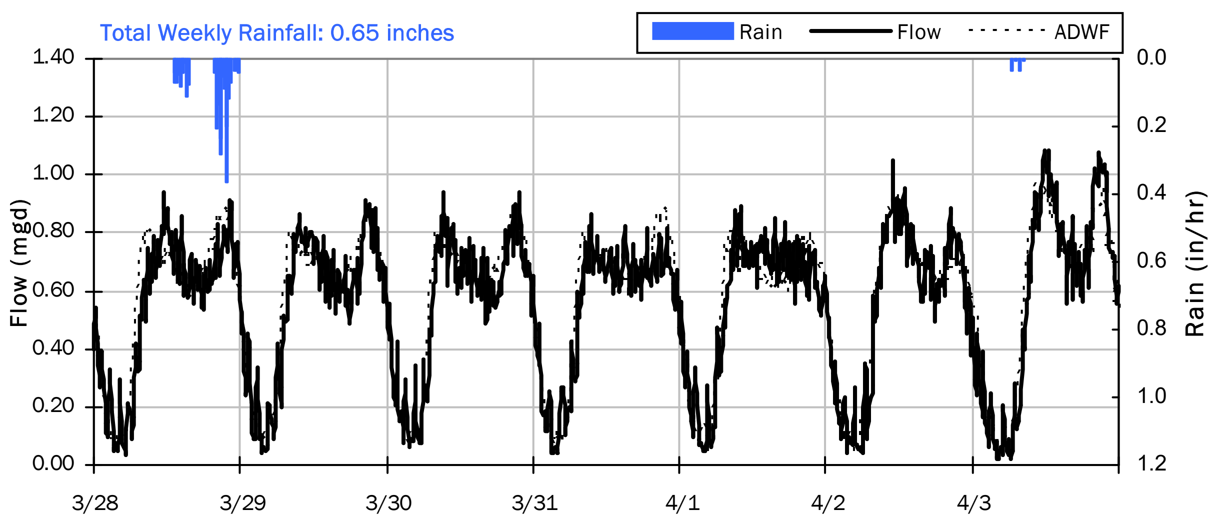


Avg Flow: 0.590 mgd Peak Flow: 1.139 mgd Min Flow: 0.032 mgd

SITE 25
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

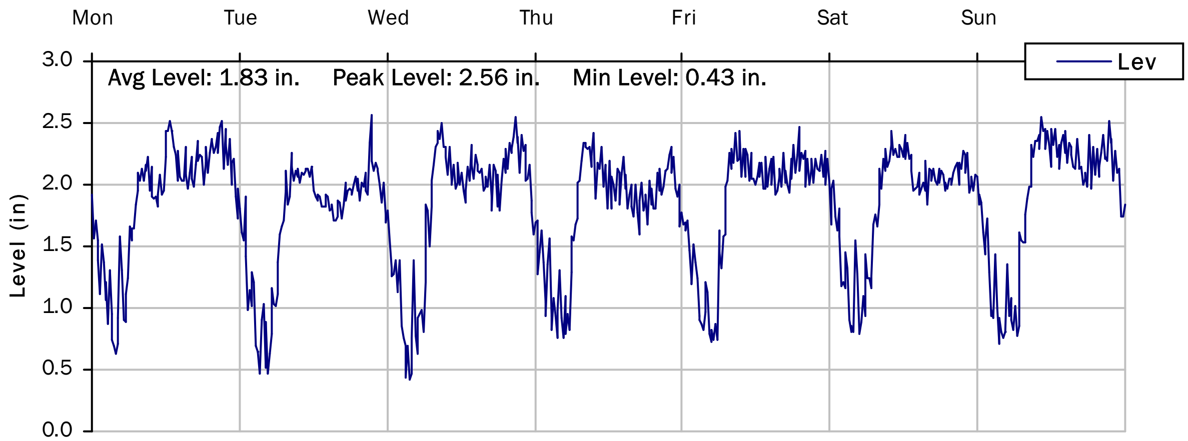


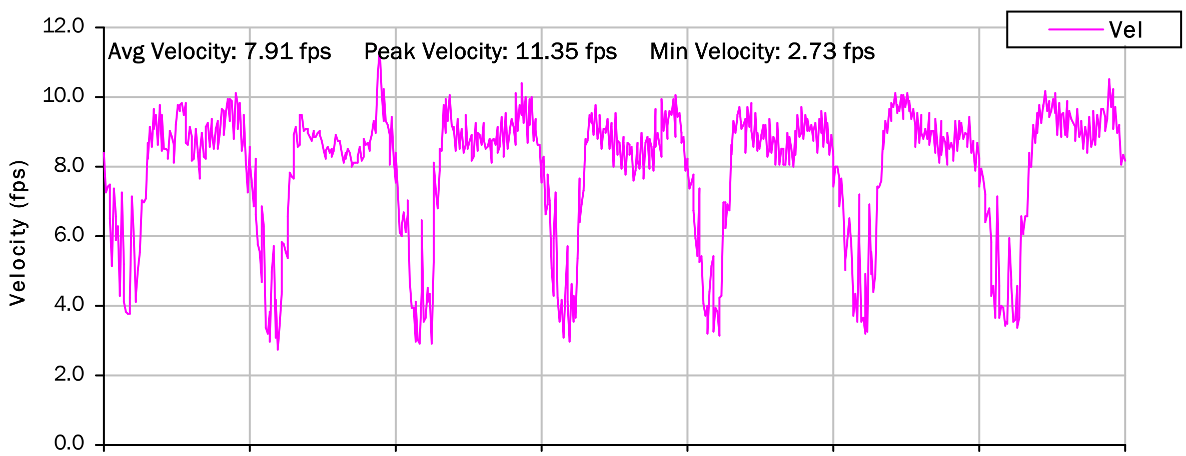


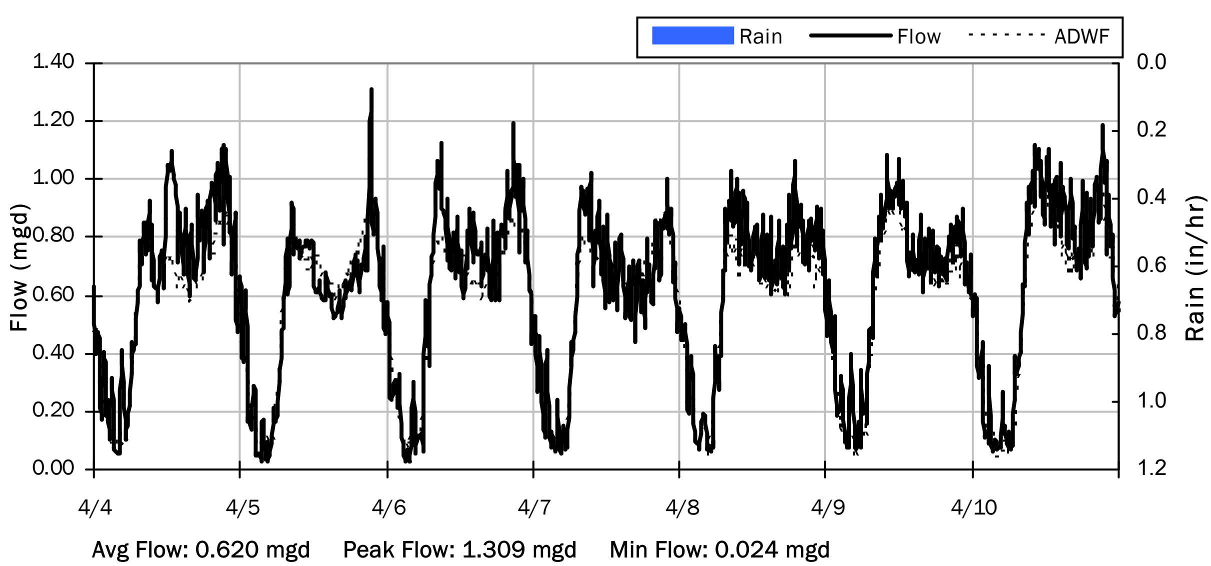


Avg Flow: 0.557 mgd   Peak Flow: 1.087 mgd   Min Flow: 0.023 mgd

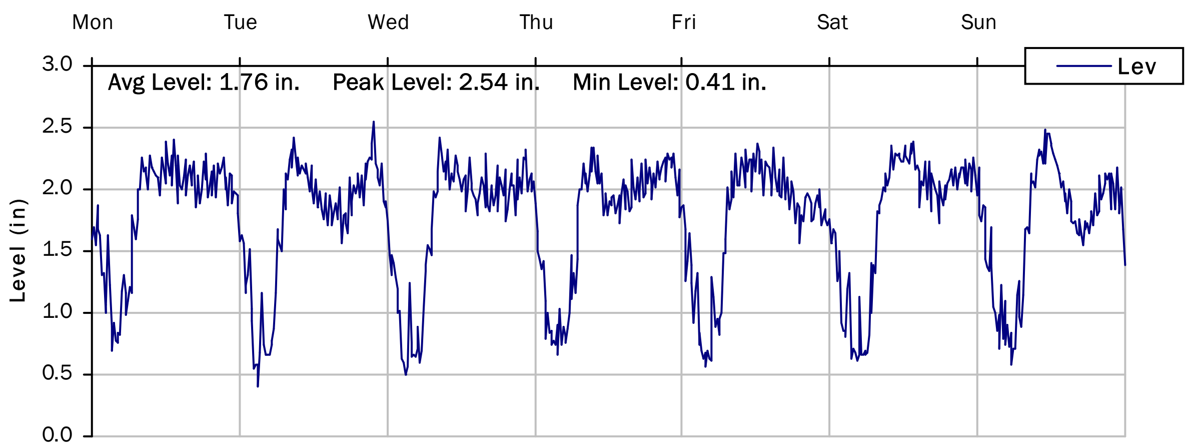
SITE 25
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

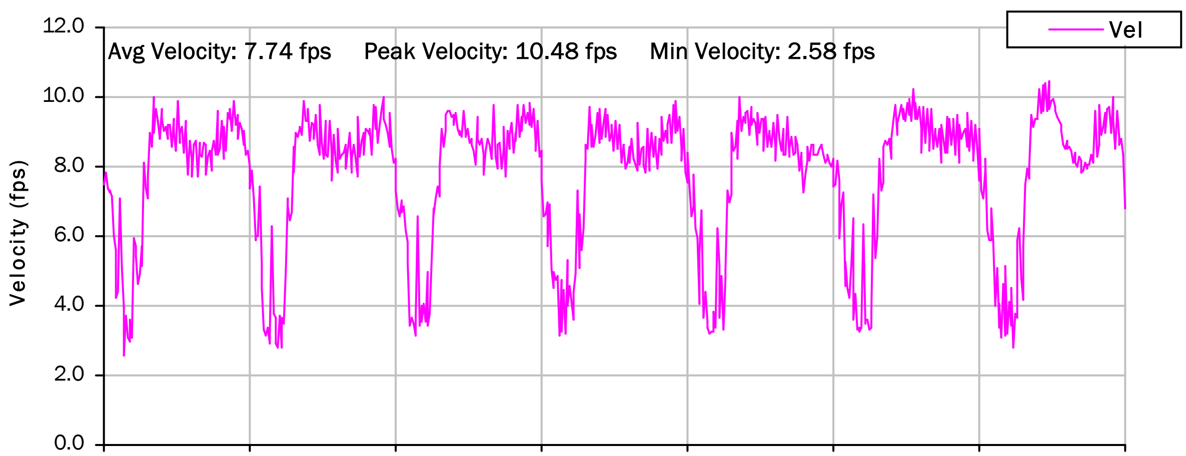


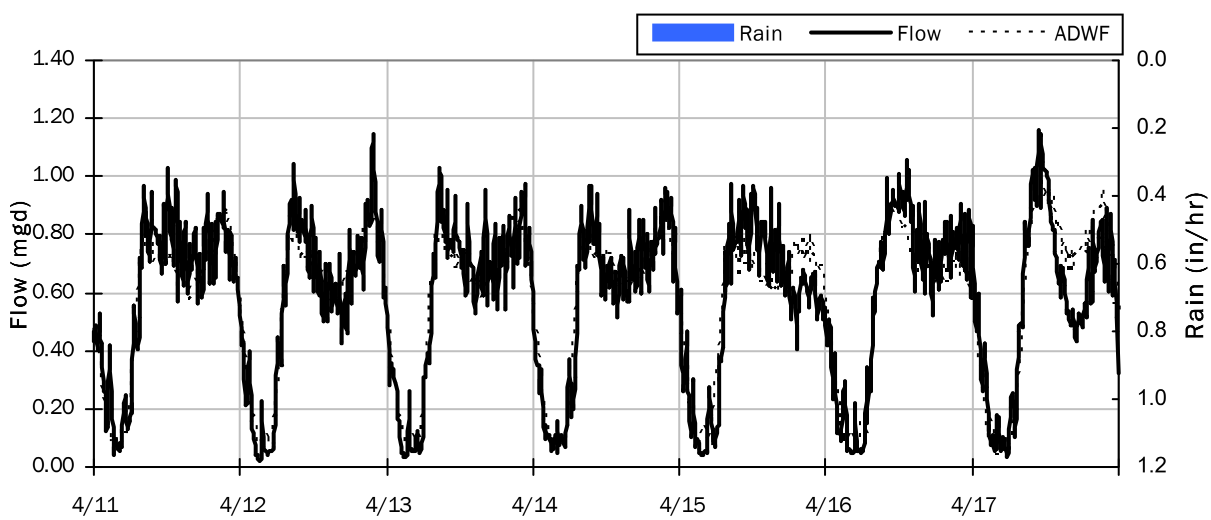




SITE 25
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

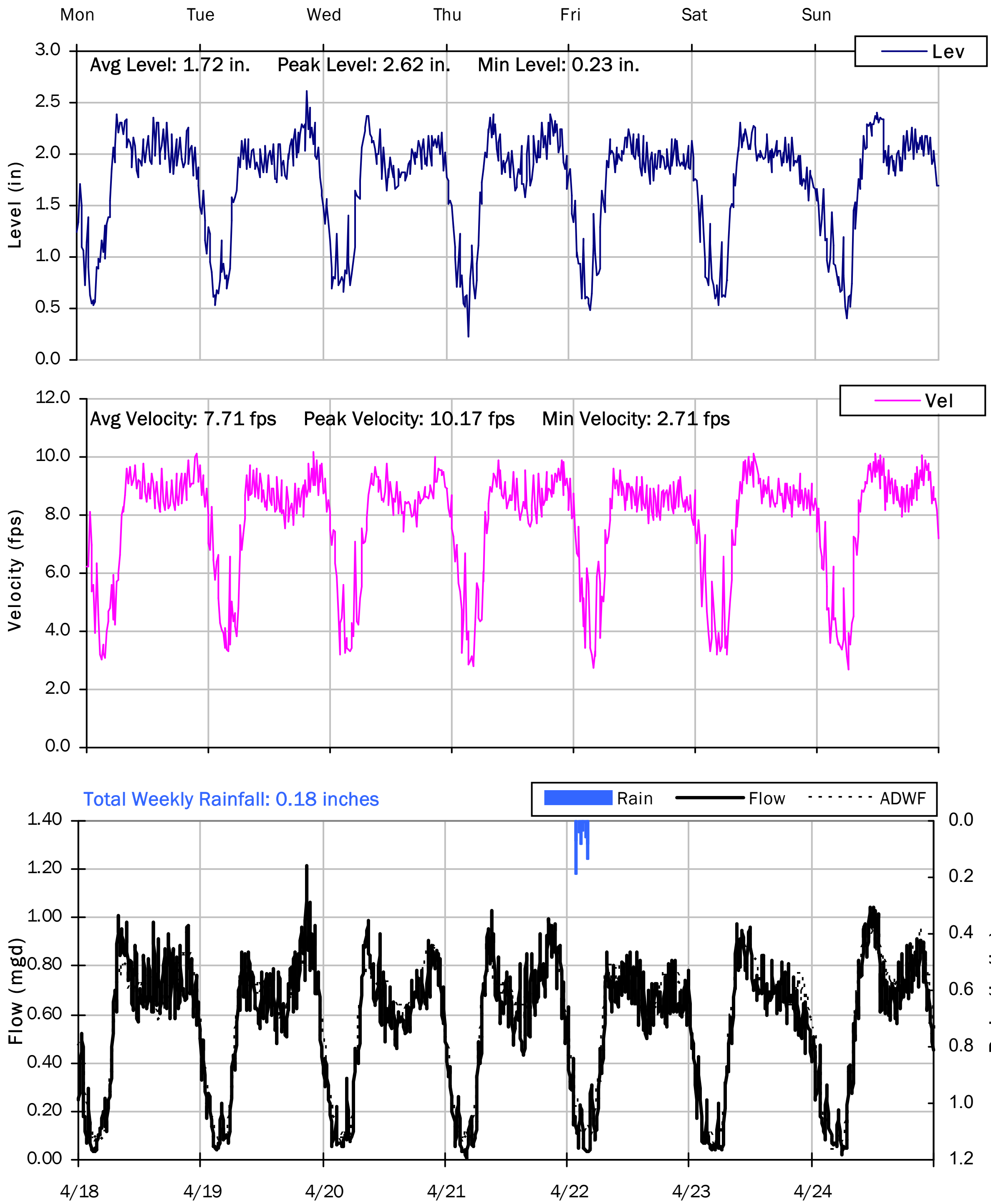






Avg Flow: 0.577 mgd Peak Flow: 1.157 mgd Min Flow: 0.022 mgd

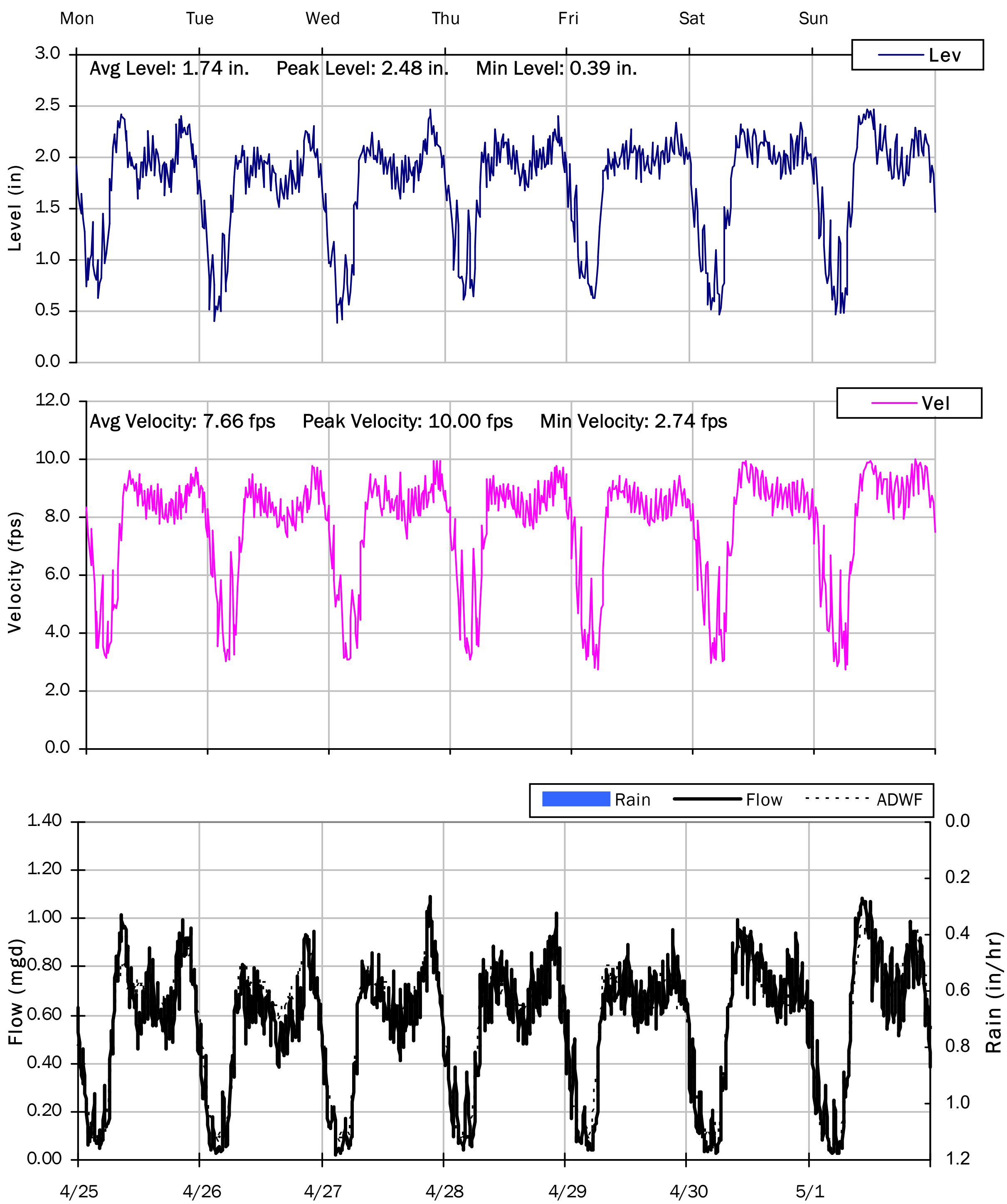
SITE 25
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



Avg Flow: 0.557 mgd   Peak Flow: 1.213 mgd   Min Flow: 0.009 mgd

SITE 25

Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

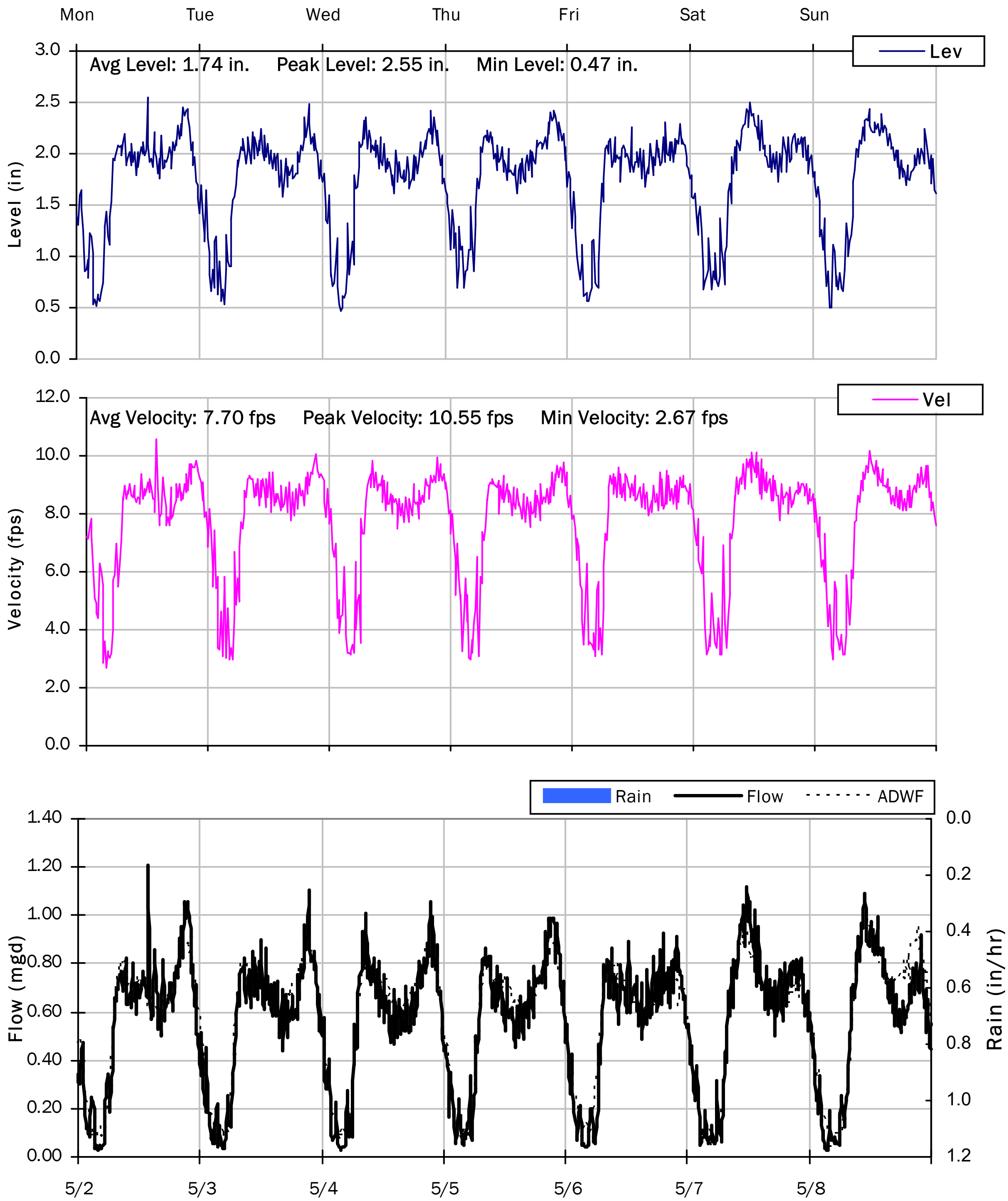


Avg Flow: 0.561 mgd   Peak Flow: 1.092 mgd   Min Flow: 0.022 mgd

SITE 25

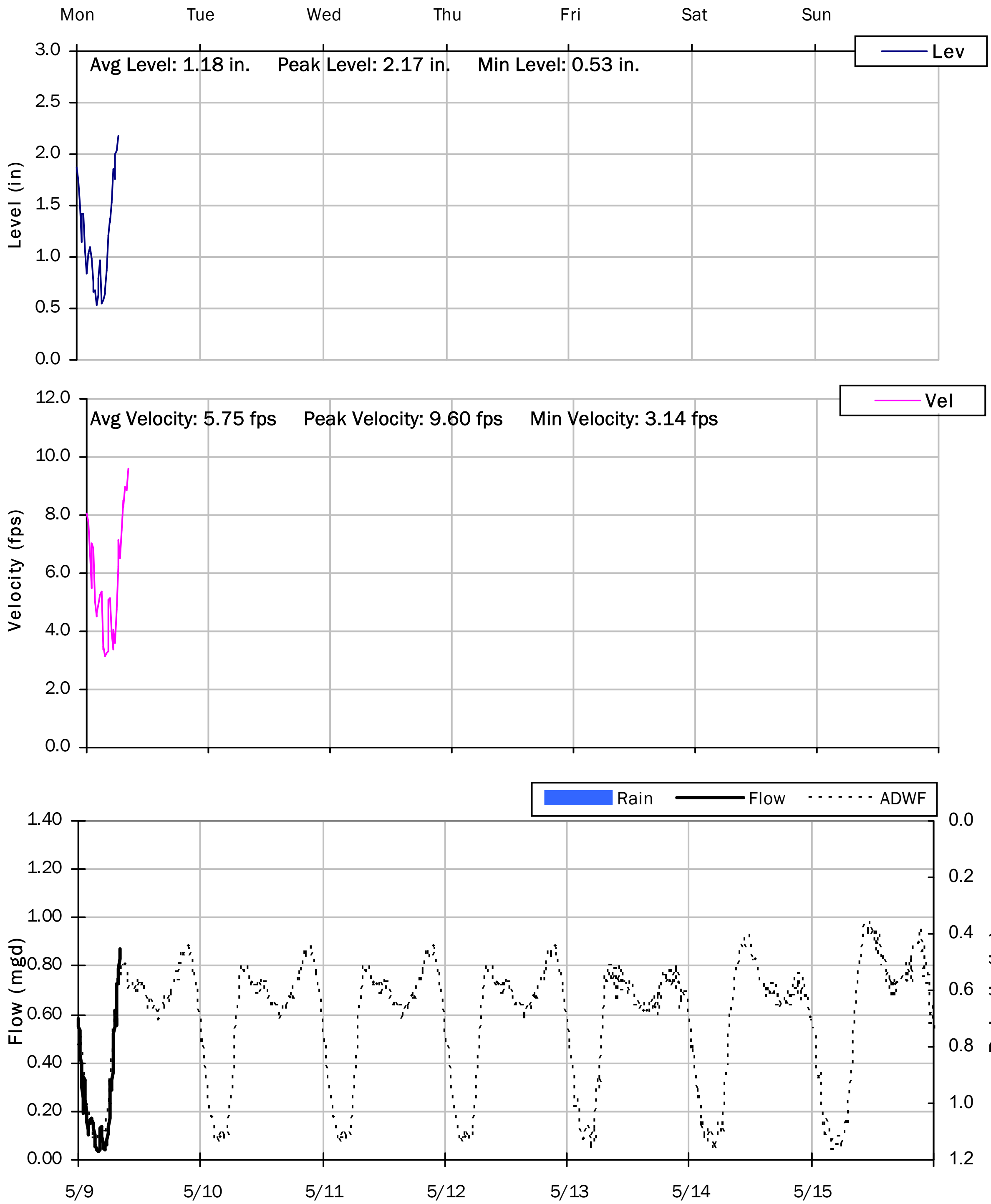
Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022



Avg Flow: 0.563 mgd Peak Flow: 1.208 mgd Min Flow: 0.029 mgd

SITE 25
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022



Avg Flow: 0.265 mgd Peak Flow: 0.873 mgd Min Flow: 0.036 mgd

Monitoring Site: Site 26

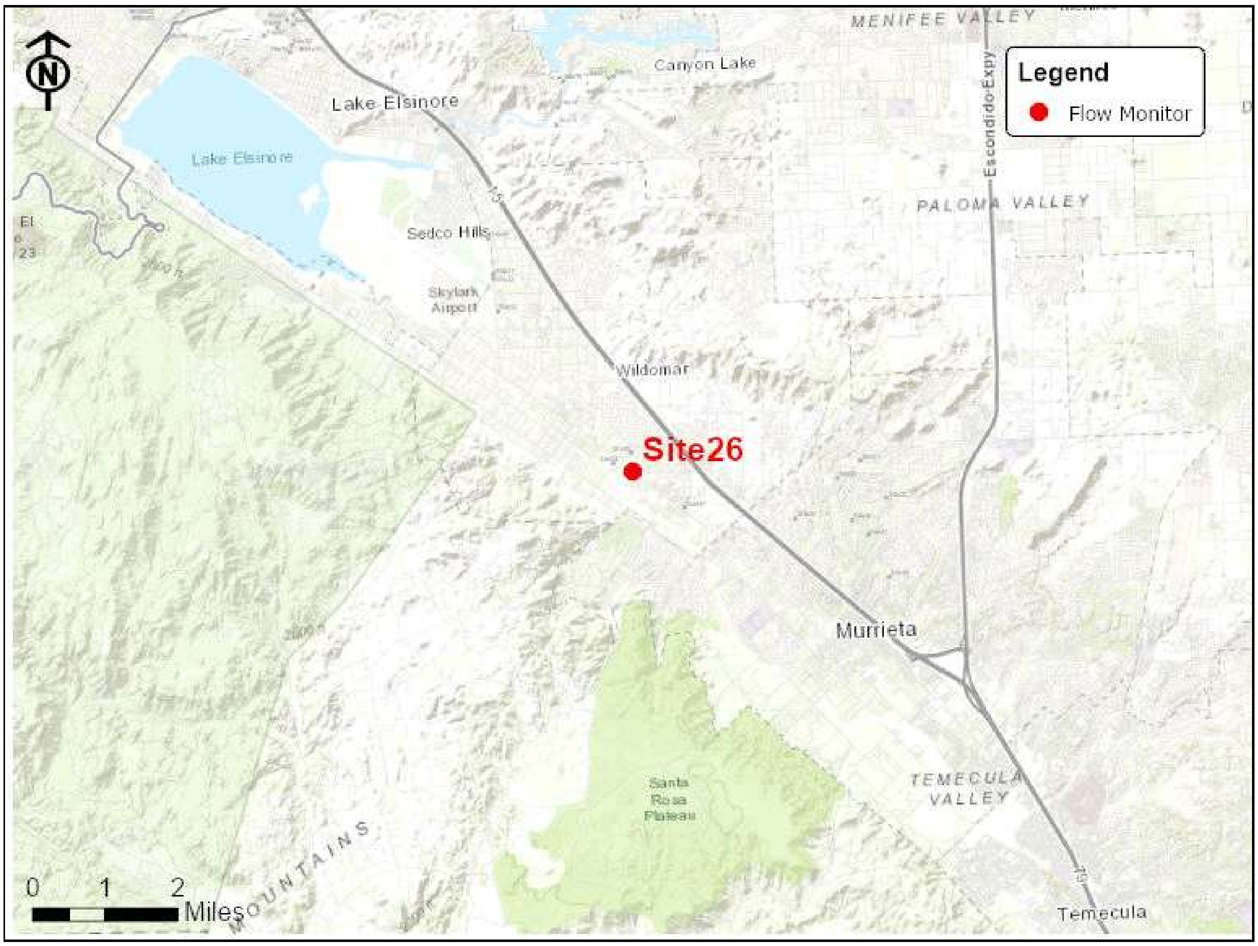
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Palomar Street and Delca Lane

Data Summary Report



Vicinity Map: Site 26

SITE 26

Site Information MH ID: MH-7176

Location: Palomar Street and Delca Lane

Coordinates: 117.2590° W, 33.5940° N

Rim Elevation (Earth): 1224 feet

Expected Pipe Diameter: 21 inches

Measured Pipe Diameter: 20.75 inches

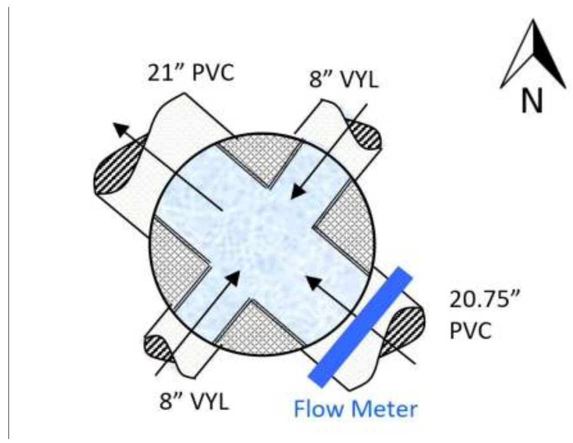
ADWF: 0.179 mgd

Peak Measured Flow: 0.382 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch

View from Street

Plan View

SITE 26

Additional Site Photos

Effluent Pipe

N Influent Pipe

SITE 26

Additional Site Photos

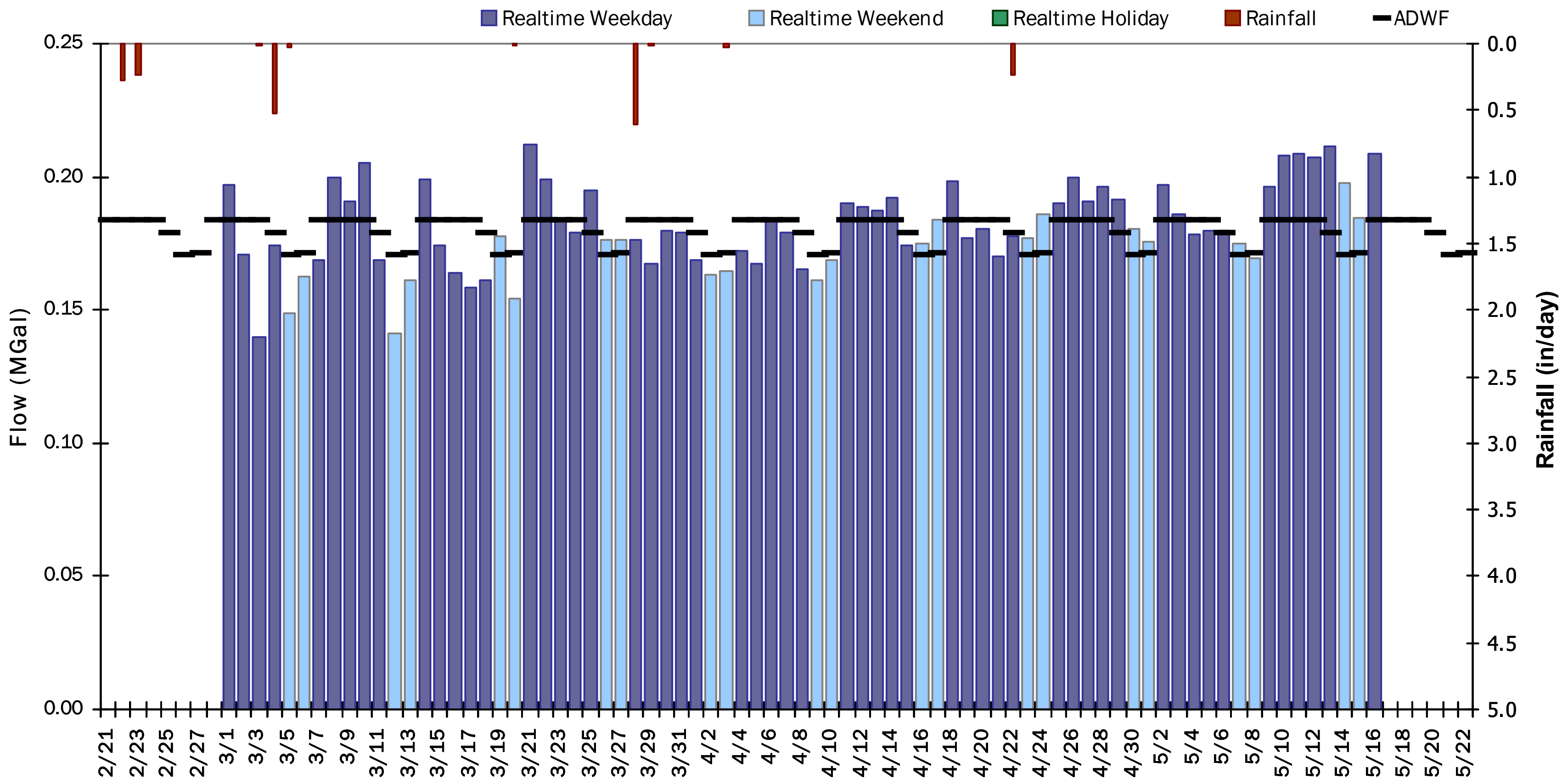
Monitored SE Influent Pipe

SITE 26

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.181 MGal   Peak Daily Flow: 0.245 MGal   Min Daily Flow: 0.140 MGal

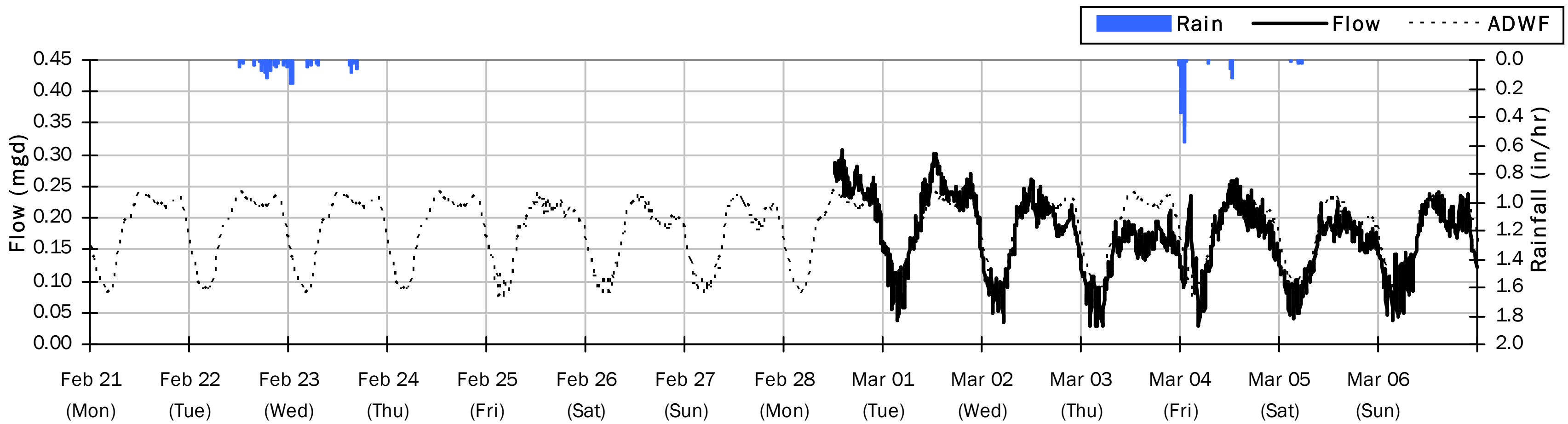
Total Rainfall: 1.45 inches

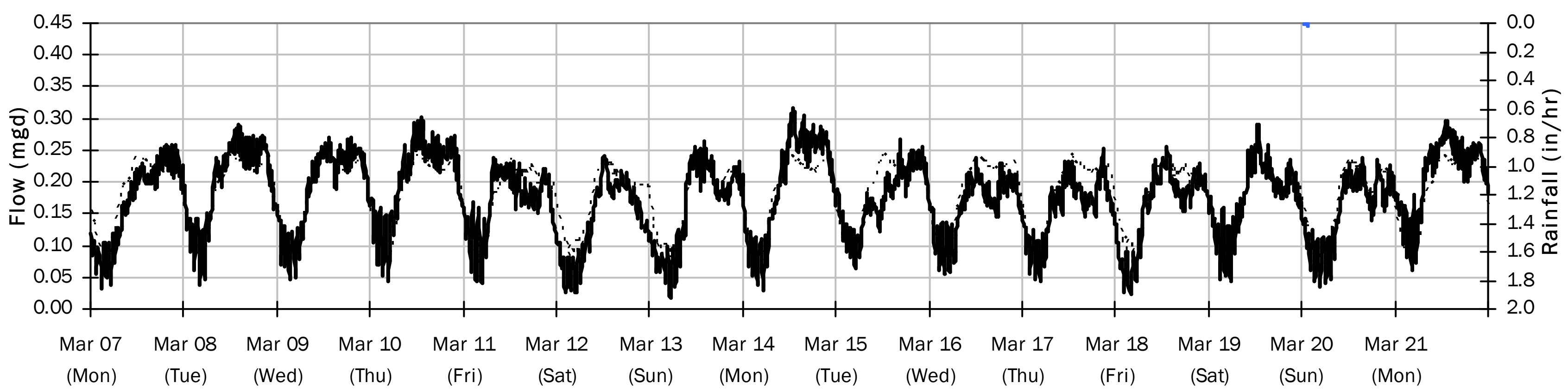


SITE 26

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.08 inches   Period Avg Flow: 0.175 mgd   Period Peak Flow: 0.316 mgd   Period Min Flow: 0.018 mgd

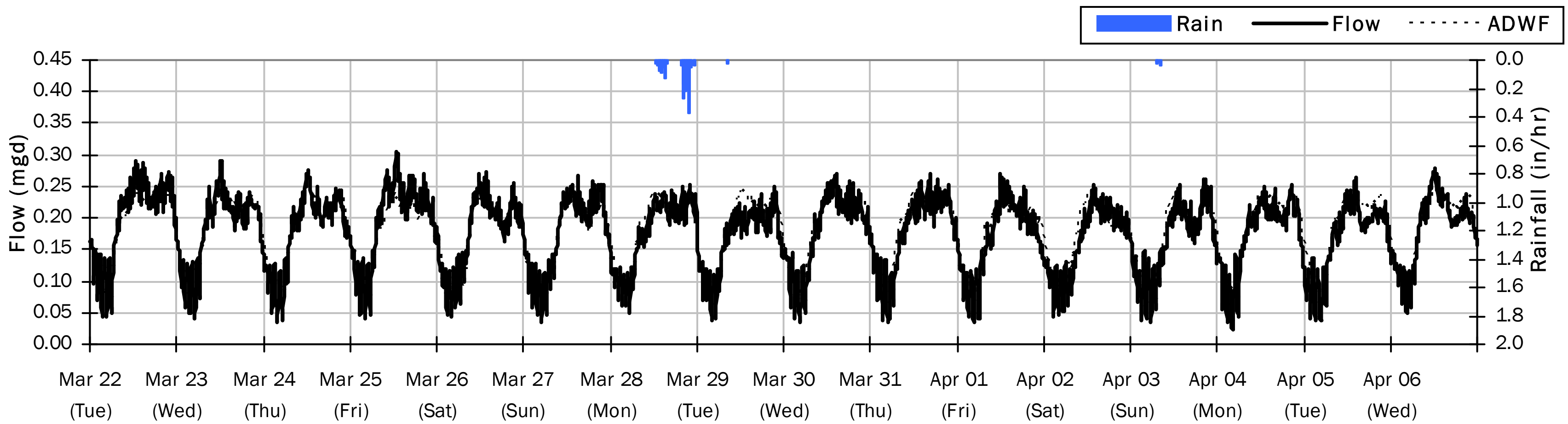


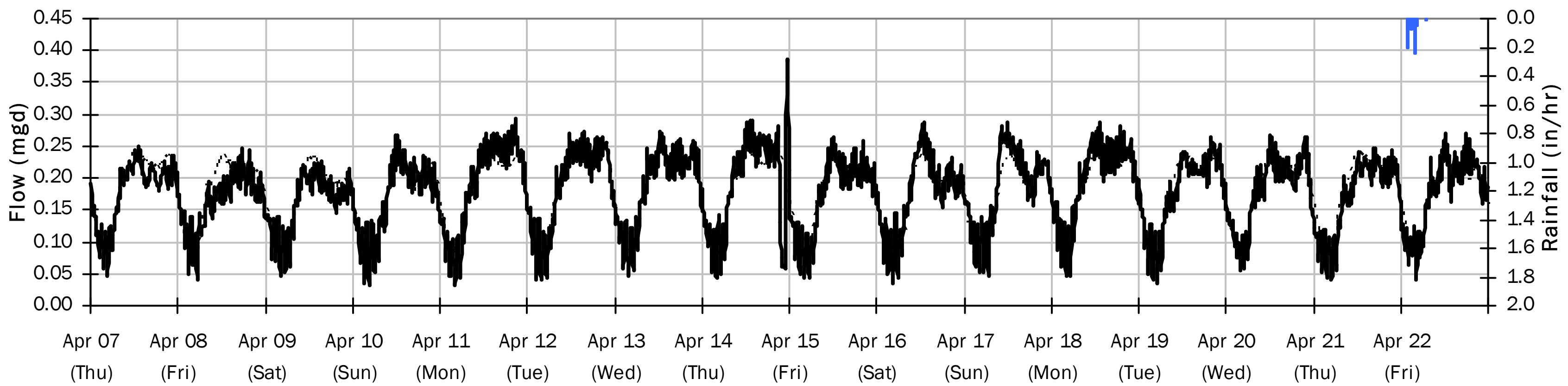


SITE 26

Flow Summary: 3/22/2022 to 4/22/2022

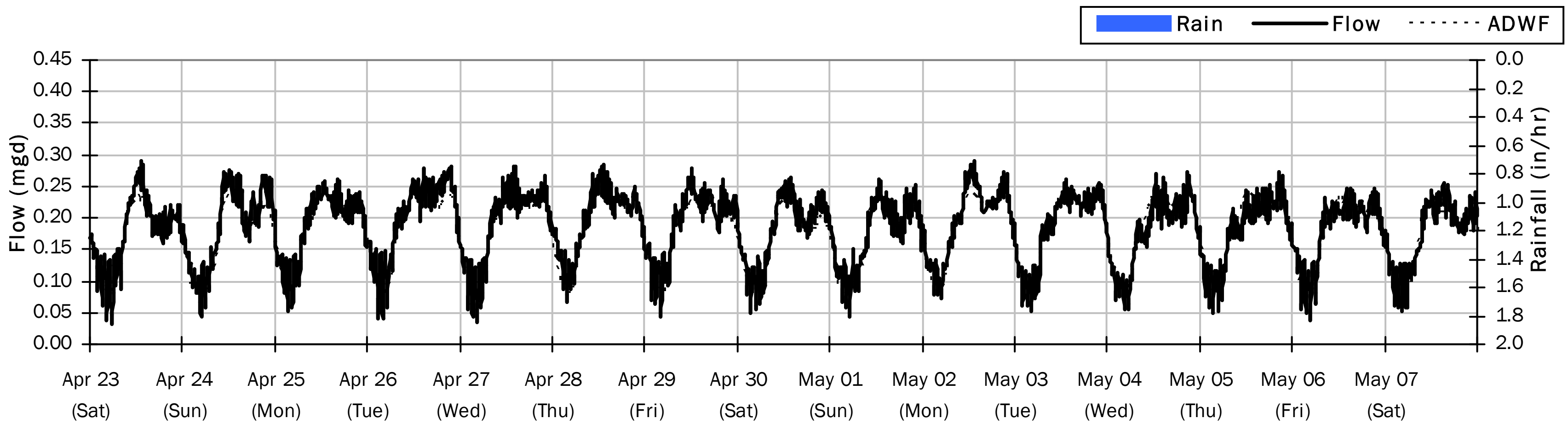
Period Rainfall: 0.87 inches   Period Avg Flow: 0.178 mgd   Period Peak Flow: 0.382 mgd   Period Min Flow: 0.024 mgd

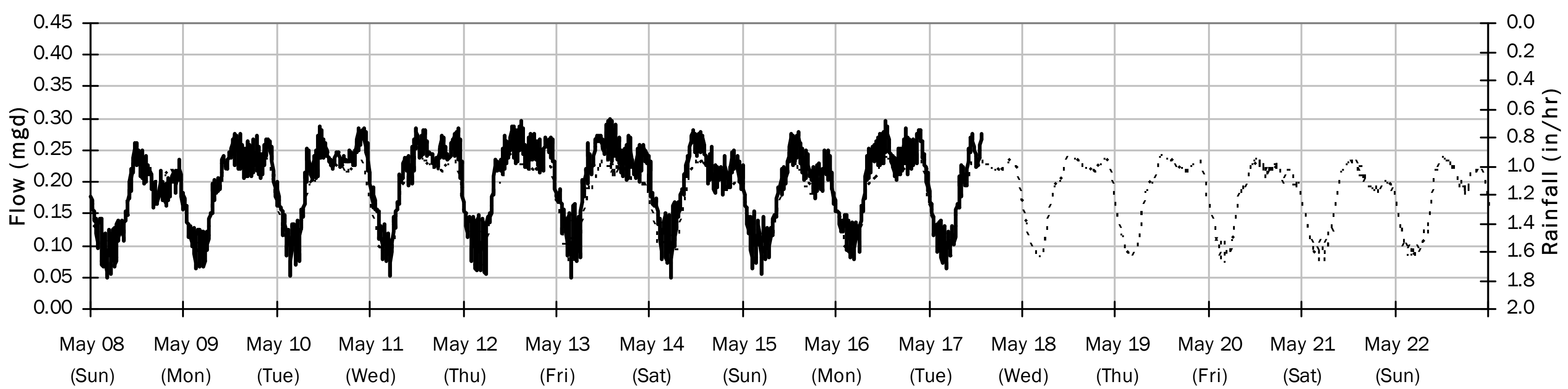




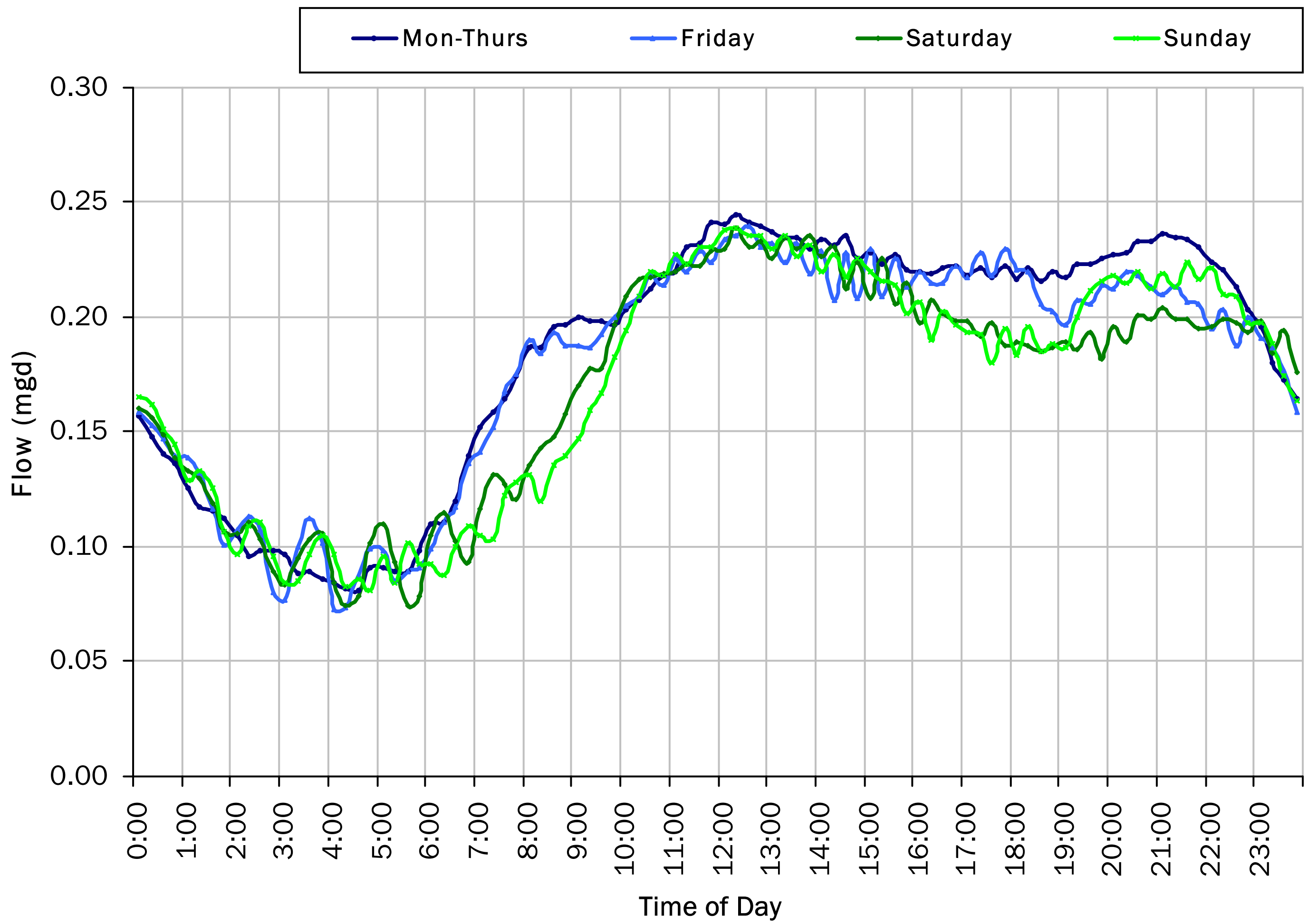
SITE 26
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches   Period Avg Flow: 0.190 mgd   Period Peak Flow: 0.300 mgd   Period Min Flow: 0.032 mgd

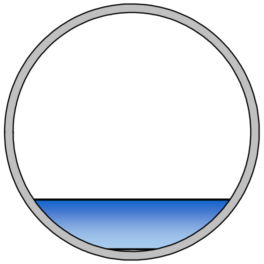




SITE 26
Average Dry Weather Flow Hydrographs



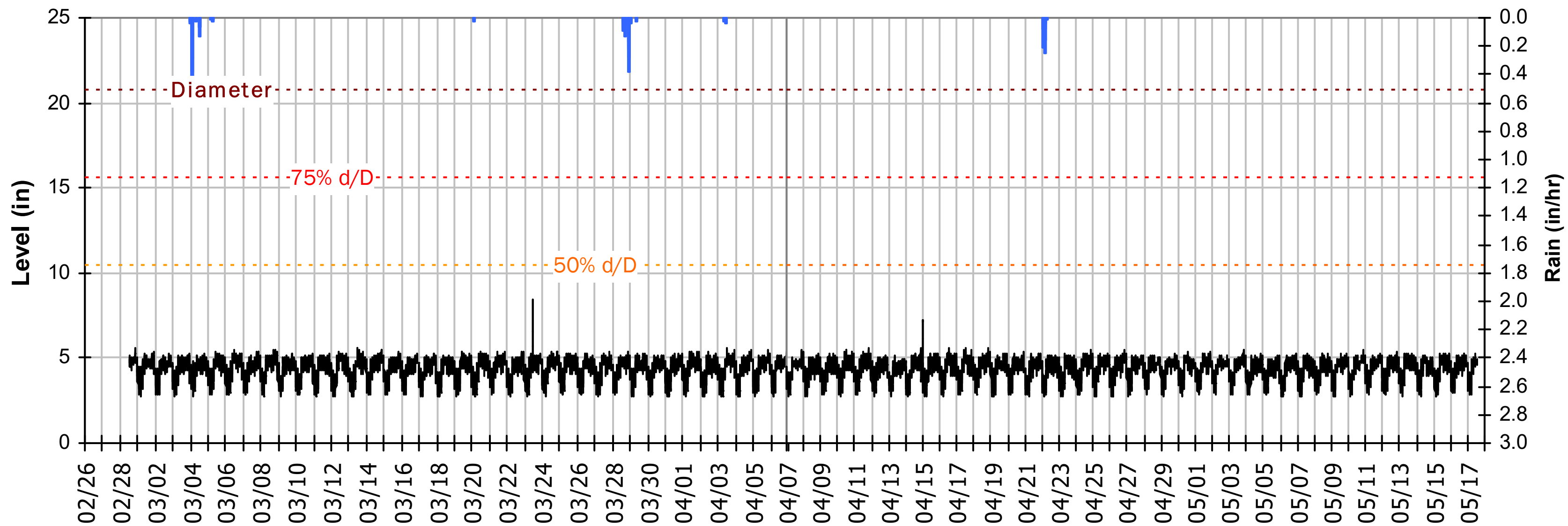
ADWF:
0.179 *mgd*

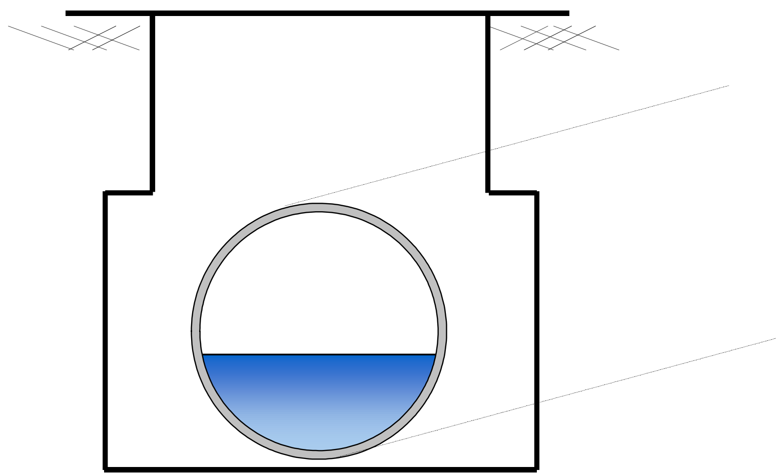


SITE 26

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

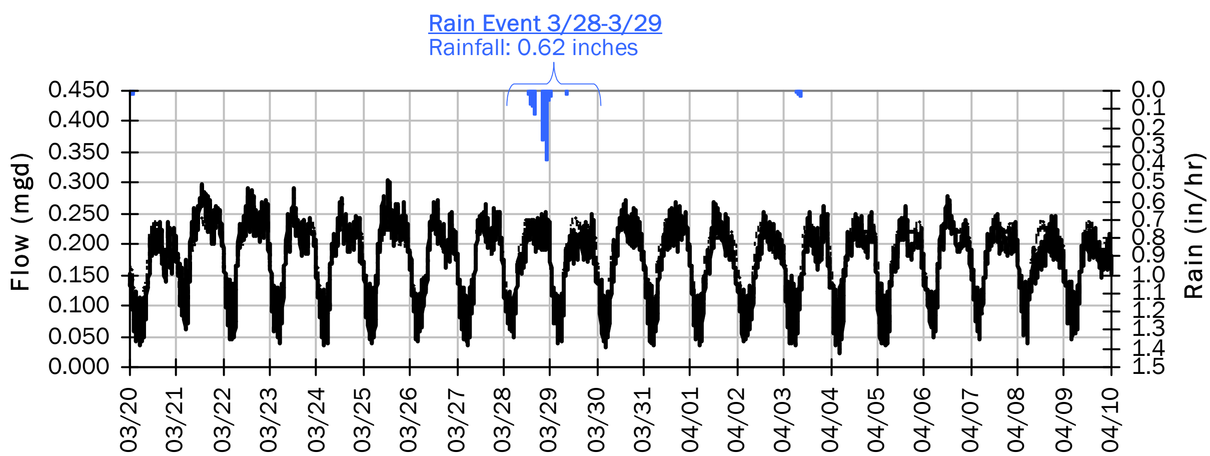




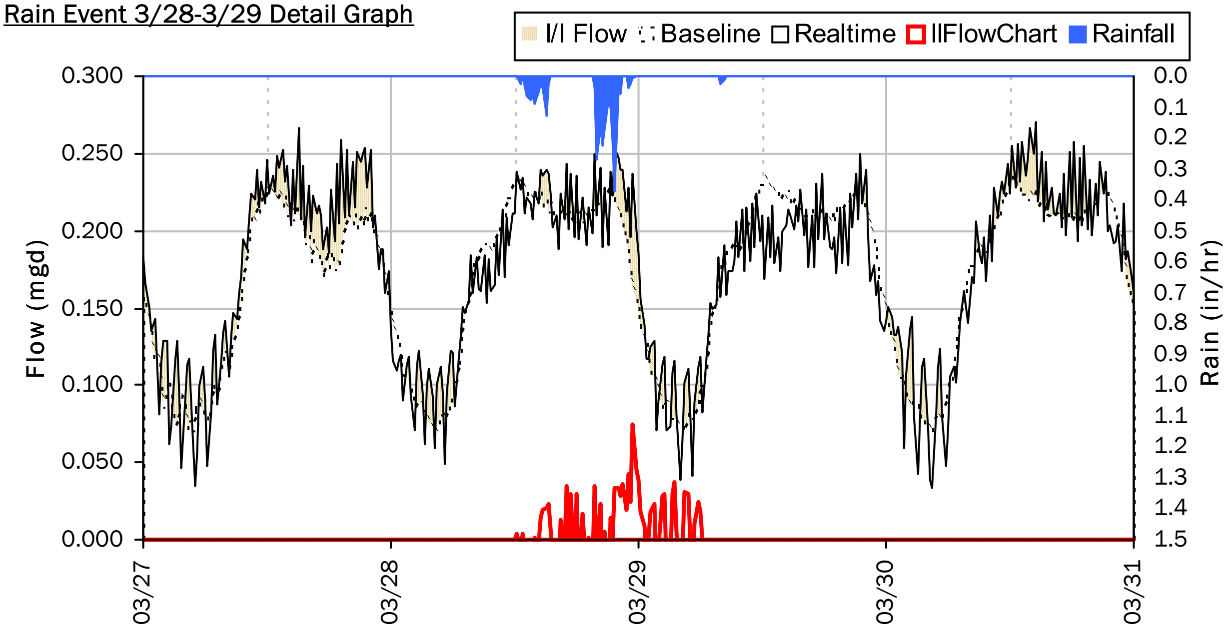
Pipe Diameter:	20.8	*inches*
Peak Measured Level:	8.39	*inches*
Peak d/D Ratio:	0.40	

SITE 26
I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



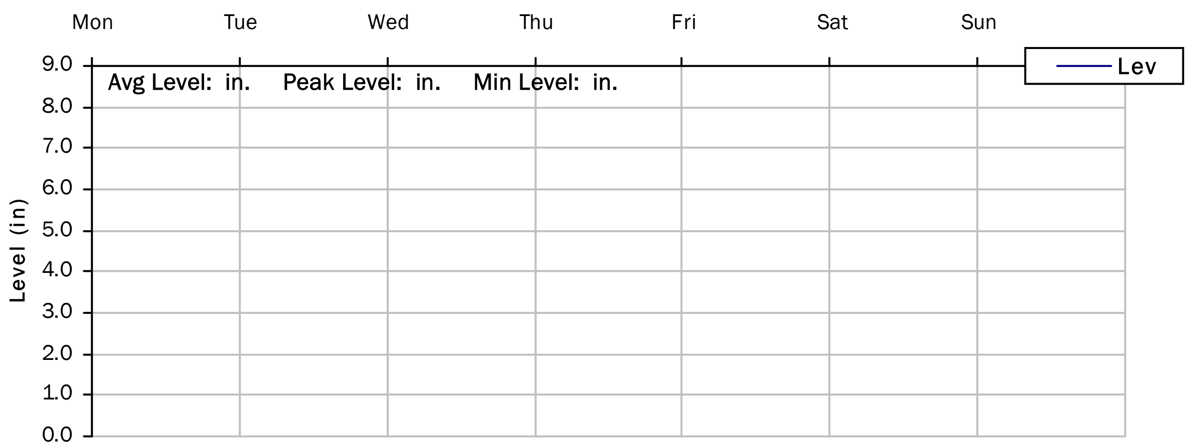
Rain Event 3/28-3/29 Detail Graph

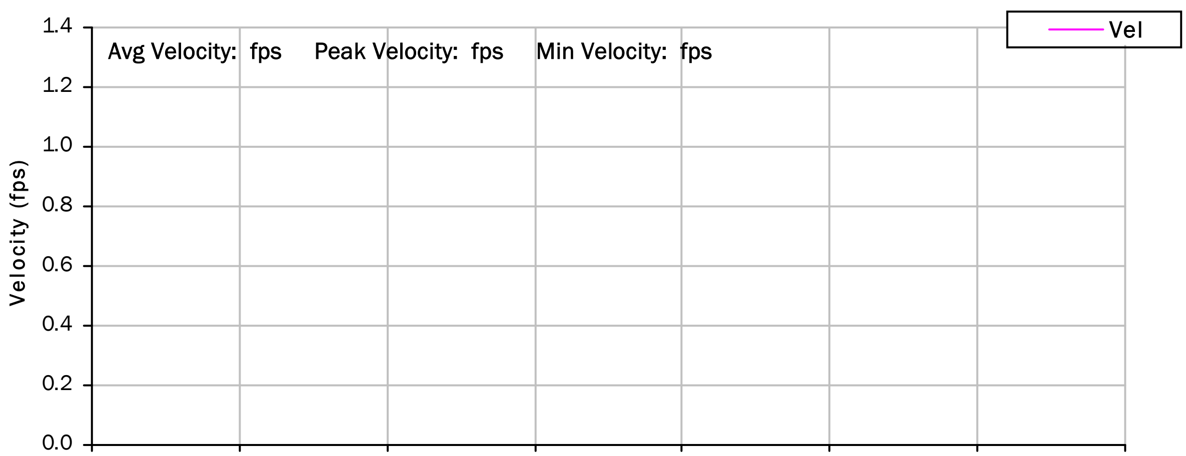


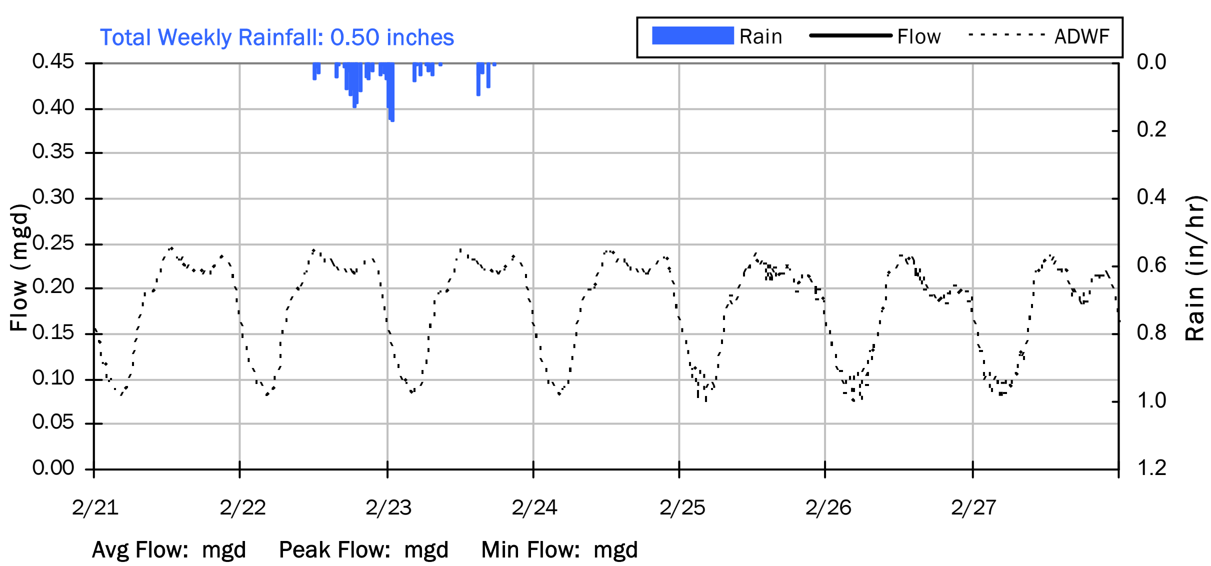
Storm Event I/I Analysis (Rain = 0.62 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.254 *mgd*	Peak I/I Rate:	0.075 *mgd*
PF:	1.42	Total I/I:	6,000 *gallons*
Peak Level:	5.39 *in*		
d/D Ratio:	0.26		

SITE 26
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



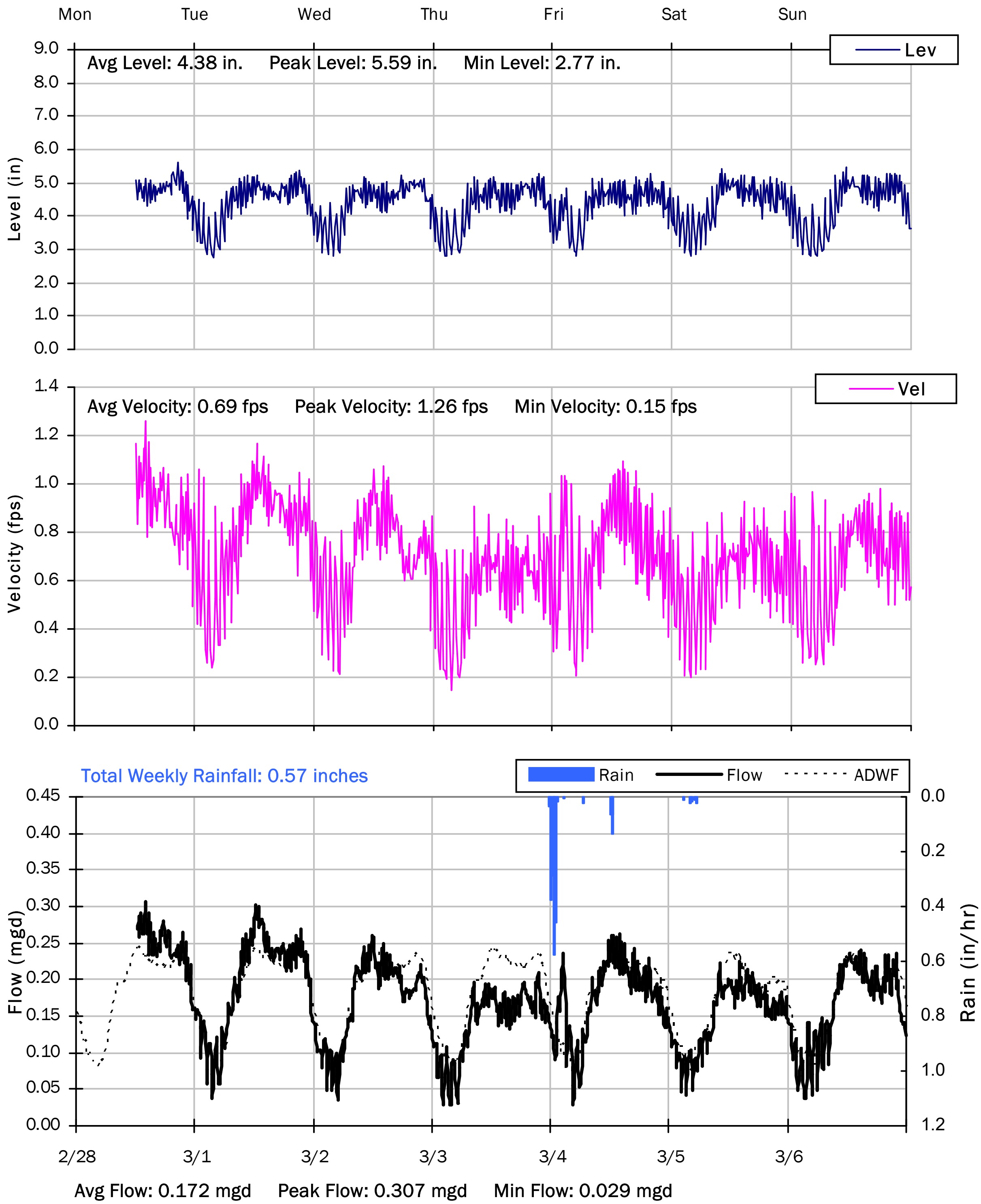




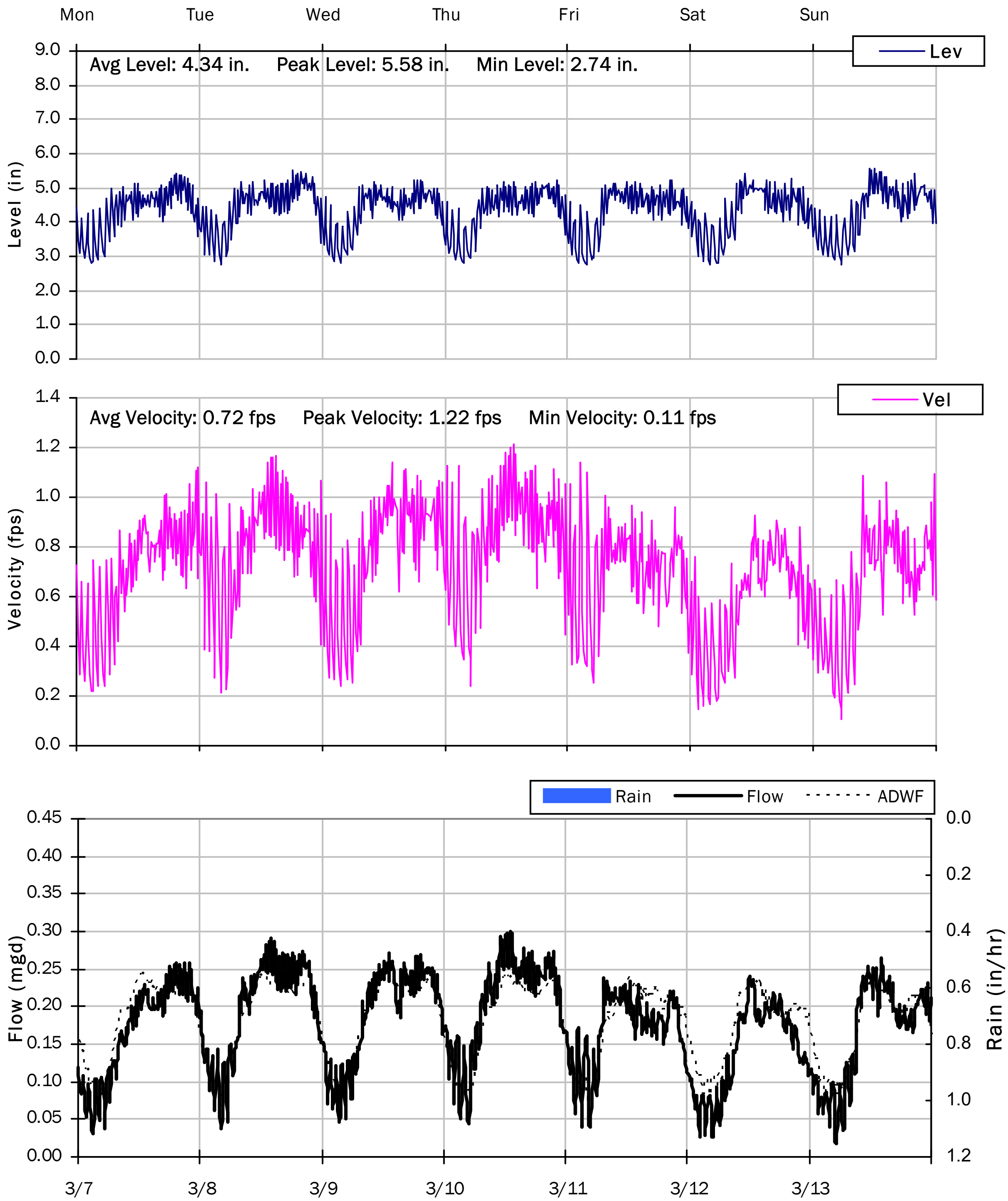
SITE 26

Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022



SITE 26
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

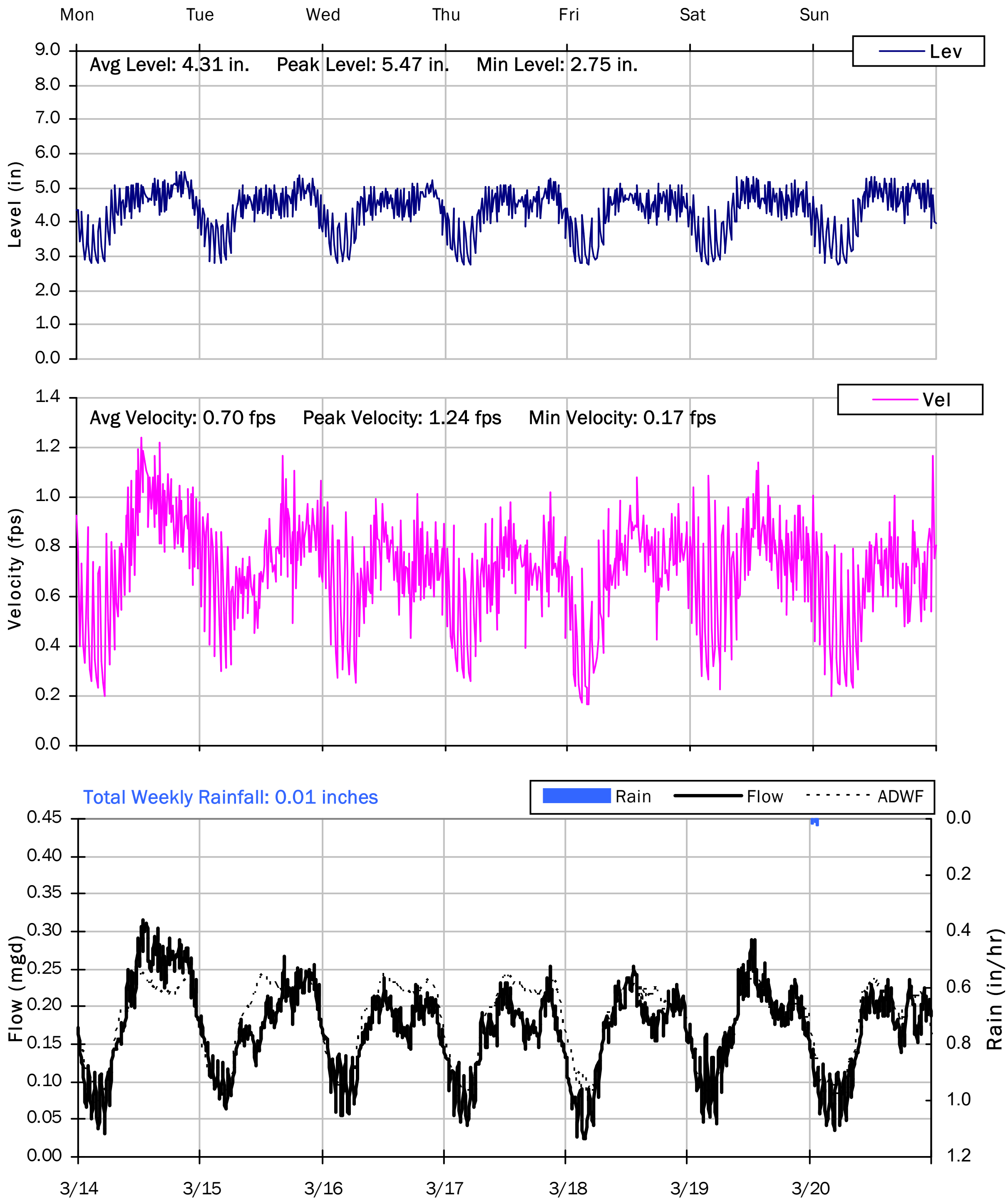


Avg Flow: 0.177 mgd Peak Flow: 0.301 mgd Min Flow: 0.018 mgd

SITE 26

Weekly Level, Velocity and Flow Hydrographs

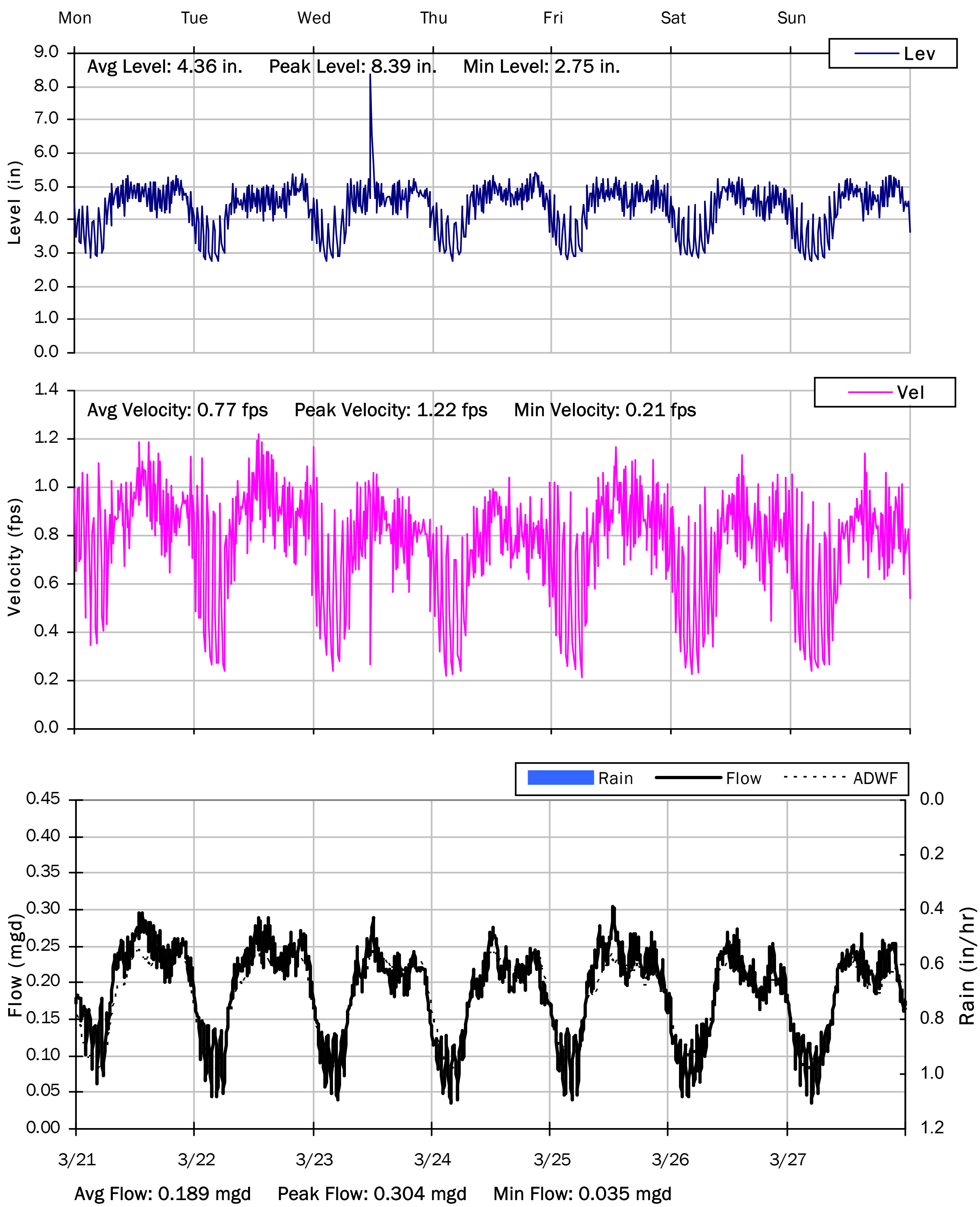
3/14/2022 to 3/21/2022



Avg Flow: 0.170 mgd Peak Flow: 0.316 mgd Min Flow: 0.024 mgd

SITE 26

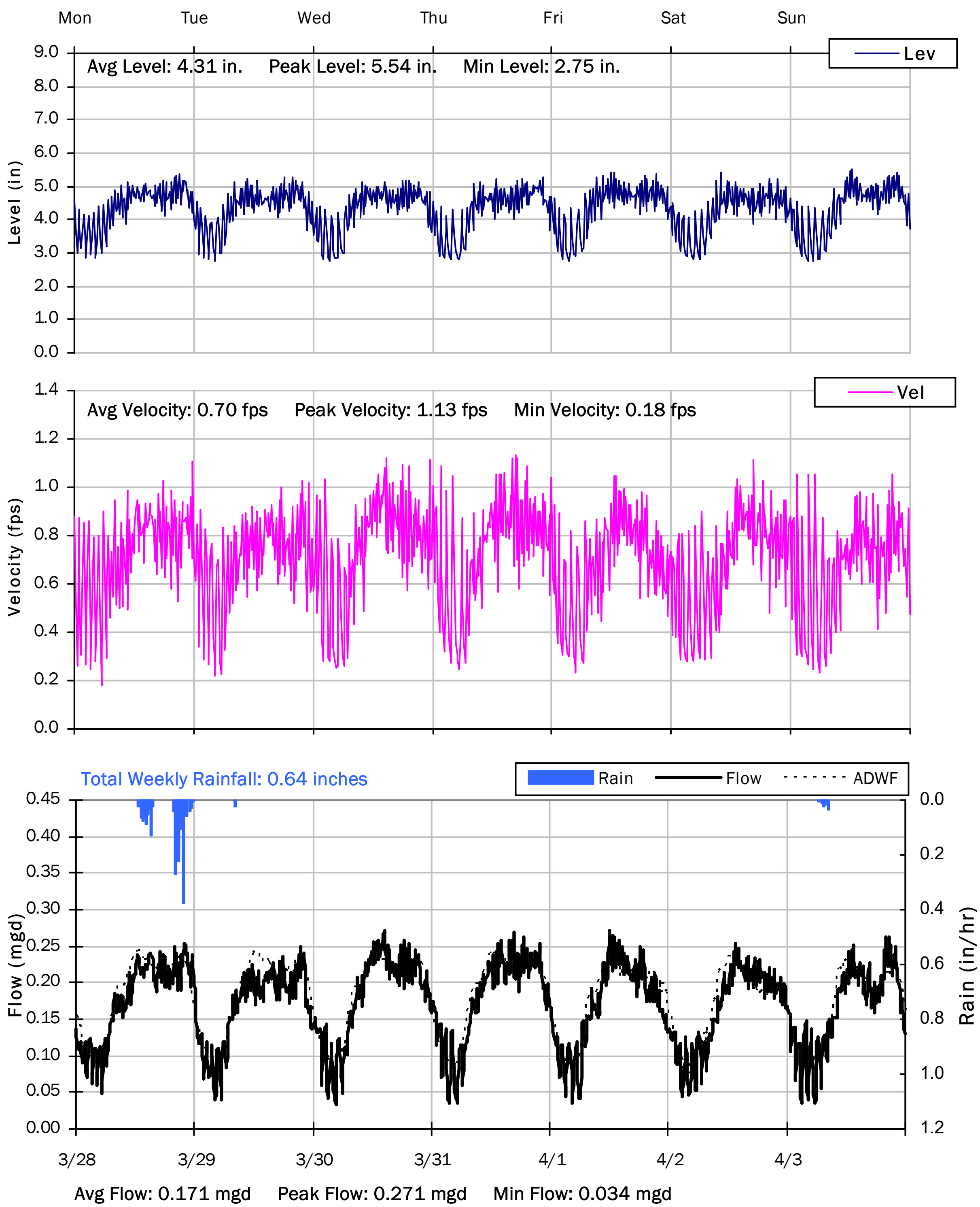
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



SITE 26

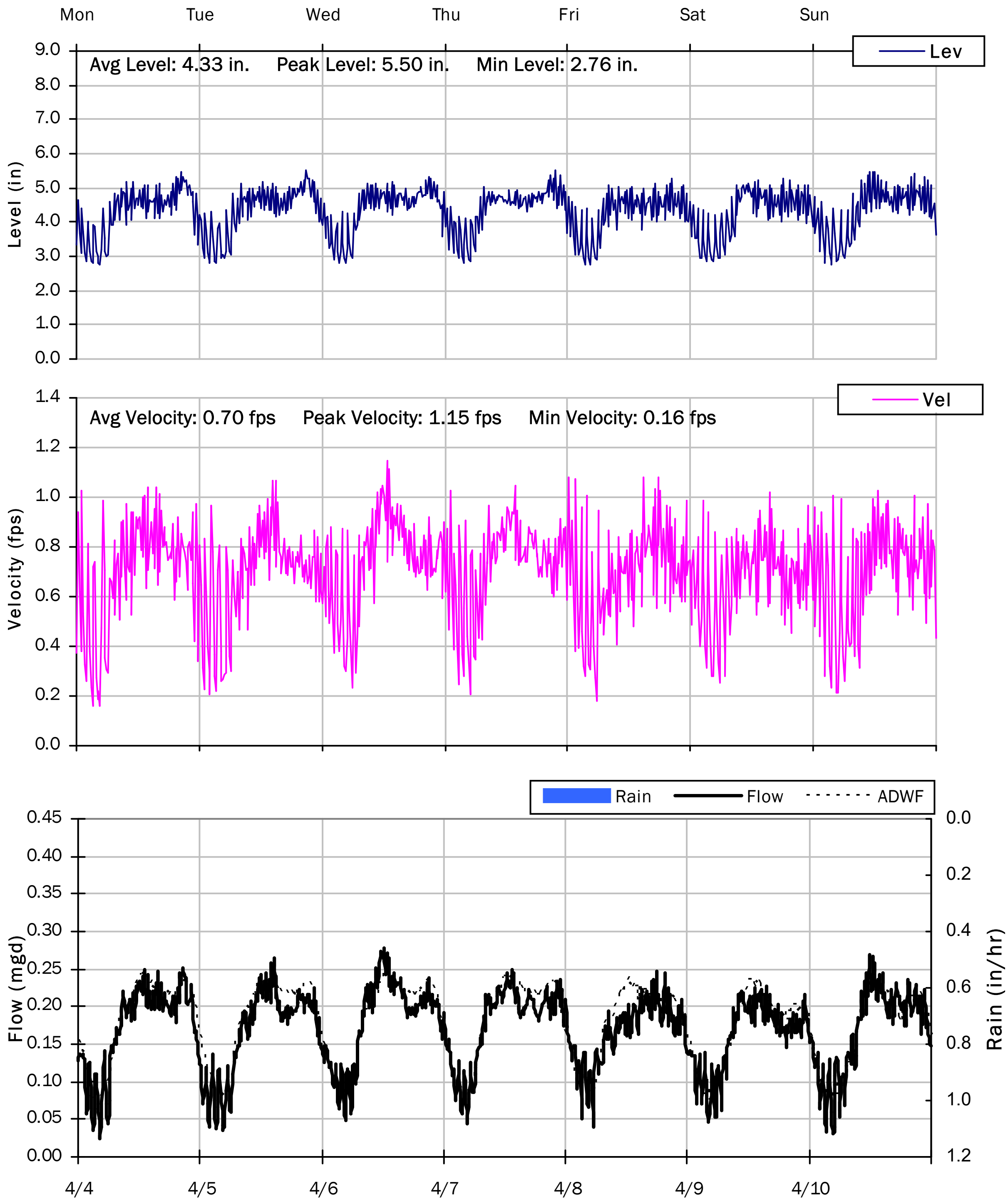
Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022



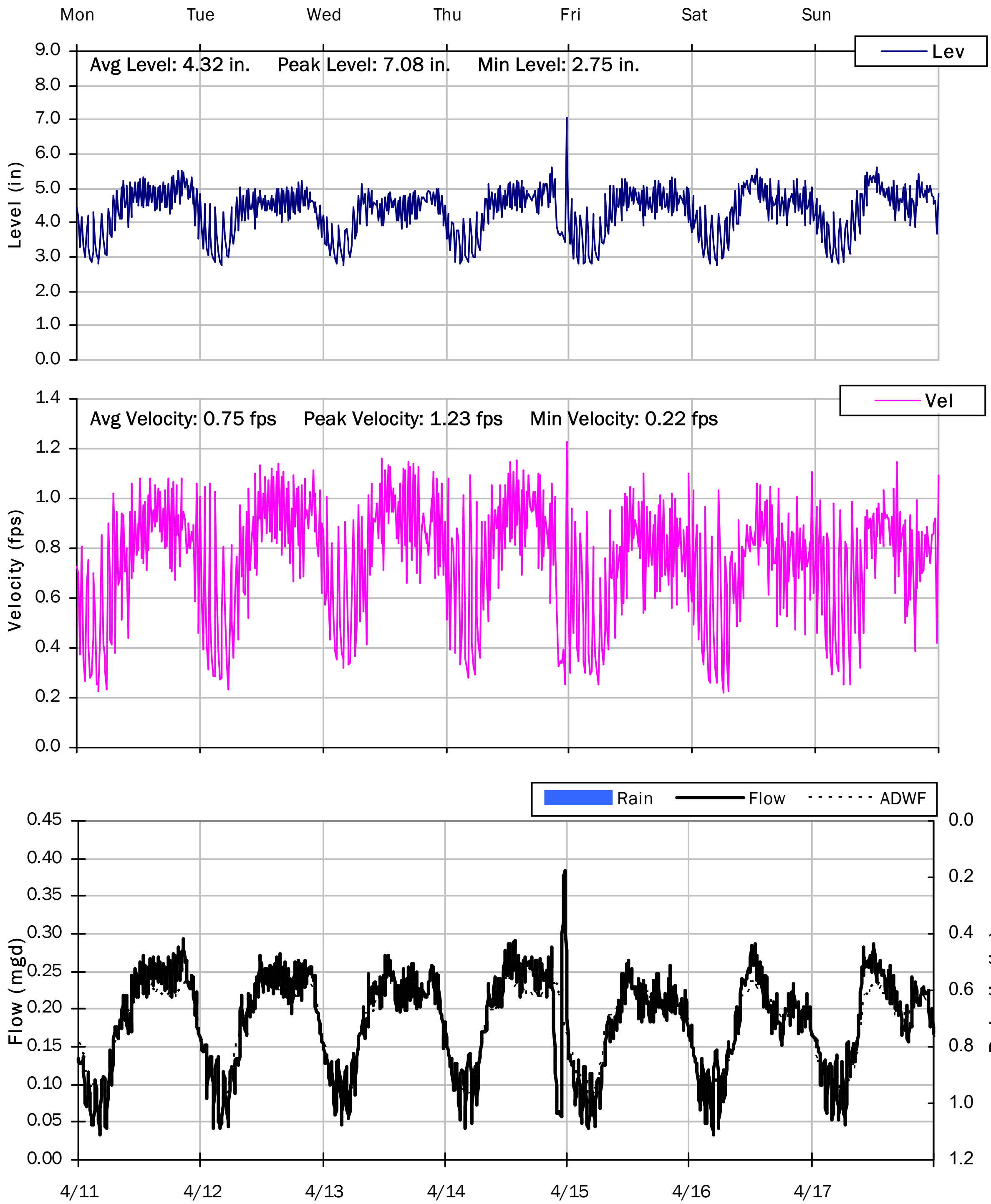
SITE 26

Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022



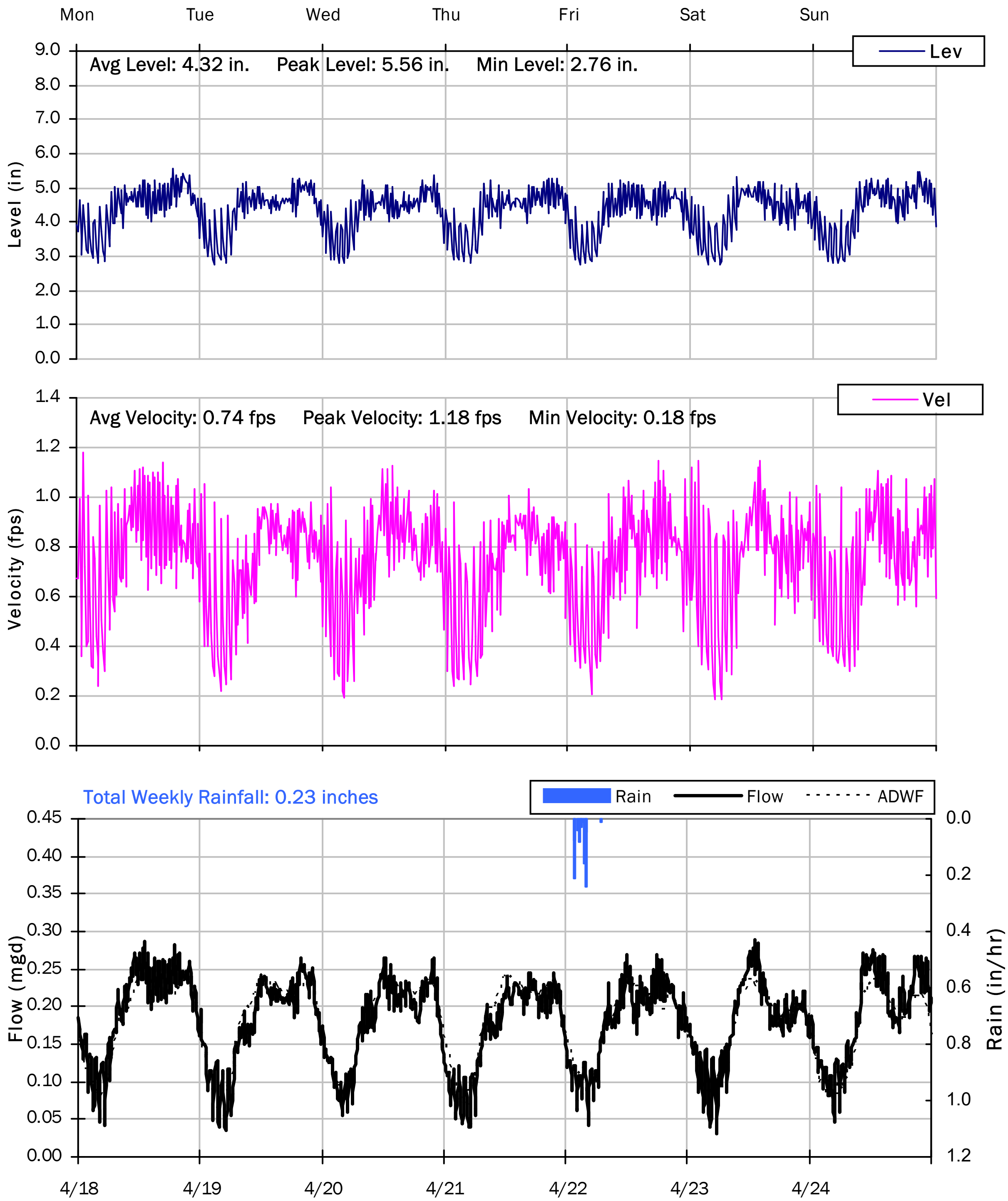
Avg Flow: 0.171 mgd Peak Flow: 0.279 mgd Min Flow: 0.024 mgd

SITE 26
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022



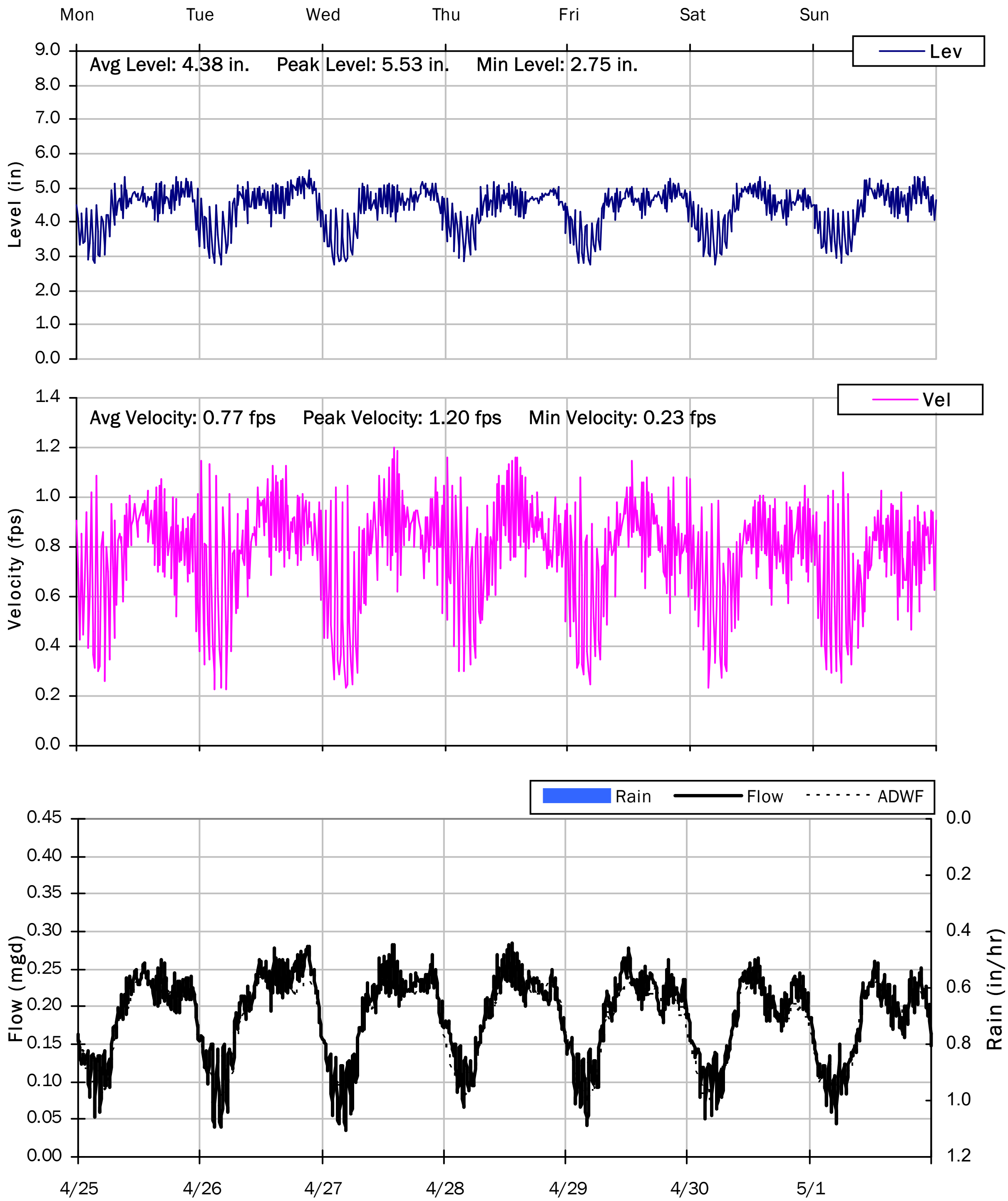
Avg Flow: 0.184 mgd Peak Flow: 0.382 mgd Min Flow: 0.032 mgd

SITE 26
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



Avg Flow: 0.181 mgd Peak Flow: 0.289 mgd Min Flow: 0.032 mgd

SITE 26
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

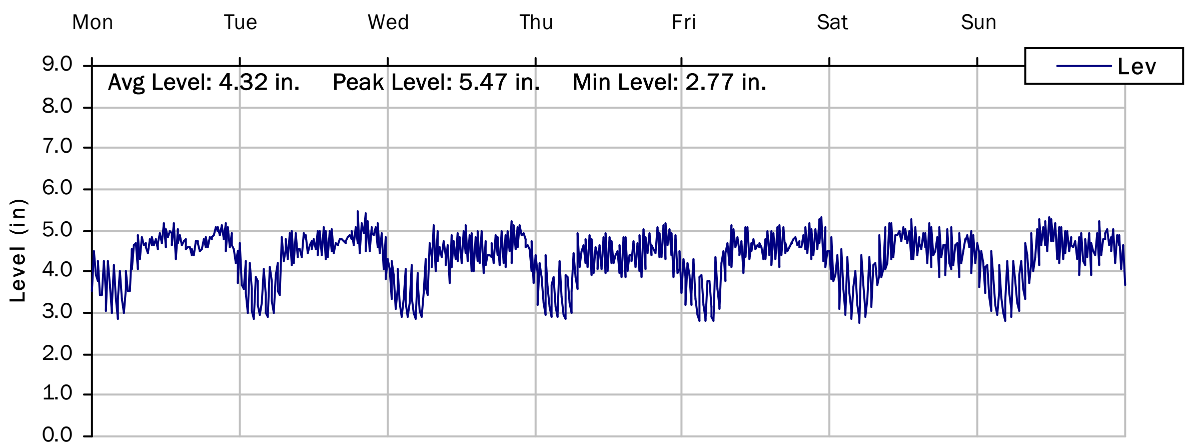


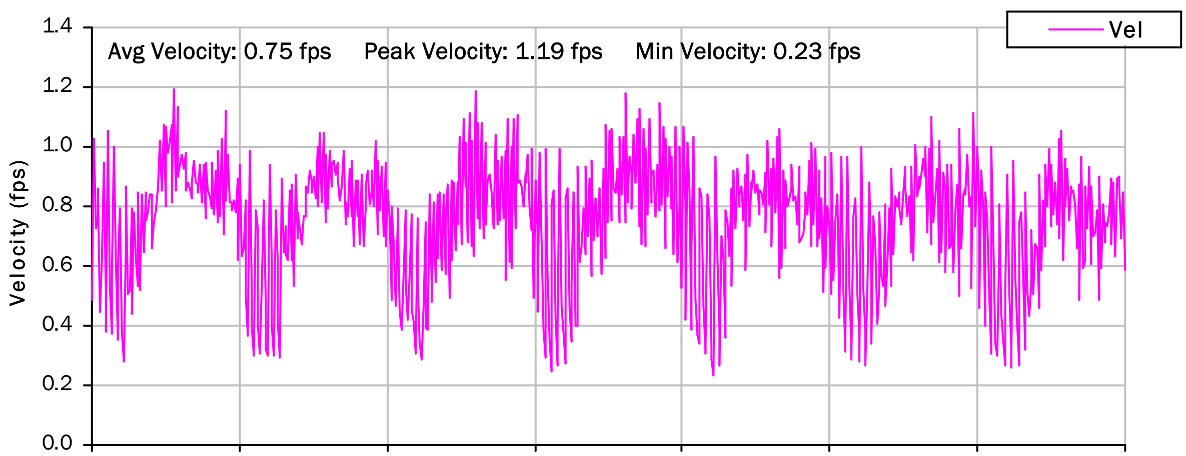
Avg Flow: 0.189 mgd Peak Flow: 0.285 mgd Min Flow: 0.035 mgd

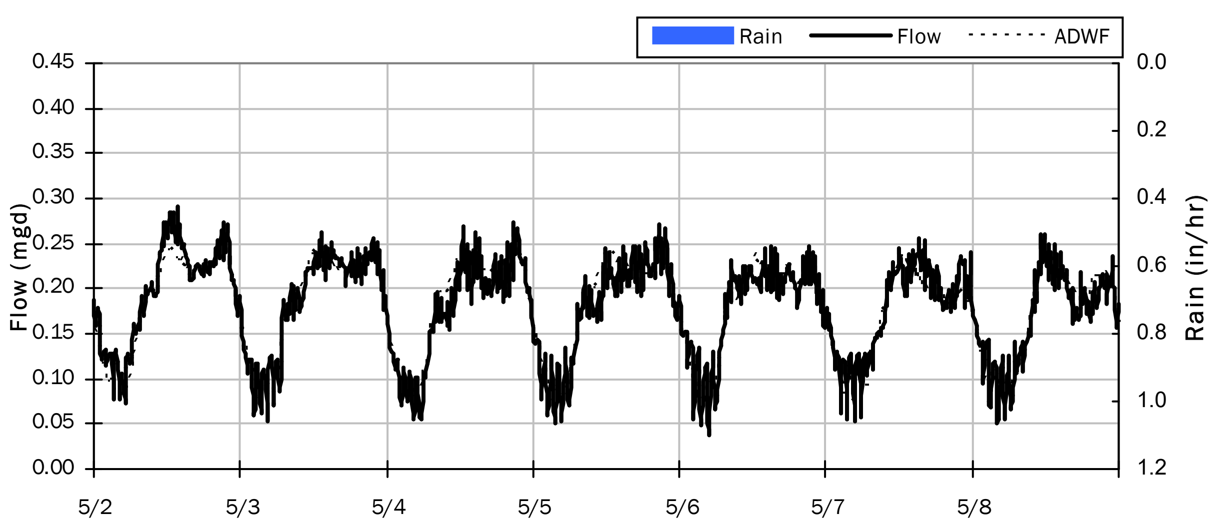
SITE 26

Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022





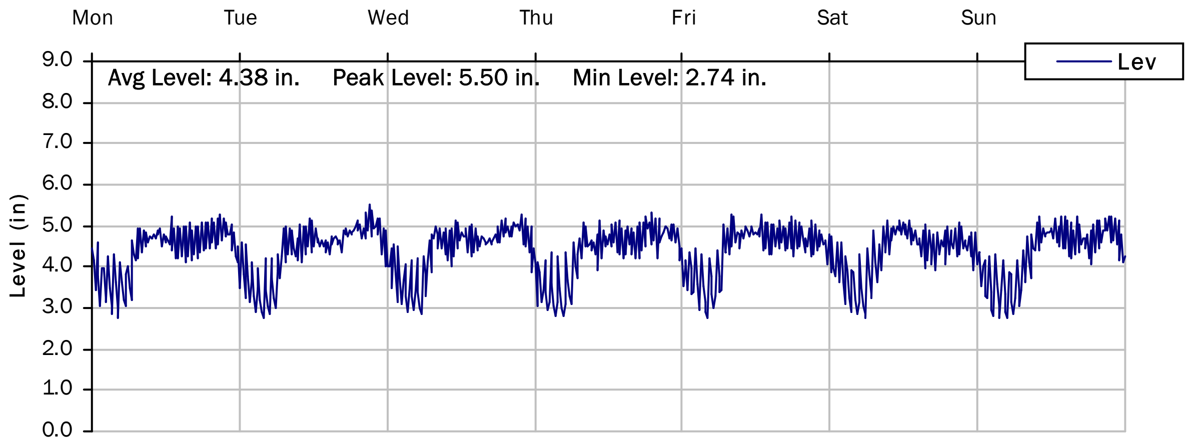


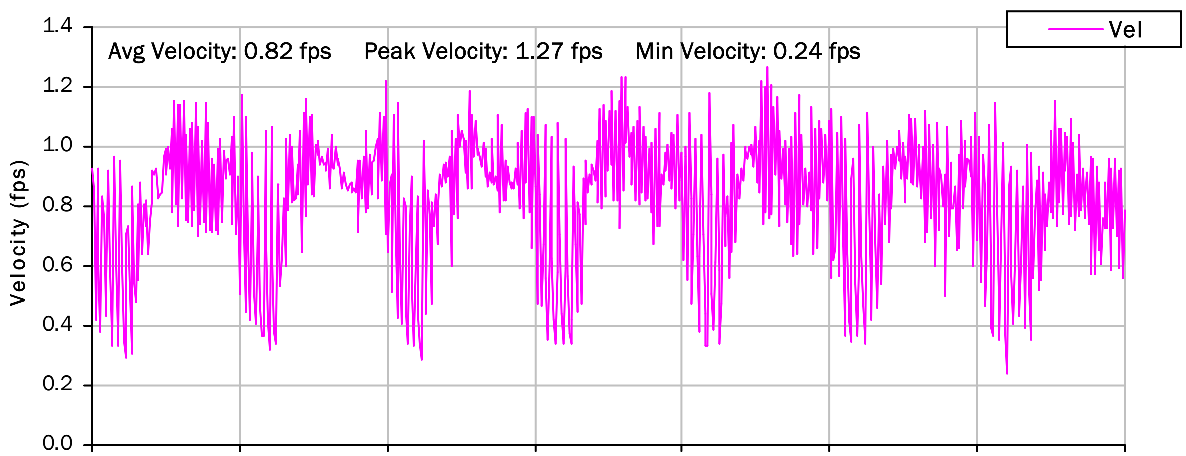
Avg Flow: 0.181 mgd Peak Flow: 0.291 mgd Min Flow: 0.038 mgd

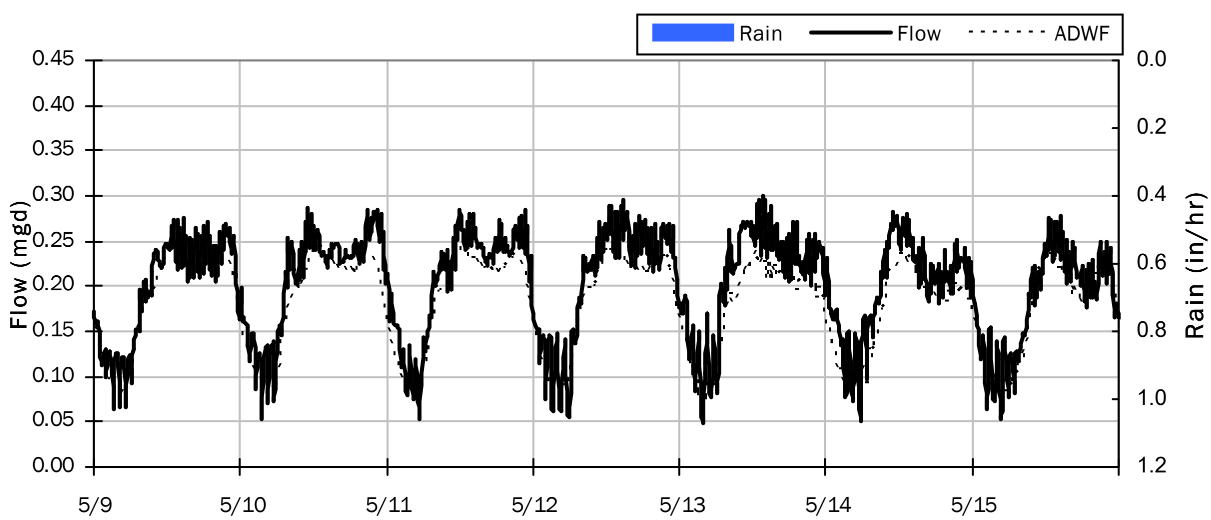
SITE 26

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022





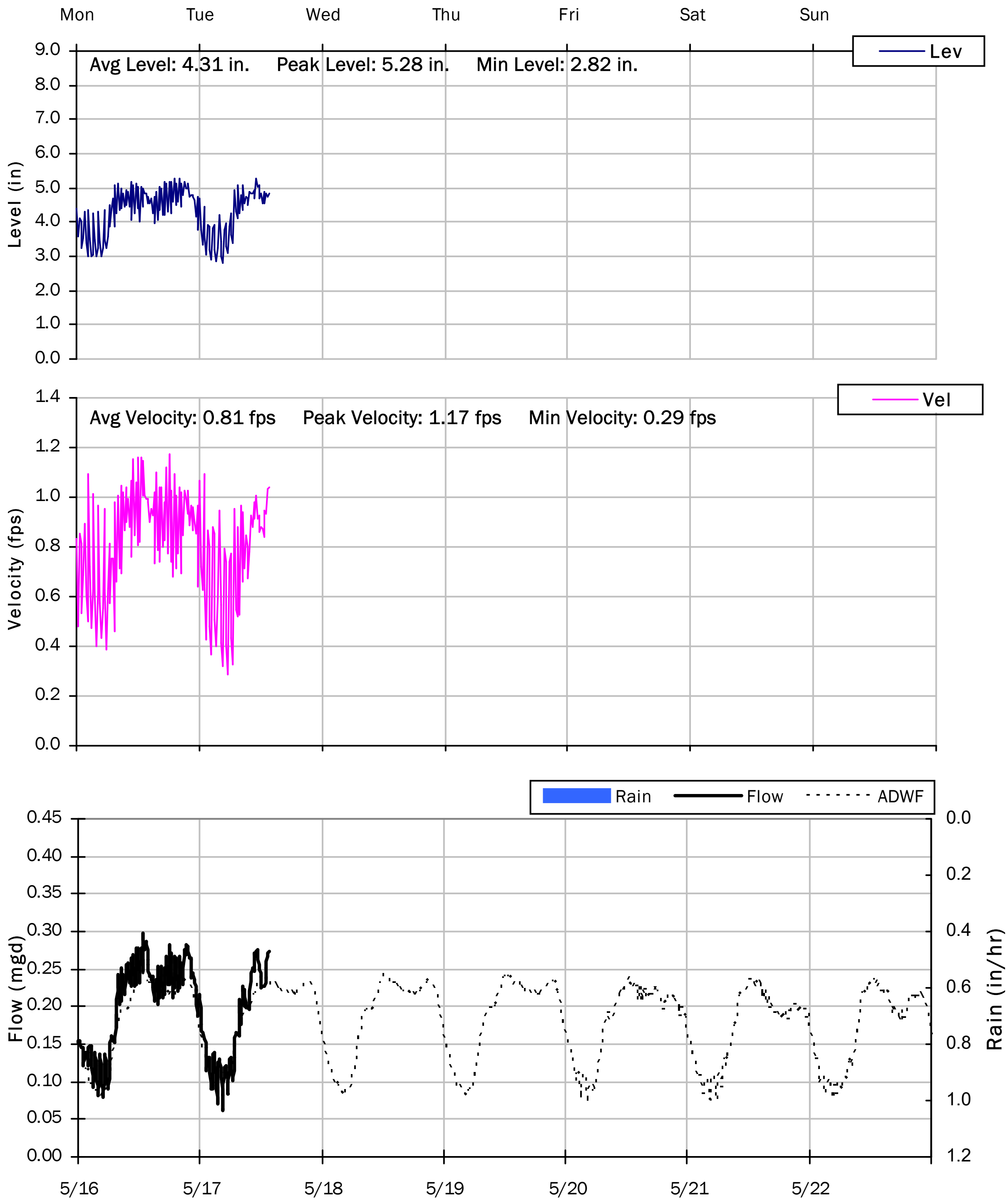


Avg Flow: 0.202 mgd Peak Flow: 0.300 mgd Min Flow: 0.049 mgd

SITE 26

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022



Avg Flow: 0.195 mgd Peak Flow: 0.297 mgd Min Flow: 0.063 mgd

Monitoring Site: Site 27

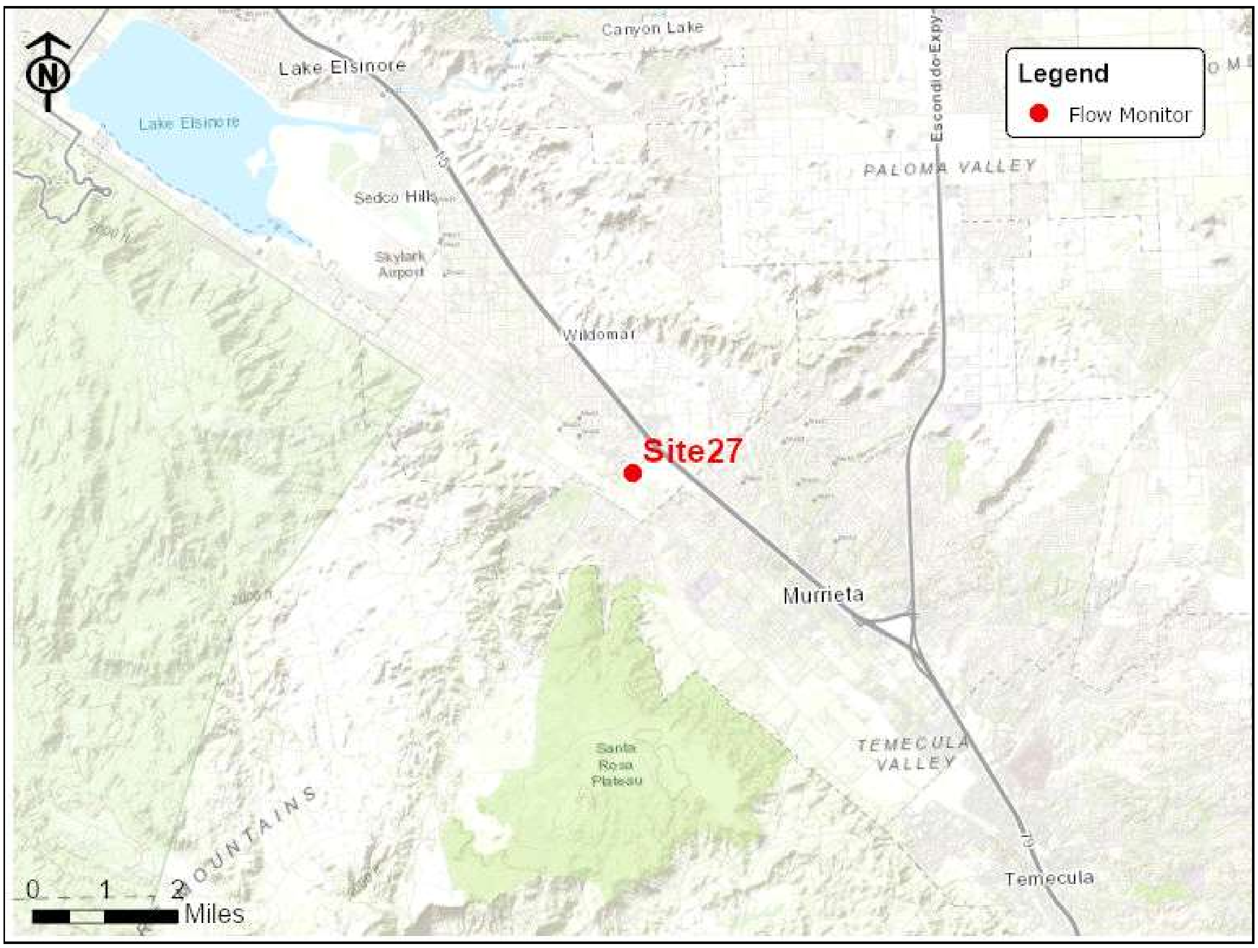
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Hardwood Lane and Wing Elm Circle

Data Summary Report



Vicinity Map: Site 27

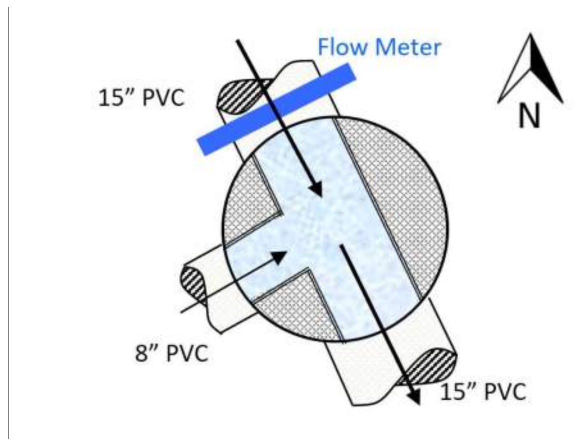
SITE 27

Site Information MH ID: MH-4515

Location:	Hardwood Lane and Wing Elm Circle
Coordinates:	117.2467° W, 33.5863° N
Rim Elevation (Earth):	1225 feet
Expected Pipe Diameter:	15 inches
Measured Pipe Diameter:	14.75 inches
ADWF:	0.148 mgd
Peak Measured Flow:	0.314 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch

View from Street


Plan View

SITE 27

Additional Site Photos

Effluent Pipe

W Influent Pipe

SITE 27

Additional Site Photos

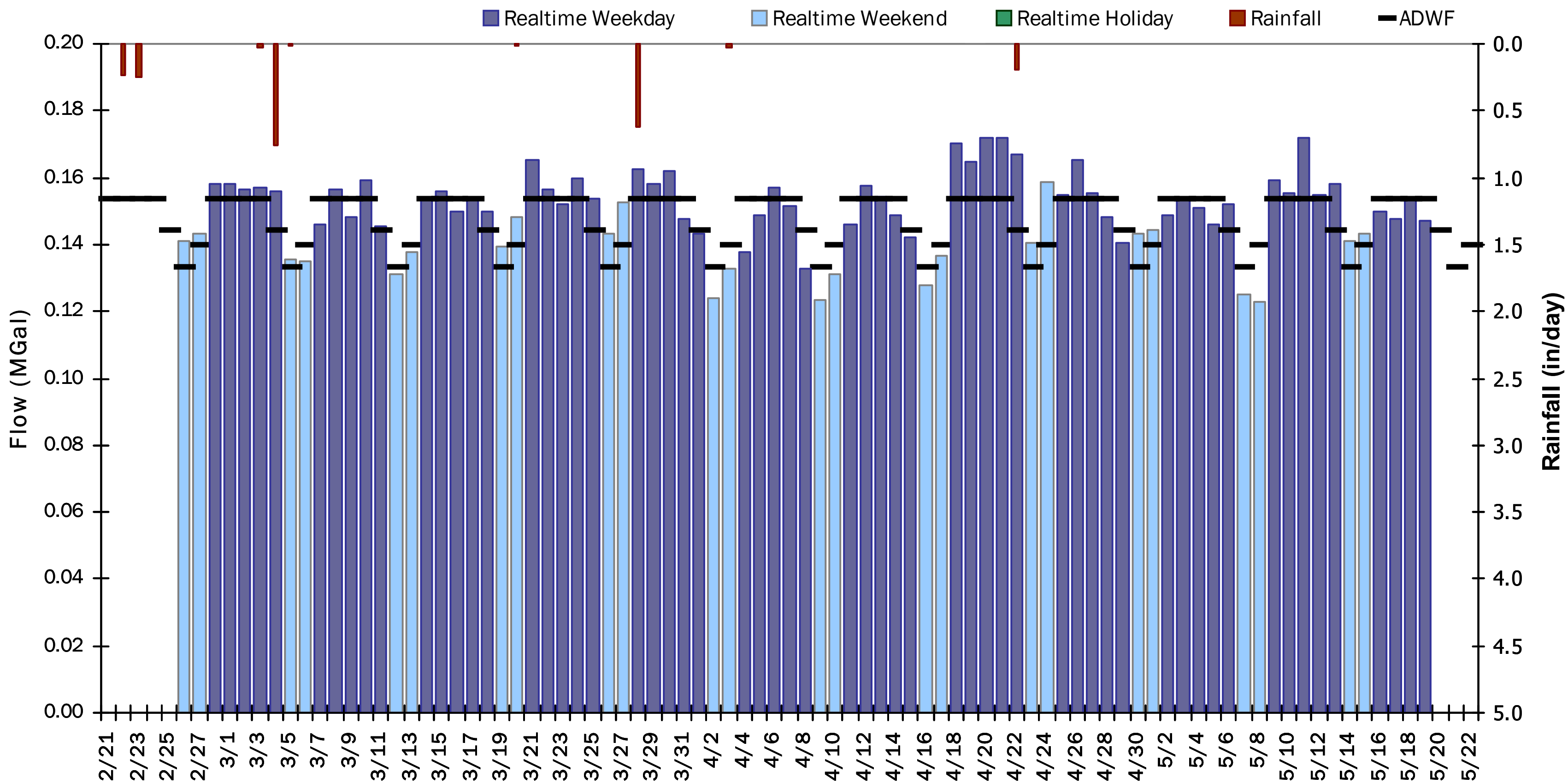
Monitored N Influent Pipe

SITE 27

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.149 MGal   Peak Daily Flow: 0.172 MGal   Min Daily Flow: 0.122 MGal

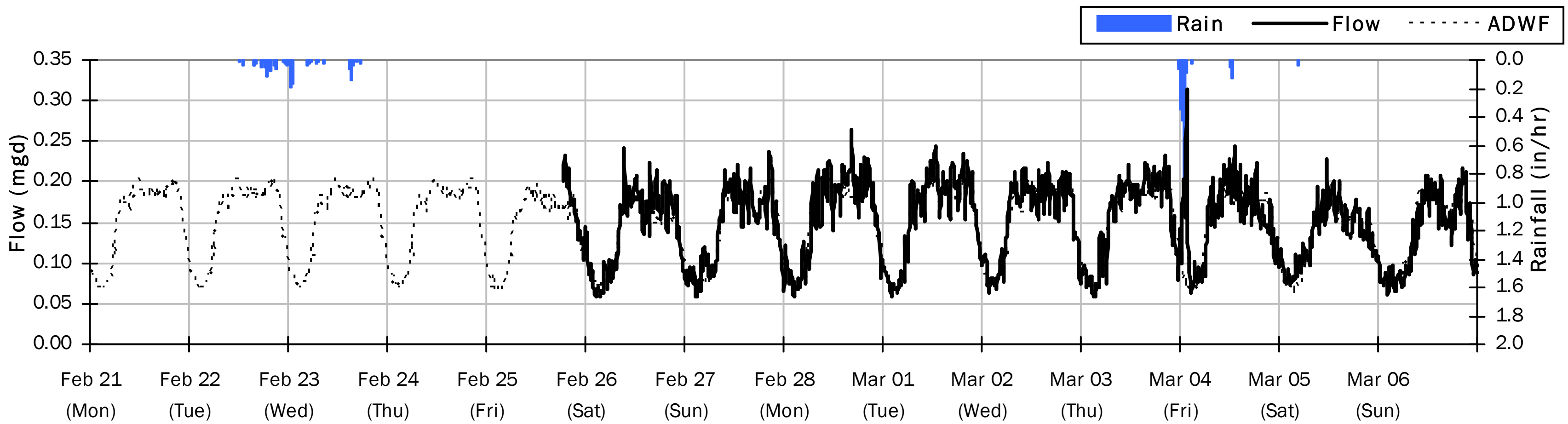
Total Rainfall: 1.64 inches

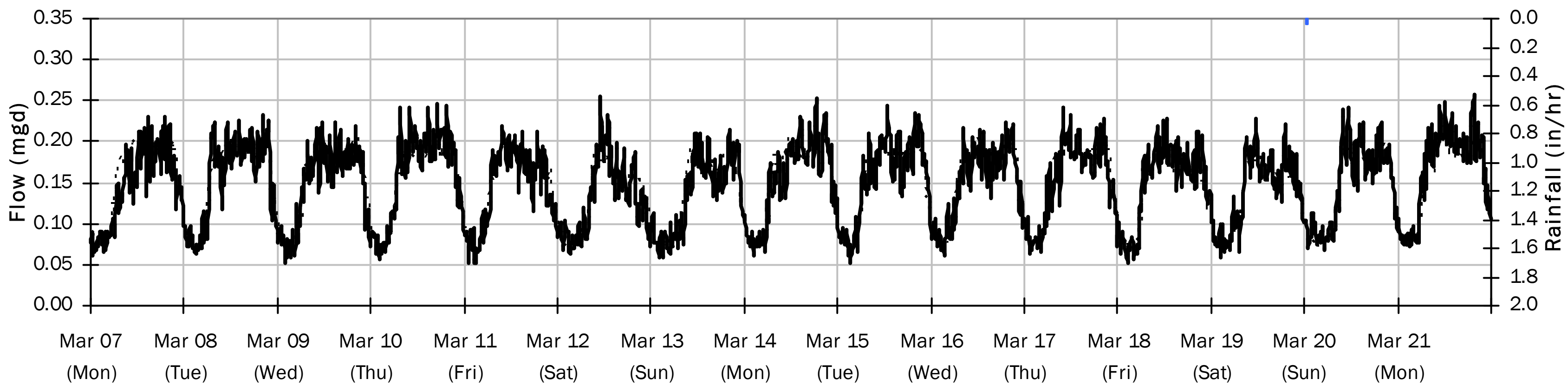


SITE 27

Flow Summary: 2/21/2022 to 3/21/2022

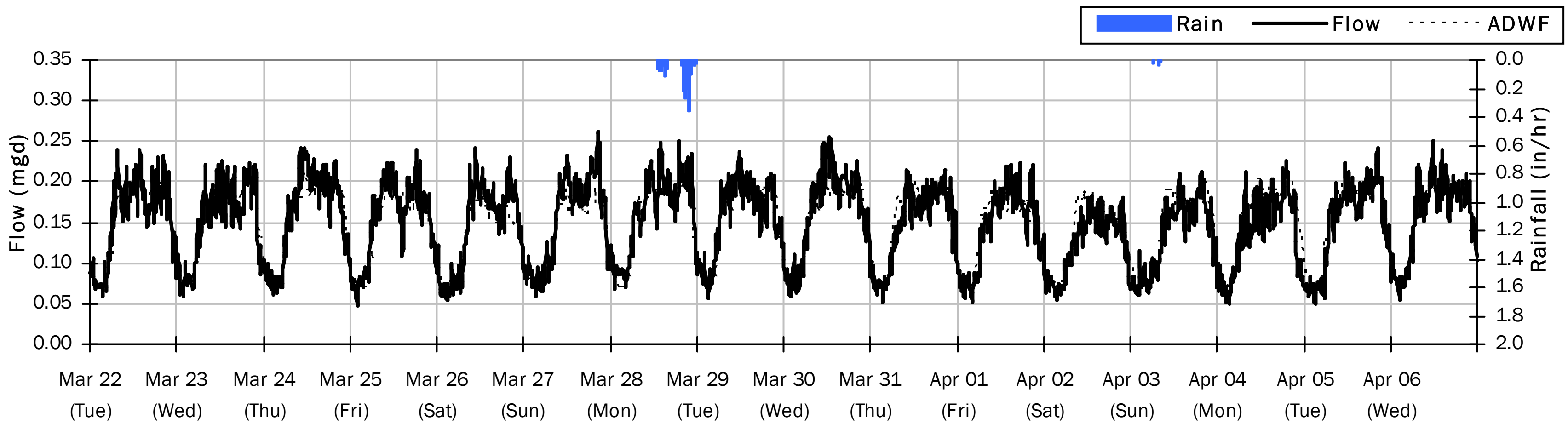
Period Rainfall: 1.29 inches   Period Avg Flow: 0.149 mgd   Period Peak Flow: 0.314 mgd   Period Min Flow: 0.051 mgd

