



March 2026

2244508*00

Crescenta Valley Water District Wastewater Master Plan

FINAL





Kennedy Jenks

35 N. Lake Ave, Suite 550
Pasadena, CA 91101
626-568-4300

**Crescenta Valley Water
District
Wastewater Master Plan**

19 March 2026



Project M-1037

Prepared for

Crescenta Valley Water District
2700 Foothill Boulevard
La Crescenta, CA 91214

KJ Project No. 2244508

Table of Contents

List of Tables.....	iv
List of Figures.....	v
List of Appendices.....	vi
List of Abbreviations.....	vi
Executive Summary	1
Background	2
Existing System Description	2
Existing and Future Sewer Flow Analysis	9
Sewer System Model Development.....	12
Collection System Evaluation	14
Capital Improvement Program Development.....	39
Section 1: Introduction	1-1
1.1 Background	1-1
1.2 Previous Work	1-4
1.2.1 2019 Sewer System Management Plan.....	1-4
1.2.1.1 Enhanced Maintenance Areas.....	1-4
1.2.1.2 Design Standards	1-5
1.2.2 Hazard Mitigation Plan	1-5
1.3 Objectives	1-6
1.4 Report Organization	1-6
Section 2: Existing System Description	2-1
2.1 Collection System Components	2-1
2.1.1 Gravity Sewer.....	2-1
2.1.2 La Granada Lift Station	2-5
2.1.2.1 Lift Station Construction.....	2-6
2.1.2.2 Electrical	2-6
2.1.2.3 Backup Generator.....	2-7
2.1.2.4 Controls	2-7
2.1.2.5 Suction Lift Pumps	2-8
2.1.3 Glenwood Nitrate Treatment Facility Brine Force Main	2-9
2.1.4 Outfall Diverter Valve	2-9
2.1.5 Flow Meters.....	2-10
2.2 Land Use	2-11
2.2.1 LA County Housing Element.....	2-12
2.3 Service Area.....	2-15
2.4 Population	2-17

Table of Contents (cont'd)

2.5	City of Los Angeles Wastewater Treatment & Disposal Agreement.....	2-17
Section 3:	Existing and Future Sewer Flow Analysis	3-1
3.1	Historical Wastewater Flow and Strength	3-1
3.2	Existing Customer Wastewater Demands.....	3-3
3.2.1	Return Flow Ratio Calculations.....	3-5
3.3	Sewer Flow Projections.....	3-7
3.3.1	UMWP Demand Projections	3-7
3.3.2	Future Sewer Flow Distribution	3-9
3.3.3	La Cañada Flintridge Future Wastewater Flow Projections.....	3-10
3.3.4	Integration of LCF Flows into Systemwide Projections	3-10
Section 4:	Sewer System Model Development	4-1
4.1	Hydraulic Model Development	4-1
4.1.1	Model Approach and Update	4-1
4.1.2	Sewer Demand Allocation.....	4-3
4.1.2.1	Existing Sewer Demand Allocation	4-3
4.1.2.2	Future Sewer Demand Allocation	4-3
4.1.3	Flow Meter Data Collection	4-4
4.2	Hydraulic Model Calibration	4-6
4.2.1	Calibration Criteria	4-6
4.2.2	Rainfall Data Analysis	4-7
4.2.3	Dry Weather Flow Calibration	4-7
4.2.3.1	Dry Weather Flow Diurnal Pattern	4-8
4.2.3.2	Dry Weather Flow Calibration Results	4-9
4.2.3.3	Dry Weather Unreliable Data	4-11
4.2.4	Wet Weather Flow Calibration	4-11
4.2.4.1	Wet Weather Calibration Results.....	4-12
4.2.4.2	Wet Weather Unreliable Data	4-13
4.2.5	Model Validation.....	4-14
4.2.5.1	Model Validation Results	4-14
4.2.6	Summary.....	4-16
Section 5:	Collection System Evaluation	5-1
5.1	Hydraulic Model Capacity Evaluation.....	5-1
5.1.1	Existing Flow Conditions	5-1
5.1.1.1	d/D Capacity Analysis	5-1
5.1.1.2	Pipe Velocity Analysis.....	5-4
5.1.1.3	Inflow & Infiltration Analysis	5-6
5.1.2	Future Flow Conditions	5-9
5.1.2.1	Future d/D Capacity Analysis.....	5-9

Table of Contents (cont'd)

	5.1.2.2	Future Pipe Velocity Analysis	5-12
5.2		La Granada Lift Station Condition Assessment.....	5-14
	5.2.1	Lift Station Building	5-14
	5.2.2	Lift Station Pumps.....	5-17
	5.2.3	Electrical and Instrumentation.....	5-23
	5.2.4	Backup Generator.....	5-24
5.3		Business Risk and Vulnerability Assessment.....	5-26
	5.3.1	Purpose.....	5-26
	5.3.2	Approach.....	5-26
	5.3.2.1	Workshop 1.....	5-26
	5.3.2.2	Data Collection	5-29
	5.3.2.3	Score Alternatives.....	5-29
	5.3.2.4	Workshop 2.....	5-30
	5.3.2.5	Develop a Prioritized CIP List	5-30
	5.3.3	Recommendations	5-38
Section 6:		Capital Improvement Program Development	6-1
6.1		Identified Projects.....	6-1
6.2		CIP Project Costs	6-3
	6.2.1	Capital Costs.....	6-3
	6.2.2	O&M Costs.....	6-4
6.3		CIP Project Schedule	6-5
	6.3.1	CIP Plan A.....	6-5
	6.3.2	CIP Plan B.....	6-5
6.4		Additional Recommendations.....	6-9
	6.4.1	Pipeline Rehabilitation Program.....	6-9
	6.4.1.1	Existing Pipeline Age & Materials	6-9
	6.4.1.2	Current Rehabilitation Practices	6-9
	6.4.1.3	Proposed Rehabilitation Methodology	6-10
	6.4.2	Recommended SSMP Updates	6-12
		<i>References.....</i>	<i>6-14</i>

Table of Contents (cont'd)

List of Tables

Table 1-1: Enhanced Maintenance Areas.....	1-5
Table 2-1: Sewer Pipe Size and Length Distribution.....	2-1
Table 2-2: Sewer Pipe Material and Length Distribution.....	2-1
Table 2-3: Sewer Pipe Age – Year Installed by Length	2-2
Table 2-4: Pump Control Setpoints	2-7
Table 2-5: Wet Well Alarm Setpoints	2-7
Table 2-6: RHNA Required Units for Unincorporated LA County	2-12
Table 2-7: WSA 2019 -2021 Average Annual Demand	2-15
Table 2-8: SSA 2019 -2021 Average Annual Demand	2-15
Table 2-9: 2020 UWMP Population – Current and Projected	2-17
Table 3-1: Wastewater Strength and Flow	3-1
Table 3-2: WSA Billed Demand Summary	3-3
Table 3-3: WSA versus SSA Water and Sewer Demands	3-4
Table 3-4: SSA Billed Water Demand by Usage Type.....	3-4
Table 3-5: Return Flow Ratios by Usage Type	3-6
Table 3-6: SSA Billed Water Demand by Usage Type.....	3-6
Table 3-7: 2020 UWMP Demand Projections and Sewer Flow Projections.....	3-8
Table 3-8: LAC 2021-2029 Potential Growth	3-9
Table 4-1: List of Flow Meters	4-5
Table 4-2: Rainfall Event Summary	4-7
Table 4-3: Dry Weather Flow Calibration Results (1/23/23 to 1/29/23).....	4-10
Table 4-4: Wet Weather Flow Calibration Results (1/7/23 to 1/12/23).....	4-13
Table 4-5: Model Validation Results (2/22/23 to 2/27/23).....	4-15
Table 5-1: I&I Analysis – February 2023, 24-Hour Storm	5-8
Table 5-2: NPFA 820 Table 4.2.2 Collection Systems Classifications (NFPA, 2023).....	5-16
Table 5-3: Pump Run Time	5-18
Table 5-4: Pump Capacity Calculations	5-18
Table 5-5: Approximate Pump TDH with Varying Roughness Values	5-18
Table 5-6: Pump Starts per Hour	5-22
Table 5-7: CVWD Business Element Definition	5-28
Table 5-8: Consequence of Failure Category Weightings	5-29
Table 5-9: Business Vulnerability Category Weightings	5-30
Table 5-10: Recommended Infrastructure Project Prioritization	5-38
Table 6-1: CVWD CIP Projects	6-2
Table 6-2: Capital Cost Assumptions	6-3
Table 6-3: CIP Projects Capital Costs.....	6-4
Table 6-4: Non-Infrastructure CIP Project O&M Costs	6-5
Table 6-5: CIP Plan A Schedule	6-6
Table 6-6: CIP Plan B Schedule	6-8

Table of Contents (cont'd)

Table 6-7: Sewer Pipe Age – Year Installed by Amount of Reaches	6-9
Table 6-8: LACSD CIPP Liner Cost Data.....	6-10

List of Figures

Figure 1-1: CVWD Historical Annual Water Production and Sewer Flows	1-2
Figure 1-2: CVWD Vicinity Map	1-3
Figure 2-1: Wastewater Collection System Overview	2-3
Figure 2-2: Collection System Pipe Age	2-4
Figure 2-3: La Granada Lift Station Vicinity Map 1	2-5
Figure 2-4: La Granada Lift Station Vicinity Map 2	2-6
Figure 2-5: AllPrime Model S-4 Pump Curve with Design Point of 135 GPM @ 44' TDH	2-9
Figure 2-6: Diverter Valve Configuration.....	2-10
Figure 2-7: Rockland PI Flow Meter Location	2-11
Figure 2-8: CVWD Land Use and Identified Housing Element Parcels	2-14
Figure 2-9: CVWD Service Areas	2-16
Figure 2-10: Flow Schematic of City of LA Agreement	2-18
Figure 2-11: Historical and Projected Trend of City of LA Agreement Costs	2-19
Figure 2-12: Historical and Projected Unit Treatment Costs vs WW Monthly Base Rates	2-19
Figure 3-1: Historical SSA Wastewater Flow and Strength (Oct 2000 – Mar 2023)	3-2
Figure 3-2: Relationship between Water and Sewer Demands	3-3
Figure 3-3: 2019-2021 Average Monthly Billed Water Demand.....	3-4
Figure 3-4: Systemwide Return Flow Ratio.....	3-5
Figure 3-5: SSA Water Demand versus Metered Sewer Flow	3-7
Figure 3-6: UWMP Demand Projections and Projected Sewer Flows	3-8
Figure 4-1: CVWD's Overall Existing Model and Setershed Locations	4-2
Figure 4-2: Model Demand Allocation Method.....	4-3
Figure 4-3: Sample DWF Diurnal Patterns.....	4-9
Figure 4-4: DWF Results for Elk Ave Flow Meter	4-10
Figure 4-5: Outlier Results for Meter FM06.....	4-11
Figure 4-6: WWF Results for Elk Ave Station	4-12
Figure 4-7: Outlier Results for Meter FM08.....	4-14
Figure 4-8: Validation Results for Elk Ave Station	4-15
Figure 4-9: Validation Results for Meter FM09	4-16
Figure 5-1: Existing System DWF d/D Capacity Results	5-2
Figure 5-2: Existing System WWF d/D Capacity Results.....	5-3
Figure 5-3: Existing System Minimum Velocity Results	5-5
Figure 5-4: Overlay of Wet and Dry Weather Events for FM01	5-7
Figure 5-5: Future Sewer Flow DWF d/D Capacity Analysis Results	5-10
Figure 5-6: Future Sewer Flow WWF d/D Capacity Analysis Results.....	5-11
Figure 5-7: Future System Minimum Velocity Results	5-13

Table of Contents (cont'd)

Figure 5-8: NFPA 820 Figure A.4.2(e) Abovegrade Wastewater Pumping Station Not Physically Separated from Wet Well; Illustration of Table 4.2.2, Row 17 (NFPA, 2023)...	5-15
Figure 5-9: La Granada Lift Station Force Main Alignment.....	5-19
Figure 5-10: Pump and System Curve.....	5-20
Figure 5-11: Lift Station Discharge Header.....	5-21
Figure 5-12: Daily Pump Cycles versus Wet Well Level Setpoints	5-22
Figure 5-13: BRVA Timeline	5-26
Figure 5-14: CVWD Risk Matrix (See Appendix E for Full Size / High Resolution Table)	5-27
Figure 5-15: System Level Risk Scoreboard.....	5-33
Figure 5-16: System Safety Condition Scoreboard.....	5-34
Figure 5-17: Consequence of Failure and Asset Condition Combined Scoreboard	5-35
Figure 5-18: Risk Matrix Using Weighted COF	5-36
Figure 5-19: Risk Matrix Using O&M Safety Condition	5-37
Figure 5-20: Recommended Project Locations.....	5-40
Figure 6-1: CIPP Liner Exponential Function Costs.....	6-11
Figure 6-2: CIPP Lining Cost Curves	6-12

List of Appendices

Appendix A	Enhanced Maintenance Area Locations
Appendix B	Housing Element 2021-2029 Parcel Information
Appendix C	Hydraulic Model Calibration Results
Appendix D	La Granada Condition Assessment Notes and Photos
Appendix E	BRVA Notes and Results
Appendix F	CIP Project One Sheets
Appendix G	CIP Project Class 5 Cost Estimate

List of Abbreviations

AACE	American Association of Cost Engineering
AC	Asset Condition
ADS	ADS Environmental Services
ADWF	Average Dry Weather Flow
AF	Acre-feet
AFY	Acre-feet per Year
AMBP	Asset Management Business Processes

Table of Contents (cont'd)

AMI	Area Median Income
APM	Asset Performance Management
APN	Assessor Parcel Number
ASCE	American Society of Civil Engineers
ASSFC	Amalgamated System Sewerage Facilities Charge
ASSSC	Amalgamated System Sewerage System Charge
ATS	Automatic Transfer Switch
BOD	Biological Oxygen Demand
BRVA	Business Risk and Vulnerability Assessment
BV	Business Vulnerability
CCTV	Closed-Circuit Television
CIP	Capital Improvement Program
CIPP	Cured-in-place piping
CMU	Concrete Masonry Unit
COF	Consequence of Failure
CVWD	Crescenta Valley Water District
d/D	Depth to Diameter
EMA	Enhanced Maintenance Area
FPS	Feet per Second
FRP	Fiberglass Reinforced Pipe
GIS	Geographic Information System
GPCD	Gallons per Capita per Day
GPM	Gallons per Minute
GWTP	Glenwood Water Treatment Plant
HGL	Hydraulic Grade Line
HMP	Hazard Mitigation Plan
HP	Horsepower
HTP	Hyperion Treatment Plant
I&I	Inflow and Infiltration
IDM	Inch-Diameter Mile
KPI	Key Performance Indicator
kW	Kilowatt
LACSD	County Sanitation Districts of Los Angeles County
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LCF	La Cañada Flintridge
LCID	La Cañada Irrigation District
MCC	Motor Control Center
MFR	Multi-Family Residential

Table of Contents (cont'd)

MGD	Million Gallons per Day
MWD	Metropolitan Water District of Southern California
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
O&M	Operation and Maintenance
OPCC	Opinion of Probable Construction Cost
PLC	Programmable Logic Controller
POR	Preferred Operating Range
PWWF	Peak Wet Weather Flow
R	Resiliency (ERP, AOP, SOP)
RDII	Rainfall-Derived Infiltration and Inflow
RES	Reliability Engineering Support
RHNA	State of California's Regional Housing Needs Assessment
RTK	Unit Hydrograph Methodology
SC	Safety Condition
SCADA	Supervisory Control and Data Acquisition
SCAG	Southern California Association of Governments
SFR	Single Family Residential
SS	Suspended Solids
SSA	Sewer Service Area
SSMP	Sewer System Management Plan
SSO	Sanitary Sewer Overflows
T	Training
TDH	Total Design Head
TSS	Total Suspended Solids
UPS	Uninterrupted Power Supply
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VCP	Vitrified Clay Pipe
VFD	Variable Frequency Drive
WaPUG	Wastewater Planning Users Group
WDR	General Waste Discharge Requirements
WEF	Water Environment Federation
WEM	Work Execution Management
WSA	Water Service Area
WTP	Water Treatment Plant
WWMP	Wastewater Master Plan
WWTP	Wastewater Treatment Plant

Executive Summary

The Crescenta Valley Water District (CVWD) has developed the 2023 Wastewater Master Plan (WWMP) to continue their mission to “provide quality wastewater services to the Crescenta Valley community in an economically responsible manner” (CVWD, 2024). The main goal of this WWMP is to provide CVWD with a roadmap of key projects and improvements to current practices that will improve the safety and reliability of the collection system to continue to serve Crescenta Valley for many years to come. The Capital Improvement Program developed as part of this WWMP is meant to be a living document, with the flexibility to adjust the timing and priority of key system improvements based on changing risk factors and the evolving needs of CVWD. This is the first WWMP that has been completed for CVWD’s collection system since its inception in the 1980’s.

Background

Crescenta Valley Water District (CVWD) is located in the La Crescenta-Montrose unincorporated area of Los Angeles County (LA County), nestled between the foothills of the San Gabriel Mountains, between the San Fernando and San Gabriel Valleys. CVWD provides water distribution and sewage collection within its boundaries to the communities of La Crescenta, Montrose, Verdugo City, and City of Glendale as well as a small portion of the City of La Cañada-Flintridge.

The CVWD WWMP has been prepared to evaluate CVWD's sewer system for existing and future sewer flow conditions. The objectives of this WWMP include the following:

- 1) Identify existing collection system deficiencies through discussions with O&M and Engineering Staff, condition assessments, and hydraulic modeling/flow data collection
- 2) Quantify impacts to the collection system as a result of future growth/densification, and identify potential future collection system deficiencies
- 3) Develop list of CIP projects prioritized by risk and develop project costs
- 4) Develop implementation strategy for potential near-term and long-term CIP projects

Existing System Description

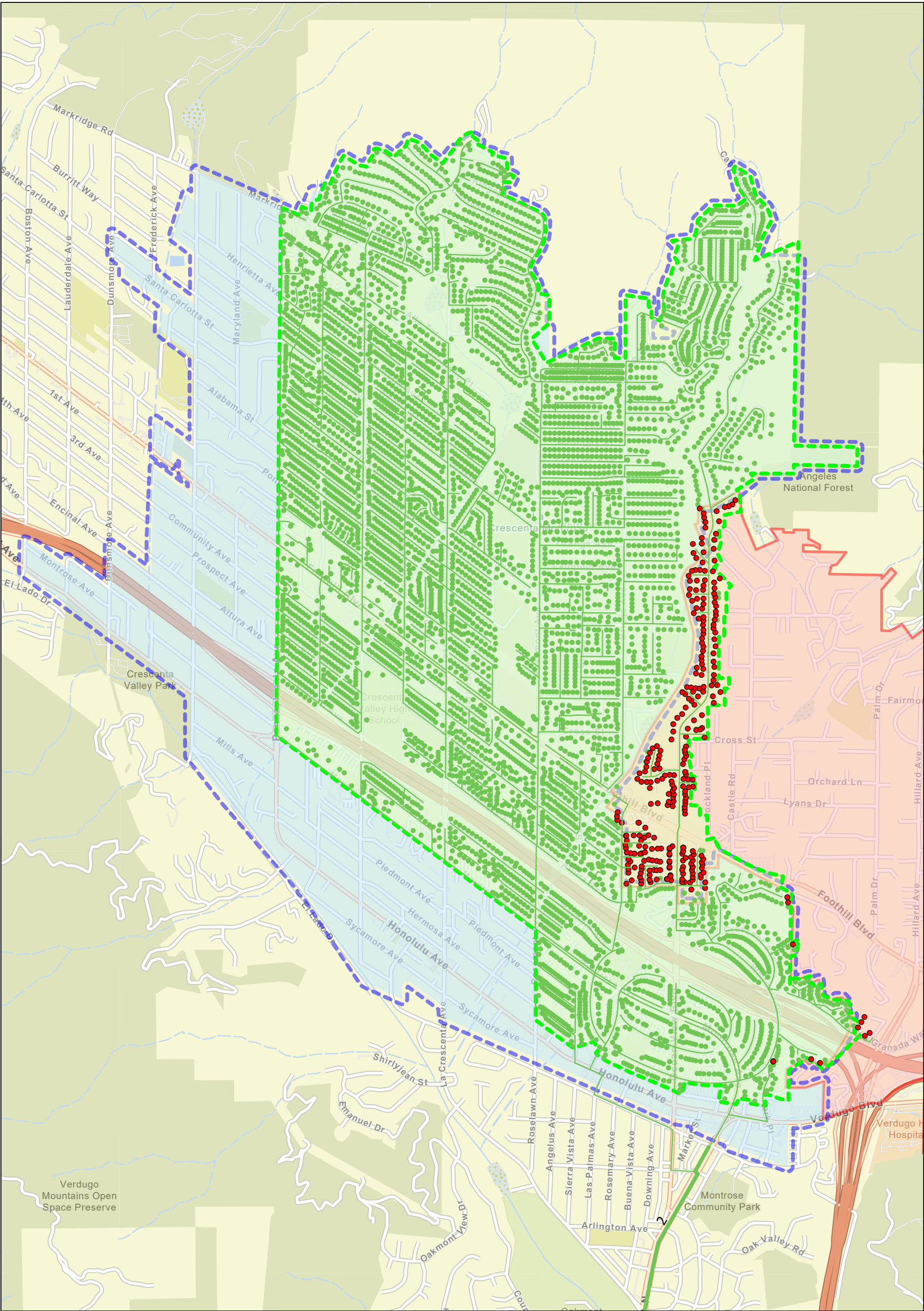
With a service area of approximately 4 square miles which serve a population of approximately 33,000 people, CVWD covers various elevations of terrain varying from 1,200 feet to nearly 3,000 feet above sea level (Pacific Institute, 2024). CVWD currently provides water service to approximately 8,800 accounts. As Figure ES-1 shows, CVWD's sewer service area (SSA) is not the same as the water service area (WSA). Compared to WSA, CVWD's SSA serves approximately two-thirds the number of customers and population, including approximately 6,000 accounts and a population of around 22,000.

CVWD's collection system has an average flow of 1.54 million gallons per day and includes 68 miles of pipeline, one lift station, and two flow monitoring stations. The collection system is primarily constructed of 8-inch vitrified clay pipe (VCP) installed in the 1980's. For the purposes of this WWMP, the SSA was subdivided into 10 sewersheds, primarily defined by major confluence points in the system where significant flows discharge into the trunk sewer lines. An overview of the sewer system is provided in Figure ES-2. This figure shows the locations of the flow meters that were installed for the 3-month data collection period. This figure also shows the locations of CVWD's enhanced maintenance areas (EMAs), which are areas in CVWD's SSA that require more regular maintenance/cleaning due to a variety of factors such as shallow slopes prone to debris buildup/blockages, or areas with historical SSO events. Table ES-1 documents the locations of these EMAs.

Table ES-1: Enhanced Maintenance Areas

EMA #	Location
1	Pine Glen Rd / Pineridge Dr
2	La Crescenta & Orange
3	Foothill & Briggs (76 Station)
4	Foothill between Sunset/Briggs, North Side
5	2000 Hilldale Dr
6	Waltonia between Hilldale and Montrose
7	Canalda and Ocean View flush tank
8	Prospect Ave between Sunset and Rosemont
9	Community between Ramsdell & Glenwood
10	Mountain Pine & Timberlake

H:\GIS_Cloud\Projects\Crescenta\ValleyWater\DistrictEvents\Crescenta_WWMP\Crescenta_WWMP.aprx Date: 1/16/2024 Printed by: Connor Ritten



Legend

LCID Sewer Customers

CVWD Sewer Customer

Sewer Gravity Mains

Sewer Service Area

Water Service Area

La Canada Irrigation District

Notes:

1. LCID Customers are sewer only customers



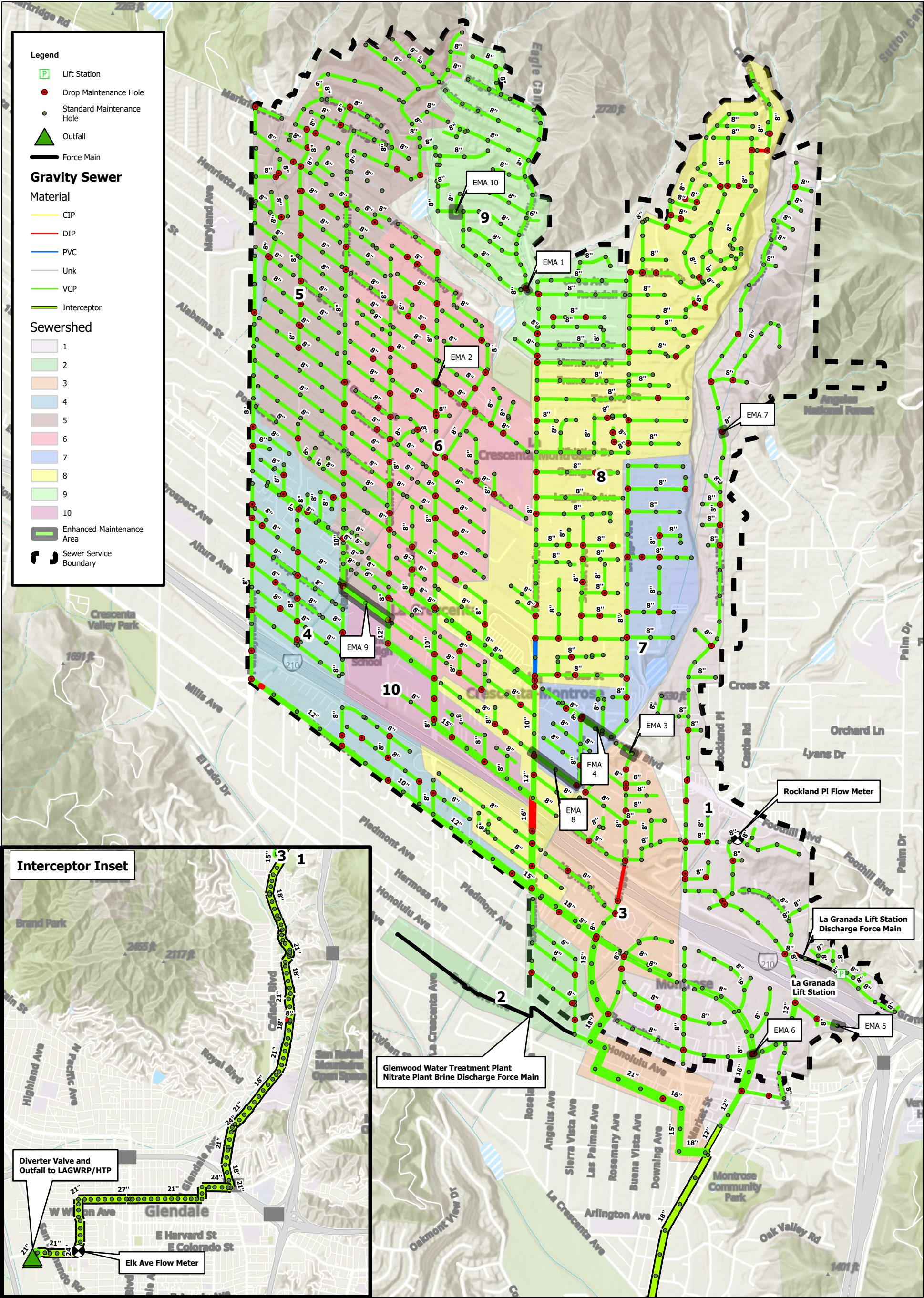
Kennedy Jenks

Crescenta Valley Water District
Wastewater Master Plan

Service Area Overview

2244508*00

Figure ES-1



Notes:

1. Gravity Sewer symbol thickness varies by pipe diameter

KJ Kennedy Jenks

Crescenta Valley Water District
Wastewater Master Plan

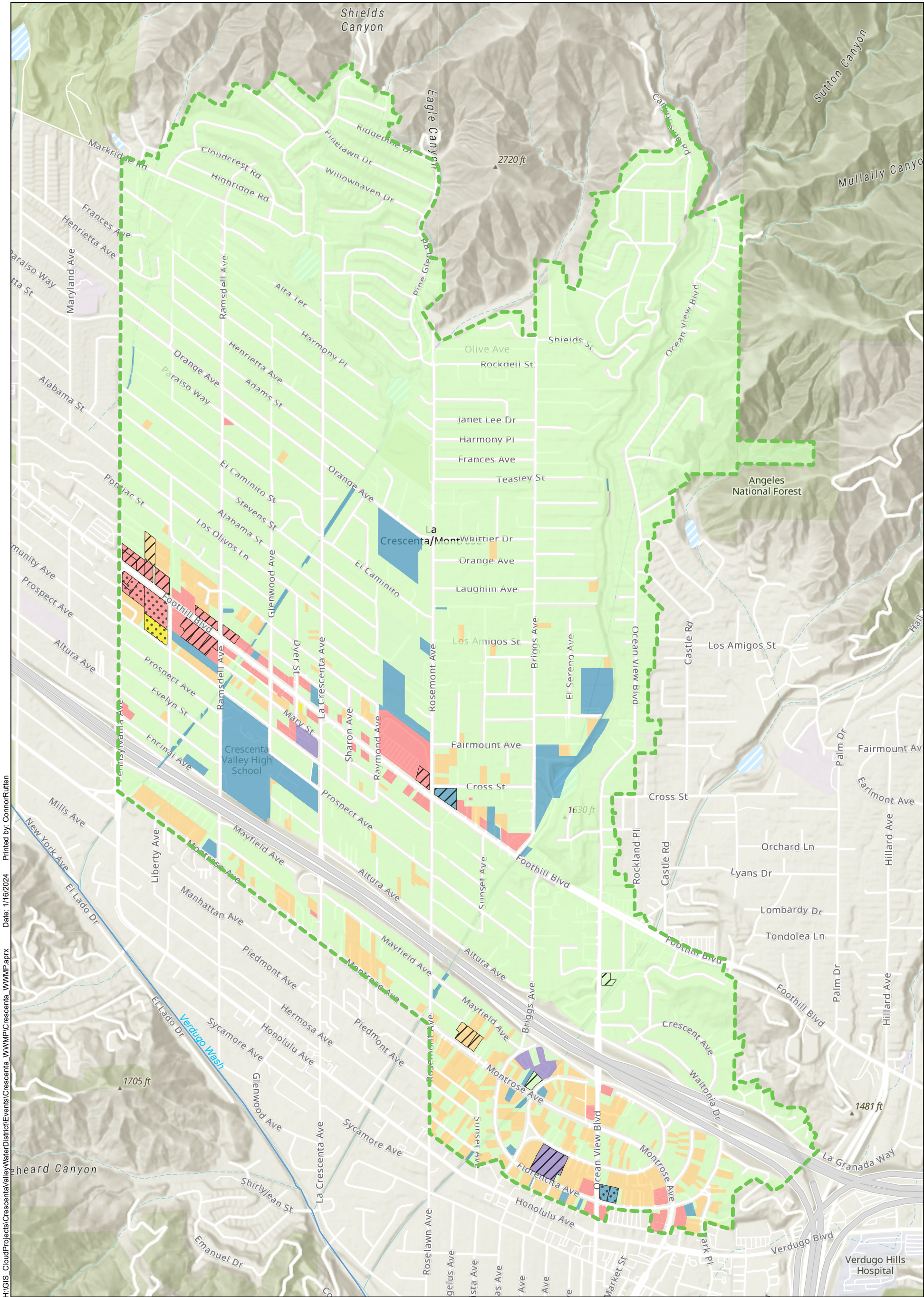
**Wastewater Collection
System Overview**

2244508*00
Figure ES-2

CVWD's service area is primarily made up of residential and some light commercial accounts, and is largely built out with limited room for additional growth without significant densification. The 2020 Urban Water Management Plan estimated CVWD's WSA population to be around 32,500 in 2020, and is expected to be 35,100 by 2045 with an average annual growth rate of only 0.3%.

Due to the State of California's (State) ongoing effort to provide more affordable housing for its growing population, the State created the Regional Housing Needs Assessment (RHNA) to evaluate where and when additional housing is needed. LA County has identified some parcels within CVWD's service area that could be candidates for rezoning/densification. These parcels are primarily along the main commercial corridors on Foothill Blvd and Honolulu Ave.

CVWD's service area land use and parcels identified for densification are shown in Figure ES-3.



H:\GIS_Cloud\Projects\Crescenta\ValleyWater\DistrictEvents\Crescenta_WWMP\Crescenta_WWMP.aprx Printed by: Connor Ritten Date: 1/16/2024

Legend
LA County Parcels
Land Use Type

SFR

MFR

Commercial

Industrial

Gov/Institutional

School

Los Angeles County Housing Element (2021-2029) - Rezoning

Los Angeles County Housing Element (2021-2029) - Sites Inventory

Sewer Service Area

N

0

500

1,000

Scale: Feet

KJ

Kennedy Jenks

Crescenta Valley Water District
Wastewater Master Plan

**Sewer Service Area
Land Use and Housing
Element Parcels**

2244508*00

Figure ES-3

CVWD does not own or operate their own wastewater treatment plant (WWTP), and therefore relies on an ongoing agreement with the City of Los Angeles (City of LA) to receive and treat their wastewater. CVWD is one of the 24 Contracting Agencies that participate in the City of LA's Treatment & Disposal of Wastewater Agreement (Agreement). Currently, almost all of CVWD's wastewater is conveyed to the Los Angeles-Glendale Water Reclamation Plant (LAGWRP). Less than 1% of CVWD's wastewater is conveyed directly to Hyperion Treatment Plant (HTP), which occurs while CVWD is backwashing their ion exchange system at their GWTP, producing a highly concentrated brine that LAGWRP is not able to receive and treat.

The City of LA charges CVWD based on the distance of CVWD's outfall to either LAGWRP or HTP (depending on where the flow is treated), as well as the quantity and strength of the sewage being treated. The final unit that the treatment fee is based on is calculated in "MGD-Miles". From 2010 to 2020, the unit cost to treat 1 MG of flow rose on average by 8% each year. In 2020, it cost CVWD roughly \$2,500 for every 1 MG of flow sent to the City of LA. If these trends continue at the same rate of growth, the unit cost for treating 1 MG of flow in 2030 will be \$5,826. By contrast CVWD's base wastewater (WW) rate has grown by 5.4% per year on average from 2010 to 2023. Therefore, the cost of treatment is outpacing the rate at which WW rates are being adjusted. CVWD may consider performing another cost of service study using the CIP cost information included in this WWMP to ensure that CVWD has enough revenue to offset rising treatment costs. Figure ES-4 shows the historical and projected trend of the City of LA Agreement costs.

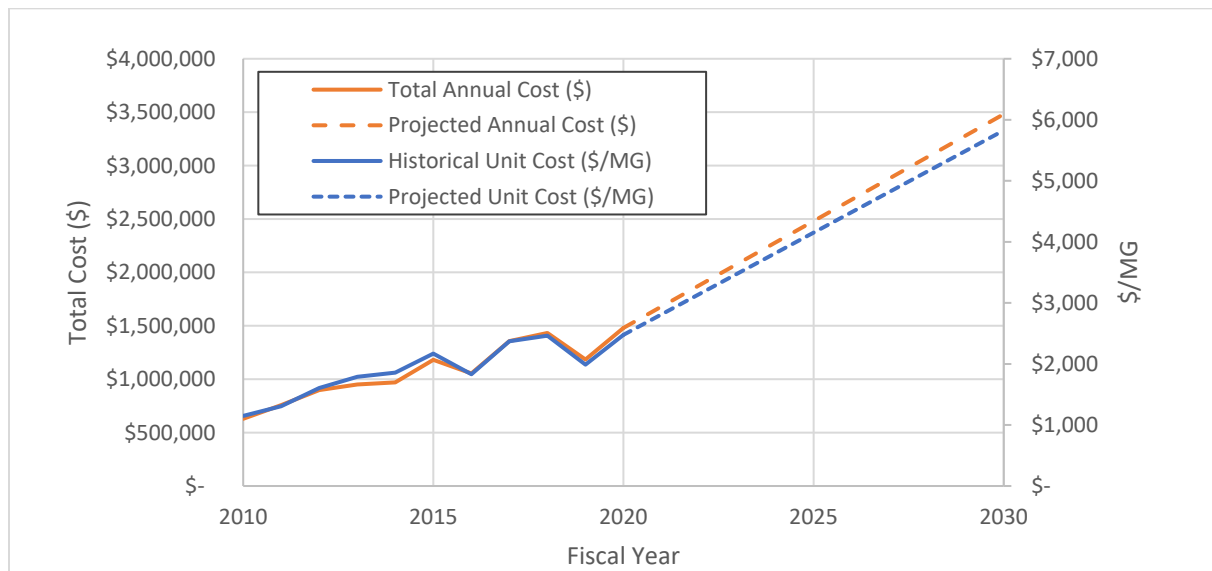


Figure ES-4: Historical and Projected Trend of City of LA Agreement Costs

Existing and Future Sewer Flow Analysis

Historical water demand and sewer flow data was used to evaluate sewer demands at the individual customer level. Future sewer flow projections were developed using a combination of population and water demand projections as well as housing data/predictions from the Housing Element. Sewer flows are not directly metered at each individual customer and must be estimated based on the customer's corresponding water demand. Because CVWD's WSA and SSA serve different populations, the water billing data required additional analysis to determine what portion of water customers were located within the SSA. Figure ES-5 shows the relative relationships between the WSA Billed Water Demand, SSA Billed Water Demand, and SSA Sewer Demand. Table ES-2 provides a summary of the water demand geolocated within the WSA versus in the SSA.

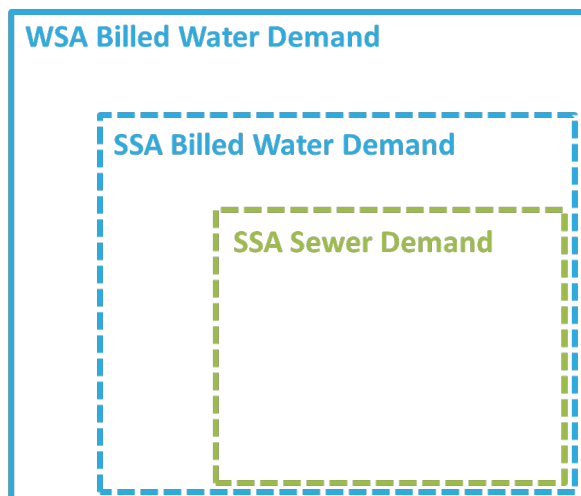


Figure ES-5: Relationship between Water and Sewer Demands

Table ES-2: WSA versus SSA Water and Sewer Demands Reduction Factor

WSA Billed Water Demand (2019- 2021, AFY)	SSA Billed Water Demand (2019- 2021, AFY)	SSA Reduction Factor (-)
3,656	2,533	0.693

To calculate the sewer demand for each individual customer, sewer return flow ratios were developed for each water customer usage type. The sewer return flow ratio represents what portion of the water demand being consumed by a water customer is then returned to the collection system as waste. On a systemwide basis, the return flow ratio has steadily increased over time, as the system water demands have significantly decreased while wastewater flows have remained relatively constant. Figure ES-6 documents the trend of the systemwide return flow ratio between 1996 to 2020. While water demands have steadily decreased over time, wastewater flows have remained relatively constant, resulting in higher return flow ratios.

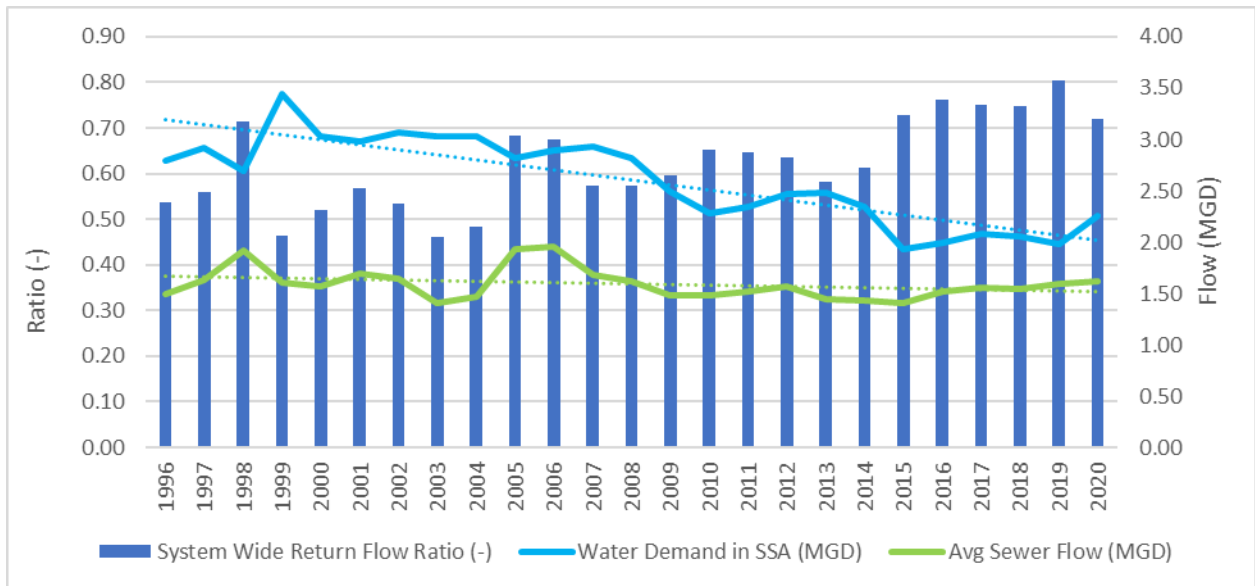


Figure ES-6: Systemwide Return Flow Ratio

In general, customers with less green space who primarily use water indoors, such as MFR customers, will have higher return flow ratios. Customers that use water for irrigation and fire protection will have no return flow, as the water is fully consumed and does not return to the sewer collection system. Several other Southern California WWMP efforts were surveyed to identify typical return flow ratios for the usage types in CVWD's system. Table ES-3 provides the return flow ratios used for this WWMP. Due to the high percentage of single family residential (SFR) demand in the SSA, the SFR return flow ratio had the largest impact on the sewer demand calculations.

Table ES-3: Return Flow Ratios by Usage Type

Usage Type	Return Flow Ratio
Commercial	80%
Fire	0%
Institutional	60%
Irrigation	0%
MFR	80%
School	50%
SFR	60.6%

Table ES-4 provides the summary of the calculated sewer flows by demand category.

Table ES-4: SSA Billed Water Demand by Usage Type

Usage Type	2019 - 2021 Average Annual Water Demand in SSA (GPM)	Return Flow Ratio	2019 - 2021 Average Annual Sewer Demand in SSA (GPM)	% Total Sewer Demand
Commercial	42	80%	33	3.0%
Fire	0.45	0%	0	0.0%
Institutional	8	60%	5	0.4%
Irrigation	33	0%	0	0.0%
MFR	355	80%	284	25.1%
School	36	50%	18	1.6%
SFR	1,196	60.6%	725	64.3%
LCF Metered Flow ¹	-	-	63	5.6%
Total	1,670 (2.41 MGD)		1,128 (1.62 MGD)	100%

Notes:

1. Composition of metered La Cañada Flintridge (LCF) Flow Unknown.

The sewer flow projections developed in this WWMP maintained alignment with population and water demand projections developed as part of the 2020 UWMP, and took into account the Housing Element parcel densification that is anticipated within the next decade. The resulting sewer flow projections actually show a net decrease in sewer flows by 2045, using the average sewer flow from 2019-2021 as the initial benchmark. Figure ES-7 and Table ES-5 summarize the sewer flow projections out to 2045.

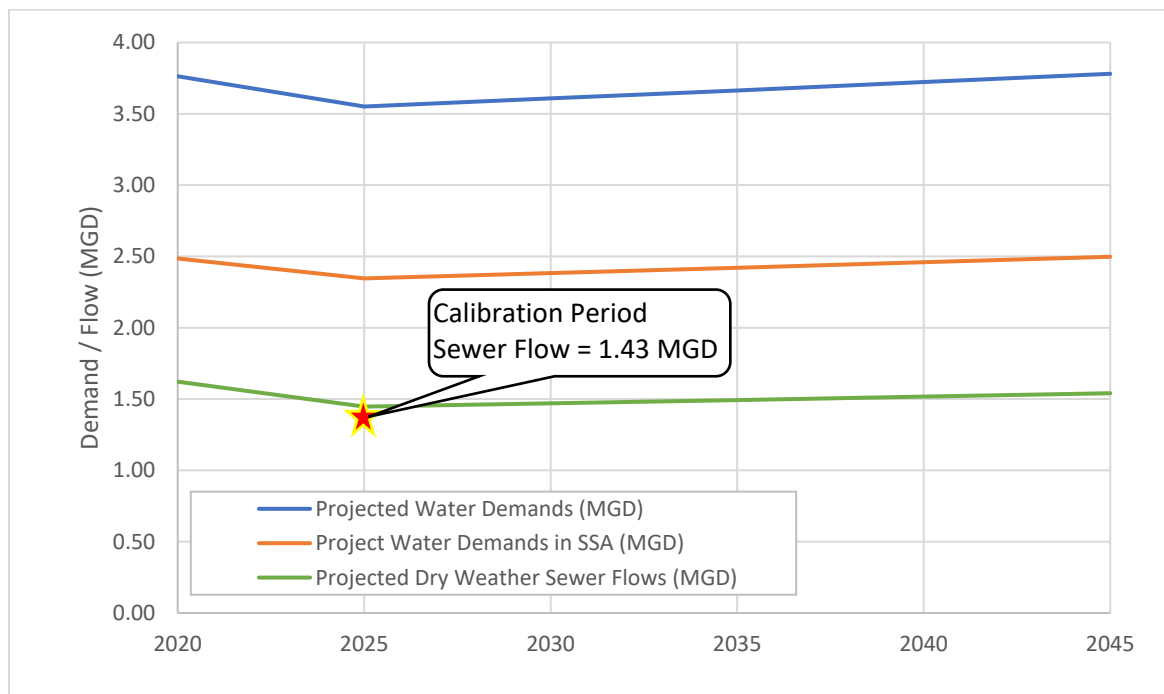


Figure ES-7: UWMP Demand Projections and Projected Sewer Flows

Table ES-5: 2020 UWMP Demand Projections and Sewer Flow Projections

Year	Population	Per Capita Water Demand (GPCD)	Projected Water Demands (MGD) ¹	Project Water Demands in SSA (MGD) ²	Projected Sewer Flows (MGD)
2020	32,462	115.9	3.76	2.49	1.62
2025	32,974	107.7	3.55	2.35	1.45
2030	33,494	107.7	3.61	2.38	1.47
2035	34,022	107.7	3.66	2.42	1.49
2040	34,558	107.7	3.72	2.46	1.52
2045	35,103	107.7	3.78	2.50	1.54

Notes:

1. 2020 Water Demand based on actual total billing data for the year 2020. The 5-year average system demand from 2015-2020 was 3.45 MGD. Because demand projections use the 5-year average as the starting point, the UWMP shows a dip in projected demands between 2020 and 2025 before continuing to climb to 2045.
2. The WSA to SSA reduction factor of 0.6606 was used to convert projected WSA water demands SSA water demands.

Sewer System Model Development

A key element of understanding the capacity of CVWD's collection system under existing and future sewer flows involved the development of the collection system hydraulic model. Innovyze's InfoSWMM software was used to develop the hydraulic model. The development of the hydraulic model involved several steps including importing CVWD's existing GIS sewer geodatabase, reviewing model connectivity, calculating/assigning existing and future flows to the model, and calibrating the model using flow meter data. Figure ES-2 provided the locations of the temporary flow meters installed to collect real time dry weather and wet weather flow data.

The calibration and validation process were based on flow data collected between December 2022 and March 2023. For calibration, data from eight out of the eleven temporary flow meters was used, in addition to the Elk Ave permanent Flow Meter, located just north of the intersection of S Pacific Ave and W Elk Ave. The selected dry weather period spanned from January 23 to January 29, 2023, covering both weekdays and weekends. The dry weather peak flow and volume calibration criteria obtained from the Wastewater Planning Users Group (WaPUG) required at least 80% agreement between measured and model-predicted hydrographs. Overall, 89% of events met the calibration criteria for both dry weather peak flow and volume.

The calibration storm event occurred on January 9, 2023, simulating a 2-year, 24-hour design storm. The storm on February 24, 2023, equivalent to a 25-year, 24-hour design storm, was selected for validation. The wet weather calibration and validation criteria required at least 60% agreement between measured and model-predicted hydrographs. Notably, 71% of wet weather peak flow and 100% of wet weather volume met the calibration criteria. During validation, 44% of wet weather peak flow and 67% of wet weather volume were met. Although validation didn't meet peak flow criteria, the predicted flows were higher than the observed flows, meaning the model results are conservative and a reasonable match between measured and modeled values. Therefore, this calibration and validation are considered acceptable.

Consequently, this model effectively assesses CVWD’s sanitary sewer system capacity and informs infrastructure improvements that will be documented in the CIP.

Figure ES-8 and Figure ES-9 provide snapshots of the Elk Ave Flow Meter calibration results, showing the agreement between the modeled and observed flow data under both dry weather flow (DWF) and wet weather flow (WWF) conditions.

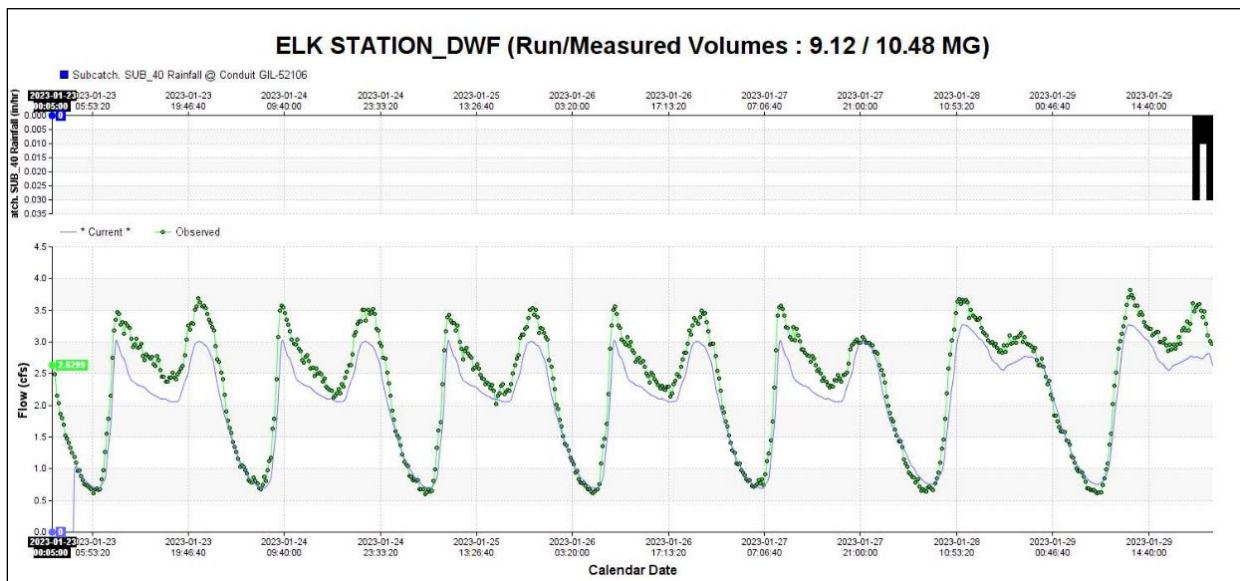


Figure ES-8: Elk Ave Flow Meter Observed versus Modeled DWF Flows

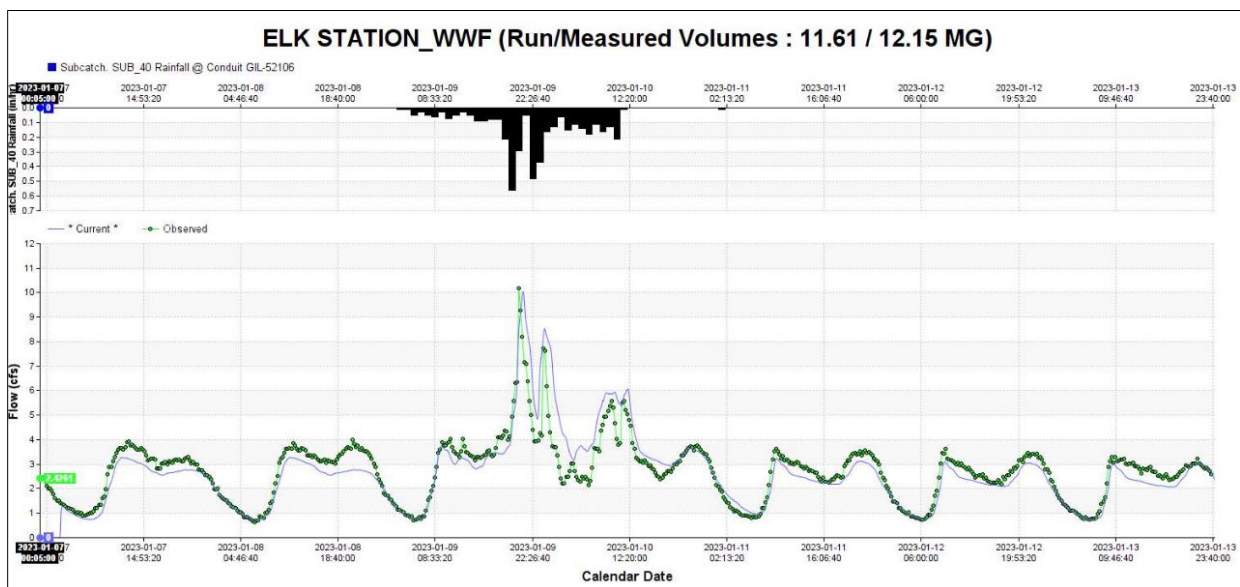


Figure ES-9: Elk Ave Flow Meter Observed versus Modeled WWF Flows

Collection System Evaluation

Several analyses were completed as part of the collection system evaluation, including the Hydraulic Model Capacity Evaluation, the La Granada Lift Station Condition Assessment, and the Business Risk and Vulnerability Assessment. These analyses were an amalgamation of several months of data collection, workshops, and field investigations to provide the most comprehensive understanding and evaluation of the collection system's performance.

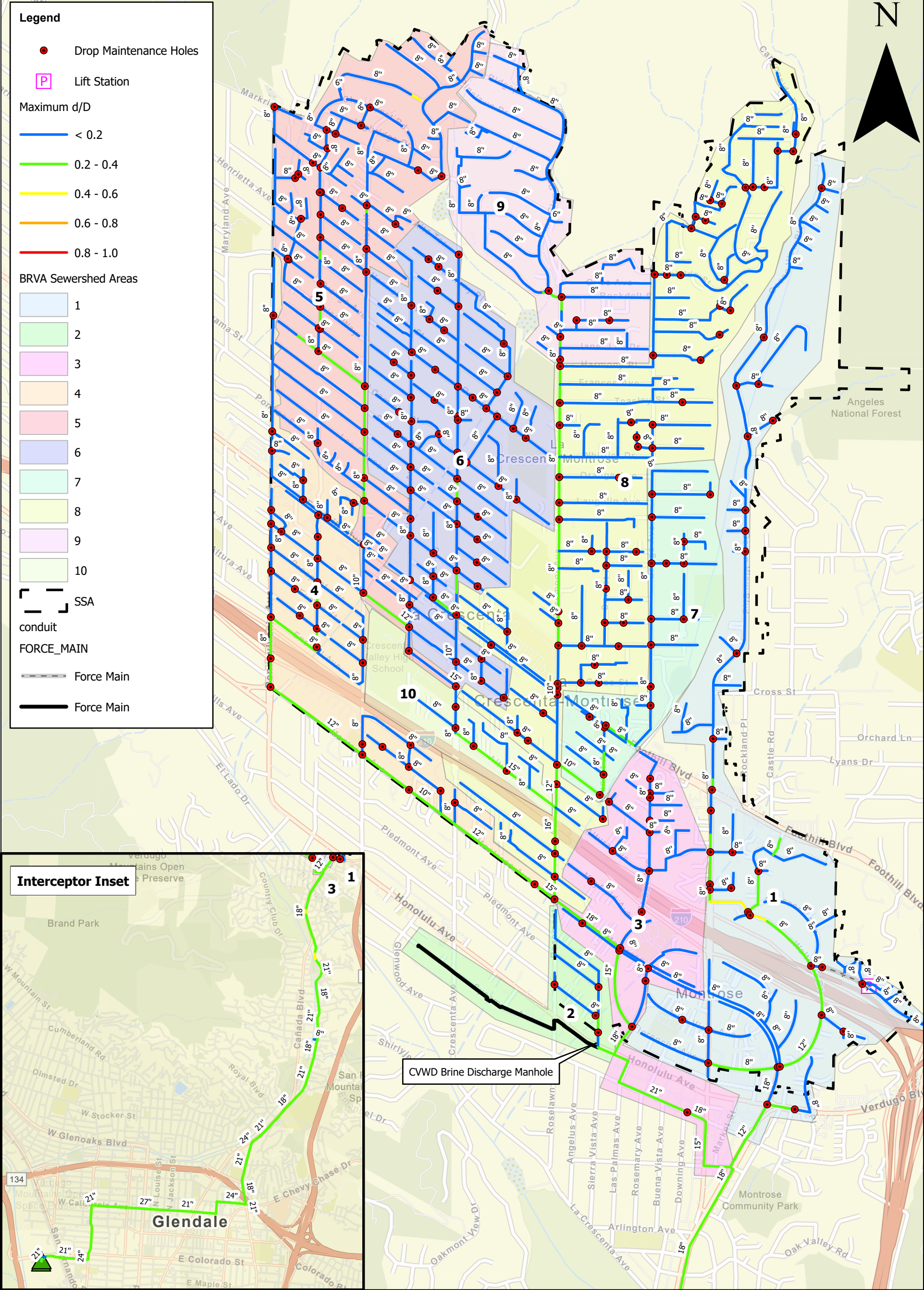
Hydraulic Model Capacity Evaluation

One of the key performance indicators (KPIs) of a sewer collection system, is limiting the occurrence of sanitary sewer overflows (SSOs). This objective hinges on the ability of each pipe within the collection system to convey to accumulated upstream sewer flows without exceeding the pipe flowing full. As soon as a gravity sewer pipe turns from gravity to pressurized flow, known as surcharging, the risk an SSO drastically increases.

Flow depth has long been a key design parameter in sewer design, exemplified by the flow depth-to-diameter (d/D) ratio. This ratio, integral to sewer design guidelines, is calculated as d/D , where 'd' represents the flow depth in inches, and 'D' is the sewer diameter in inches. Gravity sewers are typically designed with some reserve capacity, the degree of which can vary based on various design recommendations. For instance, the American Society of Civil Engineers (ASCE) and the Water Environment Federation (WEF) recommend that sewers up to 15 inches in diameter maintain dry weather d/D ratios below 50%, and larger sewers keep these ratios under 75%. Sewers are not intended to operate under surcharge conditions, hence wet weather d/D ratios should ideally remain below 100%.

Specific design criteria from the SSMP dictate that the d/D ratio should be less than 60% under ADWF and below 80% under PWWF. These standards are necessary to ensure the sewer system's effectiveness to reliably convey raw sewage through pipeline infrastructure. A focal area of concern is Waltonia Drive, influenced by shallow slopes (0.0036 – 0.0043) and a concentrated number of upstream customers. Here, the d/D ratios are measured to be between 0.52 - 0.55 under DWF and 0.67 – 0.71 under WWF in Sewershed 1. Figure ES-10 and Figure ES-11 show the results of the existing DWF and WWF d/D capacity analyses. Due to the projected sewer flows being less than existing sewer flows, the capacity evaluation results for the future flow scenarios are identical to the existing flow capacity results.

H:\GIS_CloudProjects\CrescentaValley\WaterDistrict\Events\BRVA_Results\BRVA_Results.aprx
Printed by: DrajhanKalatic
Date: 7/5/2024

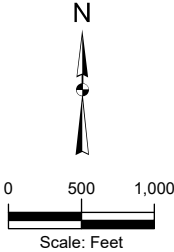


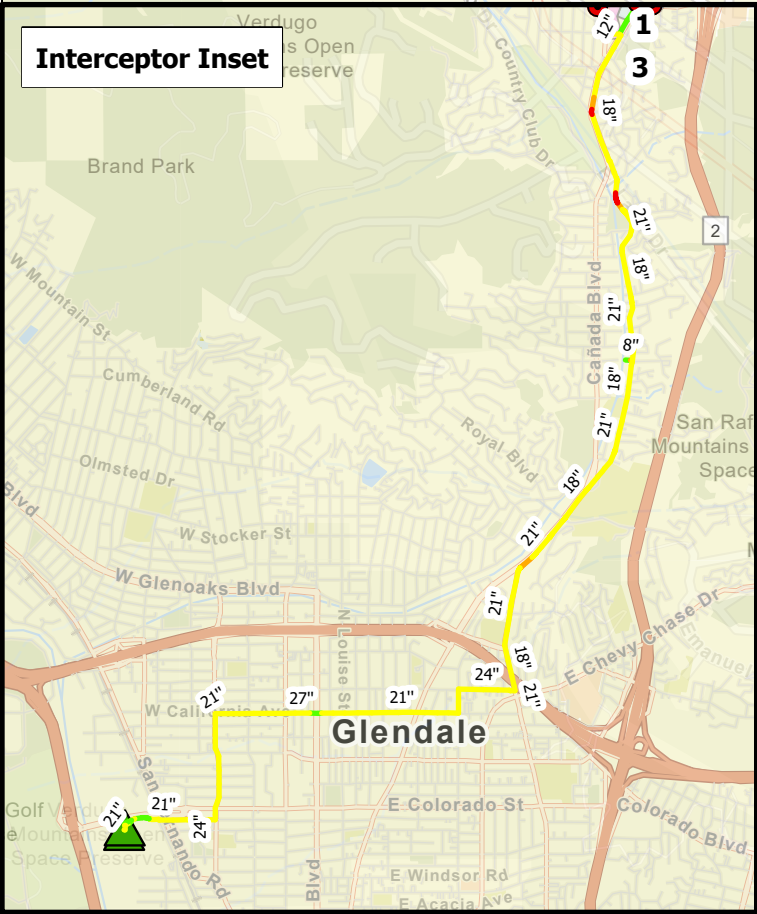
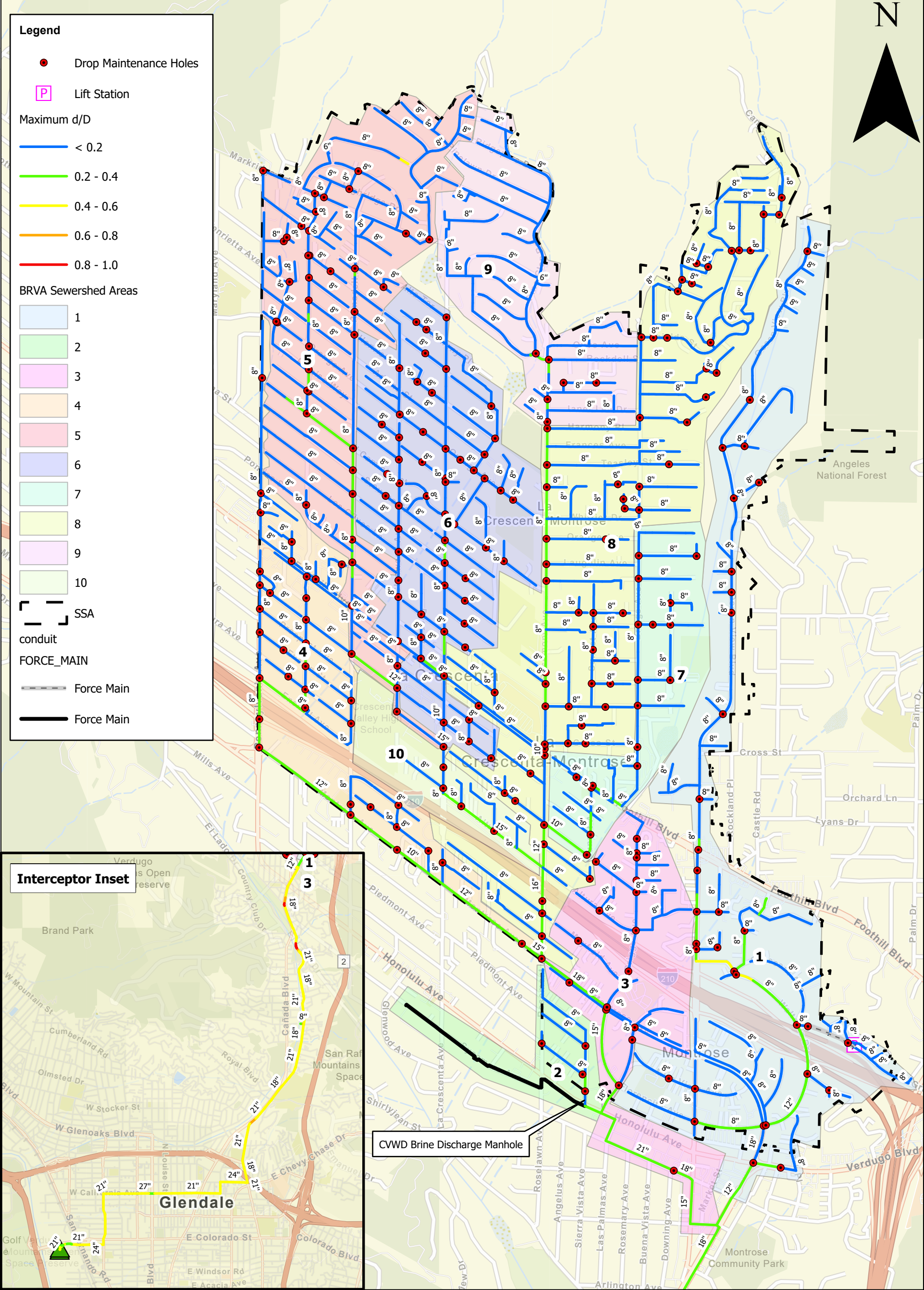
Notes:

K Kennedy Jenks
Crescenta Valley Water District
Wastewater Master Plan

System Overview
Existing ADFW d/D

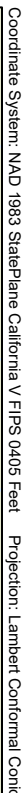
2244508*00
Figure ES-10





The other main KPI for collection systems is the range of sewer flow velocities. Pipe velocity is driven by pipe diameter, pipe slope, and sewer flow rates. Pipe velocities should be high enough to prevent debris and solids from settling and collecting at the bottom of the pipe, but low enough to avoid significant flow turbulence/hydraulic jumps, which releases more corrosive gasses that could lead to maintenance hole corrosion and/or odor complaint issues. The calibrated hydraulic model was used to evaluate system pipe velocities to identify any potential areas not achieving CVWD's design velocity criteria. According to the SSMP, sewer mains must uphold a minimum velocity of 2.5 feet per second (fps) and a maximum of 10 fps, adhering to a minimum pipe slope of 2%.

The primary goal under Average Dry Weather Flow (ADWF) conditions is to maintain a minimum velocity to achieve effective scouring. Scour velocity is crucial in addressing issues related to impacts of Fats, Oils, and Greases (FOGs) as well as sanitary products, such as baby wipes. The typical industry standard for minimum sewer velocity is 2 fps. Even using this less conservative minimum velocity criterion, the hydraulic evaluations reveal that under ADWF, 93% of collectors and 26% of trunk sewers did not meet the 2-fps criterion. One possible contribution to this issue could be the water conservation efforts that have taken place over the last decade, resulting in lower sewer flows. With the collaboration of CVWD, the O&M staff indicated that no odor complaints have been made in the SSA. Odor complaints are typical in areas with low sewer pipe velocities. Consequently, there's no need for extraordinary measures beyond regular maintenance to maintain system efficiency and reliability. This approach ensures both the effectiveness of wastewater management and the longevity of the sewer infrastructure. Figure ES-12 shows the results of the analysis.



I&I Analysis

I&I refers to the entry of groundwater (infiltration) and stormwater (inflow) into a sewer system. When a collection system is compelled to handle a greater flow than it was designed for, I&I can result in pipeline surcharging and downstream impacts to pumping and/or wastewater treatment facilities. This increased effluent not only poses challenges for wastewater treatment facilities but also escalates costs since the stormwater and groundwater mix with sewage and the entire volume must be processed at the treatment plant.

I&I can constitute a significant portion of annual flow to treatment plants, reaching up to 45% in some cases. This excess burden can overwhelm the collection system, leading to several adverse consequences.

- Uncontrolled SSOs: I&I can exceed the capacity of pipelines, pumping stations, or treatment plants, causing raw sewage to overflow and pollute the environment.
- Pipe Failures: Excess flow due to I&I can stress and damage pipes, increasing the risk of leaks and breaks.
- Soil Subsidence and Sinkholes: I&I can undermine the supporting soil around pipes, potentially leading to ground collapse and sinkholes.

These issues highlight the importance of addressing I&I effectively to safeguard public health, environmental quality, and infrastructure integrity.

Calculating I&I involves flow monitoring, where wastewater flow in the system is measured over time and compared with a baseline flow estimate. These measurements are crucial for determining the extent of I&I in the sewer system. Flow monitoring not only aids in identifying and prioritizing areas for further inspection but also serves as a basis for visual inspection methods to assess the severity of I&I in a given area.

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.

Figure ES-13 provides a visualization from a portion of flow meter data for FM01. The storm event used for I&I analysis was February 24th storm which was the same as validation period. The wet weather flow hydrograph was overlayed with the measured dry weather flow hydrograph of the days prior to the storm. The difference between the two-time series is equal to the volume of I&I entering the collection system. The total I&I volume is an indicator of combined inflow and infiltration which was calculated for all sewersheds based on available flow meter data to identify which sewersheds have the highest portion of I&I.

After analyzing the scattergraphs from different flow meters, the flow returns to ADWF levels right after the conclusion of the observed storm event, indicating the absence of groundwater infiltration.

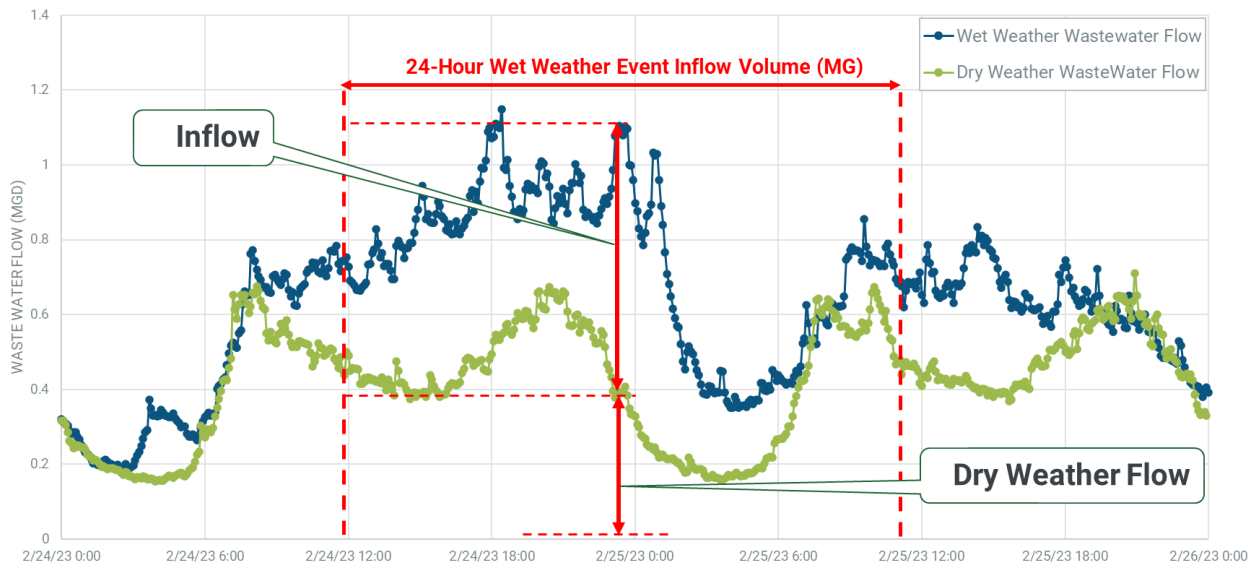


Figure ES-13: Overlay of Wet and Dry Weather Events for FM01

Table ES-6 summarizes the calculations and rankings for the sewersheds based on highest I&I rate, in units of gallons per day, per inch-diameter mile (gpd/idm).

Table ES-6 - I&I Analysis – February 2023, 24-Hour Storm

Ranking*	Sewershed	Inch- Diameter Mile (idm)	Design Storm Total Inflow Rate (Gpd/idm)
1	Sewershed 2+3	49	8,247
2	Sewershed 1	71	3,474
3	Sewershed 7	25	2,922
4	Sewershed 6+10	86	2,320
5	Sewershed 9	36	1,448
6	Sewershed 5	86	1,354
7	Sewershed 4	53	720
8	Sewershed 8	107	597

Based on the I&I analysis, Sewersheds 1, 2, and 3 make up only 22% of the collection system's piping by length but contribute 55% of the total I&I present in the collection system. Therefore, focusing on reducing I&I for this portion of the system will yield the greatest return on the invested time and resources.

La Granada Lift Station Condition Assessment

An in-person condition assessment of the La Granada Lift Station was conducted in July 2023 to identify any risks, deficiencies, and to provide improvement recommendations. A summary of the findings for each facet of the lift station is documented in the following subsections. See Appendix D for more detailed notes and photographs from the condition assessment. The summary of findings/recommendations are provided below by category.

The main issue for the entire lift station is that it does not currently comply with NFPA 820 code. The opening from the wet well is in the same room as all of the lift station electrical equipment, presenting an explosion hazard. The building is currently classified as a Class 1 Division 1 (C1D1) space. Ventilation could be added to the lift station so that it was “continuously ventilated at 12 changes per hour” to make the space Division 2 (C1D2); however, C1D2 spaces still require significant changes to the electrical equipment. The State of California Department of Industrial Relations (DIR) also has additional directives for electrical equipment in C1D2 spaces, such as requiring de-energizing the entire facility in the event that the ventilation system fails for any reason (DIR, 2021). This would require the lift station to stop conveying sewage entirely, which would require bypass pumping during the period when the lift station was not operational.

Given the current lift station configuration and the direct opening from the wet well to the pump/electrical room, there is no way to make the lift station building an “unclassified” space (not in the presence of any potentially flammable gasses).

Building Recommendations:

- Abandon interior building wet well and install wet well on the outside of the building (Figure ES-14)
- Provide proper ventilation to meet NFPA 820 requirements. Consider installing louvers or an exhaust fan for proper ventilation in the PS building.
- Assess and reinforce wood-framed roof for seismic stability.
- Evaluate the feasibility of replacing the wood-framed roof.

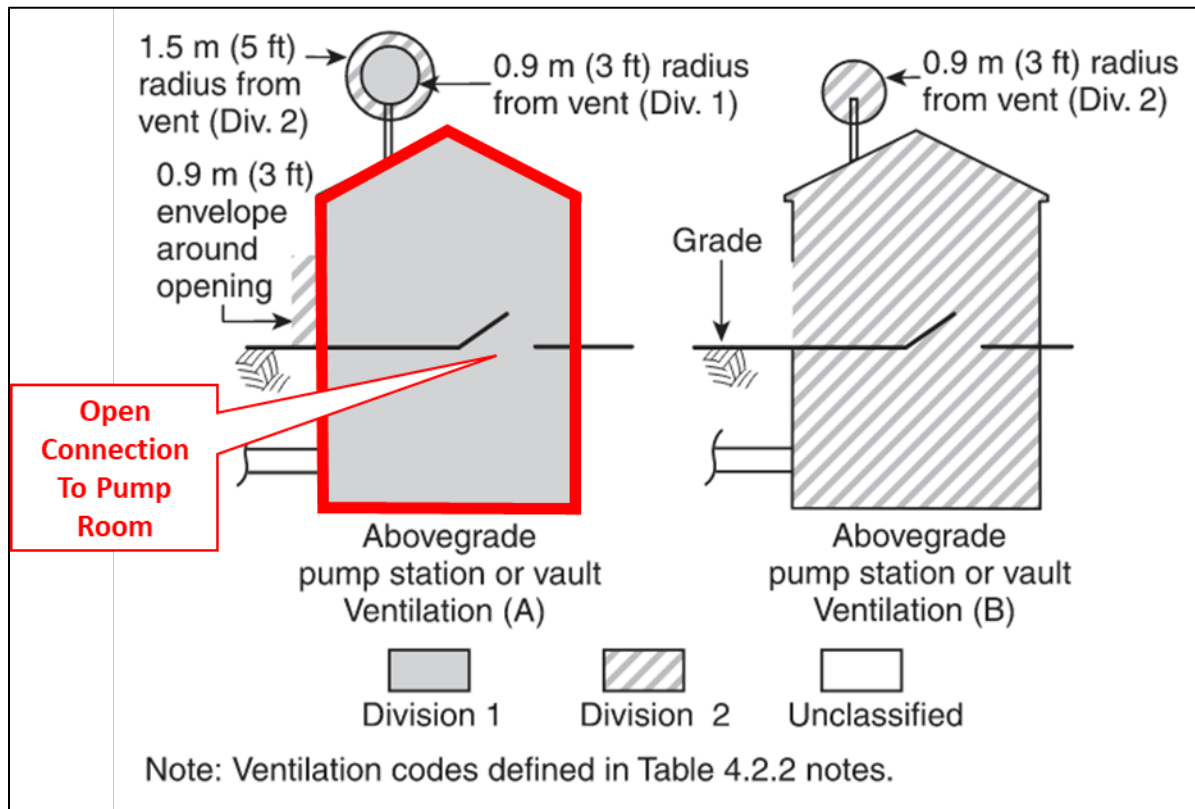


Figure ES-14: NFPA 820 Figure A.4.2(e) Above grade Wastewater Pumping Station Not Physically Separated from Wet Well; Illustration of Table 4.2.2, Row 17 (NFPA, 2023)

Three main tests were performed to evaluate pump condition and performance; a motor vibration test, pump drawdown test, and pump starts per hour analysis. The vibration test indicated that the motors/belt drives needed to be realigned to limit vibration. The pump drawdown test indicated that the pumps are operating at a lower flow rate than intended. Figure ES-15 shows the range of potential system curves overlayed with the pump manufacturer curve as well as the preferred operation range (POR). The figure shows that the pumps are operating outside of the POR and that the original design point was right on the edge of the POR, making the current AllPrime suction lift pumps not an ideal choice for this lift station's system curve.

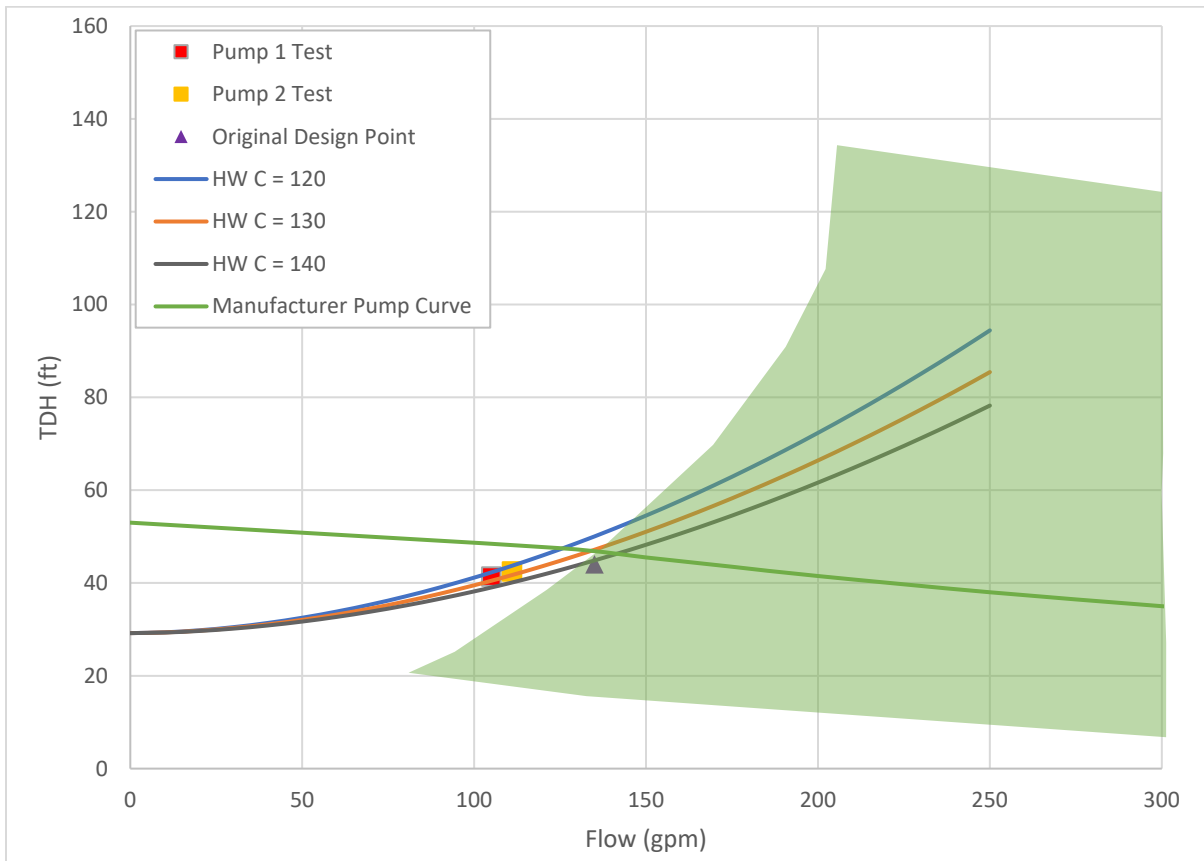


Figure ES-15: Pump and System Curve

Pump Recommendations:

- Regularly monitor motor vibration levels and rebalance the motor plate/belt drives if needed.
- Perform a more detailed evaluation of the pumps, including additional performance testing and analysis of the vibration data.
- Investigate the cause of the decrease in pump flow capacity.
 - Inspect pump components for wear/damage.
 - Install sanitary seal suction and discharge pressure gauges to measure pump TDH.
 - Eliminate the local high point on the discharge header or install a sewage air release valve at the top of the discharge header to prevent air entrainment in the force main.
- Contact pump manufacturer for potential alternative pump model/impeller sizes that intercept the system curve within the pump's POR
- Consider metering the wet well influent sewer line during a wet weather period to understand peak influent flow and potentially revise the chosen design flow rate of 135 gpm.

Electrical, Instrumentation & Controls Recommendations:

- Conduct a deeper inspection to determine precise condition of the bus bars, circuit breakers, wiring, relays, switches, etc. There may be significant signs of corrosion due the minimal separation of the wet well and electrical gear.
- Replace obsolete MCC starter components.
- Update MCC internal wiring for a single-phase to 3-phase converter.
- Explore options for replacing the compressor for the wet well bubbler. Or options for level indicator transmitters such as radar, ultrasonic, guided wave, or submersible pressure transducers.
- Address pressure gauge issues on both the discharge and suction sides.
- Consider upgrading pump motors and using Variable Frequency Drives (VFDs) for better control.
- Improve the monitoring and calibration of the wet well level measurement system.
- Examine the feasibility of updating the MCC for single-phase power.
- Evaluate the SCADA hookup and modem connection for proper functionality.

Generator Recommendations:

- Increase generator exercising frequency to prevent wet stacking and fuel degradation. With a total runtime at full speed of 38 hours, the generator would need to be run for roughly 45 minutes every week to turn over the entire fuel tank within a year.
- Decrease fuel input to allow new diesel to cycle through the tank. With the currently runtime schedule of 15 minutes per week (13 hours per year), the fuel tank only needs roughly 46 gallons of fuel so that all of the generator fuel is consumed within one year.
- Define a required level of service (LOS) for the generator, determining how many hours of continuous runtime are needed from the generator given a power outage emergency and accounting for the typical amount of time it takes to restore power to the area.

Business Risk and Vulnerability Assessment

The BRVA provides CVWD with a framework for prioritizing inspections and CIP projects based on risk while aligning the assessment with CVWD's corporate mission. The components of risk include both the existing condition of the asset as well as the consequence of failure of the asset. The BRVA brought all departments of CVWD, including Operations, Engineering, and Finance into the same room to encourage cross talk between departments and to understand how each department perceived and risk tolerance for system-level assets. The BRVA also helped CVWD understand the business practices in place to control and/or mitigate risk in the event of a failure of a portion of the collection system, as well as any improvements that may need to be made.

The BRVA approach followed the timeline shown below in Figure ES-16.

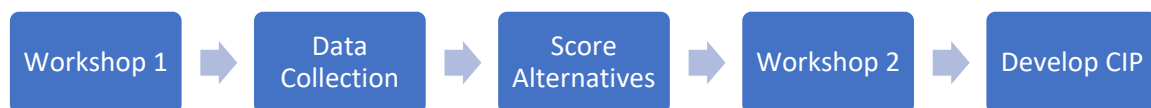


Figure ES-16: BRVA Timeline

Workshop 1

Kennedy Jenks held an all-day workshop attended by all departments of CVWD. The first goal of the workshop was to develop a risk matrix that fit CVWD's business goals and corporate mission statement. The objective of the matrix is to eliminate subjectivity from the failure analysis and confirm group consensus on the consequences of the system failures. The consequence of failure is an aggregated value composed of five major categories:

- Health and Safety for the Public and Employees
- Impact on Environment or Regulatory Compliance
- Quality of Service
- Public Image
- Financial Impact

Each of these categories during the workshop was scored on a scale of 1 to 5. Additionally, the Quality of Service criterion, meaning how many customers does an asset impact, was informed by the results of the calibrated hydraulic model. Assets conveying relatively more flow received higher Quality of Service scores, and vice versa. The 5x5 matrix shown in Figure ES-17 has the condition score of the asset on the vertical axis and the consequence of failure (COF) on the horizontal axis. The definitions for each COF category are specific to CVWD.

Corporate Risk Matrix Wastewater Master Plan										
Crescenta Valley Water District July 2022										
System Condition	Very Poor, Full Replacement	5						5	X < 1 Yr	Likelihood of Failure
	Poor Condition, Rehab. or Replacement	4						4	1 < X <5 Yrs	
	Fair Condition, Major CM	3						3	5< X <10 Yrs	
	Fair Condition, Minor CM	2						2	10< X < 20 Yrs	
	Good Condition, No Action	1						1	X > 20 Yrs	
			1	2	3	4	5			
Consequence of Failure										
Safety	No injury, and no anticipated future impacts	Minor to moderate injury – contusions & lacerations w/out lost time, first aid applied	Moderate injury/lost time or restricted duty	Major serious health issues (acute & chronic) & long-term injuries – disabling	Fatalities	Safety				
Environmental and Regulatory Impact	No negative impacts on environment, public health or regulatory compliance	No negative impacts on environment or public health; minor compliance issues (i.e., minor NPDES violation, exceed WQ standard triggering effluent limit; SSS WDR Category 3 spill; RW spill < 1,000 gals; minor Title 22 violation; Notice to Comply)	Minor negative impact to the environment and/or public health; compliance issues (i.e. repeated or major NPDES violation; SSS WDR Category 2 spill or Category 1 spill < 1000 gals; recycled water spill > 100,000 gals; minor Notice of Violation)	Moderate negative impact to the environment and/or public health; major permit violation (i.e. NPDES ACL > \$10,000; SSS WDR Category 1 spill > 1,000 gals & < 100,000 gals; recycled water spill > 500,000 & < 1M gals; Title 22 major violation; major Notice of Violation)	Significant negative impact to the environment and/or public health; major permit violation (i.e. Significant NPDES Enforcement Order; SSS WDR Category 1 spill > 100K gals; recycled water spill > 1M gals; potential for Title 22 permit revocation; any violation resolved through the Courts)	Environmental and Regulatory Impact				
Quality of Service and Delivery	No impacts on service delivery or customers	Impact limited to individual customers	Moderate localized impact to groups of customers; short-term service disruption	Sub-basin impacts with potential long-term service disruption	Service area-wide impacts; Long-term service outages	Quality of Service and Delivery				
Public Image	No to minimal Impact; odor complaint, or complaint to staff, with staff acknowledgement, action and response	Some significant social media and no local media coverage; phone call response handled by staff	Social media activity and maybe minor local media coverage; Board may receive complaints to be responded to by staff	Local media coverage with Board of Directors involved in response; potential long-term impact to community trust in District	Lead story in regional/national or industry short and long-term coverage; significant impact to community trust in the District	Public Image				
Fiscal Impact	0 < \$5K	\$5K < X < \$25K	\$25k < X < \$50K	\$50k<x<\$250k	> \$250k	Fiscal Impact				

Figure ES-17: CVWD Risk Matrix (See Appendix E for Full Size / High Resolution Table)

The second goal of the workshop was to interview staff about the collection system assets/asset regions to understand asset condition and business practices in place for each asset. Because there are over 65 miles of gravity sewer pipe, the collection system was divided into 10 regional sewersheds based on major confluence points (see Figure ES-2 for the numbered sewersheds). Additionally, each of the EMAs were analyzed as part of the BRVA. The BRVA discussion divided the collection system into the following components:

- Outfall / Diverter Valve
- Sewer Interceptor
 - The Interceptor was divided into two segments. Segment 1 is from the outfall at LAGWRP up to Hillside Drive. Segment 2 is from Hillside Drive up to Sunview Drive.
- La Granada Lift Station / Force Main
- Sewersheds 1 - 10
- EMAs 1 – 10

In addition to scoring the COF for each asset within the collection system, the business practices in place for each asset were also evaluated. Business practices are used to prevent and/or mitigate a failure event. The better the business practices are, the easier it will be for CVWD to recover from a failure event. Table ES-7 provides the business practices that were scored on a scale from 1 to 5 for each asset. These scorings were then used to calculate the total “Business Vulnerability” (BV) score for each asset.

Table ES-7: CVWD Business Element Definition

CVWD Business Practices	Definition
Work Execution Management (WEM)	How well work orders are issued, processed, and documented.
Asset Condition	What is the current condition of the asset based on O&M inspections.
Training Program	How effective is the O&M training program relative to testing the competencies needed for sustaining assets.
Site Safety Condition	How safety is the work environment when operating and/or maintaining the asset.
Resiliency	Are emergency response plans, abnormal operating procedures, and standard operating procedures well documented.
Reliability Engineering Support	How well does engineering monitor Key Performance Indicators (KPIs), conduct root cause analysis, conduct failure and risk analysis, implement resiliency strategies, and practice continuous improvement to gain system efficiencies.
Asset Performance Management Practices	Available sensors/technology to measure and document the condition of assets.
Asset Management Business (AMB) Processes	CIP in place and regularly updated

Data Collection

After Workshop 1, additional data was collected to verify the condition of some of the assets discussed. This included the La Granada Lift Station condition assessment as well as verifying pipe and maintenance hole inverts/configurations for key areas of the collection system with record drawings. The work done with the calibrated collection system hydraulic model also revealed asset condition information not previously available to CVWD, and informed the asset scores as well.

Score Alternatives

The total risk score was calculated by multiplying the weighted COF score with the weighted BV score. The lowest (least risk) score possible is a 1, while the highest (most risk) score is 25. Both of the COF and BV scores were composite scores calculated based on the weighting determined during the first workshop. Category weightings were assigned based on CVWD’s priorities and business goals.

Workshop 2

With the scorings and field data collected, the departments of CVWD and Kennedy Jenks reconvened for a second time to review the risk scores of the assets and discuss potential conceptual-level CIP projects. The risk matrix shown in Figure ES-17 was populated with the calculated COF and asset condition data to visualize the prioritization of the one-time risk mitigation opportunities that may transform into CIP projects. The total risk score profile for all assets was also provided to understand which assets carried the greatest risk, despite potentially not resulting in a CIP project based on the current condition of the asset.

Workshop 2 also yielded additional information on potential vulnerabilities within the collection system based on the discussion of the proposed CIP projects and results of the I&I analysis. This information was also considered in the final development of the CIP.

Develop CIP List

The findings of the BRVA were used to develop a prioritized CIP plan, outlining project costs and timelines driven by the asset condition and the risk/consequence of failure score. The key findings for each asset category discussed during the BRVA process are broken down into the following subsections.

Interceptor

The gravity sewer interceptor, stretching over 6 miles from Sunview Dr/Verdugo Blvd to the outfall at LAGWRP, serves as the backbone of CVWD's wastewater collection system. This unlined VCP pipe, dating back 40 years, represents a critical single point of failure. As the sole conduit for conveying wastewater across the service area, its failure would eliminate CVWD's entire sewage conveyance capacity.

While the interceptor's physical age raises concerns, discussions with staff revealed a further vulnerability: a lack of well-defined emergency procedures in case of a break. Crucial aspects included the following:

- Bypass pumping vendor coordination: Securing reliable and readily available pumping resources is essential for mitigating sewage overflows during an outage.
- Designated bypass laydown areas: Identifying temporary storage locations for bypass equipment ensures immediate deployment in case of an emergency.
- Coordination with nearby agencies: Streamlining communication and collaboration with relevant authorities can expedite response and minimize environmental impact.

The criticality of the interceptor demands immediate attention. Thus, CVWD should consider prioritizing:

- Conducting a comprehensive condition assessment: This in-depth evaluation will reveal the extent of deterioration and prioritize repair needs.

- Developing a robust emergency response plan: Establishing clear protocols for rapid response, resource allocation, and interagency coordination minimizes potential damage and ensures swift restoration of service.
- Exploring long-term rehabilitation or replacement options: Depending on the assessment results, investing in rehabilitation, or even replacing the aging pipeline can safeguard CVWD's wastewater conveyance system for decades to come.

The Diverter Valve at the outfall of the interceptor currently does not have site security (fencing/adequate lighting) and does not have a backup uninterruptible power system (UPS). If the diverter valve were to fail due to loss of power, it would fail in the last position. The Diverter Valve is normally open, conveying flow to LAGWRP. However, during the three-hour period from 12:00 AM to 3:00 AM, the diverter valve must close to convey concentrated brine directly to HTP. If a power failure was to occur at 11:30 PM, prior for brine to be discharged, the valve would fail in the “open” position, and potentially allow concentrated brine into LAGWRP's treatment facilities. Under this possible failure scenario, this will likely result in a regulatory fine against CVWD.

Finally, a private lateral connects to the interceptor at Hillside Drive that currently does not have any backflow prevention in place. Therefore, if a portion of the downstream interceptor (Segment 1) failed, this could result in a significant SSO event at Hillside Drive, and cause significant fiscal, environmental, and public image issues for CVWD.

Highway Crossings

CVWD has two key locations where gravity sewer pipe crosses above Highway 210 before continuing south. These elevated highway crossings have DIP gravity sewer pipe and are enclosed in a casing within the bridge crossing structure. These Hwy 210 crossings are located at Rosemont Ave and Briggs Ave. There is currently no CCTV or inspection history of the crossing gravity sewer pipe and/or casing pipe, and therefore the condition of these assets is unknown. CVWD recently experienced a water main break in August 2023 at the Rosemont / Hwy 210 crossing which caused significant impacts to traffic and made local news.

La Granada Lift Station

The La Granada Lift Station poses a current safety issue to CVWD operations staff, as the interior of the pump station building is classified as a Class 1 Div 1 space and is a potential explosion hazard with electrical equipment exposed to flammable gases and explosive environment.

EMAs

Each EMA was evaluated during the BRVA process, however EMA 1, located at the intersection of Pine Glen Rd and Pineridge Dr, was the key focus of discussion. Due to the “switchback” configuration of the gravity sewer in the area, this portion of gravity sewer is prone to maintenance hole blockages due to the several 90-degree turns the sewage must make before continuing downstream. This EMA is the location of a historical SSO.

Hillside Sewer Access

There are two maintenance hole locations in the northern portion of CVWD's SSA that are steep and difficult for CVWD operations staff to access and maintain. These locations are near the intersection of Dorothy St / Goss Canyon Ave and on Starfall Dr / Ridgeline Dr. Maintenance

hole blockages could result in SSOs that would travel into nearby wildlife areas that could result in fines for CVWD.

CVWD Programmatic Issues

CVWD currently does not have a digitized work order database or method for tracking/documenting work completed or condition assessment data, but are currently working on this improvement.

Figure ES-19 provides the total risk score profile from highest to lowest for the evaluated assets. The highest scoring areas included the interceptor and its components as well as the Hwy 210 crossings.

Figure ES-19 shows the system O&M safety condition scoreboard by project. Most notably, the La Granada Lift Station is rated a 5 due to the immediate safety threat it poses to O&M staff.

Figure ES-20 shows the combined COF and asset condition score, showing the driving factors for how the projects were prioritized and scheduled.

Figure ES-21 shows the risk matrix with the asset COF versus asset condition. Figure ES-22 shows the risk matrix with the O&M safety score on the horizontal axis instead to highlight the necessity of the La Granada Lift Station project. Additional risk profiles are available in Appendix E.

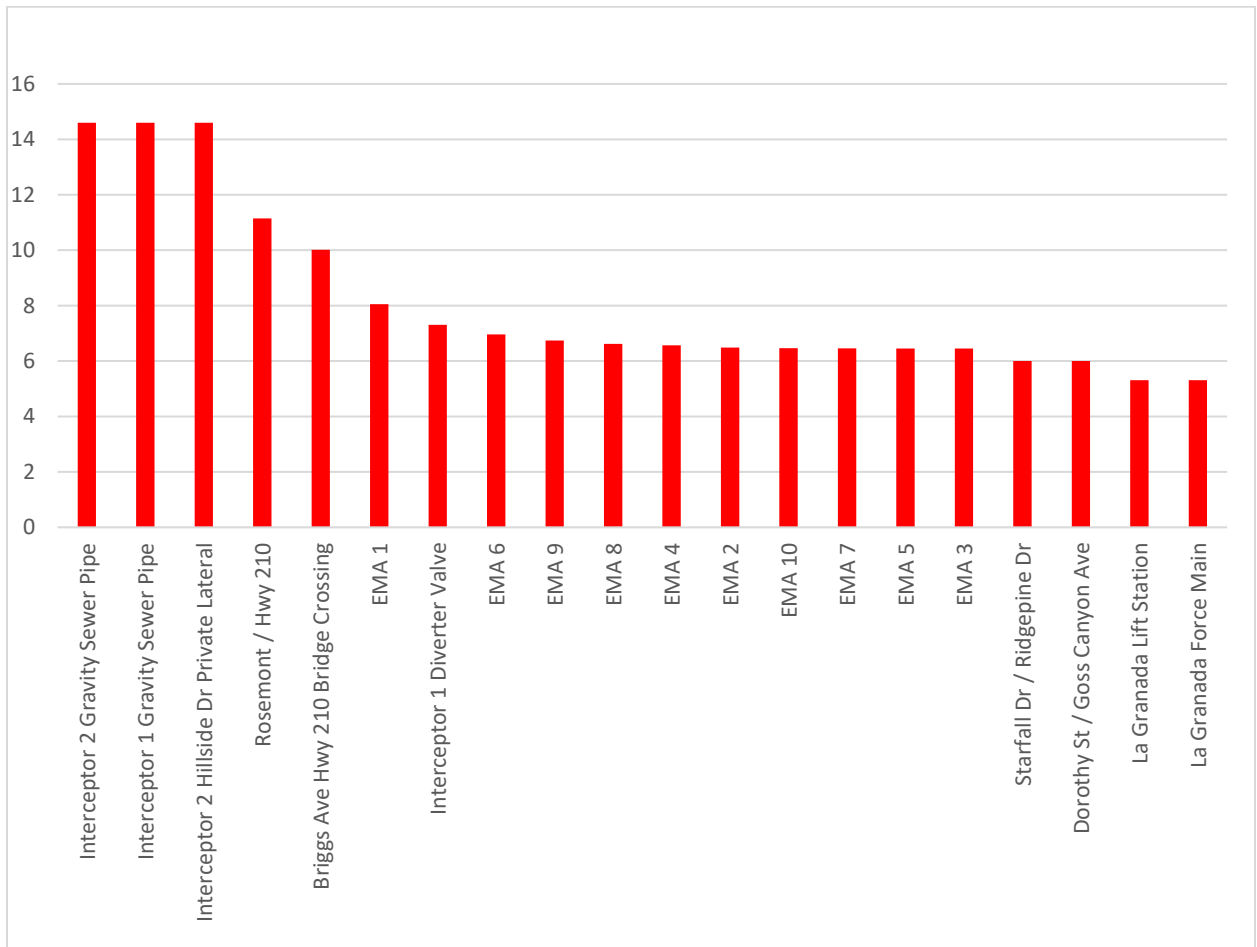


Figure ES-18: System Level Risk Scoreboard

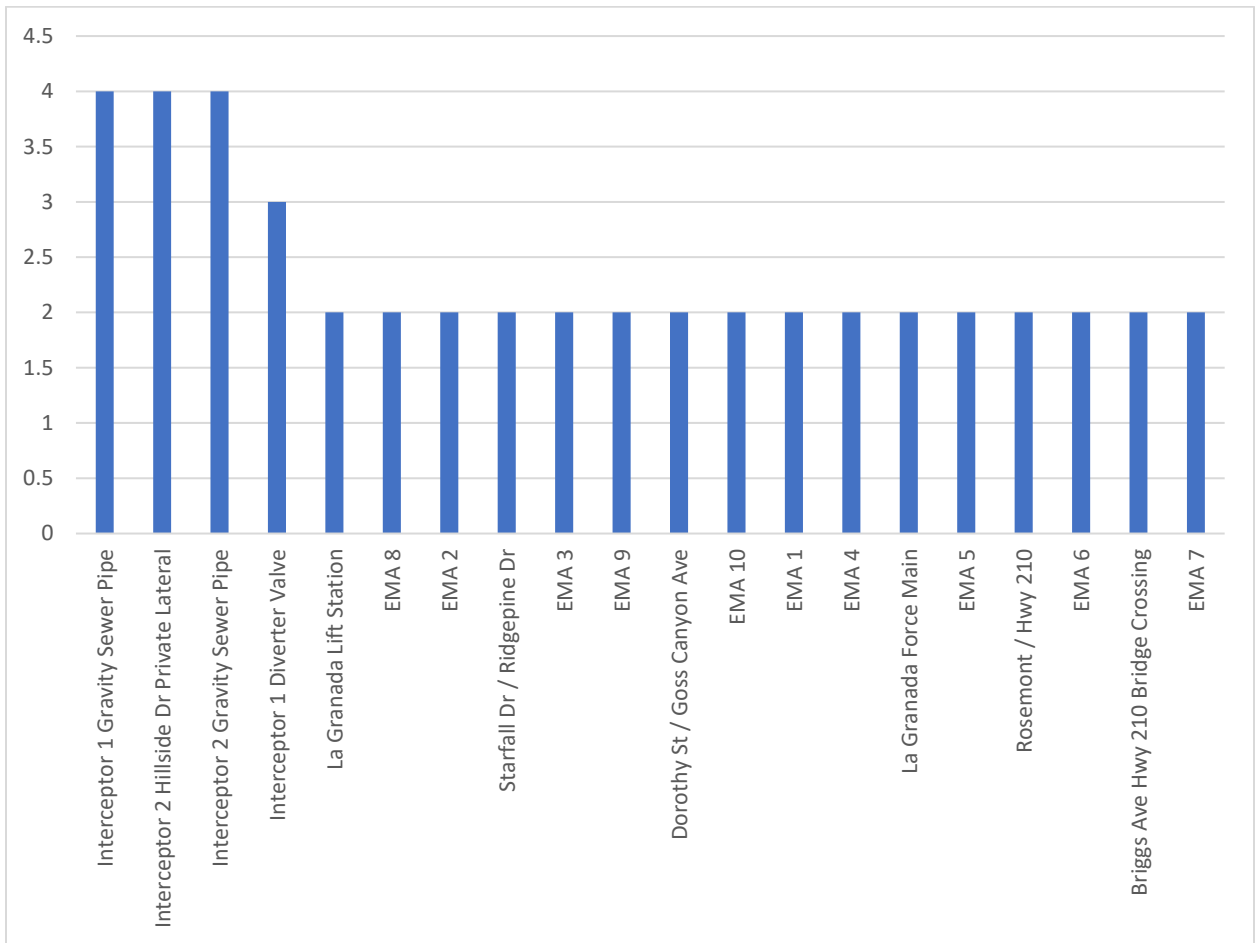


Figure ES-19: System Safety Condition Scoreboard

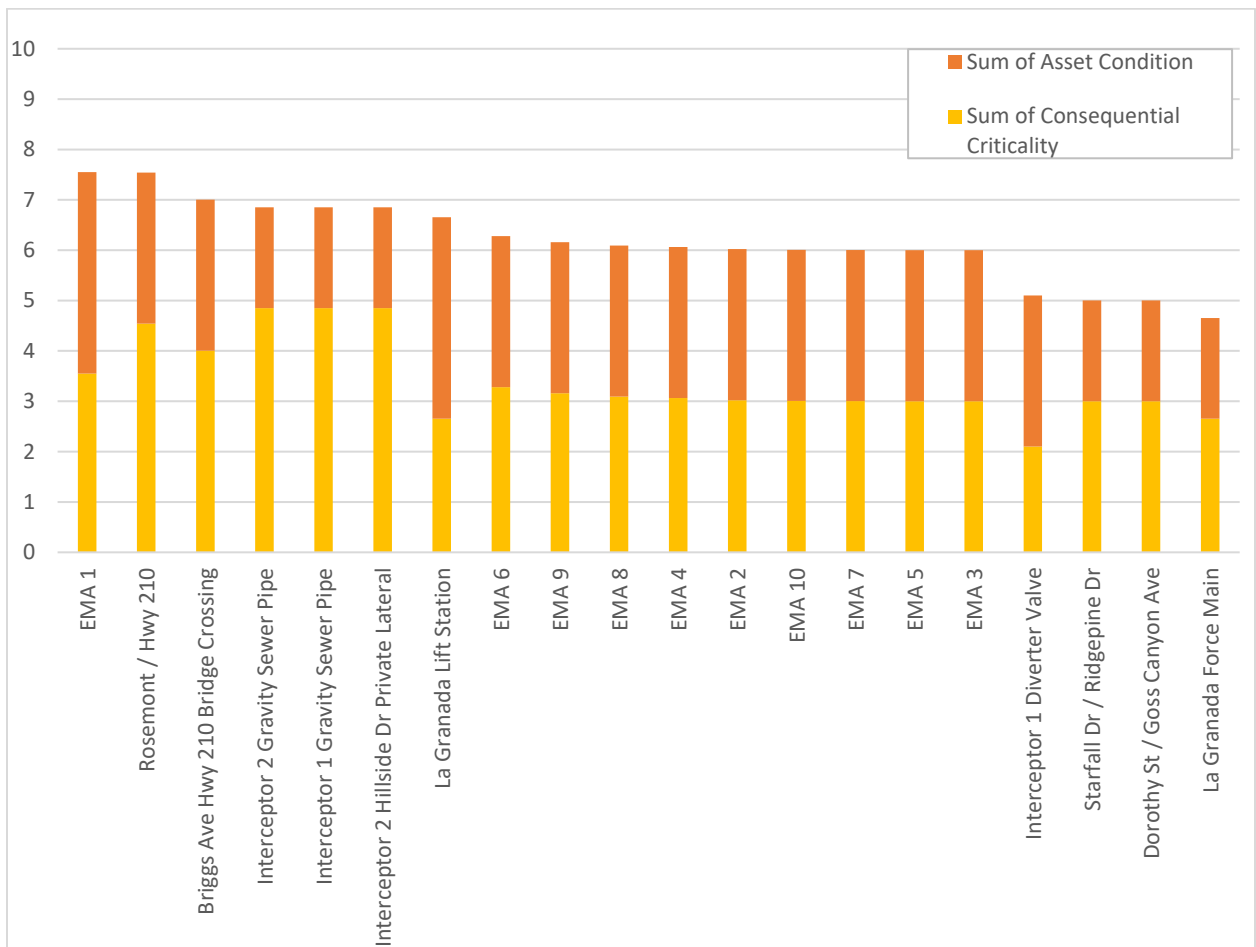


Figure ES-20: Consequence of Failure and Asset Condition Combined Scoreboard

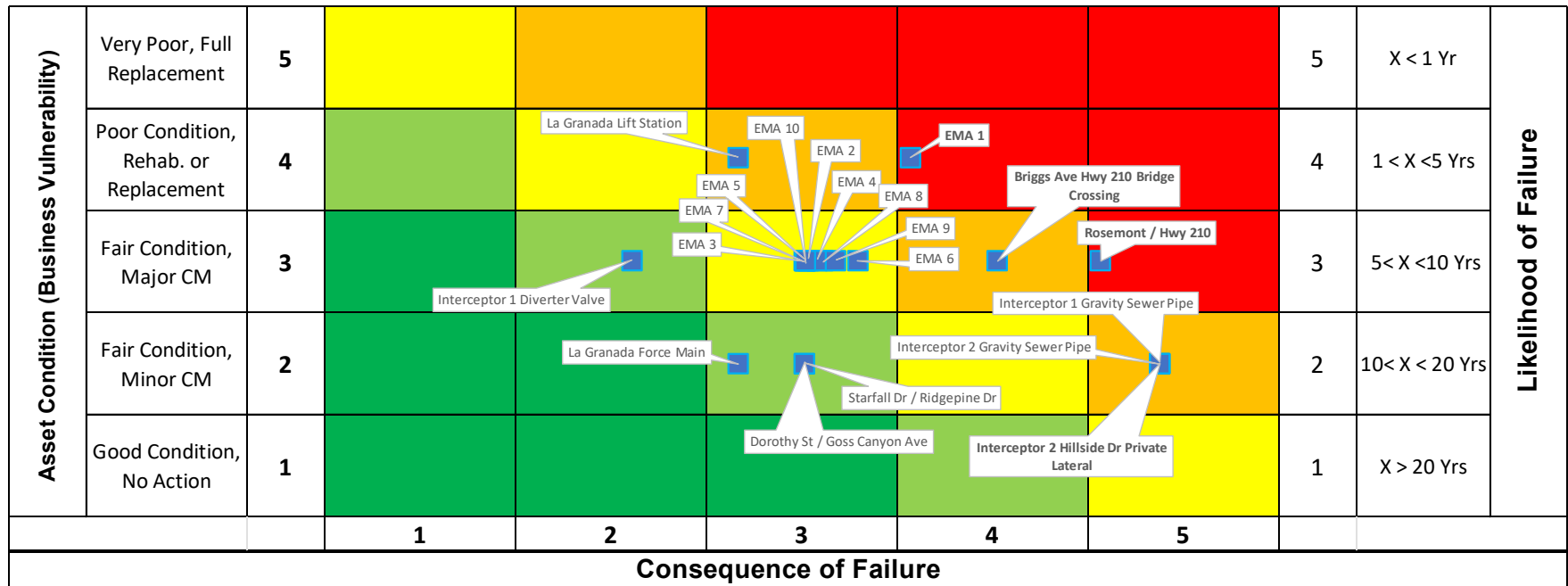


Figure ES-21: Risk Matrix Using Weighted COF

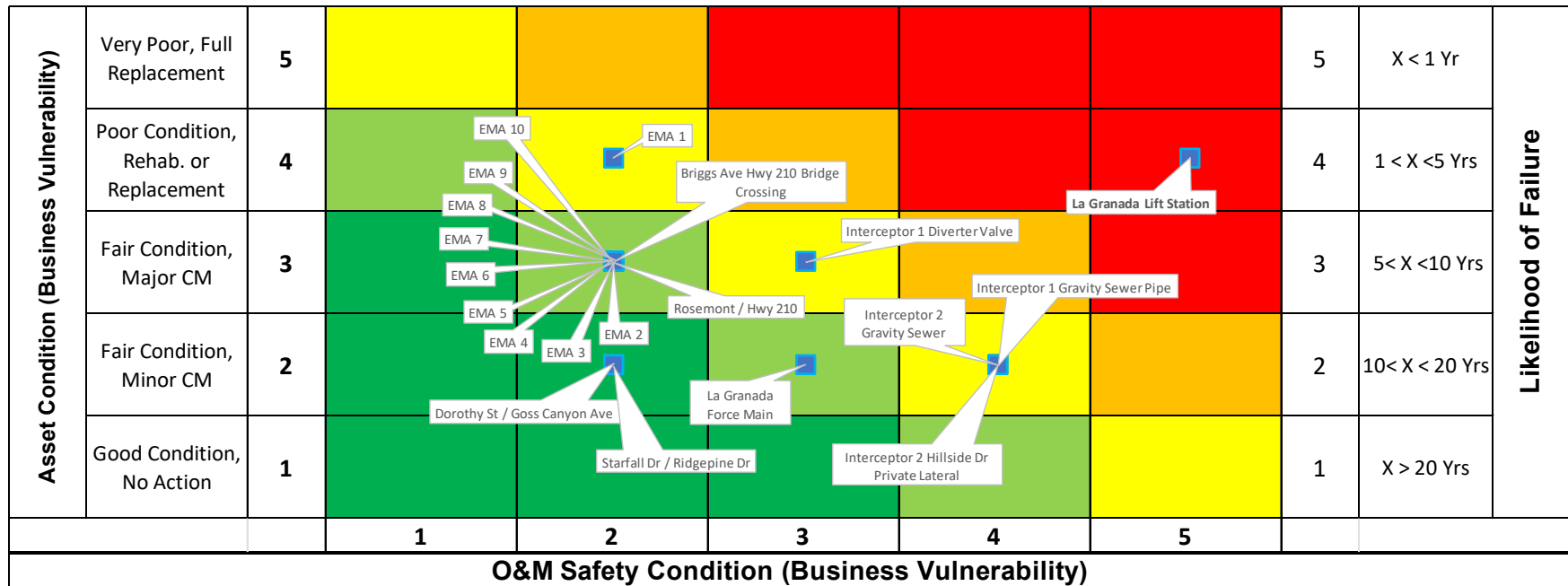


Figure ES-22: Risk Matrix Using O&M Safety Condition

Recommendations

Using the results of the BRVA process, the prioritization of the potential CIP projects was developed and is shown in Table ES-8. Projects with a “short” timeline should be completed as soon as possible, within the next 1 to 3 years. Projects with a “medium” timeline should be completed within 3-5 years. Projects with a “long” timeline should be completed within 5-10 years. Detailed 1-Page Project Summaries are also included in Appendix F. Figure ES-23 provides an overview of the proposed projects.

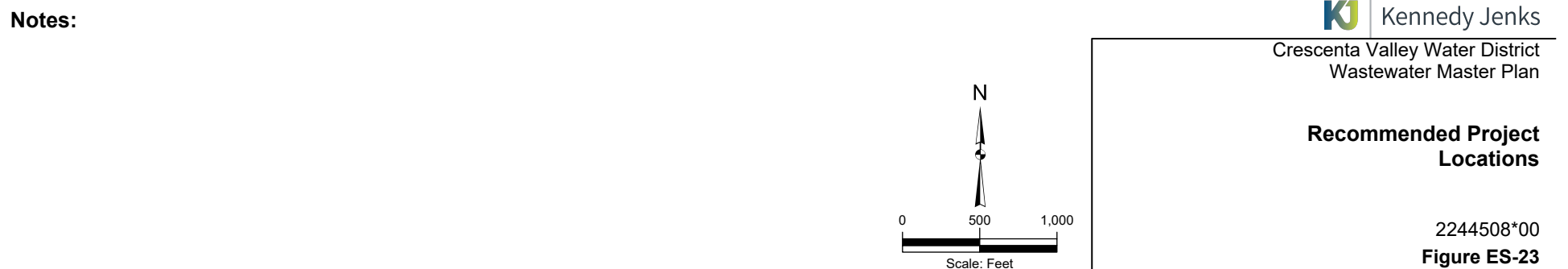
Table ES-8: Recommended Infrastructure Project Prioritization

Timeline	Project	Justification
Short	Rosemont / Hwy 210 Crossing Inspection / Rehabilitation	Unknown Condition / Big safety, financial, and regulatory risks
	Pine Glen Rd / Pineridge Dr (EMA 1)	Historical SSO, Consistent problem for Ops, safety, financial, and regulatory risks
	La Granada Lift Station Improvements	Safety issue for Ops team, current code violation
Medium	Briggs / Hwy 210 Crossing	Unknown Condition, safety, financial, and regulatory risks (serves fewer customers than Rosemont)
	Hillside Dr Private Lateral	High safety and financial risk, relatively low effort to fix
Long	Diverter Valve	Low COF – minimal regulatory/financial/safety impacts
	Dorothy St / Goss Canyon Ave Sewer Access	Low COF - minimal regulatory/financial/safety impacts
	Starfall Dr / Ridgepine Dr Sewer Access	Low COF - minimal regulatory/financial/safety impacts

Additional non-infrastructure recommendations related to best business practices are listed below. These recommendations can be completed in-house and would be completed based on availability of operations staff.

1. **SmartCover Maintenance Hole Lid Installation** – The primary purpose of SmartCovers are to monitor depth of flow within maintenance holes to alert CVWD of potential blockages/breaks in the collection system. Abnormally low flows could indicate and upstream blockage/break, while abnormally high flows would indicate a downstream blockage. The secondary benefit of the SmartCovers is that they provide additional calibration data for the hydraulic model. CVWD staff plans to install 5 SmartCovers in 2024 and 5 more in 2025. Based on discussions with CVWD staff, the following locations were selected for the 2024 SmartCovers (also shown in Figure ES-23):

- a. Waltonia Dr, MH# 3D76 – This is the location with the highest modeled d/D ratio for the collection system, largely due to the shallow slope of the gravity sewer pipe.
 - b. Sunview Dr / N Verdugo Blvd, MH#@ 3E68 – This is the beginning of the interceptor and a major confluence point on CVWD’s system.
 - c. Hillside Dr along Interceptor, MH# 39108 (no VT Number) – This is the middle of the interceptor and provides CVWD with valuable information on the status of the interceptor.
 - d. Pineridge Dr / Pine Glen Rd, MH# 2B12 – This is a historical SSO location and should be monitored given it is a high-risk EMA.
 - e. Foothill Blvd / Briggs Ave, MH# 3D7 – This is a very shallow segment of sewer pipe and is also a classified EMA prone to blockages and debris buildup.
 - f. Two future recommendations for 2025 SmartCover placements are Oceanview Blvd / Barton Rd (MH# 3D68) and Foothill Blvd / Cloud Rd (MH# 1C15). Based on input from operations, these areas are prone to blockages/debris buildup due to the flow received from upstream customers.
2. **Improved Emergency Response Training for Interceptor break** – CVWD currently has a plan outlined for how to address high flow SSO’s along the interceptor, but the plan does not address more severe conditions such as a break on the interceptor requiring immediate action. The SSMP should address on-call bypass pumping vendors, identify bypass pumping laydown areas for the interceptor alignment, and provide emergency contacts for local entities that may be impacted such as the City of Glendale.
 3. **Improved Communication with ADS to identify Elk St Flow Meter Failure** – CVWD should discuss with ADS how they could be notified of a meter failure at Elk St, as this has implications for how CVWD reports flows to the City of LA, and also removes a key indicator for CVWD for understanding how the interceptor is performing.
 4. **Develop monitoring method for Canalda tank discharge (EMA 7)** – Canalda tank current discharges unmetered flow to CVWD’s SSA. CVWD should attempt to quantify the discharge flow on a more granular scale (GPM) to understand the impacts to collection system capacity.
 5. **Targeted flow monitoring for Sewersheds 1, 2, 3** – Based on the I&I analysis performed, CVWD should consider continuing temporary flow metering during wet weather months in sewersheds 1, 2, and 3 to pinpoint sources of inflow. While smoke testing entire sewersheds is not feasible or cost effective, isolating I&I to one street or sewer alignment could then be followed with targeted smoke testing to identify stormwater cross connections and other areas of leakage.
 6. **Develop Digitized Asset Condition / Work Order Database** – creating a digitized database of work order history and asset condition assessments is crucial to allowing CVWD to effectively maintain the collection system long after key staff and operators have left, taking institutional knowledge with them. It also provides the ability to plot the condition of assets overtime and observe which assets are degrading faster than others, and which need to be prioritized for rehabilitation/repair/replacement. This database will inform CVWD’s future cured-in-place piping (CIPP) lining schedule.



