Appendix J
City of Santa Clara Sewer Capacity Assessment

Appendix J

City of Santa Clara Sanitary Sewer Capacity Assessment

May 2007

Prepared by:

RMC Water and Environment

FINAL REPORT

RMC
Water and Environment

Sacramento
San Diego
San Francisco
San Jose
Santa Monica
Walnut Creek

May 31, 2007

Mr. Rajeev Batra
City Engineer
City of Santa Clara Engineering Department
1500 Warburton Avenue
Santa Clara, CA 95050

Subject: Sanitary Sewer Capacity Assessment

Dear Mr. Batra:

RMC Water and Environment is pleased to submit this Final Report on the Sanitary Sewer Capacity Assessment for the City of Santa Clara. The report reflects the collaborative efforts of the RMC team and dedicated staff of the City's Public Works Engineering Department and Water and Sewer Utilities to prepare a comprehensive assessment of the capacity needs of the City's trunk sewer system.

The Capacity Assessment has been based on a detailed study methodology encompassing use of sewer flow monitoring, water use, and land use planning data, coupled with state-of-the-art hydraulic modeling, to identify the future capacity requirements of the City's sanitary sewer system and develop recommended capacity improvement projects. The study also complies with Regional and State regulatory requirements for all collection system agencies to prepare Sewer System Management Plans addressing the operation, maintenance, and management of their systems.

The Capacity Assessment report identifies nine capacity improvement projects in the trunk sewer system, totaling about $20 million in capital costs, that will enable the City to maintain its high level of service to the community and provide adequate capacity to serve proposed future development and redevelopment. The report also includes recommendations and guidelines for implementing the recommended capital improvement program and continuing to track the flows and capacity of the system. The hydraulic model of the trunk sewer system developed for this study will allow the City to update the capacity assessment as changes occur over time.

We appreciate the opportunity to have worked with the City on this very challenging project. We would like to thank you for your oversight and direction of this effort, for the guidance and dedication of the City's Project Manager, Falguni Amin, and for the input and assistance provided by many other City staff members on this Capacity Assessment project.

Sincerely,

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Project Manager

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City of Santa Clara
Sanitary Sewer Capacity Assessment
Final Report

Prepared by:

RMC
Water and Environment

May 2007

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Acknowledgements

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List of Abbreviations and Definitions

ADWF	Average dry weather flow: the average flow during dry (non-rainfall) periods
APN	Assessor parcel number
CIP	Capital Improvement Program
City	City of Santa Clara
CSJ	City of San Jose
CuSD	Cupertino Sanitary District
d/D	Ratio of flow depth to pipe diameter
DU	Dwelling unit
DWF	Dry weather flow: the flow during non-rainfall periods, composed of normal sanitary flow contributions from residential, commercial, institutional, and industrial users of a sewer system plus any dry season groundwater infiltration.
E2	E2 Consulting Engineers, Inc.
ECR	El Camino Real
ENR-CCI	Engineering News Record Construction Cost Index: an index published monthly by Engineering News Record magazine and used to reference construction costs (such as those for wastewater system facilities) to a specific date and location.
FAR	Floor-area-ratio: the ratio of building floor space to total parcel area
GIS	Geographic Information System: a computerized system in which geographical features (e.g., sewer facilities, parcels, land use) are linked to an attribute database to facilitate analysis and presentation of information.
gpad or gpd/ac	Gallons per day per acre
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
GWI	Groundwater infiltration: extraneous water that infiltrates a sewer system from the ground through defective pipes and manholes. Groundwater is considered to be a relatively constant daily flow that varies seasonally and depends on location of sewers with respect to the groundwater table.

IDF	Intensity-duration-frequency: rainfall statistics that establish the rainfall intensity over specified durations for various recurrence frequencies
I/I	Infiltration/inflow: extraneous groundwater and/or storm water that enter a sanitary sewer system.
K	Recession coefficient of RDI/I unit hydrograph
lf	Linear feet
mgd	Million gallons per day
PDWF	Peak dry weather flow: the peak flow during non-rainfall periods
PS	Pump Station
PWWF	Peak wet weather flow: the peak flow during a given storm event from dry weather flow plus infiltration and inflow.
R	Ratio of RDI/I volume to rainfall volume
R&D	Research and Development
RDI/I	Rainfall-dependent infiltration/inflow: the infiltration and inflow into a sewer system directly related to a rainfall event. RDI/I may cause rapid, short-term peak flows in the sewer system that recede after the rainfall has ended.
RG	Rain gauge
Regional Board	Regional Water Quality Control Board: a division of the State Water Resources Control Board that administers wastewater discharge permits in a specific region of California. The City of Santa Clara falls under the jurisdiction of the San Francisco Bay Regional Board.
RMC	RMC Water and Environment
SJ/SC WPCP	San Jose/Santa Clara Water Pollution Control Plant
SSMP	Sewer System Management Plan
State Board	State Water Resources Control Board
Surcharge	The hydraulic condition in a sewer pipeline in which the elevation of the hydraulic gradeline (water level) is above the crown (top) of the pipe. Under such a condition, the water in the pipe rises into the manholes and could overflow onto the ground if the hydraulic gradeline exceeds the elevation of the manhole rims.
T	Time to peak of RDI/I unit hydrograph

Executive Summary

Executive Summary

This report summarizes the results and recommendations of the Sanitary Sewer System Capacity Assessment for the City of Santa Clara (City). The Capacity Assessment was prepared by RMC Water and Environment (RMC) in close coordination with City staff. The Capacity Assessment will be used to guide improvements to the City's sanitary sewer system to accommodate current and future development to ensure that the City continues to maintain a high level of service to its customers.

Background and Purpose of Capacity Assessment

The City of Santa Clara is located in central Santa Clara County adjacent to the Cities of San Jose, Cupertino, and Sunnyvale. The City has a population of approximately 110,000 and is served by a wastewater collection system consisting of approximately 270 miles of sewer pipelines and six sewage pump stations. The collection system conveys wastewater flows to the San Jose/Santa Clara Water Pollution Control Plant (SJ/SC WPCP), located north of Highway 237 in San Jose. The City also receives flow from the Cupertino Sanitary District (CuSD) at Homestead Road under an agreement with the City executed in 1985. The City's sewer system and service area are shown in **Figure ES-1**.

The City is experiencing significant growth and redevelopment, necessitating an evaluation of the capacity of the sanitary sewer system to handle future wastewater flows. This evaluation will help identify future capital needs for capacity improvements and associated requirements for financing those improvements through increased connection fees or other sources of funding.

Furthermore, the City is also required to complete a capacity evaluation and capacity assurance plan as part of preparing its Sewer System Management Plan (SSMP). The SSMP addresses the overall management, operation, and maintenance of the sanitary sewer system and is required for all sewer system agencies by the Regional Water Quality Control Board, as well as under the Statewide General Waste Discharge Requirements adopted in 2006 by the State Water Resources Control Board.

The overall objectives of this Capacity Assessment study are to develop wastewater flow projections for the City's collection area using up-to-date water use and land use information; develop a hydraulic model of the trunk sewer system; use the model to identify capacity deficiencies in the existing system and future capacity requirements; and develop a phased Capital Improvement Program, including budget estimates, for implementing the required capacity improvements to the sanitary sewer system.

This Executive Summary is presented in two parts:

- ***How the Capacity Assessment was Prepared*** describes the scope and methodologies of the planning effort, including the key planning and technical assumptions incorporated into the sewer system capacity analysis.

- ***Recommended Capacity Improvement Program*** presents the recommended Capital Improvement Program (CIP), including capacity improvement projects, priorities, and estimated costs. In addition, recommendations are presented for implementing the proposed capacity improvement program.

How the Capacity Assessment Was Prepared

The City's wastewater collection system includes sewer pipelines ranging in size from 4 to 48 inches in diameter. The larger pipes, primarily the 15-inch and larger sewers and a portion of the smaller diameter pipes, comprise the trunk sewer system, which is the primary network for conveying flows generated from the City's service area to the SJ/SC WPCP. The trunk sewer system was the focus of the capacity assessment in this study.

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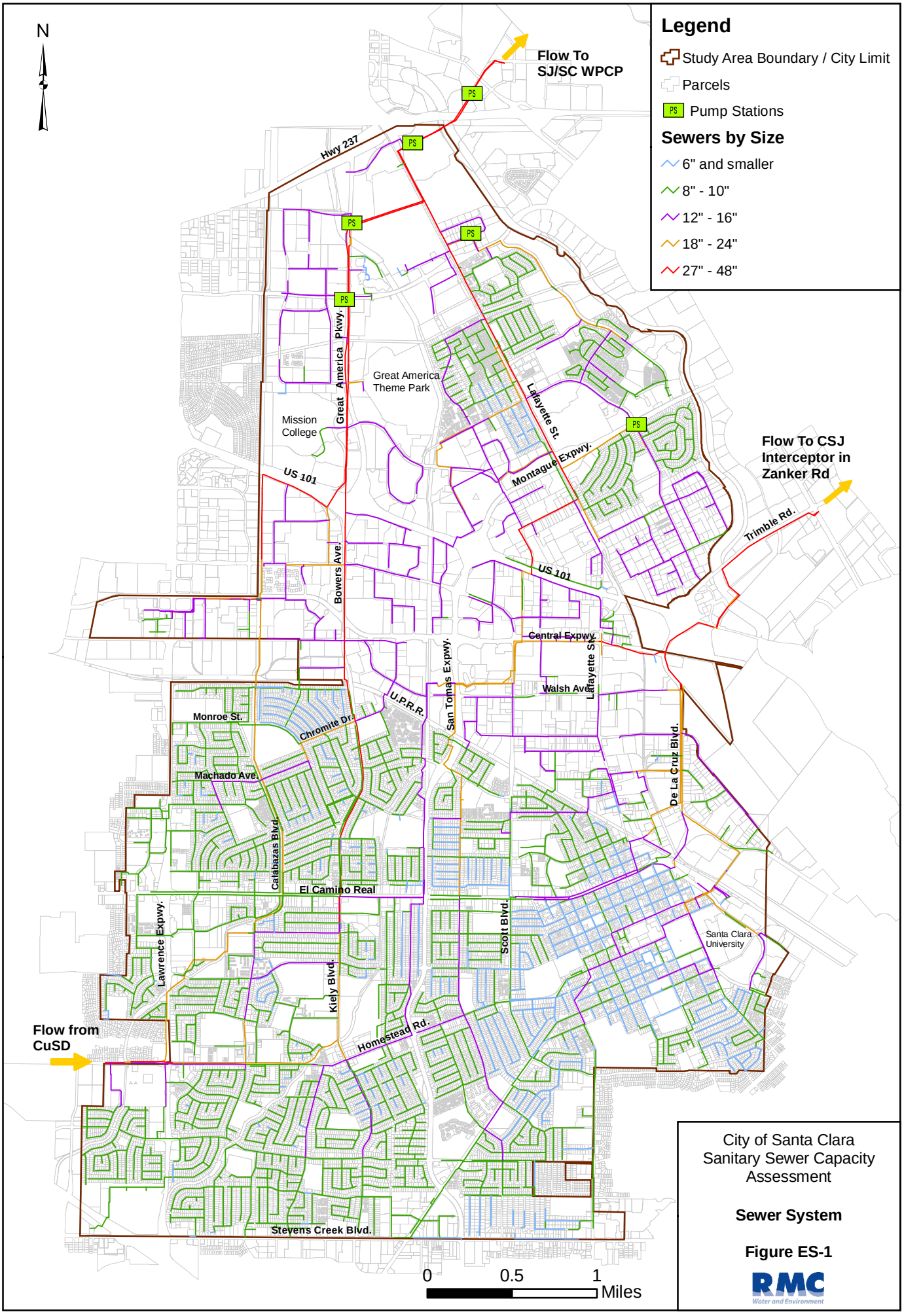
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Study Area Boundary / City Limit
Parcels
Pump Stations
Sewers by Size
6" and smaller
8" - 10"
12" - 16"
18" - 24"
27" - 48"
Flow To SJ/SC WPCP
Flow To CSJ Interceptor in Zanker Rd
Flow from CuSD
PS
Hwy 237
US 101
Great America Pkwy.
Great America Theme Park
Mission College
Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
Central Expwy.
San Tomas Expwy.
Walsh Ave.
U.P.R.R.
Monroe St.
Chromite Dr.
Machado Ave.
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Lawrence Expwy.
Kiely Blvd.
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De La Cruz Blvd.
Santa Clara University
Homestead Rd.
Stevens Creek Blvd.
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Miles
City of Santa Clara
Sanitary Sewer Capacity Assessment
Sewer System
Figure ES-1
RMC
Water and Environment

The project team used a systematic process that incorporated land use planning information, water use and flow monitoring data, and design criteria for estimating wastewater flows into a computer hydraulic model of the trunk sewer system. The modeled system is shown in **Figure ES-2**. The model was used to assess how the system would perform under various planning scenarios and identifies pipes that may not have sufficient capacity to convey the predicted flows under future conditions. Improvement projects were developed to provide the required capacity, the capital costs of the required projects were estimated, and the projects were prioritized based on the model results and anticipated timing of development.

Capacity Assessment Considers Existing and Future Planning Scenarios

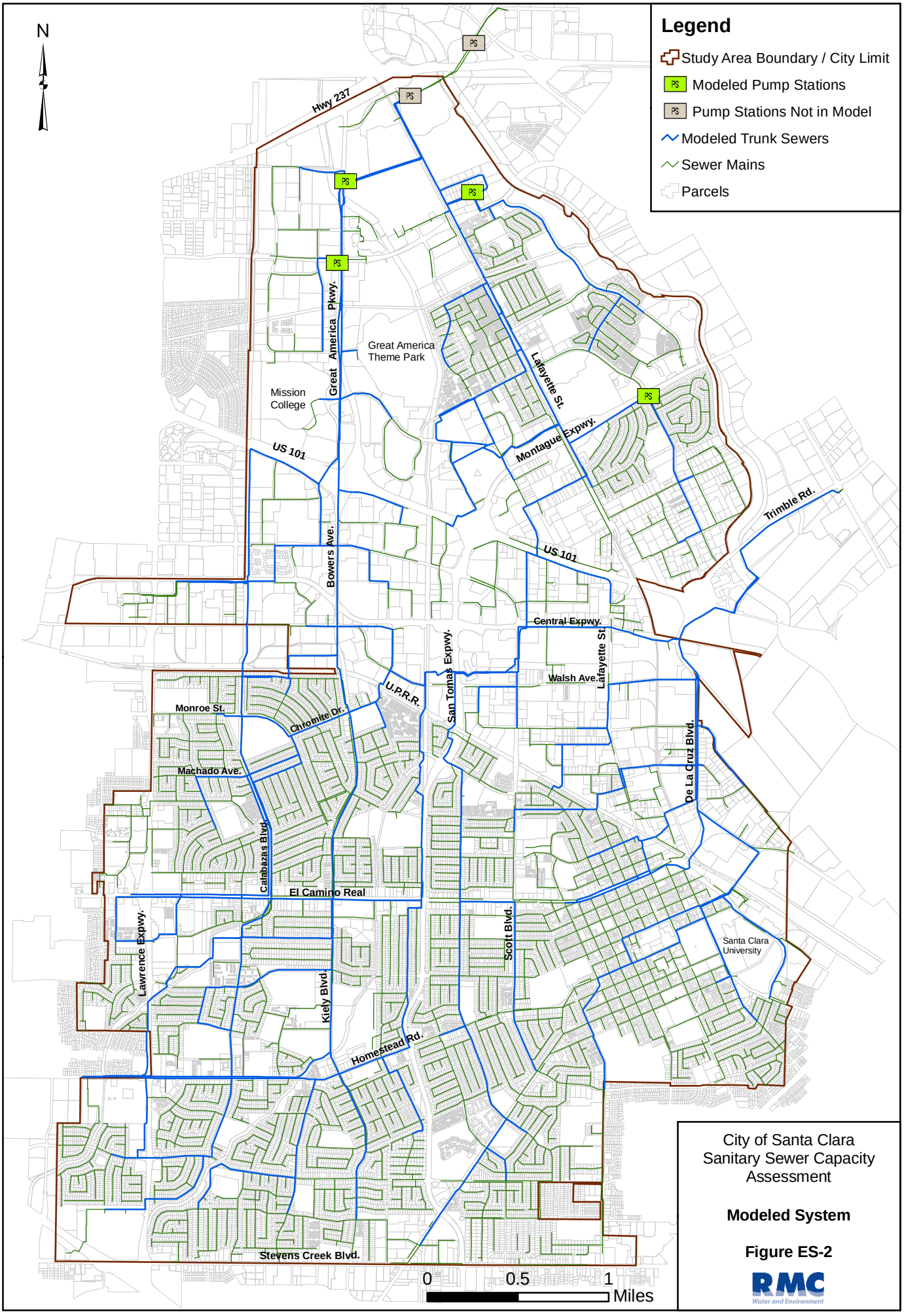
Two planning scenarios, defined based on planning information and discussions with the City's Planning Department staff, were evaluated for this study. The Existing Scenario examined the current capacity of the sewer system based on existing development and flow monitoring data collected in early 2006. The Future Scenario assumed construction of all currently planned major development and redevelopment projects in the City, as well as potential increased densities in mixed use and transit-oriented mixed use and commercial/office areas consistent with the City's 2010 General Plan and General Plan Update. **Figure ES-3** shows the location of these planned and recently constructed developments. Planned development and redevelopment represents over 10,000 new residential dwelling units and over 5 million square feet of new commercial and office space. The Future Scenario was used to examine the impact on the system of future increases in wastewater flows due to new development and redevelopment and determine the required sewer system capacity needed to serve that development.

Potential Capacity Deficiencies Were Identified for Future Flow Conditions

For each of the planning scenarios examined, projected dry and wet weather flows were simulated in the hydraulic model. The model was calibrated to actual flow monitoring data to ensure that it represents an accurate depiction of system conditions. For this study, a wet weather flow monitoring program consisting of 26 temporary flow meters installed in the system for a period of two months was used to calibrate the hydraulic model and verify existing system flows.

The model integrates various dry and wet weather flow parameters to determine system capacity under different flow and planning scenarios. Key flow components incorporated into the model included: base (dry weather) wastewater flow, estimated based on winter water use data; groundwater infiltration, which occurs when water seeps into pipes under the ground through cracks and pipe joints; and rainfall-induced infiltration and inflow (I/I) during storm events. For this Capacity Assessment, a 10-year recurrence frequency rainfall event was selected as the "design storm" to be consistent with the criteria used by the City of San Jose. The flow during a 10-year design storm represents a peak wet weather flow condition that would be expected to occur, on average, no more frequently than once every ten years.

Table ES-1 presents the estimated existing and future average dry weather flow (ADWF) and peak wet weather flow (PWWF) for a 10-year design storm for the City's sewer system developed based on the modeling conducted for this study.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Study Area Boundary / City Limit
Modeled Pump Stations
Pump Stations Not in Model
Modeled Trunk Sewers
Sewer Mains
Parcels
PS
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
US 101
Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
Central Expwy.
San Tomas Expwy.
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City of Santa Clara
Sanitary Sewer Capacity Assessment
Modeled System
Figure ES-2
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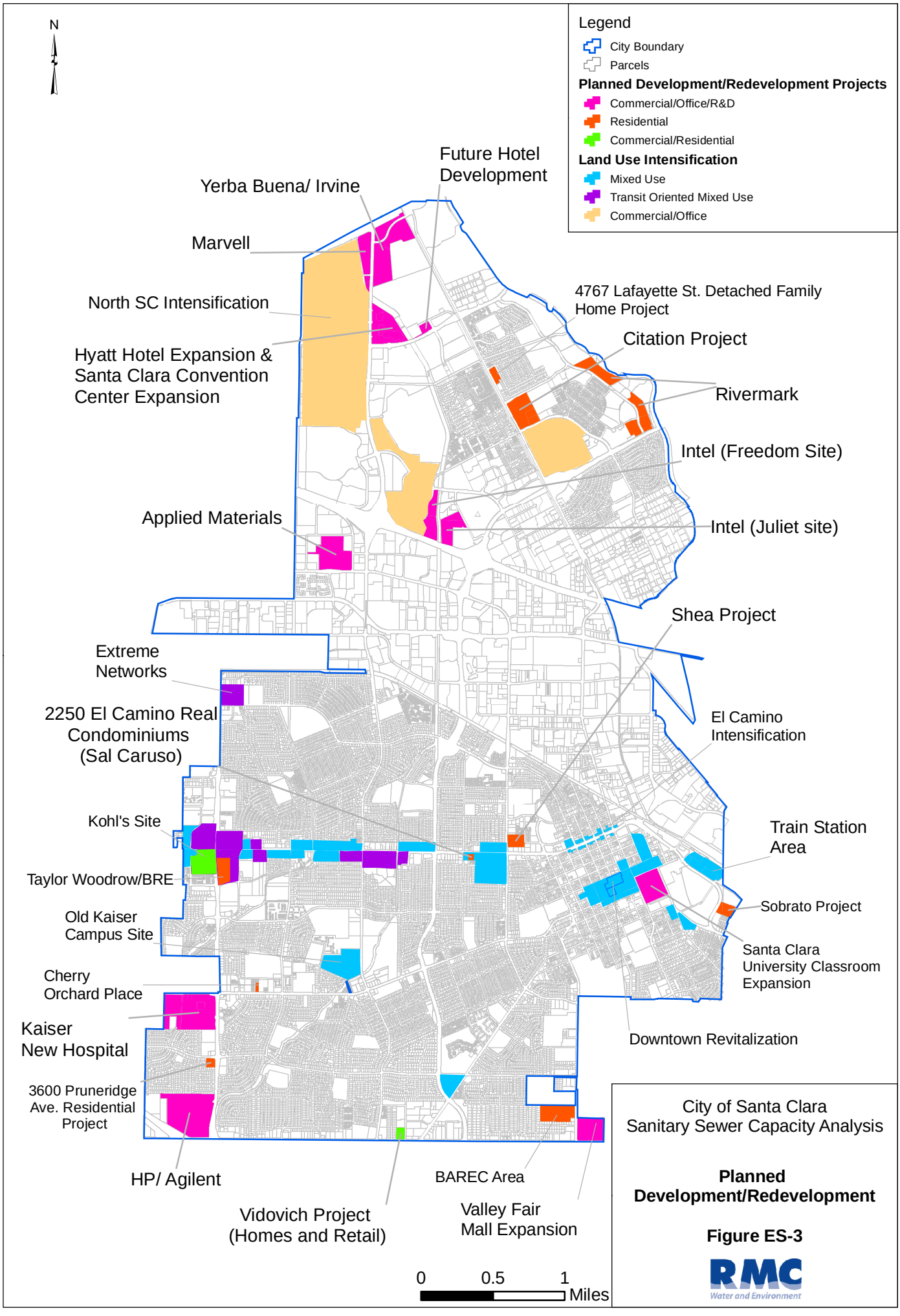
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City Boundary
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Planned Development/Redevelopment Projects
Commercial/Office/R&D
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Land Use Intensification
Mixed Use
Transit Oriented Mixed Use
Commercial/Office
Future Hotel Development
Yerba Buena/ Irvine
Marvell
North SC Intensification
Hyatt Hotel Expansion & Santa Clara Convention Center Expansion
4767 Lafayette St. Detached Family Home Project
Citation Project
Rivermark
Intel (Freedom Site)
Intel (Juliet site)
Applied Materials
Shea Project
Extreme Networks
2250 El Camino Real Condominiums (Sal Caruso)
El Camino Intensification
Kohl's Site
Train Station Area
Taylor Woodrow/BRE
Sobrato Project
Old Kaiser Campus Site
Santa Clara University Classroom Expansion
Cherry Orchard Place
Kaiser New Hospital
Downtown Revitalization
3600 Pruneridge Ave. Residential Project
HP/ Agilent
BAREC Area
Vidovich Project (Homes and Retail)
Valley Fair Mall Expansion
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City of Santa Clara
Sanitary Sewer Capacity Analysis
Planned Development/Redevelopment
Figure ES-3
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Table ES-1 Sewer System Flow Estimates

System Outfall	Existing Flow (mgd)		Future Flow (mgd)	
	ADWF	PWWF	ADWF	PWWF
North (to Northside and Rabello Pump Stations)	17.7	40.8	21.2	43.1[a]
East (to San Jose Trimble Road trunk sewer)	6.0	13.2	6.9	14.1
Total	**24**	**54**	**28**	**57**

(a) Assumes peak flow from Cupertino Sanitary District flow does not increase above its contracted maximum capacity of 13.8 mgd.

Model results were examined to determine trunk system capacity needs, as indicated by areas where the flow in the pipes would exceed their capacity and cause surcharge conditions (water levels higher than the tops of the pipes) under peak wet weather flows. **Figure ES-4** shows the existing trunk sewers that were determined by the modeling to have insufficient capacity to handle future flows.

The Proposed Improvement Projects Address the Potential Capacity Deficiencies

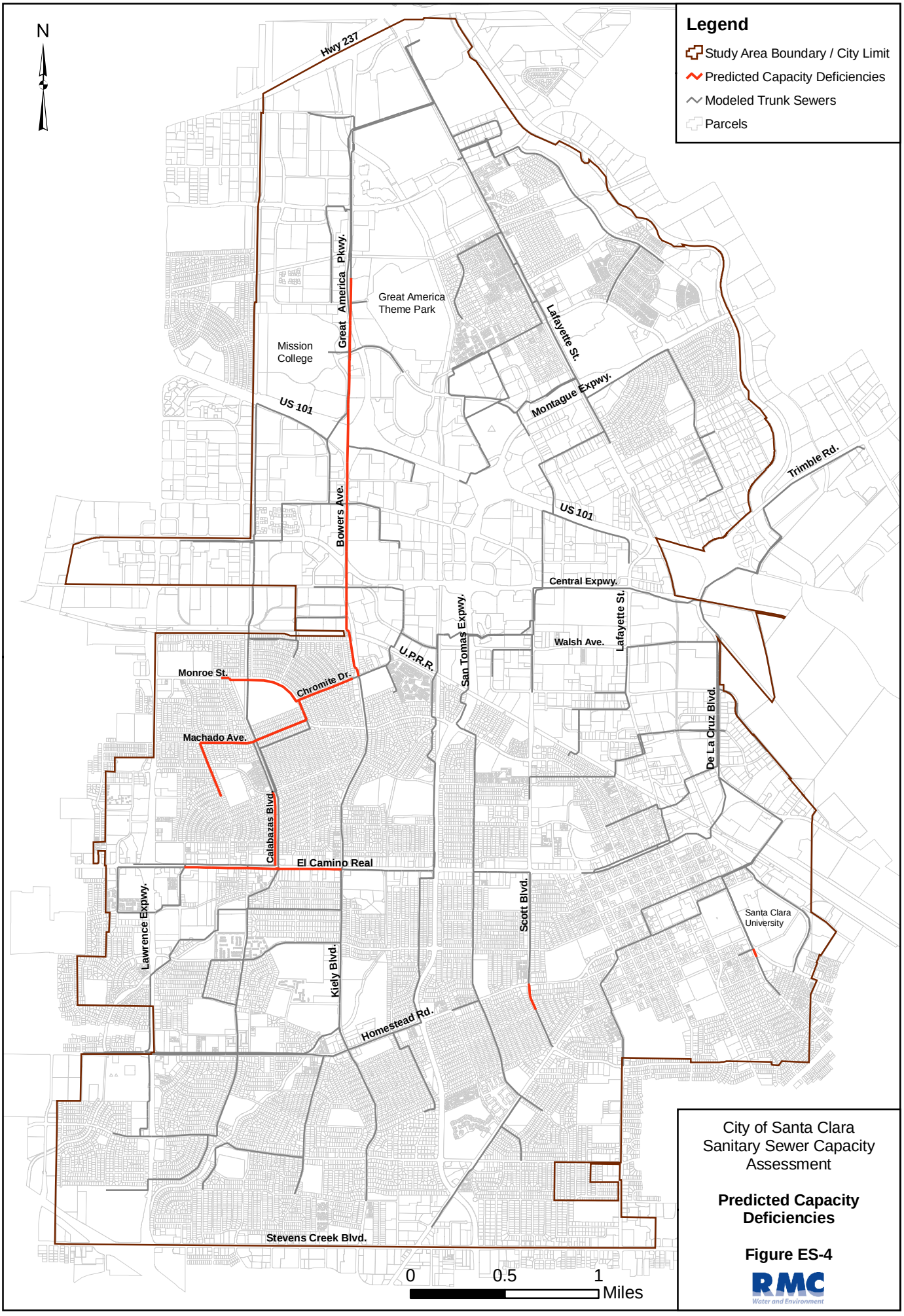
To address the capacity deficiencies identified through the modeling effort, three primary types of capacity relief alternatives were explored:

- Upsizing pipes (i.e., replacing existing pipes with larger ones)
- Construction of parallel pipes
- Flow diversions to other sewers with available capacity or to new sewer pipelines

Potential flow routing and capacity improvement alternatives were developed and tested, and proposed improvements were verified using the hydraulic model. Field visits were conducted to each proposed project site to identify site constraints and assess potential construction conditions, methods, and issues. Based on these analyses, recommended capacity improvement projects were developed.

Figure ES-5 and **Table ES-2** present the recommended capacity improvement projects. Note that the recommended plan reflects the construction of a new siphon crossing Calabazas Creek at El Camino Real, which is currently being designed as part of channel improvements being constructed by the Santa Clara Valley Water District (SCVWD). As part of that project, the City is coordinating with SCVWD to divert flows from the siphon outlet to the existing 24-inch Calabazas trunk sewer, thereby alleviating the predicted capacity deficiencies in El Camino Real east of Calabazas Creek and in the 8-inch sewer in the west side of Calabazas Boulevard north of El Camino Real.

The overall capacity improvement plan also shows a "West-to-East Trunk Alternative," which is an alternative to constructing a major relief trunk sewer in Bowers Avenue and Great America Parkway (Projects 1 and 2), two of the busiest roads in the City that already contain large diameter sewer pipelines. The West-to-East alternative would likely be easier to construct and could provide additional benefits, including greater system flexibility and potential reduction in costs for pumping flows that now are conveyed to the City's Rabello and Northside Pump Stations. However, more detailed alignment studies and constructability evaluations would be needed to reach a final decision on whether the Bowers/Great America Parkway relief sewer or West-to-East Trunk is the most viable alternative.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Study Area Boundary / City Limit
Predicted Capacity Deficiencies
Modeled Trunk Sewers
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Great America Pkwy.
Great America Theme Park
Mission College
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Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
US 101
Central Expwy.
San Tomas Expwy.
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Predicted Capacity Deficiencies
Figure ES-4
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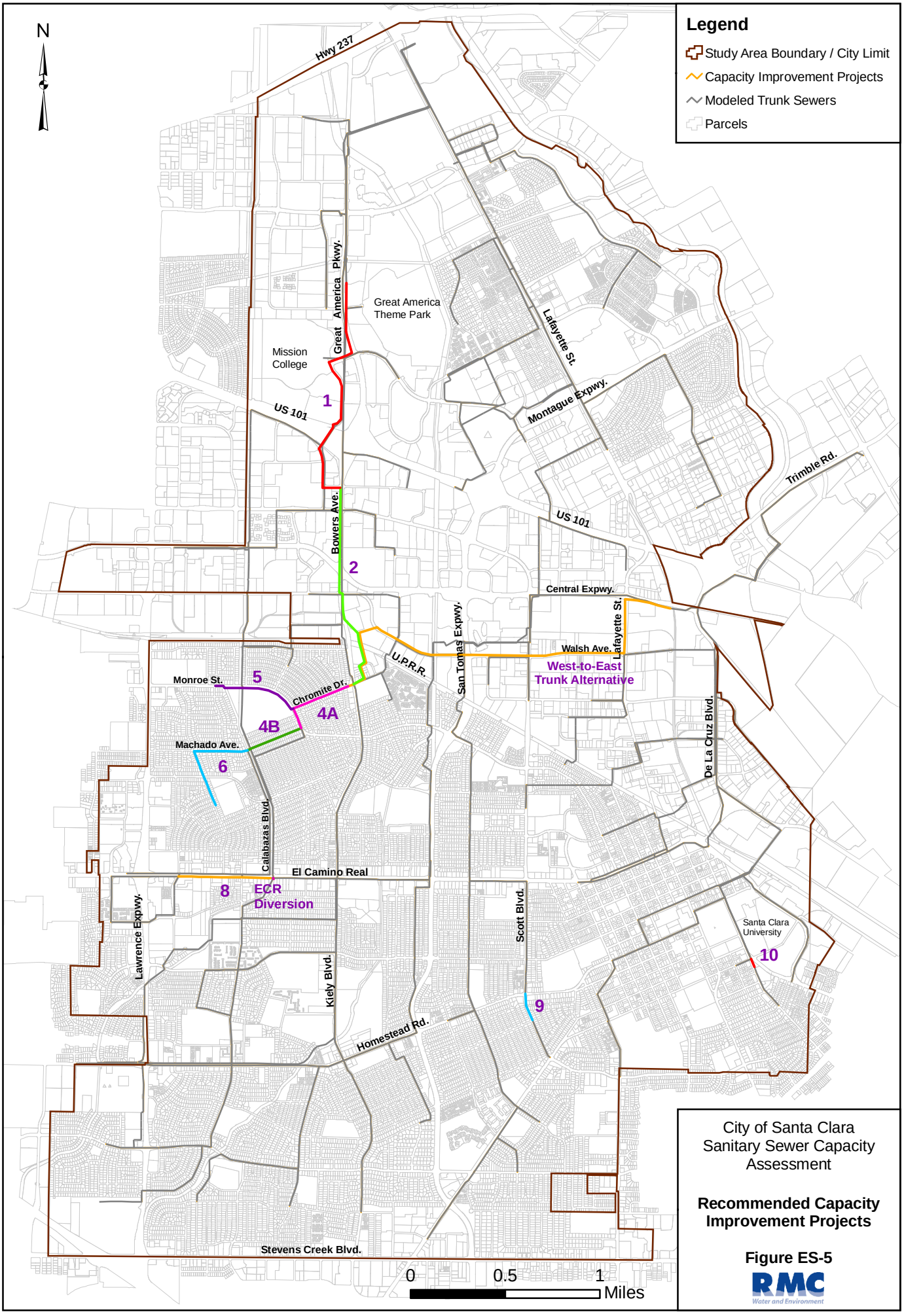
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Study Area Boundary / City Limit
Capacity Improvement Projects
Modeled Trunk Sewers
Parcels
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
US 101
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Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
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US 101
Central Expwy.
San Tomas Expwy.
U.P.R.R.
Walsh Ave.
Lafayette St.
West-to-East Trunk Alternative
Monroe St.
5
Chromite Dr.
4A
4B
Machado Ave.
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De La Cruz Blvd.
Calabazas Blvd.
El Camino Real
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ECR Diversion
Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Santa Clara University
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Stevens Creek Blvd.
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City of Santa Clara
Sanitary Sewer Capacity Assessment
Recommended Capacity Improvement Projects
Figure ES-5
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Table ES-2 Recommended Capacity Improvement Projects

Project No.[a]	Location	US MH	DS MH	Length (ft.)	Exist. Dia. (in.)	Req'd. Dia. (in.)[b]
1	Augustine Dr., Lakeside Dr., crossing of U.S. 101, Mission College Boulevard, Great America Pkwy. from Bowers Ave. to south of Hetch Hetchy ROW	S73-20	S93-57	7,200	33-36	21 (P)
2	Chromite Dr., Alhambra Dr., Bracher Park, crossing of UPRR, Bowers Ave. from Bowers Ave. to Augustine Dr.	S53-34	S73-20	6,200	27-33	21 (P)
West-to-East Trunk[c]	Chromite Dr., Alhambra Dr., Bracher Park, crossing of UPRR, Walsh Ave., Lafayette, Lafayette St., Central Expwy. From Bowers Dr. to UPRR	S53-41	S67-18	12,200	NA	24
4A	Monroe St. and Chromite Dr. from Machado Ave. to west of Bowers Ave.	S52-80	S53-41	2,200	18	24-27 (R)
4B	Machado Ave. from Calabazas Blvd. to Monroe St.	S52-103	S52-80	1,500	15	21 (R)
5	Monroe St. from Fordham Dr. to Chromite Dr.	S51-22	S52-65	2,500	10 8(siphon)	12 (R) 8(siphon) (P)
6	Nobili Ave. and Machado Ave. from Flora Vista Ave. to Calabazas Blvd.	S41-53	S52-101	3,100	10-15	15-18 (R)
8	El Camino Real from Flora Vista Ave. to Calabazas Blvd.	S41-113	S32-5	2,600	10	12-15 (R)
9	Scott Blvd. from Serra Ave. to Homestead Rd.	S25-37	S35-98	800	8	10 (R)
10	Park Ave. south of Bellomy St.	S38-75	S38-66	250	10	12 (R)

(a) Note: there are no projects 3 and 7.
(b) P = parallel sewer; R = remove and replace
(c) Alternative to Projects 1 and 2.

Recommended Capacity Improvement Program

The Capital Improvement Program (CIP) recommended in this study is designed to provide for adequate sewer system capacity for the City's existing and anticipated future development. The total estimated capital cost of the CIP is approximately $20 million, as shown in **Table ES-3**. These costs include baseline construction costs for gravity trunk sewers using open-cut and trenchless (e.g., microtunneling) methods, costs for lower lateral replacement for remove-and-replace projects, costs for major sewer junction and siphon structures, and costs allowances for project mobilization/demobilization, traffic control, bypass pumping and delay factors for remove-and-replace projects, extra dewatering requirements in areas of high groundwater, and acquisition of temporary and permanent easements if needed. The total estimated capital costs also include a 30 percent allowance for contingencies for unknown conditions and an allowance of 25 to 35 percent of construction cost (depending on project size) for engineering, administration, and legal costs. The estimated costs are considered planning or conceptual level estimates and are considered to have an estimated accuracy range of -30 to +50 percent.

The recommended projects were divided into the two priority groups based on the relative magnitude of predicted capacity deficiencies, as well as the likely timing of developments that may impact the need for the projects. The priority groups are also shown in Table ES-3.

Table ES-3 Project Costs and Priority Groups

Project No.	Estimated Construction Cost ($)	Estimated Capital Cost ($)
Priority Group 1		
2	5,286,000	7,324,000
4A	1,489,000	1,861,000
8	945,000	1,276,000
Subtotal	***7,720,000***	***10,461,000***
Priority Group 2		
1	4,539,000	5,674,000
4B	1,060,000	1,325,000
5	1,046,000	1,308,000
6	1,139,000	1,424,000
9	256,000	346,000
10	77,000	104,000
Subtotal	***8,117,000***	***10,181,000***
Total	**15,837,000**	**20,642,000**
West-to-East Alternative[a]	9,752,000	12,906,000
Total w/West-to-East Alternative	**15,764,000**	**20,550,000**

(a) Would replace Projects 1 and 2 and be included in Priority Group 1.

A preliminary schedule for completion of the recommended CIP projects over a five-year period was developed based on the project priorities. **Figure ES-6** shows a preliminary schedule for the recommended five-year CIP. Two schedules are provided to reflect the two major alternatives. However, the schedules also provide for a preliminary alignment study of both the Bowers/Great America Parkway and the West-to-East trunk alternatives. Note also that the schedule could be compressed to achieve greater economy of scale and potential cost savings by combining individual projects and/or using alternative bid schedules.

Implementation Recommendations

The City should begin implementation of the Capital Improvement Program recommended in this Sanitary Sewer Capacity Assessment, starting with the highest priority projects. The following items should be considered in project scheduling and design, and in future updates of the Capacity Assessment.

- The alignments and sizes of all recommended projects should be verified with detailed predesign analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews.

- The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.

- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Capacity Assessment in the future. The model should be kept up-to-date with any changes to existing sewer connections, development plans, and sewer system facilities.

Figure ES-6 Proposed CIP Schedule

With Projects 1 and 2

Project	Year 1	Year 2	Year 3	Year 4	Year 5
Alignment Study					
Project 8					
Project 4A					
Project 2					
Project 1					
Project 4B					
Projects 5&6					
Projects 9&10					

With West-to-East Trunk Alternative

Project	Year 1	Year 2	Year 3	Year 4	Year 5
Alignment Study					
Project 8					
Project 4A					
West-to-East Trunk					
Project 4B					
Projects 5&6					
Projects 9&10					

Planning
Design
Bid and Award
Construction

- The City should periodically calibrate its permanent flow meters at the Northside and Rabello Pump Stations and on the Trimble Road trunk sewer to ensure that accurate flow information is available to track the changes in the flows in the City's system over time.
- The City should conduct additional flow monitoring at key locations in the sewer system, particularly the area tributary to the Chromite/Machado trunk sewers where the 2006 flow monitoring indicated high I/I flows. Flow levels during large storm events should be compared to the peak flows simulated by the hydraulic model to verify the modeling predictions for the 10-year design storm and confirm the need for and sizing of Projects 4A, 4B, 5, and 6.
- The City should consider additional field investigations, including smoke testing, and manhole and pipeline television inspection, in this area to identify potential sources of I/I and possible opportunities for I/I reduction.
- The City should coordinate with the Cupertino Sanitary District on flow and planning assumptions to ensure that adequate capacity exists in the Santa Clara system to handle future flows from CuSD. The City should encourage CuSD to verify the calibration of its flow meter at Homestead Road and confirm its projections of future wastewater flows entering the Santa Clara system.
- The City should coordinate with the City of San Jose to ensure that its flow criteria and planning assumptions are consistent with those used by San Jose in its capacity master planning.
- The City should assess its connection fees and evaluate financial alternatives to fund the recommended capacity assessment CIP.

This Sanitary Sewer Capacity Assessment report is intended to be a working document to be refined and updated as additional data and new planning information becomes available. The Capacity Assessment should be updated whenever there are major changes in planning assumptions or, at a minimum, every five years.

Chapter 1

Introduction

Chapter 1 Introduction

This report presents the results and recommendations of the Sanitary Sewer Capacity Assessment for the City of Santa Clara (City). The report was prepared by RMC Water and Environment (RMC).

1.1 Background and Study Objectives

The City of Santa Clara is located in central Santa Clara County and is bounded by the City of San Jose on the north, east and south, the City of Cupertino on the southwest, and the City of Sunnyvale on the west. As shown in **Figure 1-1**, the capacity assessment study area compromises the area within the Santa Clara city limits.

The City is experiencing significant growth and redevelopment, necessitating an evaluation of the capacity of the sanitary sewer system to handle future wastewater flows. This evaluation will help identify future capital needs for capacity improvements and associated requirements for financing those improvements through increased connection fees or other sources of funding.

Furthermore, the City is also required to complete a capacity evaluation and capacity assurance plan as part of preparing its Sewer System Management Plan (SSMP). The SSMP addresses the overall management, operation, and maintenance of the sanitary sewer system and is required for all sewer system agencies by the Regional Water Quality Control Board (Regional Board), as well as under the Statewide General Waste Discharge Requirements adopted in 2006 by the State Water Resources Control Board (State Board).

The overall objectives of this Capacity Assessment study are to develop wastewater flow projections for the City's collection area using up-to-date water use and land use information; develop a hydraulic model of the trunk sewer system; use the model to identify existing capacity deficiencies and future capacity requirements; and develop a phased Capital Improvement Program, including budget estimates, for implementing the required capacity improvements to the wastewater collection system.

1.2 Wastewater Collection System

The City's wastewater collection system includes approximately 270 miles of sewer pipelines ranging from 4 to 48 inches in diameter, and six sewage pump stations. Flow from Cupertino Sanitary District enters the City's sewer system at Homestead Road. The collection system conveys wastewater to the San Jose/Santa Clara Water Pollution Control Plant (SJ/SC WPCP), located north of Highway 237 in San Jose. The City of Santa Clara collection system is shown in **Figure 1-2**.

1.3 Scope of Study

RMC was authorized by the City to provide engineering consulting services for the Sanitary Sewer Flow Monitoring Program and Sanitary Sewer Capacity Assessment under an Agreement with the City dated December 13, 2005, and amended March 21, 2006.

The scope of the Capacity Assessment, as well as a brief discussion of work conducted under each task, is described below.

- **Task 1 – Project Management and Quality Control.** Periodic progress meetings were held with the City staff to review project status and discuss project issues, and monthly status reports were prepared to document the work completed. Quality control was carried out, including checking of data and calculations, as well as senior review of proposed criteria, recommendations, and project deliverables.

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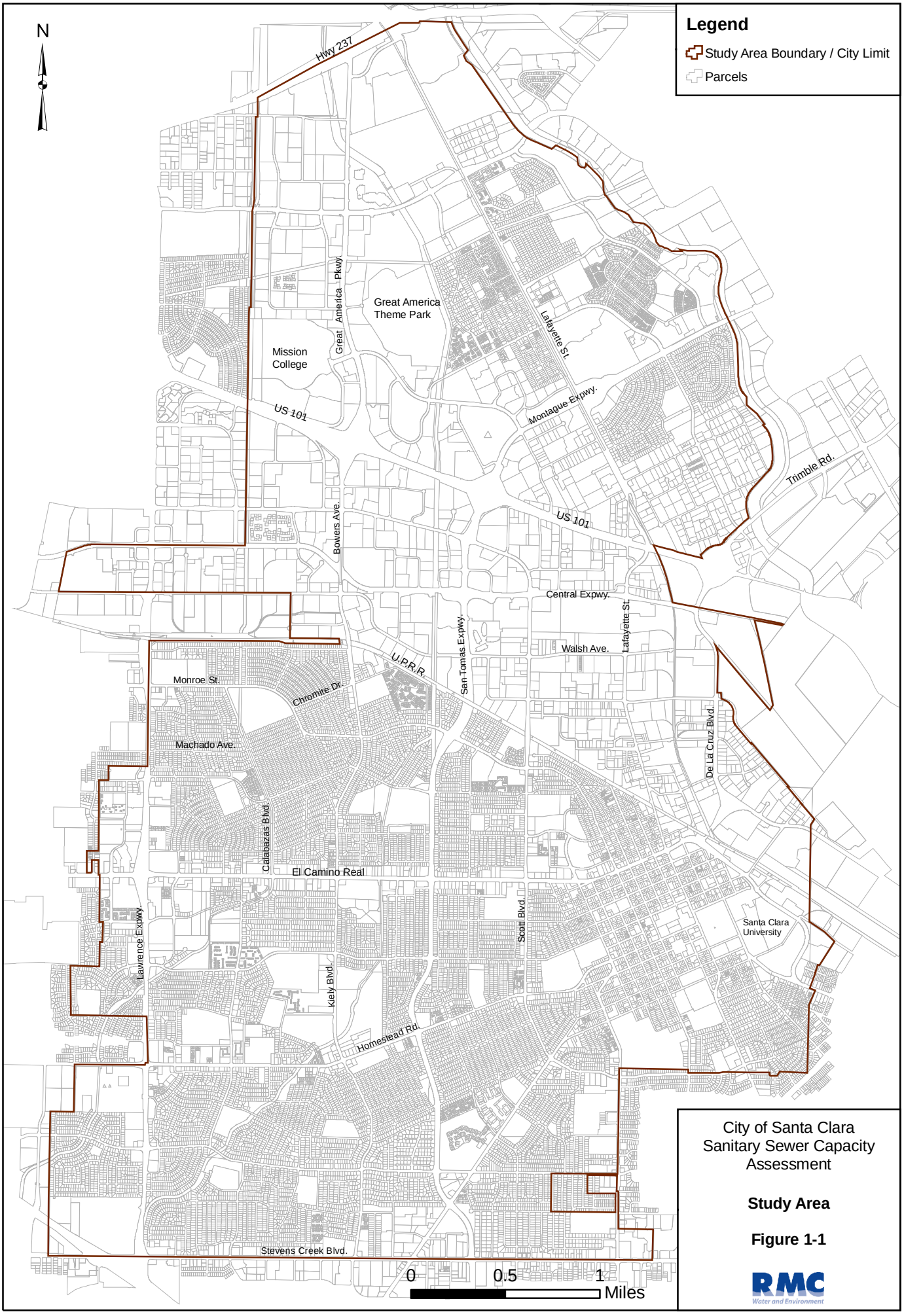
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Legend
Study Area Boundary / City Limit
Parcels
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
US 101
Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
US 101
Central Expwy.
Lafayette St.
Walsh Ave.
U.P.R.R.
San Tomas Expwy.
Monroe St.
Chromite Dr.
Machado Ave.
De La Cruz Blvd.
Calabazas Blvd.
El Camino Real
Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Santa Clara University
Homestead Rd.
Stevens Creek Blvd.
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Miles
City of Santa Clara
Sanitary Sewer Capacity Assessment
Study Area
Figure 1-1
RMC
Water and Environment

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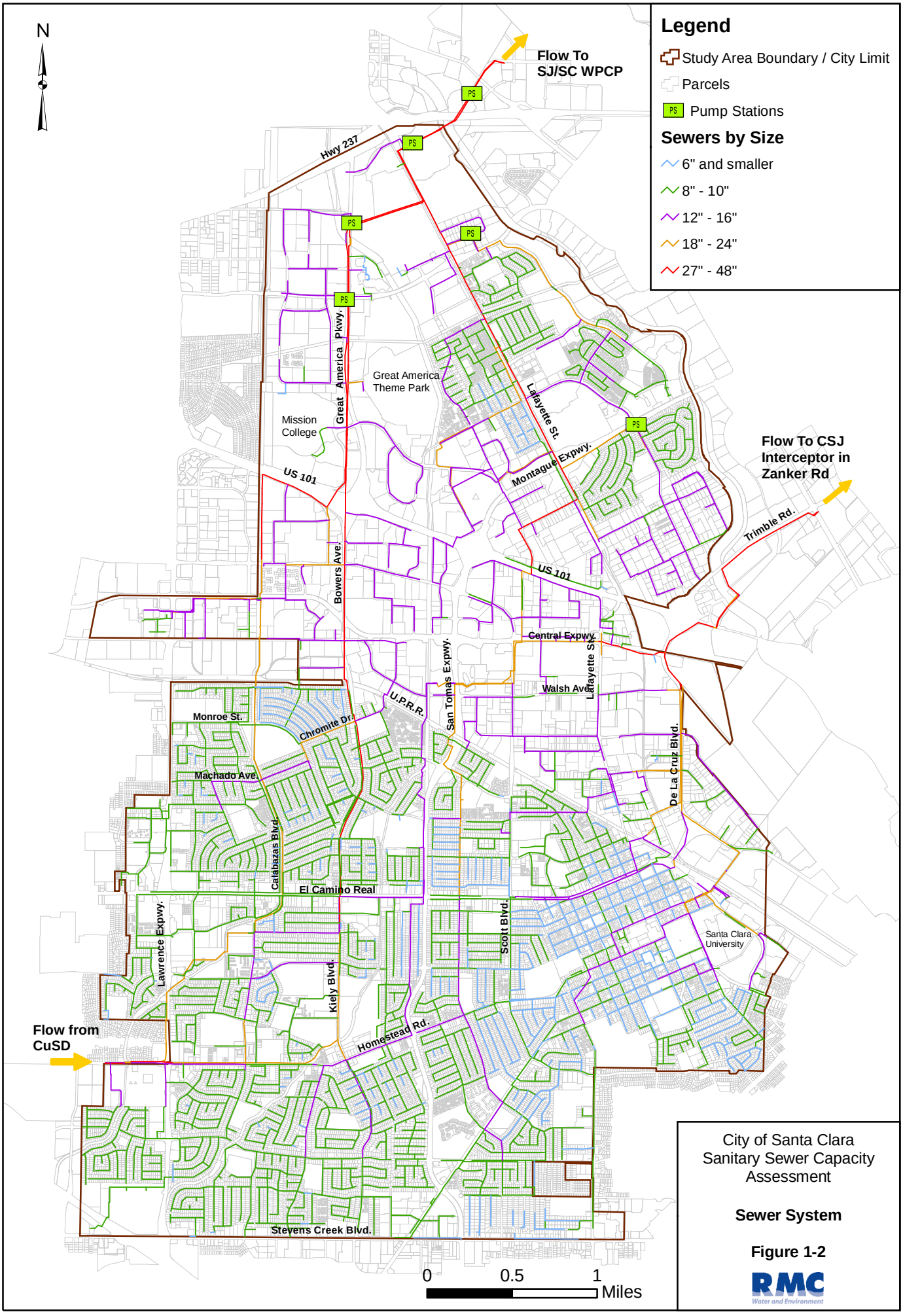
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Legend
Study Area Boundary / City Limit
Parcels
Pump Stations
Sewers by Size
6" and smaller
8" - 10"
12" - 16"
18" - 24"
27" - 48"
Flow To SJ/SC WPCP
Flow To CSJ Interceptor in Zanker Rd
Flow from CuSD
PS
Hwy 237
US 101
Great America Pkwy.
Great America Theme Park
Mission College
Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
Central Expwy.
San Tomas Expwy.
Walsh Ave.
U.P.R.R.
Monroe St.
Chromite Dr.
Machado Ave.
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Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
De La Cruz Blvd.
Santa Clara University
Homestead Rd.
Stevens Creek Blvd.
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Miles
City of Santa Clara
Sanitary Sewer Capacity Assessment
Sewer System
Figure 1-2
RMC
Water and Environment

- **Task 2 – Flow Monitoring Site Selection.** Sanitary sewer system maps and previous reports were reviewed in order to delineate the trunk sewer network and refine major sewer basins and subbasins. Meter and rain gauge sites were identified, investigated, and finalized. A flow monitoring plan with a listing and map of the final sites, schedule for the field work and site traffic control plans was prepared.
- **Task 3 – Flow Monitoring.** A flow monitoring program, consisting of the 26 meters and 3 rain gauges installed in the collection system for a period of about two months during the 2005-2006 wet weather season, was conducted to obtain data to characterize flows in the system and calibrate the hydraulic model. In addition, two existing City-owned ISCO flow meters were also calibrated and utilized for the study.
- **Task 4 – Flow Monitoring Report.** A flow monitoring report containing copies of monitor site reports, weekly plots of flow and rainfall, and summary tables of average, minimum, and maximum daily flows for each meter was submitted to the City. In addition, all data in electronic format were also submitted.
- **Task 5 - Compile and Review Existing Information.** This task involved assembling, organizing, reviewing maps and documents, and compiling the information in a format that was useful for subsequent tasks.
- **Task 6 – Develop Land Use Planning Information and Parcel Loads.** Meetings were held with the City Planning staff to identify and obtain pertinent land use planning data, vacant land inventory and other information required for the Capacity Assessment, and to discuss specific planning issues and potential growth or redevelopment areas in the City. The City's 2010 General Plan and General Plan Amendment were reviewed. Water use data was compiled for existing customers. The information collected was used to develop estimates of existing and future wastewater flows.
- **Task 7 – Develop Design Flow and Hydraulic Criteria.** This task involved developing criteria used for estimating wastewater generation and wet weather flows in the sanitary sewer system.). Design flow criteria were developed, including base wastewater flow and infiltration/inflow factors, as well as an appropriate design storm to be used for analyzing and determining the required capacity of sewer system facilities. Hydraulic criteria were proposed for evaluating and sizing system facilities for the capacity assessment.
- **Task 8 – Develop Hydraulic Model.** In this task, the model network files were built using the District's mapping and sewer inventory files and additional data developed for this project. A digital sewer subbasin map was developed for the model. Flow input data for the model were compiled using the water use and land use data and design flow criteria developed under previous tasks. The model was verified for system connectivity, calibrated for dry weather conditions, and then calibrated for wet weather conditions using actual storm events from the flow monitoring program.
- **Task 9 – Evaluate System Hydraulic Performance.** Under this task, the model was used to determine collection system capacity requirements for peak dry and wet weather conditions. The model runs identified capacity deficiencies in the existing system and the required system capacity to serve future development. Preliminary solutions to capacity deficiencies were identified and tested in the model.
- **Task 10 – Model Training and Support.** Training of City staff in use of the model was deferred until after completion of the study.
- **Task 11 – Develop Capital Improvement Projects.** Detailed analysis was conducted to refine and further develop the proposed solutions for capacity deficiencies. This work included investigation of alternative alignments and assessment of design and constructability issues.

- **Task 12 – Develop Sewer System Capital Improvement Program.** Unit construction costs for components of sewer construction were developed, and estimated capital costs for the recommended improvement projects were prepared. In conjunction with City staff, the recommended improvement projects were prioritized, and a phased Capital Improvement Program (CIP) was developed.
- **Task 13 – Prepare Capacity Assessment Report.** This report was prepared to summarize and present the results and recommendation of the study.

1.4 Report Organization

This report includes six sections, which are described below.

- **Section 1, Introduction,** presents the background, objectives, and scope of the Sanitary Sewer Capacity Assessment.
- **Section 2, Land Use and Flow Estimates,** discusses the planning area land use projections, the basis for developing estimates for each component of wastewater flows, and the flow projections for the service area.
- **Section 3, Hydraulic Model Development,** describes the modeled sewer system, development of the model network and model loads, and model calibration.
- **Section 4, Capacity Analysis,** describes the capacity analysis and design criteria, model results, and preliminary solutions for identified capacity deficiencies.
- **Section 5, Capacity Improvement Projects,** explains the process for development of capacity improvement projects, and presents the recommended projects.
- **Section 6, Recommended Capital Improvement Program,** presents the recommended CIP, including project costs, prioritization, CIP schedule, and implementation recommendations.

The Appendices to this report include plots of the flow monitoring data and documentation for the recommended CIP, including project descriptions and cost estimates.

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Chapter 2

Land Use and Flow Estimates

Chapter 2 Land Use and Flow Estimates

This chapter presents the land use and design wastewater flow estimates for the City of Santa Clara. The section describes existing and projected future land uses for the City, which form the basis for generating flows in the hydraulic model. Flow monitoring was conducted to verify existing flows in major trunk sewers. Design flow estimates were developed based on criteria developed for each flow component: base wastewater flow, groundwater infiltration, and rainfall-dependent infiltration and inflow.

2.1 Land Use Projections

Land use data form the basis for estimating wastewater flows in the sewer system. Land use data for the City of Santa Clara are based on the City's 2010 General Plan and General Plan Amendment, and information on specific developments provided by the City's Planning Department.

2.1.1 Planning Scenarios

The Sanitary Sewer Capacity Assessment Project includes two modeling scenarios: Existing and Future. For the purposes of this Capacity Assessment, the Existing Scenario was defined as current development as of winter 2005-2006. Actual water use data were used to estimate wastewater flows for the existing scenario, and flow monitoring data collected during this time period were used to calibrate the hydraulic model for existing flows.

The Future Scenario assumes construction of all currently planned major development and redevelopment projects in the City, as well as potential increased densities in mixed use and transit-oriented mixed use and commercial/office areas consistent with the City's current General Plan. The future scenario was used to examine the impact on the system of future increases in wastewater flows due to new development and redevelopment.

RMC met with the City's Planning Department in July 2006 in order to identify planned development and redevelopment for the Future Scenario. **Table 2-1** lists the planned development and redevelopment projects based on information provided by the Planning Department and compiled from the General Plan and General Plan Amendment. It includes the following categories of development/redevelopment:

- Developments under construction or recently constructed
- Planned developments, approved
- Planned developments, not yet approved
- Land use intensification per General Plan and General Plan Amendment, no specific development plan available

Figure 2-1 shows the locations of these planned and recently constructed developments. **Table 2-2** summarizes the quantity of residential and non-residential development represented by the planned developments listed in Table 2-1 and shown in Figure 2-1.

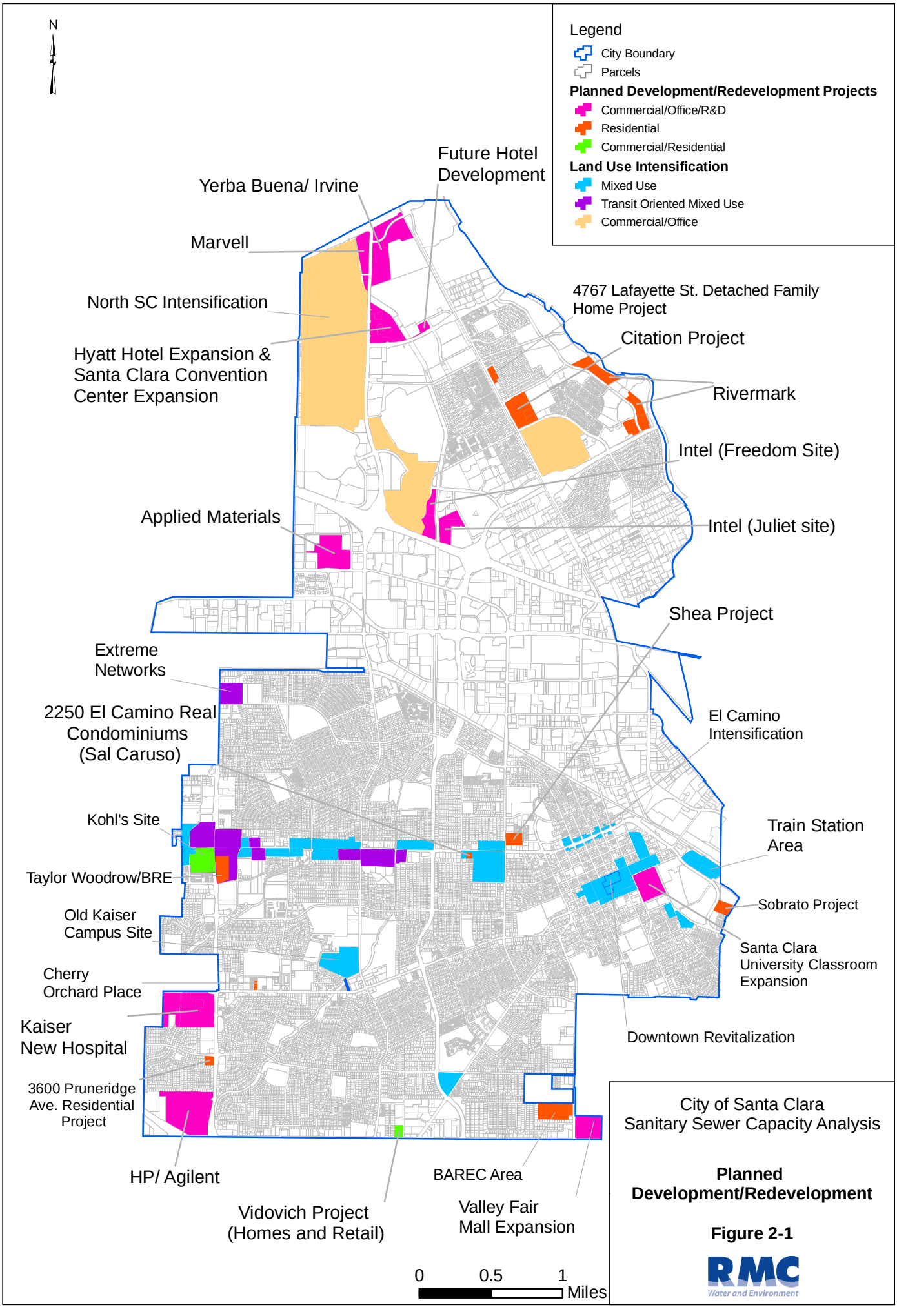
Table 2-1 Planned Development/Redevelopment

Name	Type [a]	Planned Development [b, c]	
Intel (Juliet site)	Commercial	100,000	SF
Intel (Freedom site)	Commercial	400,000	SF
Applied Materials	R&D	840,000	SF
Kaiser -New Hospital	Commercial	675,000	SF
HP/ Agilent	R&D	727,500	SF
Marvell Site (previously 3Com Pal)	R&D	278,000	SF
Yerba Buena/ Irvine	Commercial	910,000	SF
Hotel Development (previously Marriott)	Hotel	225	Rooms
Vidovich Project	Commercial	8,800	SF
	Multi Family	64	DU
Santa Clara University	Commercial	250,000	SF
Citation Project	Single Family	413	DU
Sobrato Project	Apartment	306	DU
3600 Pruneridge	Single Family	31	DU
	Multi Family	2	DU
Shea Project	Multi Family	130	DU
4767 Lafayette St	Single Family	27	DU
Hyatt Regency Hotel Expansion (previously Westin)	Hotel	250	Rooms
2250 El Camino Real (Sal Caruso)	Condominiums	45	DU
Citation Project 2	Multi Family	59	DU
Rivermark	Multi Family	964	DU
Taylor Woodrow/BRE	Single Family	63	DU
	Rental Condominiums	277	DU
Kohl's Site Development	Condominiums	490	DU
	Commercial	52,300	SF
Extreme Networks	TOMU	15	Acres
Santa Clara Convention Center New Ballroom	Commercial	24,000	SF
Valley Fair Mall Expansion	Commercial	22,000	SF
Downtown Revitalization	MU	7	Acres
Train Station Area	MU	17	Acres
BAREC Area	Single Family	110	DU
	Multi Family	165	DU
El Camino Real Intensification	MU	9	Acres
North Santa Clara Intensification	Higher Intensity Office	524	Acres
Cherry Orchard Place	Single Family	14	DU
Old Kaiser Campus	Medium Density Residential	27	Acres
General Plan Developments	MU	142	Acres
General Plan Developments	TOMU	62	Acres

(a) R&D = Research & Development; MU = Mixed Use; TOMU = Transit-Oriented Mixed Use; Multi Family = condominiums/townhouses

(b) DU = dwelling units; SF = square feet

(c) MU and TOMU assumed to be moderate and medium density residential, respectively (added to existing commercial area)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Legend
City Boundary
Parcels
Planned Development/Redevelopment Projects
Commercial/Office/R&D
Residential
Commercial/Residential
Land Use Intensification
Mixed Use
Transit Oriented Mixed Use
Commercial/Office
Future Hotel Development
Yerba Buena/ Irvine
Marvell
North SC Intensification
Hyatt Hotel Expansion & Santa Clara Convention Center Expansion
4767 Lafayette St. Detached Family Home Project
Citation Project
Rivermark
Intel (Freedom Site)
Intel (Juliet site)
Applied Materials
Shea Project
Extreme Networks
2250 El Camino Real Condominiums (Sal Caruso)
El Camino Intensification
Kohl's Site
Train Station Area
Taylor Woodrow/BRE
Sobrato Project
Old Kaiser Campus Site
Santa Clara University Classroom Expansion
Cherry Orchard Place
Kaiser New Hospital
Downtown Revitalization
3600 Pruneridge Ave. Residential Project
HP/ Agilent
BAREC Area
Vidovich Project (Homes and Retail)
Valley Fair Mall Expansion
0
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City of Santa Clara
Sanitary Sewer Capacity Analysis
Planned Development/Redevelopment
Figure 2-1
RMC
Water and Environment

Table 2-2 Planned Development Summary

Type of Development/Redevelopment	Quantity	Units
Single Family	658	DUs
Condominiums/Townhouses	2,196	DUs
Apartments	306	DUs
Hotel	475	Rooms
Commercial	2,442,100	Sq. Ft.
R&D	1,845,500	Sq. Ft.
Commercial/Office Intensification [a]	913,018	Sq. Ft.
Additional Mixed Use per GP [b]	4,444	DUs
Additional Transit-Oriented Mixed Use per GP [c]	2,772	DUs
Total Additional DUs	**10,376**	
Total Additional Sq. Ft. Commercial/Office/R&D	**5,200,618**	

(a) Assumes increase in floor-area-ratio (FAR) on 0.04.
(b) Assumes residential density of 22 DU/acre.
(c) Assumes residential density of 36 DU/acre.

2.2 Flow Monitoring Program

Flow monitoring was conducted by field services staff of E2 Consulting Engineers, subcontractor to RMC, to obtain data to quantify flows in the system and enable analysis of wet weather infiltration/inflow (I/I) and calibration of a hydraulic model. The flow monitoring program consisted of 26 flow meters and three rain gauges operating for a period of approximately ten weeks.

The flow monitoring sites are listed in **Table 2-3** and shown on **Figure 2-2**. The meters were installed from January 19 to 24, 2006, and most were removed on about April 3. Five of the meters were left in place for a few additional weeks to further verify meter calibration parameters. The meter sites utilized Sigma 910 meters with pressure depth transducers and Doppler velocity sensors. Along with the 26 meters, two existing City-owned ISCO flow meters installed on the parallel 33-inch lines at the east side of Santa Clara near Highway 101 were also calibrated per the City's request. In addition, Cupertino Sanitary District has a flow monitor installed at Homestead Road to measure sewer flows that enter Santa Clara at the western city limits; RMC also obtained data from this meter during the flow monitoring period.

Table 2-3 Flow Monitoring Locations

Flow Monitor	Location	Manhole Number	Pipe Size (in.)
1	Easement off of Lafayette St. north of Calle De Mundo	S104-23	33
2	Lafayette St. north of Calle de Mundo	S104-30	42
3	Primavera Lift Station	S105-34	24
4	Lafayette St. south of Calle De Luna	S104-36	36
5	Montague Expwy. east of Lafayette	S86-17	18
6	Lafayette at Montague Expwy.	S86-20	30
7	Mission College Blvd. north of Our Lady's Way	S83-21	33
8	Mission College Blvd. north of Our Lady's Way	S83-22	33
9	Calabazas Creek south of Kifer Rd.	S62-40	24
10	Bowers Ave. at Chromite Dr.	S53-34	30
11	Chromite Dr. at Bowers Ave.	S53-41	18
12	Scott Blvd. south of Central Expwy.	S65-34	24
13	Scott Blvd. south of Central Expwy.	S65-33	18
14	Central Expwy. west of UPRR	S67-16	27
15	De La Cruz Blvd. south of Central Expwy.	S67-26	48
16	Brokaw Rd. north-east of UPRR	S48-36	18
17	Benton St. west of The Alameda	S38-1	12
18	Los Padres Blvd. at Bray Ave.	S45-80	18
19	Los Padres Blvd. at Karen Dr.	S25-1	15
20	San Tomas Expwy. at Warburton	S44-57	15
21	Bowers Ave. south of Warburton	S43-86	27
22	Kiely Blvd. north of Homestead	S23-20	18
23	Saratoga Creek west of Kiely Blvd.	S23-12	21
24	Homestead Rd. east of Bing Dr./Princeton Way	S2147	18
25	Homestead Rd. east of Bing Dr./Princeton Way	S21-54	15
26	Wren Ave. at Lerwick Ct.	S21-23	24

During the flow monitoring period, all of the monitoring sites were visited weekly to check meter operation and site conditions, obtain field calibration measurements, and download collected data. Field calibration involves taking manual depth measurements and flow velocity measurements using a portable velocity meter. These calibration measurements were compared to and used to adjust monitor-recorded depth and velocity if needed. Calibration measurements were taken at different times of day in order to obtain calibration points for the full range of typical diurnal flows.

Three rain gauges were installed to collect representative rainfall over the service area during the monitoring period. The rain gauge locations were:

Rain Gauge 1: Santa Clara Corporation Yard

Rain Gauge 2: Primavera Pump Station

Rain Gauge 3: Santa Clara Tank Site, off of Highway 280 and Lawrence Expressway

Approximately 12 storm events occurred during the flow monitoring period, totally about six inches of rainfall. Most of the events, however, were relatively small. The duration and the total rainfall for each event are summarized in **Table 2-4**.

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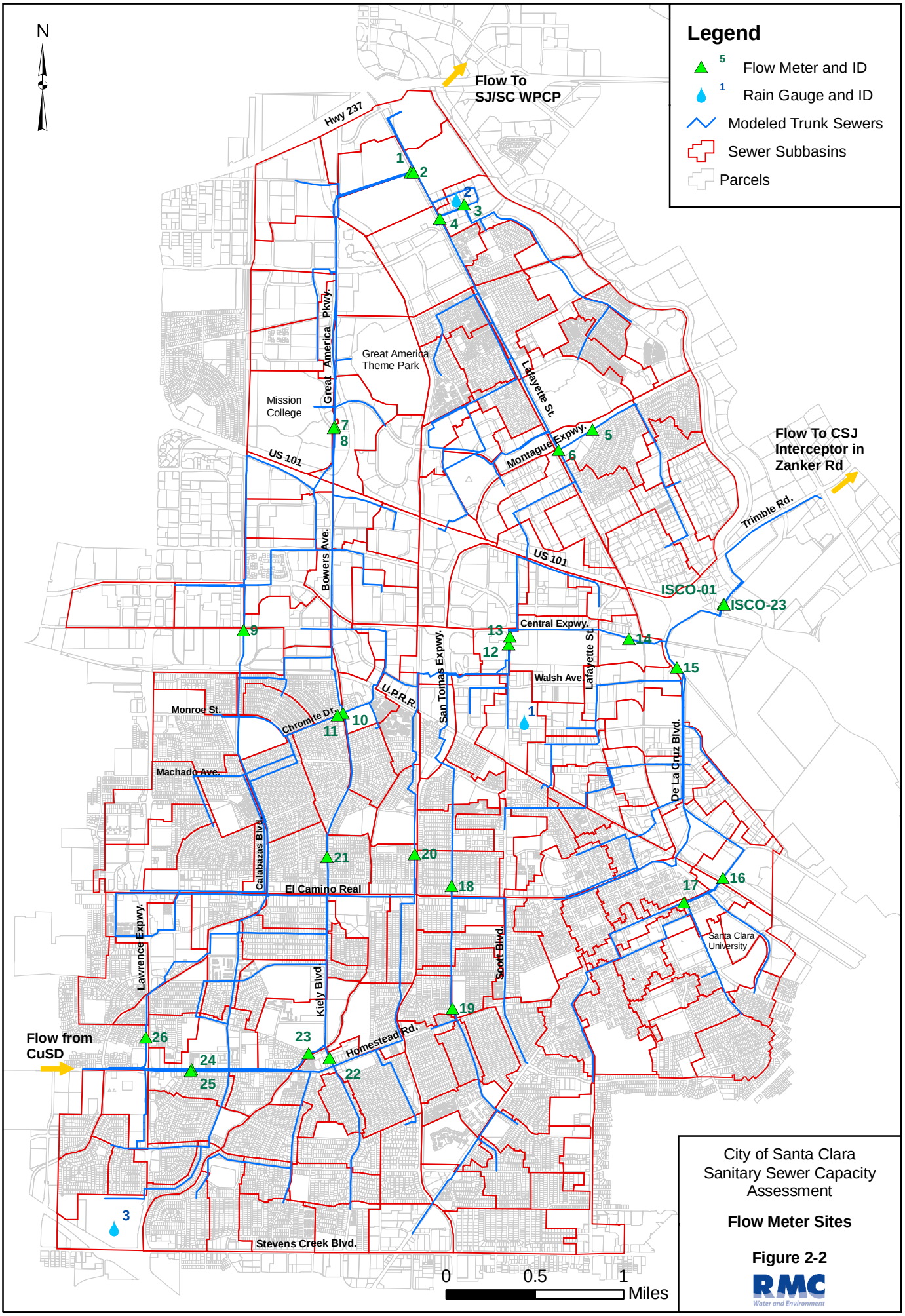
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Flow Meter and ID
Rain Gauge and ID
Modeled Trunk Sewers
Sewer Subbasins
Parcels
Flow To SJ/SC WPCP
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
US 101
Lafayette St.
Montague Expwy.
Flow To CSJ Interceptor in Zanker Rd
Trimble Rd.
Bowers Ave.
ISCO-01
ISCO-23
Central Expwy.
Walsh Ave.
San Tomas Expwy.
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De La Cruz Blvd.
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Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Santa Clara University
Homestead Rd.
Flow from CuSD
Stevens Creek Blvd.
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Miles
City of Santa Clara
Sanitary Sewer Capacity
Assessment
Flow Meter Sites
Figure 2-2
RMC
Water and Environment

Table 2-4 Rain Events during Flow Monitoring Period

Start Date/Time	End Date/Time	Duration	Storm Rainfall (in.)				Max. Hour (in.)		
		(hours)	Avg.	RG1	RG2	RG3	RG1	RG2	RG3
2/17/06 12 PM	2/17/06 8 PM	8	0.23	0.20	0.19	0.31	0.09	0.08	0.15
2/26/06 11 PM	2/28/06 2 AM	27	1.16	1.14	0.99	1.34	0.17	0.16	0.19
3/2/06 12 AM	3/2/06 4 AM	4	0.27	0.25	0.30	0.27	0.10	0.14	0.10
3/3/06 1 AM	3/3/06 5 PM	16	0.26	0.42	0.03	0.32	0.19	0.02	0.13
3/5/06 3 PM	3/6/06 4 AM	13	0.68	0.56	0.66	0.81	0.12	0.13	0.13
3/10/06 6 PM	3/11/06 7 AM	13	0.23	0.28	0.26	0.15	0.08	0.12	0.06
3/13/06 11 PM	3/14/06 7 AM	8	0.38	0.34	0.39	0.42	0.10	0.14	0.12
3/16/06 9 PM	3/17/06 12 AM	3	0.39	0.39	0.37	0.40	0.26	0.26	0.24
3/20/06 10 AM	3/21/06 5 AM	19	0.74	0.71	0.92	0.58	0.22	0.24	0.18
3/24/06 5 PM	3/25/06 6 AM	13	0.61	0.53	0.65	0.66	0.13	0.13	0.19
3/29/06 3 AM	3/29/06 10 AM	7	0.20	0.18	0.13	0.28	0.06	0.05	0.10
4/2/06 4 PM	4/3/06 2 PM	22	0.71	0.74	0.66	0.74	0.11	0.12	0.10

Following the completion of flow monitoring, E2 prepared a summary report containing copies of the meter site reports and photographs; 7-day graphs of the flow and rainfall data; and summary tables of minimum, maximum, and average daily flows and rainfall. In addition, electronic files of all data were provided to the City. The final flow monitoring report has been provided to the City as a separate attachment. Summary plots of the flow and rainfall data are included in **Appendix A** of this report.

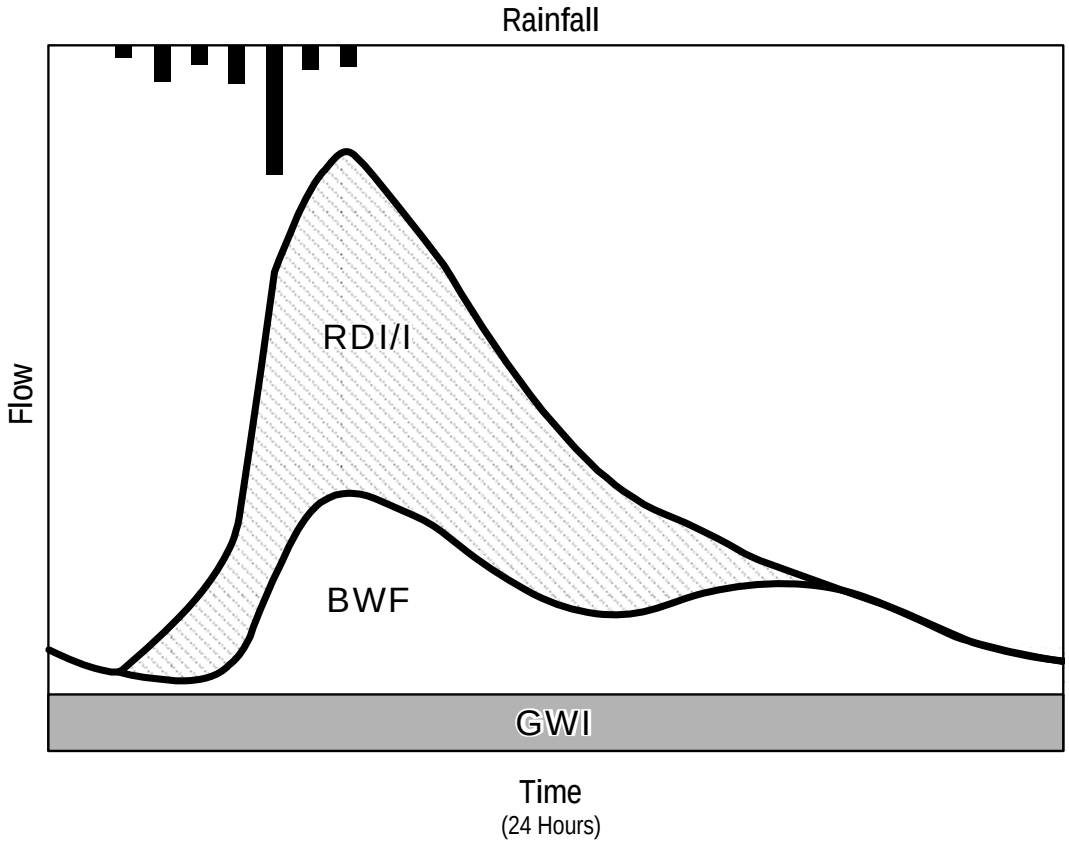
2.3 Wastewater Flows

The components of wastewater flows and methodology for quantifying each flow component are discussed below.

2.3.1 Wastewater Flow Components

Wastewater flows include three components: base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I), as illustrated conceptually in **Figure 2-3**. BWF represents the sanitary and process flow contributions from residential, commercial, institutional, and industrial users of the system. GWI is groundwater that infiltrates into defects in sewer pipes and manholes, particularly in winter and springtime in low-lying areas. GWI is typically seasonal in nature and remains relatively constant during specific periods of the year. RDI/I is storm water inflow and infiltration that enter the system in direct response to rainfall events, typically through direct connections such as holes in manhole covers or illegally connected roof leaders or area drains, or, more commonly, through defects in sewer pipes, manholes, and service laterals. RDI/I typically results in short term peak flows that recede quickly after the rainfall ends.

Figure 2-3 Wastewater Flow Components
(Not to scale)



2.3.2 Methods for Estimating Base Wastewater Flows

Base wastewater flow consists of the normal sanitary flow contribution from residential, commercial, institutional, and industrial users of the sewer system. Base wastewater flows are typically calculated by applying unit BWF factors (in gpd per acre or gpd per DU) to existing and/or future land use quantities. For residential areas, BWF factors depend primarily on residential density and the average number of persons per dwelling unit. For commercial and industrial areas, BWF factors depend primarily on the type and distribution of the commercial and industrial establishments. Since BWF factors would be expected to be similar for communities with similar types of development, BWF factors are often developed based on published values and verified by flow monitoring or analysis of water consumption data for a particular community.

For the City's Sanitary Sewer Capacity Assessment, BWF loads were developed for both existing and future development conditions. Existing loads were developed based on actual winter water use data from the City's customer billing records, and future loads were based on projected development and redevelopment projects anticipated by the City. The unit flow factors used to compute BWF from future development are summarized in **Table 2-5**. The residential factors shown in the table are consistent with the City's standard residential design flow rate of 70 gallons per capita per day (gpcd) and residential densities for various land use classifications. The rates per square foot for commercial/office and office/research & development (R&D) development are based on typical design factors used for other similar areas.

Table 2-5 Base Wastewater Flow Unit Flow Factors

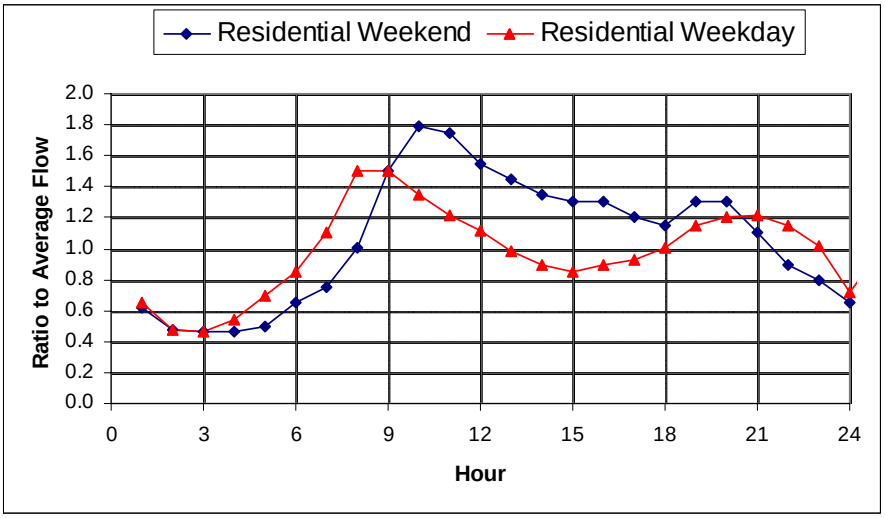
Type of Development	Unit Flow Factor	Basis
Single Family Detached	245 gpd/DU	3.5 people/DU @ 70 gpcd
Townhouses/Condominiums	175 gpd/DU	2.5 people/DU @ 70 gpcd
Apartments	154 gpd/DU	2.2 people/DU @ 70 gpcd
Hotels	100 gpd/room	
Commercial/Office	0.1 gpd/sq. ft.	
Office/R&D	0.15 gpd/sq. ft.	
Moderate Density Residential (Mixed Use)	3,200 gpd/acre	21 DU/acre @154 gpd/DU
Medium Density Residential (Transit-Oriented Mixed Use)	4,600 gpd/acre	30 DU/acre @ 154 gpd/DU
Commercial/Office/R&D Intensification[a]	+ 300 gpd/acre	+ 0.04 FAR @ 0.15 gpd/sq. ft.

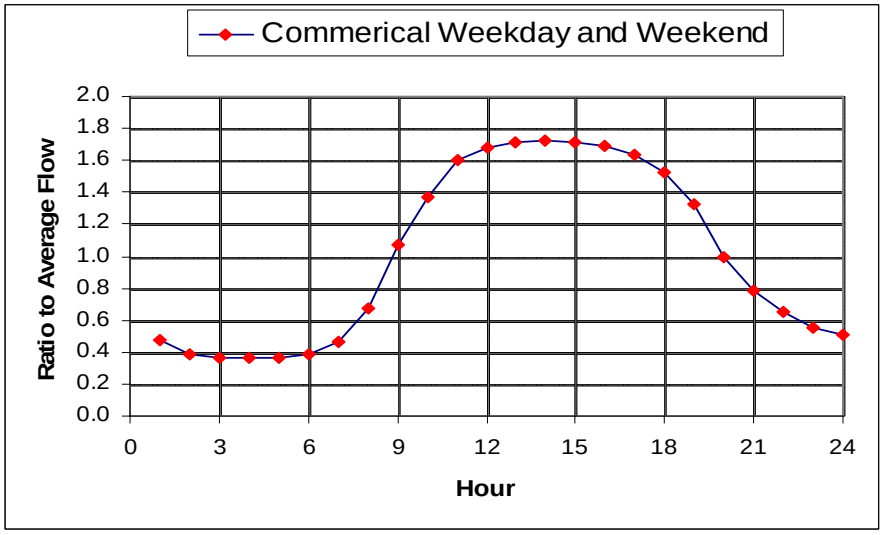
(a) Applied to areas of North Santa Clara where existing development is anticipated to increase in intensity from a current average floor-area-ratio (FAR) of 0.41 to a future average of 0.45.

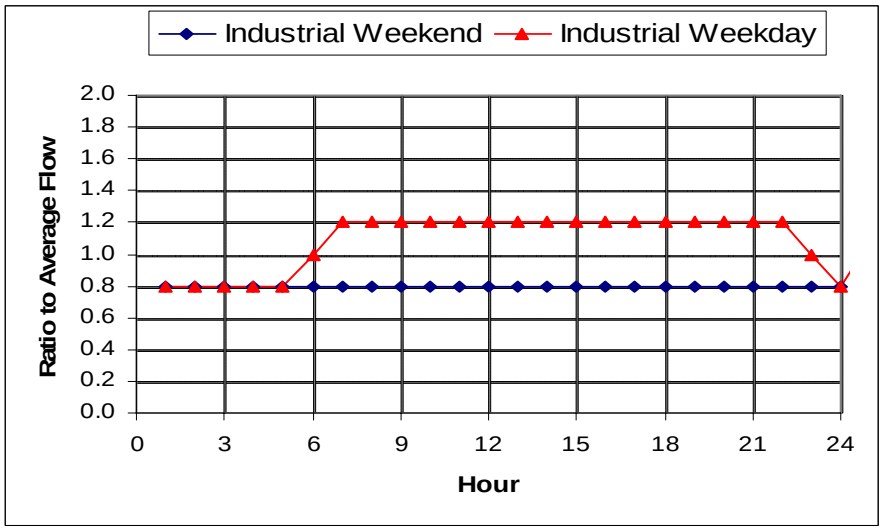
2.3.3 Diurnal Base Wastewater Flow Patterns

In most sewer systems, BWF exhibits typical diurnal patterns depending on the type of land use. For Santa Clara, typical diurnal curves were developed for residential, commercial, and industrial areas, for both weekend and weekday conditions. These curves are shown in **Figure 2-4**. Each area of the system was assigned a diurnal curve according to its predominant land use type.

Figure 2-4 Diurnal Curves







2.3.4 Large Users

For purposes of this study, a "large" discharger was defined as one discharging more than an average of 40,000 gallons per day (gpd) average flow or 50,000 gpd maximum month flow during the winter months. Based on winter 2005-2006 water and recycled water billing records provided by the City, there are eighteen large dischargers that meet the criteria outlined above. Wastewater flows for large users were based on average winter flow.

All dischargers to the sewer system are included in the City's water billing database and are therefore accounted for in the calculation of existing BWF loads. However, some large dischargers do not exhibit typical industrial diurnal wastewater flow patterns and therefore must be accounted for separately. Typically, these are users that discharge wastewater on a relatively constant basis, 24 hours per day and 7 days per week (24/7). These users were given separate constant diurnal profiles in the hydraulic model.

Table 2-6 lists the eighteen large dischargers in the Santa Clara system and those that are considered 24/7 users.

Table 2-6 Large Dischargers

Large Water User	APN	Address	Average Flow [a] (gpd)	Maximum Month Flow [a] (gpd)
KOLL	104-13-090	2151 Mission College Blvd	934,461	1,101,270
CONTAINER CORP OF AMERICA [b,c]	230-03-100	2600 De La Cruz Blvd	381,870	413,739
NEWARK GROUP INDUSTRIES INC [b,c]	230-03-090	525 Mathew St	473,003	561,917
SILICONIX INC [b]	104-39-023	2201 Laurelwood Rd	411,666	422,353
DVR POWER PLANT [d]	224-36-047	850 Duane Ave	103,354	576,000
RENAULT	216-49-019	3320 Scott Blvd	165,222	181,586
OWENS-CORNING FIBERGLAS CORP [b,c]	224-07-099	960 Central Expy	19,715	21,242
ANADITE INC	104-14-047	1440 Norman Ave	142,536	148,429
INTEL CORPORATION	104-48-010	3603 Juliette Ln	118,250	120,743
INTERNATIONAL INTEL	216-46-015	3065 Bowers Ave	91,713	97,439
AGILENT TECHNOLOGIES INC	316-17-018	5301 Stevens Creek Blvd	88,963	131,152
SCP 2001PE LLC	104-13-083	2175 Mission College Blvd	88,922	98,976
APPLIED MATERIALS INC	216-49-024	3070 Bowers Ave	88,129	100,579
DLC ASSOCIATES II	097-31-062	3495 De La Cruz Blvd	67,262	75,719
LEON MARDIROSSIAN	224-06-170	1415 Richard Ave	64,683	66,340
NATIONAL SEMICONDUCTOR CORPORATION	205-39-022	2900 Semiconductor Dr	57,636	72,896
SIGMA CIRCUITS INC	230-47-112	351 Mathew St	54,302	57,047
ADVANCED CARDIOVASCULAR SYSTEMS INC	216-30-040	3200 Lakeside Dr	35,261	51,453

(a) For December 2005 through March 2006 period.
(b) 24/7 discharger.
(c) Derived from water use data adjusted by a factor provided by the City.
(d) Based on DVR Power Plant data provided by the City.

2.3.5 Infiltration/Inflow

Infiltration/inflow is extraneous groundwater and storm water that enter the sewer system through illegal connections or defects in sewer pipelines, manholes, and service laterals. The primary types of I/I are groundwater infiltration and rainfall-dependent I/I.

Groundwater Infiltration

Groundwater infiltration is generally quantified based on actual flow monitoring data, since it is difficult to predict GWI rates based on physical system data alone. In the context of design flow criteria, GWI represents the incremental groundwater infiltration that occurs during the wet weather season above the "baseline" infiltration level during the driest months of the year.

GWI can be estimated based on minimum flows during non-rainfall periods during a wet weather flow monitoring period. Minimum flows typical occur during the nighttime or early morning hours when base wastewater flows are at a low. Alternatively, GWI can be estimated as the difference between average metered flow during non-rainfall periods and computed average BWF. In either case, the resulting GWI, is expressed on a unit basis (gpd/acre or gpad) by dividing by the sewered acreage of the monitored area. Typical GWI rates may range from 100 to over 1,000 gpad.

GWI flows were estimated through the model calibration process (described in the next chapter of this report) by comparing model-simulated BWF to actual flow measurements from the temporary flow monitoring program conducted in January through April 2006. Cases where model-predicted BWF was noticeably lower than monitored flow indicated the possible occurrence of GWI.

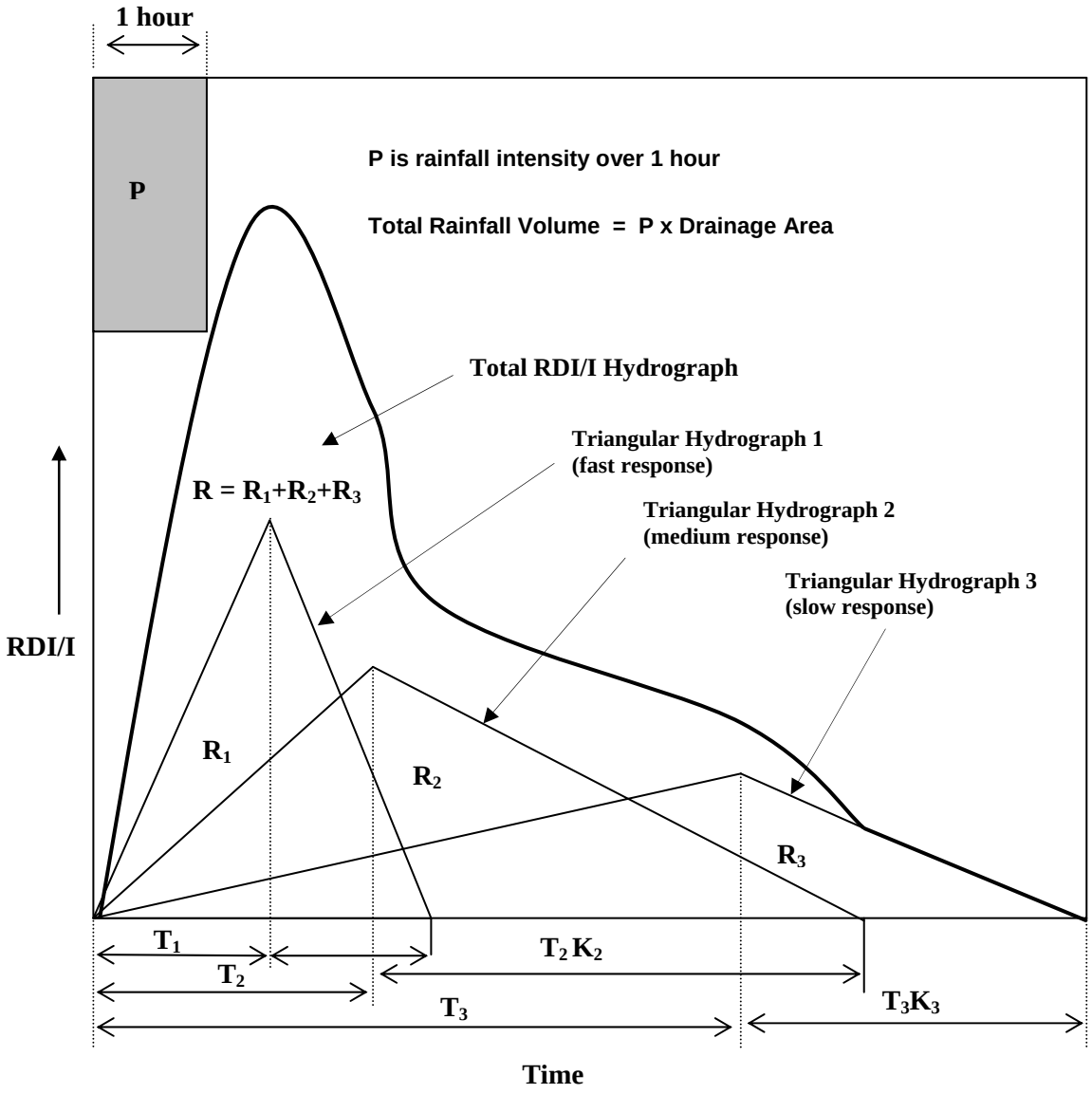
Rainfall-Dependent I/I

RDI/I flows result from rainfall events that produce infiltration and inflow of storm water runoff into the sewer system. RDI/I can be quantified as the difference between the total flow during and immediately following a storm event and the non-rainfall "base flow" (BWF plus GWI) that is estimated to have occurred during the storm period. The magnitude of the resulting RDI/I response is typically described by the percentage of the rainfall volume (called the "R value") represented by the volume of the RDI/I hydrograph. The R value can vary from storm to storm, depending on such factors as the degree of soil saturation (due to antecedent rainfall) prior to the storm event.

The shape of the RDI/I hydrograph is also important in determining the peak RDI/I response. The RDI/I hydrograph shape in often defined by separating the total RDI/I hydrograph volume into components, representing different response times to rainfall (fast, medium, and slow). Each component is identified by a percentage of the total RDI/I volume and specific time to peak (T) and recession coefficient (K), illustrated in **Figure 2-5**. The R component percentages and T and K values can be applied to each hour of rainfall to generate a "synthetic hydrograph" that approximates the volume and shape of the hydrograph from the actual observed event. These parameters, when applied to a different rainfall pattern, can be used to estimate the RDI/I response to that particular rainfall event. This methodology is used to synthesize RDI/I hydrographs for a "design storm" for collection system modeling.

Design criteria for RDI/I include design R values and hydrograph shape parameters and the hourly rainfall for the selected design storm event. As described in the next chapter of this report, R values and hydrograph parameters are determined through the process of model calibration, in which actual observed rainfall events are simulated in the hydraulic model, and the resulting model hydrographs are compared to the measured flows at flow meters locations. The RDI/I parameters are adjusted as needed to achieve the best match of modeled to monitored flows. Once calibrated, the model RDI/I parameters can be applied to a design storm to simulate wet weather flows for a design event.

Figure 2-5 RDI/I Hydrograph Components



2.3.6 Design Event

Wastewater collection systems are typically sized for a specific "design" condition, often represented by a development condition (e.g., "buildout") under a design wet weather event, in combination with a designated system performance criterion.

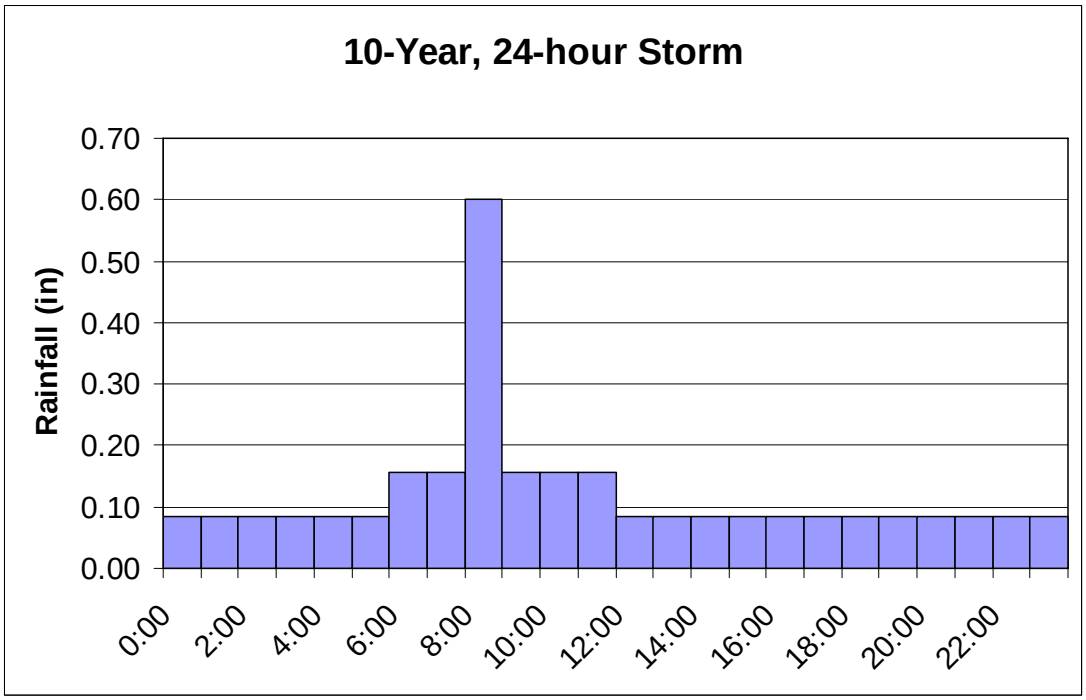
Generally, the performance criterion is defined by the maximum allowable water level in the system, which may be at the ground surface (i.e., "no overflows"), a specified distance below the ground (say 5 feet below the manhole rims), or more conservatively, by a maximum allowable flow depth to pipe diameter (d/D) ratio. The maximum d/D may vary by pipe size. A maximum allowable d/D of 1.0 (i.e., "no surcharge") is commonly used, although a smaller value (e.g., 0.75) may be used for smaller diameter sewers to account for the greater potential for reduced capacity due to obstructions in the pipes, or to add more conservatism to sizing of new pipes.

The "design event" establishes the maximum recurrence frequency under which the design performance criterion can be exceeded. Thus, if the performance criterion is "no surcharge" and the recurrence

frequency is 10 years, then the system must be designed such that pipes would not surcharge any more frequently than once every 10 years.

In practice, the design event is often equated to a specified recurrence frequency *rainfall* event, which can be developed based on historical rainfall intensity-duration-frequency (IDF) statistics. The City of San Jose has adopted a 10-year design storm for its capacity assessment program. Based on IDF data and guidelines from the *County of Santa Clara Storm Design Requirements*, a synthetic 10-year, 24-hour design storm was determined for the San Jose Airport (see **Figure 2-6** below) and applied to other areas of the system in proportion to average annual rainfall. Applying this approach to Santa Clara, the design rainfall would be approximately 1.0 to 1.2 times the San Jose Airport rainfall (varying over the service area from north to south).

Figure 2-6 10-Year Design Storm for San Jose Airport



To develop the projected RDI/I flows for the design event, the RDI/I hydrograph parameters determined from the wet weather calibration would be applied to the design storm rainfall. Note that the design event can be superimposed on an average base wastewater flow condition, based on the assumption that the peak rainfall could potentially occur at any time of the day, or it can be constructed so that the peak RDI/I roughly coincides with the peak BWF for a typical residential diurnal pattern, providing a higher level of conservatism in the design flows. The City of San Jose utilizes the more conservative assumption for sewer system planning. Therefore for Santa Clara, it was recommended that the same design event criteria be used. This is a reasonable assumption given that peak wet weather flows in the Santa Clara sewer system are relatively low.

2.3.7 Flows from Cupertino Sanitary District

Flows from Cupertino Sanitary District (CuSD) enter the City's sewer system on Homestead Road. CuSD maintains a flow meter at the discharge point to the City's system. Initially, data from the District's meter was reviewed in order to estimate CuSD flows discharging into Santa Clara; however, the data was found to be inconsistent, with unexplained changes in average daily flows over the course of the

10-month period (January through October 2006). It is believed that this meter may have been out of calibration and was calibrated at some point during the year.

As part of a separate study conducted for CuSD, RMC estimated existing and future average dry weather flow (ADWF) from CuSD based on data on sewer connections, land use, and population density. The existing flow from the metered area of CuSD (portion tributary to Santa Clara, which represents about 89 percent of the total service area flow) was estimated to be 4.9 mgd, which matches well to the total flows at the temporary meters immediately downstream of the CuSD discharge point. Therefore, for purposes of the Santa Clara model, this value was used as the existing CuSD flow. The RMC study estimates the total future (year 2030) ADWF for CuSD at about 7.2 mgd; therefore, a preliminary estimate of future ADWF from CuSD entering the Santa Clara system at Homestead Road is 6.4 mgd (89 percent of the total future flow).

2.3.8 Wastewater Flow Estimates

The estimated existing and future average dry weather flow (ADWF), peak dry weather flow (PDWF), and design storm PWWF flows for the City's system were developed based on modeling as described in Chapters 3 and 4 of this report. The results are summarized in **Table 2-7**.

Table 2-7 Sewer System Flow Estimates

System Outfall	Existing Flow (mgd)			Future Flow (mgd)		
	ADWF	PDWF	PWWF	ADWF	PDWF	PWWF
North (to Northside and Rabello Pump Stations)	17.7	23.6	40.8	21.2	28.7	43.1[a]
East (to San Jose Trimble Road trunk sewer)	6.0	8.7	13.2	6.9	10.0	14.1
Total	**24**	**32**	**54**	**28**	**38**	**57**

Note: ADWF and PDWF represent a non-rainfall wintertime condition and include groundwater infiltration. PWWF represents a 10-year frequency design storm.

(a) Assumes peak flow from Cupertino Sanitary District does not increase above its contracted maximum capacity of 13.8 mgd.

Chapter 3

Hydraulic Model Development

Chapter 3 Hydraulic Model Development

The City, in conjunction with RMC, selected DHI's MIKE URBAN™ with EPA SWMM 5 as the software to be used for the Sewer System Capacity Assessment. EPA SWMM 5 is the latest version of the U.S. EPA's public domain Storm Water Management Model, which provides a fully dynamic solution for modeling storm water and sanitary sewer systems. MIKE URBAN is an ArcGIS-based model interface that provides the user environment for building and running the model and viewing model results. RMC also utilized another modeling program, InfoWorks™, to help in model construction and validation. The process of developing the model for use in the capacity assessment is described below.

3.1 Modeled System

The hydraulic model developed for the City's Sewer System Capacity Assessment represents the trunk sewer system, the network of larger diameter pipes that comprises the "backbone" of the system. The wastewater is conveyed from the City to the San Jose/Santa Clara Water Pollution Control Plant (SJ/SC WPCP) at two locations: at the northeast corner of the City just east of Lafayette Street, where flow is pumped via the Northside and Rabello Pump Stations and force mains to the WPCP; and on the eastern side of the City east of De La Cruz Boulevard and Highway 101, where flow discharges by gravity into a 48-inch sewer in Trimble Road that conveys the flow to the City of San Jose's interceptor in Zanker Road. The City also receives flows from the Cupertino Sanitary District (CuSD), which discharge into the Santa Clara sewer system on Homestead Road at Swallow Drive.

The City's wastewater collection system includes a total of approximately 270 miles of sewer pipelines, of which approximately 28 percent, or 76 miles, are included in the modeled system. The modeled network includes almost all of the 15-inch and larger pipes, about 40 percent of the 10- and 12-inch pipes, and a few 6- and 8-inch pipes. The modeled system also includes four of the system's six wastewater pump stations: Westside, Primavera, Tasman, and De La Cruz. The Northside and Rabello Pump Stations are not explicitly modeled, as their downstream hydraulic control points are governed by the downstream force mains and hydraulic gradeline at the WPCP. Rather, the northern outlet of the model is located at the junction manhole (S114-19) just upstream of the Rabello Pump Station. The modeled network is shown in **Figure 3-1**.

3.2 Model Network Construction and Validation

Network data for the model were provided by the City in the form of AutoCAD mapping and Excel files with manhole and pipe attribute data (manhole coordinates and rim elevations; pipe diameters, lengths, and invert elevations). Through a multi-step process, the AutoCAD file and attribute data were imported into ArcGIS to create GIS datasets of all of the pipes and manholes in the City's system. The pipes and manholes to be included in the modeled network, described previously, were then extracted out of those datasets. The GIS files of the modeled pipes and manholes formed the basis for model construction and validation; these files were imported into the modeling environment in InfoWorks and subsequently into MIKE URBAN.

The model construction and validation process included the following steps:

- The modeled network was checked for connectivity, i.e., verifying that correct upstream/downstream manholes were identified for each pipe and there were no missing links in the network.
- Profiles were plotted for each series of pipe segments in the modeled network to visually check for missing or suspect data. Examples of missing or suspect data included missing rim or invert elevations, negative pipe slopes, or abrupt steps up or down in pipe inverts. Where appropriate, missing or suspect data were interpolated, or verification in the form of additional survey information or as-built drawings were requested from the City.

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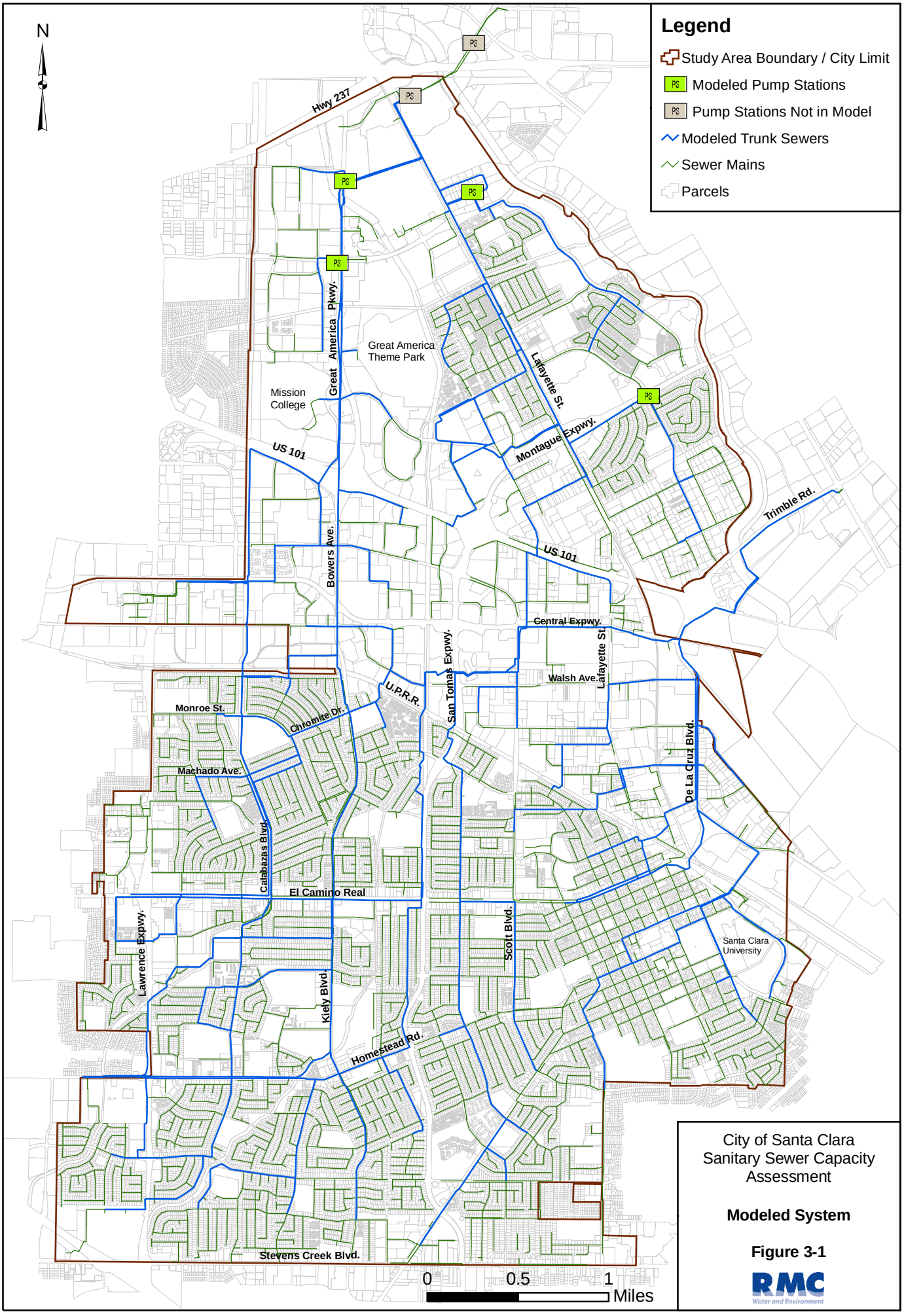
N
Legend
Study Area Boundary / City Limit
Modeled Pump Stations
Pump Stations Not in Model
Modeled Trunk Sewers
Sewer Mains
Parcels
PS
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
Lafayette St.
Montague Expwy.
US 101
Trimble Rd.
Bowers Ave.
Central Expwy.
San Tomas Expwy.
Walsh Ave
U.P.R.R.
Monroe St.
Chromite Dr.
Machado Ave.
De La Cruz Blvd.
Calabazas Blvd.
El Camino Real
Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Santa Clara University
Homestead Rd.
Stevens Creek Blvd.
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1
Miles
City of Santa Clara
Sanitary Sewer Capacity Assessment
Modeled System
Figure 3-1
RMC
Water and Environment

- As-built information was used to manually input details for each of the 22 inverted siphons in the modeled network. Dummy nodes were created as needed for the siphon angle points so that the three "legs" of the siphon (downward, horizontal, and upward) could be represented explicitly.
- As-built information was used to manually input details on the modeled pump stations. Information required included wet well elevations and dimensions, number of pumps, pump capacities, on/off levels, and discharge curves.
- Flow splits (manholes with more than one outlet pipe) were identified for further verification of outlet pipe elevations and/or the existence of weir overflows or other control structures. Field verification and/or as-built drawings were requested from the City as needed. Two structures in particular, the diversion structure at manhole S20-10 and the "flume" structure at manhole S65-30 required special investigations and model configurations.

3.3 Development of Model Loads

Flows are loaded into the model at "load manholes," each of which represents the point where flows from unmodeled sewers discharge into the modeled network. The unmodeled sewers were grouped into sewer subbasins, each with a unique load manhole in the network. Approximately 175 sewer subbasins were delineated for defining the model loads. The subbasins and load manholes are shown in **Figure 3-2.**

3.3.1 Base Wastewater Loads

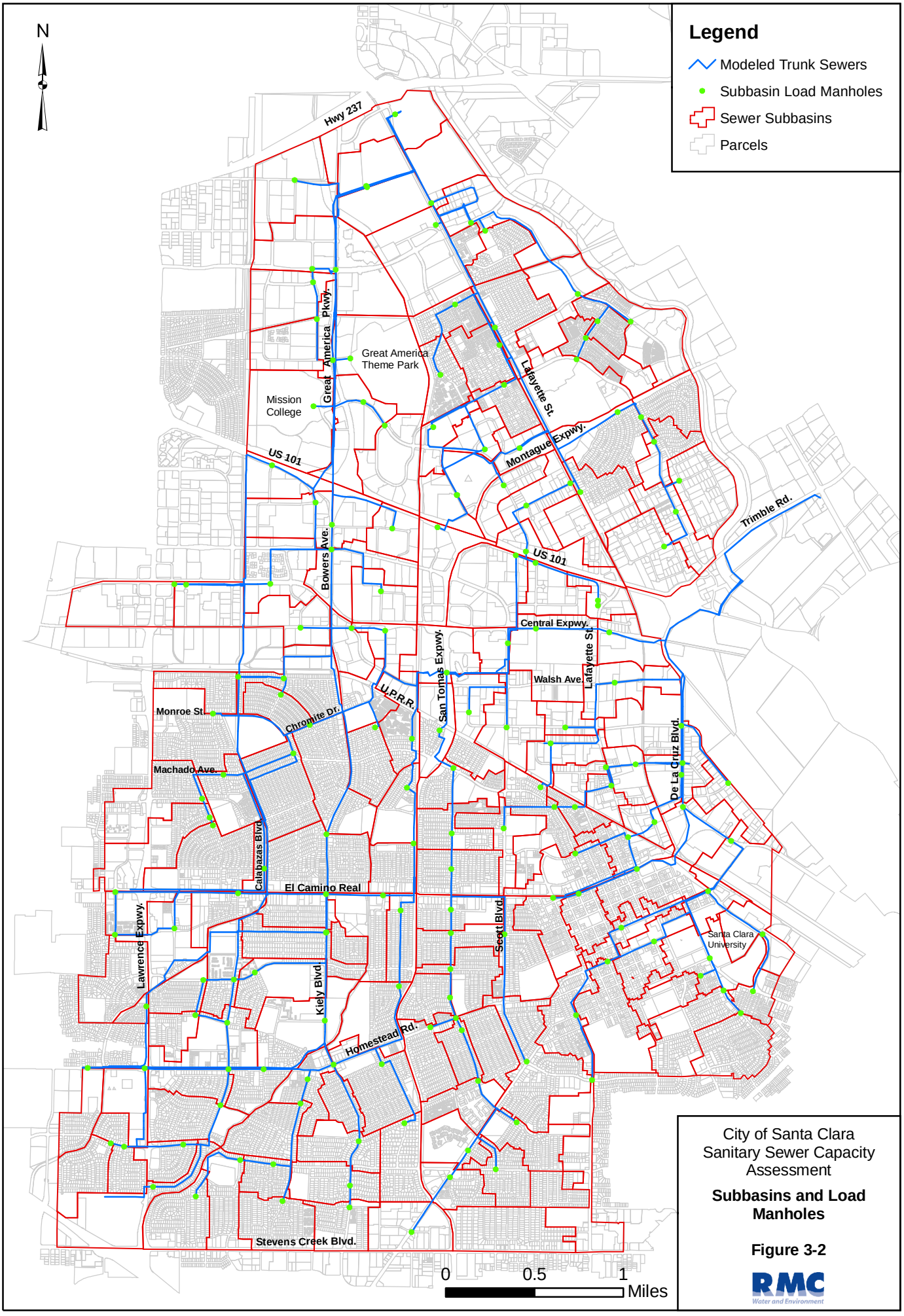
The City's water billing data and recycled water discharge data from December 2005 to March 2006 were used to develop existing loads to the hydraulic model. The billing data provided by the City was compiled into a database, with each billing record (account) associated with its Santa Clara County Assessor's Parcel Number (APN). Since many of the water billing records contained incorrect APNs or no APN at all, an extensive process was used to acquire these APNs from street address cross reference tables and other information supplied by the City. Water usage for multiple water accounts associated with the same parcel were added together. The average water use by parcel was then determined by averaging the monthly use for the four winter months (December through March). Winter water use is considered a reasonable approximation of wastewater flow because outdoor water use (irrigation) during the wintertime is minimal.

The water billing records were then linked to the City's parcel GIS file. Each of the parcels was associated with the appropriate sewer subbasin. Finally, the total average base wastewater flow per sewer subbasin was computed by adding the flows (water use) for all parcels contained with the subbasin. Each subbasin was also characterized based on its predominant land use type (residential, commercial, or industrial) in order to apply an appropriate diurnal wastewater pattern to simulate the flows in the model.

Flows from large dischargers were removed from the cumulative sewer subbasin flow and added to the model as point loads at specific locations in the modeled system. As noted in Chapter 2, model loads for large users were based on average winter flow.

3.3.2 I/I Loads

GWI and RDI/I flows were also loaded to the model by subbasin by associating each subbasin with a flow meter area. The flow meter areas are shown in **Figure 3-3**. For each subbasin, the total sewered area (i.e., area that potentially contributes I/I) was determined by summing the acreage of non-open space land uses in the subbasin. Non-open space land uses include residential, commercial, industrial, and institutional uses, but do not include parks, drainage channels, and large roadways such as freeways. I/I flows for each subbasin were computed in the model by applying the appropriate meter area GWI and RDI/I parameters (determined during the model calibration process described below) to the sewered area of the subbasin.


N
Legend
Modeled Trunk Sewers
Subbasin Load Manholes
Sewer Subbasins
Parcels
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
US 101
Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
Central Expwy.
San Tomas Expwy.
Walsh Ave.
U.P.R.R.
Monroe St.
Chromite Dr.
Machado Ave.
De La Cruz Blvd.
Calabazas Blvd.
El Camino Real
Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Homestead Rd.
Santa Clara University
Stevens Creek Blvd.
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1
Miles
City of Santa Clara
Sanitary Sewer Capacity Assessment
Subbasins and Load Manholes
Figure 3-2
RMC
Water and Environment

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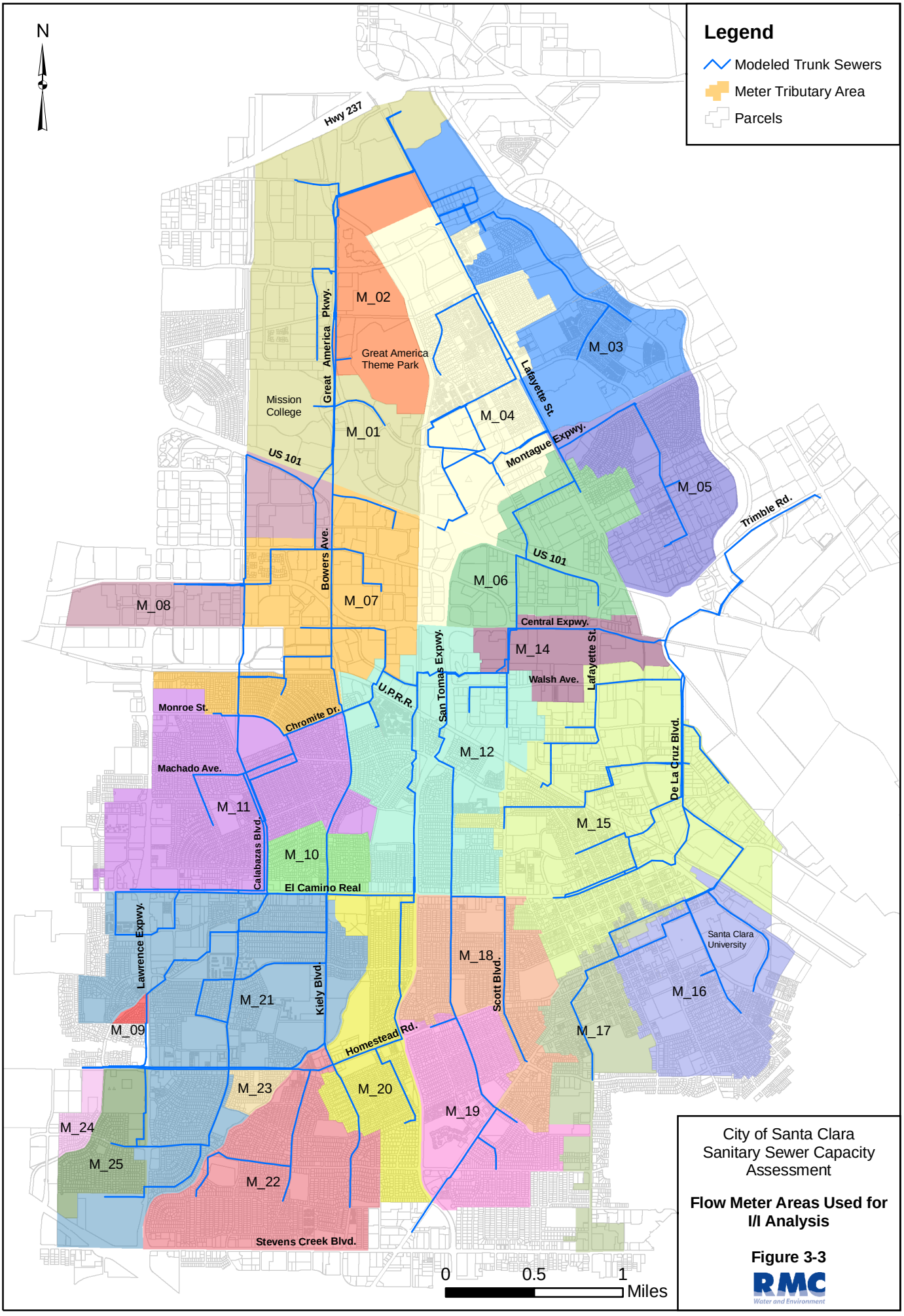
N
Legend
Modeled Trunk Sewers
Meter Tributary Area
Parcels
Hwy 237
M_02
Great America Pkwy.
Great America Theme Park
M_03
Lafayette St.
Mission College
M_04
M_01
Montague Expwy.
US 101
M_05
Trimble Rd.
US 101
Bowers Ave.
M_06
M_08
M_07
Central Expwy.
M_14
Lafayette St.
San Tomas Expwy.
U.P.R.R.
Walsh Ave.
Monroe St.
Chromite Dr.
M_12
De La Cruz Blvd.
Machado Ave.
M_11
M_15
Calabazas Blvd.
M_10
El Camino Real
Santa Clara University
Lawrence Expwy.
M_18
Scott Blvd.
Kiely Blvd.
M_21
M_16
M_09
M_17
Homestead Rd.
M_23
M_20
M_19
M_24
M_25
M_22
Stevens Creek Blvd.
0
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1
Miles
City of Santa Clara
Sanitary Sewer Capacity Assessment
Flow Meter Areas Used for I/I Analysis
Figure 3-3
RMC
Water and Environment

3.4 Model Calibration

Model calibration is the process of comparing model-computed flows to observed (monitored) flows to verify that the model is accurately simulating flows in the sewer system. The model is calibrated for both dry and wet weather conditions.

As described in Chapter 2, a temporary flow monitoring program consisting of 26 flow meters and 3 rain gauges installed in the Santa Clara system for a period of about two months (late January through early April 2006) provided data for calibration of the hydraulic model. A flow meter schematic is shown in **Figure 3-4.**

3.4.1 Dry Weather Calibration

The 7-day dry period from February 4 to 10, 2006, was used as the dry weather calibration period for the model. The dry weather calibration process was used to verify BWF loads and diurnal curves, and to quantify GWI (as indicated by monitored flows that were higher than estimated BWF). The model calibration resulted in a reasonably good match of modeled to metered flow at most locations, but some significant differences at others. These differences may be due to inaccuracies in the meter data, in water use loadings, or in the configuration of the system (e.g., upstream flow splits). The calibration process did result in further investigation and adjustments to several flow split locations in the model. Every effort was made to resolve as many of the calibration differences as possible. As shown in **Table 3-1**, the total flows in the system, as indicated by the sum of the flows at the most downstream meters (Meters 1, 2, 3, 4, 14, and 15), were within 3 percent of the modeled flows, which provides confidence that the overall flows in the model are reasonably accurate.

Table 3-1 Comparison of Meter and Model Flow

Meter	Meter Avg. Flow (mgd)	Model Avg. Flow (mgd)	Difference (mgd)	Percent Difference
1	5.45	6.06	0.61	11%
2	6.17	6.66	0.49	8%
3	1.06	0.70	-0.36	-34%
4	4.25	4.20	-0.05	-1%
14	2.15	2.23	0.08	4%
15	4.06	3.90	-0.16	-4%
Total	**23.13**	**23.74**	**0.61**	**3%**

Figure 3-5 shows example plots of model vs. metered flow for two locations in the system (Meters 1 and 15).

Figure 3-4 Meter Schematic

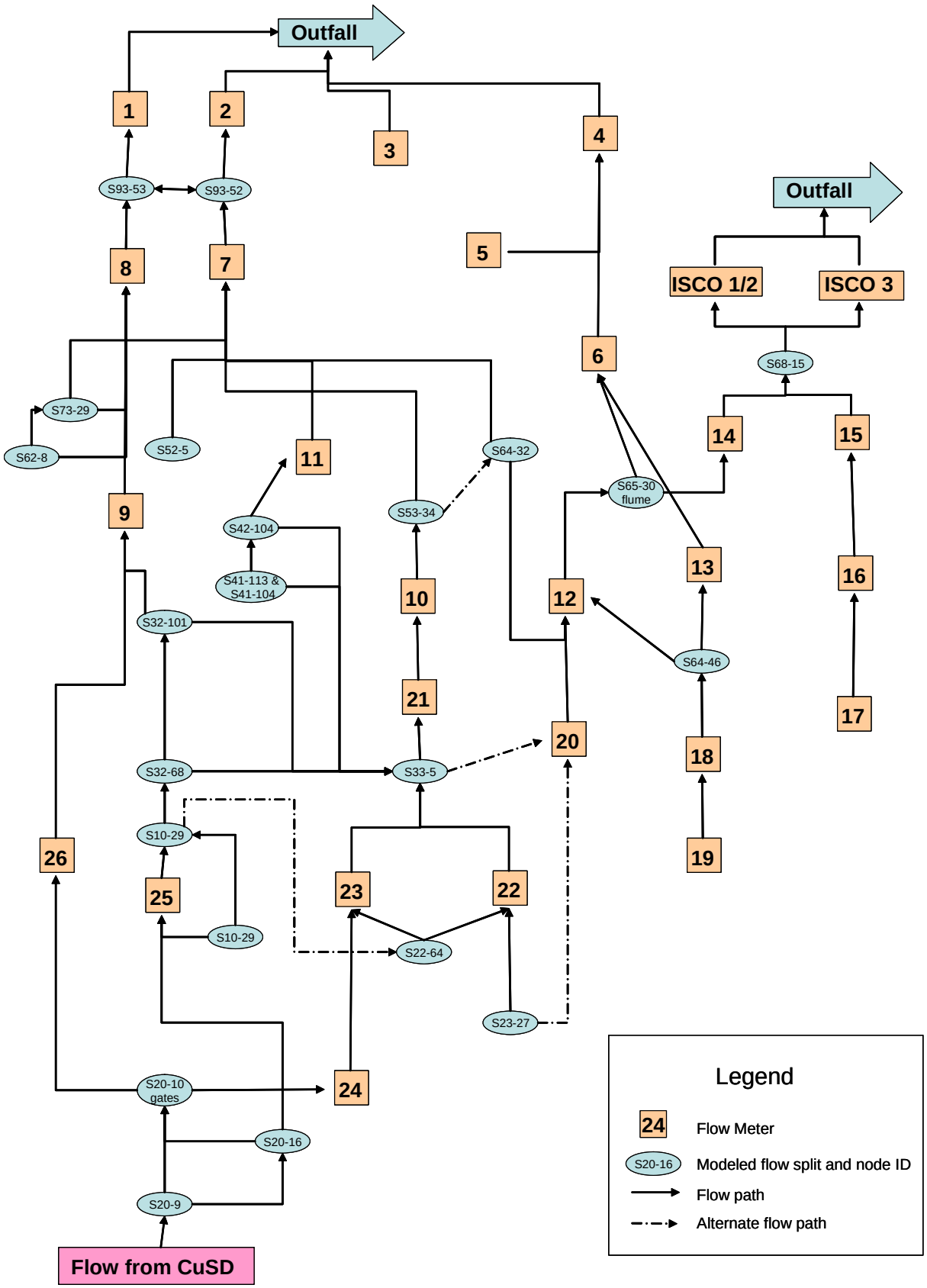
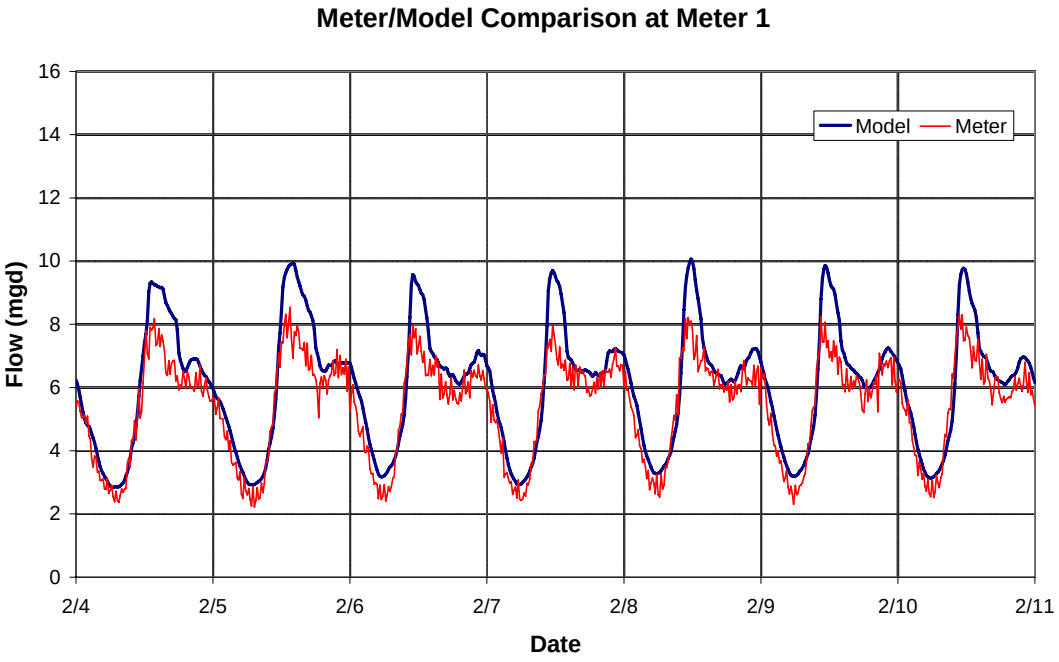
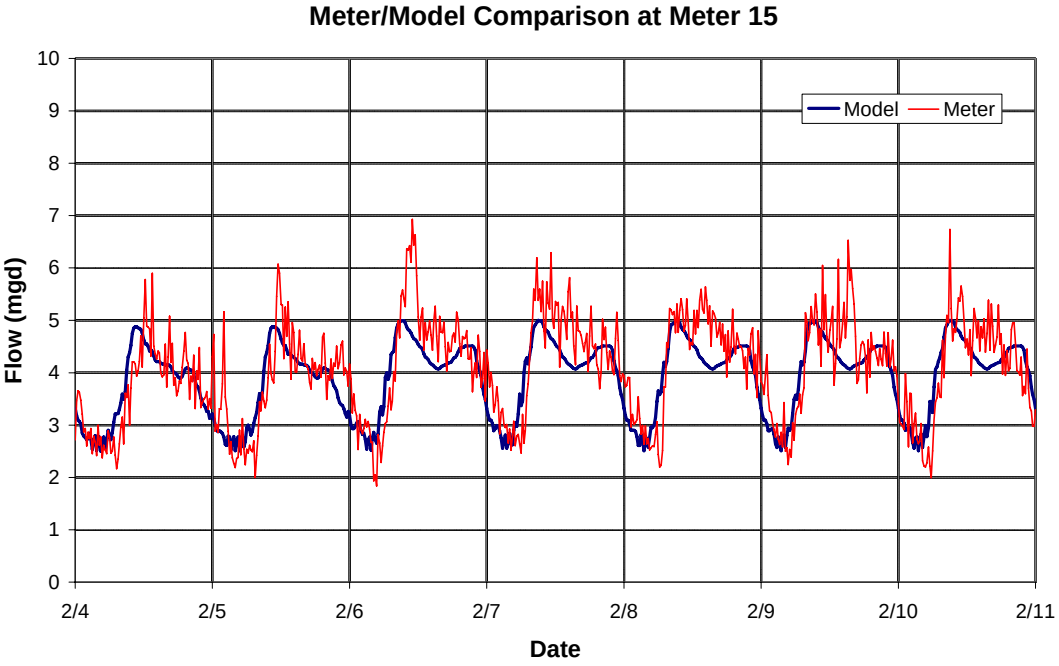


Figure 3-5 Example Dry Weather Calibration Plots



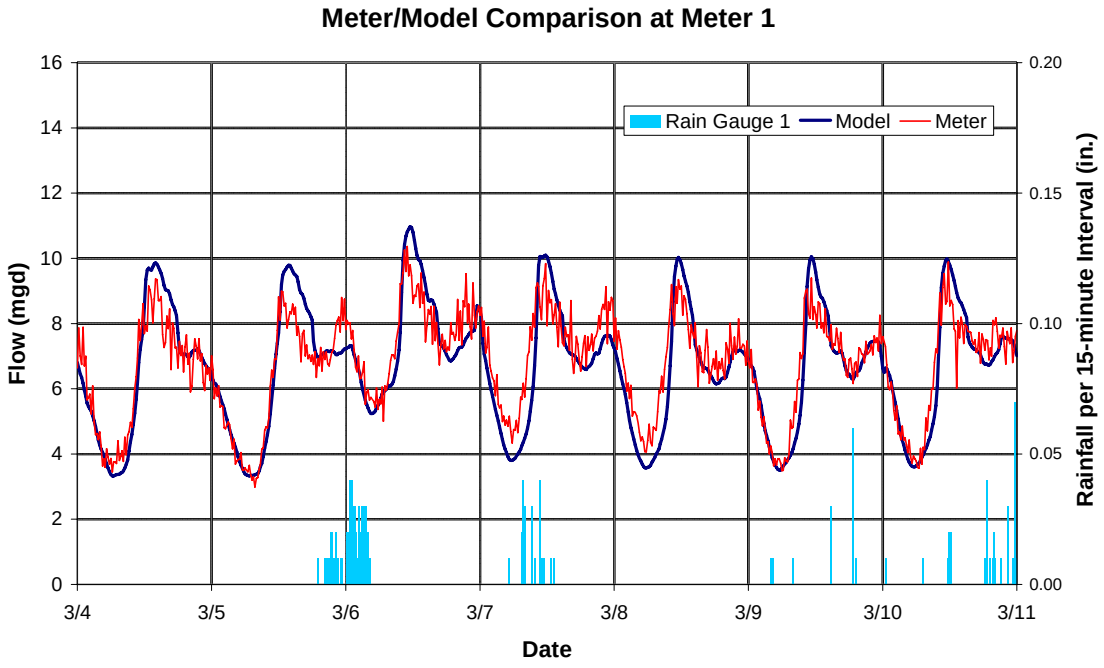


3.4.2 Wet Weather Calibration

Two of the larger storm events from the 2006 monitoring period, February 27 and March 5-6, were used for wet weather calibration. In general, the response to rainfall in the Santa Clara system is relatively small, as evidenced by the relatively low peak flow response to the rainfall events. As described in Chapter 2, RDI/I response to rainfall events was quantified in terms of three sets of triangular unit hydrograph parameters that represent the volume percentage of rainfall that enters the system as RDI/I and the shape of the RDI/I hydrograph as a function of each hour of rainfall. Through the wet weather calibration process, RDI/I hydrograph parameters were developed for each meter area. Additionally, wet weather GWI, as evidenced by elevated flows following the rainfall events, was determined for some areas.

Figure 3-6 presents some wet weather calibration plots for the same meters as shown in Figure 3-5. **Table 3-2** lists the GWI rates that were used for the dry and wet weather calibration by flow meter area and the RDI/I "R values" (percentages of rainfall) for each area.

Figure 3-6 Example Wet Weather Calibration Plots



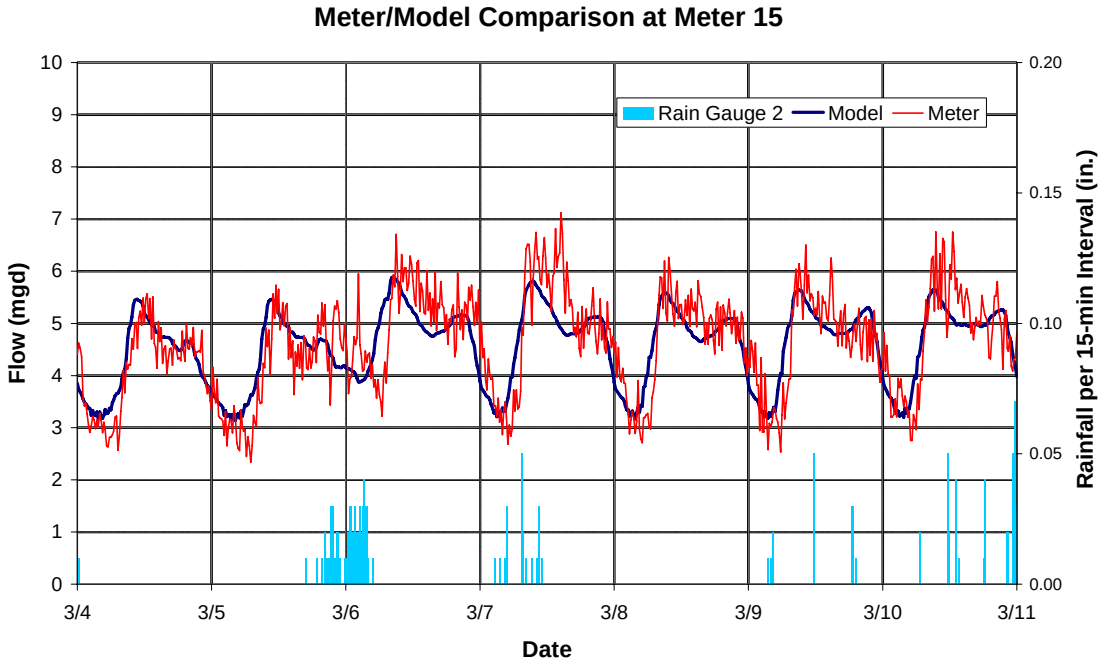


Table 3-2 GWI and RDI/I Parameters by Meter Area

Meter Area[a]	Dry Weather GWI[b] (gpd/acre)	Wet Weather GWI[c] (gpd/acre)	R1 RDI/I Vol. (%) (2 hrs. to peak)	R2 RDI/I Vol. (%) (6 hrs. to peak)	R3 RDI/I Vol. (%) (12 hrs. to peak)
M_01	0	0	0.5	0.8	0.8
M_02	0	0	0.5	0.8	0.8
M_03	0	0	0.6	0.1	0.1
M_04	500	1,300	0.6	0.1	0.1
M_05	700	1,000	0.6	0.1	0.1
M_06	0	0	0.6	0.1	0.1
M_07	1,900	1,900	0.3	0.5	0.5
M_08	0	0	0.3	0.5	0.5
M_09	0	0	0.6	0.1	0.1
M_10	0	0	0.6	0.1	0.1
M_11	1,600	2,300	0.9	1.7	6.0
M_12	0	0	0.9	1.0	0.5
M_14	0	0	0.6	0.1	0.1
M_15	300	700	1.0	0.2	0.2
M_16	900	1,600	1.0	0.2	0.2
M_17	200	200	0.6	0.1	0.1
M_18	0	0	0.8	1.0	0.1
M_19	0	0	0.3	0.1	0.1
M_20	0	0	0.6	0.1	0.1
M_21	0	0	0.6	0.1	0.1
M_22	0	0	0.6	0.1	0.1
M_23	0	0	0.6	0.1	0.1
M_24	0	0	0.6	0.1	0.1
M_25	0	0	0.6	0.1	0.1
CuSD	0	0	0.5	0.2	0.4

(a) See Figure 3-3.
(b) Represents GWI during non-rainfall periods (e.g., early to mid-February) of the 2006 flow monitoring period.
(c) Represents GWI immediately following rainfall events.

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Chapter 4

Capacity Analysis

Chapter 4 Capacity Analysis

This chapter describes the hydraulic analysis and design criteria used to evaluate system performance and size capacity relief projects, the capacity deficiencies based on the results of model runs, and preliminary solutions to identified capacity deficiencies.

4.1 Hydraulic Analysis and Design Criteria

Hydraulic analysis criteria define the conditions under which an existing component of the sewer system is considered to be deficient in capacity. As discussed in Chapter 2, these conditions are based on the design flow and performance criteria established for the system. In the case of Santa Clara, it was recommended that the trunk sewer system be evaluated with respect to its ability to convey peak flows from a 10-year design storm at service area buildout under a peak base wastewater flow condition. Based on discussions with City staff, it was also recommended that a performance criterion of no surcharge (or, more practically, minimal surcharge, e.g., no more than about one foot of surcharge if the sewer is reasonably deep) be used to identify capacity-deficient sewers.

Hydraulic *analysis* criteria may different from the hydraulic *design* criteria used to size new or relief system facilities. Hydraulic design criteria needed for sewer system capacity planning include pipe friction factor, minimum pipe diameter and depth, maximum allowable flow depth to diameter ratio (d/D), and minimum and maximum pipe slopes and velocities. **Table 4-1** presents the recommended hydraulic design criteria for the Santa Clara sewer system capacity assessment. These criteria are consistent with the City's current sanitary sewer design criteria.

Table 4-1 Hydraulic Design Criteria

Criterion	Description	Value
Manning's 'n'	Pipe friction factor	0.013
Pipe Diameter (gravity sewers)	Minimum	8 inches in residential areas, 10 inches in commercial areas, 12 inches in industrial areas
Pipe Depth	Minimum cover over pipe	6 feet
Design Pipe Capacity	Pipe capacity at peak design wet weather flow	0.75 d/D for new or relief sewers
Velocity	Minimum (pipe full or half full)	2 feet/second
	Maximum (at peak design flow)	10 feet/second
Pipe slope	Minimum	Sufficient to obtain minimum velocity
	Maximum	Less than slope that would produce maximum velocity

4.2 Capacity Analysis Results

The results of model runs for future peak dry weather flow (PDWF) and design storm peak wet weather flow (PWWF) scenarios are shown in **Figure 4-1** and **Figure 4-2,** respectively**.** The figures show pipes that are predicted to surcharge due to capacity deficiency or backwater from a downstream capacity deficiency. Note that the results shown reflect an "unrelieved" system, meaning that peak flows are dampened out in pipes that are under heavy surcharge due to backwater from downstream constrictions, and the true peak flows cannot be determined until the downstream capacity deficiencies are relieved. Therefore, the data shown for percent full capacity are only approximations of system performance.

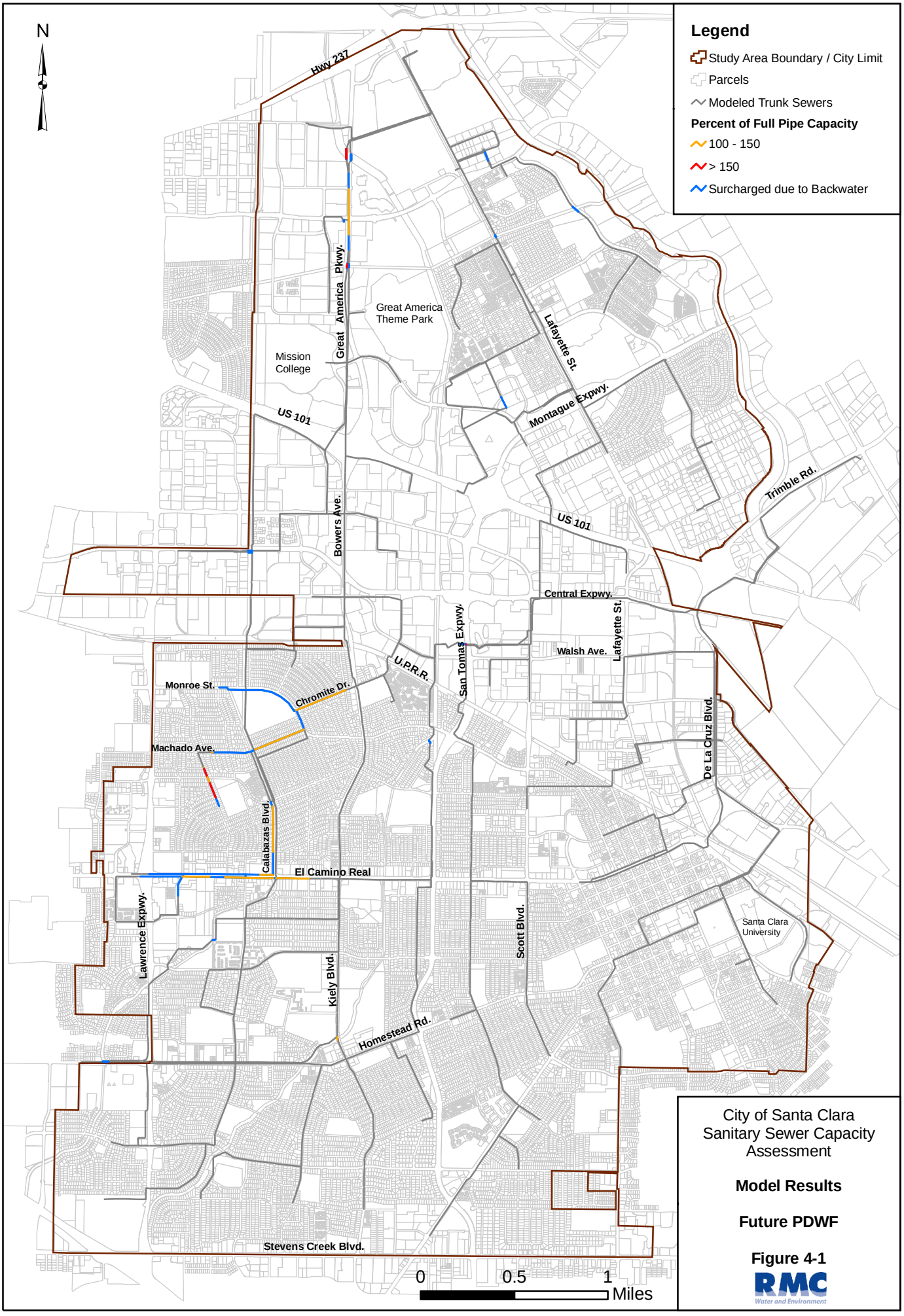
The majority of the predicted future capacity deficiencies in the system are located on the west side of the City along the 27- through 36-inch trunk sewer in Great America Parkway and Bowers Avenue and extending upstream into the smaller trunk sewers in Chromite Drive and Machado Avenue). There are also additional areas of predicted capacity deficiencies in portions of Calabazas Boulevard north of El Camino Real (ECR), ECR east and west of Calabazas Boulevard, Machado Avenue and Nobili Avenue west of Calabazas Boulevard, Monroe Street west of Chromite Drive, Scott Boulevard north of Saratoga Avenue, and Park Avenue south of Bellomy Street.

Using the model software, hydraulic profiles were generated for all areas of the system identified as being surcharged under the future design PWWF scenario. The profiles were reviewed to identify where relief capacity would be required to eliminate surcharged conditions.

It should be noted that a number of capacity deficiencies are identified in the area of the system tributary to the 18-inch trunk sewer in Chromite Drive west of Bowers Avenue (area designated as M_11 in Figure 3-3). This area is roughly bounded by Monroe Avenue and Chromite Drive on the north, ECR on the south, Bowers Avenue on the east, and the city limits on the west. The flow data from Meter 11 showed a very high volume, delayed response to rainfall, as indicated by the high values for R2 and R3 for this meter in Table 3-2. When applied to the 10-year design storm rainfall, these parameters produce a high peak response several hours after the peak of the storm. It is possible that the calibration parameters, which reasonably approximate the observed flow response to the smaller observed rainfall events in the 2006 flow monitoring period, may overestimate the response for a larger, more intense rainfall event like the 10-year design storm. Therefore, the City should consider conducting further wet weather flow monitoring in this area to verify RDI/I response prior to the design of capacity improvements.

4.2.1 Cupertino Sanitary District Flows

Based on preliminary model runs for future conditions, the projected PWWF from CuSD was estimated to be about 16 mgd. This exceeds CuSD's contracted maximum capacity of 13.8 mgd in the Santa Clara system. Model runs were also conducted assuming no future growth in CuSD, which resulted in a peak flow of 13.9 mgd, or approximately equal to the contract capacity. Therefore, for purposes of the capacity assessment presented in this report, the maximum contract flow of 13.8 mgd was assumed for CuSD.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Legend
Study Area Boundary / City Limit
Parcels
Modeled Trunk Sewers
Percent of Full Pipe Capacity
100 - 150
> 150
Surcharged due to Backwater
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
US 101
Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
Central Expwy.
San Tomas Expwy.
U.P.R.R.
Walsh Ave.
Monroe St.
Chromite Dr.
Machado Ave.
Calabazas Blvd.
El Camino Real
De La Cruz Blvd.
Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Santa Clara University
Homestead Rd.
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Assessment
Model Results
Future PDWF
Figure 4-1
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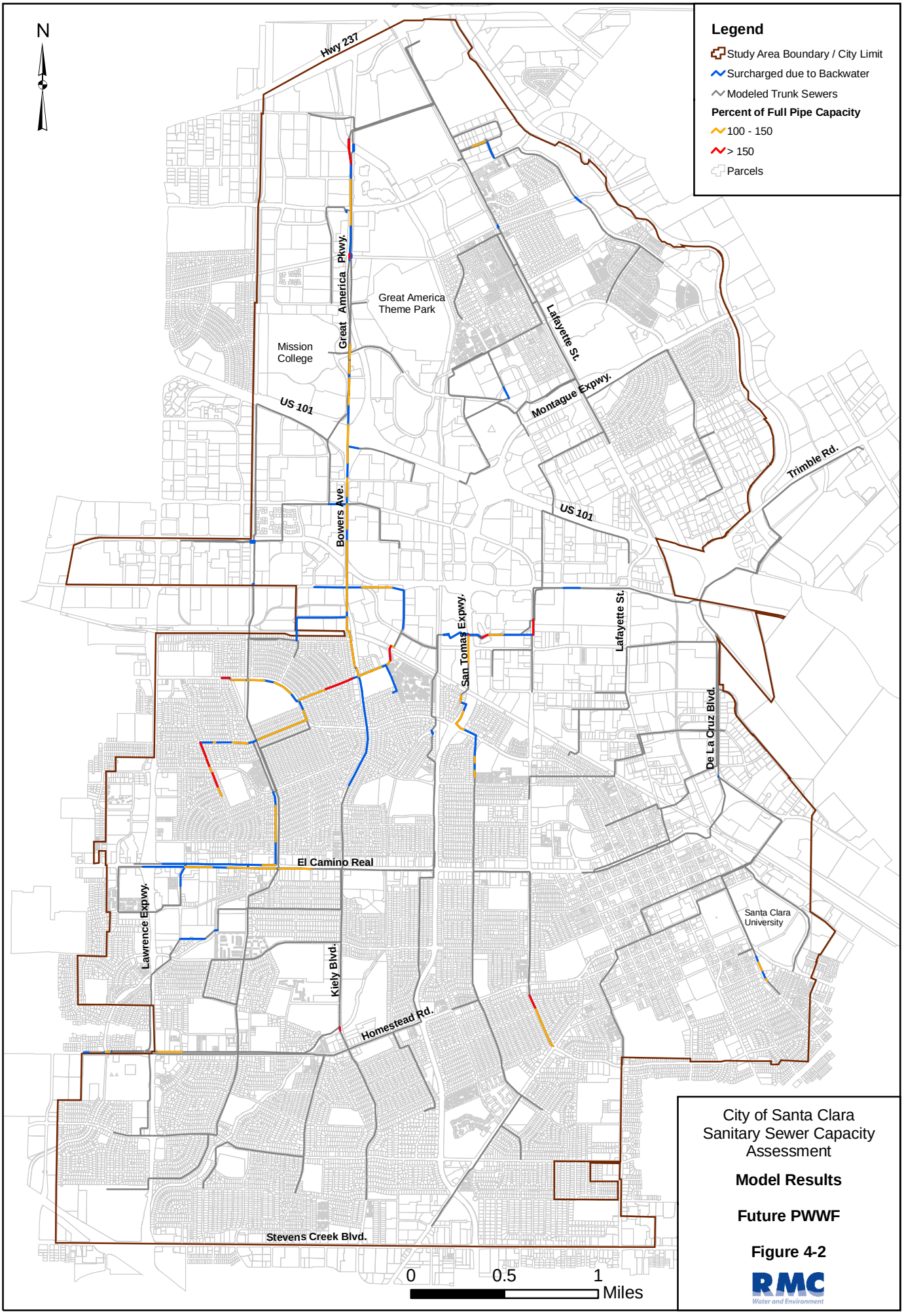
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Kiely Blvd.
Homestead Rd.
Santa Clara University
Stevens Creek Blvd.
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City of Santa Clara
Sanitary Sewer Capacity
Assessment
Model Results
Future PWWF
Figure 4-2
RMC
Water and Environment

4.3 Preliminary Solutions to Capacity Deficiencies

Based on the model results and hydraulic profiles, the identified capacity-deficient locations were further reviewed to determine if they should be recommended for capacity improvement. The criterion used to make this determination was that the capacity deficiency results in at least one foot of surcharge above pipe crown, or less than five feet of freeboard under the design storm PWWF condition. This criterion allows for flexibility to eliminate the need to provide potentially expensive capacity relief projects for barely surcharged sewers.

Based on the identified capacity deficiencies, the sizes of required replacement sewers to handle the predicted future PWWF were determined. The model was then re-run with the upsized pipes to confirm that they would resolve the predicted surcharge. The development of relief solutions was an iterative process of gradually upsizing needed pipes to eliminate any significant surcharge in the system under the design peak flow condition.

The required improvements were refined by determining parallel pipe sizes that would be equivalent to pipe replacement for larger diameter sewers requiring capacity relief (the parallel pipe sizes were estimated based on model flows and existing pipe slopes). Parallel pipes were considered an alternative to replacement for trunk sewers with required diameters of 21 inches and larger. Replacement pipes were generally assumed for smaller diameter sewers. During project refinement, other factors such as constructability issues, or the need to rehabilitate or replace a pipe that may be nearing the end of its useful life, would also be taken into consideration in determining whether to parallel or replace a capacity deficient sewer.

The preliminary capacity solutions are listed in **Table 4-2** and shown in **Figure 4-3**. Note that a capacity deficiency (identified as Project 3) was initially identified on the 24-inch Calabazas Trunk Sewer based on the initial estimate of 16 mgd future flow from CuSD. However, if CuSD flows do not exceed the 13.8 mgd contract capacity, the project would not be needed. Therefore, this project was eliminated from consideration and is not shown in Table 4-2 or Figure 4-3.

The identified projects represent preliminary solutions to the identified capacity deficiencies in the Santa Clara trunk sewer system. In the next chapter of the report, other alternatives for addressing these capacity deficiencies, including possible diversions to other trunk sewers with available capacity, or alternative relief sewer alignments that may be more cost effective to construct, are developed and evaluated in order to develop more definitive estimates for the City's long-term Capital Improvement Program for the sanitary sewer system.

Table 4-2 Capacity Deficiencies and Preliminary Solutions

Project No.	Location	US MH	DS MH	Length (ft.)	Design Flow (mgd)	Exist. Dia. (in.)	Req'd. Dia. (in.)	Parallel Dia. (in.)
1A	Great America Pkwy. from Mission College Blvd. to Hetch Hetch crossing	S83-12	S93-57	1,900	23	36	39	21
1B	Great America Pkwy. from north side of US 101 to Mission College Blvd.	S73-1	S83-12	1,800	22	33	39	21
2A	Bowers Ave. from Kifer Rd. to north side of US 101	S63-20	S73-1	5,000	20	30-33	39	21
2B	Bowers Ave. from Chromite Dr. to Kifer Rd.	S53-34	S63-20	2,600	19	27	33	21
4A	Chromite Dr. and Monroe St. from Machado Ave. to west of Bowers Ave.	S52-80	S53-41	2,200	5.0-6.9	18	24-27	18-21
4B	Machado Ave. from Calabazas Blvd. to Monroe St.	S52-103	S52-80	1,500	4.1	15	21	15
5	Monroe St. from Fordham Dr. to Chromite Dr.	S51-22	S52-65	2,500	0.96	10 8(siphon)	12 10(siphon)	--
6	Nobili Ave. and Machado Ave. from Flora Vista Ave. to Calabazas Blvd.	S41-53	S52-101	3,100	2.2-3.5	10-15	15-18	--
7	Calabazas Blvd. from El Camino Real to Cabrillo Ave.	S42-106	S42-30	2,400	0.47	8	10	--
8A	El Camino Real from Pomeroy Ave. to Bowers Ave.	S42-121	S33-5	2,600	1.2	10 6(siphon)	15 8/10(siphon)	--
8B	El Camino Real from Flora Vista Ave. to Pomeroy Ave.	S41-113	S42-121	1,800	1.0	10	12	--
9	Scott Blvd. from Serra Ave. to Homestead Rd.	S25-37	S35-98	800	0.56	8	10	--
10	Park Ave. south of Bellomy St.	S38-75	S38-66	250	0.84	10	12	--

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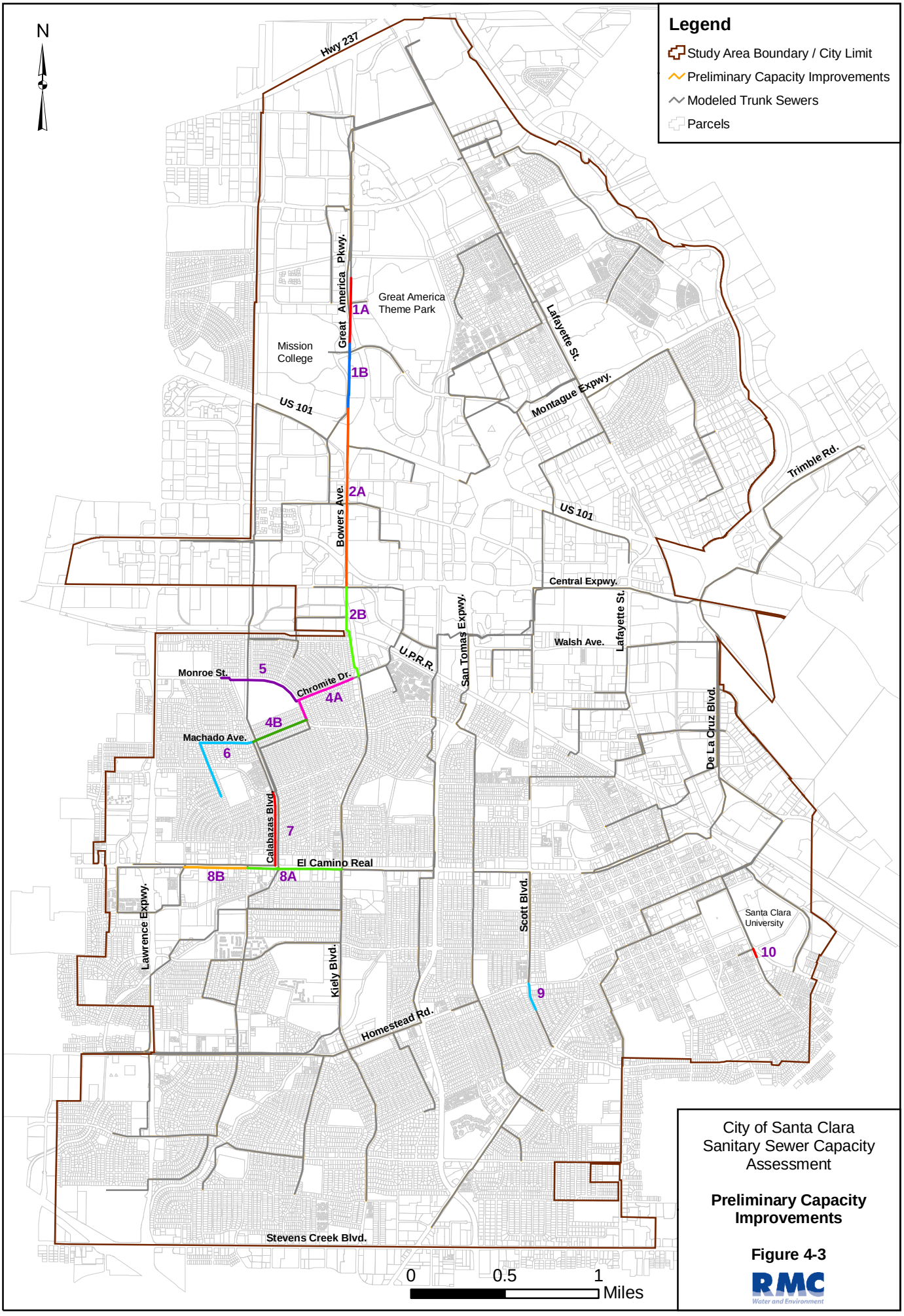
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Bowers Ave.
2A
US 101
Central Expwy.
2B
San Tomas Expwy.
U.P.R.R.
Walsh Ave.
Lafayette St.
Monroe St.
5
Chromite Dr.
4A
4B
Machado Ave.
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De La Cruz Blvd.
Calabazas Blvd.
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El Camino Real
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Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Santa Clara University
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Homestead Rd.
Stevens Creek Blvd.
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Sanitary Sewer Capacity
Assessment
Preliminary Capacity Improvements
Figure 4-3
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Water and Environment

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Chapter 5

Capacity Improvement Projects

Chapter 5 Capacity Improvement Projects

This section summarizes the improvement projects recommended for Santa Clara's wastewater collection system. Recommended improvements were developed from the results of hydraulic modeling of the trunk sewer system for predicted future flow conditions, as described in Chapter 4. This section discusses the projects, including alternative projects, needed to address potential capacity deficiencies in the existing trunk sewer system.

5.1 Potential Flow Diversion Alternatives

The first step in developing project alternatives was to identify potential flow diversions that could possibly relieve capacity deficiencies without the need for relief sewers, or by significantly reducing the length of needed relief sewers. The following potential flow diversions were identified:

- Divert a portion of the flow from the east trunk sewer to the west trunk sewer in Great America Parkway. This diversion could potentially eliminate the need for Projects 1A and/or 1B.
- Divert flow from the south sewer in El Camino Real (ECR) into the 24-inch trunk sewer that runs along the east side Calabazas Boulevard. This diversion would relieve the capacity deficiency in the south sewer in ECR, which causes flow to back up into the north sewer and then flow north into the 8-inch sewer located on the west side of Calabazas Boulevard. The diversion could be accomplished by diverting flow from the south sewer in ECR into the 24-inch Calabazas trunk sewer just east of Calabazas Creek. This diversion could potentially eliminate the need for Project 7 and Project 8A, and reduce the flow to Projects 4B and 4A.
- Divert flow from the sewer in Machado Avenue west of Calabazas Boulevard into the 24-inch Calabazas trunk sewer. This diversion could potentially eliminate the need for or reduce the required sizes of Projects 4B and 4A.
- Divert flow from the sewer in Monroe Avenue west of Calabazas Creek into the 24-inch Calabazas trunk sewer. This diversion could potentially eliminate the need for the portion of Project 5 east of Calabazas Creek, and reduce the size of Project 4A.

Modeling indicated that diversion of flow from the east to the west trunk sewer in Great America Parkway would not be effective in eliminating the need for capacity relief for that area of the system. A possible connection between manhole S83-18 on the east side of Great America Parkway and S83-17 on the west side of Great America Parkway was evaluated as a potential alternative. However, since the west pipe was higher in elevation than the east pipe a cross connection to relieve the surcharged east pipe is not feasible. The lack of available capacity in both of these pipes further downstream makes the idea of an intertie along Great America Parkway even less feasible.

Modeling of the potential flow diversions to the Calabazas trunk sewer determined that the diversion at ECR and Calabazas Creek could eliminate the need for Project 7 and the portion of Project 8B east of Calabazas Creek. However, the amount of capacity available further downstream in the Calabazas trunk sewer is limited to approximately 1 mgd based on the critical pipe segment between Kifer Road and Scott Boulevard (MHs S62-37 to S72-20). Any additional diversions (e.g., at Machado or Monroe) would result in too much flow in the Calabazas trunk sewer. Furthermore, a diversion at Machado does not appear to be hydraulically feasible because there is insufficient elevation difference between the Machado and Calabazas sewers. Therefore, only the diversion at ECR to the Calabazas trunk sewer was carried forward as a feasible alternative.

5.2 Potential Diversions to New Sewers

The second step in the alternatives analysis process was to identify locations where flows could be diverted to new trunk sewers that could be less difficult or less costly to construct than paralleling or replacing capacity deficient sewers in the same alignment. The following potential diversions to new sewers were identified:

- Divert flow from the Bowers Avenue trunk sewer into a new trunk sewer that would convey flow to the eastern side of the system and ultimately to the system outfall in Trimble Road. This diversion could potentially eliminate the need for Projects 1 and 2.
- Divert flow from the south sewer in ECR into a new sewer in Flora Vista Avenue that would convey flow to Project 6 in Nobili Avenue. This diversion and new sewer would eliminate Project 8B and the need for construction in ECR, but Project 6, 4B and 4A would likely need to be increased in size.

Examination of the model results determined that the eastern portion of the trunk sewer system has excess capacity downstream (east) of Lafayette Street, where the trunk sewer in Central Expressway increases in size to 27 inches and then to 48 inches at De La Cruz Boulevard. Therefore, constructing a new trunk sewer from Bowers Avenue to Central Expressway east of Lafayette to divert flow from the western to the eastern part of the system could potentially reduce the flow in the Bowers Avenue and Great America Parkway trunk sewers sufficiently enough to eliminate the need for capacity relief. In order to ensure adequate grade between the flow diversion point on Bowers Avenue to the connection point to the existing system at Central Expressway, flow would need to be diverted from the existing 18-inch sewer in Chromite Drive just west of Bowers Avenue, which is about 5 feet higher than the Bowers Avenue trunk. Modeling of this alternative indicates that up to 3.5 mgd could be diverted, which would be sufficient to eliminate the need for capacity relief for the Bowers Avenue/Great America Parkway trunk sewer. Therefore, a potential new west-to-east trunk sewer was carried forward as a feasible alternative.

The potential diversion of flow into a new sewer in Flora Vista Avenue is also feasible. However, this alignment would be longer than the project in ECR, would require extensive construction through residential neighborhoods, and would ultimately increase the flow to the sewers in Machado Avenue, Chromite Drive, and Bowers Avenue. Therefore, although this alternative reduces the amount of construction on ECR, it does not offer any significant advantage over the preliminary capacity solution (Project 8B).

5.3 Construction Considerations

To further develop the proposed capacity improvement projects, field visits were conducted to evaluate the proposed project alignments, identify feasible pipeline corridors, and assess potential constructability issues. Utility maps were also obtained to identify potential conflicts with major utilities (e.g., storm drains, large water or recycled water mains) in the proposed project corridors. Based on these investigations, the proposed project alignments and construction methods were refined, as described below. In general, for relief projects to be constructed in the same alignment as existing capacity-deficient trunk sewers, it was assumed that the existing pipeline would be replaced rather than paralleled. This provides a more conservative estimate, appropriate for the planning phase of these projects. For those projects in which the existing sewer is recommended for replacement with a new sewer of one or two pipe diameters larger, however, pipe bursting could also be considered as an alternative to remove and replace.

5.4 Capacity Relief Projects

Table 5-1 summarizes the recommended projects. The locations of the proposed projects are shown in **Figure 5-1** and described in the paragraphs below.

Table 5-1 Recommended Capacity Improvement Projects

Project No.[a]	Location	US MH	DS MH	Length (ft.)	Exist. Dia. (in.)	Req'd. Dia. (in.)[b]
1	Augustine Dr., Lakeside Dr., crossing of U.S. 101, Mission College Boulevard, Great America Pkwy. from Bowers Ave. to south of Hetch Hetchy ROW	S73-20	S93-57	7,200	33-36	21 (P)
2	Chromite Dr., Alhambra Dr., Bracher Park, crossing of UPRR, Bowers Ave. from Bowers Ave. to Augustine Dr.	S53-34	S73-20	6,200	27-33	21 (P)
West-to-East Trunk[c]	Chromite Dr., Alhambra Dr., Bracher Park, crossing of UPRR, Walsh Ave., Lafayette, Lafayette St., Central Expwy. From Bowers Dr. to UPRR	S53-41	S67-18	12,200	NA	24
4A	Monroe St. and Chromite Dr. from Machado Ave. to west of Bowers Ave.	S52-80	S53-41	2,200	18	24-27 (R)
4B	Machado Ave. from Calabazas Blvd. to Monroe St.	S52-103	S52-80	1,500	15	21 (R)
5	Monroe St. from Fordham Dr. to Chromite Dr.	S51-22	S52-65	2,500	10 8(siphon)	12 (R) 8(siphon) (P)
6	Nobili Ave. and Machado Ave. from Flora Vista Ave. to Calabazas Blvd.	S41-53	S52-101	3,100	10-15	15-18 (R)
8	El Camino Real from Flora Vista Ave. to Calabazas Blvd.	S41-113	S32-5	2,600	10	12-15 (R)
9	Scott Blvd. from Serra Ave. to Homestead Rd.	S25-37	S35-98	800	8	10 (R)
10	Park Ave. south of Bellomy St.	S38-75	S38-66	250	10	12 (R)

(a) P = parallel sewer; R = remove and replace
(b) Alternative to Projects 1 and 2.

5.4.1 Projects 1 and 2 – Bowers Ave, Mission College Blvd and Great America Pkwy

These projects would provide capacity relief for the trunk sewer in Bowers Avenue from Chromite Drive to Highway 101 and the east trunk sewer in Great America Parkway from Highway 101 to just south of the Hetch Hetchy right-of-way. Crossing the Union Pacific Railroad (UPRR) and Highway 101 present particular challenges for this alignment, as well as dealing with the heavy traffic along the entire pipeline alignment. Furthermore, there are several large-diameter utilities in the area of Projects 1 and 2.

The proposed project would consist of a parallel 21-inch pipeline to provide capacity relief along this alignment. The majority of the pipeline could be constructed by open trench methods. Because of the need to cross the UPRR (where Bowers Avenue is depressed below grade at the railroad crossing) and Highway 101, and because portions of the existing trunk sewer are located in utility easements that contain other sewer and storm drain pipelines, the new sewer alignment could not exactly parallel the existing trunk sewer. Therefore, a new alignment was developed to facilitate the UPRR and Highway 101 crossings, as well as to keep the pipeline in the public right-of-way as much as possible.

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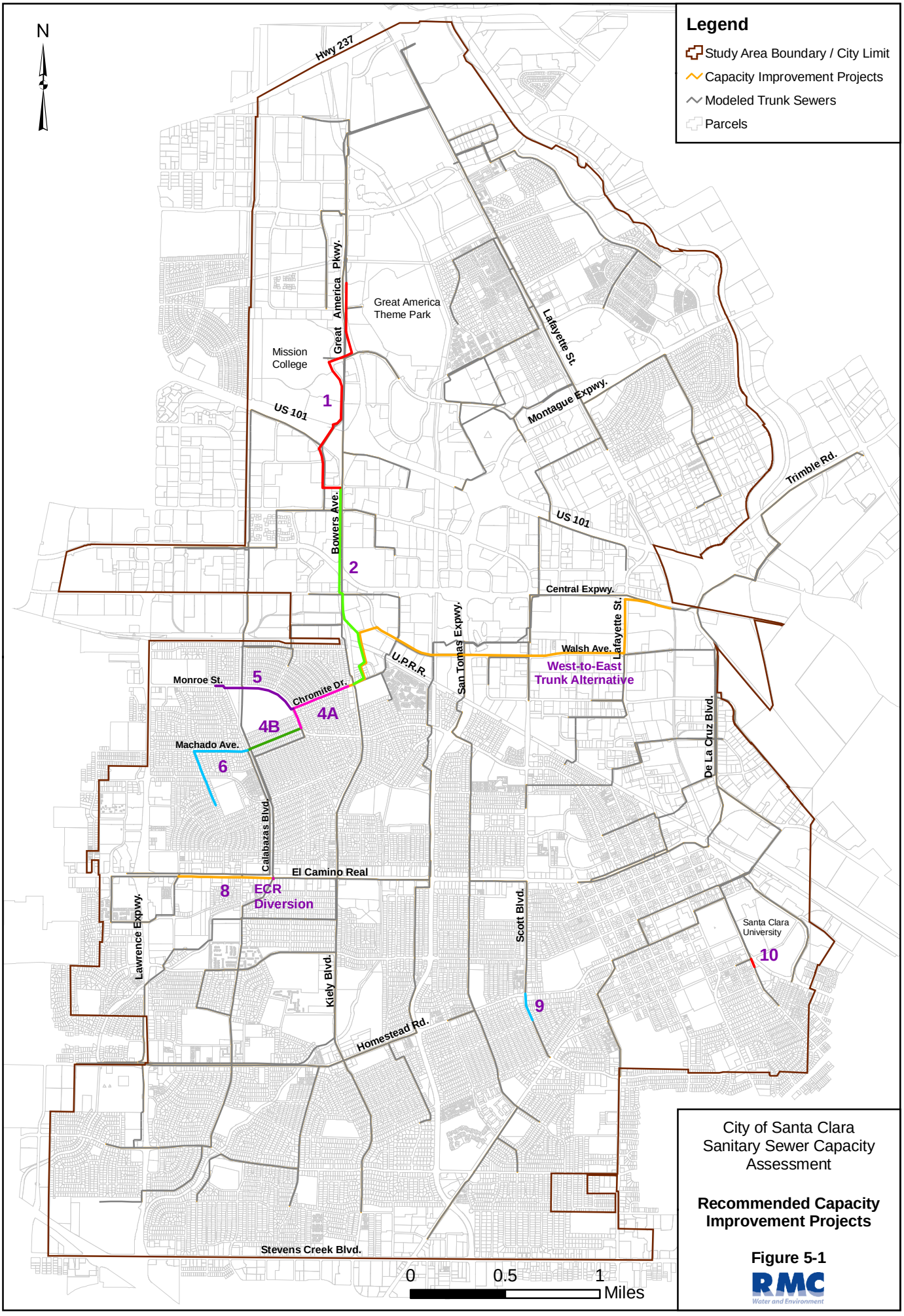
N
Legend
Study Area Boundary / City Limit
Capacity Improvement Projects
Modeled Trunk Sewers
Parcels
Hwy 237
Great America Pkwy.
Great America Theme Park
Mission College
US 101
1
Lafayette St.
Montague Expwy.
Trimble Rd.
Bowers Ave.
2
US 101
Central Expwy.
Lafayette St.
Walsh Ave.
West-to-East Trunk Alternative
San Tomas Expwy.
U.P.R.R.
Monroe St.
5
Chromite Dr.
4A
4B
Machado Ave.
6
De La Cruz Blvd.
Calabazas Blvd.
El Camino Real
8
ECR Diversion
Lawrence Expwy.
Kiely Blvd.
Scott Blvd.
Santa Clara University
10
9
Homestead Rd.
Stevens Creek Blvd.
0
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1
Miles
City of Santa Clara
Sanitary Sewer Capacity Assessment
Recommended Capacity Improvement Projects
Figure 5-1
RMC
Water and Environment

Starting at the intersection of Bowers Avenue and Chromite Drive (manhole S53-34), the pipeline would extend eastward along Chromite Drive to Alhambra Drive and then north to Bracher Park. From the south end of Bracher Park, the pipeline would be tunneled roughly 850 feet underneath the park and the UPRR and underneath a private parking lot, and would then be tunneled approximately 500 feet roughly parallel to the northern edge of the City's power substation property, terminating at approximately the intersection of Bowers Avenue and Mead Avenue. Temporary and permanent easements would be required for construction in the properties adjacent to the City's power substation.

Extending north from Mead Avenue, the pipeline could be aligned along the east side of Bowers Avenue to Central Expressway. Trenchless construction methods would be used to cross Central Expressway. The pipeline would continue north on the west side of Bowers until turning west on Augustine Drive. At Lakeside Drive it would turn north again. Junction structures would be needed where the proposed pipeline crosses the alignment of the existing 21-inch and 30-inch sewers in Lakeside Drive. From near manhole S73-6 on Lakeside Drive, the pipeline would be tunneled approximately 500 feet across Highway 101 to Mission College Boulevard, parallel to the existing 30-inch sewer crossing.

The pipeline would extend north and then east on Mission College Boulevard to Great America Parkway. It is assumed that an inverted siphon would be used to cross under the existing 33- and 36-inch trunk sewers and the 54-inch storm drain located in the utility easement that crosses the east-west segment of Mission College Boulevard. From Mission College Boulevard, the pipeline would follow the east side of Great America Parkway, terminating at manhole S93-57.

5.4.2 New West-to-East Trunk Sewer Alternative

As described above, a new west-to-east trunk sewer would be a possible alternative to Projects 1 and 2. The project would involve intercepting a portion of the flow from the sewer in Chromite Drive just west of Bowers Avenue, which currently discharges to the Bowers Avenue trunk sewer, and diverting it into a new 24-inch sewer that would run in a general west-to-east direction, discharging to the existing 27-inch trunk sewer in Central Parkway east of Lafayette Street. The advantage of this alignment would be avoiding the potentially difficult construction that would be required for Projects 1 and 2 (described above), as well as reducing the flow to the Northside and Rabello Pump Stations, thereby saving in pumping costs. A new west-to-east trunk sewer would also increase the overall flexibility of the system by connecting the west and east basins.

Various alignments for a west-to-east trunk sewer were evaluated using aerial mapping as well as field investigation. The most difficult challenge of the sewer alignment would be the crossing of the UPRR right-of-way. Based on field verification, the preferred alignment would be similar to that proposed for Project 2 from the intersection of Chromite Drive and Bowers Avenue, east to Alhambra Drive, and then north to Bracher Park. As in that project, the pipeline would be tunneled under Bracher Park and across the UPRR to the parking lot behind the buildings on Walsh Avenue. The new sewer would then turn east and be tunneled through the parking lot to Walsh Avenue, then continue east along Walsh Avenue. Twin 15-inch siphons would be installed across San Tomas Aquino Creek. The pipeline would also be tunneled underneath San Tomas Expressway. An inverted siphon would also need to be installed at the Scott Boulevard crossing to avoid a 42-inch storm drain.

On Walsh Avenue between Scott and Lafayette, the existing alignment of utilities makes placing a new 24-inch sewer a challenge. Roughly 1,500 feet of an existing 8-inch water pipeline may need to be moved to provide room for the new sewer pipeline. At Lafayette, the new sewer line would turn north, with a siphon needed to cross Lafayette Street at the south side of Central Expressway to cross under an existing storm drain.

Because the existing 27-inch trunk in Central Expressway at Lafayette Street is located in the center of the road, the proposed new trunk sewer would turn east and follow the southern shoulder of Central Expressway before connecting into the 27-inch line. To alleviate a potential backwater condition due to a

very flat section of pipe that crosses under the UPRR further downstream, the proposed west-to-east trunk pipeline was extended downstream to manhole S67-18.

The west-to-east trunk sewer would increase the peak design flow in the 48-inch Trimble Road trunk sewer from 14.1 to 16.7 mgd. Note that the most downstream parallel 33-inch lines in Trimble Road between North First Street and Zanker Road, where the City's Trimble Road trunk sewer connects into the City of San Jose's interceptors, were not included in the hydraulic model. It is assumed that these lines would have sufficient capacity to handle the increased flows. It is also assumed that the additional flow from the Trimble Road trunk sewer would have minimal impact on the flows in the interceptors in Zanker Road.

5.4.3 Projects 4A and 4B – Machado Avenue and Chromite Drive

This project would provide capacity relief on Machado Avenue, Monroe Street, and Chromite Drive from Calabazas Boulevard to just west of Bowers Avenue (manholes S52-103 to S53-41). (The existing 12-inch siphon across Calabazas Creek would not need to be upsized.) The existing 15- and 18-inch sewers would need to be replaced with 21-, 24-, and 27-inch pipes. A parallel sewer could be an option; however, there is limited room in these streets for another sewer because of other utilities. Approximately 85 lower laterals and cleanouts would also need to be replaced along this alignment, in accordance with the City's policy of replacing lower laterals whenever the main sewer is replaced. Because it is generally considered inadvisable to connect laterals to larger diameter pipelines (e.g., larger than about 18 inches), possibly a parallel 8-inch line could be installed above or adjacent to the new pipe, to which the laterals could be connected.

5.4.4 Project 5 – Monroe Street

Along Monroe Street, from Fordham Drive to Chromite Drive, approximately 2,500 feet of 10-inch sewer would be replaced with 12-inch pipe in order to increase the capacity of this sewer from manholes S51-22 to S52-65. Additionally, a parallel siphon at Calabazas Creek would be installed to increase the capacity of the existing single 8-inch siphon. It is estimated that eight lower laterals would need to be replaced as part of this project.

The portion of the project from MHs S52-51 to S52-65 could possibly be eliminated by a diversion into the 24-inch Calabazas trunk sewer. However, the model indicates that there would be limited capacity available in this pipeline once the El Camino Real Diversion is constructed, so this alternative is not recommended at this time. The diversion, or a potential partial diversion (e.g., with an overflow weir) could be considered in the future if capacity in the Calabazas trunk sewer appears to be adequate.

5.4.5 Project 6 – Nobili Avenue and Machado Avenue

This project would replace 3,100 feet of pipeline along Nobili and Machado Avenues, extending from manholes S41-53 to S52-101. The existing 10-, 12- and 15-inch sewers would be replaced with 15- and 18-inch pipe. Approximately 52 lower laterals would also need to be replaced along this alignment.

5.4.6 ECR Diversion to Calabazas Trunk Sewer

As an alternative to preliminary projects 7 and 8A, a diversion on El Camino Real can be constructed to direct flow into the 24-inch Calabazas trunk sewer. For this diversion, a new pipe would be needed to connect the sewer just downstream of the siphon on the ECR south sewer to divert the flow into the 24-inch Calabazas trunk (at approximately manhole S32-8). This diversion is not listed as a capacity improvement project in Table 5-1 because it is assumed that the connection will be coordinated with the siphon upgrade at Calabazas Creek (replacement of the existing 6-inch siphon with an 8- and 10-inch double siphon) being constructed in conjunction with the channel work being conducted by the Santa Clara Valley Water District. Only a small segment of pipe would be needed to complete this diversion, making it a cost effective alternative to preliminary projects 7 and 8A.

5.4.7 Project 8 – El Camino Real

The existing 10-inch pipeline on the south side of El Camino Real between Flora Visa Avenue and Calabazas Boulevard should be upsized to 12-inch diameter from Flora Visa Avenue to Pomeroy Avenue and to 15-inch diameter from Pomeroy Avenue to Calabazas Creek. This capacity relief project would involve replacing roughly 2,600 feet of pipeline and twelve lower laterals, from manholes S41-113 to S32-5.

5.4.8 Project 9 – Scott Boulevard

This capacity upgrade project is located on Scott Boulevard from Serra Avenue to Homestead Road. It would involve replacing 800 feet of 8-inch sewer with 10-inch pipe and 14 lower laterals, from manholes S25-37 to S35-98.

5.4.9 Project 10 – Park Avenue

The 10-inch pipe on Park Avenue, south of Bellomy Street should be replaced with a 12-inch pipe in order to provide capacity relief. This project would involve 250 feet of pipeline, from manhole S38-75 to manhole S38-66, including two lower laterals.

Chapter 6

Recommended Capital Improvement Program

Chapter 6 Recommended Capital Improvement Program

This chapter presents the recommended Capital Improvement Program (CIP) for capacity improvements to the Santa Clara wastewater collection system, along with estimated project costs and proposed schedule for construction.

6.1 Estimated Cost of Proposed Sewer Improvement Projects

The estimated costs of the proposed projects were refined based on more detailed quantity takeoffs and evaluation of likely construction methods and requirements. Unit cost criteria (updated to current dollars) and cost assumptions developed for the City of San Jose's Phase I Sanitary Sewer Master Plan Capacity Assessment were used in developing the cost estimates. These criteria include baseline construction costs for gravity trunk sewers using open-cut and trenchless (e.g., microtunneling) methods, costs for lower lateral replacement for remove-and-replace projects, costs for major sewer junction structures and siphon inlet and outlet structures, and costs allowances for project mobilization/demobilization, traffic control, bypass pumping and delay factors for remove-and-replace projects, extra dewatering requirements in areas of high groundwater, and acquisition of temporary and permanent easements if needed. A 30 percent allowance for contingencies for unknown conditions was also included, as well as an allowance of 25 to 35 percent of construction cost (depending on project size) for engineering, administration, and legal costs.

Table 6-1 summarizes the cost criteria used for preparing the project cost estimates. These cost estimates are planning or conceptual level estimates, and are considered to have an estimated accuracy range of -30 to +50 percent. This level of accuracy corresponds to an "order of magnitude" or "Class 5" cost estimate as defined by the American Association of Cost Estimators. These estimates are suitable for use for budget forecasting, CIP development, and project evaluations, with the understanding that refinements to the project details and costs would be necessary as projects proceed into the design and construction phases.

Table 6-2 presents the estimated construction and capital costs for the proposed projects and major project alternatives. More detailed breakdowns of the costs for each project are included in **Appendix B**.

Table 6-1 Summary of Cost Criteria

Item	Description/ Assumptions	Unit Cost[a]
Baseline Pipeline Construction Costs		
Open-Cut Gravity Trunk Sewers	10" - 27" diameter, 8' - 16' depth	$160 - $240/lf
Microtunneling	36" - 49" casing	$90 - $1,200/lf
	Jacking/Receiving Pits	$70,000/$40,000
Lower Lateral Replacement		$2,000
Special Structures	Junctions, siphon inlet/outlet	$6,000 - $9,000
Site Specific Construction Costs		
High Groundwater (north of Highway 101)	Dewatering plus extra sheeting and shoring	$100/lf
Bypass Pumping/Diversion	% of Baseline Construction Cost for remove and replace projects	10%
Remove/Replace Delay Factor		2%
Construction Cost Allowances		
Mobilization/Demobilization	% of Construction Cost Subtotal	5%
Traffic Control		10%
Contingencies		30%
Easement Acquisition		
Temporary Easement	Easement width = 80 ft	$4/sq. ft.
Permanent Easement	Easement width = 30 ft	$25/sq. ft.
Engineering, Administration, and Legal Costs	% of Construction Cost Total (varies depending on magnitude of Estimated Construction Cost)	25% - 35%

(a) Based on an Engineering News Record (ENR) Construction Cost Index for the San Francisco Bay Area of 9103 (March 2007).

Table 6-2 Estimated Costs of Capacity Improvement Projects

Project No.	Estimated Construction Cost ($)	Estimated Capital Cost ($)
1	4,539,000	5,674,000
2	5,286,000	7,324,000
4A	1,489,000	1,861,000
4B	1,060,000	1,325,000
5	1,046,000	1,308,000
6	1,139,000	1,424,000
8	945,000	1,276,000
9	256,000	346,000
10	77,000	104,000
Total	**15,837,000**	**20,642,000**
West-to-East Alternative	9,752,000	12,906,000
Total w/West-to-East Alternative	**15,764,000**	**20,550,000**

6.2 Comparison of Major Alternatives

As described in Chapter 5, two major alternatives were evaluated for providing capacity relief for the major trunk sewers in Bowers Avenue and Great America Parkway: paralleling or replacement of those sewers, or diverting flow to a new West-to-East trunk sewer. As presented above, the two alternatives are virtually equal in terms of estimated capital cost. Other factors that should be considered in comparing these alternatives are:

- **Constructability.** Bowers Avenue and Great America Parkway are two of the busiest roads in the City. Construction in those corridors would require extensive traffic control and potentially have significant impact on businesses in the area. The sewer alignment also has a number of significant other utilities (e.g., large storm drains). The West-to-East trunk sewer would likely have fewer traffic impacts, but could require the realignment of about 1,500 feet of water main along part of the corridor, siphon crossings under San Tomas Aquino Creek and several large storm drains, and some construction along the shoulder of busy Central Expressway.
- **Permits and Easements.** The Bowers/Great America Parkway project would require a permit from Caltrans for a new sewer crossing under Highway 101. Both projects would require crossing the UPRR west of Bowers, including obtaining a permanent sewer easement across properties adjacent to the City's power substation on the north side of the UPRR. The West-to-East trunk would require coordination with Santa Clara Valley Water District for the crossing of San Tomas Aquino Creek. Both projects would require permits from the County for work in or crossing Central Expressway and, in the case of the West-to-East project, San Tomas Expressway.
- **Project Phasing/Flexibility.** The Bowers/Great America Parkway project could be constructed and put into operation in phases, whereas the West-to-East project could not be used until the entire project was constructed. However, that project would provide greater overall system flexibility by linking the west and east basins by a major trunk.
- **Coordination with Development and Other City Projects:** Current development activity on the west side of the City may provide opportunities for the City to coordinate with developers in construction of some capacity improvement projects. For example, proposed developments in the area of El Camino Real and Lawrence Expressway may construct or fund improvements, such as the El Camino Real relief sewer (Project 8), to allow those developments to move forward more quickly. Other potential projects, either by City or other utilities, may also impact the desirability of one or the other of the major trunk system alternatives.
- **Long-term Cost Savings.** Diverting flow from the west to the east basin could reduce the overall flows to the Rabello and Northside Pump Stations. The amount of such reduction would depend on the configuration of the flow diversion to the West-to-East trunk. A rough estimate of the reduction in average daily flow would indicate a potential annual cost savings of about $10,000 based on City's estimate of $8,000 per mgd cost for power for pumping.

Because the estimated capital costs of the two major alternatives are nearly identical, it is recommended that the City pursue additional predesign level alignment and constructability evaluations of both alternatives before making a decision on which alternative to implement as part of the overall capacity improvement program.

6.3 Prioritization and Schedule for Proposed CIP Projects

A preliminary schedule for completion of the recommended CIP projects over a five-year period has been developed based on assigning relative priorities to the proposed capacity improvements. Priorities have been based on the relative magnitude of the predicted capacity deficiencies, as well as the likely timing of

developments that may impact the need for the projects. Based on these considerations, the projects have been divided into two priority groups, as listed in **Table 6-3**.

Table 6-3 Project Priority Groups

Project No.	Estimated Construction Cost ($)	Estimated Capital Cost ($)
Priority Group 1		
2	5,286,000	7,324,000
4A	1,489,000	1,861,000
8	945,000	1,276,000
Subtotal	***7,720,000***	***10,461,000***
Priority Group 2		
1	4,539,000	5,674,000
4B	1,060,000	1,325,000
5	1,046,000	1,308,000
6	1,139,000	1,424,000
9	256,000	346,000
10	77,000	104,000
Subtotal	***8,117,000***	***10,181,000***
Total	**15,837,000**	**20,642,000**
West-to-East Alternative[a]	9,752,000	12,906,000
Total w/West-to-East Alternative	**15,764,000**	**20,550,000**

(a) Would replace Projects 1 and 2 and be included in Priority Group 1.

For each project, a preliminary estimate of time required to implement the project has been developed, considering time required for design and construction, including obtaining necessary permits and easements. Based on the project schedules and priorities, **Figure 6-1** shows a preliminary schedule for the recommended five-year capacity improvement CIP. The schedule is based on proceeding with the Bowers/Great America Parkway relief sewer, but provides for a preliminary alignment study of both this and the West-to-East trunk alternative, as recommended above. If the City decides to proceed with the West-to-East alternative in lieu of the Bowers/Great America Parkway relief, then the overall CIP schedule would need to be modified.

Figure 6-1 Proposed CIP Schedule

With Projects 1 and 2

Project	Year 1	Year 2	Year 3	Year 4	Year 5
Alignment Study					
Project 8					
Project 4A					
Project 2					
Project 1					
Project 4B					
Projects 5&6					
Projects 9&10					

With West-to-East Trunk Alternative

Project	Year 1	Year 2	Year 3	Year 4	Year 5
Alignment Study					
Project 8					
Project 4A					
West-to-East Trunk					
Project 4B					
Projects 5&6					
Projects 9&10					

Planning
Design
Bid and Award
Construction

6.4 Implementation Recommendations

The City should begin implementation of the Capital Improvement Program recommended in this Sanitary Sewer Capacity Assessment, starting with the highest priority projects. The following items should be considered in project scheduling and design, and in future updates of the Capacity Assessment.

- The alignments and sizes of all recommended projects should be verified with detailed predesign analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews.
- The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.
- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Capacity Assessment in the future. The model should be kept up-to-date with any changes to existing sewer connections, development plans, and sewer system facilities.
- The City should periodically calibrate its permanent flow meters at the Northside and Rabello Pump Stations and on the Trimble Road trunk sewer to ensure that accurate flow information is available to track the changes in the flows in the City's system over time.
- The City should conduct additional flow monitoring at key locations in the sewer system, particularly the area tributary to the Chromite/Machado trunk sewers (flow meter 11 area). Flow levels during large storm events should be compared to the peak flows simulated by the hydraulic model to verify the modeling predictions for the 10-year design storm and confirm the need for and sizing of Projects 4A, 4B, 5, and 6.

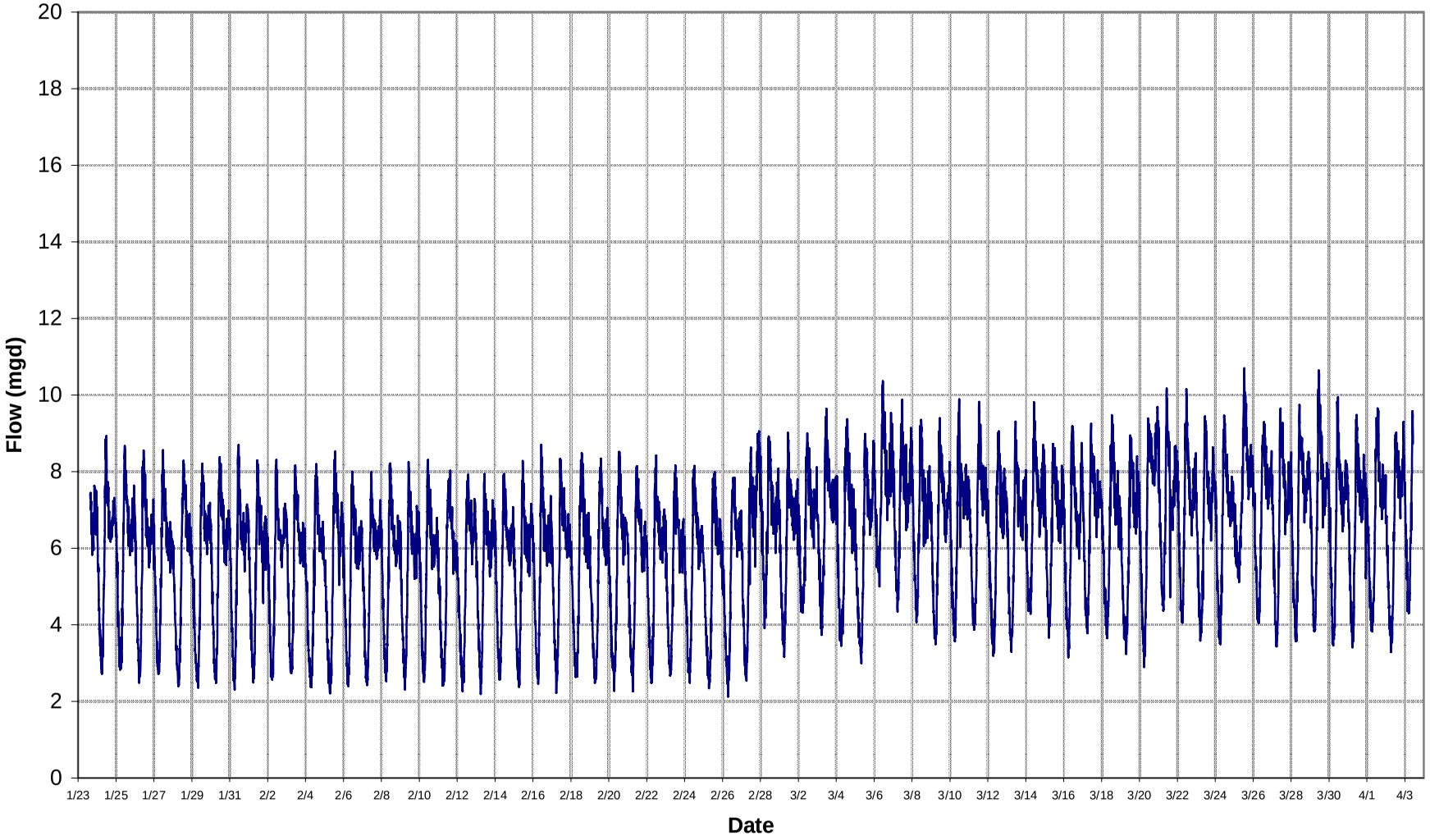
- The City should consider additional field investigations, including smoke testing, and manhole and pipeline television inspection, in the flow meter 11 area to identify potential sources of I/I and possible opportunities for I/I reduction in this area.
- The City should coordinate with the Cupertino Sanitary District on flow and planning assumptions to ensure that adequate capacity exists in the Santa Clara system to handle future flows from CuSD. The City should encourage CuSD to verify the calibration of its flow meter at Homestead Road and confirm its projections of future wastewater flows entering the Santa Clara system.
- The City should coordinate with the City of San Jose to ensure that its flow criteria and planning assumptions are consistent with those used by San Jose in its capacity master planning.
- The City should assess its connection fees and evaluate financial alternatives to fund the recommended capacity assessment CIP.

This Sanitary Sewer Capacity Assessment report is intended to be a working document to be refined and updated as additional data and new planning information becomes available. The Capacity Assessment should be updated whenever there are major changes in planning assumptions or, at a minimum, every five years.