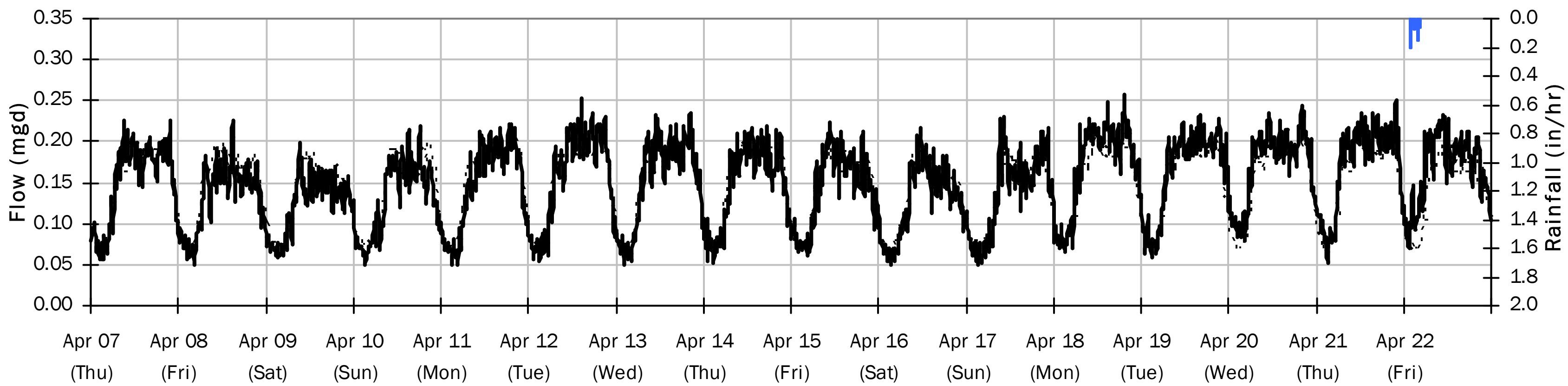




SITE 27
Flow Summary: 3/22/2022 to 4/22/2022

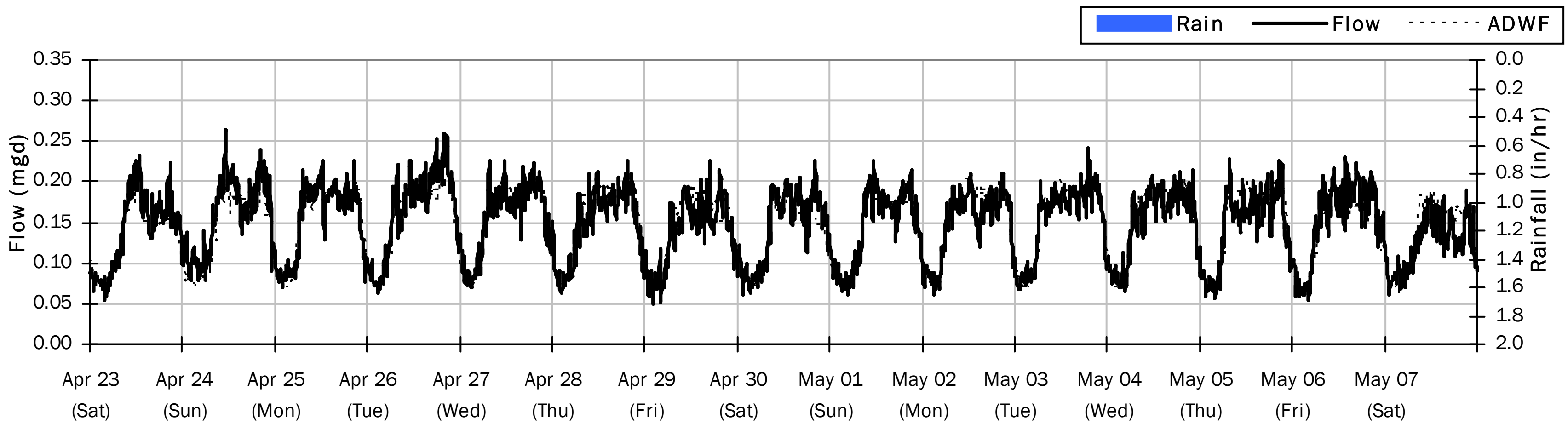
Period Rainfall: 0.83 inches   Period Avg Flow: 0.150 mgd   Period Peak Flow: 0.261 mgd   Period Min Flow: 0.048 mgd

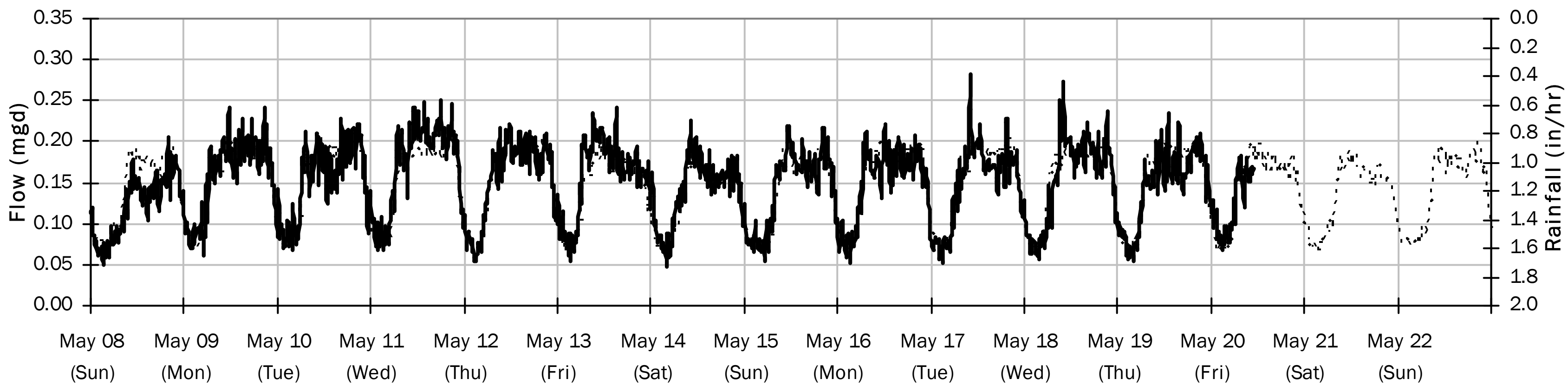




SITE 27
Flow Summary: 4/23/2022 to 5/22/2022

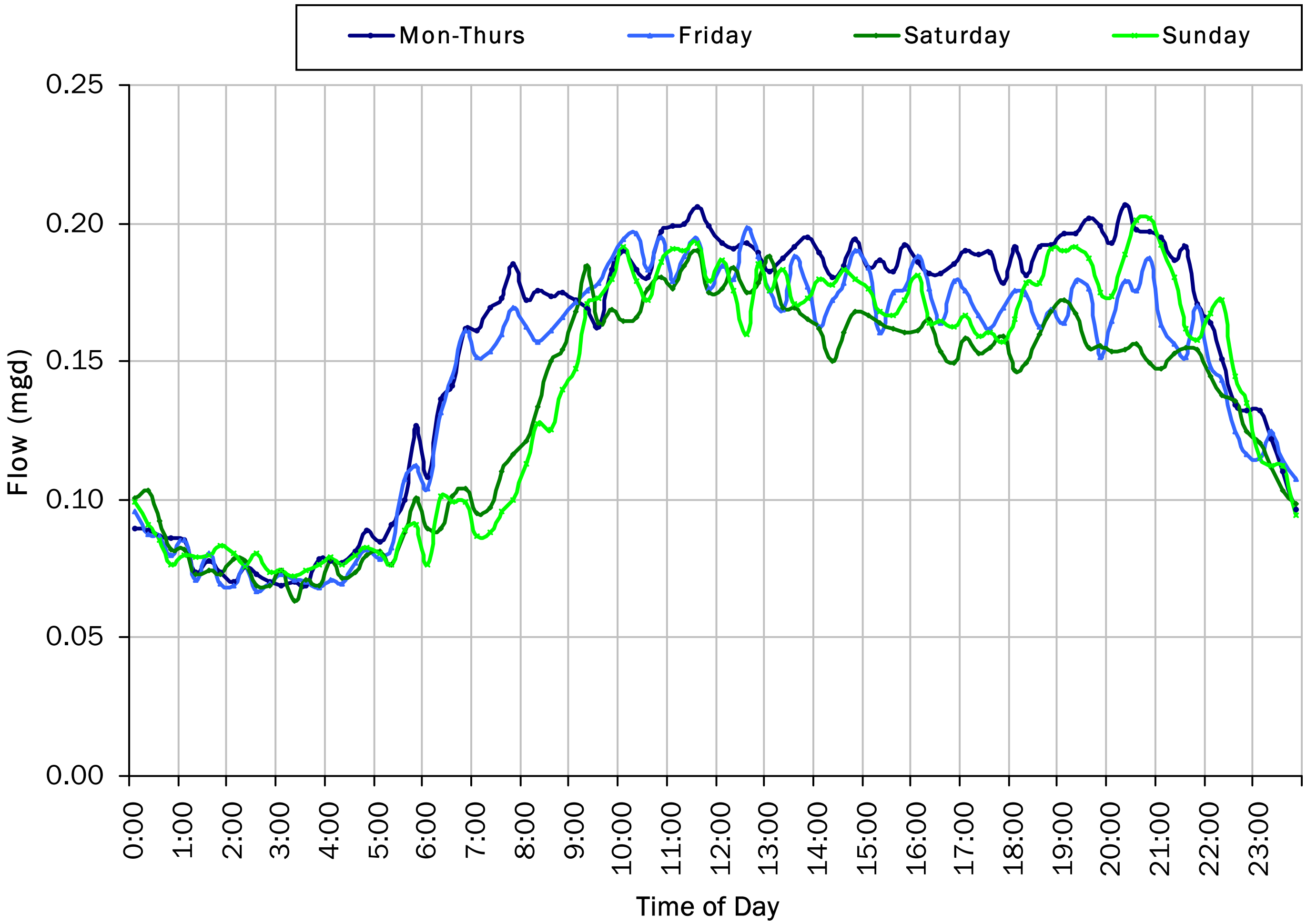
Period Rainfall: 0.00 inches   Period Avg Flow: 0.149 mgd   Period Peak Flow: 0.283 mgd   Period Min Flow: 0.047 mgd

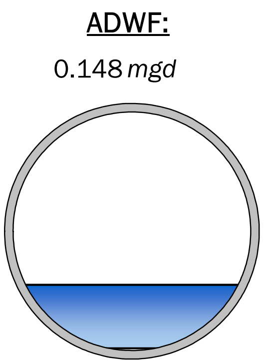




SITE 27

Average Dry Weather Flow Hydrographs

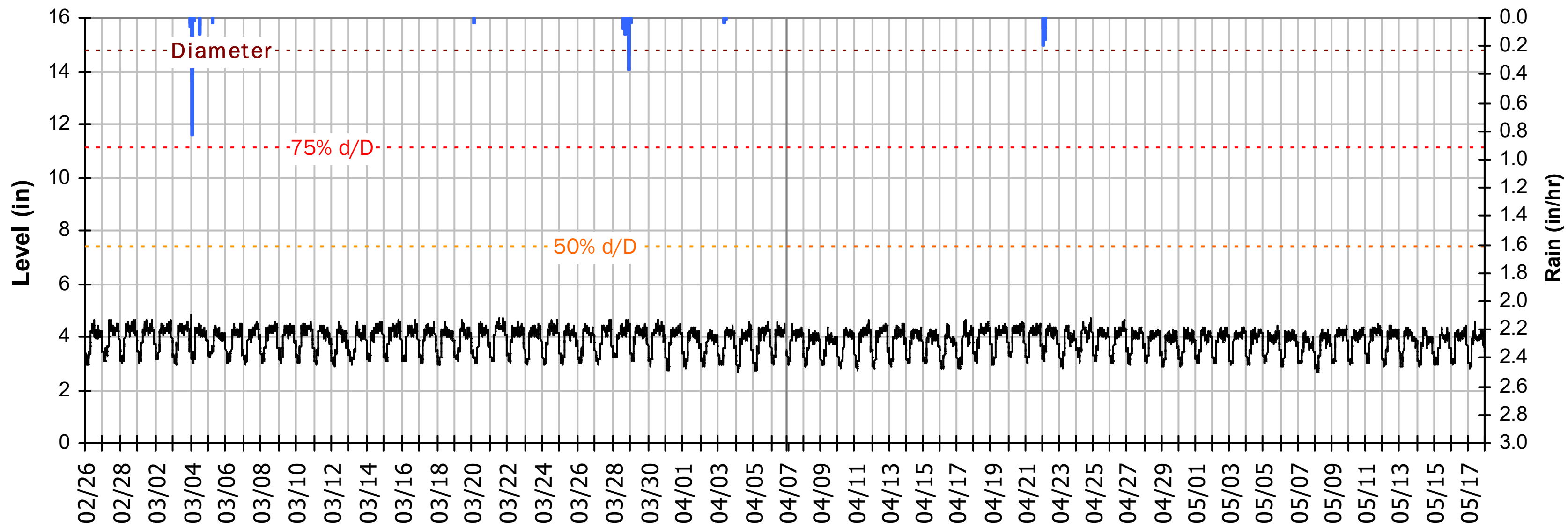


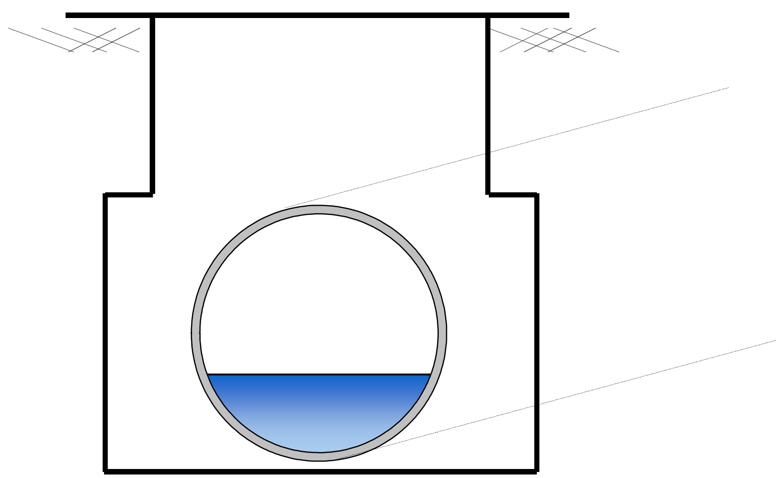


SITE 27

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



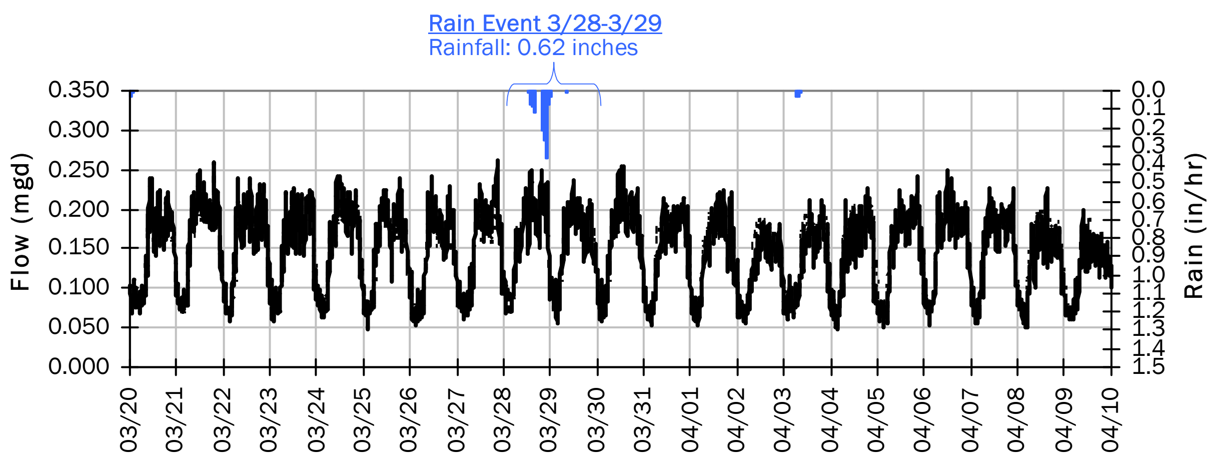


Pipe Diameter:	14.8	*inches*
Peak Measured Level:	4.85	*inches*
Peak d/D Ratio:	0.33	

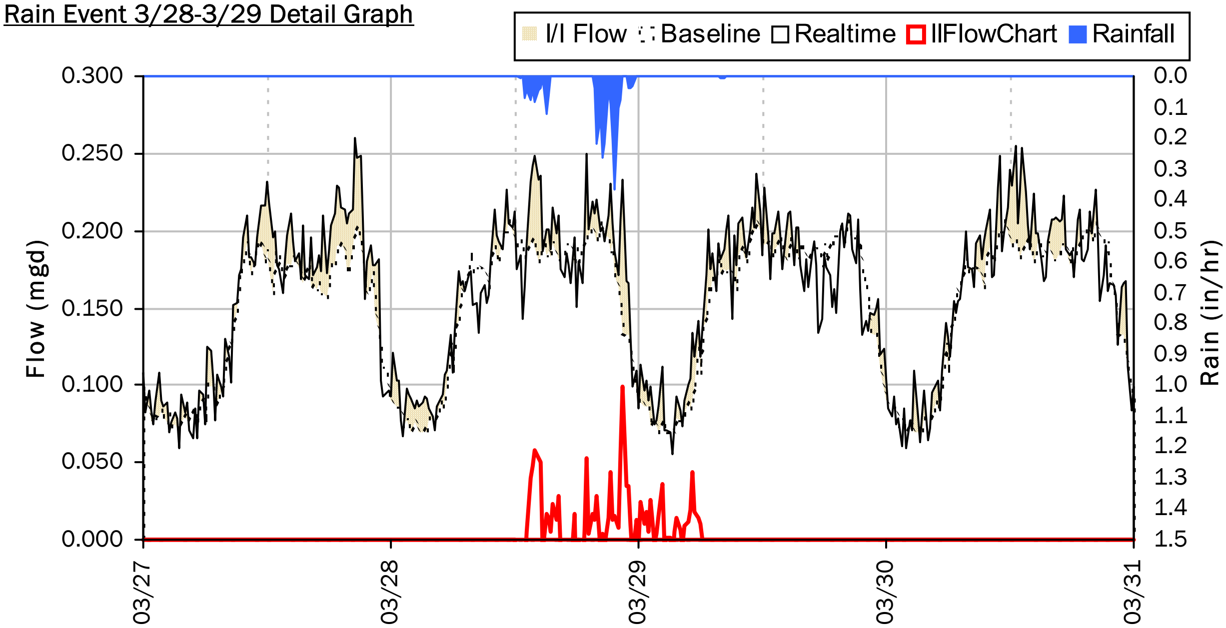
SITE 27

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.62 inches)

Capacity

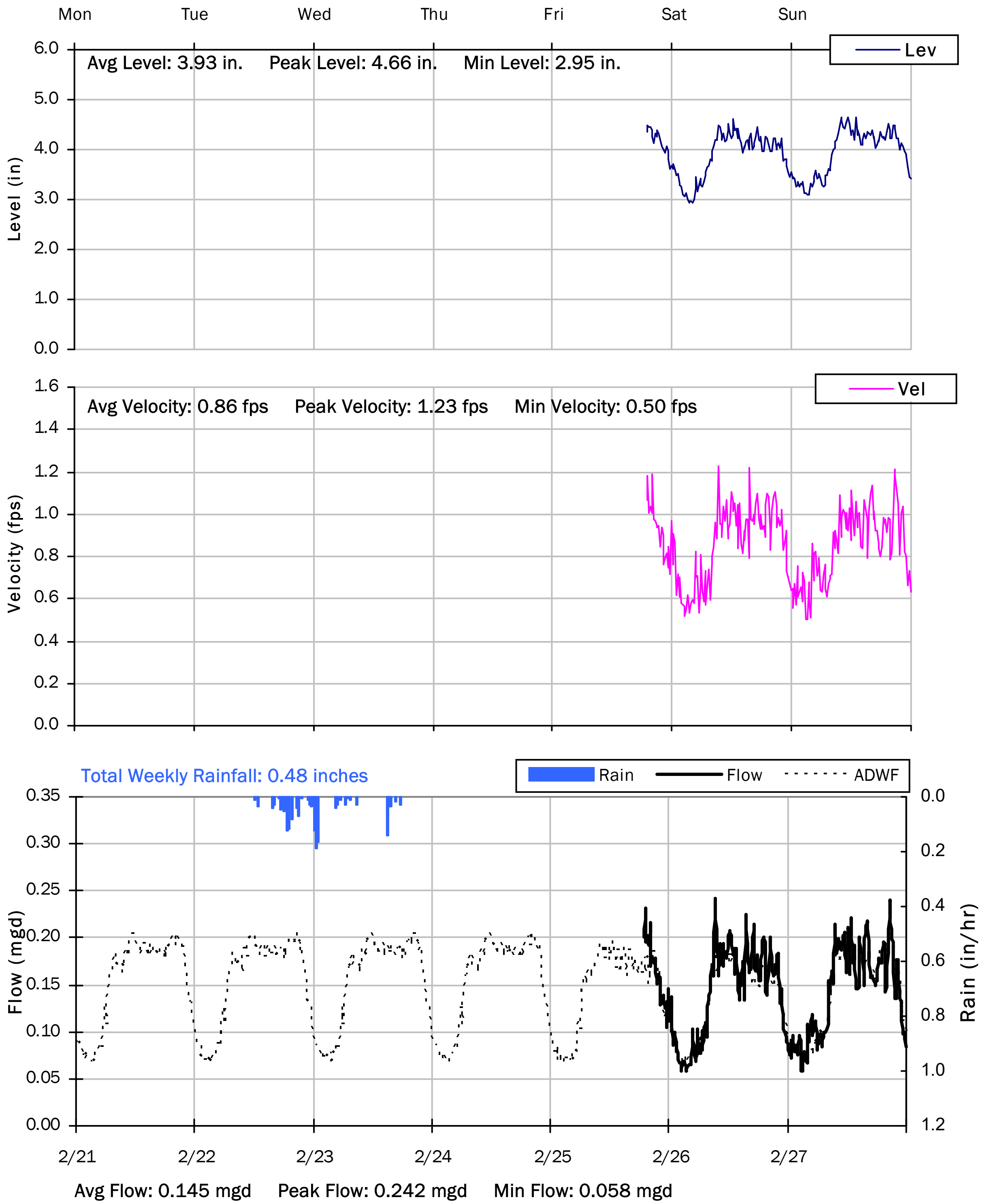
Peak Flow: 0.250 *mgd*
PF: 1.69

Peak Level: 4.62 *in*
d/D Ratio: 0.31

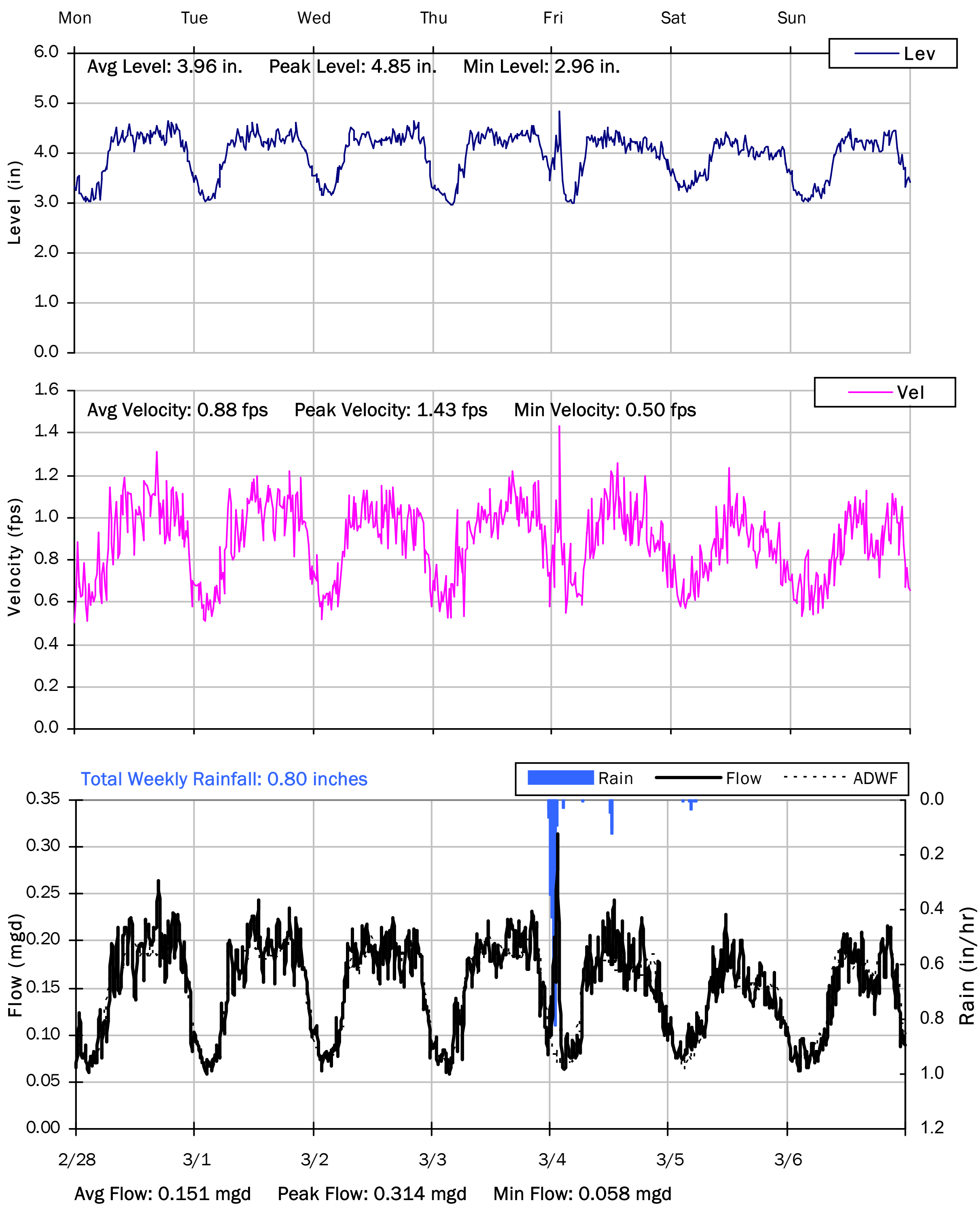
Inflow / Infiltration

Peak I/I Rate: 0.099 *mgd*
Total I/I: 9,000 *gallons*

SITE 27
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



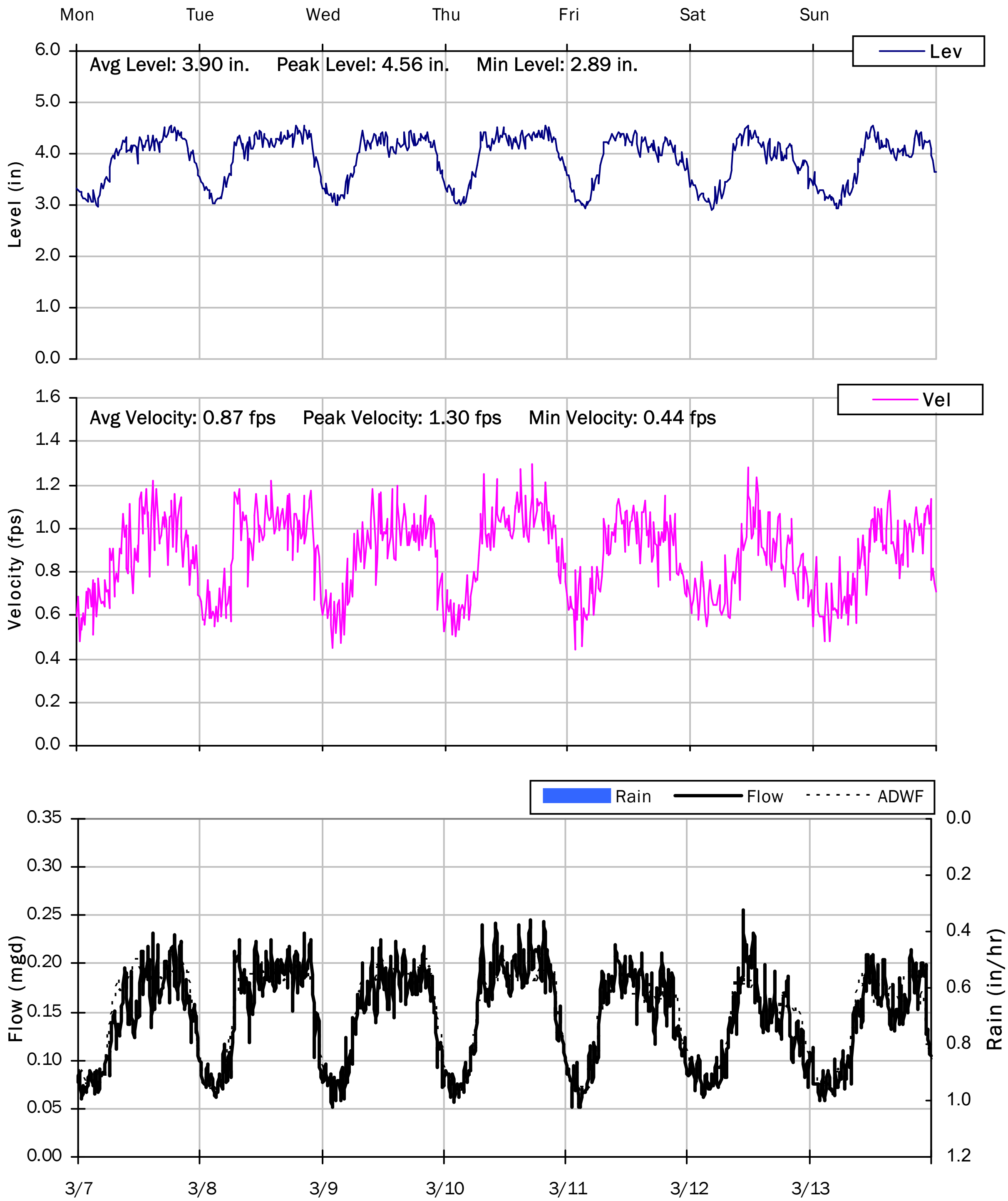
SITE 27
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



SITE 27

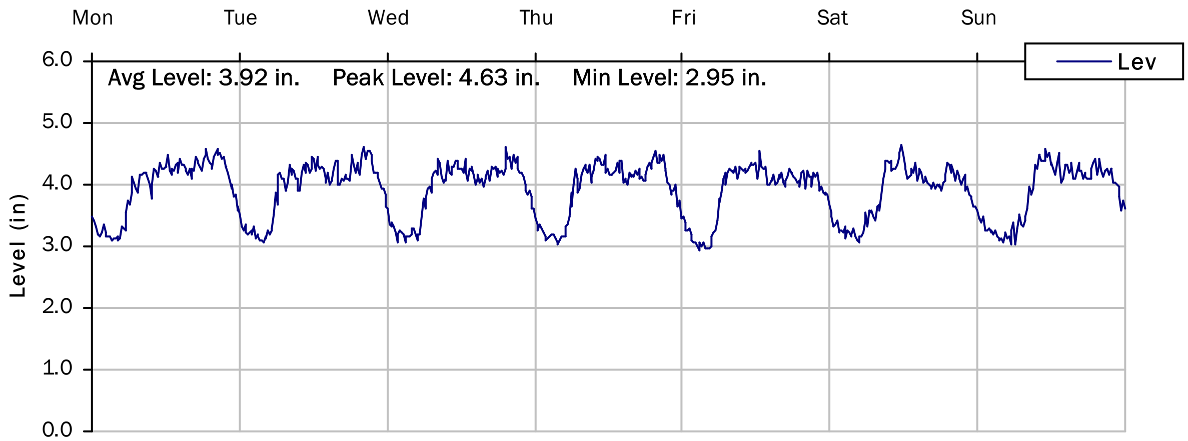
Weekly Level, Velocity and Flow Hydrographs

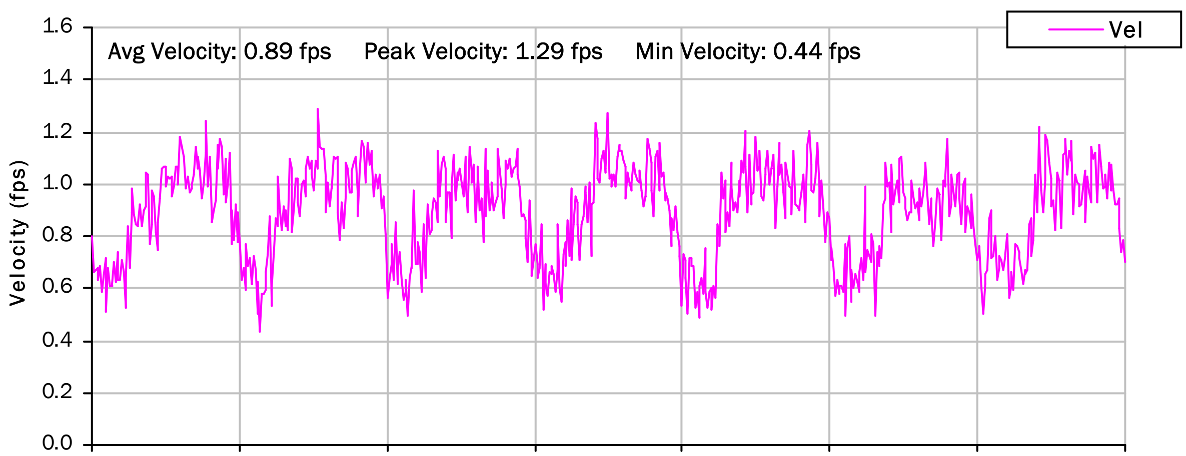
3/7/2022 to 3/14/2022

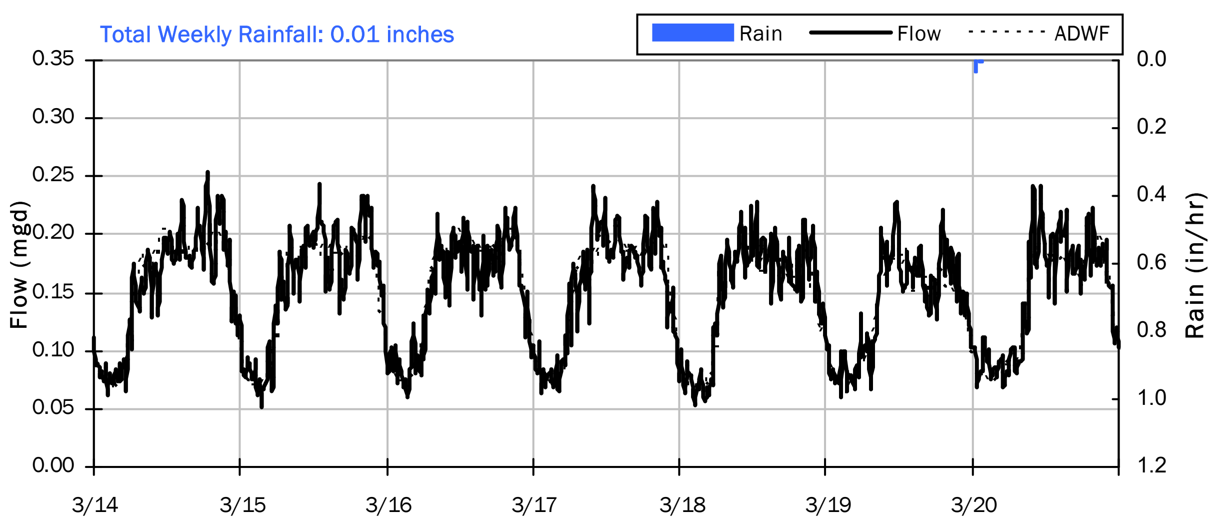


Avg Flow: 0.146 mgd   Peak Flow: 0.255 mgd   Min Flow: 0.052 mgd

SITE 27
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022

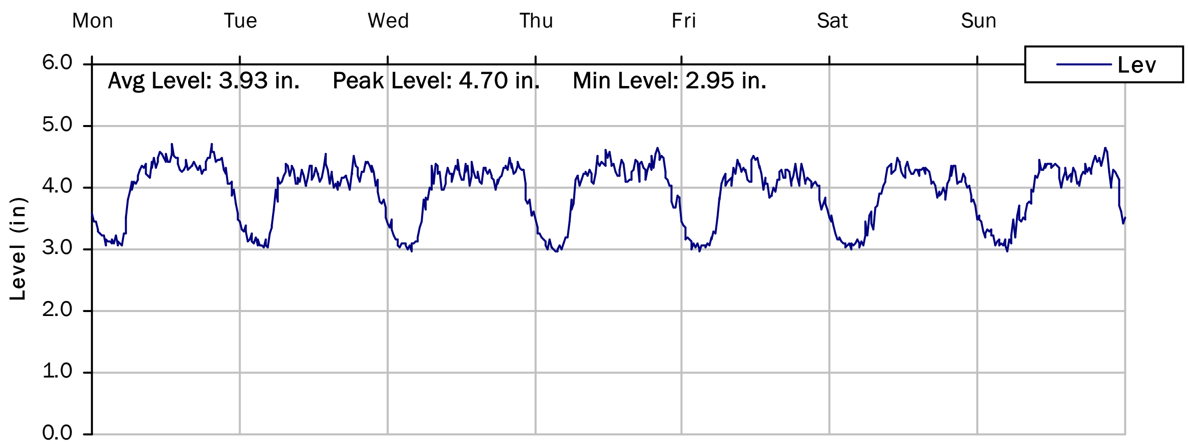


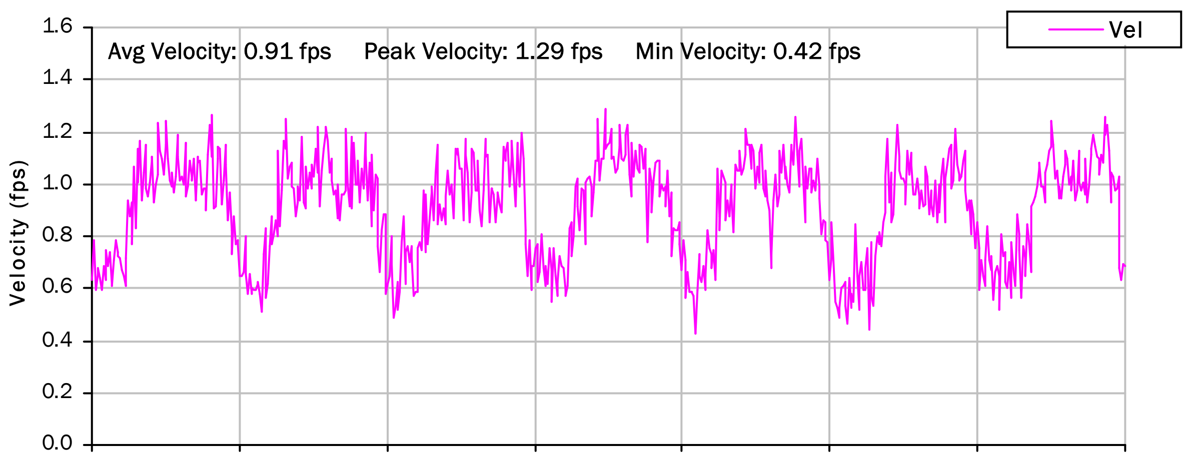


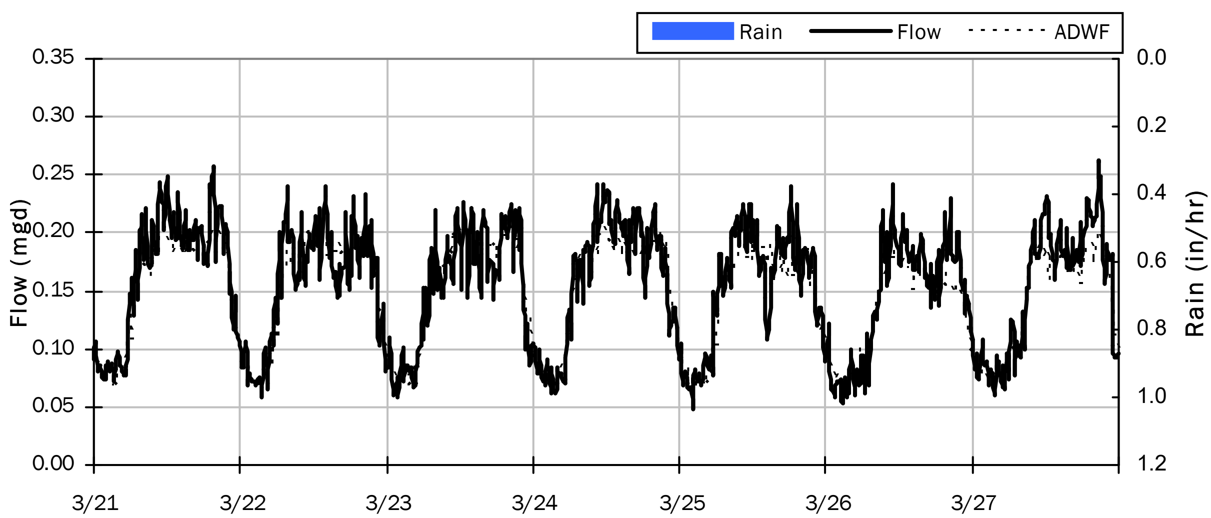


Avg Flow: 0.150 mgd Peak Flow: 0.253 mgd Min Flow: 0.051 mgd

SITE 27
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022

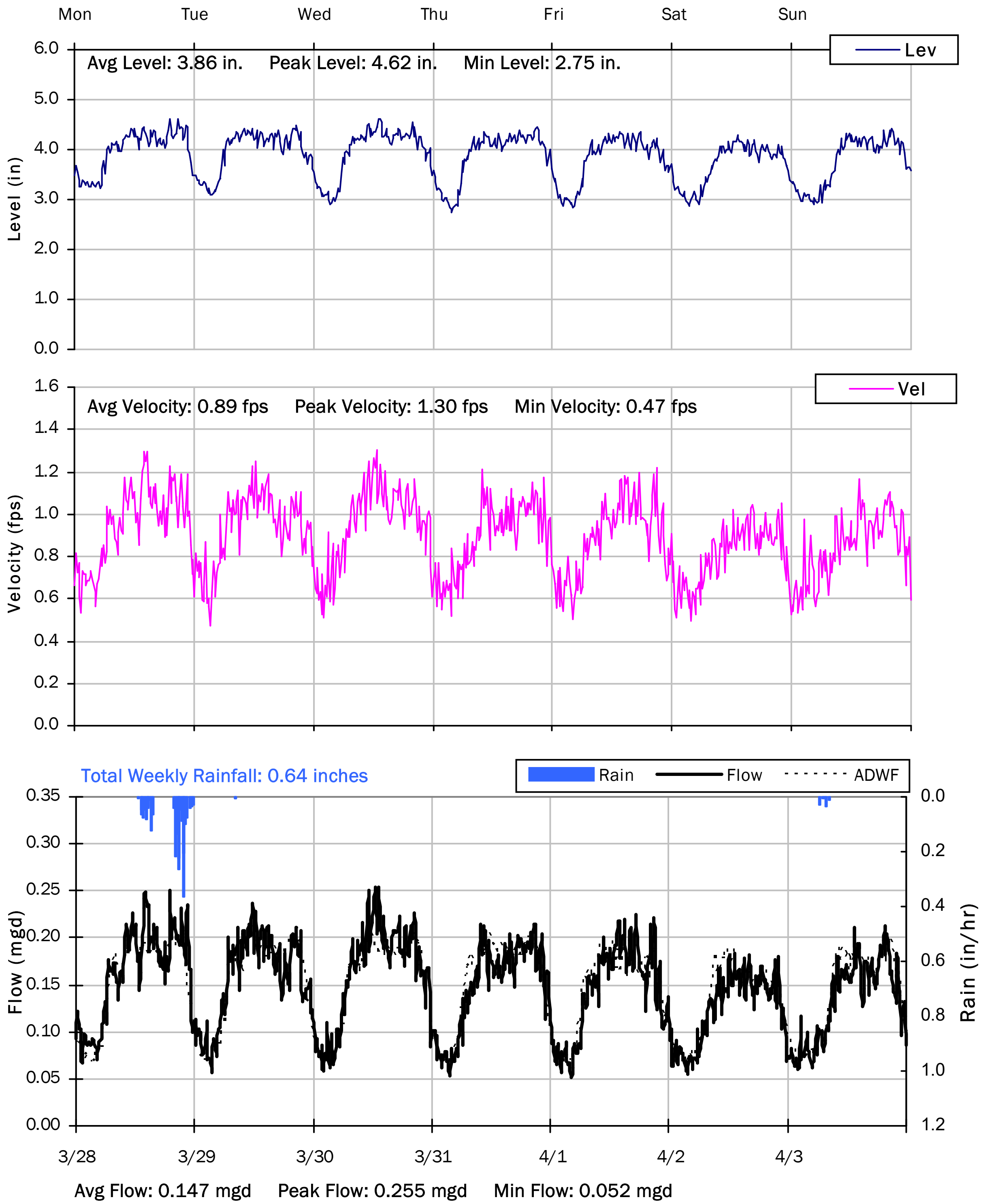




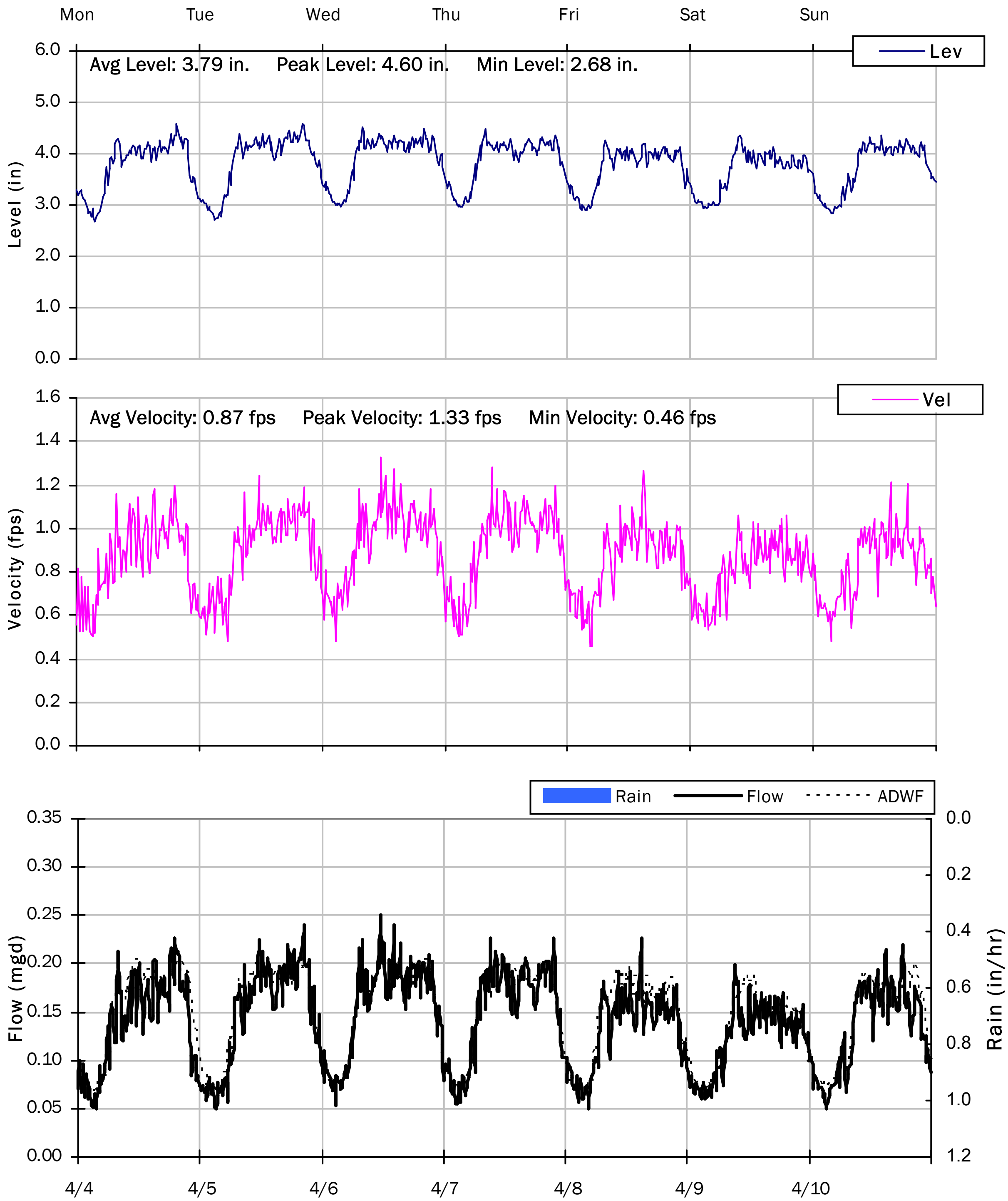


Avg Flow: 0.155 mgd   Peak Flow: 0.261 mgd   Min Flow: 0.048 mgd

SITE 27
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

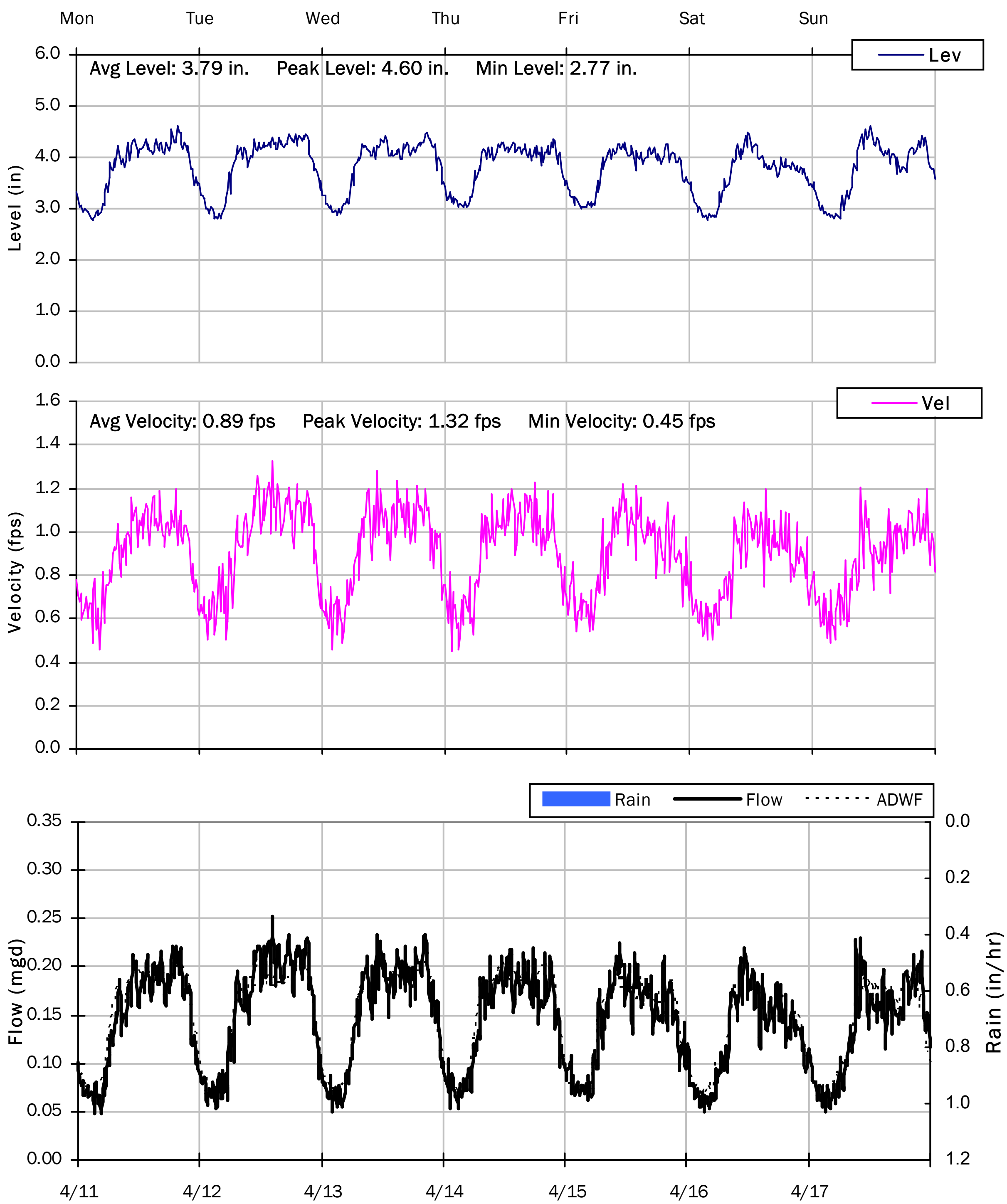


SITE 27
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022



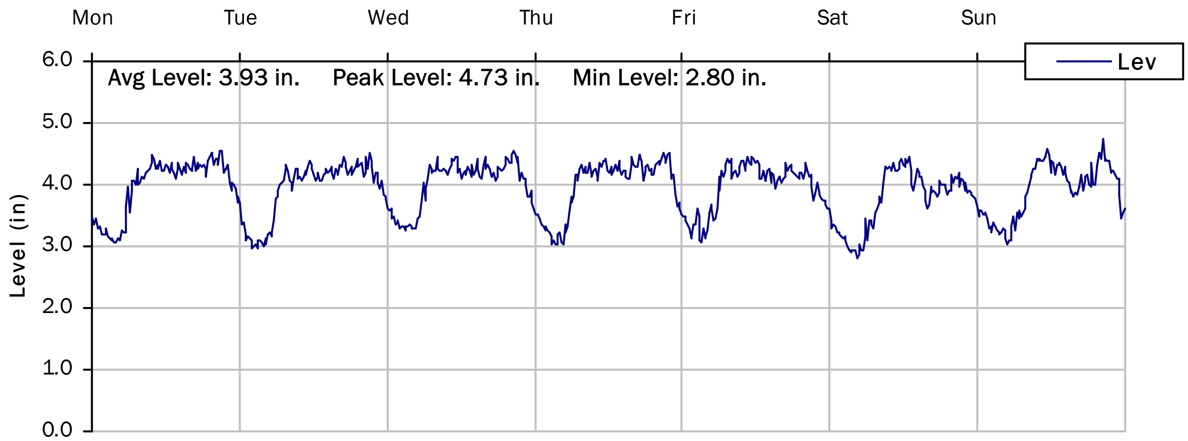
Avg Flow: 0.140 mgd   Peak Flow: 0.250 mgd   Min Flow: 0.049 mgd

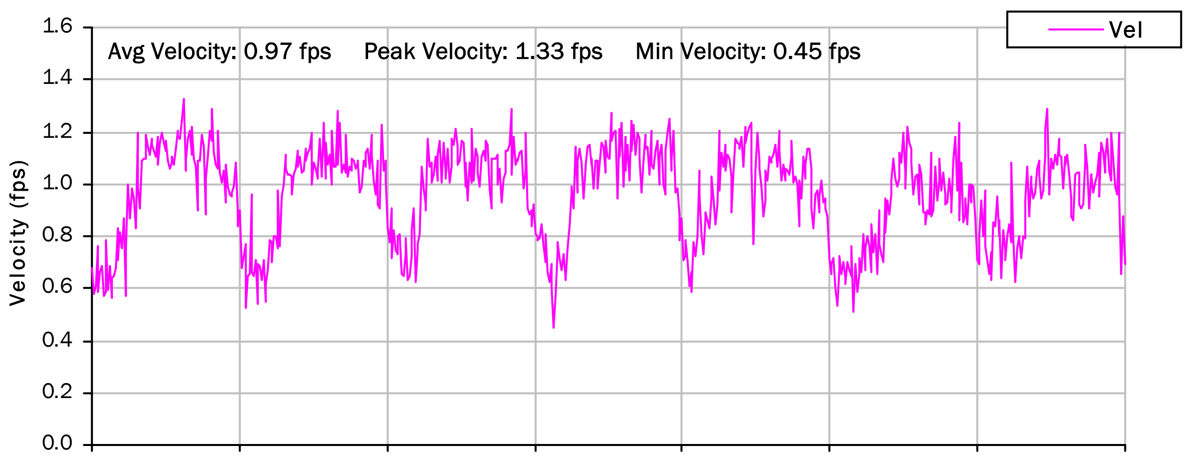
SITE 27
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

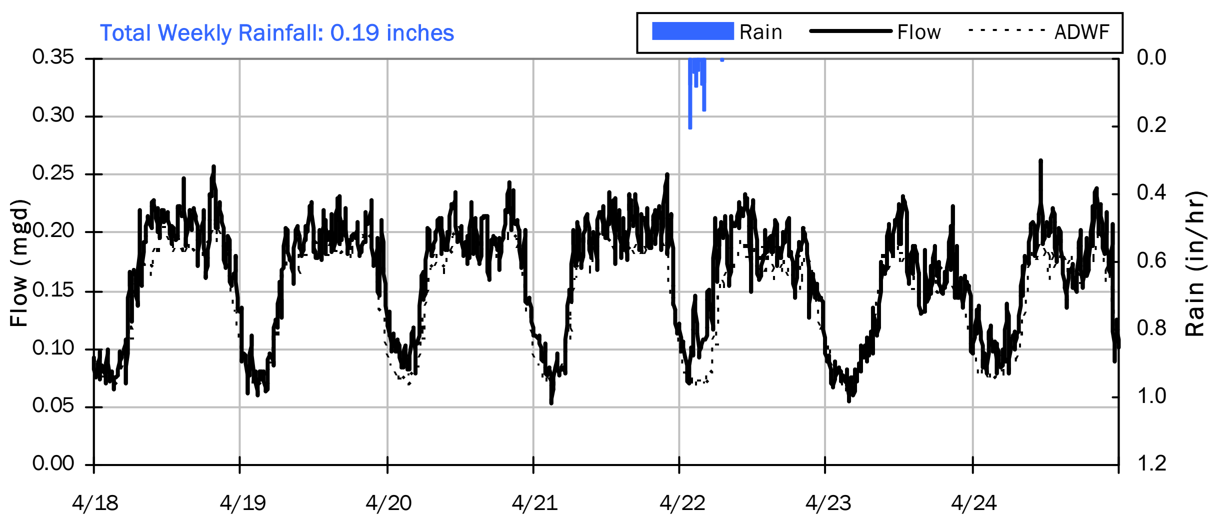


Avg Flow: 0.145 mgd   Peak Flow: 0.252 mgd   Min Flow: 0.049 mgd

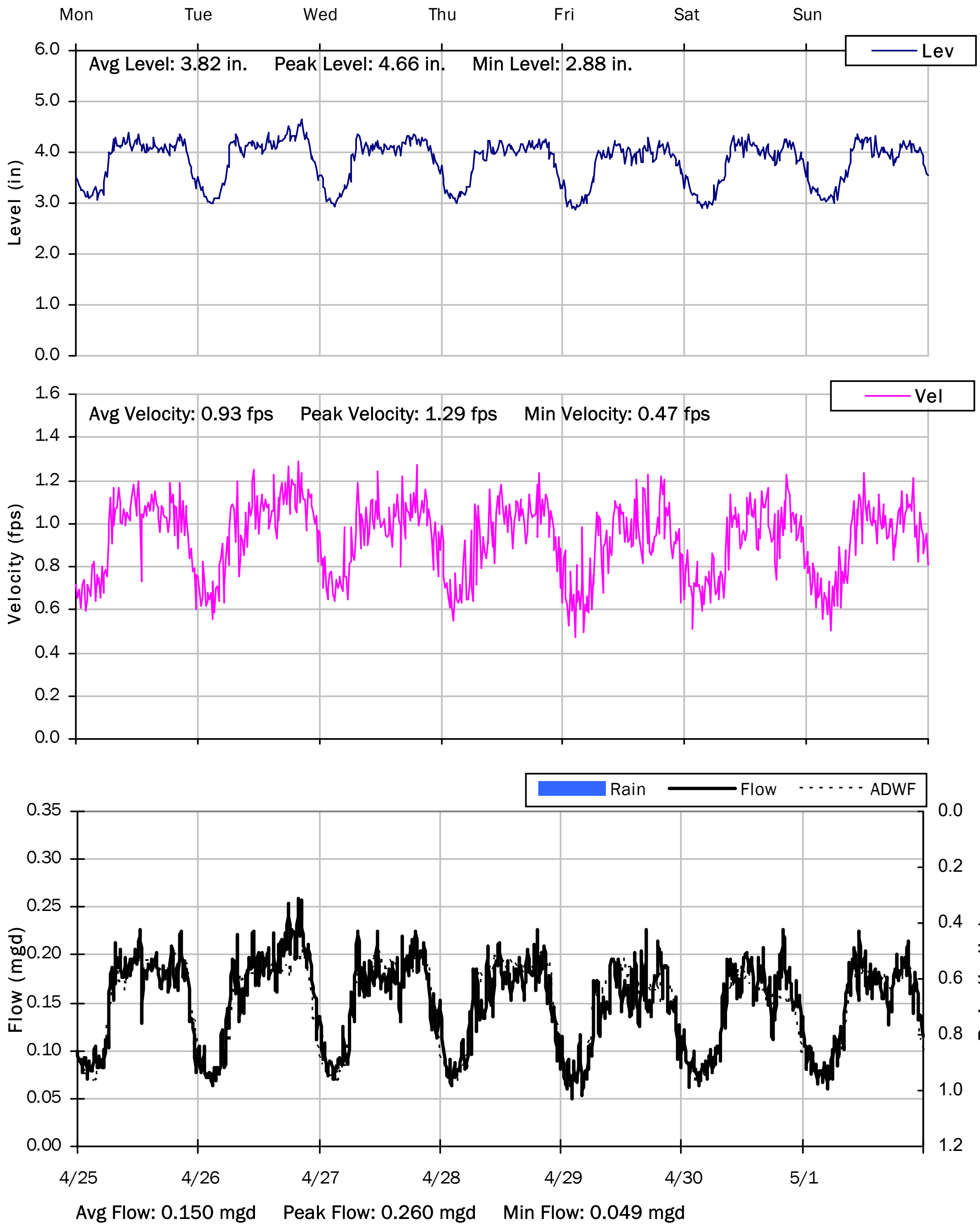
SITE 27
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



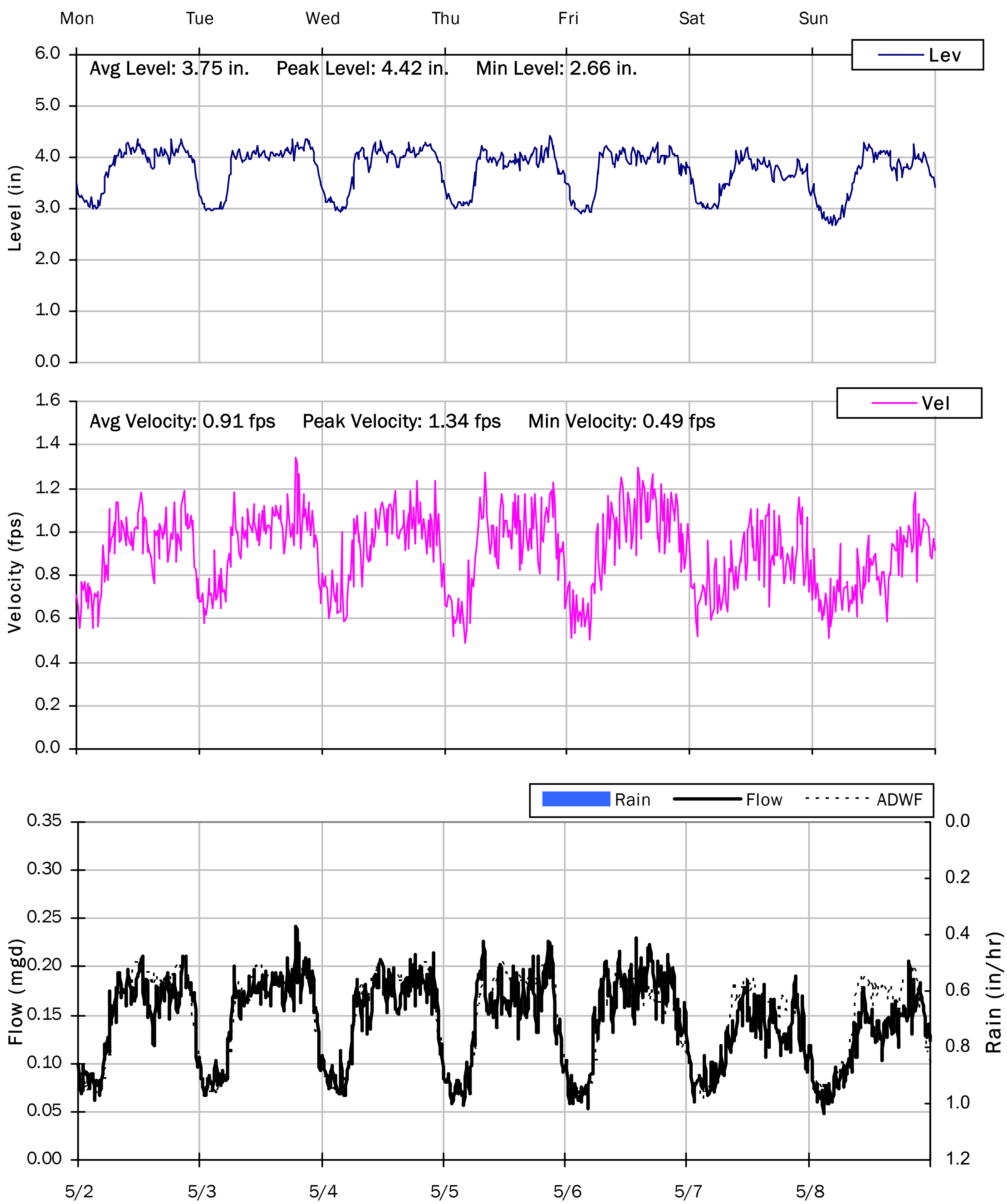




SITE 27
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

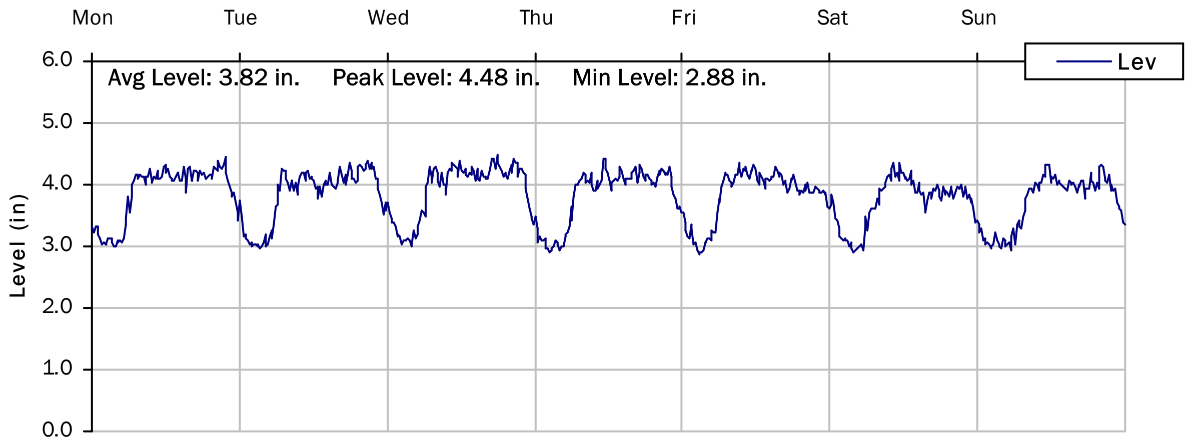


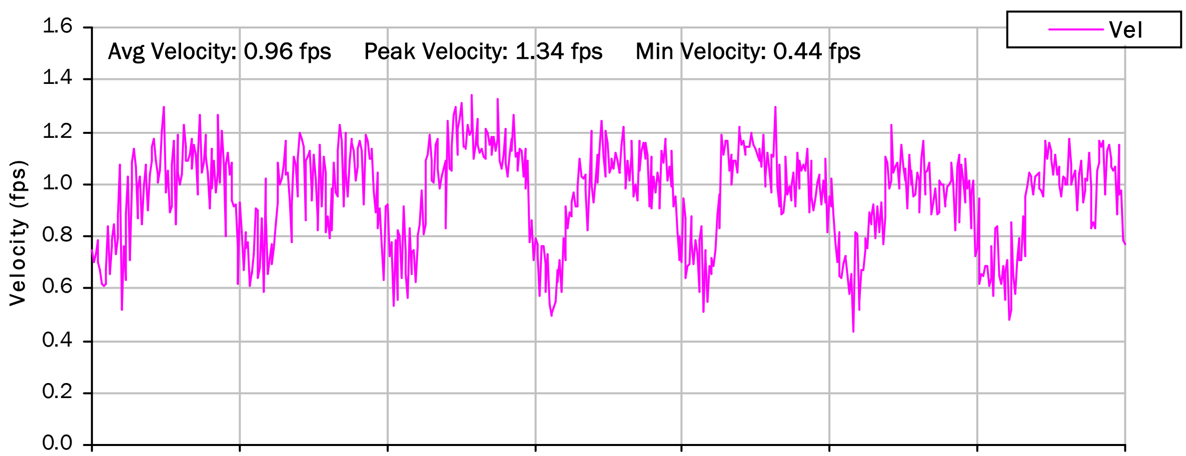
SITE 27
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

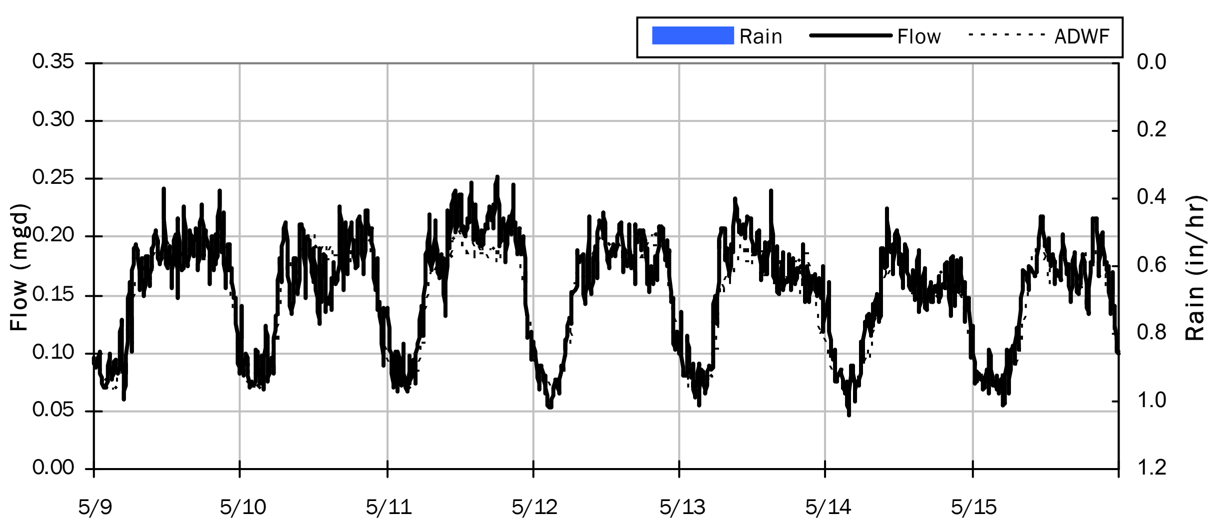


Avg Flow: 0.143 mgd Peak Flow: 0.243 mgd Min Flow: 0.049 mgd

SITE 27
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022





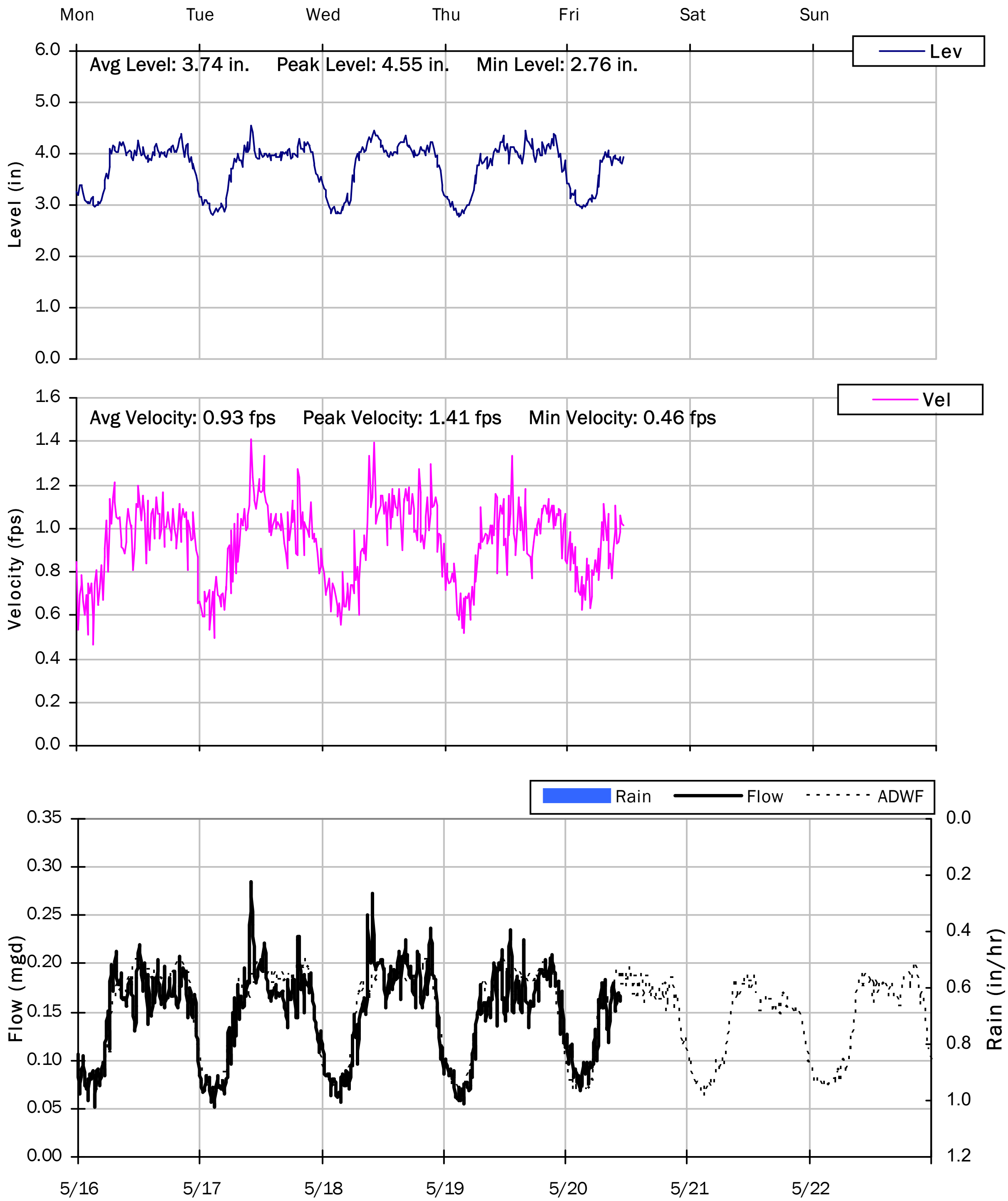


Avg Flow: 0.155 mgd Peak Flow: 0.250 mgd Min Flow: 0.047 mgd

SITE 27

Weekly Level, Velocity and Flow Hydrographs

5/16/2022 to 5/23/2022



Avg Flow: 0.147 mgd Peak Flow: 0.283 mgd Min Flow: 0.052 mgd

Monitoring Site: Site 28

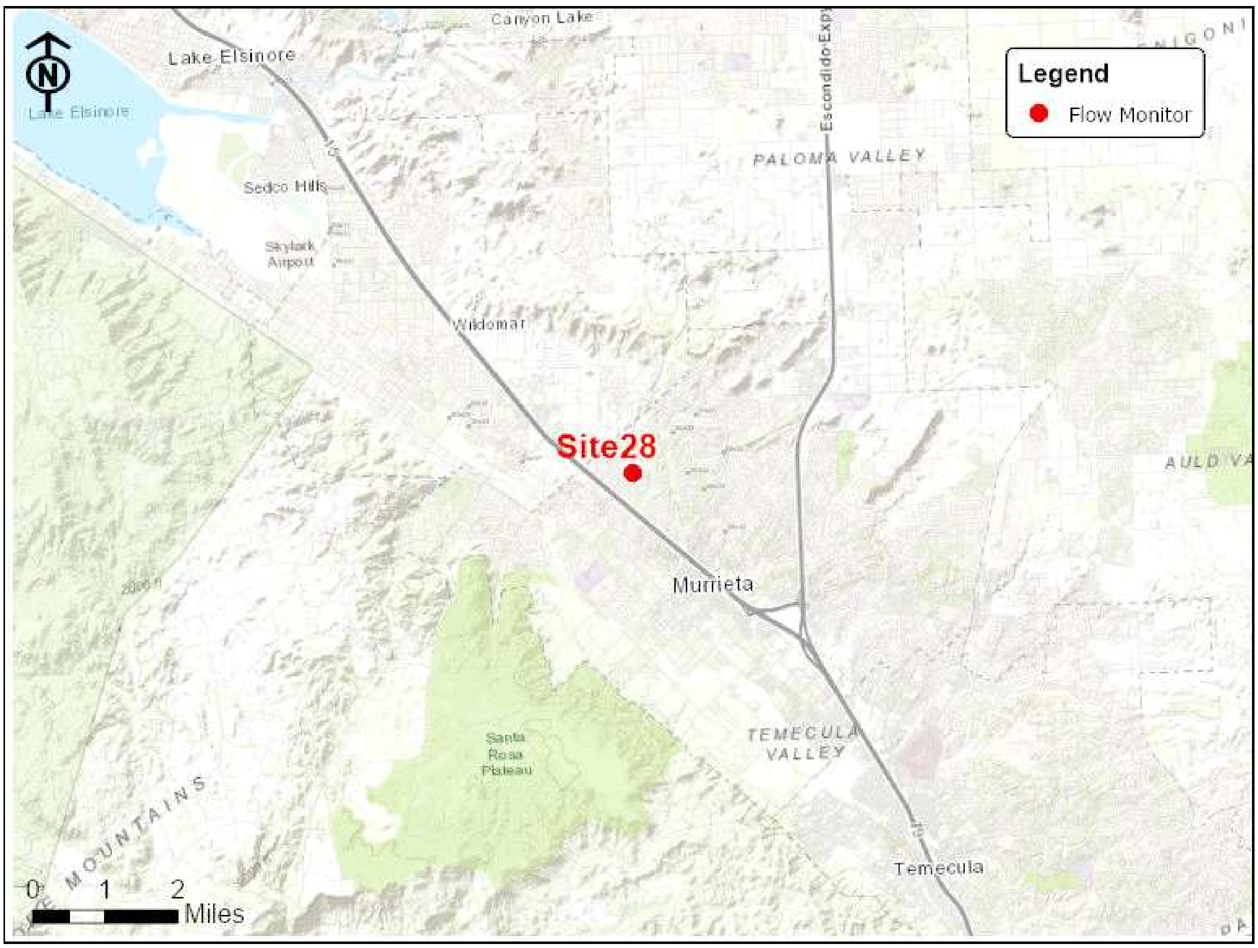
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Nutmeg Street, west of Jackson Avenue

Data Summary Report



Vicinity Map: Site 28

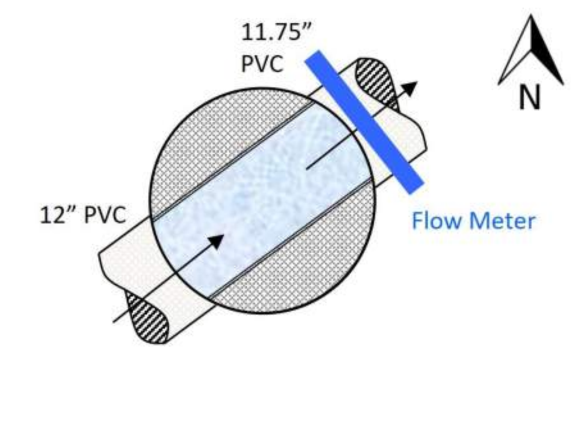
SITE 28

Site Information — MH ID: MH-5909

Location:	Nutmeg Street, west of Jackson Avenue
Coordinates:	117.2204° W, 33.5835° N
Rim Elevation (Earth):	1280 feet
Expected Pipe Diameter:	12 inches
Measured Pipe Diameter:	11.75 inches
ADWF:	0.025 mgd
Peak Measured Flow:	0.252 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch

View from Street


Plan View

SITE 28

Additional Site Photos

Effluent Pipe

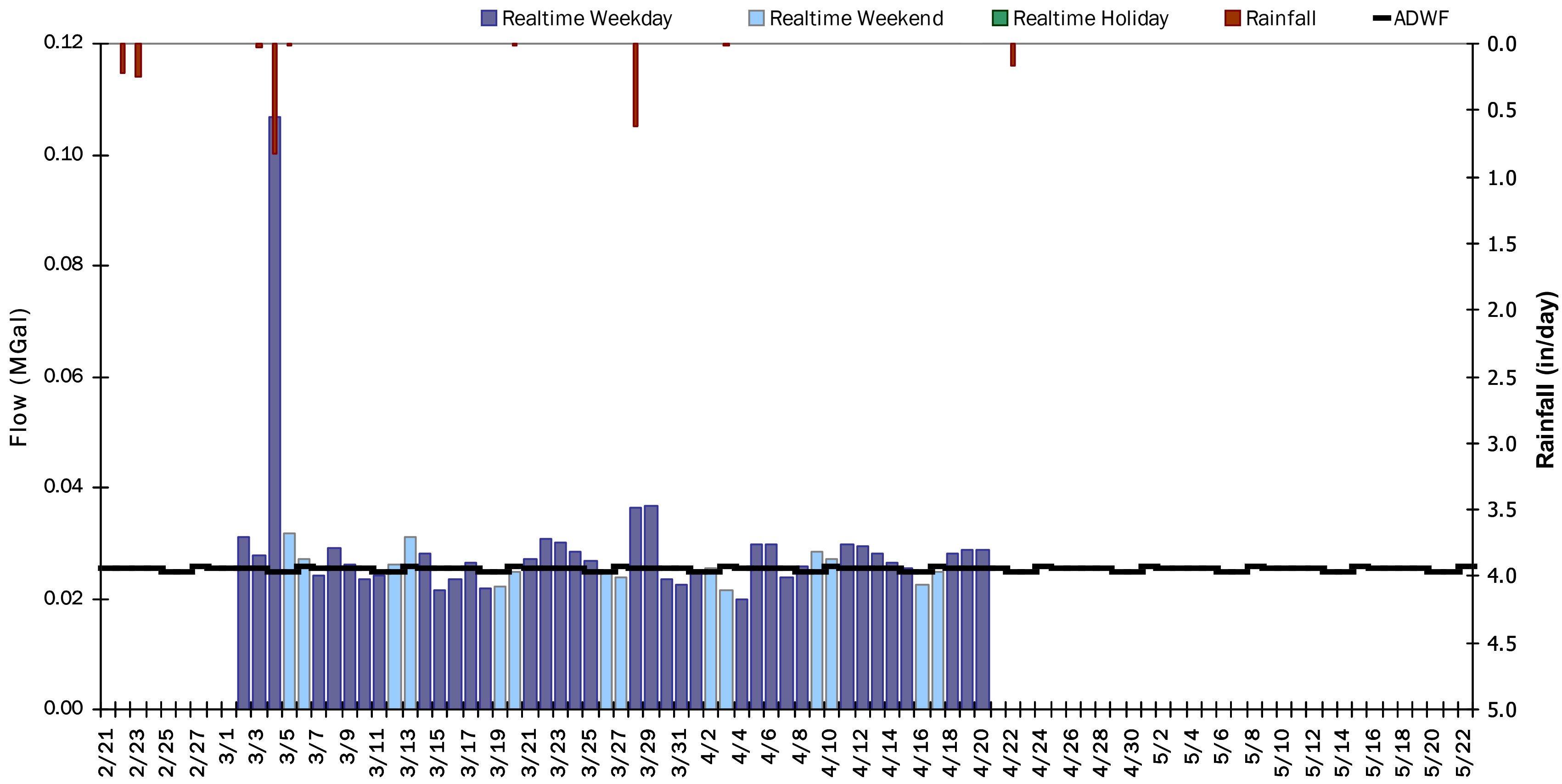
Influent Pipe

SITE 28

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.029 MGal Peak Daily Flow: 0.107 MGal Min Daily Flow: 0.020 MGal

Total Rainfall: 1.51 inches

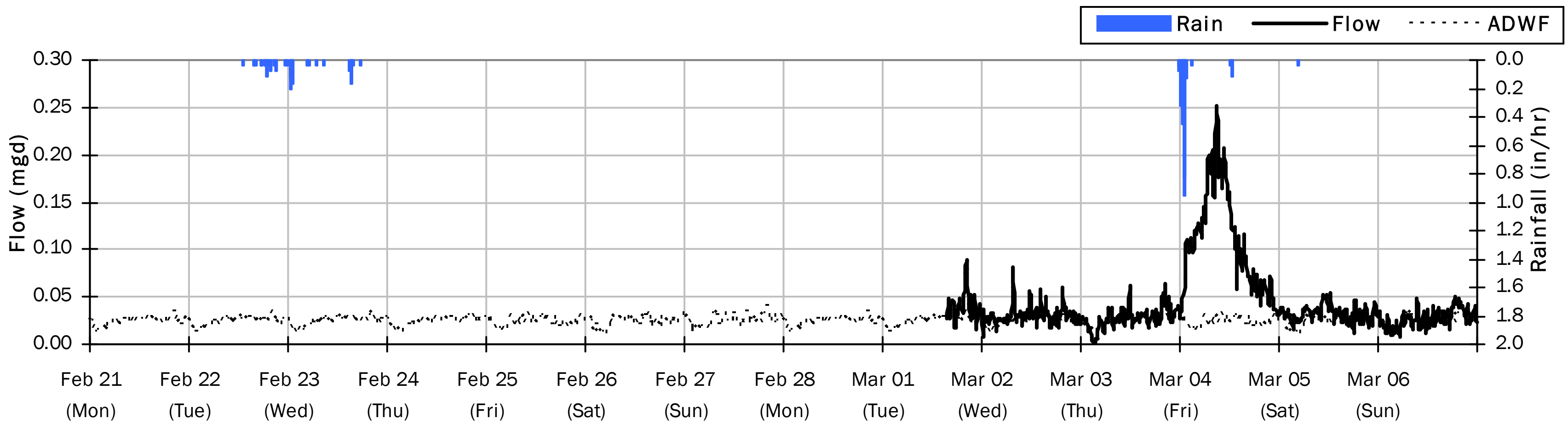


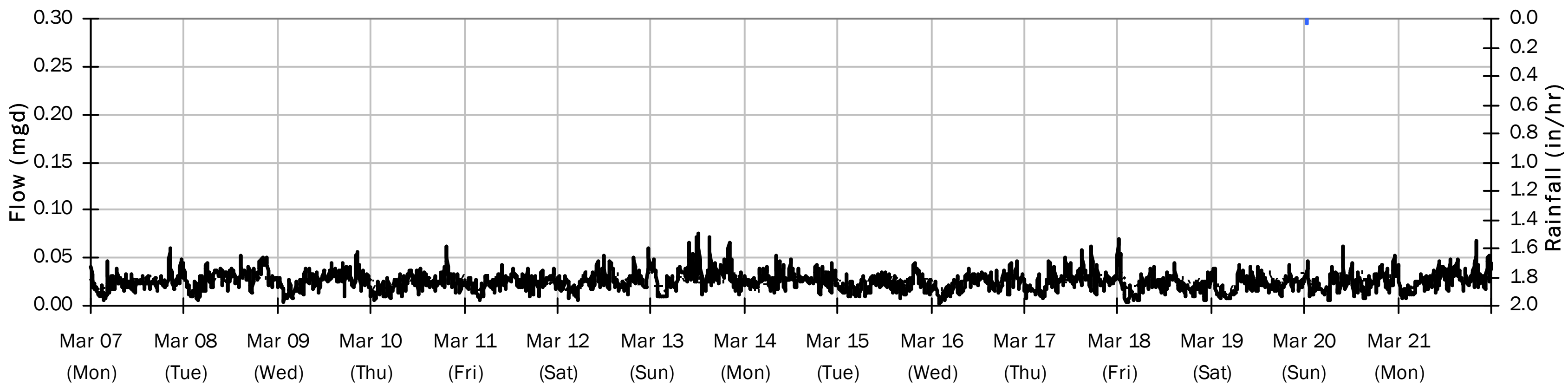
SITE 28

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.35 inches

Period Avg Flow: 0.030 mgd   Period Peak Flow: 0.252 mgd   Period Min Flow: 0.003 mgd



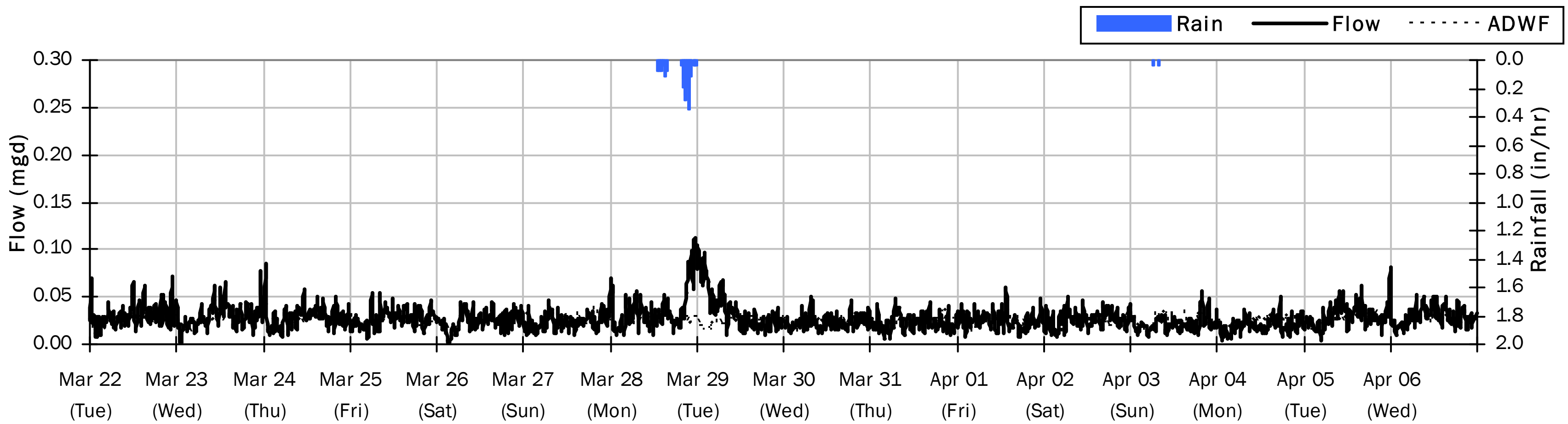


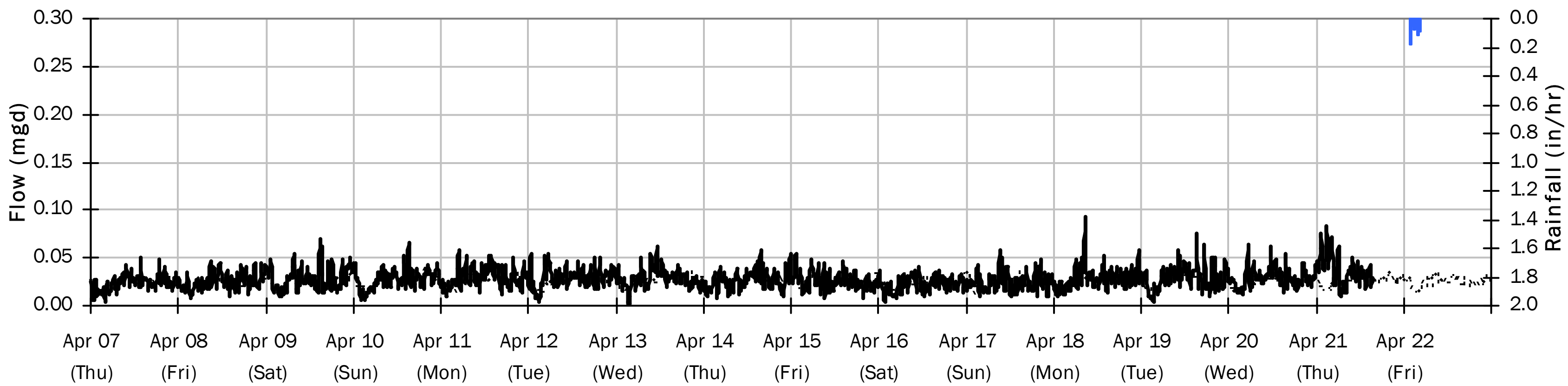
SITE 28

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.80 inches

Period Avg Flow: 0.027 mgd   Period Peak Flow: 0.112 mgd   Period Min Flow: 0.001 mgd



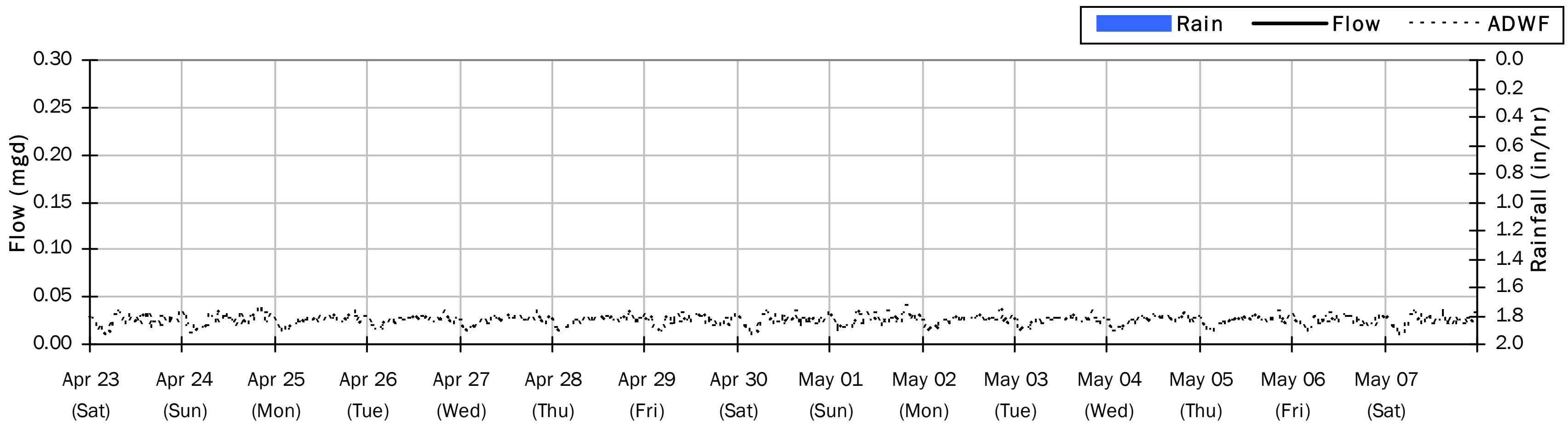


SITE 28

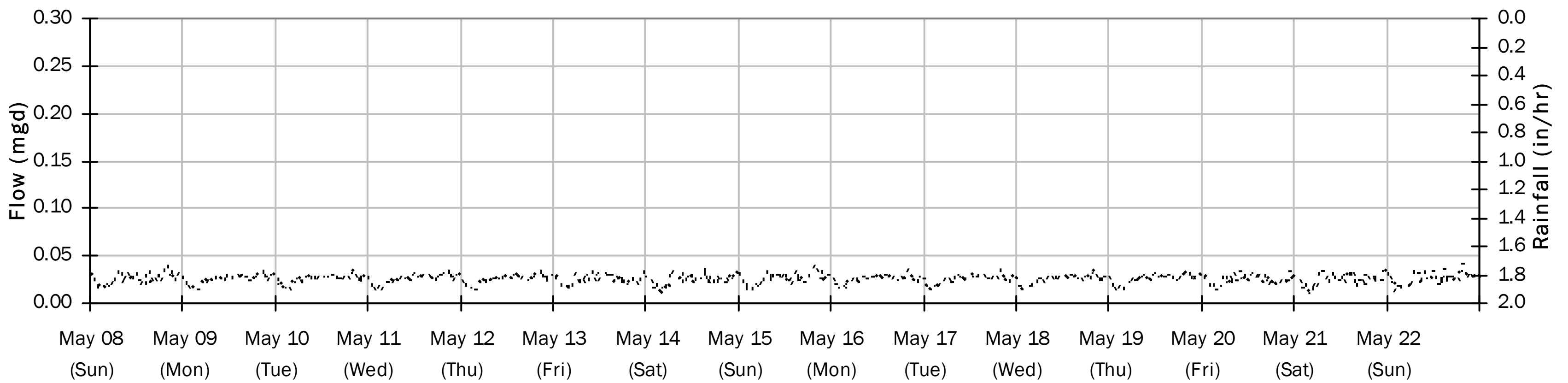
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

Period Avg Flow: mgd   Period Peak Flow: mgd   Period Min Flow: mgd

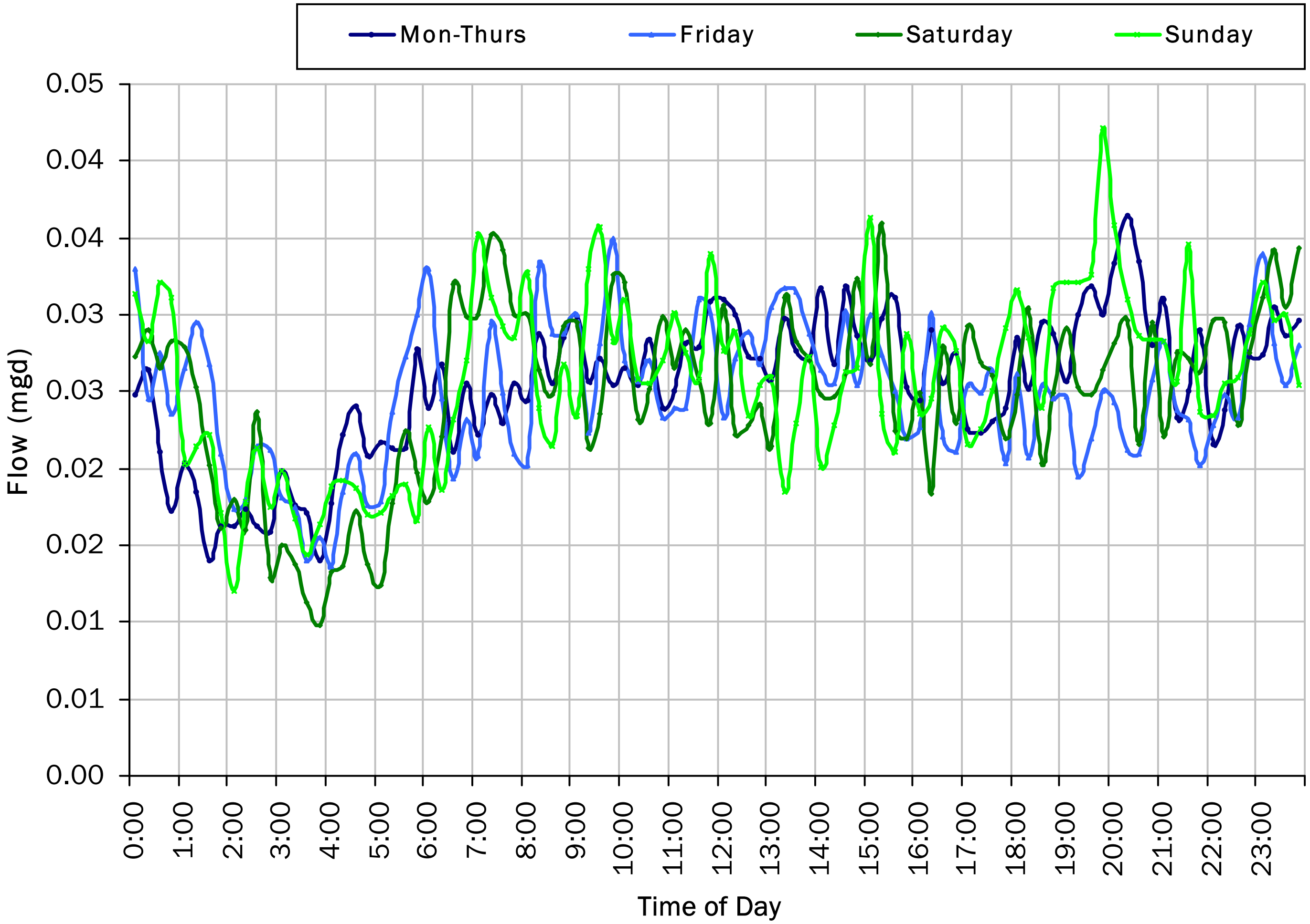


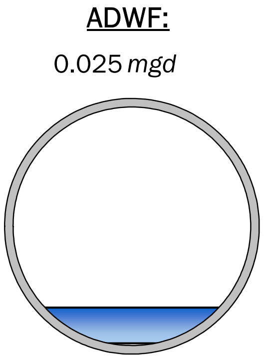
Meter removed



SITE 28

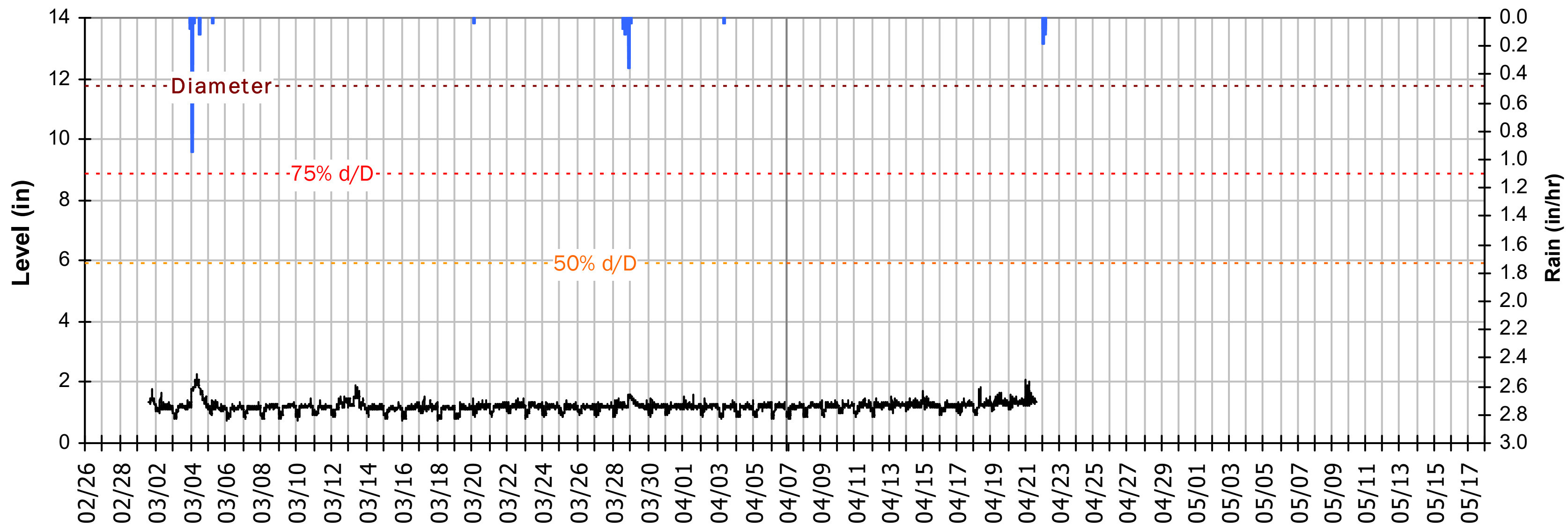
Average Dry Weather Flow Hydrographs

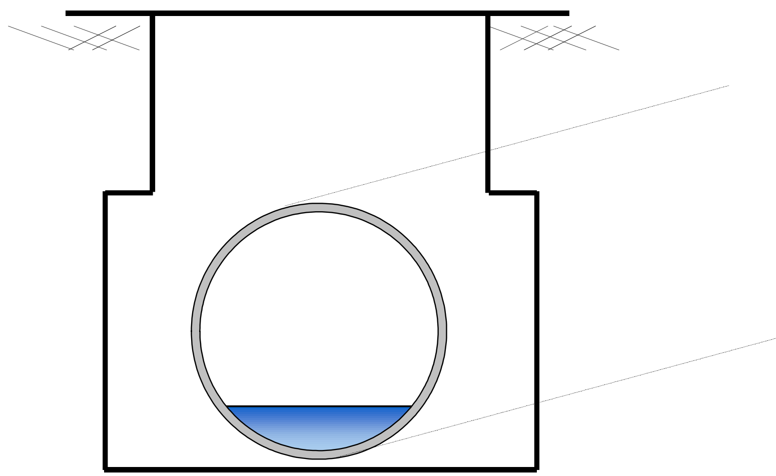




SITE 28
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



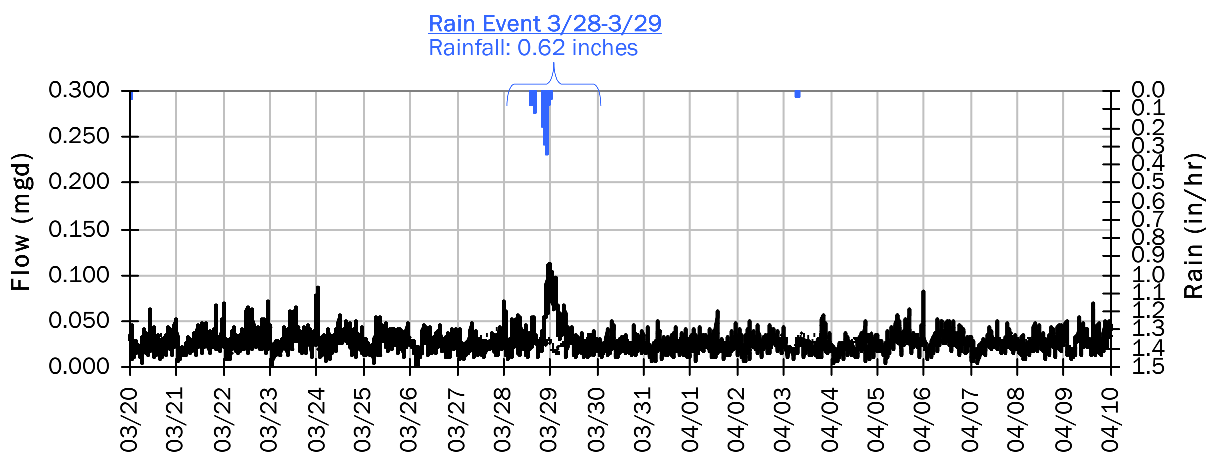


Pipe Diameter:	11.8	*inches*
Peak Measured Level:	2.25	*inches*
Peak d/D Ratio:	0.19	

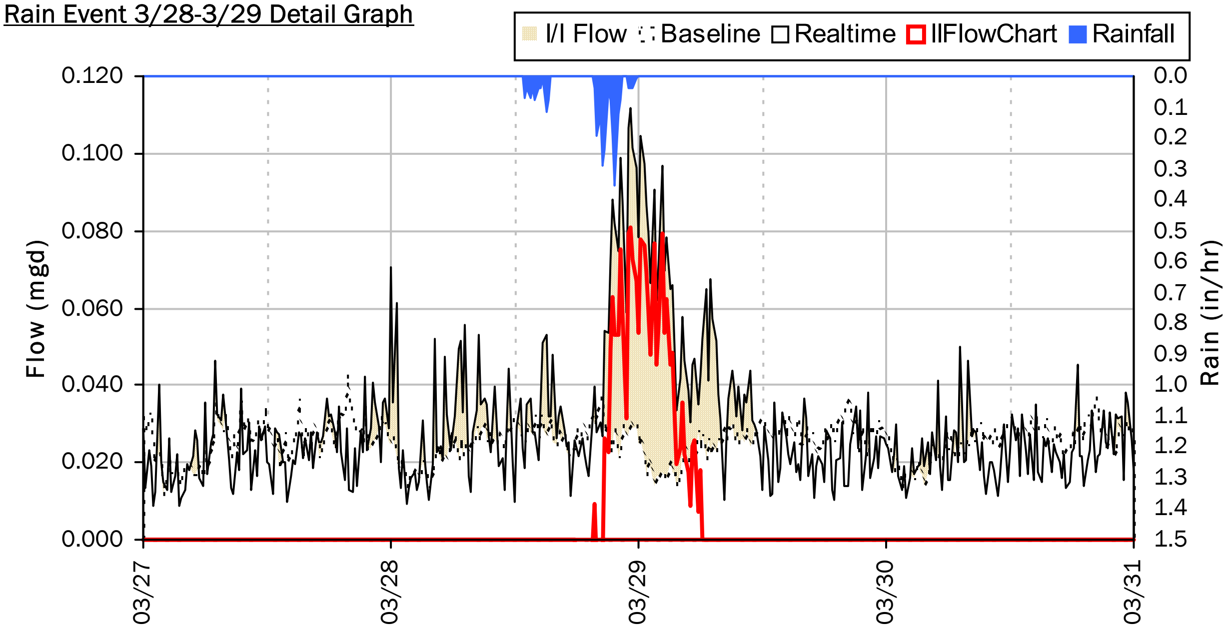
SITE 28

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



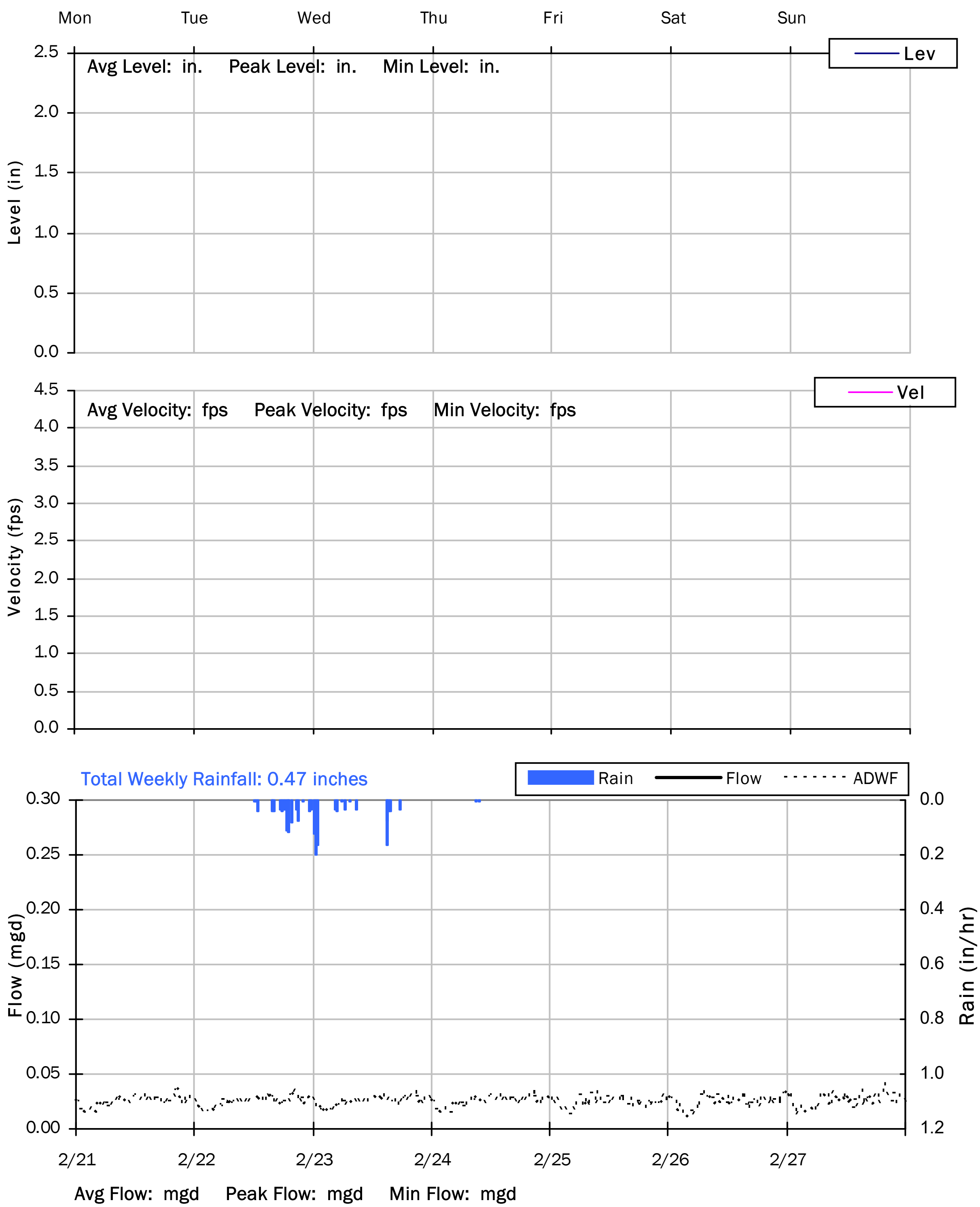
Rain Event 3/28-3/29 Detail Graph



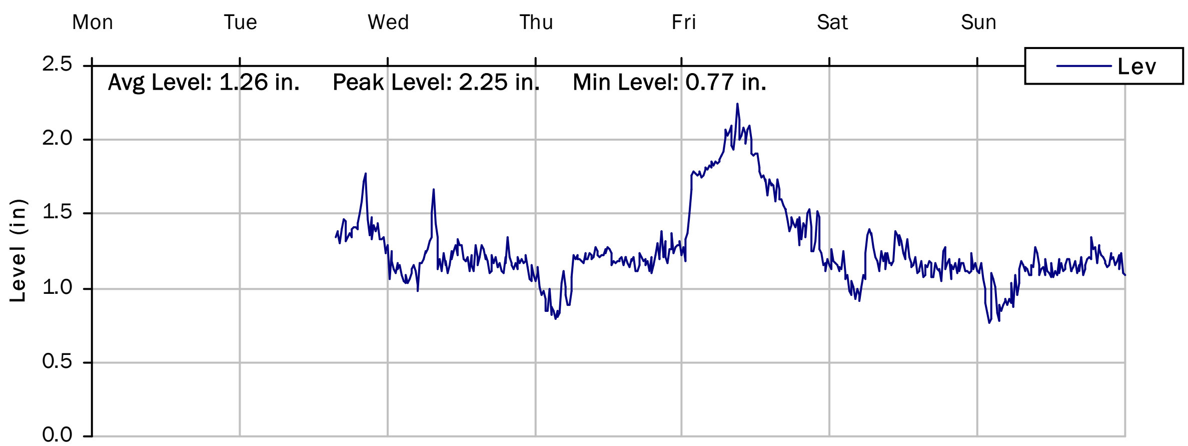
Storm Event I/I Analysis (Rain = 0.62 inches)

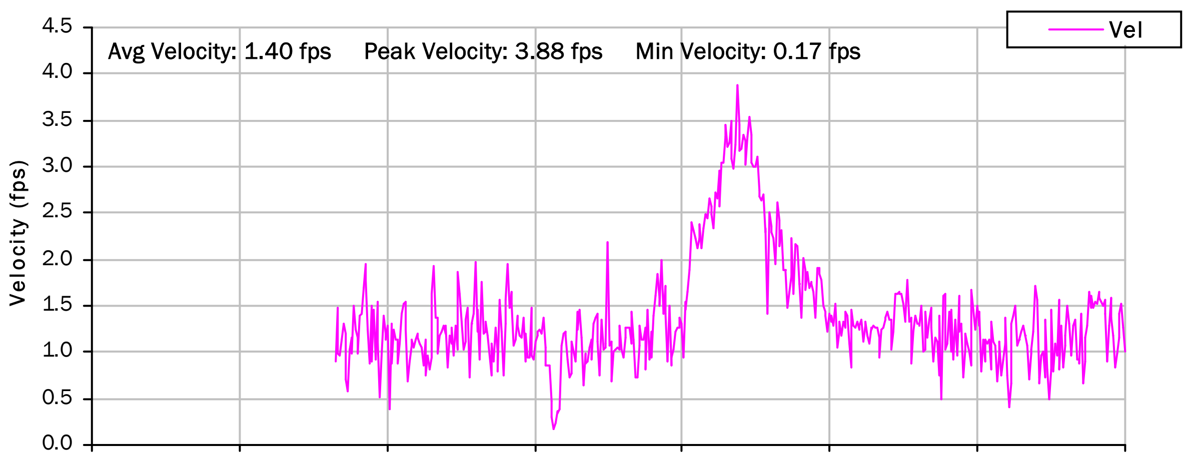
Capacity		Inflow / Infiltration	
Peak Flow:	0.112 *mgd*	Peak I/I Rate:	0.081 *mgd*
PF:	4.41	Total I/I:	18,000 *gallons*
Peak Level:	1.62 *in*		
d/D Ratio:	0.14		

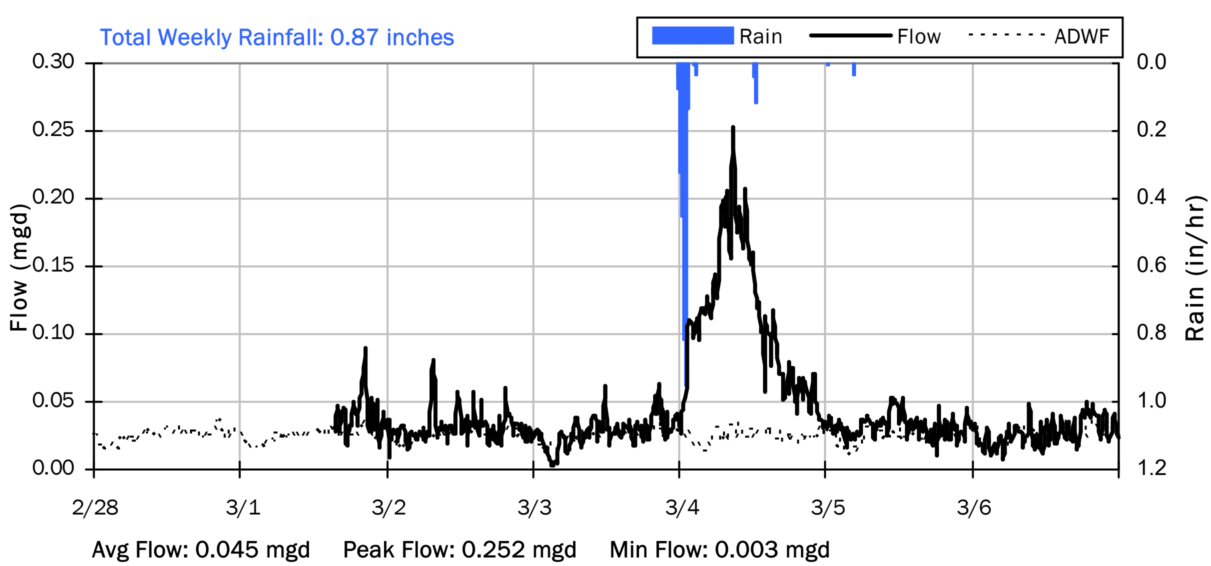
SITE 28
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



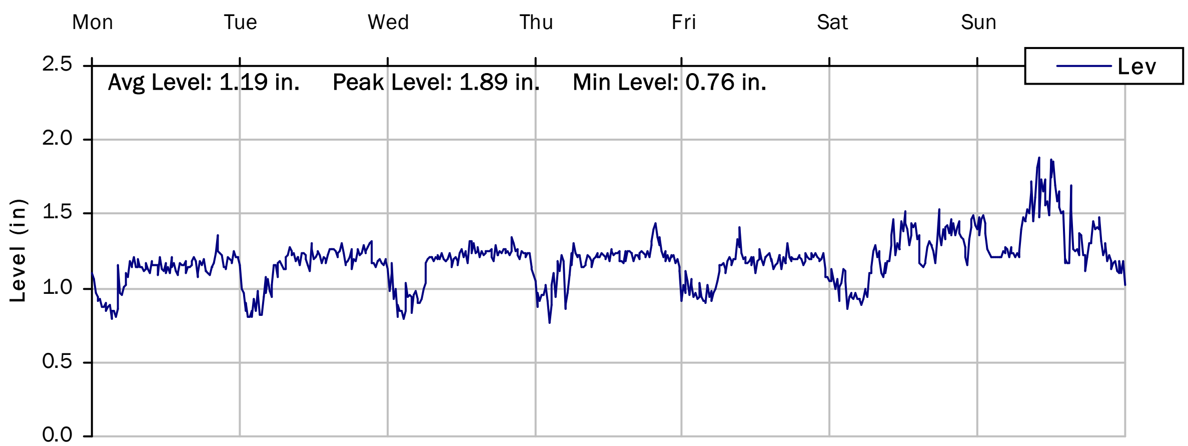
SITE 28
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

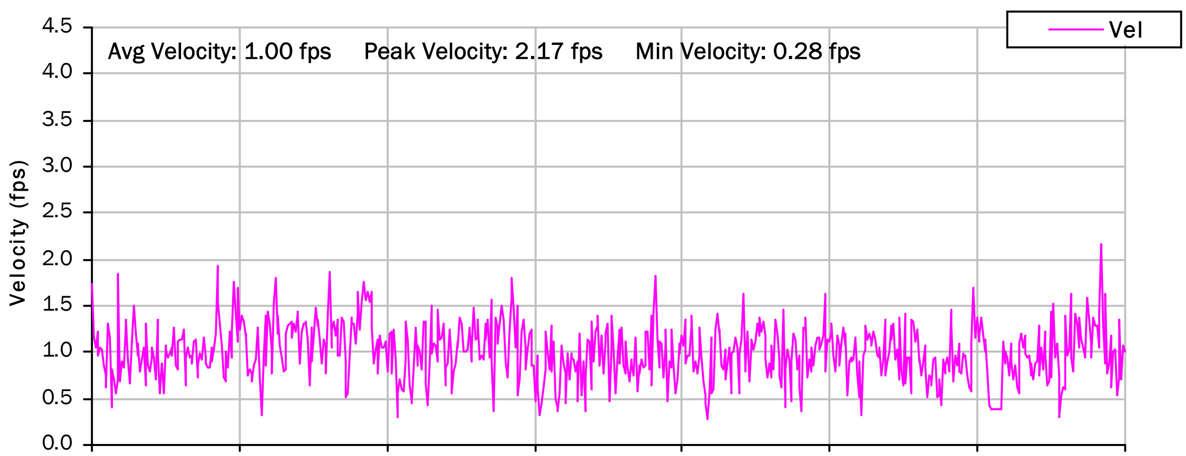


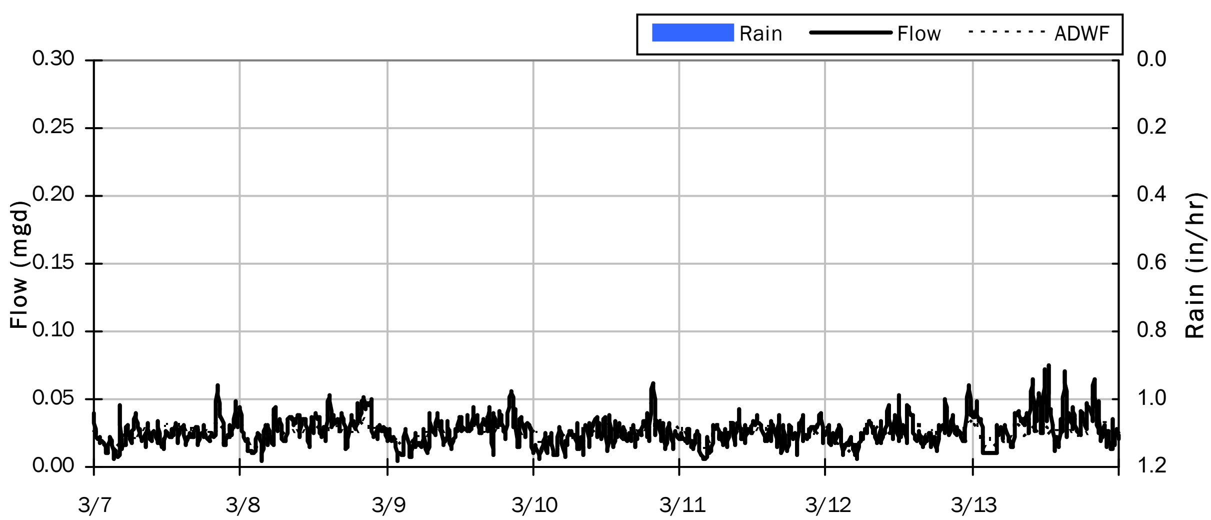




SITE 28
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

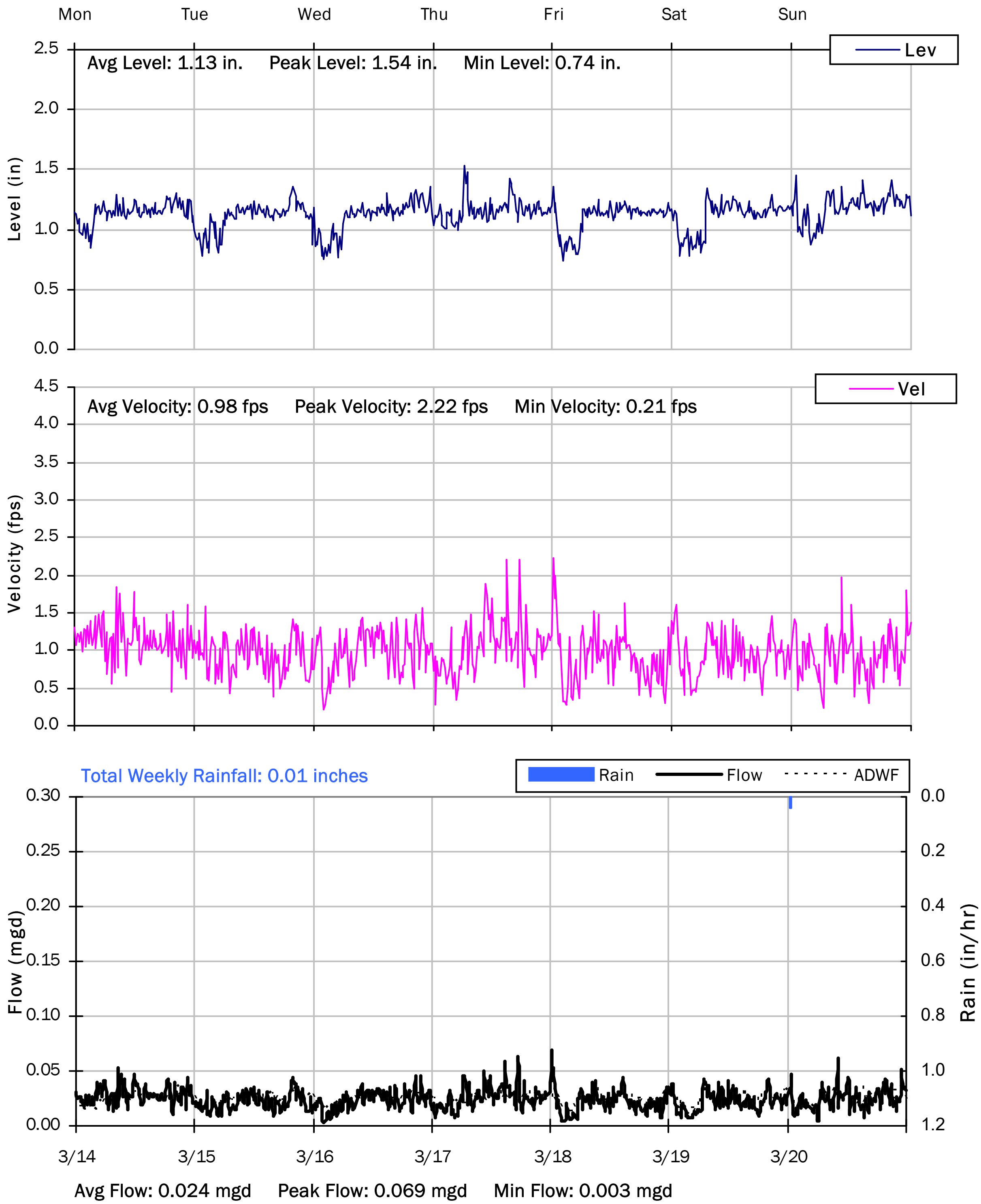






Avg Flow: 0.026 mgd Peak Flow: 0.075 mgd Min Flow: 0.004 mgd

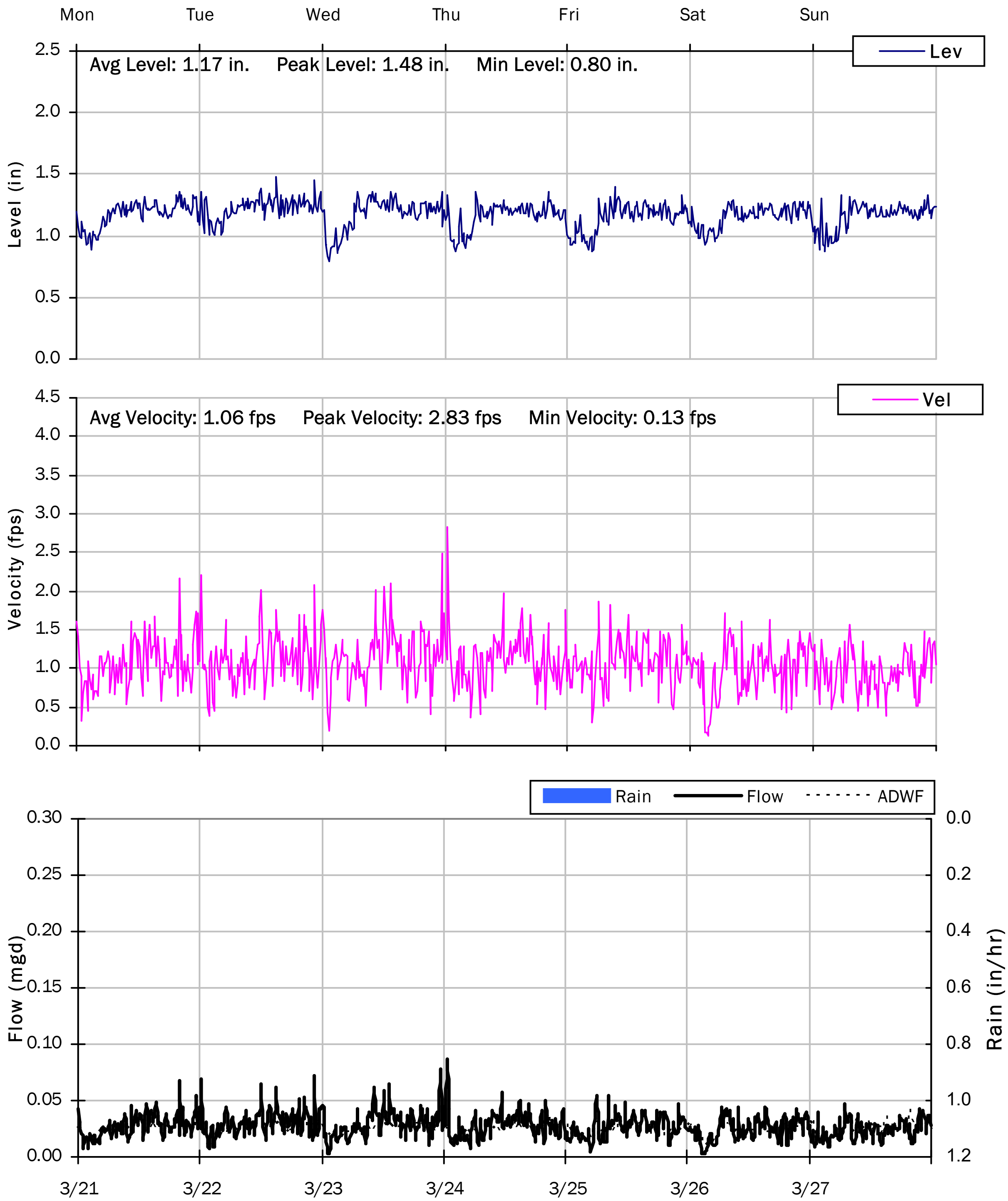
SITE 28
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



SITE 28

Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022

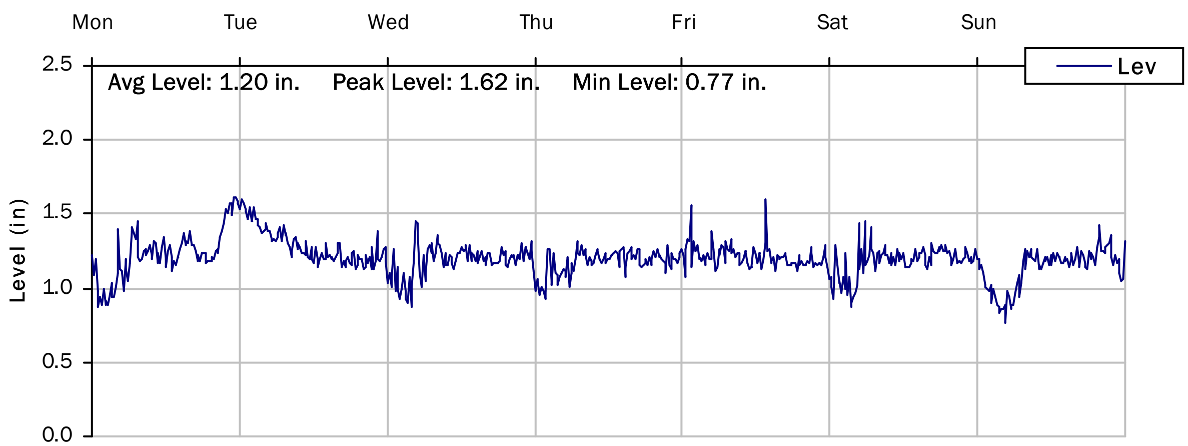


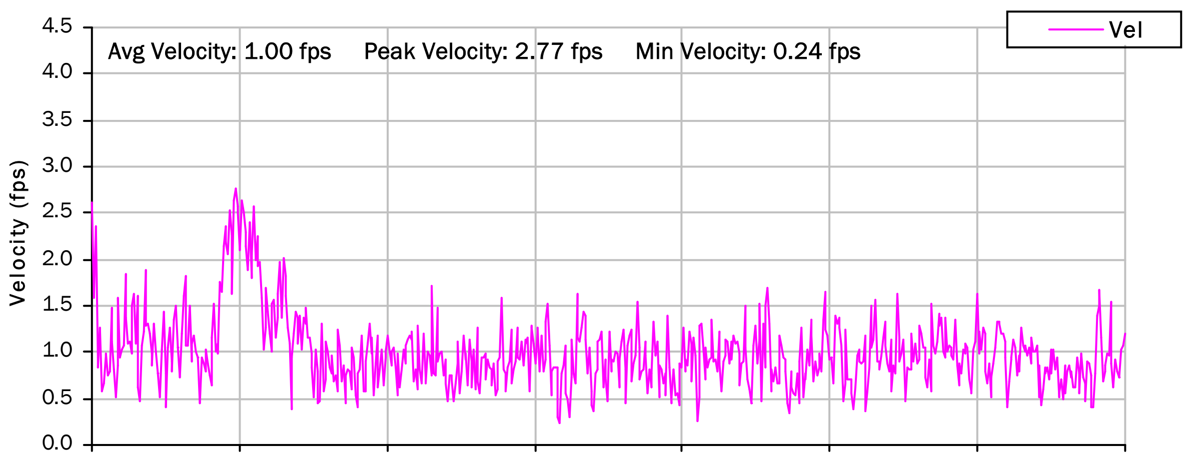
Avg Flow: 0.027 mgd Peak Flow: 0.086 mgd Min Flow: 0.003 mgd