Capital Improvement Program Development

The Capital Improvement Program (CIP) was developed based on the collection system evaluation outcomes and provides an actionable plan regarding the implementation of the proposed projects. This section outlines the development of the Capital and O&M costs, and provides potential CIP plan implementation schedules for the identified projects. This section also provides additional programmatic recommendations beyond the proposed CIP Plan for CVWD's consideration. Table ES-9 shows the identified projects, their descriptions, and their justification based on the results of the BRVA.

Table ES-9: CVWD CIP Projects

Proj. ID	Project Name	Project Description	Justification
Infrastructure Projects			
I-1	Granada Pump Station Improvements	Site safety and pump system improvements to the Granada Pump Station: entails a new wet well, new gravity sewer influent line, and building, piping, electrical, and site modifications.	Asset condition is poor and is an existing safety issue for operations staff. Regulatory issue with NFPA 820.
I-2	Pine Glen / Pineridge (EMA 1) Switchback Redesign	Improvements to prevent historical debris collection and SSO events: abandonment/demolition of existing sewer lines, new installation of reversed flow sewer line, drop maintenance hole, and chimney lateral.	Asset in poor condition and was a historical SSO site (regulatory issue). Financial risk if surrounding homes are damaged.
I-3	Rosemont / Hwy 210 Crossing Retrofit	Seismic retrofit of highway bridge crossing: retrofit each end of bridge pipe with seismically rated sewer fitting. Option for full bridge sewer line and casing pipe replacement.	Asset condition unknown. Public safety risk due to crossing Hwy 210, large regulatory and public image risk
I-4	Briggs / Hwy 210 Crossing Retrofit	Seismic retrofit of highway bridge crossing: retrofit each end of bridge pipe with seismically rated sewer fitting. Option for full bridge sewer line and casing pipe replacement.	Asset condition unknown. Public safety risk due to crossing Hwy 210, large regulatory and public image risk
I-5	Hillside Dr Private Lateral Backflow Preventer	Backflow prevention: Installation of duckbill backflow preventer on private lateral off interceptor.	Public safety risk and major financial risk. Relatively low effort to address for large gain
I-6	Dorothy / Goss Canyon Access Road	Improve maintenance hole access: obtainment of easement, construction of access road.	Operations staff safety issue, fiscal liability if backup occurs and damages nearby homes
I-7	Starfall / Ridgeline Access Road	Improve maintenance hole access: obtainment of easement, construction of access road.	Operations staff safety issue, fiscal liability if backup occurs and damages nearby homes
I-8	Diverter Valve Upgrades	Security improvements: installation of UPS, site lighting, perimeter fence.	Safety concern for both public and operations staff due to lack of security
Non-Infrastructure Projects			
N-1	Rosemont, Briggs Crossings Condition Assessment	Thoroughly inspect sewer lines and casings crossing Rosemont and Briggs bridges. Would entail consultant CCTV inspection of sewer and void between pipe and casing. One-time.	Asset condition unknown. Public safety risk due to crossing Hwy 210, large regulatory and public image risk
N-2	Smart Cover Installation	Maintenance hole monitoring and alarms through smart maintenance hole cover systems. 4 covers to stay in position, 6 covers to alternate locations. Ongoing, indefinite.	Low-cost method of evaluating system performance and identifying potential areas with frequent blockages/flow issues
N-3	Interceptor Items	Improved Emergency Response Training for Interceptor break (annual, indefinite). Improved Communication with ADS to identify Elk Ave Flow Meter Failure (one-time).	Improve training and resiliency to handle interceptor break, improve ability to know when flow meter is in a failed state
N-4	EMA 7 Monitoring	Monitoring of Canalda tank discharge. 3 months of monitoring; one-time.	Unknown asset condition, receiving unknown quantities of discharge flow
N-5	SS 1,2,3 Monitoring	Targeted flow monitoring for sewersheds 1, 2, 3. 3 months of monitoring per year for 5 years.	Narrow down areas with large I&I contributions for targeted pipe rehabilitation/lining projects
N-6	Work Order Database	Develop work order database with pipe and maintenance hole condition ratings data. One-time.	Improves APM practices by being able to visualize and prioritize pipeline replacement projects based on condition assessment data

Capital Costs

An Opinion of Probable Construction Cost (OPCC) was developed for each of the CIP projects at a Class 5 level, which represents Concept Screening level detail with an estimated accuracy range between -30% to +50, in accordance with the AACE standard cost estimating guidelines. The following assumptions and inclusions were made in the preparation of each of the cost estimates:

- Projects will be publicly bid projects.
- Prevailing wage requirements will apply.
- Assume there will be at least 3 qualified bids submitted.
- Assume all excess excavated material is hauled and disposed of.
- Assume all demolished material will be hauled and disposed of including a dump fee.
- Costs are rounded to nearest \$1,000 and are in 2024 dollars.

The estimates do not include the following:

- Hazardous materials (lead paint, asbestos, PCBs, etc.) removal or disposal is not included.
- Soil remediation, testing, removal, or disposal.

The Class 5 OPCCs and associated present worth costs for each of the CIP projects are shown in Table ES-10. See Appendix G for a detailed cost estimate breakdown.

Table ES-10: Capital Cost Assumptions

Item	Assumption
Taxes	10.25%
Mobilization/Demobilization/Permits	10%
Contractor Overhead & Profit	15%
Bonds and Insurance	2.5%
Escalation to mid-point of Construction	6%
Estimate Contingency	30%
Engineering ¹	15% / 25%
Construction Management ¹	15% / 25%

Notes:

1. Projects with Subtotal costs (before soft costs) under \$1 Million assumes 25% increase, Projects with Subtotal costs above \$1 Million assumes 15% increase.

O&M Costs

For the infrastructure CIP projects, there is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

For the non-infrastructure CIP projects, the annual O&M costs are shown in Table ES-11.

Table ES-11: Non-Infrastructure CIP Project O&M Costs

Proj. ID	Project Name	Annual O&M Cost
N-1	Rosemont, Briggs Crossings Condition Assessment	N/A
N-2	Smart Cover Installation	\$10,000
N-3	Interceptor Items	\$3,000
N-4	EMA 7 Monitoring	N/A
N-5	SS 1,2,3 Monitoring	\$12,000
N-6	Work Order Database	N/A

CIP Project Schedule

Based on the CIP project and assuming an annual CIP budget of \$500,000, there are two alternative CIP Plans based on the scopes of Projects I-3 and I-4 depending on the findings of the bridge crossing inspections. CIP Plan A reflects the best-case scenario where all that is needed to fix the bridge crossings are seismic joint installations. CIP Plan B reflects the worst-case scenario, assuming that full replacement of the bridge crossing casing and gravity sewer pipe require replacement. All dollar amounts displayed in the CIP Plans are in 2024 dollars.

CIP Plan A

CIP Plan A would consist of all listed projects, with Projects I-3 and I-4 being seismic retrofits only. Under Plan A, all project capital costs will be committed with the \$500,000 annual budget within 5 years. CIP Plan A is displayed in Table ES-12.

CIP Plan B

CIP Plan B would consist of all listed projects, with Projects I-3 and I-4 including seismic retrofits and full replacements of sewer line and casing pipe. Under Plan B, all project capital costs can be committed with the \$500,000 annual budget within 10 years. CIP Plan B is displayed in Table ES-13.

Table ES-12: CIP Plan A Schedule

Proj ID	Infrastructure Projects	Asset Condition	Total Risk Score	Year									
				1	2	3	4	5	6	7	8	9	10
I-1	Granada Pump Station Improvements	4.0	8.5	\$209,000									
I-2	Pine Glen / Pineridge (EMA 1) Switchback Redesign	4.0	8.2		\$221,000								
I-3	Rosemont / Hwy 210 Crossing Retrofit ¹	2.0	14.6		\$181,000								
I-4	Briggs / Hwy 210 Crossing Retrofit ¹	2.0	6.0			\$203,000							
I-5	Hillside Dr Private Lateral Backflow Preventer	2.0	6.0		\$35,000								
I-6	Dorothy / Goss Canyon Access Road	3.0	11.4			\$90,000							
I-7	Starfall / Ridgepine Access Road	3.0	10.0			\$107,000							
I-8	Diverter Valve Upgrades	3.0	7.3			\$41,000							
Non-Infrastructure Projects													
N-1	Rosemont, Briggs Crossings Cond. Assessment	-	-	\$231,000									
N-2	Smart Cover Installation ²	-	-	\$34,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
N-3	Interceptor Items ²	-	-	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
N-4	EMA 7 Monitoring	-	-		\$4,000								
N-5	SS 1,2,3 Monitoring	-	-	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000					
N-6	Work Order Database	-	-	\$8,000									
Project Total				\$497,000	\$466,000	\$466,000	\$25,000	\$25,000	\$13,000	\$13,000	\$13,000	\$13,000	\$13,000
CIP Budget				\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000

Notes:

- 1. Bridge crossing projects consist of seismic retrofits only.
- 2. Smart Cover Installation and Interceptor Items are ongoing and indefinite. They will continue to have O&M costs beyond this 10-year schedule.

Table ES-13: CIP Plan B Schedule

Proj ID	Infrastructure Projects	Asset Condition	Total Risk Score	Year									
				1	2	3	4	5	6	7	8	9	10
I-1	Granada Pump Station Improvements	4.0	8.5	\$209,000									
I-2	Pine Glen / Pineridge (EMA 1) Switchback Redesign	4.0	8.2		\$221,000								
I-3	Rosemont / Hwy 210 Crossing Retrofit ¹	3.0	11.4		\$250,000	\$475,000	\$475,000	\$411,000					
I-4	Briggs / Hwy 210 Crossing Retrofit ¹	3.0	10.0						\$487,000	\$487,000	\$487,000	\$441,000	
I-5	Hillside Dr Private Lateral Backflow Preventer	2.0	14.6					\$35,000					
I-6	Dorothy / Goss Canyon Access Road	2.0	6.0										\$90,000
I-7	Starfall / Ridgepine Access Road	2.0	6.0										\$107,000
I-8	Diverter Valve Upgrades	3.0	7.3									\$41,000	
Non-Infrastructure Projects													
N-1	Rosemont, Briggs Crossings Cond. Assessment	-	-	\$231,000									
N-2	Smart Cover Installation ²	-	-	\$34,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
N-3	Interceptor Items ²	-	-	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
N-4	EMA 7 Monitoring	-	-		\$4,000								
N-5	SS 1,2,3 Monitoring	-	-	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000					
N-6	Work Order Database	-	-	\$8,000									
Project Total				\$497,000	\$500,000	\$500,000	\$500,000	\$471,000	\$500,000	\$500,000	\$500,000	\$495,000	\$210,000
CIP Budget				\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000

Notes:

- 1. Bridge crossing projects consist of seismic retrofits only.
- 2. Smart Cover Installation and Interceptor Items are ongoing and indefinite. They will continue to have O&M costs beyond this 5-year schedule.

Recommended SSMP Updates

Based on the findings of this WWMP, the following changes are recommended for the next round of updates for the SSMP:

1. Update Section 5 – Design and Performance Provisions to include language recommending/requiring that the developer utilizes the new collection system hydraulic model to evaluate if the proposed development sewer flows will have any impacts on the downstream gravity sewer pipes. This will protect CVWD from approving a development flow that the existing collection system cannot accommodate within the required capacity criteria and will provide justification for CVWD to have the developer share in the costs of any required infrastructure improvements (likely upsizing the downstream gravity sewer) to accommodate the new development. If new sewer pipe is being constructed, this will also help evaluate whether or not the design criteria laid out in the SSMP will be met by the proposed sewer configuration.
2. Update Section 4.3.4 Enhanced Maintenance Areas (EMAs). Remove language specifying that sewers constructed outside of CVWD's design parameters (flat sewers) should be classified as an EMA. Due to the nature of the collection system and the decrease in sewer flows due to conservation, A majority of the collection system does not meet the minimum velocity design criterion of 2.5 fps laid out in the SSMP. Therefore, a majority of the collection system would be classified as an EMA, making difficult to distinguish which areas operations staff should focus on regularly maintaining. EMA classification should largely be based on input from operations staff during maintenance activities as well as collected condition assessment data.
3. Update the Lift Station Maintenance & Inspection Checklist to analyze the number of starts per hour per sewer lift station pump. Each pump should be starting no more than 6 times per hour to avoid the motor from overheating.

Section 1: Introduction

1.1 Background

Crescenta Valley Water District (CVWD) is located along the foothills of San Gabriel and Verdugo Mountains between the San Fernando and San Gabriel Valleys in Los Angeles County (See Figure 1-2). CVWD provides water distribution and sewage collection to the unincorporated communities of La Crescenta as well as parts of the cities of La Cañada Flintridge and Glendale. CVWD serves an area of about four-square miles and ranges in elevation from 1,200 feet to almost 3,000 feet above sea level.

The customer base is primarily residential with some light commercial accounts. CVWD currently provides water service to approximately 8,800 accounts, representing a population of approximately 33,000. As Figure 2-9 shows, CVWD's sewer service area (SSA) is a fraction of the size of the water service area (WSA). Compared to WSA, CVWD's SSA serves roughly two-thirds the number of customers and population, including roughly 6,500 accounts and a population of approximately 22,000.

CVWD's water supply over the last five years have been comprised of approximately half imported water and half local groundwater supply. CVWD pumps groundwater from the Verdugo Basin, which is highly dependent on replenishment from local rainfall. With periodic droughts over the last 15 years, CVWD has needed to supplement its water supply with about 50% imported water. CVWD purchases imported water from the Metropolitan Water District of Southern California (MWD), which is wheeled through Foothill Municipal Water District.

Figure 1-1 shows the trend of CVWD's water production and average annual wastewater flows from 1996 to 2022. As the trendlines show, water production (and in turn system demands) have steadily decreased due to water conservation efforts as a result of statewide mandates for water consumption reduction in response to extended periods of drought. These reductions in water demand, largely accomplished due to changing landscaping practices, installation of low flow water fixtures, and consumer behavioral changes, have persisted even after the end of the drought periods and after the mandates for reduction in water consumption were lifted. This is also evident in the historical trend of wastewater flows for CVWD, dropping from an average daily flow rate of 1.7 MGD in 1996 to 1.5 MGD in 2022. Pairing these recent demand reductions with the fact that CVWD's SSA is largely built out and is anticipating minimal future development/densification (see Section 2.2.1), future average annual sewer flows are not expected to increase, and instead will likely decrease as water conservation efforts continue. This WWMP therefore focuses less on constructing new infrastructure to accommodate future sewer flows and more on improving the operations/maintenance of the existing wastewater collection system assets.

Although future development within CVWD's SSA is expected to remain limited, the City of La Cañada Flintridge (LCF) is projected to experience residential growth under its 2021–2029 Housing Element. Because a portion of LCF wastewater is conveyed into CVWD's collection system near Rockland Place, this WWMP evaluates both existing LCF contributions and projected future LCF-related flows to confirm that CVWD's collection system maintains adequate capacity under future conditions.

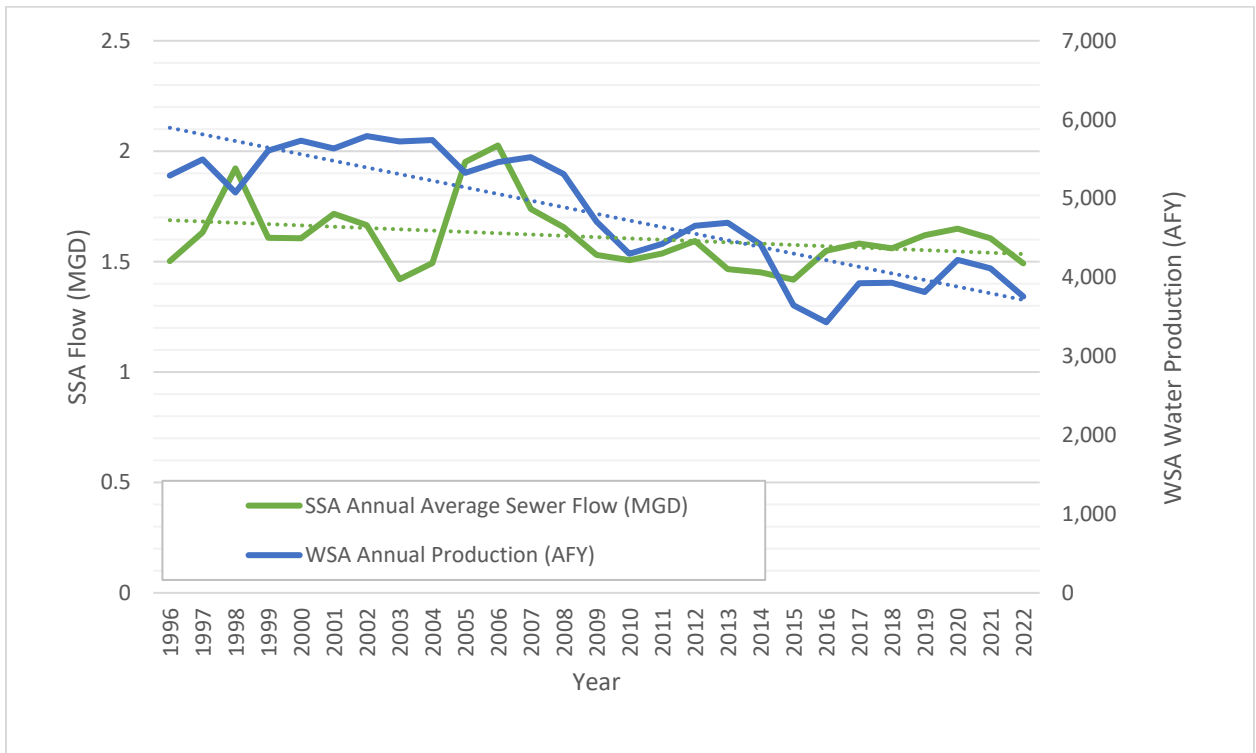


Figure 1-1: CVWD Historical Annual Water Production and Sewer Flows



H:\GIS_CloudProjects\CrescentaValleyWaterDistrict\Events\Crescenta_WWMP\aprx Printed by: Connor Rutten Date: 1/15/2024

N



KJ Kennedy Jenks

Crescenta Valley Water District
Wastewater Master Plan

CVWD Vicinity Map

2244508*00
Figure 1-2

1.2 Previous Work

This section documents the previous work and plans that CVWD has completed to operate, maintain, and plan for the future of the wastewater collection system, and how this WWMP intersects with these existing documents.

1.2.1 2019 Sewer System Management Plan

The purpose of CVWD's Sewer System Management Plan (SSMP) is to "support [CVWD's] Operations and Maintenance program and goals by providing high-level, consolidated guidelines and procedures for all aspects of CVWD's sewer system management" (Crescenta Valley Water District, 2019). First developed in 2009, the SSMP is revised, updated, and/or amended every 2 years to improve on CVWD's best practices. The goals listed for the SSMP include:

- Improve the reliability of collection system infrastructure
- Provide adequate system capacity for existing and future customers
- Minimize system leaks to reduce infiltration, inflow, and exfiltration
- Minimize the number and severity of sanitary sewer overflows (SSOs)
- Improve the response time to SSOs
- Ensure staff is well-trained to address potential wastewater system issues promptly.

The SSMP outlines several crucial programs for Operations & Maintenance (O&M) staff, including both short term, day to day programs as well as long-term planning programs. Both the Overflow Emergency Response Plan and Fats, Oils & Grease (FOG) Control Program provide O&M staff with daily tools and proper procedures for responding to sanitary sewer overflows (SSOs), and contact information for key individuals crucial to removing FOG from the collection system.

For long-term project planning, the System Evaluation and Capacity Assurance Plan (SECAP) is used to identify any capacity deficiencies that could arise from future development. The SECAP has methods for determining Inflow and Infiltration (I&I), Average Dry Weather Flow (ADWF), Peak Wet Weather Flow (PWWF), performing a capacity analysis, and defining a project for the Capital Improvement Program (CIP). This WWMP is meant to augment and refine both the standard day to day operating procedures listed in the SSMP, as well as the long term SECAP used to identify future CIP projects. This WWMP provides some recommended updates to the SSMP's design guidelines in Section 6.4.2.

1.2.1.1 Enhanced Maintenance Areas

To help identify potential CIP projects within this WWMP, CVWD's Enhanced Maintenance Areas (EMA) program was used to create an initial list of areas within the collection system causing the most problems for O&M staff. A portion of the collection system is classified as an EMA for several reasons, including customer complaints due to odor, historical locations for SSOs, lines in close proximity to trees prone to root intrusion, and shallow sewer lines more prone to accumulations of debris and blockages. EMAs are more regularly cleaned and inspected compared to the rest of the collection system to ensure they do not develop into

larger issues and/or SSOs. Table 1-1 provides a list of the current EMAs. The locations of these EMAs are shown in Figure 2-1. More detailed location information for each EMA is provided in Appendix A.

Table 1-1: Enhanced Maintenance Areas

EMA #	Location
1	Pine Glen Rd / Pineridge Dr
2	La Crescenta & Orange
3	Foothill & Briggs (76 Station)
4	Foothill between Sunset/Briggs, North Side
5	2000 Hilldale Dr
6	Waltonia between Hilldale and Montrose
7	Canalda and Ocean View flush tank
8	Prospect Ave between Sunset and Rosemont
9	Community between Ramsdell & Glenwood
10	Mountain Pine & Timberlake

1.2.1.2 Design Standards

This WWMP also utilizes specific design guidelines and standards per CVWD's SSMP governing the sizing, slope, material, connections, and construction of sewer mains within CVWD. The following standards were utilized to evaluate existing collection system capacity and to define future CIP projects:

Existing Infrastructure standards:

- Gravity sewer pipe depth to diameter (d/D) ratio should not exceed 60% under ADWF flow conditions (see Section 5.1.1.1)
- Gravity sewer pipe d/D ratio should not exceed 80% under PWWF flow conditions (see Section 5.1.1.1)

Future Infrastructure standards:

- New sewer pipe must be sized to maintain velocities between 2.5 and 10 feet per second, with a minimum slope of 2% (Section 6.1)
- New sewer pipe material shall be Vitrified Clay Pipe (VCP) (Section 6.2.1)

1.2.2 Hazard Mitigation Plan

CVWD's local Hazard Mitigation Plan (HMP) was developed in 2021. The purpose of the HMP is to reduce the risk to vital assets that provide CVWD's customers with crucial water and sewer services by mitigating potential hazards that threaten CVWD infrastructure.

The HMP quantifies the portion of CVWD's assets that are exposed to damage from earthquakes, landslides, flooding, and wildfire, and also quantifies the probability of these types of natural disasters occurring within CVWD's service area. The HMP also provides a list of potential actions/projects that can be completed to mitigate the risks of these natural disasters for both the water and sewer collection systems. The final CIP list (see Section 6.3) resulting from this WWMP can be aligned with the proposed projects in the HMP to both support project funding and justification. The HMP should be used to provide justification for certain CIP projects that mitigate CVWD's risk/vulnerability to the effects of natural disasters.

1.3 Objectives

The main objectives of this WWMP are:

- 1) Identify existing collection system deficiencies through discussions with O&M and Engineering Staff, condition assessments, and hydraulic modeling/flow data collection
- 2) Quantify impacts to the collection system as a result of future growth/densification, and identify potential future collection system deficiencies
- 3) Develop list of CIP projects prioritized by risk and develop project costs
- 4) Develop implementation strategy for potential near-term and long-term CIP projects

1.4 Report Organization

This Master Plan is organized into the following sections:

- **Section 1: Introduction** Background information on the Crescenta Valley Water District, previous reports on the sewer system, and discussions of the Master Plan's objectives.
- **Section 2: Existing System Description** describes the boundaries, geography, land use, population, and existing sewer system considered within the study.
- **Section 3: Existing and Future Sewer Flows Analysis** describes the existing and future sewer flows that are calculated for the sewer system.
- **Section 4: Sewer System Model Development** describes the sewer collection system hydraulic model development, and wet weather/dry weather flow calibration.
- **Section 5: Collection System Evaluation** describes the hydraulic model capacity evaluations, condition assessment evaluations, and the business risk and vulnerability assessment (BRVA) conducted for the sewer collection system.
- **Section 6: Capital Improvement Program** describes the proposed Capital Improvement Program (CIP) for the sewer system. This section also provides future recommendations beyond the CIP

Section 2: Existing System Description

This section describes the components of CVWD's existing wastewater collection system and service area.

2.1 Collection System Components

2.1.1 Gravity Sewer

CVWD's existing wastewater collection system is comprised of approximately 68 miles of gravity sewer mains, and over 1,200 maintenance holes. Due to the large variations in elevation across the service area, there are over 270 drop maintenance holes within CVWD's service area. The SSMP necessitates a drop maintenance hole wherever the incoming gravity sewer enters the receiving maintenance hole more than 30 inches above the invert of the maintenance hole. The gravity pipe throughout the system ranges in size from 4-inch to 27-inch diameter, with 83% of the gravity pipe being 8-inch or smaller. CVWD's most crucial element of the collection system is the gravity sewer interceptor, composed of 6.6 miles of VCP pipe ranging from 18 to 27 inches. The interceptor conveys all of the system sewer flows from the SSA to the collection system outfall located in the City of Glendale. Figure 2-1 shows the alignment of the interceptor as well as pipe material and diameter information. Figure 2-2 shows the collection system color coded by pipe age.

The distributions of gravity sewer pipe length by diameter, material, and year of installation are shown in the tables below. The collection system is mostly composed of 8-inch VCP installed in the 1980's.

Table 2-1: Sewer Pipe Size and Length Distribution

Diameter (in)	Length (mi)	Percentage
4	0.14	0.21%
6	0.04	0.06%
8	56.07	82.90%
10	1.14	1.68%
12	1.25	1.84%
15	1.23	1.82%
16	0.09	0.13%
18	3.14	4.64%
21	4.09	6.04%
24	0.41	0.61%
27	0.04	0.06%

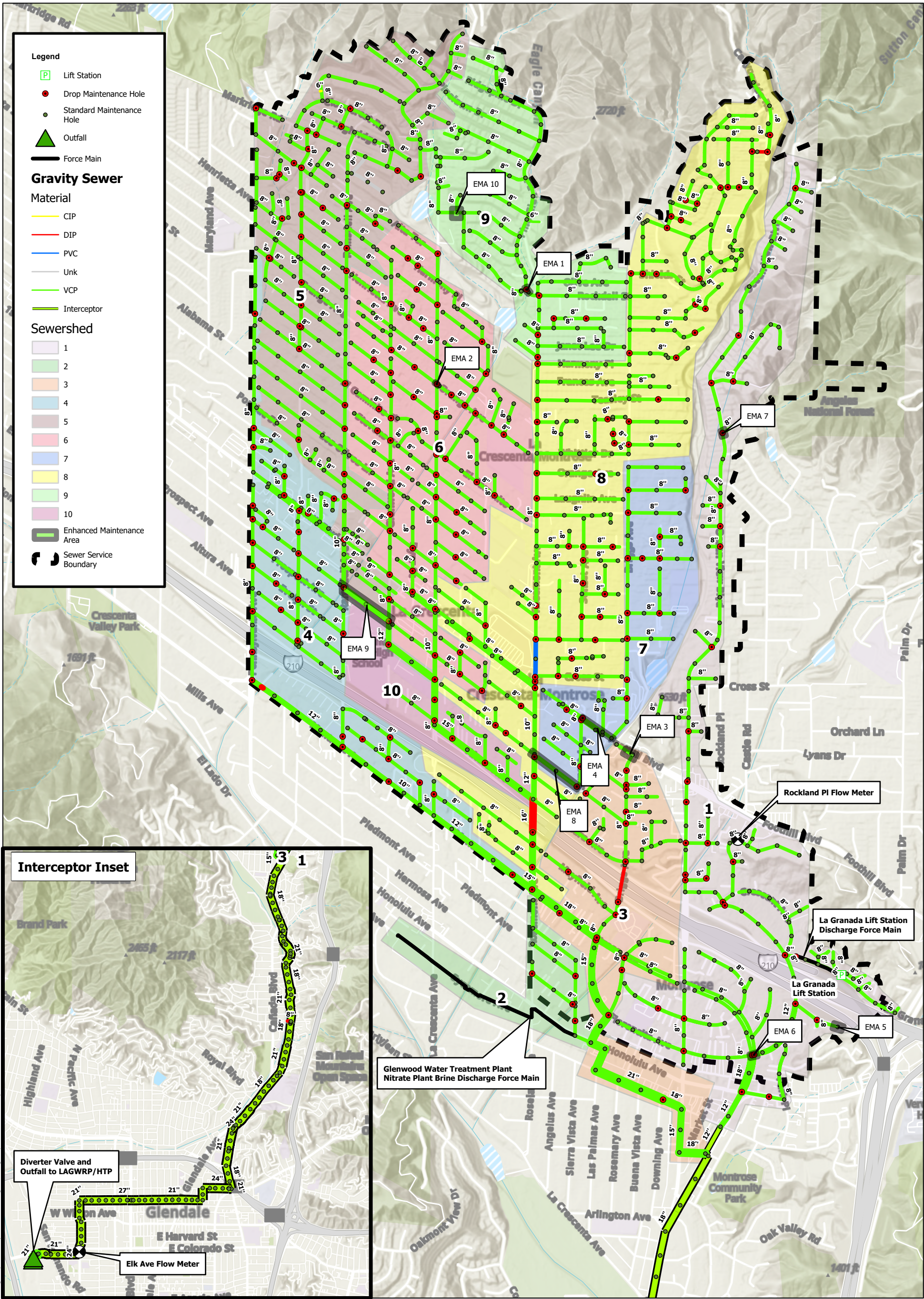
Table 2-2: Sewer Pipe Material and Length Distribution

Material	Length (mi)	Percentage
VCP	67.04	99.13%
PVC	0.133	0.20%
DIP	0.289	0.43%
CIP	0.004	0.01%
Unknown	0.164	0.24%

Table 2-3: Sewer Pipe Age – Year Installed by Length

Year Installed (Decades)	Linear Footage (ft)	Percentage
Unknown	21	1.14%
1950s	6	0.31%
1960s	135	5.61%
1970s	22	0.83%
1980s	1449	91.63%
1990s	4	0.15%
2000s	12	0.32%

The collection system was organized into 10 “sewersheds” based on key confluence points to help organize the subsequent analyses and CIP project identification. These sewersheds are shown in Figure 2-1. See Section 4.1.2 for additional information on how the sewersheds were utilized to choose flow meter data collection locations.



Notes:

1. Gravity Sewer symbol thickness varies by pipe diameter

2.1.2 La Granada Lift Station

CVWD owns and operates one single lift station, the La Granada Lift Station built circa 1980. The lift station serves approximately 45 single family residences. Figure 2-3 shows the location of the lift station, just north of Hwy 210 along La Granada Way. The lift station discharges to a 4-inch force main that conveys flow west roughly 1,350 ft to a discharge maintenance hole near the intersection of La Granada Way and Waltonia Dr.

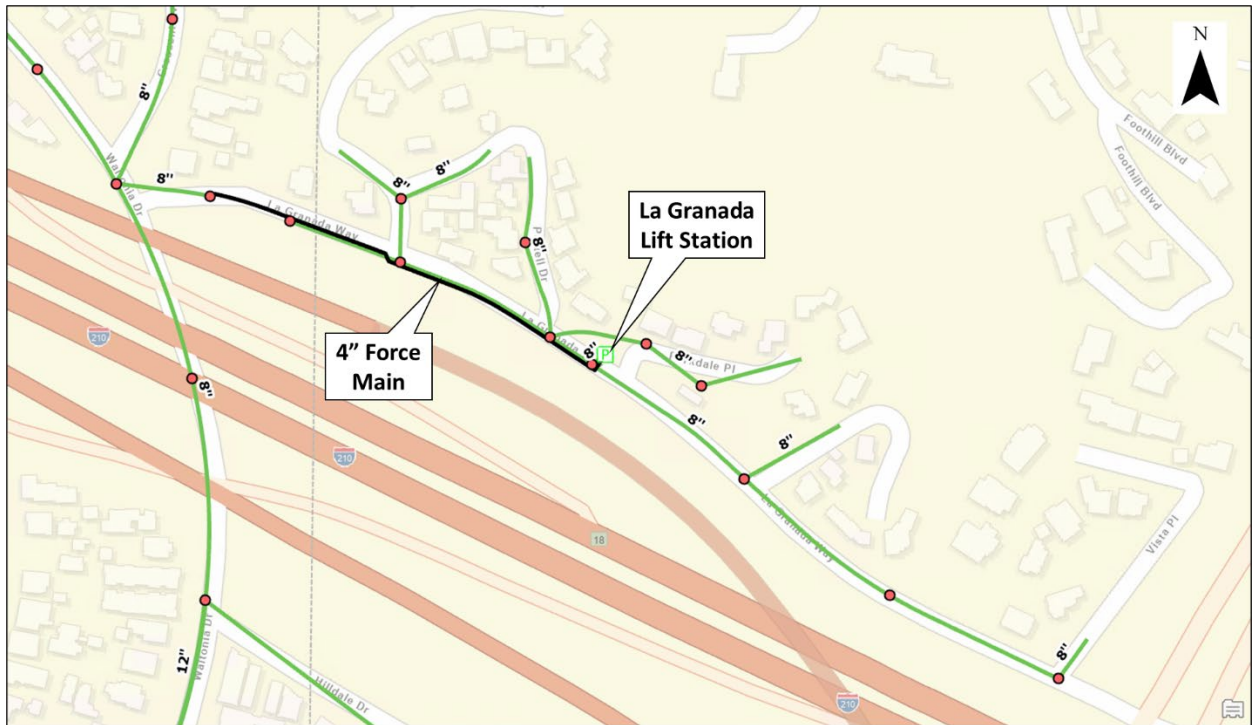


Figure 2-3: La Granada Lift Station Vicinity Map 1

A condition assessment was completed as part of this WWMP to identify any risks, deficiencies, and to provide improvement recommendations, more details can be found in Section 5.2 of this WWMP. Figure 2-4 shows the lift station building that sits on the median between La Granada Way and Parkdale Pl. The building houses the wet well access, electrical equipment, and the above-grade pump skid. The influent maintenance hole and gravity sewer enter the lift station's wet well from the south. The 4-inch force main exits the lift station building on the south side of the building as well before turning west along La Granada Way. A force main replacement project just outside of the lift station was completed in 2017 and found that the 4-inch force main was in good condition.

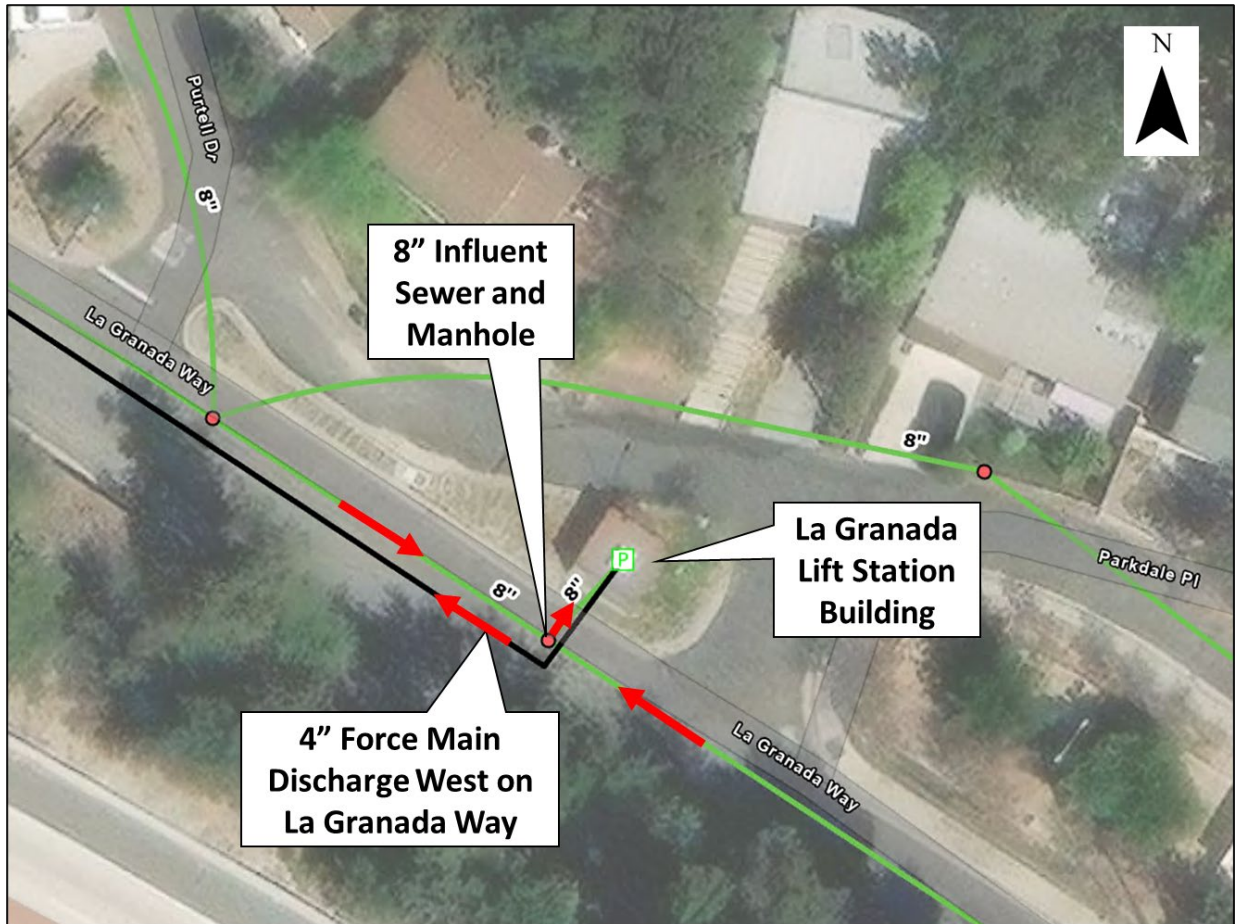


Figure 2-4: La Granada Lift Station Vicinity Map 2

2.1.2.1 Lift Station Construction

The lift station building is a 14 ft x 16 ft concrete masonry unit (CMU) building with a wood frame roof. The roof has a built-in skylight hatch to remove/replace pumps, motors, or other internal lift station components. The building has a single man door for access as well as a privacy fence around the entire site to reduce visual impact to the neighboring community. The lift station building encloses all the electrical equipment, pump, and motors, as well as the access to the lift station wet well. The circular wet well is 11 ft deep and 5 ft in diameter.

2.1.2.2 Electrical

The lift station electrical service is 200 Amps of 120/208 Volt, single phase power. This service provides ample capacity to run both 5 HP pumps and miscellaneous electrical continuously. The lift station is equipped with a motor control center (MCC), control panel, and programmable logic controller (PLC).

2.1.2.3 Backup Generator

In 2023, a permanent backup diesel generator and automatic transfer switch (ATS) were installed on site, improving the reliability of the pump station in the event of a power failure. The generator is a 35 kW generator designed to run both 5 HP pumps simultaneously in addition to miscellaneous electrical load. The generator fuel tank holds up to 132 gallons of diesel fuel, and is typically cycled for 15 minutes per week.

2.1.2.4 Controls

The PLC allows operators to change the wet well operating setpoints on site, as well as the lead/lag assignment of each pump. The lift station is continuously monitored through SCADA via radio telemetry, monitoring the following elements in real time:

- Power status (detecting power failures).
- Wet well status (monitoring high well conditions).
- Entry alarm (activated on the Remote Terminal Unit).
- Pump status (monitoring pump on/off cycles).

The telemetry system signals are monitored at the Glenwood Operations Facility. Based on a site visit performed in July of 2023, the lift station currently has the following wet well operating setpoints and alarms setpoints:

Table 2-4: Pump Control Setpoints

Wet Well Controls	Level (ft)	HGL (ft)¹
Lead Pump Start	3.80	1,290.00
Lag Pump Start	4.00	1,290.20
Lead Pump Stop	2.60	1,288.80
Lag Pump Stop	2.60	1,288.80

Notes:

1. Relative to surveyed bottom of wet well elevation 1,286.20 (NGVD 29)

Table 2-5: Wet Well Alarm Setpoints

Alarm Controls	Level (ft)	HGL (ft)¹
Wet Well Level High High Alarm	6.0	1292.20
Wet Well Level High Alarm	5.5	1291.70
Wet Well Level Low Alarm	0.5	1286.70
Wet Well Level Low Low Alarm	0.3	1286.50
Wet Well Level Invalid Alarm	0.0	1286.20

Notes:

1. Relative to surveyed bottom of wet well elevation 1,286.20 (NGVD 29)

The “lead pump start” level is currently set just above the elevation equal to the invert of the influent gravity sewer pipe (1,289.85 ft). Because the upstream maintenance hole invert is only slightly higher in elevation (1,290.00) and is also less than 30 ft away from the lift station, a rising wet well level can rapidly result in surcharging of the upstream sewer line and

maintenance hole. Because of this, the lift station is configured so that both pumps can operate simultaneously in the event of an extremely large inflow event. The “lag pump start” is only 0.20 ft above the “lead pump start” to address this concern. Both the electrical service and backup generator are sized to accommodate both pumps operating simultaneously. While infrequent, there are times during the winter months when both pumps may be operating simultaneously.

2.1.2.5 Suction Lift Pumps

The lift station is a suction lift duplex station, with each pump equipped with a 5 horsepower (HP) motor and 4-inch suction and discharge piping. The suction lift pumps are AllPrime Model S-4, self-priming centrifugal pumps. The pump system was updated in 2021, this included new belt motors and other updates to the lift station.

The design point for each suction lift pump was originally set at 135 GPM @ 44 ft total dynamic head (TDH). Figure shows the pump curve for the suction lift pumps currently installed. Because the pump curve is relatively flat and the selected operating point is already on the edge of the preferred operating range (POR), a small increase in required TDH will push the operating point of the pumps rapidly towards their shutoff head (also known as “dead head”) conditions. Therefore, running both pumps simultaneously would likely yield only a small increase in overall lift station capacity. No flow data with both pumps running is currently available to verify the capacity of the lift station with both pumps active. See Section 5.2.2 for additional analysis of the capacity of the lift station

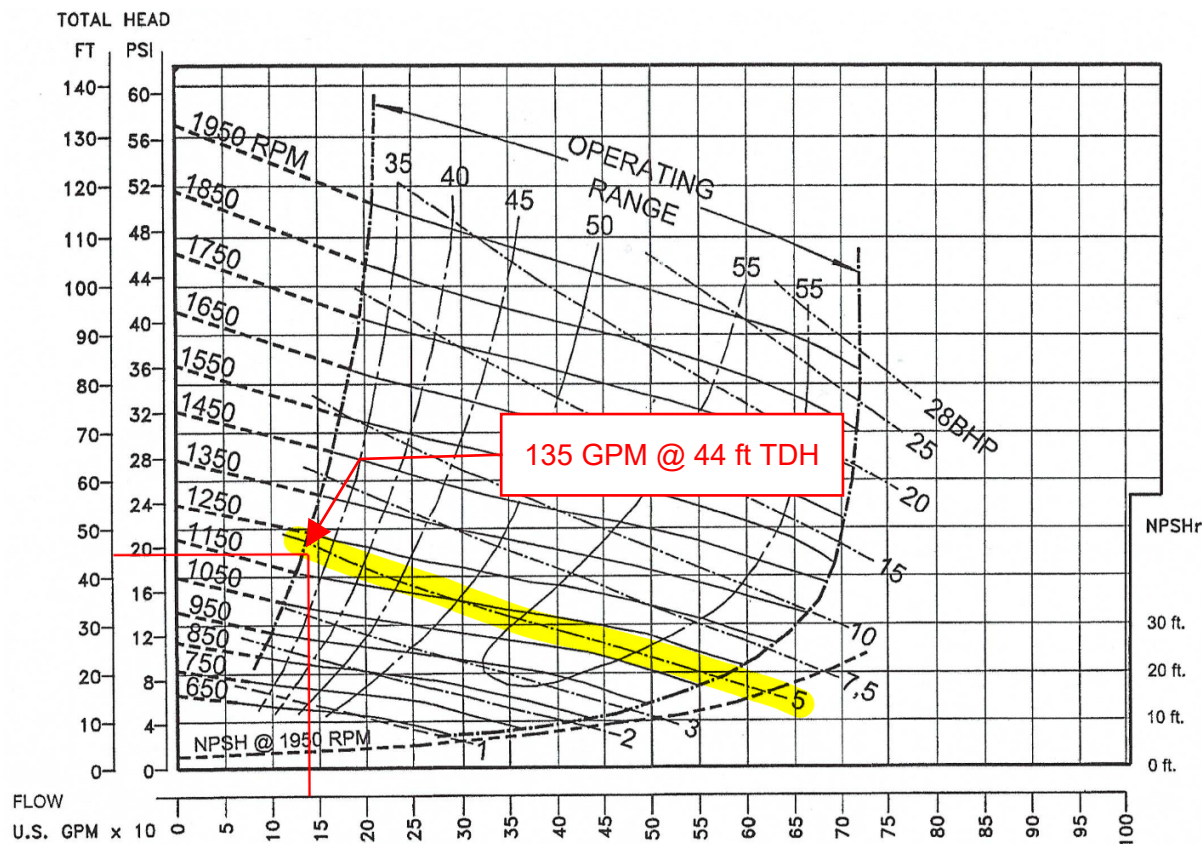


Figure 2-5: AllPrime Model S-4 Pump Curve with Design Point of 135 GPM @ 44' TDH

2.1.3 Glenwood Nitrate Treatment Facility Brine Force Main

Figure 2-1 shows the location of the Glenwood Water Treatment Plant (GWTP) Backwash Force Main, located in Sewershed 3 and discharging to the collection system at Honolulu Ave. This 6-inch fiberglass reinforced pipe (FRP) force main conveys concentrated brine backwash from the GWTP to the collection system during the backwash cycle of the ion-exchange tanks located at GWTP. The GWTP has not been in operation since 2019. This process typically occurs for three hours from 12 AM – 3 AM when sewer flows are lowest, as CVWD is required to send this concentrated flow directly to Hyperion Treatment Plant (HTP) and bypass the Los Angeles-Glendale Water Reclamation Plant (LAGWRP). Section 2.5 provides additional detail regarding the arrangement with LAGWRP and HTP.

2.1.4 Outfall Diverter Valve

In order to control whether flow is conveyed to LAGWRP or the HTP, CVWD owns and operates a 21-inch diverter valve located at the outfall of CVWDs interceptor. The valve is typically in the “open” position, conveying flow to LAGWRP, and is “closed” when CVWD is running the backwash cycle at the GWTP. Figure 2-6 shows the location of the diverter valve along Colorado Blvd.



Figure 2-6: Diverter Valve Configuration

2.1.5 Flow Meters

CVWD partners with ADS Environmental Services (ADS) to operate and maintain two flow meter locations in the SSA. The first is the Elk Ave Flow Meter (see Figure 2-1) located near the outfall of CVWD’s interceptor. This flow meter is essential for monitoring both the quantity and the strength of the sewer flows for the entirety of the SSA. The Elk Ave Flow Meter is crucial to CVWD’s operations, as it is used for reporting sewer flow and strength to the City of LA (see Section 2.5), and is the only permanent flow meter within CVWD’s system.

The second flow meter location is on Rockland Pl, which is used to quantify the flow coming from La Cañada Flintridge (LCF) just to the east of CVWD’s SSA. LCF discharges a portion of their system’s wastewater flow to CVWD due to the topography of the area and to avoid constructing a sewer lift station. CVWD then conveys this flow by gravity to LAGWRP. Figure 2-1 provides a high level overview of the location of the meter, and Figure 2-7 shows a closer image of which maintenance hole the flow meter is located in.



Figure 2-7: Rockland PI Flow Meter Location

2.2 Land Use

Based on LA County parcel zoning data, CVWD's service area contains the following land use types:

- Single Family Residential (SFR)
- Multi-Family Residential (MFR)
- Commercial
- Industrial
- Government/Institutional
- School

The predominant land use in CVWD's service area is residential (SFR and MFR), complemented by two commercial/business corridors along Foothill Boulevard and Honolulu

Ave. Figure 2-8 shows the land use types within CVWD's SSA based on LA County parcel data. Based on current LA County parcel zoning data, there are just two parcels defined as "Industrial" use (meat processing and self-storage), and no agricultural water users within CVWD. Institutional users are confined to schools, churches, parks, and freeway landscaping.

2.2.1 LA County Housing Element

The State of California's Regional Housing Needs Assessment (RHNA) continually updates the housing needs for different regions of the State to address the ongoing housing shortage and exponentially rising cost of living. The State then relies on local government agencies to develop plans to meet the housing goals set. LA County is a member of the Southern California Association of Governments (SCAG), which has developed their own RHNA Allocation Plan. LA County has been working on their portion of the RHNA Allocation Plan, titled the "Housing Element 2021-2029" (Housing Element). Table 2-6 shows the number of additional units based on affordability that Unincorporated LA County must accommodate by 2029. CVWD is located in unincorporated LA County; therefore, LA County is the regional planning authority.

Table 2-6: RHNA Required Units for Unincorporated LA County

Affordability	Extremely Low/Very Low (< 50% AMI¹)	Lower (50-80% AMI)	Moderate (80-120% AMI)	Above Moderate (>120% AMI)	Total
Required Units	25,648	13,691	14,180	36,533	90,052

Notes:

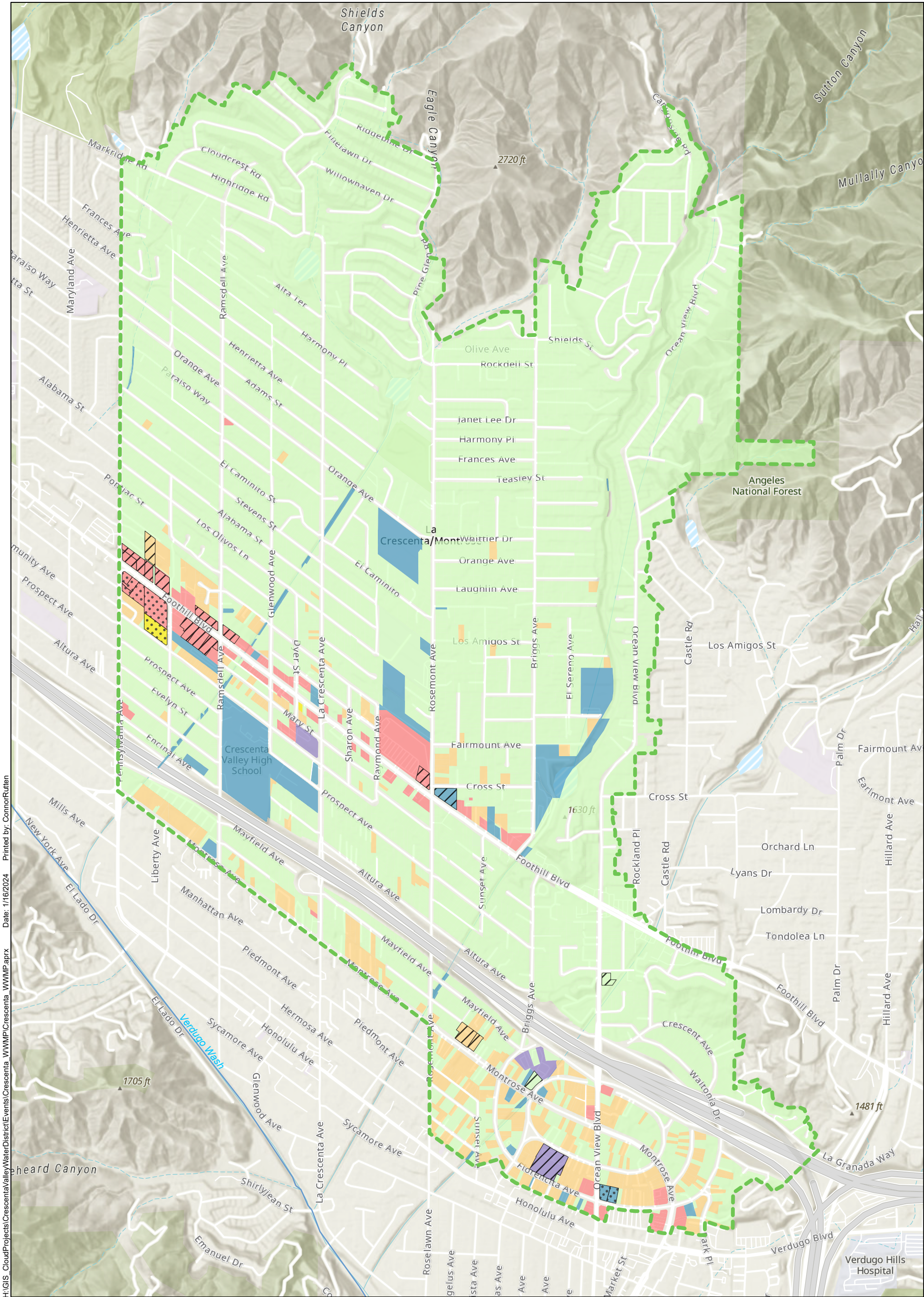
1. AMI = Area Median Income

Since the previous RHNA cycle was completed for 2014-2021, the target number of additional units has drastically risen from roughly 30,000 homes to 90,000 homes in Unincorporated LA County as Table 2-6 shows. LA County has worked to identify parcels in Unincorporated LA that are already zoned for residential use and also meet other criteria, such as being located outside of an environmentally sensitive area. Currently, there are not enough sites that are already zoned for residential use to meet the number of required units. Therefore, additional sites needed to be identified for rezoning by the year 2024 that could potentially be redeveloped into multi-family housing. These sites would ideally be located near transit corridors, amenities, and services. Three main factors were considered when evaluating whether a parcel might be redeveloped by 2029:

1. **Age of Existing Buildings:** Property owners and developers are more likely to redevelop the site if the existing buildings are relatively older. 20 years was the threshold for existing non-residential buildings, and 50 years was the threshold for existing residential buildings;
2. **Land Value vs. Improvement Value:** If the land is more valuable than the existing improvement, the property owner is more likely to redevelop the site with a more intense use, such as multi-family housing development; and

3. Contamination: Sites that are or have been contaminated (e.g. gas stations) often require a lot of money and time for clean-up. These sites are unlikely to be suitable for housing development in the near future.

A portion of these sites identified for redevelopment and/or rezoning are located within CVWD's service area, mainly along the two commercialized corridors of Foothill Blvd and Honolulu Ave. Figure 2-8 identifies the locations of these parcels. Appendix A contains additional information on the identified parcels.



H:\GIS_Cloud\Projects\Crescenta\ValleyWaterDistrict\Events\Crescenta_WWMP\Crescenta_WWMP.aprx Printed by: Connor Ritten Date: 1/16/2024

Legend
LA County Parcels
Land Use Type

SFR

MFR

Commercial

Industrial

Gov/Institutional

School

Los Angeles County Housing Element (2021-2029) - Rezoning

Los Angeles County Housing Element (2021-2029) - Sites Inventory

Sewer Service Area

 Kennedy Jenks

Crescenta Valley Water District
Wastewater Master Plan

**Sewer Service Area
Land Use and Housing
Element Parcels**

2244508*00

Figure 2-8

2.3 Service Area

CVWD provides water and sewer services to its customers; however, CVWD's water service area (WSA) and sewer service area (SSA) do not have identical boundaries. Figure 2-9 shows the WSA and SSA as well as the sewer customer locations. The WSA is roughly 4 square miles while the SSA is approximately 3.1 square miles. The WSA almost envelops the entire SSA, except for two small subset of customers located in the La Cañada Irrigation District (LCID) and La Cañada Flintridge (LCF) that CVWD serves with sewer service only (see Section 3.2).

The sewer customer locations were geolocated based on three years of complete water billing data between 2019 and 2021 (the latest dataset available at the time the project was initiated), using a combination of assessor parcel number (APN) information and address information. The total number of accounts and totalized demand geolocated within the SSA equated to 69% of WSA demands. The average billed water demand for the WSA was 3.27 MGD, while the average billed water demand for the SSA 2.26 MGD. Table 2-7 and Table 2-8 document the demand for the water customers served by CVWD by account type for both the WSA and SSA.

Table 2-7: WSA 2019 -2021 Average Annual Demand

Usage Type	2019 - 2021 Average Annual Demand (GPM)	# Active Accounts (2020)
Commercial	95	356
Fire ¹	0.4	117
Institutional	41	52
Irrigation	125	84
MFR	506	700
School	39	20
SFR	1,462	7,492
Total (GPM)	2,268	
Total (MGD)	3.27	8,826

Notes:

1. The "Fire" Usage Type is used to document water consumption used for firefighting and is metered through temporary flow meters.

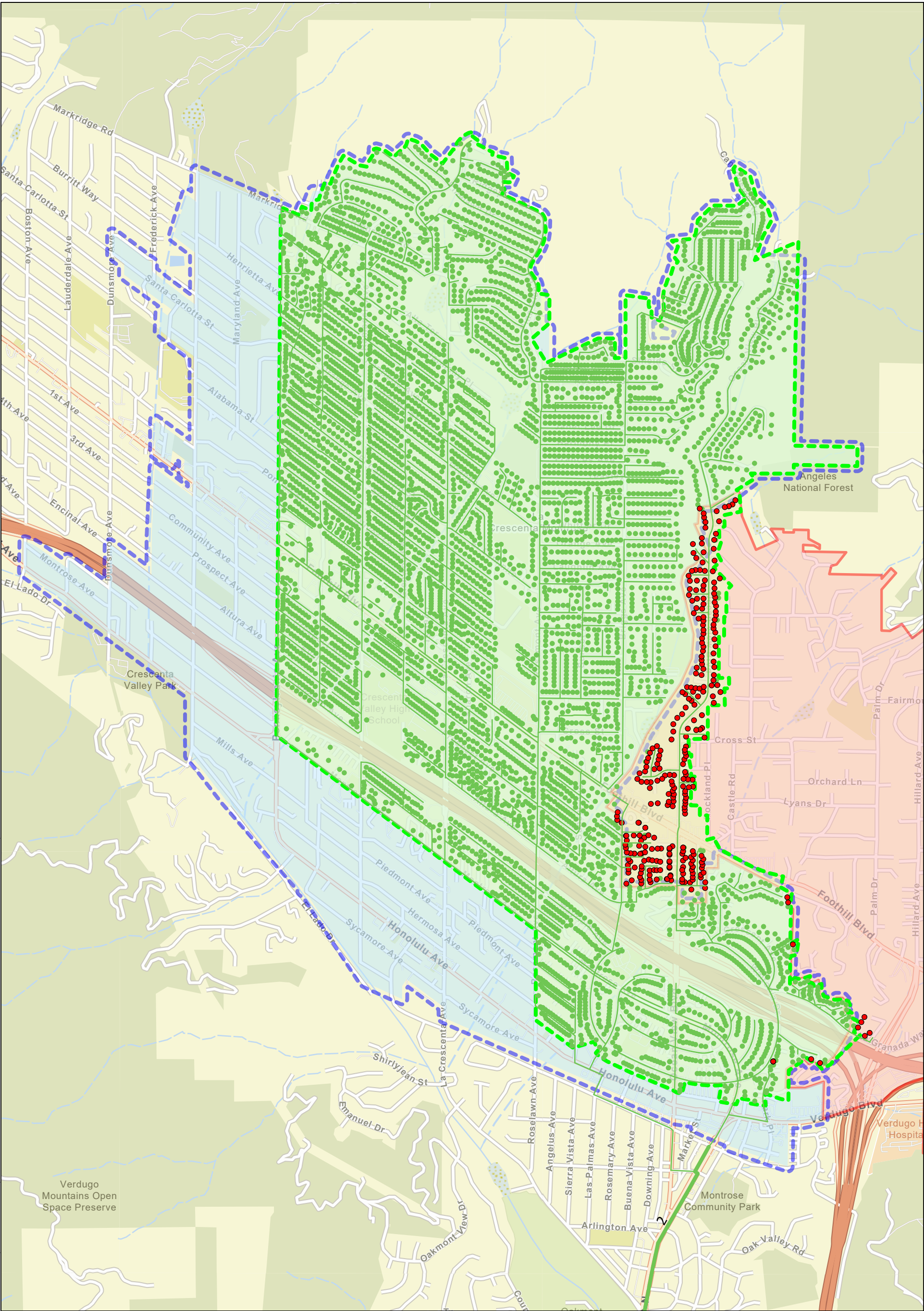
Table 2-8: SSA 2019 -2021 Average Annual Demand

Usage Type	2019 - 2021 Average Annual Demand (GPM)	# Active Accounts (2020)
Commercial	42	126
Fire ¹	0.4	56
Institutional	8	22
Irrigation	33	49
MFR	343	497
School	36	15
SFR	1,109	5,338
Total (GPM)	1,572	
Total (MGD)	2.26	6,106

Notes:

- The "Fire" Usage Type is used to document water consumption used for firefighting and is metered through temporary flow meters.

H:\GIS_Cloud\Projects\Crescenta\ValleyWater\DistrictEvents\Crescenta_WWMP\Crescenta_WWMP.aprx Date: 1/16/2024 Printed by: Connor Ritten

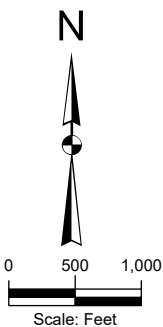


Legend

- LCID Sewer Customers
- CVWD Sewer Customer
- Sewer Gravity Mains
- ▭ Sewer Service Area
- ▭ Water Service Area
- ▭ La Canada Irrigation District

Notes:

1. LCID Customers are sewer only customers



Kennedy Jenks

Crescenta Valley Water District
Wastewater Master Plan

Service Area Overview

2244508*00

Figure 2-9

2.4 Population

The anticipated population growth within CVWD's service area is projected to increase by 8% over the next 25 years, translating to an average annual growth rate of 0.3%. **Table 2-9** provides details on the current population and the projected figures for the next quarter-century.

Table 2-9: 2020 UWMP Population – Current and Projected

Year	2020	2025	2030	2035	2040	2045
Service Population	32,462	32,974	33,494	34,022	34,558	35,103

Per the Urban Water Management Plan (UWMP) developed in 2020, the service area populations for CVWD were determined through the utilization of the DWR Population Tool ("WUE"). This tool incorporates service boundaries, US Census data, and the number of residential service connections. By leveraging past US Census data and the count of service connections, the tool calculates population by deriving persons per connection. This method enables the determination of the current service population by applying the persons per connection to the current count of service connections. Additionally, projections for the future service population can be made based on the average growth factor.

2.5 City of Los Angeles Wastewater Treatment & Disposal Agreement

CVWD does not own or operate their own wastewater treatment plant (WWTP), and therefore relies on an ongoing agreement (to be renewed in 2030) with the City of Los Angeles (City of LA) to receive and treat their wastewater. CVWD is one of the 24 Contracting Agencies that participate in the City of LA's Treatment & Disposal of Wastewater Agreement (Agreement). Almost all of CVWD's wastewater is conveyed to the Los Angeles-Glendale Water Reclamation Plant (LAGWRP). Less than 1% of CVWD's wastewater is conveyed directly to Hyperion Treatment Plant (HTP), which occurs while CVWD is backwashing their ion exchange system at their GWTP, producing a highly concentrated brine that LAGWRP is not able to receive and treat.

The City of LA charges CVWD based on the distance of CVWD's outfall to either LAGWRP or HTP (depending on where the flow is treated), as well as the quantity and strength of the sewage being treated. The final unit that the treatment fee is based on is calculated in "MGD-Miles". The equation representing the MGD-Miles calculation is as follows:

$$CVWD_{MGD-MILES} = [(DIST_{HTP}) \times (Q_{CVWD-HTP} + Q_{SLUDGE} + Q_{BRINE})] + (DIST_{LAG} \times Q_{CVWD-LAG})$$

Where:

$DIST_{HTP}$ represents the distance of CVWD's outfall to HTP, in miles;

$Q_{CVWD-HTP}$ represents the untreated wastewater flow conveyed to HTP, in MGD;

Q_{SLUDGE} represents the sludge flow generated by the treatment of CVWD flow at LAGWRP;

Q_{BRINE} represents the brine flow that bypasses LAGWRP and is conveyed directly to HTP;

$DIST_{LAG}$ represents the distance of CVWD's outfall to LAGWRP; and

$Q_{CVWD-LAG}$ represents the untreated wastewater flow conveyed to LAGWRP.

A sample calculation using flow data from FY 2019 is shown below:

$$CVWD_{MGD-MILES} = [(27.3 \text{ Miles}) \times (0.39 \text{ MGD} + 0.05 \text{ MGD} + 0.01 \text{ MGD})] + (6.3 \text{ Miles} \times 1.04 \text{ MGD}) = 18.8 \text{ MGD} - \text{Miles}$$

Figure 2-10 provides a visualization of the relationship between the calculated flows.

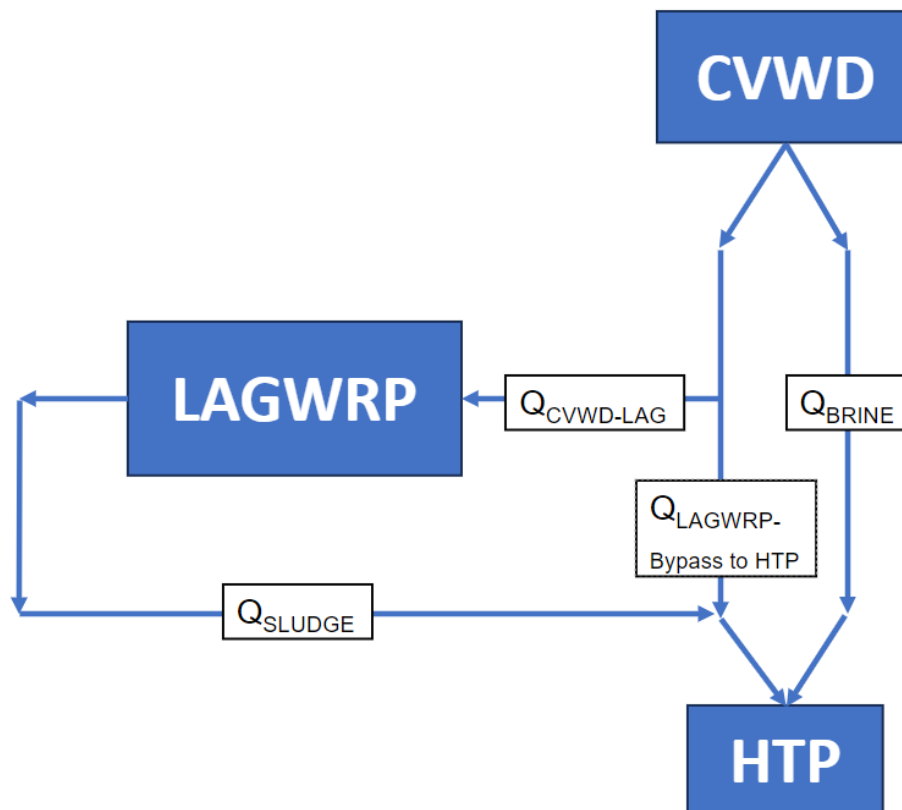


Figure 2-10: Flow Schematic of City of LA Agreement

While CVWD has no operational costs associated with a WWTP, the cost of sending wastewater to the City of LA for treatment is steadily increasing, and is outpacing CVWD's ability to offset the increasing costs by increasing customer wastewater rates. Figure 2-11

provides the total annual cost to CVWD as well as the annual unit cost, normalized by the total annual flow treated in a given year (in MG).

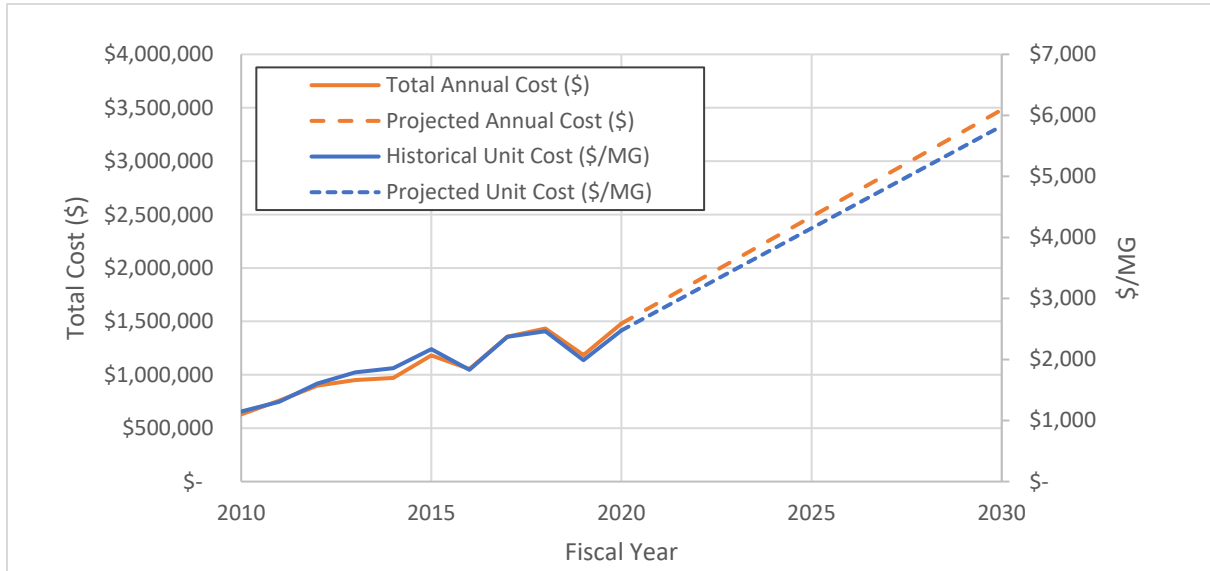


Figure 2-11: Historical and Projected Trend of City of LA Agreement Costs

From 2010 to 2020, the unit cost to treat 1 MG of flow rose on average by 8% each year. In 2020, it cost CVWD roughly \$2,500 for every 1 MG of flow sent to the City of LA. If these trends continue at the same rate of growth, the unit cost for treating 1 MG of flow in 2030 will be \$5,826. By contrast CVWD's base wastewater (WW) rate has grown by 5.4% per year on average from 2010 to 2023. Therefore, the cost of treatment is outpacing the rate at which WW rates are being adjusted. Figure 2-12 compares the rate of change for these two values. CVWD may consider performing another cost of service study using the CIP cost information included in this WWMP to ensure that CVWD has enough revenue to offset rising treatment costs.

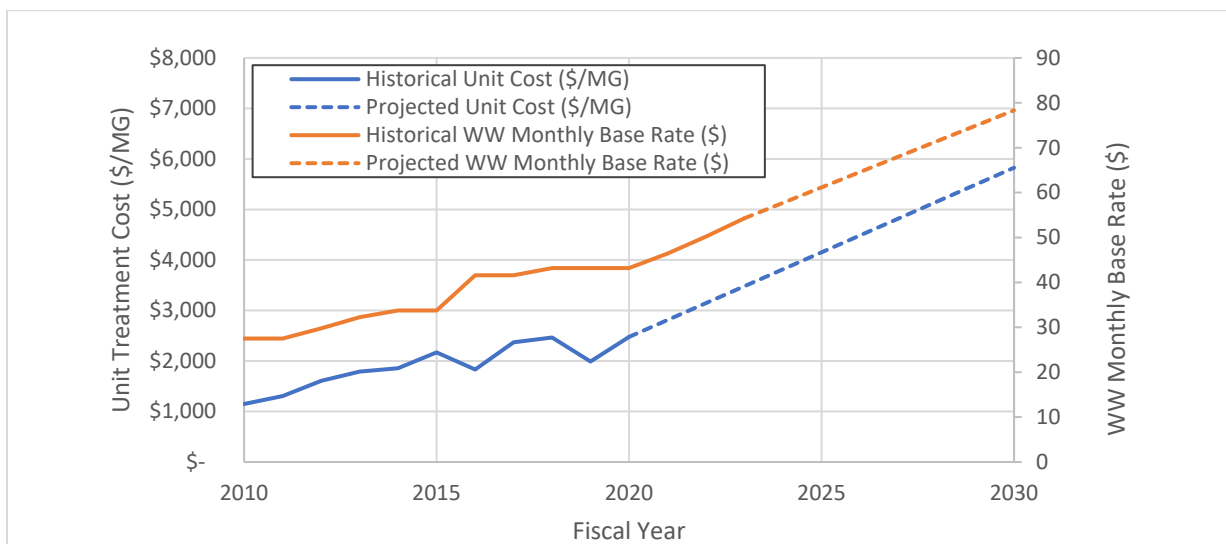


Figure 2-12: Historical and Projected Unit Treatment Costs vs WW Monthly Base Rates

Section 3: Existing and Future Sewer Flow Analysis

This section analyzes historical and existing sewer flows at both the system level and at the individual customer level, and explains what data was used to develop future sewer flow projections. This section sets the foundation for evaluating the capacity of the existing collection system under present day and future sewer flow conditions.

3.1 Historical Wastewater Flow and Strength

CVWD currently meters and measures the strength of wastewater flow at two locations in the collection system. The first location is Elk Ave, which measures the flow and strength of wastewater for the entire CVWD SSA. The second is at the Rockland PI flow meter, which meters flow from LCF. Table 3-1 provides a summary of the average flow, biological oxygen demand (BOD), and suspended solids (SS) for both meter locations from January 2010 to March 2023. BOD and SS are used to quantify the strength of the sewage when reporting to the City of LA. Typical residential wastewater has a BOD between 100 to 400 mg/L, and an SS of 100 – 400 mg/L. CVWD's wastewater falls within these normally observed ranges.

Table 3-1: Wastewater Strength and Flow

Flow Meter	Average Flow (MGD)	BOD ¹ (mg/L)	SS ² (mg/L)
Elk Ave	1.52	131	197
Rockland PI	0.106	193	194

Notes:

1. BOD = Biological Oxygen Demand
2. SS = Suspended Solids
3. Data period from Jan 2010 to Mar 2023

Figure 3-1 shows wastewater flows and strength from 2000 to March 2023. Since 2010, sewer flows have remained relatively constant on an annual average basis. Both BOD and SS fluctuate between 50 to 400 mg/L.

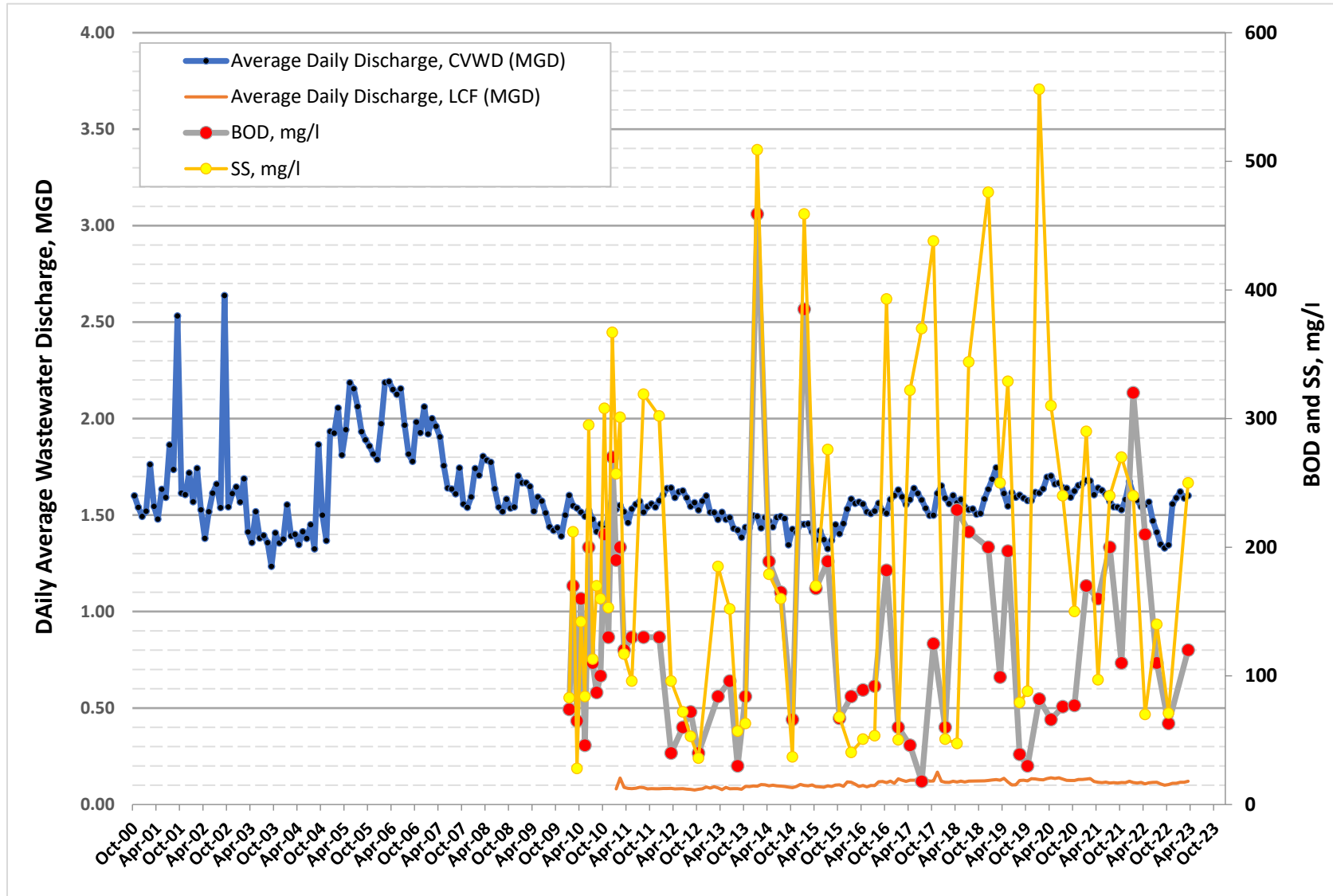


Figure 3-1: Historical SSA Wastewater Flow and Strength (Oct 2000 – Mar 2023)

3.2 Existing Customer Wastewater Demands

Sewer flows are not directly metered at each individual customer and must be estimated based on the customer's corresponding water demand. Because CVWD's WSA and SSA serve different populations, the water billing data required additional analysis to determine what portion of water customers were located within the SSA. As Section 2.3 describes, there is also a subset of LCID customers that are served by the sewer collection system but not served by CVWD's water distribution system. Figure 3-2 shows the relationship between the WSA Billed Water Demand, SSA Billed Water Demand, and SSA Sewer Demand.

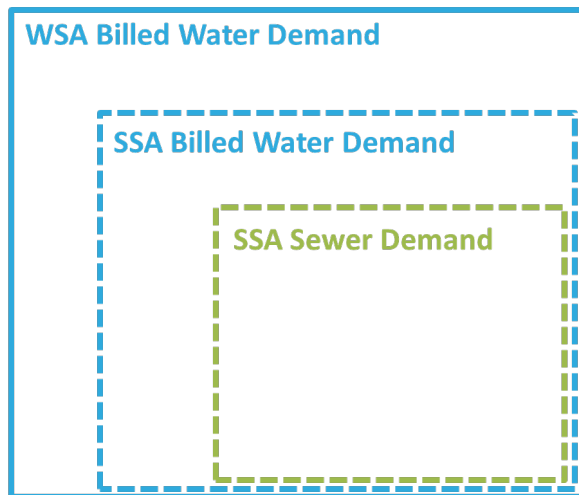


Figure 3-2: Relationship between Water and Sewer Demands

The WSA Billed Water Demand was calculated based on three years of complete water billing data from 2019 to 2021. Figure 3-3 shows the monthly billed water demand for the WSA. System demands peak in August/September and are lowest in February/March. Table 3-2 provides a summary of the WSA water billing data by year.

Table 3-2: WSA Billed Demand Summary

Year	Unique Active Meters	Annual Demand (AFY)	Average Demand (MGD)
2019	8,856	3,363	3.00
2020	8,758	3,816	3.41
2021	8,837	3,790	3.38
2019-2021 Average	-	3,656	3.26

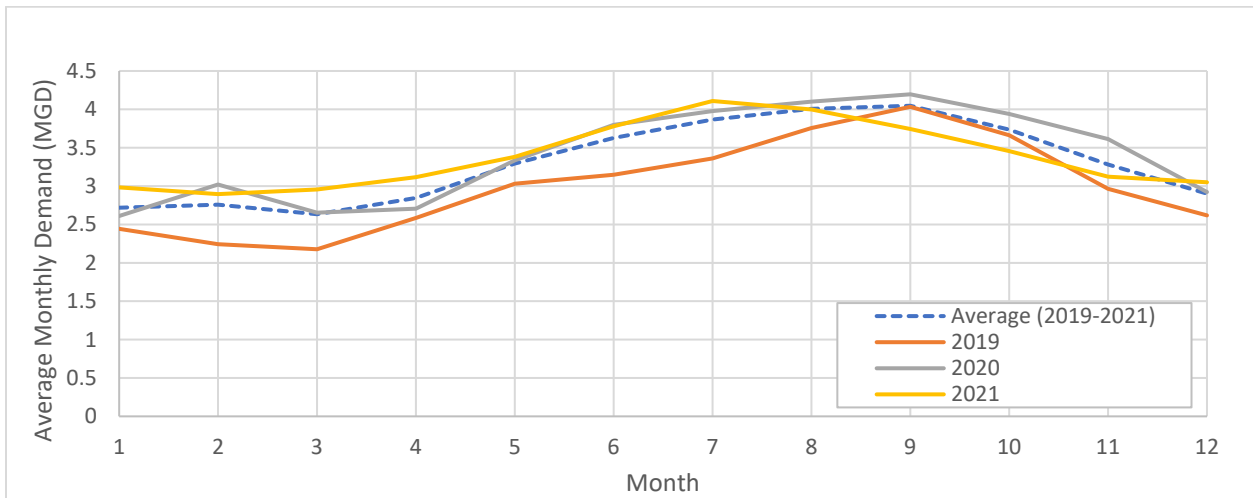


Figure 3-3: 2019-2021 Average Monthly Billed Water Demand

The next step to converting billed water demand to sewer demands is understanding what portion of the billed water demand is located inside of the SSA. As Figure 2-9 shows, the water billing customer data was geolocated based on APN/address information within GIS. By doing a spatial intersect between the SSA boundary and the water billing data, a subset of the water customers located within the SSA were identified. The total demand for these customers was calculated and is shown in Table 3-3, along with the calculated “SSA Reduction Factor” used to convert WSA billed water demand to SSA billed water demand.

Table 3-3: WSA versus SSA Water and Sewer Demands

WSA Billed Water Demand (2019-2021, AFY)	SSA Billed Water Demand (2019-2021, AFY)	SSA Reduction Factor (-)
3,656	2,533	0.693

To account for the sewer-only LCID customers, water billing data for the LCID accounts was obtained for the same time period (2019 – 2021), totaling 168 AFY of demand. The LCID sewer demands were comprised of both single family and multi-family residential accounts. Table 3-4 shows the SSA billed water demand by usage type, incorporating both CVWD water billing data and LCID sewer only customer billing data. The water billing data contained meter usage types that were used to corroborate the LA County parcel land use data. The “Fire” Usage Type is used to document water consumption used for firefighting and is metered through temporary flow meters.

Table 3-4: SSA Billed Water Demand by Usage Type

Usage Type	2019 - 2021 Average Annual Demand (GPM)	% Total Water Demand	# Accounts (2020)
Commercial	42	2.5%	126
Fire ¹	0.45	0.03%	56

Usage Type	2019 - 2021 Average Annual Demand (GPM)	% Total Water Demand	# Accounts (2020)
Institutional	8	0.5%	22
Irrigation	33	2.0%	49
MFR	355	21.2%	509
School	36	2.2%	15
SFR	1,196	71.6%	5,608
Total	1,670 (2.41 MGD)	100%	6,385

72% of the water demand in the SSA is composed of SFR customers, and 93% of the total SSA demand is composed of residential customers (SFR and MFR), indicative of the customer composition of CVWD's customers in the SSA.

3.2.1 Return Flow Ratio Calculations

Finally, to calculate the sewer demand for each customer, sewer return flow ratios were developed for each water customer usage type. The sewer return flow ratio represents what portion of the water demand being consumed by a water customer is then returned to the collection system as waste. On a systemwide basis, the return flow ratio has steadily increased over time, as the system water demands have significantly decreased while wastewater flows have remained relatively constant. Figure 3-4 documents the trend of the systemwide return flow ratio between 1996 to 2020.

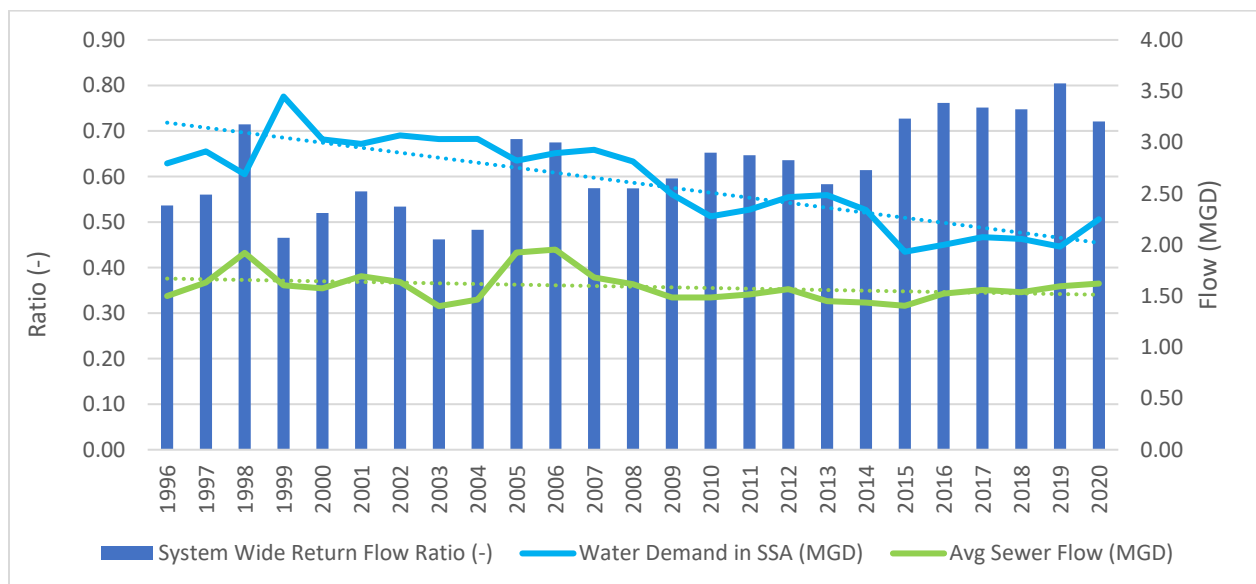


Figure 3-4: Systemwide Return Flow Ratio

The systemwide return flow ratio can be directly calculated using the flow meter data from the Elk Ave flow meter and the water billing data. However, calculating the return flow ratio for specific usage types that are not directly metered is not as straightforward. In general, customers with less green space who primarily use water indoors, such as MFR customers, will have higher return flow ratios. Customers that use water for irrigation and fire protection will have no return flow, as the water is fully consumed and does not return to the sewer collection system.

Return flow ratios can be estimated by dividing winter water demands (when outdoor usage is assumed to be minimal or zero) by the annual average demands; however, this is not an accurate method in Southern California where landscape irrigation may not follow a seasonal fluctuation as it would in other parts of the state, leading to artificially high return flow ratios. Therefore, several other Southern California WWMP efforts were surveyed to identify typical return flow ratios for the usage types in CVWD's system.

The total calculated sewer flow for the SSA needed to equal the average metered sewer flow at the Elk Ave flow meter of 1.625 MGD (2019-2021 average). Because 72% of the SSA demands are SFR customers, the SFR return flow ratio had the most impact on the total SSA sewer demand calculation. The SFR return flow ratio was iterated until the sum of all calculated SSA sewer demands equaled the measured average flow at the Elk Ave flow meter. Table 3-5 shows the chosen return flow ratios for each usage type based on other WWMP projects in the region and past project experience. Table 3-6 provides an overview of the calculation of sewer demand by usage type using the defined return flow ratios.

Table 3-5: Return Flow Ratios by Usage Type

Usage Type	Return Flow Ratio
Commercial	80%
Fire	0%
Institutional	60%
Irrigation	0%
MFR	80%
School	50%
SFR	60.6%

Table 3-6: SSA Billed Water Demand by Usage Type

Usage Type	2019 - 2021 Average Annual Water Demand in SSA (GPM)	Return Flow Ratio	2019 - 2021 Average Annual Sewer Demand in SSA (GPM)	% Total Sewer Demand
Commercial	42	80%	33	3.0%
Fire	0.45	0%	0	0.0%
Institutional	8	60%	5	0.4%
Irrigation	33	0%	0	0.0%
MFR	355	80%	284	25.1%
School	36	50%	18	1.6%
SFR	1,196	60.6%	725	64.3%
LCF Metered Flow ¹	-	-	63	5.6%
Total	1,670 (2.41 MGD)		1,128 (1.62 MGD)	100%

Notes:

1. Composition of metered LCF Flow Unknown.

Figure 3-5 shows a visual comparison of the monthly SSA water demand versus the Elk Ave metered sewer flow, as well as the calculated average SSA sewer flow of 1.62 MGD.

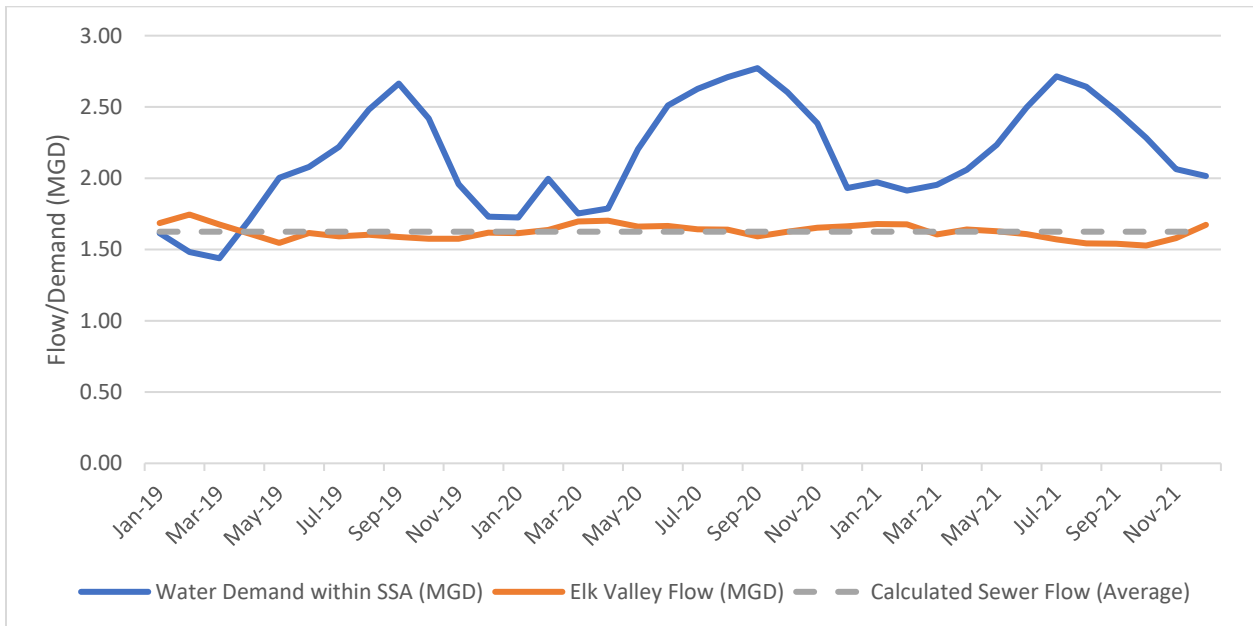


Figure 3-5: SSA Water Demand versus Metered Sewer Flow

As future flow metering efforts are completed within the different sewershed areas (see Section 6.1), it is possible to re-calculate the return flow ratio if upstream customers are all a single usage type, SFR being the most important.

3.3 Sewer Flow Projections

This section describes the various sources of data used to develop the future sewer flow projections, incorporating data from the UWMP and the 6th Cycle Housing Element.

3.3.1 UWMP Demand Projections

In order to align this WWMP with the UWMP, water demand projections from the UWMP were used as the basis for calculating the future sewer flows for CVWD's SSA. UWMP demand projections used a design demand per person of 107.7 gallons per capita per day (GPCD) based on the past five-year average and projected population growth. Per capita consumption rates are expected to remain under 107.7 GPCD and trend further below that rate as a result of ongoing water conservation efforts (SA Associates, 2021). Therefore, by holding the GPCD constant through 2045 for the sewer flow projections, the projections are considered to be conservative. Sewer flow projections should be revisited after the next UWMP cycle to refine the sewer flow projections.

Table 3-7 shows the UWMP demand projections alongside the calculated sewer flow projections. Figure 3-6 provides a visual representation of the projected water and sewer flows. The projected sewer flows utilize the WSA to SSA reduction factor as well as the return flow

ratios developed in Section 3.1, as the UWMP breaks down the projected water demands by usage category.

Table 3-7: 2020 UWMP Demand Projections and Sewer Flow Projections

Year	Population	Per Capita Water Demand (GPCD)	Projected Water Demands (MGD) ¹	Project Water Demands in SSA (MGD) ²	Projected Sewer Flows (MGD) ³
2020	32,462	115.9	3.76	2.49	1.62
2025	32,974	107.7	3.55	2.35	1.45
2030	33,494	107.7	3.61	2.38	1.47
2035	34,022	107.7	3.66	2.42	1.49
2040	34,558	107.7	3.72	2.46	1.52
2045	35,103	107.7	3.78	2.50	1.54

Notes:

1. 2020 Water Demand based on actual total billing data for the year 2020. The 5-year average system demand from 2015-2020 was 3.45 MGD. Because demand projections use the 5-year average as the starting point, the UWMP shows a dip in projected demands between 2020 and 2025 before continuing to climb to 2045.
2. The WSA to SSA reduction factor of 0.6606 was used to convert projected WSA water demands SSA water demands. See Section 3.1 for more details.
3. See Section 3.2.1 for return flow ratios used.

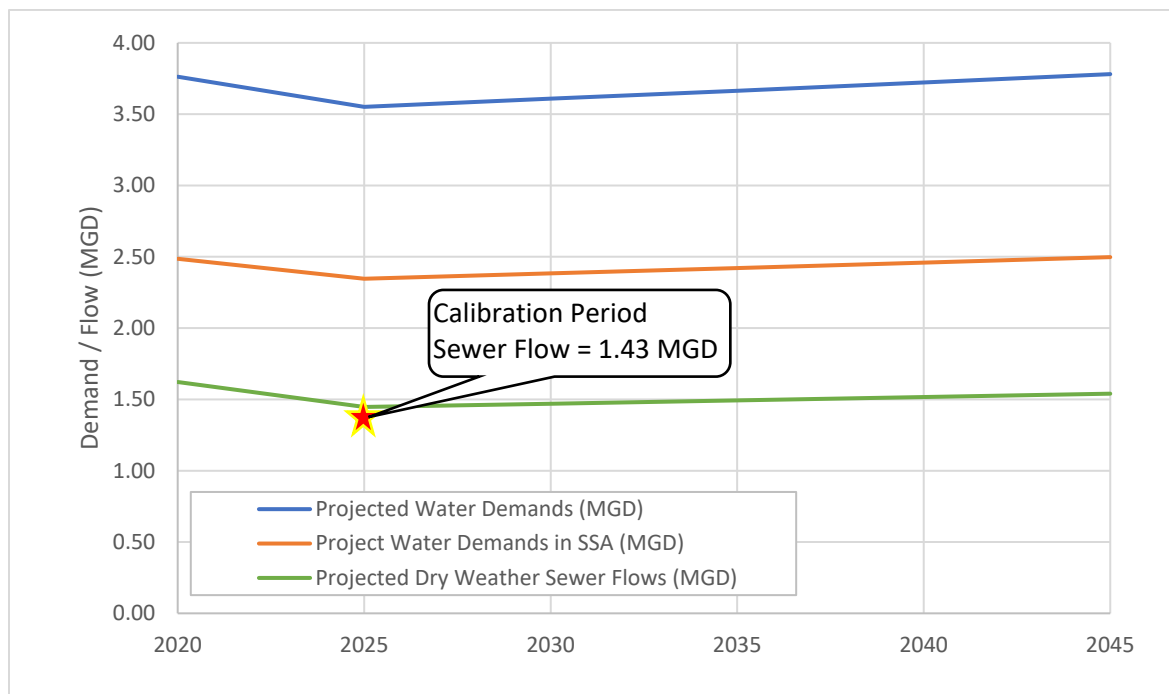


Figure 3-6: UWMP Demand Projections and Projected Sewer Flows

For reference, the average dry weather sewer flow recorded at Elk Ave flow meter was 1.43 MGD in January of 2023. See Section 4.2.3.2 for additional information.

3.3.2 Future Sewer Flow Distribution

As discussed in Section 2.2.1, LA County has identified specific parcels within CVWD's SSA that are candidates for densification and/or rezoning. While the UWMP only projects future water demands at a service area level, LA County's Housing Element provides a method for identifying where the additional projected sewer flows may occur within the SSA. The distribution of future sewer flows is important in order to understand the potential impacts to CVWD's collection system capacity. Figure 2-8 shows the locations of the identified Housing Element parcels, and Appendix A includes specific information on identified parcels. The Housing Element not only identifies the locations of the parcels but also calculates the anticipated additional population that would be supported by the densification and newly developed housing units. With an estimated population, the UWMP target GPCD of 107.7 can be applied to calculate the approximate additional water demand within CVWD's SSA. Furthermore, the usage type for the target parcels will be MFR based on the goals of the Housing Element to densify and develop more affordable housing. Therefore, the return flow ratio for MFR customers of 80% can be used to calculate the corresponding sewer flows associated with the Housing Element parcels. Table 3-8 summarizes the calculation of the total projected additional sewer demand that will occur within the SSA.

Table 3-8: LAC 2021-2029 Potential Growth

Parameter	Value	Units
Potential Rezoned Parcels	8	parcels
Rezoning total capacity	1,046	persons
Potential Sites Inventory (already properly zoned)	17	parcels
Sites Inventory capacity	452	persons
Total Anticipated Sites Inventory Population	1,498	persons
UWMP Target GPCD	107.7	gpcd
Total Water Demand based on target UWMP GPCD	161,335	gpd
Total Water Demand in SSA based on target UWMP GPCD	112.0	GPM
MFR Return Flow Ratio	80%	-
Projected Sewer Demand	129,068	gpd
Projected Sewer Demand	90	GPM

The total additional projected sewer demand is 90 GPM. Using the UWMP projections, the anticipated increase in sewer flows from 2025 to 2045 is only 0.09 MGD or 62.5 GPM. However, as the UWMP states, the ongoing water conservation efforts will likely result in further decreases in water consumption. Therefore, the difference between the projected 90 GPM based on the Housing Element and the 62.5 GPM projected by the UWMP can be contributed to future conservation efforts. Section 4.1.2.2 explains how this was accounted for in the hydraulic model.

3.3.3 La Cañada Flintridge Future Wastewater Flow Projections

Future wastewater flows associated with the City of La Cañada Flintridge were estimated based on the City's 2021–2029 Housing Element, which evaluated three housing growth scenarios:

- The required Regional Housing Needs Assessment (RHNA) allocation of 612 units
- A conservative planning scenario that includes a 20 percent buffer for the RHNA allocation (717 units)
- The City's sites inventory capacity of 689 units.

An average household size of 3.15 persons per housing unit was assumed based on Housing Element Table HE-8. Wastewater generation was calculated using a per capita water use rate of 107.7 gpcd (see Section 3.3.1) and a multi-family residential sewer return ratio of 80 percent. The resulting projected flows are summarized below.

Table 3-9: Estimated LCF Future Wastewater Flow Scenarios

Scenario	Units	Average Household Size	GPCD	Returned Flow Ratio	Estimated Flow (MGD)
RHNA Requirement	612	3.15	107.7	80%	0.166
RHNA + 20% Buffer	717	3.15	107.7	80%	0.195
Sites Inventory	689	3.15	107.7	80%	0.187

For planning and modeling purposes, the RHNA + 20% buffer scenario (0.195 MGD) was selected as the conservative future condition.

3.3.4 Integration of LCF Flows into Systemwide Projections

Projected LCF wastewater flows were added to CVWD's future SSA flows to estimate total flow conveyed through the collection system. Because CVWD does not currently have information to quantify what portion of LCF wastewater ultimately enters CVWD's system, a conservative assumption was made that 100 percent of future LCF flow discharges to CVWD at the Rockland Place meter. This assumption ensures the future hydraulic analysis does not underestimate system loading.

Table 3-10: Total Future Interceptor Average Dry Weather Flow

Year	SSA Future Flow (MGD)¹	LCF Future Flow (MGD)	Total Interceptor Flow (MGD)
2025	1.45	0.195	1.645
2030	1.47	0.195	1.665
2035	1.49	0.195	1.685
2040	1.52	0.195	1.715
2045	1.54	0.195	1.735

1. SSA flows from Table 3-7 of the existing WWMP.

Section 4: Sewer System Model Development

A key element of understanding the capacity of CVWD's collection system under existing and future sewer flows involved the development of the collection system hydraulic model. Innovyze's InfoSWMM software was used to develop the hydraulic model. The development of the hydraulic model involved several steps including importing CVWD's existing GIS sewer geodatabase, reviewing model connectivity, calculating/assigning existing and future flows to the model, and calibrating the model using flow meter data. This section provides an overview of the hydraulic model development, calibration and validation process, in addition to the comprehensive capacity analysis and modeling results.

4.1 Hydraulic Model Development

The wastewater collection system model was developed in Innovyze InfoSWMM Version 15.0. The hydraulic model horizontal datum is based on the California Zone 5 State Plane Coordinate System (NAD83). The model uses Manning's equation to calculate friction losses throughout the system with a Manning's roughness coefficient of 0.013.

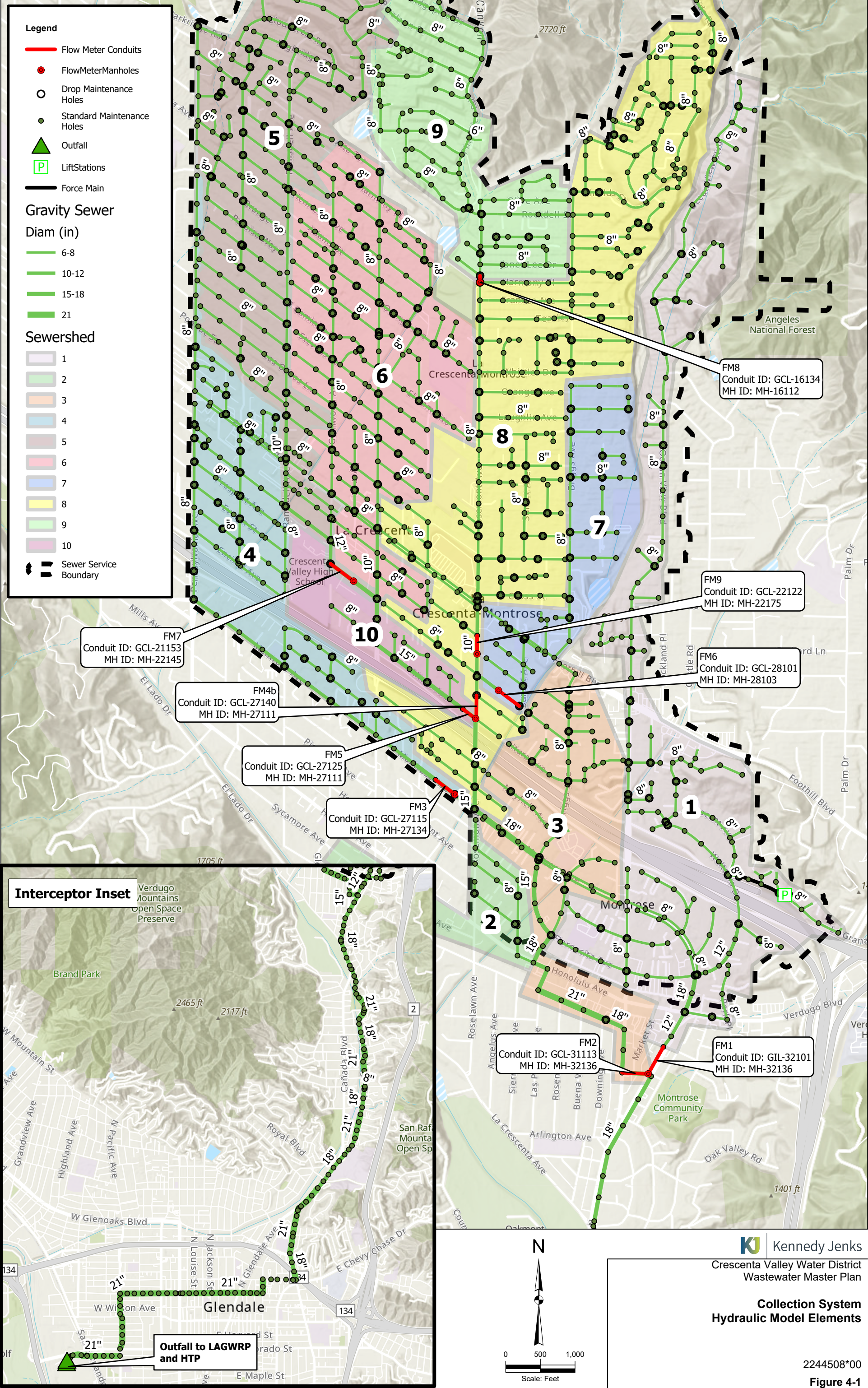
The modeled network includes all active gravity sewer pipes 8 inches or larger, maintenance holes, and the La Granada Lift Station and force main. The model also captures the cleanouts and fittings included in CVWD's GIS sewer geodatabase.

4.1.1 Model Approach and Update

The hydraulic model was constructed based on the data included in CVWD's GIS sewer geodatabase along with CVWD's sewer record drawings. The following approach was taken where information, such as diameters and inverts, were not available for conduits:

- When inverts were missing in intermediate gravity sections where upstream and downstream information was known, the inverts were interpolated using the known inverts as well as the length of the conduit with missing invert information.
- When only downstream inverts were available, the upstream inverts were calculated using the known downstream invert, the length of the conduit, and an assumed constant slope.
- When connectivity information was completely missing, appropriate assumptions were made based on engineering judgement and consultation with CVWD staff to build the network.
- For maintenance holes for which information was unknown, a rim elevation was taken from Google Earth and verified using the latest topographic data available from United States Geological Survey (USGS).

Figure 4-1 shows the collection system hydraulic model elements, sewershed boundaries, and the locations of the flow meters described in Section 4.1.3.



HGIS CloudProjects\Crescenta\ValleyWaterDistrictEvents\Crescenta_WWMP\Crescenta_WWMP.aprx Date: 2/10/2024 Printed by: ConnorRitten

K Kennedy Jenks

Crescenta Valley Water District
Wastewater Master Plan

Collection System
Hydraulic Model Elements

2244508*00
Figure 4-1

4.1.2 Sewer Demand Allocation

This section explains the methods used to allocate both the existing and future sewer demands to the hydraulic model.

4.1.2.1 Existing Sewer Demand Allocation

As Section 3.1 states, the water billing data was geolocated within GIS based on parcel number and address information. After calculating the average annual sewer demand for each customer, a tabular join was performed between the tabulated sewer demands and the geolocated customers. InfoSWMM's demand allocation manager was then used to load the hydraulic model with the calculated sewer demands, using the "nearest pipe" allocation method as shown in Figure 4-2. The sewer demand is attributed to the next downstream maintenance hole.



Figure 4-2: Model Demand Allocation Method

4.1.2.2 Future Sewer Demand Allocation

Section 3.3 explains the anticipated increase in sewer demands as well as the anticipated reduction in sewer flows due to ongoing water conservation efforts. The future sewer demands of 90 GPM that is associated with the Housing Element parcels were first allocated in the

hydraulic model using the same allocation method mentioned above. Locations of these parcels is shown in Figure 2-8.

Since the projected Housing Element sewer demands are higher than the overall anticipated demand increase documented in the UWMP, the existing sewer demands were uniformly reduced by 87% global multiplier until the total SSA ADWF was equal to the projected 2045 sewer flow of 1.54 MGD. This global reduction represents the increase in water consumption efforts over the next 20 years.

This WWMP incorporates projected future wastewater flows from LCF (0.195 MGD), as described in Section 3.3.3. These flows were assigned at the Rockland Place flow meter, which represents the point where LCF wastewater enters CVWD's collection system.

4.1.3 Flow Meter Data Collection

CVWD worked with the on-call flow metering contractor, ADS, to compile a list of suggested locations for the installation of temporary flow meters. After considering available resources, site constraints, and field/traffic conditions, temporary flow meters were subsequently installed at the locations described below. Table 4-1 lists the meter names with their corresponding Conduit ID and Operational Period. Figure 4-1 provides the flow meter locations and their corresponding sewersheds.

The sewer system study, initially set for a 90-day period from December 1 to March 1, was extended due to persistent flow imbalances at site FM04. Efforts to address the issue included installing three additional locations, including FM04a upstream of FM04. Despite these measured, the flow imbalance problem persisted. Continuing attempts to address the issue, CVWD added an installation at site FM09, six maintenance holes further upstream of FM04, with reasonable flow balance.

ADS extended the study's end period by 14 days due to lack of reliable data. Subsequently, CVWD amended the agreement, relocating FM09 to a new location referred to as FM04b, capturing the northern flow in the same maintenance hole as FM05. This relocation occurred during the courtesy extended period.

The monitoring periods for these locations are as follows:

- FM04a: January 18, 2023 – March 15, 2023
- FM04b: March 3, 2023 – March 15, 2023
- FM09: February 8, 2023 – March 3, 2023 (relocated to FM04b at CVWD's request)

Further investigation revealed that the flow readings at sites FM04 and FM04A were likely erroneous due to the configuration of the maintenance hole the meters were installed in. In both cases, the maintenance holes were drop maintenance holes, with a secondary opening towards the top of the maintenance hole that allowed some flow during wet weather events to bypass the meter entirely. Therefore, the data collected by these flow meters was not used for calibration.

In the sewer system overview, the system was divided into 10 sewersheds, each assigned a flow meter. The calibration period for all meters ran from December 1st to March 15th, excluding

FM04B and FM09. FM09 operated until 3/3/23, replaced by FM04b, which remained active until 3/15/23; both of which are situated within sewershed 8. Since no data was available for FM04B calibration period, it was not used for calibration.

FM03 had significant flow and depth changes which occurred after the ADS crew relocated the sensor from the pipe inlet to the pipe outlet on February 7th. Based on discussions with ADS staff, data from February 7th onward was considered more reliable and was used for calibration.

Appendix C contains the flow metering report developed by ADS which provides greater detail regarding the flow meter data and flow meter locations.

Table 4-1: List of Flow Meters

Meter Name	Upstream Meters	Sewershed Number	Modelled Conduit ID	Location (Street name)	Operational Period
FM01	None	1	MHS-32101	3501 N Verdugo Rd, Glendale, CA 91208	12/01/2022 to 03/15/2023
FM02	FM03, FM04b, FM05	3+2	MHS-32101	3501 N Verdugo Rd, Glendale, CA 91208	12/01/2022 to 03/15/2023
FM03	None	4	MHD-27109	2623 Montrose Ave, Montrose, CA 91020	02/07/2022 to 03/15/2023
FM04	None	-	N/A	2600 Mayfield Ave, La Crescenta-Montrose, CA 91214	12/01/2022 to 03/15/2023
FM04a	None	-	N/A	4211 Rosemont Ave, La Crescenta-Montrose, CA 91214	12/01/2022 to 03/15/2023
FM04b	FM06, FM09	8	MHS-27115	2601 Altura Ave, La Crescenta-Montrose, CA 91214	03/03/2023 to 03/15/2023
FM05	FM07	10+6	MHS-27115	2601 Altura Ave, La Crescenta-Montrose, CA 91214	12/01/2022 to 03/15/2023
FM06	None	7	MHS-28117	2533 Prospect Ave, Montrose, CA 91020	12/01/2022 to 03/15/2023
FM07	None	5	MHS-22154	2831 Prospect Ave, La Crescenta-Montrose, CA 91214	12/01/2022 to 03/15/2023
FM08	FM08	9	MHD-16134	Rosemont Ave & Harmony Pl La Crescenta-Montrose, CA 91214	12/01/2022 to 03/15/2023
FM09	None	8	MHS-22131	4428 Rosemont Ave, Montrose, CA 91020	02/08/2023 to 03/03/2023

Notes:

1. Flow meters FM04 and FM04a highlighted in red were not used for the model calibration.

4.2 Hydraulic Model Calibration

Model calibration is an iterative process involving the adjustment of model parameters until the predicted outcomes closely align with the data recorded by flow meters. When the simulated hydrographs generated by the model closely match the historical measured conditions in the collection system, the model is considered calibrated, indicating that it is an accurate representation of the real collection system. The model is calibrated and then validated using two independent sets of historical data to ensure that the calibrated model is robust and is not just calibrated for on specific subset of data. This ensures that the model can be used for predicting multiple outcomes when provided different historical precipitation events and/or demand patterns. Additional demands can then be added on top of the calibrated model to reliably predicting the impacts of future sewer flow conditions.

Calibration was carried out for the 8 temporary flow meter locations in addition to the Elk Ave permanent flow meter. The calibration adjustments made during this process are tailored to address specific conditions, focusing on both dry weather flow (DWF) and wet weather flow (WWF) conditions. Adjustments for DWF ensure the model accurately reflects the system's behavior under average and low-flow conditions. Simultaneously, adjustments for WWF are implemented to capture the system's response during periods of increased flow, such as during rainfall events. By fine-tuning the model through calibration, it becomes a more dependable tool for predicting the consequences of various scenarios in the future.

4.2.1 Calibration Criteria

When evaluating calibration results, it is important to establish the level of acceptable tolerance between actual and measured data. Best practice model calibration criteria, obtained from the Wastewater Planning Users Group's (WaPUG) Code of Practice for Hydraulic Modelling of Sewers, were adopted for this calibration.

For dry weather flow the criteria was applied to one dry weather period lasting for seven consecutive days. In addition, a meter was called calibrated if the observed and model-predicted hydrographs meet the recommended criteria listed below for at least 80% of the qualified events observed during the flow monitoring program:

- The timing of the peaks and troughs should be within 1 hour.
- The peak flow rate should be in the range -10%.
- The volume of flow should be in the range of -10%. Care should be taken to exclude periods of missing or inaccurate data.

For wet weather events, a meter was called calibrated and validated if the observed and model-predicted hydrographs meet the recommended criteria listed below for at least 60% of the qualified events observed during the flow monitoring program.

- The timing of the peaks and troughs should be similar having regard to the duration of the event.

- The peak flow rates at each significant peak should be in the range + 25%, - 15% and should be generally similar throughout the event.
- The volume of flow should be in the range +20% to -10%. Care should be taken to exclude periods of missing or inaccurate data.

The above criteria are intended to guide the calibration process. There were instances where calibration couldn't meet the specified standards. Reasons for this included unusual conditions in the system, or meter malfunctions. In such cases where the criteria were not met, a thorough and reasonable explanation was provided. It is noted that achieving the above criteria is the goal of the calibration process and that good engineering judgement is also used to assess the overall quality of a calibration.

4.2.2 Rainfall Data Analysis

A total of 13 rainfall events had occurred during the monitoring period. A review of the meter data was performed to select appropriate storms for calibration purposes. The storm selected for calibration on 1/9/2023 is equivalent to 2-Yr, 24-hour design storm (as per NOAA Atlas 14 shown in Appendix C), the storm selected for validation on 2/24/2023 is equivalent to 25-Yr, 24-hour design storm (as per NOAA Atlas 14). Table 4-2 lists the rainfall statistics (event start/end times, duration) for rainfalls of at least 0.25 inches.

Table 4-2: Rainfall Event Summary

Number	Start Time	End Time	Duration (h)	Total Rainfall (in)
1	12/11/2022 0:00	12/11/2022 9:00	10	2.93
2	12/27/2022 14:00	12/27/2022 23:00	10	0.41
3	12/31/2022 0:00	1/1/2023 01:00	26	1.96
4	1/4/2023 10:00	1/4/2023 23:00	14	0.78
5	1/5/2023 01:00	1/5/2023 11:00	11	1.88
6	1/9/2023 03:00	1/10/2023 11:00	33	4.29
7	1/14/2023 09:00	1/14/2023 20:00	14	1.47
8	1/15/2023 16:00	1/16/2023 8:00	17	0.86
9	2/24/2023 0:00	2/25/2023 15:00	39	8.49
10	2/27/2023 9:00	2/28/2023 2:00	18	0.63
11	3/1/2023 0:00	3/1/2023 5:00	6	0.81
12	3/10/2023 3:00	3/10/2023 17:00	15	0.93
13	3/14/2023 9:00	3/15/2023 5:00	19	2.04

Notes:

1. Rainfall events highlighted in red were selected for the calibration and validation periods.

4.2.3 Dry Weather Flow Calibration

The initial step in determining the DWF component of the flow data involved identifying dry days and wet days. By examining the rainfall data graph, the DWF period was selected starting from

1/23/2023 to 1/29/2023 for all meters except for FM03 & FM09, therefore these meters were calibrated from 2/17/2023 to 2/22/2023. FM04b had no data available for that period so was not used for calibration and FM09 was used instead since they are both located within sewershed 8.

The DWF calibration began with the upstream meters and proceeded downstream. The DWF calibration was performed to achieve reasonable volume, flow pattern and depth comparisons with metered responses. Based on the flow meter data provided by ADS there were no signs of groundwater infiltration flows.

In summary, the model calibration process for dry weather periods is a systematic iteration carried out for each flow meter site, involving four key steps:

1. Run the model using initial diurnal flow patterns created from meter data.
2. Compare the simulated flow model results (model hydrographs) with the field-measured flow meter data (meter hydrographs).
3. Evaluate differences and investigate potential reasons for significant mismatches between model predictions and meter data.
4. Based on Step 3, adjust relevant parameters, rerun the model, and repeat Steps 2 through 4 until the model results closely align with the flow meter data.