Appendix A

Plots of Flow Monitoring Data

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 1



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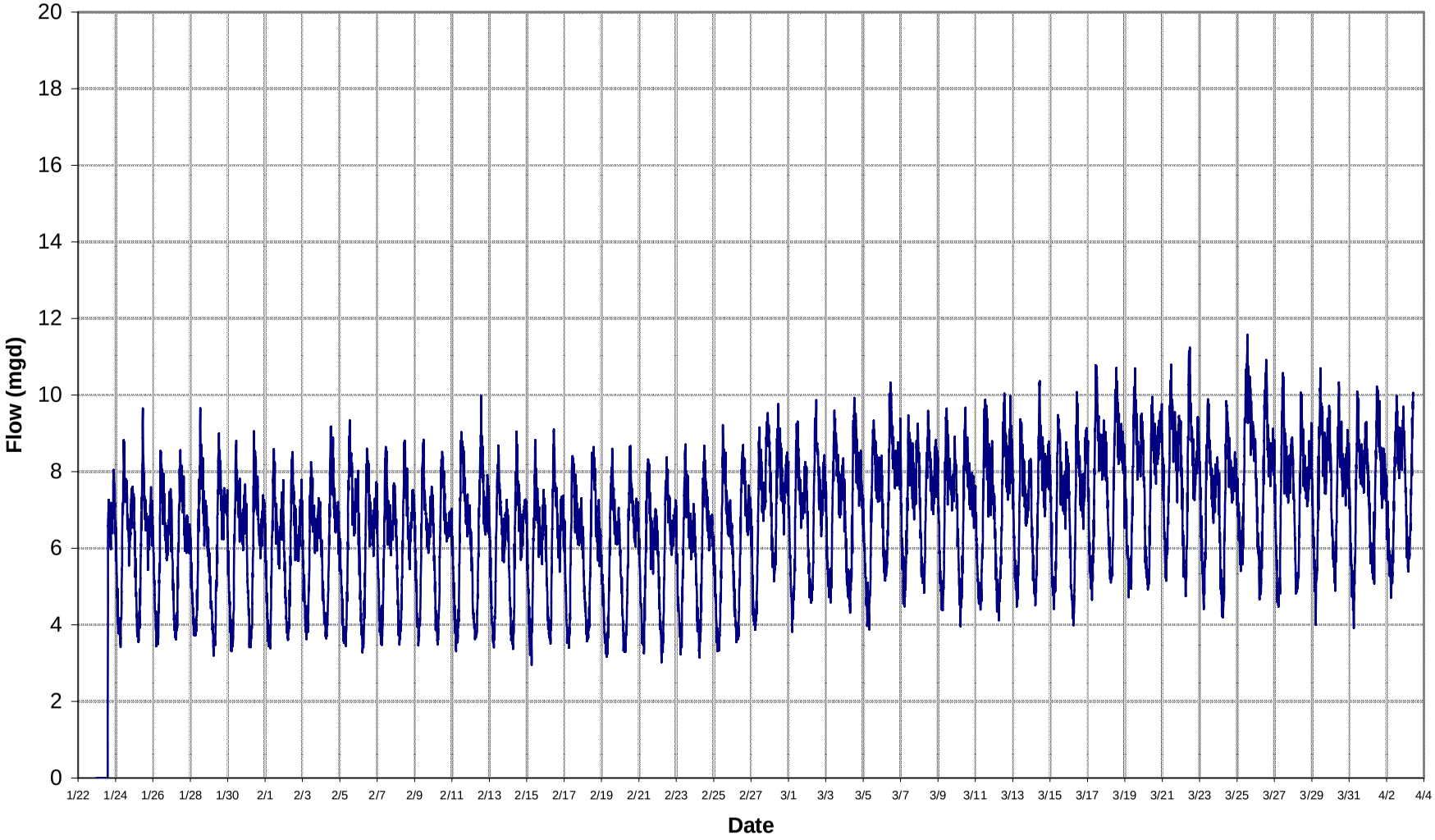
City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 2



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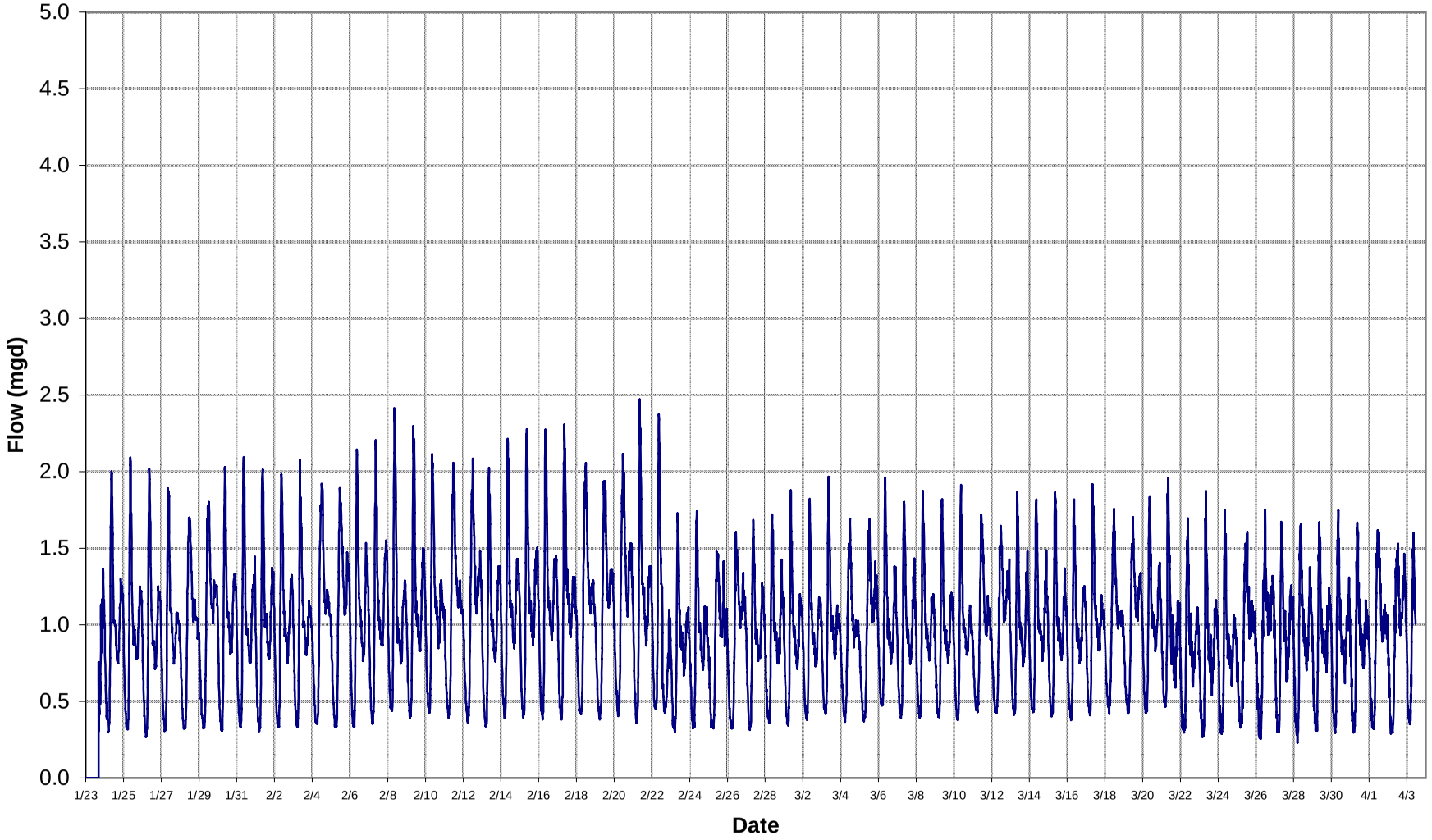
Sanitary Sewer Flow Monitoring, Site 3



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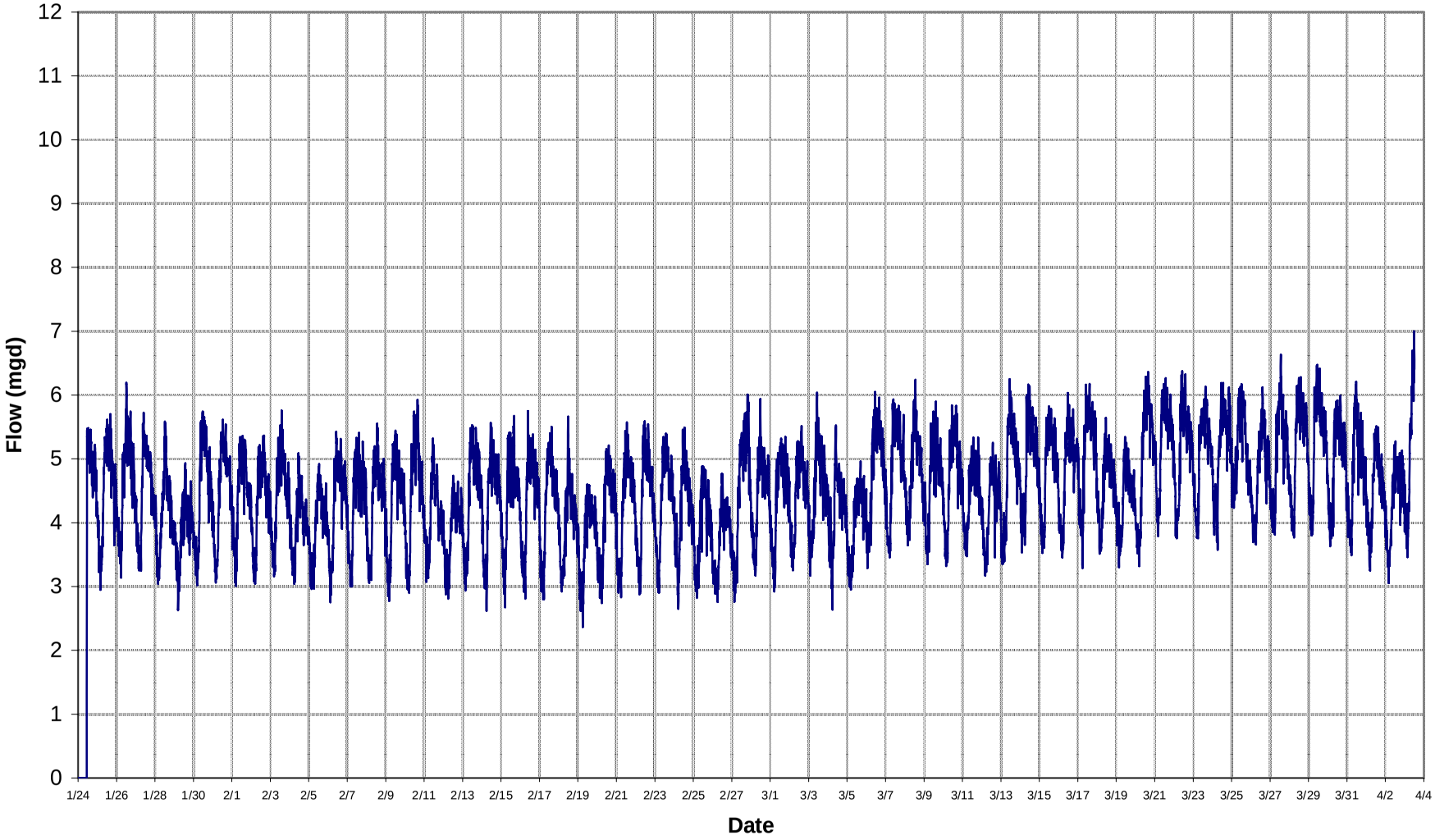
Sanitary Sewer Flow Monitoring, Site 4



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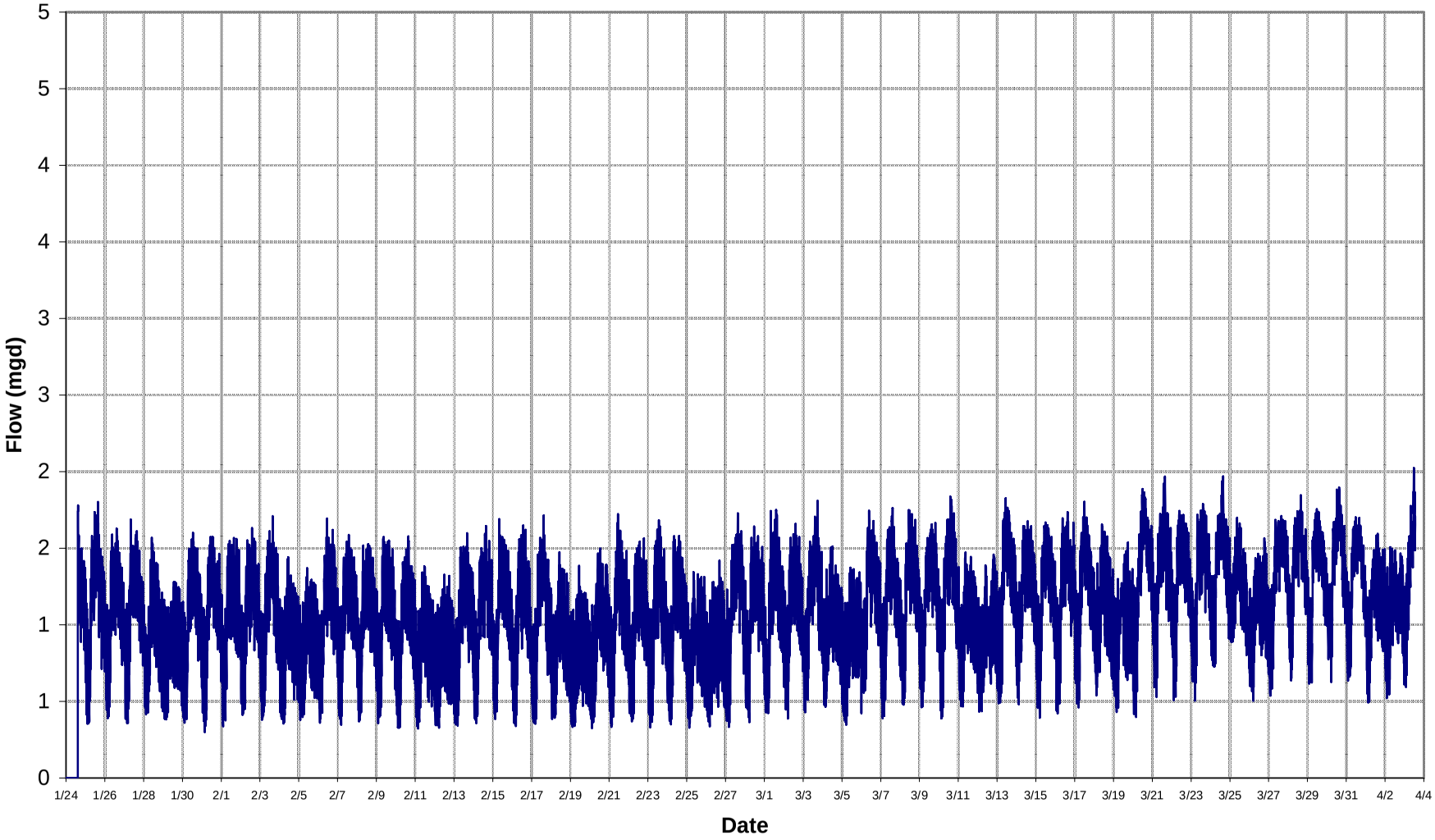

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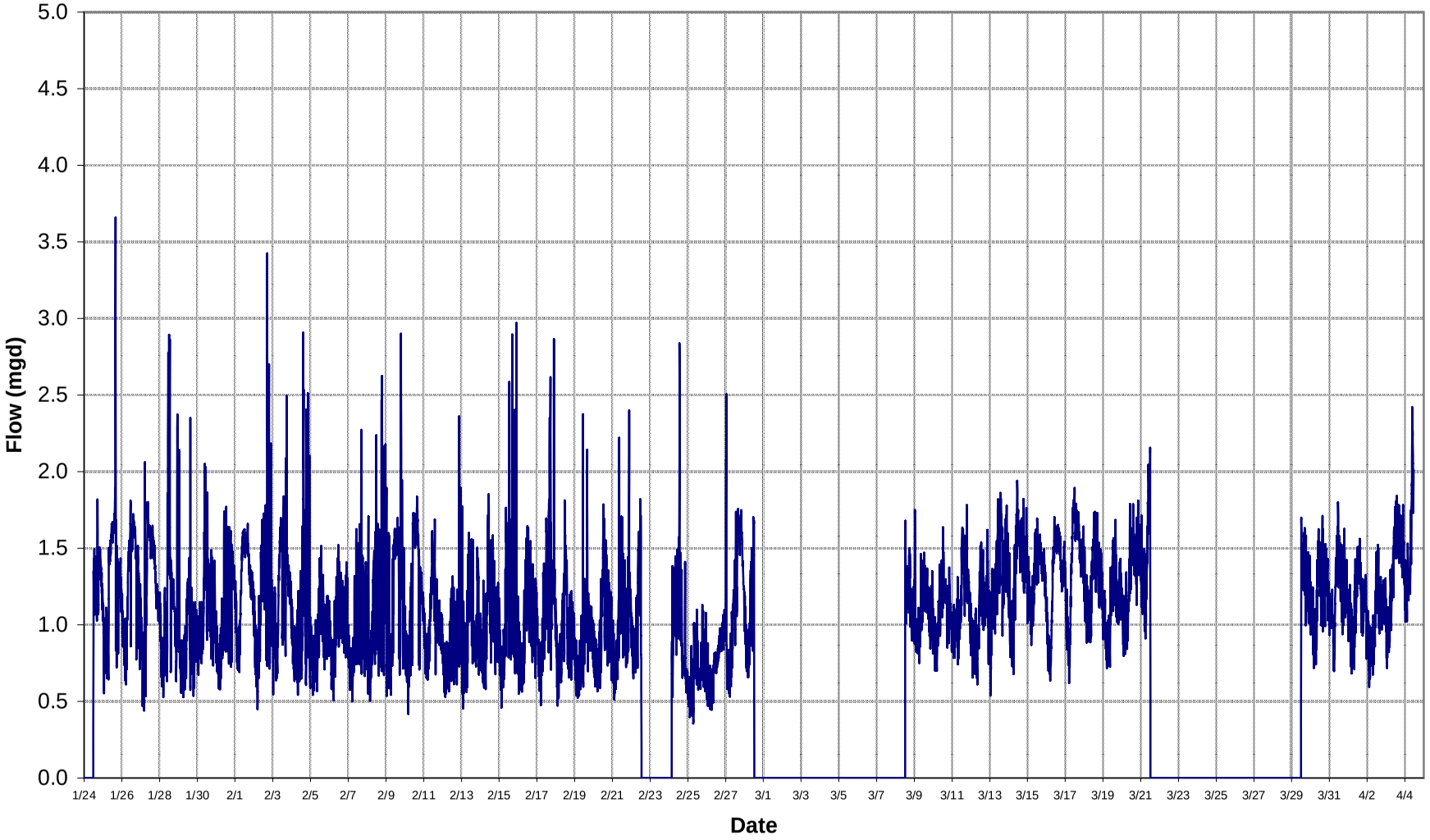
Sanitary Sewer Flow Monitoring, Site 6



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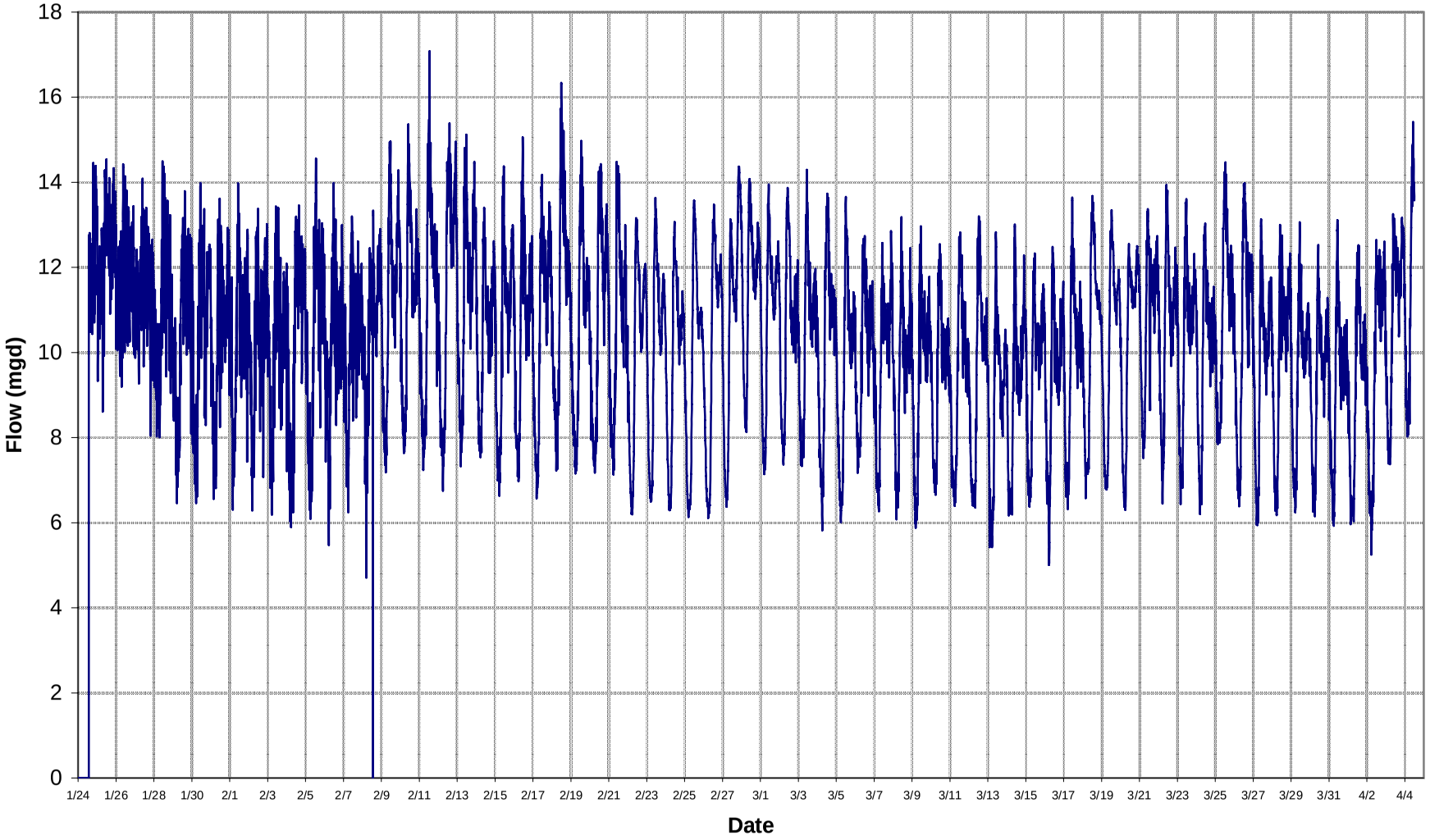
Sanitary Sewer Flow Monitoring, Site 7



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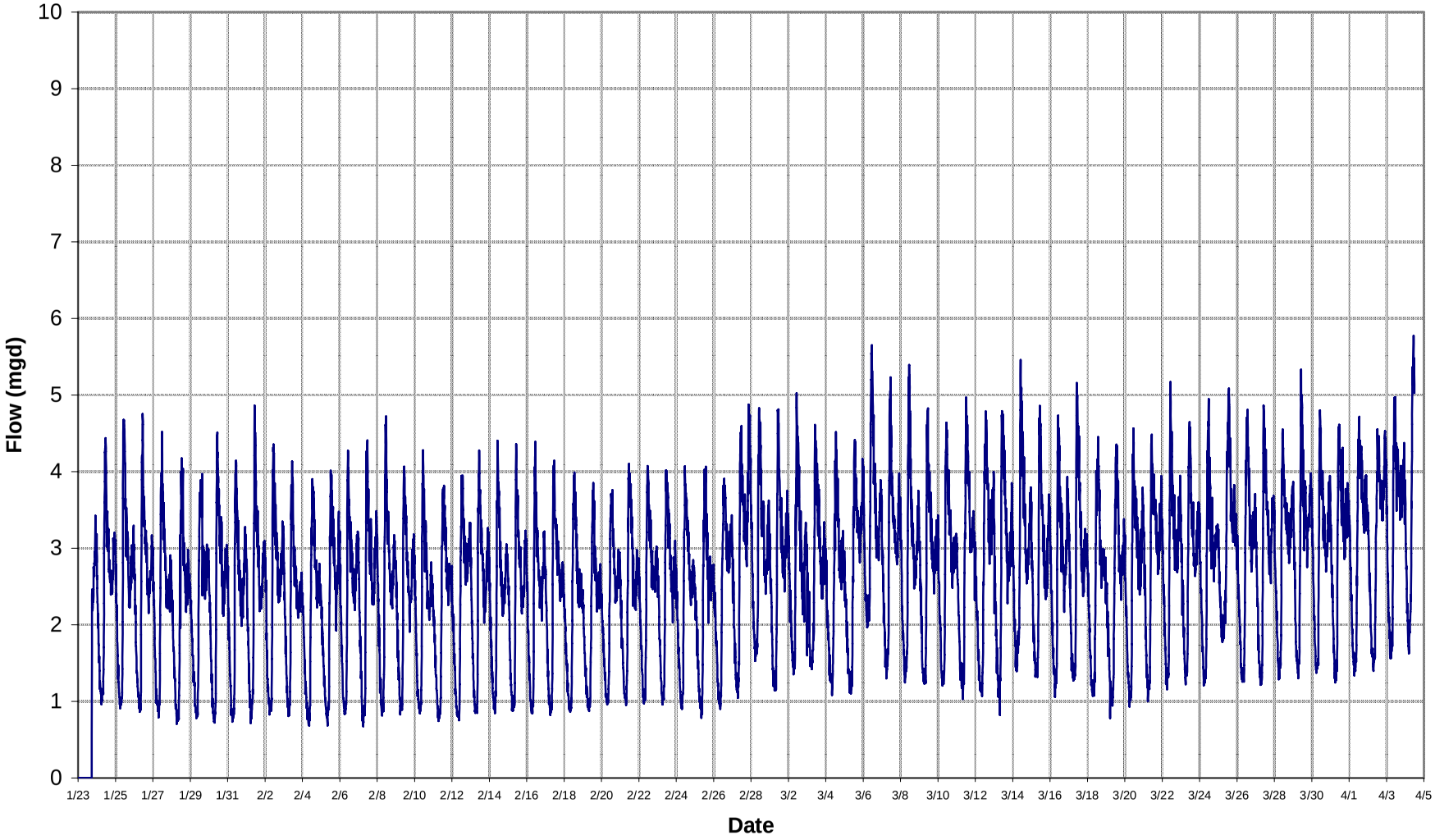
Sanitary Sewer Flow Monitoring, Site 8



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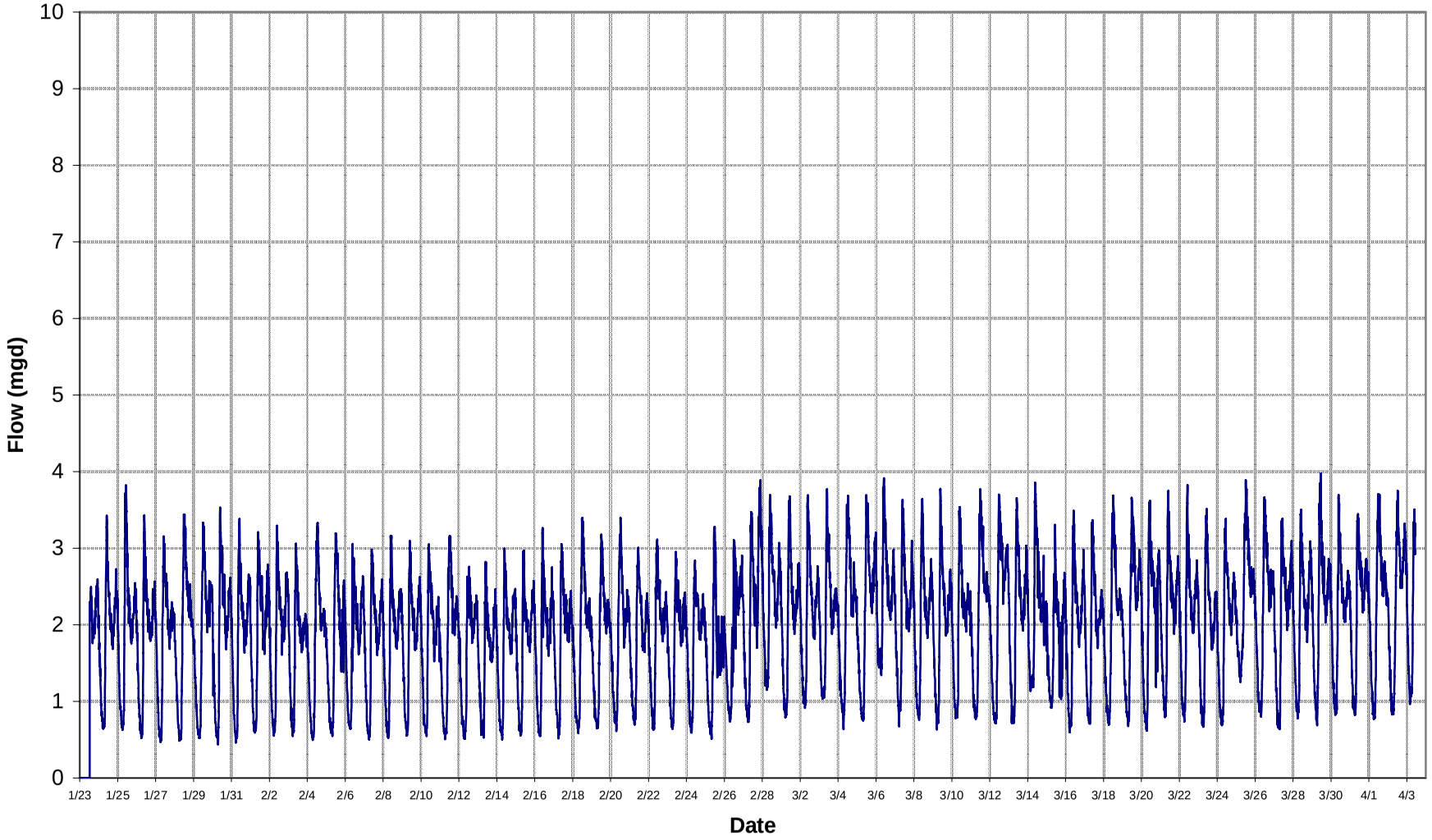
Sanitary Sewer Flow Monitoring, Site 9



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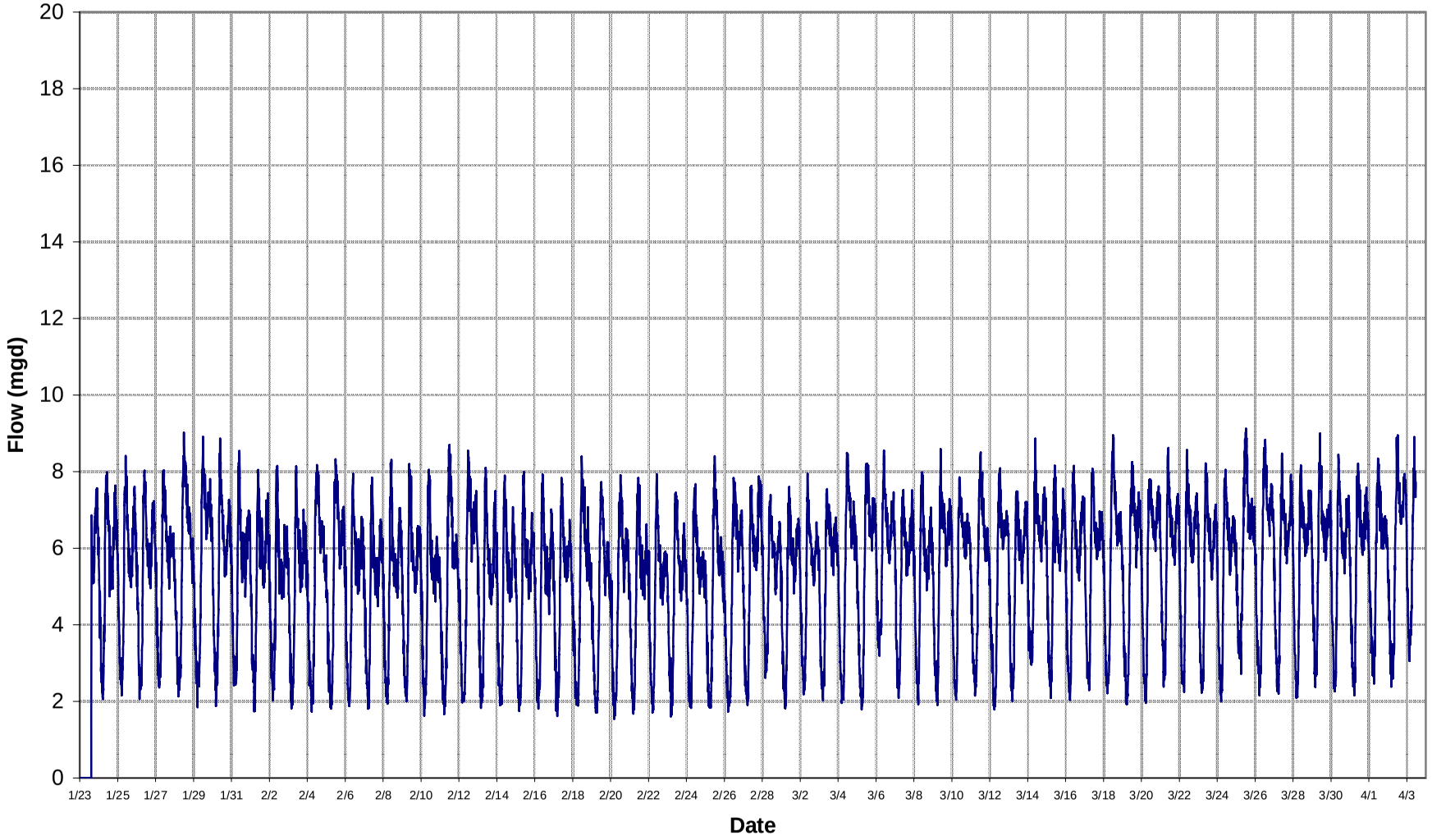
Sanitary Sewer Flow Monitoring, Site 10



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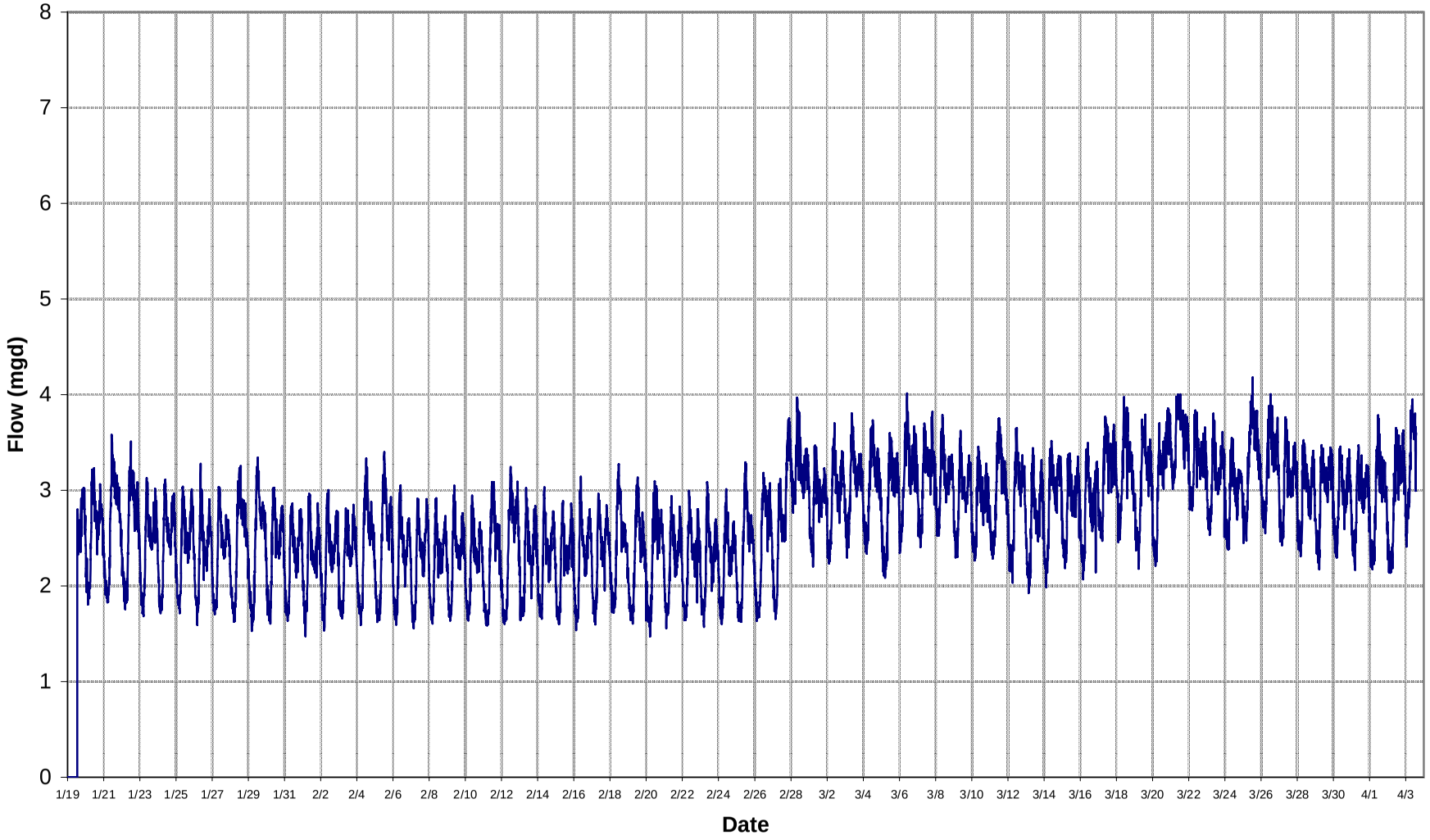
City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 11



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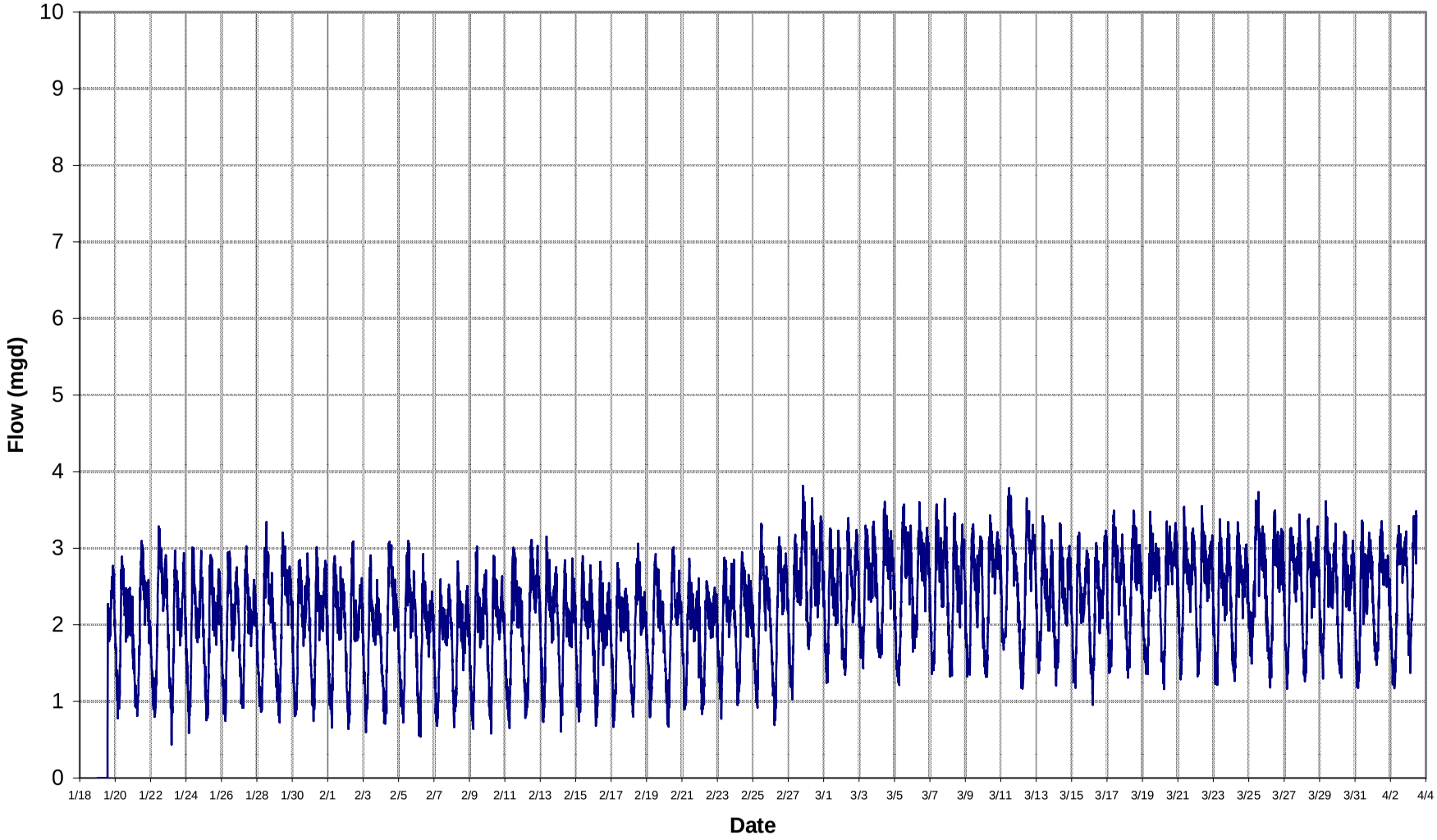
Sanitary Sewer Flow Monitoring, Site 12



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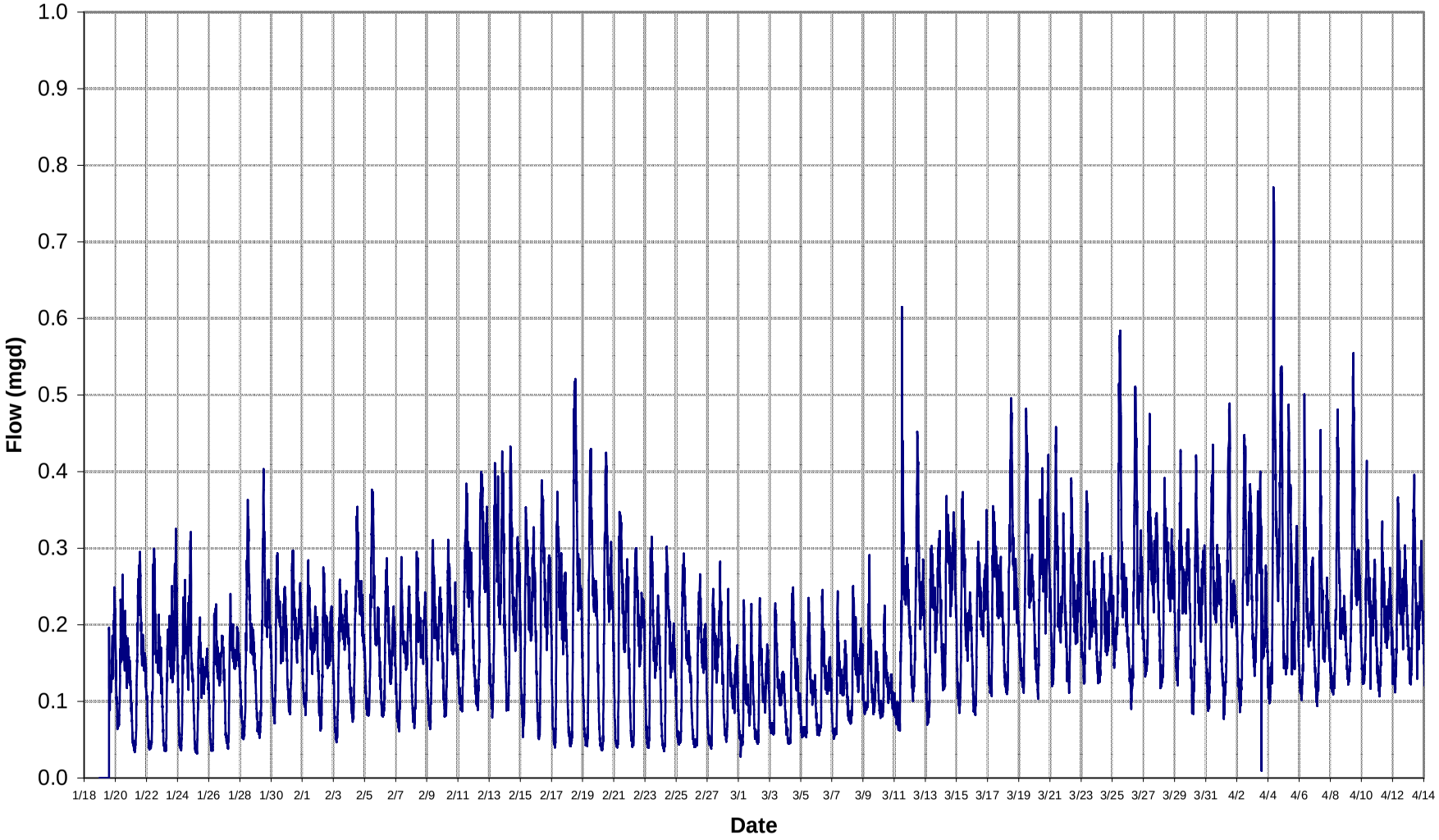
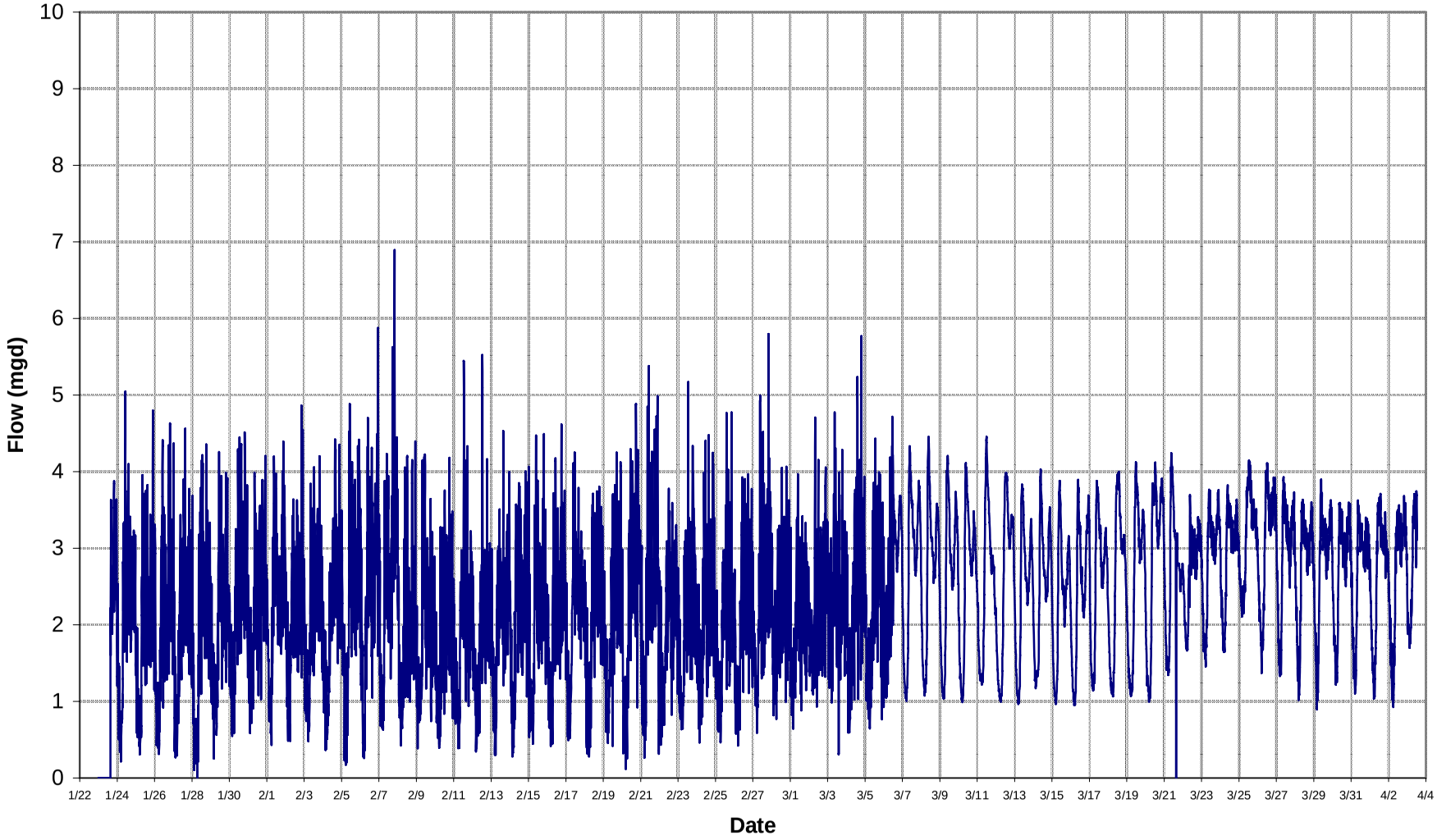
Sanitary Sewer Flow Monitoring, Site 13



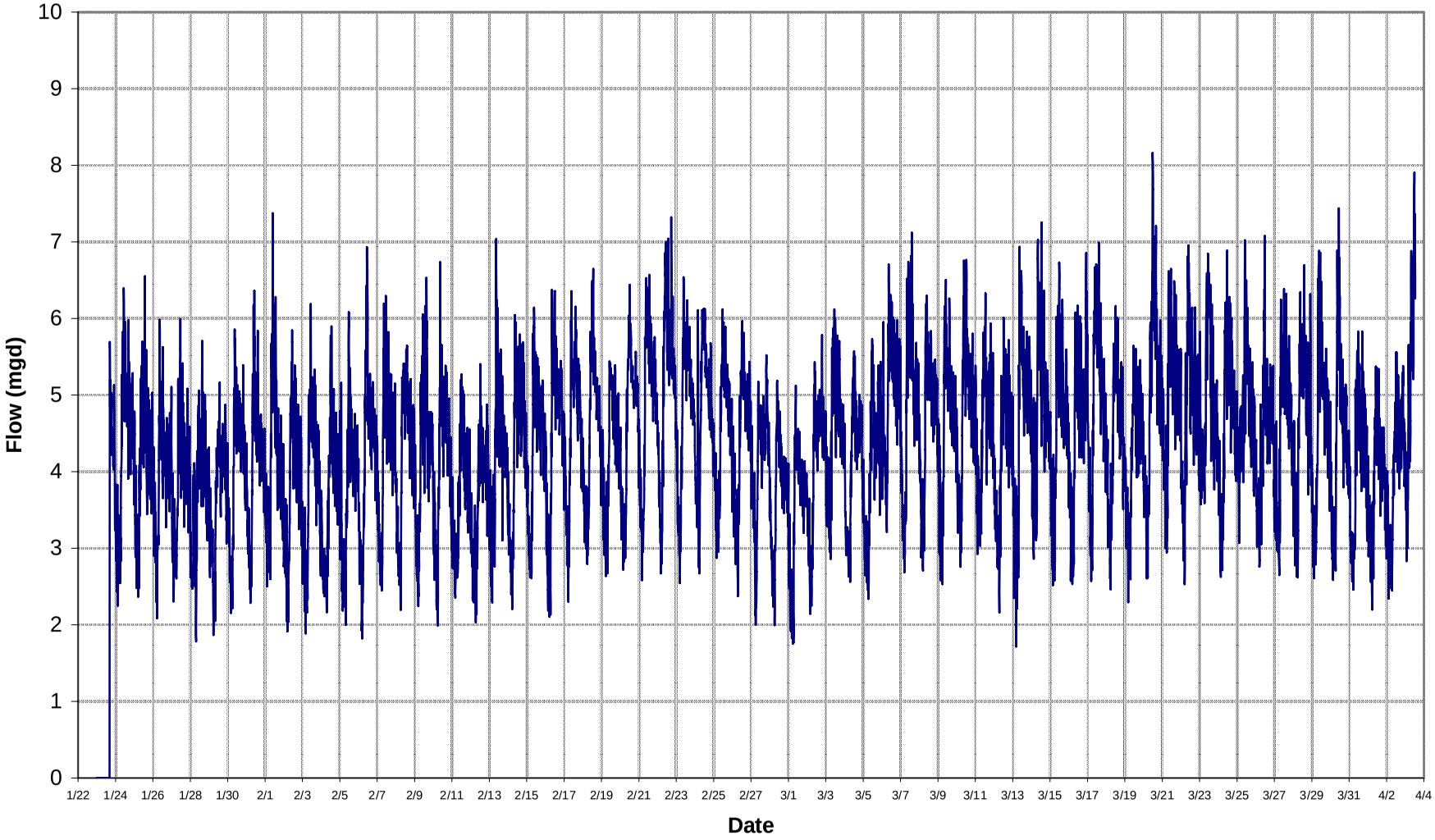
Site 13 061406.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 14



Site 14 061406.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 15



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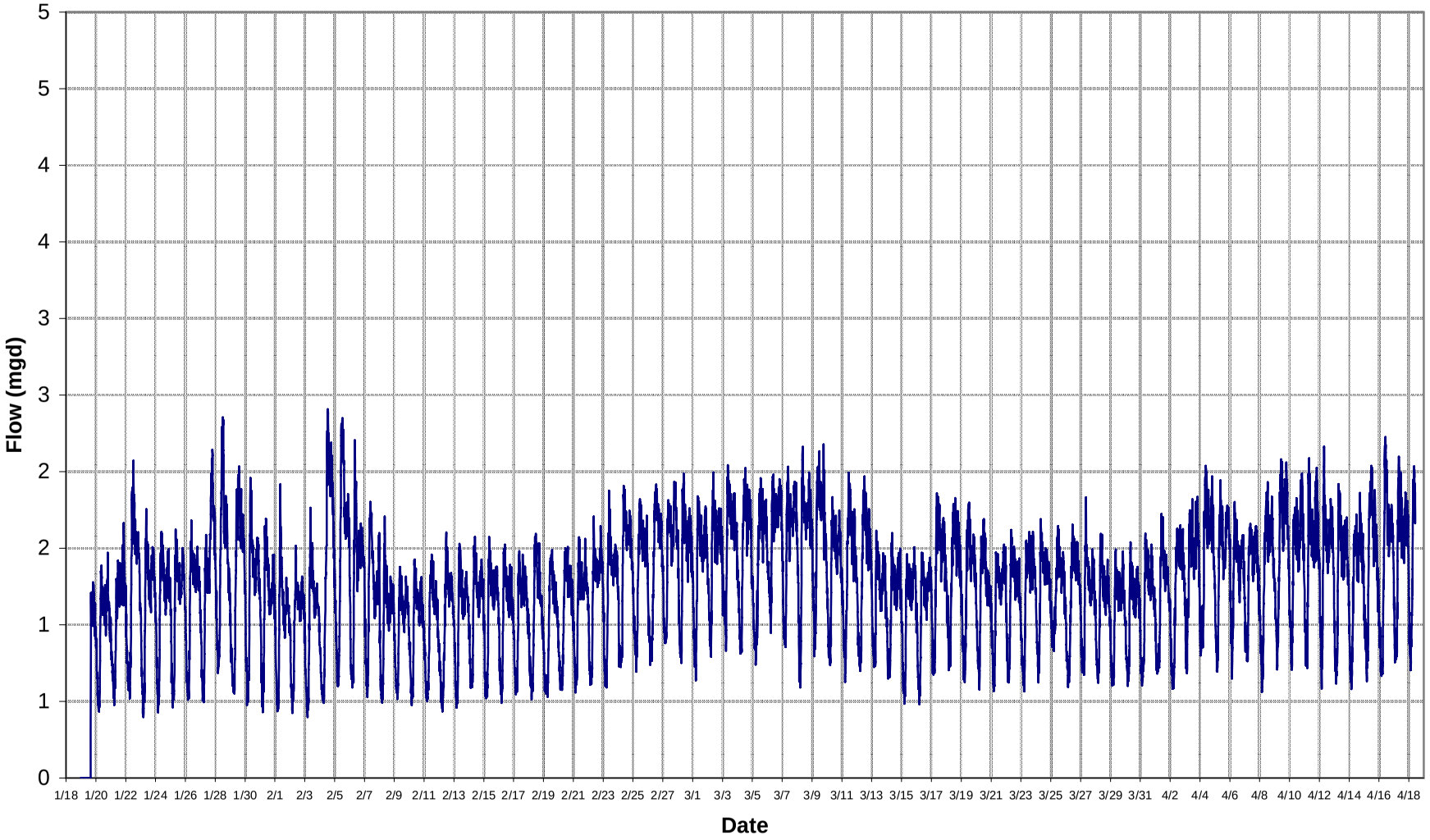
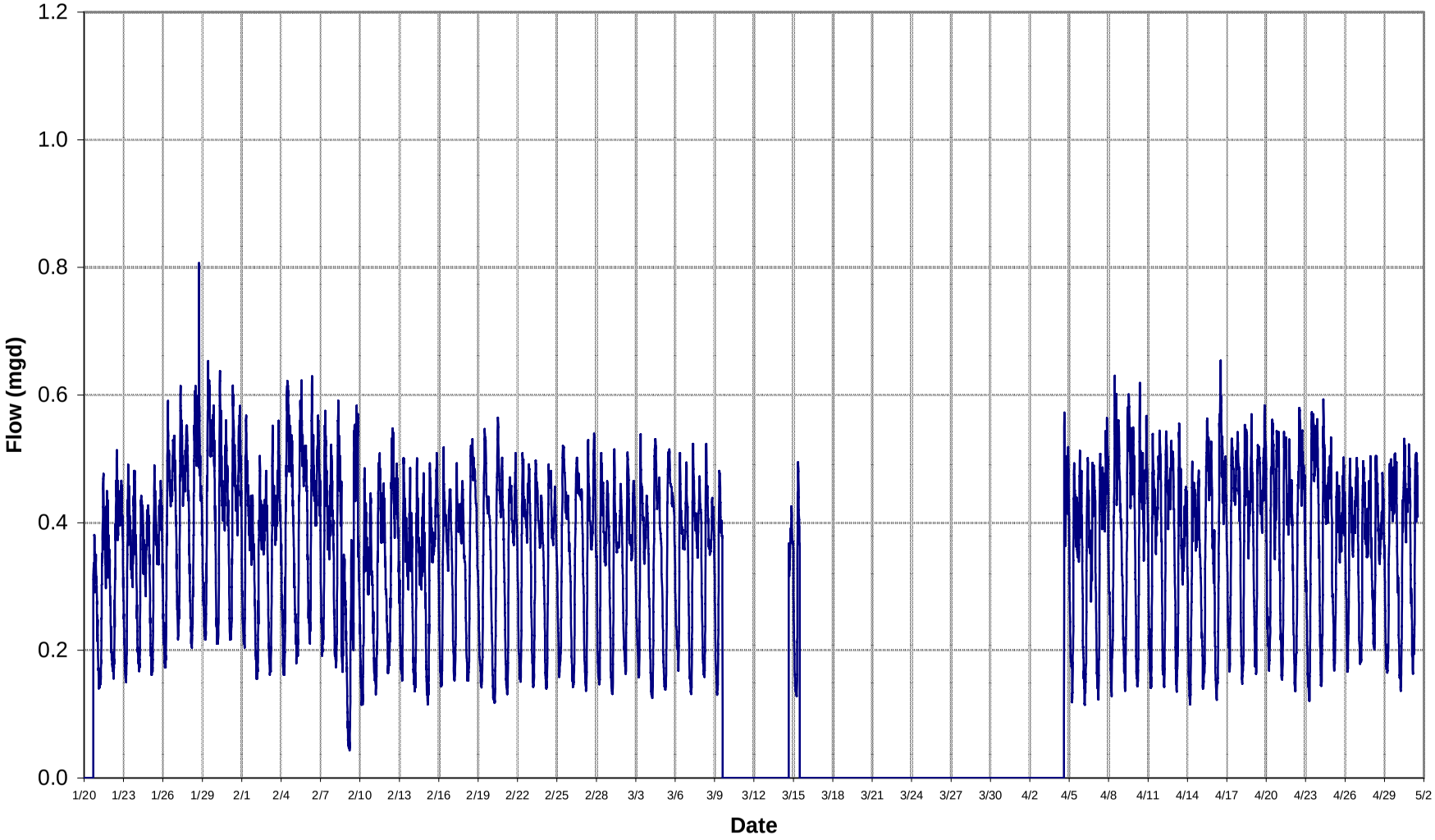
City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 16



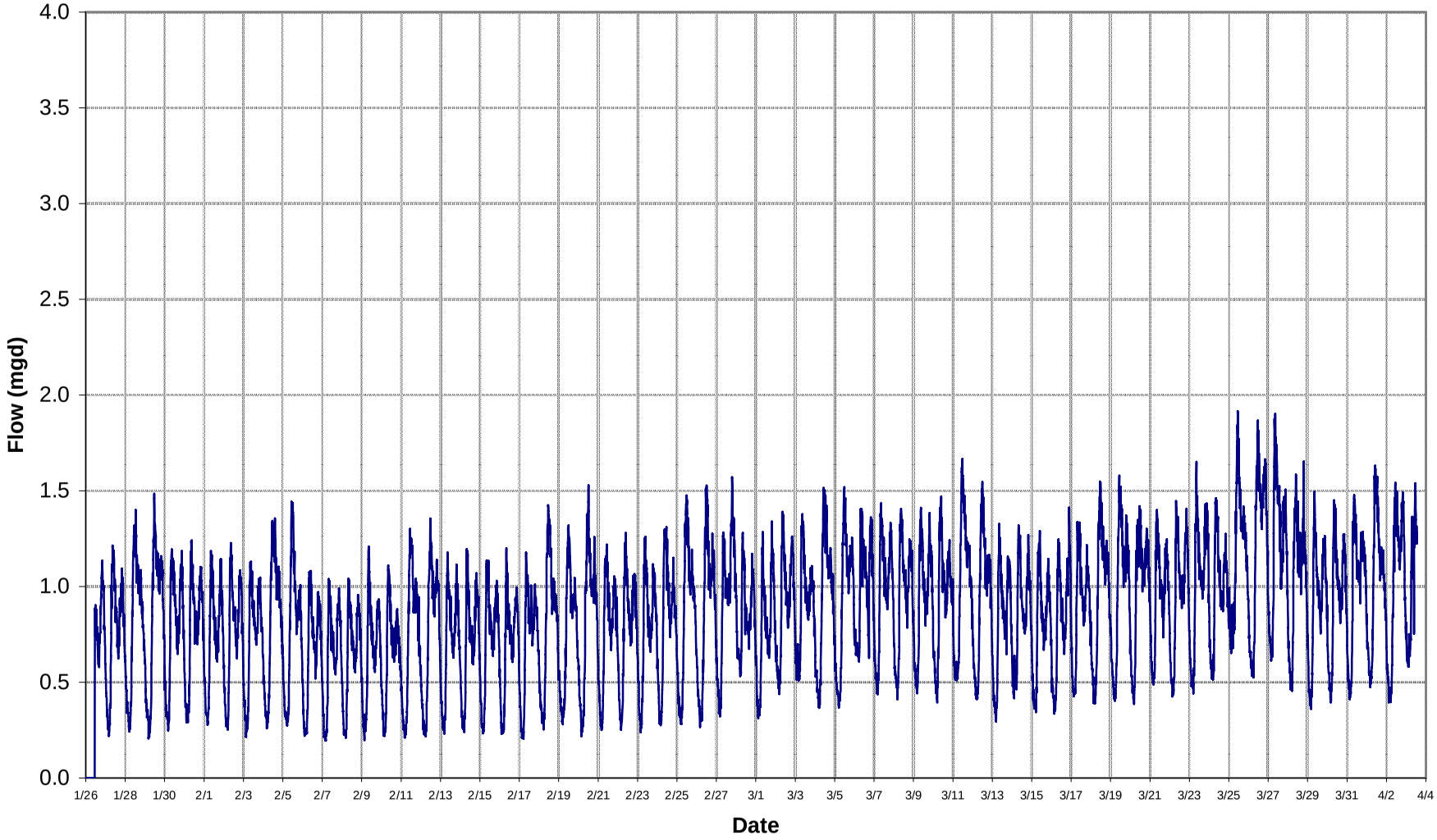
Site 16 072906.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 17



Site 17 081106.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 18



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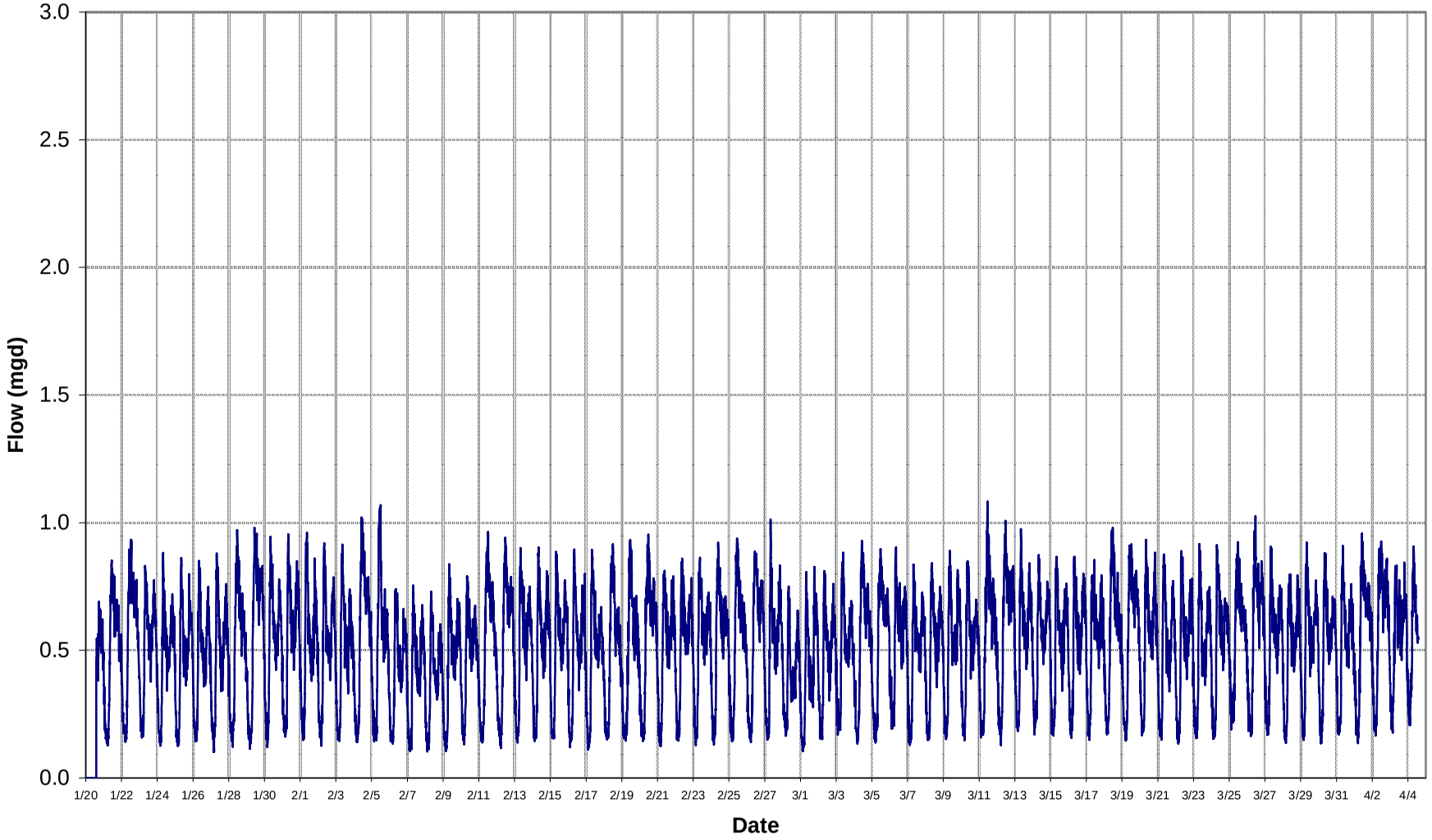
City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 19



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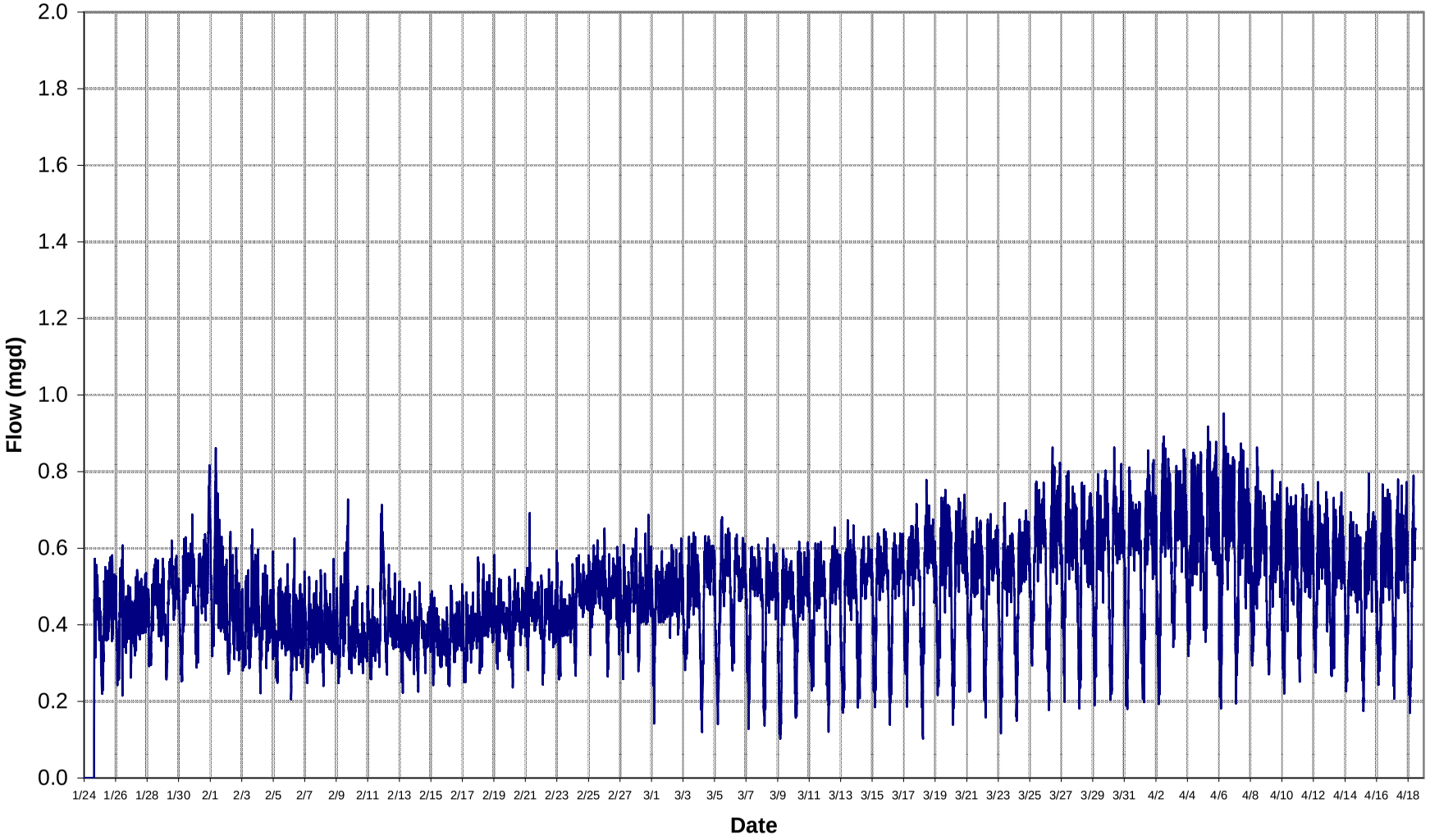
City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 20



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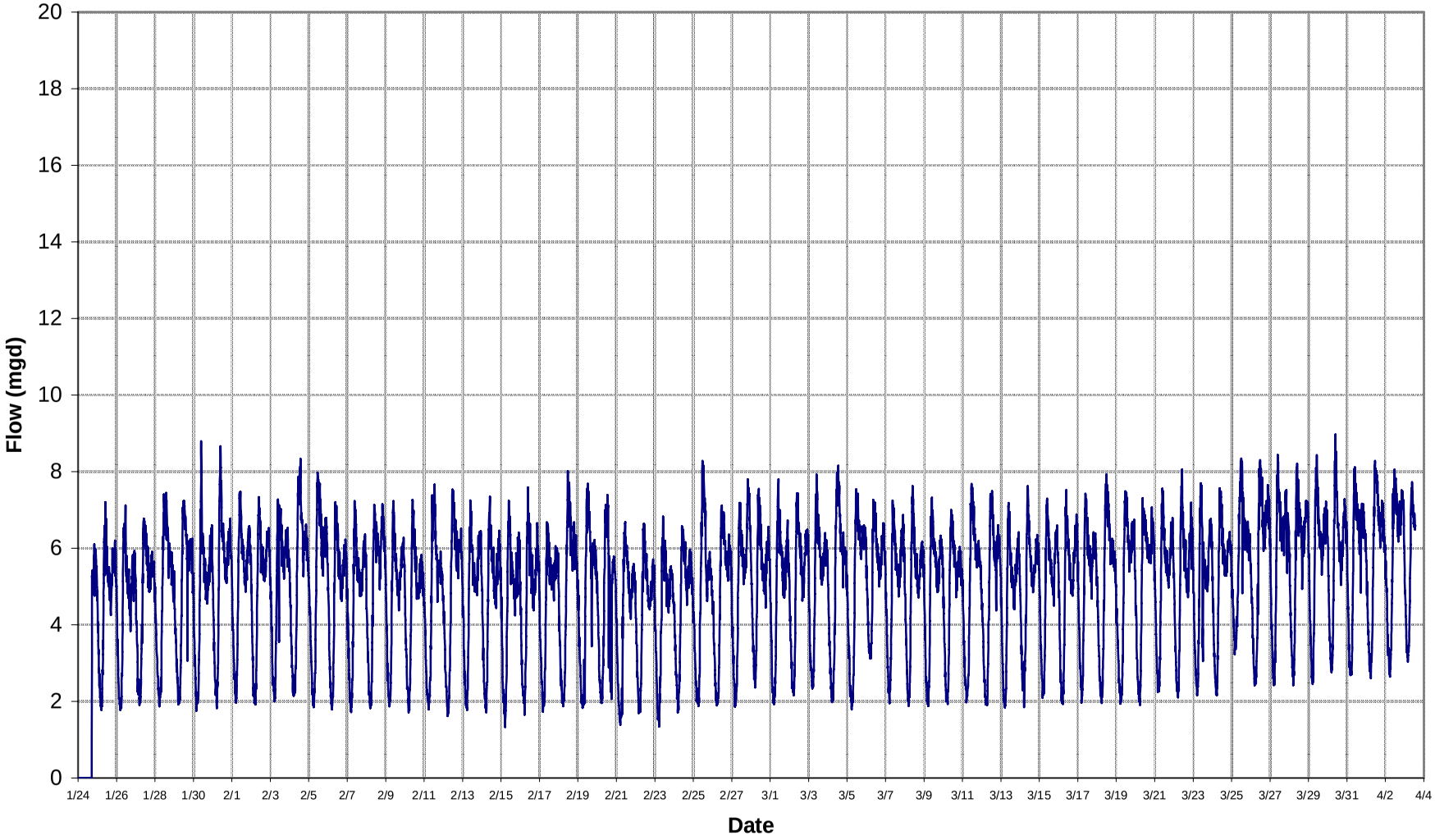
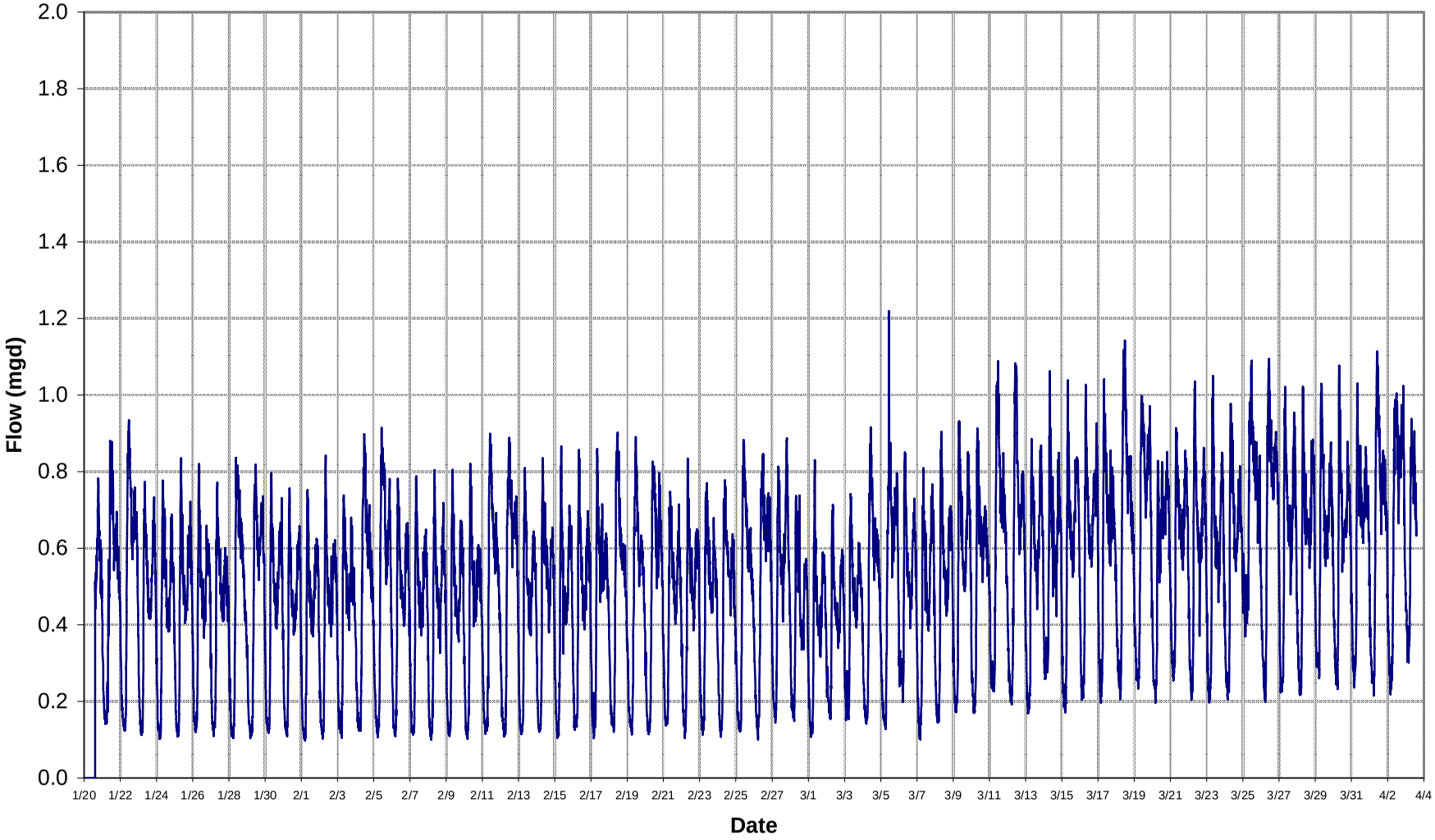
City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 21



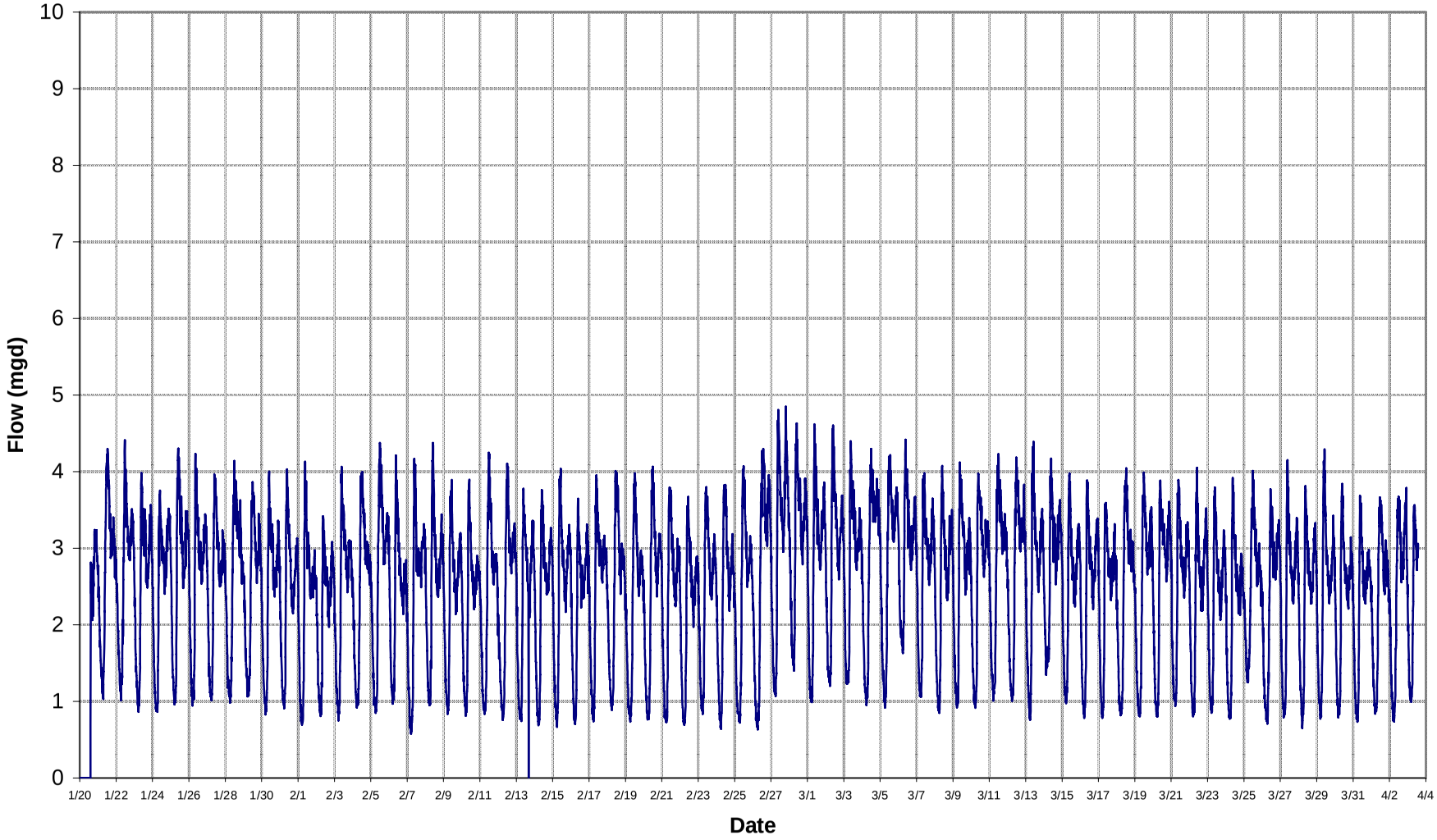
Site 21 061406.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 22

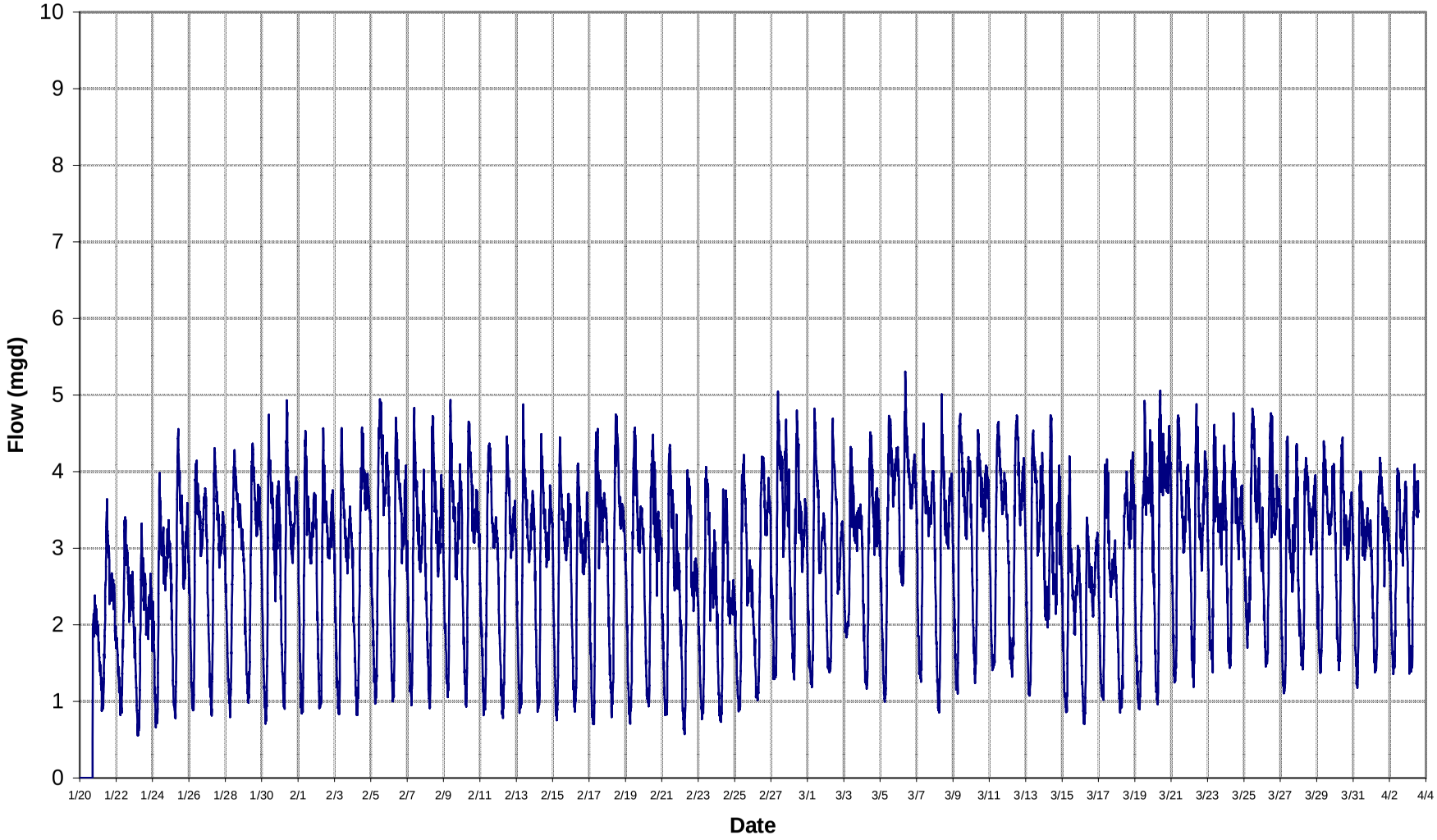


Site 22 061406.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 23

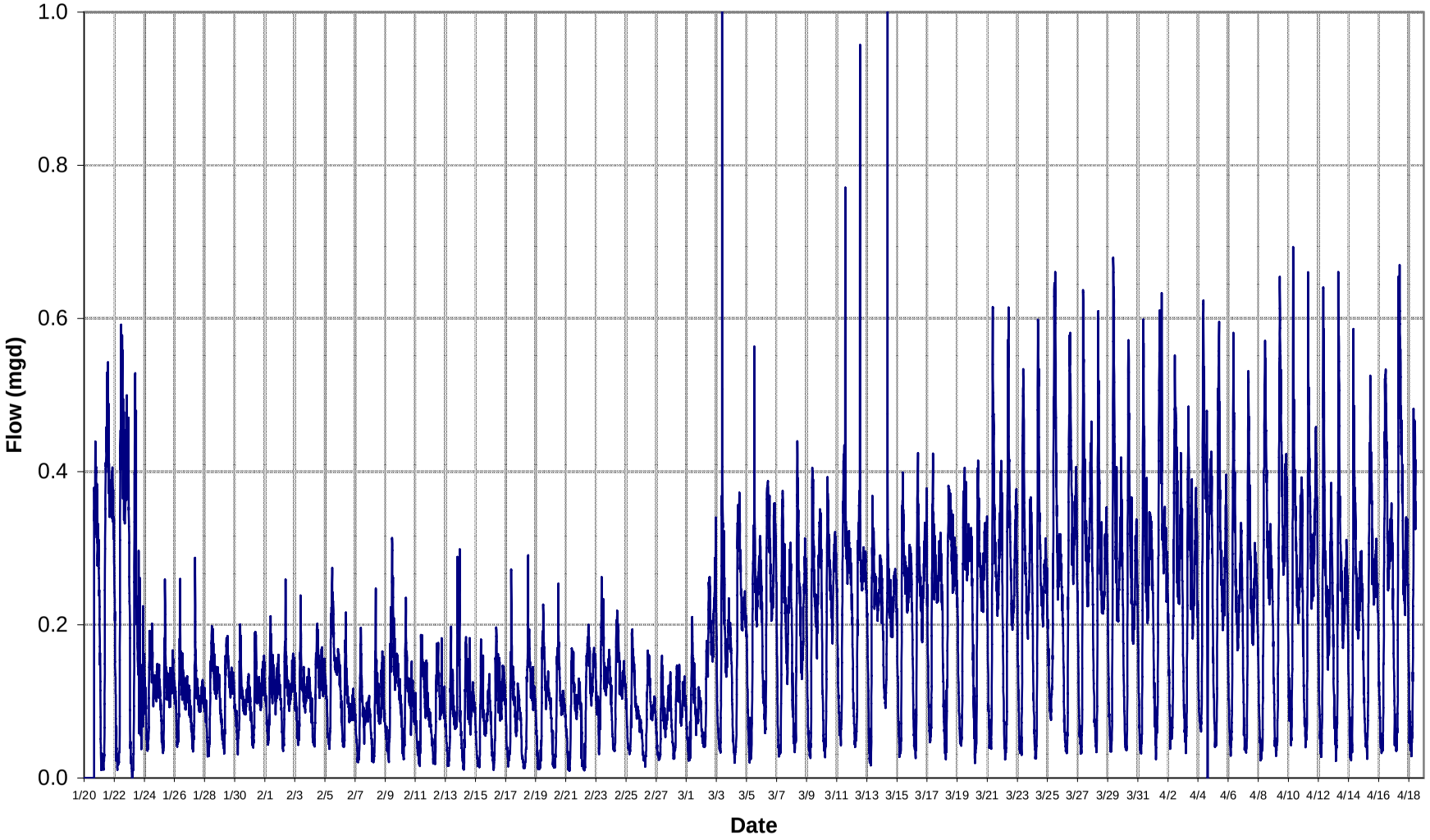


City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 24



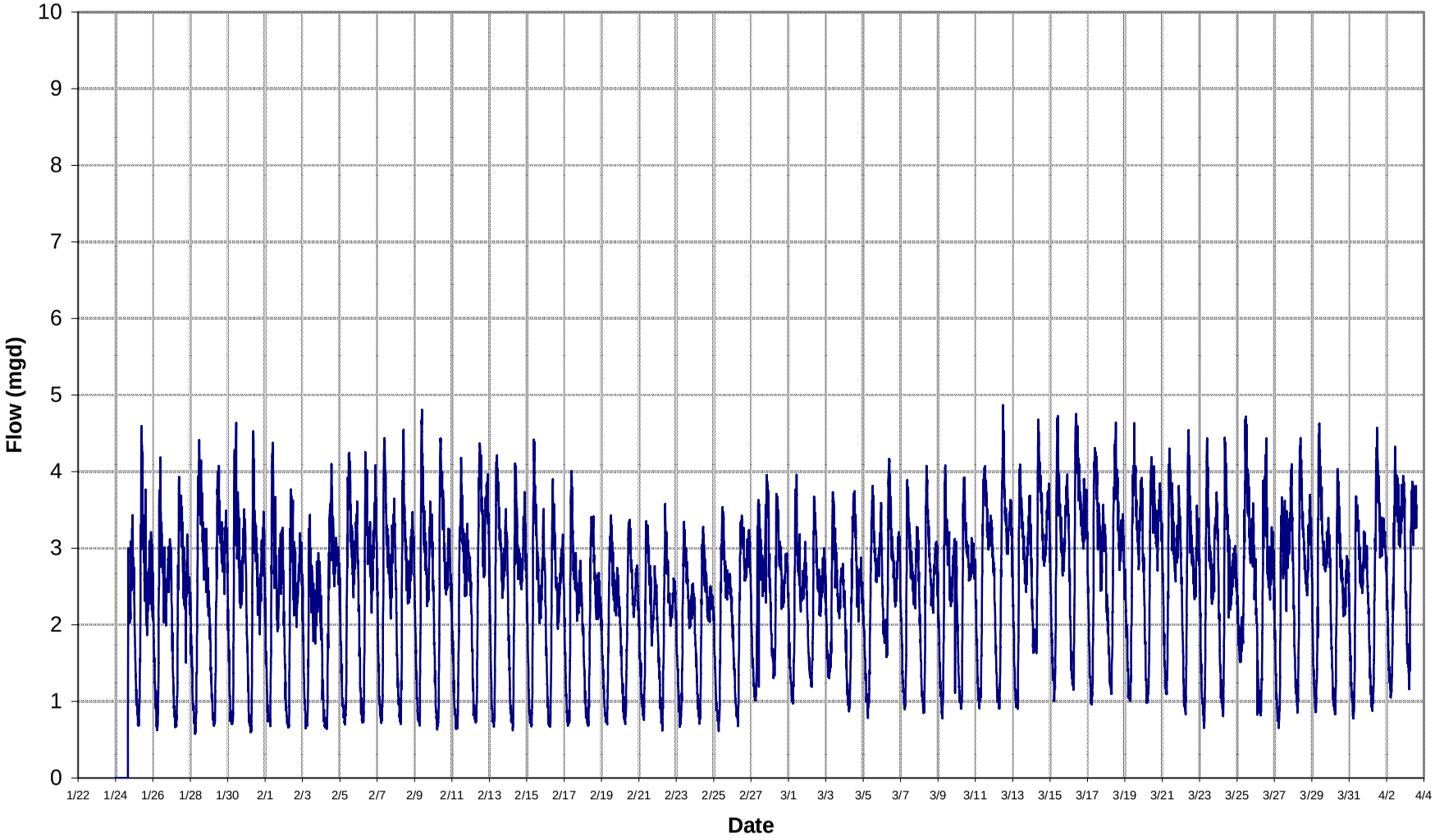
Site 24 061406.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 25



Site 25 061406.xls, Flow

City of Santa Clara
Sanitary Sewer Flow Monitoring, Site 26



Site 26 072906.xls, Flow

Appendix B

Project Descriptions and Cost Estimates

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:……	1
PROJECT LOCATION:……	Augustine Dr., Lakeside Dr., crossing of U.S. 101, Mission College Boulevard, Great America Pkwy. from Bowers Ave. to south of Hetch Hetchy ROW Near MH S73-20 to MH S93-57
BRIEF PROJECT DESCRIPTION:……	Install 7,200 feet of 21-inch pipeline.
SANITARY SEWER PLAT MAP(S):……	63, 73, 83, 93
LOCATION OF CAPACITY DEFICIENCY: ……	Bowers Ave., Mission College Blvd., and Great America Pkwy. from Augustine Dr. to south of Hetch Hetchy ROW Diameter of existing deficient pipes: 33"-36"
SPECIAL CONSIDERATIONS:……..	Caltrans permit required for crossing Hwy. 101. Best placement of new sewer in Lakeside Dr. is along the west side (to avoid 21" sewer, 12" water, and 24" storm drain). Best placement of new sewer in Mission College Blvd. is along west side (to avoid 18" storm drain and 30" and 33" sewers). Assume siphon under 54" storm drain and 33" and 36" sewers in Mission College Blvd. west of Great America Pkwy. Best placement for new sewer is along east side of Great America Pkwy. (to avoid 66" to 72" storm drain on west side).
ALTERNATIVES:……	New West-to-East pipeline extending from Bowers at Chromite to Central east of Lafayette.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH* (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Augustine Dr, Lakeside Dr. and HWY 101 Crossing	21	8-16	2,300'	210 $/ft	$483,000
HWY 101 (casing)	43	Microtunnel	700'	1,000 $/ft	$700,000
Mission College Blvd.	21	8-16	2,900'	210 $/ft	$609,000
Mission College Blvd. double 15" Siphon under utilties	49	Microtunnel	50'	1,200 $/ft	$60,000
Carrier piping for 15-inch double siphon	15	Carrier pipe	100'	180 $/ft	$18,000
Great America Parkway	21	8-16	2,000'	210 $/ft	$420,000
Jacking Pits			2 pits	$70,000	$140,000
Receiving Pits			2 pits	$40,000	$80,000
Structures					
Sewer Junction Structure: Lakeside and Augustine				$6,000	$6,000
Sewer Junction Structure: Lakeside Drive near HWY 101				$6,000	$6,000
Siphon structures at Mission College Blvd			2 structures	$6,000	$12,000
Sewer Junction Structure: Great America Pkwy. near Patrick Henry				$6,000	$6,000
Sewer Junction Structure: connection to S93-57				$6,000	$6,000
SITE SPECIFIC CONSTRUCTION COST					
High Groundwater					
Dewatering (North of HWY 101)			4,900'	50 $/ft	$245,000
Sheeting/Shoring					
Solid Shoring (North of HWY 101)			4,900'	50 $/ft	$245,000
SUBTOTAL					**$3,036,000**
Mobilization and Demobilization				5%	$151,800
Traffic Control				10%	$303,600
CONSTRUCTION COST SUBTOTAL					**$3,491,400**
Contingencies				30%	$1,047,420
CONSTRUCTION COST TOTAL					**$4,538,820**
Engineering and Inspection Costs				25%	$1,134,705
CAPITAL IMPROVEMENT COST TOTAL					**$5,673,525**
ENR = 9103 (S.F. March 2007)				**rounded**	**$5,674,000**

* Pipe lengths include carrier pipe for siphons, double siphons and tunneled sewers.

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:……	2
PROJECT LOCATION:……	Chromite Dr., Alhambra Dr., Bracher Park, crossing of UPRR, Bowers Ave. from Bowers Ave. to Augustine Dr. MH S53-34 to near MH S73-20
BRIEF PROJECT DESCRIPTION:……	Install 6,200 feet of 21-inch pipe.
SANITARY SEWER PLAT MAP(S):……	53, 63
LOCATION OF CAPACITY DEFICIENCY: ……	Bowers Ave. from Chromite Dr. to Augustine Dr. Diameter of existing deficient pipes: 27"-33"
SPECIAL CONSIDERATIONS:……..	UPRR permit required for crossing. County permit required for crossing Central Expwy. Permanent easements required through properties on Walsh and Bowers north of UPRR. Best placement for new sewer is along east side of Bowers south of Central Expwy. and along west side of Bowers north of Central Expwy (to avoid 12" water and 42" storm drain). Trenchless crossing assumed under Central Expwy.
ALTERNATIVES:……	New West-to-East pipeline extending from Bowers at Chromite to Central east of Lafayette. Alternative UPRR crossing from Park through City-owned substation not selected due to utility conflicts (this alignment might be feasible, but it is not considered best alternative).

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH* (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Chromite, Alhambra, Bracher Park, easement to Bowers	21	8-16	2,300'	210 $/ft	$483,000
UPRR Crossing (casing)	43	Microtunnel	1,350'	1,000 $/ft	$1,350,000
Central Expressway (casing)	43	Microtunnel	600'	1,000 $/ft	$600,000
Bowers Ave (Mead to Augustine)	21	8-16	3,900'	210 $/ft	$819,000
Jacking Pits			2 pits	$70,000	$140,000
Receiving Pits**			3 pits	$40,000	$120,000
Structures					
Sewer Junction Structure: Bowers and Chromite				$6,000	$6,000
Sewer Junction Structure: Bowers and Walsh				$6,000	$6,000
Sewer Junction Structure: Bowers and Central				$6,000	$6,000
Sewer Junction Structure: Bowers and Scott				$6,000	$6,000
SUBTOTAL					**$3,536,000**
Mobilization and Demobilization				5%	$176,800
Traffic Control				10%	$353,600
CONSTRUCTION COST SUBTOTAL					**$4,066,400**
Contingencies				30%	$1,219,920
CONSTRUCTION COST TOTAL					**$5,286,320**
Land Acquisition - Temporary Easement Cost (Trenchless staging)		150' wide	150'	4 $/sf	$78,750
Land Acquisition - Permanent Easement Cost (Pipeline Alignment)		30' wide	850'	25 $/sf	$637,500
Engineering and Inspection Costs				25%	$1,321,580
CAPITAL IMPROVEMENT COST TOTAL					**$7,324,150**
ENR = 9103 (S.F. March 2007)				**rounded**	**$7,324,000**

* Pipe lengths include carrier pipe for siphons, double siphons and tunneled sewers.

** For tunneling under UPRR to Bowers, two receiving pits and one jacking pit are needed.

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:……	West-to-East Alternative
PROJECT LOCATION:……	Chromite Dr., Alhambra Dr., Bracher Park, crossing of UPRR, Walsh Ave., Lafayette, Lafayette St., Central Expwy. From Bowers Dr. to UPRR MH S53-41 to MH S67-18
BRIEF PROJECT DESCRIPTION:……	Install 12,200 feet of 24-inch pipe.
SANITARY SEWER PLAT MAP(S):……	53, 54, 55, 56, 63, 64, 66, 67
LOCATION OF CAPACITY DEFICIENCY: ……	Bowers Ave., Mission College Blvd., and Great America Pkwy. from Chromite to south of Hetch Hetchy ROW Diameter of existing deficient pipes: 27"-36"
SPECIAL CONSIDERATIONS:……	UPRR Permit required for crossing. Permanent easement needed for crossing into parking lot on north side of UPRR to Walsh. SCVWD permit required for crossing San Tomas Creek. County permit required for crossing San Tomas Expwy. and work in Central Expwy. Best placement for new sewer along Walsh is on north side (to avoid 15" sewer, 12" water, and 15" storm drain. On Walsh between Scott and Lafayette, reolcation of existing water line may be needed. Best placement for new sewer along Lafayette is on west side (to avoid 45" storm drain and 12" water). Siphons (assume twin 15") required to cross San Tomas Aquino Creek and storm drains at Scott and Lafayette.
ALTERNATIVES:……	Projects 1 and 2.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH* (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Chromite, Alhambra, Bracher Park, easement to Walsh	24	8-16	2,300'	220 $/ft	$506,000
Walsh, Lafayette, and Central Expwy.	24	8-16	9,900'	220 $/ft	$2,178,000
UPRR Crossing (casing)**	49	Microtunnel	1,350'	1,200 $/ft	$1,620,000
San Tomas Aquino Creek Crossing Siphon (casing)	49	Microtunnel	200'	1,200 $/ft	$240,000
San Tomas Expwy. Crossing (casing)	49	Microtunnel	400'	1,200 $/ft	$480,000
Scott Blvd. siphon under street and strom drain (casing)	49	Microtunnel	300'	1,200 $/ft	$360,000
Lafayette at Central siphon under storm drain (casing)	49	Microtunnel	50'	1,200 $/ft	$60,000
Carrier piping for 15-inch double siphons	15	Carrier Pipe	1,100'	180 $/ft	$198,000
Relocate existing waterline on Walsh due to utility conflicts	8		1,500'	150 $/ft	$225,000
Jacking Pits			5 pits	$70,000	$350,000
Receiving Pits			6 pits	$40,000	$240,000
Structures					
Sewer Junction Structure: Chromite				$6,000	$6,000
Sewer Junction Structure: Walsh and Northwestern Pkwy.				$6,000	$6,000
Siphon structures- San Tomas Aquino Creek			2 structures	$6,000	$12,000
Sewer Junction Structure: Wash and San Tomas Expwy.				$6,000	$6,000
Siphon structures- Scott Blvd			2 structures	$6,000	$12,000
Siphon structures- Lafayette St.			2 structures	$6,000	$12,000
Sewer Junction Structure: Central Expwy. at S67-15				$6,000	$6,000
Sewer Junction Structure: Central Expwy. at S67-18				$6,000	$6,000
SUBTOTAL					$6,523,000
Mobilization and Demobilization				5%	$326,150
Traffic Control				10%	$652,300
CONSTRUCTION COST SUBTOTAL					**$7,501,450**
Contingencies				30%	$2,250,435
CONSTRUCTION COST TOTAL					**$9,751,885**
Land Acquisition - Temporary Easement Cost (Trenchless staging)		150' wide	150'	4 $/sf	$78,750
Land Acquisition - Permanent Easement Cost (Pipeline Alignment)		30' wide	850'	25 $/sf	$637,500
Engineering and Inspection Costs				25%	$2,437,971
CAPITAL IMPROVEMENT COST TOTAL					**$12,906,106**
ENR = 9103 (S.F. March 2007)				**rounded**	**$12,906,000**

* Pipe lengths include carrier pipe for siphons, double siphons and tunneled sewers.

** For tunneling under UPRR to Walsh, two receiving pits and one jacking pit are needed.

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:	4A
PROJECT LOCATION:	Monroe St. and Chromite Dr. from Machado Ave. to west of Bowers Ave. MH S52-80 TO S53-41
BRIEF PROJECT DESCRIPTION:	Replace 600 feet of 18-inch pipe with 24-inch pipe. Replace 1,600 feet of 18-inch pipe with 27-inch pipe.
SANITARY SEWER PLAT MAP(S):	52, 53
LOCATION OF CAPACITY DEFICIENCY:	Same as project location Diameter of existing deficient pipes: 18"
SPECIAL CONSIDERATIONS:	Assume parallel 8" collector sewer for lateral connections.
ALTERNATIVES:	Parallel pipe (if space available)

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Monroe St.	24	8-16	600'	220 $/ft	$132,000
Chromite Dr.	27	8-16	1,600'	240 $/ft	$384,000
Collector line on Monroe St	8	8-16	600'	160 $/ft	$96,000
Collector line of Chromite Dr.	8	8-16	1,600'	160 $/ft	$256,000
Lower Laterals plus Cleanout (Monroe St.)			8	$2,000	$16,000
Lower Laterals plus Cleanout (Chromite Dr.)			22	$2,000	$44,000
Structures					
Sewer Junction Structure: Chromite and Monroe				$6,000	$6,000
SITE SPECIFIC CONSTRUCTION COST					
Bypass Pumping / Flow Diversion Costs		10% of baseline pipe cost		10%	$51,600
Remove and Replace Factor		2% of baseline pipe cost		2%	$10,320
SUBTOTAL					**$995,920**
Mobilization and Demobilization				5%	$49,796
Traffic Control				10%	$99,592
CONSTRUCTION COST SUBTOTAL					**$1,145,308**
Contingencies				30%	$343,592
CONSTRUCTION COST TOTAL					**$1,488,900**
Engineering and Inspection Costs				25%	$372,225
CAPITAL IMPROVEMENT COST TOTAL					**$1,861,126**
ENR = 9103 (S.F. March 2007)				**rounded**	**$1,861,000**

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:……	4B
PROJECT LOCATION:……	Machado Ave. from Calabazas Blvd. to Monroe St. MH S52-103 TO S52-80
BRIEF PROJECT DESCRIPTION:……	Replace 1,500 feet of 15-inch pipe with 21-inch pipe.
SANITARY SEWER PLAT MAP(S):……	52
LOCATION OF CAPACITY DEFICIENCY: ……	Same as project location. Diameter of existing deficient pipes: 15"
SPECIAL CONSIDERATIONS:……	Assume parallel 8" collector sewer for lateral connections.
ALTERNATIVES:……	Parallel pipe (if space available)

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Machado	21	8-16	1,500'	210 $/ft	$315,000
Collector line on Machado	8	8-16	1,500'	160 $/ft	$240,000
Lower Laterals plus Cleanout (Machado)			55	$2,000	$110,000
Structures					
Sewer Junction Structure: Machado and Monroe				$6,000	$6,000
SITE SPECIFIC CONSTRUCTION COST					
Bypass Pumping / Flow Diversion Costs		10% of baseline pipe cost		10%	$31,500
Remove and Replace Factor		2% of baseline pipe cost		2%	$6,300
SUBTOTAL					**$708,800**
Mobilization and Demobilization				5%	$35,440
Traffic Control				10%	$70,880
CONSTRUCTION COST SUBTOTAL					**$815,120**
Contingencies				30%	$244,536
CONSTRUCTION COST TOTAL					**$1,059,656**
Engineering and Inspection Costs				25%	$264,914
CAPITAL IMPROVEMENT COST TOTAL					**$1,324,570**
ENR = 9103 (S.F. March 2007)				**rounded**	**$1,325,000**

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:……	5
PROJECT LOCATION:……	Monroe St. from Fordham Dr. to Chromite Dr. MH S51-22 TO S52-65
BRIEF PROJECT DESCRIPTION:……	Replace 2,400 feet of 10-inch pipe with 12-inch pipe. Parallel 6" siphon under Calabazas Creek with 8-inch siphon.
SANITARY SEWER PLAT MAP(S):……	51, 52
LOCATION OF CAPACITY DEFICIENCY: ……	Same as project location Diameter of existing deficient pipes: 10" (6" siphon)
SPECIAL CONSIDERATIONS:……..	
ALTERNATIVES:……	Project extents from S52-51 to S-52-65 could possibly be eliminated by diversion into 24" Calabazas trunk sewer if sufficient capacity is available. Pipe bursting could be an alternative to remove and replace.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Monroe	12	8-16	2,400'	170 $/ft	$408,000
Siphon at Calabazas Creek (casing)	36	Microtunnel	100'	900 $/ft	$90,000
Siphon pipe	8	Carrier Pipe	100'	150 $/ft	$15,000
Lower Laterals plus Cleanout (Monroe)			8	$2,000	$16,000
Jacking Pits			1 pits	$70,000	$70,000
Receiving Pits			1 pits	$40,000	$40,000
Structures					
Siphon structure- Calabazas Creek			2 structures	$6,000	$12,000
SITE SPECIFIC CONSTRUCTION COST					
Bypass Pumping / Flow Diversion Costs		10% of baseline pipe cost		10%	$40,800
Remove and Replace Factor		2% of baseline pipe cost		2%	$8,160
SUBTOTAL					**$699,960**
Mobilization and Demobilization				5%	$34,998
Traffic Control				10%	$69,996
CONSTRUCTION COST SUBTOTAL					**$804,954**
Contingencies				30%	$241,486
CONSTRUCTION COST TOTAL					**$1,046,440**
Engineering and Inspection Costs				25%	$261,610
CAPITAL IMPROVEMENT COST TOTAL					**$1,308,050**
ENR = 9103 (S.F. March 2007)				**rounded**	**$1,308,000**

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:	6
PROJECT LOCATION:	Nobili Ave. and Machado Ave. from Flora Vista Ave. to Calabazas Blvd. MH S41-53 TO S52-101
BRIEF PROJECT DESCRIPTION:	Replace exisiting 10-inch, 12-inch and 15-inch pipe with 700 feet of 15-inch pipe and 2,400 feet of 18-inch pipe.
SANITARY SEWER PLAT MAP(S):	41, 51, 52
LOCATION OF CAPACITY DEFICIENCY:	Same as project location. Diameter of existing deficient pipes: 10"-15"
SPECIAL CONSIDERATIONS:	
ALTERNATIVES:	Pipe bursting could be an alternative to remove and replace.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Nobili Ave	15	8-16	700'	180 $/ft	$126,000
Nobili Ave and Machado Ave	18	8-16	2,400'	190 $/ft	$456,000
Lower Laterals plus Cleanout (Nobili Ave)			31	$2,000	$62,000
Lower Laterals plus Cleanout (Machado Ave)			21	$2,000	$42,000
Structures					
Sewer Junction Structure: Machado and Calabazas				$6,000	$6,000
SITE SPECIFIC CONSTRUCTION COST					
Bypass Pumping / Flow Diversion Costs		10% of baseline pipe cost		10%	$58,200
Remove and Replace Factor		2% of baseline pipe cost		2%	$11,640
SUBTOTAL					**$761,840**
Mobilization and Demobilization				5%	$38,092
Traffic Control				10%	$76,184
CONSTRUCTION COST SUBTOTAL					**$876,116**
Contingencies				30%	$262,835
CONSTRUCTION COST TOTAL					**$1,138,951**
Engineering and Inspection Costs				25%	$284,738
CAPITAL IMPROVEMENT COST TOTAL					**$1,423,689**
ENR = 9103 (S.F. March 2007)				**rounded**	**$1,424,000**

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:	8
PROJECT LOCATION:	El Camino Real from Flora Vista Ave. to siphon at Calabazas Creek. MH S41-113 TO S32-5
BRIEF PROJECT DESCRIPTION:	Replace 2,600 feet of 10-inch pipe with 12- and 15-inch pipe.
SANITARY SEWER PLAT MAP(S):	31, 32, 41, 42
LOCATION OF CAPACITY DEFICIENCY:	Same as project location Diameter of existing deficient pipes: 10"
SPECIAL CONSIDERATIONS:	Permits required from Caltrans.
ALTERNATIVES:	Pipe bursting could be an alternative to remove and replace. Possible alternative alignment on Flora Visa Ave, from El Camino Real to Nobili (upstream end of project 6).

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
El Camino Real, Flora Vista to Pomeroy	12	8-16	1,800'	170 $/ft	$306,000
El Camino Real, Pomeroy to Calabazas	15	8-16	800'	180 $/ft	$144,000
Lower Laterals plus Cleanout (El Camino Real)			12	$2,000	$24,000
SITE SPECIFIC CONSTRUCTION COST					
Bypass Pumping / Flow Diversion Costs		10% of baseline pipe cost		10%	$45,000
Remove and Replace Factor		2% of baseline pipe cost		2%	$9,000
Concrete Pavement Replacement Allowance			2,600'	40 $/ft	$104,000
SUBTOTAL					**$632,000**
Mobilization and Demobilization				5%	$31,600
Traffic Control				10%	$63,200
CONSTRUCTION COST SUBTOTAL					**$726,800**
Contingencies				30%	$218,040
CONSTRUCTION COST TOTAL					**$944,840**
Engineering and Inspection Costs				35%	$330,694
CAPITAL IMPROVEMENT COST TOTAL					**$1,275,534**
ENR = 9103 (S.F. March 2007)				**rounded**	**$1,276,000**

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:	9
PROJECT LOCATION:	Scott Blvd. from Serra Ave. to Homestead Rd. MH S25-37 TO S35-98
BRIEF PROJECT DESCRIPTION:	Replace 800 feet of 8-inch pipe with 10-inch pipe.
SANITARY SEWER PLAT MAP(S):	25, 35
LOCATION OF CAPACITY DEFICIENCY:	Same as project location. Diameter of existing deficient pipes: 8"
SPECIAL CONSIDERATIONS:	
ALTERNATIVES:	Pipe bursting could be an alternative to remove and replace.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Scott Blvd.	10	8-16	800'	160 $/ft	$128,000
Lower Laterals plus Cleanout (Scott Blvd.)			14	$2,000	$28,000
SITE SPECIFIC CONSTRUCTION COST					
Bypass Pumping / Flow Diversion Costs		10% of baseline pipe cost		10%	$12,800
Remove and Replace Factor		2% of baseline pipe cost		2%	$2,560
SUBTOTAL					**$171,360**
Mobilization and Demobilization				5%	$8,568
Traffic Control				10%	$17,136
CONSTRUCTION COST SUBTOTAL					**$197,064**
Contingencies				30%	$59,119
CONSTRUCTION COST TOTAL					**$256,183**
Engineering and Inspection Costs				35%	$89,664
CAPITAL IMPROVEMENT COST TOTAL					**$345,847**
ENR = 9103 (S.F. March 2007)				**rounded**	**$346,000**

TRUNK SEWER SYSTEM PROJECT DESCRIPTION

PROJECT ID:……	10
PROJECT LOCATION:……	Park Ave. south of Bellomy St. MH S38-75 TO S38-66
BRIEF PROJECT DESCRIPTION:……	Replace 250 feet of 10-inch pipe with 12-inch pipe.
SANITARY SEWER PLAT MAP(S):……	38
LOCATION OF CAPACITY DEFICIENCY: ……	Same as project locatin. Diameter of existing deficient pipes: 10"
SPECIAL CONSIDERATIONS:……	
ALTERNATIVES:……	Pipe bursting could be an alternative to remove and replace.

MAJOR ITEMS	DIA. (in.)	DEPTH (feet)	LENGTH (feet)	UNIT COST	COST
BASELINE CONSTRUCTION COST					
Pipe Construction					
Park Ave.	12	8-16	250'	170 $/ft	$42,500
Lower Laterals plus Cleanout (Park Ave.)			2	$2,000	$4,000
SITE SPECIFIC CONSTRUCTION COST					
Bypass Pumping / Flow Diversion Costs		10% of baseline pipe cost		10%	$4,250
Remove and Replace Factor		2% of baseline pipe cost		2%	$850
SUBTOTAL					**$51,600**
Mobilization and Demobilization				5%	$2,580
Traffic Control				10%	$5,160
CONSTRUCTION COST SUBTOTAL					**$59,340**
Contingencies				30%	$17,802
CONSTRUCTION COST TOTAL					**$77,142**
Engineering and Inspection Costs				35%	$27,000
CAPITAL IMPROVEMENT COST TOTAL					**$104,142**
ENR = 9103 (S.F. March 2007)				**rounded**	**$104,000**

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RMC
Water and Environment

City of Santa Clara

Sanitary Sewer Master Plan Update

Final Report

Prepared by:

RMC water and environment

April 2016

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Abbreviations and Definitions

ABAG	Association of Bay Area Governments
ABWF	Average base wastewater flow
ADWF	Average dry weather flow
APN	Assessor parcel number
Backwater	A condition in which the hydraulic gradeline (see definition of HGL below) increases upstream of a location in the system due to a downstream hydraulic constriction.
BWF	Base wastewater flow: sanitary and process flow contributions from residential, commercial, institutional, and industrial users.
CIP	Capital Improvement Program
City	City of Santa Clara
CSJ	City of San Jose
CuSD	Cupertino Sanitary District
d/D	Ratio of flow depth to pipe diameter
Design Storm	A rainfall event, defined based on statistical probability of occurrence, which determines the peak wet weather flow conditions for which the capacity of sewer system facilities are evaluated and/or designed.
Diurnal Curve	Change in dry weather flow over a typical 24-hour period on an hourly basis.
DU	Dwelling unit
DWF	Dry weather flow: the flow during non-rainfall periods, composed of normal base wastewater flow plus any dry season groundwater infiltration.
ENR-CCI	Engineering News Record Construction Cost Index; an index published monthly by Engineering News Record magazine and used to reference construction costs (such as those for wastewater system facilities) to a specific date and location.
Firm capacity	The capacity of a pump station with the largest pump out of service.
fps	Feet per second
GIS	Geographic Information System: a computerized system in which geographical features (e.g., sewer facilities, parcels, land use) are linked to an attribute database to facilitate analysis and presentation of information
gpad or gpd/ac	Gallons per day per acre
gpcd	Gallons per capita per day
gpd	Gallons per day
GWDR	General Waste Discharge Requirements for Sanitary Sewer Systems: regulations adopted by the State Water Resources Control Board in 2006 that address the operation, maintenance, and management of publicly-owned sanitary sewer systems in California

GWI	Groundwater infiltration: extraneous water that infiltrations into a sewer system from the ground through defective pipes and manholes. Groundwater infiltration is considered to be a relatively constant daily flow that varies seasonally and depends on location of sewers with respect to the groundwater table.
HGL	Hydraulic Grade Line: in a gravity pipeline system, the water surface elevation in the pipes; or in a system flowing under pressure, the elevation representing the sum of pressure head plus elevation head
Hydrograph	A graph of flow versus time.
IDF	Intensity-duration-frequency: rainfall statistics that establish the rainfall intensity over specified durations for various recurrence frequencies
I/I	Infiltration/inflow (see definitions below)
Infiltration	Extraneous groundwater or storm water that enters sewer pipes, manholes, and service laterals via the soil through breaks, cracks, and defective joints.
Inflow	Storm water that enters the sewer system from the ground surface through direct drainage connections (e.g., directly connected catch basins, area drains, or roof drains) or through manhole or cleanout lids.
Inverted Siphon	A sewer configuration (also called a “siphon”), typically consisting of a downward leg, horizontal section, and upward leg, in which the flow is forced through the pipe by the pressure head created by the elevation difference between the upstream and downstream ends of the siphon**.** An inverted siphon is typically used to cross under a creek, channel, or another pipeline.
Isohyetal	A contour of equal precipitation (typically average annual rainfall)
K	Recession coefficient of RDI/I unit hydrograph (see Figure 2-4)
lf	Linear feet
Loading Manhole	A manhole in the modeled sewer network to which flows from unmodeled sewers discharge into the modeled network (also see definition of subcatchment below).
LS	Lift Station
MAP	Mean annual precipitation
mgd	Million gallons per day
NAICS	North American Industrial Classification System
O&M	Operations and maintenance
PDWF	Peak dry weather flow: the peak flow during non-rainfall periods.
PS	Pump Station
PWWF	Peak wet weather flow: the peak flow during a given storm event from dry weather flow plus infiltration and inflow.
R	Ratio of RDI/I volume to rainfall volume
RDI/I	Rainfall-dependent infiltration/inflow: the infiltration and inflow into a sewer system directly related to a rainfall event. RDI/I may cause rapid, short-term peak flows in the sewer system that recede after the rainfall has ended.
RG	Rain gauge
RMC	RMC Water and Environment

sf or sq. ft.	Square feet
SCVWD	Santa Clara Valley Water District
SECAP	System Evaluation and Capacity Assurance Plan
Siphon	See Inverted Siphon
SJ/SC RWF	San Jose / Santa Clara Regional Wastewater Facility
SSMP	Sewer System Management Plan
SSO	Sanitary sewer overflow
Subcatchment	A small area of the sewer system that contributes flow to the modeled sewer network, in which the unmodeled collection sewers are assumed to discharge to a common point (manhole) in the modeled network
Surcharge	The hydraulic condition in a sewer pipeline in which the elevation of the hydraulic gradeline (water level) is above the crown (top) of the pipe. Under such a condition, the water in the pipe rises into the manholes and could overflow onto the ground if the hydraulic gradeline exceeds the elevation of the manhole rims.
T	Time to peak of RDI/I unit hydrograph (see Figure 2-4)
TM	Technical Memorandum
WWF	Wet weather flow: the flow during rainfall periods, composed on base wastewater flow, wet season groundwater infiltration, and rainfall-dependent I/I.

Executive Summary

This report summarizes the results and recommendations of the Sanitary Sewer Master Plan Update (Master Plan) for the City of Santa Clara (City). The Master Plan was prepared by RMC Water and Environment (RMC) in close coordination with City staff. The Master Plan will be used to guide improvements to the City's sanitary sewer system to accommodate current and future development and ensure that the City continues to provide a high level of service to its customers.

Background and Purpose of Master Plan

The City of Santa Clara is located in central Santa Clara County adjacent to the Cities of San Jose, Cupertino, and Sunnyvale. The City has a population of approximately 120,000 and is served by a wastewater collection system consisting of approximately 270 miles of sewer pipelines and seven sewage pump stations. The system collects wastewater flows generated within the City limits and also flows from the major portion of the Cupertino Sanitary District (CuSD) via a connection at Homestead Road and Swallow Drive. Flow is conveyed eastward to the City of San Jose's interceptor sewer on Zanker Road and also northward to the Northside and Rabello Pump Stations, where the flow is pumped to the San Jose/Santa Clara Regional Wastewater Facility (SJ/SC RWF) for treatment and disposal. The City's sewer system and service area are shown in **Figure ES-1**.

The City's last sanitary sewer master plan was completed in 2007[1]. Since that time, the City has completed a number of sewer improvement projects and is experiencing significant growth and redevelopment in a number of areas, necessitating an evaluation of the capacity of the sanitary sewer system to handle future wastewater flows. This Master Plan will help identify future capital needs for capacity improvements and associated requirements for financing those improvements through increased connection fees or other sources of funding.

The City is also required to comply with the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (GWDR) adopted in 2006 by the State Water Resources Control Board. The GWDR, which applies to all publicly-owned sewer systems in California, includes the requirement to complete a Sewer System Management Plan (SSMP). The SSMP addresses the overall management, operation, and maintenance of the sanitary sewer system and must include a System Evaluation and Capacity Assurance Plan (SECAP). Therefore, this Master Plan is also intended to satisfy the SECAP requirements of the SSMP.

The overall objectives of this Master Plan are to develop wastewater flow projections for the City's collection area using up-to-date water use and land use information and flow monitoring data; develop an updated hydraulic model of the trunk sewer system; use the model to identify existing capacity deficiencies and future projected capacity requirements; and develop a Capital Improvement Program (CIP), including budget estimates, for implementing the required capacity improvements to the collection system.

This Executive Summary is presented in two parts:

- ***How the Capacity Assessment Was Prepared*** describes the scope and methodologies of the planning effort, including the key planning and technical assumptions incorporated into the sewer system capacity analysis.
- ***Recommended Capacity Improvement Program*** presents the recommended CIP, including capacity improvement projects, priorities, and estimated costs. In addition, recommendations are presented for implementing the proposed capacity improvement program.

[1] City of Santa Clara Sanitary Sewer Capacity Assessment, RMC Water and Environment, May 2007.

How the Capacity Assessment Was Prepared

The City's wastewater collection system includes sewer pipelines ranging in size from 4 to 48 inches in diameter. The larger pipes, primarily the 10-inch and larger sewers and a portion of the smaller diameter pipes, comprise the trunk sewer system, which is the primary network for conveying flows generated from the City's service area and CuSD to the SJ/SC RWF. The trunk sewer system, comprising about 34 percent of the total pipe footage in the system, was the focus of the capacity assessment in this study.

The project team used a systematic process that incorporated land use planning information, water use and flow monitoring data, and design criteria for estimating wastewater flows, applied in a computer hydraulic model of the trunk sewer system. The modeled system is shown in **Figure ES-2**. The model was used to assess how the system would perform under various planning and flow scenarios and identify pipes and/or pump stations that may not have sufficient capacity to convey the predicted flows under existing or future conditions. Improvement projects were developed to provide the required capacity, the capital costs of the required projects were estimated, and the projects were prioritized based on the model results.

Capacity Assessment Considers Existing and Future Planning Scenarios

Two planning scenarios were evaluated for this study: existing (2015) and future (2035) scenarios. The existing scenario examined the current capacity of the sewer system based on existing land use, with flows defined based on winter water use data and calibrated to flow monitoring data collected in the 2014/15 winter season. The future scenario incorporated information on planned development provided by the City. **Figure ES-3** shows the location of the areas of anticipated development. Planned development within the City represents over 15,000 new residential dwelling units and over 20 million square feet of commercial and industrial building floor space. In addition, CuSD has also projected an increase in their base wastewater flow due to anticipated additional development. Together, these projections are estimated to increase current base wastewater flows by over two folds. The future scenario was used to examine the impact on the system of future increases in wastewater flows due to anticipated development and determine the required sewer system capacity needed to serve both existing and future users.

Potential Capacity Deficiencies under Existing and Future Flow Conditions

For each of the planning scenarios, projected dry and wet weather flows were simulated in the hydraulic model. The model was calibrated to flow monitoring data to ensure that it represents a reasonably accurate depiction of system conditions. For this study, a flow monitoring program consisting of 25 temporary flow meters installed in the system during the 2014/15 wet weather season was conducted to provide data to calibrate the hydraulic model and verify existing system flows. The collected data was useful for confirming dry weather flows and characterizing the relative wet weather flow response in different areas of the system.

The model integrates various dry and wet weather flow parameters to determine system capacity under different flow and planning scenarios. Key flow components incorporated into the model included: base (dry weather) wastewater flow (BWF), estimated based on winter water use data; groundwater infiltration (GWI), which occurs when water seeps into pipes under the ground through cracks and pipe joints; and rainfall-dependent infiltration and inflow (RDI/I) during storm events. For this Master Plan, a 10-year return period, 24-hour duration rainfall event was selected as the "design storm" to serve as the basis for computing design peak wet weather flows in the system. A 10-year return period has become a standard design storm criterion for many Bay Area agencies. **Table ES-1** presents the estimated existing and future average dry weather flow (ADWF) and peak wet weather flow (PWWF) for the selected design storm for the City's sewer system, based on the modeling conducted for this study.

Legend

Sewers by Diameter:
- ≤ 6"
- 8" - 10"
- 12" - 16"
- 18" - 24"
- ≥ 27"

- Pump/Lift Station
- Santa Clara Force Mains
- San Jose Interceptors
- City Limit

San Jose / Santa Clara Regional Wastewater Facility

SC Influent Junction Structure

Northside PS

Rabello PS

Westside LS

Primavera LS

Stadium LS

Tasman LS

De La Cruz LS

CSJ Interceptor (not modeled)

CuSD Flow

City of Santa Clara
Sanitary Sewer
Master PlanUpdate

Figure ES-1
Sanitary Sewer Collection System Overview

0 0.5 1 Mile

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Legend

Modeled Trunk Sewers
- ≤ 6"
- 8" - 10"
- 12" - 16"
- 18" - 24"
- ≥ 27"

Modeled Pump/Lift Station
Unmodeled Sewers
San Jose Interceptors
City Limit

San Jose / Santa Clara Regional Wastewater Facility
SC Influent Junction Structure
Northside PS
Rabello PS
Westside LS
Primavera LS
Stadium LS
Tasman LS
De La Cruz LS
CSJ Interceptor (not modeled)
CuSD Flow

City of Santa Clara
Sanitary Sewer
Master Plan Update

Figure ES-2
Modeled Trunk System

0 0.5 1 Mile

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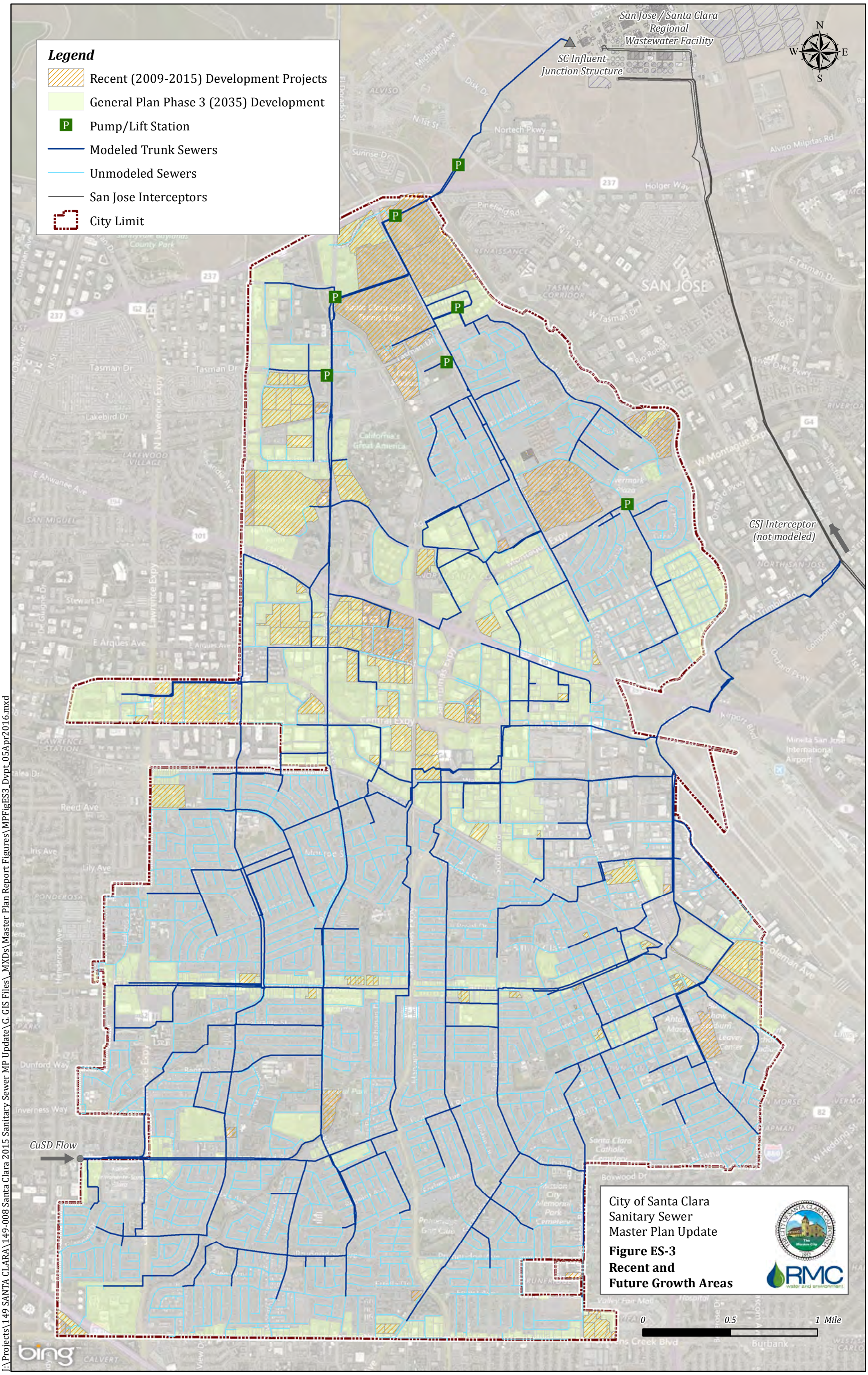

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Table ES-1: Collection System Flow Estimates

	Existing ADWF [2] (mgd)	Existing PDWF [2] (mgd)	Existing PWWF [3] (mgd)	Future ADWF [2] (mgd)	Future PDWF [2] (mgd)	Future PWWF [3,4] (mgd)
Flow Estimates by System Outfall [1]						
North (to Northside and Rabello Pump Stations)	10.2	15.2/16.0	27.9	24.6	33.5/34.4	41.0
East (to San Jose Zanker Road Interceptor)	4.7	6.4	11.7	9.8	13.3	18.3
Total	14.9	21.6/22.4	39.6	34.4	46.8/47.7	59.4
Flow Estimates by Agency [1]						
Santa Clara System	11.3	15.4/16.2	26.8	27.5	34.6/35.5	45.6
Cupertino Sanitary District	3.5	6.2	12.8	6.9	12.2	13.8
Total	14.9	21.6/22.4	39.6	34.4	46.8/47.7	59.4

1. Assuming that trunk sewer capacity deficiencies are relieved with recommended capital improvement projects presented in Table ES-2.
2. Includes groundwater infiltration for a typical wintertime period. ADWF and first value shown for PDWF includes typical non-game day flow from Levi's Stadium; second value shown for PDWF includes a peak game day flow from Levi's Stadium.
3. For 10-year design storm; assumes non-game day flow from Levi's Stadium.
4. Assuming peak wet weather flow from CuSD would not increase above its contractual maximum flow of 13.8 mgd.

Model results were examined to determine trunk system capacity needs, as indicated by areas where the flow in the pipes would exceed their capacity and cause surcharge conditions (water levels higher than the tops of the pipes). **Figure ES-4** shows the capacity assessment results for future PWWF conditions, indicating existing trunk sewers that were predicted by the model to be surcharged due to "throttle" conditions (peak flow exceeding full pipe capacity) or due to backwater from a downstream throttle condition, and locations of where the model predicts a surcharge condition severe enough to violate the City's capacity criteria, defined as water level that exceeds one (1) foot above the top of pipe. Most of these locations were predicted to be capacity issues only under future PWWF. Note that the locations of criteria violations are not necessarily the locations of the actual capacity-deficient pipes, but are typically located further upstream due to backwater from downstream deficiencies.

Note that no overflows are predicted under design storm conditions. Furthermore, all of the modeled pump stations have adequate firm capacity (capacity with largest pumping unit out of service) to convey the predicted PWWF without violating freeboard criteria or resulting in sewer overflows, although for two of the stations (Westside and Tasman), noticeable backwater surcharge was predicted because the switch-on set points for the lead pumps are higher than the influent lines.

Recommended Capacity Improvement Program

The Capital Improvement Program (CIP) recommended in this study is designed to provide for adequate sewer system capacity for the City's existing and anticipated future development. **Figure ES-5** and **Table ES-2** present the recommended capacity improvement projects. Projects have been assigned relative priorities based on the extent of criteria violations or surcharge. Priority 1 and 2 projects are required to address capacity deficiencies that result in criteria violations under current conditions, while Priority 3 projects are those that result in criteria violations under future conditions. In addition to these projects, there was also an additional project (Project E1) that was triggered by an entitlement requirement, discussed in more detail in Chapter 5.

As indicated in **Table ES-2**, the total estimated cost of the recommended capacity improvement program (without Project E1) is about $1.7 million. The total estimated cost, if the City implements Project P6-Alt instead of P6, would be approximately $2.8 million. Note that implementing Project P6-Alt would also increase the peak flow to the Rabello and Northside Pump Stations by about 1 mgd to each pump station, which could require further evaluation of and potential improvements to increase pump station capacity.

Implementation Recommendations

The City should begin implementation of the Capital Improvement Program recommended in this Master Plan, starting with the highest priority projects. The following items should be considered in project scheduling and design, and in future updates of the Master Plan.

- The alignments and sizes of projects should be verified with detailed predesign analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews.
- The estimated costs assumed open cut construction, but alternative methods such as trenchless construction or construction of parallel relief pipes could be considered during design. The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.
- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Master Plan in the future. The model should be kept up-to-date with changes to existing sewer connections, development plans, and sewer system facilities.
- The City should conduct additional flow monitoring at key locations in the sewer system, particularly the area tributary to the Chromite/Machado trunk sewers where both the 2006 and 2015 flow monitoring programs indicated high I/I. The City should also conduct smoke testing and television inspection to identify potential sources of I/I. Flow levels during large storm events should be compared to the peak flows simulated by the hydraulic model to verify the modeling predictions for the 10-year design storm and confirm the need for and sizing of Project P3 (Cabrillo Avenue Sewer Improvement).
- The City should coordinate with the CuSD on flow and planning assumptions to ensure that adequate capacity exists in the Santa Clara system to handle future flows from the District. The City should encourage CuSD to monitor the flows at the flow meter that it operates and maintains on Homestead Road at Swallow Drive on an on-going basis and periodically confirm meter calibration to verify the wastewater flows entering the Santa Clara system.
- The City should coordinate with the City of San Jose to ensure that its flow criteria and planning assumptions are consistent with those used by San Jose in its capacity master planning.
- The City should verify the need to implement project E1 (Tracy Drive Sewer Improvement). The project is triggered by the large sewer discharge assumed for parcel APN 316-17-018, which holds an entitlement agreement to discharge a potential flow of 0.95 mgd; however, it is currently discharging less than 10 percent of the entitled rate. While the City is obligated to provide capacity for entitlement holders, it is important to note that implementing this project now may result in oversized sewers where the current daily flow is not sufficient to provide the minimum cleaning velocity and thus creating potential debris and odor issues.

Legend

- Surcharge due to Backwater
- Surcharge due to Throttle
- Surcharge Criteria Violation under Existing PWWF
- Surcharge Criteria Violation under Future PWWF
- Modeled Pump/Lift Station
- Modeled Trunk Sewers
- San Jose Interceptors
- City Limit

San Jose / Santa Clara Regional Wastewater Facility

SC Influent Junction Structure

Northside PS

Rabello PS

Westside LS

Primavera LS

Stadium LS

Tasman LS

De La Cruz LS

CSJ Interceptor (not modeled)

CuSD Flow

City of Santa Clara
Sanitary Sewer
Master Plan Update

Figure ES-4
Model Predicted System Surcharge

0 0.5 1 Mile

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Legend

- Modeled Trunk Sewer
- Unmodeled Sewer
- Santa Clara Force Mains
- San Jose Interceptors
- Recommended Capital Improvement Projects
- Project for Entitlement Compliance

San Jose / Santa Clara Regional Wastewater Facility

SC Influent Junction Structure

P1: Westside Lift Station Set Point Adjustment

P4: Tasman Drive Sewer Improvement

P2: Tasman Lift Station Set Point Adjustment

CSJ Interceptor (not modeled)

P6 Alt: Calabazas Creek Sewer Improvement

P6: Sewer Diversion at Calabazas Boulevard and Machado Avenue

P3: Cabrillo Avenue Sewer Improvement

CuSD Flow

E1: Tracy Drive Sewer Improvement

P5: Sewer Diversion at Los Prades Blvd. and Saratoga Ave.

City of Santa Clara
Sanitary Sewer
Master Plan Update

Figure ES-5

Capacity Improvement Projects and Project for Entitlement Compliance

0 0.5 1 Mile

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Table ES-2: Recommended Capacity Improvement Projects

Project ID	Priority	Project Name	U/S MHID	D/S MHID	Description	Est. Capital Improvement Cost[1]
P1[2]	1	Westside Lift Station Set Point Adjustment	N/A	N/A	Adjust the set points for the pumps to a lower elevation to eliminate unnecessary backups in the influent line.	--
P2[2]	2	Tasman Lift Station Set Point Adjustment	N/A	N/A	Adjust the set points for the pumps to a lower elevation to eliminate unnecessary backups in the influent line.	--
P3	2	Cabrillo Avenue Sewer Improvement	S41-13	S41-20	Upsize 1,600 feet of 8-inch line in Cabrillo Ave. between Lawrence Expressway and Nobili Ave. to a 12-inch line.	$1,097,000
P4	3	Tasman Drive Sewer Improvement	S93-24	S93-35	Upsize 600 feet of 12-inch line in Tasman Dr. between Old Ironsides Dr. and Great America Pkwy. to a 15-inch line.	$327,000
P5	4	Sewer Diversion at Los Prades Boulevard and Saratoga Avenue	S25-85	S25-85	Install a weir in manhole S25-85 located in the intersection of Padres Blvd. and Saratoga Ave. to divert flow northwest to the existing 12-in line in Los Padres Blvd.	$77,000
P6	4	Sewer Diversion at Calabazas Boulevard and Machado Avenue	U/S of S52-93	S52-120	Install a new manhole upstream of S52-93 in the intersection of Calabazas Blvd. and Machado Ave., and install a new 15-inch high-level diversion line (approximately 200 feet) to divert excess flow from the existing 24-inch line in Calabazas Blvd. to the 21-inch line in Machado Ave. The diversion line should be about 6 inches higher than the invert of the 24-inch line.	$166,000
P6-Alt.[3]	4	Calabazas Creek Sewer Improvement	S62-31	S72-20	Upsize 1,800 feet of 24-inch line next to Calabazas Creek between Kifer Rd. and Scott Blvd. to a 27-inch line.	$1,334,000
					Estimated Total Cost for Recommended Projects P1 to P6:	$1,667,000
					Estimated Total Cost for Projects P1 to P5 and P6-Alt:	$2,835,000
E1[4]	N/A	Tracy Drive Sewer Improvement	S10-77	S22-51	Upsize approximately 6,600 feet of 10- to 12-inch line in Tracy Dr. and Pomeroy Ave. to a 15-inch line; install a new 15-inch line between manholes S22-55 and S22-46 in Pomeroy Ave. and Homestead Rd. (approximately 50 feet) to divert flow into Homestead Rd., and upsize approximately 1,400 feet of 18-inch line downstream to a 21-inch.	$4,654,000
					Estimated Total Cost (P1 to P6) including Project E1:	$6,321,000
					Estimated Total Cost (P1 to P5 and P6-Alt) including Project E1:	$7,489,000

1. All costs are presented in 2015 dollars and include 30 percent allowance for contingencies for unknown conditions and 25 percent for engineering, administration, and legal costs.
2. These proposed projects are operational, not capital improvements. Refer to Table 4-4 for recommended set points.
3. Project P6-Alt is presented for the purpose of identifying the solution and associated cost to maintain the current system flow configuration. Project P6 is the recommended project.
4. Project E1 addresses the potential capacity deficiency when parcel APN 316-17-018 begins to discharge its entitled flow of 0.95 mgd into the City's system.

Chapter 1 Introduction

This report presents the results and recommendations of the Sanitary Sewer Master Plan Update (Master Plan) for the City of Santa Clara (City). The report was prepared by RMC Water and Environment (RMC).

1.1 Background and Study Objectives

The City of Santa Clara is located in central Santa Clara County adjacent to the Cities of San Jose, Cupertino, and Sunnyvale. The City has a population of approximately 120,000 and is served by a wastewater collection system consisting of approximately 270 miles of sewer pipelines and seven sewage pump stations. The system collects wastewater flows generated within the City's service area and also wastewater flows from the major portion of the Cupertino Sanitary District (CuSD) via a connection at Homestead Road and Swallow Drive. Flow is conveyed eastward to the City of San Jose's interceptor sewer on Zanker Road and also northward to the Northside and Rabello Pump Stations, where the flow is pumped to the San Jose/Santa Clara Regional Wastewater Facility (SJ/SC RWF) for treatment and disposal. The City's sewer system and service area are shown in **Figure 1-1**.

The City's last sanitary sewer master plan was completed in 2007[2]. Since that time, the City has completed a number of sewer improvement projects and is experiencing new development in a number of areas, necessitating an evaluation of the capacity of the sanitary sewer system to handle future wastewater flows. This evaluation will help identify future capital needs for capacity improvements and associated requirements for financing those improvements through increased connection fees or other sources of funding. This Master Plan will confirm flows in the collection system and identify capital needs for capacity improvements.

The City is also required to comply with the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (GWDR) adopted in 2006 by the State Water Resources Control Board. The GWDR, which applies to all publicly-owned sewer systems in California, includes the requirement to complete a Sewer System Management Plan (SSMP). The SSMP addresses the overall management, operation, and maintenance of the sanitary sewer system and must include a System Evaluation and Capacity Assurance Plan (SECAP). Therefore, this Master Plan is also intended to satisfy the SECAP requirements of the SSMP.

The overall objectives of this Master Plan are to develop wastewater flow projections for the City's collection area using up-to-date water use and land use information and flow monitoring data; develop an updated hydraulic model of the trunk sewer system; use the model to identify existing capacity deficiencies and future anticipated capacity requirements; and develop a phased Capital Improvement Program (CIP), including budget estimates, for implementing the required capacity improvements to the collection system.

[2] City of Santa Clara Sanitary Sewer Capacity Assessment, RMC Water and Environment, May 2007.

1.2 Scope of Study

The scope of the Master Plan, as well as a brief discussion of work conducted under each task, is described below.

- **Task 1 – Project Management and Coordination.** Periodic progress meetings were held with City staff to review project status and discuss project issues, and monthly status reports were prepared to document the work completed. Quality control was carried out, including checking of data and calculations, as well as senior review of proposed criteria, recommendations, and project deliverables.
- **Task 2 – Data Collection and Review.** Data, maps, geographic information system (GIS) files, and previous reports related to the wastewater collection system were reviewed to identify the information available for completing the Master Plan.
- **Task 3 – Flow Monitoring.** A flow monitoring program, consisting of the 23 meters and 4 rain gauges installed in the collection system for a period of about two months during the 2014/15 wet weather season was conducted to obtain data to characterize flows in the system and calibrate the hydraulic model. Two additional FloDar meters were also installed at the Guadalupe Chart Station on the Trimble Road trunk sewer to confirm flows recorded by the City's existing permanent meters at that site. Four of the sites were installed early, including a meter at Levi's Stadium to capture the 2014 Thanksgiving Day football game, and at the three most downstream meters to capture total flows to the Rabello and Northside Pump Stations.
- **Task 4 – Hydraulic Model Update.** An expanded hydraulic model of the City's trunk sewer system was developed using InfoWorks™ CS modeling software. Subcatchments (small areas of unmodeled sewers that contribute flow to the modeled system) were delineated to define areas loading to the model, and flow loads to the model were compiled using water use and land use data and flow factors representing unit base wastewater flow (BWF) rates, diurnal BWF patterns, and infiltration/inflow (I/I). The expanded model also included the Northside and Rabello Pump Stations, the two associated force mains, and a junction structure between the pump stations and the SJ/SC RWF. Meetings were held with City planning staff to identify and obtain pertinent land use data and to discuss specific planning issues and potential growth or development areas in the City. Additional meetings were also held with the City of Cupertino and the CuSD to obtain updated flow projections. The model was verified for system connectivity, calibrated for dry weather conditions, and then calibrated for wet weather conditions using actual storm events from the flow monitoring program under Task 3.
- **Task 5 – Evaluate System Hydraulic Performance and Develop Capital Improvement Projects.** The model was used to determine sewer system capacity requirements and identify capacity deficiencies under peak dry and wet weather flow conditions, defined based on a design storm and system performance criteria. Potential solutions to capacity deficiencies were identified and tested in the model, and capacity improvement projects and associated costs were developed based on these analyses. The model was also used to confirm the results of the City's 2010 Pump Station Evaluation to determine if the City's pump stations are adequate to convey future flows. The recommended capacity improvement projects were prioritized to develop a Capital Improvement Program (CIP).
- **Task 6 – Prepare Sanitary Sewer Master Plan (Update) Report.** This report was prepared to summarize and present the results and recommendation of the study.

Legend

Sewers by Diameter:
- ≤ 6"
- 8" - 10"
- 12" - 16"
- 18" - 24"
- ≥ 27"

- Pump/Lift Station
- Santa Clara Force Mains
- San Jose Interceptors
- City Limit

San Jose / Santa Clara Regional Wastewater Facility

SC Influent Junction Structure

Northside PS

Rabello PS

Westside LS

Primavera LS

Stadium LS

Tasman LS

De La Cruz LS

CSJ Interceptor (not modeled)

CuSD Flow

City of Santa Clara
Sanitary Sewer
Master PlanUpdate

Figure 1-1
Sanitary Sewer Collection System Overview

0 0.5 1 Mile

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1.3 Report Organization

This report includes five Chapters, which are described below.

- **Chapter 1, Introduction,** presents the background, objectives, and scope of the Sanitary Sewer Master Plan Update.
- **Chapter 2, Basis of Flow Estimates,** discusses the planning area land use projections, the basis for developing estimates for each component of wastewater flows, and the base wastewater flow projections for the service area.
- **Chapter 3, Hydraulic Model Development,** describes the modeled sewer system, development of the model network and model loads, flow monitoring program, and model calibration.
- **Chapter 4, Capacity Analysis,** describes the capacity analysis and design criteria, model results, and potential solutions for identified capacity deficiencies.
- **Chapter 5, Recommended Capacity Improvement Program,** presents the recommended capacity improvement CIP, including project costs, prioritization, and implementation recommendations.

The Appendices to this report include plots of the flow monitoring data, model calibration graphs, model hydraulic profiles, and documentation for the recommended CIP, including project descriptions and cost estimates.

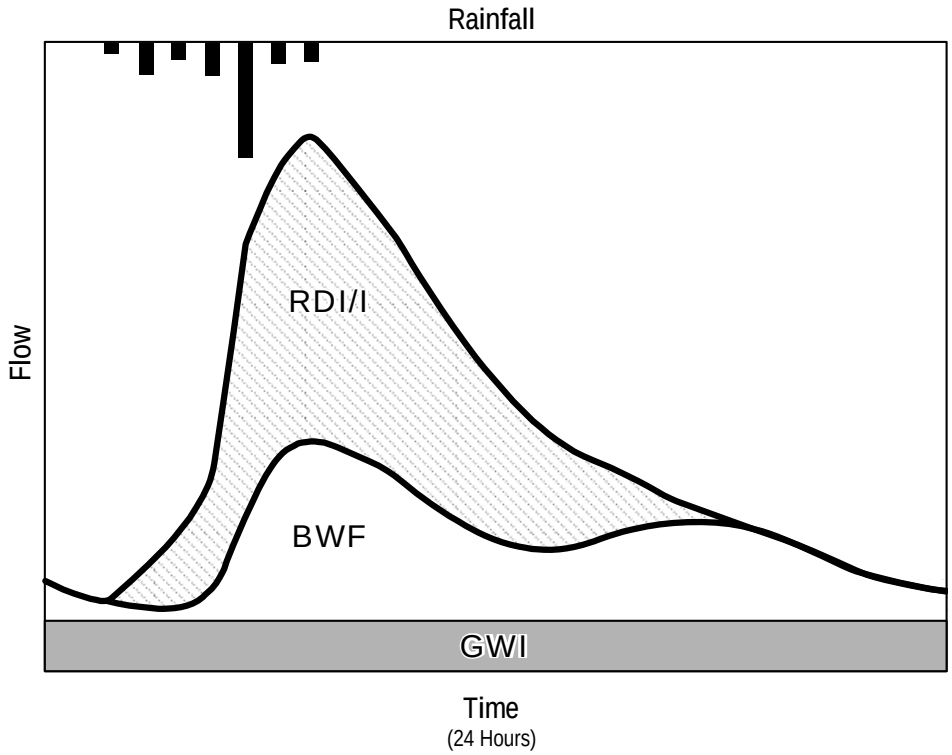
Chapter 2 Basis of Flow Estimates

This chapter presents the basis of wastewater flow estimates for the City's sanitary sewer system. The section describes the wastewater flow components used in the hydraulic model and the existing and projected future land uses for the City, which form the basis for generating base wastewater flows. Design flow estimates were developed based on criteria developed for each flow component: base wastewater flow, groundwater infiltration, and rainfall-dependent infiltration and inflow, and confirmed through model calibration, as described in Chapter 3 of this report.

2.1 Wastewater Flow Components

Wastewater flows include three components: base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I), as illustrated conceptually in **Figure 2-1**. BWF represents the sanitary and process flow contributions from residential, commercial, institutional, and industrial users of the system. GWI is groundwater that infiltrates into defects in sewer pipes and manholes, particularly in winter and springtime in low-lying areas. GWI is typically seasonal in nature and remains relatively constant during specific periods of the year. RDI/I is storm water inflow and infiltration that enter the system in direct response to rainfall events, typically through direct connections such as holes in manhole covers or illegally connected roof leaders or area drains or, more commonly, through defects in sewer pipes, manholes, and service laterals that may have resulted from poor initial construction, settlement of trench backfill, or deterioration due to age. RDI/I typically results in short-term peak flows that recede quickly after the rainfall ends.

Figure 2-1: Wastewater Flow Components



2.2 Base Wastewater Flow

For the City's Master Plan Update, BWF loads were developed for both existing and future development conditions. Existing loads were developed based on average winter water use data from the City's customer billing records, and future loads were based mainly on the General Plan Phase 3 (2035) development forecast and known development and redevelopment projects that had occurred in recent years. The loading methodology for existing conditions and for projecting future BWF are discussed in the following subsections.

2.2.1 Existing Base Wastewater Flow

Existing BWF was estimated based on actual water billing records in the City's customer billing database. Data were first processed to exclude non-wastewater generating accounts such as fire, construction, or irrigation accounts; data for the remaining accounts were converted to average water use (in gallons per day, gpd) using the billing dates and quantities. Each account's BWF was estimated based on the average water use during the four winter periods between December 2010 and February 2014. Each user was also assigned one of three land use types (residential, commercial, or industrial) according to the account's North American Industry Classification System (NAICS) designation.

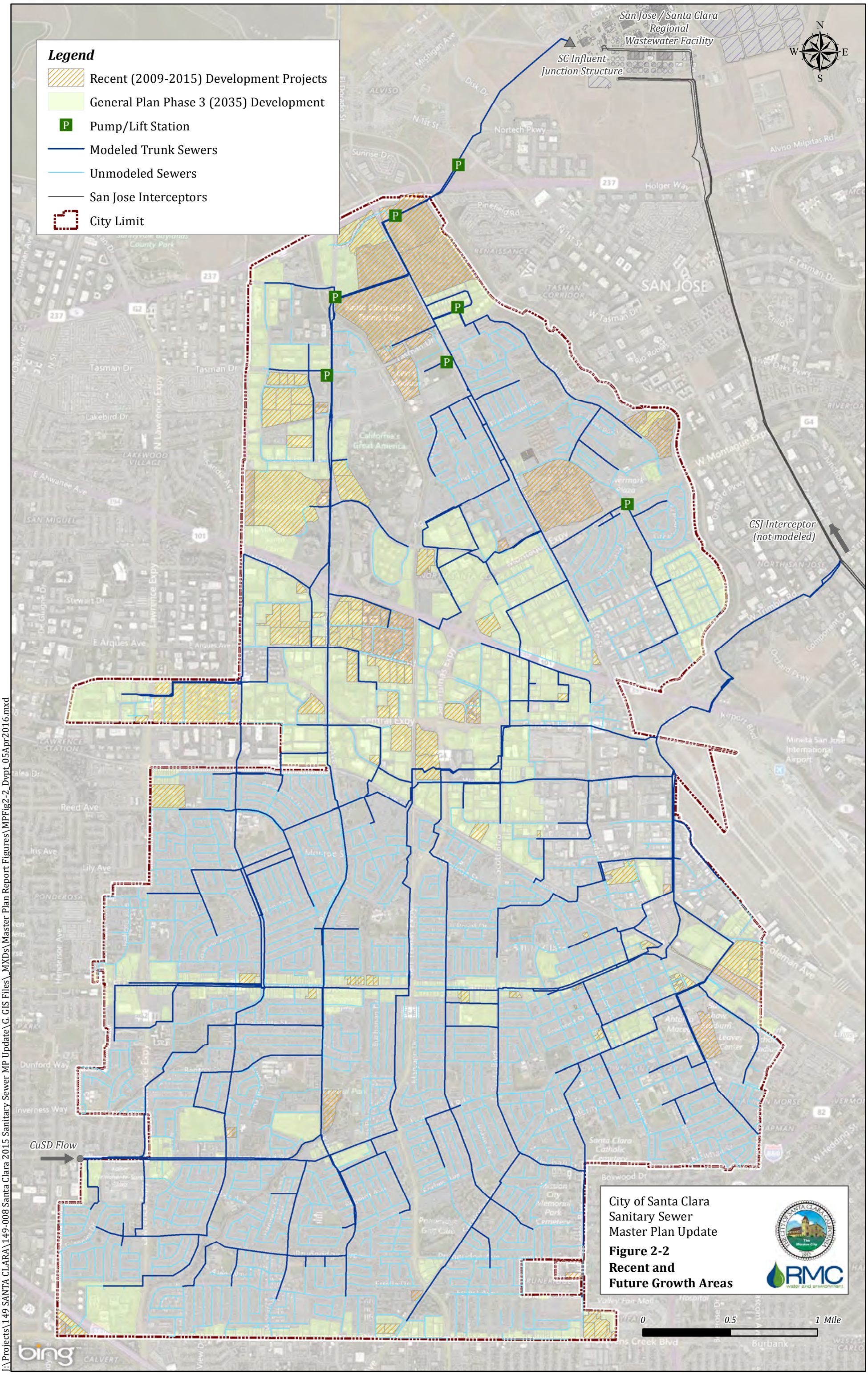
The City also has customers who use domestic wells and/or recycled water. The BWF for these customers were individually estimated based on their winter well usage data and recycled water billing data.

The BWF data (both water use and land use type) were further processed in GIS by geocoding the data to their corresponding parcels using the account's service address. The total BWF for each sewer subcatchment was then estimated by overlaying the subcatchment boundary on the parcels and summing the BWF of all parcels within each subcatchment.

The data were then imported into the hydraulic model to perform a dry weather simulation run, and the results were compared to the flow data collected during the most recent flow monitoring program, in which a total of 25 meters were installed at selected locations throughout the system and collected actual flow data between November 2014 and March 2015 (see further discussion of model calibration in Chapter 3). It was noticed that the modeled flows were consistently about 10 to 20 percent higher than the observed flows. One possible explanation was that there was some level of irrigation activities occurring even in the winter months due to the lack of rainfall in recent years. As such, a wastewater return factor of 10 to 20 percent was applied to the estimated BWF based on the water use data to attain a more reasonable match with actual flows observed in the field. The revised estimated BWF including the wastewater return factor is 6.5 million gallons per day (mgd) for residential accounts and 4.4 mgd for commercial and industrial accounts. These estimates do not include flow from the Levi's Stadium, which varies widely depending on the use of the venue and could potentially generate daily peak flows ranging from less than 0.1 mgd (for local events such as team practice or stadium public tours) to 1.0 mgd or higher (for major events such as the Super Bowl).

2.2.2 Future Base Wastewater Flow

The future scenario for this Master Plan Update refers to the projected flow condition in year 2035, which is the planning horizon for the City's current General Plan. The BWF for this scenario was estimated using multiple data sources, including the original General Plan Phase 3 development forecast that was prepared in 2009 plus various additions and corrections that City staff identified in 2015, development and redevelopment projects that have occurred between 2009 and 2015, and entitlement agreements for specific parcels. These areas are shown in **Figure 2-2**. A more detailed map and tabulation of the recent developments are included in **Appendix G**.



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The original future BWF projection was developed in 2009 as part of the City's overall General Plan Update effort, in which over one thousand parcels with development potential were identified and their developments were quantified in terms of dwelling units (for residential developments) and/or building square footage (for non-residential developments). The development quantities were multiplied by the corresponding unit flow factors depending on land use to convert the information into BWF estimates. These unit flow factors are summarized in **Table 2-1**.

Table 2-1: Base Wastewater Flow Unit Flow Factors

Type of Development	Unit Flow Factor (1)	Basis
Single Family Detached	245 gpd/DU	3.5 people/DU, 70 gpcd
Townhouse or Condominiums	175 gpd/DU	2.5 people/DU, 70 gpcd
Apartments	154 gpd/DU	2.2 people/DU, 70 gpcd
Hotels	100 gpd/room	n/a
Commercial Offices	0.1 gpd/sq. ft.	n/a
R&D Offices	0.15 gpd/sq.ft.	n/a

1. All unit flow factors are consistent with factors used in the 2007 Capacity Assessment.

Parcels that were not identified with development potential were assumed to retain the same land use through 2035 and therefore also maintain approximately the same level of wastewater generation, which was developed based on their 2005-2006 winter water billing data. This version of the future BWF projection has since then been used for various capacity evaluations, and was updated regularly when new development or redevelopment project applications were submitted to the City for capacity evaluation.

In 2015, the City identified a number of additional developments that were not accounted for in the original General Plan Phase 3 development forecast prepared in 2009. The City also identified a list of parcels with entitlement agreements that allow the owners of these parcels to discharge wastewater up to a certain flow rate without applying for permission or notifying the City. Neither set of data was accounted for in the original projection. Furthermore, the revised existing BWF estimates are noticeably lower than those developed based on the 2005-2006 winter water billing data. The decline could be mostly attributed to increased water conservation activities in response to the recent drought. This is also evidenced in the City's potable water sales records, which shows a sharp decline in the past ten years despite continuous population growth in the City. While it is possible that water use could rebound if and when the drought is over (e.g., behavioral changes such as reverting back to longer showers), some of the reduction is likely to remain permanent as a result of installing water-efficient plumbing fixtures and greater awareness of the need to continue conserving water.

In light of the various changes in water use and development information, a focused effort was undertaken to revise the City's future BWF projections. Parcels that were identified to have development potential in the revised General Plan Phase 3 forecast were re-processed using the updated development quantities. Parcels that were not identified with development potential were assumed to maintain their current water use, which is the updated existing BWF described in the previous section, instead of the original BWF based on previous 2005-2006 water use data, plus a 10 percent rebound factor to account for possible increase in water use in the future. For parcels that are on the list of development/redevelopment projects that the City has received between 2009 and 2015, their BWF was estimated according to the development quantities specified in their project applications. For parcels that hold entitlement agreements, BWF was set to their entitled flow rates.

Table 2-2 summarizes the existing (circa 2015) and future (2035) BWF for residential and non-residential sectors. Based on these estimates, BWF is projected to increase by over two fold to 27.1 mgd in 2035.

Table 2-2: Base Wastewater Flow Estimates

Land Use	Existing Flow (mgd)	Future Flow (mgd)
Residential	6.5	10.7
Non-Residential (1)	4.4	16.4
Total (2)	11.0	27.1

1. Does not include flow from the Levi's Stadium, which varies greatly depending on the use of the venue; average flow on a peak game day is approximately 0.19 mgd based on flow monitoring conducted as part of this project.
2. Does not include flow from the Cupertino Sanitary District (CuSD), which is discussed in section 2.5.

2.2.3 Diurnal Curves

In most sewer systems, BWF typically exhibits distinctive diurnal patterns depending on the land use, usually categorized as residential, commercial, and industrial. For Santa Clara, flow monitoring data showed typical responses to commercial and industrial patterns, but also two residential patterns: the northeastern part of the City in the vicinity of Lafayette Street and Montague Expressway appeared to have a more pronounced morning peak flow and a lower evening peak, while the rest of the City had a less peaky morning peak and a somewhat higher evening peak. As such, two residential diurnal curves were created to represent these two patterns.

The diurnal curves are shown in **Figure 2-3**. Each subcatchment was assigned one of the residential curves according to its location (Lafayette Area vs. all other areas); and one of the non-residential curves according to the primary type of non-residential establishments (commercial or industrial).

Figure 2-3: Wastewater Diurnal Curves

Figure 5A: Typical Residential Flow

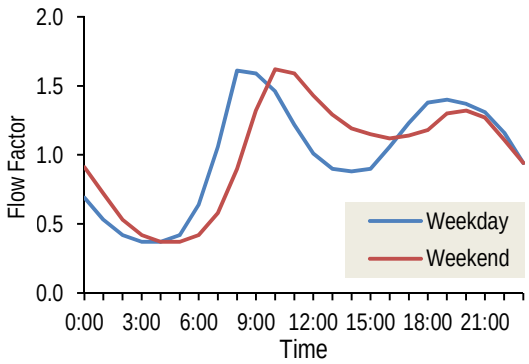


Figure 5B: Lafayette Area Residential Flow

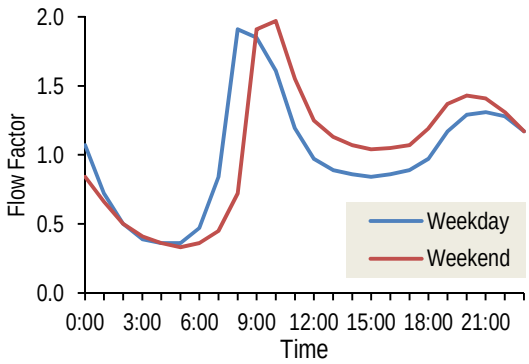


Figure 5C: Commercial Flow

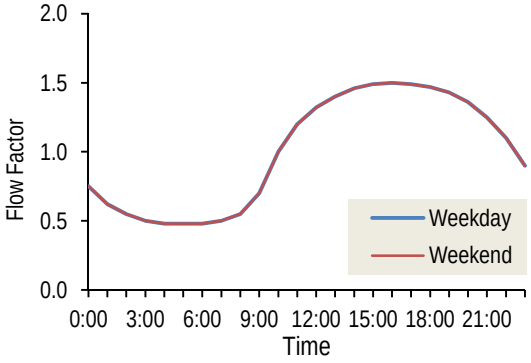
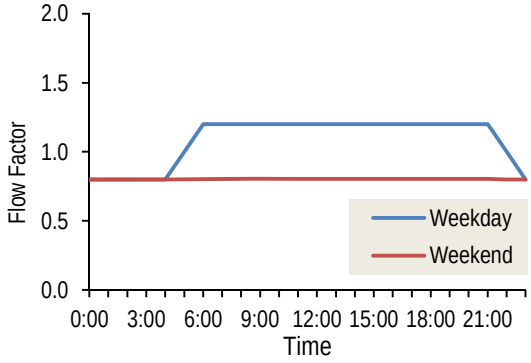


Figure 5D: Industrial Flow



Some of the City's large water users do not exhibit typical diurnal curves. To ensure their flow patterns are accurately reflected in the model, nonresidential accounts with average water use of over 50,000 gpd were identified and individually researched. A total of 18 such large users were identified, and City staff contacted each user to collect operational information regarding their sewer discharge pattern. Individual diurnal curves were created for each based on the operational hours indicated on their wastewater discharge permits or surveys. These large water users are summarized in **Table 2-3**.

Table 2-3: City's Large Water Users

Account Holder	APN	Address	Est. Average Flow (mgd)
Graphic Packaging Intl. Inc.	230-03-100	2600 De La Cruz Blvd.	0.587
Siliconix Inc.	104-39-023	2201 Laurelwood Rd.	0.405
Streamline Circuits Corp.	224-06-170	1415 Richard Ave.	0.308
Intel Corporation	104-48-010	3600 Juliette Ln.	0.191
Intel Corporation	216-46-015	3065 Bowers Ave.	0.099
Marvell Semiconductor Inc.	104-52-024	5488 Marvell Ln.	0.081
APCT Inc.	101-15-033	3495 De La Cruz Blvd.	0.074
Perkin Elmer Optoelectronics	104-13-083	2175 Mission College Blvd.	0.071
Owens Corning Sales LLC	224-07-099	960 Central Exp.	0.069
Applied Materials	216-49-024	3070 Bowers Ave.	0.067
Reaction Technology Inc.	104-51-001	3400 Bassett St.	0.067
City of Santa Clara – Electrical Dept.	230-03-067	524 Robert Ave.	0.065
Abbott Diagnostics Div.	104-50-016	5440 Patrick Henry Dr.	0.063
Diana Fruit Co. Inc.	224-40-001	651 Mathew St.	0.061
Oracle America Inc.	097-08-114	4100 Network Cl.	0.058
Digital 3011 Lafayette LLC	224-36-052	3011 Lafayette St.	0.053
Intel Corporation	104-39-020	2200 Mission College Blvd.	0.053
Agilent Technology	316-17-018	5301 Stevens Creek Blvd.	0.051

2.3 Groundwater Infiltration

Groundwater infiltration is generally quantified based on actual flow monitoring data, since it is difficult to predict GWI rates based on physical system data alone. In the context of design flow criteria, GWI represents the incremental groundwater infiltration that occurs during the wet weather season above the "baseline" infiltration level during the driest months of the year.

GWI can be estimated based on minimum flows during non-rainfall periods during a wet weather flow monitoring period. Minimum flows typical occur during the nighttime or early morning hours when base wastewater flows are at a low. Alternatively, GWI can be estimated as the difference between average metered flow during non-rainfall periods and computed average BWF. In either case, the resulting GWI, is expressed on a unit basis (gpd/acre or gpad) by dividing by the sewered acreage of the monitored area. Typical GWI rates may range from about 100 to 1,000 gpad.

GWI were estimated through the model calibration process (described in Chapter 3) by comparing model-simulated BWF to actual flow measurements from the temporary flow monitoring programs. Cases where model-predicted BWF was noticeably lower than monitored flow indicated the possible occurrence of GWI.

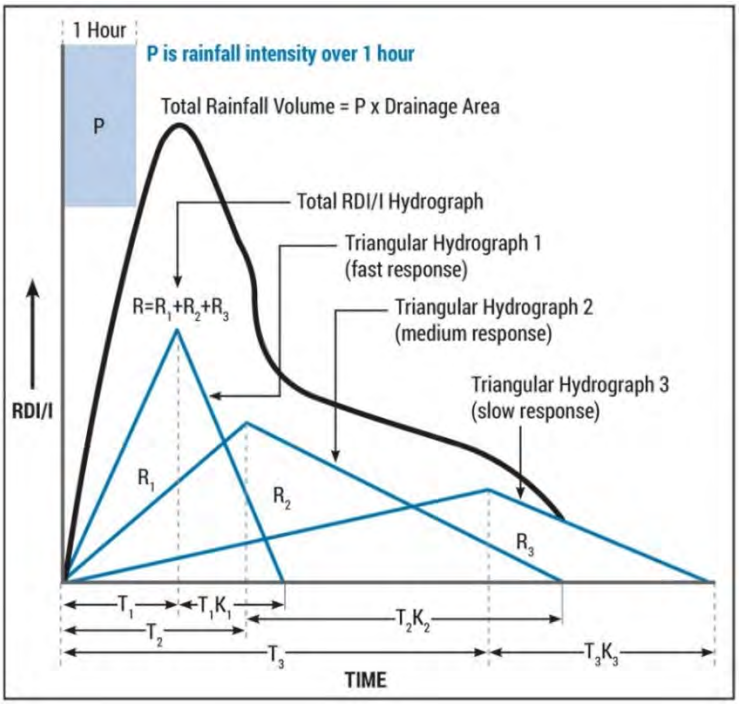
2.4 Rainfall-Dependent I/I

RDI/I flows result from rainfall events that produce infiltration and inflow of storm water into the sewer system. RDI/I can be quantified as the difference between the total flow during and immediately following a storm event and the non-rainfall "base flow" (BWF plus GWI) that is estimated to have occurred during the storm period. The magnitude of the resulting RDI/I response is typically described by the percentage of the rainfall volume (called the "R value") represented by the volume of the RDI/I hydrograph. The R value can vary from storm to storm, depending on such factors as the degree of soil saturation (due to antecedent rainfall) prior to the storm event.

The shape of the RDI/I hydrograph is also important in determining the peak RDI/I response. The RDI/I hydrograph shape is often defined by separating the total RDI/I hydrograph volume into components, representing different response times to rainfall (fast, medium, and slow). Each component is identified by a percentage of the total RDI/I volume and specific time to peak (T) and recession coefficient (K), illustrated in **Figure 2-4**. The R component percentages and T and K values can be applied to each hour of rainfall to generate a "synthetic hydrograph" that approximates the volume and shape of the hydrograph from the actual observed event. These parameters, when applied to a different rainfall pattern, can be used to estimate the RDI/I response to that particular rainfall event. This methodology is used to synthesize RDI/I hydrographs for a "design storm" for collection system modeling (see Chapter 3 for discussion of design storms).

Design criteria for RDI/I include design R values and hydrograph shape parameters and the hourly rainfall for the selected design storm event. As described in the next chapter, R values and hydrograph parameters are determined through the process of model calibration, in which actual observed rainfall events are simulated in the hydraulic model, and the resulting model hydrographs are compared to the measured flows at flow meters locations. The RDI/I parameters are adjusted as needed to achieve the best match of modeled to monitored flows. Once calibrated, the model RDI/I parameters can be applied to a design storm to simulate wet weather flows for a design event.

Figure 2-4: RDI/I Hydrograph Components



2.5 Flow from Cupertino Sanitary District

CuSD provides sewer collection services for the majority of City of Cupertino, portions of the City of Saratoga, and several unincorporated areas within Santa Clara County east of San Jose. Most of the flow is discharged into the Santa Clara system via a 27-inch sewer line in Homestead Road; the rest is discharged into the City of San Jose (CSJ) system at various other connection points.

CuSD maintains a permanent flow meter at its discharge point in Homestead Road. Meter data between November 2014 and March 2015 were reviewed and analyzed; the average dry weather flow (ADWF) was about 3.5 mgd. Similar to the declining trend observed for the City, CuSD's flow has also declined over 28 percent from the 2007 estimates of 4.9 mgd to the current estimates of 3.5 mgd, most likely also due to increased water conservation activities in response to the recent drought.

Multiple meetings were held with City staff and CuSD staff to discuss development projections within the CuSD service areas in an effort to estimate the future BWF for the CuSD system. Information from sources such as the City of Cupertino's General Plan 2020 and General Plan 2040, CuSD-SJ Joint Interceptor Cost Sharing Agreement (which indicates how much flow CuSD would be discharging into the San Jose system), ABAG projections, and CuSD meter data were discussed. Characteristics of the CuSD system, such as system age and I/I, planned sewer improvements, and known large development projects were also considered. Preliminary model simulations were conducted to understand the potential impact of the CuSD flow on the Santa Clara system under future peak design storm condition. For this Master Plan Update, City staff has directed RMC to use 6.90 mgd as CuSD's future ADWF, and cap its future PWWF at 13.8 mgd, which is the maximum flow rate set forth in the agreement[3] between the City and CuSD.

[3] Agreement between the City of Santa Clara and the Cupertino Sanitary District for (a) the purchase of capacity in Cupertino's sanitary interceptor sewer within the City of Santa Clara and (b) continued use by Cupertino Sanitary District of 13.8 MGD Peak Capacity in the City of Santa Clara's interceptor sewer system.

Chapter 3 Hydraulic Model Development

This chapter describes the process of developing and calibrating the hydraulic model for use in the capacity assessment, including the flow monitoring program that was conducted for this study.

3.1 Modeling Terminology

Network refers to the representation of the physical facilities being modeled. The primary components of the modeled network are pipes, manholes, and pump stations.

Nodes are primarily manholes, but also include pump station wet wells, outfalls (discharge points of the modeled system) and breaks (changes in slope or diameter without a structure, such as at the vertical bends in inverted siphons). The primary data associated with nodes are rim and invert elevations. In the case of wet wells, the data also includes the diameter (for a circular well) or cross-sectional area.

Pipes are connections between nodes. The primary data associated with pipes are upstream and downstream node IDs, pipe length, diameter, and upstream and downstream invert elevations. Pipes include both gravity sewers and force mains.

Pumps are represented by links connecting the wet well node(s) and the discharge manhole or upstream end of the force main. Pumps are controlled by a number of user-defined parameters, including the switch-on and switch-off levels, types of pumps, and head discharge curves.

Other model components include **Gates and Weirs**, which are represented by links with zero length. Primary data associated with gates are the opening width and invert; data associated with weirs are the crest width and crest elevation.

Subcatchments are areas that contribute flow to the modeled sewer network and represent the unmodeled sewers in the collection system. Data associated with subcatchments include base wastewater (sanitary) flow (computed based on population, water use, or other available data), type of land use (which defines the diurnal profile associated with the base wastewater flow), infiltration/inflow (I/I) parameters, and the node at which the flow from the subcatchment enters the modeled system.

Loads are the flows assigned to each subcatchment. Components of model loads include residential and commercial base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent I/I (RDI/I). As a sum, they represent the total wastewater flow applied to the model.

Models are the combination of a modeled network, its associated subcatchments and loads, and other data files (e.g., rainfall, diurnal profiles, etc.) that comprise a specific model scenario.

3.2 Delineation of Modeled System

A hydraulic model is typically developed to represent the *trunk* sewer system, which is the network of larger diameter pipes that comprises the "backbone" of the entire system. The City's original hydraulic model was developed by RMC as part of the 2007 Capacity Assessment project and included approximately 28 percent (about 76 miles) of the total sewer pipelines and four of the pump stations. The model was originally constructed using modeling software MIKE URBAN™ (SWMM version) and was converted to InfoWorks™ CS in 2008. RMC has continuously maintained and updated the model as sewer improvement projects were implemented or when new network data became available.

For this Master Plan Update, the model was expanded to include approximately 34 percent (about 92 miles) of the total pipelines and all seven pump stations. The force mains downstream of the Rabello and Northside pump stations were also added. A summary of the system's pipeline inventory is provided in **Table 3-1**. The modeled network is shown in **Figure 3-1**.

Table 3-1: Sewer Collection System Model Summary

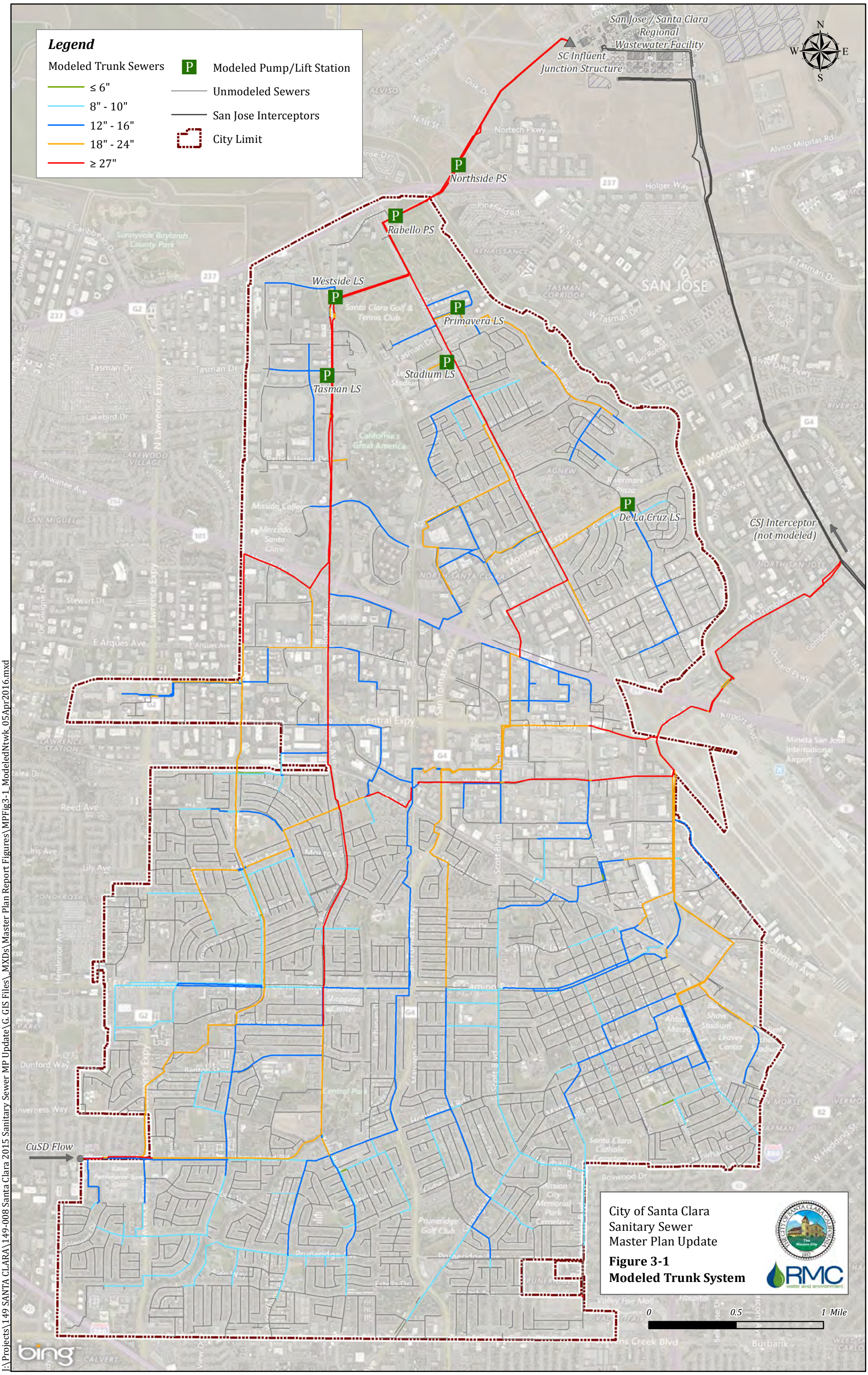
Pipe Diameter (in)	Total Length[1] (ft)	Length Modeled[1] (ft)	Percent Modeled
4-6	197,400	1,800	0.9%
8	619,600	48,300	8%
10	132,300	65,200	49%
12	224,900	120,300	53%
14-16	62,800	59,400	95%
18	43,700	42,000	96%
20-21	15,300	15,300	100%
24	49,600	49,600	100%
27	15,000	15,000	100%
30	25,900	25,900	100%
>30	38,100	38,100	100%
Force Main	13,000	13,000	100%
Total (feet)	1,437,600	493,900	34%
Total (miles)	272.3	93.5	34%
Approx. No. of Manholes	5,260	1,870	36%
No. of Siphons[2]	53	53	100%

1. Rounded to the nearest hundred feet.
2. This refers to the total number of barrels. Some siphons have multiple barrels.

All seven pump stations in the system are included in the model. A survey was conducted to collect information on pump curves and the operational sequences, as summarized in **Table 3-2** below. Pump capacity analysis was conducted for all stations and the results are summarized in Chapter 4 of this report.

Table 3-2: Collection System Pump Station Summary

No.	Station Name	No. of Pumps	Description	Emergency Bypass
1	Westside Lift Station	2	Identical Flygt 3127 pumps.	Yes
2	Tasman Lift Station	2	Identical Flygt 3127 pumps.	Yes
3	De La Cruz Lift Station	2	Identical Flygt 3127 pumps.	Yes
4	Primavera Lift Station	6	Identical Flygt 3127 pumps.	Yes
5	Stadium Lift Station	6	New lift station completed in 2014. Two identical low-flow pumps (Flygt 3127) and four identical high-flow pumps (Flygt 3153).	Yes
6	Rabello Pump Station	8	Identical Flygt 3202 pumps. Four new pumps installed in 2013 and in 2014.	Yes
7	Northside Pump Station	4	Four identical Flygt 3356 pumps.	Yes



City of Santa Clara
Sanitary Sewer
Master Plan Update

Figure 3-1
Modeled Trunk System

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Flows are loaded into the model at "loading manholes," each representing the point where flows from adjacent parcels or parcels connected to unmodeled sewers discharge to the modeled network. The parcels connected to unmodeled sewers were grouped into sewer subcatchments based on the modeled manhole to which the unmodeled sewers drain. Each subcatchment was associated with a unique load manhole in the model network. Approximately 860 sewer subcatchments and associated loading manholes were delineated for defining the model loads. The subcatchments and load manholes are shown in **Figure 3-2**.

3.3 Model Network Construction and Validation

Data of the expanded network were compiled from available as-built drawings, field measurements, and Excel files from previous modeling efforts. The network was also validated using the following steps:

- The entire modeled network (both the original network and the expanded portion) was checked for connectivity, i.e., verifying that correct upstream/downstream manholes were identified for each pipe and there were no missing links in the network.
- Profiles were plotted for each series of pipe segments to visually check for missing or suspect data, such as missing rim or invert elevations, negative pipe slopes, or abrupt steps up or down in pipe inverts. Where appropriate, data were interpolated or verified through field investigation or as-built drawings.
- As-built drawings and field data were used to develop details for the modeled pump stations, such as wet well elevations and dimensions, number of pumps, pump types, on/off levels, and discharge curves.
- Flow splits (manholes with more than one outlet pipe) were identified, and field verification and/or as-built drawings were requested as needed for further verification of outlet pipe elevations and/or the existence of weirs or other flow diversion structures.

3.4 Flow Monitoring Program

Flow monitoring was conducted between November 2014 and March 2015 to measure actual flows in the system for analysis and calibration purposes. The monitoring was conducted by V&A Consulting Engineers (V&A) as subcontractor to RMC. The flow monitoring program originally consisted of 23 flow meters and four rain gauges. Most of the meters were installed and operational from December 10, 2014 to March 4, 2015 (approximately 12 weeks). Four of the meters, Meters 1 through 4, were installed earlier on November 22, 2014 to collect data during scheduled game events at the new Levi's Stadium.

Factors that were considered in selecting the flow meter sites included:

- Location of sites used in 2006 flow monitoring program for the City's previous sewer system capacity assessment study
- Similar sized tributary areas
- Ability to isolate areas to characterize flows for model calibration
- Provides more specific information about flow splits
- Preferred hydraulic conditions (i.e., manholes on a straight line preferred over manholes on bends or with multiple incoming pipes)
- Ease of access and safety considerations

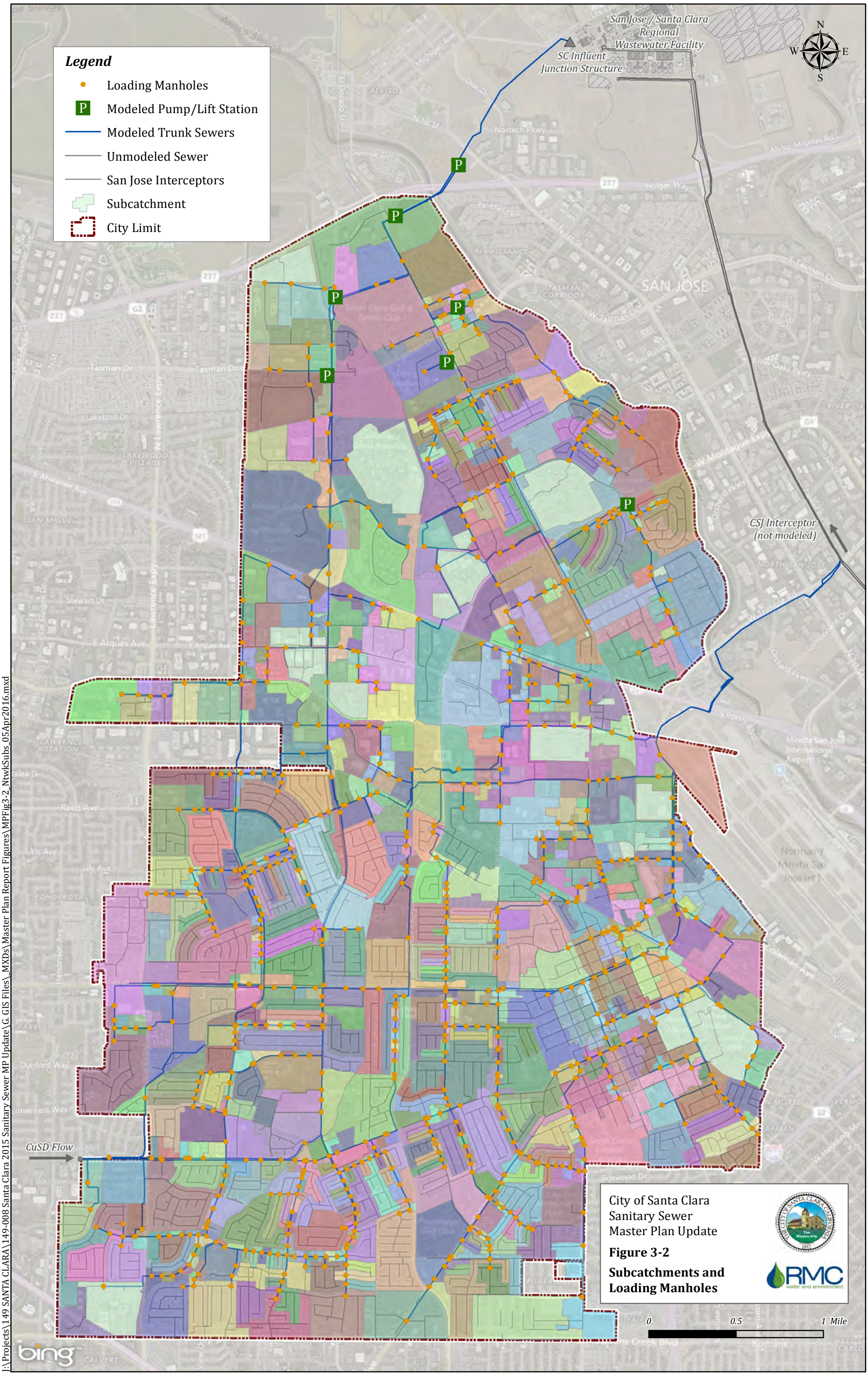
In addition to the 23 sites, the City also owns and maintains two permanent flow meters at the Guadalupe Chart Station just upstream of the connection with the City of San Jose's Interceptors. Upon review of the data collected at these two meters, it was determined that a field calibration was necessary. V&A performed field calibration, and also installed two temporary flow meters at the same site to verify and ensure data quality of the two permanent meters.

The flow monitoring sites are listed in **Table 3-3** and shown on **Figure 3-3**. A flow meter schematic is shown on **Figure 3-4**. Four rain gauges were installed to collect representative rainfall data over the service area during the monitoring period. The rain gauge locations are also shown on Figure 3-3.

Table 3-3: Summary of Flow Monitoring Sites

Meter ID	Location	Manhole ID	Pipe Size (in)	Avg. Flow [1] (mgd)	Peak Flow [2] (mgd)
1 [3]	Lafayette St. north of Calle de Mundo	S104-28	36	3.91	7.95
2 [3]	Golf course private road west of Lafayette St.	S104-26	33	3.97	8.36
3 [3]	Lafayette St. north of Calle de Mundo	S104-30	42	3.05	9.24
4 [3, 4]	Parking lot of the new Levis Stadium	S94-35	24	0.22	0.94
5	Mission College Blvd. north of Our Lady's Wy.	S83-21	33	3.97	10.3
6	Mission College Blvd. north of Our Lady's Wy.	S83-22	30	2.60	6.37
7	Upstream of Primavera Lift Station.	S105-34	24	0.89	1.81
8	Lafayette St. north of Montague Expwy.	S86-12	30	1.79	4.80
9	Calabazas Creek south of Kifer Rd.	S62-40	24	1.98	6.34
10	San Juan Ave. and Monroe St.	S52-79	24	0.80	2.80
11	Chromite Dr. and Pilot Knob Dr.	S53-40	24	1.06	4.76
12	Chromite Dr. and Alhambra	S53-23	24	1.19	4.74
13	Bowers Ave. just north of Bonnie Dr.	S53-54	30	3.50	7.22
14	South Dr. south of Loma Vista Ln.	S54-16	15	0.53	1.12
15	Nvidia Parking lot, west off of Scott Blvd. south of Central Expwy.	S65-50	18	0.45	1.44
16	Central Expwy west of UPRR	S67-13	27	1.43	2.70
17	De La Cruz Blvd. north of Martin Ave.	S58-9	24	0.40	1.48
18	De La Cruz Blvd. north of Martin Ave.	S58-8	24	1.14	
19	North of intersection of Wren Ave. at Kent Avenue	S21-18	24	1.63	3.13
20	Homestead Rd. west of Cherry Orchard Place	S21-47	18	1.74	4.00
21	Kiely Blvd. south of Kaiser Dr.	S23-6	24	2.25	3.68
22	Los Padres Blvd. at Bray Ave.	S45-80	18	0.76	4.60
23	Brokaw Rd. north-east of UPRR	S48-31	18	0.58	1.81
M1 [5]	Guadalupe Chart Station East Line	N/A	33 [6]	3.89	5.80
M2 [5]	Guadalupe Chart Station West Line	N/A	33	1.07	2.64

1. Average flow during non-rainfall period in mid- to late January.
2. Peak 15-minute flow during flow monitoring period (during December 11-12, 2014 storm event for most meters)
3. Meters 1 through 4 were installed on November 22, 2014. All other meters were installed on or around December 10, 2014. All meters were removed on or around March 4, 2015.
4. Average flow represents a typical non-game day flow; peak flow represents a game day flow.
5. Meters M1 and M2 were installed starting January 9, 2015 in addition to the two permanent meters at the Guadalupe Chart Station.
6. Field measurements and observation show this line to be a 36-inch pre-fabricated T-lock lined pipe, while design drawings show its diameter to be 33 inches. A research was done to verify the pipe diameter but did not reach a conclusive result. As such, this pipe remains a 33-inch in the model.



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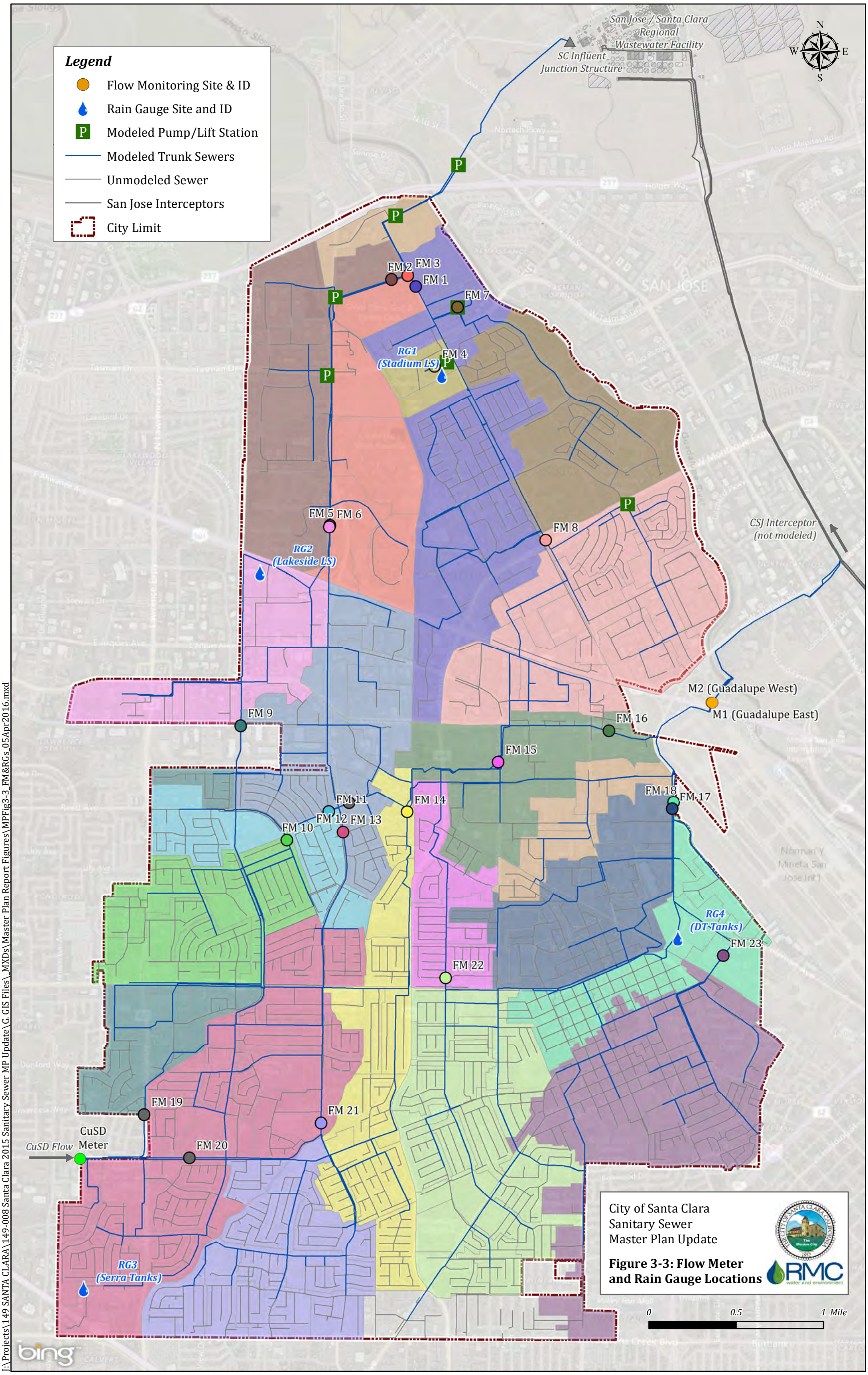

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Figure 8: City of Santa Clara Trunk Sewer System Schematic

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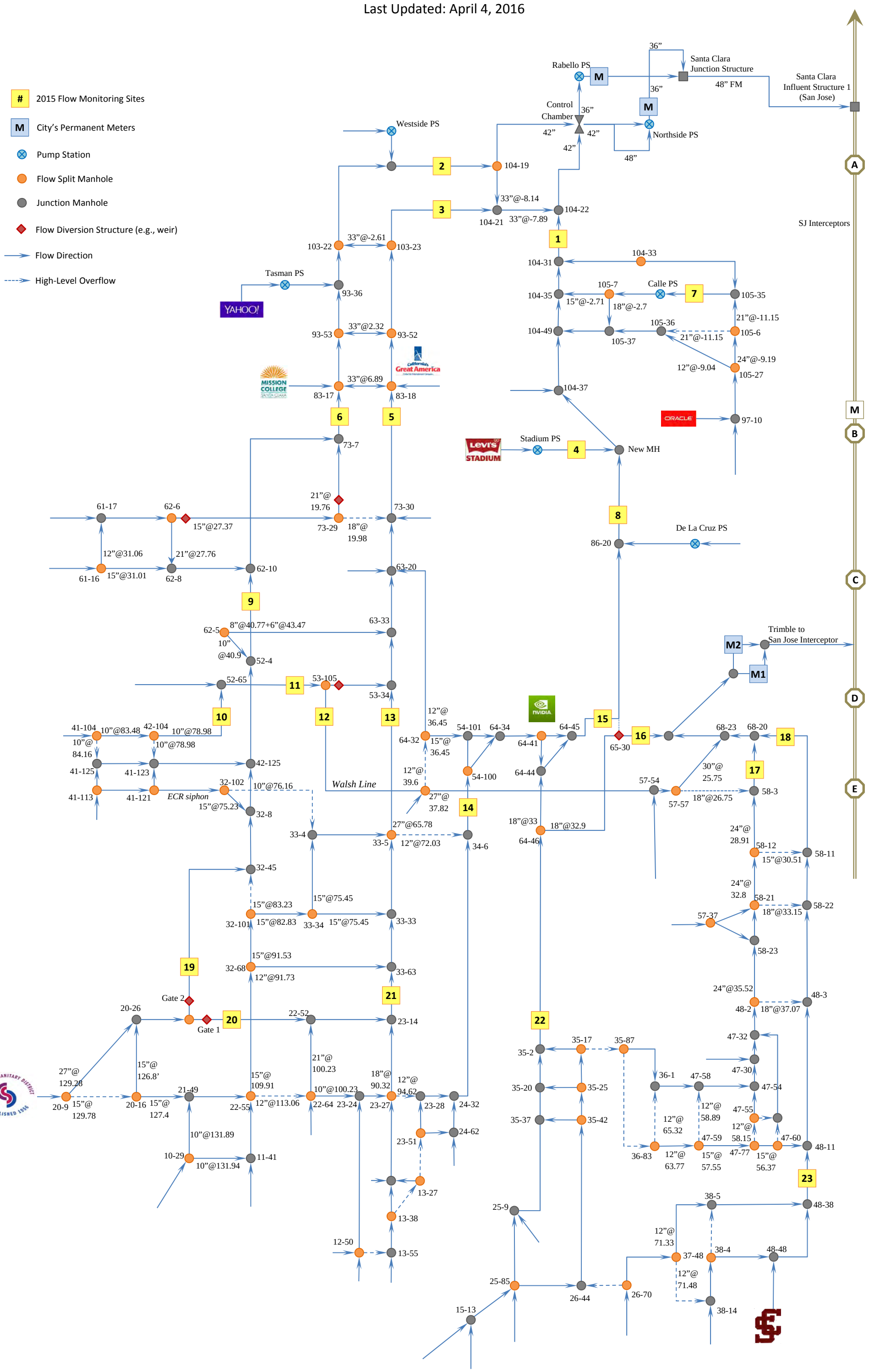


During the flow monitoring period, all of the monitoring sites and the two permanent meter sites at the Guadalupe Chart Station were visited approximately biweekly to check meter operation and site conditions, obtain field calibration measurements, and download collected data. Field calibration involves taking manual depth measurements and flow velocity measurements using a portable velocity meter. These calibration measurements were compared to and used to adjust monitor-recorded depth and velocity if needed. Calibration measurements were taken at different times of day in order to obtain calibration points for the full range of typical diurnal flows.

Approximately four storm events occurred during the flow monitoring period. The biggest event occurred on December 11, 2014, in which over 3 inches of rainfall were recorded within a 24-hour period, with a peak hour rainfall of 0.38 inch between 9 a.m. and 10 a.m. This is the event used for wet weather flow calibration, discussed further in Chapter 3.

Plots of the flow monitoring data and a tabular summary of daily average, minimum, and maximum flows for each meter are included in **Appendix A**.

3.5 Model Calibration

Model calibration is the process of comparing model-computed flows to observed (monitored) flows to verify that the model is accurately simulating flows in the sewer system. As described above, temporary flow monitoring programs consisting of 25 flow meters installed in the Santa Clara system during the 2014/15 winter season as part of the study. The data collected during this flow monitoring program were used for model calibration.

3.5.1 Dry Weather Calibration

The 14-day non-rainfall period from January 17 to January 30, 2015 was used for dry weather calibration. The dry weather calibration process was used to verify BWF loads and diurnal curves, and to quantify GWI (as indicated by monitored flows that were higher than estimated BWF). **Table 3-4** compares the model vs. metered average dry weather flow (ADWF) at each of the meter locations. **Figure 3-5** shows an example plot of model vs. metered flow for one of the flow monitoring locations in the system (Meter 5). Dry weather calibration graphs for all meters are included in **Appendix B**.

Overall, the model calibration resulted in a reasonably good match at most locations, but there were differences at some locations. These differences may be due to inaccuracies in the meter data, water use loadings, or configuration of the system (e.g., upstream flow splits, weir settings, etc.). Extensive effort was made to resolve as many of the calibration differences as possible. As shown in **Table 3-4**, the sum of the observed flows at the most downstream meters (Meters 1, 2, 3, M1 and M2) was within 6 percent of the modeled flows, which provides confidence that the overall flows in the model are reasonably accurate.

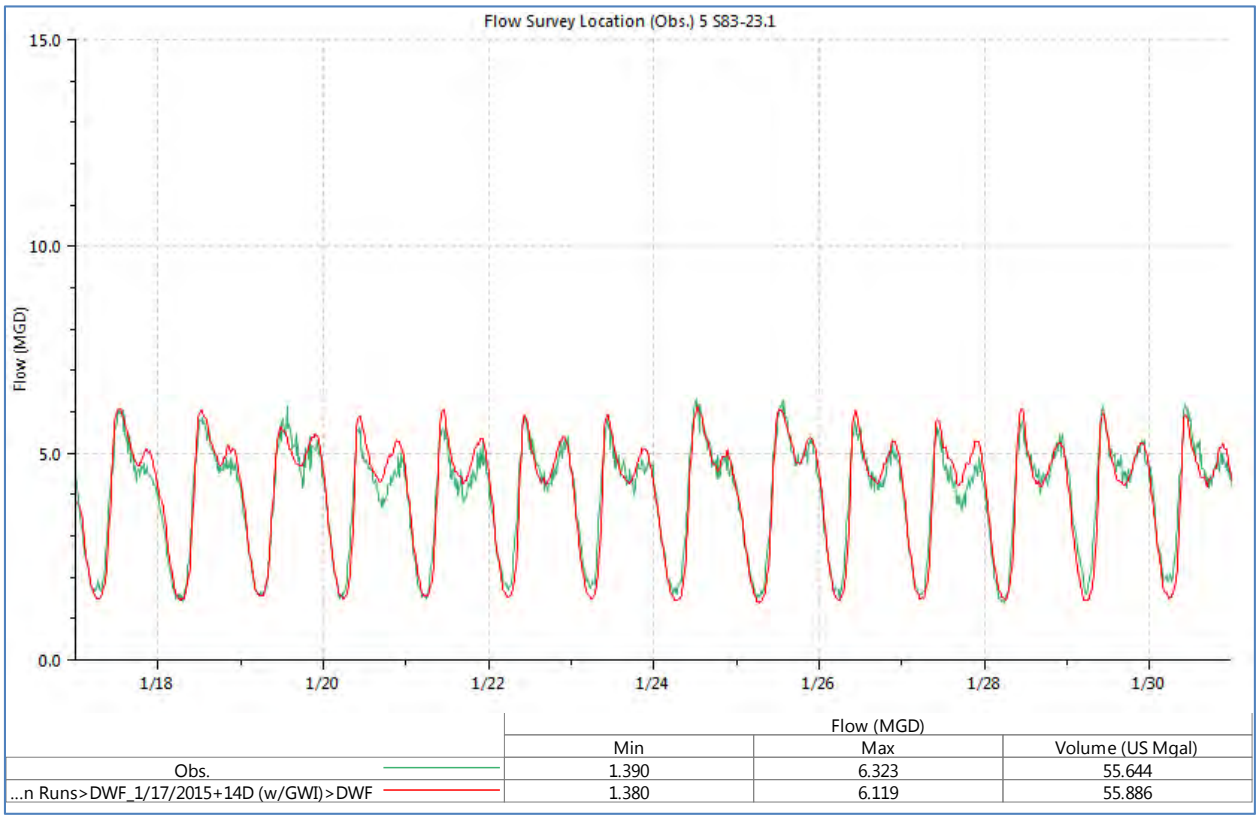
Note that the total model ADWF is higher than the estimated existing BWF shown in Table 2-2 because the model ADWF also accounts for the CuSD flow (observed flow data was used, which was approximately 3.57 mgd for the calibration period) and about 0.35 mgd of GWI that was added to the system during the calibration process, which was applied to the basins tributary to meters 10 and 11, at an estimated rate of 1,000 gpd/acre. As described in Chapter 2, GWI is calculated based on the difference between average flow on non-rainfall days during the flow monitoring period and estimated BWF for meters for which estimated BWF is noticeable lower than monitored flow. Other meter areas may also include some nominal dry weather GWI, which is assumed to be included in the BWF estimates.

Table 3-4: Dry Weather Flow Calibration Results

Meter ID	Meter Avg. Flow (mgd)	Model Avg. Flow (mgd)	Difference (mgd)	Percent Difference
1	3.91	3.42	-0.49	-12%
2	3.97	3.71	-0.26	-7%
3	3.05	3.27	0.21	7%
4 (1)	0.22	0.22	0.00	0%
5	3.97	3.99	0.02	0%
6	2.60	2.54	-0.06	-2%
7	0.89	0.74	-0.16	-17%
8	1.79	1.70	-0.09	-5%
9	1.98	2.25	0.27	13%
10	0.80	0.80	0.00	0%
11	1.06	1.10	0.04	4%
12	1.19	1.14	-0.05	-4%
13	3.50	3.59	0.09	3%
14	0.53	0.51	-0.02	-4%
15 (2)	0.45	0.81	0.36	79%
16 (2)	1.43	1.06	-0.37	-26%
15 & 16 (2)	1.88	1.87	-0.01	-1%
17	0.40	0.54	0.14	34%
18	1.14	0.99	-0.15	-13%
19	1.63	1.56	-0.07	-4%
20	1.74	1.51	-0.23	-13%
21	2.25	2.09	-0.15	-7%
22	0.76	0.91	0.14	19%
23 (3)	0.58	0.69	0.11	18%
M1 (Guadalupe East)	3.89	3.41	-0.48	-12%
M2 (Guadalupe West)	1.07	1.16	0.09	8%
Sum of D/S Meters (4)	15.90	14.97	-0.92	-6%

1. Meter 4 was installed immediately downstream of the Levi's stadium with the intention to collect data to study flow patterns during major game events. The meter did capture good flow data for a number of game events, but also encountered a technical issue in late January that caused data collected between January 20 and February 18 (overlapping with the calibration period) to be unrecoverable. As such, data collected between January 11 and January 18 (a 7-day non-rainfall period when the venue was not used for any games) was used to establish the baseline flow for the stadium.
2. Meters 15 and 16 had an unexpected shift in flow distribution between late December 2014 and early January 2015, possibly caused by a temporary blockage upstream of the two meters. City staff was informed of this shift but could not provide an explanation. Although the meter flows did return to a higher level in late January 2015, they never returned to the pre-shift level. As such, their data was deemed not suitable to be used for calibration for each meter basin individually; instead, their tributary subcatchments were calibrated together as one basin using the combined data of the two meters.
3. Meter 23 was located downstream of the Santa Clara University. The dry weather calibration period coincided with the registration week of the school's winter quarter when student population was not at its maximum. The observed flow for this meter was therefore noticeably lower than the modeled flow (which was developed based normal school period).
4. Downstream (D/S) Meters are meters 1, 2, 3, M1, and M2. See system schematic in Figure 3-4.

Figure 3-5: Example Dry Weather Calibration Graphs



	Flow (MGD)		
	Min	Max	Volume (US Mgal)
Obs.	1.390	6.323	55.644
...n Runs>DWF_1/17/2015+14D (w/GWI)>DWF	1.380	6.119	55.886

3.5.2 Wet Weather Calibration

The storm that occurred on December 11, 2014 was used for wet weather calibration. As described previously, RDI/I response to rainfall events was quantified in terms of three sets of triangular unit hydrograph parameters that represent the volume percentage of rainfall that enters the system as RDI/I and the shape of the RDI/I hydrograph as a function of each hour of rainfall. Through the wet weather calibration process, RDI/I hydrograph parameters were developed for each meter area. In general, the response to rainfall in the Santa Clara system is relatively small, as evidenced by the relatively low peak flow response to the rainfall event, with the exception of areas in the western portion of the City near Monroe Street, which showed both a high peak inflow during the rainfall event and an extended period of infiltration after the event.

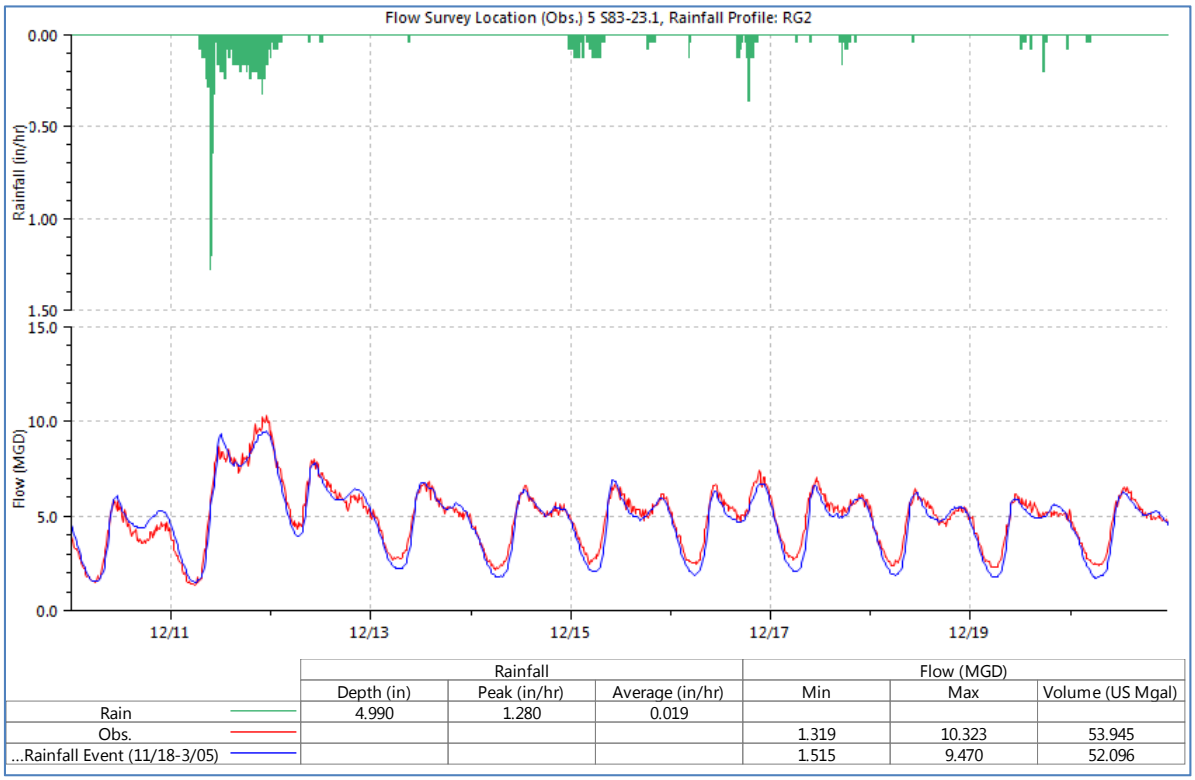
Table 3-5 lists the "R values" (as percentages of rainfall) for each flow meter area. **Figure 3-6** shows an example plot of model vs. metered flow for one of the flow monitoring locations in the system (Meter 5). A complete set of wet weather calibration graphs of modeled vs. metered flow for all meter locations are included in **Appendix C**.