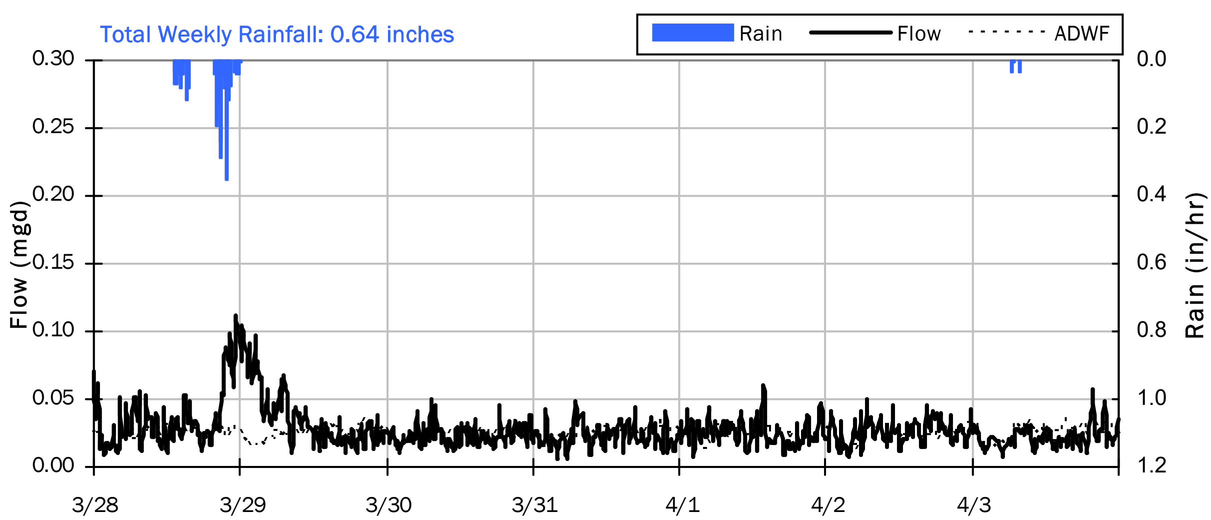
SITE 28

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022





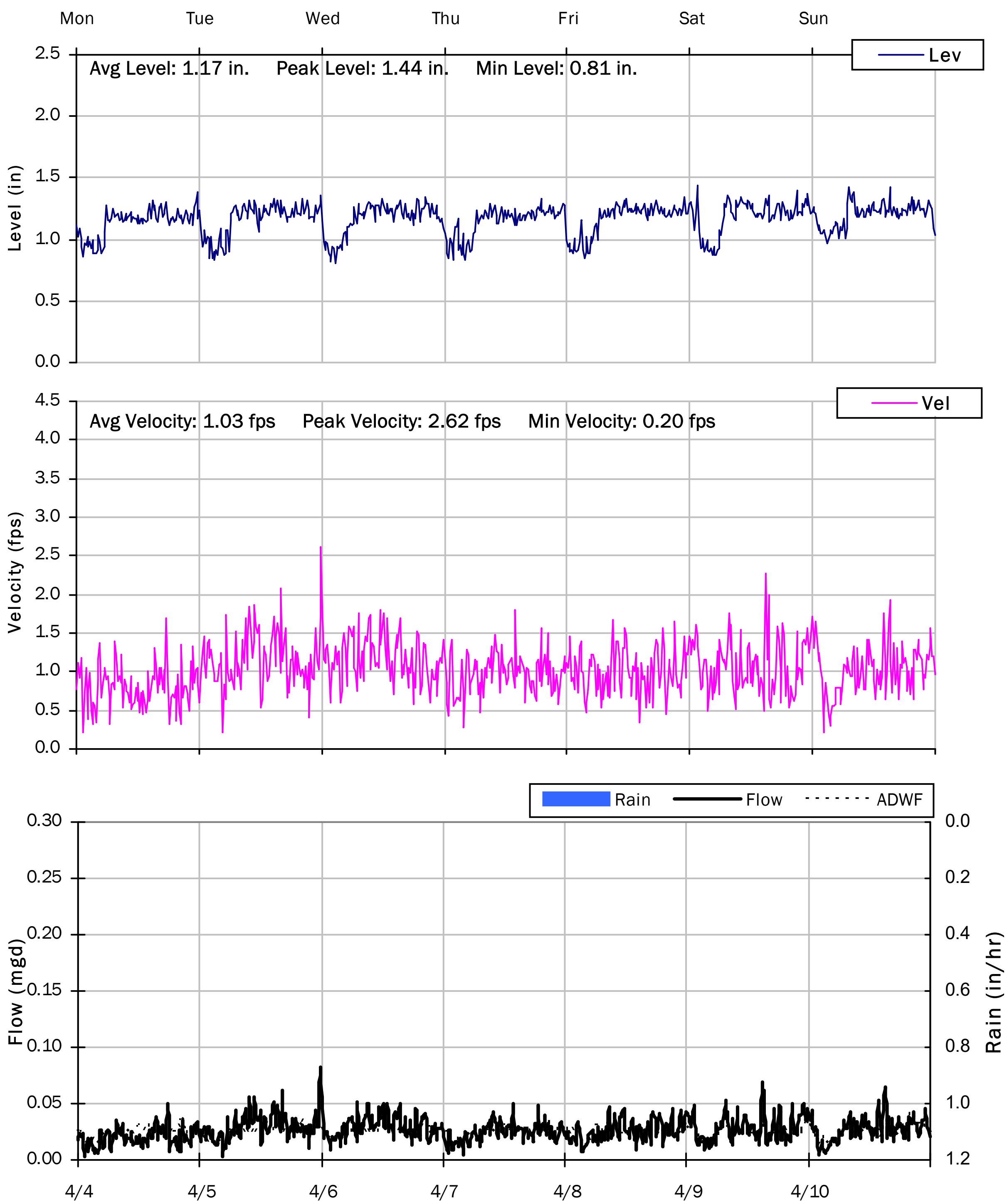


Avg Flow: 0.027 mgd Peak Flow: 0.112 mgd Min Flow: 0.005 mgd

SITE 28

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022

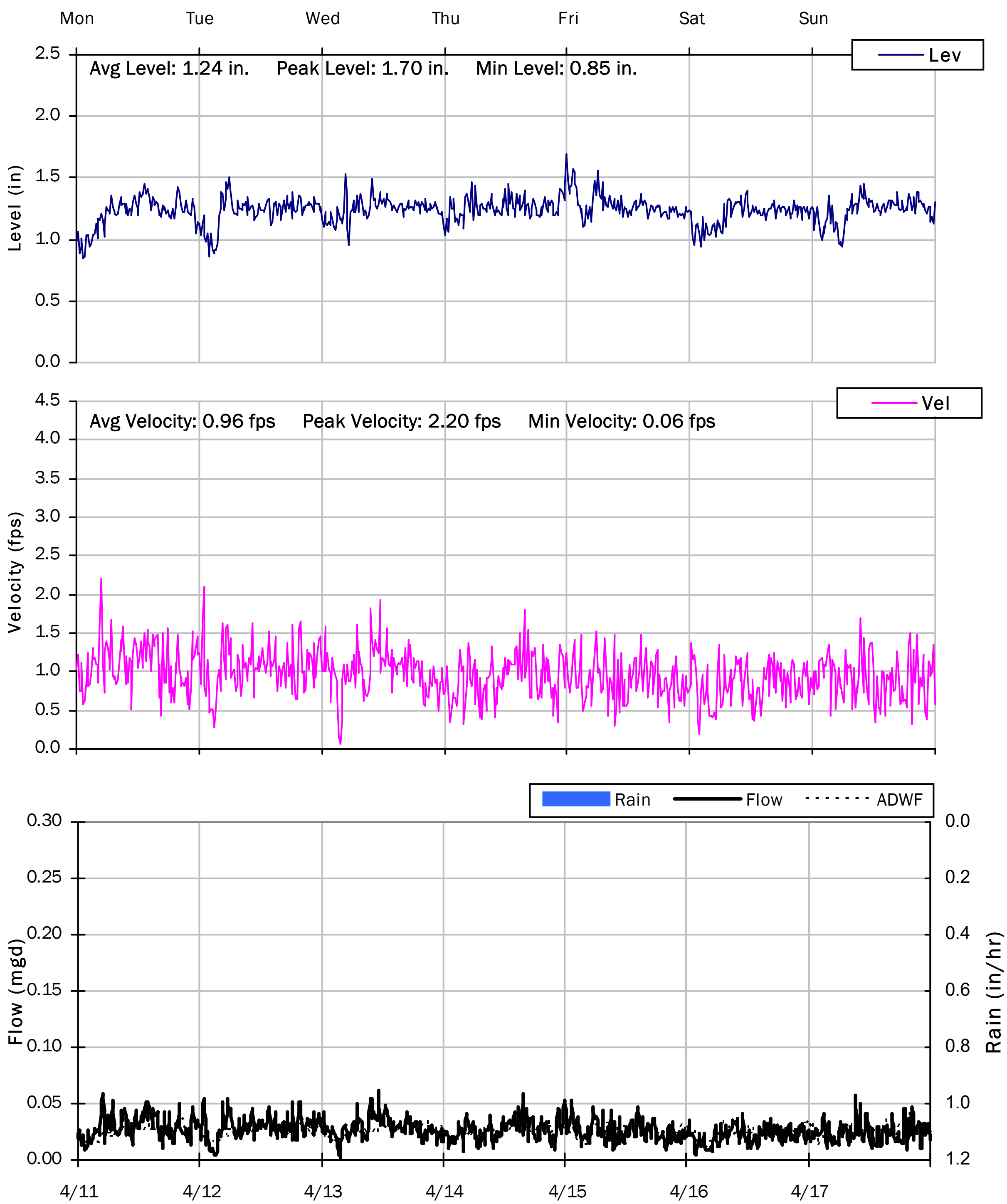


Avg Flow: 0.026 mgd Peak Flow: 0.082 mgd Min Flow: 0.003 mgd

SITE 28

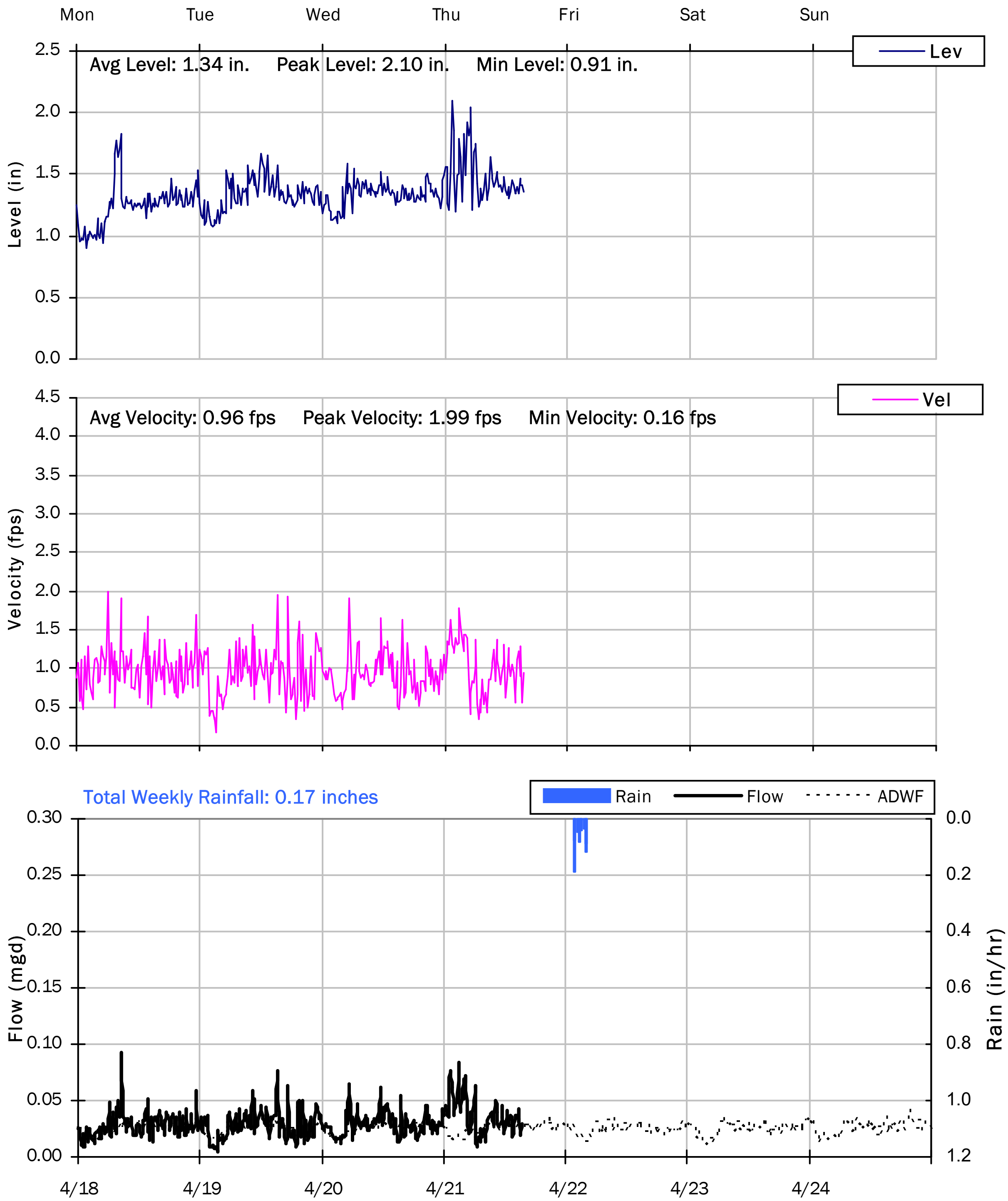
Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022



Avg Flow: 0.027 mgd   Peak Flow: 0.062 mgd   Min Flow: 0.001 mgd

SITE 28
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



Avg Flow: 0.030 mgd Peak Flow: 0.092 mgd Min Flow: 0.004 mgd

Monitoring Site: Site 29

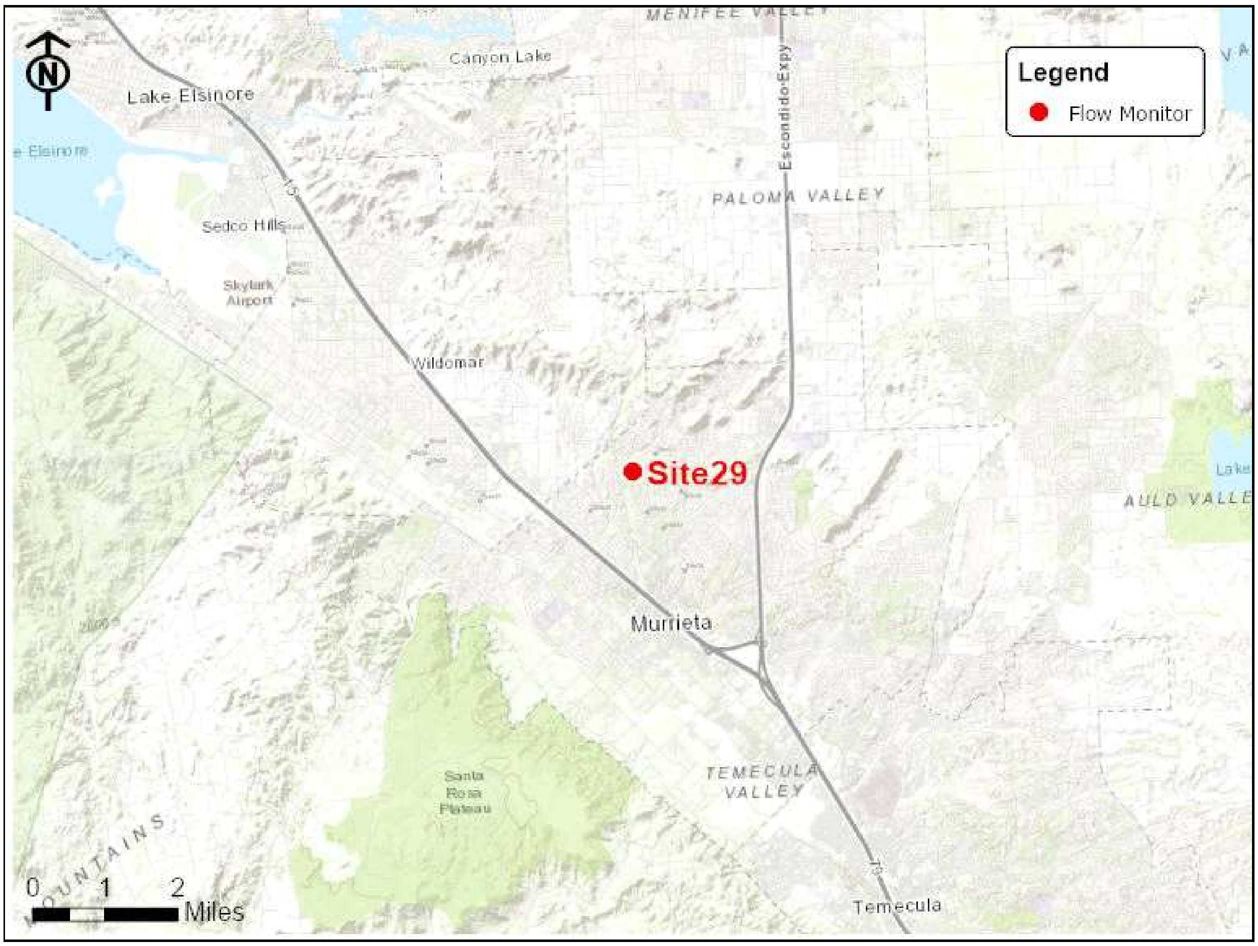
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Nutmeg Street, west of Gingerbread Drive

Data Summary Report



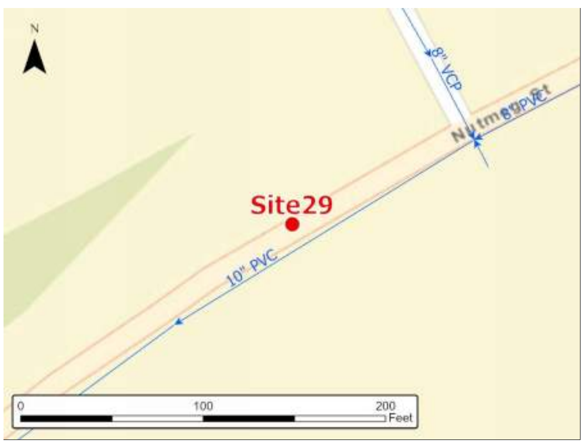
Vicinity Map: Site 29

SITE 29

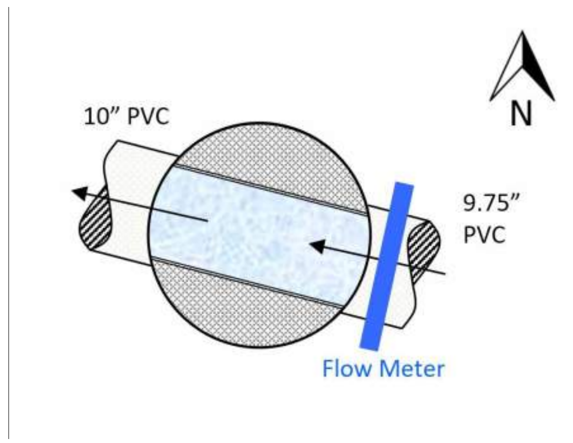
Site Information MH ID: MH-4625

Location:	Nutmeg Street, west of Gingerbread Drive
Coordinates:	117.2102° W, 33.5912° N
Rim Elevation (Earth):	1348 feet
Expected Pipe Diameter:	10 inches
Measured Pipe Diameter:	9.75 inches
ADWF:	0.138 mgd
Peak Measured Flow:	0.347 mgd
Sediment:	None

Satellite Map



Sanitary Map



Flow Sketch

View from Street

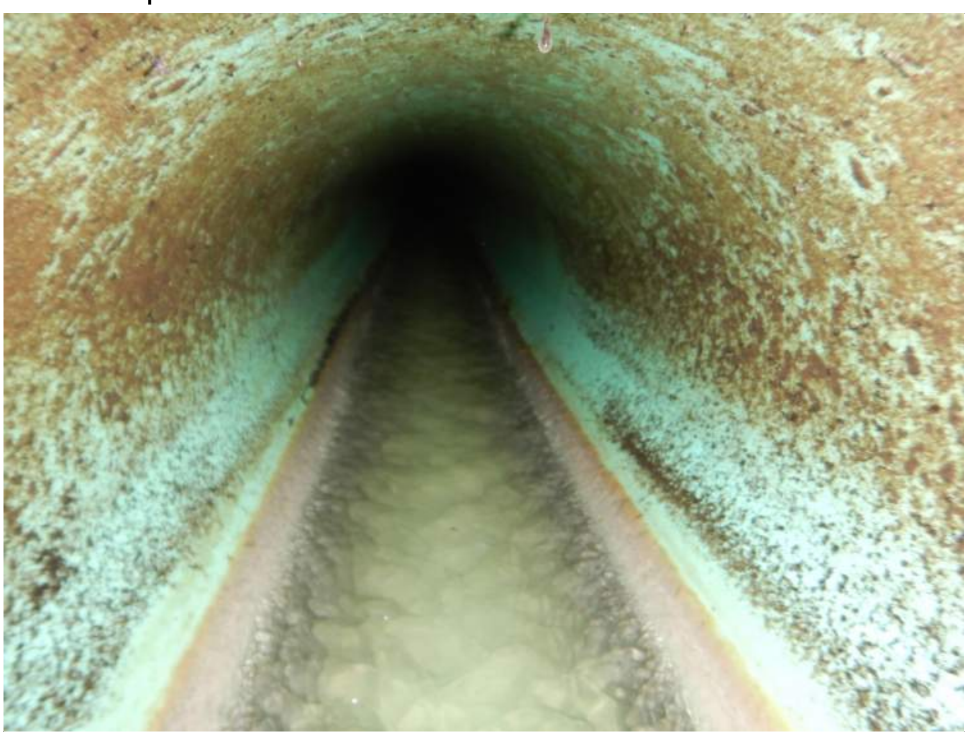

Plan View

SITE 29

Additional Site Photos

Effluent Pipe

Influent Pipe

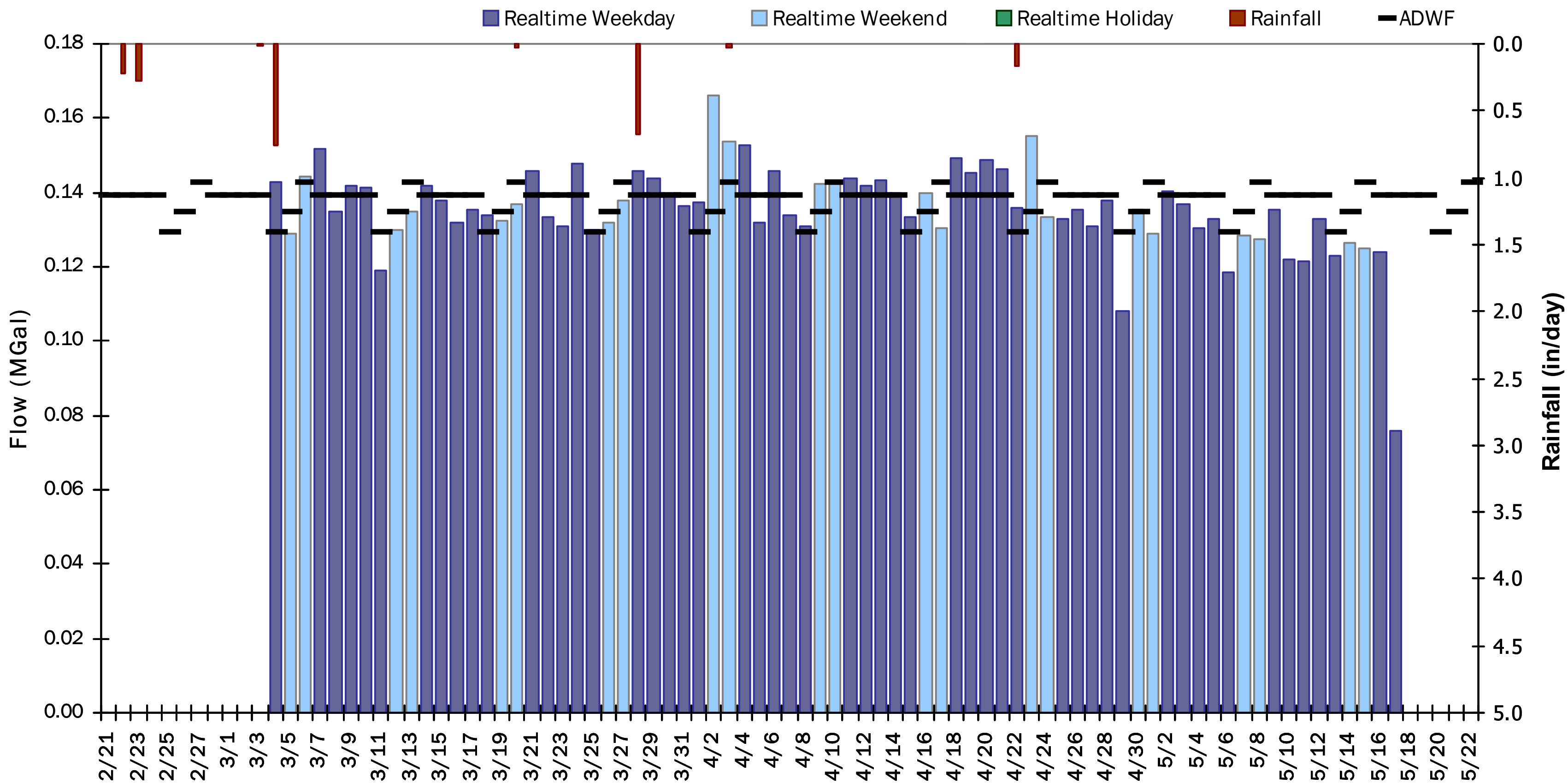


SITE 29

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.135 MGal Peak Daily Flow: 0.166 MGal Min Daily Flow: 0.041 MGal

Total Rainfall: 1.68 inches

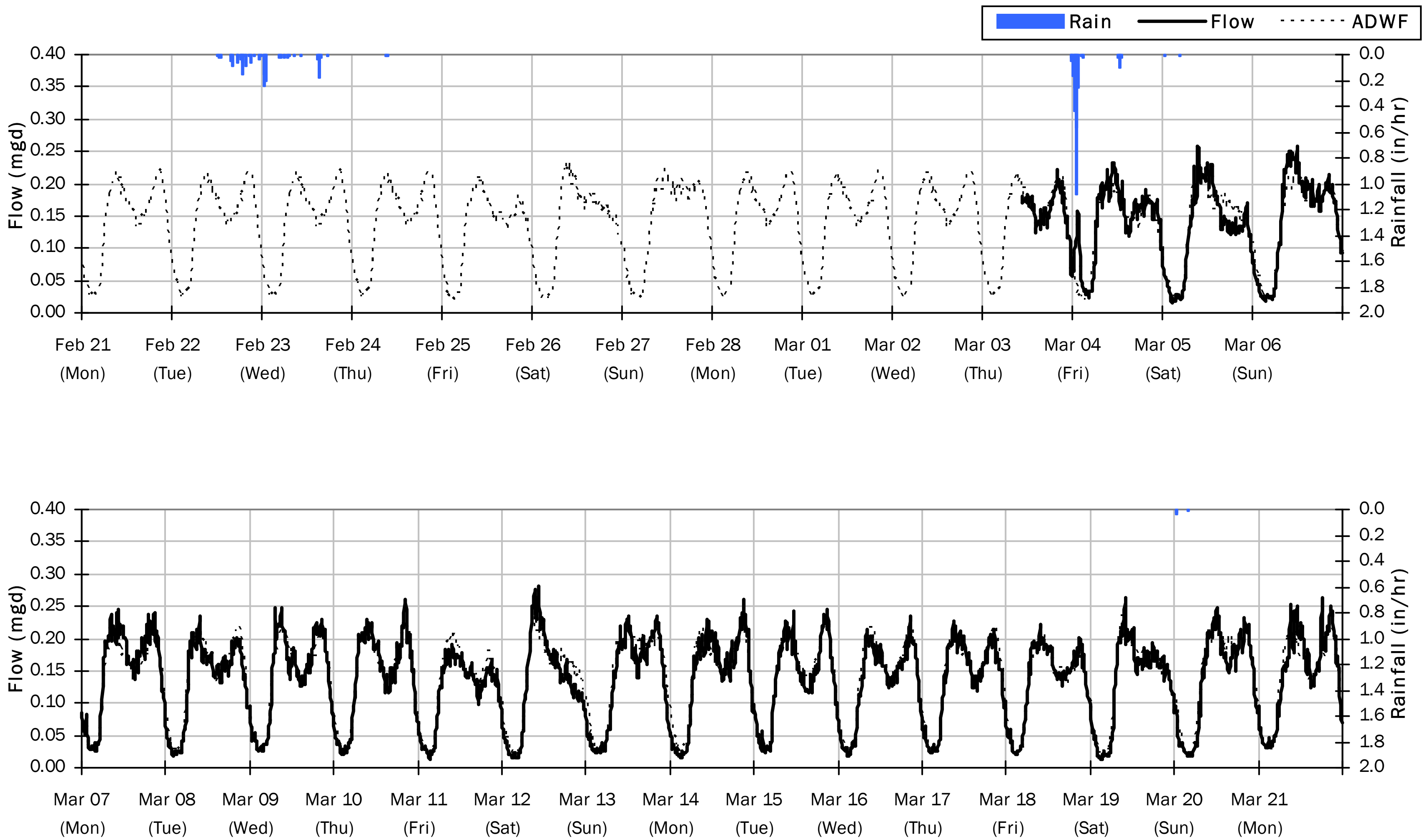


SITE 29

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.31 inches

Period Avg Flow: 0.138 mgd Period Peak Flow: 0.281 mgd Period Min Flow: 0.014 mgd

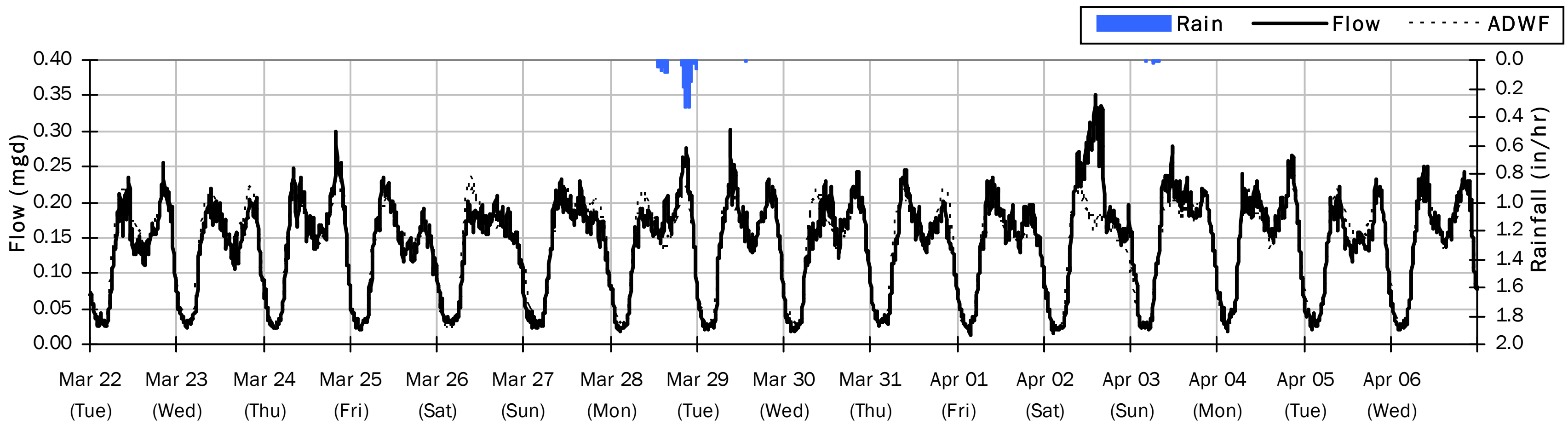


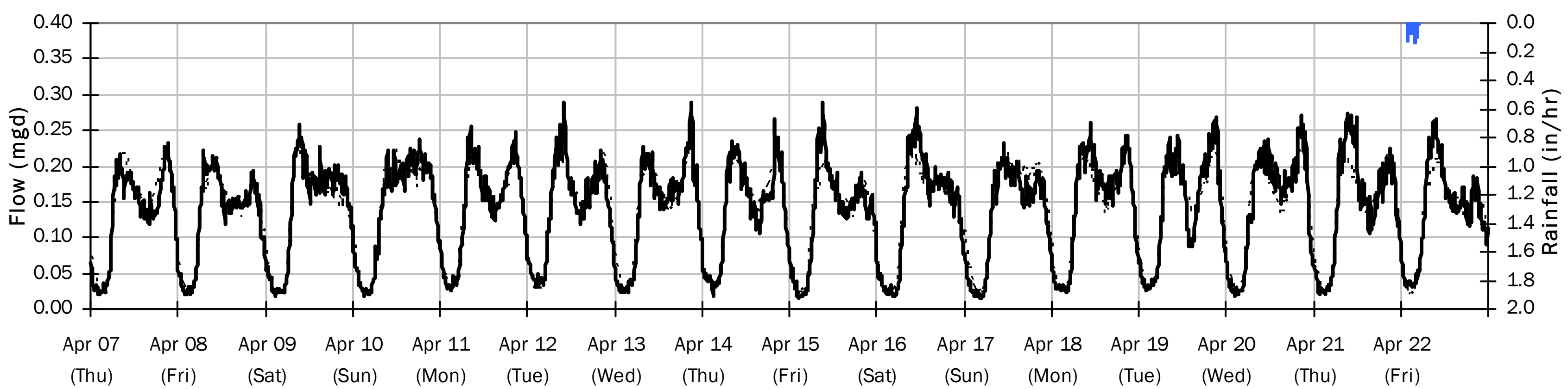
SITE 29

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.87 inches

Period Avg Flow: 0.141 mgd Period Peak Flow: 0.347 mgd Period Min Flow: 0.014 mgd

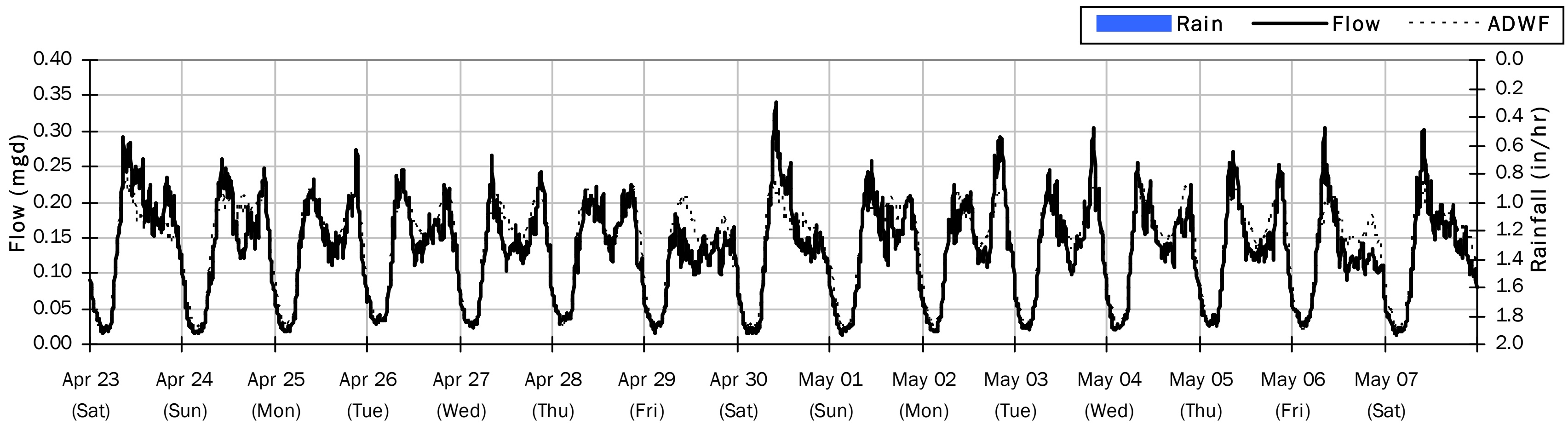


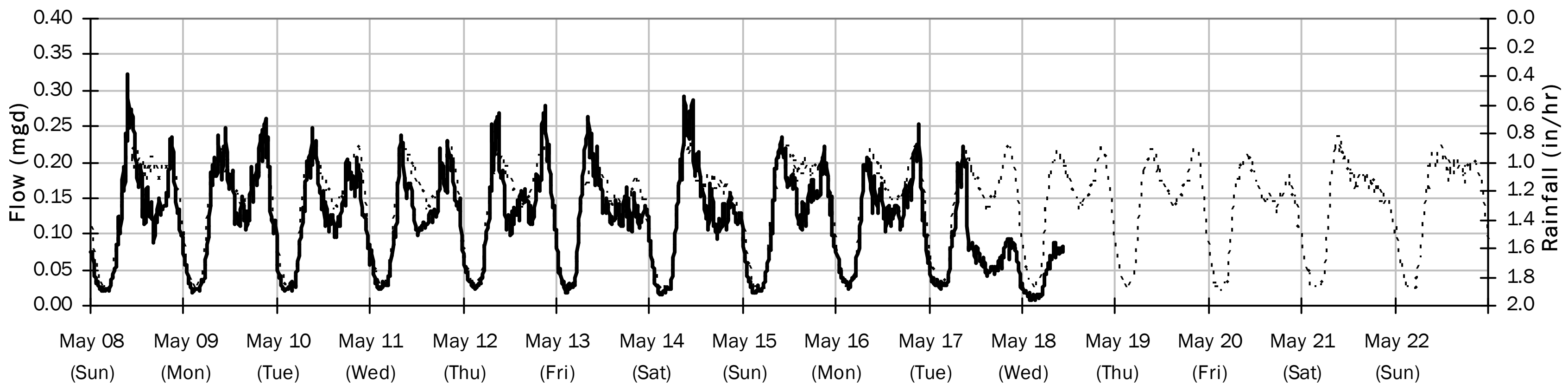


SITE 29

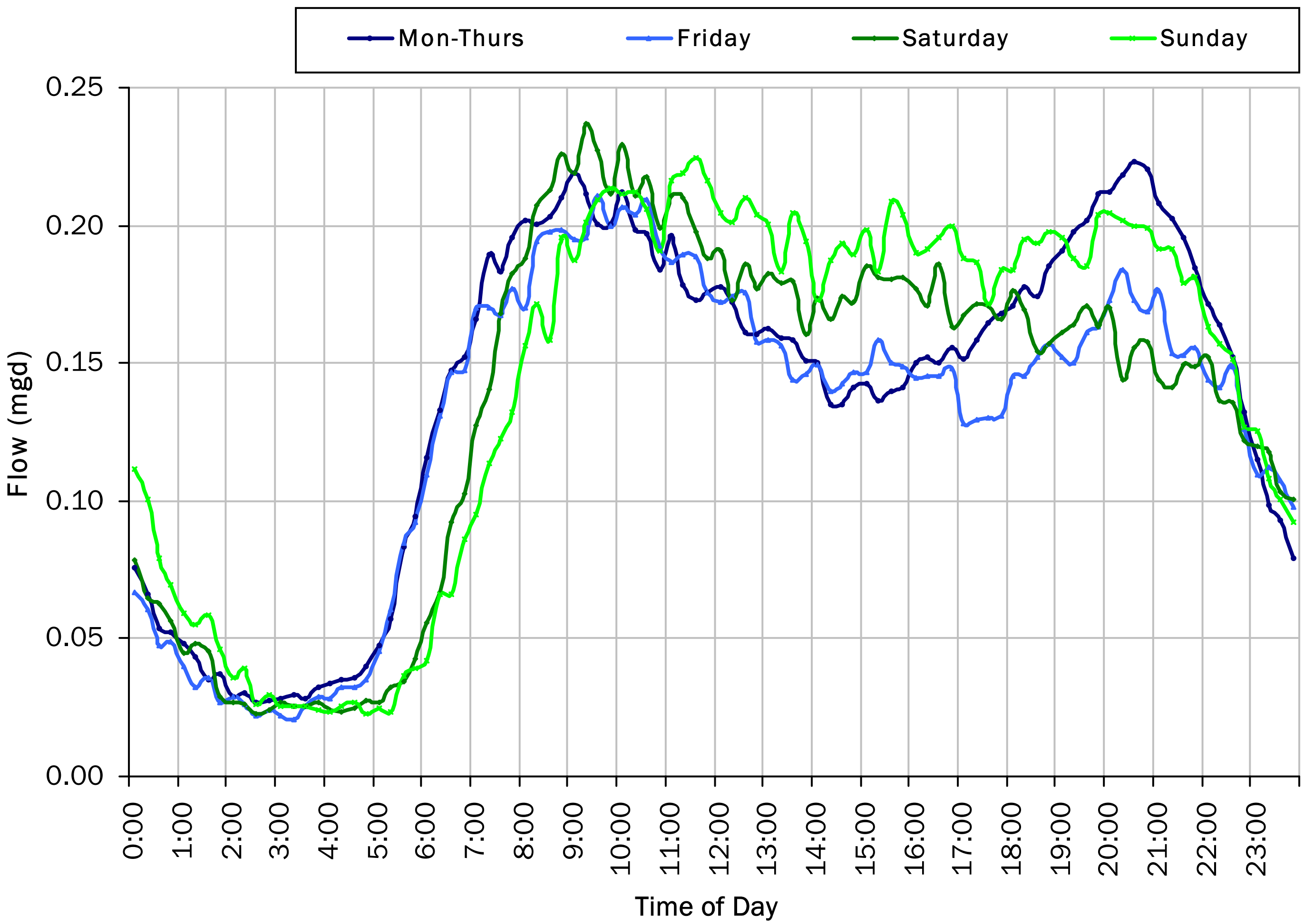
Flow Summary: 4/23/2022 to 5/22/2022

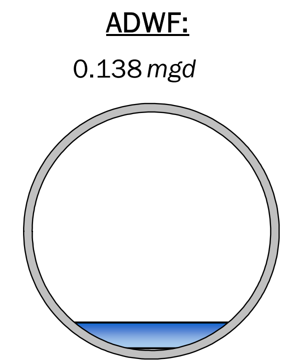
Period Rainfall: 0.00 inches   Period Avg Flow: 0.126 mgd   Period Peak Flow: 0.341 mgd   Period Min Flow: 0.007 mgd





SITE 29
Average Dry Weather Flow Hydrographs

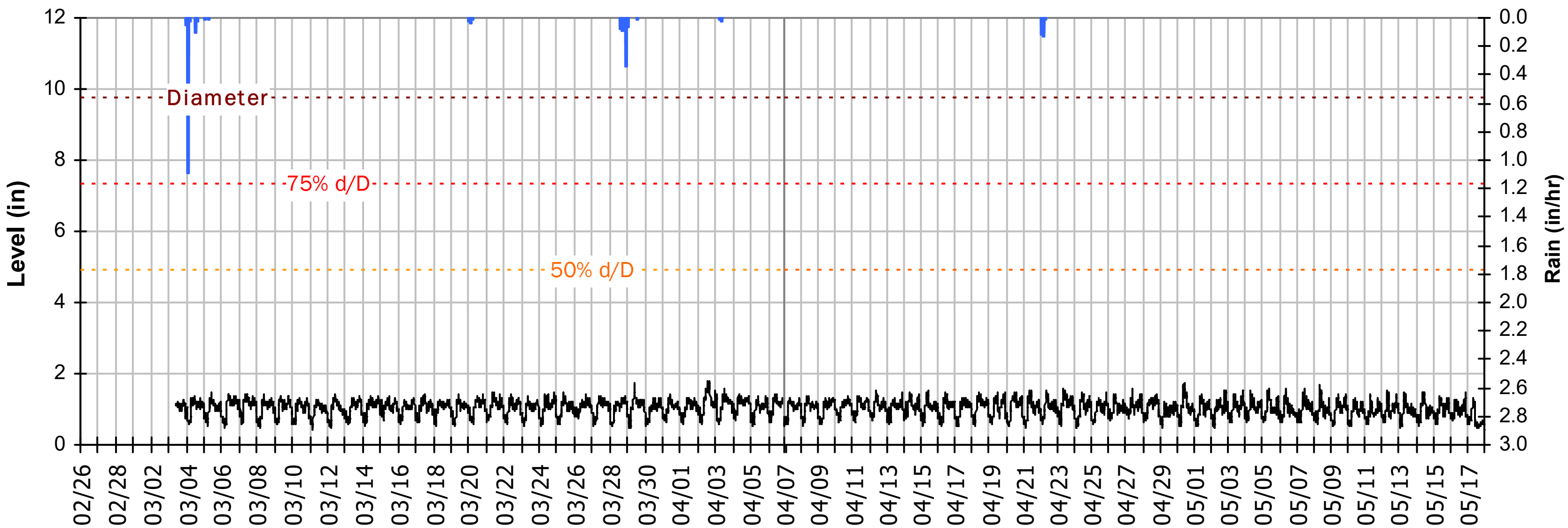


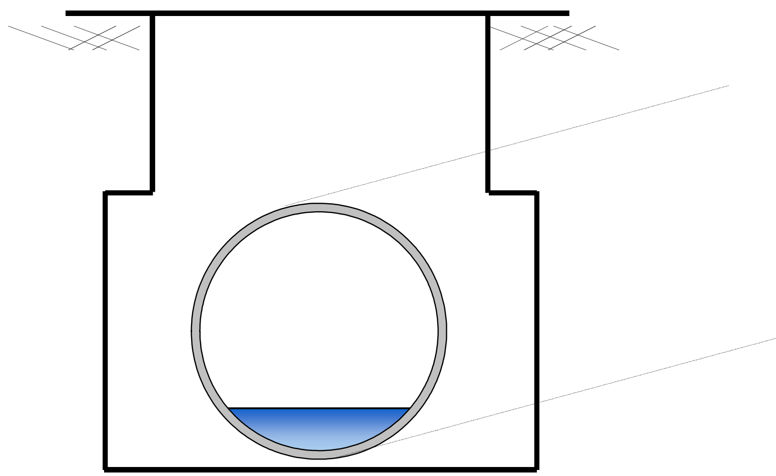


SITE 29

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



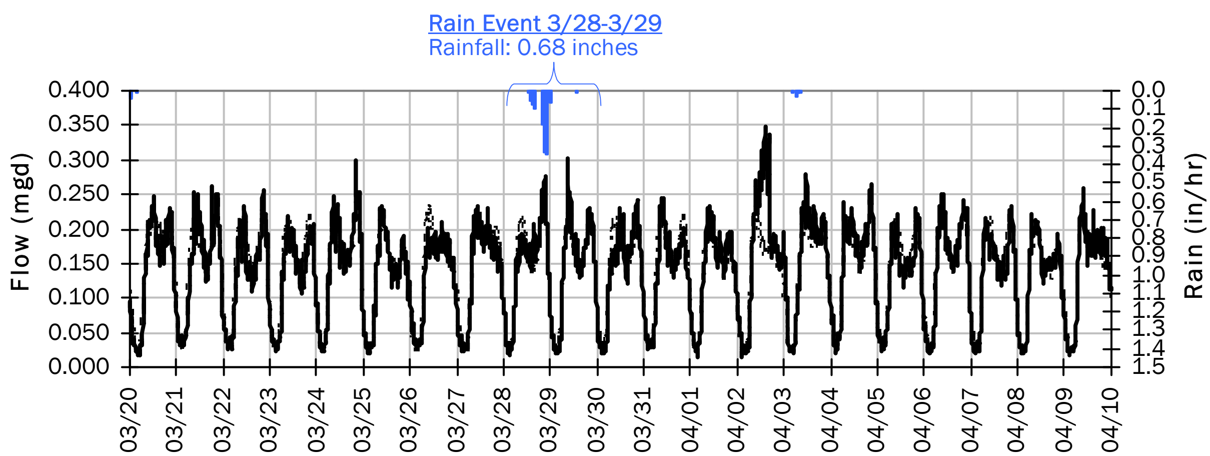


Pipe Diameter:	9.75	*inches*
Peak Measured Level:	1.78	*inches*
Peak d/D Ratio:	0.18	

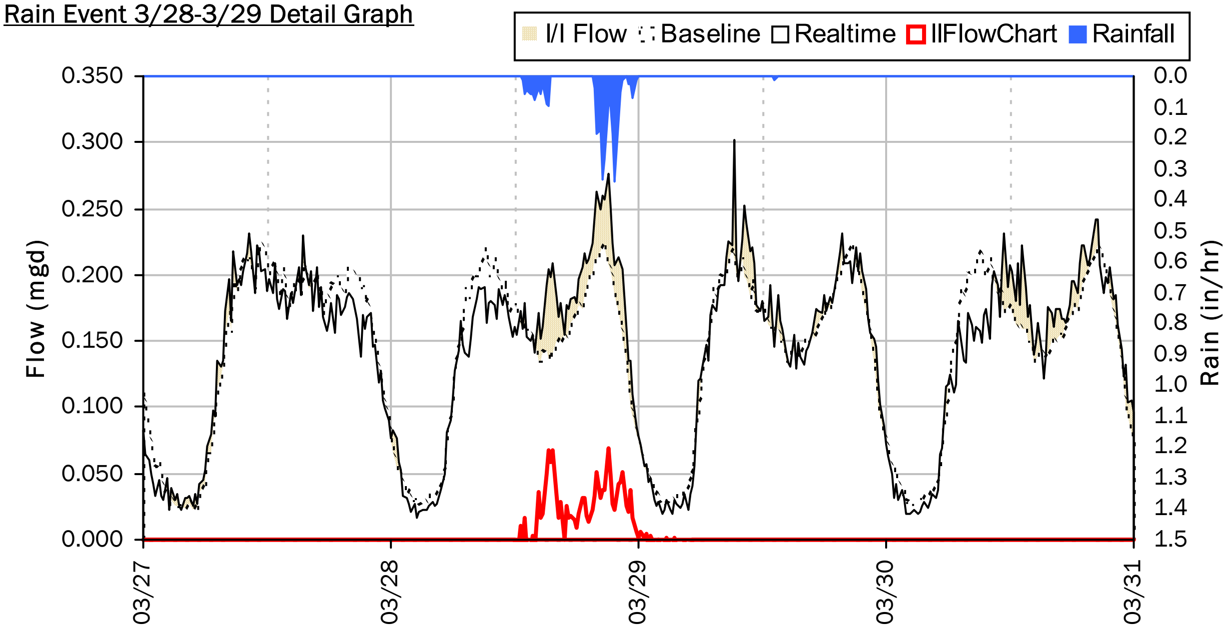
SITE 29

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



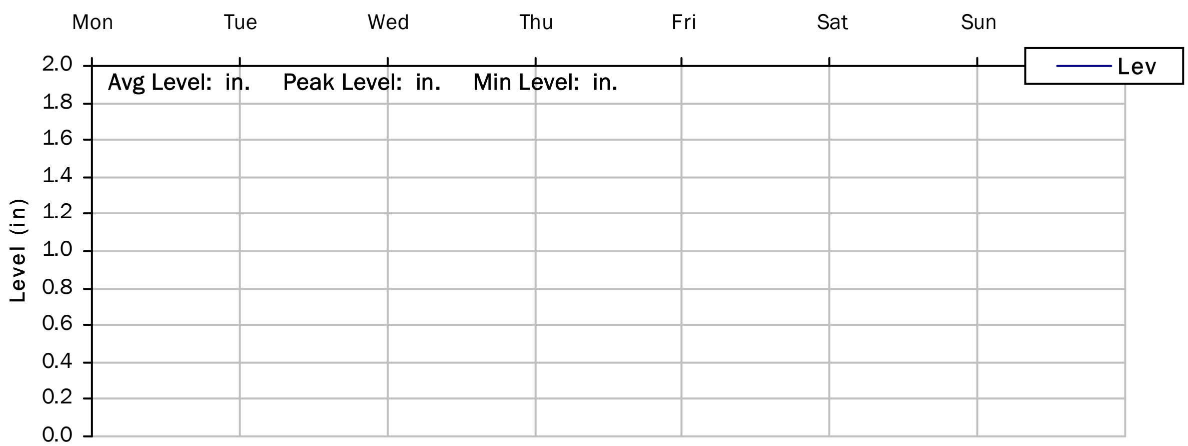
Rain Event 3/28-3/29 Detail Graph

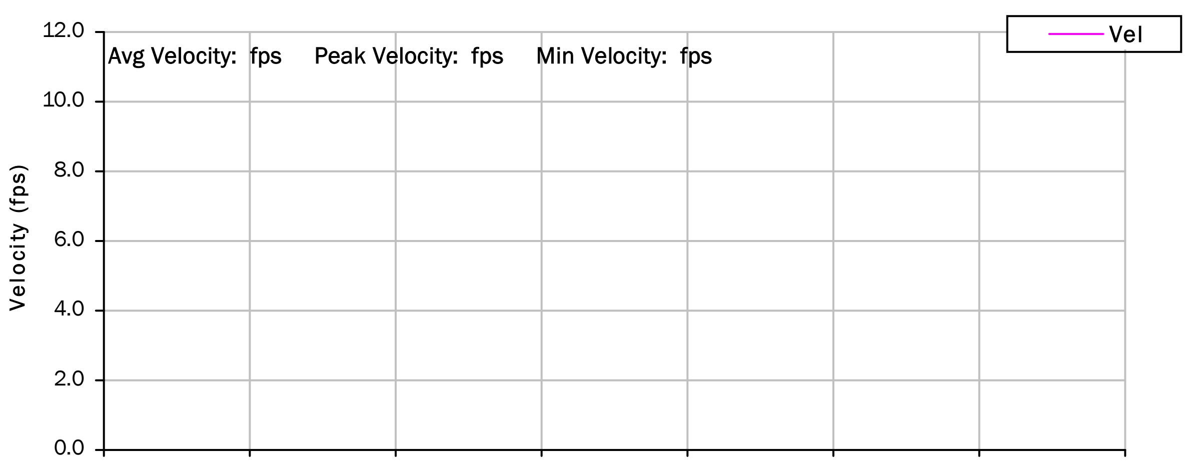


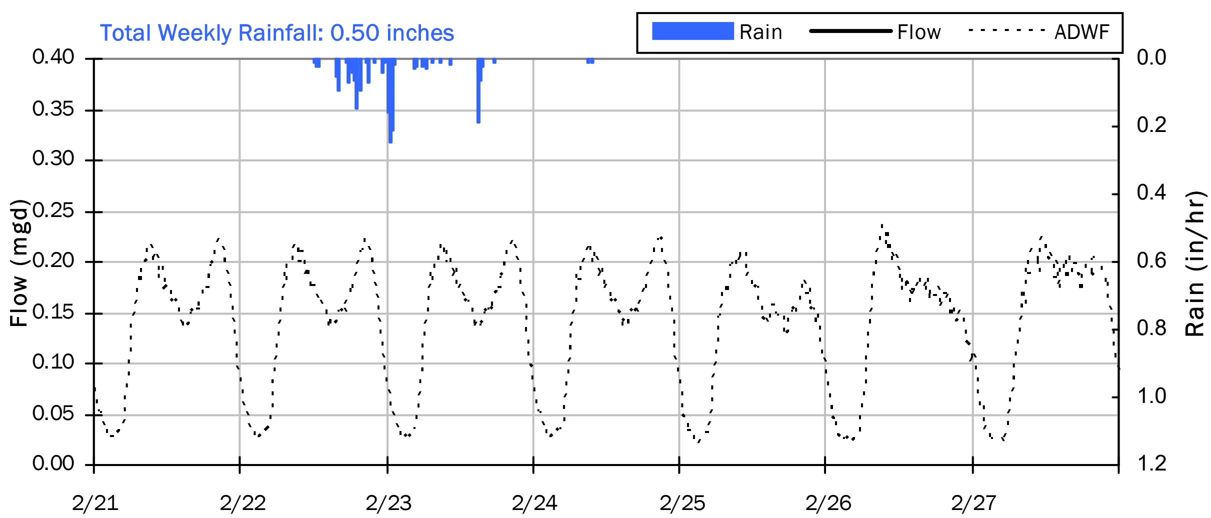
Storm Event I/I Analysis (Rain = 0.68 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.276 *mgd*	Peak I/I Rate:	0.069 *mgd*
PF:	2.01	Total I/I:	12,000 *gallons*
Peak Level:	1.38 *in*		
d/D Ratio:	0.14		

SITE 29
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

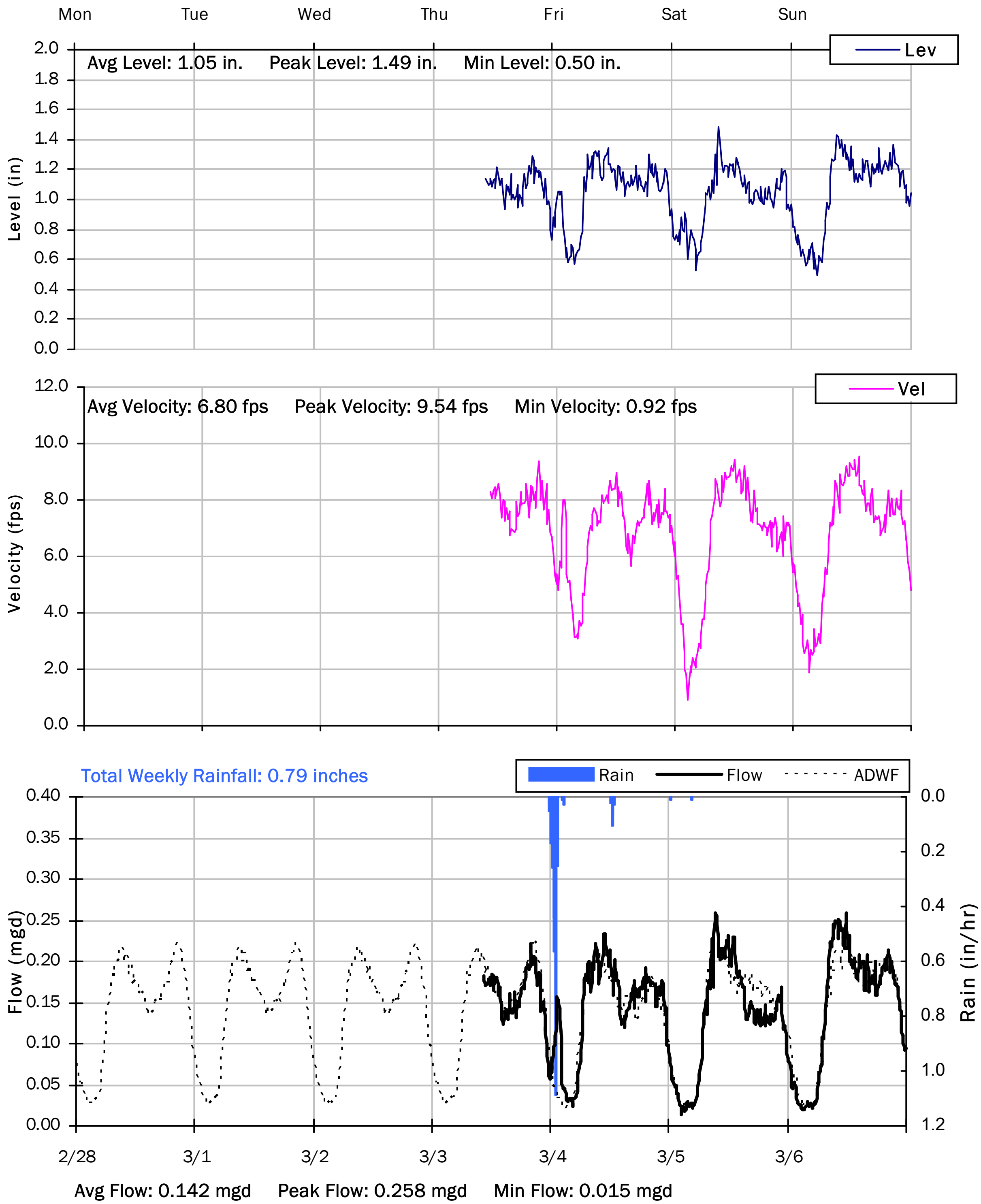




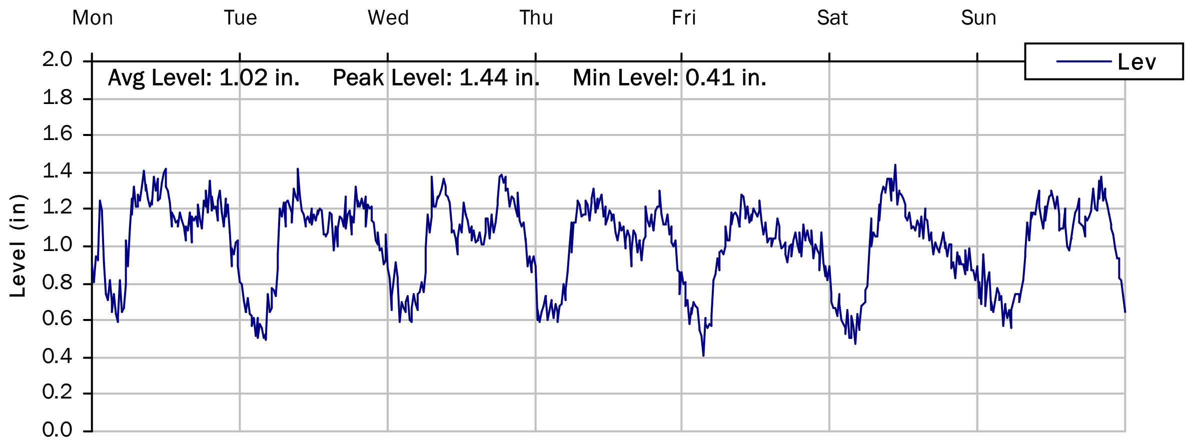


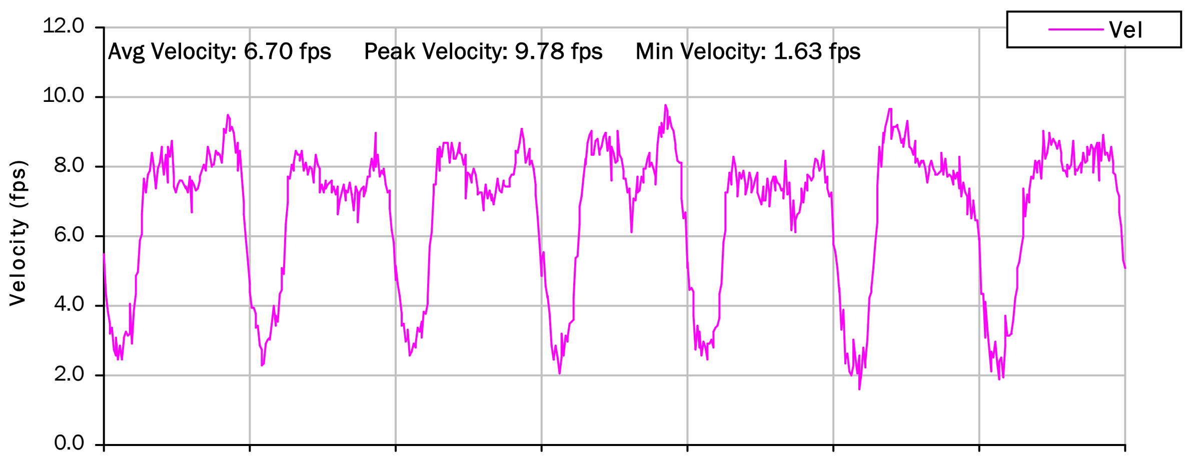
Avg Flow: mgd Peak Flow: mgd Min Flow: mgd

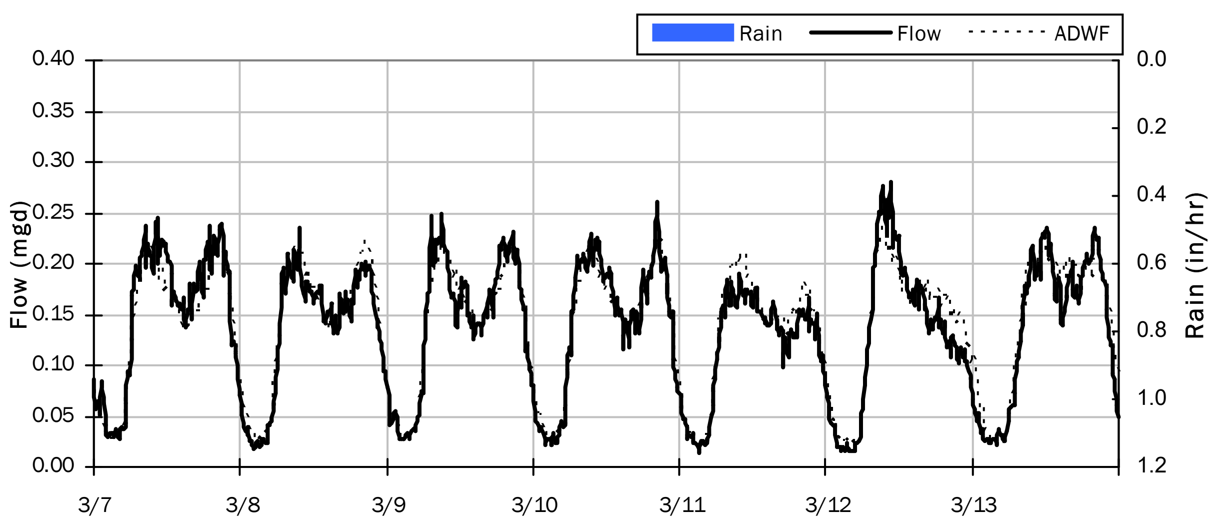
SITE 29
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



SITE 29
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

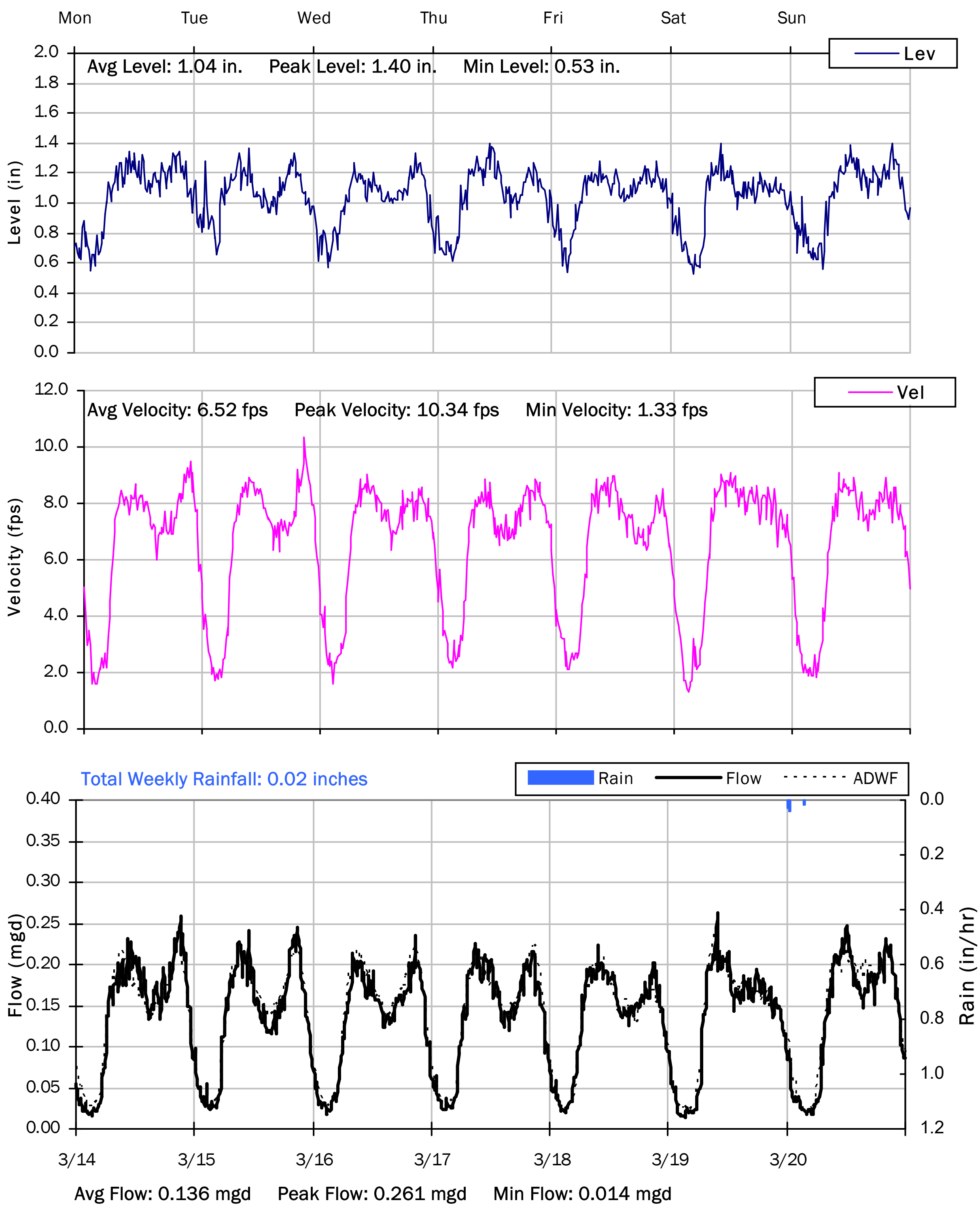




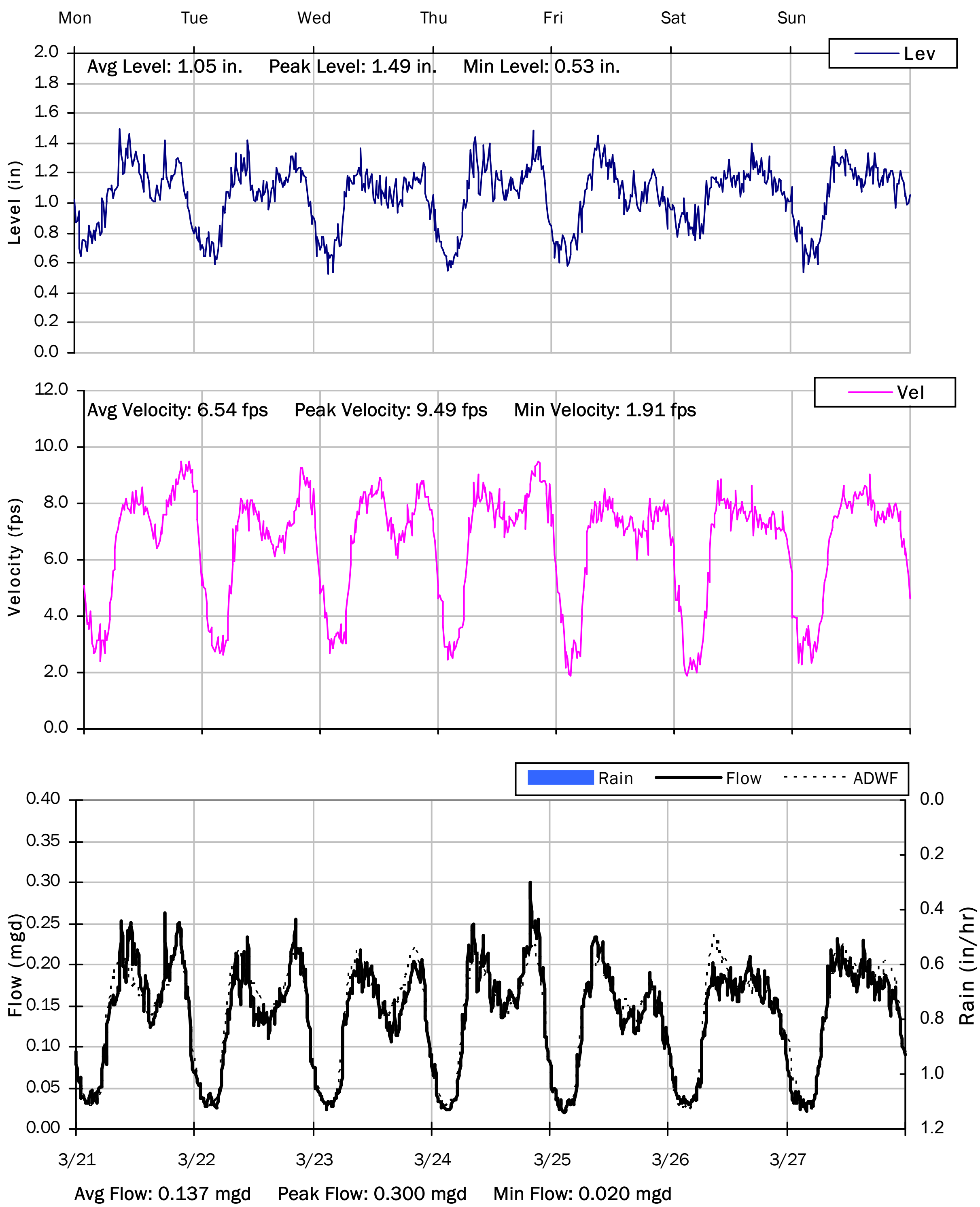


Avg Flow: 0.136 mgd   Peak Flow: 0.281 mgd   Min Flow: 0.014 mgd

SITE 29
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



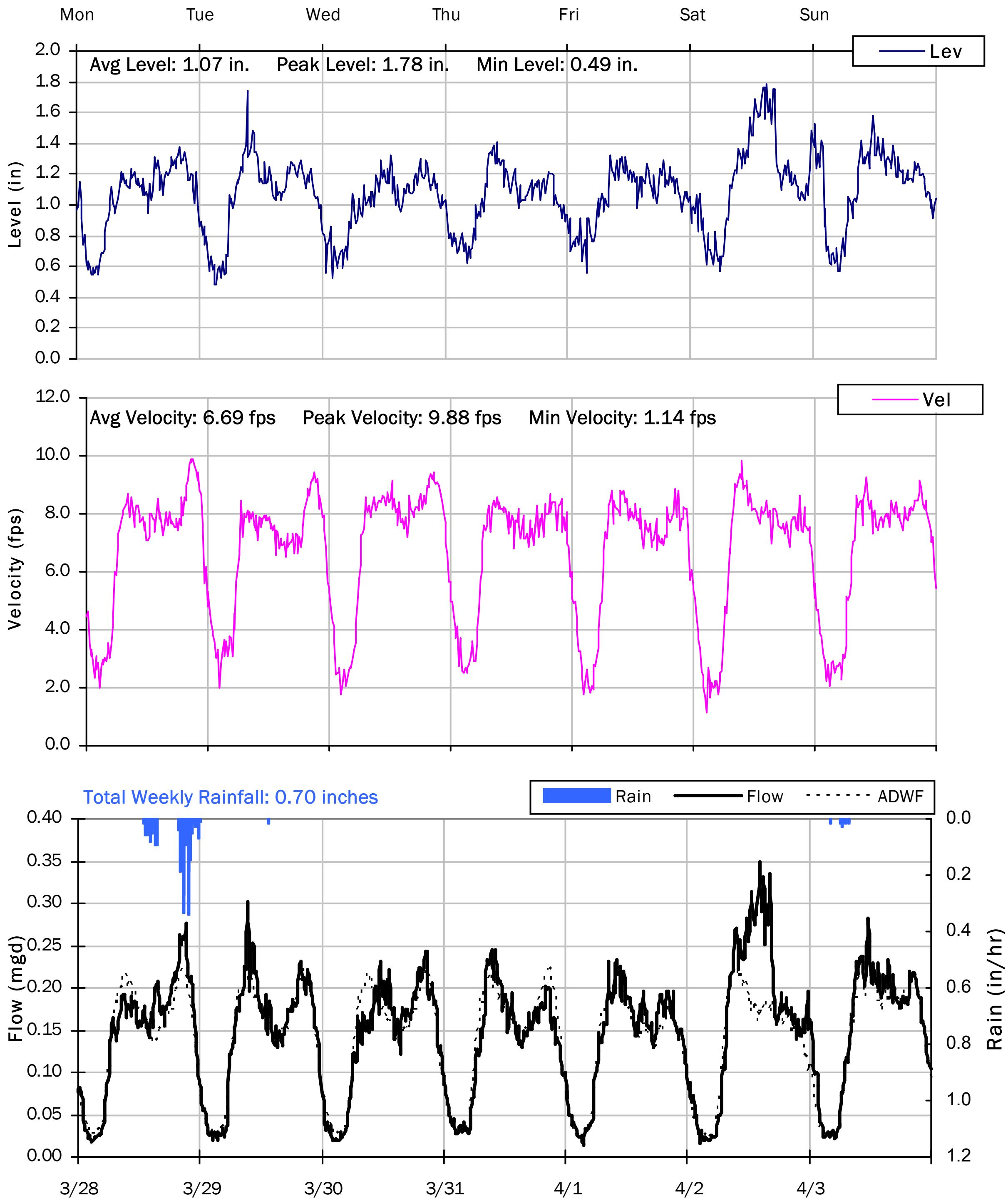
SITE 29
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



SITE 29

Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

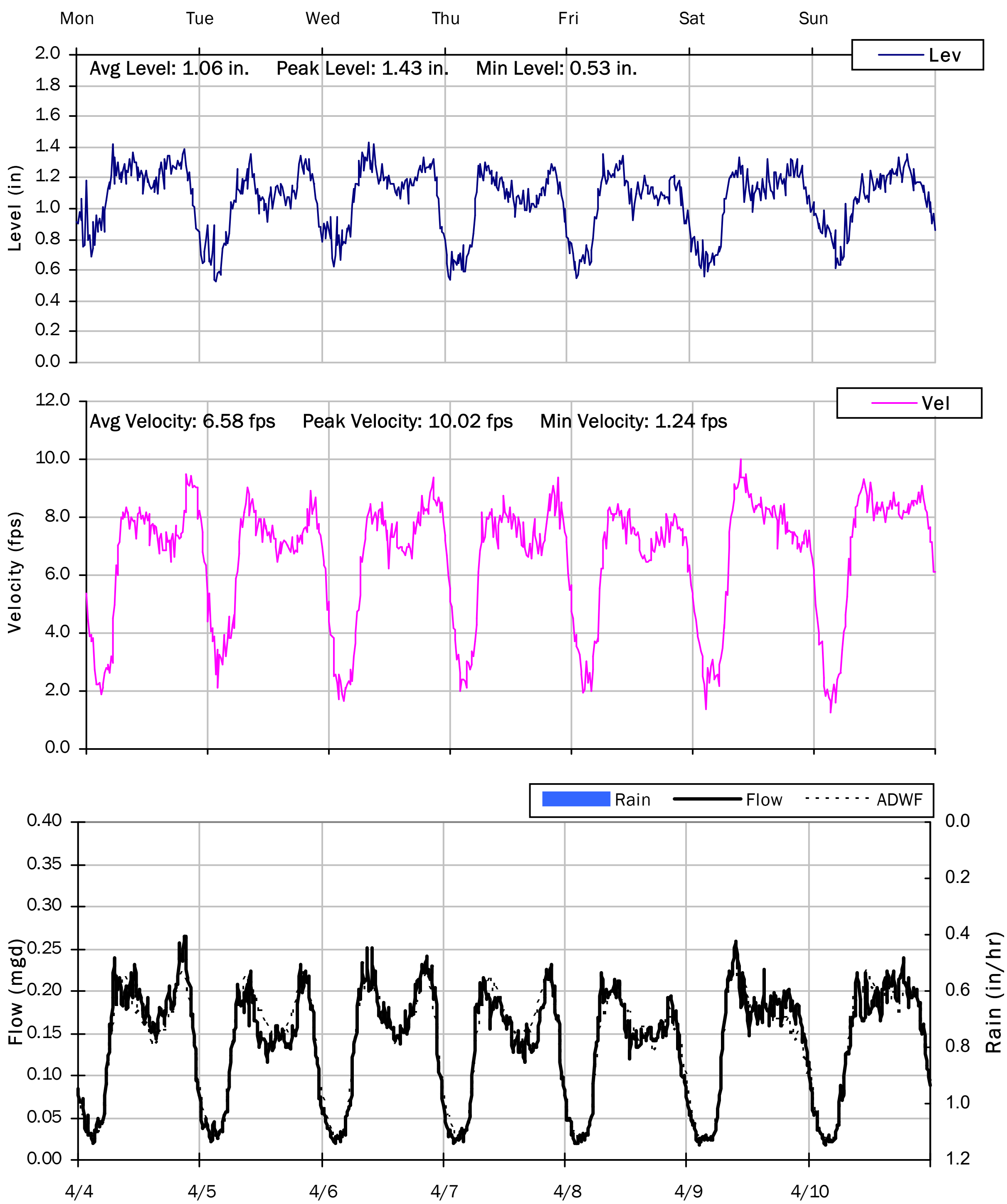


Avg Flow: 0.146 mgd Peak Flow: 0.347 mgd Min Flow: 0.014 mgd

SITE 29

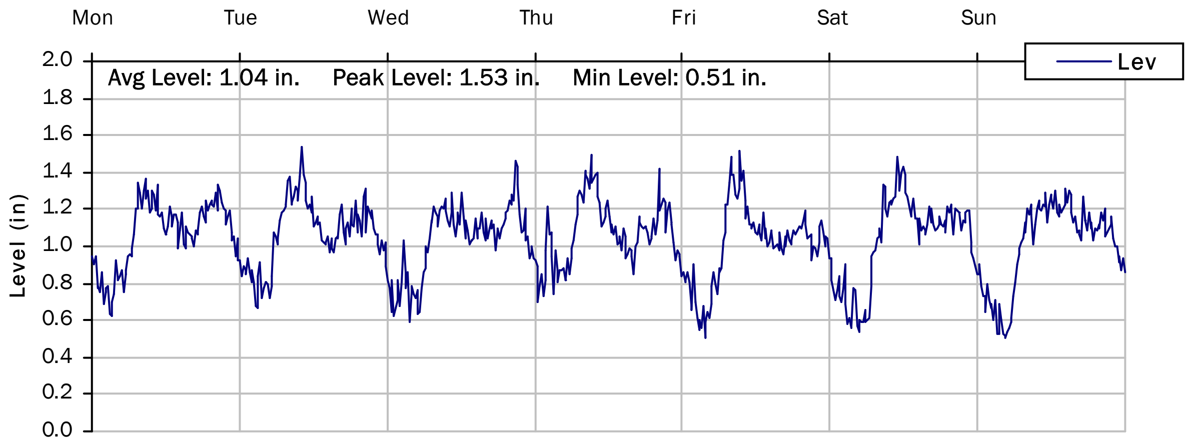
Weekly Level, Velocity and Flow Hydrographs

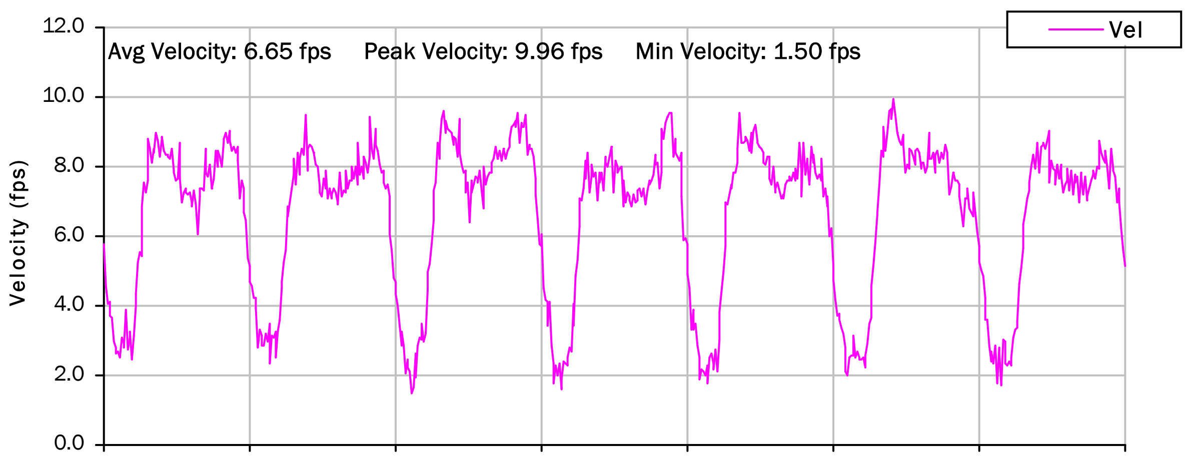
4/4/2022 to 4/11/2022

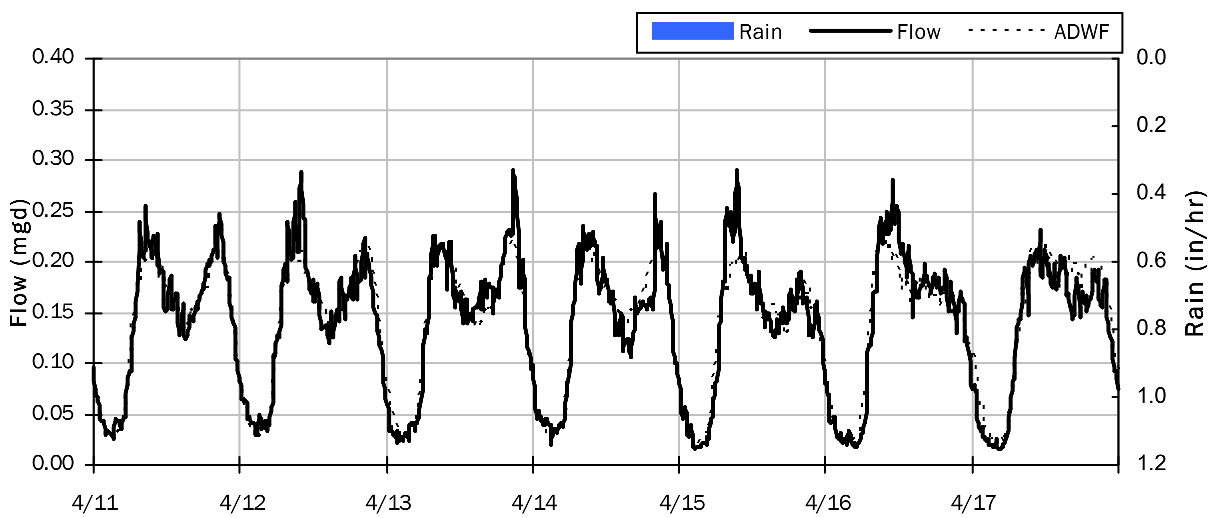


Avg Flow: 0.140 mgd   Peak Flow: 0.265 mgd   Min Flow: 0.017 mgd

SITE 29
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022





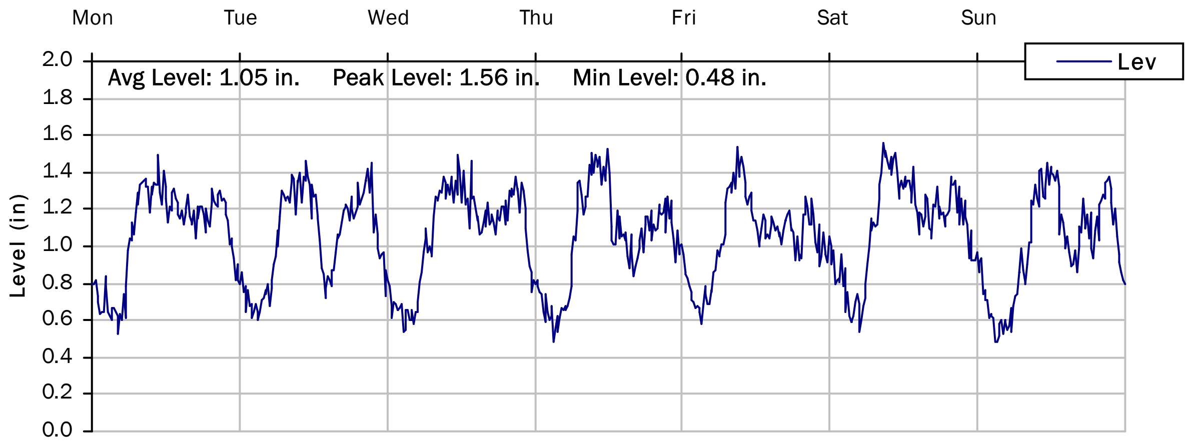


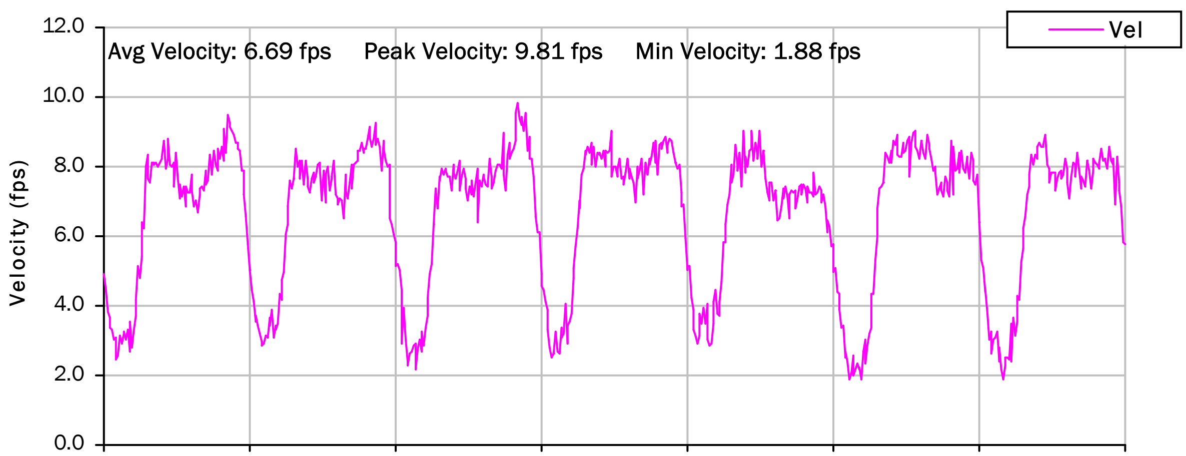
Avg Flow: 0.139 mgd Peak Flow: 0.289 mgd Min Flow: 0.015 mgd

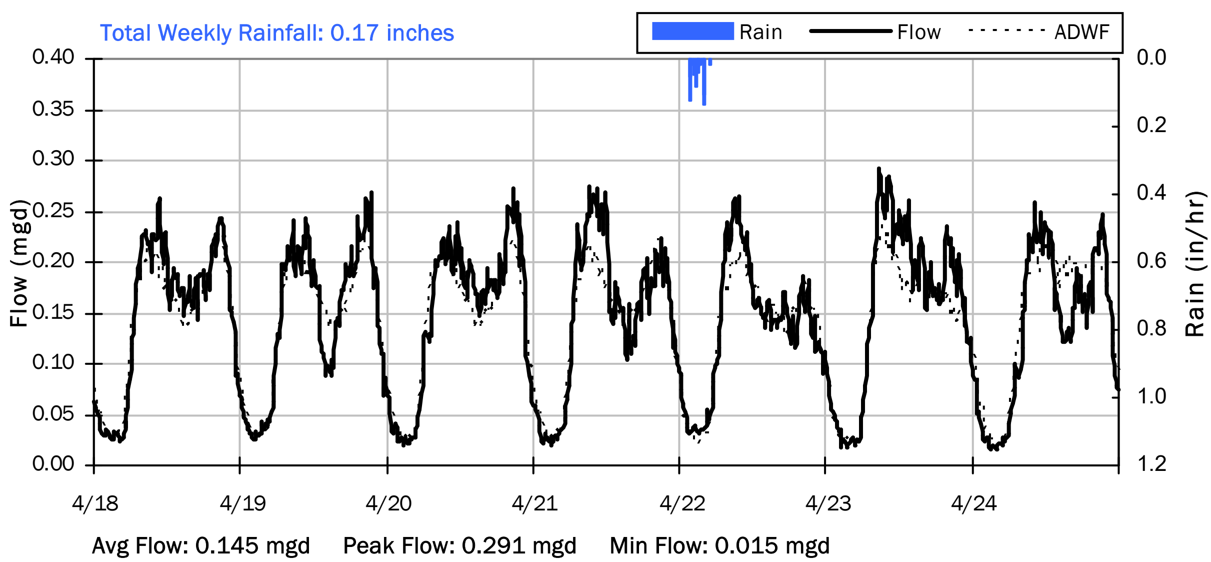
SITE 29

Weekly Level, Velocity and Flow Hydrographs

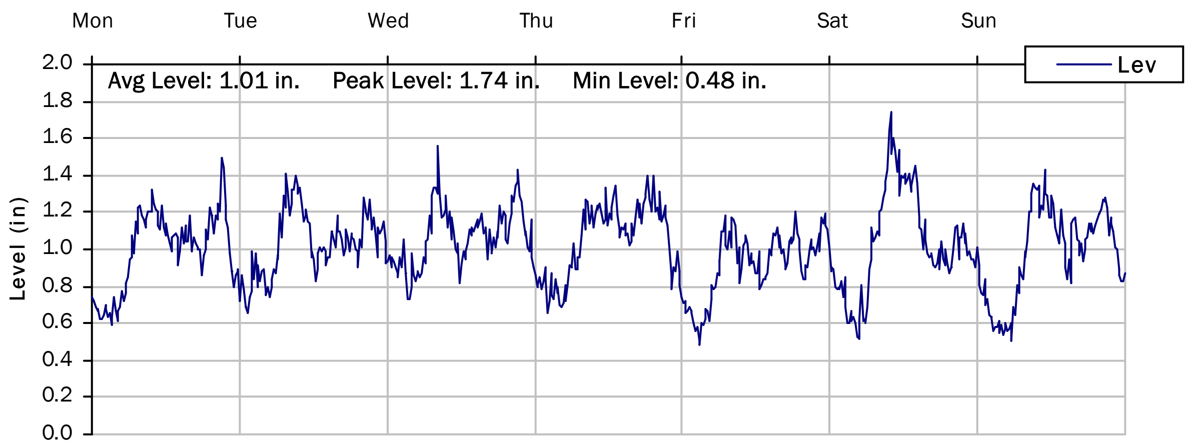
4/18/2022 to 4/25/2022

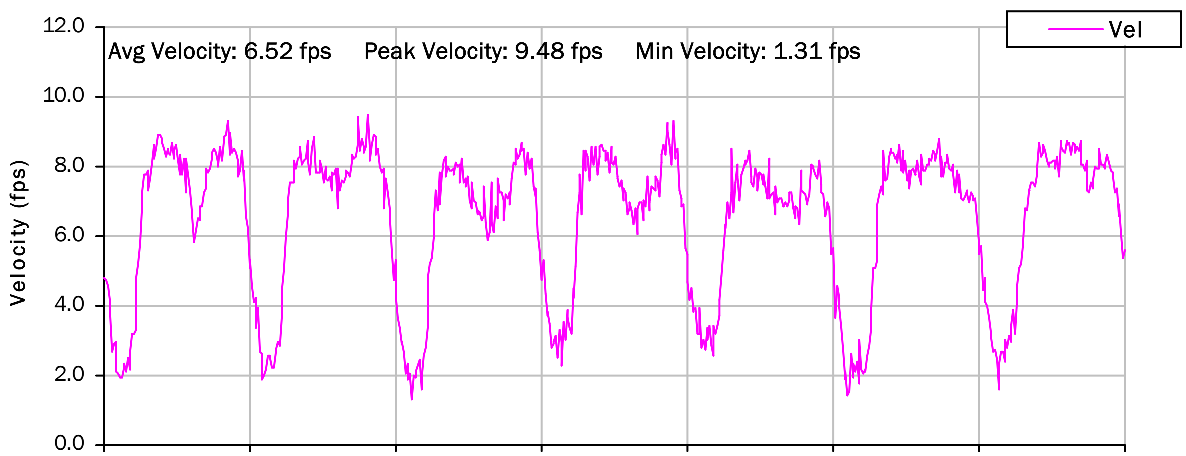


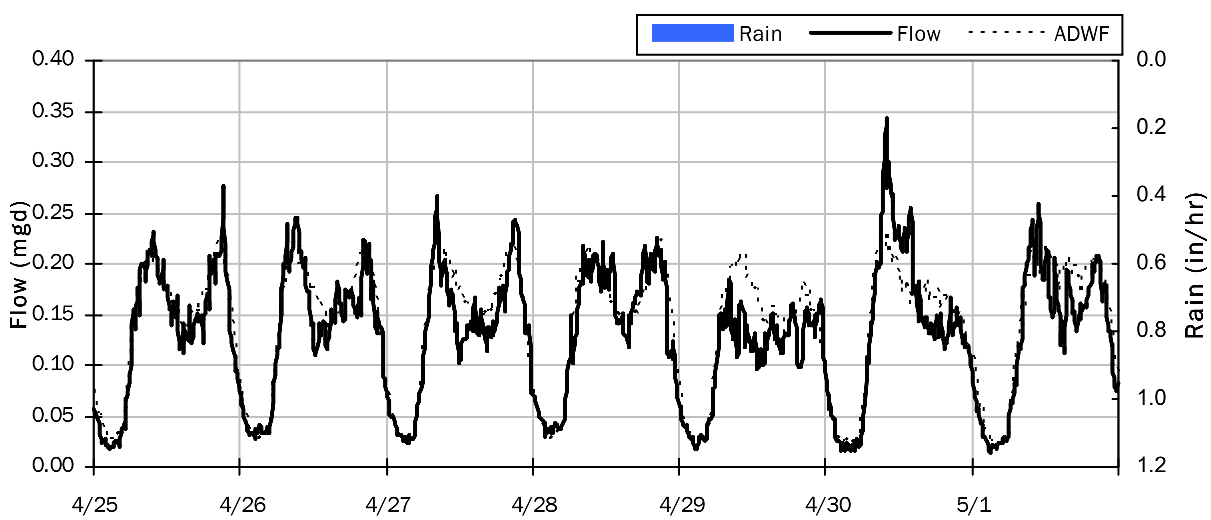




SITE 29
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022





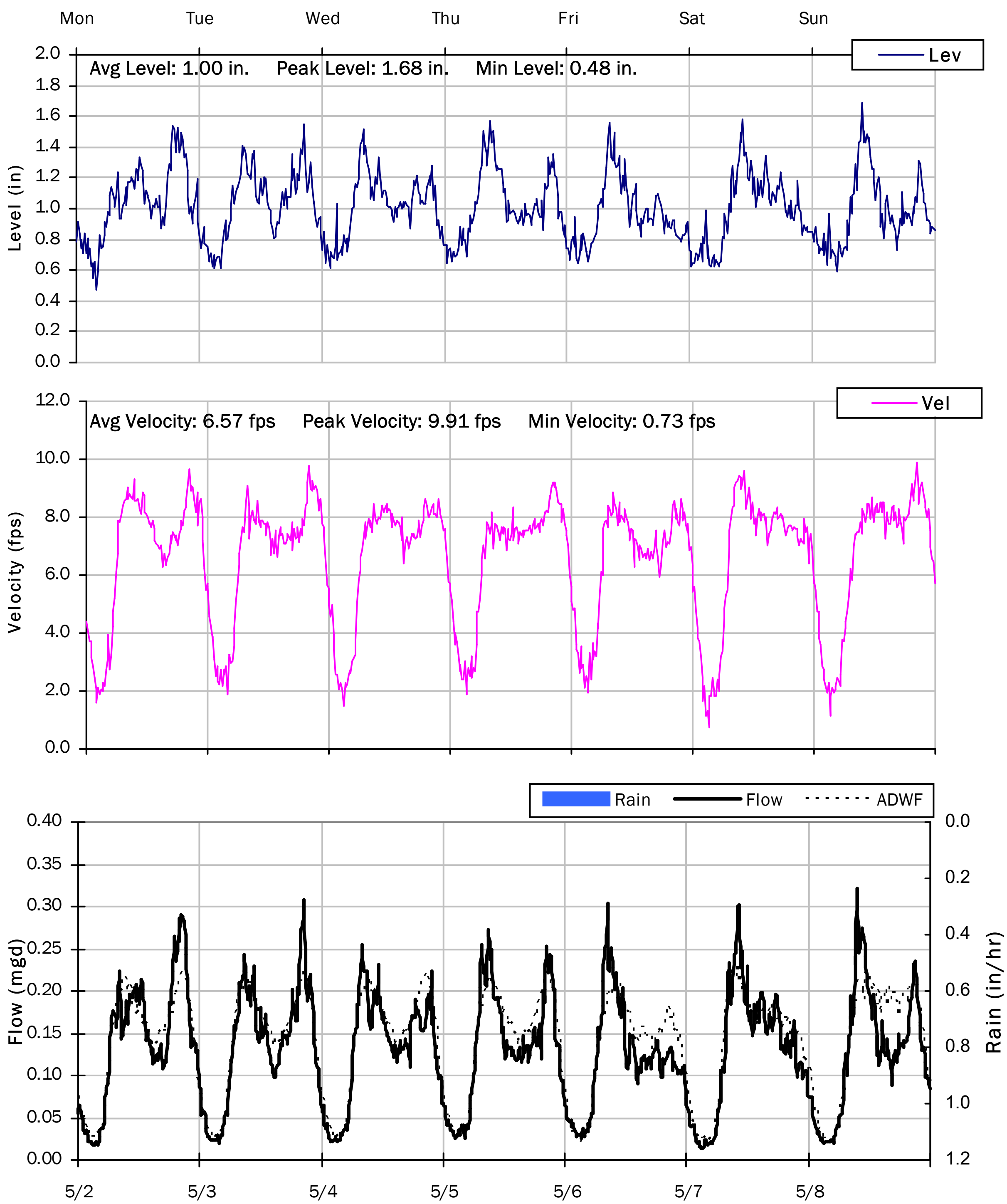


Avg Flow: 0.130 mgd Peak Flow: 0.341 mgd Min Flow: 0.013 mgd

SITE 29

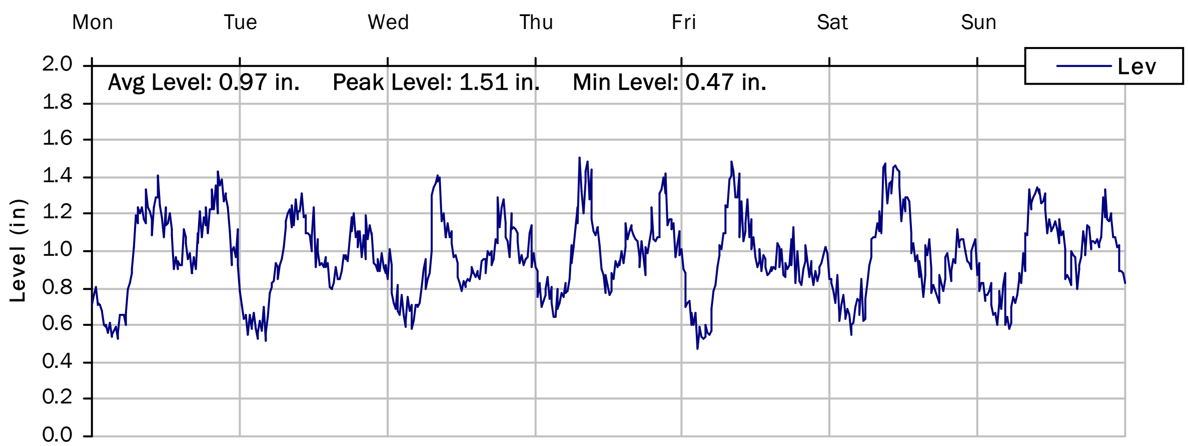
Weekly Level, Velocity and Flow Hydrographs

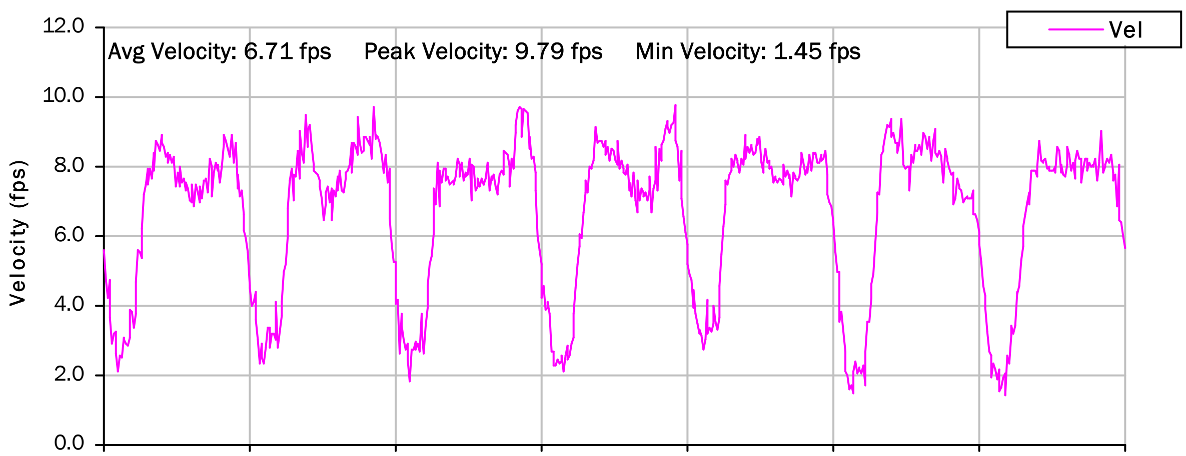
5/2/2022 to 5/9/2022

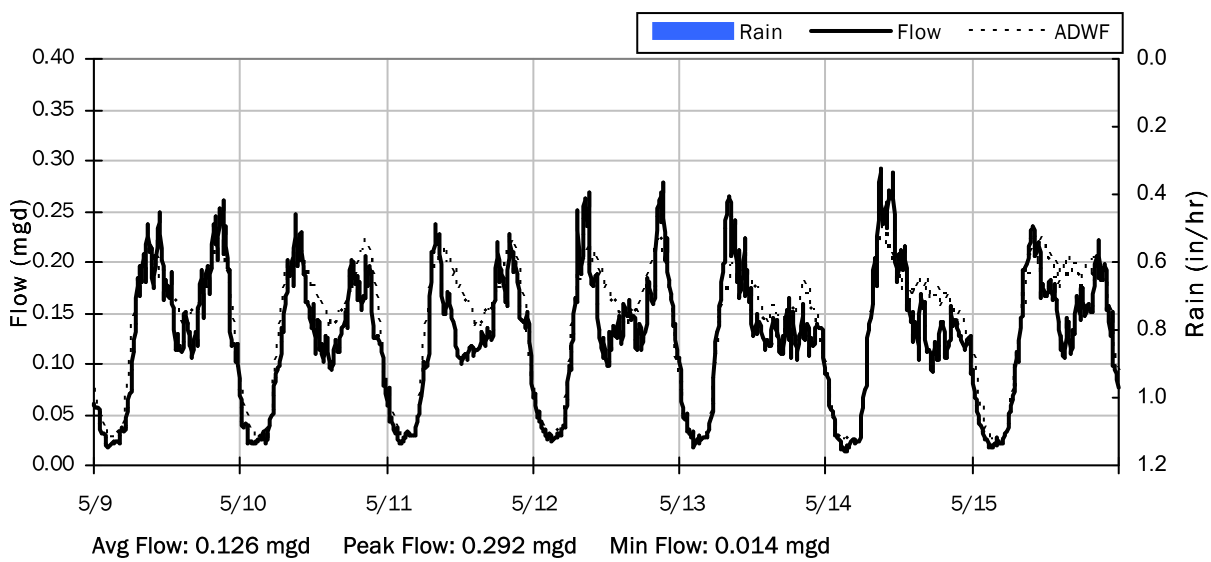


Avg Flow: 0.131 mgd Peak Flow: 0.321 mgd Min Flow: 0.013 mgd

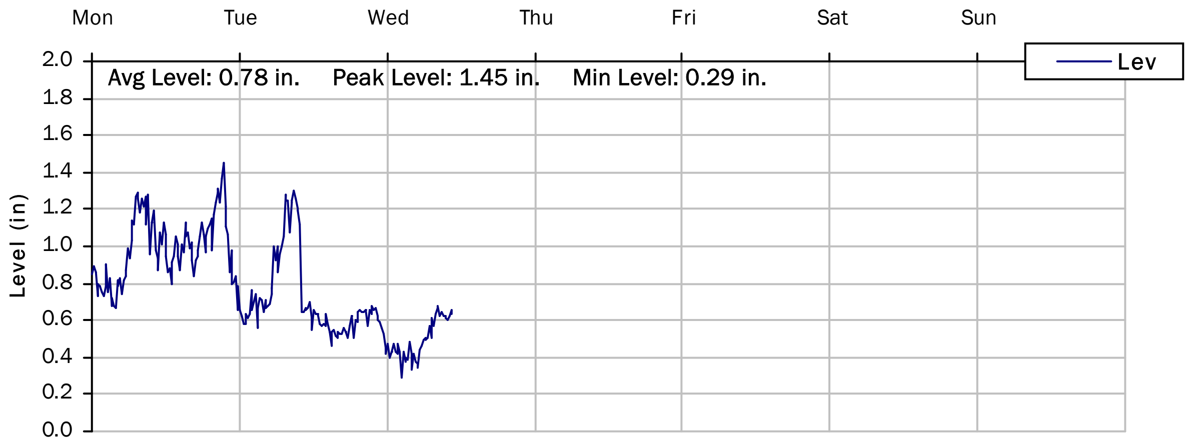
SITE 29
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022

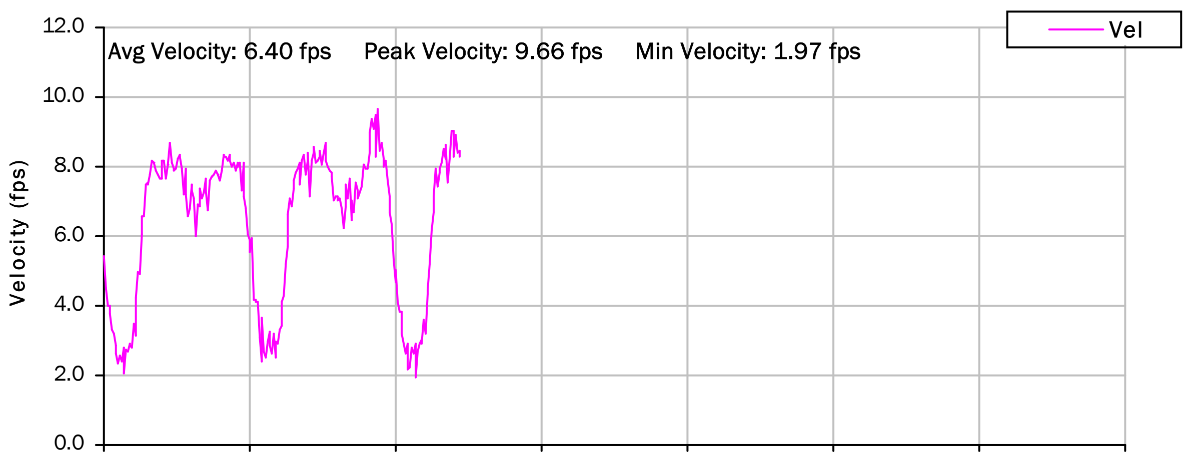


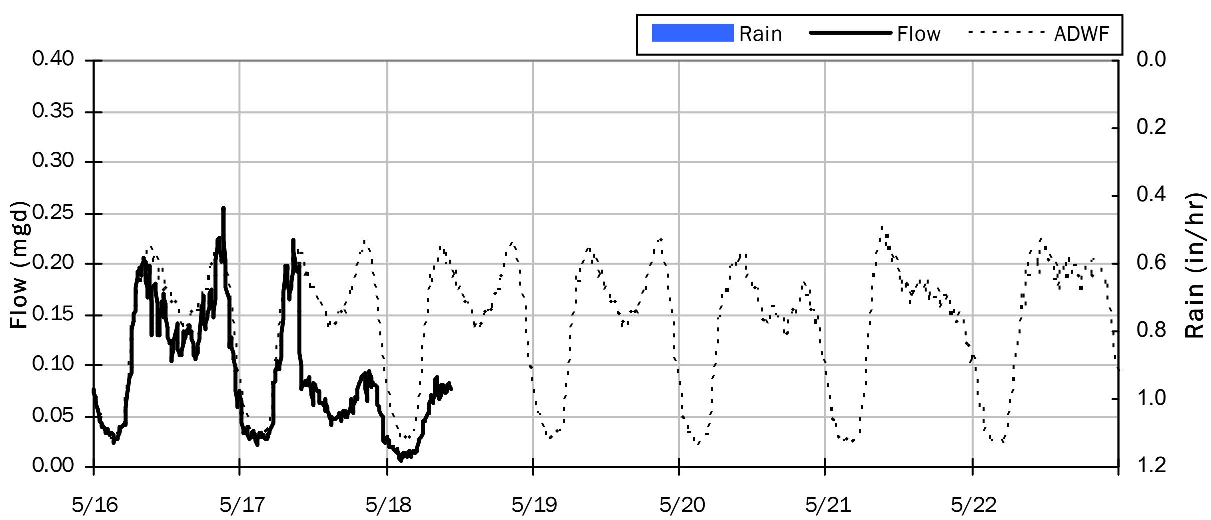




SITE 29
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Avg Flow: 0.089 mgd Peak Flow: 0.253 mgd Min Flow: 0.007 mgd

Monitoring Site: Site 30

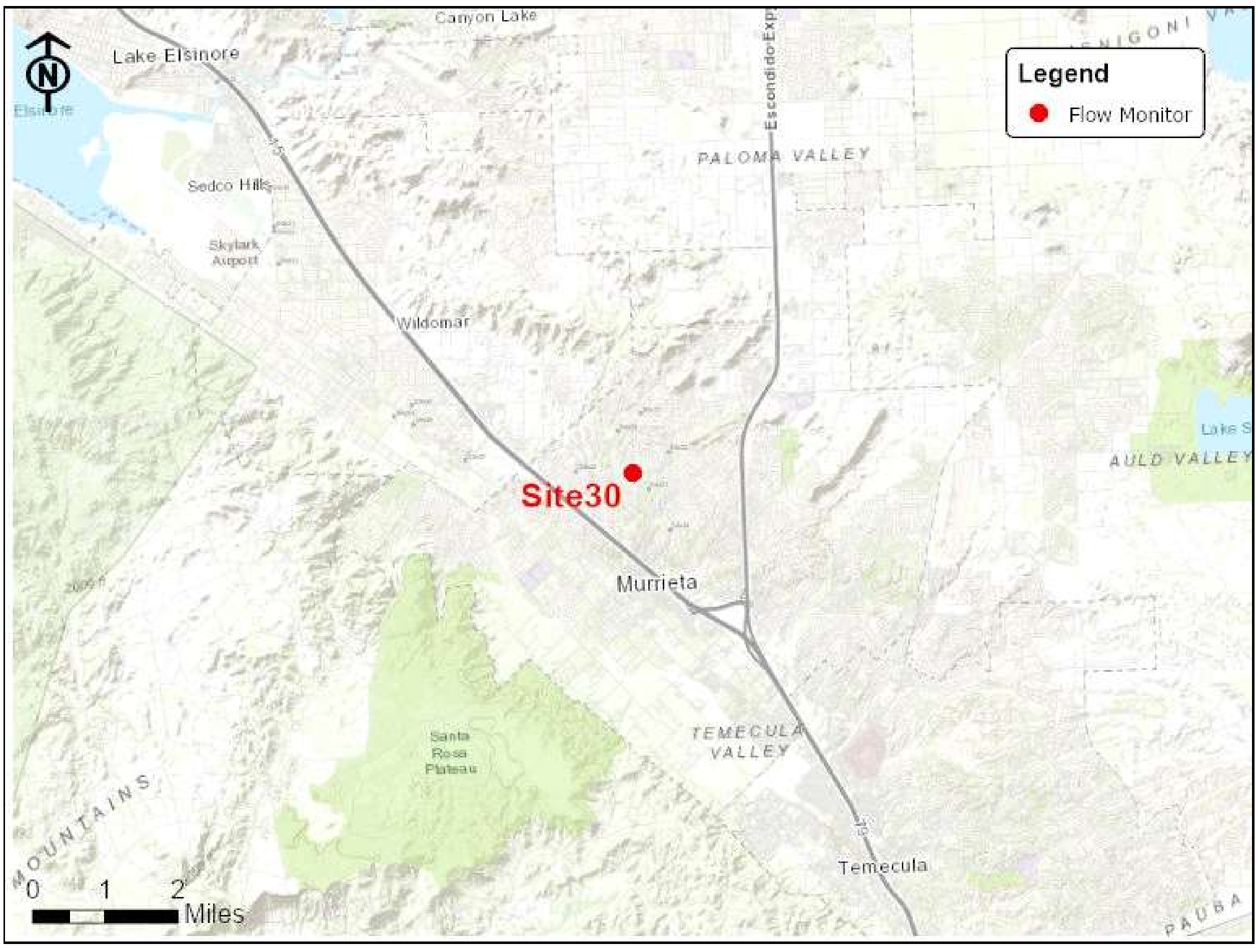
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Colony Drive, west of Avenida Florita

Data Summary Report



Vicinity Map: Site 30

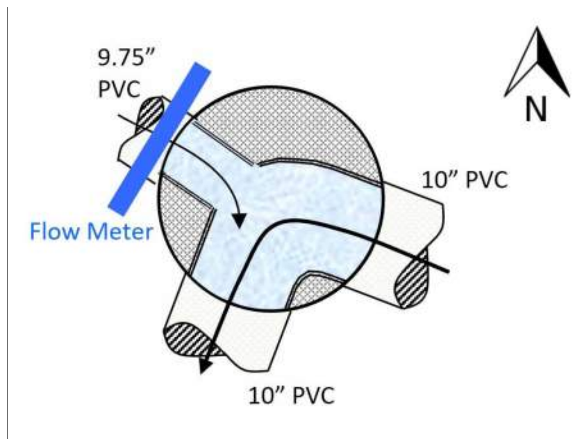
SITE 30

Site Information — MH ID: MH-4753

Location:	Colony Drive, west of Avenida Florita
Coordinates:	117.2046° W, 33.5945° N
Rim Elevation (Earth):	1257 feet
Expected Pipe Diameter:	10 inches
Measured Pipe Diameter:	9.75 inches
ADWF:	0.194 mgd
Peak Measured Flow:	0.602 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch


View from Street


Plan View

SITE 30

Additional Site Photos

Effluent Pipe

E Influent Pipe

SITE 30

Additional Site Photos

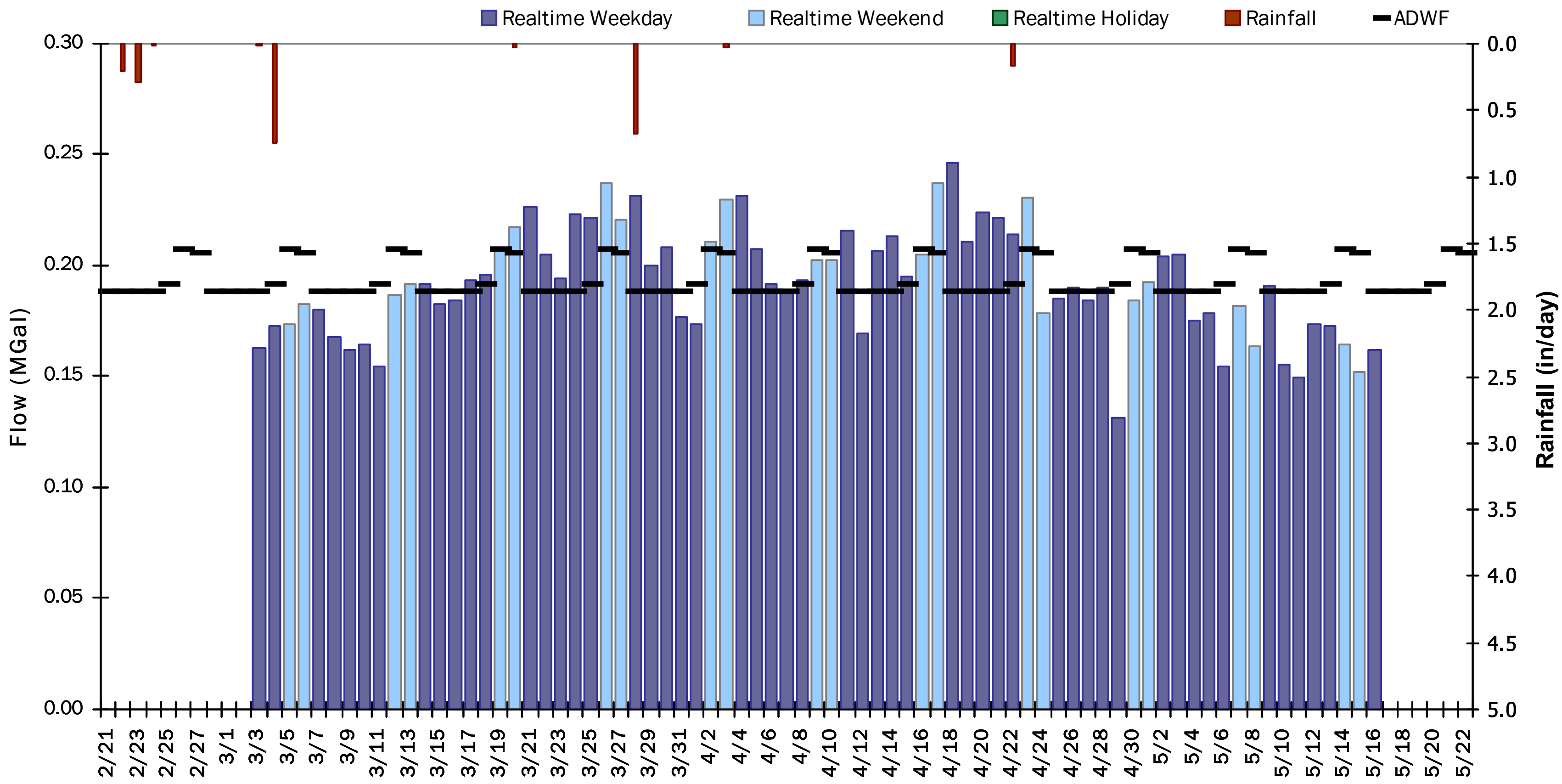
Monitored W Influent Pipe

SITE 30

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.192 MGal   Peak Daily Flow: 0.246 MGal   Min Daily Flow: 0.126 MGal

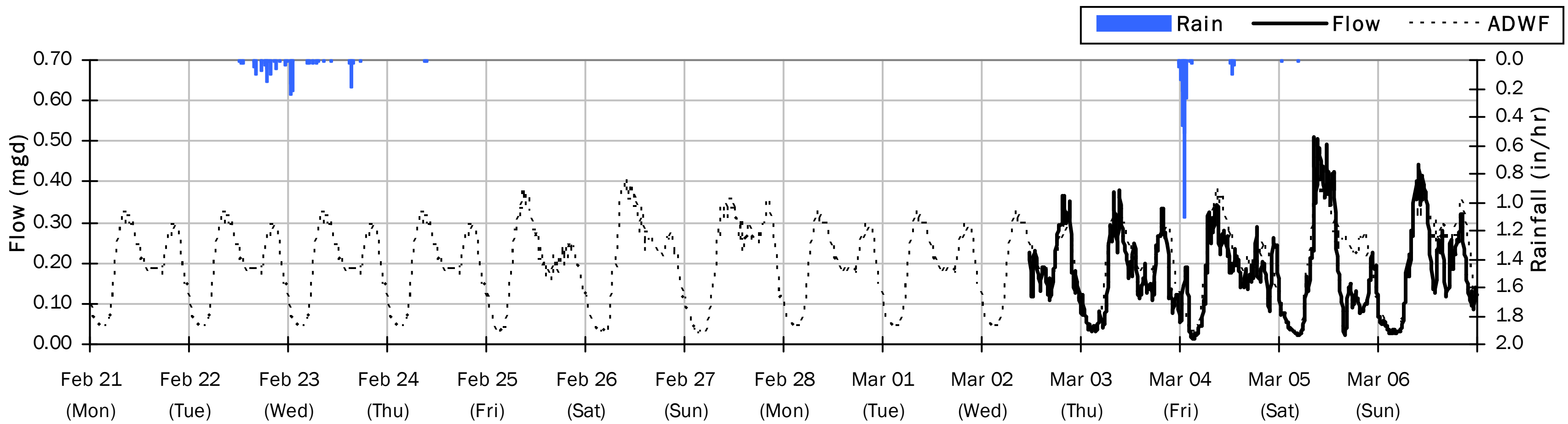
Total Rainfall: 1.67 inches

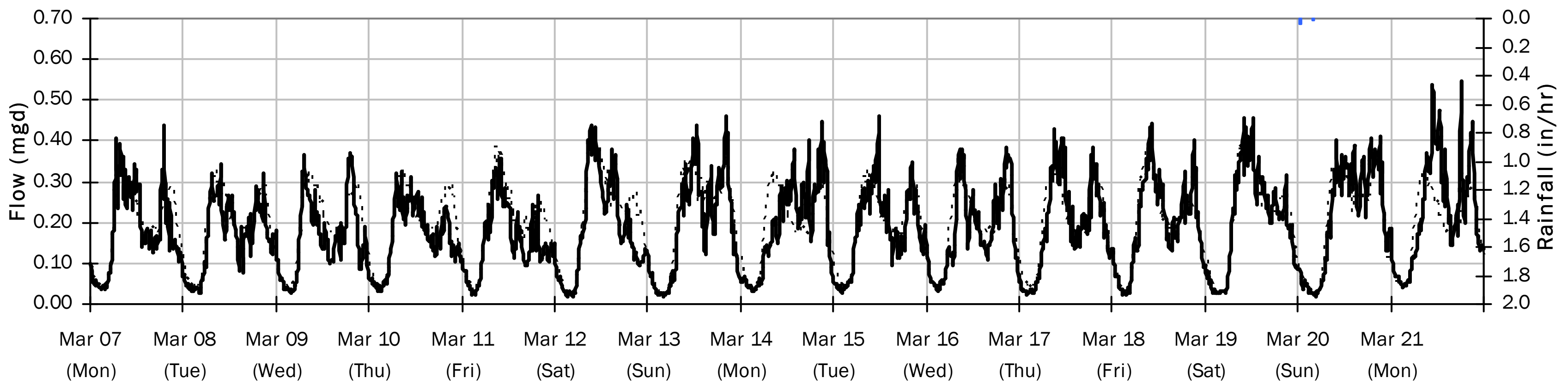


SITE 30
Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.29 inches

Period Avg Flow: 0.185 mgd Period Peak Flow: 0.548 mgd Period Min Flow: 0.013 mgd



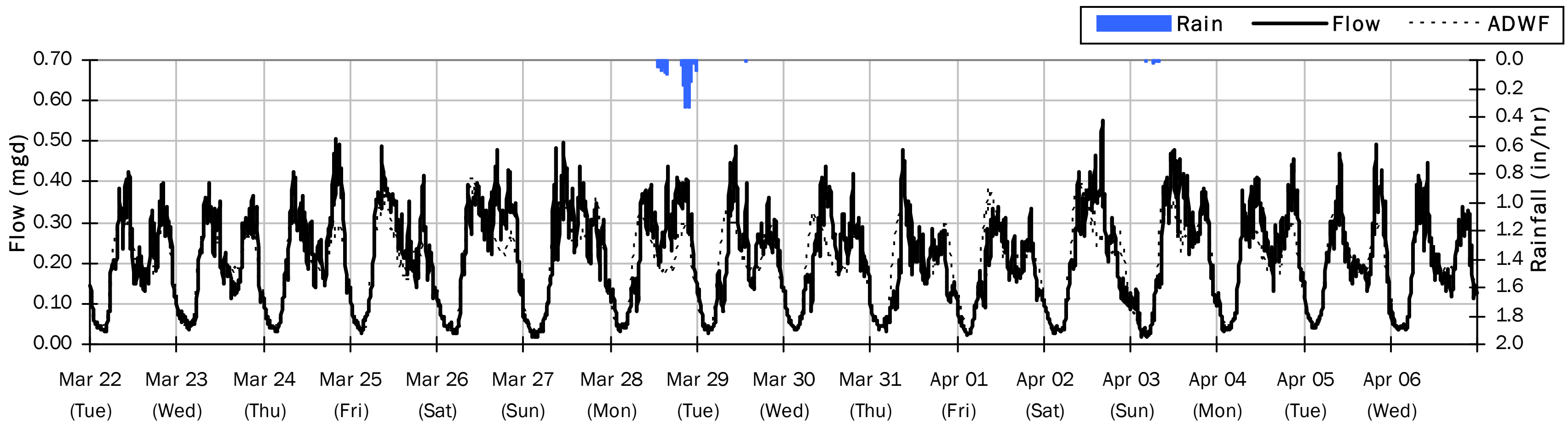


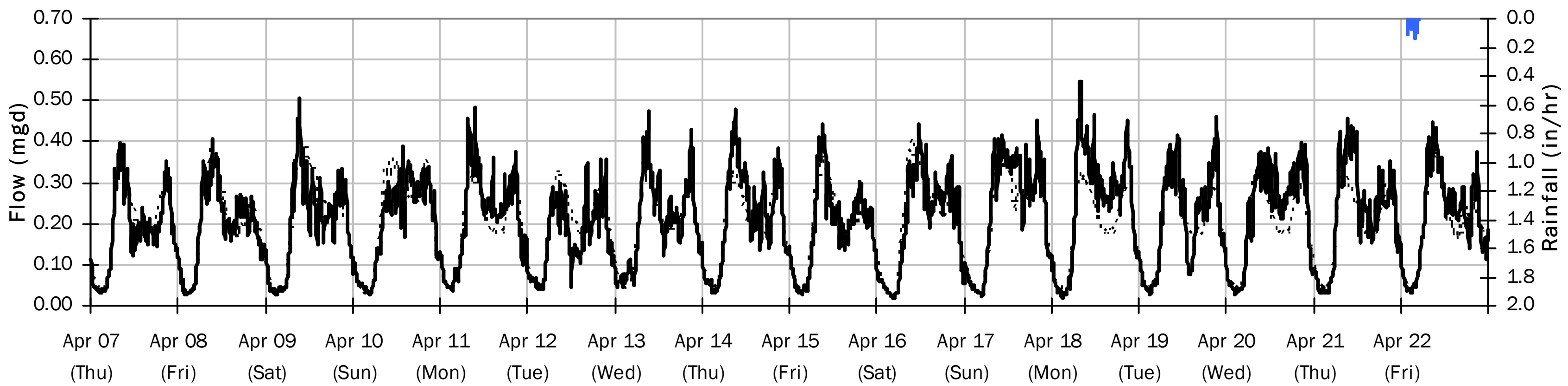
SITE 30

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.88 inches

Period Avg Flow: 0.210 mgd Period Peak Flow: 0.548 mgd Period Min Flow: 0.016 mgd

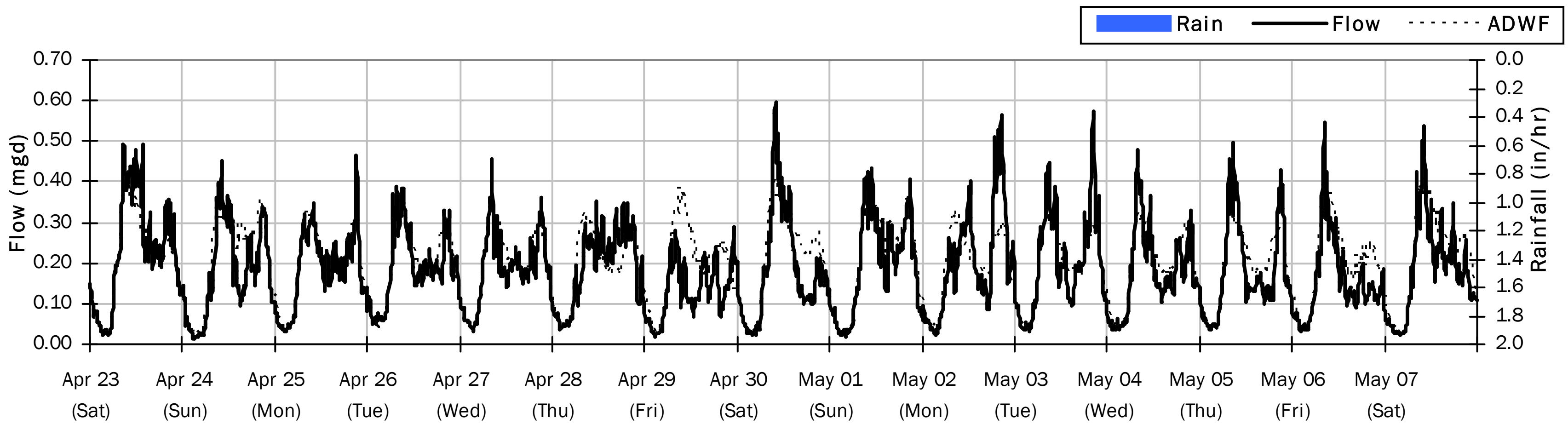


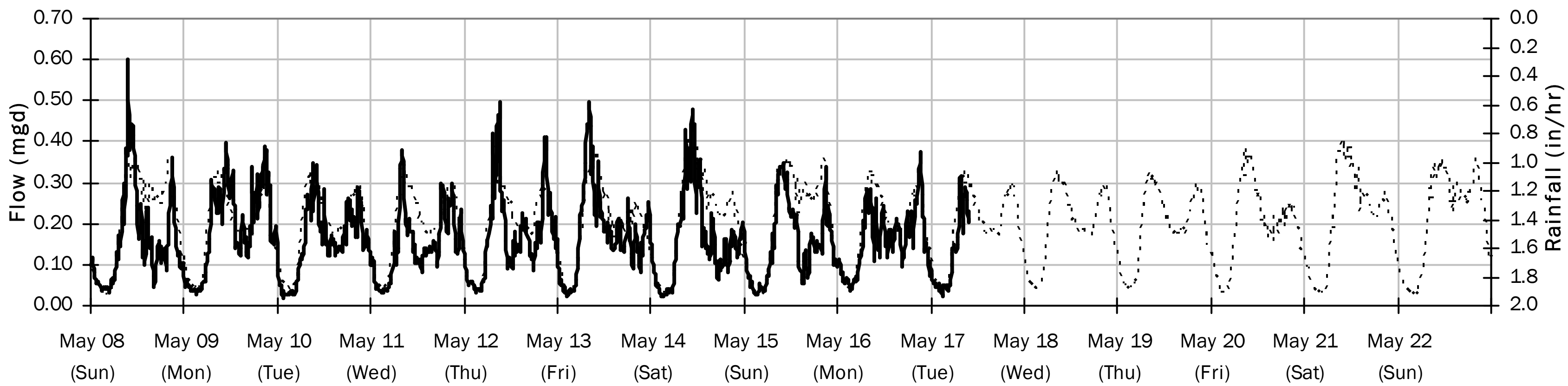


SITE 30

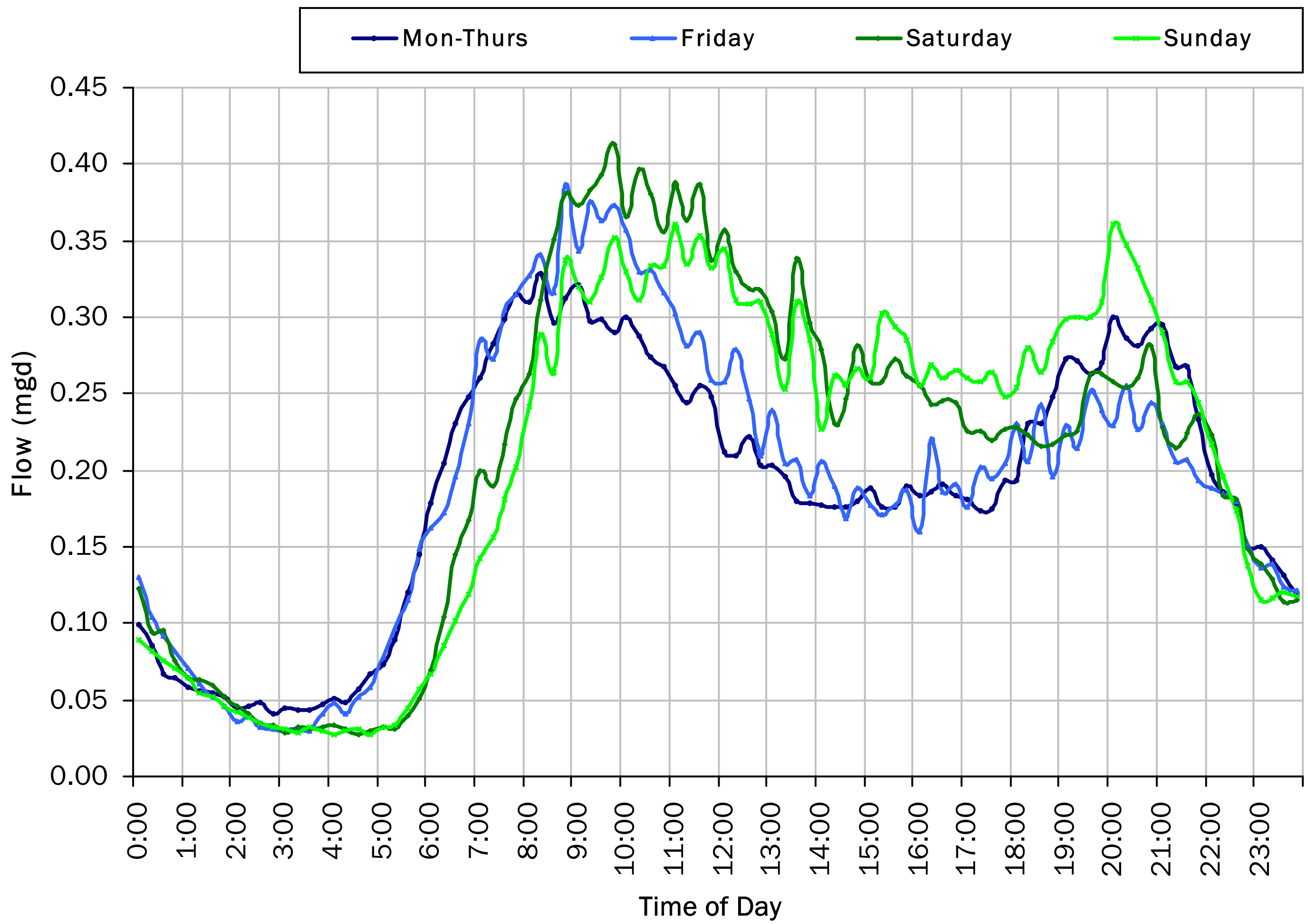
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches   Period Avg Flow: 0.176 mgd   Period Peak Flow: 0.602 mgd   Period Min Flow: 0.013 mgd