4.2.3.1 Dry Weather Flow Diurnal Pattern

After the seven-day dry weather flow data was selected from January 1/23/2023 to 1/29/2023, a distinct difference in flow patterns was identified for many of the flow meters between Saturday and Sunday flow data and Mondays through Friday flow data. Therefore, an average weekday and weekend dry weather flow hydrograph was calculated.

The flow meter data received from ADS was utilized to generate flow patterns for each meter. These patterns were then divided by the corresponding Average Daily Dry-Weather Flow (ADDWF) values, resulting in weekday and weekend diurnal pattern for each flow meter. These diurnal patterns are a series of 24 hourly unitless multipliers used to capture the variation in sewer flows that occurs throughout the day as a result of upstream customer water usage habits. The weekday diurnal patterns typically had two peaks, one between 7 and 8 AM, and one between 7 to 8 PM. The weekend diurnal pattern had more consistent usage throughout the day with a single peak near 10 AM.

These diurnal patterns were assigned to each node location based on the corresponding sewershed they were located in and adjusted as necessary during the calibration process to achieve better alignment with the metered flow. An example of dry-weather diurnal patterns generated from flow meter FM05 are represented in Figure 4-3. The blue curve is the weekday pattern, and the green curve is the weekend pattern.

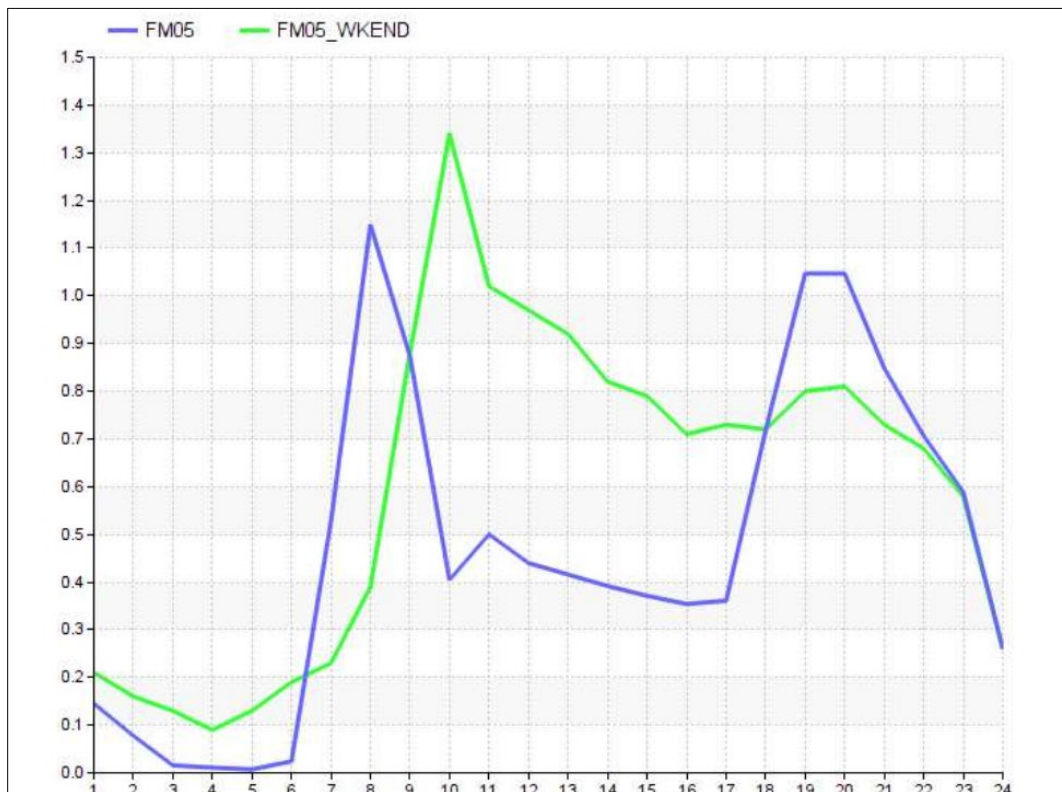


Figure 4-3: Sample DWF Diurnal Patterns

4.2.3.2 Dry Weather Flow Calibration Results

Dry weather flows predicted by the model were compared with field measured flow data for the 8 flow meters in addition to the Elk Ave permanent flow meter. The model results generally matched well with the measured data with respect to overall volume and peak flow.

FM06 experienced some outlier as mentioned later in Section 4.2.3.3. Therefore, the observed peak flow was recorded at the same time of peak flow recorded by all other meters during dry weather. FM03 & FM09 had no data available for January, instead period 2/17/2023 to 2/21/2023 was used for calibration for these meters.

Table 4-3 presents the summary of the results of the dry weather flow calibration. An example of the DWF Calibration results for the Elk Ave Station which is located at the most downstream end of the system at the interceptor is illustrated in Figure 1-1Figure 4-4 below.

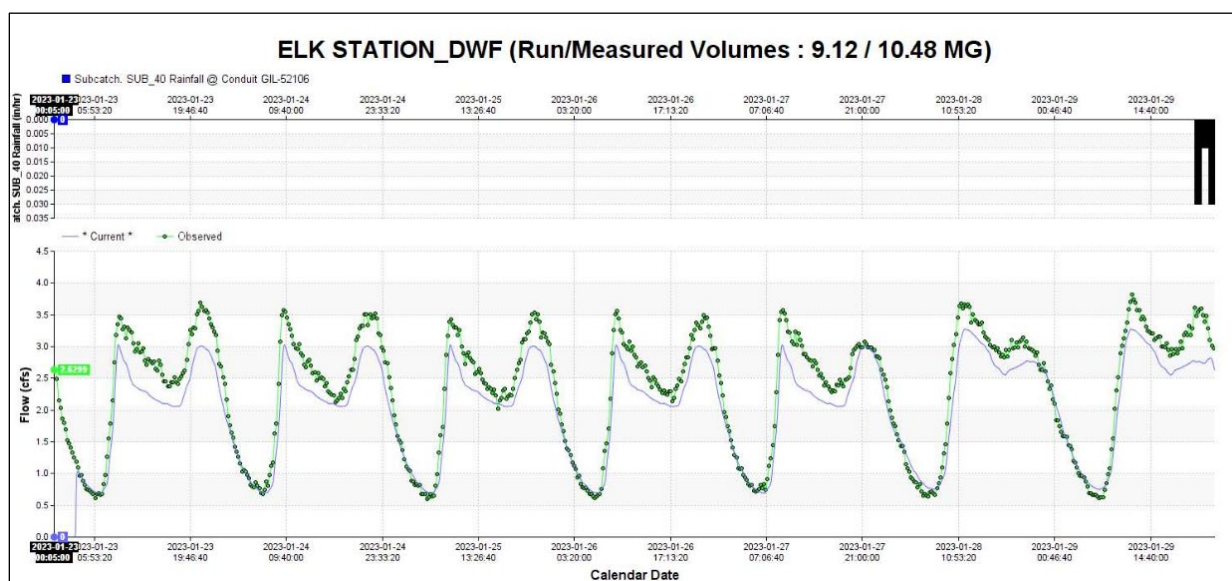


Figure 4-4: DWF Results for Elk Ave Flow Meter

Table 4-3: Dry Weather Flow Calibration Results (1/23/23 to 1/29/23)

Meter Name	Model Peak Flow (CFS)	Observed Peak Flow (CFS)	Peak Flow %Error	Model Run Volume (MG)	Observed Volume (MG)	Volume %Error
FM01	1.10	1.05	5%	3.11	3.09	1%
FM02	1.97	2.16	-9%	6.10	5.7	7%
FM03*	0.43	0.43	0%	1.34	1.32	2%
FM05	0.90	0.93	-3%	1.85	1.91	-3%
FM06	0.30	0.32	-6%	0.71	0.7	1%
FM07	0.46	0.51	-10%	1.24	1.24	0%
FM08	0.27	0.27	0%	0.73	0.71	3%
FM09*	0.56	0.54	4%	1.06	1.04	2%
ELK AVE	3.30	3.80	-13%	9.12	10.48	-13%
Summary of Number of Events that Meet Calibration Criteria (>= 80%)			89%	Summary of Number of Events that Meet Calibration Criteria (>= 80%)		

Overall, the model calibration results for the peak flow and volume for dry weather flow conditions aligned with the criteria outlined in Section 4.2.1. Peak flow criteria were met at 8 out of 9 sites, and event volume criteria were also met at 8 out of 9 sites, satisfying the 80% threshold based on qualified events observed during the flow monitoring period. The following describes the results for sites where the peak and volume criteria were not met:

- At Elk Ave Station, the model underpredicted both peak flow and the modelled event volume by 13%. Although this value exceeded the criteria, a review of the calibration curves identified a reasonable match between measured and modelled values. As a result, this calibration is considered acceptable.

In summary, both the modelled event volume & peak flow criteria's have been met for DWF calibration results. For a detailed visual representation of the calibration outcomes for each flow meter, refer to Appendix C, which contains meter-versus-model DWF plots.

4.2.3.3 Dry Weather Unreliable Data

During calibration, some meters had some outliers, where the measured data resulted in a high percentage difference of the peak flow. Therefore, volume was considered the most important characteristic to match. An example represented in Figure 4-5 of meter FM06 having a high percentage error due to outliers in the measured data.

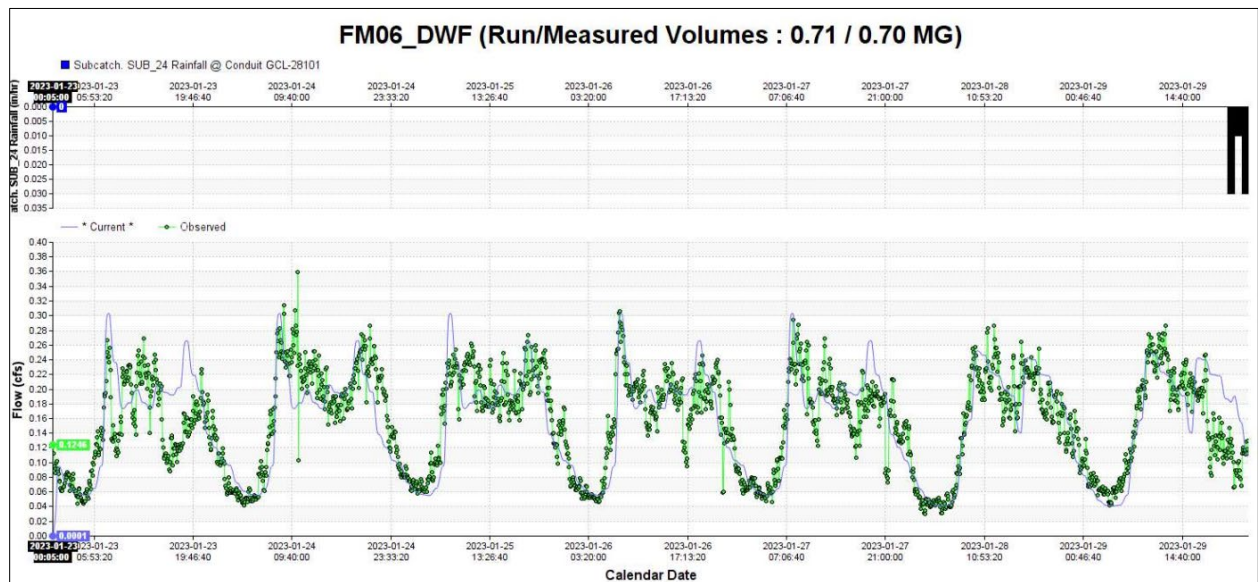


Figure 4-5: Outlier Results for Meter FM06

4.2.4 Wet Weather Flow Calibration

The calibrated dry weather model serves as the foundation for the wet weather calibration process. While the concept is similar to dry weather calibration, the objective here is to have a model that accurately represents the system's response to various rainfall events which was determined based on the highest depth of rainfall and the longest duration of rainfall. The selected rainfall event used for calibration was on 1/9/2023 which had a total rainfall depth of 4.29 inch with a peak intensity of 0.56 in/hr.

InfoSWMM employs the RTK unit hydrograph method to estimate Rainfall-Derived Infiltration and Inflow (RDII) flow into a sewer system. This method includes three hydrographs for short-term, intermediate-term, and long-term responses. Each hydrograph is defined by three parameters:

1. **R (Rainfall Fraction):** Represents the fraction of rainfall volume that enters the sewer system.

2. **T (Time to Peak):** Represents the time from the onset of rainfall to the peak of the Unit Hydrograph in hours.
3. **K (Recession Ratio):** Represents the ratio of time to recession of the Unit Hydrograph to the time to peak.

The RTK parameters measure short-term, medium-term, and long-term sewer flow responses to wet weather events. The calibration process involves adjusting these parameters for each sewershed (area upstream of the flow monitoring station) using a genetic algorithm. Iterating these parameters refines the model until the predicted RDII closely matches the measured RDII. The accuracy of RDII calibration improves with the inclusion of significant wet weather events during the flow monitoring period.

4.2.4.1 Wet Weather Calibration Results

For most of the sites, data was available for the wet weather calibration period except for FM03 & FM09. These meters were closely calibrated during the validation period. FM06 & FM08 experienced some outlier as mentioned later in Section 4.2.4.2. Therefore, the observed peak flow was recorded at the same time of peak flow recorded by all other meters during the peak storm event.

Table 4-4 presents the summary of the results of the wet weather flow calibration. An example of the WWF calibration results for the Elk Ave Station is illustrated in Figure 4-6 below.

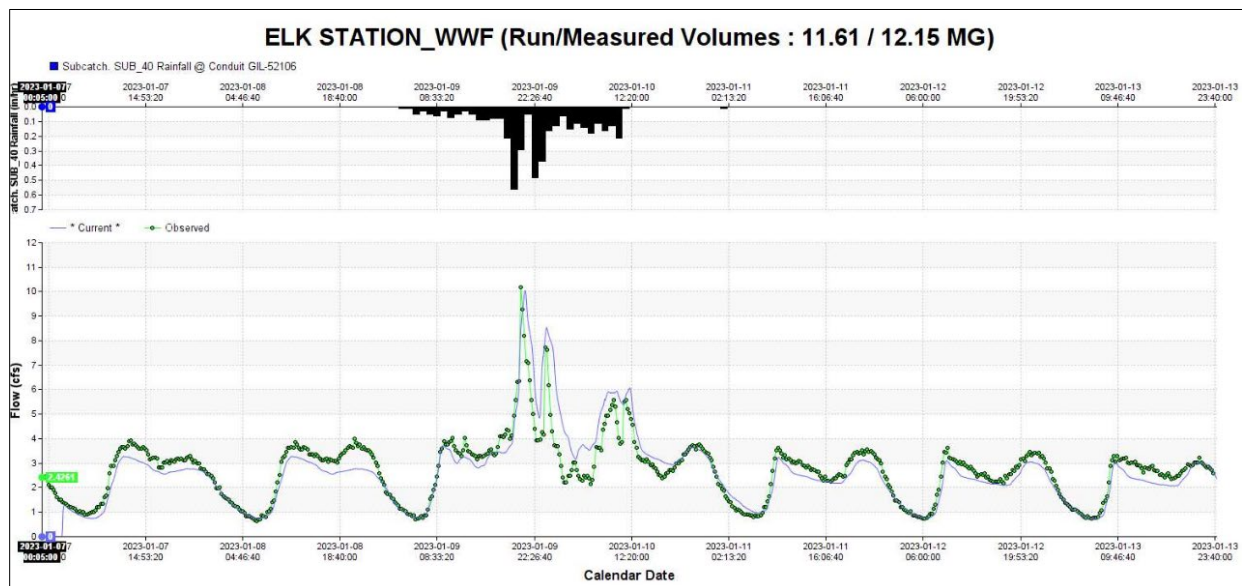


Figure 4-6: WWF Results for Elk Ave Station

Table 4-4: Wet Weather Flow Calibration Results (1/7/23 to 1/12/23)

Meter Name	Model Peak Flow (CFS)	Observed Peak Flow (CFS)	Peak Flow %Error	Model Run Volume (MG)	Observed Volume (MG)	Volume %Error
FM01	1.87	2.50	-25%	2.50	2.40	4%
FM02	7.37	6.94	6%	8.34	8.04	4%
FM05	2.80	3.34	-16%	2.44	2.36	3%
FM06	0.44	0.52	-15%	0.85	0.79	8%
FM07	0.93	1.03	-10%	1.66	1.72	-3%
FM08	0.37	0.41	-10%	0.78	0.78	0%
ELK AVE	9.16	10.16	-10%	11.61	12.15	-4%
Summary of Number of Events Meet Calibration Criteria ($\geq 60\%$)			71%	Summary of Number of Events that Meet Calibration Criteria ($\geq 60\%$)		
				100%		

In general, the model calibration results for wet weather flow conditions met the peak flow and volume calibration criteria outlined in Section 4.2.1. Peak flow criteria were met at 5 of 7 sites while event volume criteria were met for all 7 sites, satisfying the 60% threshold based on qualified events observed during the flow monitoring period. The following describes the results for sites where the peak criteria was not met:

- At FM-05, the modelled event volume was met while the peak flow criteria was 16% lower than measured value. Although this value does not meet the criteria, a review of the calibration curves identified a reasonable match between measured and modelled values. This calibration can be considered acceptable.
- At FM-01, the volume criteria were met with 4% error difference while the peak flow criteria were not met. It is noted that the model underpredicted peak flow by 25%, Although this value exceeded the criteria, a review of the calibration curves identified a reasonable match between measured and modelled values. This calibration can be considered acceptable.

Overall, both the modelled event volume & peak flow criteria's have been met for WWF calibration. A review of the continuous simulation calibration curves shows that the model reasonably predicts flows within the system at all sites. Based on detailed review of the calibration results, the model can be considered calibrated and suitable for model validation.

4.2.4.2 Wet Weather Unreliable Data

Figure 4-7 represents meter FM08 which resulted in having a high percentage error in the measured data of the peak flow. Looking into other storms of similar size we don't see those spikes; therefore, we have assumed it to be an outlier/unreliable data.

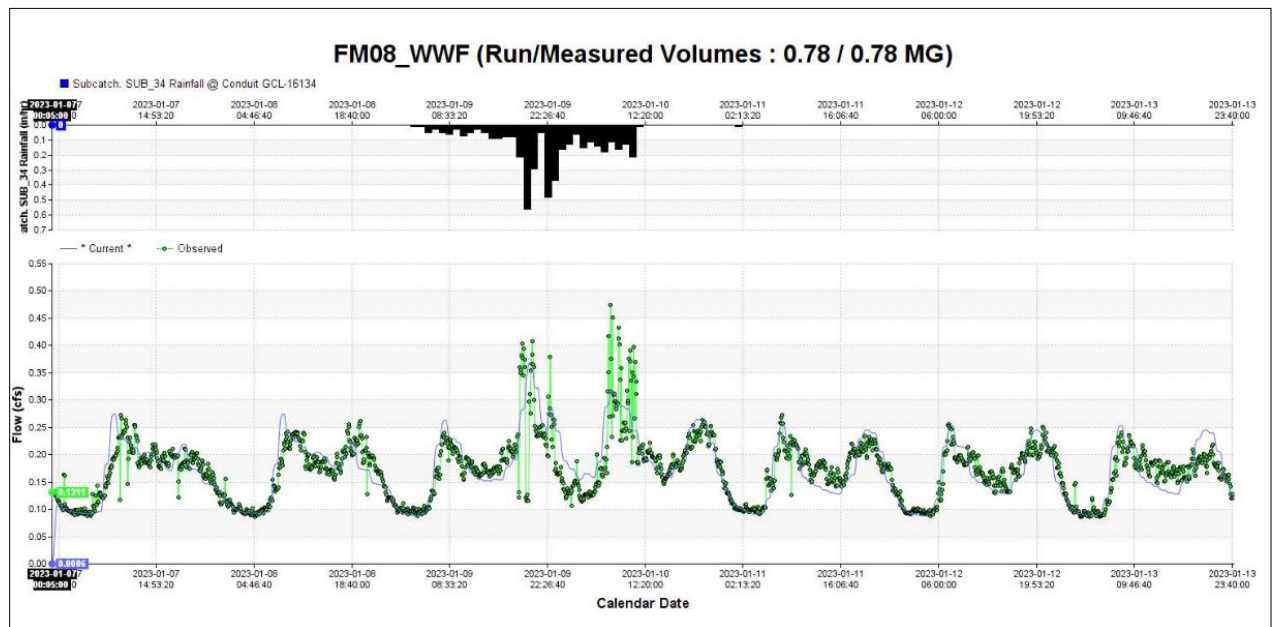


Figure 4-7: Outlier Results for Meter FM08

4.2.5 Model Validation

This section presents a summary of the model validation process. The objective of the model validation process was to test the model calibration with an independent set of rainfall and flow data, not used for calibration. Validation results are used to confirm that a model is well calibrated and suitable for use. A good validation can increase confidence in model results. It is important to note that model results generated for events larger than those considered in calibration and validation are subject to greater uncertainty.

For model validation, a comparison of the continuous simulation calibration results for all 9 sites with measured values was completed. Appendix C contains these comparison graphs.

4.2.5.1 Model Validation Results

Model validation was completed for the rainfall event that occurred on February 24, 2023. This event had a rainfall depth of 8.49 in and a peak intensity of 0.52 in/hr. It is noted that this event had a lower volume and peak intensity than that of the calibration event. Table 4-5 presents the model validation results. An example of the validation results for the ELK Ave Station is illustrated in Figure 4-8 below.

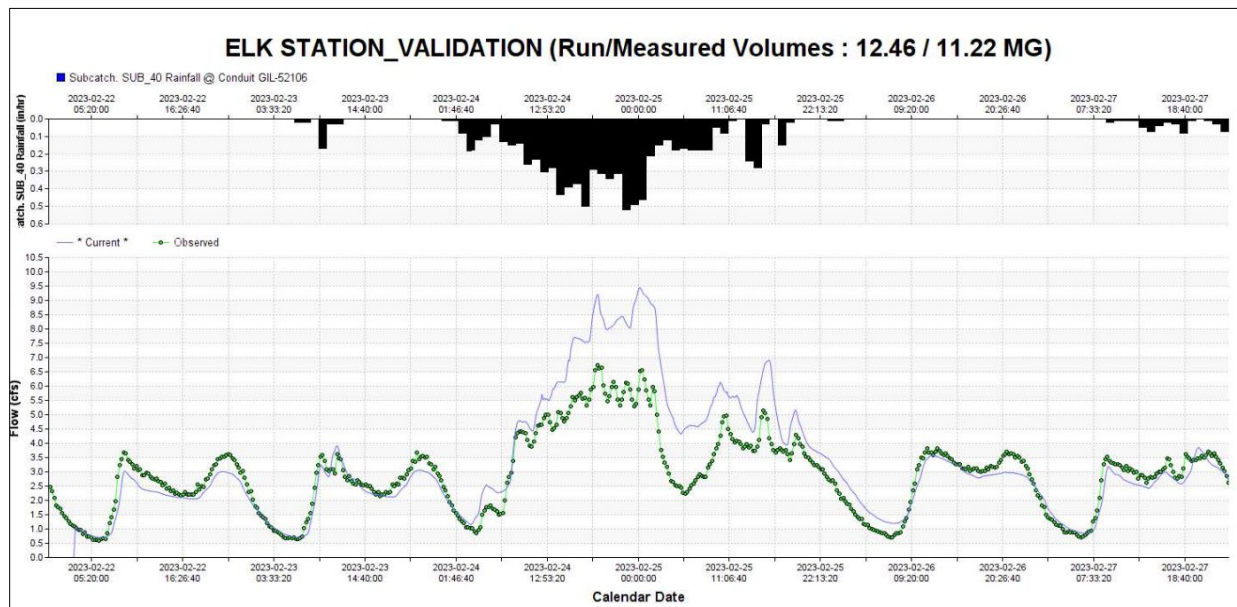


Figure 4-8: Validation Results for Elk Ave Station

Table 4-5: Model Validation Results (2/22/23 to 2/27/23)

Meter Name	Model Peak Flow (mgd)	Observed Peak Flow (mgd)	Peak Flow % Error	Model Run Volume (MG)	Observed Volume (MG)	Volume % Error
FM01	1.78	1.78	0%	3.28	3.02	9%
FM02	7.78	4.62	68%	9.29	7.51	24%
FM03	0.64	0.50	28%	1.38	1.23	12%
FM05	2.60	1.70	53%	3.06	2.52	21%
FM06	0.45	0.48	-6%	0.90	0.65	38%
FM07	0.88	0.65	35%	1.55	1.28	21%
FM09	1.03	1.05	-2%	1.72	1.56	10%
FM08	0.38	0.47	-19%	0.74	0.70	6%
ELK AVE	9.00	6.70	34%	12.46	11.22	11%
Summary of Number of Events Meet Calibration Criteria (>= 60%)			44%	Summary of Number of Events Meet Calibration Criteria (>= 60%)		
						67%

During validation, we assessed nine sites. Among these, peak flow validation criteria were met at 4 out of 9 sites, while event volume validation criteria were met at 6 out of 9 sites. Overall, the model's validation results for wet weather flow conditions aligned with the volume calibration criteria outlined in Section 4.2.1, satisfying the 60% threshold based on qualified events observed during the flow monitoring period. However, the peak flow criteria were not met. Despite this, a reasonable match was observed between measured and modeled values, making this validation acceptable.

FM06 & FM09 experienced some outlier as illustrated in Figure 4-9 below, therefore, the observed peak flow was recorded at the same time of peak flow recorded by all other meters during the peak storm event.

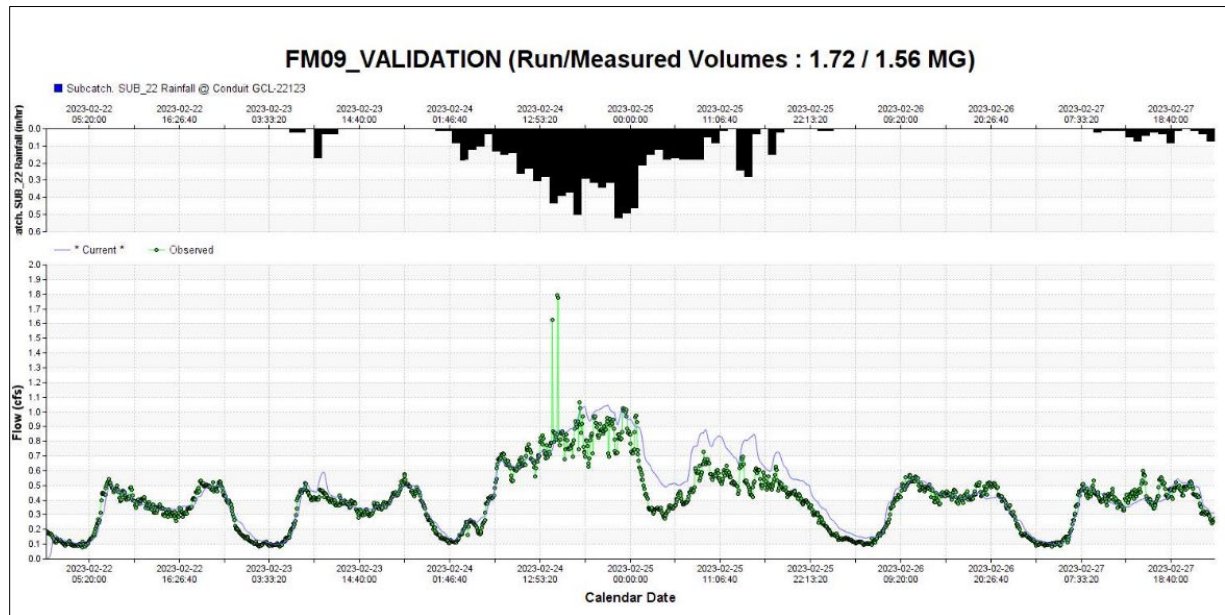


Figure 4-9: Validation Results for Meter FM09

As this model will be used to establish the capacity of the system under larger type rainfall events, a calibrated model that predicts responses to larger events is preferred. In addition, to be more conservative, its preferable that the model overpredicts measured values instead of underpredicting the response. As a result, the validation is considered acceptable, and the model is suitable for use in planning level studies.

4.2.6 Summary

To summarize, the calibration and validation activities undertaken to create a model of the sanitary sewer system which will be used to assess the capacity of CVWD's sanitary sewer and provide CVWD with a basis for improvements in its sewer infrastructure management system, or development of a Capital Improvement Program. The calibration and validation process were based on flow data collected between December 2022 and March 2023. The model calibration was limited to the rainfall events that occurred during the four-months long monitoring period. It is expected that if CVWD collects additional flow data, the model calibration and validation will be reviewed, updated and revised as needed. This also applies to the physical network data (pipes invert, size, and ground level elevation) as well. Based on the model calibration and validation, the model is suitable for planning level studies.

Section 5: Collection System Evaluation

This section details the analyses completed to evaluate the performance and reliability of the sewer collection system. The analyses include the Hydraulic Model Capacity Evaluation, the La Granada Lift Station Condition Assessment, and the Business Risk and Vulnerability Assessment. These analyses were an amalgamation of several months of data collection, workshops, and field investigations to provide the most comprehensive understanding and evaluation of the collection system's performance.

5.1 Hydraulic Model Capacity Evaluation

This section explains the capacity analyses performed using the calibrated sewer system model as well as the hydraulic model findings.

5.1.1 Existing Flow Conditions

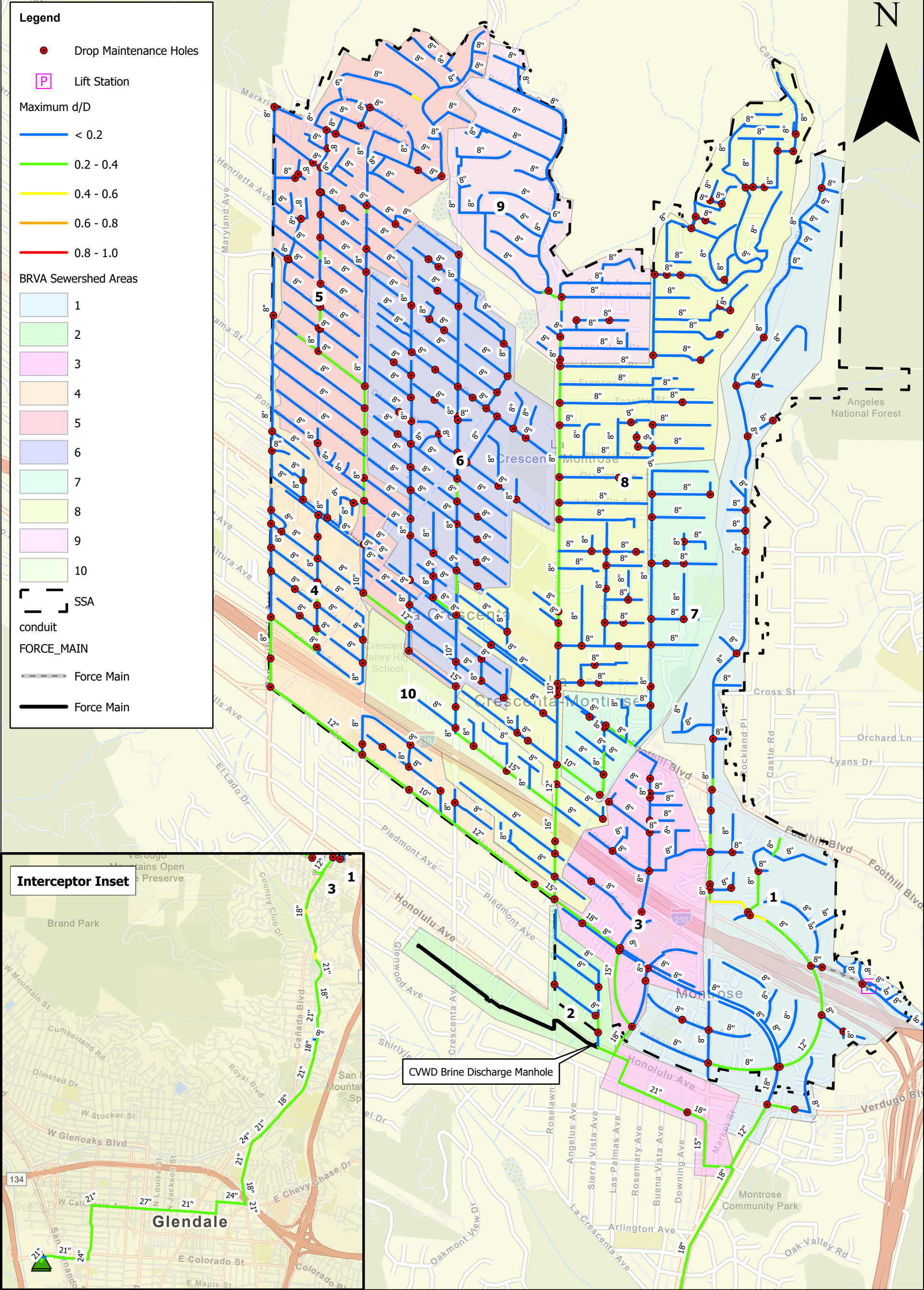
5.1.1.1 d/D Capacity Analysis

One of the key performance indicators (KPIs) of a sewer collection system, is limiting the occurrence of sanitary sewer overflows (SSOs). This objective hinges on the ability of each pipe within the collection system to convey to accumulated upstream sewer flows without exceeding the pipe flowing full. As soon as a gravity sewer pipe turns from gravity to pressurized flow, known as surcharging, the risk an SSO drastically increases.

Flow depth has long been a key design parameter in sewer design, exemplified by the flow depth-to-diameter (d/D) ratio. This ratio, integral to sewer design guidelines, is calculated as d/D , where 'd' represents the flow depth in inches, and 'D' is the sewer diameter in inches. Gravity sewers are typically designed with some reserve capacity, the degree of which can vary based on various design recommendations. For instance, the American Society of Civil Engineers (ASCE) and the Water Environment Federation (WEF) recommend that sewers up to 15 inches in diameter maintain dry weather d/D ratios below 50%, and larger sewers keep these ratios under 75%. Sewers are not intended to operate under surcharge conditions, hence wet weather d/D ratios should ideally remain below 100%.

Specific design criteria from the SSMP dictate that the d/D ratio should be less than 60% under ADWF and below 80% under PWWF. A focal area of concern is Waltonia Drive, influenced by shallow slopes (0.0036 – 0.0043) and upstream LCID customers. Here, the d/D ratios are measured to be between 0.52 - 0.55 under DWF and 0.67 – 0.71 under WWF in Sershed 1. These standards are necessary to ensure the sewer system's effectiveness to reliably convey raw sewage through pipeline infrastructure. Figure 5-1 and Figure 5-2 shows the results of the existing flow conditions d/D capacity analysis.

H:\GIS_CloudProjects\CrescentaValley\WaterDistrict\Events\BRVA_Results\BRVA_Results.aprx
Printed by: DrajhanKalatic
Date: 7/5/2024

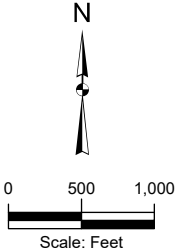


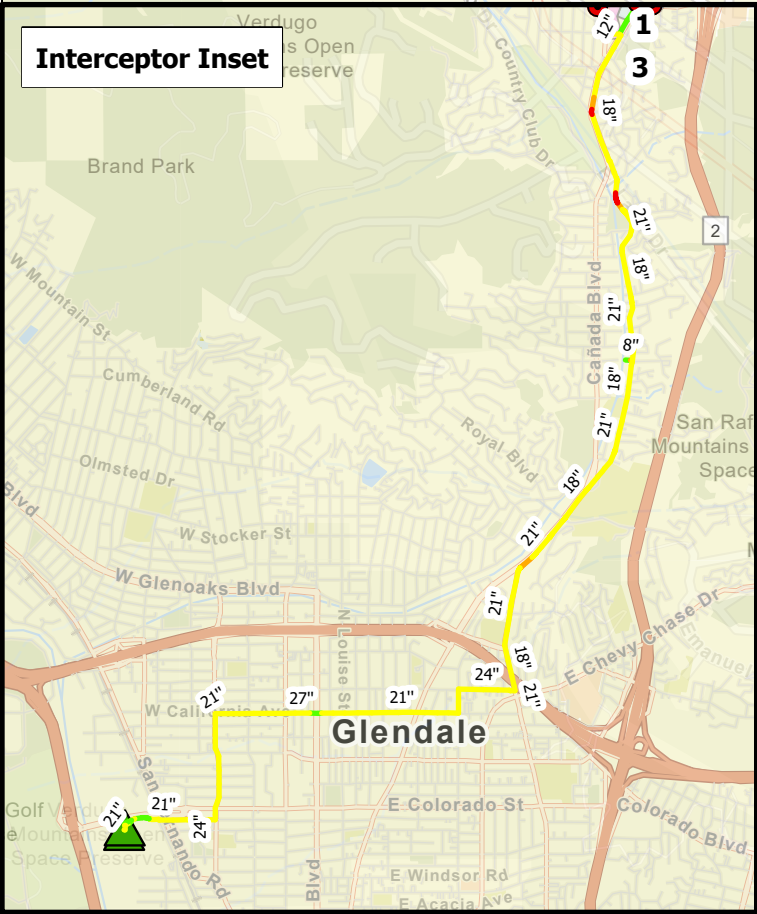
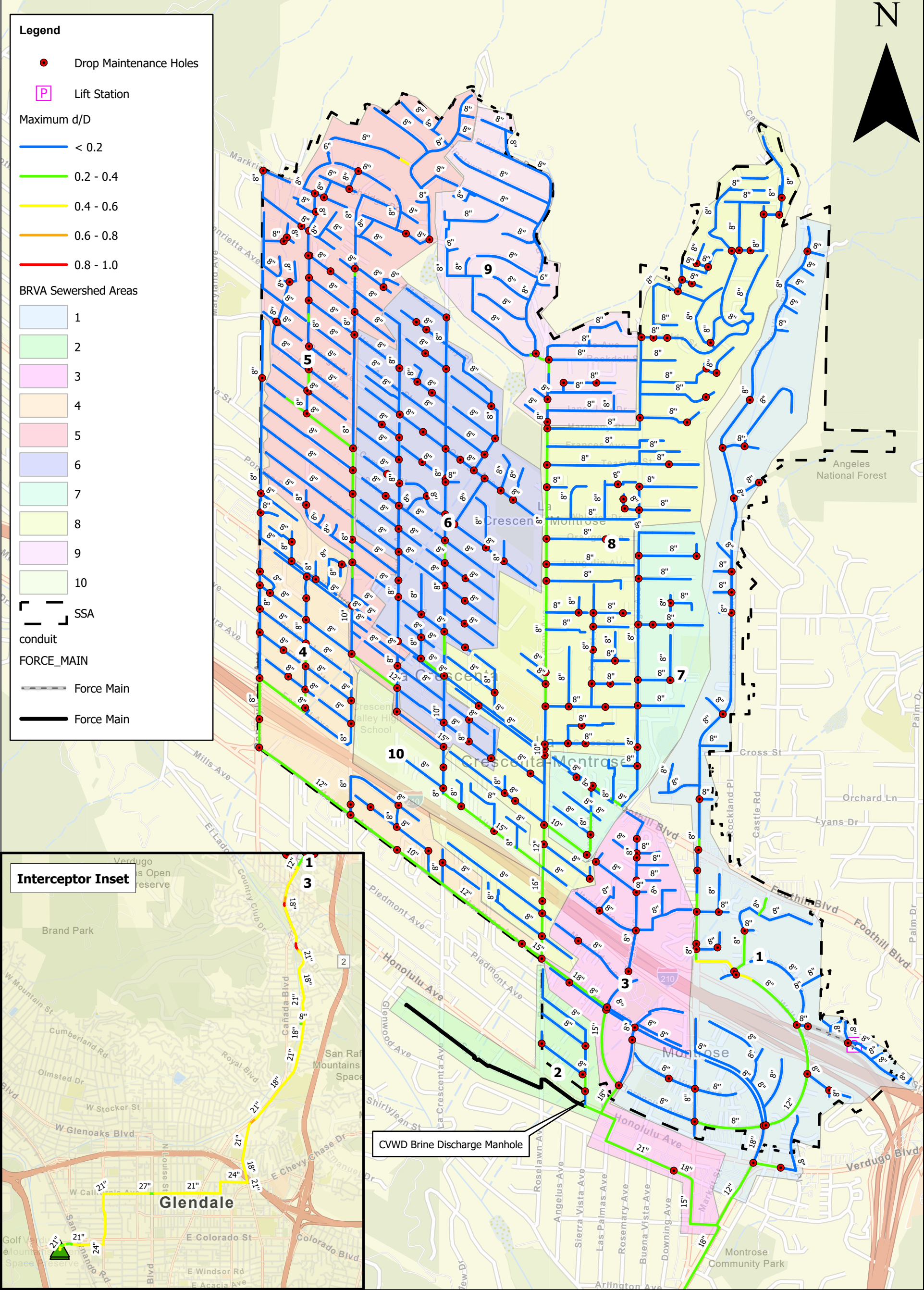
Notes:

K Kennedy Jenks
Crescenta Valley Water District
Wastewater Master Plan

System Overview
Existing ADWF d/D

2244508*00
Figure 5-1

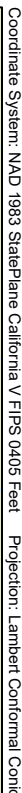




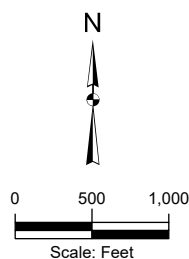
5.1.1.2 Pipe Velocity Analysis

The other main KPI for collection systems is the range of sewer flow velocities. Pipe velocity is driven by pipe diameter, pipe slope, and sewer flow rates. Pipe velocities should be high enough to prevent debris and solids from settling and collecting at the bottom of the pipe, but low enough to avoid significant flow turbulence/hydraulic jumps, which releases more corrosive gasses that could lead to maintenance hole corrosion and/or odor complaint issues. The calibrated hydraulic model was used to evaluate system pipe velocities to identify any potential areas not achieving CVWD's design velocity criteria. According to the SSMP, sewer mains must uphold a minimum velocity of 2.5 feet per second (fps) and a maximum of 10 fps, adhering to a minimum pipe slope of 2%.

The primary goal under Average Dry Weather Flow (ADWF) conditions is to maintain a minimum velocity to achieve effective scouring. Scour velocity is crucial in addressing issues related to impacts of Fats, Oils, and Greases (FOGs) as well as sanitary products, such as baby wipes. The typical industry standard for minimum sewer velocity is 2 fps. Even using this less conservative minimum velocity criterion, the hydraulic evaluations reveal that under ADWF, 93% of collectors and 26% of trunk sewers did not meet the 2-fps criterion. One possible contribution to this issue could be the water conservation efforts that have taken place over the last decade, resulting in lower sewer flows. With the collaboration of CVWD, the O&M staff indicated that no odor complaints have been made in the SSA. Odor complaints are typical in areas with low sewer pipe velocities. Consequently, there's no need for extraordinary measures beyond regular maintenance to maintain system efficiency and reliability. This approach ensures both the effectiveness of wastewater management and the longevity of the sewer infrastructure. Figure 5-3 shows the results of the analysis.



2244508*00
Figure 5-3



5.1.1.3 Inflow & Infiltration Analysis

I&I refers to the entry of groundwater (infiltration) and stormwater (inflow) into a sewer system. When a collection system is compelled to handle a greater flow than it was designed for, I&I can result in pipeline surcharging and downstream impacts to pumping and/or wastewater treatment facilities. This increased effluent not only poses challenges for wastewater treatment facilities but also escalates costs since the stormwater and groundwater mix with sewage and the entire volume must be processed at the treatment plant.

I&I can constitute a significant portion of annual flow to treatment plants, reaching up to 45% in some cases. This excess burden can overwhelm the collection system, leading to several adverse consequences.

- **Uncontrolled SSOs:** I&I can exceed the capacity of pipelines, pumping stations, or treatment plants, causing raw sewage to overflow and pollute the environment.
- **Pipe Failures:** Excess flow due to I&I can stress and damage pipes, increasing the risk of leaks and breaks.
- **Soil Subsidence and Sinkholes:** I&I can undermine the supporting soil around pipes, potentially leading to ground collapse and sinkholes.

These issues highlight the importance of addressing I&I effectively to safeguard public health, environmental quality, and infrastructure integrity.

Calculating I&I involves flow monitoring, where wastewater flow in the system is measured over time and compared with a baseline flow estimate. These measurements are crucial for determining the extent of I&I in the sewer system. Flow monitoring not only aids in identifying and prioritizing areas for further inspection but also serves as a basis for visual inspection methods to assess the severity of I&I in a given area.

5.1.1.3.1 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.

Figure 5-4 provides a visualization from a portion of flow meter data for FM01. The storm event used for I&I analysis was February 24th storm which was the same as validation period. The wet weather flow hydrograph was overlayed with the measured dry weather flow hydrograph of the days prior to the storm. The difference between the two-time series is equal to the volume of I&I entering the collection system. The total I&I volume is an indicator of combined inflow and infiltration which was calculated for all sewersheds based on available flow meter data to identify which sewersheds have the highest portion of I&I.

Infiltration refers to groundwater that enters a sewer system through faulty pipes, pipe joints, connections, or maintenance holes. Typically, it is measured during periods of high groundwater

levels during dry weather conditions after a storm event. After analyzing the scattergraphs from different flow meters, the flow returns to ADWF levels right after the conclusion of the observed storm event. This pattern suggests the absence of groundwater infiltration. Therefore, inflow data was used to determine the Inflow and Infiltration (I/I) within the system.

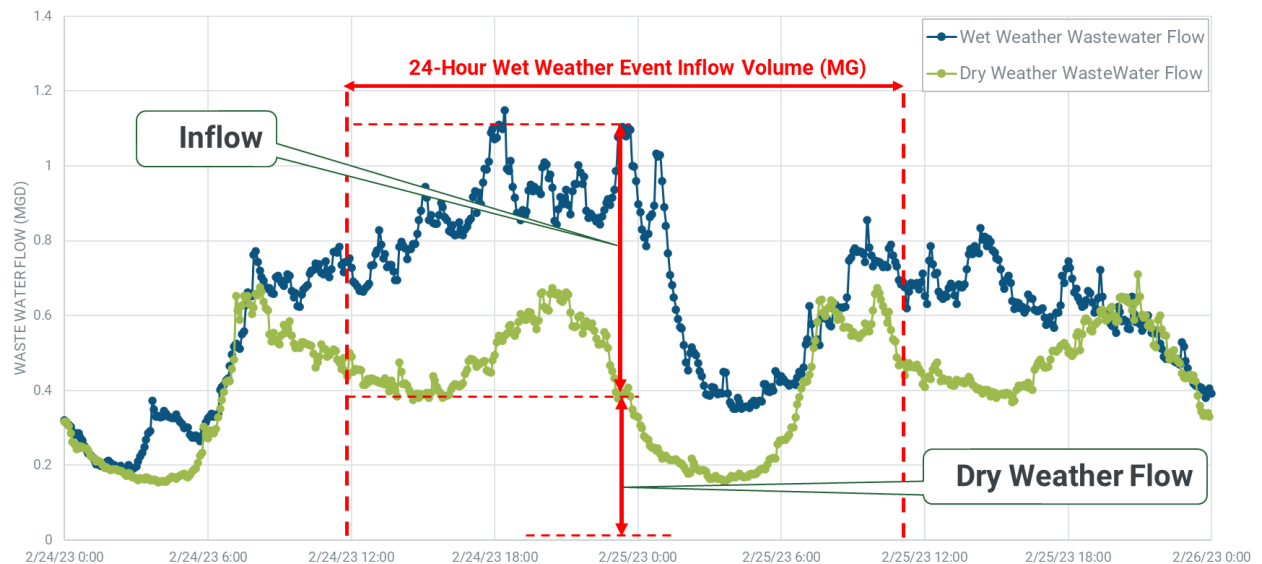


Figure 5-4: Overlay of Wet and Dry Weather Events for FM01

5.1.1.3.2 I&I Results Summary

To compare I&I levels across different sewersheds, several methods normalize the analysis metrics. One common approach is gallons per day per inch-diameter mile (gpd/idm). This unit accounts for both pipe diameter and length, allowing for meaningful comparisons even when sewersheds have different layouts.

Using gpd/idm, sewersheds can be ranked based on their highest I&I rates. This ranking helps prioritize areas with the most severe I&I problems. Table 5-1 summarizes the calculations and rankings for the sewersheds based on highest I&I rate, in units of gallons per day, per inch-diameter mile (gpd/idm).

Table 5-1: I&I Analysis – February 2023, 24-Hour Storm

Ranking*	Sewershed	Average Pipe Diameter (Inch)	Total Length (Feet)	Inch- Diameter Mile (idm)	Design Storm Total Inflow Volume (Gallons)	Design Storm Total Inflow Rate (Gpd/idm)	% Total I&I*
1	Sewershed 2+3	10.3	25,176	49	403,639	8,247	34%
2	Sewershed 1	8.2	45,258	71	245,517	3,474	21%
3	Sewershed 7	8.1	16,205	25	72,608	2,922	6%
4	Sewershed 6+10	8.4	54,599	86	200,442	2,320	17%
5	Sewershed 9	8.0	24,120	36	52,856	1,448	4%
6	Sewershed 5	8.2	55,257	86	116,773	1,354	10%
7	Sewershed 4	8.7	32,166	53	37,972	720	3%
8	Sewershed 8	8.2	68,746	107	63,917	597	5%
TOTAL			321,526		1,193,724		100%

*Ranking based on Highest I&I Rate (gpd/idm)

Based on the findings of the I&I analysis, Sewersheds 1, 2, and 3 should be targeted for future flow metering efforts to attempt to narrow down the locations of the I&I and eliminate the excessive I&I.

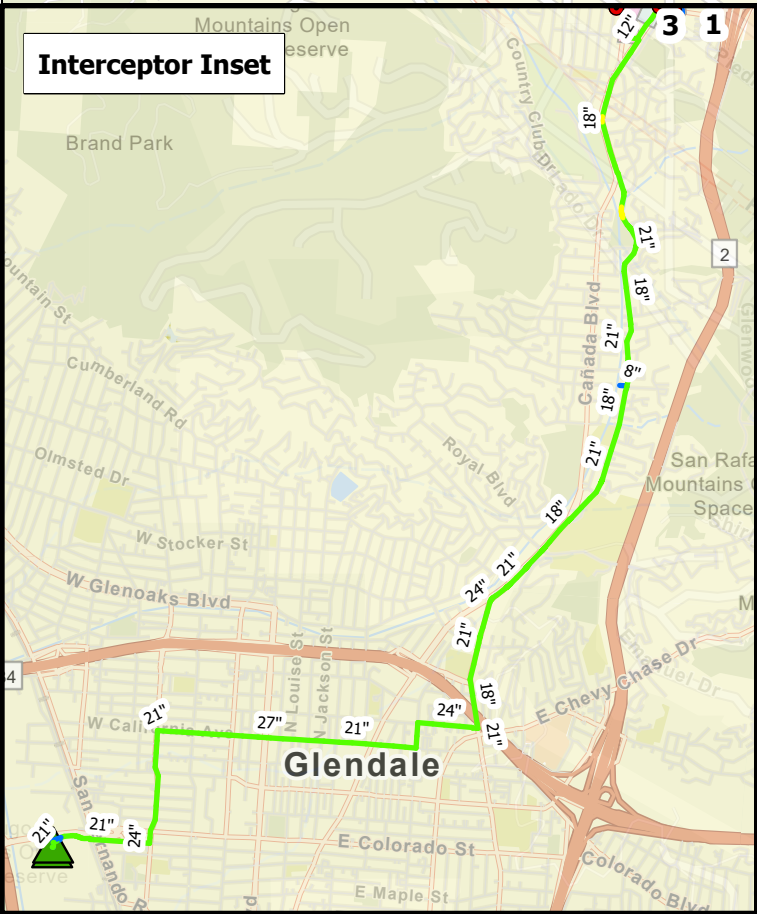
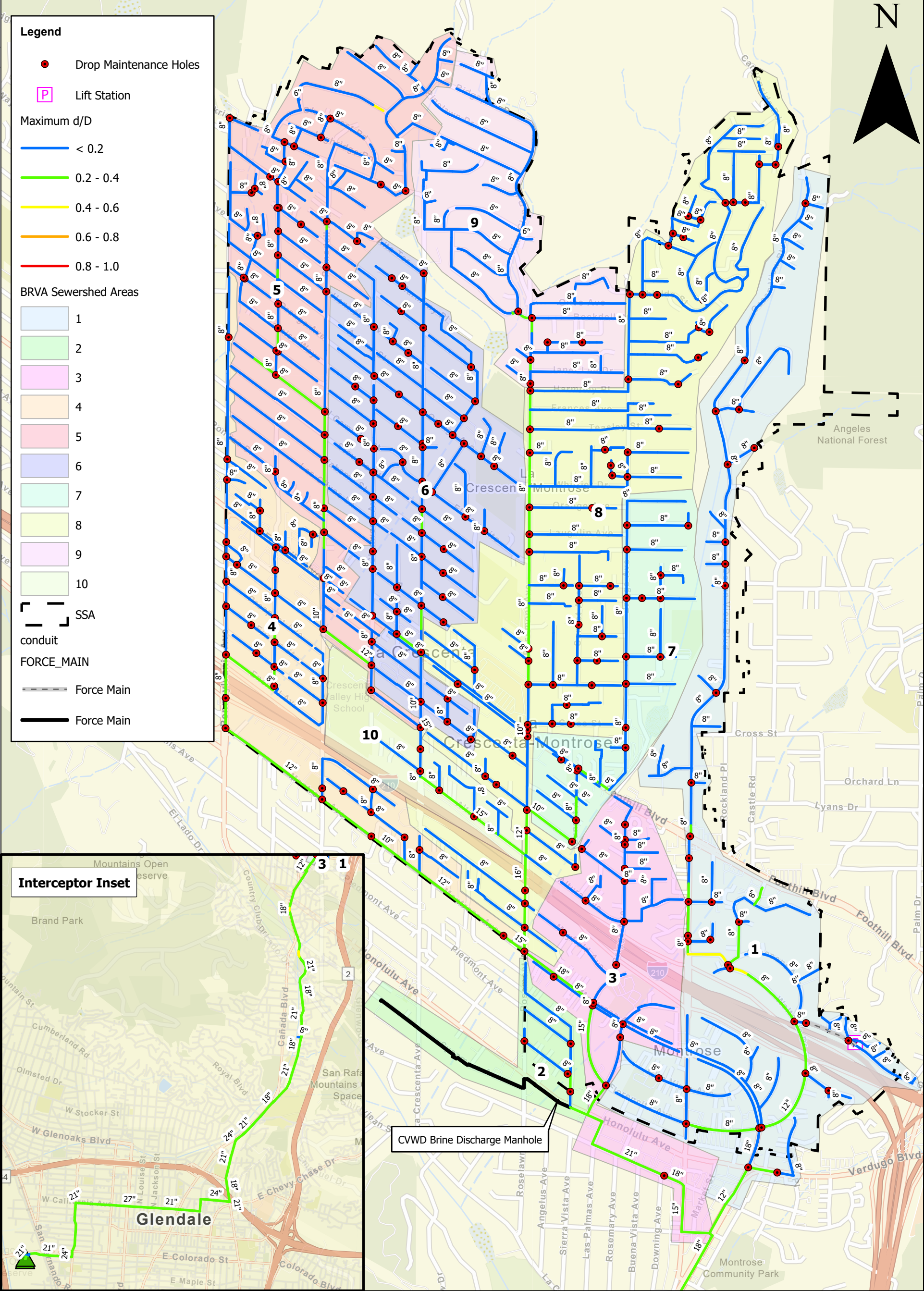
5.1.2 Future Flow Conditions

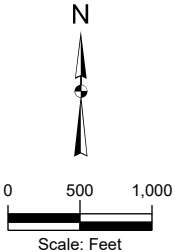
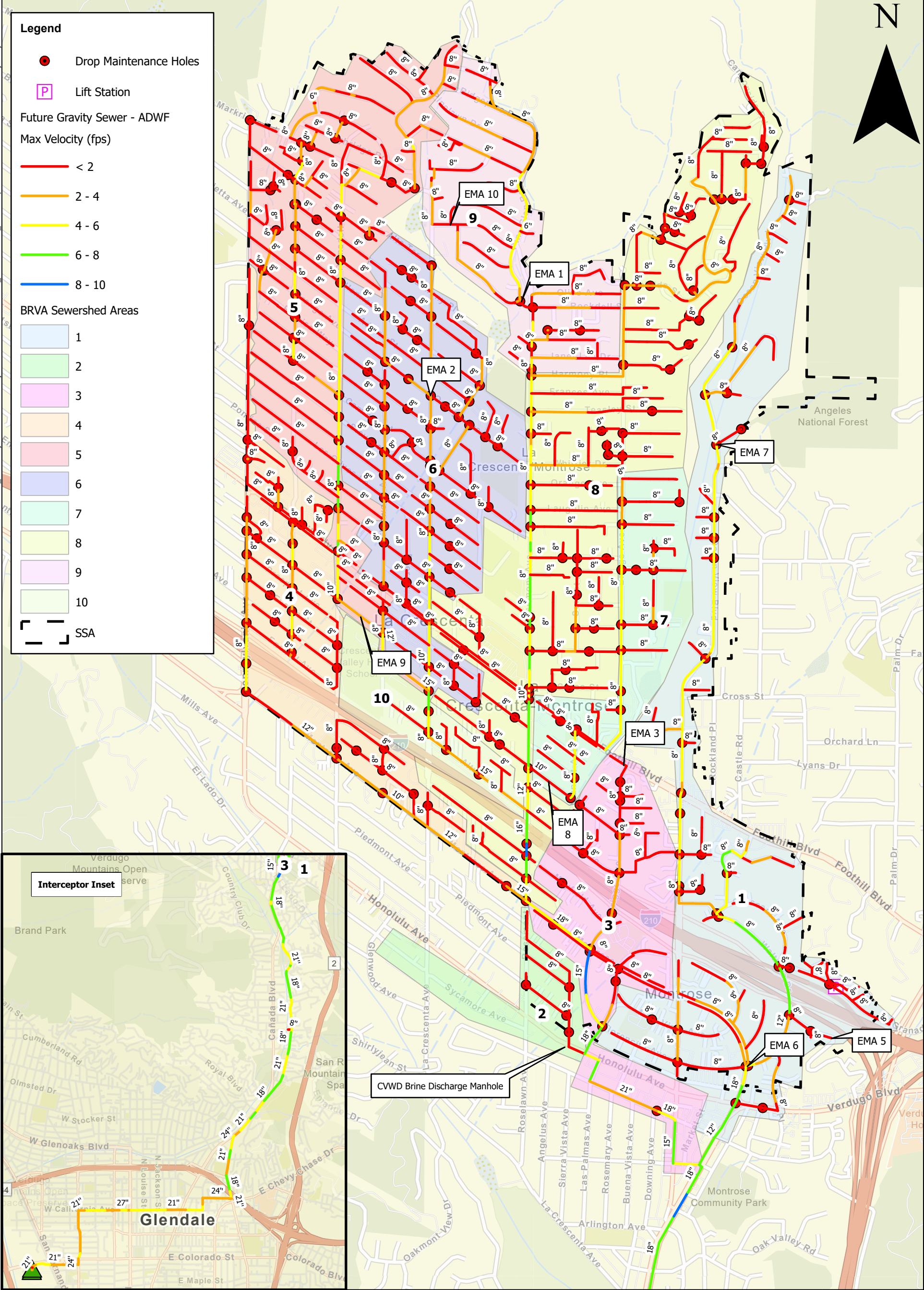
The collection system was also evaluated under future sewer flow conditions aligning with the 2045 population and demand projections provided by the 2020 UWMP. Section 3.3 describes the total projected sewer flows for CVWD's SSA.

5.1.2.1 Future d/D Capacity Analysis

An identical d/D capacity analysis was performed for the future sewer flow conditions. Because the existing and future flow conditions do not vary significantly, the same areas of concern identified in the existing flows d/D capacity analysis were identified in the future flows d/D capacity analysis, mainly on Waltonia Drive where the slope of sewer pipeline alignment is extremely flat, and the d/D ratio does not meet industry standards. Figure 5-5 shows the results of the future flow DWF d/D capacity analysis.

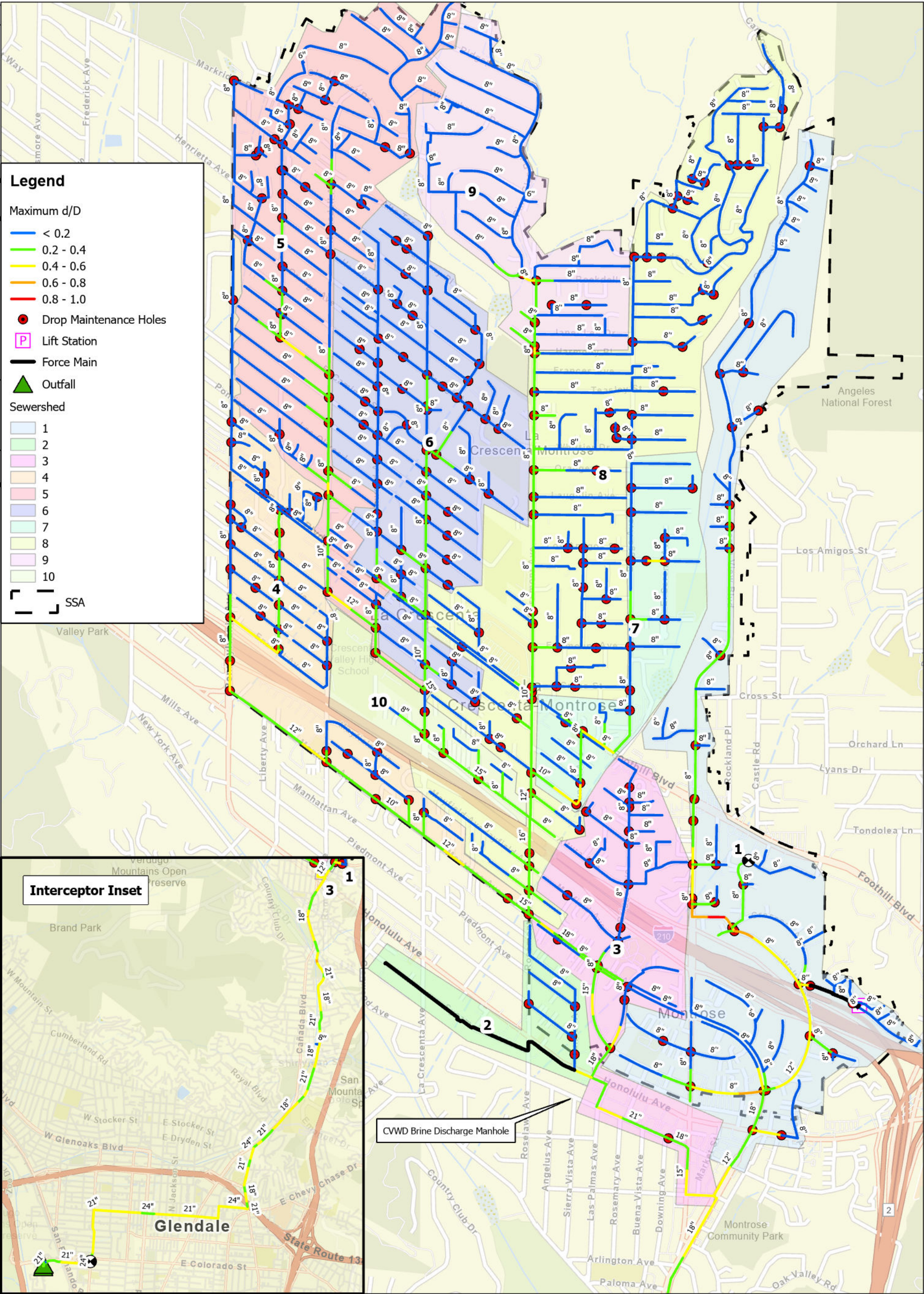
H:\GIS_CloudProjects\Crescenta\valley\WaterDistrict\Events\BRVA_Results\BRVA_Results.aprx
Date: 7/4/2024
Printed by: DrajhanKalatic





5.1.2.2 Future Pipe Velocity Analysis

An identical minimum pipe velocity analysis was done for future flow conditions. Because future flows were almost identical to existing flows, the results of the future system analysis were almost identical to the existing system analysis. Figure 5-7 shows the resulting maximum pipe velocities under future ADWF conditions.



Legend

Maximum d/D

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Drop Maintenance Holes

Lift Station

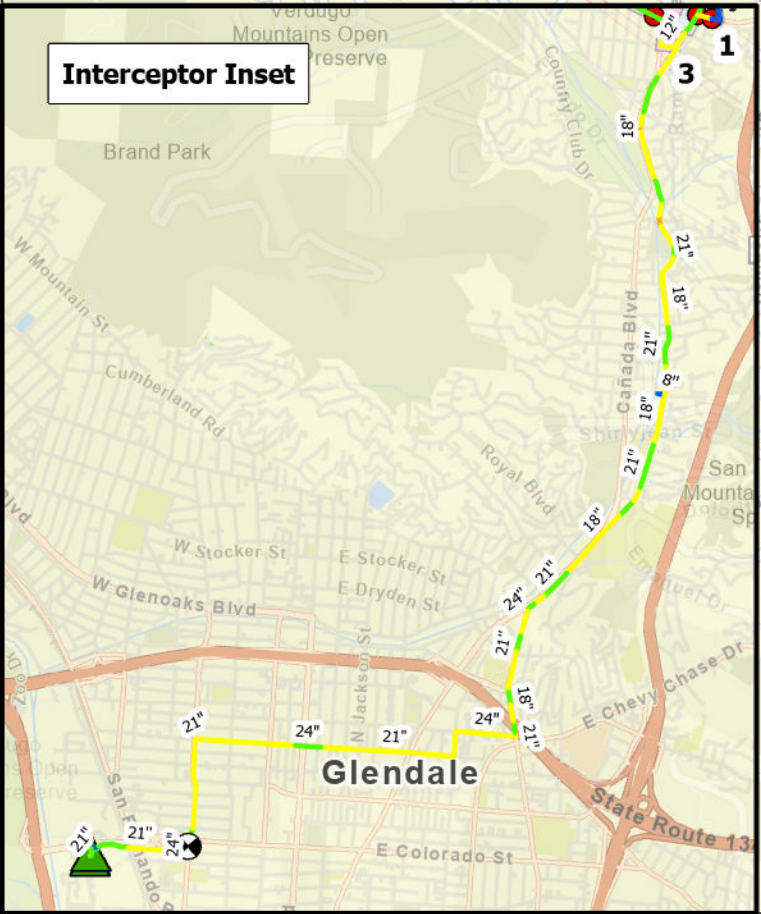
Force Main

Outfall

Sewershed

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

SSA



5.2 La Granada Lift Station Condition Assessment

An in-person condition assessment of the La Granada Lift Station was conducted in July 2023 to identify any risks, deficiencies, and to provide improvement recommendations. A summary of the findings for each facet of the lift station is documented in the following subsections. See Appendix D for more detailed notes and photographs from the condition assessment.

5.2.1 Lift Station Building

Field Observations:

The lift station building is a 14 ft x 16 ft CMU building with a wood frame roof. The roof has a built-in skylight hatch to remove/replace pumps, motors, or other internal lift station components. The building has a single man door for access as well as a privacy fence around the entire site to reduce visual impact to the neighboring community. The lift station building encloses all the electrical equipment, pump, and motors, as well as the access to the lift station wet well. The circular wet well is 11 ft deep and 5 ft in diameter.

Building Ventilation: The wet well within the lift station pump building lacks proper ventilation due to not having vents. The absence of vents may cause corrosion and lead to potential damage of station equipment. The field observations discovered a direct opening of the maintenance hole into the pump building which houses electrical equipment. This direct opening to electrical gear leaves the components vulnerable to corrosion and presents a possible explosion hazard due to the presence of flammable gasses in the wet well.

Noise Attenuation: To mitigate noise pollution, a wood-framed roof and skylight were added to the top of the CMU building. The roof and skylight appear to be in fair condition.

Building Access: The lift station building has a single door which limits access for maintenance ingress and egress. The single leaf door configuration may impact the maintainer's ability to transport tools and equipment to conduct major repair or replacement tasks, requiring overhead access through the skylight to remove/replace any larger mechanical or electrical components.

Fire Protection: Field observations discovered that the building could possibly be non-compliant with the National Fire Protection Association (NFPA) code relative to potential explosive environment exposure. Upon examination of the NFPA 820 standard, it was determined that the building is non-compliant for Fire Protection requirements in Wastewater Treatment and Collection Facilities. See Figure 5-8 and Table 5-2 which provide the relevant portions of the standards set by the NFPA.

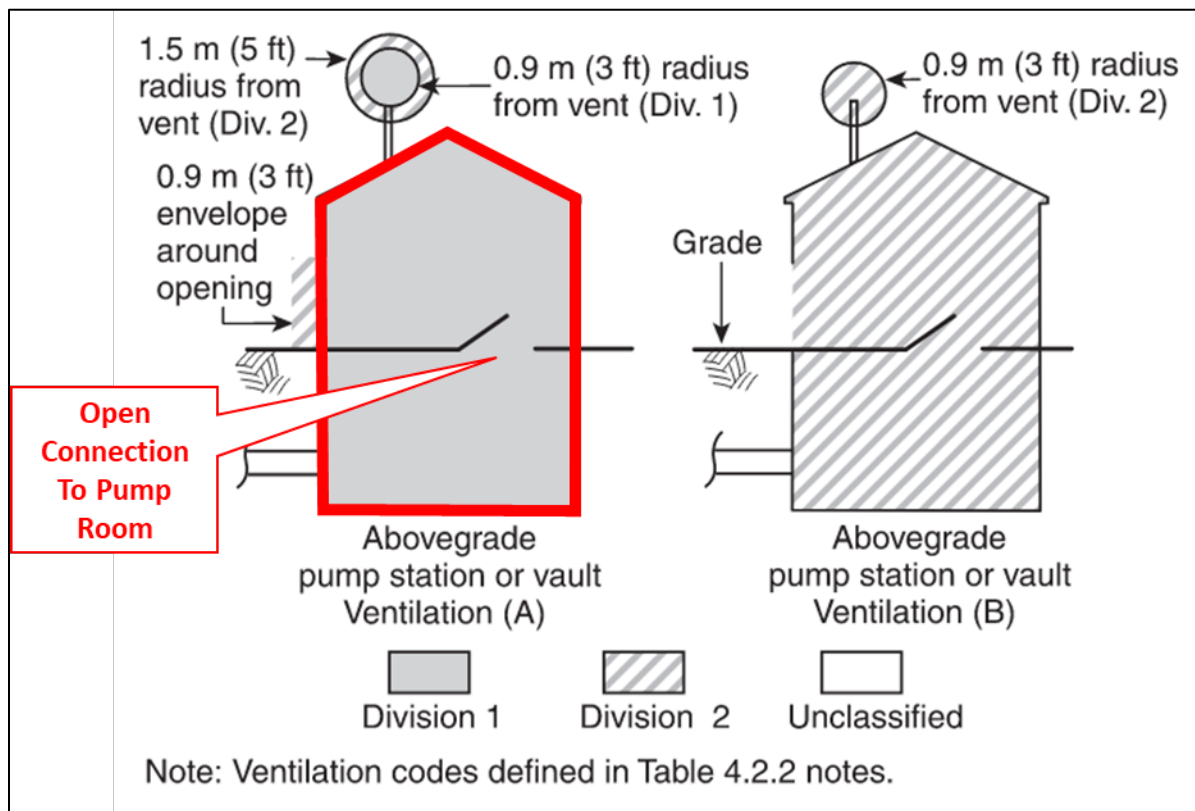


Figure 5-8: NFPA 820 Figure A.4.2(e) Above-grade Wastewater Pumping Station Not Physically Separated from Wet Well; Illustration of Table 4.2.2, Row 17 (NFPA, 2023)

Table 5-2: NPFA 820 Table 4.2.2 Collection Systems Classifications (NFPA, 2023)

Row ^a	Line ^a	Location and Function	Fire and Explosion Hazard	Ventilation ^b	Extent of Classified Location	NEC Hazardous Location Classification (All Class I, Group D)	Materials of Construction ^c	Fire Protection Measures
17	a	ABOVEGRADE WASTEWATER PUMPING STATION	Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)]	A	Entire space or room plus envelope 0.9 m (3 ft) around vents	Division 1	NC	FE
	b			A	1.5 m (5 ft) beyond vent plus envelope 0.46 m (18 in.) extending 0.9 m (3 ft) beyond openings (hatches or doors)	Division 2	NC	FE
	c	Pump room not physically separated from wet well; pumping of wastewater from a sanitary or combined sewer system through closed pumps and pipes		B	Entire space or room plus envelope 0.9 m (3 ft) around vents	Division 2	NC, LC, or LFS	FE

Note: The following codes are used in this table:

A: No ventilation or ventilated at less than 12 air changes per hour

B: Continuously ventilated at 12 changes per hour

C: Continuously ventilated at six air changes per hour

CGD: Combustible gas detection system

D: No ventilation or ventilated at less than six air changes per hour

FAS: Fire alarm system

FE: Portable fire extinguishers installed, located, and maintained in accordance with NFPA 10

LC: Limited-combustible material

LFS: Low flame spread index material

N/A: Not applicable

NC: Noncombustible material

NEC: In accordance with *NFPA 70*

NNV: Not normally ventilated

NR: No requirement

^aThe "Row" and "Line" columns are used to refer to specific figures in A.4.2 and specific requirements for each location and function.

^bThis column indicates the ventilation requirements for processes. Additional ventilation requirements are provided in Chapter 9. Ventilation signaling and alarm requirements are provided in Chapter 7.

^cThis column indicates the materials of construction for processes. Materials of construction for buildings in which these processes are housed are in accordance with the applicable building code and construction requirements provided in Chapter 8.

Figure 5-11 shows two instances of the same wet well and lift station building configuration. Both conditions have the wet well directly exposed to the pump room. "Division 1" and "Division 2" refer to the amount of ventilation provided to the classified space. Because the lift station building has no ventilation, it is classified as Division 1 (C1D1) since "no ventilation or ventilated at less than 12 air changes per hour" best describes the lift station building. The electrical equipment located in the pump building is not currently designed or rated to be in a C1D1 space, meaning that the lift station building is not currently up to code.

Ventilation could be added to the lift station so that it was “continuously ventilated at 12 changes per hour” to make the space Division 2 (C1D2); however, C1D2 spaces still require significant changes to the electrical equipment. The State of California Department of Industrial Relations (DIR) also has additional directives for electrical equipment in C1D2 spaces, such as requiring de-energizing the entire facility in the event that the ventilation system fails for any reason (DIR, 2021). This would require the lift station to stop conveying sewage entirely, which would require bypass pumping during the period when the lift station was not operational.

Given the current lift station configuration and the direct opening from the wet well to the pump/electrical room, there is no way to make the lift station building an “unclassified” space (not in the presence of any potentially flammable gasses).

Recommendations:

- Abandon interior building wet well and install wet well on the outside of the building.
- Provide proper ventilation to meet NFPA 820 requirements. Consider installing louvers or an exhaust fan for proper ventilation in the PS building.
- Assess and reinforce wood-framed roof for seismic stability.
- Evaluate the feasibility of replacing the wood-framed roof.

5.2.2 Lift Station Pumps

The All-Prime Suction Lift Pumps are equipped with 5 HP motors. The motors have the following specifications:

- 208/230 Volt, Single Phase
- 60 Hertz (Hz)
- Safety Factor 1.15 (non-overloading safety factor)
- 1750 revolutions per minute (RPM)

Field Observations:

Motor Condition: These pumps are belt-driven suction lift pumps, with the belts driven by the 5 HP motors. A vibration dampening system was not observed when inspecting the motors. A handheld vibrometer was used to measure the vibration of the motors while the corresponding pump was in operation. The allowable threshold for acceptable pump vibration is 0.05 inches per second (in/sec). Pump 1 measured 0.178 in/sec, and Pump 2 measured 0.257 in/sec, exceeding the acceptable limits and indicating the potential need to re-level the pump motors or check the belt drive alignments to ensure both are completely level and square (i.e., no tilt in the vertical belt drives).

Pump Capacity: During the field inspection, a pump drawdown test was conducted to assess the performance and condition of the pumps. Because there were no discharge pressure suction gauges, the only immediately available metric to assess pump performance was the measured flow rate. In order to perform the drawdown test, the wet well was filled using a water hose until the high water wet well level was triggered (3.8 ft as read from the PLC), causing the lead pump to kick on. A handheld stopwatch was used to measure how long it took the pump to pump the wet well level down to the low water level (2.6 ft as read from the PLC). The results of the drawdown tests for each pump are shown below in Table 5-3.

Table 5-3: Pump Run Time

	Pump 1		Pump 2	
	WW Level (ft)	Time (min:sec)	WW Level (ft)	Time (min:sec)
Start	3.8	0	3.8	0
Stop	2.6	1:40	2.6	1:35

Using this data, the average flow rate for the duration of the pump run was calculated by dividing the operating volume of the wet well by the run time of the pumps. These calculations are shown below in Table 5-4.

Table 5-4: Pump Capacity Calculations

	Pump 1	Pump 2
Runtime (minutes)	1.67	1.58
Operating Depth (ft)	1.2	1.2
WW Diameter (ft)	5	5
Operating Volume (gal)	176	176
Flow (GPM)	105	111

The results of the drawdown tests show that Pump 1 has a capacity of 105 GPM, and Pump 2 has a capacity of 111 GPM. The firm pump capacity of the lift station is the capacity of the lift station with the largest pump out of service (in this case, Pump 2 due to its higher flow rate), equal to 105 GPM. This firm capacity is below the original design specification of 135 GPM, or 78% of the original intended lift station capacity, indicating an operational inefficiency.

As mentioned above, there were no suction/discharge pressure gauges available to measure the TDH of the pumps. In order to approximate the operating TDH of the pumps, the TDH was calculated using a flow rate of 110 GPM for 3 different roughness coefficients. The static lift was determined based on record drawings of the force main. These calculations are shown in Table 5-5. Figure 5-9 shows a plan and profile view of the force main alignment, illustrating that the high point of the force main is located at the discharge maintenance hole. The range of potential system curves were overlayed with the manufacturer pump curve, along with the POR, on Figure 5-10 to understand how the pumps are performing currently versus how they were originally designed.

Table 5-5: Approximate Pump TDH with Varying Roughness Values

Length (ft)	Suction HGL (ft) ¹	Discharge HGL (ft) ²	Static Head (ft)	HW C	Flow Rate (GPM)	Pipeline ID (in)	Friction Headloss (ft)	TDH needed (ft)
1351	1,288	1317.4	29.2	100	110	4	20.0	49
1351	1,288	1317.4	29.2	120	110	4	14.3	43
1351	1,288	1317.4	29.2	140	110	4	10.7	40

Notes:

1. Bottom elevation of wet well + 2 ft
2. Elevation of discharge maintenance hole

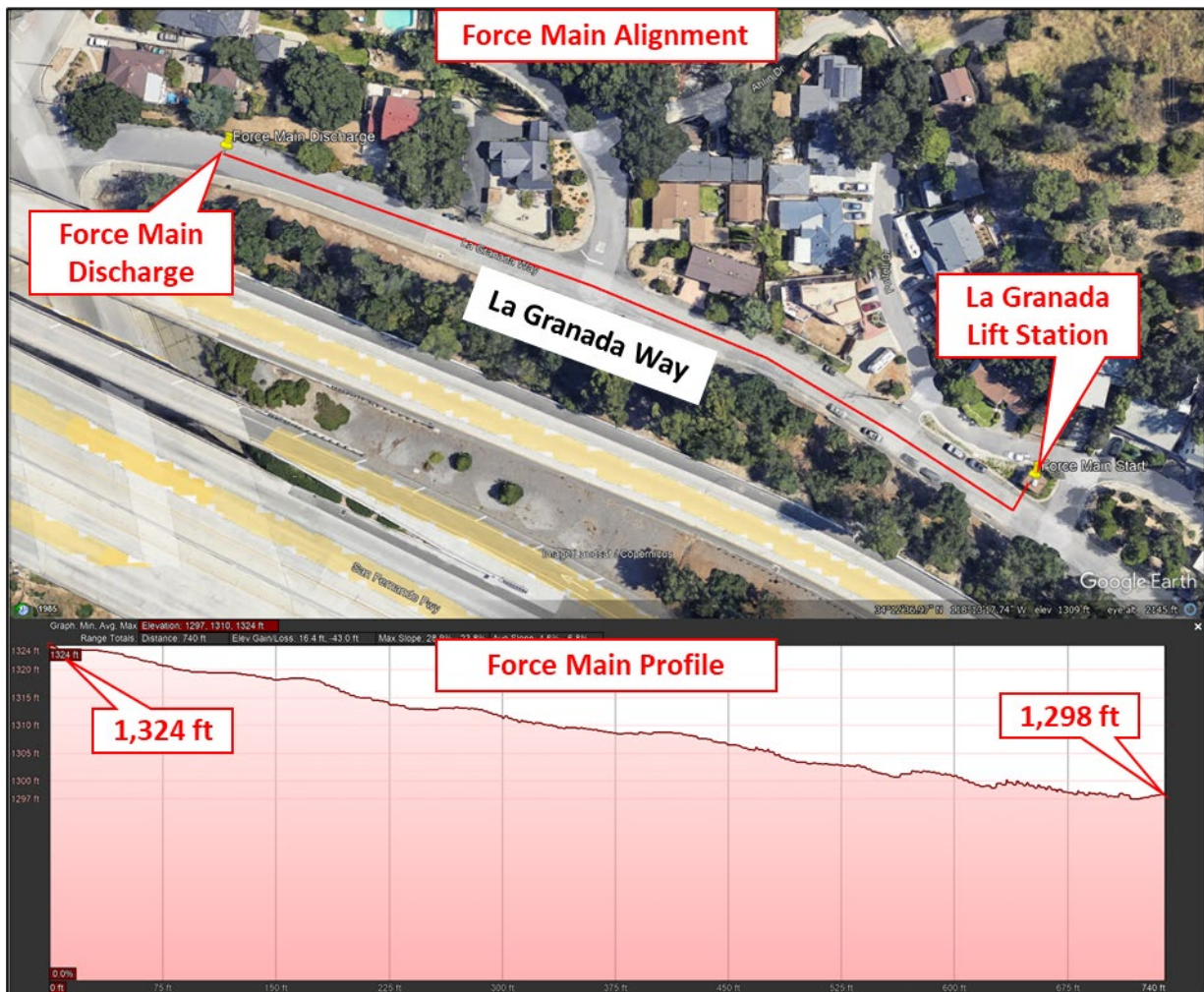


Figure 5-9: La Granada Lift Station Force Main Alignment

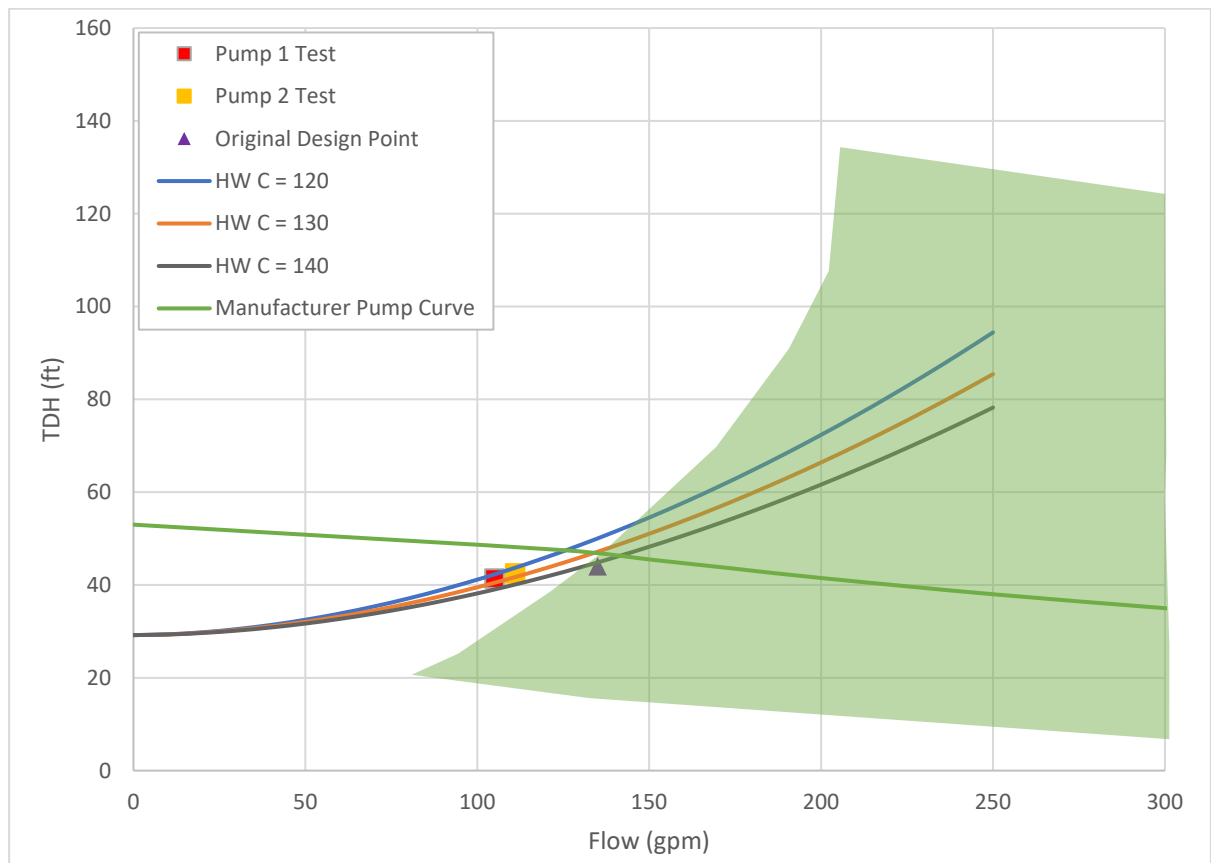


Figure 5-10: Pump and System Curve

As Figure 5-10 shows, the existing suction lift pumps are both operating to the left of the preferred operating range (POR). The potential envelope of simulated system curves contains the current pump operating flow rates between roughness coefficients 120 and 140. A system curve with a roughness coefficient of 140 best matches the original design condition of 135 GPM @ 44 ft TDH. A system curve with a roughness coefficient of 130 intersects the manufacturer pump curve at the measured flow rate. There are two possibilities for the reduction in the pump capacities; either there is additional headloss being incurred within the force main, increasing the required TDH, or the pump components are worn (such as the pump impeller) resulting in less output from the pump under the same original design head condition. The former explanation could be caused by several factors that would result in additional headloss through the force main, including buildup of FOG, partially closed discharge valves, or air entrainment at the top of the pump discharge header (Figure 5-11). The discharge header is currently a local high point for the force main before the discharge pipe returns to the subgrade below the street, and has no air release valve to allow any trapped air to escape. The presence of trapped air can effectively reduce the diameter of force main, causing excessive headloss.

Based on the flow test data, the pumps are currently operating outside of the POR. According to the original manufacturer pump curve, the pumps are operating at less than 35% efficiency when operating outside of the POR. Based on the original manufacturer information, the design point of the lift station of 135 GPM @ 44 ft TDH is already on the edge of the chosen pumps'

POR. The current AllPrime pumps are not an optimal pump selection for the La Granada Lift Station system curve. A pump operating outside of the intended POR may eventually damage the pump components and result in more frequent pump repair and/or replacement.



Figure 5-11: Lift Station Discharge Header

Pump Cycling Calculations: Since the status of each pump and the wet well level are monitored by SCADA, the number of cycles per day per pump can be evaluated. The number of cycles per day is directly related to the lead pump start and stop wet well level setpoints. Over the past 2 years, CVWD has experimented with different setpoints in an attempt to solve ragging issues. Figure 5-12 shows a 6-month period from 2022 pump cycle and flow wet well setpoint data.

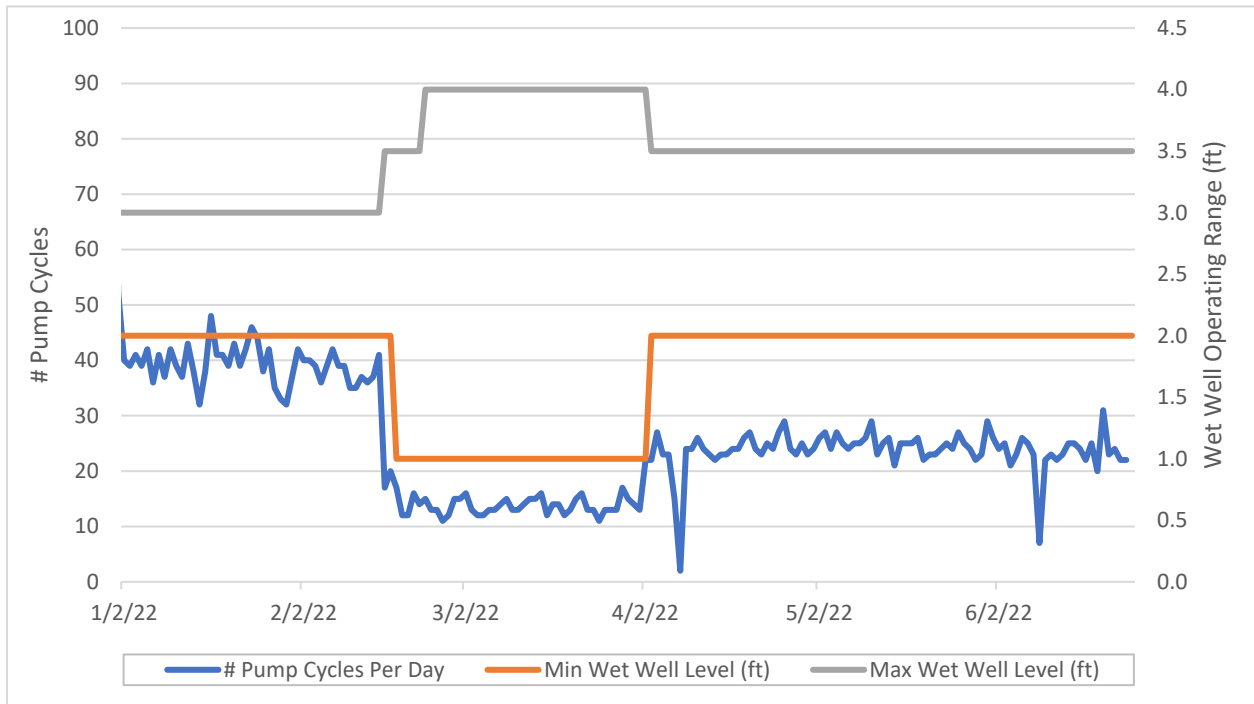


Figure 5-12: Daily Pump Cycles versus Wet Well Level Setpoints

This 6-month period shows three operating ranges for the wet well. From January to the middle of February of 2022, the operating depth for the pumps was at its smallest at 1 ft, with the lead pump on setpoint at 3 ft and the pump off setpoint at 2.0 ft. The resulted in roughly 40 pump cycles per day (20 per pump), equating to less than one pump start per hour. Table 5-6 summarizes the pump starts per hour calculations for the different wet well level setpoints.

Table 5-6: Pump Starts per Hour

Period	Pump On Level (ft)	Pump Off Level (ft)	Operating Depth (ft)	Total Number Pump Starts per Day	Starts per hour per pump ¹
Jan – Feb 2022	3.0	2.0	1.0	40	0.83
Mar – Apr 2022	4.0	1.0	3.0	15	0.31
Apr – Jun 2022	3.5	2.0	1.5	25	0.52

Notes:

1. Lead/lag assignment alternates after every pump cycle, therefore number of pump cycles are divided evenly between the two pumps.

Based on this data, no matter whether the operating depth is 1 or 3 feet, the pumps are cycling less than once per hour. The low end of the industry standard for maximum number of starts per hour is around six. Therefore, the La Granada Lift Station pumps are starting well below the recommended number of starts per hour. Operations staff may adjust the pump on/off levels as needed to improve any ragging issues without being concerned about the number of starts per hour.

Recommendations:

- Regularly monitor motor vibration levels and rebalance the motor plate/belt drives if needed.
- Perform a more detailed evaluation of the pumps, including additional performance testing and analysis of the vibration data.
- Investigate the cause of the decrease in pump flow capacity.
 - Inspect pump components for wear/damage.
 - Install sanitary seal suction and discharge pressure gauges to measure pump TDH.
 - Eliminate the local high point on the discharge header or install a sewage air release valve at the top of the discharge header to prevent air entrainment in the force main.
- Contact pump manufacturer for potential alternative pump model/impeller sizes that intercept the system curve within the pump's POR
- Consider metering the wet well influent sewer line during a wet weather period to understand peak influent flow and potentially revise the chosen design flow rate of 135 gpm.

5.2.3 Electrical and Instrumentation

The lift station is equipped with instruments that are standard for similar stations serving the same functions. The instruments included are suction pressure gauges, a bubbler level transmitter, level transducer, process logic controller (PLC), and a uninterrupted power supply.

Field Observations:

Pressure Indication: Observed the absence of pump discharge pressure gauges, failed suction pressure gauges,

Level Indication: Wet well level uses a bubbler pressure transducer. However, the bubbler air is reliant on temporary compliant. The pressure transducer for wet well level measurement is functional but the original compressor is in a failed state.

Station Controls: The Tesco Control Panel equipped with an Allen Bradley COMPACTLOGIX 5380. The control unit appears to be in good condition and still supported by the manufacturer.

Motor Control Center: The starters appear to be sized correctly, However, parts that are no longer supported by the manufacturer, Additionally, a Uninterrupted Power Supply (UPS) is included in control panel, and thermostat readings above 90 degrees were observed. There appears to be no starter overload protection. There appears that a change in the design of MCC from 3-phase power to single phase power.

Recommendations:

- Conduct a deeper inspection to determine precise condition of the bus bars, circuit breakers, wiring, relays, switches, etc. There may be significant signs of corrosion due the minimal separation of the wet well and electrical gear.
- Replace obsolete MCC starter components.

- Update MCC internal wiring for a single-phase to 3-phase converter.
- Explore options for replacing the compressor for the wet well bubbler. Or options for level indicator transmitters such as radar, ultrasonic, guided wave, or submersible pressure transducers.
- Address pressure gauge issues on both the discharge and suction sides.
- Consider upgrading pump motors and using Variable Frequency Drives (VFDs) for better control.
- Improve the monitoring and calibration of the wet well level measurement system.
- Examine the feasibility of updating the MCC for single-phase power.
- Evaluate the SCADA hookup and modem connection for proper functionality.

5.2.4 Backup Generator

Field Observations:

Lift station backup power is provided by a permanent 35 kW diesel generator. The generator has the capacity to operate both pumps simultaneously along with other station power demands. The generator set operates on a weekly basis for 15 minutes. The generator set appears to be in good condition, however, it appears to be oversized for the lift station demands. The automatic transfer switch is vulnerable attacks from hydrogen sulfide gas and may be prone to corrosion of the electrical contacts.

Fuel consumption: The 15-minute weekly runtime equates to 13 hours per year, consuming about a third of the 132 gallons of useable fuel. The 35-kW generator consumes about 3.5 gallons per hour when operating at full capacity. Therefore, the generator could run at fully capacity for 38 hours. Given the current exercise schedule, this means the fuel tank would not need a refill for almost 3 years.

$$\text{Generator Runtime per year: } 15 \frac{\text{min}}{\text{week}} * 52 \frac{\text{weeks}}{\text{year}} * \frac{1 \text{ hrs}}{60 \text{ min}} = 13 \text{ hrs per year}$$

$$\text{Total fuel tank capacity: } \frac{132 \text{ gallons}}{3.5 \text{ gallons per hr}} = 38 \text{ hours}$$

$$\text{Generator Total Runtime: } \frac{38 \text{ hrs}}{13 \text{ hrs per year}} = 2.92 \text{ years or 35 months}$$

Diesel Age: Based on the short generator run times it appears that the oversized fuel tank may have an impact on future generator performance such as reduced power output, hard starting, rough idling and increased emissions. Diesel has an effective lifespan of 6 to 12 months, but the effectiveness of fuel depends on storage conditions, temperature, and the use of diesel additives. The calculations below provide estimates of the consumption rate and total availability of the generator set relative to fuel capacity.

Recommendations:

- Increase generator exercising frequency to prevent wet stacking and fuel degradation. With a total runtime at full speed of 38 hours, the generator would need to be run for roughly 45 minutes every week to turn over the entire fuel tank within a year.

- Decrease fuel input to allow new diesel to cycle through the tank. With the currently runtime schedule of 15 minutes per week (13 hours per year), the fuel tank only needs roughly 46 gallons of fuel so that all of the generator fuel is consumed within one year.
- Define a required level of service (LOS) for the generator, determining how many hours of continuous runtime are needed from the generator given a power outage emergency and accounting for the typical amount of time it takes to restore power to the area.

5.3 Business Risk and Vulnerability Assessment

This section documents the Business Risk and Vulnerabilities Assessment (BRVA) process, detailing its purpose, employed approach, critical findings, and future project recommendations (encompassing both infrastructure and non-infrastructure initiatives). Appendix E provides additional detail on the BRVA workshop discussions and system-level asset interviews.

5.3.1 Purpose

The BRVA provides CVWD with a framework for prioritizing inspections and CIP projects based on risk while aligning the assessment with CVWD's corporate mission. The components of risk include both the existing condition of the asset as well as the consequence of failure of the asset. The BRVA brought all departments of CVWD, including Operations, Engineering, and Finance into the same room to encourage cross talk between departments and to understand how each department perceived and risk tolerance for system-level assets. The BRVA also helped CVWD understand the business practices in place to control and/or mitigate risk in the event of a failure of a portion of the collection system, as well as any improvements that may need to be made.

5.3.2 Approach

The BRVA approach followed the timeline shown below in Figure 5-13.

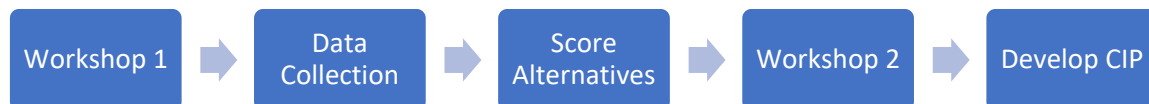


Figure 5-13: BRVA Timeline

Each element of the BRVA approach is described in the sections below.

5.3.2.1 Workshop 1

The first workshop was an all-day workshop attended by all departments of CVWD. The first goal of the workshop was to develop a risk matrix that fit CVWD's business goals and corporate mission statement. The objective of the matrix is to eliminate subjectivity from the failure analysis and confirm group consensus on the consequences of the system failures. The consequence of failure is an aggregated value composed of five major categories:

- Health and Safety for the Public and Employees
- Impact on Environment or Regulatory Compliance
- Quality of Service
- Public Image
- Financial Impact

Each of these categories during the workshop was scored on a scale of 1 to 5. Additionally, the Quality of Service criterion, meaning how many customers does an asset impact, was informed by the results of the calibrated hydraulic model. Assets conveying relatively more flow received higher Quality of Service scores, and vice versa. The 5x5 matrix shown in has the condition score of the asset on the vertical axis and the consequence of failure (COF) on the horizontal access. The definitions for each COF category are specific to CVWD.

Corporate Risk Matrix Wastewater Master Plan										
Crescenta Valley Water District July 2022										
System Condition	Very Poor, Full Replacement	5						5	X < 1 Yr	Likelihood of Failure
	Poor Condition, Rehab. or Replacement	4						4	1 < X <5 Yrs	
	Fair Condition, Major CM	3						3	5< X <10 Yrs	
	Fair Condition, Minor CM	2						2	10< X < 20 Yrs	
	Good Condition, No Action	1						1	X > 20 Yrs	
			1	2	3	4	5			
Consequence of Failure										
Safety	No injury, and no anticipated future impacts		Minor to moderate injury – contusions & lacerations w/out lost time, first aid applied		Moderate injury/lost time or restricted duty		Major serious health issues (acute & chronic) & long-term injuries – disabling		Fatalities	Safety
Environmental and Regulatory Impact	No negative impacts on environment, public health or regulatory compliance		No negative impacts on environment or public health; minor compliance issues (i.e., minor NPDES violation, exceed WQ standard triggering effluent limit; SSS WDR Category 3 spill; RW spill < 1,000 gals; minor Title 22 violation; Notice to Comply)		Minor negative impact to the environment and/or public health; compliance issues (i.e. repeated or major NPDES violation; SSS WDR Category 2 spill or Category 1 spill < 1000 gals; recycled water spill > 100,000 gals; minor Notice of Violation)		Moderate negative impact to the environment and/or public health; major permit violation (i.e. NPDES ACL > \$10,000; SSS WDR Category 1 spill > 1,000 gals & < 100,000 gals; recycled water spill > 500,000 & < 1M gals; Title 22 major violation; major Notice of Violation)		Significant negative impact to the environment and/or public health; major permit violation (i.e. Significant NPDES Enforcement Order; SSS WDR Category 1 spill > 100K gals; recycled water spill > 1M gals; potential for Title 22 permit revocation; any violation resolved through the Courts)	Environmental and Regulatory Impact
Quality of Service and Delivery	No impacts on service delivery or customers		Impact limited to individual customers		Moderate localized impact to groups of customers; short-term service disruption		Sub-basin impacts with potential long-term service disruption		Service area-wide impacts; Long-term service outages	Quality of Service and Delivery
Public Image	No to minimal Impact; odor complaint, or complaint to staff, with staff acknowledgement, action and response		Some significant social media and no local media coverage; phone call response handled by staff		Social media activity and maybe minor local media coverage; Board may receive complaints to be responded to by staff		Local media coverage with Board of Directors involved in response; potential long-term impact to community trust in District		Lead story in regional/national or industry short and long-term coverage; significant impact to community trust in the District	Public Image
Fiscal Impact		0 < \$5K	\$5K < X < \$25K		\$25k < X < \$50K		\$50k<x<\$250k		> \$250k	Fiscal Impact

Figure 5-14: CVWD Risk Matrix (See Appendix E for Full Size / High Resolution Table)

The second goal of the workshop was to interview staff about the collection system assets/asset regions to understand asset condition and business practices in place for each asset. Because there are over 65 miles of gravity sewer pipe, the collection system was divided into 10 regional sewersheds based on major confluence points, as discussed in Section 2.1. Additionally, each of the EMA areas discussed in Section 1.2.1.1 were analyzed as part of the BRVA. The BRVA discussion divided the collection system into the following components:

- Outfall / Diverter Valve

- Sewer Interceptor
 - The Interceptor was divided into two segments. Segment 1 is from the outfall at LAGWRP up to Hillside Drive. Segment 2 is from Hillside Drive up to Sunview Drive.
- La Granada Lift Station / Force Main
- Sewersheds 1 - 10
- EMAs 1 – 10

To easily categorize project locations, gravity sewer pipes were further subdivided within the 10 Sewersheds into trunk sewers and collectors. A “trunk” gravity sewer pipe was any pipe with two or more sewer alignments branching from the sewer alignment. Gravity sewer pipes with no additional upstream branching were defined as “collector” sewer pipes. Figure 5-20 shows these categorized gravity sewer pipes. Each trunk sewer is numbered to assist in categorizing project locations. The location of each asset/potential project discussed during the BRVA was described by the Sewershed number, trunk sewer number, and the nearest cross street. Appendix E documents the tabulated assets and their locations.

In addition to scoring the COF for each asset within the collection system, the business practices in place for each asset were also evaluated. Business practices are used to prevent and/or mitigate a failure event. The better the business practices are, the easier it will be for CVWD to recover from a failure event. Table 5-7 provides the business practices that were scored on a scale from 1 to 5 for each asset. These scorings were then used to calculate the total “Business Vulnerability” (BV) score for each asset.

Table 5-7: CVWD Business Element Definition

CVWD Business Practices	Definition
Work Execution Management (WEM)	How well work orders are issued, processed, and documented.
Asset Condition	What is the current condition of the asset based on O&M inspections.
Training Program	How effective is the O&M training program relative to testing the competencies needed for sustaining assets.
Site Safety Condition	How safe is the work environment when operating and/or maintaining the asset.
Resiliency	Are emergency response plans, abnormal operating procedures, and standard operating procedures well documented.
Reliability Engineering Support	How well does engineering monitor Key Performance Indicators (KPIs), conduct root cause analysis, conduct failure and risk analysis, implement resiliency strategies, and practice continuous improvement to gain system efficiencies.
Asset Performance Management Practices	Available sensors/technology to measure and document the condition of assets.

CVWD Business Practices	Definition
Asset Management Business (AMB) Processes	CIP in place and regularly updated

5.3.2.2 Data Collection

After Workshop 1, additional data was collected to verify the condition of some of the assets discussed. This included the La Granada Lift Station condition assessment (Section 5.2) as well as verifying pipe and maintenance hole inverts/configurations for key areas of the collection system with record drawings. The work done with the calibrated collection system hydraulic model also revealed asset condition information not previously available to CVWD, and informed the asset scores as well.

5.3.2.3 Score Alternatives

The total risk score for each asset is a function of the weighted COF and BV scores, and is calculated as follows:

$$\text{Total Risk Score} = COF * BV$$

The lowest (least risk) score possible is a 1, while the highest (most risk) score is 25. Both of the COF and BV scores were composite scores calculated based on the weighting determined during the first workshop. Category weightings were assigned based on CVWD's priorities and business goals.

The COF component category weightings are shown below in Table 5-8. These weightings were developed based on conversations between operations, engineering, and finance departments to reflect CVWD's priorities. Safety and Environmental categories received the highest weighting based on CVWD's commitments to public safety and the protection of the surrounding natural environment.

Table 5-8: Consequence of Failure Category Weightings

Category	Weighting
Safety (S)	30%
Environmental (E)	25%
Quality of Services (QoS)	15%
Public Image (PI)	10%
Fiscal (F)	20%
Total	100%

The following equation represents the calculation for the COF score.

$$COF = .3 * S + .25 * E + .15 * QoS + 0.1 * PI + 0.2 * F$$

Table 5-9 shows the BV component weightings. These weightings were chosen based on previous experience with other utilities along with the input from CVWD staff, assigning the

highest weighting to the safety condition of the asset due to CVWD's commitment to the safety of their employees. The next highest weighting was assigned to the asset's resiliency, followed by asset condition.

Table 5-9: Business Vulnerability Category Weightings

Category	Weighting
Work Execution Management (WEM)	12%
Asset Condition (AC)	15%
Training (T)	10%
Safety Condition (SC)	30%
Resiliency (R)	20%
Reliability Engineering Support (RES)	8%
APM Practices (APM)	3%
AMB Processes (AMB)	2%
Total	100%

The following equation is used to calculate the composite BV score.

$$BV = .12 * WEM + .15 * AC + .1 * T + 0.3 * SC + 0.2 * F \\ + .08 * RES + .03 * APM + .02 * AMB$$

5.3.2.4 Workshop 2

With the scorings and field data collected, the departments of CVWD and Kennedy Jenks reconvened for a second time to review the risk scores of the assets and discuss potential conceptual-level CIP projects. The risk matrix shown in Section 5.3.2.1 was populated with the calculated COF and asset condition data to visualize the prioritization of the one-time risk mitigation opportunities that may transform into CIP projects. The total risk score profile for all assets was also provided to understand which assets carried the greatest risk, despite potentially not resulting in a CIP project based on the current condition of the asset. These visualizations are discussed further in the following section.

Workshop 2 also yielded additional information on potential vulnerabilities within the collection system based on the discussion of the proposed CIP projects and results of the I&I analysis discussed in Section 5.1.1.3. This information was also considered in the final development of the CIP.

5.3.2.5 Develop a Prioritized CIP List

The findings of the BRVA were used to develop a prioritized CIP plan, outlining project costs and timelines driven by the asset condition and the risk/consequence of failure score. The key findings for each asset category discussed during the BRVA process are broken down into the following subsections.

5.3.2.5.1 Interceptor

The gravity sewer interceptor, stretching over 6 miles from Sunview Dr/Verdugo Blvd to the outfall at LAGWRP, serves as the backbone of CVWD's wastewater collection system. This unlined VCP pipe, dating back 40 years, represents a critical single point of failure. As the sole

conduit for conveying wastewater across the service area, its failure would eliminate CVWD's entire sewage conveyance capacity.

While the interceptor's physical age raises concerns, discussions with staff revealed a further vulnerability: a lack of well-defined emergency procedures in case of a break. Crucial aspects included the following:

- Bypass pumping vendor coordination: Securing reliable and readily available pumping resources is essential for mitigating sewage overflows during an outage.
- Designated bypass laydown areas: Identifying temporary storage locations for bypass equipment ensures immediate deployment in case of an emergency.
- Coordination with nearby agencies: Streamlining communication and collaboration with relevant authorities can expedite response and minimize environmental impact.

The criticality of the interceptor demands immediate attention. Thus, CVWD should consider prioritizing:

- Conducting a comprehensive condition assessment: This in-depth evaluation will reveal the extent of deterioration and prioritize repair needs.
- Developing a robust emergency response plan: Establishing clear protocols for rapid response, resource allocation, and interagency coordination minimizes potential damage and ensures swift restoration of service.
- Exploring long-term rehabilitation or replacement options: Depending on the assessment results, investing in rehabilitation, or even replacing the aging pipeline can safeguard CVWD's wastewater conveyance system for decades to come.

The Diverter Valve at the outfall of the interceptor currently does not have site security (fencing/adequate lighting) and does not have a backup uninterruptible power system (UPS). If the diverter valve were to fail due to loss of power, it would fail in the last position. The Diverter Valve is normally open, conveying flow to LAGWRP. However, during the three-hour period from 12:00 AM to 3:00 AM, the diverter valve must close to convey concentrated brine directly to HTP. If a power failure was to occur at 11:30 PM, prior for brine to be discharged, the valve would fail in the "open" position, and potentially allow concentrated brine into LAGWRP's treatment facilities. Under this possible failure scenario, this will likely result in a regulatory fine against CVWD.

Finally, a private lateral connects to the interceptor at Hillside Drive that currently does not have any backflow prevention in place. Therefore, if a portion of the downstream interceptor (Segment 1) failed, this could result in a significant SSO event at Hillside Drive, and cause significant fiscal, environmental, and public image issues for CVWD.

5.3.2.5.2 Highway Crossings

CVWD has two key locations where gravity sewer pipe crosses above Highway 210 before continuing south. These elevated highway crossings have DIP gravity sewer pipe and are enclosed in a casing within the bridge crossing structure. These Hwy 210 crossings are located at Rosemont Ave and Briggs Ave. There is currently no CCTV or inspection history of the crossing gravity sewer pipe and/or casing pipe, and therefore the condition of these assets is unknown. CVWD recently experienced a water main break in August 2023 at the Rosemont / Hwy 210 crossing which caused significant impacts to traffic and made local news.

5.3.2.5.3 La Granada Lift Station

The La Granada Lift Station poses a current safety issue to CVWD operations staff, as the interior of the pump station building is classified as a Class 1 Div 1 space and is a potential explosion hazard with electrical equipment exposed to flammable gases and explosive environment.

5.3.2.5.4 EMAs

Each EMA was evaluated during the BRVA process, however EMA 1, located at the intersection of Pine Glen Rd and Pineridge Dr, was the key focus of discussion. Due to the “switchback” configuration of the gravity sewer in the area, this portion of gravity sewer is prone to maintenance hole blockages due to the several 90-degree turns the sewage must make before continuing downstream. This EMA is the location of a historical SSO.

5.3.2.5.5 Hillside Sewer Access

There are two maintenance hole locations in the northern portion of CVWD’s SSA that are steep and difficult for CVWD operations staff to access and maintain. These locations are near the intersection of Dorothy St / Goss Canyon Ave and on Starfall Dr / Ridgepine Dr. Maintenance hole blockages could result in SSOs that would travel into nearby wildlife areas that could result in fines for CVWD.

5.3.2.5.6 CVWD Programmatic Issues

CVWD currently does not have a digitized work order database or method for tracking/documenting work completed or condition assessment data, but are currently working on this improvement.

Figure 5-15 provides the total risk score profile from highest to lowest for the evaluated assets. The highest scoring areas included the interceptor and its components as well as the Hwy 210 crossings.

Figure 5-16 shows the system O&M safety condition scoreboard by project. Most notably, the La Granada Lift Station is rated a 5 due to the immediate safety threat it poses to O&M staff.

Figure 5-17 shows the combined COF and asset condition score, showing the driving factors for how the projects were prioritized and scheduled.

Figure 5-18 shows the risk matrix with the asset COF versus asset condition. Figure 5-19 shows the risk matrix with the O&M safety score on the horizontal axis instead to highlight the necessity of the La Granada Lift Station project. Additional risk profiles are available in Appendix E.