Table 3-5: Wet Weather Flow Calibration Results

Meter ID	R1 RDI/I Vol. (%)	R2 RDI/I Vol. (%)	R3 RDI/I Vol. (%)	Total R (%)
1	0.3%	0.3%	0.8%	1.4%
2	0.1%	0.5%	0.8%	1.4%
3	0.1%	0.1%	0.1%	0.3%
4	1.0%	0.1%	0.1%	1.2%
5	0.1%	1.0%	1.5%	2.6%
6	0.1%	0.5%	1.5%	2.1%
7	0.2%	0.5%	0.8%	1.5%
8	0.3%	0.5%	1.2%	2.0%
9	0.5%	3.5%	8.0%	12.0%
10	1.0%	4.2%	8.0%	13.2%
11	0.1%	2.0%	15.0%	17.1%
12	0.2%	1.0%	20.0%	21.2%
13	0.1%	0.1%	0.8%	1.0%
14	0.4%	0.1%	0.5%	1.0%
15 & 16 (1)	0.1%	0.1%	0.3%	0.5%
17	0.5%	0.5%	0.5%	1.5%
18	0.5%	0.8%	1.0%	2.3%
19	0.3%	0.4%	0.5%	1.2%
20	0.1%	0.1%	0.1%	0.3%
21	0.2%	0.1%	0.1%	0.4%
22	0.1%	0.2%	0.1%	0.4%
23	0.5%	0.2%	0.1%	0.8%
CuSD	0.25%	0.35%	0.5%	1.1%

1. Meters 15 and 16 were calibrated together due to unexpected field conditions. See note 2 under Table 3-4.

Figure 3-6: Example Wet Weather Calibration Graphs for 2014 Storm Period



	Rainfall			Flow (MGD)		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Volume (US Mgal)
Rain	4.990	1.280	0.019			
Obs.				1.319	10.323	53.945
...Rainfall Event (11/18-3/05)				1.515	9.470	52.096

Chapter 4 Capacity Analysis

This chapter describes the hydraulic analysis and design criteria used to evaluate system performance and size capacity relief projects, the capacity deficiencies based on the results of model runs, and preliminary solutions to identified capacity deficiencies. The chapter also summarizes the pump station capacity evaluation and analysis.

4.1 Design Event Criteria

Peak design flows for sewer systems consist of dry weather base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I). Criteria for computing existing BWF, GWI, and RDI/I (developed as part of model calibration), and unit flow assumptions for future development were discussed in the previous chapters. However, the peak design flow criteria must also specify the set of conditions (e.g., design storm rainfall and timing with respect to seasonal GWI and diurnal BWF) that will generate the highest peak flows that the sewer system must be capable of hydraulically conveying.

The following subsections discuss design storm criteria, present data from recent storm events, and identify options and recommendations for selection of a design event for use in this Master Plan Update.

4.1.1 Design Storm Condition

The use of wet weather design events as the basis for sewer capacity evaluation is a well-accepted practice. The approach is to first calibrate a hydraulic model of the system to match wet weather flows from observed storms, and then apply the calibrated model to a design rainfall event to identify capacity deficiencies and size improvement projects. The design event may be synthesized from rainfall statistics, or may be an actual historical rainfall event of appropriate duration and intensity.

A design storm is used to simulate a peak wet weather flow condition to identify system deficiencies and develop solutions for them. Design storms are typically classified by their return period and duration. The return period defines the probability that the design rainfall will be exceeded in any given year. For example, a storm with a 10-year return period means there is a 1 in 10 chance, or 10 percent probability, of exceeding the design rainfall in a given year. The chosen return period reflects the degree of risk an agency will tolerate of experiencing sanitary sewer overflows (SSOs) due to future storm events. However, choosing a design storm with a very high return period (reflecting a very low risk tolerance) could lead to the identification of so many system capacity deficiencies that the cost of improvements is prohibitive. Additionally, sizing a system for a very rare event could mean that the system does not function well under typical conditions during much lower flows (due to slow velocities in oversized pipes, or oversized pump stations).

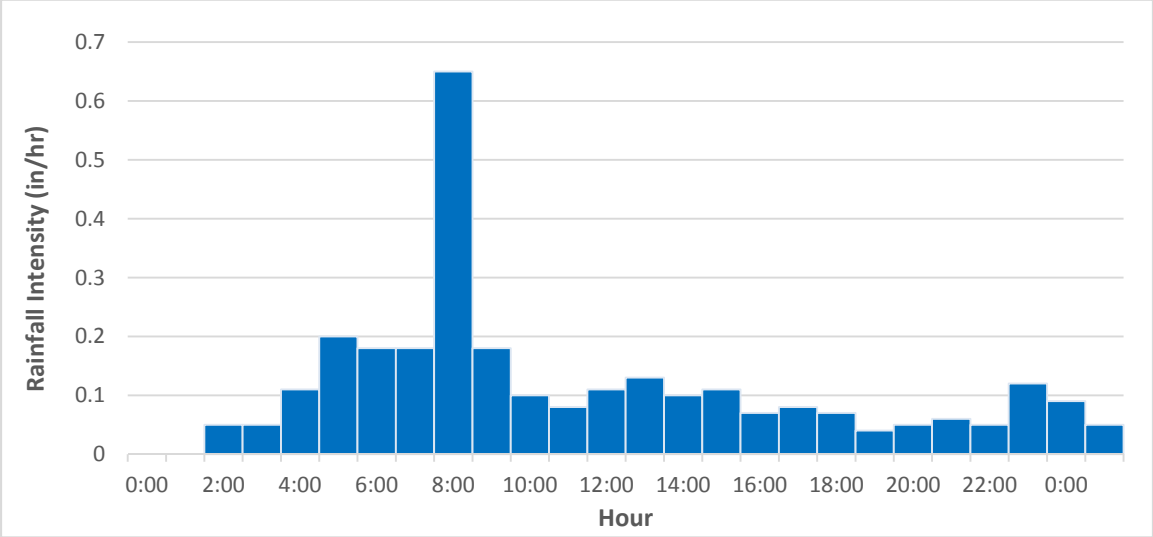
A storm duration must be specified along with the return period. Most Bay Area agencies use a 24-hour storm, though shorter or longer durations may sometimes be appropriate depending on system size and how quickly or slowly the system responds to rainfall. Design storm may be actual historical rainfall events or synthetic events that are designed to represent a certain return period for a specified storm duration or durations.

The City's 2007 Capacity Assessment used a 10-year, 24-hour storm, with one-hour and six-hour 10-year events included within the 24-hour event. This storm was based on the Santa Clara County intensity-duration-frequency (IDF) curve that was current at the time, representing rainfall statistics at the San Jose International Airport. To reflect differences in rainfall characteristics across the service area, the storm was scaled for different areas based on the isohyetal map of average annual rainfall from the Consoer, Townsend & Associates Sanitary Sewer I/I Analysis, dated 1974.

Since the completion of the Capacity Assessment, Santa Clara County released a new County Drainage Manual in October 2007. The Manual includes updated mean annual precipitation isohyetal lines from Santa Clara Valley Water District (SCVWD) and updated, distinct IDF curves for each mean annual

precipitation area. In addition to the IDF curves, Appendix D of the 2007 manual includes a 24-hr design storm pattern. According to the manual, this storm pattern is based on an actual event that occurred in December 1955, but with some adjustments to better reflect IDF statistics for various storm durations. Like the previous design storm, the design storm used for this Master Plan Update is also a 10-year, 24-hour storm that varies across the service area, but the storm pattern and hourly rainfall intensities are based on this updated Santa Clara County Drainage Manual. **Figure 4-1** shows the design storm hourly rainfall as it occurs in the vicinity of the San Jose International Airport. At this location, the total rainfall for the 1, 6-, and 24-hour durations is 0.65, 1.49, and 2.92 inches, respectively.

Figure 4-1: Design Storm Pattern for the San Jose International Airport MAP Area



The design storm represents the "point precipitation" at any single location in the system. The storm is applied in the model at the subcatchment level, with the assumption that the rainfall occurs simultaneously on all subcatchments, which is a conservative assumption.

As noted previously, the timing of the design storm also affects the resulting peak wastewater flows. If the design storm is timed to cause peak RDI/I at the same time as peak base wastewater flow, the total peak wet weather flow will be higher than if the design storm occurs during minimum or average base wastewater flow. Due to variations in the diurnal flow patterns as well as variations in the calibrated I/I response throughout the system, it is not possible to time the rainfall to create a peak-on-peak response everywhere in the system. However, the design storm was timed to achieve a peak-on-peak response in most areas of the system, with the peak hour rainfall occurring at 8:00 a.m. on a weekday.

4.2 Hydraulic Capacity Criteria

The hydraulic capacity criteria determine which sewer pipes should be relieved or replaced due to inadequate capacity to convey existing or future peak flows, and how large the new sewers should be. The criteria adopted by the City should ideally be stringent enough to ensure that sewer overflows caused by capacity limitations (as distinguished from other causes such as obstructions or structural failures) are very rare occurrences, but not so conservative that they cause the City to spend capital improvement funds unnecessarily or result in pipes that are so large that cleaning velocities cannot be achieved under normal flow conditions, causing solids build up and related problems.

The capacity deficiency criteria identify the need to replace an existing facility, while design criteria determine the sizing of new facilities. These criteria are discussed in the paragraphs below.

4.2.1 Capacity Deficiency Criteria

The capacity deficiency criteria are used to determine when the capacity of an existing sewer facility is exceeded to the extent that a relief sewer or larger replacement sewer or potential pump station capacity upgrade is required. Capacity deficiency criteria are sometimes called "trigger" criteria in that they trigger the need for a capacity relief project. These criteria often differ from criteria that are applied to determine the size of a new facility, which are typically more conservative.

It is important that the capacity deficiency criteria be coordinated with the peak design flow criteria. For example, if the peak design flow were to be based on only peak dry weather flow (PDWF), the deficiency criteria would need to be conservative (e.g., require pipes to flow less than full to allow capacity for I/I). On the other hand, if the peak design flow includes I/I from an infrequent storm event, it may be appropriate to allow the sewers to flow surcharged to some extent, since the peak flows will be infrequent and brief in duration.

Gravity Sewers

Since the peak wet weather design flow as recommended in the previous section of this chapter includes RDI/I from a 10-year return period event and is assumed to be concurrent with peak BWF, the City should consider it acceptable to allow gravity sewers to flow surcharged to some extent before a capacity relief project is triggered. For example, significant surcharging may be acceptable in larger, deeper sewers provided the hydraulic gradeline remains a reasonable distance below the ground surface and no surcharging occurs during dry weather flow conditions. For smaller or shallow sewers, a more conservative criteria could be considered to account for the chance that capacity could also be compromised by factors such as offset joints, roots, grease, and debris (which cannot be accounted for in the hydraulic model), or that surcharge could result in flow backing up into connecting laterals.

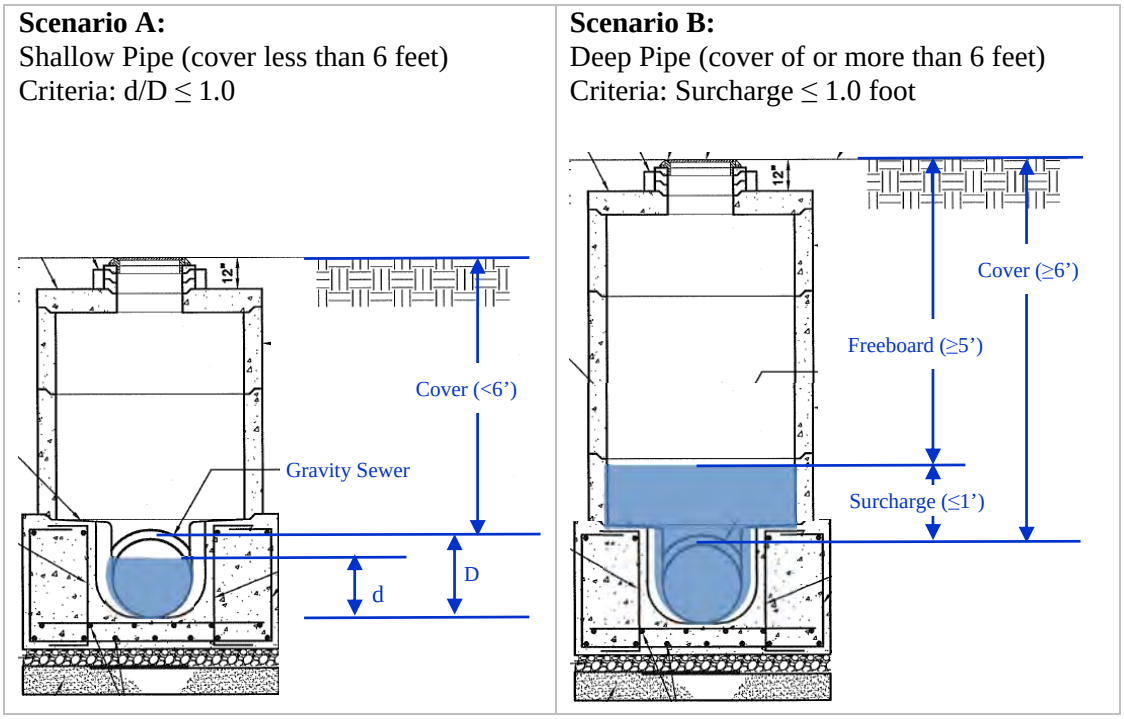
Based on discussion of these considerations, the following criteria are proposed under which gravity sewers would be considered capacity deficient:

- PDWF: No surcharge allowed ($d/D \leq 1.0$)
- PWWF:
    - Gravity sewer with less than 6 feet of cover: no surcharge allowed (i.e., $d/D \leq 1.0$)
    - Gravity sewer with 6 feet or more of cover: surcharge of up to 1 foot under PWWF (see Figure 4-2 for clarification)
- Case-by-case exceptions could be made for isolated short pipe reaches. Conversely, more stringent criteria could be applied for sewers located in areas where the consequences of an overflow would be greater (e.g., adjacent to creeks, schools, or hospitals).
- Note that for evaluating the performance of existing sewers, a Manning's "n" value of 0.013 is assumed for all pipes, regardless of material or age. Although new pipes, particularly plastic materials, would provide a lower initial roughness factor, it is assumed that over time, a "slime layer" formation on the walls of the pipes and/or other obstructions in the sewer, such as roots, debris, or structural defects, may increase pipe roughness. Therefore, an assumption of 0.013 for all pipes is considered to be appropriately conservative for master planning purposes.

Pump Stations and Force Mains

For master planning capacity assessments, the performance of pump stations and force mains are typically evaluated based on pumping capacity and peak force main velocities. Pump stations are considered to be capacity deficient if the station's firm capacity (capacity with largest pumping unit out of service) is insufficient to convey the peak design flow. Force mains are considered to be deficient if velocity under peak design flow exceeds 10 feet per second (fps).

Figure 4-2: PWWF Hydraulic Deficiency Criteria for Gravity Sewers



4.2.2 Sizing Criteria for New Sewer Facilities

The following criteria are proposed for sizing new trunk gravity sewers as part of the Master Plan. They are consistent with the City's current sanitary sewer design criteria. Note that the City may use somewhat different criteria for new developments or actual design, e.g., varying Manning's n for different pipe materials, or a more conservative d/D for smaller diameter sewer mains. These criteria would be based on the modeled design storm peak wet weather flows in the system.

- Maximum allowable flow depth-to-diameter ratio (d/D) of 0.75 under peak design flow
- A Manning's 'n' of 0.013
- Minimum pipe size of 8 inches diameter in residential areas; 10 inches in commercial areas; and 12 inches in industrial areas
- Minimum velocity of 2 feet per second (fps) at half-full pipe
- Maximum velocity of 10 fps at peak design flow
- Downstream pipes at least as large as upstream pipes
- Minimum and maximum pipe slopes determined based on above velocity criteria to the extent feasible (it is recognized that elevation constraints in the existing system may prevent achieving desired minimum slopes for some projects, and terrain may dictate higher maximum slopes in some cases)
- Minimum pipe cover of 6 feet

4.3 Capacity Analysis Results and Proposed Solutions

Based on the criteria described above, the hydraulic model was run for four sets of conditions representing combinations of existing or future development and dry weather flow or design storm wet weather flow. **Figure 4-3** shows the model results for future PWWF conditions. Pipes shown in red are predicted to be surcharged due to "throttle" (peak flow exceeding full pipe capacity), and pipes shown in blue are surcharged due to backwater from a downstream throttle condition. Locations of capacity criteria violations (surcharge of more than 1 foot due to either throttle or backwater conditions) are highlighted in yellow (pipes with criteria violations under both existing and future conditions) or orange (future conditions only).

Note that the locations of criteria violations (i.e., higher than allowable surcharge) are not necessarily the locations of the actual capacity-deficient pipes, but are typically located further upstream due to backwater from downstream throttle conditions. **Appendix D** includes model hydraulic profiles for each of these areas.

Potential solutions for the identified capacity deficiencies were developed in order to assess the potential extent of required capacity improvements and to estimate the resulting peak flow to the SJ/SC RWF once capacity deficiencies are relieved. **Table 4-1** summarizes the predicted flow under each condition. **Table 4-2** describes the solutions. The solutions model results indicate that the combined total estimated design storm future PWWF from the City's system (including flows from CuSD) would be approximately 59 mgd.

Table 4-1: Summary of Capacity Analysis Results

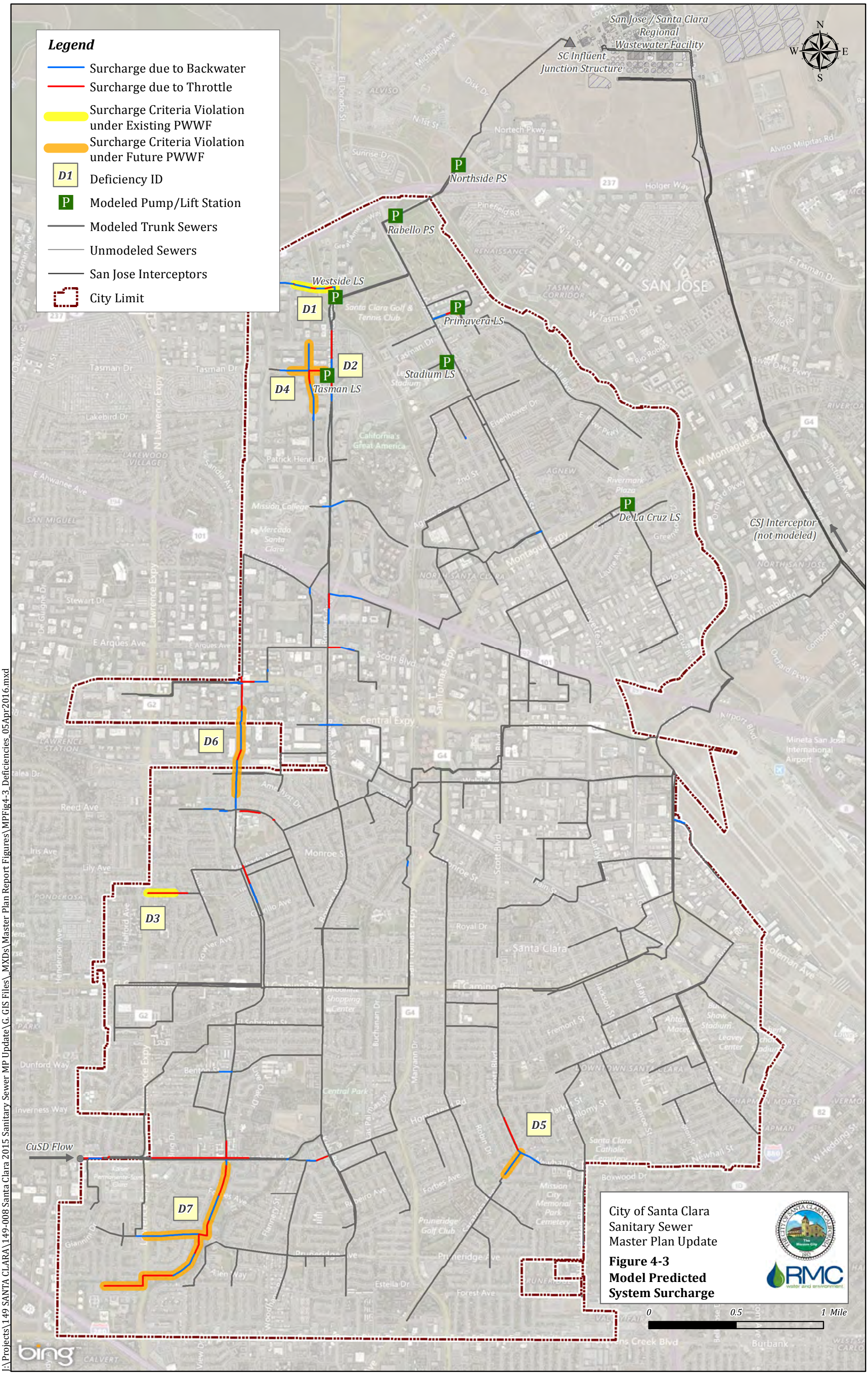
	Existing ADWF [2] (mgd)	Existing PDWF [2] (mgd)	Existing PWWF [3] (mgd)	Future ADWF [2] (mgd)	Future PDWF [2] (mgd)	Future PWWF [3,4] (mgd)
Flow Estimates by System Outfall [1]						
North (to Northside and Rabello Pump Stations)	10.2	15.2/16.0	27.9	24.6	33.5/34.4	41.0
East (to San Jose Zanker Road Interceptor)	4.7	6.4	11.7	9.8	13.3	18.3
Total	14.9	21.6/22.4	39.6	34.4	46.8/47.7	59.4
Flow Estimates by Agency [1]						
Santa Clara System	11.3	15.4/16.2	26.8	27.5	34.6/35.5	45.6
Cupertino Sanitary District	3.5	6.2	12.8	6.9	12.2	13.8
Total	14.9	21.6/22.4	39.6	34.4	46.8/47.7	59.4

1. Assuming that trunk sewer capacity deficiencies are relieved with recommended capital improvement projects presented in Table ES-2.
2. Includes groundwater infiltration for a typical wintertime period. ADWF and first value shown for PDWF includes typical non-game day flow from Levi's Stadium; second value shown for PDWF includes a peak game day flow from Levi's Stadium.
3. For 10-year design storm; assumes non-game day flow from Levi's Stadium.
4. Assuming peak wet weather flow from CuSD would not increase above its contractual maximum flow of 13.8 mgd.

Table 4-2: Capacity Deficiencies and Proposed Solutions

Def. ID	Deficiency Location [1]	Trigger Scenario	Surcharge or Criteria Violation [2]	Proposed Solution
1	Westside Lift Station	2015 PDWF	Current set point of the lead pump is about 5 feet above the invert of the influent line, causing backup issues upstream between MH S102-3 and S103-8 (station wet well).	Adjust the set point of the lead pump to be equal or lower than the invert of the influent gravity line.
2	Tasman Lift Station	2015 PDWF	Current set point of the lead pump is about 2 feet above the invert of the influent line, causing backup issues upstream between MH S93-24 and S93-35 (station wet well).	Adjust the set point of the lead pump to be equal or lower than the invert of the influent gravity line.
3	Cabrillo Avenue	2015 PWWF	Surcharge of up to 5 feet from MH S41-13 to S41-20 under existing PWWF scenario and potential overflow in S41-13, S41-14 and S41-15 under future PWWF scenarios.	Conduct smoke testing and television inspection in the flow tributary area to identify and address high inflow/infiltration sources. If field investigations indicate that I/I reduction is not feasible or cost-effective, then upsize the existing 8-inch line to a 12-inch between S41-13 and S41-20.
4	Tasman Drive and Old Ironsides Drive	2035 PWWF	Surcharge of up to 3 feet upstream of Tasman Lift Station.	Upsize 800 feet of existing 12-inch line between S93-24 and S93-35 to a 15-inch line.
5	Scott Blvd.	2035 PWWF	Surcharge of up to 1 foot between S25-78 and S26-44, and S26-57 and S25-37.	Install a weir in S25-85 to divert flow northwest to Los Padres Blvd.
6	Calabazas Creek Trunk Sewer	2035 PWWF	Surcharge of up to 3 feet in the existing 24-inch line along Calabazas Creek between S52-52 and S62-14.	Install a new 200-ft 15-inch line between S42-12 and S52-93 (Calabazas Blvd. and Machado Ave.) to partially divert flow from the 24-inch to the 21-inch on Machado Ave.
7	Tracy Dr., Pomeroy Ave., and Homestead Rd.	2035 PWWF	Surcharge and potential overflow between S10-77 and S22-55.	Upsize the existing 10- to 12-inch line between S10-77 and S22-55 to a 15-inch line, install a new 15-inch diversion line between S22-55 and S22-46, and upsize the existing 18-inch line between S22-46 and S22-51 to a 21-inch line.

1. Refer to Figure 4-3 for deficiency locations
2. Under PWWF conditions.



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4.3.1 Pump Station Firm Capacity Analysis

All seven lift and pump stations in the system were evaluated to determine if each station had adequate firm capacity to handle the design peak flow. Firm capacity is defined as the capacity of a station with the largest pump out of service. **Table 4-3** below provides a summary of station firm capacity compared with peak inflow for future PWWF conditions.

Table 4-3: Pump Station Firm Capacity Analysis

No.	Station Name	No. of Pumps	Estimated Peak Inflow (mgd) [1]	Estimated Firm Capacity (mgd)	Firm Capacity Status[6]
1	Westside Lift Station	2	0.6	0.6 [3]	Sufficient firm capacity
2	Tasman Lift Station	2	1.5	1.5 [3]	Sufficient firm capacity
3	De La Cruz Lift Station	2	1.2	1.7 [3]	Sufficient firm capacity
4	Primavera Lift Station	6	2.0	5.7 [3]	Sufficient firm capacity
5	Stadium Lift Station	6	1.0	6.0 [4]	Sufficient firm capacity
6	Rabello Pump Station	8	20 [2]	20 [5]	Sufficient firm capacity
7	Northside Pump Station	4	21 [2]	21 [5]	Sufficient firm capacity

1. Peak inflow refers to the maximum flows predicted by the model under future peak wet weather scenario using the solution network. The solution network eliminates flow restrictions upstream of the pump stations.
2. Peak inflow reflects the maximum flows predicted by the solution network in which CIP Project P6 (Sewer Diversion at Calabazas Boulevard and Machado Avenue) is implemented, which would divert excess flow from the 24-inch sewer line along Calabazas Boulevard into the 21-inch sewer line in Machado Ave, ultimately flowing to the City of San Jose's interceptor in Zanker Road. This would reduce the flow conveyed north to the Rabello and Northside Pump Stations to the values shown in the table. Conversely, implementation of Project P6-Alt. would increase the peak flow to the Rabello and Northside Pump Stations by about 1 mgd to each pump station, which could require further evaluation of and potential improvements to increase pump station capacity.
3. Source: Table 1 (Pump Station Firm Capacities and Inflows) of the City of Santa Clara Sanitary Sewer Pump Station Evaluation, Schaaf & Wheeler, December 2010. The firm capacities of Primavera, Tasman, Westside, and De La Cruz lift stations were determined by performing a drawdown test.
4. Based on results from field drawdown tests conducted on September 17, 2015.
5. Source: Rabello and Northside Pump Station Capacity and Forcemain Calibration Technical Memorandum, Schaaf & Wheeler, November 13, 2015. See Appendix E.
6. The lift and pump stations have sufficient firm capacities within the accuracy of the estimated peak flows and capacities.

Although no capacity issues were identified for the pump stations, review of pump station drawings and current on/off set points for the pumps revealed that four of the stations may experience backwater issues in the influent pipes. The current set point of the lead pump at Tasman, Westside, and De La Cruz is above the crown of the influent gravity line. Under this condition, the lead pump will not turn on until the influent line is completely submerged, causing backwater issues upstream. This can be resolved by adjusting the set points to be equal or lower than the invert of the influent line. Primavera Lift Station has a similar condition with the set point of the lag pump. **Table 4-4** summarizes the review findings and presents the suggested set points for each of the four stations. Set point revisions for Westside and Tasman are needed to address capacity criteria violations (Deficiencies 1 and 2 in Table 4-2). These settings should be evaluated by the City's pump operators to determine feasibility and if there are other operational issues that should be considered.

Table 4-4: Recommended Revised Set Levels for Lift Stations

Pump Station	Maximum Starts Per Hour Per Pump w/ Existing Set Levels (1)	Maximum Starts Per Hour Per Pump w/ Recommended Set Levels (1)	Set points	Recommended Revised Set Points (ft from Wet Well Floor) (2)
Westside Lift Station No. of Pumps: 2	7.2	3.7	Level Alarm: High | Low	8.0 | 1.2
			Lead Pump on | off	6.0 | 1.7
			Lag Pump on | off	7.0 | 2.2
Tasman Lift Station No. of Pumps: 2	4.6	6.4	Level Alarm: High | Low	7.0 | 1.2
			Lead Pump on | off	6.0 | 1.7
			Lag Pump on | off	6.5 | 2.2
De La Cruz Lift Station No. of Pumps: 2	4.8	6.2	Level Alarm: High | Low	6.0 | 1.2
			Lead Pump on | off	5.5 | 1.7
			Lag Pump on | off	6.0 | 2.2
Primavera Lift Station No. of Pumps: 6	1.0	2.0	Level Alarm: High | Low	6.0 | 1.2
			Lead Pump on | off	5.5 | 1.7
			Lag Pump 1 on | off	6.0 | 2.2
			Lag Pump 2 on | off	6.0 | 1.2
			Lag Pump 3 on | off	5.5 | 1.7
			Lag Pump 4 on | off	6.0 | 2.2
			Lag Pump 5 on | off	6.0 | 1.2

1. Based on predicted future peak wet weather flow condition.
2. Recommendations provided by Schaaf & Wheeler based on pump information provided by RMC.

Chapter 5 Recommended Capacity Improvement Program

This section summarizes the capacity improvement projects recommended for the City of Santa Clara's sanitary sewer system. Recommended improvements were developed from the results of hydraulic modeling of the trunk sewer system for predicted flow conditions, as described in Chapter 4. This section discusses the projects needed to address potential capacity deficiencies and unnecessary backups in the existing trunk sewer system including estimated capital costs and priorities for construction.

5.1 Development of Capacity Improvement Projects

Based on the proposed solutions described above, each proposed project was reviewed to identify potential design, permitting, environmental, and constructability issues. Feasible construction methods were also identified for each project, and preliminary estimates of probable construction costs were prepared. Estimated costs for capacity improvements were based on cost data compiled by RMC from similar projects. The costs are conceptual level estimates, considered to have an estimated accuracy range of -30 to +50 percent, suitable for use for budget forecasting, capital improvement program development, and project evaluations, with the understanding that refinements to the project details and costs would be necessary as projects proceed to design and construction. All costs are presented in 2015 dollars and include a 30 percent allowance for contingencies for unknown conditions and a 25 percent allowance for engineering, administration, and legal costs.

Figure 5-1 shows the locations of the proposed improvements, and **Table 5-1** presents the recommended capacity improvement projects, including brief project descriptions and estimated capital costs. Relative priorities have been assigned to the projects based on the flow scenario in which deficiency criteria are violated. Priority 1 and Priority 2 projects are required to address deficiencies that result in criteria violations under current flow conditions. Priority 3 projects are required to address deficiencies that result in criteria violations under future (2035) flow conditions.

Note that an alternative for Project P6 is also presented. While substantially more expensive than Project P6, this alternative would maintain the current system flow configuration of conveying all flows in the Calabazas Creek trunk sewer (including flows from CuSD) to the Northside and Rabello Pump Stations and avoid increasing flows in the Machado, Chromite, and Walsh Avenue trunk sewers that may be needed in the future to handle additional new development within the City. Implementation of Project P6-Alt would also increase flow to the Rabello and Northside Pump Stations by about 1 mgd to each pump station, which could require further evaluation of and potential improvements to increase pump station capacity.

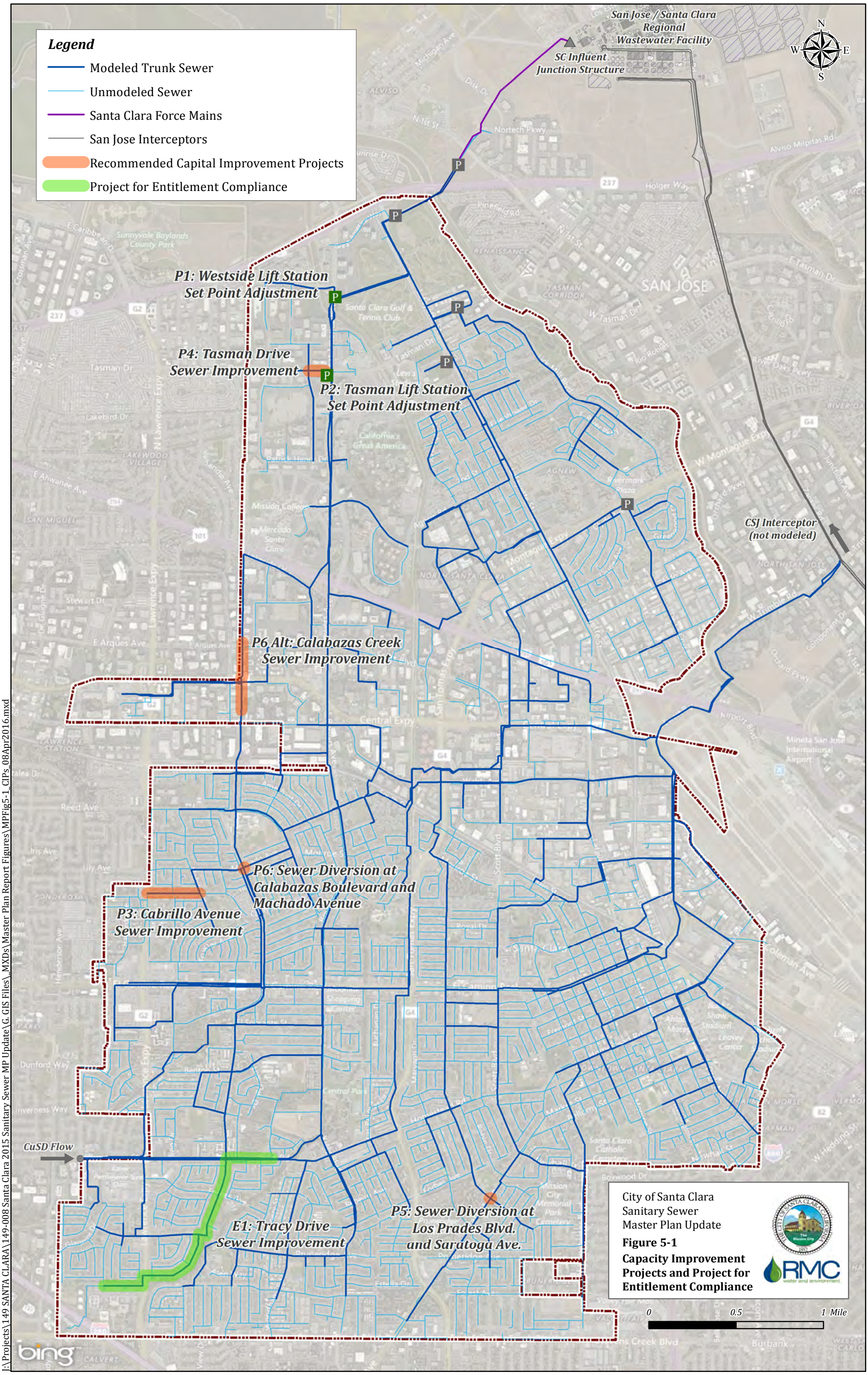
The total estimated cost of the recommended capacity improvement program is approximately $1.7 million. The total estimated cost, if the City were to implement Project P6-Alt instead of P6, would be approximately $2.8 million. More detailed project descriptions and cost estimates and maps of the recommended capacity improvement projects are included in **Appendix F**.

One of the projects was triggered due to the large sewer discharge assumed for parcel APN 316-17-018, which holds an entitlement agreement to discharge a potential flow of 0.95 mgd; however, it is currently discharging less than 10 percent of the entitled rate. While the City is obligated to provide capacity for entitlement holders, it is important to note that implementing this project may result in oversized sewers where the daily flow is not sufficient to provide the minimum cleaning velocity and thus creating potential debris and odor issues. This project is included in the summary table as project E1 (Tracy Drive Sewer Improvement), and is not part of the recommended Capital Improvement Program. It is recommended that the City implement project E1 as part of its Capital Improvement Program before the parcel begins to discharge its entitled flow of 0.95 mgd.

Table 5-1: Recommended Capacity Improvement Projects

Project ID	Priority	Project Name	U/S MHID	D/S MHID	Description	Est. Capital Improvement Cost[1]
P1[2]	1	Westside Lift Station Adjustment	N/A	N/A	Adjust the set points for the pumps to a lower elevation to eliminate unnecessary backups in the influent line.	--
P2[2]	2	Tasman Lift Station Adjustment	N/A	N/A	Adjust the set points for the pumps to a lower elevation to eliminate unnecessary backups in the influent line.	--
P3	2	Cabrillo Avenue Sewer Improvement	S41-13	S41-20	Upsize 1,600 feet of 8-inch line in Cabrillo Ave. between Lawrence Expressway and Nobili Ave. to a 12-inch line.	$1,097,000
P4	3	Tasman Drive Sewer Improvement	S93-24	S93-35	Upsize 600 feet of 12-inch line in Tasman Dr. between Old Ironsides Dr. and Great America Pkwy. to a 15-inch line.	$327,000
P5	4	Sewer Diversion at Los Prades Boulevard and Saratoga Avenue	S25-85	S25-85	Install a weir in manhole S25-85 located in the intersection of Padres Blvd. and Saratoga Ave. to divert flow northwest to the existing 12-in line in Los Padres Blvd.	$77,000
P6	4	Sewer Diversion at Calabazas Boulevard and Machado Avenue	U/S of S52-93	S52-120	Install a new manhole upstream of S52-93 in the intersection of Calabazas Blvd. and Machado Ave., and install a new 15-inch high-level diversion line (approximately 200 feet) to divert excess flow from the existing 24-inch line in Calabazas Blvd. to the 21-inch line in Machado Ave. The diversion line should be about 6 inches higher than the invert of the 24-inch line.	$166,000
P6-Alt.[3]	4	Calabazas Creek Sewer Improvement	S62-31	S72-20	Upsize 1,800 feet of 24-inch line next to Calabazas Creek between Kifer Rd. and Scott Blvd. to a 27-inch line.	$1,334,000
					Estimated Total Cost for Recommended Projects P1 to P6:	$1,667,000
					Estimated Total Cost for Projects P1 to P5 and P6-Alt:	$2,835,000
E1[4]	N/A	Tracy Drive Sewer Improvement	S10-77	S22-51	Upsize approximately 6,600 feet of 10- to 12-inch line in Tracy Dr. and Pomeroy Ave. to a 15-inch line; install a new 15-inch line between manholes S22-55 and S22-46 in Pomeroy Ave. and Homestead Rd. (approximately 50 feet) to divert flow into Homestead Rd., and upsize approximately 1,400 feet of 18-inch line downstream to a 21-inch.	$4,654,000
					Estimated Total Cost (P1 to P6) including Project E1:	$6,321,000
					Estimated Total Cost (P1 to P5 and P6-Alt) including Project E1:	$7,489,000

1. All costs are presented in 2015 dollars and include 30 percent allowance for contingencies for unknown conditions and 25 percent for engineering, administration, and legal costs.
2. These proposed projects are operational, not capital improvements. Refer to Table 4-4 for recommended set points.
3. Project P6-Alt is presented for the purpose of identifying the solution and associated cost to maintain the current system flow configuration. Project P6 is the recommended project.
4. Project E1 addresses the potential capacity deficiency when parcel APN 316-17-018 begins to discharge its entitled flow of 0.95 mgd into the City's system.



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5.2 Implementation Recommendations

The City should begin implementation of the Capital Improvement Program recommended in this Master Plan, starting with the highest priority projects. The following items should be considered in project scheduling and design, and in future updates of the Master Plan.

- The alignments and sizes of all recommended projects should be verified with detailed predesign analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews.

- The estimated costs assumed open cut construction, but alternative methods such as trenchless construction or construction of parallel relief pipes could be considered during design. The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.

- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Master Plan in the future. The model should be kept up-to-date with any changes to existing sewer connections, development plans, and sewer system facilities.

- The City should conduct additional flow monitoring at key locations in the sewer system, particularly the area tributary to the Chromite/Machado trunk sewers where both the 2006 and 2015 flow monitoring programs indicated high I/I. City should also conduct smoke testing and television inspection to identify potential sources of I/I. Flow levels during large storm events should be compared to the peak flows simulated by the hydraulic model to verify the modeling predictions for the 10-year design storm and confirm the need for and sizing of Project P3 (Cabrillo Avenue Sewer Improvement).

- The City should coordinate with the CuSD on flow and planning assumptions to ensure that adequate capacity exists in the Santa Clara system to handle future flows from the District. The City should encourage CuSD to monitor the flows at the flow meter that it operates and maintains on Homestead Road at Swallow Drive on an on-going basis and periodically confirm meter calibration to verify the wastewater flows entering the Santa Clara system.

- The City should consider adjusting its set points for the four lift stations identified in Table 4-4 to address upstream backwater issues and capacity criteria violations. These settings should be evaluated by the City's pump operators to determine feasibility and if there are other operational issues that should be considered. In addition, the City should continue to conduct regular maintenance as needed to maintain adequate firm pumping capacity at all pump stations, including cleaning the force mains as needed.

- The City should coordinate with the City of San Jose to ensure that its flow criteria and planning assumptions are consistent with those used by San Jose in its capacity master planning.

- Parcel APN 316-17-018 holds an entitlement agreement to discharge up to 0.95 mgd into the City’s system; however, it is currently discharging less than 10 percent of its entitled rate. While the City is obligated to provide capacity for entitlement holders, it is important to note that implementing this project may result in oversized sewers where the daily flow is not sufficient to provide the minimum cleaning velocity and thus creating potential debris and odor issues. However, the City should implement project E1 (Tracy Drive Sewer Improvement) to address the potential capacity deficiency before the parcel begins to discharge its entitled flow of 0.95 mgd.

This Master Plan report is intended to be a working document to be refined and updated as additional data and new planning information becomes available. The capacity assessment should be updated whenever there are major changes in planning assumptions or, at a minimum, every ten years.

Sanitary Sewer Master Plan Update

Draft Report

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City of Santa Clara

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LIST OF ACRONYMS AND ABBREVIATIONS

ADWF	Average Dry Weather Flow
APN	Assessor Parcel Number
BWF	Base Wastewater Flow
CCTV	Closed-Circuit Television
CIP	Capital Improvement Program or Capital Improvement Plan
CIPP	Cured-in-Place Pipe
City	City of Santa Clara
CMC	Chromite-Machado-Cabrillo
County	Santa Clara County
CSJ	City of San Jose
CuSD	Cupertino Sanitary District
d/D	Depth to Diameter Ratio
DDF	Depth, Duration, Frequency
DIP	Ductile Iron Pipe
DTM	Digital Terrain Model
DU	Dwelling Unit
DWF	Dry Weather Flow
EL	Existing Loads
ENR CCI	Engineering News Record Construction Cost Index
FAR	Floor-area-ratio
FM	Flow Meter
fps	Feet per second

GAP	Great America Parkway
GIS	Geographic Information System
GP	General Plan
gpd	Gallons per day
gpcd	Gallons per capita per day
GWI	Groundwater Infiltration
I/I	Infiltration and Inflow
ICM	InfoWorks ICM™
IDF	Intensity, Duration, Frequency
LiDAR	Light Detection and Ranging
LF	Linear Feet
LMN	Lined Model Network (Future)
LTFL	Long-Term Future Loads
MAP	Mean Annual Precipitation
mgd	Million gallons per day
MH	Sanitary Sewer Manhole
MP	Master Plan
NAICS	North American Industry Classification System
NAVD	North American Vertical Datum of 1988
NGVD	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NTFL	Near-Term Future Loads
PDWF	Peak Dry Weather Flow
PHD	Patrick Henry Drive
PS	Pump Station
PVC	Polyvinyl Chloride (Pipe)
PWWF	Peak Wet Weather Flow
RCP	Reinforced Concrete Pipe
RDI/I	Rainfall-Dependent Infiltration and Inflow
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SD	Specific Development
SF	Square Feet
SJ/SC RWF	San Jose / Santa Clara Regional Wastewater Facility
SMH	Sanitary Sewer Manhole
SSO	Sanitary Sewer Overflow
UMN	Unlined Model Network (Current)
USDA	United States Department of Agriculture
V&A	V&A Consulting Engineers, Inc.
VCP	Vitrified Clay Pipe
VFD	Variable Frequency Drive
W&C	Woodard & Curran
WWF	Wet Weather Flow

EXECUTIVE SUMMARY

This report summarizes the results and recommendations of the Sanitary Sewer Master Plan Update (Master Plan Update) for the City of Santa Clara (City or Santa Clara). Woodard & Curran prepared the Master Plan Update in close coordination with City staff. The Master Plan Update will be used to guide improvements to the City's sewer system to accommodate current and future development and to help the City continue to provide a high level of service to its customers.

The overall objectives of this Master Plan Update were to develop wastewater flow projections for the City's sewer service area using up-to-date development and land use information and flow monitoring data; update and expand its existing hydraulic model of the sanitary sewer system; use the model to identify existing capacity deficiencies and future capacity requirements; and develop a phased Capital Improvement Program (CIP), including cost estimates, for implementing the required capacity improvements to the sewer system.

The Master Plan Update included preparation of the following four (4) key technical memoranda (TMs), which were referenced for development of this Master Plan Update report:

- TM #1 – Santa Clara Sewer Model Development and Calibration
- TM #2 – Santa Clara Sewer Performance and Design Criteria
- TM #3 – Santa Clara Sewer Performance Evaluation
- TM #4 – Capital Improvement Plan Report

This Executive Summary provides a concise summary of the Master Plan Update report, highlighting critical information including objectives, findings, conclusions, and recommendations. It is presented in three parts:

1) **Introduction to the City's Existing Sewer System and Service Area** (**Section ES-1**) discusses the City of Santa Clara's existing sewer system infrastructure and service area.
2) **Description of How the Capacity Analysis was Prepared** (**Section 0**) describes the scope and methodologies of the planning effort, including the key planning and technical assumptions incorporated into the sewer system capacity analysis.
3) **Recommended Capital Improvement Program** (**Section ES-3**) presents the recommended CIP, including capacity improvement projects, phasing, and estimated costs. In addition, recommendations are presented for implementing the proposed CIP.

ES-1 Introduction to the City's Existing Sewer System and Service Area

Santa Clara is located in central Santa Clara County adjacent to the cities of San Jose, Cupertino, and Sunnyvale and covers approximately 18 square miles. The City has a population of approximately 130,000 and is served by a wastewater system comprising approximately 288 miles of sewer pipelines generally ranging from 4 to 48 inches in diameter (including 12 miles of private sewer pipelines) and seven (7) sewage pump stations.

The City collects wastewater generated within the City's service area from approximately 25,000 City customers (connections). Based on the City's billing database, roughly 90% of the City's existing customers are residential users and the remaining 10% are non-residential users, including commercial, municipal, and industrial users. In addition to collecting wastewater flows from customers within its service area, the City

also has an agreement to convey wastewater flows from a major portion of the Cupertino Sanitary District (CuSD) via a connection at Homestead Road and Swallow Drive.

Wastewater flows collected are generally conveyed eastward and northward. A portion of the City's flow continues eastward to the Trimble Trunk and conveyed to the City of San Jose's interceptor sewers on Zanker Road. The remainder of the City's flow and all the CuSD flow travels northward to the City's Northside and Rabello Pump Stations, where the flow is pumped to the San Jose/Santa Clara Regional Wastewater Facility (SJ/SC RWF) for treatment and disposal. The City's sewer system and service area are shown in **Figure ES-1**. A summary of the City's sanitary sewer system infrastructure is presented in **Table ES-1**.

TABLE ES-1: SUMMARY OF SANITARY SEWER SYSTEM INFRASTRUCTURE

Infrastructure	Quantity	Unit
Sewer Mains (Pipes)	1,456,400[1] / 276	Feet / Miles
Manholes	5,500	-
Siphons	34 (59 barrels[2])	-
Pump Stations	7	-

[1]Total length is rounded to the nearest one hundred feet.

[2]Some siphons have multiple barrels: Three (3) siphons have three (3) barrels, 19 siphons have two (2) barrels, and the remaining 12 siphons have a single barrel.

San Jose/Santa Clara Regional Wastewater Facility
SC Influent Junction Structure
Northside PS
Rabello PS
Westside LS
Primavera LS
Stadium LS
Tasman LS
De La Cruz LS
CSJ Interceptor (Not Modeled)
CuSD Flow

Figure ES-1
Sanitary Sewer System and Service Area

Sewer Master Plan Update

Legend

- City Boundary
- Pump Station
- Santa Clara Force Mains
- San Jose Interceptors
- CuSD Joint Usage Sewers

Sewers by Diameter

- ≤6"
- 8"-10"
- >10"-16"
- >16"-24"
- ≥27"

0 0.25 0.5 1 Miles

Project #: 0012307.00
Map Created: December 2024

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ES-2 Description of How the Capacity Analysis was Prepared

This study is intended to provide a comprehensive update of the City's Sanitary Sewer Master Plan to reflect the most current and accurate information on wastewater flows, projected growth, and system performance. To accomplish this, the City recognizes the need to update the hydraulic model of its sewer system, which is used to assess system performance and identify system capacity needs for both existing and projected future wastewater flows. This section describes how the capacity analysis was prepared and discusses the wastewater flow assumptions, hydraulic model development and calibration, design and performance criteria, and capacity analysis scenarios and results.

Wastewater Flow Assumptions

Wastewater flow assumptions are required to develop a hydraulic model that is an accurate representation of reality. The Santa Clara model includes both existing and future projected wastewater flow scenarios. Existing base wastewater flow (BWF) was estimated for each parcel within the City's service area based on recent customer water usage records obtained from the City's water billing database.

Future BWF projections were estimated by incorporating the most current development information that was available for the City's service area, which included development projects in review, specific plans, General Plan, and entitlement agreements. Based on the timing and type of development, the future base wastewater flows were assigned to one of two scenarios: near-term future or long-term future. The long-term future scenario included all development assumptions applied to the near-term future scenario plus development assumptions associated with the City's General Plan and entitlement agreements. The City's billing database records show that many entitlement holders have historically discharged less than their flow entitlements; however, considering the City is required to provide capacity to these users should they have the need to increase their discharges, the long-term future BWF scenario conservatively assumes that all entitlement holders would make use of their full discharge allowances.

Table ES-2 summarizes the average BWF assumptions applied to the hydraulic model for the City's service area.

TABLE ES-2: AVERAGE BASE WASTEWATER FLOW ASSUMPTIONS FOR SANTA CLARA[1]

Land Use Flow Scenario	Residential (mgd)	Non-Residential (mgd)	Total (mgd)
Existing	6.72	4.50	11.22
Near-Term Future	10.11	6.09	16.20
Long-Term Future[2]	13.58	15.48	29.06

[1]Does not include sewer flows from the Cupertino Sanitary District (CuSD). Refer to **Table ES-3**.

[2]Includes 5.09 mgd assumed for entitlement agreements, mostly for non-residential land uses.

The Santa Clara hydraulic model includes flow scenarios that represent both dry weather (non-rainfall) and wet weather (rainfall) conditions. In dry weather conditions, the base wastewater flows presented above account for the vast majority of total discharges to the sewer system. During wet weather conditions, total discharges to the sanitary sewer system increase due to the introduction of storm water inflow and infiltration, which enters the sanitary sewer system in direct response to rainfall events through holes in manhole covers, defects in sewer pipelines and service laterals, or illegally connected storm drainage infrastructure. If groundwater levels are high enough, some infiltration can also occur during dry weather conditions as it infiltrates into sewer infrastructure from below through defects. Wet weather flows are generated by simulating a design storm rainfall event in the hydraulic model.

Because CuSD discharges to Santa Clara's sanitary sewer system, the existing and future projected wastewater flow scenarios in the hydraulic model also include wastewater flow assumptions for CuSD for both dry and wet weather conditions. CuSD flows were incorporated into the hydraulic model as inflow hydrographs, which define the rate of wastewater flow entering a specific point (i.e., manhole) in the network during a simulation. CuSD flows for existing dry weather conditions were based on flow monitoring data. CuSD flows for existing wet weather conditions, near-term future dry and wet weather conditions, and long-term future dry and wet weather conditions were based on flows from CuSD's hydraulic model, which was most recently re-calibrated in 2023 by AKEL Engineering. For these flow scenarios, Woodard & Curran created inflow hydrographs based on the results that were exported from CuSD's re-calibrated model; the magnitude of flows was maintained but the timing was slightly shifted to match the diurnal usage pattern observed in the flow monitoring data and to align the peak wet weather response where applicable. For the long-term future wet weather flow scenario only, the peak flow was conservatively scaled up to match the contractual limit (13.8 mgd) defined in Santa Clara's agreement with CuSD.

Table ES-3 summarizes CuSD's average BWF assumptions applied to the hydraulic model for the City's service area.

TABLE ES-3: WASTEWATER FLOW ASSUMPTIONS FOR CUSD[1]

Flow Scenario	Average Dry (mgd)	Peak Dry (mgd)	Average Wet (mgd)	Peak Wet (mgd)
Existing	3.7	5.6	4.1	10.7
Near-Term Future	4.2	6.3	4.6	11.3
Long-Term Future	4.6	6.7	5.9	13.8[2]

[1]Based on CuSD's hydraulic model results for a seven (7) day period.

[2]Assumed to be contractual limit defined in agreement between Santa Clara and CuSD.

Hydraulic Model Network Development

A hydraulic model of the City's sewer system was developed for this study. The model includes all City-owned pipes and manholes within the sanitary sewer system, excluding approximately 12 miles of privately-owned sewer mains. Therefore, the model network consists of about 276 miles of sewers, including 2.7 miles of force mains, or roughly 96% of the total 288 miles of sewer pipeline within the City's system. The model also includes all seven sewage pumping stations. The model is a significant expansion of the model used for the 2016 Master Plan, which was developed to represent the trunk or "backbone" of the sewer system and as such contained approximately 34% (or 94 miles) of the total length of the City's sewers. Since 2016, Woodard & Curran has maintained and updated the City's model as sewer improvement projects were implemented, development reviews were requested, or when new network data became available, and this Master Plan Update builds on that work by significantly expanding the model network to include all City-owned sewer pipelines.

The model was used to assess how the system would perform under various planning and flow scenarios and to identify pipes or pump stations that may not have sufficient capacity to convey the predicted flows under existing or future conditions.

Hydraulic Model Calibration

Before the hydraulic model can be used for the capacity analysis performance evaluation, it must be calibrated to confirm that it is an accurate representation of the flows and hydraulic conditions in the City's sanitary sewer system. Model calibration is the process of comparing model-simulated flows to observed flows and adjusting the model assumptions and parameters as needed until a reasonably good match is

achieved. Generally, the model calibrator attempts to match flow volumes and peak flows between the model-simulated and observed data.

Model calibration is first performed for dry weather flows to achieve an accurate prediction of the base wastewater flows and baseline groundwater infiltration if present during non-rainfall conditions. Wet weather calibration is then performed to achieve an accurate prediction of the storm water inflow and infiltration that discharges to the sanitary sewer system during rainfall events.

A temporary flow monitoring program (shown in **Figure ES-2**) was conducted as part of this study to facilitate model calibration. The program obtained flow depth and velocity data (used to compute flow rate) at 31 strategically identified locations throughout Santa Clara's sanitary sewer system during both dry weather and wet weather conditions and rainfall data at three distinct locations. The observed data were compared to the model-simulated flows during the calibration process to confirm actual flows and system routing and characterize infiltration and inflow into the sewers within each distinct flow meter (FM) basin.

The model calibration process also included reviewing key flow splits in the City's sewer system to confirm flow routing, refining diurnal flow patterns to accurately represent the typical variation of flows throughout the day, and reviewing the City's largest dischargers and their discharge locations.

Table ES-4 summarizes the final model calibration results for the overall system based on discharge location by comparing model-simulated to observed flows during both dry weather and wet weather conditions for the downstream most flow meters. It was determined that a reasonably good match was achieved for the overall system considering the observed average dry weather flows and peak wet weather flows were within 10% of the model-simulated flows at both discharge locations. The period used for the dry weather calibration was the seven (7) day dry period from December 17 through December 23, 2022. Wet weather calibration was performed for the full 2022-2023 season because the flow monitoring program captured several rainfall events. The January 13-16, 2023 rainfall event produced the largest flow response and was used as the primary basis for calibrating the model to match observed peak wet weather flows. Several storms occurred within a short amount of time during the flow monitoring period, so there were likely cumulative impacts that increased the inflow and infiltration response during the subsequent storms. Additionally, the calibration focused on selecting parameters to conservatively match peak flows observed during the mid-January event which occurred later in the season after significant rainfall had already fallen and soils were generally saturated. As a result, the modeled and metered peak flows and volumes typically matched better for the later season rainfall events.

TABLE ES-4: SUMMARY OF HYDRAULIC MODEL CALIBRATION RESULTS[1]

	Average Dry Weather Flows (mgd)			Peak Wet Weather Flows (mgd)		
Discharge Location	**Observed**	**Modeled**	**Difference[2]**	**Observed**	**Modeled**	**Difference[2]**
Santa Clara Northside and Rabello Pump Stations[3]	10.54	10.09	-4.3%	23.03	24.22	+5.2%
Trimble Trunk	4.65	4.46	-4.1%	13.65	13.93	+2.1%

[1]Model results are compared to the 2022-2023 flow monitoring data.

[2]Difference is reported as modeled minus observed flow.

[3]Includes flows from CuSD.

The infiltration and inflow response to rainfall, which is referred to as rainfall-dependent infiltration and inflow (RDI/I), was quantified within each flow meter basin through the wet weather calibration process. **Figure ES-3** presents a visual representation of the wet weather calibration model results in terms of the

total RDI/I rate that was applied to the model for each meter basin to match model-simulated and observed flows. The total RDI/I rate (or "Total R") is a percentage that represents the total amount of rainfall that becomes runoff and eventually enters the sanitary sewer system as RDI/I. As shown in the figure, half of the City's flow meter basins had RDI/I rates of less than 5%. In contrast, flow meter basins concentrated within the central western portion of Santa Clara's system displayed very high RDI/I rates of greater than 80%. These flow meter basins are located within the Chromite-Machado-Cabrillo (CMC) tributary area and the adjacent Agate Drive tributary area. The flow monitoring data showed that the nature of the RDI/I responses to rainfall in these areas were indicative of significant infiltration, as the response was generally slower and took a long time to recede (i.e., several weeks following rainfall). Moreover, because consecutive rainfall events occurred within a short period of time during the flow monitoring period, the infiltration response did not fully recede before another rainfall event occurred. The flow monitoring results were consistent with the findings of other field investigations completed recently in the CMC basin, which concluded that rainfall-dependent infiltration appeared to be the most significant contributor to the wet weather response, possibly from defects in tributary sewer laterals and mains.

During the dry weather calibration process, a total of 0.158 mgd of additional GWI flow was applied to the system uniformly throughout two (2) of the 31 flow meter areas (i.e., FM 26 and FM 31), which were located in the CMC and Agate Drive tributary areas, respectively. GWI represents a seasonal increase in wastewater flows due to infiltration into the sewers during non-rainfall conditions, typically in low-lying areas or areas close to creeks or other water bodies. The need to add GWI to these flow meter basins to calibrate for dry weather conditions further suggests that significant infiltration is occurring, likely through defects in tributary sewer laterals and mains.

Flow Meter Basin

1, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19&20, 2, 2&3, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 3, 30, 31, 4, 5, 6, 7, 8, 9A, 9A&24, 9A&30, 9A&31

San Jose/Santa Clara Regional Wastewater Facility

SC Influent Junction Structure

Northside PS

Rabello PS

FM 3

FM 1

FM 2

Westside LS

Primavera LS

FM 7

FM 4

Stadium LS

Tasman LS

De La Cruz LS

FM 8

FM 5

FM 6

FM 9A

FM 30

FM 24

FM 16

FM 31

FM 15

FM 25

FM 17

FM 18

FM 11

FM 12

FM 14

FM 28

FM 10

FM 13

FM 26

FM 27

FM 23

FM 22

FM 19

FM 21

CuSD Meter

FM 20

FM 29

ALVISO, RENAISSANCE, AGNEW, PLAZA DEL REY, LAKEWOOD, SAN MIGUEL, EAST MURPHY, SCOTT MARTIN, LAWRENCE, CARMICHAEL, BOWERS, CABRILLO, GRAHAM, HOMESTEAD HIGH, PRUNERIDGE TANTAU, MAURICIA KIELY, FORBES BUCHER, WINCHESTER FOREST, BASCOM FOREST, CORY, NEWHALL SHERWOOD, CHAPMAN MORSE, DOWNTOWN SANTA CLARA, EL CAMINO LAS PALMAS, EL CAMINO LOS PADRES, SARATOGA LOS PADRES, LOMA LINDA, NORTHLAKE, CALVERT, BIRDLAND, NORTH SAN JOSE, RIVER OAKS, THE VILLAS

0 0.3 0.6 1.2 Miles

Figure ES-2
Flow Monitoring Program

Sewer Master Plan Update

Legend

- 2014-2015 & 2022-2023 Flow Meter Site
- 2022-2023 Flow Meter Site
- CuSD Flow Meter Site (FM 32)
- City of Santa Clara Boundary
- Pump Station
- San Jose Interceptors

Trunk Mains

- Gravity Main
- Force Main
- Small Diameter Mains

Woodard & Curran

Project #: 0012307.00
Map Created: December 2024

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Figure ES-3
RDI/I Rate by Flow Meter Basin

Sewer Master Plan Update

Legend

- City of Santa Clara Boundary
- 2022-23 Flow Meters
  - 2014-2015 & 2022-2023 Flow Meter Site
  - 2022-2023 Flow Meter Site

RDI/I Rate (Total R)

- 0 - < 5
- 5 - 10
- > 10 - 20
- > 20 - 40
- > 80

N

0 0.25 0.5 1 Miles

Woodard & Curran

Project #: 0012307.00
Map Created: December 2024

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Design and Performance Criteria

The capacity analysis requires selection of design and performance criteria, which are applied so that the hydraulic model can be used to determine if sewer facilities would have adequate capacity under the flow scenarios developed or if the capacity would be exceeded, requiring system improvements. **Table ES-5** presents and describes the design and performance criteria that were selected for this Master Plan Update.

TABLE ES-5: SUMMARY OF DESIGN AND PERFORMANCE CRITERIA

Criterion	Purpose	Selected
Design Storm Rainfall	Single event rainfall assumed to produce peak flows generated from a rainfall event of a desired return period to assess system capacity during wet weather conditions.	• Return Period: 10 years • Duration: 24 hours • Rainfall Depth and Temporal Distribution: Based on Santa Clara County Drainage Manual (developed from historical rainfall event in December 1955) • Storm Timing: Peak-on-peak[1] (weekday) • Antecedent Conditions: Wet, saturated soils • Spatial Distribution: Lowest intensity north and highest intensity southwest
Performance (Capacity Deficiency)	Used to determine if the capacity of an existing sewer facility is inadequate to the extent that a capacity improvement project would be needed.	• Gravity Sewers: Flow depth exceeds full pipe (d/D[2] > 1) during either dry weather or design storm wet weather conditions (i.e., no surcharge is allowed). • Pump Stations: Firm capacity[3] greater than the peak wet weather flow during the design storm. • Force Mains: Velocity exceeds 8 feet per second (fps).
Design	Used for the purpose of sizing new or relief facilities based on the City's desired level of service and are generally more conservative than the performance criteria because new facilities should be designed to a higher standard.	Gravity Sewers: • d/D < 0.75 under future peak wet weather flows • Minimum Velocity = 2 fps for daily dry weather • Maximum Velocity = 10 fps at peak design flow • Minimum Pipe Diameter = 8 inches • Minimum Cover = 6 feet (ground to pipe crown) Pump Stations: Firm capacity greater than the peak wet weather flow during the design storm. Force Mains: • Minimum/Maximum Velocity: 3 fps /8 fps • Minimum Cover = 6 feet (ground to pipe crown)

[1]Peak RDI/I occurs at approximately the same time as peak BWF for most areas of the sewer system.

[2]d/D = Depth-to-Diameter Ratio representing the depth of flow within the pipe.

[3]Capacity of the pump station assuming that the largest pump is out of service.

The design and performance criteria selected for sewer master planning efforts vary by agency and are reflective of the level of risk that is acceptable to each agency. Common criteria for several agencies both inside and outside of California were reviewed during the process of selecting the City's criteria. Ultimately, Santa Clara elected to apply relatively conservative criteria in order to identify all potential projects, recognizing that conditions may change in the future due to variable factors such as sewer condition, additional development, and climate change. However, engineering judgment was used when applying the

performance criteria to avoid identifying capacity deficiencies where gravity sewers showed only minor criteria violations.

Capacity Analysis Scenarios and Results

The capacity analysis is performed using the calibrated hydraulic model to identify sewer facilities that may not have sufficient capacity to convey the predicted flows based on the selected performance criteria. A total of 12 model scenarios were developed to assess system performance and were a combination of the wastewater flow scenario (existing, near-term future, or long-term future), design flow (dry or wet weather), and physical network assumptions (with or without assumed lining of City-identified reinforced concrete sewers likely to be in poor condition) listed in **Table ES-6**.

TABLE ES-6: SUMMARY OF CAPACITY ANALYSIS MODEL SCENARIOS

Wastewater Flow	Design Flow	Physical Network
Existing	Dry Weather	Unlined: Current system with no future lining assumed
Near-Term Future	Wet Weather	Lined: Assumes future lining of City-identified RCP trunks in poor condition
Long-Term Future		

The capacity analysis identified a total of 16 gravity sewer deficiencies, the locations of which are shown in **Figure ES-4**. In the figure, pipes shown in pink are predicted to surcharge due to "throttle" conditions, indicating that the full capacity of the pipe is less than the predicted peak flow. Pipes shown in purple are predicted to surcharge due to backwater from a downstream throttle condition. A total of 15 capacity improvement projects were developed to relieve the gravity sewer capacity deficiencies identified through the capacity analysis. The project locations and extents are shown in **Figure ES-5**. Most projects were developed to either replace the existing, capacity-deficient pipe with a larger pipe or to re-direct a portion of flows to other existing sewers with adequate available capacity. Replacement pipes were sized based on the selected design criteria to convey flow for the most conservative model scenario (i.e., long-term future wastewater flow, wet weather design flow, and lined physical network). The number of projects developed (15) is less than the number of capacity deficiencies identified (16) because model runs showed that the Agate Drive deficiency would be relieved once the Calabazas Trunk project was implemented.

The capacity analysis did not identify any pump station or force main capacity deficiencies. The firm and total capacities of each of the City's seven sewer pump stations were estimated based on basic information, pump settings, pump curves, and system curves provided by the City. Those theoretical capacities were then compared to the model-predicted peak wet weather flows generated from the design storm rainfall event. Because the theoretical firm capacity of each station did not exceed the model-predicted flow into the station, it was assumed that each station had adequate capacity to convey flows during the most conservative condition evaluated based on the City's performance criteria. Model-predicted force main velocities were also within the specified performance criteria (i.e., less than 10 fps) during the most conservative condition evaluated, and similarly, no capacity deficiencies were identified. Although the capacity analysis did not identify any pump station capacity deficiencies, the model-predicted peak design flows to the Rabello and Northside Pump Stations during long-term future wet weather conditions (44.8 mgd) are close to the combined firm capacities of these two stations (45.2 mgd). Based on discussions with the City's Water and Sewer Department, the diversion box upstream of these two pump stations contains a wet well with weir slots that the City has the ability to adjust by dropping in weir boards to control the flow. Under dry weather conditions and normal settings, approximately 80% of flows go to the Rabello PS and the remaining 20% go to the Northside PS. City staff had not observed flows overtopping the weir boards towards Northside PS, but suspects there may be a gap underneath the weir boards considering SCADA

confirms that flows go to both pump stations. The City should continue to monitor influent flows to these two pump stations as future developments come online and adjust the diversion box weir settings as needed to maximize the available capacity.

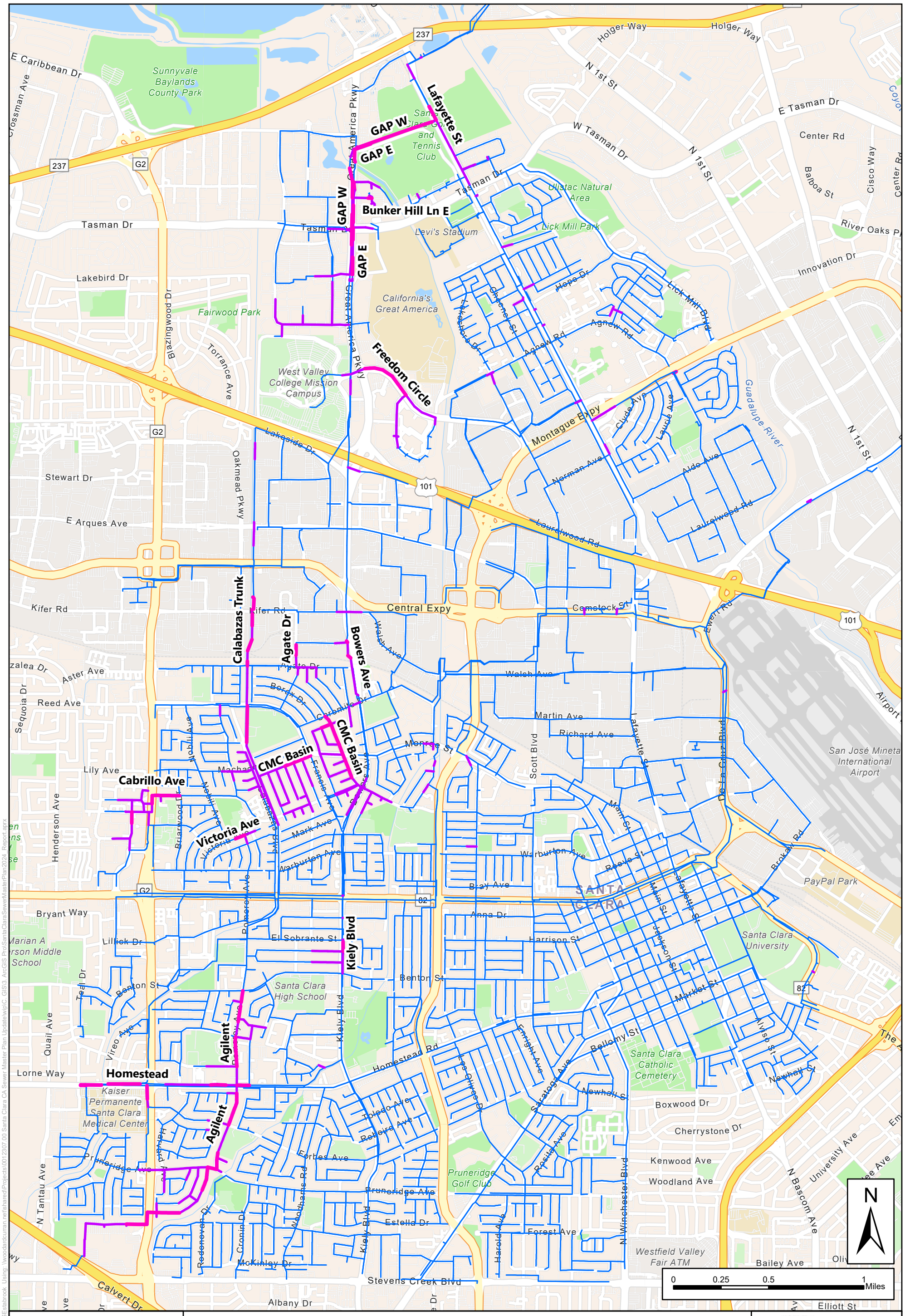

Figure ES-4
Overview of Capacity Deficiencies

Sewer Master Plan Update

Legend

Modeled Sewers

Surcharge State

- <1 (no surcharge)
- 1 (backwater surcharge)
- 2 (throttle surcharge)

Woodard & Curran

Project #: 0012307.00

Map Created: December 2024

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Figure ES-5
Overview of Capacity Improvement Projects

Sewer Master Plan Update

Legend

Modeled Sewers

Capacity Improvement Project

- Bunker Hill Ln E
- Agilent
- Bowers Ave
- CMC Basin
- Calabazas Trunk
- GAP E Trunk
- GAP W Trunk
- Homestead Rd
- Kiely Blvd
- Lafayette St
- Victoria Ave
- Freedom Circle
- Cabrillo Extent (Not Actual Project)

N

0 0.25 0.5 1 Miles

Project #: 0012307.00
Map Created: December 2024

Woodard & Curran

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ES-3 Recommended Sewer Capacity Capital Improvement Plan

The Sewer Capacity CIP recommended in this study is designed as guidance for the City to provide adequate sewer system capacity for the City's existing and anticipated future development. **Table ES-7** and **Table ES-8** provide a summary and detail of the recommended capacity improvement projects, respectively. The wastewater flow, design flow, and physical network triggers listed next to each project in **Table ES-8** represent the least conservative condition (i.e., lowest flow and available capacity) that first caused the deficiency to occur. Relative priorities of "1" (highest priority) to "7" (lowest priority) were assigned to each project based on a combination of factors including the wastewater flow trigger, design flow trigger, and physical network trigger, and assumed structural condition. Therefore, projects that address existing deficiencies without future lining assumptions in place were assigned the highest priority because they pose the greatest risk of a sanitary sewer overflow (SSO). Those projects were subsequently scheduled for earlier implementation, assuming a start date in 2025. The remaining projects, which would be triggered by future loading conditions, were assigned an implementation start date of 2035. Projects were also assigned a flow confidence level from "1" (highest confidence) to "5" (lowest confidence) to reflect the level of confidence in the data that were used to calibrate the hydraulic model, forecast flows, and identify deficiencies. Projects which were assigned a confidence level "4" or "5" had no reliable confirmation of model flows; thus, conducting flow monitoring on these project reaches prior to design would provide a greater level of confidence in modeled flows.

The total estimated capital cost of the Sewer Capacity CIP is approximately $100.6 million in 2024 dollars. These costs include baseline construction costs for new sewer mains and sewer structures using open-cut methods; and cost allowances for project mobilization/demobilization, traffic control, and bypass pumping as needed. The total estimated construction costs also include a 30% allowance for contingencies for unknown conditions, and the total estimated capital cost includes an allowance of 25% of construction cost for engineering, administration, construction management, and legal costs. Costs for lining City-identified RCP trunks are not included in the Sewer Capacity CIP as these are condition-related maintenance costs. The estimated costs are planning or conceptual level estimates to be used for budgeting purposes only and are considered to have an estimated accuracy range of -30% to +50%. Note that the Sewer Capacity CIP does not include costs for two of the specific developer-driven capacity improvement projects, Patrick Henry Drive (PHD) and Mission Point, as the developers will fund those improvements. Additionally, it is assumed that the City's overall sewer system CIP will also include costs for condition-related improvements; however, these projects are not addressed in this Master Plan Update report.

TABLE ES-7: SUMMARY OF RECOMMENDED SEWER CAPACITY CIP

Description	Quantity	Notes
Number of Projects	13	3 to be implemented in 2025; 10 after 2035
Total Length of New Sewers	38,100 LF	Approximately 7.2 miles
Range of New Sewer Diameters	8" – 48"	Standard pipe sizes only (inside diameters)
Number of New Weirs	4	Used to modify flow routing
Total Estimated CIP Cost[1]	$100.6M	Based on August 2024 dollars
Total Other Costs[2]	$75K annually $950K every 7 years $25K annually	Hydraulic Model Maintenance and Support; Future Master Plan updates (next in 2029); Technical Analyses for Model Verification

[1]Designed to reflect costs derived directly from construction of the capacity improvement projects only.

[2]Other costs associated with improvement of flow conveyance in the system.

TABLE ES-8: CAPACITY IMPROVEMENT PROJECT DETAILS

Project No.[1]	Project ID	Project Location	Pre-Project Pipe Diameter(s)[2]	Project Description	Priority[3]	Flow Confidence Level[4]	Wastewater Flow Trigger[5]	Design Flow Trigger[5]	Physical Network Trigger[5]	Project Cost[6]
1	**Agilent**	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd	10 to 22.8-inch	12,313 LF of 15 to 27-inch diameter pipe	7	N/A	LTFL (entitlement)	DWF	UMN	**$26,942,000**
2	**Homestead Road**	N Homestead Trunk from Swallow Wy to Saratoga Creek	18 to 30-inch	6,407 LF of 24 to 33-inch diameter pipe	3	3	LTFL	WWF	UMN	**$17,156,000**
3	**Kiely Boulevard**	Orthello Wy to S of El Sobrante St	8-inch	266 LF of 10-inch diameter pipe	6	4	LTFL	WWF	UMN	**$513,000**
4	**Victoria Avenue**	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave	8-inch	764 LF of 10-inch diameter pipe	6	3	LTFL	WWF	UMN	**$1,337,000**
5	**Cabrillo Avenue**	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy	8-inch	Flow Diversion Weirs only. No pipe replacement.	1	3	EL	WWF	UMN	**$154,000**
6	**CMC Basin**	Santa Maria Ave & Francis Ave; Amethyst Dr	8 to 12-inch	3655 LF of 12 to 15-inch diameter pipe	1	1 & 2	EL	WWF	UMN	**$7,263,000**
7	**Bowers Avenue**	Bowers Ave from Chromite Dr to Walsh Ave	25.7-inch	2605 LF of 30-inch diameter pipe	4	5	LTFL	WWF	LMN	**$8,047,000**
8	**Calabazas Trunk**	Calabazas Creek from S of Agate Dr to Central Expwy	22.8 to 27-inch	2791 LF of 18 to 27-inch diameter pipe	2	5	EL	WWF	LMN	**$8,731,000**
9	**Freedom Circle**	Mission College Blvd from Freedom Cir to west of Great America Pkwy	12 to 15-inch	1886 LF of 15-inch diameter pipe	5	N/A	LTFL (specific development)	DWF	UMN	**$3,830,000**
12	**GAP West Trunk**	S of West Tasman Dr to Lafayette St	28.5 to 35.7-inch	4810 LF of 36 to 42-inch diameter pipe	3	2	LTFL	WWF	UMN	**$17,781,000**
13	**GAP East Trunk**	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr	31.4-inch	231 LF of 39-inch diameter pipe	4	2	LTFL	WWF	LMN	**$1,002,000**
14	**Bunker Hill Lane East**	E of Great America Pkwy	6-inch	107 LF of 8-inch diameter pipe	7	N/A	LTFL (entitlement)	WWF	UMN	**$301,000**
15	**Lafayette Street**	N of Calle del Mundo to S of Great America Wy	34.2 to 40.3-inch	2290 LF of 42 to 48-inch diameter pipe	3	2	LTFL	WWF	UMN	**$7,515,000**
TOTAL ESTIMATED COST	**$100,572,000**									

[1]Projects are numbered from upstream to downstream. Table does not include Project Nos. 10 (Patrick Henry Drive) and 11 (Mission Point) because project costs will be paid for by the developers.

[2]Pre-project pipe diameters include future lining assumptions.

[3]Projects are prioritized based on wastewater flow, design flow, and physical network triggers as well as assumed structural condition.

[4]Rating assigned to validate the need for the project through review of flow monitoring data and reported surcharging and operational issues, and compatibility between flow meter data and the model. Descriptions of the flow confidence levels are as follows: N/A = Not assigned because project would be triggered by entitlement flow or specific development; 1 = Flow meter on or very near to the project reach surcharged during metered storm; 2 = Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm; 3 = Flow meter near the project reach (upstream or downstream) confirms flow; 4 = No flow meter near the project reach to confirm flow; 5 = Conflicting flow between meter and model.

[5]EL = Existing Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flow; WWF = Wet Weather Flow; UMN = Unlined Model Network; LMN = Lined Model Network.

[6]Costs are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area and are Class 5 estimates (planning level).

Implementation Recommendations

The City should begin implementation of the Capital Improvement Program recommended in this Master Plan Update, starting with projects needed to address existing system capacity deficiencies. The following items should be considered in project scheduling and design, and in future updates of the Master Plan:

- The City should consider conducting additional flow monitoring or observation to document flow levels during large storm events at locations in the system where the model predicts significant surcharge or where there is a significant difference between previous flow monitoring conducted and the model results. Flow levels during large storm events should be compared to the water levels simulated by the hydraulic model to verify if the modeling predictions for the design storm seem reasonable, and to confirm the need for and, if necessary, refine project sizing.
- The alignments and sizes of all recommended projects should be verified with detailed pre-design analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews. Detailed pre-design analyses should consider feasibility of trenchless construction methods including pipe-bursting and Pilot Tube Guided Auger Boring (PTGAB), especially at major roadway, railway, and creek crossings.
- The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines and laterals; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.
- Capacity improvement projects triggered by long-term future flow assumptions associated with entitlement agreements would not need to be implemented until the entitled parcel(s) begin to discharge their entitled flow(s).
- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Master Plan in the future. The model should be kept up to date with any changes to existing sewer connections, development plans, and sewer system facilities.

This Master Plan Update report is intended to be a working document to be refined and updated as additional data and new planning information become available. The capacity assessment should be updated whenever there are major changes in planning assumptions or, at a minimum, every five to ten years.

1. INTRODUCTION

This introductory section identifies the background and study objectives for the Master Plan Update, briefly describes the City's sanitary sewer system and service area and presents an overview of the report's organization by summarizing the content discussed within each section.

1.1 Background and Study Objectives

Prior to this study, the City last conducted a comprehensive assessment of its wastewater system in its 2016 Sanitary Sewer Master Plan Update[1] (2016 Master Plan). Of the seven (7) capacity improvement projects recommended in the 2016 Master Plan, three (3) projects were implemented: two (2) of which were operational adjustments to the set points for the Westside and Tasman Pump Stations to eliminate unnecessary backups in the influent gravity sewers, and the third was a capital project to upsize approximately 1,800 feet of 24-inch sewers along the Calabazas Creek trunk between Kifer Road and Scott Boulevard to 27-inch sewers.

Since 2016, in addition to completing a few sewer improvement projects, the City has experienced a significant amount of new development, necessitating an update to the 2016 Master Plan that includes an evaluation of the capacity of the sanitary sewer system to handle existing and future wastewater flows. Several development reviews have also been completed since the 2016 Master Plan. These development reviews are conducted using the City's hydraulic model to assess if the sanitary sewer system has enough available system capacity for the individual development to connect to the system.

Thus, the purpose of this study is to build an updated, comprehensive hydraulic model of the City's sewer system, calibrate the model to current flow monitoring data, and identify needed capacity improvements based on existing and projected future flows. This Master Plan Update summarizes the basis of the sewer flow estimates and the hydraulic model development and calibration process, presents the criteria used for the capacity analysis and the deficiencies identified, and describes the proposed projects to address identified capacity deficiencies. Due to the relatively high rates of I/I in specific areas of the system, this assessment also included identifying areas of higher I/I appropriate for further investigation.

1.2 Sanitary Sewer System and Service Area

Santa Clara is a city of approximately 130,000 people located in central Santa Clara County adjacent to the cities of San Jose, Cupertino, and Sunnyvale and covers approximately 18 square miles. The City's wastewater system serves approximately 25,000 City customers in its service area (primarily residential users) through approximately 288 miles of sewer pipelines generally ranging from 4 to 48 inches in diameter (including 12 miles of private sewer pipelines) and seven (7) sewage pump stations. The City also has an agreement to convey wastewater flows from a major portion of the Cupertino Sanitary District (CuSD) via a connection at Homestead Road and Swallow Drive. Wastewater flows collected are generally conveyed eastward and northward. A portion of the City's flow continues eastward to the Trimble Trunk and is conveyed to the City of San Jose's interceptor sewers on Zanker Road. The remainder of the City's flow and all the CuSD flow travels northward to the City's Northside and Rabello Pump Stations, where the flow is pumped to the San Jose/Santa Clara Regional Wastewater Facility (SJ/SC RWF) for treatment and disposal. A summary of the City's sanitary sewer system infrastructure is presented in **Table ES-1**. The City's sewer system and service area are shown in **Figure ES-1**.

[1] City of Santa Clara, Sanitary Sewer Master Plan Update, RMC Water and Environment, April 2016.

TABLE 1-1: SUMMARY OF SANITARY SEWER SYSTEM INFRASTRUCTURE

Infrastructure	Quantity	Unit
Sewer Mains (Pipes)	1,456,400[1] / 276	Feet / Miles
Manholes	5,500	-
Siphons	34 (59 barrels[2])	-
Pump Stations	7	-

[1]Total length is rounded to the nearest one hundred feet.

[2]Some siphons have multiple barrels: Three (3) siphons have three (3) barrels, 19 siphons have two (2) barrels, and the remaining 12 siphons have a single barrel.

San Jose/Santa Clara Regional Wastewater Facility
SC Influent Junction Structure
Northside PS
Rabello PS
Westside LS
Primavera LS
Stadium LS
Tasman LS
De La Cruz LS
CSJ Interceptor (Not Modeled)
CuSD Flow

Figure 1-1
Sanitary Sewer System and Service Area

Sewer Master Plan Update

Legend

- City Boundary
- Pump Station
- Santa Clara Force Mains
- San Jose Interceptors
- CuSD Joint Usage Sewers

Sewers by Diameter
- ≤6"
- 8"-10"
- >10"-16"
- >16"-24"
- ≥27"

N

0 0.25 0.5 1 Miles

Woodard & Curran

Project #: 0012307.00
Map Created: December 2024

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1.3 Report Organization

The contents of each of the sections and appendices of this Master Plan Update report are described below.

- **Section 1 – Introduction**: This introductory section provides background information on the objectives and scope of the Master Plan Update, the City's sanitary sewer system and service area, and the contents and organization of this report.
- **Section 2 – Wastewater Flow Assumptions**: This section describes the flow monitoring program and basis for estimating model flows for existing conditions and future conditions with projected development.
- **Section 3 – Hydraulic Model Development and Validation**: This section describes the modeled sanitary sewer system, development of the hydraulic model network, and the calibration of the hydraulic model for dry and wet weather flow conditions.
- **Section 4 – System Capacity Analysis**: This section defines the basis for the capacity assessment of the system, including the selected design storm and performance criteria used to identify deficiencies, and presents the capacity deficiencies identified based on the model results. The section also identifies areas of the system with high I/I and recommends additional investigations to isolate potential direct inflow sources in those areas.
- **Section 5 – Recommended Capital Improvement Plan**: This section presents the recommended capacity improvement projects based on the results of the system capacity analysis using the calibrated hydraulic model. Each recommended project is documented with a general description, planning level capital cost estimate, relative priority rating, and flow confidence level.
- **Appendices**: The appendices to the report provide additional detailed information to support the findings and recommendations presented in the report sections, including plots of flow monitoring and rainfall data and model calibrations, future land use assumptions, and detailed project descriptions, cost estimates, and figures for capacity improvement projects.

2. WASTEWATER FLOW ASSUMPTIONS

This section describes the flow monitoring program and basis for estimating model flows for existing conditions and future conditions with projected development.

2.1 Flow Monitoring Program

To support the development of the hydraulic model and Master Plan Update, a temporary flow monitoring program was conducted as part of this study. The purpose of the flow monitoring program was to obtain data to quantify actual flows and characterize infiltration and inflow (I/I) within the sewer system, and to calibrate the hydraulic model for both dry and wet weather conditions.

2.1.1 Flow Monitoring and Rain Gauge Sites

One critical purpose of a flow monitoring program is to aid in the calibration of the model, which is discussed further in **Section 3.3**. Considerations for flow meter (FM) placement to support model calibration generally include:

- Isolate areas to characterize flows for model calibration;
- Select sites on downstream trunks for flow confirmation;
- Align the location with flow meters previously used;
- Further divide tributary areas with suspected high I/I based on previous flow monitoring data to further isolate I/I;
- Prioritize preferred hydraulic conditions (i.e., manholes on a straight line preferred over manholes on bends or with multiple incoming pipes); and
- Consider ease of access and safety.

Santa Clara has conducted citywide flow monitoring programs in 2006 and 2015 as part of the City's sewer system capacity assessment study and sewer master plan, respectively. The City also conducted additional selective flow monitoring in the Chromite-Machado-Cabrillo (CMC) tributary area (an area with suspected high I/I based on previous monitoring programs) as detailed in a September 2020 report[1].

The 2022-2023 flow monitoring program for this Master Plan Update included 31 temporary gravity flow meters. Prioritizing the placement of the flow meters in the same locations used for previous monitoring programs is beneficial because it allows for comparison to the previously monitored flows to identify changes over time (e.g., increase in I/I). Therefore, the 2022-2023 program included placement of flow meters in all the same locations as in 2015 except for FM2, which was moved three manholes upstream due to safety concerns, and FM9, which was moved farther downstream to be north of Scott Blvd. The 2022-2023 program also included installation of 8 additional flow meters that were not part of the 2015 program, including a flow meter along Uranium Drive south of Mead Avenue which the City added onto the initial program. Four (4) rain gauges were also installed during the 2022-2023 program, all in the same locations as the rain gauges installed during 2015 and placed to capture spatial variability of rainfall within the City.

V&A Consulting Engineers (V&A), under sub-contract to Woodard & Curran, installed the flow meters and rain gauges and conducted the monitoring program. The flow meters and rain gauges were installed and

[1] Sewer Flow Monitoring and Inflow/Infiltration Study prepared by V&A in September 2020 included flow monitoring at 20 sites conducted during two phases.

operational from December 13, 2022 to February 13, 2023 (approximately 9 weeks). The flow meters collected flow depth and velocity data which were used to compute flow rate.

In addition to the 31 temporary flow meter sites, CuSD also maintains a permanent flow meter at the CuSD's and City's sewer connection point to monitor CuSD flows discharging to the City's sewer system. CuSD provided V&A with flow data recorded by the permanent meter for the duration of the flow monitoring period.

The location of the flow monitoring sites and rain gauges are shown in **Figure 2-1**. The figure also shows the associated tributary area (basin) for each flow meter. Note that some meters were located downstream of other meters. In those cases, the meter tributary areas are "incremental" (areas between the flow meter and tributary basins of the upstream flow meters). **Table 2-1** lists the flow meter locations and pipe diameters, and notes if the meter is incremental (i.e., has upstream flow meters). A schematic of the City's trunk sewer system including the temporary flow meters, pump stations, flow split manholes, and diversion structures is presented as **Figure 2-2**. Plots of the flow monitoring data, including flow, velocity, and level, are provided as **Appendix A**.

During the flow monitoring period, V&A visited all the temporary flow monitoring sites approximately monthly to check meter operation and site conditions, obtain field calibration measurements, and download collected data. Field calibration involves taking manual depth measurements and flow velocity measurements using a portable velocity meter. These calibration measurements were compared to and used to adjust monitor-recorded depth and velocity, if needed. Calibration measurements were taken at different times of day to obtain calibration points for the full range of typical diurnal flows.

TABLE 2-1: FLOW METER SITES

FM ID	Site Location	MH ID[1]	Upstream Meter ID(s)	Pipe Size (in)[2]
1	Lafayette St. north of Calle de Mundo	S104-28	4, 7-8, 10-12, 14-15, 19-22, 26-29	36
2	Parking Lot east of Great America Pkwy and north of Stars and Stripes Dr	S104-26	6, 9, 19-20, 29-30	33
3	Lafayette St. north of Calle de Mundo	S104-30	5-6, 9-13, 19-21, 24, 26-31	42
4	Parking lot of Levis Stadium	S94-35	--	24
5	Mission College Blvd. north of Our Lady's Wy.	S83-21	10, 11, 12, 13, 20, 21, 24, 26, 27, 28, 29, 30, 31	33
6	Mission College Blvd. north of Our Lady's Wy.	S83-22	9, 19-20, 29-30	30
7	Upstream of Primavera Lift Station.	S105-34	--	24
8	Lafayette St. north of Montague Expwy.	S86-12	11-15, 20-22, 26-29	30
9	Calabazas Creek north of Scott Blvd.	S72-17	19, 20, 29	30
10	San Juan Ave. and Monroe St.	S52-79	26-27	24
11	Chromite Dr. and Pilot Knob Dr.	S53-40	10, 26-28	24
12	Chromite Dr. and Alhambra Dr.	S53-23	10-11, 26-28	24
13	Bowers Ave. just north of Bonnie Dr.	S53-54	20-21, 29	30
14	South Dr. south of Loma Vista Ln.	S54-16	20-21, 29	15

FM ID	Site Location	MH ID[1]	Upstream Meter ID(s)	Pipe Size (in)[2]
15	Nvidia Parking lot, west off of Scott Blvd. south of Central Expwy.	S65-50	22	18
16	Central Expwy west of UPRR	S67-13	10-12, 14, 20-22, 26-29	27
17	De La Cruz Blvd. north of Martin Ave. (western sewer)	S58-9	22	24
18	De La Cruz Blvd. north of Martin Ave. (eastern sewer)	S58-8	22-23	24
19	North of intersection of Wren Ave. at Kent Avenue	S21-18	--	24
20	Homestead Rd. west of Cherry Orchard Place	S21-47	--	18
21	Kiely Blvd. north of Hearth Pl. and south of Kaiser Dr.	S23-6	20, 29	24
22	Los Padres Blvd. at Bray Ave.	S45-80	--	18
23	Brokaw Rd. northeast of UPRR	S48-31	--	18
24	Bowers Ave. (southbound) north of Central Expwy.	S63-1	10-13, 20-21, 26-29, 31	33
25	West of De La Cruz Blvd. (southbound) and east of Walsh Ave.	S57-56	10-12, 26- 28	30
26	Machado Ave. east of Santa Cruz Ave.	S52-87	--	21
27	Francis Ave. north of Cabrillo Ave.	S43-2	--	10
28	Amethyst Dr. south of Chromite Dr. and north of Kearney Ave.	S53-46	--	8
29	Homestead Rd. west of Bond Pl. and east of Cherry Orchard Pl.	S21-55	--	15
30	Parking lot south of Scott Blvd, north of Central Expwy., west of Oakmead Village Dr.	S72-33	--	15
31	Uranium Dr. south of Mead Ave.	S65-50	--	10
32	CuSD FM at Homestead Rd. and Swallow Dr.	S20-9	--	15

[1] Flow meters were placed on the downstream end of the influent pipe.

[2] GIS pipe diameter. Actual diameter as measured by V&A may be slightly different. When manholes have multiple incoming manholes, the largest pipe was monitored.

Flow Meter Basin

1, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19&20, 2, 2&3, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 3, 30, 31, 4, 5, 6, 7, 8, 9A, 9A&24, 9A&30, 9A&31

San Jose/Santa Clara Regional Wastewater Facility

SC Influent Junction Structure

Northside PS

Rabello PS

FM 3

FM 1

FM 2

Westside LS

Primavera LS

FM 7

FM 4

Stadium LS

Tasman LS

De La Cruz LS

FM 8

FM 5

FM 6

FM 9A

FM 30

FM 24

FM 16

FM 31

FM 15

FM 25

FM 17

FM 18

FM 11

FM 12

FM 14

FM 28

FM 10

FM 13

FM 26

FM 27

FM 22

FM 23

FM 19

FM 21

CuSD Meter

FM 20

FM 29

ALVISO

RENAISSANCE

AGNEW

PLAZA DEL REY

LAKEWOOD

SAN MIGUEL

EAST MURPHY

SCOTT MARTIN

LAWRENCE

NORTH SAN JOSE

RIVER OAKS

BIRDLAND

PRUNERIDGE

LOMA LINDA

NORTHLAKE

CORY

BASCOM FOREST

NEWHALL SHERWOOD

Figure 2-1
Flow Monitoring Program

Sewer Master Plan Update

Legend

- 2014-2015 & 2022-2023 Flow Meter Site
- 2022-2023 Flow Meter Site
- CuSD Flow Meter Site (FM 32)
- City of Santa Clara Boundary
- Pump Station
- San Jose Interceptors

Trunk Mains

- Gravity Main
- Force Main
- Small Diameter Mains

N

0 0.3 0.6 1.2 Miles

Woodard & Curran

Project #: 0012307.00
Map Created: December 2024

Figure Exported: 12/31/2024 By: SEstabrook Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2024_Report.aprx

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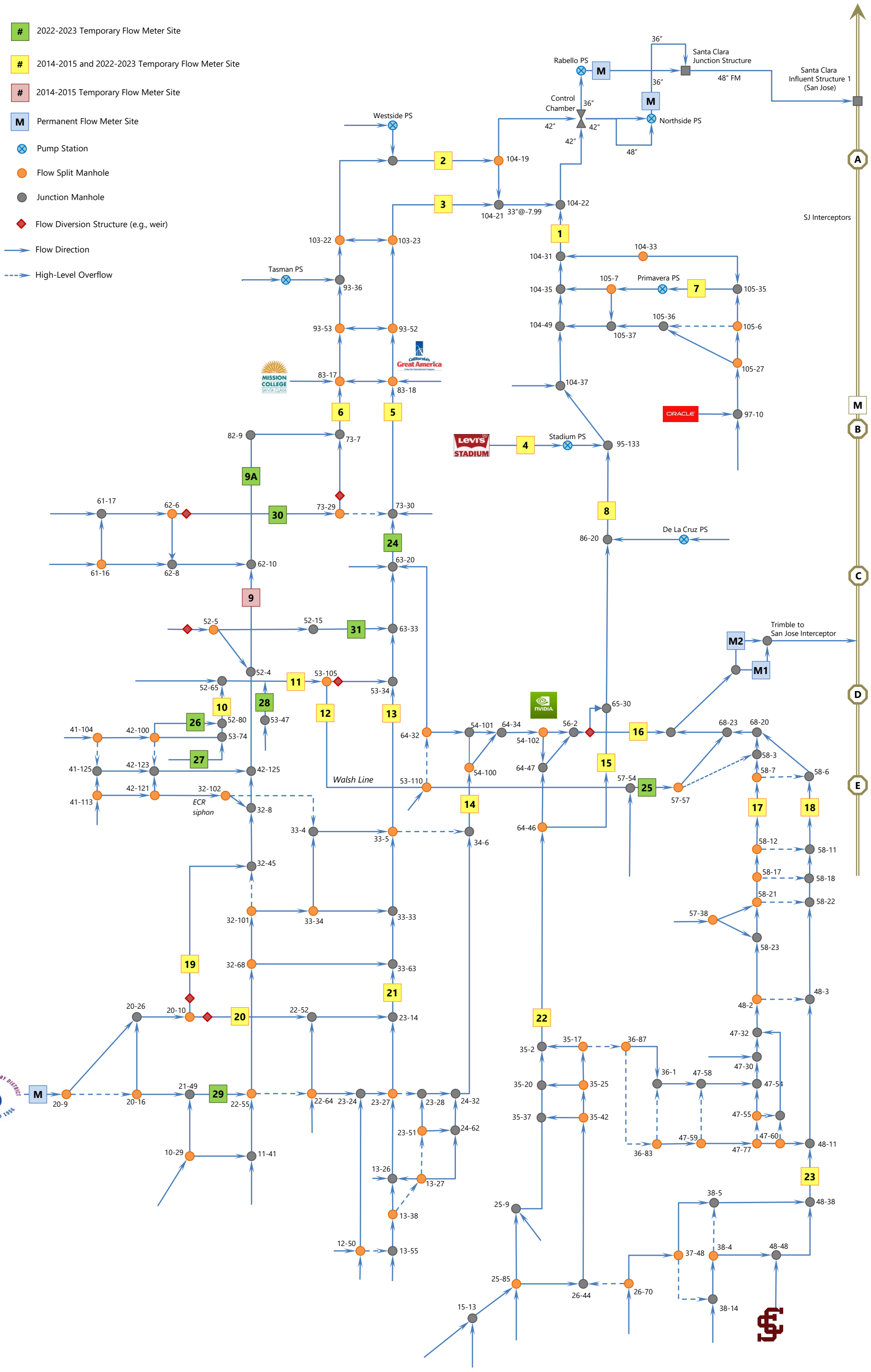
Figure 2-2: City of Santa Clara Trunk Sewer System Schematic



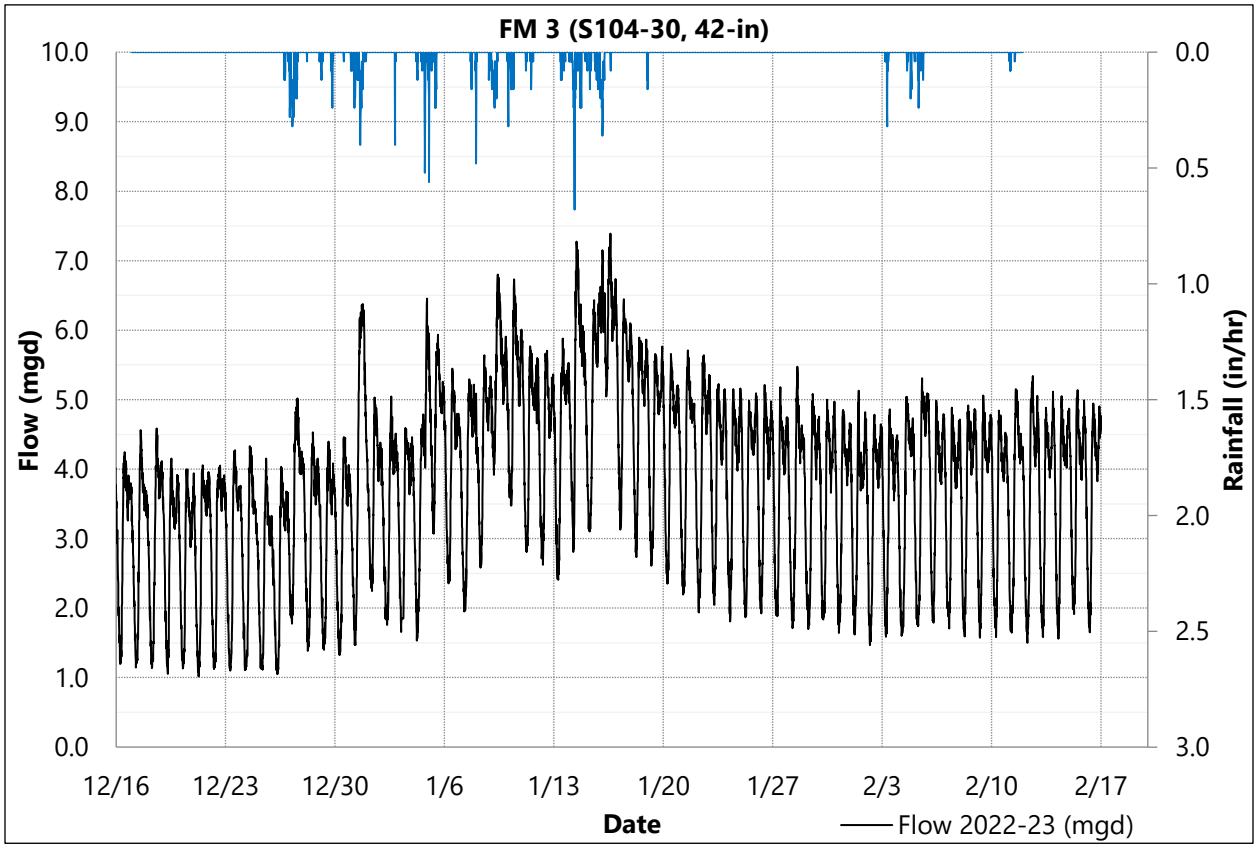
2.1.2 Flow Monitoring Data

During the flow monitoring program, V&A routinely inspected the flow meters as discussed above, and temporary flow meter data was uploaded on a regular basis to an online portal (Claros). Claros generates tabular reports and graphs of recorded level and velocity, as well as scattergraphs of level versus velocity. In addition to V&A's internal data review and quality analysis procedures, Woodard & Curran staff periodically reviewed the preliminary flow meter data over the course of the monitoring program to inspect for changes in flow indicating potential problems with the flow meter (e.g., debris buildup on the sensor), change in system operation, or customer discharges, or response to wet weather events. V&A provided "final" (quality controlled and adjusted data) after the conclusion of the program.

Two (2) of the temporary flow meters in the Chromite Drive and Machado Avenue area (FMs 11 and 28) experienced data loss during the flow monitoring period that coincided with wet weather events. Although the data loss occurred during periods with significant rainfall, there were still data available at these sites from other rainfall events that occurred during the flow monitoring period. V&A used the available data to recreate data for the missing periods.

Figure 2-3 shows typical plots of measured flow and rainfall for one flow meter for the flow monitoring period between December 2022 and February 2023. Plots of the flow monitoring data, including flow, velocity, and level, are provided for all meters as **Appendix A**.

FIGURE 2-3: PLOT OF TYPICAL FLOW DATA FOR 2022-2023 FLOW MONITORING PERIOD



2.1.3 Additional Monitoring for Dry Weather Flow Verification

In addition to the systemwide flow monitoring program conducted during the winter of 2022-2023, V&A also performed selective monitoring per direction from the City and Woodard & Curran as described below.

Review of the flow monitoring data versus model dry weather flows revealed that FM 12 was placed in the incorrect location during the initial winter 2022-2023 flow monitoring program. To remedy this, Woodard & Curran and the City requested that V&A collect one week of dry weather flow data at the correct location over the summer to enable confirmation of model dry weather flows.

Per the City's request, additional dry weather flow monitoring was also performed by V&A at eight (8) FM sites during a 7-day dry period from December 9-15, 2023 (site map included in **Appendix E**). The purpose of the additional flow monitoring was to confirm if the sewer system's routing of dry weather flows was in alignment with the City's normal operating conditions. The City's desire for confirmation was due to discrepancies observed during the winter 2022-2023 flow monitoring program and the previous flow monitoring program conducted during the winter of 2014-2015, which were identified during the model calibration process and are discussed further in **Section 3.3**.

2.2 Basis of Hydraulic Model's Wastewater Flow Estimates

This section presents the basis of wastewater flow estimates for the City's sanitary sewer system. It describes the wastewater flow components used in the hydraulic model and the existing and projected future land uses for the City, which form the basis for generating base wastewater flows that are applied to the model. Design flow estimates are based on criteria developed for three major flow components discussed below and confirmed through model calibration as described in **Section 3.3**.

2.2.1 Wastewater Flow Components

Wastewater flows include three components: base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I), as illustrated conceptually in **Figure 2-4**.

Base Wastewater Flow (BWF)

BWF represents the sanitary and process flow contributions from residential, commercial, institutional, and industrial users of the system. BWF varies throughout the day, but typically follows predictable diurnal patterns depending on the type of land use. (Note: the hydraulic modeling software refers to BWF as "foul flow.")

Groundwater Infiltration (GWI)

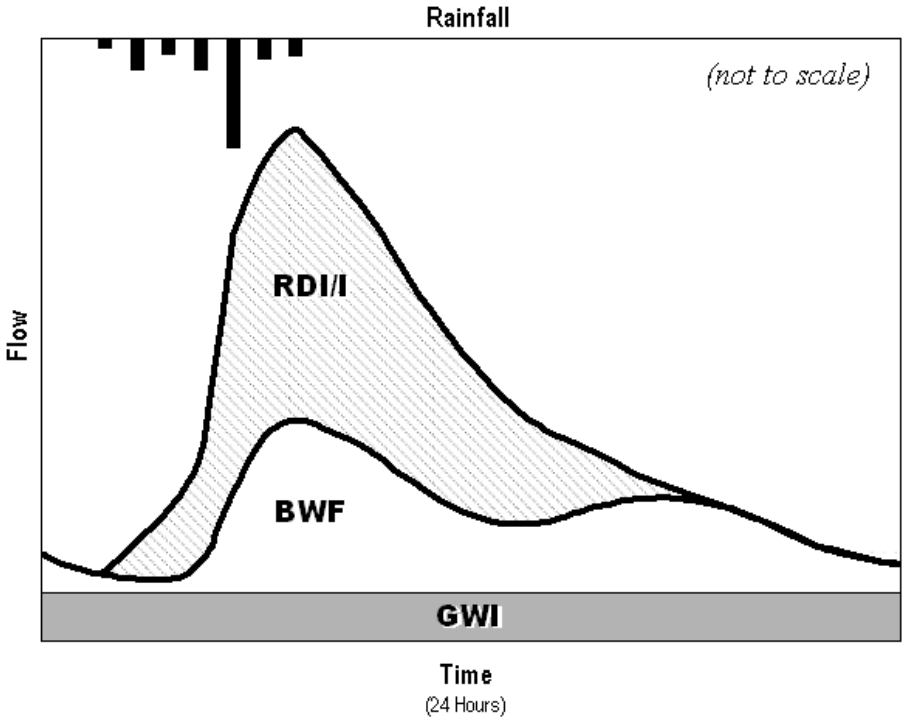
GWI is groundwater that infiltrates into defects in sewer pipes and manholes, particularly in winter and springtime in low-lying areas. GWI is typically seasonal in nature and remains relatively constant during specific periods of the year. However, rainfall typically has long-term impacts on GWI rates, as evidenced by measurable increases in GWI after prolonged periods of rainfall. (Note: the hydraulic modeling software refers to GWI as "baseflow.")

Rainfall-Dependent Infiltration and Inflow (RDI/I)

RDI/I is storm water inflow and infiltration that enter the system in direct response to rainfall events, either through direct connections such as holes in manhole covers or illegally connected roof leaders or area drains, or, more commonly, through defects in sewer pipes, manholes, and service laterals. RDI/I typically result in short term peak flows that recede relatively quickly after the rainfall ends. The magnitude of RDI/I

flows are related to the intensity and duration of the rainfall, the relative soil moisture at the time of the rainfall event, and the condition of the sewers.

FIGURE 2-4: WASTEWATER FLOW COMPONENTS



2.2.2 Base Wastewater Flow Estimates

For the City's Master Plan Update, BWF loads were developed for existing conditions, near-term future development conditions, and long-term future development conditions. Existing loads were developed based on average winter water use data from the City's customer billing records, and future loads were based mainly on specific, known development and redevelopment projects combined with the City's 2035 General Plan (GP) development forecast. The loading methodology for existing conditions and projected near-term and long-term future BWF are discussed further in the following subsections. A summary of the BWF loads associated with both existing and future land use conditions is presented in **Table 2-2**.

TABLE 2-2: SUMMARY OF BWF LOADS FOR EXISTING, NEAR-TERM, AND FUTURE CONDITIONS[1]

	Existing Conditions	Future Conditions	
Flow Component	Existing Load (mgd)[2]	Near-Term Load (mgd)	Long-Term Load (mgd)[3]
Residential BWF	6.72	10.11	13.58
Non-Residential BWF	4.49	6.09	15.48
Total Average BWF	11.21	16.20	29.06

[1]Does not include loads from CuSD, which are discussed in subsequent subsections.
[2]Estimated existing BWF calculated from winter water use data.
[3]Includes 5.09 mgd assumed for entitlement agreements, mostly for non-residential land uses.

2.2.2.1 Existing BWF Loads

Existing BWF was estimated based on actual water billing records exported from the City's customer billing database. The City's Information Technology (IT) group used the Esri ArcGIS software (GIS) to add location identifier fields to the raw billing data, including the assessor parcel number (APN) and service address.

Raw billing data were first processed to exclude non-wastewater generating accounts, which consisted of selecting only the billing data records with field "utility_type" equal to "S" for sewer. By isolating the sewer accounts, the metered potable water and recycled water accounts that do not generate sewer discharges (e.g., meters that serve fire, construction, or irrigation uses) were removed. The City also has customers who use domestic wells and/or recycled water; however, the BWF for these customers were assumed to be included in the sewer billing data per conversations with the City's finance department.

Each account's BWF was estimated based on the average water use for three winter periods (December through March) between December 2019 and March 2022. Metered water use during the winter months most closely approximates wastewater generation because outdoor water use is at a minimum. Each user was also assigned one of two land use types (i.e., residential or non-residential) according to the account's use category designation as shown in **Table 2-3**.

TABLE 2-3: LAND USE CLASSIFICATIONS AND EXISTING BWFS BY USE CATEGORY

Assigned Land Use	Use Category[1]	Use Category Description	Existing BWF (mgd)
Residential	SF	Single-family residential	3.20
	MF	Multi-family residential	3.52[2]
Non-Residential	CI	Commercial industrial	3.78[2]
	MU	Municipal	0.46
	MJ	Major sewer users	0.25
		Total	**11.21**

[1]Based on billing data field "CustomerType_Category".

[2]A portion of the customers assigned to the "CI" use category in the City's billing database were re-assigned to the "MF" use category for the purpose of estimating BWFs because they represented water use from multi-family residential buildings. Detailed land use descriptions based on the North American Industry Classification System (NAICS) were used to identify these customers.

The billing data were further processed in GIS for the purpose of associating each billing data point with its physical service location. Most water billing records were geocoded according to the APN from the City's land parcels dataset. Where parcel APN did not match between the parcel shapefile and the water billing data, billing records were geocoded according to service address. A visual assessment of the City's water meter locations and parcels using GIS confirmed that the data were available for most significantly developed parcels within the City. **Figure 2-5** shows the geocoded water billing data by customer type.

The procedure used to determine the loading point of each parcel is discussed in **Section 3.2.3**.

Existing Flow from Cupertino Sanitary District (CuSD)

CuSD provides sewer services for the majority of City of Cupertino, portions of the City of Saratoga, and several unincorporated areas within Santa Clara County adjacent to San Jose. Most of the flow is discharged into the Santa Clara system via a 27-inch sewer line in Homestead Road; the rest is discharged into the City of San Jose (CSJ) system at various other connection points.

CuSD maintains a permanent flow meter at its discharge point in Homestead Road. Meter data between December 2022 and February 2023 were reviewed and analyzed; based on the raw data, monitored average

dry weather flow (ADWF) and peak dry weather flow (PDWF), based on the period from December 17-23, 2022, were about 3.6 and 5.7 mgd, respectively. Similar to the declining trend observed for the City, CuSD's ADWF has also declined over 20% compared to the 2007 estimate of 4.9 mgd but increased slightly compared to the 2015 estimate of 3.5 mgd. The initial reduction can likely be explained by increased water conservation activities in response to drought and increased efficiency of water fixtures over time as new homes are built or existing homes are remodeled.

For the purposes of model calibration (discussed further in **Section 3.3**), the monitored flows were used as the BWF loads from CuSD in the model and were applied to the model network as inflow hydrographs. However, the raw CuSD flow data were adjusted (i.e., reduced by approximately 5% by volume, resulting in a revised ADWF closer to 3.45 mgd) when applied to the model because it was suspected that the CuSD flow meter was recording higher than actual flows. The CuSD flow meter was not calibrated prior to or during the City's flow monitoring period, whereas the temporary meters installed throughout the City were calibrated by V&A several times. Moreover, the summation of flow data recorded at FMs 19, 20, and 29 (downstream of CuSD) was less than the CuSD recorded flows prior to the adjustment.

Figure 2-5
Water Billing Data

Sewer Master Plan Update

Legend

- City of Santa Clara Boundary
- Billing Data
- Customer Type
  - CI - Non-Residential
  - MF - Residential
  - MJ - Non-Residential
  - MU - Non Residential
  - SF - Residential

0 0.25 0.5 1 Miles

N

Woodard & Curran

Project #: 0012307.00
Map Created: December 2024

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2.2.2.2 Future BWF Loads

Future loads, for both near-term and long-term projected land use conditions, were estimated based on development information tracked by Woodard & Curran, additional development information provided by the City, and unit flow factors developed for the 2016 Master Plan. The development of future load estimates, including the assumed unit flow factors, is discussed further in the following subsections.

Unit Flow Factors for Projected Future Development

Unit flow factors, which are representative of the typical per unit wastewater usage associated with a specific land use type, were referenced for the future load calculations. All unit flow factors used for the calculation are from the 2016 Master Plan and the San José-Santa Clara Regional Wastewater Facility (RWF) sewage coefficient table and are presented in **Table 2-4**, which also shows the associated density and floor-area-ratio (FAR) assumptions where applicable (i.e., for parcels associated with the City's 2035 General Plan). Unit flow factors were also calculated based on the recent billing data that were used to develop existing BWF loads. The multi-family residential unit flow factors calculated using the recent billing data were around 165 gallons per day per dwelling unit (gpd/DU) on average, which is comparable to the 2016 Master Plan unit flow factor values (i.e., 154 gpd/DU for apartments and 175 gpd/DU for condos and townhomes). However, the single-family residential unit flow factor calculated using the recent billing data (i.e., approximately 175 gpd/DU) was significantly lower compared to the 2016 Master Plan unit flow factor of 245 gpd/DU. The reduction observed in per unit water use consumption for single-family dwellings is reasonable considering that outdoor water use is higher for single-family residential customers and several water use restrictions have targeted outdoor water use and irrigation in response to prolonged drought conditions in California. However, for the purpose of this Master Plan Update effort, the City elected to use the single-family residential unit flow factor from the 2016 Master Plan, given that this is a planning exercise, and it is a more conservative assumption.

TABLE 2-4: UNIT FLOW FACTORS USED TO ESTIMATE FUTURE BWF LOADS

Land Use Category Description	Unit Flow Factor[2]	Density/FAR Assumed[3]
Very High Density Residential	121 gpd/DU	-
Apartments	154 gpd/DU	-
Corridor Mixed Use and Community Commercial (Residential)	154 gpd/DU	25 DU/acre
Regional Commercial Mixed (Residential)	154 gpd/DU	40 DU/acre
Condos and Townhomes	175 gpd/DU	-
Corridor Residential	175 gpd/DU	-
Single Family Residential	245 gpd/DU	-
Office (Low Density)	0.1 gpd/SF	-
Agricultural Open Space	0 gpd/SF	-
Retail	0.1 gpd/SF	-
Community	0.1 gpd/SF	-
Amenity	0.1 gpd/SF	-
Research and Development (R&D) Office and High-Density Office	0.15 gpd/SF	-
Daycare	0.183 gpd/SF	-

Land Use Category Description	Unit Flow Factor[2]	Density/FAR Assumed[3]
Police	0.21 gpd/SF	-
Swim center	0.3 gpd/SF	-
Retail Mixed or High-Density Retail	0.3 gpd/SF	-
Corridor Mixed Use (Non-Residential)[1]	0.335 gpd/SF	-
Regional Commercial Mixed (Non-Residential)[1]	0.335 gpd/SF	-
Fitness	0.42 gpd/SF	-
Beauty Parlor	0.47 gpd/SF	-
Hotel	0.48 gpd/SF or 100 gpd/room	-
Medical Office	0.51 gpd/SF	-
Restaurant (Small Food Service)	0.9 gpd/SF	-
Restaurant (Full Service)	1.04 gpd/SF	-
Public (Educational Facilities)	15 gpd/student or 0.21/SF	0.2
Theater	5 gpd/seat	-
Assisted Living Facility	77 gpd/bed	-
University Residences	70 gpd/bed	-
Medium Density Residential	154 gpd/DU	25 DU/acre
High Density Residential	154 gpd/DU	40 DU/acre
Low Density Residential	245 gpd/DU	25 DU/acre
Neighborhood Commercial (Residential)	154 gpd/DU	25 DU/acre
Parks/Recreation	0 gpd/SF	0.2
Neighborhood Commercial (Non-Residential)	0.1 gpd/SF	0.3
Community Commercial (Non-Residential)	0.1 gpd/SF	0.4
Regional Commercial (Non-Residential)	0.1 gpd/SF	0.5
Heavy Industrial	0.15 gpd/SF	1.25
Light Industrial	0.15 gpd/SF	0.85

[1] Unit Flow factor assumes 25% of full-service restaurants and 75% commercial.

[2] gpd = gallons per day. DU = dwelling unit. SF = square foot.

[3] Only used for the GP Phase 3 developments. For specific developments, the square footage was provided by the City or the developer.

BWF Loads for Near-Term Future Projected Development

A list of the near-term future development parcels as well as a figure depicting their locations are provided in **Appendix B**. Near-term future development parcels were identified based on a development tracking spreadsheet that Woodard & Curran created and updated regularly as part of the on-call hydraulic modeling services provided to the City, including near-term future load projections and several development reviews. In January 2023, the City Planning Department reviewed the spreadsheet and

updated the project development assumptions, including project status and timeline, number of units for projects with residential development and development square footage for projects with non-residential development, where applicable. If the City indicated that a specific development was "approved" or "under construction" as of January 2023, it was assumed to be a near-term future development. City Planning indicated a phased approach would be applied to some of the larger development projects associated with specific plans (e.g., Patrick Henry Drive), in which case a portion of the development was included in the near-term future loading scenario and the remainder was applied to the long-term future development scenario. The land use assumptions (e.g., number of units, office square footage) associated with development projects identified as near-term in the updated tracking spreadsheet were multiplied by the appropriate unit flow factors presented in **Table 2-4** to calculate the BWF loads. For near-term specific developments that were also associated with development reviews, the development reviews were referenced to confirm the calculated BWF loads.

When applying the near-term future BWF loads to the model, it was assumed that the existing BWF loads associated with the parcels identified as near-term developments would be replaced.

BWF Loads for Long-Term Future Projected Development

A list of the long-term future development parcels as well as a figure depicting their locations are provided in **Appendix B**. Long-term future development parcels were identified based on Woodard & Curran's development tracking spreadsheet discussed above and the City's 2035 General Plan assumptions. Some of the specific developments in the development tracking spreadsheet were assumed to be long-term future rather than near-term future, mostly in cases where projects were associated with specific plans (e.g., Patrick Henry Drive) and City Planning indicated a phased approach would be applied as discussed in the previous section. Like the near-term BWF loads, the BWF loads associated with the long-term future specific development projects were calculated based on the specific project's development assumptions and the corresponding unit flow factors. Parcels identified as Phase 3 developments in the City's 2035 General Plan were also identified as long-term future developments. Some parcels were removed from the original Phase 3 General Plan development parcels dataset, including parcels that were already associated with specific developments and parcels that had been removed from the General Plan based on feedback provided by City Planning. The General Plan designation field (GPLANCRT) of the General Plan parcels shapefile (*GeneralPlanParcels_Shapefile.shp*) provided by the City was used to assign the appropriate unit flow factors, density, and FAR assumptions to the Phase 3 parcels based on the corresponding land use. The long-term future BWF loads for the Phase 3 parcels were then calculated by applying those assumptions to the square footage (SF) of the parcel. For example, BWF loads for a parcel associated with a GPLANCRT of "Office (High Density)" were calculated by multiplying the area of the parcel by the unit flow factor (0.15 gpd/SF per **Table 2-4**) and the FAR (1.25 per **Table 2-4**).

BWFs for the long-term future development scenario also included flow assumptions for entitlement holders that discharge to the City's sewers. The City is obligated to provide sewer system capacity for entitlement holders up to the flows specified in the entitlement agreements. The City's billing database records show that many entitlement holders have historically discharged less than their flow entitlements; however, considering the City is required to provide capacity to these users should they have the need to increase their discharges, the long-term future BWF scenario conservatively assumes that all entitlement holders would make use of their full discharge allowances. Flow assumptions for entitlement holders were also included in the City's 2016 Master Plan. The City reviewed the entitlement flow assumptions that were included in the 2016 Master Plan and updated those assumptions for this Master Plan Update based on available information. The long-term future BWF scenario includes flow assumptions for entitlement holders totaling approximately 5.09 mgd, the vast majority of which is allocated to non-residential land users. In

limited cases where entitlement flow assumptions were applied to the same parcels with planned future development, the higher flow was applied. Therefore, where entitlement flows were assumed to be less than future flows, the more conservative future flows were used in the model for the long-term future scenario. The entitlement flow assumptions are documented in **Appendix B**.

When applying the long-term future BWF loads to the model, it was assumed that the existing BWF loads associated with the parcels identified as long-term developments would be replaced.

Future Projected Flow from Cupertino Sanitary District

Future projected load assumptions for CuSD were incorporated into Santa Clara's Master Plan Update based on the latest information available from CuSD's hydraulic model, which was most recently re-calibrated in 2023 by AKEL Engineering. CuSD exported the results from its re-calibrated hydraulic model and provided the flow hydrographs to Woodard & Curran for both near-term and long-term future development projections during both dry weather and wet weather flow conditions. Woodard & Curran created inflow hydrographs based on the results that were exported from CuSD's re-calibrated model; the magnitude of flows were maintained but the timing was slightly shifted to match the diurnal usage pattern observed in the flow monitoring data and to align the peak wet weather response where applicable. **Table 4-6** summarizes the wastewater flow assumptions applied to Santa Clara's hydraulic model to represent the future projected inflows from CuSD. Note that for the long-term future wet weather flow scenario only, the peak flow was conservatively scaled up to match the contractual limit defined in Santa Clara's agreement with CuSD which is equal to 13.8 million gallons per day (mgd).

TABLE 2-5: WASTEWATER FLOW ASSUMPTIONS FOR CUSD[1]

Flow Scenario	Average Dry (mgd)	Peak Dry (mgd)	Average Wet (mgd)	Peak Wet (mgd)
Near-Term Future	4.2	6.3	4.6	11.3
Long-Term Future	4.6	6.7	5.9	13.8[2]

[1]Based on CuSD's hydraulic model results for a seven (7) day period.

[2]Assumed to be contractual limit defined in agreement between Santa Clara and CuSD.

2.2.3 Groundwater Infiltration

GWI represents a seasonal increase in wastewater flows due to infiltration into the sewers, typically in low-lying areas or areas close to creeks or other water bodies. In the context of design flow criteria, GWI represents the incremental groundwater infiltration that occurs during the wet weather season which is in addition to the "baseline" groundwater level during the driest months of the year.

GWI is applied in the model as a constant flow in addition to the BWF. The amount of GWI in any particular area of the sewer system is determined during model calibration by comparing the modeled flows to the actual observed dry weather (non-rainfall period) flows at points in the system where flow data are available (e.g., at flow meter sites). Where modeled BWF is noticeably less than monitored dry weather flow by a constant value throughout the day, the difference is assumed to represent GWI. Note that because GWI is seasonal in nature, the modeled GWI is intended to represent a typical GWI rate during the wet weather season (wintertime) rather than a dry season (summertime) GWI. Typical wintertime GWI rates may range from about 100 to 1,000 gallons per acre per day (gpad).

The GWI determined at the monitoring location is then distributed to the upstream meter tributary area on a weighted per-contributing drainage area basis. For Santa Clara, contributing areas for most parcels were set equal to the total area of those parcels. For parcels identified as open space or parks, the contributing

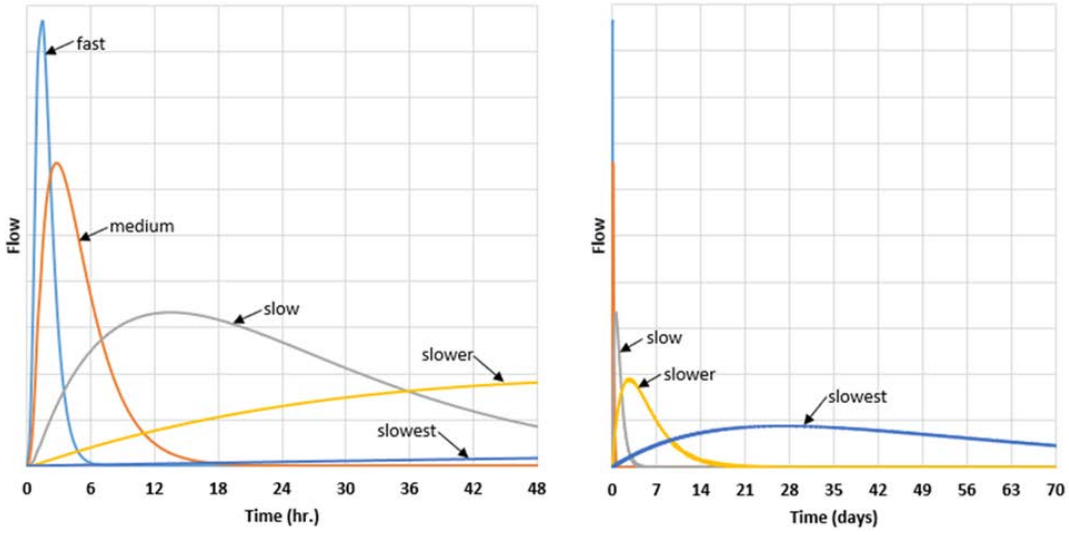
area was set equal to 0. For parcels identified as schools, the contributing area was assumed to be half of the total area to exclude grass sports fields from the contributing area calculation. All parcels with total areas greater than 5 acres were visually inspected, and the contributing area was zeroed out or reduced if it was determined that significant areas within those parcels did not contribute sewer flows.

2.3 Rainfall-Dependent I/I

RDI/I flows result from rainfall events that produce infiltration and inflow of storm water runoff into the sanitary sewer system. RDI/I can be quantified as the difference between the total flow during and immediately following a storm event and the non-rainfall "base flow" (BWF plus GWI) that is estimated to have occurred during the storm period. RDI/I varies depending on many factors including the magnitude and intensity of the storm event, area topography, type of soil and the degree of soil saturation (due to antecedent rainfall) prior to the storm event, and the condition of the sewers, manholes, and service laterals. RDI/I is usually expressed as a volume or a percentage of the rainfall volume (termed the "R value") entering the sewer system from subcatchment contributing areas for each of several flow components representing different response patterns to rainfall events (e.g., fast, medium, slow).

For this modeling effort, five RDI/I response components were used, with each component identified by a percentage of the total RDI/I volume and other parameters that reflect the timing of the flow response, as illustrated conceptually in **Figure 2-6**. The "fast" component of the hydrograph has the largest impact on the magnitude of the peak wet weather flow response, while the slower components can contribute significantly to the total volume of the RDI/I response. The slowest response component can extend out many days or weeks after the rainfall (alternately, this component could be represented as an increase in GWI). Summing all of the component hydrographs for the duration of the rainfall events results in the total RDI/I hydrograph for that area. R values and hydrograph parameters are determined through the process of wet weather model calibration, discussed in **Section 3.5** of this report, in which actual observed rainfall events are simulated in the hydraulic model, and the resulting model hydrographs are compared to the measured flows at the flow meter locations. The RDI/I parameters are adjusted as needed to achieve the best match of modeled to monitored flows. The same calibrated parameters are generally applied to all subcatchments within each meter area. Once calibrated, the model RDI/I parameters can be applied to a design storm to simulate wet weather flows for a design event.

FIGURE 2-6: RDI/I HYDROGRAPH COMPONENTS



3. HYDRAULIC MODEL DEVELOPMENT AND VALIDATION

This section provides an overview of the hydraulic modeling software and modeling terminology and describes the hydraulic model development and validation process, which includes discussion of the modeled sewer network and facilities as well as the methodology and results associated with calibration of the hydraulic model.

3.1 Hydraulic Modeling Software and Modeling Terminology

The modeling software used for development of the Master Plan Update hydraulic model was InfoWorks ICM™ by Autodesk (InfoWorks or ICM), a fully dynamic hydraulic model that was used for Santa Clara's 2016 Master Plan and the development reviews completed since as well as for many other wastewater systems in the Bay Area, including San Jose and Sunnyvale. InfoWorks uses the implicit method to solve fully dynamic equations of motion (St. Venant equations) for all pipe segments simultaneously at each time step. Detailed information regarding the model software and hydraulic theory (i.e., solution model, equation system, solver, and modeling features) can be found on Innovyze's help webpage[1]. Implicit solvers tend to be more stable than explicit solvers with pumping situations and perform better than explicit solvers when dealing with short pipes and loops in the network. Woodard & Curran used its own InfoWorks licenses for this work.

Key hydraulic modeling terms are defined below.

- **Network** refers to the representation of the physical facilities being modeled. Modeled network components include pipes, manholes, pump stations, etc.
- **Nodes** are primarily manholes, but also include pump station wet wells and outfalls (discharge points from the modeled system). Key data associated with nodes include manhole ground elevations and pump station wet well elevations and cross-sectional areas.
- **Pipes** or **conduits** are connections between nodes and include both gravity sewers and force mains. Key data associated with pipes are upstream and downstream node IDs, pipe length, diameter, roughness and headloss factors, and upstream and downstream invert elevations.
- **Pumps** are modeled individually, connecting pump station wet wells with the upstream node of associated force mains. Data associated with pumps include type (e.g., fixed or variable speed), on and off levels, pump capacities, and pump discharge curves.
- **Subcatchments** (also called **sewersheds** or **subbasins**) are areas that contribute flow to the modeled sewer network. Data associated with subcatchments include sanitary flow (computed based on population, water use, or other available data), type of diurnal sanitary flow profile (which is a function of land use), infiltration/inflow (I/I) parameters, and the node at which the flow from the subcatchment enters the modeled system.
- **Model loads** are the flows entering the modeled sewer system from each subcatchment. Model loads include residential and commercial sanitary or BWF, GWI, and RDI/I. As a sum, they represent the total sewer system flow applied to the model. Development of model loads is discussed in **Section 2.2**.

[1] Innovyze Help Menu Documentation on Hydraulic Model Theory, available online at: https://help2.innovyze.com/infoworksicm/Content/HTML/ICM_ILCM/Hydraulic_Theory.htm.

- **Models** are the combination of a modeled network, its associated subcatchments and loads, and other data (e.g., rainfall, diurnal profiles, inflows from other areas, etc.) that comprise a specific model scenario.

3.2 Hydraulic Model Network Development

The hydraulic model network includes the pipes, manholes, and other physical facilities that comprise the modeled sewer system. This section describes the modeled system, including how the sewer facilities are represented in the model, the data attributes that describe the facilities, and the processes for validating those data.

3.2.1 Modeled System

The hydraulic model network developed for this Master Plan Update includes all City-owned pipes within the sanitary sewer system based on the City's GIS data layers. Approximately 12 miles of privately-owned sewer mains were excluded from the model network; therefore, the network consists of about 276 miles of sewers, including 2.7 miles of force mains, or roughly 96% of the total 288 miles of sewer pipeline within the City's system. The hydraulic model also includes all seven sewage pumping stations. The 2016 Master Plan model was developed to represent the trunk or "backbone" of the sewer system and as such contained approximately 34% (or 94 miles) of the total length of the City's sewers. Woodard & Curran has maintained and updated the model as sewer improvement projects were implemented, development reviews were requested, or when new network data became available, and this Master Plan Update built on that work by significantly expanding the model network to include all City-owned sewer pipelines. A summary of the pipes and other facilities included in the hydraulic model network is presented in **Table 3-1**.

TABLE 3-1: SEWER SYSTEM MODEL PIPE SUMMARY

Pipe Diameter (in)	Total Length[1] (ft)
4-6	199,600
8-10	757,800
11-12	222,000
14-16	63,800
17-21	60,100
22-24	48,200
27-29	16,200
30	26,600
>30	47,700
Force Main	14,400
Total Length (feet)	1,456,400
Total Length (miles)	276
Approx. No. of Manholes	5,500
No. of Siphons	34 (59 barrels[2])

[1]Rounded to the nearest hundred feet.

[2]Some siphons have multiple barrels: Three (3) siphons have three (3) barrels, 19 siphons have two (2) barrels, and the remaining 12 siphons have a single barrel.

3.2.2 Model Network Construction and Validation

The updated and expanded model network was constructed using the City's current GIS files of the sewer system, network data from the previous trunk model, 2020 LiDAR ground elevation data, invert data obtained during previous master planning efforts on the small diameter pipes in the system, review of selected record drawings, and limited field investigations.

The GIS shapefiles were used to spatially define the model network, as well as to initially populate asset properties of pipe diameter, pipe length, and pipe material. Invert and rim elevation data were not included in the City's GIS data but are essential for the model. Therefore, elevation data were obtained from a combination of data sources.

For manhole rims, elevations were assigned based on LiDAR ground elevation data as obtained from the County of Santa Clara[1]. Elevations were adjusted from NAVD 88 to NGVD 29 by -2.69 feet based on the National Geodetic Survey Coordinate Conversion and Transformation Tool[2]. The same datum adjustment was used for the 2016 Master Plan and ongoing modeling studies.

For sewer pipe inverts, elevations were populated using the trunk model that was developed for previous master plan efforts (updated on an ongoing basis), small-diameter pipe invert elevations obtained during previous master planning efforts, and depth data from the City's current GIS (invert estimated by subtracting the depth from the inferred manhole rim), in order of priority. For areas with missing data or in areas where more information was needed to construct the model, additional as-built drawings and field investigations were requested and incorporated.

For sewer pipe diameters, diameters of trunk sewer pipes were assigned based on the trunk model that was developed for previous master plan efforts (updated on an ongoing basis). In select cases where as-builts from specific pipeline lining projects were available (e.g., along the Calabazas trunk near Kifer Road), diameters for lined pipes in the trunk system were updated to reflect their internal diameters. Nominal diameters were assumed for all other pipes. Diameters of small-diameter pipes (not included in the trunk model) were populated from the City's current GIS.

Several model construction and validation processes were applied to review the initial data that were imported into the model network. The goal of the review was to resolve potential connectivity and data entry errors associated with the GIS data. The result of the model construction and validation process was a fully connected, all-pipe model network representing the City's physical sewer infrastructure (i.e., pipes, manholes, and special structures) and sewer system inflows from individual parcels throughout the City (i.e., subcatchments).

Model construction and network validation processes included the following:

- The model network was checked for connectivity, i.e., verifying that correct upstream/downstream manholes were identified for each pipe and that there were no missing links in the network.
- Model special structures, such as siphons, sluice gates, weirs, orifices, and pumps were added as described in **Section 3.2.4**. As-built drawings and field data were used to develop details for

[1] Elevation data (2-foot resolution, hydro flattened digital terrain model (DTM) developed based on LiDAR) were published by the County of Santa Clara. The data are available for download here: https://www.arcgis.com/home/item.html?id=44a391b570a14d4687591fa2e89ebb11 (last updated October 2022).
[2] Tool used to determine height adjustments between vertical datums at specific locations of interest. Available online at: https://geodesy.noaa.gov/NCAT/.

the modeled pump stations, such as wet well elevations and dimensions, number of pumps, pump types, on/off levels, and discharge curves.

- Flow splits (manholes with more than one outlet pipe) were identified, and field verification and/or as-built drawings were requested as needed for further verification of outlet pipe elevations and/or the existence of weirs or other flow diversion structures (refer to **Section 3.2.4**).
- Manhole and pipeline network data, including rim and invert elevations and pipeline sizes, were assigned based on the following:
    - In select locations, record drawings for several pipelines were provided by the City and were used to refine elevation, size, and connectivity information. User text fields within the model were used to document the title of the referenced record drawing.
    - Where invert elevation data were missing or inconsistent with nearby elevations, and not determined through as-built information, interpolated values between known values were used as appropriate or pipe slope was used to infer invert elevations at the upstream ends of the system.
    - Elevation data in the as-builts were adjusted as needed to the NGVD 29 datum.
- Based on the data provided by the sources above, SQL scripts were created and run in order to identify missing or suspect data in the modeled network. Profiles were plotted for each series of pipe segments identified by the scripts to visually check for missing rim or invert elevations, negative or reverse pipe slopes, or abrupt steps up or down in pipe inverts. Where data indicated a discrepancy, an approach to resolve the discrepancy was identified and data were either interpolated or verified through field investigations conducted by the City or as-built drawings. Profiles were also plotted for major trunk sewers and a random subset of sewers within the system to check for missing or suspect data.
- The sources of model data (e.g., GIS, as-built/record drawings, survey/field investigation) were documented using "flags" in the model database.
- All gravity pipelines were modeled assuming a Manning's n of 0.013.
- Headloss coefficients for pipelines were inferred using InfoWorks ICM's "Inference Data Editor" tool, which infers the upstream and downstream headloss coefficients for a pipe based on the planar intersection angle at manholes or other model nodes. Larger intersection angles correspond to higher headloss coefficients.
- Model subcatchments were created to represent parcels and their wastewater discharges as discussed in **Section 3.2.3**.

3.2.3 Subcatchments

Model subcatchments define areas tributary to the modeled pipe network. For this new all-pipe model, each subcatchment represents a single assessor parcel within the City and "loads" to a pipe or pipes in the modeled network to define where flow from that parcel enters the sewer system. The model includes approximately 23,300 subcatchments, ranging in size from less than 1 acre to 110 acres.

To assign the load pipes to subcatchments, the laterals shapefile from the City's GIS was used. Load pipes were assigned to subcatchments based on proximity to the closest lateral and were defined as the sewer

pipe intersecting with the closest lateral. This process assigned a loading pipe to each of the parcels. A visual inspection complemented the process where parcels either did not have a lateral nearby or had multiple laterals. The load pipes are then refined as needed as part of the calibration process (discussed in **Section 3.3**). Additional discussion of model load development and allocation is provided in **Section 2.2**.

3.2.4 Special Structures and Flow Splits

Special structures discussed in this section include siphons, gates, weirs, and pumps. Some of these structures were not included in the GIS database of pipes and manholes and therefore were manually added to the model network based on their location. In most cases, the trunk model data were referenced when manually adding these special structures to the model network because most of the special structures were already included in the trunk model used for development reviews. The information specific to each structure that was extracted from the existing trunk network was complemented with information from as-built drawings and/or other information provided by the City where available. Overall, the trunk network included 26 weirs, three (3) gates (at two (2) manholes), and one (1) orifice. The all-pipe model network includes the same number of gates and orifices but two (2) additional weirs, so 28 weirs in total.

3.2.5 Pump Stations

All seven (7) of the City's sewage pumping stations are included in the model network. Pump data summary sheets provided by the City and available record drawings for the lift stations were used to configure the pump stations in the model. Pump on/off levels (converted to elevations) were based on the on/off wet well levels indicated in the pump station summary sheets and as-builts received as part of the 2016 Master Plan and updates received since. Firm capacity (i.e., capacity with the largest pump out of service) and total capacity for each pump station were estimated based on basic information, pump settings, pump curves, and system curves provided by the City. City staff confirmed that none of the pump stations are equipped with variable frequency drives (VFDs). **Table 3-2** presents a summary of modeled pump stations, including their estimated firm and total capacities; the calculations for which are provided in **Appendix C**. The locations of the City's pump stations are shown in **Figure 1-1**.

TABLE 3-2: SEWER SYSTEM MODEL PUMP STATION SUMMARY

No.	Pump Station Name	No. of Pumps	Firm Capacity (mgd)[1]	Total Capacity (mgd)
1	Westside	2	1.55[2]	2.53[2]
2	Tasman	2	1.61[2]	2.34[2]
3	De La Cruz	2	1.61[2]	2.52[2]
4	Primavera	6	5.72[2]	6.39[2]
5	Stadium	6	2.56[2]	2.68[2]
6	Rabello	8	25.4[3]	27.9[4]
7	Northside	4	19.8[3]	21.3[4]

[1] Firm capacity is defined as the capacity with the largest pump out of service.

[2] Theoretical firm and total capacities were estimated for Westside, Tasman, De La Cruz, Primavera, and Stadium Pump Stations based on basic information, pump settings, pump curves, and system curves provided by the City. Refer to **Appendix C** for detailed calculations for each pump station.

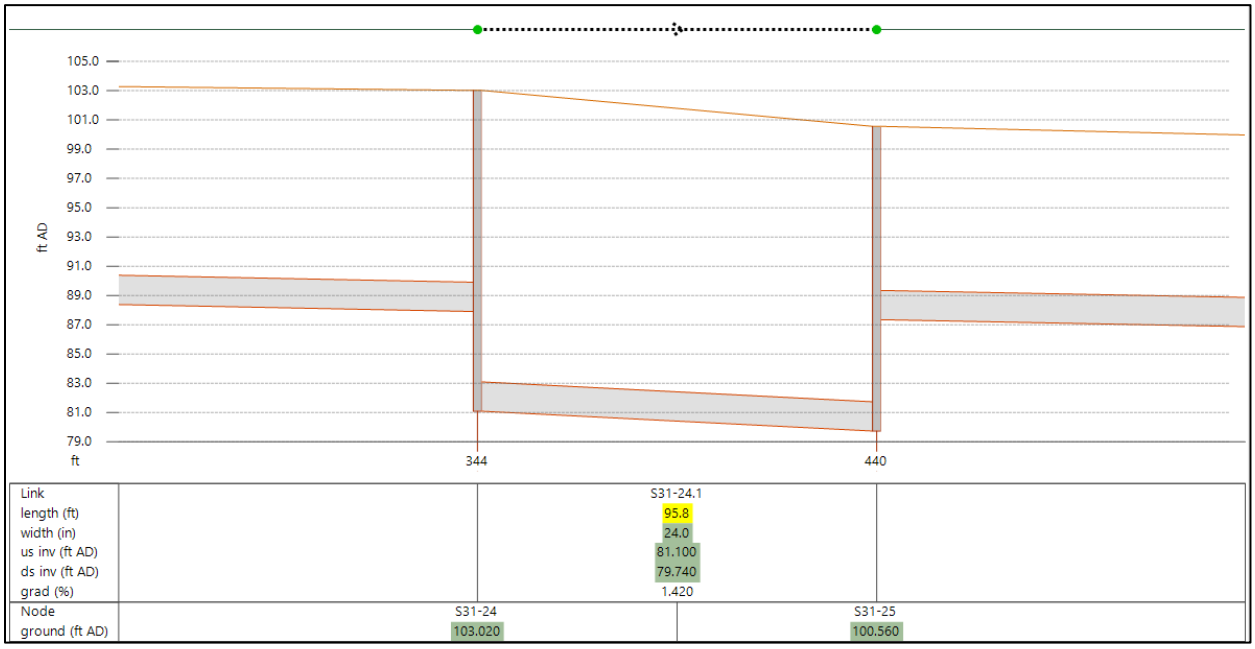
[3] Theoretical firm capacities for Rabello and Northside Pump Stations were estimated by Schaaf & Wheeler Consulting Civil Engineers (S&W) as reported in a memorandum titled "Northside and Rabello Pump Station Firm Capacity Evaluation", dated July 5, 2022.

[4] Theoretical total capacities for Rabello and Northside Pump Stations were estimated using excel spreadsheet tools developed by Schaaf & Wheeler as part of the firm capacity study (refer to footnote 3). System curves for total capacities were estimated based on inferred data because Schaaf & Wheeler did not collect test points with all pumps running.

3.2.5.1 Siphons

The model includes 59 inverted siphons ranging in diameter from 6 to 24 inches; 12 of these are single-barrel siphons, 38 are part of double-barrel siphons (i.e., at 19 locations), and 9 are triple-barrel siphons (i.e., at 3 locations). Siphons were added to the model as pipes with lengths that reflect actual siphon geometry as obtained from record drawings (sum of downslope, horizontal, and upslope portions). A sample siphon profile is shown in **Figure 3-1**.

FIGURE 3-1: SAMPLE SIPHON PROFILE



Siphons include downslope, horizontal, and upslope portions, but can be modeled appropriately without the downslope and upslope segments as shown in **Figure 3-1**. Record drawing information incorporated into the model includes siphon size, invert elevations, segment lengths and locations of the angle points. Where record drawings were not available, GIS data and/or other information provided by the City was referenced. The following rules were applied in the modeling of siphons:

- Siphons with two or more barrels were represented as separate pipes connecting to the same upstream and downstream nodes with diameter and elevations specified for each pipe.
- The friction factor (Manning's "n") was set to the same value (0.013) as those specified for gravity pipes elsewhere in the modeled system.

All siphons were assumed to operate under self-cleansing conditions preventing any major sediment build-up. Therefore, no sediment was included in the model siphons.

A list of the siphons included in the hydraulic model and the corresponding assumptions is provided in **Appendix F**.

3.2.5.2 Flow Splits

Flow splits, or diversions, are nodes in the system with two or more downstream pipes. The City collected survey information at key flow split locations that Woodard & Curran identified to confirm invert elevations, rim elevations, and flow conditions. The field-collected survey information (data sheets included as **Appendix D**) was used to update the model attribute information.

Examples of key connections, flow splits, and diversion structures include the following:

- Connection at Homestead Rd. and Swallow Dr. that sends CuSD's sewer flows to Santa Clara's system via a 27-inch sewer line.
- Diversion structure modeled to divert part of the flow going to Northside PS and to Rabello PS.
- Flume structure modeled to split the flow to the sewer going north on Lawrence Expwy and the sewer going east on Homestead Rd. (refer to **Figure 3-2**).

FIGURE 3-2: FLUME DIVERSION STRUCTURE TO HOMESTEAD RD. OR LAWRENCE EXPWY.

3.3 Model Calibration Process and Results

This section discusses the model calibration methodology and results. Model calibration is the process of comparing model-simulated flows to monitored (observed) flows and adjusting model parameters until a reasonably good match is achieved. It is not expected that the calibration results in an exact match between modeled and observed flows at every meter at all times; however, modeled flows at most meters should reasonably match the flow volumes and peak flows in the observed data. Model calibration was achieved first through comparing modeled versus metered flows during a dry weather (non-rainfall) period to achieve an accurate prediction of BWF and GWI, and then during a wet weather period to estimate the RDI/I response.

3.4 Dry Weather Flow Calibration

This section discusses the methodology and procedures used to calibrate the model for dry weather flow conditions and presents the results of the dry weather calibration.

3.4.1 Dry Weather Flow Calibration Methodology

The goal of dry weather calibration is to confirm that the modeled flows and hydraulic conditions are reasonable compared to the metered flows during non-rainfall periods. Dry weather calibration is an iterative process; if legitimate differences are found between modeled and metered flows, these differences are investigated, and adjustments would be made to the modeled flows as appropriate.

The general approach to dry weather flow calibration was as follows:

1) **Confirm overall model loads match metered flows**. Compare total model flows to metered flows at the most downstream flow meters (FM1, FM2, FM3). If significant discrepancies are identified, review the model loads and billing data for major issues. Investigate and resolve issues.
2) **Compare modeled and metered average flows to identify major discrepancies**. Starting at the upstream ends of the system and continuing downstream until the model outfall, identify any flow meters where the difference between average modeled and metered flows is greater than 30%. If discrepancies are identified at a meter, review the tributary model loads and associated billing for major issues and/or flow routing at flow splits and diversion structures. Investigate and resolve issues.
3) **Compare modeled and metered average flows to identify modest discrepancies**. Starting at the upstream ends of the system and continuing downstream until the model outfall, identify any flow meters where the difference between average modeled and metered flows is between 10% and 30%. If discrepancies are identified at a meter, review parcel loading assignments, major dischargers, or need to use a return factor or discharge cap for selected residential customers. Some modest discrepancies in average flows could be due to the need to add GWI, which are considered in conjunction with review of diurnal patterns. Investigate and resolve issues.
4) **Compare modeled average flows to pump station SCADA**. If hourly pump station SCADA are available, compare the data to modeled flows.
5) **Review diurnal patterns**. Balance adjustment of diurnal patterns with the need to add constant GWI. Adjust patterns as needed or as available information allows for large users (customers with average water use above 50,000 gpd), permitted industrial dischargers (particularly those with batch discharges), and event venues with highly variable use (e.g., Levi Stadium).
6) **Review flow monitoring and model surcharge status**. If the model predicts any surcharge during DWF, those locations should be reviewed for potential network data errors.

For meters that are downstream of multiple other meters, a flow balance was performed to confirm that the total upstream metered flow is less than or equal to the downstream metered flow (e.g., if FM 3 is downstream of FM 1 and FM 2, then FM 1 flows + FM 2 flows should be ≤ FM 3 flows).

3.4.1.1 Review of Largest Water Users

A total of 22 accounts with average winter water use of over 50,000 gpd were identified based on the billing data, which are summarized in **Table 3-3** and shown in **Figure 3-3**. During calibration, average flows from these large users were reviewed. Only base flows from the account located at 444 Saratoga Avenue were adjusted from the initial water consumption value presented below to better match modeled and metered flows; base flows were reduced by approximately 20% because an 80% return factor was applied to the FM 22 tributary area as discussed in **Section 3.4.2**. This adjustment was reasonable given that it is a very large multi-family residential property with a significant amount of irrigated landscape surrounding the 468 units. Several of these large users were assigned distinct diurnal patterns as discussed in **Section 3.4.1.2**.

TABLE 3-3: CITY'S LARGEST WATER USERS (WATER USE GREATER THAN 50,000 GPD)

Account Holder	Account No.	Address	APN	Customer Type[2]	NAICS Class Description[3]	Avg Water Use (gpd)[4]
ELEC DEPT	72271	850 Duane Ave	224-08-153	MU	Other General Government Support (Power Plant)	345,810
CALIFORNIA PAPERBOARD	63199	525 Mathew St	230-03-090	MJ	Paperboard Mills	239,508
INTEL CORPORATION	64334	3065 Bowers Ave	216-46-015	CI	Semiconductor & Related Device Manufacturing	137,542
THE IRVINE COMPANY LLC	82043	3355 Octavius Dr	216-45-058	CI	Lessors of Nonresid. Build. excpt Miniwarehou	125,548
SUMMERHILL LAWRENCE LLC[1]	81664	3494 Toomey Pl	216-60-025	CI	New MF Housing Const Excpt Operative Builders	119,422
CORESITE CORONADO STENDER LLC	62292	3035 Stender Wy	216-29-084	CI	Bare Printed Circuit Board Manufacturing	115,565
ELEC DEPT	64922	524 Robert Ave	230-03-067	MU	Other General Government Support (Power Plant)	115,177
KAISER PERMANENTE	68692	702 Lawrence Expy	316-09-046	CI	General Medical and Surgical Hospitals	109,415
SUMMERWOOD AT SARATOGA CA INC	64126	444 Saratoga Ave	294-04-000	MF	Lessors of Residential Buildings and Dwelling	101,166
APPLIED MATERIALS	64284	3300 Scott Blvd	216-49-024	CI	Semiconductor & Related Device Manufacturing	100,189
INTEL CORPORATION	64352	2150 Mission College Blvd	104-48-010	CI	Semiconductor & Related Device Manufacturing	89,168
3515-3585 MONROE STREET LLC[1]	76100	3555 Monroe St	216-25-008	CI	New MF Housing Const Excpt Operative Builders	83,570
VANTAGE DATA CENTERS LLC	64337	2880 Northwestern Pkwy	216-28-133	CI	Semiconductor & Related Device Manufacturing	83,110
STREAMLINE CIRCUITS CORP	62970	1415 Richard Ave	224-06-170	CI	Bare Printed Circuit Board Manufacturing	73,936

Account Holder	Account No.	Address	APN	Customer Type[2]	NAICS Class Description[3]	Avg Water Use (gpd)[4]
APPLE INC	76270	3250 Scott Blvd	216-29-117	CI	All Other Business Support Services	63,907
CYXTERA DATA CENTERS INC	61293	4650 Old Ironsides Dr	104-04-077	CI	Data Processing, Hosting, & Related Services	61,571
WOODSBOROUGH HOMES ASSOC	64115	950 Kiely Blvd	290-62-000	MF	Othr Orgs (HOA, TOA, Tennant Assoc&Similar)	59,979
DIGITAL REALTY TRUST LP TOTALZ	78636	2220 De La Cruz Blvd	230-03-108	CI	Data Processing, Hosting, & Related Services	59,632
SANTA CLARA UNIVERSITY	64018	500 Lafayette St	269-38-090	CI	Rooming and Boarding Houses	57,109
FUJIFILM DIAMATIX INC	82985	2230 Martin Ave	224-10-126	CI	R&D in Physical, Engineering & Life Sciences	53,903
PROMETHEUS REAL ESTATE MS #2	61640	4101 Lick Mill Blvd	097-08-100	MF	Lessors of Residential Buildings and Dwelling	53,215
APCT INC	61520	3495 De La Cruz Blvd	101-15-033	CI	Radio&TV Broadcast&Wireless Comm Equip Manuf	51,944

[1]Recent new construction.

[2]MU = Municipal; MJ = Major User; CI = Commercial Industrial; MF = Multi-Family Residential.

[3]NAICS = North American Industry Classification System. Federal standard used to classify businesses by type.

[4]Estimated based on winter water use billing data ("utility_type" = sewer records from December 2021 - March 2022). May not correspond directly with the largest sewer dischargers, especially in cases where large volumes of water may be used onsite and therefore not discharge to the sewer system (e.g., data centers). Sewer flows from large users are reviewed and updated as appropriate during the dry weather calibration procedure.

Figure 3-3
Top Water Users

Sewer Master Plan Update

PROMETHEUS REAL ESTATE MS #2
CYXTERA DATA CENTERS INC
INTEL CORPORATION
APCT INC
APPLIED MATERIALS
THE IRVINE COMPANY LLC
APPLE INC
SUMMERHILL LAWRENCE LLC
CORESTIE CORONADO STENDER LLC
INTEL CORPORATION
ELEC DEPT
VANTAGE DATA CENTERS LLC
NVIDIA CORP
3515-3585 MONROE STREET LLC
FUJIFILM DIAMATIX INC
STREAMLINE CIRCUITS CORP
ELEC DEPT
CALIFORNIA PAPERBOARD
DIGITAL REALTY TRUST LP TOTALZ
SANTA CLARA UNIVERSITY
WOODSBOROUGH HOMES ASSOC
KAISER PERMANENTE
SUMMERWOOD AT SARATOGA CA INC

0 0.25 0.5 1 Miles

N

bing

Legend

Largest Water Users (greater than 50,000 gpd)

City Boundary

Trunk Mains

Gravity Main

Force Main

Small Diameter Mains

Woodard & Curran

Project #: 0012307.00
Map Created: December 2024

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions.
Any reliance upon the map or data contained herein shall be at the users' sole risk.

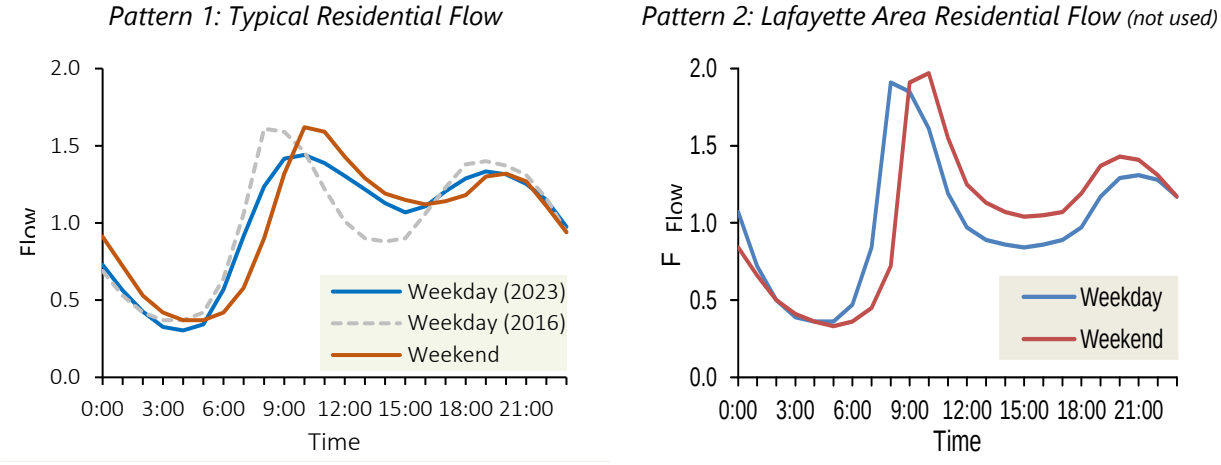
Figure Exported: 12/31/2024 By: SEstabrook Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2024_Report.aprx

3.4.1.2 Diurnal Pattern Development and Refinement

In most sewer systems, BWF typically exhibits distinctive diurnal patterns depending on the land use, usually categorized as residential and non-residential. BWF varies throughout the day in a typical way, generally peaking early in the morning in most predominantly residential areas. Typical hourly peaks from residential areas tend to be about twice the average flow. Higher peaks can occur on atypical days of the year (e.g., on major holidays such as Thanksgiving or at halftime on Super Bowl Sunday). For Santa Clara's sewer model, typical diurnal patterns were developed for residential and commercial/industrial (i.e., non-residential) wastewater flows for both weekend and weekday conditions. Additional non-residential patterns were also developed for specific large users. The patterns were applied to the subcatchment BWF in the model based on the subcatchment's land use and location.

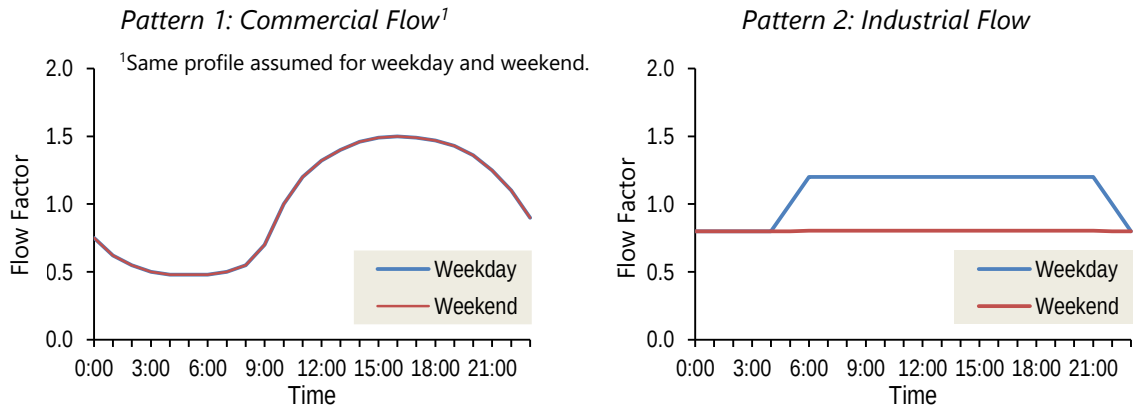
During the dry weather calibration process, the typical residential and non-residential diurnal patterns developed were reviewed and updated accordingly based on a comparison of modeled versus metered flow data. The typical residential diurnal pattern developed for the 2016 Master Plan (shown in **Figure 3-4**) was adjusted to better match the more recent flow meter data, which showed a later and less peaky residential morning peak that can likely be explained by lifestyle changes associated with the COVID-19 pandemic including work-from-home trends. Diurnal patterns exhibited at specific meters that receive predominantly residential flows (e.g., FM 22) were reviewed to refine the residential diurnal curve. The residential diurnal curve that was developed for the Lafayette Area (northeastern part of the City in the vicinity of Lafayette St. and Montague Expwy.) during the 2016 Master Plan (shown in **Figure 3-4**) was also reviewed and compared to the flow monitoring data. Based on the comparison, it was not evident that this distinct, peakier pattern was still an appropriate representation of base flows from this area, so it was removed from the model.

FIGURE 3-4: RESIDENTIAL DIURNAL PATTERNS



Similarly, typical non-residential diurnal patterns developed for the 2016 Master Plan (shown in **Figure 3-5**) were reviewed based on a comparison between modeled versus metered flow data. Specifically, diurnal patterns exhibited at meters that receive predominantly non-residential flows (e.g., FM 17) were reviewed to determine if refinement of existing and/or development of alternate non-residential diurnal curves was warranted. Based on the review, it was determined that the non-residential curves used for the 2016 Master Plan were still an appropriate representation of the typical base flows, so no adjustments were made.

FIGURE 3-5: NON-RESIDENTIAL DIURNAL PROFILES



Operational information regarding sewer discharge patterns for permitted industrial dischargers within the City was obtained during the 2016 Master Plan and was used to create individual non-residential diurnal curves for specific dischargers at that time based on batch discharge information indicated on their wastewater discharge permits or surveys. Individual diurnal patterns developed during the 2016 Master Plan were applied to the following specific non-residential dischargers: Levis Stadium (assuming a 1:00 pm home game), Great America Waterpark, Agilent, Digital LLC, Oracle, City Electric Department (power plants), Applied Material, Owens Corning, APCT Inc., Marvell Semiconductor, Intel, and Streamline Circuits. Woodard & Curran attempted to obtain more recent batch discharge information for permitted industrial dischargers from the City of San Jose but was unsuccessful. However, based on review of the modeled versus metered flow data, the individual patterns obtained for the 2016 Master Plan and applied to specific non-residential dischargers in the model reasonably represented their base flows.

3.4.2 Base Flow Adjustments and Addition of GWI

To better match the modeled and metered flows, some base flow adjustments were applied during the dry weather calibration process. Existing base loads from residential customers, both single-family and multi-family, were capped at a maximum of 300 gpd/dwelling unit. Even though the loads were developed using winter water use billing data (typically the season with the lowest outdoor irrigation), it is likely that some outdoor irrigation is still occurring, so this cap on residential water use was applied to reduce the impacts of excessive outdoor irrigation. Additionally, a return factor, which represents the proportion of water used that is returned to the wastewater system, was considered for the basins where modeled base flows were significantly higher than observed flows. A return factor of 80% was applied to the base flows from upstream basins that primarily collect sewer flows from single-family residential properties (FMs 21, 22, and 23) also to try to remove outdoor irrigation from the water use data to better match modeled and metered flows. A similar return factor was applied to these upstream basins during the 2016 Master Plan effort.

After the base flows adjustments described above were applied, GWI was then added when the observed (metered) dry weather hydrographs were greater than the model-simulated hydrographs by a relatively constant value throughout the day. A total of 0.158 mgd of additional GWI flow was applied to the system uniformly throughout 2 of the 32 flow meter areas at a rate of 250 gpad for FM 26 and 1,800 gpad for FM 31. It should be noted that it may be difficult to assess the actual amount of GWI in any given area, as the relative accuracy of the flow monitoring data, water consumption data, and other model assumptions may affect the amount of flow attributed to GWI. However, this methodology is considered adequate for modeling purposes. It should be noted that this estimate is representative of early-season GWI; however, GWI typically increases throughout the wet weather season as the soil progressively becomes saturated as

more rainfall occurs. Late-season GWI or extended rainfall-dependent infiltration is accounted for during wet weather calibration.

3.4.3 Dry Weather Flow Calibration Results

The seven (7) day dry period from December 17 through December 23, 2022 was used as the primary dry weather calibration period for comparing flow data from the 2022-2023 flow monitoring program to the model results. The primary focus of the dry weather calibration was to confirm that the calculated average BWF based on winter water consumption was consistent with the measured flows at the meter locations. The other objectives of the dry weather calibration were to confirm the flow routing in the system, particularly in areas where flow can be diverted in more than one direction (flow splits), as well as to confirm the diurnal profiles used to represent the hourly variations in BWF. The diurnal curves shown in **Figure 3-4** and **Figure 3-5** were developed and/or confirmed based on the calibration.

Table 3-4 compares the model versus meter average dry weather flows at the downstream most flow meters, **Table 3-5** and **Table 3-6**, respectively, compare the model versus 2022-2023 and 2014-2015 meter average dry weather flow at each meter location, and **Figure 3-6, Figure 3-7**, and **Figure 3-8** show plots of model versus metered dry weather flow for the total flow at the downstream-most meters (FM 1, FM 2, and FM 3, respectively). In these graphs, the green line represents the monitored (observed) flow, and the red line represents the model-simulated flow. Dry weather calibration plots of model-predicted versus metered flows at all flow meter locations for both 2022-2023 and 2014-2015 are provided as **Appendix E**.

As indicated in **Table 3-5**, the dry weather model calibration resulted in a reasonably good match of modeled to metered flow (within 10% at the downstream most flow meters). A comparison of 10% is considered a good match due to fluctuations in flows typically observed over time, as well as potential errors inherent in metering flows in a field environment. At meters with very low flows, small differences between modeled and metered flows can result in a relatively large percent difference; therefore, at these meters (e.g., FM 30), modeled flows within 0.1 mgd of the meter data were also considered a good match.

However, it should also be noted that review of the 2022-2023 flow meter data and comparison to the 2014-2015 data collected for the 2016 Master Plan revealed significant differences that, upon further investigation, were determined to be caused by temporary system conditions that were not representative of typical operations. The initial calibration showed significant, unexpected differences between modeled and metered flows along the Calabazas and Bowers trunks downstream of the Lawrence/Homestead gate structure (pictured in **Figure 3-2**). Through additional review of flow data collected for the 2016 Master Plan; system data and potential flow split locations; and field investigation by City staff, it was determined that the likely cause of the differences was two-fold. First, the Lawrence/Homestead gate structure was likely clogged with rags during the flow monitoring period, causing more flow than expected to be routed to the Calabazas trunk. Second, it was surmised that some issue in the Calabazas trunk (possibly a temporary blockage) caused significant surcharging, enough to reach the level that would route flows away from the Calabazas trunk and into the Bowers trunk through a higher-level split at El Sobrante. Moreover, this second condition seemed to change over time, with significant shifts in metered flows observed at FM 9A, with corresponding shifts at FM 13. These temporary, atypical system conditions that were present during the 2022-2023 flow monitoring period are discussed further in **Section 3.4.3.1**.

The dry weather calibration results presented in **Table 3-5** are based on a model run that attempted to replicate the first difference (clog at the Lawrence/Homestead gate structure), but the second difference (Calabazas trunk backup into Bowers trunk) could not be replicated in the model because although a blockage was suspected based on the data, it was not identified or confirmed at a specific location. Given that the dry weather calibration should be performed assuming normal operating conditions, the 2014-

2015 flow meter data was also compared to the dry weather model calibration results (with the Lawrence/Homestead gate structure settings back to normal) for the locations affected by the two issues discussed above. **Table 3-6** presents the results of that comparison.

TABLE 3-4: DRY WEATHER FLOW CALIBRATION RESULTS SUMMARY[1]

FM IDs	Discharge Location	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[2]	Difference (%)[2]
1+2+3	Lafayette and GAP[3] Trunks (FM 1+FM 2+FM3)	10.54	10.09	-0.45	-4.3%
16+17+18+25	Trimble Trunk (FM16+FM17 + FM18 + FM25)	4.65	4.46	-0.19	-4.1%

[1]Model results are compared to the 2022-2023 flow monitoring data.
[2] Difference is reported as model flow minus meter flow.
[3] GAP = Great America Parkway.

TABLE 3-5: DRY WEATHER FLOW CALIBRATION RESULTS VS. 2022-2023 FLOW MONITORING DATA[1]

FM ID	GWI (gpad)	Return Factor Applied (%)[2]	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[3]	Difference (%)
1	-	-	2.91	2.91	<-0.01	0.1%
2	-	-	4.71	4.57	-0.14	-3.0%
3	-	-	2.92	2.61	-0.31	-10.6%
4[4]	-	-	0.03	0.04	0.01	33.3%
5	-	-	2.93	3.11	0.18	6.1%
6	-	-	2.75	3.69	0.94	34.2%
7[5]	-	-	1.10	0.83	-0.27	-25%
8	-	-	1.46	1.51	0.05	3.3%
9A	-	-	2.24	3.52	1.28	57.1%
10	-	-	0.65	0.65	<0.01	0.2%
11	-	-	0.77	0.89	0.11	15%
12	-	-	0.83	0.90	0.07	8.3%
13	-	-	2.10	2.05	-0.05	-2.5%
14	-	-	0.41	0.46	0.05	12%
15	-	-	0.23	0.24	0.01	5.8%
16	-	-	1.46	1.35	-0.11	-7.5%
17	-	-	0.77	0.92	0.14	19%
18	-	-	1.18	0.97	-0.21	-18%
19	-	-	2.65	2.78	0.13	4.7%
20	-	-	0.42	0.50	0.08	19%
21	-	80%	0.89	0.95	0.06	6.5%
22	-	80%	0.82	0.87	0.04	5.4%
23	-	80%	0.59	0.66	0.07	12%

FM ID	GWI (gpad)	Return Factor Applied (%)[2]	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[3]	Difference (%)
24	-	-	2.39	2.58	0.19	8.2%
25	-	-	1.24	1.22	-0.02	-1.9%
26	250	-	0.55	0.55	<-0.01	0.4%
27	-	-	0.02	0.02	<-0.01	-6.6%
28	-	-	0.08	0.06	-0.02	-22%
29	-	-	0.20	0.23	0.03	15%
30	-	-	0.04	0.05	0.01	25%
31	1,800	-	0.24	0.23	-0.01	-6.3%
32 (CuSD)[6]	-	-	3.63	3.45	-0.18	-5.0%

[1] Model results are compared to the 2022-2023 flow monitoring data and assume a blockage at the Lawrence/Homestead gate structure.
[2] Return factors applied are based on incremental areas (i.e., do not include flows that are upstream of the tributary area).
[3] Difference is reported as model flow minus meter flow. Rounded to nearest 0.01 mgd.
[4] Flow data were highly variable due to impact from Levi's Stadium events.
[5] Flow data were likely impacted by backwater influence from the Primavera Pump Station. Raw data showed frequent spikes in flow.
[6] Raw flow data from CuSD's permanent flow meter were reduced by approximately 5% when applied to the model as discussed in **Section 2.2.2.1**.

TABLE 3-6: DRY WEATHER FLOW CALIBRATION RESULTS VS. SELECT 2014-2015 FLOW MONITORING DATA[1]

FM ID	GWI (gpad)	Return Factor Applied (%)[2]	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[3]	Difference (%)
2	-	-	4.05	4.72	0.67	16.5%
3	-	-	2.98	2.79	-0.19	6.4%
5	-	-	3.94	4.13	0.19	4.8%
6	-	-	2.65	3.00	0.35	13.2%
7	-	-	0.88	0.82	-0.06	-6.8%
9[4]	-	-	2.00	2.66	-0.66	33.0%
13	-	-	3.50	3.07	-0.43	-12.3%

[1] Model results are compared to the 2014-2015 flow monitoring data and assume normal settings (no blockages) at the Lawrence/Homestead gate structure.
[2] Model BWF values and return factors applied are based on incremental areas (i.e., do not include flows that are upstream of the tributary area).
[3] Difference is reported as model flow minus meter flow. Rounded to nearest 0.01 mgd.
[4] Located upstream of FM 9A but still along the Calabazas trunk and downstream of El Sobrante overflow connection.

FIGURE 3-6: DRY WEATHER CALIBRATION GRAPH (FM 1)

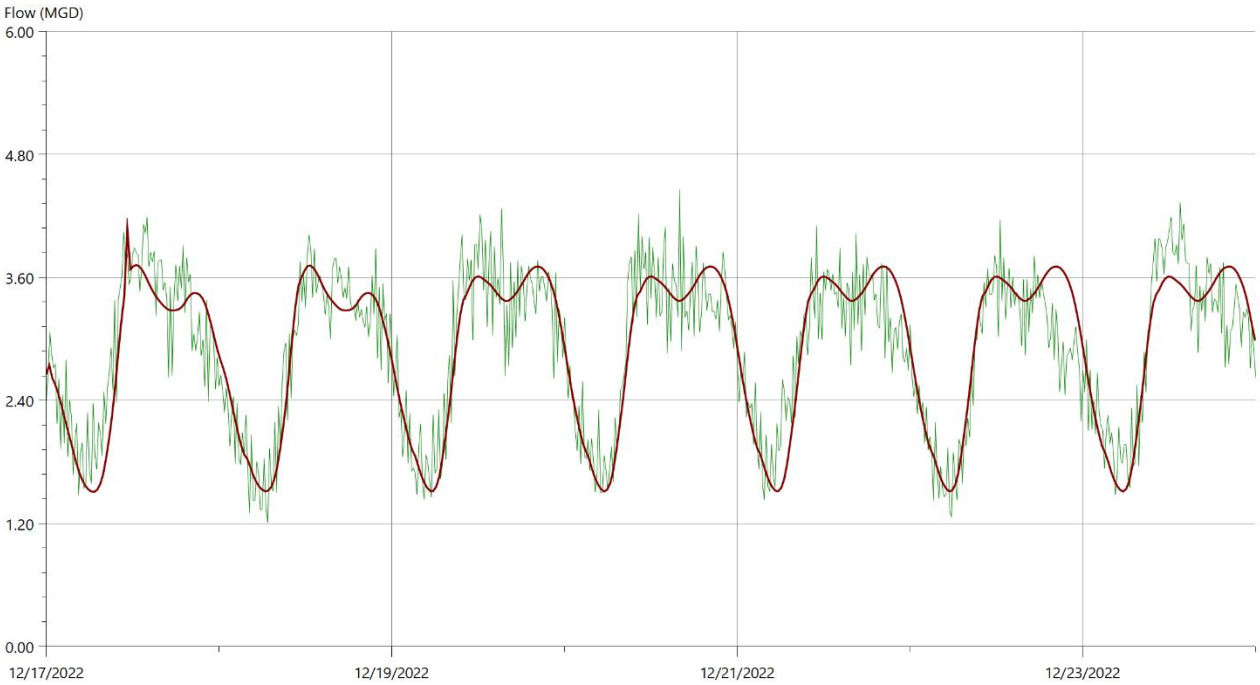


FIGURE 3-7: DRY WEATHER CALIBRATION GRAPH (FM 2)

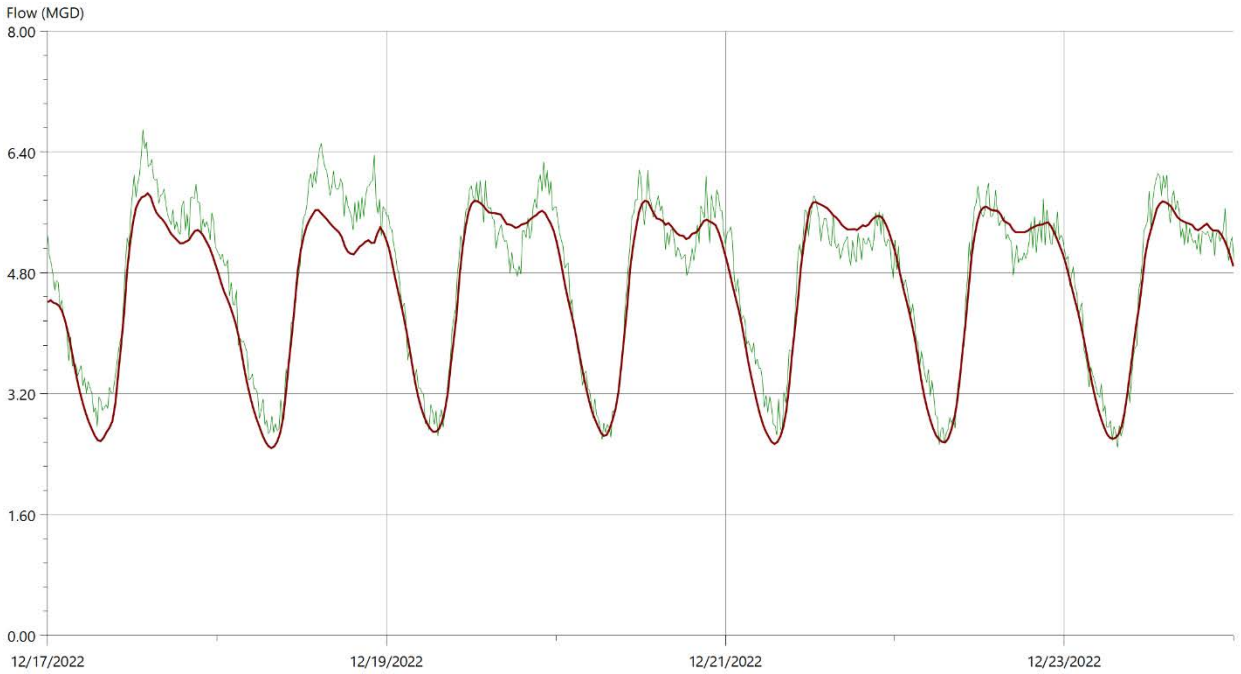


FIGURE 3-8: DRY WEATHER CALIBRATION GRAPH (FM 3)

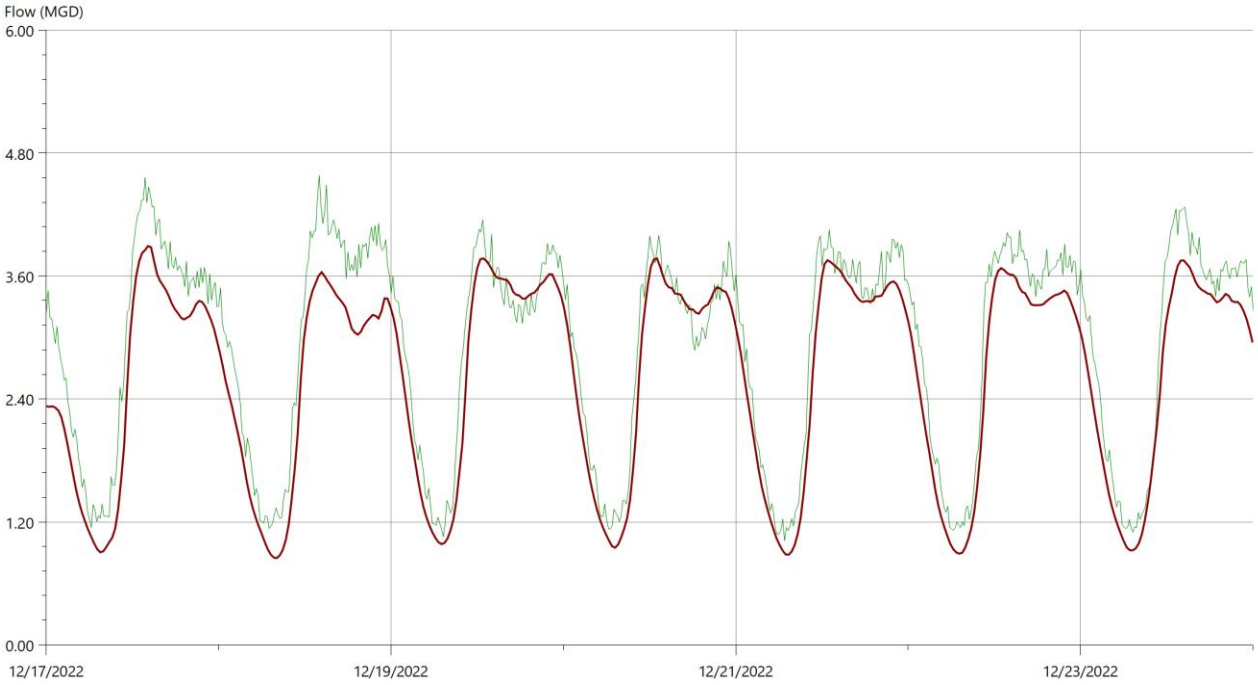


Table 3-7 summarizes the total estimated dry weather flow (DWF) within Santa Clara's sewer system based on the model calibration and the existing loads described previously.

TABLE 3-7: DRY WEATHER FLOW SUMMARY (EXISTING CONDITIONS)

Flow Component	Flow (mgd)
City Residential BWF	5.69
City Non-Residential BWF	5.53
CuSD Total BWF[1]	3.45
Total Average BWF	**14.67**
Estimated GWI[2]	0.16
Total Average DWF	**14.83**

[1]Average modeled daily dry weather flow from CuSD based on dry weather calibration period from **Table 3-5**.
[2]Calculated based on difference between metered non-rainfall period flows and estimated BWF calculated from winter water use data.

3.4.3.1 Differences Between 2022-2023 & 2014-2015 Flow Monitoring Data

During the dry weather calibration and review of the flow monitoring data, Woodard & Curran identified significant differences between the 2022-2023 and 2014-2015 flow monitoring data at the following meters:

- **FMs 19 & 20**: Based on the 2014-2015 flow monitoring data and field inspections recorded by the City, the diversion structure located at Homestead Road and Lawrence Expressway (shown in **Figure 3-2**) splits flows roughly evenly, routing approximately 50% of the flow to the trunk on Homestead and the remaining 50% to the trunk on Lawrence. The model replicated this expected split based on field measurements of gate openings at that time. However, the 2022-2023 flow monitoring data showed that approximately 80% of flow was being routed to the trunk on Lawrence and the remaining 20% was being routed to the trunk on Homestead. The City's Water and Sewer Department staff performed a field inspection to investigate the discrepancy in August 2023 and discovered that rags had built up on the center divider and were impacting the distribution of flow. After City staff removed the rags, they reported that both gates were fully open, and flows appeared to be evenly split. Staff also confirmed that gate settings had not been changed since 2015.
- **FMs 9A & 13**: The 2022-2023 flow monitoring data showed that flows in the Calabazas trunk at FM 9A were significantly lower than flows recorded at FM 9 in 2014-2015, which is located upstream of FM 9A. Additionally, the 2022-2023 flows at FM 19, which is located considerably upstream of FMs 9A and 9, were higher than the flows recorded at FM 9A. These data suggested that flows were being diverted away from the Calabazas trunk somewhere between FM 19 and FM 9A, which was not evident in the 2014-2015 flow monitoring data. Further investigation by Woodard & Curran and additional field surveys conducted by the City revealed that surcharged conditions were observed in the Calabazas line at manhole S32-101 located at the Pomeroy Avenue and El Sobrante Street intersection in March 2023 during dry weather conditions. The invert of the overflow pipeline on El Sobrante is significantly higher compared to that of the Calabazas line (+2.9 ft per the survey data), so it would take a substantial increase in hydraulic grade line for flows to back up into El Sobrante (away from FM 9A and into FM 13). When the same location was surveyed in August 2023, no surcharging was discovered, and flows appeared to have returned to normal. Woodard & Curran was unable to replicate the surcharging observed in March 2023 dry weather conditions in the model. Therefore, in addition to flows in the Calabazas trunk being higher than normal due to rag build up at the Homestead/Lawrence diversion structure (discussed above), it is suspected that there was a temporary downstream blockage in the Calabazas trunk somewhere downstream of the El Sobrante connection that forced flows to backup into the overflow pipe. Flows to El Sobrante are routed to FM 13. Other downstream flow meters affected by the atypical flow routing include FMs 2, 3, 5, 6, and 24. The reported flow differences are greater at FMs 5 and 6 compared to FMs 2 and 3 because there are interconnectors between the two GAP trunks downstream of FMs 5 and 6 but upstream of FMs 2 and 3.
- **FM 7**: The 2022-2023 flow monitoring data were likely affected by backwater influence from the pump station. Numerous spikes were observed in the raw flow data, which were not present in the 2014-2015 flow data. As shown in **Table 3-6**, the modeled dry weather flows were only 6.8% lower by volume than the 2014-2015 recorded flows; moreover, V&A installed the 2022-2023 flow meter one manhole upstream of the 2014-2015 flow meter due to the pump station backwater influence observed at the original location during the site investigations.

Per the City's request, additional dry weather flow monitoring was performed for a week in early December 2023 as described in **Section 2.1.3** to further investigate the major discrepancies which are summarized below.

Summary of Major Discrepancies Identified

It was determined that the likely cause of the differences between the 2022-2023 and 2014-2015 flow monitoring data was two-fold:

1) *Lawrence/Homestead Gate Structure Flow Split*: The Lawrence/Homestead gate structure was likely clogged with rags during the initial flow monitoring period, causing more flow than expected to be routed to the Calabazas trunk.

2) *Calabazas Trunk Line Temporary Blockage*: It was surmised that some issue in the Calabazas trunk (possibly a temporary blockage) caused significant surcharging, enough to reach the level that would route flows away from the Calabazas trunk and into the Bowers trunk through a higher-level split at El Sobrante. Moreover, this second condition seemed to change over time, with significant shifts in metered flows observed at FM 9A (located on the Calabazas trunk), with corresponding shifts at FM 13 (located on the Bowers trunk).

Conclusions from Additional DWF Monitoring Investigations

Metered ADWFs for the 7-day dry period between December 9-15, 2023 were compared to the winter 2022-2023 and winter 2014-2015 metered ADWFs at the same locations as well as model-predicted ADWFs. Graphs of metered versus modeled ADWFs are included in **Appendix E**. Based on a comparison of the results, Woodard & Curran suspects that the two major differences identified above (1. Lawrence/Homestead Gate Structure Flow Split; 2. Calabazas Trunk Line Temporary Blockage) had been resolved as of the December 2023 flow monitoring period and that the City's Calabazas and Bowers trunk lines were operating closer to normal and as intended. To prevent future clogs that could affect sewer flow routing, it is recommended that the City periodically inspect and clean the Lawrence/Homestead gate structure as well as other structures or locations prone to rags or blockages.

Key findings based on the flow monitoring data were as follows:

- During the December 2023 flow monitoring period, the flow split at the Lawrence/Homestead gate structure (FM 19 along Lawrence Expwy, and FM 20 along Homestead Rd) was operating much closer to the approximately 50/50 flow split that the City considers to be "normal" conditions. Based on the flow monitoring data, metered flows at the split were as follows:
    - *December 9-15, 2023 ADWFs*: ~39% to Lawrence Expwy / Calabazas trunk line (FM 19) vs. ~61% to Homestead Rd / Bowers trunk line (FM 20). It should be noted that this split was used in the model and is reflected in the Model Flow results shown on the attached graphs.
    - *December 17-23, 2022 ADWFs*: ~86% to Lawrence Expwy / Calabazas trunk line (FM 19) vs. ~14% to Homestead Rd / Bowers trunk line (FM 20).

- The December 2023 flow monitoring results at FM 21 (along Kifer Rd downstream of FM 20) also confirmed that flows along Homestead Rd continued through to the Bowers trunk line. The December 2023 ADWFs were similar to the winter 2014-2015 metered ADWFs.

- New flow meter sites (FM 33 along El Sobrante St and FM 34 along El Camino Real) were added to check if flows were leaving the Calabazas trunk line at these locations. The December 2023 flow monitoring results confirmed that during the monitoring period flows were retained within the

Calabazas trunk line and did not discharge to the sewers along El Sobrante St or El Camino Real. Additionally, FM 30 (east of Calabazas trunk line between E Arques Ave and Central Expwy) was repeated to confirm flows from the Calabazas trunk line were not discharging to Central Expwy. The December 2023 flow monitoring results were consistent with the 2022 data at this site, showing very low flows through FM 30.

- Shifts in ADWFs that were apparent in the winter 2022-2023 flow monitoring data at FM 9A (along the Calabazas trunk line north of E Arques Ave) and FM 13 (along Bowers Ave on the Bowers trunk line between Chromite Dr and Monroe St) were not present during the one week of December 2023 flow monitoring.

- As evident on the graphs included in **Appendix E**, the model overpredicts flows at both FM 9A and FM 13. In reviewing the collected data, however, no changes to the model flows were incorporated. Total metered flows at FM 19 and FM 20 were very similar between the 2015, 2022, and 2023 flow monitoring periods. Likewise, total metered flows at the downstream meters FM 2 and FM 3 were very similar between 2015 and 2022. The model matches overall flows at these locations well. Conversely, the total metered flows between FM 9A and FM 13 in 2023 and 2022 were 24% and 27% lower than the 2015 metered flows (at FM 9 and FM 13). However, attempting to adjust the model to replicate these lower flows would adversely affect the calibration of downstream meters.

3.5 Wet Weather Flow Calibration

This section discusses the methodology and procedures used to calibrate the model for wet weather flow conditions and presents the results of the wet weather calibration.

3.5.1 Wet Weather Flow Calibration Methodology

Wet weather calibration builds on the dry weather calibration procedure. The goal of wet weather calibration is to match modeled and metered flows during the rainfall events observed during the flow monitoring period. Specifically, the model calibrator strives to achieve a reasonably good match between the modeled and metered peak flows and volumes observed during and before and after the rainfall event. Like dry weather calibration, wet weather calibration is also an iterative process during which adjustments are made to GWI (if needed to match pre-rainfall conditions) and to model parameters governing the volume and response time of RDI/I.

To define the RDI/I parameters, actual rainfall events observed during the flow monitoring period were simulated in the hydraulic model, and the resulting model hydrographs were compared to the measured flows at the flow meter locations. The RDI/I parameters were adjusted as needed to achieve a reasonable match of modeled to monitored flows. The same calibrated parameters were applied to all subcatchments within each meter basin.

3.5.2 Wet Weather Flow Calibration Results

During wet weather calibration, the percentage volume of each of five RDI/I components representing a range of response times (pictured conceptually in **Figure 2-6**) were adjusted to simulate the volume and timing of RDI/I for monitored storm events in order to best match the overall wet weather hydrograph shape and magnitude of peak flows. To simulate a rainfall event in the model, the rainfall was assigned to subcatchments using observed data from the closest available rain gauge. The model-predicted wet weather response, which is based on the assigned rainfall intensity and RDI/I components, was then compared to the observed flow monitoring data.

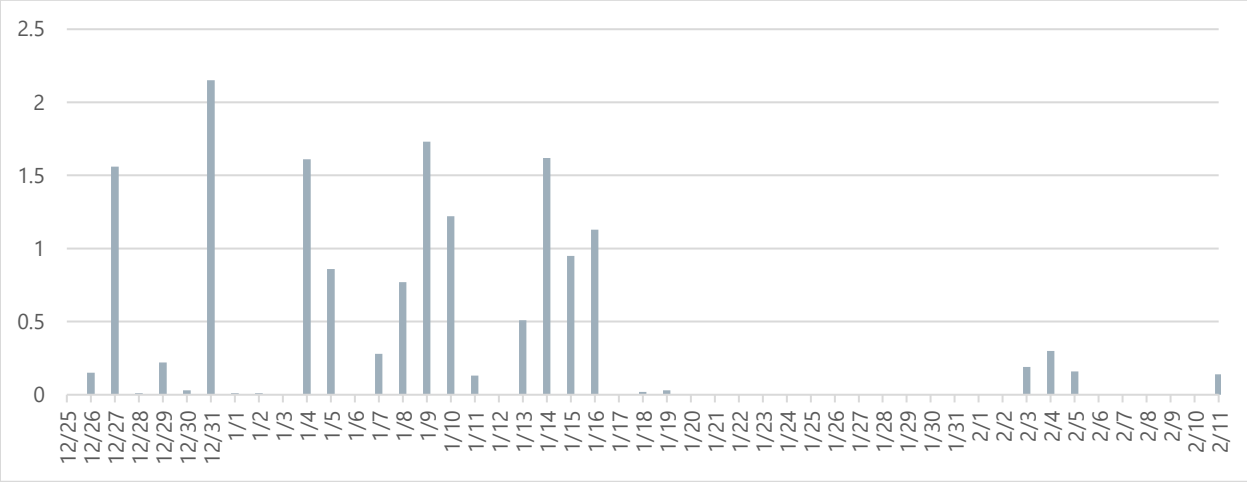
The flow monitoring program conducted in winter of 2022-2023 as part of this Master Plan Update (refer to **Section 2.1**) captured several rainfall events for the wet weather calibration effort. Rainfall for key events referenced for the wet weather calibration is summarized in **Table 3-8**. For comparison (based on the County Drainage Manual and an assumed MAP of 14.5 inches), the 10-year, 24-hour rainfall volume for central Santa Clara is approximately 2.92 inches with a peak hour intensity of 0.65 in/hr and the 5-year, 24-hour rainfall volume for central Santa Clara is approximately 2.45 inches with a peak hour intensity of 0.54 in/hr. Therefore, based on the statistics reported in **Table 3-8**, all the rainfall events observed during the flow monitoring period were individually less than a 10-year return period for the 24-hour duration and the January 4-5, 2023 storm was close to a 5-year return period. However, several of the storms occurred within a short amount of time so there were likely cumulative impacts that increased the inflow and infiltration response during subsequent storms. For example, the January 13-16, 2023 storm event was close to a 10-year storm based on NOAA statistics for the 2-day and 4-day durations. **Figure 3-9** graphically depicts the daily rainfall recorded during the temporary flow monitoring period, in inches.

TABLE 3-8: RAINFALL EVENTS REFERENCED FOR WET WEATHER CALIBRATION[1]

Date of Event	Min 24-Hour Rainfall (in)	Max 24-Hour Rainfall (in)	Min Peak 1-Hour Intensity (in/hr)[2]	Max Peak 1-Hour Intensity (in/hr)[2]
Dec 27, 2022	1.52	1.89	0.28	0.37
Dec 31, 2022	1.55	2.15	0.28	0.36
Jan 4-5, 2023	1.29	2.34	0.36	0.59
Jan 8-10, 2023	1.11	2.08	0.23	0.39
Jan 13-16, 2023	1.62	2.06	0.29	0.42

[1]Rainfall totals based on temporary rain gauge data from gauges 1-4. Minimum rainfall totals are generally from rain gauge 1 located in the northern portion of the City and maximum rainfall totals are generally from rain gauge 3 located in the southern portion of the City. [2]Intensity is reported as an hourly average of 15-minute rainfall data.

FIGURE 3-9: DAILY RAINFALL OBSERVED DURING 2022-2023 FLOW MONITORING PERIOD (IN)[1]



[1]Rainfall totals are from rain gauge 3 located in the southern portion of the City.

Table 3-9 compares the model versus meter peak wet weather flows discharged to the City's GAP and Trimble trunks, **Table 3-10** and **Table 3-11**, respectively, compare the model versus 2022-2023 and 2014-2015 meter wet weather flows at each meter location, and **Figure 3-10**, **Figure 3-11**, and **Figure 3-12**, show plots of model versus metered wet weather flow at the downstream-most meters (FM 1, FM 2, and FM 3,

respectively). In these graphs, the green line represents the monitored (observed) flow, and the red line represents the model-simulated flow. Wet weather calibration plots of model-predicted versus metered flows at all flow meter locations for both 2022-2023 and 2014-2015 are provided as **Appendix E**.

As indicated in **Table 3-10**, the wet weather model calibration resulted in a reasonably good match of modeled to metered volumes and peak flows (within 15% at most locations). However, because it was determined that temporary system conditions that were not representative of typical operations were present during the 2022-2023 flow monitoring period (discussed in **Section 3.4.3.1**), the 2014-2015 flow monitoring data were also compared to the model results at select, affected locations as shown in **Table 3-11**. As part of the wet weather calibration process, Woodard & Curran still reviewed data from both the 2014/2015 and 2022/2023 seasons to confirm that the model was at least reasonable for both conditions at all flow meter locations. The 2014/2015 wet weather season had one very large early season rainfall event, which differed from the 2022/2023 wet weather season in which several, smaller individual storms occurred in a short amount of time.

As evident in the wet weather calibration plots included in **Appendix E**, the modeled and metered peak flows and volumes typically matched better for the later season rainfall events. This is because the full 2022-2023 season was reviewed as the wet weather calibration period; the volume and peak flows associated with the early-season rainfall events are typically overestimated because the same RDI/I parameters were applied across all rainfall events. The RDI/I response typically increases throughout the wet weather season as the soil progressively becomes saturated as more rainfall occurs. Therefore, the wet weather calibration was performed to conservatively match the observed volume and peak flows resulting from higher RDI/I responses during late-season wet weather events.

FIGURE 3-10: WET WEATHER CALIBRATION RESULTS AT FM 1

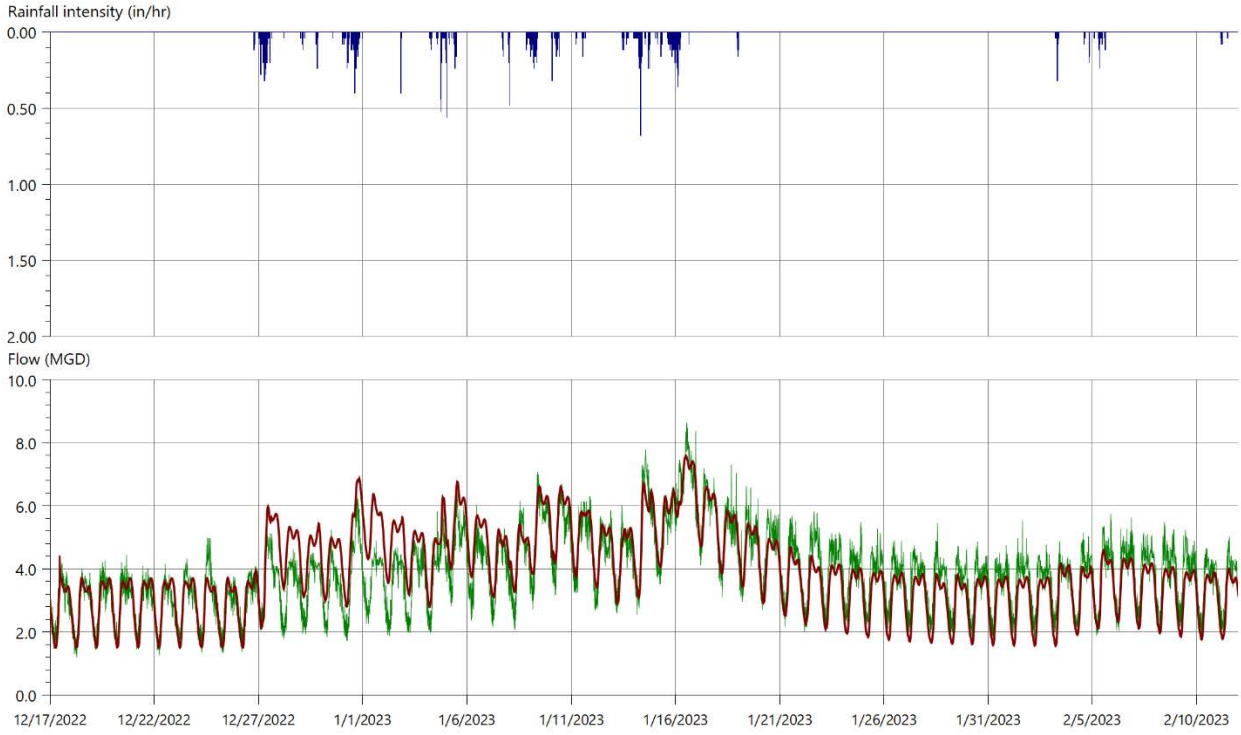


FIGURE 3-11: WET WEATHER CALIBRATION RESULTS AT FM 2

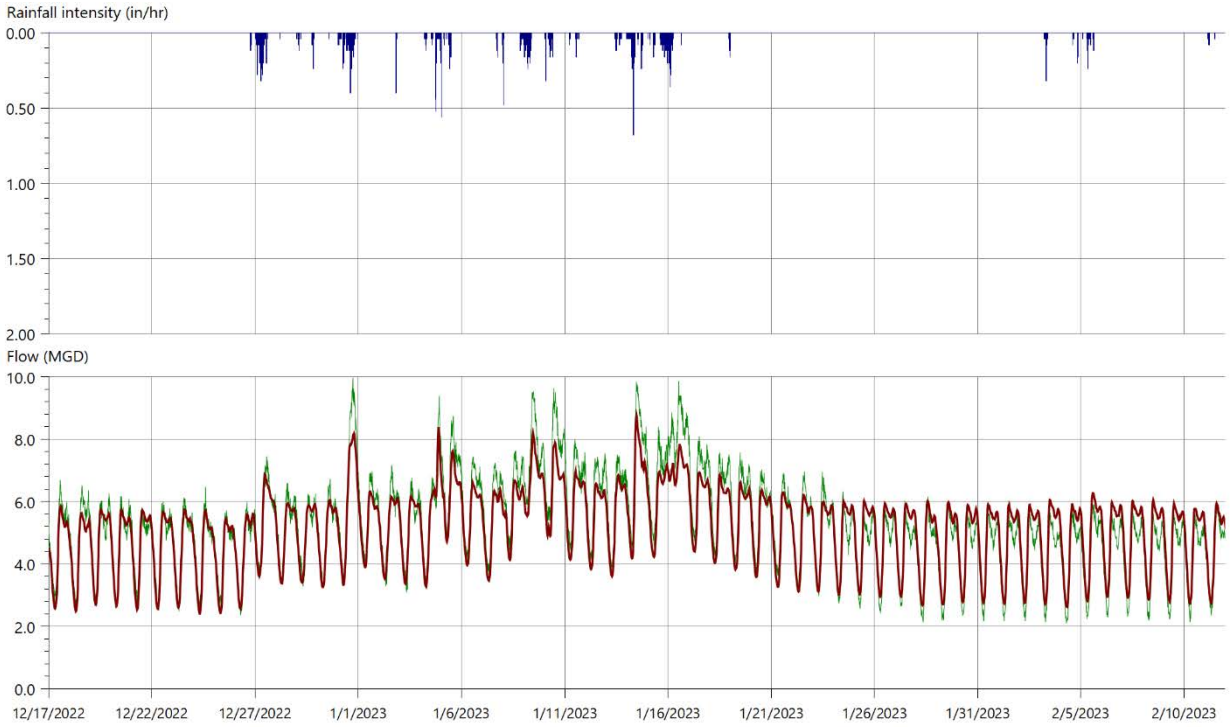
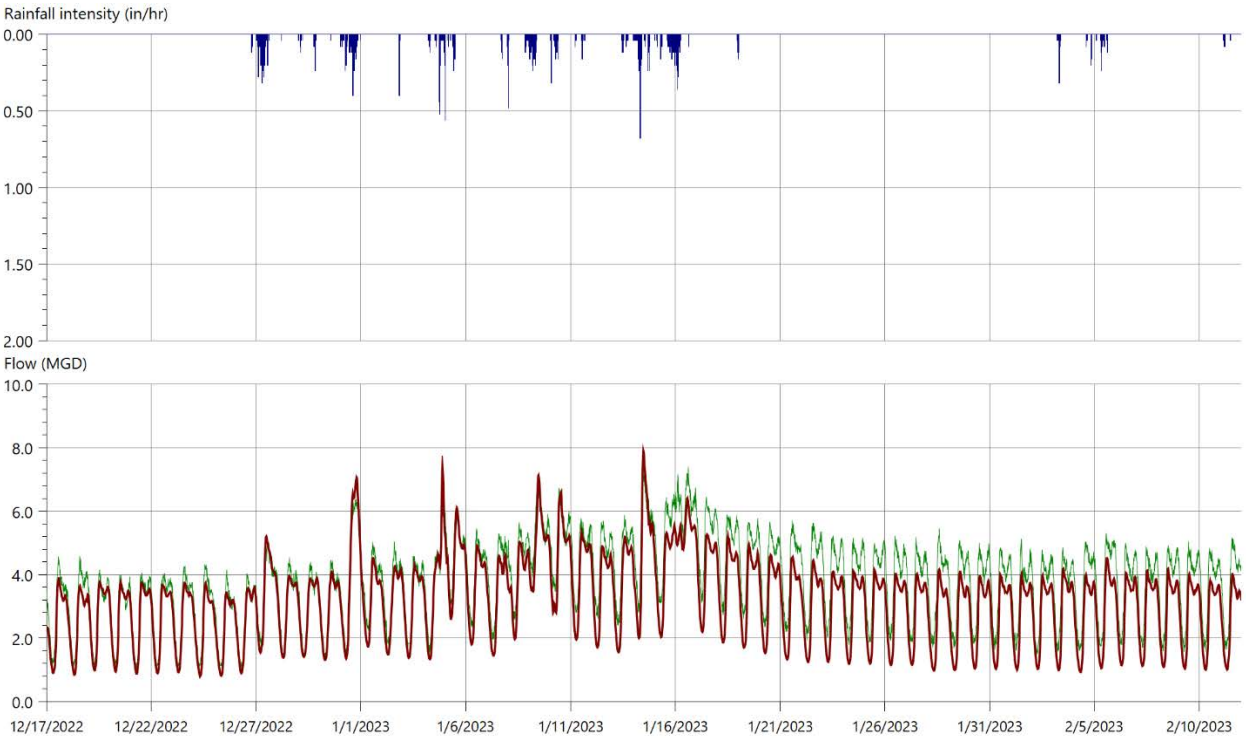


FIGURE 3-12: WET WEATHER CALIBRATION RESULTS AT FM 3



The results of the wet weather calibration are shown in **Table 3-10**. Wet weather peaking factors were calculated for each flow meter based on the ratio of peak flow to average flow.

TABLE 3-9: WET WEATHER FLOW CALIBRATION RESULTS SUMMARY[1]

FM IDs	Discharge Location	Meter PWWF (mgd)	Model PWWF (mgd)	Difference (mgd)[2]	Difference (%)[2]
1+2+3	Lafayette and GAP Trunks	23.03	24.22	1.19	5.2%
16+17+18+25	Trimble Trunk	13.65	13.93	0.28	2.1%

[1] Model results are compared to the 2022-2023 flow monitoring data.
[2] Difference is reported as model flow minus meter flow.