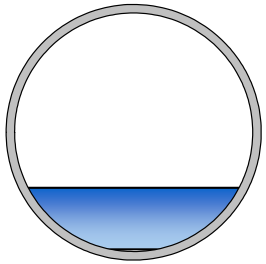


SITE 30
Average Dry Weather Flow Hydrographs



ADWF:

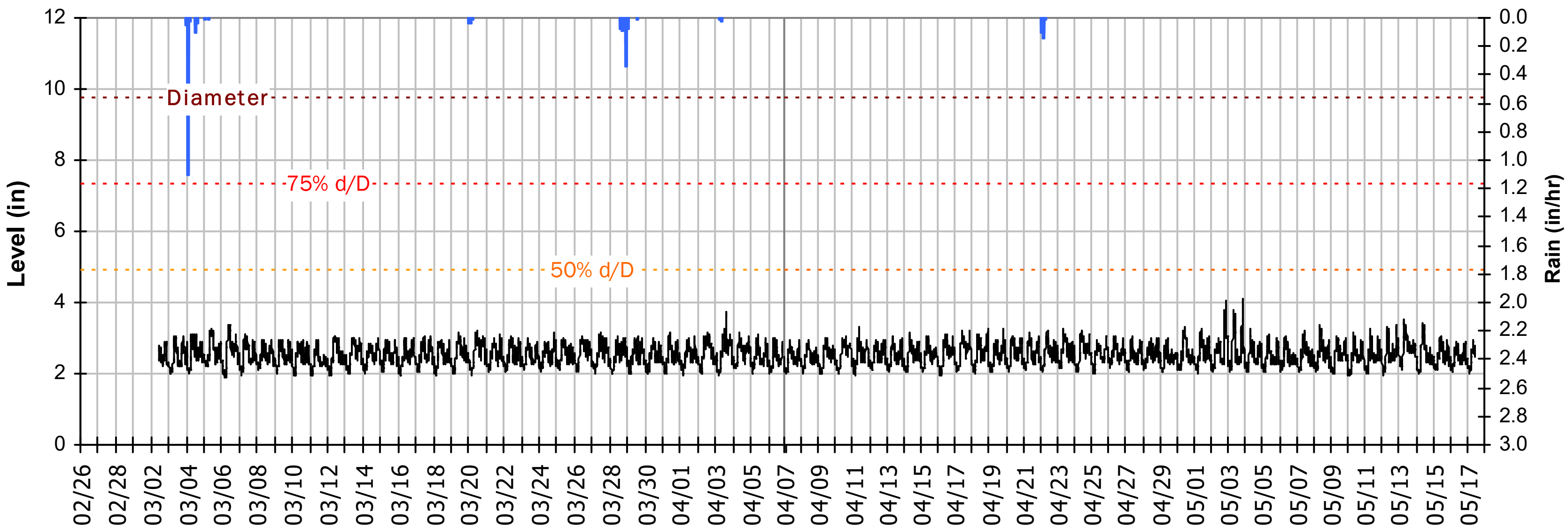
0.194 *mgd*

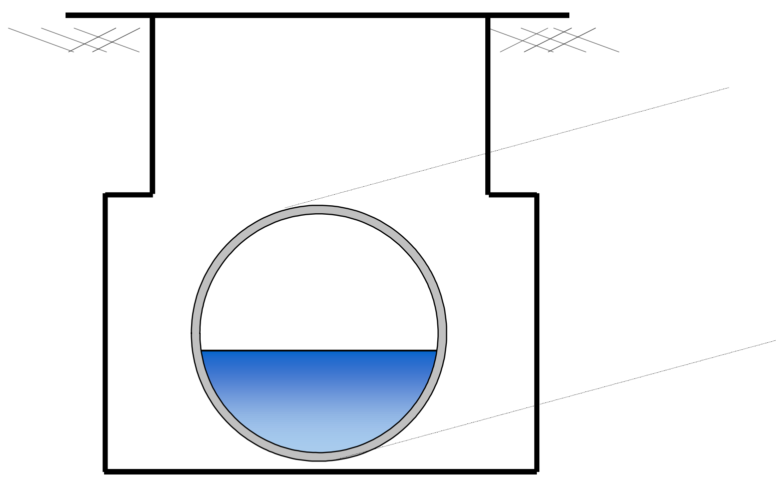


SITE 30

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



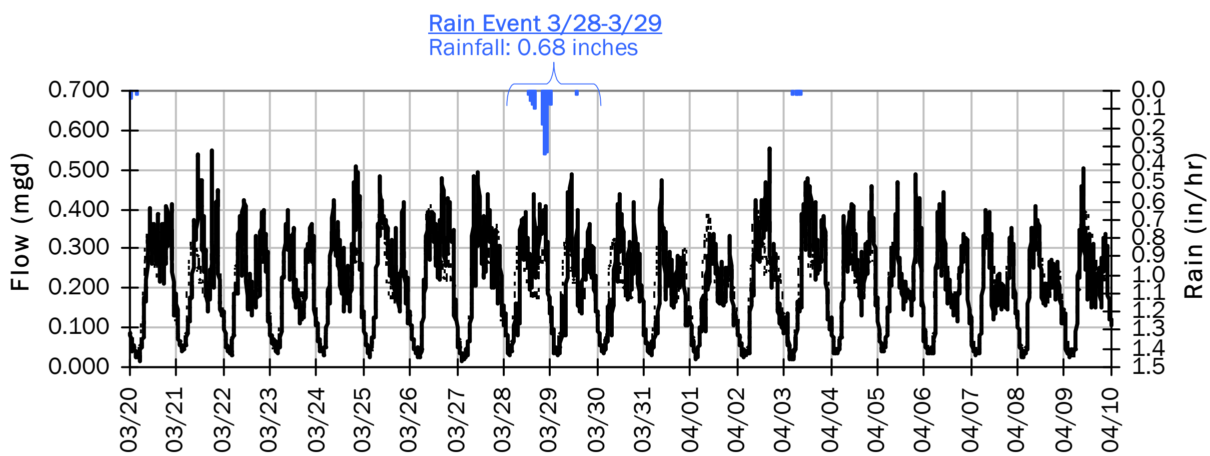


Pipe Diameter:	9.75	*inches*
Peak Measured Level:	4.12	*inches*
Peak d/D Ratio:	0.42	

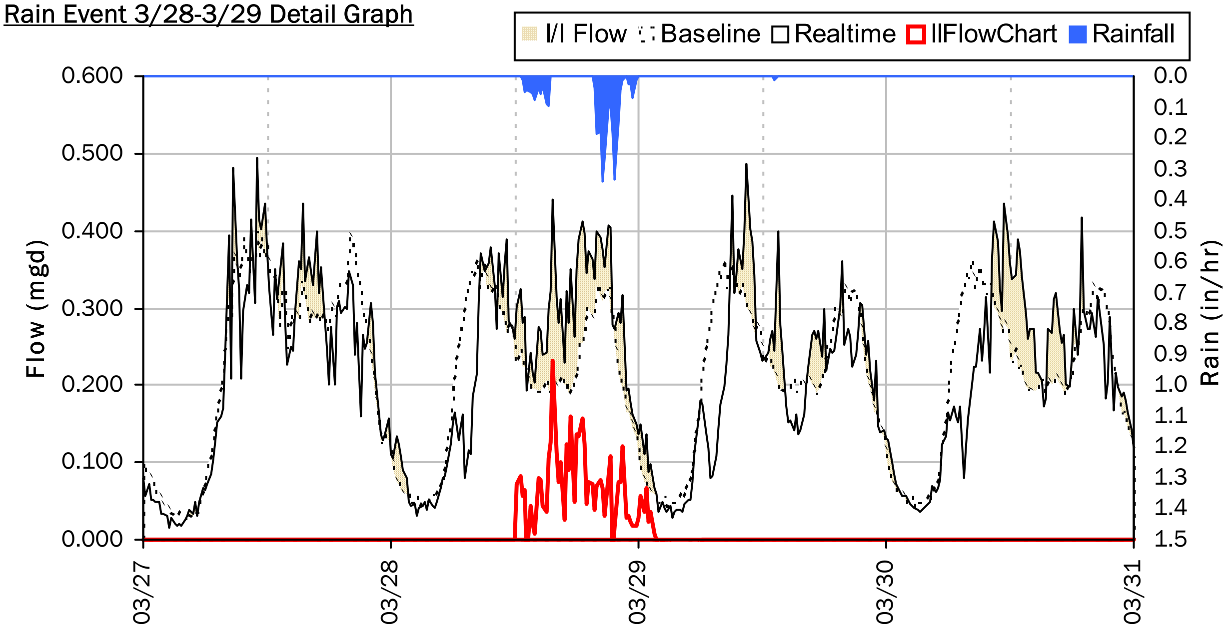
SITE 30

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3/28-3/29 Detail Graph

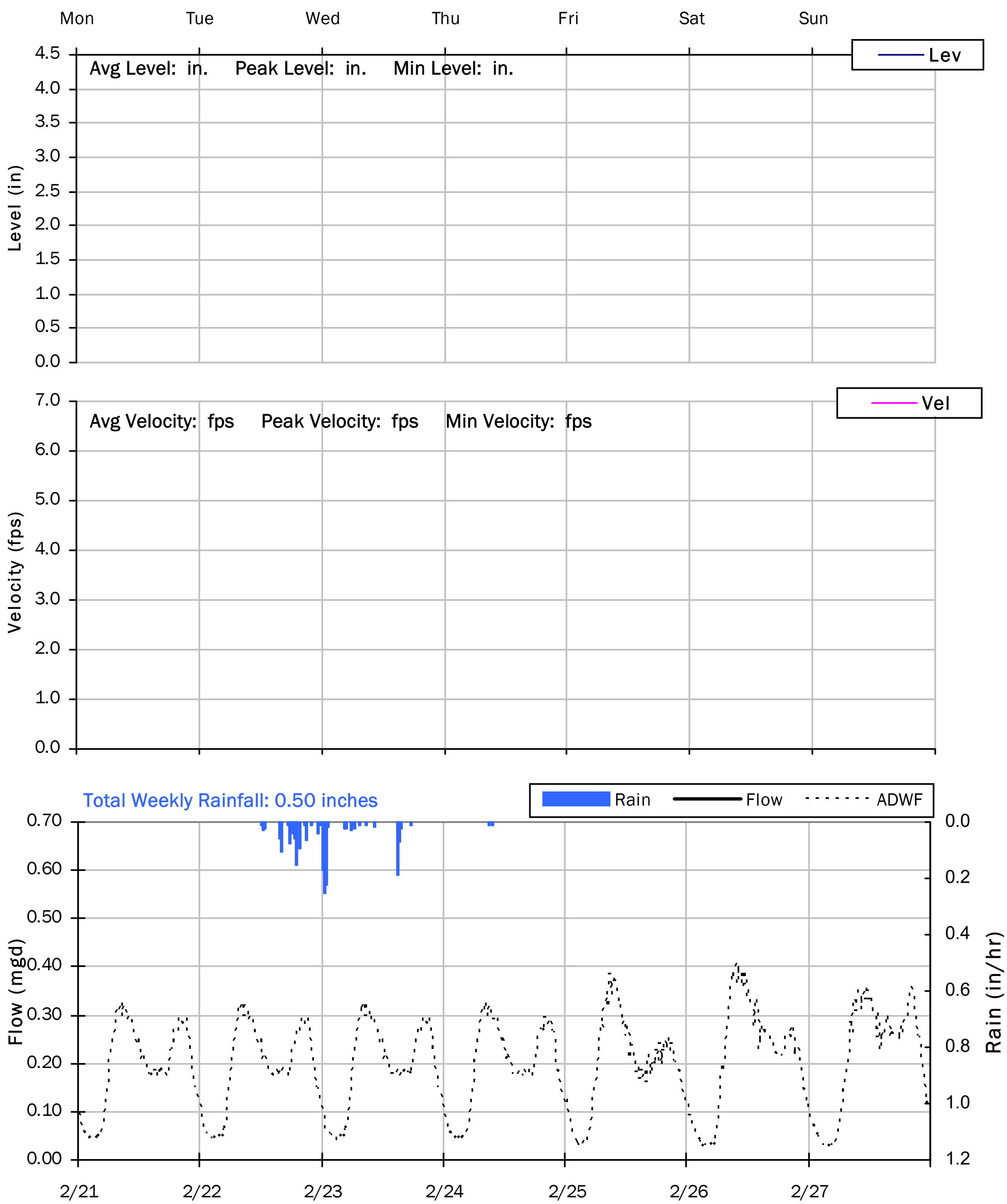


Storm Event I/I Analysis (Rain = 0.68 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.439 *mgd*	Peak I/I Rate:	0.231 *mgd*
PF:	2.26	Total I/I:	35,000 *gallons*
Peak Level:	3.02 *in*		
d/D Ratio:	0.31		

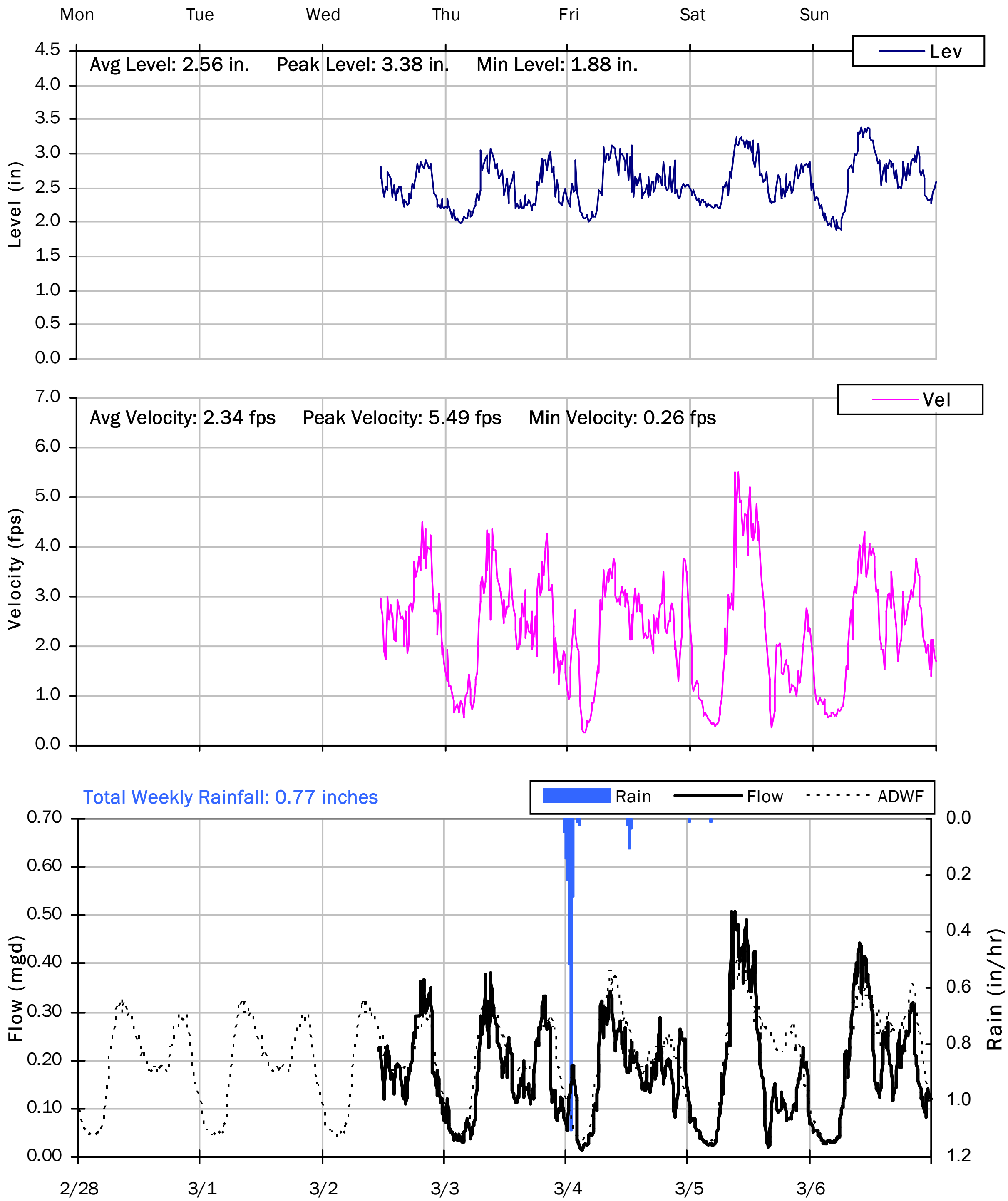
SITE 30

Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



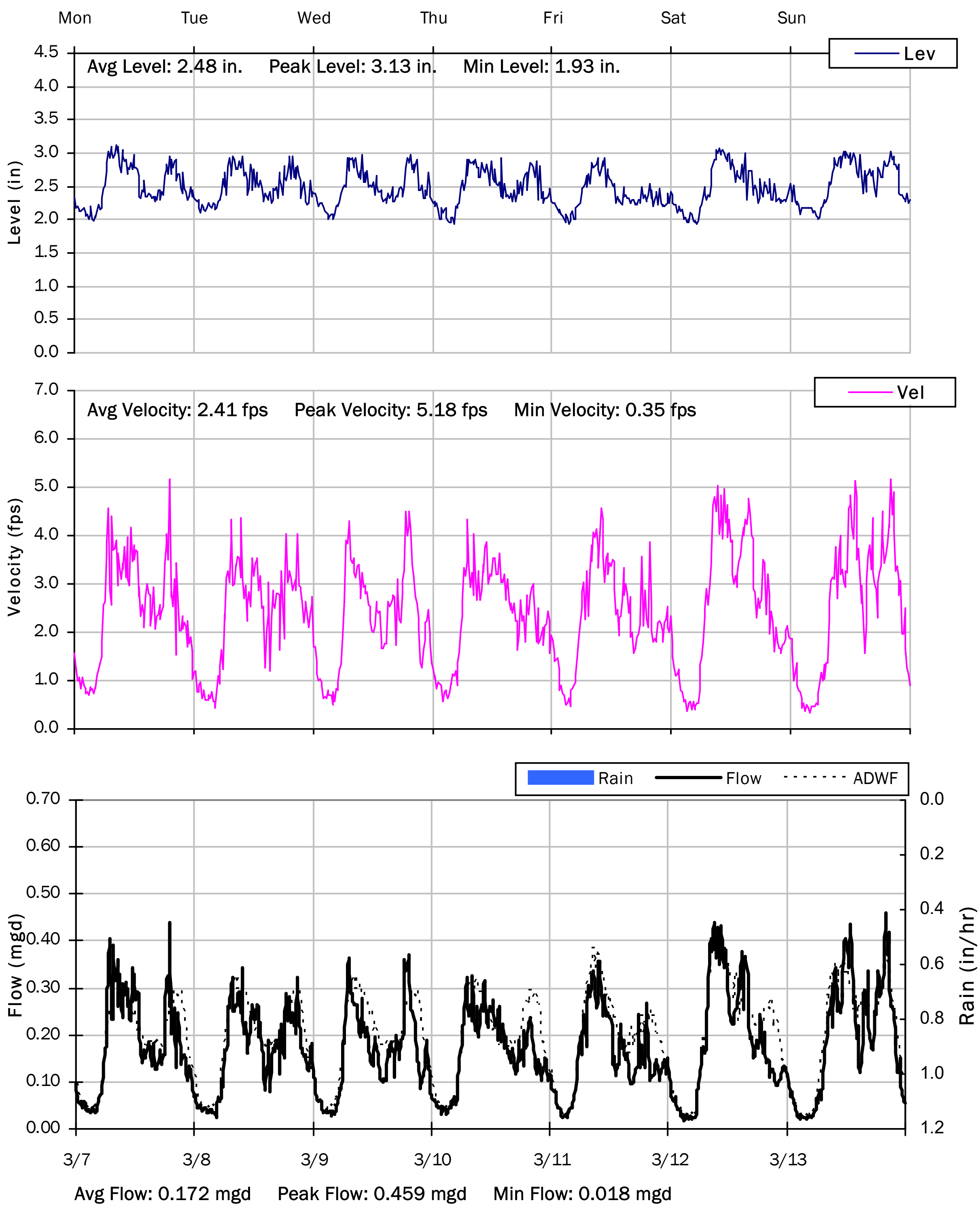
Avg Flow: mgd Peak Flow: mgd Min Flow: mgd

SITE 30
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

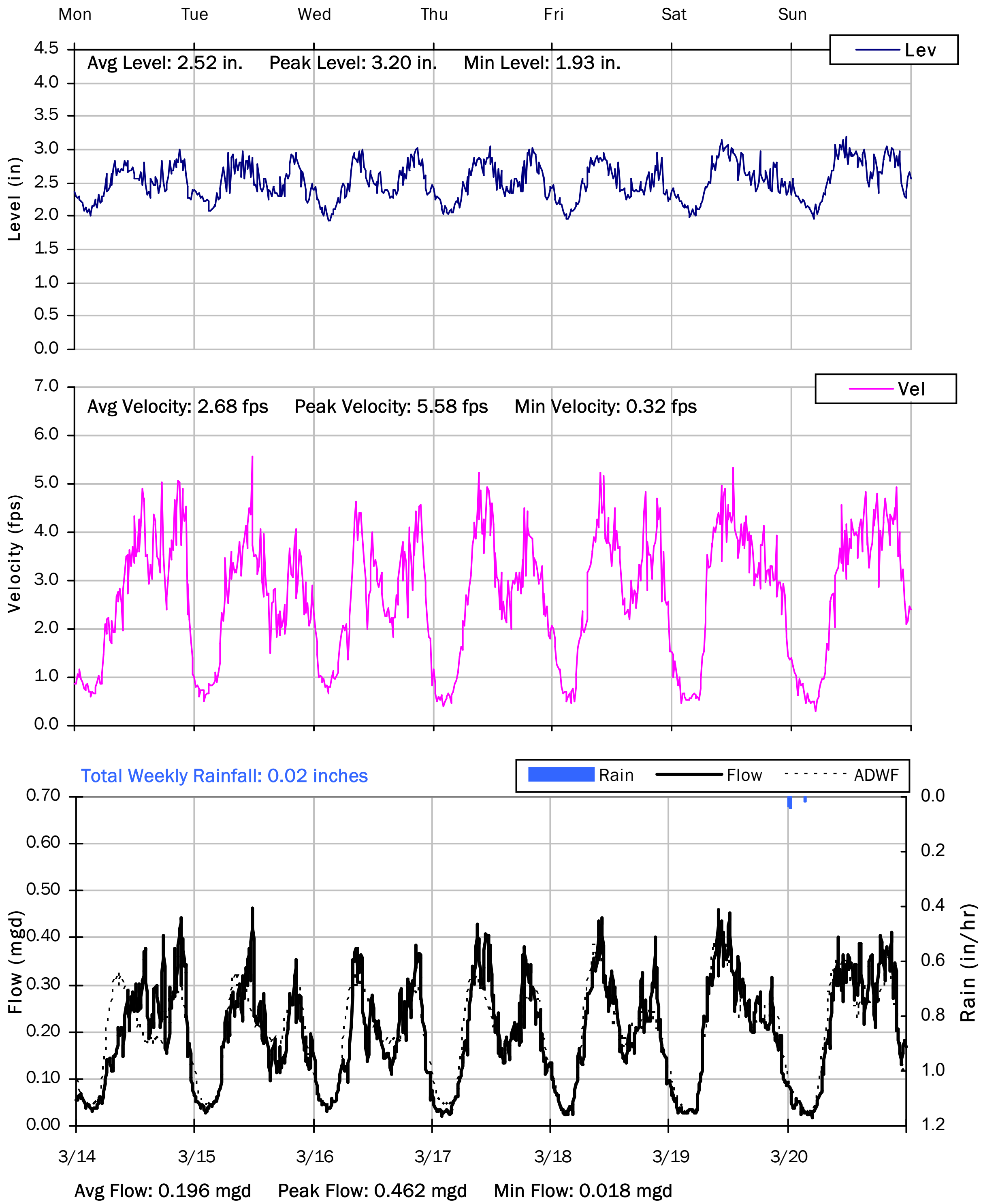


Avg Flow: 0.177 mgd Peak Flow: 0.508 mgd Min Flow: 0.013 mgd

SITE 30
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022



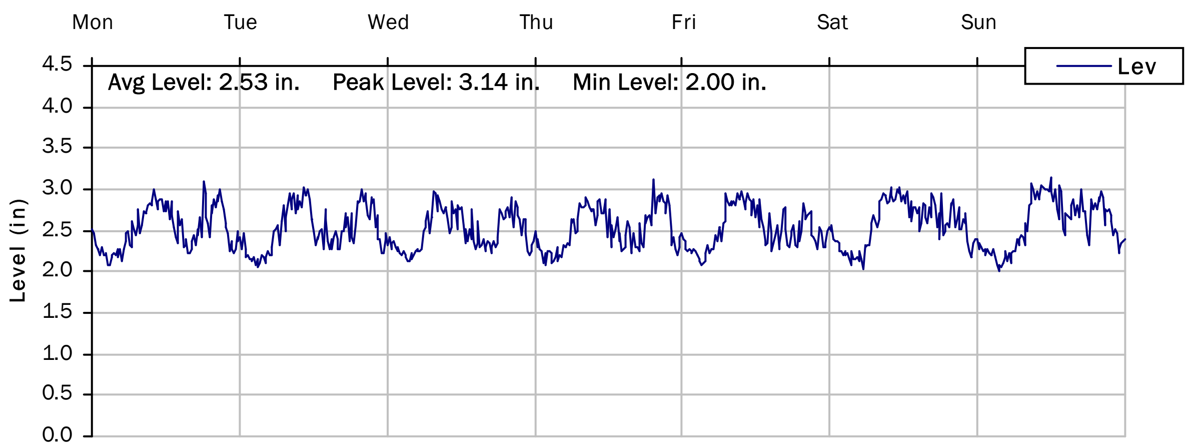
SITE 30
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022

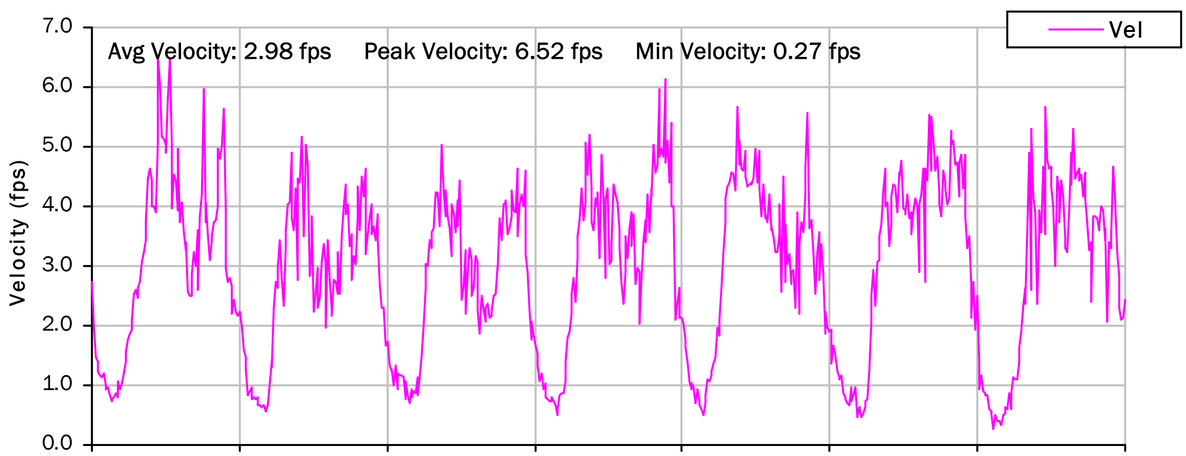


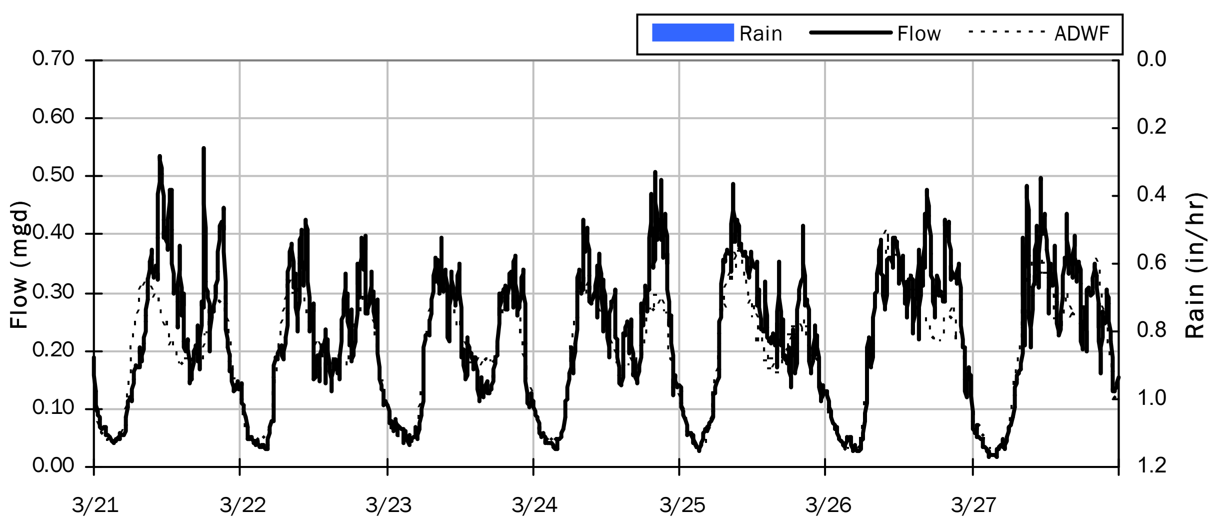
SITE 30

Weekly Level, Velocity and Flow Hydrographs

3/21/2022 to 3/28/2022

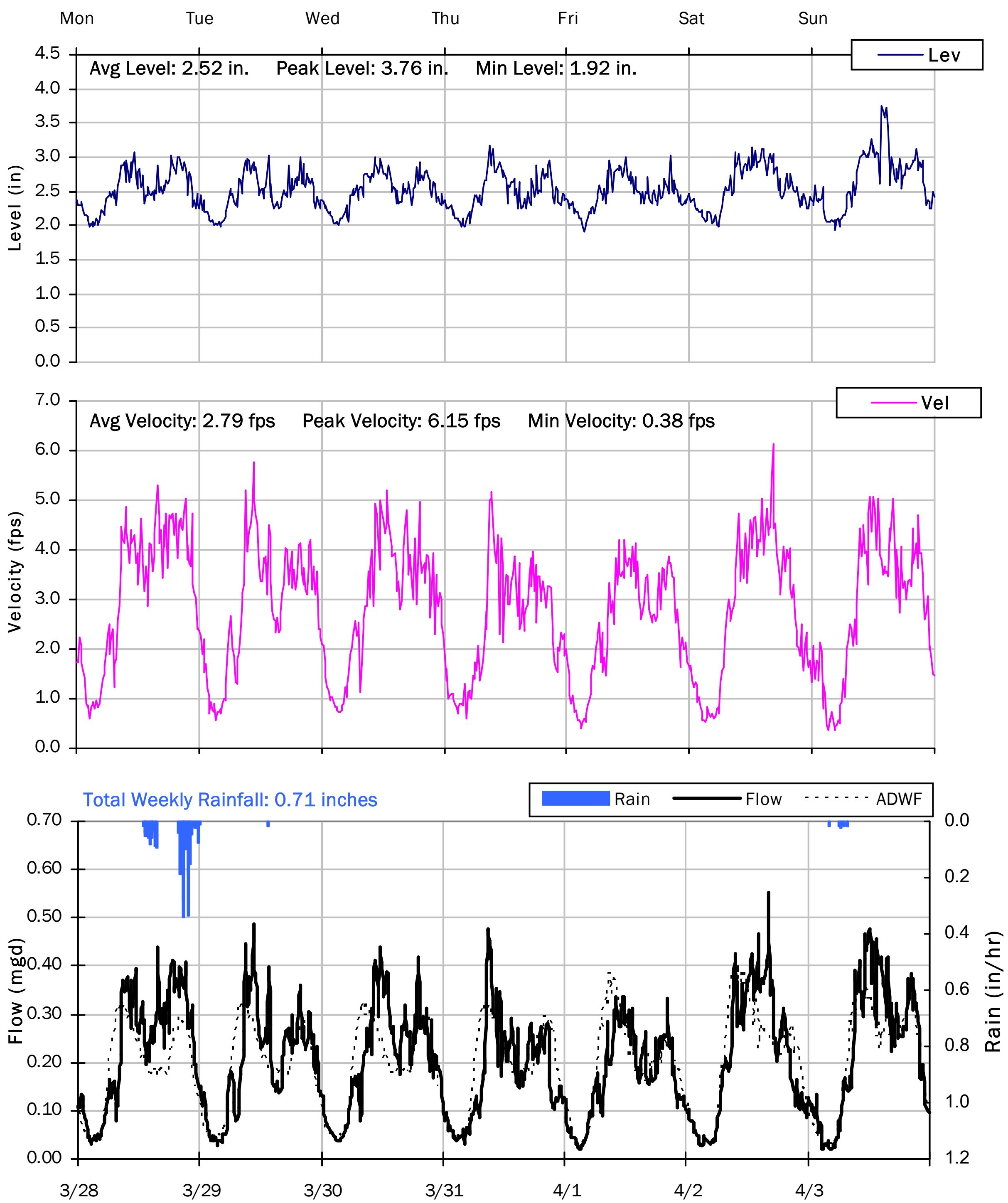






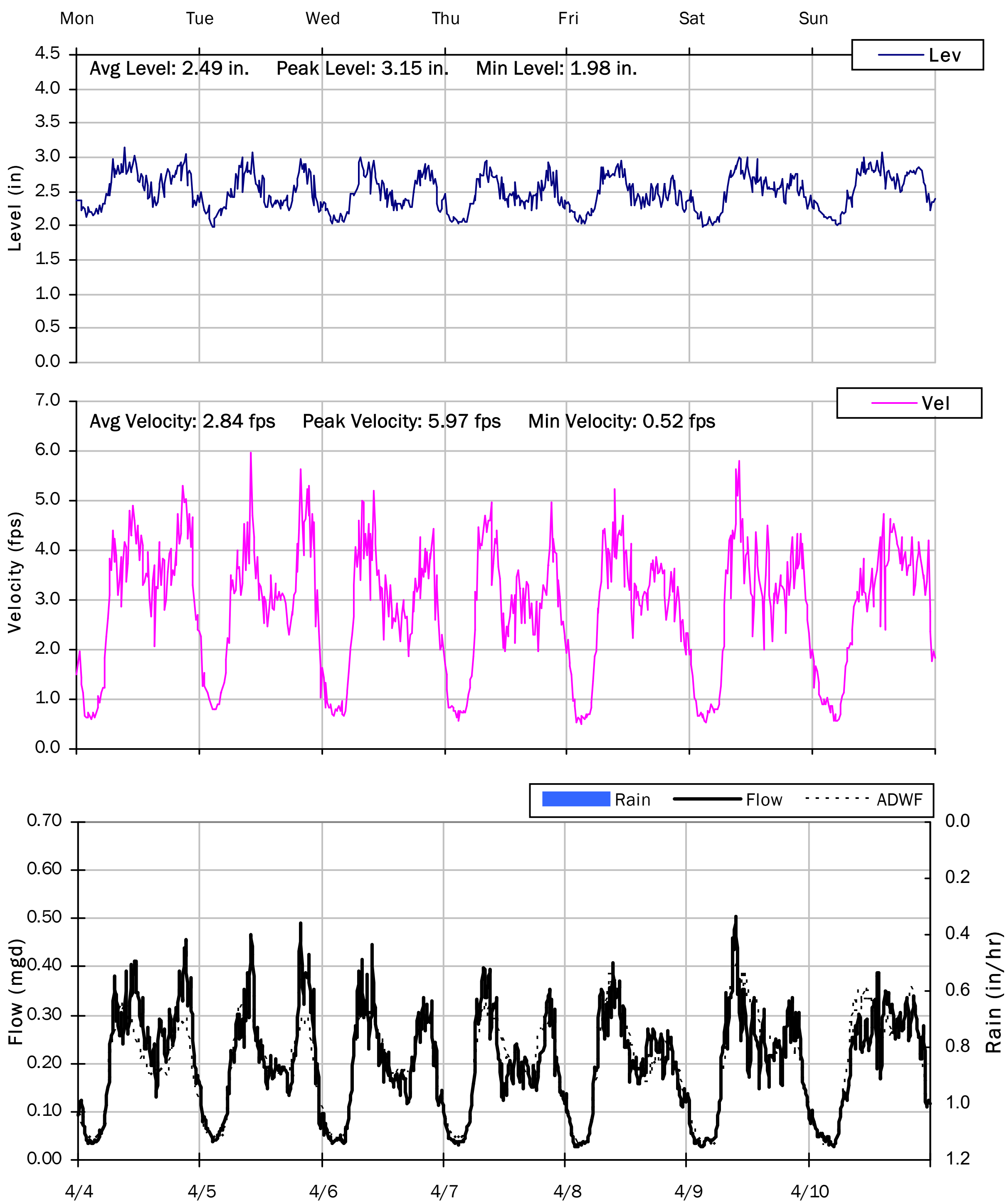
Avg Flow: 0.218 mgd Peak Flow: 0.548 mgd Min Flow: 0.016 mgd

SITE 30
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022



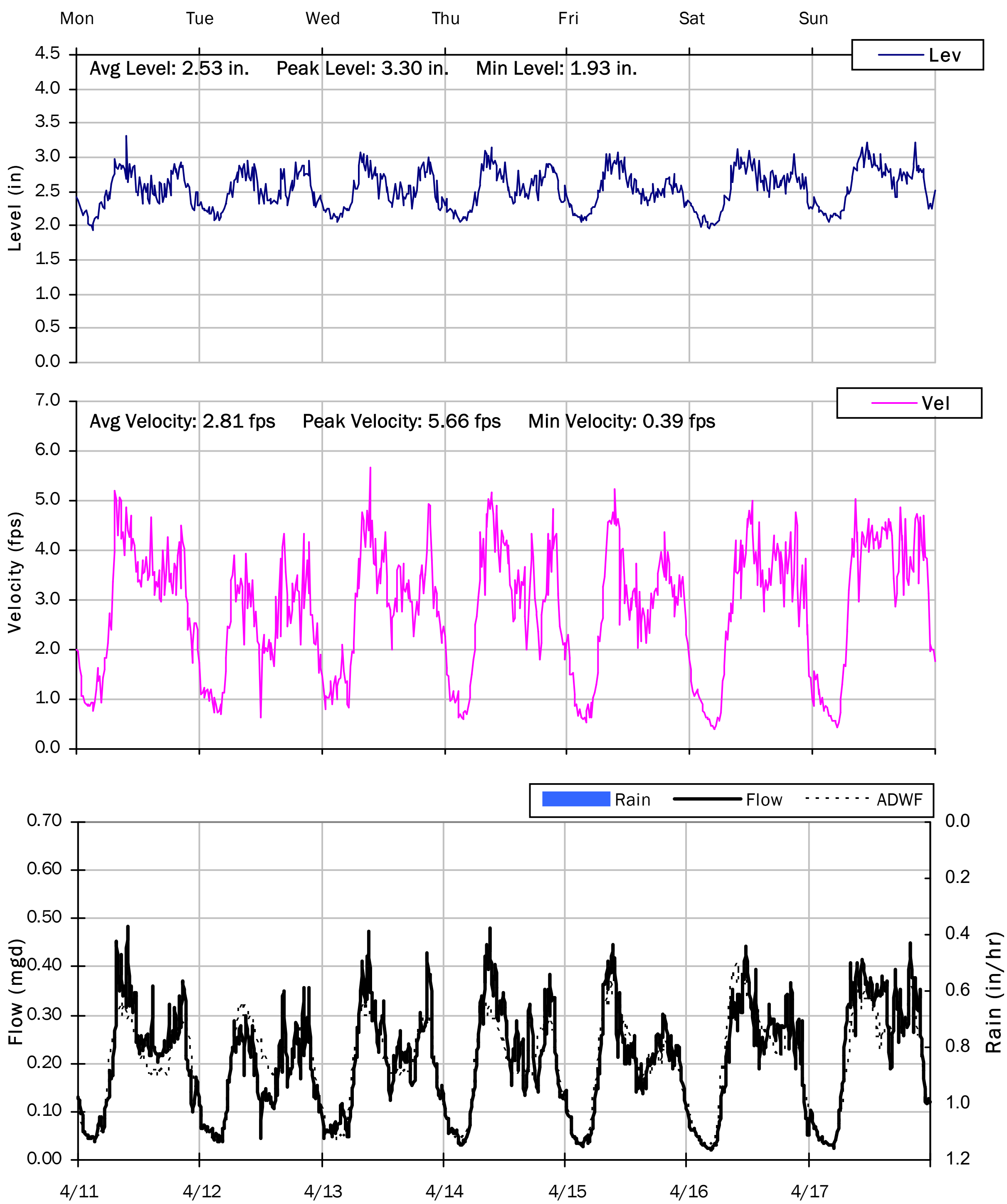
Avg Flow: 0.204 mgd Peak Flow: 0.548 mgd Min Flow: 0.019 mgd

SITE 30
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022



Avg Flow: 0.202 mgd Peak Flow: 0.505 mgd Min Flow: 0.027 mgd

SITE 30
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

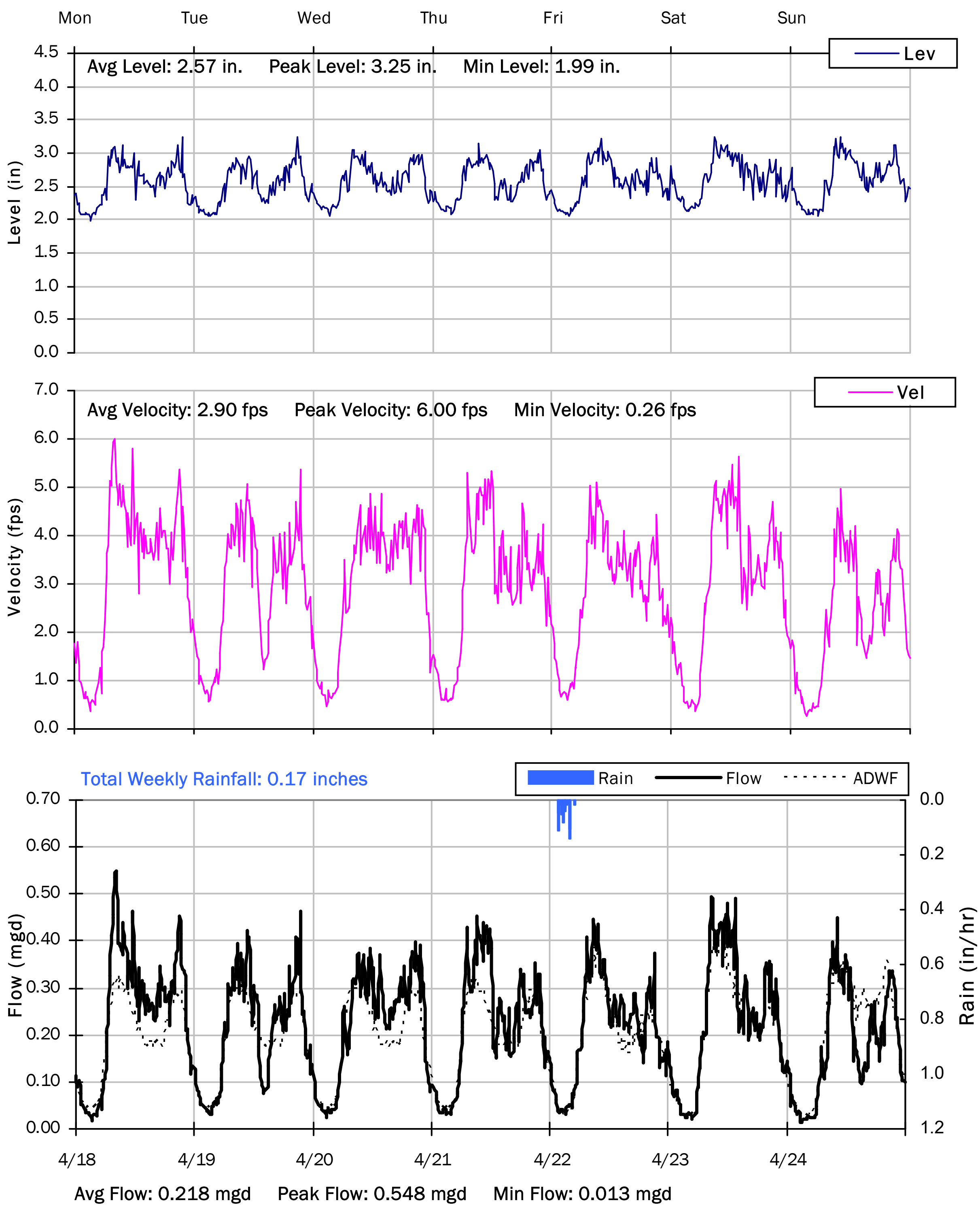


Avg Flow: 0.206 mgd Peak Flow: 0.484 mgd Min Flow: 0.019 mgd

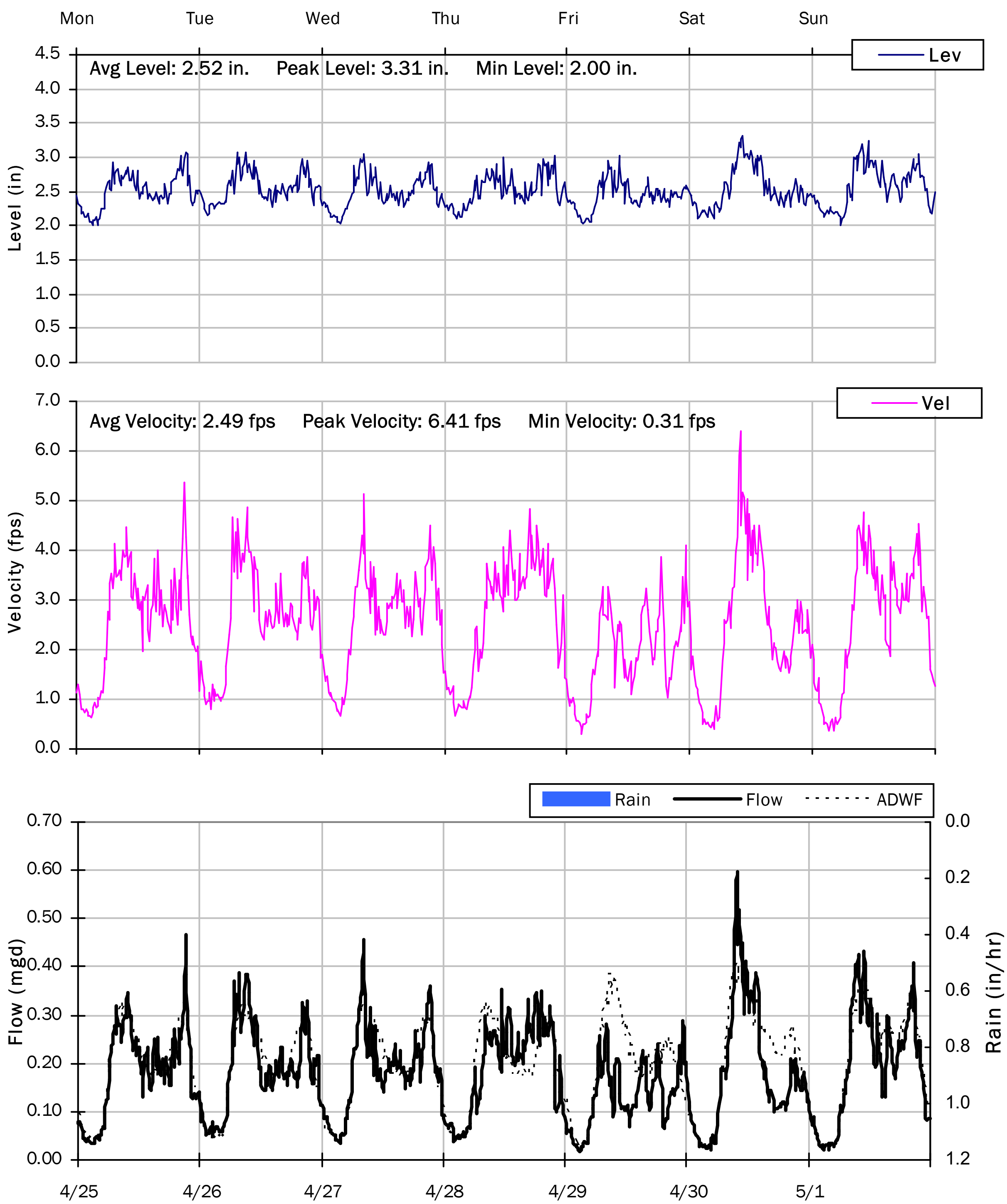
SITE 30

Weekly Level, Velocity and Flow Hydrographs

4/18/2022 to 4/25/2022



SITE 30
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

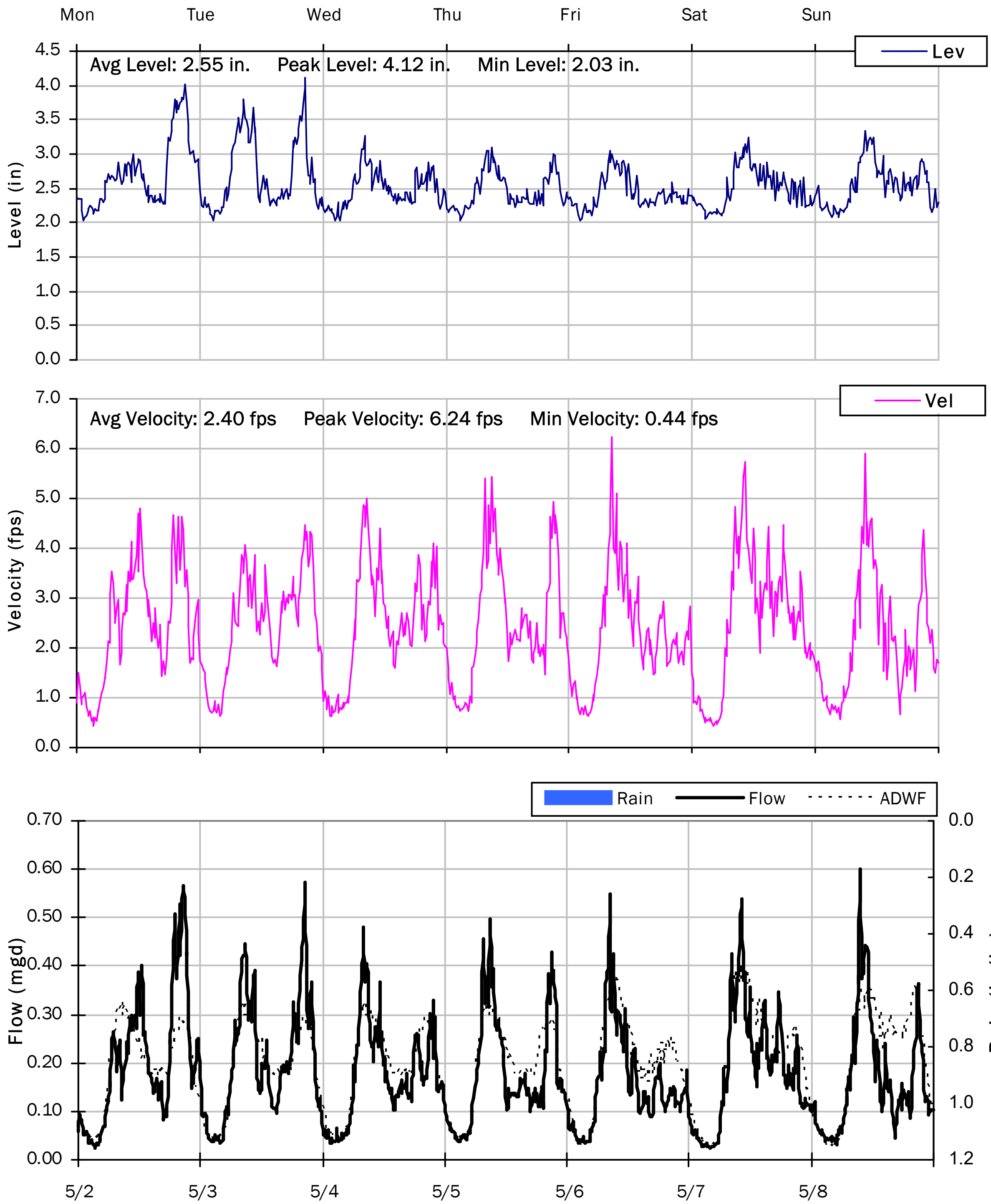


Avg Flow: 0.180 mgd Peak Flow: 0.597 mgd Min Flow: 0.016 mgd

SITE 30

Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022

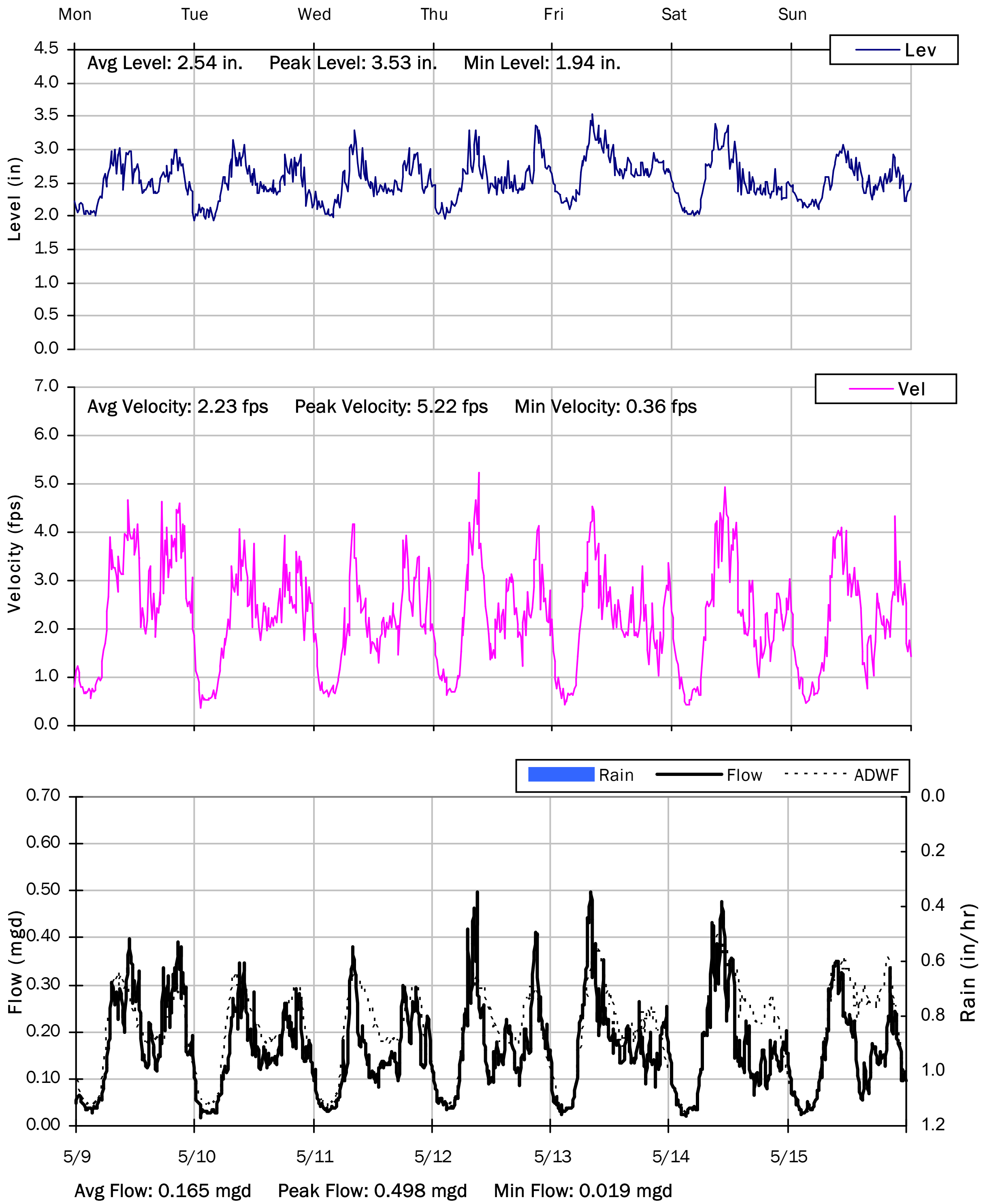


Avg Flow: 0.180 mgd Peak Flow: 0.602 mgd Min Flow: 0.024 mgd

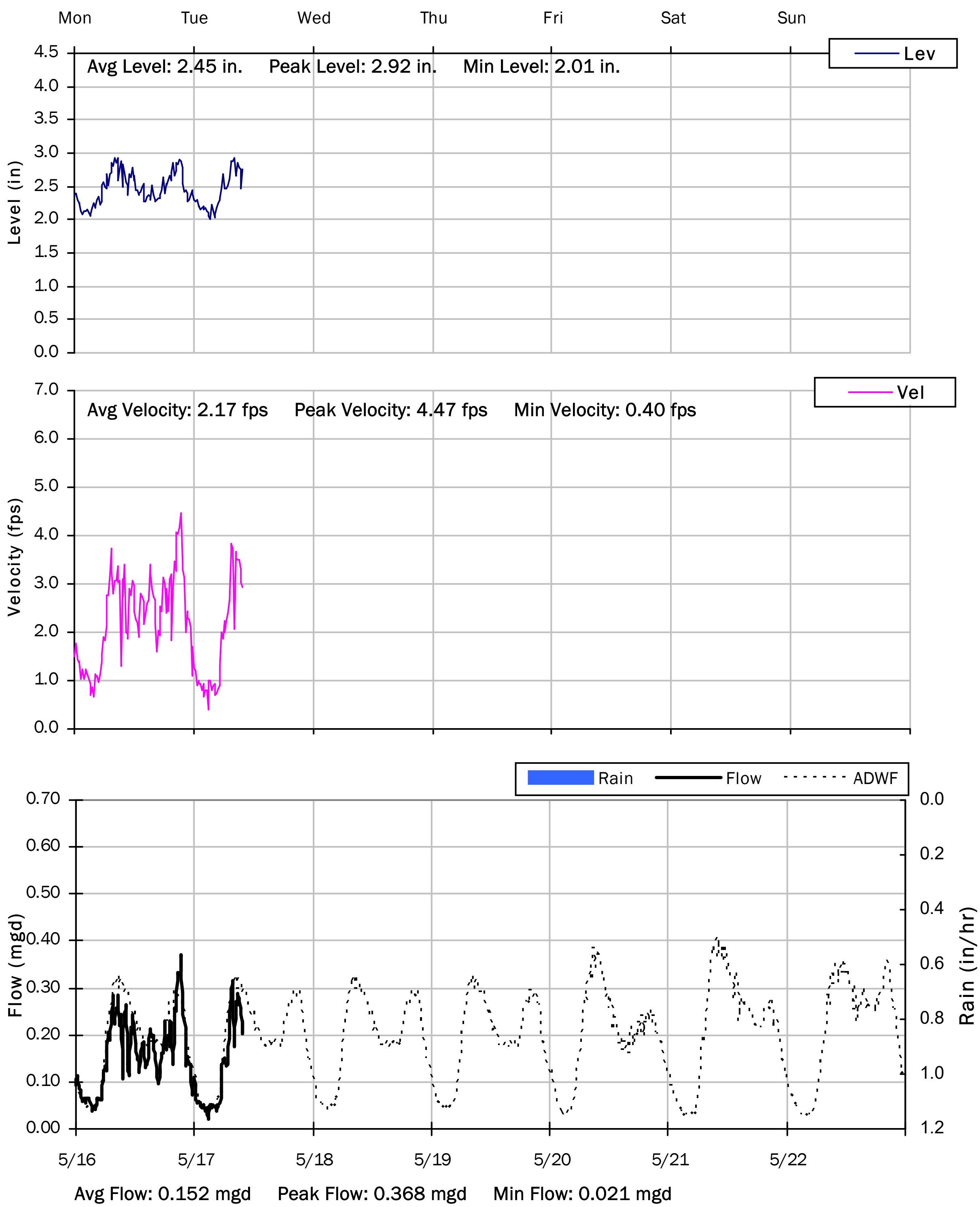
SITE 30

Weekly Level, Velocity and Flow Hydrographs

5/9/2022 to 5/16/2022



SITE 30
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022



Monitoring Site: Site 31

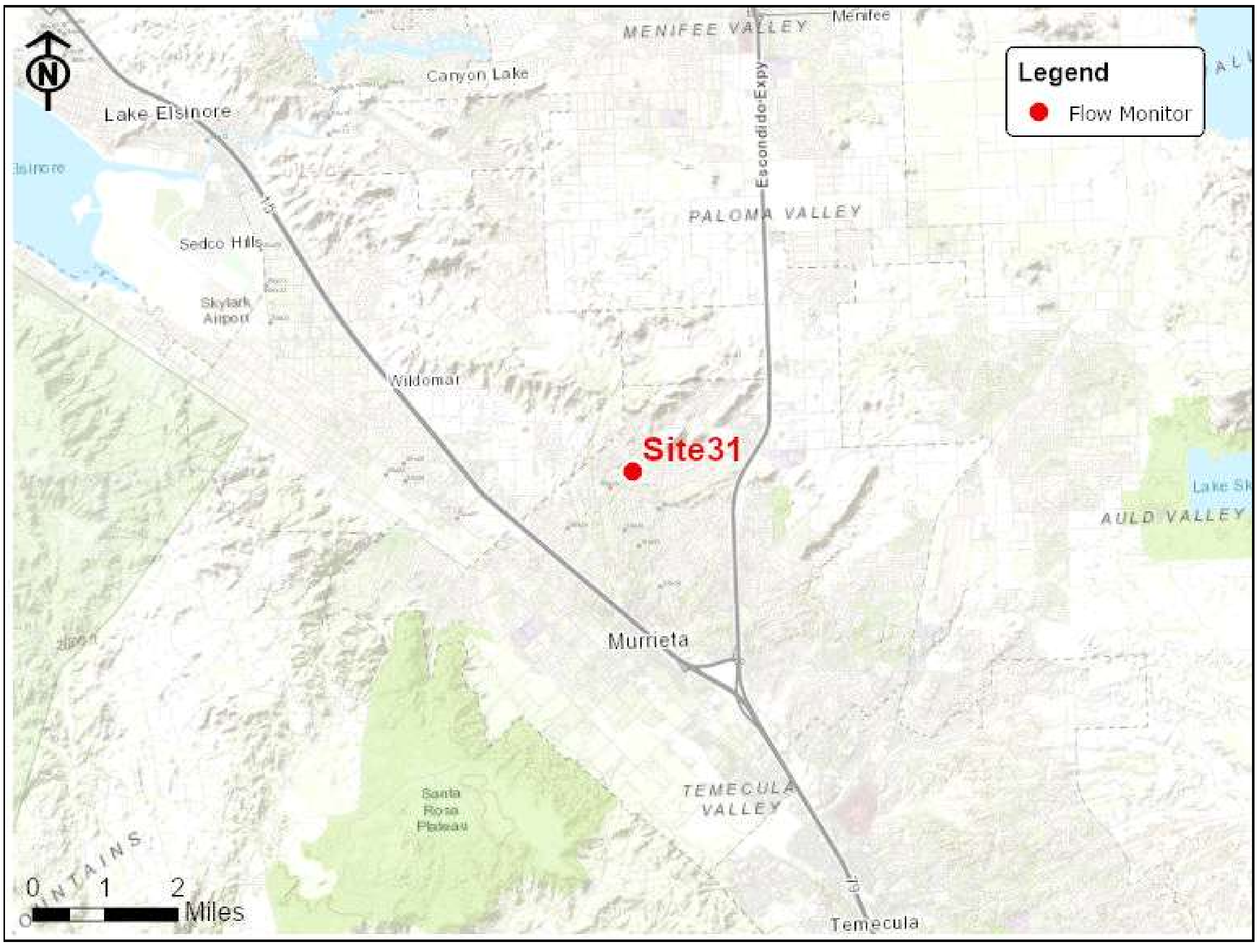
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Nutmeg Street, south of Saint Rafael Drive

Data Summary Report



Vicinity Map: Site 31

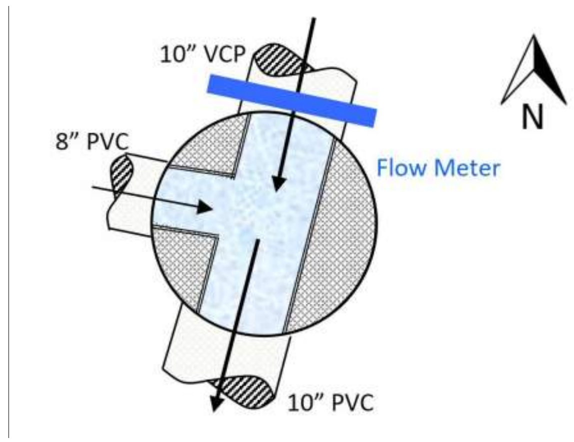
SITE 31

Site Information MH ID: MH-4329

Location:	Nutmeg Street, south of Saint Rafael Drive
Coordinates:	117.2071° W, 33.5828° N
Rim Elevation (Earth):	1437 feet
Expected Pipe Diameter:	10 inches
Measured Pipe Diameter:	10 inches
ADWF:	0.046 mgd
Peak Measured Flow:	0.268 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch

View from Street

Plan View

SITE 31

Additional Site Photos

Effluent Pipe

Monitored N Influent Pipe

SITE 31

Additional Site Photos

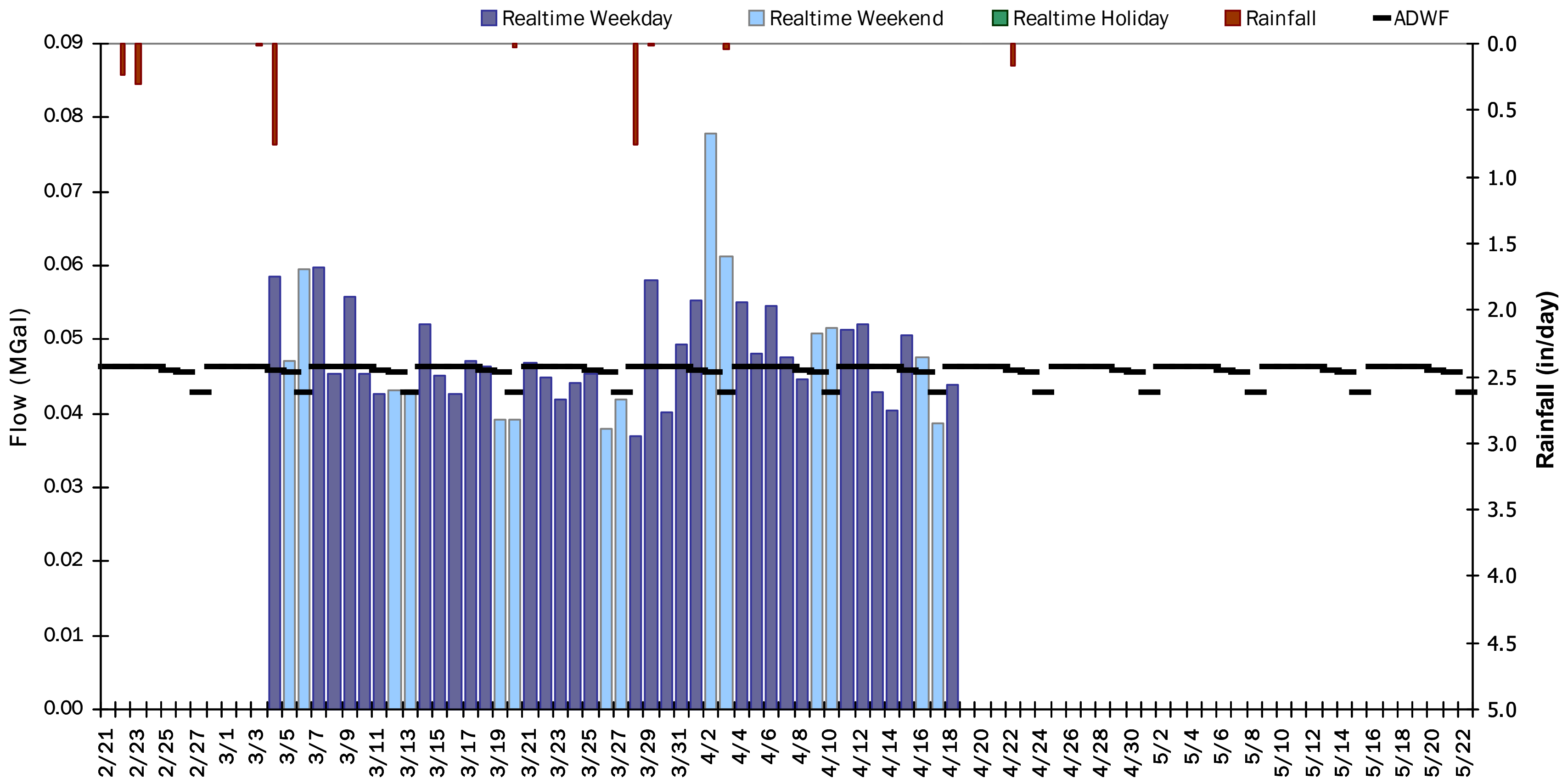
W Influent Pipe

SITE 31

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.048 MGal   Peak Daily Flow: 0.078 MGal   Min Daily Flow: 0.037 MGal

Total Rainfall: 1.60 inches

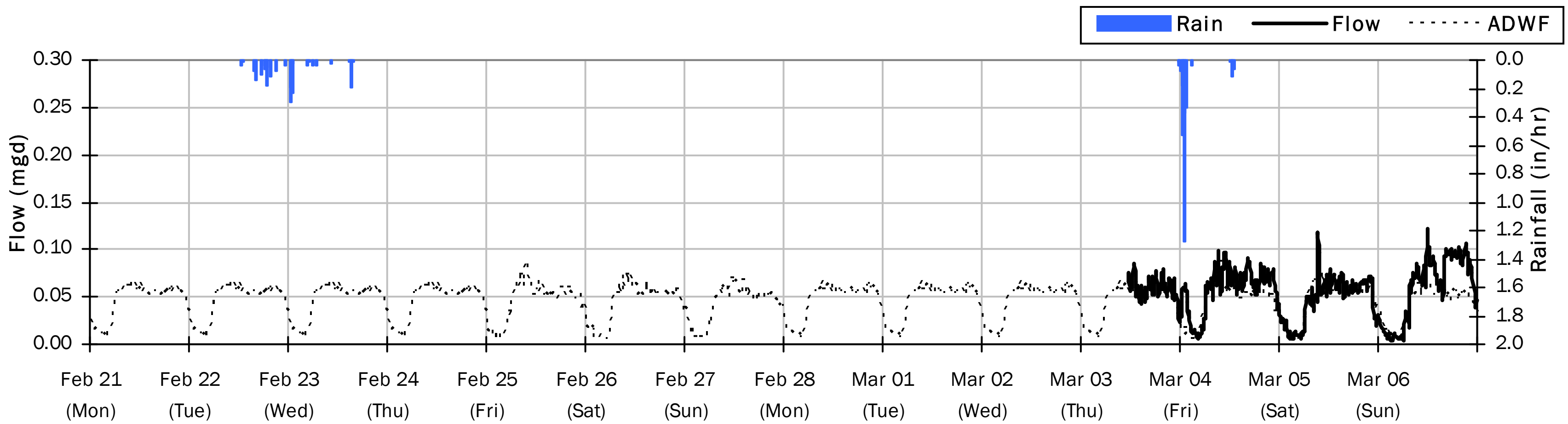


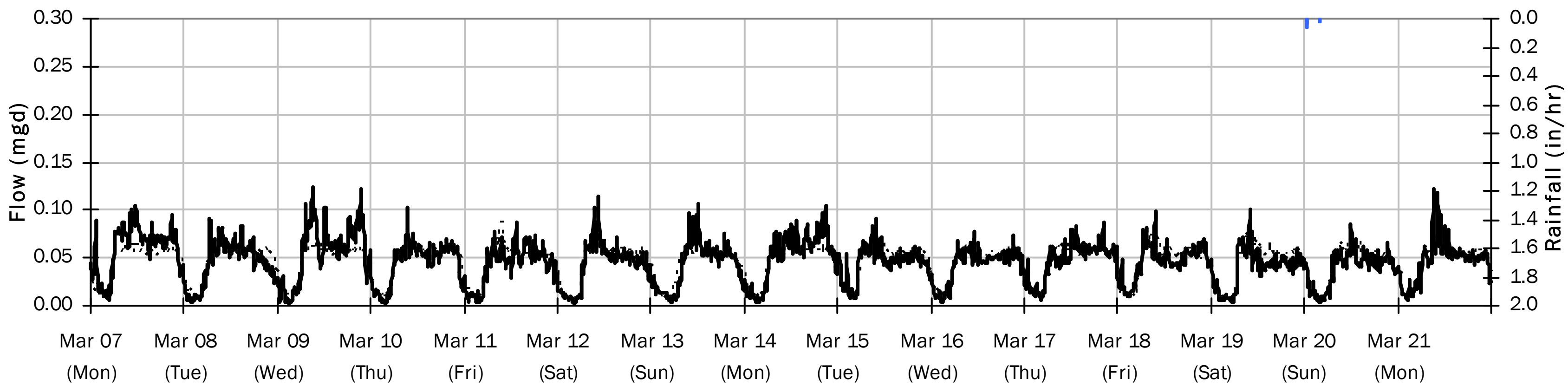
SITE 31

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.34 inches

Period Avg Flow: 0.048 mgd   Period Peak Flow: 0.123 mgd   Period Min Flow: 0.003 mgd



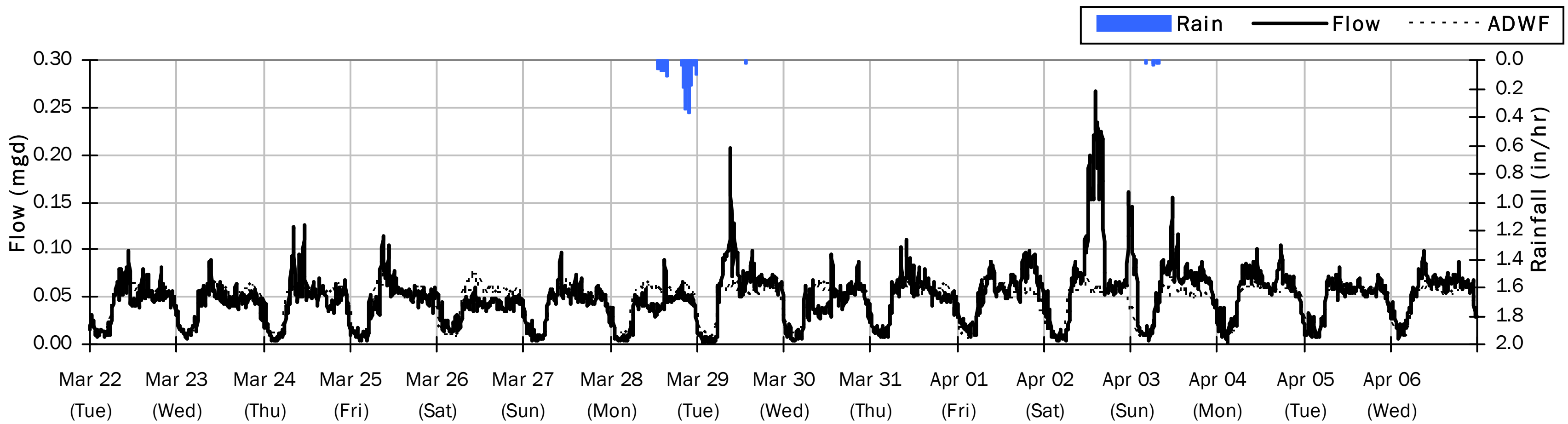


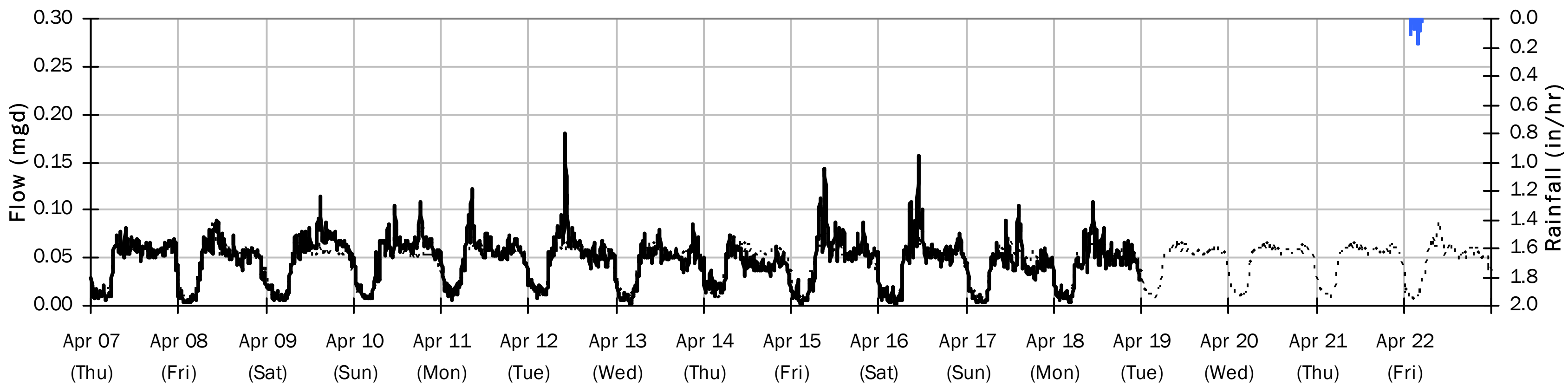
SITE 31

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.97 inches

Period Avg Flow: 0.048 mgd   Period Peak Flow: 0.268 mgd   Period Min Flow: 0.001 mgd



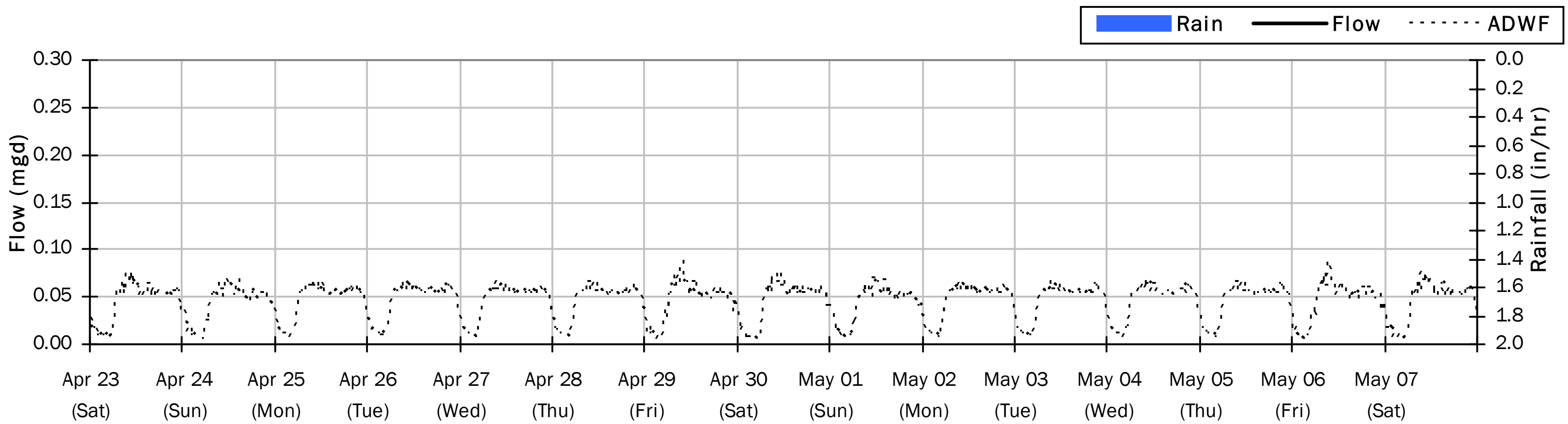


SITE 31

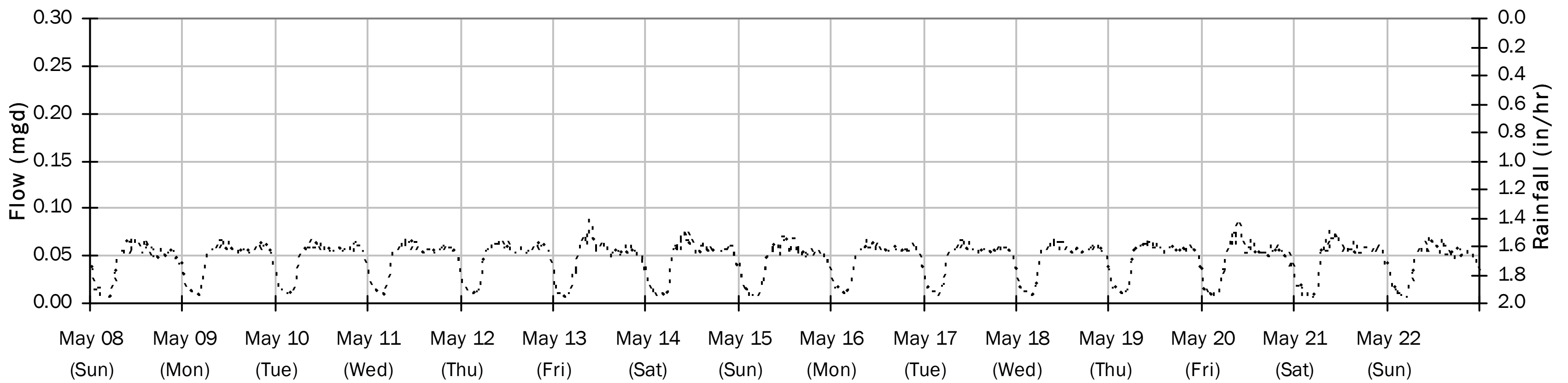
Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

Period Avg Flow: mgd   Period Peak Flow: mgd   Period Min Flow: mgd

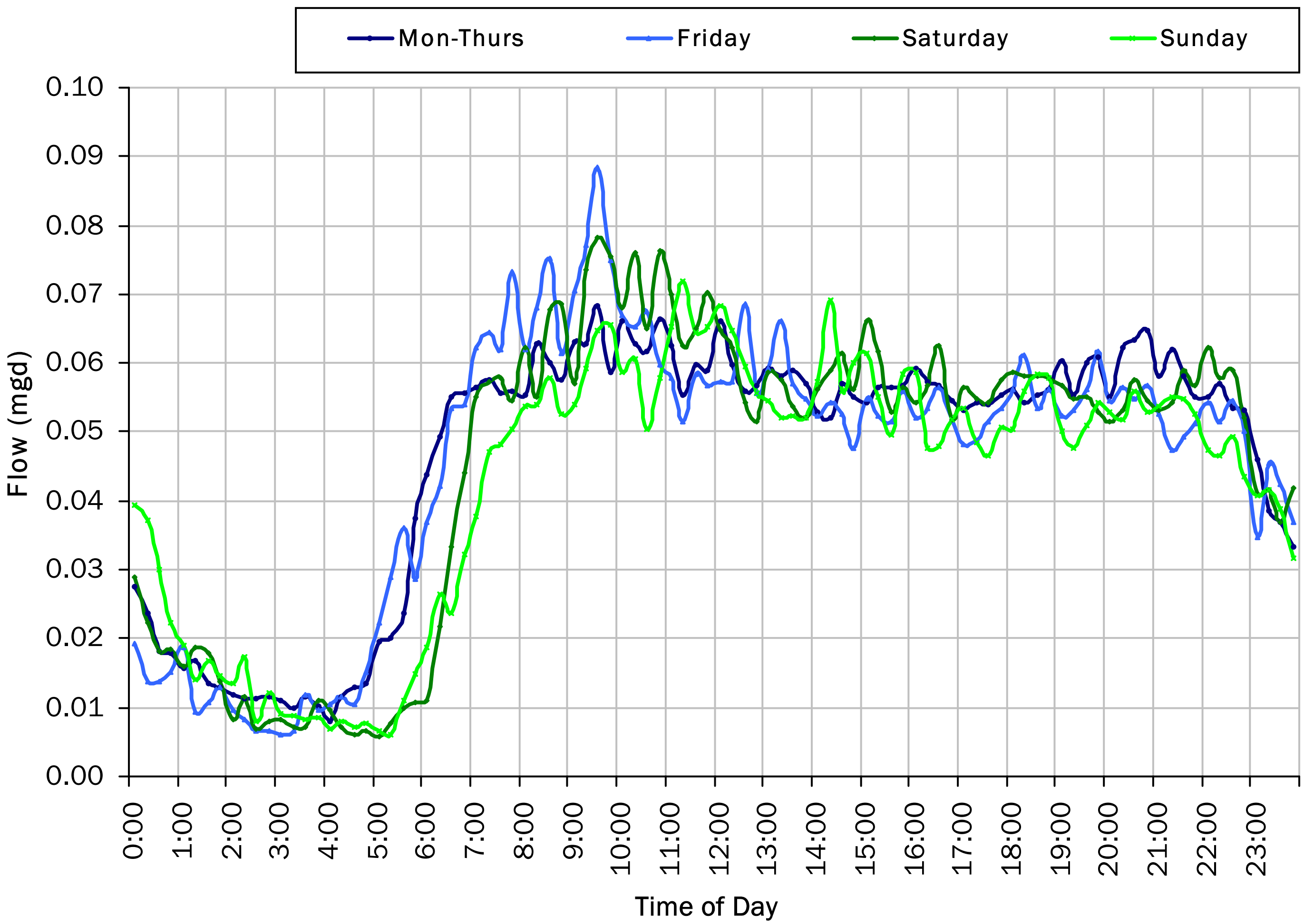


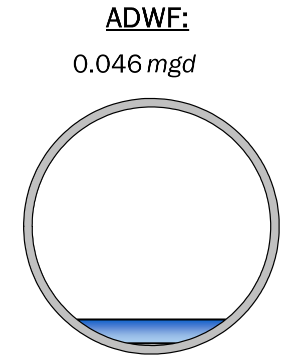
Meter Removed



SITE 31

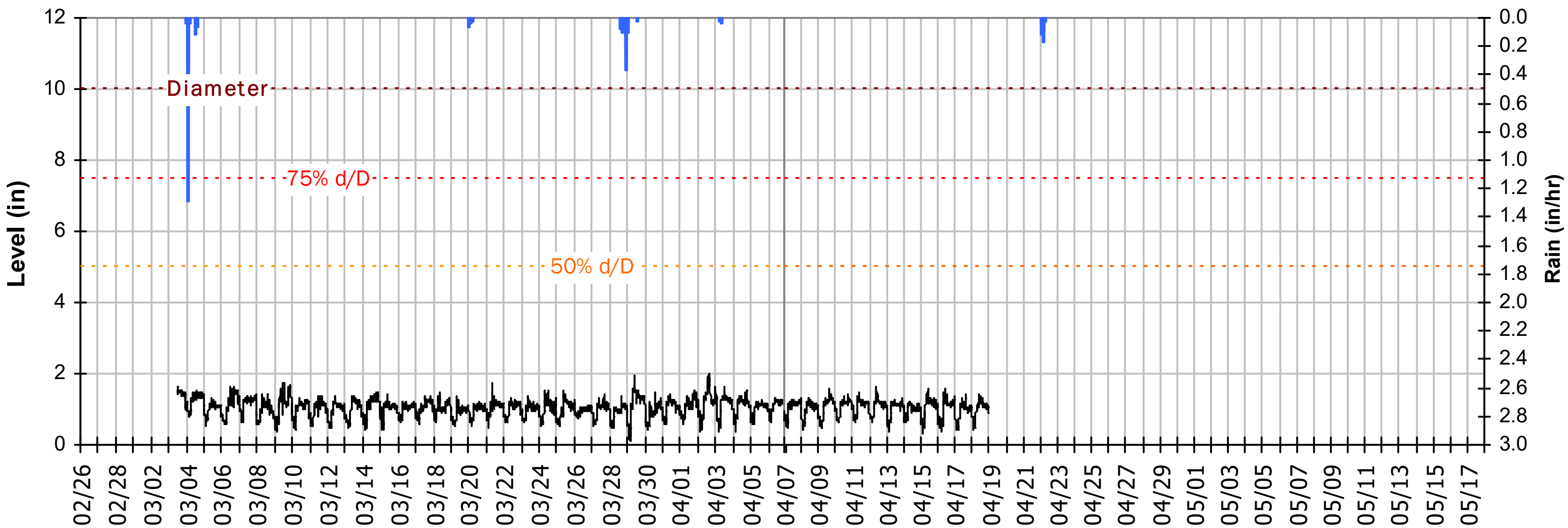
Average Dry Weather Flow Hydrographs

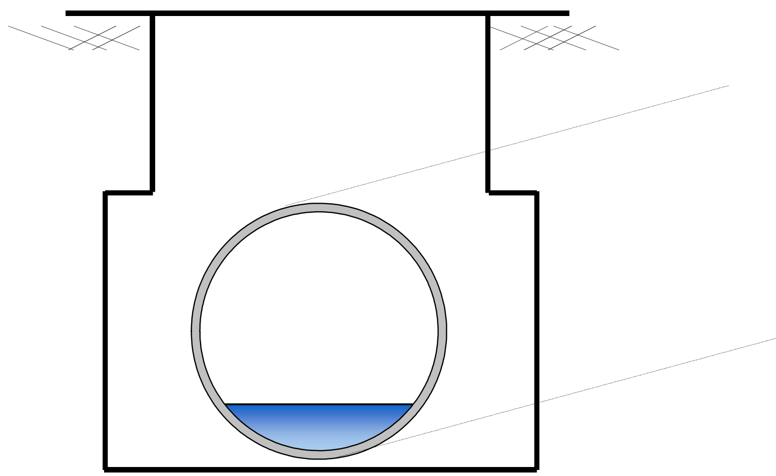




SITE 31
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



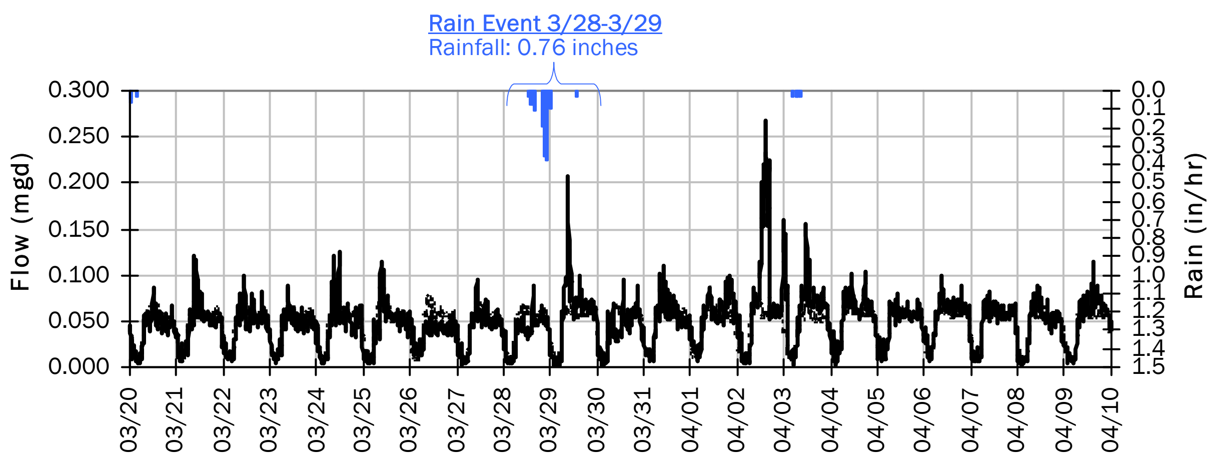


Pipe Diameter:	10	*inches*
Peak Measured Level:	1.98	*inches*
Peak d/D Ratio:	0.20	

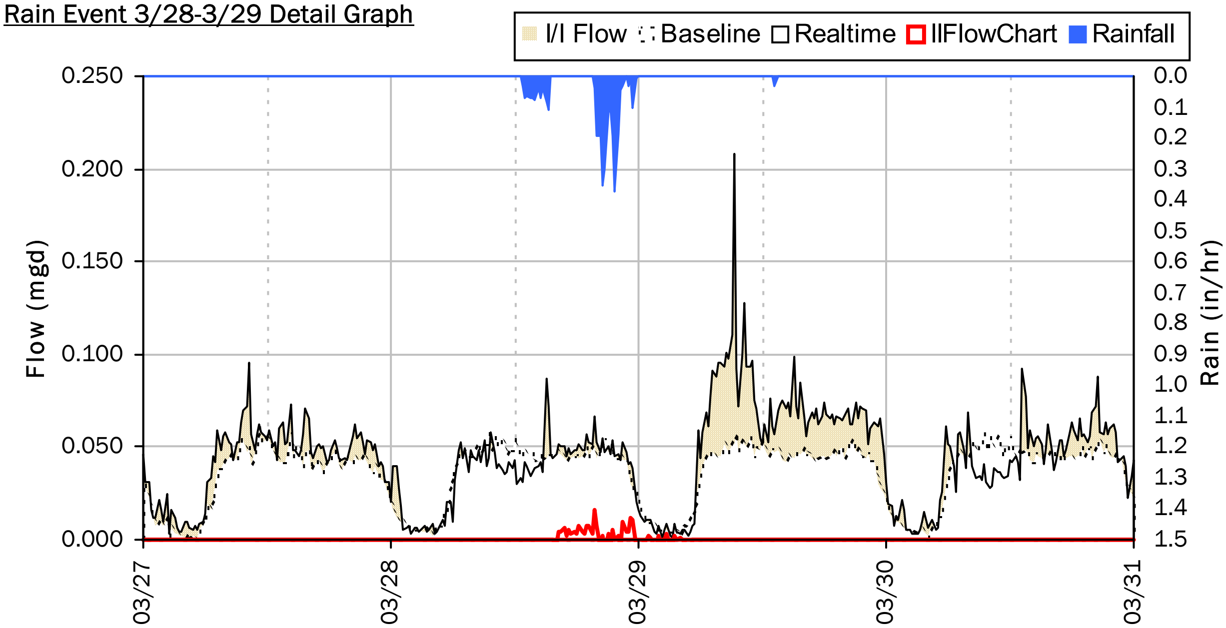
SITE 31

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



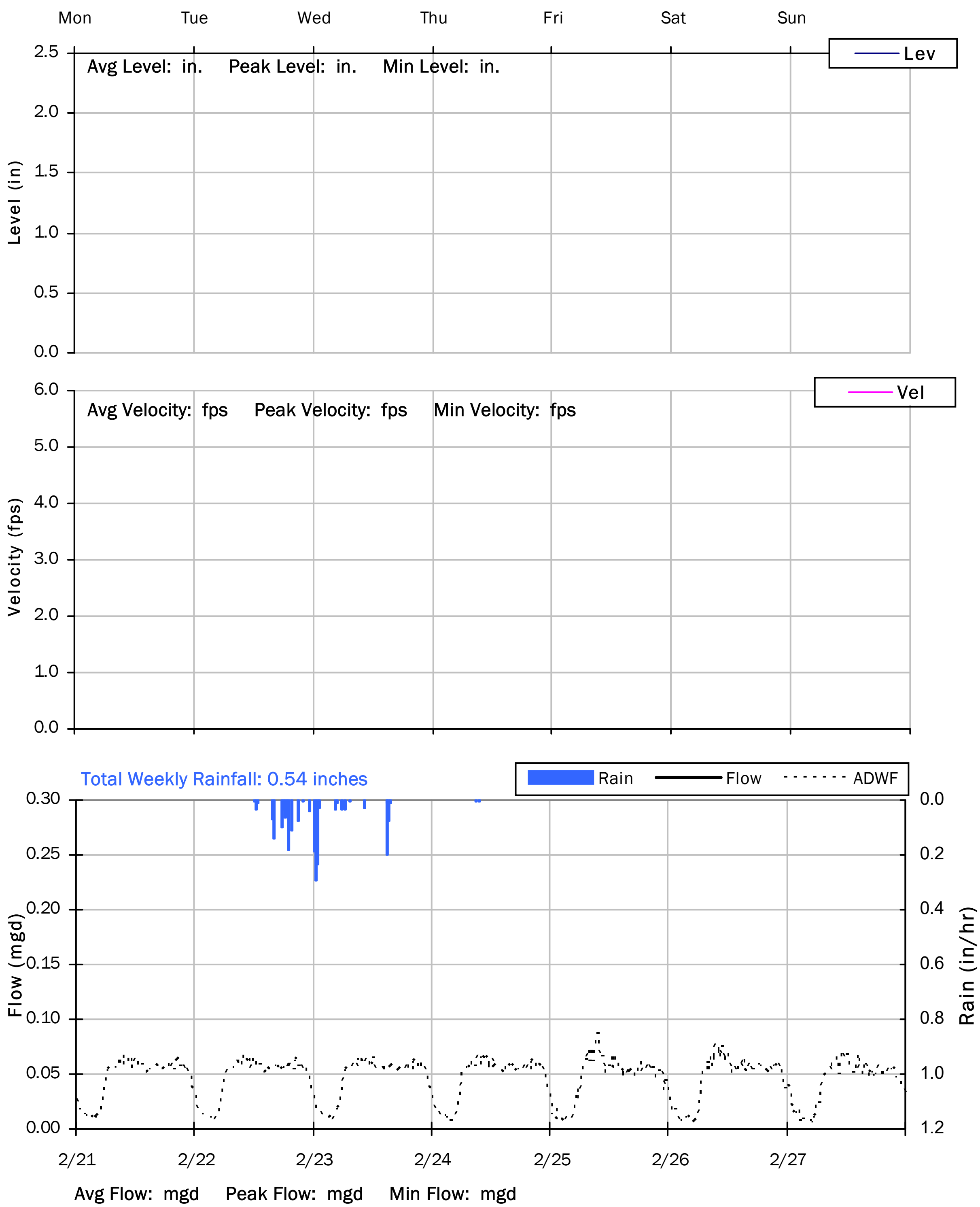
Rain Event 3/28-3/29 Detail Graph



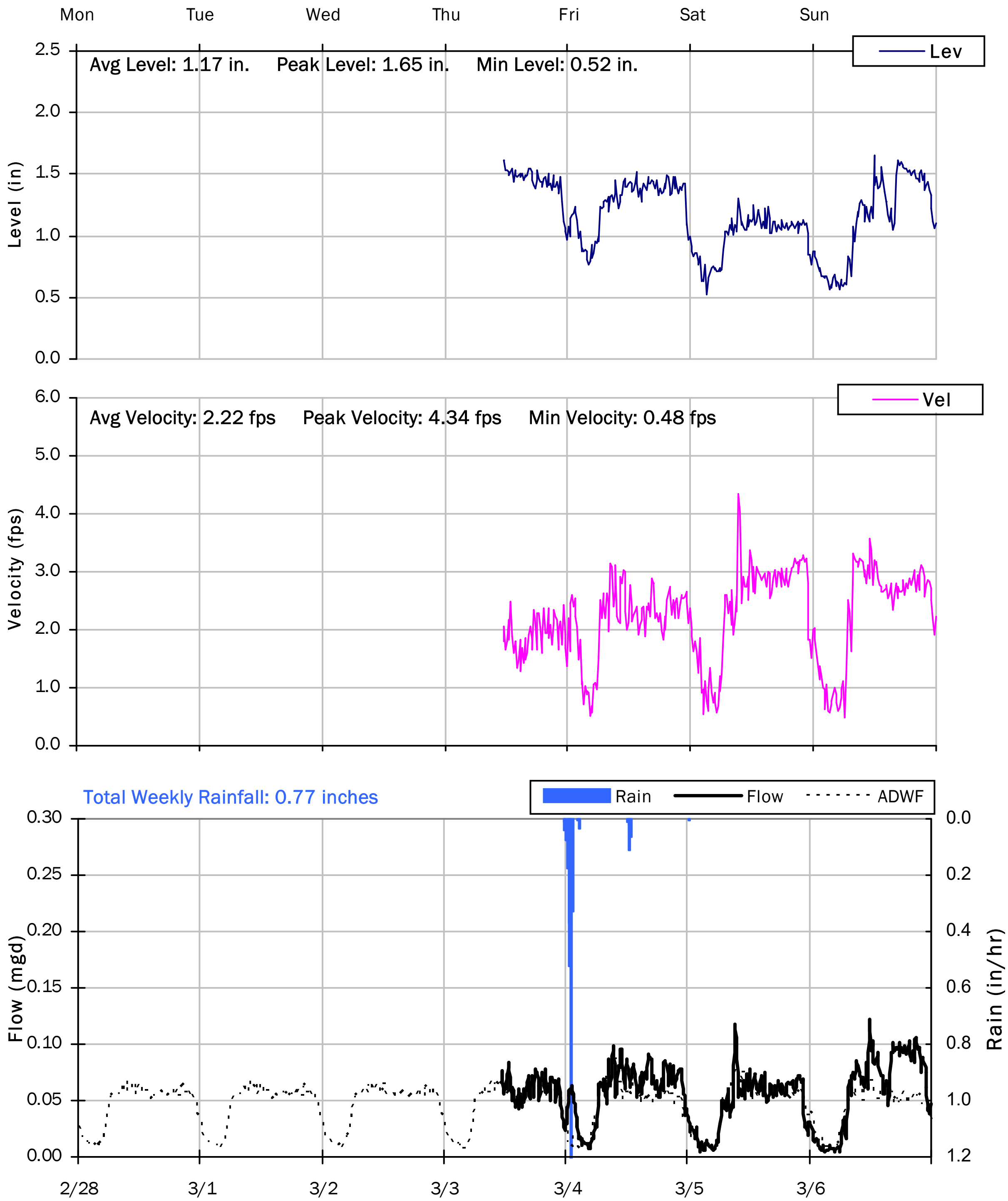
Storm Event I/I Analysis (Rain = 0.76 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.066 *mgd*	Peak I/I Rate:	0.016 *mgd*
PF:	1.45	Total I/I:	1,000 *gallons*
Peak Level:	1.18 *in*		
d/D Ratio:	0.12		

SITE 31
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

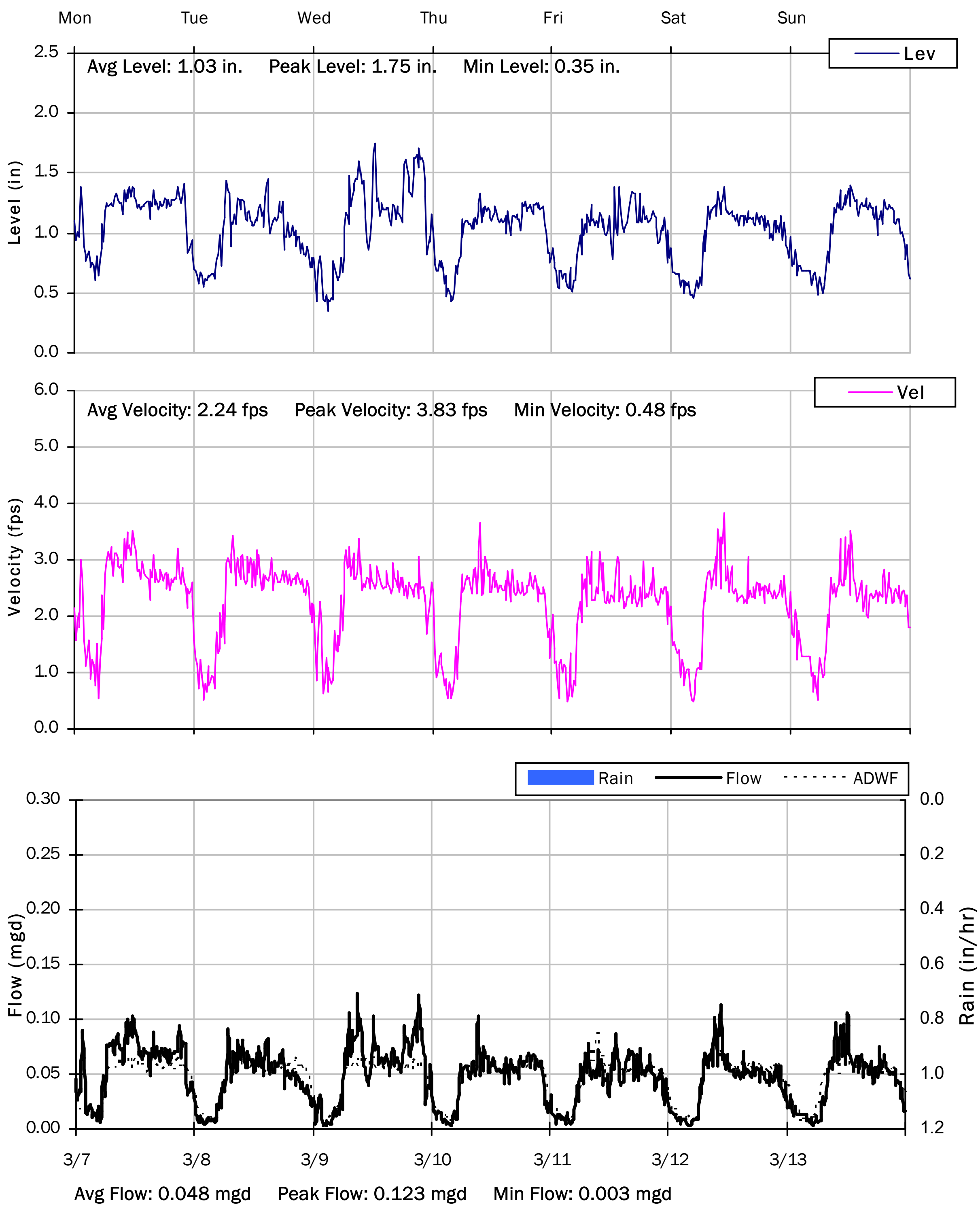


SITE 31
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

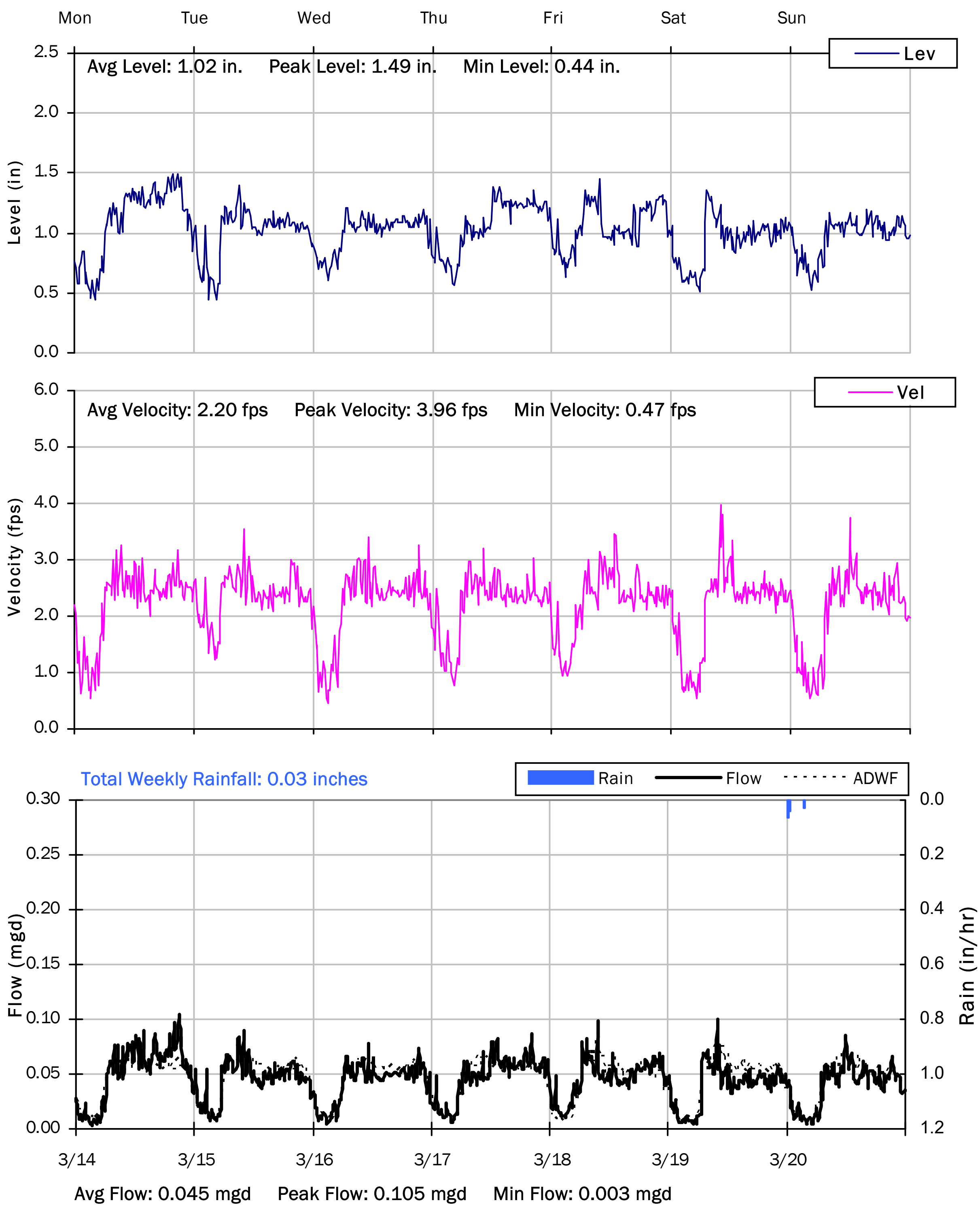


Avg Flow: 0.056 mgd   Peak Flow: 0.122 mgd   Min Flow: 0.004 mgd

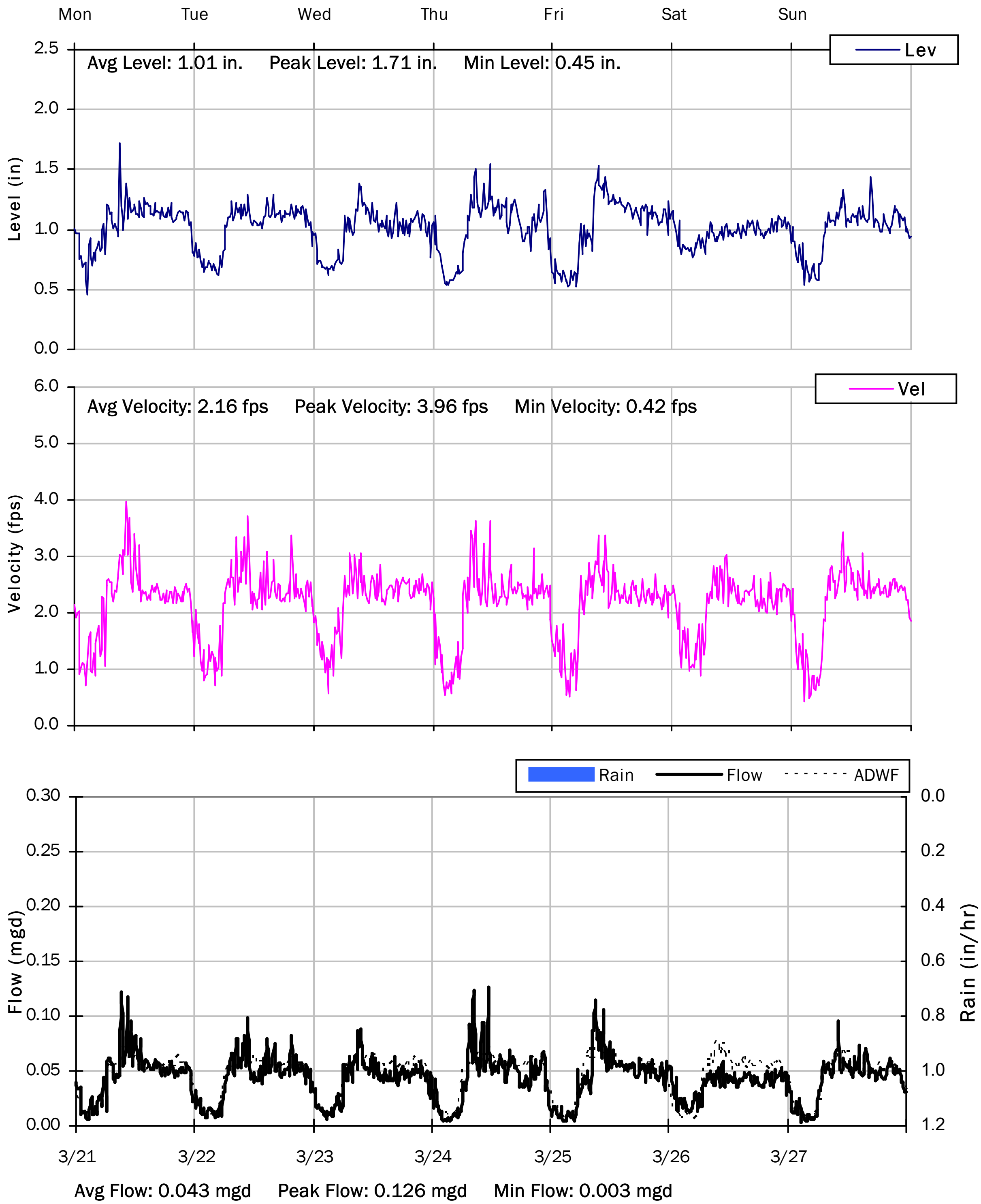
SITE 31
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022



SITE 31
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



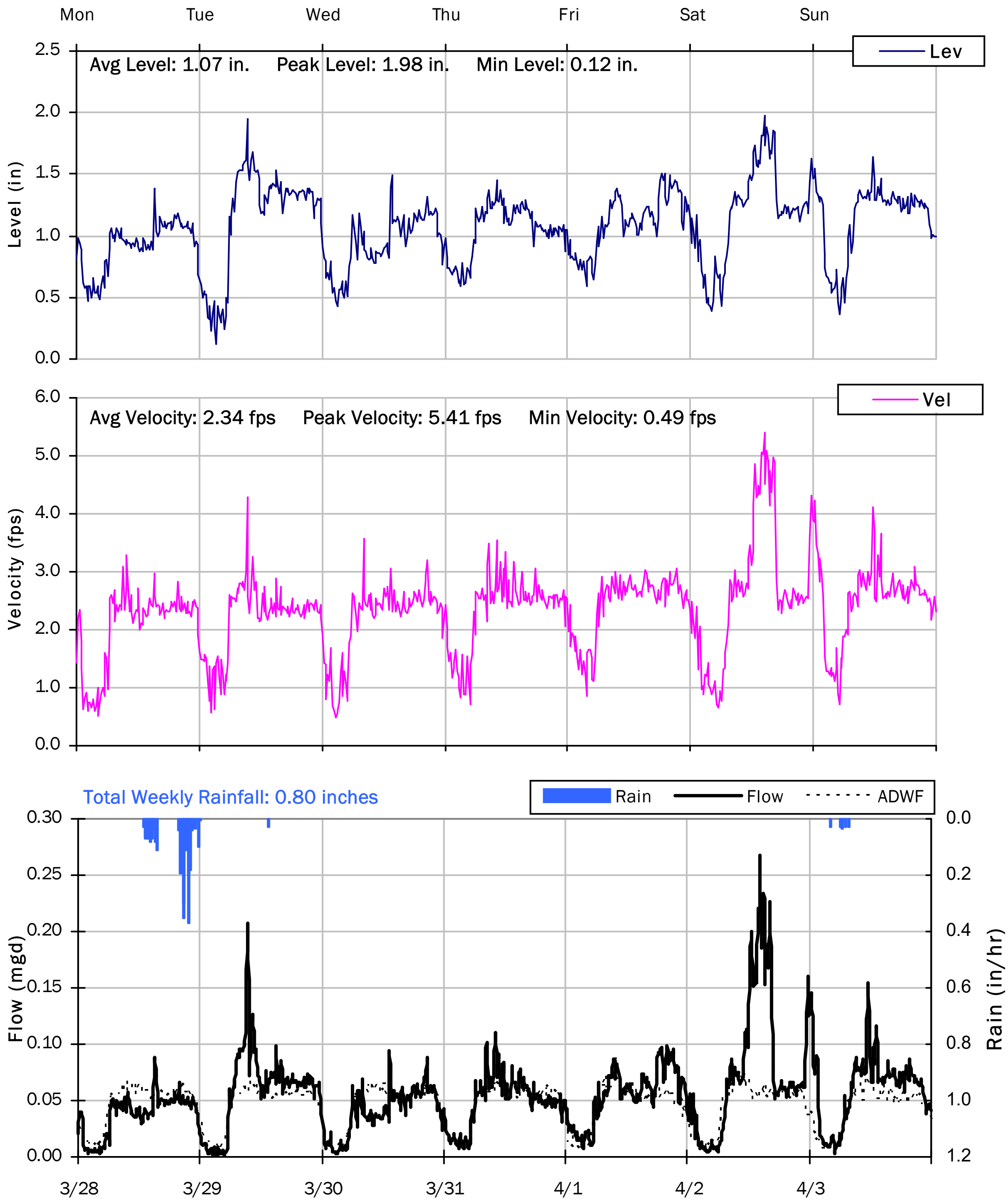
SITE 31
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



SITE 31

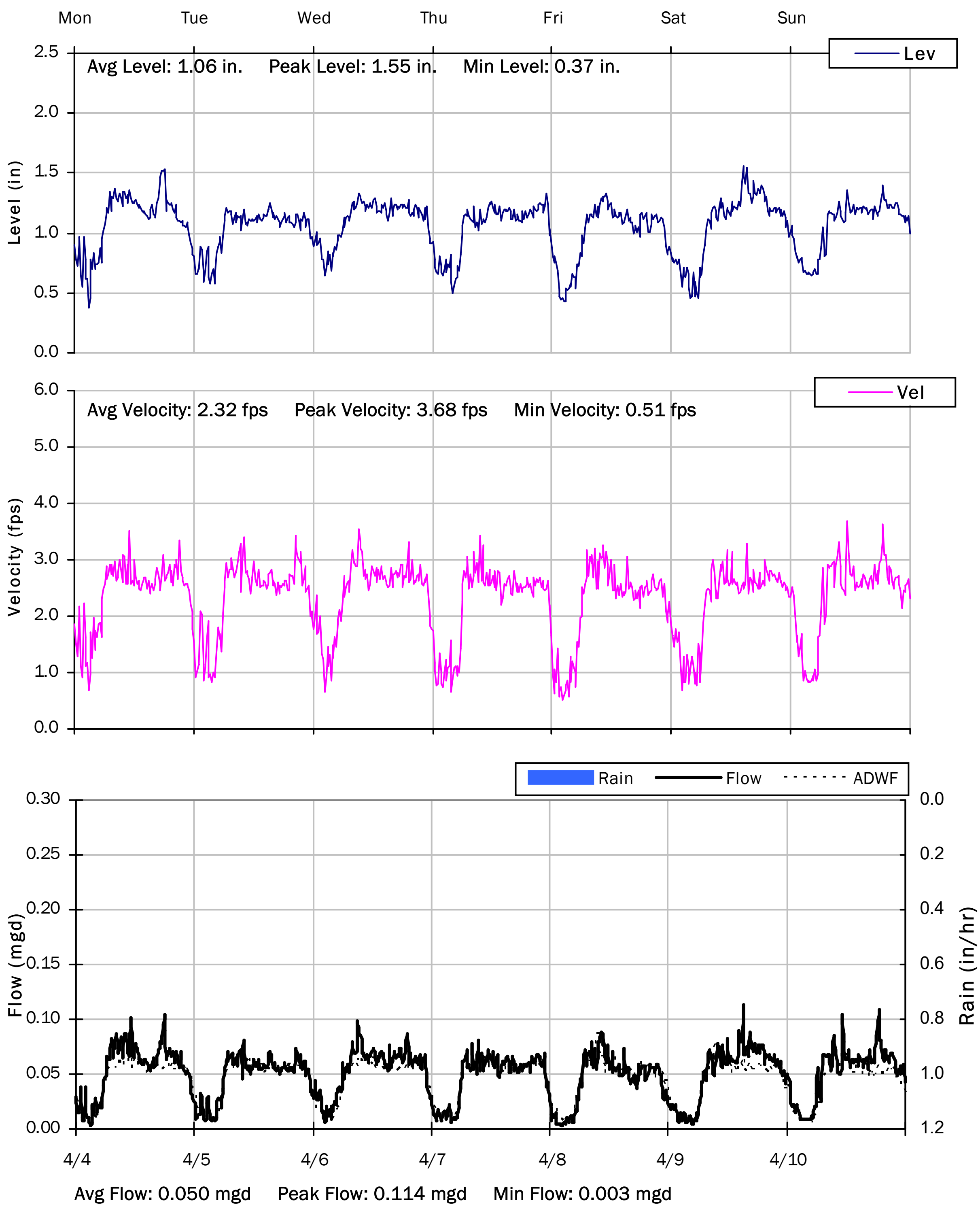
Weekly Level, Velocity and Flow Hydrographs

3/28/2022 to 4/4/2022

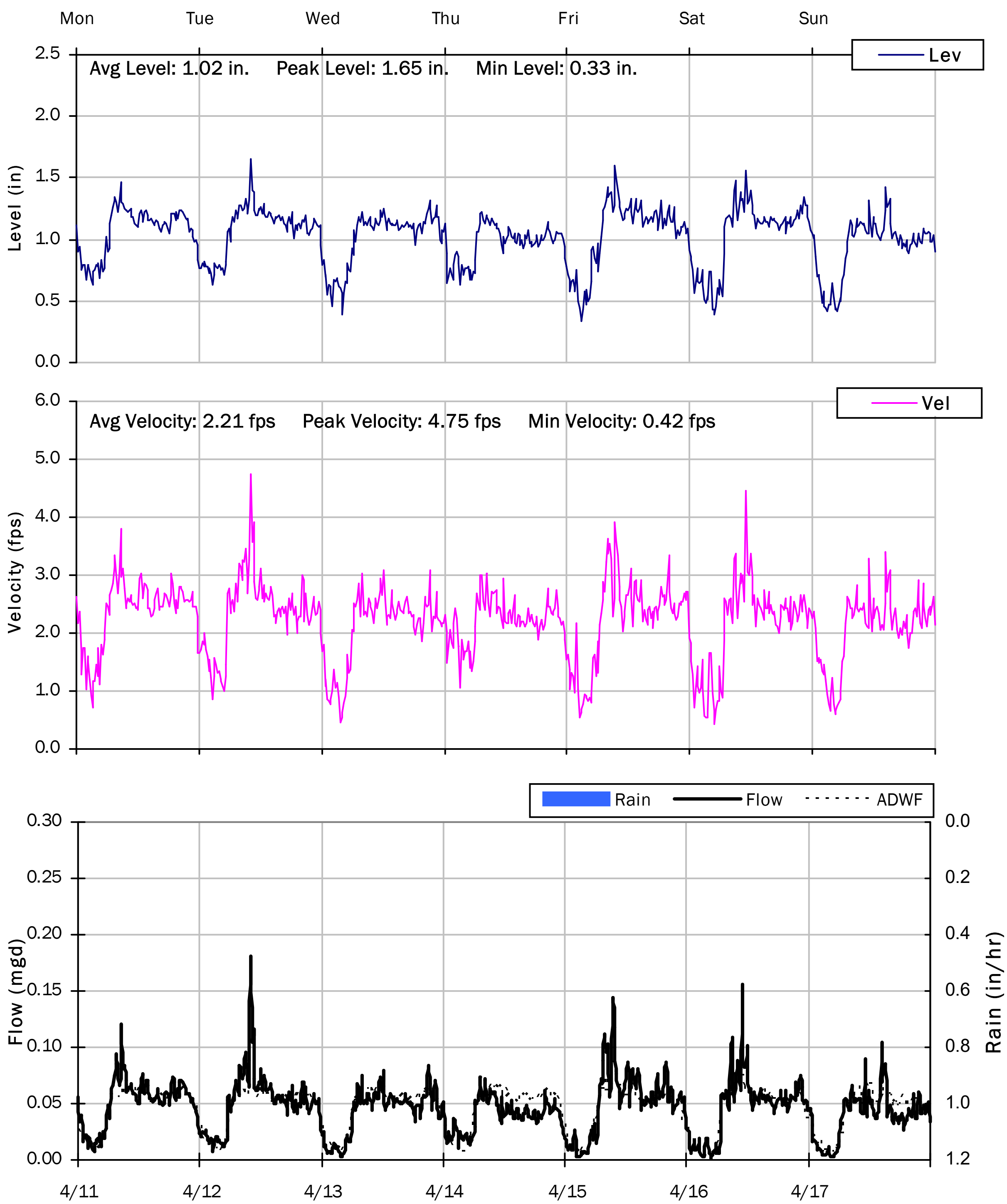


Avg Flow: 0.054 mgd Peak Flow: 0.268 mgd Min Flow: 0.001 mgd

SITE 31
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022



SITE 31
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

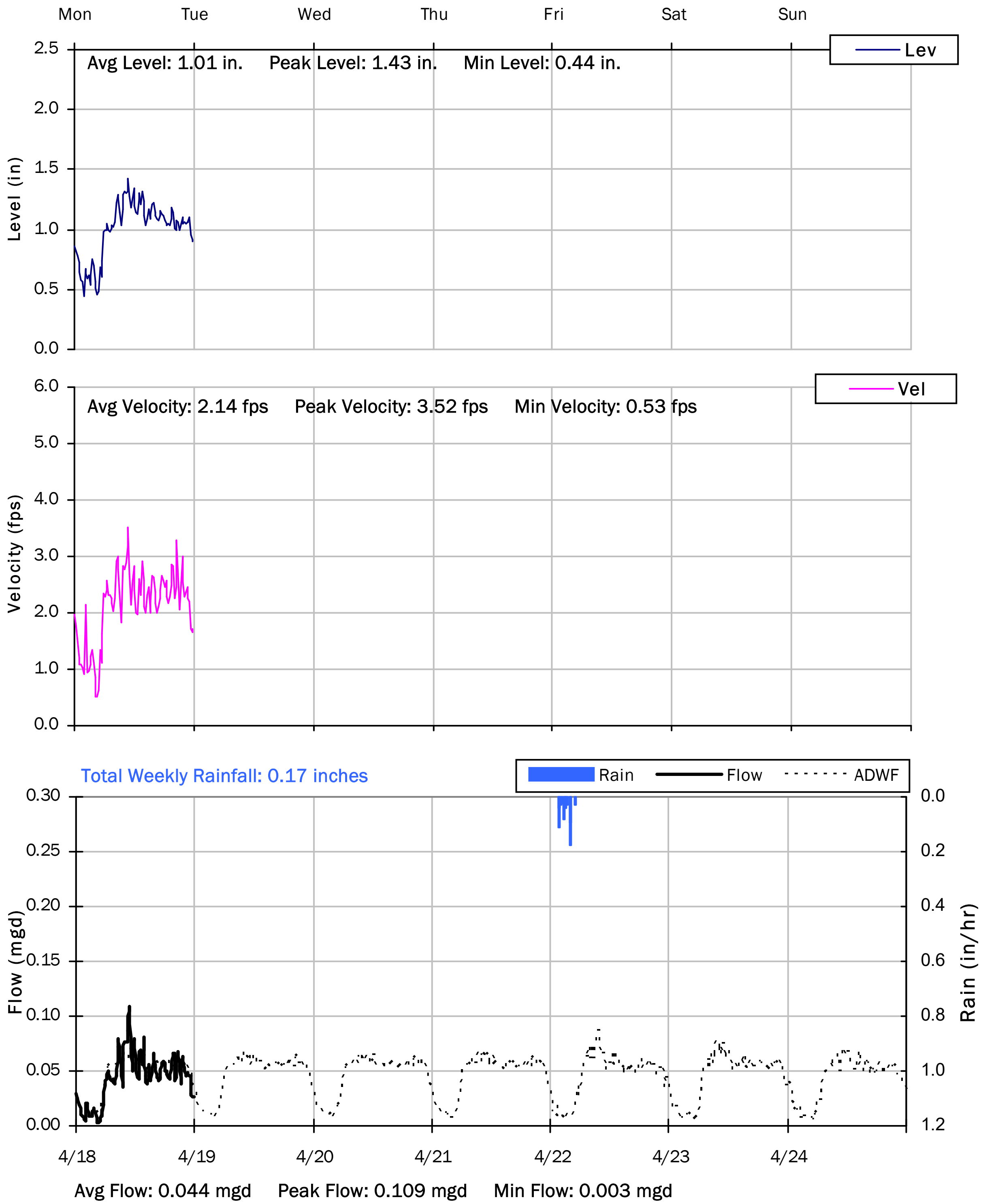


Avg Flow: 0.046 mgd   Peak Flow: 0.181 mgd   Min Flow: 0.002 mgd

SITE 31

Weekly Level, Velocity and Flow Hydrographs

4/18/2022 to 4/25/2022



Monitoring Site: Site 32

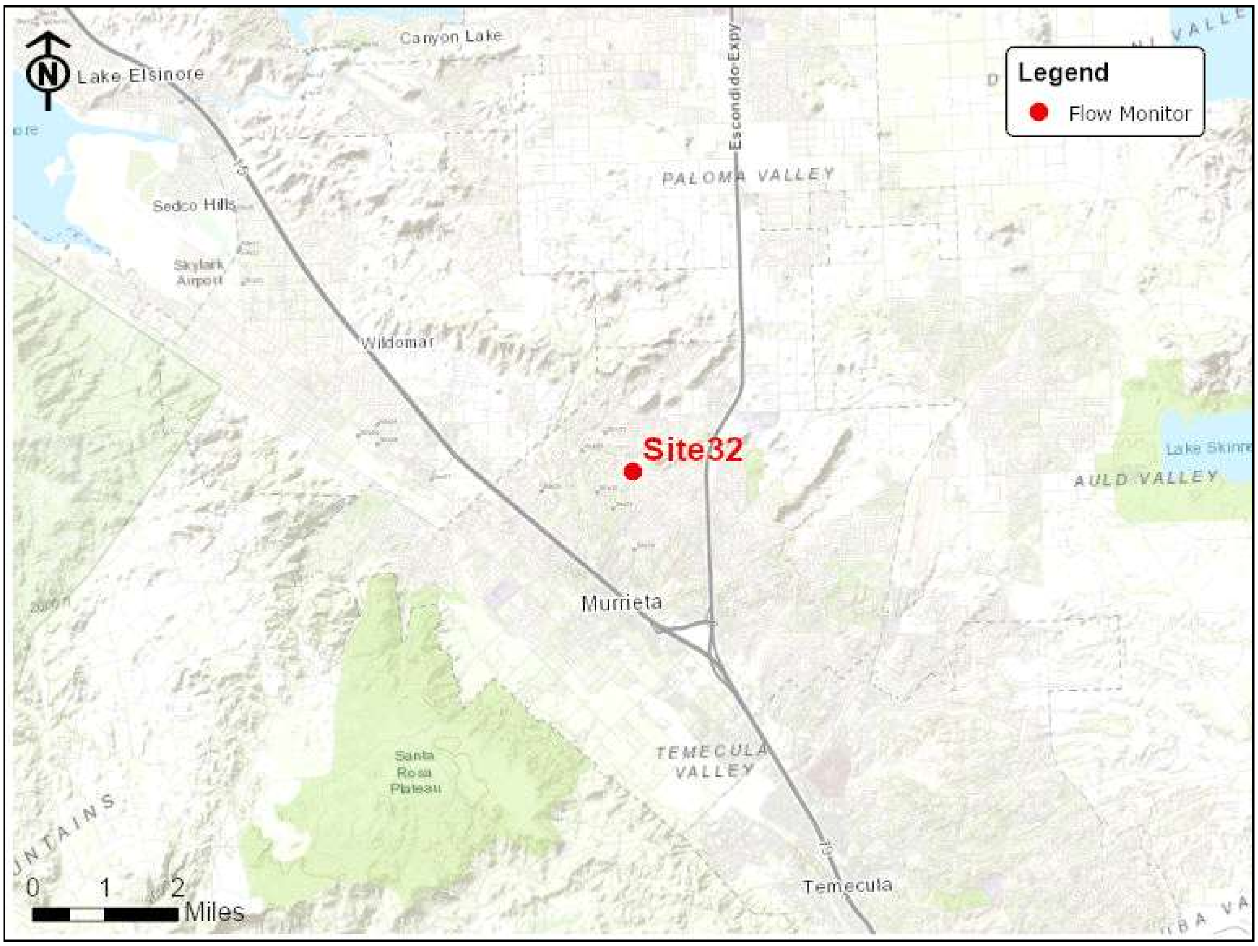
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Tarragona Drive, east of Almansa Court

Data Summary Report

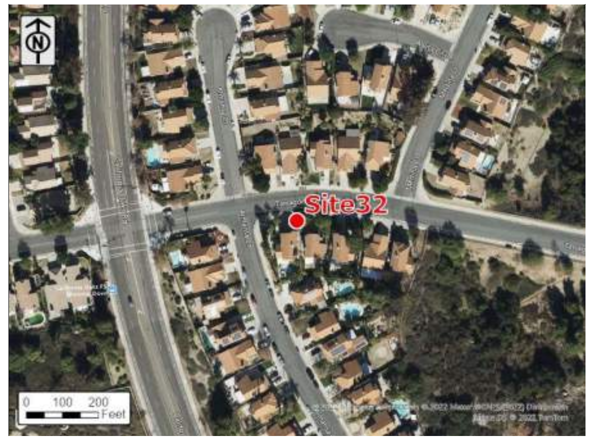


Vicinity Map: Site 32

SITE 32

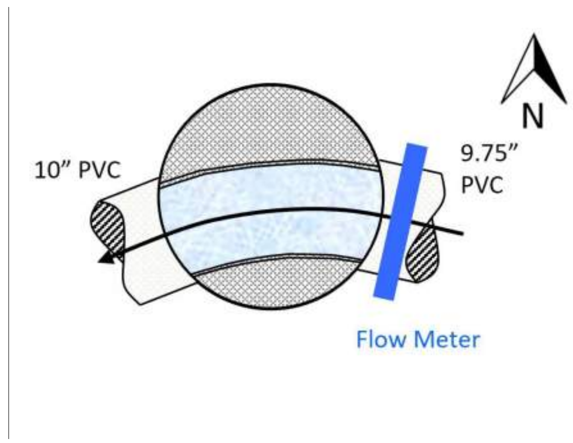
Site Information MH ID: MH-4708

Location:	Tarragona Drive, east of Almansa Court
Coordinates:	117.1985° W, 33.5868° N
Rim Elevation (Earth):	1351 feet
Expected Pipe Diameter:	10 inches
Measured Pipe Diameter:	9.75 inches
ADWF:	0.095 mgd
Peak Measured Flow:	0.208 mgd
Sediment:	None