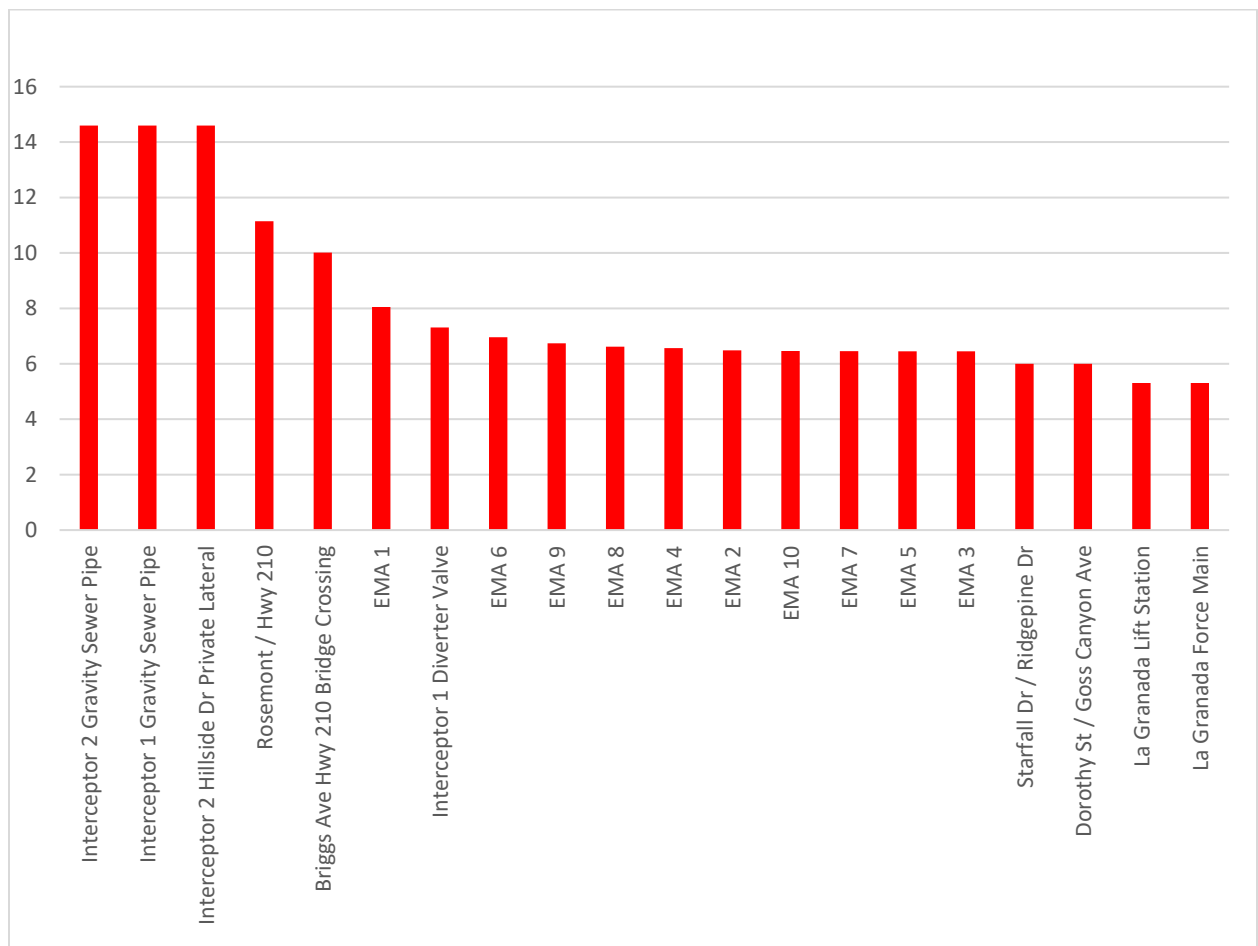


Figure 5-15: System Level Risk Scoreboard

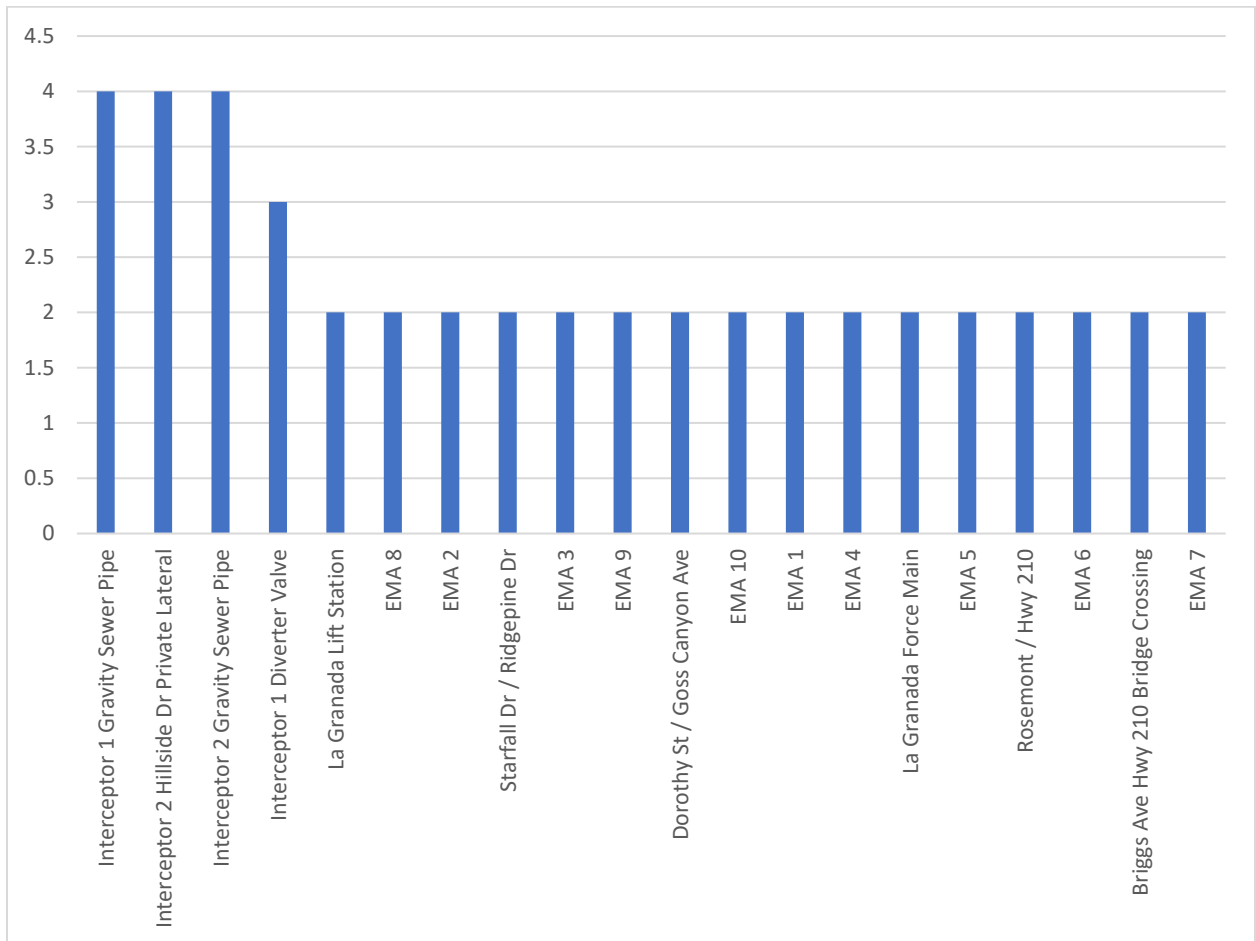


Figure 5-16: System Safety Condition Scoreboard

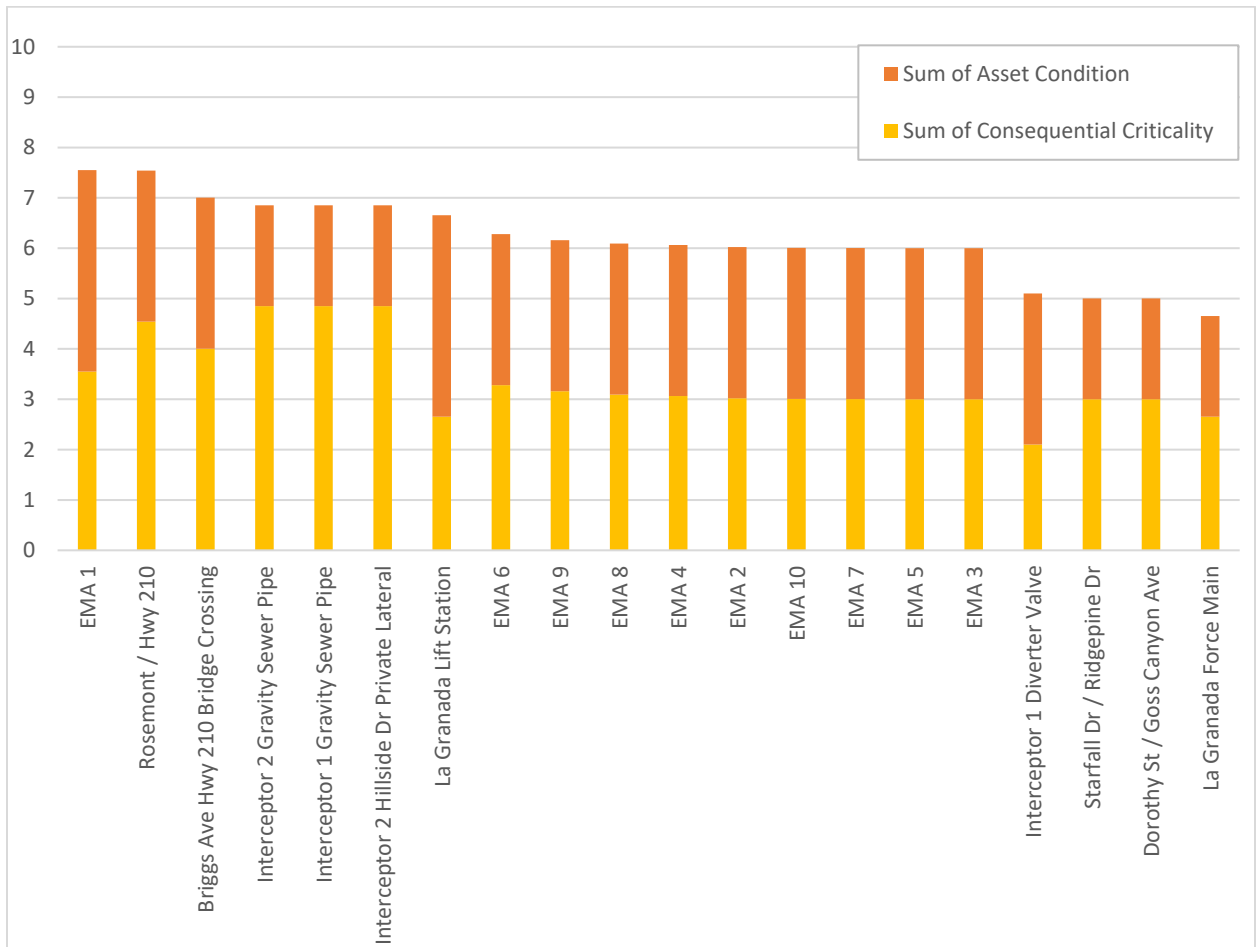


Figure 5-17: Consequence of Failure and Asset Condition Combined Scoreboard

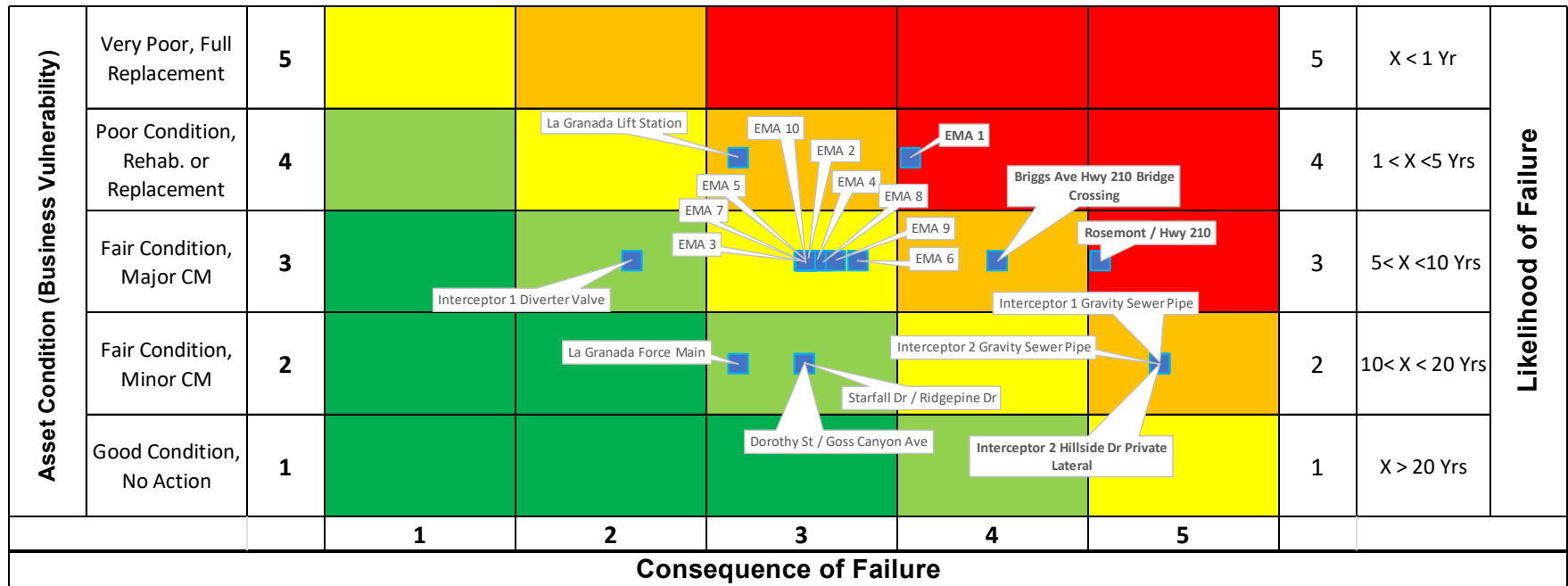


Figure 5-18: Risk Matrix Using Weighted COF

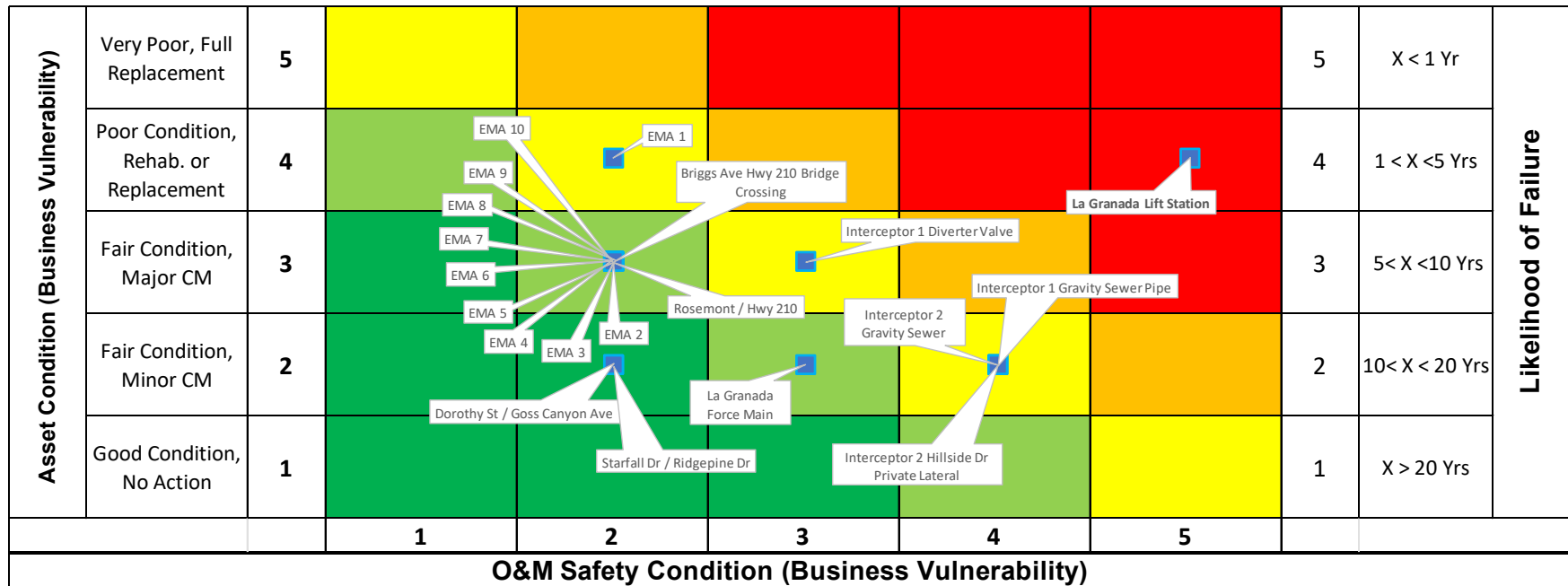


Figure 5-19: Risk Matrix Using O&M Safety Condition

5.3.3 Recommendations

Using the results of the BRVA process, the prioritization of the potential CIP projects was developed and is shown in Table 5-10. Projects with a “short” timeline should be completed as soon as possible, within the next 1 to 3 years. Projects with a “medium” timeline should be completed within 3-5 years. Projects with a “long” timeline should be completed within 5-10 years. Detailed 1-Page Project Summaries are also included in Appendix F.

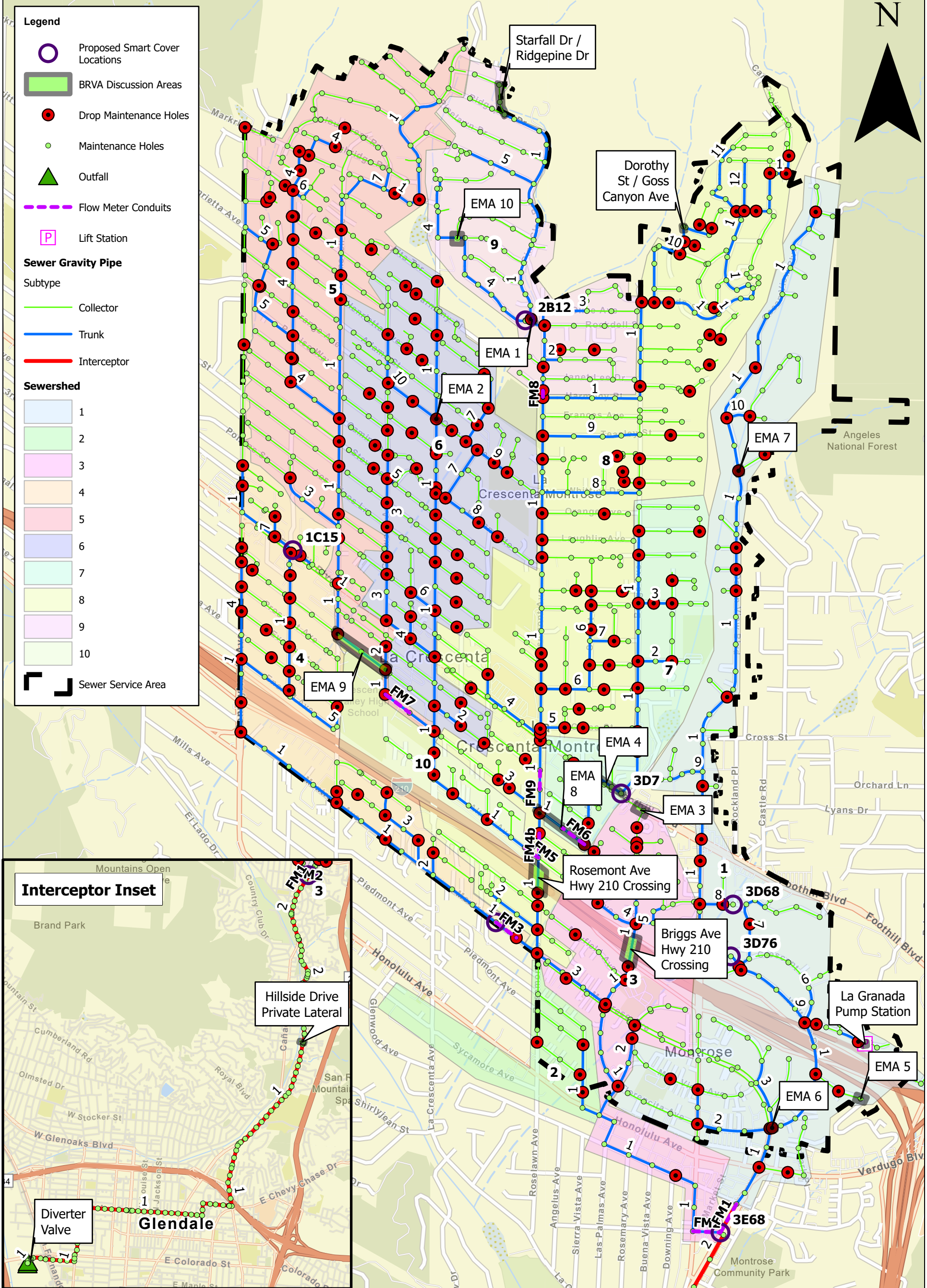
Table 5-10: Recommended Infrastructure Project Prioritization

Timeline	Project	Justification
Short	Rosemont / Hwy 210 Crossing Inspection / Rehabilitation	Unknown Condition / Big safety, financial, and regulatory risks
	Pine Glen Rd / Pineridge Dr (EMA 1)	Historical SSO, Consistent problem for Ops, safety, financial, and regulatory risks
	La Granada Lift Station Improvements	Safety issue for Ops team, current code violation
Medium	Briggs / Hwy 210 Crossing	Unknown Condition, safety, financial, and regulatory risks (serves fewer customers than Rosemont)
	Hillside Dr Private Lateral	High safety and financial risk, relatively low effort to fix
Long	Diverter Valve	Low COF – minimal regulatory/financial/safety impacts
	Dorothy St / Goss Canyon Ave Sewer Access	Low COF - minimal regulatory/financial/safety impacts
	Starfall Dr / Ridgepine Dr Sewer Access	Low COF - minimal regulatory/financial/safety impacts

Additional non-infrastructure recommendations related to best business practices are listed below. These recommendations can be completed in-house and would be completed based on availability of operations staff.

1. **SmartCover Maintenance Hole Lid Installation** – The primary purpose of SmartCovers are to monitor depth of flow within maintenance holes to alert CVWD of potential blockages/breaks in the collection system. Abnormally low flows could indicate and upstream blockage/break, while abnormally high flows would indicate a downstream blockage. The secondary benefit of the SmartCovers is that they provide additional calibration data for the hydraulic model. CVWD staff plans to install 5 SmartCovers in 2024 and 5 more in 2025. Based on discussions with CVWD staff, the following locations were selected for the 2024 SmartCovers (also shown in Figure 5-20):

- a. Waltonia Dr, MH# 3D76 – This is the location with the highest modeled d/D ratio for the collection system, largely due to the shallow slope of the gravity sewer pipe.
 - b. Sunview Dr / N Verdugo Blvd, MH# 3E68 – This is the beginning of the interceptor and a major confluence point on CVWD's system.
 - c. Hillside Dr along Interceptor, MH# 39108 (no VT Number) – This is the middle of the interceptor and provides CVWD with valuable information on the status of the interceptor.
 - d. Pineridge Dr / Pine Glen Rd, MH# 2B12 – This is a historical SSO location and should be monitored given it is a high-risk EMA.
 - e. Foothill Blvd / Briggs Ave, MH# 3D7 – This is a very shallow segment of sewer pipe and is also a classified EMA prone to blockages and debris buildup.
 - f. Two future recommendations for 2025 SmartCover placements are Oceanview Blvd / Barton Rd (MH# 3D68) and Foothill Blvd / Cloud Rd (MH# 1C15). Based on input from operations, these areas are prone to blockages/debris buildup due to the flow received from upstream customers.
2. **Improved Emergency Response Training for Interceptor break** – CVWD currently has a plan outlined for how to address high flow SSO's along the interceptor, but the plan does not address more severe conditions such as a break on the interceptor requiring immediate action. The SSMP should address on-call bypass pumping vendors, identify bypass pumping laydown areas for the interceptor alignment, and provide emergency contacts for local entities that may be impacted such as the City of Glendale.
 3. **Improved Communication with ADS to identify Elk St Flow Meter Failure** – CVWD should discuss with ADS how they could be notified of a meter failure at Elk St, as this has implications for how CVWD reports flows to the City of LA, and also removes a key indicator for CVWD for understanding how the interceptor is performing.
 4. **Develop monitoring method for Canalda tank discharge (EMA 7)** – Canalda tank current discharges unmetered flow to CVWD's SSA. CVWD should attempt to quantify the discharge flow on a more granular scale (GPM) to understand the impacts to collection system capacity.
 5. **Targeted flow monitoring for Sewersheds 1, 2, 3** – Based on the I&I analysis performed, CVWD should consider continuing temporary flow metering during wet weather months in sewersheds 1, 2, and 3 to pinpoint sources of inflow. While smoke testing entire sewersheds is not feasible or cost effective, isolating I&I to one street or sewer alignment could then be followed with targeted smoke testing to identify stormwater cross connections and other areas of leakage.
 6. **Develop Digitized Asset Condition / Work Order Database** – creating a digitized database of work order history and asset condition assessments is crucial to allowing CVWD to effectively maintain the collection system long after key staff and operators have left, taking institutional knowledge with them. It also provides the ability to plot the condition of assets overtime and observe which assets are degrading faster than others, and which need to be prioritized for rehabilitation/repair/replacement. This database will inform CVWD's future cured-in-place piping (CIPP) lining schedule.



Notes:

Kennedy Jenks
Crescenta Valley Water District
Wastewater Master Plan

Recommended Project
Locations

2244508*00
Figure 5-20

Section 6: Capital Improvement Program Development

This section takes the compiled input from the analyses described in Section 5 and provides an actionable plan regarding the implementation of the proposed projects. This section outlines the development of the Capital and O&M costs, and provides potential CIP plan implementation schedules for the identified projects. This section also provides additional programmatic recommendations beyond the proposed CIP Plan for CVWD's consideration.

6.1 Identified Projects

The projects discussed in Section 5.3.3 are listed in Table 6-1. Table 6-1 provides a description of the project as well as a justification for the project based on the results of the BRVA. 1-Page project summaries are also provided in Appendix F.

In the case of the La Granada Lift Station Improvements project, a secondary project was identified as a potential alternative to the recommendations outlined in Section 5.2, which involved the construction of a new wet well and rerouting the influent gravity sewer.

The alternative project would consist of converting the lift station into an outdoor lift station by removing the building walls and roof, and installing submersible pumps to eliminate the need for noise attenuation. Submersible pumps also offer a wide range of pump selections that will better fit the force main system curve, improving the reliability of the lift station and reducing required maintenance. The electrical equipment would be relocated to the eastern portion of the lot and placed in NEMA 4x outdoor-rated enclosures, far enough from the wet well access to maintain compliance with NFPA 820. A new subgrade valve vault would be installed to match the elevation of the existing force main discharge to remove the issue of creating a local high point. This alternative has the added benefit of keeping all project work within the site, and does not require work/digging in the public right of way. The key drawback of this alternative is that it is twice the cost (an estimated \$416,000), and would likely involve the utility power to be converted back to 3 phase power. A proposed project layout for this alternative is included in Appendix G as well.

For the purposes of developing the CIP schedules, the less expensive pump station improvements project (new wet well and rerouted inlet gravity sewer) was used.

Table 6-1: CVWD CIP Projects

Proj. ID	Project Name	Project Description	Justification
Infrastructure Projects			
I-1	Granada Pump Station Improvements	Site safety and pump system improvements to the Granada Pump Station: entails a new wet well, new gravity sewer influent line, and building, piping, electrical, and site modifications.	Asset condition is poor and is an existing safety issue for operations staff. Regulatory issue with NFPA 820.
I-2	Pine Glen / Pineridge (EMA 1) Switchback Redesign	Improvements to prevent historical debris collection and SSO events: abandonment/demolition of existing sewer lines, new installation of reversed flow sewer line, drop maintenance hole, and chimney lateral.	Asset in poor condition and was a historical SSO site (regulatory issue). Financial risk if surrounding homes are damaged.
I-3	Rosemont / Hwy 210 Crossing Retrofit	Seismic retrofit of highway bridge crossing: retrofit each end of bridge pipe with seismically rated sewer fitting. Option for full bridge sewer line and casing pipe replacement.	Asset condition unknown. Public safety risk due to crossing Hwy 210, large regulatory and public image risk
I-4	Briggs / Hwy 210 Crossing Retrofit	Seismic retrofit of highway bridge crossing: retrofit each end of bridge pipe with seismically rated sewer fitting. Option for full bridge sewer line and casing pipe replacement.	Asset condition unknown. Public safety risk due to crossing Hwy 210, large regulatory and public image risk
I-5	Hillside Dr Private Lateral Backflow Preventer	Backflow prevention: Installation of duckbill backflow preventer on private lateral off interceptor.	Public safety risk and major financial risk. Relatively low effort to address for large gain
I-6	Dorothy / Goss Canyon Access Road	Improve maintenance hole access: obtainment of easement, construction of access road.	Operations staff safety issue, fiscal liability if backup occurs and damages nearby homes
I-7	Starfall / Ridgeline Access Road	Improve maintenance hole access: obtainment of easement, construction of access road.	Operations staff safety issue, fiscal liability if backup occurs and damages nearby homes
I-8	Diverter Valve Upgrades	Security improvements: installation of UPS, site lighting, perimeter fence.	Safety concern for both public and operations staff due to lack of security
Non-Infrastructure Projects			
N-1	Rosemont, Briggs Crossings Condition Assessment	Thoroughly inspect sewer lines and casings crossing Rosemont and Briggs bridges. Would entail consultant CCTV inspection of sewer and void between pipe and casing. One-time.	Asset condition unknown. Public safety risk due to crossing Hwy 210, large regulatory and public image risk
N-2	Smart Cover Installation	Maintenance hole monitoring and alarms through smart maintenance hole cover systems. 4 covers to stay in position, 6 covers to alternate locations. Ongoing, indefinite.	Low cost method of evaluating system performance and identifying potential areas with frequent blockages/flow issues
N-3	Interceptor Items	Improved Emergency Response Training for Interceptor break (annual, indefinite). Improved Communication with ADS to identify Elk Ave Flow Meter Failure (one-time).	Improve training and resiliency to handle interceptor break, improve ability to know when flow meter is in a failed state
N-4	EMA 7 Monitoring	Monitoring of Canalda tank discharge. 3 months of monitoring; one-time.	Unknown asset condition, receiving unknown quantities of discharge flow
N-5	SS 1,2,3 Monitoring	Targeted flow monitoring for sewersheds 1, 2, 3. 3 months of monitoring per year for 5 years.	Narrow down areas with large I&I contributions for targeted pipe rehabilitation/lining projects
N-6	Work Order Database	Develop work order database with pipe and maintenance hole condition ratings data. One-time.	Improves APM practices by being able to visualize and prioritize pipeline replacement projects based on condition assessment data

6.2 CIP Project Costs

6.2.1 Capital Costs

An Opinion of Probable Construction Cost (OPCC) was developed for each of the CIP projects at a Class 5 level, which represents Concept Screening level detail with an estimated accuracy range between -30% to +50, in accordance with the AACE standard cost estimating guidelines. The following assumptions and inclusions were made in the preparation of each of the cost estimates:

- Projects will be publicly bid projects.
- Prevailing wage requirements will apply.
- Assume there will be at least 3 qualified bids submitted.
- Assume all excess excavated material is hauled and disposed of.
- Assume all demolished material will be hauled and disposed of including a dump fee.
- Costs are rounded to nearest \$1,000 and are in 2024 dollars.

The estimates do not include the following:

- Hazardous materials (lead paint, asbestos, PCBs, etc.) removal or disposal is not included.
- Soil remediation, testing, removal, or disposal.

The Class 5 OPCCs and associated present worth costs for each of the CIP projects are shown in Table 6-2. See Appendix G for a detailed cost estimate breakdown.

Table 6-2: Capital Cost Assumptions

Item	Assumption
Taxes	10.25%
Mobilization/Demobilization/Permits	10%
Contractor Overhead & Profit	15%
Bonds and Insurance	2.5%
Escalation to mid-point of Construction	6%
Estimate Contingency	30%
Engineering ¹	15% / 25%
Construction Management ¹	15% / 25%

Notes:

1. Projects with Subtotal costs (before soft costs) under \$1 Million assumes 25% increase, Projects with Subtotal costs above \$1 Million assumes 15% increase.

Table 6-3: CIP Projects Capital Costs

Proj. ID	Project Name	Capital Cost	Total BRVA Risk Score
Infrastructure Projects			
I-1	Granada Pump Station Improvements	\$209,000	8.5
I-2	Pine Glen / Pineridge (EMA 1) Switchback Redesign	\$221,-000	8.2
I-3	Rosemont / Hwy 210 Crossing Retrofit ¹	\$181,000 - \$1,611,000	11.4
I-4	Briggs / Hwy 210 Crossing Retrofit ¹	\$203,000 - \$1,902,000	10.0
I-5	Hillside Dr Private Lateral Backflow Preventer	\$35,000	14.6
I-6	Dorothy / Goss Canyon Access Road	\$90,000	6.0
I-7	Starfall / Ridgeline Access Road	\$107,000	6.0
I-8	Diverter Valve Upgrades	\$41,000	7.3
Non-Infrastructure Projects²			
N-1	Rosemont, Briggs Crossings Condition Assessment	\$231,000	-
N-2	Smart Cover Installation	\$34,000	-
N-3	Interceptor Items	\$3,000	-
N-4	EMA 7 Monitoring	\$4,000	-
N-5	SS 1,2,3 Monitoring	\$12,000	-
N-6	Work Order Database	\$8,000	-

Notes:

1. Lower end of capital cost range consists of installation of seismic joints only. Higher end of range consists of installation of seismic joints and full replacement of sewer line and casing pipe.
2. Non-Infrastructure Projects not scored as part of BRVA

6.2.2 O&M Costs

For the infrastructure CIP projects, there is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

For the non-infrastructure CIP projects, the annual O&M costs are shown in Table 6-4.

Table 6-4: Non-Infrastructure CIP Project O&M Costs

Proj. ID	Project Name	Annual O&M Cost
N-1	Rosemont, Briggs Crossings Condition Assessment	N/A
N-2	Smart Cover Installation	\$10,000
N-3	Interceptor Items	\$3,000
N-4	EMA 7 Monitoring	N/A
N-5	SS 1,2,3 Monitoring	\$12,000
N-6	Work Order Database	N/A

6.3 CIP Project Schedule

Based on the listed CIP project costs in Table 6-3 and Table 6-4 and assuming an annual CIP budget of \$500,000, there are two alternative CIP Plans based on the scopes of Projects I-3 and I-4 depending on the findings of the bridge crossing inspections. CIP Plan A reflects the best-case scenario where all that is needed to fix the bridge crossings the seismic join installations. CIP Plan B reflects the worst-case scenario, assuming that full replacement of the bridge crossing casing and gravity sewer pipe require replacement. All dollar amounts displayed in the CIP Plans are in 2024 dollars.

6.3.1 CIP Plan A

CIP Plan A would consist of all listed projects, with Projects I-3 and I-4 being seismic retrofits only. Under Plan A, all project capital costs will be committed with the \$500,000 annual budget within 5 years. CIP Plan A is displayed in Table 6-5.

6.3.2 CIP Plan B

CIP Plan B would consist of all listed projects, with Projects I-3 and I-4 including seismic retrofits and full replacements of sewer line and casing pipe. Under Plan B, all project capital costs can be committed with the \$500,000 annual budget within 10 years. CIP Plan B is displayed in Table 6-6.

Table 6-5: CIP Plan A Schedule

Proj ID	Infrastructure Projects	Asset Condition	Total Risk Score	Year									
				1	2	3	4	5	6	7	8	9	10
I-1	Granada Pump Station Improvements	4.0	8.5	\$209,000									
I-2	Pine Glen / Pineridge (EMA 1) Switchback Redesign	4.0	8.2		\$221,000								
I-3	Rosemont / Hwy 210 Crossing Retrofit ¹	2.0	14.6		\$181,000								
I-4	Briggs / Hwy 210 Crossing Retrofit ¹	2.0	6.0			\$203,000							
I-5	Hillside Dr Private Lateral Backflow Preventer	2.0	6.0		\$35,000								
I-6	Dorothy / Goss Canyon Access Road	3.0	11.4			\$90,000							
I-7	Starfall / Ridgepine Access Road	3.0	10.0			\$107,000							
I-8	Diverter Valve Upgrades	3.0	7.3			\$41,000							
Non-Infrastructure Projects													
N-1	Rosemont, Briggs Crossings Cond. Assessment	-	-	\$231,000									
N-2	Smart Cover Installation ²	-	-	\$34,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
N-3	Interceptor Items ²	-	-	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
N-4	EMA 7 Monitoring	-	-		\$4,000								
N-5	SS 1,2,3 Monitoring	-	-	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000					
N-6	Work Order Database	-	-	\$8,000									
Project Total				\$497,000	\$466,000	\$466,000	\$25,000	\$25,000	\$13,000	\$13,000	\$13,000	\$13,000	\$13,000
CIP Budget				\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000

Notes:

1. Bridge crossing projects consist of seismic retrofits only.
2. Smart Cover Installation and Interceptor Items are ongoing and indefinite. They will continue to have O&M costs beyond this 10-year schedule.

Table 6-6: CIP Plan B Schedule

Proj ID	Infrastructure Projects	Asset Condition	Total Risk Score	Year									
				1	2	3	4	5	6	7	8	9	10
I-1	Granada Pump Station Improvements	4.0	8.5	\$209,000									
I-2	Pine Glen / Pineridge (EMA 1) Switchback Redesign	4.0	8.2		\$221,000								
I-3	Rosemont / Hwy 210 Crossing Retrofit ¹	3.0	11.4		\$250,000	\$475,000	\$475,000	\$411,000					
I-4	Briggs / Hwy 210 Crossing Retrofit ¹	3.0	10.0						\$487,000	\$487,000	\$487,000	\$441,000	
I-5	Hillside Dr Private Lateral Backflow Preventer	2.0	14.6					\$35,000					
I-6	Dorothy / Goss Canyon Access Road	2.0	6.0										\$90,000
I-7	Starfall / Ridgepine Access Road	2.0	6.0										\$107,000
I-8	Diverter Valve Upgrades	3.0	7.3									\$41,000	
Non-Infrastructure Projects													
N-1	Rosemont, Briggs Crossings Cond. Assessment	-	-	\$231,000									
N-2	Smart Cover Installation ²	-	-	\$34,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
N-3	Interceptor Items ²	-	-	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
N-4	EMA 7 Monitoring	-	-		\$4,000								
N-5	SS 1,2,3 Monitoring	-	-	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000					
N-6	Work Order Database	-	-	\$8,000									
Project Total				\$497,000	\$500,000	\$500,000	\$500,000	\$471,000	\$500,000	\$500,000	\$500,000	\$495,000	\$210,000
CIP Budget				\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000

Notes:

- 1. Bridge crossing projects consist of seismic retrofits only.
- 2. Smart Cover Installation and Interceptor Items are ongoing and indefinite. They will continue to have O&M costs beyond this 5-year schedule.

6.4 Additional Recommendations

This section covers additional recommendations beyond the development of the CIP implementation plans.

6.4.1 Pipeline Rehabilitation Program

6.4.1.1 Existing Pipeline Age & Materials

Given that most pipes in the system are homogenous in terms of material and age, adopting a distinct approach for prioritizing sewer pipes for rehabilitation is crucial. The use of condition assessment data from the SSMP offers a more nuanced method to distinguish pipes based on their current condition and operational effectiveness. CVWD is currently in the process of developing a digital database of condition assessment data for the collection system gravity sewer pipes. Once this database is complete, the condition data should be imported into GIS to identify any spatial patterns among pipes with abnormally poor condition scores.

CVWD's collection system is over 99% VCP, and CVWD also requires all new gravity sewer to be VCP, as guided by the SSMP. VCP is notably resistant to sewerage contaminants, and has served CVWD well since the inception of the collection system in the 1980's in terms of resistance to seismic events and major breaks. The useful life of VCP is also commonly cited as greater than 100 years. However, VCP has limited tensile strength, making it susceptible to damage from root intrusion and prone to leaks. Table 6-7 shows the age of pipes by number of reaches within the system. A "reach" is defined as one continuous gravity sewer pipe alignment from one maintenance hole to another.

Table 6-7: Sewer Pipe Age – Year Installed by Amount of Reaches

Year Installed (Decades)	No. of reaches	Percentage
Unknown	21	1.27%
1950s	6	0.36%
1960s	135	8.19%
1970s	22	1.33%
1980s	1,449	87.87%
1990s	4	0.24%
2000s	12	0.73%

6.4.1.2 Current Rehabilitation Practices

Per CVWD's SSMP, CVWD has consistently demonstrated its capability to promptly repair any damages in the collection system as soon as deficiencies are identified. To manage extensive repairs and upgrades efficiently, any project with an estimated cost exceeding \$100,000, such as CIPP relining, hydraulic upgrades, or main replacements, is classified as a CIP project and becomes a prioritized project for CVWD. These projects are then scheduled and managed by the Engineering Department to ensure timely and effective implementation as soon as it is

practical to do so. This approach ensures that significant repairs and enhancements to the collection system are handled systematically and efficiently, maintaining the integrity and functionality of the wastewater management infrastructure.

6.4.1.3 Proposed Rehabilitation Methodology

The WWMP's recommended Rehabilitation Methodology adopts a structured and systematic approach to uphold and enhance CVWD's sewer infrastructure. The methodology is organized as follows:

- Condition Assessment
- High Risk Prioritization – BRVA, CIP Schedule
- Rehabilitation Techniques – Planning and Overview
- Design and Engineering
- Implementation
- Quality Control
- Documentation
- Community engagement
- Continuous Monitoring
- Non-Infrastructure Improvements

Utilizing recent CIPP cost data from projects KJ prepared for LACSD (see Table 6-8) , a comprehensive evaluation of the costs associated with CIPP liners was carried out, the details of which are illustrated in Figure 6-1. This analysis is instrumental for appraising future sewer rehabilitation projects. A key finding from scrutinizing past project invoices is that shorter CIPP lining projects tend to be more expensive per LF than longer projects, a phenomenon attributed to economies of scale. To determine the cost per LF for each diameter of sewer pipe owned by CVWD, an initial step involved calculating an exponential function. This function provides a baseline for understanding the varying costs associated with different pipe diameters and lengths, enabling more accurate budgeting and planning for future rehabilitation endeavors.

Table 6-8: LACSD CIPP Liner Cost Data

Project	Year	Total Cost	Liner Size	Length (ft)	Unit Cost
LACSD - District 01	2023	\$3,749,240	10"	2,342	\$80
Trunk Sewers			12"	4,425	\$102
Group 1			15"	1,089	\$177
Rehabilitation			18"	7,536	\$165
LACSD - District 05	2023	\$2,457,626	10"	1,304	\$71
Trunk Sewers			15"	10,390	\$144
Group 1			18"	609	\$206
Rehabilitation	2024	In-Progress	24"	662	\$320
LACSD - Joint			25"	19,681	\$225
Outfall H Unit 9B			28"	1,937	\$255

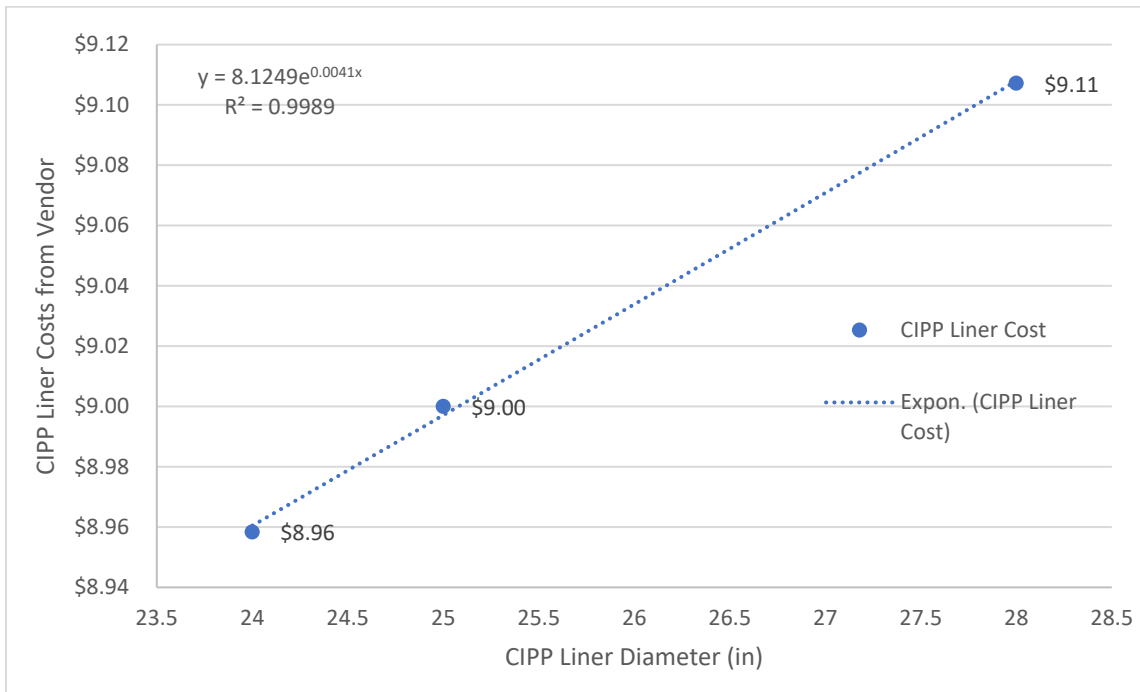


Figure 6-1: CIPP Liner Exponential Function Costs

The next phase in the analysis focused on evaluating the Economies of Scale related to CIPP lining costs. A key assumption was that contractors increase the cost for CIPP liners when the required length is less than 1,000 LF, as liners are typically sold in 1,000-foot rolls. An average incremental rate of \$0.0129 per LF was calculated for each foot below this 1,000 LF threshold. Based on these insights, a series of cost curves was developed (see Figure 6-2), providing the approximate cost per linear foot based on the estimated length of the CIPP project and the diameter of the pipe to be lined. These cost curves allow for a quick estimate of the initial cost for CIPP lining based on pipe diameter and length. This estimate method strictly covers the CIPP liner cost and does not account for additional expenses such as CCTV inspection, sewer pipe cleaning, spot repairs, and other variables that could influence the total project cost.

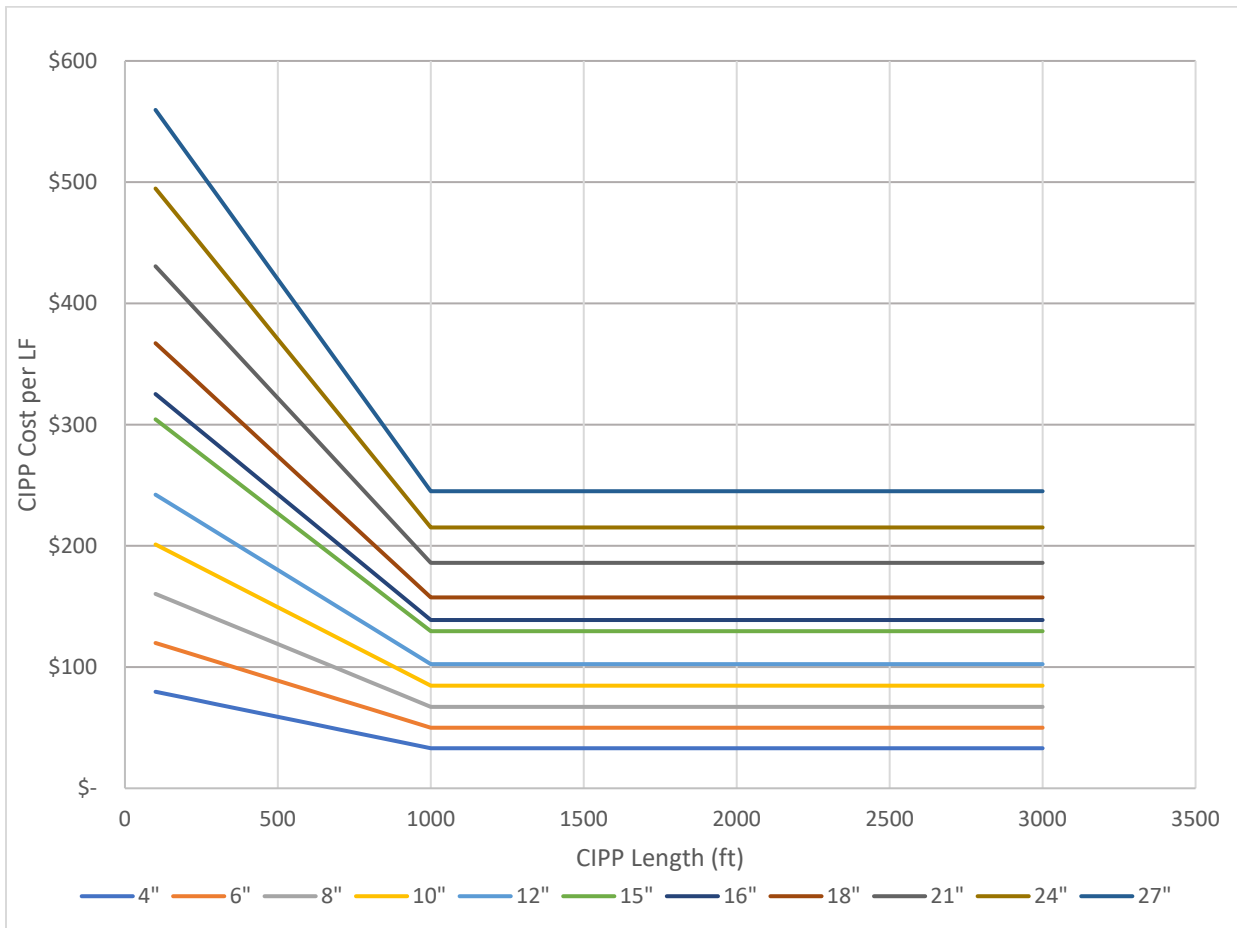


Figure 6-2: CIPP Lining Cost Curves

6.4.2 Recommended SSMP Updates

Based on the findings of this WWMP, the following changes are recommended for the next round of updates for the SSMP:

1. Update Section 5 – Design and Performance Provisions to include language recommending/requiring that the developer utilizes the new collection system hydraulic model to evaluate if the proposed development sewer flows will have any impacts on the downstream gravity sewer pipes. This will protect CVWD from approving a development flow that the existing collection system cannot accommodate within the required capacity criteria and will provide justification for CVWD to have the developer share in the costs of any required infrastructure improvements (likely upsizing the downstream gravity sewer) to accommodate the new development. If new sewer pipe is being constructed, this will also help evaluate whether or not the design criteria laid out in the SSMP will be met by the proposed sewer configuration.
2. Update Section 4.3.4 Enhanced Maintenance Areas (EMAs). Remove language specifying that sewers constructed outside of CVWD's design parameters (flat sewers) should be classified as an EMA. Due to the nature of the collection system and the

decrease in sewer flows due to conservation, A majority of the collection system does not meet the minimum velocity design criterion of 2.5 fps laid out in the SSMP. Therefore, a majority of the collection system would be classified as an EMA, making difficult to distinguish which areas operations staff should focus on regularly maintaining. EMA classification should largely be based on input from operations staff during maintenance activities as well as collected condition assessment data.

3. Update the Lift Station Maintenance & Inspection Checklist to analyze the number of starts per hour per sewer lift station pump. Each pump should be starting no more than 6 times per hour to avoid the motor from overheating.

References

- County of Los Angeles. (2022). *Revised County of Los Angeles Housing Element (2021-2029)*.
- Crescenta Valley Water District. (2019). *Sewer System Management Plan*.
- Crescenta Valley Water District. (2021). *Overview & History of CVWD's Wastewater System - Part 1*.
- Crescenta Valley Water District. (2021). *Overview & History of CVWD's Wastewater System - Part 2*.
- DIR. (2021). *Cal/OSHA - Title 8 Regulations*. State of California Department of Industrial Regulations.
- NFPA. (2023). *NFPA 820.A NFPA 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2024 Edition*.
- Pacific Institute. (2024, January 17). *California Urban Water Use Data*. Retrieved from <https://pacinst.org/>
- SA Associates. (2021). *2020 Urban Water Management Plan*.
- SA Associates. (2021). *2020 Urban Water Management Plan*.
- State of California Department of Industrial Relations. (2021). *Cal/OSHA = Title 8 Regulations*.
- Tetra Tech. (2021). *Hazard Mitigation Plan*.

Appendix A Enhanced Maintenance Area Locations

EMA #	Location
1	Pine Glen Rd / Pineridge Dr
2	La Crescenta & Orange
3	Foothill & Briggs (76 Station)
4	Foothill between Sunset/Briggs, North Side
5	2000 Hilldale Dr
6	Waltonia between Hilldale and Montrose
7	Canalda and Ocean View flush tank
8	Prospect Ave between Sunset and Rosemont
9	Community between Ramsdell & Glenwood
10	Mountain Pine & Timberlake

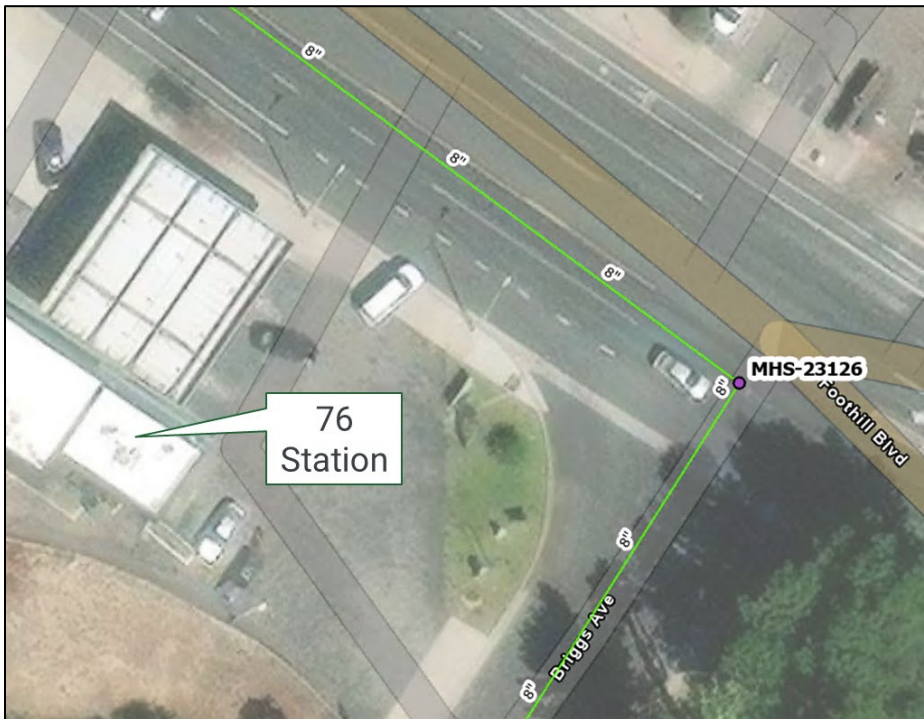
EMA 1 - Pine Glen Rd / Pineridge Dr



EMA 2 - La Crescenta & Orange



EMA 3 - Foothill & Briggs (76 Station)



EMA 4 - Foothill between Sunset/Briggs, North Side



EMA 5 - 2000 Hilldale Dr



EMA 6 - Waltonia between Hilldale and Montrose



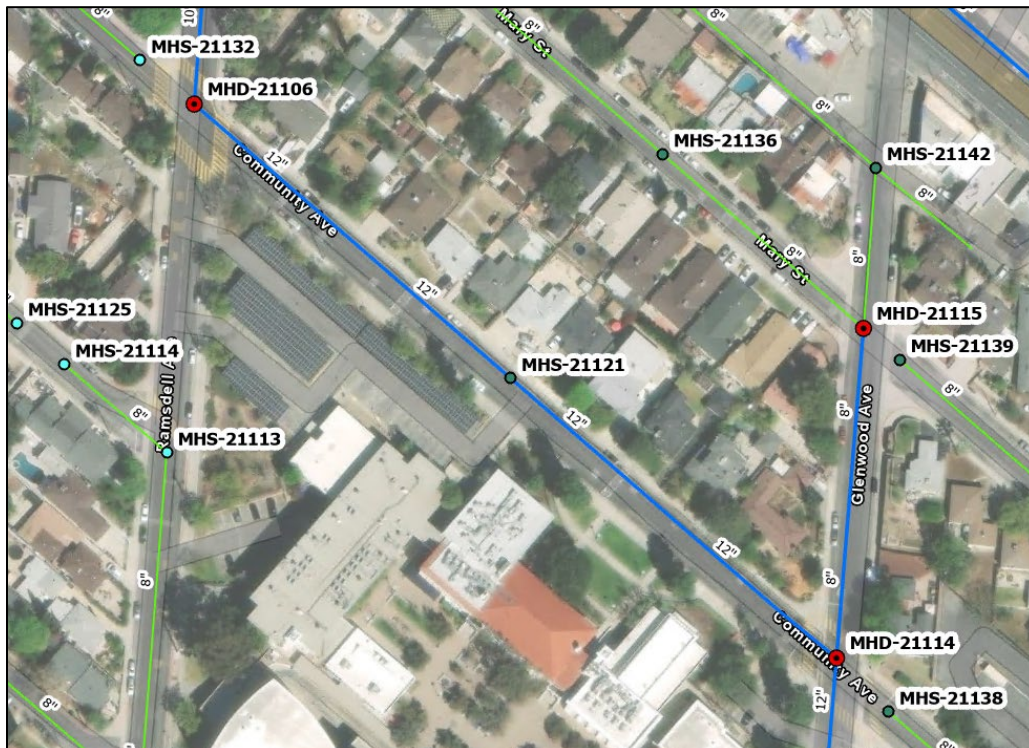
EMA 7 - Canalda and Ocean View flush tank



EMA 8 - Prospect Ave between Sunset and Rosemont



EMA 9 - Community between Ramsdell & Glenwood



EMA 10 - Mountain Pine & Timberlake



Appendix B Housing Element 2021-2029 Parcel Information

Introduction

The following is an excerpt from the Executive Summary from the Housing Element 2021 – 2029 document:

The County of Los Angeles is required to ensure the availability of residential sites, at adequate densities and appropriate development standards, in the unincorporated Los Angeles County to accommodate its share of the regional housing need--also known as the Regional Housing Needs Allocation (RHNA). Unincorporated Los Angeles County has been assigned a RHNA of 90,052 units for the 2021-2029 Housing Element planning period, which is subdivided by level of affordability as follows:

Extremely Low / Very Low (<50% AMI) - 25,648

Lower (50 - 80% AMI) - 13,691

Moderate (80 - 120% AMI) - 14,180

Above Moderate (>120% AMI) - 36,533

Total - 90,052

NOTES - Pursuant to State law, the projected need of extremely low income households can be estimated at 50% of the very low income RHNA. Therefore, the County's projected extremely low income can be estimated at 12,824 units. However, for the purpose of identifying adequate sites for RHNA, no separate accounting of sites for extremely low income households is required. AMI = Area Median Income

The Sites Inventory (Appendix A) is comprised of vacant and underutilized sites within unincorporated Los Angeles County that are zoned at appropriate densities and development standards to facilitate housing development. The Sites Inventory was developed specifically for the County of Los Angeles, and has built-in features that filter sites based on specific criteria, including access to transit, protection from environmental hazards, and other criteria unique to unincorporated Los Angeles County. Other strategies used within the Sites Inventory analysis to accommodate the County's assigned RHNA of 90,052 units include projected growth of ADUs, specific plan capacity, selected entitled projects, and capacity or planned development on County-owned sites within cities. This accounts for approximately 38 percent of the RHNA. The remaining 62 percent of the RHNA is accommodated by sites to be rezoned to accommodate higher density housing development (Appendix B).

Caveats:

This data is a snapshot in time, generally from the year 2021. It contains information about parcels, zoning and land use policy that may be outdated. The Department of Regional Planning will be keeping an internal tally of sites that get developed or rezoned to meet our RHNA goals, and we may, in the future, develop some public facing web applications or dashboards to show the progress. There may even be periodic updates to this GIS dataset as well, throughout this 8-year planning cycle.

"Rezoning"

Field Descriptions:

OBJECTID - Internal GIS ID

AIN - Assessor Identification Number*

SitusAddress - Site Address (Street and Number) from Assessor Data*

Use Code - Existing Land Use Code (corresponds to Use Type and Use Description) from Assessor Data*

Use Type - Existing Land Use Type from Assessor Data*

Use Description - Existing Land Use Description from Assessor Data*

Vacant / Nonvacant – Parcels that are vacant or non-vacant per the Use Code from the Assessor Data*

Units Total - Total Existing Units from Assessor Data*

Max Year - Maximum Year Built from Assessor Data*

Supervisory District (2021) - LA County Board of Supervisor District

Submarket Area - Inclusionary Housing Submarket Area

Planning Area - Planning Areas from the LA County Department of Regional Planning General Plan 2035

Community Name - Unincorporated Community Name

Plan Name - Land Use Plan Name from the LA County Department of Regional Planning (General Plan and Area / Community Plans)

LUP - 1 - Land Use Policy from Dept. of Regional Planning - Primary Land Use Policy (in cases where there are more than one Land Use Policy category present)*

LUP - 1 (% area) - Land Use Policy from Dept. of Regional Planning - Primary Land Use Policy (% of parcel covered in cases where there are more than one Land Use Policy category present)*

LUP - 2 - Land Use Policy from Dept. of Regional Planning - Secondary Land Use Policy (in cases where there are more than one Land Use Policy category present)*

LUP - 2 (% area) - Land Use Policy from Dept. of Regional Planning - Secondary Land Use Policy (% of parcel covered in cases where there are more than one Land Use Policy category present)*

LUP - 3 - Land Use Policy from Dept. of Regional Planning - Tertiary Land Use Policy (in cases where there are more than one Land Use Policy category present)*

LUP - 3 (% area) - Land Use Policy from Dept. of Regional Planning - Tertiary Land Use Policy (% of parcel covered in cases where there are more than one Land Use Policy category present)*

Current LUP (Description) – This is a brief description of the land use category. In the case of multiple land uses, this would be the land use category that covers the majority of the parcel*

Current LUP (Min Density - net or gross) - Minimum density for this category (as net or gross) per the Land Use Plan for this area

Current LUP (Max Density - net or gross) - Maximum density for this category (as net or gross) per the Land Use Plan for this area

Proposed LUP – Final – The proposed land use category to increase density.

Proposed LUP (Description) – Brief description of the proposed land use policy.

"Rezoning"

Field Descriptions:

Prop. LUP – Final (Min Density) – Minimum density for the proposed land use category.

Prop. LUP – Final (Max Density) – Maximum density for the proposed land use category.

Zoning - 1 - Zoning from Dept. of Regional Planning - Primary Zone (in cases where there are more than one zone category present)*

Zoning - 1 (% area) - Zoning from Dept. of Regional Planning - Primary Zone (% of parcel covered in cases where there are more than one zone category present)*

Zoning - 2 - Zoning from Dept. of Regional Planning - Secondary Zone (in cases where there are more than one zone category present)*

Zoning - 2 (% area) - Zoning from Dept. of Regional Planning - Secondary Zone (% of parcel covered in cases where there are more than one zone category present)*

Zoning - 3 - Zoning from Dept. of Regional Planning - Tertiary Zone (in cases where there are more than one zone category present)*

Zoning - 3 (% area) - Zoning from Dept. of Regional Planning - Tertiary Zone (% of parcel covered in cases where there are more than one zone category present)*

Current Zoning (Description) - This is a brief description of the zoning category. In the case of multiple zoning categories, this would be the zoning that covers the majority of the parcel*

Proposed Zoning – Final – The proposed zoning category to increase density.

Proposed Zoning (Description) – Brief description of the proposed zoning.

Acres - Acreage of parcel

Max Units Allowed - Total Proposed Land Use Policy Units

RHNA Eligible? – Indicates whether the site is RHNA Eligible or not. NOTE: This layer only shows those that are RHNA Eligible, but internal versions of this layer also show sites that were not-RHNA eligible, or removed during the development of this layer in 2020 – 2022.

Very Low Income Capacity - Total capacity for the Very Low Income level as defined in the Housing Element

Low Income Capacity - Total capacity for the Low Income level as defined in the Housing Element

Moderate Income Capacity - Total capacity for the Moderate Income level as defined in the Housing Element

Above Moderate Income Capacity - Total capacity for the Above Moderate Income level as defined in the Housing Element

Realistic Capacity - Total Realistic Capacity of parcel (totaling all income levels). Several factors went into this final calculation. See the Housing Element (Links to Other Resources above) in the following locations - "Sites Inventory - Lower Income RHNA" (p. 223), and "Rezoning - Very Low / Low Income RHNA" (p231).

Income Categories - Income Categories assigned to the parcel (relates to income capacity units)

Lot Consolidation ID - Parcels with a unique identifier for consolidation potential (based on parcel ownership)

Lot Consolidation Notes - Specific notes for consolidation

Consolidation - Adjacent Parcels - All adjacent parcels that are tied to each lot consolidation IDs

Shape_Length - Perimeter (feet)

Shape_Area - Area (sq feet)

"Sites Inventory"

Field Descriptions:

OBJECTID - Internal GIS ID

AIN - Assessor Identification Number*

ASI Status - Sites Inventory Status (Nonvacant or Vacant)

SitusAddress- Site Address (Street and Number) from Assessor Data*

SitusCity - Site Address (City) from Assessor Data*

SitusZIP - Site Address (ZIP) from Assessor Data*

LV_IV_Ratio - Land Value to Improvement Value Ratio from Assessor Data*

YearBuiltMax- Maximum Year Built from Assessor Data*

Use Code - Existing Land Use Code (corresponds to Use Type and Use Description) from Assessor Data*

Use Type - Existing Land Use Type from Assessor Data*

Use Description - Existing Land Use Description from Assessor Data*

Publicly Owned - If publicly owned, indicates whether it's Federal, State, County, or Special District

Units Total - Total Existing Units from Assessor Data*

Supervisorial District (2021) - LA County Board of Supervisor District

Submarket Area - Inclusionary Housing Submarket Area

Planning Area - Planning Areas from the LA County Department of Regional Planning General Plan 2035

Community Name - Unincorporated Community Name

Plan Name - Land Use Plan Name from the LA County Department of Regional Planning (General Plan and Area / Community Plans)

Zoning - 1 - Zoning from Dept. of Regional Planning - Primary Zone (in cases where there are more than one zone category present)*

Zoning - 1 (% area) - Zoning from Dept. of Regional Planning - Primary Zone (% of parcel covered in cases where there are more than one zone category present)*

Zoning - 2 - Zoning from Dept. of Regional Planning - Secondary Zone (in cases where there are more than one zone category present)*

Zoning - 2 (% area)- Zoning from Dept. of Regional Planning - Secondary Zone (% of parcel covered in cases where there are more than one zone category present)*

Zoning - 3 - Zoning from Dept. of Regional Planning - Tertiary Zone (in cases where there are more than one zone category present)*

Zoning - 3 (% area) - Zoning from Dept. of Regional Planning - Tertiary Zone (% of parcel covered in cases where there are more than one zone category present)*

LUP - 1 - Land Use Policy from Dept. of Regional Planning - Primary Land Use Policy (in cases where there are more than one Land Use Policy category present)*

LUP - 1 (% area) - Land Use Policy from Dept. of Regional Planning - Primary Land Use Policy (% of parcel covered in cases where there are more than one Land Use Policy category present)*

"Sites Inventory"

Field Descriptions:

LUP - 2 - Land Use Policy from Dept. of Regional Planning - Secondary Land Use Policy (in cases where there are more than one Land Use Policy category present)*

LUP - 2 (% area) - Land Use Policy from Dept. of Regional Planning - Secondary Land Use Policy (% of parcel covered in cases where there are more than one Land Use Policy category present)*

LUP - 3 - Land Use Policy from Dept. of Regional Planning - Tertiary Land Use Policy (in cases where there are more than one Land Use Policy category present)*

LUP - 3 (% area) - Land Use Policy from Dept. of Regional Planning - Tertiary Land Use Policy (% of parcel covered in cases where there are more than one Land Use Policy category present)*

SP - 1 - Specific Plan from Dept. of Regional Planning - Primary Specific Plan (in cases where there are more than one Specific Plan category present)*

SP - 1 (desc) - Specific Plan from Dept. of Regional Planning - Primary Specific Plan Category Description (in cases where there are more than one Specific Plan category present)*

SP - 1 (% area) - Specific Plan from Dept. of Regional Planning - Primary Specific Plan (% of parcel covered in cases where there are more than one Specific Plan category present)*

SP - 2 - Specific Plan from Dept. of Regional Planning - Secondary Specific Plan (in cases where there are more than one Specific Plan category present)*

SP - 2 (desc) - Specific Plan from Dept. of Regional Planning - Secondary Specific Plan Category Description (in cases where there are more than one Specific Plan category present)*

SP - 2 (% area) - Specific Plan from Dept. of Regional Planning - Secondary Specific Plan (% of parcel covered in cases where there are more than one Specific Plan category present)*

SP - 3 - Specific Plan from Dept. of Regional Planning - Tertiary Specific Plan (in cases where there are more than one Specific Plan category present)*

SP - 3 (desc) - Specific Plan from Dept. of Regional Planning - Tertiary Specific Plan Category Description (in cases where there are more than one Specific Plan category present)*

SP - 3 (% area) - Specific Plan from Dept. of Regional Planning - Tertiary Specific Plan (% of parcel covered in cases where there are more than one Specific Plan category present)*

Acres - Acreage of parcel

LUP Units - Total - Total Land Use Policy Units (note - takes into account different densities and % area covered if there are multiple categories)

Current LUP (Min Density - net or gross)- Minimum density for this category (as net or gross) per the Land Use Plan for this area

Current LUP (Max Density - net or gross) - Maximum density for this category (as net or gross) per the Land Use Plan for this area

Site Status - Status of the site - mostly shows as 'available', but some are flagged as 'Pending Project'

"Sites Inventory"

Field Descriptions:

Very Low Income Capacity - Total capacity for the Very Low Income level as defined in the Housing Element

Low Income Capacity - Total capacity for the Low Income level as defined in the Housing Element

Moderate Income Capacity - Total capacity for the Moderate Income level as defined in the Housing Element

Above Moderate Income Capacity - Total capacity for the Above Moderate Income level as defined in the Housing Element

Realistic Capacity - **Total Realistic Capacity of parcel (totaling all income levels). Several factors went into this final calculation. See the Housing Element (Links to Other Resources above) in the following locations - "Sites Inventory - Lower Income RHNA" (p. 223), and "Rezoning - Very Low / Low Income RHNA" (p231).**

Income Categories - Income Categories assigned to the parcel (relates to income capacity units)

Lot Consolidation ID - Parcels with a unique identifier for consolidation potential (based on parcel ownership)

Lot Consolidation Notes - Specific notes for consolidation

Consolidation - Adjacent Parcels - All adjacent parcels that are tied to each lot consolidation IDs

Used in Previous Housing Elements? - These are the Very Low and Low Income level parcels that showed up in previous Housing Elements

Shape_Length - Perimeter (feet)

Shape_Area - Area (sq feet)

Appendix C Hydraulic Model Calibration Results

Temporary Flow Monitoring for CVWD Sewer Hydraulic Modeling

Final Report Submitted to **Crescenta Valley Water District**
April 18, 2023



ADS ENVIRONMENTAL
SERVICES

Temporary Flow Monitoring for CVWD Sewer Hydraulic Modeling

Prepared For:

Brook Yared M.S., P.E.
Crescenta Valley Water District
2700 Foothill Blvd
La Crescenta, CA 91214

Prepared By:



ADS, LLC
15203 Springdale Street
Huntington Beach, CA 92649



April 18, 2023

Brook Yared M.S., P.E.
Crescenta Valley Water District
2700 Foothill Blvd
La Crescenta, CA 91214

SUBJECT: Temporary Flow Monitoring for CVWD Sewer Hydraulic Modeling

Dear Brook Yared,

ADS is pleased to submit the report for the Temporary Flow Monitoring for CVWD Sewer Hydraulic Modeling completed on behalf of the Crescenta Valley Water District. The metering was conducted at nine (9) locations. The study was conducted during the period of Thursday, 01 December 2022 to Wednesday, 15 March 2023.

The report contains depth, velocity, and quantity hydrographs as well as daily long tables for the metering period. An Excel file containing depth, quantity, and velocity entities for the monitoring location in 5-minute format has already been provided.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Shay Koerber at (619) 520-9168.

It has been our pleasure to be of service to you in the performance of this project. Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,

ADS ENVIRONMENTAL SERVICES

Sean O'Donnell
Hydraulic Data Analyst

Scope and Methodology

Introduction

Crescenta Valley Water District (CVWD) entered into an agreement with ADS Environmental Services to conduct flow monitoring at (8) eight locations in the Crescenta Valley, CA Sanitary Collection System. The study was originally scheduled for a period of (90) ninety days, from December 1 to March 1. However, due to a significant imbalance of flow at site FM04 (i.e. CVWD-selected manhole (MH) flow did not comprise all the flow from the tributary intended), three additional locations were installed including FM04a at the next MH upstream of FM04, which was installed at no cost as a courtesy by ADS (but the imbalance persisted).

Then, in furtherance of the effort to solve the imbalance issue, CVWD amended the agreement to include an additional installation at site FM09 (6 MHs further upstream of original FM04) where flow balance was reasonable (i.e. with only FM08 upstream) and ADS offered to extend the end period of the study by 14 days, again at no cost to CVWD as a courtesy. Then, CVWD elected to further amend the agreement and relocate FM09 to a new location FM04b (capturing the northern flow in the same MH as FM05) and operate that location through the end of the courtesy extended period. The monitoring period for FM04A is January 18, 2023 – March 15, 2023. The monitoring period for FM04B is March 3, 2023 – March 15, 2023. The monitoring period for FM09 is February 8, 2023 (installation date) – March 3, 2023 (when it was moved on CVWD request to FM04B). Following further investigation of the imbalance at site FM04 it was discovered that the tributary maps provided for sites FM04 and FM04A were not accurate. This contributed to the confusion over the imbalance and recorded data at sites FM04 and FM04A. Please refer to the project timeline/summary below for additional detail.

Site Name	Monitoring Period	Balancing	Uptime Rate	Location Notes
FM01	12/1/22-3/15/23		100%	
FM02	12/1/22-3/15/23		100%	
FM03	12/1/22-3/15/23		100%	Moved sensor to outlet on 2/7 to improve data quality which was successful.
FM04	12/1/22-2/7/23		100%	This meter was moved to new location FM09 on 2/7 at CVWD request.
FM04a	1/18/22-3/15/23		100%	ADS installed additional meter on 1/18 at no cost to help solve flow balance issue. No change in flow rates after install. Moved sensor to outlet to improve data quality but no marked improvement.
FM04b	3/3/23-3/15/23	FM08+FM06= FM04b	100%	ADS offered to extend an additional 14 days at no charge and client asked to FM09 to new FM04b (\$3800) and monitor for the remaining duration of the courtesy-extended project duration.
FM05	12/1/22-3/15/23		100%	
FM06	12/1/22-3/15/23		100%	
FM07	12/1/22-3/15/23		100%	
FM08	12/1-3/4/23		88%	Monitor experienced failure during courtesy period and we had a data gap from 3/4/23- 3/15/23. ADS reinstalled a meter and let run for an addtion 6 days from 3/16 to 3/22, data available on request.
FM09	2/8/23-3/3/23		100%	This meter was moved to new location FM04b on 3/3 at CVWD request.

The flow monitoring equipment was to be used to measure depth, velocity, and to quantify flows. The objective of this study was to confirm sanitary sewer flows in the monitored locations for planning purposes.

Project Scope

The scope of this study involved using a flow monitor to quantify wastewater flow at the designated locations for the study period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions
- Flow monitor installation
- Flow monitor confirmations and data collections
- Flow data analysis

Equipment installation was completed on November 29, 2022. The monitoring period began on December 1, 2022 and was completed on March 15, 2023. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment



The **ADS FlowShark Triton** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS FlowShark Triton monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The FS Triton monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The FS Triton monitor can support two (2) sets of sensors. The sensor option used for this project was:

The Peak Combo Sensor installed at the bottom of the pipe includes three types of data acquisition technologies.

The **up looking ultrasonic depth** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by sensor to calculate depth.

The **pressure depth** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain **peak velocity**, the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless-steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.





Data Collection, Confirmation, and Quality Assurance

Data collection was done remotely via wireless connect on a weekly basis. As needed, during the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare the meter readings to confirm that they agreed. The site met the criteria for confirmation for depth and velocity unless noted otherwise in the site commentary section. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the **Continuity Equation** and the **Manning Equation**. The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows ($< 1'$) that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs. Hydrographs are based on 15-minute averaging. Tables are provided in 5-minute format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the flow data table and hydrograph.

DEPTH - Final calculated depth measurement (in inches)

QUANTITY - Final calculated flow rate (in MGD)

VELOCITY - Final calculated flow velocity (in feet per second)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

Site Commentary

SITE INFORMATION

Pipe	Round (12 in H)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.20	6.79	0.451
Minimum	1.35	4.01	0.137
Maximum	4.42	9.20	1.533
Min Time	02/07/2023 4:15:00 AM	12/08/2022 3:15:00 AM	03/07/2023 3:45:00 AM
Max Time	01/09/2023 7:45:00 PM	01/09/2023 11:15:00 PM	01/09/2023 7:45:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

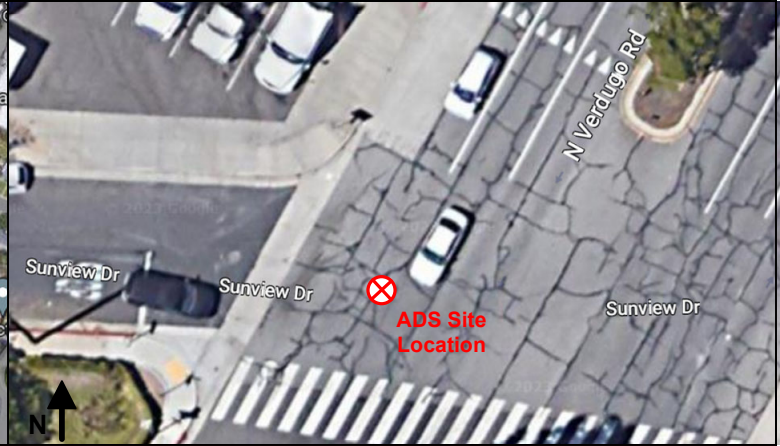
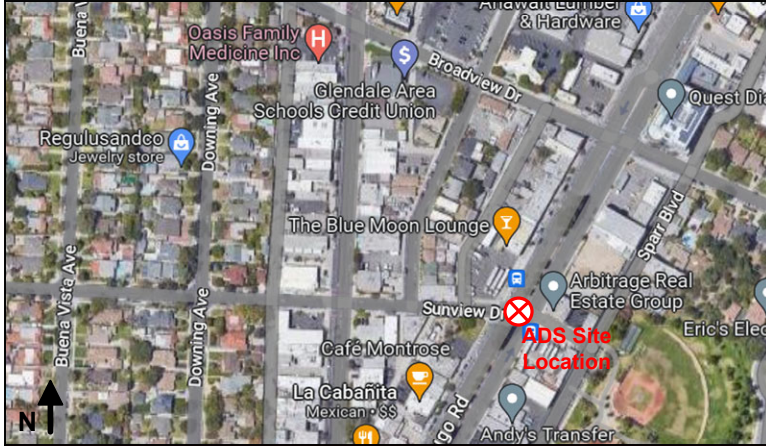
Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Project Name: CVWD.MasterPlan.TFM.CA22		City: Glendale		Agency: CVWD		FM Initials: VM	
Site Name: FM01		Install Date: 11/29/22		Monitor Type		Peak Doppler	
Address/Location: 3501 N Verdugo Rd, Glendale, CA 91208				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		MHS-32101	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		12.00 "
					Pipe Width:		12.00 "



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	11/7/22 1:00am	Manhole Depth:		10'-06"	
Site Hydraulics:	Good straight through Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:		VCP/Good	
Upstream Manhole:	Not Investigated	Land Use:	Residential ☐	Commercial ☒	Industrial ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	1.63 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	5.93 fps				
Silt:	0 Inches				

Other Information:	
	Cross Section
	Plan

Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

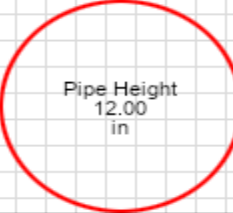
Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report
FM01

Flow Monitor

FM01



Pipe Height
12.00
in

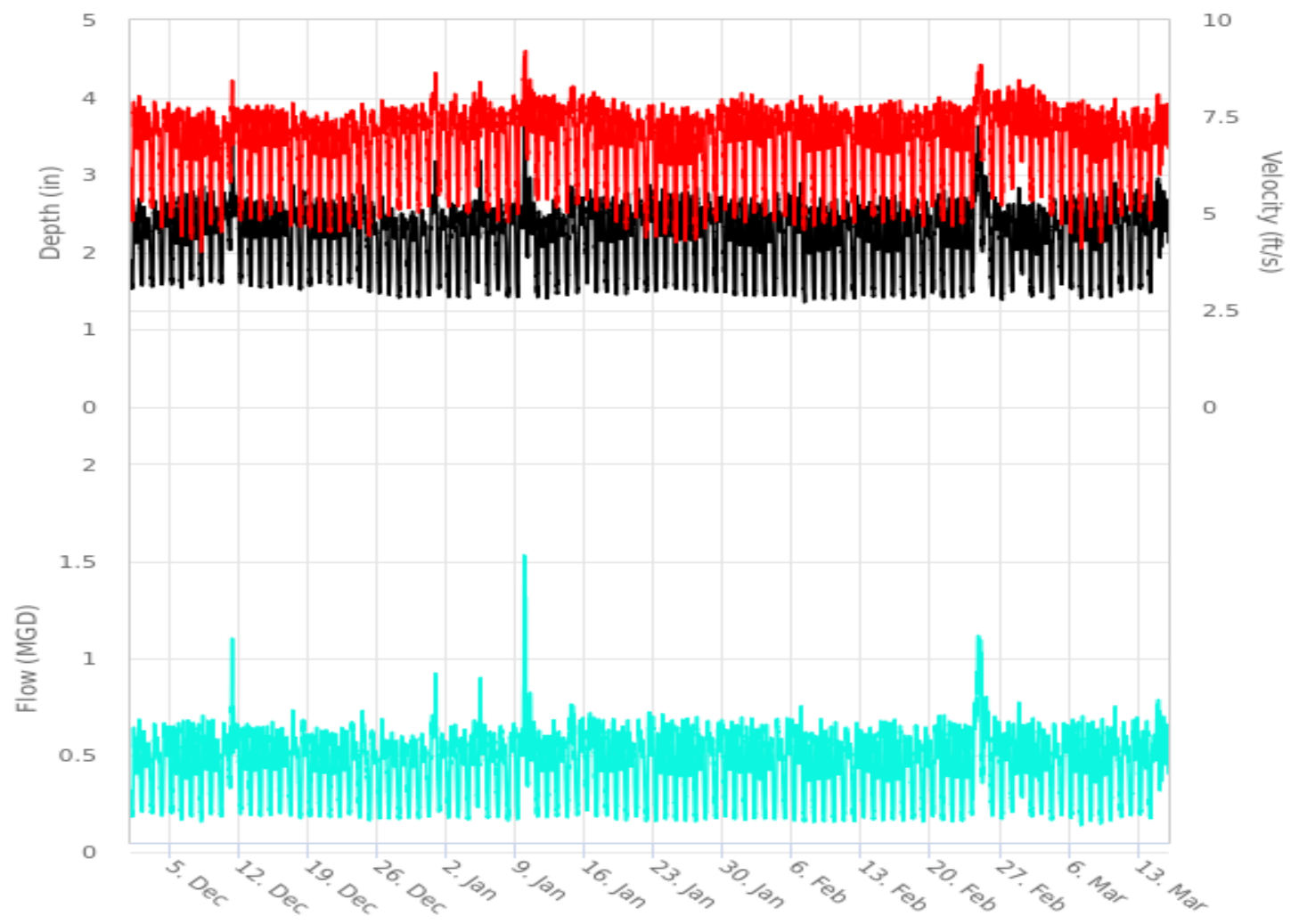
Report Period

12/01/2022
To
03/15/2023

Legend

— DFINAL
— QFINAL
— VFINAL





Scattergraph Report

FM01

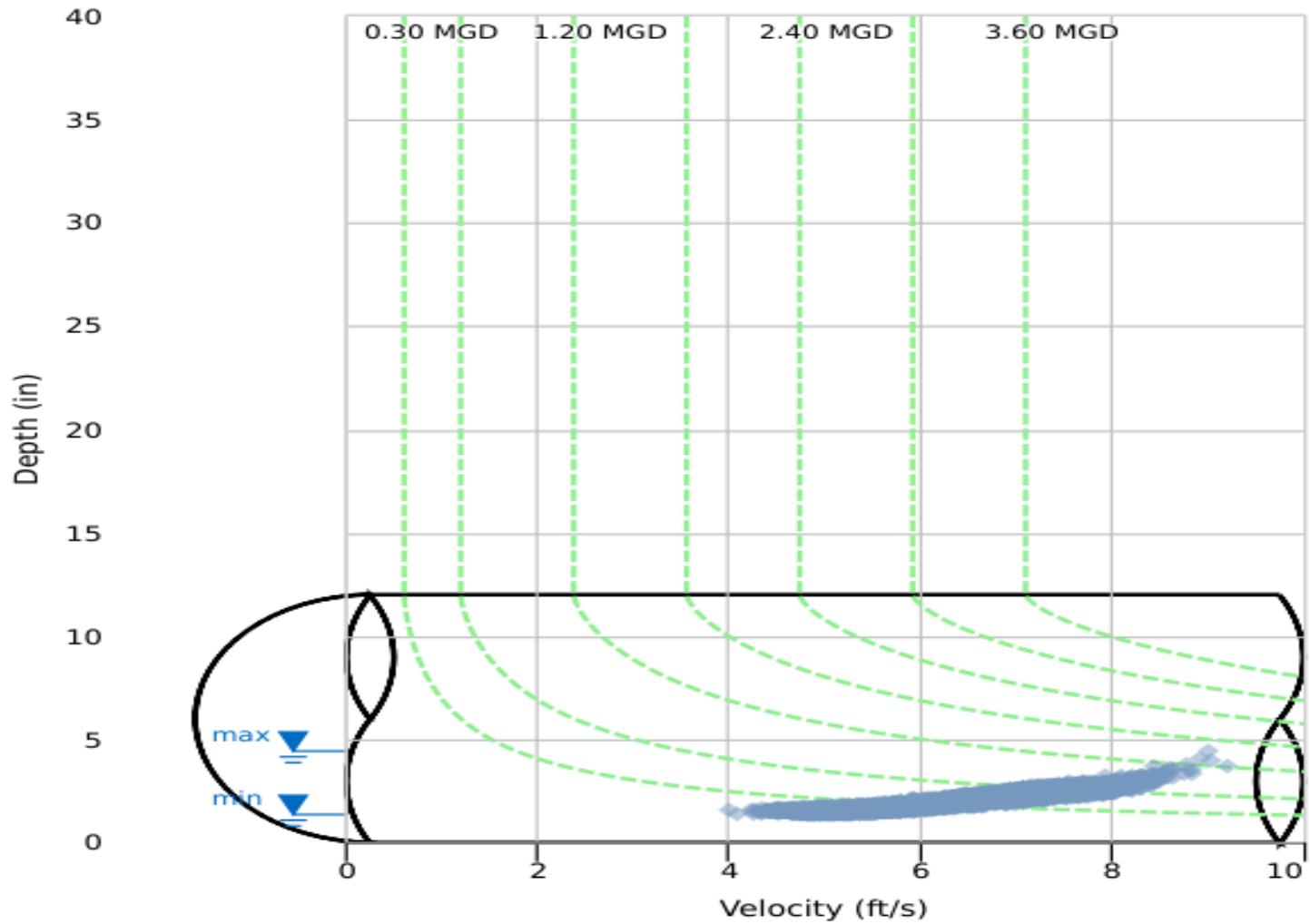
Flow Monitor
FM01

Pipe Height
12.00
in

Report Period
12/01/2022
To
03/15/2023

Legend
 ○ DFINAL - VFINAL
 --- Iso-QTM
 ▽ Min-Max Depth

ADS ENVIRONMENTAL
SERVICES



Daily Tabular Report

12/01/2022 00:00 - 03/15/2023 23:55
FM01Pipe: Round (12 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	04:00	1.53	20:50	2.78	2.16	04:15	4.58	20:50	8.15	6.77	04:15	0.173	20:50	0.727	0.436	0.436	-	
12/02/2022	03:30	1.57	08:00	2.64	2.15	03:30	5.24	08:35	7.83	6.81	03:30	0.205	08:00	0.643	0.433	0.433	-	
12/03/2022	05:00	1.54	10:55	2.69	2.19	05:00	5.06	09:30	8.00	6.82	05:00	0.193	09:30	0.673	0.449	0.449	-	
12/04/2022	04:35	1.58	09:50	2.75	2.22	04:25	4.48	19:35	7.99	6.73	04:25	0.178	09:55	0.685	0.455	0.455	-	
12/05/2022	04:40	1.58	07:40	2.74	2.22	04:10	4.76	20:30	7.90	6.69	04:30	0.193	07:40	0.683	0.447	0.447	-	
12/06/2022	04:25	1.54	08:00	2.80	2.18	04:20	4.36	19:35	7.83	6.46	04:20	0.166	08:05	0.694	0.425	0.425	-	
12/07/2022	04:45	1.64	08:05	2.81	2.24	04:35	4.26	21:05	7.65	6.44	04:35	0.178	07:55	0.679	0.438	0.438	-	
12/08/2022	03:15	1.56	08:10	2.87	2.25	03:25	3.97	20:20	7.86	6.39	03:25	0.155	07:50	0.715	0.439	0.439	-	
12/09/2022	04:10	1.61	07:55	2.83	2.25	03:35	4.62	07:55	7.82	6.41	04:10	0.193	07:55	0.715	0.435	0.435	-	
12/10/2022	03:55	1.60	10:05	2.85	2.28	04:20	4.40	10:00	7.57	6.40	04:20	0.179	10:05	0.693	0.448	0.448	-	
12/11/2022	02:15	2.01	06:50	3.70	2.57	00:15	5.76	06:55	8.50	7.16	00:40	0.328	06:50	1.128	0.579	0.579	-	
12/12/2022	03:50	1.58	19:45	2.75	2.25	03:20	4.76	19:50	7.91	6.72	03:25	0.192	19:45	0.684	0.459	0.459	-	
12/13/2022	03:50	1.56	20:25	2.72	2.21	03:50	4.81	20:30	7.94	6.70	03:50	0.186	20:25	0.667	0.445	0.445	-	
12/14/2022	04:40	1.54	08:10	2.73	2.22	03:15	4.76	20:00	7.96	6.73	04:40	0.184	08:10	0.677	0.449	0.449	-	
12/15/2022	03:40	1.54	08:15	2.75	2.19	03:40	4.89	08:15	7.94	6.72	03:40	0.186	08:15	0.695	0.442	0.442	-	
12/16/2022	04:20	1.58	08:15	2.68	2.20	02:40	4.97	09:35	7.87	6.67	04:25	0.199	09:35	0.658	0.438	0.438	-	
12/17/2022	04:00	1.57	09:35	2.89	2.24	04:50	4.60	09:35	7.98	6.63	04:50	0.182	09:35	0.752	0.452	0.452	-	
12/18/2022	04:45	1.51	11:40	2.83	2.22	05:20	4.54	11:45	7.74	6.65	05:20	0.170	11:40	0.708	0.447	0.447	-	
12/19/2022	03:55	1.56	20:10	2.72	2.23	04:25	4.56	20:10	7.75	6.54	03:25	0.182	20:10	0.668	0.442	0.442	-	
12/20/2022	03:40	1.60	08:55	2.72	2.25	03:30	4.41	19:20	7.65	6.49	03:30	0.179	08:55	0.637	0.443	0.443	-	
12/21/2022	04:35	1.58	10:15	2.71	2.24	04:40	4.46	19:30	7.58	6.45	04:35	0.178	10:15	0.647	0.436	0.436	-	
12/22/2022	04:05	1.58	08:50	2.74	2.24	04:05	4.48	19:35	7.72	6.48	04:05	0.176	08:50	0.651	0.438	0.438	-	
12/23/2022	04:25	1.58	10:00	2.76	2.25	04:00	4.66	09:45	7.78	6.60	04:25	0.189	09:45	0.684	0.449	0.449	-	
12/24/2022	04:25	1.53	11:15	2.90	2.23	04:25	4.45	10:20	7.92	6.66	04:25	0.168	11:15	0.740	0.455	0.455	-	
12/25/2022	05:15	1.49	10:35	2.72	2.13	04:25	4.15	11:10	7.72	6.58	04:25	0.151	10:35	0.658	0.417	0.417	-	
12/26/2022	03:45	1.46	10:20	2.79	2.14	04:40	4.77	10:25	8.05	6.76	03:50	0.171	10:25	0.703	0.435	0.435	-	
12/27/2022	03:50	1.44	11:00	2.61	2.10	03:50	4.86	19:00	7.92	6.87	03:50	0.168	11:05	0.630	0.425	0.425	-	
12/28/2022	04:10	1.41	08:55	2.52	2.07	04:40	4.96	10:55	7.89	6.86	04:40	0.167	09:00	0.608	0.418	0.418	-	
12/29/2022	04:20	1.42	12:25	2.55	2.09	03:50	5.04	19:35	7.96	6.86	03:50	0.172	12:30	0.613	0.419	0.419	-	
12/30/2022	04:15	1.41	11:35	2.59	2.10	04:15	4.89	11:20	7.98	6.86	04:15	0.164	11:20	0.626	0.424	0.424	-	
12/31/2022	05:10	1.45	20:40	3.33	2.28	04:05	5.15	20:40	8.79	7.14	04:05	0.180	20:40	1.009	0.508	0.508	-	
01/01/2023	05:15	1.52	12:35	2.61	2.16	04:55	5.41	14:10	7.98	6.97	04:55	0.204	12:35	0.636	0.444	0.444	-	
01/02/2023	04:35	1.41	19:50	2.72	2.14	04:10	5.14	19:50	8.21	6.91	04:25	0.175	19:50	0.709	0.441	0.441	-	
01/03/2023	04:40	1.42	19:35	2.65	2.13	04:15	5.14	20:25	7.93	6.83	04:40	0.176	19:35	0.661	0.431	0.431	-	
01/04/2023	04:35	1.40	20:40	2.69	2.17	03:00	4.93	19:20	8.17	6.85	03:50	0.167	19:20	0.694	0.447	0.447	-	
01/05/2023	03:50	1.60	10:15	3.29	2.36	01:20	5.64	08:55	8.51	7.26	03:55	0.230	10:15	0.948	0.528	0.528	-	
01/06/2023	04:05	1.44	11:25	2.63	2.16	03:45	4.95	09:00	7.98	6.87	03:45	0.172	09:05	0.635	0.443	0.443	-	
01/07/2023	04:35	1.51	11:20	2.73	2.15	04:10	4.70	12:40	7.86	6.78	04:10	0.175	11:20	0.665	0.436	0.436	-	
01/08/2023	05:00	1.41	19:45	2.66	2.16	04:40	4.72	19:35	8.16	6.87	04:50	0.160	19:35	0.682	0.448	0.448	-	
01/09/2023	04:00	1.42	19:45	4.57	2.36	03:45	4.97	23:15	9.35	7.22	03:45	0.168	19:45	1.621	0.546	0.546	-	
01/10/2023	23:55	1.85	10:30	3.05	2.39	04:30	6.26	10:15	8.62	7.45	04:30	0.333	10:30	0.858	0.542	0.542	-	
01/11/2023	04:20	1.41	09:10	2.61	2.08	04:00	5.29	09:10	8.26	7.15	04:20	0.177	09:10	0.673	0.436	0.436	-	
01/12/2023	03:25	1.40	10:45	2.77	2.11	04:20	5.32	10:45	8.68	7.01	03:15	0.180	10:45	0.771	0.436	0.436	-	
01/13/2023	03:25	1.46	08:35	2.60	2.13	03:20	5.06	08:35	7.95	7.00	03:20	0.178	08:35	0.644	0.442	0.442	-	
01/14/2023	05:15	1.44	13:05	2.90	2.24	05:10	4.73	17:45	8.52	7.08	05:10	0.165	17:45	0.788	0.488	0.488	-	
01/15/2023	04:35	1.47	12:25	2.78	2.21	03:55	5.14	18:35	8.17	7.03	04:20	0.185	18:35	0.713	0.472	0.472	-	
01/16/2023	04:50	1.59	12:10	2.83	2.32	04:25	5.29	21:20	8.25	7.11	04:25	0.212	12:10	0.732	0.505	0.505	-	
01/17/2023	03:50	1.48	20:15	2.74	2.18	03:10	4.96	07:45	8.23	6.85	03:55	0.182	07:45	0.710	0.447	0.447	-	
01/18/2023	03:55	1.49	20:30	2.76	2.19	03:55	5.07	20:30	8.12	6.81	03:55	0.184	20:30	0.717	0.447	0.447	-	
01/19/2023	04:45	1.45	19:00	2.68	2.18	04:20	4.71	19:55	7.96	6.70	04:25	0.166	19:55	0.660	0.440	0.440	-	
01/20/2023	03:25	1.45	08:05	2.79	2.18	03:35	4.55	07:50	7.93	6.62	03:35	0.161	08:05	0.698	0.433	0.433	-	
01/21/2023	04:20	1.50	10:15	2.83	2.24	05:00	4.85	09:50	7.77	6.60	04:20	0.179	10:15	0.696	0.449	0.449	-	
01/22/2023	03:55	1.48	11:15	2.91	2.28	03:45	4.28	20:25	7.95	6.62	03:45	0.155	20:25	0.745	0.469	0.469	-	
01/23/2023	03:55	1.49	20:00	2.85	2.25	03:55	4.37	19:40	7.95	6.50	03:55	0.159	19:50	0.726	0.449	0.449	-	
01/24/2023	03:15	1.54	19:10	2.81	2.25	03:10	4.29	19:50	7.85	6.41	03:10	0.165	19:45	0.695	0.439	0.439	-	
01/25/2023	04:10	1.52	08:05	2														

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/09/2023	04:30	1.39	20:45	2.66	2.09	04:20	4.64	07:50	7.92	6.67	04:20	0.153	20:50	0.656	0.411	0.411	-
02/10/2023	03:55	1.39	07:50	2.70	2.09	03:35	4.66	07:45	7.93	6.67	03:35	0.154	07:50	0.679	0.410	0.410	-
02/11/2023	04:50	1.39	09:30	2.68	2.12	03:55	4.69	09:30	7.81	6.70	03:55	0.157	09:30	0.660	0.424	0.424	-
02/12/2023	05:05	1.41	11:20	2.74	2.15	04:40	4.62	19:50	7.88	6.72	04:40	0.155	11:20	0.676	0.436	0.436	-
02/13/2023	04:55	1.44	19:10	2.74	2.16	04:55	5.02	19:15	7.89	6.74	04:55	0.173	19:10	0.679	0.435	0.435	-
02/14/2023	03:55	1.42	21:00	2.78	2.12	03:50	4.84	21:05	8.01	6.68	03:50	0.165	21:05	0.704	0.419	0.419	-
02/15/2023	03:35	1.41	20:05	2.76	2.11	02:20	4.69	20:10	8.10	6.63	04:15	0.161	20:05	0.699	0.416	0.416	-
02/16/2023	03:50	1.43	07:35	2.75	2.11	03:50	4.77	20:00	8.01	6.69	03:50	0.162	07:35	0.701	0.420	0.420	-
02/17/2023	04:00	1.40	08:00	2.61	2.13	04:00	4.71	08:00	7.86	6.74	04:00	0.156	08:00	0.642	0.427	0.427	-
02/18/2023	04:00	1.43	10:15	2.70	2.14	04:40	4.88	11:55	7.86	6.76	04:40	0.168	11:55	0.665	0.435	0.435	-
02/19/2023	04:35	1.41	10:35	2.70	2.11	04:20	4.60	10:40	7.87	6.71	04:20	0.154	10:35	0.670	0.422	0.422	-
02/20/2023	03:55	1.47	19:40	2.76	2.22	03:55	5.14	19:35	8.15	6.93	03:55	0.183	19:35	0.715	0.468	0.468	-
02/21/2023	04:40	1.40	07:35	2.82	2.15	04:20	4.68	08:00	8.05	6.74	04:40	0.156	08:00	0.723	0.436	0.436	-
02/22/2023	03:55	1.41	20:20	2.73	2.12	04:15	4.62	21:00	7.93	6.66	03:55	0.155	08:10	0.676	0.422	0.422	-
02/23/2023	03:40	1.41	20:55	2.76	2.12	03:35	4.67	20:55	8.06	6.65	03:35	0.158	20:55	0.712	0.421	0.421	-
02/24/2023	02:45	1.48	18:25	3.71	2.67	02:30	5.02	23:20	8.89	7.49	02:35	0.183	18:25	1.149	0.668	0.668	-
02/25/2023	04:00	1.99	00:45	3.38	2.54	04:40	6.26	00:55	8.87	7.57	04:05	0.351	00:45	1.032	0.603	0.603	-
02/26/2023	04:20	1.43	10:40	2.74	2.16	04:30	5.34	21:35	8.32	7.12	04:30	0.183	10:40	0.724	0.463	0.463	-
02/27/2023	04:40	1.38	20:00	2.72	2.12	04:25	5.18	20:40	8.32	7.13	04:25	0.170	20:00	0.702	0.448	0.448	-
02/28/2023	04:10	1.48	20:45	2.90	2.16	05:05	5.56	20:10	8.54	7.21	04:10	0.202	20:45	0.804	0.462	0.462	-
03/01/2023	05:25	1.70	08:10	2.68	2.22	01:35	6.28	20:50	8.35	7.40	05:25	0.280	08:10	0.692	0.484	0.484	-
03/02/2023	04:25	1.42	20:55	2.67	2.10	04:25	5.14	07:45	8.44	7.07	04:25	0.174	07:45	0.700	0.437	0.437	-
03/03/2023	03:55	1.48	10:30	2.63	2.11	04:30	5.35	07:55	8.19	7.04	04:30	0.193	07:55	0.660	0.437	0.437	-
03/04/2023	04:00	1.40	09:55	2.76	2.13	04:00	4.79	11:40	8.22	6.89	04:00	0.158	09:55	0.683	0.436	0.436	-
03/05/2023	04:20	1.58	10:20	2.75	2.24	04:55	4.50	19:00	8.04	6.81	04:55	0.181	18:55	0.689	0.463	0.463	-
03/06/2023	04:50	1.49	20:45	2.78	2.18	03:55	4.37	21:00	8.00	6.68	03:55	0.168	08:05	0.702	0.437	0.437	-
03/07/2023	03:55	1.40	07:50	2.80	2.16	03:50	4.02	07:50	7.98	6.54	03:50	0.134	07:50	0.720	0.425	0.425	-
03/08/2023	02:55	1.44	08:05	2.78	2.16	02:50	4.55	21:25	7.75	6.52	02:50	0.157	08:10	0.686	0.422	0.422	-
03/09/2023	04:00	1.41	08:00	2.82	2.17	03:30	4.24	07:45	7.82	6.52	03:30	0.145	07:55	0.699	0.427	0.427	-
03/10/2023	04:10	1.43	14:40	2.95	2.25	03:25	4.68	14:45	8.07	6.69	04:25	0.161	14:45	0.776	0.462	0.462	-
03/11/2023	05:10	1.48	11:45	2.79	2.24	05:20	4.84	10:55	7.74	6.69	05:15	0.175	10:55	0.684	0.454	0.454	-
03/12/2023	05:05	1.51	19:55	2.94	2.24	05:50	4.99	20:00	7.94	6.67	05:10	0.186	19:55	0.760	0.457	0.457	-
03/13/2023	04:20	1.52	19:40	2.77	2.24	03:30	4.93	19:40	7.87	6.66	03:30	0.188	19:40	0.696	0.451	0.451	-
03/14/2023	03:55	1.47	23:40	3.01	2.28	03:15	4.76	23:15	8.14	6.73	03:15	0.172	23:40	0.807	0.472	0.472	-
03/15/2023	03:55	1.91	00:15	2.94	2.46	02:00	5.93	09:55	7.99	7.21	03:55	0.313	00:15	0.764	0.545	0.543	-

12/01/2022 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			47.308	
Average	2.20	6.79	0.451	



Site Commentary

SITE INFORMATION

Pipe	Round (18 in H)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location.

This line is located downstream of sites FM03 and FM04. A moderate net flow was recorded between the sites.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	5.33	3.33	1.007
Minimum	2.96	1.16	0.169
Maximum	8.98	7.40	4.142
Min Time	01/25/2023 4:45:00 AM	01/30/2023 5:15:00 AM	02/12/2023 5:15:00 AM
Max Time	01/09/2023 7:45:00 PM	01/09/2023 8:00:00 PM	01/09/2023 7:45:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

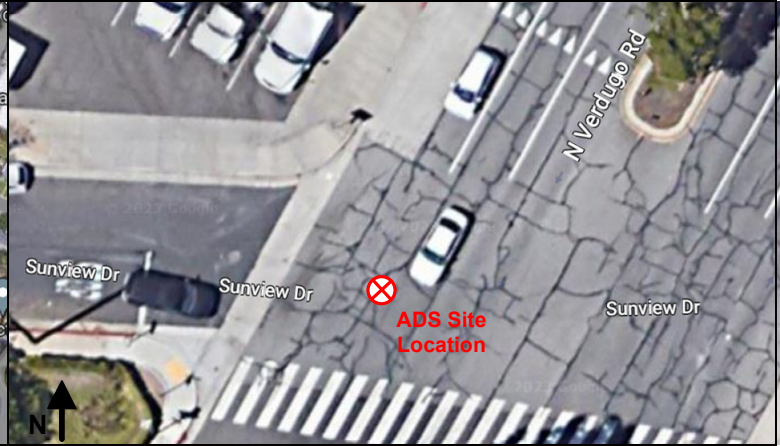
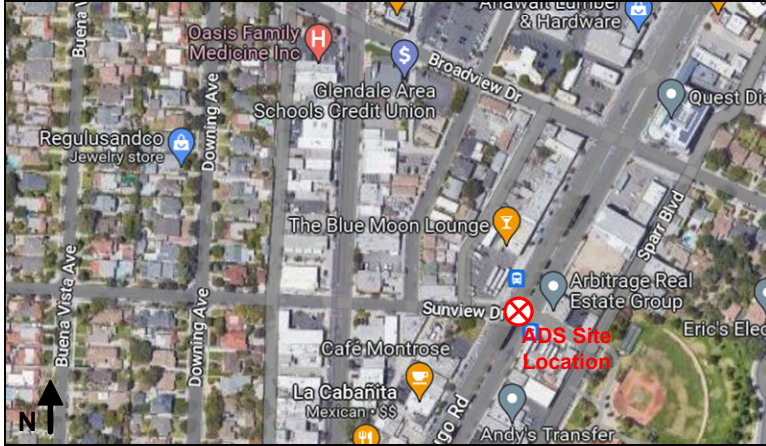
Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Project Name: CVWD.MasterPlan.TFM.CA22		City: Glendale		Agency: CVWD		FM Initials: VM	
Site Name: FM02		Install Date: 11/28/22		Monitor Type		Peak Doppler	
Address/Location: 3501 N Verdugo Rd, Glendale, CA 91208				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		MHS-32101	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		18.00 "
					Pipe Width:		18.00 "



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	11/07/22 @ 1:57 AM	Manhole Depth:		10'-06"	
Site Hydraulics:	Good straight through Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:		VCP/Good	
Upstream Manhole:	Not Investigated	Land Use:	Residential ☐	Commercial ☒	Industrial ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	3.25 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	2.00 fps				
Silt:	0 Inches				

Other Information:	
	Cross Section
	Plan

Installation Information		Backup		Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐		
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐		
Surcharge Height:	0	WWTP	☐	☒	☐		
Rain Gauge Zone:		Other	☐	☒	☐		

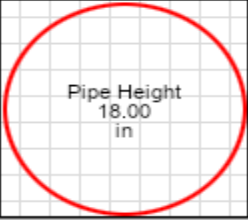
Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report
FM02

Flow Monitor

FM02



Pipe Height
18.00
in

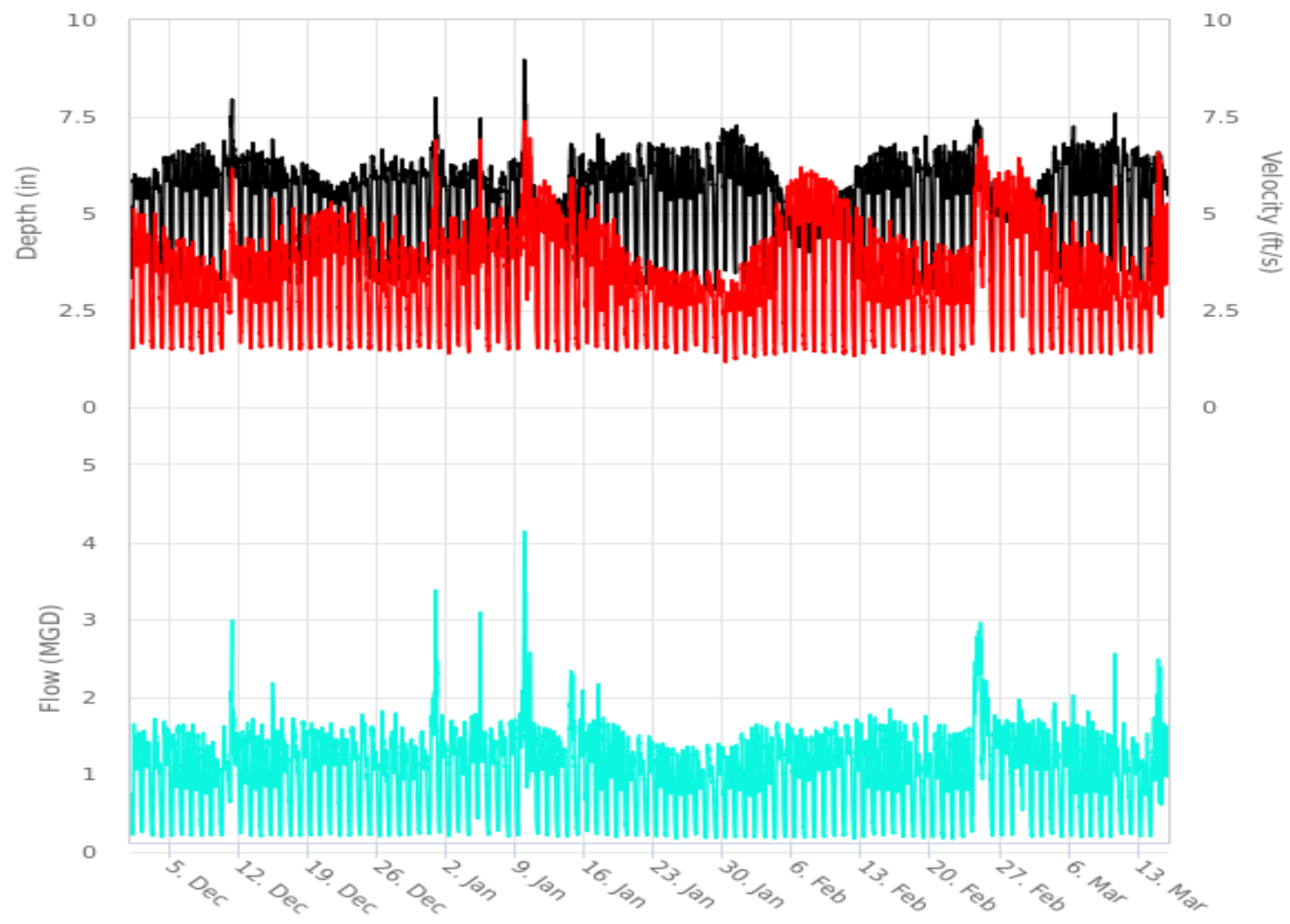
Report Period

12/01/2022
To
03/15/2023

Legend

— DFINAL
— QFINAL
— VFINAL





Scattergraph Report

FM02

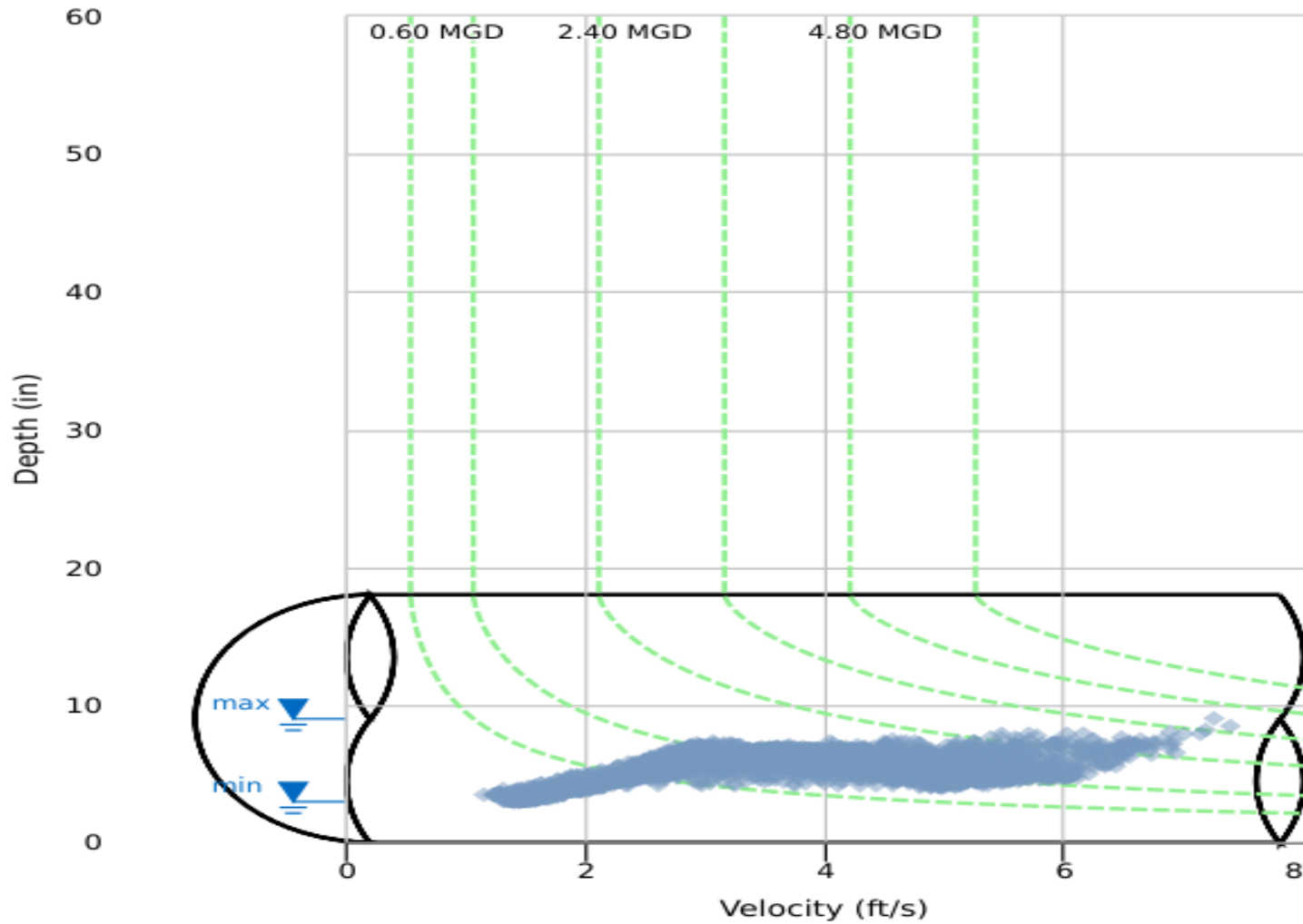
Flow Monitor
FM02

Pipe Height
18.00
in

Report Period
12/01/2022
To
03/15/2023

Legend
○ DFINAL - VFINAL
--- Iso-QTH
▼ Min-Max Depth

ADS ENVIRONMENTAL
SERVICES



Daily Tabular Report

12/01/2022 00:00 - 03/15/2023 23:55
FM02Pipe: Round (18 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	04:30	3.33	09:25	6.05	5.15	04:50	1.48	08:10	5.28	3.54	04:30	0.215	08:10	1.717	1.026	1.026	-	
12/02/2022	04:40	3.47	21:40	6.04	5.17	04:45	1.61	08:40	5.09	3.50	04:45	0.250	08:00	1.618	1.010	1.010	-	
12/03/2022	05:30	3.14	13:05	6.20	5.17	05:25	1.49	10:35	5.12	3.31	05:25	0.200	10:35	1.770	0.981	0.981	-	
12/04/2022	05:20	3.01	10:25	6.50	5.28	05:15	1.50	10:50	4.73	3.18	05:15	0.191	10:50	1.710	0.974	0.974	-	
12/05/2022	04:50	3.22	20:40	6.70	5.43	03:55	1.47	19:50	4.39	2.97	04:40	0.208	20:35	1.661	0.934	0.934	-	
12/06/2022	04:55	3.26	08:20	6.68	5.38	04:55	1.50	08:15	4.53	2.97	04:55	0.211	08:15	1.730	0.917	0.917	-	
12/07/2022	04:35	3.24	20:35	6.79	5.52	04:35	1.46	08:10	4.41	2.79	04:35	0.204	08:10	1.726	0.894	0.894	-	
12/08/2022	04:50	3.37	08:05	6.87	5.53	04:45	1.35	08:15	4.02	2.71	04:45	0.201	08:15	1.592	0.865	0.865	-	
12/09/2022	05:15	3.37	08:25	6.54	5.42	05:15	1.41	07:55	3.95	2.76	05:15	0.209	07:55	1.436	0.854	0.854	-	
12/10/2022	05:25	3.26	10:50	6.90	5.49	05:25	1.46	10:50	4.10	2.74	05:25	0.206	10:50	1.649	0.877	0.877	-	
12/11/2022	01:10	5.05	06:50	8.02	6.35	01:10	2.38	06:50	6.28	3.87	01:10	0.623	06:50	3.089	1.441	1.441	-	
12/12/2022	03:45	3.26	20:25	6.69	5.45	03:40	1.61	20:20	4.49	3.07	03:40	0.228	20:20	1.716	0.958	0.958	-	
12/13/2022	05:20	3.17	08:05	6.87	5.37	05:20	1.48	08:20	4.42	2.93	05:20	0.201	08:20	1.765	0.901	0.901	-	
12/14/2022	05:10	3.07	08:10	6.66	5.37	04:30	1.53	08:20	4.40	2.91	05:15	0.202	08:10	1.677	0.898	0.898	-	
12/15/2022	04:55	3.16	08:20	6.97	5.38	03:55	1.55	08:20	5.54	3.13	04:45	0.212	08:20	2.263	0.976	0.976	-	
12/16/2022	04:45	3.14	08:20	6.47	5.29	04:40	1.47	08:20	4.77	3.23	04:40	0.197	08:20	1.759	0.977	0.977	-	
12/17/2022	05:25	3.20	09:30	6.26	5.27	05:20	1.48	10:30	5.31	3.35	05:20	0.204	10:30	1.828	1.015	1.015	-	
12/18/2022	05:40	3.20	10:25	6.42	5.30	05:25	1.47	11:45	5.11	3.36	05:25	0.203	10:40	1.746	1.030	1.030	-	
12/19/2022	04:35	3.26	09:20	6.15	5.24	04:45	1.49	20:00	5.09	3.49	04:45	0.210	08:20	1.687	1.045	1.045	-	
12/20/2022	04:30	3.19	11:30	5.88	5.07	04:25	1.51	20:40	5.20	3.66	04:25	0.207	08:15	1.658	1.042	1.042	-	
12/21/2022	04:55	3.30	08:15	5.79	5.00	04:55	1.55	08:20	5.44	3.77	04:55	0.222	08:20	1.712	1.039	1.039	-	
12/22/2022	05:00	3.23	11:55	5.98	5.09	04:15	1.45	10:00	5.26	3.63	04:45	0.203	10:00	1.625	1.036	1.036	-	
12/23/2022	04:55	3.19	13:00	6.12	5.18	04:55	1.45	09:45	5.15	3.49	04:55	0.199	10:00	1.649	1.029	1.029	-	
12/24/2022	05:25	3.24	17:25	6.31	5.29	05:30	1.52	11:30	5.20	3.43	05:30	0.213	10:30	1.793	1.052	1.052	-	
12/25/2022	05:35	3.31	11:50	6.52	5.36	04:35	1.47	10:50	4.51	3.05	05:35	0.215	10:50	1.661	0.940	0.940	-	
12/26/2022	05:25	3.17	11:40	6.73	5.37	05:25	1.43	10:45	4.81	2.99	05:25	0.194	10:45	1.830	0.937	0.937	-	
12/27/2022	05:00	3.20	20:00	6.55	5.38	05:00	1.44	20:30	4.97	3.11	05:00	0.198	20:30	1.805	0.971	0.971	-	
12/28/2022	04:55	3.27	11:45	6.44	5.36	05:15	1.45	11:45	4.59	3.05	04:50	0.209	11:45	1.685	0.938	0.938	-	
12/29/2022	05:00	3.29	11:15	6.43	5.34	04:30	1.48	10:35	4.21	3.02	05:00	0.212	11:15	1.480	0.921	0.921	-	
12/30/2022	04:50	3.37	11:15	6.51	5.40	05:15	1.51	11:10	4.44	3.04	05:15	0.223	11:10	1.648	0.945	0.945	-	
12/31/2022	04:55	3.44	20:45	8.06	5.79	05:05	1.50	20:50	7.00	3.74	05:05	0.230	20:50	3.443	1.346	1.346	-	
01/01/2023	05:50	3.59	00:15	7.07	5.54	05:25	1.49	00:10	6.09	3.43	05:50	0.241	00:10	2.520	1.095	1.095	-	
01/02/2023	05:00	3.32	11:10	6.42	5.26	04:50	1.37	19:55	5.04	3.38	04:50	0.199	11:10	1.744	1.028	1.028	-	
01/03/2023	05:20	3.56	20:15	6.33	5.35	05:20	1.54	20:45	4.92	3.35	05:20	0.245	20:30	1.723	1.014	1.014	-	
01/04/2023	04:45	3.40	19:35	6.56	5.47	04:30	1.39	21:35	5.22	3.46	04:35	0.213	21:35	1.812	1.100	1.100	-	
01/05/2023	01:50	4.31	10:15	7.59	5.78	01:45	1.99	10:20	6.95	4.07	01:45	0.421	10:20	3.162	1.341	1.341	-	
01/06/2023	04:55	3.41	11:10	6.29	5.18	04:45	1.39	20:15	5.00	3.54	04:45	0.212	11:00	1.623	1.026	1.026	-	
01/07/2023	05:00	3.62	14:30	6.27	5.23	04:50	1.63	11:35	5.23	3.53	04:50	0.268	11:35	1.716	1.038	1.038	-	
01/08/2023	05:25	3.12	19:05	6.49	5.32	05:25	1.47	11:10	4.99	3.39	05:25	0.194	20:00	1.738	1.058	1.058	-	
01/09/2023	03:45	3.27	19:40	9.26	5.72	03:45	1.47	19:45	7.59	4.20	03:45	0.208	19:45	4.483	1.484	1.484	-	
01/10/2023	22:45	4.98	08:50	6.57	5.66	03:50	2.69	10:40	6.98	4.76	03:50	0.804	10:40	2.613	1.478	1.478	-	
01/11/2023	05:00	3.45	08:10	5.36	4.63	04:45	1.50	20:50	5.95	4.16	04:45	0.229	08:05	1.666	1.016	1.016	-	
01/12/2023	04:40	3.26	20:45	5.41	4.55	04:35	1.49	08:15	5.75	4.13	04:40	0.212	20:45	1.614	0.990	0.990	-	
01/13/2023	05:00	3.16	22:00	5.57	4.78	05:05	1.43	08:10	5.33	3.81	05:00	0.194	08:10	1.531	0.985	0.985	-	
01/14/2023	05:25	3.18	13:25	6.87	5.35	04:55	1.42	13:25	6.03	3.71	04:55	0.194	13:25	2.414	1.187	1.187	-	
01/15/2023	05:25	3.33	18:50	6.57	5.28	05:30	1.42	18:35	5.76	3.53	05:30	0.208	18:35	2.126	1.086	1.086	-	
01/16/2023	05:30	3.60	12:55	6.49	5.54	05:10	1.60	20:20	4.93	3.58	05:10	0.264	20:20	1.711	1.124	1.124	-	
01/17/2023	04:20	3.36	08:20	7.07	5.59	04:25	1.53	07:55	5.37	2.94	04:25	0.226	08:25	2.170	0.960	0.960	-	
01/18/2023	03:55	3.26	21:50	6.38	5.31	04:25	1.48	20:20	4.96	3.26	04:25	0.209	20:20	1.672	0.992	0.992	-	
01/19/2023	04:50	3.11	20:30	6.67	5.35	05:00	1.44	08:25	4.59	2.96	04:50	0.190	08:25	1.722	0.912	0.912	-	
01/20/2023	04:55	3.21	08:25	6.64	5.37	04:50	1.52	08:30	4.08	2.88	04:50	0.212	08:30	1.529	0.879	0.879	-	
01/21/2023	05:10	3.17	11:55	6.82	5.37	04:50	1.49	09:50	3.98	2.77	04:50	0.203	11:20	1.540	0.860	0.860	-	
01/22/2023	05:20	3.18	10:55	6.86	5.45	05:00	1.51	10:55	3.81	2.80	05:20	0.207	10:55	1.521	0.891	0.891	-	
01/23/2023	05:05	3.15	20:15	6.84	5.41	05:10	1.47	20:00	3.69	2.75	05:10	0.199	20:30	1.444	0.853	0.853	-	
01/24/2023	04:30	3.13	20:45	6.70	5.33	04:30	1.49	19:15	3.59	2.70	04:30	0.198	08:35	1.376	0.821	0.821	-	
01/25/2023	04:50	2.95	20:20	6														

Date	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/09/2023	05:00	3.19	20:50	5.23	4.58	05:05	1.38	08:00	5.96	4.23	05:05	0.191	21:05	1.626	1.027	1.027	-
02/10/2023	05:10	3.31	21:35	5.69	4.80	04:50	1.41	08:35	5.75	3.99	04:55	0.205	08:10	1.701	1.037	1.037	-
02/11/2023	04:55	3.44	20:00	5.76	5.04	04:10	1.34	11:10	5.47	3.70	05:25	0.209	11:10	1.703	1.044	1.044	-
02/12/2023	05:25	3.03	12:55	6.32	5.22	05:25	1.31	10:55	5.18	3.39	05:25	0.166	11:00	1.732	1.033	1.033	-
02/13/2023	05:05	3.24	21:30	6.58	5.41	04:10	1.36	20:10	4.94	3.08	05:05	0.192	19:55	1.799	0.971	0.971	-
02/14/2023	04:55	3.29	21:05	6.79	5.45	05:00	1.51	08:10	4.86	2.97	05:00	0.217	08:10	1.796	0.936	0.936	-
02/15/2023	04:00	3.41	21:00	6.79	5.55	04:00	1.37	20:35	4.87	2.92	04:00	0.206	20:35	1.877	0.946	0.946	-
02/16/2023	05:00	3.40	08:20	6.86	5.46	04:00	1.51	20:20	4.53	2.92	05:00	0.231	08:10	1.744	0.919	0.919	-
02/17/2023	05:10	3.11	08:30	6.61	5.37	05:15	1.44	08:20	4.42	2.95	05:15	0.191	08:20	1.677	0.912	0.912	-
02/18/2023	05:10	3.15	09:40	6.83	5.42	04:40	1.41	09:40	4.45	2.85	04:40	0.191	09:40	1.768	0.901	0.901	-
02/19/2023	05:10	3.08	10:20	7.11	5.36	05:10	1.34	10:25	4.36	2.80	05:10	0.175	10:25	1.807	0.877	0.877	-
02/20/2023	04:45	3.05	20:10	6.77	5.45	04:45	1.43	20:15	4.44	2.92	04:45	0.183	20:15	1.717	0.935	0.935	-
02/21/2023	04:45	3.06	08:20	6.83	5.38	04:35	1.36	08:05	4.21	2.80	04:35	0.176	08:20	1.662	0.870	0.870	-
02/22/2023	04:40	3.00	08:35	6.89	5.45	05:00	1.33	19:55	4.11	2.79	05:00	0.167	20:15	1.576	0.885	0.885	-
02/23/2023	04:30	3.07	20:40	6.77	5.42	04:25	1.44	08:20	4.25	2.85	04:25	0.188	08:20	1.623	0.894	0.894	-
02/24/2023	02:45	3.54	16:05	7.43	6.28	02:35	1.60	23:30	6.96	4.72	02:35	0.255	23:30	2.991	1.834	1.834	-
02/25/2023	23:55	5.31	00:00	6.97	5.85	23:55	3.02	01:05	6.98	5.11	23:55	0.850	00:00	2.815	1.659	1.659	-
02/26/2023	05:15	3.25	10:55	5.61	4.80	05:20	1.43	19:50	6.14	4.23	05:20	0.201	11:30	1.801	1.114	1.114	-
02/27/2023	04:30	3.26	15:35	5.32	4.74	03:55	1.42	15:35	6.15	4.41	04:30	0.206	15:35	1.735	1.127	1.127	-
02/28/2023	04:45	3.37	21:20	5.72	4.86	04:45	1.44	20:15	6.56	4.54	04:45	0.213	21:00	2.000	1.183	1.183	-
03/01/2023	06:00	4.56	00:10	5.61	5.08	05:55	2.29	04:05	6.27	5.00	05:55	0.520	00:05	1.872	1.331	1.331	-
03/02/2023	05:00	3.20	22:35	5.94	4.97	05:00	1.33	08:20	5.72	3.92	05:00	0.183	20:40	1.755	1.085	1.085	-
03/03/2023	04:45	3.22	19:00	6.20	5.24	04:40	1.38	08:10	5.28	3.53	04:40	0.192	08:10	1.694	1.053	1.053	-
03/04/2023	05:20	3.48	11:50	6.78	5.56	04:50	1.47	11:00	5.09	3.15	04:50	0.231	11:05	1.956	1.024	1.024	-
03/05/2023	05:20	3.24	10:45	6.91	5.61	05:25	1.37	10:50	4.30	2.99	05:25	0.192	10:45	1.726	1.001	1.001	-
03/06/2023	04:45	3.30	10:05	7.31	5.60	04:45	1.39	09:30	4.89	2.81	04:45	0.200	09:40	2.042	0.927	0.927	-
03/07/2023	04:15	3.21	20:25	6.93	5.52	04:20	1.37	20:20	4.62	2.79	04:20	0.189	20:20	1.849	0.901	0.901	-
03/08/2023	04:40	3.29	08:10	6.89	5.49	04:20	1.37	08:05	4.29	2.78	04:20	0.197	08:05	1.708	0.889	0.889	-
03/09/2023	04:35	3.21	20:50	6.90	5.51	04:35	1.40	08:15	4.00	2.66	04:35	0.193	08:30	1.589	0.854	0.854	-
03/10/2023	04:45	3.21	14:40	7.64	5.84	04:55	1.33	15:05	5.81	2.91	04:55	0.183	15:05	2.627	1.025	1.025	-
03/11/2023	05:25	3.50	11:30	6.99	5.66	05:20	1.42	12:20	4.26	2.83	05:20	0.223	12:20	1.740	0.932	0.932	-
03/12/2023	06:10	3.39	21:50	6.75	5.57	06:10	1.47	10:40	3.94	2.75	06:10	0.219	10:40	1.505	0.894	0.894	-
03/13/2023	04:45	3.26	20:45	6.59	5.41	04:35	1.37	20:40	4.31	2.67	04:45	0.196	20:45	1.628	0.829	0.829	-
03/14/2023	04:35	3.27	23:40	6.69	5.44	04:40	1.38	23:30	6.62	3.51	04:40	0.196	23:35	2.553	1.118	1.118	-
03/15/2023	06:35	5.01	00:00	6.57	5.82	06:40	2.30	05:05	6.45	4.21	06:35	0.602	05:05	2.391	1.365	1.361	-

12/01/2022 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			105.695	
Average	5.33	3.33	1.007	



FM03

Site Commentary

SITE INFORMATION

Pipe	Round (15 in H)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location. A change in flow pattern was observed following a service visit on February 7 when the ADS crew moved the sensor from the pipe inlet to the pipe outlet seeking improved hydraulic conditions. Data confidence from February 7 forward is considered best of the data set collected.