TABLE 3-10: WET WEATHER FLOW CALIBRATION RESULTS VS. 2022-2023 FLOW MONITORING DATA[1]

FM ID	Meter PWWF (mgd)[2]	Model PWWF (mgd)	Difference (mgd, %)	Avg Flow (mgd)[3]	Peaking Factor[4]
1	8.67	7.59	-1.07, -12.4%	2.91	3.0
2	9.97	8.75	-1.22, -12.2%	4.71	2.1
3	7.39	7.88	0.49, 6.6%	2.92	2.5
4[5]	1.25	0.44	-0.81, -64.8%	0.04	31.3
5	8.96	7.78	-1.18, -13.2%	2.93	3.1
6	4.88	7.90	3.02, 61.8%	2.75	1.8
7	2.27	1.80	-0.47, -20.5%	1.10	2.1
8	3.12	2.77	-0.36, -11.5%	1.46	2.1
9	3.85	7.59	3.74, 97.1%	2.24	1.7
10	3.41	3.28	-0.13, -3.7%	0.65	5.2
11	4.94	4.57	-0.37, -7.4%	0.77	6.4
12	-[6]	5.28	-[6]	0.83	-[6]
13	8.56	5.75	-2.81, -32.8%	2.10	4.1
14	1.14	1.05	-0.10, -8.5%	0.41	2.8
15	0.84	0.95	0.11, 12.6%	0.23	3.6
16	2.77	3.03	0.26, 9.2%	1.46	1.9
17	1.68	1.62	-0.06, -3.3%	0.77	2.2
18	2.53	2.81	0.28, 11.1%	1.18	2.1
19	5.98	5.94	-0.05, -0.7%	2.65	2.3
20	1.94	2.26	0.32, 16.6%	0.42	4.6
21	2.90	3.30	0.39, 13.6%	0.89	3.3
22	1.95	2.07	0.11, 5.8%	0.82	2.4
23	1.22	1.49	0.27, 2.2%	0.59	2.1
24	8.30	7.14	-1.16, -13.9%	2.39	3.5
25	6.67	6.47	-0.197, -3.0%	1.24	5.4

FM ID	Meter PWWF (mgd)[2]	Model PWWF (mgd)	Difference (mgd, %)	Avg Flow (mgd)[3]	Peaking Factor[4]
26	1.70	1.70	0.004, 0.2%	0.55	3.1
27	0.47	0.46	-0.001, -0.2%	0.02	23.5
28	1.36	0.88	-0.48, -3.5%	0.08	17.0
29	1.16	1.04	-0.12, -10.4%	0.20	5.8
30	0.14	0.11	-0.02, -17.0%	0.04	3.5
31	1.23	1.28	0.06, 4.6%	0.24	5.1
32[7]	9.51	8.95	-0.56, -5.9%	3.45	6.0

[1] Model results are compared to the 2022-2023 flow monitoring data and assume a blockage at the Lawrence/ Homestead gate structure.
[2] Based on meter response during January 15-16, 2023 rainfall event.
[3] Average metered dry weather flow from **Table 3-5**.
[4] Ratio of metered peak flow to metered average flow.
[5] FM 4 base flows were highly variable because of sporting events held at Levi's Stadium. FM was calibrated to match the wet weather response from rainfall on non-gamedays, resulting in an underestimation of total gameday flows.
[6] Meter was not installed in the correct location during the wet weather flow monitoring period, so data are not available.
[7] Permanent CuSD flow meter.

TABLE 3-11: WET WEATHER FLOW CALIBRATION RESULTS VS. SELECT 2014-2015 FLOW MONITORING DATA[1]

FM ID	Meter PWWF (mgd)[2]	Model PWWF (mgd)	Difference (mgd, %)
2+3	17.59	17.72	0.13, 0.7%
5+6	16.69	16.30	-0.39, -2.3%
9[3]	6.34	6.43	0.09, 1.4%
13	7.22	7.65	0.43, 6.0%

[1] Model results are compared to the 2014-2015 flow monitoring data and assume normal settings (no blockages) at the Lawrence/Homestead gate structure.
[2] Based on meter response during December 11, 2014 rainfall event.
[3] FM 9 is located along the Calabazas trunk but upstream of FM 9A (south of Central Expressway).

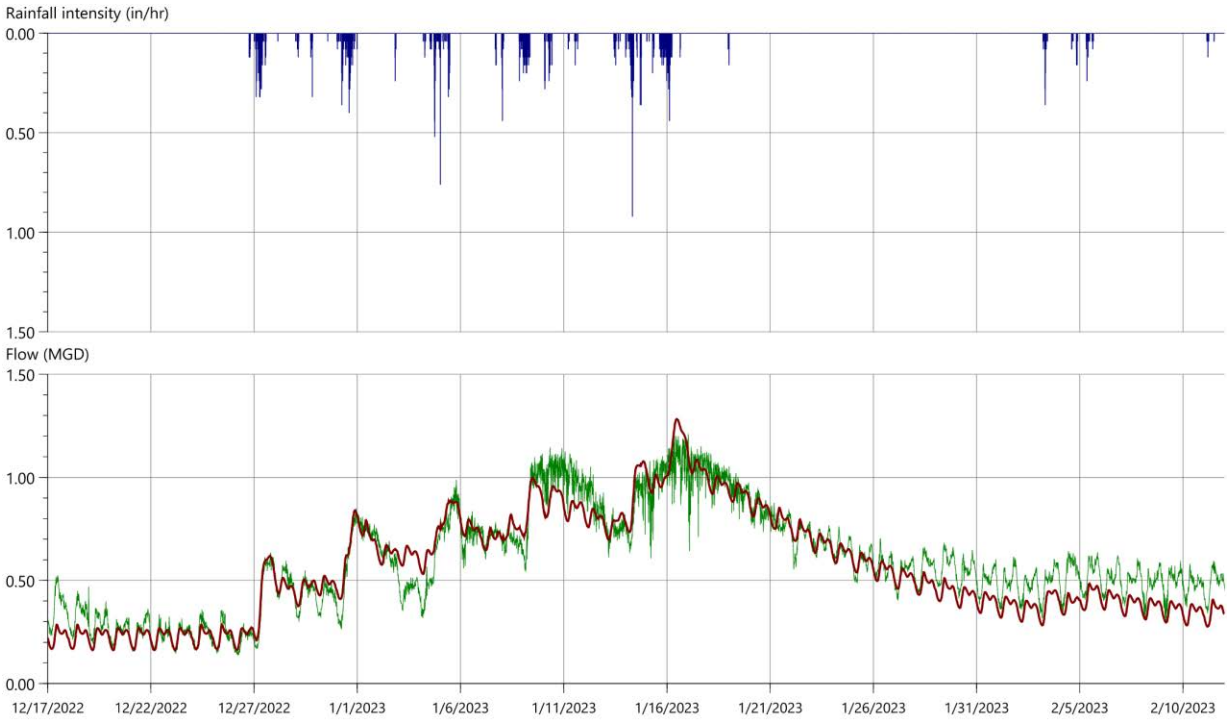
3.5.2.1 RDI/I Response

As discussed in **Section 2.3** and shown in **Figure 2-6**, RDI/I is estimated in the model using five runoff components that reflect a range of response times from fast to slow. The total RDI/I hydrograph for each flow meter basin is the summation of all the component hydrographs for the duration of the rainfall events.

As expected, a very high RDI/I response was observed within the meter basins that collect flows from the CMC tributary area which is upstream of FMs 11 and 12 (discussed in **Section 2.1**) and at FM 31 which is a basin that is adjacent to the CMC tributary area but upstream of FM 24. Examples of the very high RDI/I responses observed at a few of these meters (FM 31 and FM 27) are presented in **Figure 3-13** and **Figure 3-14**. In both examples, the nature of the response is indicative of significant infiltration as the response is generally slower and takes a long time to recede (i.e., several weeks after the January 15-16, 2023 storm as shown in the figures). Moreover, because several consecutive rainfall events occurred within a short period of time, the infiltration response did not fully recede before another rainfall event occurred.

These flow monitoring results are consistent with the findings of other field investigations that were completed recently in the CMC basin. The City retained V&A to perform I/I investigations within the CMC tributary area with the objective of identifying specific areas of high I/I to a sub-basin or micro-basin level. Investigation methods included targeted night-time I/I reconnaissance and CCTV inspections, which occurred during the 2022-2023 winter wet weather season. V&A's report[1], which details the scope and findings of these investigations, concluded that rainfall-dependent infiltration appeared to be the most severe component in the CMC basin, as opposed to the rainfall-dependent inflow. V&A observed a rapid response but also long-term, sustained rainfall-dependent infiltration, which are presumably due to increased groundwater elevations that take a long time to recede. V&A suspected that the rainfall-dependent infiltration was entering the sewer system from defects in sewer laterals and mains, rather than from defects within the sewer manhole structures. City staff suspect that laterals in some areas within the CMC basin were constructed using Orangeburg pipe material, which is known to have high rates of defects and may be a significant source of RDI/I. V&A's report recommended that the City consider smoke testing in the CMC basin, which may better identify lateral defects. Options to identify and reduce RDI/I in the CMC basin were identified and are suggested as part of the system capacity assessment (refer to **Section 4.6.3**).

FIGURE 3-13: WET WEATHER CALIBRATION RESULTS – RDI/I RESPONSE AT FM 31



[1] Sewer Flow Monitoring and Inflow/Infiltration Study prepared by V&A for City of Santa Clara dated August 2023.

FIGURE 3-14: WET WEATHER CALIBRATION RESULTS – RDI/I RESPONSE AT FM 27

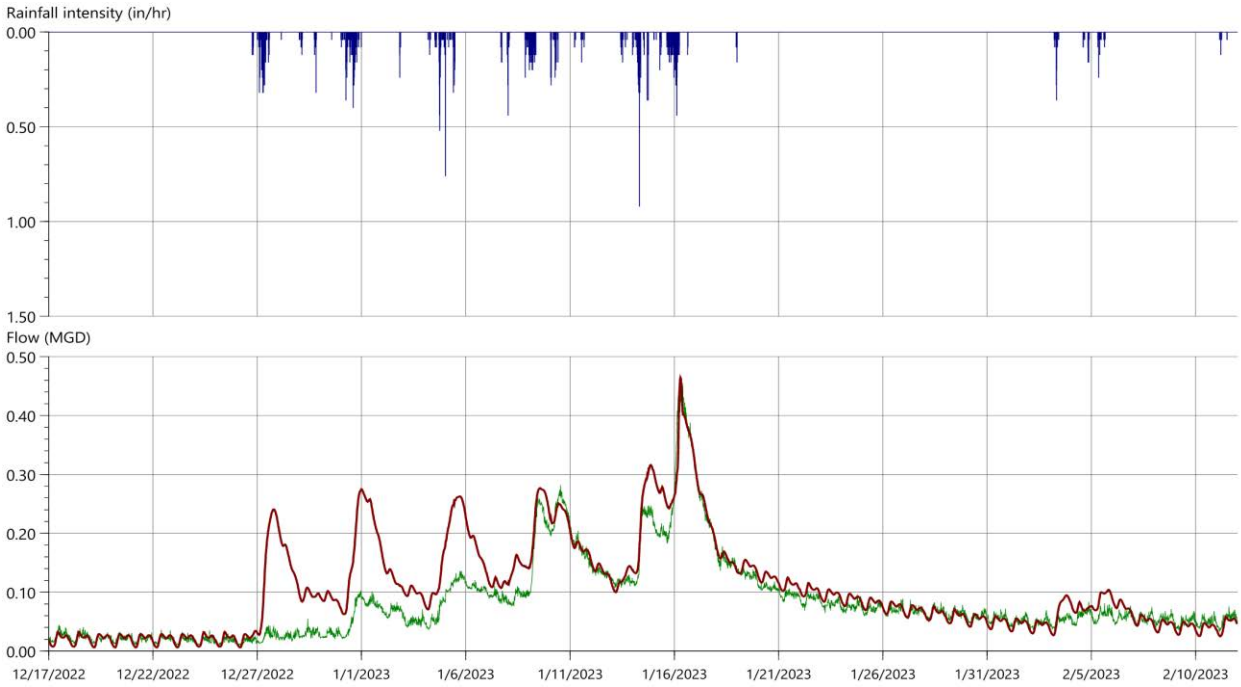


Figure 3-15 on the next page presents a visual representation of the wet weather calibration results in terms of the total RDI/I rate that was applied to the model for each meter basin to try to match modeled and metered flows.

Figure 3-15
RDI/I Rate by Flow Meter Basin

Sewer Master Plan Update

Legend

- City of Santa Clara Boundary
- 2022-23 Flow Meters
  - 2014-2015 & 2022-2023 Flow Meter Site
  - 2022-2023 Flow Meter Site

RDI/I Rate (Total R)

- 0 - < 5
- 5 - 10
- > 10 - 20
- > 20 - 40
- > 80

N

0 0.25 0.5 1 Miles

The City of Santa Clara California — The Mission City — 1852

Woodard & Curran

Project #: 0012307.00
Map Created: December 2024

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions.
Any reliance upon the map or data contained herein shall be at the users' sole risk.

Figure Exported: 12/27/2024 By: SEstabrook Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2024_Report.aprx

4. SYSTEM CAPACITY ANALYSIS

This section defines the basis for the capacity assessment of the system, including the selected design storm and performance criteria used to identify deficiencies, and presents the capacity deficiencies identified based on the model results. The section also identifies areas of the system with high I/I and recommends additional investigations to isolate potential direct inflow sources in those areas.

4.1 Hydraulic Assumptions Used for the Capacity Analysis

This section summarizes the hydraulic assumptions used for the capacity evaluation, including the dry weather flow scenarios (i.e., existing, near-term future, long-term future), wet weather design flows, performance (or capacity deficiency) criteria, and physical model network.

Section 2 discusses the various flow components and the development of existing, near-term future, and long-term future wastewater flows (referred to as model "loads"). It also discusses the application of a design storm in conjunction with calibrated model parameters that represent rainfall-dependent infiltration and inflow (RDI/I) into the sewer system to generate wet weather design flows.

Section 4.1.1 presents the characteristics of the City's design storm event that is used to generate wet weather design flows and summarizes the performance criteria that are applied to identify system capacity deficiencies and the design criteria that are applied to develop project solutions for the identified capacity deficiencies.

The physical model network assumptions, including development of a new "Lined Model Network" as requested by the City, is described in more detail in **Section 4.1.2**.

4.1.1 Summary of Design Storm, Performance Criteria, and Design Criteria

Criteria used by other agencies both inside and outside of California were referenced when selecting the criteria that was used for the City's sewer system capacity analysis. These references are further discussed in TM #2 (Santa Clara Sewer Performance and Design Criteria), which was submitted to the City.

Design Storm

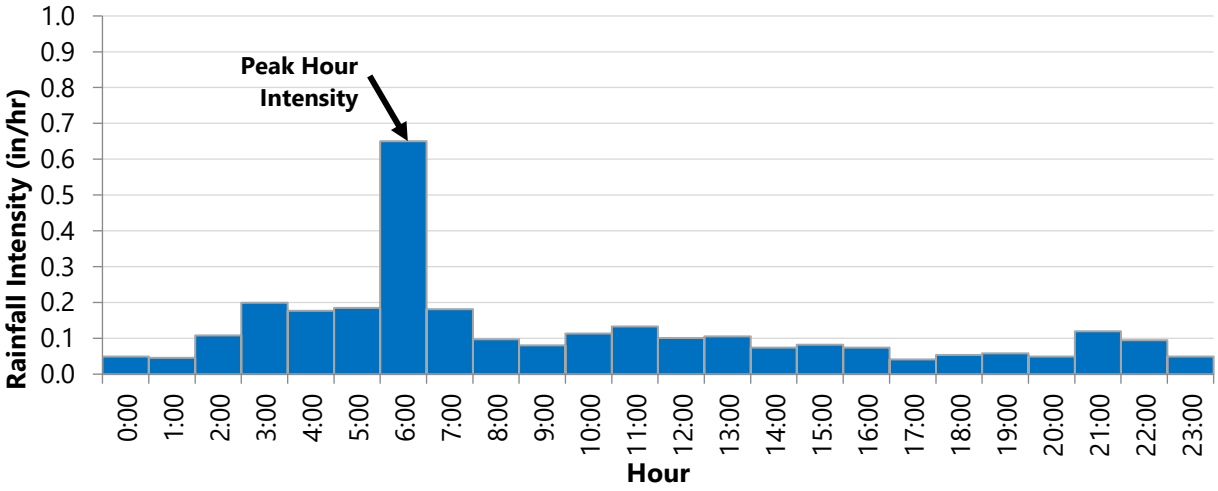
Key factors needed to define a design storm event for the purpose of sewer modeling and master planning include return period, rainfall depth, storm duration, temporal and spatial distribution of rainfall, storm timing, and antecedent conditions. Characteristics of the selected design storm related to these key factors are presented in **Table 4-1** and discussed further below.

The City elected to continue to use the same 10-year, 24-hour design storm event that was used for its 2016 Master Plan for this Master Plan Update. The design storm used for the 2016 Master Plan Update is a 10-year, 24-hour storm that varies across the service area. The storm pattern and hourly rainfall intensities are based on the Santa Clara County's Drainage Manual (October 2007)[1]. The manual includes mean annual precipitation (MAP) isohyetal lines from Santa Clara Valley Water District (SCVWD) and distinct intensity, depth, frequency (IDF) curves for each MAP area in Appendix B. In addition to the IDF curves, Appendix D of the manual includes a 24-hour design storm pattern. According to the manual, this storm pattern is based on an actual three-day rainfall event that occurred in December 1955, but with some adjustments to better reflect IDF statistics for various storm durations.

[1] Santa Clara County's Drainage Manual is available online at: https://stgenpln.blob.core.windows.net/document/DrainageManual_Final.pdf.

Figure 4-1 shows the design storm hourly rainfall as it occurs in the vicinity of central Santa Clara, including the San Jose International Airport area. At this location, the total rainfall for the 1-, 6-, and 24-hour durations is 0.65, 1.49, and 2.92 inches, respectively. For this graph, the storm timing has been adjusted so that the peak intensity coincides with the weekday morning peak of the diurnal wastewater pattern.

FIGURE 4-1: DESIGN STORM EVENT FOR CENTRAL SANTA CLARA (MAP ~14.5 INCHES)



Santa Clara selected its design storm event based on the key considerations presented in **Table 4-1** with respect to its desired level of service to reflect the level of risk that is acceptable to the City. For future modeling efforts, the City may consider applying a more conservative design storm event with a higher return period and/or perform a sensitivity analysis to evaluate potential impacts of climate change. The analysis could either be performed prior to, or concurrent with, the next update.

TABLE 4-1: RAINFALL DESIGN EVENT CRITERIA USED FOR SANTA CLARA MASTER PLAN UPDATE

Design Event Criterion	Santa Clara Selection
Return Period	10 years
Rainfall Depth	Based on County Drainage Manual IDF curves
Storm Duration	24 hours
Rainfall Temporal Distribution	Based on County Drainage Manual (developed from historical rainfall event in December 1955)
Storm Timing	Peak-on-Peak (weekday)
Spatial Rainfall Distribution	Lowest intensity: North Highest intensity: Southwest
Antecedent Conditions	Wet, saturated soils

The key factors used to define Santa Clara's selected design storm event are further described below:

- *Return Period*: The return period defines the probability that the design rainfall will be exceeded in any given year. For example, a storm with a 5-year return period means that there is a 1 in 5 chance, or 20 percent probability, that the design rainfall will be exceeded in any given year. For sewer modeling and master planning applications, the chosen return period reflects the degree of risk that an agency is willing to accept regarding the potential of experiencing sanitary sewer overflows

(SSOs) due to future storm events. However, selecting a design storm with a very high return period (reflecting a very low risk tolerance) could lead to identification of a significant number of system capacity deficiencies that would make the cost of improvements prohibitive. Additionally, sizing a system for a very infrequent event could mean that the system does not function well under typical conditions during much lower flows (due to slow velocities in oversized pipes, or oversized pump stations).

- *Rainfall Depth*: Synthetic design storms are typically based on rainfall IDF or depth, duration, frequency (DDF) statistics that have been compiled for a local area. These statistics give the rainfall depths or intensities for various return periods (e.g., 2-year, 5-year, etc.) and durations of rainfall (e.g., 1-hour, 2-hour, etc.). Rainfall IDF statistics are available through the National Oceanic and Atmospheric Administration (NOAA), which provides the IDF statistics for any location in the U.S. based on latitude/longitude coordinates. IDF curves specific to Santa Clara County (one for each MAP area) for various return periods and durations are provided in Appendix B of the 2007 County Drainage Manual. These IDF curves were used to define the selected design storm event. MAP varies spatially throughout Santa Clara, with the highest average annual rainfall typically occurring in the southern portion of the City. In central Santa Clara, according to the County Drainage Manual, the MAP is approximately 14.5 inches, and the 10-year, 24-hour rainfall depth is approximately 2.92 inches (versus 2.63 inches according to NOAA Atlas 14).

- *Storm Duration*: A storm duration must be specified for the design storm along with the return period. Most Bay Area agencies use a 24-hour storm, although shorter or longer durations may sometimes be appropriate (e.g., a shorter duration in a very small system with fast response to rainfall or in an area where storm events are typically very brief; a longer duration in a very large system or one with a very slow response to rainfall). Typically, the 24-hour duration storms are constructed such that the more intense rainfall occurs during a shorter (e.g., 4- to 6-hour) period. Santa Clara's selected design storm uses a 24-hour duration.

  Rainfall Temporal Distribution: The temporal rainfall distribution of a design storm may be based on a synthetic storm or an actual historical event. Commonly used synthetic storm distributions include nested storms (which incorporate design rainfall intensities for a given return period for several durations within the total storm duration), or a "SCS" storm distribution, a dimensionless 24-hour rainfall distribution developed by the SCS (Soil Conservation Service), now known as the NRCS (Natural Resources Conservation Service). The SCS developed four 24-hour distributions, with each distribution representative of a specific region of the U.S., as presented in the USDA guidance document Urban Hydrology for Small Watersheds TR-55 (June 1986). The City's service area generally falls within the area covered by the "Type I" distribution, but it is close to the boundary between the "Type I" and "Type IA" distributions. It is sometimes preferable to use historical rainfall patterns to depict the design storm temporal rainfall distribution of the design event. As described above and shown in **Figure 4-3**, Santa Clara County's Drainage Manual defines a temporal rainfall distribution based on a historical event that occurred during December of 1955. The rainfall for a historical storm could be scaled to match the desired rainfall depth and return period of the design storm. **Table 4-2** compares the peak hour intensity of the County Drainage Manual design storm distribution to the peak hour intensities of the synthetic distributions (SCS-I and SCS-IA, and nested) based on the County Drainage Manual IDF statistics for a 10-year, 24-hour rainfall event. As shown in the table, in central Santa Clara, peak hour rainfall intensity of the County Drainage Manual distribution is very similar to that of the synthetic SCS Type I distribution, moderately lower than that of the synthetic nested distribution, and significantly higher than that of the SCS Type IA

distribution. The temporal distribution of Santa Clara's selected design storm is based on an actual historical event (i.e., December 1955).

TABLE 4-2: CHARACTERISTICS OF DESIGN STORM DISTRIBUTIONS CONSIDERED[1]

Frequency	Duration	IDF Statistics Source	Temporal Distribution	Volume (in)	Peak Hour Intensity (in/hr)
10-yr	24-hr	Historical, County Drainage Manual	Historical, County Drainage Manual	2.92	0.65
10-yr	24-hr	NOAA	Synthetic, Nested	2.92	0.64
10-yr	24-hr	NOAA	Synthetic, SCS-I	2.92	0.76
10-yr	24-hr	NOAA	Synthetic, SCS-IA	2.92	0.46

[1]Based on County Drainage Manual and assumed MAP of 14.5 inches for central Santa Clara.

- *Storm Timing*: The selected event is based on the Santa Clara County Drainage Manual design storm with peak-on-peak BWF timing. Generally, peak-on-peak timing is achieved by adjusting the timing of the peak intensity of the rainfall event so that it occurs one to two hours prior to the peak BWF to account for the typical delay between the rainfall occurring and observation of the RDI/I response. For the 2016 Master Plan, the design storm rainfall was timed such that the peak rainfall occurred around 8 a.m., resulting in a peak RDI/I flow at approximately the same time as the typical weekend day peak BWF in most areas of the system (graphically depicted in **Figure 4-2**). Given that the peak BWF typically occurs earlier on a weekday compared to a weekend day, Santa Clara's selected design storm for this Master Plan Update was evaluated assuming an earlier peak rainfall intensity (around 6 a.m.) so as to align the peak intensity with the typical weekday peak BWF (graphically depicted in **Figure 4-3**).

FIGURE 4-2: DESIGN STORM EVENT FOR CENTRAL SANTA CLARA (WEEKEND)

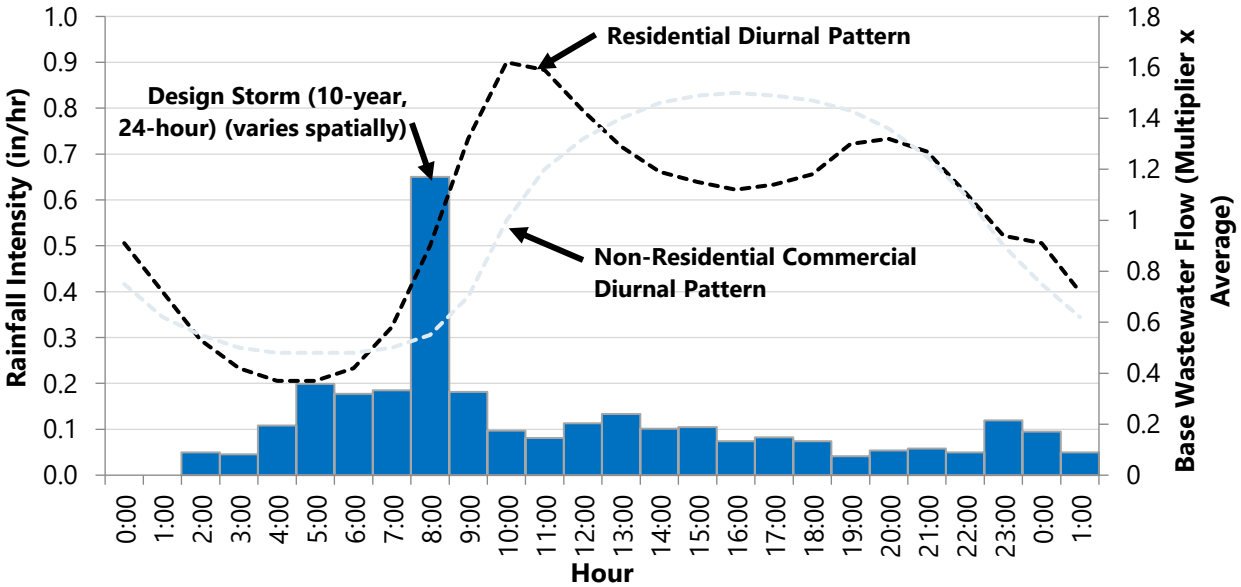
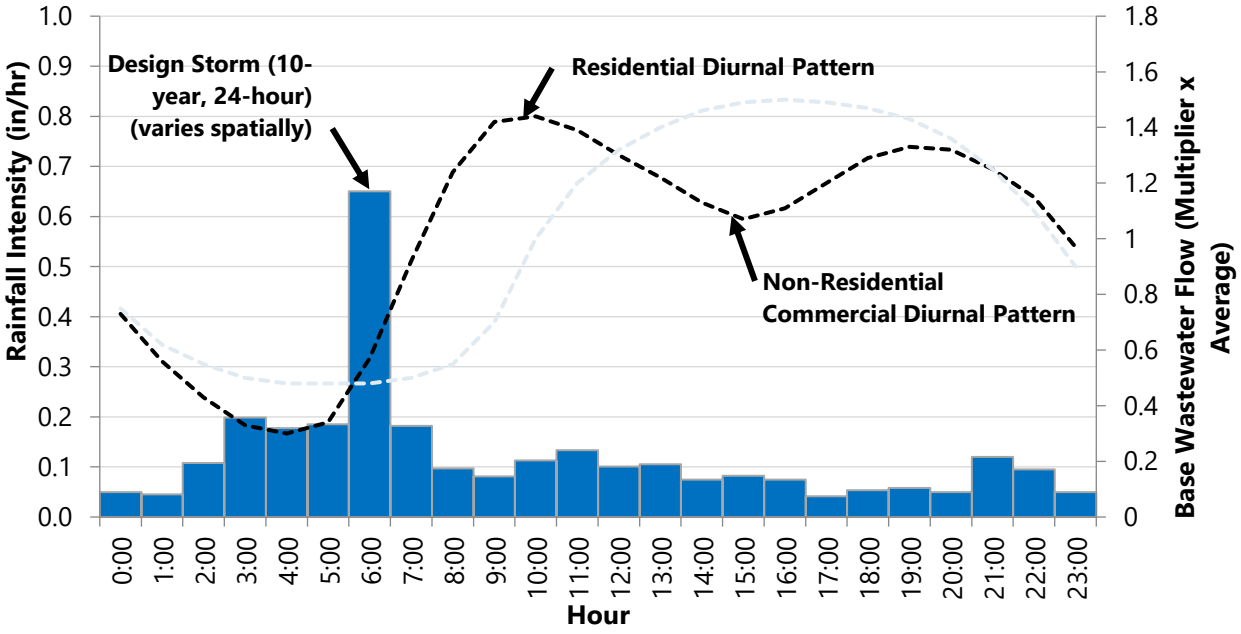
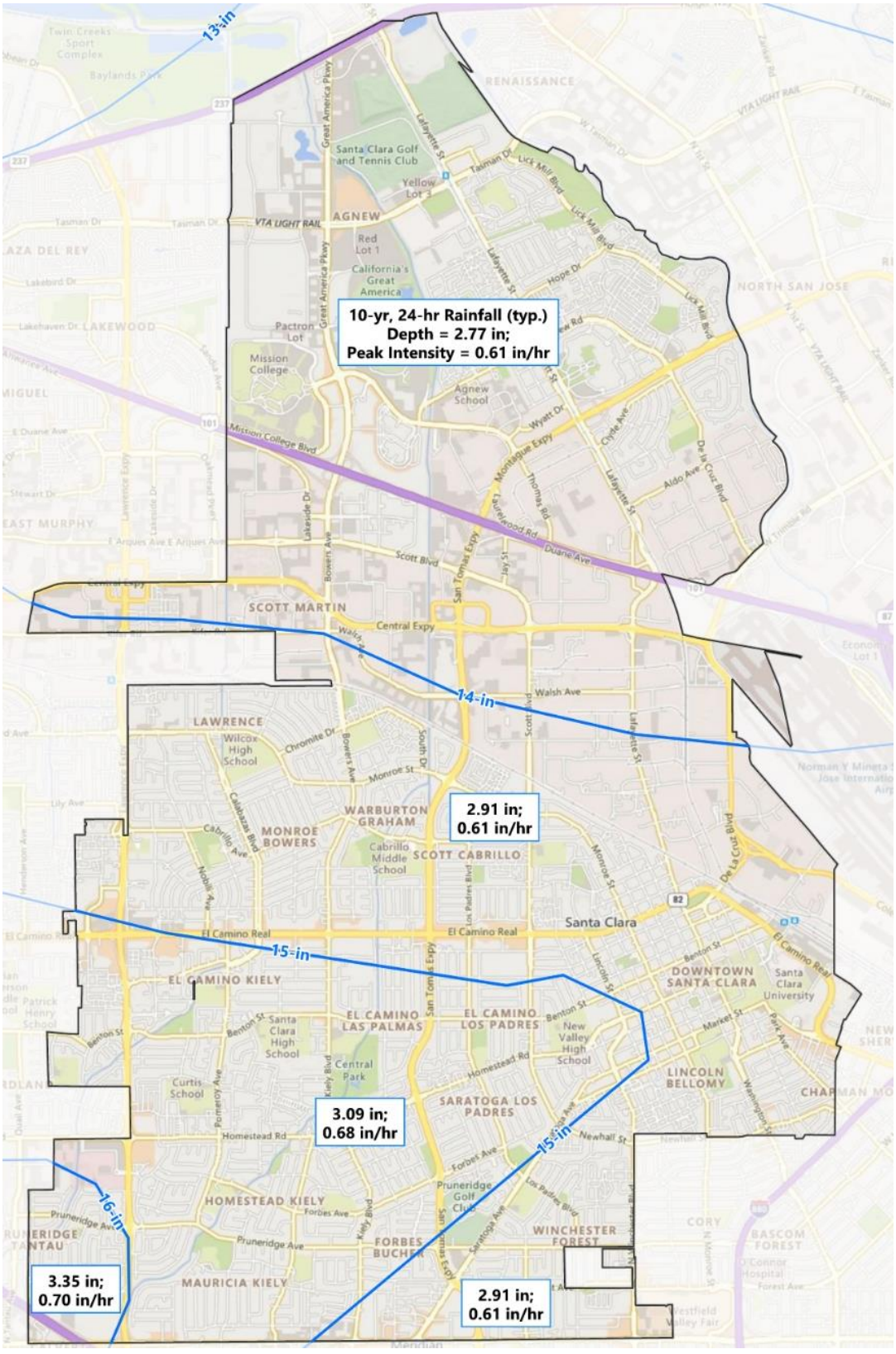


FIGURE 4-3: DESIGN STORM EVENT FOR CENTRAL SANTA CLARA (WEEKDAY)



- *Spatial Rainfall Distribution*: The magnitude of rainfall may vary spatially, generally based on topography and the typical movement of storms over the service area. Based on the County Drainage Manual, MAP in the City's service area varies from about 13 to 16 inches in a north to southwest direction. While this pattern may not hold true for every storm event, it is common practice to apply the spatial variation of average annual rainfall to the design storm. As such, the IDF curves (one for each MAP) provided in Appendix B of the County Drainage Manual were referenced to obtain IDF statistics (rainfall depth, duration, and peak intensity) for subareas within the City. **Figure 4-4** presents the spatial variation of rainfall depth and peak intensity throughout the City's service area for a 10-year, 24-hour event that the selected design storm is based upon; it illustrates that the highest and most intense rainfall typically occurs within the southwest portion of the City.
- *Antecedent Conditions*: Based on flow monitoring data from the 2022-2023 winter season, flow response to rainfall in portions of the City's service area (e.g., CMC tributary area) is characterized by prolonged elevated flows extending for several days and in some cases weeks after storm events. Thus, a storm happening later in the season after several storm events have occurred may produce higher peak flows because the ground is saturated (meaning less rainfall can be "absorbed" by the soil) and flows are already elevated due to the preceding events. This "wet" antecedent condition can be modeled as a prolonged RDI/I response (when the model simulation includes multiple events) or as an elevated, antecedent GWI condition (when modeling a single event such as a design storm). Because it is not unusual for large storm events to occur after periods of preceding rainfall, it is common to define a design storm as occurring under "saturated soil" or "wet" antecedent conditions; this approach was applied when defining Santa Clara's selected design storm. Assuming dry or moderately dry soil conditions would be a less conservative approach.

FIGURE 4-4: SPATIAL VARIATION OF RAINFALL THROUGHOUT SANTA CLARA'S SERVICE AREA



Capacity Deficiency Criteria

Capacity deficiency criteria are used to determine if the capacity of an existing sewer facility is exceeded to the extent that a capacity improvement project is needed. These criteria are sometimes called "trigger" criteria, in that they trigger the need for a capacity improvement project. An agency defines its capacity deficiency criteria based on its desired level of service. As such, the criteria vary by agency and are reflective of the level of risk that is acceptable to each agency.

The capacity deficiency criteria differ from the design criteria that are applied to determine the size of a new facility; the latter typically being more conservative. The difference between capacity deficiency criteria and design criteria reflect the concept that some existing facilities can continue to provide adequate, if not optimal, conveyance capacity without undue risk, but new facilities should be designed to a higher standard.

The capacity deficiency criteria utilized for the Master Plan Update to identify capacity deficiencies under both Peak Dry Weather Flow (PDWF) and Peak Wet Weather Flow (PWWF) design flow conditions are summarized in **Table 4-3**. The City's selected criteria were conservative in order to identify all potential projects, recognizing that conditions may change in the future due to variable risk factors (e.g., sewer condition, additional development, climate change). Evaluating system capacity based on conservative criteria provides an "advance warning" of more vulnerable areas of the system that could require deficiencies to be corrected as these future potential risks materialize. All projects identified were prioritized based on the cause and extent of the model-predicted capacity deficiency as discussed in **Section 5**.

TABLE 4-3: CAPACITY DEFICIENCY CRITERIA USED FOR SANTA CLARA MASTER PLAN UPDATE

Facility	Design Flow Condition(s)	Capacity Deficiency Criteria
Gravity Sewer	PDWF or PWWF	No surcharge allowed (d/D[1] ≤ 1.0)
Force Main	PDWF or PWWF	Velocities less than 10 feet per second
Pump Station	PDWF or PWWF	Flows less than firm capacity[2]

[1] Ratio of depth (d) of water to pipe diameter (D), which represents the approximate percent full within a pipe.
[2] Firm capacity is defined as the capacity of the pump station with the largest pump out of service.

For evaluating the performance of existing sewers, a Manning's "n" value of 0.013 was assumed for all pipes, regardless of material or age. Although new pipes, particularly plastic materials, would provide a lower initial roughness factor, it was assumed that over time, a "slime layer" formation on the walls of the pipes and/or other obstructions in the sewer, such as roots, debris, or structural defects, may increase pipe roughness. Therefore, an assumption of 0.013 for all pipes was considered appropriately conservative for master planning purposes.

Note that engineering judgment was used in conjunction with applying the capacity deficiency criteria presented above to identify model-predicted capacity deficiencies in gravity sewers. Gravity sewers that showed only minor criteria violations were not considered deficient if one or more of the following conditions applied:

- Surcharged on one end only (i.e., downstream end caused by backwater);
- Isolated flat pipe segments;
- Invert differences (i.e., offsets) between adjacent pipes;
- Smaller diameter sewers connected to larger diameter pipes at equal inverts; or
- Sewers protected from overflows by a high-level flow diversion or parallel pipe.

Design Criteria

The key design criteria that were applied for the Master Plan Update when developing project solutions to relieve the identified capacity deficiencies are summarized in **Table 4-4**. The City's "Design Criteria" (April 2015)[1], which specify criteria for hydraulic design of sanitary sewer facilities (e.g., pipe material and diameter and roughness for gravity sewers), were referenced to develop the design criteria used for this Master Plan Update.

TABLE 4-4: DESIGN CRITERIA USED FOR SANTA CLARA MASTER PLAN UPDATE

Facility	Component	Design Criteria
Gravity Sewer	d/D Ratio	Less than or equal to 0.75 unless minimum velocities are a concern.
Gravity Sewer	Velocity	Minimum 2 fps during existing peak dry weather flow; maximum 10 fps during design peak wet weather flow.
Gravity Sewer	Diameter	Minimum 8-inch, 10-inch, and 12-inch for residential, commercial, and industrial land uses, respectively; downstream pipes at least as large as upstream pipes where feasible.
Gravity Sewer	Roughness	Manning's n friction coefficient of 0.013.
Gravity Sewer	Inverts	Match crowns at junctions of side sewers and trunk sewers.
Gravity Sewer	Slope	Determined based on velocity criteria to the extent feasible.
Gravity Sewer	Cover	6 feet from finished grade to sewer crown if feasible.
Gravity Sewer	Material[1]	RCP for 24-inch and larger; VCP for greater than 12- to 24-inch or PVC if approval given by Director of Public Works / City Engineer; VCP or PVC SDR 26 for 12-inch and smaller.
Gravity Sewer	Alignment[2]	Generally, 5-foot offset from street centerline on side opposite the storm drain and 8-foot clear distance separation from all other parallel facilities.
Gravity Sewer	Manhole Placement and Spacing[2]	Located at sewer main or street intersections, at upstream terminal ends of sewer lines, at any change in pipe direction, slope, diameter, or material, and where laterals have the same diameter as the sewer main or are 8 inches or larger. Nominal and maximum manhole spacing shall be 450 and 500 feet, respectively.
Force Main	Velocity	Minimum 3 fps to prevent solids from settling out and maximum 8 fps to prevent excessive head losses in the force main.
Force Main	Cover	6 feet from finished grade to sewer crown if feasible.
Pump Station	Roughness	Hazen-Williams C-value of 100 but must have proper operation at C-value of 120.

[1] Note that material is tracked in the hydraulic model, but roughness values are what impact the hydraulic analysis.
[2] Note that these details were considered for the hydraulic modeling analysis but are generally more applicable to project development during the pre-design stage.

[1] City of Santa Clara's Sanitary Sewer Design Criteria (Section 5) are available online at: https://www.santaclaraca.gov/home/showpublisheddocument/61878/636766631787130000.

4.1.2 Physical Model Network

Two physical model networks were used to evaluate the capacity of the City's sanitary sewer system. One of these networks included future lining assumptions applied to City-identified RCP trunks and VCP siphons within the City's sewer system based on information provided by the City ("Lined Model Network"); the other did not ("Unlined Model Network"). **Section 4.1.2.1** discusses the assumptions applied to the Lined Model Network in more detail.

The following assumptions were applied to the physical model network (both the Lined Model Network and Unlined Model Network):

- A Manning's n of 0.013 was assumed for all pipes in the model, including lined pipes. Lined pipes can initially reduce the friction factor. However, over time, with sedimentation and fouling, the friction factor may increase. Assuming a friction factor of 0.013 for lined pipes therefore represents a conservative assumption.
- The flume diversion structure located at Homestead Road and Lawrence Expressway (Lawrence/Homestead gate structure), which splits the flow to either the eastern sewer on Homestead or the northern sewer on Lawrence Expressway, was modeled assuming a 50% flow split for the capacity evaluation. Therefore, half of the influent sewer flows are sent east to the Homestead sewer and the other half are sent north to the Lawrence sewer. This even flow split assumption was applied for the capacity evaluation because it is the City's normal and desired flow setting at that structure. It should be noted that the model calibration (described in **Section 3.3**) considered both normal settings and a temporary blockage condition which existed during the flow monitoring period but was investigated and cleared by City staff thereafter.
- Pump stations were set up in the model using Archimedean screw pumps, meaning that all the influent sewer flows from the upstream sewer system would be pumped out through the force main at the same flow rate they reach the pump station (i.e., influent flow rate = effluent flow rate). Pump station firm capacities were estimated based on information provided by the City and compared to the model PWWF as described further in **Section 4.4**.
- Non-free-fall (submerged) conditions were assumed at the downstream most discharge structure where the Rabello and Northside force mains outfall to a discharge box structure. Based on information provided by the City, the water level in the structure was set to be eight (8) feet above the crown of the force mains which was the approximate water level during a City field inspection completed on June 19, 2024. At the time of the field inspection, the City noted that the high-water level within the structure appeared to be approximately 13 feet above the crown of the force mains; however, considering it is not known when or how often that condition occurs, it was not used as the design condition.
- Project solutions for the following specific development projects that were already identified and modeled during previous development reviews were included in the appropriate future loading model scenario(s) based on timing:
    - *Patrick Henry Drive (PHD)*: Included in both the near-term future and long-term future model load scenarios. The sanitary sewer improvements within the PHD plan area and the upsize of the Great America Parkway (GAP) West Trunk (from PHD to the Bay Division pipelines crossing) are both to be paid by the developers; therefore, the previously modeled improvements for PHD will not be further discussed in this Master Plan Update or included in the City's Sewer Capacity CIP.

- o *Mission Point*: Included in the long-term future model load scenario only. The City is allowing either of two developer-proposed alternatives, one of which (Revised Option 2A) is included in the model. Both alternatives are assumed to be completely at the developer's cost and therefore will not be further discussed in this Master Plan Update or included in the City's Sewer Capacity CIP.
- o *Freedom Circle*: Included in the long-term future model load scenario only. No separate infrastructure fee area has been established for the Freedom Circle Focus Area; therefore, the previously modeled improvements are presented in this Master Plan Update and will be included in the City's Sewer Capacity CIP.

4.1.2.1 Lined Model Network Assumptions

The Lined Model Network assumes RCP trunks identified by the City to be in poor condition would be lined in future as shown in **Table 4-6** and **Figure 4-5**). The Lined Model Network also assumes that select unlined siphons constructed of either vitrified clay pipe (VCP), cast iron pipe (CIP), or ductile iron pipe (DIP) material would be lined as identified in the table provided as **Appendix F**. The table also includes condition assessment information (i.e., structural quick rating score) from recent CCTV inspections that the City conducted on select siphons between January 2024 and May 2024. The four siphons with the highest severity grade of 4 were part of the group of siphons identified for future lining.

Future lining assumptions were only incorporated into the Lined Model Network, while sewers and siphons already lined were incorporated into both the lined and unlined networks. Gravity sewers and siphons assumed to be lined in the future were assigned a reduced diameter based on an assumed liner thickness and the "FLIN" (future lining) model flag was then applied to the diameter field.

Liner thicknesses, and the corresponding diameter reductions, were calculated based on conservative assumptions. Woodard & Curran referenced information provided by the City from recent lining projects and expertise from condition assessment experts to develop conservative lining assumptions based on the original diameter as shown in **Table 4-5**.

TABLE 4-5: FUTURE LINER THICKNESS ASSUMPTIONS FOR RCP TRUNKS AND SIPHONS (LINED MODEL NETWORK ONLY)[1]

Original Diameter (in)	Assumed Liner Thickness (in)	Assumed Diameter Reduction (in)
12	0.297	0.594
18	0.446	0.892
19	0.471	0.942
20	0.496	0.992
21	0.521	1.042
24	0.596	1.192
27	0.671	1.342
30	0.745	1.49
33	0.82	1.64
36	0.895	1.79
39	0.97	1.94
42	1.046	2.092
53	1.324	2.648

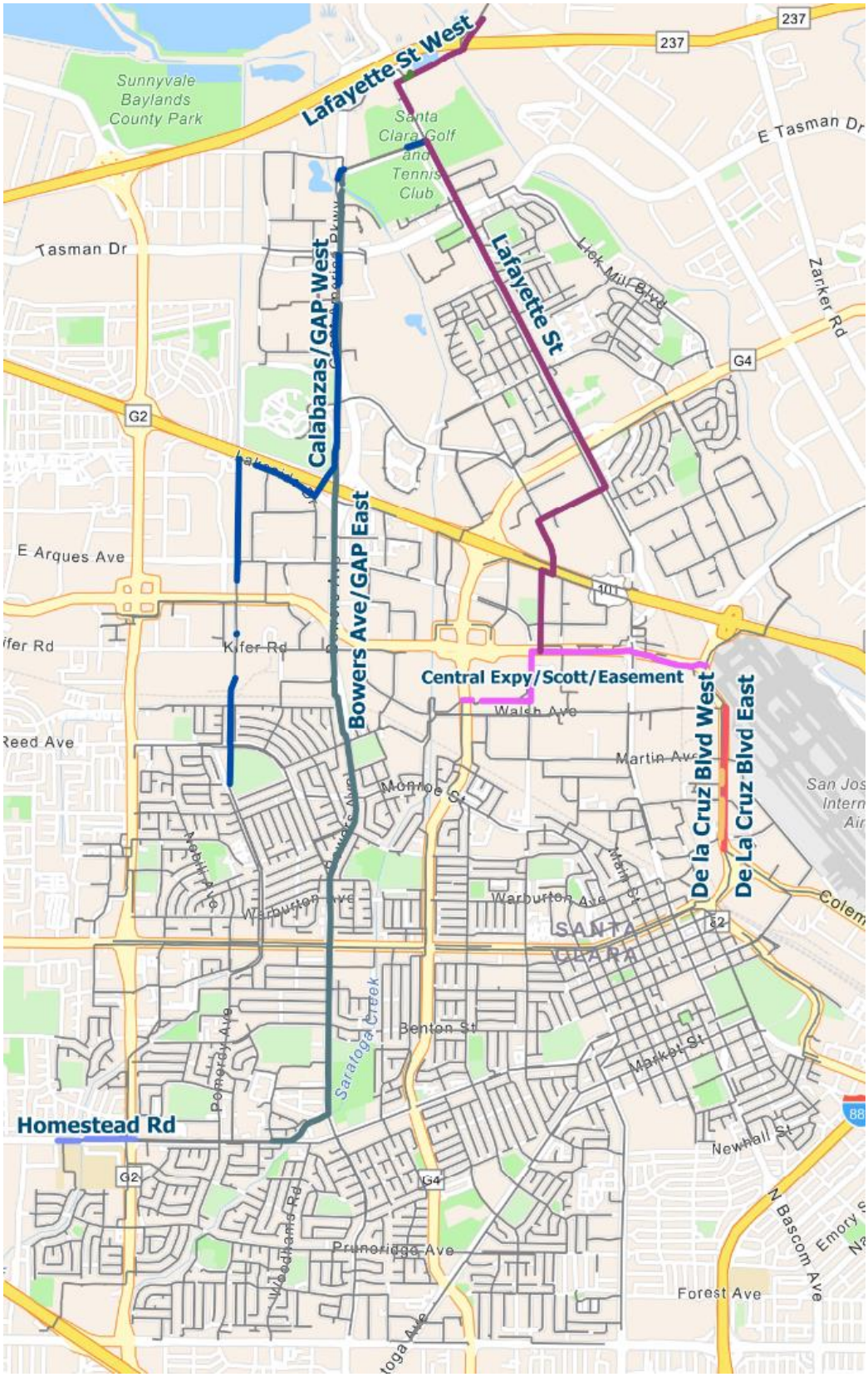
[1] Assumed future liner thicknesses were conservatively calculated based on key assumptions such as host pipe condition, groundwater table, soil properties, etc.

TABLE 4-6: RCP TRUNKS IDENTIFIED FOR FUTURE LINING (LINED MODEL NETWORK ONLY)

Trunk	Lined Section[1]	Original Diameter (in)	Lined Diameter (in)[2]	Capacity Reduction[3]
Homestead	S20-9 to S21-43	27-30	25.7-28.5	12.8%
Calabazas	S52-113 to S83-17	24-33	22.8-31.4	12.8%
Bowers	S22-51 to S83-18	21-33	20-31.4	12.8%
Lafayette	S65-30 to S115-8	24-53	22.8-50.4	12.8%
Central Expressway	S64-44 to S67-21	24-27	22.8-25.7	12.9%
De La Cruz East	S48-11 to S58-2	24	22.8	12.8%
De la Cuz West	S48-2 to S58-14	24	22.8	12.7%
Lafayette West	S114-23 to S114-18	42	39.9	12.8%
GAP E Trunk	S83-18 to S104-30	33-42	31.4-39.9	12.8%
GAP W Trunk	S83-17 to S104-51	30-33	28.5-31.4	12.8%

[1] Upstream to downstream manhole. [2] Rounded to the nearest 0.01-in. [3] Capacity Reduction was calculated as the maximum percent difference of the full capacities of the unlined and lined scenarios.

FIGURE 4-5: RCP TRUNKS IDENTIFIED FOR FUTURE LINING (LINED MODEL NETWORK ONLY)



4.2 Capacity Evaluation Results

The calibrated model was run for existing, near-term future, and long-term future load conditions using both the Unlined Model Network and Lined Model Network to identify areas of the system that fail to meet the specified performance criteria described in **Section 4.1.1**. Areas that fail to meet the specified performance criteria were identified as capacity deficiencies.

This section presents the results of the system capacity evaluation as it relates to the City's gravity sewers (**Section 4.3**) and pump stations and force mains (**Section 4.4**).

4.3 Gravity Sewer System Capacity Deficiencies

All the capacity deficiencies identified in the model for the City's gravity sewer pipes are summarized in **Table 4-7**, including the load scenario, design flow, and physical network conditions that would trigger each deficiency. An overview map showing the locations of all the model-identified capacity deficiencies is provided as **Figure 4-6**. In the figure, pipes shown in pink are predicted to surcharge due to "throttle" conditions, indicating that the full capacity of the pipe is less than the predicted peak flow. Pipes shown in purple are predicted to surcharge due to backwater from a downstream throttle condition. The deficiencies listed in **Table 4-7** are the gravity sewer pipes that would fail to meet the City's specified performance criteria and would therefore need some type of capacity relief, either by increasing their capacity (e.g., upsize to larger diameter) or reducing the flow (e.g., divert flow away from pipe, reducing RDI/I). Project solutions modeled to relieve the identified capacity deficiencies are discussed in **Section 4.5**.

Profiles of the capacity deficient sewers, both before and after project implementation, are provided in **Appendix G**. Profiles are not provided for the specific development projects identified in **Section 4.1.2** that have been previously modeled as part of the development review process (i.e., PHD, Mission Point, Freedom Circle). Note that model-predicted surcharging or overflows (depicted in the before profiles) do not necessarily mean that pipes would be capacity deficient at that location, as flows can back up due to downstream capacity limitations and cause surcharging or potential overflows at upstream locations due to backwater. Additionally, although the profiles indicate where modeled surcharging would occur due to backwater versus due to a capacity limitation ("throttle" condition), the results reflect an "unrelieved" system, meaning that peak flows are dampened out in the pipes that are under heavy surcharge or reduced due to overflows. This means that, as upstream deficiencies are relieved through capacity projects, the peak flows reaching downstream pipes would increase, potentially causing additional surcharging or overflows and triggering additional deficiencies and projects. Therefore, it would be necessary to model the project solutions starting upstream and then proceed to review the deficiencies downstream to confirm that any additional downstream deficiencies are addressed, as the system starts to be relieved.

TABLE 4-7: SUMMARY OF MODEL-PREDICTED GRAVITY SEWER CAPACITY DEFICIENCIES

Deficiency Name	Wastewater Flow Trigger[1]			Design Flow Trigger		Network Trigger	
	Existing (EL)	Near-Term Future (NTFL)	Long-Term Future (LTFL)	Dry Weather (DWF)	Wet Weather (WWF)	Unlined (UMN)	Future Lined (LMN)
Agilent			✓ (E)	✓		✓	N/A
Homestead Road			✓		✓	✓	N/A
Kiely Boulevard			✓ (GP)		✓	✓	N/A
Victoria Avenue			✓ (SD, GP)		✓	✓	N/A
Cabrillo Avenue	✓				✓	✓	N/A

Deficiency Name	Wastewater Flow Trigger[1]			Design Flow Trigger		Network Trigger	
	Existing (EL)	Near-Term Future (NTFL)	Long-Term Future (LTFL)	Dry Weather (DWF)	Wet Weather (WWF)	Unlined (UMN)	Future Lined (LMN)
CMC Basin	✓				✓	✓	N/A
Bowers Avenue			✓		✓		✓
Calabazas Trunk	✓				✓		✓
Agate Drive			✓ (O[2])		✓	✓	N/A
Freedom Circle			✓ (SD)	✓		✓	N/A
PHD		✓ (SD)		✓		✓	N/A
Mission Point			✓ (SD)	✓		✓	N/A
GAP West Trunk			✓		✓	✓	N/A
GAP East Trunk			✓		✓		✓
Bunker Hill Lane East			✓ (E)		✓	✓	N/A
Lafayette Street			✓		✓	✓	N/A

[1] Deficiency cause: SD = Specific Development Project; GP = General Plan; E = Entitlement Flow. O = Other (see notes). If no specific cause is listed, deficiency would be caused by future lining assumption and/or cumulative impacts from upstream due to development and/or relieving upstream capacity constraints.

[2] During wet weather design flows only, Agate Drive deficiency would be triggered because the Calabazas Trunk has insufficient capacity. Flows from Calabazas would backup and overflow to the Agate Drive sewers in the model through manhole S52-4, which is located just upstream of the Agate Drive siphon crossing. However, once the Calabazas Trunk deficiency is relieved, the model runs show that the Agate Drive deficiency would go away. Therefore, **Section 4.5** does not include a capacity improvement project specific to Agate Drive, but **Section 4.6** discusses this area in more detail due to the prolonged RDI/I observed during the flow monitoring program.

Figure 4-6
Overview of Capacity Deficiencies

Sewer Master Plan Update

Legend

Modeled Sewers

Surcharge State

- <1 (no surcharge)
- 1 (backwater surcharge)
- 2 (throttle surcharge)

Woodard & Curran

Project #: 0012307.00

Map Created: December 2024

0 0.25 0.5 1 Miles

N

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions.
Any reliance upon the map or data contained herein shall be at the users' sole risk.

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4.4 Pump Station and Force Main Capacity Deficiencies

Table 4-8 compares the estimated (theoretical) firm and total capacity of each modeled pump station to the modeled flows under buildout PWWF conditions. The table indicates that all pump stations would have sufficient capacity to convey model-predicted buildout PWWF. The table also indicates that model-predicted force main velocities under buildout PWWF for Westside, Tasman, De La Cruz, Primavera, and Stadium Pump Stations would all be less than the capacity deficiency criteria threshold of 10 fps. Velocities are not reported for the Rabello and Northside Pump Station force mains because sufficient information was not available to reasonably represent the operation of these pump stations and force mains in the model (i.e., City could not confirm settings at the flow split gate structure upstream of the pump stations located at S114-19; City reported that the force main discharge pipes are normally submerged but could not provide monitored level data; actual typical pump operations / pump sequencing is unknown).

It should be noted that the model-predicted PWWFs and force main velocities presented may be slightly underpredicted compared to actual measured flows because of the way that the pumps are modeled; all pump stations are represented in the model network using Archimedean screw pumps, meaning that all the influent sewer flows from the upstream sewer system would be pumped through the force main at the same flow rate they reach the pump station (i.e., influent flow rate = effluent flow rate). Therefore, modeled Archimedean screw pumps mimic the smoother trunk flows coming into the pump station rather than the "peakier" downstream flows created by nature of the pumps turning on and off. However, considering SCADA flow data were not available to compare observed flows to model-predicted flows, this approach was considered to be a reasonable representation of flows and velocities.

TABLE 4-8: SUMMARY OF MODEL-PREDICTED PUMP STATION AND FORCE MAIN CAPACITY DEFICIENCIES

Pump Station (Number of Pumps)	Model-Predicted Buildout PWWF (mgd)[1]	Firm Capacity (mgd)	Total Capacity (mgd)	Force Main Velocity at Buildout PWWF (mgd)[1]	Capacity Deficiency[4]
Westside (2)	0.99	1.55[2]	2.53[2]	4.41	No
Tasman (2)	0.52	1.61[2]	2.34[2]	3.20	No
De La Cruz (2)	0.64	1.61[2]	2.52[2]	2.92	No
Primavera (6)	2.65	5.72[2]	6.39[2]	7.9	No
Stadium (6)	0.66	2.56[2]	2.68[2]	4.78	No
Rabello (8)	44.8	25.4[3]	27.9[5]	-	No
Northside (4)		19.8[3]	21.3[5]	-	No

[1] Model Buildout PWWF values and force main velocities reported are from the long-term future load scenario using the Lined Model Network and the relieved system (assuming project solutions have been implemented). mgd = million gallons per day.

[2] Theoretical firm and total capacities were estimated for Westside, Tasman, De La Cruz, Primavera, and Stadium Pump Stations based on basic information, pump settings, pump curves, and system curves provided by the City. Refer to **Appendix C** for detailed calculations for each pump station.

[3] Theoretical firm capacities for Rabello and Northside Pump Stations were estimated by Schaaf & Wheeler Consulting Civil Engineers (S&W) as reported in a memorandum titled "Northside and Rabello Pump Station Firm Capacity Evaluation", dated July 5, 2022.

[4] A capacity deficiency would be identified for cases where model-predicted PWWF exceeds the theoretical firm capacity or where force main velocity during PWWF exceeds 10 fps (refer to **Table 4-3** for the capacity deficiency criteria).

[5] Theoretical total capacities for Rabello and Northside Pump Stations were estimated using excel spreadsheet tools developed by Schaaf & Wheeler as part of the firm capacity study (refer to footnote 3). System curves for total capacities were estimated based on inferred data because Schaaf & Wheeler did not collect test points with all pumps running.

4.5 Capacity Improvement Projects

This section presents the capacity improvement projects that were identified for the City's sanitary sewer system based on the results of the performance evaluation described in **Sections 4.3** and **4.4**. An overview map showing the locations of all the model-identified capacity improvement projects is provided as **Figure 4-7**.

For most of the gravity sewer capacity deficiencies identified in **Table 4-7**, a project was developed to either replace the existing pipe with a larger pipe or redirect flows to other existing sewers with adequate available capacity. The PHD and Mission Point projects were already modeled during the development review process and will be paid for by the developers (as discussed in **Sections 4.1.2** and **5.6**); these projects will not be included in the Master Plan Update's Sewer Capacity CIP but are still included in **Table 4-9** for reference. The Freedom Circle project is also included in **Table 4-9** and discussed below; no separate infrastructure fee area has been established for the Freedom Circle Focus Area, so the previously modeled improvements are included in the City's Sewer Capacity CIP. Additionally, a specific project was not identified to address the Agate Drive deficiency because model runs showed that this deficiency would be relieved once the Calabazas Trunk project was implemented to relieve existing capacity constraints within the Calabazas Trunk. The assumptions used to define the capacity improvement projects, including the design criteria applied (refer to **Section 4.1.1** for more detail), are discussed briefly below.

Replacement pipes were sized to convey the buildout PWWF using the Lined Model Network with a maximum d/D ratio of 0.75; some exceptions were made to allow a slightly higher d/D ratio (always less than 1) to avoid oversizing isolated, flat segments just to meet this criterion. Existing pipe slopes and depths were preserved when upsizing sewers in-place. Projects that included re-sloping (i.e., replacing the existing pipe at a different slope) are identified as such in the project descriptions. Diameters were increased as minimally as possible to prevent oversizing and subsequent low velocities during dry weather conditions, while also considering standard pipe sizes.

Iterative model runs with all capacity improvement projects in place were performed to verify that no additional sewer system capacity deficiencies would occur after upstream capacity improvements were implemented and to review the flow and capacity of the pump stations in the sewer system. These model runs assessed the cumulative impact of increased capacity from upstream projects on peak flows in pipes downstream. Therefore, project solutions for the GAP West and GAP East Trunks were modeled last.

The recommended capacity improvement projects are all listed in **Table 4-9** and discussed in more detail in the following subsections. In total, the table presents fifteen (15) capacity improvement projects which were identified as part of this Master Plan Update. Each project is documented in further detail in **Appendix G** with an individual plan view map and profile views of the impacted sewers before and after project implementation. Project prioritization and planning-level capital cost estimates were prepared for each of the thirteen (13) recommended projects to be funded by the City and included in its Sewer Capacity CIP; these are presented in **Section 5** of this report.

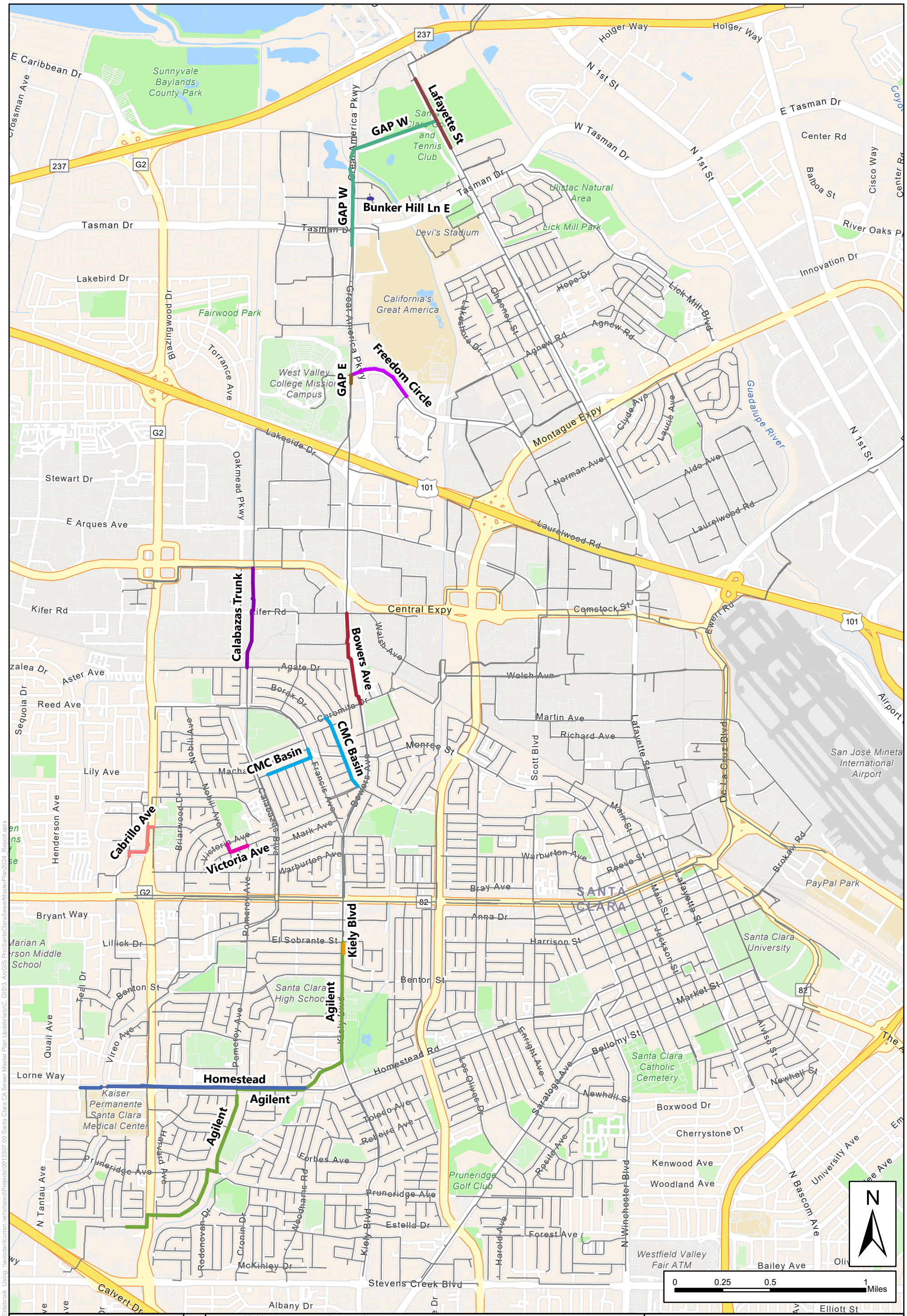

Figure 4-7
Overview of Capacity Improvement Projects

Sewer Master Plan Update

Legend

- Modeled Sewers
- Capacity Improvement Project
- Bunker Hill Ln E
- Agilent
- Bowers Ave
- CMC Basin
- Calabazas Trunk
- GAP E Trunk
- GAP W Trunk
- Homestead Rd
- Kiely Blvd
- Lafayette St
- Victoria Ave
- Freedom Circle
- Cabrillo Extent (Not Actual Project)

THE CITY OF SANTA CLARA CALIFORNIA — The Mission City — 1852

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Figure Exported: 12/27/2024 By: SEstabrook Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\Santa Clara Sewer Master Plan2024_Report.aprx

TABLE 4-9: SUMMARY OF CAPACITY IMPROVEMENT PROJECTS

Project	Triggers[1]	Project Details					
		MH IDs (US - DS)	Length (LF)[2]	Pre-Project Diameters (in)[3]	Post-Project Diameters (in)[3]	New Weirs	Location & Description
1. Agilent (*Section 4.5.1*)	LTFL DWF UMN	S10-77 - S33-33	12,313	10, 21, 24	15, 24, 27	S22-55	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd
2. Homestead Road (*Section 4.5.2*)	LTFL WWF UMN	S20-9 - S23-18 (excluding siphon)	6,407	18, 27, 30	24, 30, 33	S20-16	N Homestead Trunk from Swallow Wy to Saratoga Creek
3. Kiely Boulevard (*Section 4.5.3*)	LTFL WWF UMN	S33-42 - S33-35	270	8	10	-	Orthello Wy to S of El Sobrante St
4. Victoria Avenue (*Section 4.5.4*)	LTFL WWF UMN	S42-113 - S42-36	765	8	10	-	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave
5. Cabrillo Avenue (*Section 4.5.5*)	EL WWF UMN	-	-	-	-	S40-16, S41-38	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy
6. CMC Basin (*Section 4.5.6*)	EL WWF UMN	S52-104 - S52-80 S43-14 - S53-103	3,655	8	12, 15	-	Santa Maria Ave & Francis Ave; Amethyst Dr
7. Bowers Avenue (*Section 4.5.7*)	LTFL WWF LMN	S53-34 - S63-20	2,605	25.7	30	-	Chromite Dr to Walsh Ave
8. Calabazas Trunk (*Section 4.5.8*)	EL WWF LMN	S52-4 - S62-31 S62-31 - S62-10 S62-37 - S62-38	2,760[4]	22.8, 24, 27	18, 27	-	Calabazas Creek from S of Agate Dr to Central Expwy
9. Freedom Circle (*Section 4.5.9*)	LTFL DWF UMN	S84-12 - S83-18	1,885[5]	12	15	-	Mission College Blvd from Freedom Cir to west of Great America Pkwy

Project	Triggers[1]	Project Details					
		MH IDs (US - DS)	Length (LF)[2]	Pre-Project Diameters (in)[3]	Post-Project Diameters (in)[3]	New Weirs	Location & Description
10. Patrick Henry Drive (PHD)[6]	LTFL DWF UMN	S92-16 – S93-50	6,185	-	6-39	-	Patrick Henry Drive and Great America Parkway.
11. Mission Point[6]	LTFL DWF UMN	S92-15 – PHD-11	6,560	-	12-15	-	West Tasman Drive and Great America Parkway.
12. GAP West Trunk (*Section 4.5.10)*	LTFL WWF UMN	S93-42 - S104-19 (excluding siphon)	4,810	28.5-35.7	36, 42	-	S of West Tasman Dr to Lafayette St
13. GAP East Trunk (*Section 4.5.11)*	LTFL WWF LMN	S83-20 to S83-18	231	31.4	39	-	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr
14. Bunker Hill Lane East (*Section 4.5.12)*	LTFL WWF UMN	S93-10 - S93-7	110	6	8	-	E of Great America Pkwy
15. Lafayette Street (*Section 4.5.13)*	LTFL WWF UMN	S104-29 - S104-8	2,290[5]	34.2, 40.3, 42	42, 48	-	N of Calle del Mundo to S of Great America Wy

[1] Triggers include: EL = Existing Loads; NTFL = Near-Term Future Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flows; WWF = Wet Weather Flows; UMN = Unlined Model Network; LMN = Lined Model Network.

[2] Length of sewers included in upsizing project, rounded up to the nearest 5 linear feet (LF).

[3] Range of pipe diameters included in the project. If the project sewers were identified for future lining, the pre-project diameters represent the future lined diameter assumption that was applied to the Lined Model Network which may be different from the existing diameters that exist in the field.

[4] Includes length of sewers to be re-sloped and new parallel sewer segment. [5] Includes length of sewers to be re-sloped.

[6] Proposed project to be paid for by the developer.

4.5.1 Agilent

The Agilent capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during dry weather conditions, in the Unlined Model Network (as indicated in **Table 4-7**).

The recommended project includes replacement of 12,557 LF of 10-, 21-, and 24-inch pipe with 15-, 24-, and 27-inch pipe along Tracy Drive, Pruneridge Avenue, Pomeroy Avenue, Homestead Road (South Homestead Trunk), Saratoga Creek, and Kiely Boulevard (from manhole S10-79 to S33-33). The recommended project also includes installation of a weir at manhole S22-55 to divert the influent flows from Homestead Road South Trunk and Pomeroy Avenue sewers to the Homestead Road South Trunk, which would be upsized as part of the project. The recommended project would maximize capacity in the Homestead Road South Trunk and send as much flow as possible to an upsized Bowers Avenue Trunk.

An alternative involving diverting flows to the larger diameter Homestead Road North Trunk instead of the South Trunk was also preliminarily considered and investigated. However, pipe condition data provided by the City showed that the Homestead Road South Trunk was known to be in worse condition; this pipe had defect scores of 4 or 5 (assigned based on the severity of the worst defect detected) along the stretch of pipe that would be upsized. Therefore, the recommended alternative includes upsizing of the Homestead Road South Trunk. Moreover, it should be noted that a capacity improvement project was also identified for the Homestead Road North Trunk and is discussed in **Section 4.5.2**.

The primary reason for this capacity deficiency is a historic entitlement flow of 0.95 mgd associated with Parcel APN 316-17-018 located at 5301 Stevens Creek Boulevard (current owner Agilent Technologies). This entitlement flow is significantly greater than the company's recent historical water usage of approximately 0.02 mgd (based on winter season water billing data from 2019-2022). Implementing this project in the near term would result in oversized sewers where the daily flow is not sufficient to provide the minimum cleaning velocity and thus could create potential debris and odor issues. However, the City should implement the Agilent capacity improvement project to address the potential capacity deficiency before the parcel begins to discharge its entitled flow of 0.95 mgd. Based on model runs, the maximum flow that Agilent could discharge before the capacity project would be needed is approximately 0.23 mgd; the deficiency would first occur in the sewers along Pomeroy Avenue, south of Homestead Road.

4.5.2 Homestead Road

The Homestead Road capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. The long-term future loads scenario assumes that the Cupertino Sanitary District (CuSD) discharges a future flow to the City's sanitary sewer system up to its current contractual limit (13.8 mgd), which contributes to the deficiency identified in the Homestead Road sewers.

The recommended project includes replacement of 6,565 LF of 18-inch, 27-inch, and 30-inch pipe with 24-inch, 30-inch, and 33-inch pipe along Homestead Road from Swallow Way to Saratoga Creek (from manhole S20-9 to S23-18). The proposed upsizing project that was modeled maintains the existing pipe slopes; however, if feasible, the City may wish to evaluate alternatives during preliminary design that would re-slope and steepen the flatter pipe segments (i.e., proposed 33-inch pipes between manholes S20-18 and S21-43). It should be noted that the proposed project does not include improvements to the siphon between manhole S20-26 and S20-18 because the siphon would not be capacity deficient. Per the City's records, that siphon is not currently lined and is made of polyethylene with an internal diameter of 20.2

inches; therefore, it was not assumed for future lining in the Lined Model Network based on the material classification.

The recommended project also includes installation of a weir at manhole S20-16 to divert as much flow as possible to maximize the available capacity within the upsized Homestead Road South Trunk (refer to description of the Agilent project in **Section 4.5.1**). The Homestead Road and Agilent capacity improvement projects would work together to maximize capacity within both trunks along Homestead Road to send as much flow as possible to an upsized Bowers Avenue Trunk. This approach targets replacement efforts to older pipelines assumed to be in worse condition and diverts flow away from the Calabazas Trunk, which is relatively shallow in some locations (i.e., at higher risk of sewer overflows) and also had capacity issues during wet weather flows which were first identified under existing loading conditions using the Lined Model Network and under near-term loading conditions in the Unlined Model Network (refer to **Section 4.5.8** for discussion of the Calabazas Trunk project).

4.5.3 Kiely Boulevard

The Kiely Boulevard capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. Simulation results show that the capacity deficiency is caused by cumulative impacts of increased discharges from General Plan parcels (discussed in **Section 2.2.2.2**), specifically parcels draining to the Homestead Road North Trunk and the sewer along Brookdale Drive.

The recommended project includes upsizing of one 270 LF segment of 8-inch pipe to 10-inch pipe on Kiely Boulevard from Orthello Way to south of El Sobrante Street (from manhole S32-42 to S33-35).

4.5.4 Victoria Avenue

The Victoria Avenue capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. According to the simulation results, the capacity deficiency is caused by cumulative impacts of increased discharges from the El Camino Real Specific Plan and General Plan parcels, specifically parcels draining to the sewers on the north side of El Camino Real and along Warburton Avenue.

The recommended project includes upsizing and re-sloping of 515 LF of 8-inch pipe to 10-inch pipe on Fowler Avenue from Pomeroy Avenue to Nobili Avenue and installation of 250 LF of new 10-inch pipe on Nobili Avenue from Fowler Avenue to Victoria Avenue (from manhole S42-113 to S42-36). The project also would include abandoning 255 LF of existing 8-inch sewer between Fowler Avenue and Victoria Avenue (from manhole S42-48 to S42-36), which crosses through an easement underneath single-family residential parcels.

The recommended project is an alternative solution to the project that was preliminarily modeled, which included upsizing of only two pipe segments along Victoria Avenue from Pomeroy Avenue to Nobili Avenue (from manhole S42-36 to S42-113). However, upon further review and based on discussions with the City, the alternative was expanded so that the pipe located within the existing easement could be abandoned.

This project solution does not include two pipe segments between manholes S42-113 and S41-53, because they would have adequate capacity based on the City's capacity criteria (no surcharge), thus they were not included in the proposed project. However, considering these pipe segments are located between the Victoria Avenue proposed project and the recently upsized section downstream of manhole S41-53, the City may wish to consider expanding the project to include these pipes during preliminary design.

4.5.5 Cabrillo Avenue

The Cabrillo Avenue capacity improvement project would relieve the surcharge capacity deficiency first triggered in the Unlined Model Network under existing sewer loads during wet weather conditions. Note that the capacity deficiency is also triggered during dry weather conditions but only under long-term future loads.

The recommended project includes installation of two weirs (at manhole S40-16 and S41-38) to divert as much flow as possible away from the capacity deficient sewers along Cabrillo Avenue and maximize use of available capacity within adjacent existing sewers. The first weir would be installed in manhole S40-16 at the intersection of Halford Avenue and Buckley Street and would divert flow east through the sewers along Buckley Street and away from the sewers to the north along Halford Avenue that eventually drain to Cabrillo Avenue. The second weir, which would be located downstream of the first weir, would be installed in manhole S41-38 at the intersection of Lawrence Expressway and Saint Lawrence Drive and would continue to divert flow east through the sewers along Saint Lawrence Drive and away from the sewers to the north that eventually drain to Cabrillo Avenue. Model simulation results suggest a maximum change in d/D of 28% (from 37% to 65% full) in the sections downstream of the weirs. However, with flows diverted away from Cabrillo Avenue through these two new weirs, the capacity deficiency along Cabrillo Avenue would be eliminated.

An alternative solution was preliminarily modeled to upsize existing 8-inch pipes to 12-inch along Cabrillo Avenue (from manhole S41-13 to S41-20) and one pipe segment on Lawrence Expressway from 8-inch to 10-inch; however, the City preferred the recommended solution which avoids the need for pipe replacement. Additionally, any pipe replacement along Lawrence Expressway would require obtaining a permit from Santa Clara County, which would add cost and complexity to the project.

4.5.6 CMC Basin

The CMC Basin capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under existing sewer loads, during wet weather conditions, in the Unlined Model Network.

The recommended upsizing project includes replacement of approximately 3,655 LF of 8-inch pipe with 12-inch pipe along Amethyst Drive (from manhole S43-14 to S53-103) and 15-inch pipe along Santa Maria Avenue and Francis Avenue (from manhole S52-104 to S52-80).

Although the model runs show that the recommended upsizing project would meet the City's d/D design criteria under PWWF as shown in the project solution profile presented in **Appendix G**, it would not meet the City's velocity design criteria under PDWF (i.e., minimum of 2 fps) within the upsized 12-inch pipe segments between S43-14 and S53-103 on Amethyst Drive and the upsized 15-inch pipe segments between S52-104 and S53-74 on Santa Maria Avenue. These criteria often come into conflict with one another because increasing the size of the pipe to meet the required maximum d/D criterion under a relatively short-duration PWWF condition means that the pipe will experience lower velocities during normal dry weather conditions which occur much more often.

Flow meters within the CMC Basin tributary area exhibited a very high RDI/I response during the monitoring program. Therefore, it is recommended that the City conduct I/I investigations prior to project implementation to attempt to pinpoint and eliminate significant sources of excessive I/I within the CMC Basin, if possible. However, model runs show that the RDI/I would need to be reduced by at least 50% to 60% to eliminate the capacity deficiency. Refer to **Section 4.6** for a more detailed discussion on I/I, including source detection and control methods and previous investigations and recommendations for Santa Clara.

4.5.7 Bowers Avenue

The Bowers Avenue capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Lined Model Network only. The capacity deficiency would be caused by the assumed future lining of the Bowers Trunk, which the City identified as a RCP sewer.

The recommended upsizing project includes replacement of approximately 2,605 LF of existing 27-inch pipe (25.7-inch with assumed future lining) with 30-inch pipe along Bowers Avenue (from manhole S53-34 to S63-20) from Chromite Drive to Walsh Avenue. The project profile in **Appendix G** shows that the downstream end of the downstream-most pipe segment included in the proposed project (from manhole S63-26 to S63-20) would exceed the City's 0.75 maximum d/D design criterion under PWWF; however, the pipe was not upsized because the resulting d/D ratio was still less than 1 and the City preferred to keep diameters consistent rather than upsize one isolated pipe segment just to meet the d/D design criterion.

4.5.8 Calabazas Trunk

The Calabazas Trunk capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under existing sewer loads, during wet weather conditions, in the Lined Model Network. The capacity deficiency also appears in the Unlined Model Network under near-term and long-term future loads during wet weather flow conditions.

The recommended project includes upsizing of approximately 2,000 LF of existing 22.8 – 27-inch pipes along Calabazas Creek (from manhole S52-4 to S62-10) from south of Agate Drive to Central Expressway. It should be noted that the recommended project includes pipe segments that are already lined between manhole S62-51 and S62-32. The Lined Model Network assumes existing, unlined 27-inch RCP pipes would be lined resulting in a diameter of 25.7-inch. Roughly 750 LF of pipe between manhole S62-31 and S62-10 of the 2,000 LF that would be upsized to 27-inch would also be re-sloped. In addition to upsizing and re-sloping, the project includes installation of a new 18-inch pipe between manhole S62-37 and S62-38 that runs parallel to the existing sewer to relieve the capacity restriction at that location due to a storm drain crossing north of Kifer Road.

The model runs show that the Calabazas Trunk project would eliminate the overflow diversion from the Calabazas Trunk into the Agate Drive sewers at manhole S52-4, which is located just upstream of the Agate Drive siphon crossing. Therefore, the Calabazas Trunk project solution would eliminate the Agate Drive capacity deficiency so that no additional project would be required for Agate Drive.

4.5.9 Freedom Circle

The Freedom Circle capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during dry weather conditions, in the Unlined Model Network. The capacity deficiency would be caused by increased flows from the Freedom Circle Focus Area specific development project that would discharge into the City's sewers along Freedom Circle Drive and Mission College Boulevard. This project was previously modeled during the development review process but is still identified as a Master Plan Update project to be included in the City's Sewer Capacity CIP. The recommended project is a slight modification of the project identified during the development review and includes re-sloping to meet the City's design criteria d/D (maximum of 0.75 during PWWF).

The recommended upsizing project includes replacement and re-sloping of 1,885 LF of 12-inch pipe and 15-inch pipe with 15-inch pipe along Mission College Boulevard (from manhole S84-12 - S83-18) from Freedom Circle Drive to west of Great America Parkway. The downstream most segment of the project (from

manhole S83-13 to S83-18) was assumed to connect to the GAP East trunk at equal crown elevations to minimize impacts from the GAP East trunk hydraulics.

4.5.10 GAP West Trunk

The GAP West Trunk capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. The GAP West Trunk sits lower than the GAP East Trunk, to which it is interconnected, and therefore reaches capacity first. However, a capacity deficiency project was also identified for the GAP East Trunk (triggered by the Lined Model Network only) and is discussed further in **Section 4.5.11**. Considering that the capacity deficient sewers are located towards the downstream end of the City's sewer system, the capacity deficiency would likely be caused by the cumulative impacts of long-term future loads on the system combined with wet weather conditions. The deficiency would be slightly exacerbated with assumed future lining of the GAP West Trunk, which the City identified as a RCP sewer.

The recommended upsizing project includes replacement of approximately 4,810 LF of existing 28.8-31.7-inch pipe (already lined), 30-inch pipe, and 33-inch pipe with 36-inch and 42-inch pipe along Great America and the easement north of Stars and Stripes Drive (from manhole S93-42 to S104-19) from south of West Tasman Drive to Lafayette Street. The recommended project does not include improvements to the existing siphon between manhole S103-19 and S103-16, because the simulation results do not predict this siphon to be deficient. It should be noted that this siphon was assumed to be lined in the future as part of the Lined Model Network, but it is not currently lined. Even with the reduced diameter assumed based on future lining, the siphon would not be capacity deficient. However, the City may wish to consider evaluating alternatives during preliminary design that would replace or remove this siphon that crosses under the San Tomas Aquino Creek, if feasible.

It should also be noted that the project does not include the GAP West Trunk improvements associated with the PHD development. The cost to upsize the GAP West Trunk from the PHD specific development project's discharge point to the Bay Division pipelines crossing (from manhole S83-5 to S93-53) is to be paid by the developers as discussed in **Section 4.1.2**; therefore, this portion of the project is not included in the Master Plan Update and will not be reflected in the City's Sewer Capacity CIP. The Master Plan Update and Sewer Capacity CIP will only include the GAP West Trunk capacity improvements located downstream (north of Old Glory Lane) and which are not part of the PHD agreement. There are, however, two pipe segments between manholes S93-48 and S93-42 that are downstream of the PHD project and the GAP West project that would still have capacity based on the City's capacity criteria of no surcharge. They are not included in the proposed project, but the City may wish to consider expanding the project to include them during preliminary design.

4.5.11 GAP East Trunk

The GAP East Trunk capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Lined Model Network only because the City identified the GAP East Trunk as a RCP sewer. Therefore, the capacity deficiency would not be triggered in the Unlined Model Network. Considering the capacity deficient sewers are located at the downstream end of the City's sewer system, the deficiency is due to the combined effects of the assumed future lining plus long-term future loads plus wet weather conditions.

The recommended upsizing project includes replacement of approximately 230 LF of existing 33-inch (assumed lined inside diameter of 31.4-inches) to 39-inch pipe from manhole S83-20 to S83-18 (at the manhole connecting the Freedom Circle trunk with the GAP East Trunk). The scope of the recommended

improvement project is minimal because simulation results show that the recommended improvements to the GAP West Trunk (discussed in **Section 4.5.10**) would relieve most of the deficiencies in the GAP East Trunk.

4.5.12 Bunker Hill Lane East

The Bunker Hill Lane East capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. The primary cause of the capacity deficiency is due to historic entitlements held by parcel APNs 104-55-012 and 104-55-013 (located near Bunker Hill Lane and east of Great America Parkway by the Santa Clara Convention Center). Combined, these two parcels are entitled to discharge up to 0.27 mgd into the City's sewer system.

Assuming that the entitlement flow would be loaded to the City's sewer system, the existing 6-inch sewers between manhole S93-13 and S93-7 would be surcharged during PWWF conditions (as shown in the profile provided in **Appendix G**); specifically, the sewer between manhole S93-10 and S93-7 would be capacity deficient and would need to be upsized to convey the flow. Therefore, the recommended project includes replacement of the existing 6-inch pipe that would experience the throttle surcharge (between manhole S93-10 and S93-7) with approximately 110 LF of 8-inch pipe. The project solution profile in **Appendix G** shows that the pipe segment immediately downstream of the pipe to be upsized would still be surcharged at the downstream end. However, this model-predicted surcharge is a backwater surcharge on one end only that is caused by the hydraulic grade line from the connection to the larger diameter GAP East Trunk. Prior to project implementation, the City should verify the inverts of sewers along the project alignment and at the downstream connection to the GAP East trunk sewer.

This project should not be implemented until these parcels begin to discharge their entitled flow.

4.5.13 Lafayette Street

The Lafayette Street capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. Considering the capacity deficient sewers are located towards the downstream end of the City's sewer system, the capacity deficiency would likely be caused by the cumulative impacts of long-term future loads on the system combined with wet weather conditions. The deficiency would be slightly exacerbated with assumed future lining of the Lafayette Trunk, which the City identified as a RCP sewer.

The recommended upsizing project includes replacement of approximately 2,290 LF of existing 36-inch (34.2-inch with assumed future lining), 40.3-inch pipe (already lined), and 42-inch pipe with 42-inch and 48-inch pipe along Lafayette Street (from manhole S104-29 to S104-8) from north of Calle del Mundo to south of Great America Way. The project also includes some re-sloping of the existing pipe segments from manhole S104-22 to S104-14; per record information, the existing slope is minimal at approximately 0.02%.

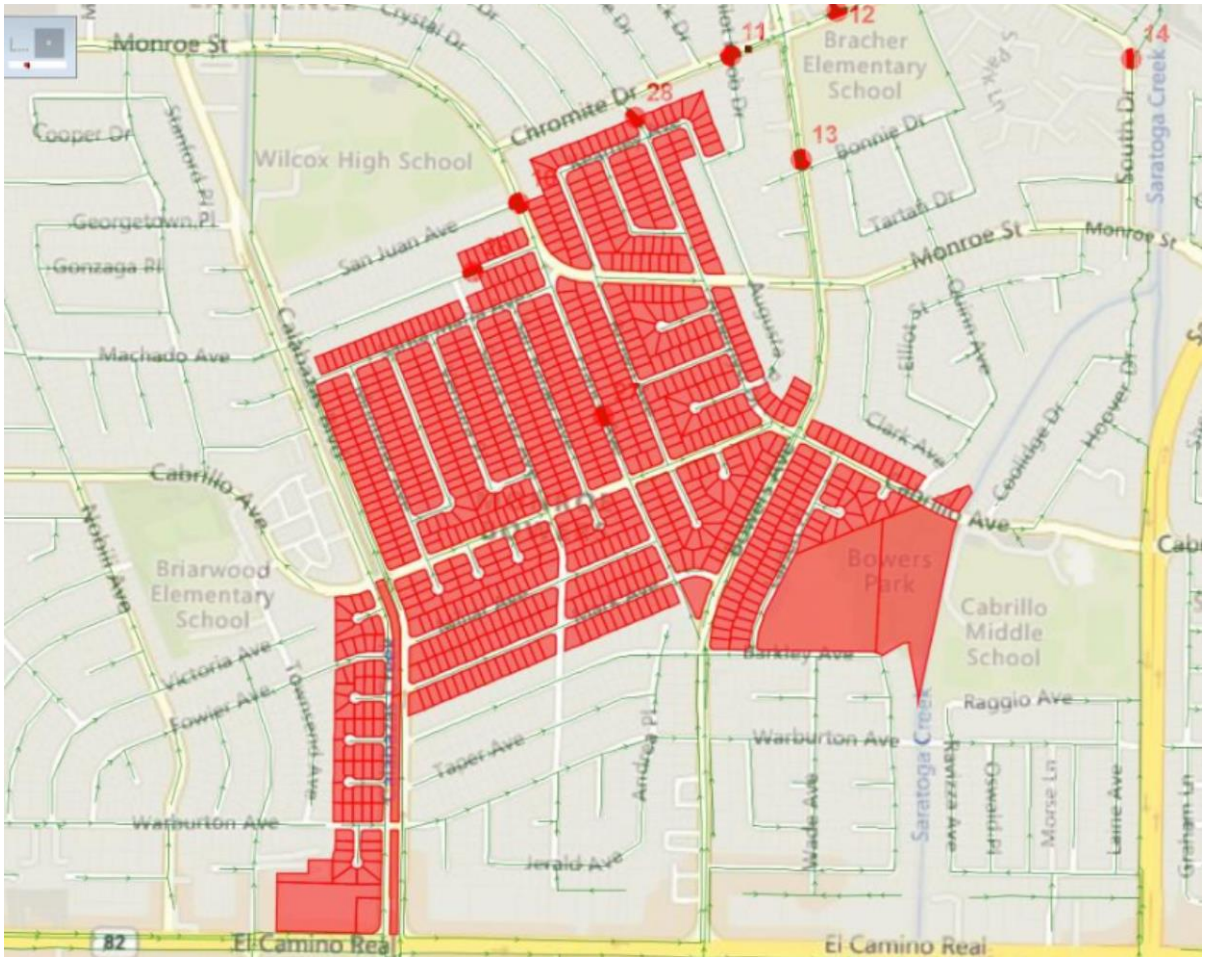
4.6 Infiltration and Inflow Discussion

There are various methods for characterizing the relative contributions of RDI/I from different areas of the sewer system. Because the critical issue with respect to RDI/I is the impact that peak flows have on the system, the focus is on characterizing peak RDI/I in particular. Potential approaches to quantify peak RDI/I include: the ratio of PWWF to average dry weather flow (ADWF), referred to as the wet weather peaking factor; peak RDI/I per acre of contributing area; and peak RDI/I per foot of pipe; where PWWF and peak RDI/I are based on design storm flows. The RDI/I response can be characterized for each metered basin based on these parameters.

4.6.1 Completed Infiltration and Inflow Investigations

Based on the flow monitoring data collected during the winter 2022-2023 season and as discussed in **Sections 2.1** and **3.5.2.1**, a very high RDI/I response was observed within the flow meter (FM) basins in the CMC tributary area, the extent of which is shown in **Figure 4-8**.

FIGURE 4-8: CMC BASIN TRIBUTARY AREA



During the flow monitoring period, wet weather peaking factors of 23.5 and 17.0 were observed in the FM 27 and FM 28 basins, respectively; these peaking factors (presented in **Section 3.5.2**) were much higher than the peaking factors observed in other FM basins throughout the City which, when averaged together not including FM 27, FM 28, and FM 4 (Levis stadium flows), were approximately 3.4. The adjacent Agate Drive tributary area (FM 31) also showed a significant and sustained response to rainfall. The nature of the responses at FM 27 and FM 31 were indicative of significant infiltration, as the response was generally slower and took a long time to recede (i.e., several weeks following rainfall). Moreover, because several consecutive rainfall events occurred within a short period of time during the flow monitoring period, the infiltration response did not fully recede before another rainfall event occurred. For example, the FM 31 data indicate that depth of flow did not return to baseline levels in between rainfall events from December 27, 2023, and January 19, 2024, as shown in **Figure 4-9**. Based on NOAA rainfall statistics (refer to **Figure 4-10**), actual rainfall observed during the wet weather monitoring season was greater than a 10-yr event for longer durations (10+ days).

FIGURE 4-9: OBSERVED FLOW MONITORING DATA AT FM 31 (S62-50, 10")

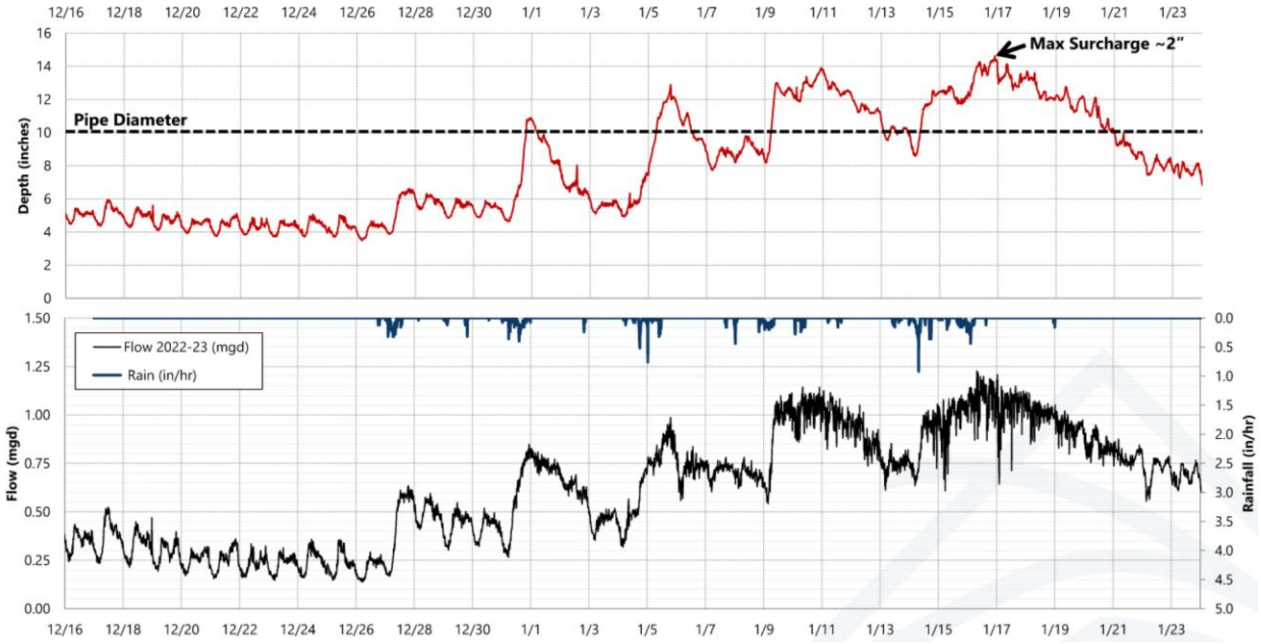
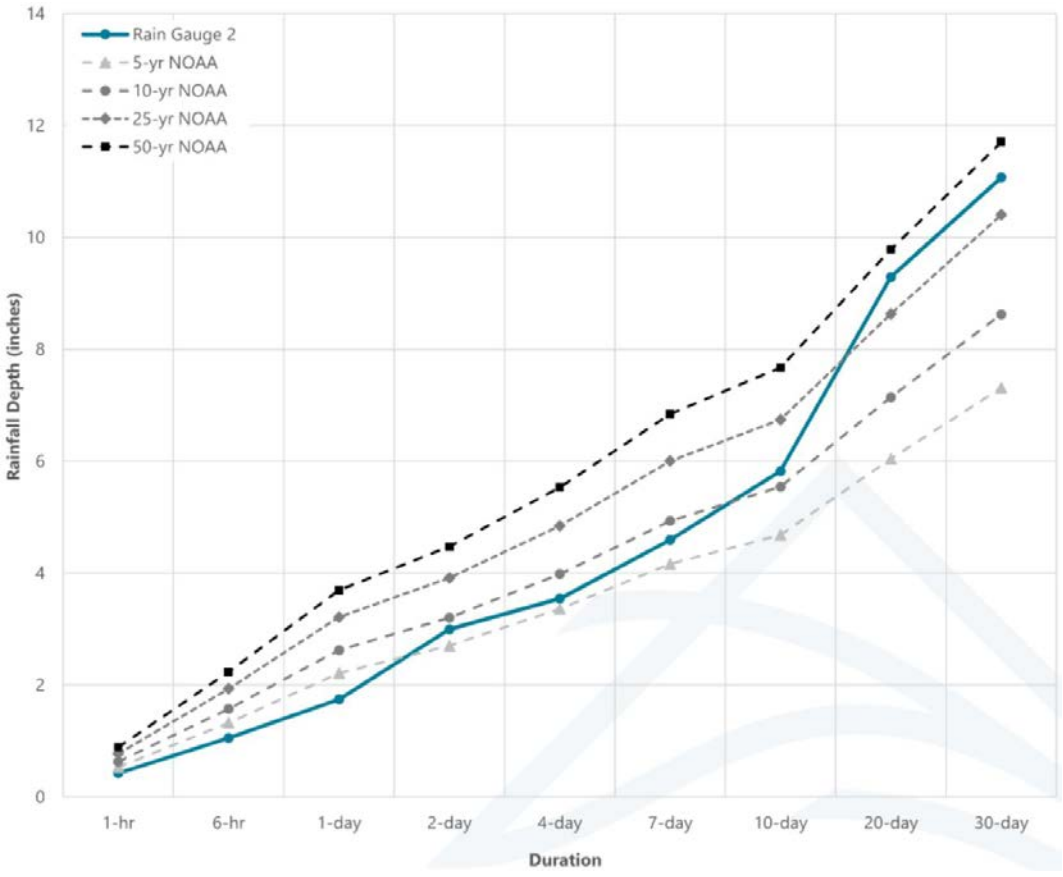


FIGURE 4-10: NOAA RAINFALL STATISTICS COMPARED TO OBSERVED JANUARY 2023 RAINFALL IN SANTA CLARA, CA



The flow monitoring results are consistent with the findings of other field investigations that V&A recently completed in the CMC basin as discussed in **Section 3.5.2.1**. V&A's associated report recommended that the City consider smoke testing in the CMC basin, which may better identify lateral defects.

4.6.2 I/I Source Detection and Control Methods

A necessary step in identifying potential I/I control measures is a realistic assessment of the actual sources of I/I in the sewer system. Based on the pattern and magnitude of flows in the City's sewer system, the likely sources of RDI/I flows are defects in sewers and service laterals, and possibly some direct connections (e.g., illegally connected roof and area drains, direct connections from the storm drain system, etc.). Appropriate I/I control methods depend on the type and sources of I/I. Control methods must include detection as well as correction.

Direct Inflow Sources

Direct inflow sources can contribute significantly to both volume and peak rates of I/I and have the greatest probability of being cost effective to eliminate. The main methods used to detect and locate direct inflow sources are smoke and dye testing (dye testing is used primarily as a confirmatory test). Smoke testing is considered to be a relatively easy and inexpensive method (cost is approximately $1.00 to $1.25 per foot if a substantial length of pipe is tested), and discovery of just a few direct storm drain cross-connections, for example, can make the effort worthwhile. However, unless there is some indication or knowledge of the existence of direct connections in the system, finding them may require an extensive smoke testing program, which requires public notification measures and access to private property to document the smoke returns. For this reason, smoke testing is generally targeted at specific areas with high peak RDI/I rates.

Generally, the most numerous types of sources found during smoke testing are not direct inflow connections but defects in shallow pipes, primarily laterals. Rehabilitation of laterals may be a challenging institutional issue (see discussion below on correction of private property I/I sources).

Manholes subject to ponding or located in drainage courses may also be sources of direct inflow. The amount of I/I depends on the manhole location, type of manhole cover (number and size of holes), and the condition of the cover and frame. Physical inspection of manholes is the most effective way to identify such conditions, and correction is relatively straightforward (replace cover, realign frame, raise manhole to grade, remove or relocate manhole in watercourse, etc.). Physical inspection can be conducted in conjunction with sewer inspection or routine cleaning work, or as a separate activity.

Elimination of direct inflow connections requires disconnection of the source and re-direction of the drainage to an appropriate location. This may simply be to the ground surface (as in the case of roof drains), or connection to a nearby storm drain or street gutter. In general, each identified source needs to be evaluated on a case-by-case basis to identify the appropriate corrective measure.

Infiltration Sources in Sewer Mains and Manholes

Infiltration sources are defects in sewer pipes or manholes caused by defective materials or construction, general deterioration, or damage caused by physical conditions such as ground movement or settlement, traffic loads, or root intrusion. Infiltration sources (defects) are detected by inspection: visual inspection in the case of manholes and CCTV inspection for sewer mains. However, visual observation of active I/I is generally not feasible because the RDI/I generally occurs for only short periods during rainfall events, and the pipes may fill up during those periods, making CCTV inspection difficult or impossible.

Infiltration correction methods involve rehabilitation or replacement of entire pipe segments or manholes or spot repair of localized defects. There are numerous materials and methods used for this type of rehabilitation. In general, however, the cost per unit amount of I/I removed is relatively high, because the defects individually contribute relatively small amounts of flow. It is recognized that infiltration in the sewer system will "migrate" to other nearby defects that are left un-repaired. Therefore, a fairly extensive area of the system may need to be included in the rehabilitation effort in order to achieve substantial flow reduction. Furthermore, reductions greater than about 30% can rarely be achieved without also addressing the infiltration from private laterals. Generally, rehabilitation to reduce infiltration is cost effective only if a significant amount of infiltration can be isolated to a relatively small area, or there are extremely costly improvements required downstream to convey, treat, and dispose of the excess flow.

I/I Sources on Private Property

I/I sources on private property are primarily defective laterals, but may also include broken cleanouts or cleanout caps, or directly connected roof and area drains. Smoke testing is the primary method for detecting private property I/I sources.

It should be noted that low lying areas and any buildings with basements are likely to have sump pumps. It is possible that some sump pumps may be directly connected to the sewer system, rather than the storm system, or may be discharging to the street, in which case those flows would likely enter the storm system but could also enter the sewer system through manhole cover openings. Connected sump pumps would not be identified by any of the source detection methods described here, but building inspectors may have more information about whether these types of connections exist in the area. Therefore, for more aggressive programs, building or property inspections can be conducted, and/or laterals can be CCTV inspected or tested for leaks using air or water pressure tests. These types of inspections and tests generally require that the lateral have cleanout access, ideally at both the connection to the building plumbing and at or near the property line. However, new technologies are now available, such as cameras that can be "launched" up the lateral during CCTV inspection of the mainline, that make it easier to inspect private laterals.

4.6.3 I/I Investigation Recommendations for Santa Clara

Reducing I/I through locating defects and sewer main replacement programs could be an effective alternative to capacity improvement projects; specifically, the capacity improvement project recommended for the CMC Basin. However, it can be difficult to predict the extent of I/I reduction that could be achieved through any individual I/I reduction project. In the CMC Basin tributary area, for example, model runs show that RDI/I would need to be reduced by at least 50% to 60% to eliminate the CMC Basin capacity deficiency (i.e., surcharge along Amethyst Drive and Santa Maria Avenue and Francis Avenue) and the need for a capacity improvement project that includes upsizing the existing sewers.

Even if the required I/I reduction is achievable, the cost of the significant sewer main (and sewer lateral) replacement needed to achieve meaningful reductions of I/I is often more expensive than adding additional conveyance capacity. Moreover, the time needed to implement I/I reduction projects and assess their impacts on system through pre-and-post-implementation flow monitoring programs could be significant. Therefore, I/I reduction may not be a cost-effective approach.

Still, it is recommended that the City's Sewer Capacity CIP include some budget for I/I source detection methods to attempt to further characterize and pinpoint significant sources of I/I to the sanitary sewer system. The V&A report (discussed in **Section 4.6.1**) recommended CIPP lining of pipe segments that were investigated via CCTV during the study because all showed condition defects; however, it is recommended that further basin wide investigations be completed prior to implementing targeted rehabilitation projects.

At minimum, smoke testing and CCTV investigations should be conducted within the CMC Basin prior to implementation of the capacity improvement project discussed in **Section 4.5.1**, which consists of upsizing the capacity deficient sewers. Additionally, the City should consider conducting smoke testing and CCTV investigations within the FM 31 basin area that is tributary to the Agate Drive sewers. An allowance for these recommended I/I investigations is included in the Sewer Capacity CIP in the form of other additional costs (refer to **Section 5.5**).

5. RECOMMENDED SEWER CAPACITY CAPITAL IMPROVEMENT PROGRAM

This section presents the specific sewer projects that are recommended for inclusion in the City's Sewer Capacity CIP based on the findings of the sewer system capacity analysis discussed in **Section 4**.

The sections below give an overview of the process, information and assumptions used, specifically:

- Project development process
- The methodology used to prioritize projects and estimate their costs
- Indirect cost resulting from implementing the capacity improvement projects
- Level of confidence in the projects
- Projects that will not be financed by the City
- An overall summary of all recommended projects, along with a brief discussion for each project focusing on the rationale and validation to justify the need for the project (refer to **Sections 4.5.1-4.5.13** for more detailed descriptions of the model-predicted capacity deficiencies and the solutions modeled)
- Project schedule

Details for each project are included in **Appendix G**.

5.1 Project Development Process

Capital improvement projects were developed to address potential deficiencies identified in the capacity analysis. One project was developed from up to three alternatives analyzed for each of the capacity deficiencies presented in **Section 4**.

The capacity deficiencies were relieved by a) increasing the capacity of deficient segments by upsizing sewers, adding additional parallel pipes, and/or re-slopping segments b) decreasing the flow through deficient pipe segments by diverting flow towards pipe segments with more capacity, or c) a combination of both a and b. All new pipes were sized according to the City's Design Criteria (refer to **Table 4-4**), except when the City decided not to do so, which is stated in the project descriptions included in **Section 4.5**.

Each project solution was tested in the hydraulic model to confirm that it would provide system capacity relief and to determine the pipe size required for any new sewers. Finally, the proposed pipe alignment was reviewed using GIS maps and aerial imagery to identify potential constructability issues. Complicating factors such as highway crossings, railroad crossings, creek proximity and crossings, and projects on sewers with many laterals (thereby impacting flow control during construction) were noted. Although this constructability review was done at a high level for planning rather than a detailed design level, the issues identified provide a reasonable starting point for further project development during the pre-design phase. The goal of the constructability review was to flag key areas where trenchless construction may be required. Pipe-bursting may be feasible but was not evaluated during this Master Plan Update; detailed utility separation and geotechnical investigations would be required to fully evaluate feasibility.

5.2 Project Prioritization Methodology

Each project was prioritized from "1" (highest priority) to "7" (lowest priority) based on a combination of factors including the wastewater flow trigger (existing load or EL vs. near-term future load or NTFL vs. long-term future load or LTFL), design flow trigger (dry weather flow or DWF vs. wet weather flow or WWF), physical network trigger (future lined network or LMN vs. no future lining network or UMN), and assumed

structural condition trigger (RCP segments present vs. not present). Projects that address existing deficiencies with future lining assumptions not in place should have the highest priority because they pose the greatest risk of a sanitary sewer overflow (SSO). **Table 5-1** shows the ranking classifications used to assign priorities to each of the projects.

TABLE 5-1: PROJECT PRIORITIZATION RANKING[1]

Priority Ranking	Wastewater Flow Trigger(s)	Design Flow Trigger(s)	Physical Network Trigger	Structural Condition Trigger	Notes
1	EL	WWF	UMN	-	
2	EL	WWF	LMN	-	
3	LTFL	WWF	UMN	RCP trunk	Not Priority 1 or 2 but alignment includes RCP trunk identified for future lining.
4	LTFL	WWF	LMN	RCP trunk	Not Priority 1 or 2 but alignment includes RCP trunk identified for future lining.
5	LTFL	DWF	UMN	-	
6	LTFL	WWF	UMN	-	
7	LTFL (entitlement)	DWF or WWF	UMN	-	

[1]Note: Triggers include: EL = Existing Loads; NTFL = Near-Term Future Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flows; WWF = Wet Weather Flows; UMN = Unlined Model Network; LMN = Lined Model Network.

5.3 Project Level of Confidence

The capacity improvement projects developed to resolve the hydraulic deficiencies are primarily based on forecasted flows predicted from the calibrated model. As discussed in **Section 4.1**, the hydraulic model utilizes a design rainfall event along with other modeling assumptions to identify hydraulic deficiencies and resulting capacity improvement projects. Because these assumptions impact the recommended capacity improvement projects, it becomes necessary to independently validate the need for these projects by reviewing local flow monitoring data, review of reported surcharging and operational issues, and compatibility between flow meter data and the model. The project validation process, often referred to as a 'level of confidence' evaluation, was conducted for each recommended project with the results discussed by project in **Section 5.7**. The confirmation levels used in the validation process are shown in **Table 5-2**.

TABLE 5-2: PROJECT FLOW CONFIRMATION LEVELS

Flow Confirmation Level	Description
1	Flow meter on or very near to the project reach surcharged during metered storm.
2	Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm.
3	Flow meter near the project reach (upstream or downstream) confirms flow.
4	No flow meter near the project reach to confirm flow.
5	Conflicting flow between meter and model.

For projects with a Level 1 rating, the need for the project has effectively already been confirmed by previous flow monitoring data. Level 2 projects were confirmed to have reasonably accurate model flows based on

model comparison to flow meter data but have no confirmed surcharging during the monitoring period (calibration events may have been too small to cause surcharging at these locations). Level 3 projects were confirmed to have reasonably accurate model flows based on model comparison to flow meter data. Level 4 and 5 projects have no reliable confirmation of model flows; conducting flow monitoring on these project reaches prior to design would provide a greater level of confidence in modeled flows.

It should be noted that projects triggered by projected flows from historic entitlement agreements or specific future development flow estimates were not assigned a confidence level as it relates to monitored flows.

5.4 Project Cost Estimates

Planning level cost estimates were developed for each recommended project. This level of cost estimate corresponds to the Planning-Level "Class-5" cost as defined by the American Association of Cost Engineers, International (AACE 2005). The AACE provides guidelines on accuracy ranges defined as percentages +/- of the expected average bid cost of the work. The Planning Level cost is expected to range from a high of: +30% to+100% and from a low of: -20% to -50% of the eventual cost of the project.

The cost index used for escalation of past bid prices was the Engineering News Records Construction Cost Index (ENR 2024) for the San Francisco area as of August 2024 (CCI of 15367.24).

Cost criteria include baseline construction costs for gravity trunk sewers using open-cut construction[1]. Unit costs for gravity trunk sewers vary with pipe diameter and depth. Baseline costs include all standard materials, equipment, possible weir installation or adjustment, potential lateral reconnection, potential manhole modifications, and labor to construct a pipeline project, except for site-specific items (e.g., possible dewatering and shoring needs or bypass pumping). The unit cost for open-cut construction ranged from $654 per linear-foot (LF) for a shallow (pipe depth less than 16 feet), 8-inch sewer to $1,579 per LF for a deep (from 25 to 30 ft of depth), 60-inch sewer.

An allowance of 10% of baseline construction costs was provided for traffic control, or 20% for high traffic areas. Additional allowances were provided for dewatering, bypass pumping, remove and replace activities, and pavement restoration. Subtotal construction costs reflect these allowances plus the baseline construction cost. The estimated construction subtotal cost for each project also includes an allowance for mobilization/demobilization (5% of subtotal construction costs), plus an additional allowance for contingencies and unknown conditions (30% of construction cost subtotal, and an allowance for engineering and inspection costs (25% of construction cost). Costs for lining City-identified RCP trunks are not included in the Sewer Capacity CIP as these are condition-related maintenance costs.

The itemized cost estimate for each project is detailed in the individual project information sheets included in **Appendix G**. Note that all costs presented in this Master Plan Update report represent August 2024 costs for the San Francisco Area and are not escalated for future years.

5.5 Other Costs

The project cost estimates developed would reflect costs derived directly from construction of the projects only. However, there would be other additional costs associated with improvement of flow conveyance in the City's sanitary sewer system. For this Master Plan Update, these costs were categorized as three-fold:

[1] Pipe-bursting may be feasible but was not evaluated during this Master Plan Update. Detailed utility separation and geotechnical investigations would be required to fully evaluate feasibility.

1) **Hydraulic Model Maintenance & Support Costs**, which include continuous updates to the hydraulic model to reflect improvements to the system, updates to base flow scenarios based on specific development project status or General Plan updates, and maintenance of consistent documentation in model files;

2) **Future Master Plan Update Costs**, which include updates to the master plan to incorporate updates to the hydraulic model, compare model results to flow monitoring data, update model calibration, perform system capacity evaluations, develop capacity improvement projects to resolve deficiencies, and produce accompanying memoranda and reports; and

3) **Technical Analyses to Support System Verification and Hydraulic Model Accuracy**, which includes performing I/I studies, conducting flow monitoring to verify system hydraulic conditions (in addition to flow monitoring mentioned above), analyzing water usage and sewer generation rates, performing pump station evaluations, evaluating proposed improvements for system performance, and conducting other studies and analyses.

Table 5-3 shows the additional anticipated other costs by category, which were provided by the City. Note that these costs reflect 2024 US Dollars and should be escalated for future years.

TABLE 5-3: OTHER COSTS IN ADDITION TO SEWER CAPACITY CIP PROJECT COSTS

Category	Frequency	Cost[1]
Hydraulic Model Maintenance & Support	Annual	$75,000
Future Master Plan Updates	Every 7 years (next funding need in 2029)	$950,000
Technical Analyses to Support System Verification and Hydraulic Model Accuracy	Annual	$25,000

[1]Cost is estimated in 2024 Dollars. Use an escalation factor of 3% to 5% per year for subsequent years.

5.6 Project Costs Financed by Developers

As discussed in **Section 4.5**, two capacity improvement projects were developed to address the model-predicted deficiencies resulting from the PHD and Mission Point developments. These improvement projects will be paid for by the developers and not by the City. For this reason, they are not included in the Sewer Capacity CIP project list and are not addressed further in this section. Any changes to their respective design and/or elimination may impact the sizing and timing of the capacity improvement projects identified in this study, specifically those proposed downstream along the GAP and Lafayette trunks.

5.7 Summary of Recommended Capacity Improvement Projects

Based on results of the capacity evaluation discussed in **Section 4**, there are thirteen (13) recommended capacity improvement projects with a total length of approximately 38,100 LF of new pipelines. The total estimated cost of the capacity improvement projects is approximately $100.6 million.

Table 5-4 shows a summary of the capacity improvement projects, including their priority, flow confidence level, wastewater flow trigger, design flow trigger, physical network trigger, and the estimated planning-level cost. Refer to **Figure 4-7** provides a system overview map and shows the locations of all thirteen (13) projects. **Appendix G** includes a plan view figure for and a detailed description of each project as well as an associated cost estimate. The projects are listed in upstream-to-downstream order. The project descriptions on the cost estimate page follow a standard format, consisting of a summary project description, project triggers, estimated cost, priority, and any associated comments, assumptions, or project alternatives. Each cost estimate page also includes an itemized cost estimate, as well as the estimated existing and future flows and dry weather velocities. Note the comments listed on each project description

page. In some cases, the need for additional verification is noted. A brief discussion for each project focusing on the rationale and validation justifying the project need is included in the **Sections 5.7.1-5.7.13**.

TABLE 5-4: CAPACITY IMPROVEMENT PROJECTS

Project No.[1]	Project ID	Project Location	Pre-Project Pipe Diameter(s)[2]	Project Description	Priority[3]	Flow Confidence Level[4]	Wastewater Flow Trigger[5]	Design Flow Trigger[5]	Physical Network Trigger[5]	Project Cost[6]
1	**Agilent**	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd	10 to 22.8-inch	12,313 LF of 15 to 27-inch diameter pipe	7	N/A	LTFL (entitlement)	DWF	UMN	**$26,942,000**
2	**Homestead Road**	N Homestead Trunk from Swallow Wy to Saratoga Creek	18 to 30-inch	6,407 LF of 24 to 33-inch diameter pipe	3	3	LTFL	WWF	UMN	**$17,156,000**
3	**Kiely Boulevard**	Orthello Wy to S of El Sobrante St	8-inch	266 LF of 10-inch diameter pipe	6	4	LTFL	WWF	UMN	**$513,000**
4	**Victoria Avenue**	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave	8-inch	764 LF of 10-inch diameter pipe	6	3	LTFL	WWF	UMN	**$1,337,000**
5	**Cabrillo Avenue**	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy	8-inch	Flow Diversion Weirs only. No pipe replacement.	1	3	EL	WWF	UMN	**$154,000**
6	**CMC Basin**	Santa Maria Ave & Francis Ave; Amethyst Dr	8 to 12-inch	3655 LF of 12 to 15-inch diameter pipe	1	1 & 2	EL	WWF	UMN	**$7,263,000**
7	**Bowers Avenue**	Bowers Ave from Chromite Dr to Walsh Ave	25.7-inch	2605 LF of 30-inch diameter pipe	4	5	LTFL	WWF	LMN	**$8,047,000**
8	**Calabazas Trunk**	Calabazas Creek from S of Agate Dr to Central Expwy	22.8 to 27-inch	2791 LF of 18 to 27-inch diameter pipe	2	5	EL	WWF	LMN	**$8,731,000**
9	**Freedom Circle**	Mission College Blvd from Freedom Cir to west of Great America Pkwy	12 to 15-inch	1886 LF of 15-inch diameter pipe	5	N/A	LTFL (specific development)	DWF	UMN	**$3,830,000**
12	**GAP West Trunk**	S of West Tasman Dr to Lafayette St	28.5 to 35.7-inch	4810 LF of 36 to 42-inch diameter pipe	3	2	LTFL	WWF	UMN	**$17,781,000**
13	**GAP East Trunk**	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr	31.4-inch	231 LF of 39-inch diameter pipe	4	2	LTFL	WWF	LMN	**$1,002,000**
14	**Bunker Hill Lane East**	E of Great America Pkwy	6-inch	107 LF of 8-inch diameter pipe	7	N/A	LTFL (entitlement)	WWF	UMN	**$301,000**
15	**Lafayette Street**	N of Calle del Mundo to S of Great America Wy	34.2 to 40.3-inch	2290 LF of 42 to 48-inch diameter pipe	3	2	LTFL	WWF	UMN	**$7,515,000**
TOTAL ESTIMATED COST	**$100,572,000**									

[1]Projects are numbered from upstream to downstream. Table does not include Project Nos. 10 (Patrick Henry Drive) and 11 (Mission Point) because project costs will be paid for by the developers.

[2]Pre-project pipe diameters include future lining assumptions.

[3]Projects are prioritized based on wastewater flow, design flow, and physical network triggers as well as assumed structural condition.

[4]Rating assigned to validate the need for the project through review of flow monitoring data and reported surcharging and operational issues, and compatibility between flow meter data and the model. Descriptions of the flow confidence levels are as follows: N/A = Not assigned because project would be triggered by entitlement flow or specific development; 1 = Flow meter on or very near to the project reach surcharged during metered storm; 2 = Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm; 3 = Flow meter near the project reach (upstream or downstream) confirms flow; 4 = No flow meter near the project reach to confirm flow; 5 = Conflicting flow between meter and model.

[5]EL = Existing Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flow; WWF = Wet Weather Flow; UMN = Unlined Model Network; LMN = Lined Model Network.

[6]Costs are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area and are Class 5 estimates (planning level).

5.7.1 Agilent

This project was assigned priority 7 (least priority) as it was created to accommodate mainly the historic entitlement flow from Agilent Technologies (average dry weather flow of 0.95 million gallons per day or mgd).

Because the project is driven by the projected flows from the Agilent historic entitlement agreement, it was not assigned a confidence level as it relates to monitored flows. This project should not be implemented until the City has more certainty on the parcel's plan to discharge its entitled flow.

It should also be noted that a trenchless crossing would be required to cross under Lawrence Expressway (from manhole S11-77 to S11-80) so the cost estimate assumes that the PTGAB construction method would be used for these segments.

5.7.2 Homestead Road

This project was assigned priority 3 as it is triggered under the long-term future peak wet weather flows in the unlined model network. The deficiency in the north Homestead trunk is just upstream of FMs 19 and 20. Neither flow meter surcharged during monitored wet weather flow events. As a result, the project has a confidence Level 3 because the downstream flow meters confirmed the flow but did not surcharge during the monitored events. This project is also highly dependent on the projected future incoming peak wet weather flows (13.8 mgd) from CuSD, which were based on the current contractual agreement. Any change to the contractual agreement affecting the maximum flow would affect the resulting deficiency and project.

It should also be noted that a trenchless crossing would be required to cross under Lawrence Expressway (from manhole S20-10 to S21-43) so the cost estimate assumes that the PTGAB construction method would be used for this segment. Special considerations should be given to the construction set up upstream of this crossing as manhole S20-10 houses the Lawrence/Homestead gate structure.

5.7.3 Kiely Boulevard

This project was assigned priority 6 as it is triggered under the long-term future peak wet weather flows in the unlined model network. Although its wastewater flow, design flow, and physical network triggers are the same as those assigned to the Homestead Road project, it is much lower priority because it is not located on an alignment that includes RCP trunks identified for future lining by the City.

The Kiely Boulevard trunk flowed into FM 13, which was located on the Bowers Avenue trunk a considerable distance downstream of the deficient segment. As a result, this project has a confidence Level 4 and conducting flow monitoring on the project reach prior to design would provide a greater level of confidence.

5.7.4 Victoria Avenue

This project was assigned priority 6 as it is triggered under the long-term future peak wet weather flows in the unlined model network. Although its wastewater flow, design flow, and physical network triggers are the same as those assigned to the Homestead Road project, it is much lower priority because it is not located on an alignment that includes RCP trunks identified for future lining by the City.

The Victoria Avenue trunk flowed into FM 26 which did not surcharge during the monitored rainfall events. FM 26 was downstream of the project (i.e., not on the Victoria Avenue trunk itself). The project therefore has confidence Level 3 as the model was confirmed to have reasonably accurate model flows based on model comparison to flow meter data, but there was no confirmed surcharging during the wet weather calibration events.

5.7.5 Cabrillo Avenue

This project was assigned priority 1 as it is triggered under the existing peak wet weather flows in the unlined model network. As discussed in **Section 4.5.5**, this project consists of the installation of two weirs to divert flow to segments with more capacity, which are reflected in the costs for the Cabrillo Avenue project.

The Cabrillo Avenue trunk flowed into FM 26 which did not surcharge during the monitored rainfall events. FM 26 was downstream of the project (i.e., not on the Cabrillo trunk itself). The project therefore has confidence Level 3 as the model was confirmed to have reasonably accurate model flows based on model comparison to flow meter data, but there was no confirmed surcharging during the wet weather calibration events.

5.7.6 CMC Basin

The segments in Santa Maria Ave and Amethyst Drive become deficient under existing loads and wet weather flow due to high rainfall-derived infiltration and inflow (RDI/I) that occur in the CMC basin. As a result, they have a priority ranking of 1.

The Amethyst Drive trunk flowed into FM 28 which surcharged during the monitored rainfall event on January 1st, 5th, and 9th, 2023. As a result, the project was assigned a high level of confidence (i.e., Level 1) because the need has been confirmed by previous flow monitoring data.

The Santa Maria Ave project flowed into FM 10. FM 10 showed a high RDI/I response during the monitored rainfall events but did not surcharge. This project was assigned a Level 2 confidence rating as the model was confirmed to have reasonably accurate model flows based on model comparison to flow meter data, but there was no confirmed surcharging during the wet weather calibration events.

The recommended capacity improvement upsizing project was developed to accommodate the flow during wet weather; however, the City also has the option to reduce the RDI/I in the basin. The cost of reducing the RDI/I would include smoke testing to identify specific sources of infiltration and additional flow monitoring in the basin. An annual allowance for these other non-construction costs is shown in **Section 5.5**.

5.7.7 Bowers Avenue

This project was assigned priority 4 as it is triggered under long-term future peak wet weather flows in the lined model network and is located on an alignment that includes RCP trunks identified for future lining by the City.

The Bowers Avenue deficiency was just downstream of flow meter 13 which did not surcharge during the monitored wet weather events. However, as described in **Section 3.4.3.1**, the 2022-2023 flow monitoring data at FM 13 showed that observed flows in the Bowers trunk at this location were significantly lower than the model-predicted flows based on the assumed system flow routing under normal conditions. Further investigation by Woodard & Curran and additional field surveys conducted by the City revealed that the system was not operating under normal conditions during the 2022-2023 flow monitoring program; the Lawrence/Homestead gate structure was routing significantly more flow to the trunk on Lawrence Expressway (80%) and only 20% to the trunk on Homestead Road, compared to the approximate 50/50 split that is observed during normal conditions. Additionally, City staff observed surcharge conditions farther downstream during dry weather, suggesting that some of the increased flows to the trunk on Lawrence Expressway were backing up through the El Sobrante overflow pipe towards FM 13 and away from FM 9A. Because of these atypical and temporary issues, a flow balance between FMs 13 and 9A was impossible to

achieve. Model-predicted flows assuming normal system flow routing were compared to the 2014-2015 flow monitoring data and matched more closely, but due to the inconsistencies discussed above with the 2022-2023 flow monitoring data, this project was assigned a confidence Level 5 (flow meter shows significantly different flow than model). Therefore, it is recommended that additional flow monitoring be conducted prior to design to provide a greater level of confidence in modeled flows.

It should be noted that the proposed alignment would require a trenchless crossing under the Caltrain railroad tracks (between manhole S53-7 and S63-36). Additionally, the alignment between manholes S63-36 and S63-27 has many bends and does not follow the Bowers Avenue public right-of-way (ROW). The design of the new project may want to consider realigning the sewer to be closer to Bowers Avenue.

5.7.8 Calabazas Trunk

The Calabazas Trunk project is triggered by existing wet weather flows in the lined model network and therefore was assigned a priority ranking of 2. The Calabazas Trunk Improvements assume that all deficiencies upstream have been relieved. Because this project is a higher priority than the projects upstream (i.e., Agilent and Homestead Road), this assumption should be considered during the design phase.

The deficient segments of the Calabazas trunk flowed into FM 9A located somewhat downstream. FM 9A did not surcharge during the monitored wet weather events. However, as described in **Section 3.4.3.1** and in **Section 5.7.7** above, inconsistencies with the 2022-2023 flow monitoring data made it impossible to achieve a flow balance at FMs 9A and 13. Due to the atypical flow routing, the model comparison to FM 9A is inconclusive. As a result, this project has confidence Level 5 (flow meter shows significantly different flow than model), and it is recommended that additional flow monitoring be conducted prior to design to provide a greater level of confidence in modeled flows.

It should be noted that the alignment would require a trenchless crossing under the Caltrain and private railroad tracks to the north (between manhole S52-4 and S62-52).

5.7.9 Freedom Circle

The proposed project was assigned priority ranking 5 as it is triggered by long-term future dry weather flows as a result of the proposed Freedom Circle Focus Area development project. It is therefore highly dependent on the final loads generated by the proposed development and should be reviewed should those flows change.

This project is driven by the projected flows from the Freedom Circle Focus Area specific development. As a result, it was not assigned a confidence level as it relates to monitored flows.

5.7.10 GAP West Trunk

The proposed project was assigned priority ranking 3 as it is triggered by long-term future loads combined with wet weather flow conditions in the unlined model network and is located on an alignment that includes RCP trunks identified for future lining by the City.

The GAP West trunk had a flow meter on the deficient sewer segment (FM 2). Flow monitoring data showed the sewer did not surcharge during the monitored wet weather events although the d/D ratio reached 75%. As a result, the project has a confidence Level 2 (flow meter on capacity deficient pipe reach confirms model flow, but did not surcharge).

It should be noted that the alignment would require a trenchless crossing under the Valley Transportation Authority (VTA) light rail tracks on West Tasman Drive.

Because of their interconnections, the GAP West and East trunks should be evaluated together during the pre-design and design phases.

5.7.11 GAP East Trunk

The proposed project was assigned priority ranking 4 as it is triggered under long-term future peak wet weather flows in the lined model network and is located on an alignment that includes RCP trunks identified for future lining by the City.

The GAP East trunk had FM 5 just upstream of the deficient sewer segment. However, the flow meter data did not show a surcharge condition under the monitored wet weather events. As a result, this project was assigned a confidence Level 2.

Because of their interconnections, the GAP West and East trunks should be evaluated together during the pre-design and design phases.

5.7.12 Bunker Hill East Lane

This project was assigned priority 7 (least priority) because it is triggered by long-term future loads as a result of a historic entitlement flow assumption from parcels with APNs 104-55-012 and 104-55-013 (site of the current Santa Clara Convention Center) under wet weather flows. During the pre-design phase, the City should verify the inverts along the alignment and at the downstream connection with the GAP East Trunk at manhole S93-7.

This project is driven by the projected flows from the historic entitlement agreement from the two parcels identified above. As a result, it was not assigned a confidence level as it relates to monitored flows.

5.7.13 Lafayette Street

This project was assigned priority 3 as it is triggered under long-term future peak wet weather flows in the unlined model network and is located on an alignment that includes RCP trunks identified for future lining by the City. As discussed in **Section 4.5.13**, the project would include re-sloping of some minimally sloped (approximately 0.02%) existing pipe segments according to record information. Due to lack of data, it was not possible to confirm if there are other utilities near the deficient segment in Lafayette Street. Therefore, the project alignment was developed assuming that there are no obstacles in upsizing and re-sloping the segments to relieve the deficiency. However, this assumption should be confirmed during the pre-design phase.

The Lafayette trunk had FM 1 on one of the deficient sewer segments. Flow monitoring data showed the sewer did not surcharge during the monitored wet weather events and the d/D ratio reached a maximum of 50%. As a result, the project has a confidence Level 2 (flow meter on capacity deficient pipe reach confirms model flow, but did not surcharge).

5.8 Schedule

A preliminary Sewer Capacity CIP schedule was developed and is presented in **Table 5-5**. Because none of the projects have a near-term future loads wastewater flow trigger, the projects are scheduled for either implementation within the next five years (2025-2030), if triggered by existing loads, or implementation within the next 10 years (or beyond 2035), if triggered by long-term future loads. Projects triggered by

entitlement flows (i.e., Agilent and Bunker Hill Lane East) are still listed for implementation beyond 2035; however, if the entitlement holders do not exercise their rights, then implementation of these projects would not be necessary. Preliminary design, including condition assessments (e.g., smoke testing, CCTV, etc.), final design, and permitting activities should commence two (2) to three (3) years prior to project trigger. It is worth noting that all costs are calculated in August 2024 dollars; thus, if a project is scheduled to be constructed in 2035, the cost should be scaled to 2035 using an escalation factor of 3% to 5% per year.

TABLE 5-5: CAPACITY IMPROVEMENT PROJECTS SCHEDULE

Project No.	Project ID	Schedule
1	Agilent	2035
2	Homestead Road	2035
3	Kiely Boulevard	2035
4	Victoria Avenue	2035
5	Cabrillo Avenue	2025
6	CMC Basin	2025
7	Bowers Avenue	2035
8	Calabazas Trunk	2025
9	Freedom Circle	2035
12	GAP West Trunk	2035
13	GAP East Trunk	2035
14	Bunker Hill Lane East	2035
15	Lafayette Street	2035

5.9 Implementation Recommendations

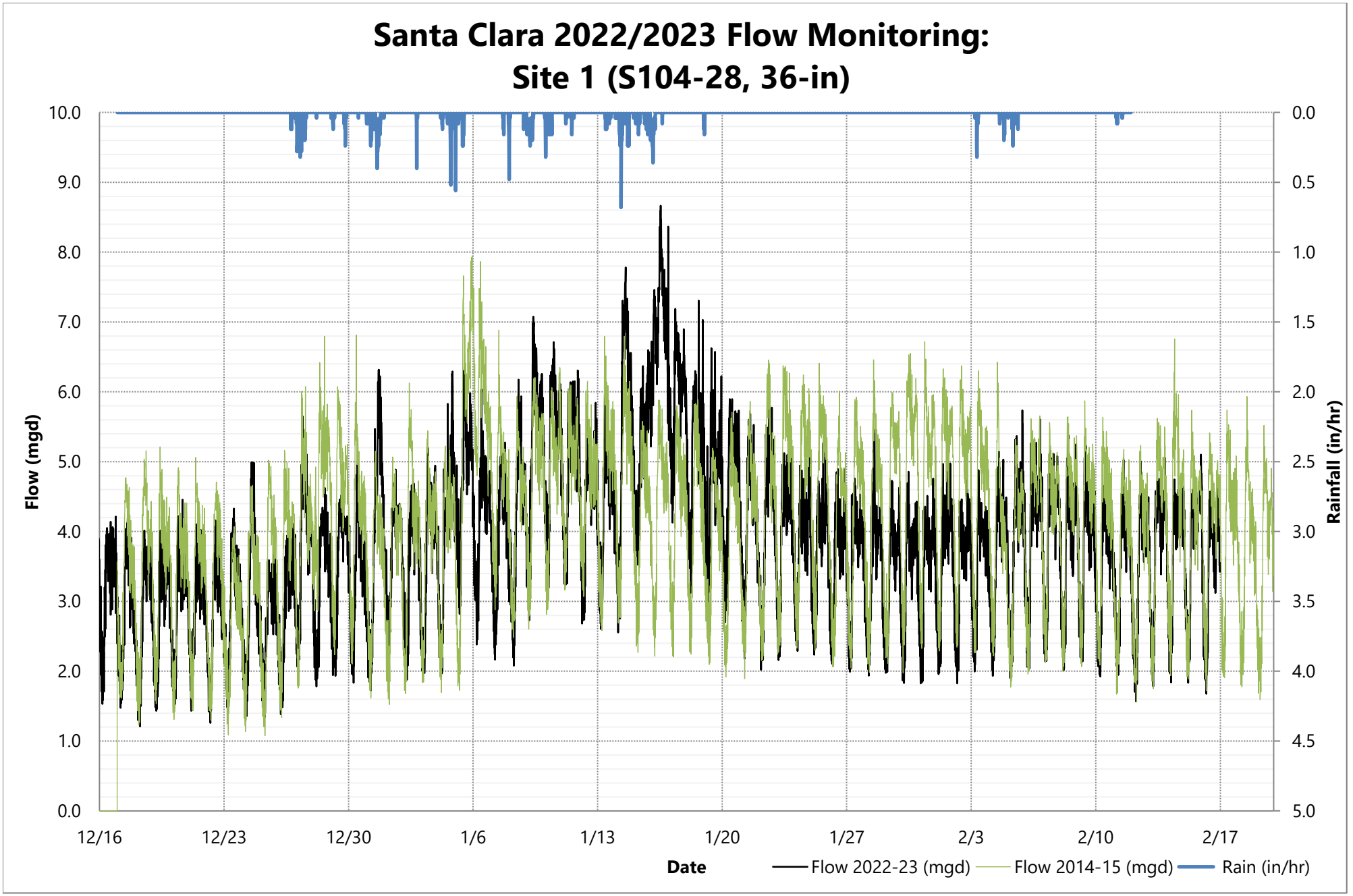
The City should begin implementation of the Sewer Capacity CIP recommended in this Master Plan Update, starting with the highest priority projects needed to address existing system capacity deficiencies. The following items should be considered in project scheduling and design, and in future updates of the Master Plan:

- The City should consider conducting additional flow monitoring or observation to document flow levels during large storm events at locations in the system where the model predicts significant surcharge or where there is a significant difference between previous flow monitoring conducted and the model results. Flow levels during large storm events should be compared to the water levels simulated by the hydraulic model to verify if the modeling predictions for the design storm seem reasonable, and to confirm the need for and, if necessary, refine project sizing.
- The alignments and sizes of all recommended projects should be verified with detailed pre-design analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews. Detailed pre-design analyses should consider feasibility of trenchless construction methods including pipe-bursting and Pilot Tube Guided Auger Boring (PTGAB), especially at major roadway, railway, and creek crossings.
- The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines and laterals; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.

- Capacity improvement projects triggered by long-term future flow assumptions associated with entitlement agreements would not need to be implemented until the entitled parcel(s) begin to discharge their entitled flow(s).
- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Master Plan in the future. The model should be kept up to date with any changes to existing sewer connections, development plans, and sewer system facilities.

This Master Plan Update report is intended to be a working document to be refined and updated as additional data and new planning information become available. The capacity assessment should be updated whenever there are major changes in planning assumptions or, at a minimum, every five to ten years.

APPENDIX A: FLOW MONITORING DATA PLOTS


Santa Clara 2022/2023 Flow Monitoring:
Site 1 (S104-28, 36-in)
Flow (mgd)
Rainfall (in/hr)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
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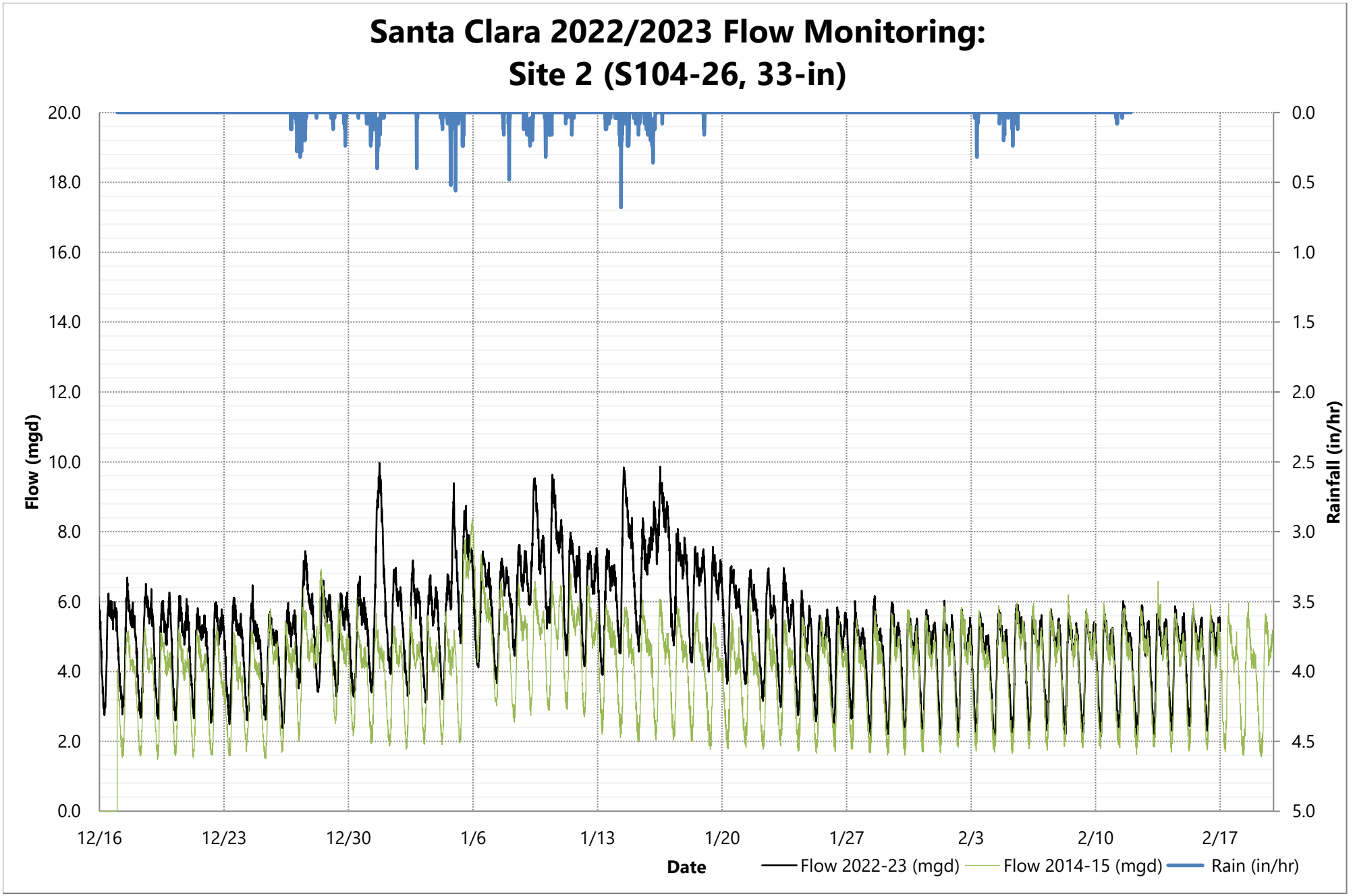
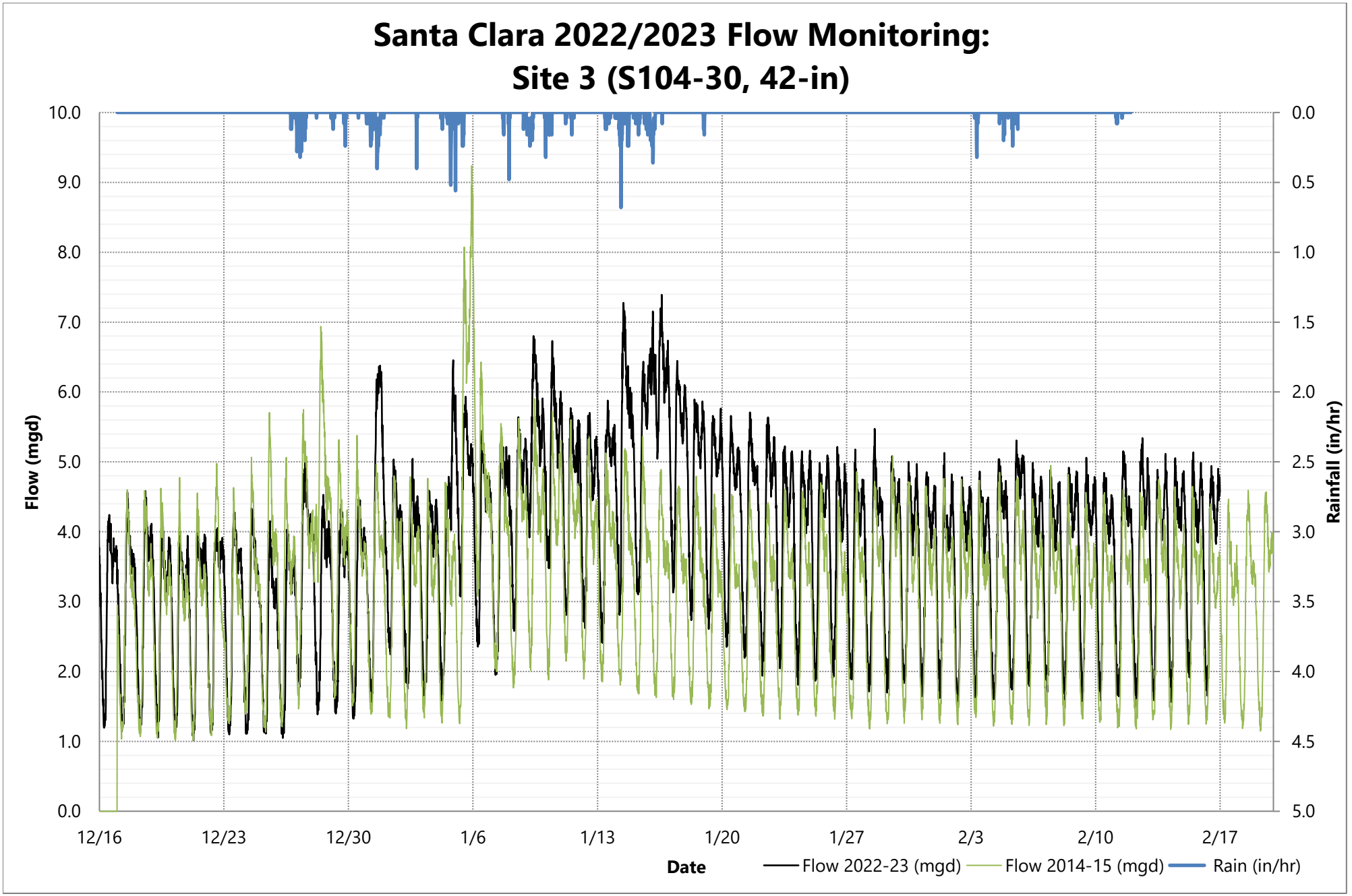
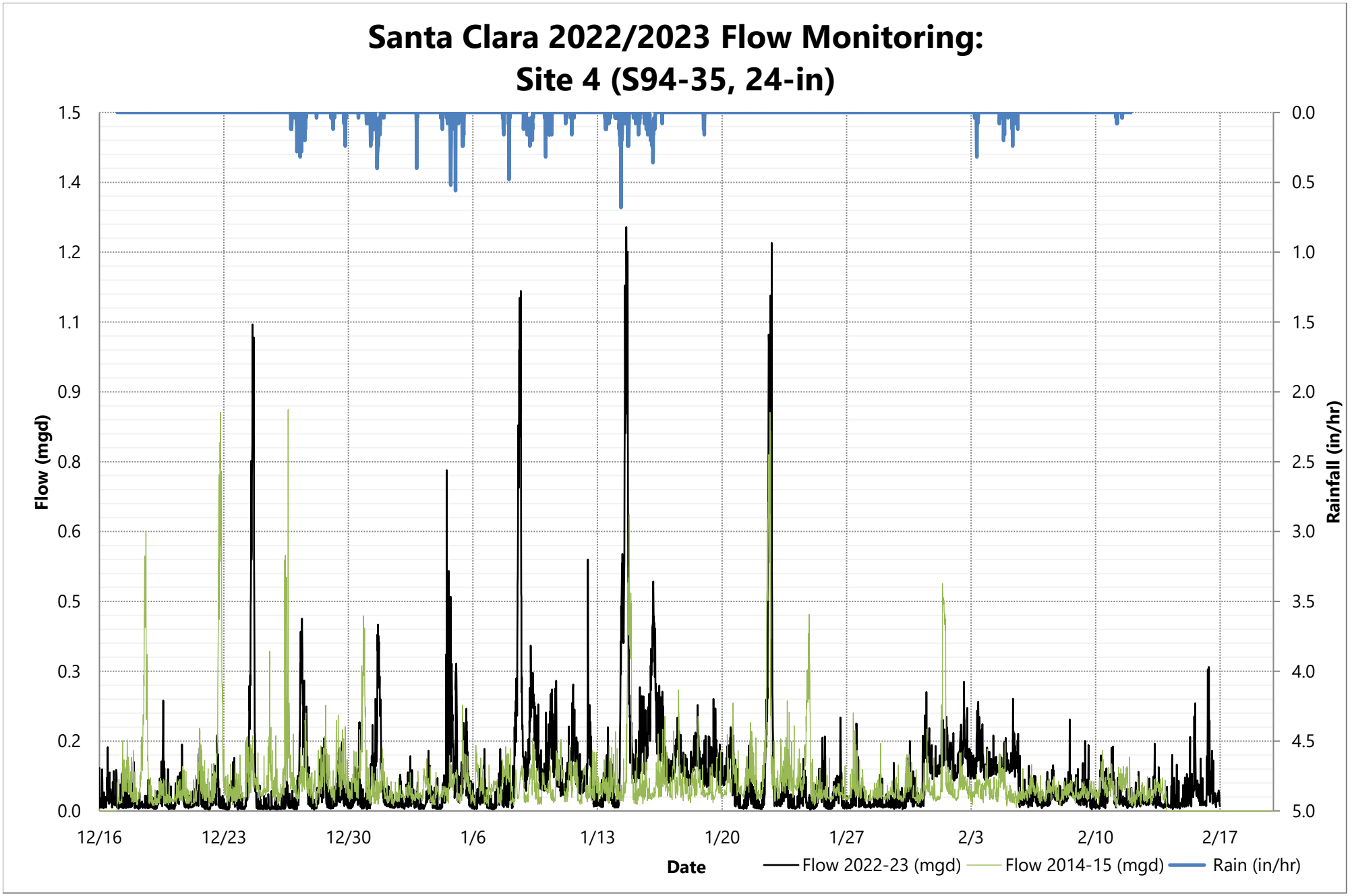
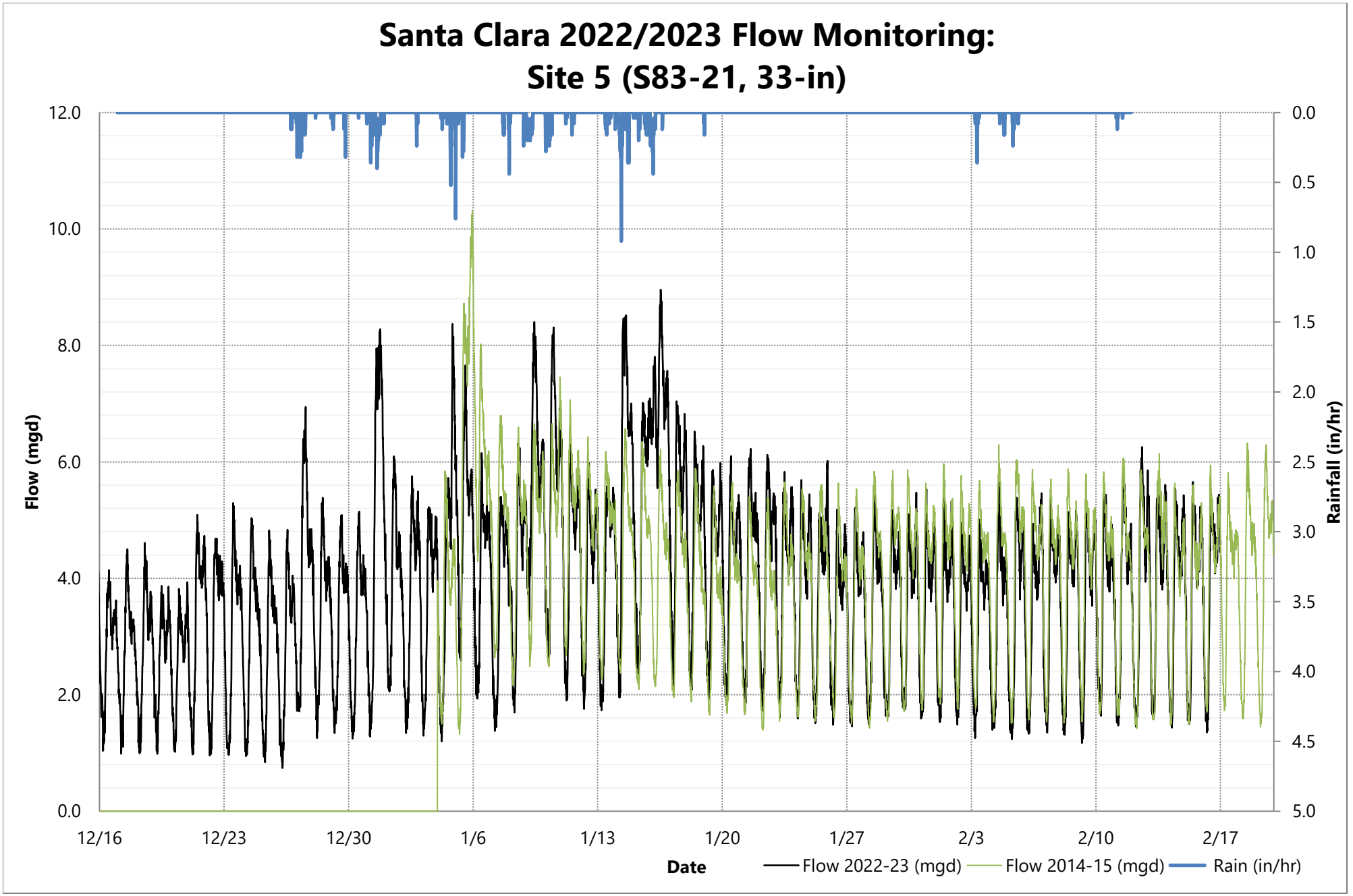
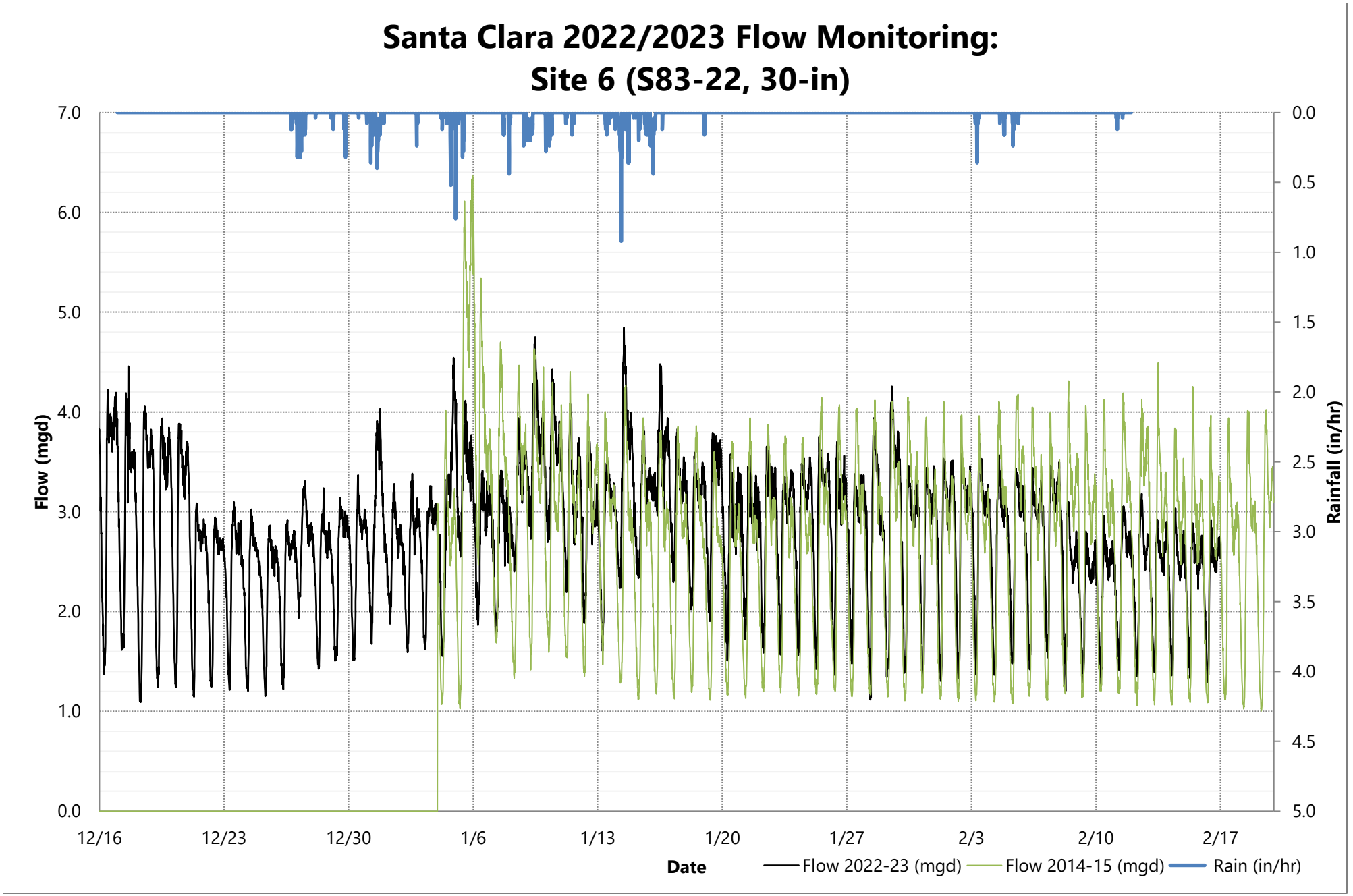
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

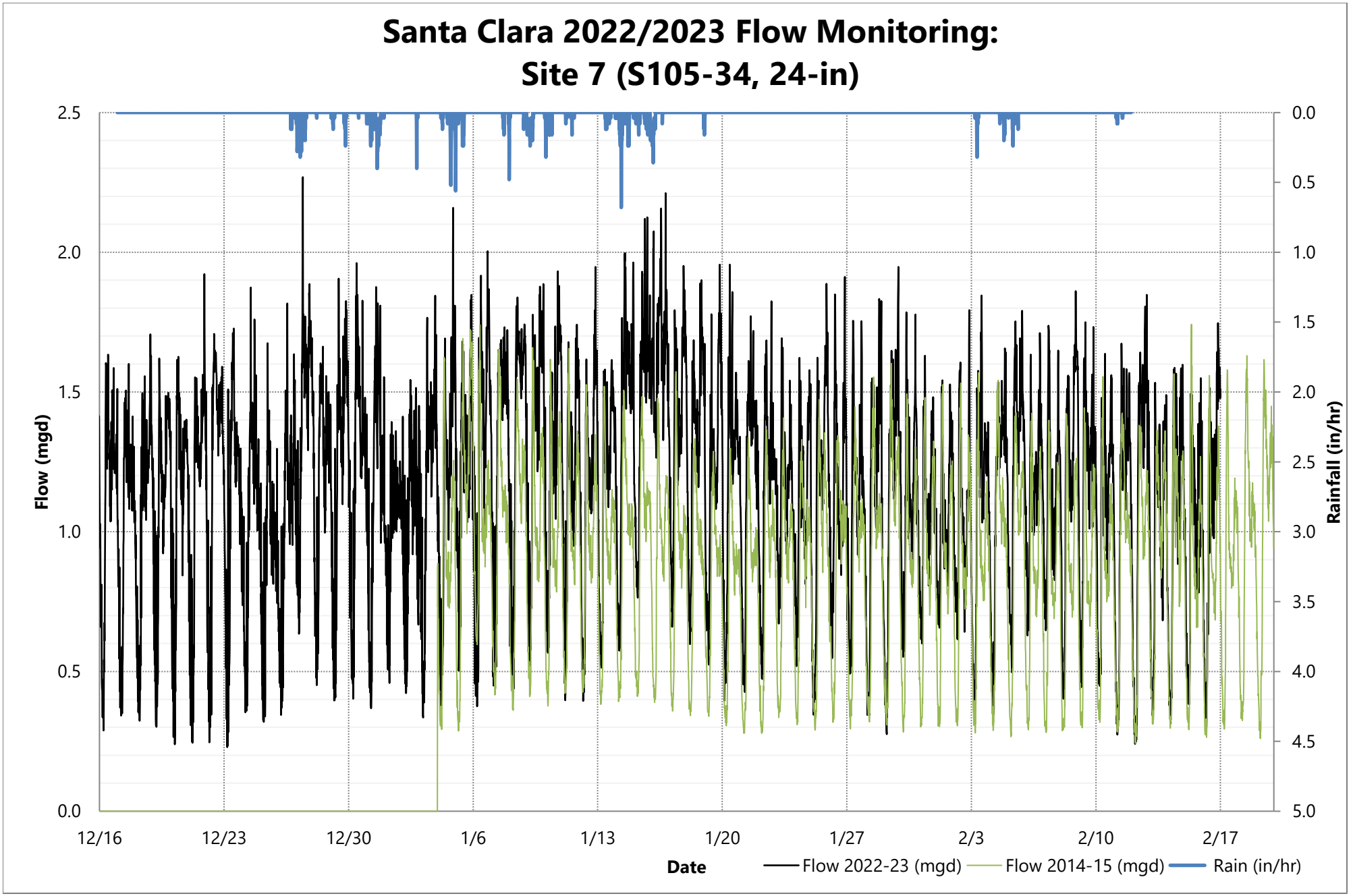

Santa Clara 2022/2023 Flow Monitoring:
Site 2 (S104-26, 33-in)
Flow (mgd)
Rainfall (in/hr)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)


Santa Clara 2022/2023 Flow Monitoring:
Site 3 (S104-30, 42-in)
Flow (mgd)
Rainfall (in/hr)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

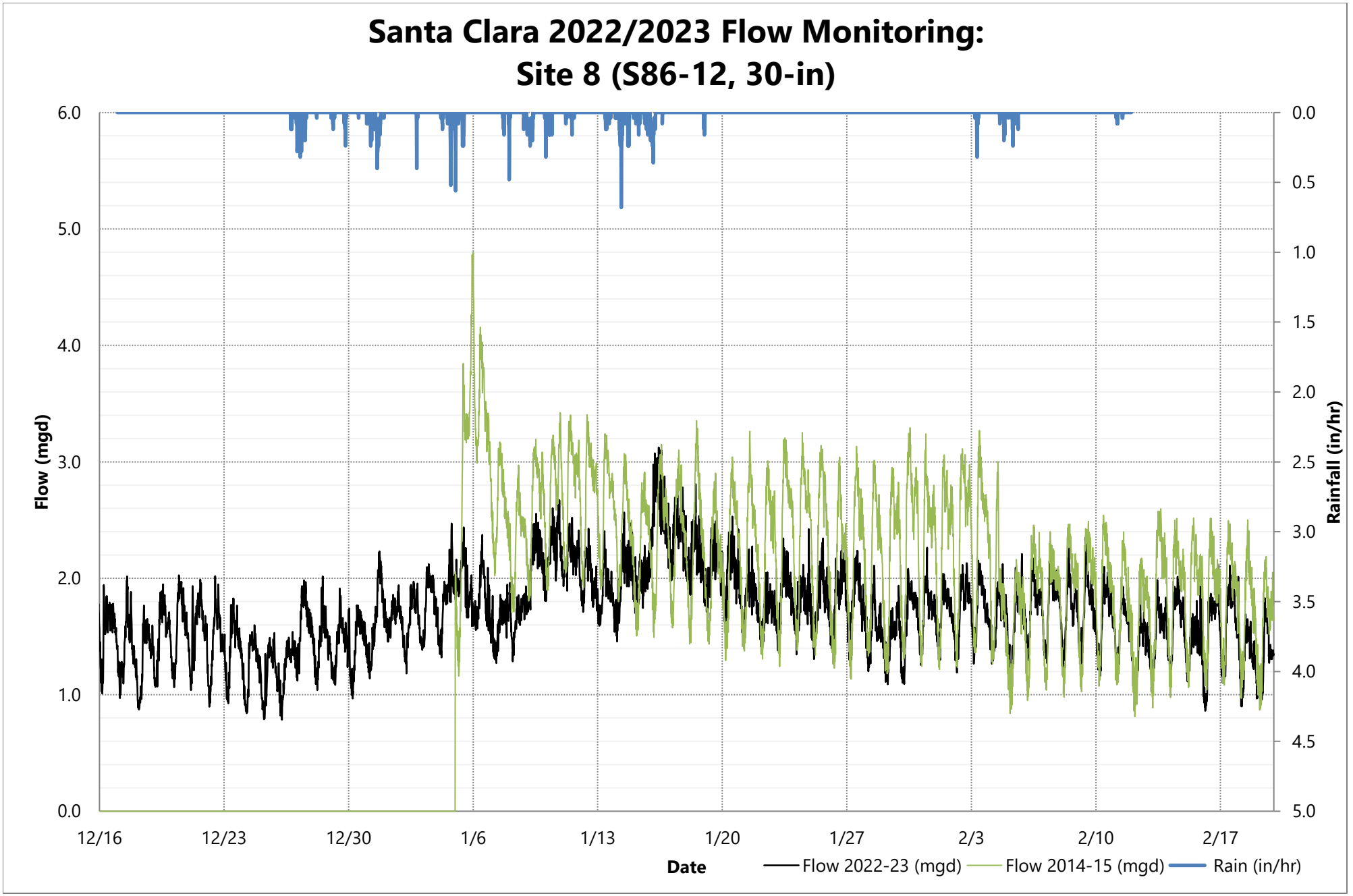

Santa Clara 2022/2023 Flow Monitoring:
Site 4 (S94-35, 24-in)
Flow (mgd)
Rainfall (in/hr)
1.5
1.4
1.2
1.1
0.9
0.8
0.6
0.5
0.3
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

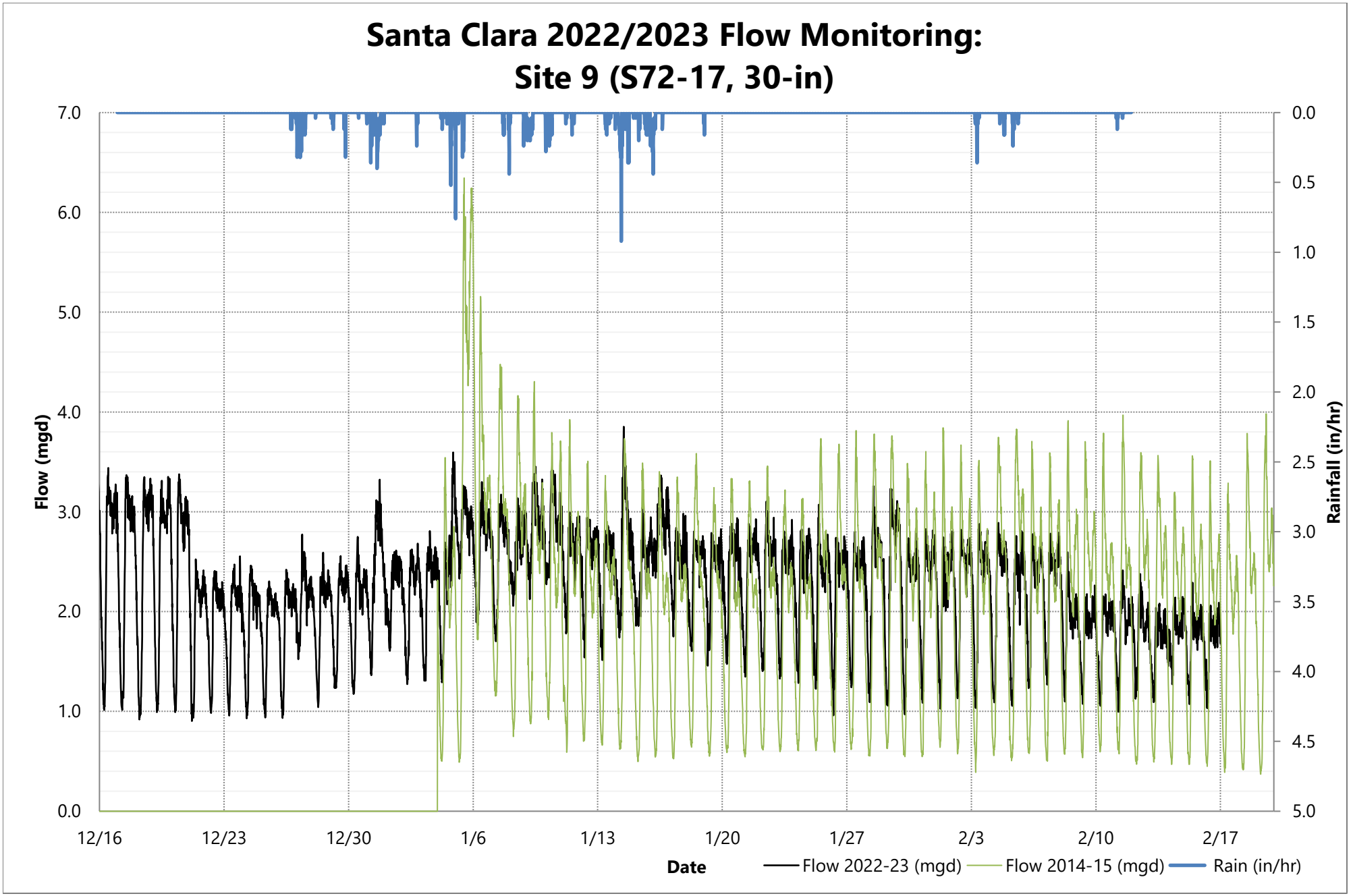

Santa Clara 2022/2023 Flow Monitoring:
Site 5 (S83-21, 33-in)
Flow (mgd)
Rainfall (in/hr)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

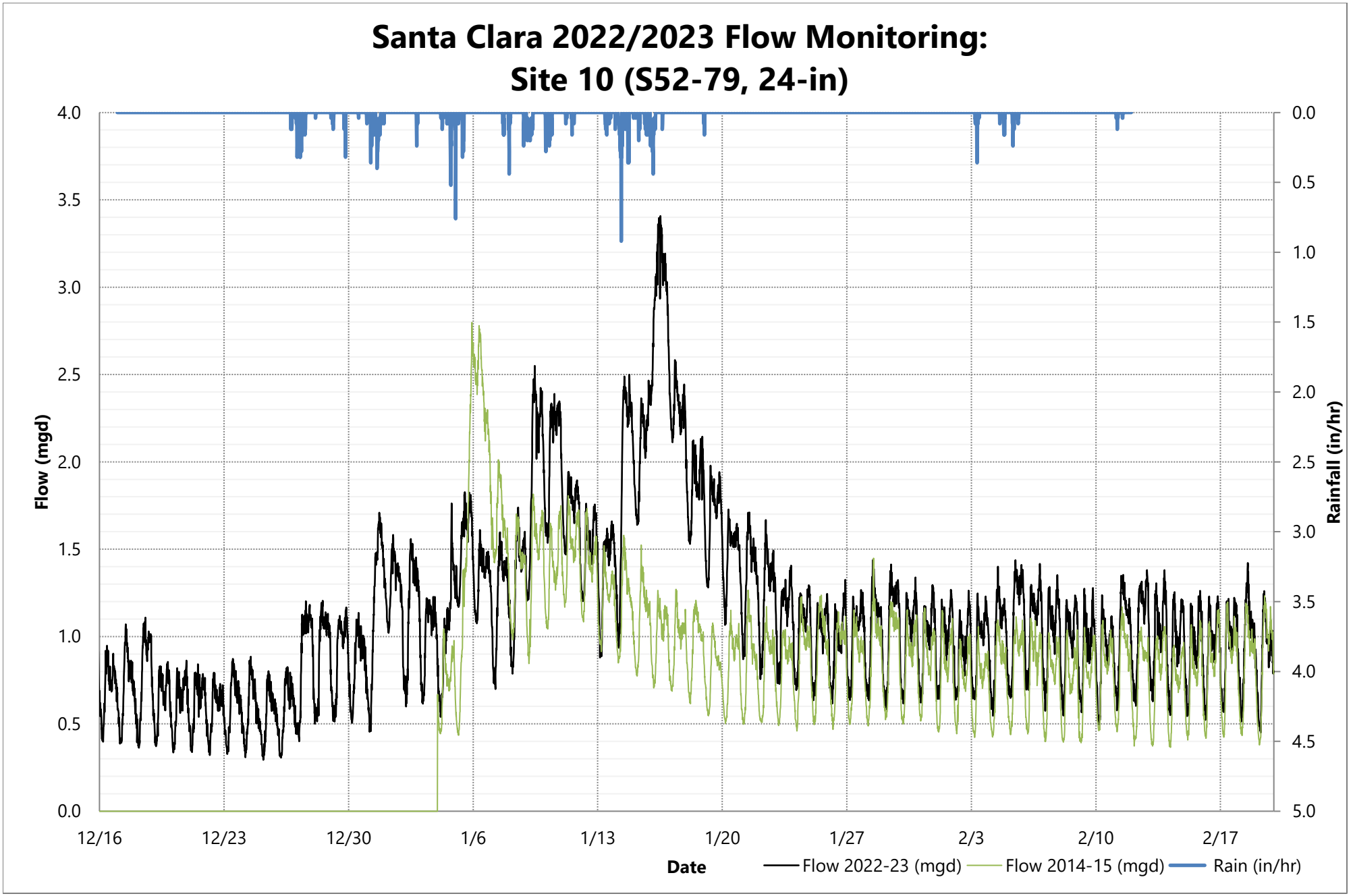

Santa Clara 2022/2023 Flow Monitoring:
Site 6 (S83-22, 30-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

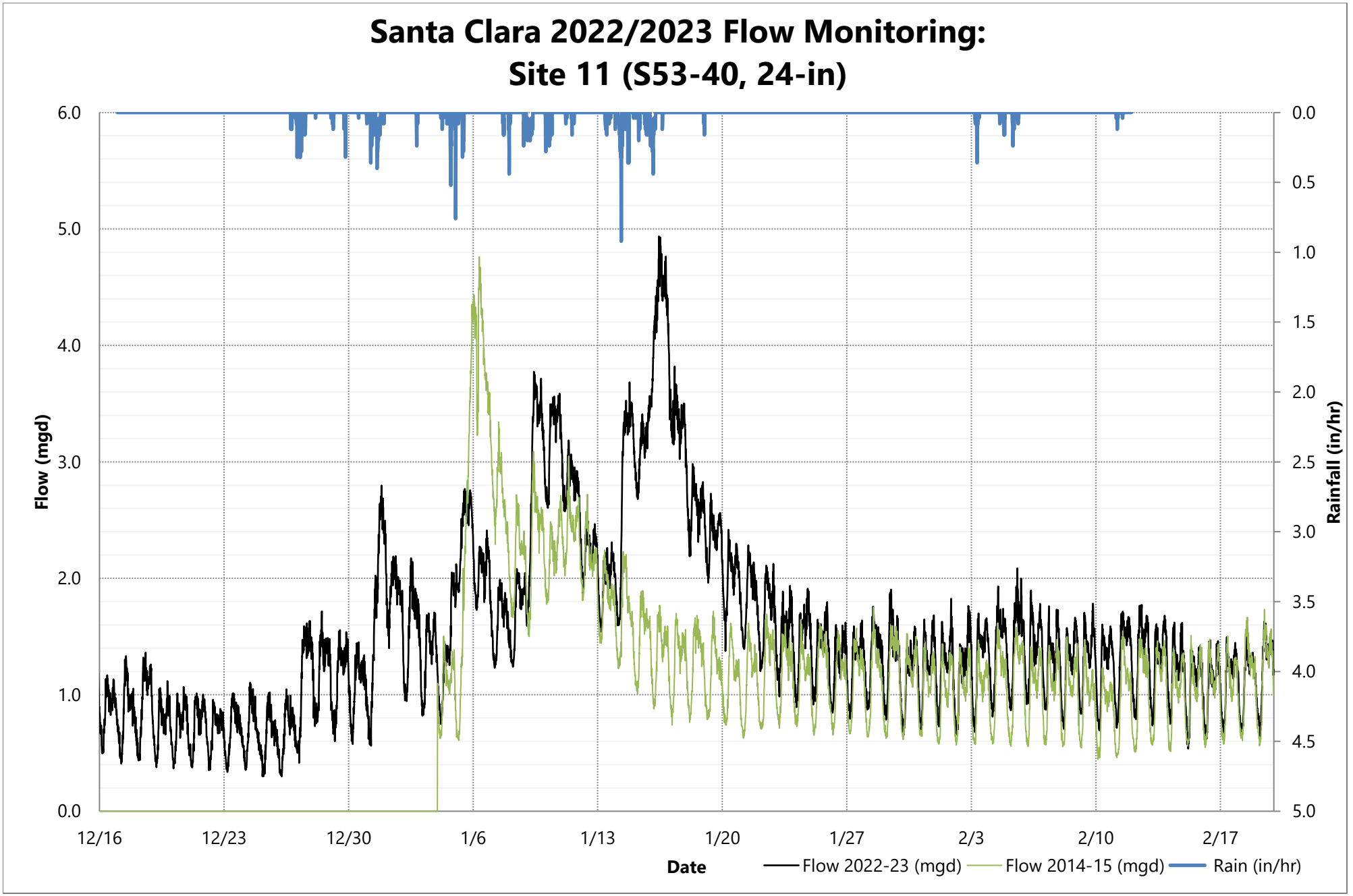

Santa Clara 2022/2023 Flow Monitoring:
Site 7 (S105-34, 24-in)
Flow (mgd)
Rainfall (in/hr)
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

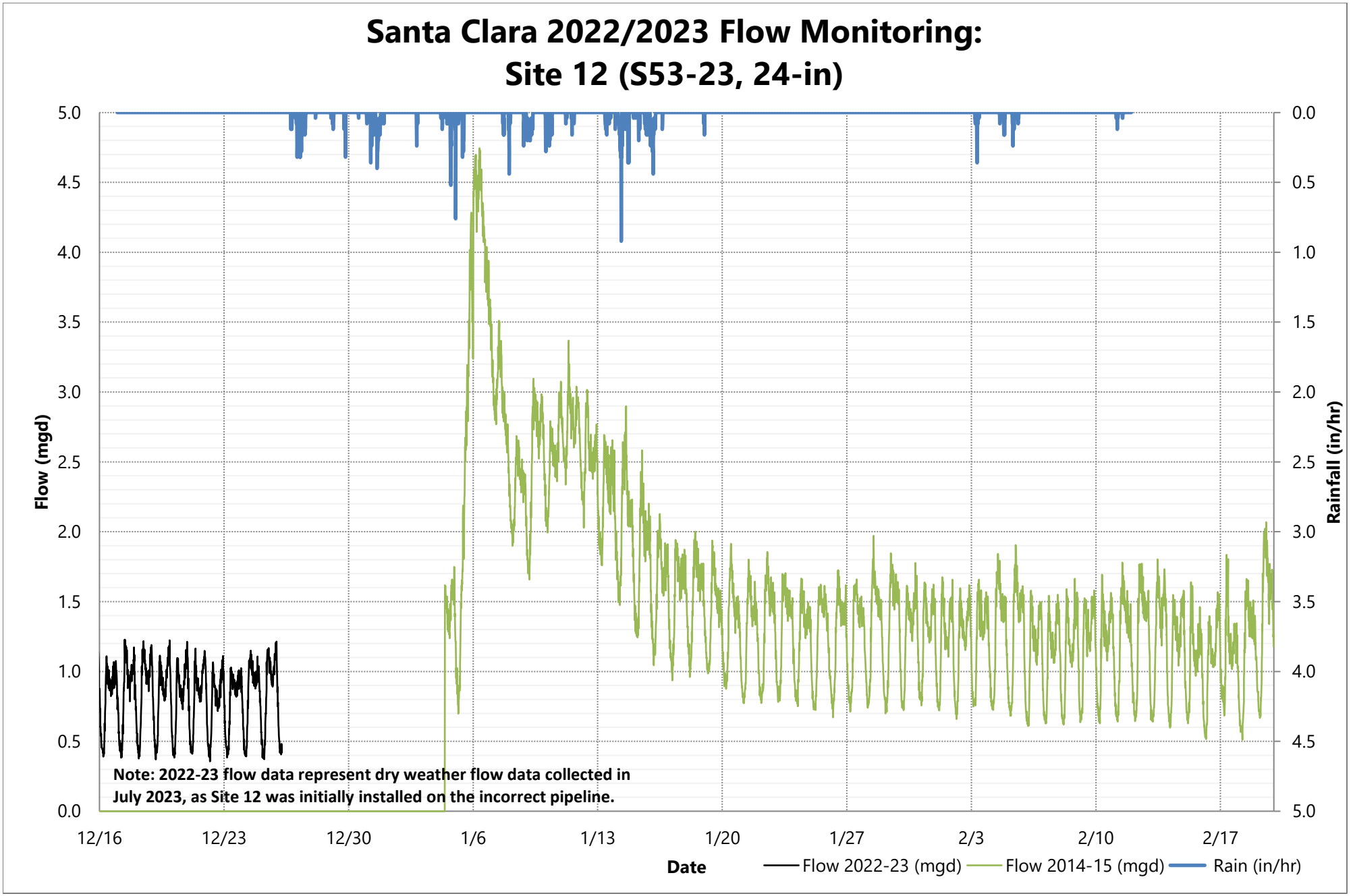
Santa Clara 2022/2023 Flow Monitoring: Site 8 (S86-12, 30-in)

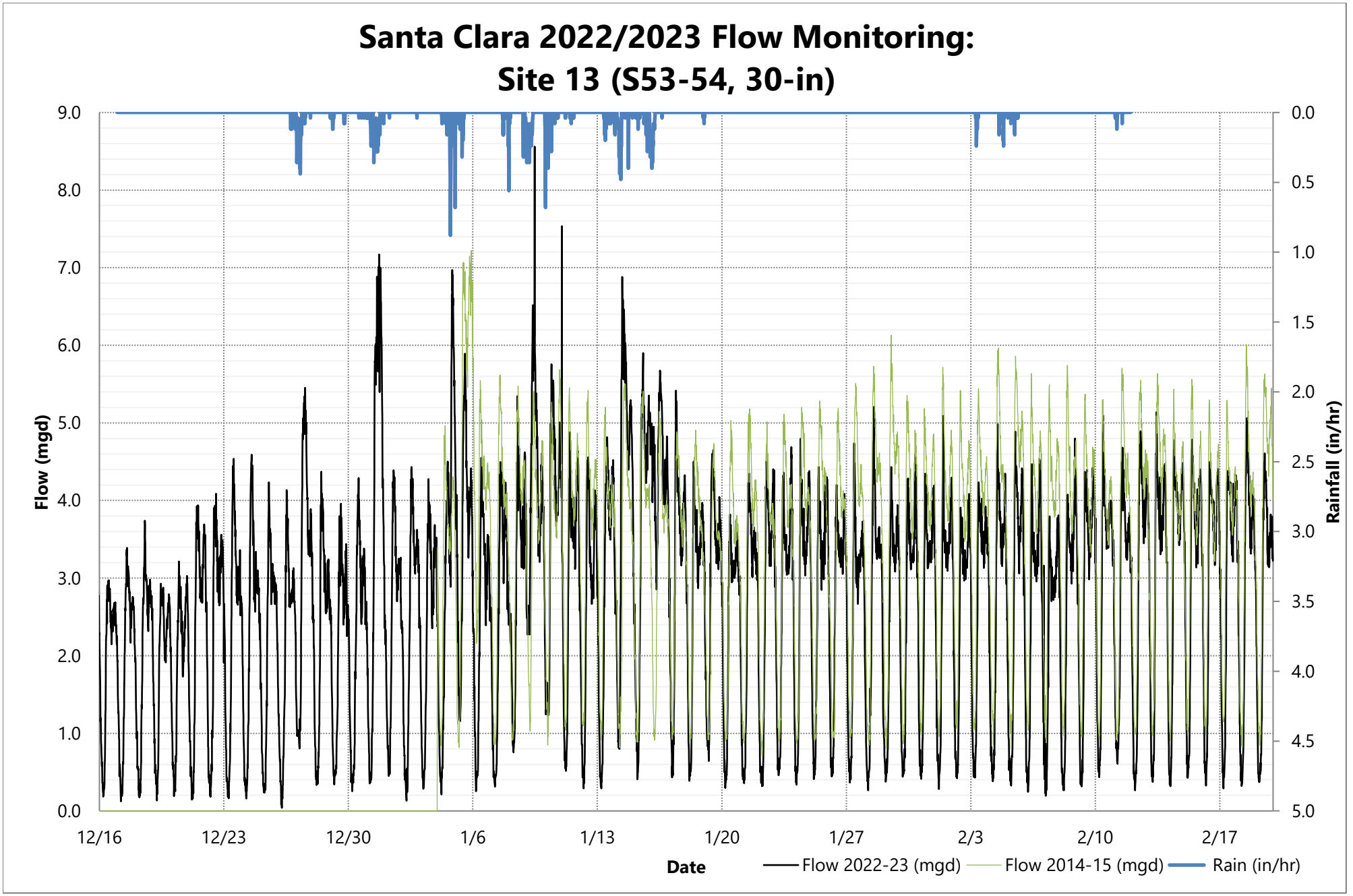


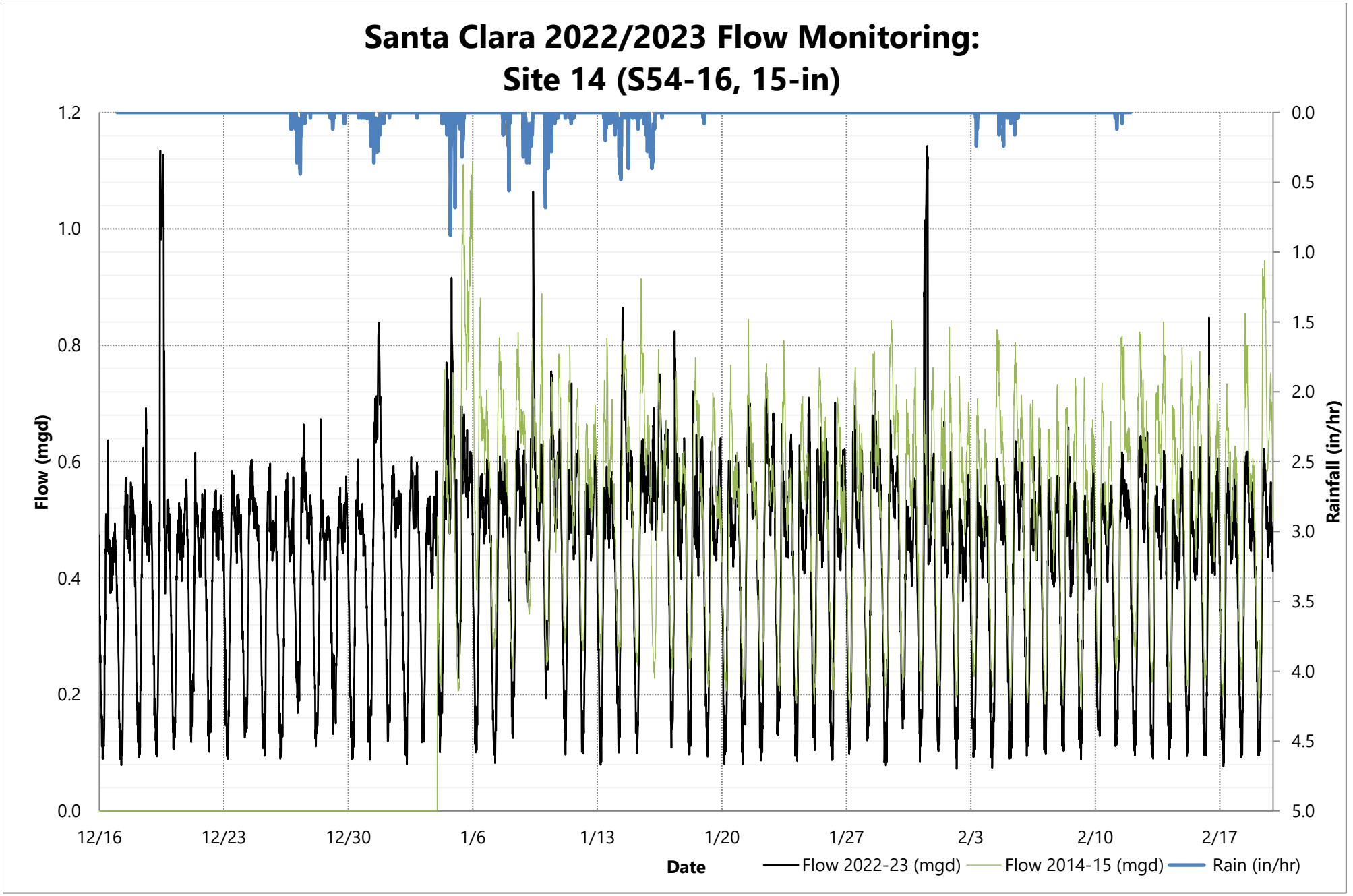

Santa Clara 2022/2023 Flow Monitoring:
Site 9 (S72-17, 30-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

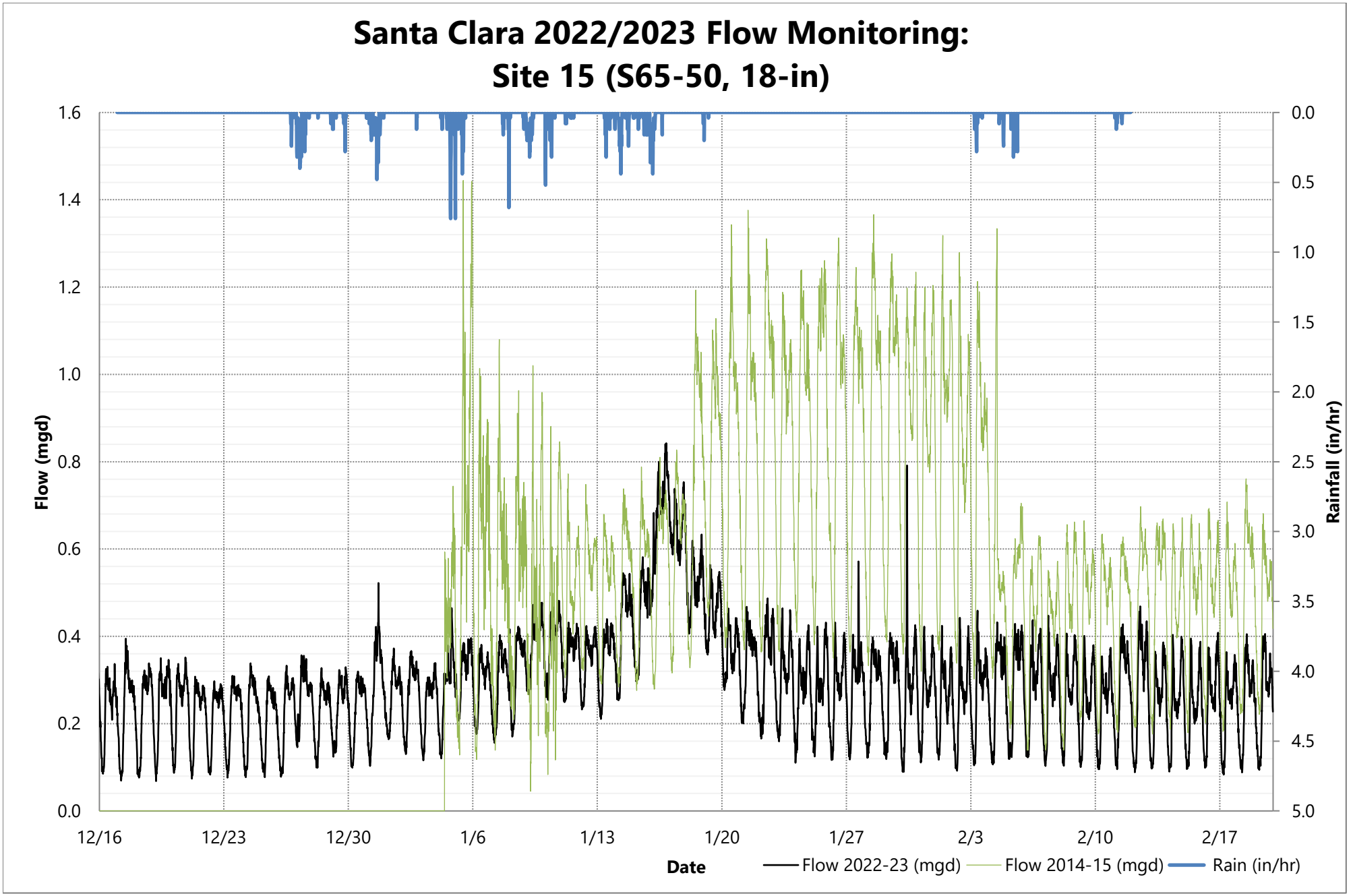

Santa Clara 2022/2023 Flow Monitoring:
Site 10 (S52-79, 24-in)
Flow (mgd)
Rainfall (in/hr)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

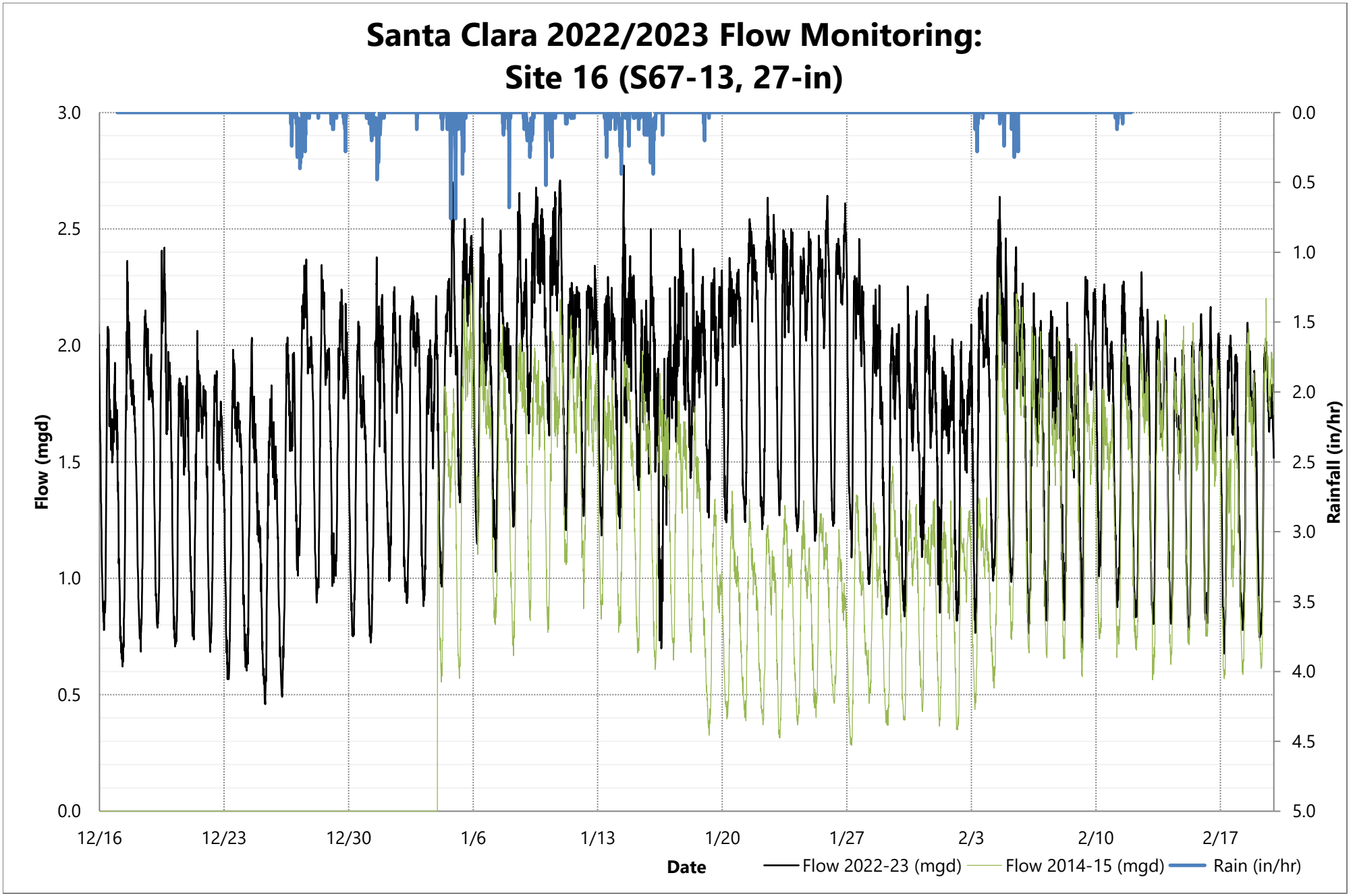

Santa Clara 2022/2023 Flow Monitoring:
Site 11 (S53-40, 24-in)
Flow (mgd)
Rainfall (in/hr)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

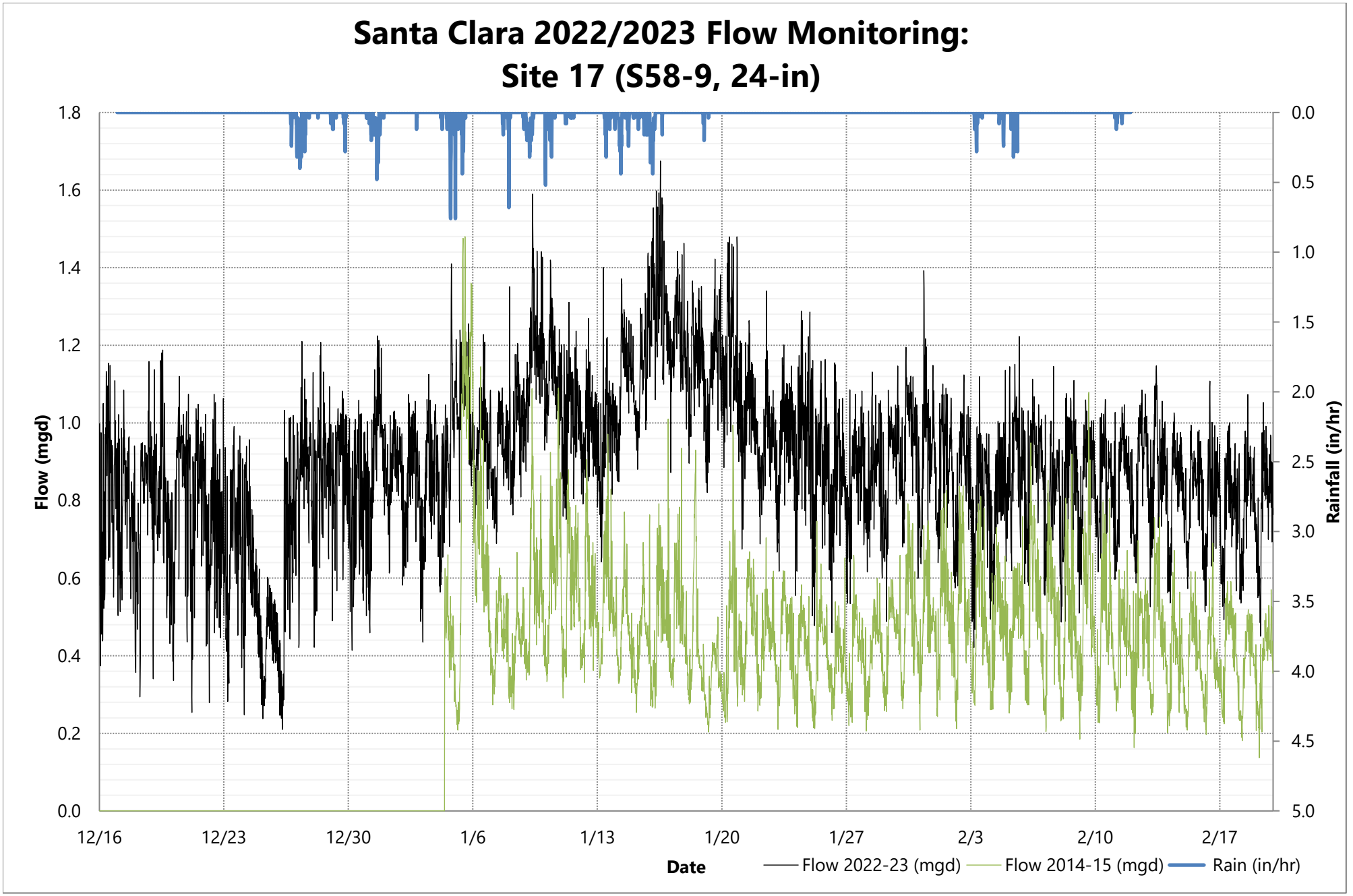

Santa Clara 2022/2023 Flow Monitoring:
Site 12 (S53-23, 24-in)
Flow (mgd)
Rainfall (in/hr)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Note: 2022-23 flow data represent dry weather flow data collected in July 2023, as Site 12 was initially installed on the incorrect pipeline.
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

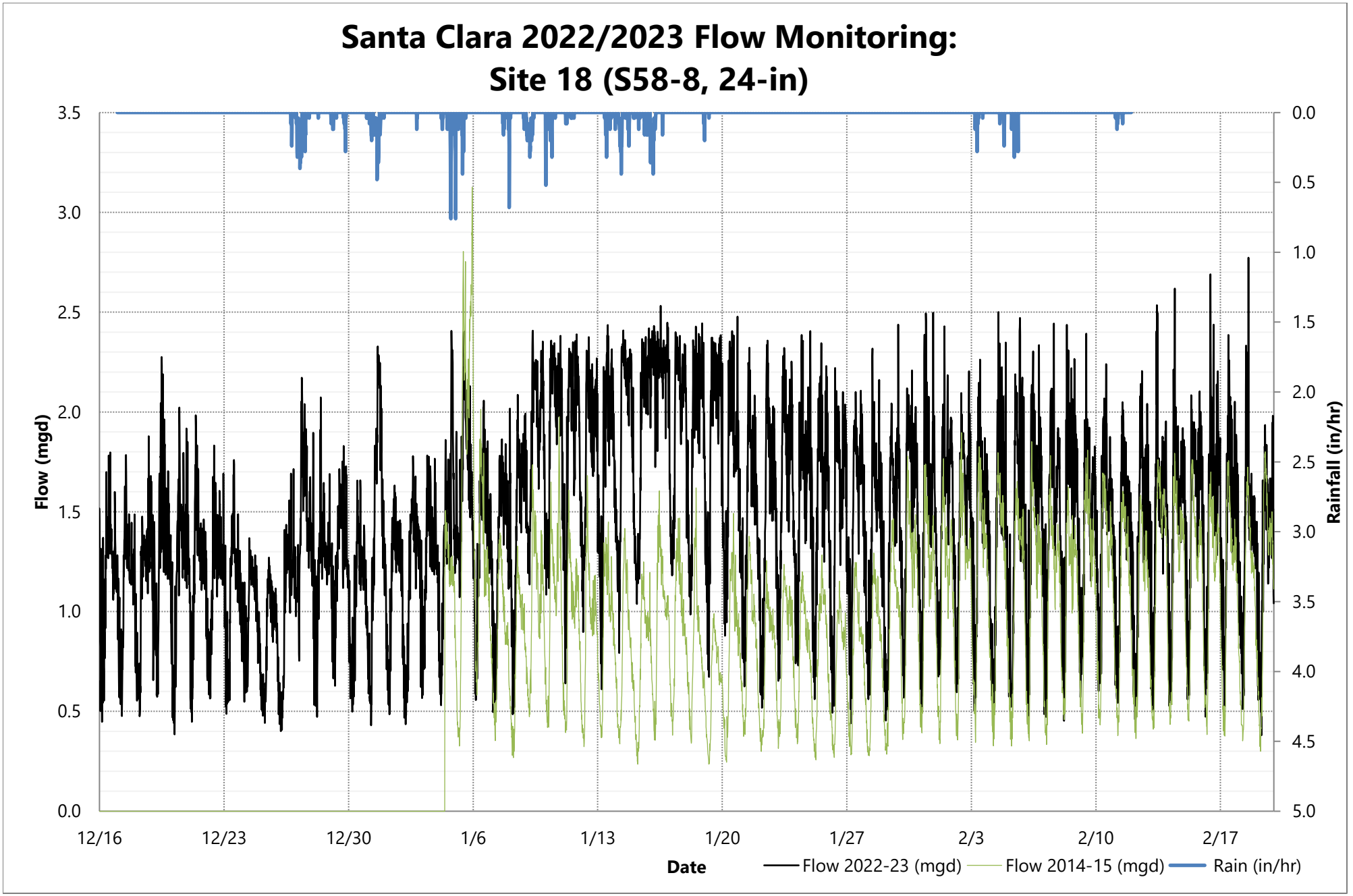

Santa Clara 2022/2023 Flow Monitoring:
Site 13 (S53-54, 30-in)
Flow (mgd)
Rainfall (in/hr)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

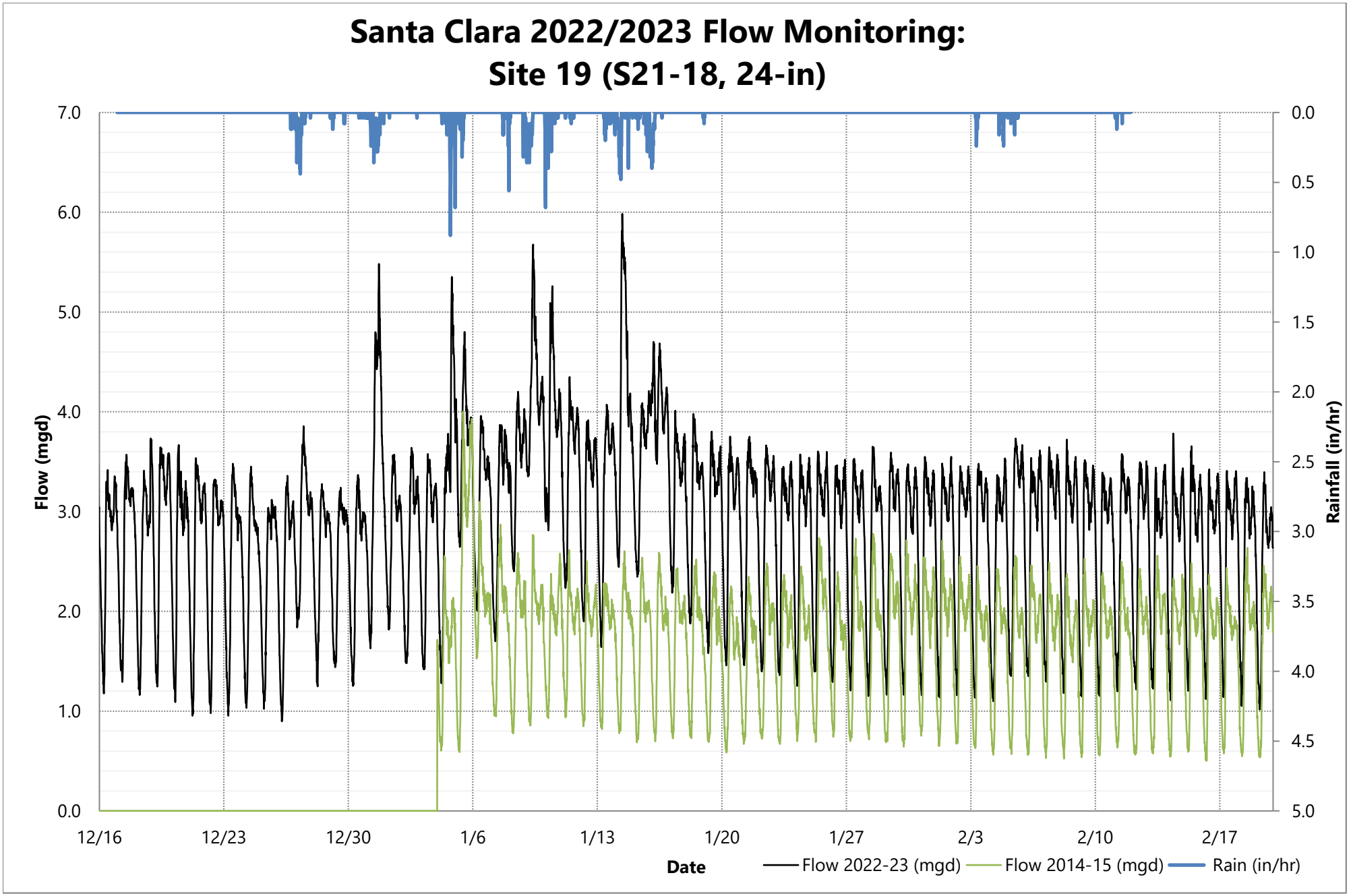

Santa Clara 2022/2023 Flow Monitoring:
Site 14 (S54-16, 15-in)
Flow (mgd)
Rainfall (in/hr)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