Satellite Map

Sanitary Map



Flow Sketch

View from Street

Plan View

SITE 32

Additional Site Photos

Effluent Pipe

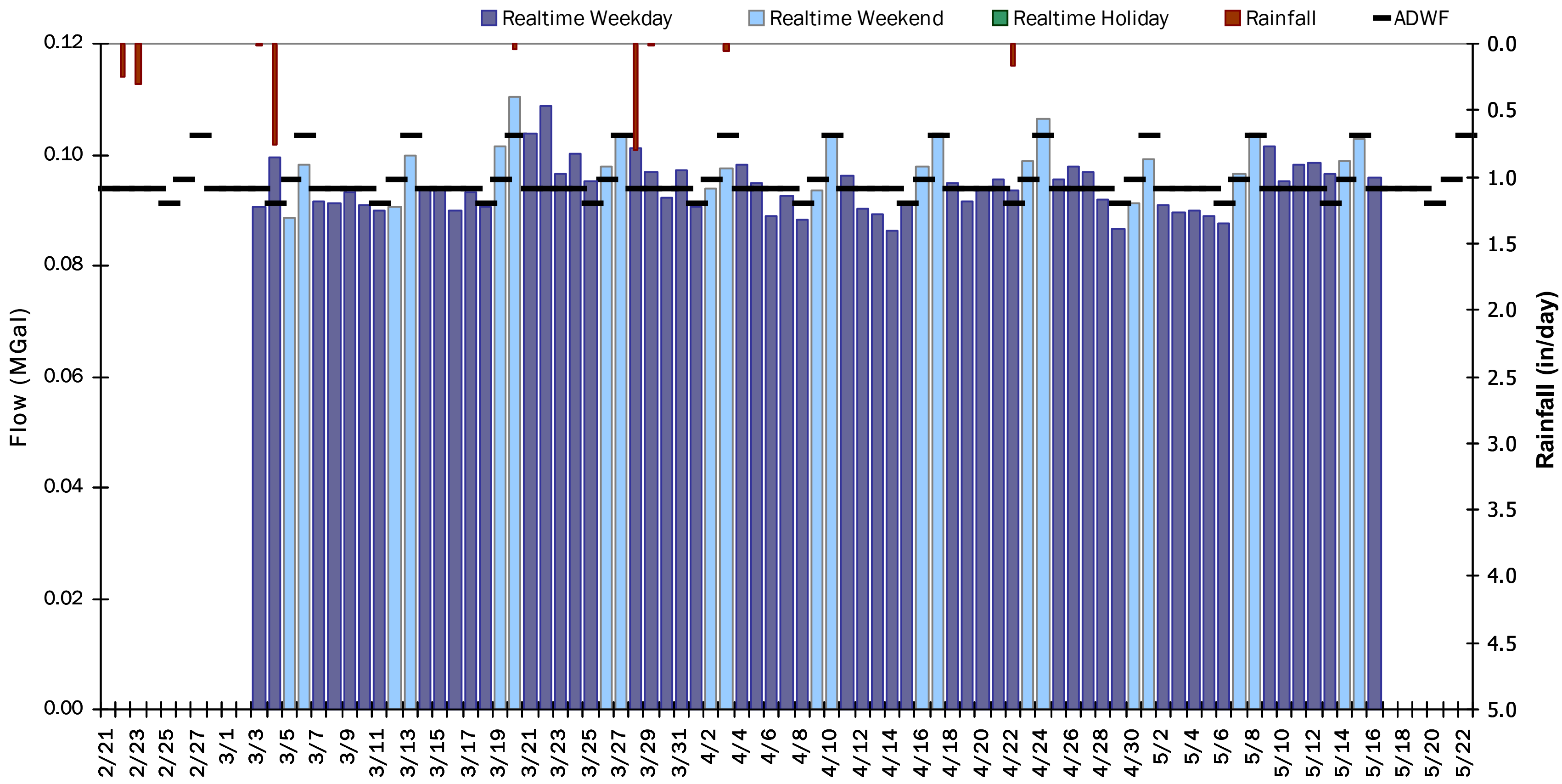
Influent Pipe

SITE 32

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.095 MGal   Peak Daily Flow: 0.110 MGal   Min Daily Flow: 0.070 MGal

Total Rainfall: 1.84 inches

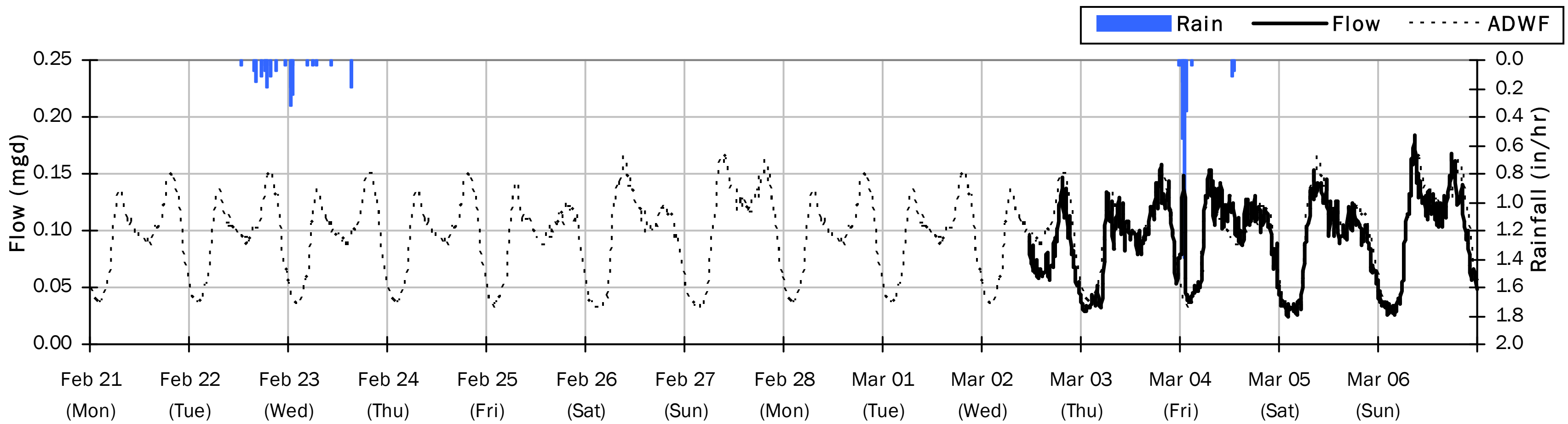


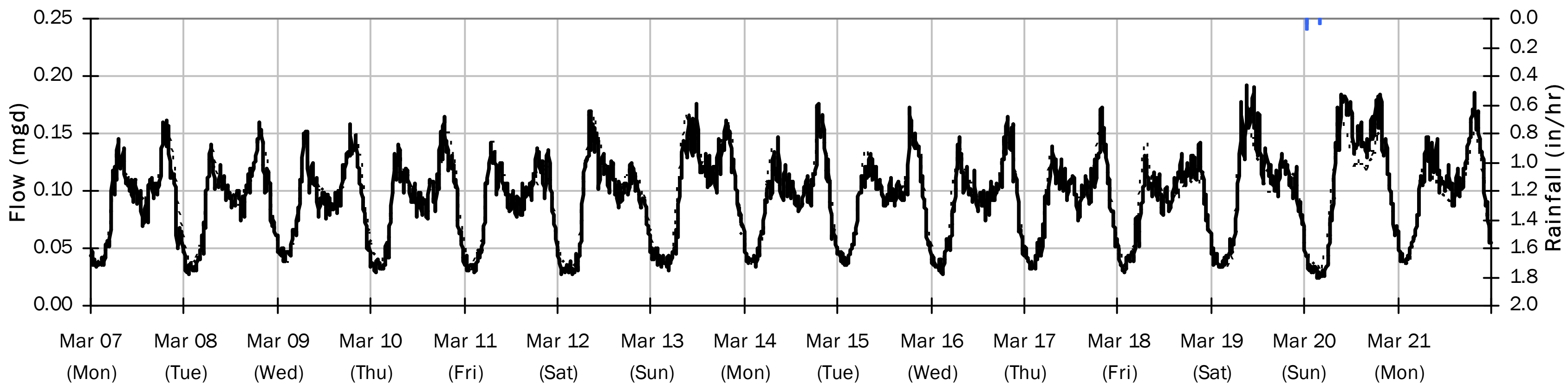
SITE 32

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.37 inches

Period Avg Flow: 0.094 mgd   Period Peak Flow: 0.192 mgd   Period Min Flow: 0.024 mgd

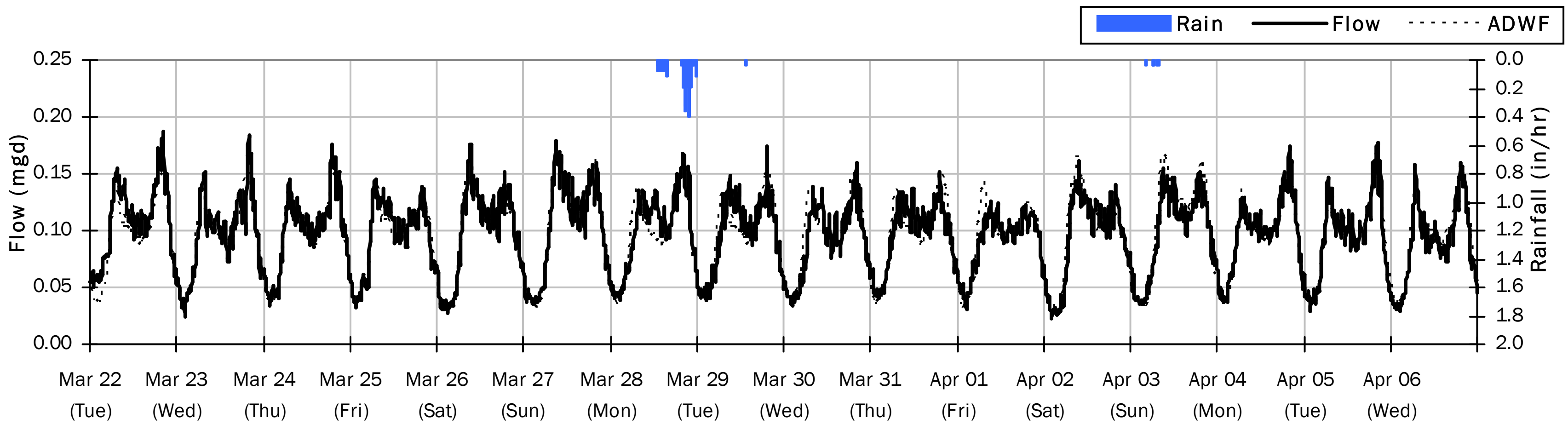


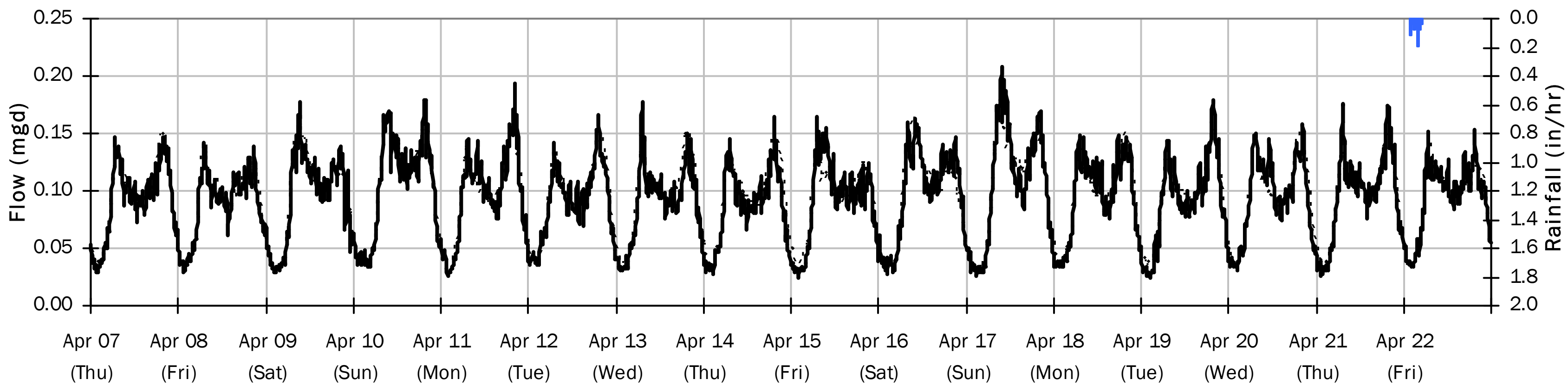


SITE 32

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 1.03 inches   Period Avg Flow: 0.095 mgd   Period Peak Flow: 0.208 mgd   Period Min Flow: 0.023 mgd



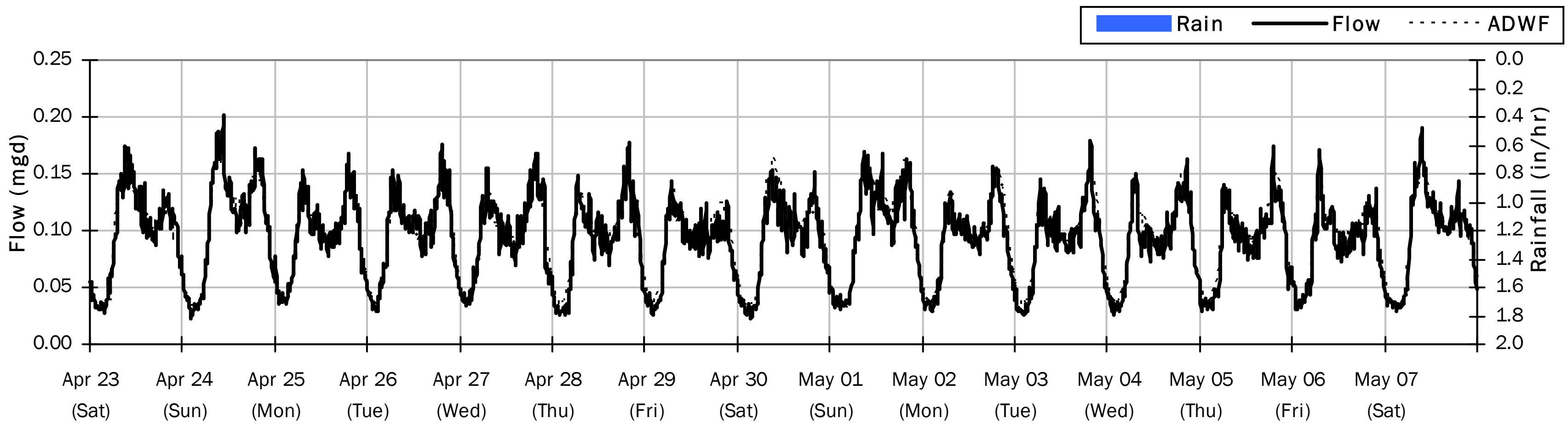


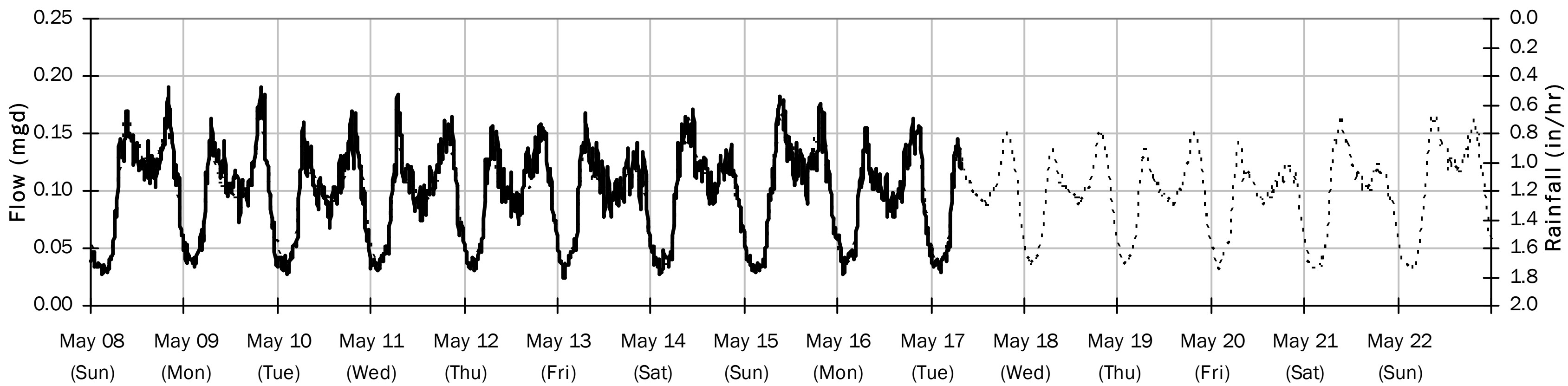
SITE 32

Flow Summary: 4/23/2022 to 5/22/2022

Period Rainfall: 0.00 inches

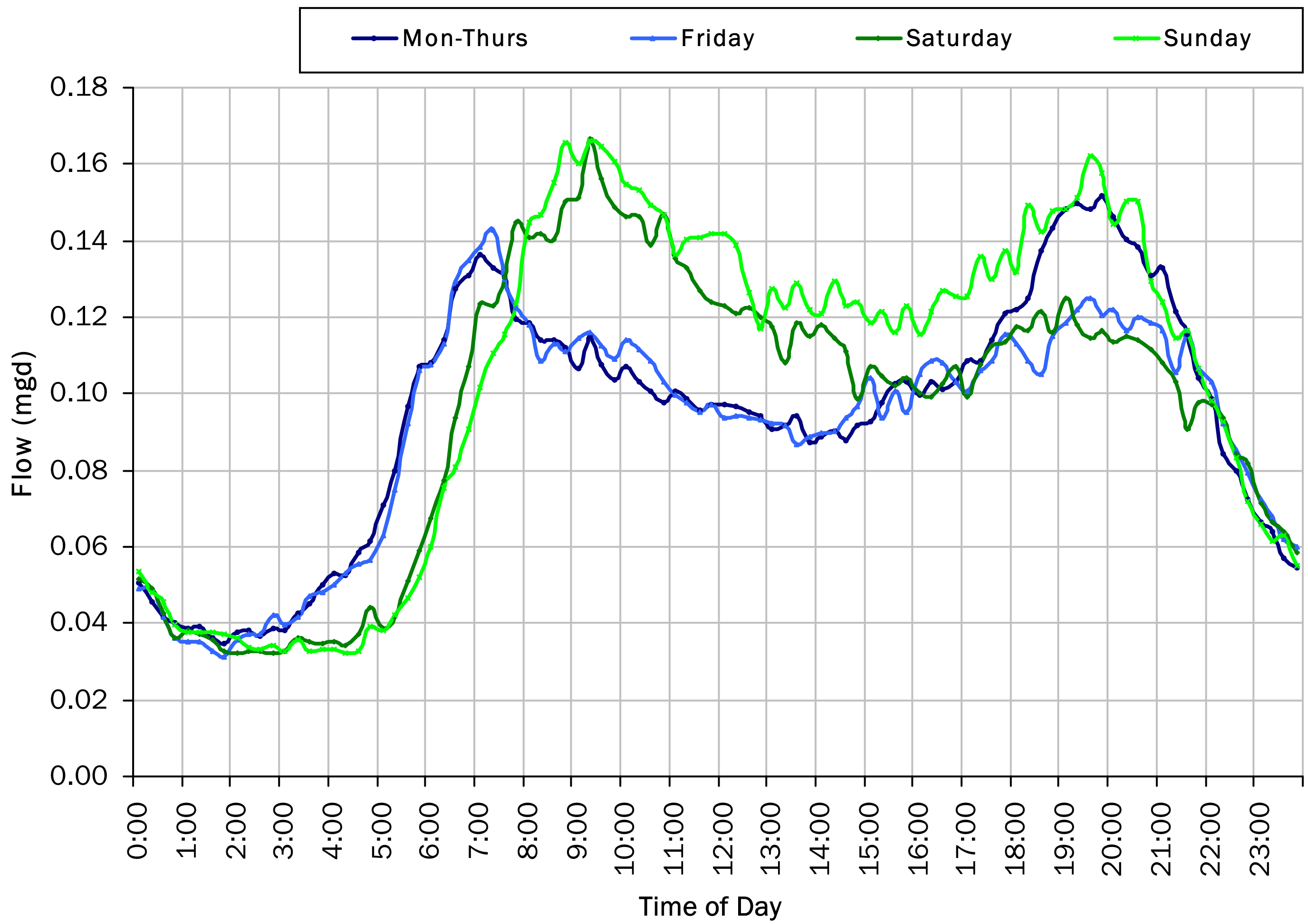
Period Avg Flow: 0.095 mgd   Period Peak Flow: 0.201 mgd   Period Min Flow: 0.023 mgd

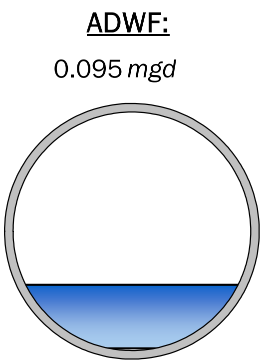




SITE 32

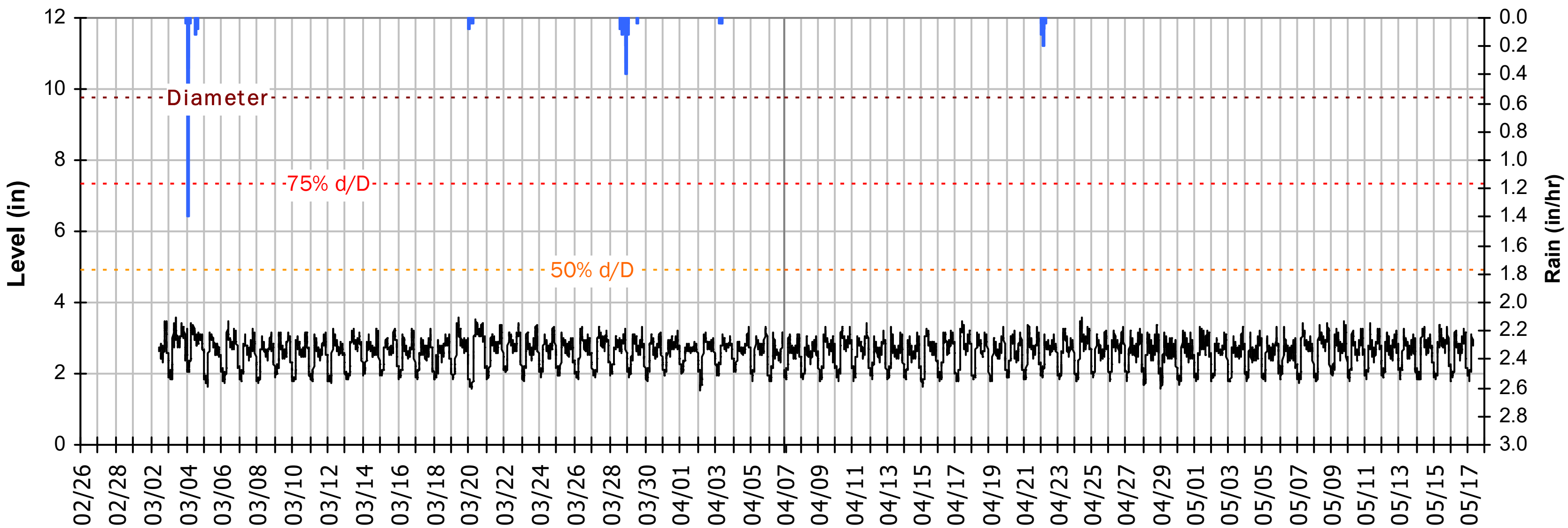
Average Dry Weather Flow Hydrographs

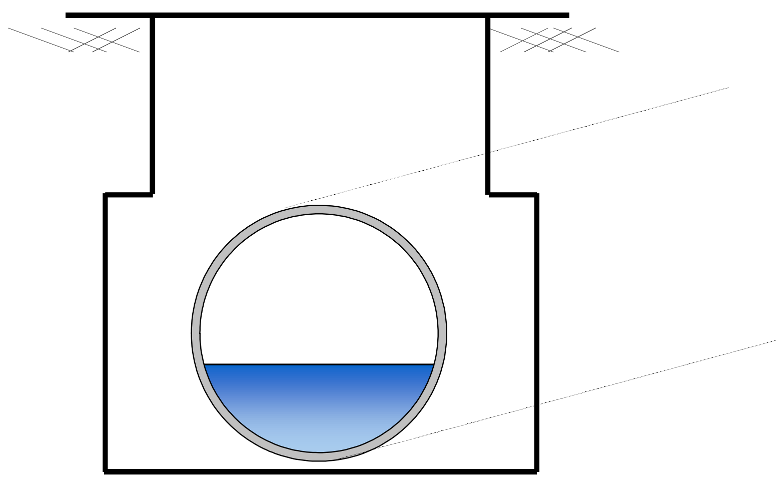




SITE 32
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



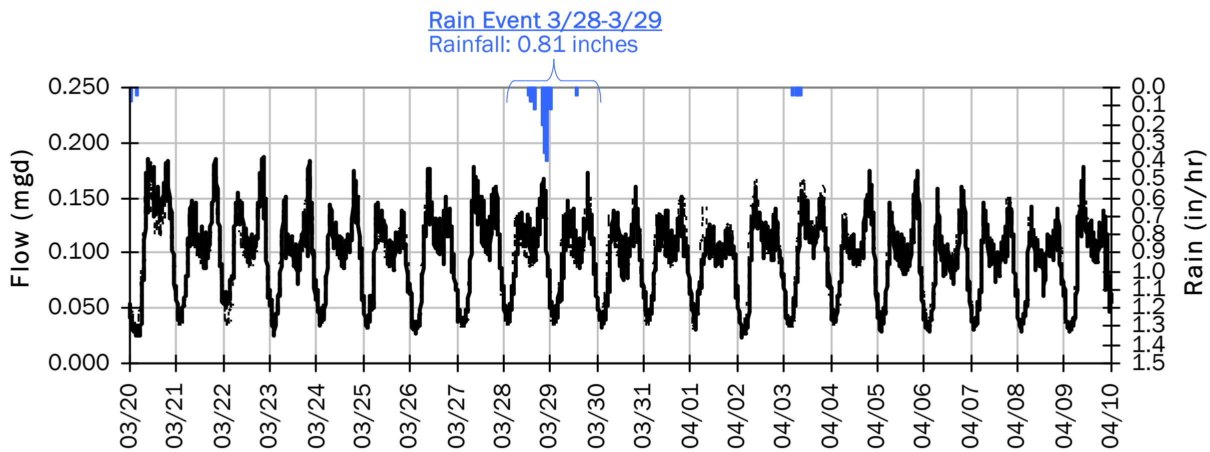


Pipe Diameter:	9.75	*inches*
Peak Measured Level:	3.56	*inches*
Peak d/D Ratio:	0.36	

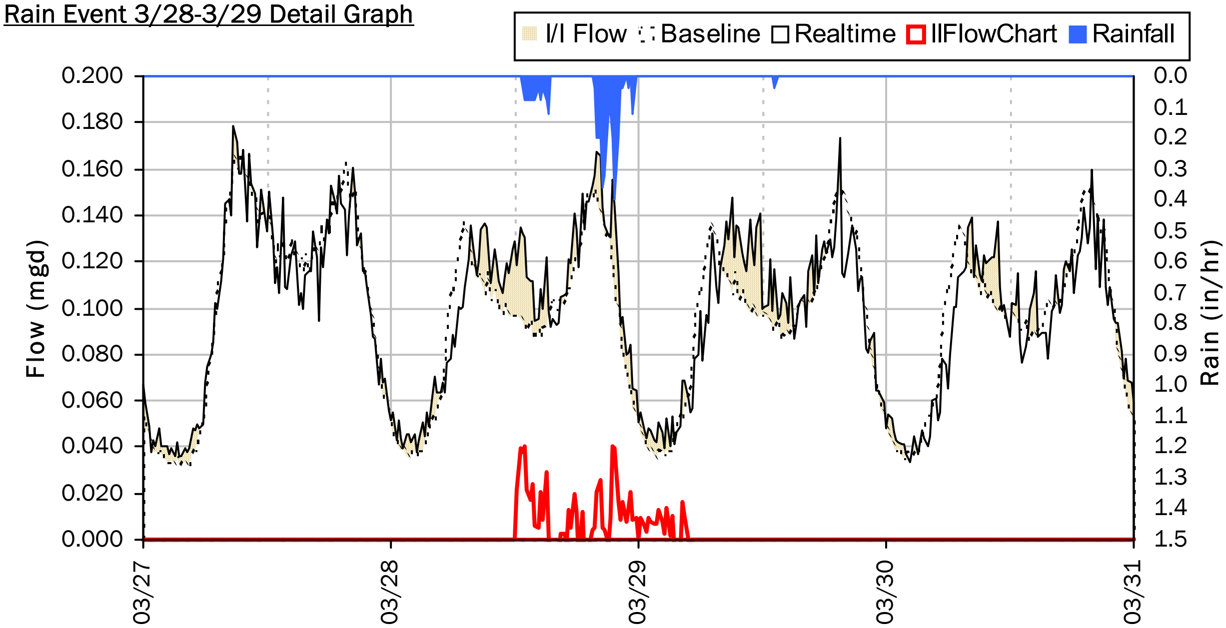
SITE 32

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



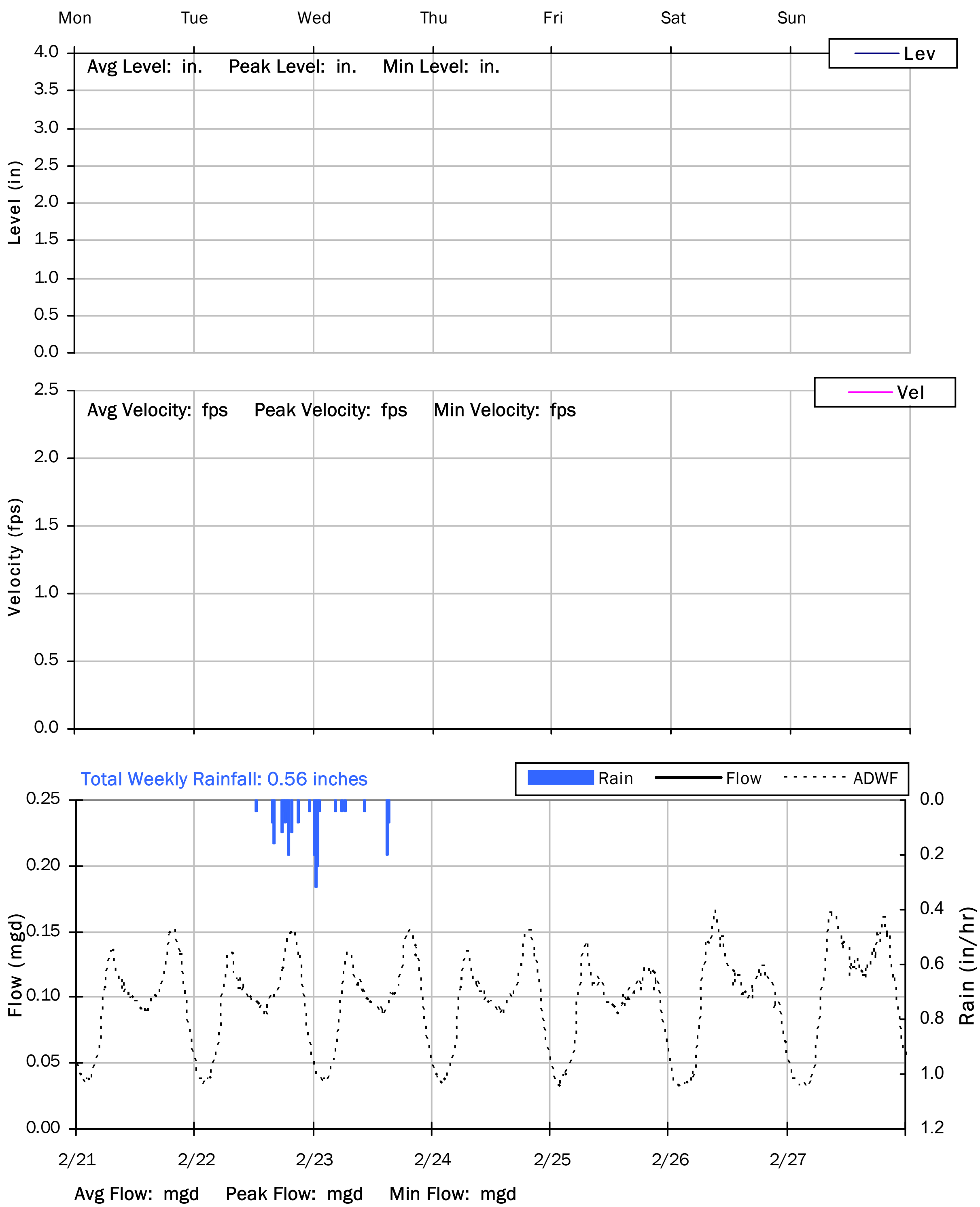
Rain Event 3/28-3/29 Detail Graph



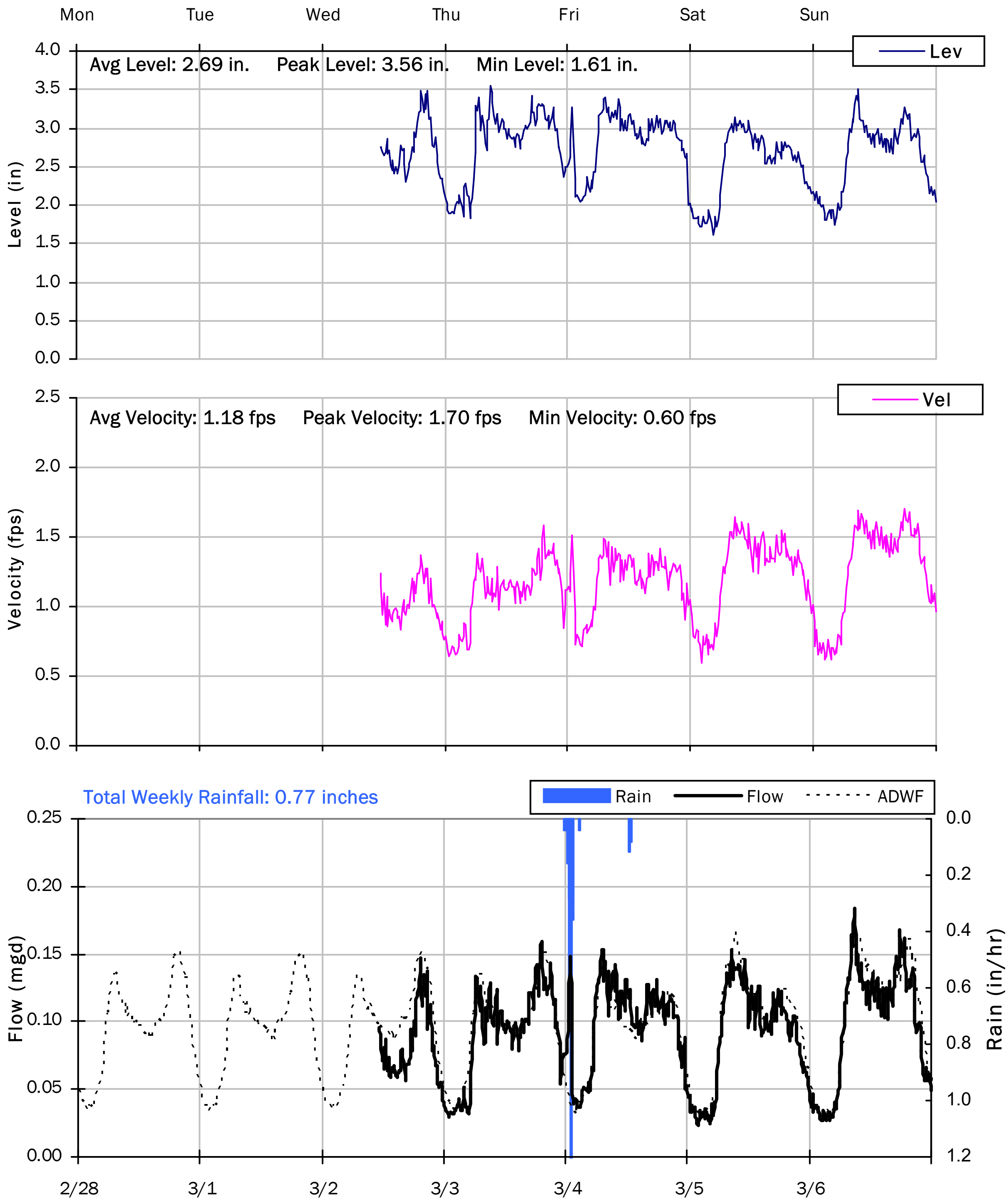
Storm Event I/I Analysis (Rain = 0.81 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.168 *mgd*	Peak I/I Rate:	0.040 *mgd*
PF:	1.76	Total I/I:	7,000 *gallons*
Peak Level:	3.24 *in*		
d/D Ratio:	0.33		

SITE 32
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022

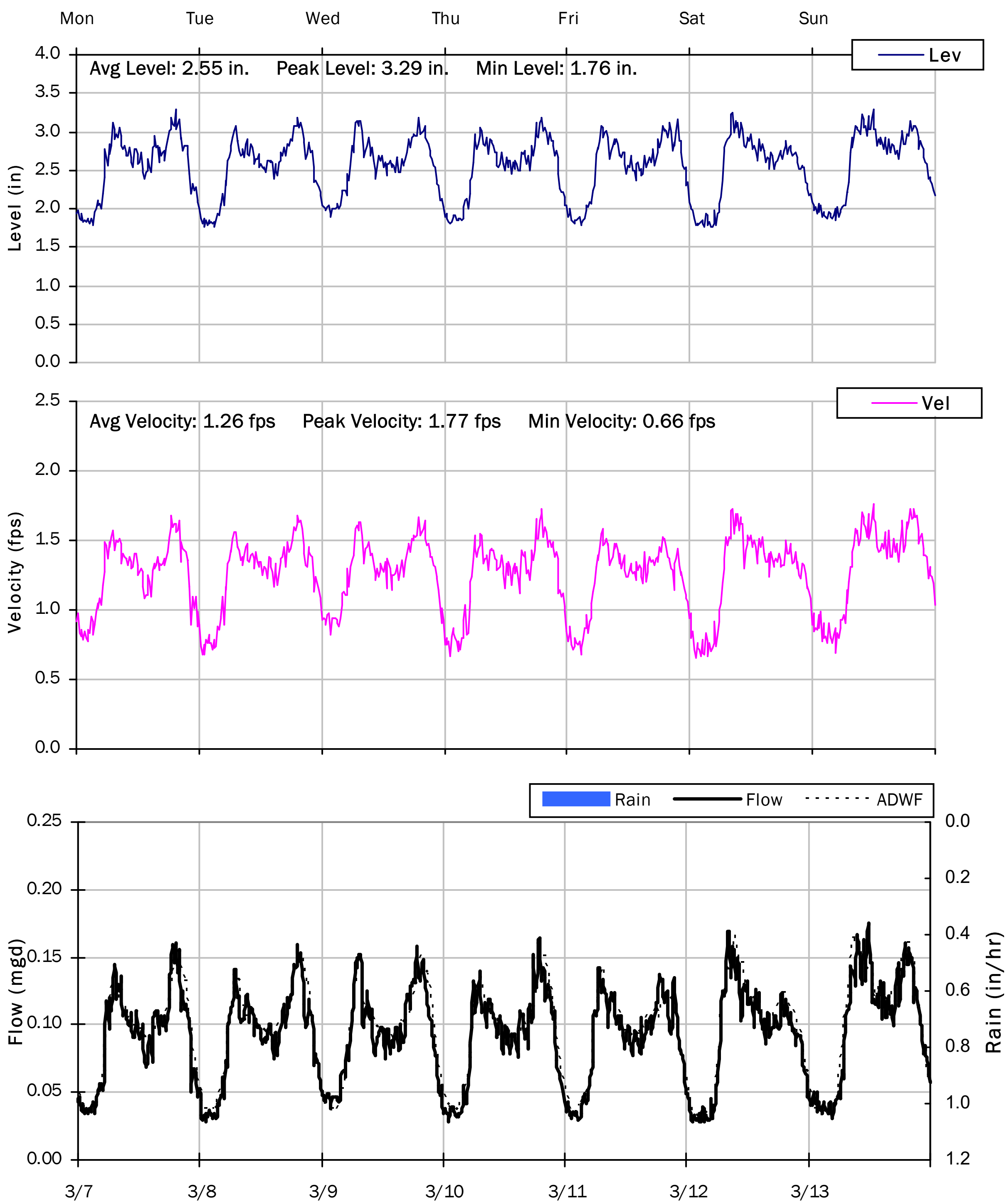


SITE 32
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022



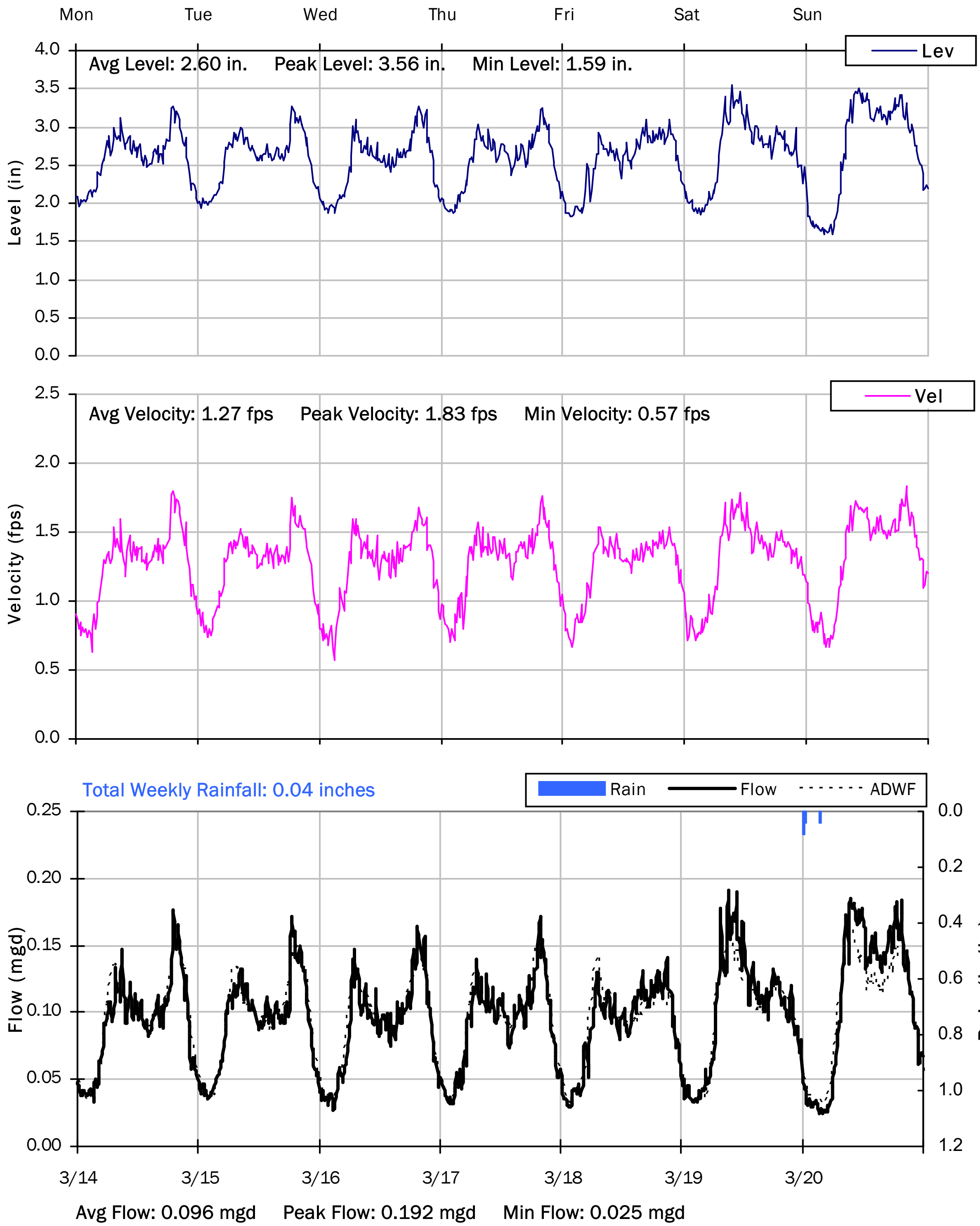
Avg Flow: 0.093 mgd Peak Flow: 0.183 mgd Min Flow: 0.024 mgd

SITE 32
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022

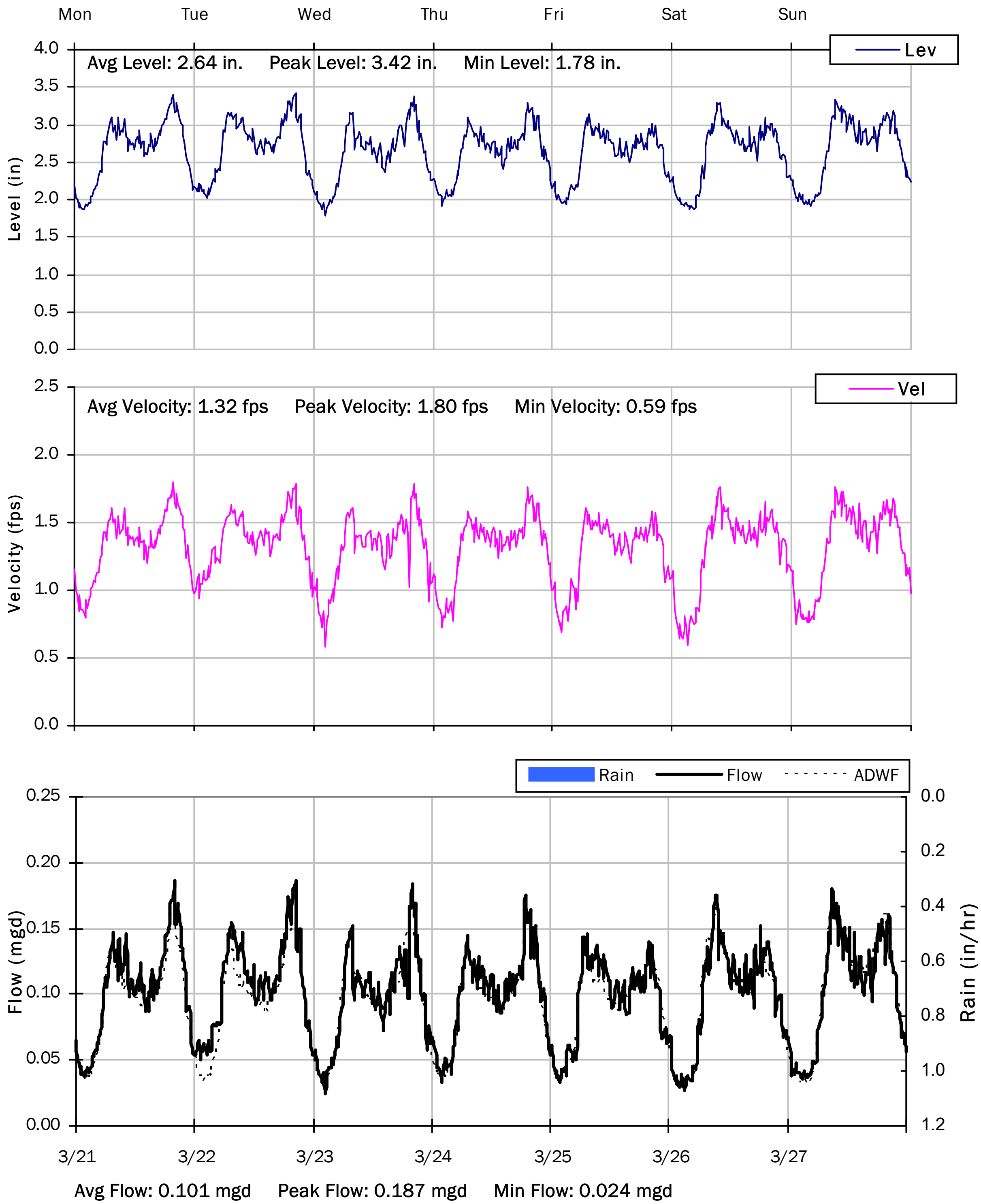


Avg Flow: 0.092 mgd Peak Flow: 0.176 mgd Min Flow: 0.028 mgd

SITE 32
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



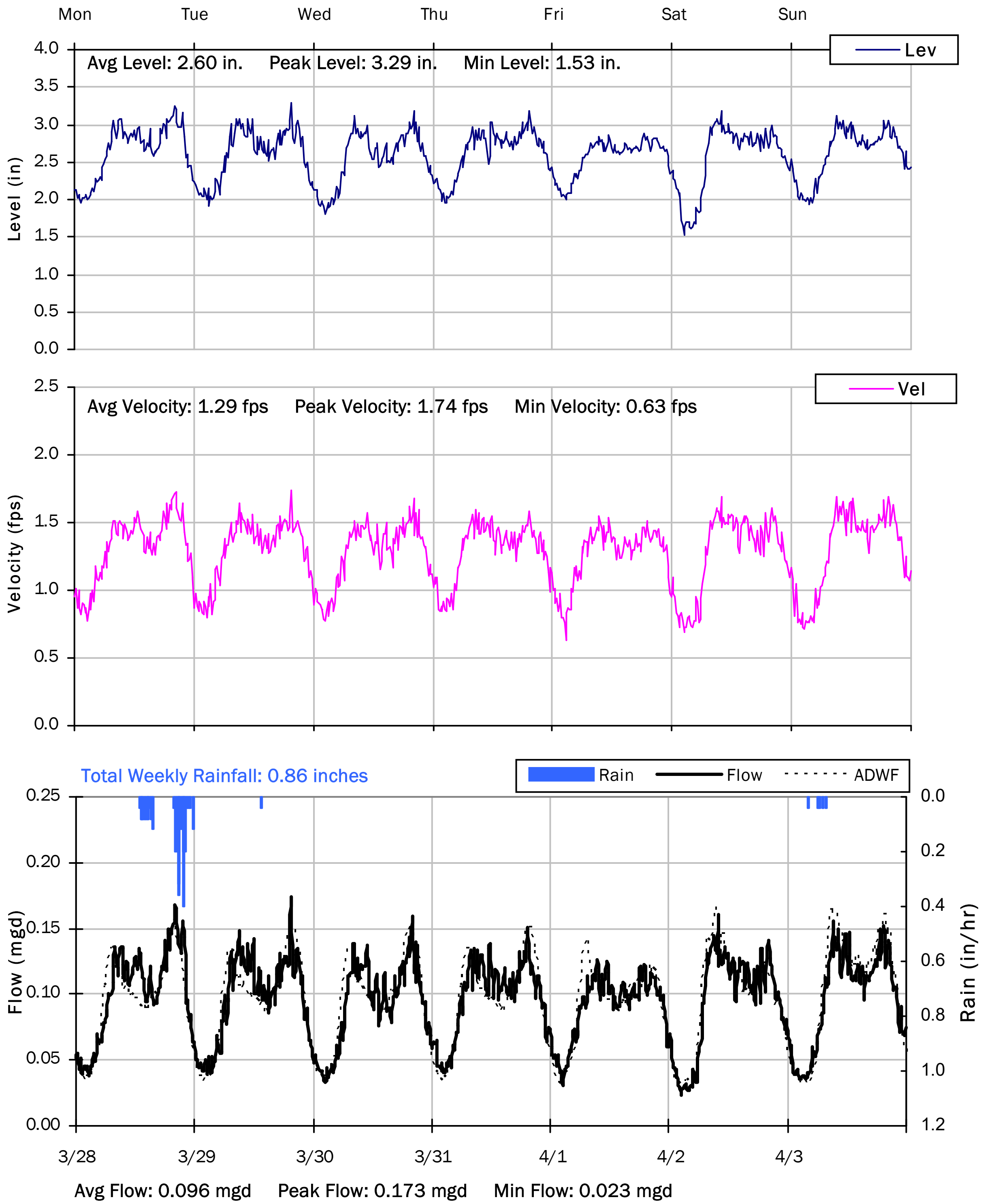
SITE 32
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



SITE 32

Weekly Level, Velocity and Flow Hydrographs

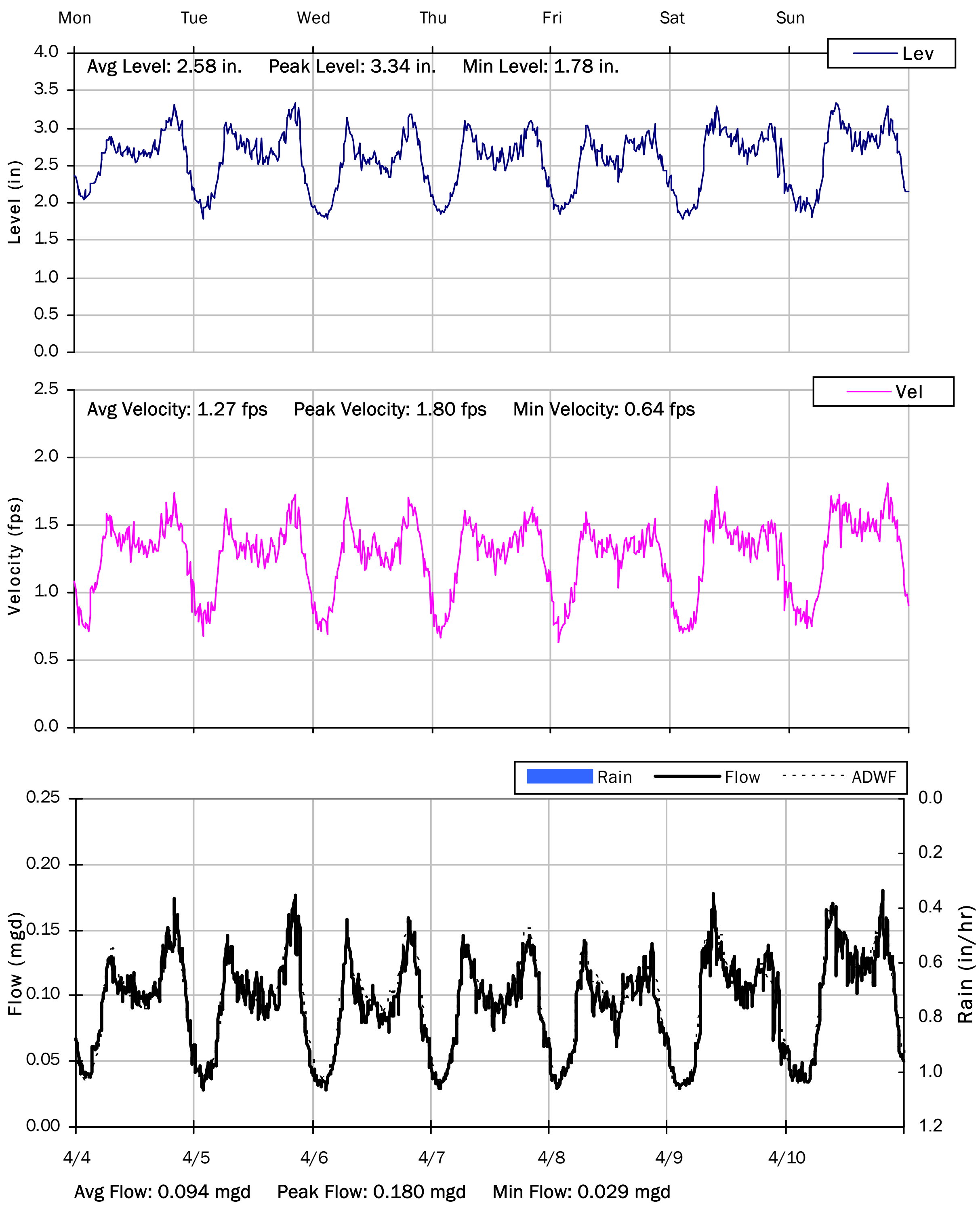
3/28/2022 to 4/4/2022



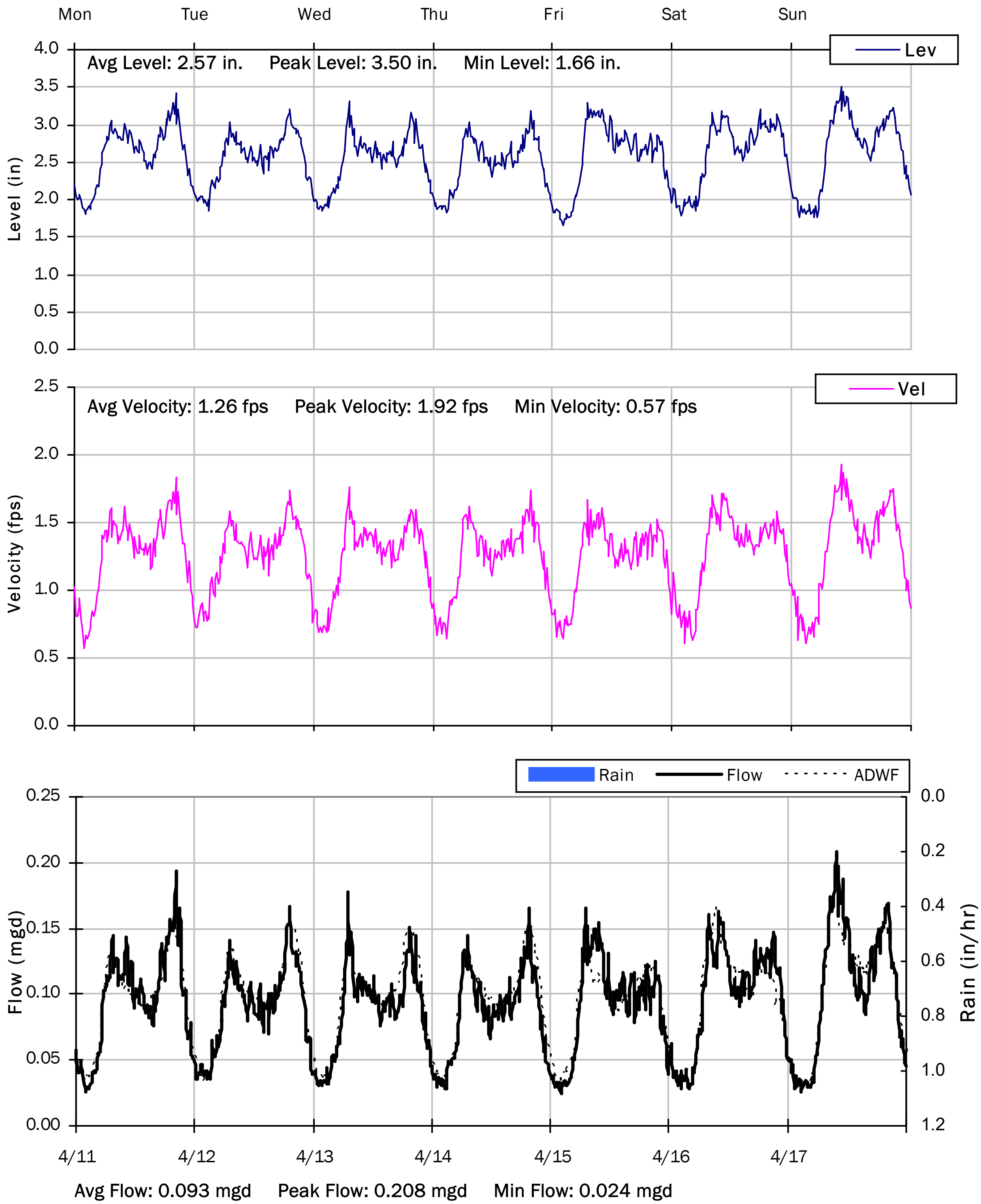
SITE 32

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022



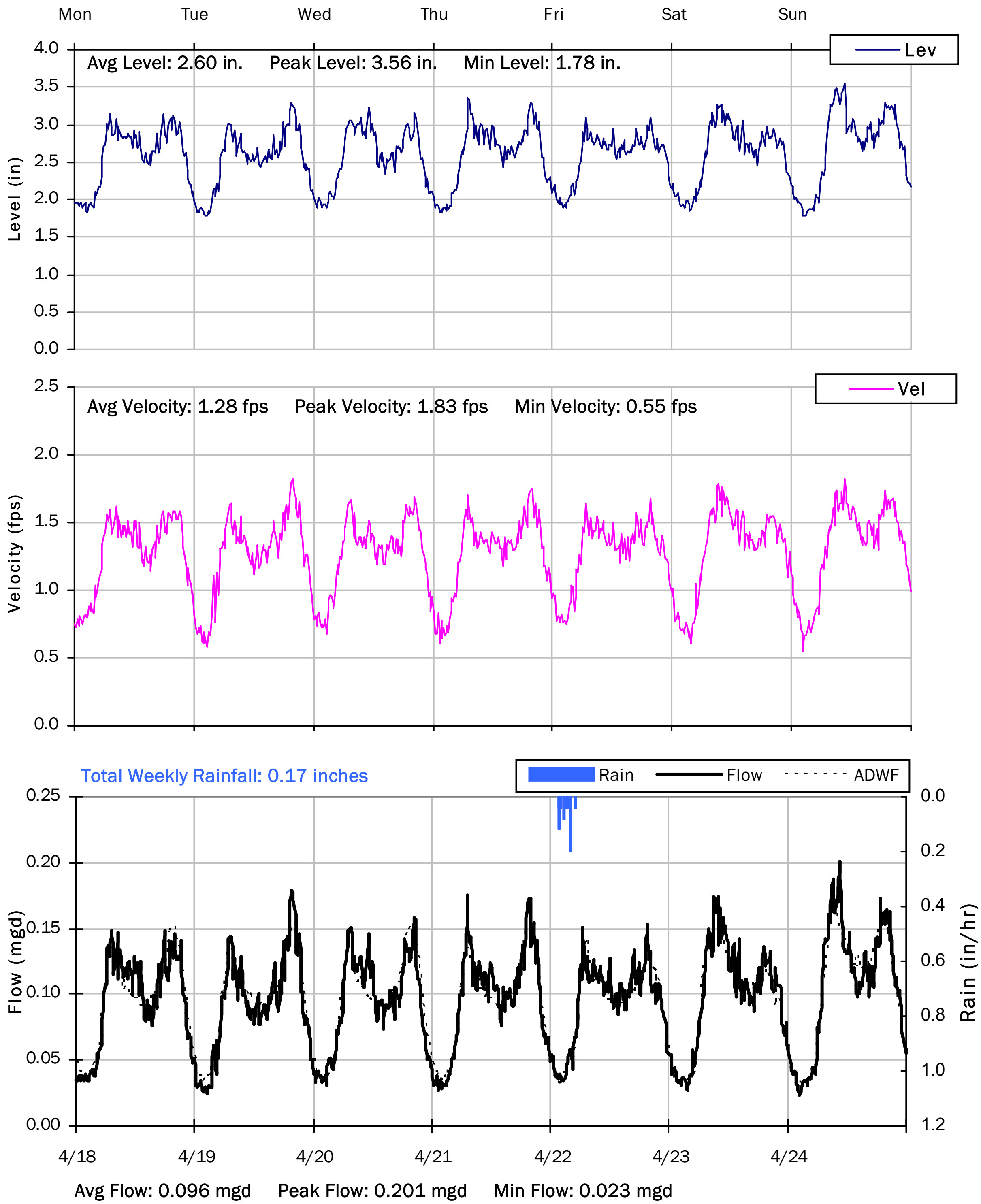
SITE 32
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022



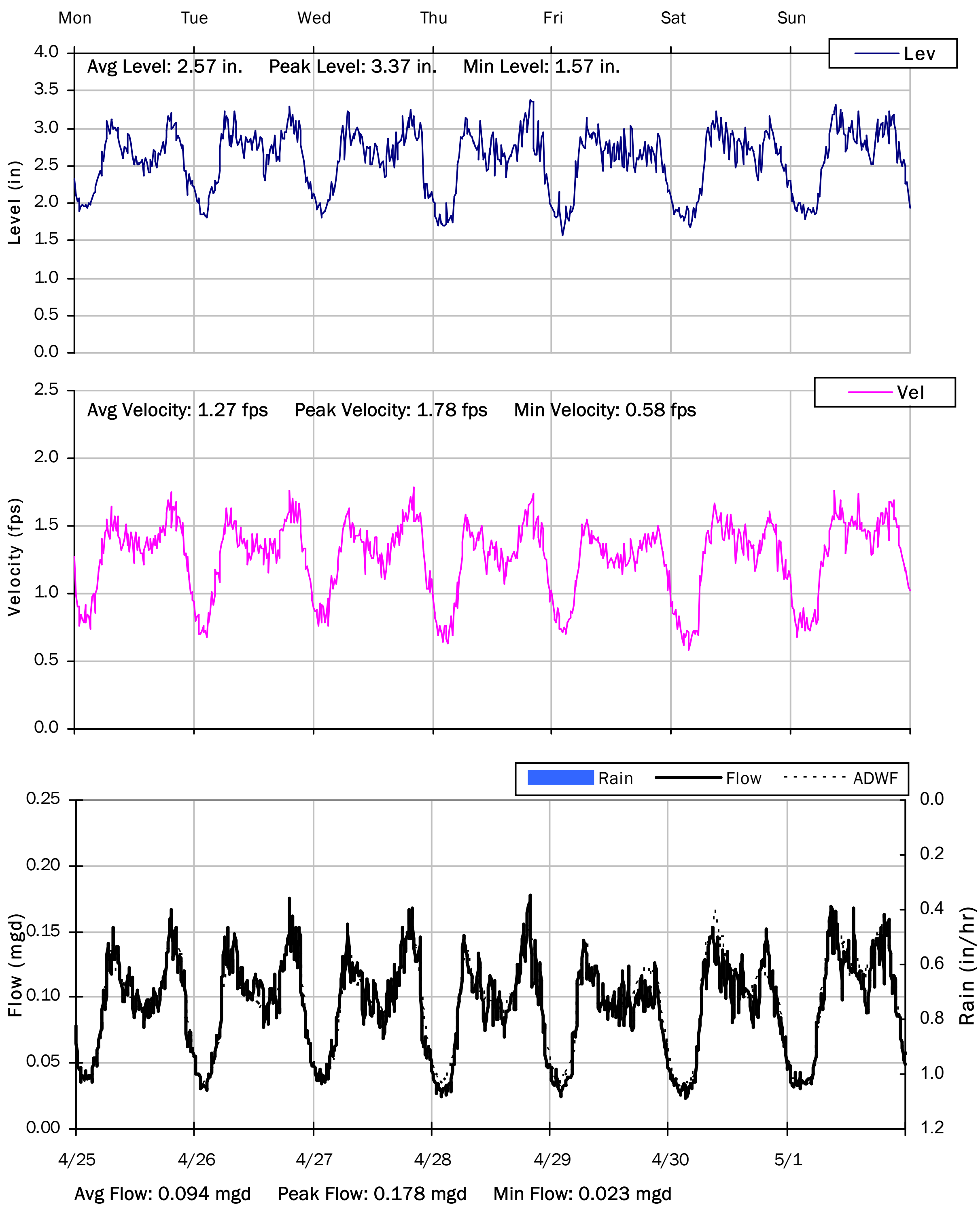
SITE 32

Weekly Level, Velocity and Flow Hydrographs

4/18/2022 to 4/25/2022



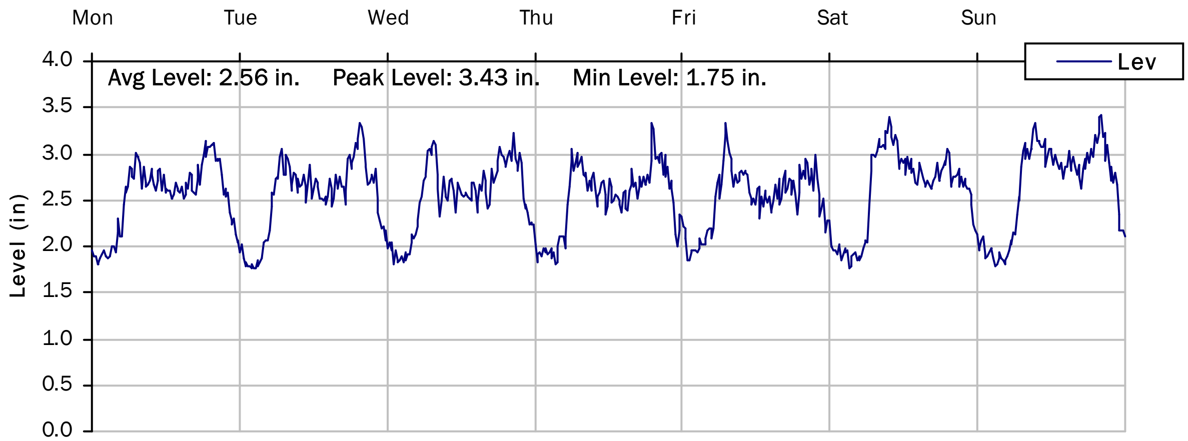
SITE 32
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

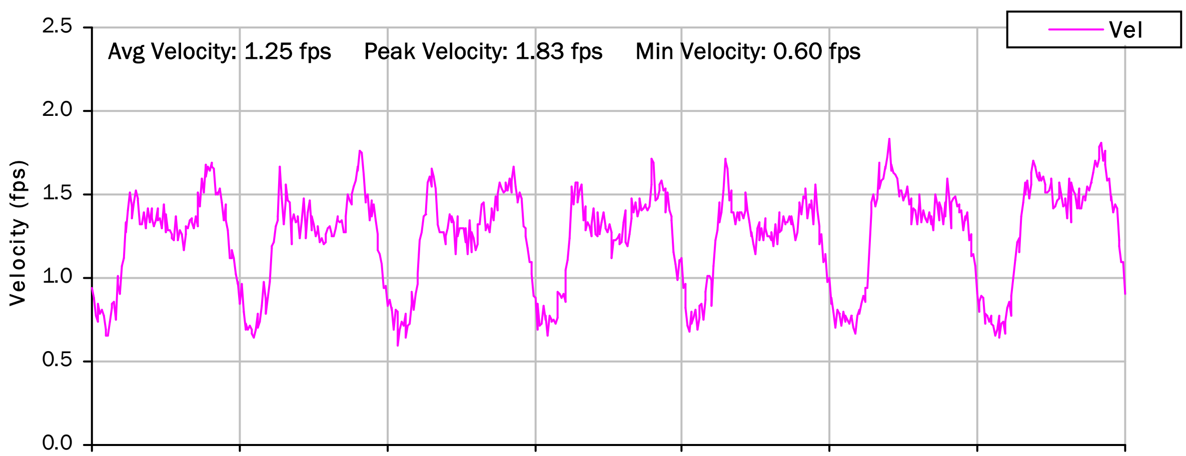


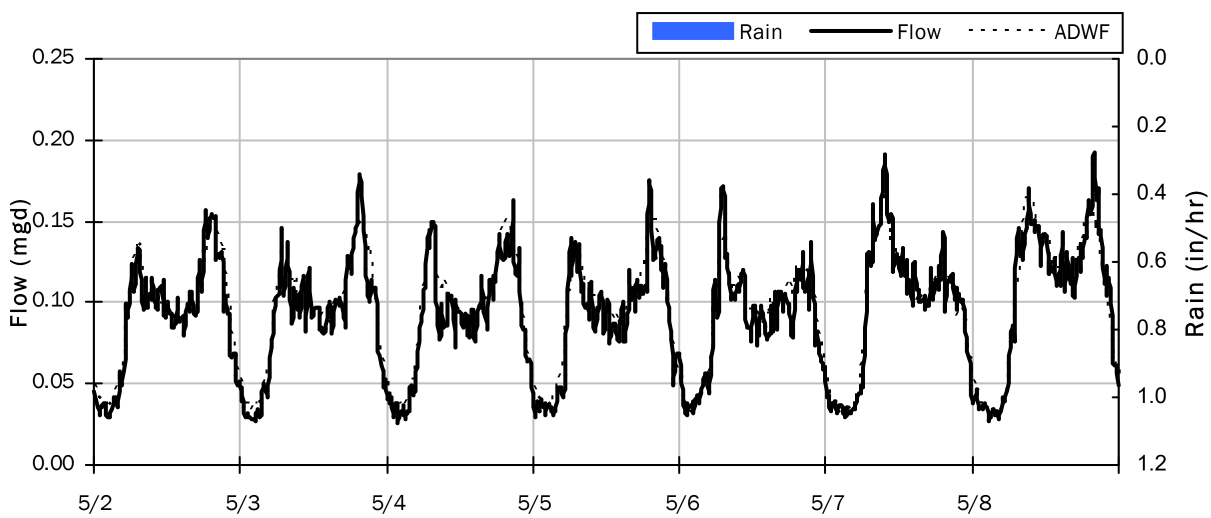
SITE 32

Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022

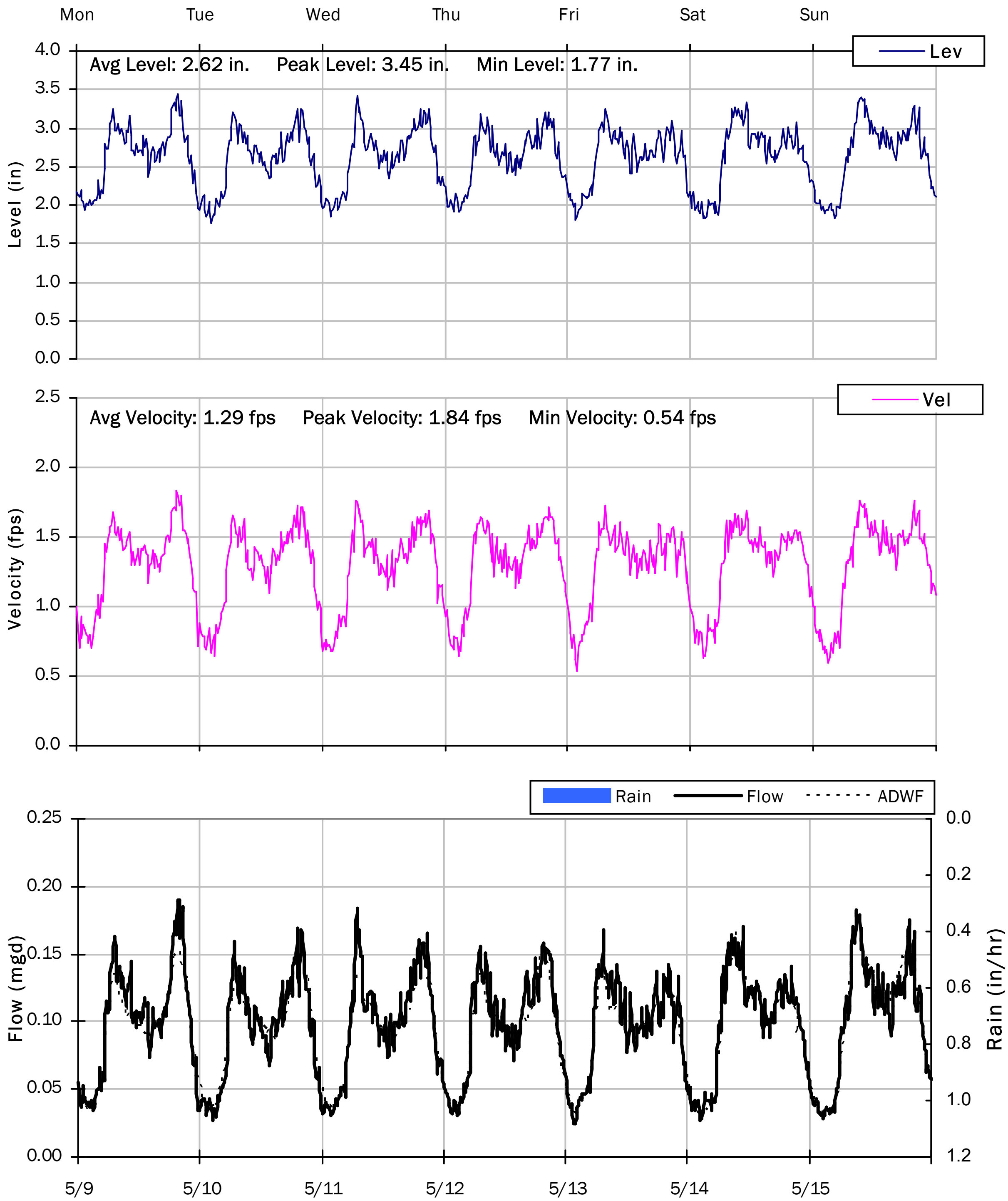






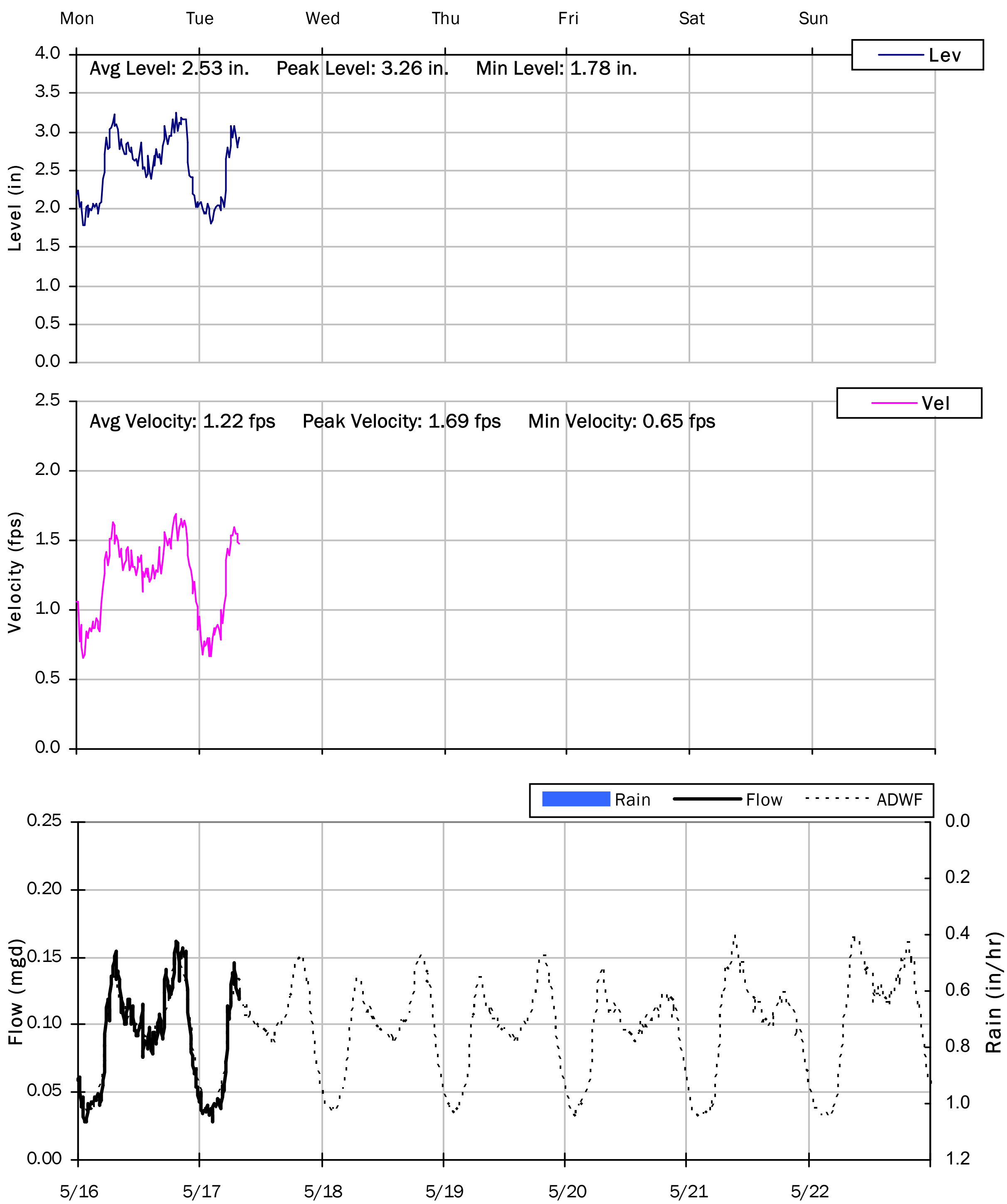
Avg Flow: 0.092 mgd Peak Flow: 0.191 mgd Min Flow: 0.026 mgd

SITE 32
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022



Avg Flow: 0.099 mgd Peak Flow: 0.190 mgd Min Flow: 0.024 mgd

SITE 32
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022



Avg Flow: 0.089 mgd   Peak Flow: 0.162 mgd   Min Flow: 0.028 mgd

Monitoring Site: Site 33

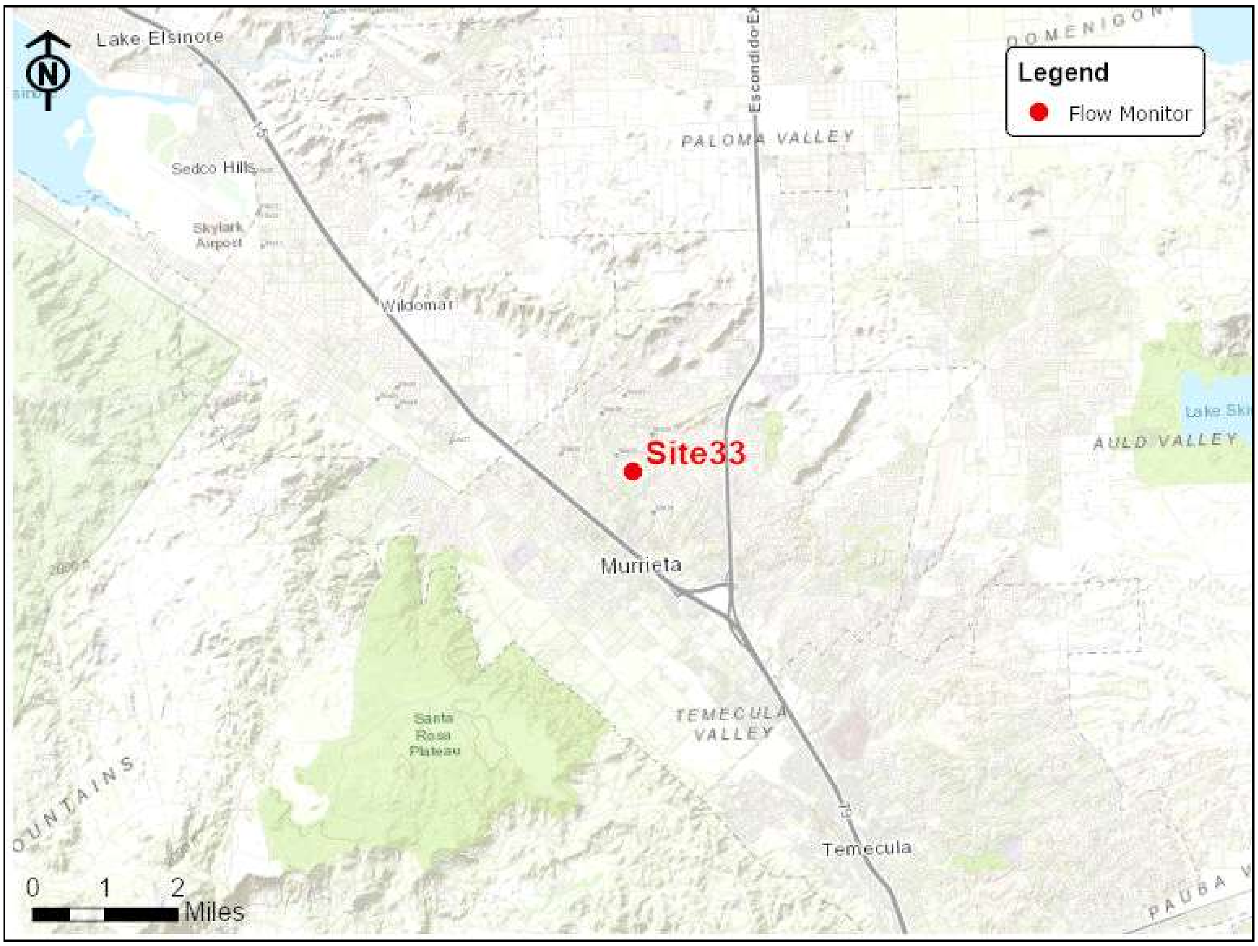
Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Behind Via Tonada in California Oaks Golf Course

Data Summary Report



Vicinity Map: Site 33

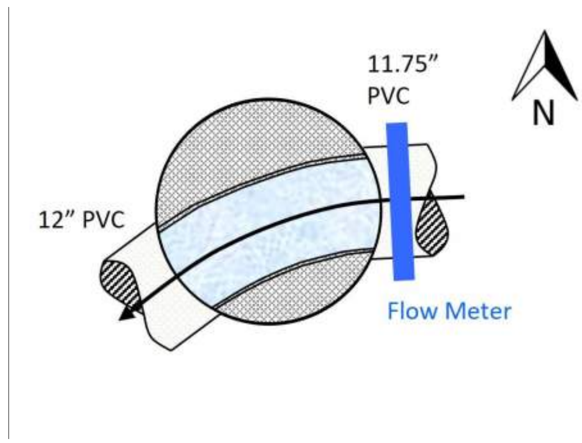
SITE 33

Site Information | MH ID: MH-4879

Location:	Behind Via Tonada in California Oaks Golf Course
Coordinates:	117.2034° W, 33.5794° N
Rim Elevation (Earth):	1250 feet
Expected Pipe Diameter:	12 inches
Measured Pipe Diameter:	11.75 inches
ADWF:	0.273 mgd
Peak Measured Flow:	0.559 mgd
Sediment:	None

Satellite Map

Sanitary Map



Flow Sketch

Photo Not Taken

View from Street


Plan View

SITE 33

Additional Site Photos

Effluent Pipe

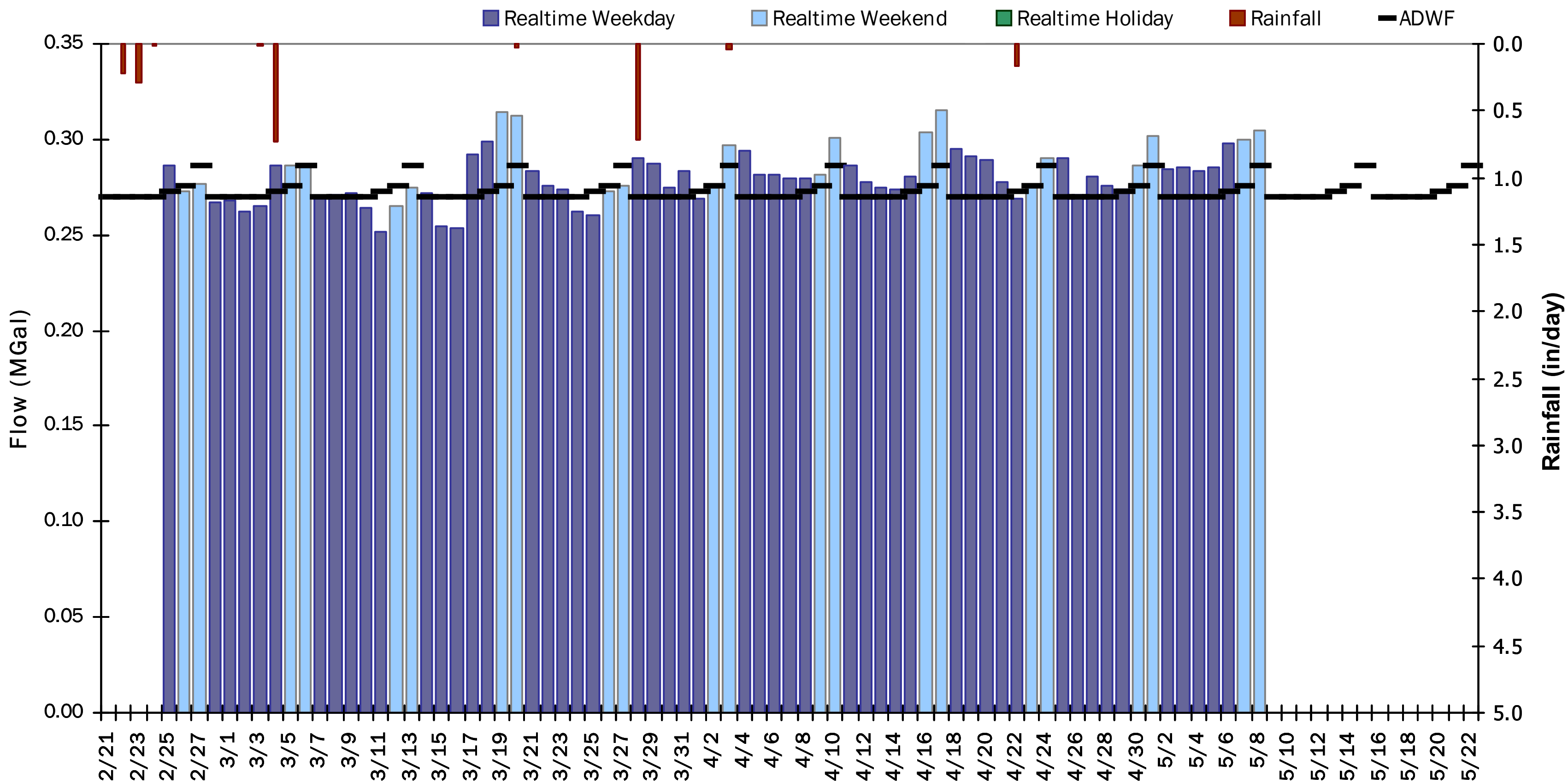
Influent Pipe

SITE 33

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.282 MGal   Peak Daily Flow: 0.382 MGal   Min Daily Flow: 0.210 MGal

Total Rainfall: 1.70 inches

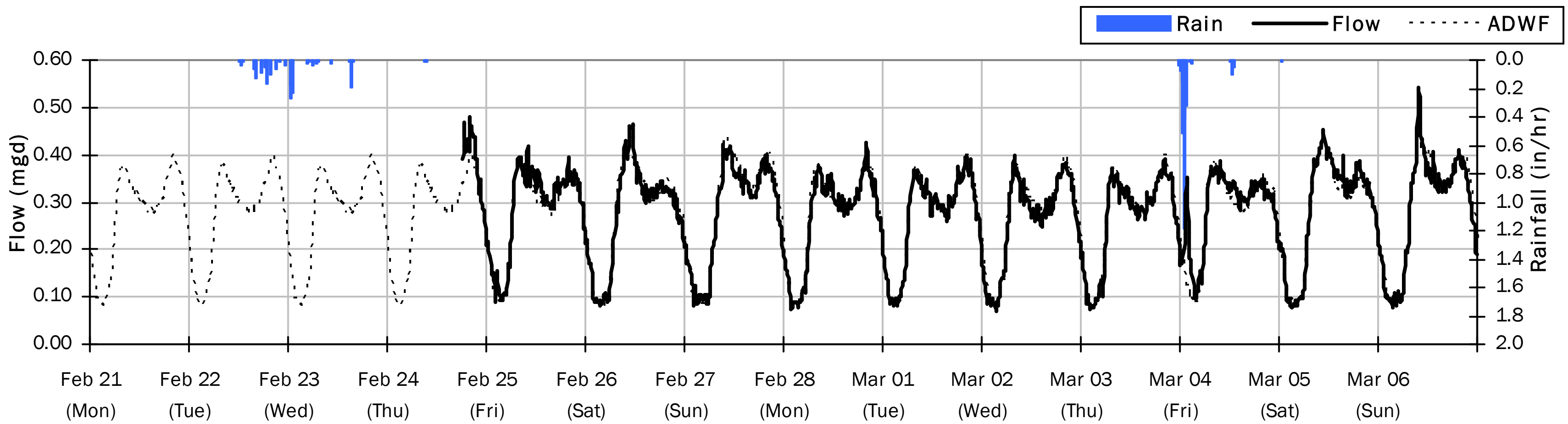


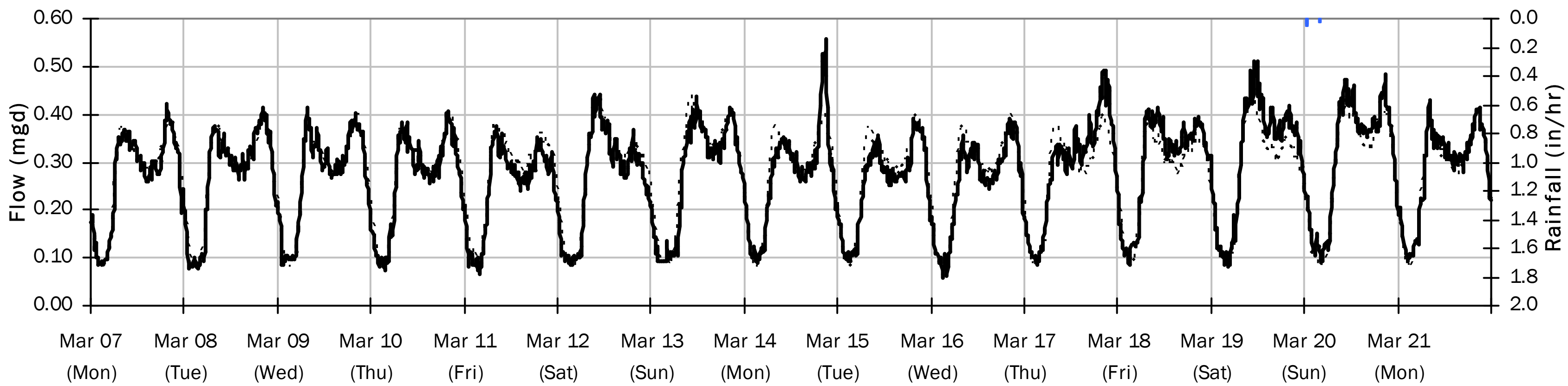
SITE 33

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.30 inches

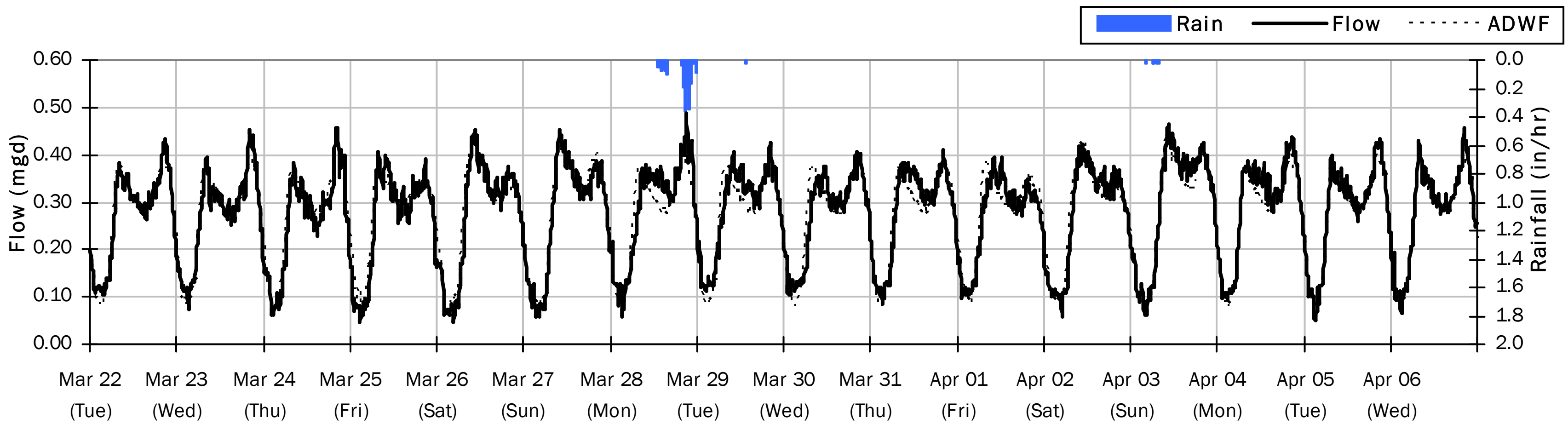
Period Avg Flow: 0.277 mgd   Period Peak Flow: 0.559 mgd   Period Min Flow: 0.058 mgd

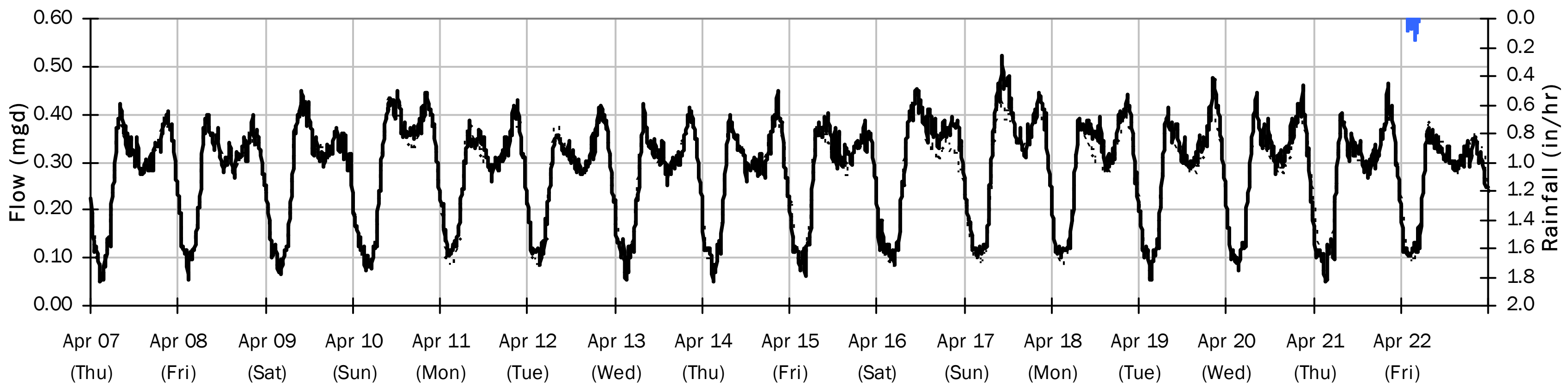




SITE 33
Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.92 inches   Period Avg Flow: 0.282 mgd   Period Peak Flow: 0.523 mgd   Period Min Flow: 0.045 mgd

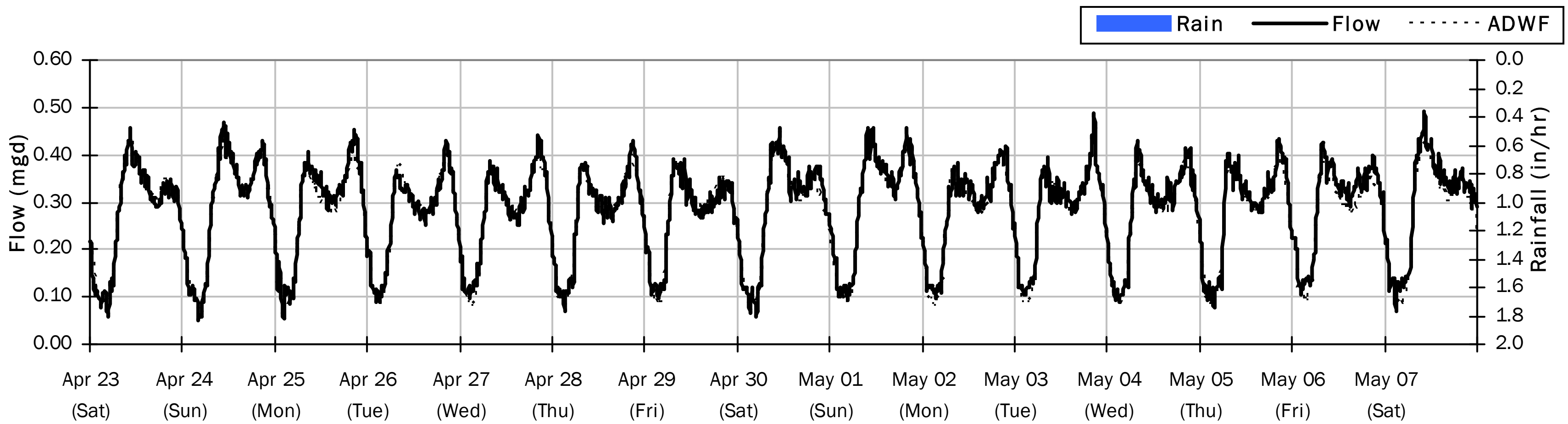


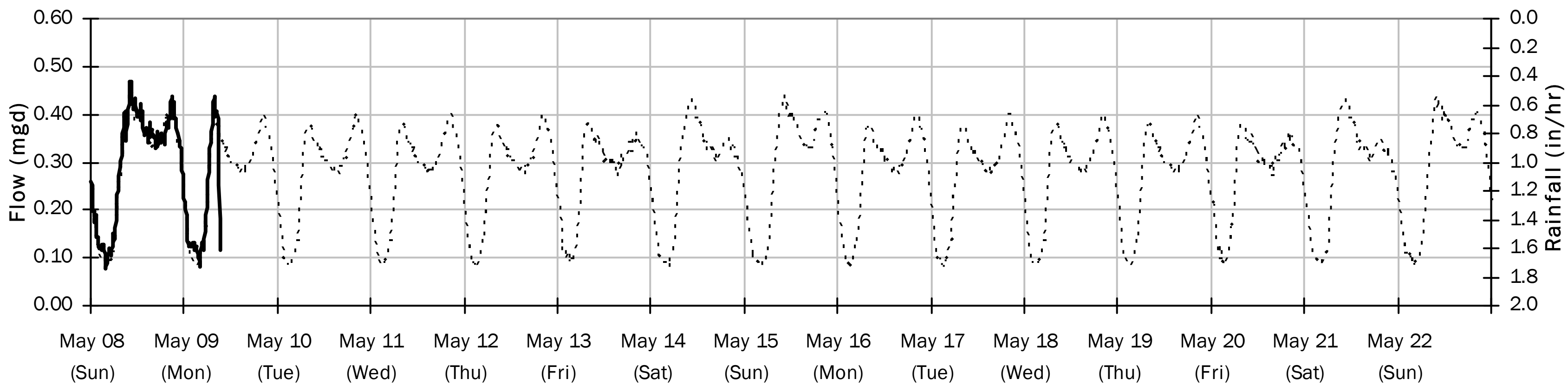


SITE 33

Flow Summary: 4/23/2022 to 5/22/2022

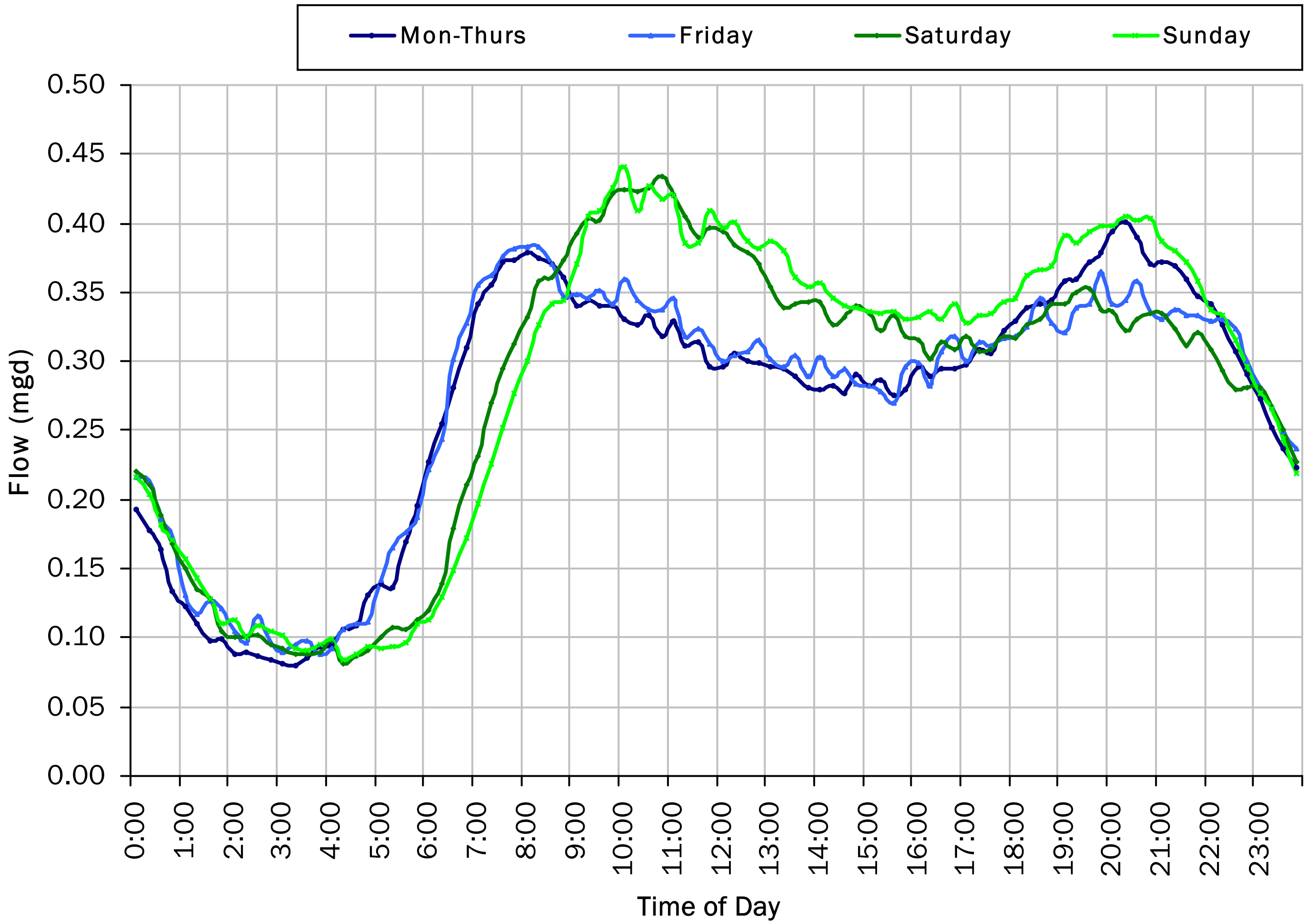
Period Rainfall: 0.00 inches   Period Avg Flow: 0.285 mgd   Period Peak Flow: 0.491 mgd   Period Min Flow: 0.052 mgd





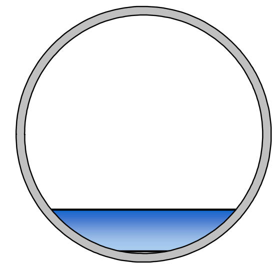
SITE 33

Average Dry Weather Flow Hydrographs



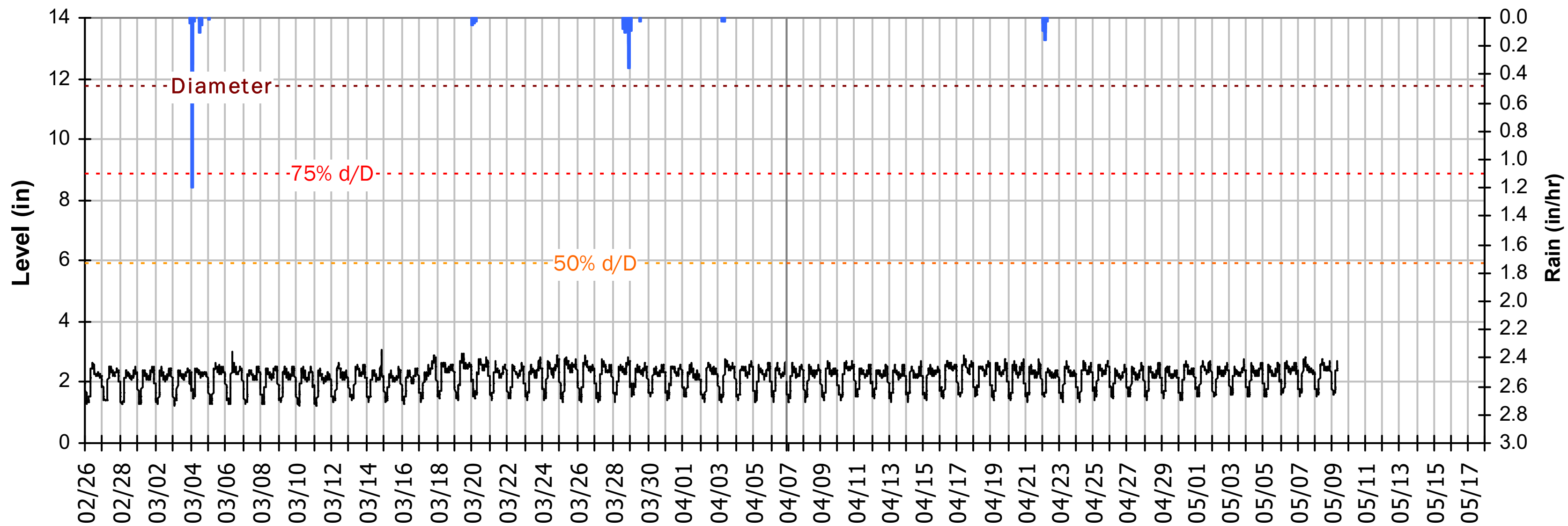
ADWF:

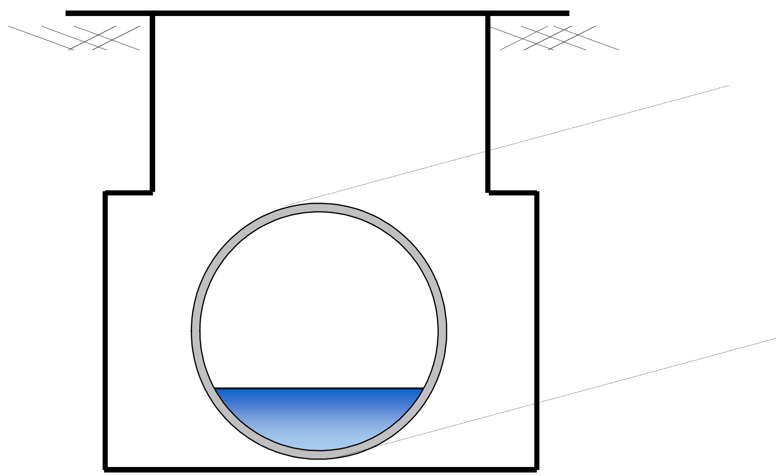
0.273 *mgd*



SITE 33
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



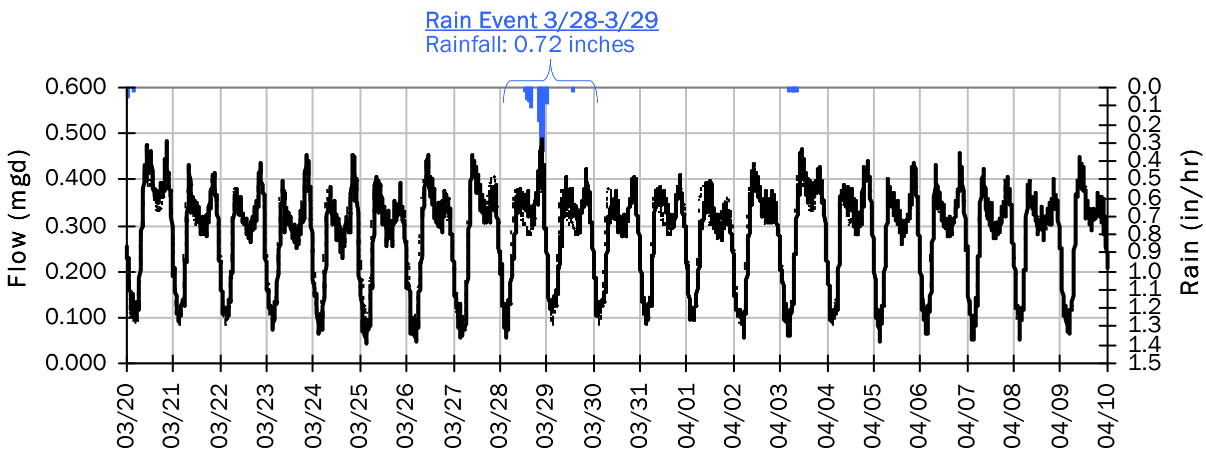


Pipe Diameter:	11.8	*inches*
Peak Measured Level:	3.08	*inches*
Peak d/D Ratio:	0.26	

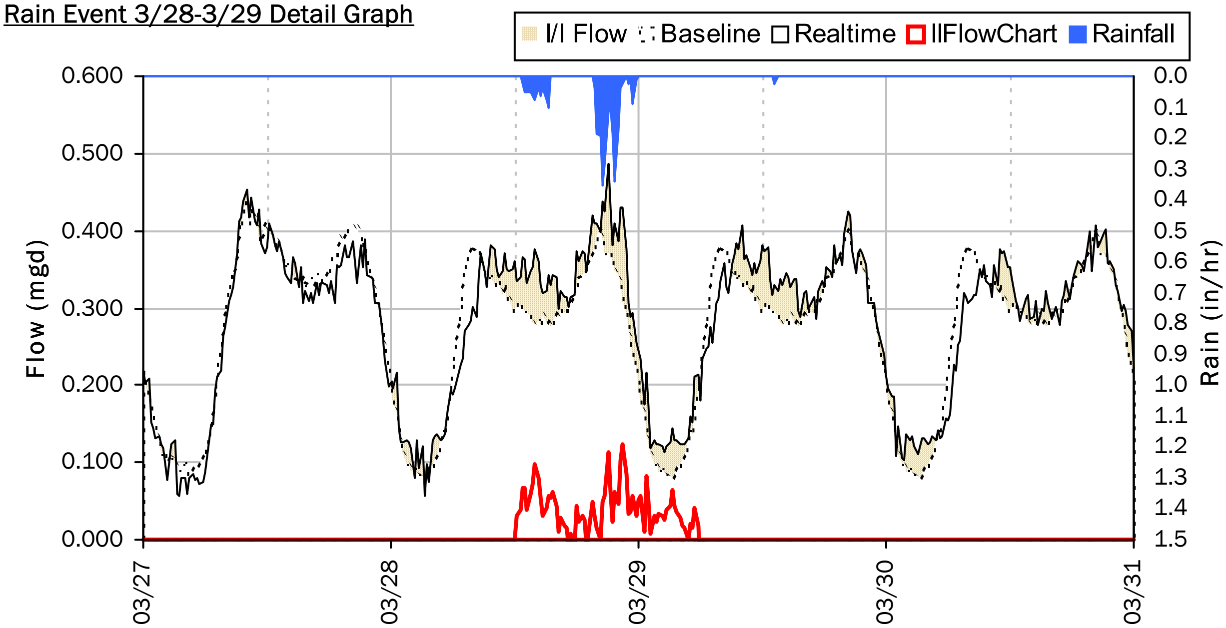
SITE 33

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



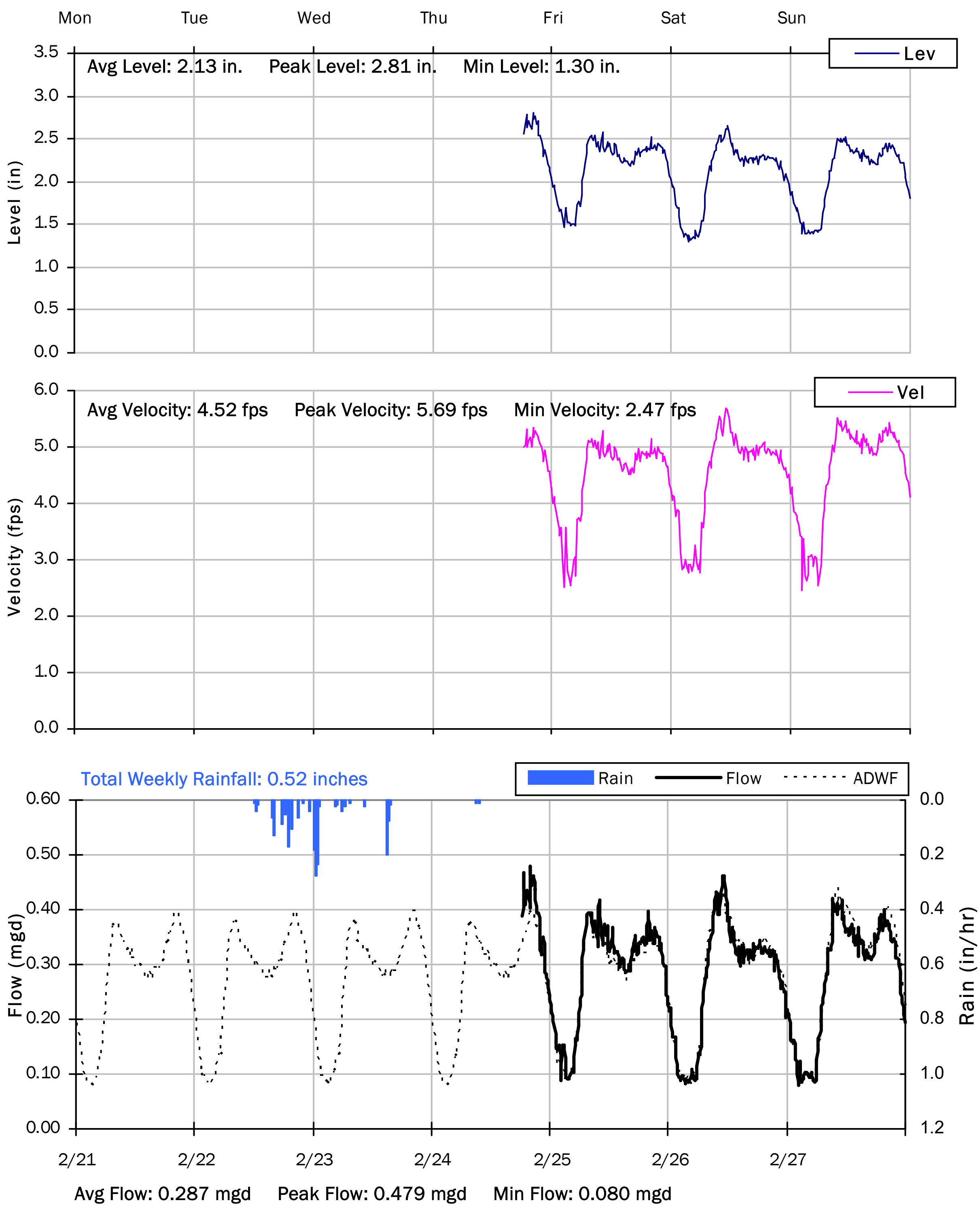
Rain Event 3/28-3/29 Detail Graph



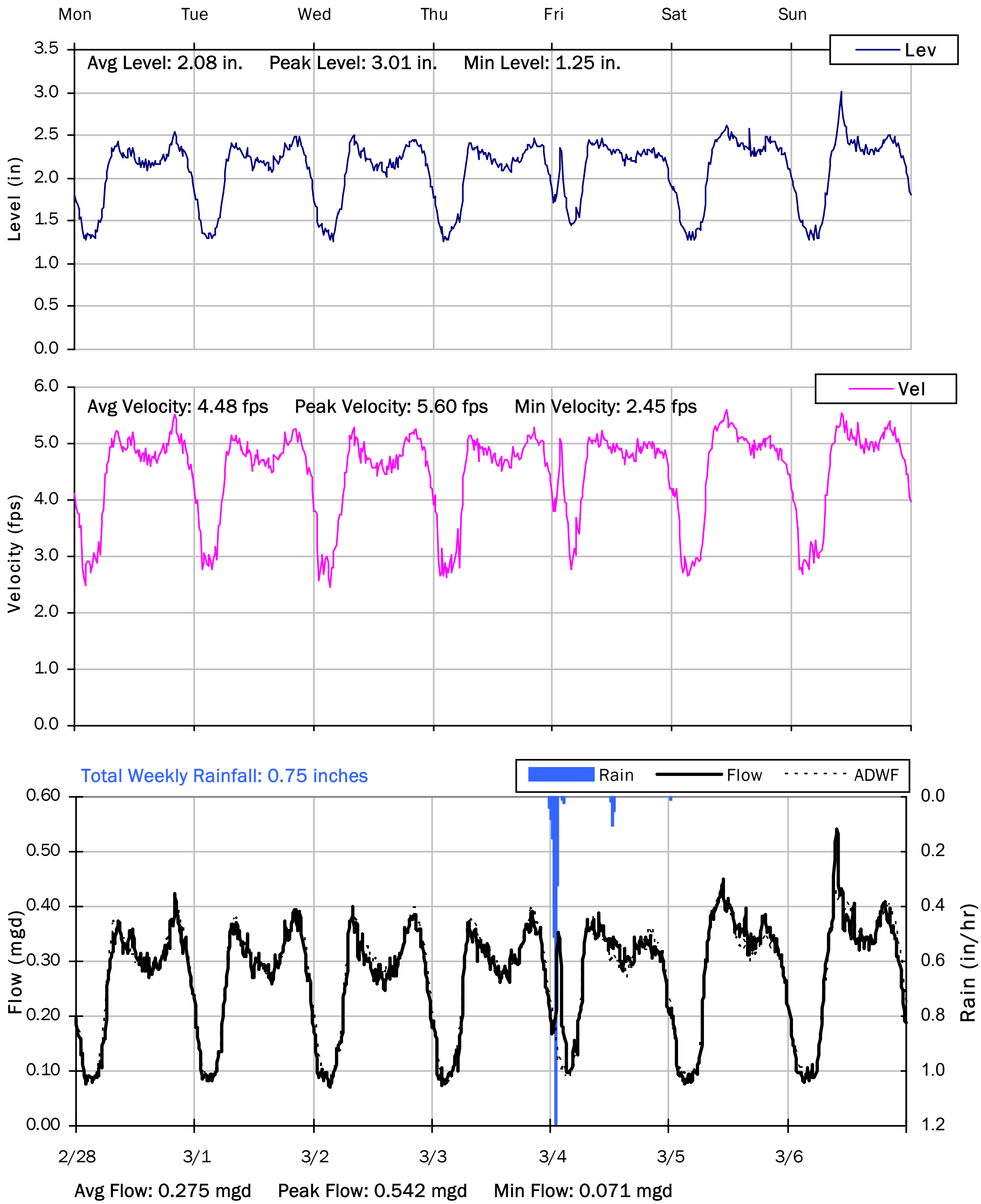
Storm Event I/I Analysis (Rain = 0.72 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.486 *mgd*	Peak I/I Rate:	0.124 *mgd*
PF:	1.78	Total I/I:	29,000 *gallons*
Peak Level:	2.82 *in*		
d/D Ratio:	0.24		

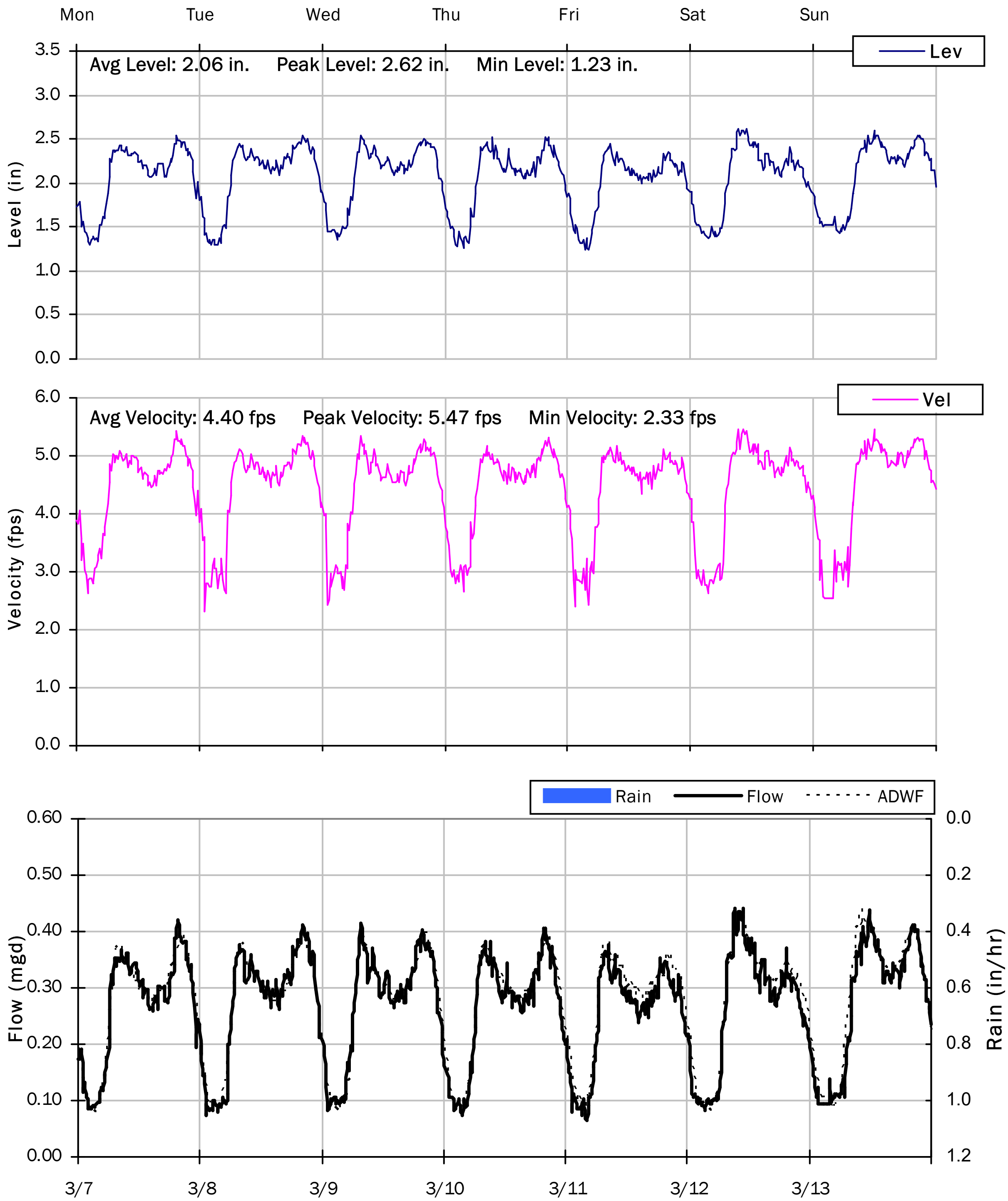
SITE 33
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



SITE 33
Weekly Level, Velocity and Flow Hydrographs
2/28/2022 to 3/7/2022

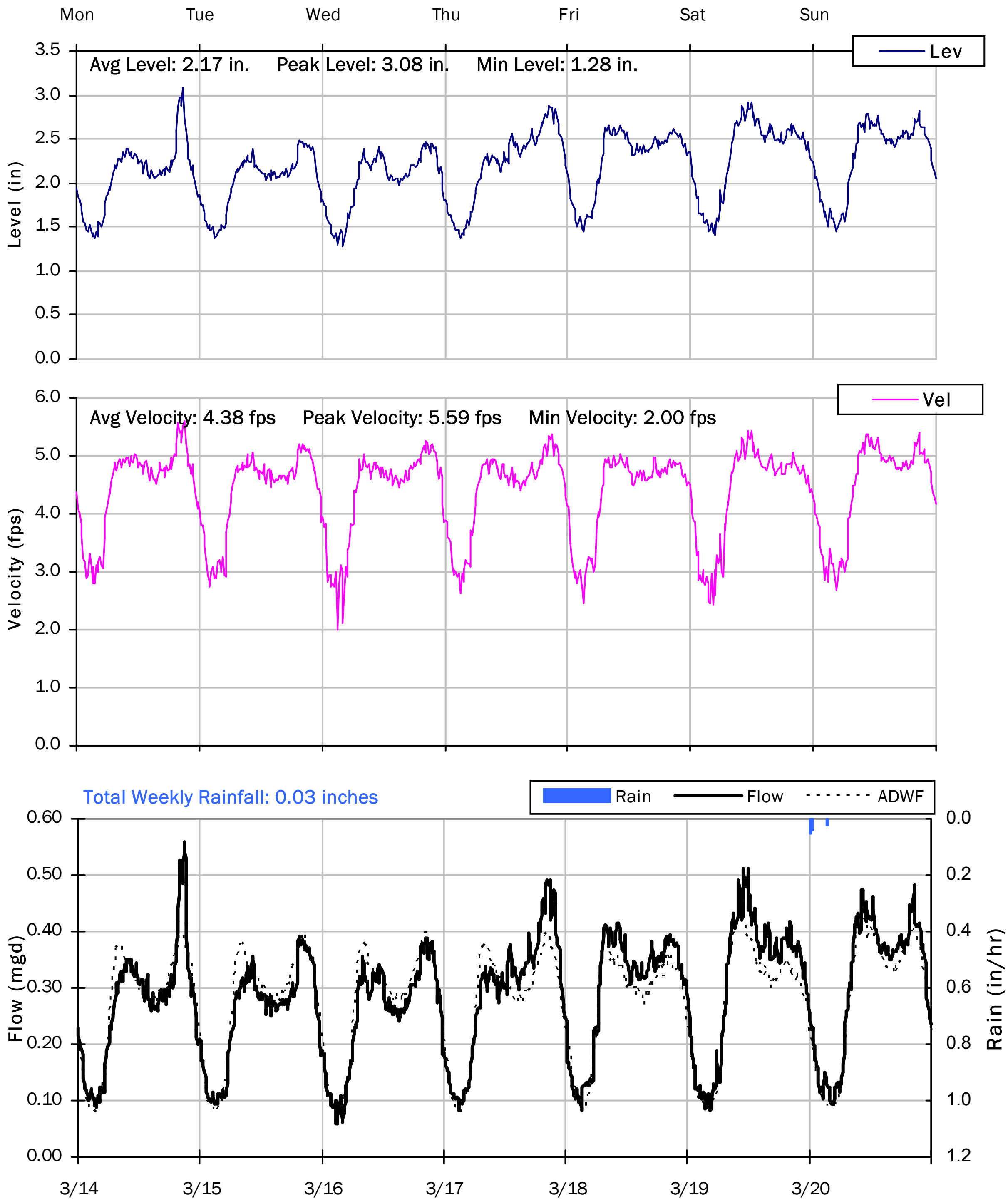


SITE 33
Weekly Level, Velocity and Flow Hydrographs
3/7/2022 to 3/14/2022



Avg Flow: 0.267 mgd   Peak Flow: 0.442 mgd   Min Flow: 0.066 mgd

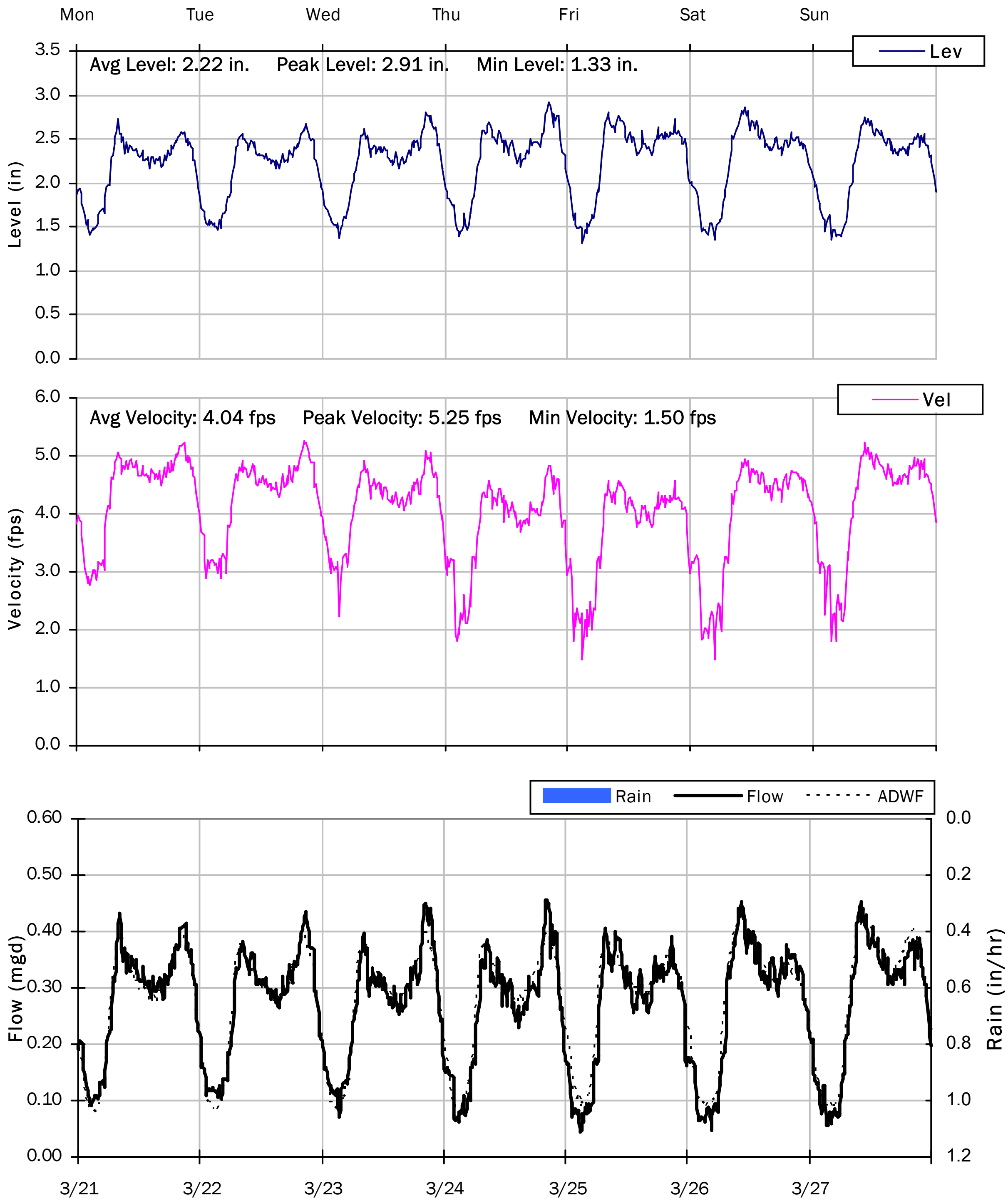
SITE 33
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