This line is located upstream of site FM02 (See FM02 Site Commentary for More Details).

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	1.52	3.53	0.145
Minimum	1.05	0.85	0.034
Maximum	2.55	8.35	0.317
Min Time	02/05/2023 9:45:00 PM	02/27/2023 4:00:00 AM	02/27/2023 4:00:00 AM
Max Time	02/24/2023 6:15:00 PM	01/23/2023 5:00:00 AM	02/24/2023 6:15:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

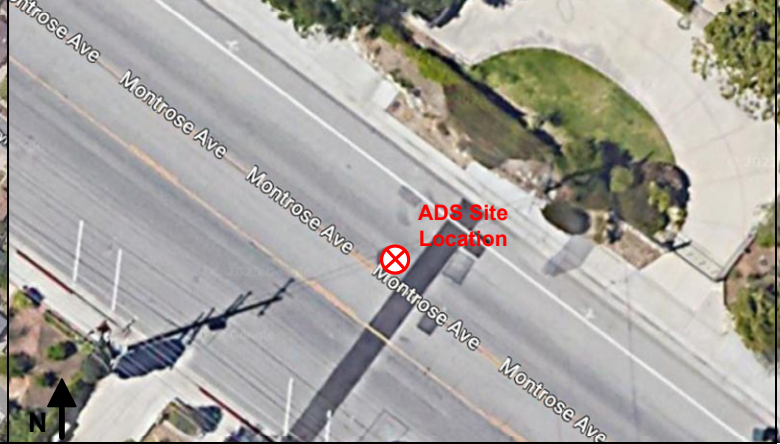
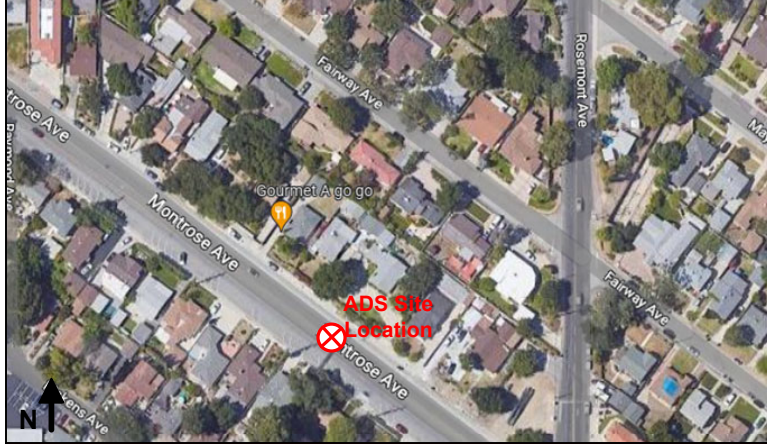
DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	99
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	99

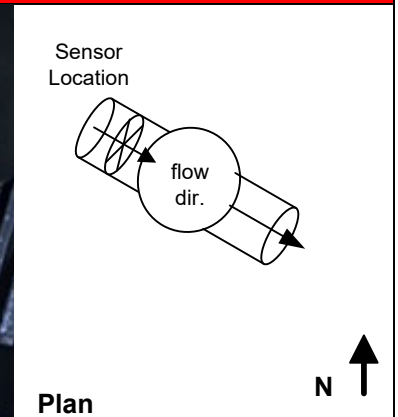
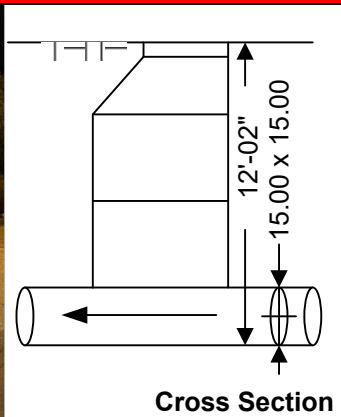


Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM03		Install Date: 11/29/23		Monitor Type		Peak Doppler	
Address/Location: 2623 Montrose Ave, Montrose, CA 91020				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		Unknown	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		15.00 "
					Pipe Width:		15.00 "



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	11/7/2 @ 1:42 AM	Manhole Depth:		12'-02"	
Site Hydraulics:	Low Straight Through Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:		VCP/Good	
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	1.13 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	4.58 fps				
Silt:	0 Inches				

Other Information:



Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report
FM03

Flow Monitor

FM03

Pipe Height
15.00
in

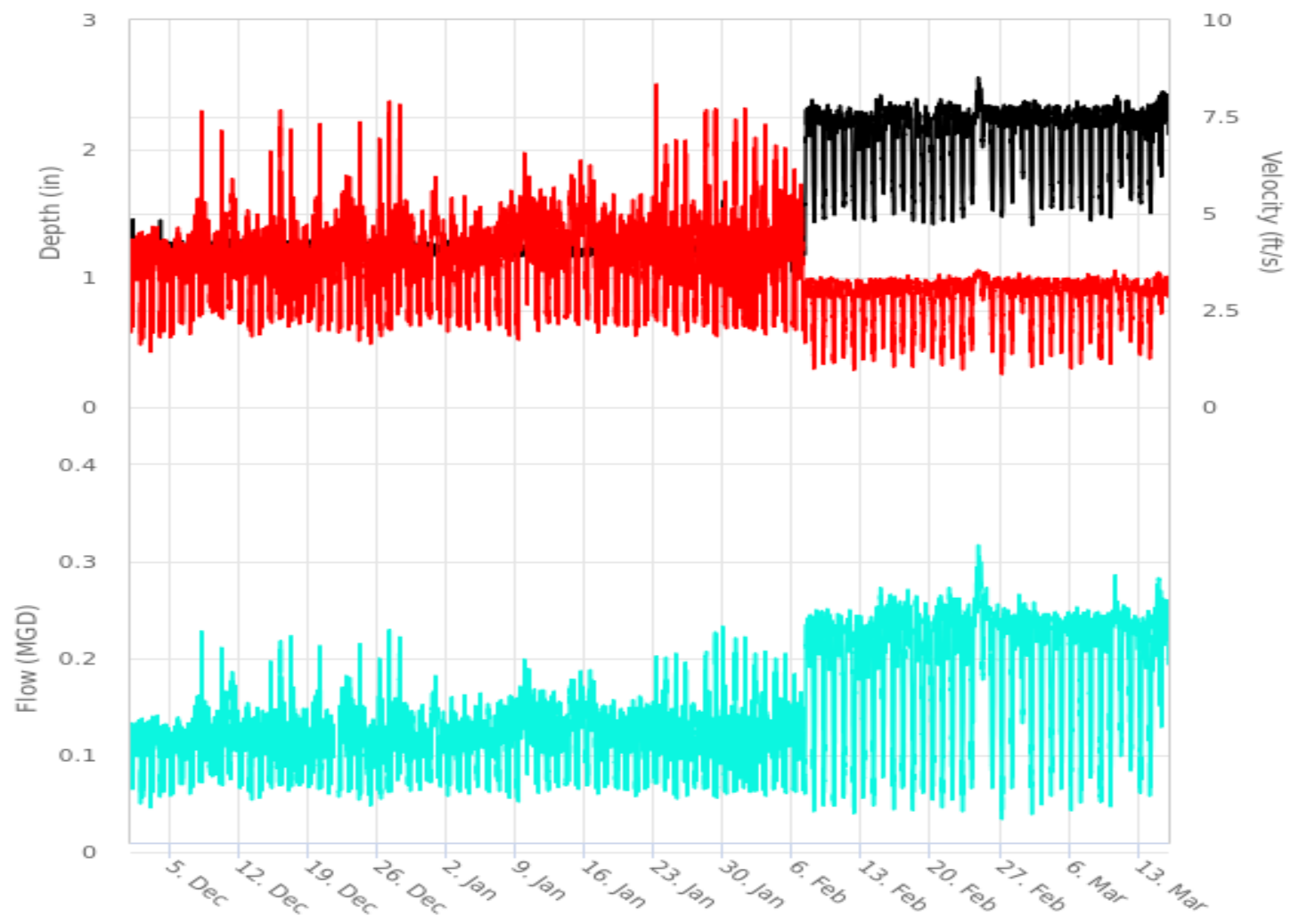
Report Period

12/01/2022
To
03/15/2023

Legend

— DFINAL
— QFINAL
— VFINAL

ADS ENVIRONMENTAL
SERVICES



Scattergraph Report

FM03

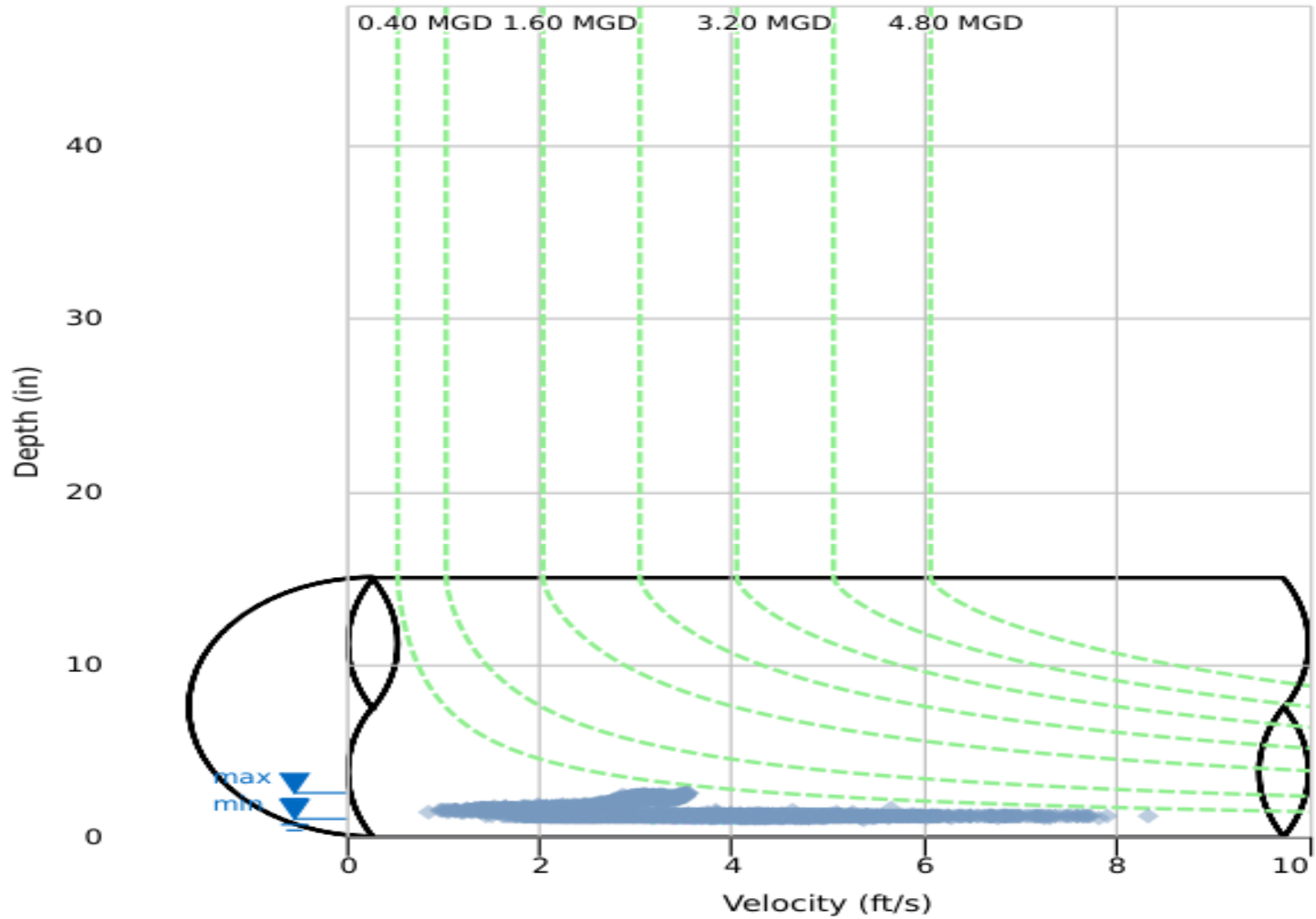
Flow Monitor
FM03

Pipe Height
15.00
in

Report Period
12/01/2022
To
03/15/2023

Legend
○ DFINAL - VFINAL
--- Iso-QTM
▼ Min-Max Depth

ADS ENVIRONMENTAL
SERVICES



Daily Tabular Report

12/01/2022 00:00 - 03/15/2023 23:55
FM03Pipe: Round (15 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	09:10	1.20	01:40	1.63	1.23	01:50	1.72	15:10	5.14	3.65	05:40	0.059	15:10	0.156	0.112	0.112	-	
12/02/2022	05:20	1.19	03:50	1.30	1.22	01:30	1.33	11:15	5.21	3.55	01:30	0.044	11:15	0.158	0.108	0.108	-	
12/03/2022	06:55	1.18	02:10	1.29	1.22	00:25	1.29	10:20	5.01	3.73	00:25	0.041	10:20	0.150	0.113	0.113	-	
12/04/2022	19:00	1.20	00:45	1.54	1.22	00:10	1.47	06:40	4.63	3.59	00:10	0.047	07:05	0.146	0.109	0.109	-	
12/05/2022	06:10	1.19	00:15	1.28	1.22	00:50	1.65	19:45	5.17	3.65	00:50	0.054	19:45	0.155	0.110	0.110	-	
12/06/2022	06:10	1.19	01:55	1.31	1.21	01:35	2.00	21:10	4.64	3.69	01:35	0.064	21:10	0.138	0.111	0.111	-	
12/07/2022	15:25	1.18	01:05	1.31	1.22	00:10	1.61	20:10	6.36	3.89	00:10	0.050	20:10	0.193	0.118	0.118	-	
12/08/2022	14:15	1.18	02:35	1.30	1.22	00:55	2.22	04:45	7.93	4.01	00:55	0.069	04:25	0.239	0.122	0.122	-	
12/09/2022	13:30	1.18	14:55	1.31	1.24	06:40	2.34	19:10	5.36	3.57	06:40	0.073	19:10	0.173	0.112	0.112	-	
12/10/2022	04:30	1.18	20:30	1.32	1.24	07:40	2.13	04:55	7.93	3.65	07:40	0.065	05:00	0.235	0.114	0.114	-	
12/11/2022	03:00	1.18	00:40	1.31	1.25	23:40	2.35	06:45	6.03	4.03	02:15	0.074	06:45	0.193	0.127	0.127	-	
12/12/2022	16:45	1.18	00:10	1.30	1.23	07:15	2.01	19:05	6.42	3.68	07:15	0.060	19:05	0.193	0.114	0.114	-	
12/13/2022	17:45	1.18	01:25	1.30	1.22	06:45	1.77	20:25	5.95	3.61	06:45	0.053	20:25	0.176	0.110	0.110	-	
12/14/2022	15:15	1.17	04:10	1.31	1.22	06:55	1.65	19:25	5.45	3.68	06:55	0.049	19:30	0.167	0.112	0.112	-	
12/15/2022	09:45	1.18	01:40	1.29	1.23	07:00	1.50	04:10	6.77	3.64	07:00	0.045	04:40	0.203	0.112	0.112	-	
12/16/2022	04:40	1.16	02:55	1.30	1.23	15:20	2.06	04:40	7.75	3.63	06:40	0.062	04:35	0.220	0.112	0.112	-	
12/17/2022	15:30	1.19	01:35	1.30	1.23	00:05	1.87	05:35	7.38	3.63	00:05	0.057	05:35	0.232	0.112	0.112	-	
12/18/2022	14:50	1.18	19:45	1.29	1.24	23:35	2.03	08:50	5.59	3.47	07:05	0.060	08:50	0.169	0.108	0.108	-	
12/19/2022	14:15	1.17	03:15	1.30	1.22	07:30	1.78	19:40	5.75	3.76	07:30	0.054	22:35	0.174	0.115	0.115	-	
12/20/2022	04:30	1.17	05:10	1.30	1.21	00:55	1.84	04:45	7.93	3.92	07:35	0.057	03:45	0.230	0.118	0.118	-	
12/21/2022	12:50	1.14	12:40	1.31	1.22	05:15	1.78	19:35	5.27	3.73	05:15	0.054	08:00	0.146	0.104	0.056	-	
12/22/2022	23:40	1.17	02:40	1.29	1.21	01:55	1.83	19:30	6.59	4.15	01:55	0.054	19:40	0.201	0.127	0.120	-	
12/23/2022	19:40	1.16	03:35	1.31	1.21	07:00	1.84	04:40	7.12	3.88	07:00	0.056	04:40	0.216	0.116	0.116	-	
12/24/2022	17:40	1.17	01:30	1.30	1.21	02:45	1.54	05:05	7.73	3.79	02:45	0.050	05:05	0.223	0.114	0.114	-	
12/25/2022	13:05	1.17	21:30	1.29	1.21	06:35	1.58	11:55	4.83	3.39	06:35	0.047	11:55	0.142	0.101	0.101	-	
12/26/2022	19:00	1.16	02:55	1.31	1.21	08:15	1.78	04:30	7.85	3.71	08:15	0.053	04:30	0.226	0.111	0.111	-	
12/27/2022	17:45	1.16	02:15	1.32	1.20	07:15	1.84	05:00	8.21	4.31	01:30	0.057	05:00	0.239	0.128	0.128	-	
12/28/2022	05:45	1.16	01:10	1.29	1.20	00:50	2.26	05:45	8.04	4.43	00:35	0.071	05:45	0.228	0.132	0.132	-	
12/29/2022	18:00	1.17	16:05	1.29	1.21	07:15	1.98	23:20	5.45	3.68	07:15	0.058	23:20	0.160	0.111	0.111	-	
12/30/2022	11:40	1.16	04:45	1.30	1.20	07:00	1.91	12:50	5.99	3.60	07:00	0.058	12:50	0.174	0.107	0.107	-	
12/31/2022	10:40	1.17	01:45	1.29	1.21	07:20	1.92	13:05	6.04	4.07	07:20	0.062	20:30	0.186	0.122	0.122	-	
01/01/2023	21:00	1.17	08:40	1.28	1.21	08:05	2.07	00:00	5.07	3.70	08:05	0.062	00:00	0.156	0.112	0.112	-	
01/02/2023	15:20	1.17	00:40	1.30	1.21	02:40	1.81	12:35	5.90	3.83	02:35	0.055	12:40	0.175	0.115	0.115	-	
01/03/2023	16:25	1.17	03:55	1.28	1.21	05:35	1.68	19:05	5.60	3.76	05:35	0.051	14:30	0.170	0.113	0.113	-	
01/04/2023	19:40	1.17	03:10	1.29	1.21	00:55	1.56	22:00	5.31	3.80	00:55	0.050	22:00	0.159	0.114	0.114	-	
01/05/2023	16:20	1.17	06:30	1.28	1.21	02:25	2.06	08:50	5.30	3.95	02:25	0.062	10:05	0.167	0.119	0.119	-	
01/06/2023	12:40	1.16	04:15	1.30	1.20	07:00	1.77	19:55	5.01	3.61	07:00	0.054	04:05	0.156	0.108	0.108	-	
01/07/2023	09:55	1.17	02:35	1.30	1.21	07:45	1.85	11:40	6.59	3.92	07:45	0.056	11:40	0.194	0.117	0.117	-	
01/08/2023	15:20	1.16	05:35	1.29	1.21	07:45	1.72	11:30	5.89	4.08	07:45	0.051	11:30	0.169	0.122	0.122	-	
01/09/2023	15:40	1.17	03:45	1.30	1.22	06:40	1.67	20:00	7.01	4.34	06:35	0.049	20:00	0.216	0.132	0.132	-	
01/10/2023	13:20	1.17	02:50	1.29	1.22	03:35	2.47	15:25	6.95	4.52	03:55	0.075	15:25	0.208	0.137	0.137	-	
01/11/2023	21:35	1.17	06:45	1.28	1.21	06:35	1.89	12:35	5.85	4.19	06:35	0.057	19:10	0.176	0.125	0.125	-	
01/12/2023	23:05	1.17	05:05	1.29	1.21	06:10	1.83	17:55	5.88	4.17	06:10	0.054	17:55	0.176	0.125	0.125	-	
01/13/2023	12:45	1.16	06:35	1.31	1.20	06:45	2.04	13:15	6.70	3.91	06:45	0.065	13:15	0.194	0.116	0.116	-	
01/14/2023	19:35	1.16	05:35	1.29	1.21	01:10	2.14	13:50	7.87	4.47	01:10	0.064	13:50	0.233	0.135	0.135	-	
01/15/2023	15:40	1.17	08:30	1.31	1.21	08:00	1.76	13:05	6.57	4.49	08:00	0.054	17:30	0.191	0.135	0.135	-	
01/16/2023	11:30	1.17	09:05	1.27	1.21	07:00	2.19	12:15	7.02	4.39	04:35	0.065	12:15	0.210	0.132	0.132	-	
01/17/2023	22:55	1.16	03:15	1.30	1.21	06:50	1.81	20:40	6.08	3.87	06:50	0.056	20:40	0.178	0.116	0.116	-	
01/18/2023	20:15	1.16	00:10	1.28	1.20	00:30	1.94	19:55	6.52	3.96	01:50	0.060	19:55	0.187	0.117	0.117	-	
01/19/2023	16:35	1.17	00:25	1.28	1.21	06:35	1.96	20:55	5.35	3.84	06:35	0.059	20:55	0.161	0.115	0.115	-	
01/20/2023	13:00	1.16	00:20	1.27	1.20	06:10	1.83	11:20	6.16	3.87	06:10	0.056	11:20	0.184	0.115	0.115	-	
01/21/2023	17:05	1.16	01:35	1.30	1.21	02:05	1.75	16:15	5.92	3.80	02:00	0.055	12:20	0.175	0.113	0.113	-	
01/22/2023	20:45	1.16	05:05	1.30	1.20	07:45	1.77	20:20	5.88	3.89	07:45	0.053	20:20	0.167	0.116	0.116	-	
01/23/2023	19:00	1.16	05:45	1.42	1.21	23:55	1.99	05:10	8.75	4.04	23:55	0.062	04:20	0.204	0.122	0.122	-	
01/24/2023	05:15	1.16	06:15	1.30	1.20	00:35	1.97	04:10	7.30	3.85	01:25	0.061	04:10	0.224	0.114	0.114	-	
01/25/2023	05:35	1.16	04:20	1.56	1.21	07:05	1.72	03:45	7.24									

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/07/2023	03:25	1.18	23:00	2.39	1.95	05:25	1.15	12:00	3.37	2.90	05:25	0.040	23:00	0.254	0.196	0.171	-
02/08/2023	04:10	1.42	08:40	2.38	2.07	04:30	0.87	19:40	3.39	2.76	04:30	0.034	08:45	0.254	0.191	0.191	-
02/09/2023	04:05	1.45	13:45	2.36	2.04	03:50	1.00	21:50	3.38	2.77	03:50	0.040	11:20	0.257	0.188	0.188	-
02/10/2023	05:05	1.49	18:40	2.38	2.04	03:30	0.89	11:05	3.34	2.74	03:30	0.038	13:50	0.251	0.186	0.186	-
02/11/2023	04:15	1.55	16:35	2.34	2.04	04:35	0.99	14:00	3.32	2.75	04:35	0.043	18:00	0.252	0.184	0.184	-
02/12/2023	06:20	1.44	10:35	2.31	1.99	04:25	0.85	13:35	3.32	2.69	04:25	0.035	13:20	0.248	0.177	0.177	-
02/13/2023	05:10	1.45	08:40	2.30	2.01	02:30	0.94	19:45	3.33	2.74	02:30	0.043	22:25	0.247	0.181	0.181	-
02/14/2023	05:15	1.44	20:55	2.42	2.06	04:15	0.84	13:15	3.34	2.78	05:05	0.033	20:50	0.275	0.192	0.192	-
02/15/2023	04:55	1.64	19:50	2.36	2.13	02:20	1.49	21:55	3.37	2.91	02:35	0.075	21:55	0.267	0.205	0.205	-
02/16/2023	04:50	1.49	08:25	2.35	2.08	05:10	0.97	08:25	3.37	2.80	05:10	0.041	08:25	0.268	0.195	0.195	-
02/17/2023	05:10	1.52	15:20	2.37	2.07	02:10	1.30	15:30	3.42	2.85	02:10	0.060	15:30	0.273	0.196	0.196	-
02/18/2023	04:45	1.44	11:20	2.39	2.03	03:50	1.00	13:05	3.35	2.78	03:50	0.041	11:15	0.267	0.187	0.187	-
02/19/2023	05:15	1.42	10:20	2.35	2.00	04:25	1.04	09:50	3.31	2.74	04:25	0.041	10:20	0.261	0.180	0.180	-
02/20/2023	05:05	1.41	22:30	2.39	2.03	03:50	1.16	19:55	3.45	2.78	03:50	0.048	22:30	0.272	0.187	0.187	-
02/21/2023	04:15	1.44	20:15	2.38	2.07	02:55	1.04	19:35	3.44	2.81	02:55	0.044	19:35	0.276	0.194	0.194	-
02/22/2023	04:25	1.43	08:30	2.36	2.04	02:50	1.06	11:35	3.39	2.82	02:50	0.045	11:35	0.269	0.191	0.191	-
02/23/2023	04:40	1.46	19:30	2.32	2.05	04:10	0.87	21:00	3.38	2.84	04:10	0.037	19:40	0.259	0.191	0.191	-
02/24/2023	03:10	1.57	18:20	2.56	2.17	02:05	1.40	18:15	3.56	3.13	02:05	0.063	18:15	0.319	0.229	0.229	-
02/25/2023	04:40	2.00	00:00	2.45	2.24	05:15	2.62	00:00	3.51	3.19	05:15	0.167	00:00	0.296	0.237	0.237	-
02/26/2023	06:20	1.52	18:00	2.35	2.04	04:20	1.17	19:25	3.38	2.87	04:20	0.054	18:05	0.258	0.193	0.193	-
02/27/2023	04:05	1.47	09:45	2.38	2.06	04:05	0.84	14:10	3.41	2.82	04:05	0.034	09:40	0.256	0.194	0.194	-
02/28/2023	05:10	1.58	08:55	2.36	2.12	04:50	1.26	21:15	3.47	2.92	04:50	0.057	21:15	0.268	0.205	0.205	-
03/01/2023	06:35	1.76	22:40	2.40	2.22	05:45	2.39	21:40	3.44	3.08	05:45	0.127	11:20	0.263	0.227	0.227	-
03/02/2023	04:35	1.40	09:25	2.41	2.08	04:15	0.76	22:00	3.36	2.81	04:15	0.029	09:25	0.262	0.195	0.195	-
03/03/2023	05:10	1.53	18:45	2.36	2.08	04:15	0.97	20:15	3.35	2.84	04:15	0.043	10:30	0.250	0.197	0.197	-
03/04/2023	04:40	1.54	09:40	2.36	2.07	03:30	1.13	10:30	3.35	2.84	03:30	0.050	18:15	0.251	0.194	0.194	-
03/05/2023	04:35	1.52	22:30	2.35	2.04	03:25	1.34	21:10	3.35	2.88	04:35	0.061	22:25	0.255	0.193	0.193	-
03/06/2023	04:25	1.54	17:45	2.40	2.10	04:00	0.95	13:45	3.36	2.84	04:00	0.041	18:10	0.255	0.198	0.198	-
03/07/2023	05:35	1.52	13:40	2.36	2.07	05:00	1.09	20:20	3.45	2.84	05:00	0.046	21:50	0.254	0.194	0.194	-
03/08/2023	04:10	1.44	13:30	2.36	2.07	02:10	1.51	21:20	3.42	2.87	02:10	0.069	09:45	0.250	0.196	0.196	-
03/09/2023	04:35	1.48	10:05	2.37	2.06	03:35	0.83	08:40	3.35	2.77	03:35	0.035	12:45	0.250	0.190	0.190	-
03/10/2023	04:30	1.46	18:45	2.42	2.10	04:05	0.79	14:50	3.55	2.90	04:05	0.032	14:50	0.288	0.205	0.205	-
03/11/2023	04:25	1.70	21:20	2.39	2.10	04:25	1.69	11:20	3.44	2.98	04:25	0.084	21:15	0.258	0.204	0.204	-
03/12/2023	06:05	1.60	18:00	2.36	2.05	04:05	1.54	21:10	3.34	2.89	04:55	0.073	14:20	0.259	0.193	0.193	-
03/13/2023	05:10	1.57	22:25	2.37	2.06	04:05	1.25	21:10	3.36	2.78	04:05	0.057	22:25	0.251	0.188	0.188	-
03/14/2023	04:50	1.49	17:10	2.45	2.07	03:20	1.16	23:50	3.51	2.88	03:20	0.052	23:50	0.286	0.198	0.198	-
03/15/2023	06:45	1.77	09:55	2.46	2.25	06:35	2.38	00:05	3.49	3.06	06:35	0.127	00:30	0.285	0.230	0.229	-

12/01/2022 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			15.165	
Average	1.52	3.53	0.145	



FM04

Site Commentary

SITE INFORMATION

Pipe	Round (15 in H)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Tuesday, 07 February 2023**, along with observed minimum and maximum data, are provided in the following table.

This site hydraulics were generally poor here, so data confidence is lower than typical. No surcharge conditions were experienced at this location.

Equipment was removed at this location on February 7 and moved 1 manhole upstream to location FM04A.

This line is located downstream of sites FM05, FM06, and FM08. A large imbalance was recorded between the sites. Following the install of FM04B it was discovered that this imbalance was due to this location being in a different tributary than what was previously believed.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	1.32	7.99	0.273
Minimum	1.09	5.07	0.161
Maximum	3.23	11.41	1.031
Min Time	01/21/2023 6:00:00 AM	12/01/2022 4:35:00 AM	12/01/2022 4:45:00 AM
Max Time	01/26/2023 11:45:00 PM	01/09/2023 7:35:00 PM	01/10/2023 4:05:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Tuesday, 07 February 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	98
VFINAL (ft/s)	99
QFINAL (MGD - Total MG)	98



Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM04		Install Date: 11/29/22		Monitor Type: Peak Doppler			
Address/Location: 2600 Mayfield Ave, La Crescenta-Montrose, CA 91214				Monitor Model: Triton +			
				Data Acquisition: Manual/Wireless Collect			
				Manhole ID: Unknown			
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height: 15.00 "		
					Pipe Width: 15.00 "		



Investigation Information:		Manhole Information:				
Date/Time of Investigation:	11/7/22 @ 1:35 AM	Manhole Depth:	12'-07"			
Site Hydraulics:	Good Straight Through Flow	Manhole Material / Condition	Precast/Good			
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:	VCP/Good			
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐	Other ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0	
Depth of Flow:	1.25 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.				
Range (Air DOF):	+/-					
Peak Velocity:	7.72 fps					
Silt:	0 Inches					

Other Information:	
	Cross Section
	Plan

Installation Information		Backup	Yes	No	?	Distance
Installation Type: Outlet	Trunk		☐	☒	☐	
Sensors Devices: Ultrasonic/Velocity/Pressure	Lift / Pump Station		☐	☒	☐	
Surcharge Height: 0	WWTP		☐	☒	☐	
Rain Gauge Zone:	Other		☐	☒	☐	

Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report
FM04

Flow Monitor

FM04

Pipe Height
15.00
in

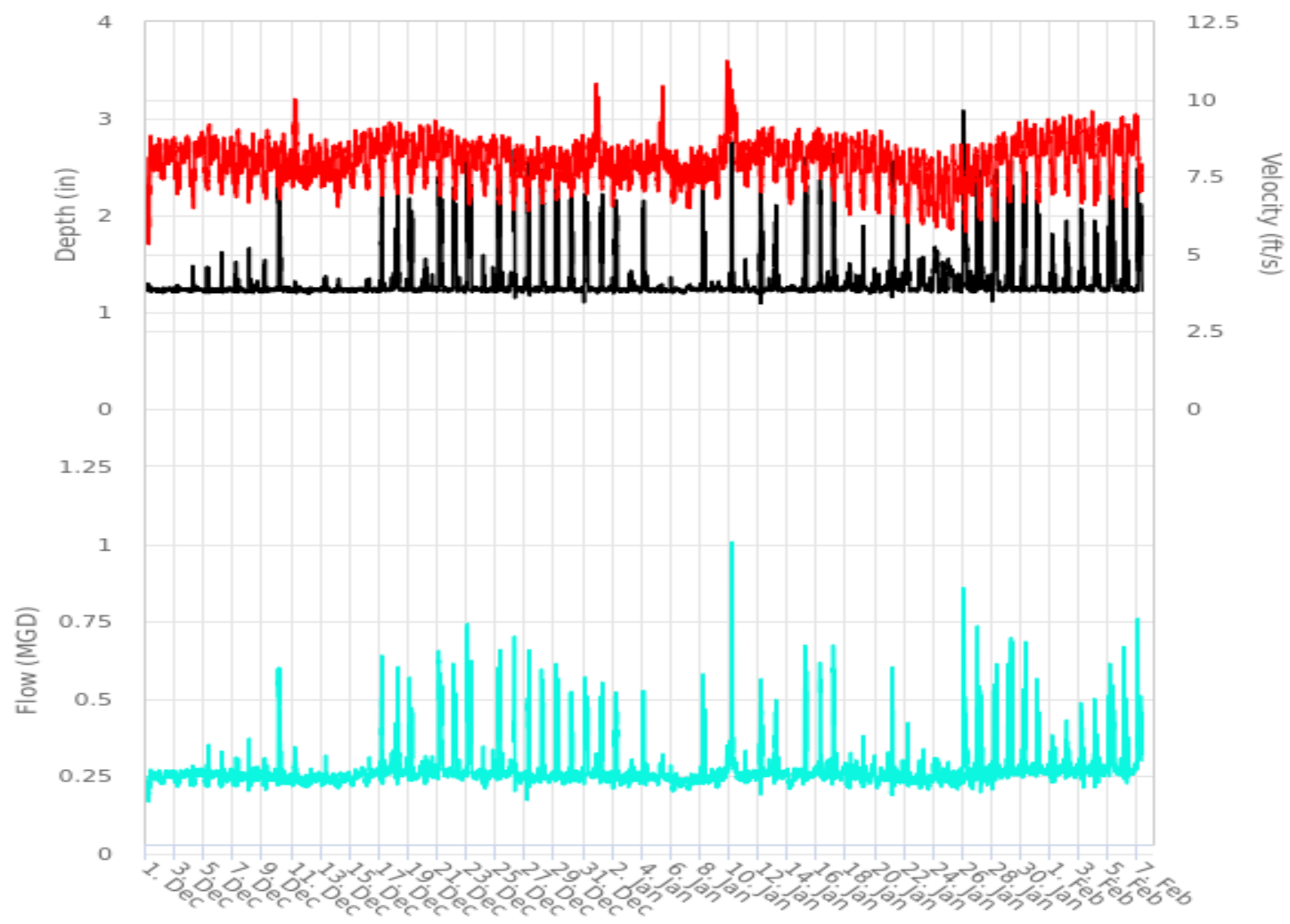
Report Period

12/01/2022
To
02/07/2023

Legend

— DFINAL
— QFINAL
— VFINAL

ADS ENVIRONMENTAL
SERVICES®

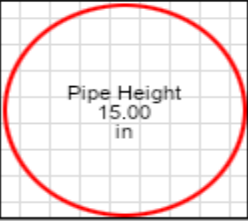


Scattergraph Report

FM04

Flow Monitor

FM04



Pipe Height
15.00
in

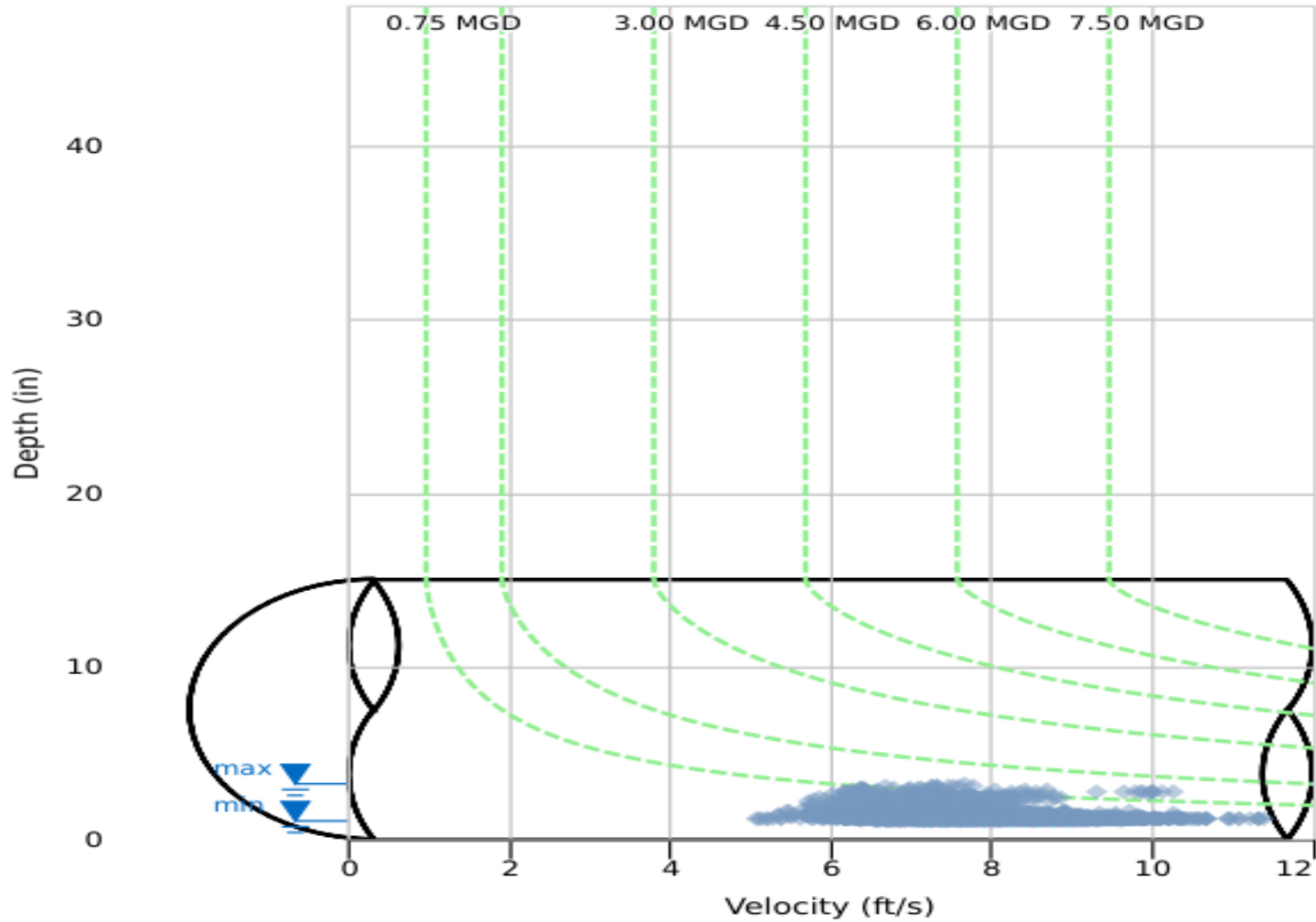
Report Period

12/01/2022
To
02/07/2023

Legend

- DFINAL - VFINAL
- - - Iso-QTM
- ▼ Min-Max Depth





Daily Tabular Report

12/01/2022 00:00 - 02/07/2023 06:15
FM04Pipe: Round (15 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	01:50	1.20	05:30	1.31	1.23	04:35	5.07	07:40	9.16	7.74	04:45	0.161	07:40	0.281	0.239	0.239	-	
12/02/2022	03:00	1.19	03:10	1.28	1.23	03:35	7.10	08:45	8.95	8.15	03:35	0.218	08:45	0.280	0.250	0.250	-	
12/03/2022	02:10	1.20	04:05	1.30	1.23	03:50	6.85	19:50	8.96	8.08	03:50	0.209	08:55	0.279	0.250	0.250	-	
12/04/2022	02:40	1.20	04:35	1.62	1.24	06:20	6.38	20:35	9.09	8.06	00:40	0.215	04:35	0.322	0.251	0.251	-	
12/05/2022	02:45	1.19	04:10	1.61	1.23	05:15	6.76	07:40	9.30	8.16	05:15	0.205	07:20	0.406	0.253	0.253	-	
12/06/2022	06:45	1.20	04:20	2.00	1.24	03:55	6.71	19:35	8.97	8.02	03:15	0.212	04:20	0.440	0.250	0.250	-	
12/07/2022	19:30	1.20	04:05	1.62	1.24	04:30	6.67	07:55	9.12	7.99	00:10	0.206	04:15	0.339	0.248	0.248	-	
12/08/2022	08:20	1.19	01:45	1.78	1.24	00:45	6.06	08:15	9.04	7.99	00:45	0.183	01:45	0.408	0.249	0.249	-	
12/09/2022	04:50	1.20	02:25	1.81	1.25	04:45	6.33	07:30	9.08	7.96	04:45	0.189	02:25	0.406	0.251	0.251	-	
12/10/2022	01:15	1.15	02:55	2.61	1.38	05:05	6.59	09:50	9.01	7.79	00:50	0.212	02:55	0.659	0.285	0.285	-	
12/11/2022	06:35	1.20	04:40	1.51	1.23	16:35	6.81	04:40	10.26	8.00	16:35	0.205	04:40	0.428	0.247	0.247	-	
12/12/2022	03:55	1.18	06:55	1.28	1.23	00:15	6.85	07:40	9.11	7.91	00:10	0.203	07:40	0.284	0.243	0.243	-	
12/13/2022	21:00	1.20	07:15	1.45	1.24	02:00	6.74	07:15	8.85	7.86	06:05	0.213	07:15	0.347	0.245	0.245	-	
12/14/2022	19:30	1.20	04:50	1.39	1.23	04:05	6.35	21:40	8.85	7.90	04:00	0.198	21:45	0.269	0.244	0.244	-	
12/15/2022	03:25	1.20	20:25	1.27	1.23	03:10	6.72	08:25	9.11	8.16	03:10	0.206	20:25	0.289	0.252	0.252	-	
12/16/2022	03:35	1.20	07:40	1.57	1.24	05:15	6.86	07:55	9.26	8.23	03:30	0.215	07:40	0.390	0.256	0.256	-	
12/17/2022	15:45	1.21	03:45	2.71	1.30	04:40	6.82	09:10	9.50	8.42	05:55	0.224	03:45	0.716	0.282	0.282	-	
12/18/2022	19:40	1.21	07:15	2.55	1.32	05:00	6.80	08:35	9.43	8.26	05:00	0.218	07:15	0.727	0.282	0.282	-	
12/19/2022	13:45	1.20	01:25	2.26	1.34	03:05	6.86	18:50	9.23	8.22	06:35	0.233	01:35	0.588	0.286	0.286	-	
12/20/2022	06:05	1.21	03:30	1.69	1.26	03:20	6.95	21:15	9.42	8.37	03:20	0.217	03:30	0.364	0.266	0.266	-	
12/21/2022	16:30	1.20	01:40	2.49	1.46	03:45	6.80	07:45	9.31	8.31	00:45	0.228	01:20	0.674	0.330	0.330	-	
12/22/2022	20:55	1.19	00:45	2.44	1.40	04:25	6.71	07:50	8.98	8.05	16:20	0.220	00:45	0.686	0.302	0.302	-	
12/23/2022	08:20	1.20	00:10	2.74	1.48	04:20	6.51	20:20	8.94	8.04	16:35	0.234	00:10	0.832	0.327	0.327	-	
12/24/2022	07:55	1.20	02:45	1.94	1.25	06:00	6.72	19:40	9.03	8.13	06:00	0.205	02:45	0.447	0.256	0.256	-	
12/25/2022	19:35	1.20	06:55	2.52	1.43	05:20	6.48	18:50	8.92	8.09	01:35	0.235	06:55	0.665	0.312	0.312	-	
12/26/2022	06:55	1.14	06:05	2.78	1.35	04:55	6.33	10:20	8.67	7.71	06:45	0.200	06:05	0.757	0.277	0.231	-	
12/27/2022	03:25	1.10	06:20	2.66	1.38	04:40	6.36	20:20	8.91	7.69	03:25	0.173	06:20	0.683	0.285	0.258	-	
12/28/2022	10:00	1.20	02:25	2.66	1.42	04:35	6.59	20:10	8.71	7.79	01:05	0.223	02:25	0.656	0.296	0.296	-	
12/29/2022	00:40	1.21	03:50	2.53	1.37	03:45	6.70	09:15	8.58	7.73	15:20	0.219	02:30	0.628	0.279	0.279	-	
12/30/2022	09:45	1.20	03:55	2.39	1.35	03:00	6.46	22:00	9.08	7.92	01:05	0.221	02:05	0.580	0.281	0.281	-	
12/31/2022	00:15	1.10	07:05	2.29	1.41	04:20	6.82	20:40	10.70	8.28	00:15	0.224	07:05	0.604	0.312	0.312	-	
01/01/2023	00:45	1.21	05:20	2.56	1.33	23:55	6.35	00:05	10.62	7.99	23:55	0.207	05:20	0.652	0.276	0.276	-	
01/02/2023	01:25	1.19	07:15	2.45	1.34	00:35	6.77	21:40	8.84	7.78	00:35	0.210	07:15	0.650	0.274	0.274	-	
01/03/2023	20:10	1.19	05:35	1.65	1.24	01:35	6.79	21:40	8.82	7.92	01:35	0.207	05:35	0.364	0.248	0.248	-	
01/04/2023	10:20	1.21	02:05	2.51	1.27	05:25	6.68	08:10	8.73	7.88	05:25	0.212	02:05	0.671	0.254	0.254	-	
01/05/2023	07:00	1.20	23:05	1.47	1.24	01:45	6.90	10:05	10.68	8.22	01:45	0.216	10:05	0.332	0.256	0.256	-	
01/06/2023	02:35	1.19	07:40	1.28	1.22	02:45	6.29	08:35	8.47	7.53	02:45	0.189	07:40	0.270	0.231	0.231	-	
01/07/2023	18:40	1.21	23:20	1.34	1.24	06:55	6.22	23:25	8.62	7.58	06:55	0.201	23:20	0.299	0.237	0.237	-	
01/08/2023	00:20	1.21	04:05	2.87	1.30	04:55	6.84	22:50	8.60	7.77	05:25	0.217	08:00	0.835	0.263	0.263	-	
01/09/2023	07:05	1.21	06:20	1.39	1.24	04:05	6.34	19:35	11.41	8.36	04:05	0.198	23:10	0.367	0.262	0.262	-	
01/10/2023	00:00	1.13	03:55	2.80	1.31	18:15	7.40	02:55	10.39	8.73	18:15	0.228	04:05	1.031	0.303	0.303	-	
01/11/2023	20:40	1.19	02:15	1.78	1.24	01:30	6.93	22:40	9.21	8.10	01:30	0.218	02:15	0.397	0.253	0.253	-	
01/12/2023	03:15	1.09	04:10	2.38	1.33	04:40	6.74	08:30	9.36	8.32	03:25	0.189	04:10	0.593	0.287	0.287	-	
01/13/2023	15:00	1.20	04:00	2.32	1.30	02:05	6.99	08:25	8.90	8.12	01:40	0.223	04:00	0.565	0.273	0.273	-	
01/14/2023	19:45	1.19	05:45	1.29	1.24	04:20	6.25	18:10	9.15	8.02	01:30	0.203	11:15	0.282	0.249	0.249	-	
01/15/2023	00:00	1.21	04:10	2.81	1.39	06:00	6.96	22:50	9.12	8.11	01:25	0.221	04:10	0.742	0.300	0.300	-	
01/16/2023	21:25	1.20	04:30	2.59	1.31	05:25	7.30	01:45	9.22	8.28	11:00	0.227	04:30	0.699	0.279	0.279	-	
01/17/2023	07:05	1.20	02:15	2.68	1.38	04:15	6.45	07:55	9.15	8.07	23:55	0.220	02:15	0.698	0.295	0.295	-	
01/18/2023	16:45	1.20	04:55	1.78	1.26	05:15	5.84	20:15	9.00	7.91	01:25	0.199	07:15	0.362	0.253	0.253	-	
01/19/2023	14:45	1.19	04:30	2.06	1.28	02:15	6.04	08:10	9.21	7.90	02:15	0.200	04:30	0.430	0.257	0.257	-	
01/20/2023	07:25	1.19	23:10	1.62	1.27	05:20	6.22	07:45	9.17	7.79	02:15	0.208	20:35	0.371	0.250	0.250	-	
01/21/2023	01:50	1.09	03:45	2.59	1.32	04:55	6.09	09:10	8.61	7.53	04:20	0.171	03:45	0.603	0.257	0.257	-	
01/22/2023	20:10	1.20	05:35	2.28	1.31	04:30	5.95	19:35	8.55	7.37	06:40	0.208	05:35	0.468	0.248	0.248	-	
01/23/2023	19:15	1.20	06:55	1.85	1.30	05:15	5.57	07:35	8.50	7.21	16:25	0.197	06:55	0.431	0.241	0.241	-	
01/24/2023	07:50	1.19	01:55	1.71	1.38	05:25	5.45	07:40	8.41	7.10	00:15	0.212	23:25	0.329	0.256	0.256	-	
01/25/2																		

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/07/2023	06:15	1.22	03:35	2.38	1.77	03:00	6.89	00:20	8.28	7.44	00:30	0.252	00:15	0.595	0.408	0.095	-

12/01/2022 00:00 - 02/07/2023 06:15

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			18.547	
Average	1.32	7.99	0.273	

FM04a

Site Commentary

SITE INFORMATION

Pipe	Round (15 in H)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Wednesday, 18 January 2023 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site was installed at a location chosen by the client as an alternative to FM04 because of the imbalance at that location. It was installed 1 manhole upstream of FM04. This new location also did not capture the intended tributary area flow from upstream. A change in flow pattern was observed following a service visit on February 7 when the ADS crew moved the sensor location to the outlet pipe in an attempt to seek improved hydraulic conditions. However, a hydraulic jump was present at both sensor locations, so data prior to and after February 7 are of lower confidence than typical.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	1.36	4.80	0.168
Minimum	1.20	2.43	0.083
Maximum	1.64	8.27	0.273
Min Time	02/05/2023 12:15:00 PM	01/19/2023 4:30:00 AM	01/19/2023 4:25:00 AM
Max Time	02/16/2023 3:30:00 AM	01/27/2023 7:30:00 AM	01/31/2023 7:10:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

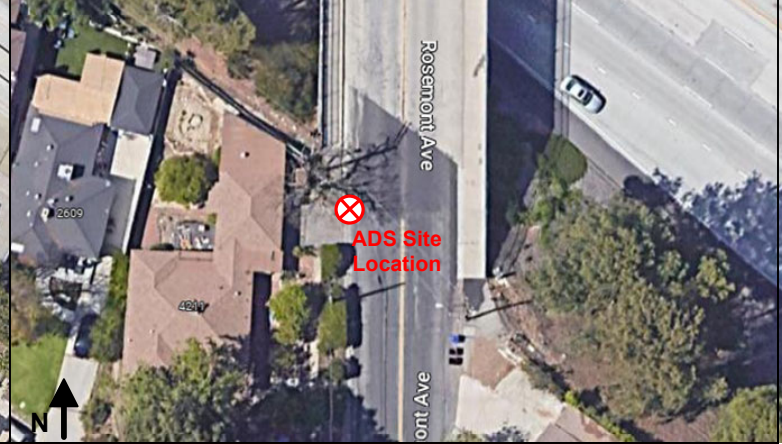
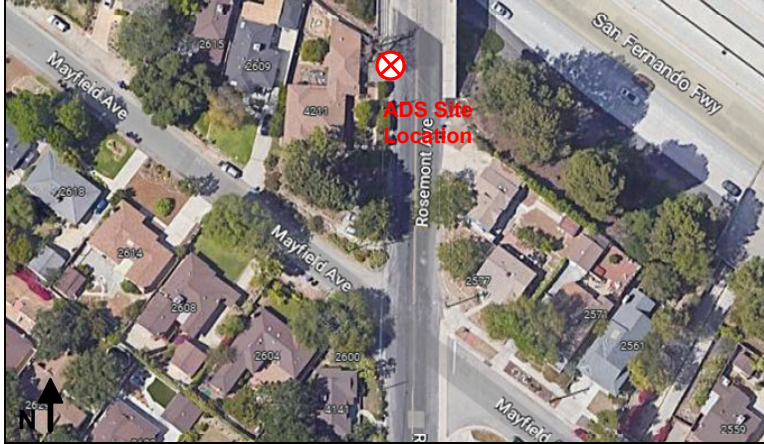
DATA UPTIME

Data uptime observed during **Wednesday, 18 January 2023 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM04a		Install Date: 01/18/23		Monitor Type		Peak Doppler	
Address/Location: 4211 Rosemont Ave, La Crescenta-Montrose, CA 91214				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		Unknown	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		15.00 "
					Pipe Width:		15.00 "



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	01/18/23 @ 5:47 AM	Manhole Depth:		12'-06"	
Site Hydraulics:	Fast Straight Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition: VCP/Good			
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	1.38 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	4.50 fps				
Silt:	0 Inches				

Other Information:	
	Cross Section
	Plan

Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

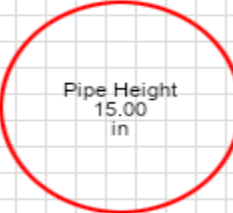
Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report
FM04a

Flow Monitor

FM04a



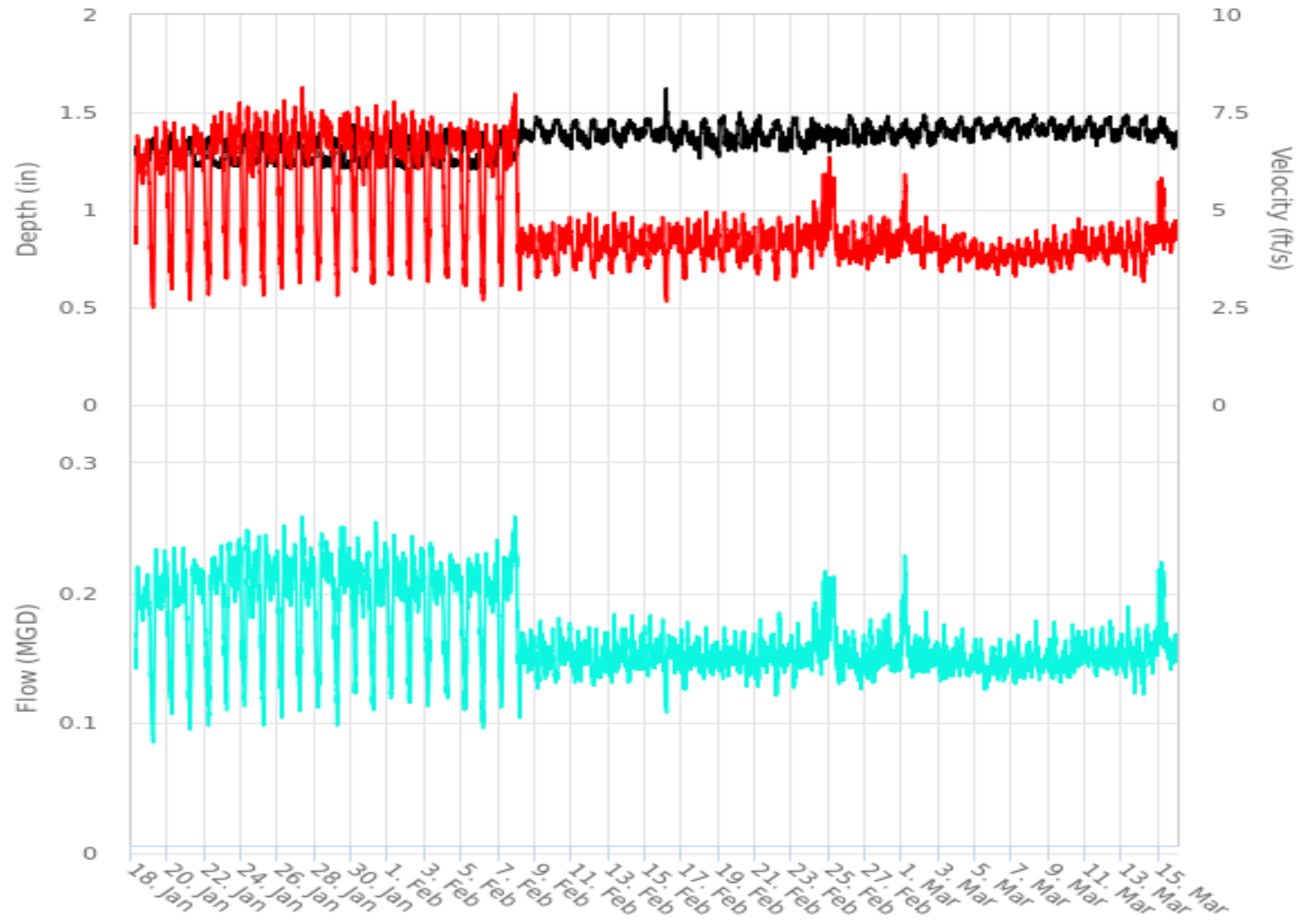
Pipe Height
15.00
in

Report Period

01/18/2023
To
03/15/2023

Legend

- DFINAL
- QFINAL
- VFINAL

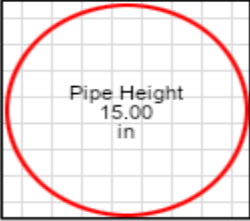


Scattergraph Report

FM04a

Flow Monitor

FM04a



Pipe Height
15.00
in

Report Period

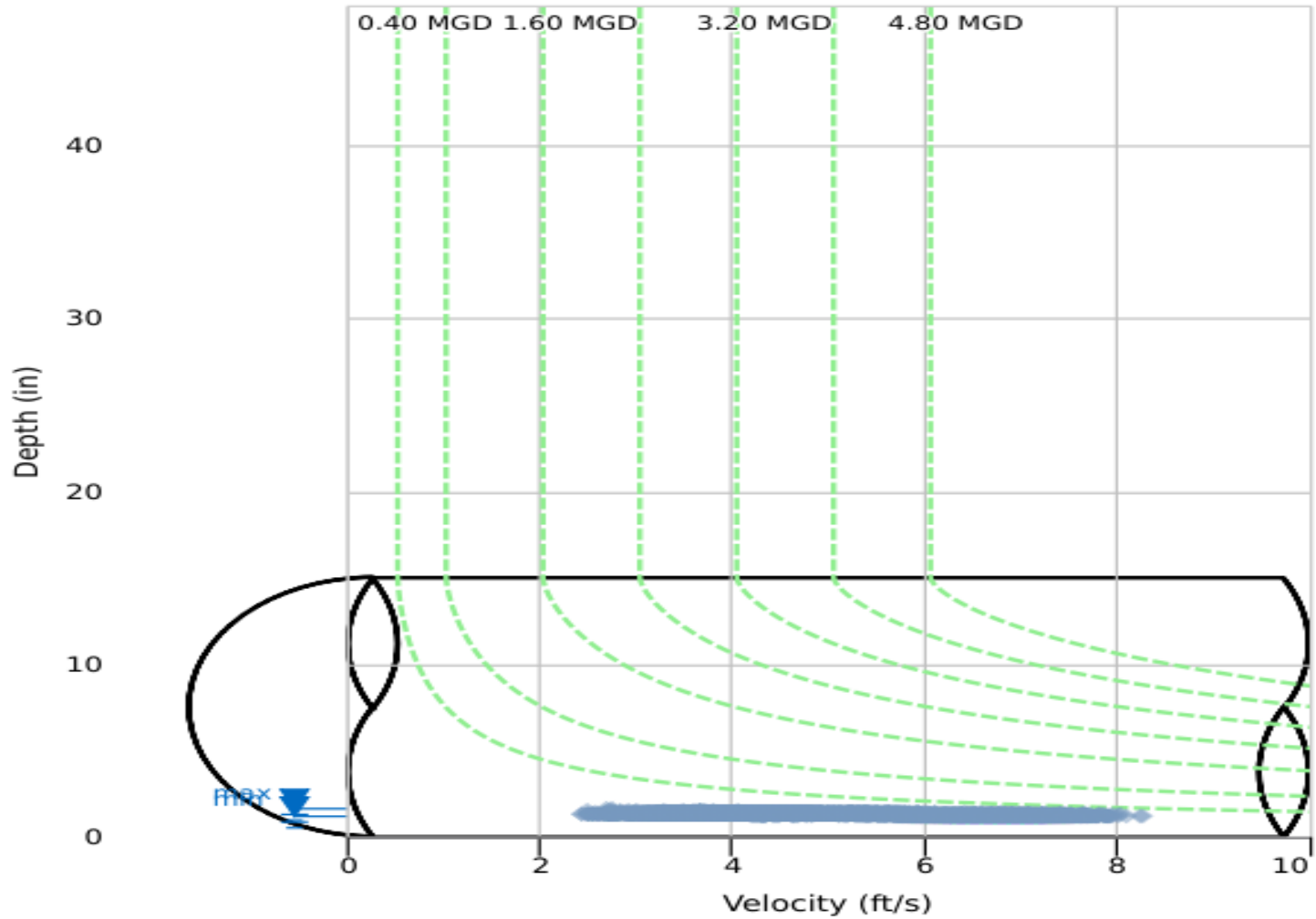
01/18/2023
To
03/15/2023

Legend

- DFINAL - VFINAL
- - - Iso-Q™
- ⏏ Min-Max Depth



ADS ENVIRONMENTAL
SERVICES®



Daily Tabular Report

01/18/2023 00:00 - 03/15/2023 23:55
FM04aPipe: Round (15 in H), Silt0.00 in

Date	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/18/2023	14:55	1.22	05:40	1.32	1.26	05:45	3.63	07:40	7.26	6.16	05:45	0.125	07:40	0.227	0.196	0.150	-
01/19/2023	21:20	1.23	05:25	1.38	1.28	04:30	2.43	19:05	7.45	5.62	04:25	0.083	07:35	0.240	0.183	0.183	-
01/20/2023	19:55	1.21	03:55	1.40	1.28	05:00	2.79	07:50	7.40	5.78	05:00	0.101	07:25	0.243	0.188	0.188	-
01/21/2023	21:20	1.21	04:25	1.38	1.28	05:00	2.66	09:40	7.41	5.80	05:00	0.093	09:40	0.234	0.187	0.187	-
01/22/2023	19:45	1.21	05:30	1.39	1.27	05:15	2.71	21:45	7.60	5.93	04:50	0.096	21:45	0.241	0.190	0.190	-
01/23/2023	18:30	1.22	04:25	1.38	1.28	04:45	2.92	21:50	7.89	6.17	04:45	0.101	19:35	0.257	0.200	0.200	-
01/24/2023	12:35	1.22	05:10	1.40	1.29	04:05	2.93	07:50	7.97	6.08	04:05	0.109	22:25	0.270	0.198	0.198	-
01/25/2023	08:15	1.21	01:40	1.41	1.28	04:25	2.75	07:20	7.72	6.09	04:25	0.093	07:00	0.253	0.197	0.197	-
01/26/2023	11:20	1.21	03:20	1.40	1.27	04:55	2.87	21:45	7.92	6.13	04:55	0.097	07:20	0.254	0.197	0.197	-
01/27/2023	12:30	1.22	03:15	1.40	1.28	04:30	3.01	07:30	8.27	6.16	04:30	0.104	07:30	0.266	0.199	0.199	-
01/28/2023	19:40	1.21	05:15	1.40	1.28	04:10	2.93	08:45	8.02	6.12	04:10	0.101	08:45	0.260	0.197	0.197	-
01/29/2023	16:55	1.21	03:10	1.38	1.27	05:10	2.59	13:50	8.04	6.18	05:10	0.092	13:50	0.273	0.197	0.197	-
01/30/2023	13:50	1.20	02:35	1.48	1.27	04:10	3.25	08:25	7.94	6.27	04:10	0.116	07:45	0.254	0.201	0.201	-
01/31/2023	13:00	1.21	09:00	1.46	1.28	03:40	2.81	07:10	7.96	6.01	03:40	0.102	07:10	0.273	0.194	0.194	-
02/01/2023	21:25	1.21	02:30	1.42	1.27	03:10	3.14	07:40	7.91	6.08	03:15	0.113	07:40	0.249	0.195	0.195	-
02/02/2023	18:40	1.21	04:45	1.39	1.28	05:00	2.97	07:55	7.74	6.04	05:00	0.107	07:55	0.248	0.195	0.195	-
02/03/2023	17:15	1.21	02:25	1.41	1.28	04:25	2.94	08:45	7.78	6.01	04:25	0.105	08:45	0.245	0.194	0.194	-
02/04/2023	15:10	1.21	06:50	1.42	1.28	04:25	3.11	19:25	7.42	5.95	05:20	0.114	10:05	0.235	0.193	0.193	-
02/05/2023	12:15	1.20	01:45	1.42	1.28	04:55	2.93	11:20	7.48	5.92	04:55	0.106	20:15	0.237	0.190	0.190	-
02/06/2023	13:25	1.21	22:05	1.43	1.29	03:50	2.62	08:20	7.29	5.80	03:50	0.093	22:05	0.262	0.188	0.188	-
02/07/2023	08:55	1.22	04:35	1.42	1.30	04:35	2.89	21:20	8.10	6.12	03:20	0.108	21:25	0.261	0.202	0.202	-
02/08/2023	00:50	1.32	06:30	1.47	1.39	03:50	2.74	00:00	6.11	4.16	03:50	0.098	00:05	0.215	0.153	0.153	-
02/09/2023	17:30	1.33	01:40	1.48	1.41	03:00	3.20	06:55	4.82	3.96	03:00	0.123	06:55	0.185	0.149	0.149	-
02/10/2023	23:25	1.31	04:10	1.47	1.39	02:55	3.22	21:45	4.90	4.12	02:55	0.127	07:05	0.191	0.152	0.152	-
02/11/2023	20:15	1.30	04:30	1.46	1.39	04:00	3.22	22:05	5.13	4.11	03:55	0.121	22:05	0.182	0.151	0.151	-
02/12/2023	16:55	1.32	04:15	1.47	1.40	05:35	3.20	08:15	5.12	3.96	04:55	0.125	08:15	0.183	0.147	0.147	-
02/13/2023	16:15	1.31	01:55	1.48	1.40	05:10	3.18	07:55	5.02	4.12	05:10	0.123	07:55	0.188	0.153	0.153	-
02/14/2023	16:00	1.34	02:50	1.47	1.41	04:40	3.32	06:55	4.90	4.00	04:40	0.128	06:55	0.185	0.151	0.151	-
02/15/2023	13:25	1.34	01:20	1.47	1.40	03:55	3.40	22:55	4.95	4.09	04:20	0.132	06:50	0.187	0.153	0.153	-
02/16/2023	15:05	1.29	03:30	1.64	1.39	03:25	2.50	06:55	4.90	4.08	04:05	0.105	06:55	0.178	0.150	0.150	-
02/17/2023	23:30	1.24	01:40	1.47	1.37	03:20	3.14	07:10	5.06	4.15	03:20	0.123	07:10	0.191	0.150	0.150	-
02/18/2023	00:05	1.25	06:25	1.48	1.37	04:45	3.33	08:05	5.04	4.12	15:40	0.126	08:35	0.179	0.149	0.149	-
02/19/2023	00:15	1.26	06:30	1.49	1.38	05:05	3.22	08:05	5.12	4.15	05:05	0.129	08:05	0.178	0.151	0.151	-
02/20/2023	07:25	1.29	03:55	1.51	1.39	04:25	3.45	08:40	5.04	4.07	12:40	0.122	08:40	0.185	0.150	0.150	-
02/21/2023	00:00	1.27	05:05	1.50	1.39	03:50	3.27	06:55	5.04	4.13	03:50	0.123	06:55	0.190	0.151	0.151	-
02/22/2023	14:20	1.28	05:20	1.47	1.38	04:00	2.97	06:50	4.95	4.11	03:05	0.115	07:05	0.189	0.150	0.150	-
02/23/2023	16:35	1.28	06:15	1.48	1.38	03:40	3.16	07:35	5.11	4.14	03:40	0.123	07:35	0.188	0.150	0.150	-
02/24/2023	05:00	1.26	02:25	1.48	1.40	01:55	3.26	23:35	6.20	4.55	01:55	0.130	23:00	0.226	0.169	0.169	-
02/25/2023	00:50	1.27	09:05	1.44	1.38	14:05	3.41	00:55	6.44	4.56	14:05	0.121	00:40	0.225	0.167	0.167	-
02/26/2023	14:10	1.31	02:50	1.49	1.40	12:05	3.40	22:25	4.90	4.01	18:15	0.123	07:45	0.176	0.149	0.149	-
02/27/2023	12:15	1.32	02:05	1.47	1.40	03:30	3.32	07:00	4.94	4.05	12:15	0.126	07:00	0.187	0.151	0.151	-
02/28/2023	12:20	1.32	05:00	1.50	1.40	05:15	3.60	23:40	5.00	4.20	20:25	0.134	06:35	0.189	0.156	0.156	-
03/01/2023	14:30	1.31	05:35	1.47	1.39	12:45	3.70	03:35	6.10	4.43	12:45	0.128	03:35	0.237	0.164	0.164	-
03/02/2023	12:35	1.30	05:10	1.50	1.40	05:00	3.32	06:45	5.01	4.09	10:15	0.133	06:45	0.193	0.153	0.153	-
03/03/2023	22:25	1.34	03:55	1.50	1.41	00:30	3.25	06:45	4.64	3.94	00:30	0.124	07:00	0.179	0.148	0.148	-
03/04/2023	20:50	1.33	05:00	1.48	1.41	03:20	3.37	07:25	4.60	3.95	16:20	0.130	07:25	0.179	0.149	0.149	-
03/05/2023	11:05	1.35	04:55	1.48	1.42	14:10	3.37	09:05	4.32	3.78	11:05	0.121	07:05	0.168	0.144	0.144	-
03/06/2023	18:50	1.34	04:10	1.48	1.42	04:30	3.07	07:20	4.45	3.82	04:30	0.124	07:20	0.171	0.146	0.146	-
03/07/2023	10:10	1.35	04:05	1.48	1.42	03:50	3.26	20:00	4.37	3.86	03:45	0.128	07:05	0.171	0.148	0.148	-
03/08/2023	19:15	1.36	04:45	1.49	1.42	01:35	3.53	07:15	4.63	3.89	11:30	0.131	07:15	0.181	0.149	0.149	-
03/09/2023	21:30	1.35	04:00	1.48	1.42	03:55	3.37	07:20	4.68	3.88	15:45	0.126	07:20	0.180	0.147	0.147	-
03/10/2023	21:55	1.33	07:00	1.49	1.41	04:40	3.31	14:20	5.28	4.07	04:40	0.129	07:05	0.190	0.153	0.153	-
03/11/2023	14:25	1.32	05:15	1.49	1.41	04:10	3.57	21:55	4.68	4.07	14:25	0.126	21:55	0.181	0.154	0.154	-
03/12/2023	14:45	1.33	06:40	1.49	1.41	04:55	3.52	08:45	4.82	4.09	15:55	0.135	08:45	0.184	0.154	0.154	-
03/13/2023	22:00	1.35	05:45	1.50	1.42	15:55	3.24	20:55	4.94	4.03	15:55	0.121	07:30	0.194	0.153	0.153	-
03/14/2023	09:55	1.33	07:05	1.49	1.41	02:10	3.00	23:30	6.11	4.11	03:45	0.119	23:30	0.235	0.155	0.155	-
03/15/2023	19:20	1.30	01:55	1.48	1.40	15:35	3.81	02:50	6.03	4.54	15:35	0.137	02:45	0.229	0.169	0.168	-

01/18/2023 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			9.523	
Average	1.36	4.80	0.168	

FM04b

Site Commentary

SITE INFORMATION

Pipe	Round (12 in H)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Friday, 03 March 2023 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site was installed as an additional alternative to FM04 and FM04A because of the imbalances at those locations. This 2nd client-revised location continued to operate until the end of the period, thus only has data for the final 13 days of the **courtesy-extended** study period.

Flow balancing with the upstream locations FM08 and FM06 works much better at this location. A moderate net flow was recorded between the sites.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.51	4.88	0.394
Minimum	1.44	2.01	0.074
Maximum	6.14	6.93	1.479
Min Time	03/10/2023 4:45:00 AM	03/08/2023 2:15:00 AM	03/08/2023 4:30:00 AM
Max Time	03/10/2023 2:25:00 PM	03/15/2023 4:50:00 AM	03/10/2023 2:15:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

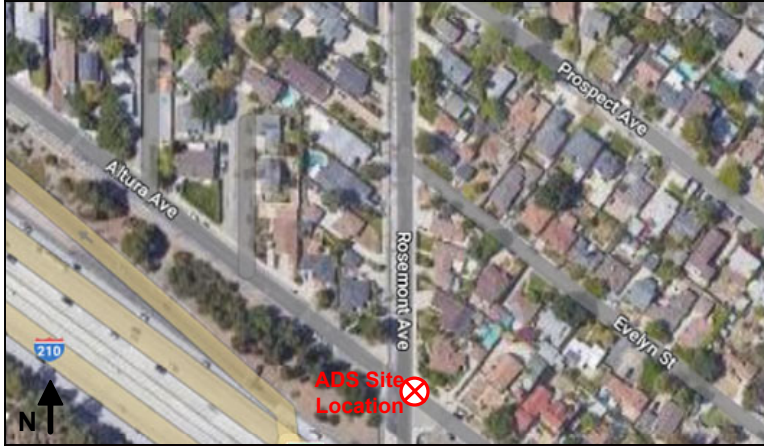
Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Friday, 03 March 2023 to Wednesday, 15 March 2023** is provided in the following table:

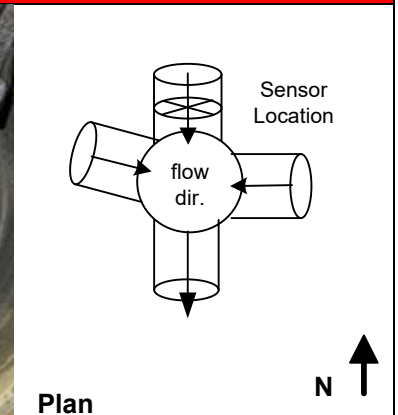
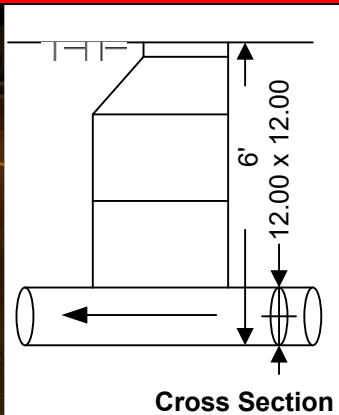
Percent Uptime	
DFINAL (in)	99
VFINAL (ft/s)	99
QFINAL (MGD - Total MG)	99

Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM04b		Install Date: 3/3/23		Monitor Type		Peak Doppler	
Address/Location: 2601 Altura Ave, La Crescenta-Montrose, CA 91214				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		MHS-27115	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		12.00 "
					Pipe Width:		12.00 "



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	3/3/23 @ 5:00 AM	Manhole Depth:		6'	
Site Hydraulics:	Good Straight Through Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:		VCP/Good	
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	2.25 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	3.90 fps				
Silt:	0 Inches				

Other Information:



Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report

FM04b

Flow Monitor

FM04b

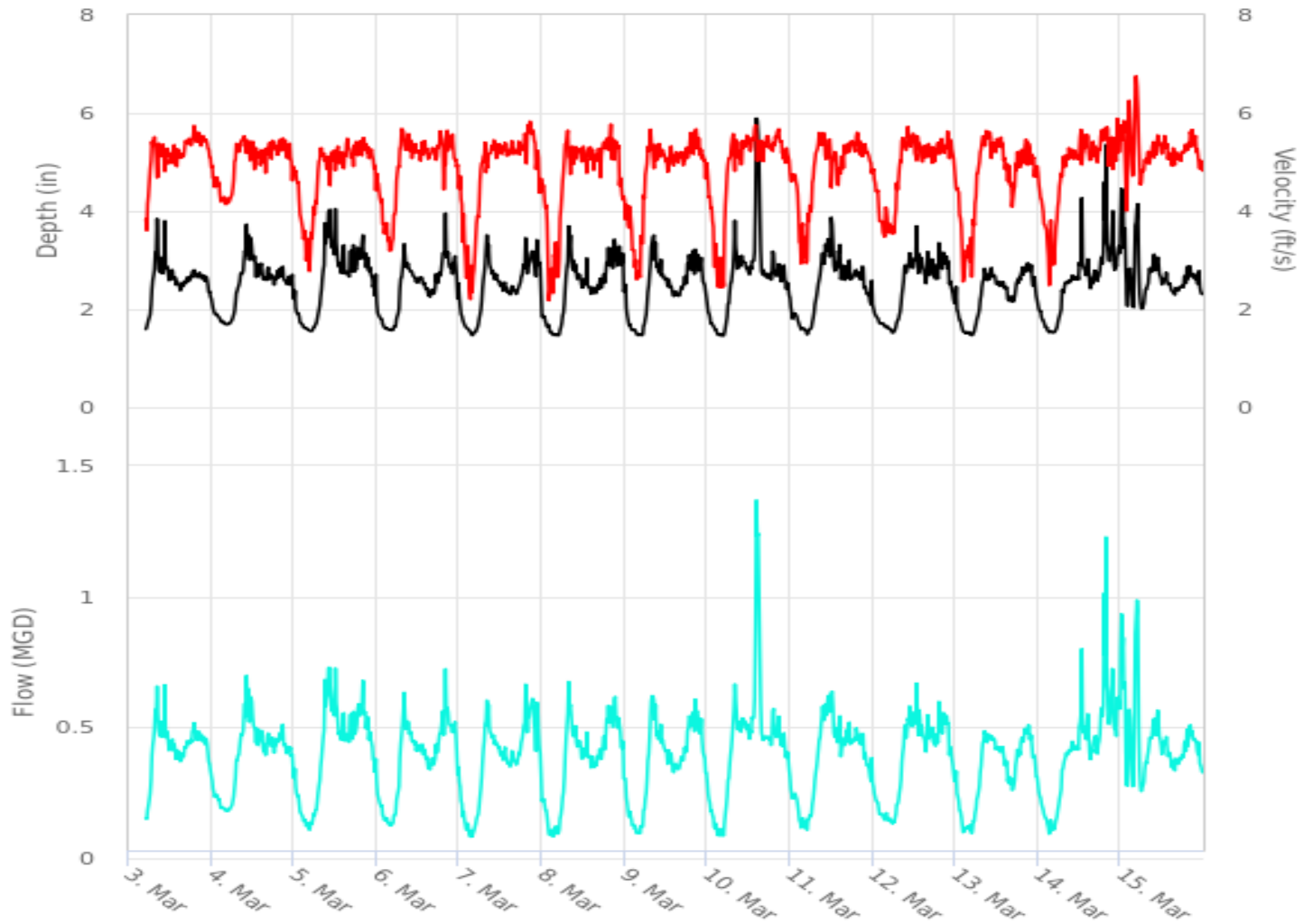
Pipe Height
12.00
in

Report Period

03/03/2023
To
03/15/2023

Legend

- DFINAL
- QFINAL
- VFINAL



Scattergraph Report

FM04b

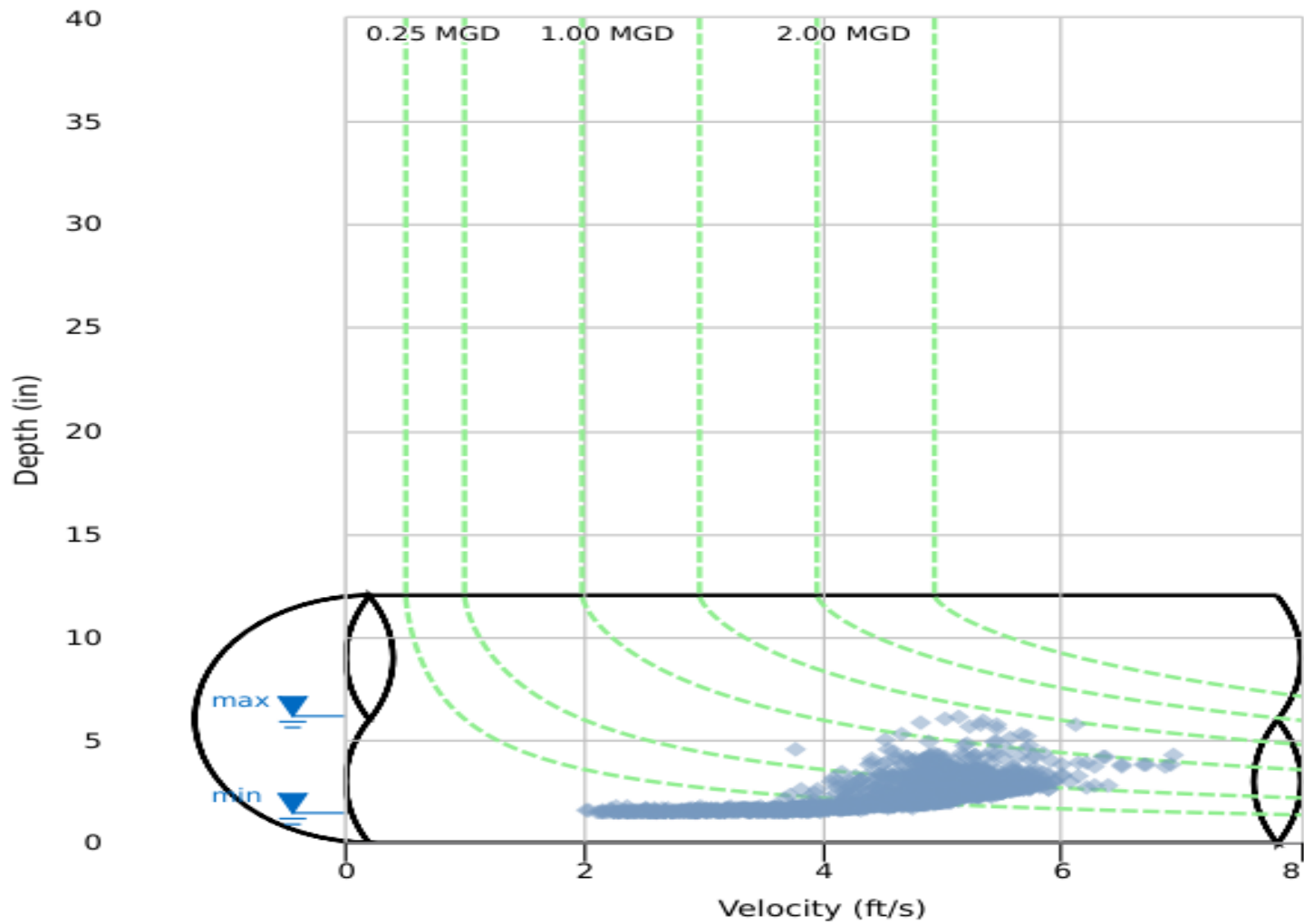
Flow Monitor
FM04b

Pipe Height
12.00
in

Report Period
03/03/2023
To
03/15/2023

Legend
○ DFINAL - VFINAL
--- Iso-Q™
▲ Min-Max Depth

ADS ENVIRONMENTAL SERVICES®



Daily Tabular Report

03/03/2023 00:00 - 03/15/2023 23:55
FM04bPipe: Round (12 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
03/03/2023	05:15	1.59	08:20	4.97	2.63	05:20	3.34	19:05	5.80	5.20	05:20	0.143	08:20	0.899	0.431	0.338	-	
03/04/2023	04:25	1.67	10:15	4.28	2.49	04:25	4.05	09:40	5.74	5.00	04:25	0.174	10:15	0.843	0.391	0.391	-	
03/05/2023	05:05	1.54	10:35	4.53	2.62	04:30	2.47	19:15	5.67	4.78	04:30	0.096	10:25	0.809	0.413	0.413	-	
03/06/2023	04:30	1.56	20:00	4.18	2.44	04:25	2.95	08:00	5.84	4.90	04:25	0.115	20:00	0.792	0.380	0.380	-	
03/07/2023	03:55	1.46	19:25	4.12	2.44	03:55	2.13	20:35	5.93	4.75	03:55	0.075	19:25	0.811	0.372	0.372	-	
03/08/2023	04:30	1.45	08:15	4.08	2.45	02:15	2.01	20:05	5.87	4.69	04:30	0.074	07:50	0.716	0.372	0.372	-	
03/09/2023	03:50	1.46	20:00	4.18	2.43	03:30	2.40	20:55	5.93	4.74	03:55	0.085	20:00	0.769	0.369	0.369	-	
03/10/2023	04:45	1.44	14:25	6.14	2.65	04:50	2.21	14:10	6.15	4.86	04:50	0.077	14:15	1.479	0.435	0.435	-	
03/11/2023	05:00	1.48	12:00	3.92	2.46	05:00	2.15	19:45	5.82	4.85	05:00	0.077	10:15	0.712	0.380	0.380	-	
03/12/2023	05:50	1.51	12:50	3.71	2.44	03:15	3.20	10:30	5.83	4.87	05:50	0.124	12:45	0.671	0.379	0.379	-	
03/13/2023	04:50	1.46	08:40	3.34	2.30	04:55	2.36	09:00	5.76	4.70	04:55	0.084	08:40	0.593	0.335	0.335	-	
03/14/2023	03:30	1.51	19:45	5.57	2.57	03:30	2.42	23:10	6.14	4.83	03:30	0.090	19:45	1.257	0.410	0.410	-	
03/15/2023	02:00	1.96	00:15	4.79	2.69	01:55	3.91	04:50	6.93	5.26	02:00	0.223	04:50	1.107	0.458	0.456	-	

03/03/2023 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			5.029	
Average	2.51	4.87	0.393	

FM05

Site Commentary

SITE INFORMATION

Pipe	Elliptical (15 in H x 14.88 in W)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location.

This line is located downstream of sites FM07. A moderate net flow was recorded between the sites.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.68	3.39	0.342
Minimum	1.55	1.91	0.088
Maximum	7.14	5.59	2.018
Min Time	01/19/2023 4:15:00 AM	12/21/2022 4:30:00 AM	01/19/2023 4:15:00 AM
Max Time	01/09/2023 7:30:00 PM	12/31/2022 8:30:00 PM	01/09/2023 7:30:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

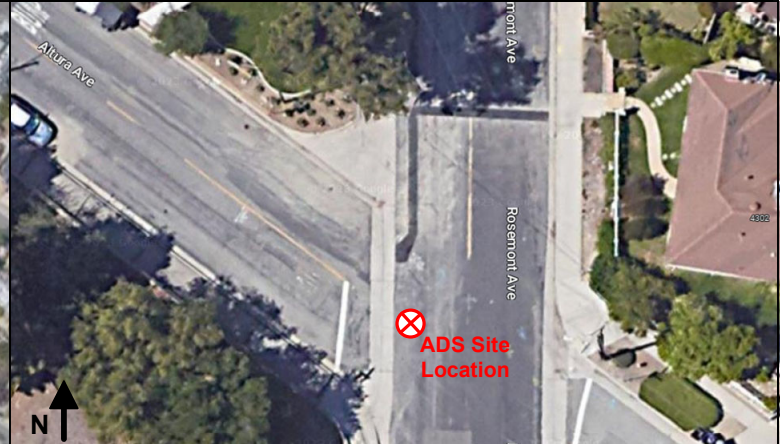
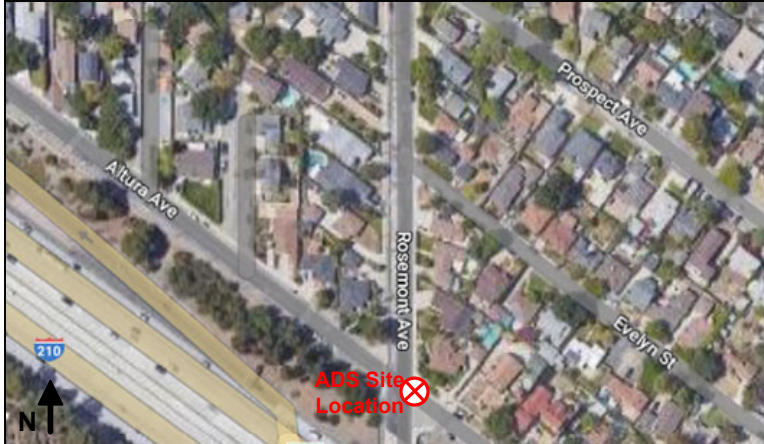
DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

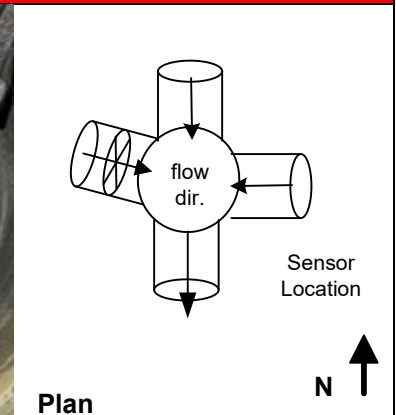
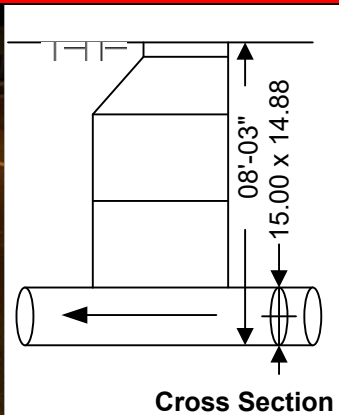


Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM05		Install Date: 11/28/22		Monitor Type		Peak Doppler	
Address/Location: 2601 Altura Ave, La Crescenta-Montrose, CA 91214				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		MHS-27115	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		15.00 "
					Pipe Width:		14.88 "



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	11/07/22 @1:26 AM	Manhole Depth:		08'-03"	
Site Hydraulics:	Good Straight Through Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:		VCP/Good	
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	2.88 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	4.59 fps				
Silt:	0 Inches				

Other Information:



Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

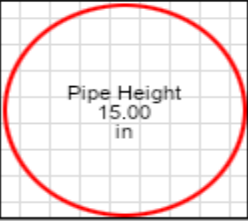
Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report

FM05

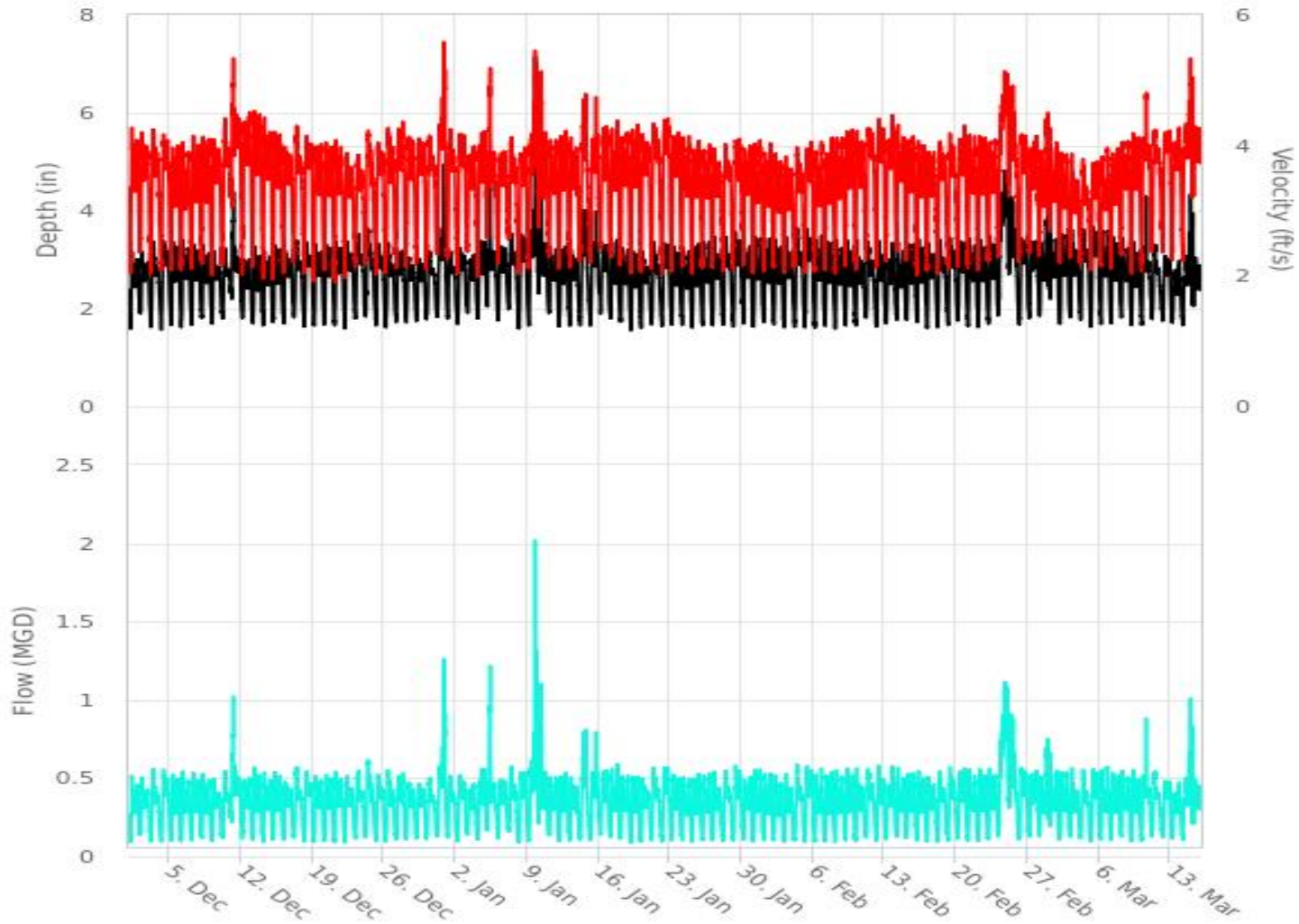
Flow Monitor
FM05



Pipe Height
15.00
in

Report Period
12/01/2022
To
03/15/2023

Legend
— DFINAL
— QFINAL
— VFINAL



Scattergraph Report

FM05

Flow Monitor

FM05

Pipe Height
15.00
in

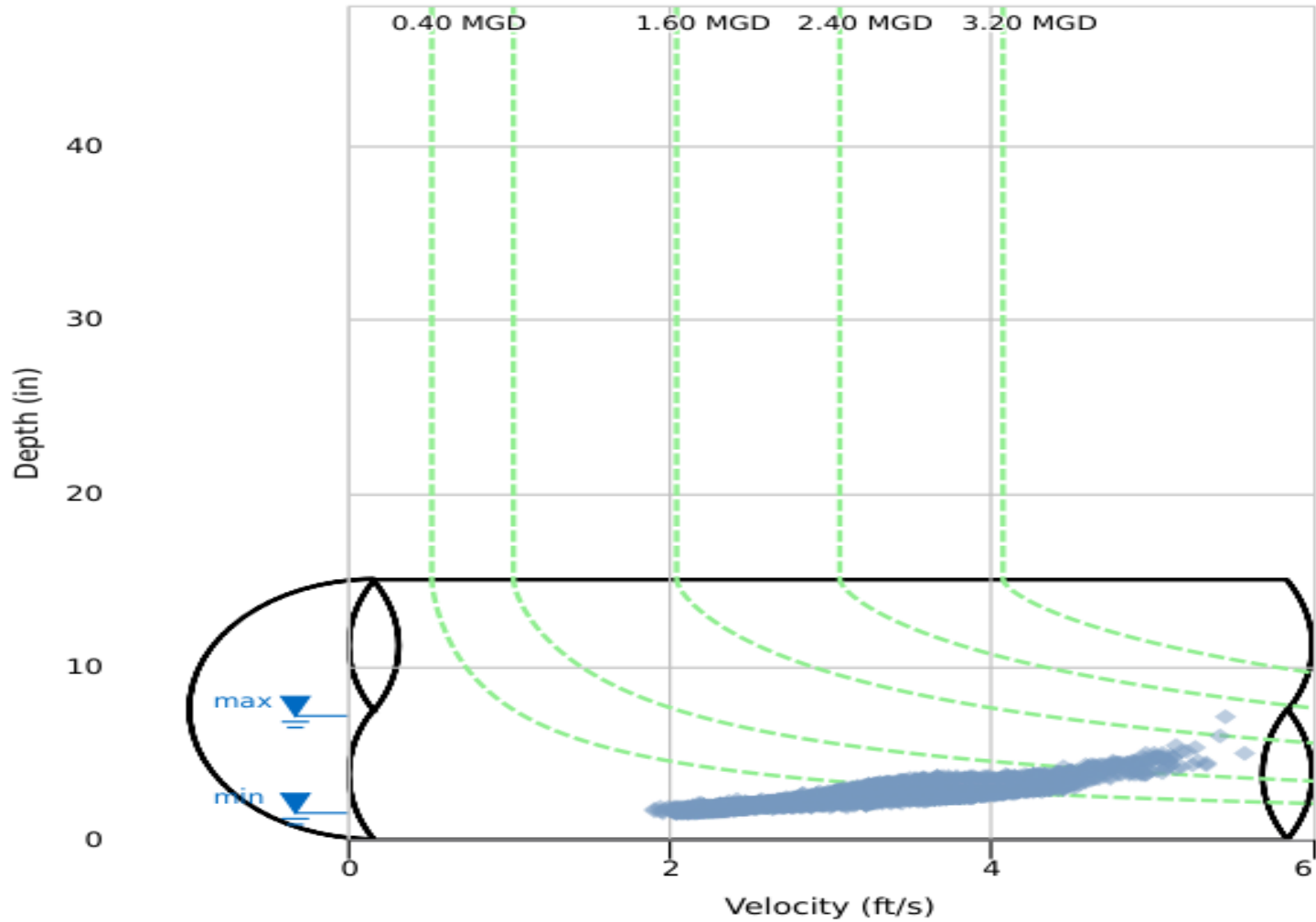
Report Period

12/01/2022
To
03/15/2023

Legend

- DFINAL - VFINAL
- Iso-QTM
- Min-Max Depth

ADS ENVIRONMENTAL
SERVICES®



Daily Tabular Report

12/01/2022 00:00 - 03/15/2023 23:55

FM05Pipe: Elliptical (15 in H x 14.88 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	04:25	1.58	08:05	3.17	2.50	02:40	1.88	08:10	4.33	3.42	04:05	0.087	08:10	0.524	0.311	0.311	-	
12/02/2022	04:20	1.89	08:20	3.18	2.56	02:55	2.27	17:40	4.26	3.44	02:55	0.135	08:05	0.515	0.318	0.318	-	
12/03/2022	04:30	1.62	10:20	3.40	2.60	03:20	1.93	10:05	4.31	3.37	05:15	0.094	10:20	0.574	0.327	0.327	-	
12/04/2022	05:00	1.57	10:35	3.39	2.66	04:25	2.01	10:35	4.27	3.34	05:15	0.092	10:35	0.570	0.336	0.336	-	
12/05/2022	04:20	1.65	08:05	3.38	2.65	04:10	2.06	19:35	4.08	3.23	04:20	0.097	08:05	0.535	0.319	0.319	-	
12/06/2022	03:50	1.61	08:00	3.42	2.65	03:55	2.04	08:05	4.14	3.18	03:55	0.093	08:05	0.557	0.315	0.315	-	
12/07/2022	04:25	1.67	08:15	3.34	2.64	04:20	2.08	08:00	4.21	3.27	04:20	0.100	08:00	0.543	0.320	0.320	-	
12/08/2022	03:55	1.80	08:10	3.30	2.61	04:55	2.13	11:05	4.37	3.30	04:55	0.114	11:05	0.549	0.316	0.316	-	
12/09/2022	04:45	1.69	08:10	3.20	2.56	04:45	1.99	08:10	4.17	3.36	04:45	0.097	08:10	0.512	0.313	0.313	-	
12/10/2022	05:15	1.75	10:20	3.25	2.55	04:25	2.11	10:30	4.44	3.48	05:15	0.110	10:30	0.555	0.324	0.324	-	
12/11/2022	02:40	2.18	06:35	4.52	2.96	02:40	2.97	06:35	5.42	4.17	02:40	0.210	06:35	1.080	0.471	0.471	-	
12/12/2022	03:50	1.79	08:10	3.02	2.49	03:25	1.92	20:50	4.56	3.69	03:25	0.109	20:50	0.508	0.329	0.329	-	
12/13/2022	04:45	1.69	08:00	3.28	2.46	04:30	2.08	07:50	4.57	3.59	04:30	0.101	07:50	0.575	0.318	0.318	-	
12/14/2022	04:20	1.64	08:05	3.18	2.50	04:25	1.90	08:05	4.49	3.48	04:20	0.090	08:05	0.547	0.316	0.316	-	
12/15/2022	03:35	1.71	08:05	3.30	2.57	02:45	1.91	08:05	4.26	3.37	03:10	0.103	08:05	0.548	0.318	0.318	-	
12/16/2022	05:00	1.67	08:20	3.18	2.60	04:05	1.96	07:55	4.07	3.31	05:00	0.099	07:55	0.483	0.317	0.317	-	
12/17/2022	04:50	1.80	10:55	3.45	2.68	04:25	2.15	11:20	4.36	3.40	04:25	0.119	10:55	0.587	0.342	0.342	-	
12/18/2022	05:20	1.60	11:30	3.40	2.65	05:20	1.99	11:35	4.20	3.35	05:20	0.090	11:30	0.558	0.335	0.335	-	
12/19/2022	04:55	1.64	08:00	3.33	2.64	03:10	1.80	20:40	4.08	3.31	03:10	0.090	08:05	0.518	0.327	0.327	-	
12/20/2022	04:05	1.67	08:20	3.32	2.65	03:05	1.99	08:00	4.09	3.26	03:05	0.096	08:15	0.525	0.322	0.322	-	
12/21/2022	04:35	1.63	08:10	3.40	2.69	04:30	1.81	08:05	4.14	3.21	04:30	0.085	08:10	0.554	0.324	0.324	-	
12/22/2022	04:40	1.59	09:45	3.40	2.71	04:40	1.93	09:45	4.00	3.17	04:40	0.086	09:45	0.536	0.322	0.322	-	
12/23/2022	04:30	1.77	13:50	4.03	2.78	04:35	2.09	13:50	4.14	3.19	04:30	0.111	13:50	0.704	0.338	0.338	-	
12/24/2022	05:20	1.83	11:20	3.65	2.80	05:05	2.14	11:35	4.28	3.32	05:05	0.118	11:35	0.625	0.357	0.357	-	
12/25/2022	05:20	1.65	10:00	3.37	2.67	05:05	1.97	10:30	4.15	3.29	05:05	0.095	10:30	0.545	0.330	0.330	-	
12/26/2022	04:50	1.59	10:55	3.37	2.58	05:10	1.99	10:40	4.37	3.35	04:50	0.089	10:40	0.569	0.323	0.323	-	
12/27/2022	04:35	1.71	20:30	3.24	2.58	04:20	2.09	20:25	4.44	3.44	04:40	0.105	20:25	0.551	0.326	0.326	-	
12/28/2022	05:05	1.71	11:30	3.06	2.52	04:25	2.07	10:40	4.21	3.42	04:35	0.106	11:30	0.482	0.312	0.312	-	
12/29/2022	04:25	1.73	11:15	3.06	2.50	03:20	2.13	11:20	4.17	3.41	04:30	0.112	11:15	0.480	0.307	0.307	-	
12/30/2022	04:20	1.77	11:00	3.18	2.56	04:20	2.04	11:00	4.22	3.40	04:20	0.106	11:00	0.514	0.317	0.317	-	
12/31/2022	04:25	1.82	20:35	5.05	2.92	05:05	2.27	20:35	5.69	3.75	05:05	0.123	20:35	1.326	0.445	0.445	-	
01/01/2023	05:45	1.78	00:05	4.19	2.64	05:40	2.19	00:05	5.25	3.52	05:45	0.115	00:05	0.943	0.342	0.342	-	
01/02/2023	05:00	1.67	11:50	3.26	2.57	05:15	2.00	11:50	4.28	3.39	05:15	0.098	11:50	0.540	0.324	0.324	-	
01/03/2023	04:45	1.90	20:25	3.13	2.61	05:10	2.34	19:40	4.05	3.36	04:40	0.137	19:40	0.478	0.320	0.320	-	
01/04/2023	04:50	1.79	13:20	3.41	2.70	04:05	1.91	21:20	4.30	3.35	04:05	0.105	21:20	0.575	0.340	0.340	-	
01/05/2023	04:00	2.03	10:05	5.17	3.01	04:00	2.53	10:05	5.26	3.63	04:00	0.161	10:05	1.264	0.429	0.429	-	
01/06/2023	04:35	1.74	18:10	3.29	2.71	04:30	2.18	19:55	4.02	3.31	04:35	0.111	18:15	0.502	0.336	0.336	-	
01/07/2023	04:35	1.98	11:15	3.55	2.80	05:10	2.54	11:30	4.17	3.41	04:20	0.158	11:15	0.588	0.360	0.360	-	
01/08/2023	04:45	1.59	12:15	3.57	2.76	06:00	1.94	18:55	3.99	3.24	06:00	0.088	19:40	0.549	0.347	0.347	-	
01/09/2023	04:15	1.64	19:30	7.38	3.21	03:20	2.08	19:30	5.61	3.67	04:15	0.097	19:30	2.160	0.517	0.517	-	
01/10/2023	03:40	2.28	10:25	4.82	3.22	03:40	2.71	10:20	5.20	3.83	03:40	0.204	10:20	1.130	0.493	0.493	-	
01/11/2023	03:30	1.90	20:30	3.24	2.64	03:45	2.21	07:50	4.16	3.37	03:45	0.128	07:50	0.518	0.328	0.328	-	
01/12/2023	04:15	1.62	20:15	3.28	2.58	04:15	1.93	20:20	4.26	3.34	04:15	0.089	20:30	0.540	0.317	0.317	-	
01/13/2023	04:40	1.62	08:05	3.23	2.55	04:40	2.06	08:10	4.17	3.33	04:40	0.095	08:05	0.514	0.310	0.310	-	
01/14/2023	05:25	1.64	17:55	4.21	2.81	05:25	2.17	17:55	4.97	3.51	05:25	0.101	17:55	0.900	0.393	0.393	-	
01/15/2023	05:00	1.64	18:30	4.02	2.73	04:55	2.18	18:35	4.80	3.41	05:00	0.102	18:35	0.814	0.357	0.357	-	
01/16/2023	05:05	1.88	20:25	3.33	2.78	05:00	2.37	19:00	4.38	3.57	05:00	0.136	19:00	0.567	0.371	0.371	-	
01/17/2023	04:55	1.78	21:20	3.48	2.63	04:45	2.23	21:20	4.40	3.43	04:55	0.121	21:20	0.610	0.334	0.334	-	
01/18/2023	05:05	1.72	08:10	3.24	2.58	03:40	1.97	20:55	4.27	3.41	03:40	0.101	20:55	0.526	0.323	0.323	-	
01/19/2023	04:20	1.54	09:55	3.66	2.54	04:15	2.01	09:55	4.41	3.43	04:20	0.086	09:55	0.656	0.320	0.320	-	
01/20/2023	04:25	1.59	08:20	3.18	2.51	04:25	2.02	07:50	4.23	3.45	04:25	0.091	07:50	0.507	0.315	0.315	-	
01/21/2023	05:10	1.66	10:20	3.40	2.55	05:05	2.05	10:25	4.43	3.52	05:10	0.098	10:25	0.590	0.332	0.332	-	
01/22/2023	05:05	1.63	10:45	3.36	2.62	05:05	1.96	10:30	4.43	3.57	05:05	0.091	19:35	0.581	0.352	0.352	-	
01/23/2023	04:45	1.66	08:10	3.35	2.56	03:45	2.05	19:40	4.28	3.50	04:45	0.101	08:10	0.558	0.328	0.328	-	
01/24/2023	04:40	1.64	07:55	3.31	2.55	04:40	2.07	07:55	4.25	3.36	04:40	0.097	07:55	0.548	0.313	0.313	-	
01/25/2023	04:30	1.61	20:05	3.38	2.60	04:												

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/07/2023	04:55	1.64	08:10	3.42	2.63	04:20	2.01	21:15	4.17	3.23	04:20	0.095	21:10	0.557	0.318	0.318	-
02/08/2023	03:50	1.58	12:50	3.54	2.62	04:05	2.00	12:50	4.21	3.33	04:05	0.088	12:50	0.597	0.326	0.326	-
02/09/2023	04:35	1.65	08:10	3.41	2.57	04:25	2.11	21:20	4.28	3.41	04:35	0.101	08:10	0.565	0.322	0.322	-
02/10/2023	05:05	1.64	08:10	3.46	2.53	05:05	2.05	08:15	4.33	3.42	05:05	0.096	08:15	0.592	0.315	0.315	-
02/11/2023	05:05	1.80	09:50	3.43	2.57	05:00	2.16	09:55	4.37	3.57	05:05	0.116	09:50	0.582	0.335	0.335	-
02/12/2023	05:05	1.63	11:10	3.47	2.57	04:55	2.09	11:15	4.49	3.57	04:55	0.097	11:10	0.618	0.340	0.340	-
02/13/2023	04:05	1.69	19:50	3.36	2.56	03:40	2.17	19:20	4.52	3.57	03:40	0.107	19:20	0.589	0.336	0.336	-
02/14/2023	05:20	1.74	08:00	3.38	2.57	05:05	2.32	08:05	4.39	3.48	05:20	0.122	08:05	0.576	0.325	0.325	-
02/15/2023	03:15	1.77	08:05	3.33	2.64	02:35	2.19	19:40	4.19	3.34	03:30	0.115	08:05	0.537	0.327	0.327	-
02/16/2023	04:40	1.72	07:50	3.44	2.67	04:40	1.98	07:50	4.13	3.26	04:40	0.099	07:50	0.563	0.324	0.324	-
02/17/2023	04:10	1.59	08:15	3.38	2.61	04:10	2.03	20:15	3.97	3.24	04:10	0.090	08:10	0.525	0.312	0.312	-
02/18/2023	05:10	1.60	09:30	3.47	2.63	05:10	2.02	11:20	4.12	3.31	05:10	0.091	09:30	0.560	0.326	0.326	-
02/19/2023	05:55	1.66	10:10	3.47	2.66	05:05	2.03	10:10	4.25	3.32	05:45	0.099	10:10	0.585	0.332	0.332	-
02/20/2023	04:20	1.74	09:55	3.39	2.70	03:00	2.00	20:20	4.36	3.42	03:00	0.105	20:20	0.576	0.349	0.349	-
02/21/2023	04:30	1.62	08:20	3.48	2.62	03:55	2.07	08:10	4.27	3.31	04:30	0.096	08:20	0.584	0.322	0.322	-
02/22/2023	04:10	1.61	08:05	3.44	2.63	03:30	2.05	08:05	4.21	3.32	04:10	0.096	08:05	0.573	0.325	0.325	-
02/23/2023	04:15	1.67	08:00	3.49	2.66	04:30	2.19	20:30	4.22	3.29	04:30	0.107	08:05	0.572	0.327	0.327	-
02/24/2023	02:45	1.85	18:00	4.84	3.58	02:35	2.25	18:35	5.19	4.08	02:35	0.125	18:35	1.126	0.643	0.643	-
02/25/2023	23:55	2.51	00:50	4.67	3.27	23:55	3.13	00:45	5.14	3.96	23:55	0.271	00:45	1.074	0.516	0.516	-
02/26/2023	05:15	1.66	11:25	3.47	2.74	04:45	2.18	11:25	4.29	3.43	05:05	0.106	11:25	0.592	0.361	0.361	-
02/27/2023	03:50	1.79	17:30	3.41	2.76	04:05	2.32	19:50	4.22	3.35	04:05	0.123	17:30	0.565	0.350	0.350	-
02/28/2023	04:40	1.84	23:50	4.00	2.83	04:25	2.27	23:50	4.58	3.35	04:45	0.126	23:50	0.771	0.364	0.364	-
03/01/2023	05:45	2.18	00:00	3.87	2.95	05:45	2.64	03:50	4.36	3.44	05:45	0.187	00:00	0.692	0.383	0.383	-
03/02/2023	04:45	1.69	08:00	3.56	2.76	04:45	2.18	20:40	3.99	3.15	04:45	0.106	08:00	0.565	0.330	0.330	-
03/03/2023	04:35	1.81	08:00	3.64	2.74	04:00	2.25	08:00	3.95	3.06	04:00	0.123	08:00	0.582	0.313	0.313	-
03/04/2023	05:00	1.76	10:50	3.64	2.80	04:10	2.15	10:20	3.90	3.05	05:00	0.113	10:20	0.571	0.326	0.326	-
03/05/2023	05:05	1.62	10:35	3.70	2.87	05:10	2.08	20:15	3.89	3.08	05:10	0.095	10:35	0.572	0.345	0.345	-
03/06/2023	05:00	1.67	20:00	3.62	2.77	04:10	2.11	20:10	4.01	3.10	05:00	0.102	19:35	0.580	0.327	0.327	-
03/07/2023	04:40	1.68	08:10	3.50	2.69	03:00	2.07	19:30	4.04	3.20	04:40	0.102	08:15	0.551	0.323	0.323	-
03/08/2023	04:15	1.78	07:55	3.50	2.67	04:15	2.26	07:55	4.15	3.35	04:15	0.119	07:55	0.578	0.330	0.330	-
03/09/2023	04:25	1.65	08:10	3.39	2.58	04:25	1.98	08:05	4.21	3.39	04:25	0.093	08:10	0.560	0.320	0.320	-
03/10/2023	03:50	1.65	14:25	4.40	2.72	03:50	2.02	14:25	4.94	3.57	03:50	0.095	14:25	0.950	0.371	0.371	-
03/11/2023	05:00	1.76	11:15	3.34	2.59	04:15	2.35	11:05	4.28	3.54	05:00	0.123	12:25	0.556	0.335	0.335	-
03/12/2023	04:55	1.74	10:55	3.11	2.54	05:10	2.31	12:50	4.29	3.58	04:55	0.119	11:00	0.502	0.331	0.331	-
03/13/2023	04:30	1.67	21:05	3.01	2.40	05:15	2.19	21:05	4.32	3.57	04:30	0.107	21:05	0.486	0.300	0.300	-
03/14/2023	04:35	1.65	23:30	4.46	2.59	03:55	2.21	23:30	5.53	3.75	04:40	0.105	23:30	1.084	0.363	0.363	-
03/15/2023	03:50	2.05	04:55	4.03	2.71	06:25	3.15	04:55	5.17	4.01	03:55	0.205	04:55	0.879	0.397	0.396	-

12/01/2022 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			35.870	
Average	2.68	3.39	0.342	



FM06

Site Commentary

SITE INFORMATION

Pipe	Elliptical (10.13 in H x 10 in W)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location. Review of the scattergraph shows this site operated in multiple data regimes during the period. A decrease in flow was observed from March 8 – March 15. This portion of the data is of lower confidence than the data recorded earlier in the study.