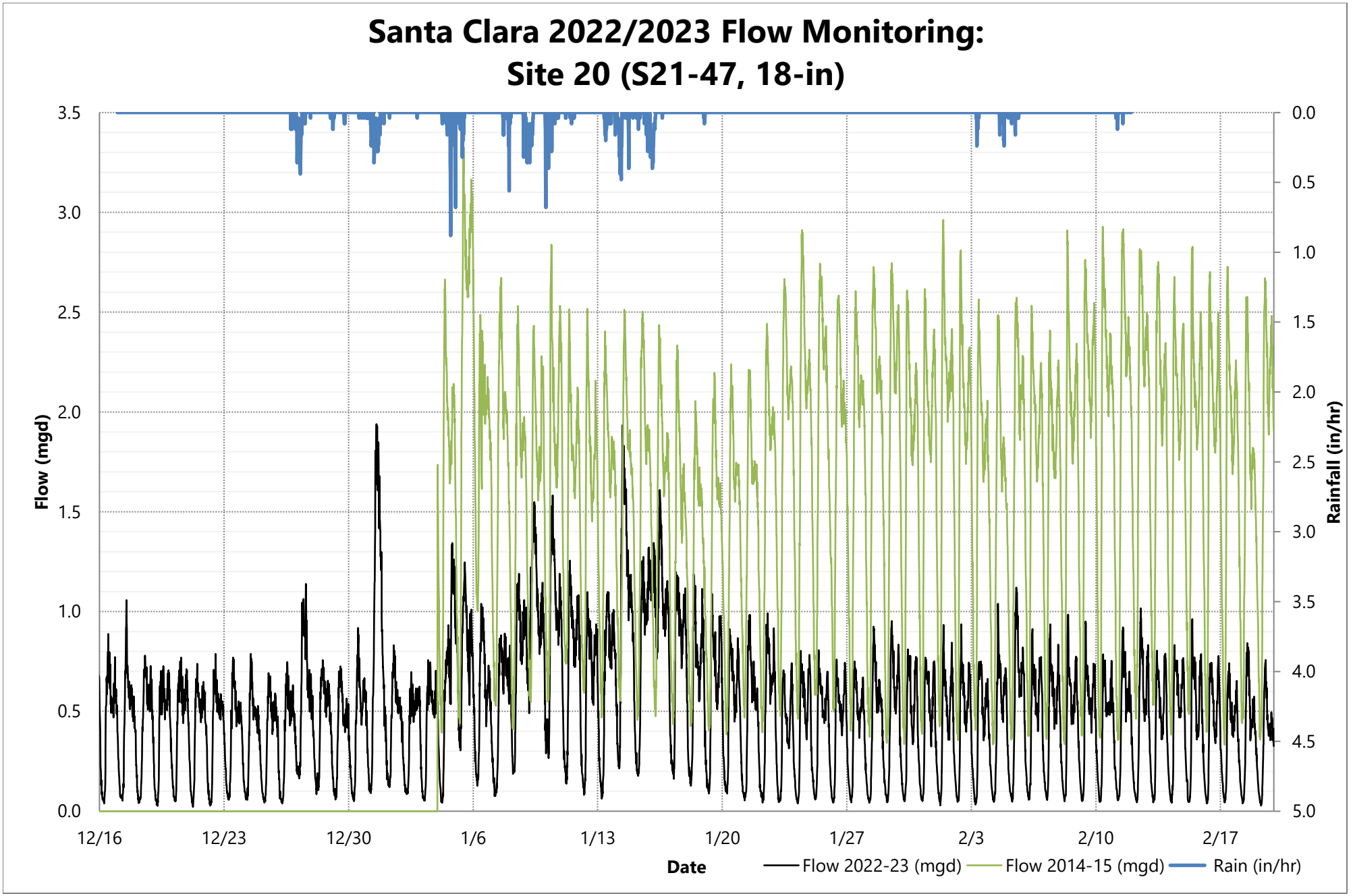

Santa Clara 2022/2023 Flow Monitoring:
Site 15 (S65-50, 18-in)
Flow (mgd)
Rainfall (in/hr)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

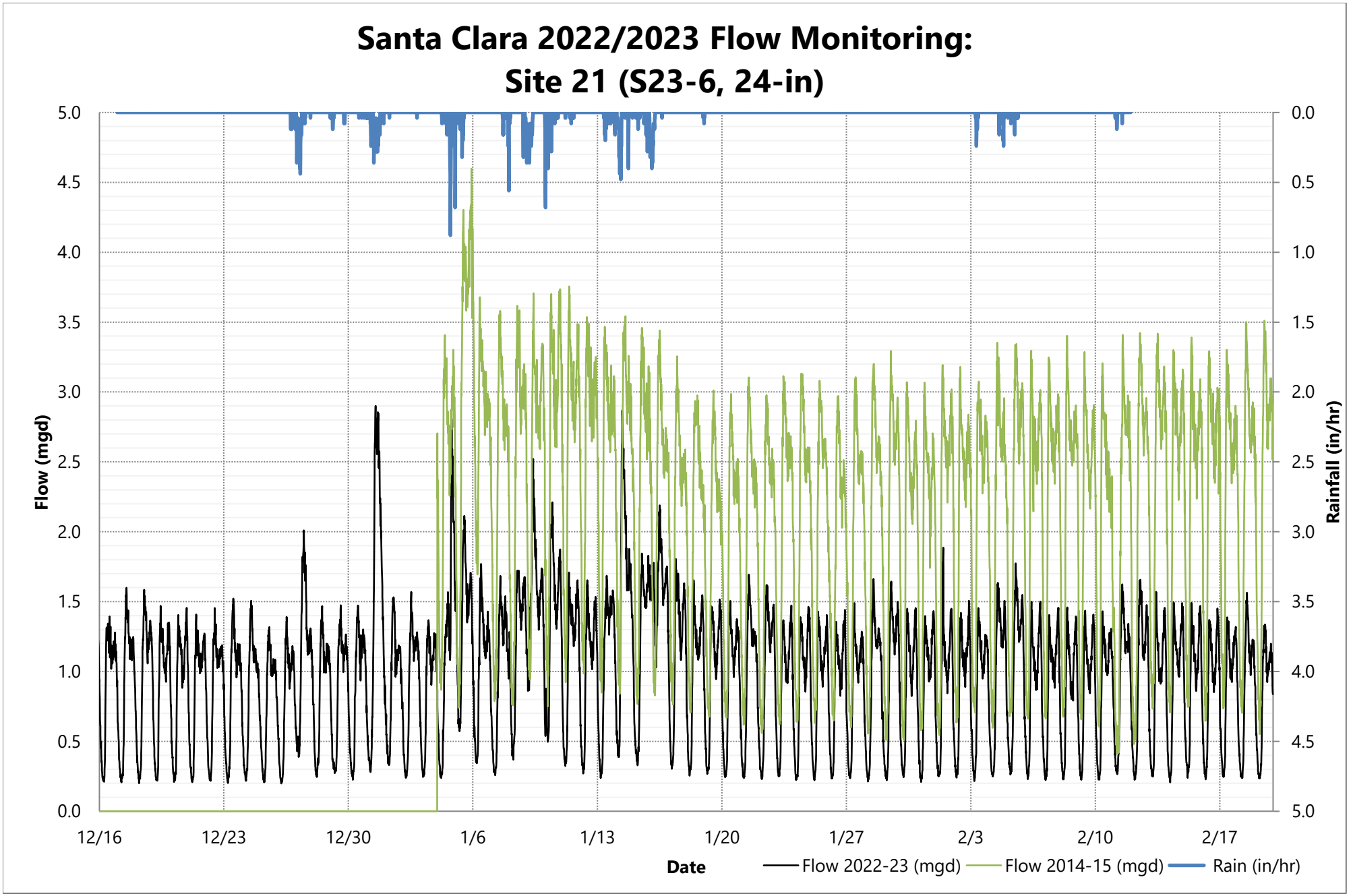

Santa Clara 2022/2023 Flow Monitoring:
Site 16 (S67-13, 27-in)
Flow (mgd)
Rainfall (in/hr)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

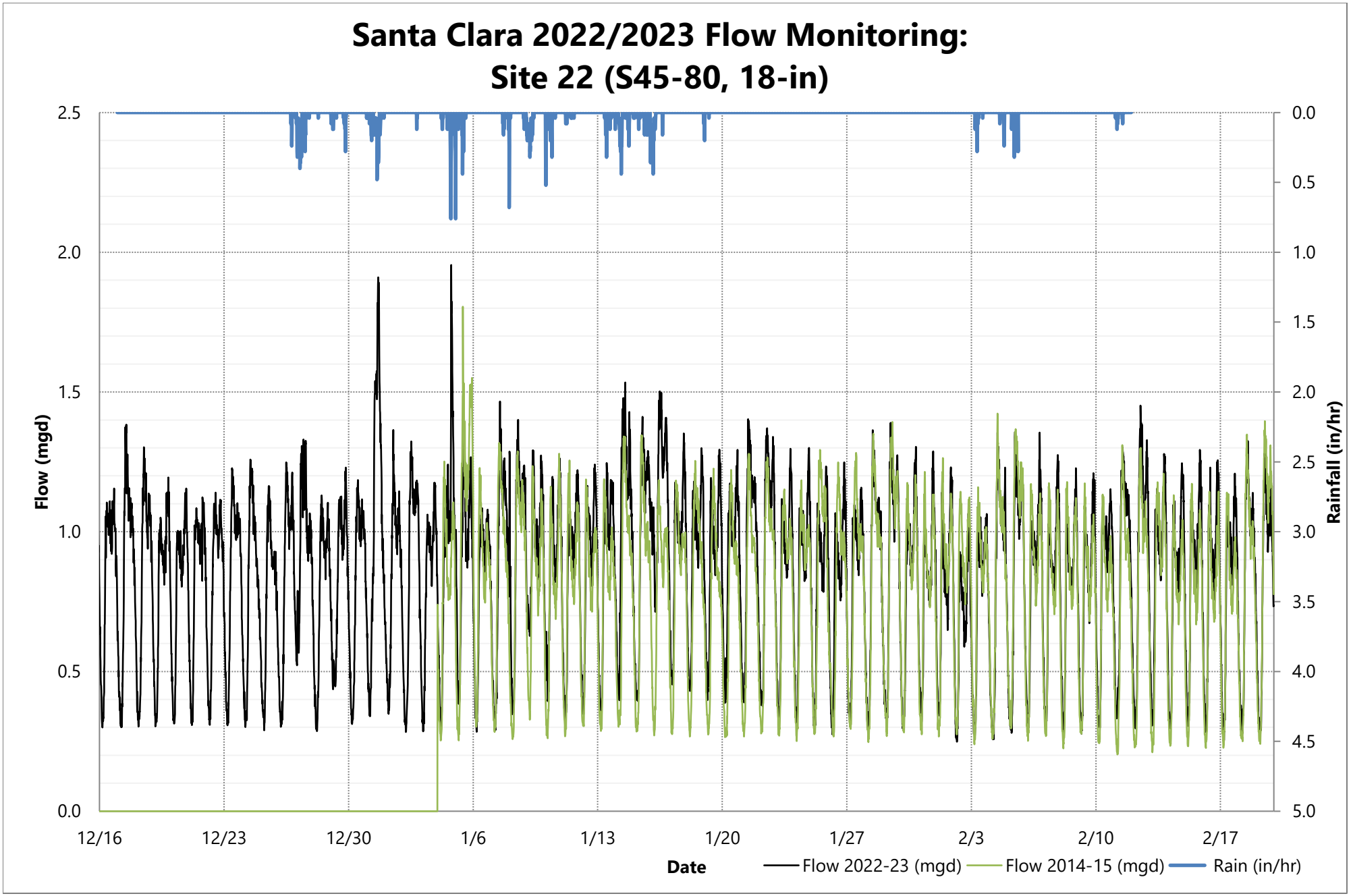

Santa Clara 2022/2023 Flow Monitoring:
Site 17 (S58-9, 24-in)
Flow (mgd)
Rainfall (in/hr)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

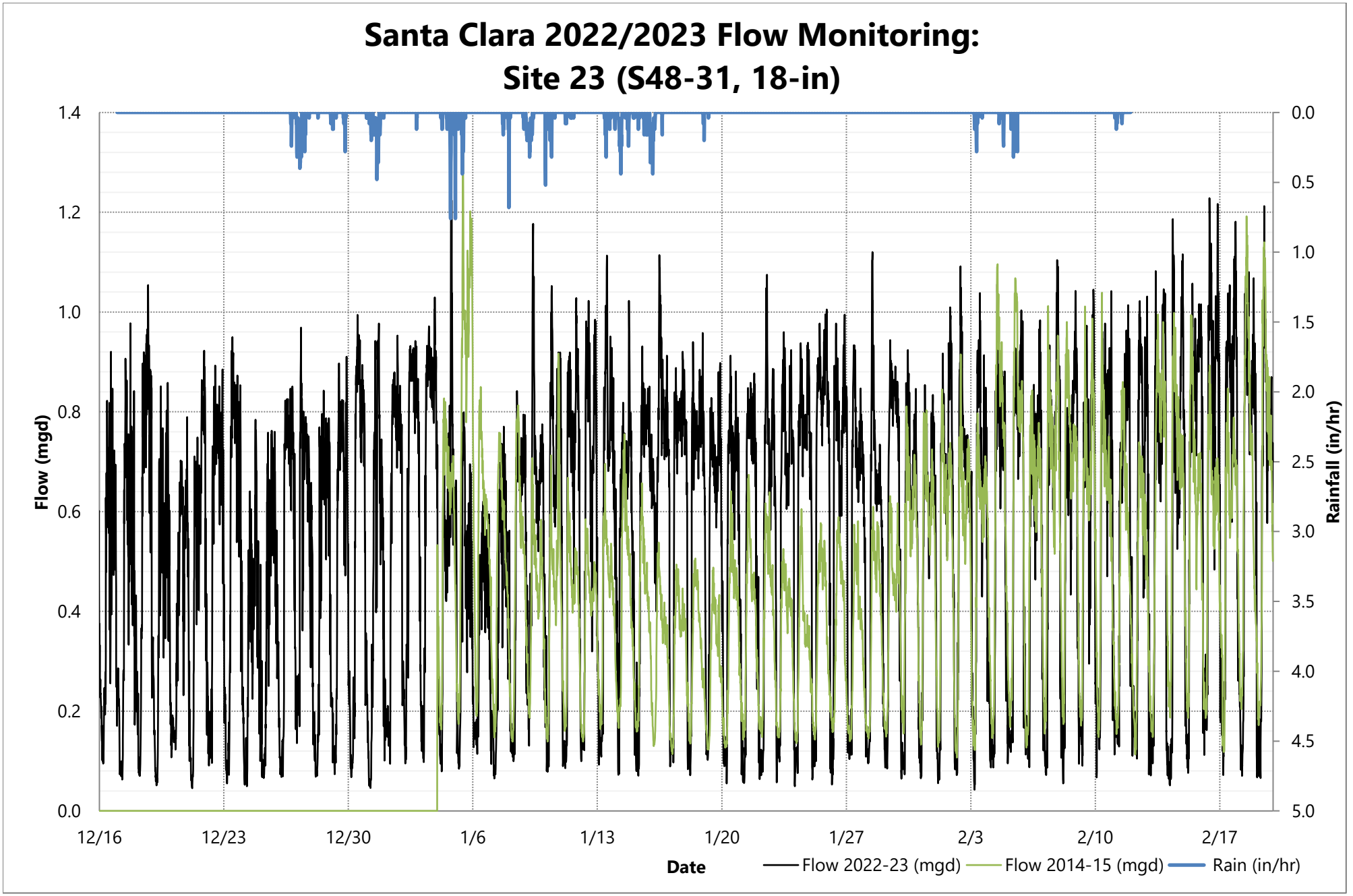

Santa Clara 2022/2023 Flow Monitoring:
Site 18 (S58-8, 24-in)
Flow (mgd)
Rainfall (in/hr)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

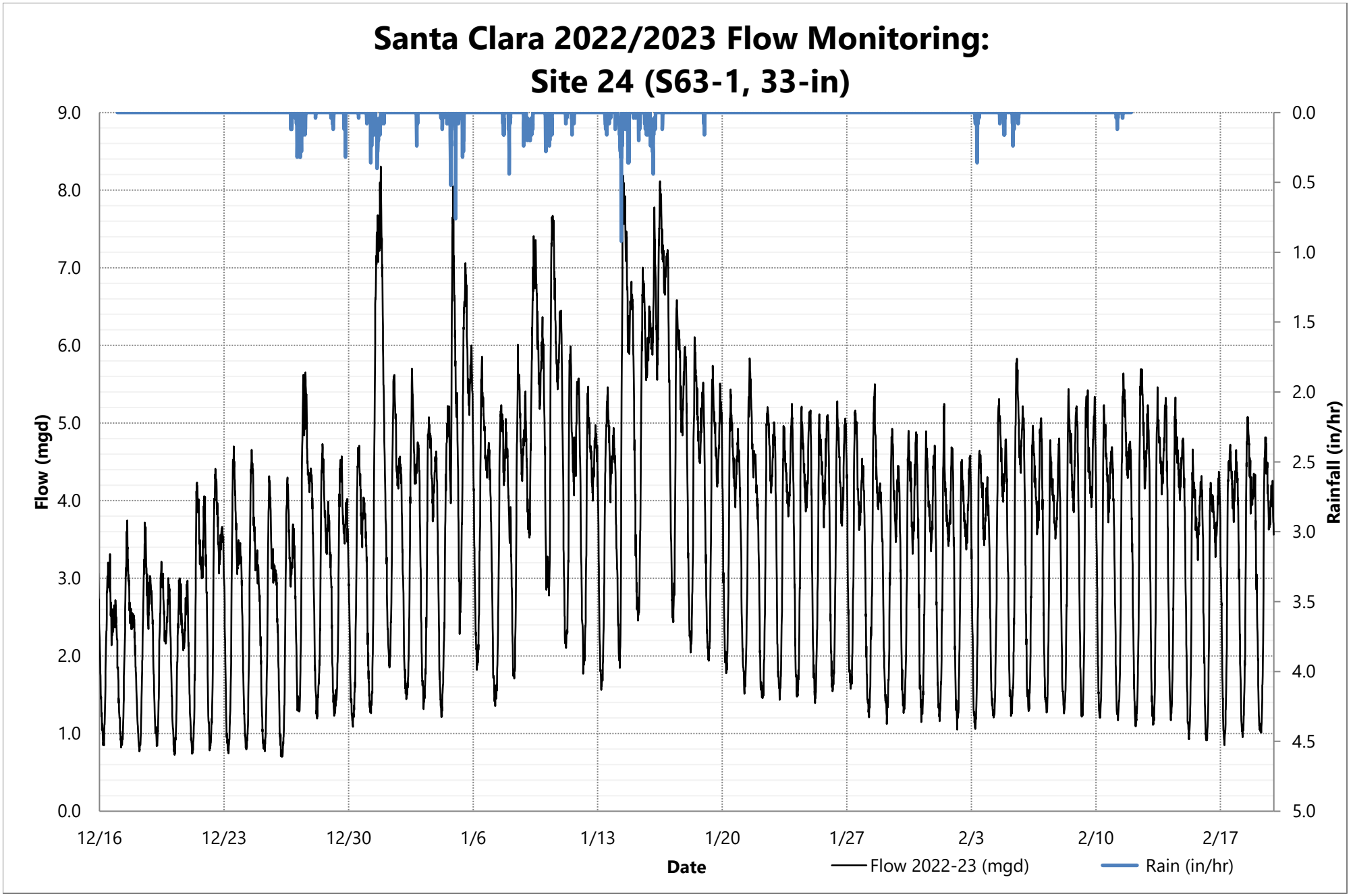

Santa Clara 2022/2023 Flow Monitoring:
Site 19 (S21-18, 24-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

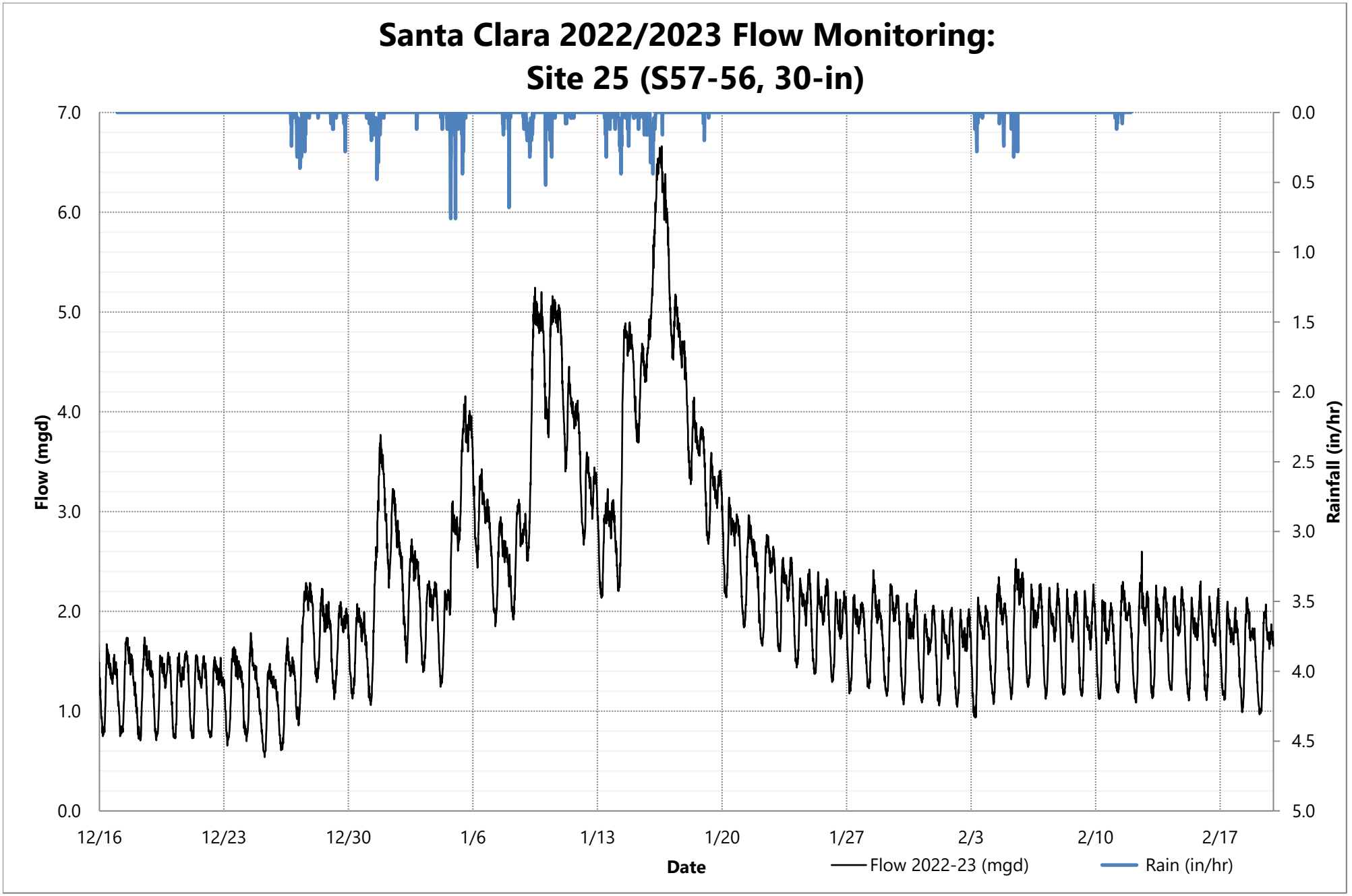

Santa Clara 2022/2023 Flow Monitoring:
Site 20 (S21-47, 18-in)
Flow (mgd)
Rainfall (in/hr)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

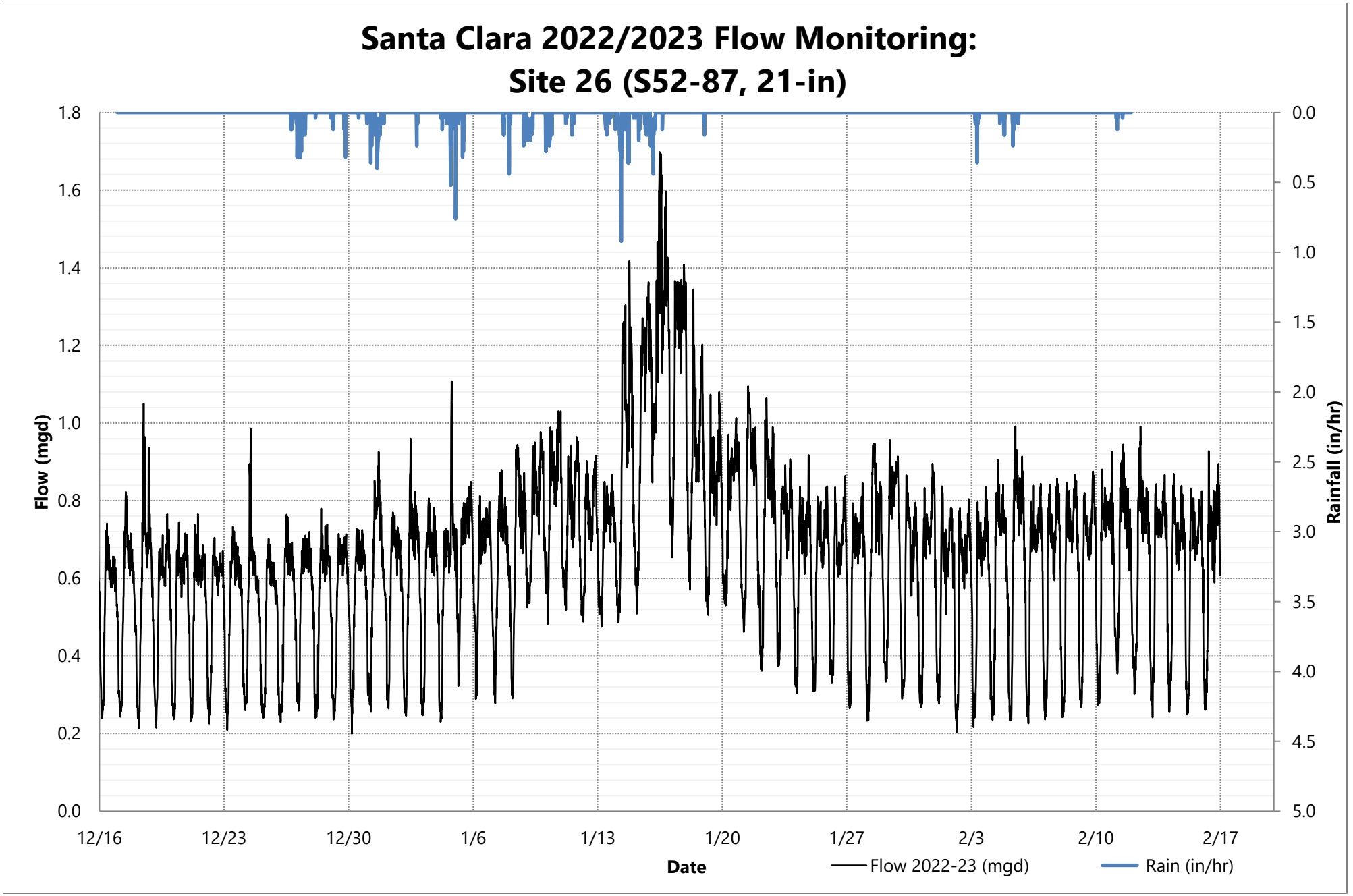

Santa Clara 2022/2023 Flow Monitoring:
Site 21 (S23-6, 24-in)
Flow (mgd)
Rainfall (in/hr)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

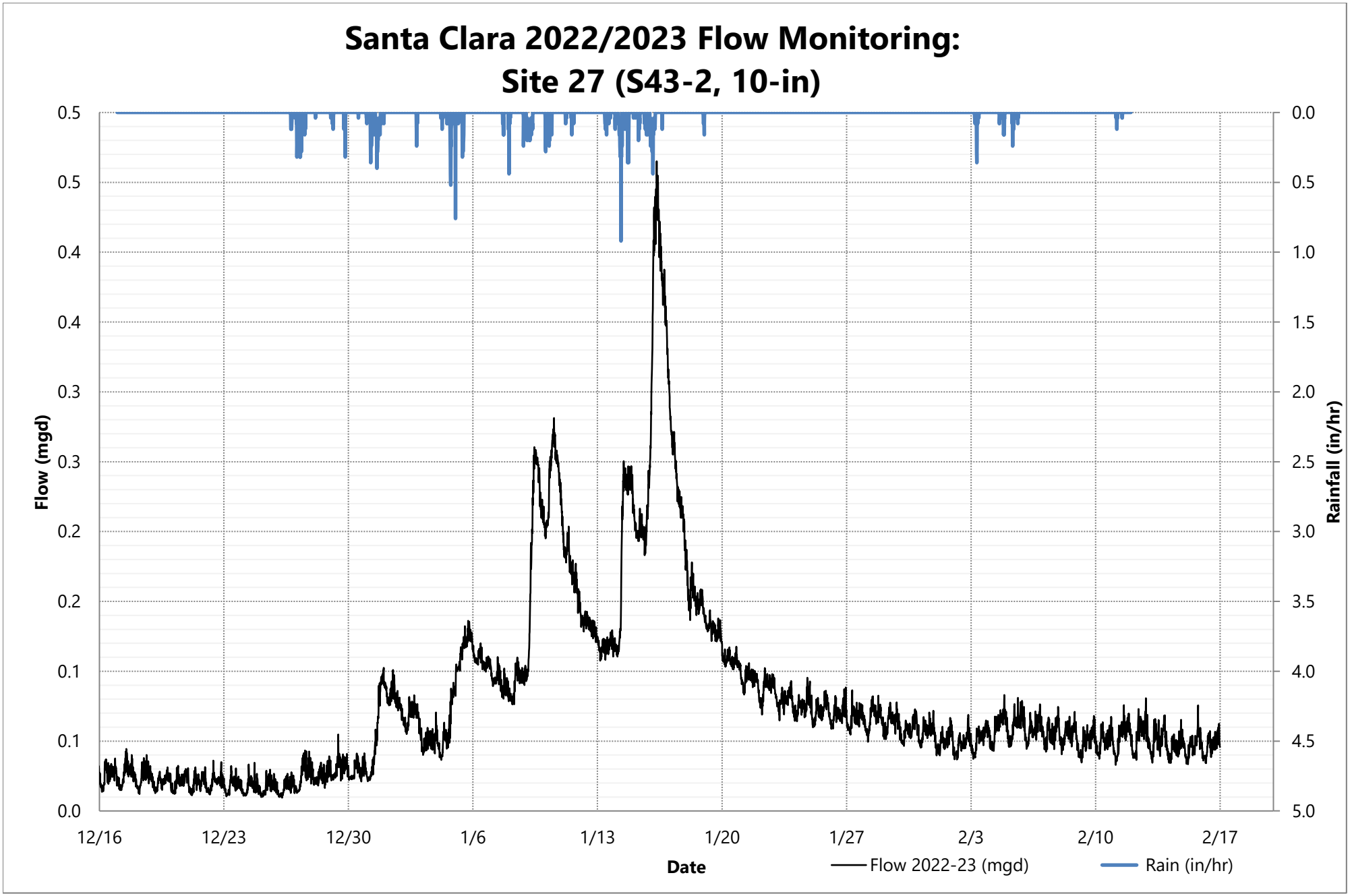

Santa Clara 2022/2023 Flow Monitoring:
Site 22 (S45-80, 18-in)
Flow (mgd)
Rainfall (in/hr)
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

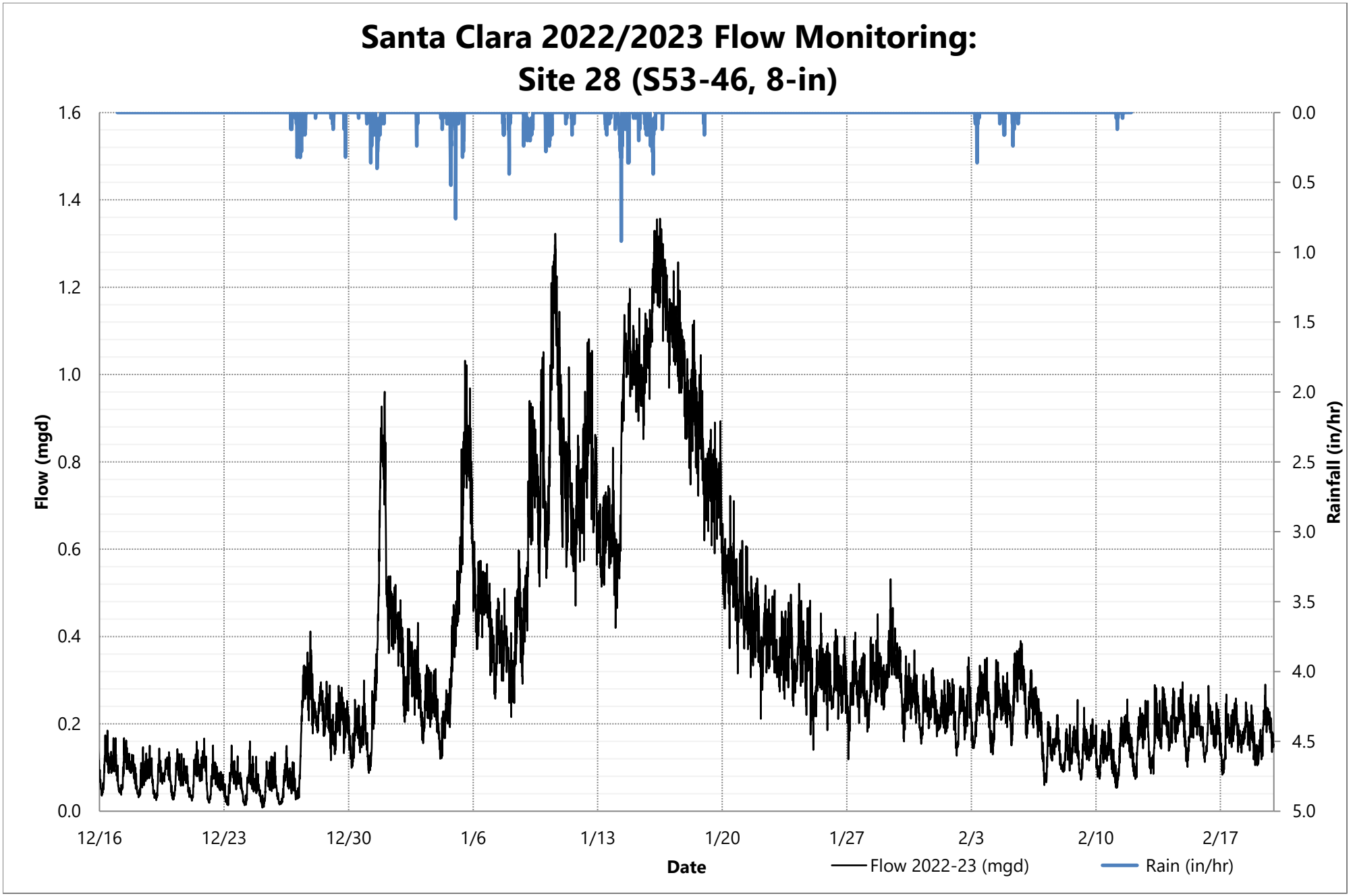

Santa Clara 2022/2023 Flow Monitoring:
Site 23 (S48-31, 18-in)
Flow (mgd)
Rainfall (in/hr)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

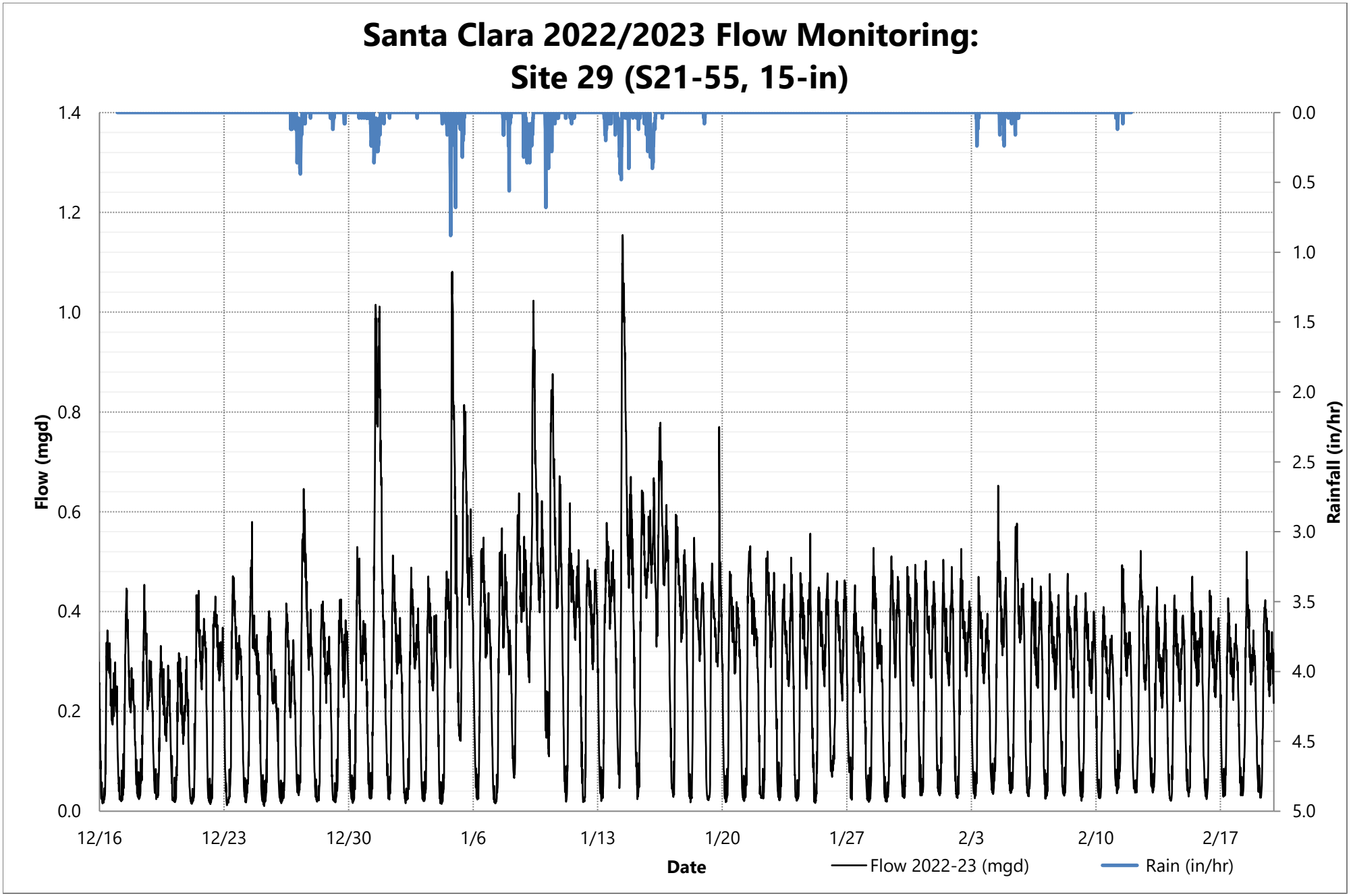

Santa Clara 2022/2023 Flow Monitoring:
Site 24 (S63-1, 33-in)
Flow (mgd)
Rainfall (in/hr)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

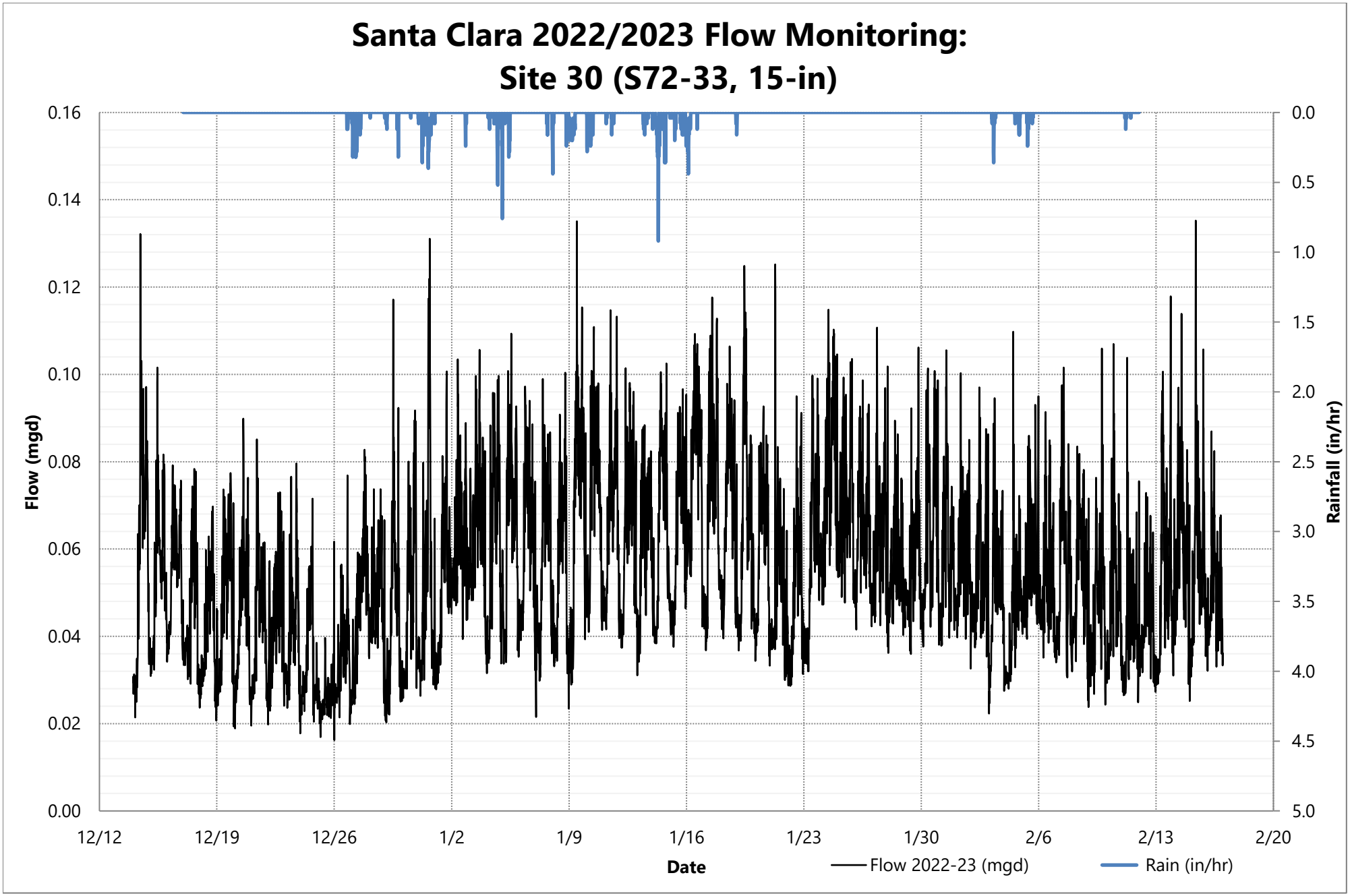

Santa Clara 2022/2023 Flow Monitoring:
Site 25 (S57-56, 30-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

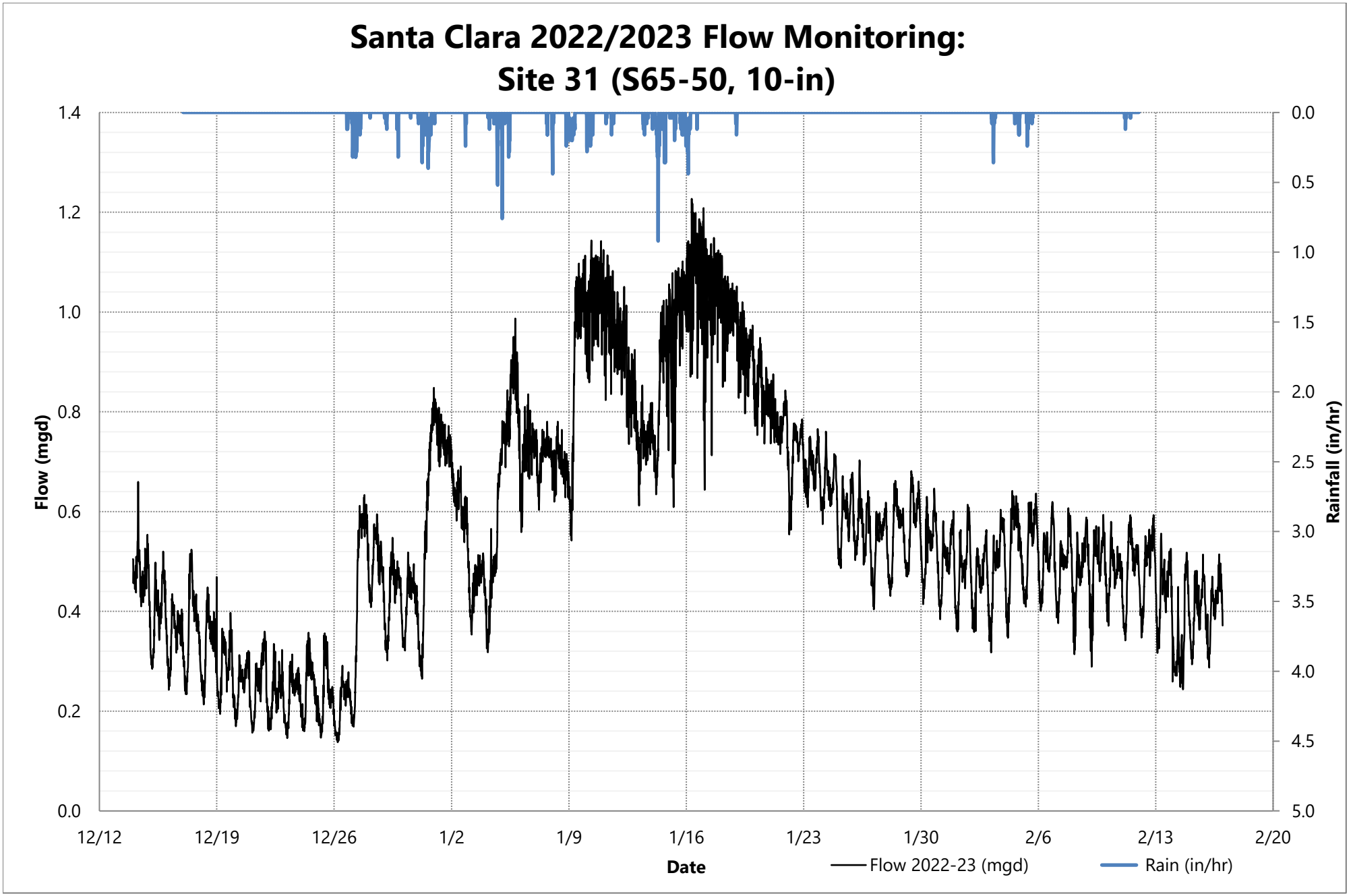

Santa Clara 2022/2023 Flow Monitoring:
Site 26 (S52-87, 21-in)
Flow (mgd)
Rainfall (in/hr)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

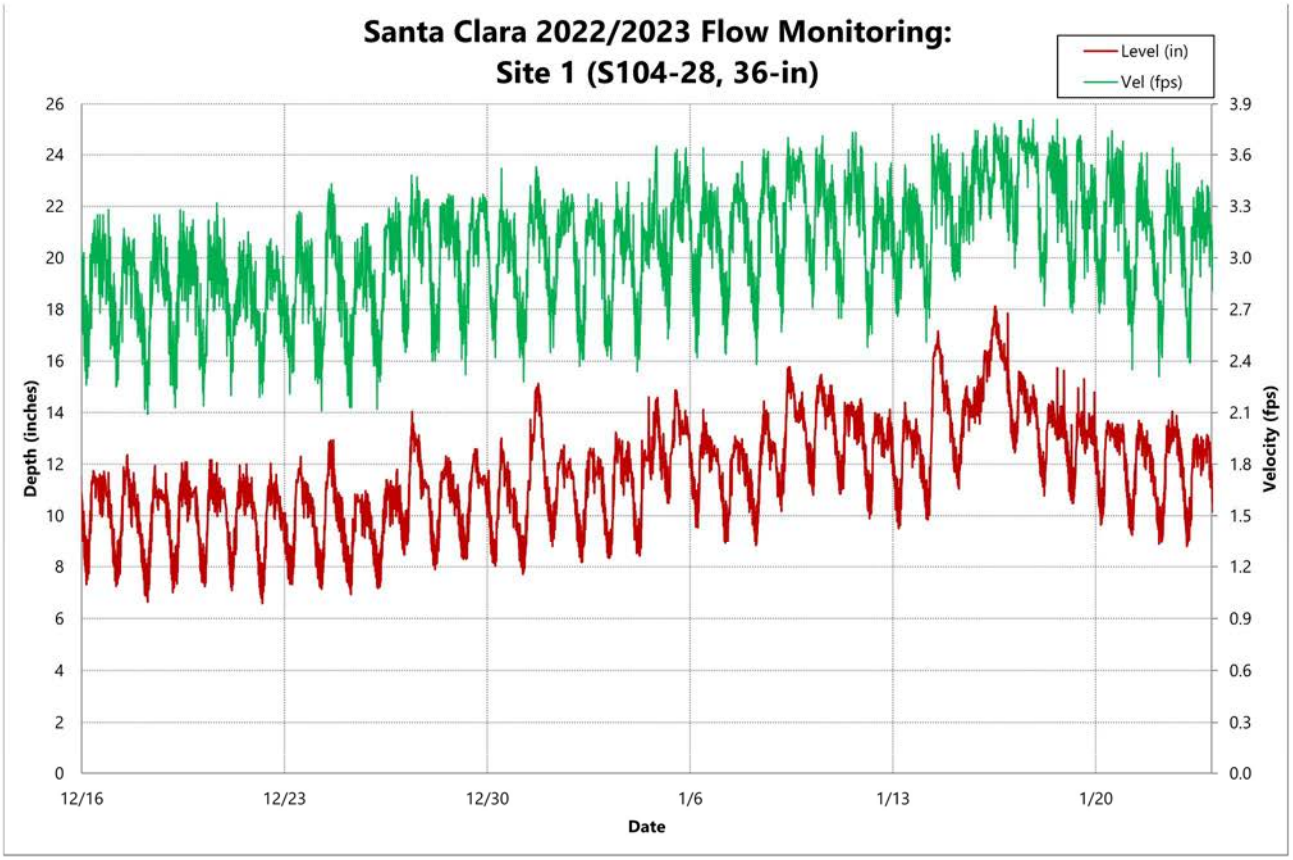

Santa Clara 2022/2023 Flow Monitoring:
Site 27 (S43-2, 10-in)
Flow (mgd)
Rainfall (in/hr)
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

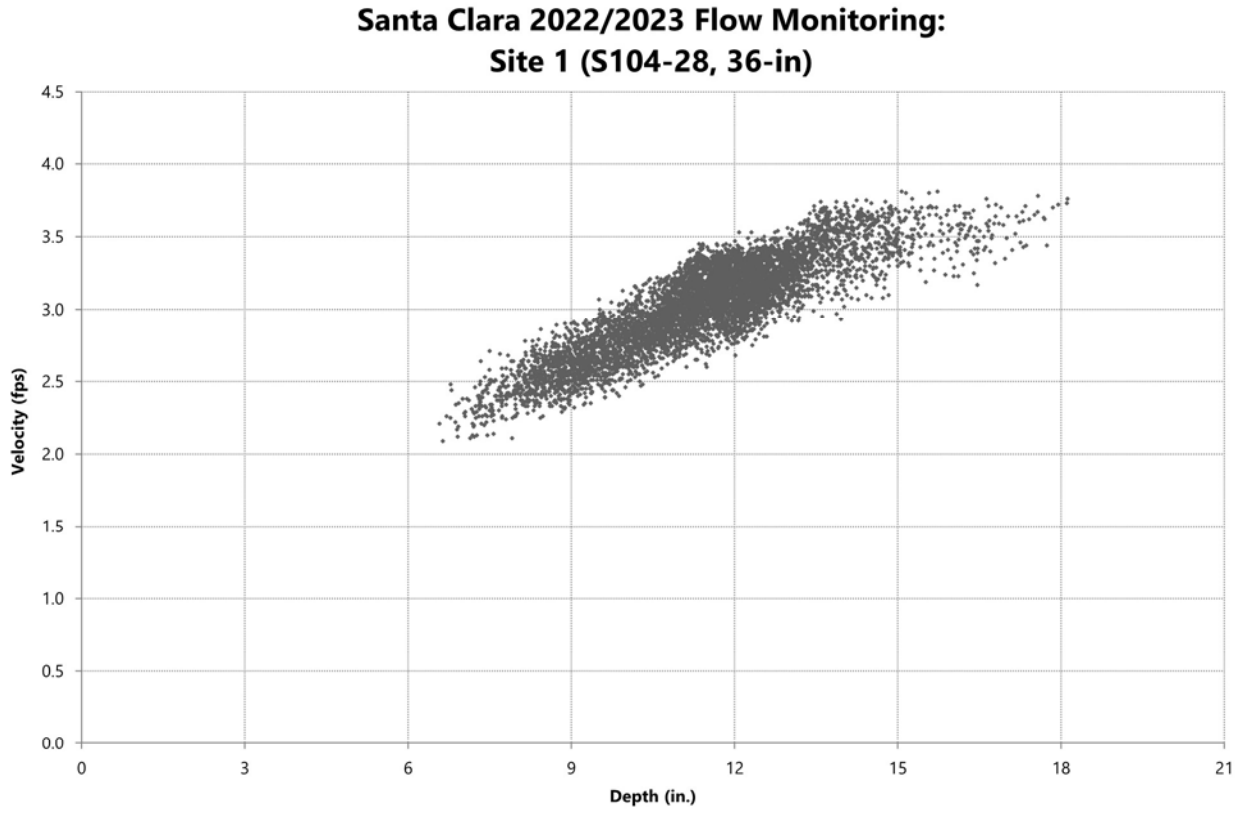

Santa Clara 2022/2023 Flow Monitoring:
Site 28 (S53-46, 8-in)
Flow (mgd)
Rainfall (in/hr)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

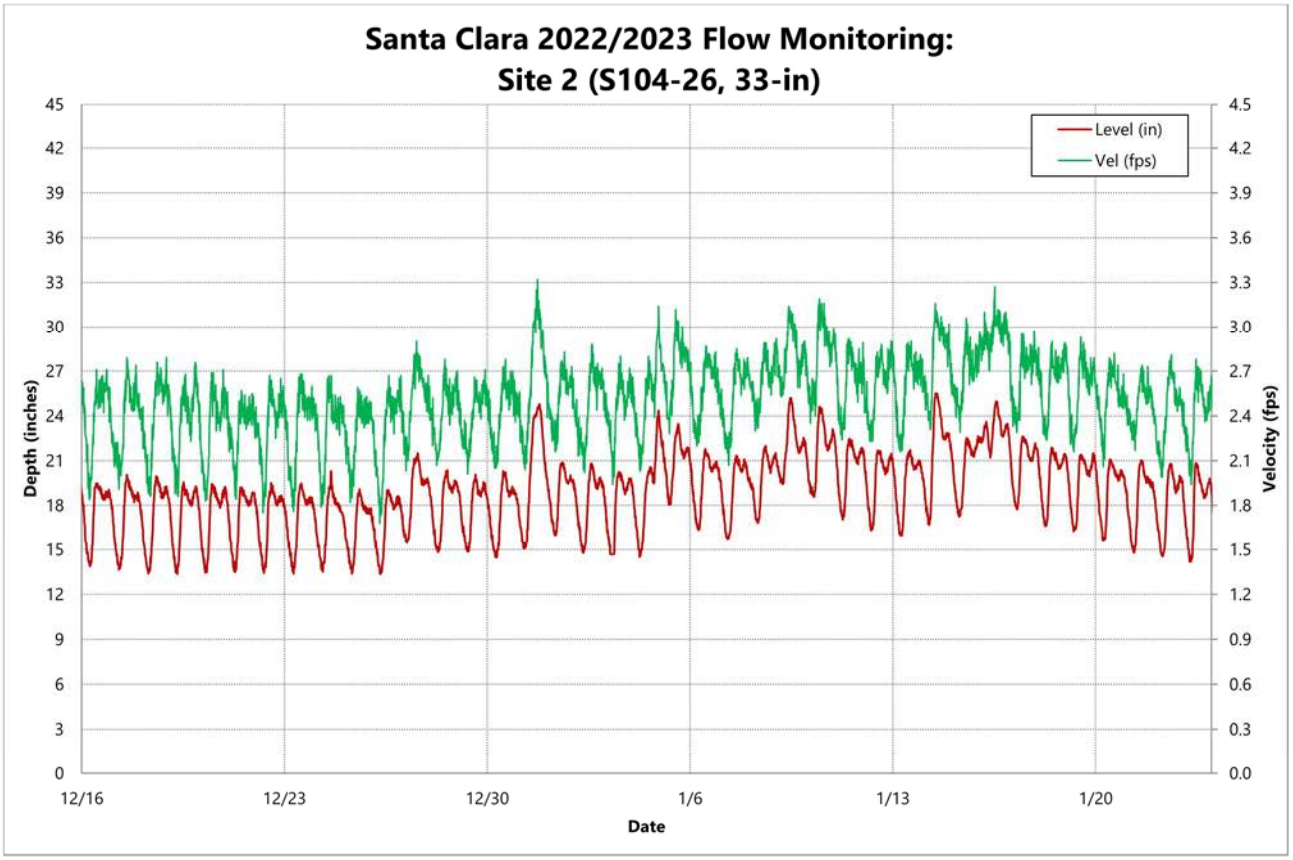

Santa Clara 2022/2023 Flow Monitoring:
Site 29 (S21-55, 15-in)
Flow (mgd)
Rainfall (in/hr)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

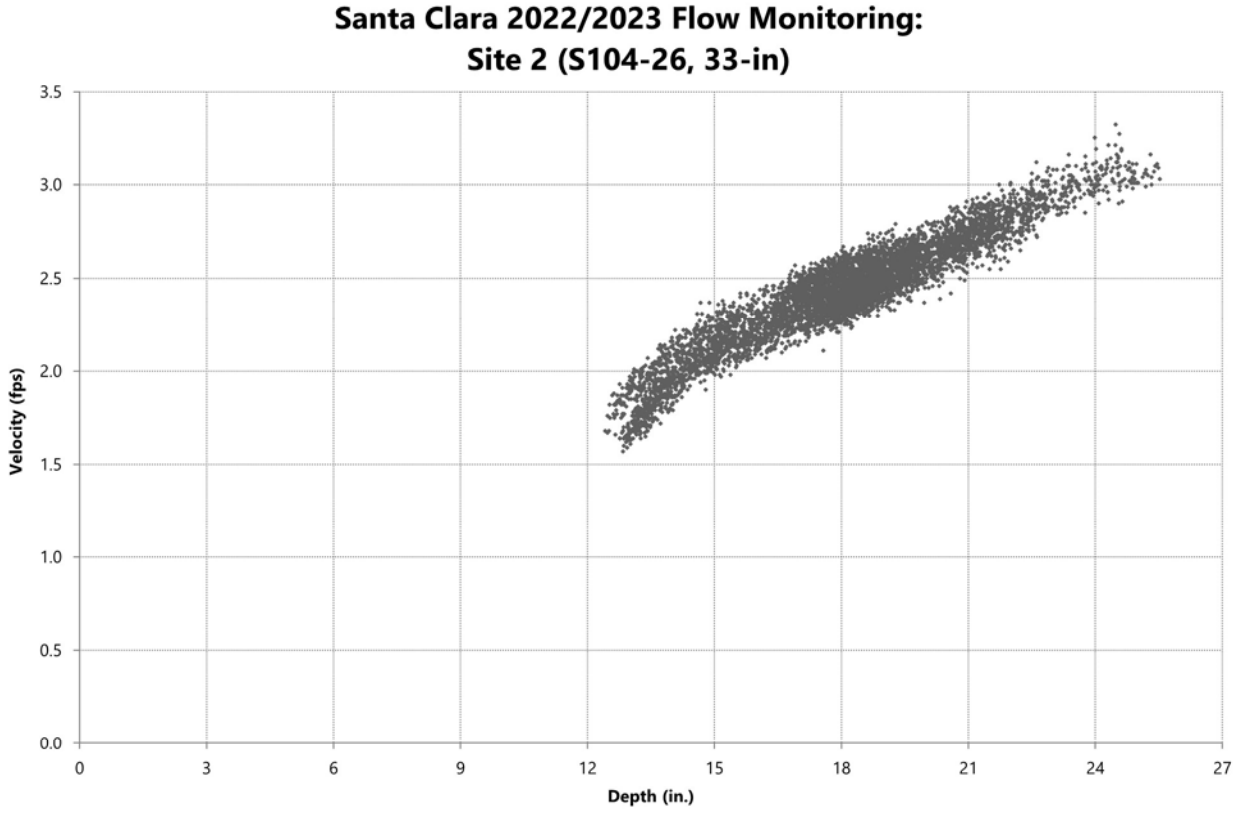

Santa Clara 2022/2023 Flow Monitoring:
Site 30 (S72-33, 15-in)
Flow (mgd)
Rainfall (in/hr)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/12
12/19
12/26
1/2
1/9
1/16
1/23
1/30
2/6
2/13
2/20
Date
Flow 2022-23 (mgd)
Rain (in/hr)

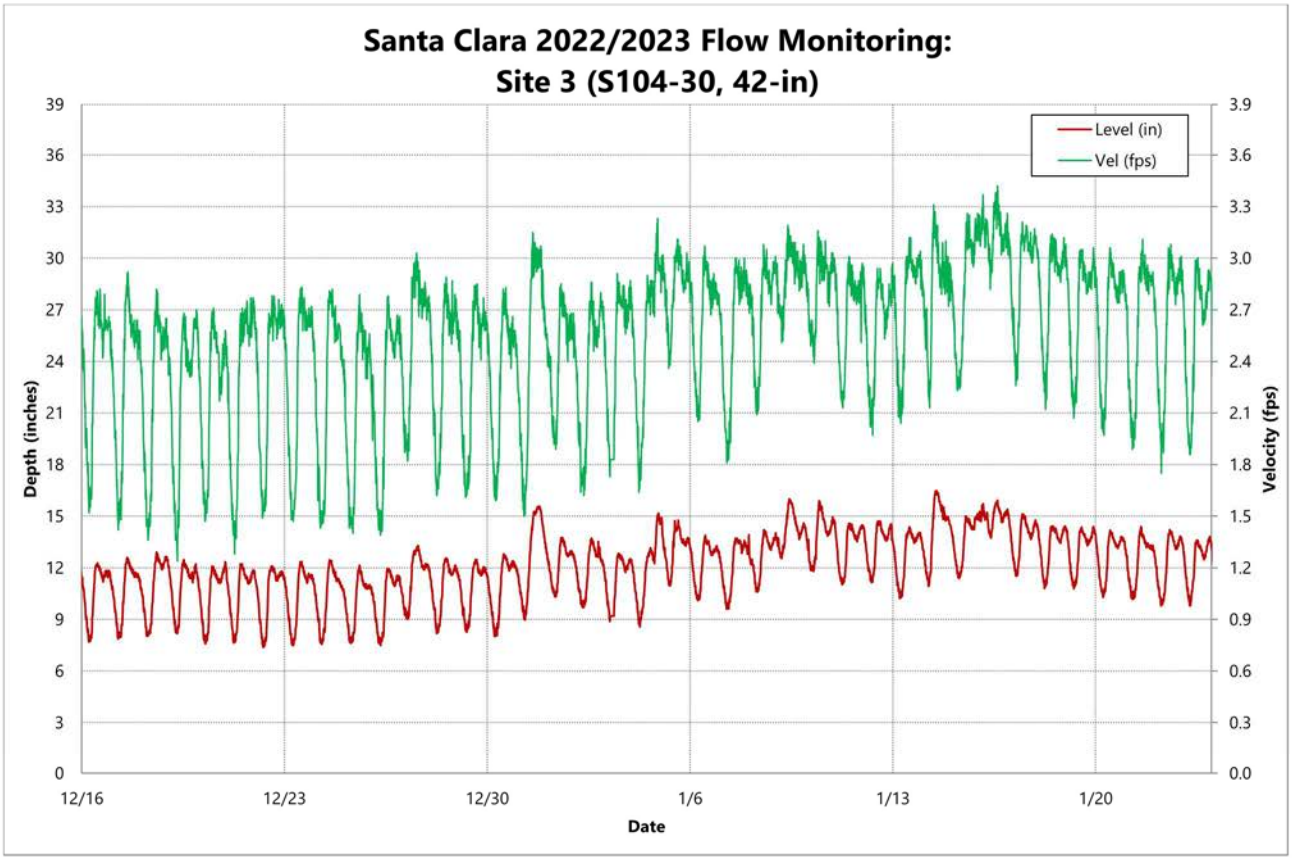

Santa Clara 2022/2023 Flow Monitoring:
Site 31 (S65-50, 10-in)
Flow (mgd)
Rainfall (in/hr)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/12
12/19
12/26
1/2
1/9
1/16
1/23
1/30
2/6
2/13
2/20
Date
Flow 2022-23 (mgd)
Rain (in/hr)

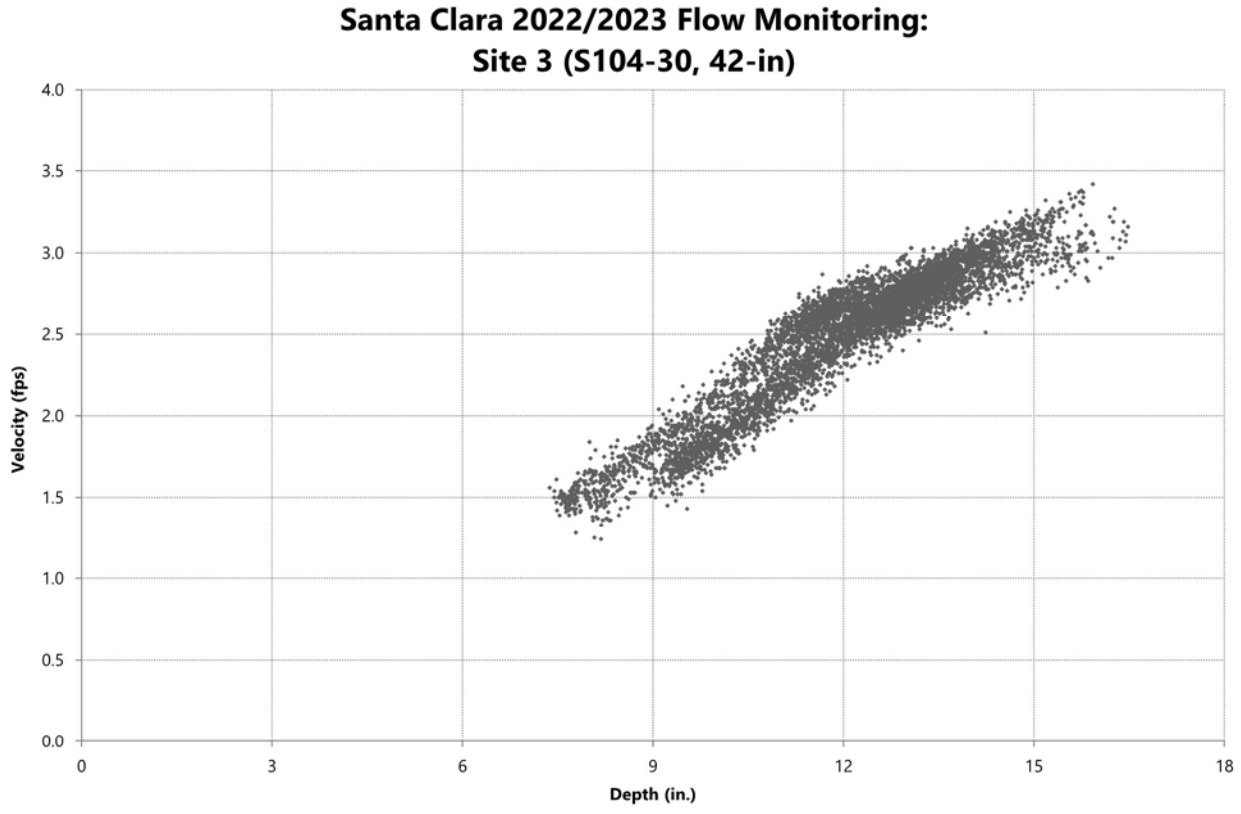

Santa Clara 2022/2023 Flow Monitoring:
Site 1 (S104-28, 36-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

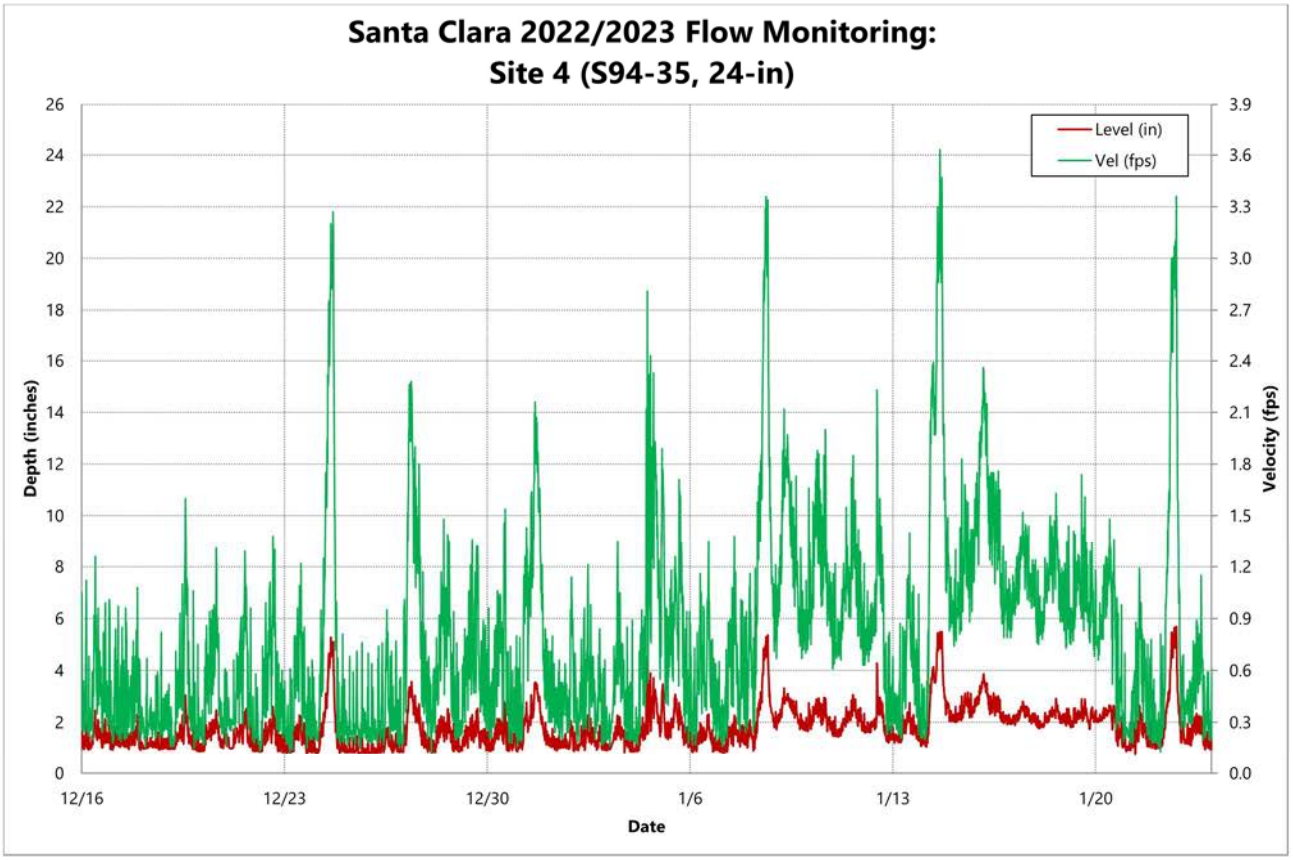

Santa Clara 2022/2023 Flow Monitoring:
Site 1 (S104-28, 36-in)
Velocity (fps)
Depth (in.)

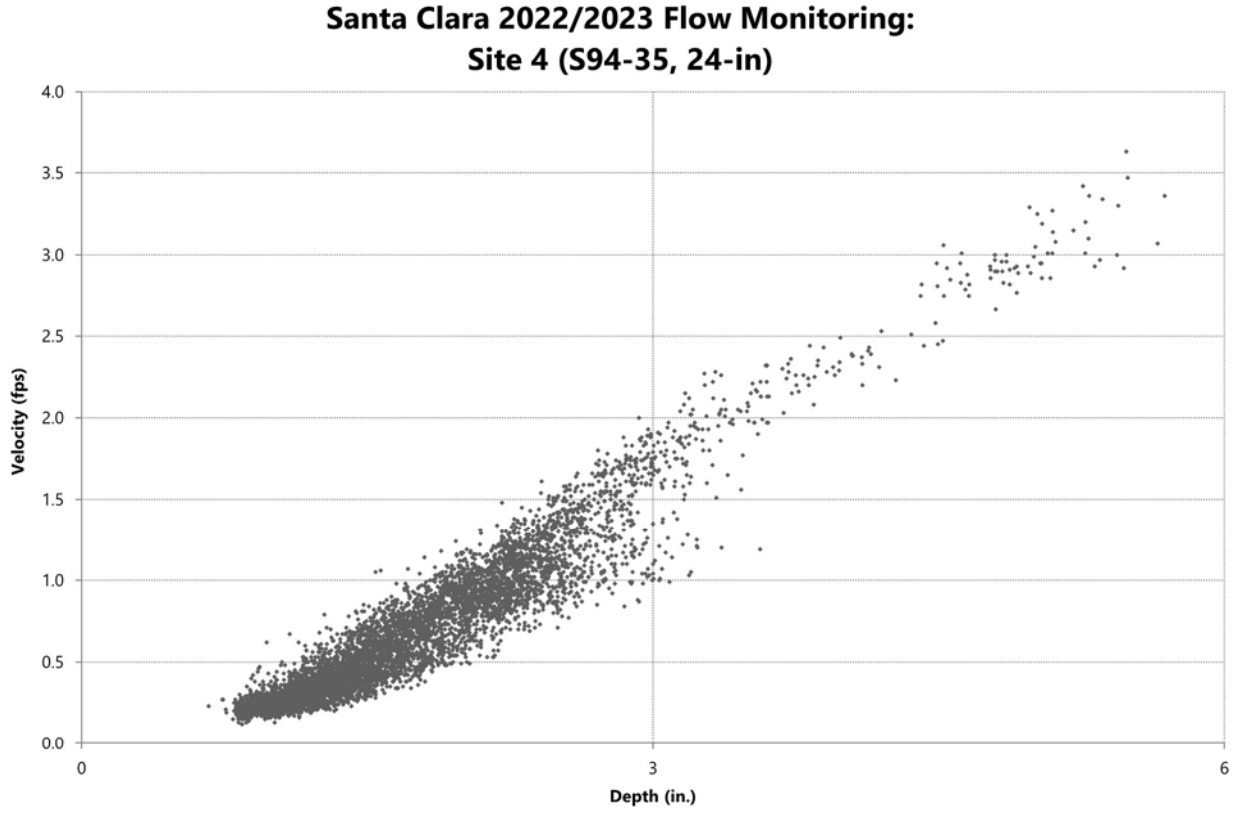

Santa Clara 2022/2023 Flow Monitoring:
Site 2 (S104-26, 33-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

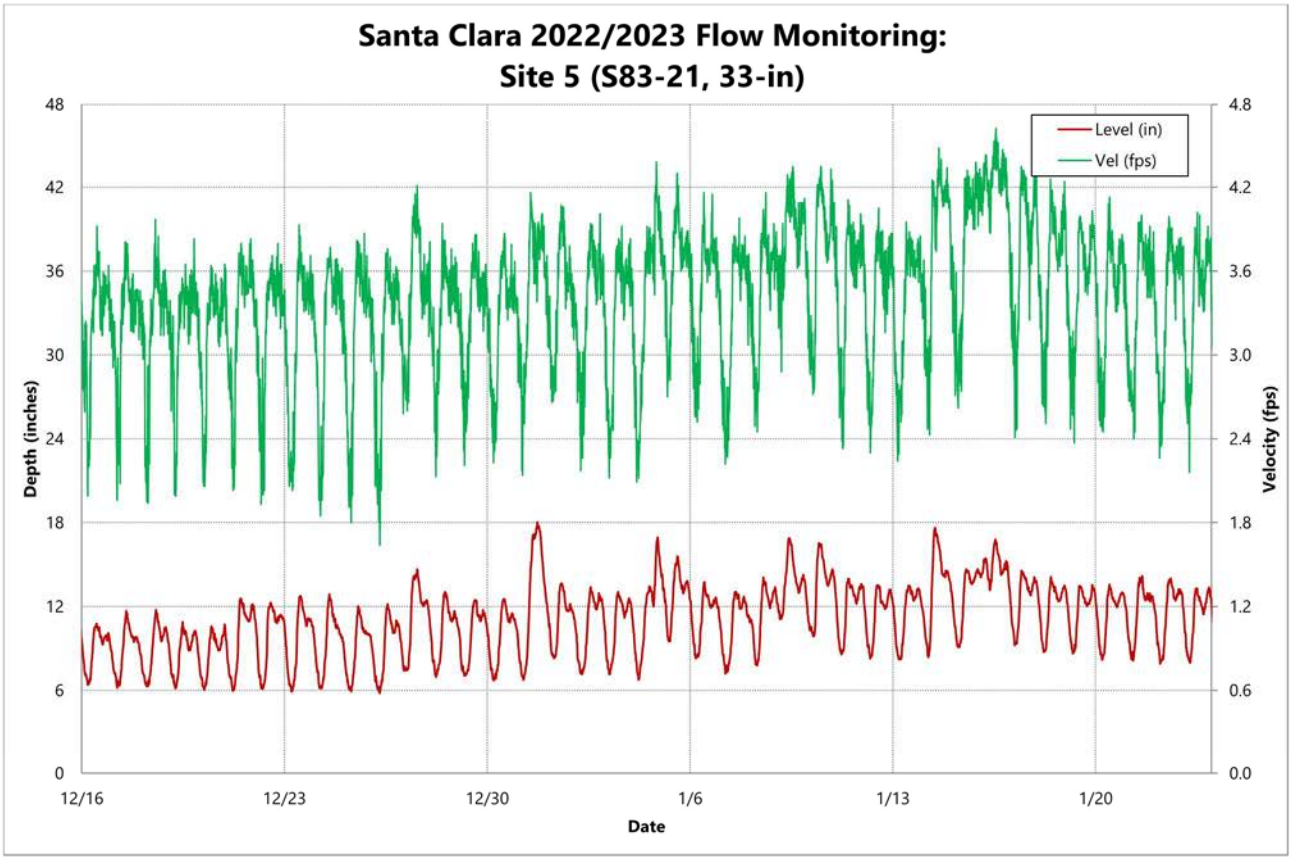

Santa Clara 2022/2023 Flow Monitoring:
Site 2 (S104-26, 33-in)
Velocity (fps)
Depth (in.)

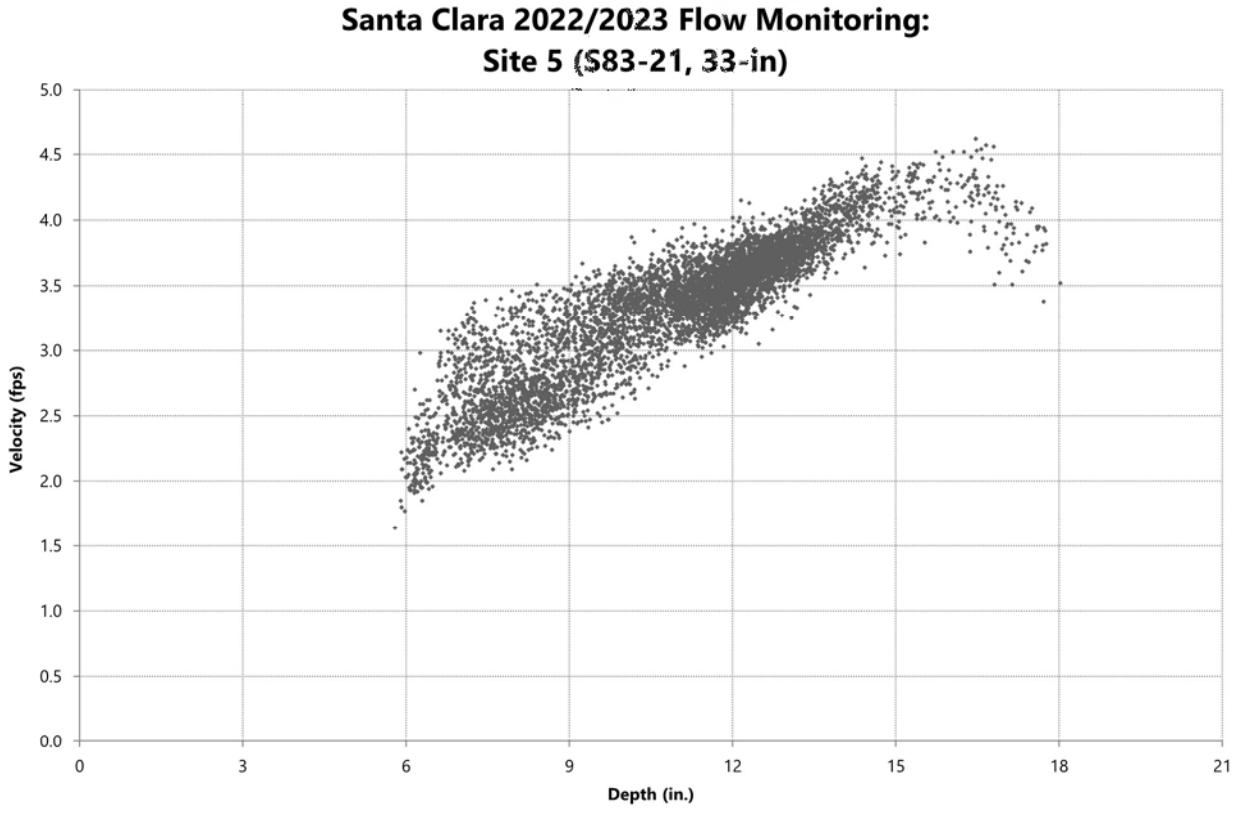

Santa Clara 2022/2023 Flow Monitoring:
Site 3 (S104-30, 42-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

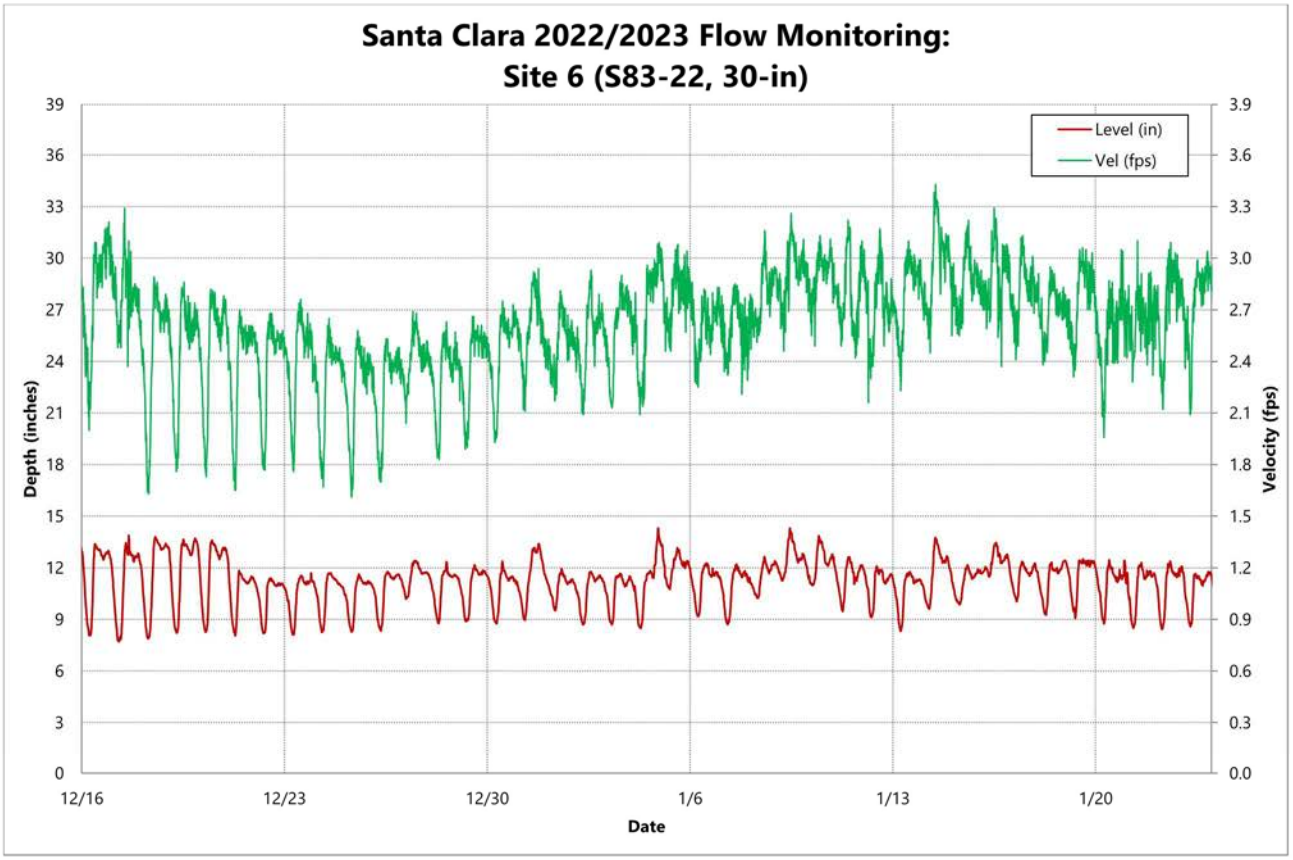

Santa Clara 2022/2023 Flow Monitoring:
Site 3 (S104-30, 42-in)
Velocity (fps)
Depth (in.)

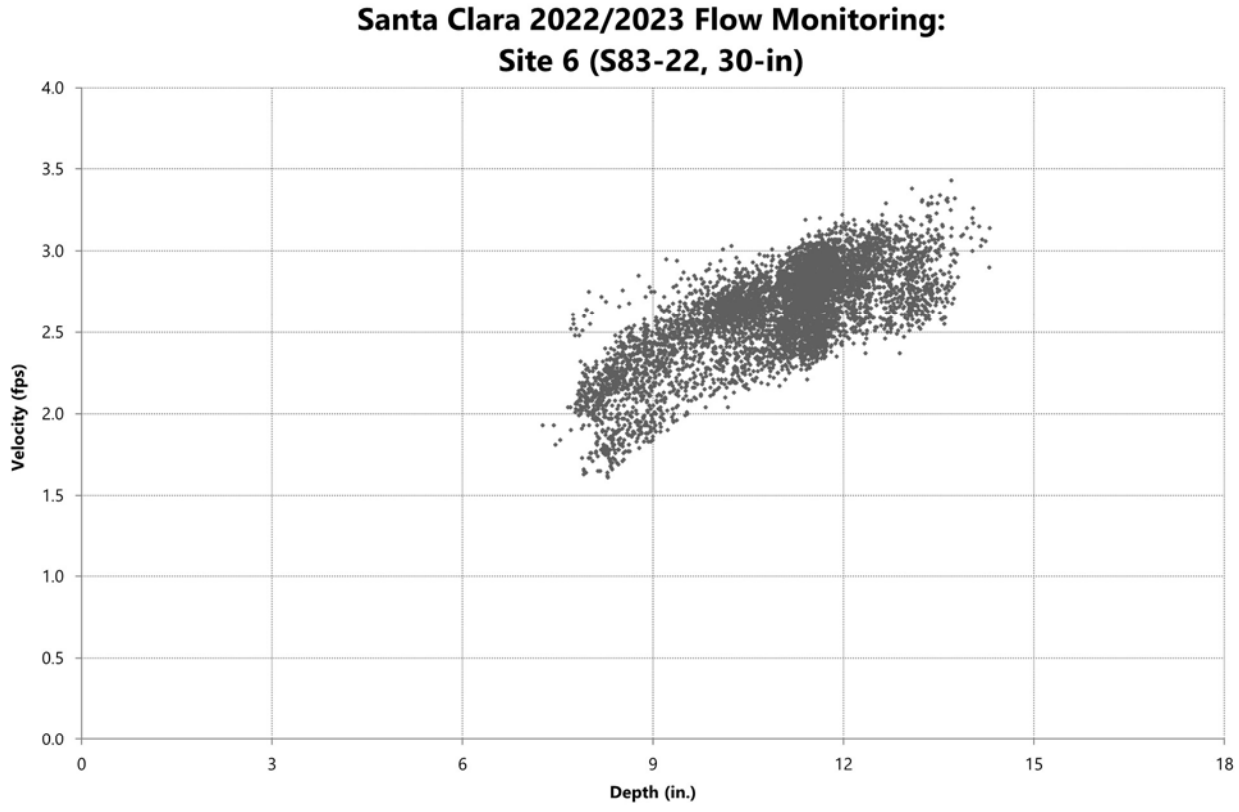

Santa Clara 2022/2023 Flow Monitoring:
Site 4 (S94-35, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

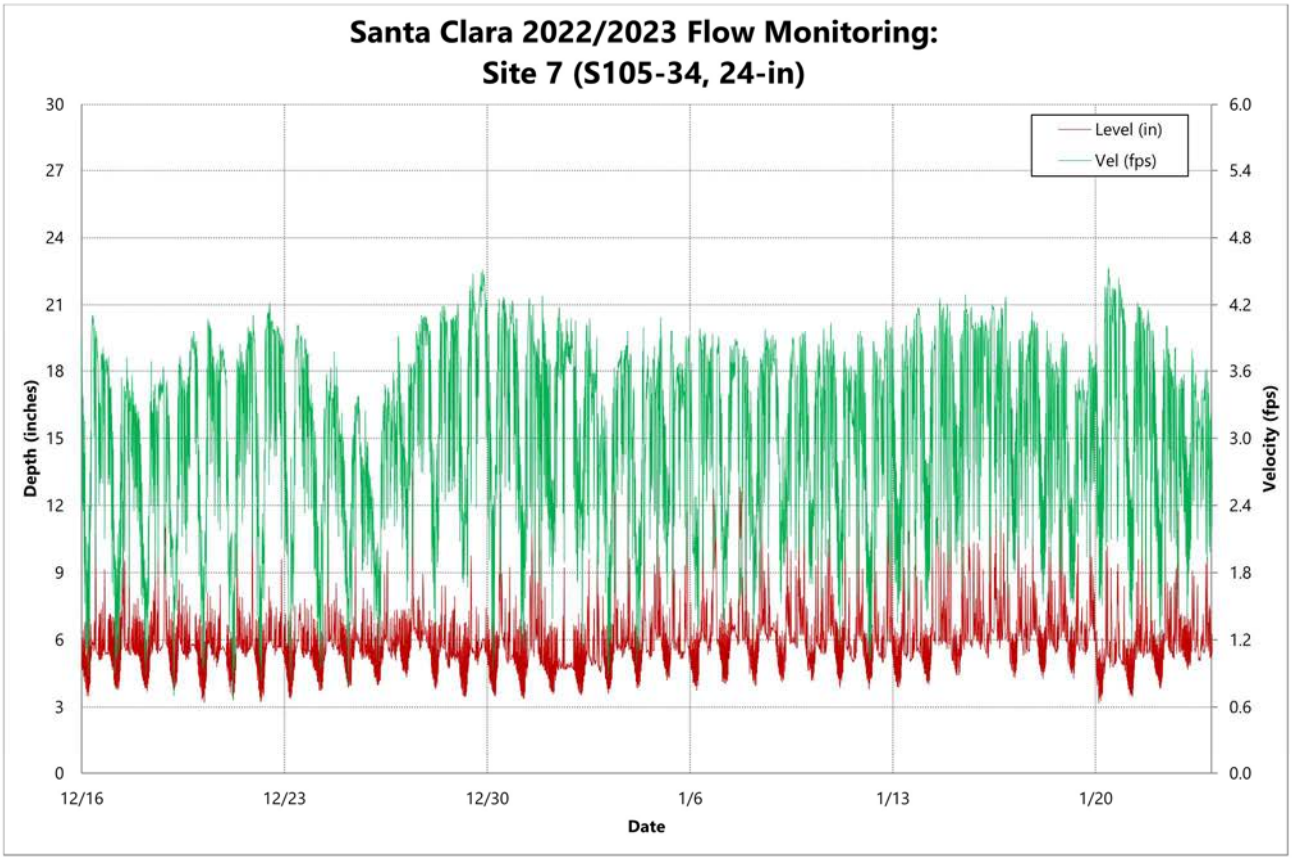

Santa Clara 2022/2023 Flow Monitoring:
Site 4 (S94-35, 24-in)
Velocity (fps)
Depth (in.)

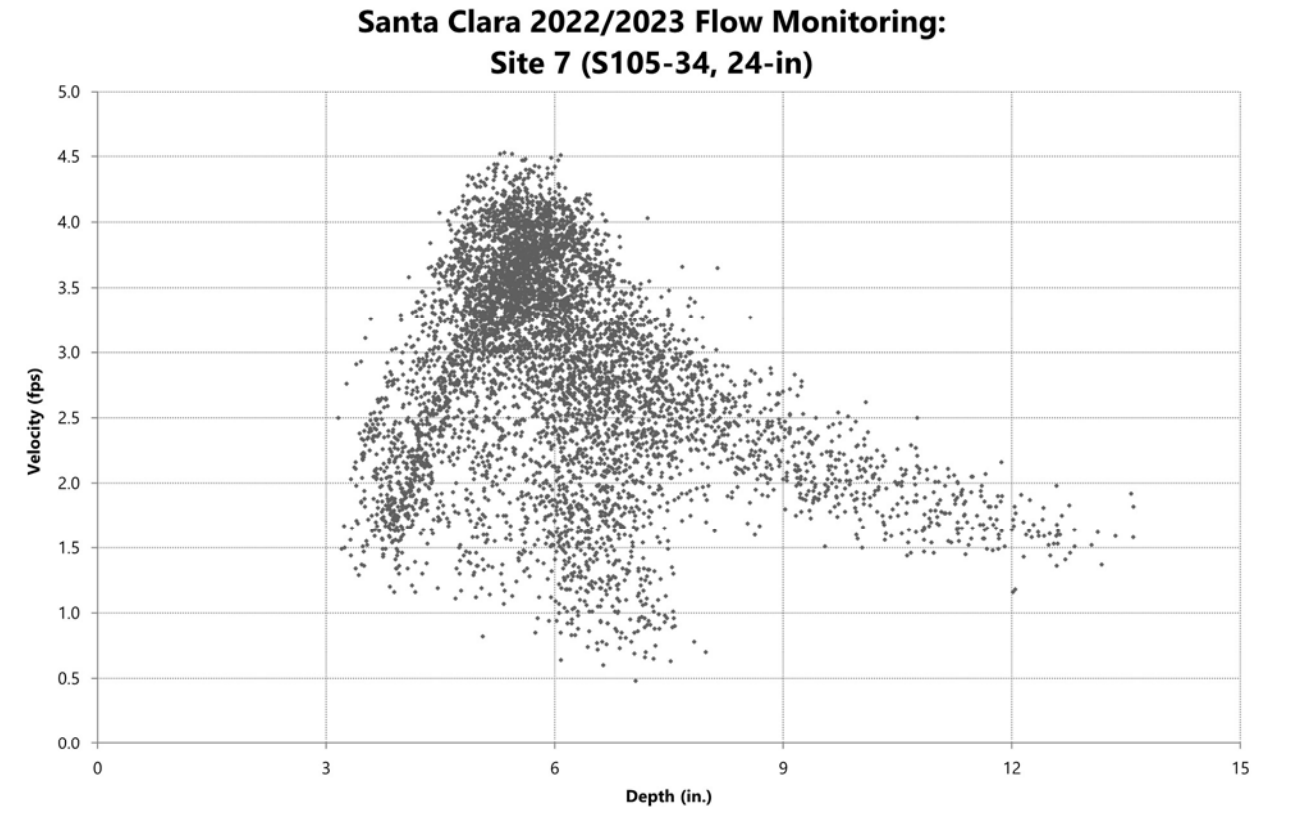

Santa Clara 2022/2023 Flow Monitoring:
Site 5 (S83-21, 33-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
48
42
36
30
24
18
12
6
0
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

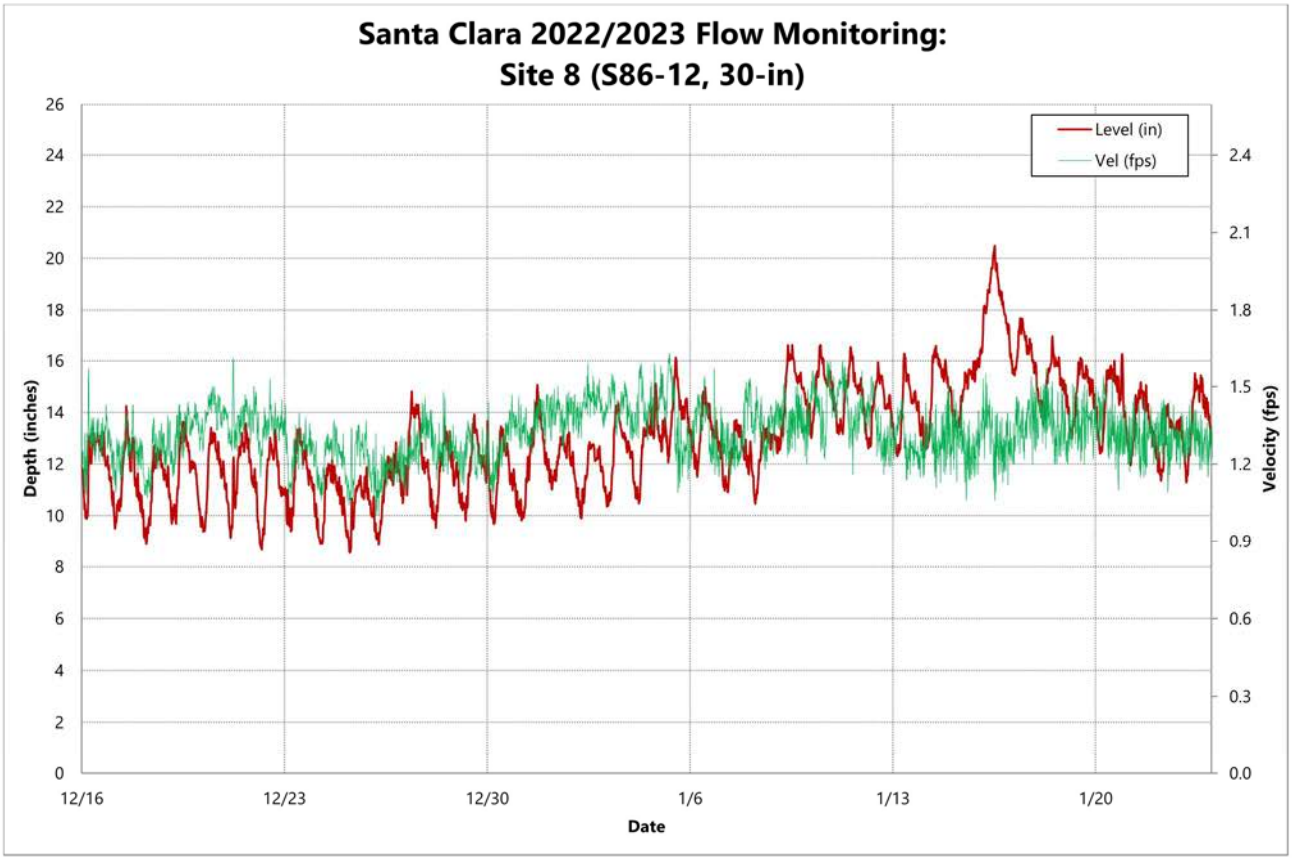

Santa Clara 2022/2023 Flow Monitoring:
Site 5 (S83-21, 33-in)
Velocity (fps)
Depth (in.)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15
18
21

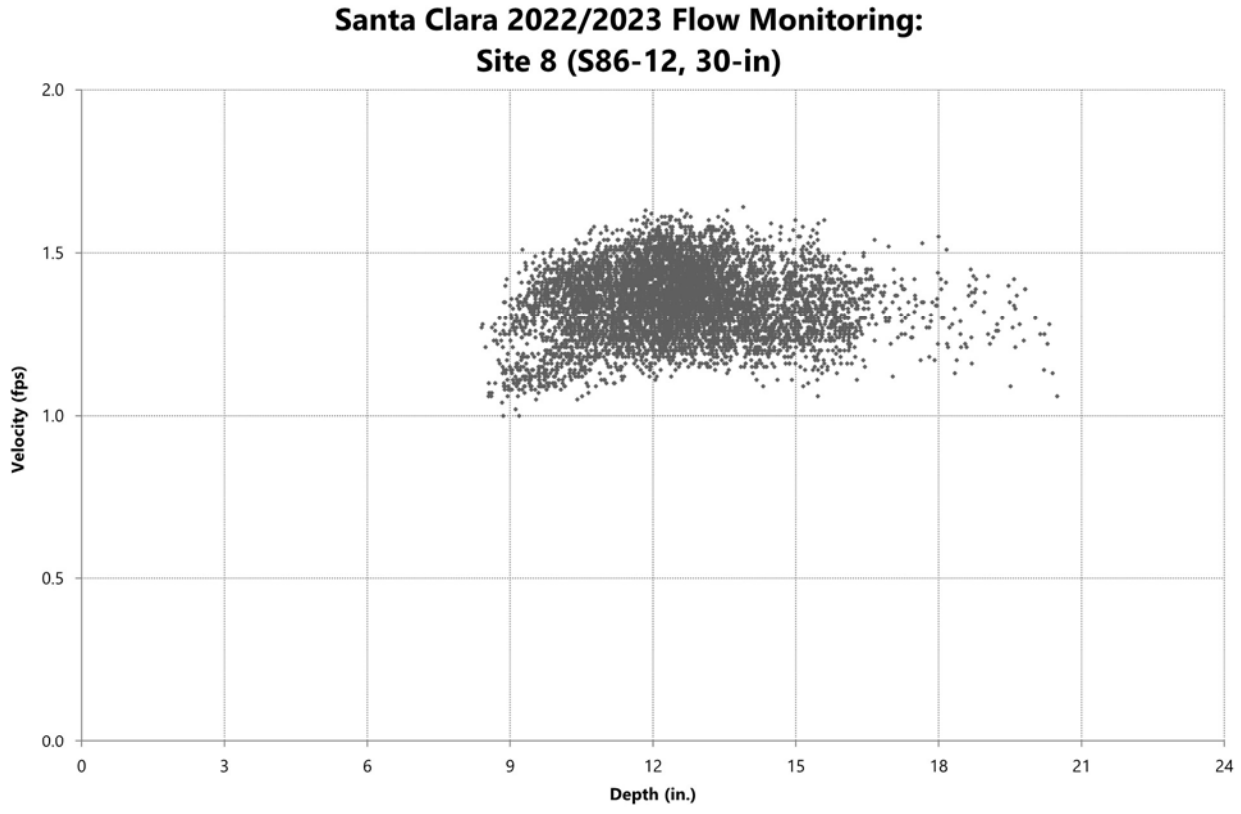

Santa Clara 2022/2023 Flow Monitoring:
Site 6 (S83-22, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

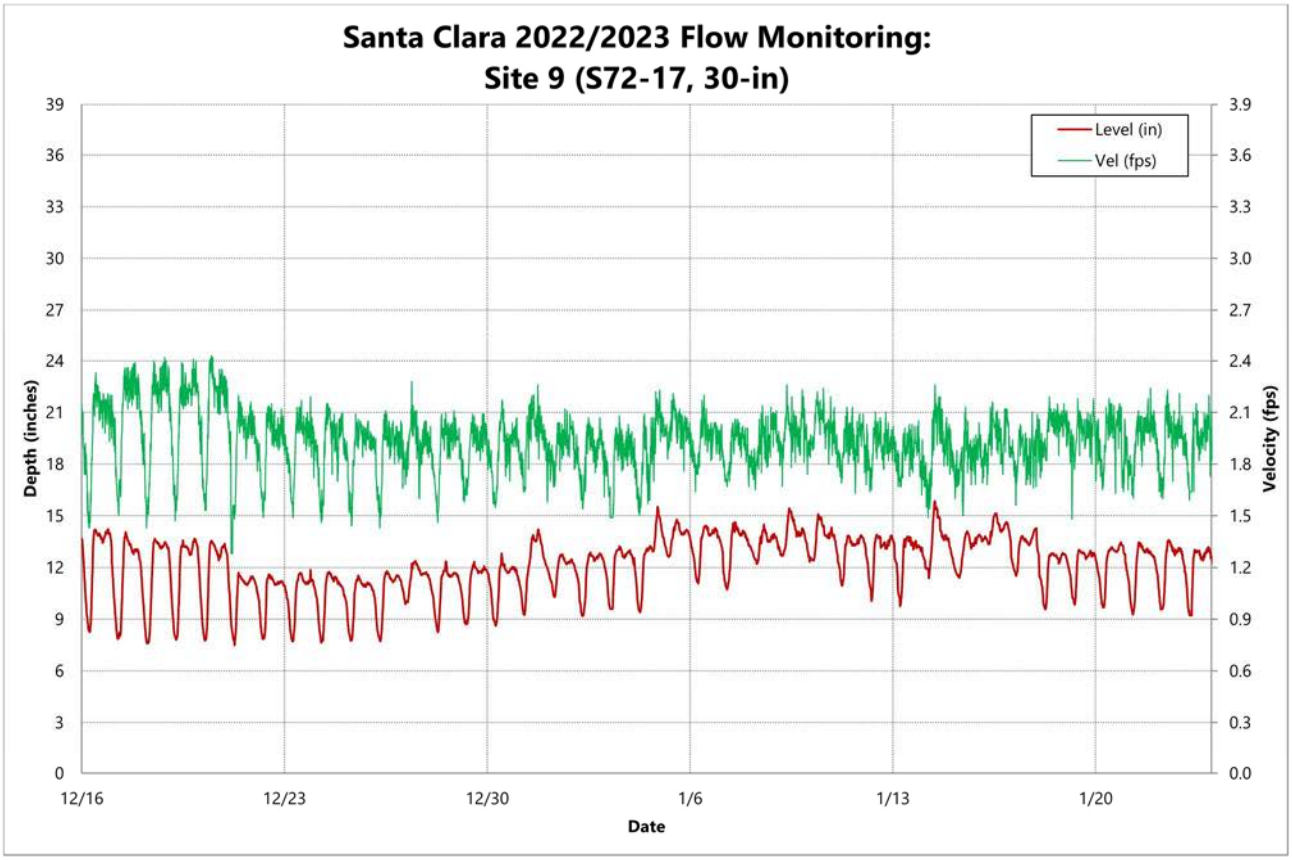

Santa Clara 2022/2023 Flow Monitoring:
Site 6 (S83-22, 30-in)
Velocity (fps)
Depth (in.)

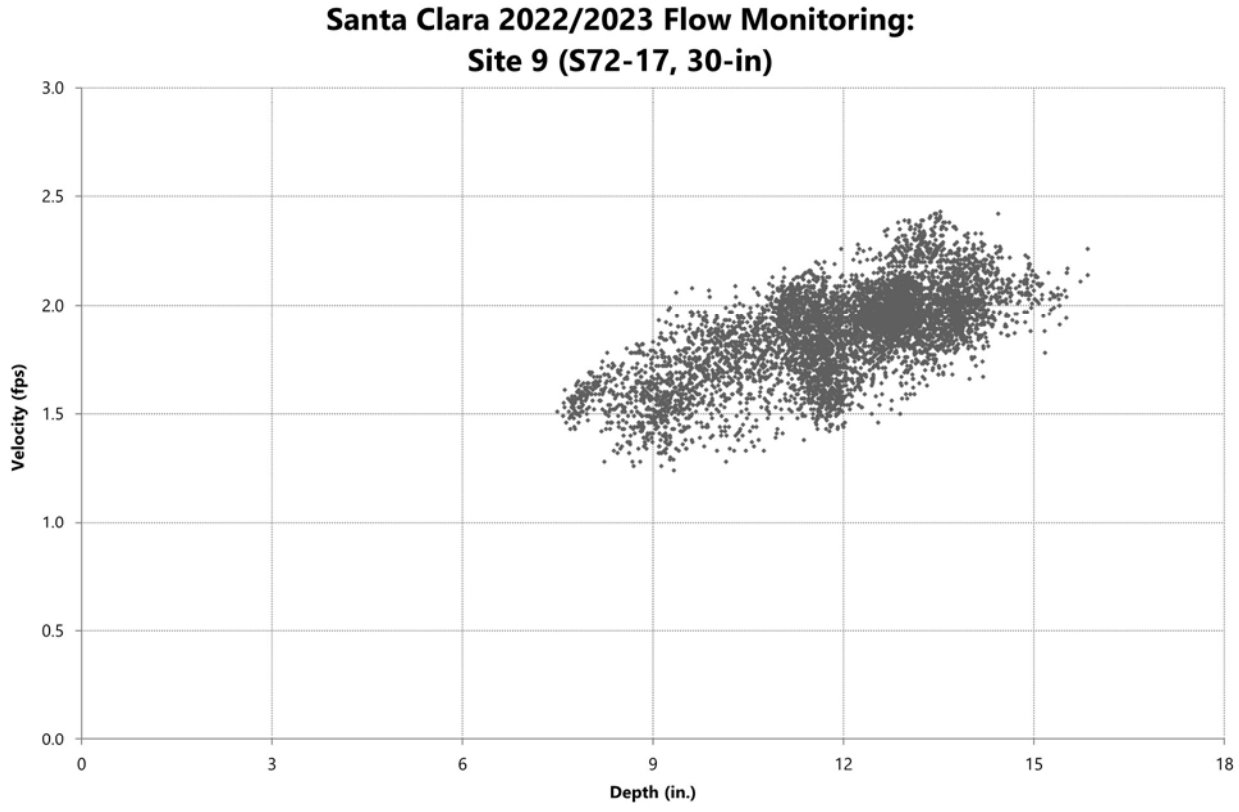

Santa Clara 2022/2023 Flow Monitoring:
Site 7 (S105-34, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
3
6
9
12
15
18
21
24
27
30
0.0
0.6
1.2
1.8
2.4
3.0
3.6
4.2
4.8
5.4
6.0

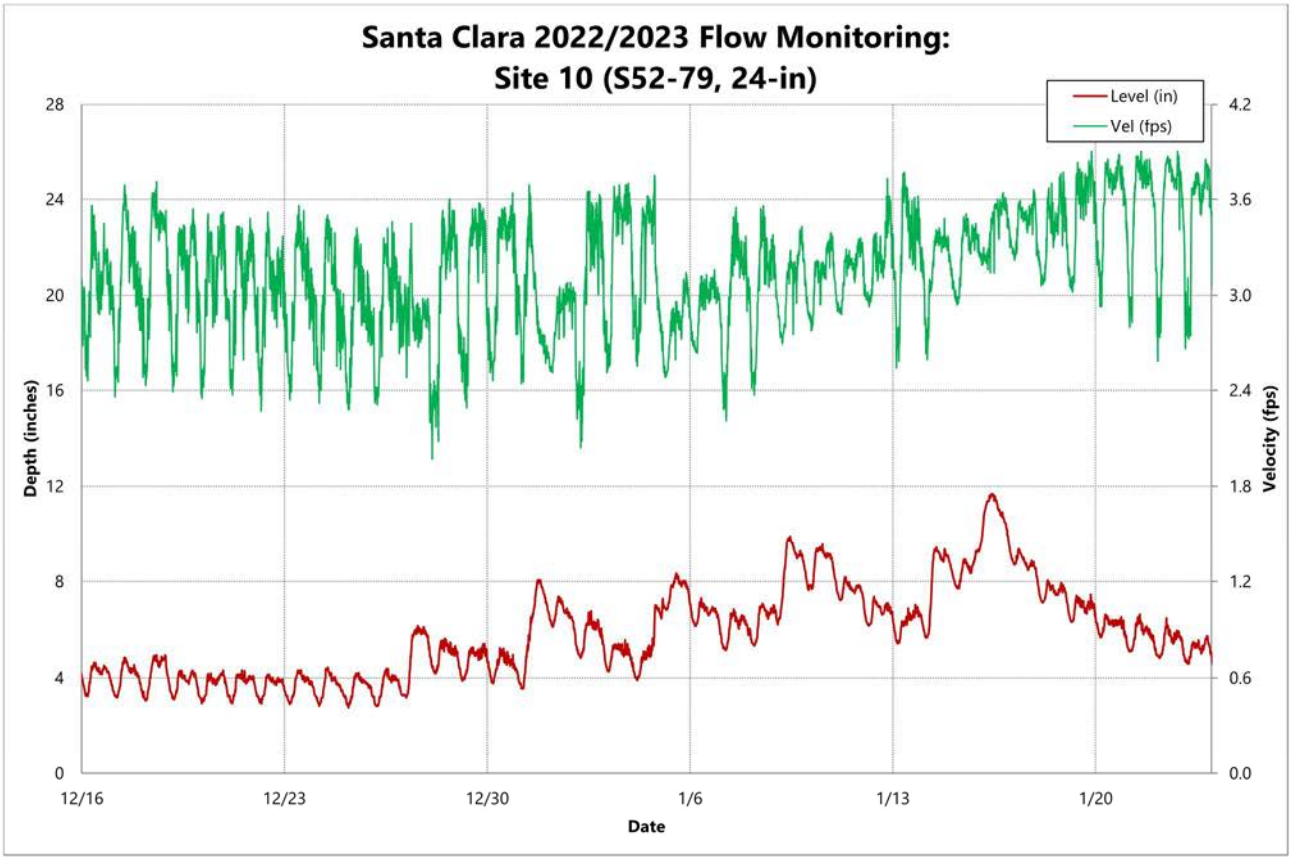

Santa Clara 2022/2023 Flow Monitoring:
Site 7 (S105-34, 24-in)
Velocity (fps)
Depth (in.)
0
3
6
9
12
15
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

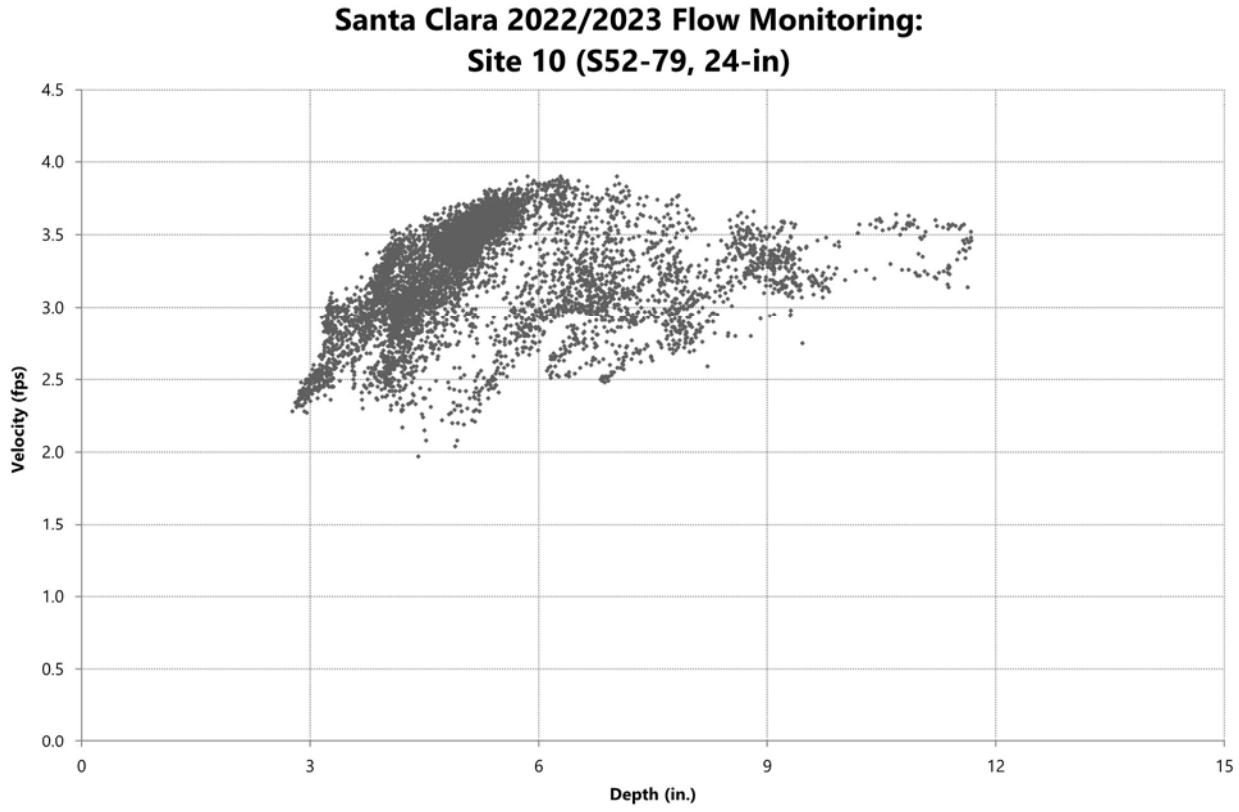

Santa Clara 2022/2023 Flow Monitoring:
Site 8 (S86-12, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

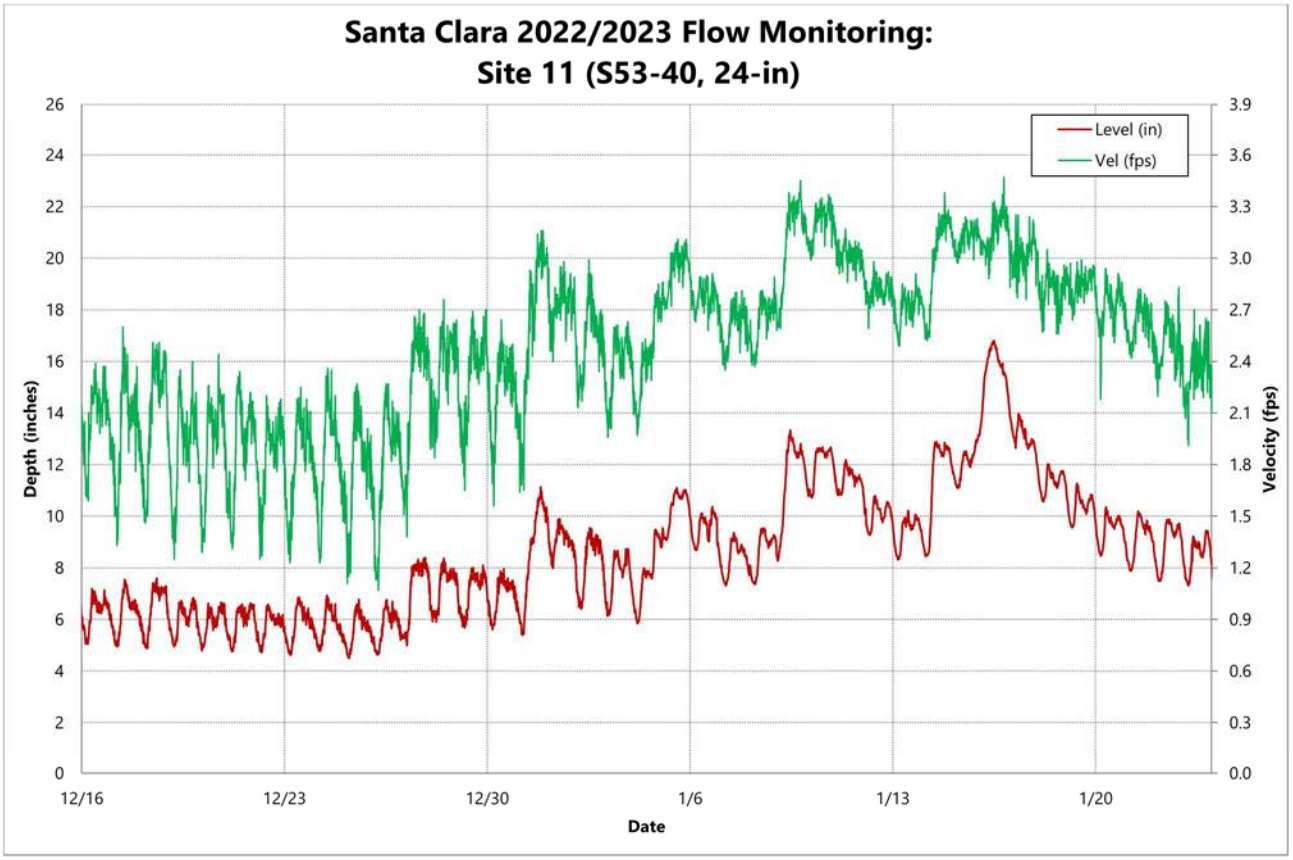

Santa Clara 2022/2023 Flow Monitoring:
Site 8 (S86-12, 30-in)
Velocity (fps)
Depth (in.)

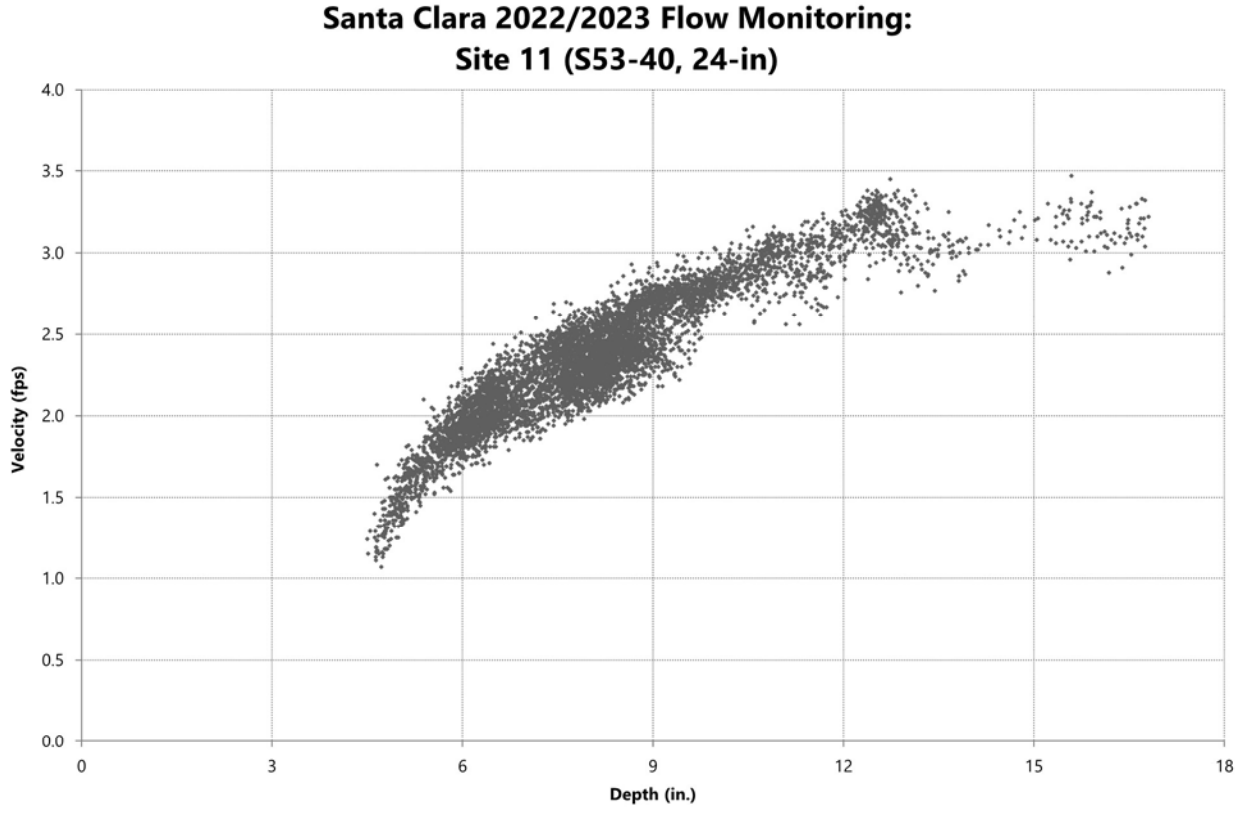

Santa Clara 2022/2023 Flow Monitoring:
Site 9 (S72-17, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

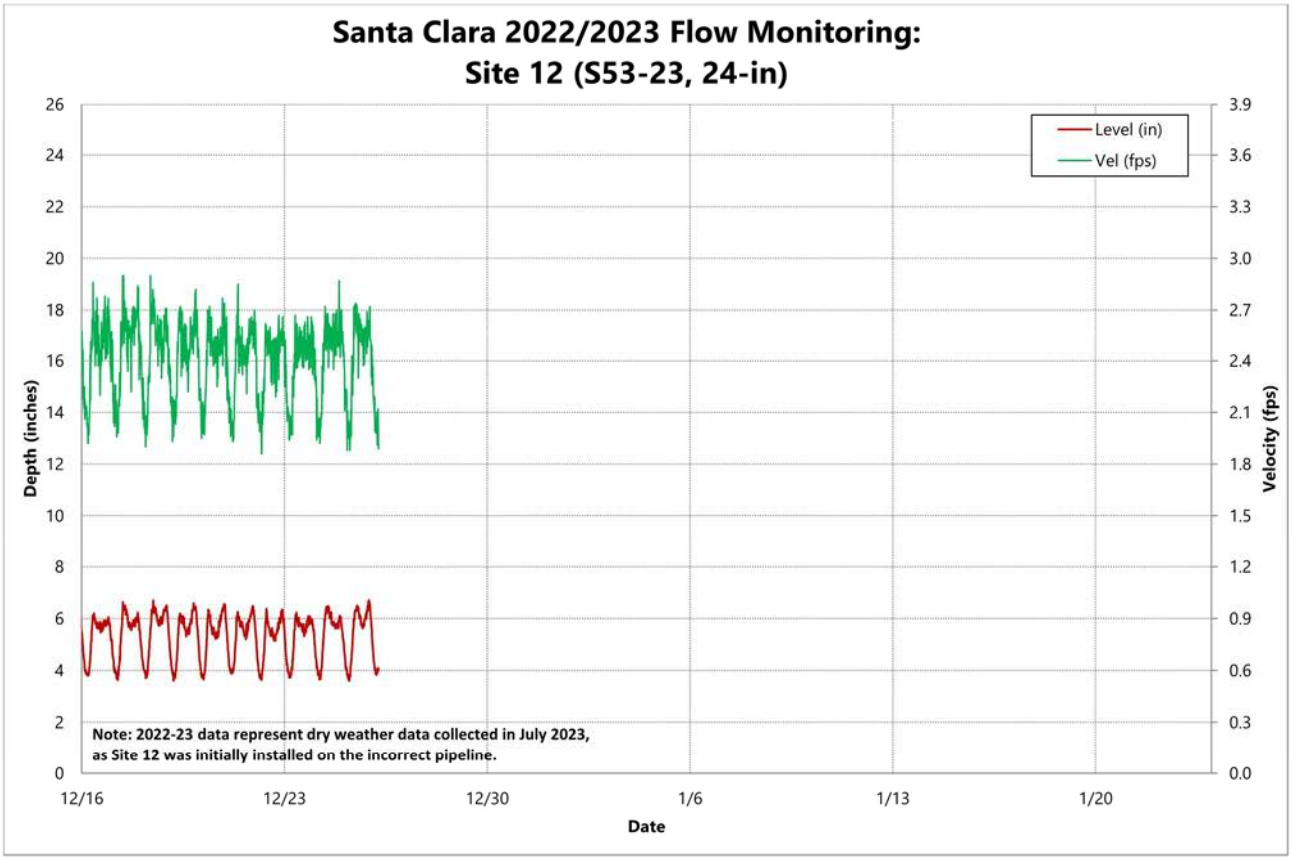

Santa Clara 2022/2023 Flow Monitoring:
Site 9 (S72-17, 30-in)
Velocity (fps)
Depth (in.)

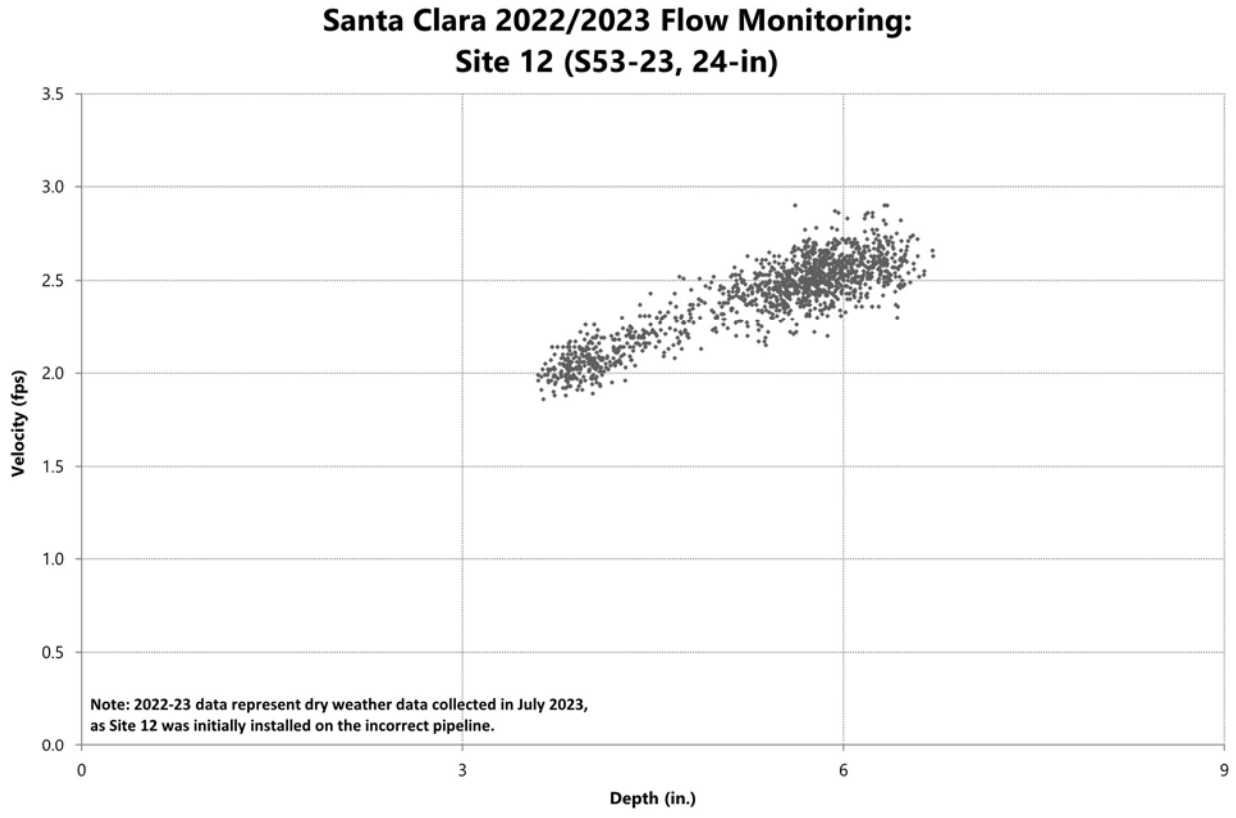

Santa Clara 2022/2023 Flow Monitoring:
Site 10 (S52-79, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
28
24
20
16
12
8
4
0
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

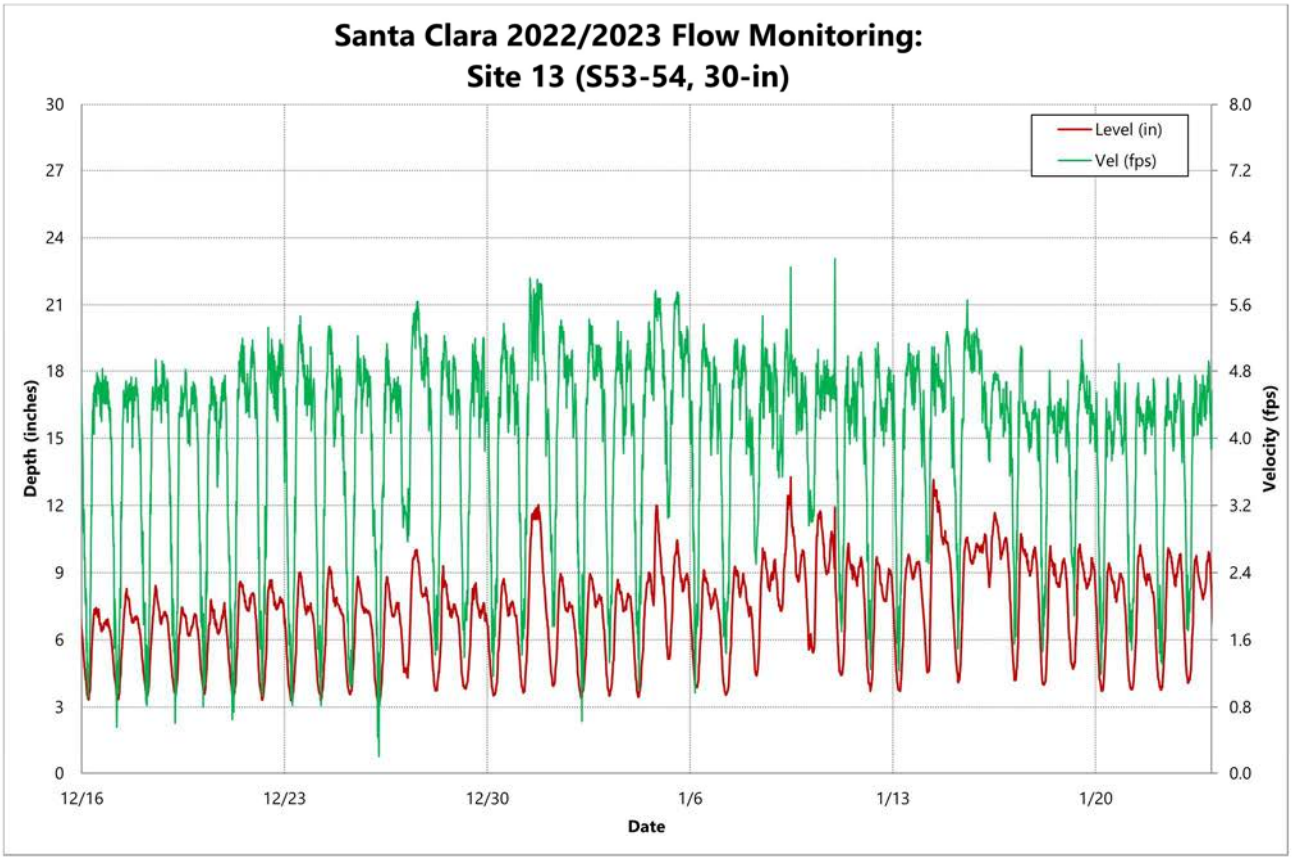

Santa Clara 2022/2023 Flow Monitoring:
Site 10 (S52-79, 24-in)
Velocity (fps)
Depth (in.)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15

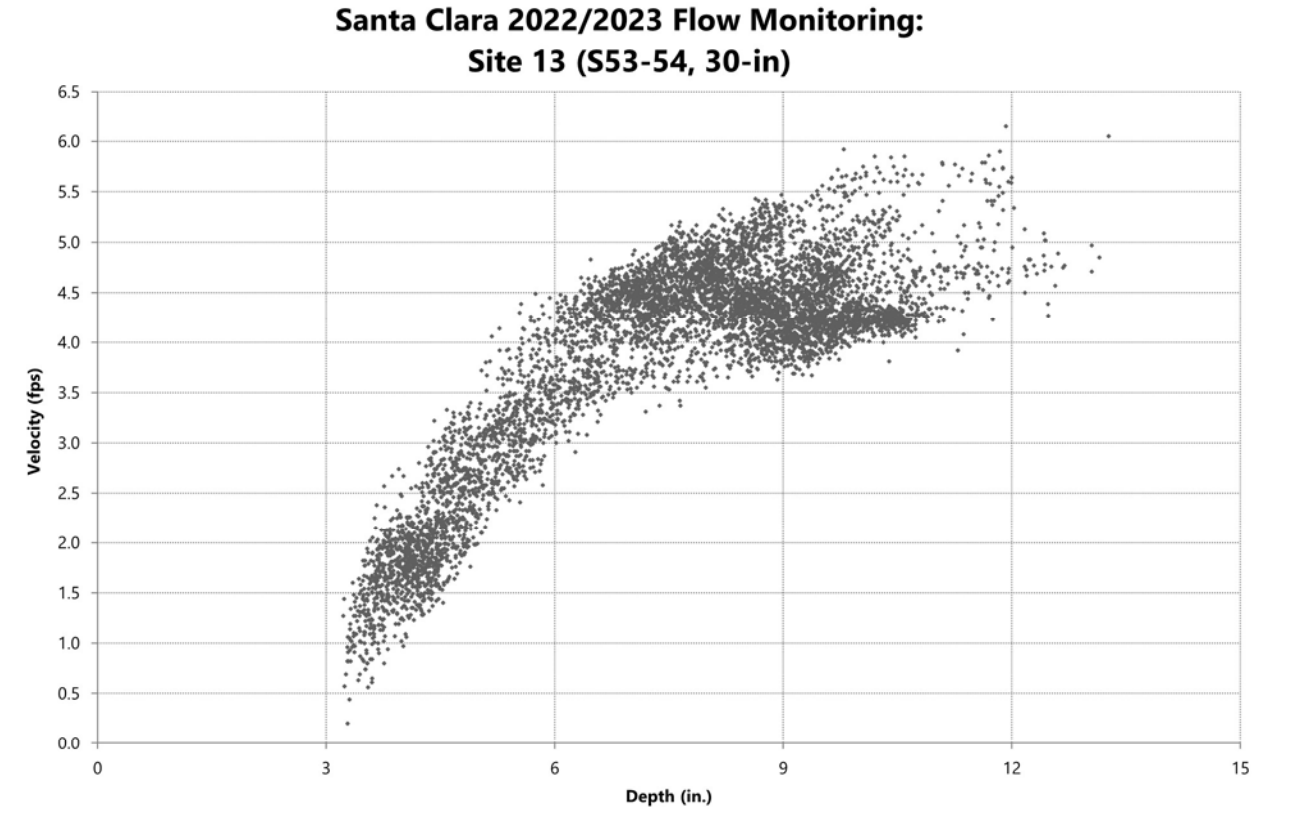

Santa Clara 2022/2023 Flow Monitoring:
Site 11 (S53-40, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

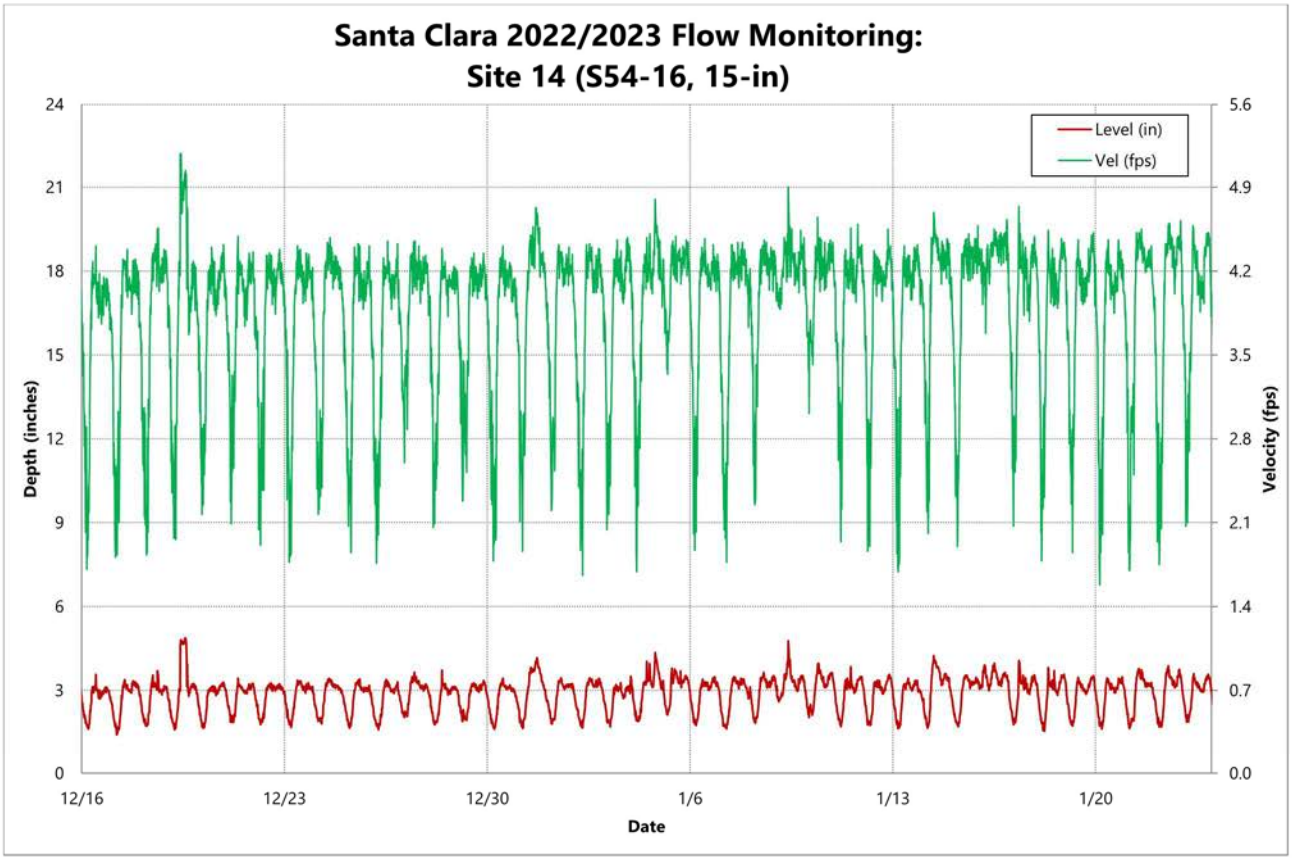

Santa Clara 2022/2023 Flow Monitoring:
Site 11 (S53-40, 24-in)
Velocity (fps)
Depth (in.)

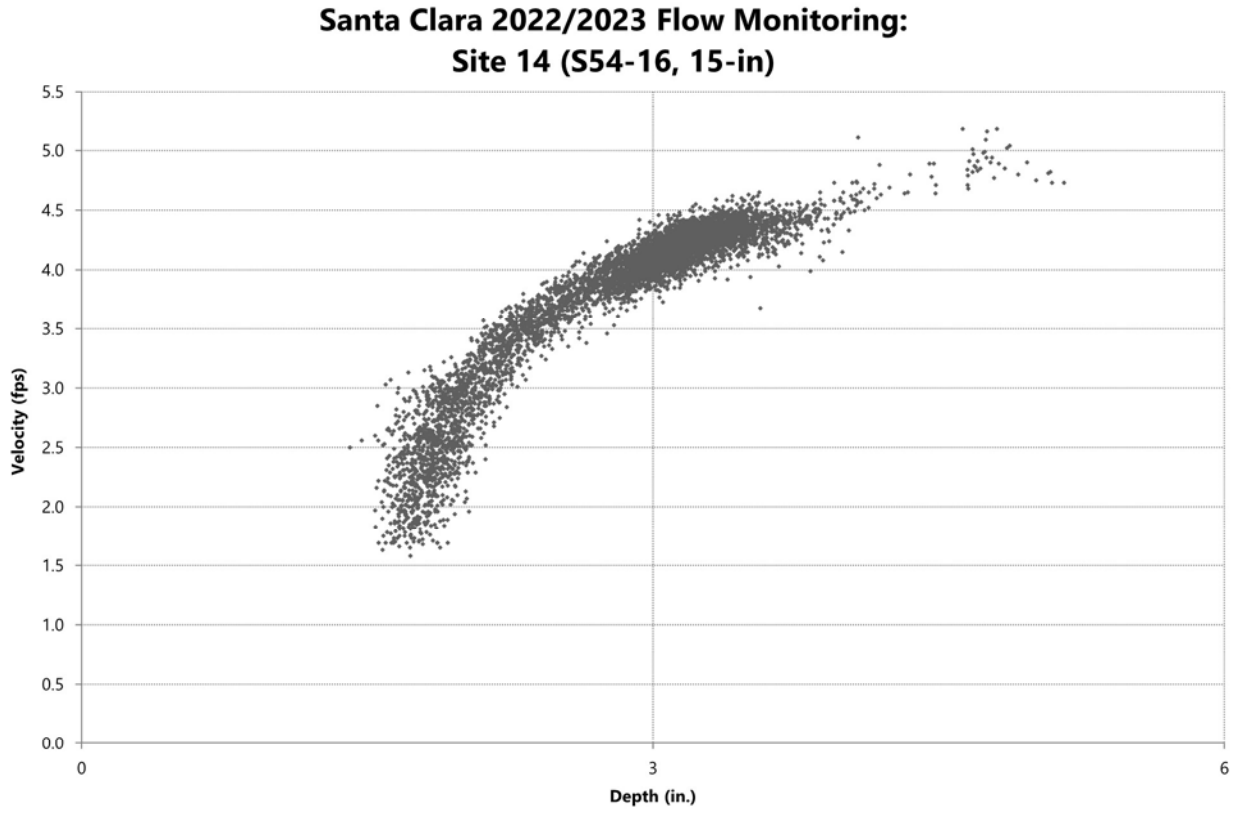

Santa Clara 2022/2023 Flow Monitoring:
Site 12 (S53-23, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
Note: 2022-23 data represent dry weather data collected in July 2023,
as Site 12 was initially installed on the incorrect pipeline.

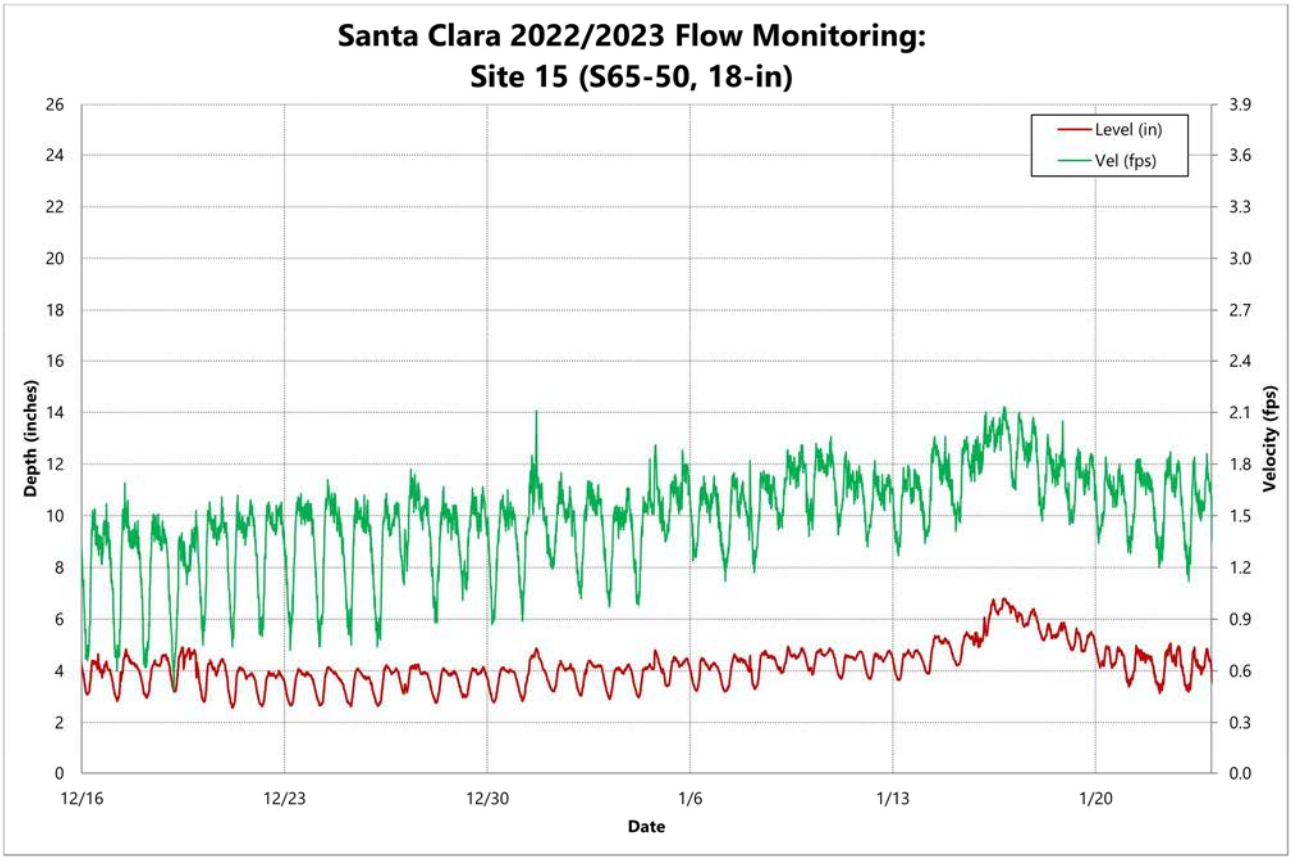

Santa Clara 2022/2023 Flow Monitoring:
Site 12 (S53-23, 24-in)
Velocity (fps)
Depth (in.)
Note: 2022-23 data represent dry weather data collected in July 2023,
as Site 12 was initially installed on the incorrect pipeline.

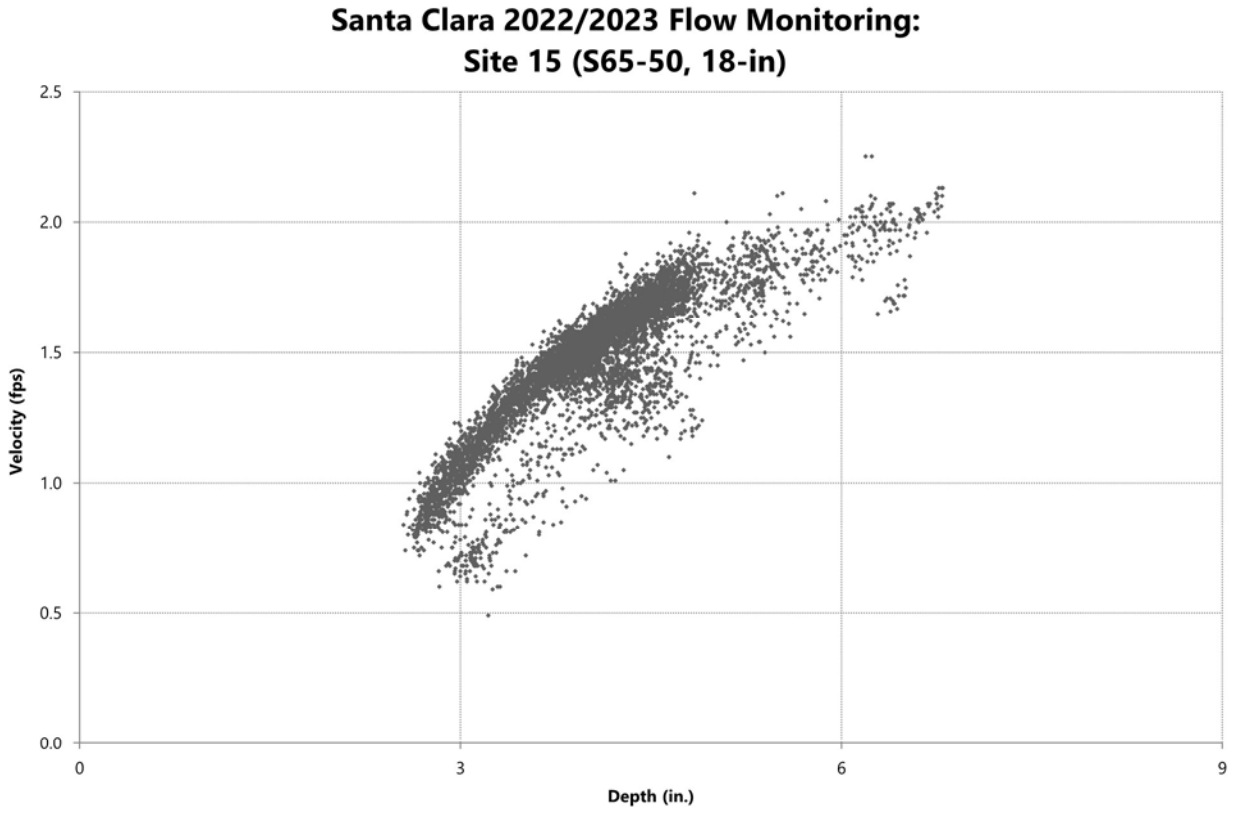

Santa Clara 2022/2023 Flow Monitoring:
Site 13 (S53-54, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
3
6
9
12
15
18
21
24
27
30
0.0
0.8
1.6
2.4
3.2
4.0
4.8
5.6
6.4
7.2
8.0

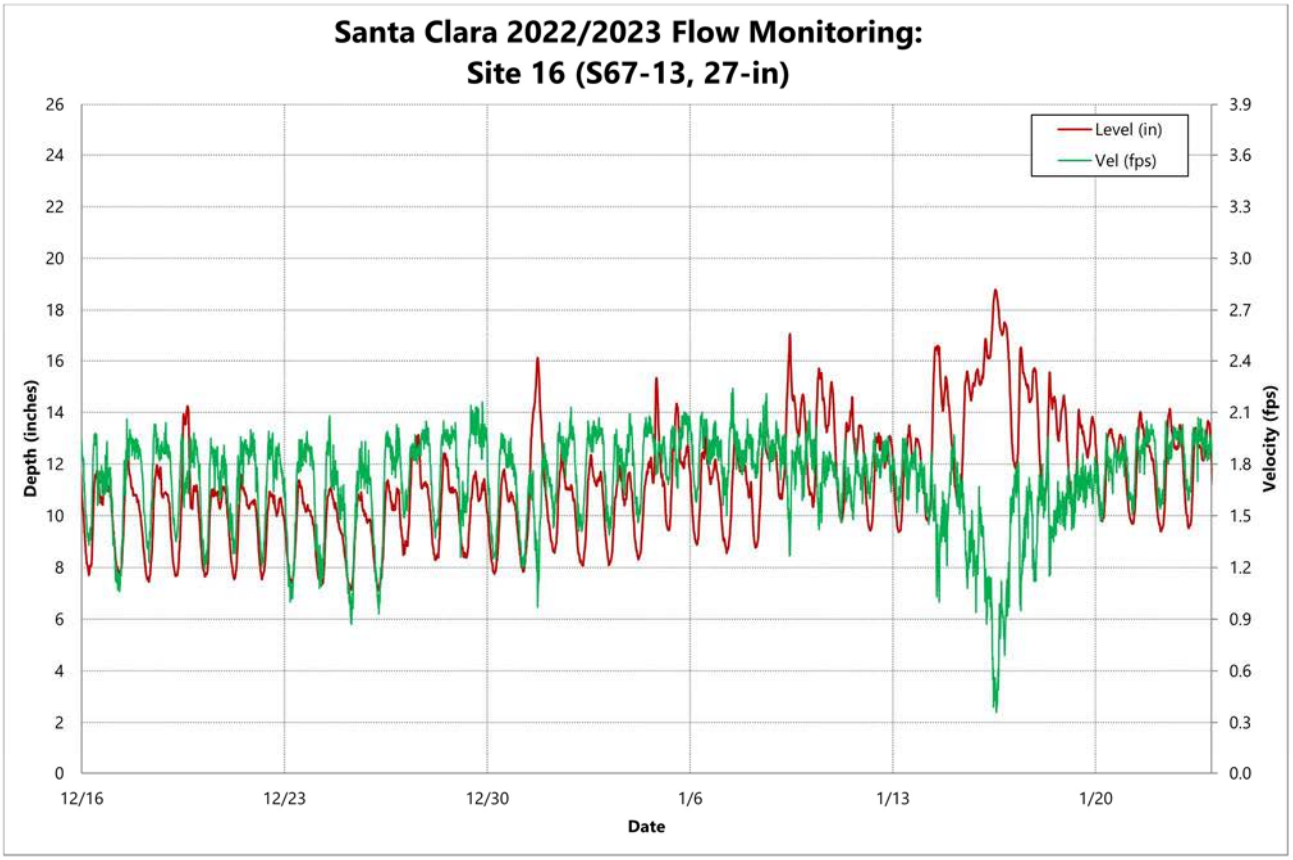

Santa Clara 2022/2023 Flow Monitoring:
Site 13 (S53-54, 30-in)
Velocity (fps)
Depth (in.)
0
3
6
9
12
15
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5

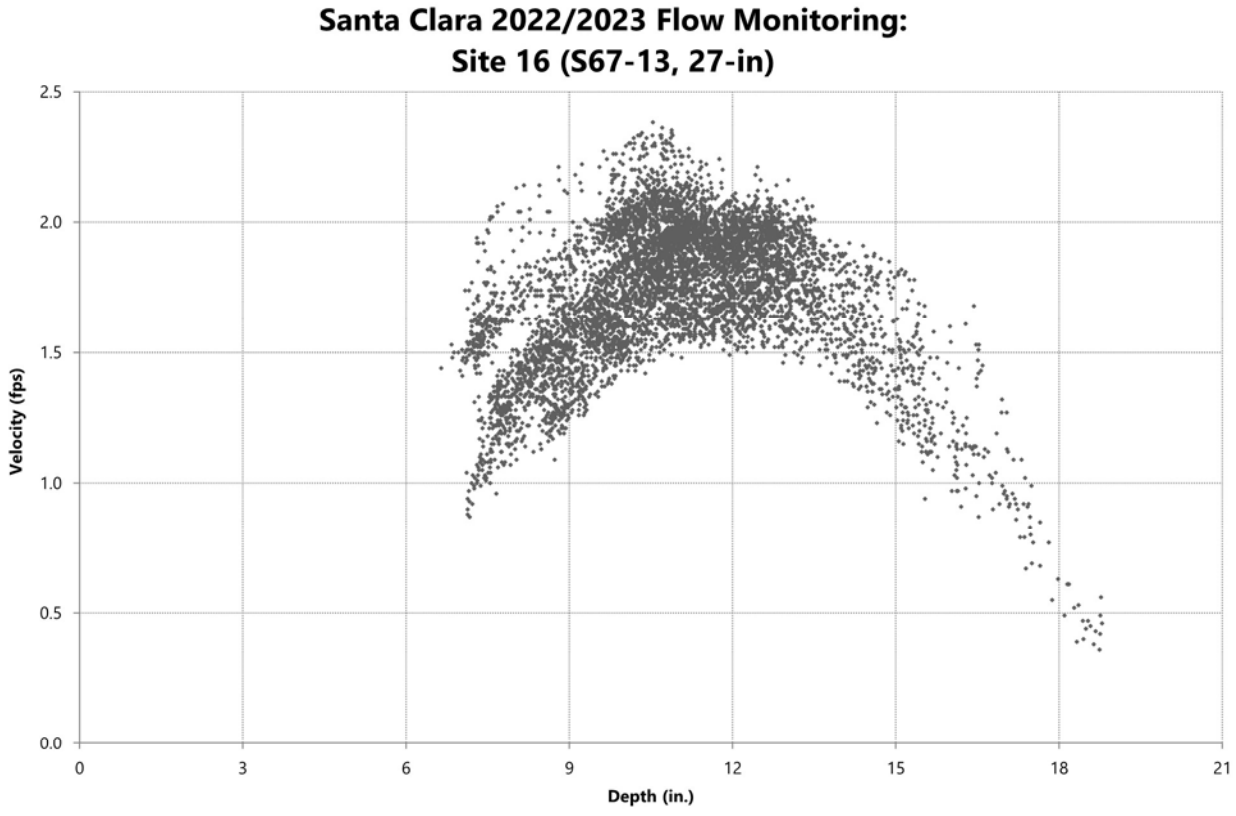

Santa Clara 2022/2023 Flow Monitoring:
Site 14 (S54-16, 15-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
24
21
18
15
12
9
6
3
0
5.6
4.9
4.2
3.5
2.8
2.1
1.4
0.7
0.0
12/16
12/23
12/30
1/6
1/13
1/20

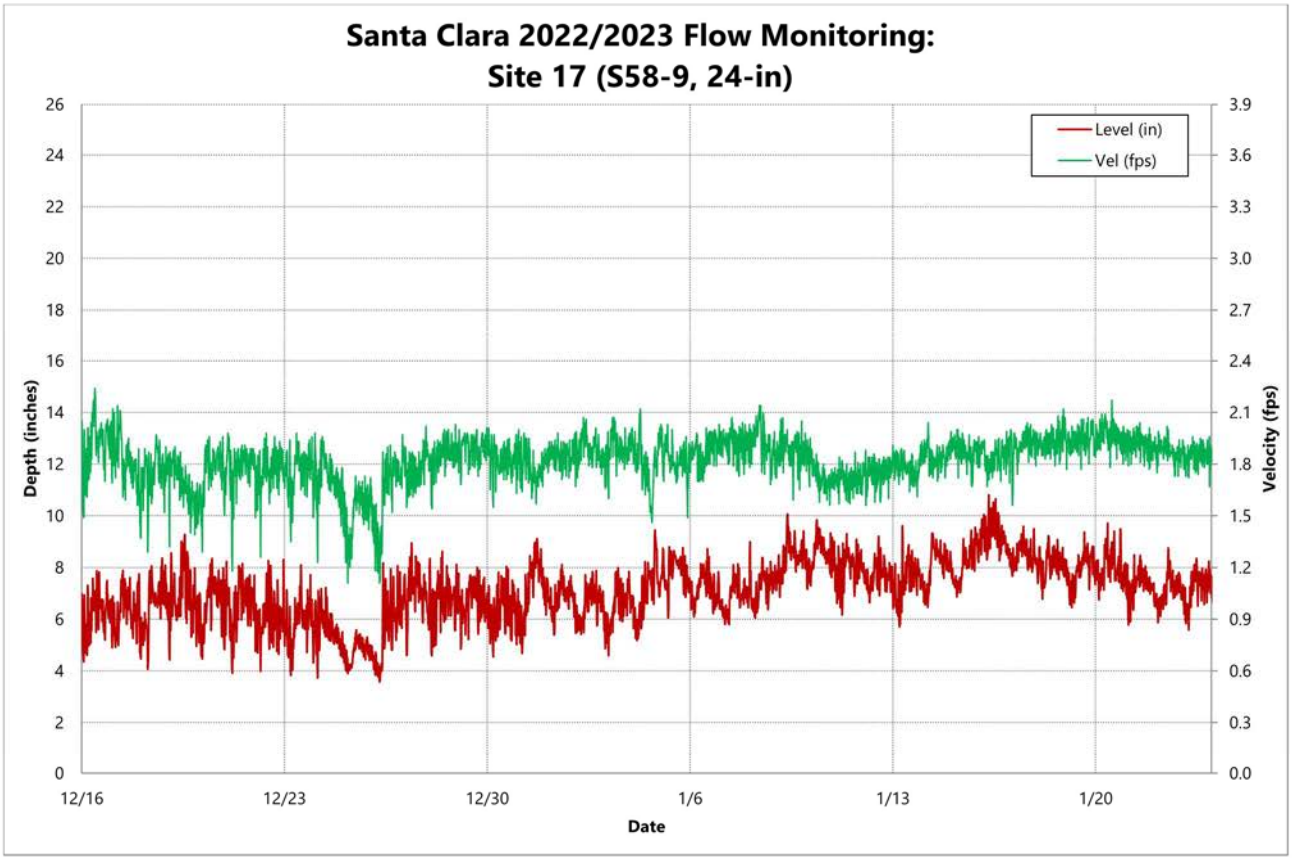

Santa Clara 2022/2023 Flow Monitoring:
Site 14 (S54-16, 15-in)
Velocity (fps)
Depth (in.)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6

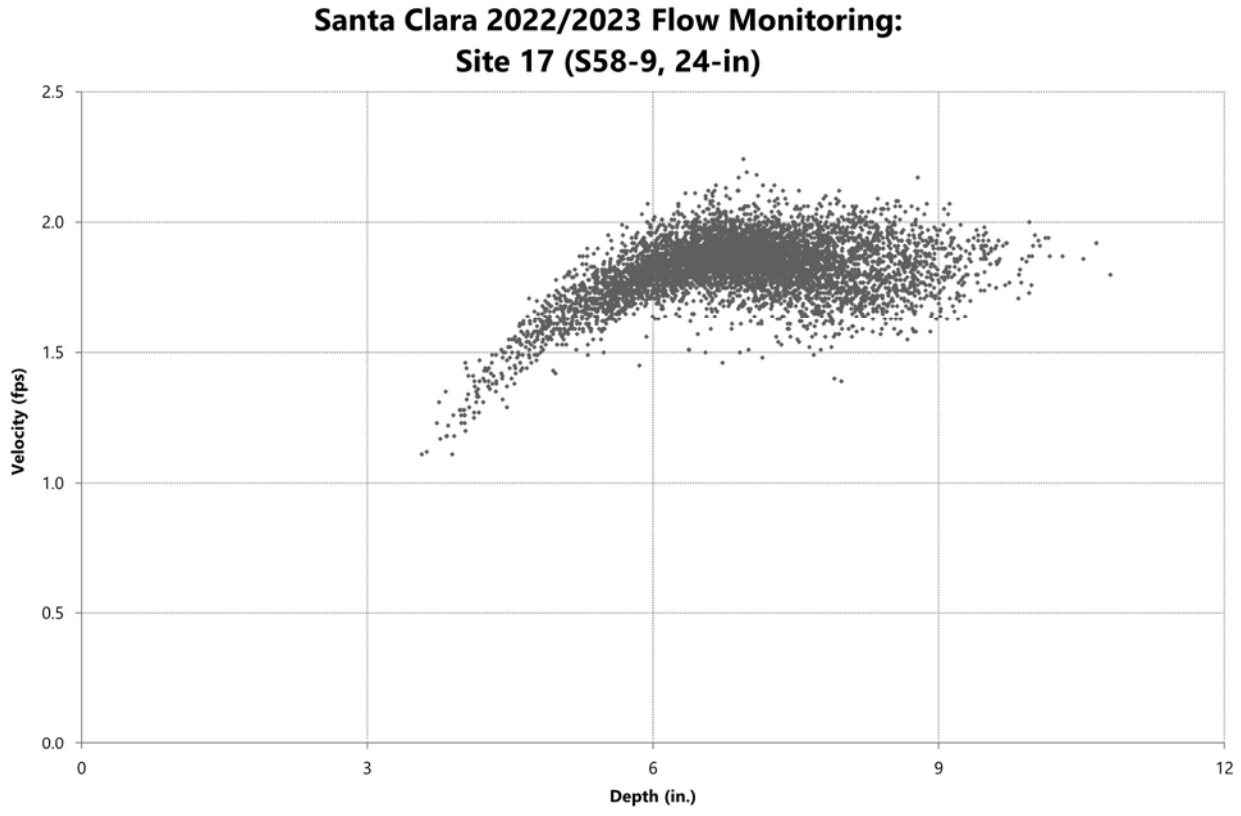

Santa Clara 2022/2023 Flow Monitoring:
Site 15 (S65-50, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

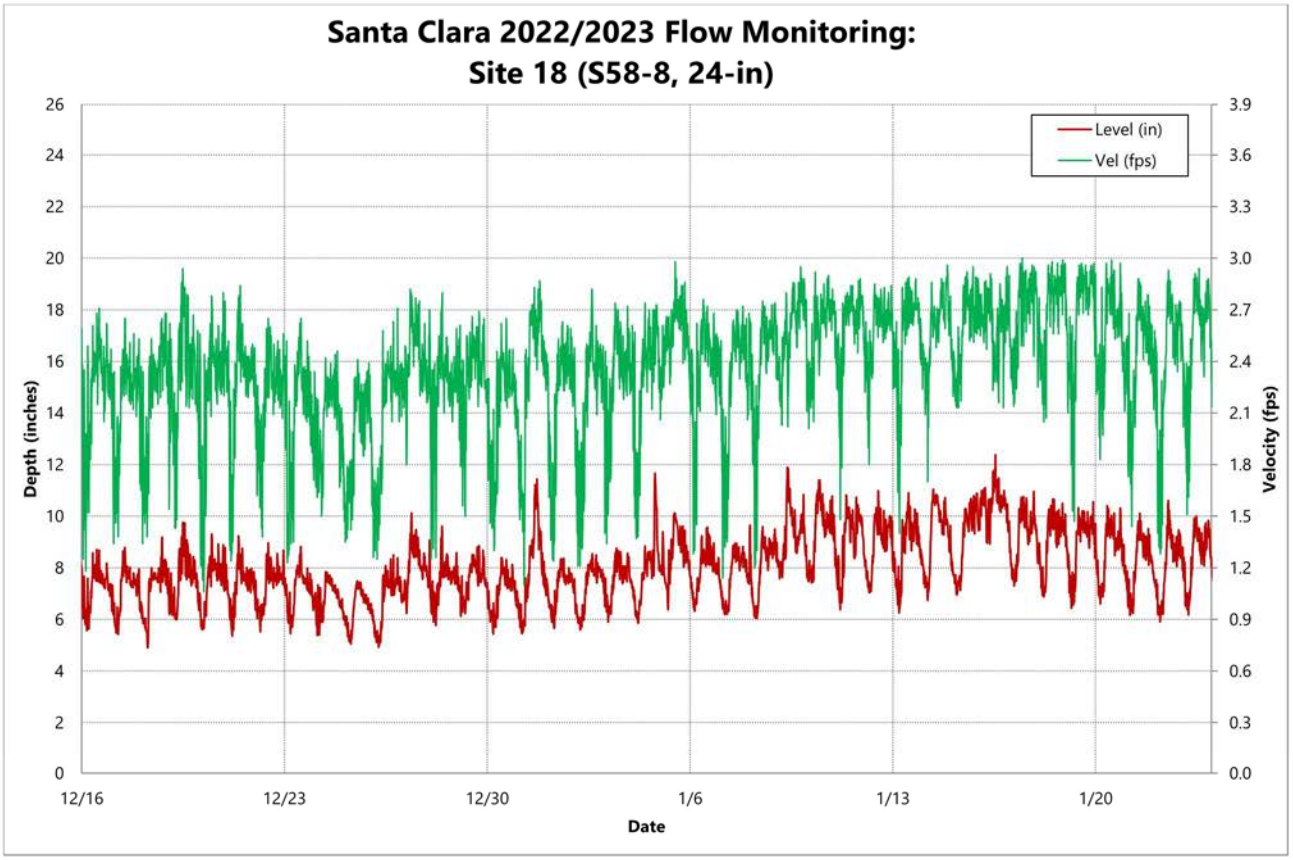

Santa Clara 2022/2023 Flow Monitoring:
Site 15 (S65-50, 18-in)
Velocity (fps)
Depth (in.)

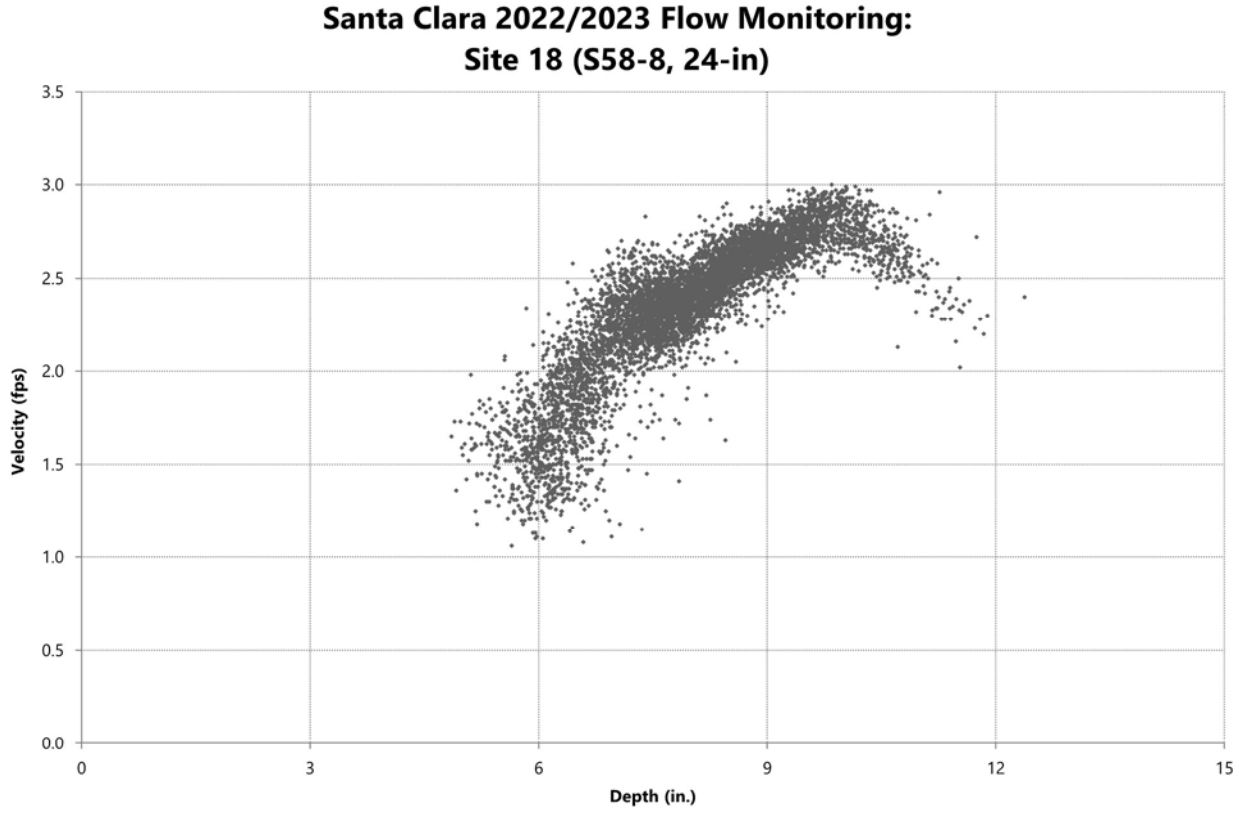

Santa Clara 2022/2023 Flow Monitoring:
Site 16 (S67-13, 27-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

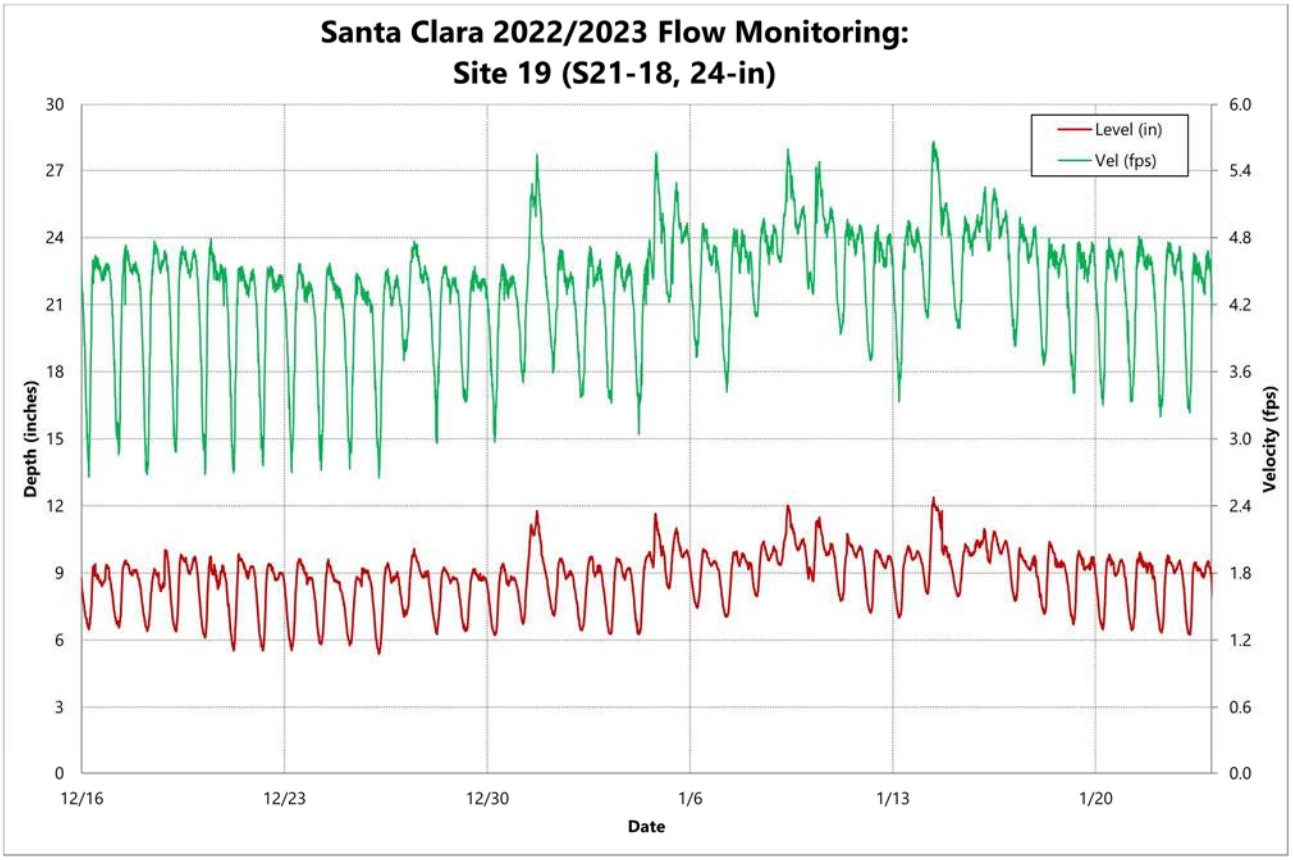

Santa Clara 2022/2023 Flow Monitoring:
Site 16 (S67-13, 27-in)
Velocity (fps)
Depth (in.)

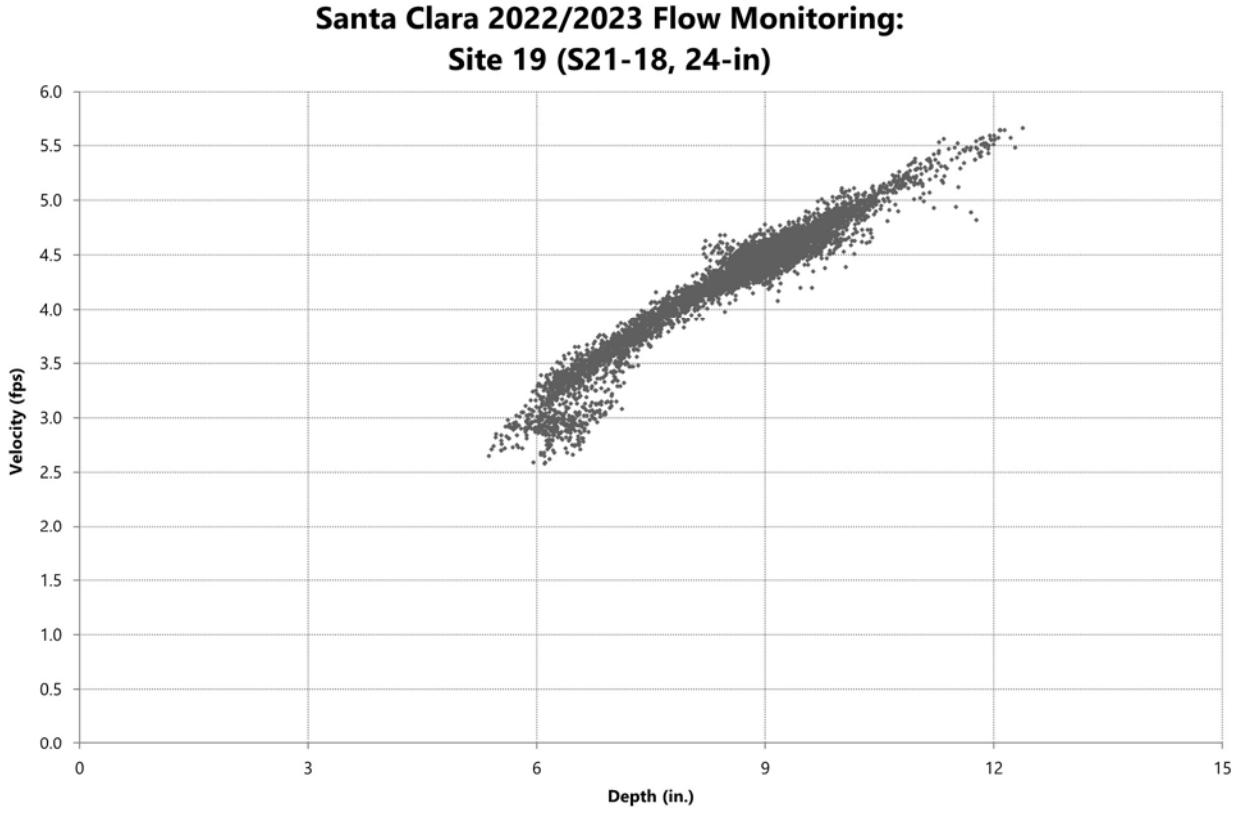

Santa Clara 2022/2023 Flow Monitoring:
Site 17 (S58-9, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

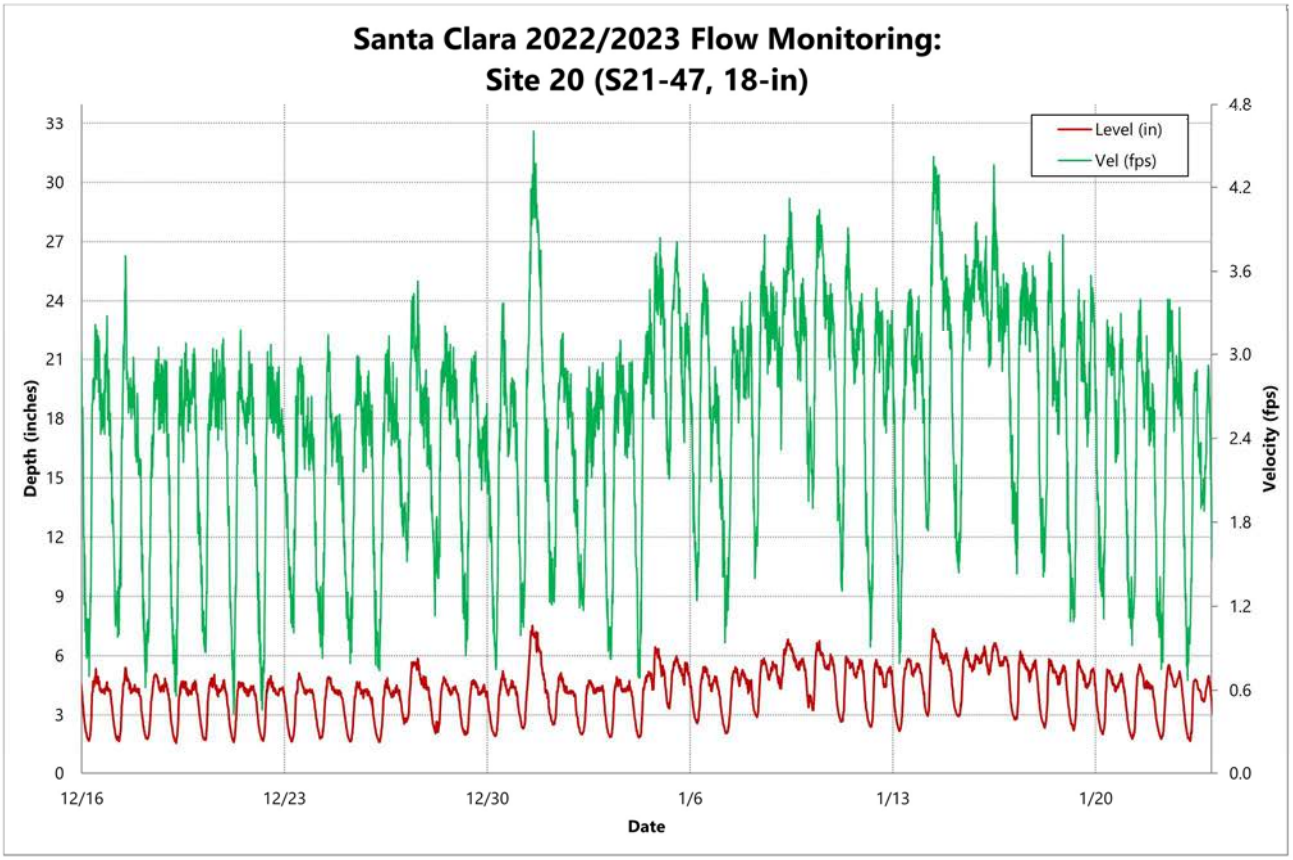

Santa Clara 2022/2023 Flow Monitoring:
Site 17 (S58-9, 24-in)
Velocity (fps)
Depth (in.)

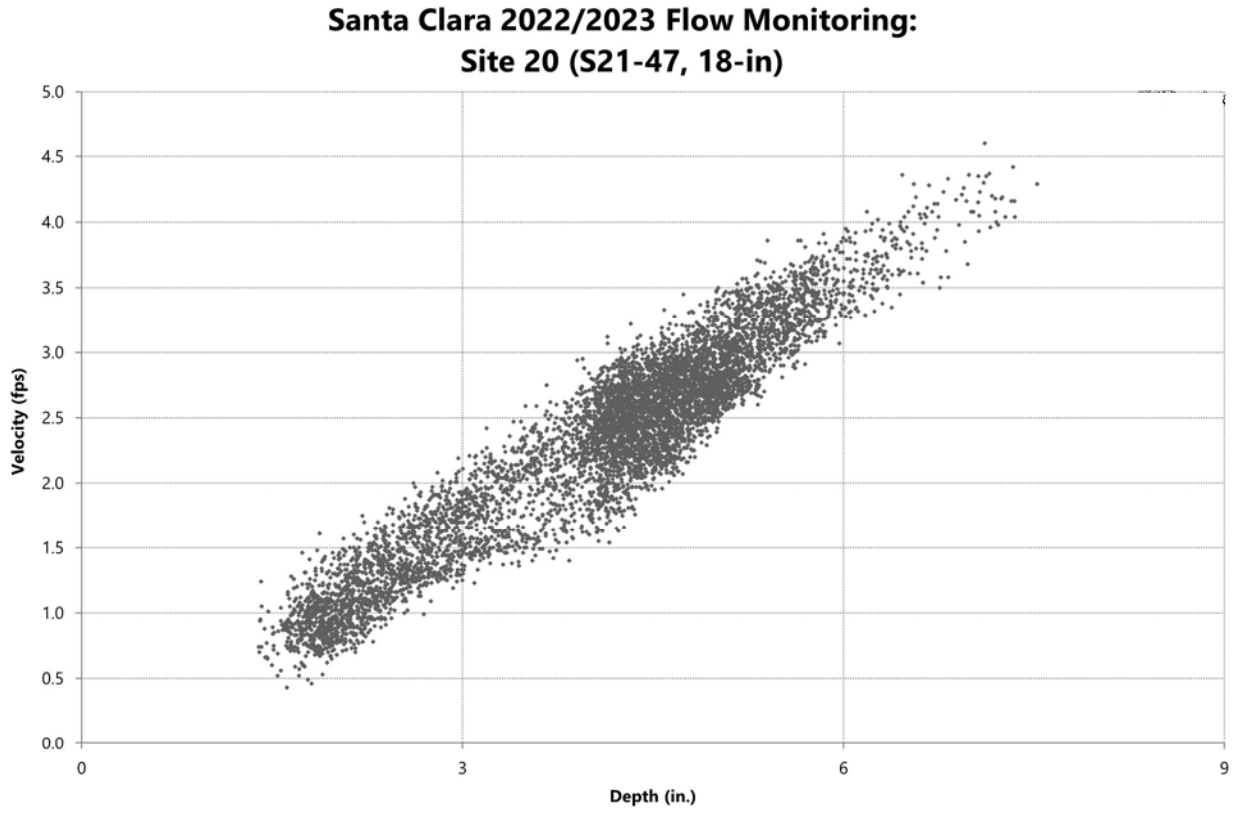

Santa Clara 2022/2023 Flow Monitoring:
Site 18 (S58-8, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

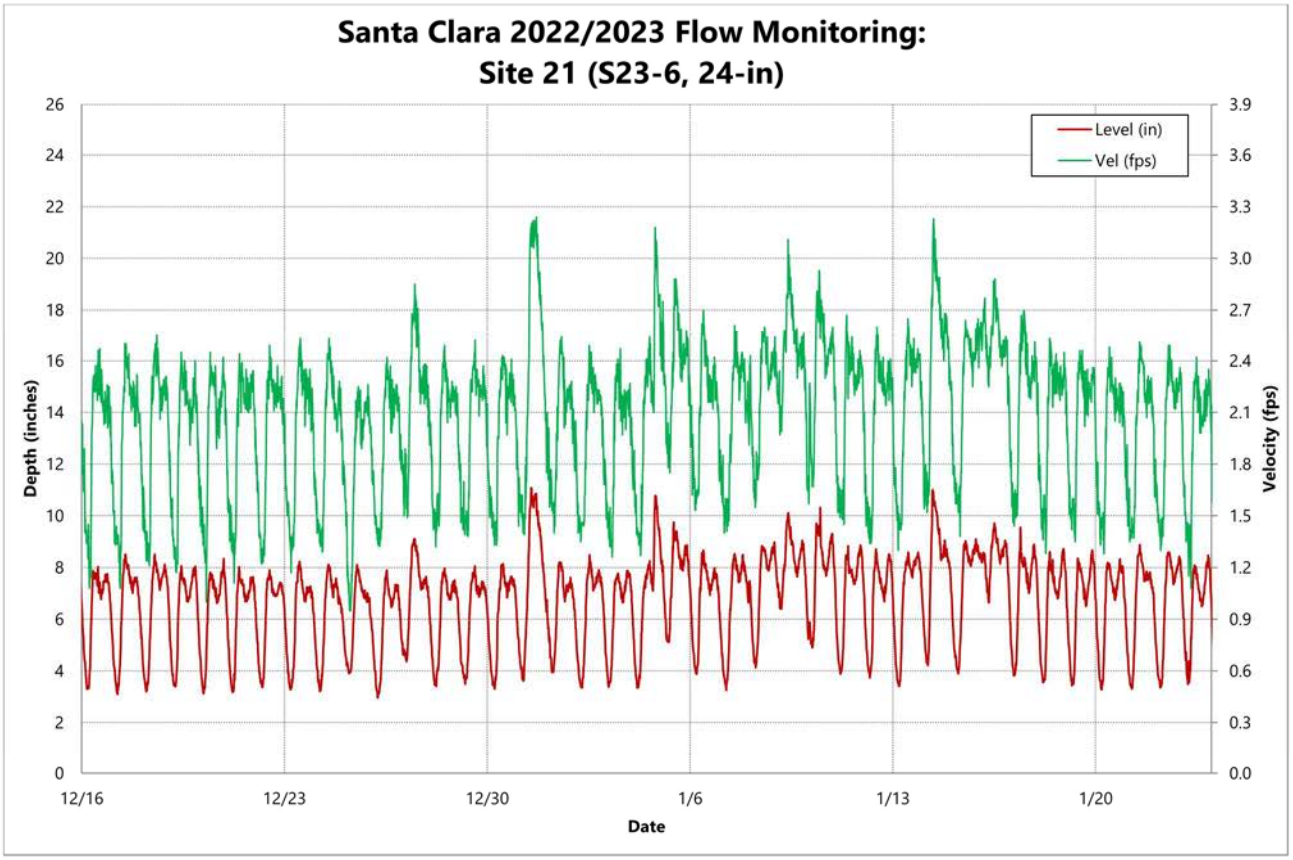

Santa Clara 2022/2023 Flow Monitoring:
Site 18 (S58-8, 24-in)
Velocity (fps)
Depth (in.)

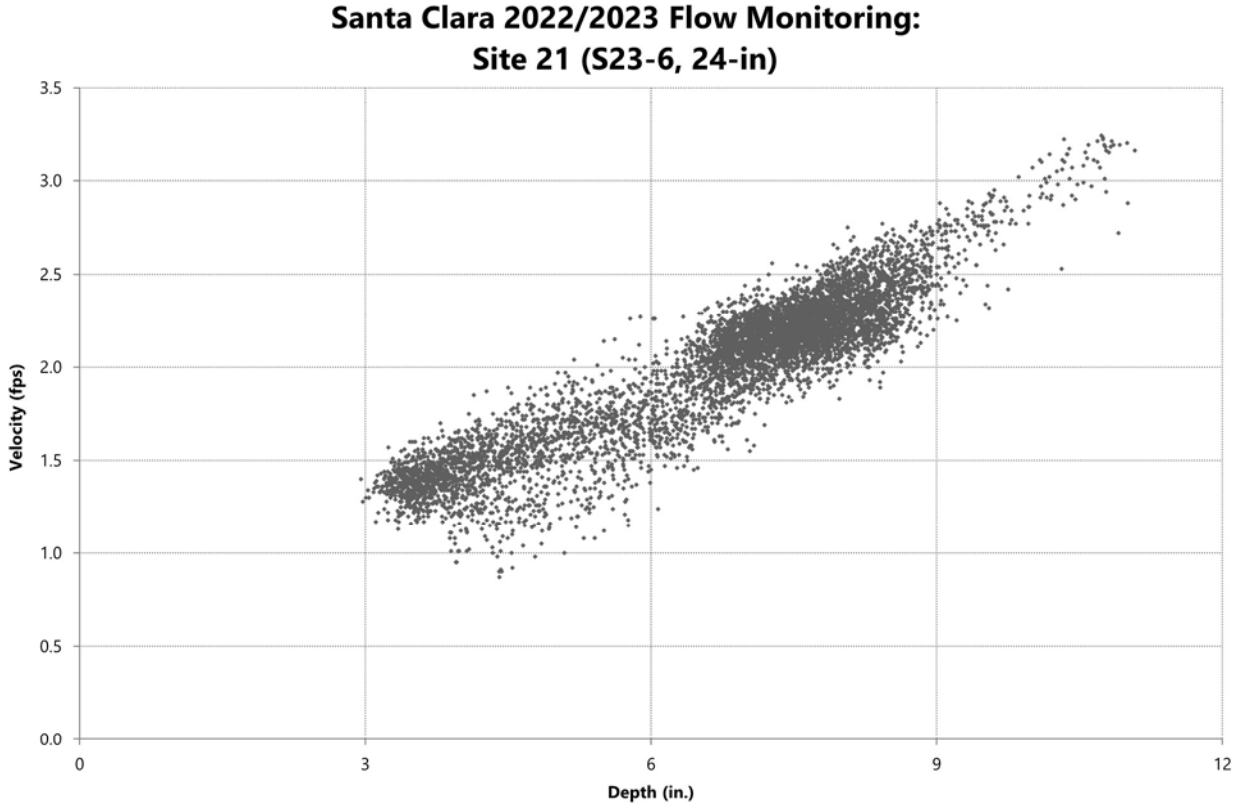

Santa Clara 2022/2023 Flow Monitoring:
Site 19 (S21-18, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
3
6
9
12
15
18
21
24
27
30
0.0
0.6
1.2
1.8
2.4
3.0
3.6
4.2
4.8
5.4
6.0

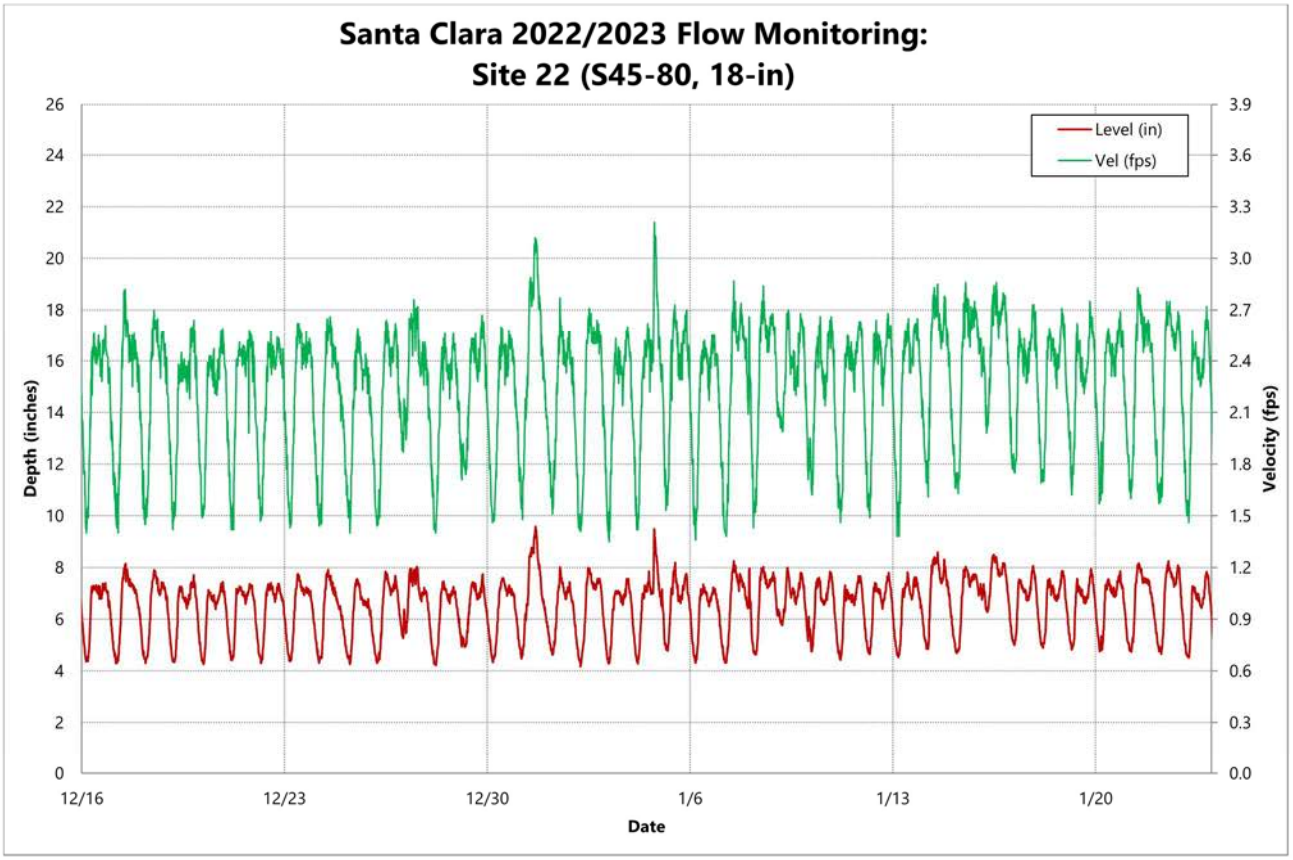

Santa Clara 2022/2023 Flow Monitoring:
Site 19 (S21-18, 24-in)
Velocity (fps)
Depth (in.)
0
3
6
9
12
15
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0

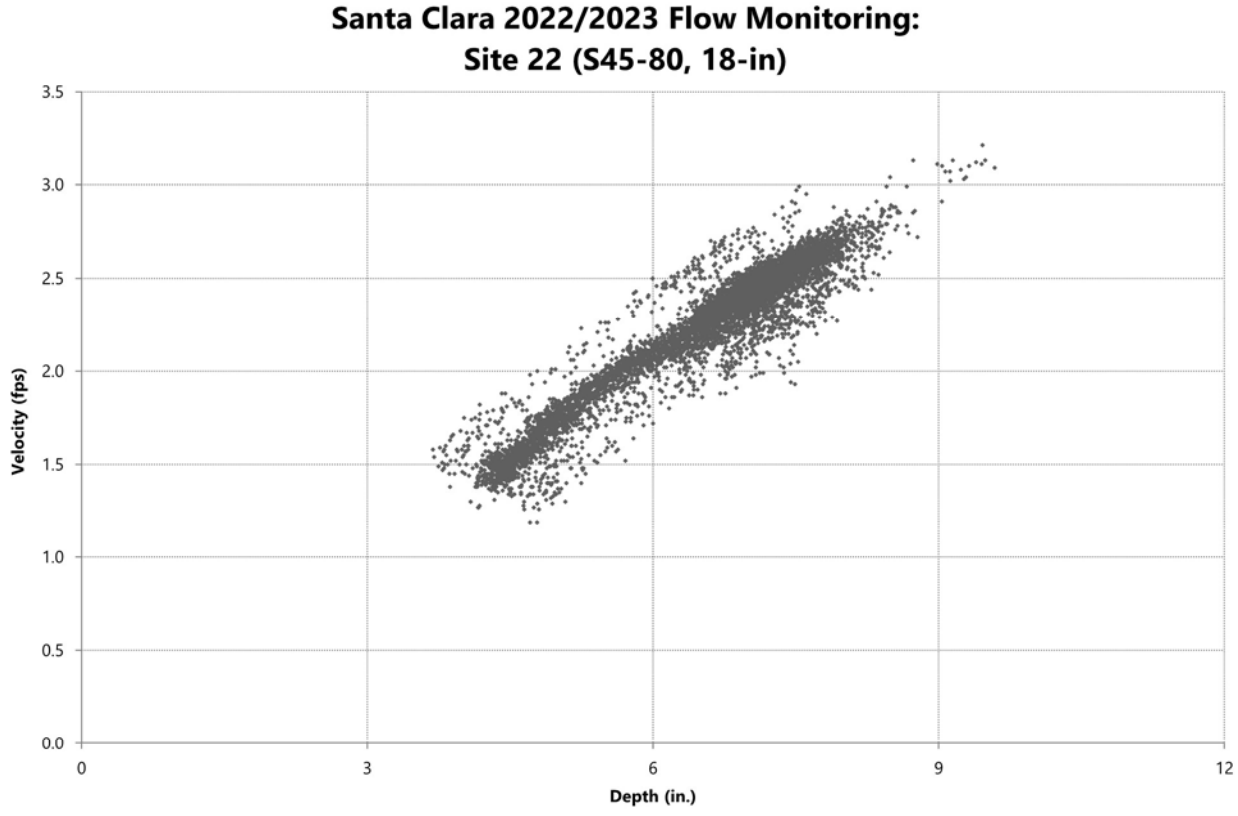

Santa Clara 2022/2023 Flow Monitoring:
Site 20 (S21-47, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
0
3
6
9
12
15
18
21
24
27
30
33
0.0
0.6
1.2
1.8
2.4
3.0
3.6
4.2
4.8
12/16
12/23
12/30
1/6
1/13
1/20

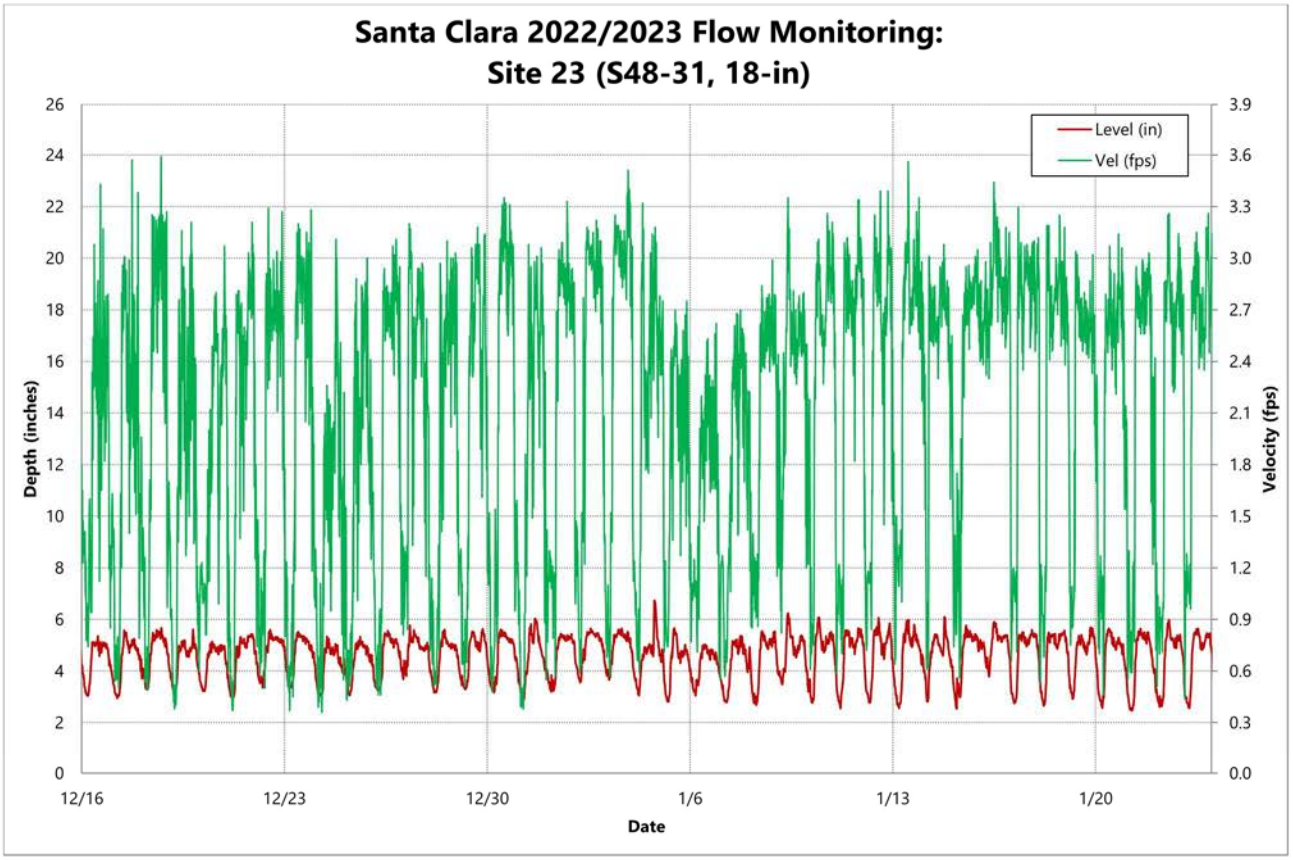

Santa Clara 2022/2023 Flow Monitoring:
Site 20 (S21-47, 18-in)
Velocity (fps)
Depth (in.)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
0
3
6
9

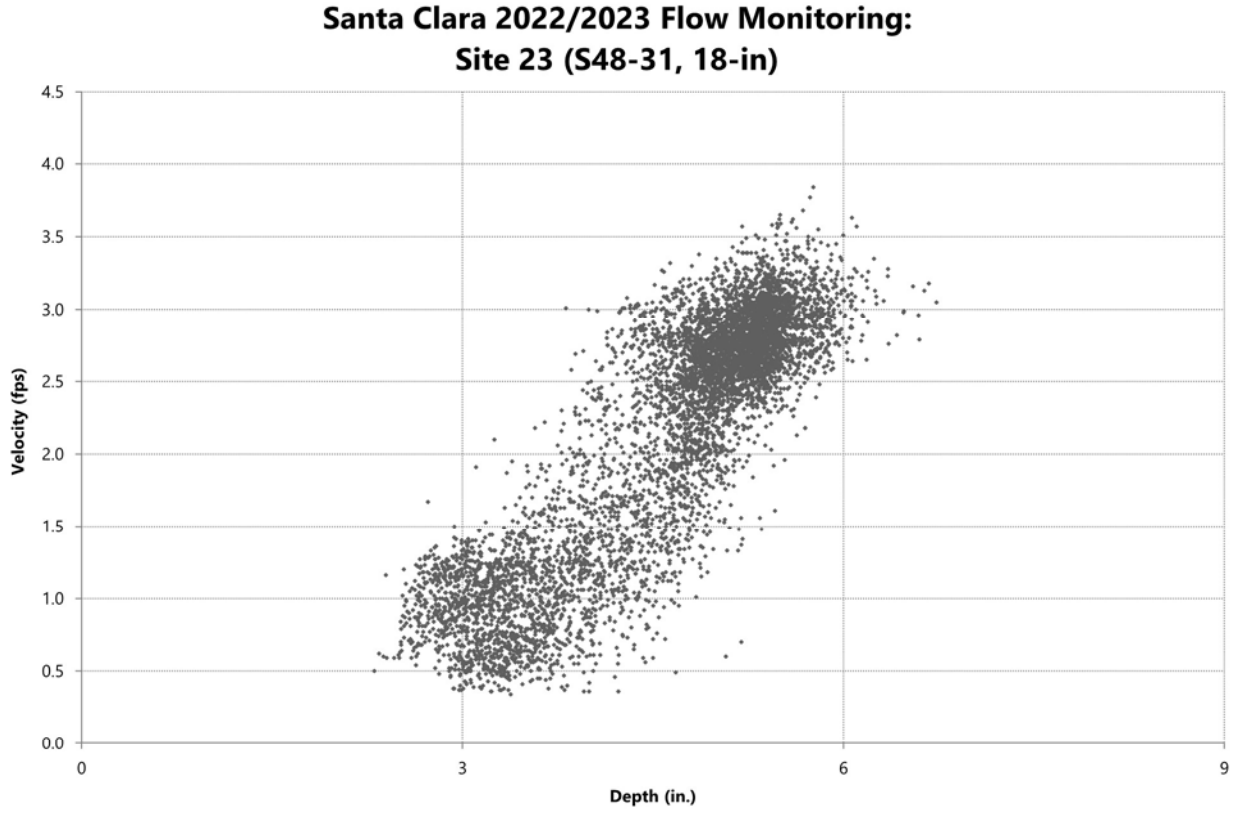

Santa Clara 2022/2023 Flow Monitoring:
Site 21 (S23-6, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

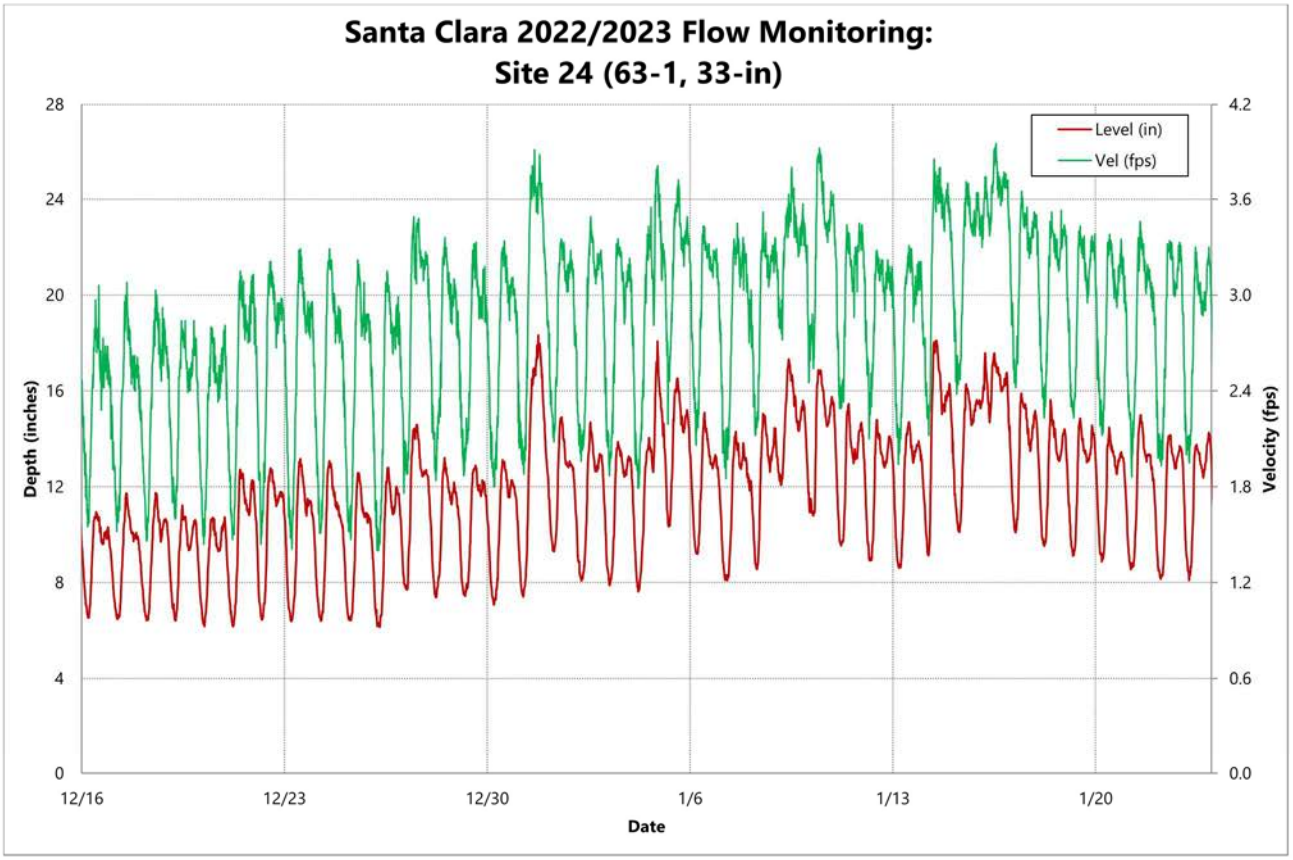

Santa Clara 2022/2023 Flow Monitoring:
Site 21 (S23-6, 24-in)
Velocity (fps)
Depth (in.)