Avg Flow: 0.285 mgd Peak Flow: 0.559 mgd Min Flow: 0.058 mgd

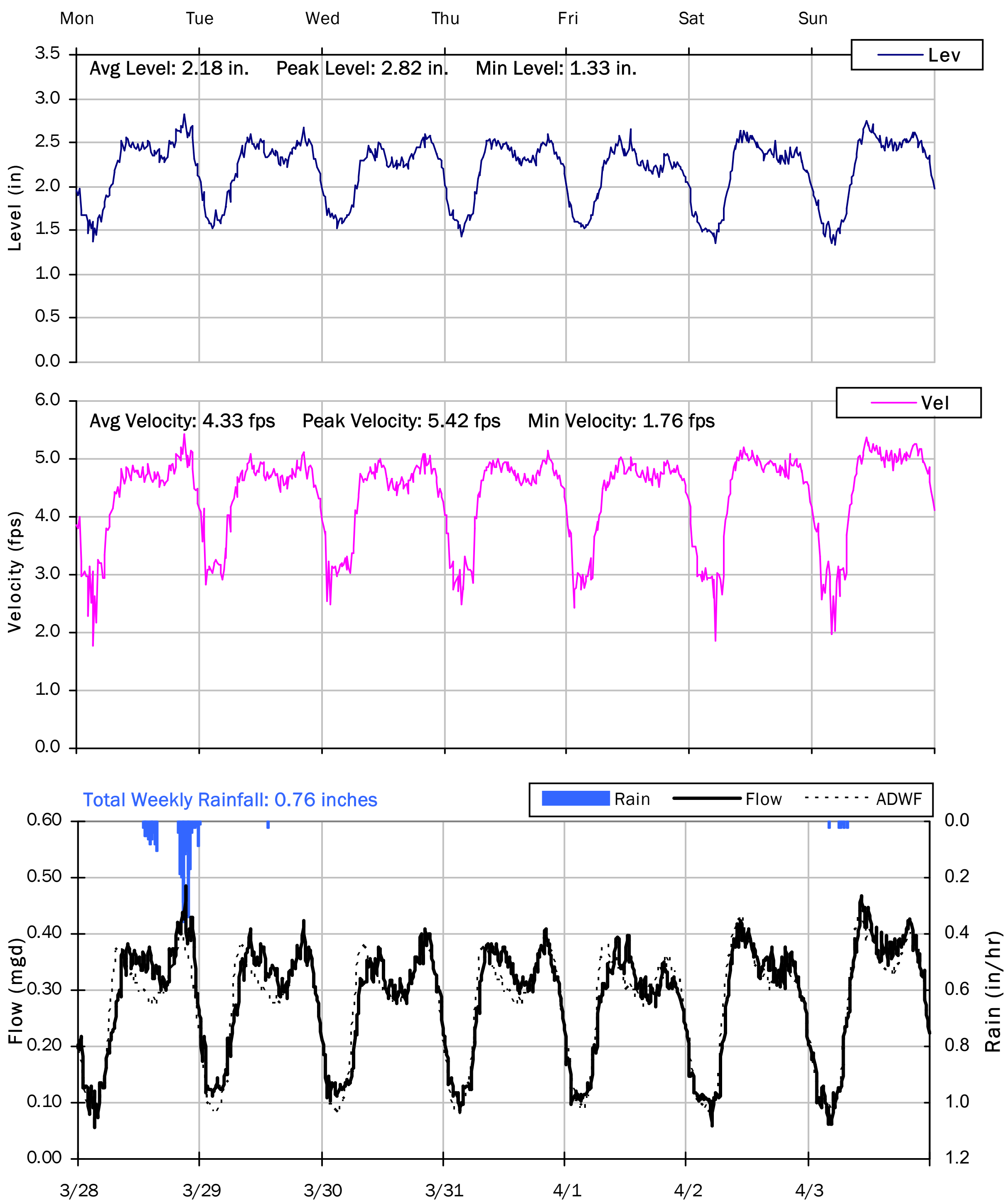
SITE 33

Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



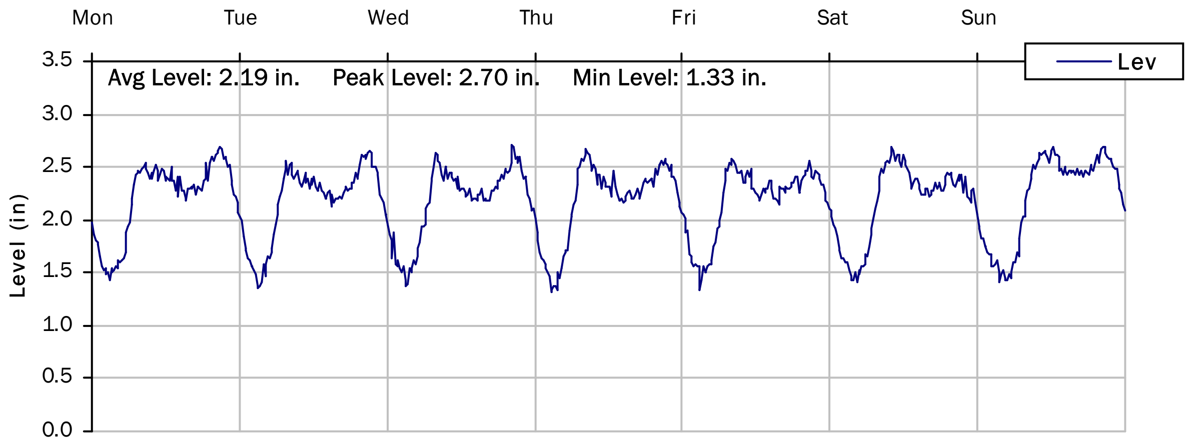
Avg Flow: 0.272 mgd   Peak Flow: 0.455 mgd   Min Flow: 0.045 mgd

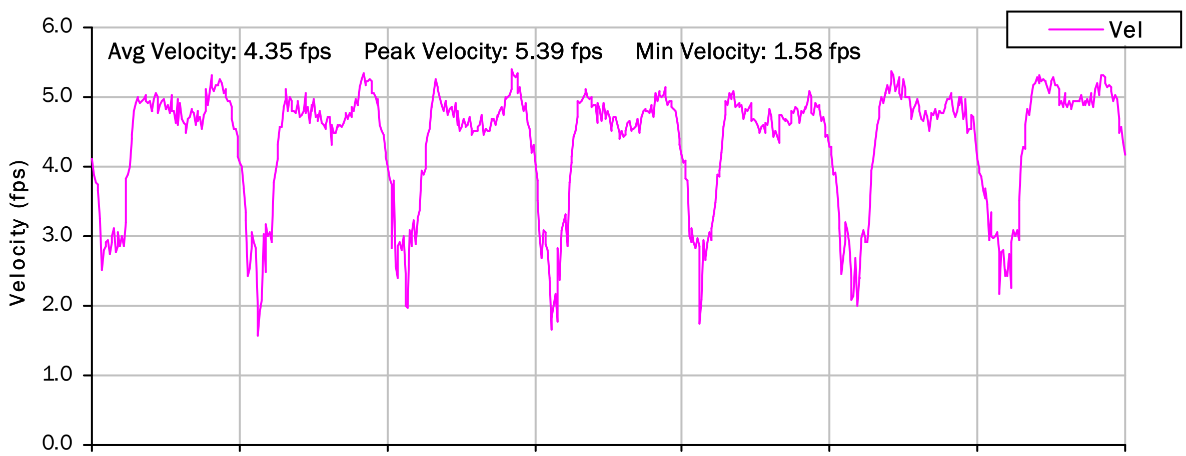
SITE 33
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022

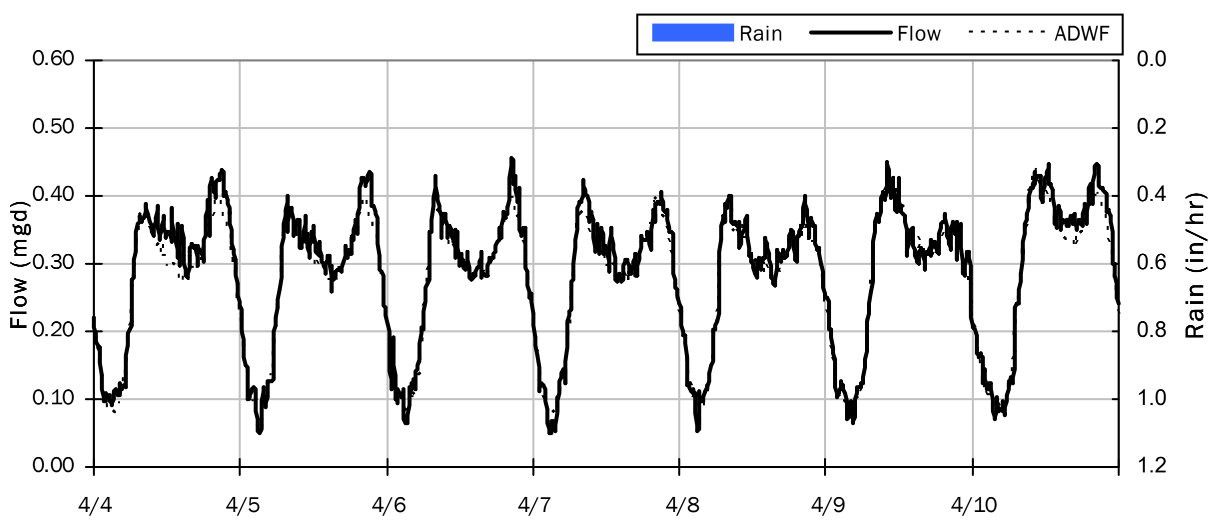


Avg Flow: 0.282 mgd Peak Flow: 0.486 mgd Min Flow: 0.056 mgd

SITE 33
Weekly Level, Velocity and Flow Hydrographs
4/4/2022 to 4/11/2022

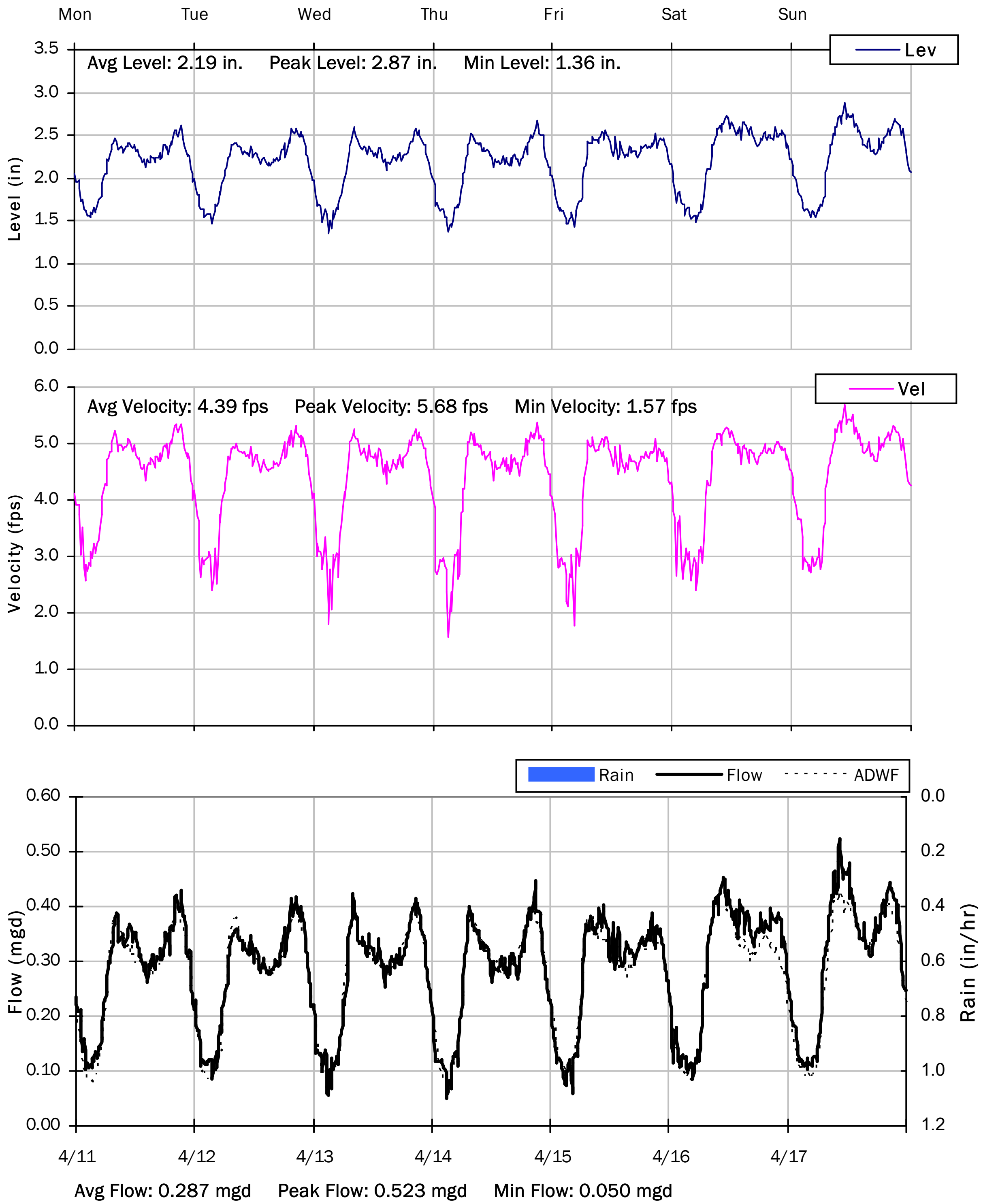




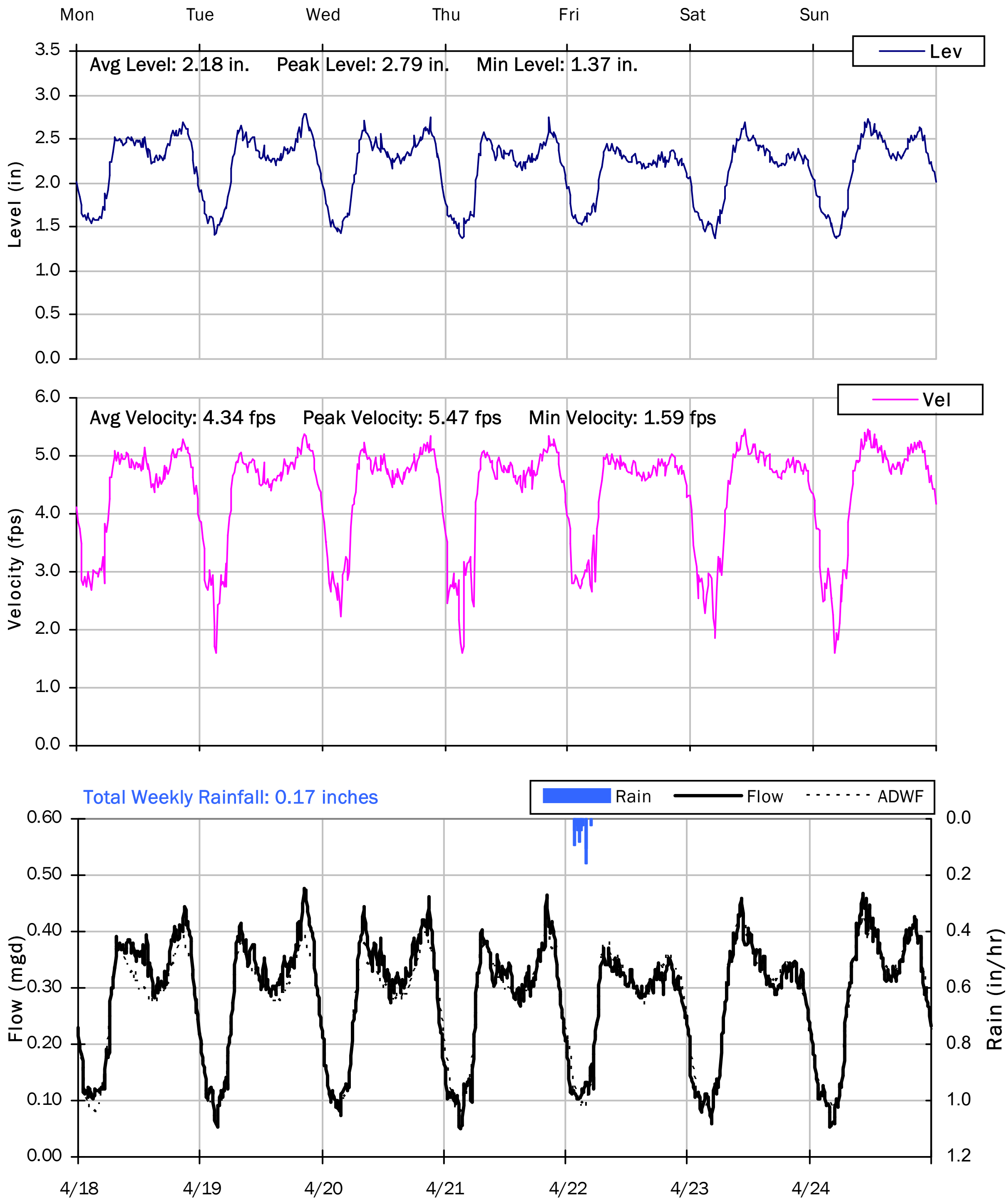


Avg Flow: 0.286 mgd Peak Flow: 0.456 mgd Min Flow: 0.049 mgd

SITE 33
Weekly Level, Velocity and Flow Hydrographs
4/11/2022 to 4/18/2022

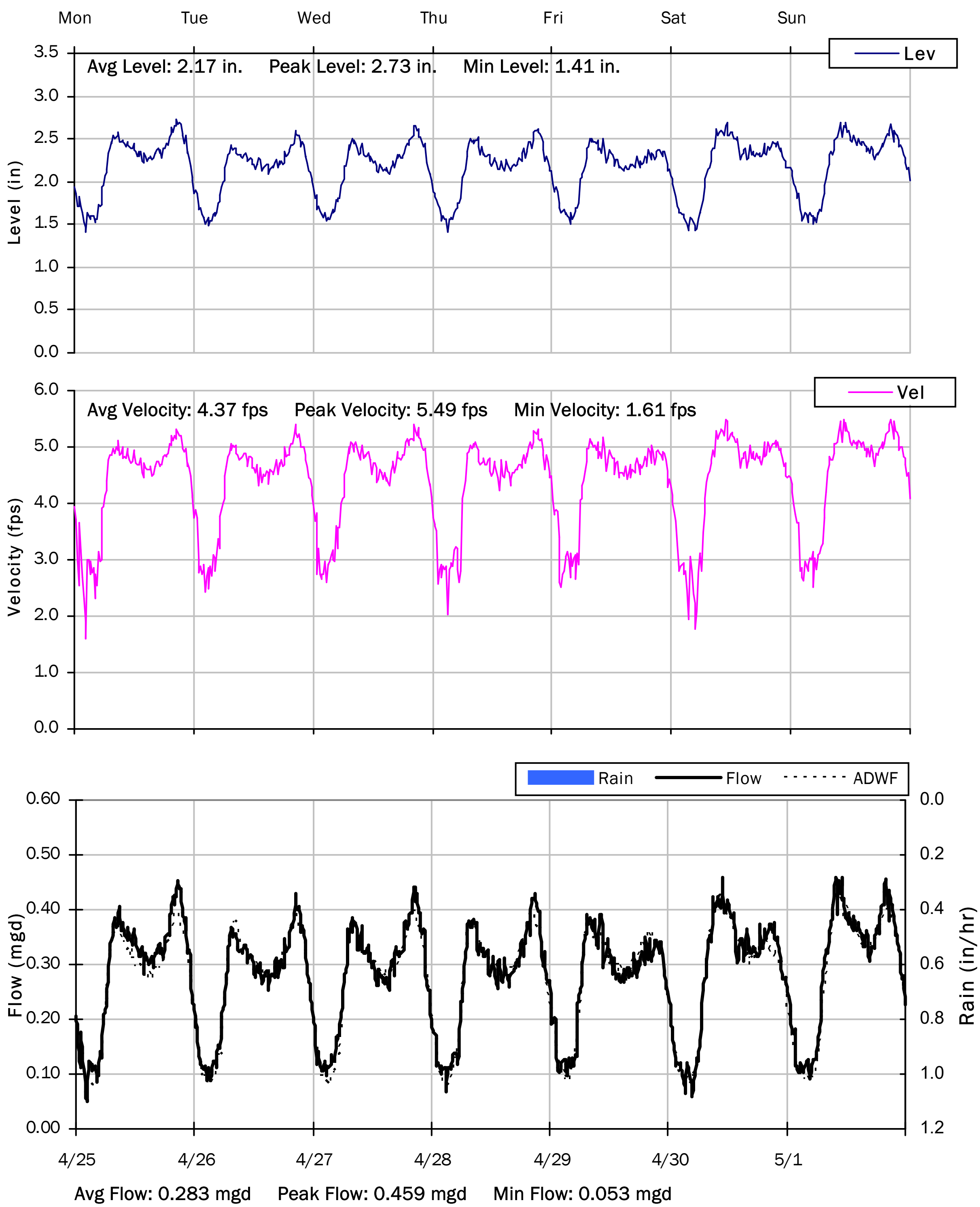


SITE 33
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022

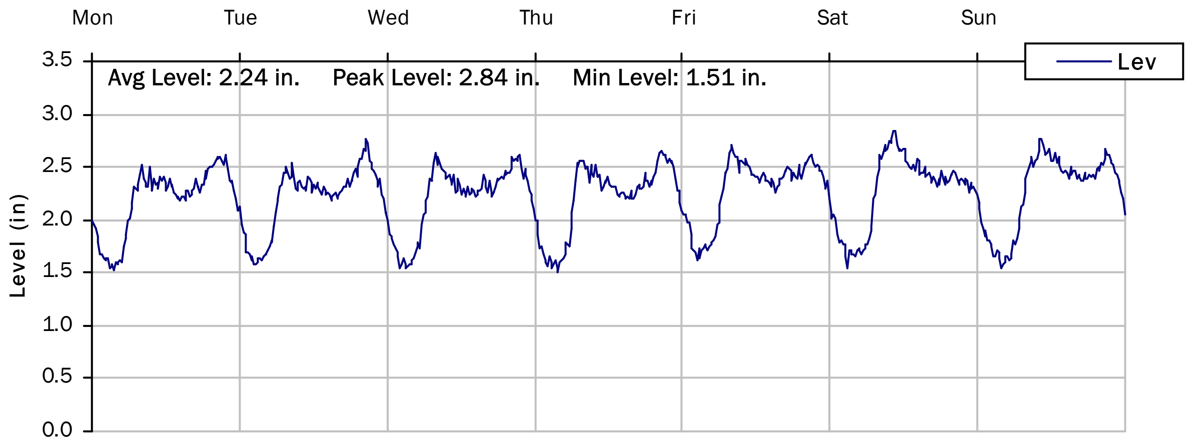


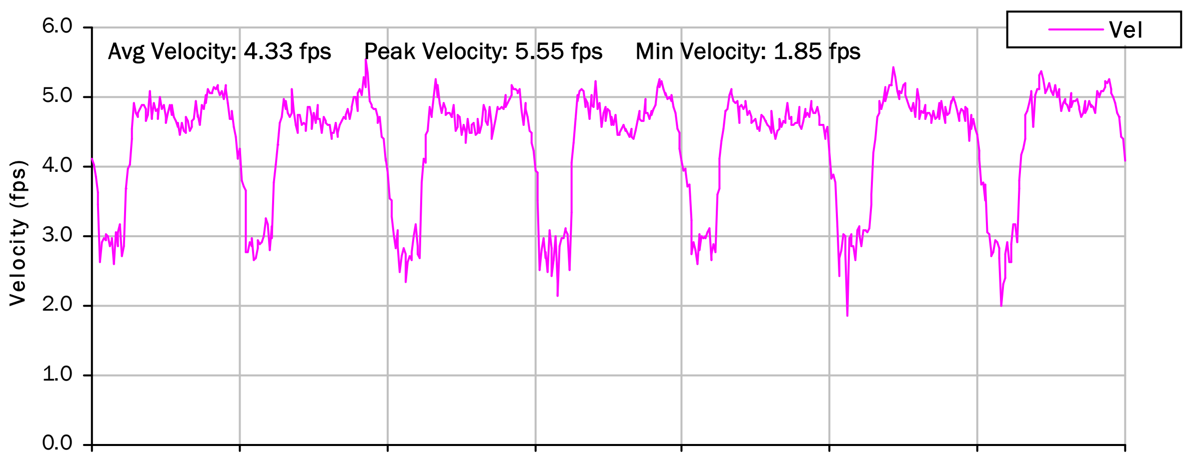
Avg Flow: 0.284 mgd Peak Flow: 0.476 mgd Min Flow: 0.051 mgd

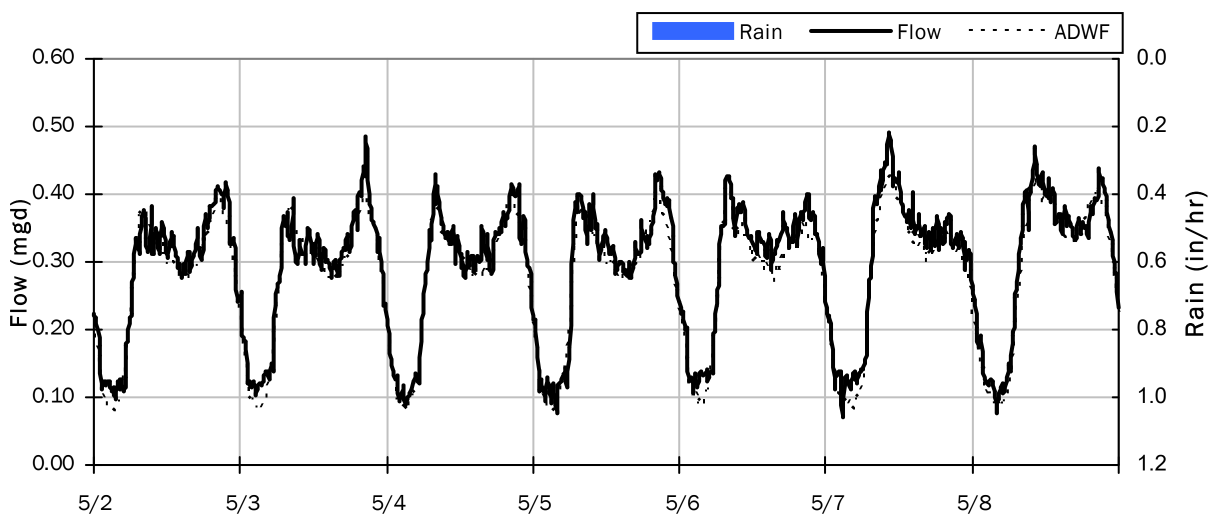
SITE 33
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022



SITE 33
Weekly Level, Velocity and Flow Hydrographs
5/2/2022 to 5/9/2022

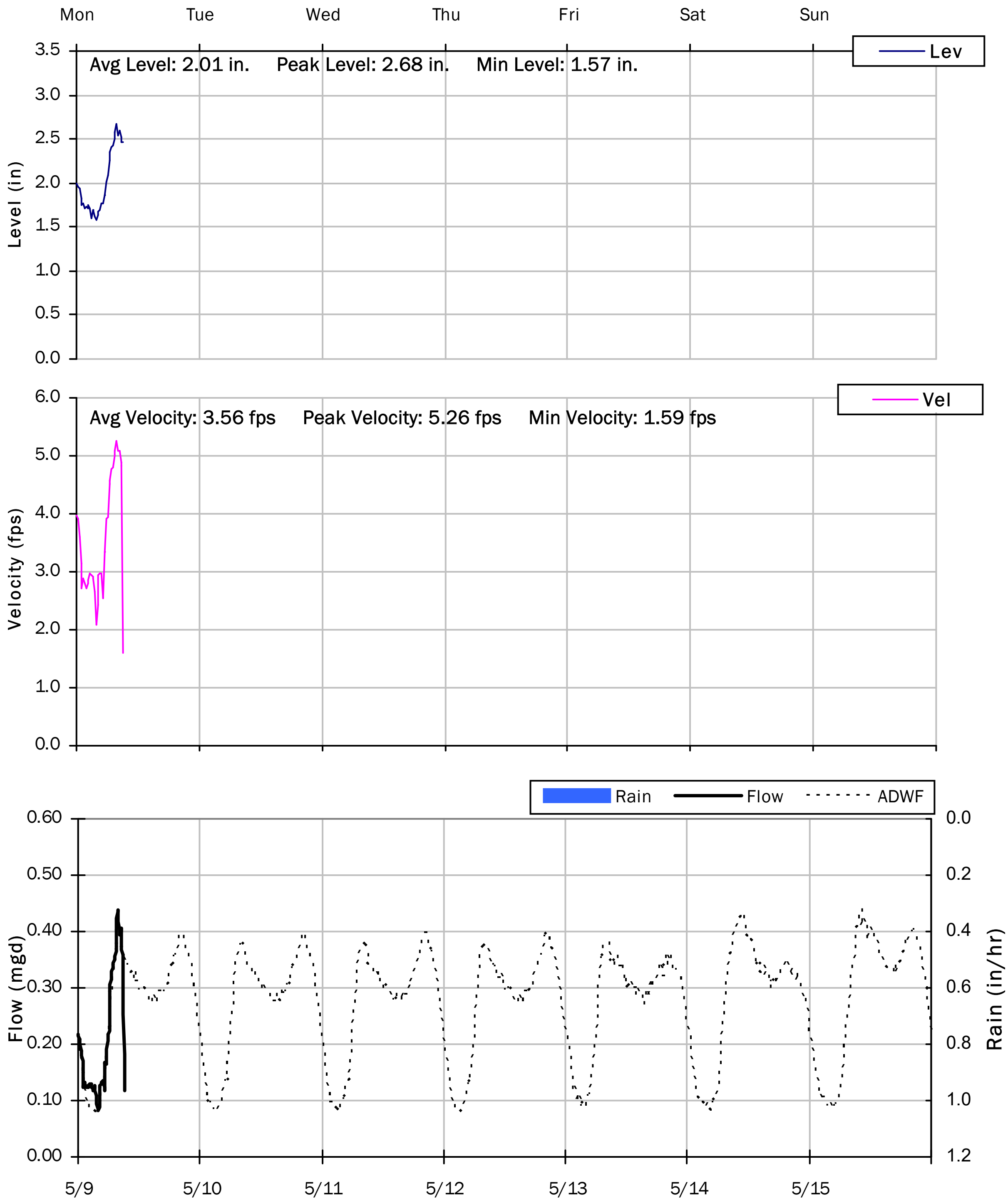






Avg Flow: 0.291 mgd Peak Flow: 0.491 mgd Min Flow: 0.070 mgd

SITE 33
Weekly Level, Velocity and Flow Hydrographs
5/9/2022 to 5/16/2022



Avg Flow: 0.210 mgd Peak Flow: 0.438 mgd Min Flow: 0.081 mgd

Monitoring Site: Site 34

Elsinore Valley Municipal Water District

Sanitary Sewer Flow Monitoring

February 21, 2022 - May 22, 2022

Location: Symphony Park Lane and Chalone Drive

Data Summary Report

Vicinity Map: Site 34

SITE 34

Site Information — MH ID: MH-4940

Location: Symphony Park Lane and Chalone Drive

Coordinates: 117.1987° W, 33.5711° N

Rim Elevation (Earth): 1233 feet

Expected Pipe Diameter: 10 inches

Measured Pipe Diameter: 9.75 inches

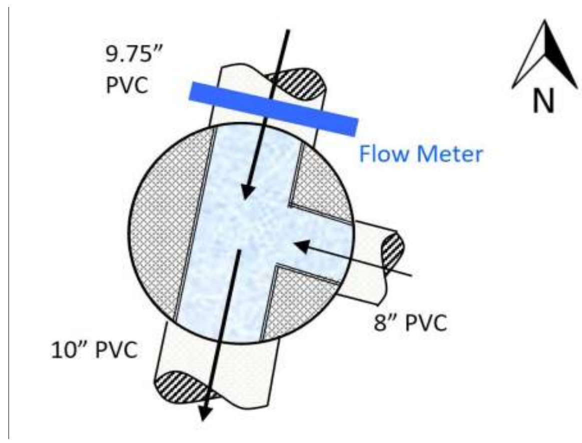
ADWF: 0.047 mgd

Peak Measured Flow: 0.126 mgd

Sediment: None

Satellite Map

Sanitary Map



Flow Sketch

View from Street


Plan View

SITE 34

Additional Site Photos

Effluent Pipe

E Influent Pipe

SITE 34

Additional Site Photos

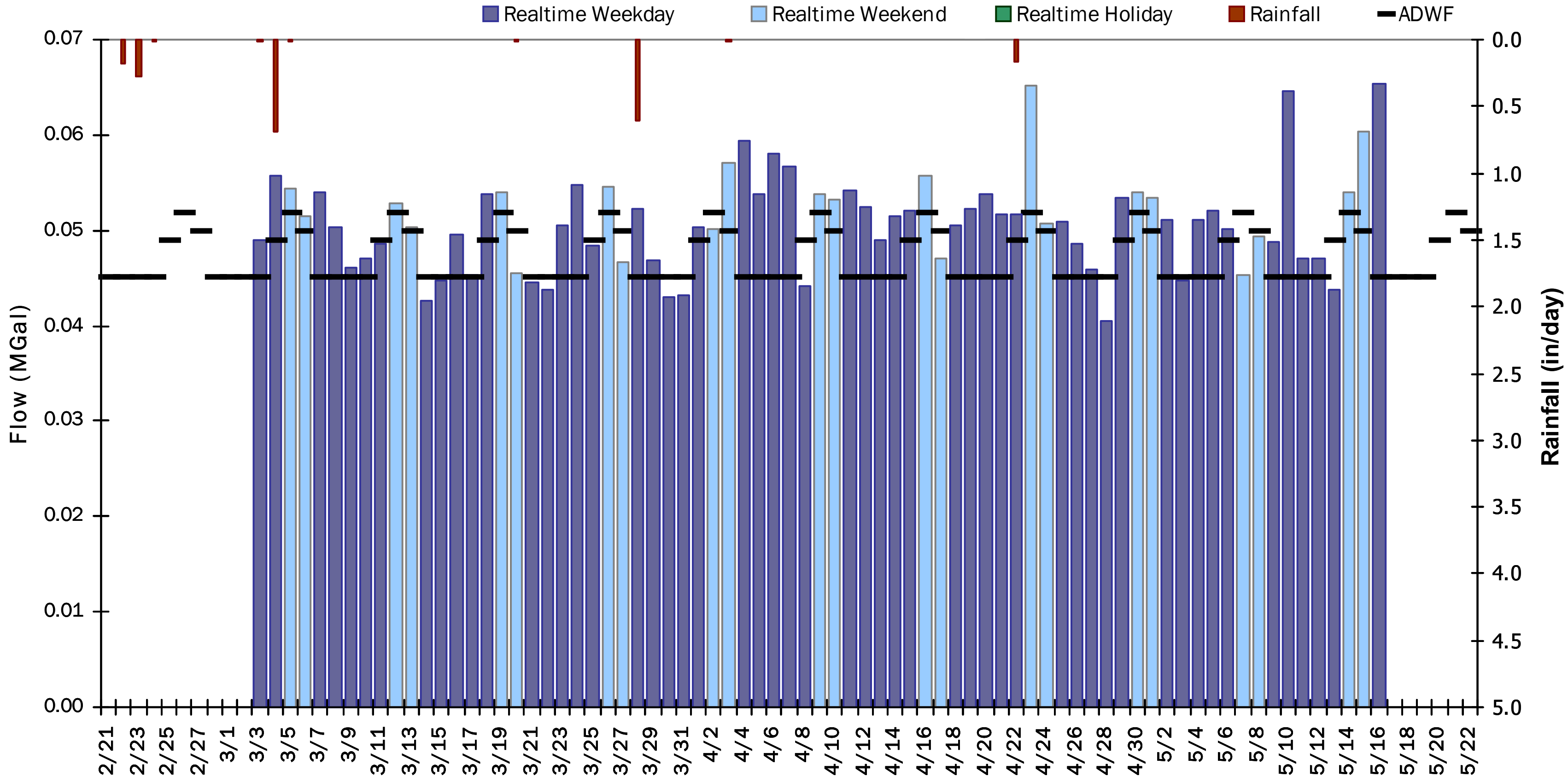
Monitored N Influent Pipe

SITE 34

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.051 MGal   Peak Daily Flow: 0.065 MGal   Min Daily Flow: 0.041 MGal

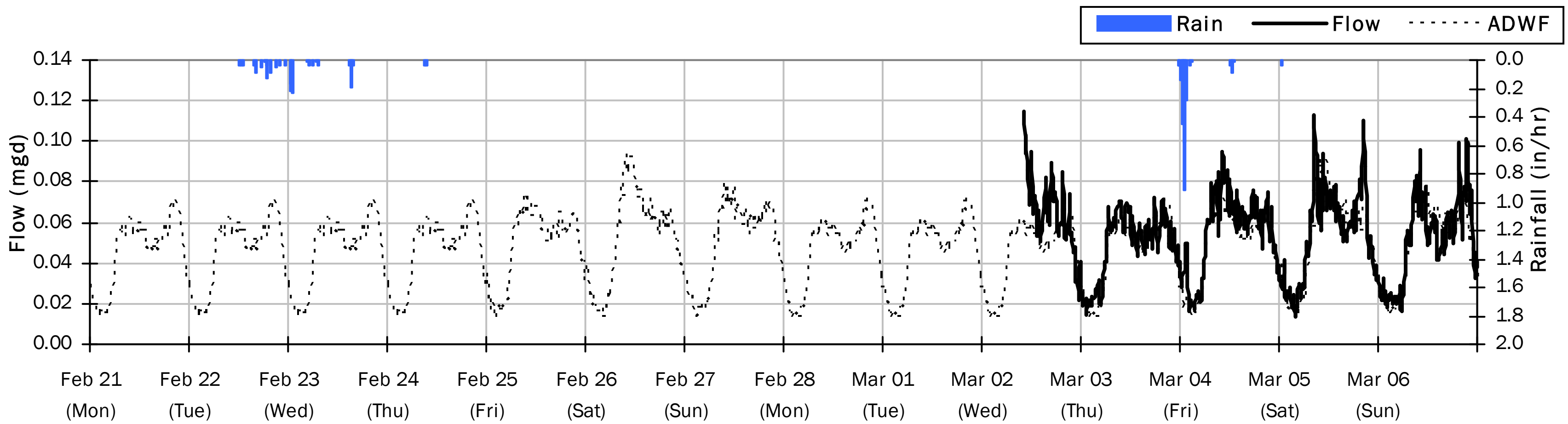
Total Rainfall: 1.51 inches

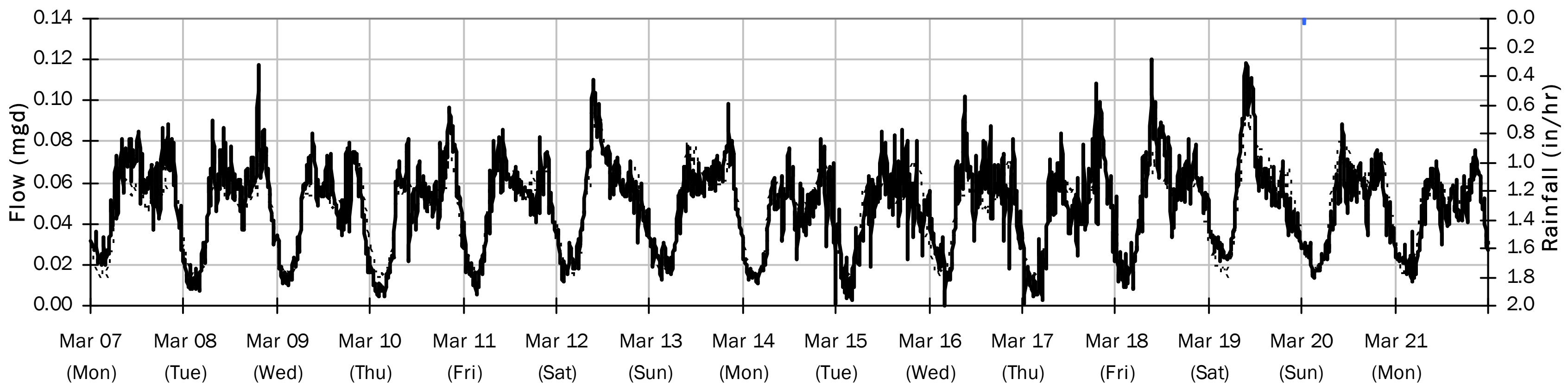


SITE 34

Flow Summary: 2/21/2022 to 3/21/2022

Period Rainfall: 1.19 inches   Period Avg Flow: 0.050 mgd   Period Peak Flow: 0.119 mgd   Period Min Flow: 0.000 mgd

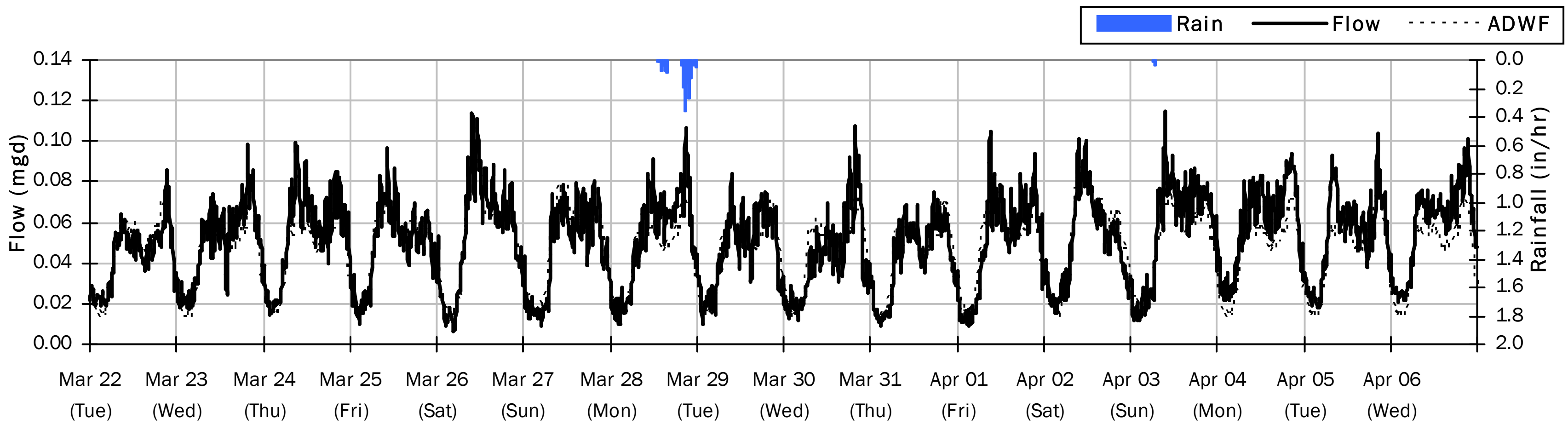


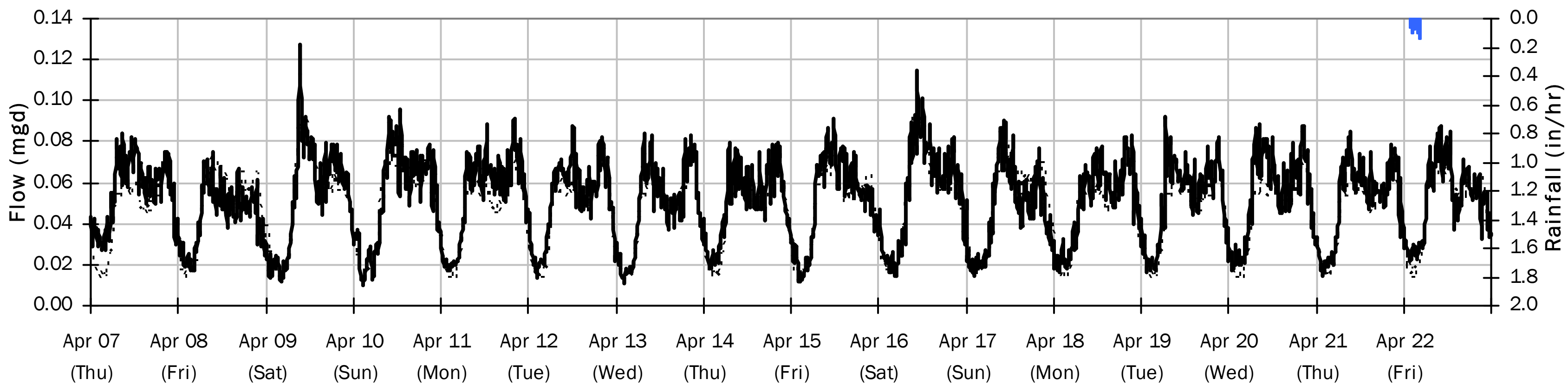


SITE 34

Flow Summary: 3/22/2022 to 4/22/2022

Period Rainfall: 0.78 inches   Period Avg Flow: 0.051 mgd   Period Peak Flow: 0.126 mgd   Period Min Flow: 0.006 mgd



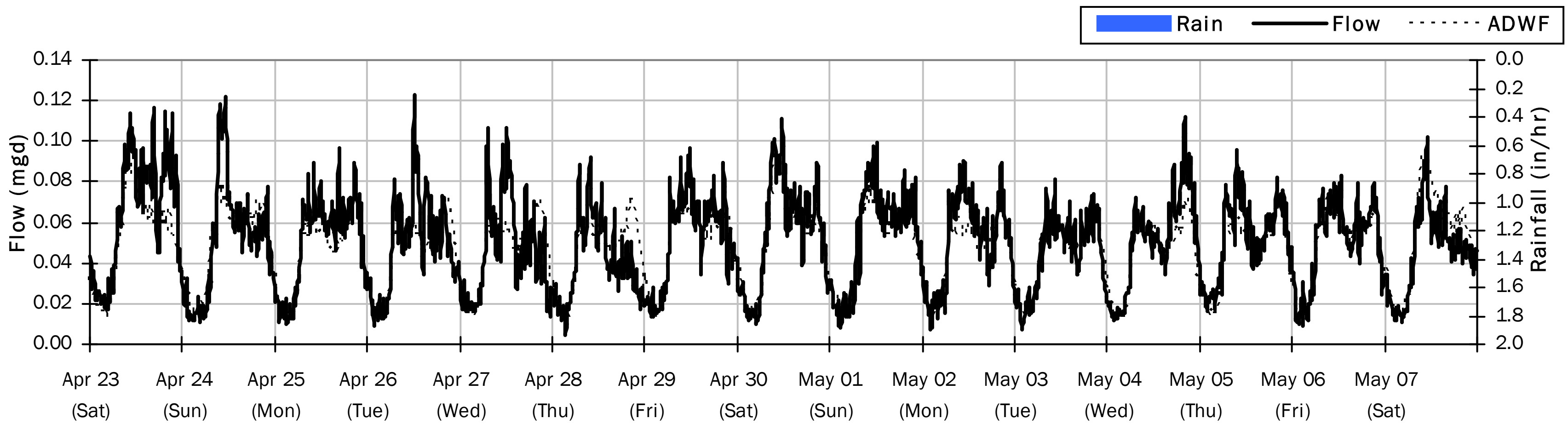


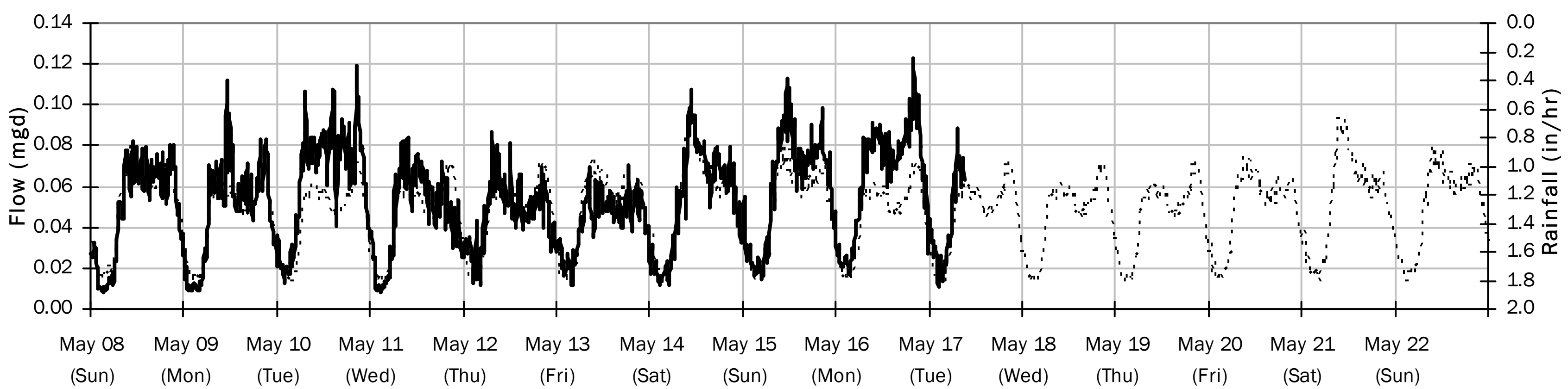
SITE 34

Flow Summary: 4/23/2022 to 5/22/2022

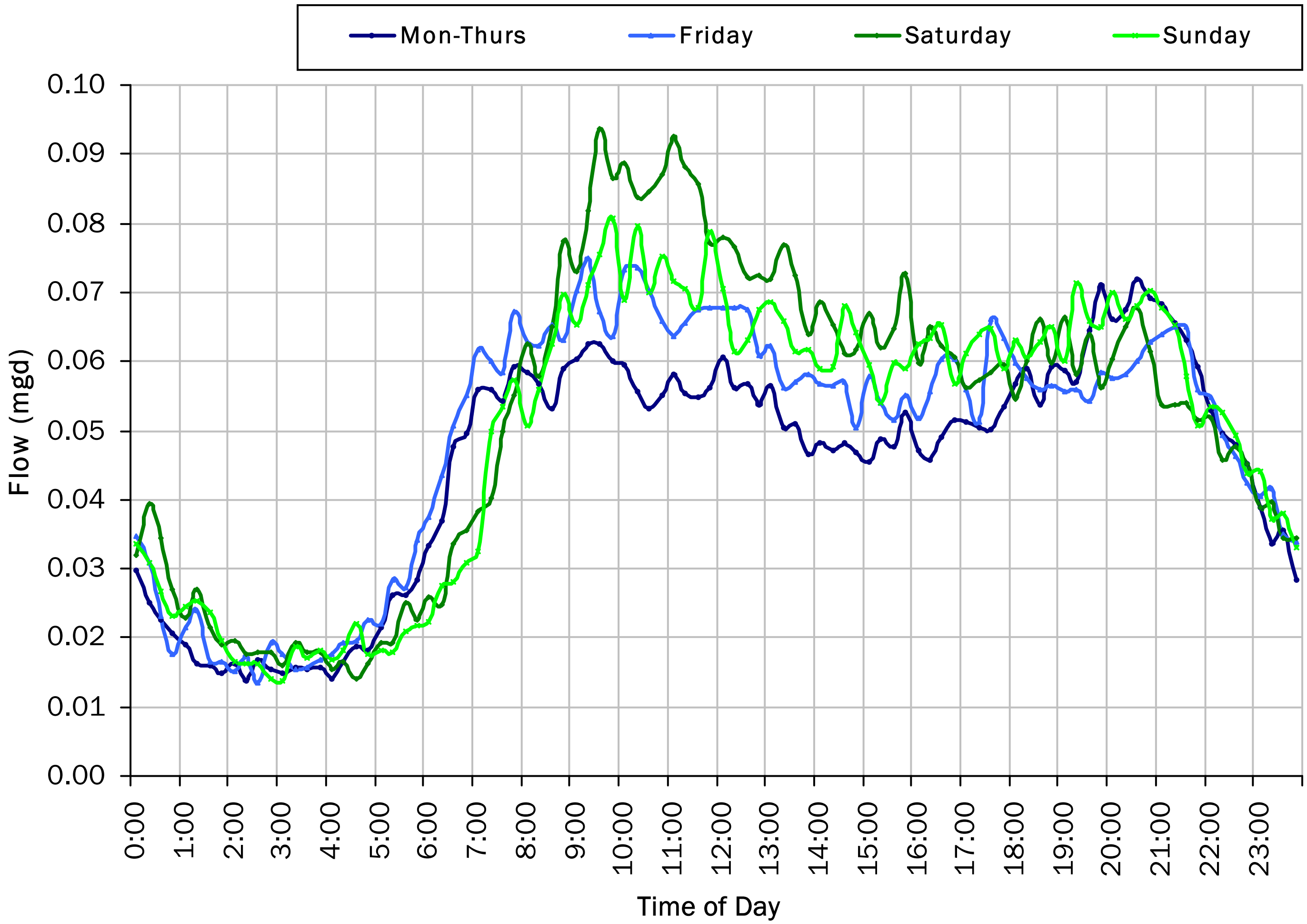
Period Rainfall: 0.00 inches

Period Avg Flow: 0.051 mgd   Period Peak Flow: 0.123 mgd   Period Min Flow: 0.004 mgd



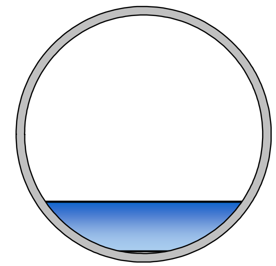


SITE 34
Average Dry Weather Flow Hydrographs



ADWF:

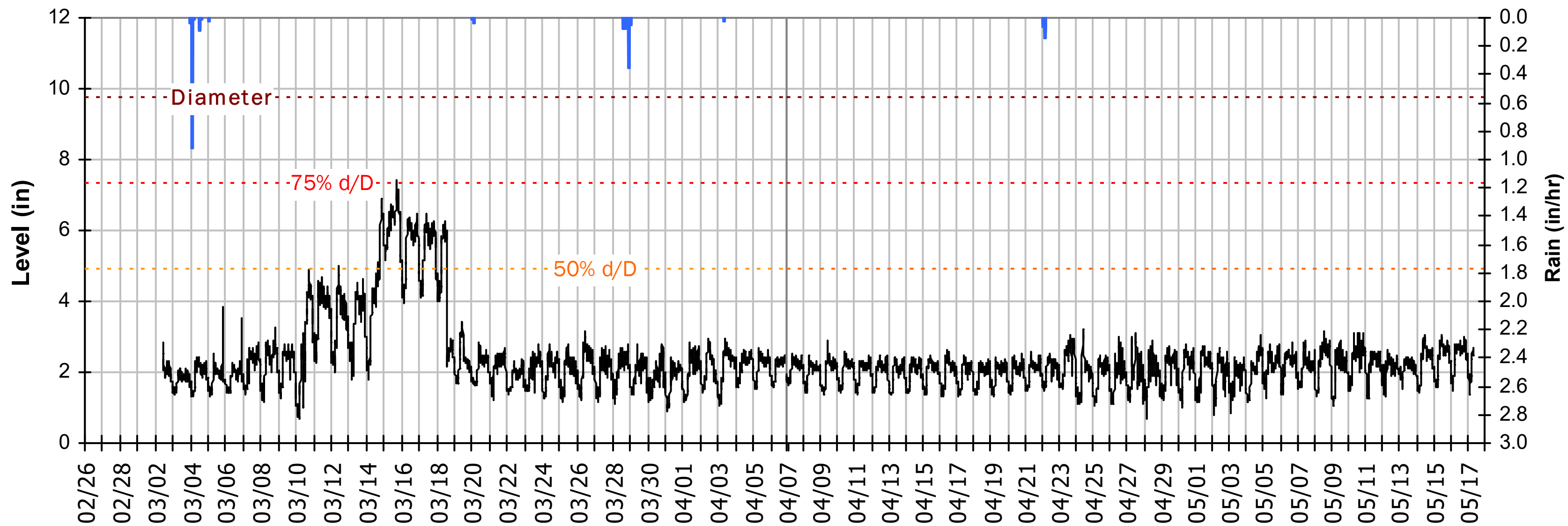
0.047 *mgd*

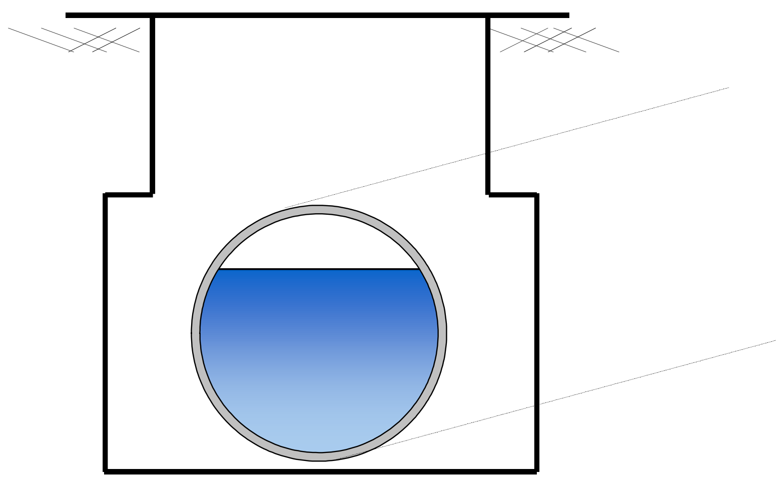


SITE 34

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



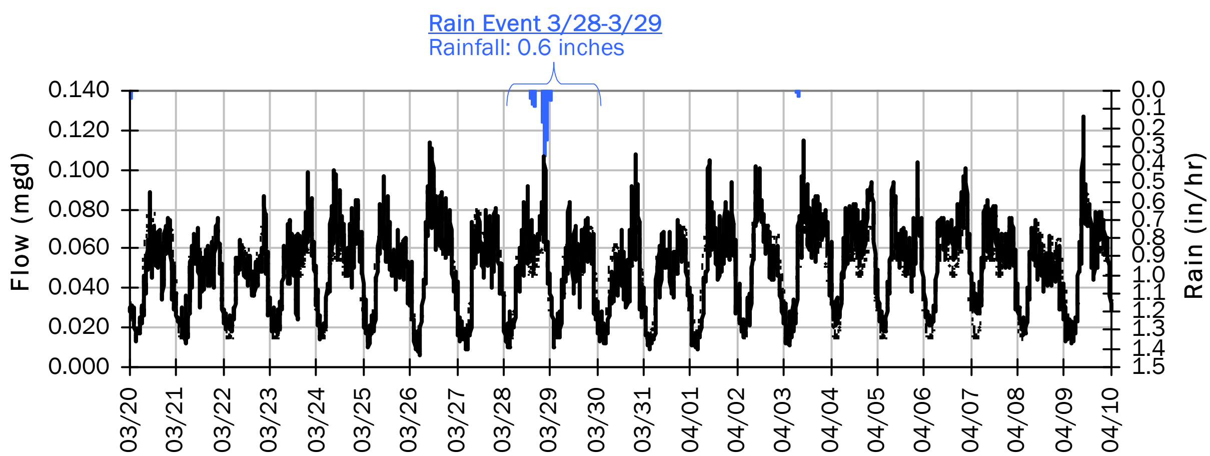


Pipe Diameter:	9.75	*inches*
Peak Measured Level:	7.40	*inches*
Peak d/D Ratio:	0.76	

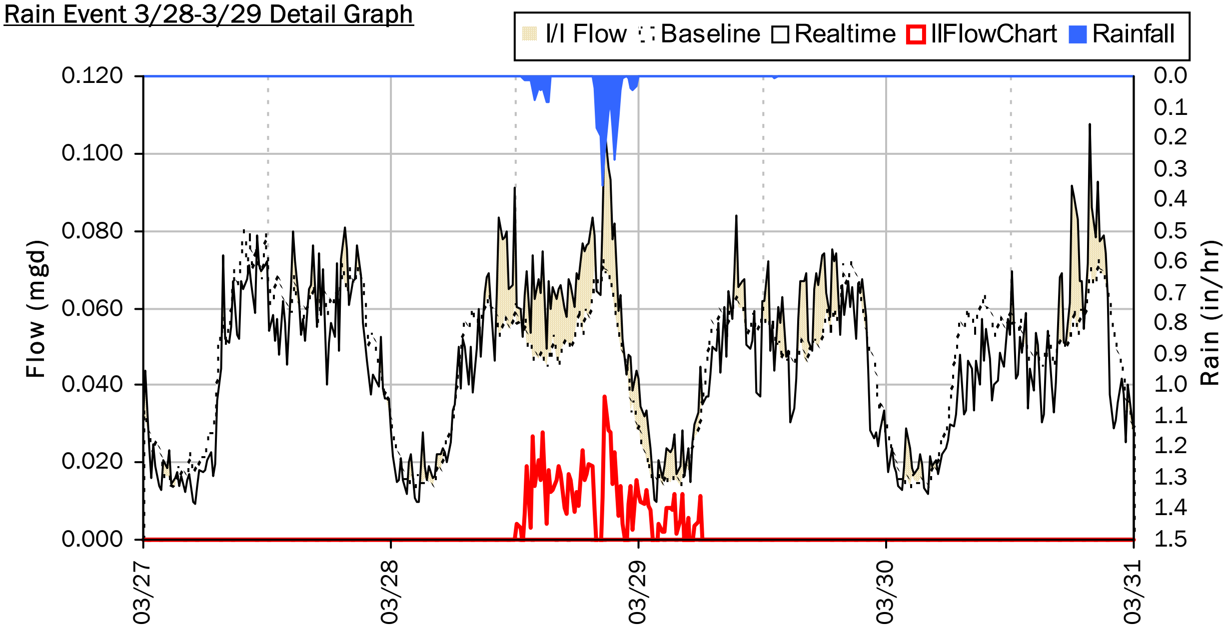
SITE 34

I/I Summary: Rain Event 3/28-3/29

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



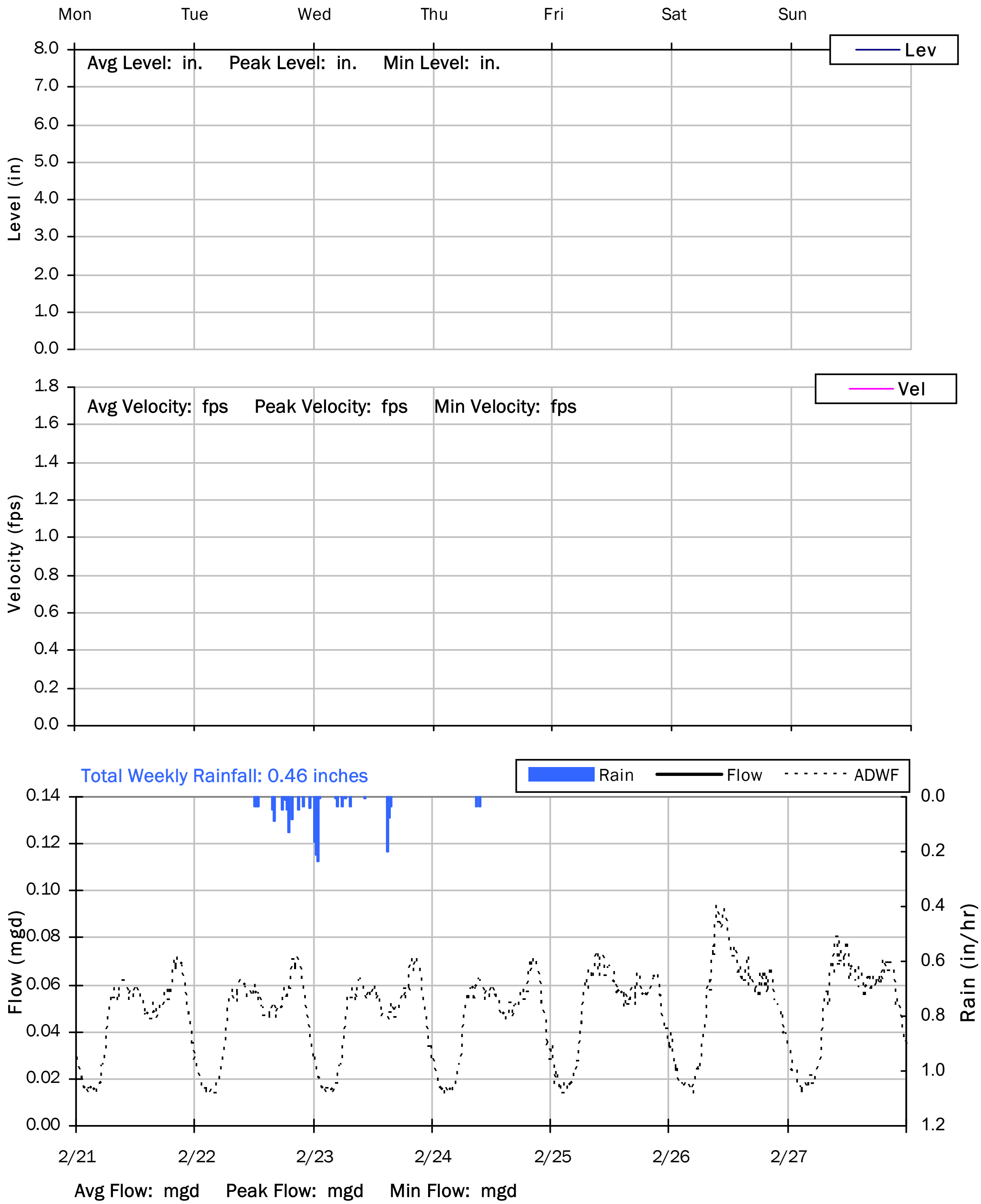
Rain Event 3/28-3/29 Detail Graph



Storm Event I/I Analysis (Rain = 0.60 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.107 *mgd*	Peak I/I Rate:	0.037 *mgd*
PF:	2.25	Total I/I:	8,000 *gallons*
Peak Level:	2.78 *in*		
d/D Ratio:	0.29		

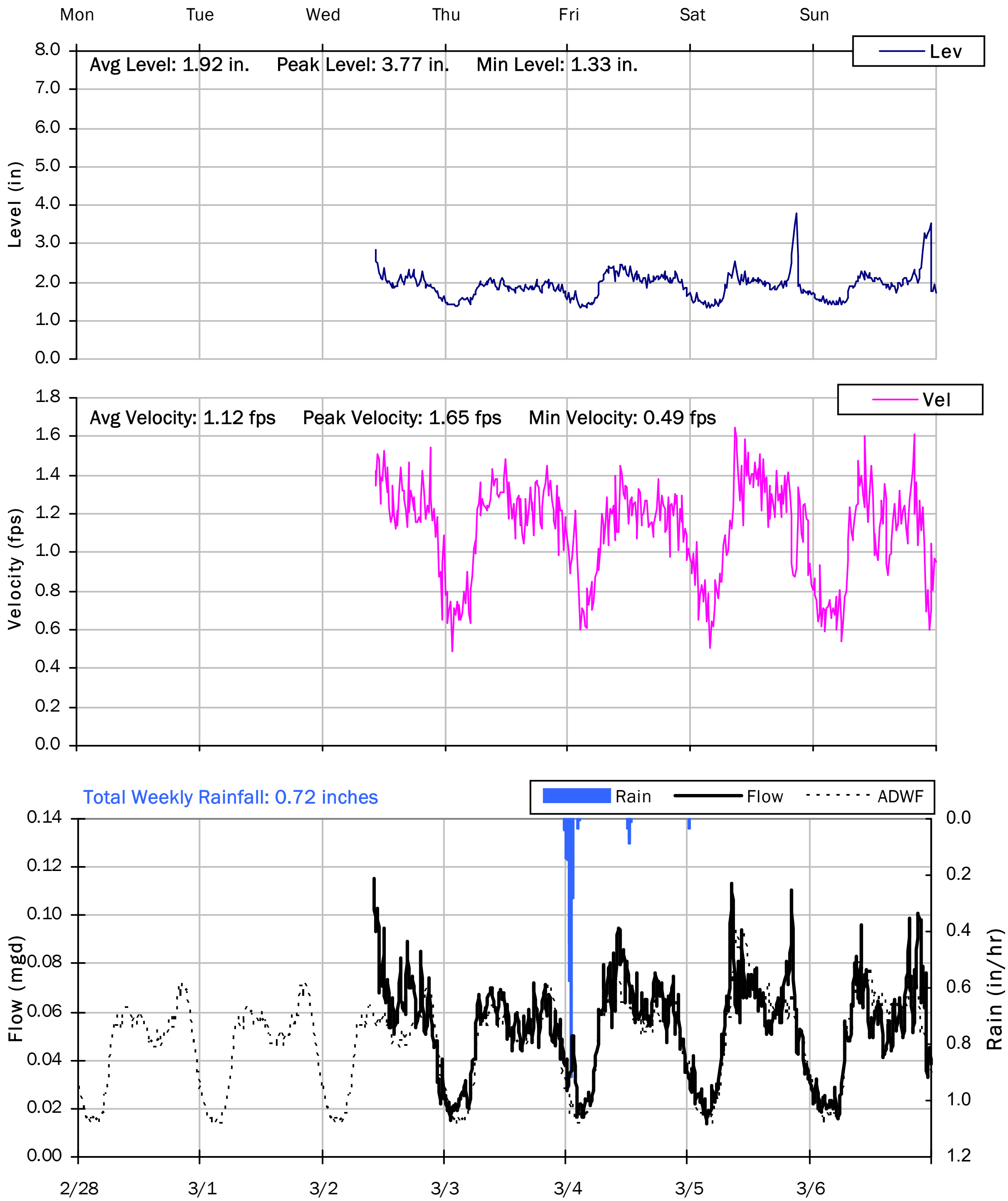
SITE 34
Weekly Level, Velocity and Flow Hydrographs
2/21/2022 to 2/28/2022



SITE 34

Weekly Level, Velocity and Flow Hydrographs

2/28/2022 to 3/7/2022

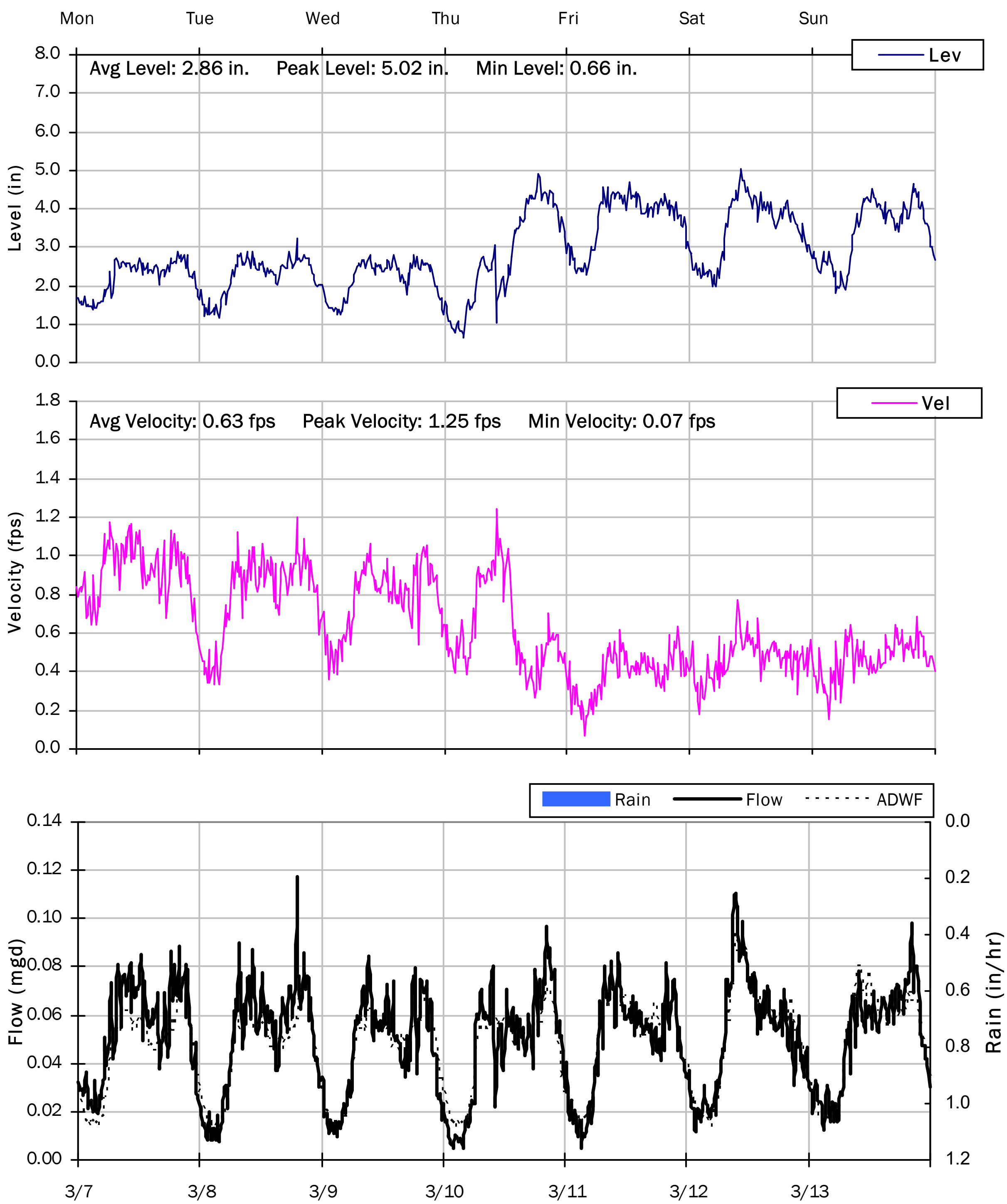


Avg Flow: 0.054 mgd Peak Flow: 0.115 mgd Min Flow: 0.014 mgd

SITE 34

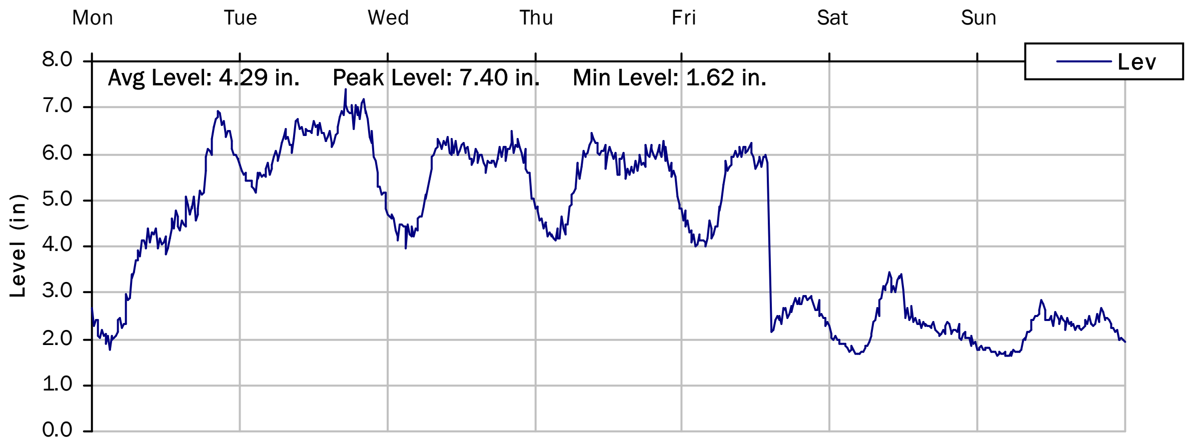
Weekly Level, Velocity and Flow Hydrographs

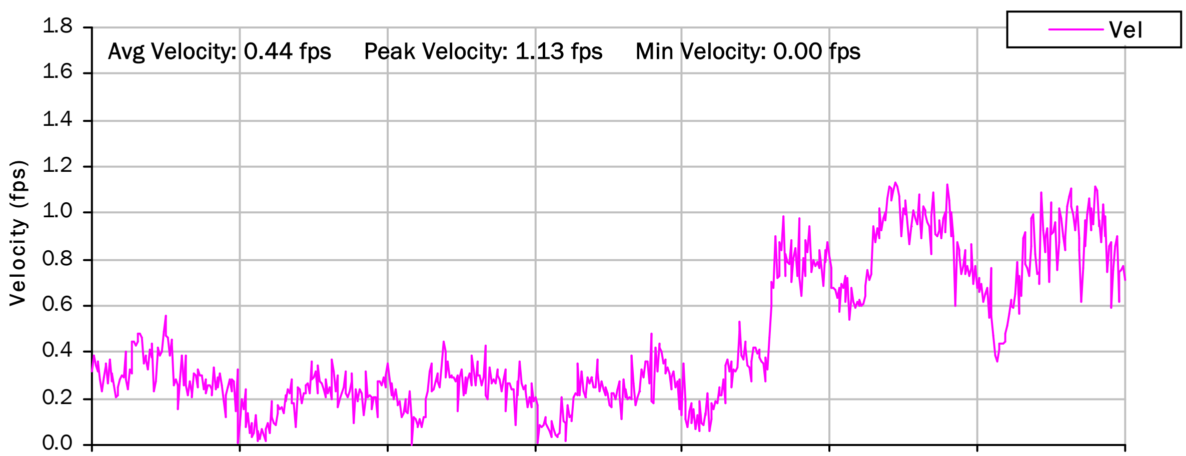
3/7/2022 to 3/14/2022

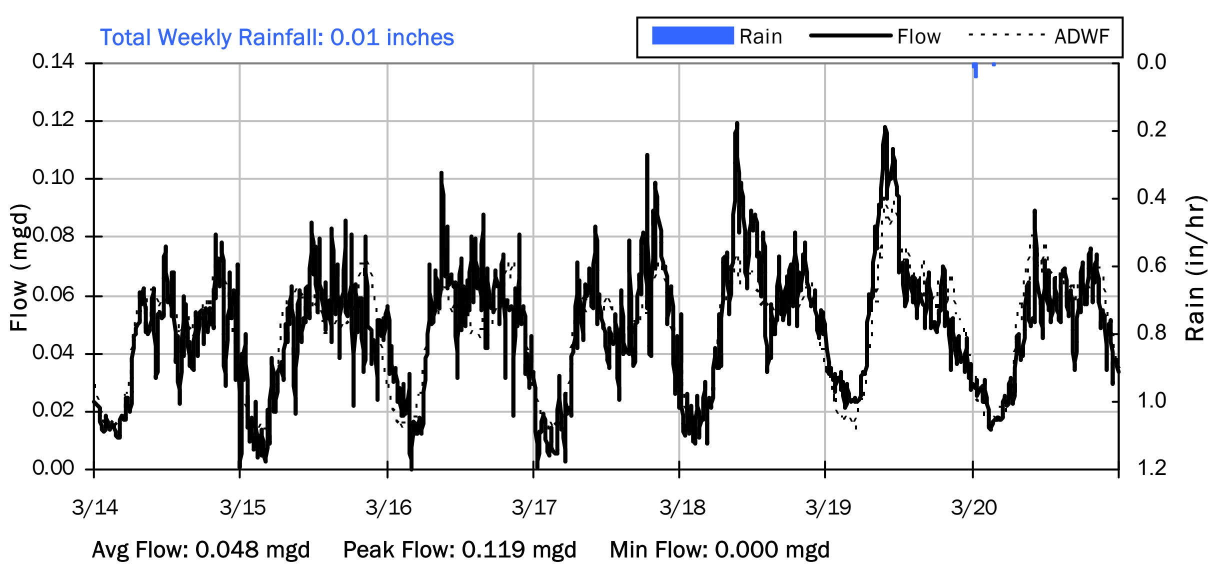


Avg Flow: 0.050 mgd Peak Flow: 0.117 mgd Min Flow: 0.005 mgd

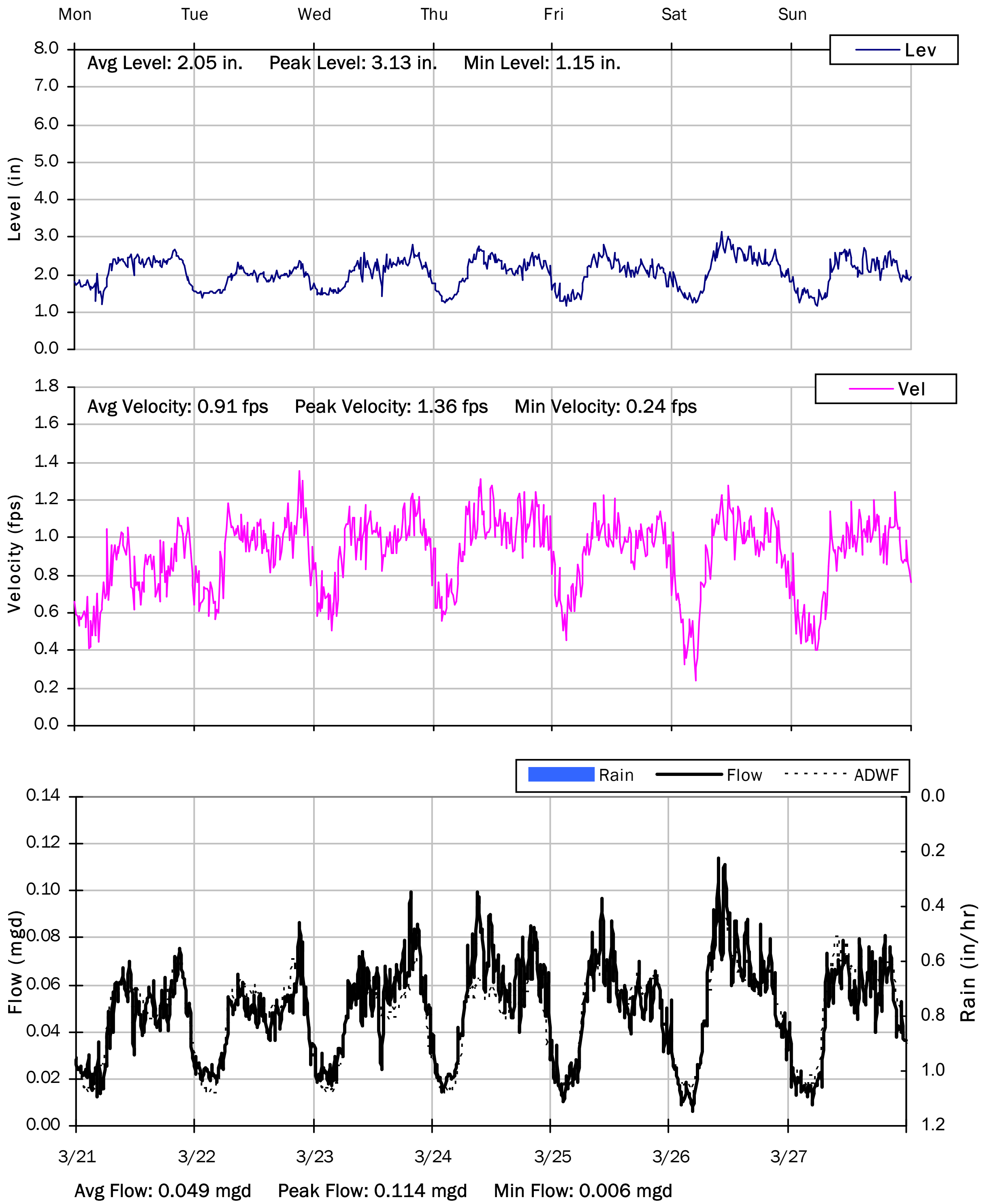
SITE 34
Weekly Level, Velocity and Flow Hydrographs
3/14/2022 to 3/21/2022



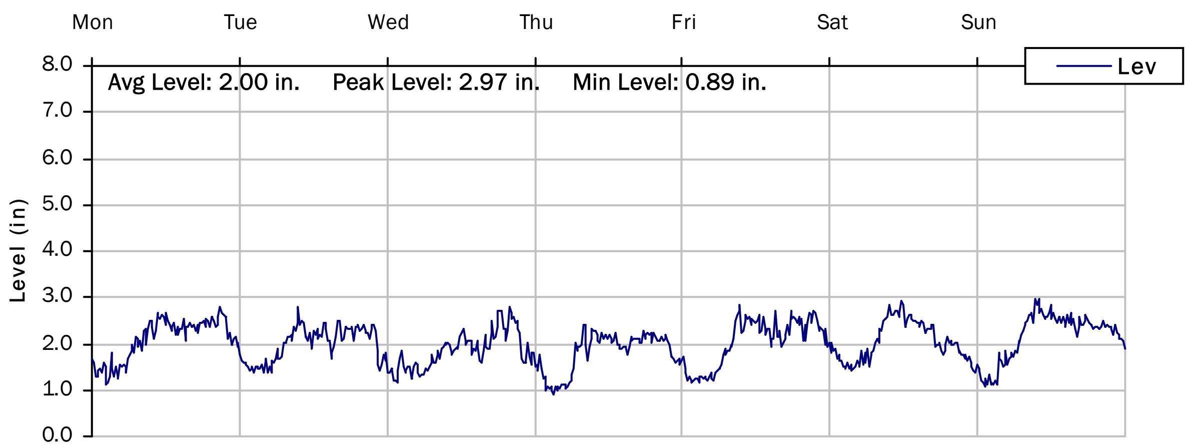


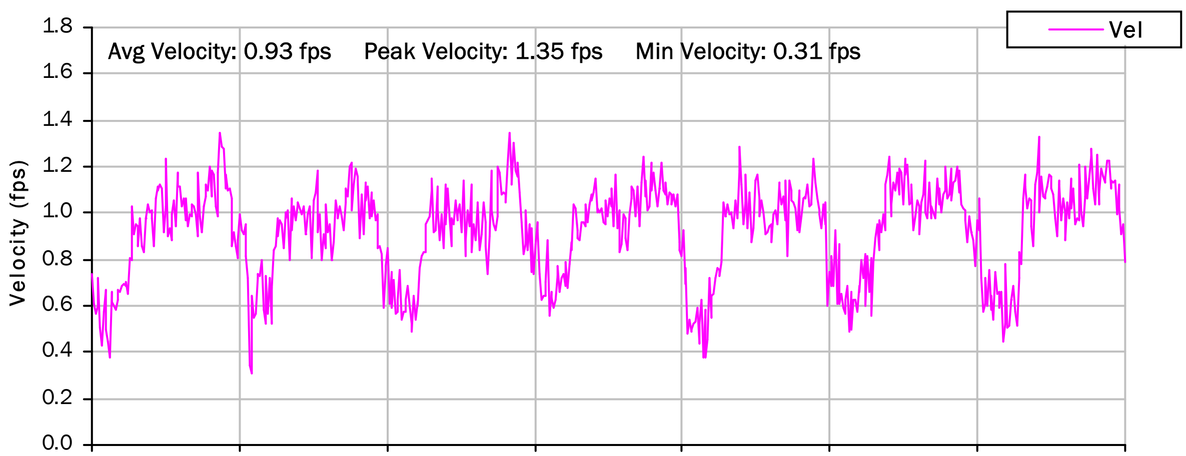


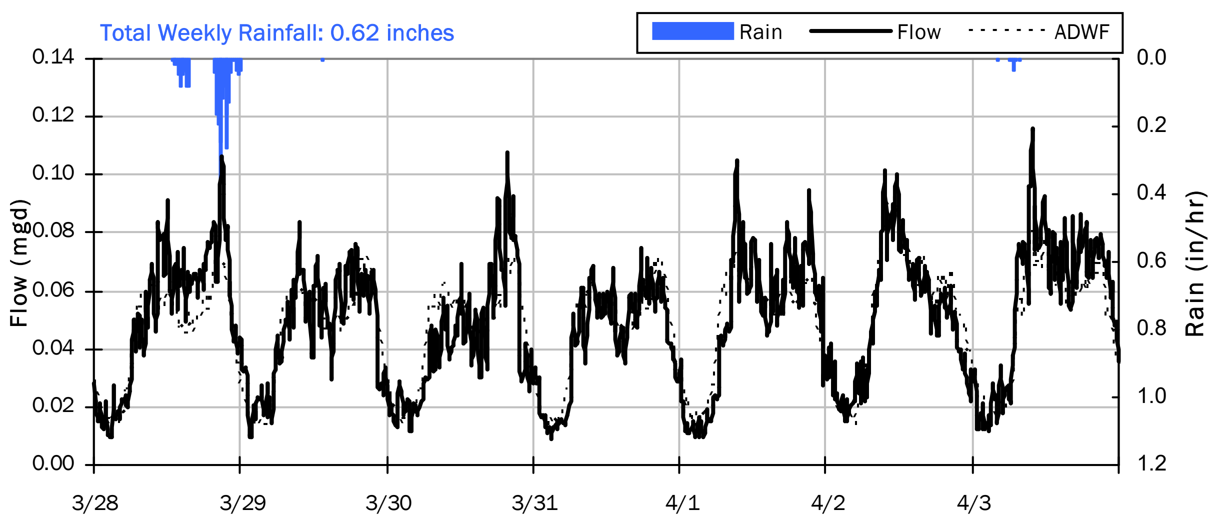
SITE 34
Weekly Level, Velocity and Flow Hydrographs
3/21/2022 to 3/28/2022



SITE 34
Weekly Level, Velocity and Flow Hydrographs
3/28/2022 to 4/4/2022





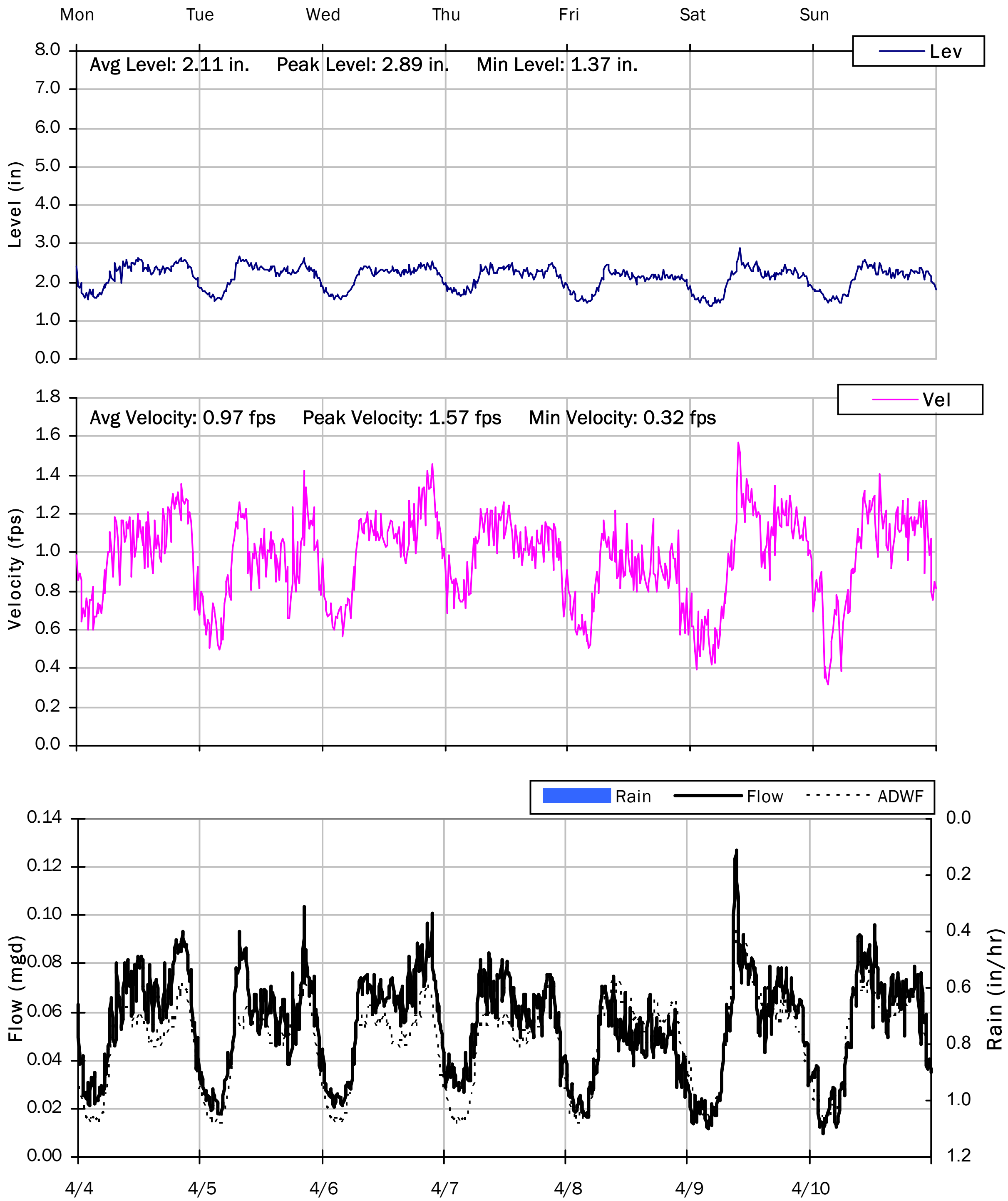


Avg Flow: 0.049 mgd   Peak Flow: 0.115 mgd   Min Flow: 0.009 mgd

SITE 34

Weekly Level, Velocity and Flow Hydrographs

4/4/2022 to 4/11/2022

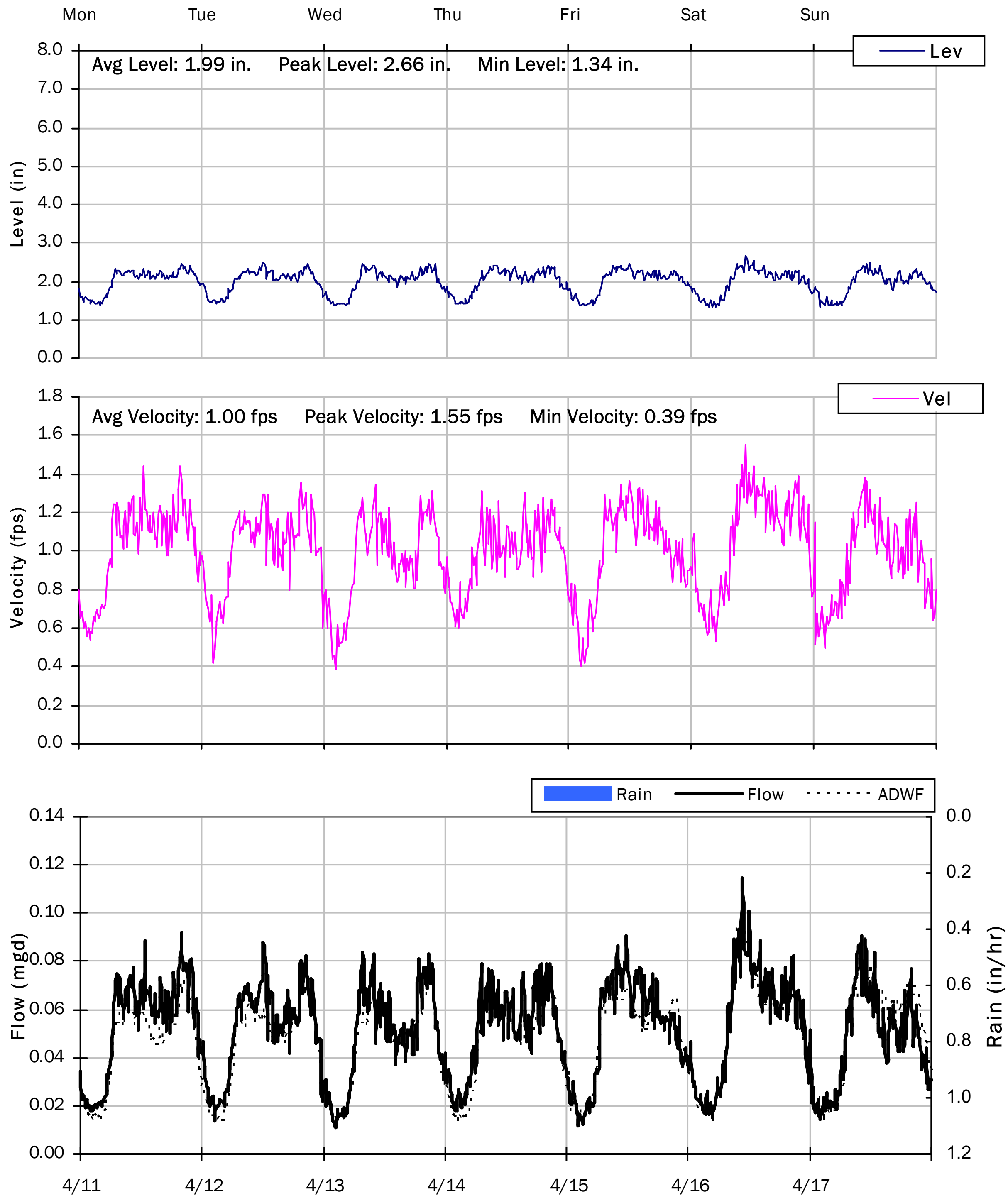


Avg Flow: 0.054 mgd Peak Flow: 0.126 mgd Min Flow: 0.010 mgd

SITE 34

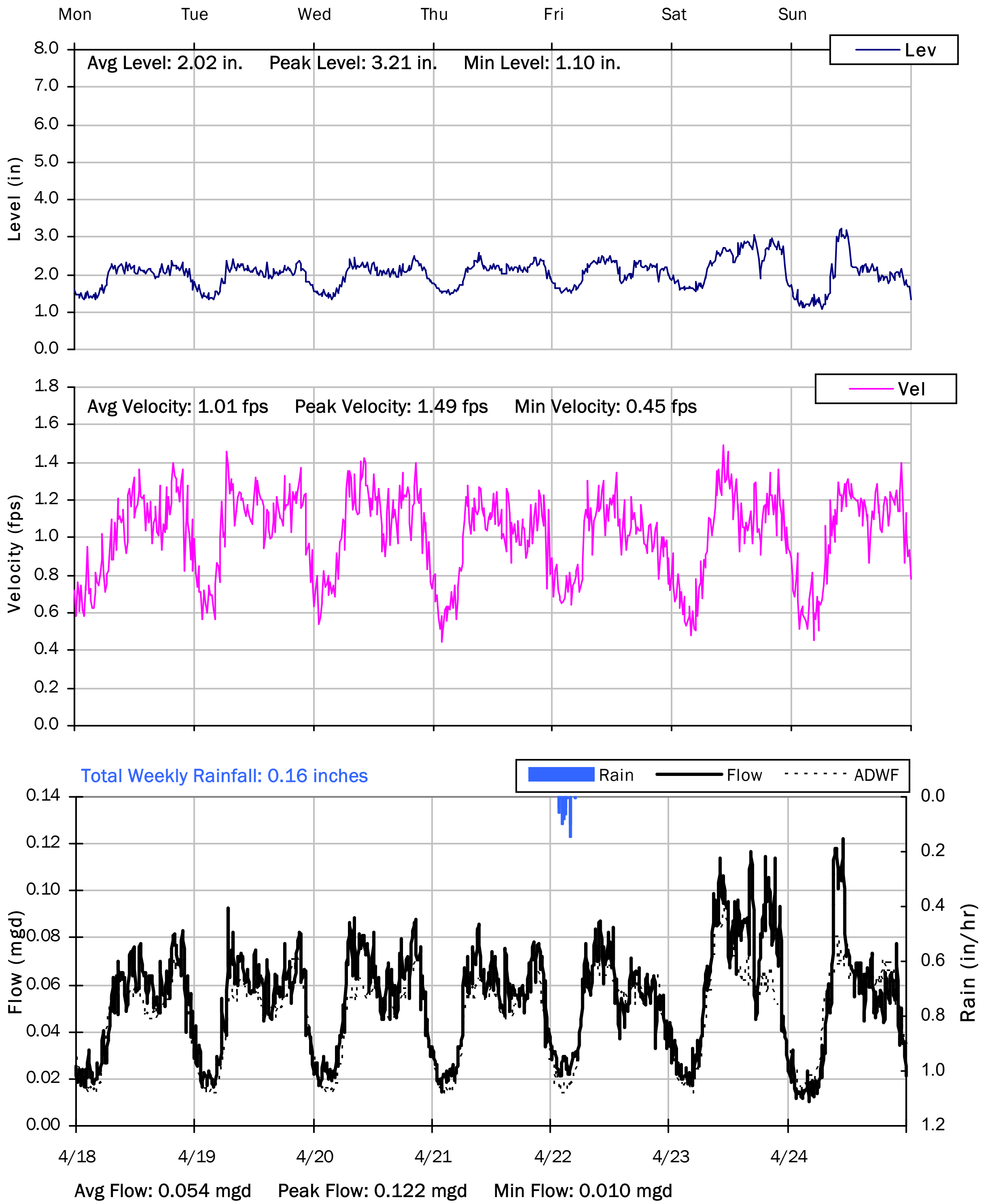
Weekly Level, Velocity and Flow Hydrographs

4/11/2022 to 4/18/2022

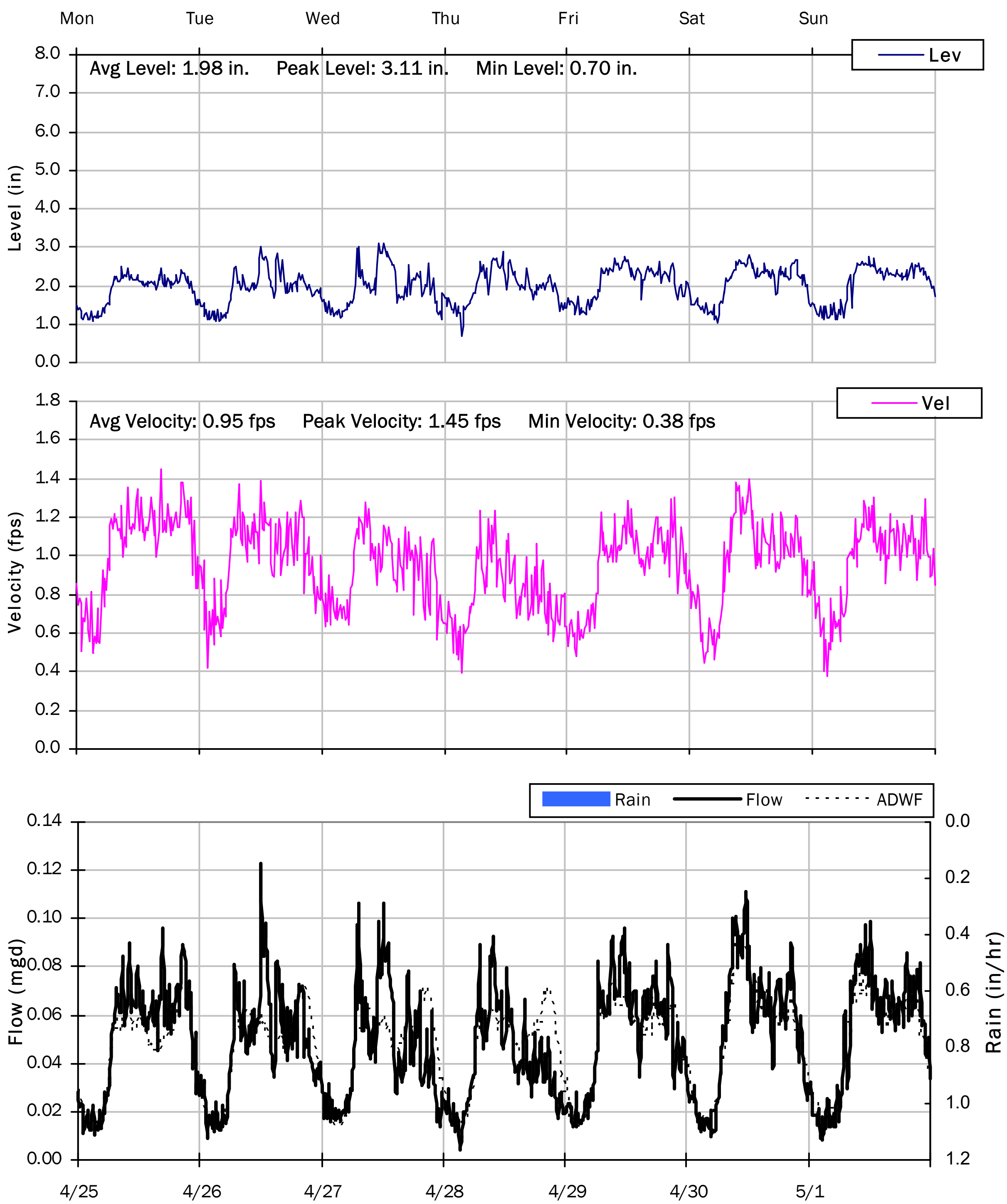


Avg Flow: 0.052 mgd Peak Flow: 0.115 mgd Min Flow: 0.011 mgd

SITE 34
Weekly Level, Velocity and Flow Hydrographs
4/18/2022 to 4/25/2022



SITE 34
Weekly Level, Velocity and Flow Hydrographs
4/25/2022 to 5/2/2022

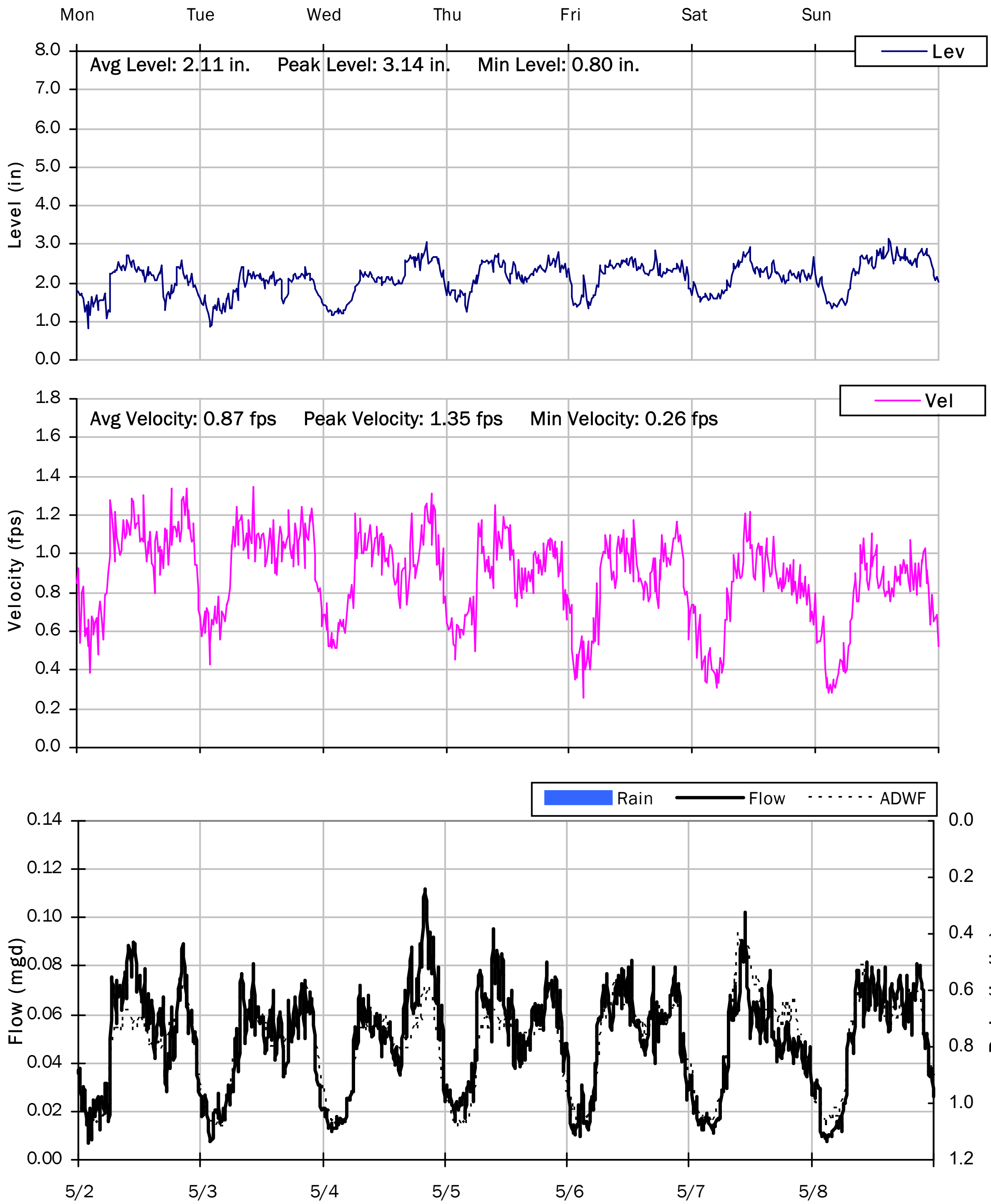


Avg Flow: 0.050 mgd Peak Flow: 0.123 mgd Min Flow: 0.004 mgd

SITE 34

Weekly Level, Velocity and Flow Hydrographs

5/2/2022 to 5/9/2022

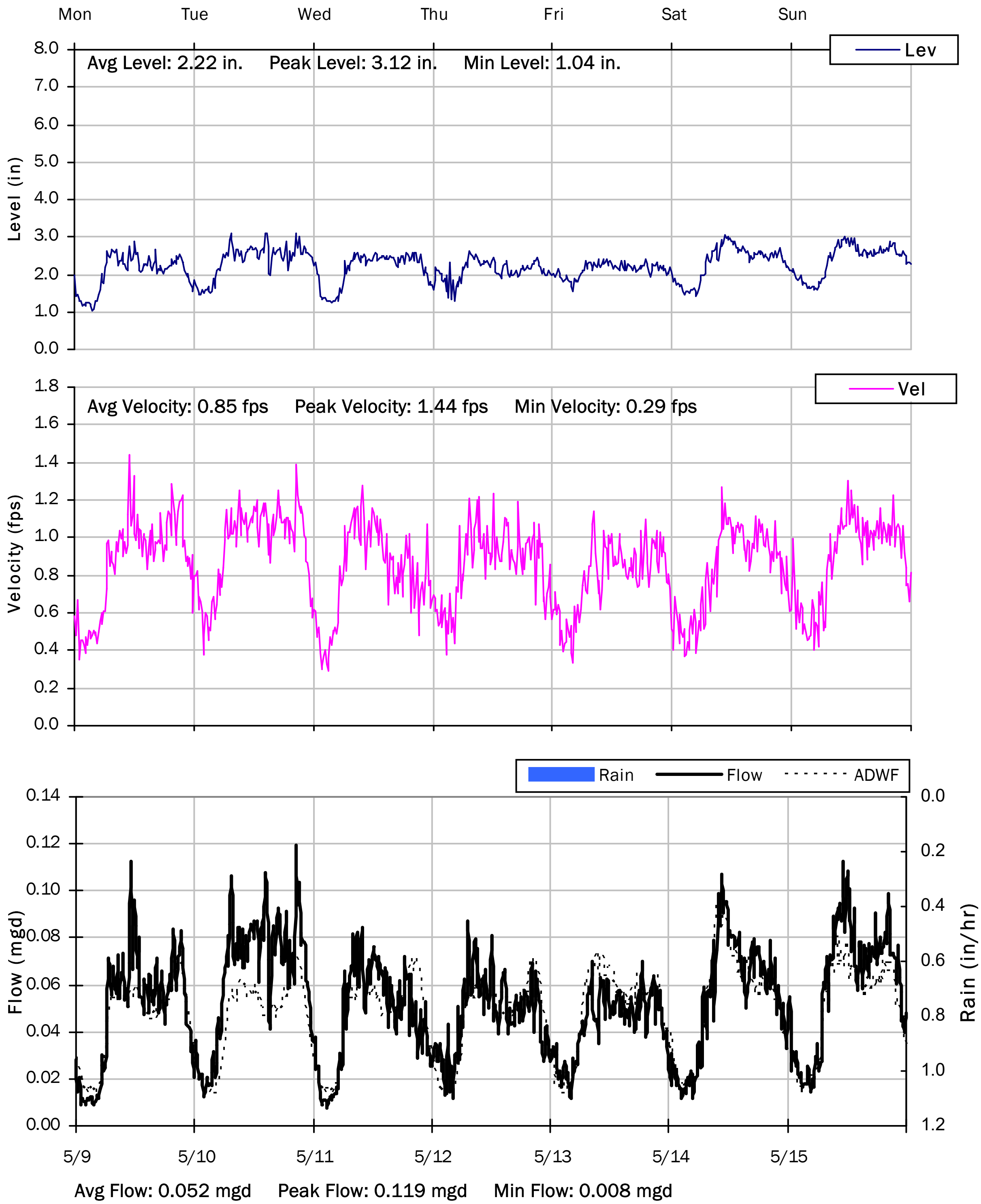


Avg Flow: 0.049 mgd Peak Flow: 0.112 mgd Min Flow: 0.007 mgd

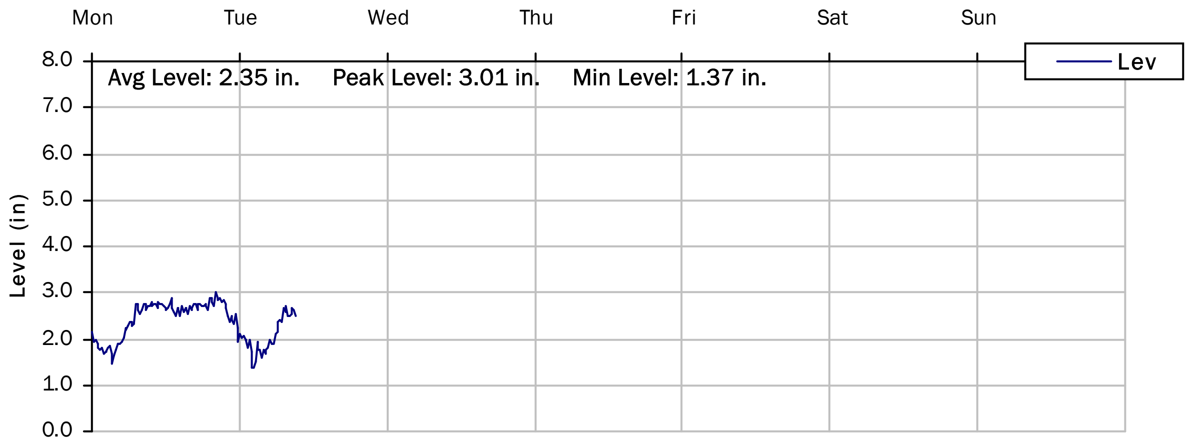
SITE 34

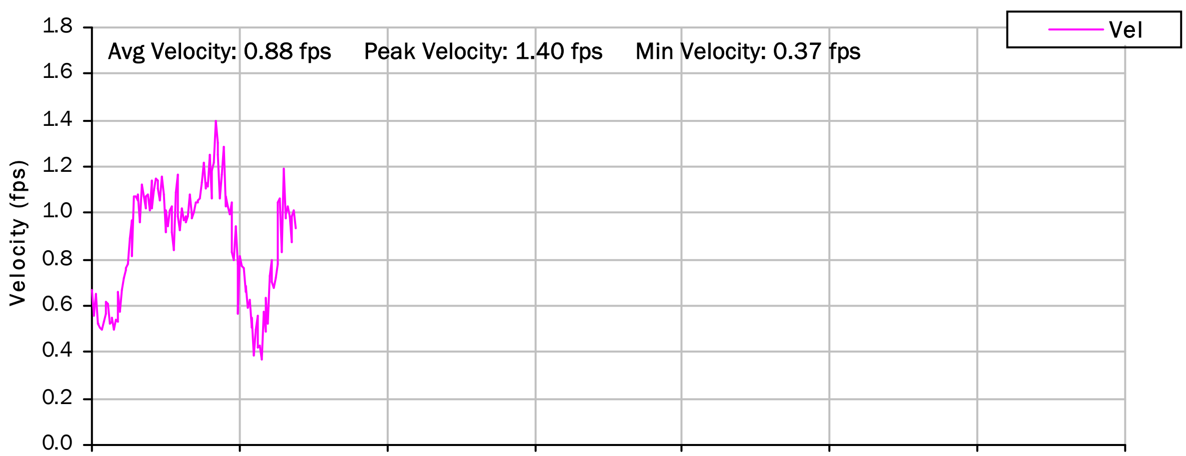
Weekly Level, Velocity and Flow Hydrographs

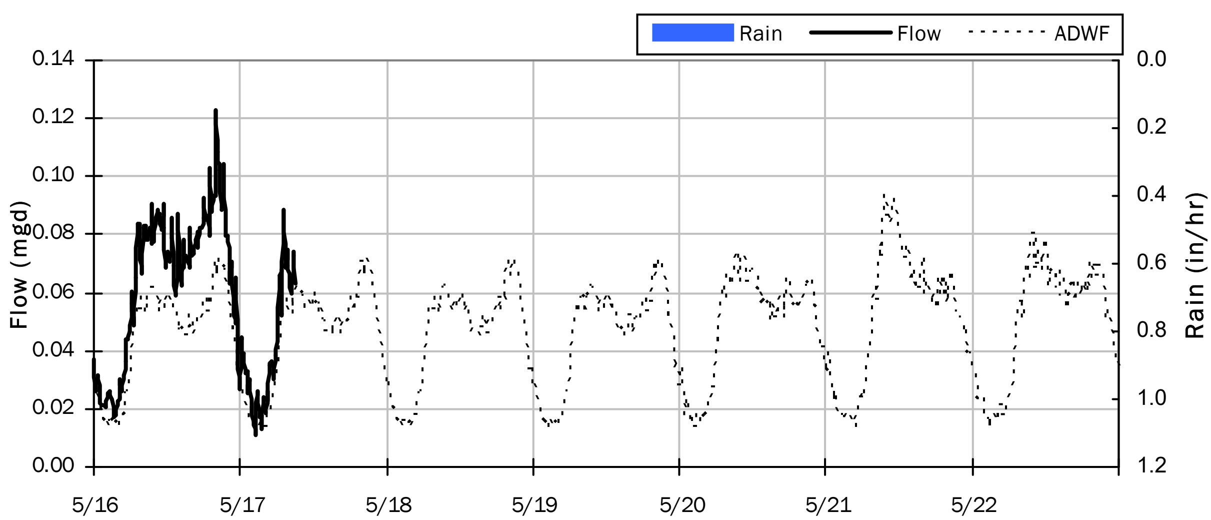
5/9/2022 to 5/16/2022



SITE 34
Weekly Level, Velocity and Flow Hydrographs
5/16/2022 to 5/23/2022







Avg Flow: 0.059 mgd Peak Flow: 0.123 mgd Min Flow: 0.011 mgd

V&A Project No. 21-0345

V&A consulting engineers
1000 Broadway
Suite 320
Oakland, CA 94607
510.903.6600
510.903.6601, Fax

Appendix F

FLOW FACTORS AND RETURN TO SEWER RATIOS

Wastewater Master Plan: Flow Factors and Return to Sewer Ratios discussion

Board Meeting

March 20, 2023

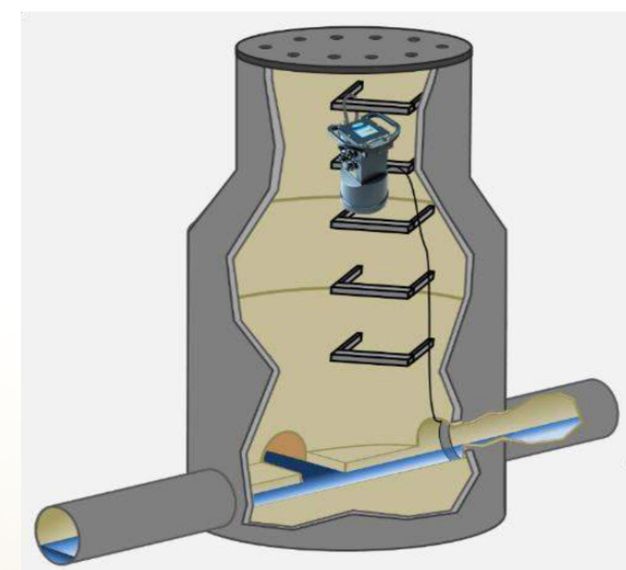
Elsinore Valley Municipal Water District

Flow Monitoring Summary

Flow Monitoring Program Objectives

1. Calibration of hydraulic model
   - Dry weather flow calibration
   - Wet weather flow calibration
2. Return to Sewer (RTS) and Wastewater Generation Flow Factor Calculations
3. Infiltration and Inflow Analysis
4. Measure Dry and Wet Weather Flows

Temporary Flow Monitoring Data



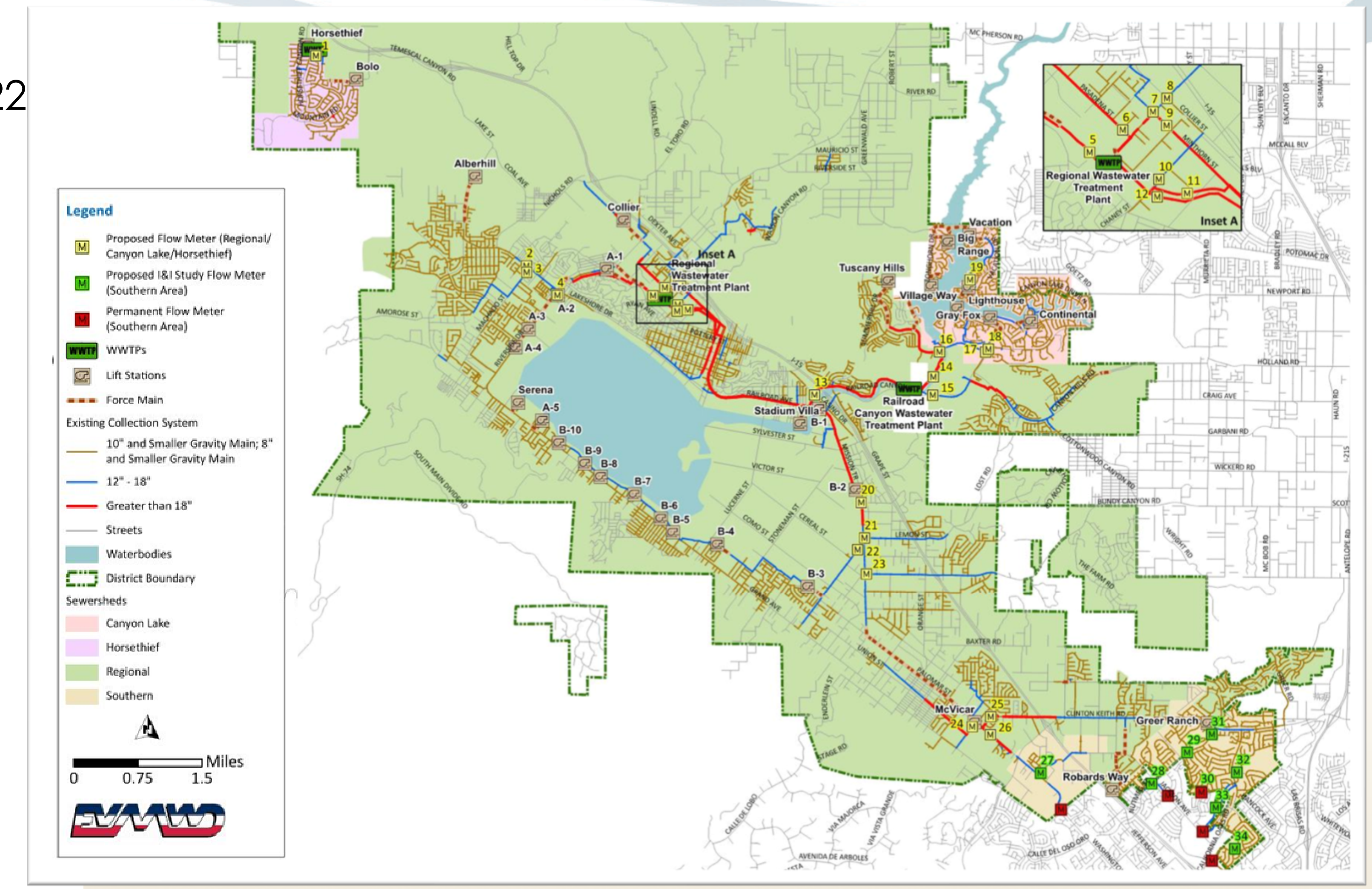
Comprehensive flow monitoring program

Flow Monitoring program #1

- March 3 through May 22, 2022
- Duration: 11 weeks
- 34 sites
  - 20 Regional
  - 1 Horsethief
  - 5 Railroad Canyon
  - 8 Southern Section
- 2 rain events

Flow Monitoring program #2

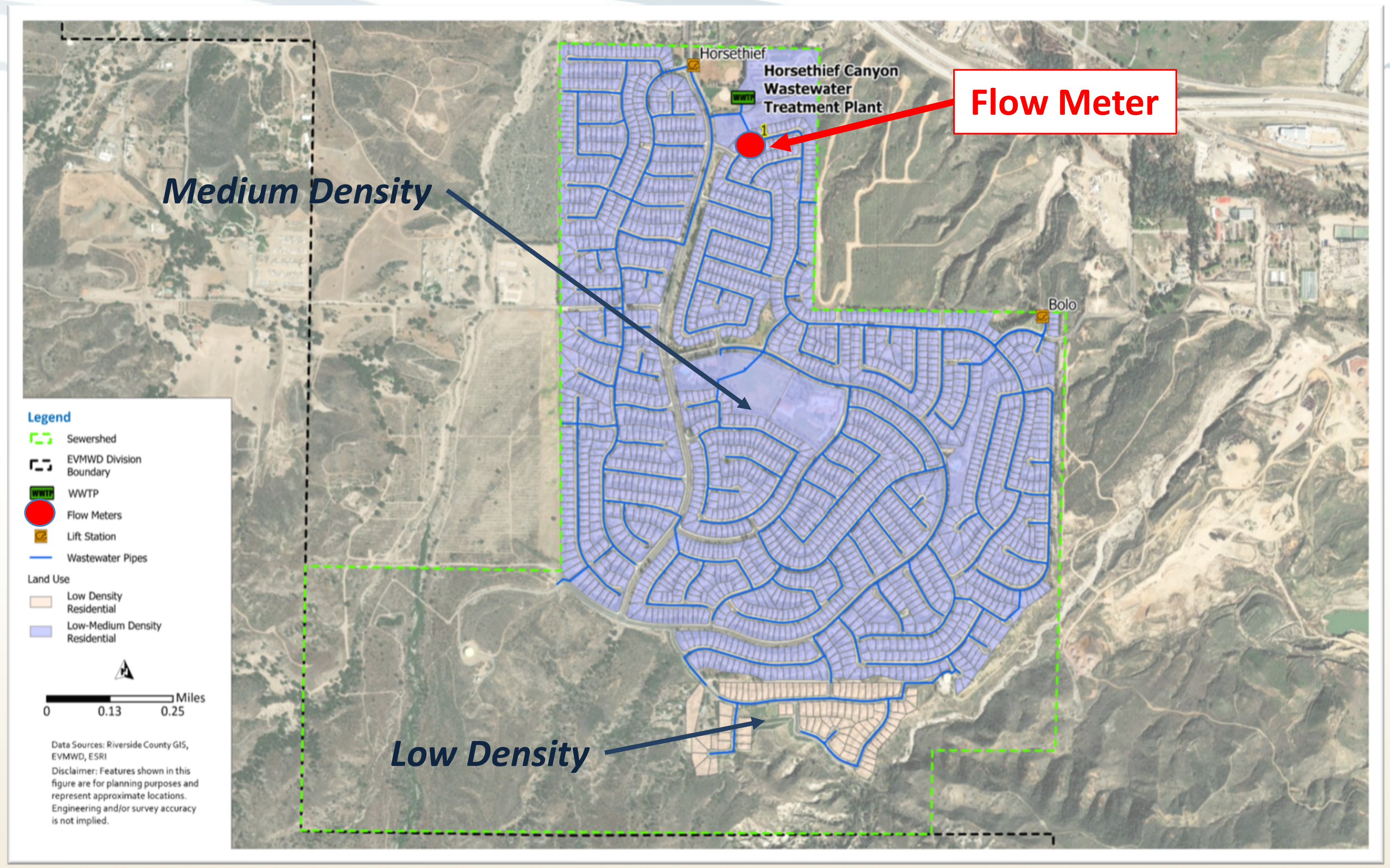
- December 9, 2022 through January 13, 2023
- Duration: 5 weeks
- 7 sites in Southern Section only for I/I Study
- 9 rain events



Metering in the Horsethief basin

Horsethief Area

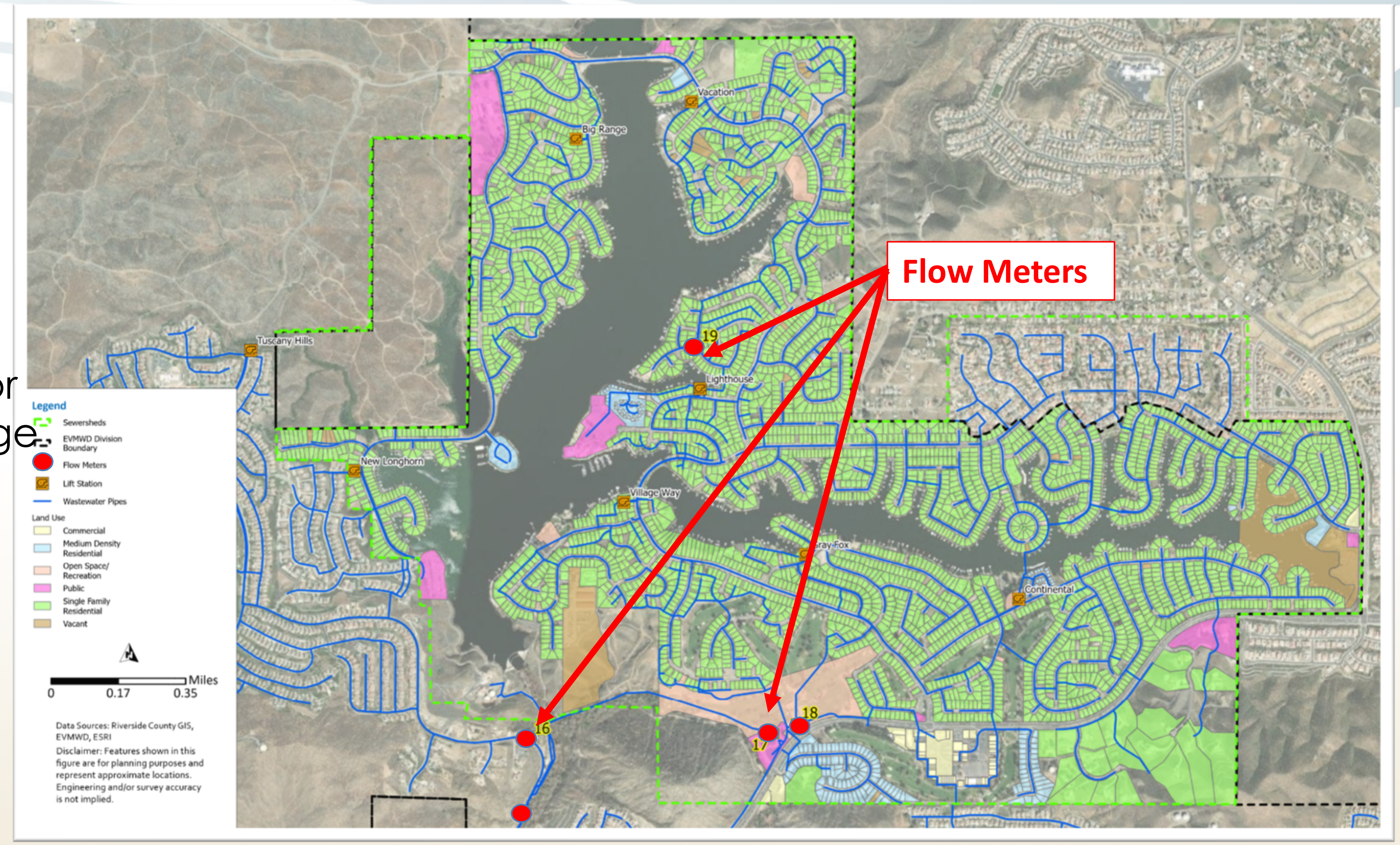
- 1 flow monitoring site
- 100% Residential Land Use



Railroad Canyon metering

Railroad Canyon

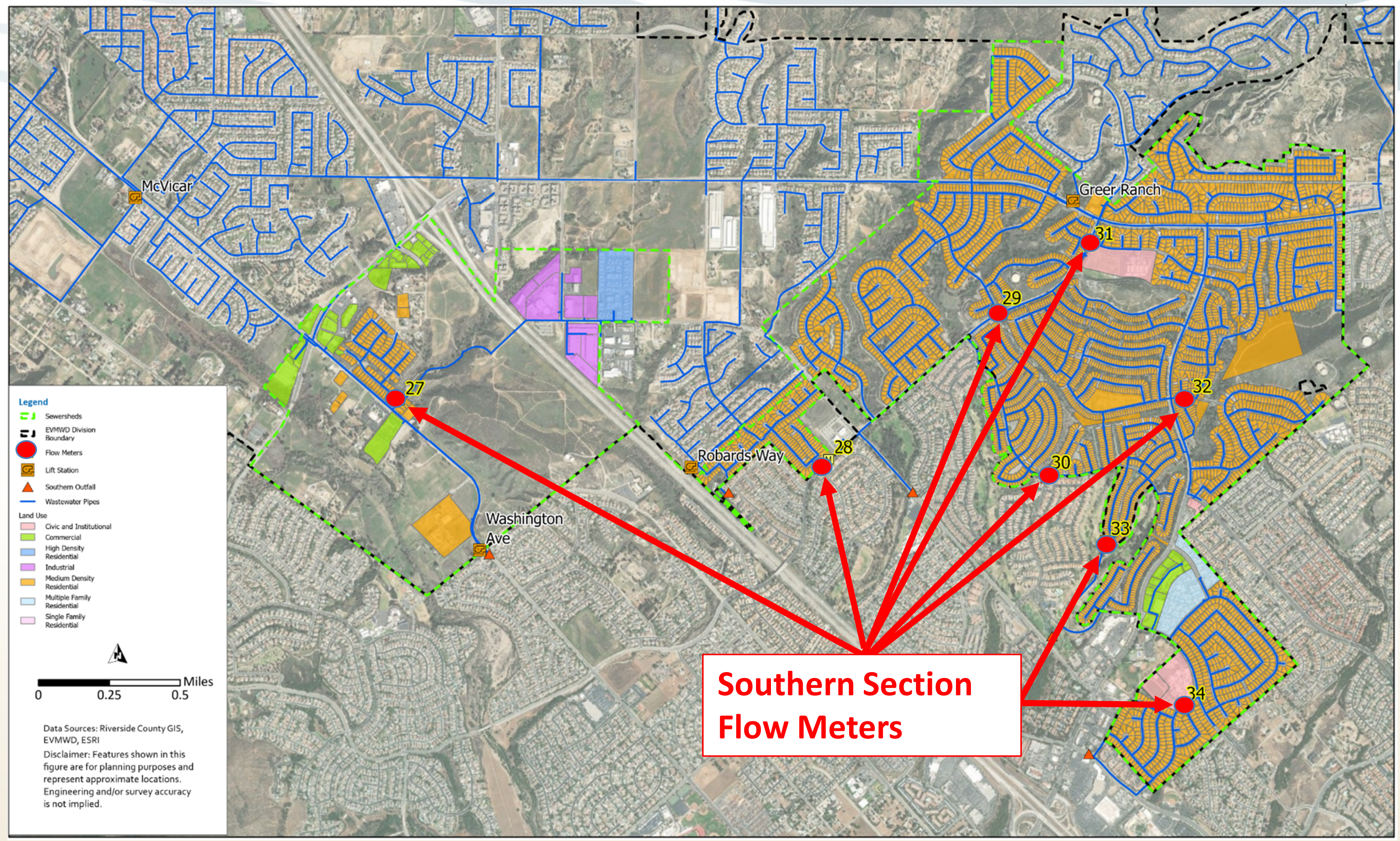
- 5 sites
- To Identify Potential Scalping Volumes for recycled water usage.
- Residential Land Use Isolation



Southern Section metering locations

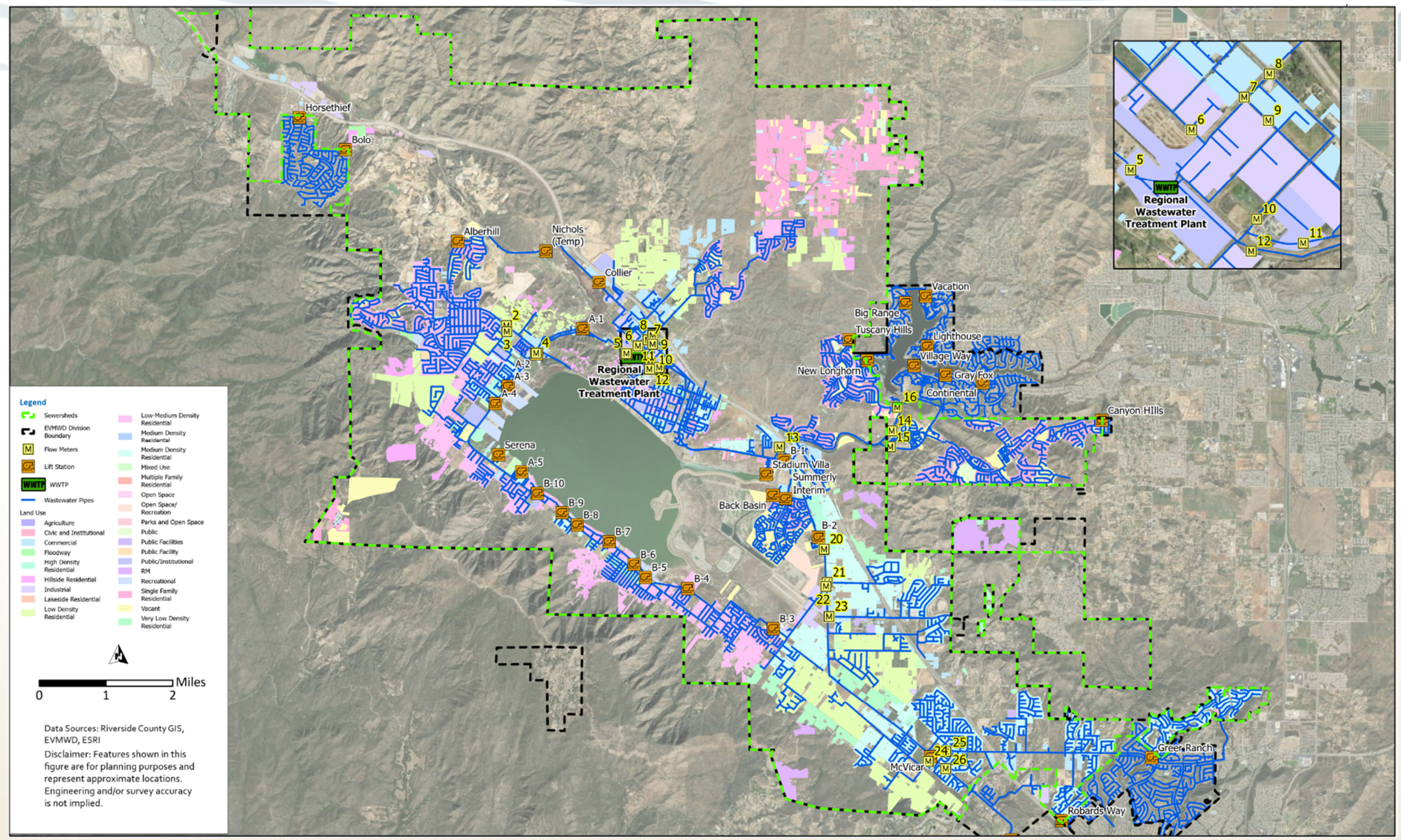
Southern Section

- 8 meters
- Micro Basin Isolation with I/I and Isolated residential land uses
- Total sewer flow for potential diversion to Rancho WRF