This line is located upstream of site FM04 (See FM04, FM04A, and FM04B Site Commentary for More Details).

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.42	1.46	0.101
Minimum	1.25	0.32	0.014
Maximum	4.83	2.39	0.345
Min Time	01/22/2023 5:30:00 AM	03/10/2023 1:00:00 AM	03/10/2023 4:00:00 AM
Max Time	01/09/2023 7:30:00 PM	01/09/2023 11:00:00 PM	01/05/2023 10:00:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

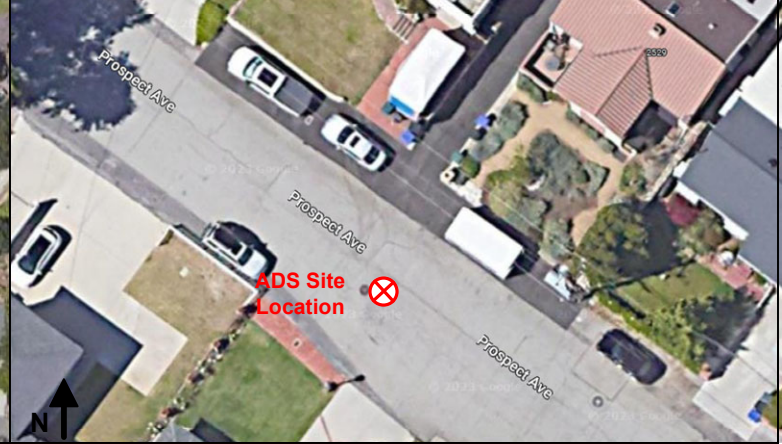
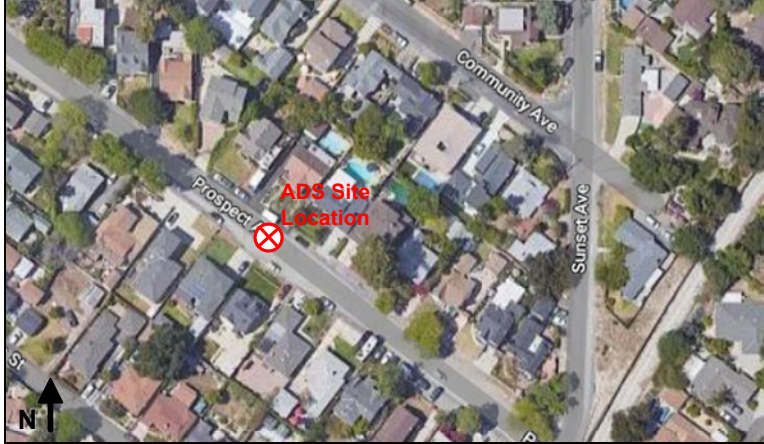
DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	98
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	98.

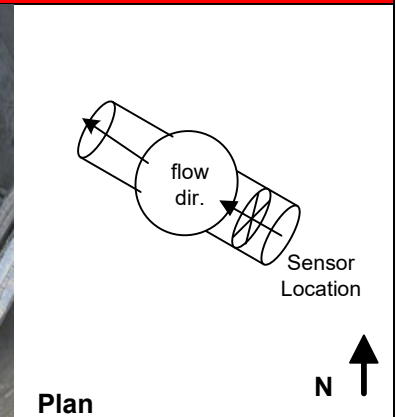
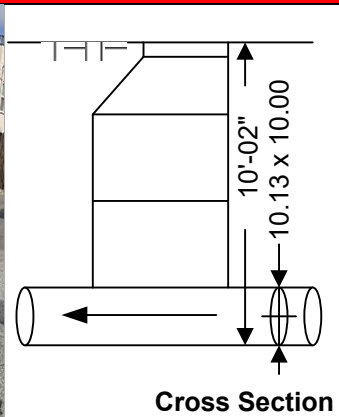


Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM06		Install Date: 11/28/22		Monitor Type		Peak Doppler	
Address/Location: 2533 Prospect Ave, Montrose, CA 91020				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		Unknown	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		10.13 "
					Pipe Width:		10.00 "



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	11/07/22 @1:17 AM	Manhole Depth:		10'-02"	
Site Hydraulics:	Good Straight Through Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:		VCP/Good	
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	2.50 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	2.14 fps				
Silt:	0 Inches				

Other Information:



Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

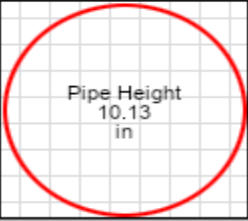
Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

Hydrograph Report

FM06

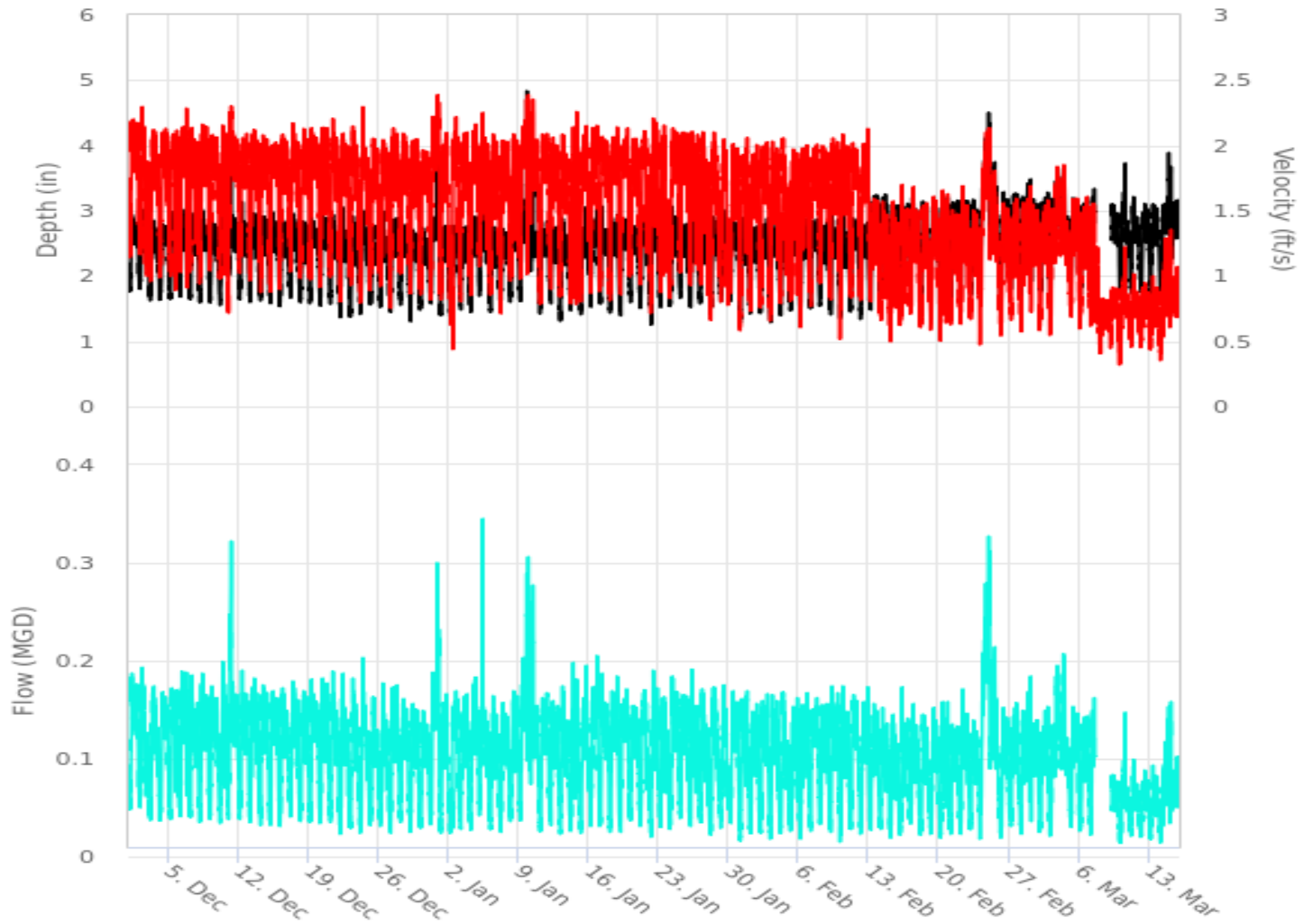
Flow Monitor
FM06



Pipe Height
10.13
in

Report Period
12/01/2022
To
03/15/2023

Legend
— DFINAL
— QFINAL
— VFINAL

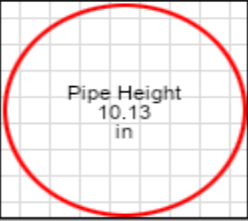


Scattergraph Report

FM06

Flow Monitor

FM06



Pipe Height
10.13
in

Report Period

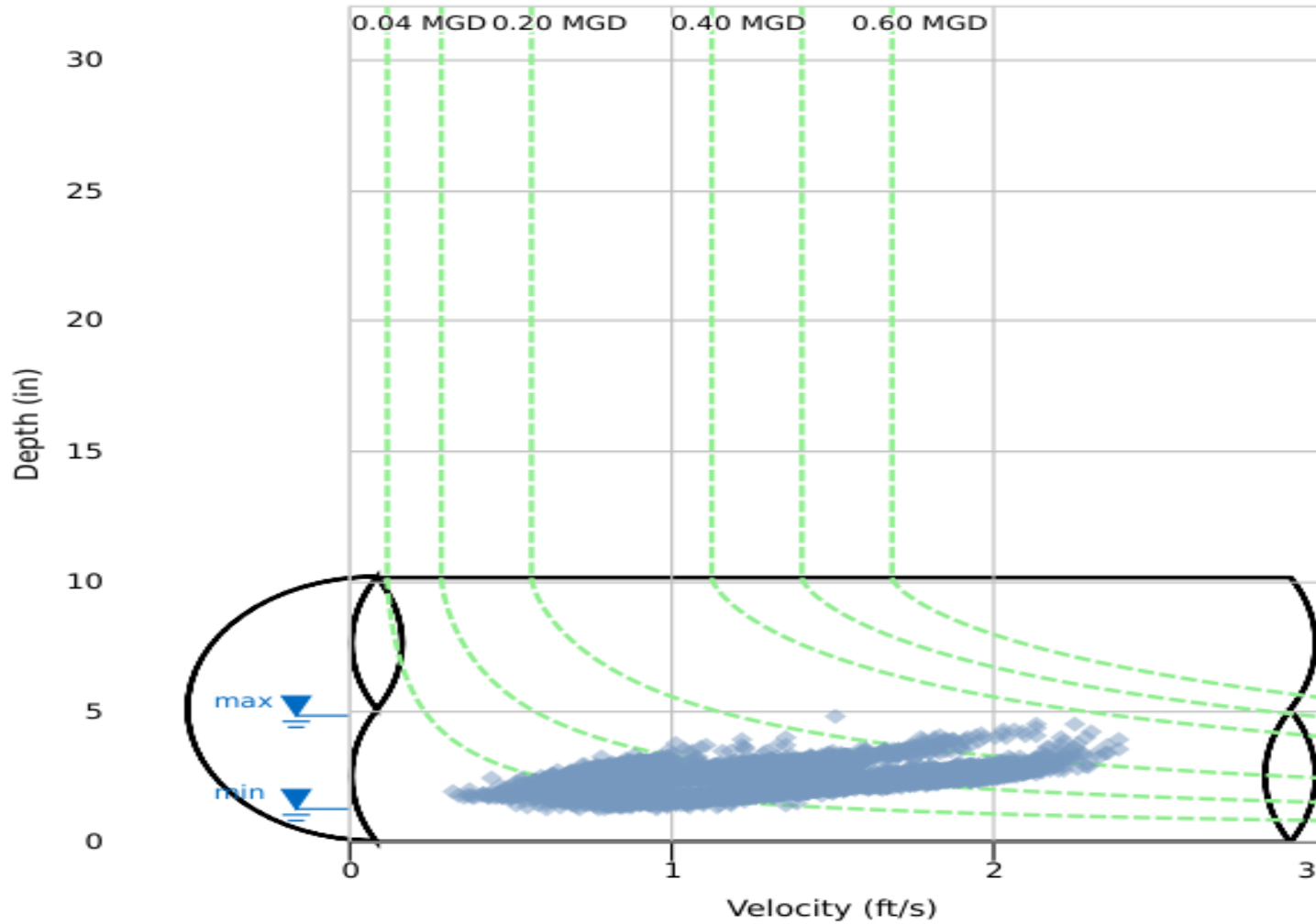
12/01/2022
To
03/15/2023

Legend

- DFINAL - VFINAL
- - - Iso-Q™
- ▼ Min-Max Depth



ADS ENVIRONMENTAL
SERVICES®



Daily Tabular Report

12/01/2022 00:00 - 03/15/2023 23:55

FM06Pipe: Elliptical (10.13 in H x 10 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	02:35	1.77	08:20	2.96	2.44	04:40	1.07	07:30	2.28	1.80	03:00	0.045	08:20	0.192	0.123	0.123	-	
12/02/2022	04:10	1.80	08:35	3.11	2.40	21:00	0.92	09:10	2.37	1.58	04:05	0.048	08:35	0.202	0.106	0.106	-	
12/03/2022	04:15	1.61	11:55	2.98	2.31	04:30	0.88	11:10	2.17	1.67	04:30	0.034	13:15	0.189	0.108	0.108	-	
12/04/2022	04:45	1.62	14:25	2.84	2.34	02:00	0.96	17:15	2.32	1.68	02:00	0.036	17:15	0.175	0.110	0.110	-	
12/05/2022	04:10	1.63	08:20	3.12	2.41	16:30	0.72	20:55	2.30	1.72	04:10	0.036	08:20	0.188	0.117	0.117	-	
12/06/2022	04:35	1.68	08:25	3.05	2.41	01:10	0.69	19:05	2.41	1.72	01:10	0.037	19:05	0.198	0.117	0.117	-	
12/07/2022	04:20	1.61	08:15	2.99	2.38	01:20	0.94	08:20	2.26	1.64	05:00	0.037	08:20	0.196	0.110	0.110	-	
12/08/2022	04:40	1.59	07:45	3.13	2.40	02:40	0.93	09:20	2.26	1.73	02:40	0.033	09:20	0.202	0.118	0.118	-	
12/09/2022	03:40	1.56	13:25	3.01	2.32	03:40	1.00	13:25	2.23	1.68	03:40	0.035	13:25	0.198	0.109	0.109	-	
12/10/2022	03:50	1.55	10:00	3.18	2.34	23:35	0.65	09:40	2.21	1.63	02:40	0.033	10:00	0.208	0.107	0.107	-	
12/11/2022	01:00	1.97	06:30	4.24	2.73	00:05	0.68	05:10	2.34	1.89	00:05	0.036	06:35	0.325	0.150	0.150	-	
12/12/2022	03:05	1.61	08:45	3.35	2.40	03:05	0.97	15:40	2.20	1.72	03:05	0.035	08:45	0.215	0.116	0.116	-	
12/13/2022	03:55	1.57	18:50	3.13	2.40	02:00	0.95	12:30	2.24	1.72	03:55	0.035	18:50	0.193	0.117	0.117	-	
12/14/2022	04:35	1.61	11:20	2.96	2.36	04:55	0.56	20:30	2.23	1.69	04:55	0.021	11:20	0.183	0.111	0.111	-	
12/15/2022	04:40	1.57	11:00	3.07	2.35	04:30	0.84	08:15	2.20	1.70	04:35	0.030	19:55	0.183	0.111	0.111	-	
12/16/2022	03:20	1.53	10:10	2.88	2.32	03:20	0.87	10:05	2.12	1.67	03:20	0.029	10:05	0.175	0.108	0.108	-	
12/17/2022	05:10	1.66	12:30	3.03	2.33	03:45	0.98	10:40	2.23	1.69	05:10	0.039	12:30	0.183	0.109	0.109	-	
12/18/2022	04:35	1.59	12:20	2.91	2.30	05:15	0.89	12:35	2.17	1.67	03:45	0.034	20:35	0.178	0.107	0.107	-	
12/19/2022	02:40	1.58	07:35	2.98	2.36	04:25	0.91	15:20	2.17	1.72	02:45	0.033	07:40	0.187	0.114	0.114	-	
12/20/2022	04:35	1.53	09:50	3.05	2.38	02:50	0.87	20:45	2.23	1.69	02:50	0.032	09:50	0.193	0.114	0.114	-	
12/21/2022	04:20	1.57	12:10	3.08	2.33	03:55	0.92	10:25	2.30	1.69	04:20	0.035	10:25	0.200	0.110	0.110	-	
12/22/2022	04:00	1.36	11:05	3.13	2.25	04:00	0.77	10:50	2.24	1.62	04:00	0.022	11:05	0.197	0.103	0.103	-	
12/23/2022	03:25	1.33	10:30	3.00	2.24	04:10	0.82	10:15	2.24	1.67	04:10	0.024	10:15	0.190	0.104	0.104	-	
12/24/2022	03:40	1.39	10:20	3.10	2.25	04:20	0.76	10:20	2.39	1.59	03:40	0.023	10:20	0.221	0.100	0.100	-	
12/25/2022	05:50	1.55	10:25	2.79	2.18	03:35	0.83	21:20	2.13	1.57	03:35	0.030	10:55	0.167	0.093	0.093	-	
12/26/2022	04:10	1.51	10:15	3.08	2.22	04:10	0.86	11:10	2.10	1.61	04:10	0.028	10:15	0.188	0.098	0.098	-	
12/27/2022	05:25	1.39	09:35	3.00	2.27	05:10	0.65	11:35	2.20	1.65	05:10	0.022	09:35	0.189	0.106	0.106	-	
12/28/2022	04:30	1.52	12:10	2.92	2.26	03:25	0.93	14:50	2.19	1.64	04:30	0.032	12:10	0.171	0.102	0.102	-	
12/29/2022	04:55	1.28	18:00	2.83	2.20	05:05	0.70	19:05	2.12	1.61	05:05	0.020	10:25	0.162	0.098	0.098	-	
12/30/2022	03:20	1.47	09:10	2.80	2.17	05:25	0.82	12:10	2.07	1.58	04:55	0.028	09:10	0.162	0.094	0.094	-	
12/31/2022	03:40	1.55	20:25	4.01	2.47	04:00	0.77	22:10	2.43	1.72	04:00	0.030	20:30	0.311	0.126	0.126	-	
01/01/2023	03:55	1.36	00:05	3.34	2.26	03:55	0.78	00:10	2.37	1.64	03:55	0.022	00:05	0.240	0.104	0.104	-	
01/02/2023	03:40	1.36	10:35	2.93	2.23	10:10	0.30	18:05	2.31	1.47	10:10	0.020	18:05	0.178	0.093	0.093	-	
01/03/2023	05:40	1.48	20:15	2.81	2.26	05:15	0.77	19:05	2.18	1.61	04:35	0.027	20:20	0.167	0.101	0.101	-	
01/04/2023	04:55	1.41	14:55	3.10	2.32	05:00	0.77	14:55	2.32	1.66	05:00	0.024	14:55	0.214	0.109	0.109	-	
01/05/2023	01:30	1.68	10:05	4.87	2.47	00:45	0.92	10:00	2.31	1.75	01:30	0.040	10:00	0.389	0.123	0.123	-	
01/06/2023	04:10	1.37	10:25	2.79	2.18	04:10	0.76	10:35	2.17	1.61	04:10	0.022	10:35	0.168	0.096	0.096	-	
01/07/2023	04:00	1.47	10:25	2.74	2.21	05:30	0.68	19:25	2.15	1.59	05:30	0.023	10:20	0.165	0.097	0.097	-	
01/08/2023	03:50	1.59	11:50	2.92	2.34	04:20	0.85	11:55	2.14	1.65	04:20	0.032	11:55	0.181	0.108	0.108	-	
01/09/2023	04:20	1.61	19:35	5.01	2.61	21:05	0.91	23:05	2.44	1.73	03:25	0.034	19:25	0.336	0.133	0.133	-	
01/10/2023	23:35	2.01	10:15	3.80	2.57	12:05	1.31	10:25	2.40	1.84	23:25	0.070	10:20	0.289	0.134	0.134	-	
01/11/2023	03:10	1.41	19:30	2.85	2.30	04:35	0.74	09:05	2.19	1.68	02:40	0.024	09:05	0.174	0.108	0.108	-	
01/12/2023	05:35	1.49	09:20	2.83	2.29	05:30	0.88	10:40	2.14	1.66	05:35	0.029	09:20	0.172	0.105	0.105	-	
01/13/2023	03:35	1.30	09:15	2.94	2.24	03:25	0.78	09:10	2.18	1.61	03:25	0.021	09:10	0.186	0.101	0.101	-	
01/14/2023	04:30	1.45	13:20	3.32	2.38	04:15	0.68	19:05	2.36	1.32	04:15	0.023	11:00	0.215	0.086	0.086	-	
01/15/2023	05:10	1.38	18:25	3.11	2.27	05:05	0.75	18:25	2.23	1.62	05:10	0.023	18:25	0.208	0.104	0.104	-	
01/16/2023	05:15	1.52	19:45	3.22	2.39	04:30	0.82	21:10	2.20	1.71	04:35	0.030	19:45	0.214	0.116	0.116	-	
01/17/2023	05:05	1.55	08:00	3.09	2.30	02:05	0.84	09:15	2.11	1.68	02:05	0.029	08:00	0.193	0.107	0.107	-	
01/18/2023	03:10	1.40	20:00	2.99	2.30	03:05	0.80	10:50	2.26	1.65	03:10	0.024	20:00	0.192	0.108	0.108	-	
01/19/2023	04:45	1.38	18:55	2.92	2.31	04:45	0.74	21:20	2.16	1.67	04:45	0.022	19:00	0.174	0.110	0.110	-	
01/20/2023	04:20	1.59	18:40	2.91	2.31	02:30	0.82	12:15	2.20	1.68	02:30	0.032	11:55	0.165	0.107	0.107	-	
01/21/2023	03:30	1.48	11:10	2.97	2.26	05:05	0.91	14:05	2.24	1.60	03:30	0.030	14:05	0.184	0.100	0.100	-	
01/22/2023	05:35	1.25	10:40	3.02	2.27	04:35	0.68	10:40	2.32	1.65	05:30	0.019	10:40	0.207	0.106	0.106	-	
01/23/2023	04:35	1.50	20:55	3.00	2.31	03:35	0.85	12:50	2.22	1.44	03:35	0.029	12:50	0.174	0.092	0.092	-	
01/24/2023	03:30	1.50	10:30	3.40	2.34	03:00	0.78	10:05	2.23	1.67	03:00	0.027	10:30	0.232	0.112	0.112	-	
01/25/2023	03:30	1.65	18:45	2.91	2.32	03:20	0.98	19:55	2.16	1.69	03:20	0.037	18:50	0.				

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/07/2023	03:35	1.48	19:25	2.90	2.35	04:35	0.73	19:50	2.09	1.61	04:35	0.024	19:25	0.169	0.107	0.107	-
02/08/2023	01:45	1.52	18:50	3.00	2.28	02:30	0.85	09:30	2.12	1.60	01:45	0.030	18:50	0.173	0.101	0.101	-
02/09/2023	04:45	1.39	07:35	2.98	2.29	03:25	0.79	21:15	2.13	1.60	04:50	0.024	07:40	0.182	0.103	0.103	-
02/10/2023	02:45	1.28	09:15	2.98	2.26	02:40	0.44	09:30	2.13	1.55	02:45	0.012	09:30	0.177	0.099	0.099	-
02/11/2023	04:10	1.40	11:15	2.98	2.26	05:45	0.65	09:20	2.07	1.57	05:45	0.021	11:20	0.169	0.100	0.100	-
02/12/2023	03:35	1.33	21:40	2.94	2.23	05:55	0.70	21:40	2.21	1.58	03:30	0.021	21:40	0.190	0.098	0.098	-
02/13/2023	05:05	1.47	18:05	3.30	2.52	03:05	0.77	13:45	1.67	1.27	05:05	0.026	12:10	0.164	0.092	0.092	-
02/14/2023	05:10	1.69	15:15	3.39	2.60	04:45	0.59	09:10	1.61	1.13	04:45	0.024	09:10	0.156	0.086	0.086	-
02/15/2023	03:30	1.58	20:15	3.15	2.55	04:05	0.46	09:25	1.63	1.05	04:05	0.017	08:05	0.149	0.078	0.078	-
02/16/2023	03:15	1.49	08:05	3.33	2.57	02:50	0.55	08:05	1.74	1.15	03:15	0.019	08:05	0.178	0.087	0.087	-
02/17/2023	03:40	1.85	10:45	3.22	2.62	03:15	0.67	11:20	1.73	1.19	05:10	0.032	11:20	0.160	0.092	0.092	-
02/18/2023	04:05	1.56	09:40	3.15	2.51	04:05	0.58	18:20	1.66	1.11	04:05	0.020	11:50	0.149	0.082	0.082	-
02/19/2023	04:40	1.59	10:45	3.23	2.51	03:40	0.51	16:40	1.72	1.15	03:40	0.021	12:00	0.156	0.084	0.084	-
02/20/2023	05:20	1.55	21:05	3.24	2.54	03:35	0.44	19:10	1.69	1.06	03:35	0.018	21:05	0.161	0.079	0.079	-
02/21/2023	04:35	1.53	21:15	3.21	2.57	04:55	0.60	19:10	1.60	1.14	04:55	0.021	19:10	0.146	0.087	0.087	-
02/22/2023	03:15	1.57	08:55	3.33	2.64	04:25	0.60	09:00	1.73	1.15	03:15	0.022	09:00	0.176	0.090	0.090	-
02/23/2023	04:40	1.69	10:25	3.19	2.61	01:50	0.64	18:55	1.66	1.12	02:15	0.027	11:10	0.149	0.086	0.086	-
02/24/2023	02:40	1.61	23:15	4.52	3.26	02:05	0.44	23:15	2.17	1.49	02:05	0.017	23:15	0.333	0.163	0.163	-
02/25/2023	23:45	2.22	00:45	4.60	3.08	22:30	0.78	00:20	2.26	1.36	22:30	0.055	00:45	0.354	0.129	0.129	-
02/26/2023	04:40	1.54	11:20	3.32	2.64	04:25	0.49	18:25	1.61	1.11	04:25	0.017	11:20	0.160	0.088	0.088	-
02/27/2023	04:50	1.79	20:30	3.32	2.73	05:20	0.59	15:15	1.72	1.14	05:20	0.025	15:15	0.174	0.093	0.093	-
02/28/2023	05:00	1.55	21:55	3.44	2.74	05:30	0.57	10:50	1.70	1.15	05:00	0.021	22:00	0.175	0.095	0.095	-
03/01/2023	05:40	1.90	04:00	3.52	2.82	05:30	0.68	03:55	1.74	1.25	05:30	0.032	03:55	0.191	0.103	0.103	-
03/02/2023	04:35	1.75	20:50	3.39	2.64	02:35	0.53	08:20	1.73	1.16	02:35	0.023	20:50	0.161	0.091	0.091	-
03/03/2023	02:40	1.58	16:50	3.50	2.75	02:05	0.53	20:25	1.87	1.26	02:40	0.019	20:25	0.200	0.108	0.108	-
03/04/2023	23:30	2.42	10:35	3.70	2.95	22:25	0.97	11:50	1.99	1.40	23:25	0.067	11:50	0.218	0.123	0.123	-
03/05/2023	05:25	1.82	09:50	3.22	2.65	05:10	0.54	16:05	1.65	1.20	05:10	0.024	09:50	0.159	0.094	0.094	-
03/06/2023	04:15	1.65	20:40	3.16	2.60	01:40	0.58	12:00	1.67	1.20	03:40	0.024	20:05	0.150	0.092	0.092	-
03/07/2023	03:45	1.53	12:50	3.84	2.43	13:10	0.42	12:50	1.81	0.96	03:35	0.020	12:50	0.224	0.079	0.043	-
03/08/2023	-	-	-	-	-	04:35	0.39	18:55	0.88	0.66	-	-	-	-	-	-	-
03/09/2023	23:25	2.38	08:00	3.18	2.79	03:45	0.40	18:30	0.95	0.76	23:25	0.039	10:55	0.089	0.065	0.048	-
03/10/2023	04:50	1.65	14:50	3.90	2.60	03:55	0.20	14:50	1.49	0.74	03:55	0.008	14:50	0.188	0.058	0.058	-
03/11/2023	05:10	1.70	10:55	3.34	2.54	05:10	0.43	10:55	1.04	0.75	05:10	0.017	10:55	0.106	0.055	0.055	-
03/12/2023	06:25	1.73	14:00	3.17	2.49	03:45	0.43	13:35	0.97	0.72	03:45	0.019	14:00	0.093	0.051	0.051	-
03/13/2023	04:40	1.67	09:35	3.13	2.50	03:20	0.40	09:30	1.22	0.69	03:20	0.017	09:30	0.114	0.049	0.049	-
03/14/2023	03:15	1.68	23:20	3.91	2.61	03:05	0.33	23:10	1.55	0.77	03:05	0.013	23:10	0.180	0.060	0.060	-
03/15/2023	02:00	2.05	04:55	3.72	2.79	02:00	0.54	05:00	1.54	0.82	02:00	0.028	05:00	0.178	0.067	0.067	-

12/01/2022 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			10.409	
Average	2.42	1.46	0.101	

FM07

Site Commentary

SITE INFORMATION

Pipe	Elliptical (15 in H x 14.88 in W)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location.

This line is located upstream of site FM05 (See FM05 Site Commentary for More Details).

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.35	2.61	0.212
Minimum	1.28	1.50	0.053
Maximum	4.18	3.72	0.666
Min Time	02/21/2023 4:00:00 AM	12/24/2022 4:25:00 AM	12/25/2022 4:35:00 AM
Max Time	01/09/2023 7:45:00 PM	01/09/2023 7:45:00 PM	01/09/2023 7:45:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

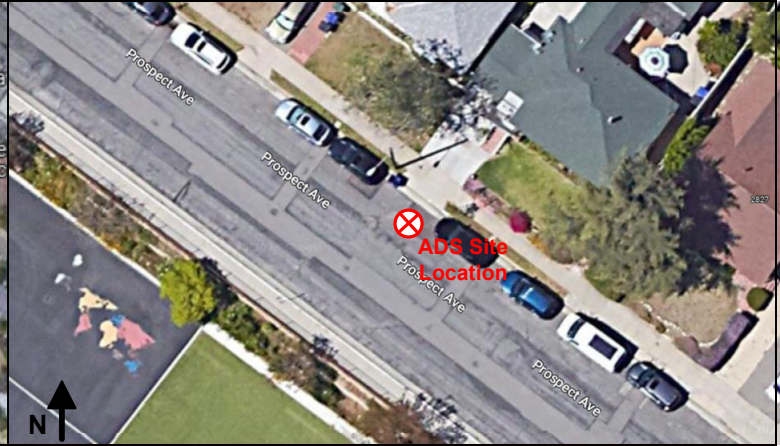
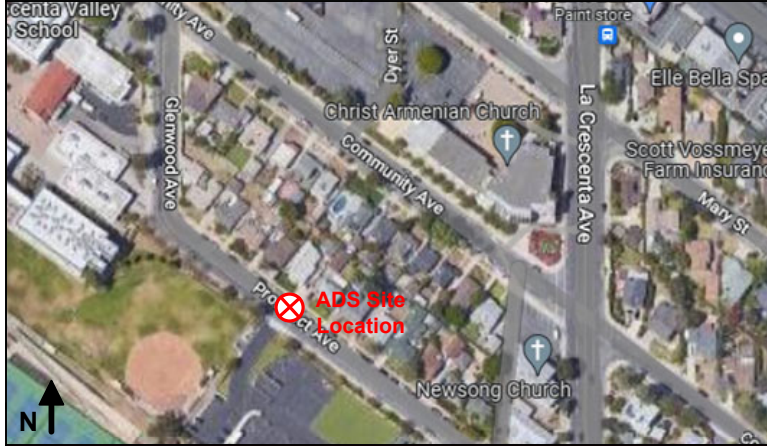
DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM07		Install Date: 11/28/23		Monitor Type		Peak Doppler	
Address/Location: 2831 Prospect Ave, La Crescenta-Montrose, CA 91214				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		Unknown	
Access: Drive		Type of System:		Pipe Height:		15.00 "	
		Sanitary ☒ Storm ☐ Combined ☐		Pipe Width:		14.88 "	



Investigation Information:		Manhole Information:			
Date/Time of Investigation:	11/07/23 @12:59 AM	Manhole Depth:		08'-04"	
Site Hydraulics:	Good Straight Through Flow	Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:		VCP/Good	
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐ Other ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	2.50 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-				
Peak Velocity:	3.23 fps				
Silt:	0 Inches				

Other Information:	
	Cross Section
	Plan

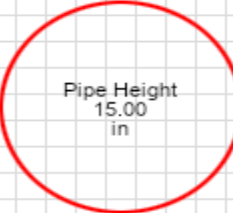
Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

Additional Site Information / Comments:
Standard Traffic Control with No Safety Concerns

Hydrograph Report
FM07

Flow Monitor

FM07



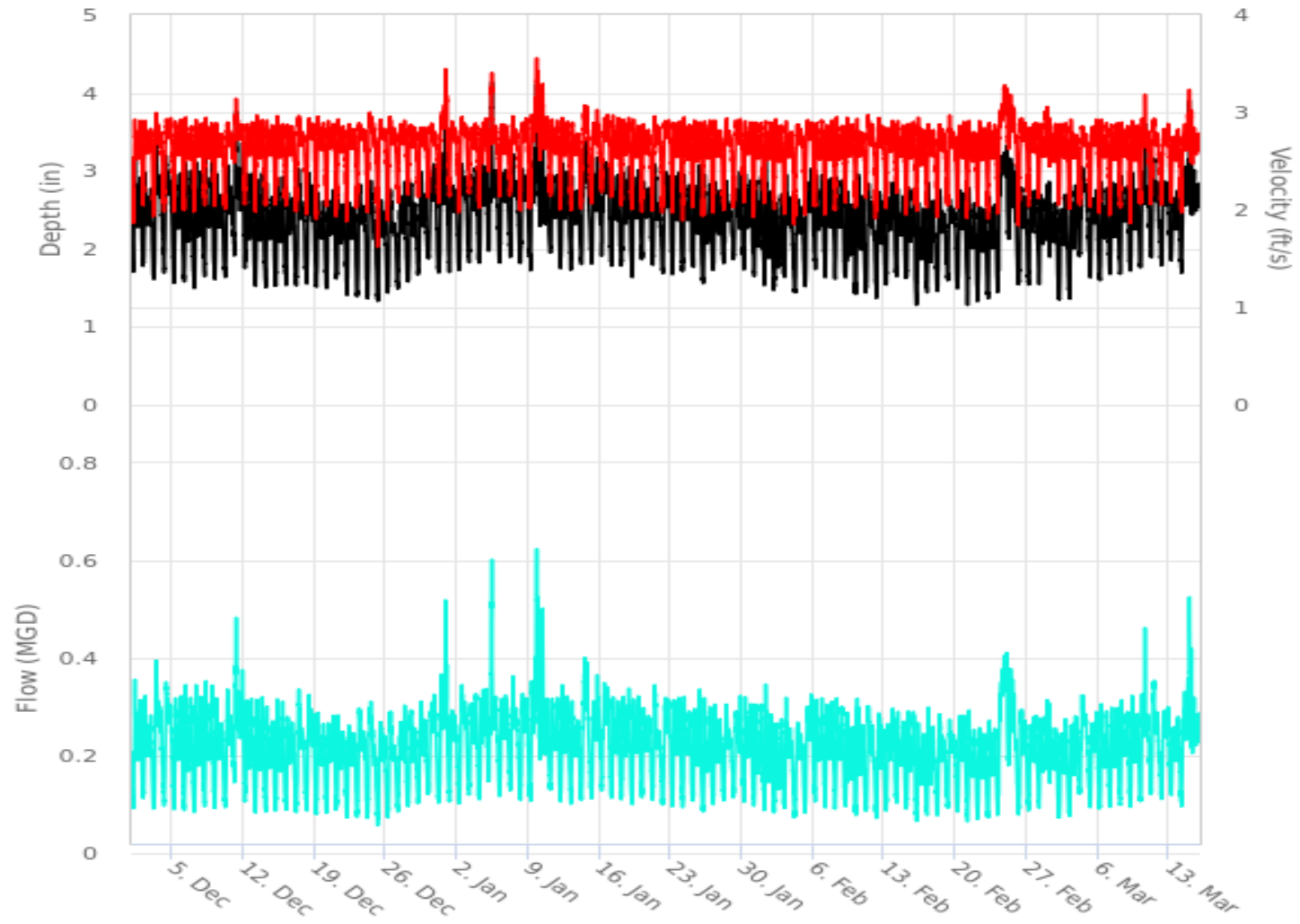
Pipe Height
15.00
in

Report Period

12/01/2022
To
03/15/2023

Legend

- DFINAL
- QFINAL
- VFINAL

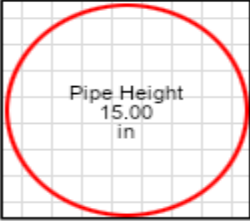


Scattergraph Report

FM07

Flow Monitor

FM07



Pipe Height
15.00
in

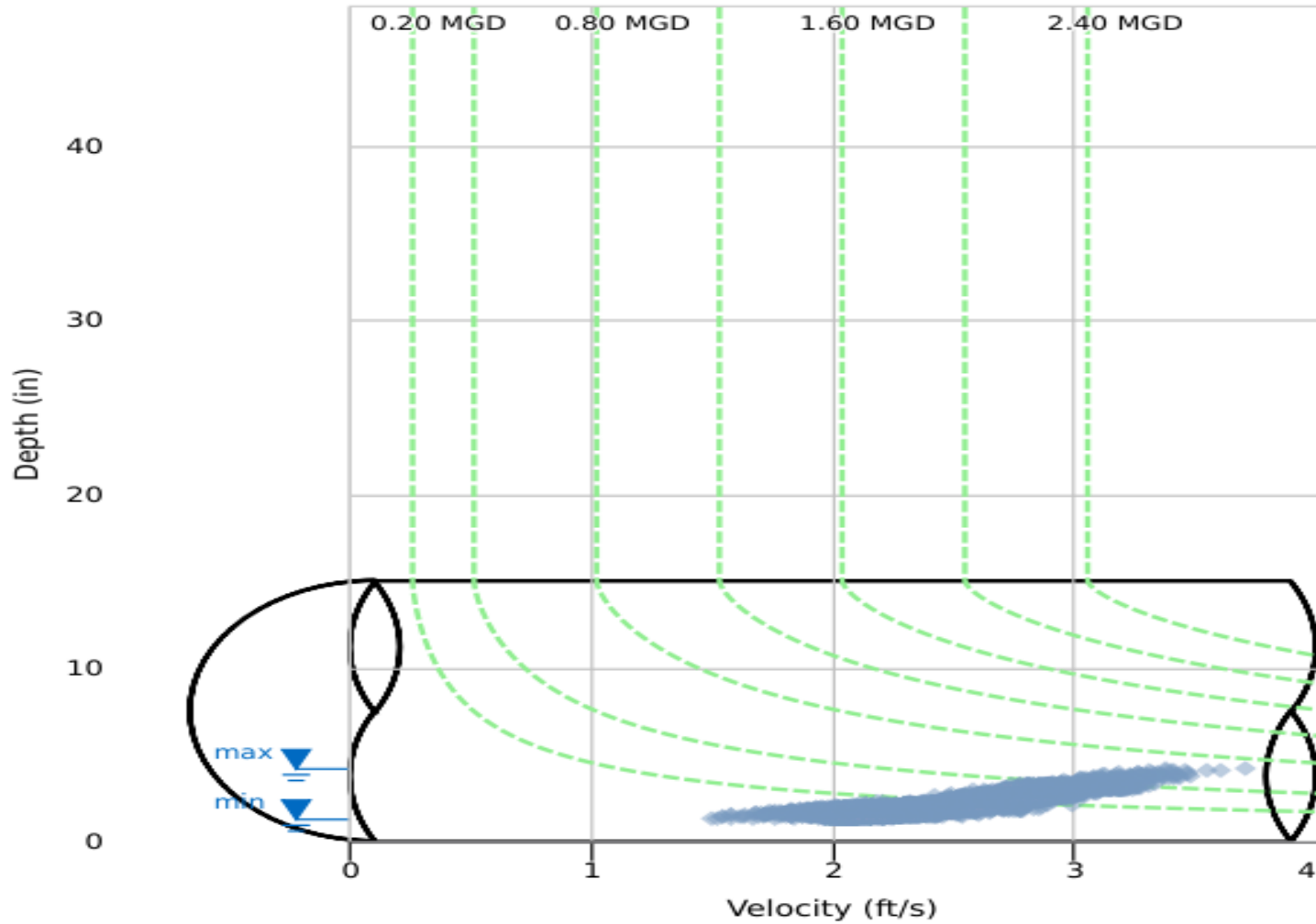
Report Period

12/01/2022
To
03/15/2023

Legend

- DFINAL - VFINAL
- - - Iso-QTM
- ▼ Min-Max Depth





Daily Tabular Report

12/01/2022 00:00 - 03/15/2023 23:55

FM07Pipe: Elliptical (15 in H x 14.88 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	04:40	1.70	08:00	3.21	2.43	02:40	1.83	08:05	2.95	2.55	04:35	0.092	08:05	0.364	0.217	0.217	-	
12/02/2022	03:15	1.77	08:20	3.00	2.37	03:50	1.92	08:20	2.94	2.60	03:50	0.106	08:20	0.329	0.212	0.212	-	
12/03/2022	05:05	1.60	10:25	3.38	2.52	03:20	1.88	10:15	3.05	2.59	04:20	0.089	10:15	0.400	0.236	0.236	-	
12/04/2022	05:00	1.69	09:50	3.24	2.53	04:55	1.96	10:25	2.97	2.62	04:55	0.096	09:50	0.361	0.237	0.237	-	
12/05/2022	04:40	1.54	20:40	3.02	2.37	03:55	1.89	07:40	2.97	2.62	04:40	0.087	20:40	0.331	0.214	0.214	-	
12/06/2022	04:40	1.57	07:50	3.17	2.35	03:35	1.68	08:20	2.98	2.59	03:35	0.077	08:20	0.357	0.210	0.210	-	
12/07/2022	04:10	1.49	08:05	3.15	2.30	03:00	1.79	07:40	2.97	2.60	04:10	0.083	08:10	0.351	0.205	0.205	-	
12/08/2022	04:45	1.61	08:15	3.20	2.39	04:45	1.98	07:45	2.99	2.59	04:45	0.090	08:15	0.358	0.214	0.214	-	
12/09/2022	05:10	1.60	08:10	3.01	2.31	04:10	2.03	08:15	2.91	2.58	05:10	0.092	08:15	0.324	0.203	0.203	-	
12/10/2022	05:00	1.62	10:25	3.11	2.36	02:50	1.83	10:30	2.92	2.58	05:00	0.091	10:25	0.343	0.212	0.212	-	
12/11/2022	02:30	1.89	07:00	3.88	2.80	02:15	2.45	06:40	3.16	2.79	02:35	0.142	06:55	0.504	0.288	0.288	-	
12/12/2022	03:35	1.74	19:15	3.00	2.34	03:45	1.99	20:15	2.95	2.60	03:40	0.102	19:15	0.325	0.209	0.209	-	
12/13/2022	04:50	1.52	20:55	3.09	2.24	04:45	1.87	07:45	2.98	2.60	04:45	0.078	20:55	0.341	0.197	0.197	-	
12/14/2022	04:55	1.50	07:45	2.86	2.21	04:45	2.03	07:40	2.99	2.58	04:45	0.084	07:45	0.309	0.191	0.191	-	
12/15/2022	03:05	1.52	20:40	2.95	2.22	02:55	2.02	08:05	2.99	2.58	02:55	0.086	08:05	0.320	0.193	0.193	-	
12/16/2022	04:50	1.53	08:00	2.73	2.21	03:00	1.84	08:05	2.90	2.57	04:45	0.088	08:05	0.283	0.190	0.190	-	
12/17/2022	04:50	1.52	10:50	3.04	2.30	04:55	1.85	10:50	2.97	2.61	04:55	0.078	10:50	0.340	0.206	0.206	-	
12/18/2022	05:40	1.55	11:25	3.00	2.30	04:10	1.75	11:20	2.96	2.62	05:40	0.083	11:25	0.330	0.207	0.207	-	
12/19/2022	04:30	1.51	08:05	2.74	2.15	02:35	1.68	08:05	2.99	2.60	04:35	0.072	08:05	0.294	0.185	0.185	-	
12/20/2022	04:30	1.49	20:15	2.77	2.18	04:45	1.85	07:45	2.93	2.61	04:45	0.078	21:15	0.286	0.190	0.190	-	
12/21/2022	03:05	1.61	07:40	2.78	2.16	02:15	1.71	08:05	2.95	2.60	02:15	0.079	08:00	0.288	0.186	0.186	-	
12/22/2022	04:40	1.40	09:00	2.63	2.16	02:50	1.71	09:00	2.93	2.59	04:20	0.071	09:00	0.271	0.187	0.187	-	
12/23/2022	04:10	1.38	08:50	2.84	2.23	04:00	1.62	09:15	2.93	2.63	04:00	0.060	08:50	0.303	0.199	0.199	-	
12/24/2022	05:05	1.36	12:30	2.93	2.17	04:25	1.50	10:20	3.04	2.66	04:25	0.054	12:30	0.323	0.194	0.194	-	
12/25/2022	05:00	1.33	13:40	2.69	2.07	04:35	1.52	11:30	2.97	2.61	04:35	0.053	11:30	0.275	0.179	0.179	-	
12/26/2022	04:40	1.43	11:30	2.77	2.11	03:50	1.58	10:15	2.98	2.61	05:00	0.063	11:30	0.296	0.182	0.182	-	
12/27/2022	04:20	1.48	20:15	2.88	2.18	05:20	2.03	19:55	2.96	2.63	04:20	0.083	20:15	0.307	0.192	0.192	-	
12/28/2022	04:35	1.57	11:45	2.86	2.16	04:50	2.12	11:25	2.89	2.64	04:45	0.095	11:25	0.299	0.189	0.189	-	
12/29/2022	03:15	1.66	11:10	3.05	2.31	03:00	1.83	20:30	2.90	2.62	03:00	0.090	11:10	0.326	0.207	0.207	-	
12/30/2022	05:25	1.87	17:45	3.13	2.52	03:50	2.09	13:05	2.91	2.64	03:50	0.119	17:15	0.332	0.235	0.235	-	
12/31/2022	04:40	1.69	20:45	3.77	2.55	04:15	1.80	20:40	3.48	2.74	04:15	0.089	20:40	0.530	0.256	0.256	-	
01/01/2023	05:30	1.68	00:00	3.22	2.44	05:55	2.12	00:00	3.20	2.67	05:30	0.105	00:00	0.396	0.227	0.227	-	
01/02/2023	04:50	1.72	11:55	3.10	2.48	03:05	1.94	11:45	3.01	2.62	04:40	0.100	11:40	0.351	0.230	0.230	-	
01/03/2023	04:35	1.82	20:25	3.06	2.52	04:45	2.11	19:25	2.93	2.64	04:40	0.118	20:20	0.329	0.235	0.235	-	
01/04/2023	04:40	1.81	13:20	3.12	2.54	04:40	2.00	21:10	2.96	2.63	04:40	0.108	13:20	0.346	0.237	0.237	-	
01/05/2023	01:35	1.97	10:05	4.16	2.77	03:15	2.36	10:00	3.46	2.77	03:15	0.146	10:00	0.604	0.283	0.283	-	
01/06/2023	04:45	1.82	18:05	3.04	2.54	04:15	2.11	09:55	2.90	2.63	04:40	0.116	18:05	0.330	0.236	0.236	-	
01/07/2023	05:40	1.89	11:50	3.22	2.59	04:10	2.13	11:40	3.01	2.64	05:40	0.127	11:55	0.368	0.244	0.244	-	
01/08/2023	04:40	1.81	11:00	3.04	2.52	05:35	1.97	20:30	2.98	2.62	05:35	0.107	11:00	0.335	0.235	0.235	-	
01/09/2023	05:15	1.69	19:45	4.18	2.78	04:35	1.89	19:45	3.72	2.79	05:15	0.099	19:45	0.666	0.294	0.294	-	
01/10/2023	03:30	2.27	10:20	3.77	2.76	03:35	2.48	10:15	3.37	2.83	03:35	0.186	10:15	0.519	0.286	0.286	-	
01/11/2023	03:35	1.95	20:20	2.96	2.49	04:05	2.08	07:45	2.95	2.63	04:05	0.125	20:20	0.320	0.229	0.229	-	
01/12/2023	04:00	1.73	08:00	3.14	2.45	02:25	1.93	08:00	3.03	2.58	04:00	0.101	08:00	0.362	0.222	0.222	-	
01/13/2023	04:25	1.72	07:50	3.05	2.41	04:30	1.97	07:40	2.95	2.58	04:25	0.099	07:50	0.329	0.214	0.214	-	
01/14/2023	05:20	1.80	13:15	3.39	2.64	04:50	1.96	13:10	3.12	2.65	04:50	0.105	13:10	0.413	0.257	0.257	-	
01/15/2023	05:35	1.81	18:45	3.21	2.56	04:10	1.97	18:20	3.05	2.63	05:35	0.110	18:35	0.369	0.241	0.241	-	
01/16/2023	04:55	1.90	11:20	3.14	2.63	04:40	2.16	19:25	3.01	2.70	05:00	0.127	11:20	0.350	0.254	0.254	-	
01/17/2023	04:40	1.78	19:20	2.95	2.40	03:00	1.97	07:45	2.99	2.63	04:40	0.109	08:00	0.323	0.218	0.218	-	
01/18/2023	03:25	1.78	21:00	3.08	2.42	03:30	1.88	07:40	2.98	2.61	03:30	0.100	21:00	0.340	0.219	0.219	-	
01/19/2023	05:15	1.62	20:30	3.04	2.43	03:15	1.93	08:05	2.96	2.58	05:15	0.097	20:25	0.329	0.219	0.219	-	
01/20/2023	03:30	1.86	08:15	2.89	2.45	04:50	1.89	08:15	2.90	2.58	04:50	0.108	08:15	0.308	0.220	0.220	-	
01/21/2023	06:00	1.78	10:20	3.09	2.39	04:40	1.92	10:20	2.99	2.61	04:40	0.104	10:20	0.350	0.216	0.216	-	
01/22/2023	05:30	1.68	11:40	3.00	2.46	04:00	1.76	19:30	2.94	2.63	04:00	0.089	19:30	0.324	0.230	0.230	-	
01/23/2023	03:45	1.67	19:30	3.04	2.40	03:15	1.88	07:40	2.92	2.59	03:40	0.096	19:30	0.334	0.216	0.216	-	
01/24/2023	03:50	1.71	08:15	2.97	2.38	04:05	1.74	07:50	2.99	2.59	04:05	0.088	08:15	0.327	0.213	0.213	-	
01/25/2023	05:40	1.70	20:05	3.09	2.38	03:50</												

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/07/2023	04:45	1.63	20:20	2.92	2.36	03:20	1.93	20:50	2.95	2.56	04:40	0.093	20:45	0.314	0.208	0.208	-
02/08/2023	03:30	1.61	07:45	2.93	2.37	03:30	1.97	07:50	2.96	2.58	03:30	0.089	07:50	0.320	0.211	0.211	-
02/09/2023	04:30	1.63	08:05	2.76	2.13	04:25	2.05	08:05	2.97	2.59	04:25	0.095	08:05	0.295	0.181	0.181	-
02/10/2023	04:40	1.42	09:25	3.04	2.11	03:25	1.76	08:05	2.95	2.57	03:25	0.074	08:05	0.320	0.178	0.178	-
02/11/2023	03:45	1.44	10:55	2.89	2.15	04:50	1.99	09:45	3.03	2.63	04:50	0.082	10:55	0.315	0.189	0.189	-
02/12/2023	04:50	1.36	11:05	2.74	2.16	03:45	1.67	11:10	2.98	2.59	04:30	0.067	11:05	0.293	0.187	0.187	-
02/13/2023	04:35	1.54	19:45	2.86	2.26	03:30	1.96	19:40	2.96	2.60	03:30	0.085	19:40	0.309	0.200	0.200	-
02/14/2023	05:10	1.62	07:55	2.79	2.21	05:10	2.15	07:50	2.93	2.60	05:10	0.099	07:55	0.294	0.191	0.191	-
02/15/2023	01:40	1.56	08:10	2.81	2.22	03:00	1.90	21:15	2.94	2.56	03:00	0.089	08:15	0.298	0.191	0.191	-
02/16/2023	03:15	1.28	08:00	2.60	1.99	01:55	1.94	07:50	2.99	2.55	03:25	0.065	07:50	0.271	0.163	0.163	-
02/17/2023	04:40	1.44	08:10	2.85	2.12	04:40	1.97	08:05	2.91	2.55	04:40	0.076	08:05	0.302	0.178	0.178	-
02/18/2023	05:00	1.44	10:05	2.78	2.15	02:45	1.63	11:50	2.90	2.57	02:45	0.073	10:05	0.288	0.184	0.184	-
02/19/2023	05:50	1.59	10:05	2.65	2.20	05:10	2.00	09:50	3.03	2.57	05:10	0.089	09:50	0.281	0.189	0.189	-
02/20/2023	04:10	1.49	10:40	2.76	2.20	03:00	1.83	19:40	2.93	2.57	04:15	0.083	19:40	0.290	0.190	0.190	-
02/21/2023	04:00	1.28	08:10	2.80	2.08	02:50	1.78	08:05	2.93	2.54	04:00	0.064	08:05	0.295	0.173	0.173	-
02/22/2023	03:20	1.33	07:45	2.55	2.03	04:45	1.99	07:50	2.94	2.55	03:20	0.069	07:50	0.259	0.168	0.168	-
02/23/2023	04:45	1.36	08:05	2.68	2.08	04:00	1.54	07:40	2.91	2.55	04:00	0.060	07:55	0.276	0.174	0.174	-
02/24/2023	02:35	1.44	23:50	3.36	2.66	02:20	1.69	18:00	3.33	2.88	02:20	0.067	18:00	0.423	0.285	0.285	-
02/25/2023	23:55	2.08	00:50	3.22	2.56	23:45	2.54	00:00	3.22	2.84	23:50	0.169	00:50	0.394	0.256	0.256	-
02/26/2023	03:30	1.54	10:50	2.80	2.23	04:30	1.72	11:20	2.98	2.62	04:30	0.075	11:20	0.301	0.197	0.197	-
02/27/2023	03:45	1.52	19:40	2.77	2.26	03:45	1.78	19:45	2.96	2.62	03:45	0.075	19:45	0.294	0.200	0.200	-
02/28/2023	04:55	1.51	23:50	2.83	2.22	04:15	1.89	23:45	3.09	2.64	04:15	0.090	23:45	0.317	0.195	0.195	-
03/01/2023	06:25	1.89	04:05	2.86	2.30	16:10	2.14	00:00	3.02	2.69	06:15	0.144	04:05	0.310	0.207	0.207	-
03/02/2023	04:55	1.34	19:30	2.72	2.09	02:55	2.02	19:20	2.93	2.58	04:25	0.071	19:20	0.279	0.177	0.177	-
03/03/2023	05:35	1.35	18:35	2.83	2.17	03:10	1.58	07:50	2.95	2.57	03:10	0.065	18:35	0.284	0.186	0.186	-
03/04/2023	04:05	1.90	10:10	3.07	2.53	04:05	2.01	10:45	2.91	2.59	04:05	0.116	10:15	0.329	0.232	0.232	-
03/05/2023	05:20	1.63	19:45	2.76	2.31	05:25	1.99	19:45	2.96	2.60	05:25	0.092	19:45	0.294	0.205	0.205	-
03/06/2023	04:45	1.59	08:00	2.88	2.25	02:50	1.75	08:05	2.96	2.58	02:50	0.081	08:05	0.313	0.197	0.197	-
03/07/2023	04:10	1.67	08:05	2.86	2.29	04:00	1.78	07:40	2.92	2.56	04:00	0.086	21:15	0.303	0.200	0.200	-
03/08/2023	03:35	1.68	08:00	2.96	2.36	03:25	1.96	07:45	2.91	2.57	03:25	0.096	08:00	0.319	0.210	0.210	-
03/09/2023	04:15	1.72	08:00	2.98	2.35	03:50	1.82	08:00	2.94	2.55	03:50	0.094	08:00	0.326	0.206	0.206	-
03/10/2023	03:55	1.75	14:35	3.61	2.56	03:30	1.78	14:15	3.21	2.62	03:30	0.093	14:35	0.466	0.241	0.241	-
03/11/2023	05:55	1.88	11:10	3.18	2.54	04:00	2.01	12:15	2.98	2.60	04:30	0.120	12:15	0.363	0.235	0.235	-
03/12/2023	05:20	1.78	14:15	2.88	2.44	04:40	2.02	20:50	2.93	2.59	05:20	0.109	20:50	0.307	0.220	0.220	-
03/13/2023	04:15	1.85	21:00	2.76	2.35	04:10	2.05	21:00	2.84	2.57	04:10	0.116	21:00	0.282	0.205	0.205	-
03/14/2023	04:45	1.69	23:25	3.97	2.56	04:45	1.80	23:25	3.32	2.63	04:45	0.088	23:25	0.553	0.244	0.244	-
03/15/2023	03:45	2.39	00:00	3.62	2.78	06:30	2.45	00:05	3.07	2.71	06:30	0.203	00:05	0.448	0.274	0.273	-

12/01/2022 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			22.250	
Average	2.35	2.61	0.212	

FM08

Site Commentary

SITE INFORMATION

Pipe	Round (8 in H)
Silt	0.00 (in)

OBSERVATIONS

Average flow depth, velocity, and quantity data observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. Backwater conditions were experienced at this location. A period of data loss was observed from March 4 – March 15 during the courtesy-extended data period. The reason for the data loss was a monitor malfunction.

This line is located upstream of site FM04 (See FM04, FM04A, and FM04B Site Commentary for More Details).

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	1.66	3.03	0.104
Minimum	1.23	0.82	0.051
Maximum	5.76	3.54	0.307
Min Time	02/14/2023 3:40:00 AM	01/05/2023 10:00:00 AM	12/13/2022 3:30:00 AM
Max Time	01/05/2023 9:50:00 AM	12/18/2022 9:25:00 PM	01/10/2023 7:25:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the none average.

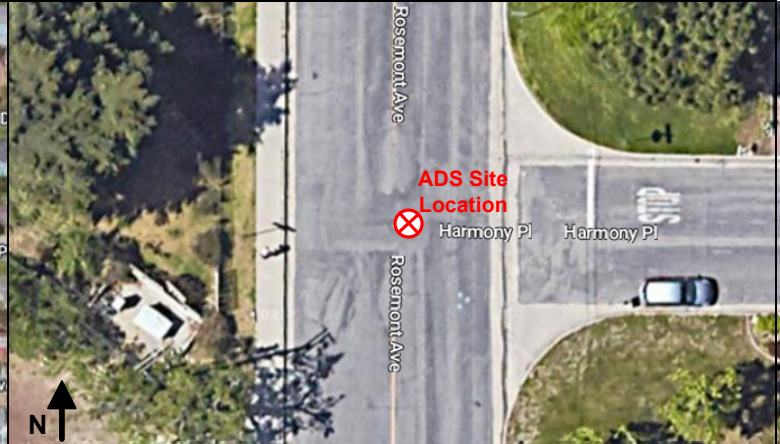
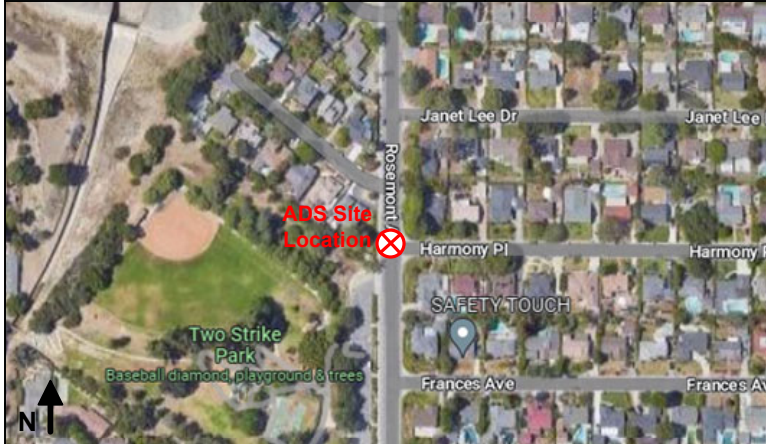
DATA UPTIME

Data uptime observed during **Thursday, 01 December 2022 to Wednesday, 15 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	88.819
VFINAL (ft/s)	88.819
QFINAL (MGD - Total MG)	88.819



Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM08		Install Date: 11/28/23		Monitor Type		Peak Doppler	
Address/Location: Rosemont Ave & Harmony PI La Crescenta-Montrose, CA 91214				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		MHD-16134	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		8.00 "
					Pipe Width:		8.00 "



Investigation Information:		Manhole Information:				
Date/Time of Investigation:	11/07/22 @ 12:48 AM	Manhole Depth:	10'-05"			
Site Hydraulics:	Good Straight Through Flow	Manhole Material / Condition	Precast/Good			
Upstream Input: (L/S, P/S)	--	Pipe Material / Condition:	VCP/Good			
Upstream Manhole:	Not Investigated	Land Use:	Residential ☒	Commercial ☐	Industrial ☐	Other ☐
Downstream Manhole:	Not investigated	Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0	
Depth of Flow:	2.00 " +/- 0.25"	Safety Notes: 2 man crew required and one blower is to be operated at all times.				
Range (Air DOF):	+/-					
Peak Velocity:	3.74 fps					
Silt:	0 Inches					

Other Information:	
	Cross Section
	Plan

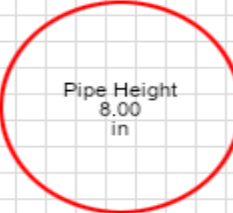
Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

Additional Site Information / Comments:
Standard Traffic Control with No Safety Concerns

Hydrograph Report

FM08

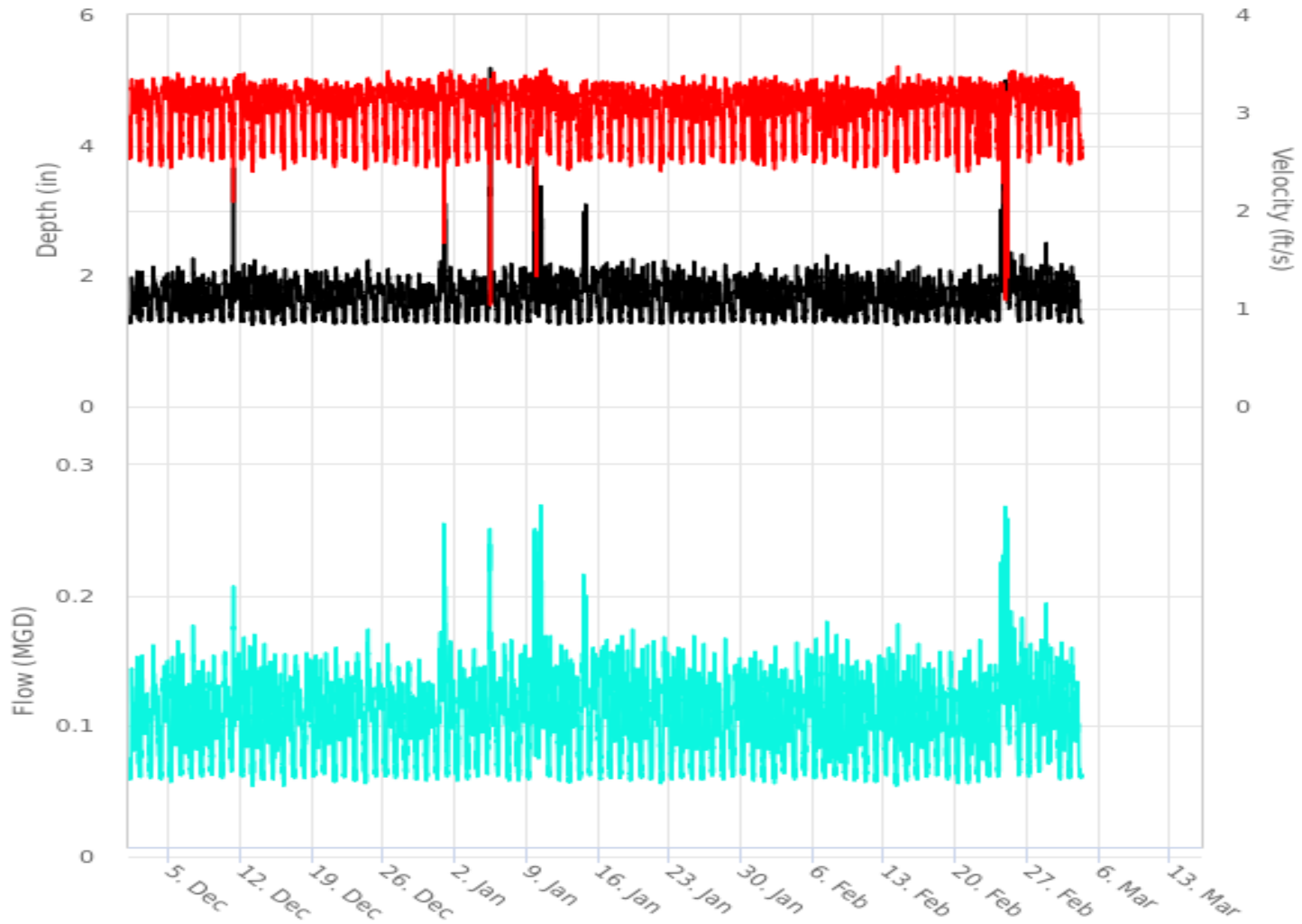
Flow Monitor
FM08



Pipe Height
8.00
in

Report Period
12/01/2022
To
03/15/2023

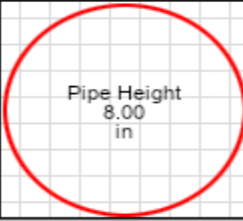
Legend
— DFINAL
— QFINAL
— VFINAL



Scattergraph Report

FM08

Flow Monitor
FM08



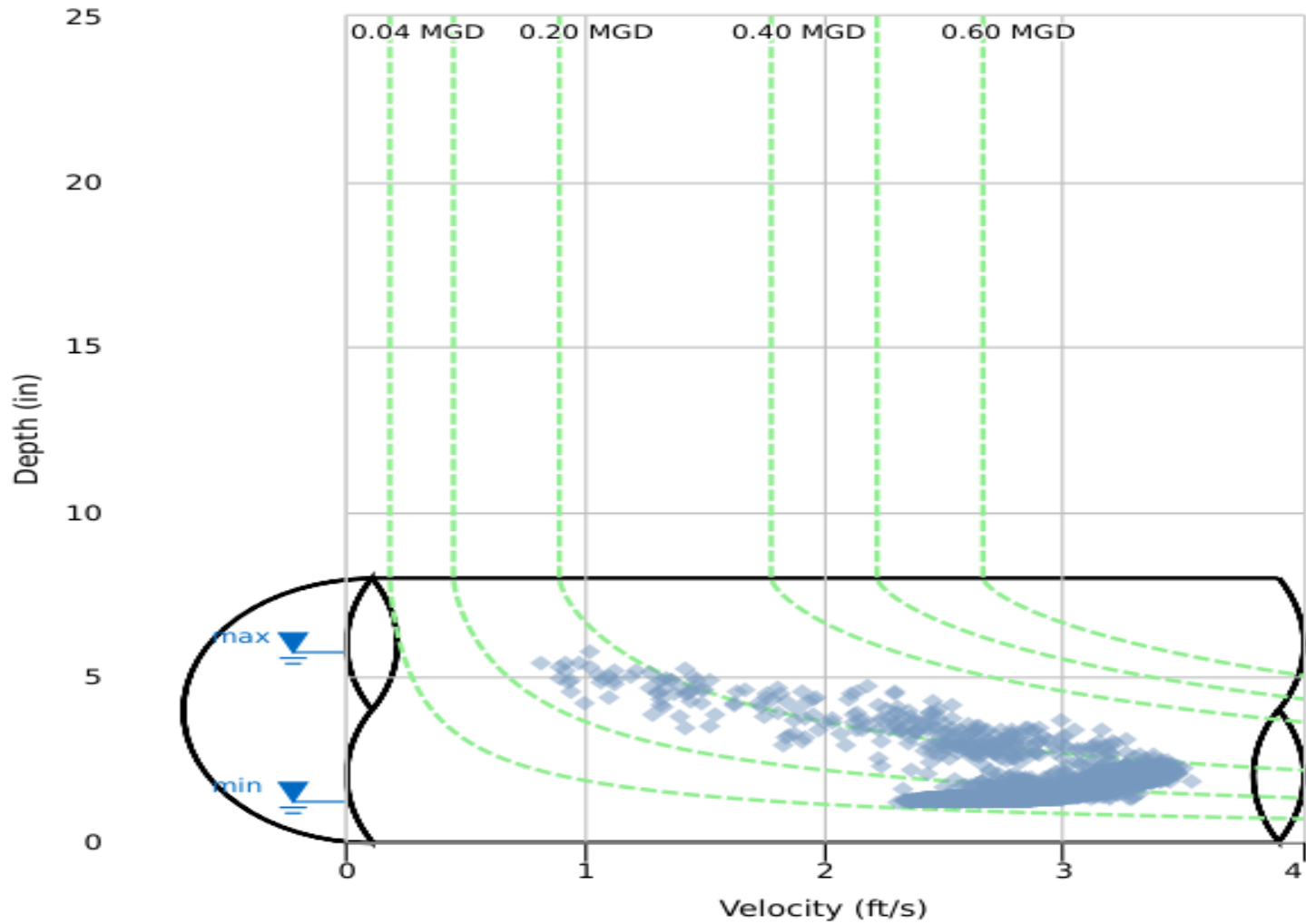
Pipe Height
8.00
in

Report Period
12/01/2022
To
03/15/2023

Legend

- DFINAL - VFINAL
- Iso-QTM
- Min-Max Depth





Daily Tabular Report

12/01/2022 00:00 - 03/15/2023 23:55
FM08Pipe: Round (8 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)							Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total	
12/01/2022	04:40	1.27	20:15	2.14	1.57	04:25	2.41	08:00	3.38	3.02	04:25	0.056	20:15	0.158	0.096	0.096	-	
12/02/2022	05:10	1.29	08:05	2.10	1.60	03:25	2.45	08:10	3.36	3.03	03:25	0.058	08:05	0.157	0.099	0.099	-	
12/03/2022	03:25	1.30	10:05	2.24	1.63	03:30	2.44	10:05	3.37	3.02	03:25	0.059	10:05	0.175	0.102	0.102	-	
12/04/2022	03:50	1.28	20:00	2.13	1.66	04:55	2.42	19:20	3.40	3.05	03:35	0.057	20:00	0.160	0.105	0.105	-	
12/05/2022	03:20	1.27	20:40	2.18	1.62	03:35	2.42	20:05	3.44	3.05	03:35	0.057	20:05	0.171	0.102	0.102	-	
12/06/2022	04:10	1.28	07:50	2.11	1.59	04:15	2.46	07:45	3.39	3.03	04:15	0.059	07:50	0.161	0.098	0.098	-	
12/07/2022	04:35	1.28	07:40	2.29	1.60	04:30	2.41	07:40	3.40	3.03	04:30	0.057	07:40	0.182	0.099	0.099	-	
12/08/2022	04:10	1.28	20:40	2.11	1.60	04:35	2.41	07:35	3.37	3.03	04:35	0.057	07:45	0.157	0.099	0.099	-	
12/09/2022	04:25	1.31	07:25	2.09	1.60	02:30	2.47	07:30	3.37	3.05	02:30	0.060	07:25	0.157	0.099	0.099	-	
12/10/2022	06:35	1.28	09:25	2.14	1.62	02:15	2.42	09:40	3.38	3.05	02:15	0.058	10:10	0.162	0.102	0.102	-	
12/11/2022	01:30	1.31	06:30	4.19	1.79	06:30	1.48	20:15	3.43	3.10	01:45	0.063	06:35	0.223	0.116	0.116	-	
12/12/2022	05:45	1.29	07:50	2.30	1.65	04:10	2.44	07:35	3.44	3.03	04:10	0.059	07:50	0.181	0.104	0.104	-	
12/13/2022	03:30	1.24	08:00	2.26	1.62	03:30	2.31	07:55	3.38	2.97	03:30	0.051	07:55	0.177	0.099	0.099	-	
12/14/2022	04:55	1.27	07:55	2.15	1.63	05:15	2.40	07:55	3.40	3.03	02:30	0.055	07:55	0.166	0.102	0.102	-	
12/15/2022	04:20	1.26	08:00	2.13	1.61	04:15	2.54	08:05	3.39	3.05	04:15	0.058	08:05	0.162	0.100	0.100	-	
12/16/2022	04:20	1.24	07:55	2.11	1.61	04:15	2.36	08:00	3.36	3.02	04:20	0.053	08:00	0.159	0.099	0.099	-	
12/17/2022	02:00	1.29	10:15	2.08	1.63	03:50	2.42	09:35	3.36	3.04	03:50	0.057	09:35	0.156	0.102	0.102	-	
12/18/2022	06:15	1.27	10:30	2.13	1.66	05:50	2.44	21:25	3.54	3.09	05:50	0.058	10:30	0.162	0.106	0.106	-	
12/19/2022	04:15	1.28	20:05	2.14	1.60	05:25	2.47	19:45	3.37	3.05	04:15	0.060	20:05	0.161	0.100	0.100	-	
12/20/2022	05:05	1.30	07:30	2.12	1.59	03:30	2.50	07:30	3.38	3.03	03:30	0.062	07:30	0.162	0.098	0.098	-	
12/21/2022	04:55	1.25	07:50	2.16	1.64	04:50	2.36	08:20	3.34	3.00	04:50	0.054	07:50	0.163	0.102	0.102	-	
12/22/2022	02:20	1.28	09:30	2.12	1.65	05:25	2.43	09:35	3.37	3.01	05:25	0.058	09:30	0.159	0.103	0.103	-	
12/23/2022	03:15	1.26	09:40	2.21	1.66	04:50	2.36	07:55	3.41	3.03	04:50	0.054	11:50	0.162	0.104	0.104	-	
12/24/2022	04:15	1.25	11:15	2.39	1.69	04:10	2.38	10:55	3.41	3.05	04:15	0.054	11:15	0.186	0.109	0.109	-	
12/25/2022	05:50	1.30	13:25	2.08	1.66	05:05	2.45	12:05	3.34	3.06	05:05	0.059	13:25	0.153	0.106	0.106	-	
12/26/2022	04:50	1.28	10:25	2.17	1.63	02:40	2.46	10:30	3.46	3.06	04:55	0.059	10:25	0.170	0.103	0.103	-	
12/27/2022	04:45	1.29	09:15	2.07	1.61	03:35	2.45	10:50	3.37	3.05	04:45	0.059	09:15	0.151	0.100	0.100	-	
12/28/2022	04:45	1.28	09:15	2.12	1.60	03:10	2.43	10:50	3.38	3.04	04:45	0.058	09:15	0.160	0.099	0.099	-	
12/29/2022	04:40	1.28	10:10	2.04	1.60	03:30	2.44	09:25	3.41	3.06	04:30	0.058	10:10	0.154	0.100	0.100	-	
12/30/2022	04:00	1.26	09:35	2.13	1.59	03:55	2.38	09:35	3.39	3.04	03:55	0.055	09:35	0.164	0.099	0.099	-	
12/31/2022	05:10	1.27	20:20	5.20	1.89	20:20	1.22	17:50	3.48	2.99	05:15	0.056	20:15	0.284	0.121	0.121	-	
01/01/2023	04:30	1.28	00:05	2.68	1.66	00:05	2.48	11:00	3.47	3.10	04:35	0.060	00:00	0.185	0.107	0.107	-	
01/02/2023	05:50	1.27	11:20	2.10	1.68	04:40	2.39	09:55	3.43	3.06	04:40	0.055	11:30	0.160	0.108	0.108	-	
01/03/2023	03:05	1.28	20:25	2.10	1.65	03:50	2.42	20:25	3.41	3.06	03:50	0.058	20:25	0.161	0.104	0.104	-	
01/04/2023	02:25	1.30	08:00	2.02	1.65	03:20	2.43	08:55	3.40	3.07	03:20	0.058	18:40	0.149	0.105	0.105	-	
01/05/2023	04:00	1.30	09:50	5.76	1.88	10:00	0.82	19:10	3.49	3.02	03:20	0.063	09:35	0.268	0.119	0.119	-	
01/06/2023	01:45	1.29	18:10	2.30	1.68	02:55	2.48	18:10	3.41	3.07	03:00	0.061	18:10	0.183	0.108	0.108	-	
01/07/2023	02:40	1.26	09:50	2.32	1.66	05:05	2.42	09:55	3.38	3.05	05:30	0.057	09:50	0.177	0.105	0.105	-	
01/08/2023	04:50	1.27	19:45	2.18	1.67	04:55	2.40	19:50	3.41	3.04	04:55	0.056	19:50	0.169	0.106	0.106	-	
01/09/2023	02:35	1.28	20:00	5.05	1.88	20:00	1.19	20:40	3.41	2.96	04:00	0.056	20:15	0.264	0.118	0.118	-	
01/10/2023	03:25	1.37	07:05	3.90	1.91	02:35	2.23	09:55	3.48	3.15	01:50	0.069	07:25	0.307	0.131	0.131	-	
01/11/2023	03:35	1.28	07:45	2.23	1.69	04:30	2.45	07:45	3.43	3.06	04:30	0.059	07:45	0.176	0.108	0.108	-	
01/12/2023	01:55	1.26	07:20	2.19	1.67	04:50	2.40	07:30	3.35	3.00	04:50	0.056	07:25	0.165	0.105	0.105	-	
01/13/2023	05:25	1.27	08:00	2.15	1.67	03:50	2.33	20:55	3.25	2.94	02:10	0.056	07:55	0.156	0.102	0.102	-	
01/14/2023	02:05	1.27	12:15	3.44	1.78	17:45	2.23	12:00	3.37	3.00	03:10	0.058	12:15	0.269	0.115	0.115	-	
01/15/2023	01:35	1.29	10:05	2.20	1.73	03:25	2.49	17:55	3.35	3.06	03:30	0.061	10:05	0.165	0.112	0.112	-	
01/16/2023	05:15	1.27	20:05	2.22	1.72	04:25	2.51	19:25	3.34	3.05	04:25	0.058	20:00	0.168	0.111	0.111	-	
01/17/2023	03:10	1.28	21:10	2.24	1.67	04:30	2.45	09:20	3.37	3.02	04:30	0.060	21:15	0.171	0.105	0.105	-	
01/18/2023	05:35	1.27	07:45	2.33	1.66	04:05	2.46	07:40	3.39	3.00	02:05	0.059	07:40	0.184	0.103	0.103	-	
01/19/2023	03:30	1.27	07:45	2.35	1.66	02:45	2.41	07:50	3.34	2.98	02:45	0.056	07:45	0.180	0.103	0.103	-	
01/20/2023	05:25	1.29	19:45	2.21	1.65	05:00	2.44	08:10	3.30	3.01	05:00	0.058	19:45	0.164	0.103	0.103	-	
01/21/2023	01:40	1.26	09:30	2.28	1.66	04:40	2.42	09:50	3.32	2.98	02:05	0.057	09:30	0.173	0.104	0.104	-	
01/22/2023	03:40	1.26	10:00	2.30	1.67	02:15	2.37	10:20	3.35	2.99	03:40	0.054	10:00	0.173	0.105	0.105	-	
01/23/2023	04:40	1.28	07:45	2.22	1.64	01:45	2.40	08:00	3.34	2.99	04:40	0.056	07:40	0.167	0.102	0.102	-	
01/24/2023	02:40	1.26	07:25	2.16	1.62	01:50	2.44	07:35	3.40	3.02	01:50	0.058	07:25	0.166	0.101	0.101	-	
01/25/2023	04:00																	

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						Rain (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/07/2023	01:15	1.30	07:50	2.35	1.63	02:05	2.45	07:50	3.37	2.95	02:05	0.058	07:50	0.186	0.099	0.099	-
02/08/2023	05:20	1.29	07:45	2.23	1.59	04:40	2.49	07:45	3.41	2.99	02:50	0.061	07:45	0.175	0.097	0.097	-
02/09/2023	05:05	1.28	07:55	2.18	1.57	05:00	2.48	07:45	3.38	2.98	05:05	0.058	07:50	0.167	0.095	0.095	-
02/10/2023	03:10	1.28	07:35	2.08	1.58	02:35	2.41	07:30	3.32	2.98	01:15	0.056	07:35	0.153	0.095	0.095	-
02/11/2023	05:25	1.27	08:35	2.10	1.63	02:10	2.38	08:40	3.30	3.00	02:10	0.055	08:55	0.154	0.101	0.101	-
02/12/2023	05:20	1.27	12:05	2.18	1.66	02:20	2.38	12:50	3.36	3.00	05:05	0.055	12:50	0.164	0.104	0.104	-
02/13/2023	04:30	1.30	10:15	2.13	1.65	04:55	2.44	19:10	3.41	3.07	04:55	0.059	19:10	0.165	0.105	0.105	-
02/14/2023	03:40	1.23	07:30	2.24	1.58	04:25	2.33	07:35	3.50	3.02	03:20	0.053	07:35	0.179	0.097	0.097	-
02/15/2023	04:40	1.27	20:10	2.22	1.60	04:35	2.45	07:50	3.41	3.05	04:35	0.057	20:15	0.167	0.100	0.100	-
02/16/2023	05:00	1.28	07:30	2.19	1.57	05:05	2.41	07:45	3.43	3.06	05:05	0.057	07:30	0.168	0.097	0.097	-
02/17/2023	04:30	1.28	19:50	2.08	1.59	05:00	2.48	07:55	3.38	3.08	03:30	0.060	19:50	0.154	0.100	0.100	-
02/18/2023	05:35	1.28	10:10	2.24	1.63	02:25	2.47	09:15	3.40	3.08	05:35	0.058	10:10	0.173	0.103	0.103	-
02/19/2023	04:15	1.26	10:05	2.10	1.59	05:35	2.43	10:30	3.42	3.04	04:20	0.057	10:25	0.161	0.099	0.099	-
02/20/2023	04:10	1.27	20:35	2.13	1.62	04:10	2.37	10:15	3.41	3.04	04:10	0.054	20:35	0.159	0.102	0.102	-
02/21/2023	04:35	1.27	07:45	2.15	1.56	04:25	2.39	07:45	3.41	3.02	04:25	0.056	07:45	0.166	0.095	0.095	-
02/22/2023	04:35	1.27	15:10	3.07	1.60	15:10	1.91	07:30	3.40	3.02	04:25	0.056	07:30	0.177	0.099	0.099	-
02/23/2023	05:00	1.29	20:30	2.13	1.61	05:10	2.44	19:35	3.33	3.01	05:10	0.059	20:30	0.160	0.099	0.099	-
02/24/2023	01:50	1.30	21:10	5.45	2.65	19:25	0.89	12:30	3.36	2.56	01:45	0.058	23:35	0.304	0.152	0.152	-
02/25/2023	14:10	1.41	00:05	3.69	1.92	00:30	1.83	15:25	3.47	3.21	00:35	0.080	00:50	0.240	0.134	0.134	-
02/26/2023	06:10	1.30	11:00	2.45	1.73	02:25	2.50	11:05	3.42	3.11	02:25	0.061	11:00	0.196	0.114	0.114	-
02/27/2023	03:55	1.31	07:35	2.17	1.68	02:50	2.46	07:35	3.39	3.06	02:50	0.060	07:35	0.168	0.107	0.107	-
02/28/2023	03:20	1.30	19:50	2.98	1.70	04:05	2.53	07:45	3.42	3.08	03:55	0.063	19:50	0.246	0.110	0.110	-
03/01/2023	04:45	1.34	07:50	2.16	1.71	03:50	2.63	07:45	3.43	3.11	04:45	0.071	07:45	0.166	0.111	0.111	-
03/02/2023	04:35	1.29	07:30	2.19	1.66	04:30	2.46	07:45	3.37	3.02	04:35	0.058	07:40	0.165	0.104	0.104	-
03/03/2023	01:05	1.28	07:40	2.15	1.64	03:25	2.45	07:05	3.34	2.99	03:25	0.058	07:40	0.161	0.102	0.102	-
03/04/2023	05:35	1.27	00:00	1.46	1.32	05:15	2.45	00:00	2.88	2.65	05:15	0.058	00:00	0.082	0.064	0.017	-
03/05/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/06/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/07/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/08/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/09/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/10/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/11/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/12/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/13/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/14/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/15/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

12/01/2022 00:00 - 03/15/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	Rain (in)
Total			9.721	
Average	1.66	3.03	0.104	



FM09

Site Commentary

SITE INFORMATION

Pipe	Round (10.38 in H)
Silt	0.00 (in)

OBSERVATIONS

5-minute flow depth, velocity, and quantity data observed during **Wednesday, 08 February 2023 to Friday, 03 March 2023**, along with observed minimum and maximum data, are provided in the following table.

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location. This site was installed at the request of the client because of the imbalance at FM04. It was installed 6 manholes upstream of site FM04 and was used to see if higher flow totals would be recorded at the location. Equipment at this location was removed on March 3 at CVWD request and used at new location FM04b.

This line is located downstream of site FM08. A moderate net flow was recorded between the sites.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	1.29	7.69	0.224
Minimum	0.70	3.79	0.050
Maximum	3.73	10.16	1.159
Min Time	02/12/2023 4:35:00 AM	02/17/2023 4:50:00 AM	02/12/2023 4:25:00 AM
Max Time	02/24/2023 3:10:00 PM	02/08/2023 7:20:00 PM	02/24/2023 3:05:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions table are based on the five minutes average and data on the graphical reports are based on the fifteen minutes average.

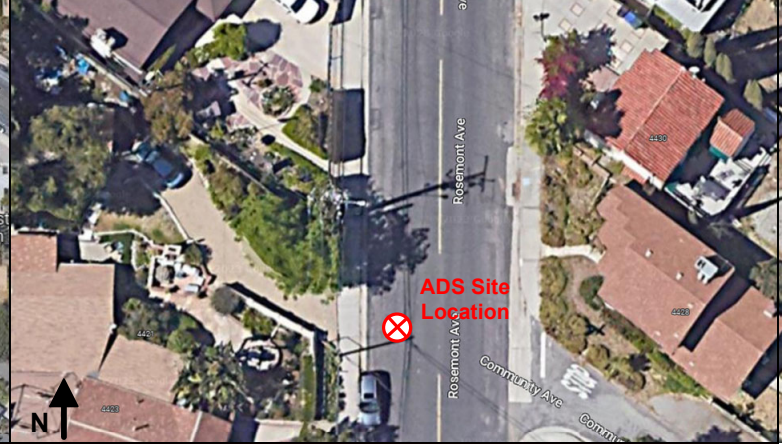
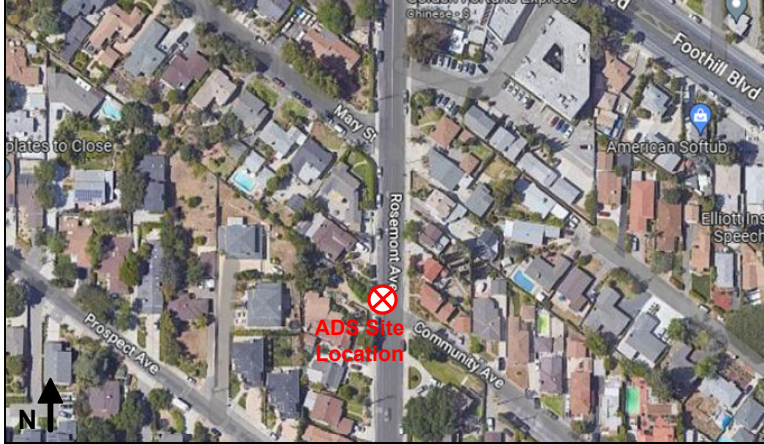
DATA UPTIME

Data uptime observed during **Wednesday, 08 February 2023 to Friday, 03 March 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



Project Name: CVWD.MasterPlan.TFM.CA22		City: Montrose		Agency: CVWD		FM Initials: VM	
Site Name: FM09		Install Date: 2/8/23		Monitor Type		Peak Doppler	
Address/Location: 4428 Rosemont Ave, Montrose, CA 91020				Monitor Model		Triton +	
				Data Acquisition		Manual/Wireless Collect	
				Manhole ID		Unknown	
Access: Drive	Type of System:	Sanitary ☒	Storm ☐	Combined ☐	Pipe Height:		10.38 "
					Pipe Width:		10.38 "



Investigation Information:				Manhole Information:			
Date/Time of Investigation:		2/8/23 @ 5:06 AM		Manhole Depth:		12'-00"	
Site Hydraulics:		Low Fast Flow		Manhole Material / Condition		Precast/Good	
Upstream Input: (L/S, P/S)		--		Pipe Material / Condition: VCP/Good			
Upstream Manhole:		Not Investigated		Land Use:	Residential ☒	Commercial ☐	Industrial ☐
Downstream Manhole:		Not investigated		Oxygen: 20.9	H2S: 0	LEL: 0	CO: 0
Depth of Flow:	0.75 " +/- 0.25"			Safety Notes: 2 man crew required and one blower is to be operated at all times.			
Range (Air DOF):	+/-						
Peak Velocity:	7.19 fps						
Silt:	0 Inches						

Other Information:			
	Cross Section		Plan

Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☒	☐	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	☐	☒	☐	
Surcharge Height:	0	WWTP	☐	☒	☐	
Rain Gauge Zone:		Other	☐	☒	☐	

Additional Site Information / Comments:	
Standard Traffic Control with No Safety Concerns	

Hydrograph Report
FM09

Flow Monitor

FM09

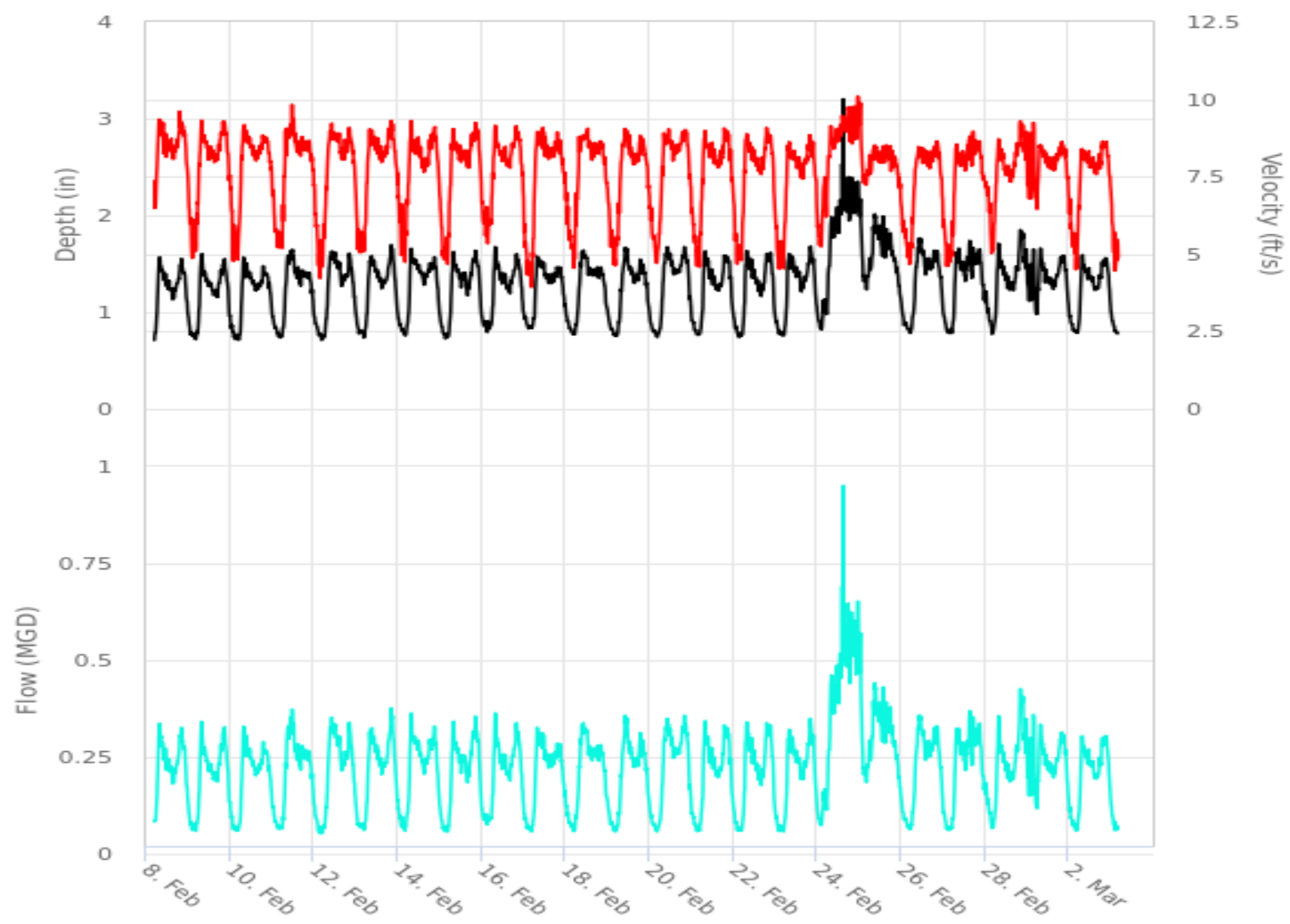
Pipe Height
10.38
in

Report Period

02/08/2023
To
03/03/2023

Legend

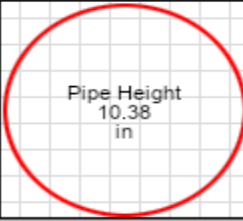
- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



Scattergraph Report

FM09

Flow Monitor
FM09



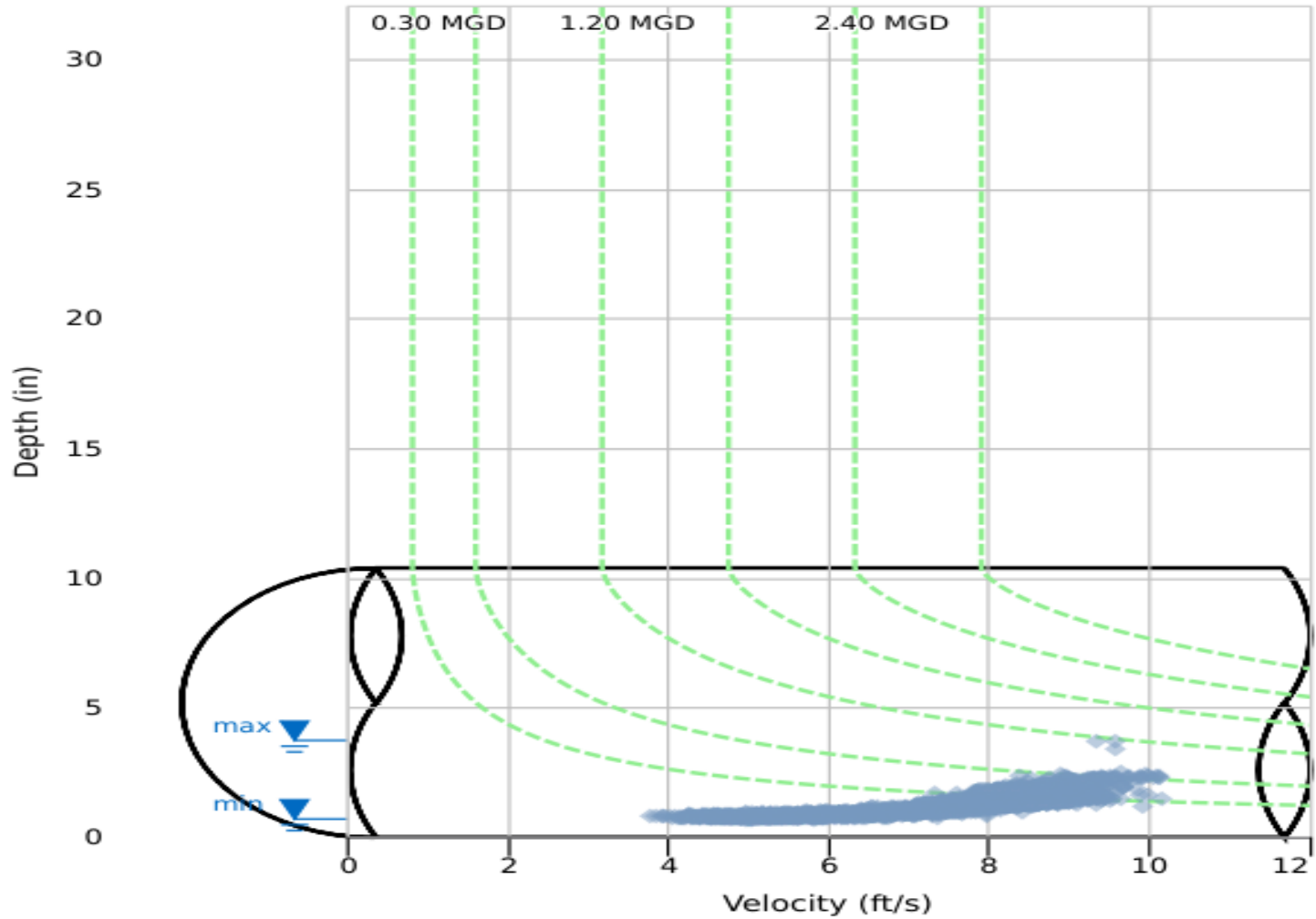
Pipe Height
10.38
in

Report Period
02/08/2023
To
03/03/2023

Legend

- DFINAL - VFINAL
- Iso-QTM
- Min-Max Depth





Daily Tabular Report

02/08/2023 00:00 - 03/03/2023 23:55
FM09Pipe: Round (10.38 in H), Silt0.00 in

DFINAL (in)						VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
02/08/2023	04:55	0.71	07:55	1.57	1.29	05:25	6.28	19:20	10.16	8.53	05:00	0.076	07:40	0.338	0.236	0.187	-
02/09/2023	04:35	0.70	08:05	1.61	1.19	02:10	4.69	07:50	9.45	7.83	04:35	0.055	08:05	0.345	0.200	0.200	-
02/10/2023	05:10	0.70	07:50	1.57	1.19	04:30	4.29	08:25	9.55	7.77	04:30	0.053	07:50	0.334	0.199	0.199	-
02/11/2023	05:15	0.73	11:55	1.66	1.23	03:45	4.82	11:35	10.00	7.80	03:45	0.060	11:35	0.380	0.211	0.211	-
02/12/2023	04:35	0.70	10:20	1.64	1.23	05:00	4.12	10:20	9.50	7.63	04:25	0.050	10:20	0.366	0.209	0.209	-
02/13/2023	04:55	0.73	20:20	1.70	1.25	02:40	4.66	20:20	9.38	7.74	04:40	0.060	20:20	0.381	0.214	0.214	-
02/14/2023	04:20	0.75	07:50	1.69	1.27	04:25	4.54	07:55	9.44	7.74	04:25	0.056	07:50	0.369	0.218	0.218	-
02/15/2023	03:20	0.72	20:30	1.66	1.24	04:35	4.36	20:35	9.35	7.67	04:35	0.053	20:35	0.362	0.210	0.210	-
02/16/2023	03:25	0.76	07:45	1.68	1.25	03:35	5.25	07:50	9.28	7.76	03:25	0.070	07:50	0.369	0.210	0.210	-
02/17/2023	02:55	0.82	08:00	1.58	1.25	04:50	3.79	11:00	9.31	7.48	04:50	0.054	11:00	0.330	0.206	0.206	-
02/18/2023	04:50	0.77	10:10	1.66	1.24	04:45	4.19	07:45	9.36	7.65	04:45	0.054	10:25	0.345	0.210	0.210	-
02/19/2023	04:25	0.75	10:15	1.69	1.22	04:30	4.17	10:10	9.18	7.51	04:30	0.051	10:15	0.363	0.203	0.203	-
02/20/2023	04:25	0.72	10:25	1.70	1.28	04:25	4.39	20:45	9.18	7.65	04:25	0.051	20:00	0.360	0.221	0.221	-
02/21/2023	04:20	0.76	08:55	1.67	1.23	04:45	4.44	18:50	9.17	7.59	03:20	0.057	08:00	0.357	0.206	0.206	-
02/22/2023	03:20	0.73	07:45	1.66	1.24	04:30	4.05	19:05	9.22	7.52	04:30	0.050	07:45	0.353	0.208	0.208	-
02/23/2023	04:35	0.75	20:10	1.74	1.25	02:15	4.25	20:10	8.92	7.33	04:50	0.054	20:10	0.375	0.205	0.205	-
02/24/2023	02:20	0.81	15:10	3.73	1.78	01:40	4.90	23:20	10.14	8.34	01:40	0.070	15:05	1.159	0.395	0.395	-
02/25/2023	23:40	1.14	00:45	2.30	1.63	23:55	6.53	00:40	10.13	8.04	23:55	0.150	00:45	0.630	0.312	0.312	-
02/26/2023	05:15	0.78	10:30	1.80	1.32	05:50	4.41	20:20	8.87	7.33	04:45	0.062	10:30	0.370	0.220	0.220	-
02/27/2023	04:55	0.77	15:10	1.82	1.31	04:00	4.16	17:25	9.03	7.41	04:00	0.054	15:10	0.387	0.222	0.222	-
02/28/2023	04:05	0.77	20:15	1.86	1.33	03:50	4.94	20:20	9.43	7.66	04:05	0.065	20:20	0.431	0.228	0.228	-
03/01/2023	05:25	0.97	07:40	1.72	1.37	05:45	6.16	04:00	9.37	7.98	05:45	0.110	04:00	0.375	0.240	0.240	-
03/02/2023	04:45	0.76	07:55	1.60	1.24	04:10	4.21	21:40	8.69	7.43	04:10	0.055	21:10	0.314	0.201	0.201	-
03/03/2023	03:45	0.78	00:00	1.02	0.86	02:25	4.35	00:00	7.24	5.46	02:25	0.059	00:00	0.140	0.085	0.014	-

02/08/2023 00:00 - 03/03/2023 23:55

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			5.149	
Average	1.29	7.69	0.224	

Project/Phase: La Canada-Flintridge CVWD

Installed: 11/28/06

Diameter

ADS Job #

Address / Location: Rockland Dr west of La Canada Plaza near telephone pole near curb

Initials: RR

7.75 X 7.75

12216.22.325

Thomas Guide #534-H2

Installation

Stainless steel ring with ultrasonic sensor, U/P/V

Safety

Std Safety Plan

Gas Investigation

O2	20.9	%
H2S	0	ppm
CO	0	ppm
LEL	0	%

Traffic

Light

Pipe Material

PCV

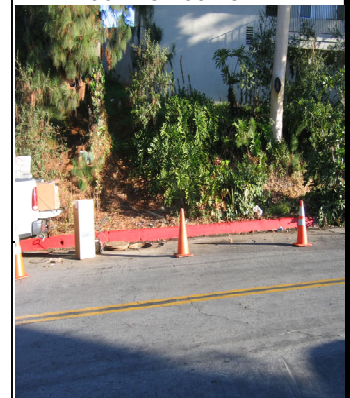
Manhole Depth

4'

Pipe and M.H. Condition

Very good w/good rungs

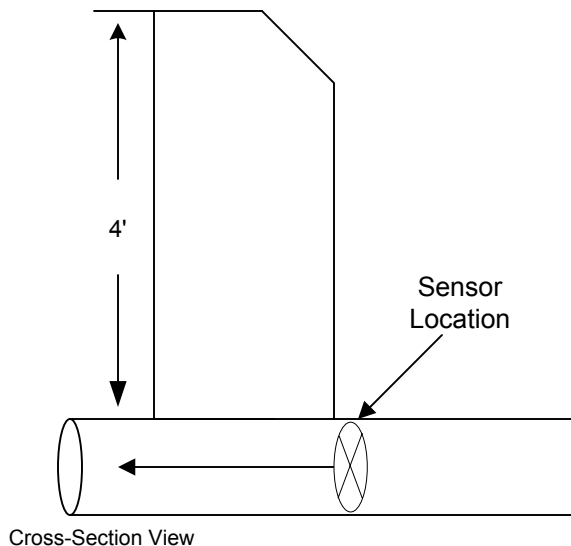
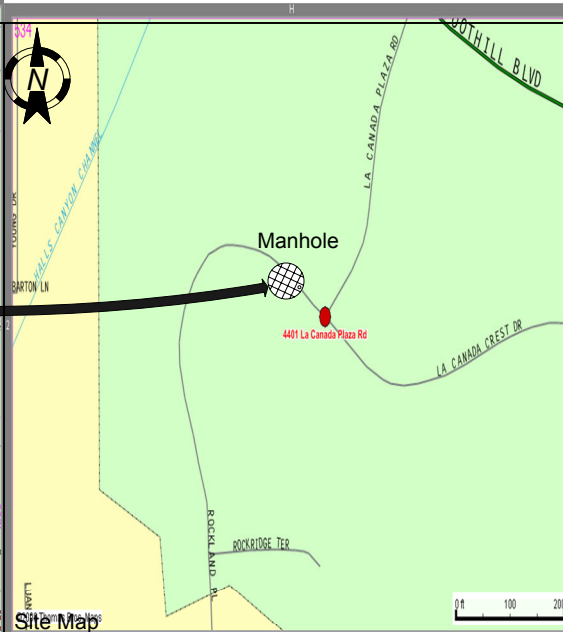
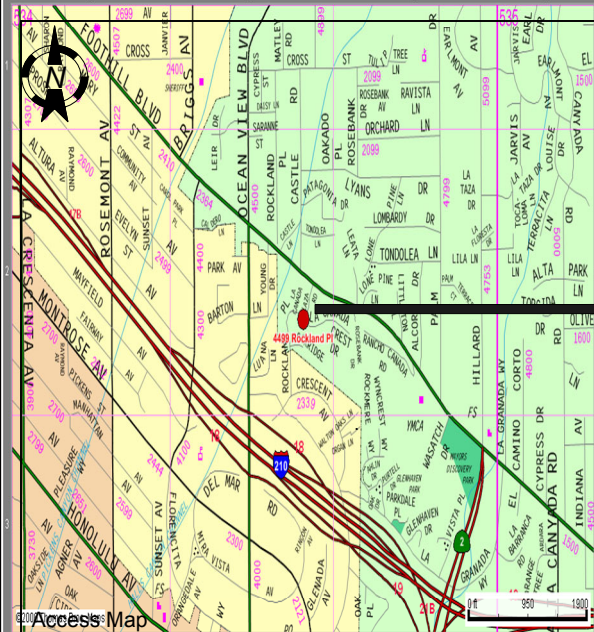
FlowShark S/N: 20103
IP#: 166.213.163.254



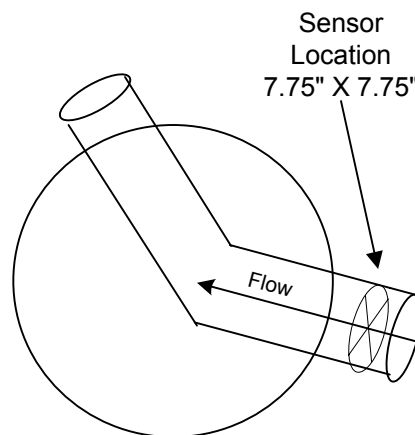
Access:

Vehicle

Landmark: Painted red curb



Cross-Section View



Plan View

Drawings Not to Scale

Hydraulics

Low flow below velocity reading requirements. No other flow altering affects

Surcharge : N/A

Height : ---

Time 1225

DOF .13

+/- .25

Velocity
Low flow, unable to read

Silt 0





NOAA Atlas 14, Volume 6, Version 2
Location name: La Crescenta, California, USA*
Latitude: 34.217°, Longitude: -118.2354°
Elevation: 1430 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

PF tabular

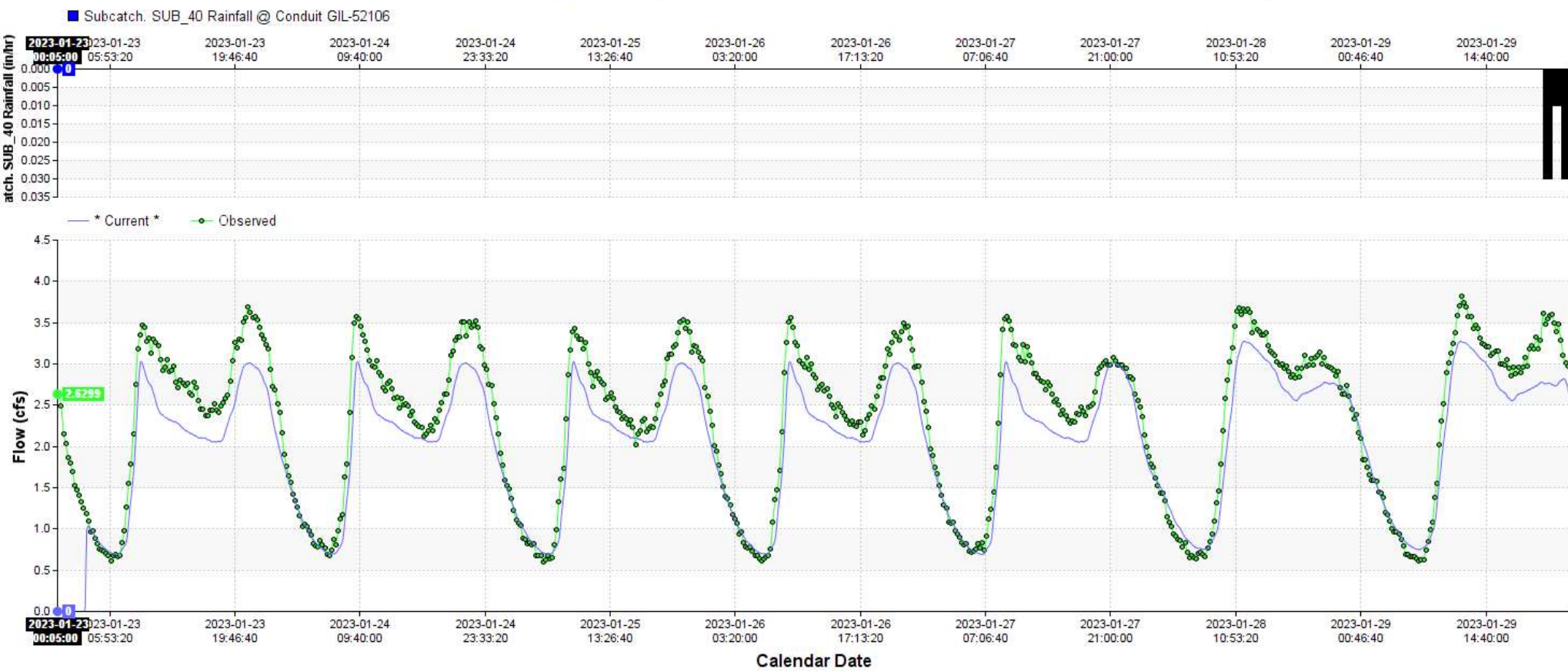
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.188 (0.157-0.228)	0.253 (0.211-0.306)	0.342 (0.284-0.415)	0.418 (0.344-0.512)	0.526 (0.419-0.668)	0.614 (0.478-0.798)	0.708 (0.537-0.943)	0.809 (0.596-1.11)	0.954 (0.673-1.37)	1.07 (0.729-1.60)
10-min	0.269 (0.225-0.326)	0.362 (0.302-0.439)	0.490 (0.407-0.595)	0.599 (0.493-0.734)	0.754 (0.600-0.958)	0.881 (0.685-1.14)	1.02 (0.770-1.35)	1.16 (0.854-1.59)	1.37 (0.964-1.96)	1.54 (1.05-2.29)
15-min	0.326 (0.272-0.394)	0.438 (0.365-0.531)	0.592 (0.492-0.720)	0.724 (0.597-0.887)	0.912 (0.726-1.16)	1.06 (0.829-1.38)	1.23 (0.931-1.64)	1.40 (1.03-1.92)	1.65 (1.17-2.37)	1.86 (1.26-2.76)
30-min	0.447 (0.373-0.541)	0.600 (0.500-0.727)	0.812 (0.675-0.986)	0.992 (0.818-1.22)	1.25 (0.995-1.59)	1.46 (1.14-1.90)	1.68 (1.28-2.24)	1.92 (1.42-2.64)	2.27 (1.60-3.25)	2.55 (1.73-3.79)
60-min	0.644 (0.538-0.780)	0.866 (0.722-1.05)	1.17 (0.973-1.42)	1.43 (1.18-1.75)	1.80 (1.43-2.29)	2.10 (1.64-2.73)	2.43 (1.84-3.23)	2.77 (2.04-3.80)	3.27 (2.30-4.68)	3.68 (2.50-5.46)
2-hr	0.939 (0.784-1.14)	1.26 (1.06-1.53)	1.72 (1.43-2.09)	2.12 (1.74-2.60)	2.69 (2.14-3.42)	3.17 (2.46-4.11)	3.68 (2.79-4.90)	4.23 (3.12-5.81)	5.04 (3.56-7.23)	5.72 (3.89-8.50)
3-hr	1.18 (0.981-1.42)	1.58 (1.32-1.92)	2.15 (1.79-2.62)	2.65 (2.18-3.25)	3.38 (2.69-4.29)	3.98 (3.10-5.17)	4.64 (3.52-6.18)	5.35 (3.94-7.34)	6.40 (4.51-9.17)	7.27 (4.94-10.8)
6-hr	1.69 (1.41-2.04)	2.26 (1.89-2.74)	3.08 (2.56-3.74)	3.79 (3.12-4.64)	4.83 (3.84-6.13)	5.69 (4.43-7.38)	6.62 (5.02-8.82)	7.64 (5.63-10.5)	9.13 (6.44-13.1)	10.4 (7.06-15.4)
12-hr	2.29 (1.91-2.77)	3.09 (2.57-3.74)	4.19 (3.48-5.10)	5.14 (4.24-6.31)	6.52 (5.19-8.28)	7.64 (5.95-9.92)	8.85 (6.71-11.8)	10.2 (7.48-13.9)	12.0 (8.48-17.3)	13.6 (9.24-20.2)
24-hr	3.08 (2.73-3.56)	4.19 (3.70-4.83)	5.71 (5.03-6.60)	7.00 (6.13-8.17)	8.86 (7.50-10.7)	10.4 (8.59-12.7)	12.0 (9.67-15.1)	13.7 (10.8-17.7)	16.1 (12.2-21.8)	18.1 (13.2-25.3)
2-day	3.88 (3.43-4.47)	5.34 (4.72-6.16)	7.36 (6.49-8.52)	9.10 (7.96-10.6)	11.6 (9.83-14.0)	13.7 (11.3-16.8)	15.8 (12.8-20.0)	18.2 (14.3-23.6)	21.6 (16.3-29.2)	24.4 (17.8-34.1)
3-day	4.38 (3.88-5.04)	6.09 (5.38-7.02)	8.48 (7.48-9.81)	10.5 (9.22-12.3)	13.6 (11.5-16.3)	16.0 (13.3-19.7)	18.7 (15.1-23.5)	21.6 (17.0-28.0)	25.8 (19.5-34.8)	29.3 (21.4-40.9)
4-day	4.70 (4.16-5.42)	6.57 (5.81-7.58)	9.20 (8.11-10.6)	11.5 (10.0-13.4)	14.8 (12.5-17.9)	17.6 (14.6-21.6)	20.6 (16.6-25.9)	23.8 (18.7-30.9)	28.5 (21.6-38.6)	32.5 (23.7-45.4)
7-day	5.42 (4.80-6.25)	7.58 (6.70-8.75)	10.6 (9.39-12.3)	13.3 (11.7-15.6)	17.3 (14.6-20.8)	20.6 (17.1-25.3)	24.2 (19.5-30.4)	28.1 (22.1-36.4)	33.9 (25.6-45.7)	38.7 (28.3-54.1)
10-day	5.82 (5.16-6.71)	8.16 (7.22-9.41)	11.5 (10.1-13.3)	14.4 (12.6-16.8)	18.7 (15.8-22.6)	22.3 (18.5-27.5)	26.2 (21.2-33.1)	30.6 (24.1-39.6)	36.9 (27.9-49.9)	42.3 (30.9-59.1)
20-day	6.81 (6.03-7.85)	9.63 (8.51-11.1)	13.6 (12.0-15.8)	17.1 (15.0-20.0)	22.3 (18.9-26.9)	26.7 (22.1-32.8)	31.4 (25.4-39.6)	36.7 (28.9-47.5)	44.4 (33.5-59.9)	50.9 (37.1-71.1)
30-day	7.91 (7.00-9.11)	11.2 (9.90-12.9)	15.9 (14.0-18.4)	20.0 (17.5-23.3)	26.0 (22.0-31.3)	31.0 (25.7-38.2)	36.5 (29.5-46.0)	42.5 (33.5-55.1)	51.4 (38.8-69.4)	58.9 (43.0-82.3)
45-day	9.32 (8.25-10.7)	13.1 (11.6-15.2)	18.5 (16.3-21.4)	23.2 (20.3-27.1)	30.1 (25.5-36.3)	35.8 (29.7-44.1)	42.0 (34.0-52.9)	48.8 (38.4-63.3)	58.8 (44.5-79.5)	67.3 (49.1-94.0)
60-day	10.7 (9.48-12.3)	15.0 (13.2-17.3)	20.9 (18.4-24.2)	26.1 (22.8-30.4)	33.6 (28.4-40.5)	39.8 (33.0-49.0)	46.5 (37.7-58.7)	53.9 (42.5-69.9)	64.8 (48.9-87.5)	73.8 (53.9-103)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