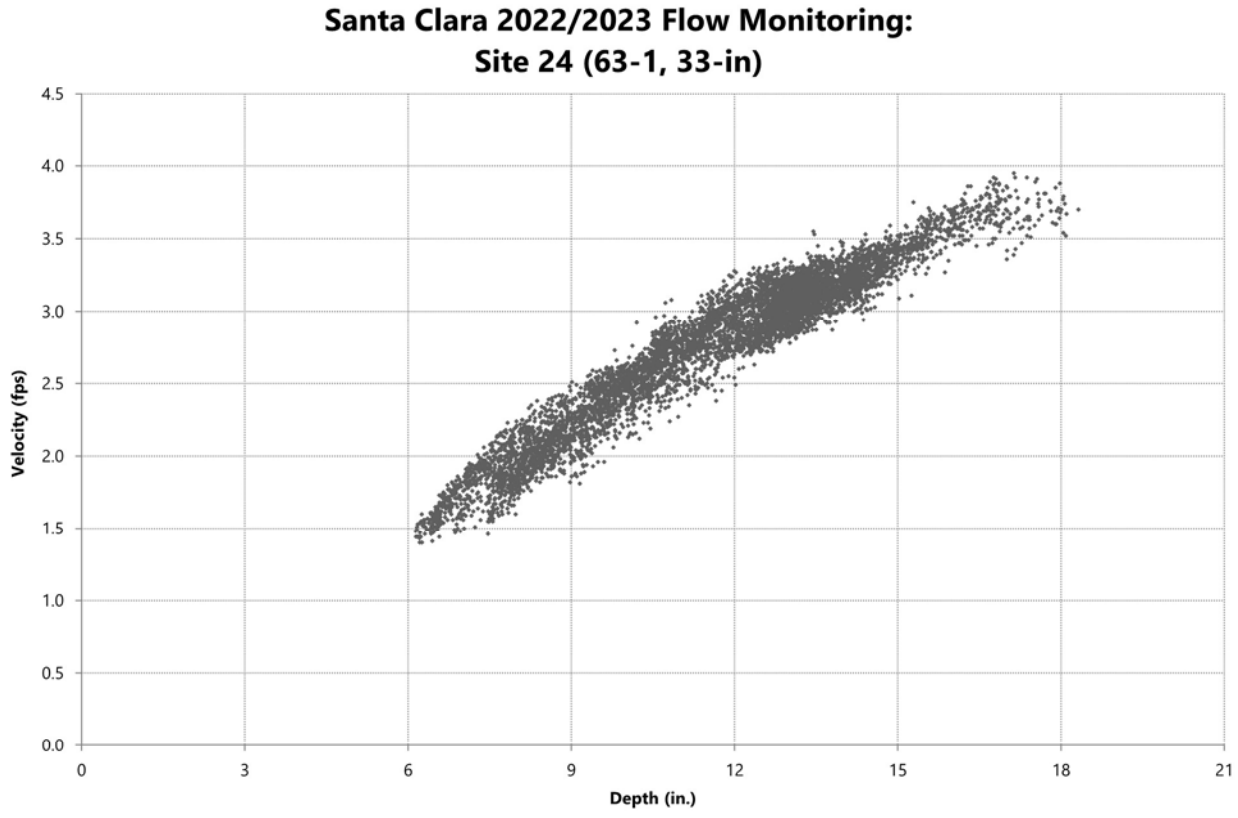

Santa Clara 2022/2023 Flow Monitoring:
Site 22 (S45-80, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20


Santa Clara 2022/2023 Flow Monitoring:
Site 22 (S45-80, 18-in)
Velocity (fps)
Depth (in.)

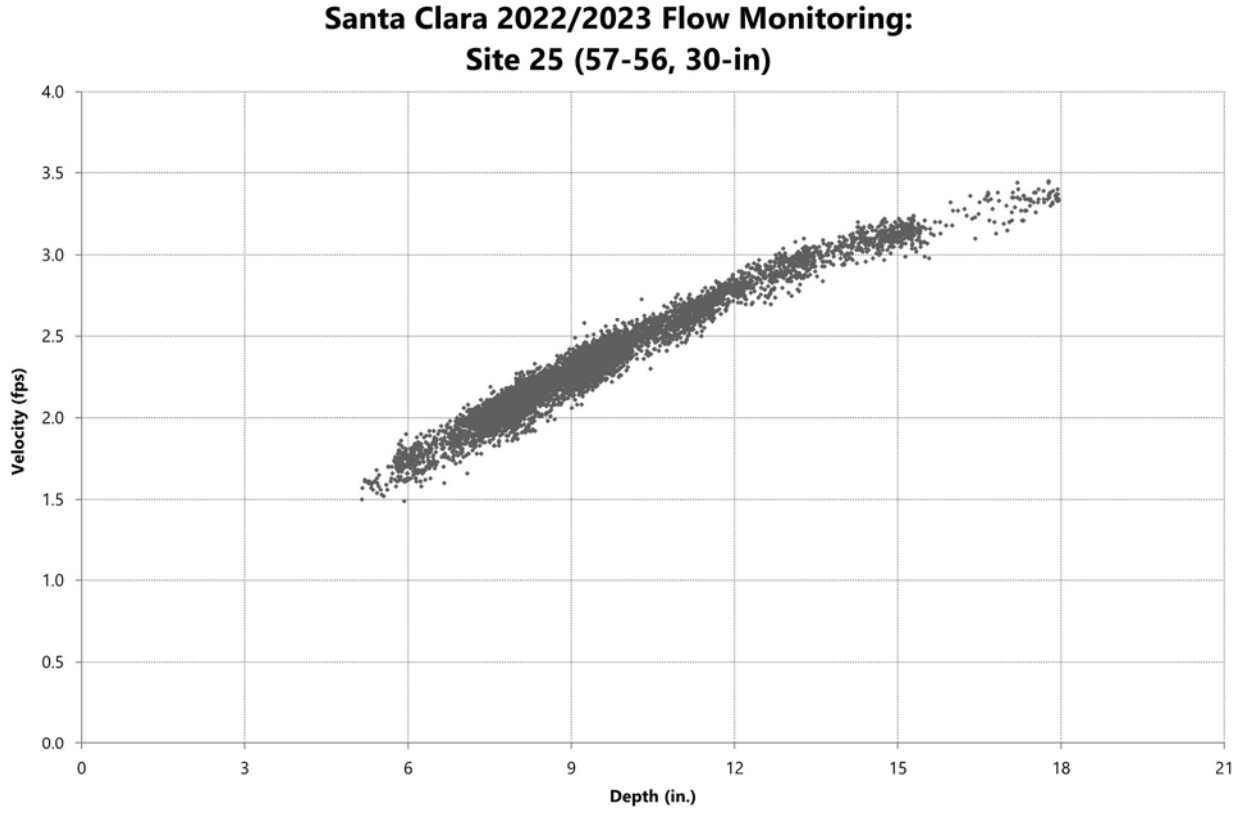

Santa Clara 2022/2023 Flow Monitoring:
Site 23 (S48-31, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

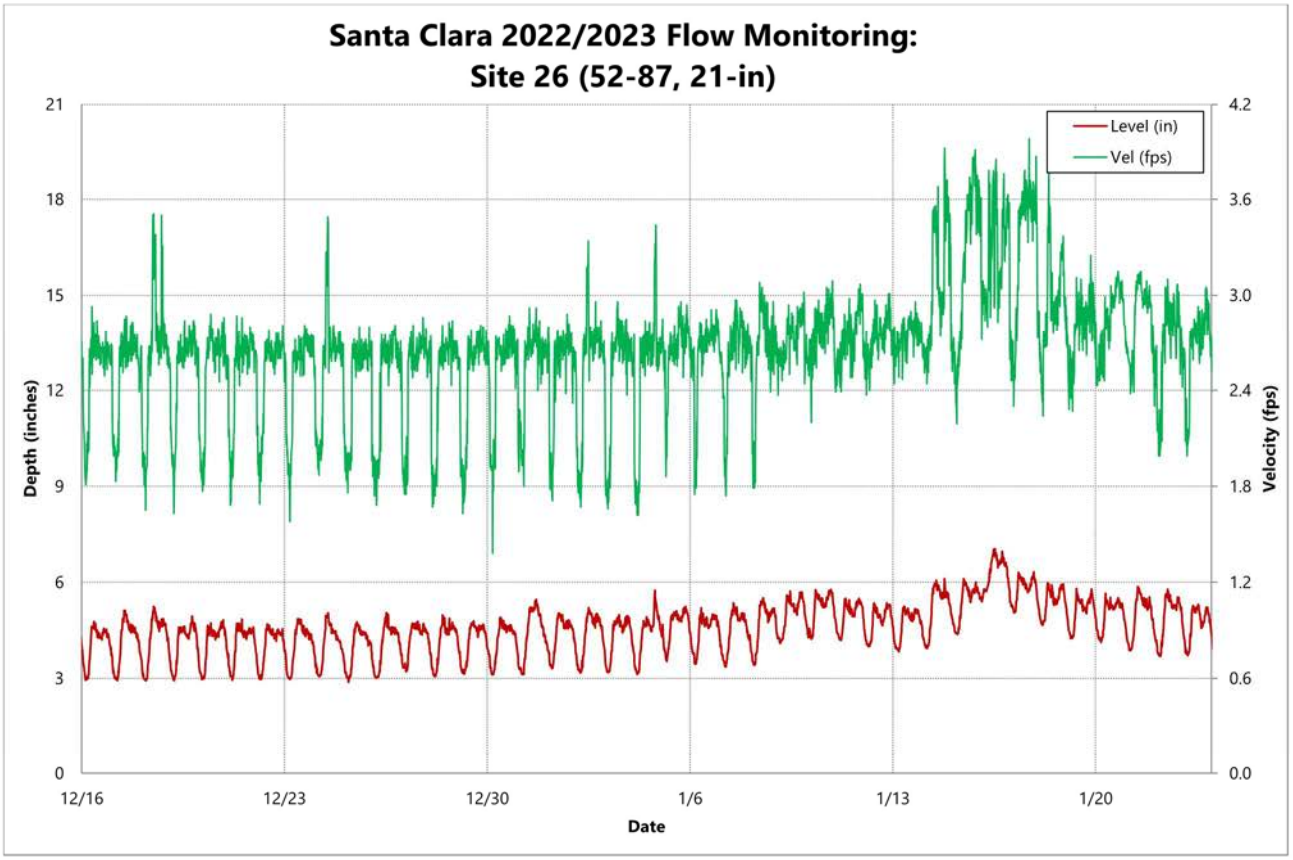

Santa Clara 2022/2023 Flow Monitoring:
Site 23 (S48-31, 18-in)
Velocity (fps)
Depth (in.)

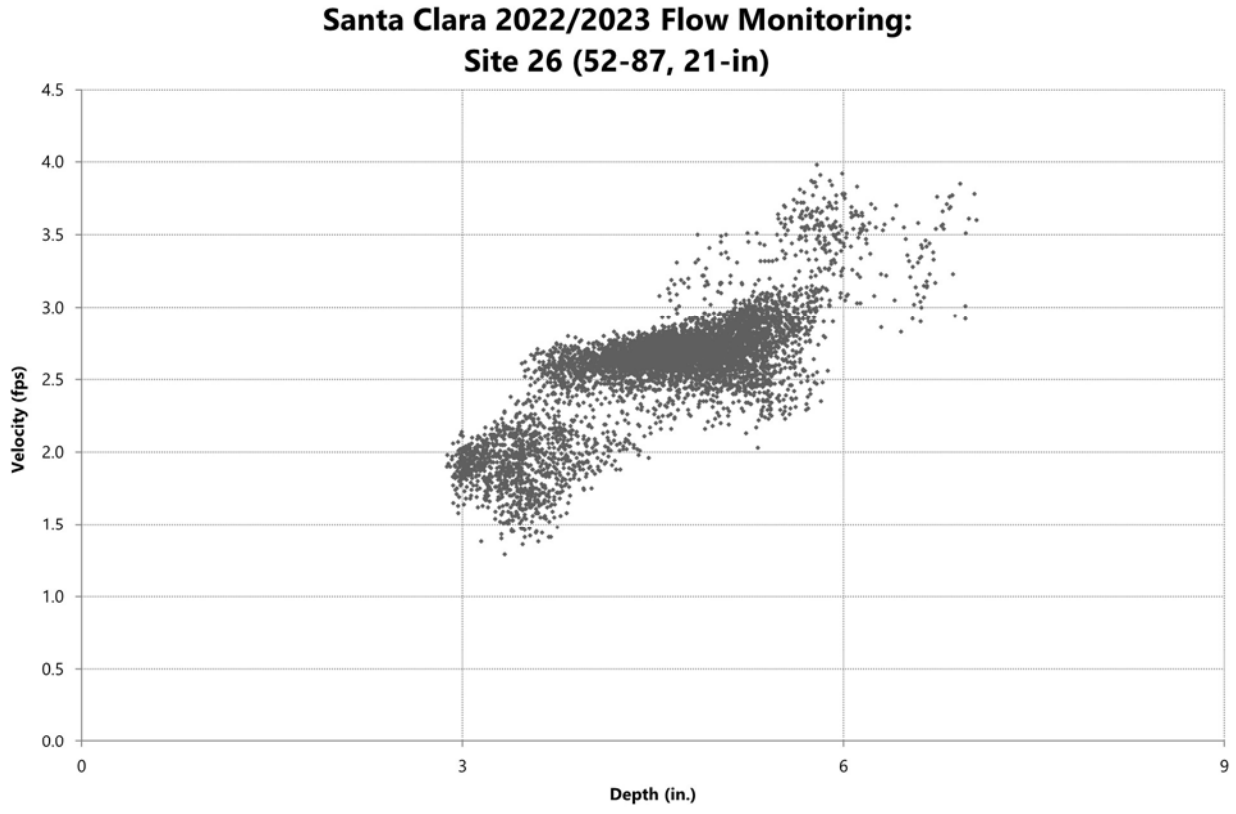

Santa Clara 2022/2023 Flow Monitoring:
Site 24 (63-1, 33-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
28
24
20
16
12
8
4
0
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

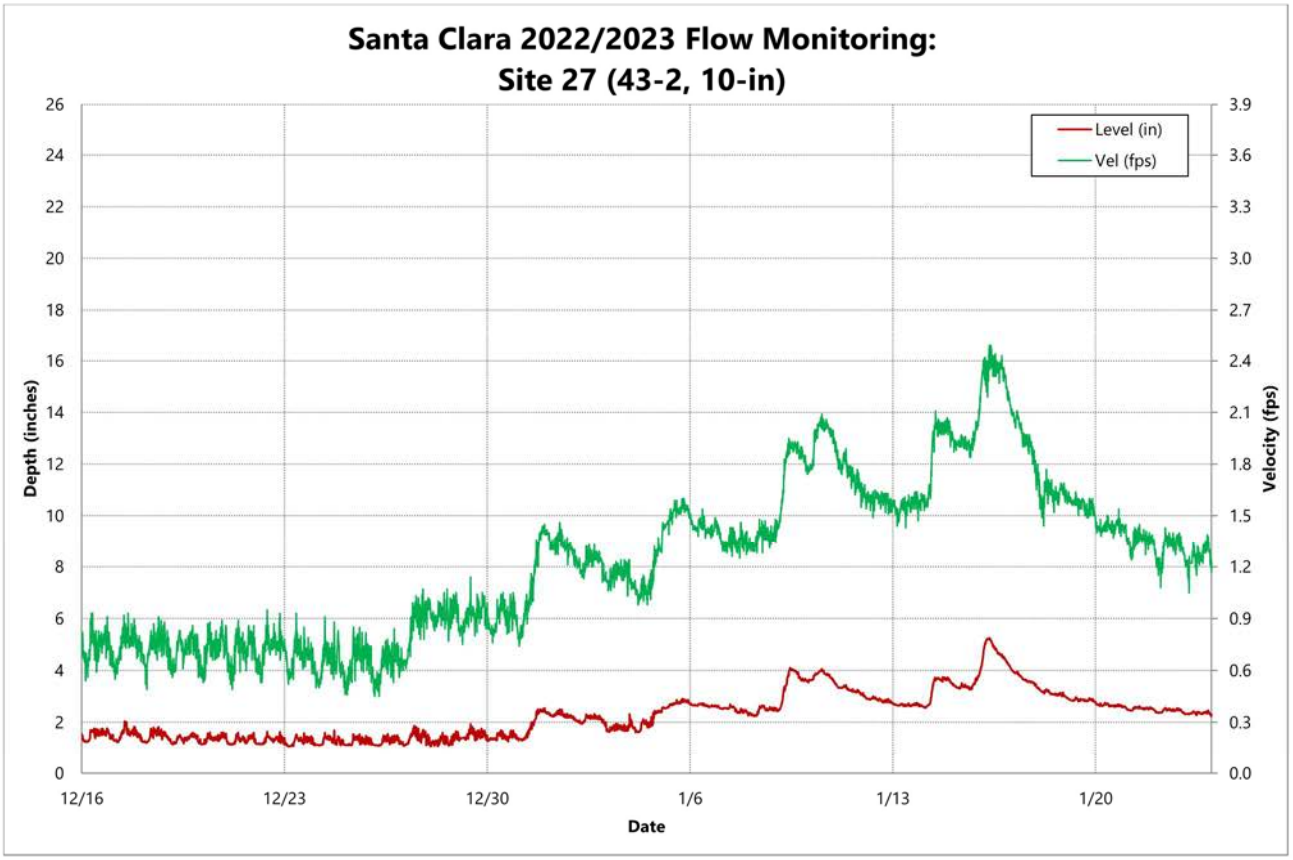

Santa Clara 2022/2023 Flow Monitoring:
Site 24 (63-1, 33-in)
Velocity (fps)
Depth (in.)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15
18
21

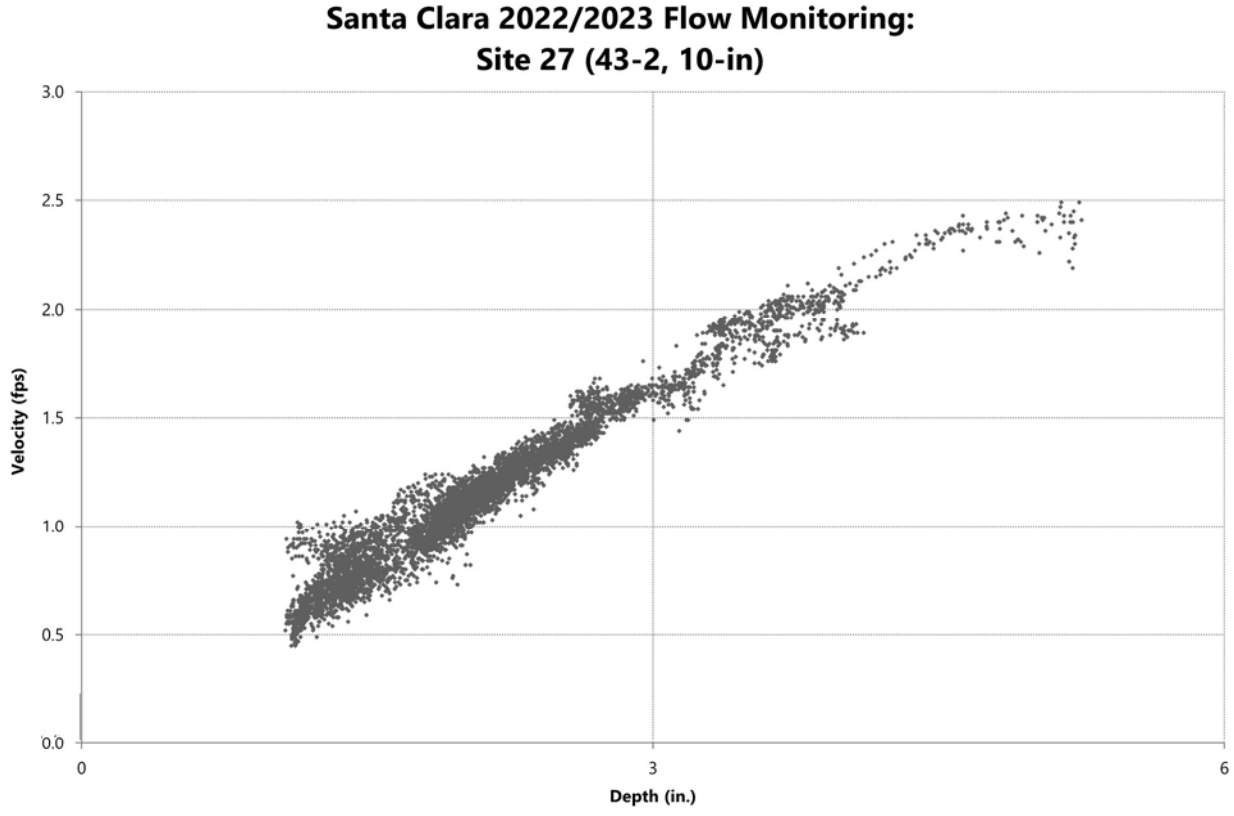
Santa Clara 2022/2023 Flow Monitoring:
Site 25 (57-56, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

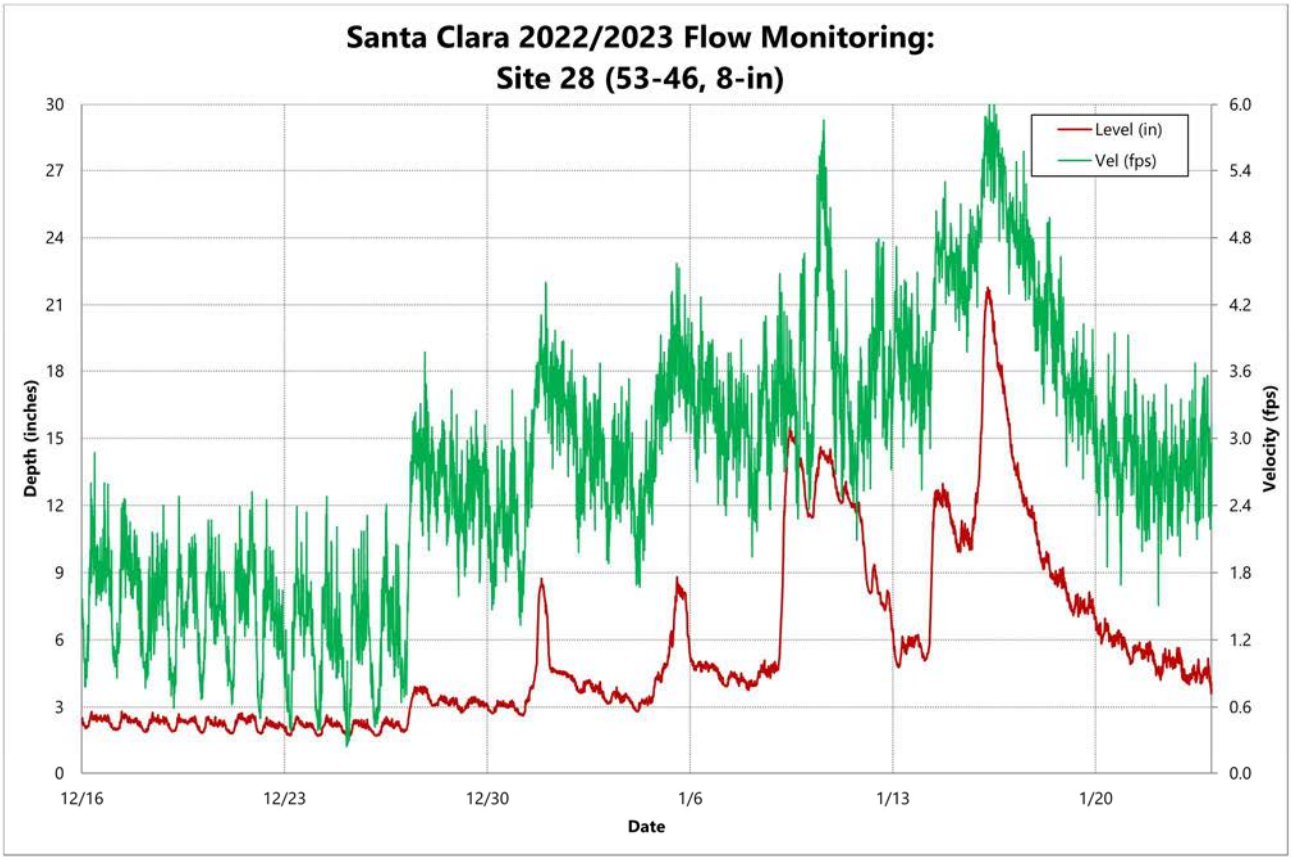

Santa Clara 2022/2023 Flow Monitoring:
Site 25 (57-56, 30-in)
Velocity (fps)
Depth (in.)

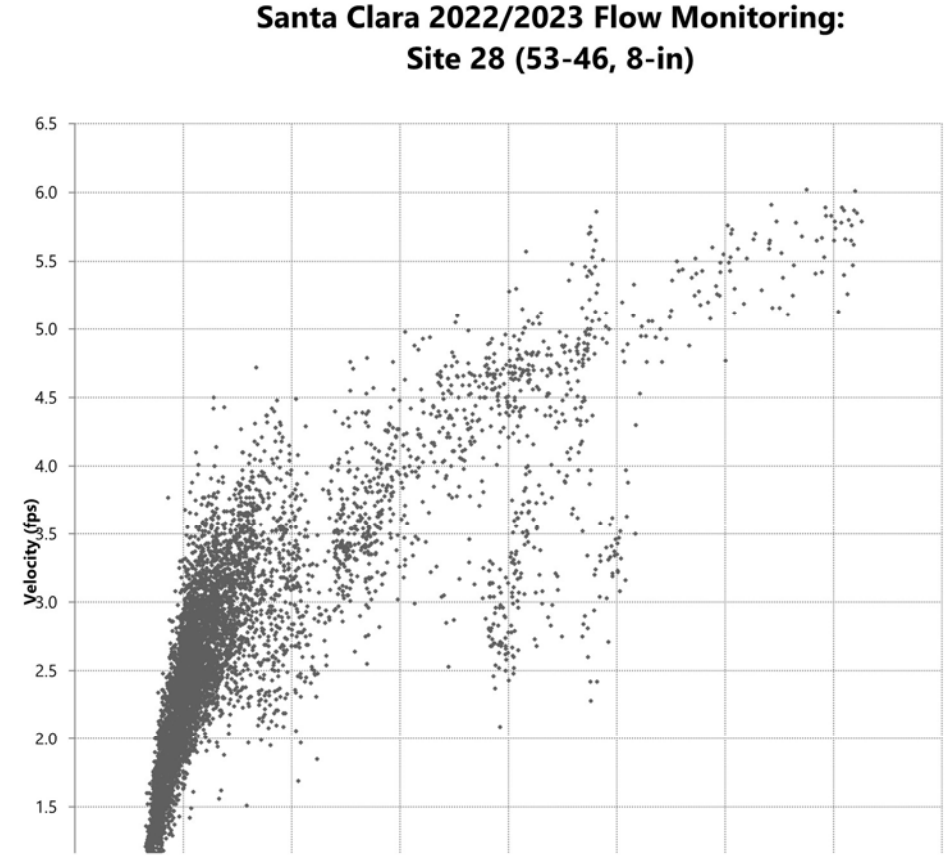

Santa Clara 2022/2023 Flow Monitoring:
Site 26 (52-87, 21-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
3
6
9
12
15
18
21
0.0
0.6
1.2
1.8
2.4
3.0
3.6
4.2

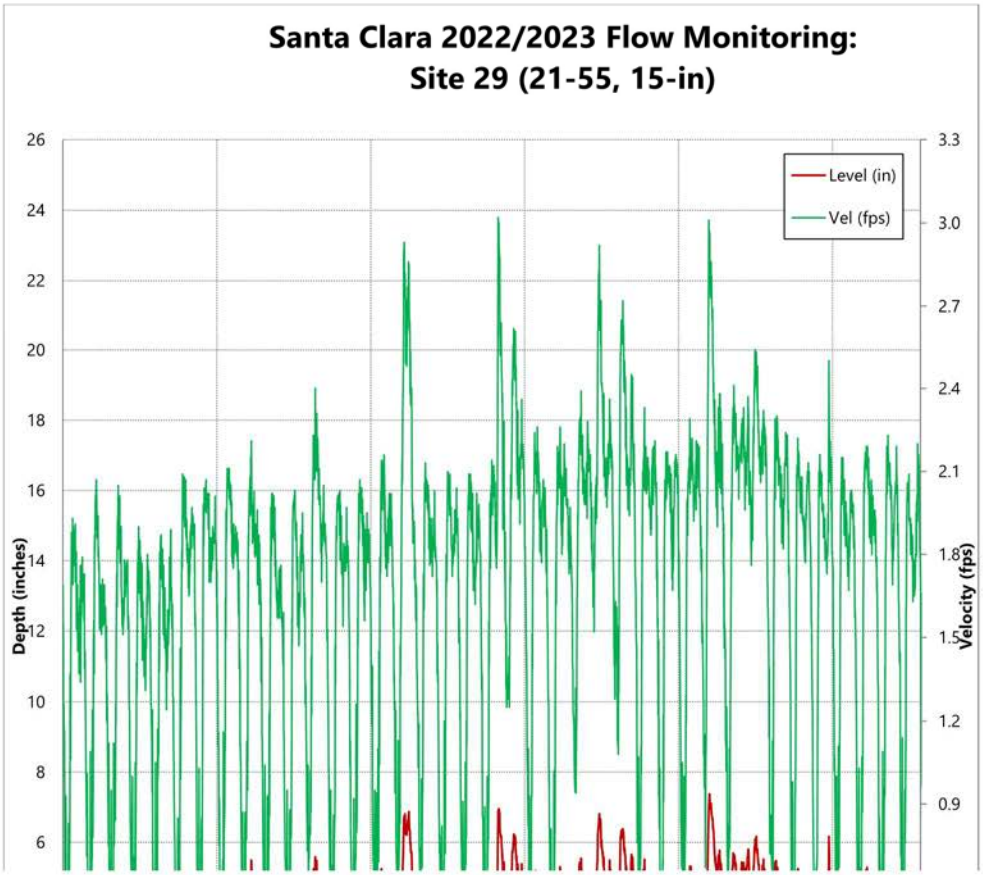

Santa Clara 2022/2023 Flow Monitoring:
Site 26 (52-87, 21-in)
Velocity (fps)
Depth (in.)
0
3
6
9
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

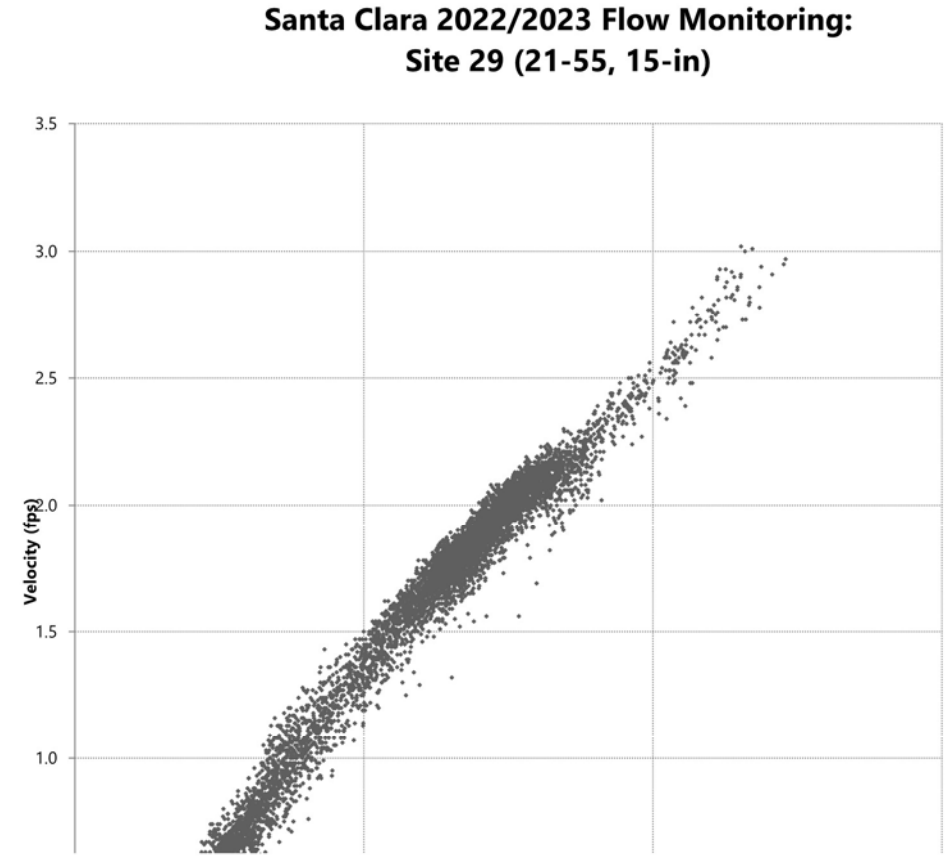

Santa Clara 2022/2023 Flow Monitoring:
Site 27 (43-2, 10-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

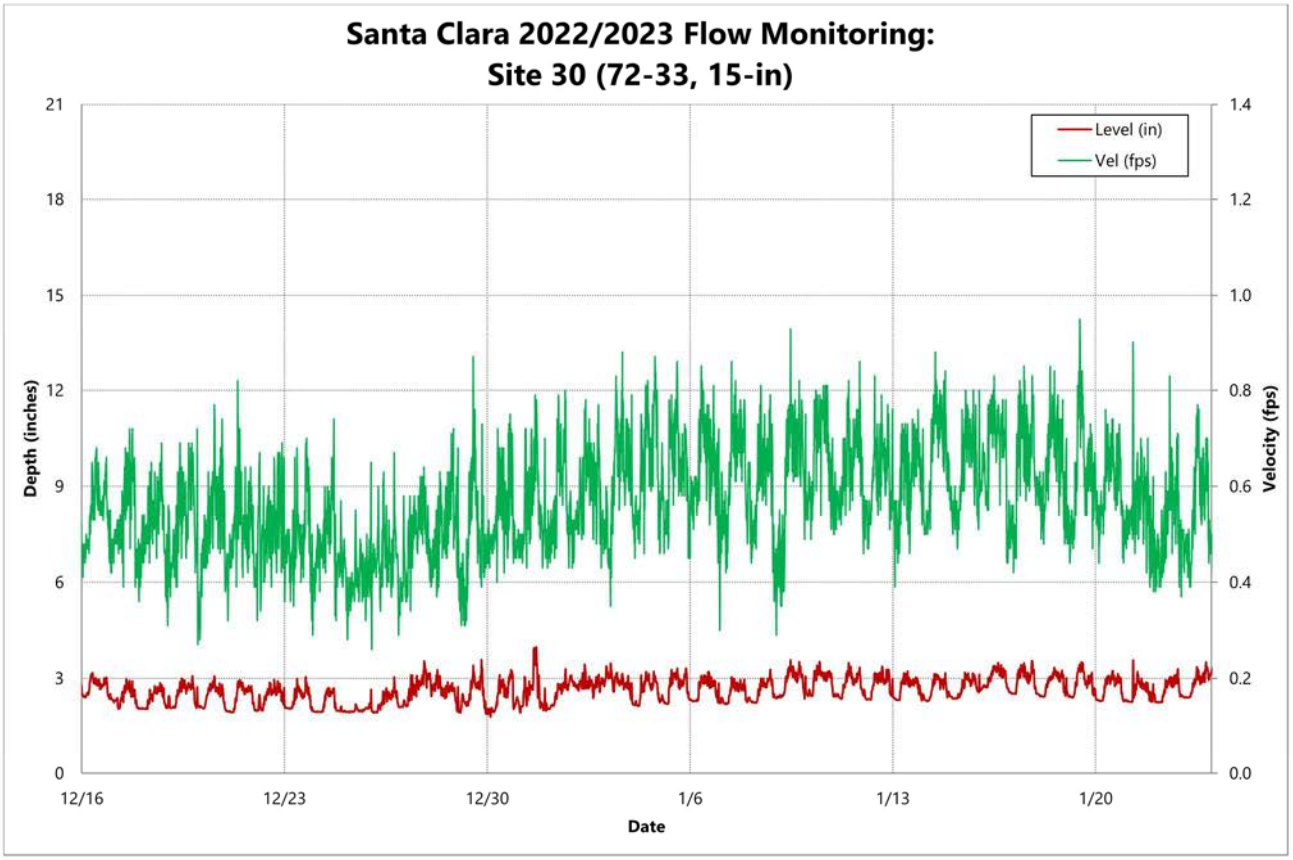

Santa Clara 2022/2023 Flow Monitoring:
Site 27 (43-2, 10-in)
Velocity (fps)
Depth (in.)

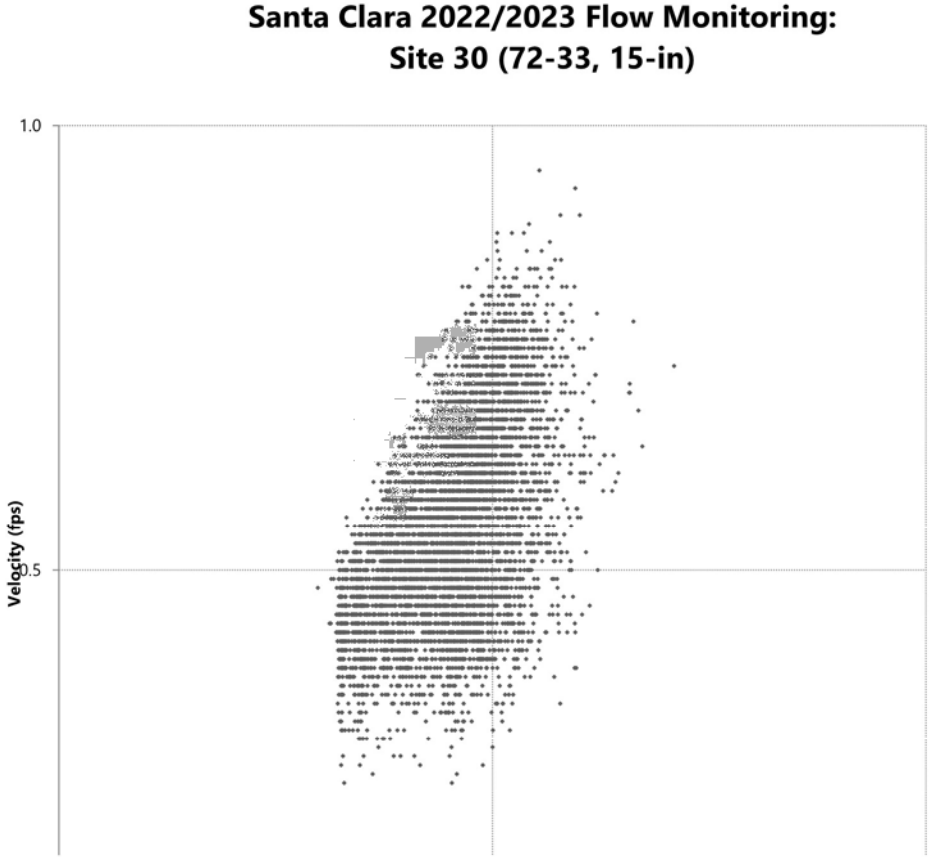

Santa Clara 2022/2023 Flow Monitoring:
Site 28 (53-46, 8-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
3
6
9
12
15
18
21
24
27
30
0.0
0.6
1.2
1.8
2.4
3.0
3.6
4.2
4.8
5.4
6.0

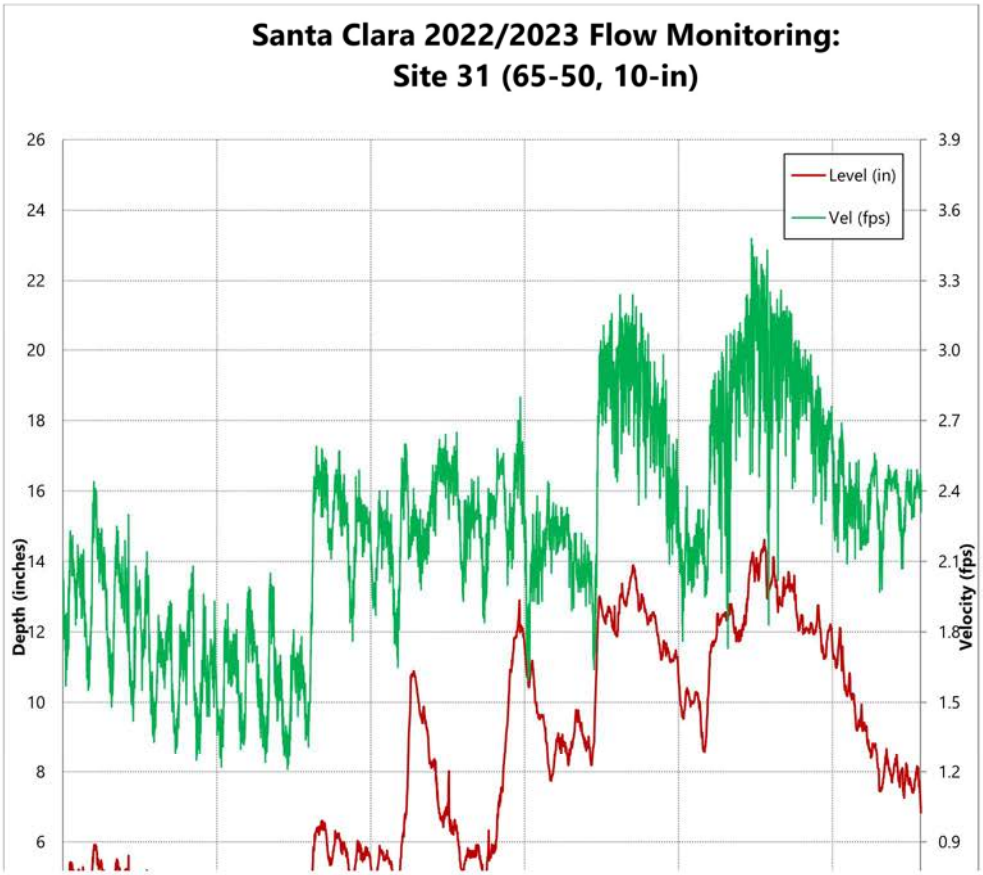

Santa Clara 2022/2023 Flow Monitoring:
Site 28 (53-46, 8-in)
Velocity (fps)
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5

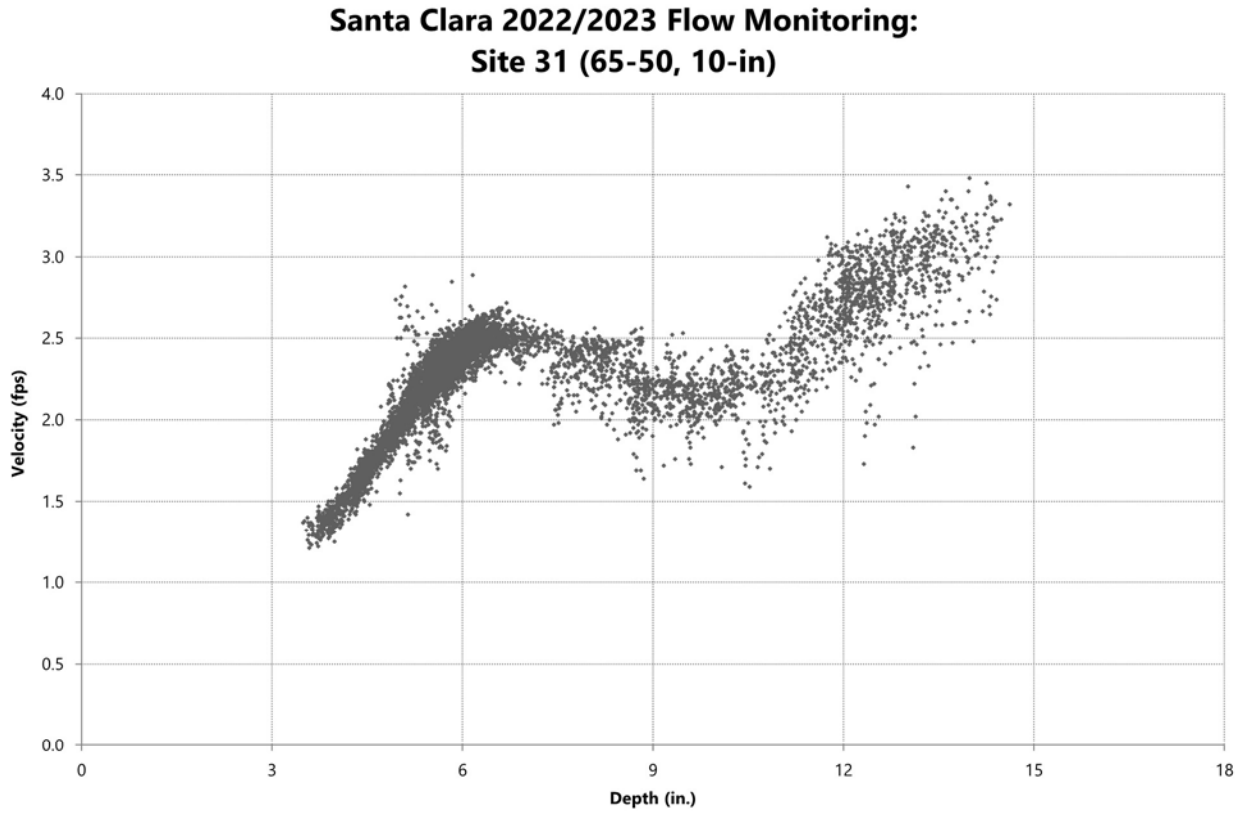

Santa Clara 2022/2023 Flow Monitoring:
Site 29 (21-55, 15-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
26
24
22
20
18
16
14
12
10
8
6
3.3
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9


Santa Clara 2022/2023 Flow Monitoring:
Site 29 (21-55, 15-in)
Velocity (fps)
3.5
3.0
2.5
2.0
1.5
1.0


Santa Clara 2022/2023 Flow Monitoring:
Site 30 (72-33, 15-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
21
18
15
12
9
6
3
0
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
12/16
12/23
12/30
1/6
1/13
1/20


Santa Clara 2022/2023 Flow Monitoring:
Site 30 (72-33, 15-in)
Velocity (fps)
1.0
0.5


Santa Clara 2022/2023 Flow Monitoring:
Site 31 (65-50, 10-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
26
24
22
20
18
16
14
12
10
8
6
3.9
3.6
3.3
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9


Santa Clara 2022/2023 Flow Monitoring:
Site 31 (65-50, 10-in)
Velocity (fps)
Depth (in.)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15
18

APPENDIX B: FUTURE DEVELOPMENT ASSUMPTIONS

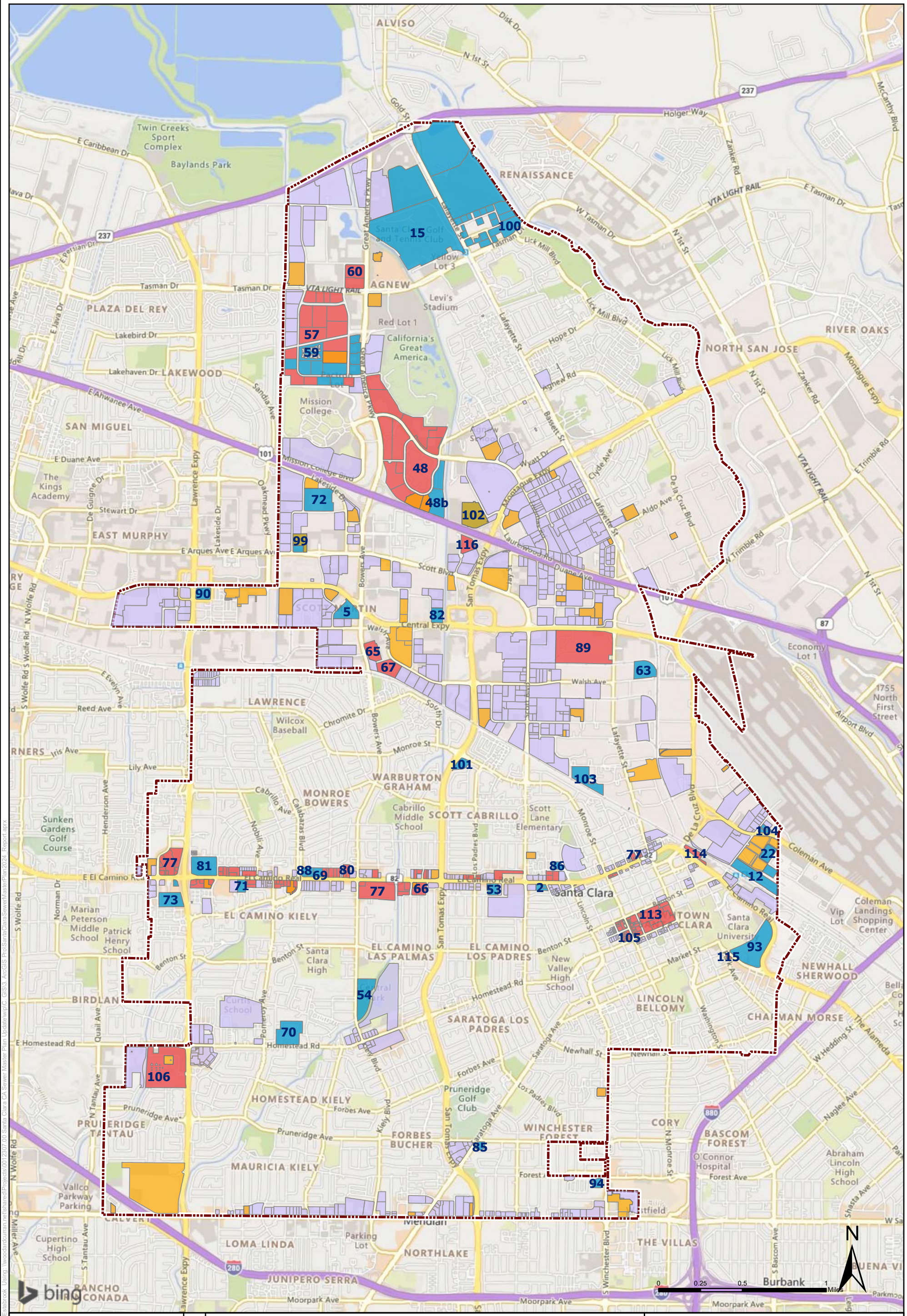


Figure B-1: Map of Future Development & Entitlement Parcels

Sewer Master Plan Update

Legend

- City Limit
- Parcel with Future Flow Assumption
  - Near-Term Specific Development (2025-2030)
  - Long-Term Specific Development (2030-2035)
  - Long-Term General Plan Phase 3 (2030-2035)
  - Entitlements

Woodard & Curran

Figure Exported: 12/27/2024 By: SEstabrook Using: \\woodardcurran.net\shared\Projects\001230\7.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\Santa Clara Sewer Master Plan2024_Report.aprx

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
1890 El Camino Real	PLN2015-11361	BLD2017-47840	1890	El Camino Real	269-01-081, 269-63-000	35, 36	Still under construction, May 2023	2	Under construction	56	Condos					Near-Term	0.0098	0
Bowers Ave	PLN2012-09162	BLD2016 41725 & BLD2016-41470	3000	Bowers Ave.	216-48-033	63	Empty lots as of 9/2021. No billing point associated with this parcel. No longer a development Update (5/19/23): two 165,000 square foot five-story office buildings totaling 330,000 square feet; a five-level parking garage and surface lots providing a total of 980 parking spaces; and site and public right-of-way improvements.	5	Approved			330,000	Office			Near-Term	0	0.033
VTA BART station and yard			480	Brokaw Road	230-06-054		Billing database does not account for development.	12				351,512	Community (yard, BART station, and parking garage)			Near-Term	0	0.032339104
Related (land use changed in parcels 4 & 5)	PLN2014-10554		2351, 5155	2351, 5155 Stars and Stripes Dr	104-03-036	94, 103, 104, 105, 114	Some parcels within development constructed and accounted for in billing database. Others not.	15	Approved	1,680	Apts	4,080,000 2,889,640	Office Mixed Use	4,128	Hotel	Near-Term	0.32872	0.98910174
Coleman Highline (old FMC site) - Gateway Crossing project added	PLN2016-12318		1205	Coleman Ave	230-46-069, 230-59-001	48	No billing point here. Development proposal in review (see folder T001).	22	Phase 1 Under Construction	230 760 610	Studio 1-b Units (SF) 2-d Units (SF)	15,000	Retail	700 (rooms)	Hotel	Near-Term	0.28171	0.114
Freedom Circle Focus Area					104-40-019, 104-40-020, 104-40-030, 104-40-031, 104-40-034, 104-40-035, 104-40-038, 104-41-031, 104-41-032, 104-41-043, 104-41-044, 104-42-020, 104-42-021		Focus Area approved - Specific Plan still required. Development timing for residential should be considered near-term. (6/1/2023)	48	Approved	2,500	Apts	4,229,000	Retail/Office			Near-Term	0.385	0.5085
Greystar	PLN2017-12516		3905	Freedom Circle	104-40-021, 104-40-036		Development permit approved. Could be moving forward in the next couple of years.	48	Approved	1,100	Apts	2,000	Retail			Near-Term	0.1694	0.0002
South Bay Development	PLN2007-06433 & PLN2013-09743	BLD2015-40394	2350	Mission College Bl.			Site under construction until summer 2018 therefore not confident billing database accounts for full building being occupied. The proposed project consists of the construction of two 6-story office buildings each supporting 150,000 square fet of space (300,000 square feet total), a 6,000 square foot retail building and a 6-level parking garage. The site currently contains the 13-story Regency Plaza Interational building (251,000 square feet).	49	Constructed			306,000	Office/Retail (6,000 SF)				0	0.0306
Summer Hill Apartments	PLN2017-12723		2230 (?), 2232 & 2240 El Camino Real	El Camino Real	290-10-090, 290-10-091	35	Development not constructed yet (not even under construction). Billing database only accounts for the existing non-residential use.	53	Approved	151	Apts	5,000 5,000	Retail Restaurant			Near-Term	0.023254	0.0057
Santa Clara CRC, ISC & ISHOF (International Swim Center)	PLN2015-10939	BLD1974-42418	Central Park	Kiely Boulevard	290-26-029	23, 33	Development not even under construction. Recreation/swim center (275,369 SF) and a theater (400 seats)	54	Approved			275,369	Swim center (UFF = 0.3 GPD/SF)	400	Seats (UFF = 5 gpd/seat)	Near-Term	0.002	0.0826107
(Now called Kylli) Yahoo! at Tasman (In addition to the previously modeled Yahoo! development)	PLN2002-07218, PLN2017-12724		5010 Old Ironsides	Surrounded by Patrick Henry, Hetch Hetchy ROW, Old Ironsides Dr., and Tasman Dr.	104-04-064, 104-04-065, 104-04-111, 104-04-112, 104-04-113, 104-04-142, 104-04-143, 104-04-150, 104-04-151		General Plan amendment for a nine-parcel property to amend the designation from High-Intensity Office/Research to a newly-established mixed-use designation allowing a high-intensity mix of office, commercial, and residential uses. The Project proposes a PD rezone for the development of 3,000,000 +/- square feet of commercial office/lab space, 100,000 +/- square feet of neighborhood retail, 1,800 +/- new multi-family residential, a childcare facility, and indoor and outdoor community spaces.	57	Under Review	1,800		3,000,000 100,000 5,000 800 10,000	Office Retail Community Police Daycare			Future	0.2772	0.303048

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
Patrick Henry Specific Plans Phase 1					104-04-078, 104-04-093, 104-04-094, 104-04-123, 104-04-131, 104-04-136, 104-04-138, 104-04-139, 104-04-140, 104-04-141, 104-53-000			59	Approved	1,200	Condos	200,000 110,000	Retail Public (Commercial facilities)			Near-Term	2.1	0.04796
2901 Tasman Dr	PLN2020-14361		2901	Tasman Dr	104-49-025, 104-49-026	S93		60	Under Review			1,070,344	R&D			Future	0	0.1605516
651 Walsh Ave	PLN2018-13303 (Debby)		651	Walsh Ave	224-04-059	57, 67	Approved. To be accounted for as future data center.	63	Under construction			435,050	Data Center			Near-Term	0	0.059173
2805 Bowers Avenue	PLN2021-15069		2805	Bowers Avenue	216-28-063		Accounted for in model as future data center.	65	Under Review			244,068	Data Center			Future	0	0.012816
2500 El Camino Real (Mariani)	PLN2016-11686	BLD1968-33480	2500	El Camino Real	290-46-001, 290-46-002, 290-46-003, 290-46-015, 290-46-016, 290-46-017	34	Last submittal - 2018	66	Under Review	392	Condos	8,000	Restaurant	311 (rooms)	Hotel	Future	0.0686	0.03942
2590 Walsh Ave Vantage Data Center CA3			2590	Walsh Ave	216-28-112	63	Will be modeled as future data center.	67				450,800	Data Center			Future	0	0.01692
3035 El Camino Real	PLN2018-13265		3035	El Camino Real	220-32-059	42		69	Under construction	42	Condos					Near-Term	0.00735	0
3131 Homestead Rd	PLN2019-13869 PLN2018-13339 (Debby)		3131	Homestead Rd	290-24-071	22		70	Under construction	225	Apts					Near-Term	0.070991976	0
3402/3410 El Camino Real	PLN2017-12578	BLD2019-57108 (3406 ECR, same APN)	3402/3410	El Camino Real	290-01-136			71	Under construction	69	Apts	10,000 3,458	Restaurant Commercial			Near-Term	0.010626	0.0110578
3625 Peterson Way	PLN2018-13144		3625	Peterson Way	216-30-049	72, 73	Two 8-story office buildings totaling 632,216 SF; a 13,370 SF 1-story ammenity building, 4 level parking structure.	72	Approved			658630	Office	13,370	Ammenity	Near-Term	0	0.1008
ECR (Gateway Village) - See line 116	PLN2012-09540	BLD2016-41881 (for apartment BLD)	3610, 3700	3610, 3640, 3650, & 3700 ECR	313-06-002, 313-06-008	30, 40	Development under construction 2017 through 2018. Billing database would not have accounted for development.	73	Residencies constructed	476	Condos	23,010 15,340 14,750 9,357 15,257 9,386	Restaurant (small food Service) Restaurant (full Service) Retail Fitness Beauty Parlor Medical Office			Near-Term	0.0833	0.05402519
El Camino Real Specific Plans EIR				El Camino Real	220-31-079, 220-31-080, 220-02-049, 220-31-075, 220-32-056, 220-32-054, 220-02-020, 220-02-048, 220-02-045, 220-02-040, 220-02-046, 220-02-022, 290-03-084, 290-03-083, 290-03-081, 290-03-085, 290-03-059, 290-03-088, 290-03-087, 290-03-064, 290-63-008, 290-02-102, 290-02-095, 290-02-094, 290-01-012, 290-01-114, 290-01-113, 290-01-117, 290-01-116, 290-01-115, 224-15-037, 216-01-053, 216-01-047, 216-01-043, 216-01-050, 224-28-051, 269-03-086, 269-03-130, 213-34-008, 213-34-011, 213-34-005, 213-34-013, 213-34-012, 213-34-010, 213-34-004, 224-49-009, 224-49-008, 269-03-079, 269-03-131, 224-28-069, 216-01-040, 290-06-020, 290-06-021, 224-15-034, 224-49-012, 224-14-111, 224-14-089, 224-14-090, 224-15-017, 224-28-067, 224-28-048, 224-28-035, 224-28-050			77	Re-do Under Review	1,920 401 2,580	Corridor Mixed Use Corridor Residential Regional Commercial Mixed	182,646 224,658	Corridor Mixed Use Regional Commercial Mixed			Future	0.763175	0.13644684

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
Warmington Residential	PLN22-00151 PLN22-00160		2855	El Camino Real	220-31-082, 220-31-083		Pending review. 23 new townhomes and 65 affordable senior apartment units and 3,912 square feet of ground floor commercial in a five-story building. Total residential load = 0.014 MGD, non-residential load = 0.00039 MGD. Model has a total residential load of 0.0082 mgd. Model corrected.	80	Under Review	47	Condos & townhomes					Future	0.008225	0
Prometheus	PLN2015-11478		3501	El Camino Real	220-03-010		Part of ECR Specific Plan. three-, four- and five-story development would sit on 10.6 acres and comprise 701 apartments above 84,000 square feet of retail space. Model loads match proposed development description.	81	Not a File	700	Apts	86,000	Retail				0.1078	0.0086
2905 Stender Way Data Center	PLN2019-14118		2905	Stender Way	216-29-108		Parcel accounted for in model as future data center.	82	Under construction							Near-Term	0	0
275 Saratoga Ave	PLN2021-15005		275	Saratoga Avenue	303-46-051		4 Story Assisted Living Facility – 61,287 SF including 146 bed spaces	85	Under Review					146	Beds	Near-Term	0.011242	0
1601 Civic Center Dr	PLN202-14401		1601	Civic Center Dr	224-49-006	S46	106 DU affordable apartments	86	Approved	106	Apts					Near-Term	0.016324	0
3155 El Camino Real	PLN2020-14674		3155	El Camino Real	220-32-057, 220-32-058		60-unit, three-story townhome development	88	Approved	60	Townhomes					Near-Term	0.0105	0
960 Central Expressway	PLN21-15299		960	Central Expressway	224-07-099		Architectural review of three development scenarios for redevelopment of an existing Heavy Industrial (MH) zoned parcel occupied by 747,424 square feet of industrial warehouse buildings and 130,00 square feet of covered truck loading docks and surface parking. The proposal is to demolish the existing structures and site improvements to construct three Class "A" speculative buildings totaling up to 890,000 square feet for warehousing and/or data center uses, associated parking, on- and off-site improvements and landscaping. The proposal includes subdivision of the parcel into three separate parcels and the addition of new ingress and egress driveways along the project frontages. Development replaces Large User 9 (trade flow = 0.0994 MGD). Actual usage (based on billing database) is 0.01713 MGD. For the development load, assumed data center (Scenario 1) usage. Note data center survey received. Parcel will be counted as a future data center.	89	Under Review			388,482	Data Center			Future	0	0.1136448
3517 Ryder St			3517	Ryder St	216-34-052		Part of Lawrence Station development. 5-story 328-unit residential complex. Building Permit Under Review	90	Approved	328	Apts					Near-Term	0.050512	0

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
Santa Clara University Master Plan (5-years plan)	PLN2014-10779	BLD2016-42681 (Charney Hall of Law_UC), BLD2017-48533 (South Residence Hall)_UC), BLD2018-49473 (Benson Hall_UC)	500	El Camino Real	230-13-023	38, 39	Finn Residence Hall - construction begun February 2018. Constructed by October 2019. Billing database likely does not account for discharge. Approximately 30 residents live on each of the twelve wings, with one Community Facilitator on each wing. Total number of residents = 360. Phase 2 involves the construction of a four-story, 250 bed residence hall with a gross floor area of 55,800 sf on the site of the existing 19,000 square foot Fine Arts Building to be demolished. Construction has not begun. Benson Hall - This project involves one and two-story additions to the north and west building elevations totaling 21 ,363 sf and includes partial renovations of the building interior to accommodate the new additions and create meeting and common space. Residence hall loads accounted for in new subcatchment 23013023.	93	Under construction							Near-Term	0.0427	0
Worthington Circle (Former BAREC site/Summerhill and Charity Housing at 90 N. Winchester Blvd)	PLN2016-12389		1834	Worthington Circle	303-17-053		Agrihood Mixed-Use Development Project. Construction initiated September 2021. Development not accounted for in billing database. Parcel does not have a billing point. residential mixed-use development consisting of up to 160 mixed-income apartments,165 affordable senior apartments, 36 townhomes and approximately 1.5 acres of agricultural open space. Development accounted for in model in subcatchment 30317053 which replaced original development subcatchment DVPT_NWinchester.	94	Under construction	36 325	SF Apt	65,340		Agricultural Open Space		Near-Term	0.05635	0
3375 Scott Blvd.	PLN2016-12232		3375	Scott Blvd.	216-31-059, 216-31-060	72	Project would demolish the existing office buildings and construct a six-story, 237,107 SF office building, and a four-level parking structure with an attached two-story amenity building. Remove existing billing point loads. Model reflects development flow in new sub ID 21631059 and 21631060.	99	Approved			237,107	Office			Near-Term	0	0.0237107
Tasman East Specific Plan (+1,500 units)	PLN2016-12400			Surrounded by TasmanDr, Lafayette St, Calle Del Mundo, and Guadalupe River	097-05-062, 097-05-063, 097-05-110, 097-05-060, 097-05-061, 097-05-059, 097-05-058, 097-05-056, 097-05-057, 097-46-019, 097-46-029, 097-46-016, 097-46-017, 097-46-018, 097-46-033, 097-46-011, 097-46-024, 097-46-002, 097-46-020, 097-46-027	104, 105	Project website (link below) lists 5 approved projects (2343 Calle del Mundo, 5123 Calle del Sol, 2200 Calle de Luna, 2300 Calle de Luna, and 2302/2310 Calle del Mundo) and 6 proposed projects. These projects have not been subject to individual development reviews and are therefore not specifically reflected in the model. Instead, the model reflects the original (June 2018) review of the overall Tasman East Specific Plan. Modeling the specific approved or proposed projects within this Specific Plan is not in the scope of work for the near-term network development.	100	Under construction	5,998	Transit Neighborhood	93,600 10,000 35,147	Retail Daycare School			Near-Term	0.725758	0.046664575

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
2330 Monroe St	PLN2019-13723		2330	Monroe Steet	224-37-068	54	Architectural Review for an approved 2-3 story building containing 65 affordable residential units in a mix of studios and one-, two-, and threebedroom units, including 25 percent of the units set aside for people with developmental disabilities. Currently vacant lot with no billing point. Model accounts for development flow in new sub ID 22437068.	101	Under construction	65	Apt					Near-Term	0.01001	0
2201 Laurelwood	PLN2019-13742	BLD2021-61850	2201	Laurelwood	104-39-023	75	Proposed future data center (data center Ref ID = 13). Will be included in the model as a future data center. Development replaces large user LU02 (Siliconix) with modeled trade flow = 1.2327 mgd. Actual flow (based on billing data) = 0.00711 mgd. Construction begun June 2019. Model updated with development parcel. Future data center flows to be modeled as inflow file. LU02 subcatchment deleted from model.	102	Under construction			536,730	Data Center			Near-Term	0	0.091020833
1200 Memorex Drive data center	PLN2019-14055		1200	Memorex Drive	224-66-006		Development will be modeled as a future data center (data center Ref ID = 80). New sub ID 22466006 added to model to represent data center parcel. Remove existing billing point.	103	Under construction							Near-Term	0	0
1290, 1240 Coleman Ave and 312 Brokaw Rd - Santa Clara Dual-Branded Hotel	PLN2019-14051; CEQ2020-01073		1290, 1240, 312	1290 and 1240 Coleman Ave and 312 Brokaw Rd	230-05-045, 230-05-049, 230-05-050	48, 49	Model accounts for development with new subs IDs 23005045, 049, and 050. Development consists of 396 room, 6-story hotel, totaling 204,444 square feet. Old sub ID 23005045, Parcel_23005049, Parcel_23005050, Parcel_23005049!, and Parcel_23005050! replaced.	104	Approved			7,480	Restaurant	630.3447	Hotel	Near-Term	0.0351	0.0077792
906, 930, 940, 950 Monroe St	PLN2020-14457		906, 930, 940, 950	Monroe St	269-20-086, 269-20-087, 269-20-095		Residential mix-use redevelopment. Construct a five story building with 61 condo rental units, 3,844 sf general retail, a 6,224 sf restaurant on the ground floor, 116 residential parking spaces, and 71 retail parking spaces. The project also includes relocation of two existing historic houses located at 906 and 930 Monroe. Development accounted for in model with new sub IDs 26920086, 26920095, and 26920087.	105	Under Review	64	condos	3,844	Retail	6,224	Restaurant	Future	0.0112	0.00685736
Kaiser Entitlement					316-09-046		Entitlement flow.	106								Future	0	0
Downtown Precise Plan			Various	Various	269-22-088, 269-22-089, 269-22-072, 269-22-096, 269-22-084, 269-22-079, 269-22-094, 269-22-093, 269-22-095, 269-22-108, 269-22-109, 269-22-110, 269-22-111, 269-22-112, 269-22-097, 269-22-098, 269-22-099, 269-22-100, 269-22-101, 269-22-102, 269-22-103, 269-22-104, 269-22-105, 269-22-106, 269-22-107, 269-22-113, 269-22-114, 269-22-115, 269-20-082, 269-20-083, 269-20-084, 269-20-085, 269-20-089, 269-20-090, 269-20-091, 269-20-078, 269-20-075, 269-20-081, 269-20-080, 269-62-000, 269-20-079, 269-20-074, 269-20-077		Development review dated 3/20/2023. Note that 5 parcels are on top of other recent developments (Ref_ID 23 and 105).	113		386 578	Condos Apts	637,440 197,900	Commercial Retail	74,160 SF	Hotel	Future	0.156562	0.1191308
611 El Camino Real			611	El Camino Real	230-06-053		70 affordable apartment units to replace existing women's facility. The zone is ML-Light Industrial but the general plan use has it as Public/Quasi Public as the parcel is owned by the City of Santa Clara.	114		70	Apt					Future	0.01078	0
2655 The Alameda	PLN2022-00448		2655	The Alameda	230-12-012		4-story mixed use development with 1,500 SF ground floor commercial & 39 residential units	115		39	Apt	1,500	Commercial			Future	0.006006	0.00015

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
3301 Olcott Street	PLN22-00560		3301	Olcott Street	224-47-019		189,153 SF (Building 1 discharging to MH S74-28) 151,384 SF (Building 2 discharging to MH S74-43) commercial R&D office.	116				340,537	Office R&D			Future	0	0.025540275
Santa Clara Station Area Plan							Plan is in the early stages of development--no project description yet--for now, use GP estimates from Table 5.2.1, footnote 1.											
4701 Great America Parkway			4701	Great America Parkway	104-42-014, 104-42-014-019	83	Amusement park lease may be up in the next couple of years, but no details are available. Assume will operate as is into the future.	NA										

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
230-03-090	HYIN	211,963.46	4.87	Heavy Industrial	0.15	1.25	0	0.0000	0.0397	Future
294-18-037	NHMX	18,696.46	0.43	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
290-23-059	NHMX	23,162.02	0.53	Neighborhood Commercial	0.1	0.3	25	0.0020	0.0007	Future
104-51-015	LDRD	27,934.37	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-016	LDRD	28,860.54	0.66	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
104-51-017	LDRD	28,221.53	0.65	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-008	LDRD	21,568.32	0.50	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
104-51-007	LDRD	23,675.58	0.54	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-15-025	LDRD	8,849.96	0.20	Office: 100%	0.1	0.85	0	0.0000	0.0008	Future
104-51-006	LDRD	27,949.92	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-009	LDRD	19,521.75	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-51-014	LDRD	23,350.55	0.54	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-51-005	LDRD	31,103.49	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-15-092	LDRD	54,693.70	1.26	Office: 100%	0.1	0.85	0	0.0000	0.0046	Future
104-15-141	LDRD	46,524.15	1.07	Office: 100%	0.1	0.85	0	0.0000	0.0040	Future
104-15-140	LDRD	32,608.15	0.75	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-51-010	LDRD	33,028.98	0.76	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-15-029	LDRD	16,356.77	0.38	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
104-51-013	LDRD	24,912.63	0.57	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future
290-29-009	PKOS	1,357,204.52	31.16	Parks/Recreation	0	0.2	0	0.0000	0.0000	Future
101-11-042	LHIN	34,719.96	0.80	Light Industrial	0.15	0.85	0	0.0000	0.0044	Future
220-02-047	CMXU	14,277.06	0.33	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
220-01-059	CMXU	26,194.76	0.60	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
220-01-055	CMXU	29,422.83	0.68	Community Commercial	0.1	0.4	25	0.0026	0.0012	Future
220-01-053	CMXU	13,950.79	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future
220-31-077	CMXU	14,566.71	0.33	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
220-31-078	CMXU	15,046.30	0.35	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
220-01-054	CMXU	30,351.56	0.70	Community Commercial	0.1	0.4	25	0.0027	0.0012	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
220-02-015	VLDR	9,665.35	0.22	Low Density Residential	245	0	25	0.0014	0.0000	Future
220-02-014	VLDR	9,376.27	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-013	VLDR	9,375.20	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-012	VLDR	9,376.26	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-011	VLDR	9,376.20	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-010	VLDR	9,375.63	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-009	VLDR	9,291.32	0.21	Low Density Residential	245	0	25	0.0013	0.0000	Future
230-05-005	RGCO	6,564.42	0.15	Regional Commercial	0.1	0.5	0	0.0000	0.0003	Future
230-05-020	RGCO	27,964.10	0.64	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
230-05-037	RGCO	53,420.53	1.23	Regional Commercial	0.1	0.5	0	0.0000	0.0027	Future
230-05-017	RGCO	25,013.75	0.57	Regional Commercial	0.1	0.5	0	0.0000	0.0013	Future
230-05-016	RGCO	25,005.08	0.57	Regional Commercial	0.1	0.5	0	0.0000	0.0013	Future
230-05-015	RGCO	23,825.51	0.55	Regional Commercial	0.1	0.5	0	0.0000	0.0012	Future
230-05-084	RGCO	20,980.12	0.48	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
230-05-021	RGCO	166,493.71	3.82	Regional Commercial	0.1	0.5	0	0.0000	0.0083	Future
230-05-083	RGCO	22,351.24	0.51	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
230-05-054	RGCO	83,262.85	1.91	Regional Commercial	0.1	0.5	0	0.0000	0.0042	Future
104-14-052	LDRD	41,745.26	0.96	Office: 100%	0.1	0.85	0	0.0000	0.0035	Future
104-14-090	LDRD	33,524.38	0.77	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-14-141	LDRD	23,021.12	0.53	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-14-071	LDRD	30,847.01	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-14-053	LDRD	23,417.60	0.54	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-14-047	LDRD	30,846.99	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-14-124	LDRD	131,211.66	3.01	Office: 100%	0.1	0.85	0	0.0000	0.0112	Future
104-14-036	LDRD	19,855.46	0.46	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-14-048	LDRD	30,847.01	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-15-131	LDRD	444,843.84	10.21	Office: 100%	0.1	0.85	0	0.0000	0.0378	Future
104-14-023	LDRD	19,842.58	0.46	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-14-038	LDRD	30,846.99	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
101-09-023	LDRD	170,155.51	3.91	Office: 100%	0.1	0.85	0	0.0000	0.0145	Future
290-05-060	CMXU	18,140.31	0.42	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future
220-01-018	CMXU	12,754.24	0.29	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
220-01-044	CMXU	18,789.19	0.43	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
220-31-114	CMXU	44,562.59	1.02	Community Commercial	0.1	0.4	25	0.0039	0.0018	Future
230-05-116	LHIN	449,148.01	10.31	Light Industrial	0.15	0.85	0	0.0000	0.0573	Future
230-47-068	LHIN	23,098.35	0.53	Light Industrial	0.15	0.85	0	0.0000	0.0029	Future
230-03-108	HYIN	821,203.99	18.85	Heavy Industrial	0.15	1.25	0	0.0000	0.1540	Future
230-03-047	HYIN	14,575.93	0.33	Heavy Industrial	0.15	1.25	0	0.0000	0.0027	Future
290-55-012	NHMX	1,549.42	0.04	Neighborhood Commercial	0.1	0.3	25	0.0001	0.0000	Future
290-02-092	CMXU	13,792.24	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future
290-05-076	CMXU	29,128.38	0.67	Community Commercial	0.1	0.4	25	0.0026	0.0012	Future
290-05-074	CMXU	22,490.01	0.52	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
290-05-055	CMXU	45,529.94	1.05	Community Commercial	0.1	0.4	25	0.0040	0.0018	Future
290-05-054	CMXU	22,055.98	0.51	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-04-007	CMXU	98,212.43	2.25	Community Commercial	0.1	0.4	25	0.0087	0.0039	Future
290-04-006	CMXU	48,009.37	1.10	Community Commercial	0.1	0.4	25	0.0042	0.0019	Future
290-04-005	CMXU	23,809.87	0.55	Community Commercial	0.1	0.4	25	0.0021	0.0010	Future
290-04-004	CMXU	32,223.14	0.74	Community Commercial	0.1	0.4	25	0.0028	0.0013	Future
290-04-003	CMXU	28,816.85	0.66	Community Commercial	0.1	0.4	25	0.0025	0.0012	Future
290-04-002	CMXU	24,001.59	0.55	Community Commercial	0.1	0.4	25	0.0021	0.0010	Future
290-04-045	CMXU	25,858.00	0.59	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
290-02-099	CMXU	6,669.50	0.15	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
290-02-098	CMXU	6,540.84	0.15	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
290-02-087	CMXU	3,637.06	0.08	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
290-02-105	CMXU	12,089.50	0.28	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
290-02-104	CMXU	13,782.03	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-02-101	CMXU	6,483.39	0.15	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
290-02-100	CMXU	9,650.45	0.22	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
290-02-103	CMXU	41,169.09	0.95	Community Commercial	0.1	0.4	25	0.0036	0.0016	Future
101-13-003	LHIN	311,364.82	7.15	Light Industrial	0.15	0.85	0	0.0000	0.0397	Future
101-09-024	RGCO	92,430.01	2.12	Regional Commercial	0.1	0.5	0	0.0000	0.0046	Future
303-02-013	PUQP	74,316.43	1.71	Public/Institutional	0.21	0.2	0	0.0000	0.0031	Future
290-23-088	PUQP	1,173,909.65	26.95	Public/Institutional	0.21	0.2	0	0.0000	0.0493	Future
303-21-071	RGCO	48,269.26	1.11	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
303-21-072	RGCO	21,356.10	0.49	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-19-072	RGCO	18,582.19	0.43	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
303-22-014	RGCO	10,447.18	0.24	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-23-036	RGCO	159,016.92	3.65	Regional Commercial	0.1	0.5	0	0.0000	0.0080	Future
303-23-002	RGCO	21,753.41	0.50	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-23-032	CMXU	59,698.08	1.37	Community Commercial	0.1	0.4	25	0.0053	0.0024	Future
303-22-015	RGCO	11,663.35	0.27	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
303-22-039	RGCO	22,016.42	0.51	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-21-068	RGCO	24,215.83	0.56	Regional Commercial	0.1	0.5	0	0.0000	0.0012	Future
303-22-037	RGCO	22,012.72	0.51	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-18-046	RGCO	48,506.89	1.11	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
303-18-023	RGCO	19,000.00	0.44	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
303-18-022	RGCO	28,265.76	0.65	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
303-18-037	RGCO	9,191.61	0.21	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-23-044	CMXU	35,632.59	0.82	Community Commercial	0.1	0.4	25	0.0031	0.0014	Future
303-19-078	RGCO	31,754.11	0.73	Regional Commercial	0.1	0.5	0	0.0000	0.0016	Future
303-18-050	RGCO	48,396.21	1.11	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
303-18-049	RGCO	120,162.09	2.76	Regional Commercial	0.1	0.5	0	0.0000	0.0060	Future
303-23-043	CMXU	40,282.23	0.92	Community Commercial	0.1	0.4	25	0.0036	0.0016	Future
303-23-029	CMXU	45,256.12	1.04	Community Commercial	0.1	0.4	25	0.0040	0.0018	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
303-23-026	CMXU	14,329.30	0.33	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
303-23-030	RGCO	79,488.65	1.82	Regional Commercial	0.1	0.5	0	0.0000	0.0040	Future
303-18-048	RGCO	63,348.69	1.45	Regional Commercial	0.1	0.5	0	0.0000	0.0032	Future
303-23-037	RGCO	66,753.62	1.53	Regional Commercial	0.1	0.5	0	0.0000	0.0033	Future
303-23-034	RGCO	99,561.24	2.29	Regional Commercial	0.1	0.5	0	0.0000	0.0050	Future
303-23-035	CMXU	45,156.65	1.04	Community Commercial	0.1	0.4	25	0.0040	0.0018	Future
303-23-022	CMXU	13,600.82	0.31	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
290-01-125	CMXU	98,936.97	2.27	Community Commercial	0.1	0.4	25	0.0087	0.0040	Future
303-20-073	RGCO	720.06	0.02	Regional Commercial	0.1	0.5	0	0.0000	0.0000	Future
303-18-042	RGCO	8,656.02	0.20	Regional Commercial	0.1	0.5	0	0.0000	0.0004	Future
303-18-036	RGCO	9,198.41	0.21	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-19-077	RGCO	18,664.05	0.43	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
303-19-075	RGCO	9,375.00	0.22	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-20-068	RGCO	8,879.83	0.20	Regional Commercial	0.1	0.5	0	0.0000	0.0004	Future
303-20-069	RGCO	2,310.91	0.05	Regional Commercial	0.1	0.5	0	0.0000	0.0001	Future
303-20-070	RGCO	3,080.93	0.07	Regional Commercial	0.1	0.5	0	0.0000	0.0002	Future
303-20-071	RGCO	10,741.45	0.25	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-20-072	RGCO	4,061.67	0.09	Regional Commercial	0.1	0.5	0	0.0000	0.0002	Future
303-20-074	RGCO	11,981.14	0.28	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
303-18-035	RGCO	11,513.82	0.26	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
296-20-006	RGCO	21,323.88	0.49	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
290-02-096	CMXU	9,078.63	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
290-05-053	CMXU	28,774.74	0.66	Community Commercial	0.1	0.4	25	0.0025	0.0012	Future
290-01-123	CMXU	138,195.80	3.17	Community Commercial	0.1	0.4	25	0.0122	0.0055	Future
290-23-048	MDRE	49,544.21	1.14	Medium Density Residential	154	0	25	0.0044	0.0000	Future
290-39-037	NHMX	48,028.13	1.10	Neighborhood Commercial	0.1	0.3	25	0.0042	0.0014	Future
290-39-083	NHMX	16,996.75	0.39	Neighborhood Commercial	0.1	0.3	25	0.0015	0.0005	Future
290-23-092	NHMX	61,504.56	1.41	Neighborhood Commercial	0.1	0.3	25	0.0054	0.0018	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-39-053	NHMX	40,305.12	0.93	Neighborhood Commercial	0.1	0.3	25	0.0036	0.0012	Future
290-39-081	NHMX	16,798.50	0.39	Neighborhood Commercial	0.1	0.3	25	0.0015	0.0005	Future
290-39-012	NHMX	15,174.41	0.35	Neighborhood Commercial	0.1	0.3	25	0.0013	0.0005	Future
290-39-035	NHMX	19,585.89	0.45	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
293-02-028	NHMX	208,966.89	4.80	Neighborhood Commercial	0.1	0.3	25	0.0185	0.0063	Future
290-39-065	NHMX	23,534.53	0.54	Neighborhood Commercial	0.1	0.3	25	0.0021	0.0007	Future
290-23-053	NHMX	159,663.43	3.67	Neighborhood Commercial	0.1	0.3	25	0.0141	0.0048	Future
290-23-049	NHMX	84,194.27	1.93	Neighborhood Commercial	0.1	0.3	25	0.0074	0.0025	Future
290-23-071	NHMX	46,444.96	1.07	Neighborhood Commercial	0.1	0.3	25	0.0041	0.0014	Future
293-02-036	NHMX	61,913.63	1.42	Neighborhood Commercial	0.1	0.3	25	0.0055	0.0019	Future
269-20-020	CMXU	5,784.49	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-28-061	CMXU	25,783.00	0.59	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
269-20-099	CMXU	3,996.19	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-075	CMXU	3,608.44	0.08	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
269-28-024	CMXU	9,180.95	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
269-20-101	CMXU	3,758.41	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0002	Future
224-26-050	CMXU	10,726.43	0.25	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
293-02-025	NHMX	17,597.17	0.40	Neighborhood Commercial	0.1	0.3	25	0.0016	0.0005	Future
293-02-029	NHMX	15,975.24	0.37	Neighborhood Commercial	0.1	0.3	25	0.0014	0.0005	Future
293-02-021	NHMX	29,723.03	0.68	Neighborhood Commercial	0.1	0.3	25	0.0026	0.0009	Future
293-25-037	NHMX	22,463.73	0.52	Neighborhood Commercial	0.1	0.3	25	0.0020	0.0007	Future
104-14-095	LDRD	46,270.51	1.06	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
104-14-024	LDRD	31,233.37	0.72	Office: 100%	0.1	0.85	0	0.0000	0.0027	Future
104-14-096	LDRD	21,592.89	0.50	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
104-16-112	RGCO	910,541.85	20.90	Regional Commercial	0.1	0.5	0	0.0000	0.0455	Future
104-16-111	RGCO	131,271.33	3.01	Regional Commercial	0.1	0.5	0	0.0000	0.0066	Future
104-50-025	LDRD	359,669.04	8.26	Office: 100%	0.1	0.85	0	0.0000	0.0306	Future
296-20-003	RGCO	28,882.37	0.66	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
296-20-011	RGCO	111,910.33	2.57	Regional Commercial	0.1	0.5	0	0.0000	0.0056	Future
104-52-024	LDRD	523,726.09	12.02	Office: 100%	0.1	0.85	0	0.0000	0.0445	Future
104-52-023	HDRD	942,817.65	21.64	Office	0.15	1.25	0	0.0000	0.1768	Future
290-39-050	PUQP	16,357.67	0.38	Public/Institutional	0.21	0.2	0	0.0000	0.0007	Future
296-21-010	RGCO	100,277.78	2.30	Regional Commercial	0.1	0.5	0	0.0000	0.0050	Future
296-21-009	RGCO	28,038.05	0.64	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
296-21-008	RGCO	28,053.03	0.64	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
296-21-007	RGCO	25,832.30	0.59	Regional Commercial	0.1	0.5	0	0.0000	0.0013	Future
296-21-005	RGCO	19,411.04	0.45	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
296-21-006	RGCO	19,507.52	0.45	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
296-20-004	RGCO	45,412.92	1.04	Regional Commercial	0.1	0.5	0	0.0000	0.0023	Future
296-34-017	RGCO	82,216.67	1.89	Regional Commercial	0.1	0.5	0	0.0000	0.0041	Future
296-34-018	RGCO	39,059.89	0.90	Regional Commercial	0.1	0.5	0	0.0000	0.0020	Future
224-29-017	CMXU	7,496.67	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
216-28-113	LHIN	143,382.91	3.29	Light Industrial	0.15	0.85	0	0.0000	0.0183	Future
216-28-126	LHIN	191,506.23	4.40	Light Industrial	0.15	0.85	0	0.0000	0.0244	Future
294-18-034	NHMX	22,695.80	0.52	Neighborhood Commercial	0.1	0.3	25	0.0020	0.0007	Future
296-17-036	RGCO	11,138.36	0.26	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
296-17-001	RGCO	16,631.96	0.38	Regional Commercial	0.1	0.5	0	0.0000	0.0008	Future
296-17-037	RGCO	9,679.83	0.22	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
296-20-005	RGCO	17,441.64	0.40	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
296-21-030	RGCO	33,437.98	0.77	Regional Commercial	0.1	0.5	0	0.0000	0.0017	Future
296-21-011	RGCO	17,214.11	0.40	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
296-21-012	RGCO	49,573.01	1.14	Regional Commercial	0.1	0.5	0	0.0000	0.0025	Future
296-37-030	RGCO	71,651.08	1.64	Regional Commercial	0.1	0.5	0	0.0000	0.0036	Future
296-37-031	RGCO	47,537.77	1.09	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
296-34-015	RGCO	135,803.85	3.12	Regional Commercial	0.1	0.5	0	0.0000	0.0068	Future
296-34-016	RGCO	300,944.07	6.91	Regional Commercial	0.1	0.5	0	0.0000	0.0150	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-50-001	LDRD	161,596.64	3.71	Office: 100%	0.1	0.85	0	0.0000	0.0137	Future
230-05-057	RGCO	37,460.68	0.86	Regional Commercial	0.1	0.5	0	0.0000	0.0019	Future
104-01-100	HDRD	896,389.01	20.58	Office	0.15	1.25	0	0.0000	0.1681	Future
104-04-117	LDRD	187,293.35	4.30	Office: 100%	0.1	0.85	0	0.0000	0.0159	Future
104-04-147	LDRD	38,029.74	0.87	Office: 100%	0.1	0.85	0	0.0000	0.0032	Future
104-15-101	LDRD	1,585.42	0.04	Office: 100%	0.1	0.85	0	0.0000	0.0001	Future
104-50-011	LDRD	245,423.15	5.63	Office: 100%	0.1	0.85	0	0.0000	0.0209	Future
104-50-018	LDRD	299,221.75	6.87	Office: 100%	0.1	0.85	0	0.0000	0.0254	Future
104-50-007	LDRD	163,238.01	3.75	Office: 100%	0.1	0.85	0	0.0000	0.0139	Future
104-50-016	LDRD	472,755.41	10.85	Office: 100%	0.1	0.85	0	0.0000	0.0402	Future
104-01-107	HDRD	3,590.42	0.08	Office	0.15	1.25	0	0.0000	0.0007	Future
104-52-026	HDRD	374,809.37	8.60	Office	0.15	1.25	0	0.0000	0.0703	Future
104-04-119	LDRD	159,816.73	3.67	Office: 100%	0.1	0.85	0	0.0000	0.0136	Future
104-04-118	LDRD	175,792.09	4.04	Office: 100%	0.1	0.85	0	0.0000	0.0149	Future
104-43-054	RGCO	170,051.74	3.90	Regional Commercial	0.1	0.5	0	0.0000	0.0085	Future
104-42-017	HDRD	280,398.58	6.44	Office	0.15	1.25	0	0.0000	0.0526	Future
104-04-120	LDRD	166,248.03	3.82	Office: 100%	0.1	0.85	0	0.0000	0.0141	Future
104-16-091	RGCO	162,086.73	3.72	Regional Commercial	0.1	0.5	0	0.0000	0.0081	Future
104-14-120	LDRD	24,376.36	0.56	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future
104-14-121	LDRD	19,520.29	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-14-131	LDRD	19,544.67	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-14-154	LDRD	42,839.05	0.98	Office: 100%	0.1	0.85	0	0.0000	0.0036	Future
104-14-159	LDRD	124,601.55	2.86	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
104-14-160	LDRD	238,912.02	5.48	Office: 100%	0.1	0.85	0	0.0000	0.0203	Future
104-48-010	HDRD	1,695,829.23	38.93	Office	0.15	1.25	0	0.0000	0.3180	Future
104-38-011	LDRD	157,141.89	3.61	Office: 100%	0.1	0.85	0	0.0000	0.0134	Future
104-16-113	HDRD	609,770.70	14.00	Office	0.15	1.25	0	0.0000	0.1143	Future
104-13-090	LDRD	208,242.04	4.78	Office: 100%	0.1	0.85	0	0.0000	0.0177	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-13-091	LDRD	56,780.67	1.30	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
104-13-094	LDRD	215,698.87	4.95	Office: 100%	0.1	0.85	0	0.0000	0.0183	Future
104-13-095	LDRD	215,831.58	4.95	Office: 100%	0.1	0.85	0	0.0000	0.0183	Future
216-29-116	LHIN	277,119.40	6.36	Light Industrial	0.15	0.85	0	0.0000	0.0353	Future
104-12-180	NHMX	10,379.13	0.24	Neighborhood Commercial	0.1	0.3	25	0.0009	0.0003	Future
104-15-087	LDRD	81,123.41	1.86	Office: 100%	0.1	0.85	0	0.0000	0.0069	Future
104-15-061	LDRD	56,001.87	1.29	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
104-15-047	LDRD	40,392.68	0.93	Office: 100%	0.1	0.85	0	0.0000	0.0034	Future
104-51-004	LDRD	35,579.63	0.82	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
104-15-127	LDRD	30,658.22	0.70	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-15-089	LDRD	58,355.47	1.34	Office: 100%	0.1	0.85	0	0.0000	0.0050	Future
104-51-011	LDRD	27,074.40	0.62	Office: 100%	0.1	0.85	0	0.0000	0.0023	Future
104-15-096	LDRD	54,801.05	1.26	Office: 100%	0.1	0.85	0	0.0000	0.0047	Future
104-51-012	LDRD	27,699.23	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-15-114	LDRD	10,746.71	0.25	Office: 100%	0.1	0.85	0	0.0000	0.0009	Future
104-51-003	LDRD	32,105.77	0.74	Office: 100%	0.1	0.85	0	0.0000	0.0027	Future
104-51-002	LDRD	28,444.71	0.65	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-001	LDRD	23,285.21	0.53	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-15-105	LDRD	5,951.68	0.14	Office: 100%	0.1	0.85	0	0.0000	0.0005	Future
104-15-109	LDRD	235,123.60	5.40	Office: 100%	0.1	0.85	0	0.0000	0.0200	Future
104-15-113	LDRD	125,741.82	2.89	Office: 100%	0.1	0.85	0	0.0000	0.0107	Future
104-15-135	LDRD	48,996.33	1.12	Office: 100%	0.1	0.85	0	0.0000	0.0042	Future
104-15-128	LDRD	102,258.97	2.35	Office: 100%	0.1	0.85	0	0.0000	0.0087	Future
104-15-123	LDRD	177,907.28	4.08	Office: 100%	0.1	0.85	0	0.0000	0.0151	Future
104-15-097	LDRD	239,795.76	5.50	Office: 100%	0.1	0.85	0	0.0000	0.0204	Future
104-15-122	LDRD	185,710.26	4.26	Office: 100%	0.1	0.85	0	0.0000	0.0158	Future
104-15-124	LDRD	52,383.65	1.20	Office: 100%	0.1	0.85	0	0.0000	0.0045	Future
104-15-130	LDRD	268,248.12	6.16	Office: 100%	0.1	0.85	0	0.0000	0.0228	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-15-134	LDRD	124,677.01	2.86	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
104-14-091	LDRD	95,797.97	2.20	Office: 100%	0.1	0.85	0	0.0000	0.0081	Future
104-15-133	LDRD	136,626.87	3.14	Office: 100%	0.1	0.85	0	0.0000	0.0116	Future
104-39-012	LDRD	46,027.35	1.06	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
104-15-132	LDRD	35,477.40	0.81	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
104-15-125	LDRD	110,690.62	2.54	Office: 100%	0.1	0.85	0	0.0000	0.0094	Future
104-14-125	LDRD	248,197.72	5.70	Office: 100%	0.1	0.85	0	0.0000	0.0211	Future
104-14-158	LDRD	66,441.61	1.53	Office: 100%	0.1	0.85	0	0.0000	0.0056	Future
104-14-068	LDRD	18,508.21	0.42	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
104-14-089	LDRD	201,639.86	4.63	Office: 100%	0.1	0.85	0	0.0000	0.0171	Future
104-14-142	LDRD	37,016.40	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
104-14-111	LDRD	27,695.18	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-14-110	LDRD	40,106.86	0.92	Office: 100%	0.1	0.85	0	0.0000	0.0034	Future
104-14-143	LDRD	16,149.72	0.37	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
104-14-144	LDRD	17,509.25	0.40	Office: 100%	0.1	0.85	0	0.0000	0.0015	Future
104-14-171	LDRD	289,159.69	6.64	Office: 100%	0.1	0.85	0	0.0000	0.0246	Future
104-14-140	LDRD	36,975.96	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
104-14-139	LDRD	52,502.92	1.21	Office: 100%	0.1	0.85	0	0.0000	0.0045	Future
104-14-168	LDRD	284,381.69	6.53	Office: 100%	0.1	0.85	0	0.0000	0.0242	Future
104-14-166	LDRD	43,576.87	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
104-14-170	LDRD	29,087.38	0.67	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
104-14-133	LDRD	15,395.68	0.35	Office: 100%	0.1	0.85	0	0.0000	0.0013	Future
104-14-114	LDRD	49,019.67	1.13	Office: 100%	0.1	0.85	0	0.0000	0.0042	Future
104-14-161	LDRD	43,451.86	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
104-14-132	LDRD	32,756.94	0.75	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-14-146	LDRD	43,629.84	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
104-14-169	LDRD	169,127.91	3.88	Office: 100%	0.1	0.85	0	0.0000	0.0144	Future
104-14-106	LDRD	66,746.62	1.53	Office: 100%	0.1	0.85	0	0.0000	0.0057	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-14-118	LDRD	39,669.06	0.91	Office: 100%	0.1	0.85	0	0.0000	0.0034	Future
104-14-156	LDRD	76,619.12	1.76	Office: 100%	0.1	0.85	0	0.0000	0.0065	Future
104-14-107	LDRD	50,125.41	1.15	Office: 100%	0.1	0.85	0	0.0000	0.0043	Future
104-14-164	LDRD	46,277.09	1.06	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
104-14-108	LDRD	19,513.18	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-13-097	HDRD	42,636.40	0.98	Office	0.15	1.25	0	0.0000	0.0080	Future
104-14-113	LDRD	24,349.67	0.56	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future
216-48-030	LDRD	78,112.76	1.79	Office: 100%	0.1	0.85	0	0.0000	0.0066	Future
216-32-030	LDRD	90,656.42	2.08	Office: 100%	0.1	0.85	0	0.0000	0.0077	Future
216-48-026	LDRD	53,536.77	1.23	Office: 100%	0.1	0.85	0	0.0000	0.0046	Future
216-46-019	LHIN	73,951.07	1.70	Light Industrial	0.15	0.85	0	0.0000	0.0094	Future
216-48-005	LDRD	97,626.99	2.24	Office: 100%	0.1	0.85	0	0.0000	0.0083	Future
216-48-004	LDRD	94,115.77	2.16	Office: 100%	0.1	0.85	0	0.0000	0.0080	Future
216-48-035	LDRD	111,197.42	2.55	Office: 100%	0.1	0.85	0	0.0000	0.0095	Future
216-32-040	LDRD	361,825.88	8.31	Office: 100%	0.1	0.85	0	0.0000	0.0308	Future
216-32-041	LDRD	74,070.56	1.70	Office: 100%	0.1	0.85	0	0.0000	0.0063	Future
216-48-003	LDRD	131,522.42	3.02	Office: 100%	0.1	0.85	0	0.0000	0.0112	Future
216-29-107	LHIN	147,528.17	3.39	Light Industrial	0.15	0.85	0	0.0000	0.0188	Future
216-29-083	LHIN	43,868.28	1.01	Light Industrial	0.15	0.85	0	0.0000	0.0056	Future
216-49-023	LDRD	151,178.71	3.47	Office: 100%	0.1	0.85	0	0.0000	0.0129	Future
216-01-041	CMXU	27,647.14	0.63	Community Commercial	0.1	0.4	25	0.0024	0.0011	Future
216-01-060	CMXU	63,809.87	1.46	Community Commercial	0.1	0.4	25	0.0056	0.0026	Future
216-01-059	RGMX	38,518.76	0.88	Regional Commercial	0.1	0.5	40	0.0054	0.0019	Future
216-01-051	CMXU	28,186.25	0.65	Community Commercial	0.1	0.4	25	0.0025	0.0011	Future
290-39-034	NHMX	19,585.27	0.45	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
290-39-033	NHMX	19,583.68	0.45	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
290-08-010	CMXU	15,857.59	0.36	Community Commercial	0.1	0.4	25	0.0014	0.0006	Future
290-08-141	CMXU	17,637.41	0.40	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-08-135	CMXU	21,723.07	0.50	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
216-26-027	MDRE	12,224.97	0.28	Medium Density Residential	154	0	25	0.0011	0.0000	Future
216-26-028	MDRE	13,090.94	0.30	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-029	MDRE	14,020.44	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-030	MDRE	13,942.08	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-031	MDRE	13,941.47	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-032	MDRE	13,927.52	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-033	MDRE	13,913.87	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-034	MDRE	13,899.89	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-035	MDRE	13,896.39	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-036	MDRE	27,978.65	0.64	Medium Density Residential	154	0	25	0.0025	0.0000	Future
216-48-025	LDRD	71,026.36	1.63	Office: 100%	0.1	0.85	0	0.0000	0.0060	Future
216-29-106	LHIN	93,596.65	2.15	Light Industrial	0.15	0.85	0	0.0000	0.0119	Future
213-37-015	RGMX	43,810.63	1.01	Regional Commercial	0.1	0.5	40	0.0062	0.0022	Future
313-05-012	RGMX	51,476.79	1.18	Regional Commercial	0.1	0.5	40	0.0073	0.0026	Future
224-09-173	LHIN	20,081.82	0.46	Light Industrial	0.15	0.85	0	0.0000	0.0026	Future
224-09-178	HDRD	320,161.58	7.35	Office	0.15	1.25	0	0.0000	0.0600	Future
224-47-011	HDRD	147,038.83	3.38	Office	0.15	1.25	0	0.0000	0.0276	Future
269-28-029	CMXU	12,611.17	0.29	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
269-20-000	CMXU	13,257.80	0.30	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
269-16-081	LDRE	40,665.93	0.93	Low Density Residential	245	25	25	0.0057	0.0000	Future
269-05-058	CMXU	5,066.77	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
224-08-146	LDRD	242,279.02	5.56	Office: 100%	0.1	0.85	0	0.0000	0.0206	Future
224-42-001	LDRD	56,303.38	1.29	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
224-42-011	LDRD	27,425.81	0.63	Office: 100%	0.1	0.85	0	0.0000	0.0023	Future
224-42-010	LDRD	29,601.66	0.68	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
224-47-010	HDRD	90,447.13	2.08	Office	0.15	1.25	0	0.0000	0.0170	Future
224-09-168	LDRD	141,873.70	3.26	Office: 100%	0.1	0.85	0	0.0000	0.0121	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-09-176	LDRD	37,256.71	0.86	Office: 100%	0.1	0.85	0	0.0000	0.0032	Future
224-09-175	LDRD	51,330.24	1.18	Office: 100%	0.1	0.85	0	0.0000	0.0044	Future
224-47-009	HDRD	88,616.97	2.03	Office	0.15	1.25	0	0.0000	0.0166	Future
224-47-018	HDRD	187,994.16	4.32	Office	0.15	1.25	0	0.0000	0.0352	Future
269-26-092	CMXU	5,045.57	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-065	CMXU	26,816.67	0.62	Community Commercial	0.1	0.4	25	0.0024	0.0011	Future
269-28-028	CMXU	6,806.80	0.16	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
269-26-079	CMXU	5,538.36	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-26-120	CMXU	5,411.85	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-26-084	CMXU	9,310.59	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
269-26-081	CMXU	7,925.53	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-20-065	CMXU	11,043.91	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
269-26-082	CMXU	5,078.92	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-011	CMXU	3,873.44	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0002	Future
269-20-053	CMXU	10,883.87	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
269-26-121	CMXU	8,170.95	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-20-037	CMXU	10,487.24	0.24	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
294-01-003	CMXU	19,029.93	0.44	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
294-01-006	CMXU	18,958.54	0.44	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
269-28-012	CMXU	4,638.02	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-20-038	CMXU	6,308.92	0.14	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
269-20-039	CMXU	6,131.89	0.14	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-28-067	CMXU	4,940.43	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-066	CMXU	4,782.93	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-20-098	CMXU	3,747.28	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
269-20-021	CMXU	5,648.19	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-20-100	CMXU	3,521.06	0.08	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
269-28-018	CMXU	6,061.11	0.14	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
269-28-025	CMXU	4,653.62	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-074	CMXU	4,009.02	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-015	CMXU	7,590.17	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-28-054	CMXU	3,855.92	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0002	Future
269-28-073	CMXU	8,234.43	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-16-034	CMXU	40,806.52	0.94	Community Commercial	0.1	0.4	25	0.0036	0.0016	Future
294-36-001	RGCO	9,162.97	0.21	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
294-35-021	RGCO	8,695.67	0.20	Regional Commercial	0.1	0.5	0	0.0000	0.0004	Future
294-36-002	MDRE	9,312.85	0.21	Medium Density Residential	154	0	25	0.0008	0.0000	Future
294-35-020	MDRE	8,936.77	0.21	Medium Density Residential	154	0	25	0.0008	0.0000	Future
294-39-010	CMXU	25,661.70	0.59	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
294-39-004	CMXU	6,113.49	0.14	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
294-39-009	CMXU	25,319.39	0.58	Community Commercial	0.1	0.4	25	0.0022	0.0010	Future
294-35-023	RGCO	108,335.81	2.49	Regional Commercial	0.1	0.5	0	0.0000	0.0054	Future
294-39-002	CMXU	44,529.78	1.02	Community Commercial	0.1	0.4	25	0.0039	0.0018	Future
294-39-001	CMXU	127,776.81	2.93	Community Commercial	0.1	0.4	25	0.0113	0.0051	Future
294-35-025	RGCO	78,581.26	1.80	Regional Commercial	0.1	0.5	0	0.0000	0.0039	Future
294-01-015	CMXU	132,726.89	3.05	Community Commercial	0.1	0.4	25	0.0117	0.0053	Future
294-01-004	CMXU	22,443.42	0.52	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
294-01-011	CMXU	23,291.59	0.53	Community Commercial	0.1	0.4	25	0.0021	0.0009	Future
294-18-035	NHMX	395,927.79	9.09	Neighborhood Commercial	0.1	0.3	25	0.0350	0.0119	Future
216-29-059	LHIN	80,632.00	1.85	Light Industrial	0.15	0.85	0	0.0000	0.0103	Future
216-46-002	HDRD	183,201.72	4.21	Office	0.15	1.25	0	0.0000	0.0344	Future
216-49-017	LDRD	155,505.49	3.57	Office: 100%	0.1	0.85	0	0.0000	0.0132	Future
216-49-019	LDRD	166,629.95	3.83	Office: 100%	0.1	0.85	0	0.0000	0.0142	Future
216-49-018	LDRD	149,900.69	3.44	Office: 100%	0.1	0.85	0	0.0000	0.0127	Future
216-31-063	LDRD	89,829.40	2.06	Office: 100%	0.1	0.85	0	0.0000	0.0076	Future
224-28-064	CMXU	25,154.69	0.58	Community Commercial	0.1	0.4	25	0.0022	0.0010	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
294-01-010	CMXU	114,948.89	2.64	Community Commercial	0.1	0.4	25	0.0102	0.0046	Future
294-18-031	NHMX	13,733.57	0.32	Neighborhood Commercial	0.1	0.3	25	0.0012	0.0004	Future
269-16-083	LDRE	21,969.79	0.50	Low Density Residential	245	25	25	0.0031	0.0000	Future
269-16-082	LDRE	6,750.64	0.15	Low Density Residential	245	25	25	0.0009	0.0000	Future
316-19-032	RGCO	39,604.73	0.91	Regional Commercial	0.1	0.5	0	0.0000	0.0020	Future
313-06-003	RGMX	29,253.05	0.67	Regional Commercial	0.1	0.5	40	0.0041	0.0015	Future
313-05-010	RGMX	29,601.59	0.68	Regional Commercial	0.1	0.5	40	0.0042	0.0015	Future
313-05-011	RGMX	56,183.00	1.29	Regional Commercial	0.1	0.5	40	0.0079	0.0028	Future
205-38-023	DHRE	87,447.39	2.01	High Density Residential	154	40	40	0.0124	0.0000	Future
205-38-021	DHRE	194,466.58	4.46	High Density Residential	154	40	40	0.0275	0.0000	Future
205-38-024	DHRE	82,952.93	1.90	High Density Residential	154	40	40	0.0117	0.0000	Future
205-38-001	DHRE	35,017.13	0.80	High Density Residential	154	40	40	0.0050	0.0000	Future
205-38-007	DHRE	39,416.06	0.90	High Density Residential	154	40	40	0.0056	0.0000	Future
205-38-008	DHRE	39,857.56	0.92	High Density Residential	154	40	40	0.0056	0.0000	Future
205-38-022	DHRE	76,671.09	1.76	High Density Residential	154	40	40	0.0108	0.0000	Future
205-38-020	DHRE	24,243.28	0.56	High Density Residential	154	40	40	0.0034	0.0000	Future
230-08-021	LDRE	10,700.73	0.25	Low Density Residential	245	25	25	0.0015	0.0000	Future
216-28-094	LDRD	152,700.83	3.51	Office: 100%	0.1	0.85	0	0.0000	0.0130	Future
230-06-049	RGMX	131,470.74	3.02	Regional Commercial	0.1	0.5	40	0.0186	0.0066	Future
230-06-048	RGMX	33,651.84	0.77	Regional Commercial	0.1	0.5	40	0.0048	0.0017	Future
205-39-002	DHRE	109,402.55	2.51	High Density Residential	154	40	40	0.0155	0.0000	Future
205-39-024	MDRE	29,086.65	0.67	Medium Density Residential	154	0	25	0.0026	0.0000	Future
269-01-085	CMXU	53,012.27	1.22	Community Commercial	0.1	0.4	25	0.0047	0.0021	Future
269-02-077	CMXU	30,191.78	0.69	Community Commercial	0.1	0.4	25	0.0027	0.0012	Future
269-02-078	CMXU	13,026.73	0.30	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
269-02-080	CMXU	10,578.66	0.24	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
230-06-033	RGMX	548,274.30	12.59	Regional Commercial	0.1	0.5	40	0.0775	0.0274	Future
213-35-032	RGMX	50,554.93	1.16	Regional Commercial	0.1	0.5	40	0.0071	0.0025	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
213-35-035	RGMX	95,178.19	2.18	Regional Commercial	0.1	0.5	40	0.0135	0.0048	Future
274-43-059	RGCO	19,161.77	0.44	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
224-49-010	CMXU	60,265.32	1.38	Community Commercial	0.1	0.4	25	0.0053	0.0024	Future
230-08-018	LDRE	21,973.57	0.50	Low Density Residential	245	25	25	0.0031	0.0000	Future
230-08-019	LDRE	9,003.59	0.21	Low Density Residential	245	25	25	0.0013	0.0000	Future
230-08-020	LDRE	6,561.48	0.15	Low Density Residential	245	25	25	0.0009	0.0000	Future
216-28-083	LDRD	214,833.40	4.93	Office: 100%	0.1	0.85	0	0.0000	0.0183	Future
216-48-032	LDRD	55,403.94	1.27	Office: 100%	0.1	0.85	0	0.0000	0.0047	Future
216-48-029	LDRD	85,689.32	1.97	Office: 100%	0.1	0.85	0	0.0000	0.0073	Future
224-04-071	HYIN	322,762.73	7.41	Heavy Industrial	0.15	1.25	0	0.0000	0.0605	Future
224-10-119	LDRD	180,002.68	4.13	Office: 100%	0.1	0.85	0	0.0000	0.0153	Future
224-10-069	LDRD	94,509.08	2.17	Office: 100%	0.1	0.85	0	0.0000	0.0080	Future
224-10-130	LDRD	58,158.84	1.34	Office: 100%	0.1	0.85	0	0.0000	0.0049	Future
224-10-107	LDRD	30,686.39	0.70	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
224-10-106	LDRD	19,213.62	0.44	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
224-10-105	LDRD	148,684.73	3.41	Office: 100%	0.1	0.85	0	0.0000	0.0126	Future
224-10-080	LDRD	61,246.48	1.41	Office: 100%	0.1	0.85	0	0.0000	0.0052	Future
224-10-118	LDRD	77,019.71	1.77	Office: 100%	0.1	0.85	0	0.0000	0.0065	Future
224-10-066	LDRD	32,927.93	0.76	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
224-10-068	LDRD	37,041.51	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-10-067	LDRD	36,958.61	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-11-064	LDRD	411,756.58	9.45	Office: 100%	0.1	0.85	0	0.0000	0.0350	Future
224-11-063	LDRD	280,884.22	6.45	Office: 100%	0.1	0.85	0	0.0000	0.0239	Future
224-58-001	PUQP	414,248.77	9.51	Public/Institutional	0.21	0.2	0	0.0000	0.0174	Future
224-57-008	LDRD	35,388.10	0.81	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
224-45-009	LDRD	35,765.74	0.82	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
230-07-014	LDRE	5,533.35	0.13	Low Density Residential	245	25	25	0.0008	0.0000	Future
230-07-047	LDRE	22,778.52	0.52	Low Density Residential	245	25	25	0.0032	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
230-07-048	LDRE	7,214.30	0.17	Low Density Residential	245	25	25	0.0010	0.0000	Future
230-07-045	LDRE	8,284.00	0.19	Low Density Residential	245	25	25	0.0012	0.0000	Future
230-07-046	LDRE	4,658.13	0.11	Low Density Residential	245	25	25	0.0007	0.0000	Future
230-06-042	PUQP	520,830.24	11.96	Public/Institutional	0.21	0.2	0	0.0000	0.0219	Future
269-05-011	CMXU	5,249.97	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-05-056	CMXU	5,223.89	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-05-003	CMXU	5,049.62	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-05-091	MDRE	8,193.12	0.19	Medium Density Residential	154	0	25	0.0007	0.0000	Future
269-05-093	CMXU	16,596.41	0.38	Community Commercial	0.1	0.4	25	0.0015	0.0007	Future
230-09-017	RGMX	52,635.73	1.21	Regional Commercial	0.1	0.5	40	0.0074	0.0026	Future
230-09-020	RGMX	481,376.41	11.05	Regional Commercial	0.1	0.5	40	0.0681	0.0241	Future
230-08-061	RGMX	31,261.22	0.72	Regional Commercial	0.1	0.5	40	0.0044	0.0016	Future
230-08-078	RGMX	89,580.36	2.06	Regional Commercial	0.1	0.5	40	0.0127	0.0045	Future
269-02-039	CMXU	5,529.70	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-02-006	CMXU	5,458.81	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-02-008	CMXU	5,100.25	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-02-082	CMXU	6,828.27	0.16	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
269-03-003	CMXU	7,875.27	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-02-005	CMXU	7,968.31	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-02-004	CMXU	7,979.70	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-03-004	CMXU	11,000.36	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
269-03-006	CMXU	4,000.14	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-02-079	CMXU	8,975.61	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
269-03-132	CMXU	1,564.90	0.04	Community Commercial	0.1	0.4	25	0.0001	0.0001	Future
269-03-051	CMXU	23,569.95	0.54	Community Commercial	0.1	0.4	25	0.0021	0.0009	Future
269-02-083	CMXU	34,085.10	0.78	Community Commercial	0.1	0.4	25	0.0030	0.0014	Future
216-28-062	LHIN	85,429.32	1.96	Light Industrial	0.15	0.85	0	0.0000	0.0109	Future
216-28-091	LDRD	84,980.10	1.95	Office: 100%	0.1	0.85	0	0.0000	0.0072	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
216-28-092	LDRD	11,676.99	0.27	Office: 100%	0.1	0.85	0	0.0000	0.0010	Future
216-28-093	LDRD	5,193.89	0.12	Office: 100%	0.1	0.85	0	0.0000	0.0004	Future
216-28-103	LDRD	125,080.84	2.87	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
216-28-102	LDRD	265,103.47	6.09	Office: 100%	0.1	0.85	0	0.0000	0.0225	Future
216-28-127	LHIN	223,792.30	5.14	Light Industrial	0.15	0.85	0	0.0000	0.0285	Future
216-28-044	LHIN	108,141.49	2.48	Light Industrial	0.15	0.85	0	0.0000	0.0138	Future
216-28-089	LDRD	256,220.27	5.88	Office: 100%	0.1	0.85	0	0.0000	0.0218	Future
216-28-090	LDRD	7,325.70	0.17	Office: 100%	0.1	0.85	0	0.0000	0.0006	Future
216-28-084	LDRD	7,511.17	0.17	Office: 100%	0.1	0.85	0	0.0000	0.0006	Future
216-28-055	LHIN	82,516.42	1.89	Light Industrial	0.15	0.85	0	0.0000	0.0105	Future
216-28-047	LHIN	53,122.75	1.22	Light Industrial	0.15	0.85	0	0.0000	0.0068	Future
224-06-169	LDRD	20,348.77	0.47	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
224-06-149	LDRD	56,242.08	1.29	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
224-06-142	LDRD	35,499.06	0.81	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
216-26-070	MDRE	36,540.64	0.84	Medium Density Residential	154	0	25	0.0032	0.0000	Future
216-28-115	LHIN	137,562.20	3.16	Light Industrial	0.15	0.85	0	0.0000	0.0175	Future
216-31-069	LDRD	125,038.39	2.87	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
216-30-053	HDRD	128,918.91	2.96	Office	0.15	1.25	0	0.0000	0.0242	Future
216-30-042	HDRD	23,650.32	0.54	Office	0.15	1.25	0	0.0000	0.0044	Future
216-31-068	LDRD	236,103.75	5.42	Office: 100%	0.1	0.85	0	0.0000	0.0201	Future
216-30-044	HDRD	61,150.67	1.40	Office	0.15	1.25	0	0.0000	0.0115	Future
216-30-043	HDRD	19,180.76	0.44	Office	0.15	1.25	0	0.0000	0.0036	Future
224-65-010	LDRD	546,769.64	12.55	Office: 100%	0.1	0.85	0	0.0000	0.0465	Future
216-26-042	MDRE	12,284.17	0.28	Medium Density Residential	154	0	25	0.0011	0.0000	Future
216-26-041	MDRE	14,342.90	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-040	MDRE	14,354.33	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-043	MDRE	14,269.73	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-039	MDRE	28,745.58	0.66	Medium Density Residential	154	0	25	0.0025	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
216-26-038	MDRE	14,391.60	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-037	MDRE	16,815.24	0.39	Medium Density Residential	154	0	25	0.0015	0.0000	Future
224-71-006	LDRD	3,156.19	0.07	Office: 100%	0.1	0.85	0	0.0000	0.0003	Future
269-20-062	CMXU	1,790.65	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-061	CMXU	1,732.17	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-060	CMXU	1,722.60	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-059	CMXU	1,722.33	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-058	CMXU	1,732.82	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-057	CMXU	1,790.54	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
216-50-005	LDRD	7,974.91	0.18	Office: 100%	0.1	0.85	0	0.0000	0.0007	Future
269-05-104	CMXU	659.00	0.02	Community Commercial	0.1	0.4	25	0.0001	0.0000	Future
216-28-114	LHIN	138,163.27	3.17	Light Industrial	0.15	0.85	0	0.0000	0.0176	Future
216-48-031	LDRD	795,820.37	18.27	Office: 100%	0.1	0.85	0	0.0000	0.0676	Future
216-48-006	LDRD	75,580.15	1.74	Office: 100%	0.1	0.85	0	0.0000	0.0064	Future
216-31-032	RGCO	44,669.28	1.03	Regional Commercial	0.1	0.5	0	0.0000	0.0022	Future
216-31-072	HDRD	21,880.32	0.50	Office	0.15	1.25	0	0.0000	0.0041	Future
216-31-071	HDRD	57,595.21	1.32	Office	0.15	1.25	0	0.0000	0.0108	Future
216-26-073	MDRE	30,638.70	0.70	Medium Density Residential	154	0	25	0.0027	0.0000	Future
224-06-146	LDRD	6,350.31	0.15	Office: 100%	0.1	0.85	0	0.0000	0.0005	Future
224-06-175	LDRD	5,020.27	0.12	Office: 100%	0.1	0.85	0	0.0000	0.0004	Future
224-06-085	LDRD	36,326.27	0.83	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-06-119	LDRD	18,751.84	0.43	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
224-06-120	LDRD	2,271.83	0.05	Office: 100%	0.1	0.85	0	0.0000	0.0002	Future
224-28-039	CMXU	9,300.57	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-29-008	CMXU	7,826.61	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-29-023	CMXU	6,795.49	0.16	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
224-29-009	CMXU	8,474.60	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-29-010	CMXU	11,433.43	0.26	Community Commercial	0.1	0.4	25	0.0010	0.0005	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-29-016	CMXU	7,496.72	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
216-31-062	LDRD	113,507.12	2.61	Office: 100%	0.1	0.85	0	0.0000	0.0096	Future
216-30-050	HDRD	43,557.94	1.00	Office	0.15	1.25	0	0.0000	0.0082	Future
216-30-057	HDRD	38,594.54	0.89	Office	0.15	1.25	0	0.0000	0.0072	Future
216-31-070	LDRD	105,255.55	2.42	Office: 100%	0.1	0.85	0	0.0000	0.0089	Future
216-30-045	HDRD	5,236.77	0.12	Office	0.15	1.25	0	0.0000	0.0010	Future
216-30-040	LDRD	653,406.10	15.00	Office: 100%	0.1	0.85	0	0.0000	0.0555	Future
216-28-081	LHIN	186,276.94	4.28	Light Industrial	0.15	0.85	0	0.0000	0.0238	Future
216-28-109	LHIN	88,943.87	2.04	Light Industrial	0.15	0.85	0	0.0000	0.0113	Future
224-47-020	HDRD	23,418.70	0.54	Office	0.15	1.25	0	0.0000	0.0044	Future
224-28-068	CMXU	5,239.94	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
224-26-055	CMXU	9,006.06	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-28-037	CMXU	4,034.10	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
224-28-036	CMXU	4,034.77	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
216-01-056	RGMX	15,712.15	0.36	Regional Commercial	0.1	0.5	40	0.0022	0.0008	Future
216-01-044	CMXU	21,689.08	0.50	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
216-01-042	RGMX	14,775.77	0.34	Regional Commercial	0.1	0.5	40	0.0021	0.0007	Future
216-01-058	RGMX	54,219.09	1.24	Regional Commercial	0.1	0.5	40	0.0077	0.0027	Future
104-42-018	HDRD	325,210.13	7.47	Office	0.15	1.25	0	0.0000	0.0610	Future
104-13-083	LDRD	249,231.13	5.72	Office: 100%	0.1	0.85	0	0.0000	0.0212	Future
104-13-085	LDRD	130,494.37	3.00	Office: 100%	0.1	0.85	0	0.0000	0.0111	Future
290-10-068	CMXU	17,341.17	0.40	Community Commercial	0.1	0.4	25	0.0015	0.0007	Future
224-08-049	HDRD	98,542.70	2.26	Office	0.15	1.25	0	0.0000	0.0185	Future
224-08-119	LDRD	68,705.01	1.58	Office: 100%	0.1	0.85	0	0.0000	0.0058	Future
224-08-120	LDRD	64,431.51	1.48	Office: 100%	0.1	0.85	0	0.0000	0.0055	Future
224-08-151	HDRD	89,600.68	2.06	Office	0.15	1.25	0	0.0000	0.0168	Future
290-10-031	CMXU	15,120.32	0.35	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
290-10-096	RGMX	920,253.35	21.13	Regional Commercial	0.1	0.5	40	0.1301	0.0460	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-10-028	RGMX	42,075.24	0.97	Regional Commercial	0.1	0.5	40	0.0060	0.0021	Future
290-10-078	RGMX	41,167.15	0.95	Regional Commercial	0.1	0.5	40	0.0058	0.0021	Future
290-08-136	CMXU	21,499.91	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-08-109	CMXU	21,499.92	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-08-116	CMXU	21,499.74	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-08-137	CMXU	21,154.45	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0008	Future
290-08-153	CMXU	28,068.52	0.64	Community Commercial	0.1	0.4	25	0.0025	0.0011	Future
290-08-152	CMXU	33,051.55	0.76	Community Commercial	0.1	0.4	25	0.0029	0.0013	Future
290-07-138	CMXU	52,654.99	1.21	Community Commercial	0.1	0.4	25	0.0047	0.0021	Future
224-06-130	LDRD	40,600.66	0.93	Office: 100%	0.1	0.85	0	0.0000	0.0035	Future
224-06-166	LDRD	86,532.24	1.99	Office: 100%	0.1	0.85	0	0.0000	0.0074	Future
224-06-165	LDRD	66,796.10	1.53	Office: 100%	0.1	0.85	0	0.0000	0.0057	Future
224-06-127	LDRD	39,269.31	0.90	Office: 100%	0.1	0.85	0	0.0000	0.0033	Future
224-06-150	LDRD	19,193.90	0.44	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
224-06-176	LDRD	36,651.21	0.84	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-10-117	LDRD	288,521.71	6.62	Office: 100%	0.1	0.85	0	0.0000	0.0245	Future
224-10-098	LDRD	83,754.38	1.92	Office: 100%	0.1	0.85	0	0.0000	0.0071	Future
224-35-017	HYIN	207,087.34	4.75	Heavy Industrial	0.15	1.25	0	0.0000	0.0388	Future
224-10-097	LDRD	87,984.01	2.02	Office: 100%	0.1	0.85	0	0.0000	0.0075	Future
224-61-002	LDRD	44,428.12	1.02	Office: 100%	0.1	0.85	0	0.0000	0.0038	Future
224-61-007	LDRD	26,414.71	0.61	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-61-008	LDRD	25,675.79	0.59	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-10-115	LDRD	73,391.17	1.68	Office: 100%	0.1	0.85	0	0.0000	0.0062	Future
224-61-001	LDRD	16,149.31	0.37	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
224-61-003	LDRD	8,601.44	0.20	Office: 100%	0.1	0.85	0	0.0000	0.0007	Future
224-61-004	LDRD	64,004.31	1.47	Office: 100%	0.1	0.85	0	0.0000	0.0054	Future
224-10-121	LDRD	204,760.26	4.70	Office: 100%	0.1	0.85	0	0.0000	0.0174	Future
224-60-013	HYIN	118,217.10	2.71	Heavy Industrial	0.15	1.25	0	0.0000	0.0222	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-10-126	LDRD	188,685.04	4.33	Office: 100%	0.1	0.85	0	0.0000	0.0160	Future
224-10-057	LDRD	72,205.64	1.66	Office: 100%	0.1	0.85	0	0.0000	0.0061	Future
224-61-009	LDRD	62,780.64	1.44	Office: 100%	0.1	0.85	0	0.0000	0.0053	Future
224-10-122	LDRD	137,809.08	3.16	Office: 100%	0.1	0.85	0	0.0000	0.0117	Future
224-10-123	LDRD	27,813.12	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
224-10-125	LDRD	96,709.30	2.22	Office: 100%	0.1	0.85	0	0.0000	0.0082	Future
224-60-014	HYIN	189,025.30	4.34	Heavy Industrial	0.15	1.25	0	0.0000	0.0354	Future
224-61-005	PUQP	147,332.98	3.38	Public/Institutional	0.21	0.2	0	0.0000	0.0062	Future
224-61-006	PUQP	438,706.55	10.07	Public/Institutional	0.21	0.2	0	0.0000	0.0184	Future
224-61-010	LDRD	62,783.57	1.44	Office: 100%	0.1	0.85	0	0.0000	0.0053	Future
224-10-131	LDRD	68,534.53	1.57	Office: 100%	0.1	0.85	0	0.0000	0.0058	Future
224-45-008	LDRD	17,716.99	0.41	Office: 100%	0.1	0.85	0	0.0000	0.0015	Future
224-45-027	LDRD	199,140.76	4.57	Office: 100%	0.1	0.85	0	0.0000	0.0169	Future
224-57-003	LDRD	106,948.39	2.46	Office: 100%	0.1	0.85	0	0.0000	0.0091	Future
224-57-013	LDRD	56,556.82	1.30	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
224-57-006	LDRD	43,541.19	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
224-57-007	LDRD	45,835.48	1.05	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
224-45-006	LDRD	13,852.82	0.32	Office: 100%	0.1	0.85	0	0.0000	0.0012	Future
224-45-028	LDRD	94,706.79	2.17	Office: 100%	0.1	0.85	0	0.0000	0.0081	Future
224-57-011	LDRD	155,439.63	3.57	Office: 100%	0.1	0.85	0	0.0000	0.0132	Future
224-45-029	LDRD	189,474.75	4.35	Office: 100%	0.1	0.85	0	0.0000	0.0161	Future
224-45-030	LDRD	630,206.01	14.47	Office: 100%	0.1	0.85	0	0.0000	0.0536	Future
224-45-031	LDRD	133,774.51	3.07	Office: 100%	0.1	0.85	0	0.0000	0.0114	Future
224-07-123	LDRD	223,031.31	5.12	Office: 100%	0.1	0.85	0	0.0000	0.0190	Future
224-07-121	LDRD	592,999.10	13.61	Office: 100%	0.1	0.85	0	0.0000	0.0504	Future
224-08-109	LDRD	45,669.11	1.05	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
224-08-101	LDRD	28,681.23	0.66	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
224-08-102	LDRD	29,091.31	0.67	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-08-058	LDRD	29,720.80	0.68	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
224-08-092	LDRD	66,219.60	1.52	Office: 100%	0.1	0.85	0	0.0000	0.0056	Future
224-43-003	LDRD	85,296.50	1.96	Office: 100%	0.1	0.85	0	0.0000	0.0073	Future
224-08-147	LDRD	133,093.62	3.06	Office: 100%	0.1	0.85	0	0.0000	0.0113	Future
224-43-002	LDRD	197,082.09	4.52	Office: 100%	0.1	0.85	0	0.0000	0.0168	Future
224-08-085	LDRD	118,687.70	2.72	Office: 100%	0.1	0.85	0	0.0000	0.0101	Future
224-08-132	LDRD	19,701.48	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
224-08-133	LDRD	20,721.64	0.48	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
224-08-153	LHIN	336,272.79	7.72	Light Industrial	0.15	0.85	0	0.0000	0.0429	Future
224-08-134	LDRD	59,221.47	1.36	Office: 100%	0.1	0.85	0	0.0000	0.0050	Future
224-42-007	LDRD	36,961.31	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-08-144	LDRD	79,841.88	1.83	Office: 100%	0.1	0.85	0	0.0000	0.0068	Future
224-08-099	LDRD	57,516.22	1.32	Office: 100%	0.1	0.85	0	0.0000	0.0049	Future
224-08-135	LDRD	25,991.68	0.60	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-08-143	LDRD	16,209.74	0.37	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
224-08-082	LHIN	264,753.16	6.08	Light Industrial	0.15	0.85	0	0.0000	0.0338	Future
224-08-136	LDRD	20,109.40	0.46	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
224-08-006	LDRD	43,564.96	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
224-42-008	LDRD	42,463.43	0.97	Office: 100%	0.1	0.85	0	0.0000	0.0036	Future
224-08-145	LDRD	58,919.34	1.35	Office: 100%	0.1	0.85	0	0.0000	0.0050	Future
224-09-113	LDRD	320,572.47	7.36	Office: 100%	0.1	0.85	0	0.0000	0.0272	Future
224-08-142	LDRD	33,502.96	0.77	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
224-08-137	LDRD	20,714.89	0.48	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
224-08-138	LDRD	25,545.20	0.59	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-08-141	LDRD	31,949.48	0.73	Office: 100%	0.1	0.85	0	0.0000	0.0027	Future
224-08-123	LDRD	22,059.18	0.51	Office: 100%	0.1	0.85	0	0.0000	0.0019	Future
224-42-003	LDRD	84,435.13	1.94	Office: 100%	0.1	0.85	0	0.0000	0.0072	Future
224-08-122	LDRD	24,633.00	0.57	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-08-127	LDRD	28,216.48	0.65	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
224-08-089	LDRD	53,116.36	1.22	Office: 100%	0.1	0.85	0	0.0000	0.0045	Future
224-09-140	LDRD	89,912.39	2.06	Office: 100%	0.1	0.85	0	0.0000	0.0076	Future
224-42-002	LDRD	41,805.84	0.96	Office: 100%	0.1	0.85	0	0.0000	0.0036	Future
224-65-009	LDRD	228,010.35	5.23	Office: 100%	0.1	0.85	0	0.0000	0.0194	Future
224-15-030	CMXU	5,401.82	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
224-20-094	CMXU	18,193.10	0.42	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future
224-20-095	CMXU	22,728.81	0.52	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
224-20-096	CMXU	29,526.30	0.68	Community Commercial	0.1	0.4	25	0.0026	0.0012	Future
224-20-081	CMXU	32,679.25	0.75	Community Commercial	0.1	0.4	25	0.0029	0.0013	Future
224-14-114	CMXU	17,491.07	0.40	Community Commercial	0.1	0.4	25	0.0015	0.0007	Future
224-14-094	CMXU	21,945.47	0.50	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
224-14-109	CMXU	12,329.51	0.28	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
224-14-110	CMXU	9,560.58	0.22	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-14-106	CMXU	15,079.50	0.35	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
224-15-031	CMXU	9,926.16	0.23	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
224-14-086	CMXU	14,645.77	0.34	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
224-15-022	CMXU	15,656.29	0.36	Community Commercial	0.1	0.4	25	0.0014	0.0006	Future
224-15-029	RGMX	53,635.66	1.23	Regional Commercial	0.1	0.5	40	0.0076	0.0027	Future
224-48-009	CMXU	9,239.30	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-48-011	CMXU	22,092.35	0.51	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
224-26-073	CMXU	20,776.62	0.48	Community Commercial	0.1	0.4	25	0.0018	0.0008	Future
224-26-060	CMXU	11,107.62	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
224-26-065	CMXU	7,439.28	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-26-012	CMXU	7,575.30	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-26-066	CMXU	8,788.94	0.20	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-26-058	CMXU	13,547.21	0.31	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
224-20-080	MDRE	58,008.42	1.33	Medium Density Residential	154	0	25	0.0051	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-29-038	CMXU	13,664.26	0.31	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
224-28-058	CMXU	11,846.08	0.27	Community Commercial	0.1	0.4	25	0.0010	0.0005	Future
224-29-030	CMXU	8,121.91	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-25-074	PUQP	451,036.23	10.35	Public/Institutional	0.21	0.2	0	0.0000	0.0189	Future
224-29-007	CMXU	16,145.09	0.37	Community Commercial	0.1	0.4	25	0.0014	0.0006	Future
224-29-041	CMXU	31,918.48	0.73	Community Commercial	0.1	0.4	25	0.0028	0.0013	Future
224-29-018	CMXU	7,426.58	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-29-033	CMXU	146,637.38	3.37	Community Commercial	0.1	0.4	25	0.0130	0.0059	Future
293-02-034	NHMX	7,757.23	0.18	Neighborhood Commercial	0.1	0.3	25	0.0007	0.0002	Future
293-02-033	NHMX	21,414.98	0.49	Neighborhood Commercial	0.1	0.3	25	0.0019	0.0006	Future
293-02-032	NHMX	33,739.12	0.77	Neighborhood Commercial	0.1	0.3	25	0.0030	0.0010	Future
293-02-030	NHMX	1,803.92	0.04	Neighborhood Commercial	0.1	0.3	25	0.0002	0.0001	Future
293-02-031	NHMX	1,748.95	0.04	Neighborhood Commercial	0.1	0.3	25	0.0002	0.0001	Future
104-55-013	RGCO	69,034.46	1.58	Regional Commercial	0.1	0.5	0	0.0000	0.0035	Future
104-39-024	LDRD	360.55	0.01	Office: 100%	0.1	0.85	0	0.0000	0.0000	Future
224-75-023	LHIN	1,538.63	0.04	Light Industrial	0.15	0.85	0	0.0000	0.0002	Future
097-37-112	NHMX	1,413.10	0.03	Neighborhood Commercial	0.1	0.3	25	0.0001	0.0000	Future
269-05-089	CMXU	18,382.06	0.42	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future
316-09-044	PUQP	603,655.61	13.86	Public/Institutional	0.21	0.2	0	0.0000	0.0254	Future
097-11-000	DHRE	197,344.59	4.53	High Density Residential	154	40	40	0.0279	0.0000	Future
290-21-059	MDRE	1,181.34	0.03	Medium Density Residential	154	0	25	0.0001	0.0000	Future
290-53-025	MDRE	2,499.33	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future
316-51-008	MDRE	1,142.09	0.03	Medium Density Residential	154	0	25	0.0001	0.0000	Future
104-59-039	MDRE	2,415.77	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future
224-76-061	MDRE	843.21	0.02	Medium Density Residential	154	0	25	0.0001	0.0000	Future
290-71-058	CMXU	2,141.60	0.05	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
104-15-142	LDRD	55,510.68	1.27	Office: 100%	0.1	0.85	0	0.0000	0.0047	Future
104-15-143	LDRD	80,861.26	1.86	Office: 100%	0.1	0.85	0	0.0000	0.0069	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
269-05-094	CMXU	13,850.43	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future
104-12-215	MDRE	4,110.43	0.09	Medium Density Residential	154	0	25	0.0004	0.0000	Future
269-05-106	CMXU	561.94	0.01	Community Commercial	0.1	0.4	25	0.0000	0.0000	Future
216-28-129	LHIN	59,722.21	1.37	Light Industrial	0.15	0.85	0	0.0000	0.0076	Future
290-44-143	MDRE	5,236.45	0.12	Medium Density Residential	154	0	25	0.0005	0.0000	Future
269-33-051	MDRE	3,016.20	0.07	Medium Density Residential	154	0	25	0.0003	0.0000	Future
269-05-090	CMXU	293.06	0.01	Community Commercial	0.1	0.4	25	0.0000	0.0000	Future
294-01-014	CMXU	20,318.83	0.47	Community Commercial	0.1	0.4	25	0.0018	0.0008	Future
303-17-051	MDRE	41,241.29	0.95	Medium Density Residential	154	0	25	0.0036	0.0000	Future
316-09-052	PUQP	495.30	0.01	Public/Institutional	0.21	0.2	0	0.0000	0.0000	Future
097-22-00G	NHMX	5,537.12	0.13	Neighborhood Commercial	0.1	0.3	25	0.0005	0.0002	Future
216-31-067	LDRD	179,532.35	4.12	Office: 100%	0.1	0.85	0	0.0000	0.0153	Future
216-01-054	CMXU	19,102.84	0.44	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
224-49-011	CMXU	5,195.08	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
104-48-009	HDRD	495.30	0.01	Office	0.15	1.25	0	0.0000	0.0001	Future
104-52-027	HDRD	174,604.01	4.01	Office	0.15	1.25	0	0.0000	0.0327	Future
224-06-177	LDRD	1,351.59	0.03	Office: 100%	0.1	0.85	0	0.0000	0.0001	Future
216-31-093	LDRD	247,968.38	5.69	Office: 100%	0.1	0.85	0	0.0000	0.0211	Future
293-02-035	NHMX	26,099.53	0.60	Neighborhood Commercial	0.1	0.3	25	0.0023	0.0008	Future
104-38-016	LDRD	109,021.33	2.50	Office: 100%	0.1	0.85	0	0.0000	0.0093	Future
104-38-014	LDRD	301,191.72	6.91	Office: 100%	0.1	0.85	0	0.0000	0.0256	Future
220-35-001	MDRE	2,769.02	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-002	MDRE	2,227.07	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-003	MDRE	3,074.10	0.07	Medium Density Residential	154	0	25	0.0003	0.0000	Future
220-35-004	MDRE	2,326.29	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-005	MDRE	2,086.74	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-006	MDRE	2,140.26	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-009	MDRE	2,738.91	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
220-35-007	MDRE	3,277.50	0.08	Medium Density Residential	154	0	25	0.0003	0.0000	Future
220-35-008	MDRE	3,148.35	0.07	Medium Density Residential	154	0	25	0.0003	0.0000	Future
205-39-026	MDRE	122,629.84	2.82	Medium Density Residential	154	0	25	0.0108	0.0000	Future
224-42-013	LDRD	84,412.03	1.94	Office: 100%	0.1	0.85	0	0.0000	0.0072	Future
224-42-014	LDRD	98,739.54	2.27	Office: 100%	0.1	0.85	0	0.0000	0.0084	Future
230-06-055	PUQP	68,335.37	1.57	Public/Institutional	0.21	0.2	0	0.0000	0.0029	Future
274-43-099	RGCO	264,044.93	6.06	Regional Commercial	0.1	0.5	0	0.0000	0.0132	Future
097-08-109	DHRE	233,446.43	5.36	High Density Residential	154	40	40	0.0330	0.0000	Future
303-18-051	RGCO	70,063.84	1.61	Regional Commercial	0.1	0.5	0	0.0000	0.0035	Future
296-37-035	RGCO	89,133.81	2.05	Regional Commercial	0.1	0.5	0	0.0000	0.0045	Future
224-57-016	LDRD	57,961.86	1.33	Office: 100%	0.1	0.85	0	0.0000	0.0049	Future
224-59-031	HYIN	224,958.92	5.16	Heavy Industrial	0.15	1.25	0	0.0000	0.0422	Future
104-14-172	LDRD	73,656.43	1.69	Office: 100%	0.1	0.85	0	0.0000	0.0063	Future
205-39-029	MDRE	1,204,315.75	27.65	Medium Density Residential	154	0	25	0.1064	0.0000	Future
205-39-028	MDRE	559,453.44	12.84	Medium Density Residential	154	0	25	0.0494	0.0000	Future

Flow Assumptions for Parcels with Entitlements
(Provided by the City)

LABELID	APN	OWNERNAM	Entitled Flow (gpd) 2016	Entitled Flow (gpd) 2024	Flow Difference (gpd) 2023-2016	Entitled Flow (mgd) 2024
1	230-03-090	Newark Group Industries Inc.	267,189	267,189	0	0.2671890
2	101-11-042	Dorothy Nutto Trustee	11,656	11,657	1	0.0116570
4	104-15-131	M West Prop Co. LLC	49,672	28,686	-20,986	0.0286860
5	104-39-023	Siliconix Inc	1,232,651	1,232,651	0	1.2326510
6	101-09-023	Dick Lee Corp	30,700	30,700	0	0.0307000
8	230-03-079	Xeres Ventures LLC	5,890	5,538	-352	0.0055380
9	230-47-068	Robert Jung Et. Al.	14,655	14,655	0	0.0146550
10	290-03-087	G6 Hospitality Property LLC	14,408	14,345	-63	0.0143450
11	101-13-003	AMB Property Corporation LP	8,132	8,106	-26	0.0081060
12	303-02-013	Annine Untiedt Trustee & Et. Al.	29,000	29,000	0	0.0290000
13	303-23-029	Machado Children's Trust	49,300	49,300	0	0.0493000
14	290-01-113	Shri Jai Ranchhodrai Inc	39,078	19,045	-20,033	0.0190450
15	104-50-025	Coherent	220,414	220,414	0	0.2204140
17	296-20-004	LJS LLC	9,780	9,777	-3	0.0097770
18	104-49-026	Marriott Plaza Associates L.P.	14,694	14,630	-64	0.0146300
19	104-50-018	Abbott Laboratories	9,998	9,998	0	0.0099980
20	104-43-054	City of Santa Clara	58,719	58,719	0	0.0587190
21	104-14-154	Cemex	6,911	5,689	-1,222	0.0056890
23	104-16-113	West Valley-Mission Community College Dist	54,000	54,000	0	0.0540000
24	104-51-001	Ixys Corporation	15,837	18,006	2,169	0.0180060
25	104-14-089	Kang Family Partners LP	58,282	58,282	0	0.0582820
26	104-40-020	Intel Corporation	17,608	17,608	0	0.0176080
27	104-40-031	Santa Clara Towers LP	29,540	29,540	0	0.0295400
28	216-48-035	James Lindsey Trustee & Et. Al.	32,303	32,303	0	0.0323030
29	216-34-076	Si 34 LLC	22,499	22,751	252	0.0227510
30	216-34-079	Si 34 LLC	12,591	12,464	-127	0.0124640
31	216-32-040	Ksl Capital Partners	40,384	40,384	0	0.0403840
32	216-01-060	Sunita Kumar Et. Al.	13,572	13,572	0	0.0135720
34	216-34-005	Erik Naslund Trustee	40,069	40,069	0	0.0400690
35	224-46-007	Act Ponderosa LLC Et. Al.	7,351	6,006	-1,345	0.0060060
36	224-08-146	Digital 1350 Duane LLC	79,530	79,530	0	0.0795300
37	224-09-165	Akt America Inc	62,052	61,209	-843	0.0612090
38	294-39-010	Donna Bonasera Trustee & Et. Al.	8,091	8,118	27	0.0081180
39	216-46-003	Chawla Ventures LLC	38,218	38,218	0	0.0382180
40	316-19-032	Yangs Brother Intl Corp	14,326	14,326	0	0.0143260
41	316-17-018	Agilent Technologies Inc	949,151	949,151	0	0.9491510
42	274-43-071	Federated Western Properties, Inc.	19,348	19,348	0	0.0193480
43	213-35-035	K D W Santa Clara	21,798	21,798	0	0.0217980
44	224-04-071	Gahrahmat Fam LP II	20,189	20,189	0	0.0201890
45	224-59-029	Hertz Investors Inc	41,582	20,791	-20,791	0.0207910
46	224-06-170	Leon and Colette Mardirossian Trustee	68,135	73,268	5,133	0.0732680
48	216-30-053	Ashford Santa Claraparts LP	86,122	86,122	0	0.0861220
49	216-28-101	Vantage Data Centers	121,199	95,370	-25,829	0.0652462
49	216-28-118	Vantage Data Centers		95,370	95,370	0.0301238
50	216-46-020	Latham & Watkins, LLP	32,114	31,841	-273	0.0318410
51	216-31-060	Cooperage-Rose Investments	26,309	26,309	0	0.0263090
52	216-30-054	Sierra-Santa Clara Inc	65,520	65,520	0	0.0655200
53	104-04-077	Digital-Pr Old Ironsides 1 LLC	24,091	29,240	5,149	0.0292400
54	104-13-083	SCP 2001 PE LLC	88,636	89,422	786	0.0894220
56	290-46-016	Dennis Mariani Trustee & Et. Al.	19,000	19,000	0	0.0190000
57	290-06-020	Moonlite Associates LLC	40,188	40,188	0	0.0401880
58	224-35-017	Sunset Properties Inc	8,767	8,767	0	0.0087670
59	224-60-013	1065 Martin Ave LLC	18,125	22,667	4,542	0.0226670
60	224-10-126	San Tomas Income Partners LLC	58,788	58,788	0	0.0587880
61	224-60-014	Martin Investment Properties LLC	11,239	11,218	-21	0.0112180
62	224-08-101	Renault & Handley Employee's Investment Co	11,139	11,139	0	0.0111390
63	224-08-147	1100 Space Park LLC	41,036	41,015	-21	0.0410150
64	224-08-085	Pacific Bell Lease	17,921	20,083	2,162	0.0200830
65	224-08-134	Harbor Electronics Inc	44,586	44,586	0	0.0445860
66	224-20-080	Masonic Hall Corp of Santa Clara	35,934	35,934	0	0.0359340
67	104-55-005	City of Santa Clara	117,735	117,735	0	0.1177350
68	104-55-013	City of Santa Clara	148,087	148,087	0	0.1480870
69	224-03-085	2045-2055 Lafayette Street	42,000	42,000	0	0.0420000
70	316-09-035	Kaiser Foundation Hospital	374,350	374,350	0	0.3743500
71	230-46-061	BFV LLC	13,111	13,111	0	0.0131110

Owner	APN	Subcatchment ID	WC Address	Additional foul flow (MGD)	Trade flow (MGD)	Customer Type	NAICS Description	DC Num/ RefID	DC/NTD/LTD Name
CALIFORNIA PAPERBOARD	230-03-090	311	525 Mathew Street	0	0.2672	MJ	Paperboard Mills	GP_Ph3	
BAB FACILITIES GROUP	101-11-042	1574	3295 Woodward Avenue	0	0.0117	CI	General Warehousing and Storage	GP_Ph3	
SILICONIX INC	104-39-023	2593	2201 Laurelwood Road	0	1.2327	CI	Semiconductor & Related Device Manufacturing	102	2201 Laurelwood Data Center
SST INVESTMENTS LLC	101-09-023	2978	805 Aldo Avenue	0	0.0307	CI	Lessors of Nonresid. Build. excpt Miniwarehou	GP_Ph3	
ALTAFLEX	230-47-068	4586	336 Martin Avenue	0	0.0147	CI	Bare Printed Circuit Board Manufacturing	GP_Ph3	
MOTEL SIX # 263	290-03-087	5628	3208 El Camino Real	0.0099	0.0045	CI	Hotels (except Casino Hotels) and Motels	77	ECR_CMU
MISSION HOSPITAL INC	303-02-013	6122	410 North Winchester Boulevard	0	0.029	CI	Homes for the Elderly	GP_Ph3	
SCCW LLC	303-23-029	6850	3655 Stevens Creek Boulevard	0.0339	0.0154	CI	Car Washes	GP_Ph3	
SHRI JAI RANCHHODRAI INC	290-01-113	7089	3550 El Camino Real	0.0141	0.005	CI	Hotels (except Casino Hotels) and Motels	77	ECR_CMU
COHERENT INC	104-50-025	9416	5100 Patrick Henry Drive	0	0.2204	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
BRIGHT HORIZONS CHILDREN CTR	296-20-004	10028	4945 Stevens Creek Boulevard	0	0.0098	CI	Child Day Care Services	GP_Ph3	
ONTARIO AIRPORT HOTEL CORP	104-43-054	11327	4949 Great America Parkway	0.0404	0.0183	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
CEMEX INC	104-14-154	11740	1555 Russell Avenue	0	0.0057	CI	Ready-Mix Concrete Manufacturing	GP_Ph3	
VIVID INC	104-51-001	11892	3400 Bassett Street	0	0.018	CI	Household Appliance Stores	GP_Ph3	
BILTMORE HOTEL & SUITES	104-14-089	11910	2151 Laurelwood Road	0	0.0583	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
GOLDEN STATE RESTAURANTS	104-40-020	11915	3935 Freedom Circle	0	0.0176	CI	Full-Service Restaurants	48	Freedom Circle
SCT OWNER LLC	104-40-031	11917	3945 Freedom Circle	0	0.0295	CI	Lessors of Nonresid. Build. excpt Miniwarehou	48	Freedom Circle
PROMEX INC	216-48-035	12068	3075 Oakmead Village Drive	0	0.0323	CI	Radio&TV Broadcast&Wireless Comm Equip Manuf	GP_Ph3	
AFFYMETRIX INC	216-34-079	12070	3450 Central Expressway	0	0.0125	CI	R&D in Physical, Engineering & Life Sciences		
WESTERN ATHLETIC CLUBS	216-32-040	12071	3250 Central Expressway	0	0.0404	CI	Fitness and Recreational Sports Centers	GP_Ph3	
HAWTHORN SUITES LTD	216-01-060	12109	2455 El Camino Real	0.0093	0.0042	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
PONDEROSA OFFICE CENTER	224-46-007	14397	3080 Olcott Street	0	0.006	CI	Lessors of Nonresid. Build. excpt Miniwarehou		
EQUINIX INC	224-08-146	14398	1350 Duane Avenue	0	0.0795	CI	Data Processing, Hosting, & Related Services	GP_Ph3	
AKT AMERICA INC	224-09-165	14400	3101 Scott Boulevard	0	0.0612	CI	Semiconductor & Related Device Manufacturing		
M.B. EXCLUSIVELY PROPERTIES LL	294-39-010	15281	3941 Stevens Creek Boulevard	0.0056	0.0025	CI	Lessors of Nonresid. Build. excpt Miniwarehou	GP_Ph3	
DUARTE COMMUNICATIONS INC	216-46-003	15637	3200 Coronado Drive	0	0.0382	CI	Lessors of Nonresid. Build. excpt Miniwarehou		
WOODCREST HOTEL	316-19-032	16763	5415 Stevens Creek Boulevard	0	0.0143	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
AGILENT TECHNOLOGY #9000089889	316-17-018	16766	5301 Stevens Creek Boulevard	0	0.9492	CI	Semiconductor & Related Device Manufacturing		
KDW CORP	213-35-035	17444	1550 Halford Avenue	0.0161	0.0057	CI	Lessors of Nonresid. Build. excpt Miniwarehou	GP_Ph3	
STREAMLINE CIRCUITS CORP	224-06-170	18371	1415 Richard Avenue	0	0.0733	CI	Bare Printed Circuit Board Manufacturing		
SANTA CLARA TENANT CORP	216-30-053	18456	2885 Lakeside Drive	0	0.0861	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
CORESITE CORONADO STENDER LLC	216-46-021	18967	3020 Coronado Drive	0	0.0209	CI	Data Processing, Hosting, & Related Services	DC_47	Coresite / Telecom SV7
PENINSULAR INVESTMENTS INC	216-30-054	19335	3100 Lakeside Drive	0	0.0655	CI	Hotels (except Casino Hotels) and Motels		
CYXTERA DATA CENTERS INC	104-04-077	20154	4650 Old Ironsides Drive	0	0.0292	CI	Data Processing, Hosting, & Related Services	59	Patrick Henry Drive
VAREX IMAGING WEST HLDNGS INC	104-13-083	20170	2175 Mission College Boulevard	0	0.0894	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
LOMBARDI AUTO	290-46-016	20411	2540 El Camino Real	0.0131	0.0059	CI	Gasoline Stations with Convenience Stores	66	2570 ECR
D&T FOODS CO	224-60-013	20508	1061 Martin Avenue	0	0.0227	CI	Ice Cream and Frozen Dessert Manufacturing	GP_Ph3	
FUJIFILM DIAMATIX INC	224-10-126	20509	2210 Martin Avenue	0	0.0588	CI	R&D in Physical, Engineering & Life Sciences	GP_Ph3	
ONSPEC TECHNOLOGY PARTNERS INC	224-08-101	20554	975 Comstock Street	0	0.0111	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
DIGITAL REALTY TRUST LP	224-08-147	20568	1100 Space Park Drive	0	0.041	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
ELEC DEPT	224-08-085	20575	3025 Raymond Street	0	0.0201	MU	Other General Government Support	GP_Ph3	
HARBOR ELECTRONICS INC	224-08-134	20582	3021 Kenneth Street	0	0.0446	CI	Othr Electronic Parts and Equip Wholesalers	GP_Ph3	
NIC 13 THE WESTMONT OWNER LLC	224-20-080	21015	1675 Scott Boulevard	0.0359	0	CI	Residential Mental Retardation Facilities	GP_Ph3	
HUDSON TECHMART COMM CTR LLC	104-55-013	21654	5201 Great America Parkway	0	0.1481	CI	Lessors of Residential Buildings and Dwelling	GP_Ph3	
MICROSOFT CORPORATION	224-03-085	21746	2045 Lafayette Street	0	0.042	CI	Data Processing, Hosting, & Related Services		
ELEC DEPT SUBSTATION	216-46-022	22799	2920 Coronado Drive	0	0.0109	MU	Other General Government Support		
MACYS WEST INC # 17012B	274-43-071	23069	3051 Stevens Creek Boulevard	0	0.003	CI	Department Stores (except Discount Stores)		
	104-55-012	25819		0	0				
	316-09-035	26155		0	0.372				
	230-46-069	26350		0	0.0017				

Hydraulic Model Input Data for Parcels with Entitlements
(Based on Information Provided by the City)

Owner	APN	Subcatchment ID	WC Address	Additional foul flow (MGD)	Trade flow (MGD)	Customer Type	NAICS Description	DC Num/ RefID	DC/NTD/LTD Name
	216-31-060	26372		0	0.0263			99	3375 Scott Blvd
	316-09-054	26708		0	0.0024				
AFFYMETRIX INC	216-34-076	26820	3380 Central Expressway	0	0.0221	CI	R&D in Physical, Engineering & Life Sciences		
AFFYMETRIX INC	216-34-076	26821	3380 Central Expressway	0	0.0007	CI	R&D in Physical, Engineering & Life Sciences		
VANTAGE DATA CENTERS LLC	216-28-118	26847	2820 Northwestern Parkway	0	0.0301	CI	Semiconductor & Related Device Manufacturing		
456200 HERTZ MAIL STOP 2	224-59-029	26853	1000 Walsh Avenue	0	0.0005	CI	Passenger Car Rental		
VANTAGE DATA CENTERS LLC	216-28-131	26913	2565 Walsh Avenue	0	0.0038	CI	Data Processing, Hosting, & Related Services		
VANTAGE DATA CENTERS LLC	216-28-131	26914	2565 Walsh Avenue	0	0.0614	CI	Data Processing, Hosting, & Related Services	DC_28	Vantage SC I (1/6) CA11 / V1
	104-55-005	26993		0	0.1177				
	230-46-069	27003		0	0.0017				
	230-46-069	27005		0	0.0009				
	230-46-069	27006		0	0.0003				
	230-46-069	27007		0	0.0024				
	230-46-069	27008		0	0.0012				
	230-46-069	27010		0	0.0023				
	216-59-038	27288		0	0.0023				
	216-59-038	27289		0	0.0023				
	216-59-038	27290		0	0.002				
	216-59-038	27291		0	0.0017				
	216-59-037	27293		0	0.0023				
	216-59-037	27294		0	0.002				
	216-59-037	27295		0	0.0019				
	216-59-037	27296		0	0.0017				
	216-59-037	27297		0	0.0023				
	216-59-037	27298		0	0.0023				
	216-59-037	27299		0	0.0019				
	216-59-037	27300		0	0.0176				
MACYS WEST INC # 17012B	274-43-092	27337	3051 Stevens Creek Boulevard	0	0.0161	CI	Department Stores (except Discount Stores)		
MACYS WEST INC # 17012B	274-43-071	27355	3051 Stevens Creek Boulevard	0	0.0003	CI	Department Stores (except Discount Stores)		

Flow Assumptions for Parcels with Entitlements and Planned Future Development
(Based on Information Provided by the City)

Entitlement Information from City				Assumptions Used for Future Flow Calculations[3]									
Entitlement APN	Entitlement ID	Entitled Flow (gpd)	Future Flow (gpd)[1]	Phase[2]	Land Use	Parcel Area (SF)	Non-Res Dev. Area (SF)	FAR	No. of Res Units	No. of Hotel Rooms	Non-Res UFF (gpd/SF)	Res UFF (gpd/unit)	Hotel UFF (gpd/room)
104-15-131	4	28,686	37,812	GP Phase 3	Office: 100%	444,844	-	0.85	-	-	0.1	-	-
101-13-003	11	8,106	39,699	GP Phase 3	Light Industrial	311,365	-	0.85	-	-	0.15	-	-
104-50-018	19	9,998	25,434	GP Phase 3	Office: 100%	299,222	-	0.85	-	-	0.1	-	-
104-16-113	23	54,000	114,332	GP Phase 3	Office	609,771	-	1.25	-	-	0.15	-	-
224-04-071	44	20,189	60,518	GP Phase 3	Heavy Industrial	322,763	-	1.25	-	-	0.15	-	-
224-59-029	45	20,791	42,180	GP Phase 3	Heavy Industrial	224,959	-	1.25	-	-	0.15	-	-
224-35-017	58	8,767	38,829	GP Phase 3	Heavy Industrial	207,087	-	1.25	-	-	0.15	-	-
224-60-014	61	11,218	35,442	GP Phase 3	Heavy Industrial	189,025	-	1.25	-	-	0.15	-	-
230-46-061	71	13,111	395,710	NTD	Mixed Use	-	1,140,000[4]	-	1,600	225	0.1	154 or 175	100

[1]Where entitlement flows were less than future flows, the more conservative future flows were used in the model for the long-term future scenario.

[2]GP = General Plan. NTD = Near-Term Development. The one NTD is the Gateway Crossing project (Reference ID = 22).

[3]UFF = Unit Flow Factor. FAR = Floor-Area Ratio. SF = Square Feet. Parcel Area, FAR, and UFF were used to calculate GP Phase 3 future flows. No. of Units/Rooms, UFFs, and dev. area were used to calculate NTD future flows.

[4]Includes 15,000 SF of retail/commercial for the Gateway Crossing Project, plus 1,125,000 SF of office/R&D space associated with the adjacent Coleman Highline development that still needs to connect to the sewer system.

APPENDIX C: PUMP STATION CAPACITY CALCULATIONS

Westside Lift Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	49	*Total length from bottom of wetwell to discharge elevation (17.4') to the discharge manhole (32')*
FM diameter (inches)	8	*Two 8" discharge lines.*
FM area (ft^2)	0.35	*Calculated*
Material	C.I.	*Cast Iron*
Approx Year Built	1977	*Approx. pump age: 2 years (source: pump station survey)*
number of pumps	2	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-17.4	*Source: Dwg 77054-16, Sheet C-13. 1977*
approx discharge elevation	0.0	*Source: Dwg 77054-16, Sheet C-13. 1977*
f	0.020	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	1.48	*Calculated*
K - allowance for minor losse	5	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On Set Pt	On Elev.	Lift	Off	Off Level	Lift
Pump #1 (IW ID: S103-8.1)	7.5	-9.9	9.9	5.33	-12.07	12.07
Pump #2 (IW ID: S103-8.2)	8	-9.4	9.4	5.33	-12.07	12.07

Table 3: Pump Curves

Sources: Pump curves provided by City. Two pumps are identical.

Pump Model: Flygt NP 3127 MT 3~ Adaptive 438 Pump Serial Number: 3127.090-1780054

	Pump #1 & #2	
HEAD (ft)	Flow (gpm)	Flow (mgd)
15	1215	1.75
20	1100	1.58
25	980	1.41
30	865	1.25
35	745	1.07
40	620	0.89
45	505	0.73
50	390	0.56
55	265	0.38
60	190	0.27
65	80	0.12
70	0	0.00

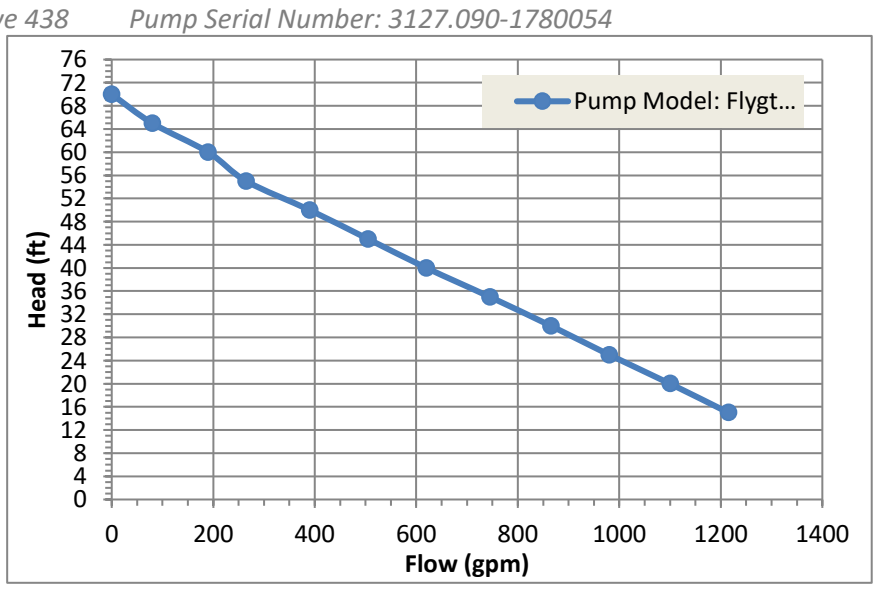


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
15	1215	1.75	2430	3.50
20	1100	1.58	2200	3.17
25	980	1.41	1960	2.82
30	865	1.25	1730	2.49
35	745	1.07	1490	2.15
40	620	0.89	1240	1.79
45	505	0.73	1010	1.45
50	390	0.56	780	1.12
55	265	0.38	530	0.76
60	190	0.27	380	0.55
65	80	0.12	160	0.23
70	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Firm TDH	Total TDH	Other (use as-needed)
Lift:	9.9	9.4	

Flow			Velocity (ft/s)	Minor Headloss (ft)	Friction Headloss (ft)		Total Dynamic Head (ft)					
					Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs										
0.00	0	0.0	0.0	0.0	0.0	0.0	9.9	9.9	9.4	9.4	0.0	0.0
0.23	162	0.4	1.0	0.1	0.0	0.0	10.0	10.0	9.5	9.5	0.1	0.1
0.47	324	0.7	2.1	0.3	0.1	0.1	10.3	10.4	9.8	9.9	0.4	0.5
0.70	486	1.1	3.1	0.7	0.2	0.3	10.9	10.9	10.4	10.4	1.0	1.0
0.93	648	1.4	4.1	1.3	0.4	0.5	11.6	11.7	11.1	11.2	1.7	1.8
1.17	810	1.8	5.2	2.1	0.6	0.7	12.6	12.7	12.1	12.2	2.7	2.8
1.40	972	2.2	6.2	3.0	0.9	1.0	13.8	13.9	13.3	13.4	3.9	4.0
1.63	1134	2.5	7.2	4.1	1.2	1.3	15.2	15.3	14.7	14.8	5.3	5.4
1.87	1296	2.9	8.3	5.3	1.6	1.7	16.8	16.9	16.3	16.4	6.9	7.0
2.10	1458	3.2	9.3	6.7	2.0	2.1	18.6	18.8	18.1	18.3	8.7	8.9
2.33	1620	3.6	10.3	8.3	2.5	2.6	20.7	20.8	20.2	20.3	10.8	10.9
2.57	1782	4.0	11.4	10.1	3.0	3.1	22.9	23.1	22.4	22.6	13.0	13.2
2.80	1944	4.3	12.4	12.0	3.5	3.7	25.4	25.5	24.9	25.0	15.5	15.6
3.03	2106	4.7	13.5	14.0	4.2	4.2	28.1	28.2	27.6	27.7	18.2	18.3
3.27	2269	5.1	14.5	16.3	4.8	4.9	31.0	31.1	30.5	30.6	21.1	21.2
3.50	2431	5.4	15.5	18.7	5.5	5.5	34.1	34.1	33.6	33.6	24.2	24.2

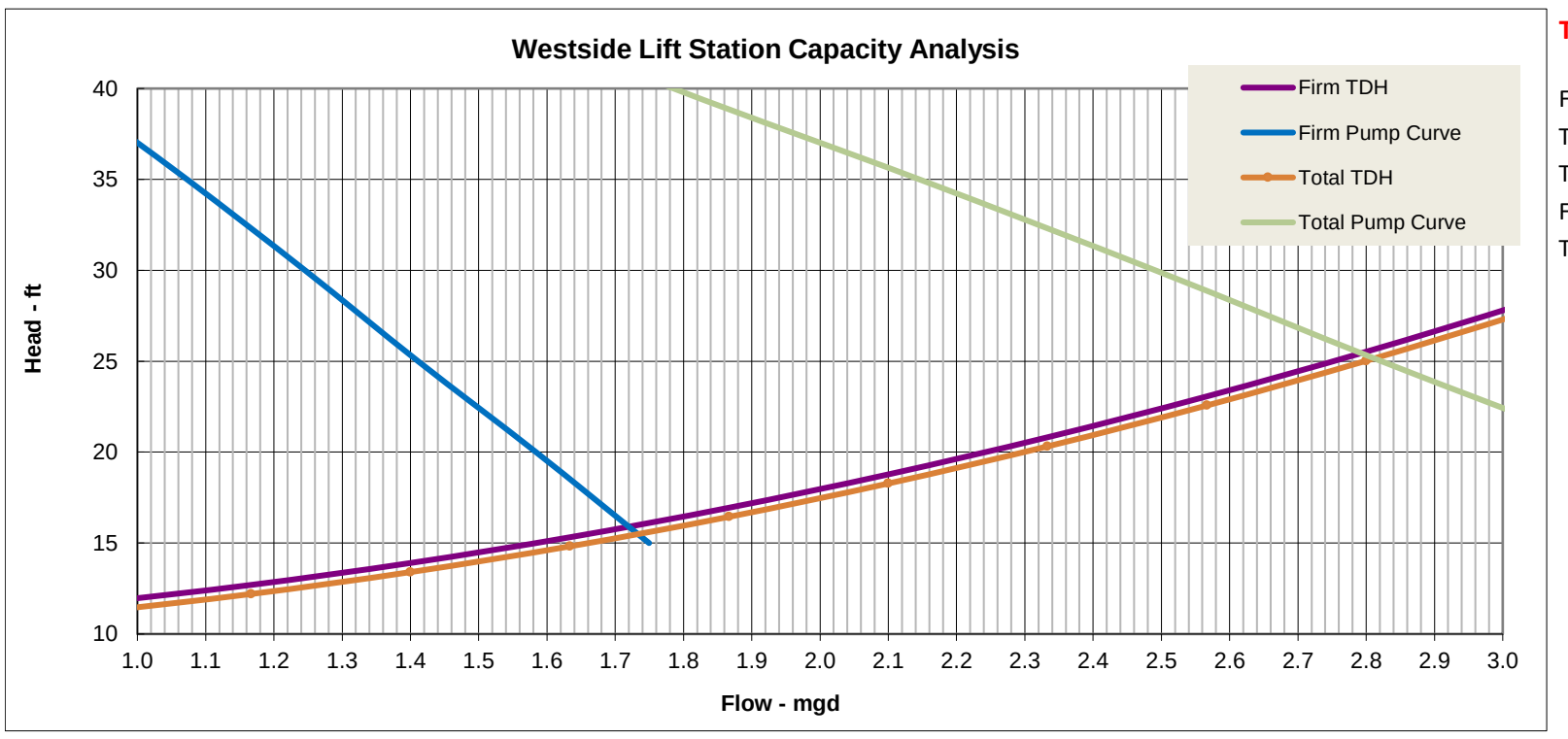


Table 6: Estimated Capacity

Firm Capacity:	1.72	mgd
Total Capacity:	2.81	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**1.55**	mgd
Total Capacity:	**2.53**	mgd

Tasman Lift Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	47	*Total length from bottom of wetwell to discharge elevation (-12.5' to 4.3') to the discharge manhole (~30')*
FM diameter (inches)	8	*Two discharge lines.*
FM area (ft^2)	0.35	*Calculated*
Material	D.I.	*Ductile Iron*
Approx Year Built		
number of pumps	2	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-12.50	*Source: Dwg 9542-D, Sheet 29. 1986*
approx discharge elevation	4.30	*Source: Dwg 9542-D, Sheet 29. 1986*
f	0.0	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	1.40	*Calculated*
K - allowance for minor losse	10	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On Set Pt	On Elev.	Lift	Off	Off Level	Lift
Pump #1 (IW ID: S103-8.1)	7.3	-5.20	9.50	2.7	-9.8	14.1
Pump #2 (IW ID: S103-8.2)	9.8	-2.70	7.00	2.7	-9.8	14.1

Table 3: Pump Curves

Sources: Pump curves provided by City. Two pumps are identical.

Pump Model: Flygt NP 3127 LT3~ Adaptive 425 *Pump Serial Number: 3127.070-1780057*

	Pump #1 & #2	
HEAD (ft)	Flow (gpm)	Flow (mgd)
7	1730	2.49
10	1630	2.35
15	1470	2.12
20	1280	1.84
25	1090	1.57
30	930	1.34
33	830	1.20
35	740	1.07
38	570	0.82
40	420	0.60
45	240	0.35
50	80	0.12
52	0	0.00

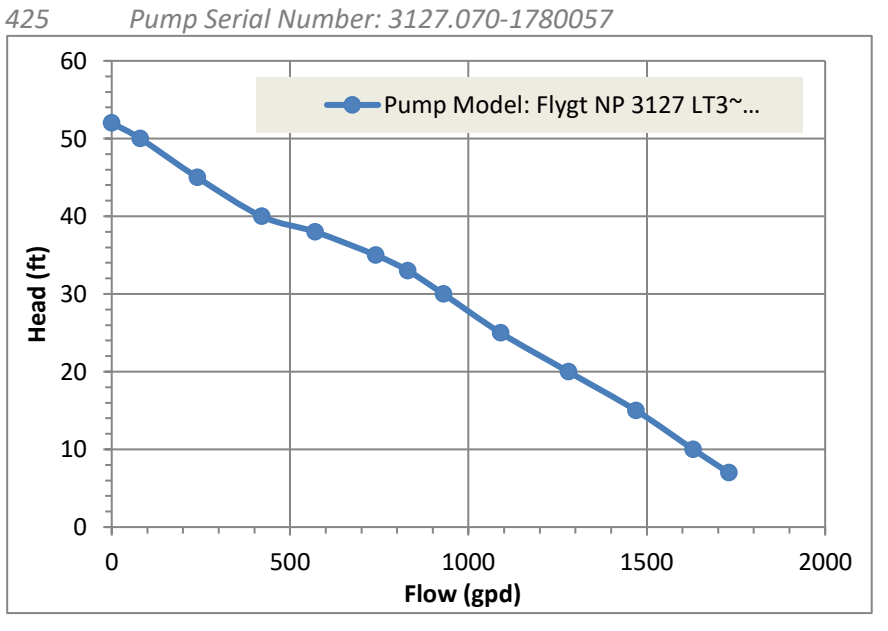


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
7	1730	2.49	3460	4.98
10	1630	2.35	3260	4.69
15	1470	2.12	2940	4.23
20	1280	1.84	2560	3.69
25	1090	1.57	2180	3.14
30	930	1.34	1860	2.68
33	830	1.20	1660	2.39
35	740	1.07	1480	2.13
38	570	0.82	1140	1.64
40	420	0.60	840	1.21
45	240	0.35	480	0.69
50	80	0.12	160	0.23
52	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Firm TDH	Total TDH	Other (use as-needed)
Lift:	9.5	7	

Flow			Velocity (ft/s)	Minor Headloss (ft)	Friction Headloss (ft)		Total Dynamic Head (ft)					
							Firm TDH		Total TDH		Other	
mgd	gpm	cfs			Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
0.00	0	0.0	0.0	0.0	0.0	0.0	9.5	9.5	7.0	7.0	0.0	0.0
0.25	171	0.4	1.1	0.2	0.0	0.0	9.7	9.7	7.2	7.2	0.2	0.2
0.49	343	0.8	2.2	0.7	0.1	0.1	10.3	10.4	7.8	7.9	0.8	0.9
0.74	514	1.1	3.3	1.7	0.2	0.3	11.4	11.5	8.9	9.0	1.9	2.0
0.99	685	1.5	4.4	3.0	0.4	0.5	12.9	13.0	10.4	10.5	3.4	3.5
1.23	856	1.9	5.5	4.6	0.7	0.8	14.8	14.9	12.3	12.4	5.3	5.4
1.48	1028	2.3	6.6	6.7	0.9	1.1	17.1	17.3	14.6	14.8	7.6	7.8
1.73	1199	2.7	7.7	9.1	1.3	1.4	19.9	20.0	17.4	17.5	10.4	10.5
1.97	1370	3.1	8.8	11.9	1.7	1.8	23.1	23.2	20.6	20.7	13.6	13.7
2.22	1542	3.4	9.8	15.1	2.1	2.3	26.7	26.8	24.2	24.3	17.2	17.3
2.47	1713	3.8	10.9	18.6	2.6	2.7	30.7	30.8	28.2	28.3	21.2	21.3
2.71	1884	4.2	12.0	22.5	3.2	3.3	35.1	35.2	32.6	32.7	25.6	25.7
2.96	2056	4.6	13.1	26.8	3.8	3.8	40.0	40.1	37.5	37.6	30.5	30.6
3.21	2227	5.0	14.2	31.4	4.4	4.4	45.3	45.4	42.8	42.9	35.8	35.9
3.45	2398	5.3	15.3	36.4	5.1	5.1	51.0	51.0	48.5	48.5	41.5	41.5
3.70	2569	5.7	16.4	41.8	5.9	5.8	57.2	57.1	54.7	54.6	47.7	47.6

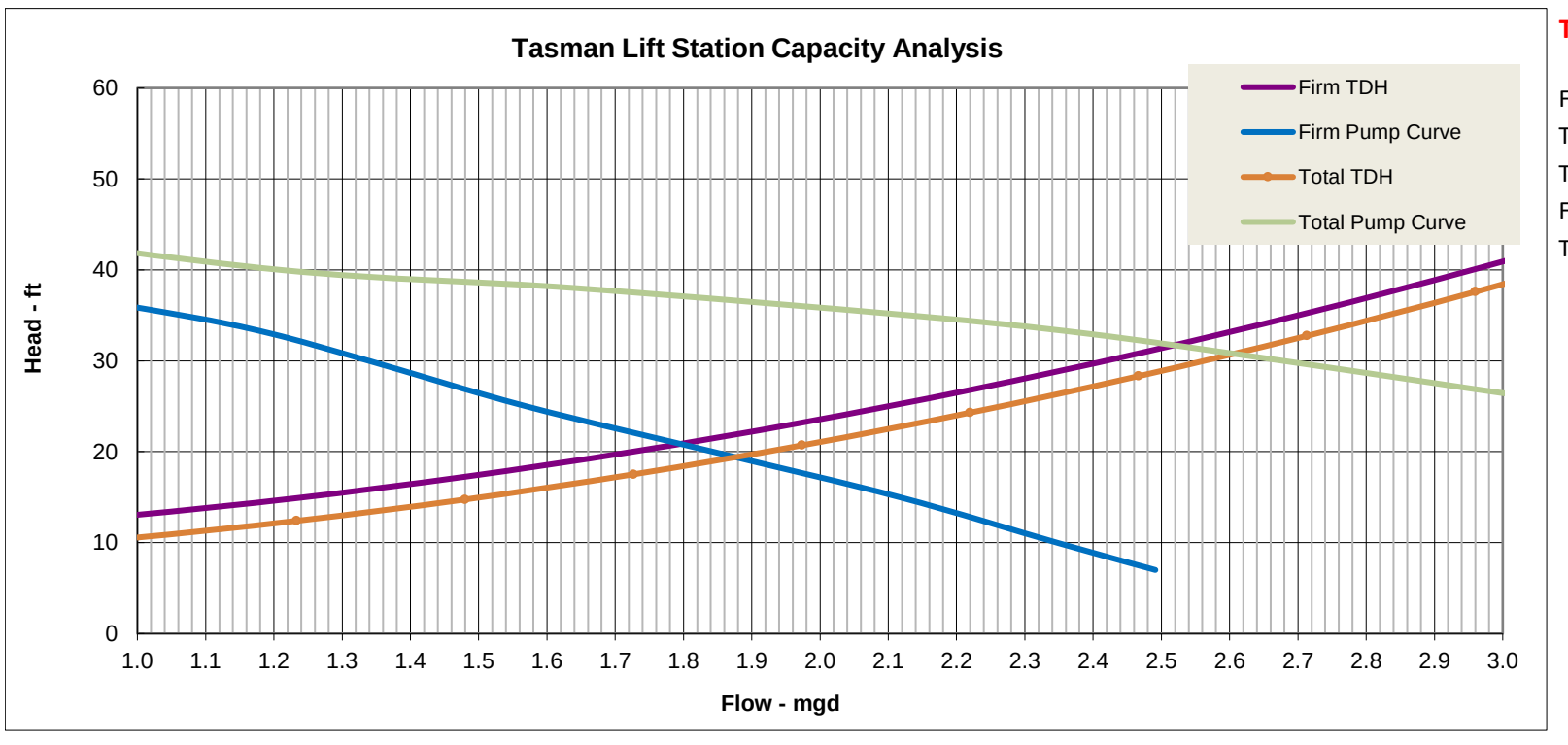


Table 6: Estimated Capacity

Firm Capacity:	1.79	mgd
Total Capacity:	2.60	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**1.61**	mgd
Total Capacity:	**2.34**	mgd

De La Cruz Lift Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	23	*Total length from bottom of wetwell to discharge elevation (-6.74' to 12.05') to the discharge manhole (~4')*
FM diameter (inches)	8	*Two discharge lines.*
FM area (ft^2)	0.35	*Calculated*
Material	DIP	*Source: Dwg 10016-D, Sheet 2. 1992*
Approx Year Built	1992	*FYI: approx. pump age: 5 years (source: pump station survey)*
number of pumps	2	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-6.74	*Source: Dwg 10016-D, Sheet 2. 1992*
approx discharge elevation	12.05	*Source: Dwg 10016-D, Sheet 2. 1992*
f	0.0	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	0.68	*Calculated*
K - allowance for minor losses	5	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On Set Pt	On Elev.	Lift	Off	Off Level	Lift
Pump #1 (IW ID: S103-8.1)	3.5	-3.24	15.29	1	-5.74	17.79
Pump #2 (IW ID: S103-8.2)	4	-2.74	14.79	1	-5.74	17.79

Table 3: Pump Curves

Sources: Pump curves provided by City. Two pumps are identical.

Pump Model: Flygt NP 3127 LT3~ Adaptive 425 *Pump Serial Number: 3127.090-1780054*

	Pump #1 & #2	
HEAD (ft)	Flow (gpm)	Flow (mgd)
15	1470	2.12
20	1280	1.84
25	1080	1.56
30	930	1.34
33	830	1.20
35	740	1.07
37	570	0.82
40	420	0.60
45	240	0.35
50	80	0.12
51	0	0.00
		0.00
		0.00
		0.00

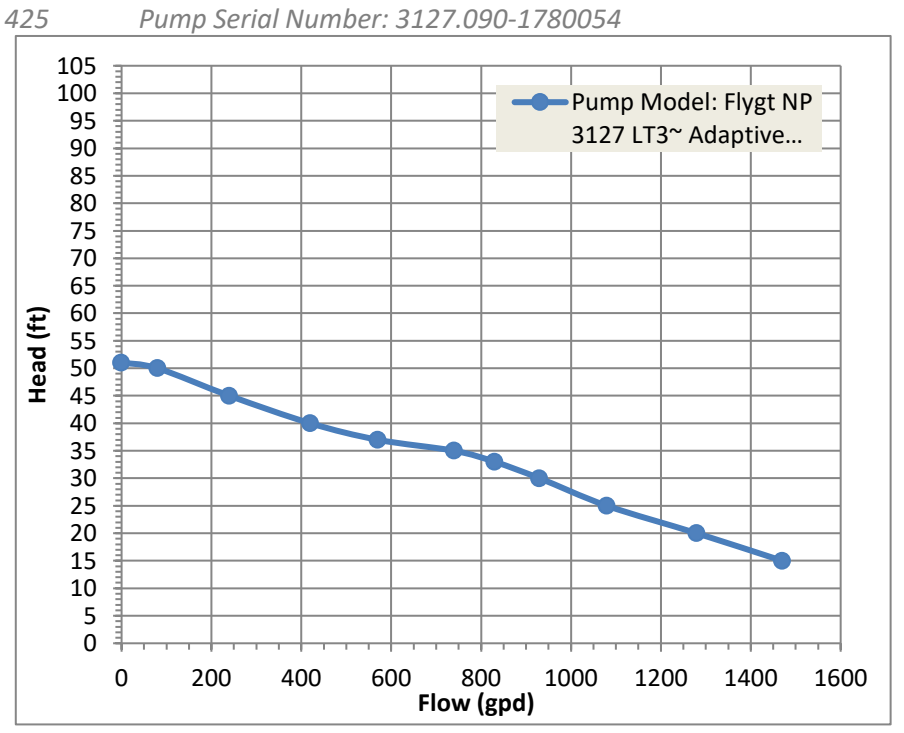


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
15	1470	2.12	2940	4.23
20	1280	1.84	2560	3.69
25	1080	1.56	2160	3.11
30	930	1.34	1860	2.68
33	830	1.20	1660	2.39
35	740	1.07	1480	2.13
37	570	0.82	1140	1.64
40	420	0.60	840	1.21
45	240	0.35	480	0.69
50	80	0.12	160	0.23
51	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Firm TDH	Total TDH	Other (use as-needed)
Lift:	15.29	14.79	

Flow			Velocity (ft/s)	Minor Headloss (ft)	Friction Headloss (ft)		Total Dynamic Head (ft)					
					Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs										
0.00	0	0.0	0.0	0.0	0.0	0.0	15.3	15.3	14.8	14.8	0.0	0.0
0.29	199	0.4	1.3	0.1	0.0	0.0	15.4	15.4	14.9	14.9	0.1	0.2
0.57	398	0.9	2.5	0.5	0.1	0.1	15.9	15.9	15.4	15.4	0.6	0.6
0.86	597	1.3	3.8	1.1	0.2	0.2	16.6	16.6	16.1	16.1	1.3	1.3
1.15	796	1.8	5.1	2.0	0.3	0.3	17.6	17.6	17.1	17.1	2.3	2.3
1.43	995	2.2	6.4	3.1	0.4	0.5	18.9	18.9	18.4	18.4	3.6	3.6
1.72	1194	2.7	7.6	4.5	0.6	0.7	20.4	20.5	19.9	20.0	5.1	5.2
2.01	1394	3.1	8.9	6.1	0.8	0.9	22.3	22.3	21.8	21.8	7.0	7.1
2.29	1593	3.5	10.2	8.0	1.1	1.2	24.4	24.5	23.9	24.0	9.1	9.2
2.58	1792	4.0	11.4	10.2	1.4	1.4	26.8	26.9	26.3	26.4	11.6	11.6
2.87	1991	4.4	12.7	12.5	1.7	1.8	29.6	29.6	29.1	29.1	14.3	14.3
3.15	2190	4.9	14.0	15.2	2.1	2.1	32.5	32.6	32.0	32.1	17.3	17.3
3.44	2389	5.3	15.3	18.1	2.5	2.5	35.8	35.8	35.3	35.3	20.5	20.5
3.73	2588	5.8	16.5	21.2	2.9	2.9	39.4	39.4	38.9	38.9	24.1	24.1
4.01	2787	6.2	17.8	24.6	3.4	3.3	43.2	43.2	42.7	42.7	28.0	27.9
4.30	2986	6.7	19.1	28.2	3.9	3.7	47.4	47.3	46.9	46.8	32.1	32.0

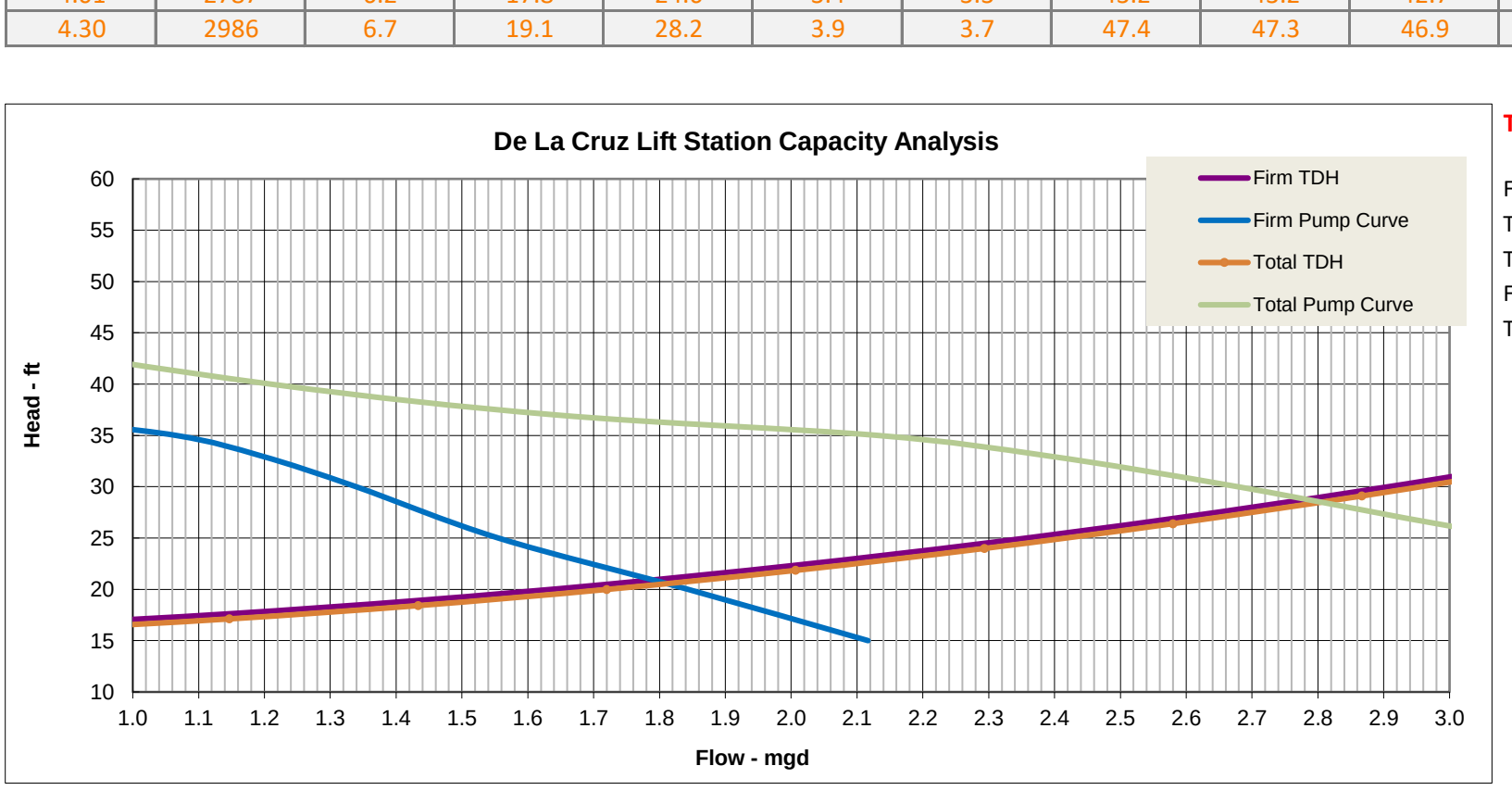


Table 6: Estimated Capacity

Firm Capacity:	1.79	mgd
Total Capacity:	2.8	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**1.61**	mgd
Total Capacity:	**2.52**	mgd

Primavera Pump Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	68	*Source; Sanitary Sewer Pump Station Evaluation, Schaaf & Wheeler, 2010.*
FM diameter (inches)	16	*1 discharge line*
FM area (ft^2)	1.40	*Calculated*
Material	C.I.	*Cast Iron*
Approx Year Built	unknown	
number of pumps	6	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-22.00	*Source: Dwg 9518, Sheet 57, 1988*
approx discharge elevation	-0.35	*Source: Dwg 9518, Sheet 57, 1988*
f	0.02	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	1.02	*Calculated*
K - allowance for minor losses	20	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On	On Level	Lift	Off	Off Level	Lift
Pump #1	9	-13.00	12.65	4.8	-17.20	16.85
Pump #2	9.3	-12.70	12.35	4.8	-17.20	16.85
Pump #3	9.7	-12.30	11.95	5.2	-16.80	16.45
Pump #4	9.8	-12.20	11.85	5.2	-16.80	16.45
Pump #5	9.9	-12.10	11.75	5.3	-16.70	16.35
Pump #6	10.2	-11.80	11.45	7.5	-14.50	14.15

Table 3: Pump Curves

Sources: Pump curves provided by City

Pump Model: Flygt NP 3127 MT 3~ Adaptive 438 *Pump Serial Number: 3127.090-1260005*

	Pump #1-#6	
HEAD (ft)	Flow (gpm)	Flow (mgd)
15	1210	1.74
20	1090	1.57
25	980	1.41
30	860	1.24
35	735	1.06
40	615	0.89
45	500	0.72
50	380	0.55
55	260	0.37
58	190	0.27
60	145	0.21
65	60	0.09
69	0	0.00

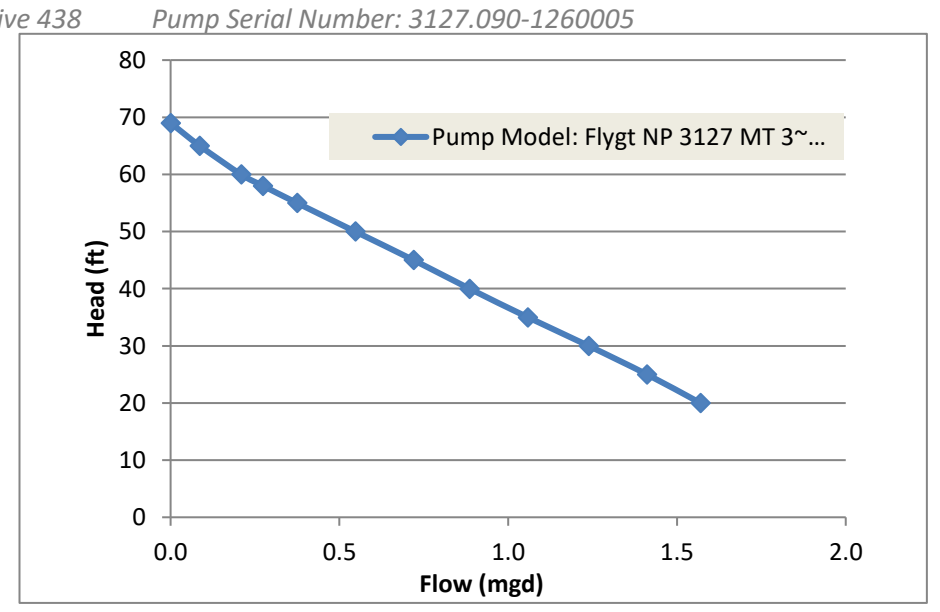


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
15	6050	8.71	7260	10.45
20	5450	7.85	6540	9.42
25	4900	7.06	5880	8.47
30	4300	6.19	5160	7.43
35	3675	5.29	4410	6.35
40	3075	4.43	3690	5.31
45	2500	3.60	3000	4.32
50	1900	2.74	2280	3.28
55	1300	1.87	1560	2.25
58	950	1.37	1140	1.64
60	725	1.04	870	1.25
65	300	0.43	360	0.52
69	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Pump #1 only (Firm)			All On (High Level)			Other (use as-needed)		
Lift:	12.65			11.45					

Flow			Velocity (ft/s)	Minor Headloss (ft)	Friction Headloss (ft)		Total Dynamic Head (ft)					
					Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs										
0.00	0	0.0	0.0	0.0	0.0	0.0	12.7	12.7	11.5	11.5	0.0	0.0
0.70	486	1.1	0.8	0.2	0.0	0.0	12.8	12.9	11.6	11.7	0.2	0.2
1.40	972	2.2	1.6	0.7	0.0	0.0	13.4	13.4	12.2	12.2	0.8	0.8
2.10	1458	3.2	2.3	1.7	0.1	0.1	14.4	14.4	13.2	13.2	1.8	1.8
2.80	1944	4.3	3.1	3.0	0.2	0.2	15.8	15.8	14.6	14.6	3.1	3.2
3.50	2431	5.4	3.9	4.7	0.2	0.3	17.6	17.6	16.4	16.4	4.9	4.9
4.20	2917	6.5	4.7	6.7	0.3	0.4	19.7	19.7	18.5	18.5	7.1	7.1
4.90	3403	7.6	5.4	9.2	0.5	0.5	22.3	22.3	21.1	21.1	9.6	9.7
5.60	3889	8.7	6.2	12.0	0.6	0.6	25.2	25.2	24.0	24.0	12.6	12.6
6.30	4375	9.7	7.0	15.2	0.8	0.8	28.6	28.6	27.4	27.4	15.9	15.9
7.00	4861	10.8	7.8	18.7	1.0	0.9	32.3	32.3	31.1	31.1	19.7	19.6
7.70	5347	11.9	8.5	22.6	1.2	1.1	36.4	36.4	35.2	35.2	23.8	23.8
8.40	5833	13.0	9.3	26.9	1.4	1.3	41.0	40.9	39.8	39.7	28.3	28.3
9.10	6319	14.1	10.1	31.6	1.6	1.5	45.9	45.8	44.7	44.6	33.2	33.1
9.80	6806	15.2	10.9	36.7	1.9	1.8	51.2	51.1	50.0	49.9	38.5	38.4
10.50	7292	16.2	11.6	42.1	2.1	2.0	56.9	56.7	55.7	55.5	44.2	44.1

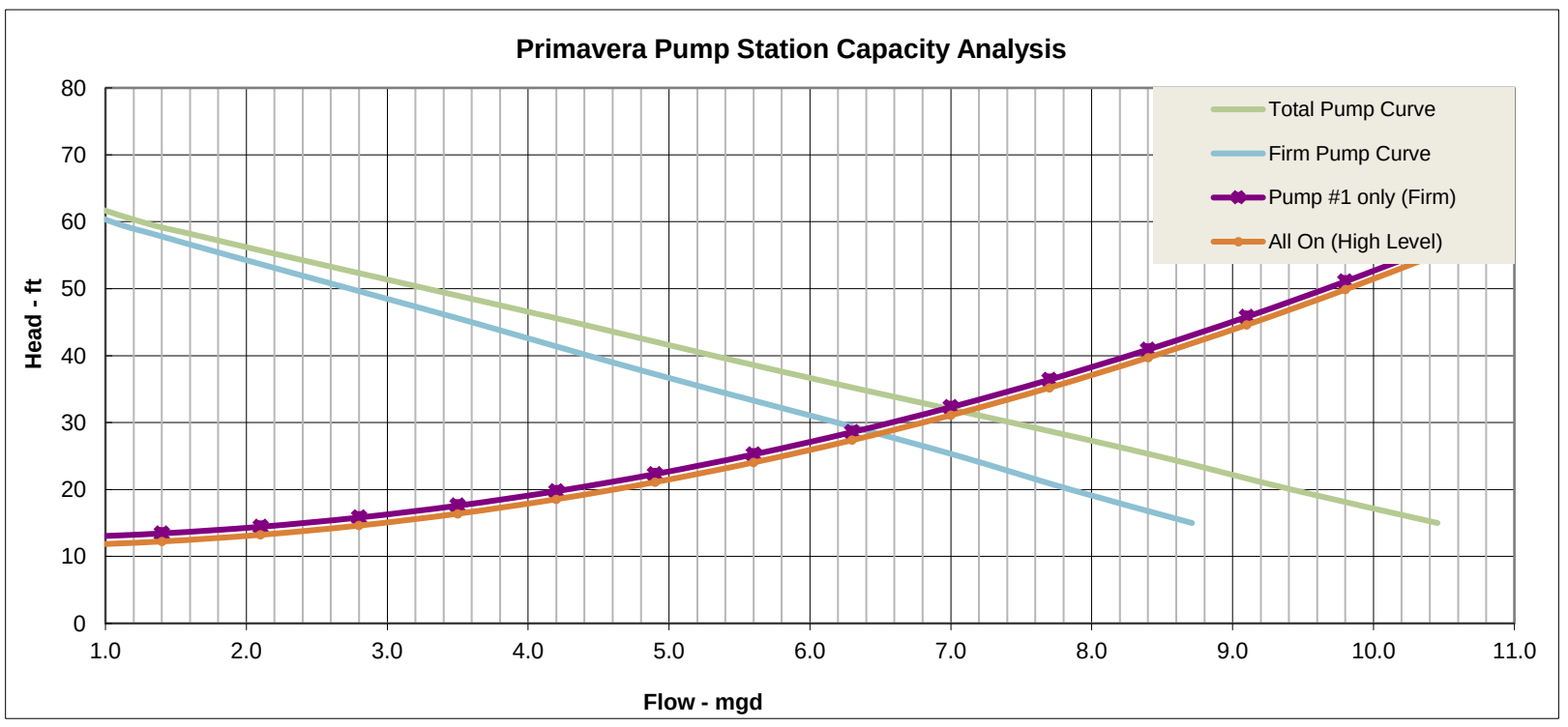


Table 6: Estimated Capacity

Firm Capacity:	6.35	mgd
Total Capacity:	7.1	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**5.72**	mgd
Total Capacity:	**6.39**	mgd

Levis Stadium Pump Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	220	*Source: As-Built Drawings*
FM diameter (inches)	10	*Note: Two 6-inch and four 8-inch turn into 10 inch FM.*
FM area (ft^2)	0.55	*Calculated*
Material	N/A	
Approx Year Built	2014	*Approx. pump age: 1 year (source: pump station survey)*
number of pumps	6	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-16.63	*Source: Dwg M101, Sheet 11, 2013*
approx discharge elevation	-2	*Source: Dwg C-102, Sheet 5, 2012*
f	0.02	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	5.28	*Calculated*
K - allowance for minor losse	20	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On	On Level	Lift	Off	Off Level	Lift
Pump #1	11.75	-12.9	10.9	11.25	-15.4	13.4
Pump #2	12.75	-11.9	9.9	12.25	-12.4	10.4
Pump #3	8.55	-8.1	6.1	8.05	-10.6	8.6
Pump #4	9.55	-7.1	5.1	9.05	-9.3	7.3
Pump #5	10.55	-6.1	4.1	10.05	-8.3	6.3
Pump #6	11.55	-5.6	3.6	11.1	-7.6	5.6

Table 3: Pump Curves

Sources: Pump curves provided by City

	Lower Flow		Higher Flow	
	Pump #1-#2		Pump #3-#6	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
0				
5				
10			1470	2.12
15	760	1.09	1300	1.87
20	670	0.96	1105	1.59
25	575	0.83	910	1.31
30	480	0.69	740	1.07
35	390	0.56	590	0.85
40	300	0.43	345	0.50
45	210	0.30	130	0.19
50	130	0.19	20	0.03
55	45	0.06		
60				
65				
70				
75				
80				
85				
90				
95				
100				

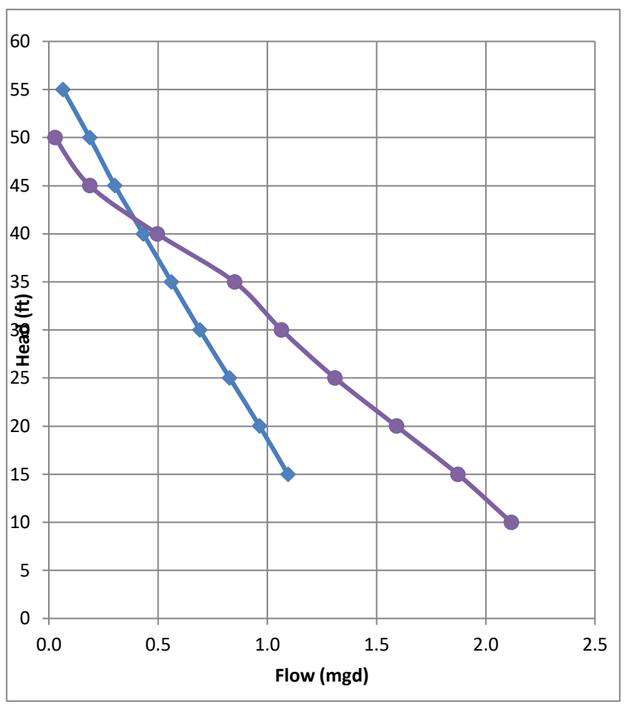


Table 4: Operation Scenarios

	Pump #1-#5 On		All Pumps On	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
0				
5				
10				
15			6,720	9.68
20	4,655	6.70	5,760	8.29
25	3,880	5.59	4,790	6.90
30	3,180	4.58	3,920	5.64
35	2,550	3.67	3,140	4.52
40	1,635	2.35	1,980	2.85
45	810	1.17	940	1.35
50	320	0.46	340	0.49
55	90	0.13	90	0.13
60				
65				
70				
75				
80				

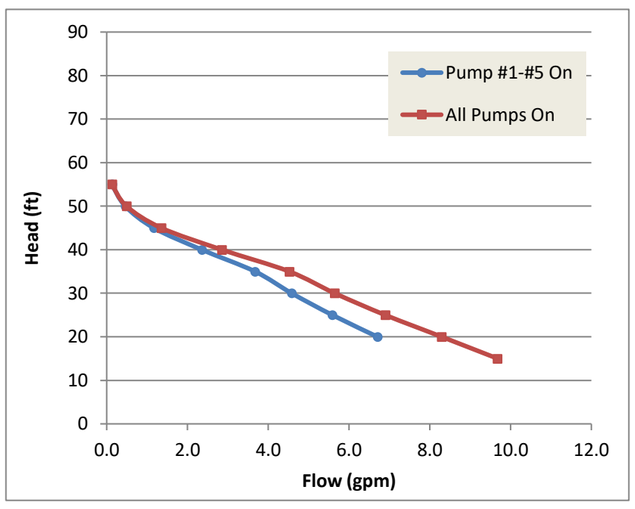


Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Pump #1-5 (Firm)			All On (High Level)					
Lift:	4.1			3.6					
				Friction Headloss (ft)		Total Dynamic Head (ft)			
Flow			Velocity (ft/s)	Minor Headloss (ft)	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs								
0	0	0.0	0.0	0.0	0.0	0.0	4.1	4.1	3.6	3.6
5	3472	7.7	14.2	62.5	16.5	16.1	83.1	82.7	82.7	82.2
10	6944	15.5	28.4	250.2	66.0	58.0	320.3	312.3	319.8	311.8
15	10417	23.2	42.6	562.9	148.6	123.0	715.6	689.9	715.1	689.5
20	13889	30.9	56.8	1000.7	264.2	209.5	1269.0	1214.3	1268.5	1213.8
25	17361	38.7	71.0	1563.6	412.8	316.7	1980.4	1884.4	1980.0	1883.9
30	20833	46.4	85.1	2251.6	594.4	443.9	2850.0	2699.6	2849.6	2699.1
35	24306	54.2	99.3	3064.6	809.1	590.6	3877.7	3659.3	3877.3	3658.8
40	27778	61.9	113.5	4002.8	1056.7	756.3	5063.6	4763.1	5063.1	4762.7
45	31250	69.6	127.7	5066.0	1337.4	940.7	6407.5	6010.7	6407.0	6010.3
50	34722	77.4	141.9	6254.3	1651.1	1143.3	7909.5	7401.7	7909.1	7401.3
55	38194	85.1	156.1	7567.7	1997.9	1364.1	9569.7	8935.8	9569.2	8935.4
60	41667	92.8	170.3	9006.2	2377.6	1602.6	11387.9	10612.9	11387.5	10612.4
65	45139	100.6	184.5	10569.8	2790.4	1858.6	13364.3	12432.5	13363.8	12432.1
75	48611	108.3	198.7	12258.4	3236.2	2132.1	15498.7	14394.6	15498.3	14394.1
70	52083	116.0	212.9	14072.2	3715.1	2422.7	17791.3	16498.9	17790.9	16498.5

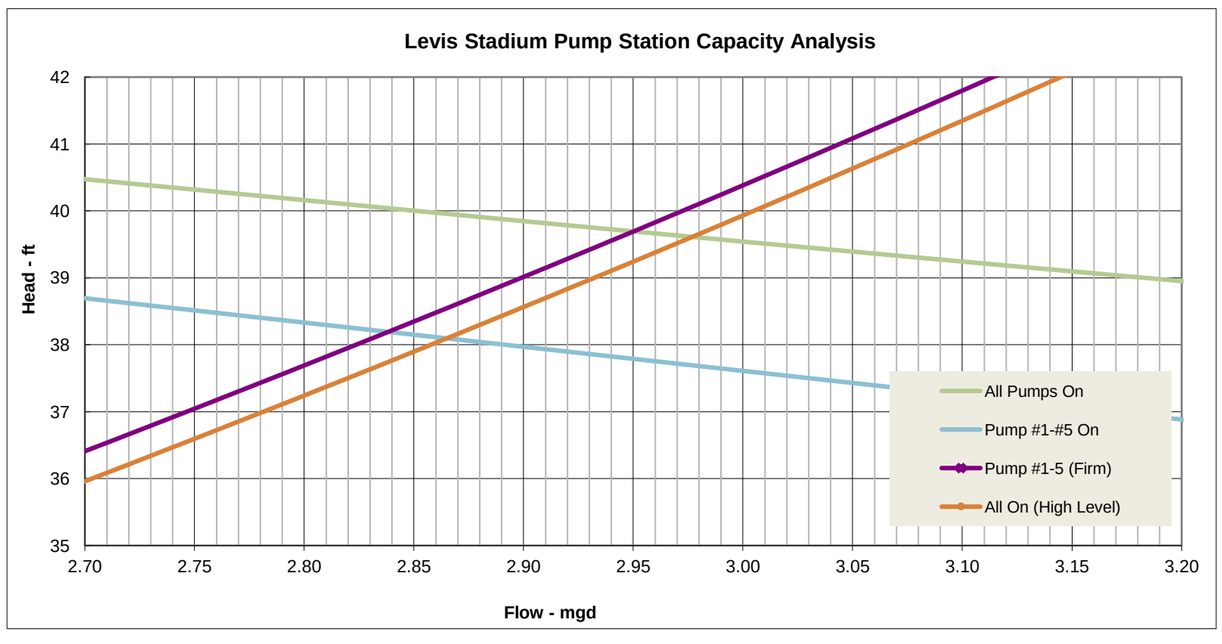


Table 6: Estimated Capacity

Firm Capacity:	2.84	mgd
Total Capacity:	2.98	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**2.56**	mgd
Total Capacity:	**2.68**	mgd

(manual input base on info from the graph. This is the total pump capacity with the largest pump out of service)
(manual input base on info from the graph)
(per recommendations from Dennis G)

APPENDIX D: FIELD-COLLECTED SURVEY INFORMATION DATA SHEETS

Field Verification

Date: 3/20/23 Time: 10:30 am Weather: (Dry)/Rain

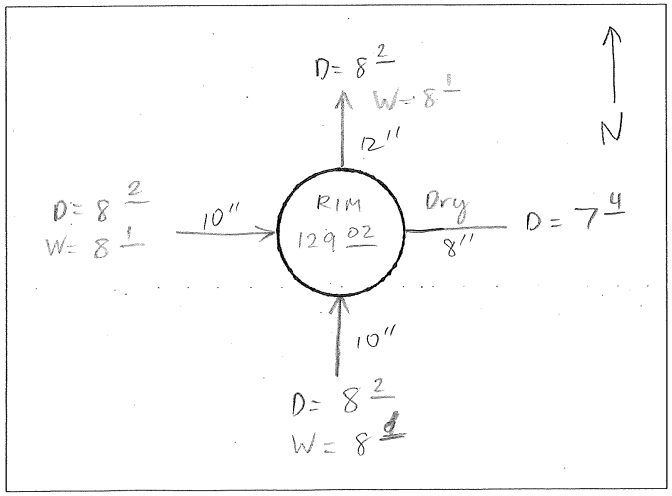
Name of Field Observer(s): CL & KT

MH Number: S12-50

Street/Intersection: Pruneridge @ Woodhams

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 10:10 am Weather: (Dry)/Rain

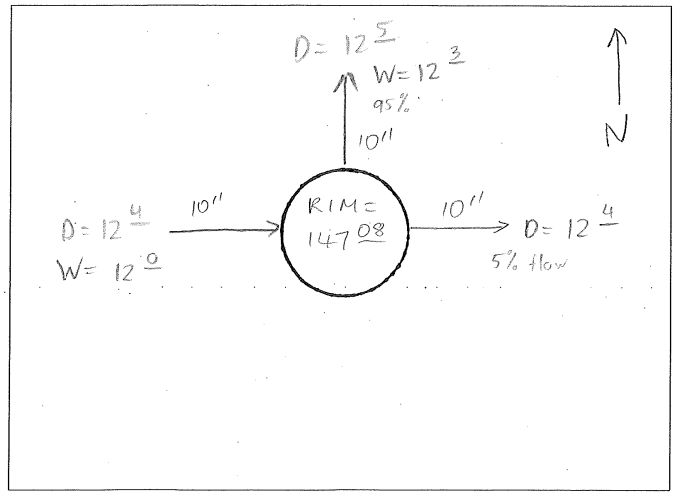
Name of Field Observer(s): CL & KT

MH Number: S10-29

Street/Intersection: Pruneridge @ Norwood Cir

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
most flow goes north. East pipe blocked by debris.