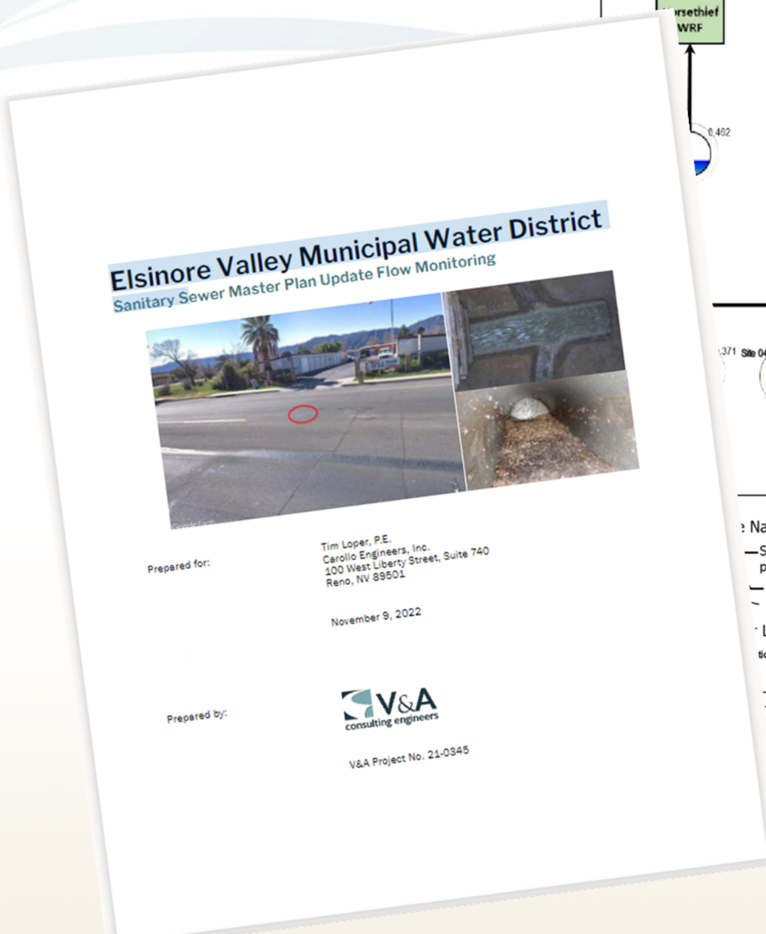


Regional System metering locations

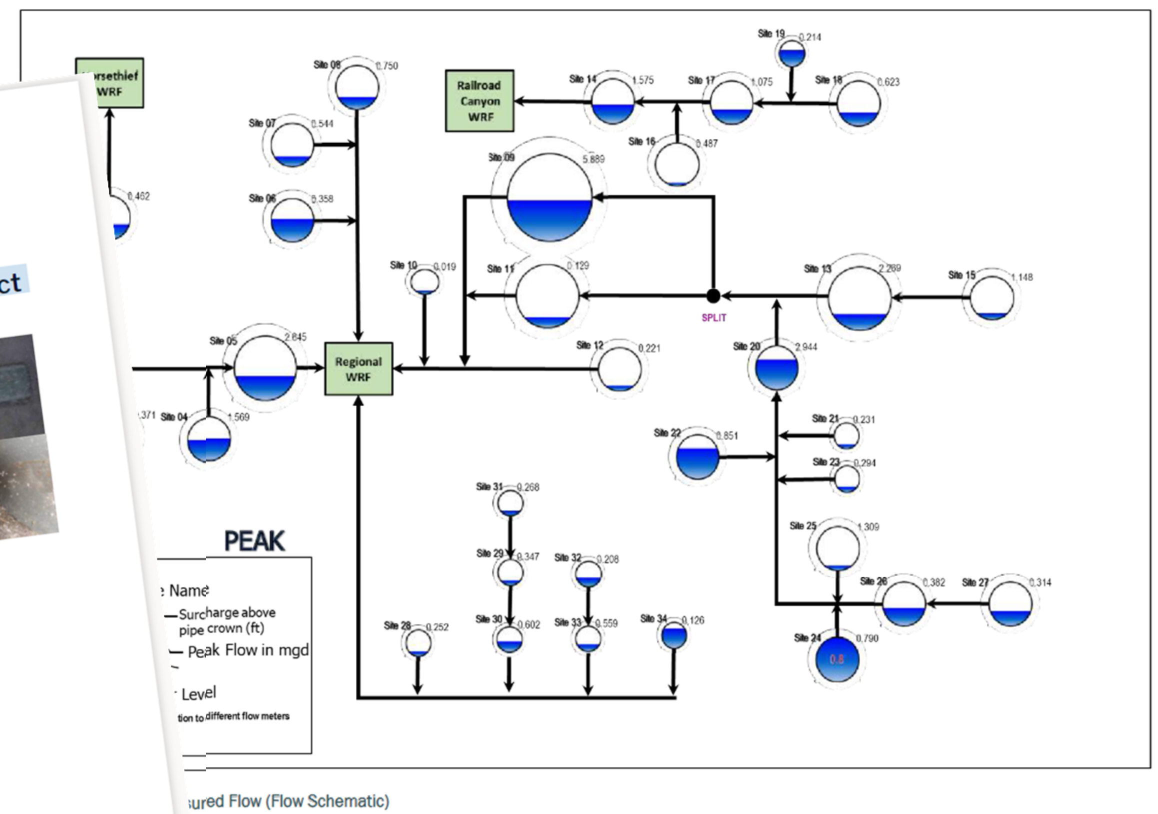
Regional System
- 20 meters
- Mix of residential, commercial and industrial users
- Location selection based on capacity deficient areas and flow totalization



Reporting documented complete monitoring program



Comprehensive Report



Basin Schematics

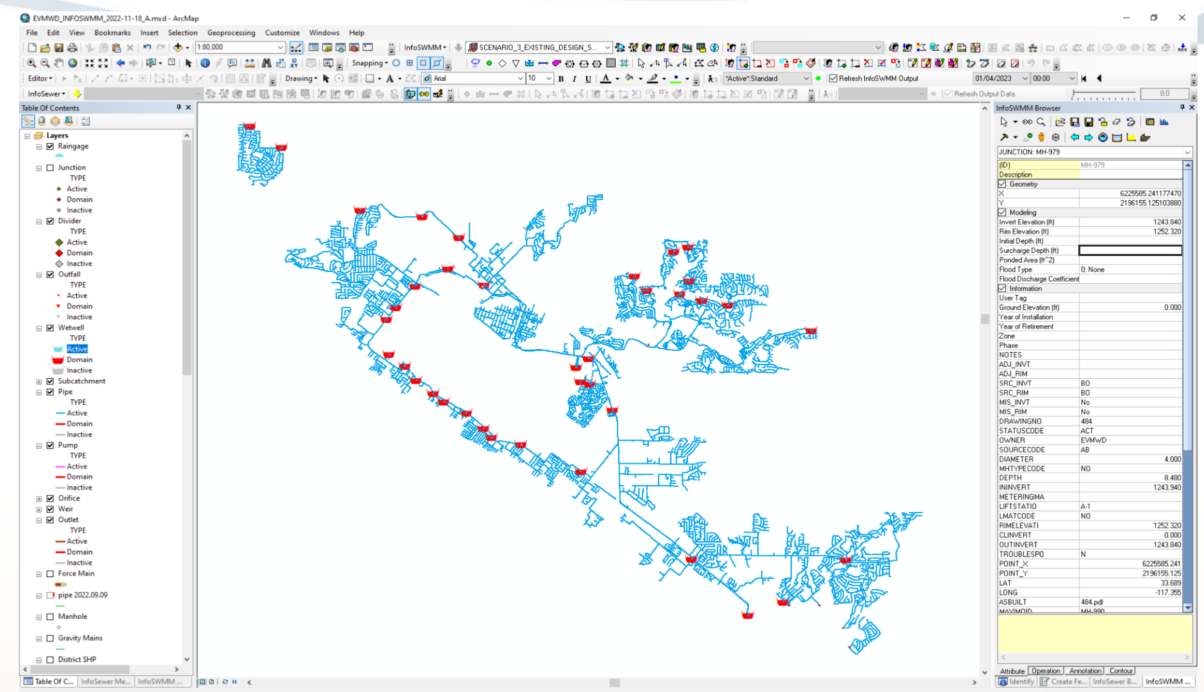
Site	ADWF (MGD)	Peak Measured Flow (MGD)	Peaking Factor
Site 01	0.199	0.46	2.3
Site 02	0.253	0.57	2.3
Site 03	0.179	0.37	2.1
Site 04	0.738	1.57	2.1
Site 05	1.293	2.64	2.0
Site 06	0.085	0.36	4.2
Site 07	0.048	0.54	11.4
Site 08	0.419	0.75	1.8
Site 09	3.458	5.89	1.7
Site 10	0.003	0.02	6.7
Site 11	0.061	0.13	2.1
Site 12	0.116	0.22	1.9
Site 13	0.720	2.27	3.1
Site 14	0.702	1.57	2.2
Site 15	0.556	1.15	2.1
Site 16	0.177	0.49	2.7
Site 17	0.507	1.07	2.1

Flow Metrics

Model Calibration

Model Calibration Overview and Objectives

1. Spatially allocated AMI data provided the first level of accuracy for model calibration
2. Calibration of hydraulic model
   - Dry weather flow calibration
   - Wet weather flow calibration
3. Return to Sewer and Wastewater Generation Flow Factor Calculations
4. Infiltration and Inflow Analysis

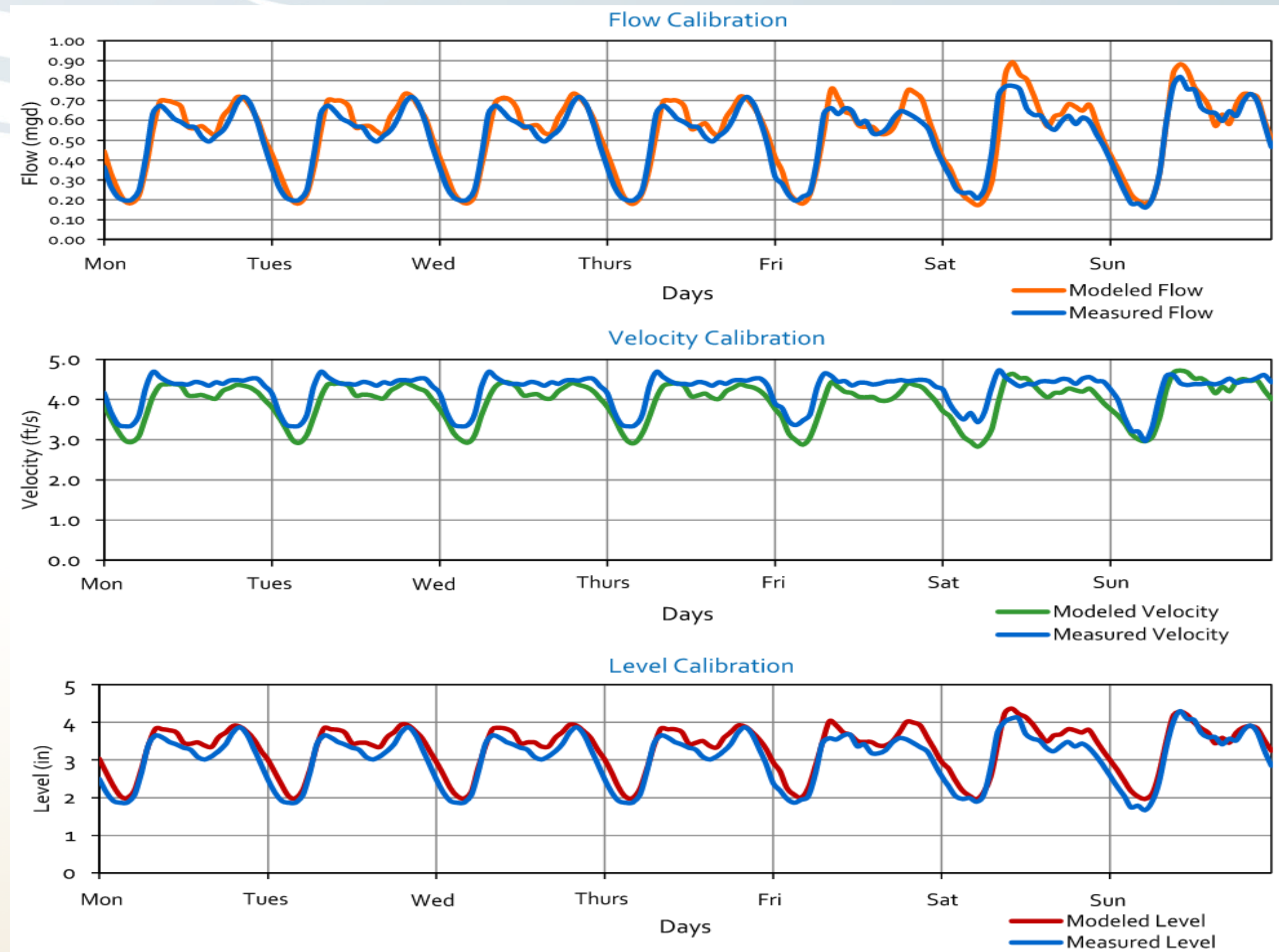


Sewer System Hydraulic model screenshot from InfoSWMM

Flow monitoring data is the basis for hydraulic model calibration

Model Calibration

- Dry and Wet Weather Flows from Flow Monitoring in March-April 2022
- Calibration parameters:
  - Flows
  - Velocity
  - Level (depth in pipe)
- Hourly Flow Variation
- Basin Specific Usage

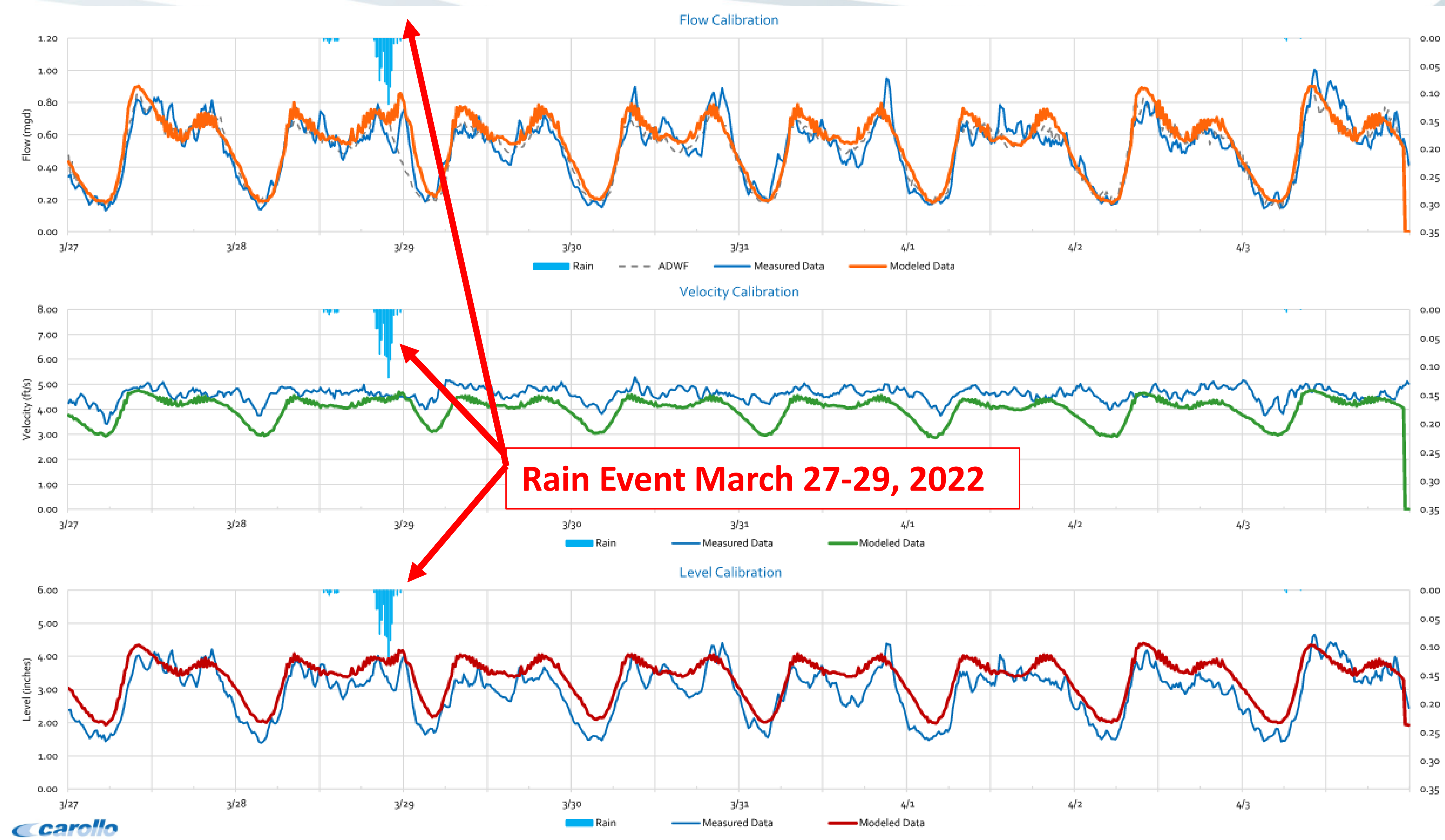


Calibration Results from Flow Monitoring Site 17

Wet weather results were calibrated to measured inflow and infiltration (I/I) factors

Wet Weather

- First flow monitoring period captured 2 rain events on:
  - March 4 (0.78" in 3 hrs)
  - March 27-29 (0.5"to 0.9")
- R-Factors
- Basin Specific
- Long Term Simulations
- I/I parameter development

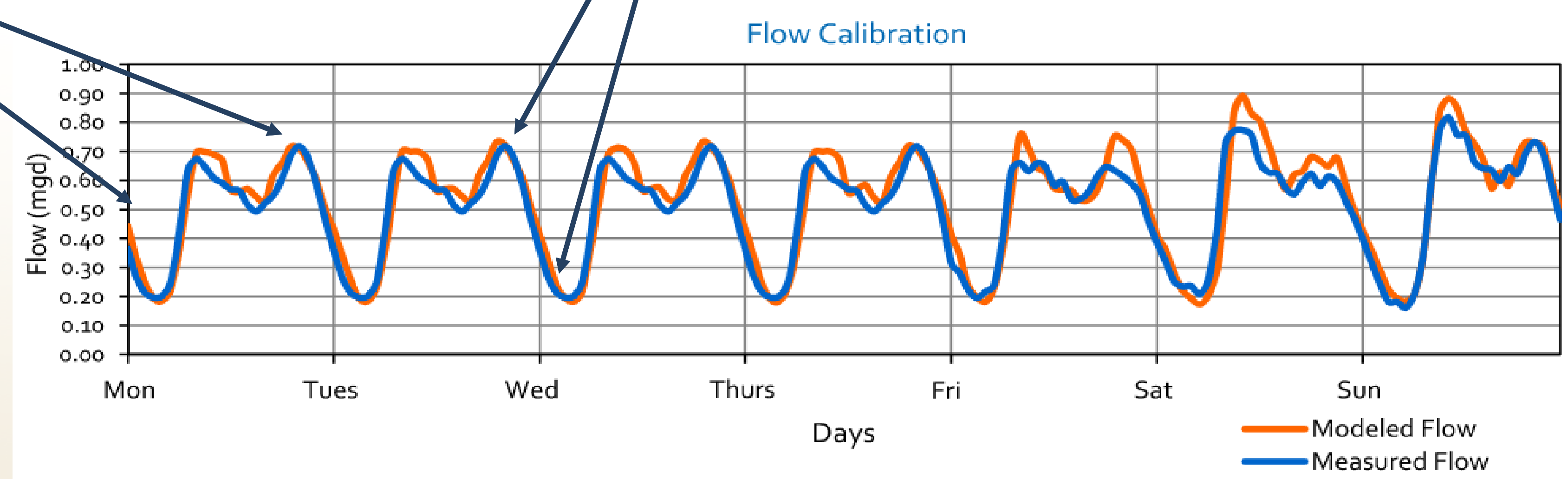


The calibration results meet industry standards

Wastewater Planning Users Group (WaPUG) Calibration Standards

Average and peak flows ±10% of measured data

Flow peaks and troughs timed within one hour



Detailed comparisons of measured and modeled data were completed for each meter site

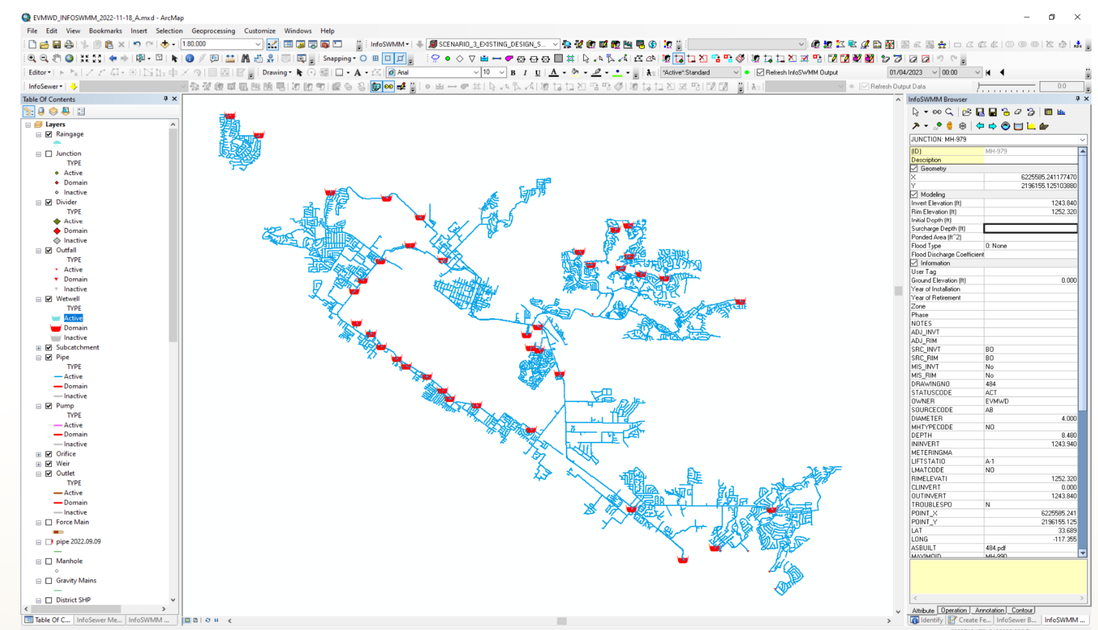
Model Calibration Summary

	Measured Data[1]				Modeled Data				Percent Error[3]			
Day	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.50	0.72	3.0	4.23	0.52	0.73	3.3	3.96	4.6%	2.0%	8.4%	-6.4%
Tues.	0.50	0.72	3.0	4.23	0.52	0.73	3.3	3.96	4.6%	2.0%	8.4%	-6.4%
Wed.	0.50	0.72	3.0	4.23	0.52	0.73	3.3	3.96	4.6%	2.0%	8.4%	-6.4%
Thur.	0.50	0.72	3.0	4.23	0.52	0.73	3.3	3.96	4.6%	2.0%	8.4%	-6.4%
Fri.	0.50	0.66	3.0	4.23	0.52	0.76	3.3	3.90	4.4%	14.2%	8.8%	-7.9%
Sat.	0.52	0.77	3.1	4.25	0.54	0.89	3.3	3.93	4.6%	15.4%	8.7%	-7.5%
Sun.	0.53	0.82	3.1	4.17	0.55	0.88	3.3	4.04	4.7%	7.7%	5.8%	-3.1%
Summary	-	-										
Weekday	0.50	--	3.0	4.23	0.52	--	3.3	3.95	4.6%	--	8.5%	-6.7%
Weekend	0.52	--	3.1	4.21	0.55	--	3.3	3.98	4.6%	--	7.2%	-5.3%
ADWF[4]	0.51	--	3.0	4.22	0.53	--	3.3	3.96	4.6%	--	8.1%	-6.3%

Example (Site #17) shows that flows, level, and level were all within 4.6%-8.5% (= within 10% criterion)

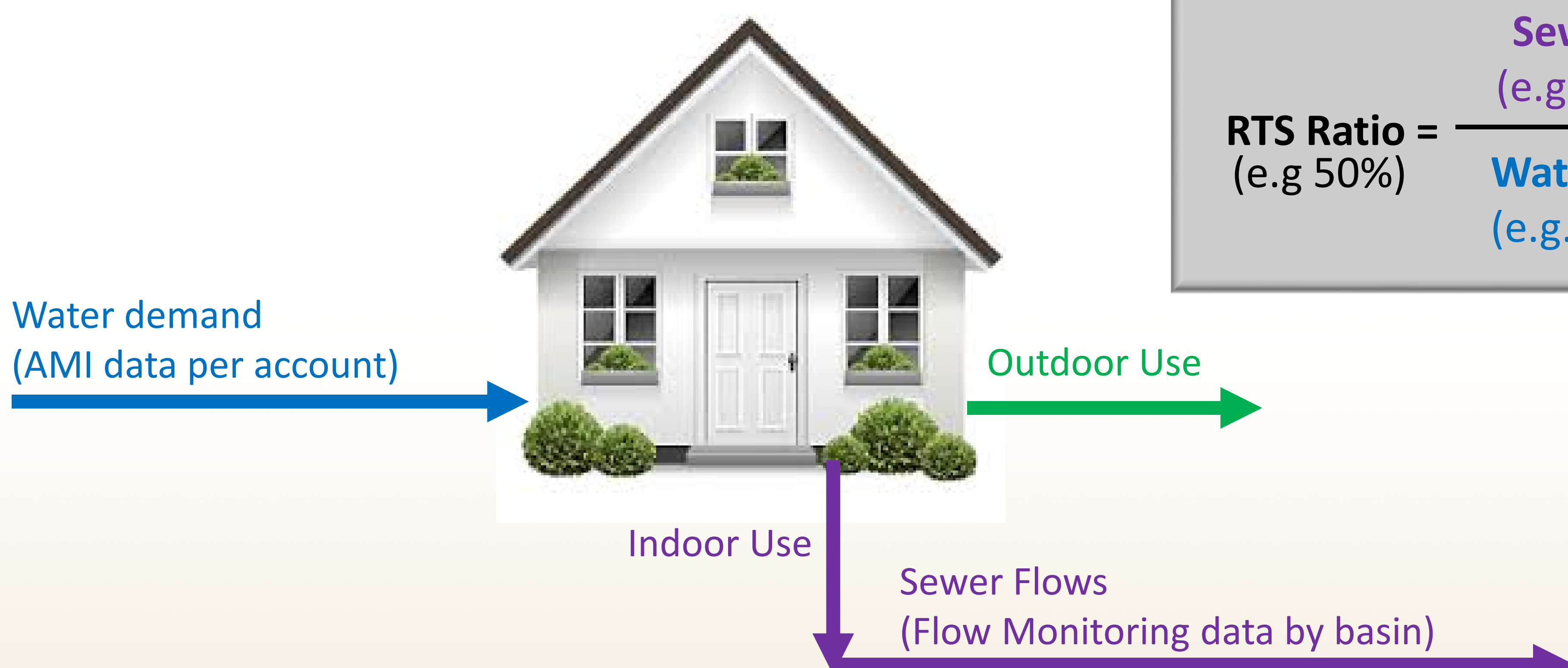
// Model Calibration Summary

1. AMI data provided real data for spatial and volume allocation
2. Model calibration for wet and dry weather for flow, velocity and level showed strong correlations
3. Industry standards were used to determine calibration performance
4. Model results show accurate correlation to field conditions



Return to Sewer Calculations

Definition of Return to Sewer (RTS) ratios



$$\text{RTS Ratio} = \frac{\text{Sewer Flow (e.g. 60 gpcd)}}{\text{Water demand (e.g. 120 gpcd)}}$$

(e.g 50%)

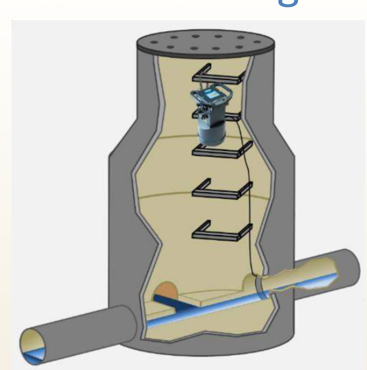
Return to sewer ratios are key metrics for wastewater flow forecasting

1. Return to Sewer Ratios (RTS) are the calculated percent of total water use that ends up in the sewer system
   - Used to calculate wastewater flow factors
   - Good measure of sewer generation by land use type
2. Wastewater flow factors are applied to future (land use and population based) water demand forecasts to project future wastewater generation that are used to plan future facilities
3. RTS calculations utilize real usage from the wastewater flow monitoring data and water consumption from aggregated AMI data

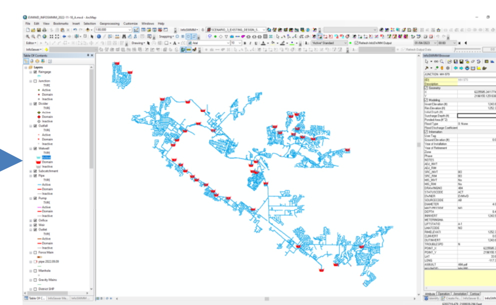
The wastewater flow factors are based on real data backed up by a defensible approach

AMI/Annual Water Billing Data

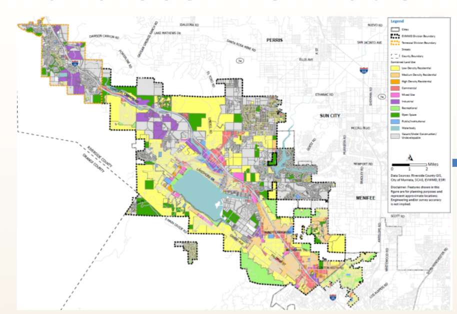
Temporary Sewer Flow Monitoring Data



Hydraulic Model



Land Use Information



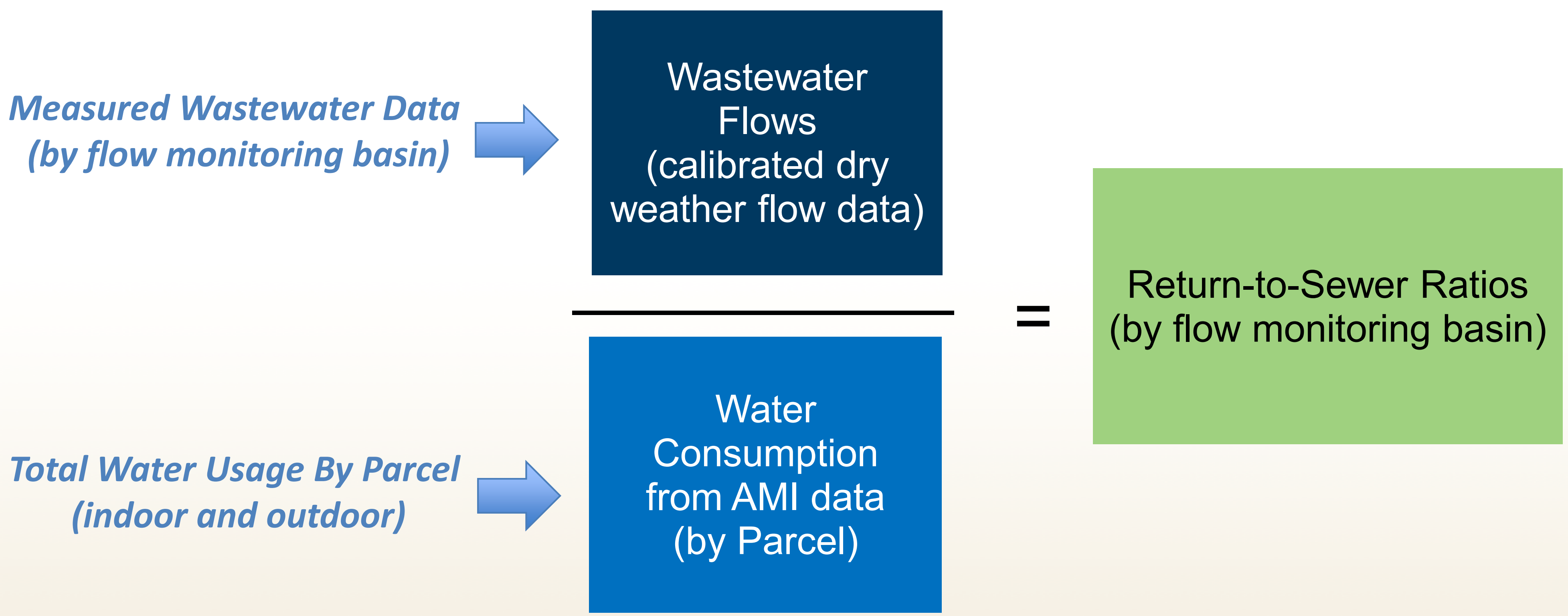
RTS Ratios

Land Use Category	Modeled Return to Sewer (%)
Business Park	59%
General Commercial	57%
Limited Industrial	85%
Open Space - Recreation	4%
Public Institutional	49%
Hillside Residential[1]	34%
Very Low Density Residential (0.1 – 0.5 DU/acre)	47%
Low Density Residential (0.5-2 DU/acre)	50%
Low Medium Density Residential (2-4 DU/acre)	41%
Medium Density Residential (4-6 DU/acre)	45%
Medium High Density Residential (6-12 DU/acre)	46%
High Density Residential (12-24 DU/acre)	65%
Mixed Use (24 DU/acre max)	38%

Wastewater Flow Factors

Land Use Category	2022 WDF (gpd/acre)	Modeled Return to Sewer (%)	2022 WWFF, Rounded (gpd/acre)	2016 WDF (gpd/acre)	2016 Return to Sewer (%)	2016 WWFF (gpd/acre)
Business Park	800	59%	500	900	30%	270
General Commercial	2,300	57%	1,300	1,500	54%	810
Limited Industrial	700	85%	600	700	57%	400
Open Space - Recreation	2,300	4%	100	2,300	4%	100
Public Institutional	1,300	49%	600	1,700	42%	710
Hillside Residential[1]	1,400	34%	500	700	13%	90
Very Low Density Residential (0.1 – 0.5 DU/acre)	700	47%	300	400	90%	360
Low Density Residential (0.5-2 DU/acre)	1,200	50%	600	1,000	55%	550
Low Medium Density Residential (2-4 DU/acre)	2,000	41%	800	2,000	31%	620
Medium Density Residential (4-6 DU/acre)	2,200	45%	1,000	2,300	34%	780
Medium High Density Residential (6-12 DU/acre)	2,400	46%	1,100	2,100	42%	880
High Density Residential (12-24 DU/acre)	2,600	65%	1,700	1,900	57%	1,090
Mixed Use (24 DU/acre max)	1,700	38%	700	1,600	47%	750

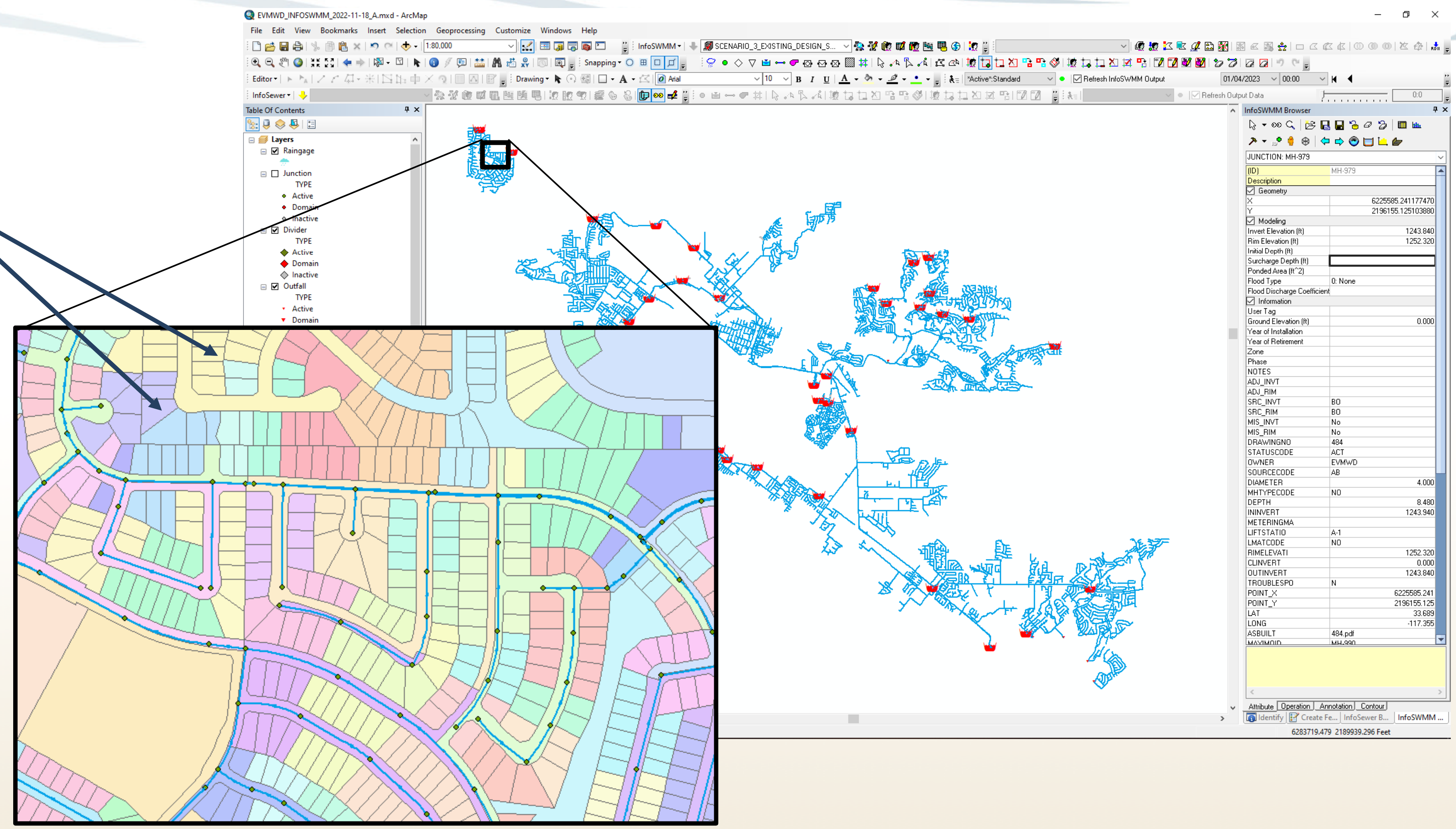
Return-to-sewer (RTS) ratios were calculated using AMI and flow monitoring data of the same period and basin areas



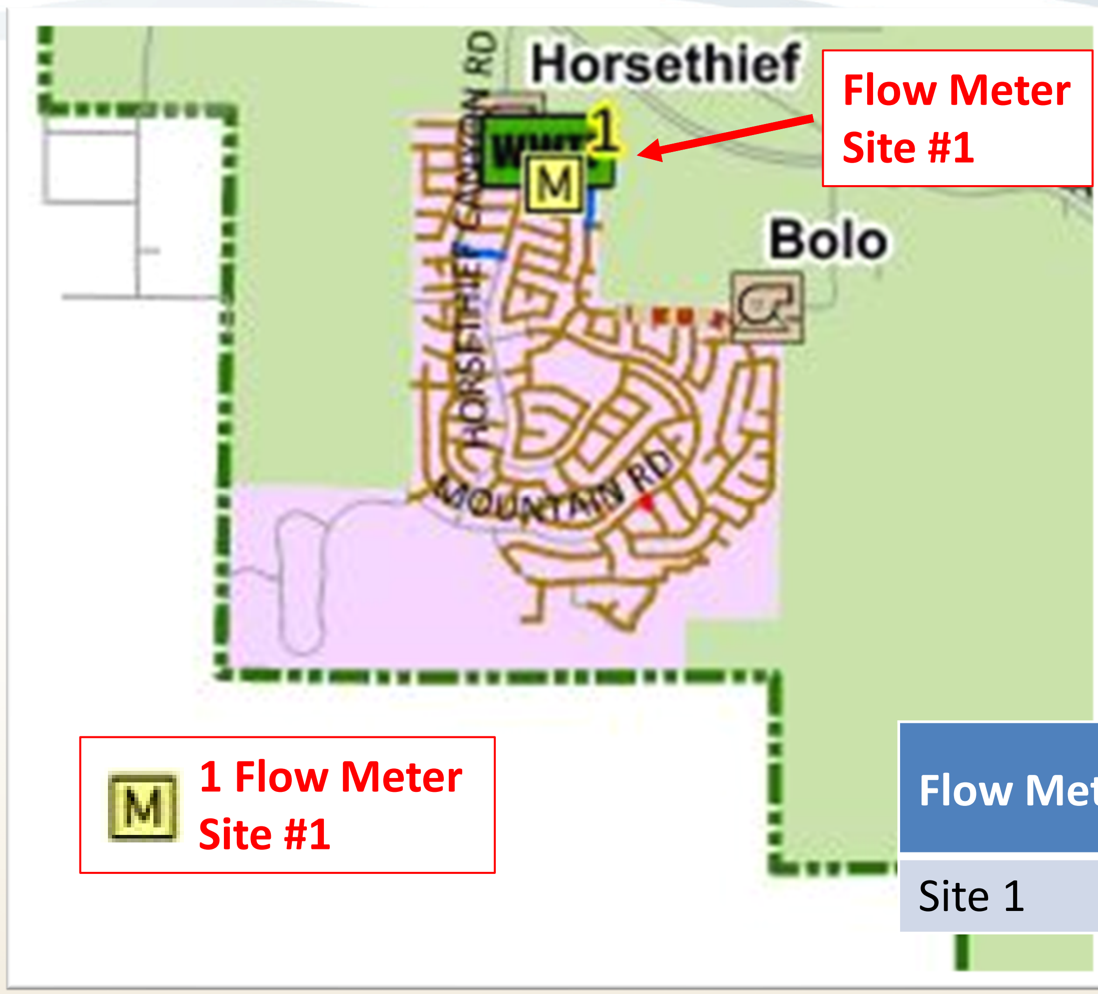
Parcel level sewersheds were developed to allocate AMI water billing data into the sewer system hydraulic model

AMI Data Records were allocated for each individual parcel

AMI Data Records can be aggregated and compared to wastewater flow measurements



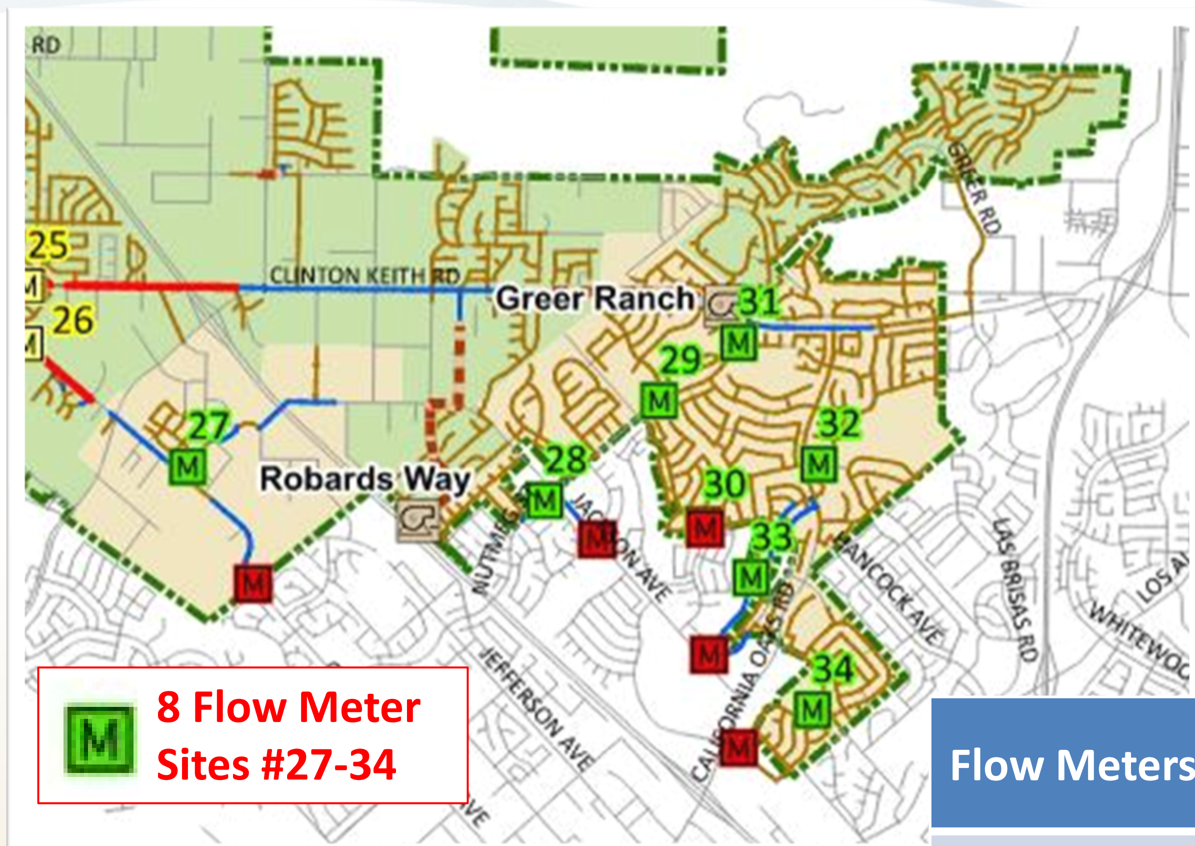
Return-to-sewer (RTS) ratio calculation: Example: Horsethief Area



Horsethief Area
- 100% residential
- Total water consumption: 0.62 mgd
- Average dry weather wastewater flow: 0.2 mgd
- RTS Ratio = 32%

Flow Meters	Sewershed	ADWF (mgd)	AMI Data (mgd)	Return-to-Sewer
Site 1	Horsethief	0.20	0.62	32%

Return-to-sewer (RTS) ratio calculation: Example: Southern Section



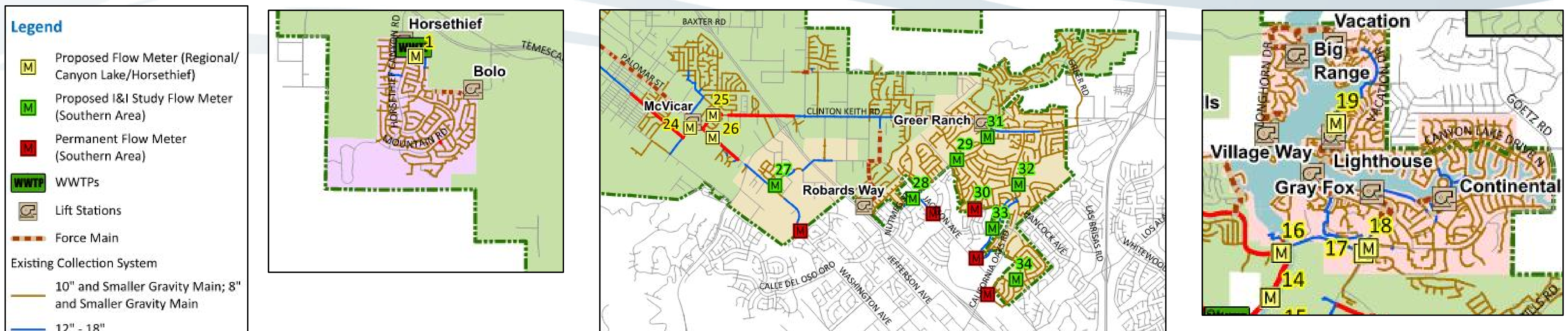
Southern Section

- 100% residential
- Total water consumption: 1.31 mgd
- Average dry weather wastewater flow: 0.7 mgd
- RTS Ratio = 53%

Flow Meters	Sewershed	ADWF (mgd)	AMI Data (mgd)	Return-to-Sewer
Sites 27-34	Southern	0.70	1.31	53%

// Horsethief, Southern, Railroad Canyon Exam

Option 2 – Use this slide or previous slides



Flow Meters	Sewershed	ADWF (mgd)	AMI Data (mgd)	Return-to-Sewer
Site 1	Horsethief	0.20	0.62	32%
Sites 17-19	Railroad Canyon	0.50	1.25	40%
Sites 27-34	Southern	0.70	1.31	53%
Total Sites 1,17-19, 27-34	Southern/ Horsethief	0.90	1.94	**44%**

Wastewater Flow projection factors were derived from the Water Demand Factors and RTS ratios

Land Use Category	Water Demand Factor[1] (gpd/acre)	Return to Sewer Ratio[2] (%)	Wastewater Flow Factor (gpd/acre)
Business Park	800	60%	500
General Commercial	2,300	63%	1,400
Limited Industrial	700	73%	500
Public Institution	1,300	42%	500
Hillside Residential	1,400	36%	500
Very Low Residential	700	44%	300
Low Density Residential	1,200	53%	600
Low/Med Density Residential	2,000	44%	900
Medium Density Residential	2,200	45%	1,000
Med/High Density Residential	2,400	45%	1,100
High Density Residential	2,600	79%	2,100
Mixed Use	21,000	40%	8,400

(1) WDFs from extensive calculations for the 2023 Water Master Plan
(2) RTS ratios per previous slides using combination of Flow Monitoring data and AMI data
(3) Calculated as WDF * RTS ratio

The 2022 calibrated wastewater flow factors are in general agreement with the values used by similar agencies in California

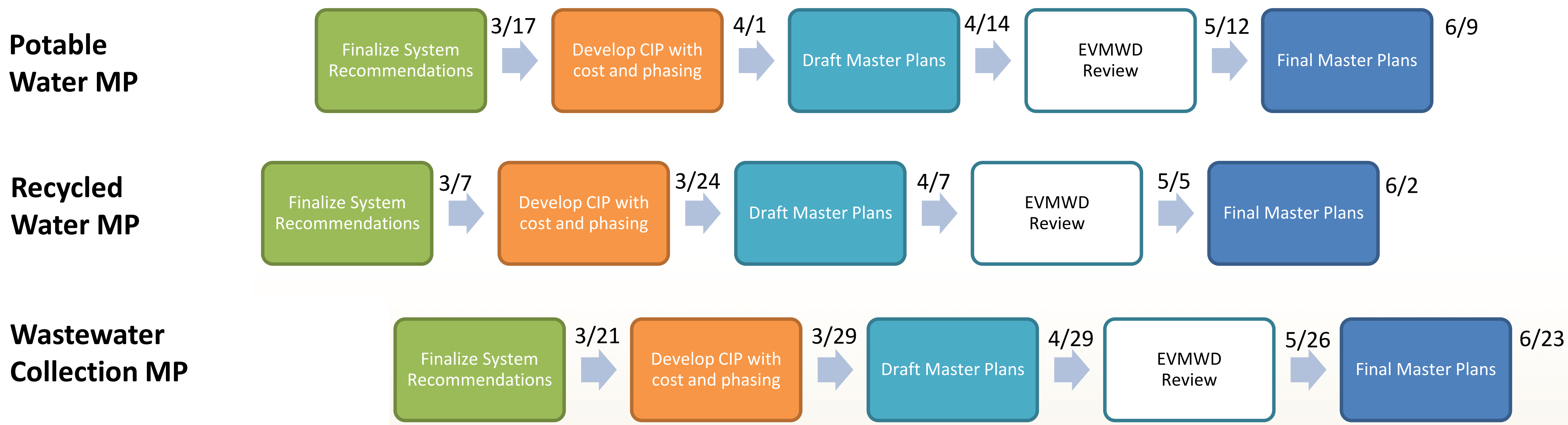
Land Use Category	2023 EVMWD	Rancho	Banning	Chino Hills	Visalia	Lemoore	Tracy
Business Park	800				450	760	
General Commercial	1,400		1,150	1,300	900	750	900
Limited Industrial	500		750	1,300	600	850	750
Public Institutional	500		410	100	450	400	550
Hillside Residential(1)	500		50		280	450	
Very Low Density Residential	300	250	180		470	450	350
Low Density Residential	600	500	540	900	470	950	
Low Medium Density Residential	900	750	1,020	900	1,000	950	1,000
Medium Density Residential	1,000	1,250	1,020	900	1,000	1,470	1,000
Medium High Density Residential	1,100	2,000	1,260	1,500	1,700	1,470	2,600
High Density Residential	2,100	4,500	1,260	1,500	1,700	2,200	3,600
Mixed Use	8,400	4,500			850	1,100	

Summary

- Flow monitoring program provided valuable usage data on wastewater generation
- Model calibration provided a robust process to build accuracy
- Water usage data (AMI) was correlated to measured wastewater flow data to calibrate return to sewer ratios (RTS)
- Calibrated RTS were applied to water demand factors to determine wastewater flow factors
- AMI data and flow monitoring data provided a rigorous methodology for determining flow factors
- Calculation methodology provided clear justification for changes to flow factors

Next Steps

Next Steps


Potable Water MP
Finalize System Recommendations
3/17
Develop CIP with cost and phasing
4/1
Draft Master Plans
4/14
EVMWD Review
5/12
Final Master Plans
6/9
Recycled Water MP
Finalize System Recommendations
3/7
Develop CIP with cost and phasing
3/24
Draft Master Plans
4/7
EVMWD Review
5/5
Final Master Plans
6/2
Wastewater Collection MP
Finalize System Recommendations
3/21
Develop CIP with cost and phasing
3/29
Draft Master Plans
4/29
EVMWD Review
5/26
Final Master Plans
6/23


THANK YOU
EVMWD
Elsinore Valley Municipal Water District

Appendix G

2014 FLOW MONITORING REPORT

SANITARY SEWER FLOW MONITORING AND INFLOW / INFILTRATION STUDY

Elsinore Valley Municipal Water District

July 2014

V&A

SANITARY SEWER FLOW MONITORING AND INFLOW / INFILTRATION STUDY

Prepared for

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Prepared by

July 2014

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TABLES

FIGURES

APPENDIX

ABBREVIATIONS, TERMS AND DEFINITIONS USED IN THIS REPORT

Table i. Abbreviations

Abbreviation	Term
ADWF	average dry weather flow
CCTV	closed-circuit television
CIP	capital improvement plan
CO	carbon monoxide
d/D	depth/diameter ratio
FM	flow monitor
gpd	gallons per day
gpm	gallons per minute
GWI	groundwater infiltration
H_2S	hydrogen sulfide
I/I	inflow and infiltration
IDM	inch-diameter-mile (miles of pipeline multiplied by the diameter of the pipeline in inches)
IDW	inverse distance weighting
LEL	lower explosive limit
mgd	million gallons per day
NOAA	National Oceanic and Atmospheric Administration
Q	flow rate
RDI	rainfall-dependent infiltration
RRI	rainfall-responsive infiltration
RG	rain gauge
SSO	sanitary sewer overflow
WEF	Water Environment Federation
WRCC	Western Regional Climate Center

Table ii. Terms and Definitions

Term	Definition
Average dry weather flow (ADWF)	Average flow rate or pattern from days without noticeable inflow or infiltration response. ADWF usage patterns for weekdays and weekends differ and must be computed separately. ADWF can be expressed as a numeric average or as a curve showing the variation in flow over a day. ADWF includes the influence of normal groundwater infiltration (not related to a rain event).
Basin	Sanitary sewer collection system upstream of a given location (often a flow meter), including all pipelines, inlets, and appurtenances. Also refers to the ground surface area near and enclosed by pipelines. A basin may refer to the entire collection system upstream from a flow meter or exclude separately monitored basins upstream.
Design storm	A theoretical storm event of a given duration and intensity that aligns with historical frequency records of rainfall events. For example, a 10-year, 24-hour design storm is a storm event wherein the volume of rain that falls in a 24-hour period would historically occur once every 10 years. Design storm events are used to predict I/I response and are useful for modeling how a collection system will react to a given set of storm event scenarios.
Infiltration and inflow	Infiltration and inflow (I/I) rates are calculated by subtracting the ADWF flow curve from the instantaneous flow measurements taken during and after a storm event. Flow in excess of the baseline consists of inflow, rainfall-responsive infiltration, and rainfall-dependent infiltration. **Total I/I** is the total sum in gallons of additional flow attributable to a storm event.
Infiltration, *groundwater*	Groundwater infiltration (**GWI**) is groundwater that enters the collection system through pipe defects. GWI depends on the depth of the groundwater table above the pipelines as well as the percentage of the system that is submerged. The variation of groundwater levels and subsequent groundwater infiltration rates is seasonal by nature. On a day-to-day basis, groundwater infiltration rates are relatively steady and will not fluctuate greatly.
Infiltration, *rainfall-dependent*	Rainfall-dependent infiltration (**RDI**) is similar to groundwater infiltration but occurs as a result of storm water. The storm water percolates into the soil, submerges more of the pipe system, and enters through pipe defects. RDI is the slowest component of storm-related infiltration and inflow, beginning gradually and often lasting 24 hours or longer. The response time depends on the soil permeability and saturation levels.
Infiltration, *rainfall-responsive*	Rainfall-responsive infiltration (**RRI**) is storm water that enters the collection system through pipe defects, but normally in sewers constructed close to the ground surface such as private laterals. RRI is independent of the groundwater table and reaches defective sewers via the pipe trench in which the sewer is constructed, particularly if the pipe is placed in impermeable soil and bedded and backfilled with a granular material. In this case, the pipe trench serves as a conduit similar to a French drain, conveying storm drainage to defective joints and other openings in the system.
Inflow	**Inflow** is defined as water discharged into the sewer system, including private sewer laterals, from **direct** connections such as downspouts, yard and area drains, holes in manhole covers, cross-connections from storm drains, or catch basins. Inflow creates a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows. Overflows are often attributable to high inflow rates.

Term	Definition
Normalization	To run an “apples-to-apples” comparison amongst different basins, calculated metrics must be **normalized**. Individual basins will have different runoff areas, pipe lengths and sanitary flows. There are three common methods of normalization. Depending on the information available, one or all methods can be applied to a given project: ❖ Pipe Length: The metric is divided by the length of pipe in the upstream basin expressed in units of inch-diameter-mile (IDM). ❖ Basin Area: The metric is divided by the estimated drainage area of the basin in acres. ❖ ADWF: The metric is divided by the average dry weather sanitary flow (ADWF).
Normalization, *inflow*	The peak I/I flow rate is used to quantify inflow. Although the instantaneous flow monitoring data will typically show an inflow peak, the inflow response is measured from the I/I flow rate (in excess of baseline flow). This removes the effect of sanitary flow variations and measures only the I/I response: ❖ Pipe Length: The peak I/I flow rate is divided by the length of pipe (IDM) in the upstream basin. The result is expressed in gallons per day (gpd) per IDM (gpd/IDM). ❖ Basin Area: The peak I/I flow rate is divided by the geographic area of the upstream basin. The result is expressed in gpd per acre. ❖ ADWF: The peak I/I flow rate is divided by the average dry weather flow (ADWF). This is a ratio and is expressed without units.
Normalization, *GWI*	The estimated GWI rates are compared to acceptable GWI rates, as defined by the Water Environment Federation, and are used to identify basins with high GWI: ❖ Pipe Length: The GWI flow rate is divided by the length of pipe (IDM) in the upstream basin. The result is expressed in gallons per day (gpd) per IDM (gpd/IDM). ❖ Basin Area: The GWI flow rate is divided by the geographic area of the upstream basin. The result is expressed in gpd per acre. ❖ ADWF: The GWI flow rate is divided by the average dry weather flow (ADWF). This is a ratio and is expressed without units.
Normalization, *RDI*	The estimated RDI rates at a period 24 hours or more after the conclusion of a storm event are used to identify basins with high RDI: ❖ Pipe Length: The RDI flow rate is divided by the length of pipe (IDM) in the upstream basin. The result is expressed in gallons per day (gpd) per IDM (gpd/IDM). ❖ Basin Area: The RDI flow rate is divided by the geographic area of the upstream basin. The result is expressed in gpd per acre. ❖ ADWF: The RDI flow rate is divided by the average dry weather flow (ADWF). This is a ratio and is expressed without units.

Term	Definition
Normalization, *total I/I*	The estimated totalized I/I in gallons attributable to a particular storm event is used to identify basins with high total I/I. Because this is a totalized value rather than a rate and can be attributable solely to an individual storm event, the volume of the storm event is also taken into consideration. This allows for a comparison not only between basins but also between storm events: ❖ Pipe Length: Total gallons of I/I is divided by the length of pipe (IDM) in the upstream basin and the rainfall total (inches) of the storm event. The result is expressed in gallons per IDM per inch-rain. ❖ Basin Area (R-Value): Total gallons of I/I is divided by total gallons of rainfall water that fell within the acreage of the basin area. This is a ratio and is expressed as a percentage. R-Value is described as "the percentage of rainfall that enters the collection system." Systems with R-Values less than 5%[1] are often considered to be performing well. ❖ ADWF: Total gallons of I/I is divided by the ADWF and the rainfall total of the storm event. The result is expressed in million gallons per MGD of ADWF per inch of rain.
Peaking factor	Ratio of peak measured flow to average dry weather flow. This ratio expresses the degree of fluctuation in flow rate over the monitoring period and is used in capacity analysis.
Surcharge	When the flow level is higher than the crown of the pipe, then the pipeline is said to be in a **surcharged** condition. The pipeline is surcharged when the *d/D* ratio is greater than 1.0.
Synthetic hydrograph	A set of algorithms has been developed to approximate the actual I/I hydrograph. The synthetic hydrograph is developed strictly using rainfall data and response parameters representing response time, recession coefficient and soil saturation.
Weekend/weekday ratio	The ratio of weekend ADWFs to weekday ADWFs. In residential areas, this ratio is typically slightly higher than 1.0. In business districts, depending on the type of service, this ratio can be significantly less than 1.0.

[1] Keefe, P.N. "Test Basins for I/I Reduction and SSO Elimination." 1998 WEF Wet Weather Specialty Conference, Cleveland.

EXECUTIVE SUMMARY

Scope and Purpose

V&A has completed sanitary sewer flow monitoring and rainfall monitoring with inflow and infiltration (I/I) analysis within Elsinore Valley Municipal Water District (District). Flow and rainfall monitoring was performed over a period of approximately one month from February 21 to March 30, 2014 at 27 open-channel flow monitoring sites and three rain gauge locations. The purpose of this study was to measure sanitary sewer flows at the flow monitoring sites, estimate available sewer capacity and conduct analyses pertaining to infiltration and inflow (I/I) occurring in the basins upstream from the flow monitoring sites.

Average Dry Weather Flows

Days least affected by rainfall were used to estimate the ADWF. Additionally, days that appeared to have normal flow patterns were selected over days that may have had unexplained loading patterns, such as peak discharge events. Table 1 lists the average dry weather flow (ADWF) recorded during this study for the flow monitoring sites. Detailed graphs of the flow monitoring data on a site-by-site basis are included in *Appendix A*.

Table 1. Dry Weather Flow Summary[2]

Monitoring Site	ADWF (mgd)	Peak Average Dry Weather Flow (mgd)	Dry Weather Flow Peaking Factor
Site 1	0.194	0.386	2.0
Site 2	0.417	0.777	1.9
Site 3	0.141	0.291	2.1
Site 4	0.237	0.429	1.8
Site 5	2.089	3.437	1.6
Site 6	0.076	0.183	2.4
Site 7	0.222	0.343	1.5
Site 8	0.047	0.084	1.8
Site 9	0.140	0.228	1.6
Site 10	0.374	0.590	1.6
Site 11	0.186	0.281	1.5
Site 12	2.925	4.608	1.6
Site 13	0.780	1.715	2.2
Site 14	0.165	0.313	1.9
Site 15	0.016	0.044	2.7
Site 16	0.138	0.246	1.8

[2] The ADWF patterns for weekdays and weekends are different and were isolated for this study, shown in Appendix A. The peak average dry weather flow refers to the peak value, weekday or weekend, for the established ADWF curves. The dry weather peaking factor is the peak average dry weather flow divided by the ADWF.

Monitoring Site	ADWF (mgd)	Peak Average Dry Weather Flow (mgd)	Dry Weather Flow Peaking Factor
Site 17	0.228	0.373	1.6
Site 18	0.129	0.363	2.8
Site 19	0.351	0.628	1.8
Site 20	0.467	0.844	1.8
Site 21	0.079	0.160	2.0
Site 22	0.012	0.019	1.5
Site 23	0.074	0.137	1.8
Site 24	1.381	2.377	1.7
Site 25	0.106	0.166	1.6
Site 26	0.555	0.905	1.6
Site 27	0.434	0.719	1.7

Site Flow Monitoring and Capacity Results

Peak measured flows and the flow level (depth) at peak flow times are important factors to consider in order to understand the capacity of the flow monitoring system. Peak flows and flow levels typically, though not always, occur during wet weather events. Table 2 summarizes the peak recorded flows, levels, *d*/*D* ratios, and peaking factors per site during the entire flow monitoring period, regardless of wet weather or dry weather conditions. Capacity analysis data is presented on a site-by-site basis and represents the hydraulic conditions only at the point site locations. Hydraulic conditions in other areas of the collection system will differ.

Table 2. Capacity Analysis Summary[3]

Monitoring Site	ADWF (mgd)	Peak Measured Flow (mgd)	Flow Study Peaking Factor	Diameter (in)	Peak Level (in)	*d*/*D* Ratio	Level Surcharged above Crown (ft.)
Site 1	0.194	0.485	2.5	10	2.06	0.21	-
Site 2	0.417	0.913	2.2	12	3.53	0.29	-
Site 3	0.141	0.360	2.5	14.5	4.37	0.30	-
Site 4	0.237	0.534	2.3	12	6.44	0.54	-
Site 5	2.089	4.725	2.3	29.5	11.56	0.39	-
Site 6	0.076	0.328	4.3	24	16.06	0.67	-
Site 7	0.222	0.440	2.0	15	2.56	0.17	-
Site 8	0.047	0.156	3.3	14.5	2.68	0.18	-

[3] The peak measured flow is the peak instantaneous flow measured during the entire flow study and may or may not have occurred during a rainfall event. The "Flow Study Peaking Factor" is the peak measured flow divided by the ADWF. The sites with peaking factor higher than the typical design values are highlighted in red

Monitoring Site	ADWF (mgd)	Peak Measured Flow (mgd)	Flow Study Peaking Factor	Diameter (in)	Peak Level (in)	*d*/*D* Ratio	Level Surcharged above Crown (ft.)
Site 9	0.140	0.296	2.1	23.5	5.56	0.24	-
Site 10	0.374	1.026	2.7	26.25	9.27	0.35	-
Site 11	0.186	0.554	3.0	26.5	4.78	0.18	-
Site 12	2.925	7.485	2.6	54	18.10	0.34	-
Site 13	0.780	4.346	5.6	35.5	13.78	0.39	-
Site 14	0.165	0.866	5.2	21	2.82	0.13	-
Site 15	0.016	0.079	4.9	10	2.45	0.25	-
Site 16	0.138	0.318	2.3	12	9.51	0.79	-
Site 17	0.228	1.123	4.9	15	6.20	0.41	-
Site 18	0.129	1.702	13.2	15	5.82	0.39	-
Site 19	0.351	0.818	2.3	21	6.43	0.31	-
Site 20	0.467	2.134	4.6	21	8.47	0.40	-
Site 21	0.079	0.266	3.4	12	4.26	0.36	-
Site 22	0.012	0.180	14.4	12	1.55	0.13	-
Site 23	0.074	0.226	3.0	23.5	2.78	0.12	-
Site 24	1.381	6.363	4.6	23.5	34.54	1.47	0.9
Site 25	0.106	0.422	4.0	21	4.14	0.20	-
Site 26	0.555	1.116	2.0	23.5	4.43	0.19	-
Site 27	0.434	1.151	2.6	18	31.66	1.76	1.1

The following capacity analysis results are noted:

- **Peaking Factor:** Peaking factor is defined as the peak measured flow divided by the average dry weather flow (ADWF). A peaking factor threshold value of 3.0 is commonly used for sanitary sewer design. Thirteen out of 27 sites had peaking factors higher than the common threshold value. It should be noted that a high peaking factors for some of the sites can be a result of very low ADWF.
- ***d*/*D* Ratio:** The *d*/*D* ratio is the peak measured depth of flow (*d*) divided by the pipe diameter (*D*). A *d*/*D* ratio of 0.75 is a common maximum threshold value used for pipe design. The *d*/*D* ratio for each site was computed based on the maximum depth of flow for the flow monitoring study. Sites 24 and 27 reached a surcharged condition during the study.

Figure 1 and Figure 2 show bar graphs summarizing the site by site peaking factors and d/D ratios, respectively.

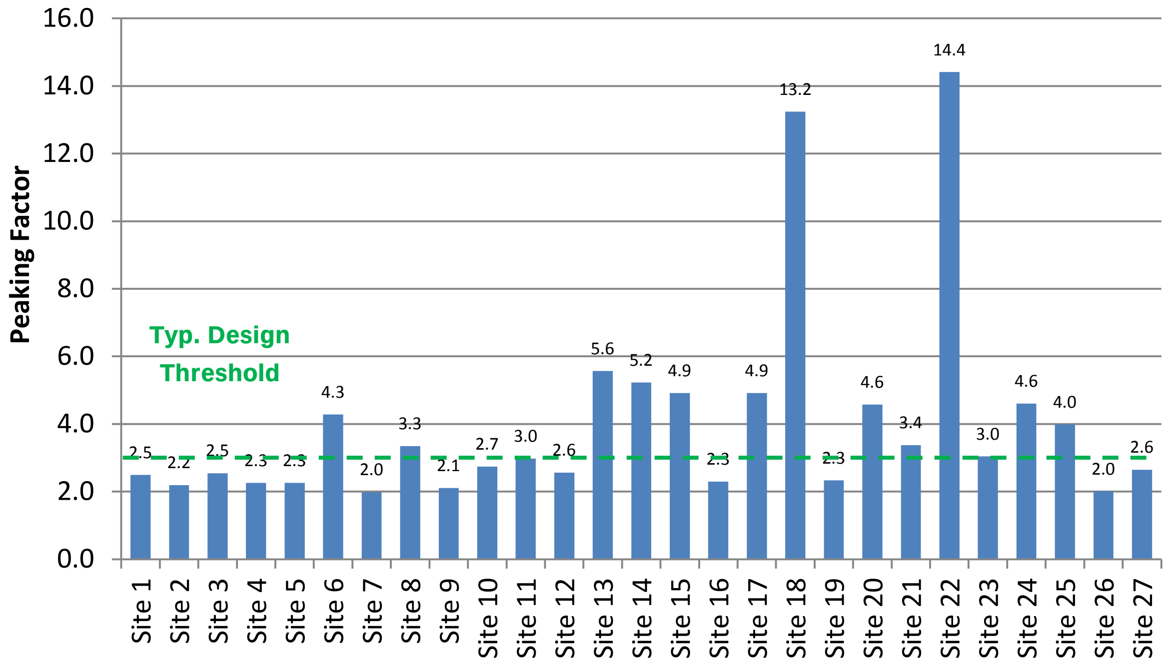


Figure 1. Capacity Summary: Peaking Factors

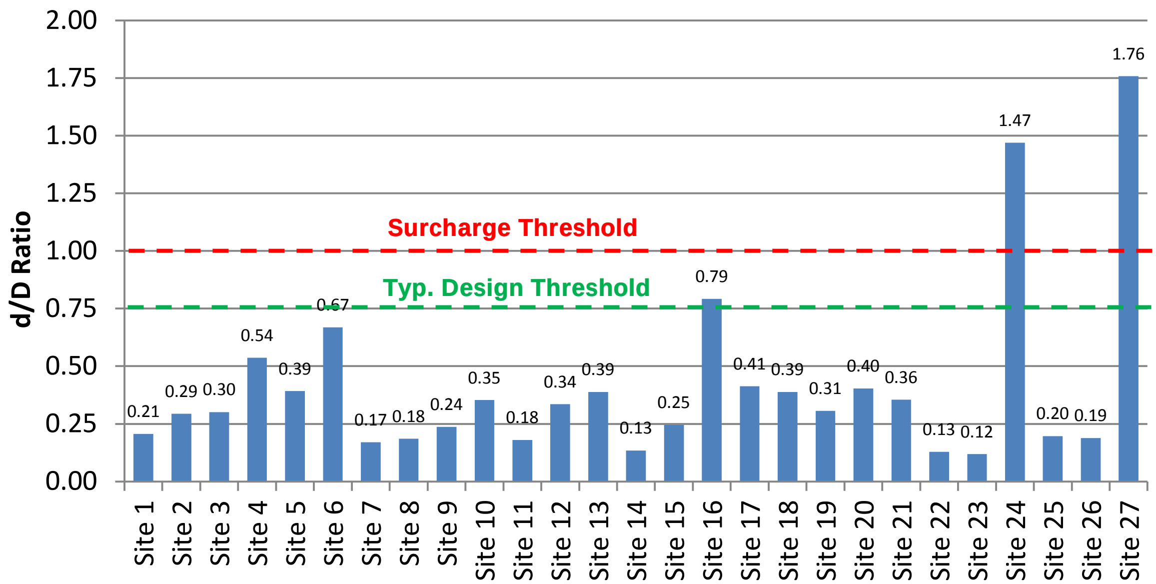


Figure 2. Capacity Summary: d/D Ratios

Site Inflow and Infiltration Analysis Results

Table 3 summarizes the I/I analysis results per each flow monitoring site for this study. I/I analysis was based on the rainfall event occurred on February 28 through March 1, 2014. The following additional information should be noted.

- The method of normalization for this study is only based on ADWF. There is potential for sites with extremely low ADWF measurements to be skewed high. Sites 6, 8, 15, 16, 21, 22 and 23 have average dry weather flows less than 0.1 mgd.
- The results and analyses of this report are given for informational purposes. The District engineer (or representative) should conduct proper due diligence and use the analyses presented in this report at his/her discretion.
- For Peak I/I, RDI and Total I/I analyses, the applicable ratios in the upper third (highest eight ratios) of the flow monitoring sites are shown color coded in red.

Table 3. Summary of Inflow/Infiltration Analysis[4]

Site	ADWF (mgd)	Peak I/I Rate (mgd)	Peak I/I per ADWF Ratio	RDI Rate (mgd)	RDI per ADWF Ratio	Total I/I (gallons)	Total I/I per ADWF Ratio	Ground Water Infiltration Issue?
Site 1	0.194	0.239	1.2	Negl.	0.0%	53,000	0.10	-
Site 2	0.417	0.476	1.1	0.045	8.5%	161,000	0.16	-
Site 3	0.141	0.224	1.6	0.017	9.2%	59,000	0.17	-
Site 4	0.237	0.182	0.8	0.005	1.6%	19,000	0.03	-
Site 5	2.089	2.605	1.2	0.103	3.7%	604,000	0.12	-
Site 6	0.076	0.200	2.6	0.031	25.1%	145,000	0.79	-
Site 7	0.222	0.116	0.5	0.016	5.5%	62,000	0.12	-
Site 8	0.047	0.054	1.2	0.009	14.1%	26,000	0.23	-
Site 9	0.140	0.126	0.9	0.008	4.2%	41,000	0.12	-
Site 10	0.374	0.607	1.6	0.032	6.3%	232,000	0.26	-
Site 11	0.186	0.347	1.9	Negl.	0.0%	36,000	0.08	Yes
Site 12	2.925	4.289	1.5	0.900	22.8%	3,697,000	0.53	-
Site 13	0.780	3.396	4.4	0.854	81.4%	3,156,000	1.50	-
Site 14	0.165	0.689	4.2	Negl.	0.0%	58,000	0.13	-
Site 15	0.016	0.059	3.6	0.004	16.0%	39,000	0.90	-
Site 16	0.138	n/a	n/a	n/a	n/a	n/a	n/a	Yes
Site 17	0.228	0.910	4.0	0.090	31.9%	506,000	0.82	-
Site 18	0.129	1.526	11.9	0.130	80.5%	515,000	1.49	-
Site 19	0.351	0.446	1.3	0.077	18.2%	198,000	0.21	-
Site 20	0.467	1.616	3.5	0.087	13.7%	607,000	0.48	-
Site 21	0.079	0.185	2.3	0.021	21.1%	74,000	0.29	-

[4] n/a = not applicable. Site 16 was not monitored for the rainfall event; there was no rain dependent I/I analysis completed for this site. I/I flow rate is the measured flow less the expected ADWF, yielding the I/I flow rate attributed to rainfall. The peak I/I rate is the peak of the I/I flow rate and is used as an indicator of inflow. The Peak I/I per ADWF ratio is the Peak I/I Rate divided by the ADWF – this is similar to peaking factor. Please refer to the I/I methods section for more information.

Site	ADWF (mgd)	Peak I/I Rate (mgd)	Peak I/I per ADWF Ratio	RDI Rate (mgd)	RDI per ADWF Ratio	Total I/I (gallons)	Total I/I per ADWF Ratio	Ground Water Infiltration Issue?
Site 22	0.012	0.168	13.5	0.003	22.2%	24,000	0.60	-
Site 23	0.074	0.133	1.8	0.014	15.3%	35,000	0.13	-
Site 24	1.381	4.768	3.5	0.284	15.9%	1,129,000	0.25	-
Site 25	0.106	0.273	2.6	0.040	33.2%	109,000	0.27	-
Site 26	0.555	0.434	0.8	0.033	4.8%	183,000	0.09	-
Site 27	0.434	0.643	1.5	0.104	30.1%	256,000	0.18	-

Recommendations

V&A advises that future I/I reduction plans consider the following recommendations:

1. **Determine I/I Reduction Program:** The District should examine its I/I reduction needs to determine a future I/I reduction program.
   a. If peak flows, sanitary sewer overflows, and pipeline capacity issues are of greater concern, then priority can be given to investigate and reduce sources of inflow within the basins with the greatest inflow problems. The highest inflow was occurring in the upstream basins of Sites 13, 14, 15, 17, 18, 20, 22 and 24.
   b. If total infiltration and general pipeline deterioration are of greater concern, then the program can be weighted to investigate and reduce sources of infiltration within the basins with the greatest infiltration problems.
      i. The highest normalized rainfall-dependent infiltration was occurring in the upstream basins of Sites 6, 12, 13, 17, 18, 22, 25, and 27.
      ii. The highest groundwater infiltration was occurring in the upstream basins of Sites 11 and 16.
2. **I/I Investigation Methods:** Potential I/I investigation methods include the following:
   a. Smoke testing
   b. Mini-basin flow monitoring
   c. Nighttime reconnaissance work to (1) investigate and determine direct point sources of inflow and (2) determine the areas and pipe reaches responsible for high levels of infiltration contribution.
3. **I/I Reduction Cost-Effectiveness Analysis:** The City should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow and infiltration and systematically rehabilitating or replacing the faulty pipelines or (2) continued treatment of the additional rainfall-dependent I/I flow.
4. **Downstream Pipe Capacity Analysis:** High levels of inflow resulted in peak flow problems at Sites 24 and 27 where surcharged conditions occurred. If bigger storm events occur, this issue can become more severe and can result in a sanitary sewer overflow (SSO). Pipeline capacity issues within the local collection system should be analyzed to minimize the potential for SSOs.

INTRODUCTION

Scope and Purpose

V&A has completed sanitary sewer flow monitoring and rainfall monitoring with inflow and infiltration (I/I) analysis within the District. Flow and rainfall monitoring was performed over a period of approximately one month from February 21 to March 30, 2014 at 27 open-channel flow monitoring sites and three rain gauge locations. The purpose of this study was to measure sanitary sewer flows at the flow monitoring sites, estimate available sewer capacity and conduct analyses pertaining to infiltration and inflow (I/I) occurring in the basins upstream from the flow monitoring sites.

Flow Monitoring Sites and Rain Gauges

Flow monitoring sites are the locations where the flow monitors were placed. Capacity and flow rate information is presented on a site-by-site basis. Rain data was obtained from three rain gauges installed by V&A. The flow monitoring and rain gauge locations are listed in Table 4 and shown in Figure 3.

Table 4. List of Flow Monitoring and Rain Gauge Locations

Monitoring Site	Manhole ID	Pipe Diameter (in)	Location
Site 1	82	10	Eagle Run Street and Abbeywood Drive Latitude: 33.7306°; Longitude: -117.4254° Rim Elevation: 1364 feet above sea level
Site 2	702	12	Lakeshore Drive, between Orange Street and Machado Street Latitude: 33.6894°; Longitude: -117.3745° Rim Elevation: 1323 feet above sea level
Site 3	951	14.5	Machado Street, between Broadway Street and Lakeshore Drive Latitude: 33.6882°; Longitude: -117.3744° Rim Elevation: 1323 feet above sea level
Site 4	1410	12	North of Lehr Drive and Riverside Drive Latitude: 33.6832°; Longitude: -117.3677° Rim Elevation: 1280 feet above sea level
Site 5	1440	29.5	Inside the Treatment Plant Latitude: 33.6836°; Longitude: -117.3431° Rim Elevation: 1266 feet above sea level
Site 6	1035	24	Pasadena Avenue and 3rd Street Latitude: 33.6854°; Longitude: -117.3403° Rim Elevation: 1261 feet above sea level
Site 7	8698	15	Collier Avenue and 3rd Street Latitude: 33.6882°; Longitude: -117.336° Rim Elevation: 1277 feet above sea level
Site 8	8697	14.5	W Minthorn Street and 3rd Street Latitude: 33.6867°; Longitude: -117.3377° Rim Elevation: 1275 feet above sea level

Monitoring Site	Manhole ID	Pipe Diameter (in)	Location
Site 9	1463	23.5	Between Chaney Street and Collier Avenue Latitude: 33.6802°; Longitude: -117.336° Rim Elevation: 1264 feet above sea level
Site 10	1450	26.25	In the east of the Treatment Plant Latitude: 33.6817°; Longitude: -117.3392° Rim Elevation: 1268 feet above sea level
Site 11	1455	26.5	Between Chaney Street and Collier Avenue Latitude: 33.681°; Longitude: -117.3333° Rim Elevation: 1277 feet above sea level
Site 12	10094	54	Between Chaney Street and Collier Avenue Latitude: 33.6815°; Longitude: -117.3311° Rim Elevation: 1279 feet above sea level
Site 13	2976	35.5	North of Elm Street and E Lakeshore Drive Latitude: 33.6622°; Longitude: -117.304° Rim Elevation: 1281 feet above sea level
Site 14	2555	21	South end of Via De La Valle Latitude: 33.6714°; Longitude: -117.2719° Rim Elevation: 1334 feet above sea level
Site 15	768	10	North of Pinto Drive and Big Range Road Latitude: 33.6946°; Longitude: -117.2699° Rim Elevation: 1405 feet above sea level
Site 16	1151	12	East of Lighthouse Drive and Wake Court Latitude: 33.6859°; Longitude: -117.2646° Rim Elevation: 1404 feet above sea level
Site 17	2235	15	East end of Early Round Drive Latitude: 33.6748°; Longitude: -117.2615° Rim Elevation: 1404 feet above sea level
Site 18	1688	15	Gray Fox Drive and Blue Bird Drive Latitude: 33.6802°; Longitude: -117.2591° Rim Elevation: 1390 feet above sea level
Site 19	5998	21	West of Sprucewood Way and Canyon Hills Road Latitude: 33.6645°; Longitude: -117.2575° Rim Elevation: 1478 feet above sea level
Site 20	2888	21	Longhorn Drive Latitude: 33.6645°; Longitude: -117.2774° Rim Elevation: 1321 feet above sea level
Site 21	3682	12	East of Orchard Street and Bundy Canyon Road Latitude: 33.6269°; Longitude: -117.2818° Rim Elevation: 1332 feet above sea level
Site 22	3466	12	East of Lemon Street and Jaro Drive Latitude: 33.6343°; Longitude: -117.2865° Rim Elevation: 1304 feet above sea level
Site 23	4240	23.5	McVicar Street near Palomar Street Latitude: 33.5952°; Longitude: -117.2639° Rim Elevation: 1218 feet above sea level
Site 24	3836	14.5	Mission Trail and Canyon Drive Latitude: 33.6237°; Longitude: -117.2903° Rim Elevation: 1293 feet above sea level

Monitoring Site	Manhole ID	Pipe Diameter (in)	Location
Site 25	7175	21	East of Catt Road and Palomar Street Latitude: 33.5947°; Longitude: -117.26° Rim Elevation: 1217 feet above sea level
Site 26	5039	23.5	Catt Road and Lexi Lane Latitude: 33.5978°; Longitude: -117.2513° Rim Elevation: 1303 feet above sea level
Site 27	3447	18	Mission Trail and Corydon Road Latitude: 33.6317°; Longitude: -117.2922° Rim Elevation: 1279 feet above sea level
Rain Gauges			
RG 1		Elsinore Valley Wastewater Treatment Plant Latitude: 33.683145°; Longitude: -117.342613°	
RG 2		By Canyon Lake Latitude: 33.685835°; Longitude: -117.264899°	
RG 3		Wildomar Pump Station Latitude: 33.596662°; Longitude: -117.262929°	

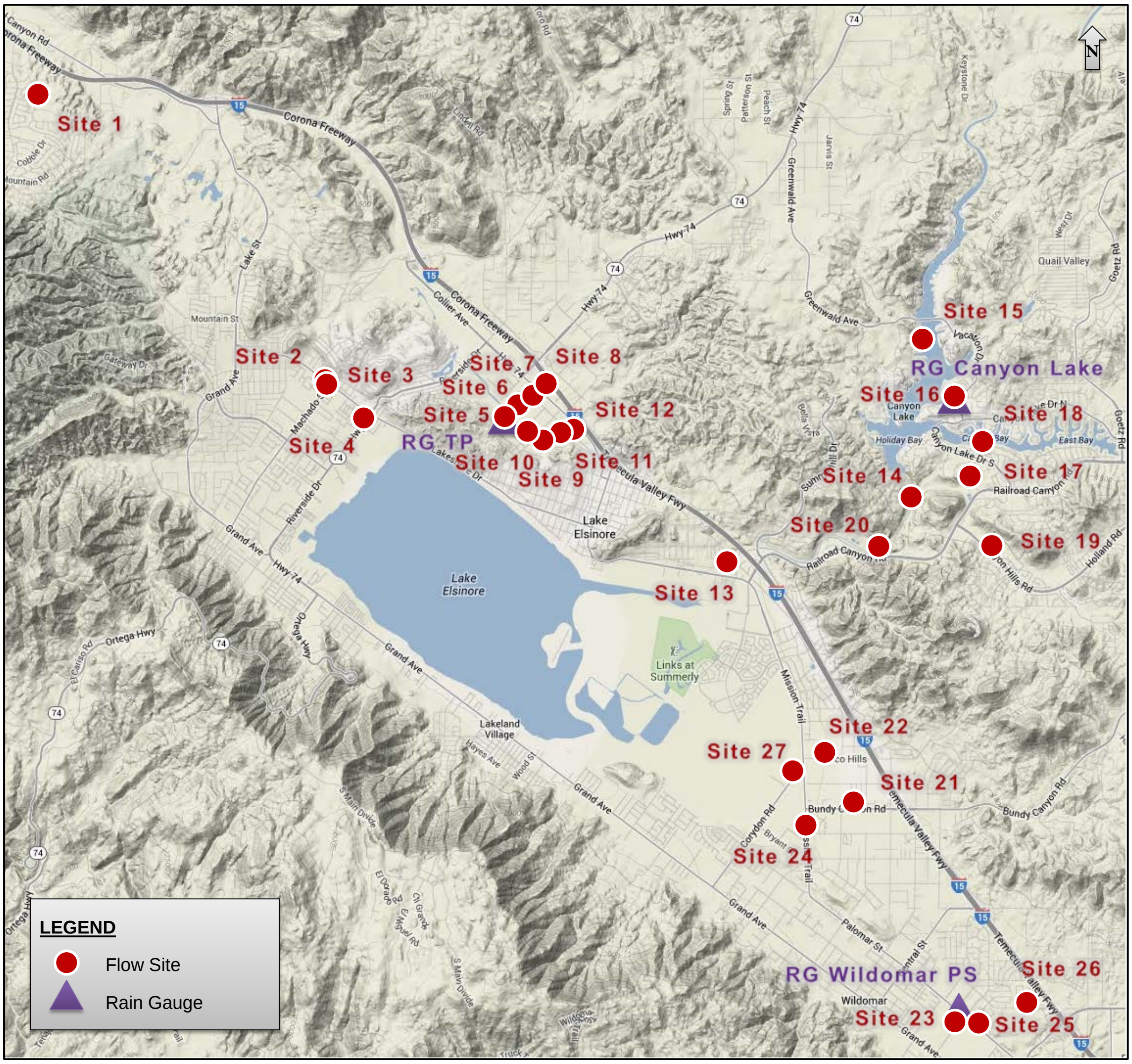


Figure 3. Map of Flow Monitoring Sites and Rain Gauges

METHODS AND PROCEDURES

Confined Space Entry

After the flow monitoring sites were determined, a confined space entry was followed in order to install the flow meter into the manhole. A confined space (Photo 1) is defined as any space that is large enough and so configured that a person can bodily enter and perform assigned work, has limited or restricted means for entry or exit and is not designed for continuous employee occupancy. In general, the atmosphere must be constantly monitored for sufficient levels of oxygen (19.5% to 23.0%), and the absence of hydrogen sulfide (H_2S) gas, carbon monoxide (CO) gas, and lower explosive limit (LEL) levels. A typical confined space entry crew has members with OSHA-defined responsibilities of Entrant, Attendant and Supervisor. The Entrant is the individual performing the work. He or she is equipped with the necessary personal protective equipment needed to perform the job safely, including a personal four-gas monitor (Photo 2). If it is not possible to maintain line-of-sight with the Entrant, then more Entrants are required until line-of-sight can be maintained. The Attendant is responsible for maintaining contact with the Entrants to monitor the atmosphere using another four-gas monitor and maintaining records of all Entrants, if there is more than one. The Supervisor is responsible for developing the safe work plan for the job at hand prior to entering.

Photo 1. Confined Space Entry

Photo 2. Typical Personal Four-Gas Monitor

Flow Meter Installation

V&A installed one Teledyne Isco 2150 meter in each monitoring site listed in Table 4. Isco 2150 meters use submerged sensors with a pressure transducer to collect depth readings and an ultrasonic Doppler sensor to determine the average fluid velocity. The ultrasonic sensor emits high-frequency sound waves, which are reflected by air bubbles and suspended particles in the flow. The sensor receives the reflected signal and determines the Doppler frequency shift, which indicates the estimated average flow velocity. The sensor is typically mounted at a manhole inlet to take advantage of smoother upstream flow conditions. The sensor may be offset to one side to lessen the chances of fouling and sedimentation where these problems are expected to occur. Manual level and velocity measurements were taken during installation of the flow meters and again when they were removed and compared to simultaneous level and velocity readings from the flow meters to ensure proper calibration and accuracy. Figure 4 shows a typical installation for a flow meter with a submerged sensor.

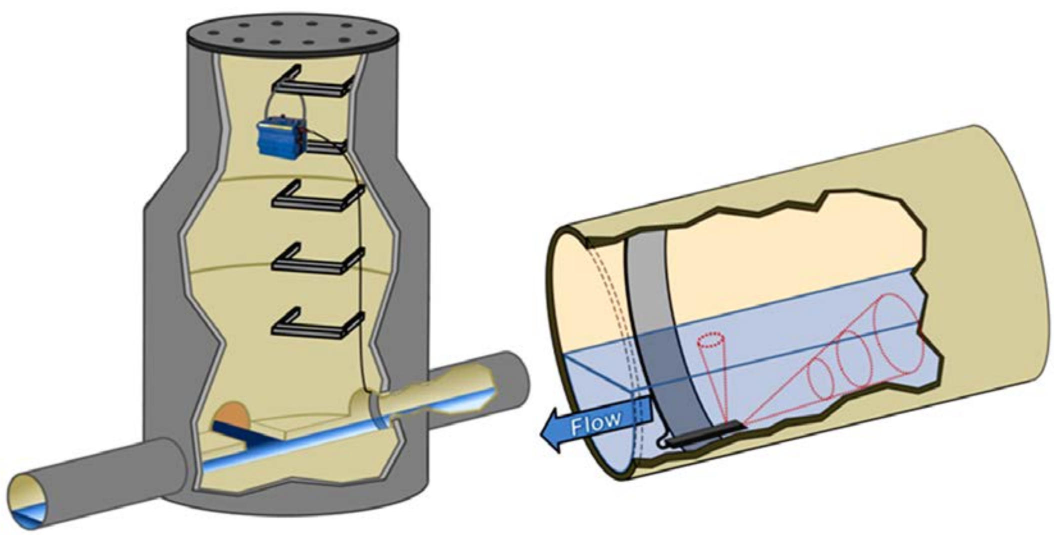


Figure 4. Typical Installation for Flow Meter with Submerged Sensor

Flow Calculation

Data retrieved from the flow meter was placed into a spreadsheet program for analysis. Data analysis includes data comparison to field calibration measurements, as well as necessary geometric adjustments as required for sediment (sediment reduces the pipe's wetted cross-sectional area available to carry flow). Area-velocity flow metering uses the continuity equation,

$$Q = V \cdot A$$

where *Q* is the volume flow rate, *V* is the average velocity as determined by the ultrasonic sensor, and *A* is the cross-sectional area of flow as determined from the depth of flow. For circular pipe,

$$A = \left[\frac{D^2}{4}\cos^{-1}\left(1-\frac{2d}{D}\right)\right] - \left[\left(\frac{D}{2}-d\right)\left(\frac{D}{2}\right)\sin\left(\cos^{-1}\left(1-\frac{2d}{D}\right)\right)\right]$$

where *D* is the pipe diameter and *d* is the depth of flow.

Background Knowledge of Inflow / Infiltration

Inflow and infiltration (I/I) consists of storm water and groundwater that enter the sewer system through pipe defects and improper storm drainage connections and is defined as follows:

Definition and Typical Sources

- **Inflow:** Storm water inflow is defined as water discharged into the sewer system, including private sewer laterals, from direct connections such as downspouts, yard and area drains, holes in manhole covers, cross-connections from storm drains, or catch basins.
- **Infiltration:** Infiltration is defined as water entering the sanitary sewer system through defects in pipes, pipe joints, and manhole walls, which may include cracks, offset joints, root intrusion points, and broken pipes.

Figure 5 illustrates the possible sources and components of I/I.

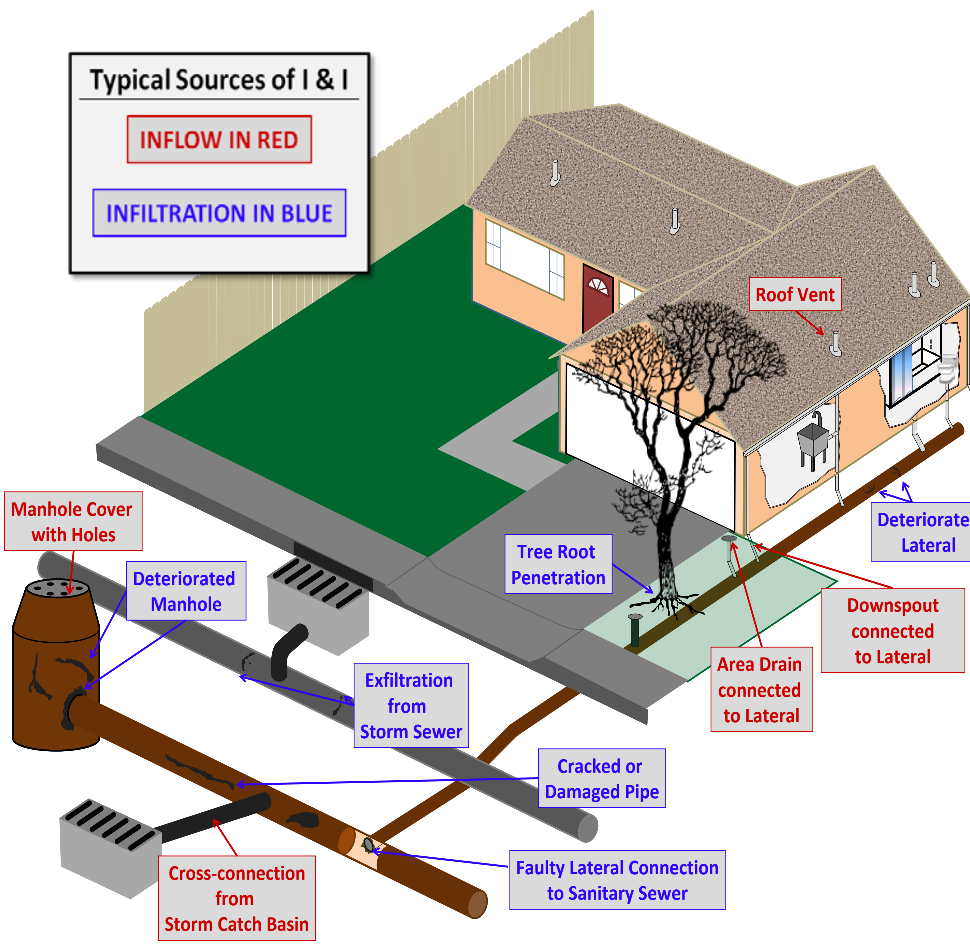


Figure 5. Typical Sources of Infiltration and Inflow

Infiltration Components

Infiltration can be further subdivided into components as follows:

- **Groundwater Infiltration:** Groundwater infiltration depends on the depth of the groundwater table above the pipelines as well as the percentage of the system submerged. The variation of groundwater levels and subsequent groundwater infiltration rates is seasonal by nature. On a day-to-day basis, groundwater infiltration rates are relatively steady and will not fluctuate greatly.
- **Rainfall-Dependent Infiltration:** This component occurs as a result of storm water and enters the sewer system through pipe defects, as with groundwater infiltration. The storm water first percolates directly into the soil and then migrates to an infiltration point. Typically, the time of concentration for rainfall-related infiltration may be 24 hours or longer, but this depends on the soil permeability and saturation levels.
- **Rainfall-Responsive Infiltration** is storm water which enters the collection system indirectly through pipe defects, but normally in sewers constructed close to the ground surface such as private laterals. Rainfall-responsive infiltration is independent of the groundwater table and reaches defective sewers via the pipe trench in which the sewer is constructed, particularly if the pipe is placed in impermeable soil and bedded and backfilled with a granular material. In this case, the pipe trench serves as a conduit similar to a French drain, conveying storm drainage to defective joints and other openings in the system. This type of infiltration can have a quick response and graphically can look very similar to inflow.

Impact and Cost of Source Detection and Removal

- **Inflow:**
  - **Impact:** This component of I/I creates a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows. Because the response and magnitude of inflow is tied closely to the intensity of the storm event, the short-term peak instantaneous flows may result in surcharging and overflows within a collection system. Severe inflow may result in sewage dilution, resulting in upsetting the biological treatment (secondary treatment) at the treatment facility.
  - **Cost of Source Identification and Removal:** Inflow locations are usually less difficult to find and less expensive to correct. These sources include direct and indirect cross-connections with storm drainage systems, roof downspouts, and various types of surface drains. Generally, the costs to identify and remove sources of inflow are low compared to potential benefits to public health and safety or the costs of building new facilities to convey and treat the resulting peak flows.

- **Infiltration:**
  - **Impact:** Infiltration typically creates long-term annual volumetric problems. The major impact is the cost of pumping and treating the additional volume of water, and of paying for treatment (for municipalities that are billed strictly on flow volume).
  - **Cost of Source Detection and Removal:** Infiltration sources are usually harder to find and more expensive to correct than inflow sources. Infiltration sources include defects in deteriorated sewer pipes or manholes that may be widespread throughout a sanitary sewer system.

Graphical Identification of I/I

Inflow is usually recognized graphically by large-magnitude, short-duration spikes immediately following a rain event. Infiltration is often recognized graphically by a gradual increase in flow after a wet-weather event. The increased flow typically sustains for a period after rainfall has stopped and then gradually drops off as soils become less saturated and as groundwater levels recede to normal levels. Real-time flows were plotted against ADWF to analyze the I/I response to rainfall events. Figure 6 illustrates a sample of how this analysis is conducted and some of the measurements that are used to distinguish infiltration and inflow. Similar graphs were generated for the individual flow monitoring sites and can be found in *Appendix A*.

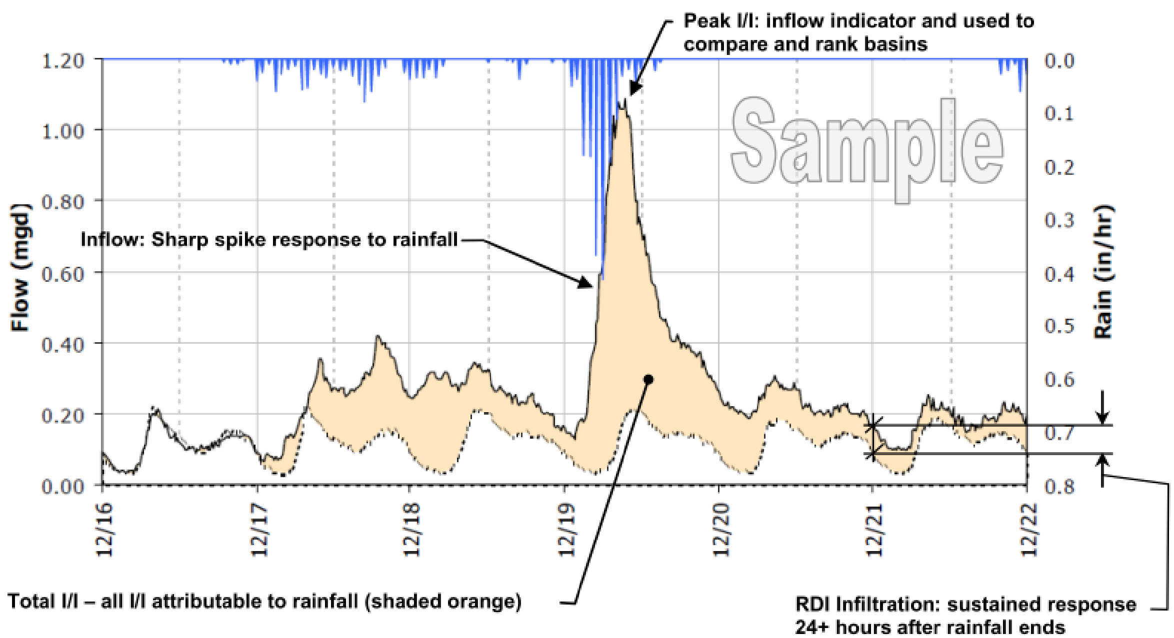


Figure 6. Sample Infiltration and Inflow Isolation Graph

Figure 7 shows sample graphs indicating the typical graphical response patterns for inflow and infiltration in a more detailed version.

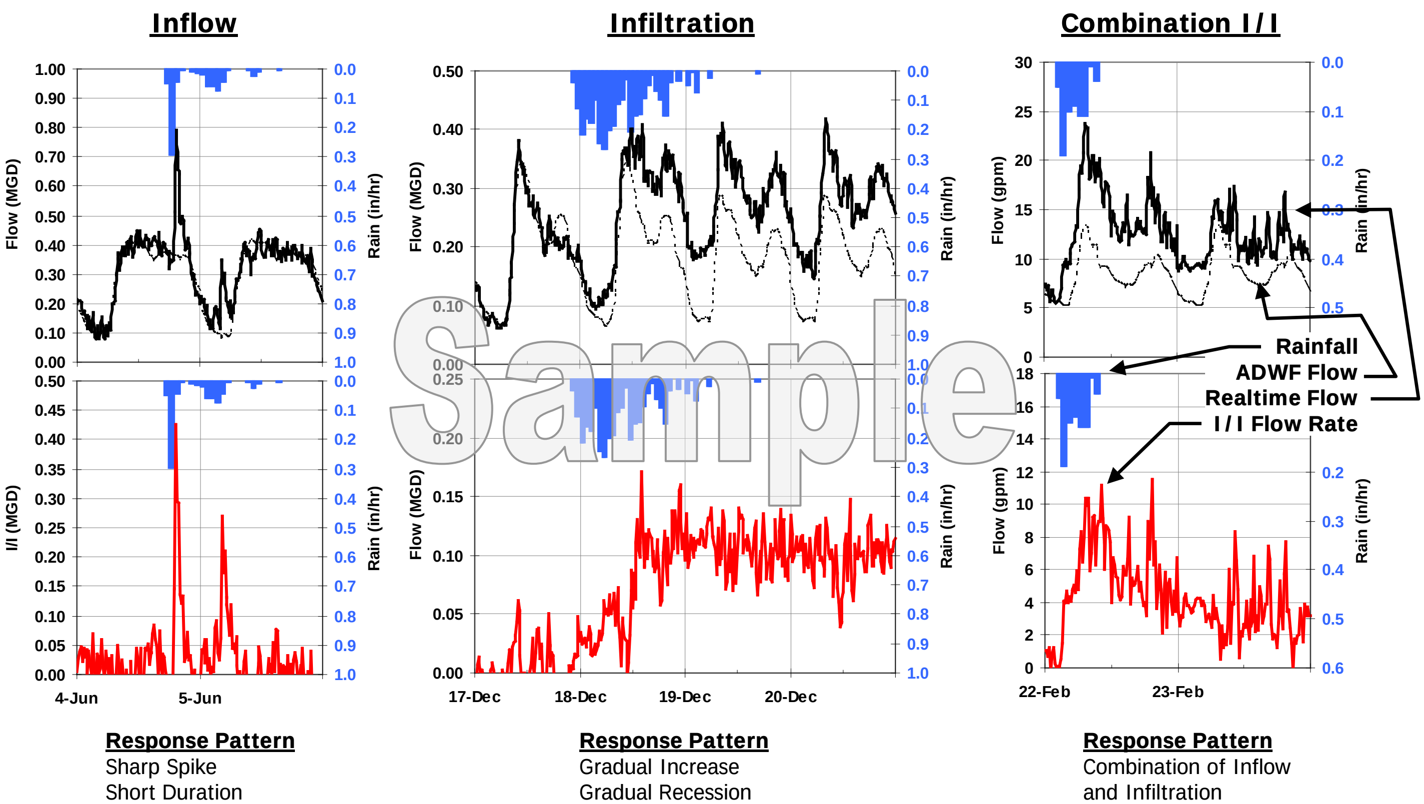


Figure 7. Inflow and Infiltration: Graphical Response Patterns

Analysis Methods

After differentiating I/I flows from ADWF flows, various calculations can be made to: (1) determine which I/I component (inflow or infiltration) is more prevalent at a particular site, and (2) to compare the relative magnitude of the I/I components between drainage basins and between storm events. Some analysis methods are shown as follows:

Inflow Indicators

Inflow is characterized by sharp, direct spikes occurring during a rainfall event. Peak I/I rates are used for inflow analysis[5]. After determining the peak I/I flow rate for a given site, and for a given storm event, there are three ways to *normalize* the peak I/I rates for an "apples-to-apples" comparison amongst the different drainage basins:

- ***Peak I/I Flow Rate per IDM:*** Peak measured I/I rate divided by length of pipe within the drainage basin, expressed in units of inch-diameter-mile (IDM) (miles of pipeline multiplied by the diameter of the pipeline in inches).

[5] I/I flow rate is the realtime flow less the estimated average dry weather flow rate. It is an estimate of flows attributable to rainfall. By using peak measured flow rates (inclusive of ADWF), the I/I flow rate would be skewed higher or lower depending on whether the storm event I/I response occurs during low flow or high flow hours.

- ***Peak I/I Flow Rate per Acre:*** Peak measured I/I rate divided by the geographic area of the upstream basin in acres.
- ***Peak I/I Flow Rate to ADWF Ratio:*** Peak measured I/I rate divided by average dry weather flow (ADWF). This is a ratio and is expressed without units.

Infiltration Indicators

- **Rainfall-Dependent Infiltration:** Infiltration occurring after the conclusion of a storm event is classified as rainfall-dependent infiltration. Analysis is conducted by looking at the infiltration rates at set periods after the conclusion of a storm event. Depending on the system and the time required for flows to return to ADWF levels, different set periods may be examined to determine the basins with the greatest or most sustained rainfall-dependent infiltration rates.

- **Dry Weather Groundwater Infiltration:** GWI analysis is conducted by looking at minimum dry weather flow to average dry weather flow ratios and comparing them to established standards to quantify the rate of excess groundwater infiltration. As with inflow, GWI infiltration rates can be normalized by means of pipe length (IDM), basin area (acres), and dry weather flow rates (ADWF). These methods are discussed in further detail in the *Groundwater Analysis* section later in this report.

Combined I/I Indicators

The total inflow and infiltration is measured in gallons per site and per storm event. Because it is based on total I/I volume, it is an indicator of combined inflow and infiltration and is used to identify the overall volumetric influence of I/I within the monitoring basin. As with inflow, pipe length, basin area, and dry weather flow are used to normalize combined I/I for basin comparison:

- ***Combined I/I Flow Rate per IDM:*** Total infiltration (gallons) divided by length of pipe (IDM) and divided by storm event rainfall (inches of rain).
- ***R-Value:*** Total infiltration (gallons) divided by the total rainfall that fell within the acreage of a particular basin (gallons of rainfall). This is expressed as a percentage and is explained as "the percent of rain that falls that enters the sanitary sewer collection system." Systems with R-values less than 5%[6] are often considered to be performing well.
- ***Combined I/I Flow Rate per ADWF:*** Total infiltration (gallons) divided by the ADWF (gpd) and divided by storm event rainfall (inches of rain).

The "per-IDM" and "per-ACRE" normalization methods require the measurements (boundary conditions and length of pipe) of the basins upstream from the flow monitoring sites. This information was not available; the "per-ADWF" method was the only method used to compare I/I response amongst the flow monitoring sites.

[6] Keefe, P.N. "Test Basins for I/I Reduction and SSO Elimination." 1998 WEF Wet Weather Specialty Conference, Cleveland.

RESULTS AND ANALYSIS

Rainfall Event Analysis

In order to perform I/I analysis, rainfall data should be collected in order to distinguish the wet weather days from the dry weather days. Rainfall intensity, duration, and frequency are also required to conduct the synthetic I/I analysis. Rain data collected from three sites was analyzed for the duration of the study to capture rainfall across the limits of the District boundary, illustrated earlier in Figure 3.

Rain Gauge Data

There was one major rainfall event that occurred over the course of the flow monitoring period. Figure 8 graphically displays the rainfall activity recorded at RG 1 over the flow monitoring period for illustration purpose.

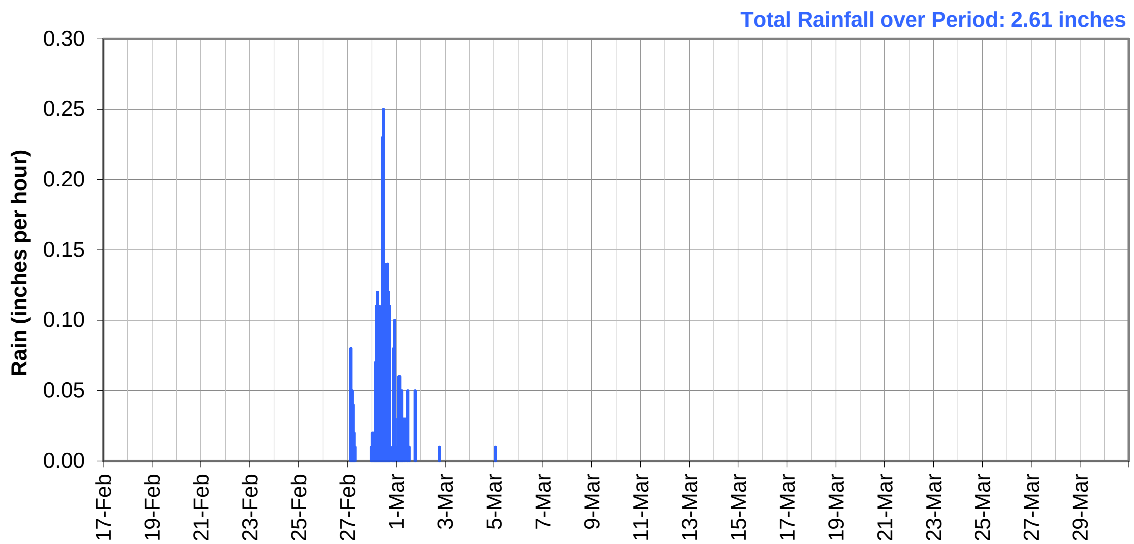


Figure 8. Rainfall Activity at the RG 1

Figure 9 shows the rain accumulation plot of the period rainfall, as well as the historical average rainfall[7] in the District during this project duration. The total historical rainfall is 3.2 inches.

[7] Historical data taken from the WRCC (Station 042805 in Elsinore): http://www.wrcc.dri.edu/summary/climsmsca.html

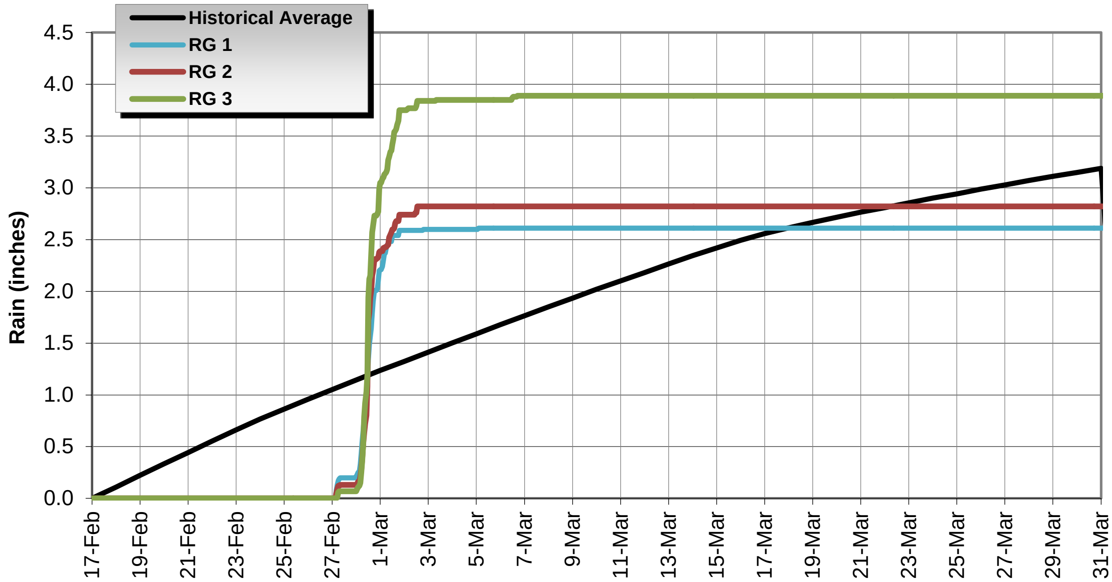


Figure 9. Accumulated Precipitation Monitored from Different Locations

Rainfall Event Classification

It is important to classify the relative size of a major storm event that occurs over the course of a flow monitoring period[8]. Storm events are classified by intensity and duration. Based on historical data, frequency contour maps for storm events of given intensity and duration have been developed by the National Oceanic and Atmospheric Administration (NOAA) for all areas within the continental United States. For example, the NOAA Rainfall Frequency Atlas[9] classifies a 10-year, 24-hour storm event in Elsinore Valley as approximately 3 to 4 inches (Figure 10). This means that in any given year, at this specific location, there is a 10% chance that 3 to 4 inches of rain will fall in any 24-hour period.

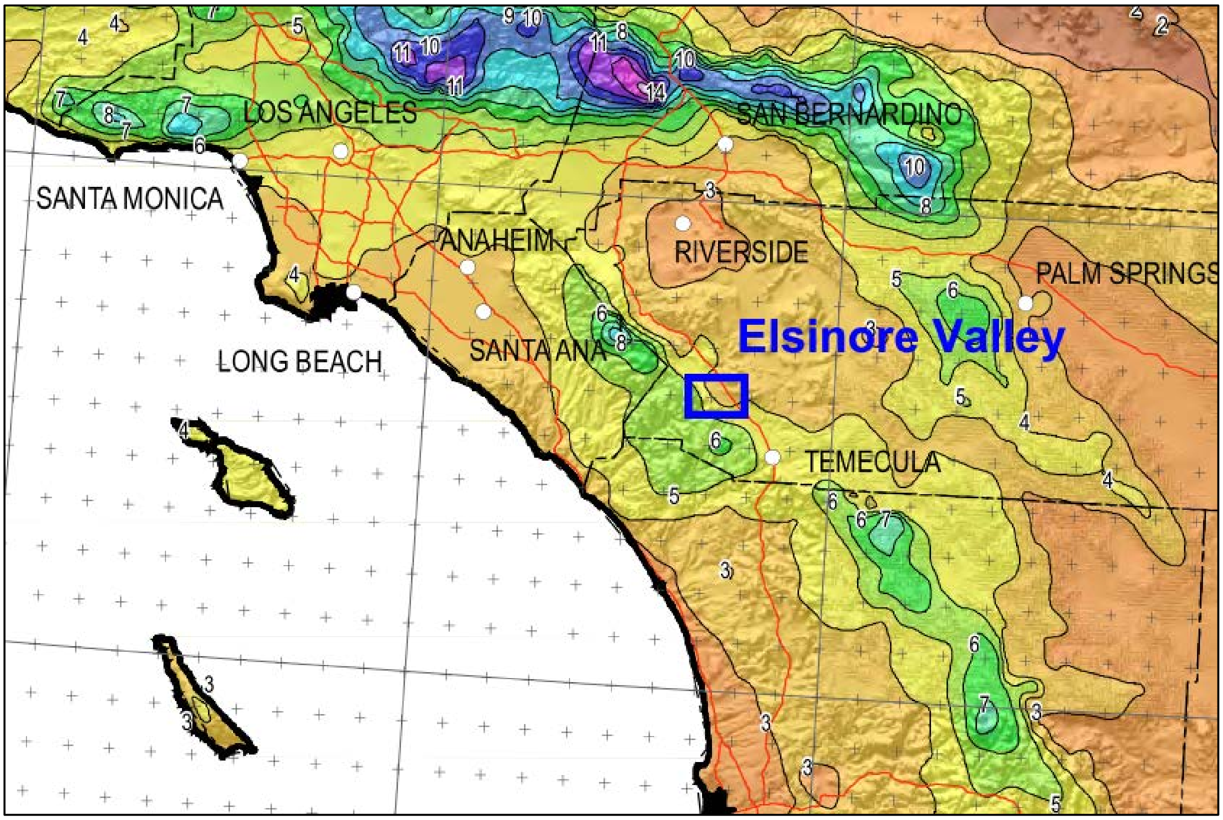


Figure 10. NOAA Isopluvials of 10-Year, 24-Hour Precipitation in inches

From the NOAA frequency maps, for a specific latitude and longitude, the rainfall densities for period durations ranging from 1 day to 10 days are known for rain events ranging from 1-year to 100-year intensities. These are plotted to develop a rain event frequency map specific to each rainfall monitoring site. Superimposing the peak measured densities for all the rainfall events on the rain event frequency plot determines the classification of the storm event, shown in Figure 11 through Figure 13 for all the rain gauges.

[8] Sanitary sewers are often designed to withstand I/I contribution to sanitary flows for specific-sized “design” storm events.

[9] NOAA Atlas 14, Volume 6, Version 2 California ftp://hdsc.nws.noaa.gov/pub/hdsc/data/sw/ca10y24h.pdf

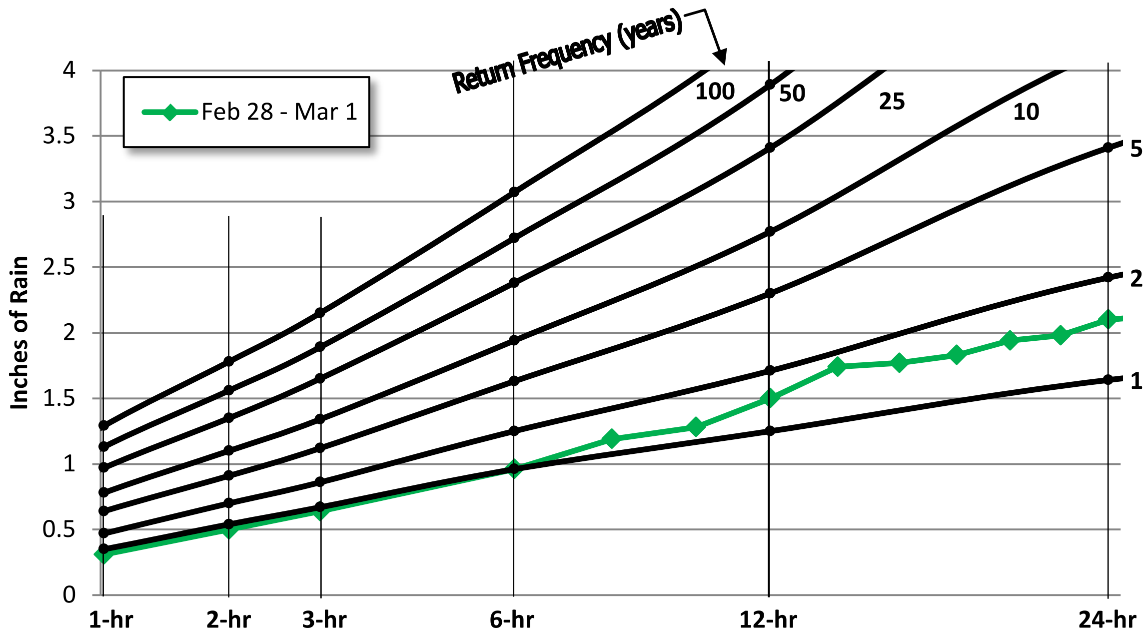


Figure 11. Storm Event Classification at RG 1

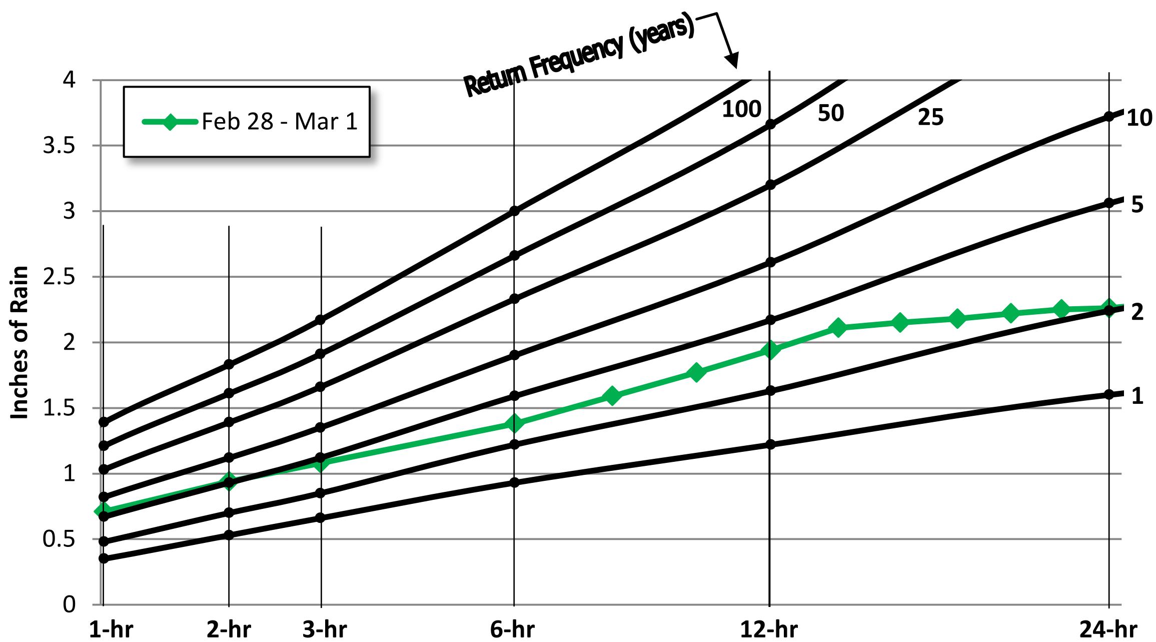


Figure 12. Storm Event Classification at RG 2

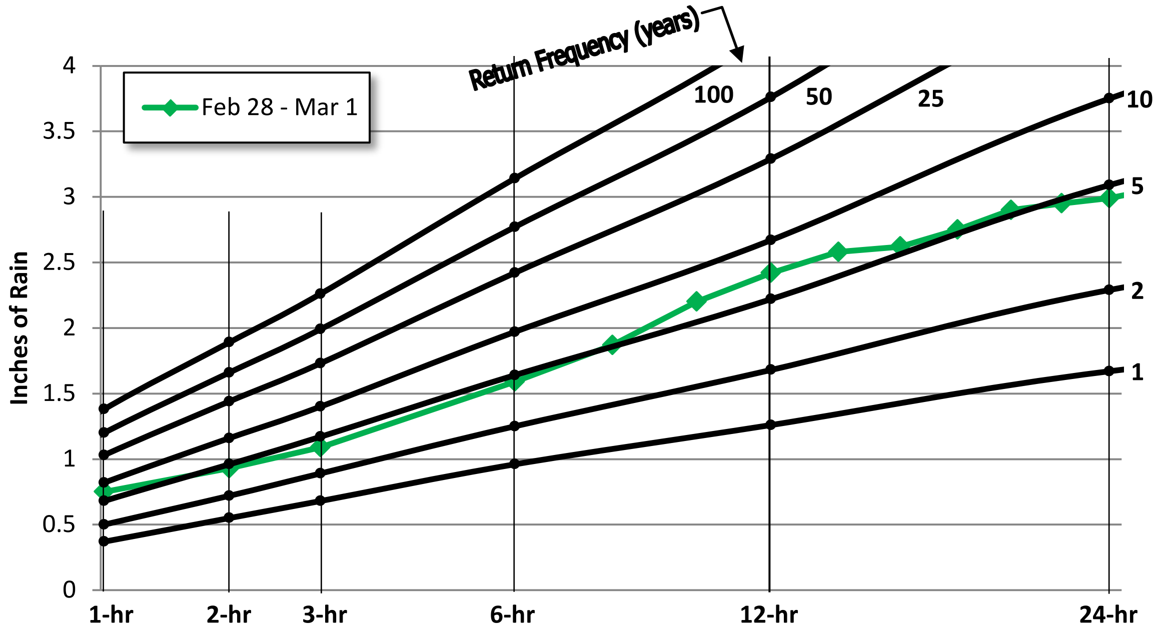


Figure 13. Storm Event Classification at RG 3

Table 5 summarizes the classification of the rainfall events that occurred during the flow monitoring period.

Table 5. Classification of Rainfall Events

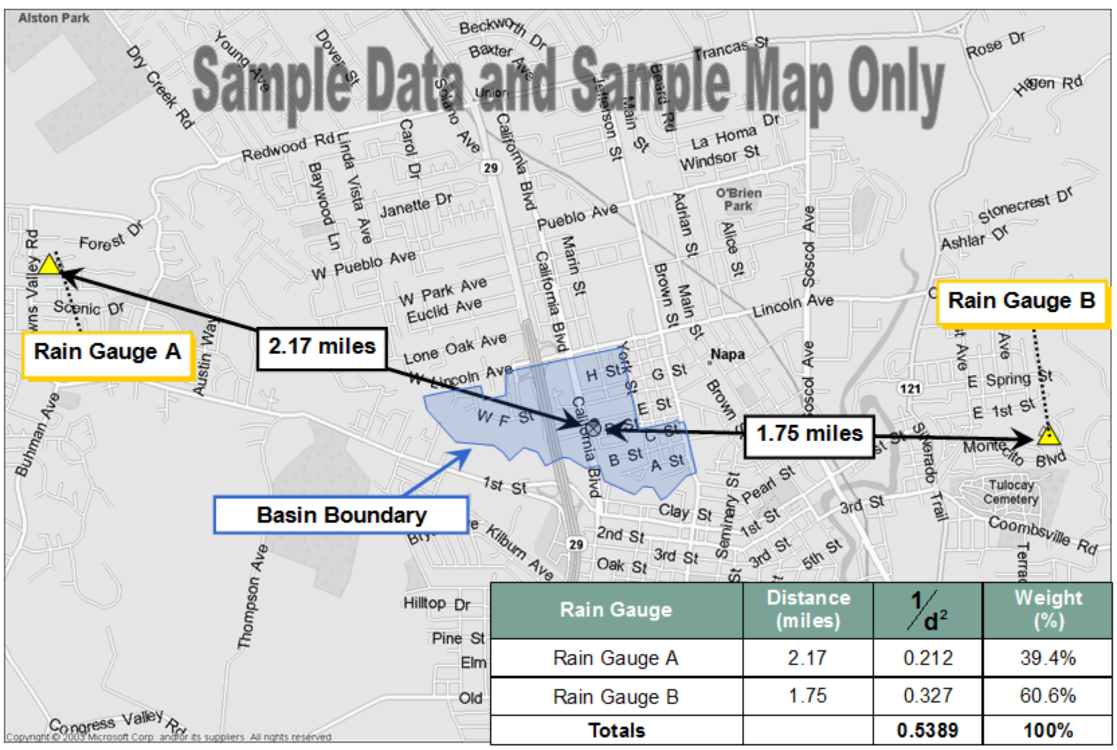
Rain Gauge	1-Hour Duration	6-Hour Duration	12-Hour Duration	24-Hour Duration
RG 1	1-Year	1-Year	1 to 2-Year	1 to 2-Year
RG 2	1-Year	2 to 5-Year	2 to 5-Year	2-Year
RG 3	5-Year	5-Year	5 to 10-Year	5-Year

Rainfall: Rain Gauge Triangulation

The rainfall affecting the sanitary sewer collection system basins must be calculated based on the proximity to the rain gauge locations. The mean precipitation for the sanitary sewer collection system was calculated by taking data from seven local rain gauges and using the Inverse Distance Weighting (IDW) method. The IDW is an interpolation method that assumes the influence of each rain gauge location diminishes with distance. The center of a sanitary sewer collection system was identified and a weighted average was taken of the precipitation data from nearby rain gauge locations. The IDW function is as follows:

$$weight(d) = \frac{1/d^p}{\sum 1/d^p}, \qquad \text{where:} \qquad d = \text{distance} \qquad p = \text{power } (p > 0)$$

The value of *p* is user defined. The most common choice for hydrological studies of watershed areas is *p* = 2. Figure 14 illustrates the IDW method with sample data. In this study, the sizes of basins are very small even though the basin boundaries were not completely established. Therefore, the rain gauge triangulation was performed for the monitoring sites. The rain gauge distribution as calculated for each flow monitoring site is shown in Table 6.



Rain Gauge	Distance (miles)	$1/d^2$	Weight (%)
Rain Gauge A	2.17	0.212	39.4%
Rain Gauge B	1.75	0.327	60.6%
Totals		**0.5389**	**100%**

Figure 14. Rainfall Inverse Distance Weighting Method

Table 6. Rain Gauge Distribution by Monitoring Site

Monitoring Site	RG 1	RG 2	RG 3	Total Rainfall over Period
Site 1	65%	23%	12%	2.81
Site 2	91%	6%	3%	2.66
Site 3	91%	6%	3%	2.66
Site 4	91%	6%	3%	2.66
Site 5	100%	0%	0%	2.61
Site 6	100%	0%	0%	2.61
Site 7	100%	0%	0%	2.61
Site 8	100%	0%	0%	2.61
Site 9	100%	0%	0%	2.61
Site 10	100%	0%	0%	2.61
Site 11	100%	0%	0%	2.61
Site 12	100%	0%	0%	2.61
Site 13	0%	100%	0%	2.82
Site 14	0%	100%	0%	2.82
Site 15	0%	100%	0%	2.82
Site 16	0%	100%	0%	2.82
Site 17	0%	100%	0%	2.82
Site 18	0%	100%	0%	2.82
Site 19	0%	100%	0%	2.82
Site 20	0%	100%	0%	2.82
Site 21	18%	27%	55%	3.37
Site 22	18%	27%	55%	3.37
Site 23	0%	0%	100%	3.89
Site 24	18%	27%	55%	3.37
Site 25	0%	0%	100%	3.89
Site 26	0%	0%	100%	3.89
Site 27	18%	27%	55%	3.37

Flow Monitoring: Average Dry Weather Flows

Average Dry Weather Flow Calculation

Weekday and weekend flow patterns differ and must be separated when determining average dry weather flows. Days least affected by rainfall were used to estimate weekend and weekday average flows. Additionally, days that appeared to have normal flow patterns were selected over days that may have had unexplained loading patterns, such as peak discharge events. The overall average dry weather flow (ADWF) is calculated per the following equation:

$$ADWF = \left(ADWF_{Mon-Fri} \times \frac{5}{7} \right) + \left(ADWF_{Sat-Sun} \times \frac{2}{7} \right)$$

Figure 15 illustrates the varying flow patterns within a work week.

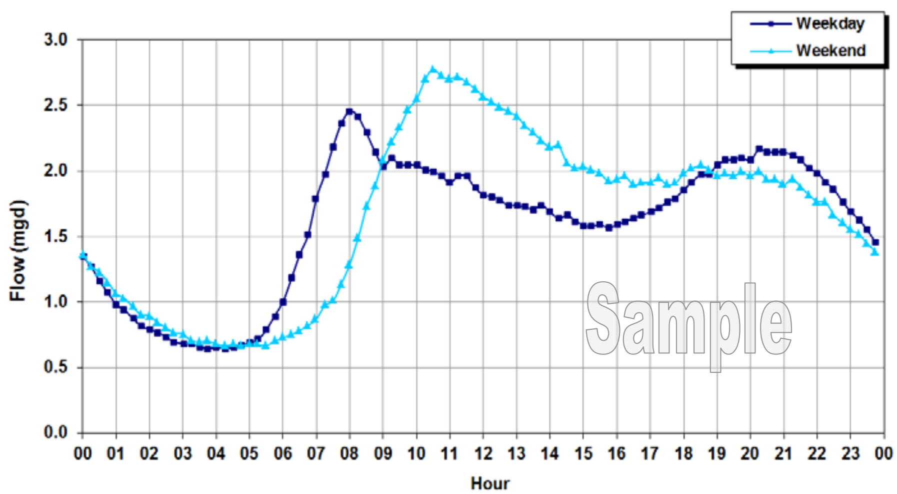


Figure 15. Sample ADWF Diurnal Flow Patterns

Table 7 lists the average dry weather flow (ADWF) recorded during this study for the flow monitoring sites. Detailed graphs of the flow monitoring data on a site-by-site basis are included in *Appendix A*.