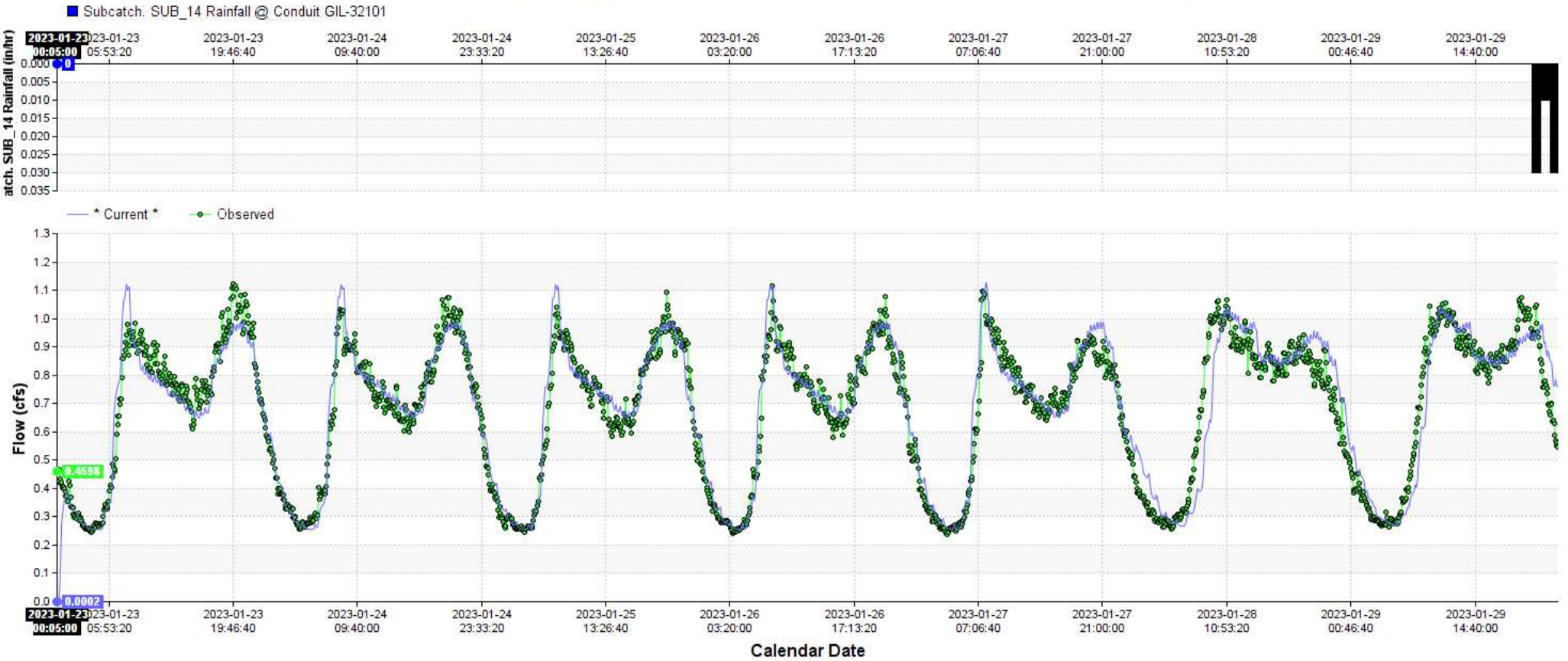
[Back to Top](#)

PF graphical

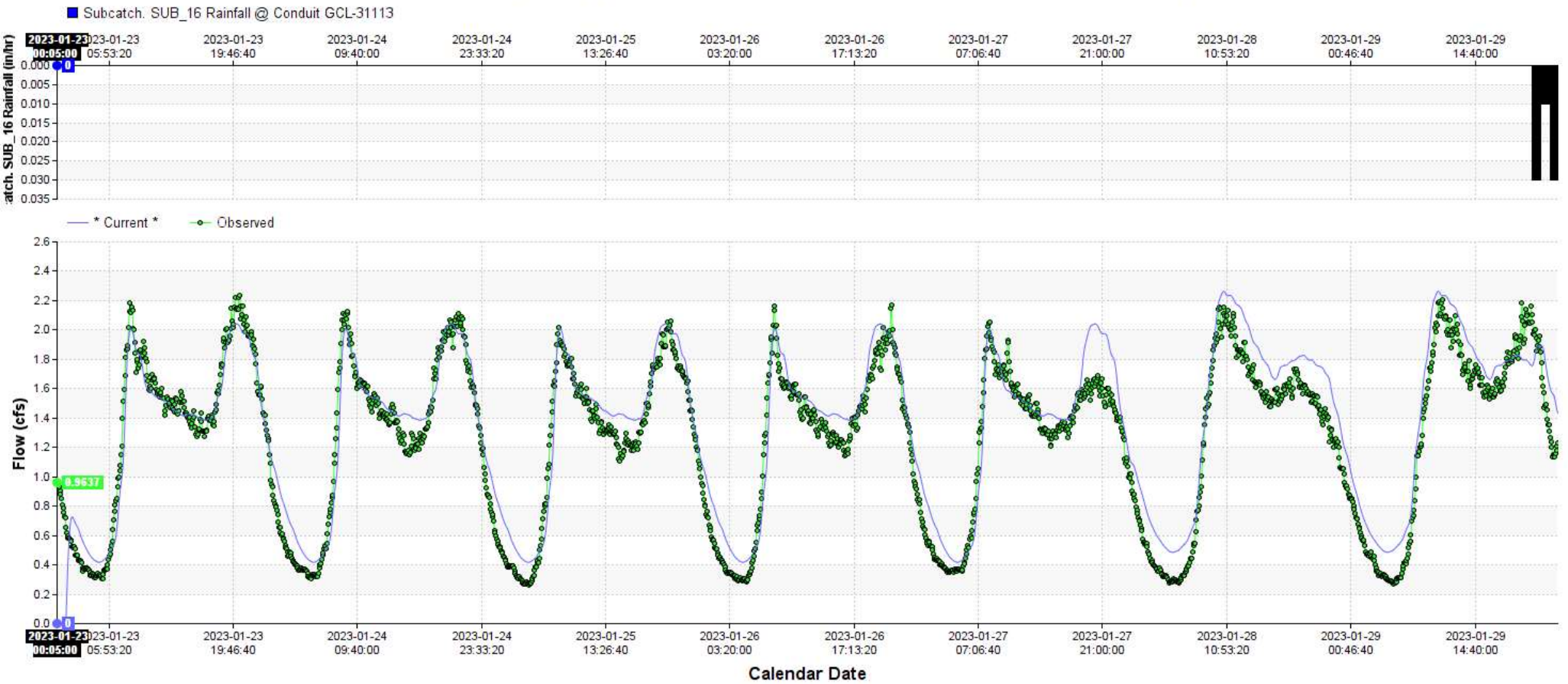
ELK STATION_DWF (Run/Measured Volumes : 9.12 / 10.48 MG)



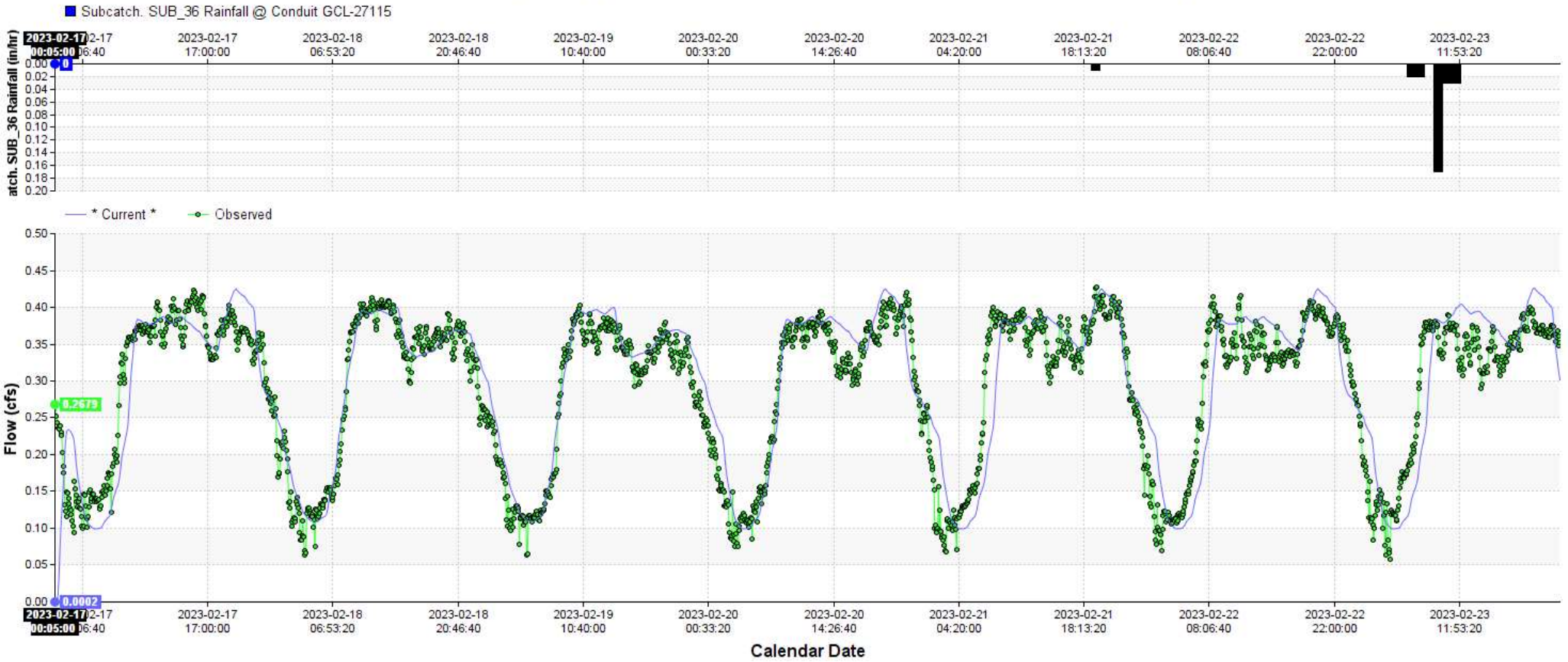
FM01_DWF (Run/Measured Volumes : 3.11 / 3.09 MG)



FM02_DWF (Run/Measured Volumes : 6.10 / 5.70 MG)

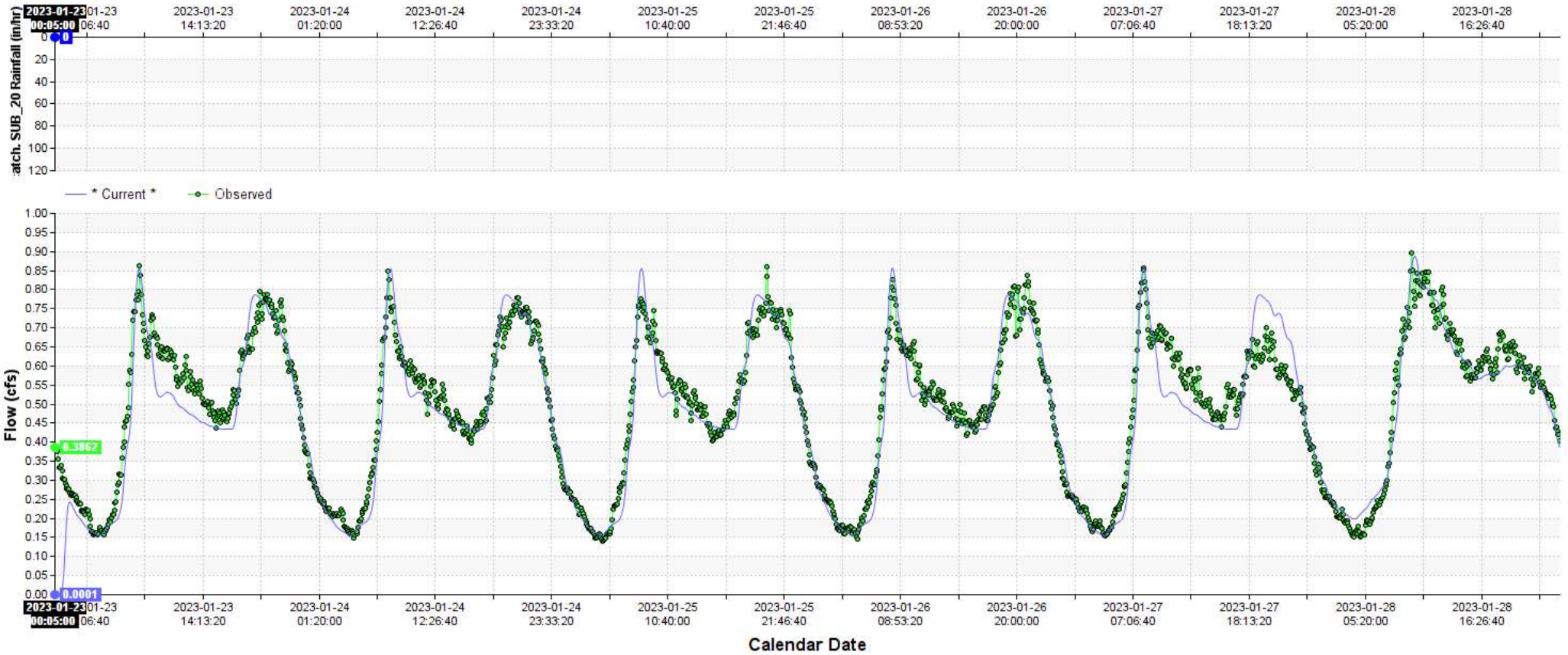


FM03_DWF (Run/Measured Volumes : 1.34 / 1.32 MG)

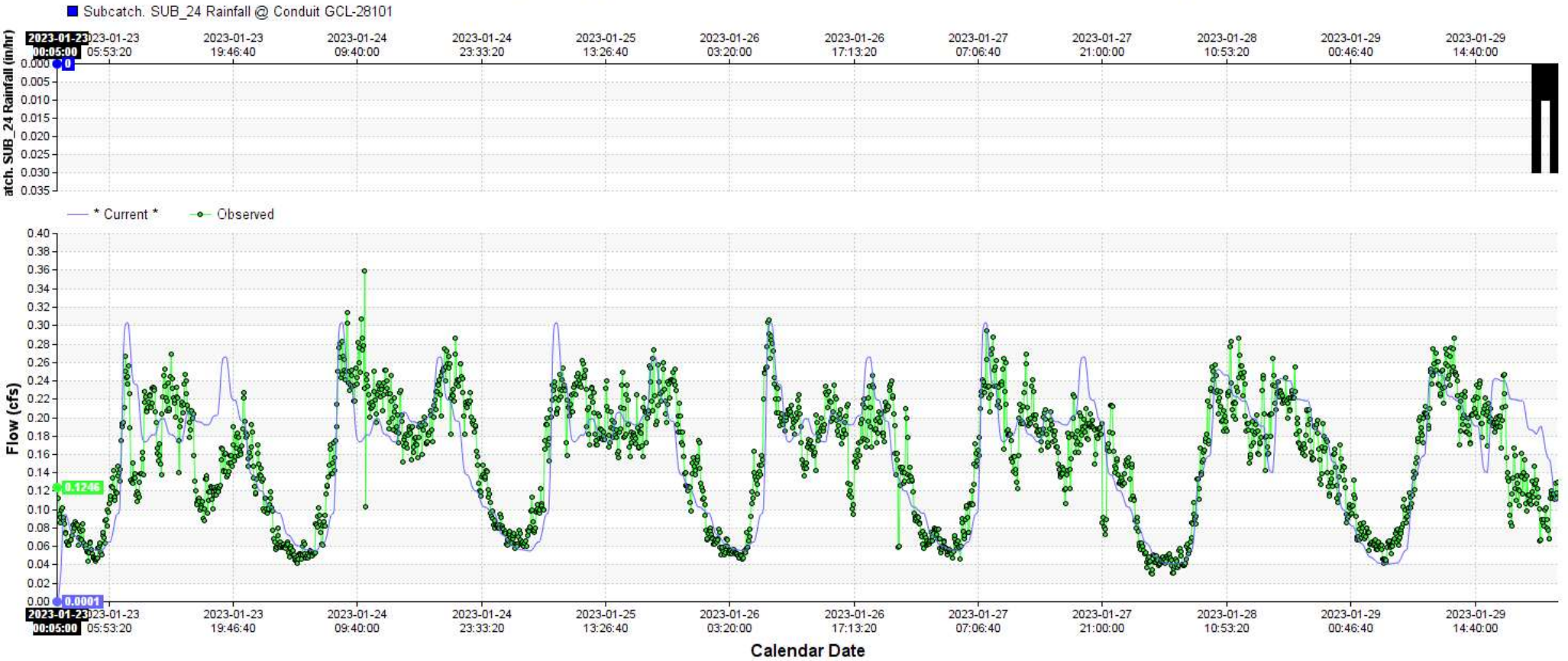


FM05_DWF (Run/Measured Volumes : 1.85 / 1.91 MG)

■ Subcatch. SUB_20 Rainfall @ Conduit GCL-27125

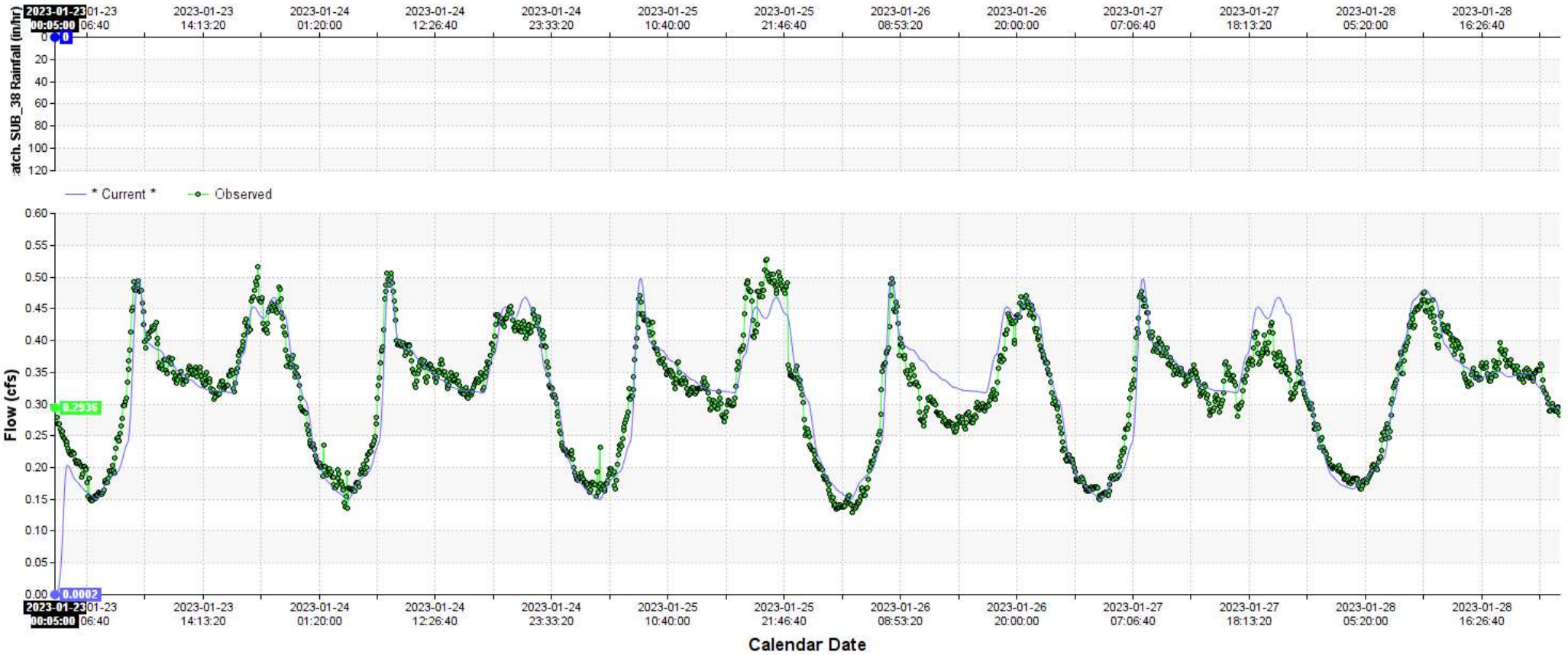


FM06_DWF (Run/Measured Volumes : 0.71 / 0.70 MG)

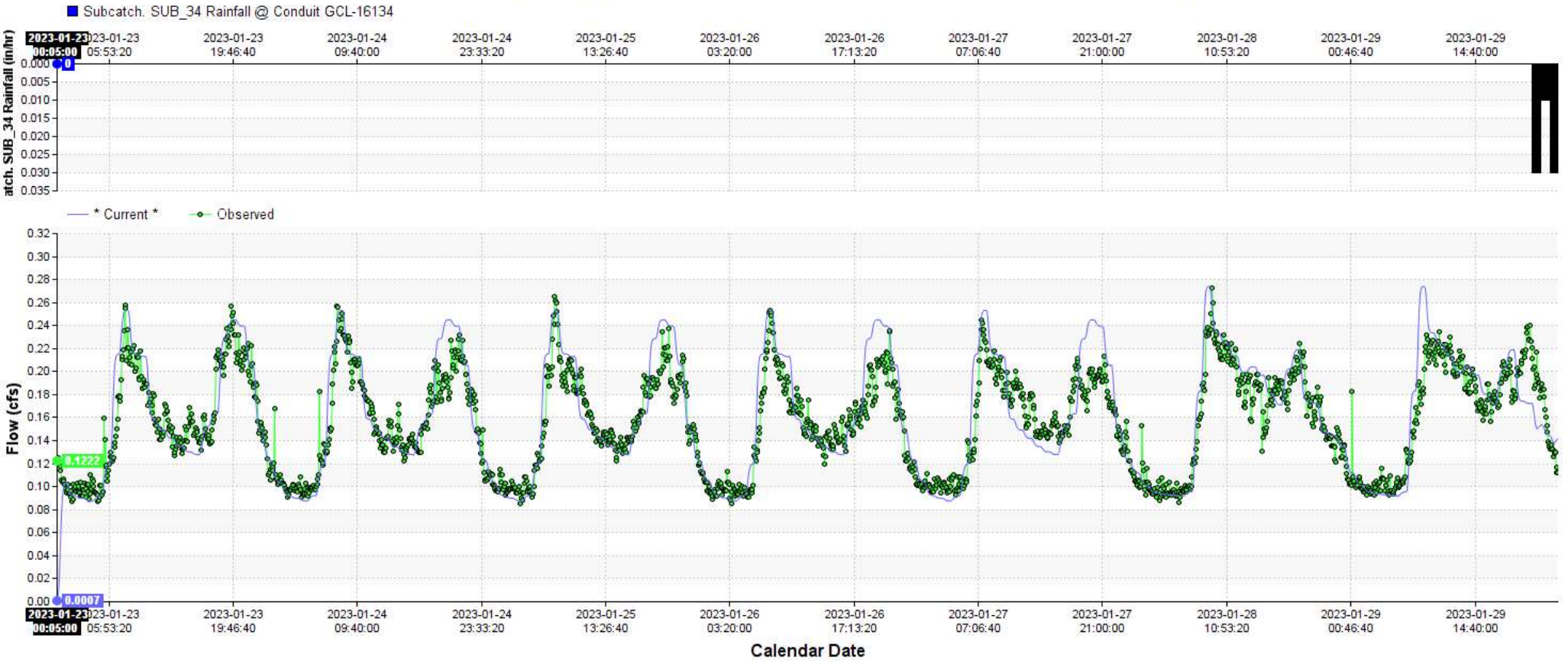


FM07_DWF (Run/Measured Volumes : 1.24 / 1.24 MG)

Subcatch. SUB_38 Rainfall @ Conduit GCL-21153

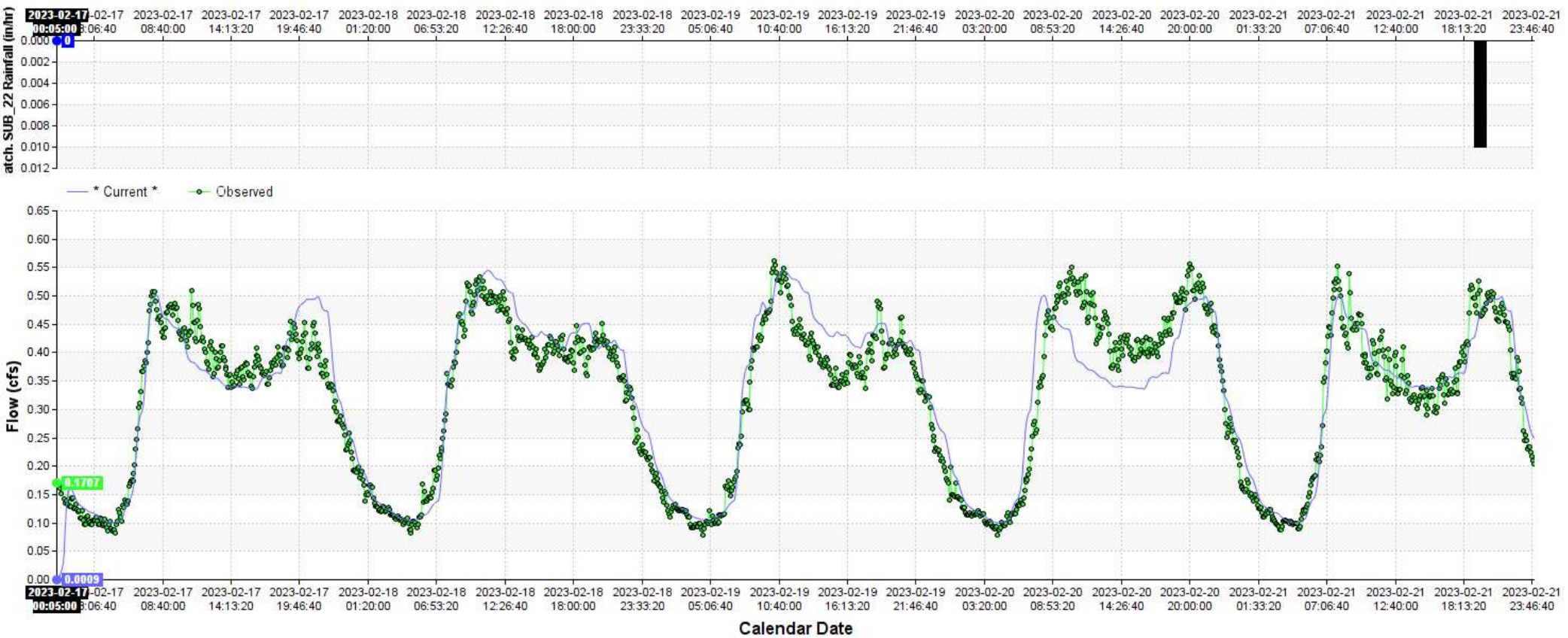


FM08_DWF (Run/Measured Volumes : 0.73 / 0.71 MG)

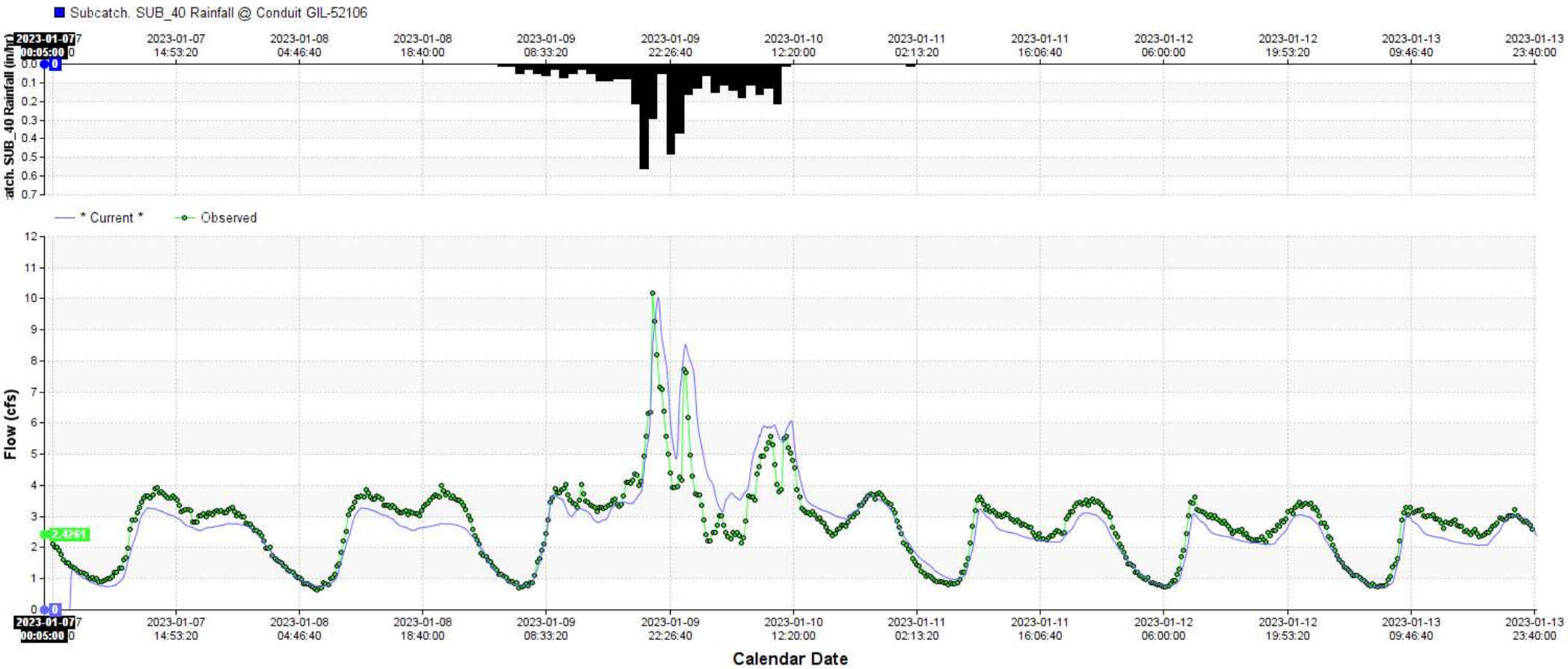


FM09_DWF (Run/Measured Volumes : 1.06 / 1.04 MG)

■ Subcatch. SUB_22 Rainfall @ Conduit GCL-22123

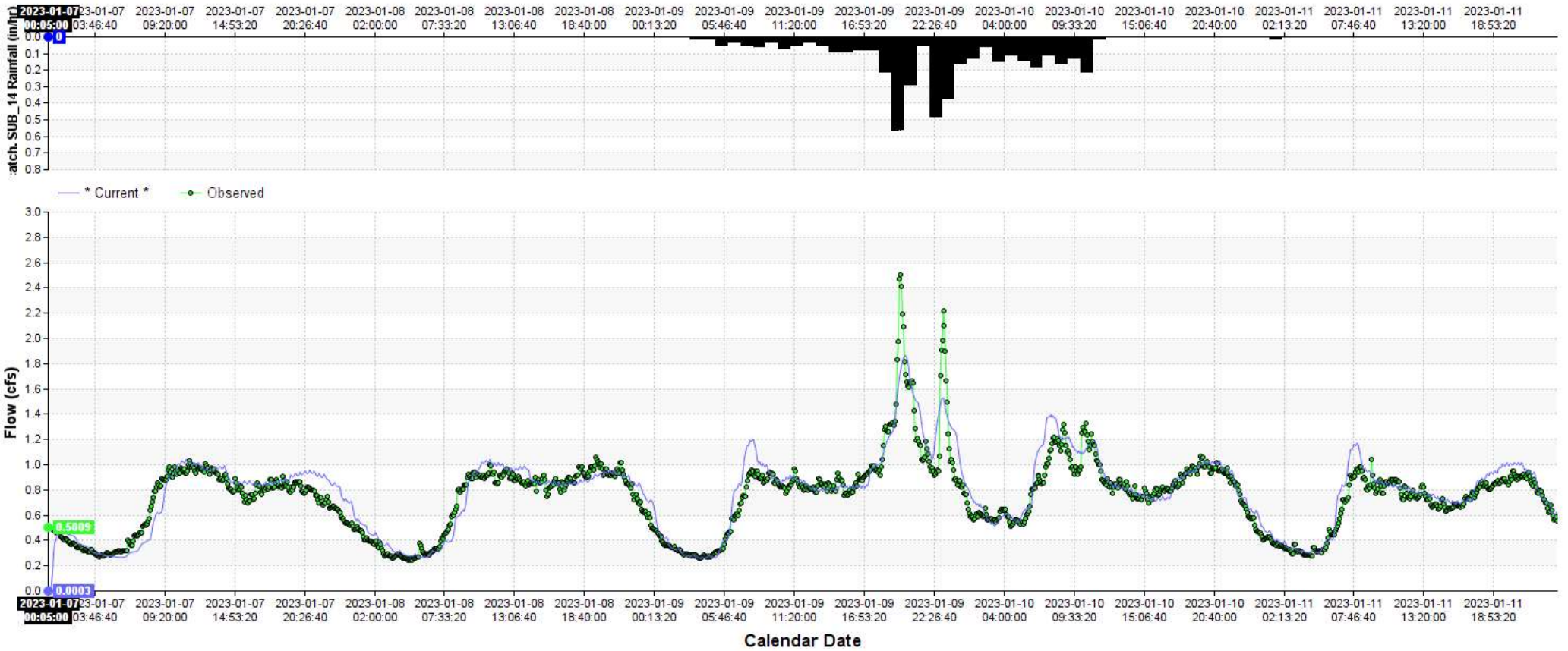


ELK STATION_WWF (Run/Measured Volumes : 11.61 / 12.15 MG)



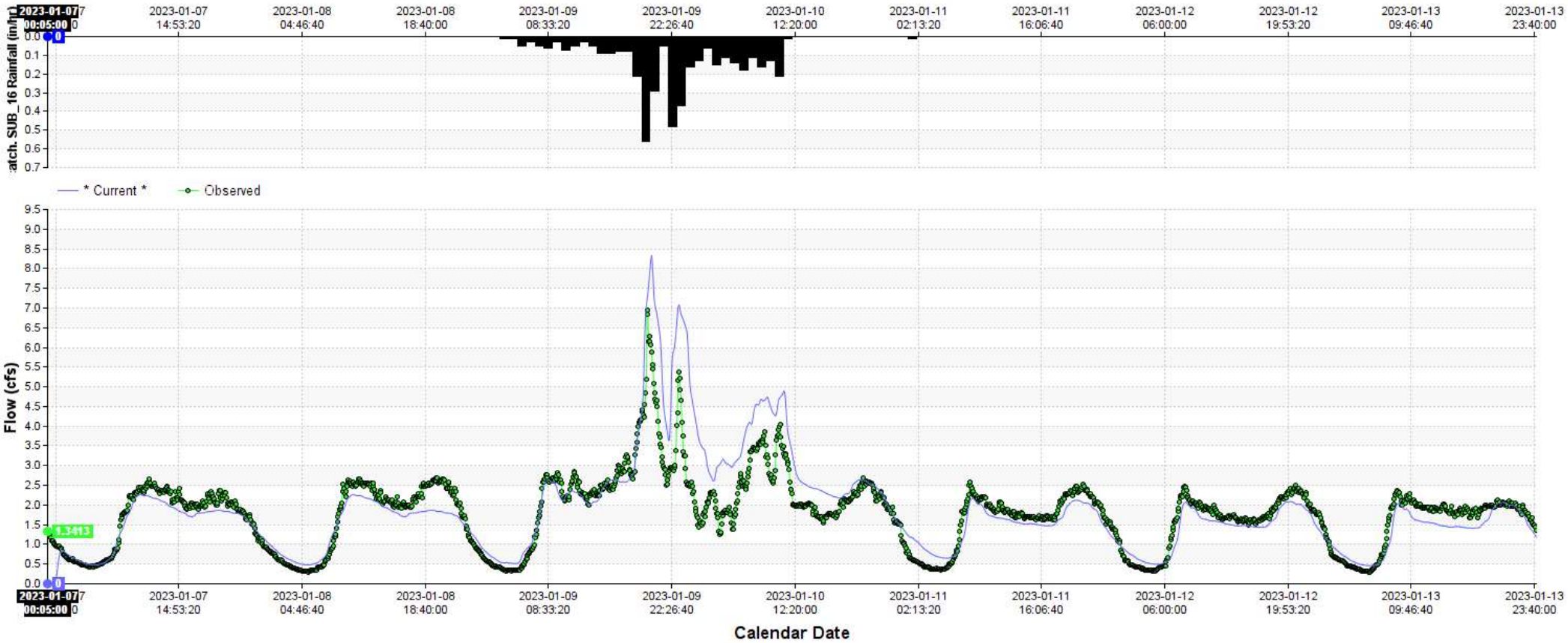
FM01_WWF (Run/Measured Volumes : 2.50 / 2.40 MG)

■ Subcatch. SUB_14 Rainfall @ Conduit GIL-32101



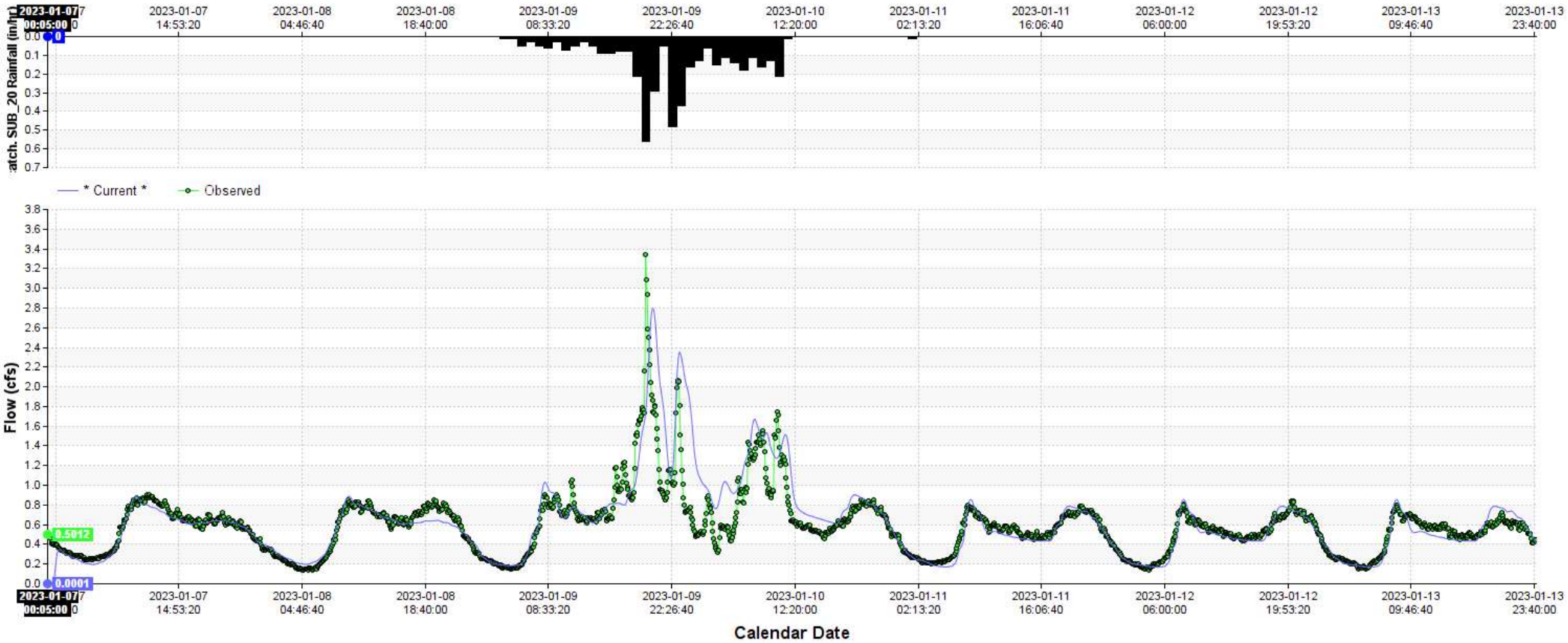
FM02_WWF (Run/Measured Volumes : 8.34 / 8.04 MG)

■ Subcatch. SUB_16 Rainfall @ Conduit GCL-31113



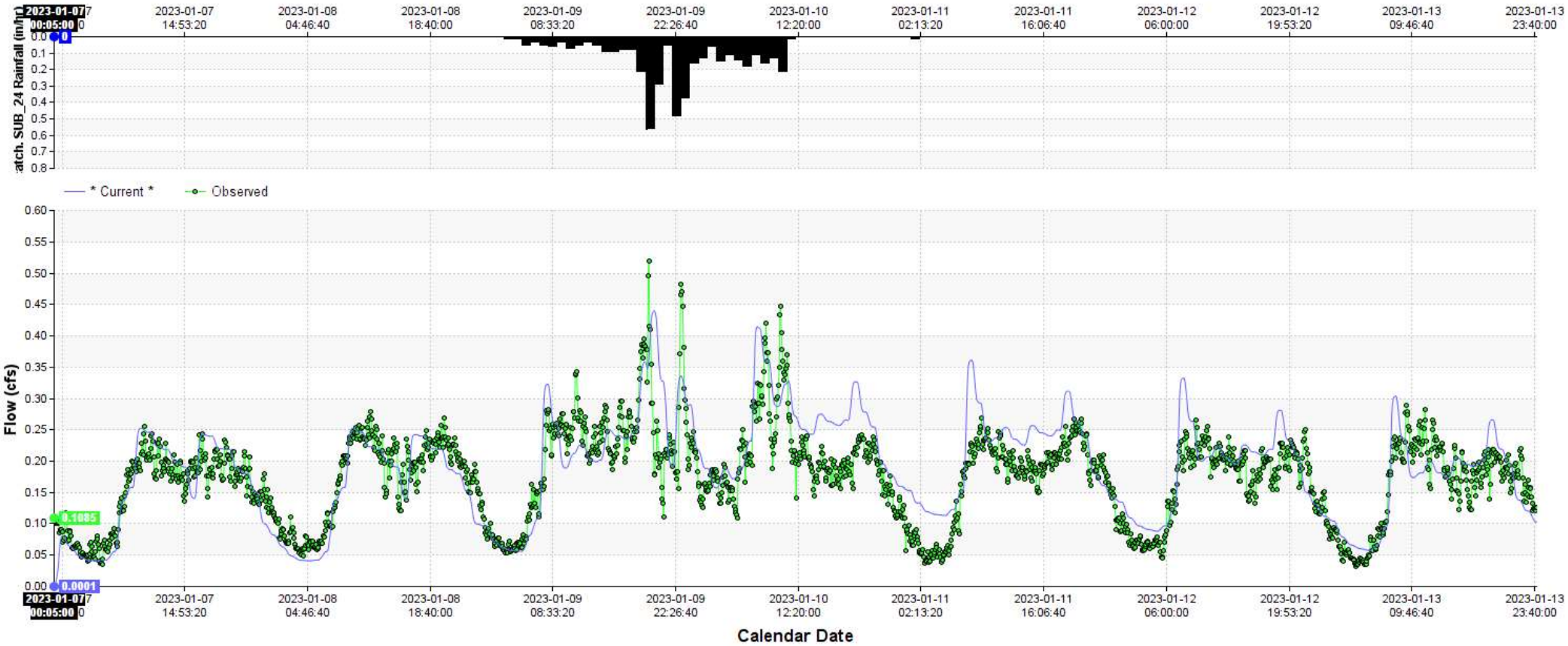
FM05_WWF (Run/Measured Volumes : 2.80 / 2.67 MG)

Subcatch. SUB_20 Rainfall @ Conduit GCL-27125



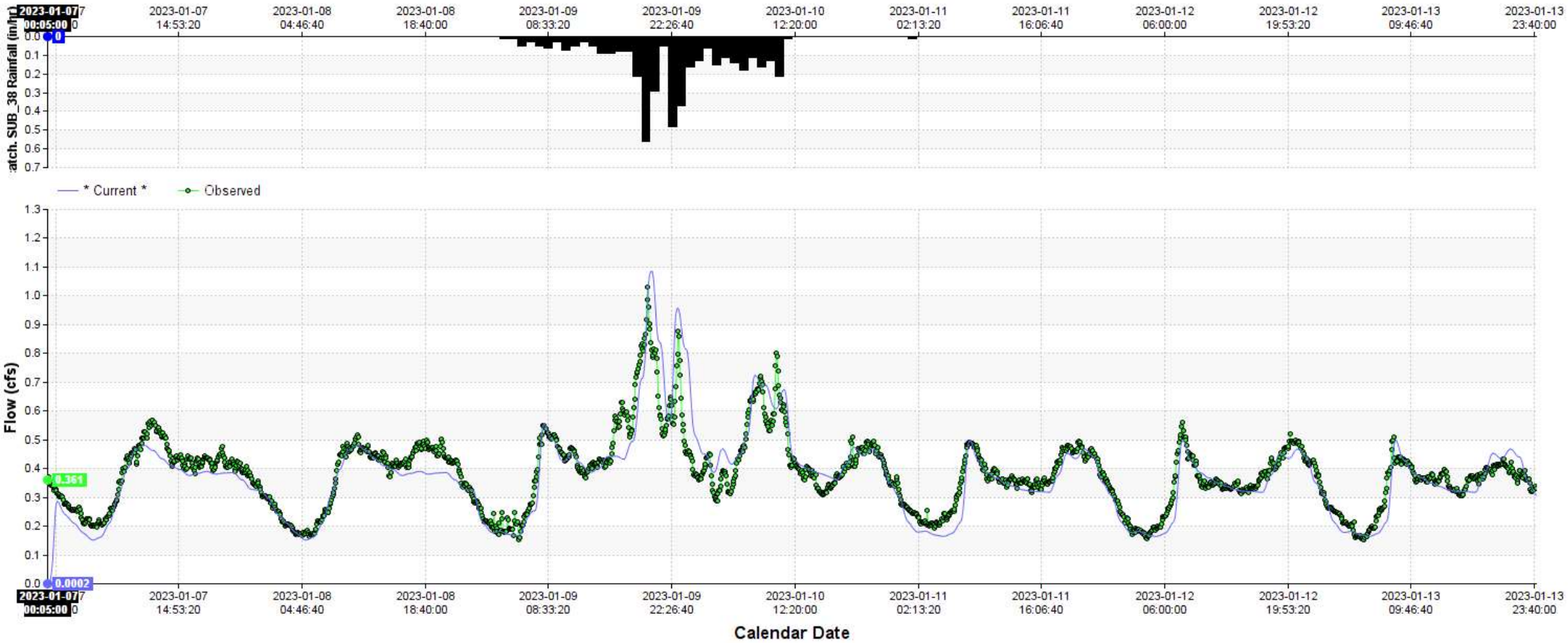
FM06_WWF (Run/Measured Volumes : 0.85 / 0.79 MG)

■ Subcatch. SUB_24 Rainfall @ Conduit GCL-28101



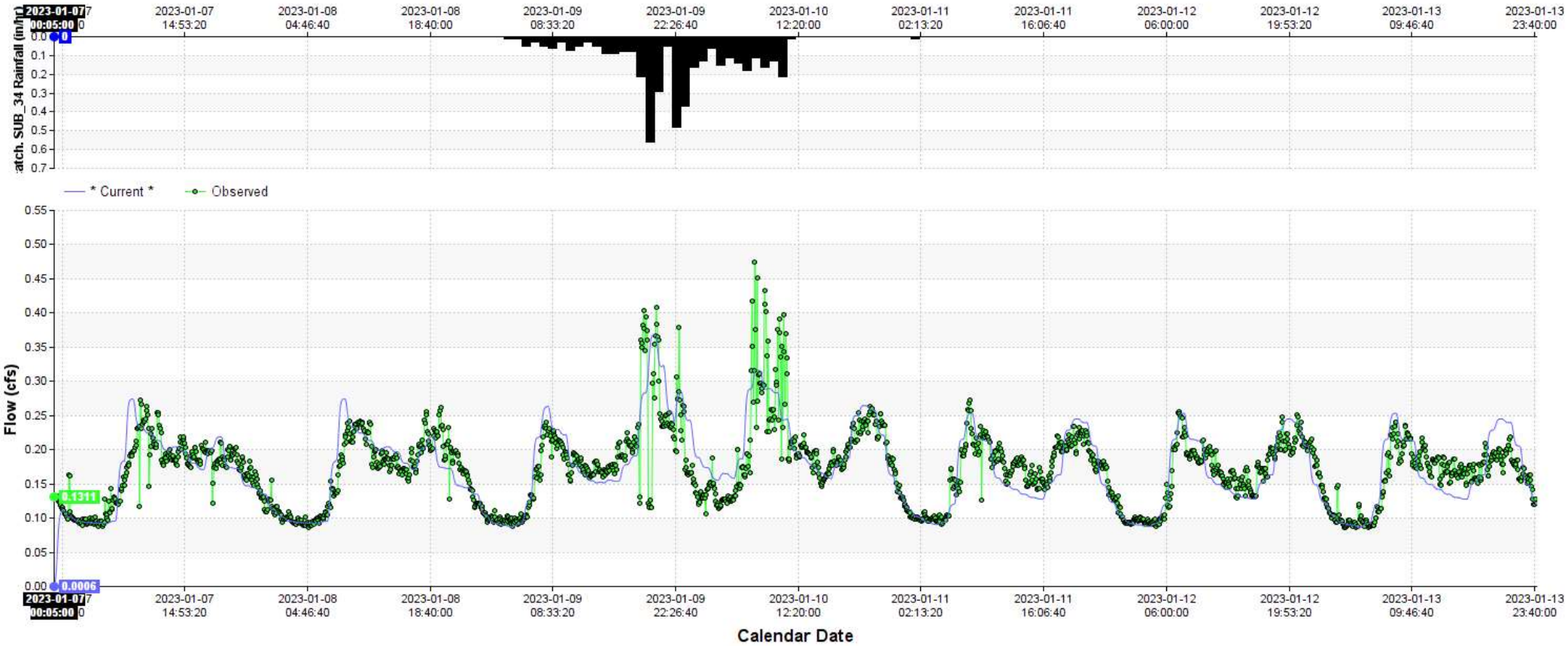
FM07_WWF (Run/Measured Volumes : 1.66 / 1.72 MG)

■ Subcatch. SUB_38 Rainfall @ Conduit GCL-21153

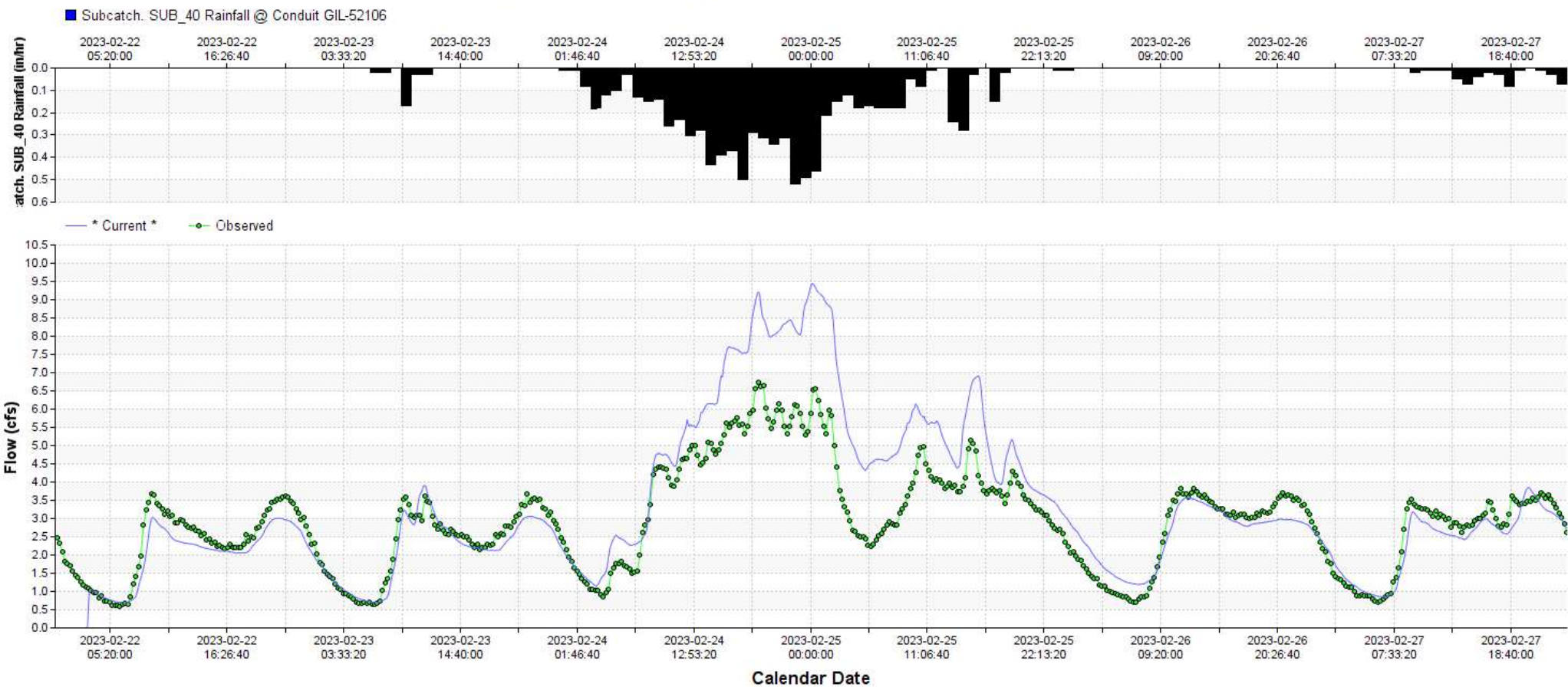


FM08_WWF (Run/Measured Volumes : 0.78 / 0.78 MG)

■ Subcatch. SUB_34 Rainfall @ Conduit GCL-16134

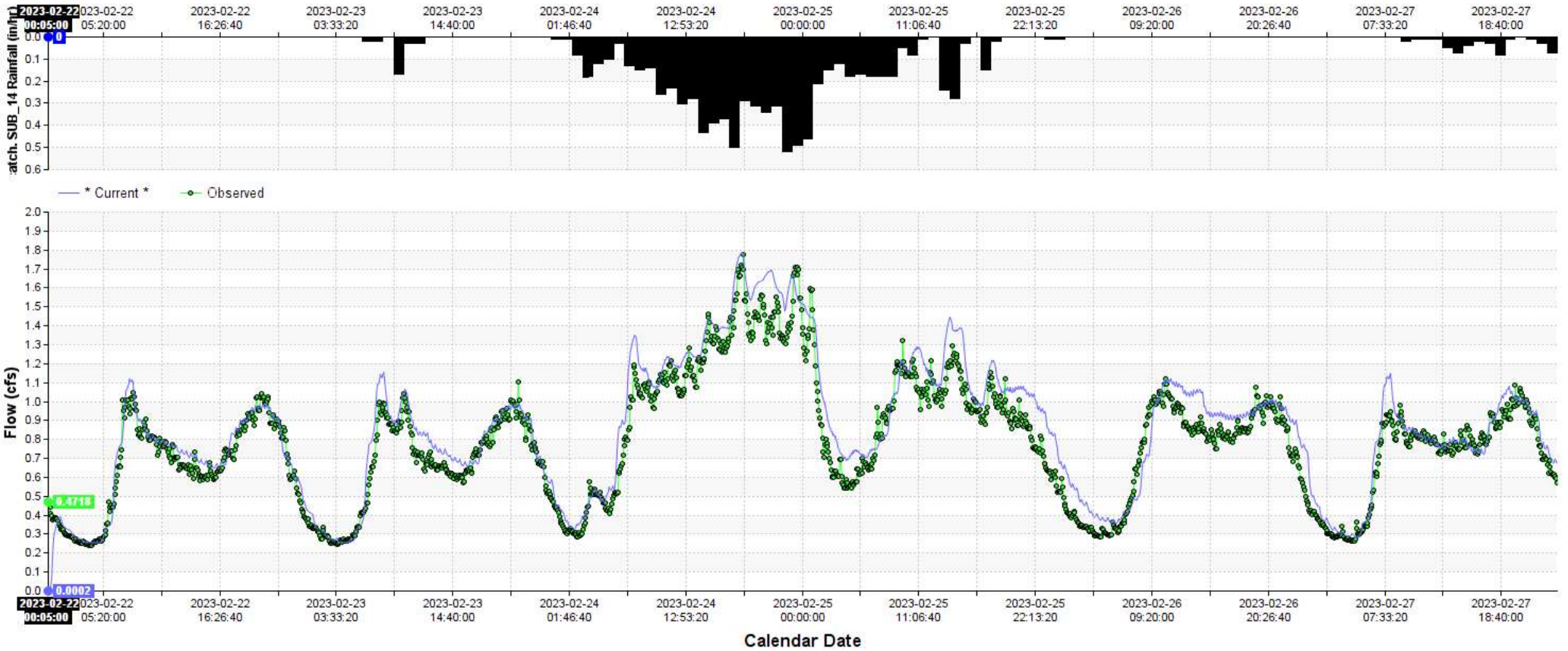


ELK STATION_VALIDATION (Run/Measured Volumes : 12.46 / 11.22 MG)



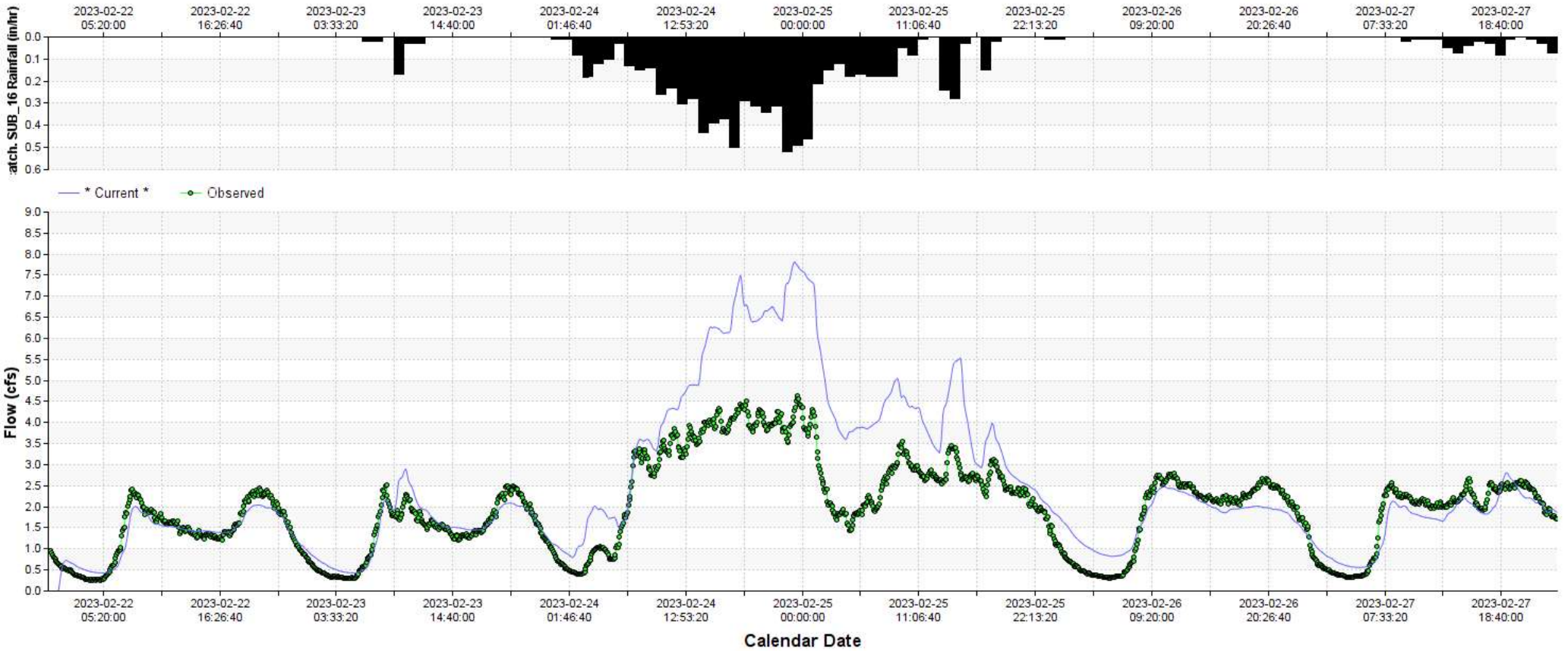
FM01_VALIDATION (Run/Measured Volumes : 3.28 / 3.02 MG)

■ Subcatch. SUB_14 Rainfall @ Conduit GIL-32101



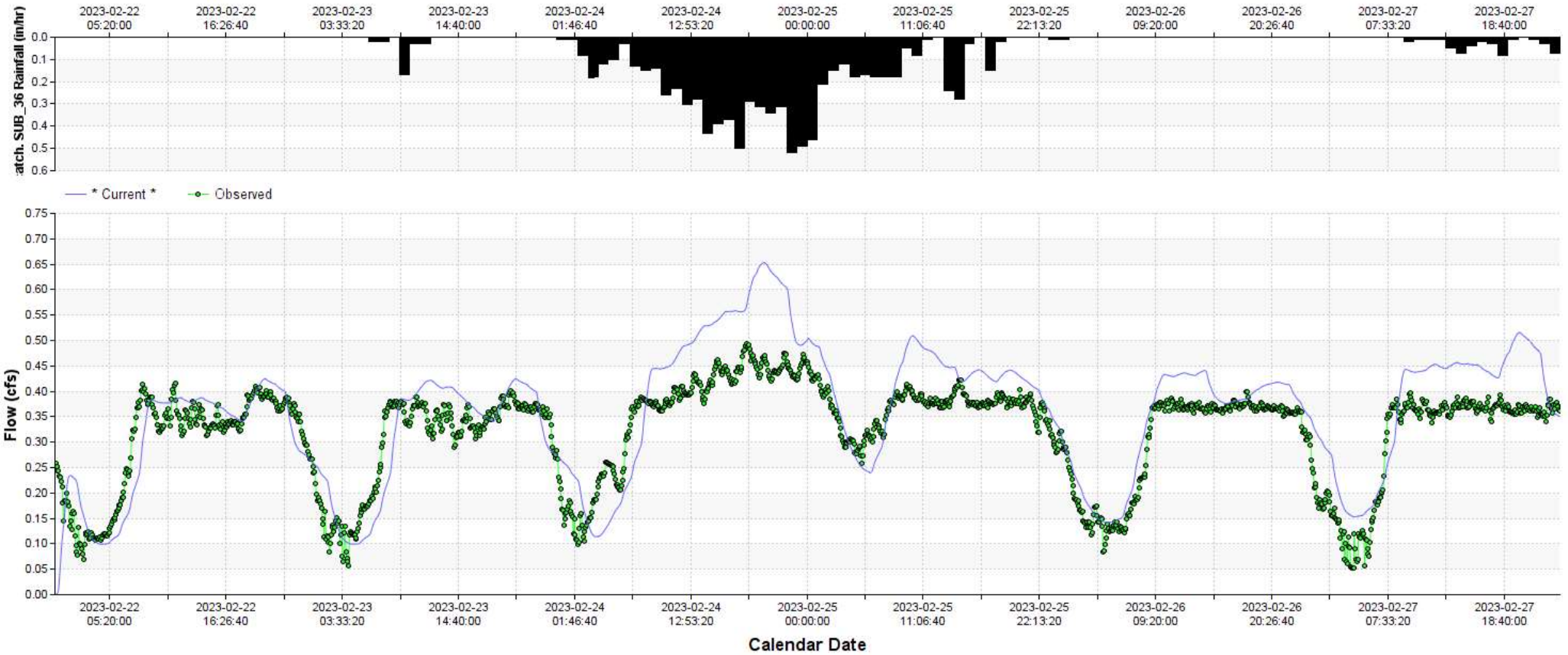
FM02_VALIDATION (Run/Measured Volumes : 9.29 / 7.51 MG)

■ Subcatch. SUB_16 Rainfall @ Conduit GCL-31113

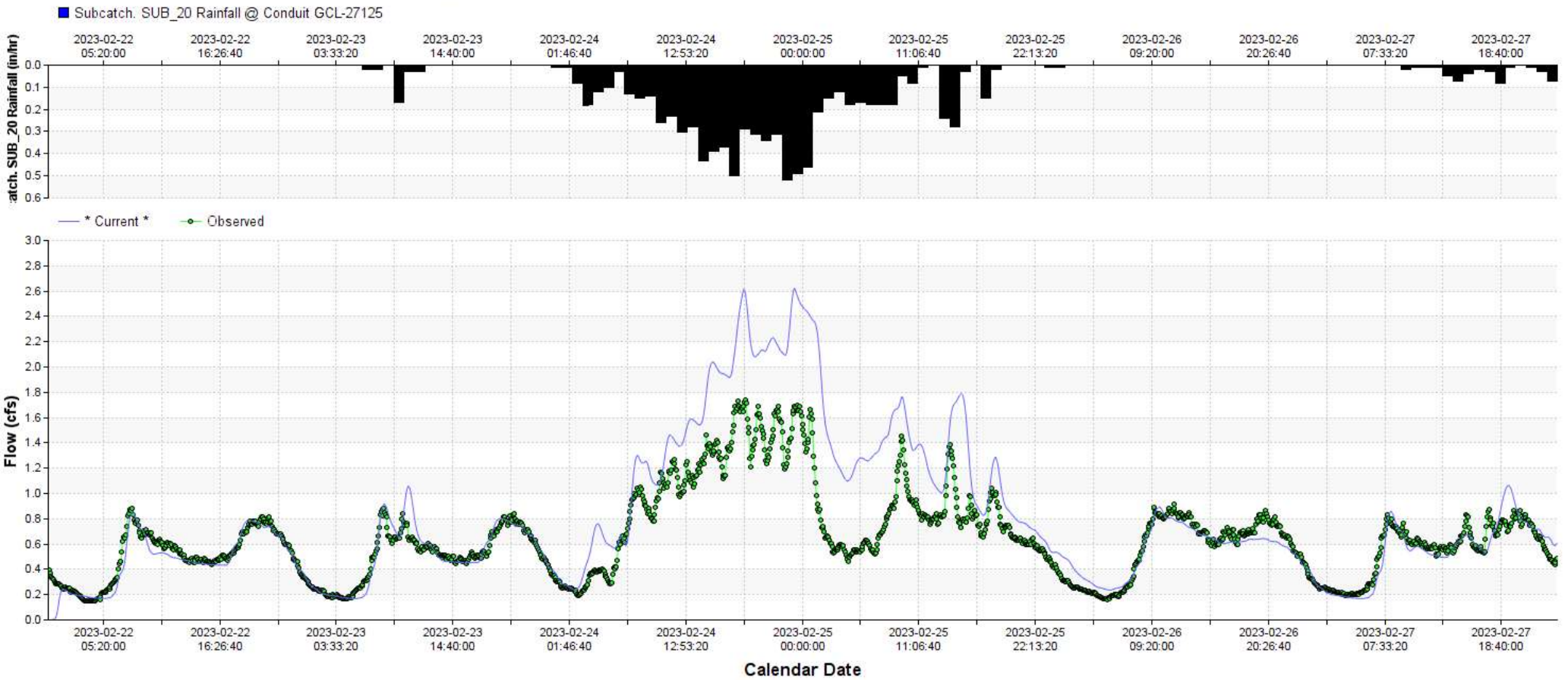


FM03_VALIDATION (Run/Measured Volumes : 1.38 / 1.23 MG)

■ Subcatch. SUB_36 Rainfall @ Conduit GCL-27115

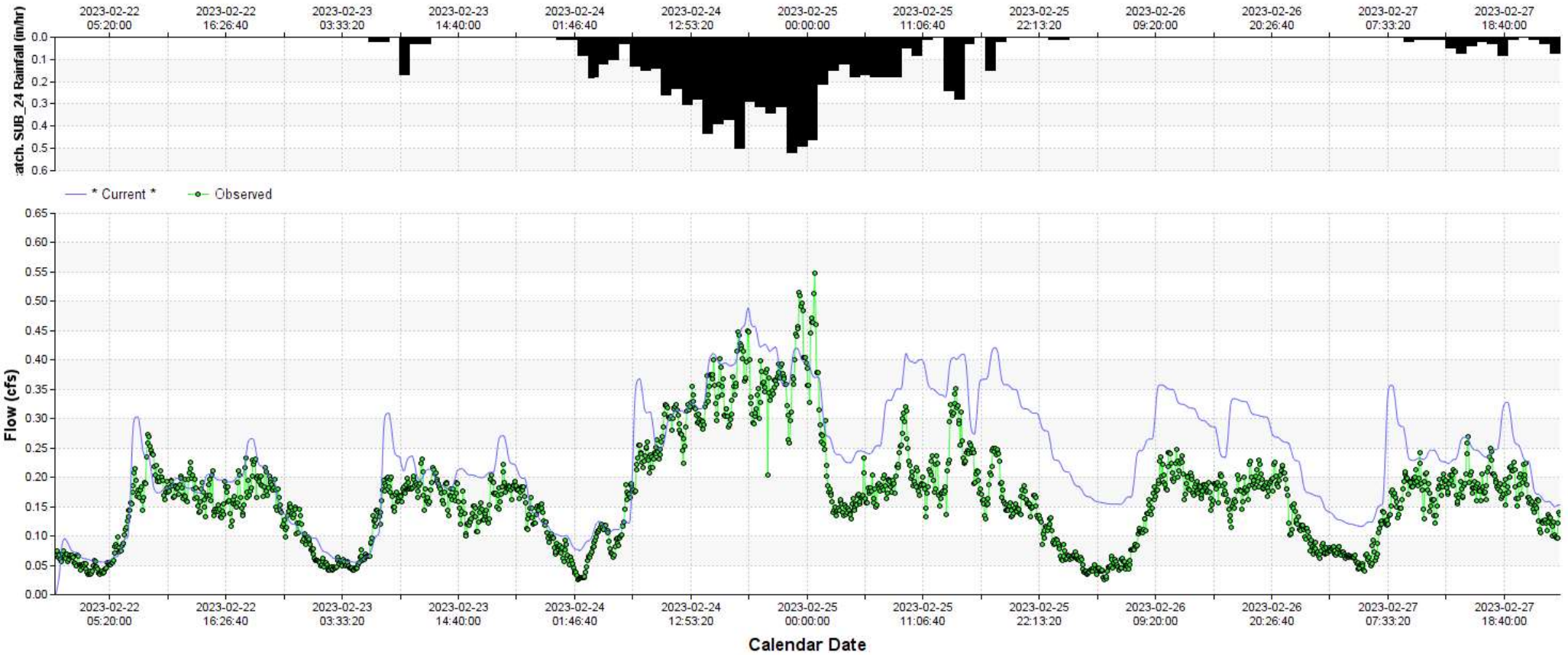


FM05_VALIDATION (Run/Measured Volumes : 3.06 / 2.52 MG)



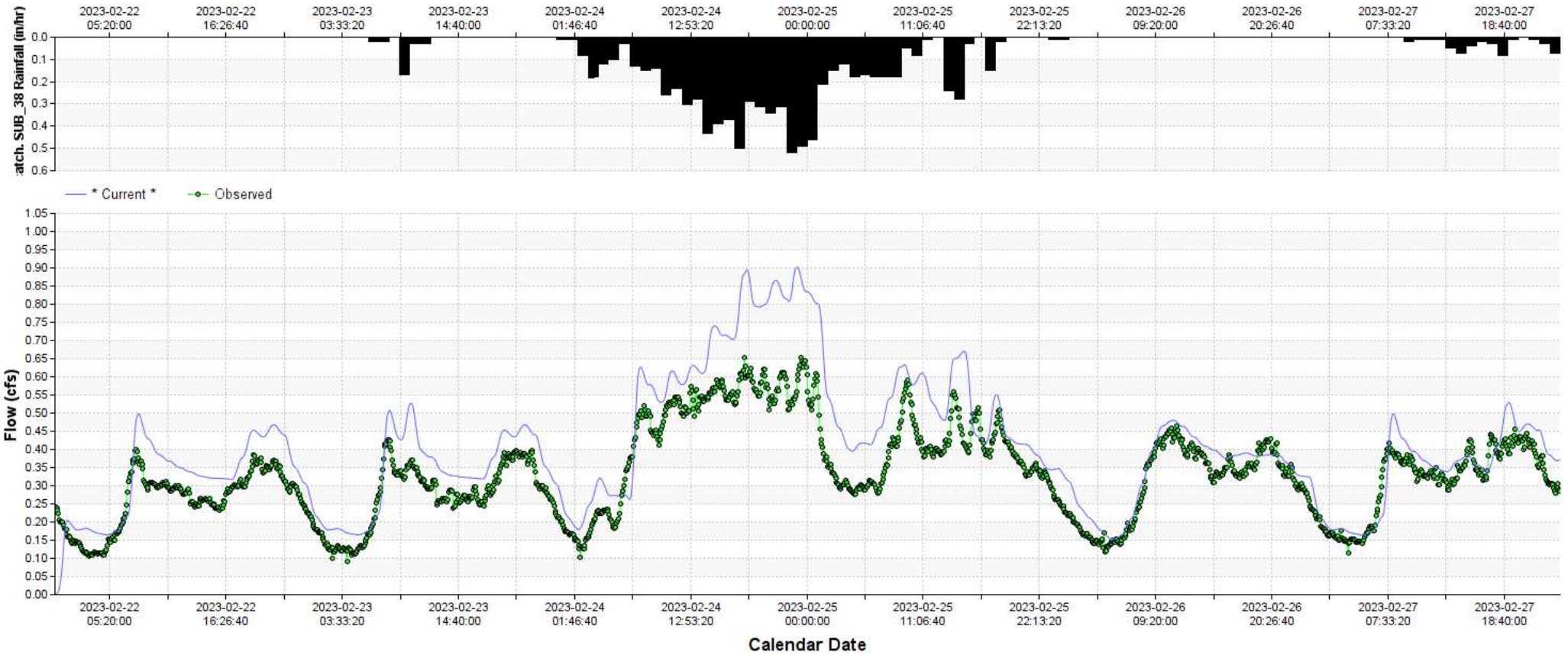
FM06_VALIDATION (Run/Measured Volumes : 0.90 / 0.65 MG)

■ Subcatch. SUB_24 Rainfall @ Conduit GCL-28101



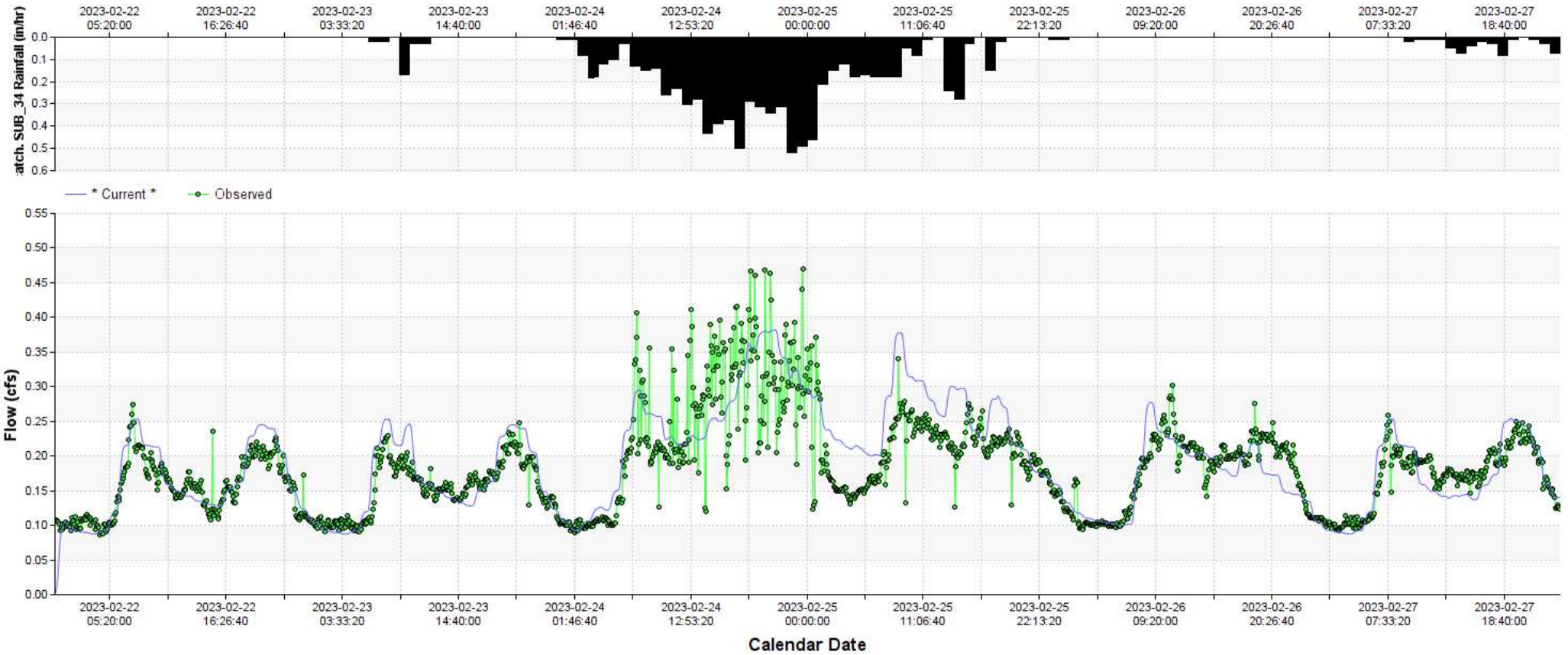
FM07_VALIDATION (Run/Measured Volumes : 1.55 / 1.28 MG)

■ Subcatch. SUB_38 Rainfall @ Conduit GCL-21153



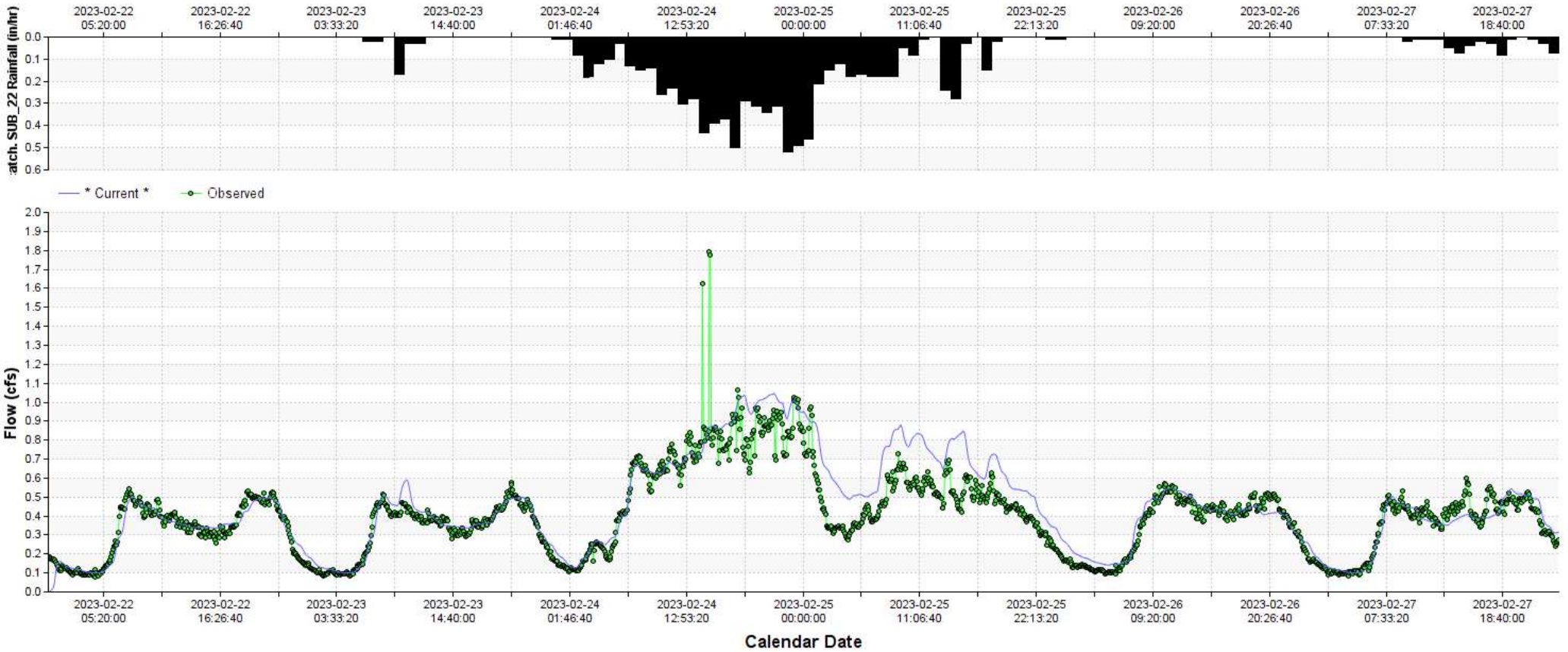
FM08_VALIDATION (Run/Measured Volumes : 0.74 / 0.70 MG)

■ Subcatch. SUB_34 Rainfall @ Conduit GCL-16134



FM09_VALIDATION (Run/Measured Volumes : 1.72 / 1.56 MG)

■ Subcatch. SUB_22 Rainfall @ Conduit GCL-22123



Appendix D La Granada Condition Assessment Notes and Photos



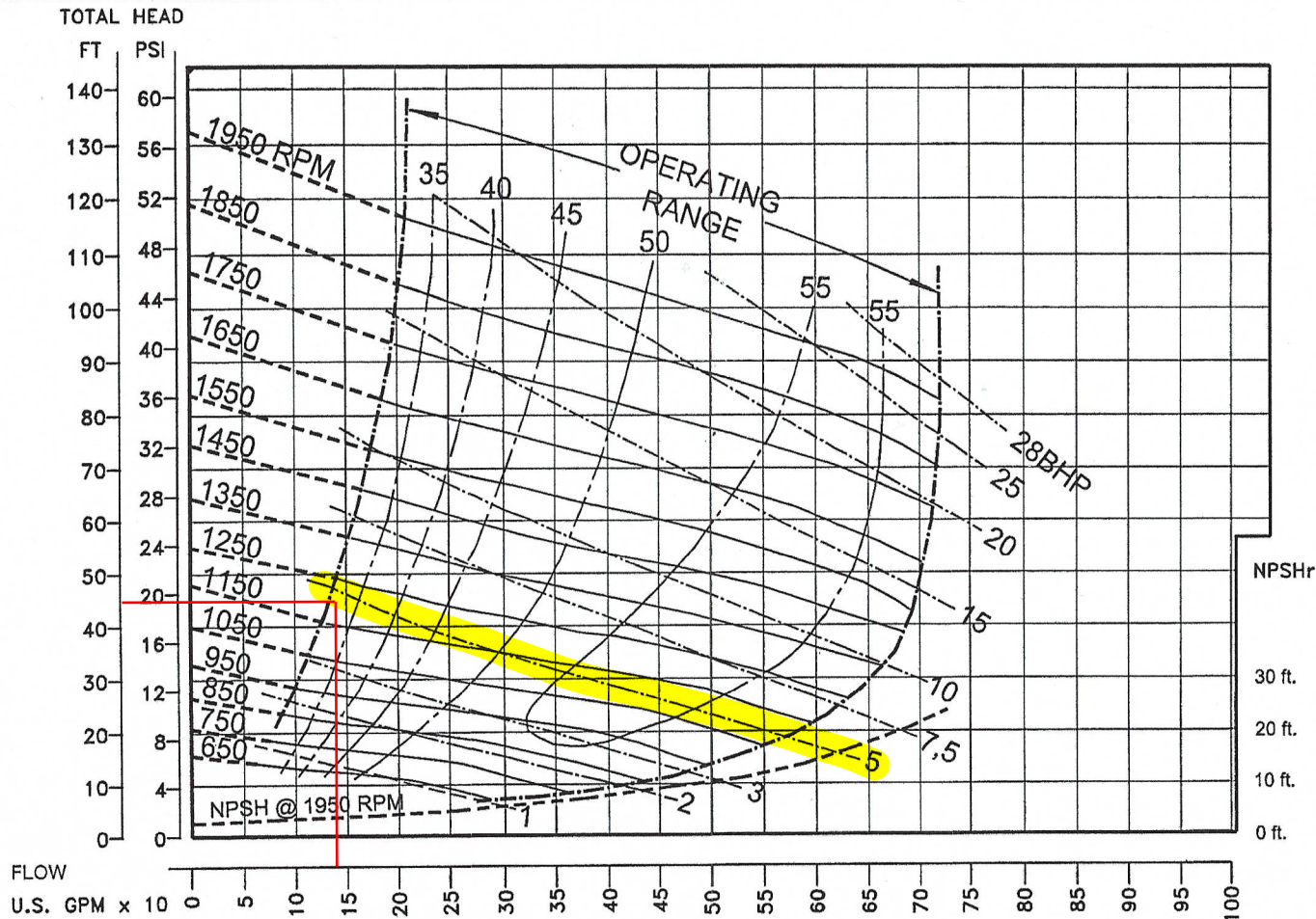
PERFORMANCE CURVE MODEL S-4 4"x4"

DATA

Impeller Dia. 9 3/4"

R.P.M. Various

Solid Dia Max. 3"



SELF PRIMING

650 rpm 5'	- 750 rpm 8'
850 rpm 16'	- 950 rpm 19'
1050 rpm 22'	- 1150 rpm 24'
1250 rpm 25'	- 1350 rpm 25'
1450 rpm 25'	- 1550 rpm 25'
1650 rpm 25'	- 1750 rpm 25'
1850 rpm 25'	- 1950 rpm 25'

Before use this table, check the NPSH.

ALL PRIME PUMPS DIVISION
OF

POWER & PUMPS INC.

MASTER DISTRIBUTOR NORTH AMERICA



1-800-803-0353

GPM CORPORATION
P.O. BOX 120
RIPON, CALIFORNIA 95366
(209) 599-6026 FAX (209) 599-6098

Granada Lift Station Condition Assessment

July 19, 2023, 9:00 AM – 11:00 AM

Attendees:

CVWD – Raymond (Ops), Jake Whittaker, Jennifer Bautista, Darlene Telles
KJ – Ralph Stevens, Connor Rutten, Drajhan Kalafatic

PS Building

1. Wet well has no vent, manhole opens into pump building which also houses all electrical equipment/controls. Class 1 Div 1 without proper ventilation (no louvers or exhaust fan, just skylight opened by about 6-8 inches). No real way to measure air changes per hour (ACH).



Figure 1: Manhole opening inside of pump station building



Figure 2: Manhole, Blower, and Suction end of Pumps

2. Pump station roof and skylight is wood frame added to CMU building after initial pump station building was constructed. Roof added for sound attenuation. Wood framing showing some signs of water damage/deterioration. No information on seismic stability of roof. Skylight utilized to pull pump parts out of building when maintenance needed.



Figure 3: Roof Skylight

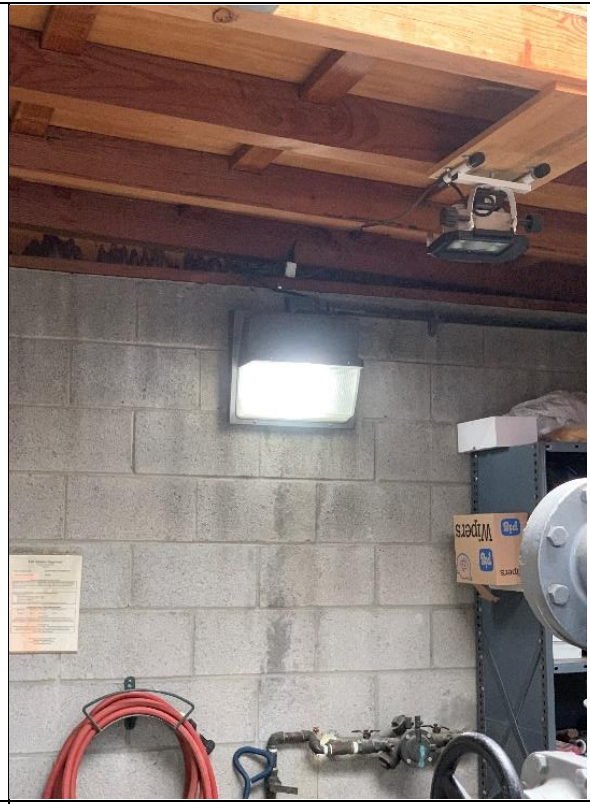


Figure 4: Roof Wooden Framing

3. Single wide mandoor to access PS Building

WW Pumps

1. All-Prime Suction Lift Pumps. Model, pump curve, etc to be confirmed.



Figure 5: AllPrime Suction Lift Pump



Figure 6: AllPrime Nameplate

2. Belt Driven Motors. 5 HP, 208/230 Volt, 60 Hz, SF 1.15, 1750 RPM. Concerns with vibrations based on vibration meter reading.



Figure 7: Pump Motors, Belt Housing, and mounting plate

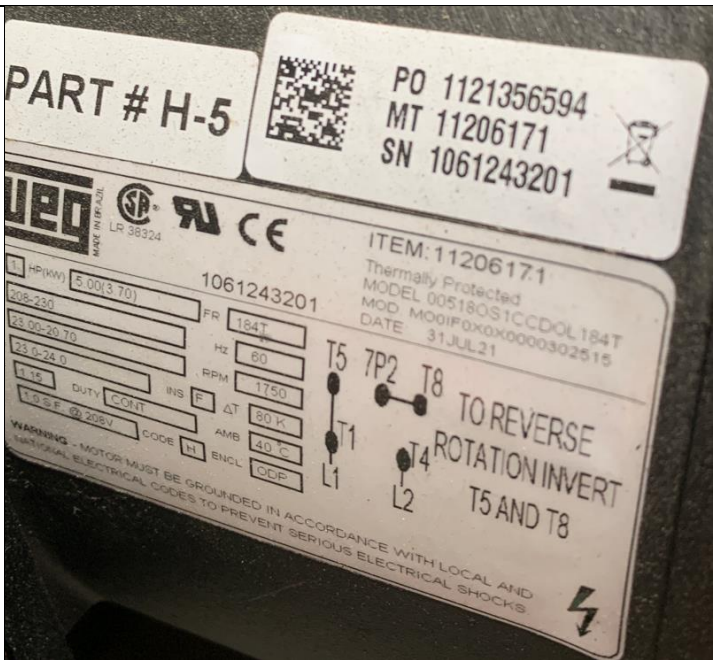


Figure 8: Motor Nameplate

3. Pump 1 reads 0.178 inch/second, Pump 2 reads 0.257 inch/second. Both are outside the acceptable range, normal threshold is 0.050 inches per second. Will require vibration plates to be recalibrated to reduce vibrations.



Figure 9: Pump 1 Vibration Meter



Figure 10: Pump 2 Vibration Meter

4. Had to manually fill WW to trigger pumps to cycle. Pumps usually kick on every 1-2 hours. Pumps automatically cycle between lead and lag. It is possible that both pumps kick on simultaneously if needed. Generator sized to run both pumps.

	Pump 1		Pump 2	
	WW Level (ft)	Time (min:sec)	WW Level (ft)	Time (min:sec)
Start	3.8	0	3.8	0
Stop	2.6	1:40	2.6	1:35

	Pump 1	Pump 2
Runtime (minutes)	1.67	1.58
Operating Depth (ft)	1.2	1.2
WW Diameter (ft)	5	5
Operating Volume (gal)	176	176
Flow (gpm)	105	111

Approximate TDH for pump calcs for range of Roughness Coefficients C:

Length (ft)	Suction HGL (ft) (Bottom elev of wet well plus 2 ft for water level)	Discharge HGL (ft) (Elevation of discharge manhole)	Static Head Needed (ft)	HW C	Design Flow Rate (gpm)	Pipeline ID (in)	H_friction (ft)	TDH needed (ft)
1351	1,288	1317.4	29.2	110	110	4	16.8	46
1351	1,288	1317.4	29.2	120	110	4	14.3	43
1351	1,288	1317.4	29.2	130	110	4	12.3	41

Instrumentation

1. No pressure gauge on discharge side of pumps.
2. Pressure gauges on suction side of pumps, but they are stuck at a reading of -10 psi. Gauge reads “gauge pressure” which is relative to atmospheric pressure (14.7 psi). So “0” represents atmospheric pressure. Typically, When pumps aren’t operating, the gauge would read close to “0”. During operation, gauge pressure should then drop as pump kicks on, typically in the range of -2 to -5 gauge pressure (psi). These gauges help to understand if pump is running out of net positive suction head (NPSH). With suction and discharge pressure gauges, could directly measure TDH across pump and understand pump performance. A suction gauge would also let us measure the NPSH available (NPSHa) to the pump and compare to the listed manufacturer recommended NPSH required (NPSHr). Typically when the suction gauge pressure starts reading at -20 to -25, cavitation is an issue and there is risk of pipe gasket and pipe implosion.



Figure 11: Suction Gauges



Figure 12: Suction Pressure Gauge

4. Pressure transducer used to measure wet well level. Better than ultrasonic due to bubbler and grease cap potentially messing with level reading of US sensor. <https://www.app4water.com/product/1-submersible-level-transducer/>. Moisture protection, surge protector installed.



Figure 17: Moisture Protection



Figure 18: Surge Protection

Control Panel

1. Tesco Control Panel

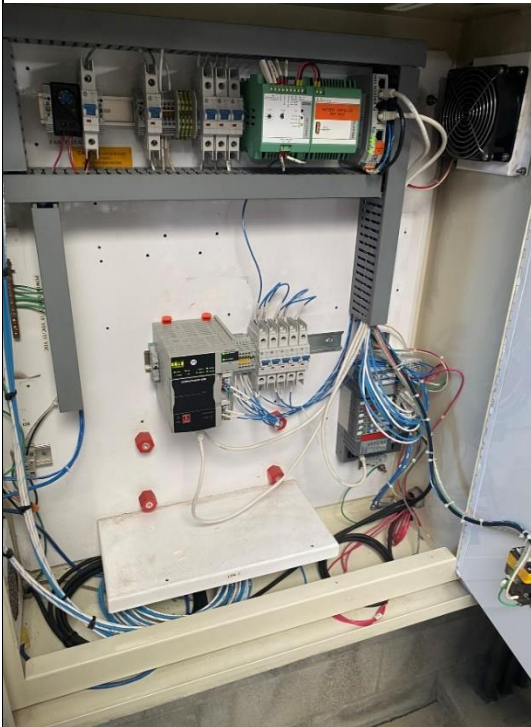


Figure 19: Control Panel Interior



Figure 20: Control Panel Location

2. Pump Controller is Allen Bradley COMPACTLOGIX 5380. <https://www.rockwellautomation.com/en-us/products/hardware/allen-bradley/programmable-controllers/small-controllers/compactlogix-family/compactlogix-5380-controllers.html>
3. UPS present in control panel.



Figure 21: Controller

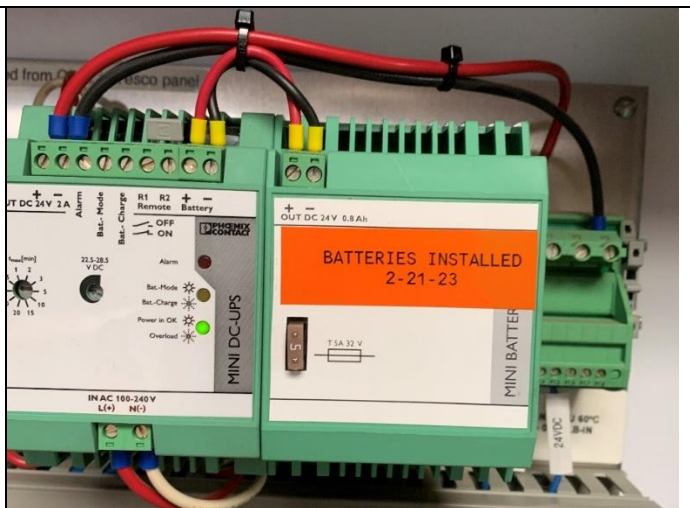


Figure 22: Controller UPS

4. Thermostat present – was reading north of 90 degrees when we were there

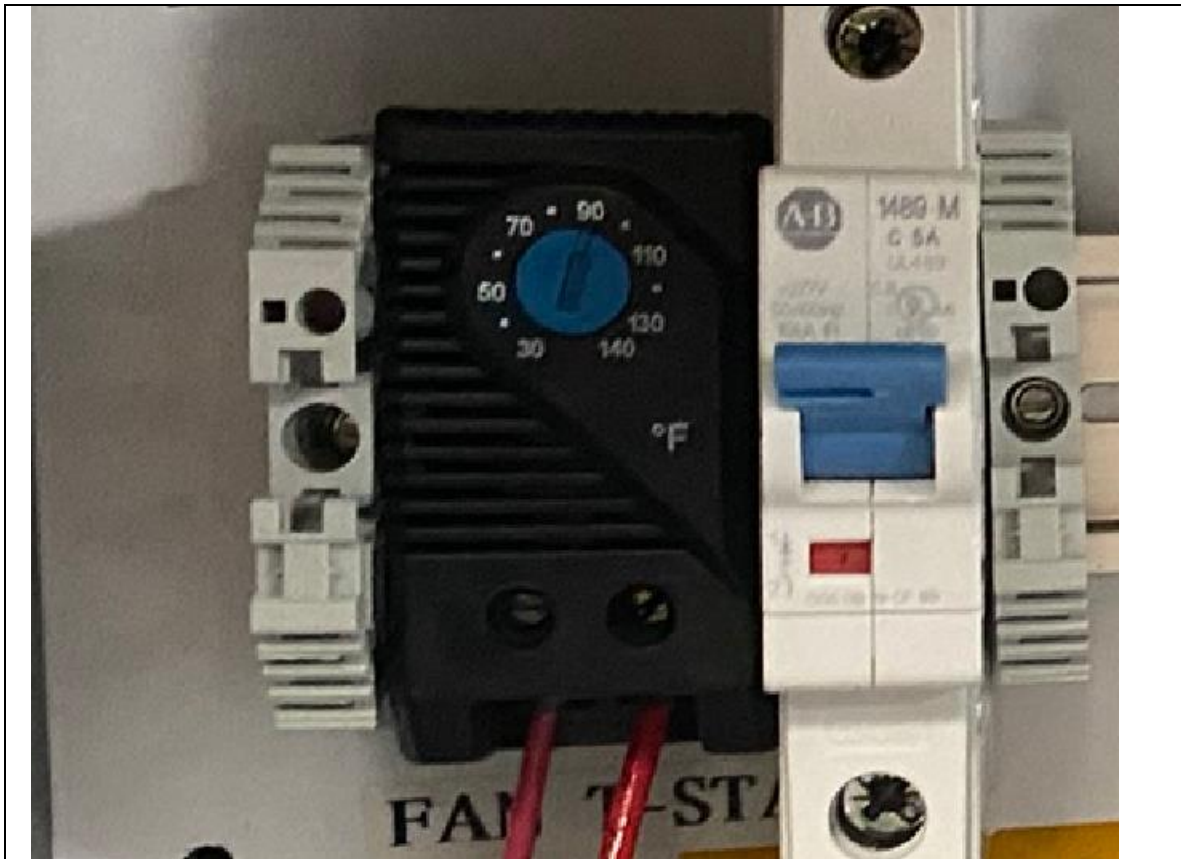


Figure 23: Thermostat

PLC

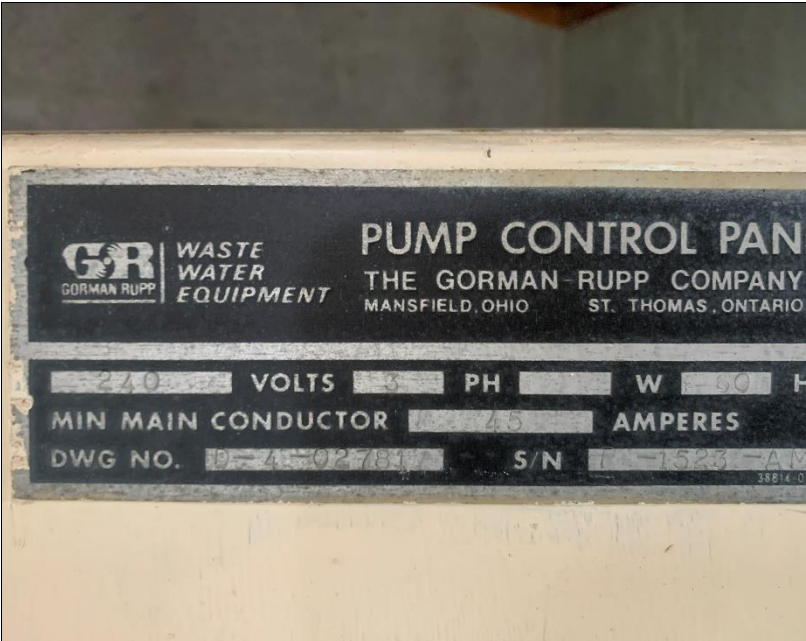


Figure 24: PLC / MCC



Figure 25: Panel Location

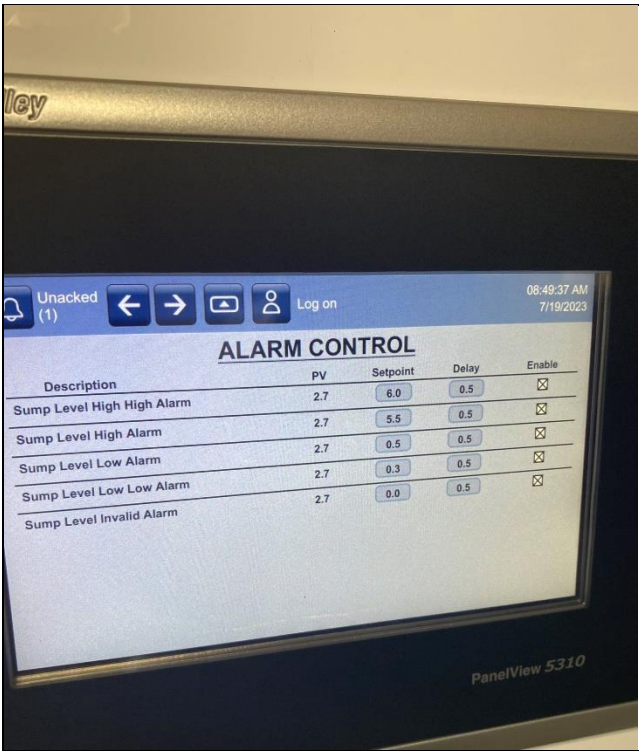


Figure 26: PLC Alarms

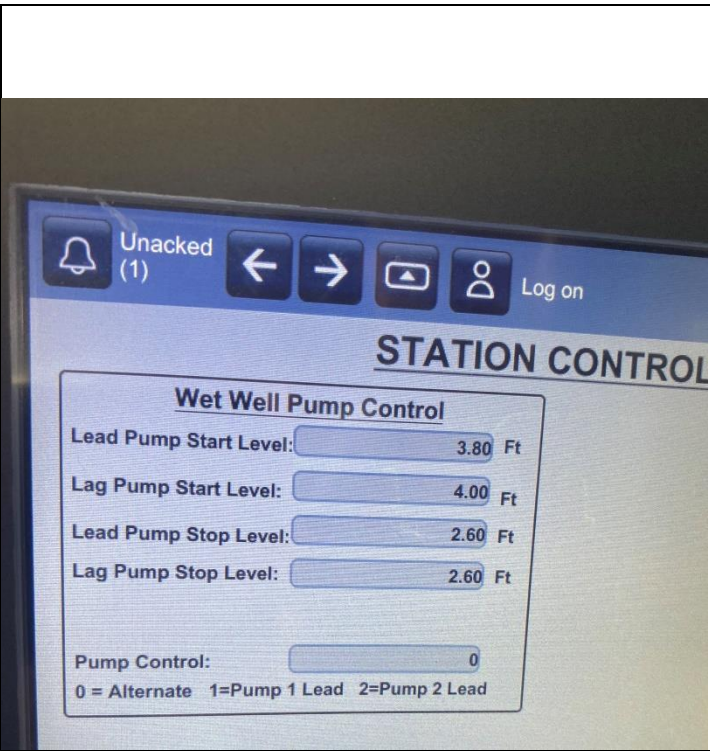


Figure 27: PLC WW Level Control

MCC

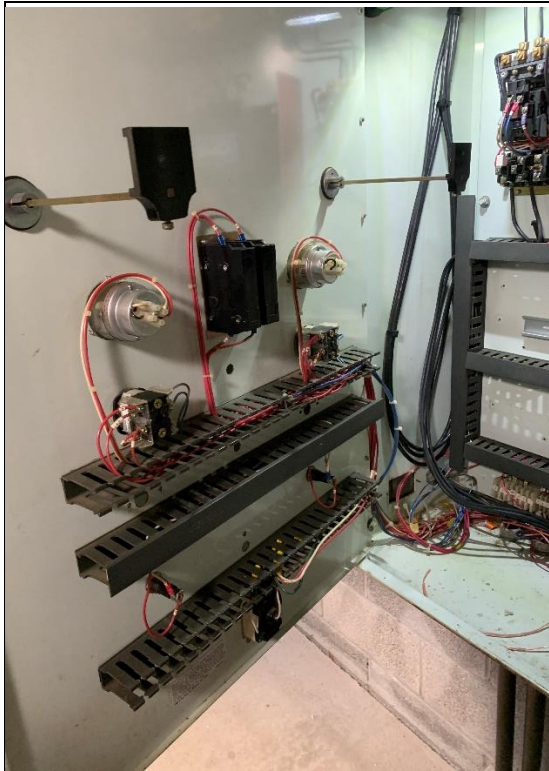


Figure 28: MCC Interior

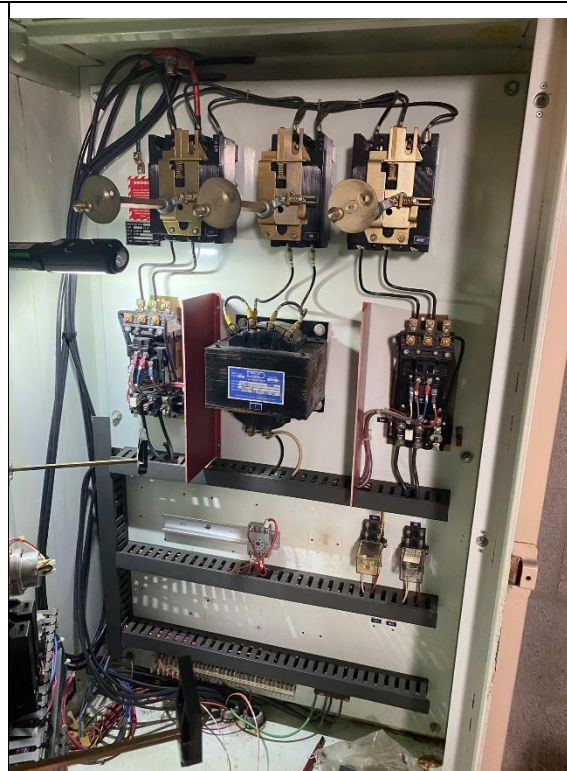


Figure 29: MCC Interior



Figure 30: MCC Internal Panel



Figure 31: MCC Internal Panel HOA and Runtime

5. Ralph: starters sized correctly but part is obsolete. If it was to break, no way to order identical part for replacement in-kind.
6. No pump starter overload protection?
7. MCC previous design for 3 phase power. Changed to single phase. Internal wiring should be updated with a single phase to 3 phase converter, install 3 phase 5 HP VFDs to control pump speed. Would allow for smaller motors to be installed as well. Pump motors would last longer. Need to check minimum speed of motor and where All Prime pump would perform at lower speeds. Possible that lower speeds/flow velocities would cause more problems, but right now pumps are cycling too quickly (running for less than 2 min each).

Modem



Figure 32: Modem Location

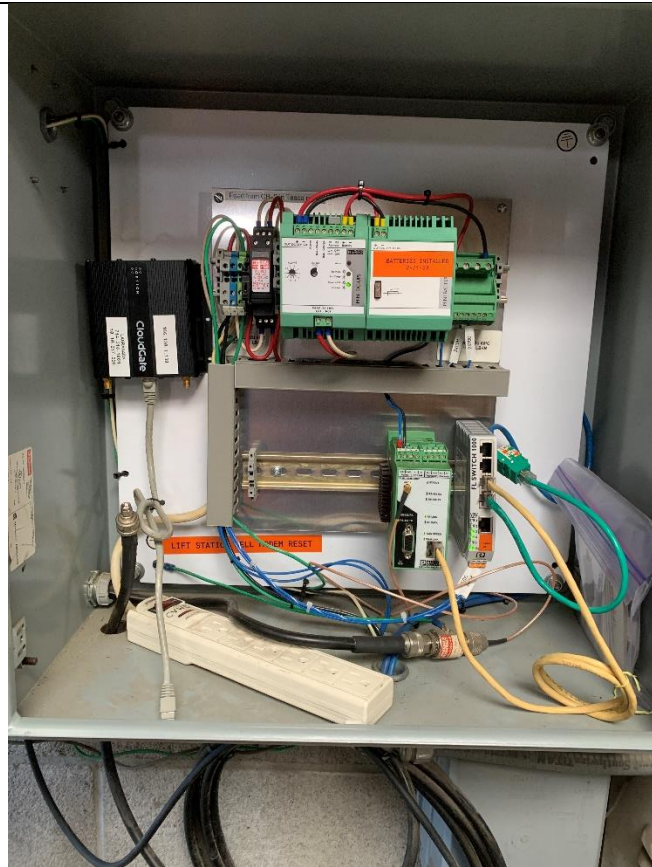


Figure 33: Modem Internals



Figure 34: Cloudgate SCADA Modem – not hooked up?

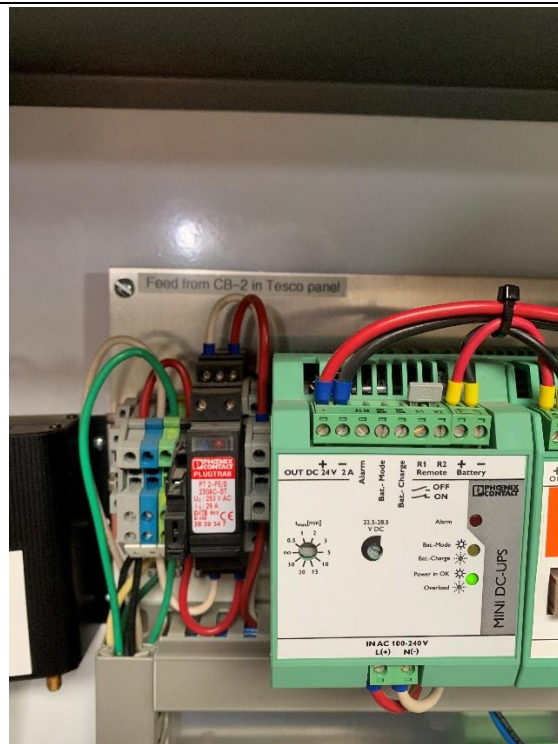


Figure 35: UPS Signals



Figure 36: SCADA Hookup – Appears to be hooked up to Coaxial here

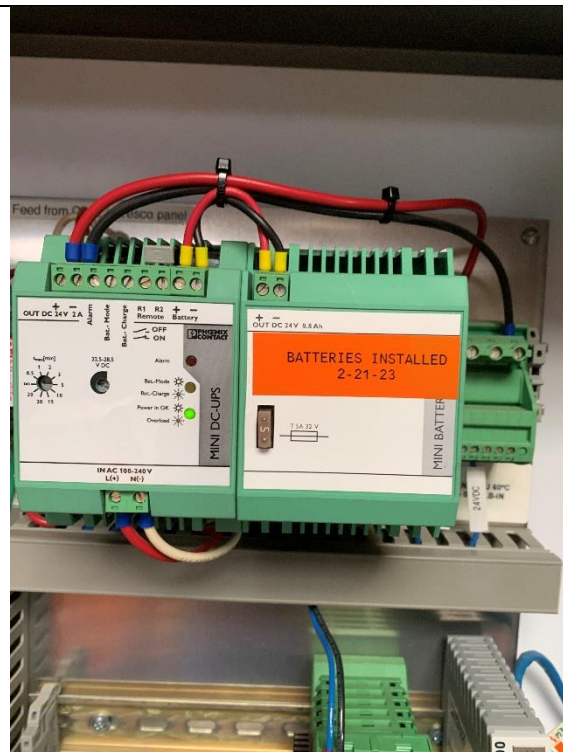


Figure 37: UPS Battery - Labeled

Generator

1. Generator is 35 kW. has enough capacity to run both pumps simultaneously. Generator only exercised 15 min every week. Recommend exercising more to avoid wet stacking issue and old diesel issues.
2. Fuel tank runtime: 15 min per week is 13 hrs total runtime in a year. 132 gallons of useable fuel, 35 kW generator running at full capacity consumes about 3.5 gallons per hour. $132 / 3.5$ is ~38 hours of runtime. $38 / 13$ is almost 3 years to fully draw the fuel tank down. Diesel has an expected lifespan of 6-12 months. Recommend cycling fuel tank quicker or operating generator more frequently to ensure diesel does not expire or clog generator when it is truly needed during an outage. Also will reduce wet stacking and improve overall generator performance. a fraction of diesel fuel tank volume.



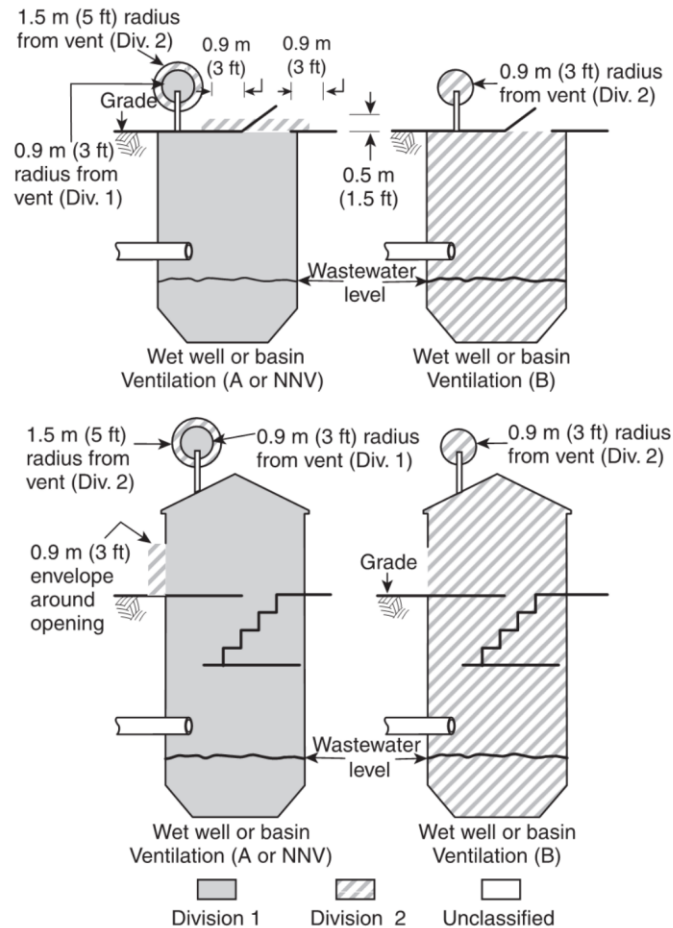
Figure 38: Generator



Figure 39: Generator Fuel Tank

NFPA Information

Pump Station does not appear to meet the requirements of NFPA 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities. NFPA 820 provides ventilation requirements for wastewater facilities to reduce fire and explosion hazards. Wet well vents directly to control room as indicated by lower left image below. Per KJ's interpretation, the current space without continuous ventilation is Class 1, Division 1, which the existing electrical equipment is not designed for.

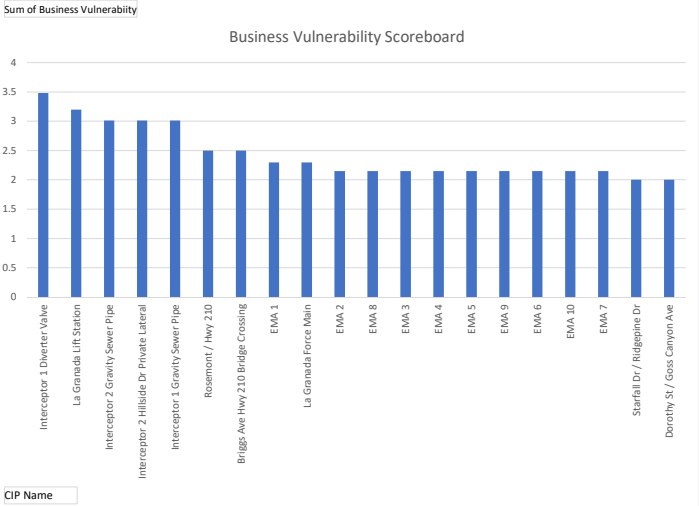
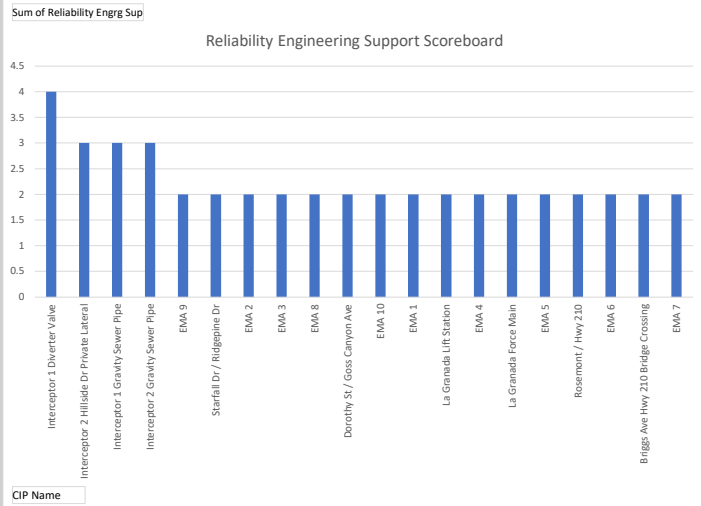
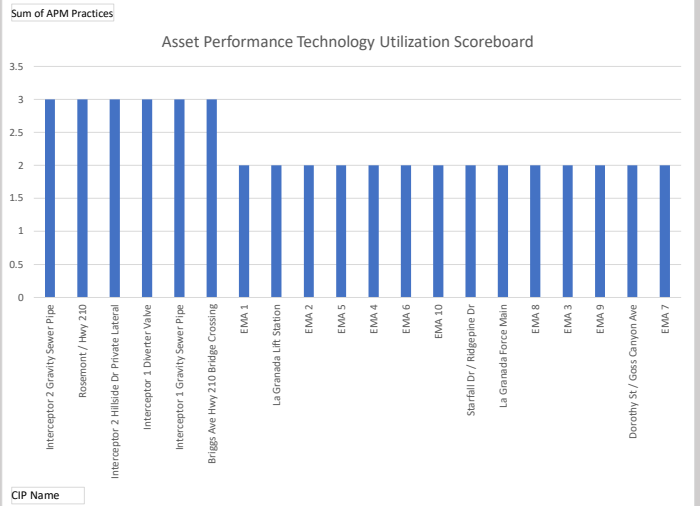
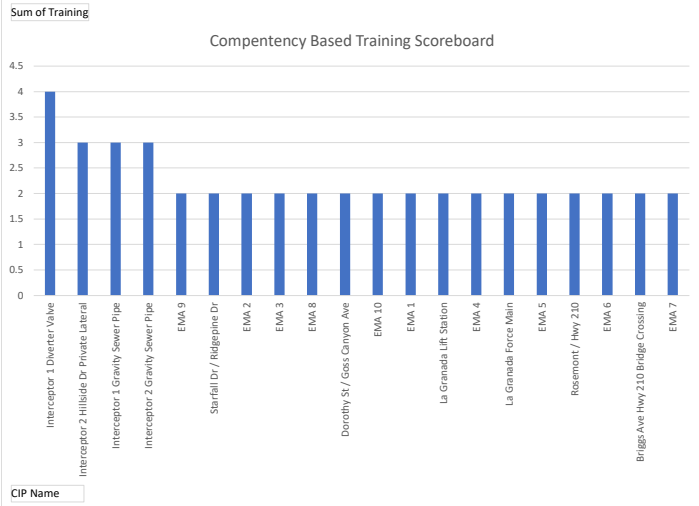
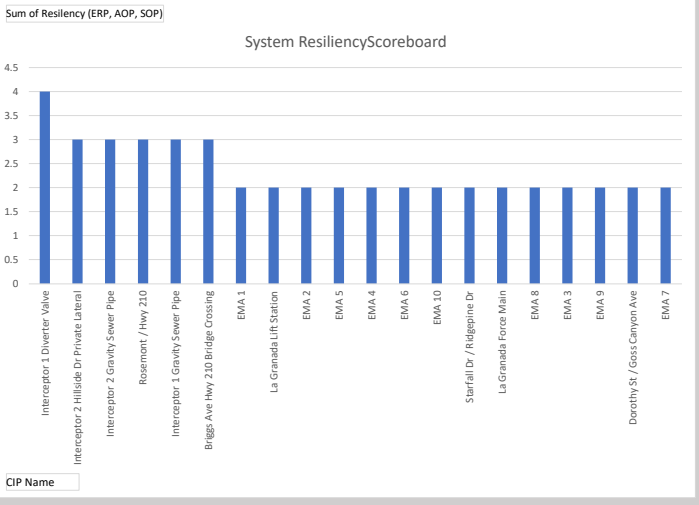
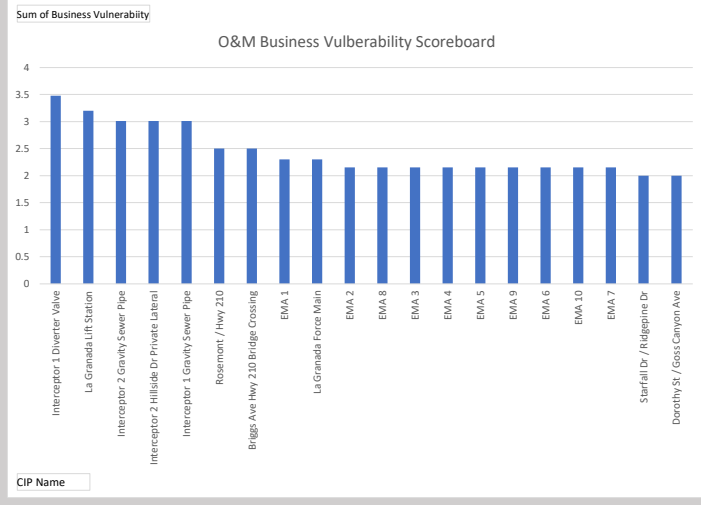
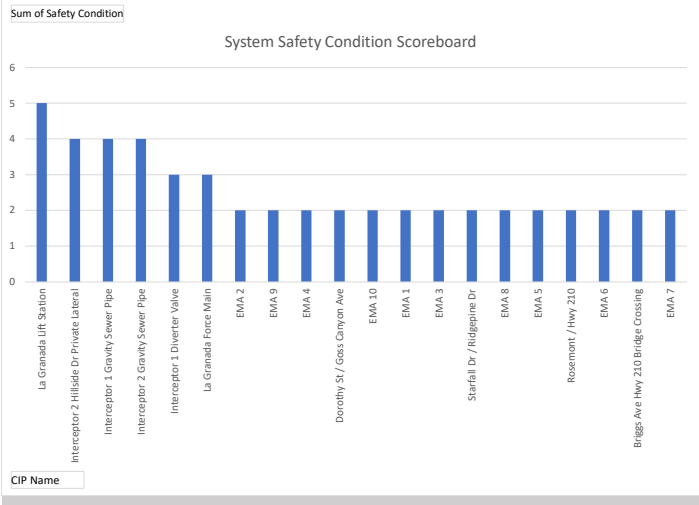
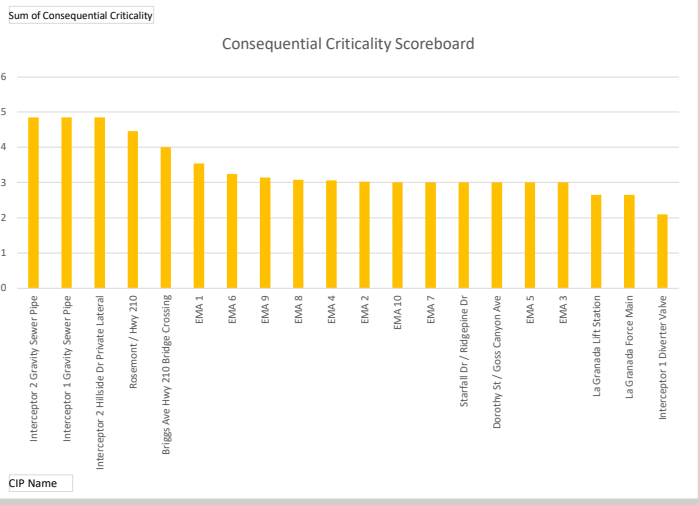
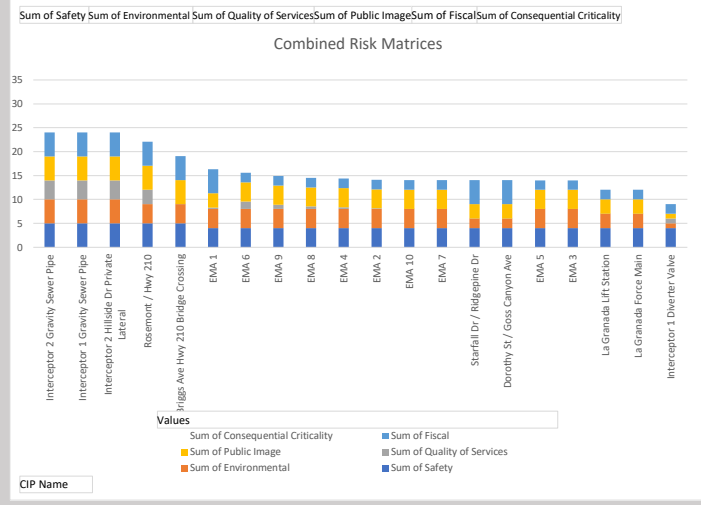
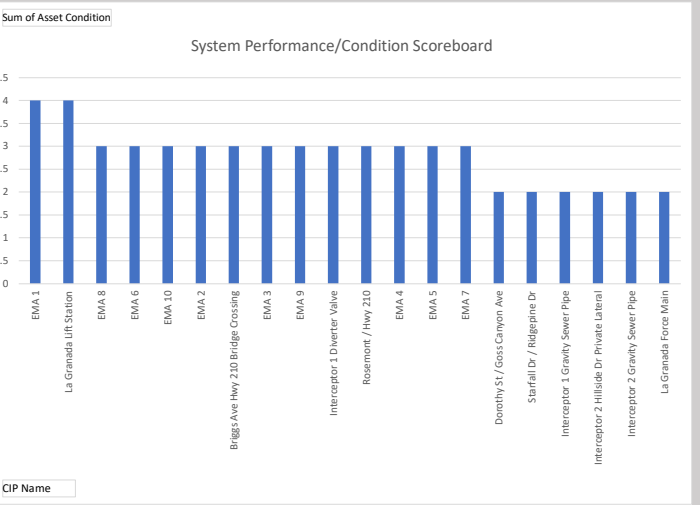
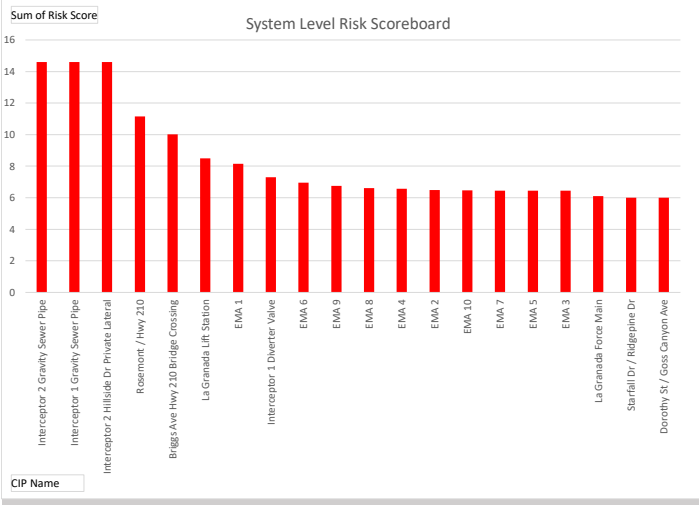


Appendix E BRVA Notes and Results

Corporate Risk Matrix | Wastewater Master Plan

Crescenta Valley Water District | July 2022

System Condition	Very Poor, Full Replacement	5						5	X < 1 Yr	Likelihood of Failure
	Poor Condition, Rehab. or Replacement	4						4	1 < X <5 Yrs	
	Fair Condition, Major CM	3						3	5< X <10 Yrs	
	Fair Condition, Minor CM	2						2	10< X < 20 Yrs	
	Good Condition, No Action	1						1	X > 20 Yrs	
		1	2	3	4	5				
Consequence of Failure										
Safety	No injury, and no anticipated future impacts	Minor to moderate Injury – contusions & lacerations w/out lost time, first aid applied	Moderate injury/lost time or restricted duty	Major serious health issues (acute & chronic) & long-term injuries – disabling	Fatalities	Safety				
Environmental and Regulatory Impact	No negative impacts on environment, public health or regulatory compliance	No negative impacts on environment or public health; minor compliance issues (i.e., minor NPDES violation, exceed WQ standard triggering effluent limit; SSS WDR Category 3 spill; RW spill < 1,000 gals; minor Title 22 violation; Notice to Comply)	Minor negative impact to the environment and/or public health; compliance issues (i.e. repeated or major NPDES violation; SSS WDR Category 2 spill or Category 1 spill < 1000 gals; recycled water spill > 100,000 gals; minor Notice of Violation)	Moderate negative impact to the environment and/or public health; major permit violation (i.e. NPDES ACL > \$10,000; SSS WDR Category 1 spill > 1,000 gals & < 100,000 gals; recycled water spill > 500,000 & < 1M gals; Title 22 major violation; major Notice of Violation)	Significant negative impact to the environment and/or public health; major permit violation (i.e. Significant NPDES Enforcement Order; SSS WDR Category 1 spill > 100K gals; recycled water spill > 1M gals; potential for Title 22 permit revocation; any violation resolved through the Courts)	Environmental and Regulatory Impact				
Quality of Service and Delivery	No impacts on service delivery or customers	Impact limited to individual customers	Moderate localized impact to groups of customers; short-term service disruption	Sub-basin impacts with potential long-term service disruption	Service area-wide impacts; Long-term service outages	Quality of Service and Delivery				
Public Image	No to minimal Impact; odor complaint, or complaint to staff, with staff acknowledgement, action and response	Some significant social media and no local media coverage; phone call response handled by staff	Social media activity and maybe minor local media coverage; Board may receive complaints to be responded to by staff	Local media coverage with Board of Directors involved in response; potential long-term impact to community trust in District	Lead story in regional/national or industry short and long-term coverage; significant impact to community trust in the District	Public Image				
Fiscal Impact	0 < \$5K	\$5K < X < \$25K	\$25k < X < \$50K	\$50k<x<\$250k	> \$250k	Fiscal Impact				



Business Risk and Vulnerabilities Analysis Scoring Details

#	Sewershed	Trunk Line	Crossstreet/ Intersection	Description	CIP Name	Enhanced Maintenance Area	Key Customers?	Class	#of Units Available	#of Units Required Max	#of Units Required Min	Function	Performance Criteria	Key Process Indicators	Failure Evident to Ops	Safety	Environmental	Quality of Services	Public Image	Fiscal	Consequential Criticality
1	0	Interceptor 1	Colorado Blvd / Edenhurst Ave	Plug Valve, Dezurik, 21", motor control valve, can't operate manually. Normally closed. Flow goes to Glendale Plant. Diverts brine water to hyperion between 12 am to 3 am when Nitrate plant is operational. If the valve fails in closed position, no water would get to recycled plant. Fail in open position, sending all sewage to hyperion. No UPS currently	Interceptor 1 Diverter Valve		Entire service area	Valve	1	1	1	Normally open, sending flow to Glendale Plant. When closed, diverts flow to Hyperion collector. Occurs when sending brackish water from nitrate plant from 12 AM to 3 AM.	SCADA signal signaling "open" or "closed"	Open, Closed, Invalid, Power Failure	Yes	4	1	1.00	1	2	2.10
2	0	Interceptor 1	Hillside Drive to Glendale Outfall	The physical Gravity Sewer Pipe and manholes used to convey flow south	Interceptor 1 Gravity Sewer Pipe		Entire service area	Gravity Sewer	1	1	1	Main conveyance line (minus single lateral at Hillside)	Conveying flow	Wait for flow monitor delay to show drop in flow rate	No	5	5	4.00	5	5	4.85
3	0	Interceptor 2	Hillside Dr	Hillside Dr Private Lateral	Interceptor 2 Hillside Dr Private Lateral		Single Customer	Gravity Sewer	1	1	1	Convey and monitor flow (primary flow meter)	Flow and measured level; are we receiving readings or not?		No	5	5	4.00	5	5	4.85
4	0	Interceptor 2	N Verdugo Blvd/Broadview Dr to Hillside Drive	The physical Gravity Sewer Pipe and manholes used to convey flow south	Interceptor 2 Gravity Sewer Pipe		Entire service area	Gravity Sewer	1	1	1	Convey and monitor flow (primary flow meter)	Flow and measured level; are we receiving readings or not?	SCADA link tells if no data is being received, but not to Ops	No	5	5	4.00	5	5	4.85
5	8	1	Rosemont / Hwy 210	15" Rosemont and Altura. includes 24" carrier/sipline pipe over 210 freeway. Pipe ID 1747, shear points on either side of 210 freeway. If failure, flow drops out of pipe onto freeway	Rosemont / Hwy 210		Crescenta Valley High School	Gravity Sewer	1	1	1	Sewage Collection across freeway	d/D		No	5	4	3.61	5	5	4.54
6	3	1	Briggs Ave / Hwy 210	8" Sewer Bridge Crossing, identical bridge crossing scores to Rosemont Bridge Crossing.	Briggs Ave Hwy 210 Bridge Crossing		76 Station, Foothill Car Wash, Strip Mall	Gravity Sewer	1	1	1	Sewage Collection across freeway	d/D		No	5	4	0.04	5	5	4.01
7	2	La Granada Lift Station		2 pumps, All-Prime pumps, suction lift above ground pumps. 12 feet deep wet well, 4 ft to max water level, 6 ft diameter cylinder. Spray on liner. Installing backup power generator with ATS, diesel generator, 35 kw, Cummings, automated through SCADA, radio and cell telemetry. just replaced rotating assembly on 1 pump, planning on doing the second pump next. Builiding is closed, ventilated.	La Granada Lift Station		Local La Granada neighborhood (about 40 homes, all residential)	Pump Station	2	1	1	Pump raw sewage from ~45 homes to 4" force main	Adequately draining/cycling wet well volume	SCADA power fail comm happens almost instantaneously. High wet well level will be first notice. Pump should be operating around 120 gpm	Yes	4	3	0.02	3	2	2.65
8	2	La Granada Force Main		4 in Ductile Iron force main, high point is discharge manhole	La Granada Force Main		-	Force Main	1	1	1	Convey sewage from lift station to manhole	conveying flow, no backflow into wet well			4	3	0.02	3	2	2.65
9	8	10	Dorothy St / Goss Canyon Ave	8" Near Dorothy St, Pipes 929, 973, pipes on side slope, difficult to access, very steep. Maintenance hole 594 is ery difficult to access	Dorothy St / Goss Canyon Ave		Rosemont Middle School, the Marketplace Shopping Center	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	2	0.01	3	5	3.00
10	9	1	Starfall Dr / Ridgepine Dr	8" on backside of Starfall Dr. Pipes on side slope, difficult to access, very steep.	Starfall Dr / Ridgepine Dr		About 10 homes, top of system	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	2	0.01	3	5	3.00
11	9	1	Pine Glen Rd / Pineridge Dr	8" Rosemont and Harmony, Pine Ridge and Pine Glen Rd is Key SSO area, shallow area acts as grease trap, enhanced maintenance area, pipe 1921 is shallow slope	EMA 1	1	Residences	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.33	3	5	3.55
12	7	1	Sunset / Foothill	Flat slope with debris buildup	EMA 4	4	Mountain Avenue Elementary School, Pickens Canyon Park	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.43	4	2	3.06
13	6	1	La Crescenta & Orange	La Crescenta & Orange	EMA 2	2	All residences	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.14	4	2	3.02
14	3	1	Foothill & Briggs	Foothill & Briggs 76 Station	EMA 3	3	76 Station, Strip Mall	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.00	4	2	3.00
15	1	1	Hilldale Dr	Hilldale Dr	EMA 5	5	Residence only?	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.00	4	2	3.00
16	1	1	Waltonia between Hilldale and Montrose	Waltonia between Hilldale and Montrose	EMA 6	6	LCID customers	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	1.86	4	2	3.28
17	1	1	Canalda and Ocean view flush tank	Canalda and Ocean view flush tank	EMA 7	7	Canalda flush tank	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.02	4	2	3.00
18	7	1	Prospect Ave between Sunset and Rosemont	Prospect Ave between Sunset and Rosemont	EMA 8	8	Mountain Avenue Elementary School, Pickens Canyon Park	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.62	4	2	3.09
19	5	1	Community between Ramsdell & Glenwood	Community between Ramsdell & Glenwood	EMA 9	9	All residences	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	1.07	4	2	3.16
20	9	4	Mountain Pine & Timberlake	Mountain Pine & Timberlake	EMA 10	10	All residences	Gravity Sewer	1	1	1	Sewage Collection	d/D		No	4	4	0.04	4	2	3.01

Business Risk and Vulnerabilities Analysis Scoring Details

#	Sewershed	Trunk Line	Crossstreet/ Intersection	Description	CIP Name	Enhanced Maintenance Area	WEM	Asset Condition	Training	Safety Condition	Resiliency (ERP, AOP, SOP)	Reliability Engrg Sup	APM Practices	AM Bus Processes	Business Vulnerability	Risk Score	One-time Recommendation	Responsibility
1	0	Interceptor 1	Colorado Blvd / Edenhurst Ave	Plug Valve, Dezurik, 21", motor control valve, can't operate manually. Normally closed. Flow goes to Glendale Plant. Diverts brine water to hyperion between 12 am to 3 am when Nitrate plant is operational. If the valve fails in closed position, no water would get to recycled plant. Fail in open position, sending all sewage to hyperion. No UPS currently	Interceptor 1 Diverter Valve		4	3	4	3	4	4	3	2	3.48	7.3	Install UPS so that valve fail position is closed (sending flow to Hyperion). How much power do you need to operate the valve? Do inspection every 3 years on motor and valve	
2	0	Interceptor 1	Hillside Drive to Glendale Outfall	The physical Gravity Sewer Pipe and manholes used to convey flow south	Interceptor 1 Gravity Sewer Pipe		2	2	3	4	3	3	3	2	3.01	14.6	Install smart cover on key manhole to register rapid change in flow depth, indicating clog New camera van (\$220k)	
3	0	Interceptor 2	Hillside Dr	Hillside Dr Private Lateral	Interceptor 2 Hillside Dr Private Lateral		2	2	3	4	3	3	3	2	3.01	14.6	Install backflow prevention on private lateral (duck bill flap valve, low pressure)	Brook, Darlene, Jake?
4	0	Interceptor 2	N Verdugo Blvd/Broadview Dr to Hillside Drive	The physical Gravity Sewer Pipe and manholes used to convey flow south	Interceptor 2 Gravity Sewer Pipe		2	2	3	4	3	3	3	2	3.01	14.6	Communicate ability to monitor flow/depth with ADS. Verify if we are in a fault condition Look into generating work order history Improve training/SOP for what happens if sewer line break Install smart cover at Verdugo / Broadview	Brook, Darlene, Jake?
5	8	1	Rosemont / Hwy 210	15" Rosemont and Altura. includes 24" carrier/sipline pipe over 210 freeway. Pipe ID 1747, shear points on either side of 210 freeway. If failure, flow drops out of pipe onto freeway	Rosemont / Hwy 210		3	3	2	2	3	2	3	2	2.50	11.4	Proper pipe joints on either end at the shear points, Koboda pipe	
6	3	1	Briggs Ave / Hwy 210	8" Sewer Bridge Crossing. identical bridge crossing scores to Rosemont Bridge Crossing.	Briggs Ave Hwy 210 Bridge Crossing		3	3	2	2	3	2	3	2	2.50	10.0		
7	2	La Granada Lift Station		2 pumps, All-Prime pumps, suction lift above ground pumps. 12 feet deep wet well, 4 ft to max water level, 6 ft diameter cylinder. Spray on liner. Installing backup power generator with ATS, diesel generator, 35 kw, Cummings, automated through SCADA, radio and cell telemetry. just replaced rotating assembly on 1 pump, planning on doing the second pump next. Builiding is closed, ventilated.	La Granada Lift Station		2	4	2	5	2	2	2	2	3.20	8.5	Floats are sources of hidden failure (get stuck). Remove floats and just rely in transmitter for level control Offset pump runtimes to 60/40 not 50/50	
8	2	La Granada Force Main		4 in Ductile Iron force main, high point is discharge manhole	La Granada Force Main		2	2	2	3	2	2	2	2	2.30	6.1		
9	8	10	Dorothy St / Goss Canyon Ave	8" Near Dorothy St, Pipes 929, 973, pipes on side slope, difficult to access, very steep. Maintenance hole 594 is ery difficult to access	Dorothy St / Goss Canyon Ave		2	2	2	2	2	2	2	2	2.00	6.0		
10	9	1	Starfall Dr / Ridgepine Dr	8" on backside of Starfall Dr. Pipes on side slope, difficult to access, very steep.	Starfall Dr / Ridgepine Dr		2	2	2	2	2	2	2	2	2.00	6.0		
11	9	1	Pine Glen Rd / Pineridge Dr	8" Rosemont and Harmony, Pine Ridge and Pine Glen Rd is Key SSO area, shallow area acts as grease trap, enhanced maintenance area, pipe 1921 is shallow slope	EMA 1	1	2	4	2	2	2	2	2	2	2.30	8.2	Possible reroute options - evaluate hydraulics	
12	7	1	Sunset / Foothill	Flat slope with debris buildup	EMA 4	4	2	3	2	2	2	2	2	2	2.15	6.6	Leverage SSMP to enforce FOG requirements. Business problem; take FOG samples, anything over 100 mg/L FOG is an issue, over 50 is iffy	
13	6	1	La Crescenta & Orange	La Crescenta & Orange	EMA 2	2	2	3	2	2	2	2	2	2	2.15	6.5		
14	3	1	Foothill & Briggs	Foothill & Briggs 76 Station	EMA 3	3	2	3	2	2	2	2	2	2	2.15	6.5		
15	1	1	Hilldale Dr	Hilldale Dr	EMA 5	5	2	3	2	2	2	2	2	2	2.15	6.5		
16	1	1	Waltonia between Hilldale and Montrose	Waltonia between Hilldale and Montrose	EMA 6	6	2	3	2	2	2	2	2	2	2.15	7.1		
17	1	1	Canalda and Ocean view flush tank	Canalda and Ocean view flush tank	EMA 7	7	2	3	2	2	2	2	2	2	2.15	6.5		
18	7	1	Prospect Ave between Sunset and Rosemont	Prospect Ave between Sunset and Rosemont	EMA 8	8	2	3	2	2	2	2	2	2	2.15	6.7		
19	5	1	Community between Ramsdell & Glenwood	Community between Ramsdell & Glenwood	EMA 9	9	2	3	2	2	2	2	2	2	2.15	6.8		
20	9	4	Mountain Pine & Timberlake	Mountain Pine & Timberlake	EMA 10	10	2	3	2	2	2	2	2	2	2.15	6.5		

Business Risk and Vulnerabilities Analysis Scoring Details

#	Sewershed	Trunk Line	Crossstreet/ Intersection	Description	CIP Name	Enhanced Maintenance Area	BRVA Discussion Notes	Model ID
1	0	Interceptor 1	Colorado Blvd / Edenhurst Ave	Plug Valve, Dezurik, 21", motor control valve, can't operate manually. Normally closed. Flow goes to Glendale Plant. Diverts brine water to hyperion between 12 am to 3 am when Nitrate plant is operational. If the valve fails in closed position, no water would get to recycled plant. Fail in open position, sending all sewage to hyperion. No UPS currently	Interceptor 1 Diverter Valve		Valve vault is 6 ft deep, homeless population, not a well lit area, during power failure is waiting for Edison. Breach of contract for sending brackish flow to Glendale, potentially \$5k a day. If motor breaks, manually adjust in 1 day. Visual assessment showing that no water passed through, still original valve. Spare parts for valve should be accounted for.	GIL-52101
2	0	Interceptor 1	Hillside Drive to Glendale Outfall	The physcial Gravity Sewer Pipe and manholes used to convey flow south	Interceptor 1 Gravity Sewer Pipe		Glorietta Park is where sag is located, underground reservoir is potential cross connection, windy road, heavy traffic. Response time could be 2 hrs when seismic event shears upper portion of interceptor, flow lag to flow meter. Bypass and repair; find 18" pipe, trench it out, Emergency response. Chemicals used for root control, CCTV every 3 years appears to be correct interval based on root control.	GIL-52101
3	0	Interceptor 2	Hillside Dr	Hillside Dr Private Lateral	Interceptor 2 Hillside Dr Private Lateral		Glendale community college high traffic area. Response time would be 45 min, would fill up waste tank. 64,000 gallons. CCTV done every 3 years, do we have work order reports? Work orders are rather informal. Takes about a month to video the whole interceptor. Contract between manager and operator; first thing state will ask for is "give me your work order history". Prove that due diligence had been done to maintain asset. Generate email to notify when inspection needs to occur. Cardographs/City Orders require money, tell the story to the board to justify why . VCP pipe, root intrusion, sag at some point. Railroad crossing on san fernando rd. Darlene says need more detail on ERP. Automated bypass valve if one interceptor fails, use Glendale's, and vice versa. Service is impaired, haven't told customers to stop flushing yet	
4	0	Interceptor 2	N Verdugo Blvd/Broadview Dr to Hillside Drive	The physcial Gravity Sewer Pipe and manholes used to convey flow south	Interceptor 2 Gravity Sewer Pipe		Holiday weekend, 11:00 AM is probably worst case. Thanksgiving day is peak flow. Contractor takes HOURS to respond if main staff not available. Mutual agreement with City of Glendale to come take care of break/overflow. This agreement has not been reviewed/executed. VCP pipe, root intrusion, sag at some point. ADS handles flow meter outage, District staff is not. Properly trained to handle failure?	GIL-39102
5	8	1	Rosemont / Hwy 210	15" Rosemont and Altura. includes 24" carrier/sipline pipe over 210 freeway. Pipe ID 1747, shear points on either side of 210 freeway. If failure, flow drops out of pipe onto freeway	Rosemont / Hwy 210		Hard to inspect bridge crossings (contained within bridge cells)	GCL-27120
6	3	1	Briggs Ave / Hwy 210	8" Sewer Bridge Crossing, identical bridge crossing scores to Rosemont Bridge Crossing.	Briggs Ave Hwy 210 Bridge Crossing		Hard to inspect bridge crossings (contained within bridge cells)	GCL-28104
7	2	La Granada Lift Station		2 pumps, All-Prime pumps, suction lift above ground pumps. 12 feet deep wet well, 4 ft to max water level, 6 ft diameter cylinder. Spray on liner. Installing backup power generator with ATS, diesel generator, 35 kw, Cummings, automated through SCADA, radio and cell telemetry. just replaced rotating assembly on 1 pump, planning on doing the second pump next. Builiding is closed, ventilated.	La Granada Lift Station		Overflow goes into storm drain, potential exposure. Don't do 50/50 split on runtime for pumps, do 60/40 or 70/30 so that pumps don't fail simultaneously	GCL-33114
8	2	La Granada Force Main		4 in Ductile Iron force main, high point is discharge manhole	La Granada Force Main			GCL-33114
9	8	10	Dorothy St / Goss Canyon Ave	8" Near Dorothy St, Pipes 929, 973, pipes on side slope, difficult to access, very steep. Maintenance hole 594 is ery difficult to access	Dorothy St / Goss Canyon Ave			GCL-10152
10	9	1	Starfall Dr / Ridgepine Dr	8" on backside of Starfall Dr. Pipes on side slope, difficult to access, very steep.	Starfall Dr / Ridgepine Dr			GCL-4135
11	9	1	Pine Glen Rd / Pineridge Dr	8" Rosemont and Harmony, Pine Ridge and Pine Glen Rd is Key SSO area, shallow area acts as grease trap, enhanced maintenance area, pipe 1921 is shallow slope	EMA 1	1	EMAs have 2's across the board on Business Vulnerabilities, but 3/4 on asset condition (reason they are being closely monitored/maintained)	GCL-9184
12	7	1	Sunset / Foothill	Flat slope with debris buildup	EMA 4	4		GCL-23182
13	6	1	La Crescenta & Orange	La Crescenta & Orange	EMA 2	2		GCL-16204
14	3	1	Foothill & Briggs	Foothill & Briggs 76 Station	EMA 3	3		GCL-28175
15	1	1	Hilldale Dr	Hilldale Dr	EMA 5	5		GCL-32132
16	1	1	Waltonia between Hilldale and Montrose	Waltonia between Hilldale and Montrose	EMA 6	6		GCL-32140
17	1	1	Canalda and Ocean view flush tank	Canalda and Ocean view flush tank	EMA 7	7		GCL-18118
18	7	1	Prospect Ave between Sunset and Rosemont	Prospect Ave between Sunset and Rosemont	EMA 8	8		GCL-27104
19	5	1	Community between Ramsdell & Glenwood	Community between Ramsdell & Glenwood	EMA 9	9		GCL-21142
20	9	4	Mountain Pine & Timberlake	Mountain Pine & Timberlake	EMA 10	10		GCL-9155



Crescenta Valley Water District – 2023 Wastewater Master Plan

CIP Project Review Workshop

12/12/2023

Meeting at CVWD, 3730 Glenwood Ave, Glendale, CA

8:00 am – 12:00 pm

Meeting Objective: Review potential CIP Projects and get input/feedback on prioritization of CIP projects. Gather more background on EMA classification and FOG removal practices.

Attendees:

Name	Company	Role/Title
Connor Rutten	Kennedy Jenks	Project Engineer
Paul Chau	Kennedy Jenks	Project Manager
Drajhan Kalafatic	Kennedy Jenks	Staff Engineer
Brook Yared	CVWD	Interim Director of Engineering and Operations
Elias Sebhata	CVWD	Senior Engineer
Jennifer Bautista	CVWD	Project Coordinator
Kellen Boyce	CVWD	Assistant Operations Manager
James Lee	CVWD	General Manager
Darlene Telles	CVWD	Operations and Maintenance Manager
Siaki Mortenson	CVWD	Ops Group

Agenda:

- 1) **BRVA Methodology Review and Review Risk Calculation (Criticality x Business Vulnerability)**
- 2) **CIP Project Prioritization Discussion**
- 3) **Recommended Non-Infrastructure Projects**
- 4) **Interview – What causes an EMA? Identify causes for EMAs 1-10**
- 5) **Review Previous Work (demand analysis, model calibration, condition assessment, BRVA workshop)**
- 6) **CIP Budget**
- 7) **Existing EMA List**



Action Items:

1) KJ:

- a) Provide CVWD with a longer list to place the future Smart covers. An estimate of ~5 covers will be purchased yearly.
- b) Provide initial CIP plan to CVWD. Iterate on annual budget with James/District.
- c) Add CMMS as medium-term project.

2) CVWD:

- a) Provide KJ groundwater monitoring well info/data.
- b) Provide KJ an updated list of existing EMAs/justification for EMA classification
- c) Provide KJ a better description of seasonal creek location that floods near Waltonia Drive.



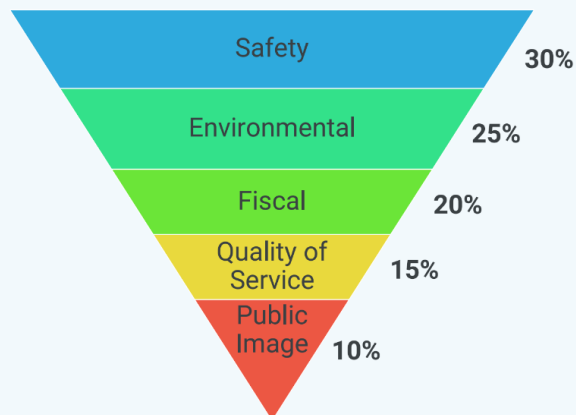
Workshop Notes:

1) BRVA Methodology Review and Review Risk Calculation (Criticality x Business Vulnerability)

- a) Both weightings were approved by CVWD members.

BRVA Methodology Review - Weightings

- Consequential Criticality and Business Vulnerability
- Each Category Scored from 1-5



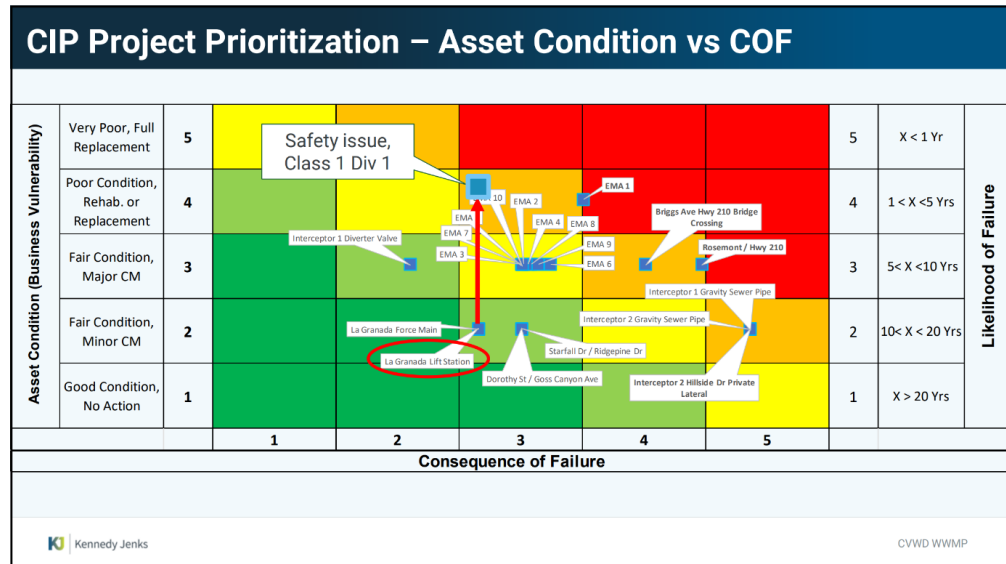
KJ Kennedy Jenks

CVWD WWMP

- **Business Vulnerability**
 - Work Execution Management (WEM) 12%
 - Asset Condition (AC) 15%
 - Training (T) 10%
 - **Safety Condition (SC) 30%**
 - **Resiliency (R) 20%**
 - Reliability Engineering Support (RES) 8%
 - Asset Performance Management Practices (APM) 3%
 - Asset Management Business Processes (AMB) 2%
 - 100%**



- b) Total Risk Score
- i) High risk score doesn't mean it needs to be a CIP.
 - ii) Project prioritization – Asset Condition vs COF



- iii) Risk scores look appropriate.
- (1) Brook Y. – Approves risk standing of projects.

- c) Consequence of Failure
- i) La Granada LS – Safety Issue Class 1 Div 1, vertical shift due to it not meeting regulation standards. (LS increases is priority)

2) CIP Project Prioritization Discussion

a) Ranked Infrastructure Projects

Timeline	Project	Justification
Short	Rosemont / Hwy 210 Crossing	Unknown Condition / Big safety, financial, and regulatory risks
	Pine Glen / Pineridge (EMA 1)	Historical SSO, Consistent problem for Ops, safety, financial, and regulatory risks
	Granada PS Ventilation	Safety issue for Ops team, current code violation
Medium	Briggs / Hwy 210 Crossing	Unknown Condition, safety, financial, and regulatory risks (serves fewer customers than Rosemont)
	Hillside Dr Private Lateral	High safety and financial risk, relatively low effort to fix
Long	Diverter Valve	Low COF – minimal regulatory/financial/safety impacts
	Dorothy St / Goss Canyon Ave Sewer Access	Low COF - minimal regulatory/financial/safety impacts
	Starfall Dr / Ridgeline Dr Sewer Access	Low COF - minimal regulatory/financial/safety impacts

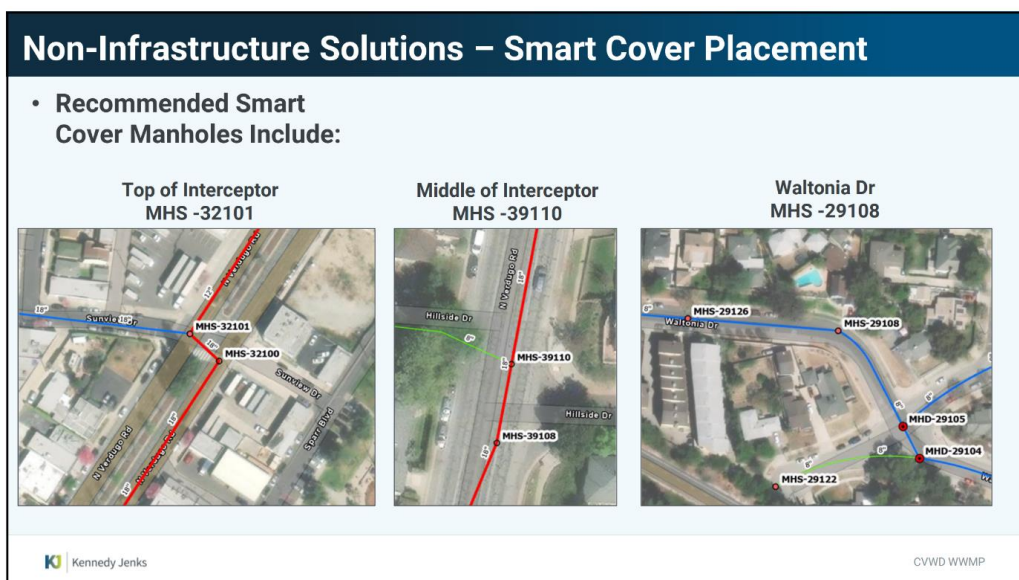
- i) Briggs/Hwy 210 crossing – short or medium?



- ii) District in the process of addressing all bridge crossings.
- iii) Good opportunity to address everything together.
 - (1) Briggs, La Crescenta, Rosemont, etc.
 - (2) Lump in w/ Rosemont crossing for short-term.
 - (3) These bridges contain a sewer main going through them.
 - (a) 5 bridge crossings w/ pipes
 - (4) Do inspections first (short term project), seismic retrofit based on inspection findings

3) Recommended Non-Infrastructure Projects

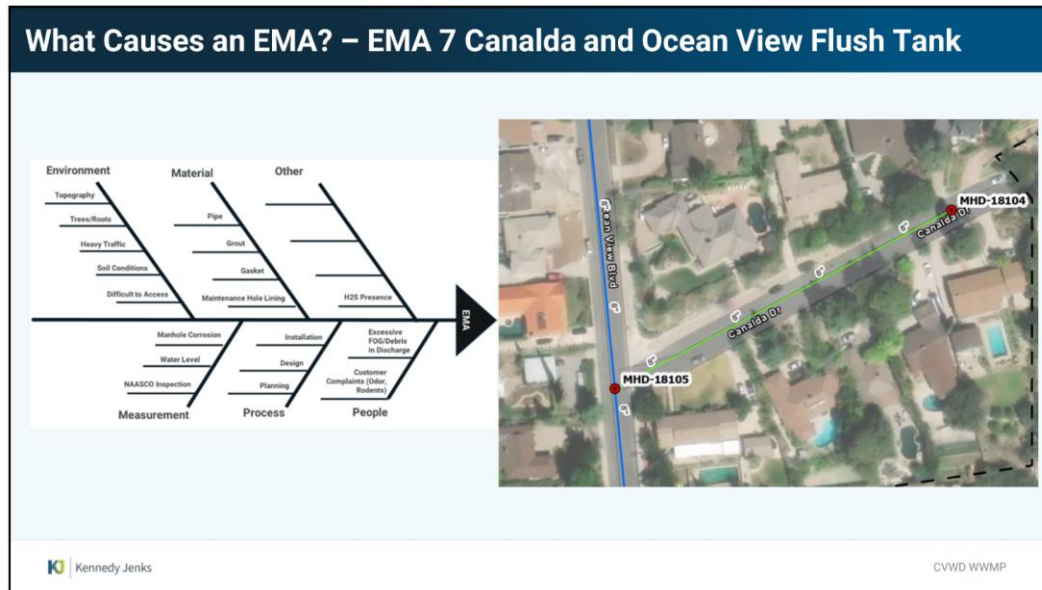
- a) Smart Cover Installation
 - i) What would be a reason/justification to install a smart cover in a given location?
 - (1) Major confluence points, specifically along interceptor
 - (2) Anecdotal info from Ops on known “problem” locations
 - ii) Bought 5 this year.
 - iii) Want recommendation for rotating flow monitoring locations.
 - (1) Develop sampling points to present to the Board.
- b) FOG Control Program
 - i) LACDPW and Glendale PW have pre-treatment program for area – wouldn’t make sense to run another program and double charge the residents.
 - ii) Contact info and procedures are set in place for FOG.
 - iii) It has been a long time since contacted agency for inspection. Average of 2 weeks for them to send out inspector.
 - iv) Not enough food establishments to consider starting a new program.
- c) KJ proposes the following 3 locations for FOG control / Smart Cover placement:





- i) CVWD would like a longer list to place the future Smart covers. An estimate of ~5 covers will be purchased yearly.

4) Interview – What causes an EMA? Identify causes for EMAs 1-10



- a) Canalda tank – monitored once a week, applied to entire year.
- b) CVWD does not charge customer to treat this flow, but it is discounted by City of LA when calculating total treatment cost.

5) Review Previous Work (demand analysis, model calibration, condition assessment, BRVA workshop)

- a) Sewershed Inflow Analysis
 - i) Lumping Inflow and WWF together
 - ii) Key Takeaways:
 - (1) Peak DWF peaking factor ~2 (PDWF/ADWF, Typical for Design)
 - (2) PWWF peaking factor ~4 (PWWF/ADWF, Typical for Design)
- b) Flow Metering – FM01
 - i) Groundwater Infiltration
 - (1) Closer to Glendale aquifer is about 200-300 ft.
 - (2) Higher up the hill is not necessary.
 - (3) Monitoring wells owned by City of LA, CVWD doesn't have much data but will send what they have.
 - (4) Water table is up to 30-40 ft in upstream/northern portion of service area.
 - (5) Have had water pool at reservoir site.



6) CIP Budget

- a) KJ to provide initial CIP plan.
- b) Iterate on annual budget with James/District.
- c) Prioritize by criticality and see what should be done.
- d) Pursuit of grant funding.

7) Existent EMA List

- a) CVWD should be sending KJ an updated list.
- b) CVWD uses WinCan, but tracks everything manually.
- c) Springbook is the CMS system that CVWD uses.
- d) CVWD uses experience to maintain and clean sewer reaches due to costs and life expectancy of machinery.
- e) SSO simulation is done once a year at random – this is a training for response system in case of sewer damages.
- f) CVWD would like to have a software to track and implement work orders.
 - i) Add CMMS as medium-term project.
- g) Waltonia Drive – MHS 29108
 - i) Dry Creek next to Waltonia Dr.
 - (1) Ephemeral stream is created East of this location when it rains. CVWD to send better description of location.
 - ii) No Dye tracking has been done.
 - (1) Recommend dye test to track flow of dry creek.
 - iii) Look at run-time data.

Crescenta Valley Water District

Business Risk and Vulnerabilities Interview Workshop – Meeting Notes

Action Items for KJ are highlighted yellow

Action Items for the District are highlighted blue

Attendees

District Staff:

Jennifer Bautista – Project Coordinator (3 years with Eng Dept)

David Gould – Director of Engineering (25 years)

Brook Yared – Senior Engineer

Darlene Telles – Ops and Maintenance Manager (10 years)

Jake Whittaker – Construction Supervisor (7 years, Water Dist and Collection System)

Robert Wood – Ops and Maintenance (17 years)

Jaysen Ortega – Ops and Maintenance (9 years)

Siaki Mortenson – Ops and Maintenance (7 years)

Kellen Boyce – Assistance Ops Manager (20 years, Mainly Water Side, crossing over when possible)

Christy Colby – Regulatory and Public Affairs Manager (19.5 years)

James Lee – Director of Finance and Administration (5 years)

Nem Ochoa – General Manager (3.5 years)

Kennedy Jenks:

Paul Chau – Project Manager

Gerald Fejarang – Asset Management Lead

Connor Rutten – Project Engineer

1) Introductions

- a) Paul: James asked about San Gabriel Valley Municipal Water District Board Seat

2) Risk Matrix Review and Refinement

a) Risk Matrix Methodology

- i) Mission and Vision Statements influence matrix
- ii) Likelihood of failure is more subjective than probability of failure, which is more statistical.
- iii) What happens to the equipment if we “do nothing” to it? No maintenance?
 - 1. Submersible pump: lasts maybe 1-2 years? Flygt submersibles can last 3-5 years. Engineer will say 5-10 years but Operator knows it's less.
 - 2. Increase in debris during COVID. More ragging at Granada.
- iv) Risk Matrix – use one risk matrix for all business, can modify to use for sewer and water.
- v) Risk Matrix Values are listed in the correct order (Safety -> Financial)

b) Safety

- i) Darlene and Jake are main safety leads, but no official role
- ii) 480 Volt Equipment – Not lethal, but it can hurt

- iii) Historical incidents (lost finger, crushed foot) considered a “4” on the matrix. OSHA came, fines

c) Environmental and Regulatory Impact

- i) 1,000 gal spill is trigger point, paperwork.
- ii) No NPDES permit, no WDR (Waste Discharge Requirements), not technically liable, considered “lucky” per Christy
- iii) Report ANY spill, even if not required to
- iv) No recycled water currently but it will need to be integrated in the future.
- v) Kept RW language in this version of the risk matrix, state that it currently does not apply to the District but will in the future
- vi) Anything greater than a “1” in their eyes is not acceptable
- vii) SSO – GM got involved heavily even with just 1 SSO and customer failure. Putting folks in hotels if the spill is serious enough.

d) Quality of Service and Delivery

- i) Just 1 sewer lift station (Granada)
- ii) Lost power at Granada and lost SCADA. Misplaced wire. Entire station was disabled. Could still flush toilets, customers never saw the impact. Lots of visual impacts and noises, flashing lights. Some said “1”, some said “2”.
- iii) Gerald: Go with higher number from the group to be conservative.
- iv) Lift station was out of service for 24 hours in total. 27-minute response time. There was a spill.
- v) Interceptor severed, single point of failure, can’t convey sewage anymore.
- vi) 7 major “confluence points” in system, or “subbasins”.
- vii) Any impact on interceptor outside of CVWD = 5 for quality of service. Interceptor may technically be outside of District’s service area, but there will be a large impact to Glendale/surrounding area.

e) Public Image

- i) “Some” social media – 2 (Nextdoor App, always chatting even when no issues)
- ii) LA Times – 5
- iii) Local TV News – 4
- iv) Local Newspaper – 3. Crescenta Valley Weekly newsletter

f) Fiscal Impact

- i) GM Signing authority - \$25k
- ii) Credit Card Limits - \$2,500 (Jake), \$5,000 (Darlene and David)
- iii) > \$100 requires purchase order authorization
- iv) Currently “in the red”, borrowing against reserves to keep Sewer system going
- v) Fiscal tiers: < 5k, 5-25k, 25-50k, 50-250k, >250k
- vi) SSO fines are usually primarily due to failure to report, failure to act quickly

3) BRVA Asset Interviews

a) System Overview/Comments

- i) 66 miles of gravity sewer, 7.5 miles interceptor

- ii) How do you know if part of interceptor failed? Flow meter will indicate if flow changes +/- 50%. How do we know what segment of interceptor failed? We don't know. Have to go hunting. Drive it, check customer notifications.
 - iii) Sewer pipelines in bridges, list as discreet line items in BRVA. David: sewers within bridges; pull those from Hazard Mitigation Plan. Drive over it every day, installed in 80's.
 - iv) David: important to tell a compelling story to justify CIP
 - v) Sewer areas previously defined in atlas sheets by letter and number grid
- b) BRVA Asset Scoring Methodology
 - i) We can adjust weights on each category in next session. We can use weighted scores for the assets, but sometimes the criticality of failure gets buried. Requires discussion with group.
- c) We had previously talked about criticality. The other part is **vulnerability**.
 - i) Training
 - ii) Safety condition
 - 1. if you are entering the failure, and the area is unsafe, someone gets hurt, prolongs downtime
 - iii) Resiliency
 - 1. Emergency Response Plans, shared resources with other agencies like backhoes, etc
 - iv) Reliability engineering support
 - v) APM Practices
 - 1. predictive failure models, smart covers to monitor flow depths, using tech to predict failure
 - vi) AM Business Process
 - 1. provide all previous info to Brook to make business decisions
 - vii) Business Vulnerability
- d) **One-Time Opportunities**
 - i) What does the Ops staff want? How do we make your lives easier? This generates:
 - ii) **One-Time Opportunity**: What are we recommending to alleviate the issue?
 - iii) Who will be **responsible**/lead the way for this improvement?
- e) **Interceptor – 2 Segments**
 - i) **Segment 1: Hillside Dr. to Outfall at Glendale**
 - 1. **Function**: This segment must reliably convey AND monitor flow going to LAG/Hyperion
 - 2. Avg flow – 1.6 MGD, Peak flow – 2.2 MGD
 - 3. Diverter valve at outfall – LAG/Hyperion
 - 4. Brine from IX can't go to LAG – contractual agreement
 - 5. Elk Ave – Flow Monitoring Station
 - (a) **Failure Modes**
 - (i) **No Flow – Dominant Mode of Failure is 0 Flow.**
 - (ii) Failure mode 2: reduced capacity < 50%, alarm sent
 - (b) Alarm for flow/depth changes – cellular system & email notices
 - (c) **Brook One-Time Opportunity**: Show Ops alarm system works and how Ops can access it. Brook gets email if no flow readings. Who's license is "on the line"? Technically David who is Director of Ops. Maybe Brook.

(d) Need to know type of meter (Make and Model) – CVWD to follow up on this

(e) Will meter alert in fault condition? Unknown. **One Time Opportunity.**

(f) If no flow, possibility of overflow (backup) and threat to public safety.

(g) Safety – 5, Env – 5, Quality – 4, Public – 5

(h) Flow data – every 2 minutes

(i) Response times

(i) Min 1 hour response time at night (weekends)

(ii) 30 min daytime during the weekdays

(iii) 4 hours during a Holiday

(iv) Mutual aid agreement with City of Glendale. CVWD needs to talk to Glendale and discuss these issues.

(v) One Time Opportunity: Talk to Glendale and discuss worst case response times and action items

ii) Segment 2: N Verdugo Blvd to single lateral connection near Hillside Dr.

1. This Segment Passes through Earthquake fault

2. Varied slopes along this alignment, 1% to 8-9%. **Potential for hydraulic jump. Identify in model.**

3. Heavy traffic on windy Verdugo Blvd

4. Glendale underground storage tank (10 MG) at Glorietta Park. Potential cross connection to sewer where sewer passes by. Causing sag in sewer line.

5. Glendale has parallel large-diameter sewer

6. Glendale CC traffic

7. No flow monitoring in this segment. Wouldn't know a break occurred until flow meter variance after 2 hrs when flow reaches flow meter (travel time)

8. Material: Primarily VCP

9. Safety – 5, env -5, quality – 4, public – 5, fiscal – 5

10. Dominant failure mode = clog, root

11. Implement smart cover on this segment to get notification of backup earlier than waiting for 2 hours; one time opportunity. Identify key locations for this based on work order history, key confluence points, etc...

12. Asset condition – 2

13. 2 year warranty on root removal chemical

14. Want new CCTV/Vac van - \$220k

15. Inspection every 3 years – it takes them about 3 years to finish CCTV'ing all assets, so then they start cycle again.

16. Work Orders

(a) No formal work order documentation

(b) The cost of not doing work orders or having work order history could be large in the form of fines. State asks for work order history if there is a spill

(c) One Time Opportunity for Darlene: Set up work order documentation system.

(d) Work Execution Management is a 2; needs to be streamlined to include work order history

17. VCP, Root Intrusion, Sag. **Asset Condition is a 2**, minor maintenance.

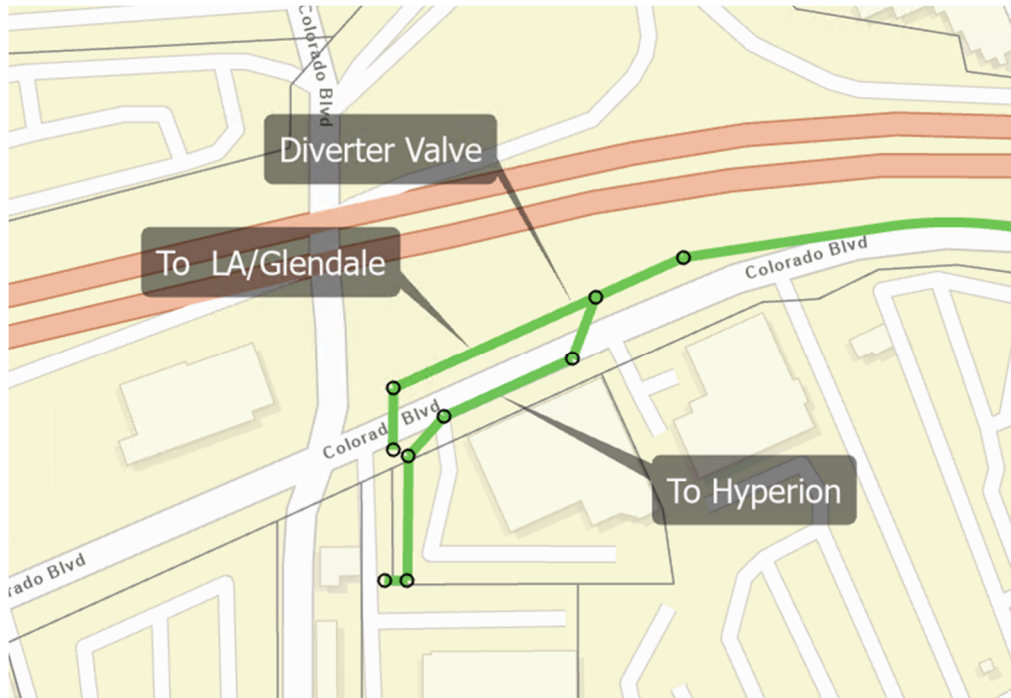
18. David concerned by capacity, d/D = 0.5 is criteria

19. 1 isolated odor complaint
20. Railroad crossing at San Fernando Blvd

21. One time opportunities

- (a) Update SSMP/SOPs to cover event of Interceptor Break. What does the bypassing scenario look like? Where does contractor put bypass piping and pumps?
 - (b) One time opportunity: Install duckbill valve for Hillside Dr crossing to prevent backflow
 - (c) Incorporate Glendale GIS to understand potential connection points to their system
22. Want to get FEMA funding – help support the funding by pointing to Master Plan and SSMP
 23. Have a CIP strategy, but it hasn't been implemented
 24. 60% for ADWF is potentially not that conservative. When wet weather flows come, they'd be in trouble.

iii) **Diverter valve**



- (a) **Function:** Normally OPEN, but CLOSES to divert backwash brine solution to Hyperion between 12 am – 3 am.
- (b) 21" plug valve located in a vault. Vault is approximately 6-7 feet deep. Requires confined space entry. Make: Dezurik, \$20k, motor controlled, remote controlled.
- (c) Estimated full replacement cost: \$50k
- (d) Homeless folks around diverter valve – tapping into power supply
- (e) Normally OPEN for most of day. Flow goes to LAG (LA/Glendale Recycled Water Plant)
- (f) When CLOSED, 12 am – 3 am, Northern outfall: to Hyperion. Brine solution used to regenerate exchange plant. Brine water takes sodium from NaCl, makes balls, Cl-

binds to nitrates, during backwash, solution is washed out to waste tank (64,000 gal). Sump pumps at night pump through force main to sewer line

- (g) Fails in last position. We need to modify this valve fail state to stay CLOSED so that brine solution never makes it to LAG. **One time opportunity: Install UPS so that valve can fail to CLOSED always.**
- (h) Waste backwash pumps – do they get confirmation from valve on status? Not currently. They either have to operate valve manually or manually shut off backwash pumps.
- (i) Glendale can handle brine if it happens, CVWD notifies them ahead of time. Glendale has own way to divert flow to Hyperion.
- (j) Cellular communication, 5G
- (k) Valve failure at night, requires confined space entry, ladder slips; not a well-lit area.
- (l) Maintenance on electrical panel, contractor wears full arc flash PPE.
- (m) Safety – 4, Env – 1, Qual – 1, Public – 1, Fiscal - 2
- (n) What is lead time on 21” plug valve?
- (o) Get critical spare parts
- (p) Installed in 1990
- (q) Break asset into actual valve, motor, and electrical controls.
- (r) Potential training to understand how to assemble valve, motor, improve ability to maintain valve.

f) Northwest Lift Station

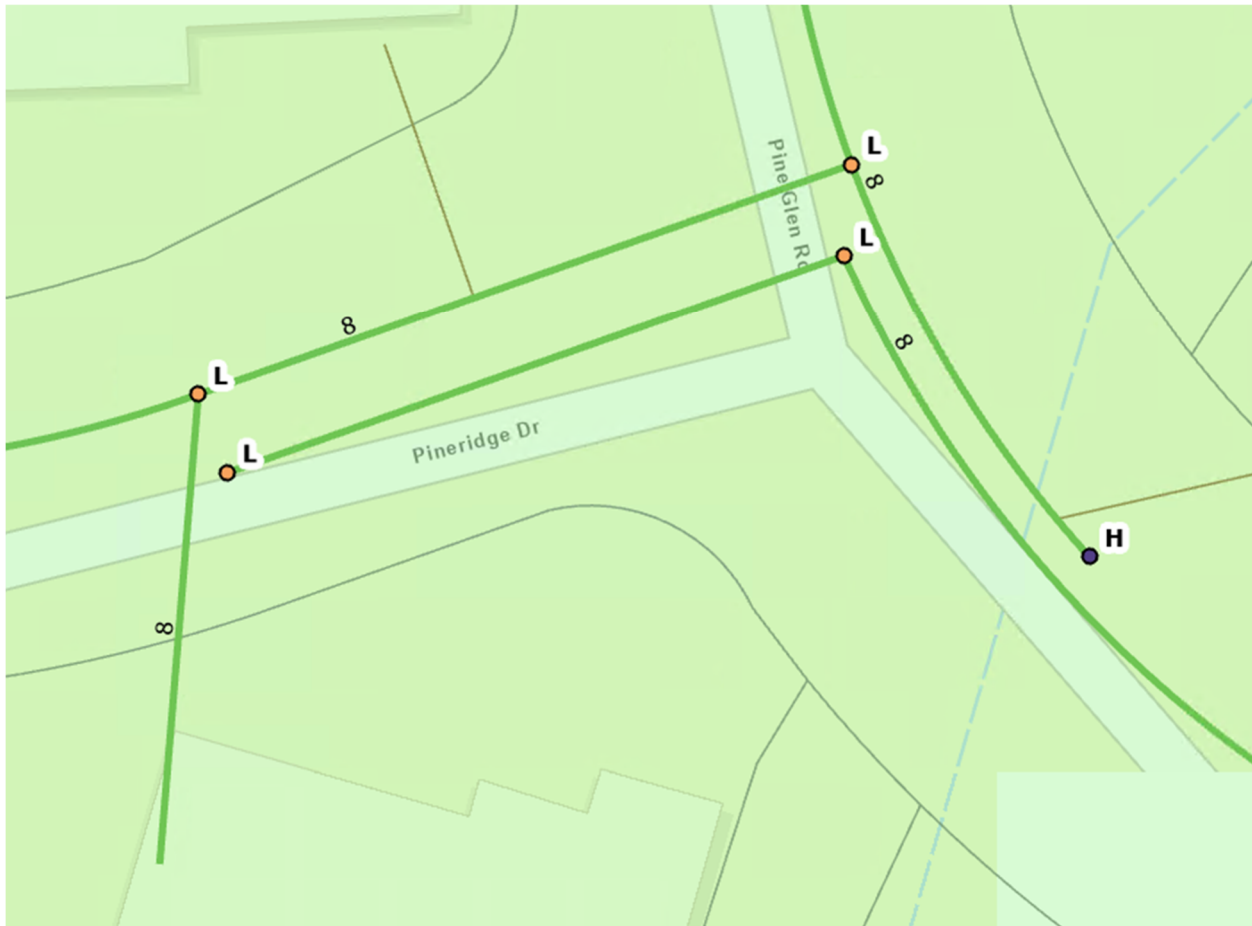
- i) Abandoned; used to be scalping plant.
- ii) Lines not rebuilt so they are shallower, area of concern for SSOs

g) Granada Lift Station

- i) Serves about 45 homes
- ii) FM – ductile iron
- iii) 2 pumps – 1 + 1 config (lead/lag)
- iv) Suction lift – above ground
 - 1. Formerly Gorman Rupp, Now All Prime Pumps
 - 2. Active operating level – bottom 4 ft
 - 3. 6-ft diameter wet well
 - 4. Will be implementing back up diesel generator w/ ATS – permanent 35 kW
 - 5. Remote control through SCADA – radio telemetry
 - 6. Spill goes to storm drain
 - 7. NO temp sensors
 - 8. Safety – 4, env – 3, quality – 2, public – 3, fiscal – 2
 - 9. **One Time Opportunity: Go to 60/40 operational split so both pumps don't fail simultaneously**
 - 10. Asset condition – 2
 - 11. Clearwell was just re-lined
 - 12. Doesn't have a flow meter
 - 13. Force main in good condition

14. Using both floats and level transducers to control pumps. If using floats, make sure to check floats every day to make sure float isn't stuck. Why not remove float? The float can't tell you if it fails, it just gets stuck.

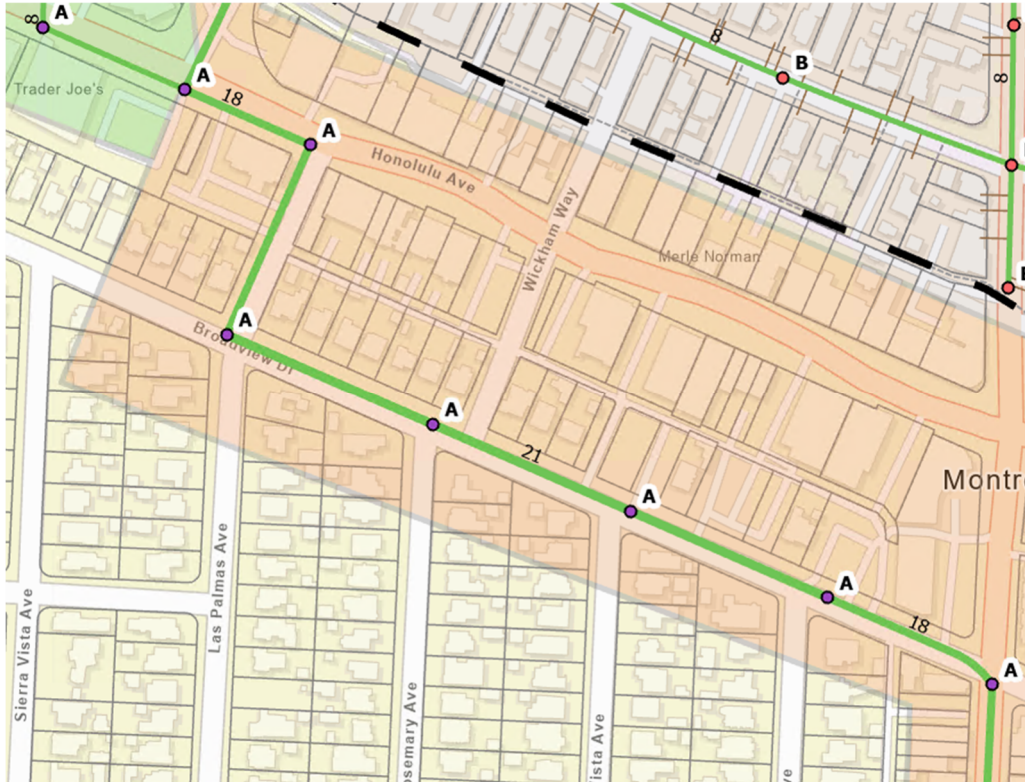
- h) Bottom of Area L – Switchback gravity sewer (Area 9)
 - i) Possibly deepen manholes. Went deep to go underneath storm drain
 - ii) Not represented well by GIS
 - iii) Area of concern
 - iv) Safety 4, Env 4, Qual 3, Public, 3, Fiscal 5
 - v) Re-routed pipelines – look at options in hydraulic analysis
 - vi) SSO causes: debris, grease, garbage disposal



- i) Dorothy Ln – Pipe on hillside, hard to maintain – MH 594, Put gate on customer 2349 Jayma Lan property to get to manhole, better access roadway. Look for potential reroute options. Safety 4, Env 2, Qual 2, Public 3, Fiscal 5
- j) Starfall Dr – Pipe on hillside, hard to maintain – MHS 4103, Safety 4, Env 2, Qual 2, Public 3, Fiscal 5
- k) Enhanced Maintenance Areas in SSMP – shallow pipes
- l) I-210 Crossing – Pipe in casing
 - i) Shear pints at either end of bridge
 - ii) Safety 5, Env 4, Quality 4, Public 5, Fiscal 5

- iii) Add upstream valve for isolation/plug during emergency bypass
- iv) Emergency rerouting? Need to incorporate into SSMP and ERP. Specific contractor on call to call and respond, need specific action for bridge crossings.
Need to inspect bridge crossings

m) Montrose Trader Joes – hydraulic jump? Model doesn't show anything



n) Foothill / Sunset flat spots

- i) Pool plaster debris, illegal dumping, shrinks diameter
- ii) Pipe 2136
- iii) Flat spot
- iv) Traffic, bicyclists, dumping grease from Arbys
- v) Safety 4, Env 4, Qual service 3, public image 4, fiscal impact 2



- o) Lots of drop manholes, erosion of bottom shelf
 - i) Rosemont and Rockdell, Waltonia drop manholes
 - ii) Drop manhole locations in system – remediate erosion of bottom of drop manholes

Appendix F CIP Project One Sheets

CIP Project I-2: Pine Glen / Pineridge Switchback Redesign

Project Type: Infrastructure

Implementation Timeframe: Short

Estimated Capital Cost: \$221,000

Estimated O&M Cost: N/A. There is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

Project Description: This project consists of improvements to the existing sewer pipe layout to prevent historical debris collection and SSO. This entails abandonment/demolition of existing sewer lines and new installation of a reversed flow sewer line, a drop manhole, and a chimney lateral. The proposed redesign is shown in Figure 3.

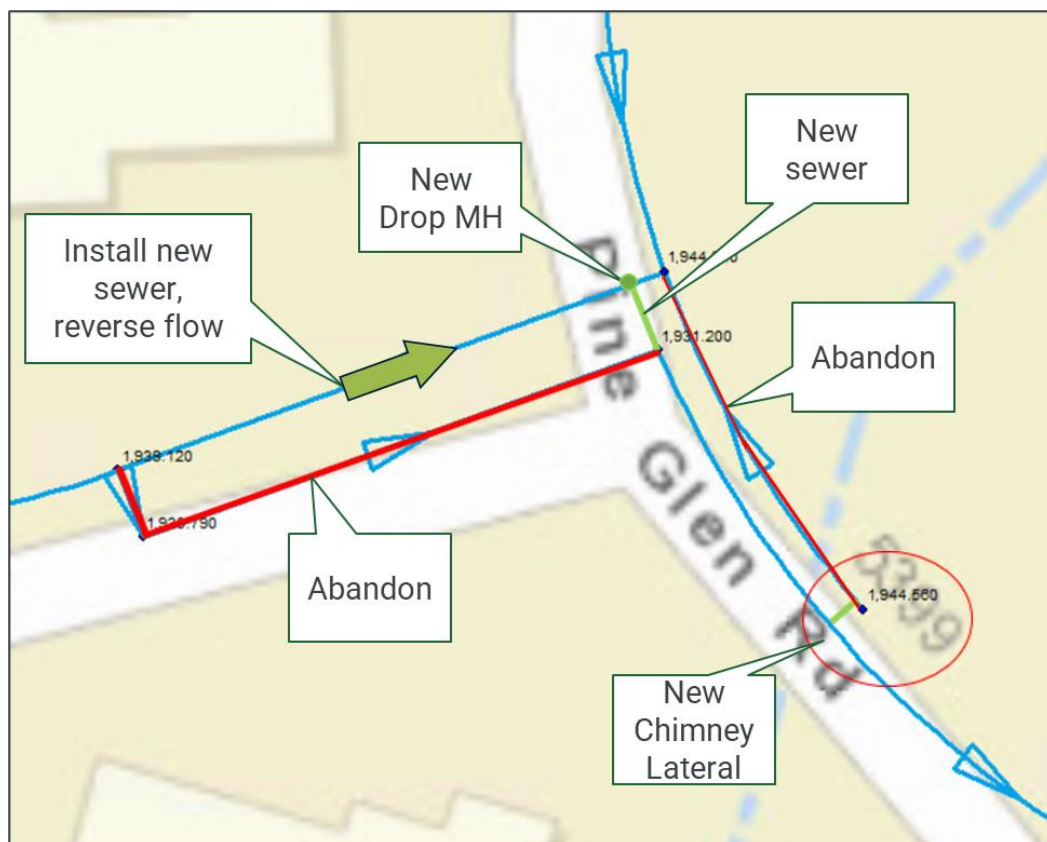


Figure 3: Pine Glen / Pineridge Switchback Redesign

CIP Project I-3: Rosemont / Hwy 210 Crossing Retrofit

Project Type: Infrastructure

Implementation Timeframe: Short

Estimated Capital Cost:

Seismic retrofit only: \$181,000

Seismic retrofit + full bridge sewer line and casing pipe replacement: \$1,611,000

Estimated O&M Cost: N/A. There is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

Project Description: This project consists of improvements to the sewer pipe within the Rosemont Ave / Hwy 210 Crossing. This entails retrofitting each end of the bridge pipe with seismically rated sewer fittings. Additionally, there is an option for a full replacement of the bridge sewer line and casing pipe. The project is shown in Figure 4.

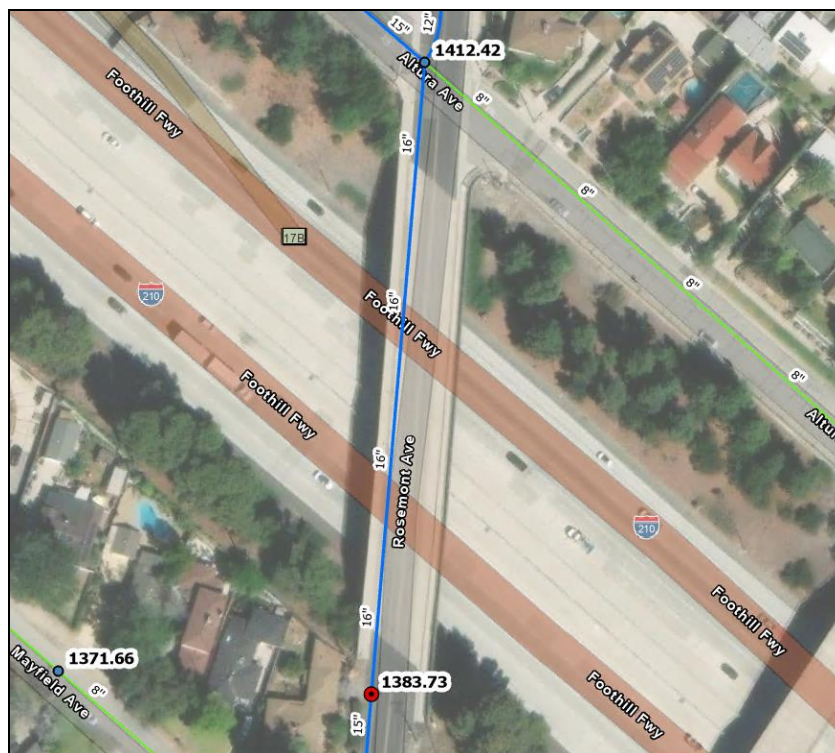


Figure 4: Rosemont / Hwy 210 Crossing Retrofit

CIP Project I-4: Briggs / Hwy 210 Crossing Retrofit

Project Type: Infrastructure

Implementation Timeframe: Medium

Estimated Capital Cost:

Seismic retrofit only: \$203,000

Seismic retrofit + full bridge sewer line and casing pipe replacement: \$1,902,000

Estimated O&M Cost: N/A. There is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

Project Description: This project consists of improvements to the sewer pipe within the Briggs Ave / Hwy 210 Crossing. This entails retrofitting each end of the bridge pipe with seismically rated sewer fittings. Additionally, there is an option for a full replacement of the bridge sewer line and casing pipe. The project is shown in Figure 5.

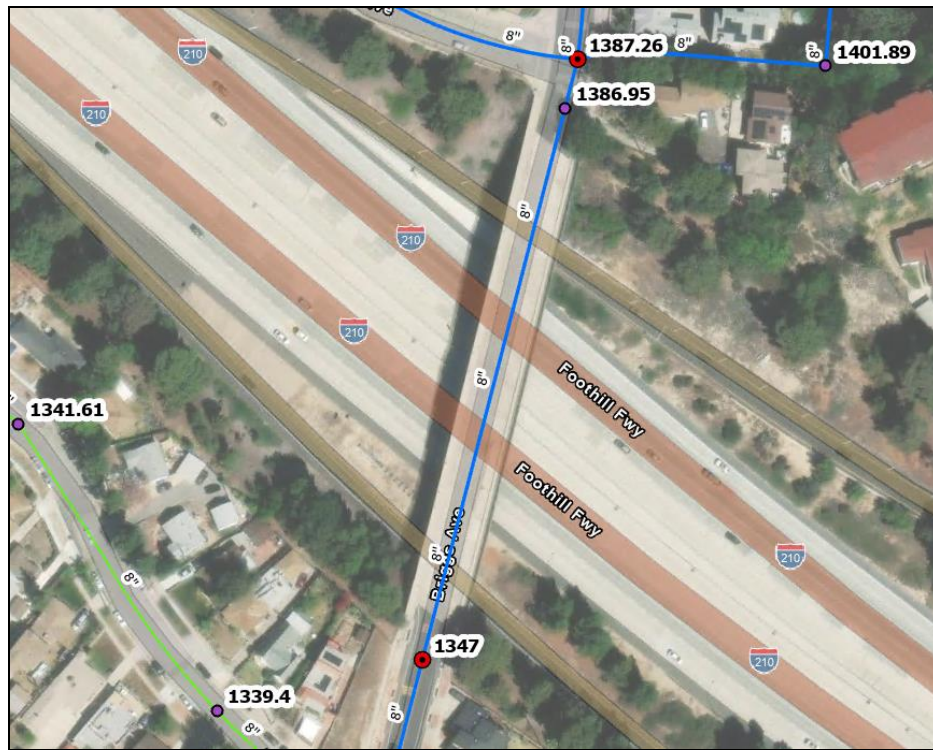


Figure 5: Briggs / Hwy 210 Crossing Retrofit

CIP Project I-5: Hillside Dr Private Lateral Backflow Preventer

Project Type: Infrastructure

Implementation Timeframe: Medium

Estimated Capital Cost: \$35,000

Estimated O&M Cost: N/A. There is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

Project Description: This project consists of the installation of a duckbill backflow preventer on a private lateral off the interceptor to prevent backflow. The project is shown in Figure 6.

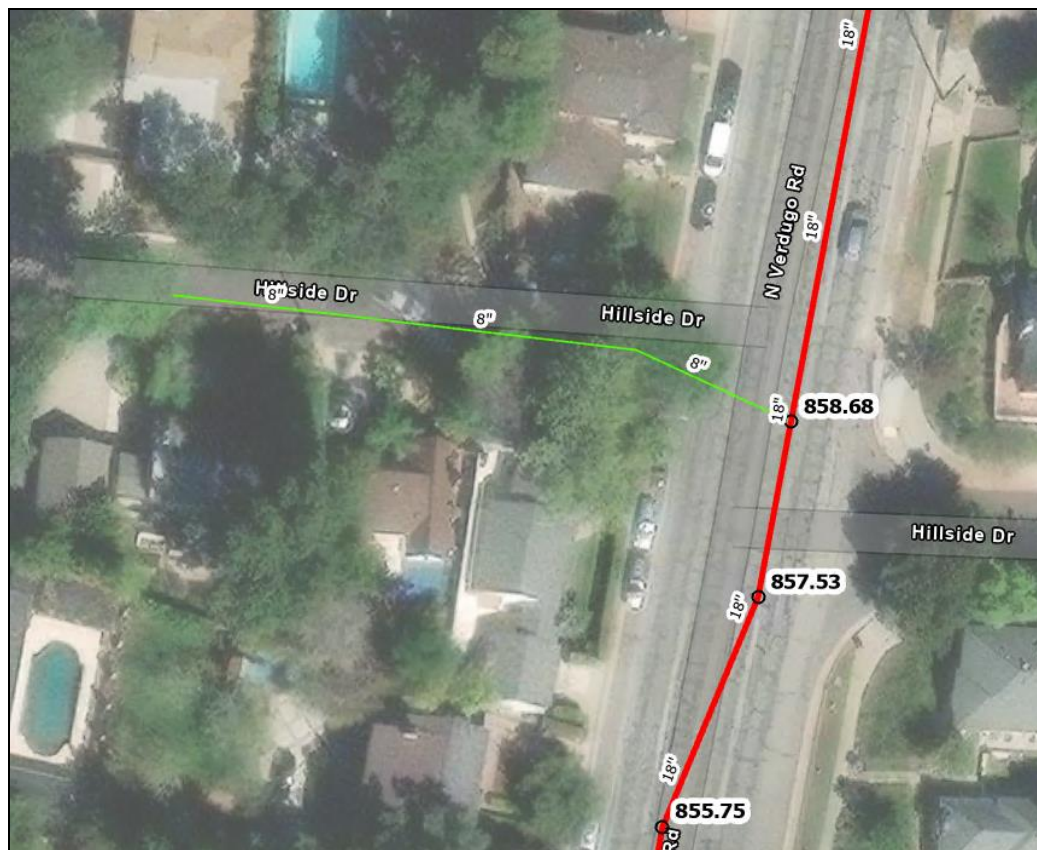


Figure 6: Hillside Dr Private Lateral Backflow Preventer

CIP Project I-6: Dorothy / Goss Canyon Access Road

Project Type: Infrastructure

Implementation Timeframe: Long

Estimated Capital Cost: \$90,000

Estimated O&M Cost: N/A. There is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

Project Description: This project consists of improving manhole access. This entails the obtainment of an easement and construction of a new access road to the manhole. The project is shown in Figure 7.



Figure 7: Dorothy / Goss Canyon Access Road

CIP Project I-7: Starfall / Ridgeline Access Road

Project Type: Infrastructure

Implementation Timeframe: Long

Estimated Capital Cost: \$107,000

Estimated O&M Cost: N/A. There is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

Project Description: This project consists of improving manhole access. This entails the obtainment of an easement and construction of a new access road to the manhole. The project is shown in Figure 8.



Figure 8: Starfall / Ridgeline Dr Access Road

CIP Project I-8: Diverter Valve Upgrades

Project Type: Infrastructure

Implementation Timeframe: Long

Estimated Capital Cost: \$41,000

Estimated O&M Cost: N/A. There is assumed to be no increase in maintenance requirements or cost beyond CVWD's existing regular maintenance activities and existing O&M budget, respectively.

Project Description: This project consists of security improvements to the diverter valve, which entails the installation of a UPS, site lighting, and a perimeter fence. The project location is shown in Figure 9.

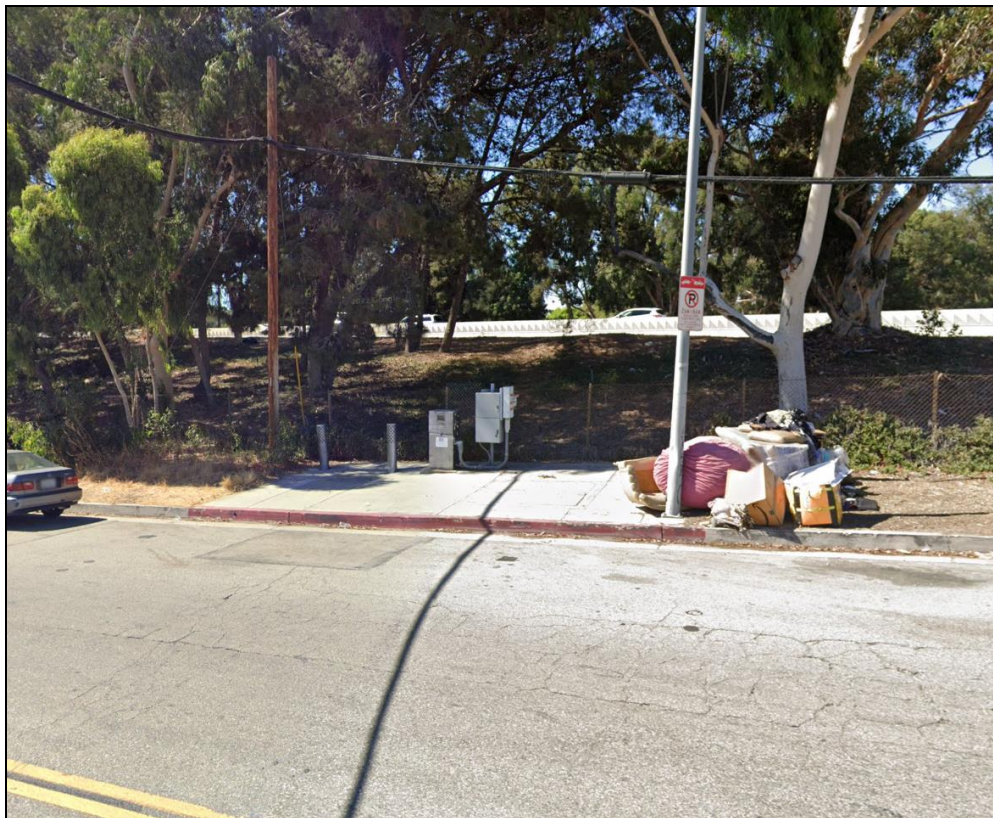


Figure 9: Diverter Valve Upgrades Location

CIP Project N-1: Rosemont, Briggs Crossings Condition Assessment

Project Type: Non-Infrastructure

Project Frequency: One-Time

Implementation Timeframe: Short

Estimated Capital Cost: \$231,000

Estimated O&M Cost: N/A. This is a one-time project.

Project Description: This project consists of a thorough inspection of the sewer pipes and casings in the Rosemont and Briggs bridges crossing HWY 210. This would entail consultant CCTV inspection of the sewer pipe and void between pipe and casing. The project locations are shown in Figure 10.



Figure 10: Rosemont, Briggs Crossings Condition Assessment

CIP Project N-2: Smart Cover Installation

Project Type: Non-Infrastructure

Project Frequency: Ongoing, indefinite

Implementation Timeframe: Short

Estimated Capital Cost: \$34,000

Estimated O&M Cost: \$10,000/year

Project Description: This project consists of manhole monitoring and alarms through smart manhole cover systems. This would entail 4 covers to stay in position, and 6 covers to alternate locations. CVWD have already purchased 5 covers. The estimated capital cost is for the purchase of an additional 5 covers, and the annual O&M cost accounts for 10 covers. A few recommended smart cover manhole locations are shown in Figure 11.



Figure 11: Smart Cover Installation

CIP Project N-3: Interceptor Items

Project Type: Non-Infrastructure

Project Frequency:

1. Annual, indefinite
2. One-Time

Implementation Timeframe: Short

Estimated Capital Cost:

1. \$3,000
2. N/A

Estimated O&M Cost:

1. \$3,000/year
2. N/A. This is a one-time task.

Project Description: This project consists of two tasks:

1. Improved Emergency Response Training for Interceptor Break. FTE equivalents, 4 operators, 2 days training per year. The estimated capital cost is for the first annual training, and the annual O&M cost is for a recurring annual training.
2. Improved Communication with ADS to identify Elk Ave Flow Meter Failure. This is simply completed by contacting ADS to request an automated message via email/text indicating whether the flow meter has failed, which has negligible cost.

CIP Project N-4: EMA 7 Monitoring

Project Type: Non-Infrastructure

Project Frequency: One-Time; 3 months of monitoring.

Implementation Timeframe: Short

Estimated Capital Cost: \$4,000

Estimated O&M Cost: N/A. This is a one-time project.

Project Description: This project consists of monitoring of Canalda tank discharge. This would entail 3 months of meter operation and maintenance, and data analysis and reporting. The project location is shown in Figure 12.

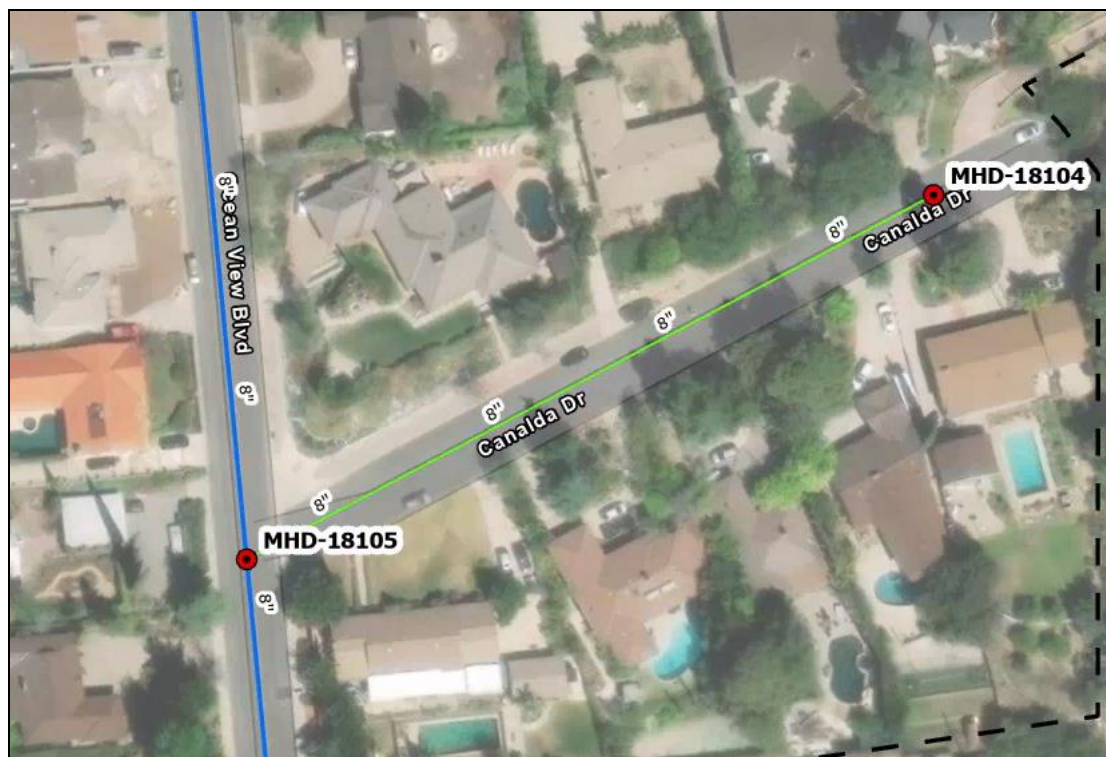


Figure 12: EMA 7 Monitoring

CIP Project N-5: SS 1,2,3 Monitoring

Project Type: Non-Infrastructure

Project Frequency: 3 months of monitoring per year for 5 years.

Implementation Timeframe: Short

Estimated Capital Cost: \$12,000

Estimated O&M Cost: \$12,000/year

Project Description: This project consists of targeted flow monitoring for sewersheds 1, 2, and 3. This would entail 3 months/year of meter operation and maintenance, and data analysis and reporting for the 3 sewersheds for 5 years. The estimated capital cost is for the first year of monitoring, and the annual O&M cost is for the recurring monitoring each year.

CIP Project N-6: Work Order Database

Project Type: Non-Infrastructure

Project Frequency: One-Time

Implementation Timeframe: Short

Estimated Capital Cost: \$8,000

Estimated O&M Cost: N/A. This is a one-time project.

Project Description: This project consists of the development of a work order database with pipe and manhole condition ratings data. FTE equivalent, O&M Manager, 2 hours of labor per week for a year.

Appendix G CIP Project Class 5 Cost Estimate

OPINION OF PROBABLE CONSTRUCTION COST
BASIS OF ESTIMATE
PROJECT INFORMATION

Client:	Crescenta Valley Water District (CVWD)
Project:	CVWD 2022 Wastewater Master Plan
KJ Job No.:	2244508*00
Estimate Date:	2/12/2024
Prepared By:	Christian Eustaquio
Reviewed By:	Kieran Christie
Estimate Type:	Conceptual
AACEI Estimate Classification:	5

PROJECT DESCRIPTION:

The Crescenta Valley Water District Sewer Master Plan has been prepared to evaluate the City's sewer system for existing and future conditions. The purpose of this Master Plan is to update the District's Geographic Information System (GIS), identify deficiencies in the existing public sewer system, prioritize the deficient reaches, recommend alternatives to eliminate the deficiencies, and thereby provide the District with a basis for improvements in its sewer infrastructure management system, or development of a Capital Improvement Plan.

ESTIMATE DOCUMENTS:

<u>DRAWINGS:</u>	N/A
<u>DOCUMENTS:</u>	Crescenta Valley Water District Wastewater Master Plan

SOURCE OF COST DATA:

RS Means Costwork published cost estimating data 2023 for project location zip code, engineer's experience on similar projects.

ESTIMATE ASSUMPTIONS:

The followings assumptions were made in the preparation of this estimate:

Projects will be publicly bid projects.
Prevailing wage requirements will apply.
Assume there will be at least 3 qualified bids submitted.

SPECIFIC INCLUSIONS:

Assume all excess excavated material is hauled and disposed of.
Assume all demolished material will be hauled and disposed of including a dump fee.

SPECIFIC EXCLUSIONS:

The estimate does not include the following:
Hazardous materials (lead paint, asbestoes, PCBs, etc.) removal or disposal in not included.
Soil remediation, testing , removal, or disposal.

MAJOR CHANGES FROM PREVIOUS ESTIMATE:

N/A

DESIGN CONTINGENCY:

A design and estimating contingency of 30% has been included as detailed on summary sheet.

Note: This allowance is intended to provide a Design Contingency allowance. It is not intended to provide for a Construction Contingency for change orders during construction or to cover unforeseen conditions.

ESCALATION:

Annual Inflation Escalation Factor:	TBD
Design, Bidding, to NTP	<u>Varies per project</u>
Construction Duration (Divided by 2)	<u>Varies per project</u>
Time Until Project Midpoint (Months)	<u>Varies per project</u>
Calculated Escalation	<u>Varies per project</u>

ACCURACY:

The level of accuracy is commensurate with levels developed by the AACEI, the Association for the Advancement of Cost Engineering International. At increasing levels of design completion, the narrower the range between upper and lower limits and the greater the accuracy of the estimate. This estimate is considered a Class 3 estimate, which are generally prepared to form the basis for budget authorization, appropriation, and/or funding. Typically engineering is from 10% to 40% complete, and would comprise a minimum of process flow diagrams, utility flow diagrams, preliminary piping and instrumentation diagrams, plot plan, developed layout drawings, and essentially complete engineered process and utility equipment lists. They are typically prepared to support full project funding requests, and become the first of the project phase "control estimates" against which all actual costs and resources will be monitored for variation to budget. Most Class 3 estimates involve more deterministic estimating methods than stochastic methods. Typical accuracy ranges for Class 3 estimates are -10% to -20% on the low side, and +10% to +30% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. (AACE International Recommended Practices and Standards).

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Granada PS Improvements
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs \$/Unit	Total Capital Cost	Notes/Source
Capital Costs						
1.0	Building Modifications					
1.1	Cut Wall Penetration - 4" Pipe	2	EA	\$ 700	\$ 1,400	
1.2	Install 4" Link Seal	2	EA	\$ 250	\$ 500	
2.0	New Wet Well					
2.1	Set new 36" Wet Well - 11' deep	1	LS	\$ 17,250	\$ 17,250	15% of unit cost is accounting for installation
2.2	Excavation	21	CY	\$ 12	\$ 257	15' depth, 7' diameter hole
2.3	Penetration for influent gravity sewer	1	LS	\$ 500	\$ 500	
3.0	Piping Modifications					
3.1	Install Additional Suction Piping	20	LF	\$ 45	\$ 900	4" DI coated piping horizontal run
3.2	Install Suction/Discharge Pressure Gauges	4	EA	\$ 150	\$ 600	
3.3	Intallation Labor	1	LS	\$ 1,000	\$ 1,000	Labor cost to be 15% of the material cost or \$1,000, whichever is larger
4.0	New Gravity Sewer Influent Line					
4.1	Demolition of Pavement	40	SY	\$ 52	\$ 2,080	Demolition of 360 SF of pavement. Assume 6" Pavement - includes load/haul/dump + dump fee
4.2	8" VCP	25	LF	\$ 32	\$ 800	Assume \$32/LF for pipe install, incl. exc & backfill
4.3	Abandon existing influent line in place	1	LS	\$ 1,600	\$ 1,600	Plug with brick bulkhead
4.4	Repavement of Road	40	SY	\$ 20	\$ 800	Repaving of 360 SF
5.0	Site Modifications					
5.1	Clear and Grubbing	12	SY	20	\$ 240	Cost goes up due to small quantity
5.2	Small Tree Removal Adder	1	LS	\$ 1,000	\$ 1,000	
6.0	Electrical Modifications					
6.1	Electrical Demo	1	LS	\$ 5,000	\$ 5,000	Assume \$5k adder for electrical deneenergizing, removal of MCC panel, cleaning up conduits/wiring
6.2	Install 5 HP VFD	2	EA	\$ 1,000	\$ 2,000	VFD will take 1 phase power, convert to 3 phase. \$500 per for material, \$500 for install
7.0	Bypass Pumping	1	LS	\$ 31,050	\$ 31,050	Consider a 4 month downtime period for pump station for all mods
Materials & Labor Subtotal				\$ 66,977		
Total Capital Cost				\$66,977		
	Taxes	@	10.25%	\$ 3,000		Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits	@	10%	\$ 7,000		
	Contractor Overhead & Profit	@	15%	\$ 12,000		
	Bonds and Insurance	@	2.5%	\$ 2,000		
	Escalation to mid-point of Construction	@	6%	\$ 16,000		Assume 2 yrs
	Estimate Contingency	@	30%	\$ 32,000		
Subtotal w/ Contractor Markups and Contingency				\$139,000		All values are subtotaled
	Engineering		25%	\$ 35,000		
	Construction Management		25%	\$ 35,000		
Total				\$209,000		

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Granada PS Improvements
Estimate: Class 5 - Concept Screening

Prepared By: DK
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs \$/Unit	Total Capital Cost	Notes/Source
Capital Costs						
1.0	Pump Station Demo					
1.1	CMU Building Demo	225	SF	\$ 8	\$ 1,800	Assuming \$8 per SF for CMU Demo (Avg range is from \$4-\$8)
1.2	Electrical Demo	1	LS	\$ 5,000	\$ 5,000	Assume \$5k adder for electrical denenergizing, removal of MCC panel, cleaning up conduits/wiring
1.3	Mechanical/Instrumentation Demo	1	LS	\$ 7,500	\$ 7,500	Assuming \$7.5k for mechanical equipment removal
2.0	Site Modifications					
2.1	Clear and Grubbing	36	SY	\$ 20.00	\$ 724	Cost goes up due to small quantity
2.2	Small Tree Removal	1	LS	\$ 1,000	\$ 1,000	
2.3	Grading	100	SF	\$ 8	\$ 800	The average cost per SF is approximately \$6.5 to \$8
3.0	Submersible Pumps					
3.1	New 5 HP Submersible Pump - Lift Station	2	EA	\$ 15,000	\$ 30,000	Cost from Xylem
3.2	4'x4' double leaf, spring assisted hatch	1	EA	\$ 2,700	\$ 2,700	Obtained Costs from BH RMS OPCC
3.3	Install Suction/Discharge Pressure Gauges	2	EA	\$ 150	\$ 300	
3.4	Installation Labor	1	LS	\$ 5,000	\$ 5,000	
4.0	Discharge Valve Vault					
4.1	New 6'x6'x6' Valve Vault	1	LS	\$ 9,000	\$ 9,000	Cost from BH RMS * 1.7 factor to account for cubic foot
4.2	4'x4' double leaf, spring assisted hatch	1	EA	\$ 2,700	\$ 2,700	Obtained Costs from BH RMS OPCC
4.3	4" Plug Valve	3	EA	\$ 1,000	\$ 3,000	
4.4	4" Check Valve	1	EA	\$ 1,000	\$ 1,000	
4.5	New 4" discharge piping	50	LF	\$ 45	\$ 2,250	
4.6	Installation Labor	1	LS	\$ 3,000	\$ 3,000	
5.0	Instrumentation & Electrical Improvements					
5.1	New single-phase to three-phase electrical supply	1	EA	\$ 1,500	\$ 1,500	
5.2	New MCC	1	EA	\$ 5,000	\$ 5,000	
5.3	NEMA 4X Enclosures	1	EA	\$ 3,500	\$ 3,500	
5.4	Equipment pad/stand	1	EA	\$ 6,000	\$ 6,000	
5.5	Pressure Transducer	1	EA	\$ 1,000	\$ 1,000	
5.6	Controls Set-up & Integration	1	LS	\$ 3,000	\$ 3,000	
5.7	Installation Labor	1	LS	\$ 6,000	\$ 6,000	
6.0	Bypass Pumping	1	LS	\$ 31,050	\$ 31,050	
	Materials & Labor Subtotal				\$ 132,824	
	Total Capital Cost				\$132,824	
	Taxes @ 10.25%			\$ 7,000		Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits @ 10%			\$ 14,000		
	Contractor Overhead & Profit @ 15%			\$ 23,000		
	Bonds and Insurance @ 2.5%			\$ 4,000		
	Escalation to mid-point of Construction @ 6%			\$ 33,000		Assume 2 yrs
	Estimate Contingency @ 30%			\$ 64,000		
	Subtotal w/ Contractor Markup and Contingency				\$277,900	All values are subtotaled
	Engineering 25%			\$ 69,000		
	Construction Management 25%			\$ 69,000		
Total					\$416,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Pine Glen / Pineridge (EMA 1) Switchback Redesign
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs \$/Unit	Total Capital Cost	Notes/Source
Capital Costs						
1.0	Bypass Pumping	1	LS	\$ 3,450	\$ 3,450	Assume 2 weeks of bypass pumping + incidentals
2.0	Traffic Control Allowance	1	LS	\$ 2,500	\$ 2,500	Allowance includes signage, cones, option for flaggers
3.0	Demolition of Pavement	507	SY	\$ 52	\$ 26,364	Assume 6" Pavement - includes load/haul/dump + dump fee
4.0	Demolition of Existing 8" VCP	80	LF	\$ 12	\$ 960	Assume \$5 labor to remove, & incl. load/haul/dump + dump fee
5.0	Abandonment of Existing 8" VCP	1	LS	\$ 1,600	\$ 1,600	Abandonment of existing pipe and plug with brick bulkhead
6.0	New Sewer					
6.1	Pipe Bedding	5	CY	\$ 50	\$ 227	Assume 6" below pipe, 12" above pipe, by pipe length and diameter
6.2	8" VCP	85	LF	\$ 32	\$ 2,720	Assume \$32/LF for pipe install, incl. exc & backfill
6.3	New Drop MH	1	EA	\$ 15,000	\$ 15,000	
7.0	New Chimney Lateral				\$ -	
7.1	4" PVC	20	LF	\$ 32	\$ 640	Assume \$32/LF for pipe install, incl. exc & backfill
7.2	Connection to Sewer Main	1	LS	\$ 3,300	\$ 3,300	Assume 8 hours Pipe Crew + \$500 of material
7.3	Flush and Test	1	LS	\$ 3,200	\$ 3,200	Assume 1-2 days of work
8.0	Repavement of Road	507	SY	\$ 20	\$ 10,140	
	Materials & Labor Subtotal				\$ 70,101	
	Total Capital Cost				\$70,101	
	Taxes	@	10.25%		\$ 4,000	Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits	@	10%		\$ 7,000	
	Contractor Overhead & Profit	@	15%		\$ 12,000	
	Bonds and Insurance	@	2.5%		\$ 2,000	
	Escalation to mid-point of Construction	@	6%		\$ 17,000	Assume 2 yrs
	Estimate Contingency	@	30%		\$ 34,000	
	Subtotal w/ Contractor Markups and Contingency				\$146,200	All values are subtotaled
	Engineering		25%		\$ 37,000	
	Construction Management		25%		\$ 37,000	
Total					\$221,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Rosemont / Hwy 210 Crossing Retrofit Alternative 1
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

[illegible]

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Rosemont / Hwy 210 Crossing Retrofit Alternative 2
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs		Notes/Source
				\$/Unit	Total Capital Cost	
Capital Costs						
1.0	Bypass Pumping	1	LS	\$ 13,800	\$ 13,800	Assume 8 weeks of bypass pumping + incidentals
2.0	Traffic Control Allowance	1	LS	\$ 10,000	\$ 10,000	Assume 2 months of traffic control; Signage, cones, option for flaggers
3.0	Demolition of Pavement	2,222	SY	\$ 52	\$ 115,556	Assume 6" Pavement - includes load/haul/dump + dump fee
4.0	Demolition of Existing 16" DIP	500	LF	\$ 25	\$ 12,500	
5.0	Demolition of Existing Casing Pipe	500	LF	\$ 35	\$ 17,500	
6.0	Installation of Seismic Joints					
6.1	24" US Pipe SAM1 Seismic Fitting	2	LS	\$ 1,000	\$ 2,000	
6.2	16" HDPE	40	LF	\$ 72	\$ 2,880	Assume 1" wall thickness, includes exc/backfill
6.3	Connection to Sewer Main	1	LS	\$ 3,300	\$ 3,300	Assume 8 hours Pipe Crew + \$500 of material
6.4	40" Steel Casing Pipe	40	LF	\$ 669	\$ 26,750	Casing around the gravity sewer line
7.0	New Sewer					
7.1	16" DIP	460	LF	\$ 72	\$ 33,120	Assume 1" wall thickness, includes exc/backfill
7.2	Connection to Sewer Main	1	LS	\$ 3,300	\$ 3,300	Assume 8 hours Pipe Crew + \$500 of material
7.3	40" Steel Casing Pipe	460	LF	\$ 669	\$ 307,625	Casing around the gravity sewer line
8.0	Repavement of Road	2,222	SY	\$ 20	\$ 44,444	
	Materials & Labor Subtotal				\$ 592,775	
	Total Capital Cost				\$592,775	
	Taxes	@	10.25%		\$ 30,000	Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits	@	10%		\$ 62,000	
	Contractor Overhead & Profit	@	15%		\$ 103,000	
	Bonds and Insurance	@	2.5%		\$ 20,000	
	Escalation to mid-point of Construction	@	6.0%		\$ 145,000	Assume 2 yrs
	Estimate Contingency	@	30%		\$ 286,000	
	Subtotal w/ Contractor Markups and Contingency				\$1,238,800	All values are subtotaled
	Engineering		15%		\$ 186,000	
	Construction Management		15%		\$ 186,000	
Total					\$1,611,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Briggs / Hwy 210 Crossing Retrofit Alternative 1
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

[illegible]

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Briggs / Hwy 210 Crossing Retrofit Alternative 2
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs		Notes/Source
				\$/Unit	Total Capital Cost	
Capital Costs						
1.0	Bypass Pumping	1	LS	\$ 3,450	\$ 3,450	Assume 2 weeks of bypass pumping + incidentals
2.0	Traffic Control Allowance	1	LS	\$ 2,500	\$ 2,500	allowance includes signage, cones, option for flaggers
3.0	Demolition of Pavement	2,222	SY	\$ 52	\$ 115,556	Assume 6" Pavement - includes load/haul/dump + dump fee
4.0	Demolition of Existing 8" DIP	500	LF	\$ 12	\$ 6,000	Assume \$5 labor to remove, & incl. load/haul/dump + dump fee
5.0	Demolition of Existing Casing Pipe	500	LF	\$ 35	\$ 17,500	
6.0	Installation of Seismic Joints					
6.1	12" US Pipe SAM1 Seismic Fitting	2	LS	\$ 1,000	\$ 2,000	
6.2	8" HDPE	40	LF	\$ 20	\$ 800	Assume 0.6" wall thickness
6.3	Connection to Sewer Main	1	LS	\$ 3,300	\$ 3,300	Assume 8 hours Pipe Crew + \$500 of material
6.4	32" Steel Casing Pipe	40	LF	\$ 949	\$ 37,960	Casing around the gravity sewer line
7.0	New Sewer					
7.1	8" DIP	460	LF	\$ 56	\$ 25,760	Gravity sewer line, incl. exc/backfill
7.2	Connection to Sewer Main	1	LS	\$ 3,300	\$ 3,300	Assume 8 hours Pipe Crew + \$500 of material
7.3	32" Steel Casing Pipe	460	LF	\$ 949	\$ 436,540	Casing around the gravity sewer line
8.0	Repavement of Road	2,222	SY	\$ 20	\$ 44,444	
	Materials & Labor Subtotal				\$ 699,110	
	Total Capital Cost				\$699,110	
	Taxes	@	10.25%		\$ 36,000	Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits	@	10%		\$ 74,000	
	Contractor Overhead & Profit	@	15%		\$ 121,000	
	Bonds and Insurance	@	2.5%		\$ 23,000	
	Escalation to mid-point of Construction	@	6.0%		\$ 172,000	Assume 2 yrs
	Estimate Contingency	@	30%		\$ 338,000	
	Subtotal w/ Contractor Markups and Contingency				\$1,463,200	All values are subtotaled
	Engineering		15%		\$ 219,000	
	Construction Management		15%		\$ 219,000	
Total					\$1,902,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Hillside Dr Private Lateral Backflow Preventer
Estimate: Class 5 - Concept Screening

Prepared By:	CE
Date Prepared:	Feb-2024
K/J Proj. No.	2244508*00

[illegible]

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Dorothy / Goss Canyon Access Road
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item				Total Costs		
No.	Description	Qty	Units	\$/Unit	Total Capital Cost	Notes/Source
Capital Costs						
1.0	Construction of 15 ft-wide Graded Dirt Road	333	SY	\$ 3	\$ 1,000	Assume 15' wide, 200' long
2.0	Trucking of material	333	CU-YD	\$ 51.75	\$ 17,250	Assume 3' depth
3.0	Road Easement	1	LS	\$ 5,000	\$ 5,000	
4.0	15' Manual Single Leaf Swing Barrier Gate Arm	1	EA	\$ 5,000	\$ 5,000	Assume 8 hours labor + \$2,800 for material
5.0	Miscellaneous Signage	1	LS	\$ 500	\$ 500	
Materials & Labor Subtotal					\$ 28,750	
Total Capital Cost					\$28,750	
	Taxes	@	10.25%	\$ 1,000		Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits	@	10%	\$ 3,000		
	Contractor Overhead & Profit	@	15%	\$ 5,000		
	Bonds and Insurance	@	2.5%	\$ 1,000		
	Escalation to mid-point of Construction	@	6.0%	\$ 7,000		Assume 2 yrs
	Estimate Contingency	@	30%	\$ 14,000		
Subtotal w/ Contractor Markups and Contingency					\$59,800	All values are subtotaled
	Engineering		25%	\$ 15,000		
	Construction Management		25%	\$ 15,000		
Total					\$90,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Starfall / Ridgeline Access Road
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs		Notes/Source
				\$/Unit	Total Capital Cost	
Capital Costs						
1.0	Construction of 15 ft-wide Graded Dirt Road	333	SY	\$ 3	\$ 1,000	Assume 15' wide, 200' long
2.0	Trucking of material	333	CU-YD	\$ 51.75	\$ 17,250	Assume 3' depth
3.0	Sewer Pipe Retrofit Allowance	1	LS	\$ 5,000	\$ 5,000	Steel Pipe Casing, etc. to reinforce pipe for truck crossing
4.0	Road Easement	1	LS	\$ 5,000	\$ 5,000	
5.0	15' Manual Single Leaf Swing Barrier Gate Arm	1	EA	\$ 5,000	\$ 5,000	Assume 8 hours labor + \$2,800 for material
6.0	Miscellaneous Signage	1	LS	\$ 500	\$ 500	
Materials & Labor Subtotal					\$ 33,750	
Total Capital Cost					\$33,750	
	Taxes @	10.25%		\$ 2,000		Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits @	10%		\$ 4,000		
	Contractor Overhead & Profit @	15%		\$ 6,000		
	Bonds and Insurance @	2.5%		\$ 1,000		
	Escalation to mid-point of Construction @	6.0%		\$ 8,000		Assume 2 yrs
	Estimate Contingency @	30%		\$ 16,000		
Subtotal w/ Contractor Markups and Contingency					\$70,800	All values are subtotaed
	Engineering	25%		\$ 18,000		
	Construction Management	25%		\$ 18,000		
Total					\$107,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Infrastructure: Diverter Valve Upgrades
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item			Total Costs Total Capital Cost	
No.	Description	Qty	Units	\$/Unit \$/Unit
Capital Costs				
1.0	Traffic Control Allowance	1	LS	\$ 500 \$ 500
2.0	Install Uninterruptible Power Supply	1	EA	\$ 5,000 \$ 5,000
3.0	Install Fence			
3.1	10'-Tall Chain-Link Fence	40	LF	\$ 80 \$ 3,200
3.2	10' x 20' Double Door Swing Gate	1	LS	\$ 3,500 \$ 3,500
4.0	Install Lighting			
4.1	10' Light Pole Kit with Single LED Area Light	1	EA	\$ 1,500 \$ 1,500
Materials & Labor Subtotal				\$ 13,700
				Total Capital Cost \$13,700
	Taxes @ 10.25%			\$ 1,000
	Mobilization/Demobilization/Permits @ 10%			\$ 1,000
	Contractor Overhead & Profit @ 15%			\$ 2,000
	Bonds and Insurance @ 2.5%			\$ -
	Escalation to mid-point of Construction @ 6.0%			\$ 3,000
	Estimate Contingency @ 30%			\$ 6,000
Subtotal w/ Contractor Markup and Contingency				\$26,700
				All values are subtotaled
	Engineering 25%			\$ 7,000
	Construction Management 25%			\$ 7,000
Total				\$41,000

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Non-Infrastructure: Rosemont, Briggs Crossings Condition Assessment
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item				Total Costs		Notes/Source
No.	Description	Qty	Units	\$/Unit	Total Capital Cost	
Capital Costs						
1.0	Bypass Pumping	2	LS	\$ 3,750	\$ 7,500	Assume 10% of CCTV. Assume 1 week of bypass pumping per crossing. Assume 2 months of traffic control; Signage, cones, option for flaggers Based on consultant quote. For both Rosemont and Briggs crossings.
2.0	Traffic Control Allowance	2	LS	\$ 2,500	\$ 5,000	
3.0	Pit Excavation	2	LS	\$ 40,000	\$ 80,000	
4.0	Consultant CCTV Inspection	2	LS	\$ 18,750	\$ 37,500	CCTV of 500 LF of sewer and exploratory CCTV (borescope) of the void between the pipe and casing; for both Rosemont and Briggs crossings.

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Non-Infrastructure: Smart Cover Installation
 Estimate: Class 5 - Concept Screening

Prepared By: CE
 Date Prepared: Feb-2024
 K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs Total Capital Cost		Notes/Source
				\$/Unit		
Capital Costs						
1.0	Smart Cover Installation	5	EA	\$ 5,190	\$ 25,950	
	Materials & Labor Subtotal				\$ 25,950	
	Total Capital Cost				\$25,950	
	Taxes	@	10.25%		\$ 1,000	Assumed 50% of cost is materials
	Mobilization/Demobilization/Permits	@	10%		\$ 3,000	
	Contractor Overhead & Profit	@	15%		\$ 4,000	
Total					\$34,000	

Engineers Opinion of Probable Cost
CVWD CIP Projects



Project: Non-Infrastructure: Interceptor Items
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item				Total Costs		Notes/Source
No.	Description	Qty	Units	\$/Unit	Total Capital Cost	
Capital Costs						
1.0	Yearly Emergency Response Training for Interceptor Break	64	Equiv. Hours	\$ 35.28	\$ 3,000	For 4 operators, 2 days training per year. Based on FY2023-2024 Pay Schedule for Operations and Maintenance Worker III, Step 1.
	Materials & Labor Subtotal				\$ 3,000	
Total					\$ 3,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Non-Infrastructure: Monitoring Method for Canalda Tank Discharge (EMA 7)
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs		Notes/Source
				\$/Unit	Total Capital Cost	
Capital Costs						
1.0	Flow Meter Operation and Maintenance	3	Equiv. Months	\$ 787	\$ 2,361	For 1 flow meter for 3 months. Based on vendor quote.
2.0	Data Analysis and Reporting	3	Equiv. Months	\$ 400	\$ 1,200	For 1 flow meter for 3 months. Based on vendor quote.
	Materials & Labor Subtotal				\$ 3,561	
	Total Capital Cost				\$3,561	
	Taxes	@	10.25%		\$ 200	Assumed 50% of cost is materials
Total					\$4,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Non-Infrastructure: Targeted Flow Monitoring for Sewersheds 1, 2, 3
Estimate: Class 5 - Concept Screening

Prepared By: CE
Date Prepared: Feb-2024
K/J Proj. No. 2244508*00

Item				Total Costs		Notes/Source
No.	Description	Qty	Units	\$/Unit	Total Capital Cost	
Capital Costs						
1.0	Flow Meter Operation and Maintenance	9	Equiv. Months	\$ 787	\$ 7,083	For 3 flow meters, for 3 months/year. Based on vendor quote.
2.0	Data Analysis and Reporting	9	Equiv. Months	\$ 400	\$ 3,600	For 3 flow meters, for 3 months/year. Based on vendor quote.
	Materials & Labor Subtotal				\$ 10,683	
	Total Capital Cost				\$10,683	
	Taxes	@	10.25%	\$ 1,000		Assumed 50% of cost is materials
Total					\$12,000	

Engineers Opinion of Probable Cost CVWD CIP Projects



Project: Non-Infrastructure: Work Order Database w/ Pipe & MH Condition Ratings Data **Prepared By:** CE
Estimate: Class 5 - Concept Screening **Date Prepared:** Feb-2024
K/J Proj. No. 2244508*00

Item No.	Description	Qty	Units	Total Costs Total Capital		Notes/Source
				\$/Unit	Cost	
Capital Costs						
1.0	Work Order Database Labor	104	Equiv. Hours	\$ 58.87	\$ 6,122	For 2 hours of labor per week for 1 year. Based on FY2023-2024 Pay Schedule for Operations and Maintenance Manager (Median).
	Materials & Labor Subtotal				\$ 6,122	
	Estimate Contingency	@	30%		\$ 1,837	
Total					\$ 8,000	

35 N. Lake Avenue
Suite 550, Pasadena, CA 91101

Paul Chau, PE
(626) 568-4311