Table 7. Dry Weather Flow Summary

Site	Weekday ADWF (mgd)	Weekend ADWF (mgd)	Overall ADWF (mgd)	Weekend / Weekday Ratio	Peak Dry Weather Flow (mgd)	Dry Weather Flow Peaking Factor	Days Used for ADWF Calculation
Site 1	0.185	0.218	0.194	1.18	0.386	1.98	2/25, 2/26, 3/2, 3/3, 3/4, 3/5
Site 2	0.404	0.448	0.417	1.11	0.777	1.86	2/21, 2/22, 2/26, 3/2, 3/3, 3/4, 3/5
Site 3	0.136	0.155	0.141	1.14	0.291	2.06	2/21, 2/22, 2/24, 2/25, 2/26, 3/2, 3/3, 3/4, 3/5
Site 4	0.230	0.252	0.237	1.09	0.429	1.81	2/21, 2/822, 2/25, 2/26, 2/27, 3/2, 3/4, 3/5

Site	Weekday ADWF (mgd)	Weekend ADWF (mgd)	Overall ADWF (mgd)	Weekend / Weekday Ratio	Peak Dry Weather Flow (mgd)	Dry Weather Flow Peaking Factor	Days Used for ADWF Calculation
Site 5	2.053	2.177	2.089	1.06	3.437	1.65	2/22, 2/23, 2/24, 2/25, 2/26, 3/2, 3/3, 3/4, 3/5
Site 6	0.074	0.083	0.076	1.12	0.183	2.39	2/21, 2/22, 2/23, 2/24, 2/25, 3/22, 3/23, 3/25, 3/26
Site 7	0.218	0.230	0.222	1.05	0.343	1.55	2/22, 2/23, 2/24, 2/25, 2/26, 3/2
Site 8	0.048	0.044	0.047	0.92	0.084	1.80	2/22, 2/23, 2/24, 2/26, 2/27, 3/6, 3/7, 3/8, 3/9
Site 9	0.139	0.143	0.140	1.03	0.228	1.63	2/22, 2/24, 2/25, 2/26, 3/2
Site 10	0.359	0.412	0.374	1.15	0.590	1.58	3/7, 3/8, 3/9, 3/10, 3/11, 3/12, 3/13, 3/14, 3/15, 3/16
Site 11	0.186	0.184	0.186	0.99	0.281	1.51	3/8, 3/9, 3/10, 3/11, 3/12, 3/13, 3/14, 3/15, 3/16
Site 12	2.901	2.985	2.925	1.03	4.608	1.58	2/21, 2/22, 2/25, 2/26
Site 13	0.757	0.836	0.780	1.11	1.715	2.20	3/18, 3/19, 3/20, 3/21, 3/22, 3/23, 3/24, 3/25
Site 14	0.156	0.189	0.165	1.21	0.313	1.89	2/22, 2/23, 2/24, 2/25, 2/26, 3/2, 3/3, 3/4, 3/5
Site 15	0.014	0.022	0.016	1.66	0.044	2.74	2/22, 2/23, 2/24, 2/25, 2/26, 2/27, 3/4, 3/5
Site 16	0.140	0.134	0.138	0.96	0.246	1.78	3/28, 3/29, 3/30, 3/31, 4/1, 4/2, ,4/3
Site 17	0.223	0.240	0.228	1.08	0.373	1.63	2/22, 2/23, 2/24, 2/25, 2/26
Site 18	0.124	0.140	0.129	1.13	0.363	2.82	2/22, 2/23, 2/24, 2/25, 2/26, 3/5, 3/6, 3/7, 3/8, 3/9, 3/10, 3/11, 3/12, 3/13
Site 19	0.347	0.360	0.351	1.04	0.628	1.79	2/22, 2/23, 2/24, 2/25, 2/26
Site 20	0.447	0.516	0.467	1.15	0.844	1.81	2/22, 2/23, 2/24, 2/25, 2/26, 2/27
Site 21	0.077	0.083	0.079	1.08	0.160	2.03	2/21, 2/22, 2/23, 2/24, 2/25, 2/26, 2/27
Site 22	0.012	0.013	0.012	1.07	0.019	1.52	2/21, 2/22, 2/23, 2/25, 2/26, 3/1, 3/2, 3/3, 3/4, 3/5
Site 23	0.073	0.078	0.074	1.07	0.137	1.85	2/22, 2/23, 2/25, 2/26, 2/27
Site 24	1.355	1.448	1.381	1.07	2.377	1.72	2/21, 2/22, 2/23, 2/25, 2/26, 2/27
Site 25	0.110	0.097	0.106	0.88	0.166	1.57	3/8, 3/9, 3/10, 3/11, 3/12, 3/13, 3/14, 3/15, 3/16
Site 26	0.549	0.570	0.555	1.04	0.905	1.63	3/8, 3/9, 3/10, 3/11, 3/12, 3/13, 3/14, 3/15, 3/16
Site 27	0.426	0.456	0.434	1.07	0.719	1.65	3/5, 3/6, 3/7, 3/8, 3/9, 3/17, 3/18, 3/19, 3/20, 3/21, 3/22, 3/23, 3/24, 3/25, 3/26, 3/27, 3/28, 3/29, 3/30

Flow Monitoring: Peak Measured Flows and Pipeline Capacity Analysis

Peak measured flows and the corresponding flow levels (depths) are important to understand the capacity limitations of a collection system. The peak flows and flow levels reported are from the peak measurements as taken across the entirety of the flow monitoring period. Peak flows and levels may not correspond to a rainfall event, but instead may be caused due to blockages, grease or roots that cause a backflow condition.

The following capacity analysis terms are defined as follows:

- **Peaking Factor:** Peaking factor is defined as the peak measured flow divided by the average dry weather flow (ADWF). A peaking factor threshold value of 3.0 is commonly used for sanitary sewer design.
- ***d*/*D* Ratio:** The *d*/*D* ratio is the peak measured depth of flow (*d*) divided by the pipe diameter (*D*). A *d*/*D* ratio of 0.75 is a common maximum threshold value used for pipe design. The *d*/*D* ratio for each site was computed based on the maximum depth of flow for the flow monitoring study.

Table 8 summarizes the peak recorded flows, levels, *d*/*D* ratios, and peaking factors per site during the flow monitoring period. Capacity analysis data is presented on a site-by-site basis and represents the hydraulic conditions only at the point site locations. Hydraulic conditions in other areas of the collection system will differ.

Table 8. Capacity Analysis Summary

Monitoring Site	ADWF (mgd)	Peak Measured Flow (mgd)	Peaking Factor	Diameter (in)	Peak Level (in)	*d*/*D* Ratio	Level Surcharged above Crown (ft.)
Site 1	0.194	0.485	2.5	10	2.06	0.21	-
Site 2	0.417	0.913	2.2	12	3.53	0.29	-
Site 3	0.141	0.360	2.5	14.5	4.37	0.30	-
Site 4	0.237	0.534	2.3	12	6.44	0.54	-
Site 5	2.089	4.725	2.3	29.5	11.56	0.39	-
Site 6	0.076	0.328	4.3	24	16.06	0.67	-
Site 7	0.222	0.440	2.0	15	2.56	0.17	-
Site 8	0.047	0.156	3.3	14.5	2.68	0.18	-
Site 9	0.140	0.296	2.1	23.5	5.56	0.24	-
Site 10	0.374	1.026	2.7	26.25	9.27	0.35	-
Site 11	0.186	0.554	3.0	26.5	4.78	0.18	-
Site 12	2.925	7.485	2.6	54	18.10	0.34	-
Site 13	0.780	4.346	5.6	35.5	13.78	0.39	-
Site 14	0.165	0.866	5.2	21	2.82	0.13	-
Site 15	0.016	0.079	4.9	10	2.45	0.25	-

Monitoring Site	ADWF (mgd)	Peak Measured Flow (mgd)	Peaking Factor	Diameter (in)	Peak Level (in)	*d*/*D* Ratio	Level Surcharged above Crown (ft.)
Site 16	0.138	0.318	2.3	12	9.51	0.79	-
Site 17	0.228	1.123	4.9	15	6.20	0.41	-
Site 18	0.129	1.702	13.2	15	5.82	0.39	-
Site 19	0.351	0.818	2.3	21	6.43	0.31	-
Site 20	0.467	2.134	4.6	21	8.47	0.40	-
Site 21	0.079	0.266	3.4	12	4.26	0.36	-
Site 22	0.012	0.180	14.4	12	1.55	0.13	-
Site 23	0.074	0.226	3.0	23.5	2.78	0.12	-
Site 24	1.381	6.363	4.6	23.5	34.54	1.47	0.9
Site 25	0.106	0.422	4.0	21	4.14	0.20	-
Site 26	0.555	1.116	2.0	23.5	4.43	0.19	-
Site 27	0.434	1.151	2.6	18	31.66	1.76	1.1

The following capacity analysis results are noted:

- **Peaking Factor:** Thirteen out of 27 sites had peaking factors higher than the common threshold value. It should be noted that a high peaking factors for some of the sites can be a result of very low ADWF.
- ***d*/*D* Ratio:** Sites 24 and 27 reached a surcharged condition during the study.

Figure 16 and Figure 17 show bar graphs summarizing the site by site peaking factors and d/D ratios, respectively.

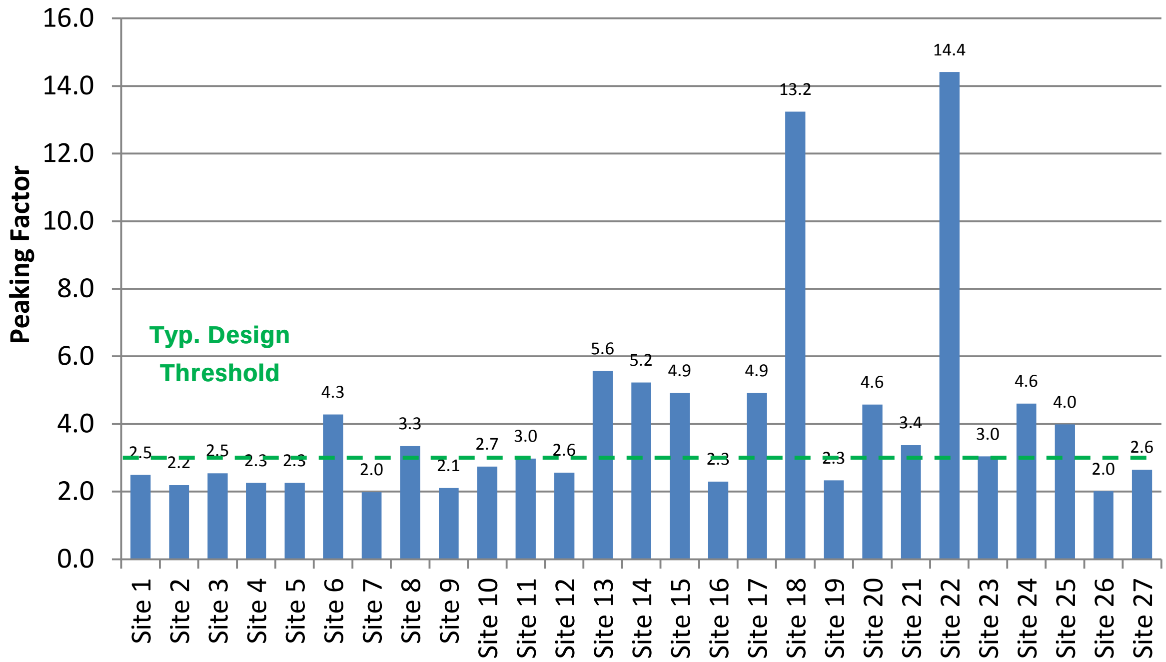


Figure 16. Capacity Summary: Peaking Factors

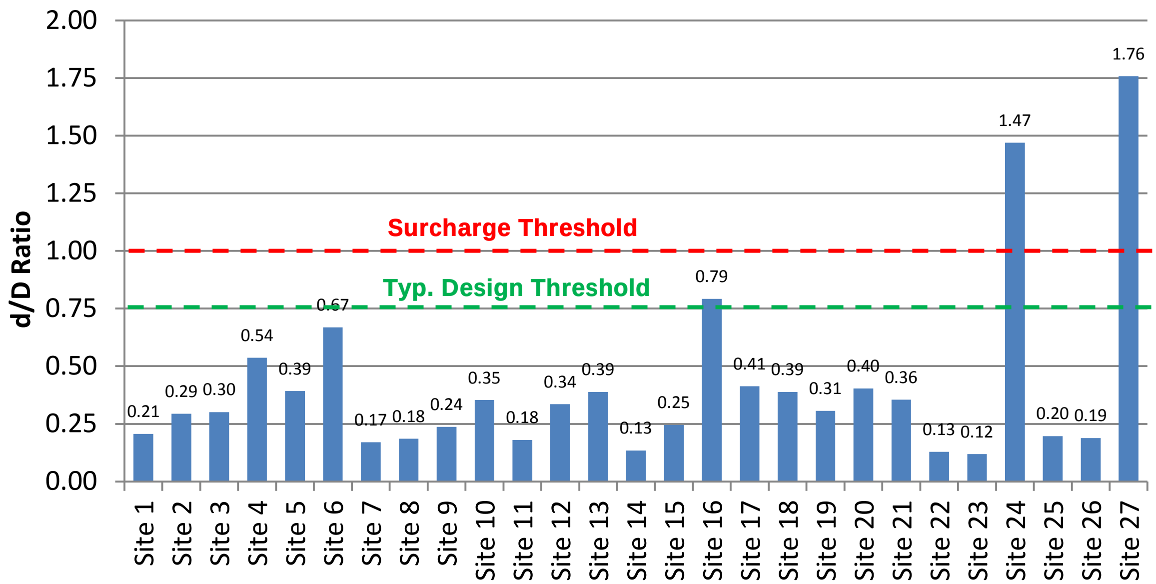


Figure 17. Capacity Summary: d/D Ratios

Inflow and Infiltration: Results

I/I analysis is based on the only rainfall event which occurred on February 28 through March 1, 2014. Refer to Appendix A for more detailed information. Site 16 was not monitored during the rainfall event and is not included in the rain dependent analyses that follow.

Since the method of normalization for this study is only based on ADWF, there is potential for sites with extremely low ADWF measurements to be skewed high. It is noted that Sites 6, 8, 15, 21, 22 and 23 have average dry weather flows less than 0.1 mgd.

The results and analyses of this report are given for informational purposes; however, the District engineer (or representative) should conduct proper due diligence and use the analyses presented in this report at his/her discretion.

Inflow Results Summary

Table 9 summarizes the inflow analysis results. Flow monitoring sites with the Peak I/I to ADWF ratios in the upper third (highest eight ratios) of the flow monitoring sites are shown color coded in red. Figure 18 shows bar graph summary of the inflow per ADWF. It should be noted that 7 out the 9 sites are from the same general area near Canyon Lake.

Table 9. Inflow Analysis Summary

Monitoring Site	ADWF (mgd)	Peak I/I Rate (mgd)	Peak I/I per ADWF Ratio
Site 1	0.194	0.239	1.2
Site 2	0.417	0.476	1.1
Site 3	0.141	0.224	1.6
Site 4	0.237	0.182	0.8
Site 5	2.089	2.605	1.2
Site 6	0.076	0.200	2.6
Site 7	0.222	0.116	0.5
Site 8	0.047	0.054	1.2
Site 9	0.140	0.126	0.9
Site 10	0.374	0.607	1.6
Site 11	0.186	0.347	1.9
Site 12	2.925	4.289	1.5
Site 13	0.780	3.396	4.4
Site 14	0.165	0.689	4.2
Site 15	0.016	0.059	3.6
Site 17	0.228	0.910	4.0
Site 18	0.129	1.526	11.9

Monitoring Site	ADWF (mgd)	Peak I/I Rate (mgd)	Peak I/I per ADWF Ratio
Site 19	0.351	0.446	1.3
Site 20	0.467	1.616	3.5
Site 21	0.079	0.185	2.3
Site 22	0.012	0.168	13.5
Site 23	0.074	0.133	1.8
Site 24	1.381	4.768	3.5
Site 25	0.106	0.273	2.6
Site 26	0.555	0.434	0.8
Site 27	0.434	0.643	1.5

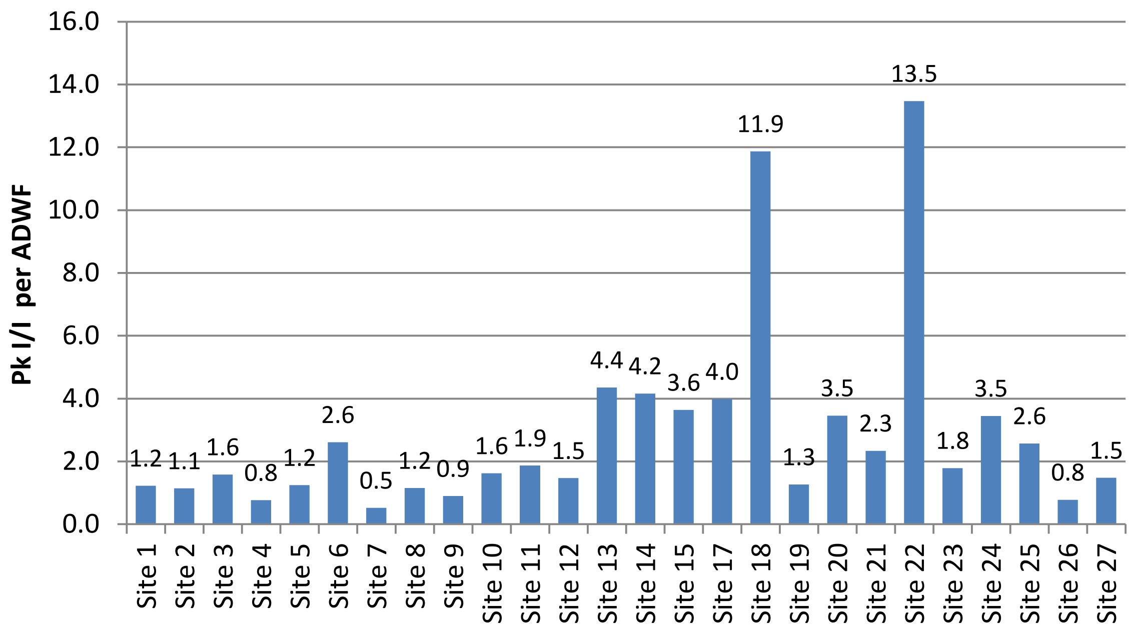


Figure 18. Inflow Analysis Summary – Peak I/I to ADWF

Infiltration Results Summary

Table 10 summarizes the RDI analysis for each monitoring site. The RDI analysis was performed for the 24-hour period from March 2, 12:00 am to March 3, 12:00 am, approximately 24 hours after the conclusion of the major portion of the rainfall on February 28. Flow monitoring sites with an RDI to ADWF ratios in the upper third (highest eight ratios) of the flow monitoring sites are shown color coded in red. Figure 19 shows bar graph summaries of the RDI per ADWF.

Table 10. RDI Analysis Summary

Monitoring Site	ADWF (mgd)	RDI Rate (mgd)	RDI per ADWF
Site 1	0.194	Negligible	0.0%
Site 2	0.417	0.045	8.5%
Site 3	0.141	0.017	9.2%
Site 4	0.237	0.005	1.6%
Site 5	2.089	0.103	3.7%
Site 6	0.076	0.031	25.1%
Site 7	0.222	0.016	5.5%
Site 8	0.047	0.009	14.1%
Site 9	0.140	0.008	4.2%
Site 10	0.374	0.032	6.3%
Site 11	0.186	Negligible	0.0%
Site 12	2.925	0.900	22.8%
Site 13	0.780	0.854	81.4%
Site 14	0.165	Negligible	0.0%
Site 15	0.016	0.004	16.0%
Site 17	0.228	0.090	31.9%
Site 18	0.129	0.130	80.5%
Site 19	0.351	0.077	18.2%
Site 20	0.467	0.087	13.7%
Site 21	0.079	0.021	21.1%
Site 22	0.012	0.003	22.2%
Site 23	0.074	0.014	15.3%
Site 24	1.381	0.284	15.9%
Site 25	0.106	0.040	33.2%
Site 26	0.555	0.033	4.8%
Site 27	0.328	0.104	30.1%

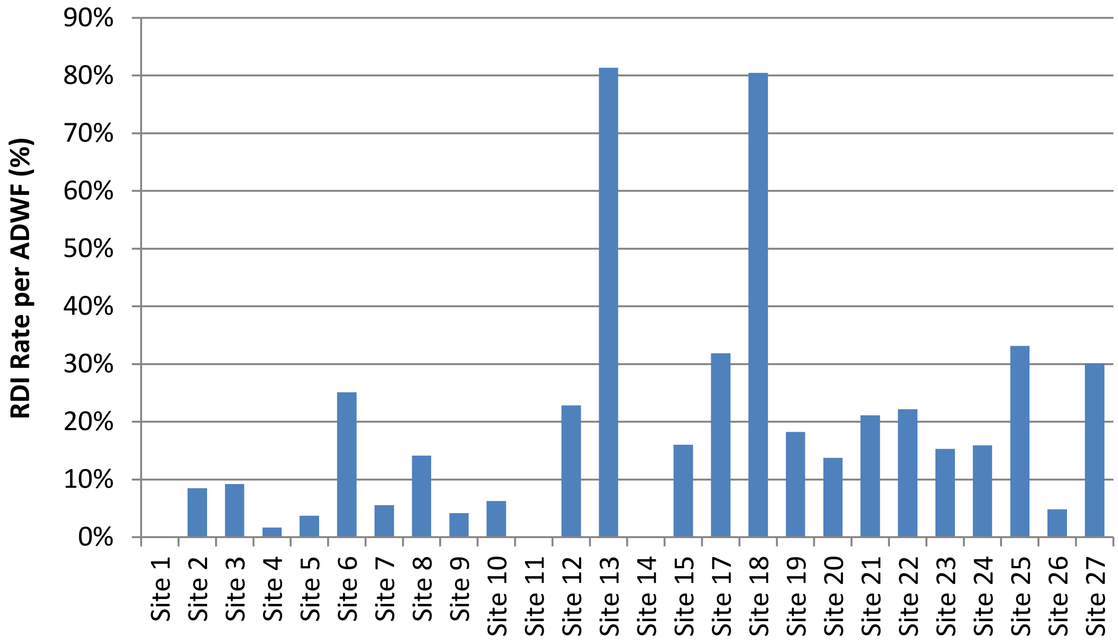


Figure 19. RDI Analysis Summary – RDI Rate to ADWF

Groundwater Infiltration Results Summary

Dry weather (ADWF) flow can be expected to have a predictable diurnal flow pattern. While each site is unique, experience has shown that, given a reasonable volume of flow and typical loading conditions, the daily flows fall into a predictable range when compared to the daily average flow. If a site has a large percentage of groundwater infiltration occurring during the periods of dry weather flow measurement, the amplitudes of the peak and low flows will be dampened[10]. Figure 20 shows a sample of two flow monitoring sites, both with nearly the same average daily flow, but with considerably different peak and low flows. In this *sample* case, Site B1 may have a considerable volume of groundwater infiltration.

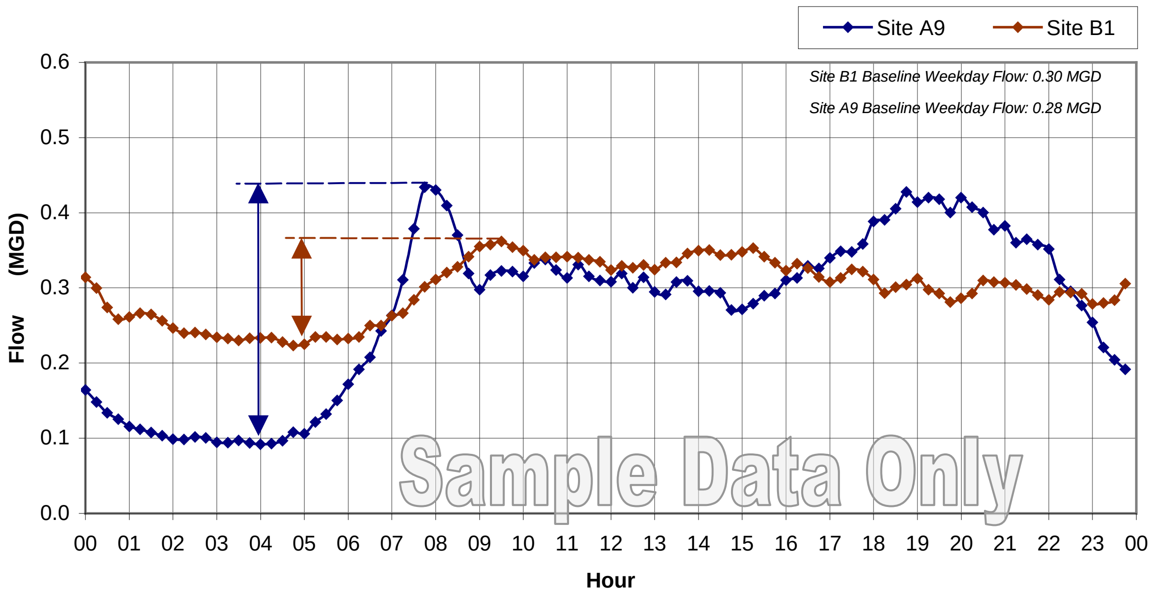


Figure 20. Groundwater Infiltration Sample Figure

It can be useful to compare the low-to-ADWF flow ratios for the flow metering sites. A site with abnormal ratios, and with no other reason to suspect abnormal flow patterns (such as proximity to pump station, treatment facilities, etc.), has a possibility of higher levels of groundwater infiltration in comparison to the rest of the collection system. Figure 21 plots the low-to-ADWF flow ratios against the ADWF flows for the sites monitored during this study. The dotted line shows "typical" low-to-ADWF ratios per the Water Environment Federation (WEF)[11].

Sites 11 and 16 had GWI rates that were above the WEF typical Low-to-Average Ratio, indicating the possibility of excessive groundwater infiltration.

[10] Theoretically imagining an extreme case, if there were 0.2 mgd of ADWF flow and 2.0 mgd of groundwater infiltration, the peaks and lows would be barely recognizable; the ADWF flow would be nearly a straight line.

[11] WEF Manual of Practice No. 9, "Design and Construction of Sanitary and Storm Sewers."

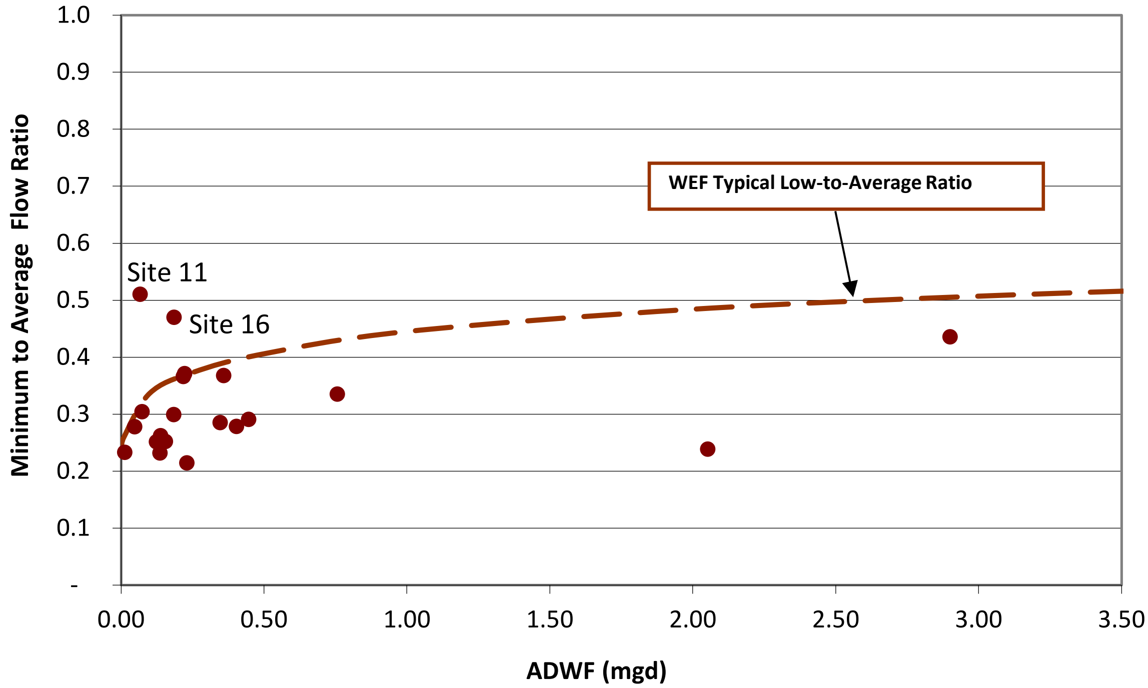


Figure 21. Minimum Flow Ratios vs. ADWF[12]

[12] Due to attenuation, it should be expected that sites with larger flow volumes should not have quite the peak-to-average and low-to-average flow ratios as sites with lesser flow volumes, which is why the WEF typical trend lines slope closer to 1.0 as the ADWF increases, as shown in the figure.

Combined I/I Results Summary

Table 11 summarizes the combined I/I flow results for the Rainfall Event 1. Combined I/I analysis considers the totalized volume of both inflow and rainfall-dependent infiltration over the course of a storm event. Combined I/I flows were normalized by the ADWF and rainfall; flow monitoring sites with a combined I/I to ADWF per inch Rain ratios in the upper third (highest eight ratios) of the flow monitoring sites are shown color coded in red. Figure 22 show bar graph summaries of the combined I/I analysis.

Table 11. Combined I/I Analysis Summary

Monitoring Site	ADWF (mgd)	Total I/I (gallons)	Total I/I per ADWF per inch of Rain (million gallons/mgd/in)
Site 1	0.194	53,000	0.10
Site 2	0.417	161,000	0.16
Site 3	0.141	59,000	0.17
Site 4	0.237	19,000	0.03
Site 5	2.089	604,000	0.12
Site 6	0.076	145,000	0.79
Site 7	0.222	62,000	0.12
Site 8	0.047	26,000	0.23
Site 9	0.140	41,000	0.12
Site 10	0.374	232,000	0.26
Site 11	0.186	36,000	0.08
Site 12	2.925	3,697,000	0.53
Site 13	0.780	3,156,000	1.50
Site 14	0.165	58,000	0.13
Site 15	0.016	39,000	0.90
Site 17	0.228	506,000	0.82
Site 18	0.129	515,000	1.49
Site 19	0.351	198,000	0.21
Site 20	0.467	607,000	0.48
Site 21	0.079	74,000	0.29
Site 22	0.012	24,000	0.60
Site 23	0.074	35,000	0.13
Site 24	1.381	1,129,000	0.25
Site 25	0.106	109,000	0.27
Site 26	0.555	183,000	0.09
Site 27	0.434	256,000	0.18

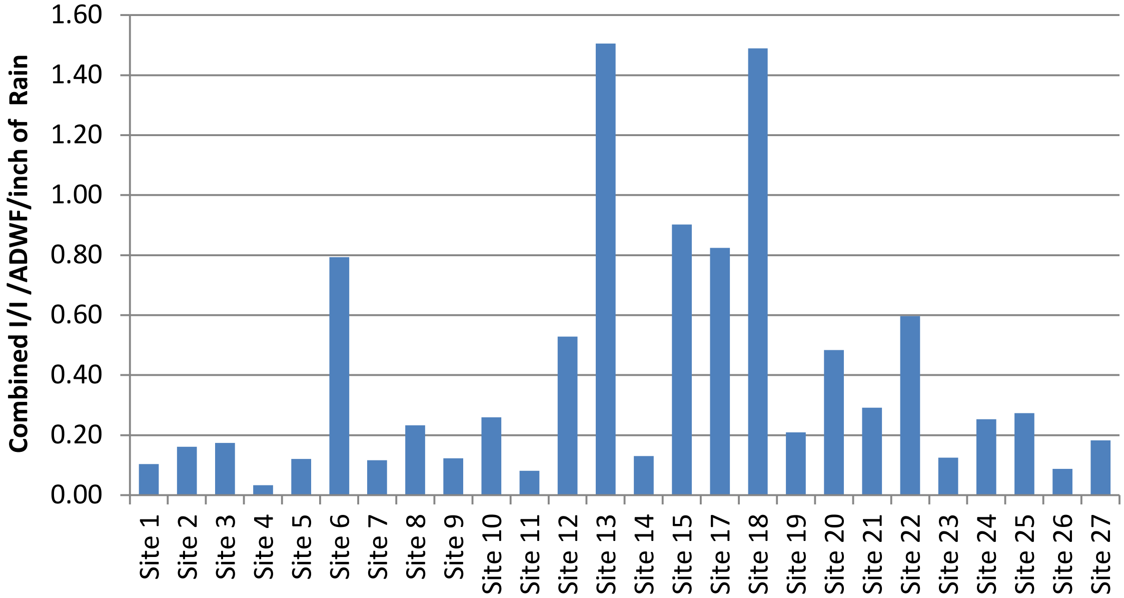


Figure 22. Combined I/I Analysis Summary – Total I/I to ADWF

Synthetic Hydrographs

In order to model design storms, synthetic hydrographs were developed to approximate the actual RDI hydrograph shape in terms of the time to the peak and the recession coefficient. The actual RDI hydrograph was best matched with a synthetic hydrograph by separating the synthetic hydrograph into seven volume components (R1 through R7). The seven components represent different response times to the rainfall event and, therefore, different infiltration or inflow paths into the sewer system. R1 is characterized by a short response time and is assumed to consist of mainly inflow. R7 represents slower response and longer recession times and consists of mostly infiltration. Levels of soil saturation are also considered. Using synthetic hydrograph analysis, appropriate time and recession parameters were estimated by a trial-and-error procedure until a good match was obtained. For example, the hydrograph and its component hydrographs for Rainfall Event 1 for Site 20 are shown in Figure 23.

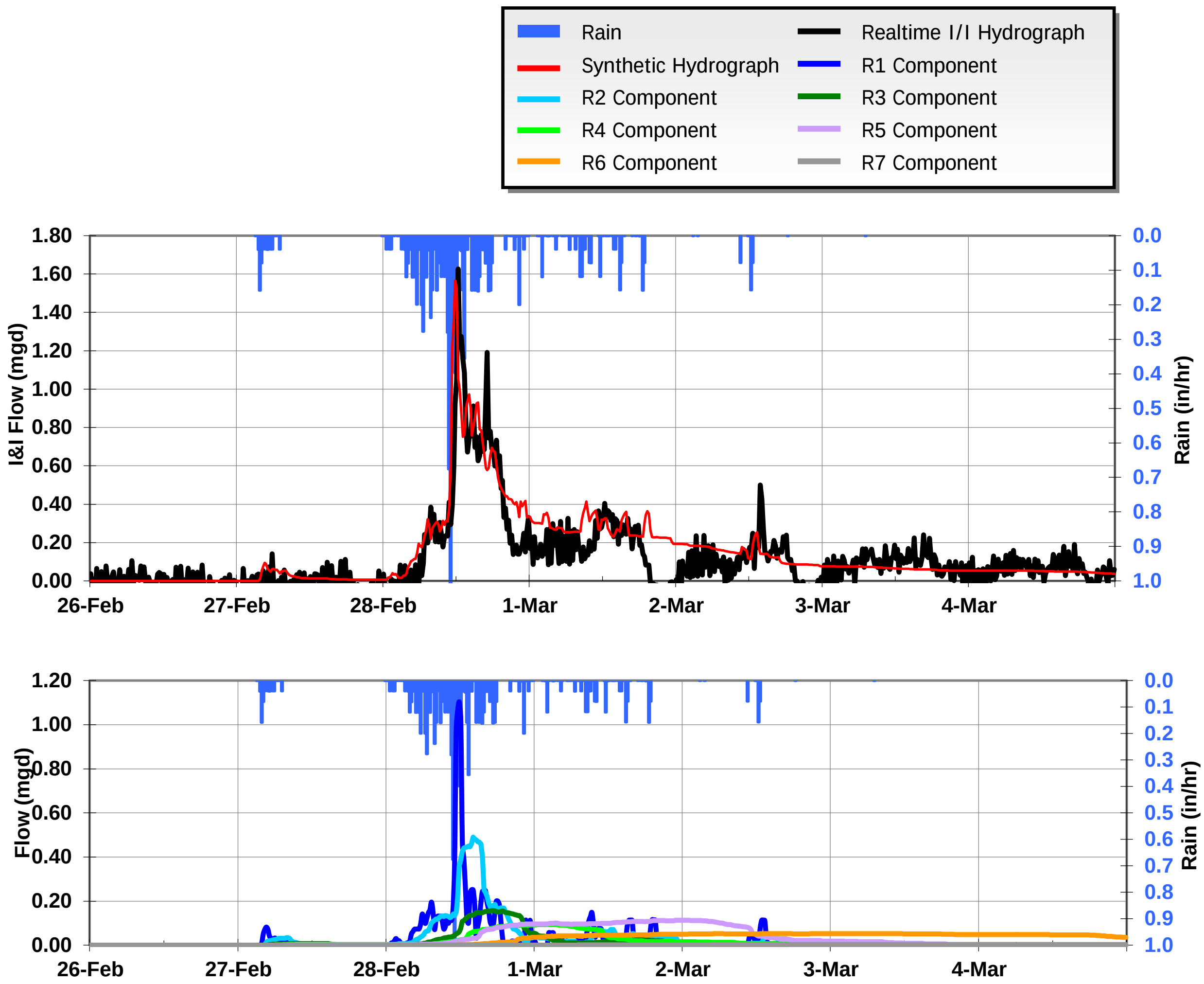


Figure 23. Synthetic Hydrograph for Site 20

Design Storm Development

With the I/I response modeled by a synthetic hydrograph, design storms can be applied. This serves two functions: (a) predicted flows are based on the same storm event and are therefore normalized to each other, making for easier and better comparisons, and (b) the resulting I/I flows can be predicted for a design storm event. This helps to calibrate modeling efforts that will determine if the collection system has adequate capacity to handle very large storm events.

V&A used a 10-year, 24-hour design storm for this analysis. Storm events were taken from the NOAA Precipitation-Frequency Atlas of the Western United States. Figure 24 demonstrates the design storm magnitude and profile for RG 1 for illustration purposes.

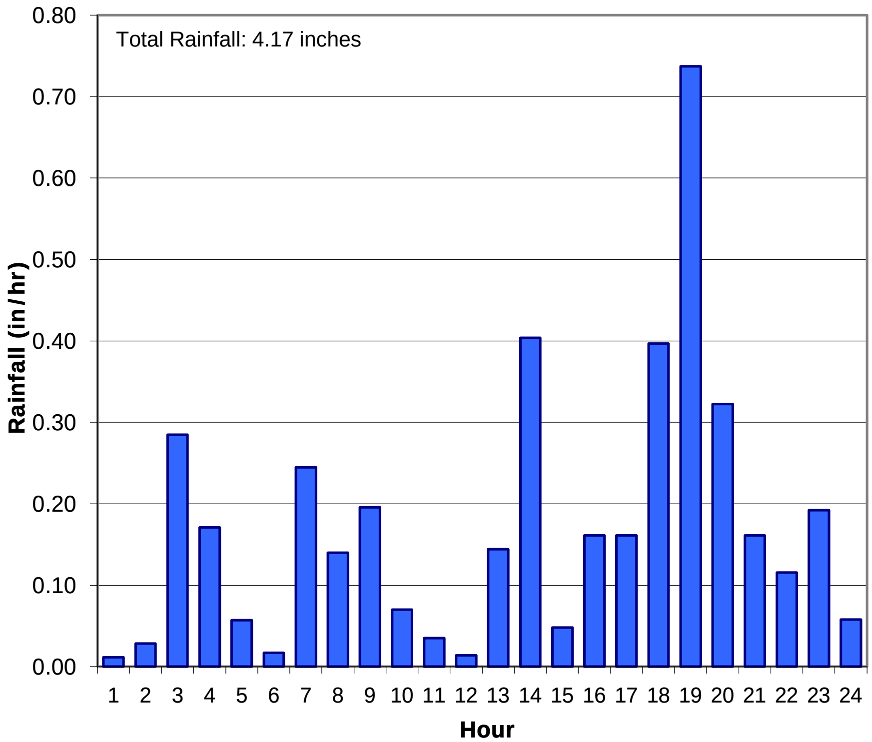


Figure 24. 10-Year, 24-Hour Design Storm Values and Profile for RG1

Design Storm Response Summary

The 10-year, 24-hour storm event was applied to the synthetic I/I hydrograph components developed for each flow monitoring site. This method produces the best estimated response to the design storm events. These results assume full ground saturation, and the peak I/I flows from the design storm coincide with peak dry weather flows to get a "worst-case" scenario of peak wet weather flows. Table 12 summarizes the final results for each design storm on a **site-by-site** basis.

Table 12. Design Storm I/I Analysis Summary

Monitoring Site	Peak Dry Weather Flow (mgd)	Peak I/I Rate (mgd)	Peak Flow (mgd)	Total I/I (gallons)
Site 1	0.386	0.585	0.971	222,000
Site 2	0.777	0.927	1.704	361,000
Site 3	0.291	0.437	0.728	187,000
Site 4	0.429	0.539	0.968	185,000
Site 5	3.437	7.334	10.771	2,621,000
Site 6	0.183	0.591	0.774	335,000
Site 7	0.343	0.370	0.713	141,000
Site 8	0.084	0.090	0.174	63,000
Site 9	0.228	0.327	0.555	131,000
Site 10	0.590	2.359	2.949	676,000
Site 11	0.281	0.719	1.000	261,000
Site 12	4.608	14.019	18.627	7,792,000
Site 13	1.715	4.698	6.413	3,345,000
Site 14	0.313	1.270	1.583	402,000
Site 15	0.044	0.091	0.135	62,000
Site 16[13]	n/a	n/a	n/a	n/a
Site 17	0.373	0.983	1.356	543,000
Site 18	0.363	1.724	2.087	706,000
Site 19	0.628	0.816	1.444	327,000
Site 20	0.844	2.358	3.202	1,368,000
Site 21	0.160	0.228	0.388	103,000
Site 22	0.019	0.192	0.211	56,000
Site 23	0.137	0.191	0.328	94,000
Site 24	2.377	5.783	8.160	1,399,000
Site 25	0.166	0.254	0.420	125,000
Site 26	0.905	0.674	1.579	414,000
Site 27	0.719	0.819	1.538	454,000

[13] Site 16 was not monitored for the rainfall event; there was no rain dependent I/I analysis completed for this site.

RECOMMENDATIONS

V&A advises that future I/I reduction plans consider the following recommendations:

1. **Determine I/I Reduction Program:** The District should examine its I/I reduction needs to determine a future I/I reduction program.
    a. If peak flows, sanitary sewer overflows, and pipeline capacity issues are of greater concern, then priority can be given to investigate and reduce sources of inflow within the basins with the greatest inflow problems. The highest inflow was occurring in the upstream basins of Sites 13, 14, 15, 17, 18, 20, 22 and 24.
    b. If total infiltration and general pipeline deterioration are of greater concern, then the program can be weighted to investigate and reduce sources of infiltration within the basins with the greatest infiltration problems.
        i. The highest normalized rainfall-dependent infiltration was occurring in the upstream basins of Sites 6, 12, 13, 17, 18, 22, 25, and 27.
        ii. The highest groundwater infiltration was occurring in the upstream basins of Sites 11 and 16.
2. **I/I Investigation Methods:** Potential I/I investigation methods include the following:
    a. Smoke testing
    b. Mini-basin flow monitoring
    c. Nighttime reconnaissance work to (1) investigate and determine direct point sources of inflow and (2) determine the areas and pipe reaches responsible for high levels of infiltration contribution.
3. **I/I Reduction Cost-Effectiveness Analysis:** The City should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow and infiltration and systematically rehabilitating or replacing the faulty pipelines or (2) continued treatment of the additional rainfall-dependent I/I flow.
4. **Downstream Pipe Capacity Analysis:** High levels of inflow resulted in peak flow problems at Sites 24 and 27 where surcharged conditions occurred. If bigger storm events occur, this issue can become more severe and can result in a sanitary sewer overflow (SSO). Pipeline capacity issues within the local collection system should be analyzed to minimize the potential for SSOs.

Appendix H

REHABILITATION AND REPLACEMENT PROJECT DETAILS

Appendix H

REHABILITATION AND REPLACEMENT PROJECT DETAILS

Table H.1 Existing Gravity Mains With PACP Scores Greater Than 4

GIS ID	Length (Feet)	Diameter (Inches)	Location	Install Date	Material	As-Built	PACP
GM-550	149.0	6	Vacation Drive	1970	VCP	1619_B	5
GM-572	153.2	6	Vacation Drive	1970	VCP	1619_B	5
GM-879	157.0	6	San Joaquin Drive West	1970	VCP	1619_B	5
GM-2263	478.9	6	Sumner Avenue	Unknown	Unknown	5495_B	5
GM-2282	258.9	6	Campus Way	Unknown	Unknown	5495_B	5
GM-2319	440.4	6	Easement	Unknown	Unknown	5495_B	5
GM-2325	431.9	6	Ellis Street	Unknown	Unknown	5495_B	5
GM-2350	499.6	6	Pottery Street	Unknown	Unknown	5495_B	5
GM-2853	157.2	6	Ellis Street	Unknown	Unknown	5495_B	5
GM-2911	185.9	6	Easement	Unknown	VCP	5495_B	5
GM-2929	175.5	6	Pottery Street	Unknown	PVC	5495_B	5
GM-2931	596.0	6	Pottery Street	Unknown	Unknown	5495_B	5
GM-3169	340.9	6	Main Street	Unknown	VCP	5495_B	5
GM-2280	361.4	6	Townsend Street	Unknown	Unknown	5495_B	4
GM-2928	319.3	6	Adobe Street	Unknown	Unknown	5495_B	4
GM-8767	230.0	6	East Hill Street	Unknown	VCP	5495_B	4
GM-11029	248.9	6	Pottery Street	Unknown	PVC	5495_B	4
GM-11030	183.3	6	Adobe Street	Unknown	PVC	5495_B	4
GM-566	217.3	8	Vacation Drive	1970	VCP	1619_B	5
GM-578	275.7	8	Easement	1970	VCP	1619_B	5
GM-904	245.0	8	Trigger Drive	1969	VCP	1890_B	5
GM-1083	405.5	8	Soissons Street	1999	PVC	3143_B	5
GM-1087	361.8	8	Biarritz Street	1999	PVC	3143_B	5
GM-1088	372.7	8	Biarritz Street	1999	PVC	3143_B	5
GM-1093	297.9	8	Soissons Street	1999	PVC	3143_B	5
GM-1209	346.1	8	Parkview Place	1981	VCP	749A_B	5
GM-1214	199.9	8	Wisconsin Street	1970	VCP	480_B	5
GM-1395	231.8	8	Redwood Drive	1971	VCP	2004_B	5
GM-1416	428.9	8	Easement	1970	VCP	1945_B	5

GIS ID	Length (Feet)	Diameter (Inches)	Location	Install Date	Material	As-Built	PACP
GM-1917	140.0	8	Easement	1971	VCP	1992_B	5
GM-1927	270.7	8	Village Way Drive	1969	VCP	1652_B	5
GM-1931	331.4	8	Easement	1971	VCP	1990_B	5
GM-1933	448.8	8	Village Way Drive	1969	VCP	1652_B	5
GM-1951	366.6	8	Blue Teal Drive	1969	VCP	1652_B	5
GM-1995	208.4	8	Rim Rock Place	1970	VCP	1750_B	5
GM-2316	341.2	8	Flint Street	1998	PVC	5495_B	5
GM-2531	296.3	8	Easement	1970	VCP	1784_B	5
GM-2572	282.1	8	Easement	1970	VCP	1784_B	5
GM-2673	321.5	8	Emperor Drive	1970	VCP	1557_B	5
GM-2695	243.2	8	Railroad Canyon Road	1970	VCP	1557_B	5
GM-2913	367.4	8	Franklin Street	Unknown	PVC	5495_B	5
GM-3055	414.5	8	Easement	1971	VCP	2019_B	5
GM-3063	243.0	8	Easement	1970	VCP	1957_B	5
GM-3082	314.3	8	Easement	1970	VCP	1957_B	5
GM-3101	462.0	8	Easement	1970	PVC	1773_B	5
GM-3138	310.4	8	Riverside Drive	1970	VCP	480_B	5
GM-3858	400.0	8	Grand Avenue	1984	VCP	M1583_B	5
GM-3860	400.0	8	Grand Avenue	1984	VCP	M1583_B	5
GM-3883	265.0	8	Walls Street	1984	VCP	M1583_B	5
GM-3909	225.0	8	Raley Avenue	1984	VCP	M1583_B	5
GM-3911	265.0	8	Grand Avenue	1984	VCP	M1583_B	5
GM-4054	207.8	8	Benner Street	1984	VCP	M1583_B	5
GM-4056	320.0	8	Booth Street	1984	VCP	M1583_B	5
GM-4244	286.0	8	Grand Avenue	1984	VCP	M1583_B	5
GM-4279	315.2	8	Samuel Drive	1988	VCP	961_B	5
GM-4309	270.0	8	Rome Hill Road	1984	VCP	M1583_B	5
GM-6256	328.6	8	Madison Avenue	2001	PVC	3390_B	5
GM-6332	56.5	8	Oak Creek Road	2001	PVC	3402_B	5
GM-7848	314.6	8	Canyon Lake Drive North	2002	PVC	N/A	5
GM-10212	218.5	8	Easement	1971	PVC	1992_B	5
GM-13223	71.4	8	Easement	1970	PVC	1619_B	5
GM-13344	168.4	8	Volta Del Tintori Street	2006	PVC	5025_B	5
GM-329	306.7	8	Coconut Way	1988	VCP	670_B	4
GM-1926	264.6	8	Easement	1969	VCP	1652_B	4
GM-1998	279.8	8	Widgeon Place	1970	VCP	1736_B	4
GM-2016	358.7	8	Lands End Place	1970	VCP	1736_B	4

GIS ID	Length (Feet)	Diameter (Inches)	Location	Install Date	Material	As-Built	PACP
GM-2057	267.7	8	Gulf Stream Drive	1970	VCP	1750_B	4
GM-2064	370.2	8	Gulf Stream Drive	1970	VCP	1750_B	4
GM-2126	434.9	8	Continental Drive	1970	VCP	1557_B	4
GM-2537	175.0	8	Early Round Drive	1970	VCP	1784_B	4
GM-2663	435.3	8	Cinnamon Teal Drive	1970	VCP	1557_B	4
GM-2932	181.6	8	Easement	Unknown	Unknown	5495_B	4
GM-3031	350.0	8	Big Tee Drive	1971	VCP	1974_B	4
GM-3062	233.9	8	Railroad Canyon Road	1971	VCP	1974_B	4
GM-3084	322.3	8	Easement	1970	PVC	1957_B	4
GM-3191	255.6	8	Jamieson Street	Unknown	PVC	6_B	4
GM-3465	345.0	8	Macy Street	1970	VCP	480_B	4
GM-3950	217.2	8	Hays Avenue	1984	VCP	M1583_B	4
GM-4772	184.1	8	Hunwut Drive	1986	PVC	700_B	4
GM-5456	275.0	8	Falconer Drive	1988	PVC	841_B	4
GM-7893	394.7	8	Torn Ranch Road	2003	PVC	3861_B	4
GM-7980	260.7	8	Ivy Court	2002	PVC	3885_B	4
GM-7983	160.1	8	Date Court	2002	PVC	3885_B	4
GM-8660	311.1	8	Turtle Dove Drive	2003	PVC	4021_B	4
GM-12062	14.4	8	Mountain Street	2005	PVC	4507_B	4
GM-13367	63.1	8	Easement	2006	PVC	M4356_B	4
GM-3665	416.7	10	Easement	1984	VCP	M1501_B	5
GM-1224	303.4	10	Rose Avenue	1970	VCP	480_B	4
GM-9765	213.2	10	Easement	1970	PVC	480_B	4
GM-2555	448.4	12	Easement	1970	VCP	1784_B	5
GM-5937	27.2	12	Strickland Avenue	2001	PVC	M2943_B	5
GM-13423	72.2	12	Easement	1970	PVC	M4656_B	5
GM-13432	19.2	12	Easement	1993	PVC	480_B	5
GM-1362	333.5	12	Redwood Drive	1969	VCP	1693_B	4
GM-1410	237.3	12	Easement	1970	VCP	2004_B	4
GM-3232	372.2	15	Avenue 9	1988	PVC	649_B	5
GM-9700	150.3	21	Meadowridge Lane	2004	PVC	4284_B	5
GM-3688	400.0	21	Easement	1984	VCP	M1501_B	4
GM-3690	386.1	21	Mission Trail	1984	VCP	M1501_B	4
GM-1253	290.7	24	Third Street	1990	PVC	M2190_B	4

Notes:
Abbreviations: GIS - geographic information system; ID - identity; PACP - Pipeline Assessment Certification Program; PVC - polyvinyl chloride; VCP - vitrified clay pipe.

Table H.2 Existing Gravity Mains With Less Than 20-Years of Remaining Useful Life

GIS ID	Length (Feet)	Diameter (Inches)	Location	Install Date	Material	As-Built	Remaining Useful Life
GM-14522	290.0	8	Cottonwood Canyon Road	1982	DIP	M1649_B	10
GM-501	56.7	8	Easement	1985	ACP	48_B	13
GM-502	90.5	8	Easement	1985	ACP	48_B	13
GM-503	133.6	8	Easement	1985	ACP	48_B	13
GM-504	22.1	8	Easement	1985	ACP	48_B	13
GM-505	268.9	8	Easement	1985	ACP	48_B	13
GM-506	336.2	8	Easement	1985	ACP	48_B	13
GM-507	18.4	8	Easement	1985	ACP	48_B	13
GM-508	14.3	8	Easement	1985	ACP	48_B	13
GM-509	89.5	8	Easement	1985	ACP	48_B	13
GM-510	28.5	8	Easement	1985	ACP	48_B	13
GM-511	50.0	8	Easement	1985	ACP	48_B	13
GM-512	60.5	8	Easement	1985	ACP	48_B	13
GM-525	226.3	8	Easement	1985	ACP	48_B	13
GM-526	371.4	8	Easement	1985	ACP	48_B	13
GM-535	267.4	8	Easement	1985	ACP	48_B	13
GM-4603	396.0	8	Almond Street	1988	DIP	1184_B	16
GM-5223	153.3	8	Easement	1989	DIP	901_B	17
GM-5224	180.8	8	Provence Drive	1989	DIP	901_B	17
GM-5243	222.3	10	Easement	1989	DIP	901_B	17
GM-14125	292.0	14	Cottonwood Canyon Road	1984	DIP	M1649_B	12

Notes:
Abbreviations: ACP - asbestos concrete pipe; DIP - ductile iron pipe.

Appendix I

HYDRAULIC MODEL DOCUMENTATION

Appendix I

HYDRAULIC MODEL DOCUMENTATION

The purpose of this document is to provide technical details related to the Elsinore Valley Municipal Water District (EVMWD) wastewater collection system model so that users can more easily apply the model to answer a variety of questions about the collection system. The model was developed as part of the on-going Sewer System Master Plan (SSMP) project. This document explains how the model was developed and used.

Model Information

Model Development History

EVMWD's hydraulic model was originally created for the November 2008 EVMWD Wastewater Master Plan. As part of the 2016 SSMP, the model was converted to Innovyze's InfoSWMM Suite 12.0 software and updated to include additional infrastructure that had been constructed since 2008. The 2008 and 2016 hydraulic models were "skeletonized" models meaning that only the trunk sewer system was included in the model, generally including pipelines 10-inches in diameter and larger.

Hydraulic Modeling Software

Innovyze's InfoSWMM Suite 14.5 software was selected to model the EVMWD sewer system for this SSMP. InfoSWMM is a fully dynamic geospatial wastewater and stormwater modeling and management software application. The application is fully ArcGIS integrated, which allows for a modeling system that can be fully integrated with geographic information system (GIS) software and permits all the advanced ArcGIS functions to be utilized. InfoSWMM includes several proprietary tools used throughout model development.

It should be noted that Innovyze is planning to sunset the InfoSWMM hydraulic modeling software platform when Esri's ArcMap software application is no longer supported, which is scheduled for 2026. Based on discussions with EVMWD staff, it was agreed that this SSMP would continue to utilize Innovyze's InfoSWMM modeling package. During the next round of master plan updates, however, EVMWD should plan on converting their existing hydraulic model to a new software platform.

Model Data Sources

EVMWD provided detailed information for the update of the model. Key information included:

- 2016 Wastewater Model (InfoSWMM format).
- GIS file of sewer manholes (January 2022).
- GIS file of gravity mains (January 2022).
- GIS file of force mains (January 2022).
- GIS file of lift stations (January 2022).
- GIS file of parcels (January 2022).
- Advanced Metering Infrastructure (AMI) water consumption data by account with septic customers.
- Monthly consumption data by account from the Finance Department.
- Previous SSMP (2016).
- Drawings of sewer system facilities in design or construction.
- GIS of elevation contours.
- GIS of land use in the service area.
- GIS file of service and sewershed boundaries for each of the water reclamation facility (WRFs) in the EVMWD service area.
- GIS of the Water Reclamation Facilities (WRFs).
- Lift station control settings and pump capacity information.

Model Elements

The following provides a brief overview of the major elements of the hydraulic model and the required input parameters associated with each:

- Junctions: Sewer manholes, cleanouts, as well as other locations where pipe sizes change or where pipelines intersect are represented by junctions in the hydraulic model. Junctions are also used to represent locations where flows are split or diverted between two or more downstream links. Required inputs for junctions include rim elevation, invert elevation, and surcharge depth (used to represent pressurized systems).
- Pipes: Gravity sewers and force mains are represented as pipes in the hydraulic model. Input parameters for pipes include length, friction factor (e.g., Manning's n for gravity mains, Hazen Williams C for force mains), invert elevations, diameter, and whether or not the pipe is a force main.
- Storage Nodes: For sewer system modeling, storage nodes typically are used to represent lift station wet wells (although other types of storage basins would be modeled as storage nodes). Input parameters for storage nodes include invert elevation, maximum depth, and cross sectional area.
- Pumps: Pumps are included in the hydraulic model as links. Input parameters for pumps include pump curves and operational controls.

- Outfalls: Outfalls represent areas where flow leaves the system. For sewer system modeling, an outfall typically represents the connection to the influent pump station or headworks of a wastewater treatment plant. Input parameters for outfalls include ground elevation and outfall type (free fall, fixed head, etc.).
- Rain Gauges: Rain gauges are input into the hydraulic model to simulate historical or theoretical rainfall events.
- Inflows: The following are the three types of wastewater flow sources that can be applied to individual model junctions (and storage nodes):
  - Dry Weather: Dry weather inflows simulate base sanitary wastewater flows and represent the average flow. The dry weather flows (DWF) can be multiplied by up to four patterns that vary the flow by month, day, hour, and day of the week (e.g., weekday or weekend).
  - External: External inflows can represent any number of flows into the collection system, such as backwash flow from a wellhead treatment facility. Typically, external inflows are used for loads other than base sanitary flows. External inflows are applied to a specific model junction by applying a baseline flow value and a pattern that varies the flow by hour, day, or month of the year. This option was used to simulate future infiltration and inflow (I/I).
  - Rainfall Derived Infiltration and Inflow (RDII): RDII flows are applied in the model by assigning a unit hydrograph and a corresponding tributary area to a given junction. The unit hydrographs consist of several parameters that are used to adjust the volume of RDII that enters the system at a given location.

Model Scope

As part of this SSMP, the hydraulic model was expanded into an "all-pipe" model. Two options were considered for how to achieve this expansion. The first option was to review the 2016 hydraulic model and add in the non-modeled sewer mains as well as other new infrastructure that has been completed since 2016. The second option was to create a new model from scratch using EVMWD's most recent GIS database. The latter option was selected to provide the most consistency with EVMWD's most recent GIS database.

Model Development

Model Construction

The model was constructed by first initializing a new hydraulic model in InfoSWMM and assigning a project coordinate system that is consistent with EVMWD's GIS database (NAD_1983_StatePlane_California_VI_FIPS_0406_Feet). Once the new model was initialized, the project preferences were adjusted to use InfoSWMM's "sewer interface" and to adjust the model input parameters to store absolute rim elevations and to store absolute pipeline invert elevations.

Next, the model information fields were expanded to include all relevant fields from EVMWD's manhole and pipeline GIS layers. Examples of the information fields that were added to the model include pipeline "STATUSCODE", "INSTALLDAT", and "OWNER", amongst many others.

Once the model information fields were expanded, the most current manholes, gravity mains, lift stations, and force mains were imported into the model using the "Exchange->Import Manager" tool built into InfoSWMM. The relevant hydraulic fields (e.g., pipe diameter, inverts, rims, etc.) were imported into the model in addition to the information fields from GIS as discussed above. EVMWD's gravity main and force main layers were imported as Pipes and EVMWD's manhole layer data points were imported as Junctions. EVMWD's lift station layer data points were imported as wet wells.

Next, each lift station pump, force main discharge node, and model outfall were digitized manually in the model. The model pump capacity/total dynamic head, wet well geometry, and operational controls for each lift station were input based on the previous hydraulic model and compared/updated to reflect the information provided by EVMWD. The modeled outfalls were represented as "Free Discharge" type outfalls in the model.

Next additional model input parameters were assigned to the model elements that weren't included in the GIS database. These include:

- A manning's roughness of 0.013 was assigned to all gravity mains in the model by default. These values were modified as needed during model calibration.
- Each force main was tagged as such in the model and a Hazen Williams Roughness (C-Factor) of 120 was assigned in the model as a default.
- Model junctions connected to a force main were assigned a surcharge depth of 500 feet to allow for them to flow under pressure with overflowing during model simulations.

Once these input parameters were added, the hydraulic model network was reviewed to ensure that there were no missing data gaps, areas of suspect or erroneous data, and to verify network connectivity:

- Various model connectivity and network review/fix utilities were used to verify that the network connectivity was imported correctly. Examples included the "Orphan Node" and "Orphan Link" tools, as well as the "Trace Upstream Network" and "Trace Downstream Network" tools.

- Each hydraulic modeling data table was reviewed/sorted to identify suspect/missing pipe diameter, invert, and rim elevation data. Any model element with missing/suspect data was flagged and added into a model domain. Each element was reviewed and corrected individually. In general, the EVMWD GIS database was largely complete, but for areas of missing invert data, appropriate model inverts were inferred from the upstream and downstream nodes or other reasonable assumptions were made.
- Every model element was reviewed systematically using the "Create Profile Plot" to ensure that there were no errors in in the model input invert data and that each pipeline direction and inverts were logical.

Wastewater "Load" Allocation

In collection system hydraulic modeling, the term "load" is generically used to indicate a base wastewater flow input into the model. This can be easily confused with constituent loads (such as biochemical oxygen demand). For the purposes of this document, the terms load and base wastewater flow are used interchangeably, and represent a flow into the system and not a constituent concentration.

Various techniques can be used to assign wastewater flows to individual model junctions, depending on the type of data that is available. Baseline wastewater loads were allocated (assigned to specific nodes) in the hydraulic model based on parcels with AMI data provided by EVMWD. The following steps outline the wastewater load allocation process:

- EVMWD provided AMI data for the year 2022. This data was processed to determine the average consumption per customer, for the period of time in which the flow monitoring program was deployed (see the SSMP Chapter 3 for more detailed information regarding the flow monitoring program). The AMI data were filtered to exclude landscape irrigation meters, septic customers, and other customers not connected to the sewer system (e.g., Temescal District).
- The AMI data were geocoded and linked to EVMWD's parcel layer, by customer.
- Each sewered parcel within the EVMWD service area was assigned to an individual model node using GIS techniques (a combination of "near" and "join" functions utilizing the geocoded AMI data, sewer main, manhole, and lateral shapefiles) and then visually checked/verified to ensure that it was assigned to the correct model node. The resulting parcel level sewershed shapefile included all of the necessary data to import into the model, including average consumption during the flow monitoring program, parcel area (acres), and model manhole identification (ID). The attribute data from this sewershed shapefile was exported to excel and the AMI consumption was summarized by model ID and imported into the hydraulic model as a

"Node DWF." The modeled sewersheds basins and flowmeter locations are shown in the attached Figure 1. A separate shapefile called "Sewersheds_by_Parcel" was previously sent to EVMWD for review at a more granular level.

- The measured average dry weather flow (ADWF) for each flow monitoring tributary area was calculated by subtracting the upstream measured ADWF (if applicable) from each flowmeter's measured ADWF using the flow monitoring schematic provided in Chapter 3 of the SSMP.
- The measured flow tributary to each flow monitoring basin was compared to the AMI consumption data during the flow monitoring program to determine an adjustment factor to apply to the AMI consumption for that meter basin in the hydraulic model. The adjustment factors, or return-to-sewer ratios that were applied to the modeled loads by flow monitoring tributary area to closely match the actual measured flows. The modeled load adjustment factors are provided by flow monitoring basin in Table 1.

Diurnal Pattern Development

A diurnal curve is a pattern of hourly multipliers that are applied to the base flow to simulate the variation in flow that occurs throughout the day. Two diurnal curves were developed for each flow monitoring tributary area, one representing weekday flow and one representing weekend flow. The diurnal patterns were initially developed based on the flow monitoring data. These provide a good starting point for the development of diurnal patterns, however, the patterns must be adjusted to account for the unique hydraulics and flow attenuation/travel times for each meter basin, and to account for upstream flow influences. The initial diurnal patterns were adjusted as part of the calibration process until the model simulated flows matched the field measured flows as closely as possible while still producing reasonable diurnal variations. Diurnal patterns for each of the flow monitoring tributary areas are included in the DWF calibration sheets, provided in Appendix B of the SSMP.

Model Calibration

Hydraulic model calibration is a crucial component of the hydraulic modeling effort. Calibrating the model to match data collected during the flow monitoring program ensures the most accurate results possible. The calibration process consists of calibrating to both dry and wet weather conditions.

For this project, a temporary flow monitoring program was conducted at 34 flowmeter sites from February 22, 2021 through May 22, 2022. DWF calibration provides an accurate depiction of base wastewater flow generated within the study area. The wet weather flow (WWF) calibration consists of calibrating the hydraulic model to a specific storm event(s) to accurately simulate the peak and total I/I volume entering the sewer system.

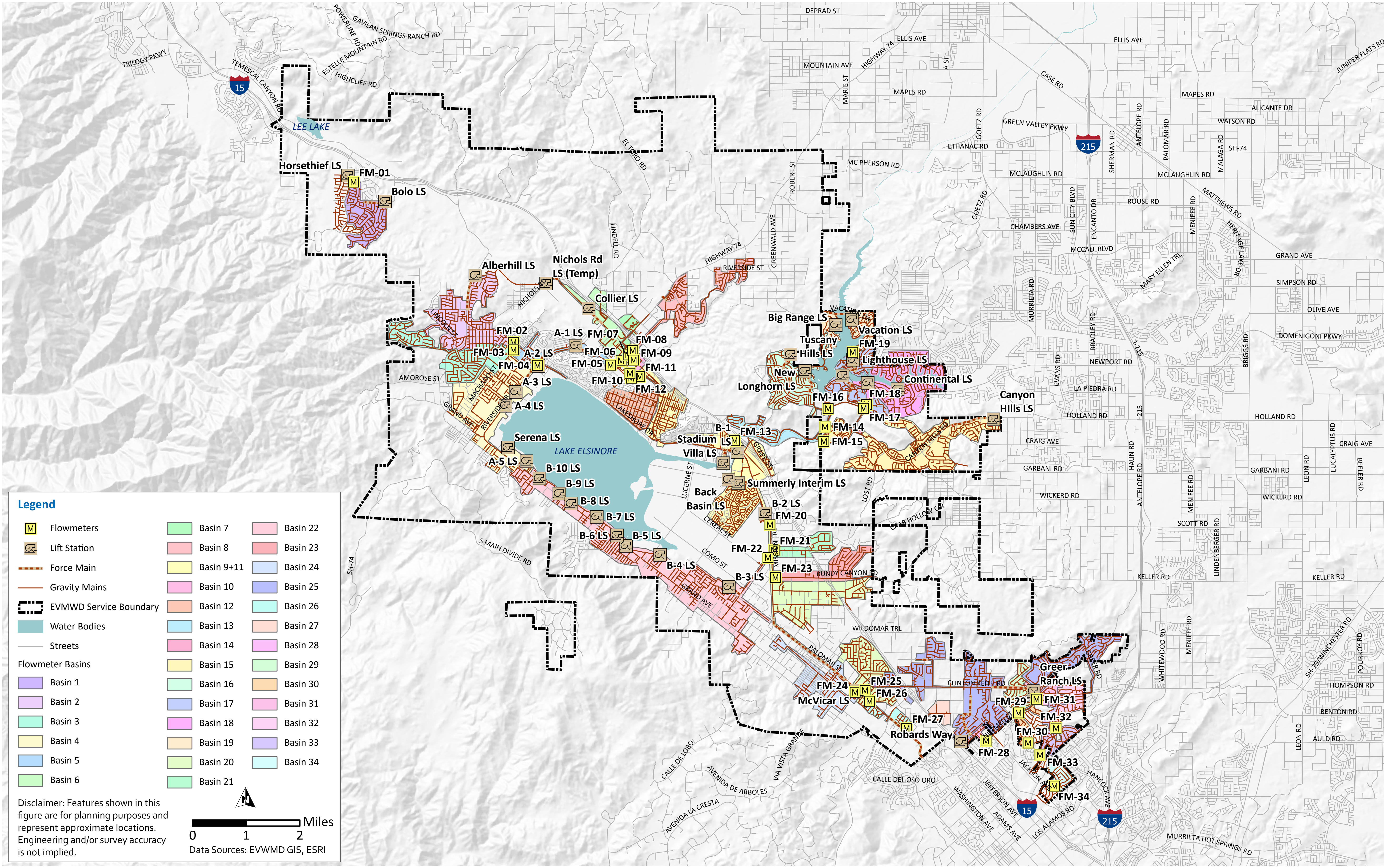


Figure 1 Flowmeter and Flowmeter Basin Locations

Table 1 EVMWD Sewer Collection System Model Scenarios[(1)]

Flowmeter	ADWF (mgd)	AMI During Monitoring (mgd)	Model Scaling Factor
FM-01	0.21	0.452	0.46
FM-02	0.265	0.899	0.29
FM-02/3	0.007	0.012	0.56
FM-03	0.18	0.348	0.52
FM-04	0.709	0.829	0.85
FM-05	0.143	0.118	*1.21*
FM-06	0.073	0.426	0.17
FM-07	0.04	0.137	0.29
FM-08	0.431	0.442	0.98
FM-09	0.218	1.284	0.17
FM-10	0.005	0.014	0.37
FM-11	0.146	0.146	1
FM-12	0.125	0.167	0.75
FM-13	0.07	0.127	0.55
FM-14	0.024	0.024	1
FM-15	0.548	0.852	0.64
FM-16	0.192	0.473	0.41
FM-17	0.129	0.302	0.43
FM-18	0.274	0.406	0.68
FM-19	0.1	0.275	0.36
FM-20	0.434	0.657	0.66
FM-21	0.024	0.056	0.44
FM-22	0.388	0.758	0.51
FM-23	0.096	0.15	0.65
FM-24	0.165	0.273	0.61
FM-25	0.557	0.851	0.65
FM-26	0.044	0.069	0.63
FM-27	0.141	0.081	*1.74*
FM-28	0.026	0.035	0.73
FM-29	0.099	0.206	0.48
FM-30	0.044	0.035	*1.25*
FM-31	0.046	0.075	0.62
FM-32	0.113	0.301	0.37

Flowmeter	ADWF (mgd)	AMI During Monitoring (mgd)	Model Scaling Factor
FM-33	0.187	0.163	*1.15*
FM-34	0.045	0.099	0.45

Notes:
Abbreviations: mgd - million gallons per day.
(1) Values shown in blue indicate scaling factors greater than one. These basins are downstream of other meters where the accuracy of the flowmeters themselves (typically +/-5 percent in both the upstream and downstream direction) meters can compound to show unrealistic scaling factors. When combined with upstream meters, the weighted scaling factors are reasonable.

Calibration Standards

The hydraulic model was calibrated in accordance with international modeling standards. The Wastewater Planning Users Group (WaPUG), a section of the Chartered Institution of Water and Environmental Management, has established generally agreed upon principles for model verification. The dry weather and wet weather calibration focused on meeting the recommendations on model verification contained in the "Code of Practice for the Hydraulic Modeling of Sewer Systems," published by the WaPUG (WaPUG 2002), as summarized below:

- Dry Weather Calibration Standards: Dry weather calibration should be carried out for two dry weather days and the modeled flows and depths should be compared to the field measured flows and depths. Both the modeled and field measured flow hydrographs should closely follow each other in both shape and magnitude.
  In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:
  - The timing of flow peaks and troughs should be within 1 hour.
  - The peak flow rate should be within the range of ±10 percent.
  - The volume of flow (or the average rate of flow) should be within the range of ±10 percent. If applicable, care should be taken to exclude periods of missing or inaccurate data.
- Wet Weather Calibration Standards: The model simulated flows should be compared to the field measured flows. The flow hydrographs for both events should closely follow each other in both shape and magnitude, until the flow has substantially returned to DWF rates. In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:
  - The timing of the peaks and troughs should be similar with regard to the duration of the events.
  - The peak flow rates at significant peaks should be in the range of +25 percent to -15 percent and should be generally similar throughout.
  - The volume of flow (or the average flow rate) should be within the range of +20 percent to -10 percent.

WaPUG does not specify standards for level and velocity calibration.

Dry Weather Calibration

The following describes the dry weather calibration effort:

- Selection sets were created for each flow monitoring tributary area, and the diurnal patterns described above were applied to the base wastewater flows.
- The base wastewater flows for each basin were adjusted based on the return-to-sewer ratios provided in Table 1.
- The model was run for a period of 7-days and the modeled simulated flows, levels, and velocities were compared to the field measured data.
- The diurnal patterns were modified as discussed previously until the field measured flows and model simulated flows matched well.
- Once the model's simulated flows acceptably matched the field measured flows, the model's simulated velocity and flow depth were compared to the field measured velocity and flow depth. Adjustments were made to various model parameters until the modeled and measured velocity and depth closely matched one another. The main parameter that was adjusted to better match levels and velocities was the manning's roughness coefficient. Any changes from the default roughness (0.013) were applied within a reasonable range (0.008 to 0.022) and applied to the mains associated with the individual flowmeter as well as upstream and downstream of the meter for mains of similar pipe slope and installation year. The attached Table 2 shows the changes to manning's roughness that were applied in the model by meter site. All modeled Manning's roughness coefficients were within a reasonable range.

The DWF calibration results are shown in Appendix B of the SSMP. Notable findings of the DWF calibration are summarized below:

- The DWF calibration showed an excellent correlation between the model simulated data and the field measured data.
- The modeled flow at Site 11 was lower than the field measured flows. This flowmeter measured flows in the original 27-inch diameter trunk that conveyed flows from the B-series lift stations. The majority of flow that used to be conveyed through Site 11 has been diverted to the 54-inch Lakeshore Trunk. Carollo reviewed the as-builts for the diversions to the 54-inch trunk and replicated the weir height in the diversion structures per the as-built drawings, but the model was not able to replicate the flow conveyed to Site 11 within 10-percent. However, the flows coming into Site 11 are negligible compared to the flows diverted to the Lakeshore Trunk Sewer, so the impact of the flow differences at Site 11 will not significantly impact the overall accuracy of the model.

- As shown in Appendix B of the SSMP, the model simulated levels and velocities matched well compared to the field measured data. The modeled levels/velocities in a few sites (2, 6, 11, 19, and 22) differed somewhat from the measured data. Further investigation into these sites, including a detailed review of as-built drawings, operational records, etc. could help to further refine the modeling results for these sites.

Table 2 Modeled Manning's Roughness Coefficient by Flowmeter

Flowmeter	Modeled Manning's Roughness Coefficient
FM-01	0.018
FM-02	0.008
FM-03	0.016
FM-04	0.012
FM-05	0.019
FM-06	0.01
FM-07	0.019
FM-08	0.011
FM-09	0.018
FM-10	0.022
FM-11	0.018
FM-12	0.013
FM-13	0.009
FM-14	0.015
FM-15	0.01
FM-16	0.008
FM-17	0.01
FM-18	0.015
FM-19	0.019
FM-20	0.013
FM-21	0.02
FM-22	0.02
FM-23	0.017
FM-24	0.022
FM-25	0.011
FM-26	0.02
FM-27	0.022
FM-28	0.017

Flowmeter	Modeled Manning's Roughness Coefficient
FM-29	0.008
FM-30	0.02
FM-31	0.019
FM-32	0.022
FM-33	0.008
FM-34	0.019

Wet Weather Calibration

The wet weather calibration enables the hydraulic model to accurately simulate I/I entering the collection system during a historical rainfall event. As outlined below, the WWF calibration process consists of several elements:

- Identify calibration rainfall events. The most significant wet weather event captured during the flow monitoring program occurred on March 29, 2022. This was the main rainfall event used for model calibration. In addition, the influent flow into each WRF from the December 2021 wet weather events were simulated in the hydraulic model to validate the I/I parameters generated from the wet weather calibration.
- Define RDII tributary areas. For the WWF calibration, RDII flows are superimposed on top of the DWF. The model calculates RDII by assigning "RDII Inflows" to each node in the model. RDII inflows consist of both a unit hydrograph and the total area that is tributary to the model node (determined using the model sewersheds described above). The tributary area provides a means to transform hourly rainfall depth from the rainfall hyetographs into a rainfall volume. The rainfall volume is transformed into actual RDII flows using the unit hydrograph, as described in the next step.
- Create I/I parameter database and modify to match field measured flows. The main step in the WWF calibration process involved creating a custom unit hydrograph for each flowmeter tributary area using the "RTK Method," which is widely used in collection system master planning. Using the RTK Method, the RDII unit hydrograph is the summation of three separate triangular hydrographs (short term, medium term, and long term), which are each defined by three parameters: R, T, and K. R represents the fraction of rainfall over the sewer basin that enters the collection system; T represents the time to peak of the of the hydrograph; and K represents the ratio of time to recession to the time to peak. Therefore, there are a total of nine separate variables associated with a unit hydrograph. Table 3 summarizes the model simulated RTK parameters by monitoring basin.

Table 3 Modeled RTK Parameters

Flowmeter	ADWF (mgd)	AMI During Monitoring (mgd)	Model Scaling Factor
FM01	Short-Term	0.003	0.6
	Medium-Term	0.002	15
	Long-Term	0	30
FM02	Short-Term	0.002	0.1
	Medium-Term	0.001	10
	Long-Term	0.003	30
FM03	Short-Term	0.003	0.4
	Medium-Term	0.001	10
	Long-Term	0.001	15.3
FM04	Short-Term	0.006	0.6
	Medium-Term	0.005	10
	Long-Term	0.003	30
FM05	Short-Term	0.05	0
	Medium-Term	0.001	10
	Long-Term	0.001	15.3
FM06	Short-Term	0.002	0.2
	Medium-Term	0.002	15
	Long-Term	0	0
FM07	Short-Term	0.002	0.2
	Medium-Term	0	3
	Long-Term	0	5
FM08	Short-Term	0.002	0.1
	Medium-Term	0.001	10
	Long-Term	0	0
FM09	Short-Term	0.02	0.1
	Medium-Term	0	0
	Long-Term	0	0
FM10	Short-Term	0.001	0.1
	Medium-Term	0	16
	Long-Term	0	30
FM11	Short-Term	0.02	0.1
	Medium-Term	0.003	10
	Long-Term	0	0

Flowmeter	ADWF (mgd)	AMI During Monitoring (mgd)	Model Scaling Factor
FM12	Short-Term	0.005	0.2
	Medium-Term	0.003	10
	Long-Term	0	0
FM13	Short-Term	0.005	0.4
	Medium-Term	0.003	10
	Long-Term	0.002	30
FM14	Short-Term	0	2
	Medium-Term	0	3
	Long-Term	0.003	30
FM15	Short-Term	0.005	0.1
	Medium-Term	0	0
	Long-Term	0	0
FM16	Short-Term	0.001	0.5
	Medium-Term	0.001	10
	Long-Term	0	5
FM17	Short-Term	0.003	2.5
	Medium-Term	0	10
	Long-Term	0.001	30
FM18	Short-Term	0.003	0.5
	Medium-Term	0.001	7
	Long-Term	0.002	30
FM19	Short-Term	0.003	1
	Medium-Term	0.001	7
	Long-Term	0.01	30
FM20	Short-Term	0.001	2
	Medium-Term	0	0
	Long-Term	0	0
FM21	Short-Term	0.014	0.5
	Medium-Term	0.003	10
	Long-Term	0.003	30
FM22	Short-Term	0.006	0.1
	Medium-Term	0.001	10
	Long-Term	0.003	30

Flowmeter	ADWF (mgd)	AMI During Monitoring (mgd)	Model Scaling Factor
FM23	Short-Term	0.009	0.1
	Medium-Term	0.005	10
	Long-Term	0.005	30
FM24	Short-Term	0.006	2
	Medium-Term	0.006	15
	Long-Term	0	0
FM25	Short-Term	0.005	0.5
	Medium-Term	0.003	10
	Long-Term	0.003	30
FM26	Short-Term	0.001	0.1
	Medium-Term	0	0
	Long-Term	0	25
FM27	Short-Term	0.012	0.5
	Medium-Term	0.004	12
	Long-Term	0.005	30
FM28	Short-Term	0.04	2.5
	Medium-Term	0.01	3.4
	Long-Term	0	30
FM29	Short-Term	0.004	0.6
	Medium-Term	0.001	10
	Long-Term	0	15.3
FM30	Short-Term	0.01	0.4
	Medium-Term	0.008	10
	Long-Term	0.001	30
FM31	Short-Term	0	0.3
	Medium-Term	0.008	17
	Long-Term	0.01	30
FM32	Short-Term	0.003	0.3
	Medium-Term	0.001	12
	Long-Term	0.002	15.3

Flowmeter	ADWF (mgd)	AMI During Monitoring (mgd)	Model Scaling Factor
FM33	Short-Term	0.004	0.3
	Medium-Term	0.002	15
	Long-Term	0.002	30
FM34	Short-Term	0.004	0.6
	Medium-Term	0.003	10
	Long-Term	0.008	30

The hydrograph utilizes the R-values (percent of rainfall that enters the collection system) calculated for each flowmeter basin to simulate I/I. The nine variables in each unit hydrograph were initially set based on engineering judgment and then adjusted until the model simulated flows (both peak flows and average flows) matched closely with the field measured flows.

As with the dry weather calibration, the wet weather calibration process compared the measured flow, velocity, and level data with the model output. Comparisons were made for average and peak flows as well as the temporal distribution of flow until flows returned to their baseline levels.

The WWF calibrations sheets for all sites are provided in Appendix B of the SSMP. There is good correlation between the model-simulated flows and the flows that were measured at each flowmeter location. The velocity and level discrepancies noted in the DWF calibration also translated to the WWF calibration, but overall, the model accurately simulated the effects of wet weather events and was considered calibrated and ready to use for capacity analysis purposes.

As previously mentioned, the wet weather events in December 2021 were also simulated in the model and compared to the measured flows at each WRF. There are inherent uncertainties associated with simulating historical events through a collection system model, but the model validation plots shown in Appendix B of the SSMP show good correlation between the model predicted flows and the measured flow at each WRF during the December 2021 rainfall events.

Model Calibration Summary

The EVMWD hydraulic model was calibrated using a robust calibration methodology and produced model simulated flows, levels, and velocities that compare well to the field measured data. There are a few sites where the modeled levels and velocities can be refined based on additional information, but overall the model is a useful tool for the purposes of the SSMP evaluation, as well as subsequent planning endeavors.

Hydraulic Model User Guide

Scenario Management

The InfoSWMM Scenario Explorer is a powerful tool that allows the user to define and manage many different scenarios and organize model results. Knowing how to define model scenarios is important so that model data inputs are understood and the model provides the expected results.

InfoSWMM allows the user to set up different scenarios that are used to simulate different conditions or events, all using a single model database. For example, the collection system infrastructure for the 2050 planning horizon could be used with sets of loads from different planning horizons to represent a variety of flow conditions. Different sets of infrastructure could also be defined in data sets to represent current or future infrastructure configurations.

A specific scenario includes data sets, facility sets, and simulation options. Although there are a variety of ways to set up these scenarios, EVMWD's model was set up using a specific, query based approach that has been proven to work well. This document explains this approach.

Figure 2 is a screen capture of the Scenario Explorer for EVMWD's model. On the left is a listing of the different scenarios that are defined. The right half of the window shows three tabs, one each for the data sets, facility sets, and simulation options. To edit any of the information in these three tabs, the user must select a scenario to edit that is not an active scenario. Active scenarios have a red check on the file cabinet symbol to the left of the scenario name. To de-activate a particular scenario so that it can be edited, either change scenarios before entering the Scenario Explorer, or select a different scenario on the left side of the Scenario Explorer and then click on the activate button in the upper left corner of the Scenario Explorer window.

A number of unique data sets can be defined for each data set category. For example, the DWF set, which contains load information, could have data sets defined for 2030, 2040, 2050, etc. The same types of loads could be defined in data sets for any future planning year as well. When setting up a scenario, the user would assign the desired DWF set to a particular scenario. When a particular scenario is active and the user makes edits to the DWF data, only the information in that specific data set will be edited. Therefore, edits to a specific data set will apply to all scenarios referencing that data set and not to scenarios referencing different data sets. A complete description of these data sets can be found in the InfoSWMM Users Guide.

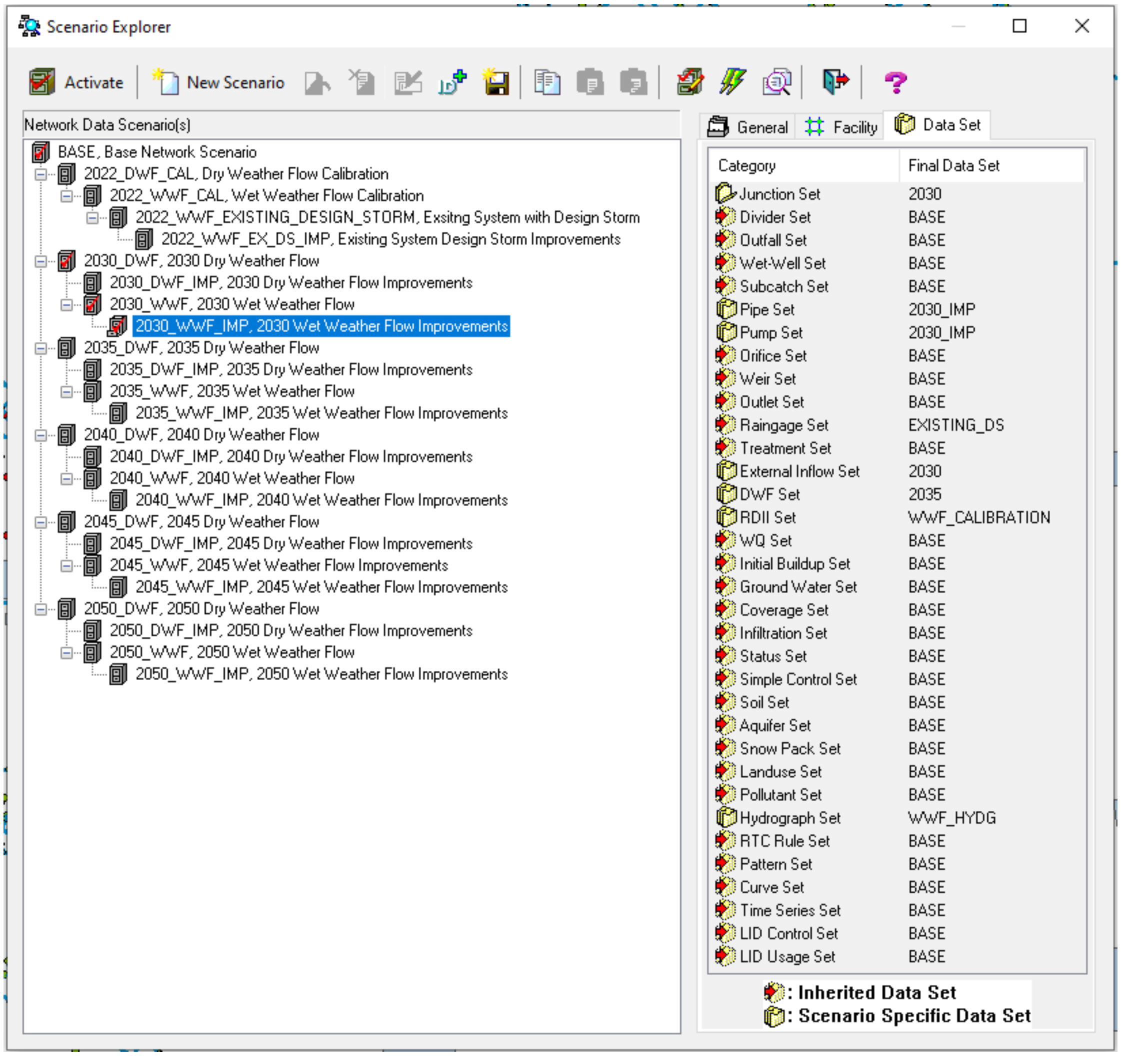


Figure 2 Scenario Explorer Window

Facilities Sets

A facility set defines the network facilities (components such as pipes, pumps, wet wells and manholes) to be used in a simulation. Only one facility set can be active at a time. Facility sets are created through the facility tab as shown on Figure 3.

In EVMWD's model, facility sets are selected by queries that use values in the following information attribute fields: ACTIVE2022, ACTIVE2030, ACTIVE2035, ACTIVE2040, ACTIVE2045, and ACTIVE2050. The queries include or exclude individual facilities according to values stored in the attribute fields. The values in these attribute fields need to be populated for each facility that is in the model for the facility to be active in the respective scenarios. The advantage of using queries over other methods is that the same facility set can be extracted for a particular simulation each time that the scenario is activated. Other methods in the facilities tab, such as the active network, and Intelli-selection methods rely more on the user's memory to ensure the same facilities are selected for a scenario. InfoSWMM has a Facility Manager feature that is used with the Intelli-selection method, but these features are not used for EVMWD's model.

Defining facility sets by queries takes a little more work to set up than the other methods of selecting facilities, but this approach avoids the risk inherent in some of the other methods that the facilities for a scenario may not be correct. Using the query set will always activate the same entities each time a scenario is activated.

Query sets can be created or modified by the user to create different model scenarios. A query set is just a grouping of individual queries. Separate queries need to be defined for each different type of facility (pipes, manholes, etc.). The following section explains the functionality of the Query Set Manager.

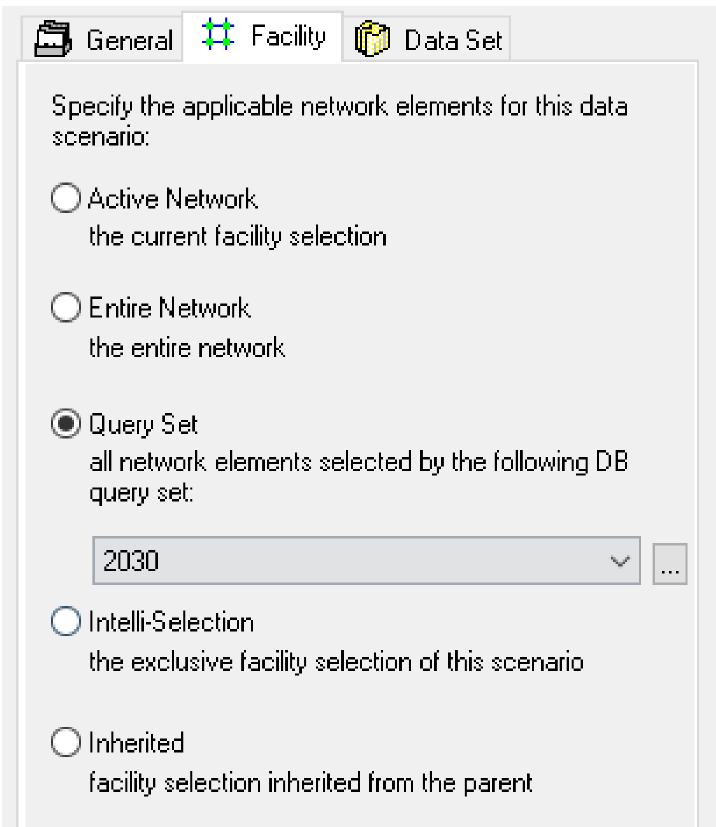


Figure 3 Facility Set Tab in the Scenario Manager

Query Set Manager

The Query Set Manager can be opened from the Facility tab of the Scenario Explorer, the Facility Manager, and the Domain Manager. A query set is a group of individual queries that are used together to select a group of entities. For a collection system model, a query set typically has a query for pipes, manholes, pumps, and wet-wells. The object of using a query set is to make sure that all the different entities associated with a particular model scenario are used to consistently activate the same entities. Figure 4 shows the query set window. In the query set window, the top portion of the window shows the different query sets that are available. Query sets can be created, cloned, modified, or deleted. The middle portion of the query set window shows the specific queries for each type of entity. The lower portion of the query set window contains details about the database query that is selected in the middle window.

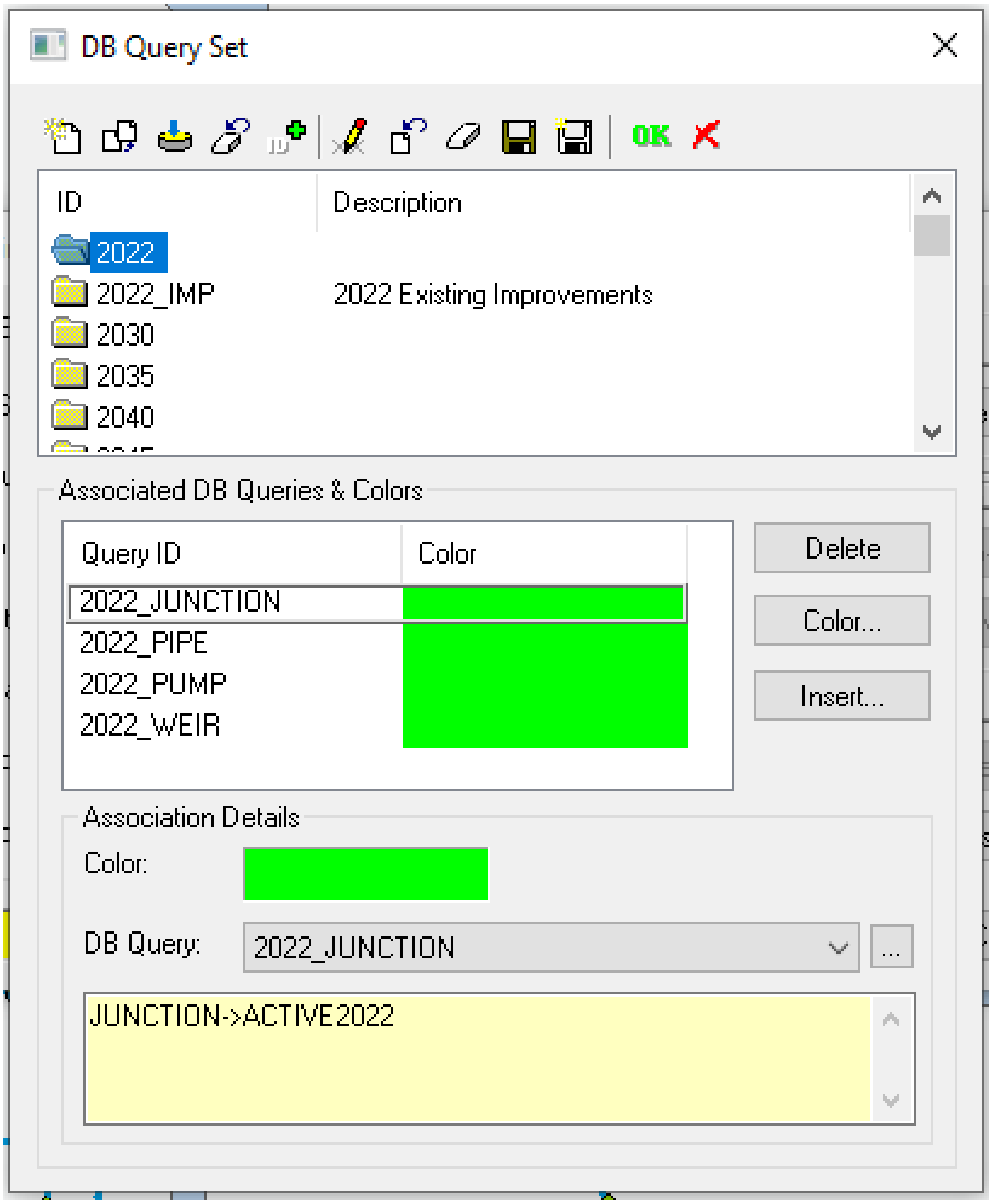


Figure 4 Query Set Window

Database Queries

The user edits a query by selecting the three-dot button to open the DB Query Editor. Figure 5 shows the DB Query window. In the DB query window, the user can select queries that have already been defined, clone and edit queries, or create and validate queries to perform any function where the model software uses queries. Database Queries that have been set up for EVMWD's model are based upon the following information attribute fields: ACTIVE2022, ACTIVE2030, ACTIVE2035, ACTIVE2040, ACTIVE2045, and ACTIVE2050 within the following model elements: junctions, pipes, wet wells, pumps, outfalls, weirs.

The DB Queries used for the 2030 planning horizon are shown below.

- Junctions: ACTIVE2030 = "Yes"
- Pipes: ACTIVE2030 = "Yes"
- Wet-wells: ACTIVE2030 = "Yes"
- Pumps: ACTIVE2030 = "Yes"
- Weirs: ACTIVE2030 = "Yes"
- Outfalls: ACTIVE2030 = "Yes"

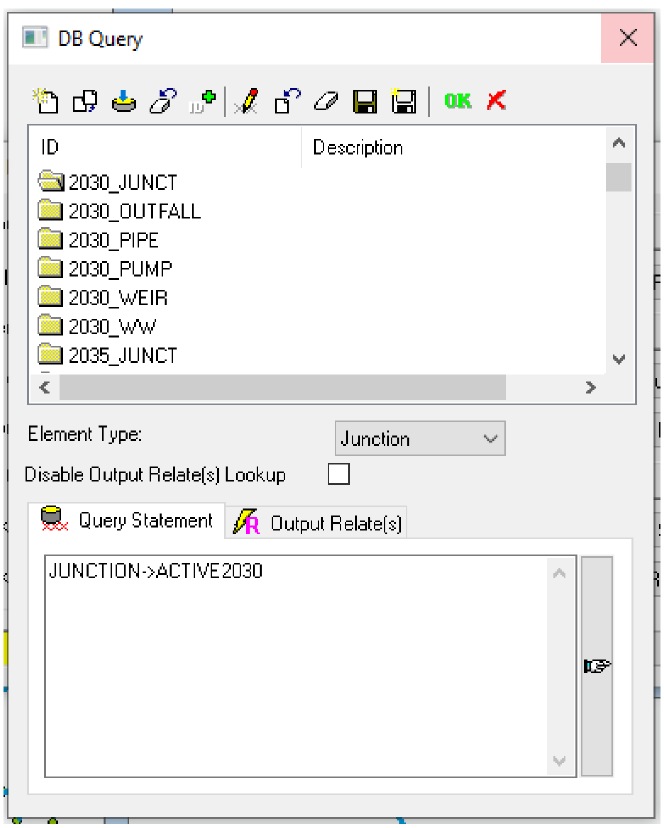


Figure 5 DB Query Window

Simulation Options

There are three different categories of options that can be selected under the general tab, as shown on Figure 6.

- Report Options – The report option can be used to change the title and size of tabular reports, but these reports are used infrequently. The options include output for node and output for link checkboxes that can be cleared to exclude them from report generation.
- Simulation Options – Simulation options set the flow units, peaking factors, water quality parameters, and a variety of other settings for running a simulation. Under most circumstances, the default parameters will be sufficient.
- Climatology Options – Simulation climate can be set with this option. This was not adjusted or used in EVMWD's model.

All the scenarios created in this collection system model have specific simulation options applied to each scenario. All DWF scenarios use the "BASE" option and all WWF scenarios use the "DESIGN_STORM" option, with exception to the WWF calibration scenario which uses the "CAL_WWF" simulation option.

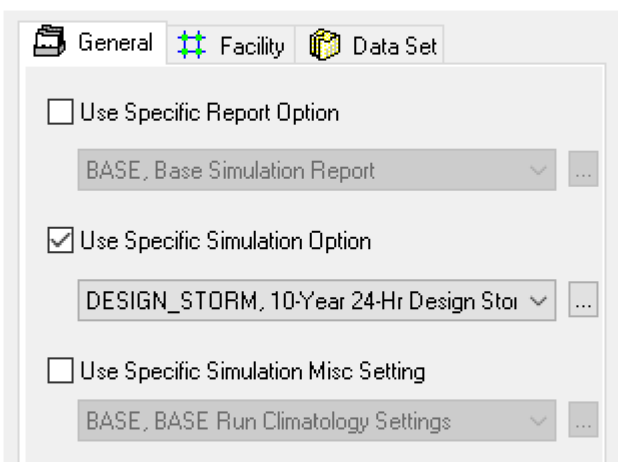


Figure 6 DB Query Window

EVMWD Sewer Collection System Model Scenarios

The collection system model contains twenty-four scenarios, as defined in Table 4. These scenarios were used to complete the 2022 SSMP. Table 5 lists the data sets that were used for each scenario. The Scenario Explorer also lists a "Base" scenario in addition to the scenarios in Table 4 and Table 5, but this base scenario is not set up to run a model simulation.

Table 4 EVMWD Sewer Collection System Model Scenarios

Scenario	Description
2022_DWF_CAL	DWF Calibration
2022_WWF_CAL	WWF Calibration
2022_WWF_EXISTING_DESIGN_STORM	Existing System with Design Storm
2022_WWF_EX_DS_IMP	Existing System Design Storm Improvements
2030_DWF	2030 DWF
2030_DWF_IMP	2030 DWF Improvements
2030_WWF	2030 WWF
2030_WWF_IMP	2030 WWF Improvements
2035_DWF	2035 DWF
2035_DWF_IMP	2035 DWF Improvements
2035_WWF	2035 WWF
2035_WWF_IMP	2035 WWF Improvements
2040_DWF	2040 DWF
2040_DWF_IMP	2040 DWF Improvements
2040_WWF	2040 WWF
2040_WWF_IMP	2040 WWF Improvements
2045_DWF	2045 DWF
2045_DWF_IMP	2045 DWF Improvements
2045_WWF	2045 WWF Improvements
2045_WWF_IMP	2045 WWF Improvements
2050_DWF	2050 DWF
2050_DWF_IMP	2050 DWF Improvements
2050_WWF	2050 WWF
2050_WWF_IMP	2050 WWF Improvements

Table 5 Data Sets Used for Each Model Scenario

Scenario	Junctions	Pipes	Wet Wells	Pumps	Node DWF	Node RDII	Node Inflow (Future RDII)
2022_DWF_CAL	2022	2022	Base	BASE	2022_DWF	Base	Base
2022_WWF_CAL	2022	2022	Base	BASE	2022_DWF	WWF_CALIBRATION	Base
2022_WWF_EXISTING_ DESIGN_STORM	2022	2022	Base	BASE	2022_DWF	Base	Base
2022_WWF_EX_DS_IMP	2022	2022_EXISTING_IMP	Base	2022_EXSITING_IMP	2022_DWF	Base	Base
2030_DWF	2030	2030	Base	2030	2030	Base	Base
2030_DWF_IMP	2030	2030_IMP	Base	2030_IMP	2030	Base	Base
2030_WWF	2030	2030	Base	2030	2030_WWF	WWF_CALIBRATION	2030
2030_WWF_IMP	2030	2030_IMP	Base	2030_IMP	2035	WWF_CALIBRATION	2030
2035_DWF	2035	2035	Base	2035_IMP	2035	Base	Base
2035_DWF_IMP	2035	2035_IMP	Base	2035_IMP	2035	Base	Base
2035_WWF	2035	2035	Base	2035	2035_WWF	WWF_CALIBRATION	2035
2035_WWF_IMP	2035	2035_IMP	Base	2035_IMP	2035_WWF	WWF_CALIBRATION	2035
2040_DWF	2040	2040	Base	2040	2040	Base	Base
2040_DWF_IMP	2040	2040_IMP	Base	2040_IMP	2040	Base	Base
2040_WWF	2040	2040	Base	2040	2040_WWF	WWF_CALIBRATION	2040
2040_WWF_IMP	2040	2040_IMP	Base	2040_IMP	2040_WWF	WWF_CALIBRATION	2040
2045_DWF	2045	2045	Base	2045	2045	Base	Base
2045_DWF_IMP	2045	2045_IMP	Base	2045_IMP	2045	Base	Base
2045_WWF	2045	2045	Base	2045	2045_WWF	WWF_CALIBRATION	2045
2045_WWF_IMP	2045	2045_IMP	Base	2045_IMP	2045_WWF	WWF_CALIBRATION	2045
2050_DWF	2050	2050	Base	2050	2050	Base	Base
2050_DWF_IMP	2050	2050_IMP	Base	2050_IMP	2050	Base	Base
2050_WWF	2050	2050	Base	2050	2050_WWF	WWF_CALIBRATION	2050
2050_WWF_IMP	2050	2050_IMP	Base	2050_IMP	2050_WWF	WWF_CALIBRATION	2050

Loads

Loads in the wastewater collection system model are in the units of gallons per minute (gpm). The loads in a collection system model can be allocated to junctions in the following data sets: Node DWF, Node RDII, or Node Inflow. The Node DWF dataset contains base DWFs from DWF calibration as well as DWF associated with infill development, known or planned development, and septic to sewer conversion project areas. The source of each Node DWF load can be found in the "ALLOC_CODE" field within the Node DWF dataset.

The Node RDII dataset contains RDII loading from the WWF calibration; this is applied to all future WWF scenarios. These RDII loads were derived during WWF calibration by creating RTK hydrographs for each sewershed basin.

In conjunction to the Node RDII dataset, Node Inflow adds additional RDII loading for all future development. I/I for all future development was assumed to be 500 gallons per day per acre. The pattern of RDII inflow from the WWF calibration was used to apply future RDII to simulate realistic future peak flow conditions. This future RDII pattern can be found by navigating to the bottom of the SWMM browser to the Operation tab and then to Time Series.

Wastewater Loads for the modeling conducted as part of the 2022 SSMP were based on assumptions and boundary conditions that are documented in the Final Report.

Diurnal Patterns

Diurnal curves for wastewater flows were developed using the flow monitoring data collected from each temporary flowmeter that was installed to calibrate the model. These diurnal patterns were set so that the flow pattern predicted by the model at each meter provided a reasonable approximation of the measured flow.

A list of diurnal patterns created for this Collection system model can be found by navigating to the bottom of the SWMM browser to the Operation tab and then to Time Series.

Useful Model Software Features

Database Editor

The Database Editor (DBEditor) allows the user to open the Collection system model database and edit user input fields (except ID). From the Open Table dialog box of DBEditor, the user can see that the model stores database tables in ten separate folders (see Figure 7). After selecting the desired table from under the relevant folder, the user has the option of choosing a display scope found on the bottom of the dialog box to open the desired records of the database.

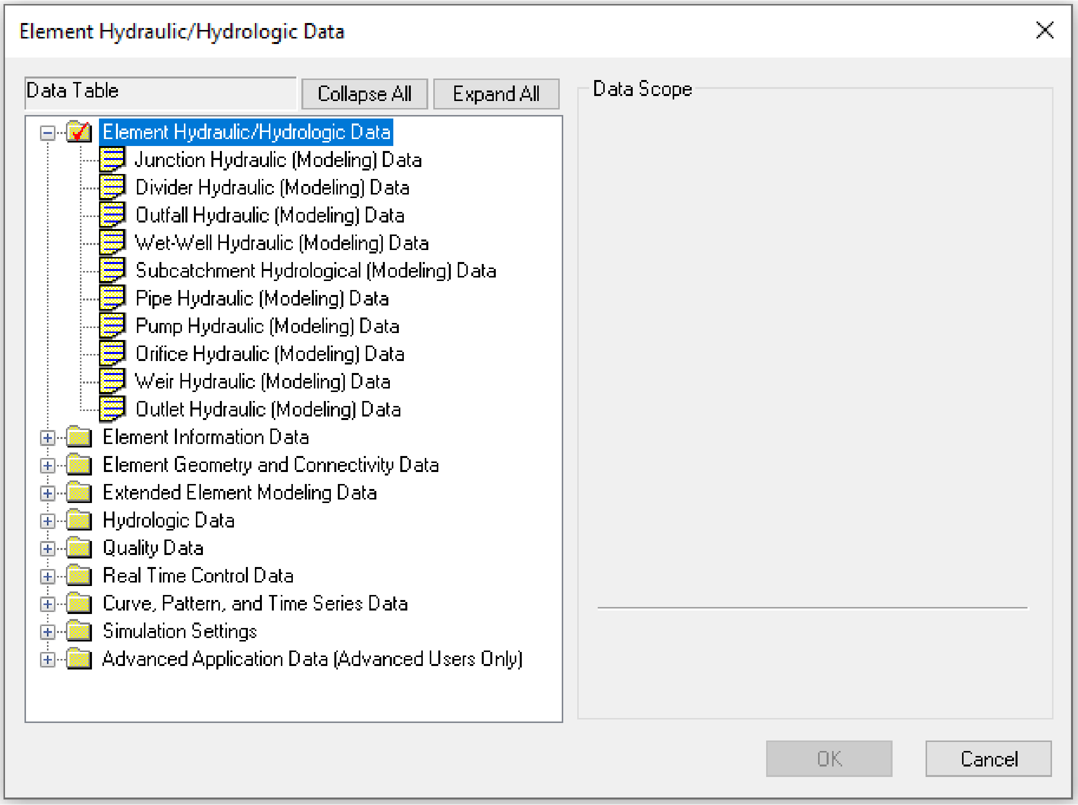


Figure 7 Database Editor Window

The DB Editor allows the user to:

- View Data - View (including custom format) modeling data tables.
- Add/Delete Custom Fields - Customize data tables by adding user-defined fields.
- Perform Block Edits - Allows the user to edit table data values, one record at a time or numerous records simultaneously. The Block Editor is a powerful tool to perform the same edit to many entities in the table.

Domains

A domain is a temporarily selected subset of network components. The domain can be used to efficiently identify a subset of the model entities for editing, or to display results. Domains can be created using the Domain Manager. The Domain Manager allows the user to use graphical selection, query sets, user defined queries, pre-defined queries, categories of network elements, and selection sets to add to or remove from the domain. Selection sets are groups of entities that have been added to a domain and then saved for later use. Several selection sets have already been created and can be used through the domain manager. The user may want to define additional selection sets for specific analyses. To create a domain, the user opens the Domain manager window that is shown on Figure 8. The user will then clear the

Domain of any previously selected entities by selecting the reset button. Then using the various tools for adding to a domain, select the tool or query method by selecting the corresponding radio button on the left, and then define a set of entities using the queries or graphical selection. Select add to add these entities to the domain. If desired, repeat this process with multiple queries or selections until the desired domain has been established. The remove button can be used to refine the selection or to correct errors. If the domain is to be saved for later use, select the save button, and enter a selection set name when prompted.

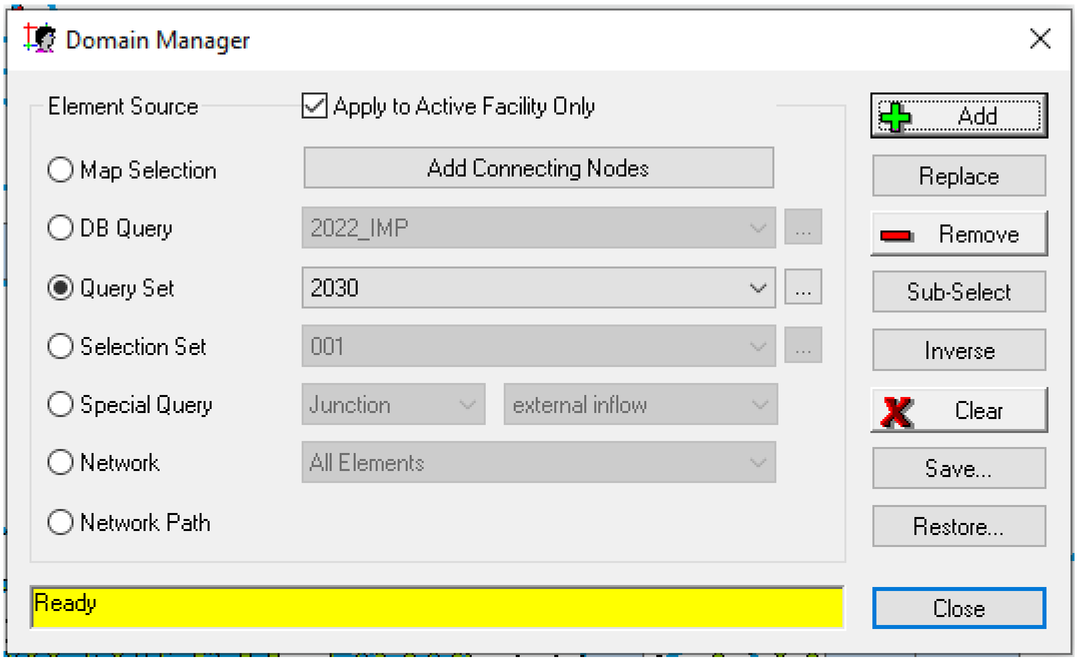


Figure 8 Domain Manager Window

The following is an examples of how the Domain Manager was used to edit and manage model data for the 2022 Model Update. A set of domains were created to separate the network into the 34 flow monitoring sub-basins, so the load and flow diurnal pattern can be assigned and/or adjusted to each manhole within a specific sub-basin. In addition, one domain was created for the 34 gravity pipes that had the inline meters installed. This domain was later used for model calibration to adjust diurnal patterns and loads for manholes upstream of each of those pipes.

Running InfoSWMM Simulations

The Environmental Protection Agency (EPA) SWMM Engine was used for each of the model scenarios. The EPA SWMM Engine solves the hydraulic equations over a period of time to route flows through a wastewater collection system. The advantage of the EPA SWMM Engine is that it enables the user to route flows and flow peaks through the collection system, to evaluate the timing of flow peaks. The peak flows from all areas of a collection system do not usually occur at the same time, so an EPA SWMM analysis gives a more realistic representation of flows than a steady-state simulation.

Simulation and Time Setting Options

Prior to running a SWMM analysis, the user will need to ensure that loads are properly determined and diurnal patterns have been applied to all flows. The user must also ensure that the simulation time option has been set for an SWMM analysis. The collection system model uses an 8-day simulation duration with a one-hour reporting interval for the DWF scenarios, and a 3-day simulation duration with a one-hour reporting interval for all future WWF scenarios. Output results exclude the data from the first day of simulation; this is so the flow routing can be fully established for all pipes in the model before data reporting.

To run an SWMM analysis, complete the following steps:

1. Choose the Run Manager command from the Tools menu. The Run Manager dialog box appears on the screen.
2. Click the Run button. Upon successful completion of the simulation, the Output Source Status Indicator (the stoplight) should show green. Close the Run Manager dialog box.

Figure 9 illustrates the Run Manager. Detailed settings of the report, simulation, and climatology options are viewed by clicking the three-dot button shown on the right of each scroll-down menu. The following simulation scenarios can be found in the Simulation Options pulldown menu:

- BASE – DWF.
- CAL_WWF – used for WWF calibration.
- DESIGN_STORM – used for future WWF scenarios.

Simulation Options can be edited by selecting the three dots which opens the Simulation Options window. The Simulation Options window can be seen on Figure 10.

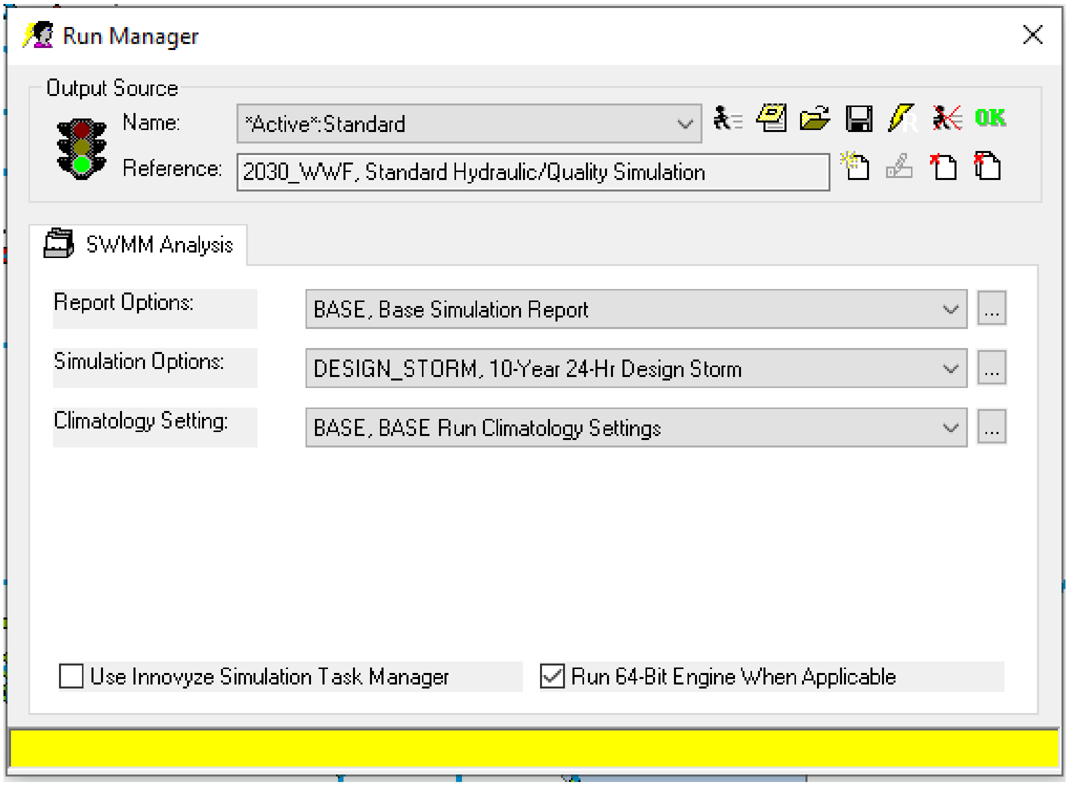


Figure 9 Run Manager Window

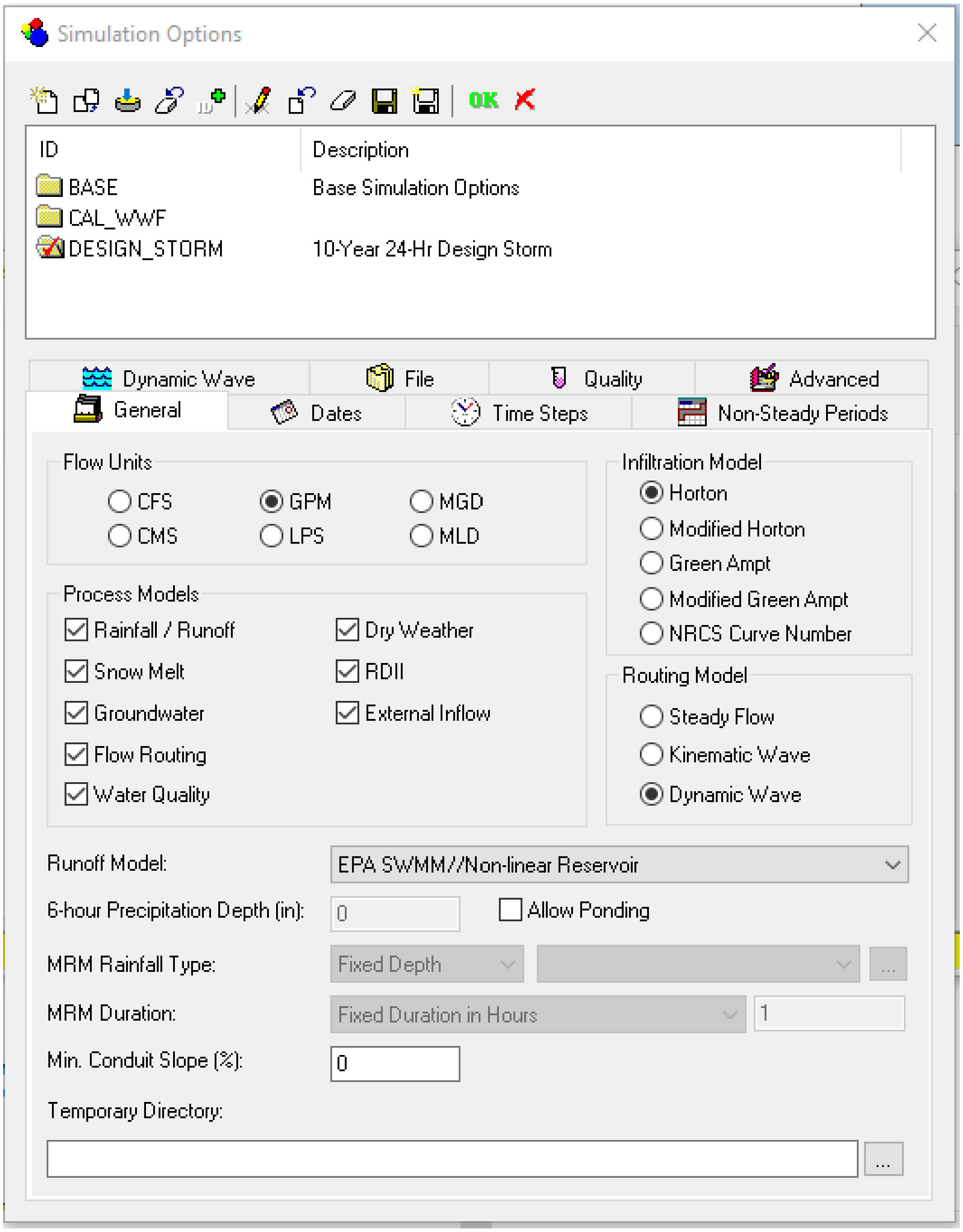


Figure 10 Simulation Option Window

Model Output

Upon completion of each simulation, the user can view, query, and display modeling results using the Report Manager. The report manager is where the user can generate reports and graphs for any element(s) as modeled in the collection system model. The results from SWMM analysis may be reviewed from the Attribute Browser window or using the Report Manager dialog box.

Attribute Browser

The output fields in the Attribute Browser display the output results for the latest model run. Figure 11 shows an example of output results.

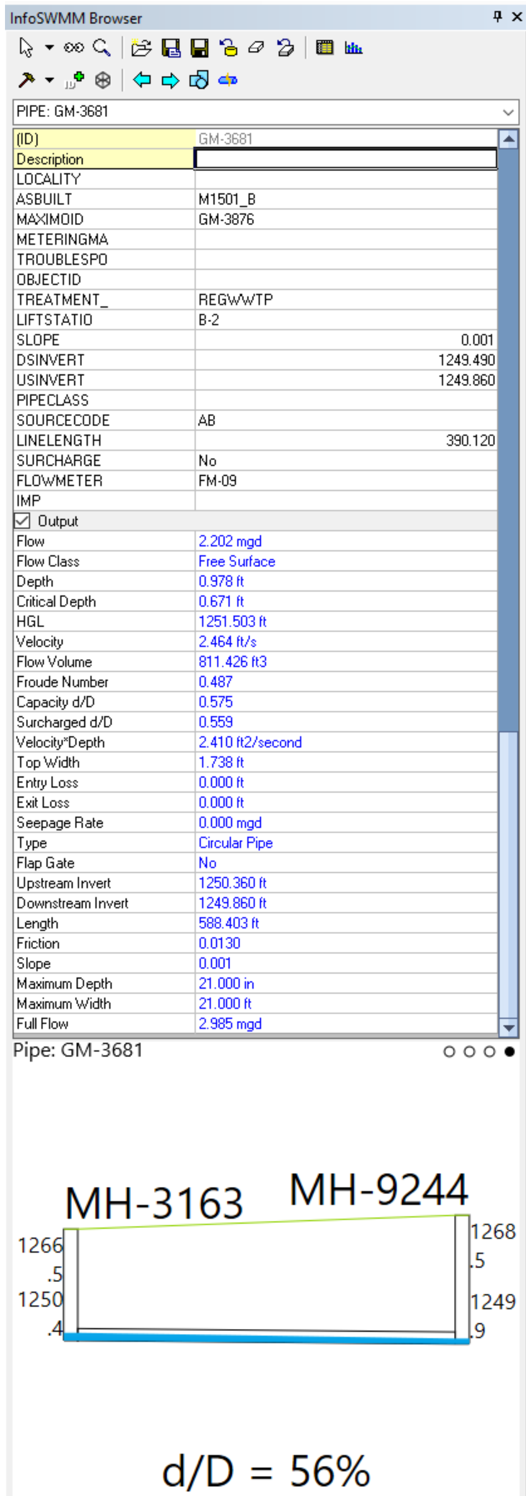


Figure 11 Example of Output Results

Report Manager

The Report Manager can generate various types of tabular reports and graphs for any (sets of) element(s) as modeled in the collection system model. Table 6 lists the types of tabular reports and graphs that can be generated from the Report Manager.

Table 6 Reports and Graphs Within Report Manager

Report	Graph
Junction Report	Junction Graph
Outfall Report	Outfall Graph
Wet-Well Report	Wet-Well Graph
Pipe Report	Pipe Graph
Pump Report	Pump Graph
Weir Report	Weir Graph
Junction Summary	Junction Group Graph
Outfall Summary	Outfall Group Graph
Wet-Well Summary	Wet-Well Group Graph
Wet-Well Volume Summary	Pipe Group Graph
Pipe Summary	Pump Group Graph
Pump Summary	Weir Group Graph
Weir Summary	System Graph
Flow Classification Summary	Hydraulic Grade Line Profile
Highest Continuity and Time Step Critical Element	Pump Operation Curve
Routing Time Step Summary	
Continuity Flow Routing	

To initiate the Report Manager, from the Tools menu, select Report Manager. From the initial dialog box, the user selects the new button, shown on Figure 12, and is provided with the Output Report/Graph dialog box as shown on Figure 13.

The output sources section on the left is used to select the output source for which the user wishes to generate a report or graph. For the current simulation, *Active* is selected. The sequence for creating a report or graph is to:

1. Select the desired output source.
2. Select the desired output report or graph for viewing.

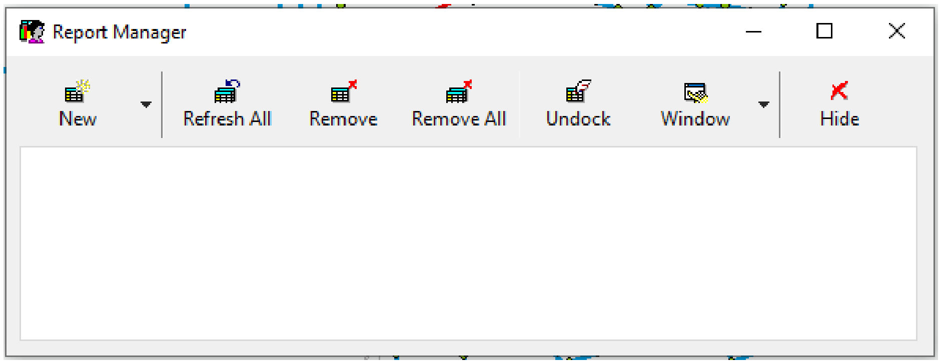


Figure 12 Report Manager Window

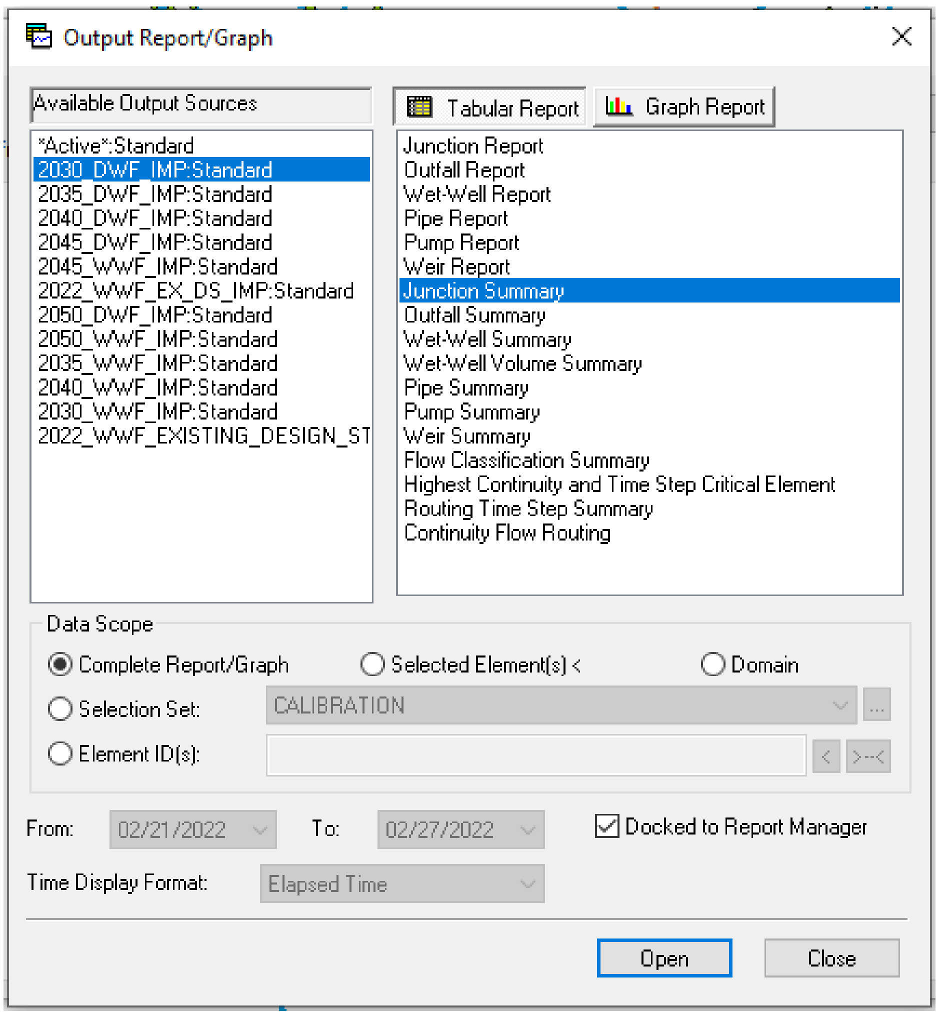


Figure 13 Output Report and Graph Window

Graphs

One of the most useful ways to see the collection system model results is through time-series graphs. To open a graph, perform the following:

1. Select Report Manager from the Tools menu. Once opened, choose the "New" button. When the output report/graph dialog box appears on the screen, select desired output source Available Output Sources area. Choose Pipe Graph in the Graph tab, and then click on the "Open" button.
2. The user is then prompted to select a pipe. Move and place the cursor on the desired pipe and press the left mouse button. A graph appears on the screen showing the daily flow variation for the selected pipe. (See Figure 14 as an example.)
3. To change to a velocity, water depth, or d/D graph, choose the desired variable from the drop-down list above. You can also click on the "Report" button to view the graph as a tabular report.

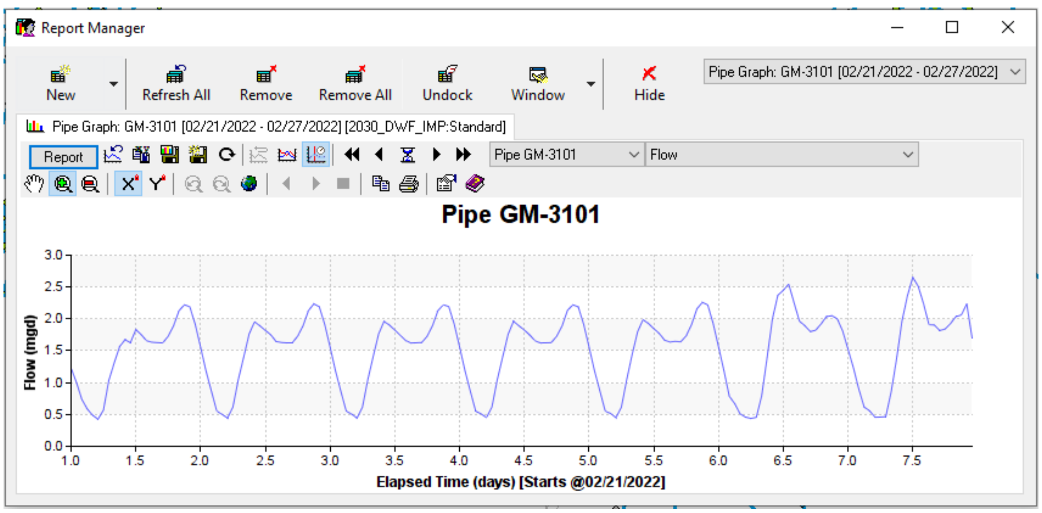


Figure 14 Example Graph for a Gravity Main Over 7 days

To create a pipe profile graph, select Create Profile Plot from the Tools menu. When the New Profile Plot dialog box appears on the screen, choose Select Elements, click on the "Open" button, and then select a pipe (see Figure 15).

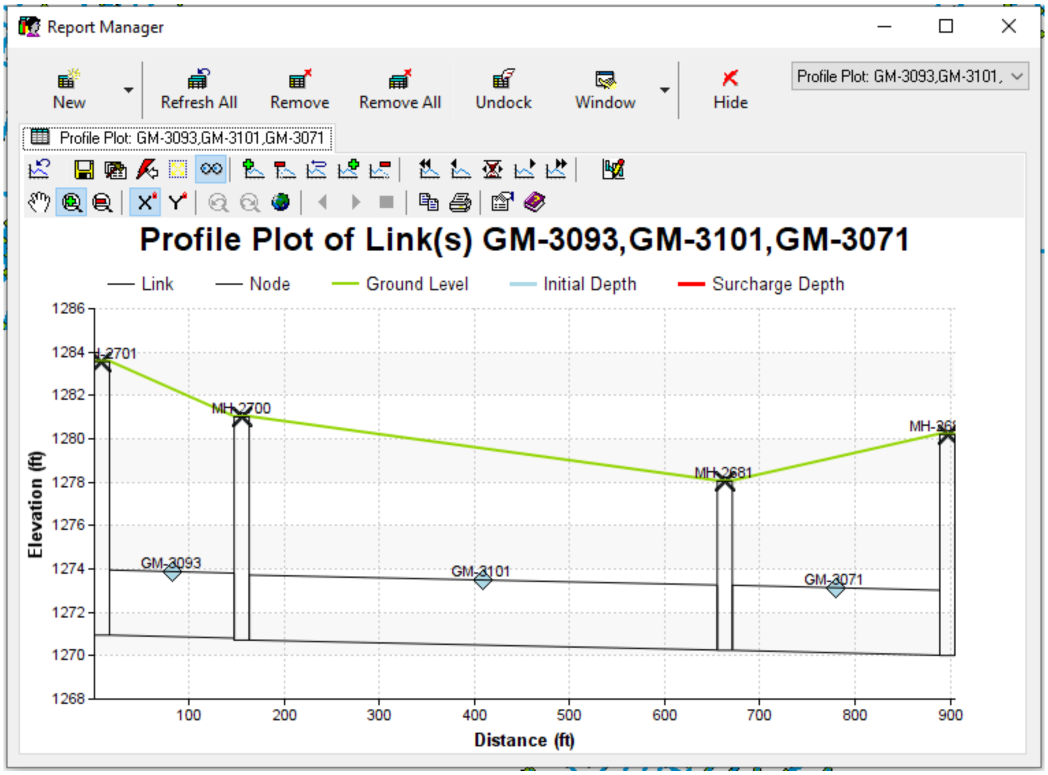


Figure 15 Example of a Pipe Profile Plot

Tabular Reports

Tabular reports can be used to determine if the existing sewer system pipes have adequate capacity. The user can print or export the content of an output tabular report. Alternatively, the report can be selected, copied, and then pasted into a spreadsheet or word processing program.