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 10:45 am Weather: (Dry)/Rain

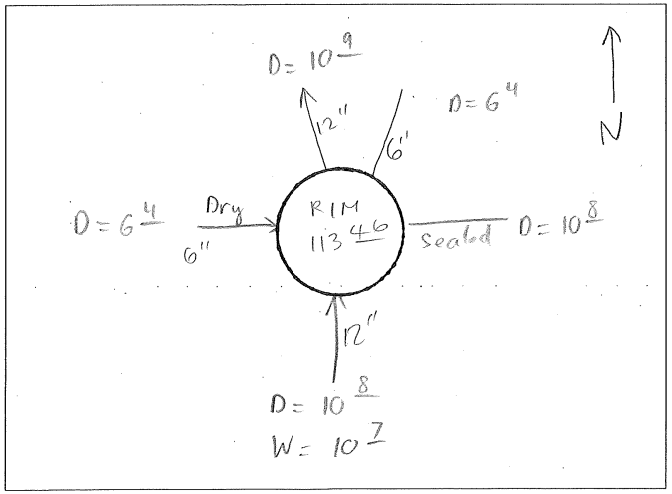
Name of Field Observer(s): CL & KT

MH Number: S13-38

Street/Intersection: Kiely @ S. of Forbes

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

flow goes north

Other Observations:

All VCP

Field Verification

Date: 3/20/23 Time: 10:45 am Weather: (Dry)/Rain

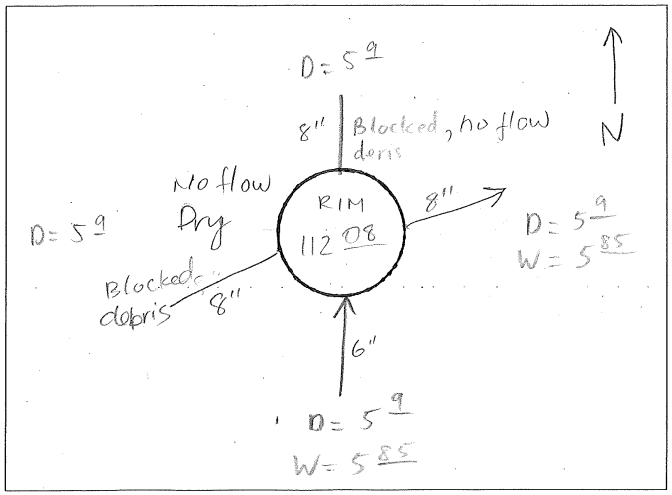
Name of Field Observer(s): CL & KT

MH Number: S13-27

Street/Intersection: Kiely @ Forbes

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

All from south into east.

Other Observations:

All VCP

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Field Verification

Date: 3/2/23 Time: 2:30 pm Weather: (Dry)/Rain

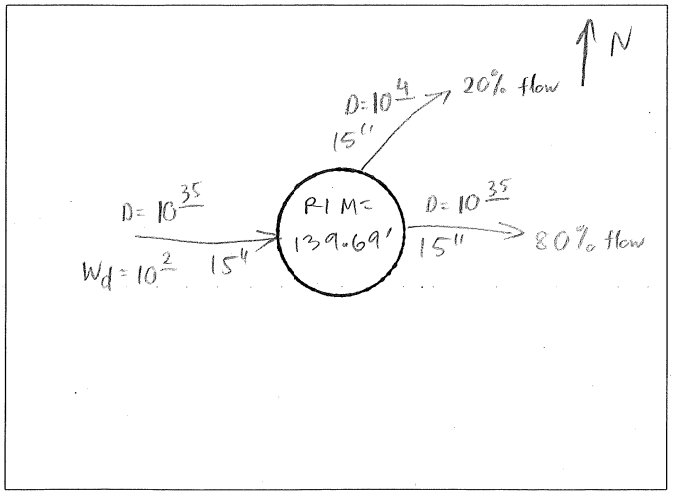
Name of Field Observer(s): CL & KT (CHANH LE EKHOI TRAN)

MH Number: S20-16 West of

Street/Intersection: Homestead Rd @ Kaiser Entrance

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



ELEVATION IS BASED ON NAVD88.
D = INVERT DEPTH
W OR Wd = DEPTH OF WATER LEVEL

Where is most of the flow going out to? Or is the flow evenly split?

80% going W to E
20% to NE

Other Observations:

Wd = 10 2 VCP
Fast flow

Field Verification

Date: 4/5/23 Time: 2:45 pm Weather: (Dry)/Rain

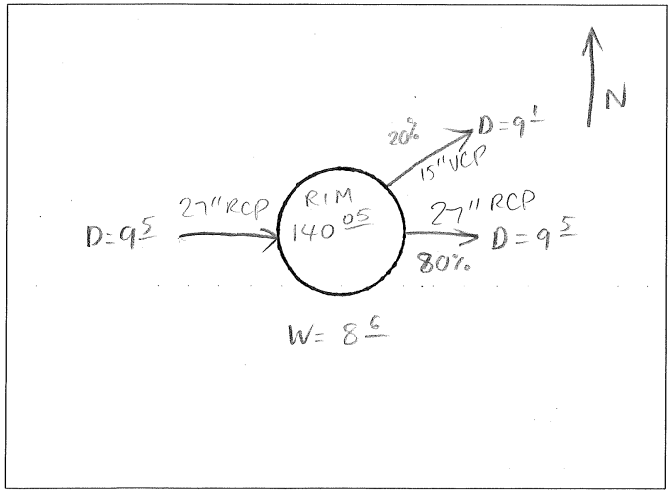
Name of Field Observer(s): CL & KT

MH Number: S 20-9

Street/Intersection: Homestead @ Swallow

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 2:30 pm Weather: (Dry)/Rain

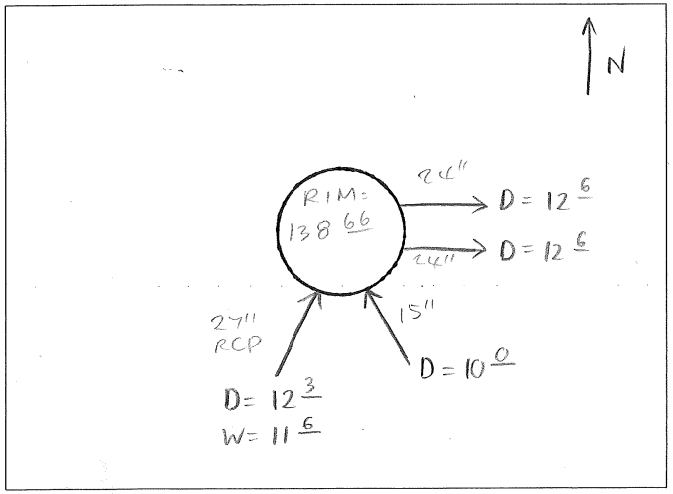
Name of Field Observer(s): CL & KT

MH Number: S 20-26

Street/Intersection: Homestead @ West of Kaiser Entrance

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/2/23 Time: 2:45 pm Weather: (Dry)/Rain

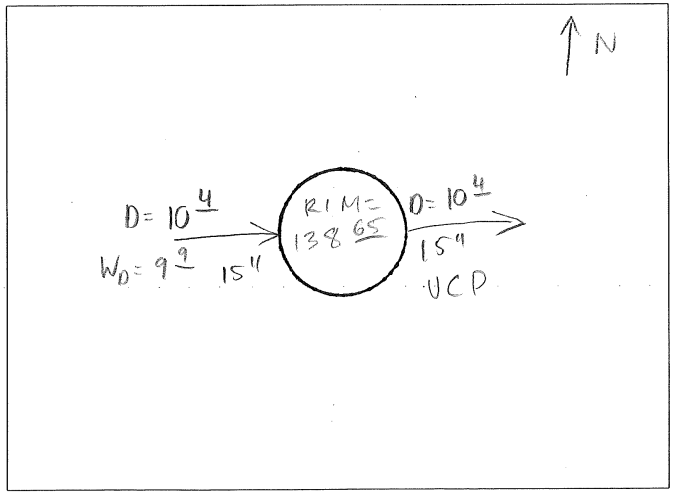
Name of Field Observer(s): CL & KT

MH Number: S 20-17

Street/Intersection: Homestead @ Kaiser Entrance

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
VCP

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Field Verification

Date: 3/20/23 Time: 11:15 am Weather: Dry/Rain

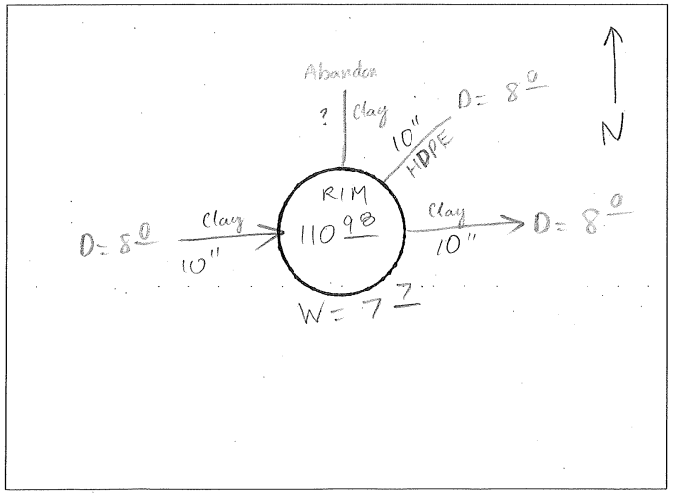
Name of Field Observer(s): CL & KT

MH Number: S22-64

Street/Intersection: Homestead @ Saratoga Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 3 pm Weather: Dry/Rain

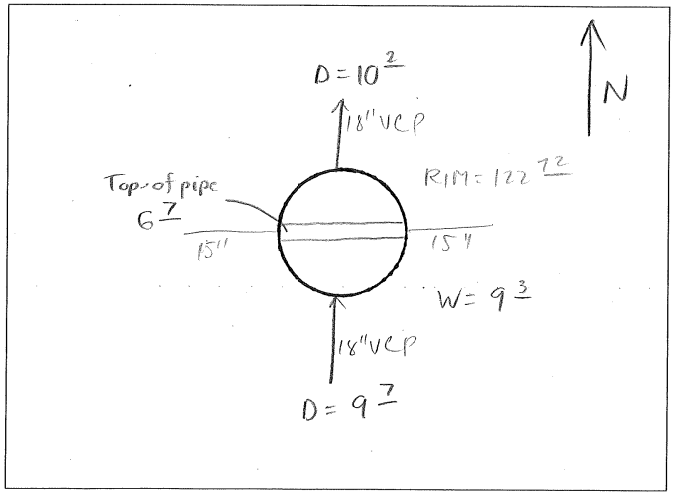
Name of Field Observer(s): CL & KT

MH Number: S22-55

Street/Intersection: Homestead @ Pomeroy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

Field Verification

Date: 3/20/23 Time: 11:30 am Weather: (Dry)/Rain

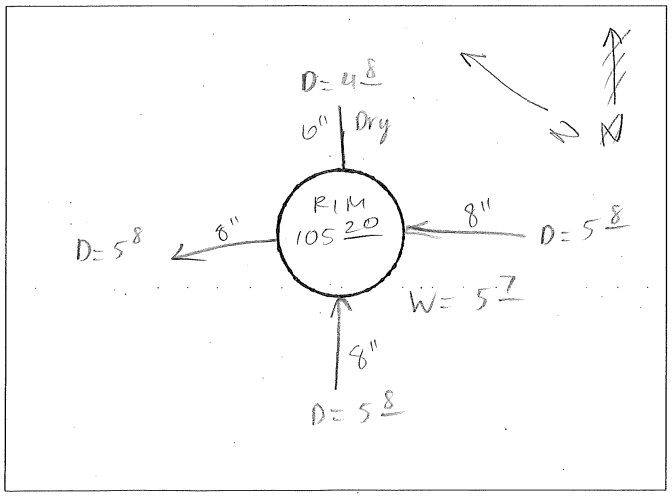
Name of Field Observer(s): CL & KT

MH Number: S23-51

Street/Intersection: Kiely @ Barcell

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

flow all goes west

Other Observations:

All VCP

Field Verification

Date: 3/27/23 Time: 10 am Weather: (Dry)/Rain

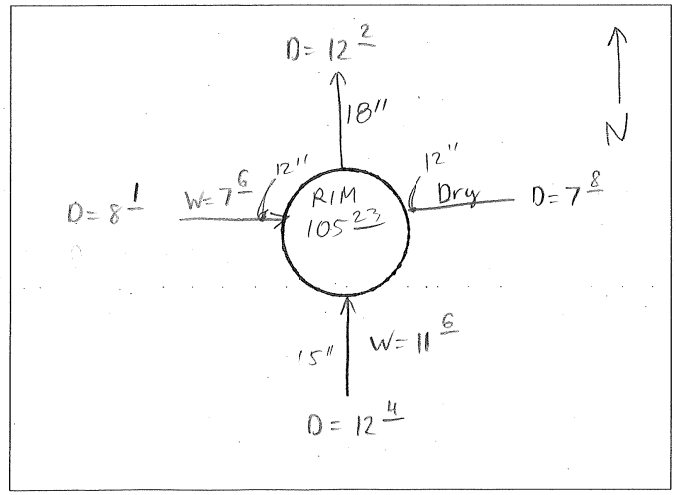
Name of Field Observer(s): CL & KT

MH Number: S23-27

Street/Intersection: Homestead @ Kiely

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Can't tell how flow is split.

Other Observations:

Field Verification

Date: 3/20/23 Time: 1:45 pm Weather: (Dry)/Rain

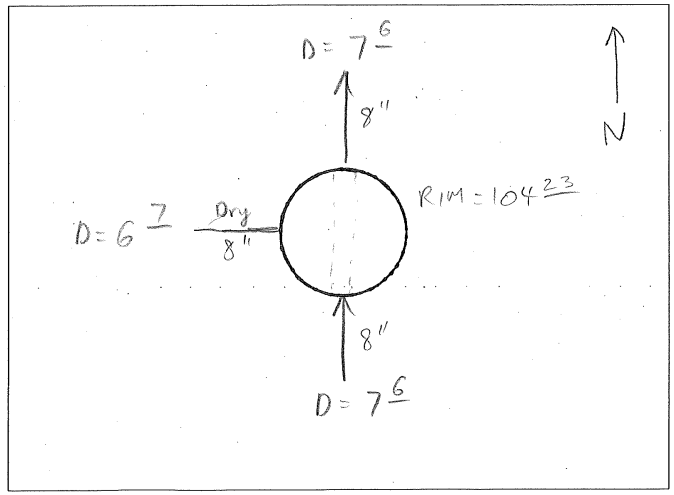
Name of Field Observer(s): CL & KT

MH Number: S26 - 70

Street/Intersection: Newhall @ N. Winchester

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W = 7 4
All VCP

Field Verification

Date: 4/6/23 Time: 9:15 am Weather: (Dry)/Rain

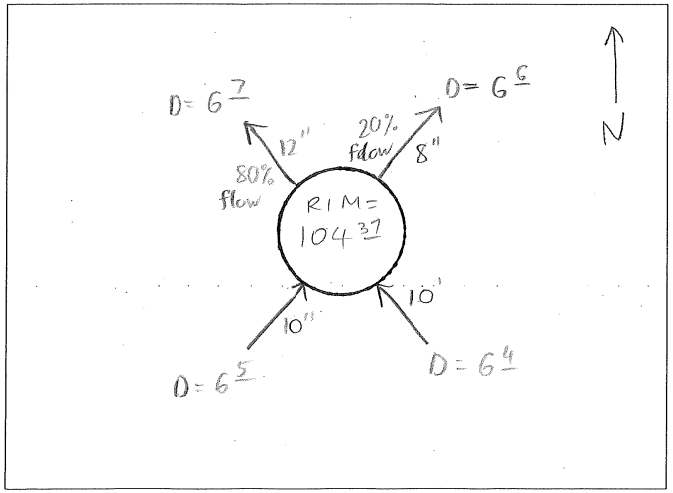
Name of Field Observer(s): CL & KT

MH Number: S25-85

Street/Intersection: Los Padres @ Saratoga

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W = 6 2
All VCP

Field Verification

Date: 3/20/23 Time: 11:45 am Weather: (Dry)/Rain

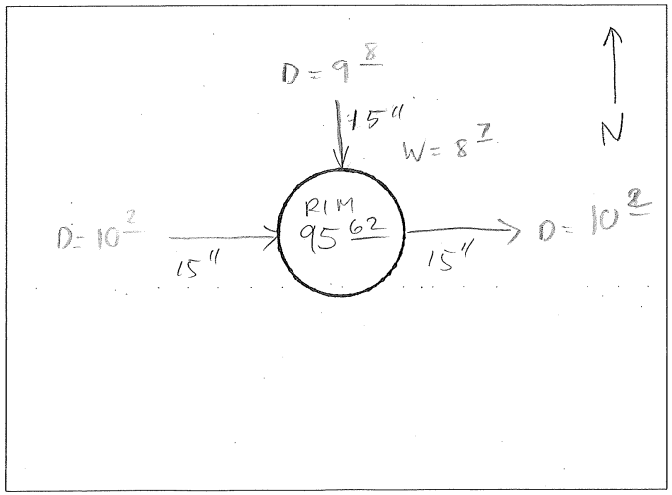
Name of Field Observer(s): CL & KT

MH Number: S32 - 101

Street/Intersection: Pomeroy @ El Sobrante

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

most flow goes to the east

Other Observations:

All VCP

Field Verification

Date: 4/5/23 Time: 3:15 pm Weather: (Dry)/Rain

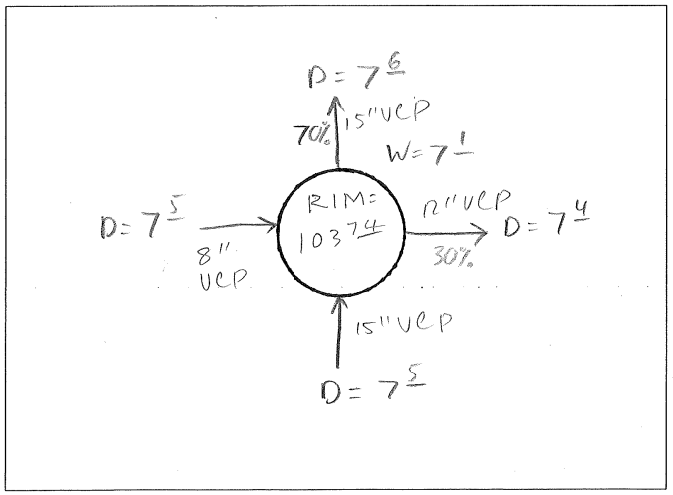
Name of Field Observer(s): CL & KT

MH Number: S 32 - 68

Street/Intersection: Benton @ Pomeroy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 3/17/23 Time: 11:15 am Weather: Dry/Rain

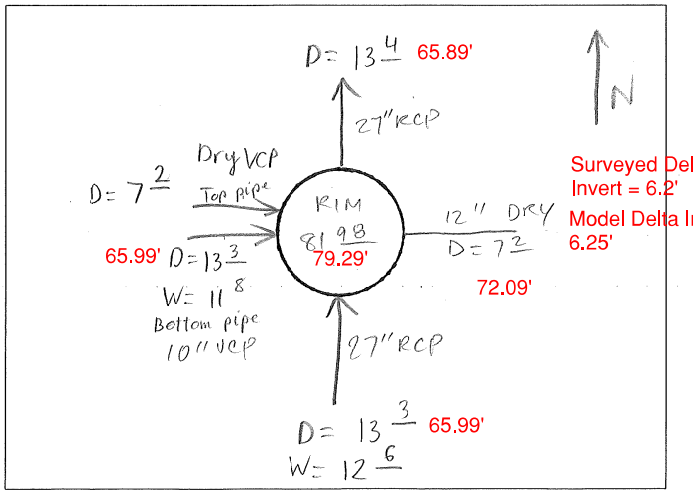
Name of Field Observer(s): CL & KT

MH Number: S33-5

Street/Intersection: ECR @ Kiely

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/20/23 Time: 11:50 am Weather: Dry/Rain

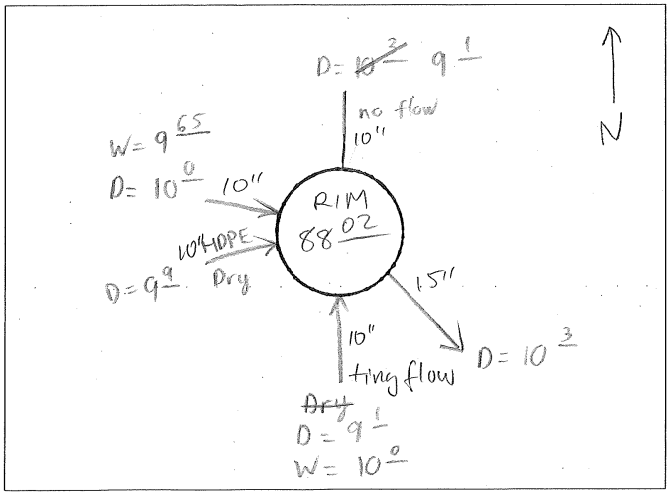
Name of Field Observer(s): CL & KT

MH Number: S32-102

Street/Intersection: Calabazas @ ECR

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All 100% flow from north western pipe to south eastern pipe

Field Verification

Date: 3/20/23 Time: 9:45 am Weather: (Dry)/Rain

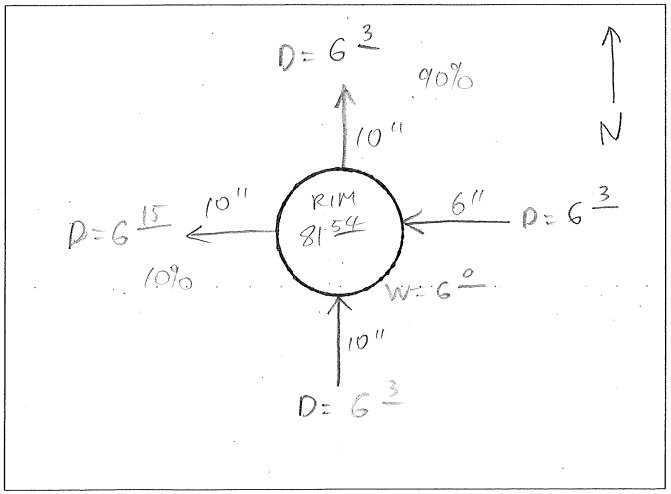
Name of Field Observer(s): CL & KT

MH Number: S35-25

Street/Intersection: Scott @ Clay

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
most flows to north (90%).

Other Observations:
All VCP

Field Verification

Date: 3/17/23 Time: 11:30 am Weather: (Dry)/Rain

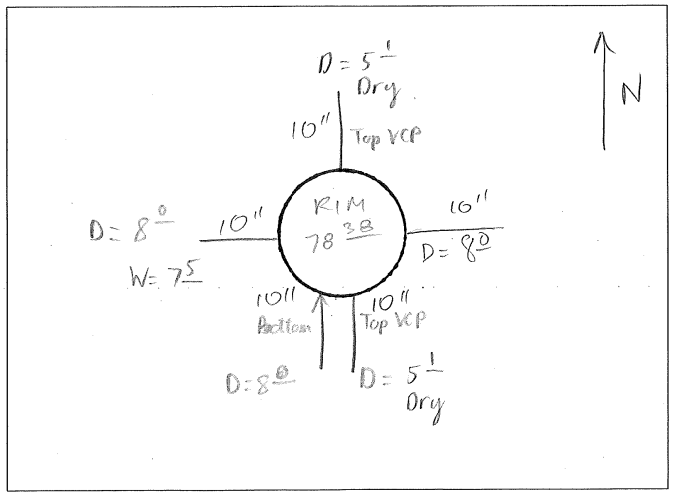
Name of Field Observer(s): CL & KT

MH Number: S35-17

Street/Intersection: ECR @ Scott

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/6/23 Time: 9:30 am Weather: (Dry)/Rain

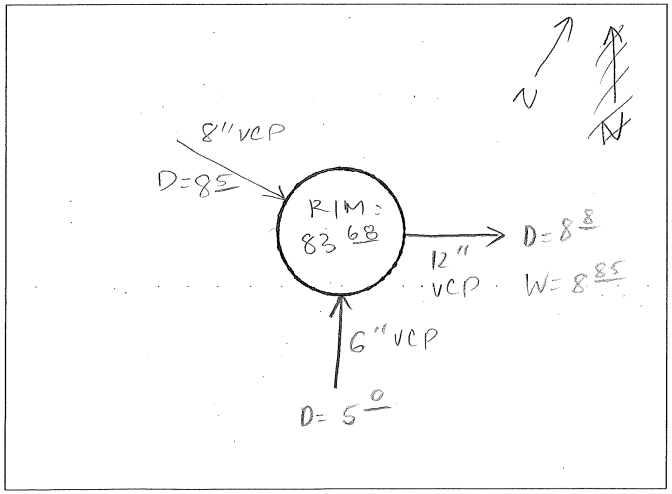
Name of Field Observer(s): CL & KT

MH Number: S 37-49

Street/Intersection: Monroe @ Homestead

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 9:30 am Weather: (Dry)/Rain

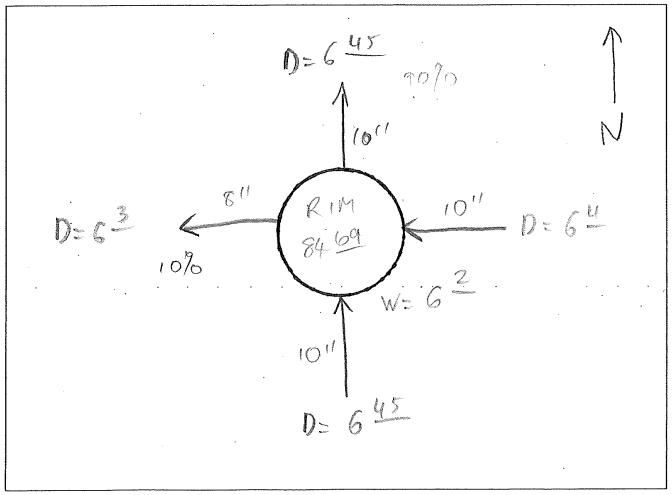
Name of Field Observer(s): CL & KT

MH Number: S 35-42

Street/Intersection: Scott @ Harrison

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
most flow goes north (90%).

Other Observations:
All VCP

Field Verification

Date: 3/17/23 Time: 10:45 am Weather: (Dry)/Rain

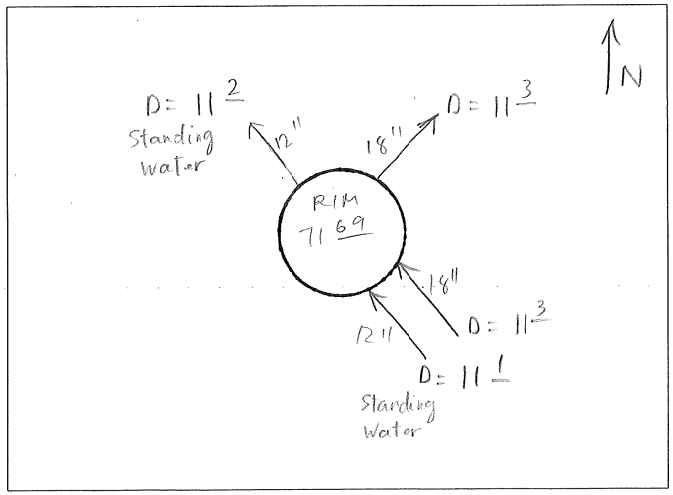
Name of Field Observer(s): CL & KT

MH Number: S38 - 4

Street/Intersection: The Alameda @ Benton

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Most flow from 18" SE to 18" NE.
12" SE to 12" NW seems to have standing water or slow moving

Other Observations:

All VCP
W = 10 95

Field Verification

Date: 3/20/23 Time: 9:15 am Weather: (Dry)/Rain

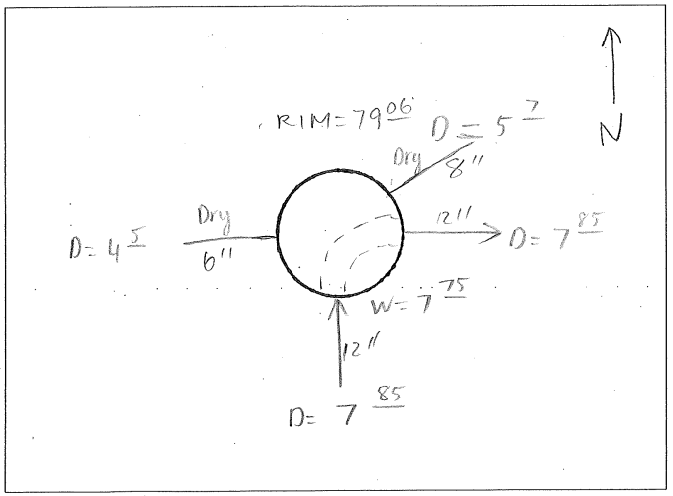
Name of Field Observer(s): CL & KT

MH Number: S37 - 90

Street/Intersection: Monroe @ Benton

Manhole sketch:

Draw all inlet and cutlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

Field Verification

Date: 3/17/23 Time: 11 am Weather: (Dry)/Rain

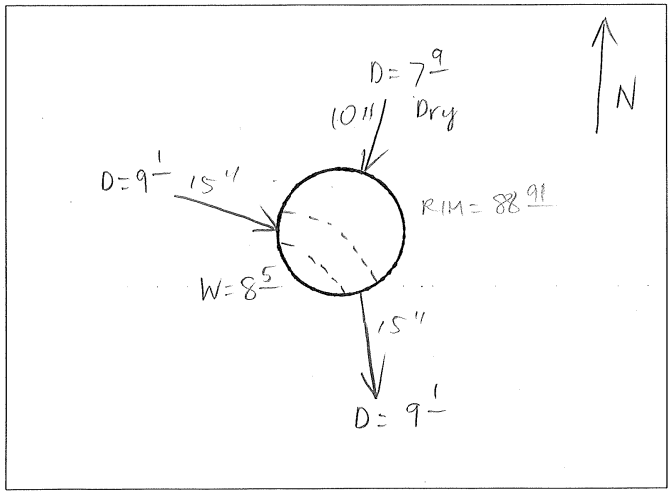
Name of Field Observer(s): CL & KT

MH Number: S 42 - 125

Street/Intersection: ECR @ Calabazas

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 4/5/23 Time: 3:20 pm Weather: (Dry)/Rain

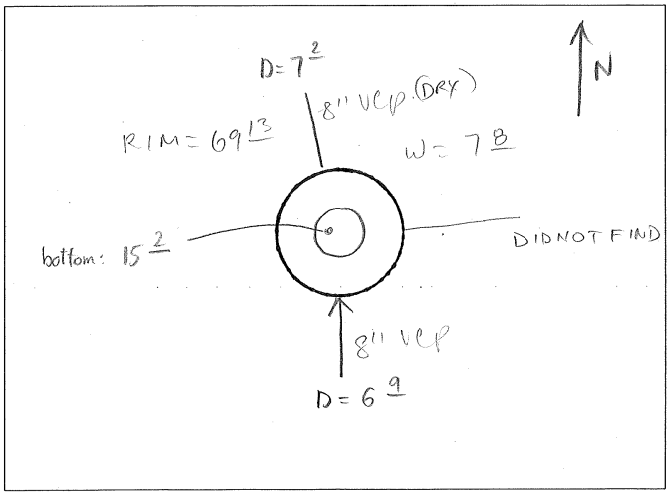
Name of Field Observer(s): CL & KT

MH Number: S 42 - 30

Street/Intersection: Calabazas @ Cabrillo

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 10 am Weather: (Dry)/Rain

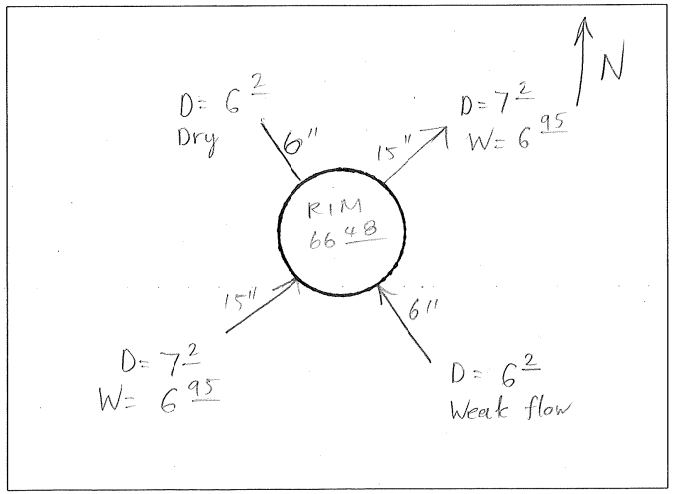
Name of Field Observer(s): CL & KT

MH Number: S47-77

Street/Intersection: Lafayette @ ECR

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/17/23. Time: 10:20 am Weather: (Dry)/Rain

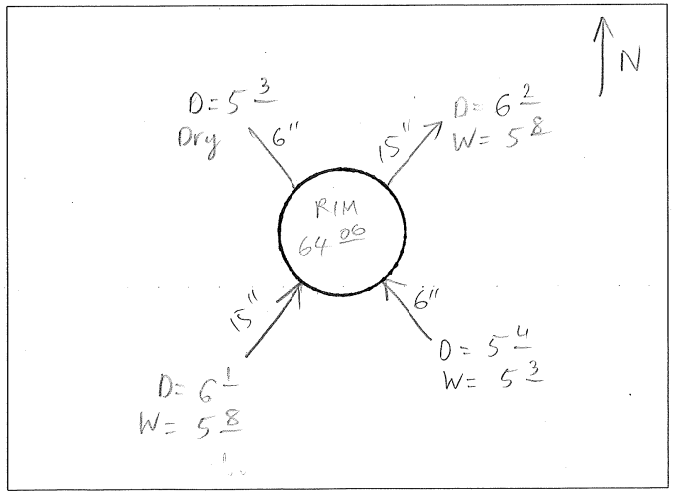
Name of Field Observer(s): CL & KT

MH Number: S47-60

Street/Intersection: ECR @ Alviso St

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 2 pm Weather: (Dry)/Rain

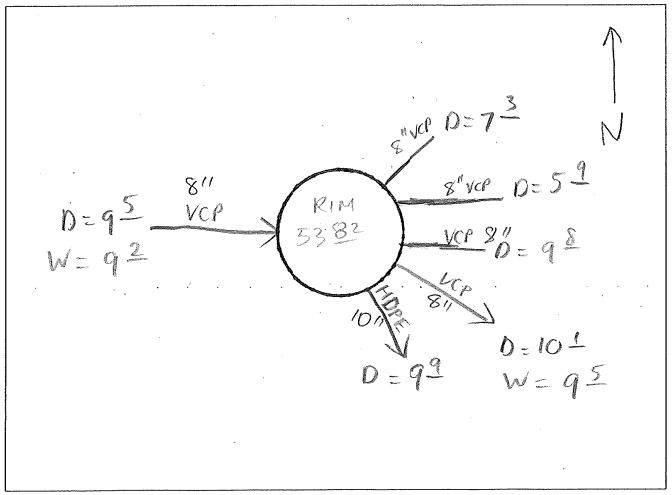
Name of Field Observer(s): CL & KT

MH Number: S52-05

Street/Intersection: Agate @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Most flow goes out to the VCP pipe

Other Observations:

Field Verification

Date: 3/17/23 Time: 9:45 am Weather: (Dry)/Rain

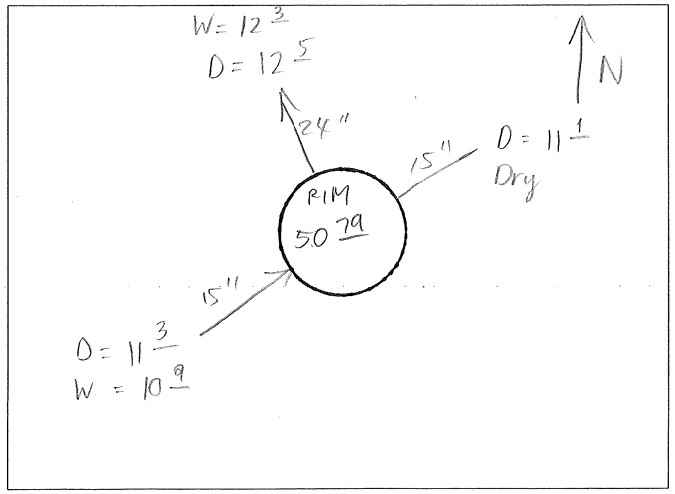
Name of Field Observer(s): CL & KT

MH Number: S48 - 2

Street/Intersection: De La Cruz @ Reed

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

All flow S/E to N/W.

Other Observations:

Field Verification

Date: 3/20/23 Time: 2:35 pm Weather: (Dry)/Rain

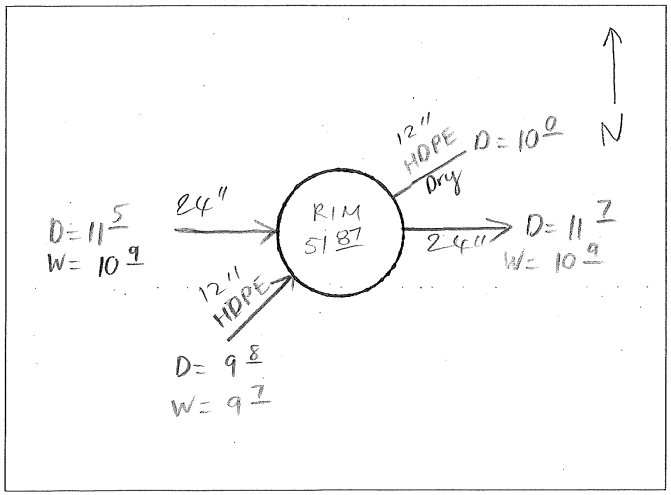
Name of Field Observer(s): CL & KT

MH Number: S53-110

Street/Intersection: Chromite @ East of Cortez

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/2/23 Time: 3:15 pm Weather: (Dry)/Rain

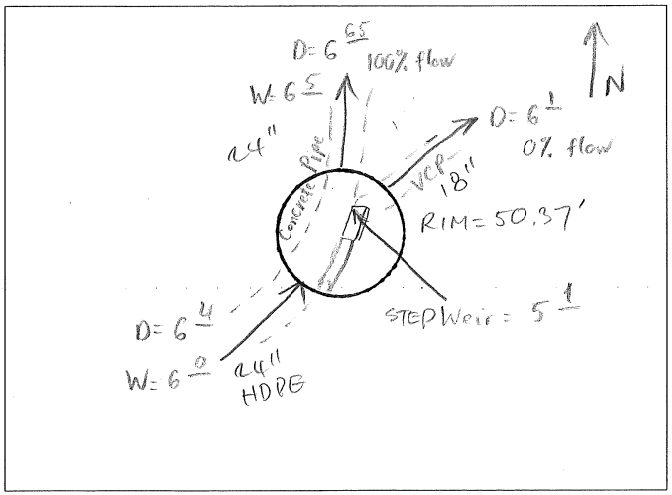
Name of Field Observer(s): CL & KT

MH Number: S53-105

Street/Intersection: Chromite @ East Pilot Knob

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

flow goes from SW to N

No flow goes into VCP

Other Observations:

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 4/6/23 Time: 10:15 am Weather: (Dry)/Rain

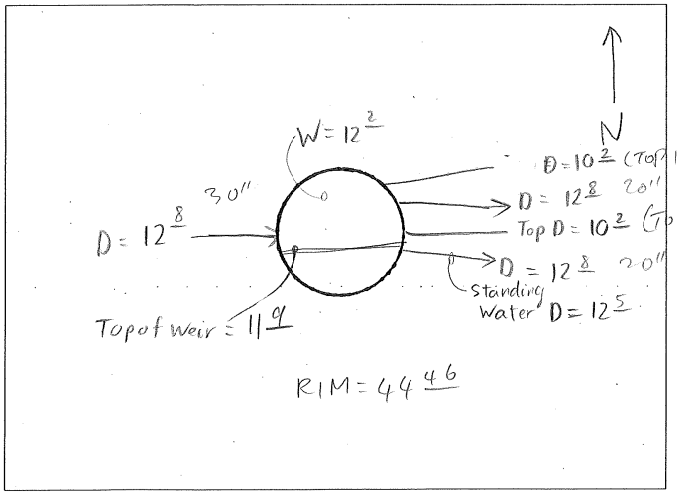
Name of Field Observer(s): CL & KT

MH Number: S55-51

Street/Intersection: Walsh @ Scott

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 4:15 pm Weather: (Dry)/Rain

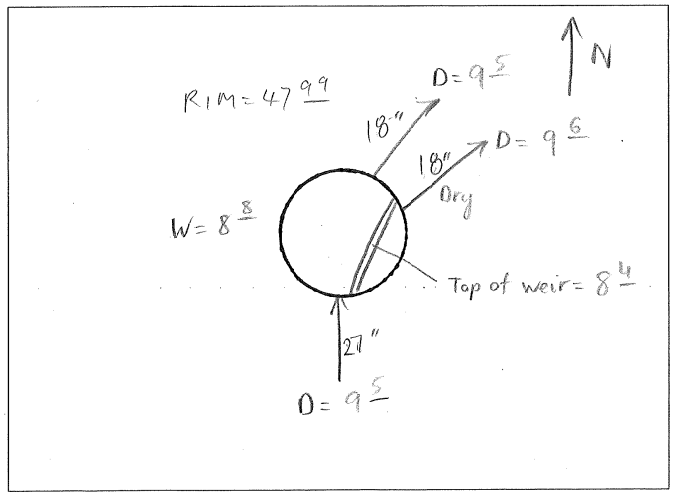
Name of Field Observer(s): CL & KT

MH Number: S54-94

Street/Intersection: Parking lot South of Walsh

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/6/23 Time: 9:45 am Weather: (Dry)/Rain

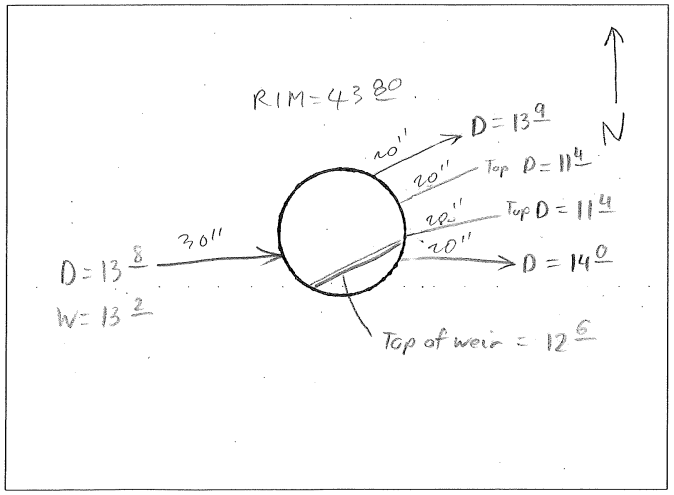
Name of Field Observer(s): CL & KT

MH Number: S56-58

Street/Intersection: Walsh @ Lafayette

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
ALL PIPES = HPPE

Field Verification

Date: 4/6/23 Time: 10 am Weather: (Dry)/Rain

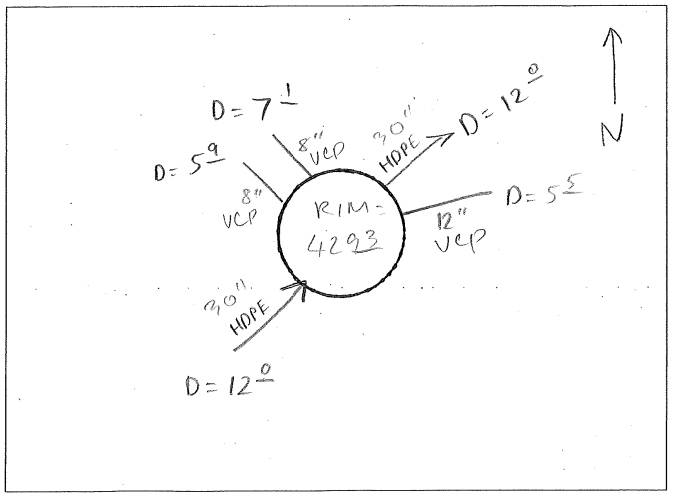
Name of Field Observer(s): CL & KT

MH Number: S56-02

Street/Intersection: Walsh in front of sub-station

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W = 11 1

Field Verification

Date: 3/17/23 Time: 9:30 am Weather: (Dry)/Rain

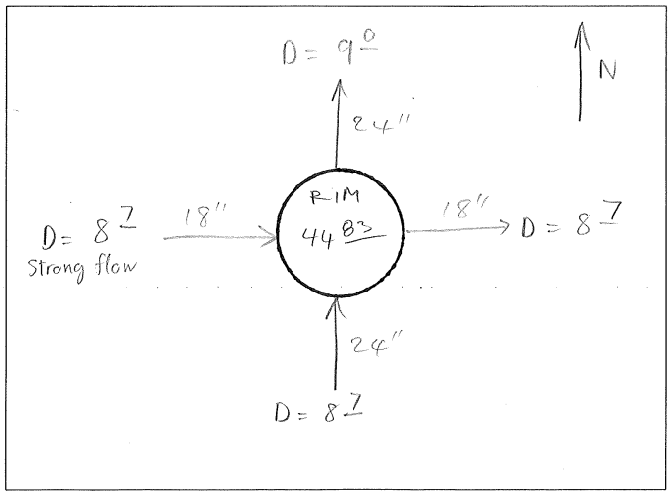
Name of Field Observer(s): CL & KT

MH Number: 558-21

Street/Intersection: De la Cruz @ Mathew

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Mostly going out to north pipe

Other Observations:
W_D = 8 1

Field Verification

Date: 3/17/23 Time: 9 am Weather: (Dry)/Rain

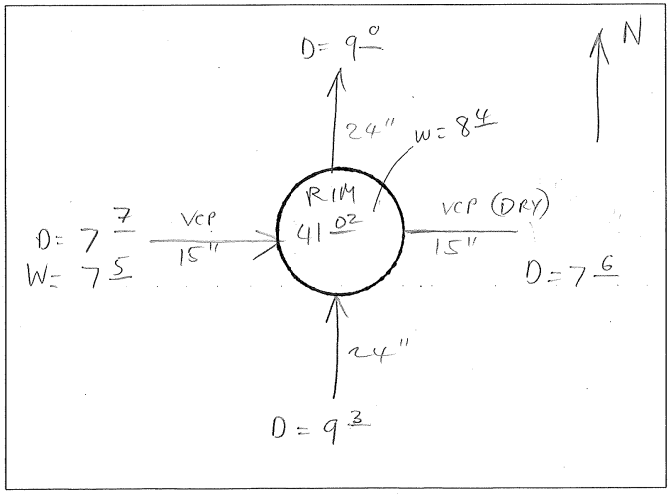
Name of Field Observer(s): CL & KT

MH Number: 558-12

Street/Intersection: De la Cruz @ Martin

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 2 pm Weather: (Dry)/Rain

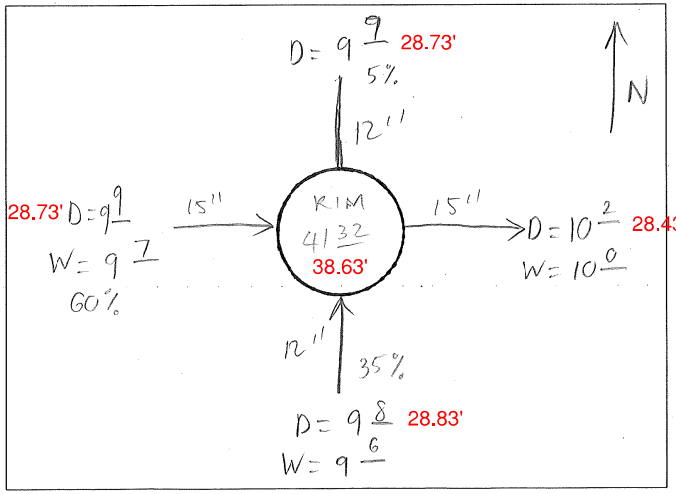
Name of Field Observer(s): CL & KT

MH Number: SG2-11

Street/Intersection: Corrin @ Central

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/17/23 Time: 2:15 pm Weather: (Dry)/Rain

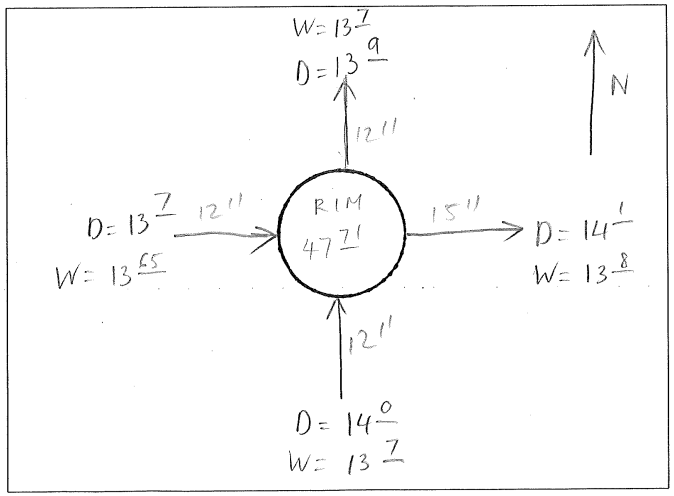
Name of Field Observer(s): CL & KT

MH Number: SG1 - 16

Street/Intersection: Central Expy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
strong flow: west to east.
weak flow from south.

Other Observations:
All VCP

Field Verification

Date: 3/6/23 Time: 3:00 pm Weather: (Dry)/Rain

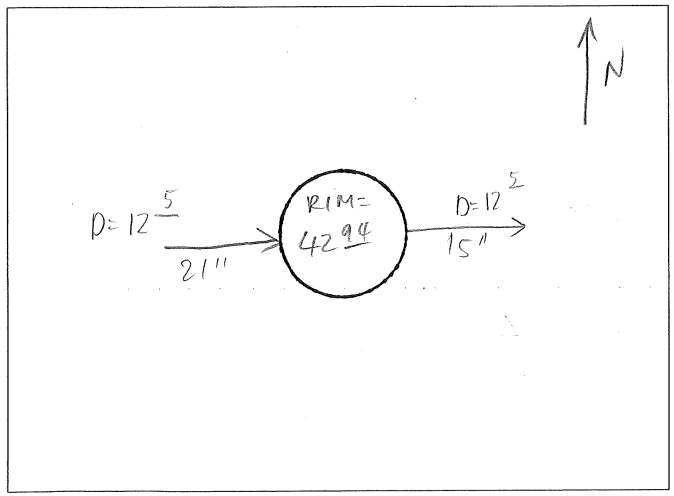
Name of Field Observer(s): CL & KT

MH Number: S62 - 7

Street/Intersection: Central Expwy @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP
W_D = 12 6/8

Field Verification

Date: 3/6/23 Time: 2:45 pm Weather: (Dry)/Rain

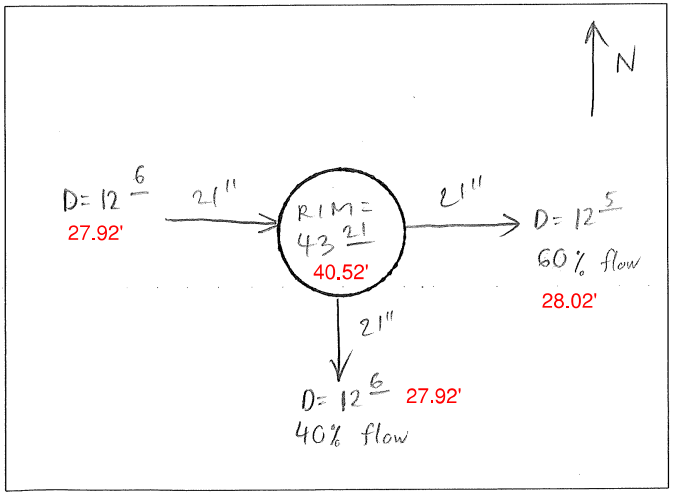
Name of Field Observer(s): CL & KT

MH Number: S62 - 6

Street/Intersection: Central Expwy @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Most flow goes east

Other Observations:

W_D = 12 4/8 28.12'

All VCP

Field Verification

Date: 3/17/23 Time: 1:45 pm Weather: (Dry)/Rain

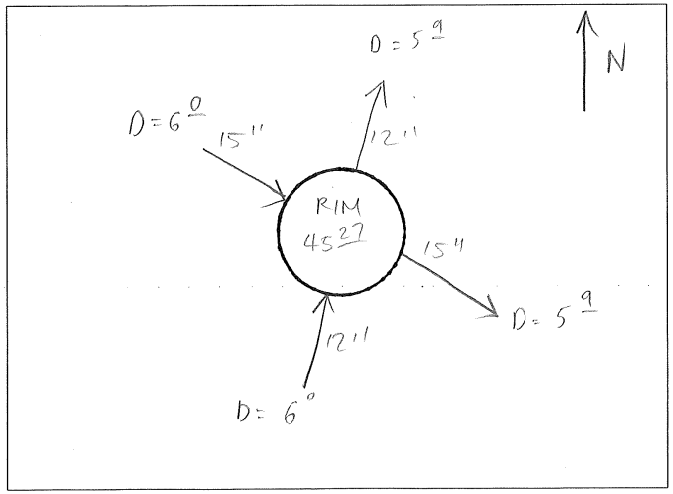
Name of Field Observer(s): CL & KT

MH Number: SG4 - 32

Street/Intersection: Walsh @ Northwestern

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP
W = 5 85

Field Verification

Date: 3/6/23 Time: 3:15 pm Weather: Dry/Rain

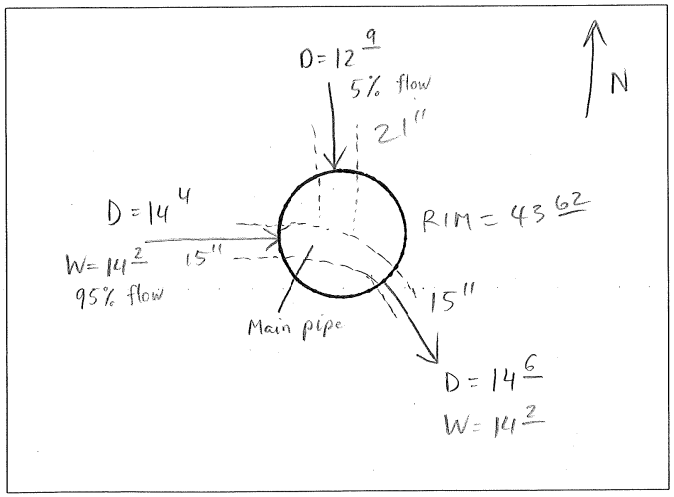
Name of Field Observer(s): CL & KT

MH Number: SG2 - 8

Street/Intersection: Central Expwy @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

Field Verification

Date: 4/5/23 Time: 3:45 pm Weather: (Dry)/Rain

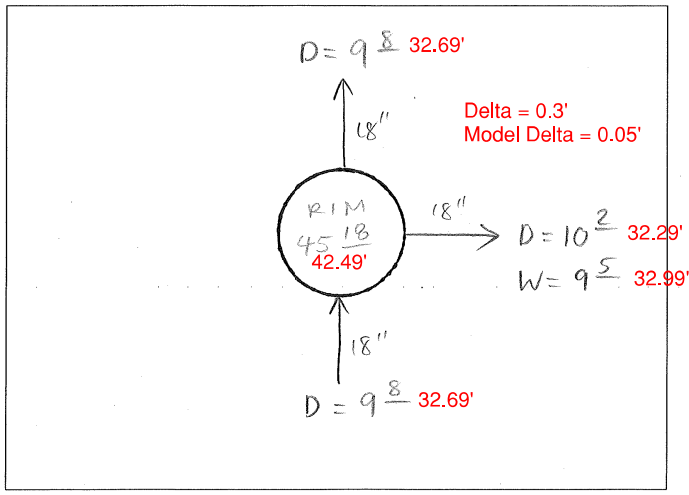
Name of Field Observer(s): CL & KT

MH Number: S64-46

Street/Intersection: San Tomas Expy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

70% North

30% East

Other Observations:

All VCP

Field Verification

Date: 4/5/23 Time: 4 pm Weather: (Dry)/Rain

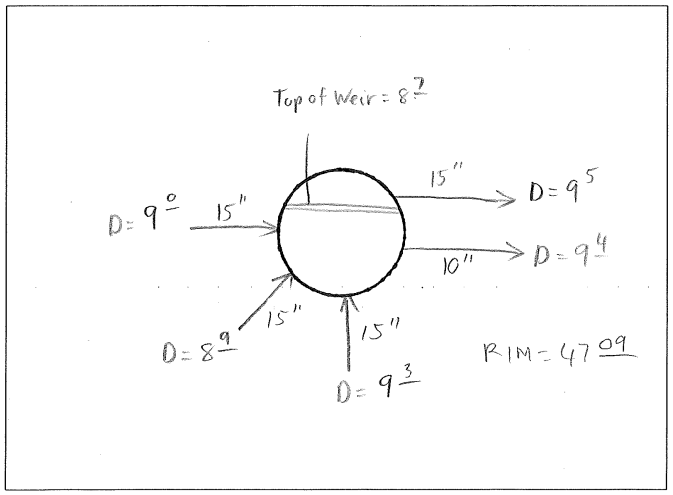
Name of Field Observer(s): CL & KT

MH Number: S64-34

Street/Intersection: San Tomas Creek trail North of Walsh

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

W_D = 8 9/9

All VCP

Field Verification

Date: _____ Time: _____ Weather: Dry/Rain

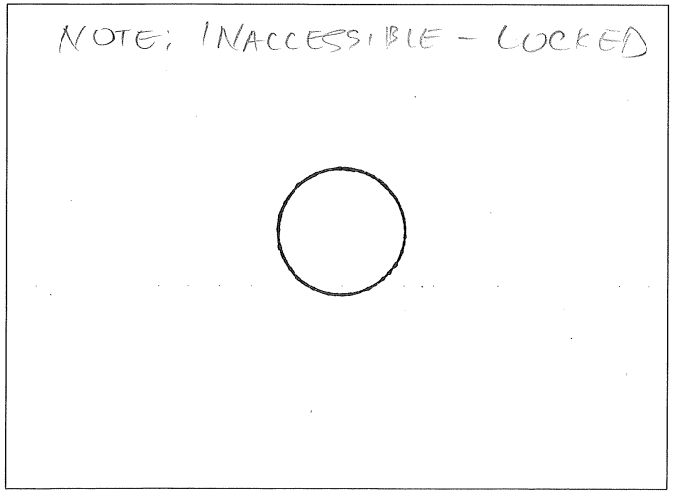
Name of Field Observer(s): _____

MH Number: S68-9

Street/Intersection: _____

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/3/23 Time: 11:15 am Weather: (Dry)/Rain

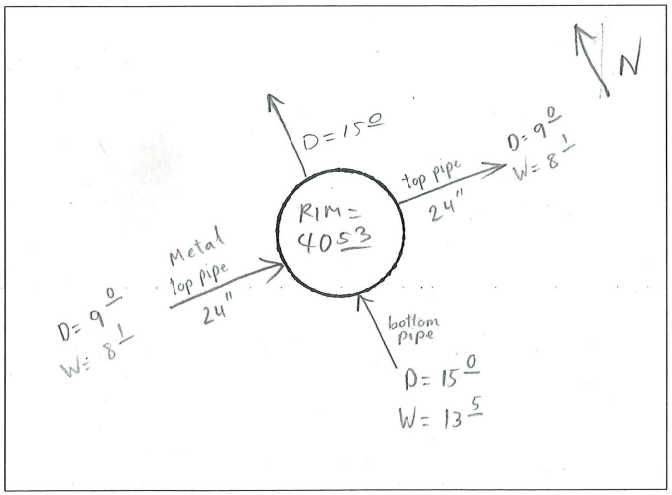
Name of Field Observer(s): CL & KT

MH Number: S65-30

Street/Intersection: Central Expwy @ ~~North~~ East of Scott Blvd

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
top pipe obstructs the view of the bottom pipe

Field Verification

Date: 3/17/23 Time: 3:30 pm Weather: (Dry)/Rain

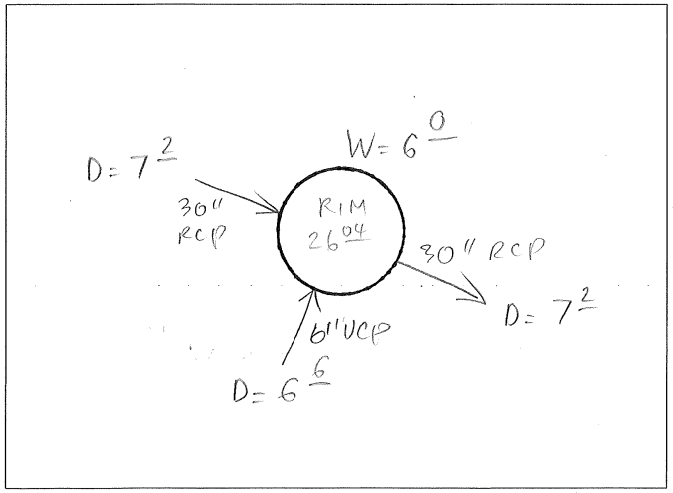
Name of Field Observer(s): CL & KT

MH Number: S72-3

Street/Intersection: Lakeside

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: _____ Time: _____ Weather: Dry/Rain

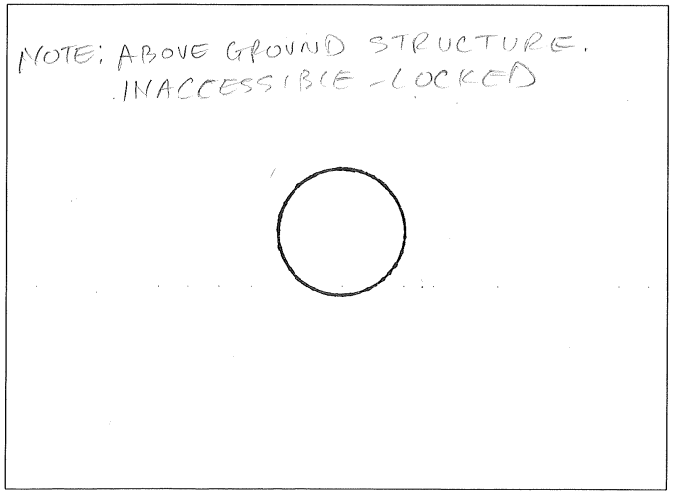
Name of Field Observer(s): _____

MH Number: S68-10

Street/Intersection: _____

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:15 pm Weather: (Dry)/Rain

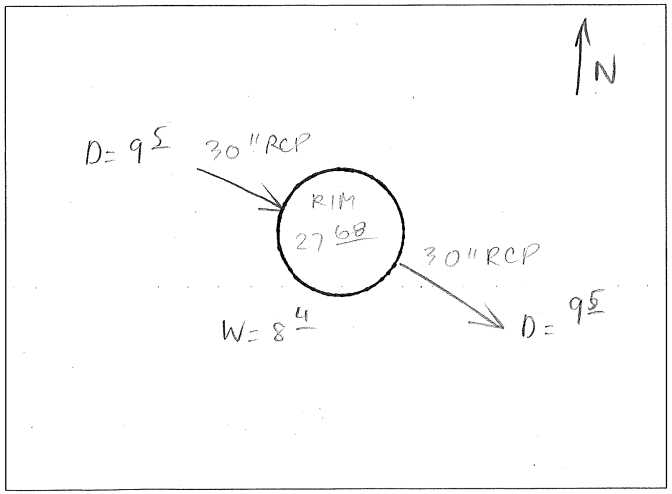
Name of Field Observer(s): CL & KT

MH Number: S72-5

Street/Intersection: Lakeside @ E of Peterson

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:20 pm Weather: (Dry)/Rain

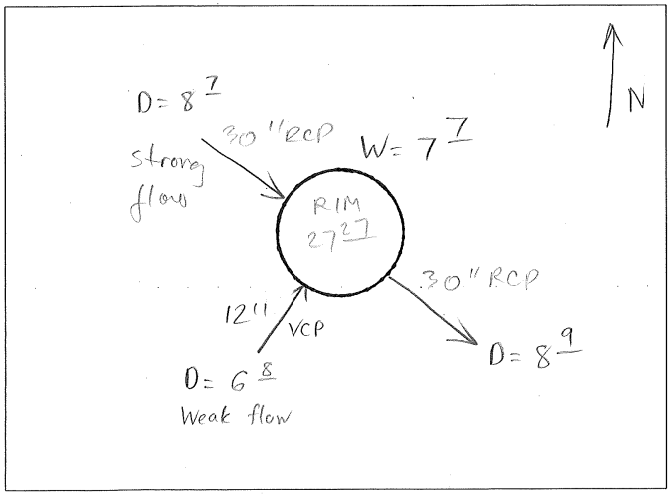
Name of Field Observer(s): CL & KT

MH Number: S72-4

Street/Intersection: Lakeside @ Peterson

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:50 pm Weather: (Dry)/Rain

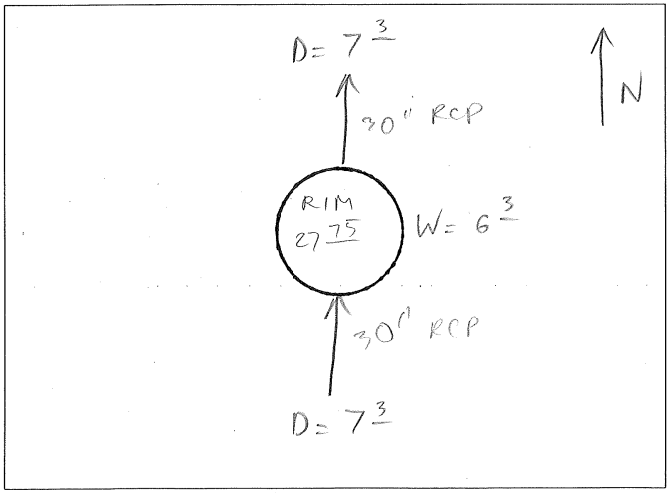
Name of Field Observer(s): CL & KT

MH Number: S72-7

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:45 pm Weather: (Dry)/Rain

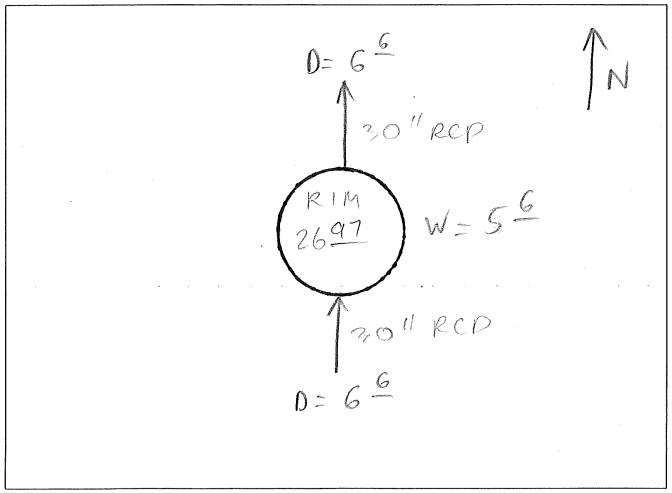
Name of Field Observer(s): CL & KT

MH Number: S72-6

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:55 pm Weather: (Dry)/Rain

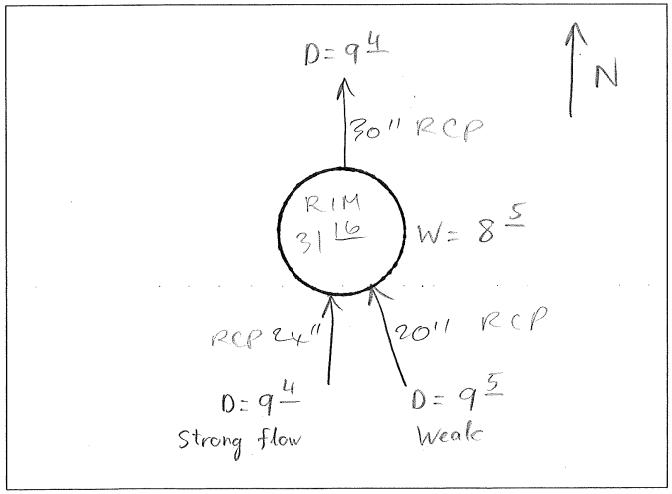
Name of Field Observer(s): CL & KT

MH Number: S72-11

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:50 pm Weather: (Dry)/Rain

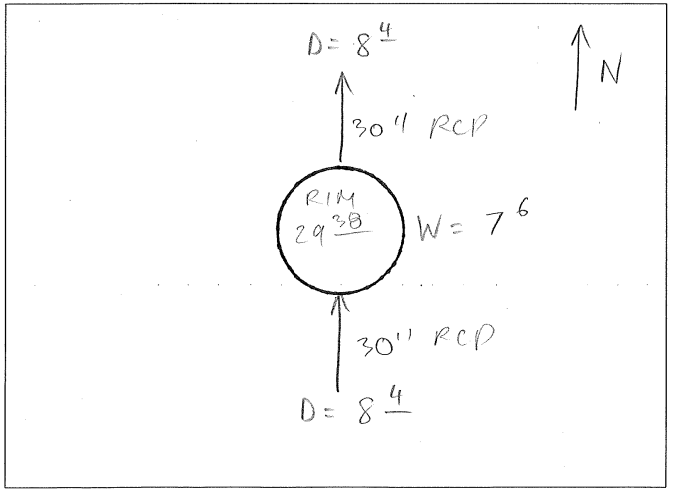
Name of Field Observer(s): CL & KT

MH Number: S72-8

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 2:50 pm Weather: (Dry)/Rain

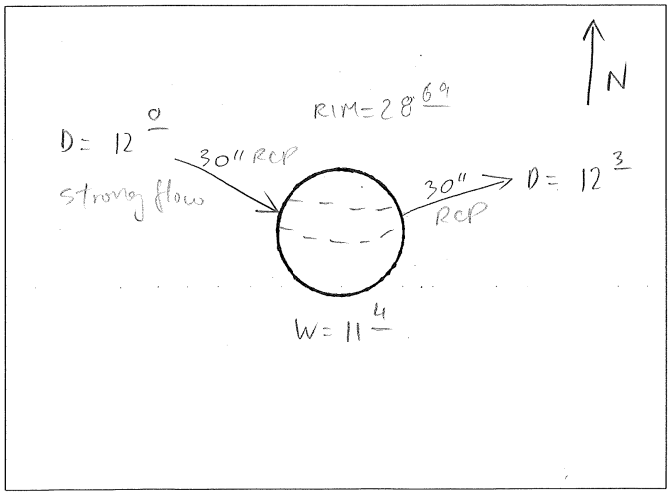
Name of Field Observer(s): CL & KT

MH Number: S73-6

Street/Intersection: Lakeside Dr

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3 pm Weather: (Dry)/Rain

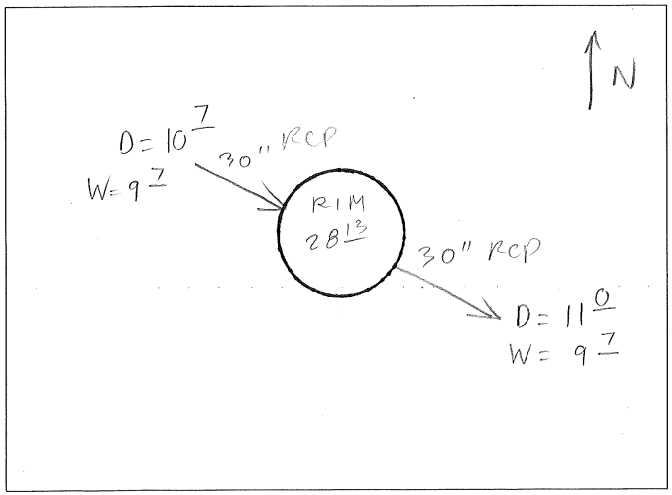
Name of Field Observer(s): CL & KT

MH Number: S73-5

Street/Intersection: Lakeside Rd

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 4/5/23 Time: 2:10 pm Weather: (Dry)/Rain

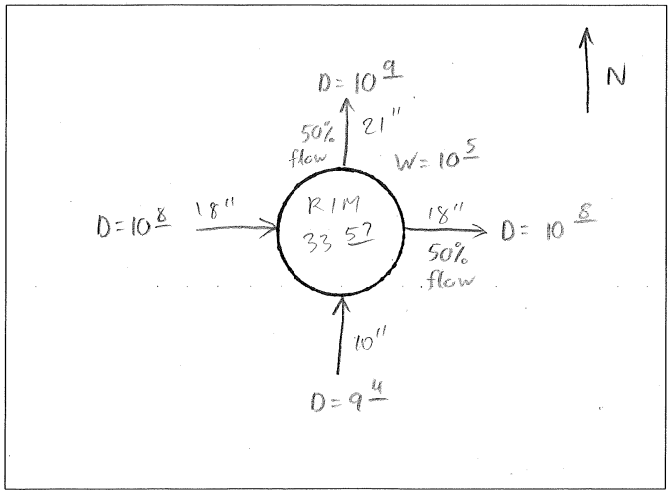
Name of Field Observer(s): CL & KT

MH Number: S 73 - 29

Street/Intersection: Scott @ Lakeside

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow (evenly split)?

Other Observations:
All VCP

Field Verification

Date: 3/17/23 Time: 2:40 pm Weather: (Dry)/Rain

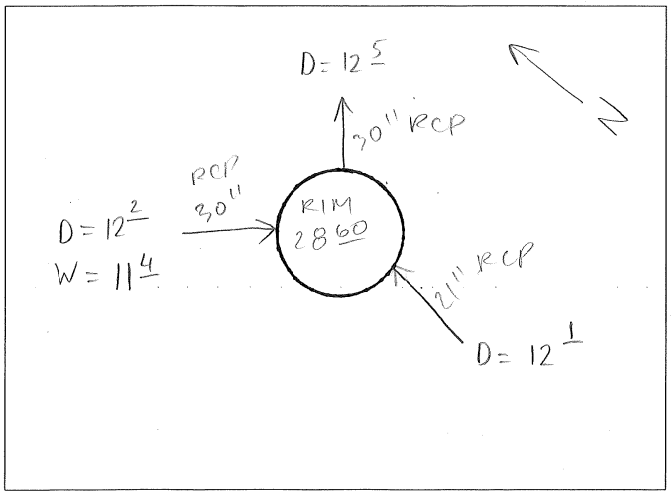
Name of Field Observer(s): CL & KT

MH Number: S73 - 7

Street/Intersection: Lakeside Dr

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Most flow goes from NW to NE.

Other Observations:
W = 11 4

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 3/17/23 Time: 3:40 pm Weather: (Dry)/Rain

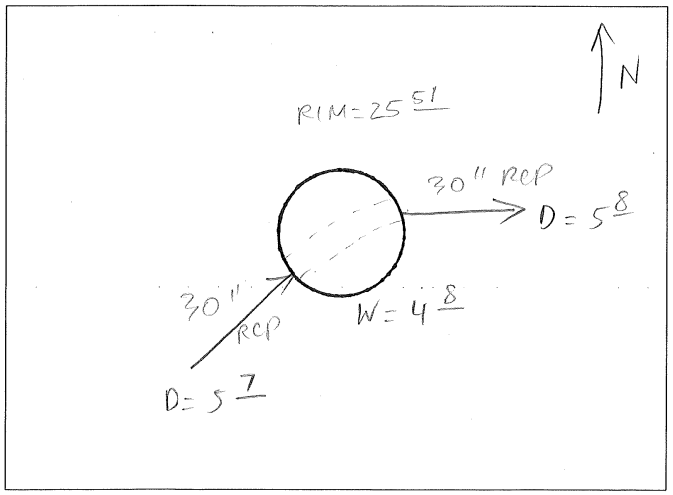
Name of Field Observer(s): CL & KT

MH Number: S82-9

Street/Intersection: Lakeside @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 2 pm Weather: (Dry)/Rain

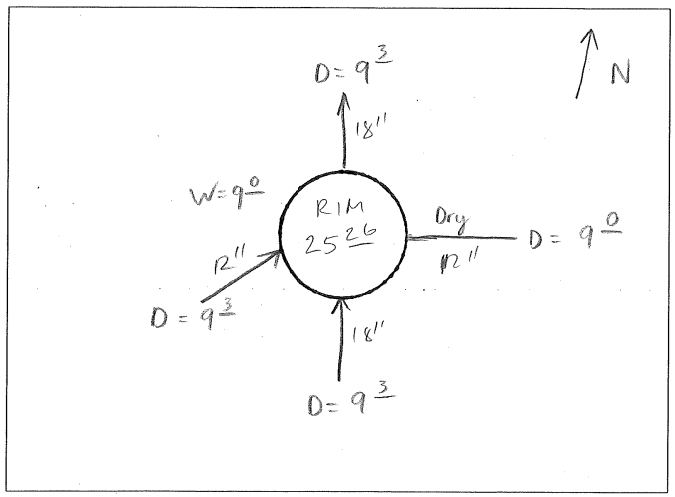
Name of Field Observer(s): CL & KT

MH Number: S 74 - 46

Street/Intersection: Juliette Ln

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 3pm Weather: (Dry)/Rain

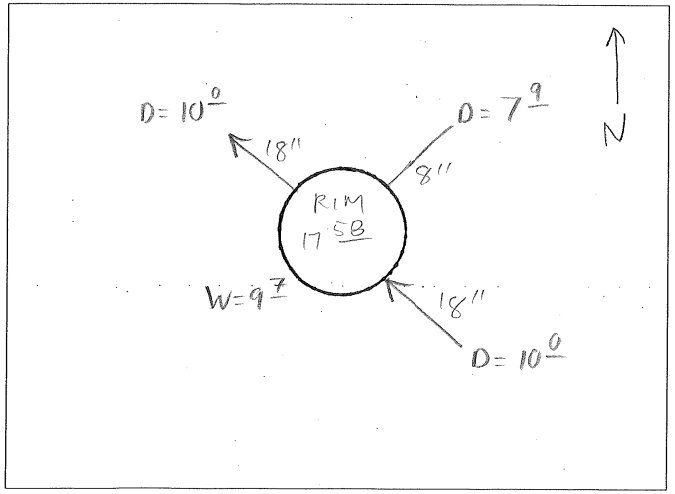
Name of Field Observer(s): CL & KT

MH Number: S 85-9

Street/Intersection: Bassett @ Second St

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

Field Verification

Date: 3/17/23 Time: 3:35 pm Weather: (Dry)/Rain

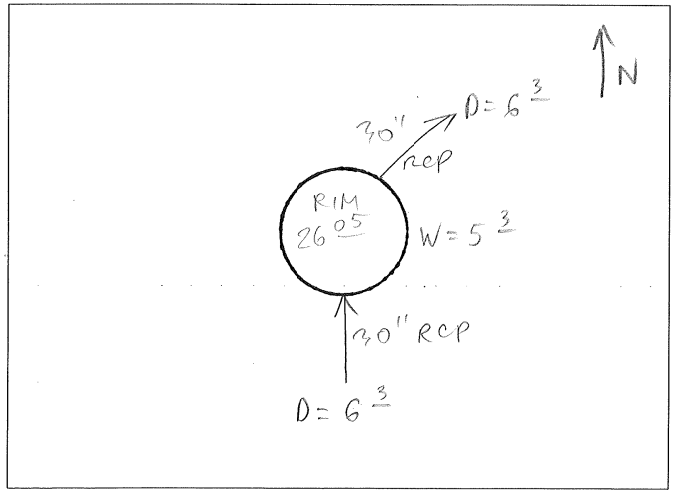
Name of Field Observer(s): CL & KT

MH Number: S 82-10

Street/Intersection: Lakeside @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/8/23 Time: 11:10 am Weather: (Dry)/Rain

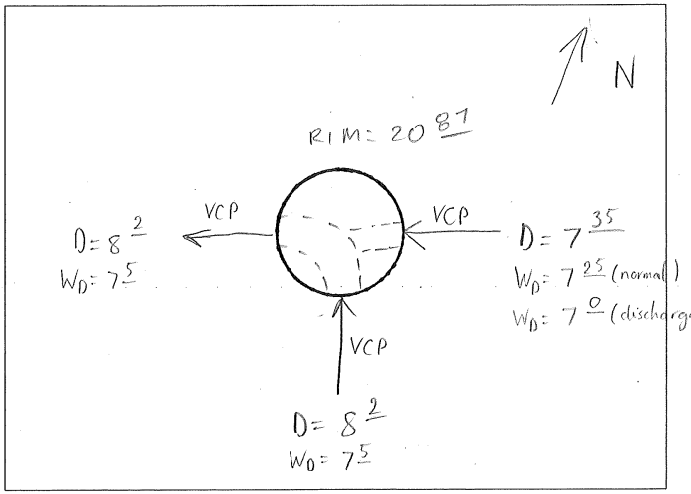
Name of Field Observer(s): CL & KT

MH Number: S87 - 1

Street/Intersection: Della Cruz @ Montague Expwy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/20/23 Time: 2:50 pm Weather: (Dry)/Rain

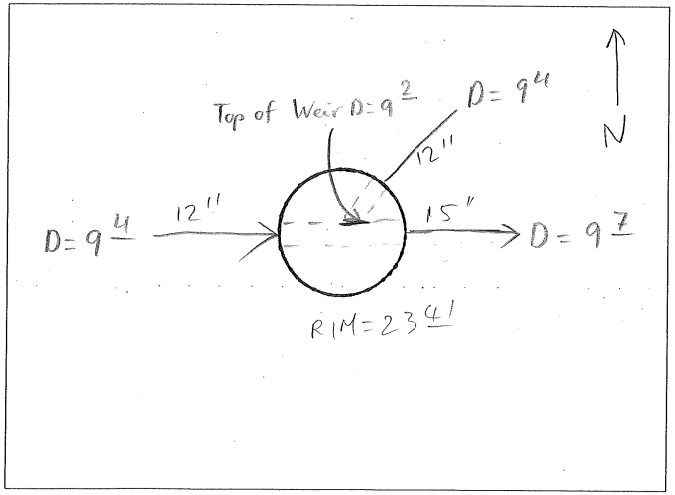
Name of Field Observer(s): CL & KT

MH Number: S85-76

Street/Intersection: MCB @ Burton

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W: 9 3

Field Verification

Date: 3/20/23 Time: 3:15 pm Weather: (Dry)/Rain

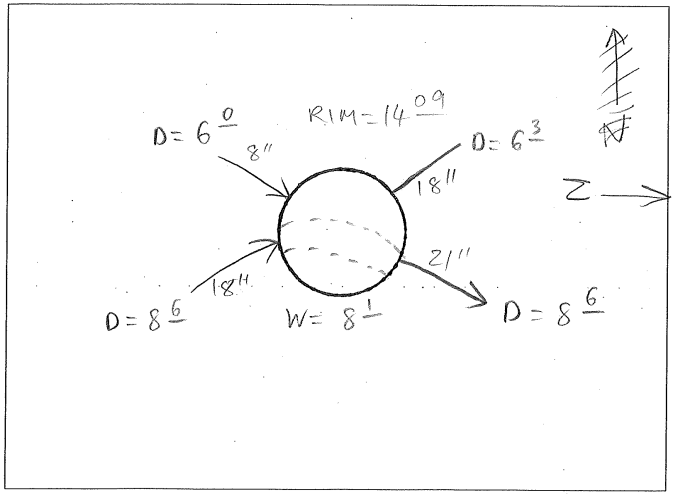
Name of Field Observer(s): CL & KT

MH Number: S95-74

Street/Intersection: Wilcox @ E of Esperanza

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/3/23 Time: 11:45 am Weather: (Dry)/Rain

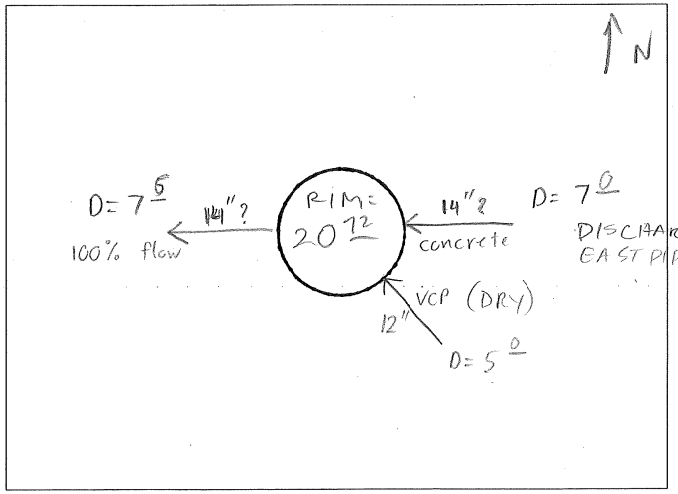
Name of Field Observer(s): CL & KT

MH Number: S87-02

Street/Intersection: De la Cruz Lift Station

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Most flow goes from East to West on the concrete pipe

Other Observations:
Water level when discharging is 5 7 and 6 5 when water is standing still

Field Verification

Date: 3/6/23 Time: 2:15 pm Weather: (Dry)/Rain

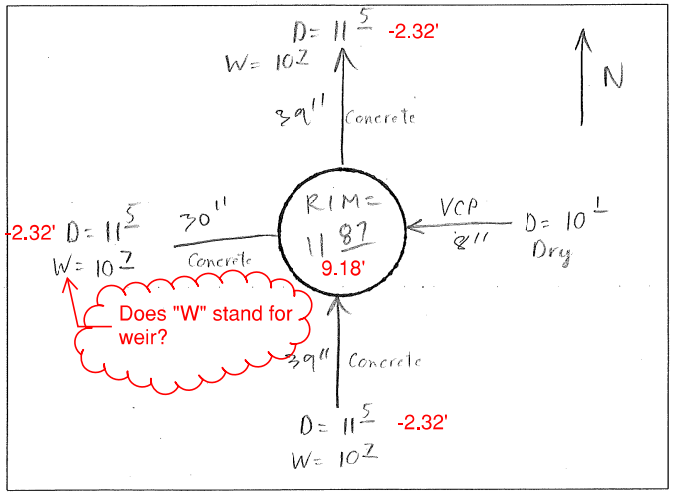
Name of Field Observer(s): CL & KT

MH Number: S103 - 23

Street/Intersection: Great America Pkwy @ Convention Center

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
flow mostly goes north

Other Observations:

Field Verification

Date: 3/6/23 Time: 2:30 pm Weather: (Dry)/Rain

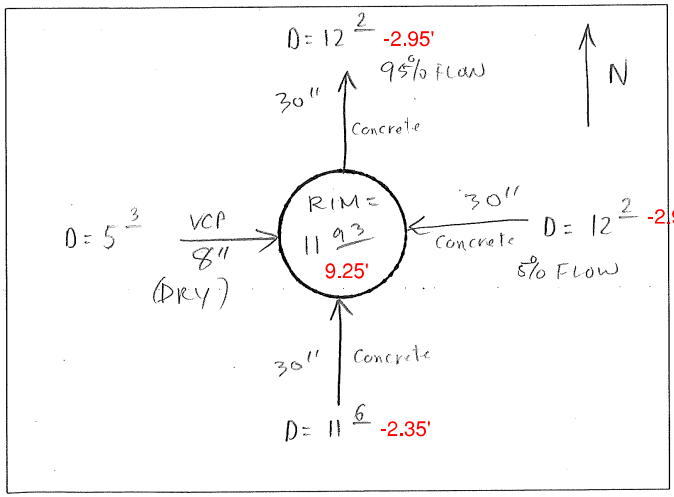
Name of Field Observer(s): CL & KT

MH Number: S103 - 22

Street/Intersection: Great America Pkwy @ 5200 block

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
flow most goes north

Other Observations:
W_D = 10 8/8

Field Verification

Date: 4/5/23 Time: 11:40 pm Weather: (Dry)/Rain

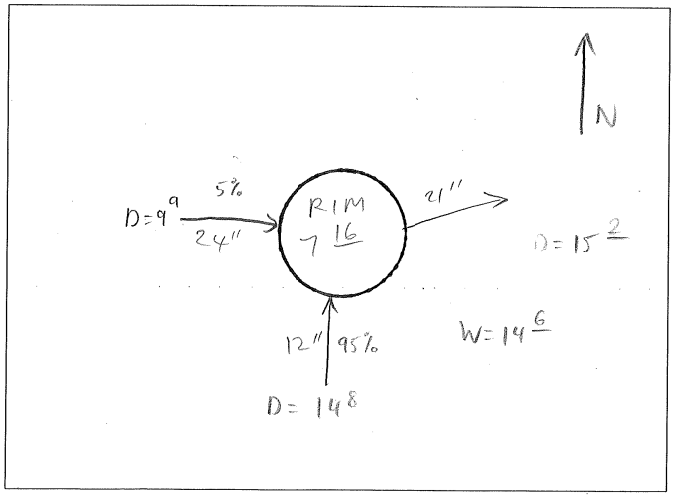
Name of Field Observer(s): CL & KT

MH Number: S105-36

Street/Intersection: Calle De Sol @ Calle De Luna

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/6/23 Time: 2:00 pm Weather: (Dry)/Rain

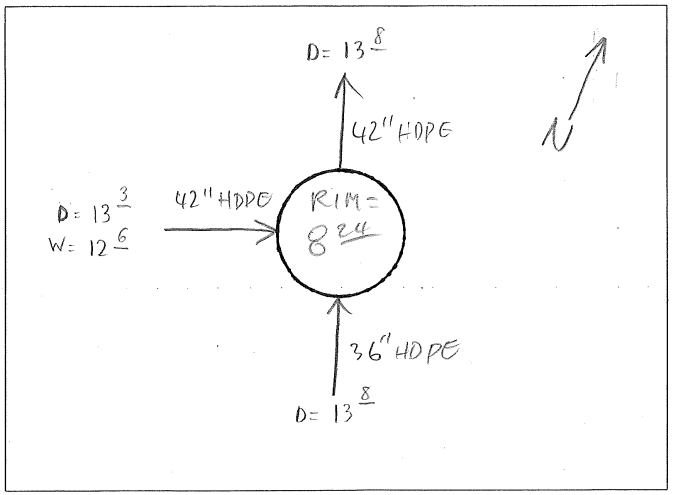
Name of Field Observer(s): CL & KT

MH Number: S104-19

Street/Intersection: Lafayette St

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 1:30 pm Weather: (Dry)/Rain

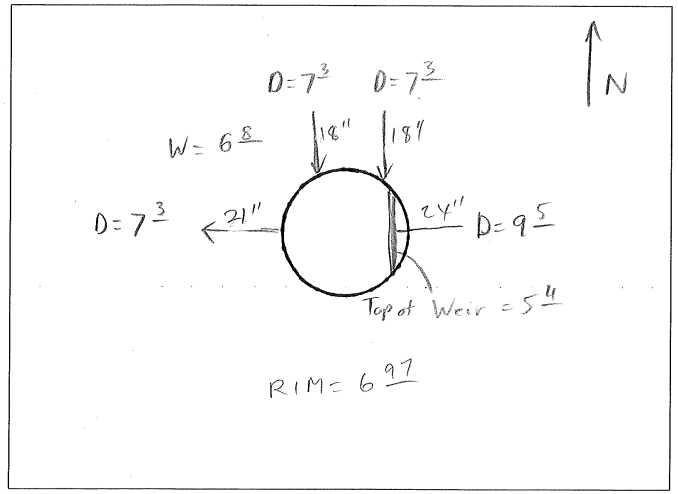
Name of Field Observer(s): CL & KT

MH Number: S105-37

Street/Intersection: Calle De Sol @ Calle De Luna

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

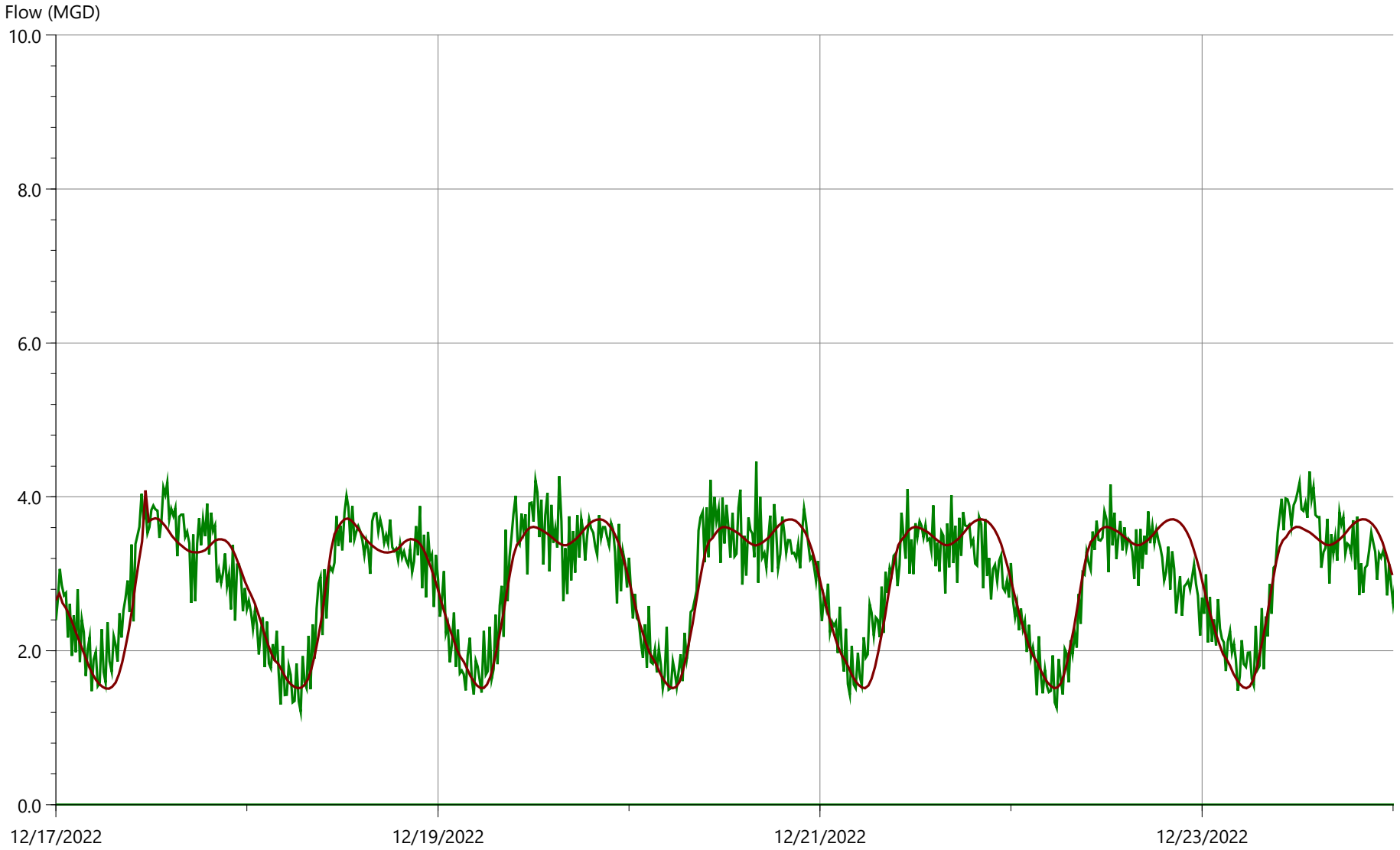
APPENDIX E: CALIBRATION RESULTS

Dry Weather Flow Calibration Plots
Modeled vs. 2022-2023 Metered Flows

(*assumes clog at Homestead/Lawrence gate structure*)

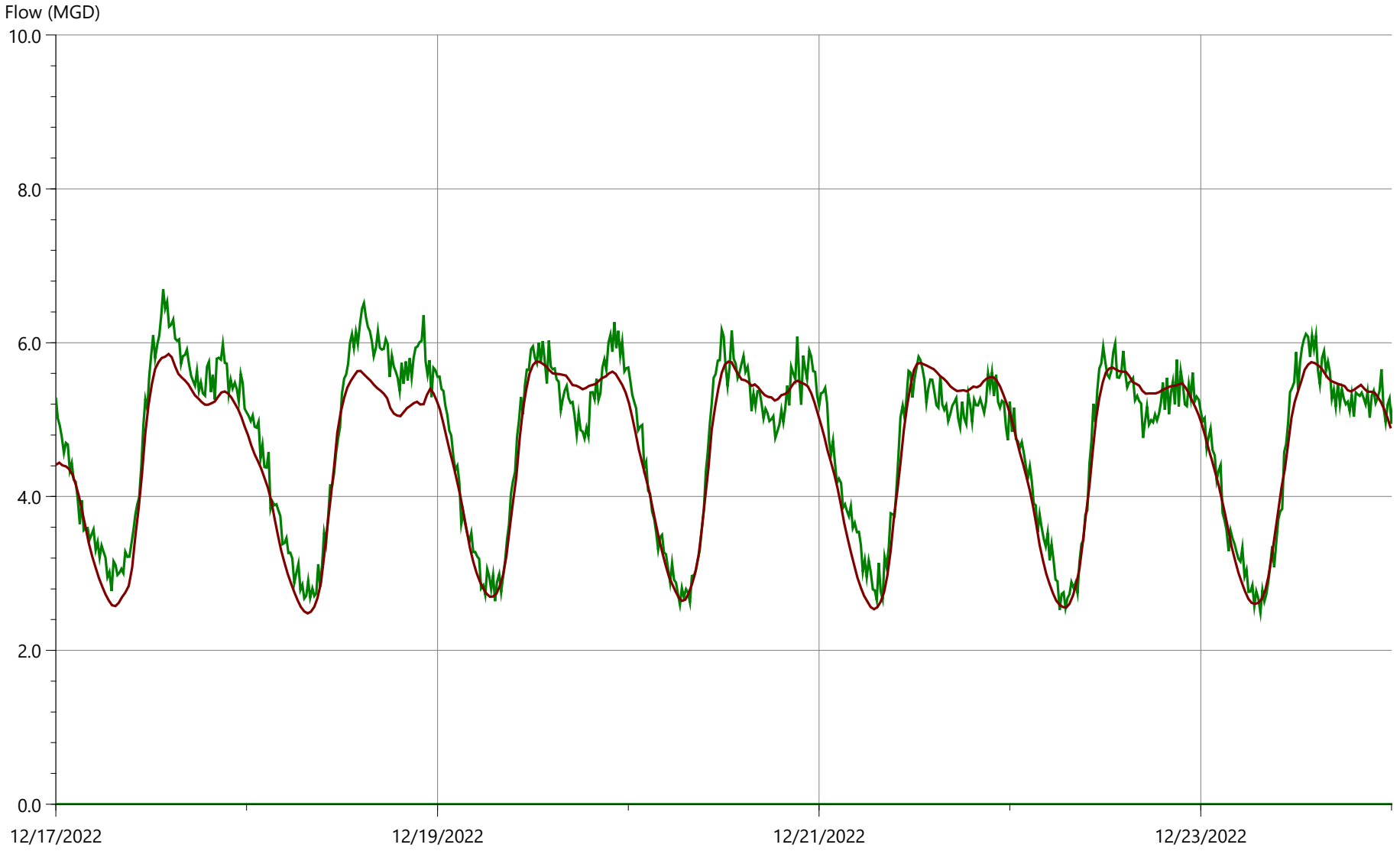
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1



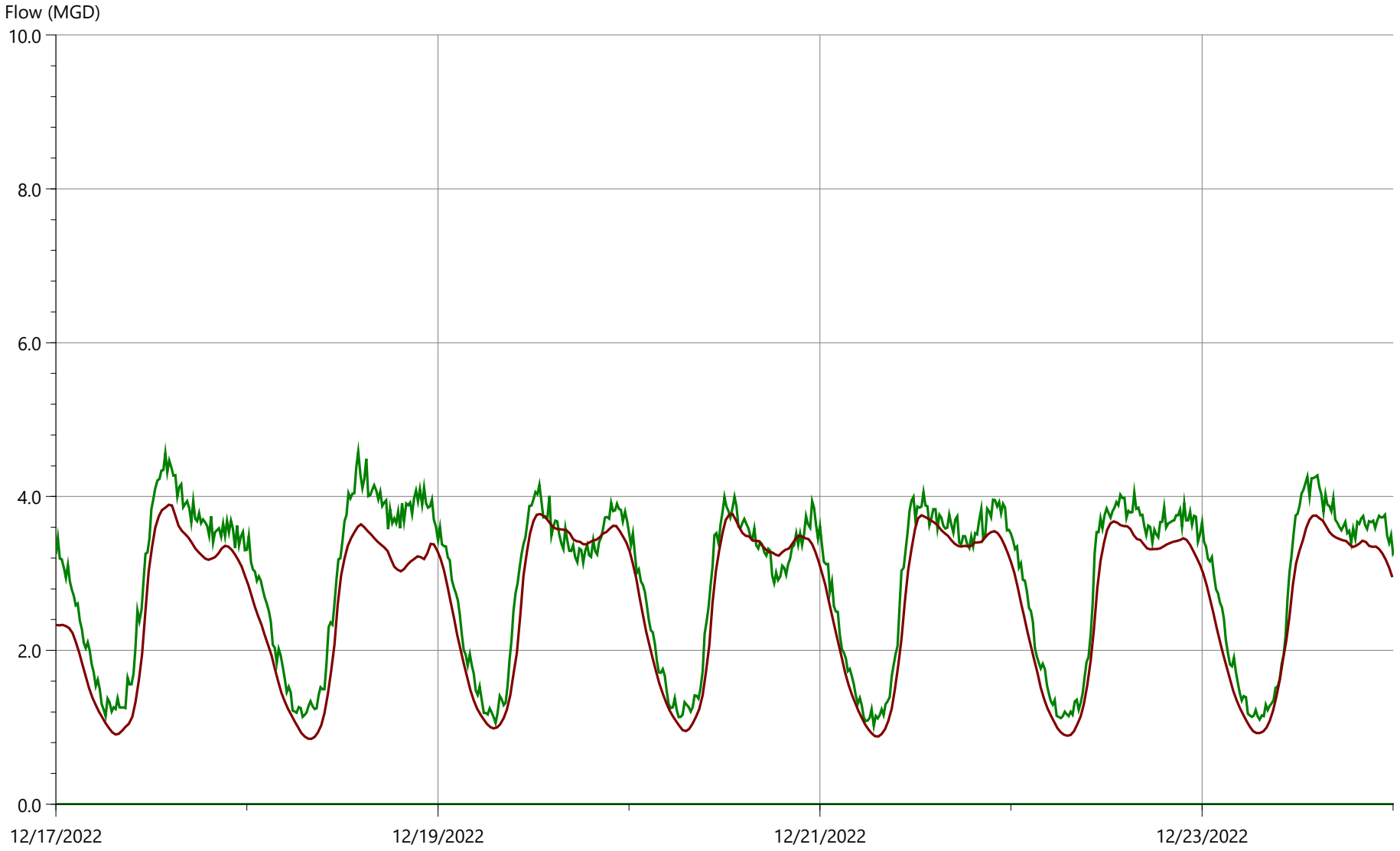
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	1.210	4.456	20.361
...ation (Homestead Blockage) DWF	1.509	4.082	20.343

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1



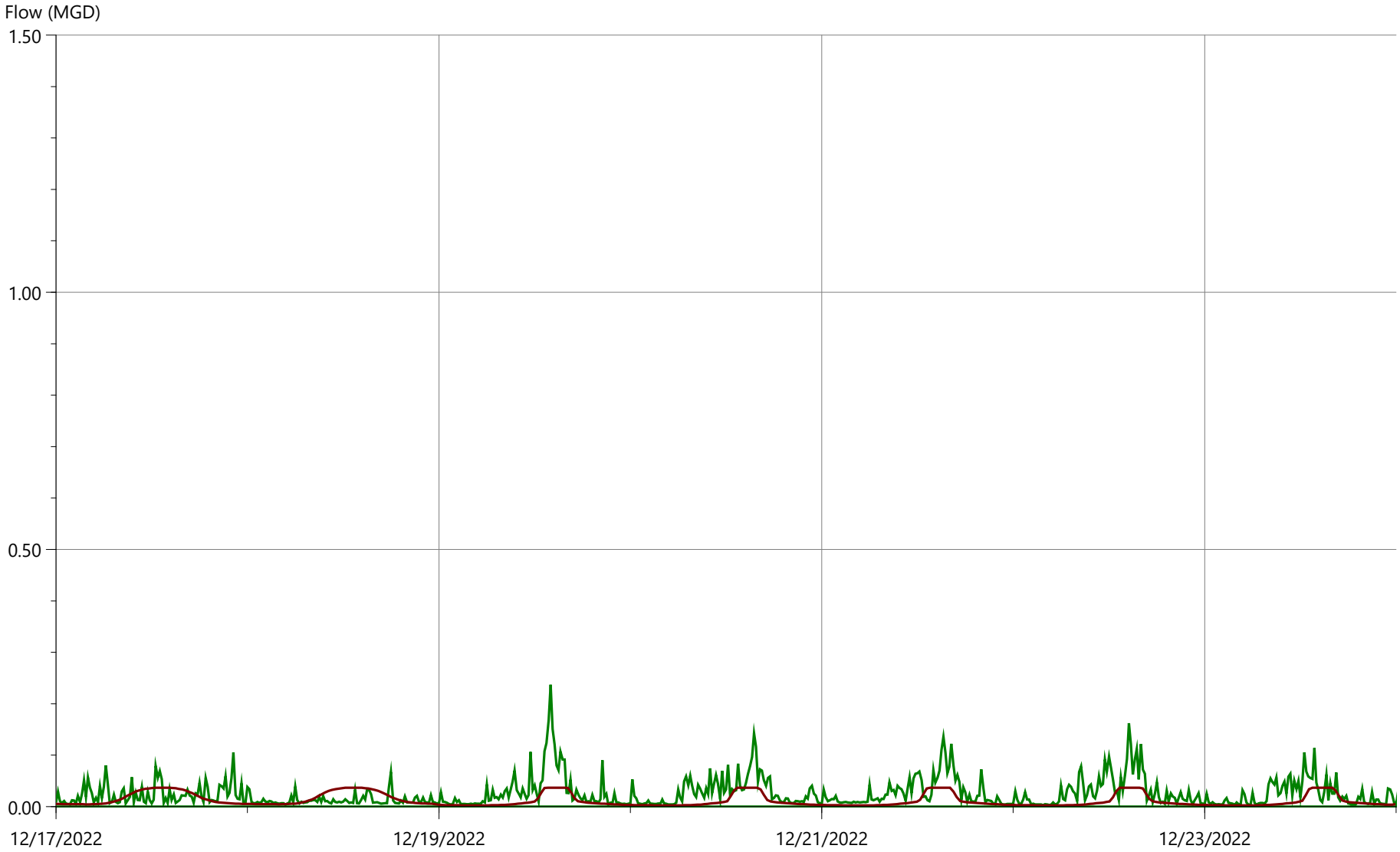
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	2.491	6.695	33.003
...ation (Homestead Blockage) DWF	2.482	5.853	31.993

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1



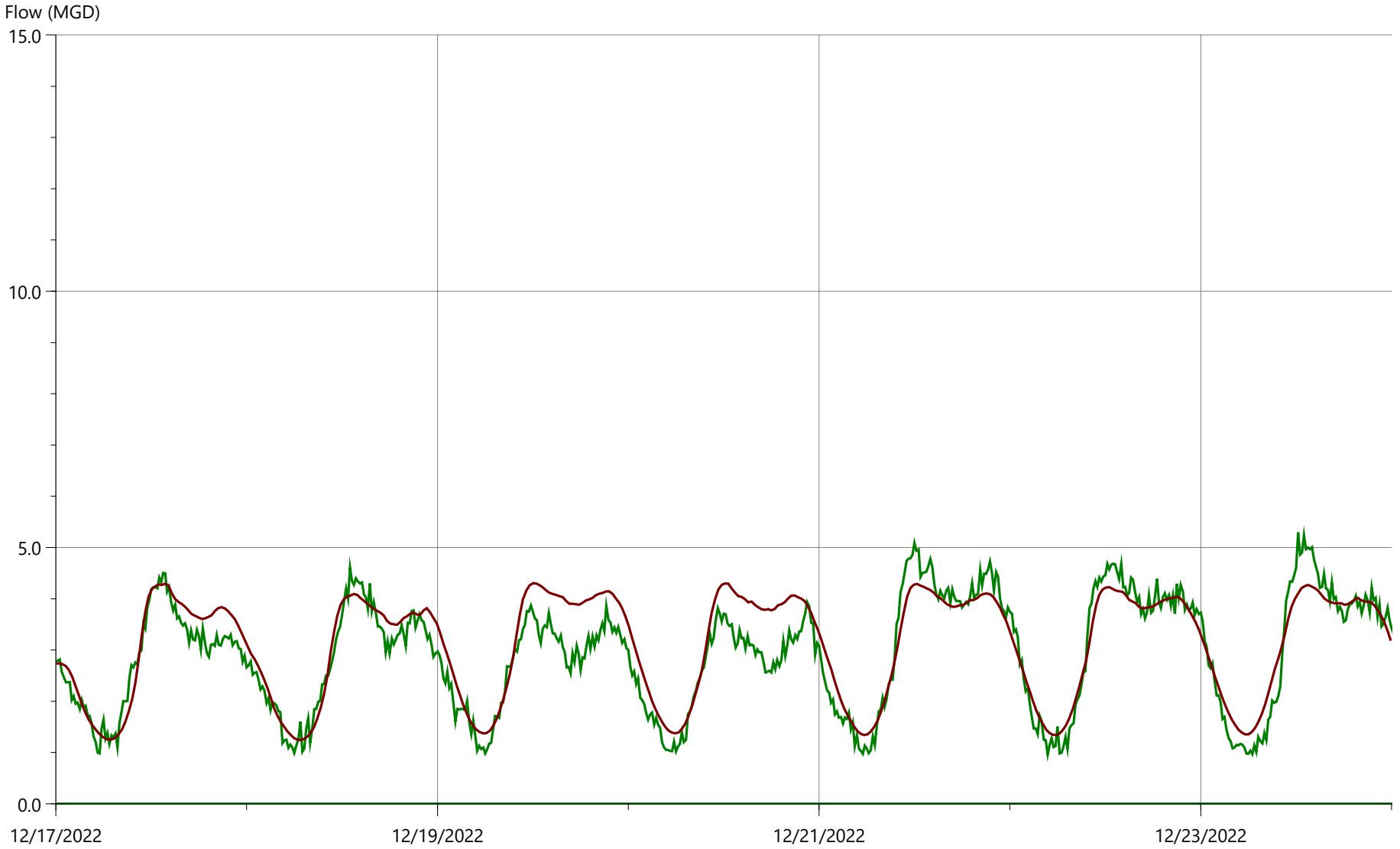
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	1.016	4.583	20.466
...ation (Homestead Blockage) DWF	0.850	3.894	18.244

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1



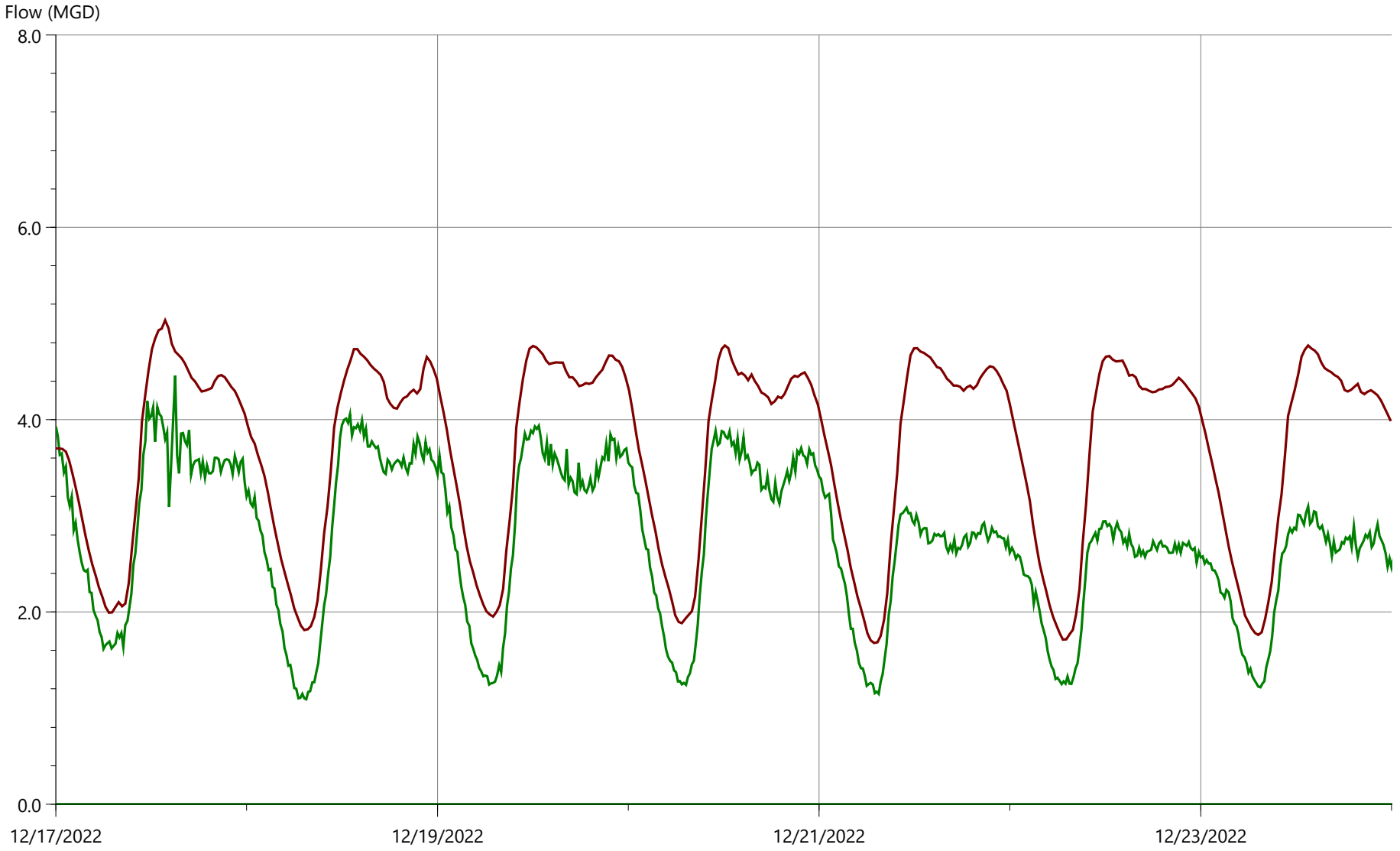
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.003	0.237	0.181
...ation (Homestead Blockage) DWF	0.003	0.037	0.085

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1



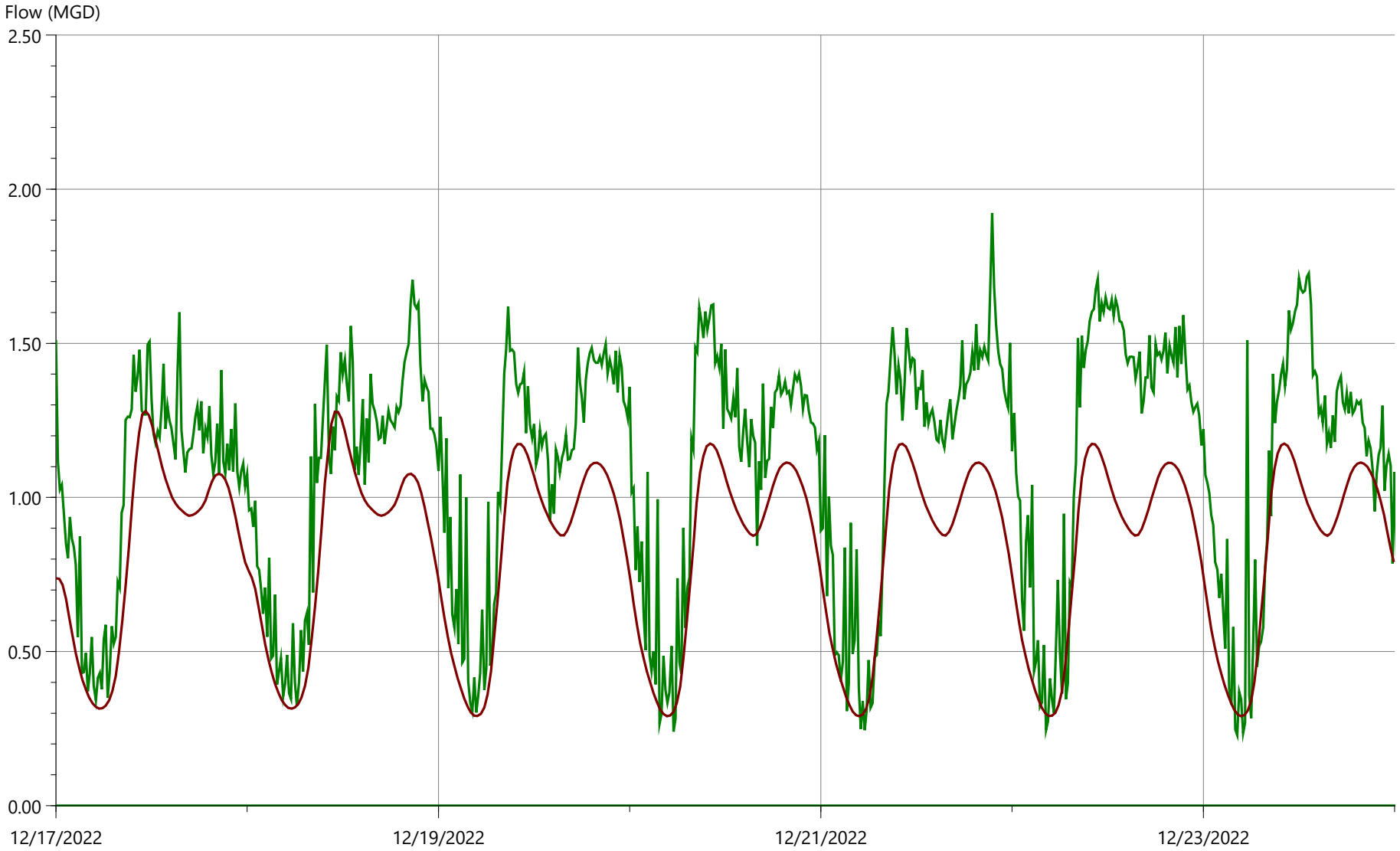
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.957	5.296	20.493
...ation (Homestead Blockage) DWF	1.247	4.301	21.735

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1



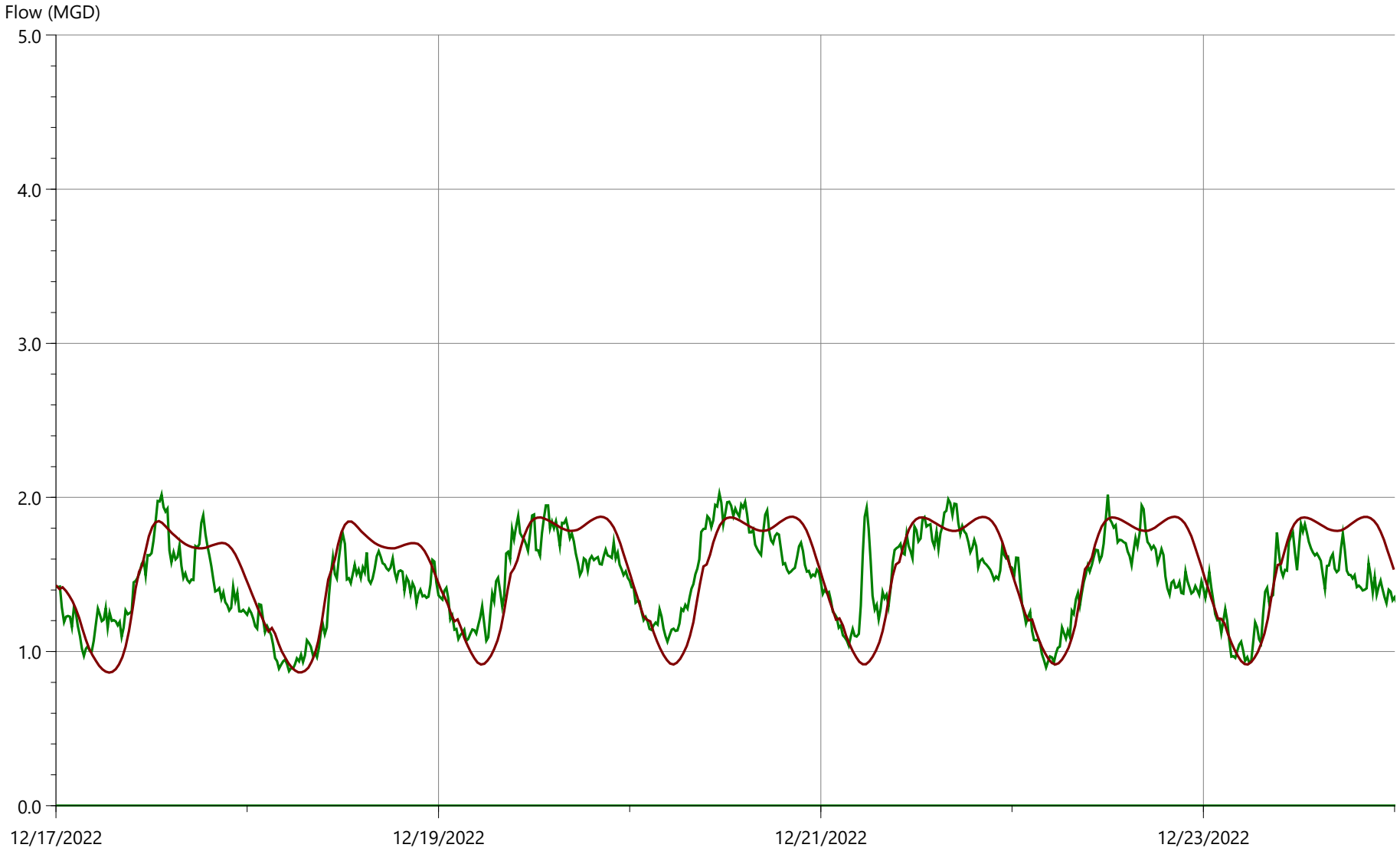
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	1.092	4.457	19.238
...ation (Homestead Blockage) DWF	1.676	5.034	25.837

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1



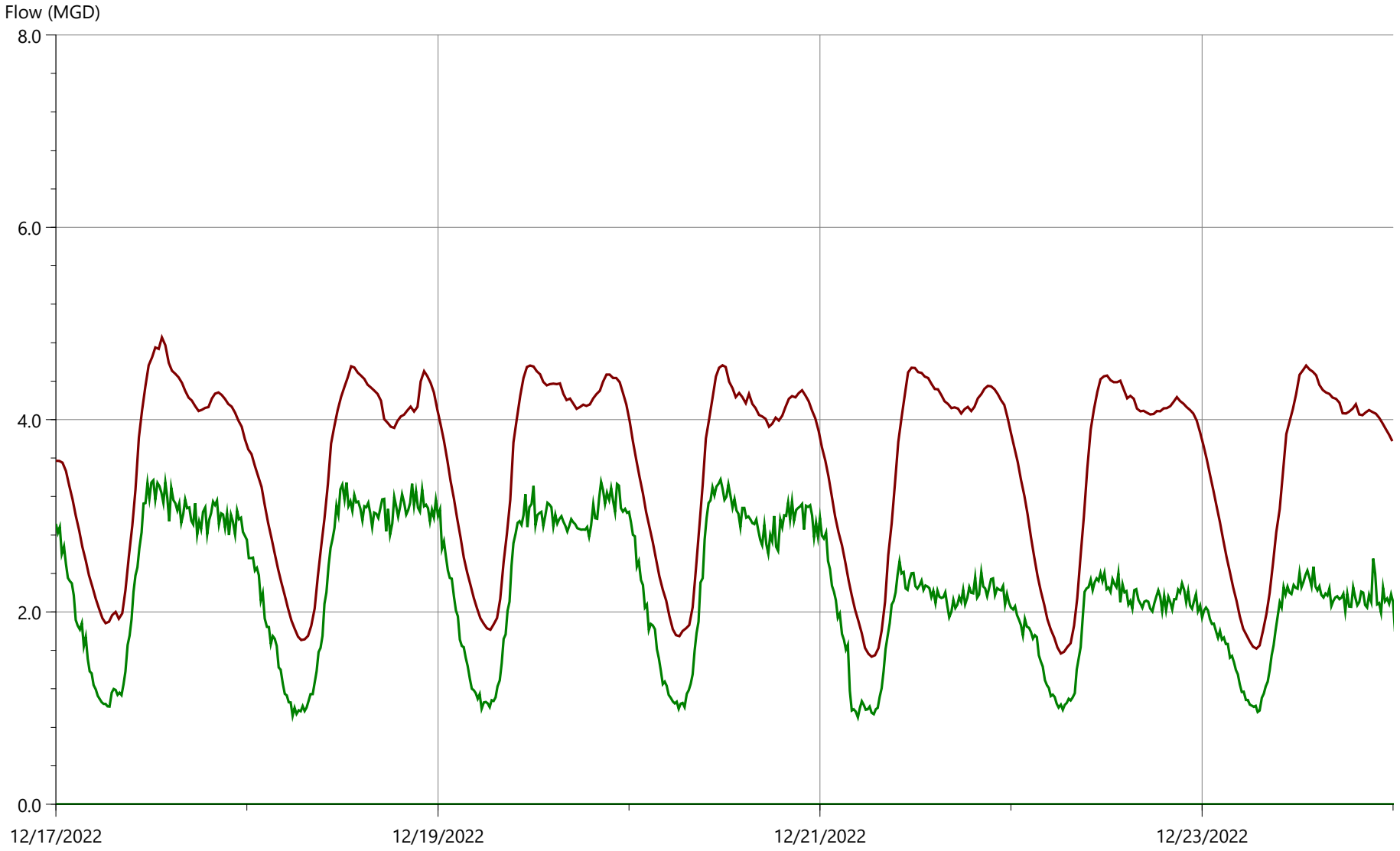
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.229	1.922	7.675
...ation (Homestead Blockage) DWF	0.290	1.280	5.781

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1



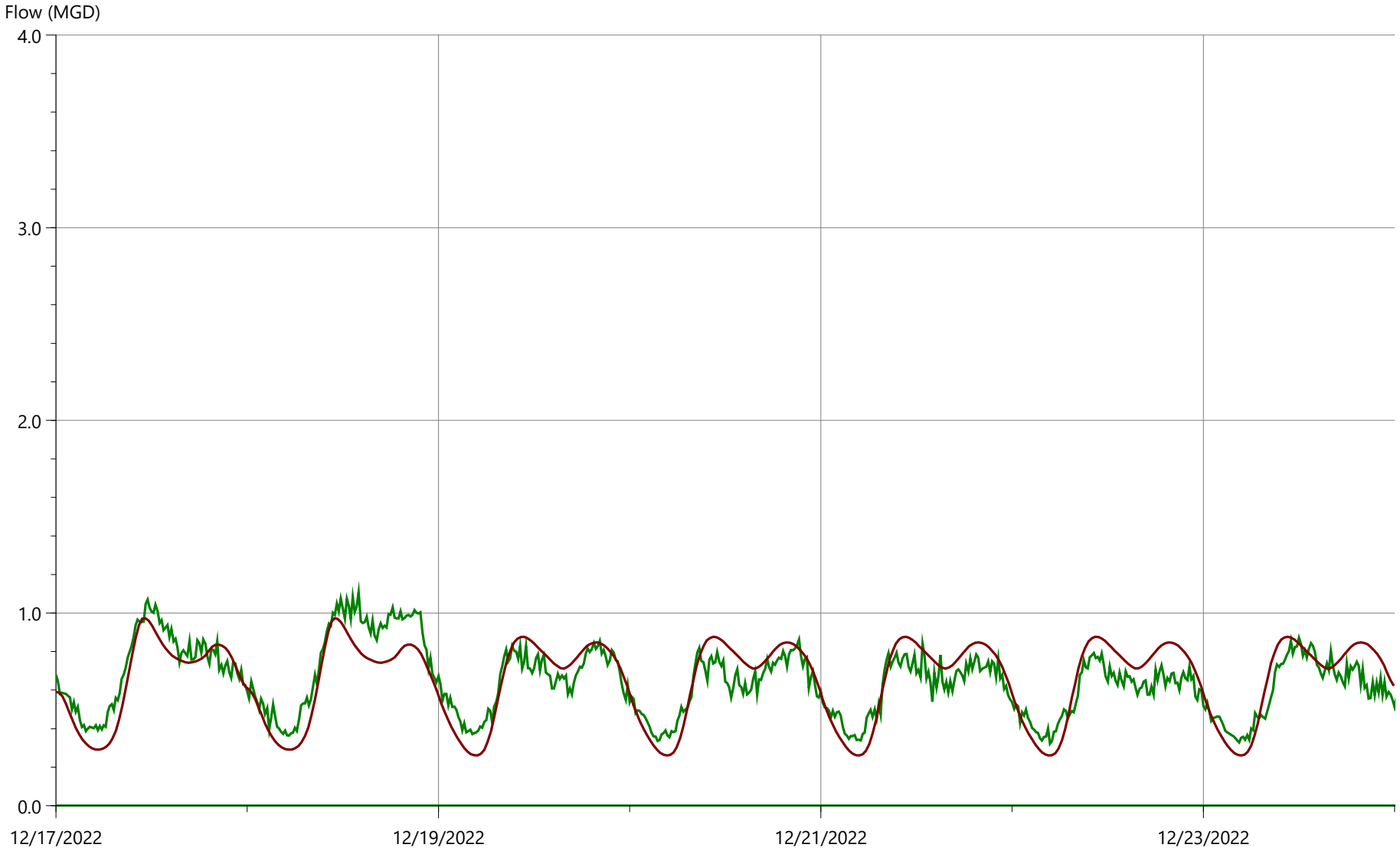
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.873	2.026	10.240
...ation (Homestead Blockage) DWF	0.864	1.875	10.578

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S72-20.1



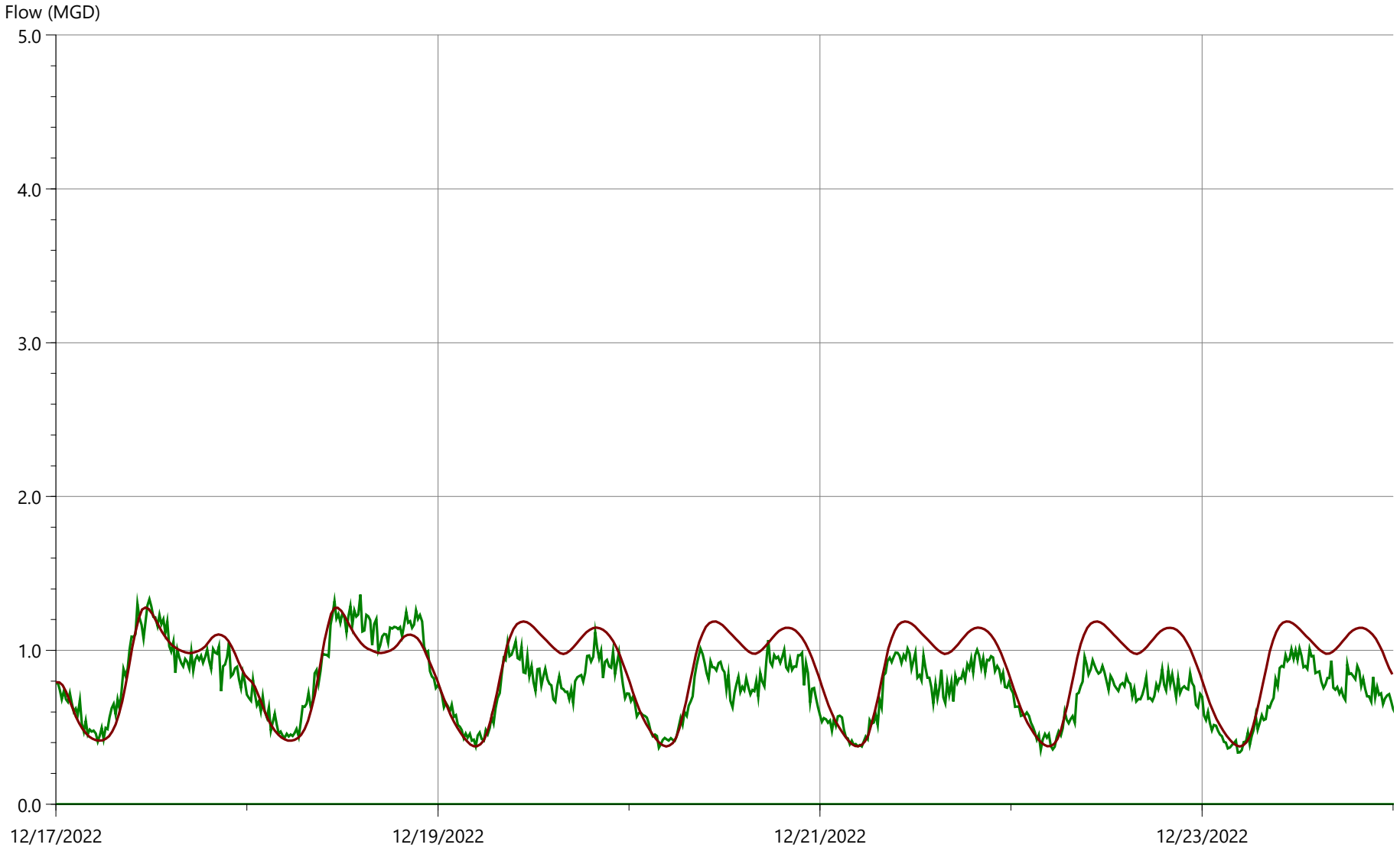
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.904	3.377	15.707
...ation (Homestead Blockage) DWF	1.535	4.856	24.662

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1



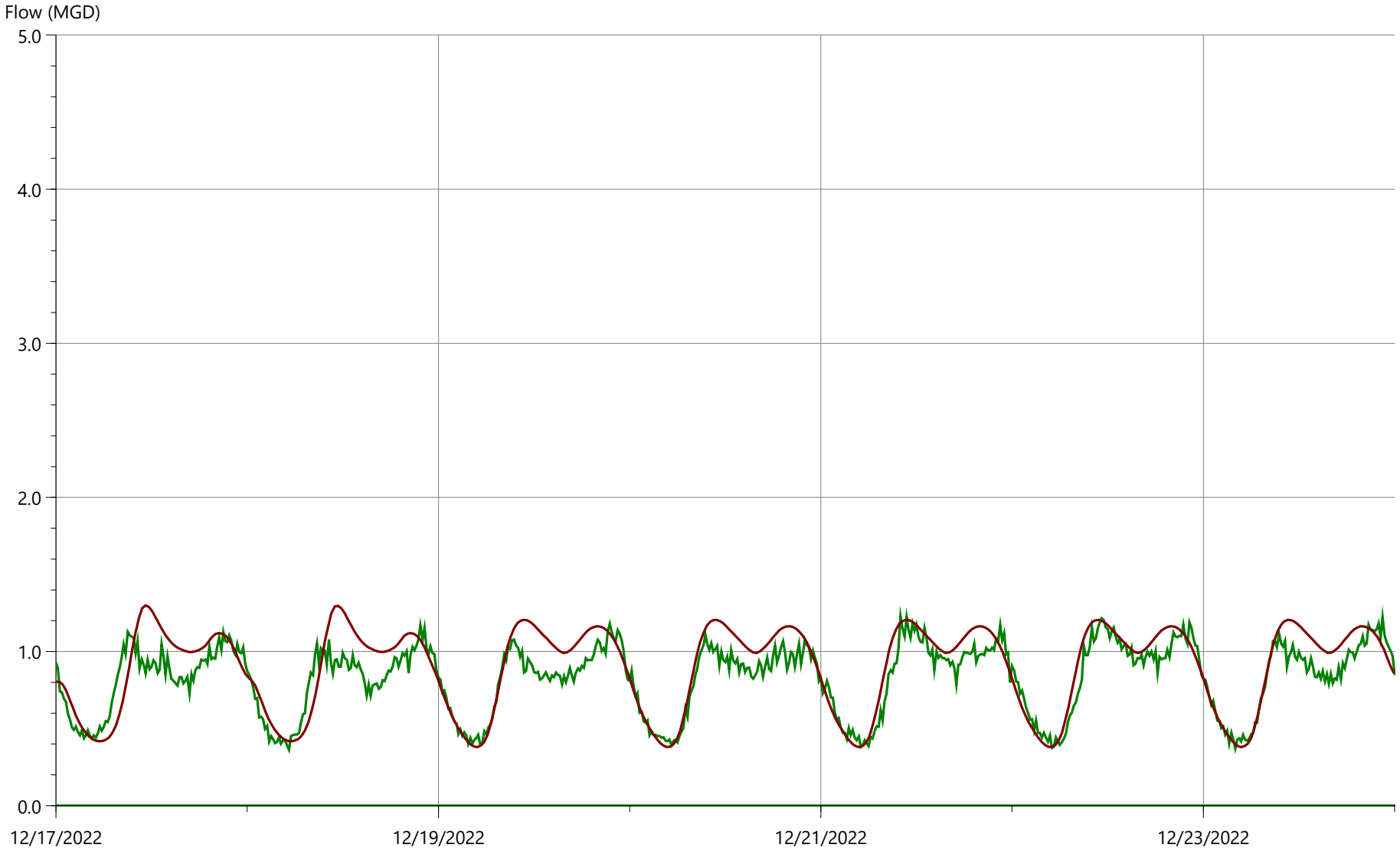
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.321	1.108	4.553
...ation (Homestead Blockage) DWF	0.261	0.973	4.560

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1



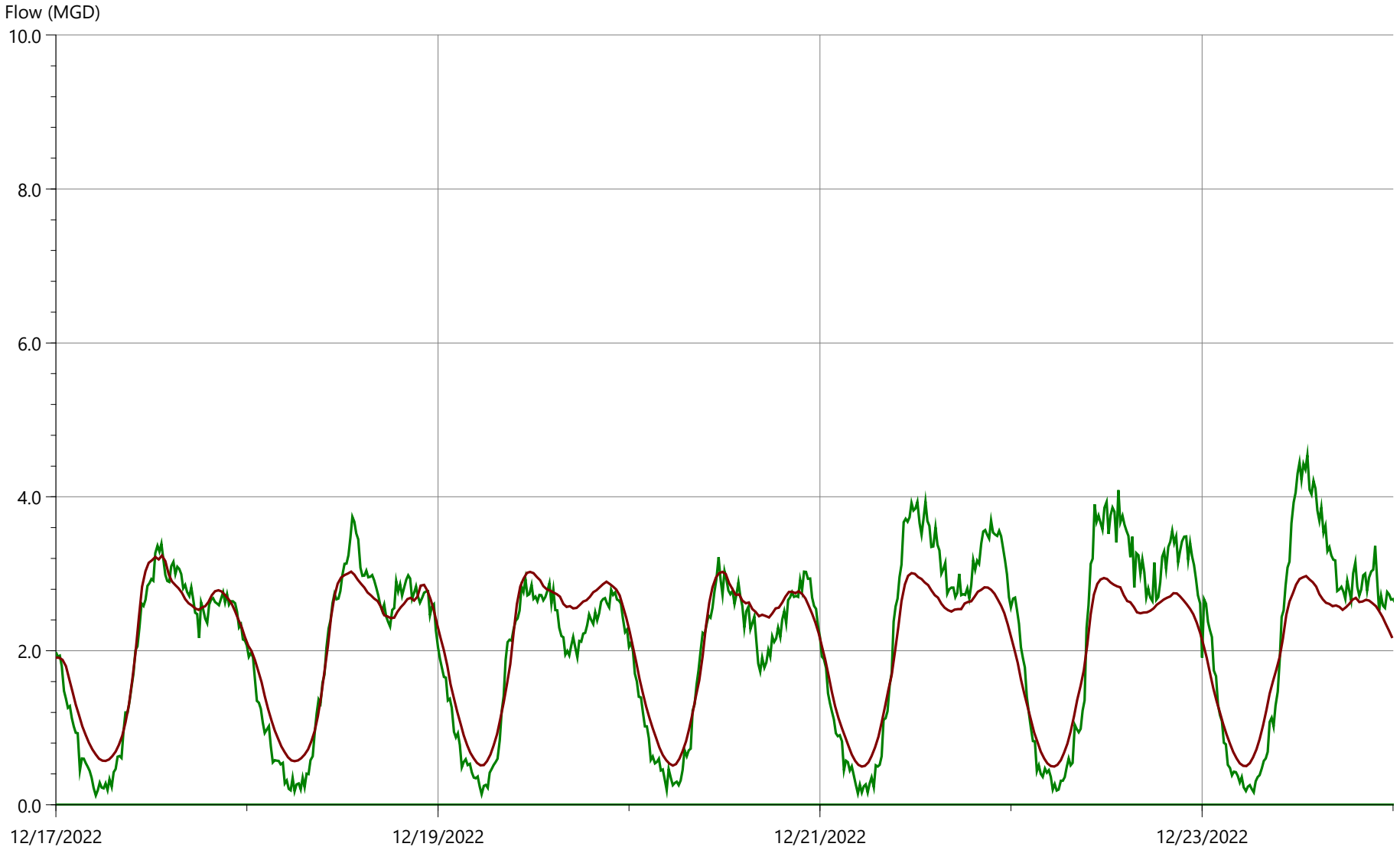
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.336	1.363	5.402
...ation (Homestead Blockage) DWF	0.376	1.279	6.198

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1



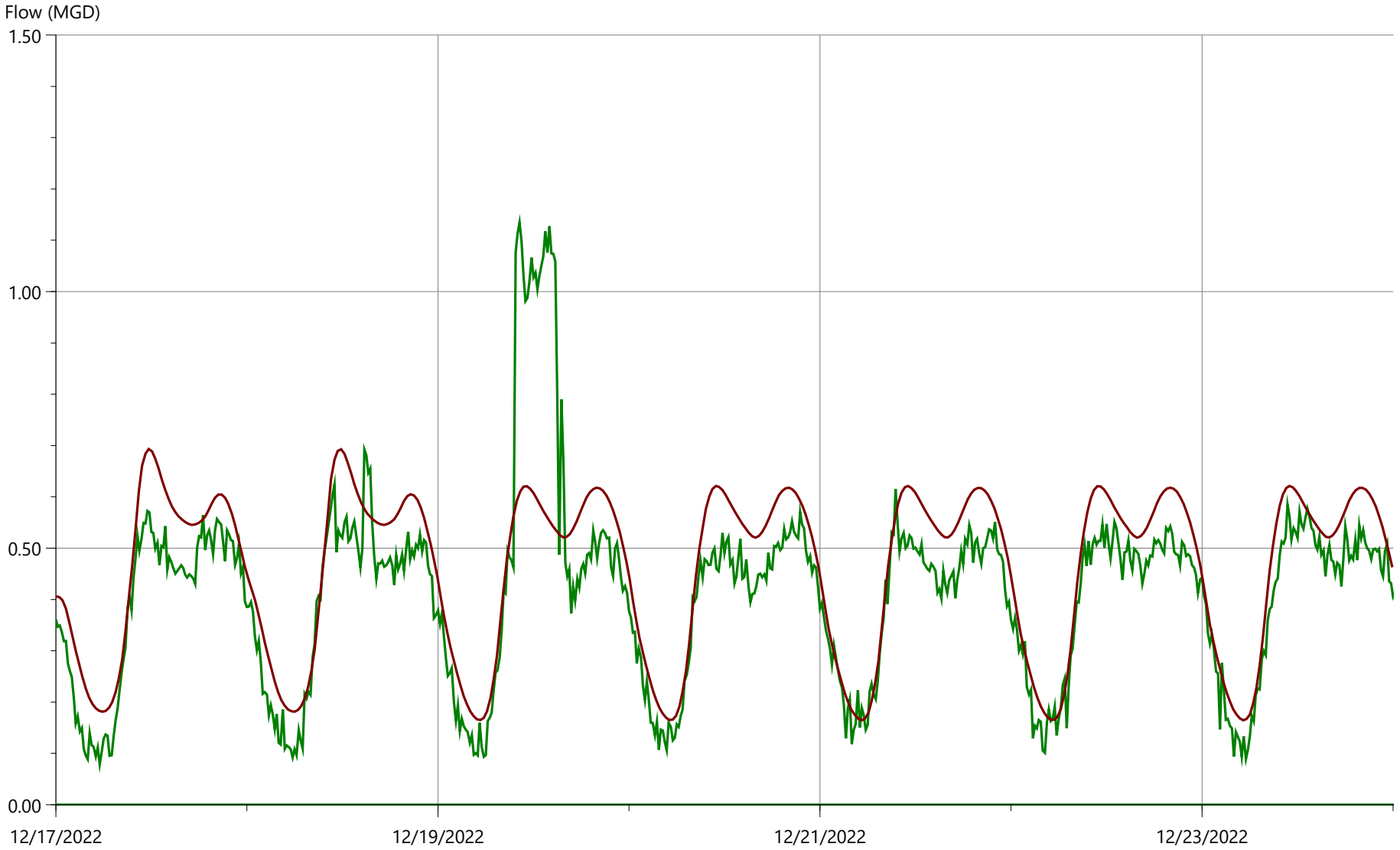
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.363	1.229	5.803
...ation (Homestead Blockage) DWF	0.380	1.299	6.286

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1



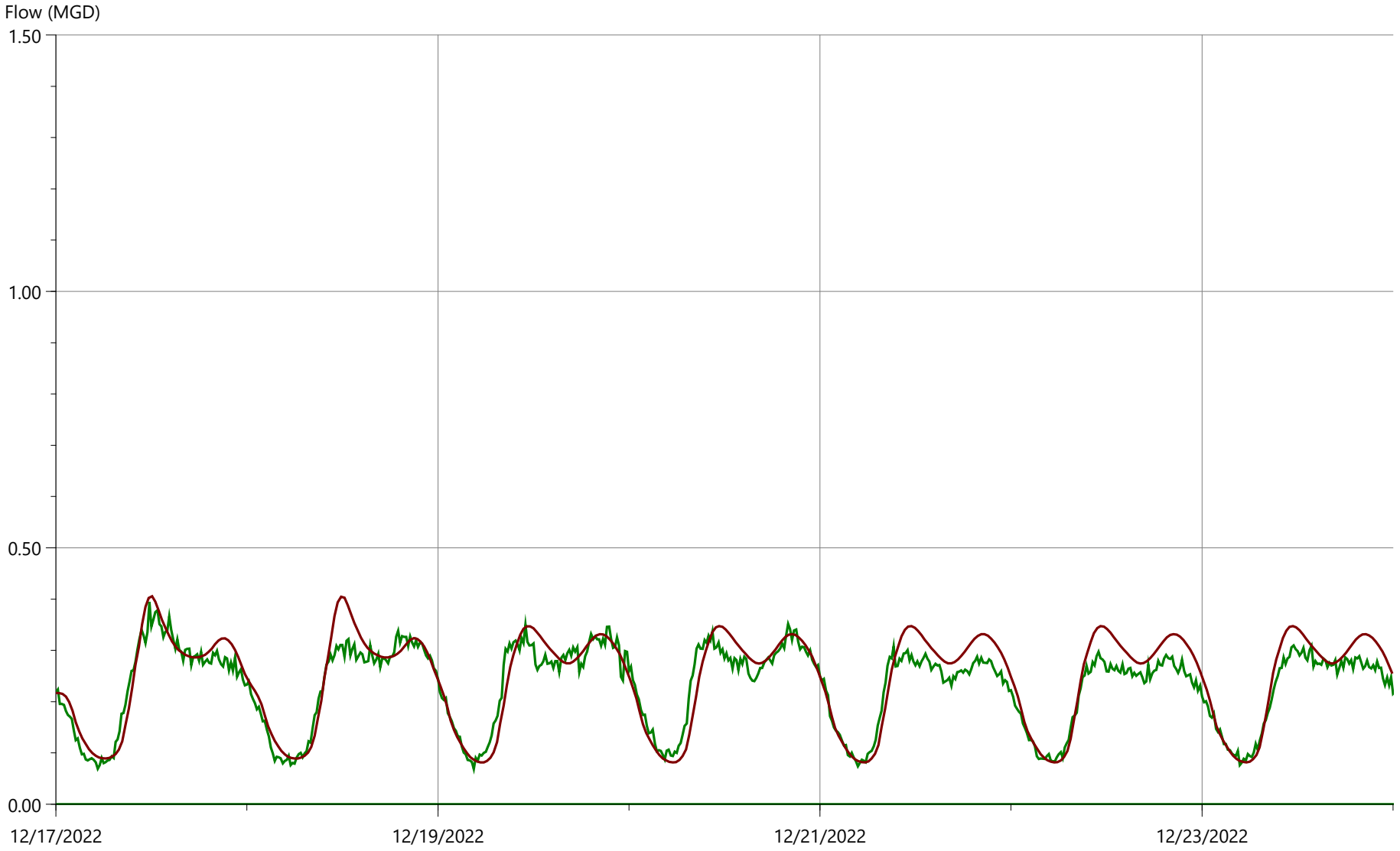
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.122	4.539	14.702
...ation (Homestead Blockage) DWF	0.496	3.237	14.336

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1



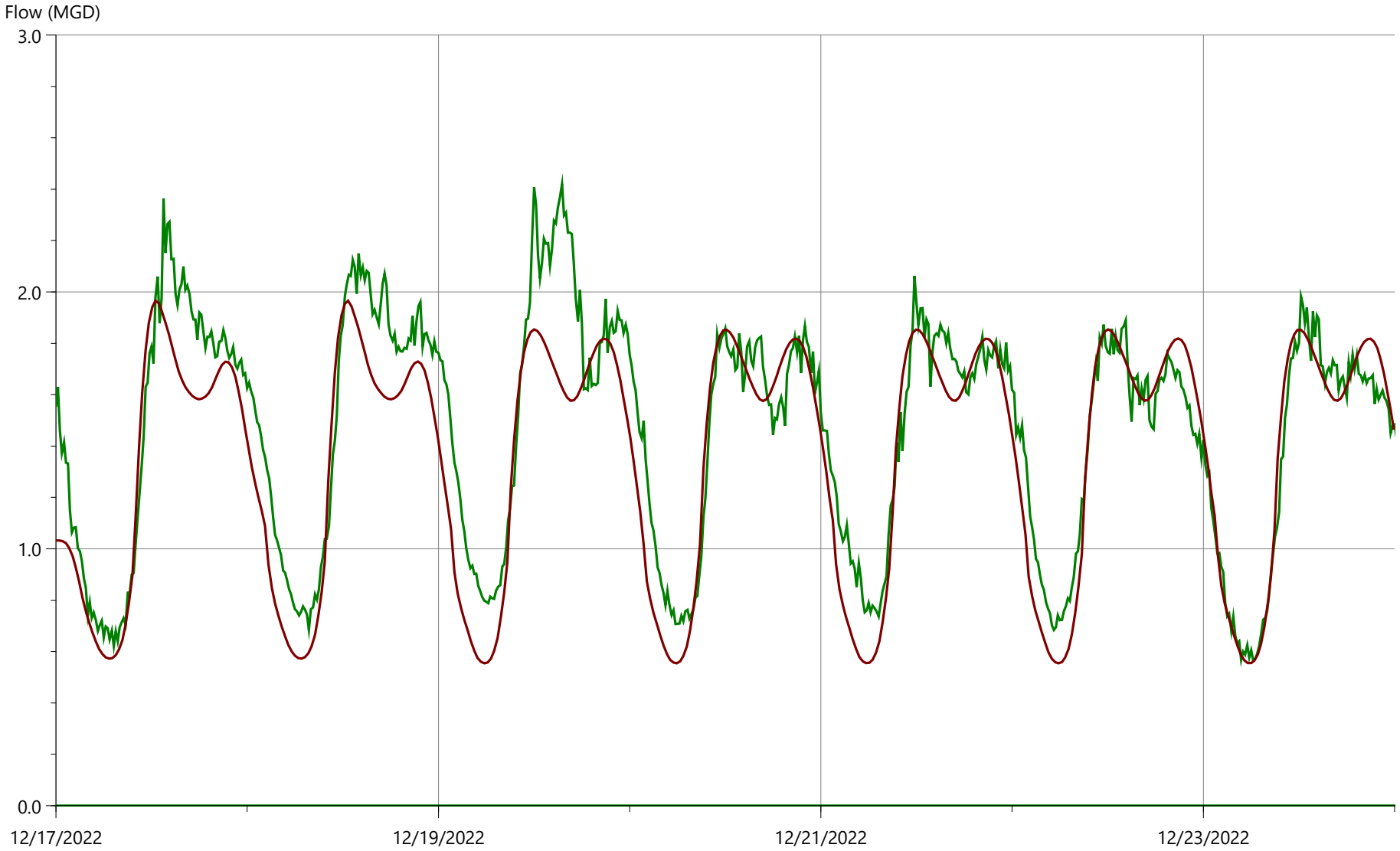
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.079	1.135	2.874
...ation (Homestead Blockage) DWF	0.165	0.693	3.216

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1



	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.068	0.395	1.615
...ation (Homestead Blockage) DWF	0.081	0.406	1.709

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1

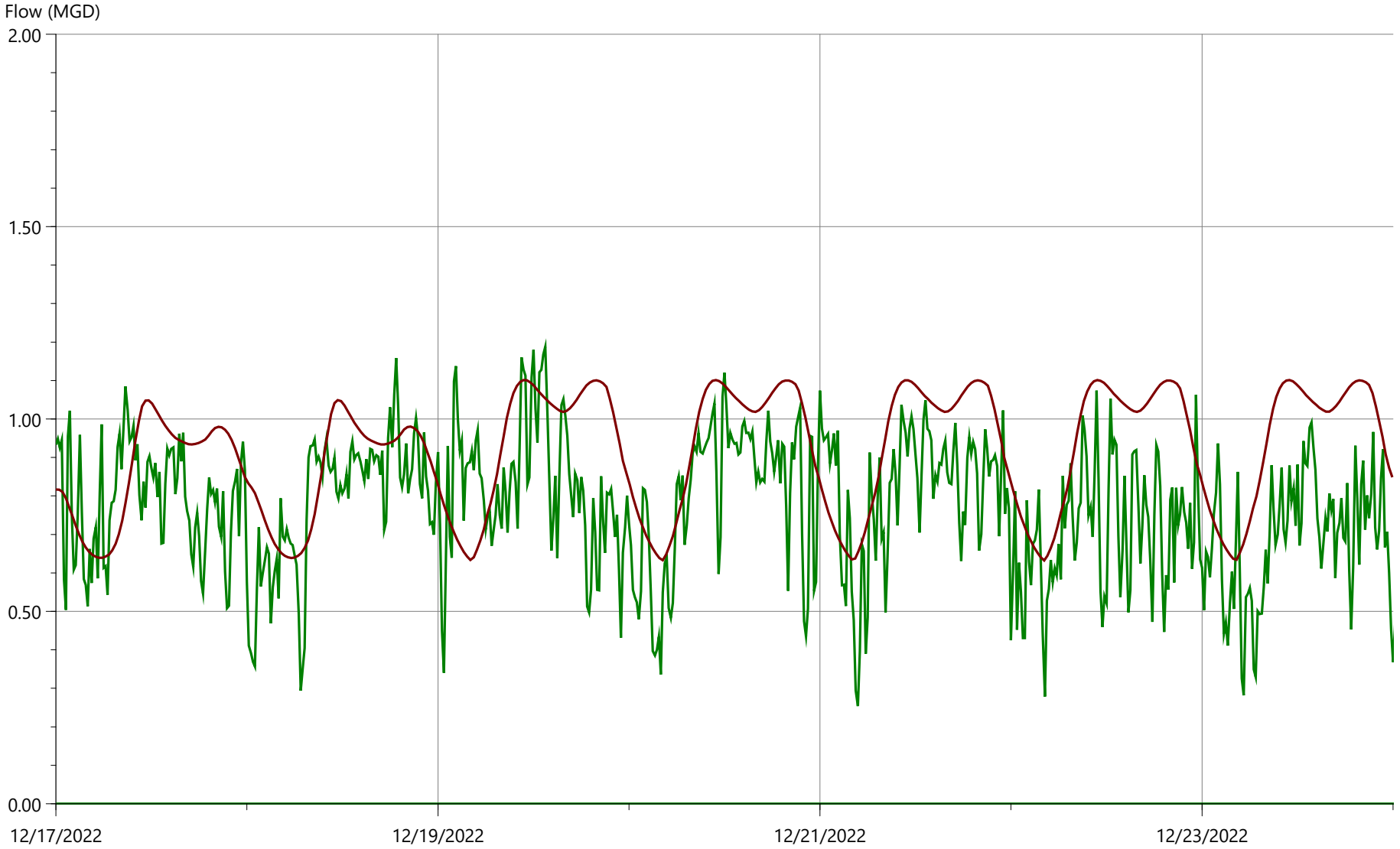


	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.566	2.420	10.213
...ation (Homestead Blockage) DWF	0.555	1.966	9.440

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)

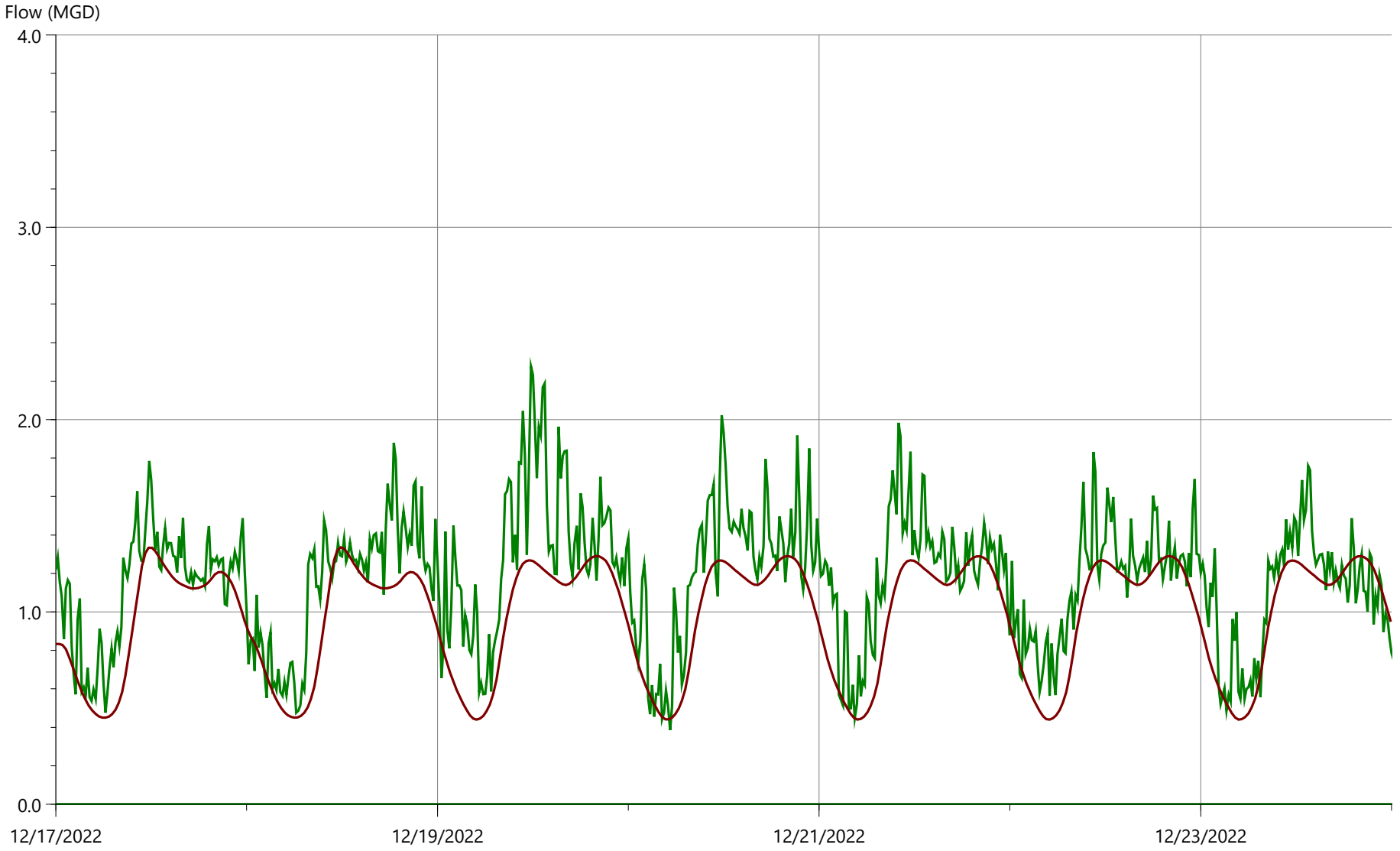
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...

Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2



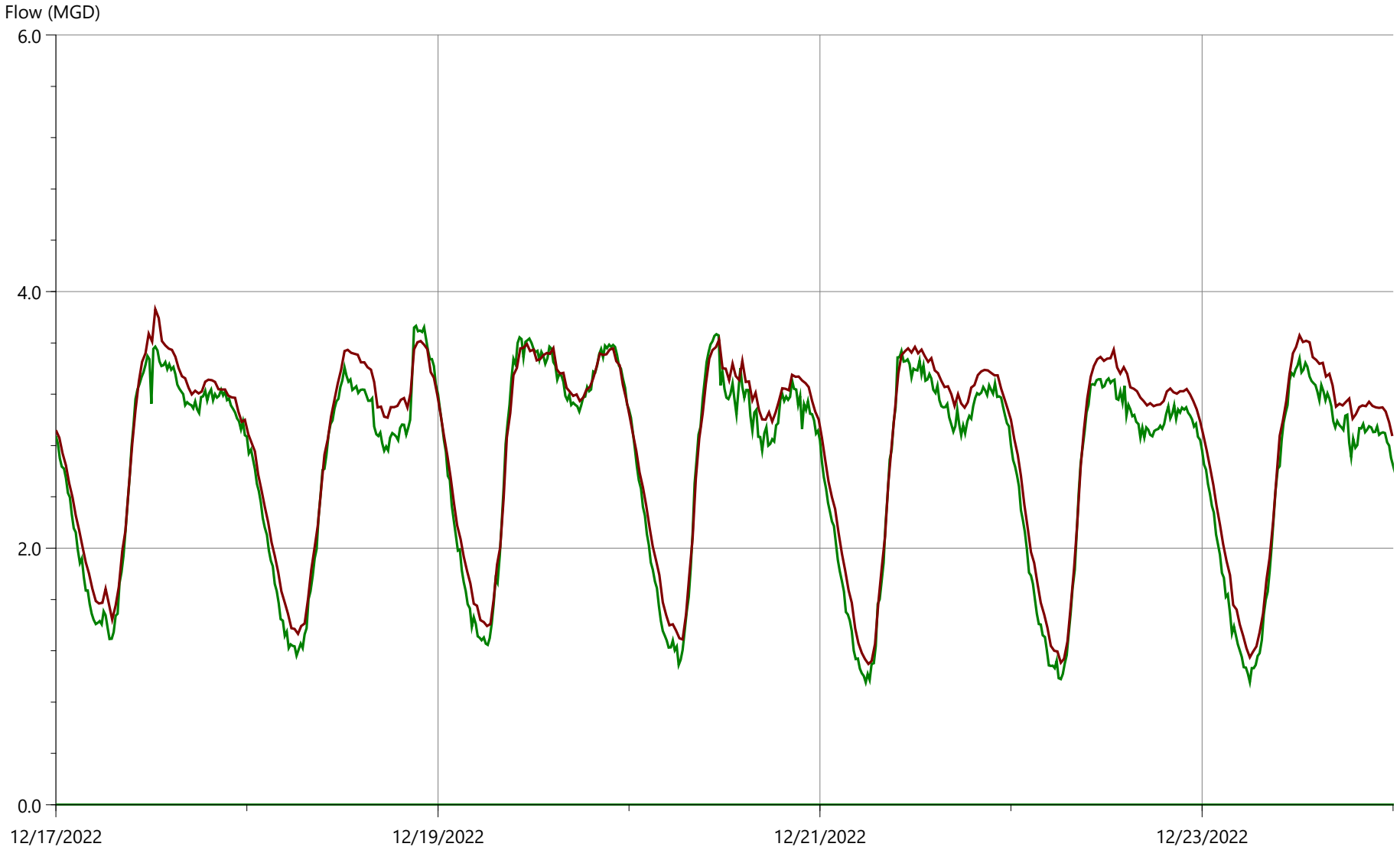
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.254	1.188	5.406
...ation (Homestead Blockage) DWF	0.632	1.101	6.417

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1



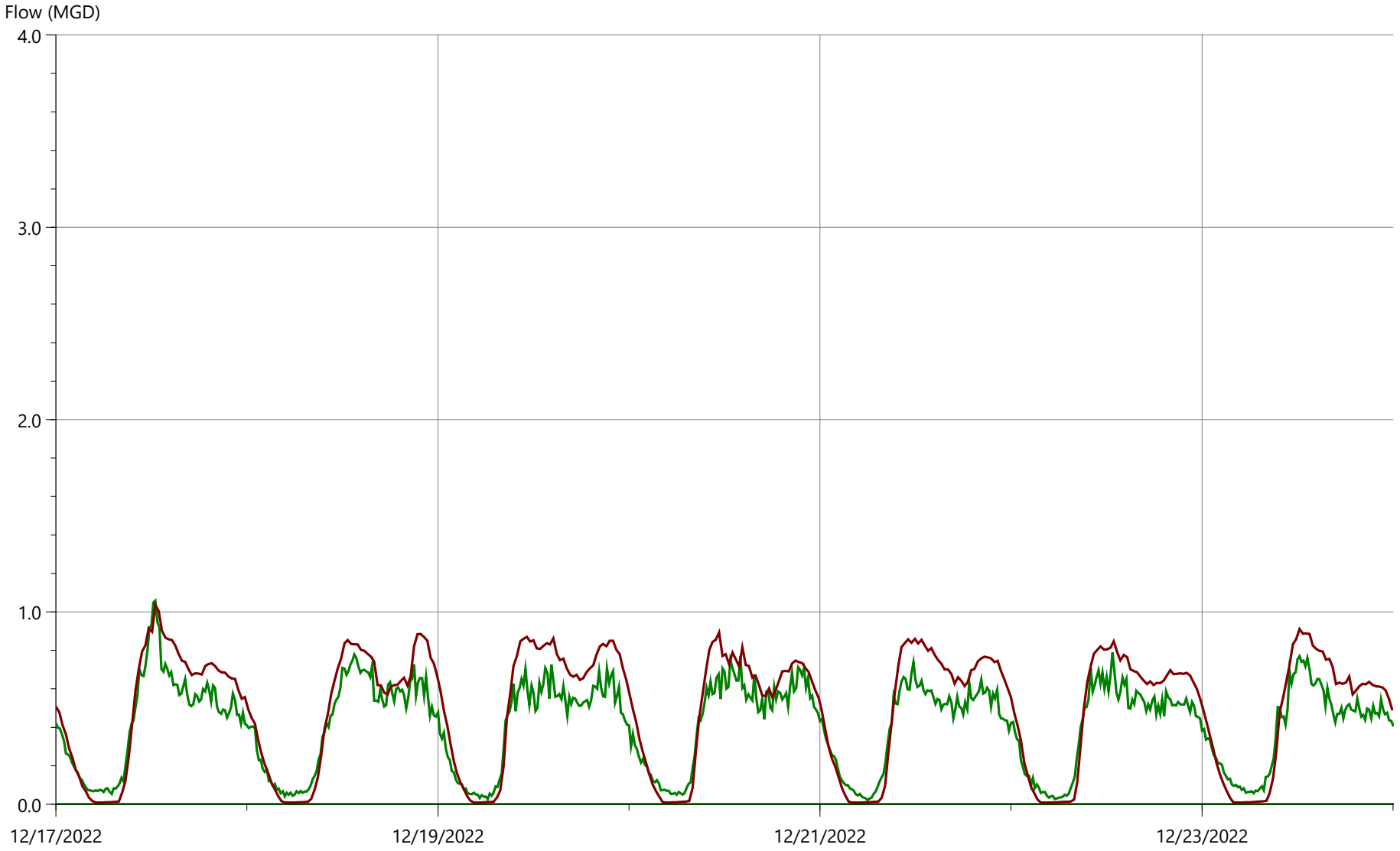
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.385	2.276	8.249
...ation (Homestead Blockage) DWF	0.440	1.336	6.799

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1



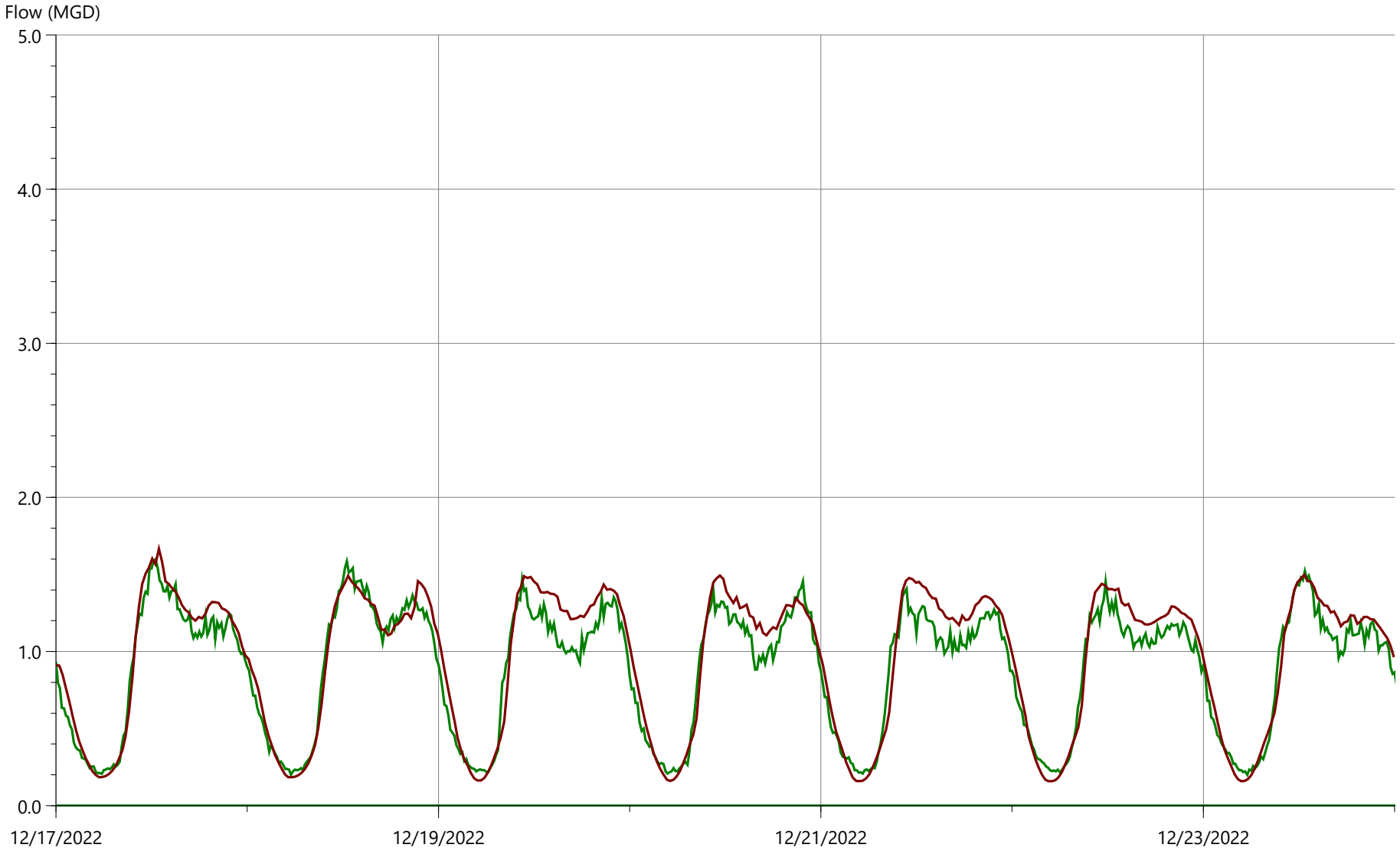
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.955	3.733	18.569
...ation (Homestead Blockage) DWF	1.098	3.862	19.445

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1



	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.022	1.058	2.906
...ation (Homestead Blockage) DWF	0.009	1.037	3.464

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1

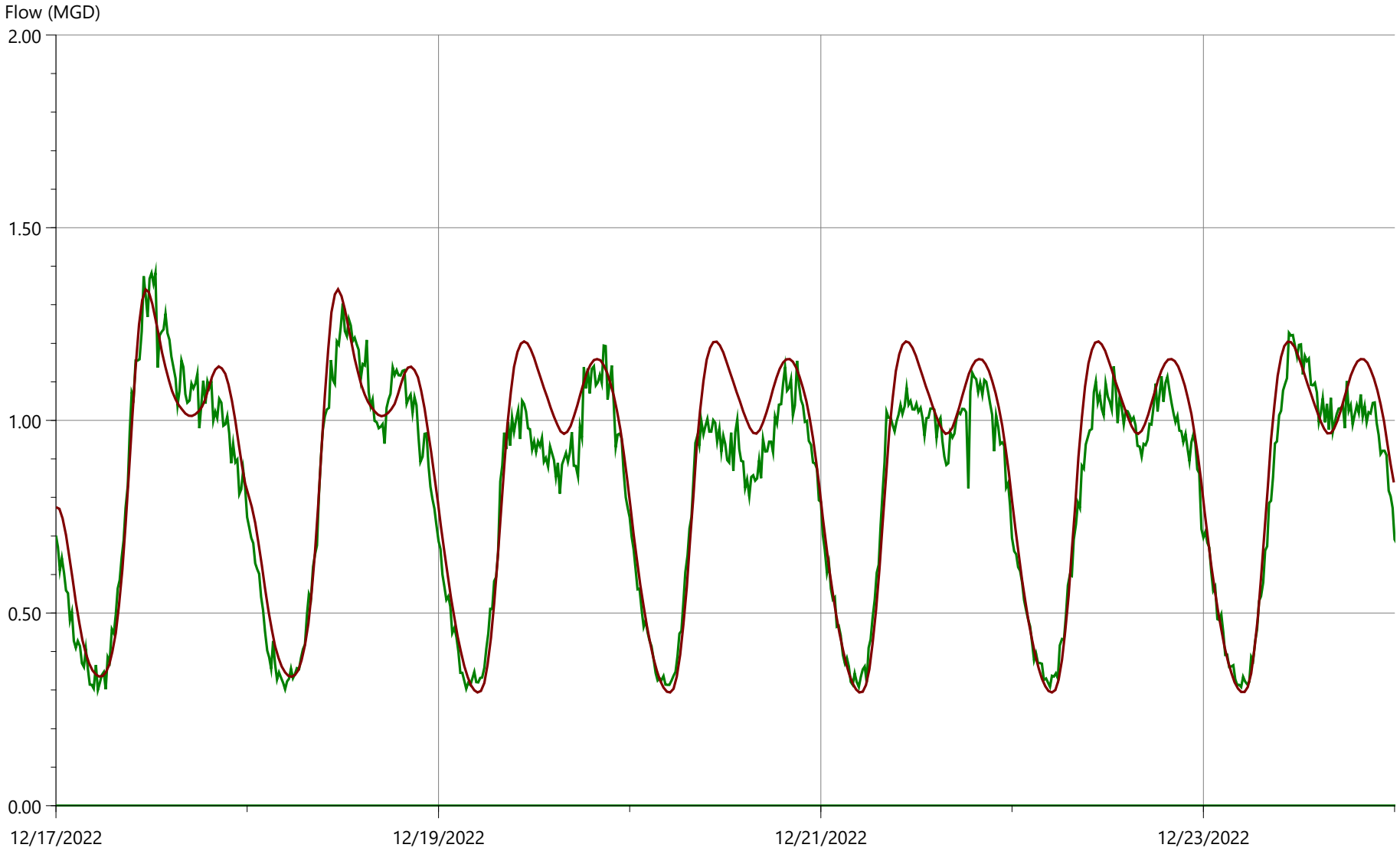


	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.200	1.598	6.243
...ation (Homestead Blockage) DWF	0.158	1.667	6.646

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)

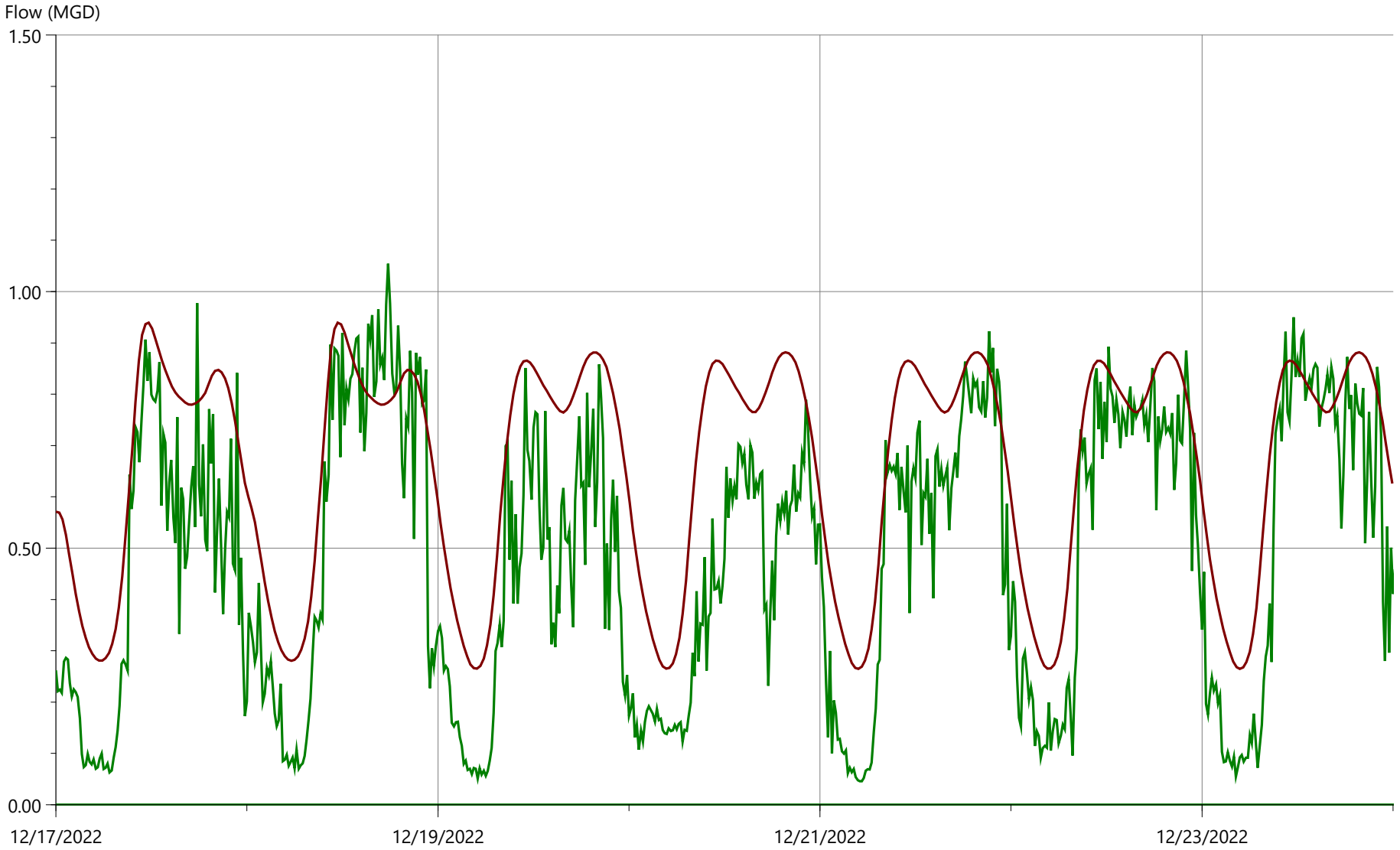
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...

Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1



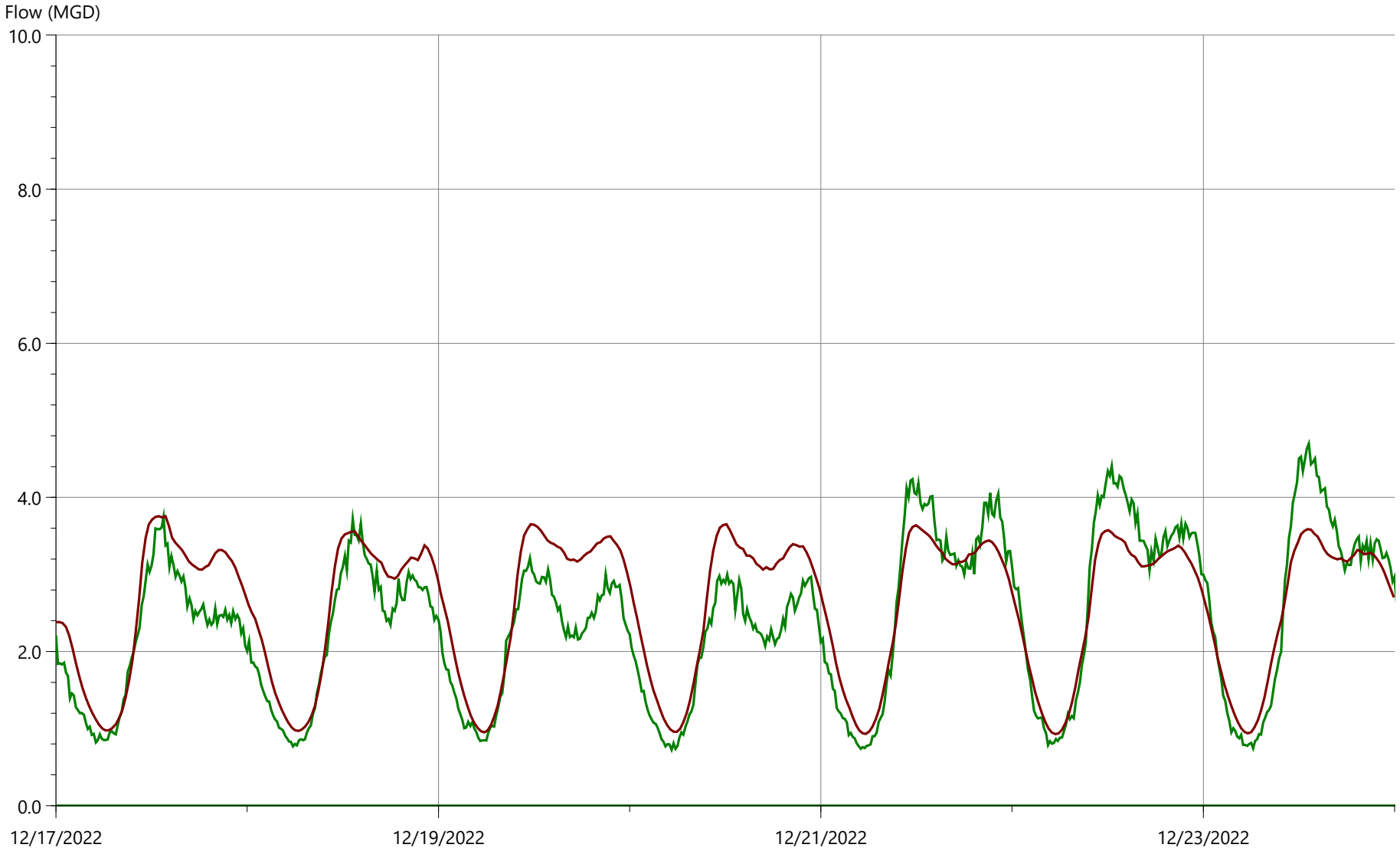
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.300	1.382	5.769
...ation (Homestead Blockage) DWF	0.294	1.340	6.078

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1



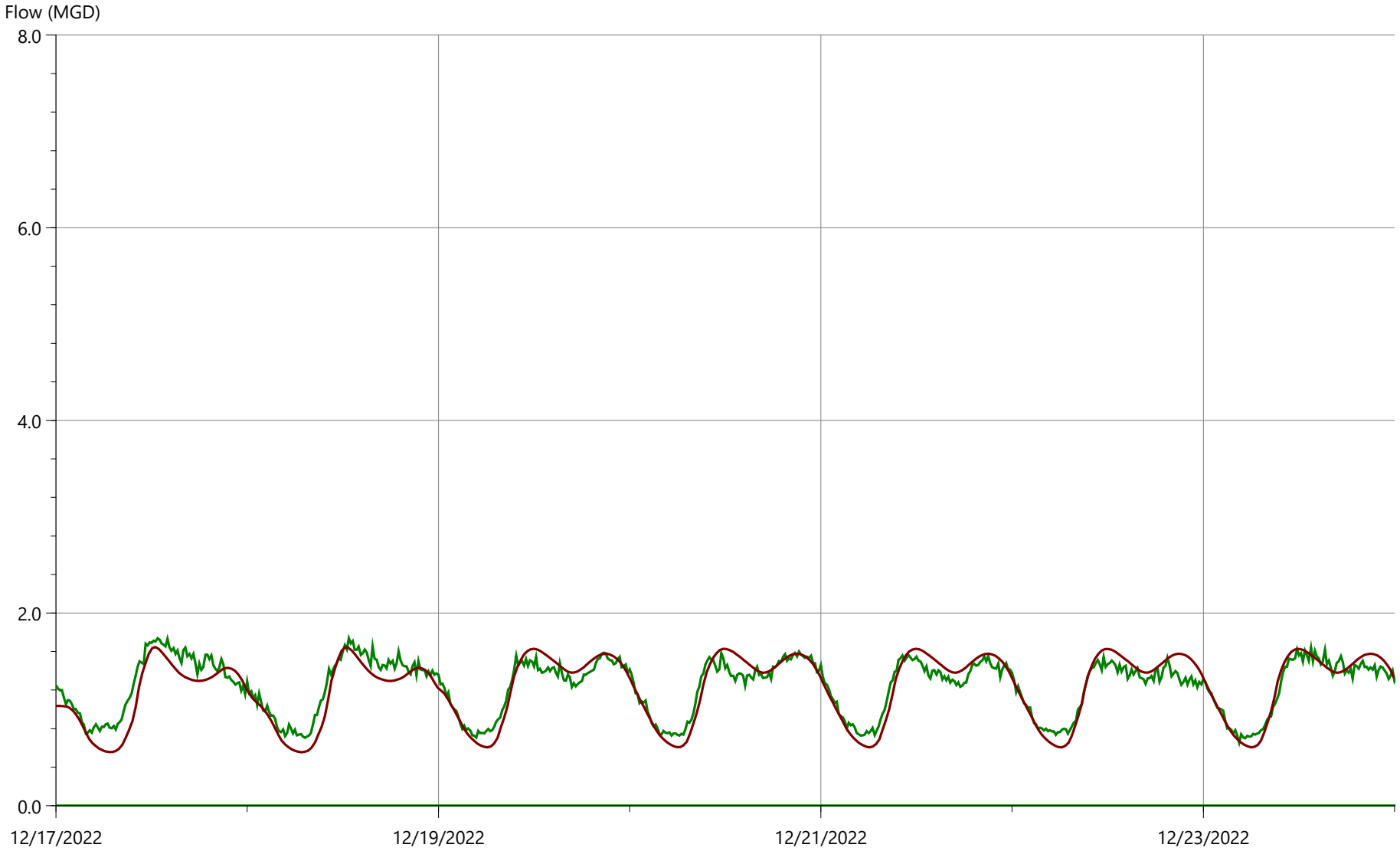
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.046	1.054	3.386
...ation (Homestead Blockage) DWF	0.265	0.939	4.607

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1



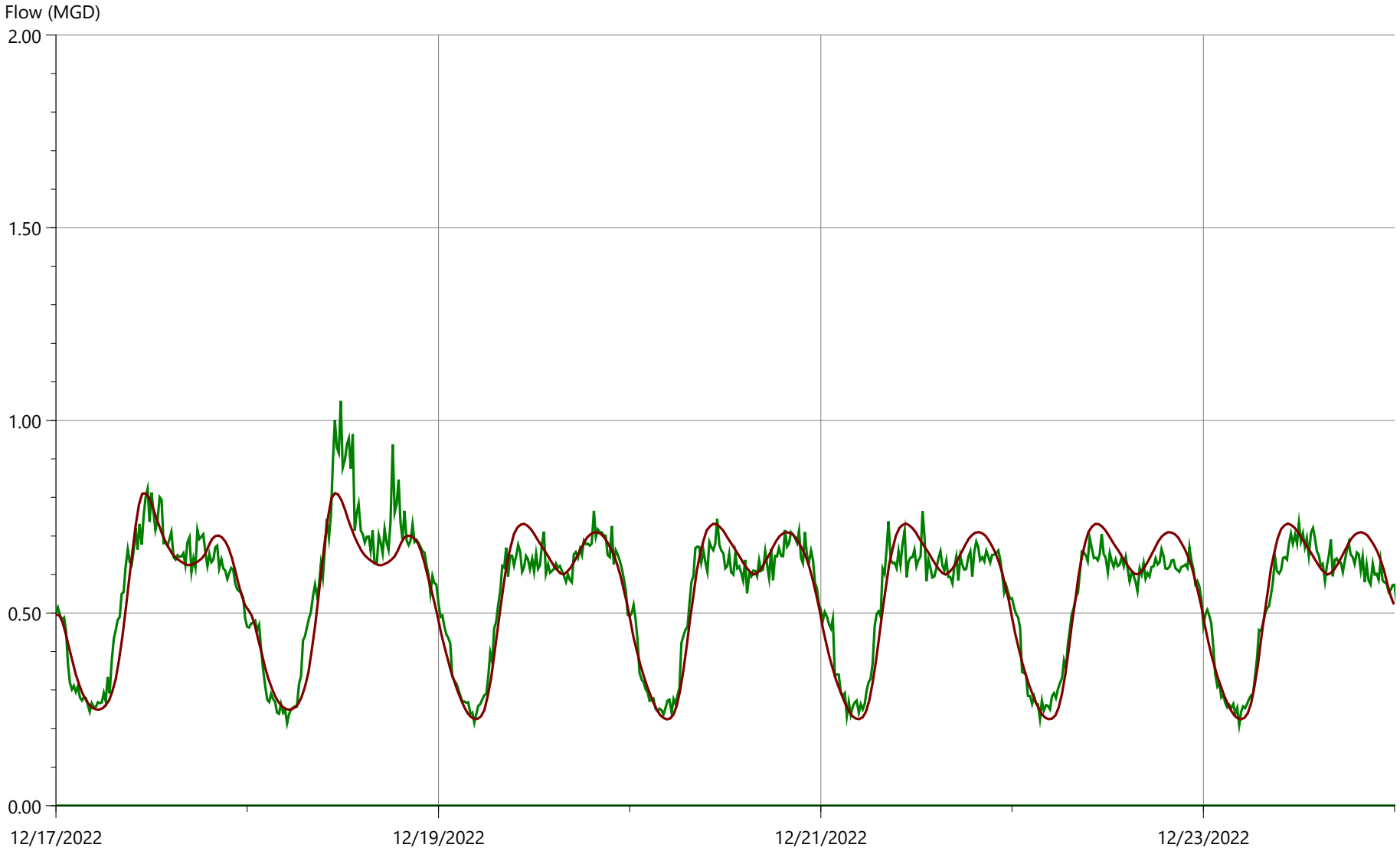
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.725	4.699	16.699
...ation (Homestead Blockage) DWF	0.928	3.757	18.065

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1



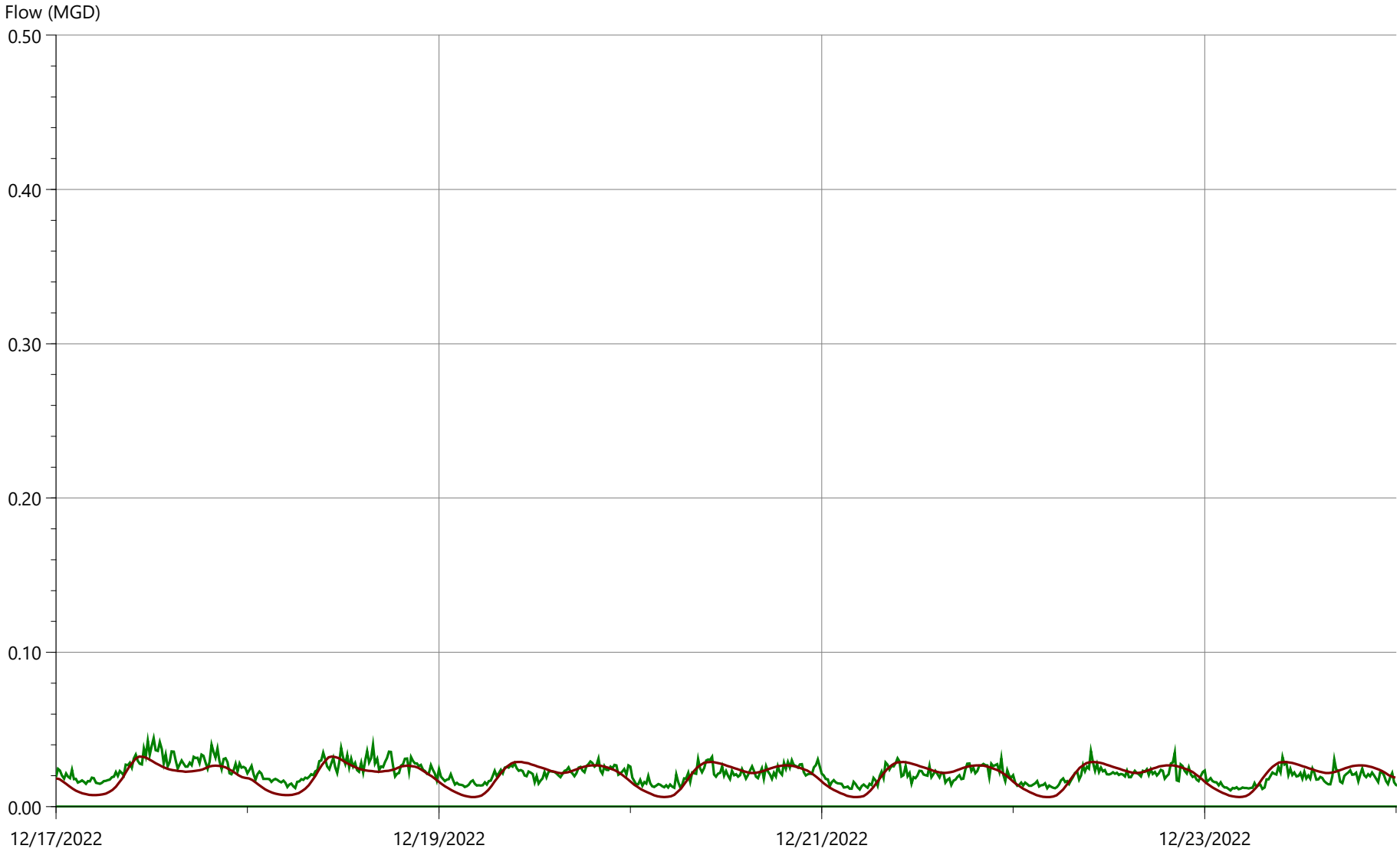
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.653	1.739	8.697
...ation (Homestead Blockage) DWF	0.555	1.646	8.531

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1



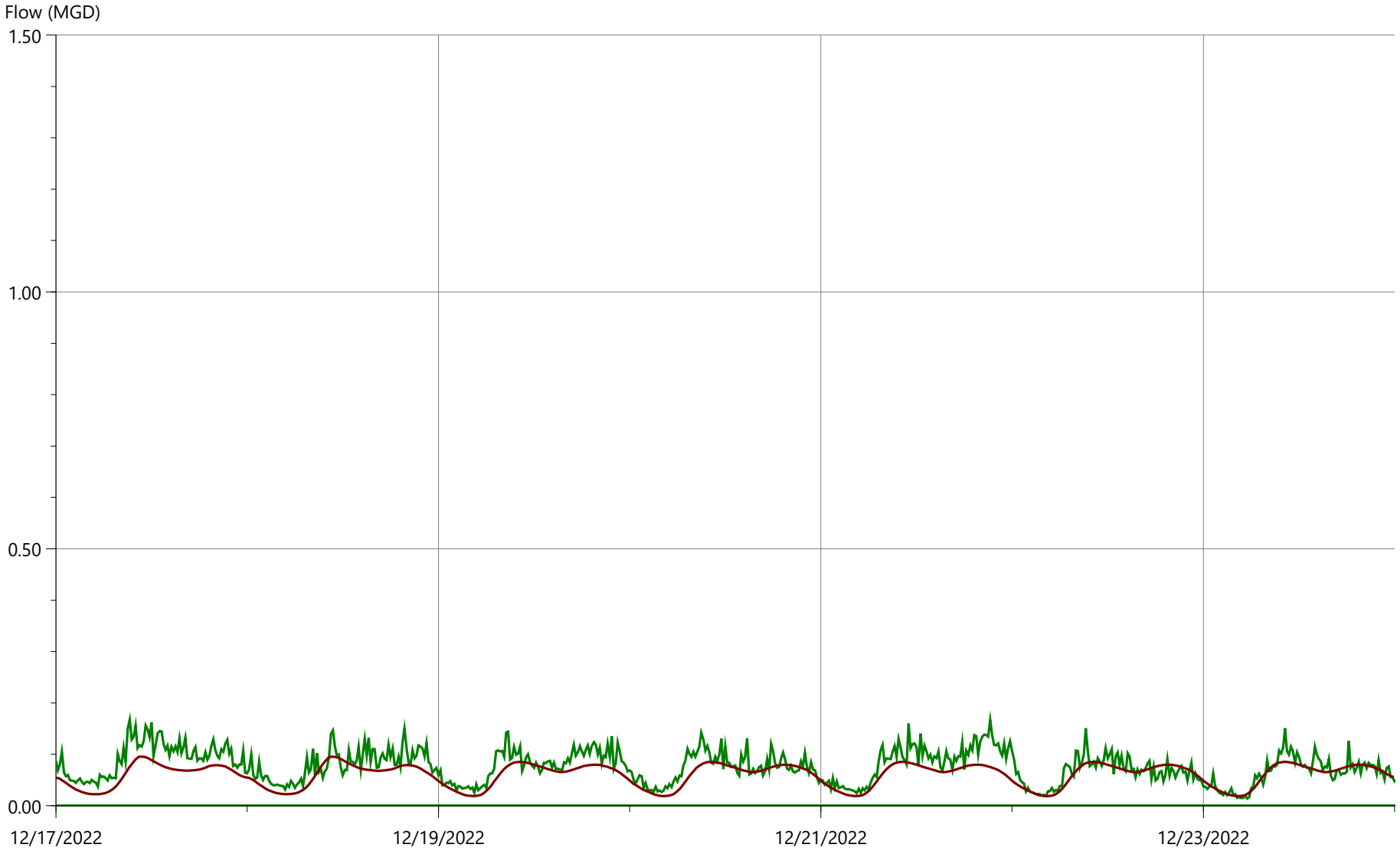
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.209	1.050	3.846
...ation (Homestead Blockage) DWF	0.224	0.811	3.832

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1



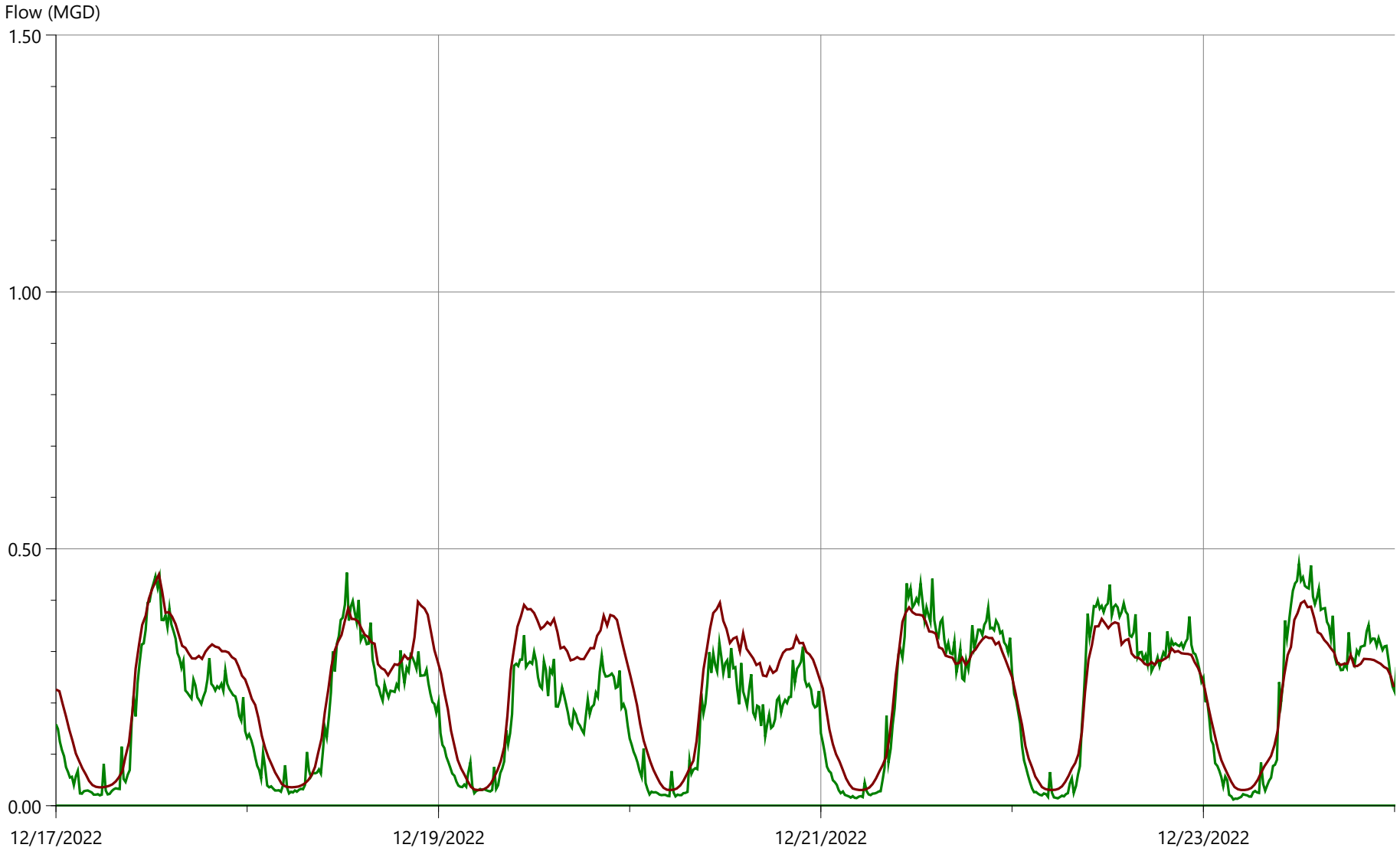
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.010	0.044	0.151
...ation (Homestead Blockage) DWF	0.006	0.032	0.141

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1



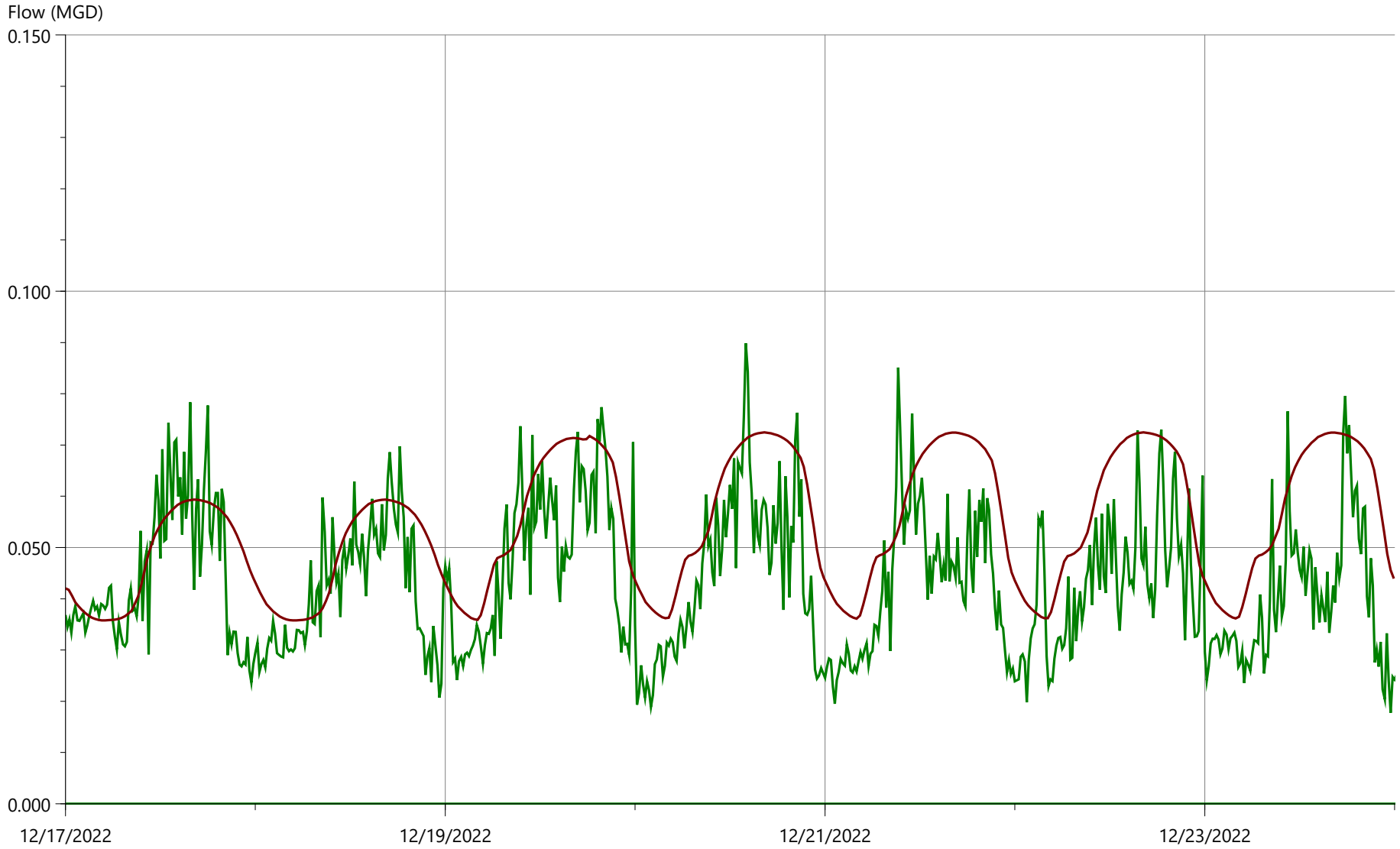
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.014	0.167	0.542
...ation (Homestead Blockage) DWF	0.019	0.096	0.421

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1



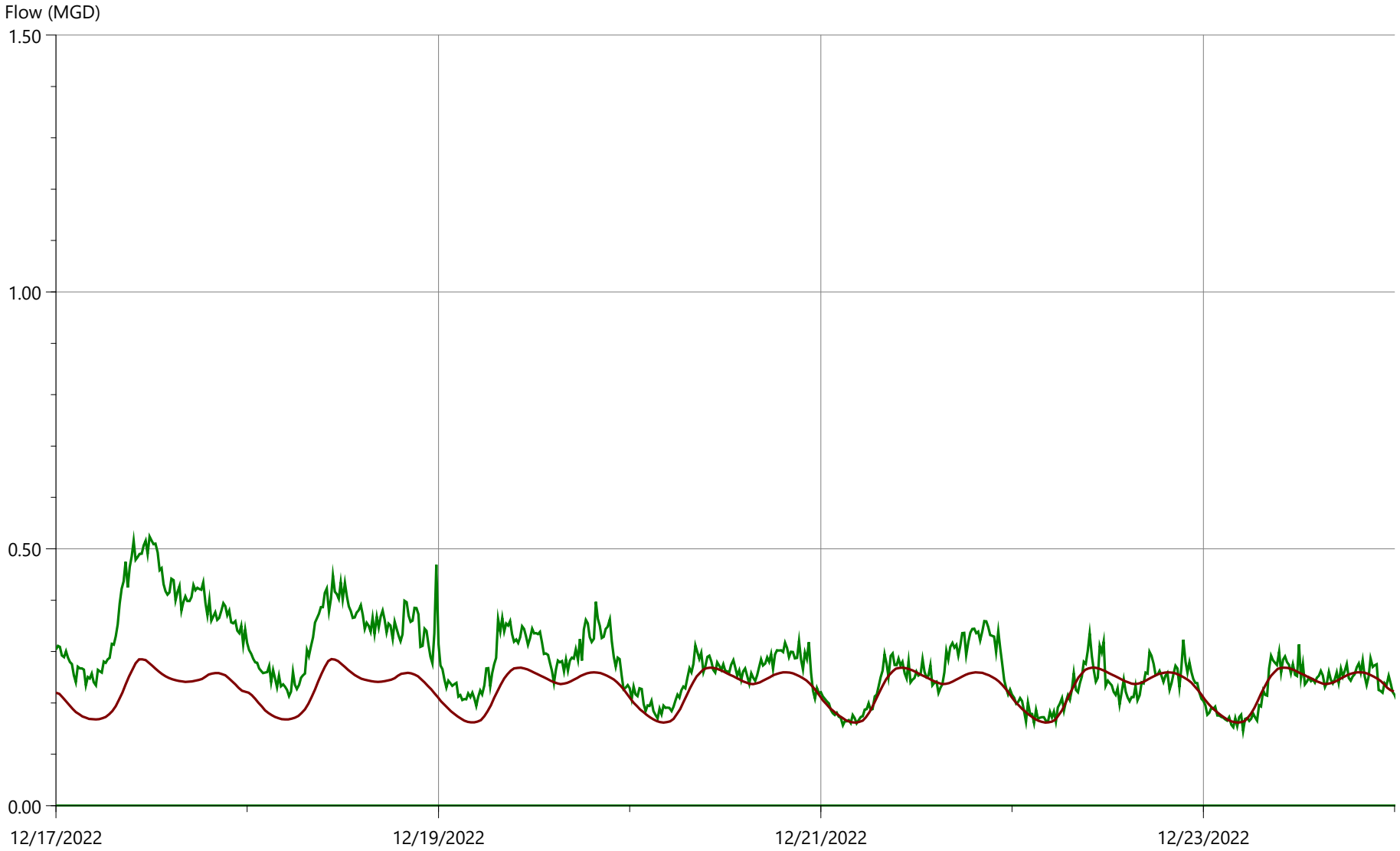
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.012	0.471	1.385
...ation (Homestead Blockage) DWF	0.030	0.450	1.589

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1



	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.018	0.090	0.305
...ation (Homestead Blockage) DWF	0.036	0.072	0.380

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1



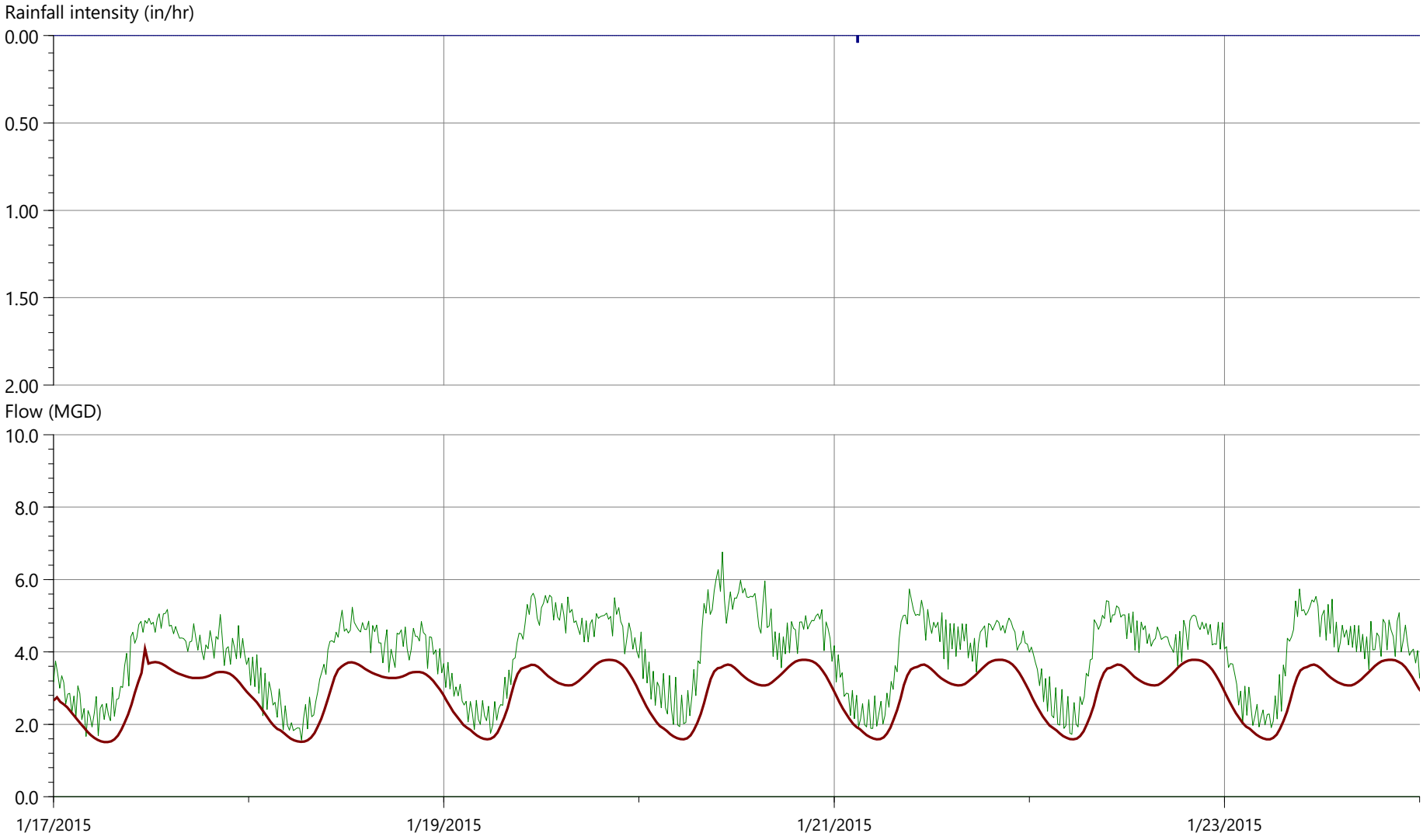
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.146	0.524	1.961
...ation (Homestead Blockage) DWF	0.162	0.285	1.599

Dry Weather Flow Calibration Plots
Modeled vs. 2014-2015 Metered Flows

(*assumes normal settings at Homestead/Lawrence gate structure*)

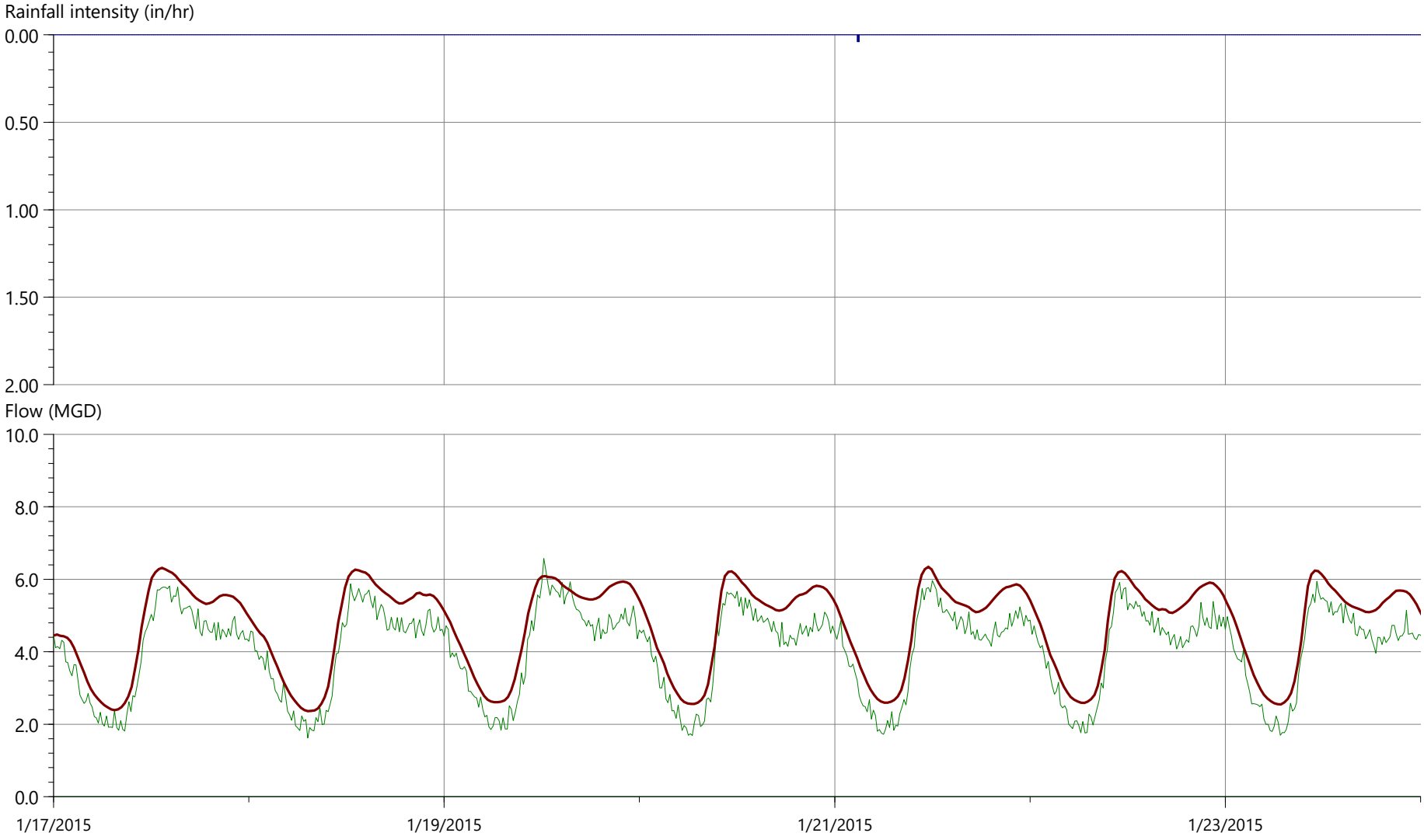
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1, Rainfall Profile: 1



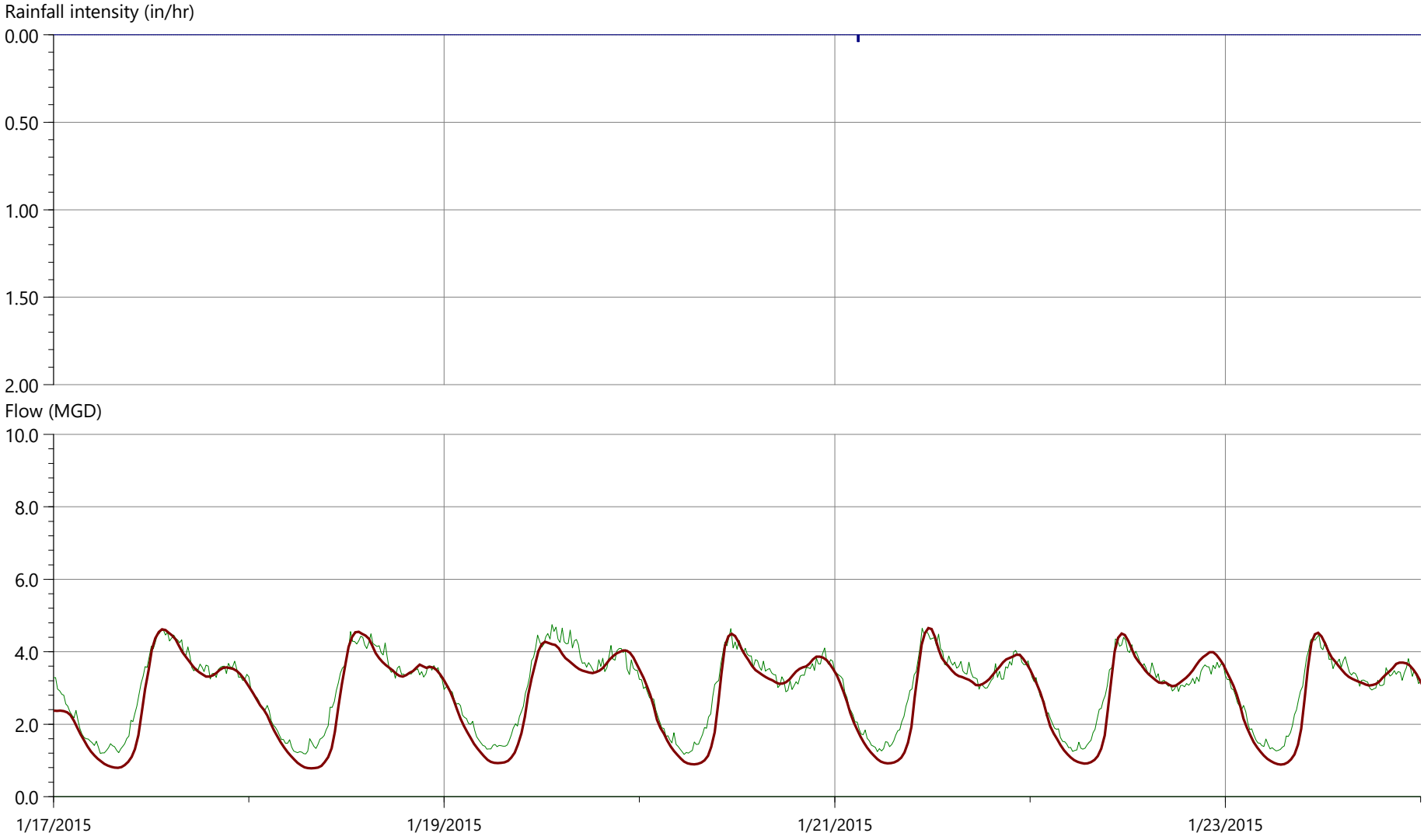
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				1.565	6.760	27.798
...4d_10232023>DWF				1.509	4.083	20.338

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1, Rainfall Profile: 1



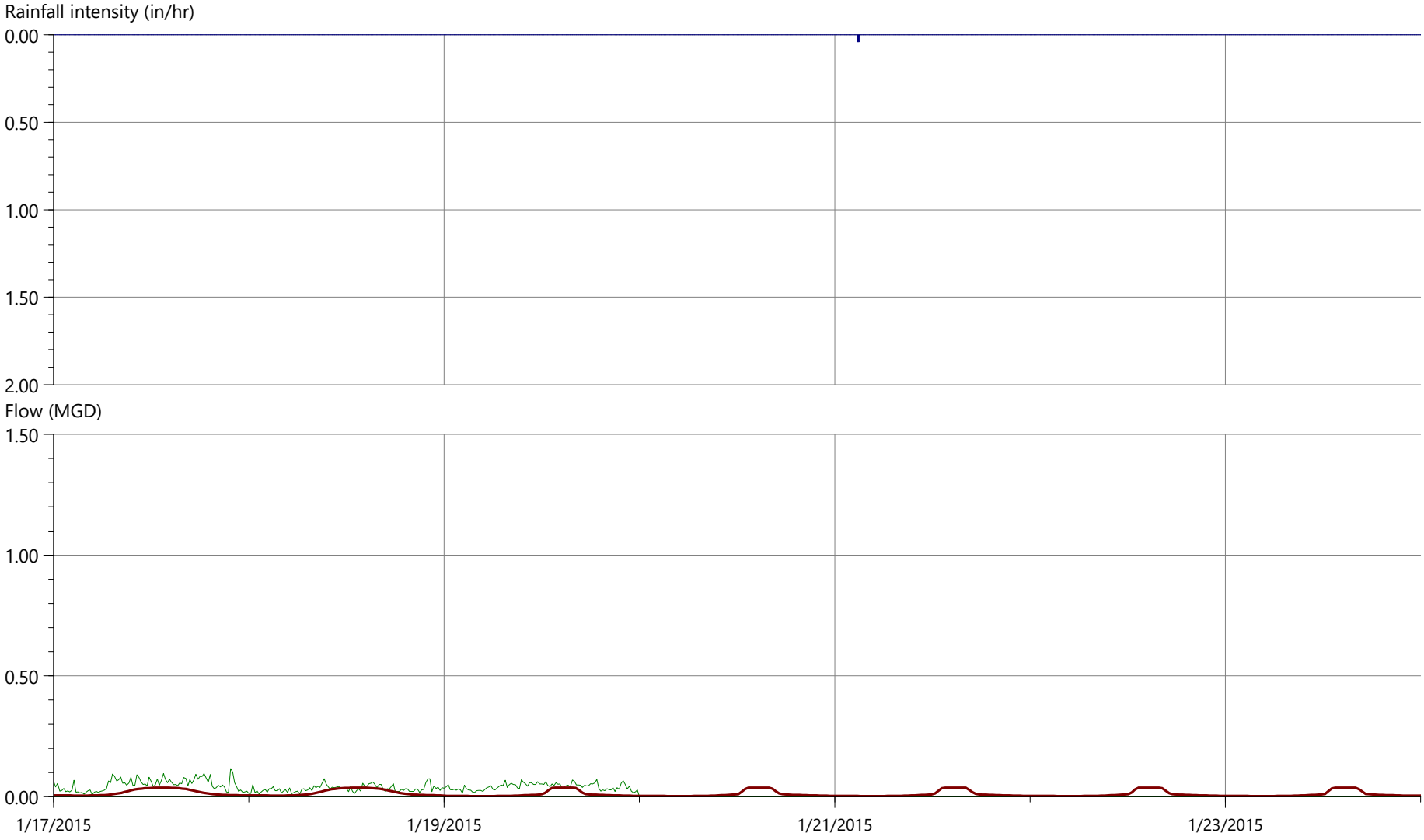
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				1.622	6.578	28.333
...4d_10232023>DWF				2.363	6.345	33.008

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1, Rainfall Profile: 1



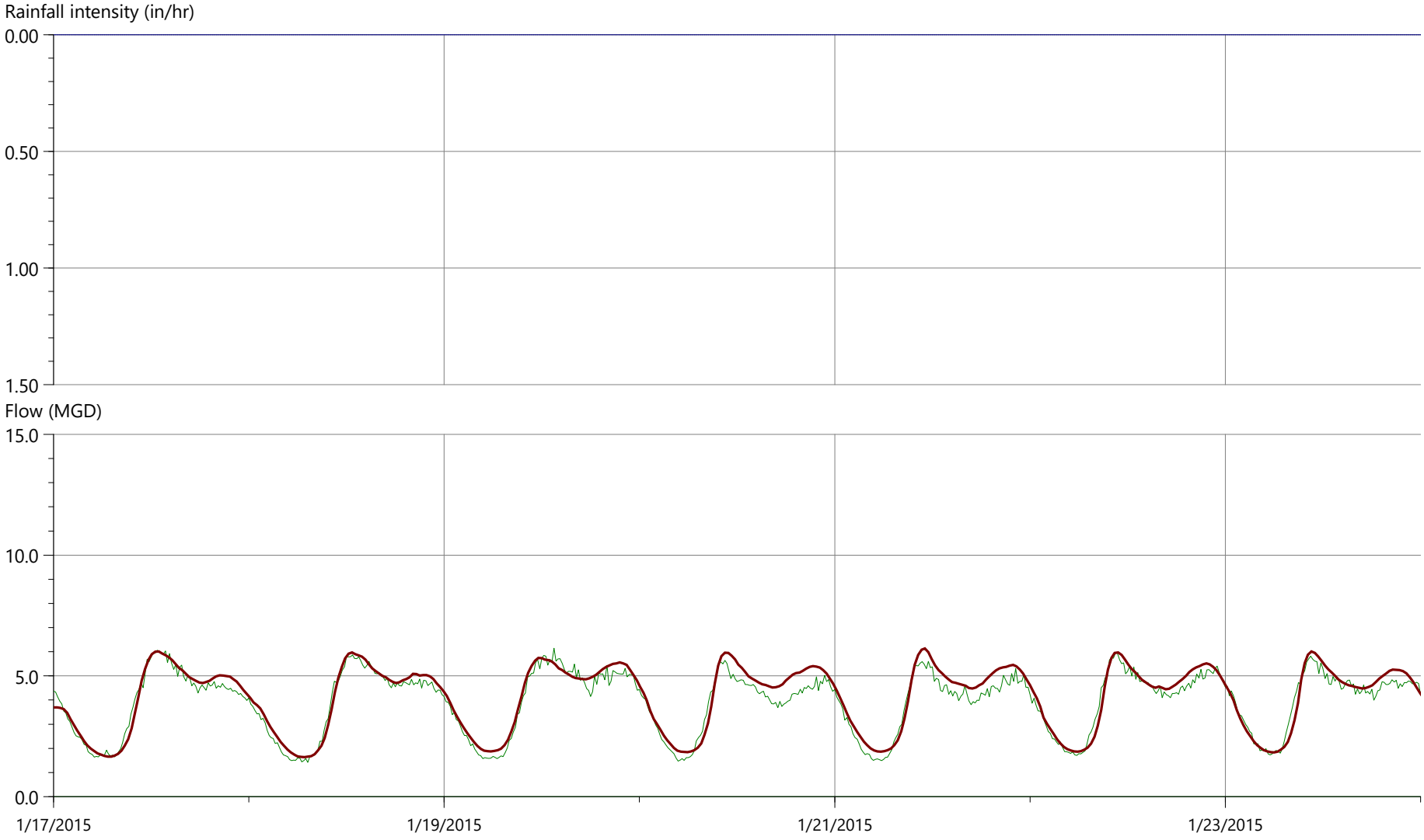
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				1.168	4.748	20.854
...4d_10232023>DWF				0.780	4.654	19.551

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1, Rainfall Profile: 1



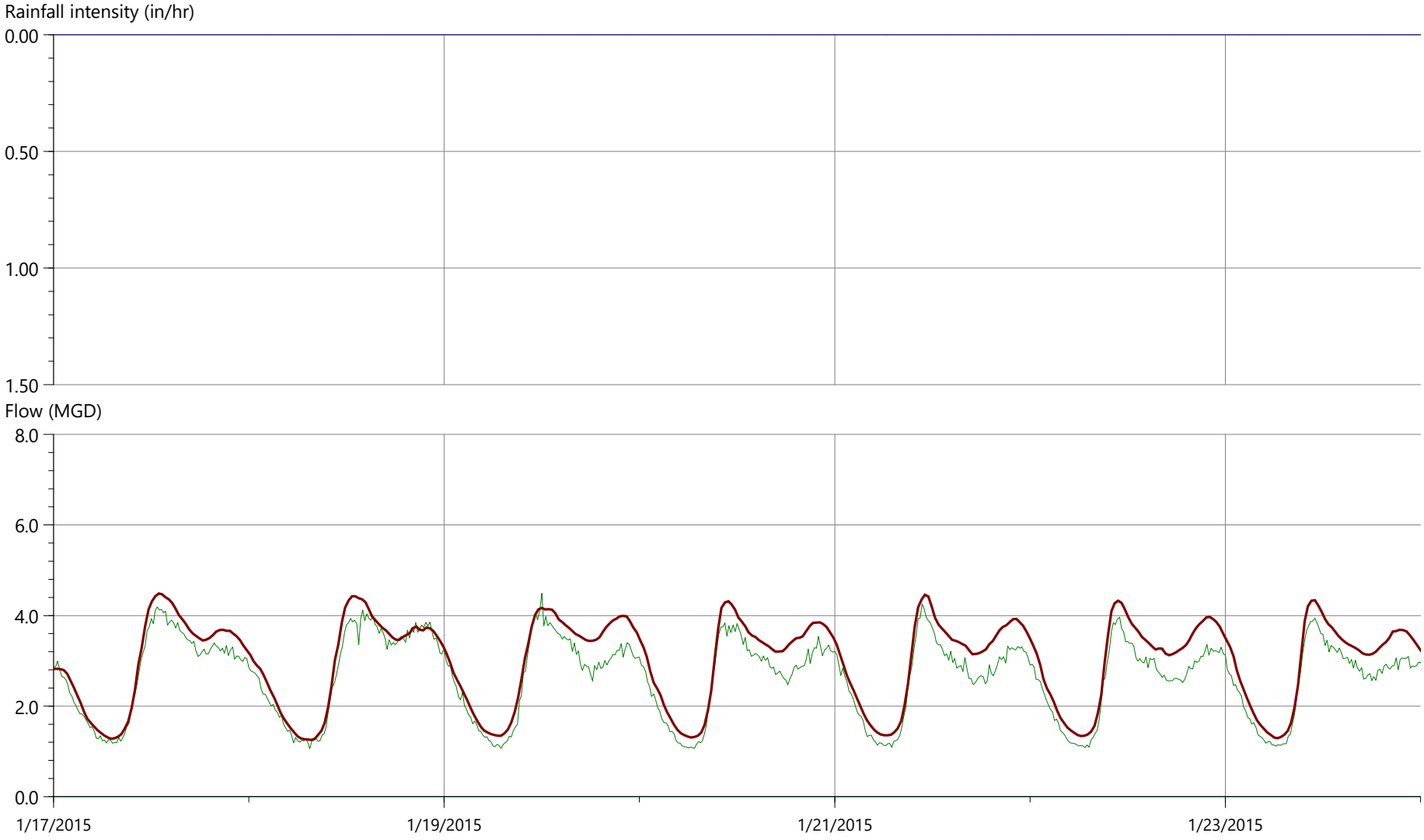
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				0.000	0.116	0.125
...4d_10232023>DWF				0.003	0.037	0.085

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1, Rainfall Profile: 2



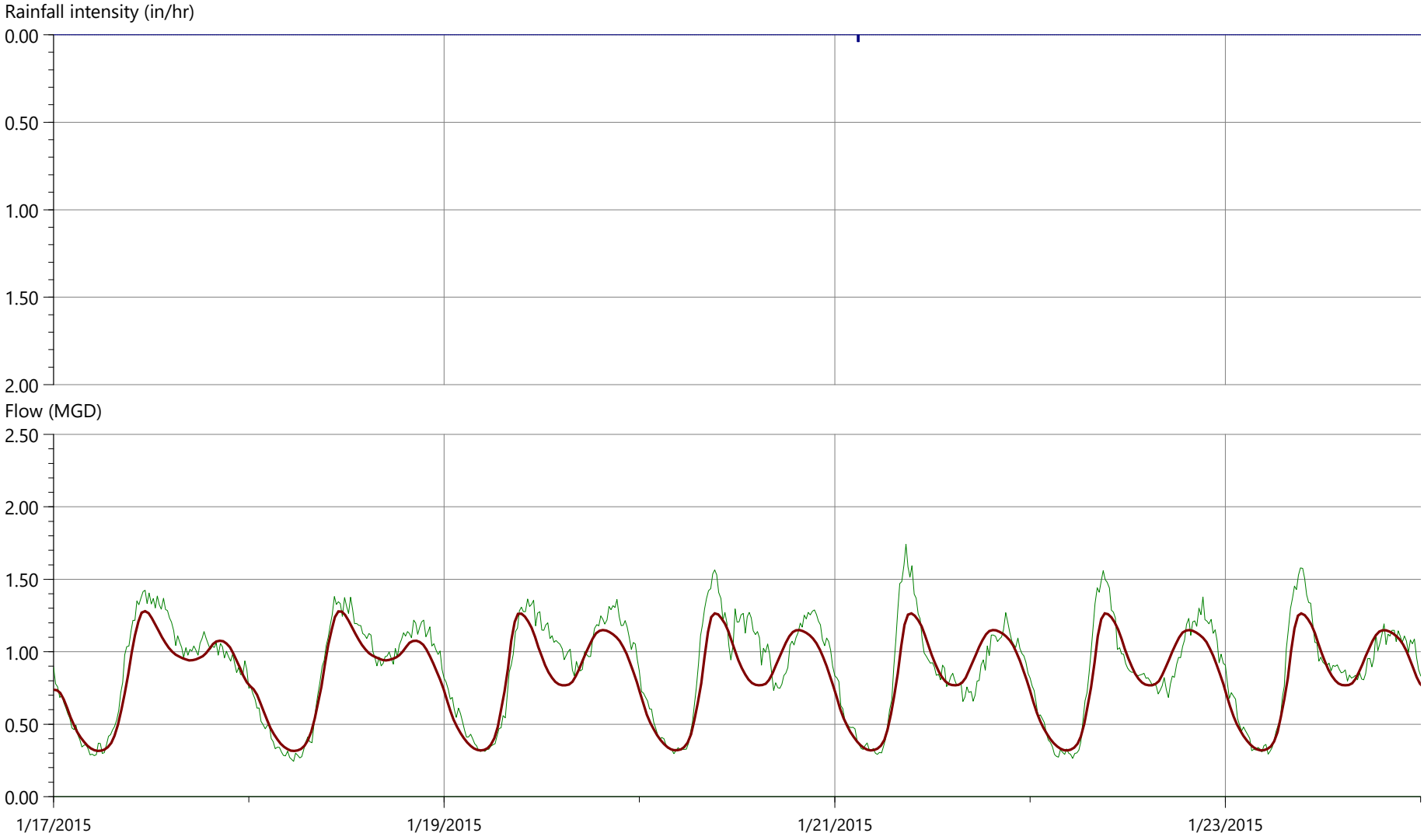
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				1.422	6.144	27.553
...4d_10232023>DWF				1.638	6.131	28.906

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1, Rainfall Profile: 2



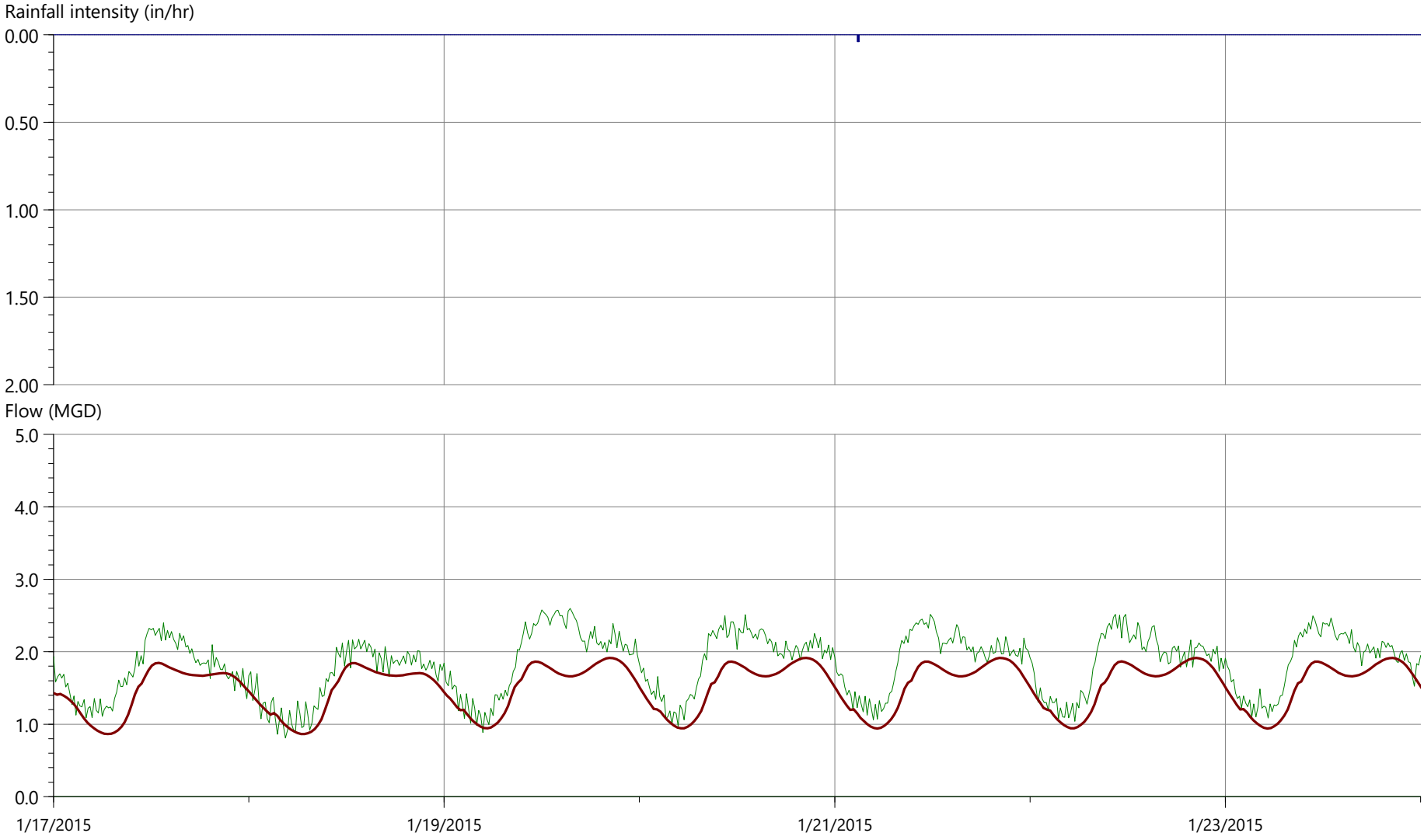
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				1.058	4.493	18.522
...4d_10232023>DWF				1.253	4.485	20.993

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1, Rainfall Profile: 1



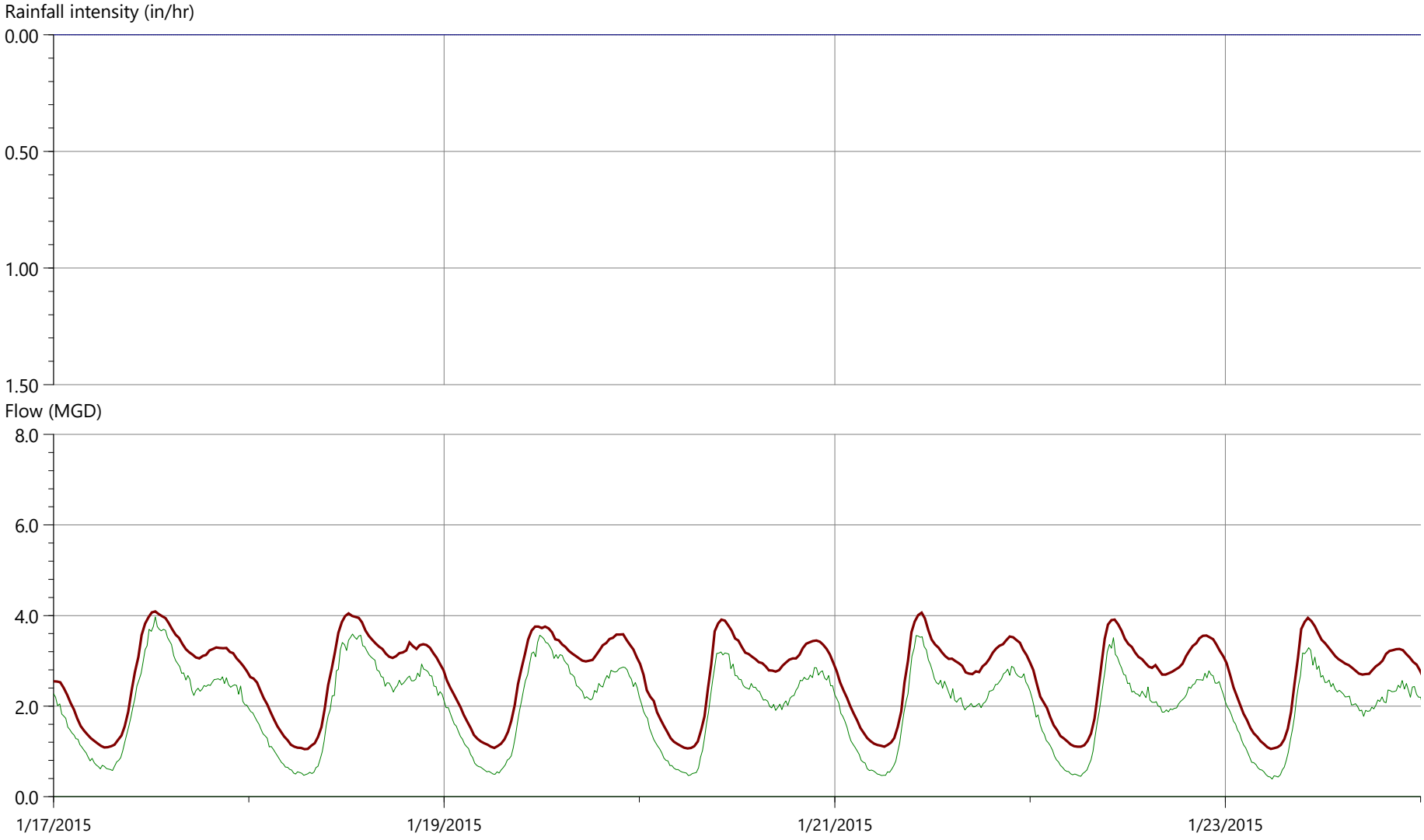
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				0.243	1.742	6.178
...4d_10232023>DWF				0.315	1.280	5.774

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1, Rainfall Profile: 1



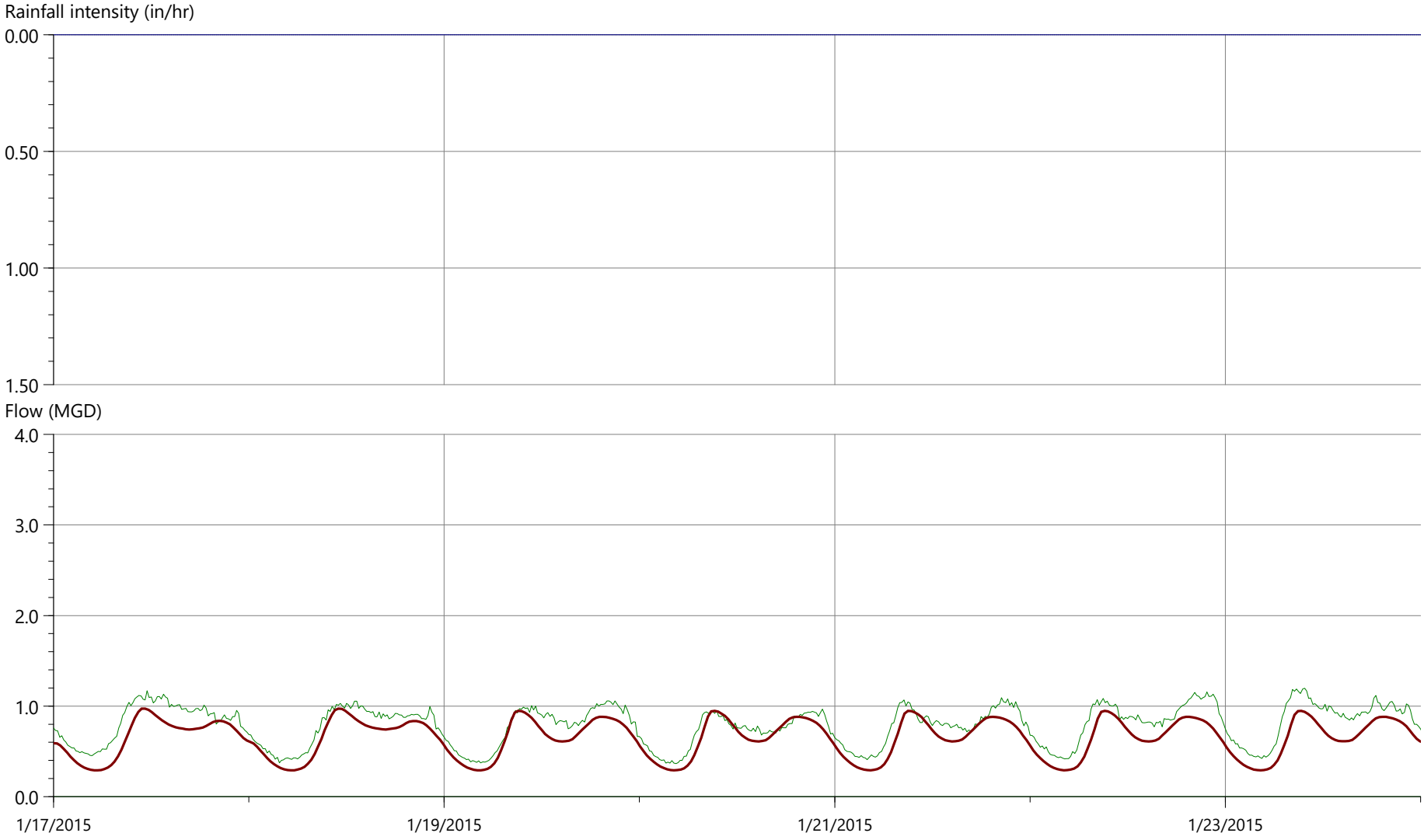
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				0.811	2.598	12.782
...4d_10232023>DWF				0.864	1.915	10.581

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S62-48.1, Rainfall Profile: 2



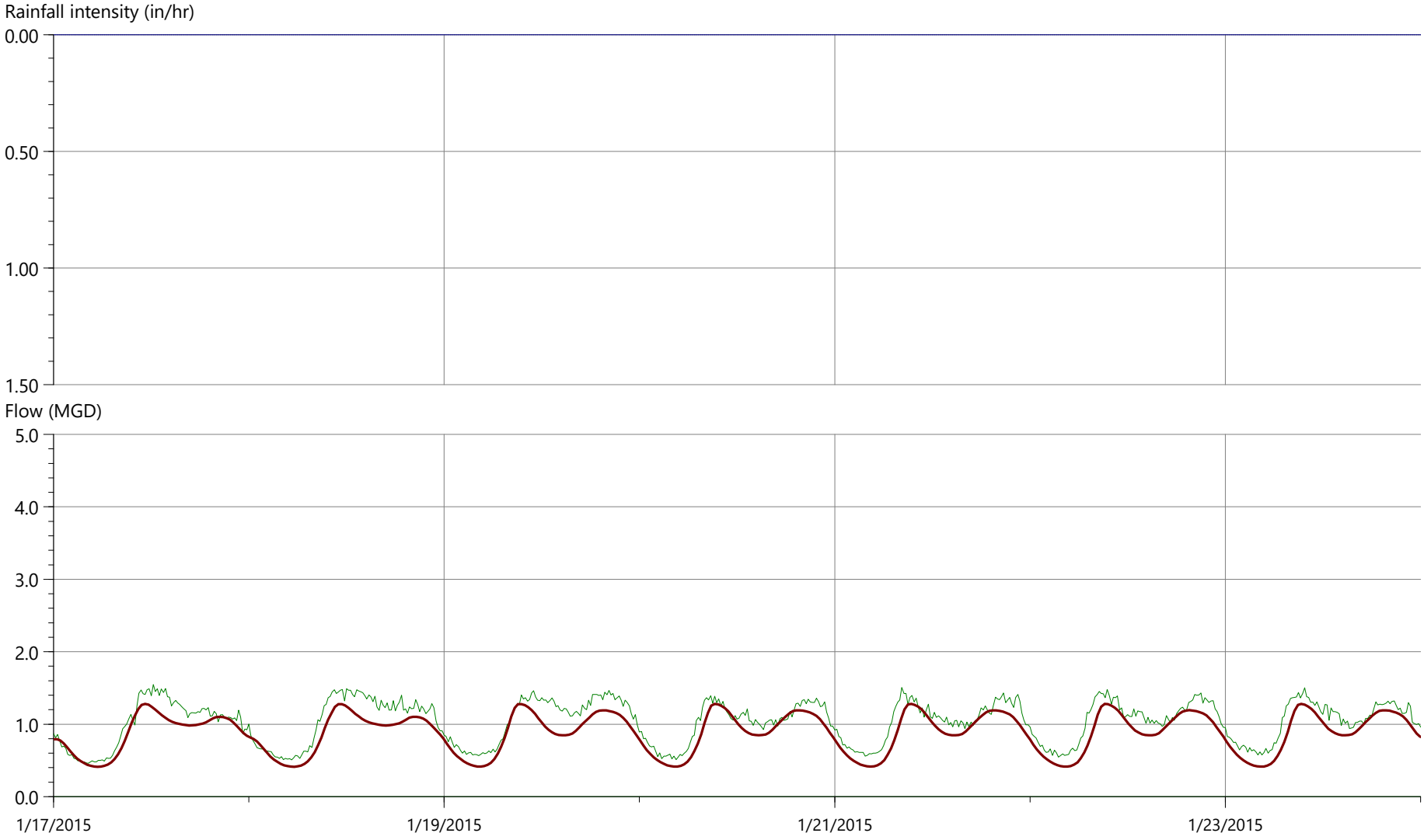
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.389	3.968	13.993
...4d_10232023>DWF				1.048	4.093	18.629

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1, Rainfall Profile: 2



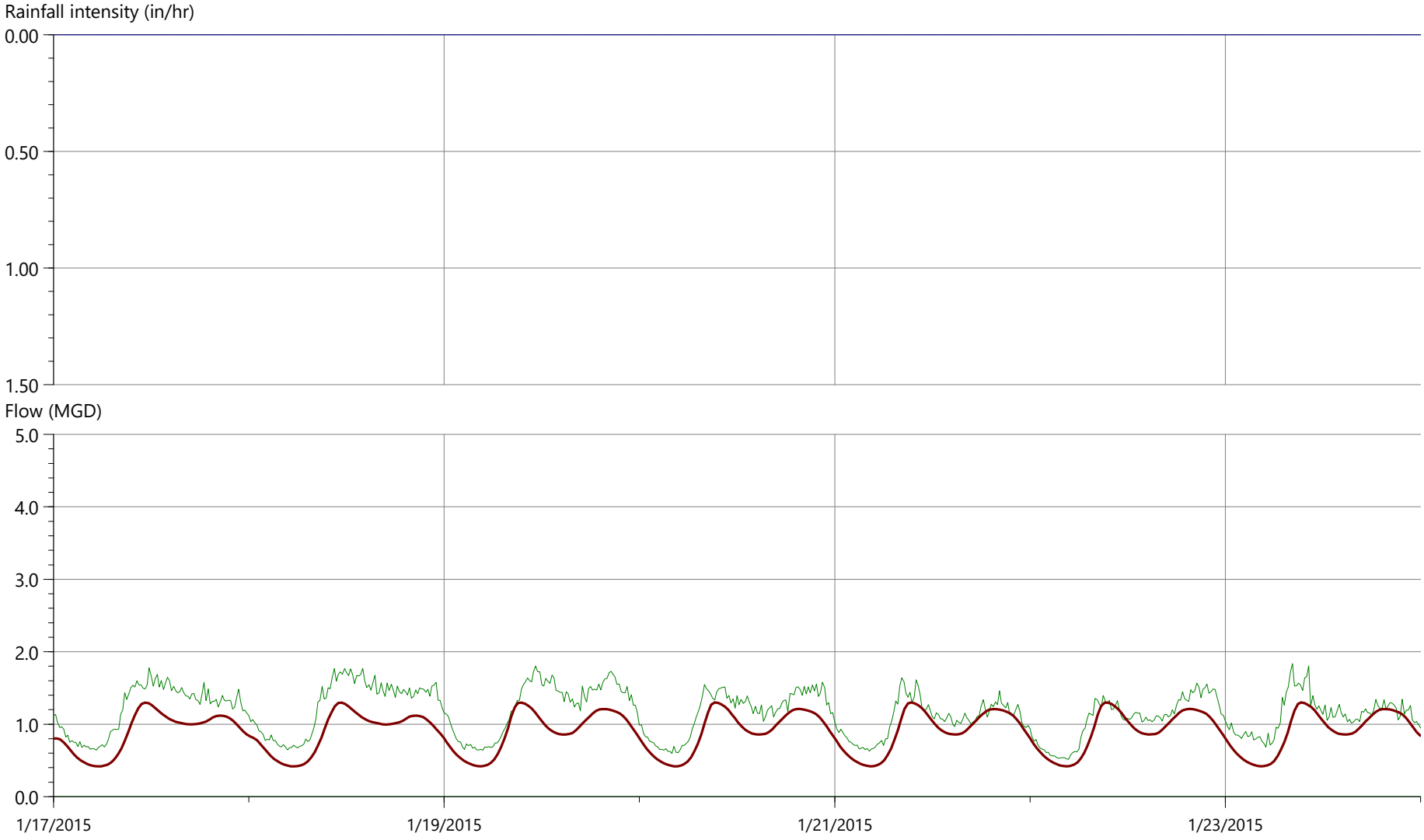
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.365	1.198	5.546
...4d_10232023>DWF				0.291	0.973	4.553

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1, Rainfall Profile: 2



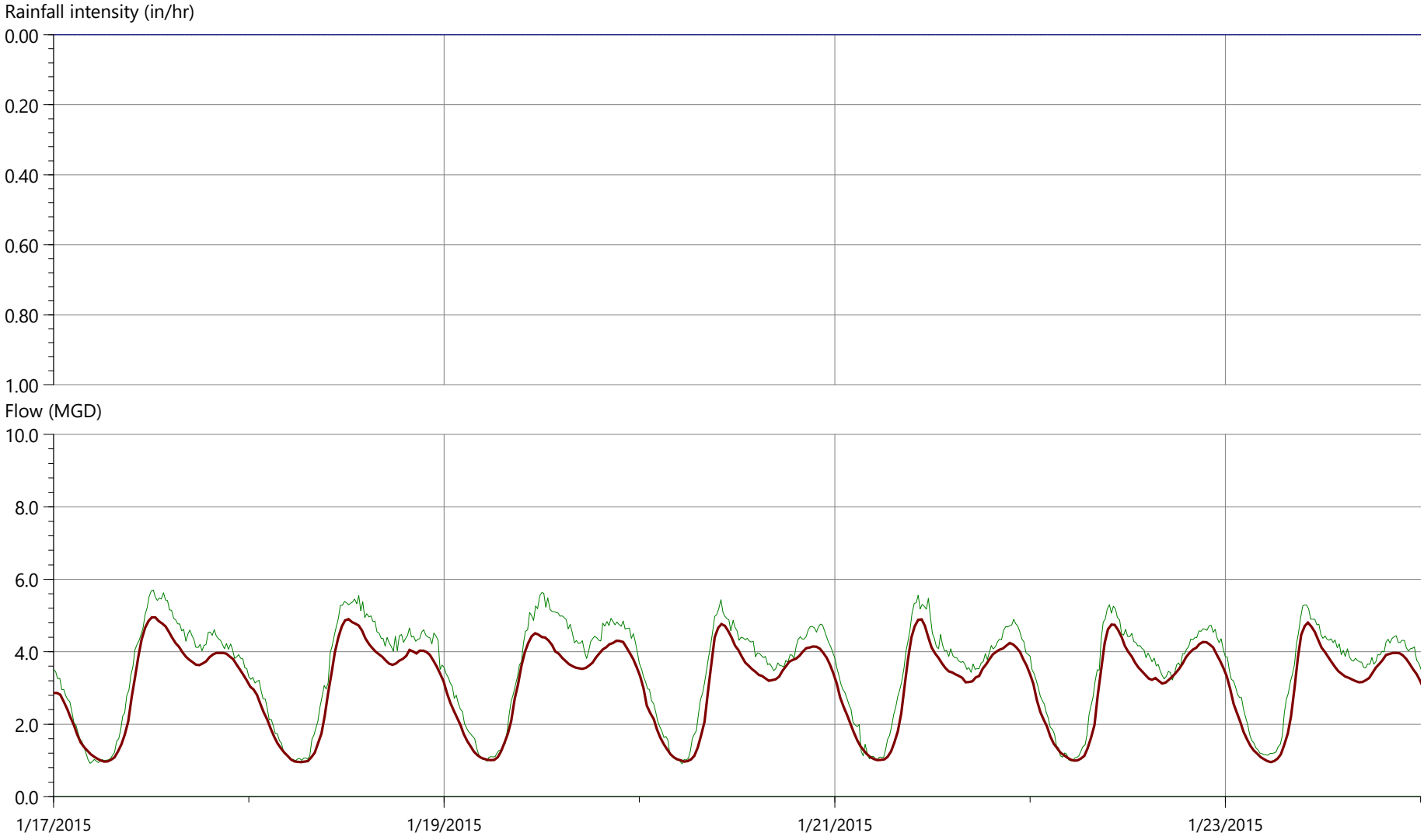
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.459	1.547	7.290
...4d_10232023>DWF				0.413	1.280	6.190

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1, Rainfall Profile: 2



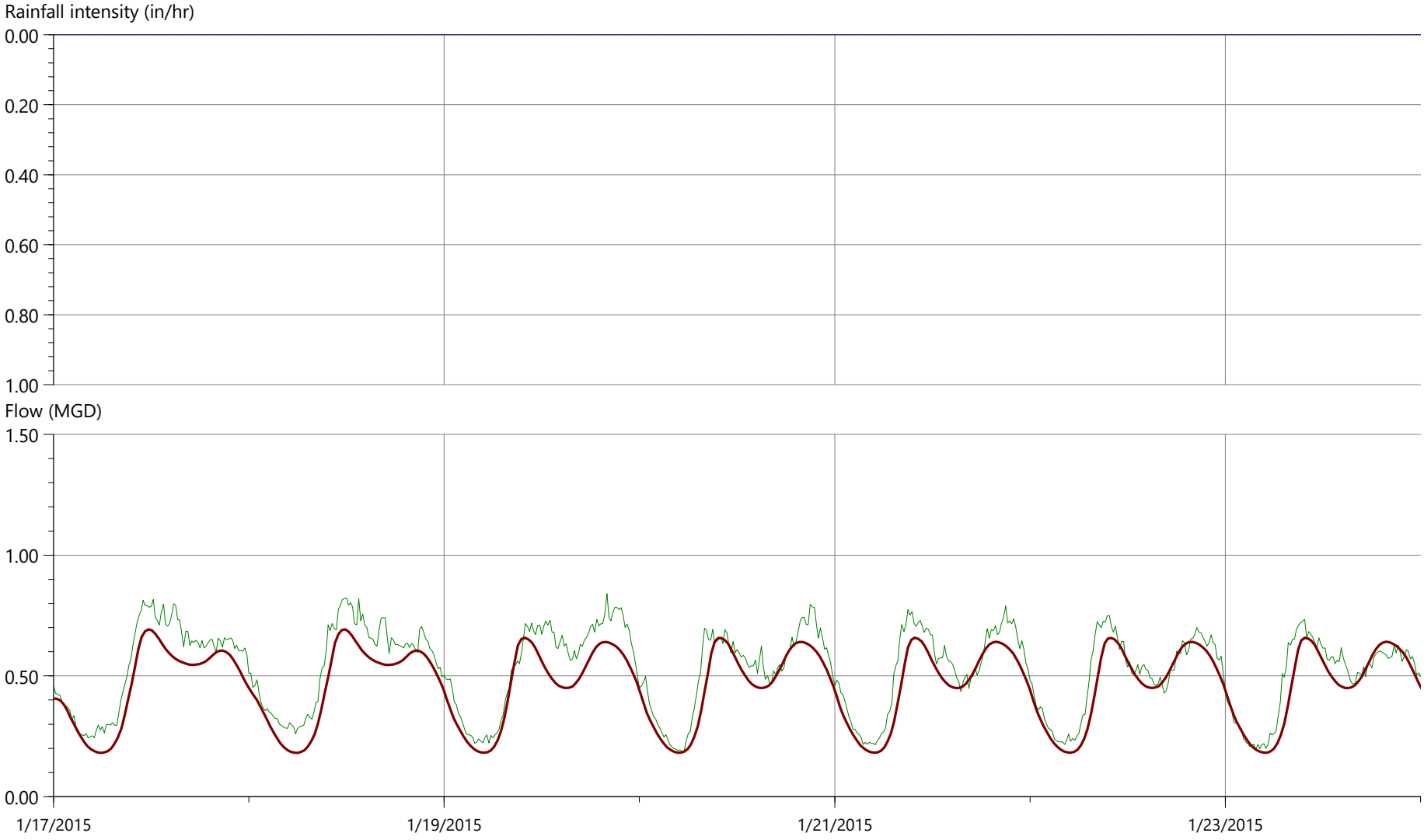
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.516	1.835	8.168
...4d_10232023>DWF				0.418	1.300	6.278

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1, Rainfall Profile: 3



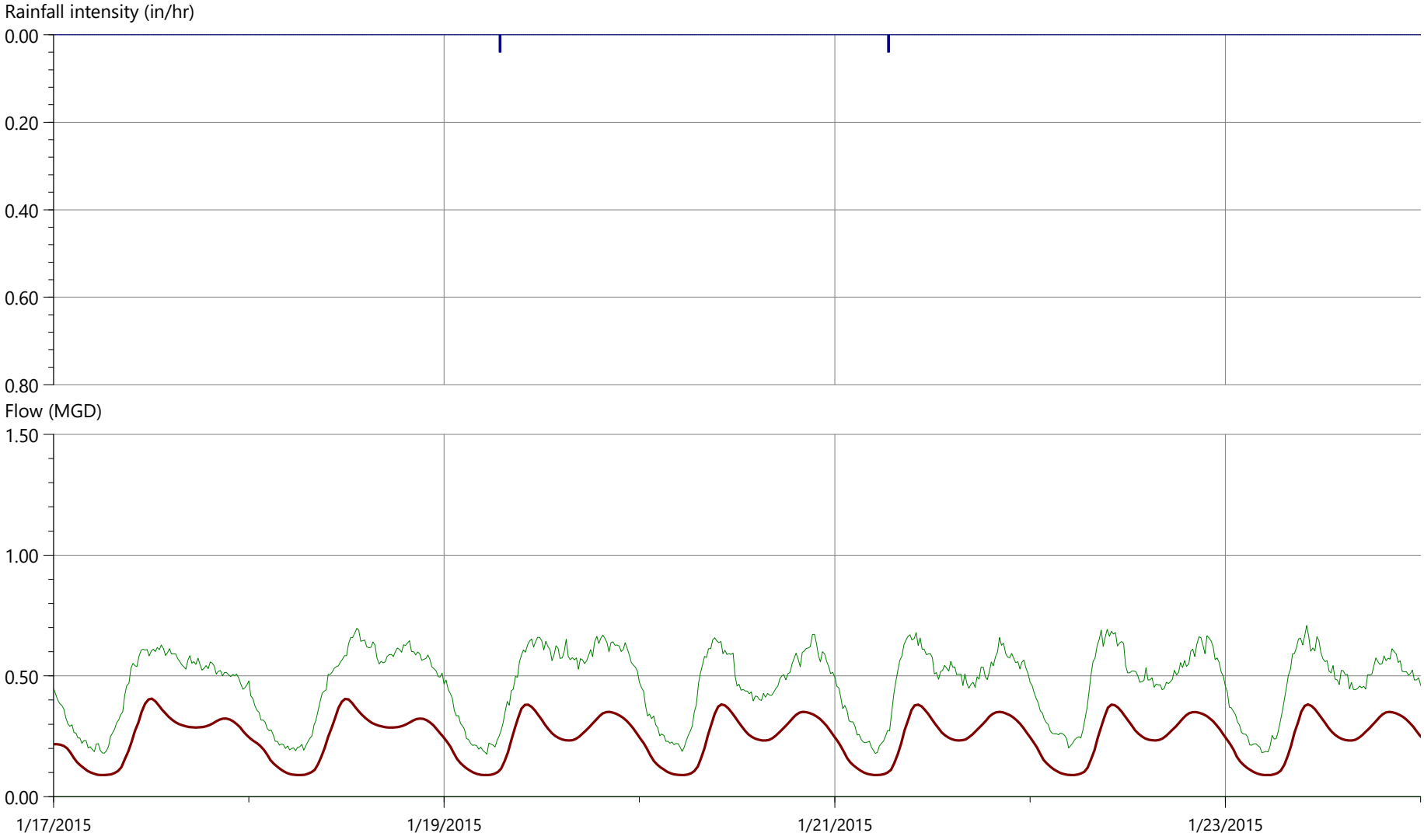
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.904	5.704	24.523
...4d_10232023>DWF				0.954	4.945	21.504

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1, Rainfall Profile: 3



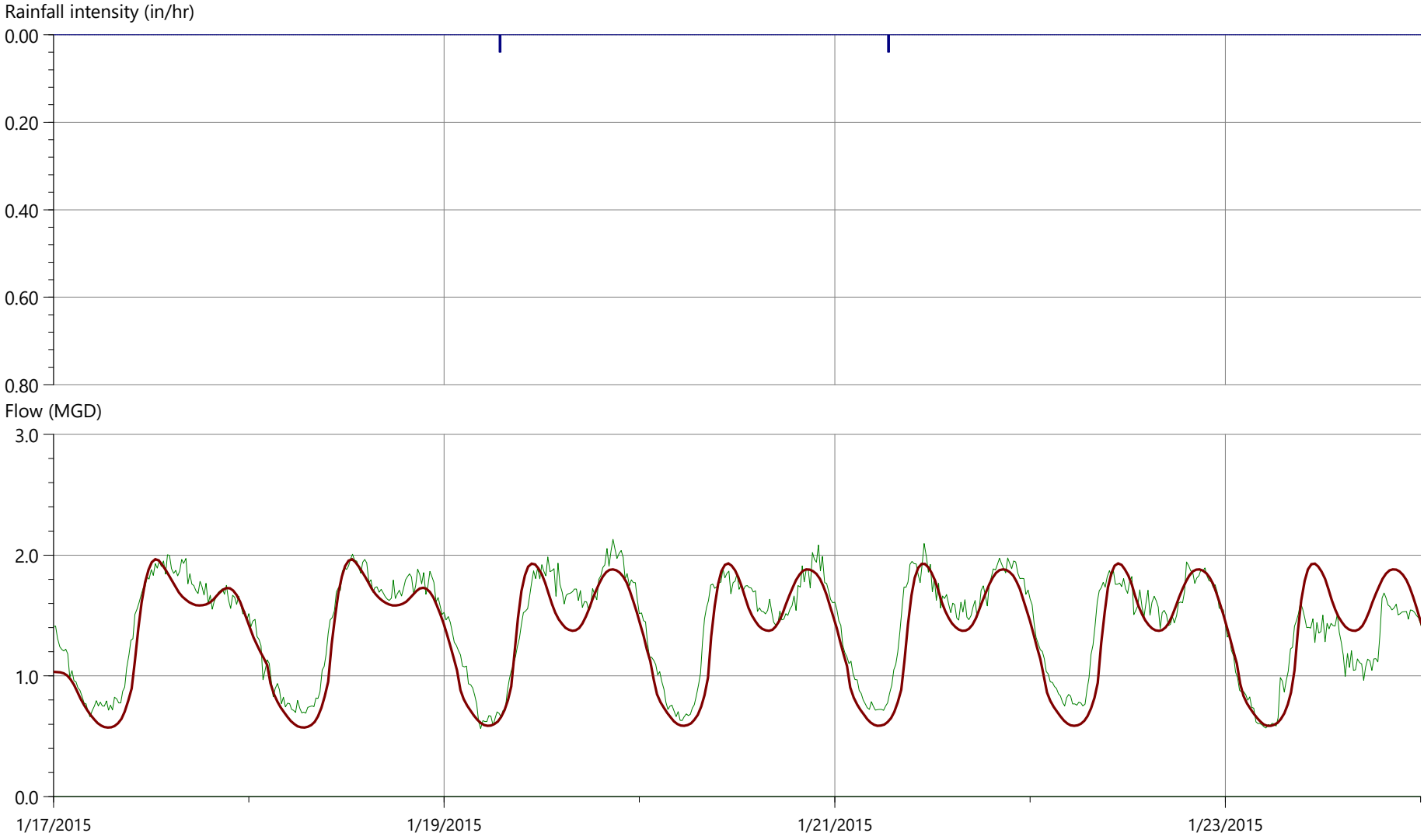
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.187	0.840	3.691
...4d_10232023>DWF				0.181	0.693	3.212

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1, Rainfall Profile: 4



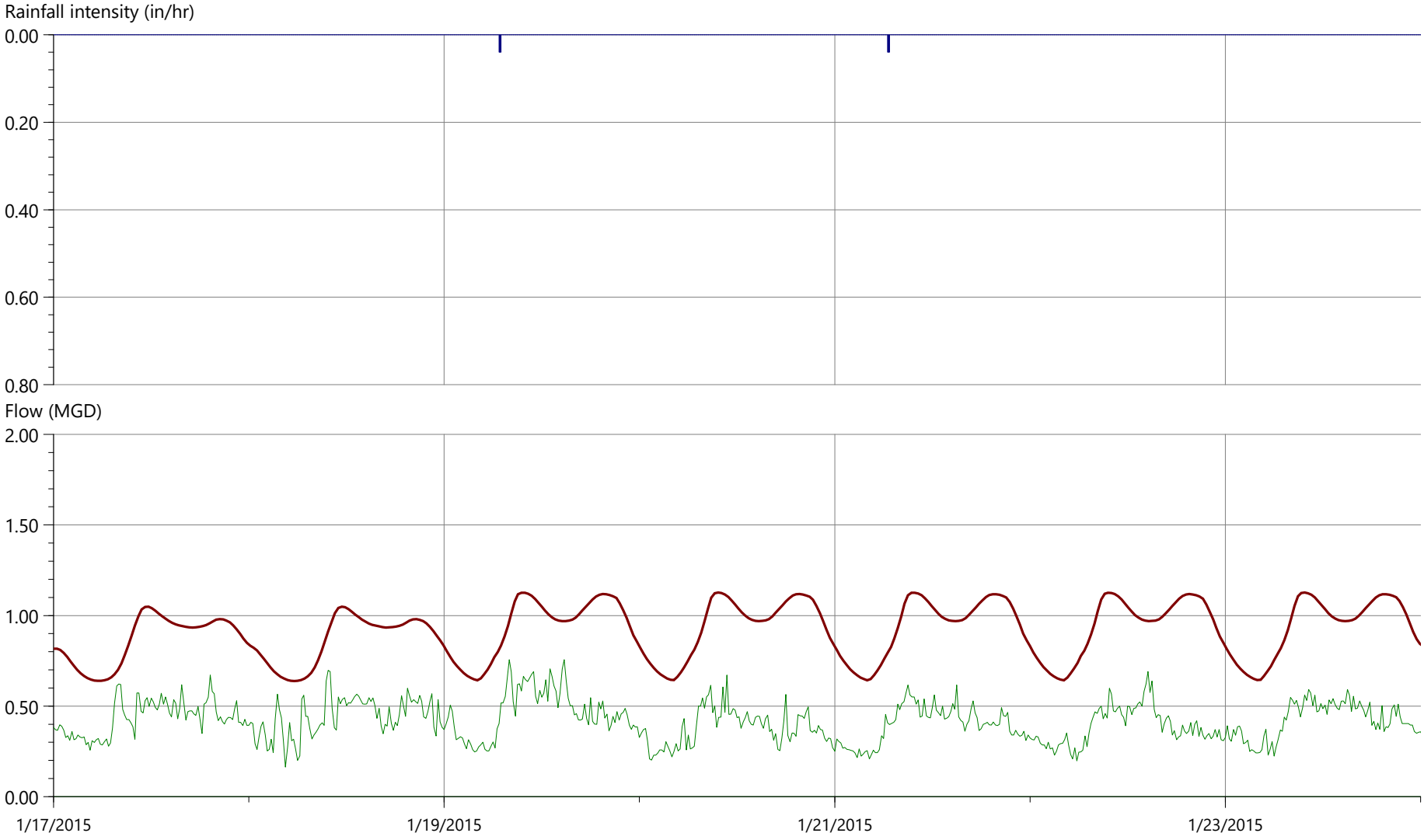
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.176	0.708	3.273
...4d_10232023>DWF				0.089	0.406	1.711

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1, Rainfall Profile: 4



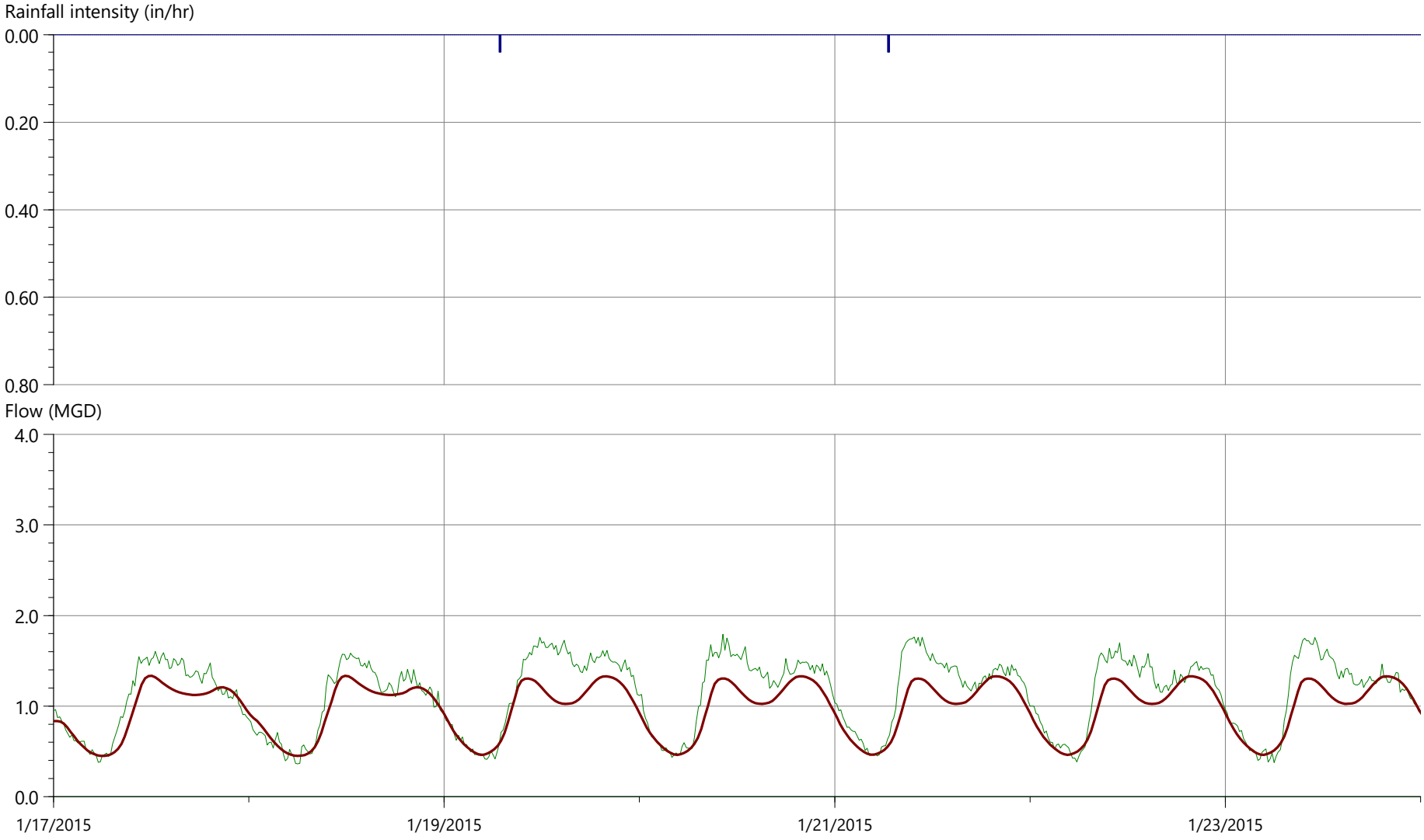
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.564	2.132	9.871
...4d_10232023>DWF				0.572	1.966	9.424

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2, Rainfall Profile: 4



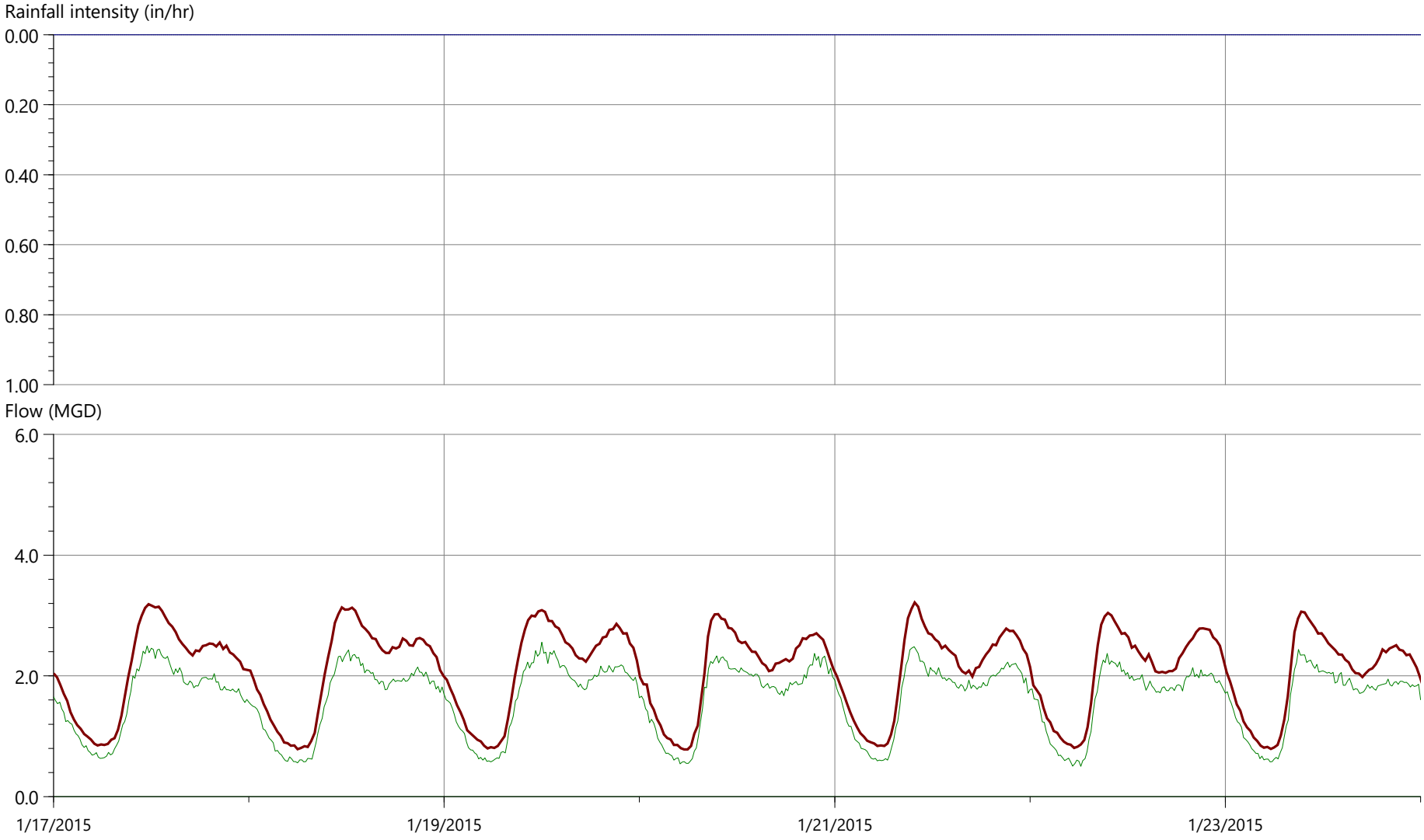
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.163	0.757	2.925
...4d_10232023>DWF				0.639	1.126	6.419

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1, Rainfall Profile: 4



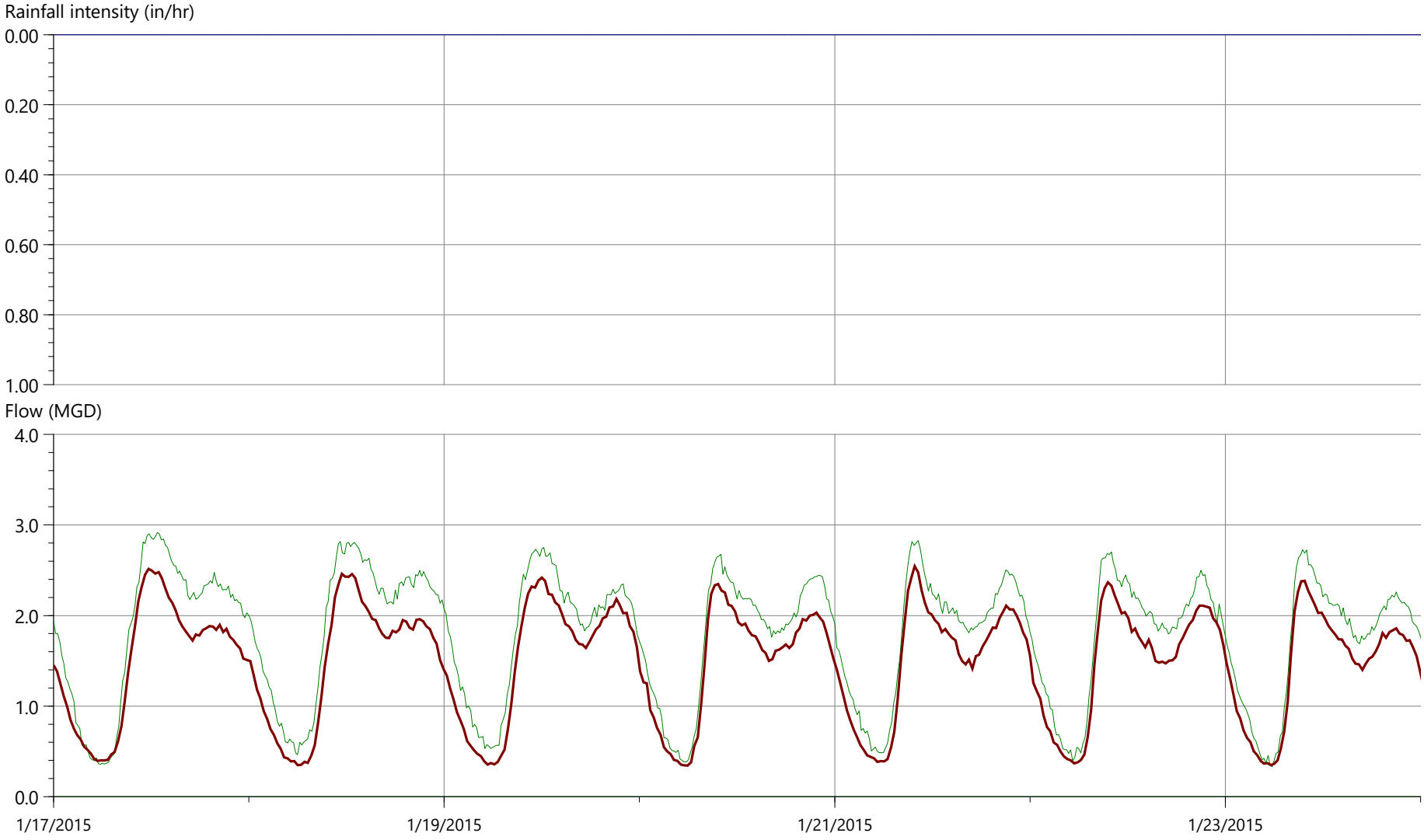
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.363	1.793	7.940
...4d_10232023>DWF				0.450	1.336	6.796

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1, Rainfall Profile: 3



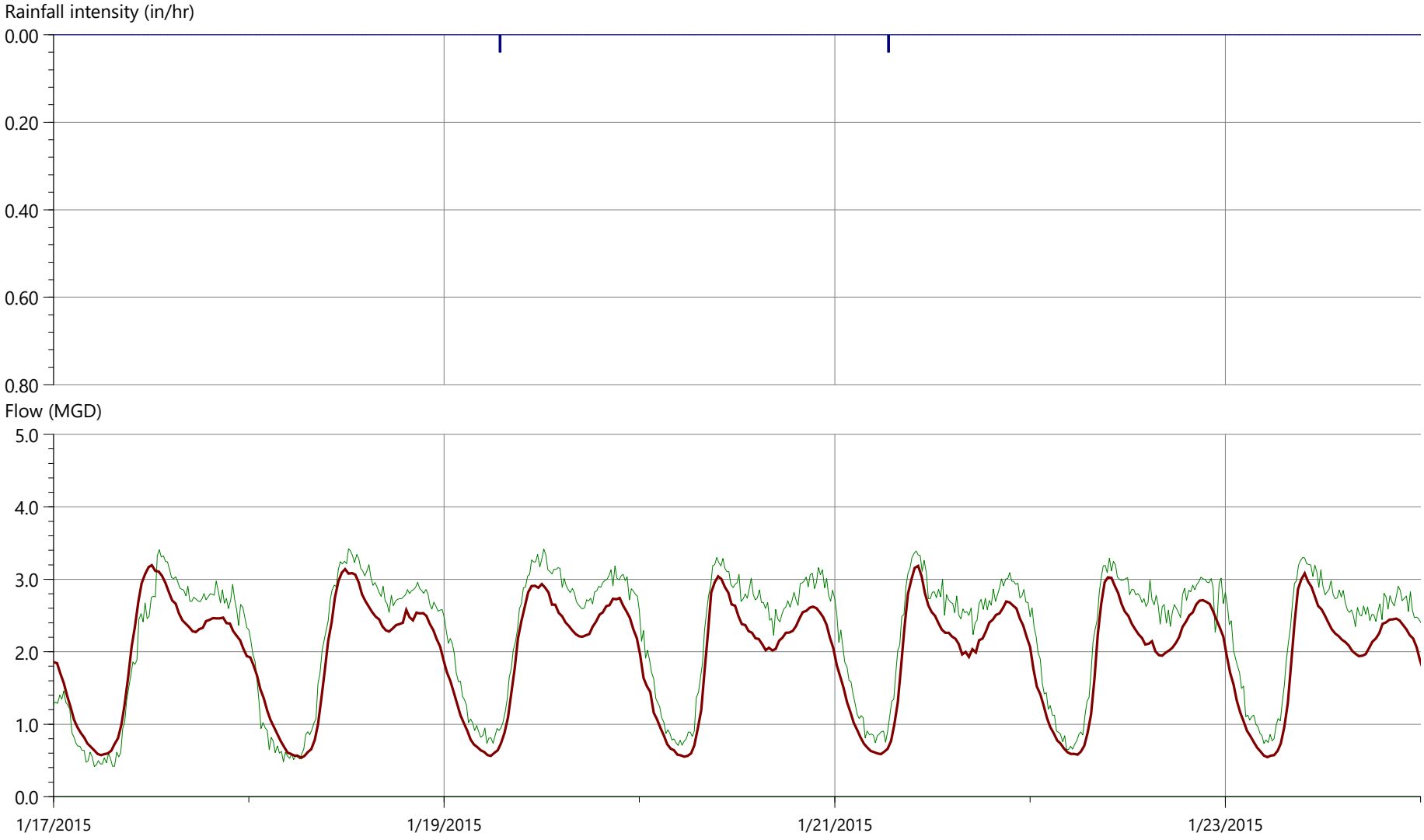
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.503	2.559	11.445
...4d_10232023>DWF				0.782	3.218	14.555

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1, Rainfall Profile: 3



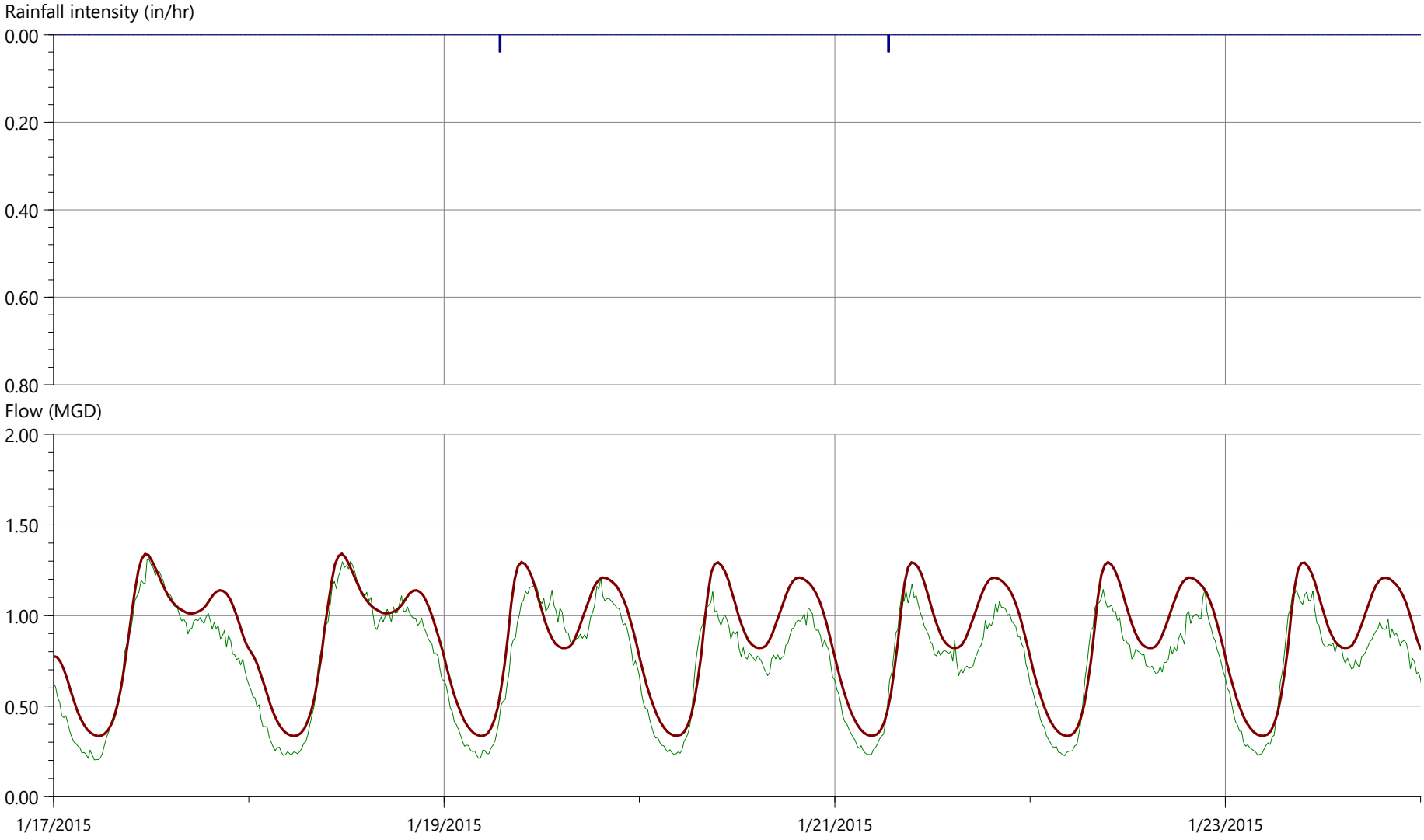
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.333	2.916	12.509
...4d_10232023>DWF				0.342	2.544	10.374

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1, Rainfall Profile: 4



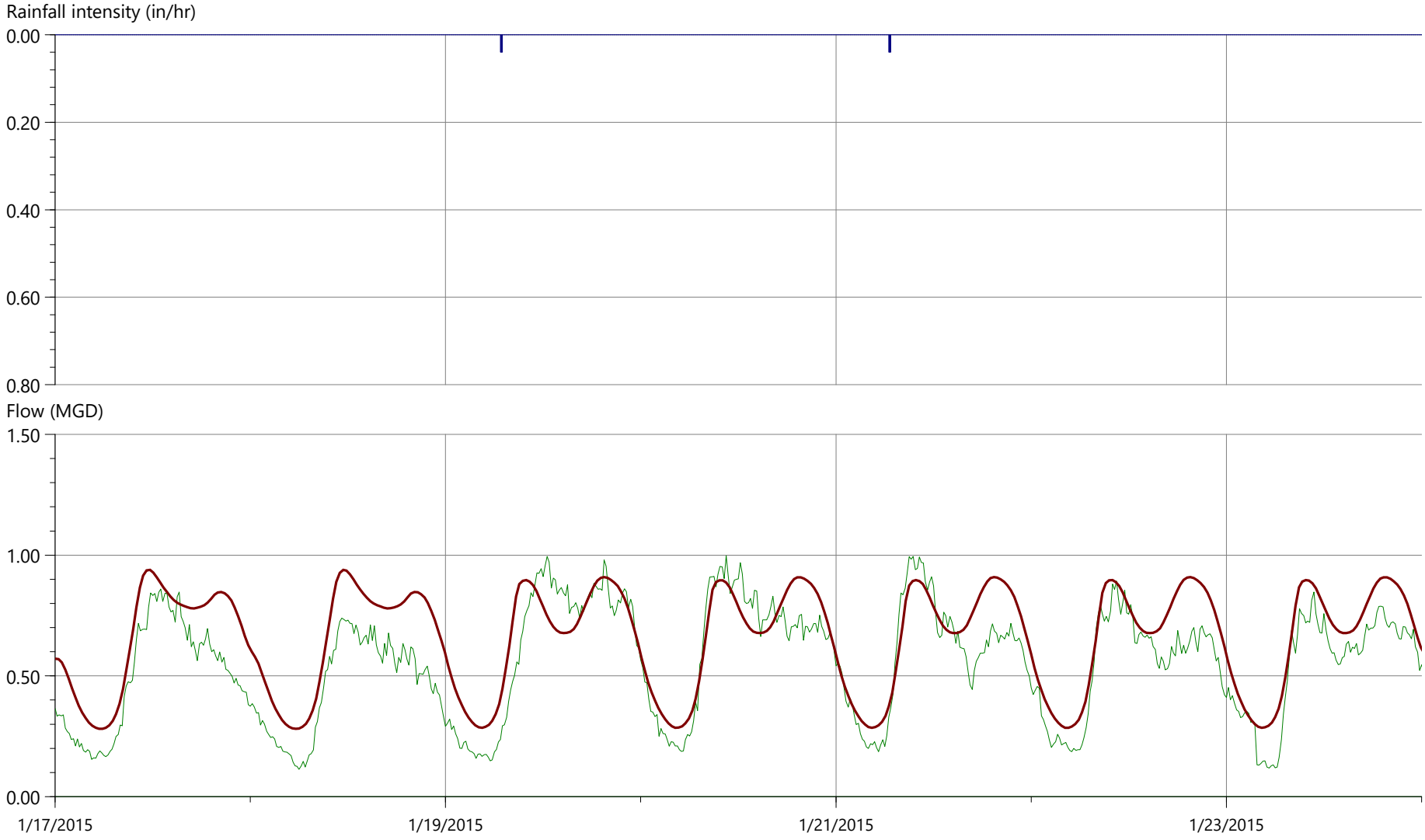
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.415	3.422	15.707
...4d_10232023>DWF				0.535	3.196	13.548

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1, Rainfall Profile: 4



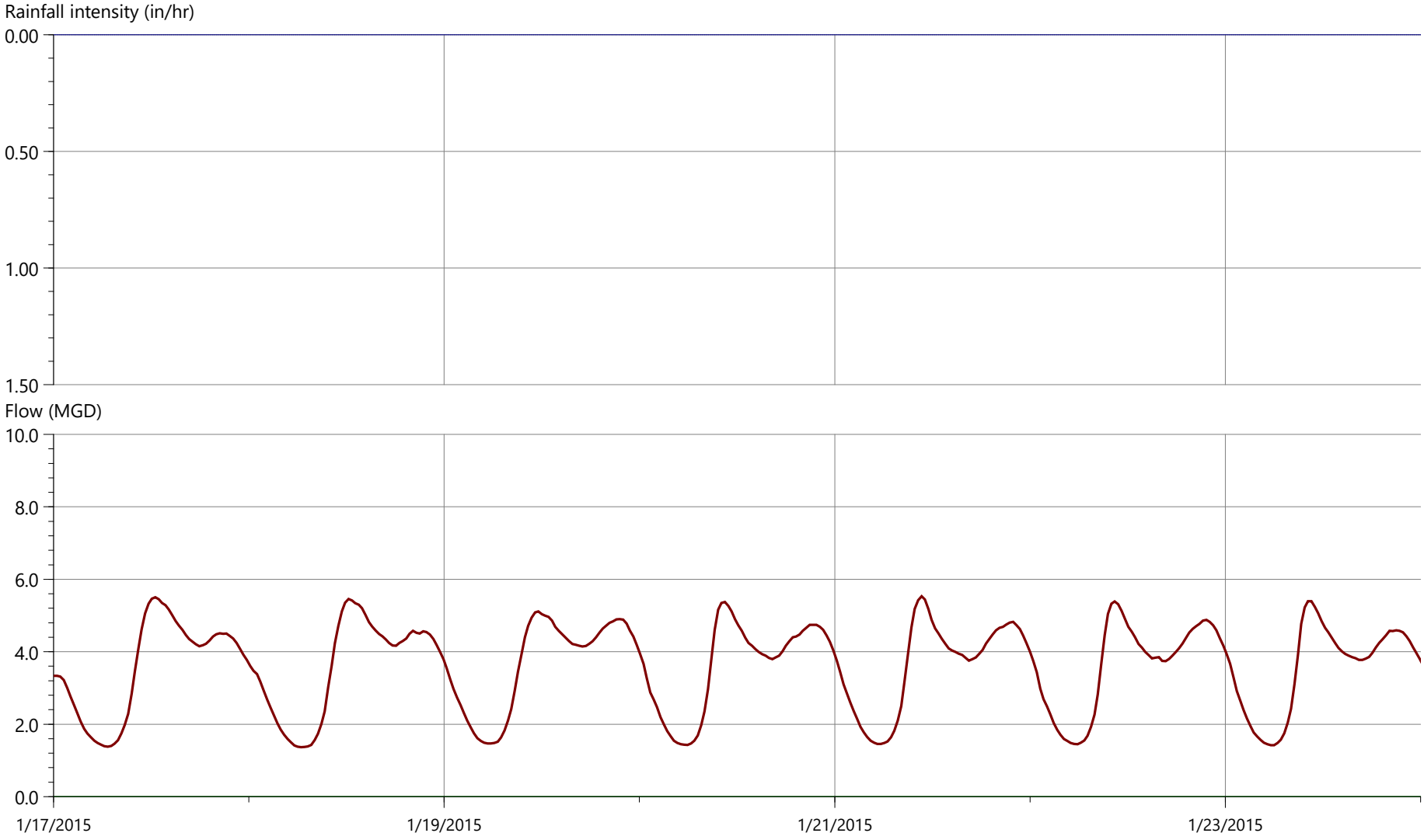
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.203	1.310	5.264
...4d_10232023>DWF				0.335	1.340	6.068

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1, Rainfall Profile: 4



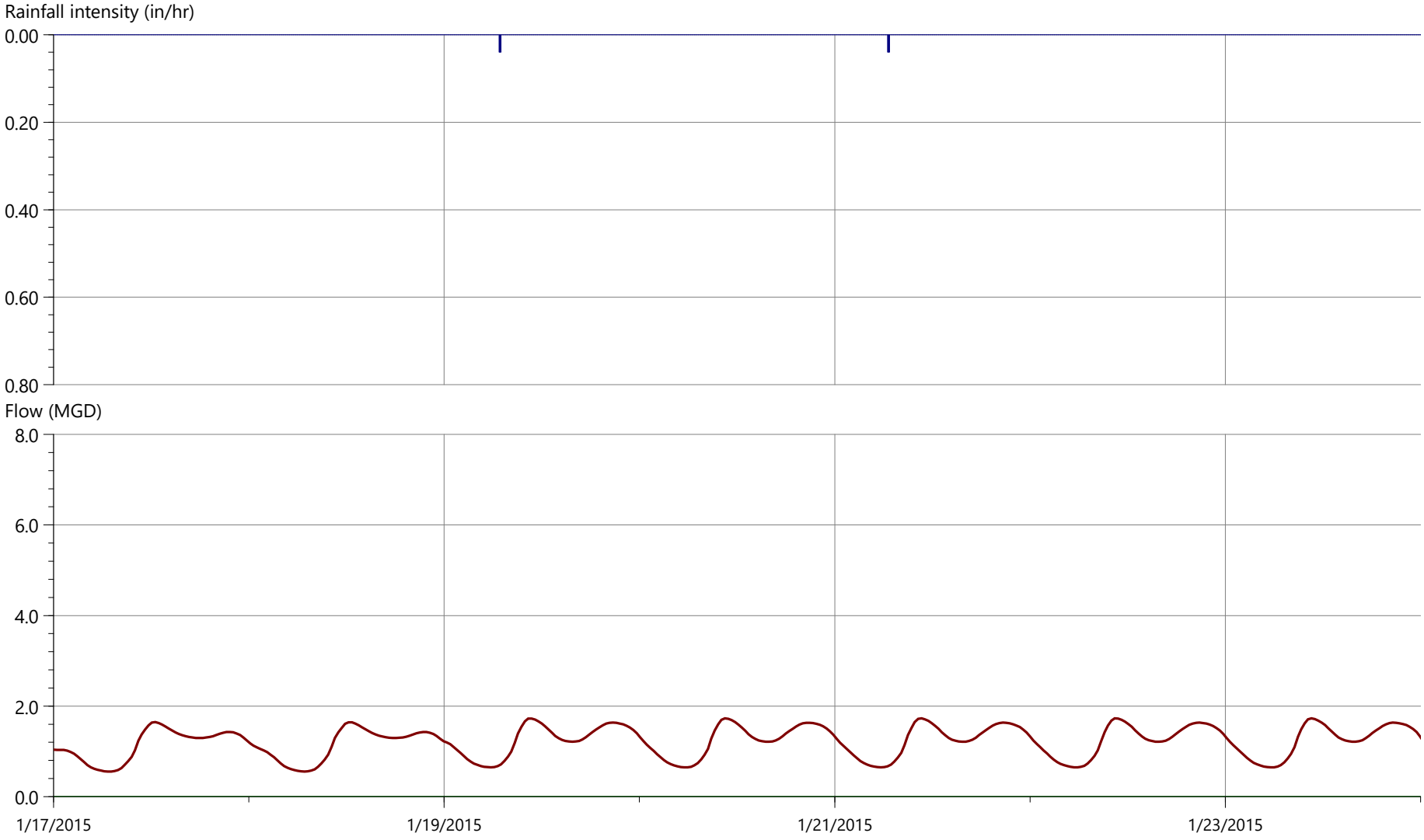
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.113	0.998	3.870
...4d_10232023>DWF				0.281	0.939	4.601

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1, Rainfall Profile: 2



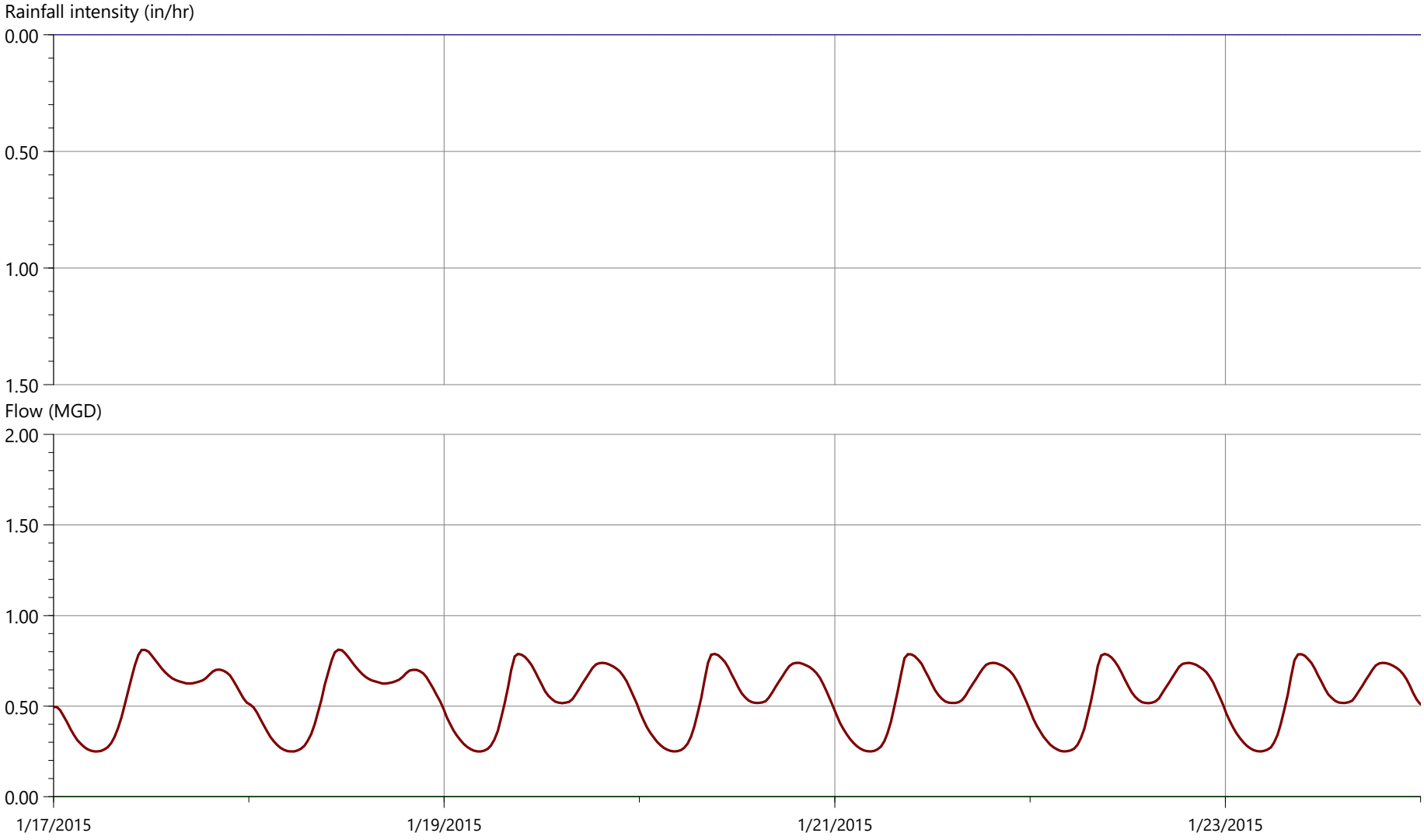
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				1.364	5.533	25.234

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1, Rainfall Profile: 4



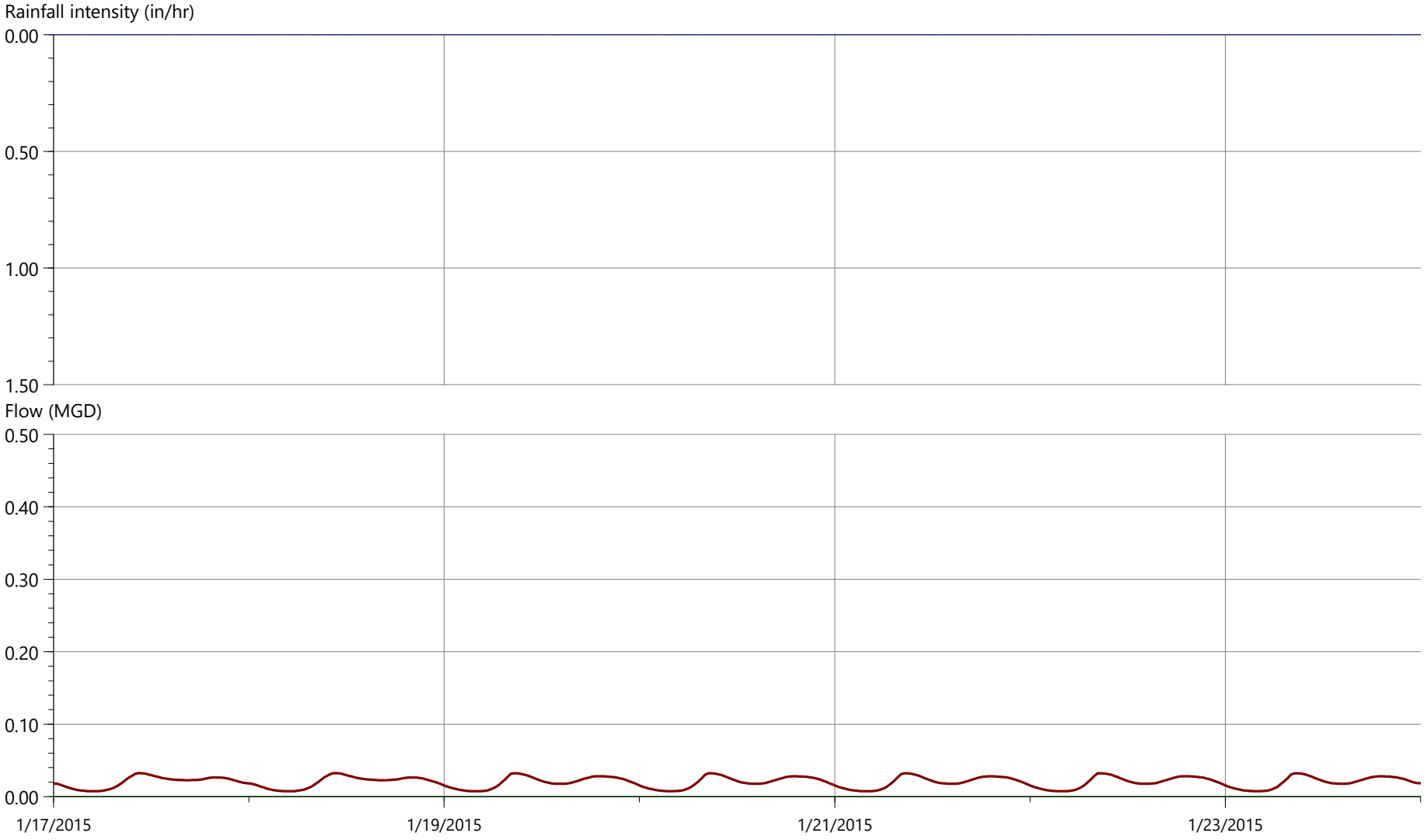
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.555	1.729	8.523

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1, Rainfall Profile: 2



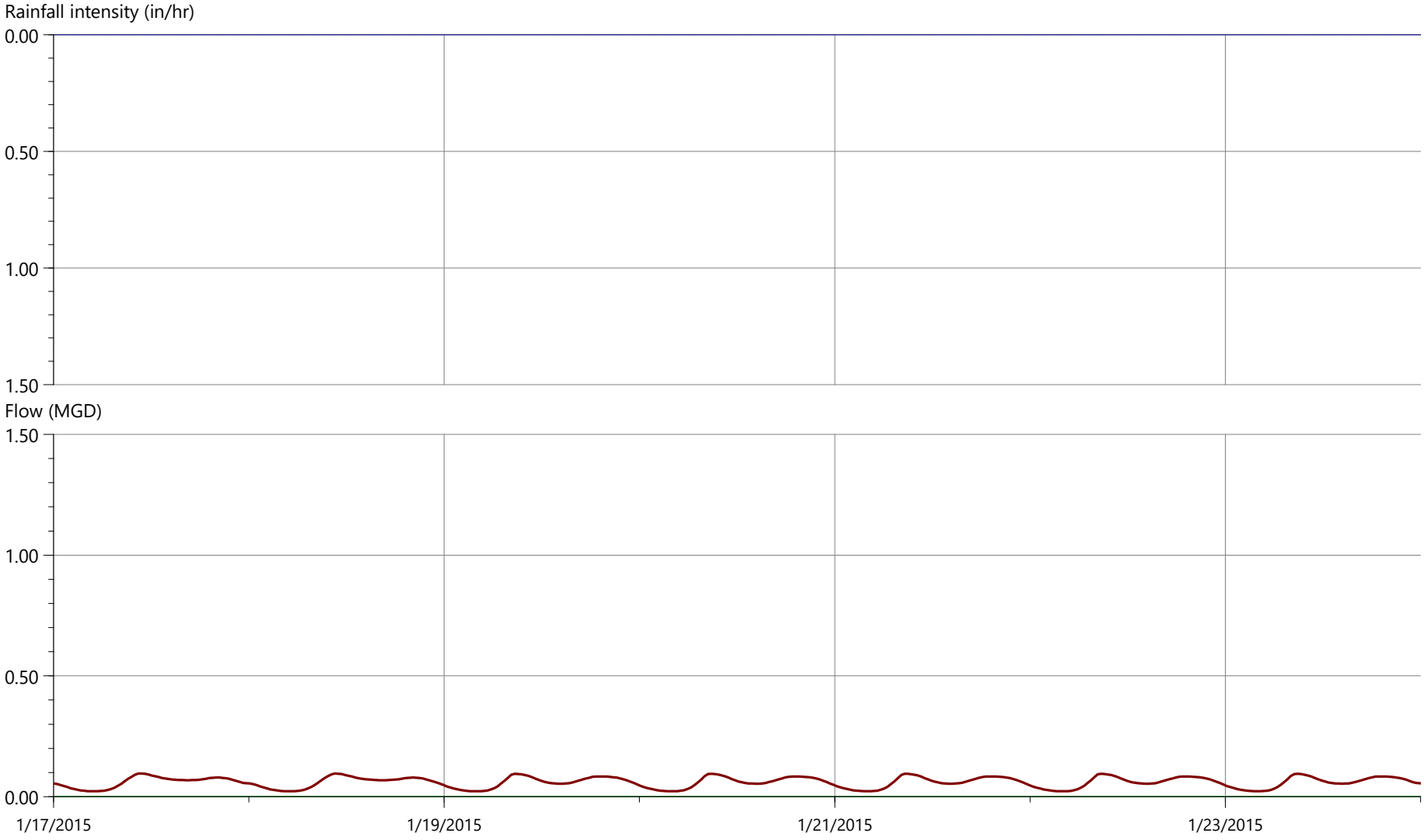
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.249	0.811	3.826

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1, Rainfall Profile: 2



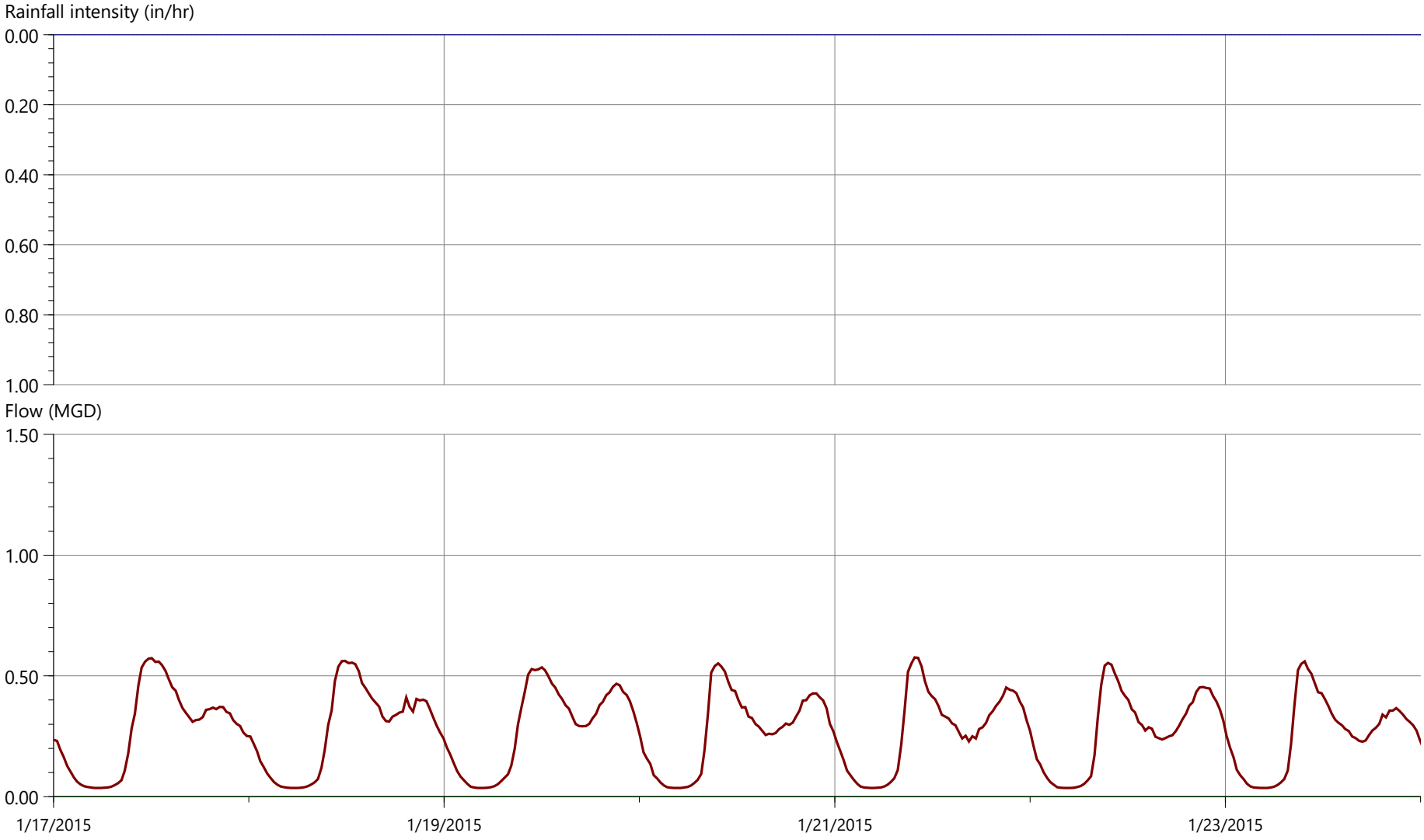
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.007	0.032	0.141

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1, Rainfall Profile: 2



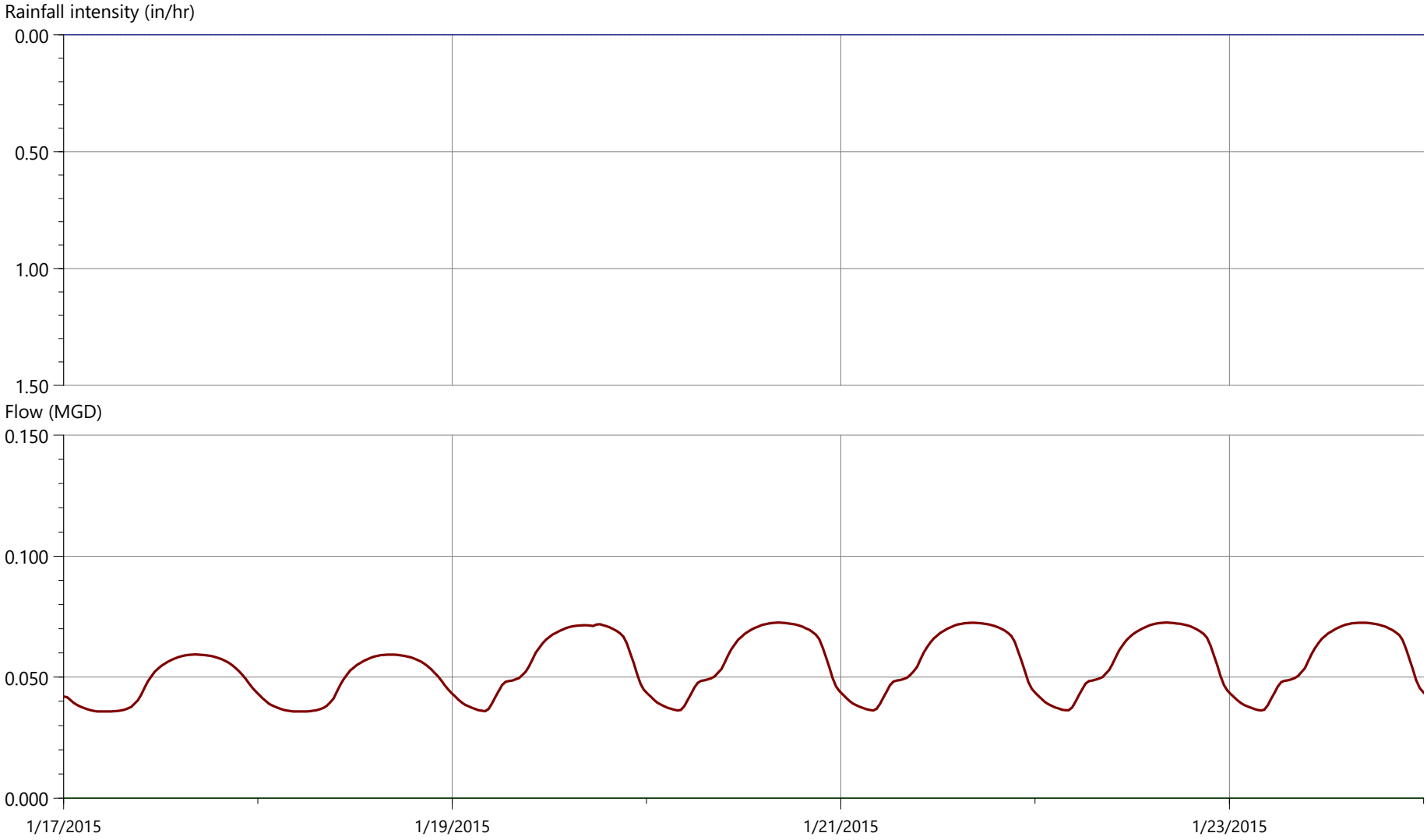
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.022	0.096	0.420

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1, Rainfall Profile: 3



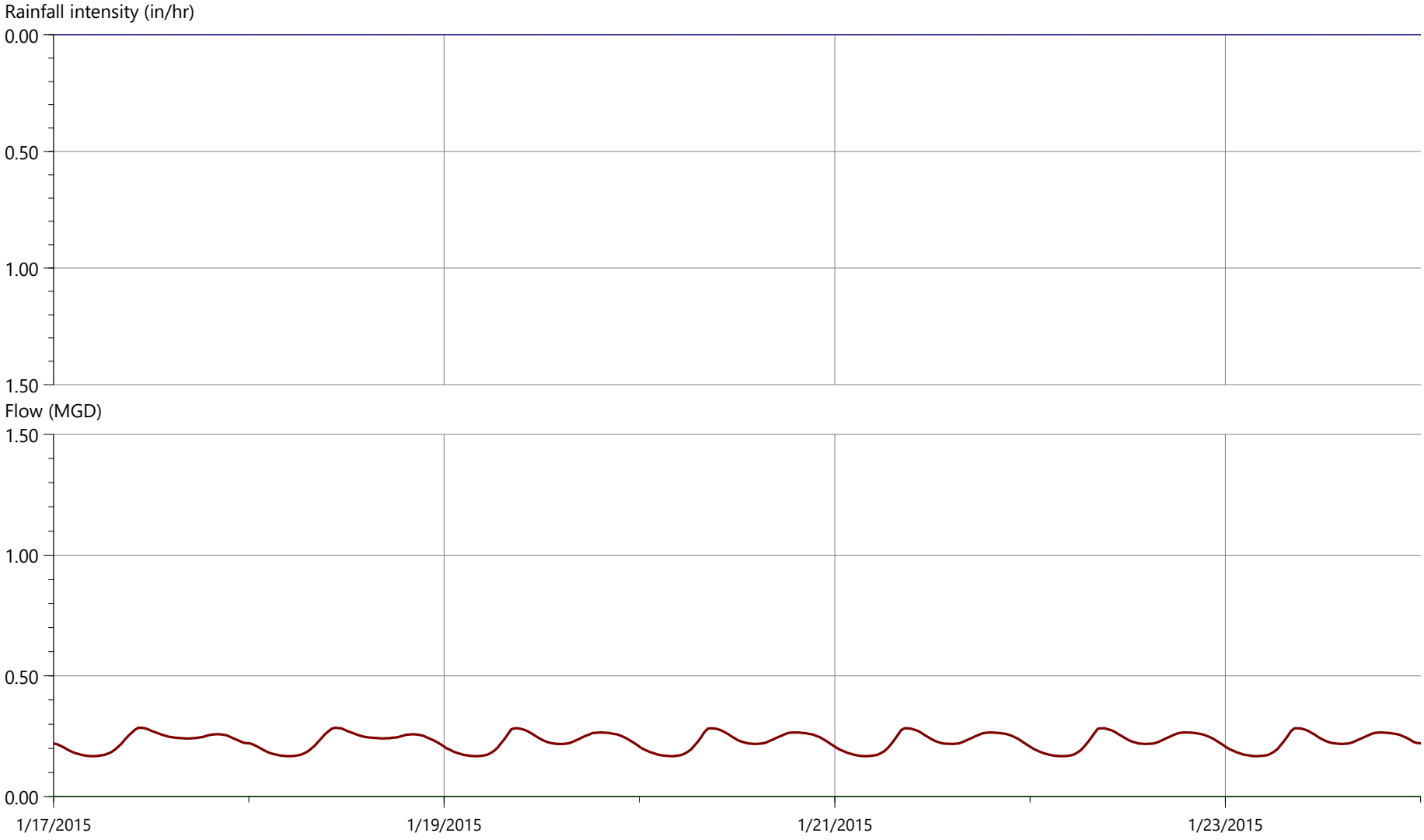
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.036	0.576	1.915

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.036	0.073	0.381

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1, Rainfall Profile: 2



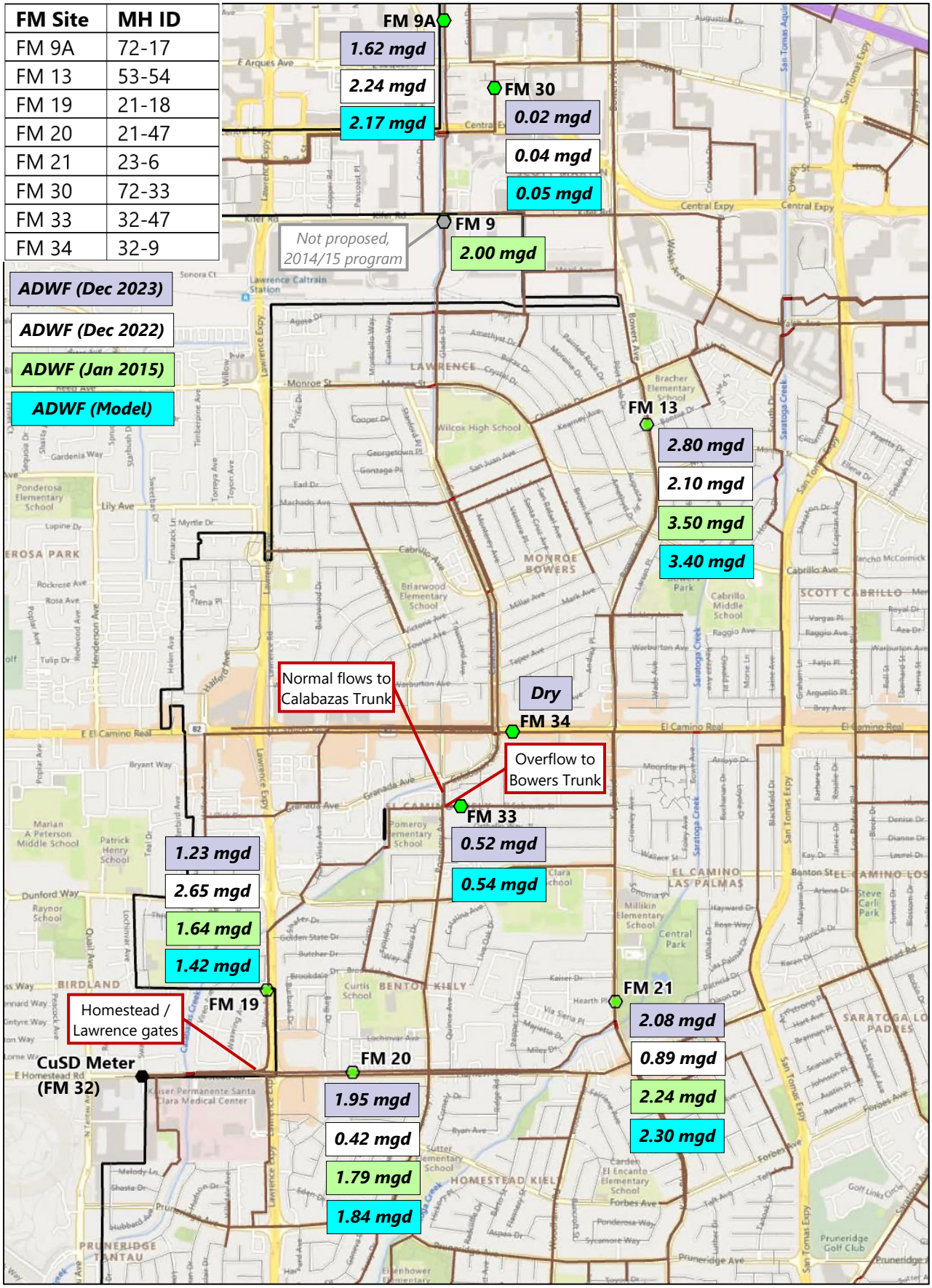
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.168	0.285	1.598

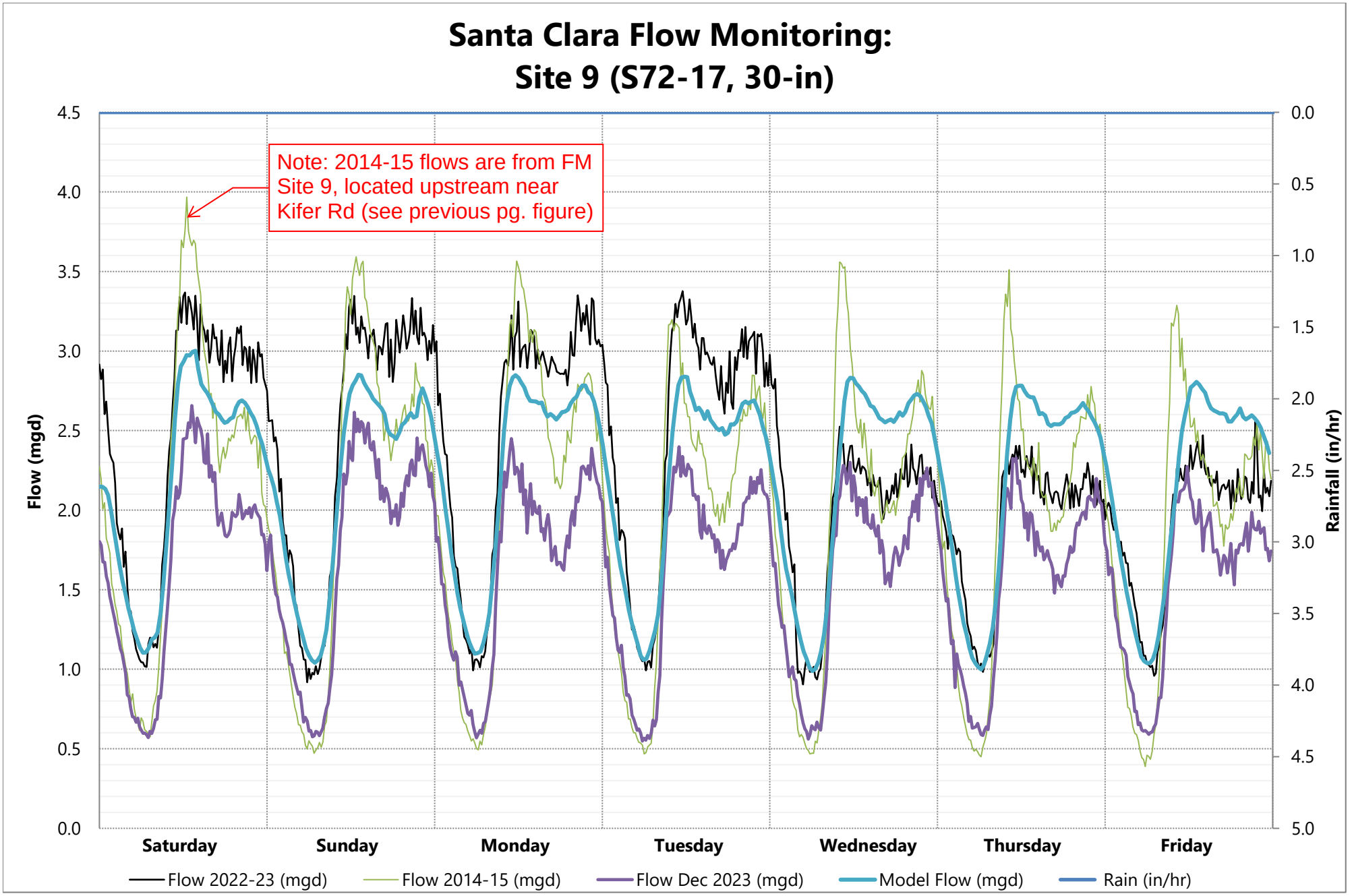
Dry Weather Flow Calibration Plots
Modeled vs. Metered Flows (Dec 2024, Dec 2022, Jan 2015)

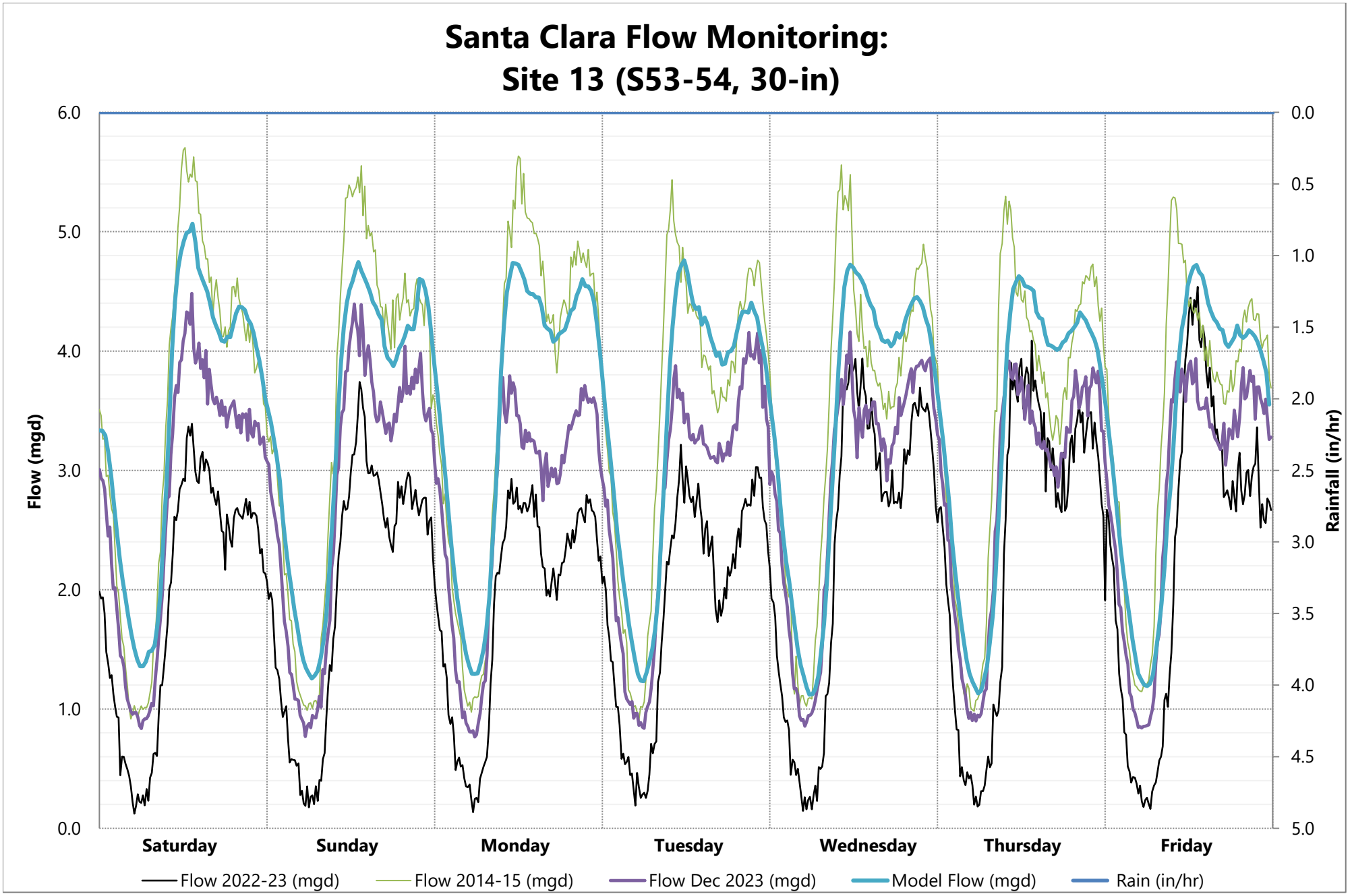
(*assumes normal settings at Homestead/Lawrence gate structure*)

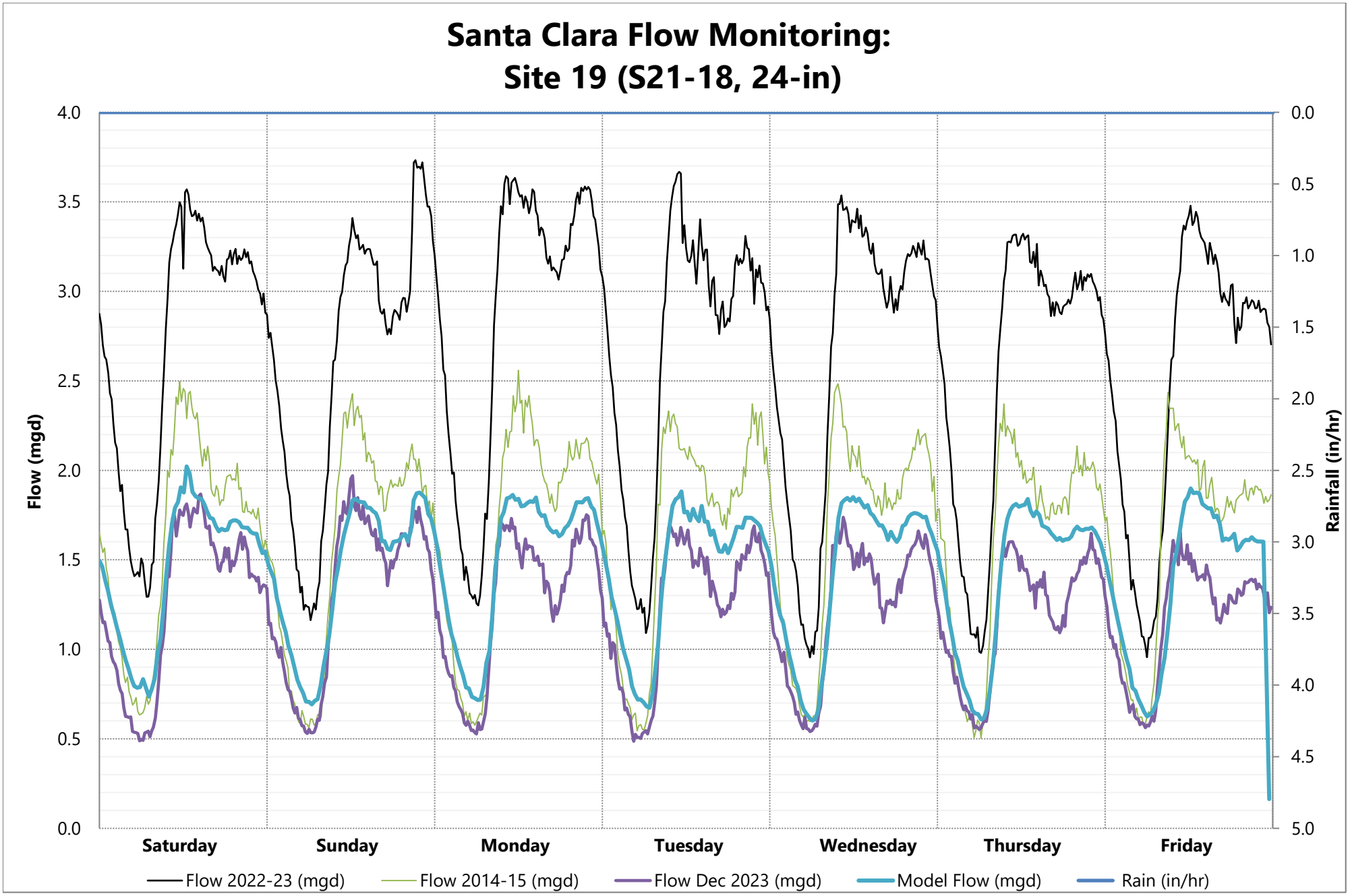
City of Santa Clara
Sanitary Sewer Master Plan Update
Site Locations for Additional Dry Weather Flow Monitoring

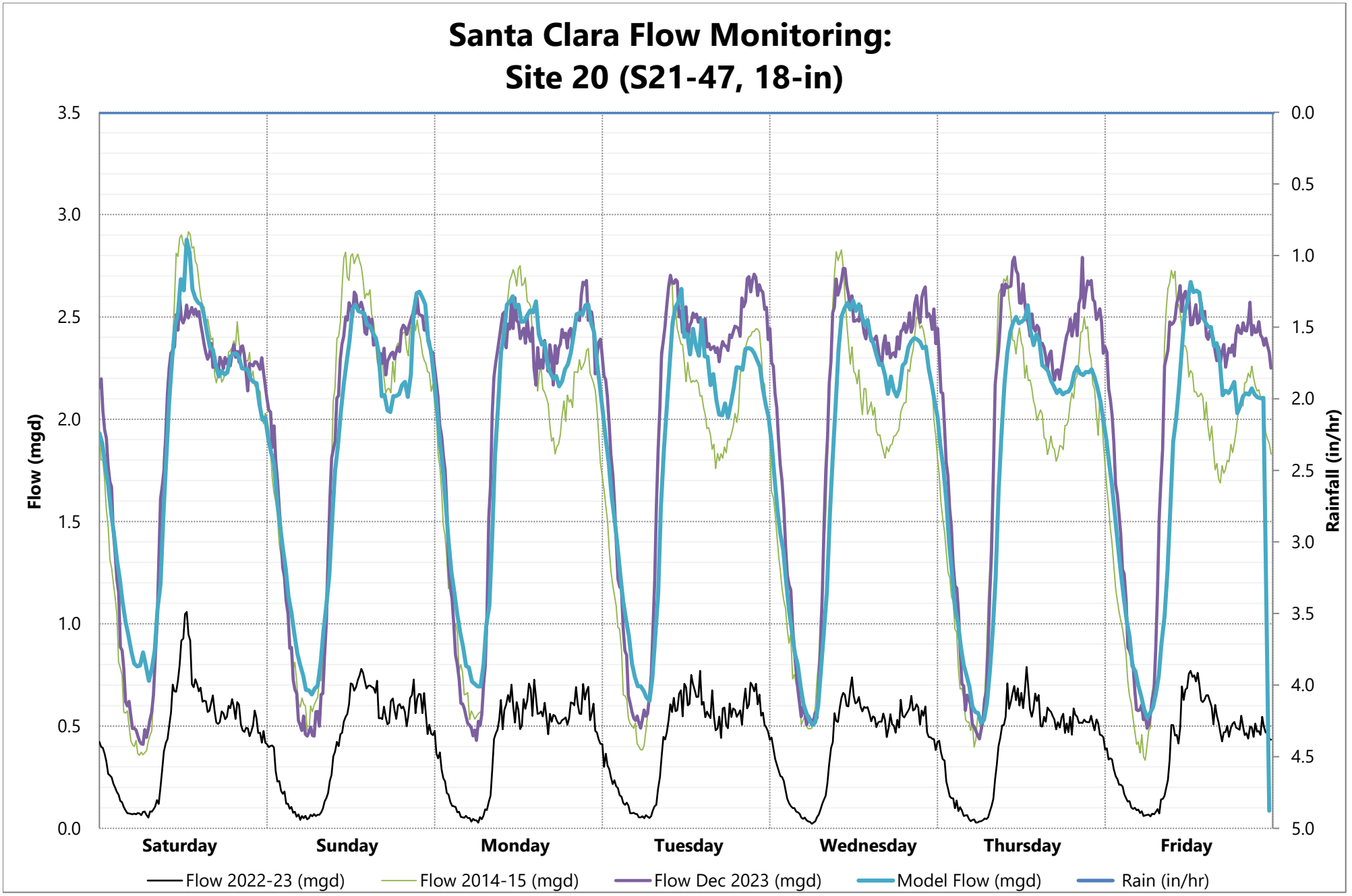
FM Site	MH ID
FM 9A	72-17
FM 13	53-54
FM 19	21-18
FM 20	21-47
FM 21	23-6
FM 30	72-33
FM 33	32-47
FM 34	32-9

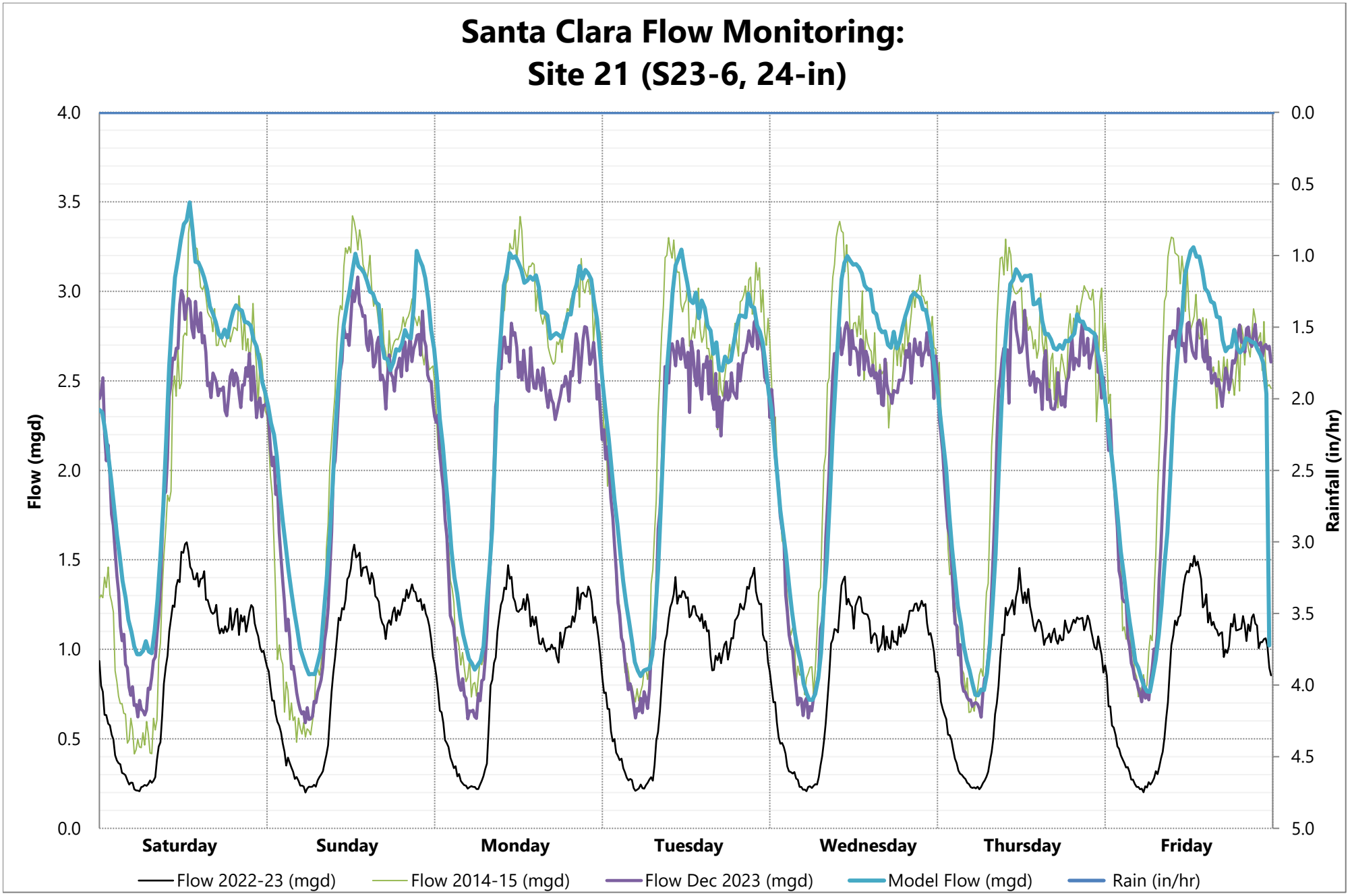


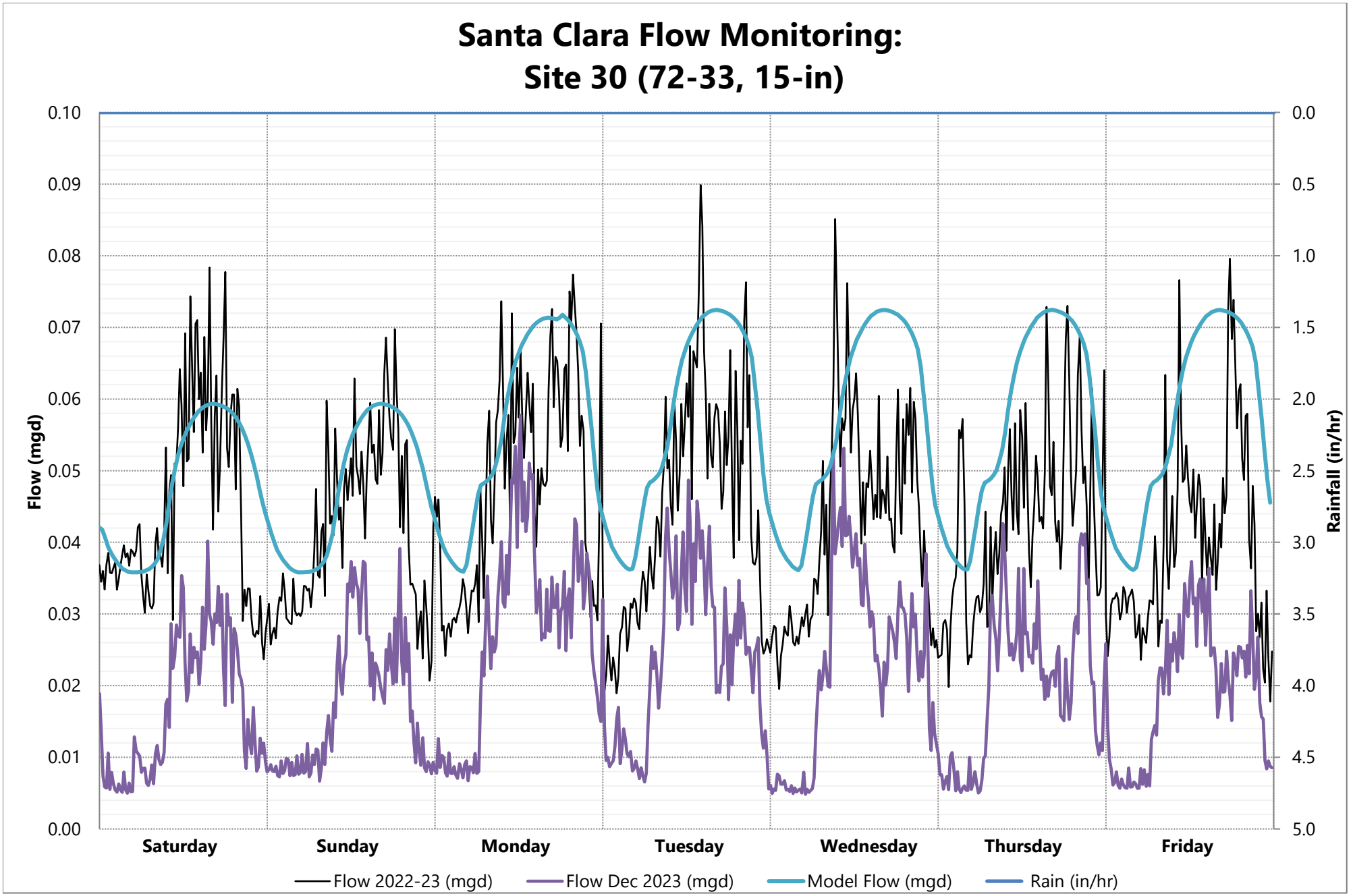

Santa Clara Flow Monitoring:
Site 9 (S72-17, 30-in)
Note: 2014-15 flows are from FM Site 9, located upstream near Kifer Rd (see previous pg. figure)
Flow (mgd)
Rainfall (in/hr)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)

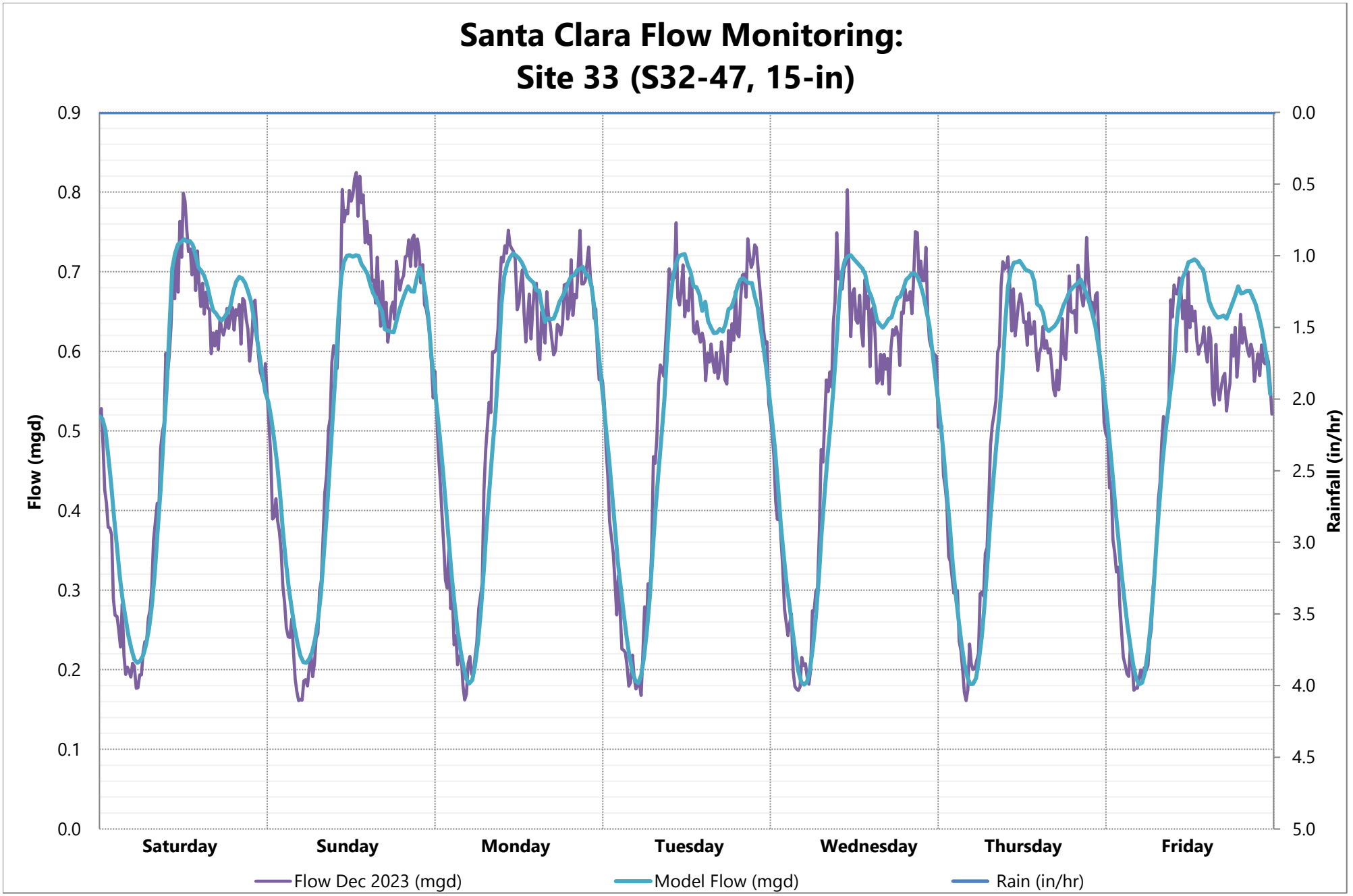

Santa Clara Flow Monitoring:
Site 13 (S53-54, 30-in)
Flow (mgd)
Rainfall (in/hr)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 19 (S21-18, 24-in)
Flow (mgd)
Rainfall (in/hr)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 20 (S21-47, 18-in)
Flow (mgd)
Rainfall (in/hr)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 21 (S23-6, 24-in)
Flow (mgd)
Rainfall (in/hr)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 30 (72-33, 15-in)
Flow (mgd)
Rainfall (in/hr)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)

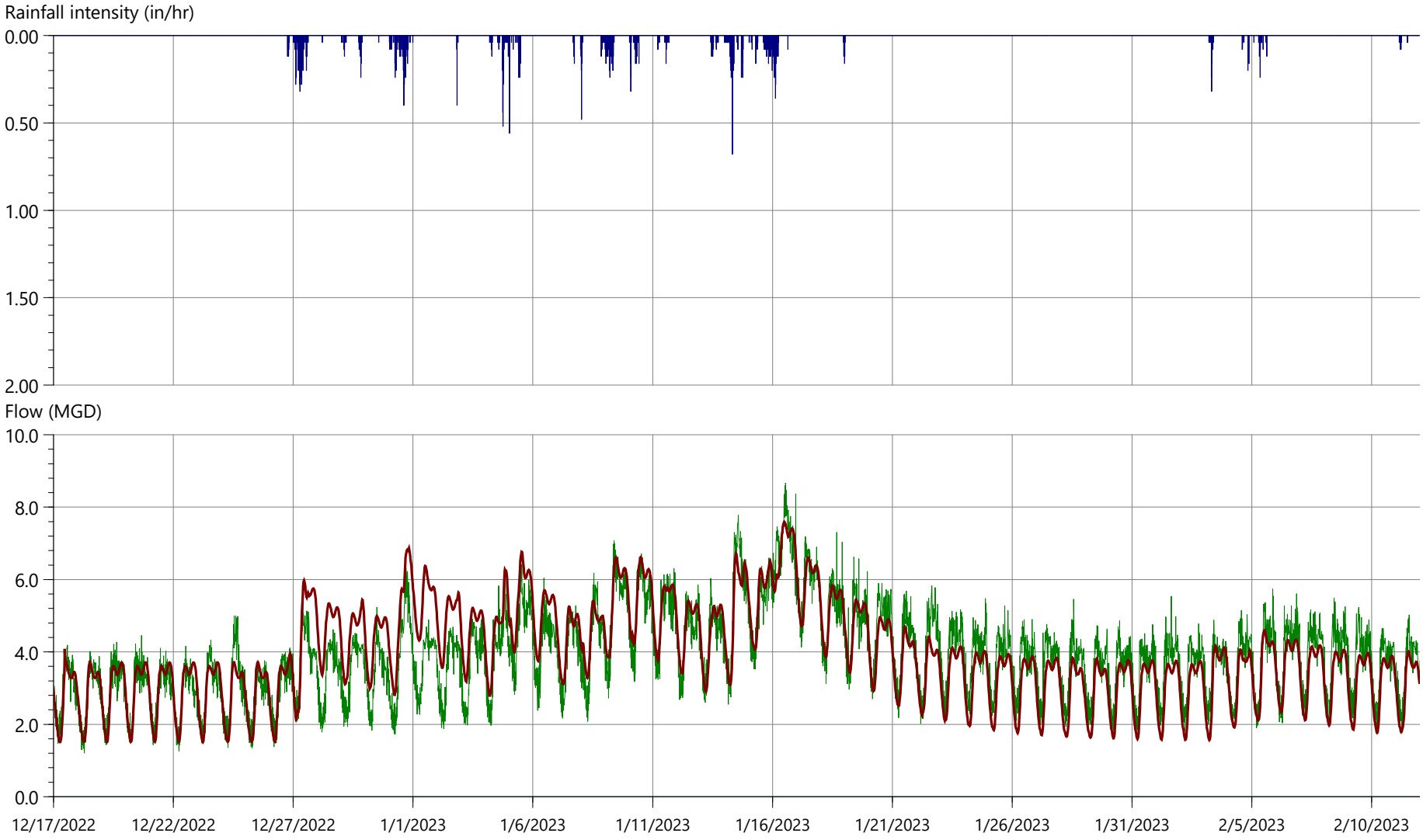

Santa Clara Flow Monitoring:
Site 33 (S32-47, 15-in)
Flow (mgd)
Rainfall (in/hr)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)

Wet Weather Flow Calibration Plots
Modeled vs. 2022-2023 Metered Flows

(*assumes clog at Homestead/Lawrence gate structure*)

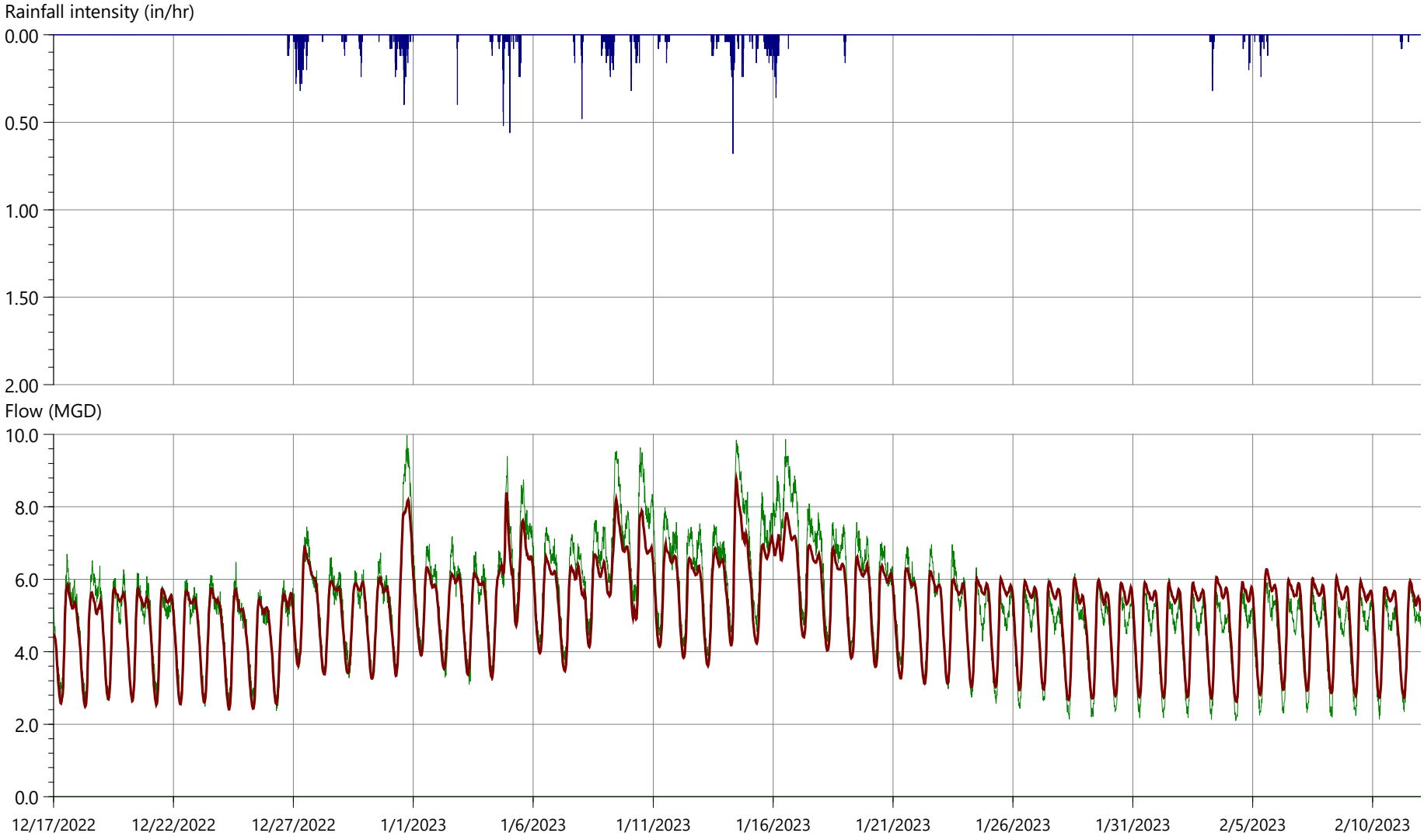
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1, Rainfall Profile: 1



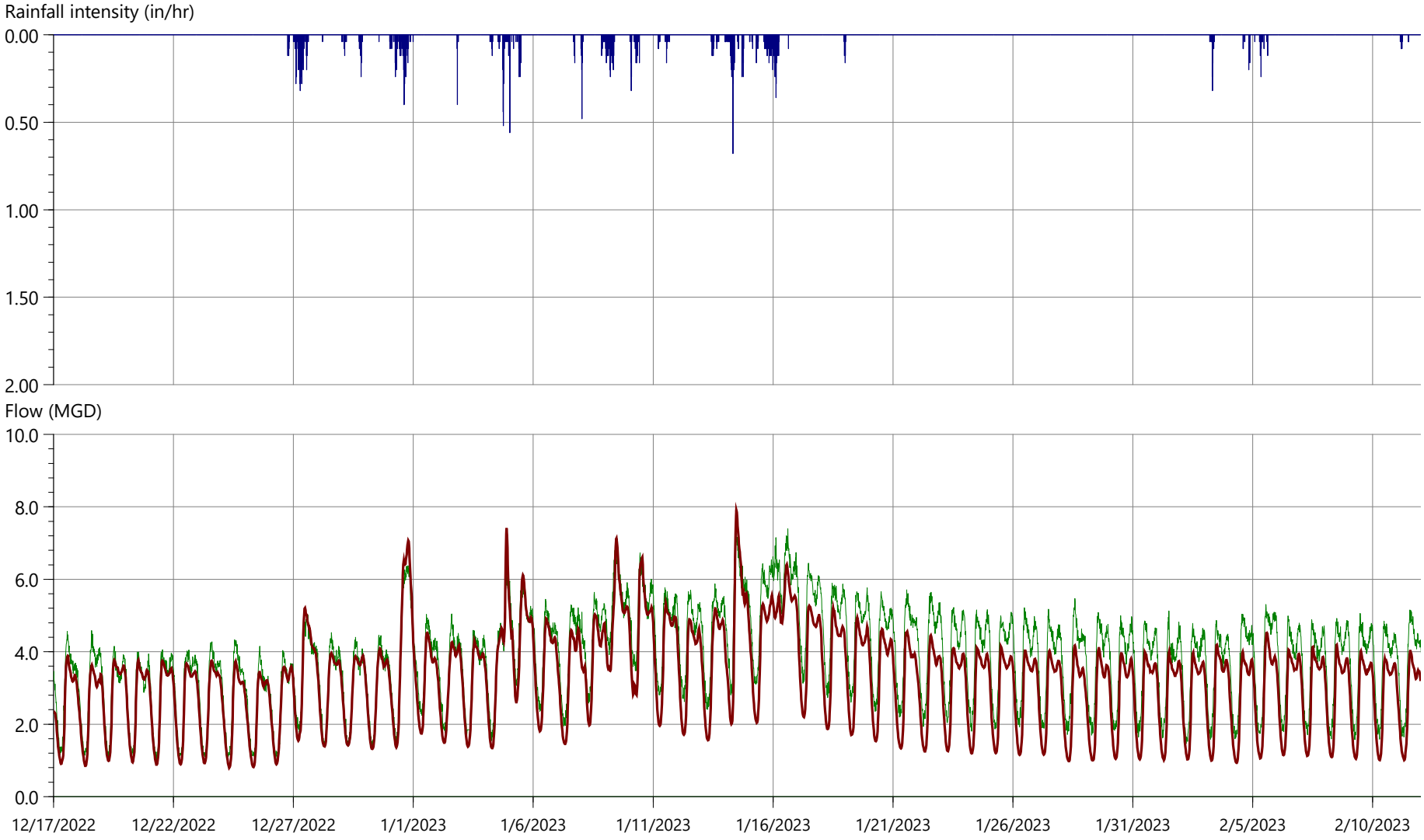
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				1.210	8.665	223.590
... Data 2023 and 2015				1.509	7.594	225.159

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1, Rainfall Profile: 1



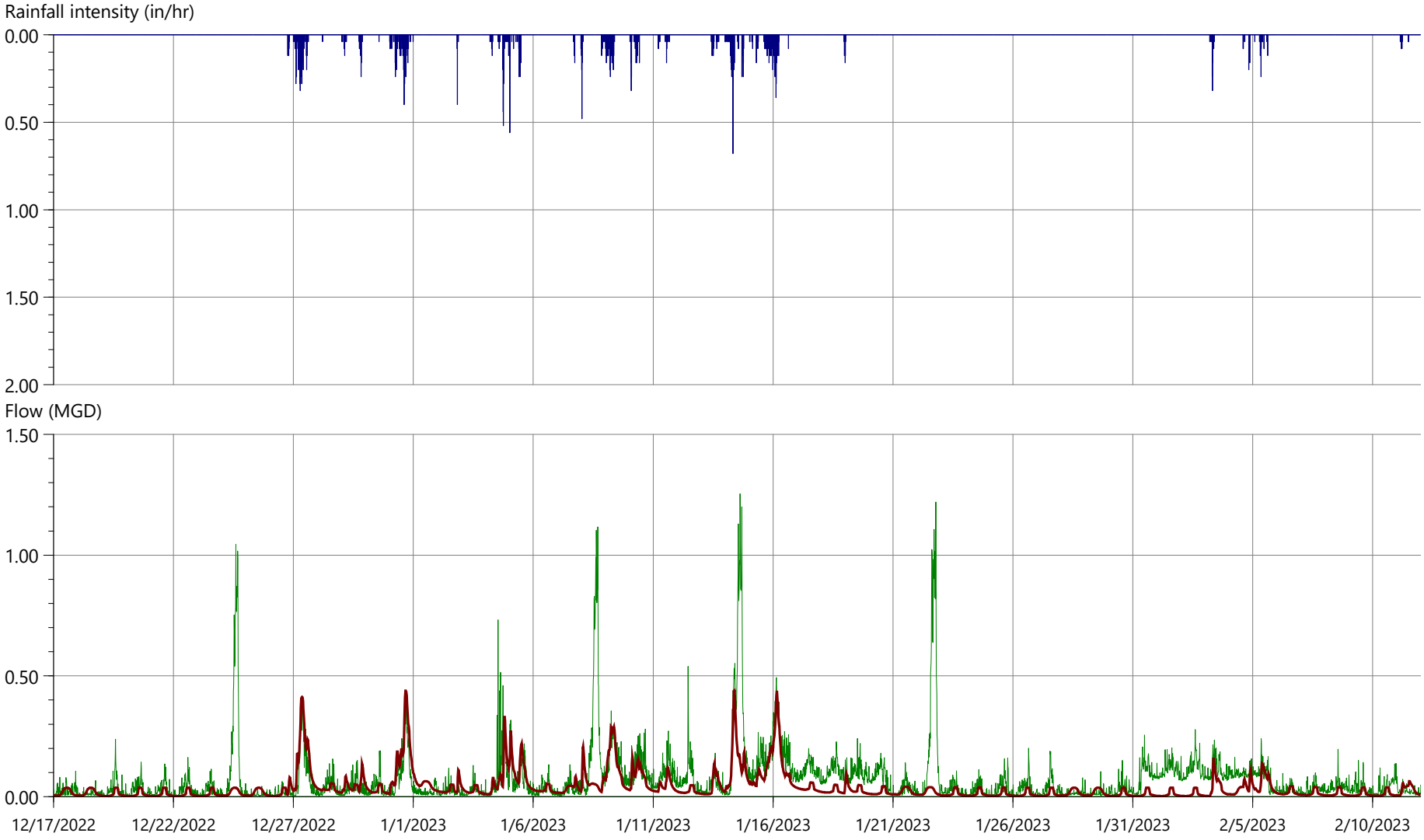
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				2.099	9.967	301.286
... Data 2023 and 2015				2.407	8.766	295.289

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1, Rainfall Profile: 1



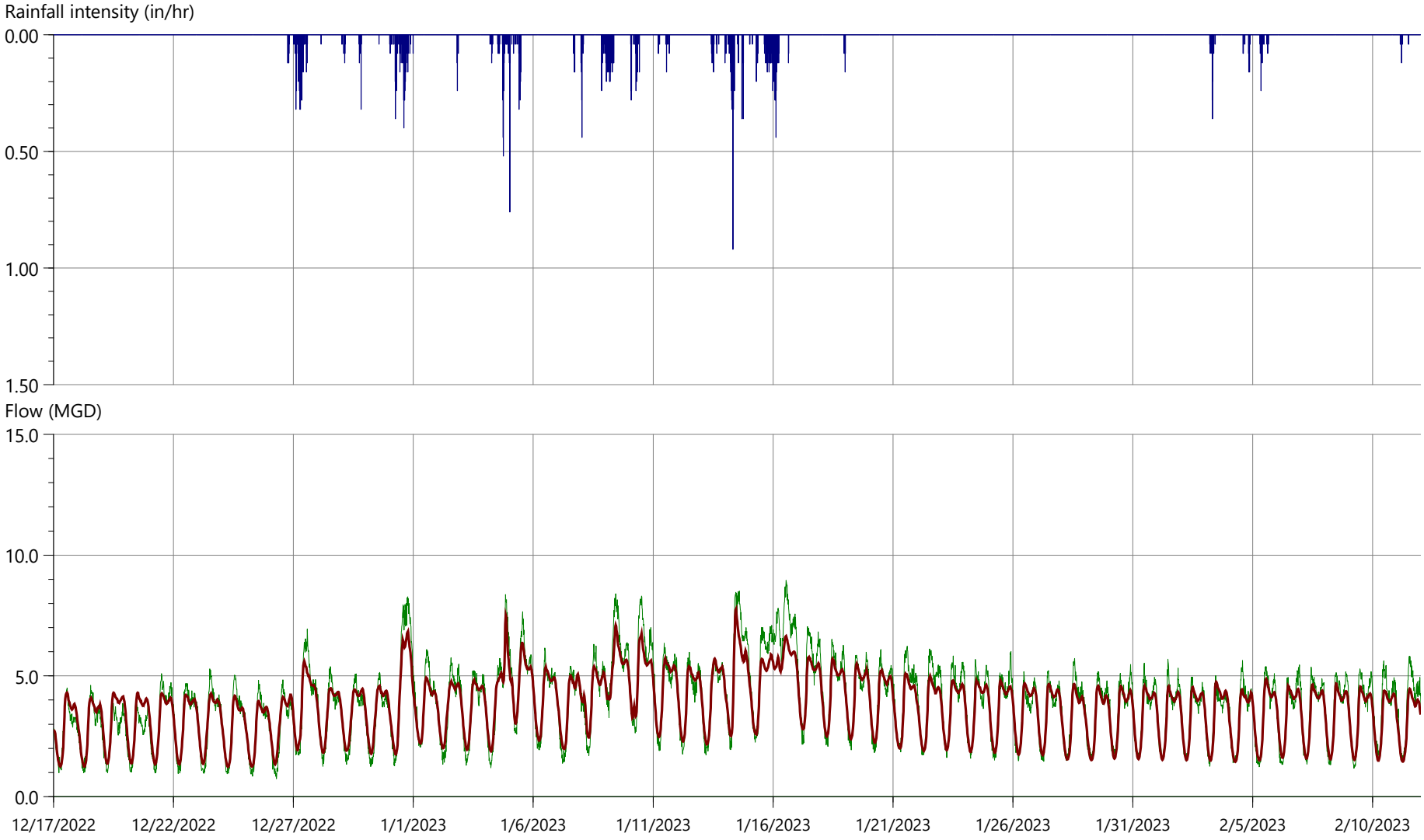
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				1.016	7.391	219.358
... Data 2023 and 2015				0.799	7.906	184.787

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1, Rainfall Profile: 1



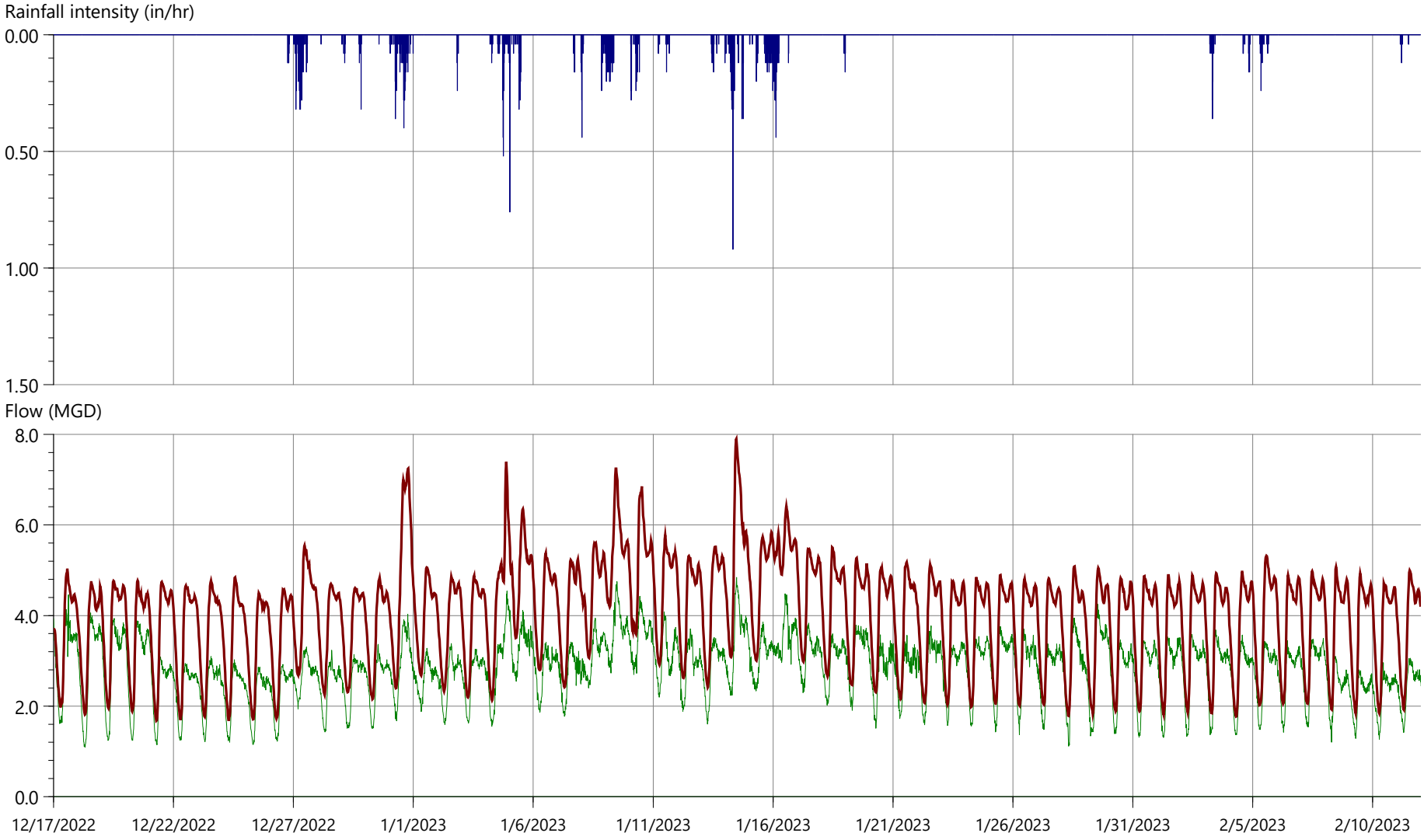
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				0.003	1.254	4.199
... Data 2023 and 2015				0.003	0.440	2.251

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1, Rainfall Profile: 2



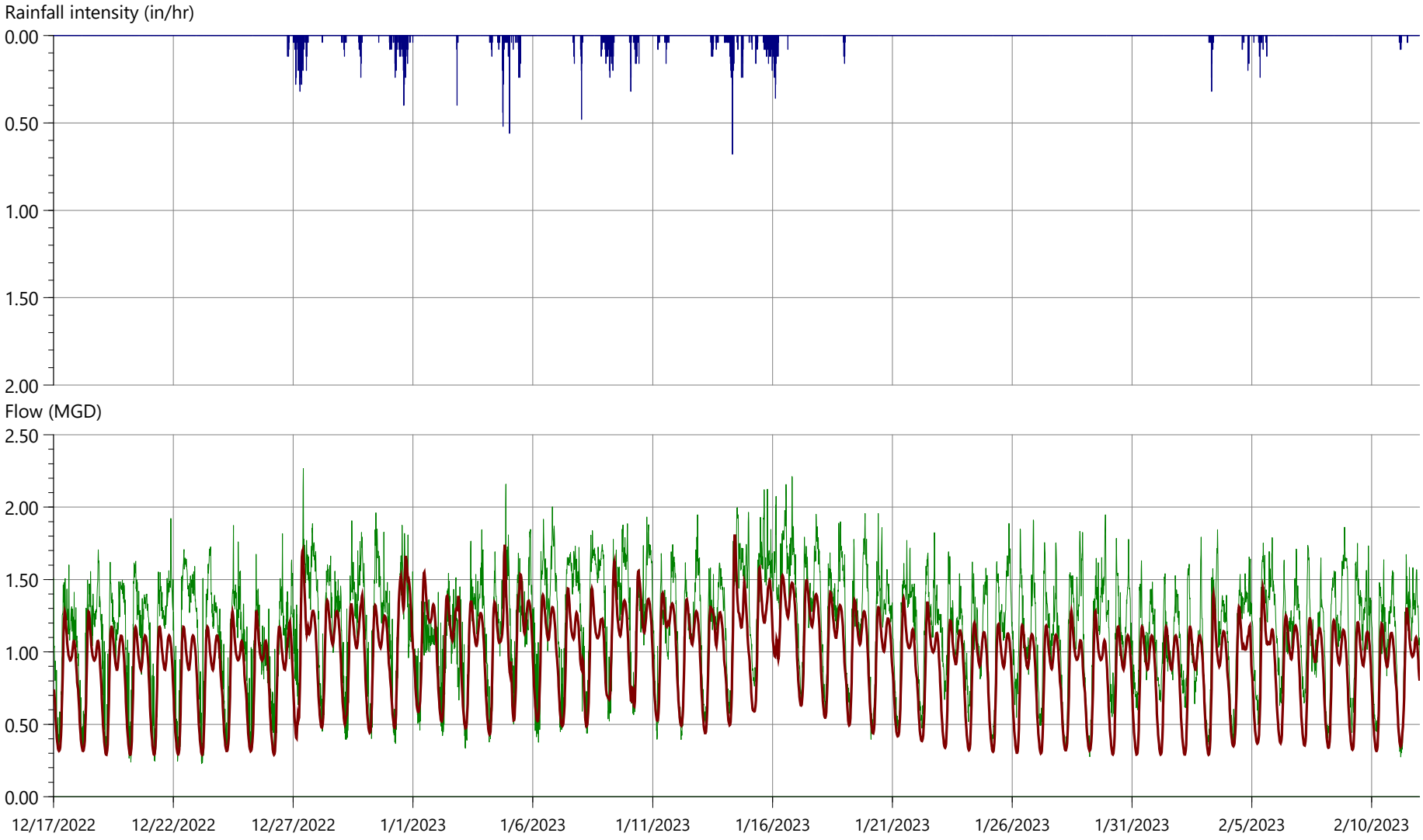
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.742	8.959	222.725
... Data 2023 and 2015				1.239	7.776	214.979

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1, Rainfall Profile: 2



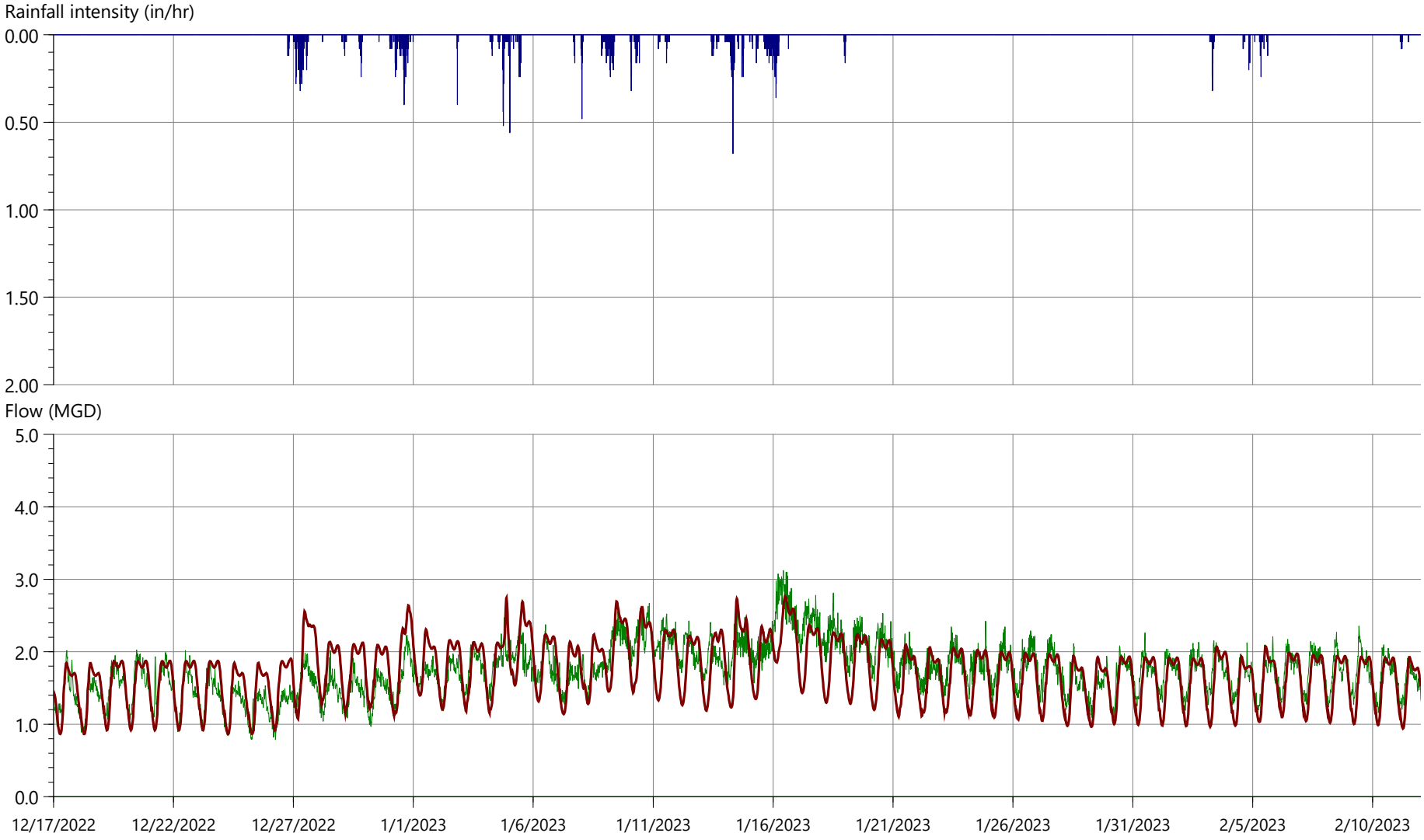
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				1.092	4.844	161.024
... Data 2023 and 2015				1.676	7.903	232.228

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1, Rainfall Profile: 1



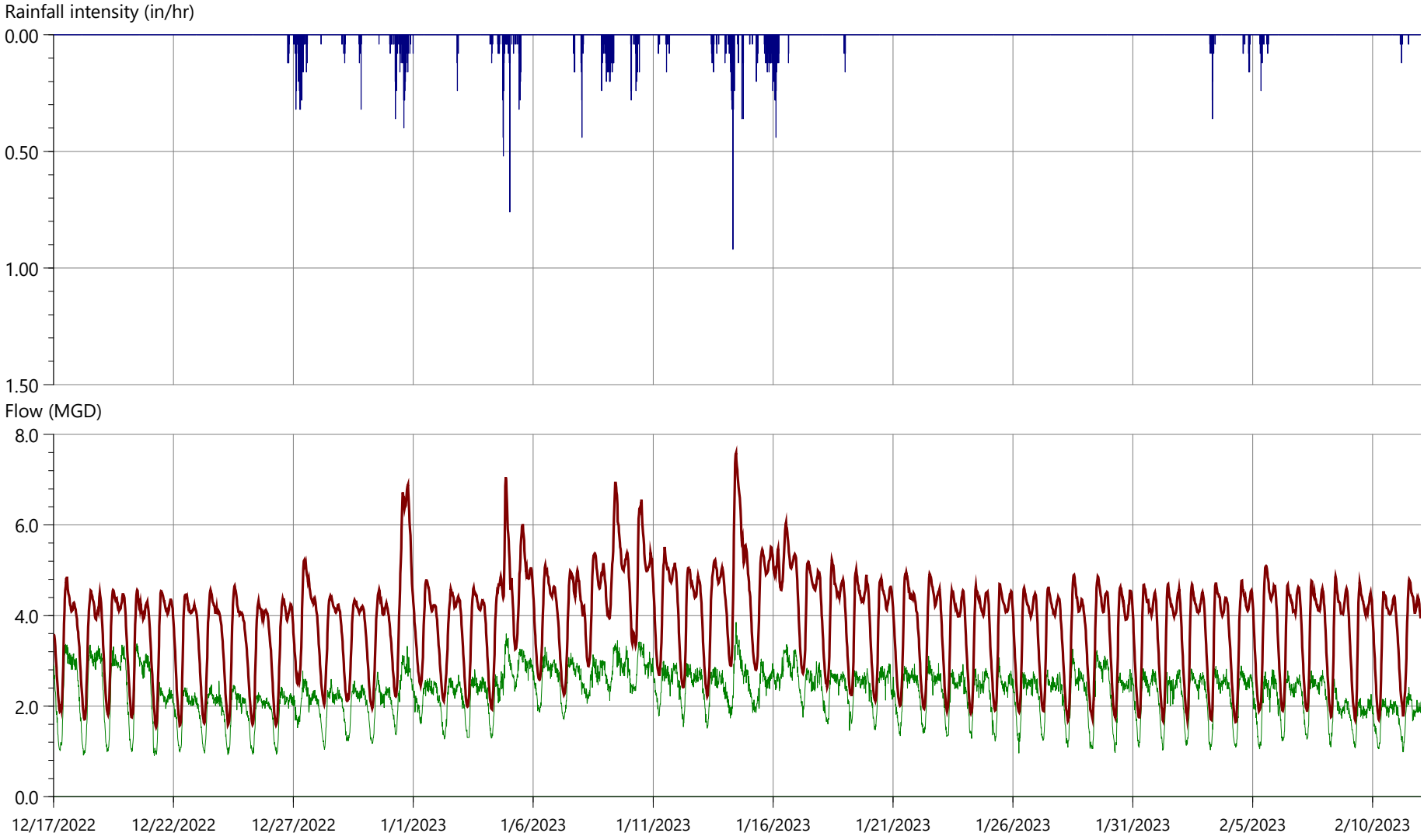
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				0.229	2.269	66.613
... Data 2023 and 2015				0.290	1.804	53.713

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1, Rainfall Profile: 1



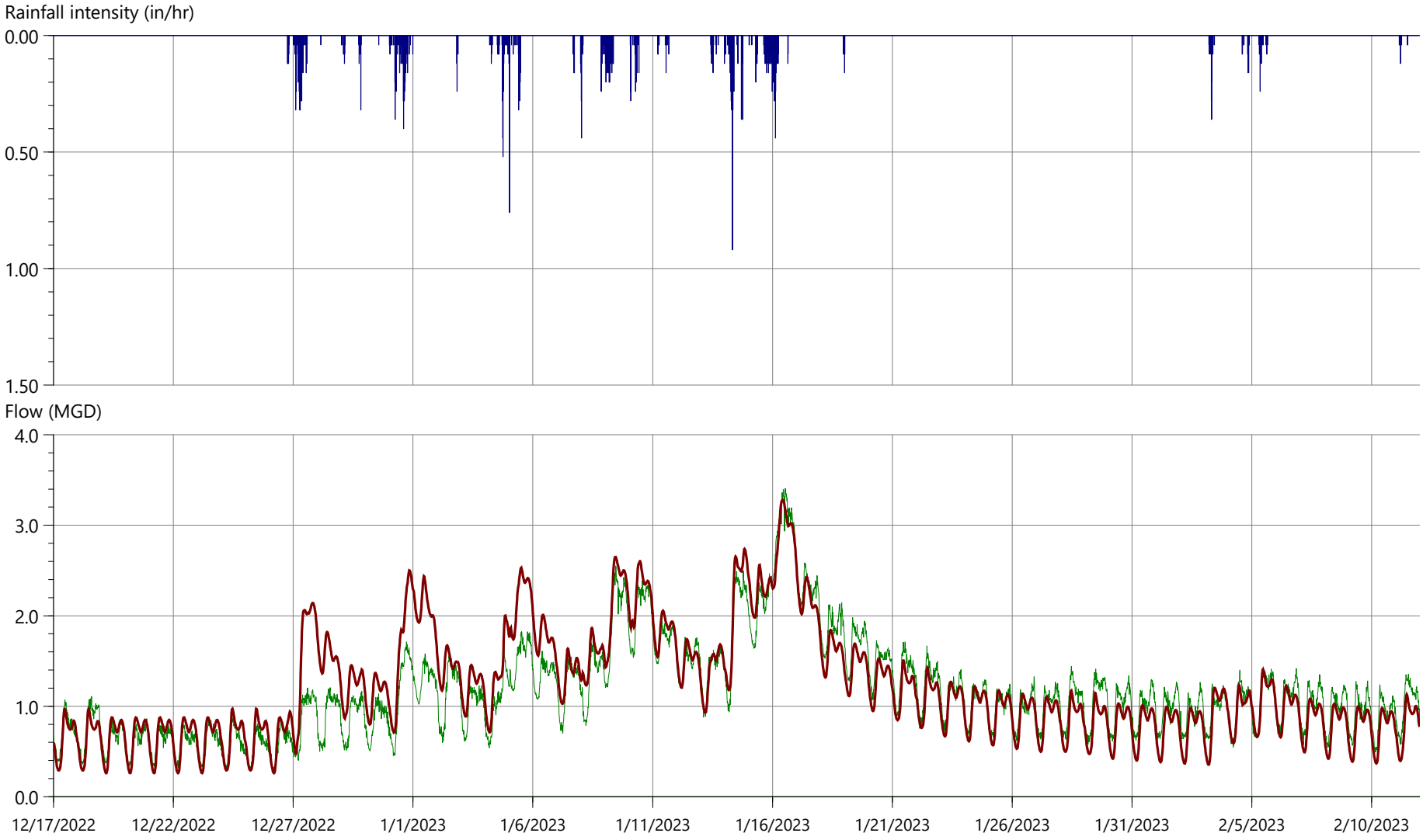
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				0.785	3.123	99.151
... Data 2023 and 2015				0.864	2.765	98.422

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S72-20.1, Rainfall Profile: 2



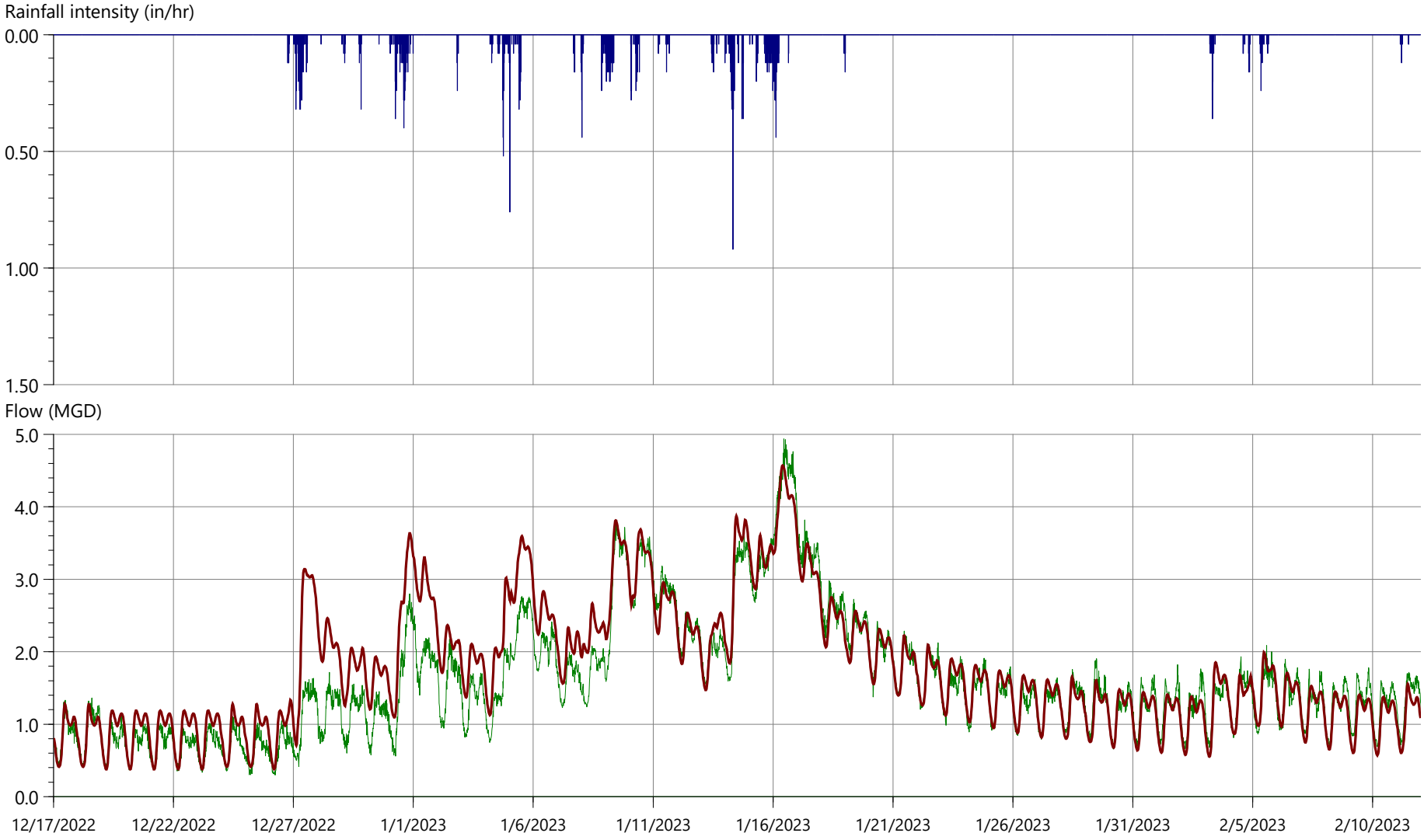
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.904	3.852	130.258
... Data 2023 and 2015				1.535	7.588	220.094

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1, Rainfall Profile: 2



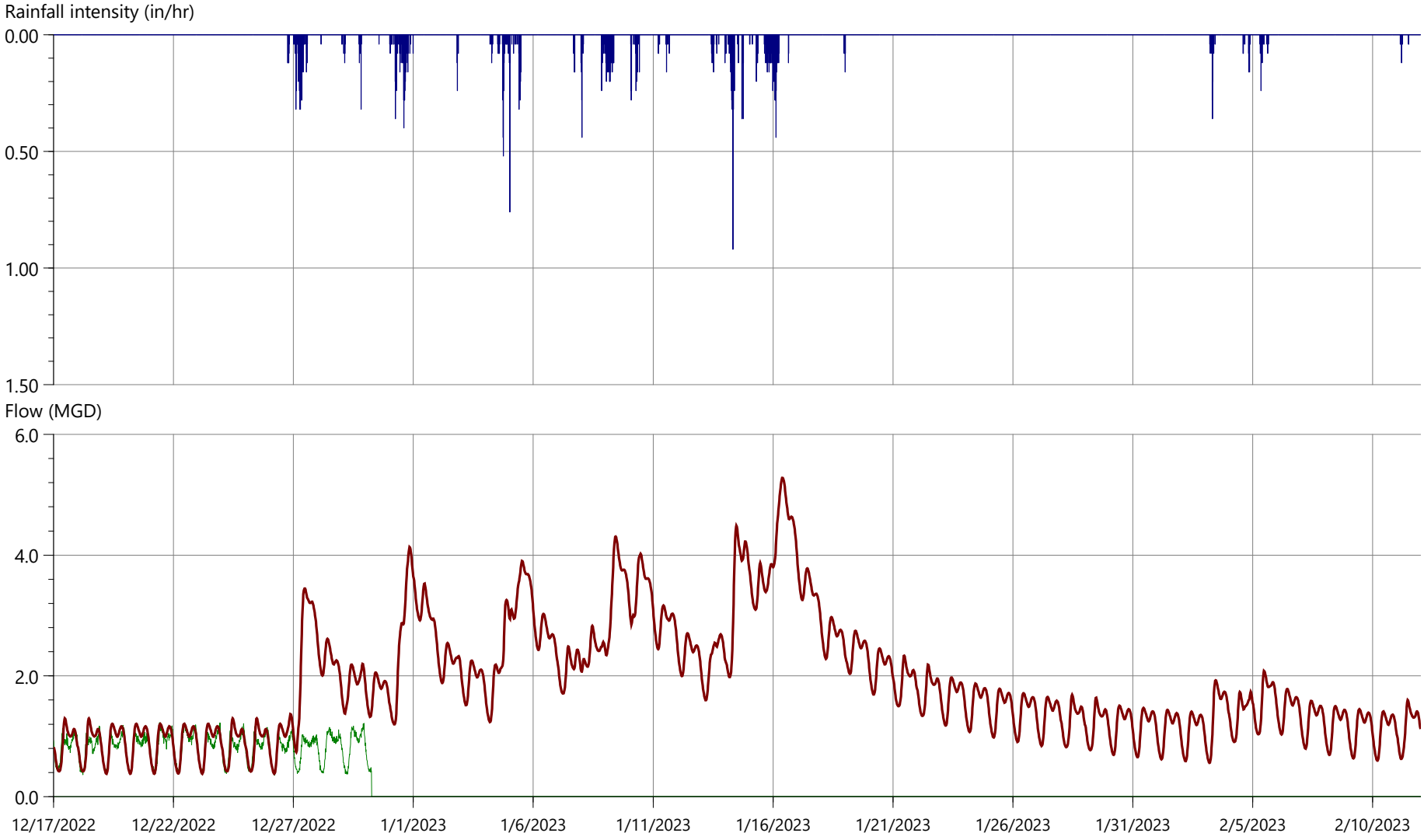
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.293	3.408	66.545
... Data 2023 and 2015				0.261	3.281	69.344

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1, Rainfall Profile: 2



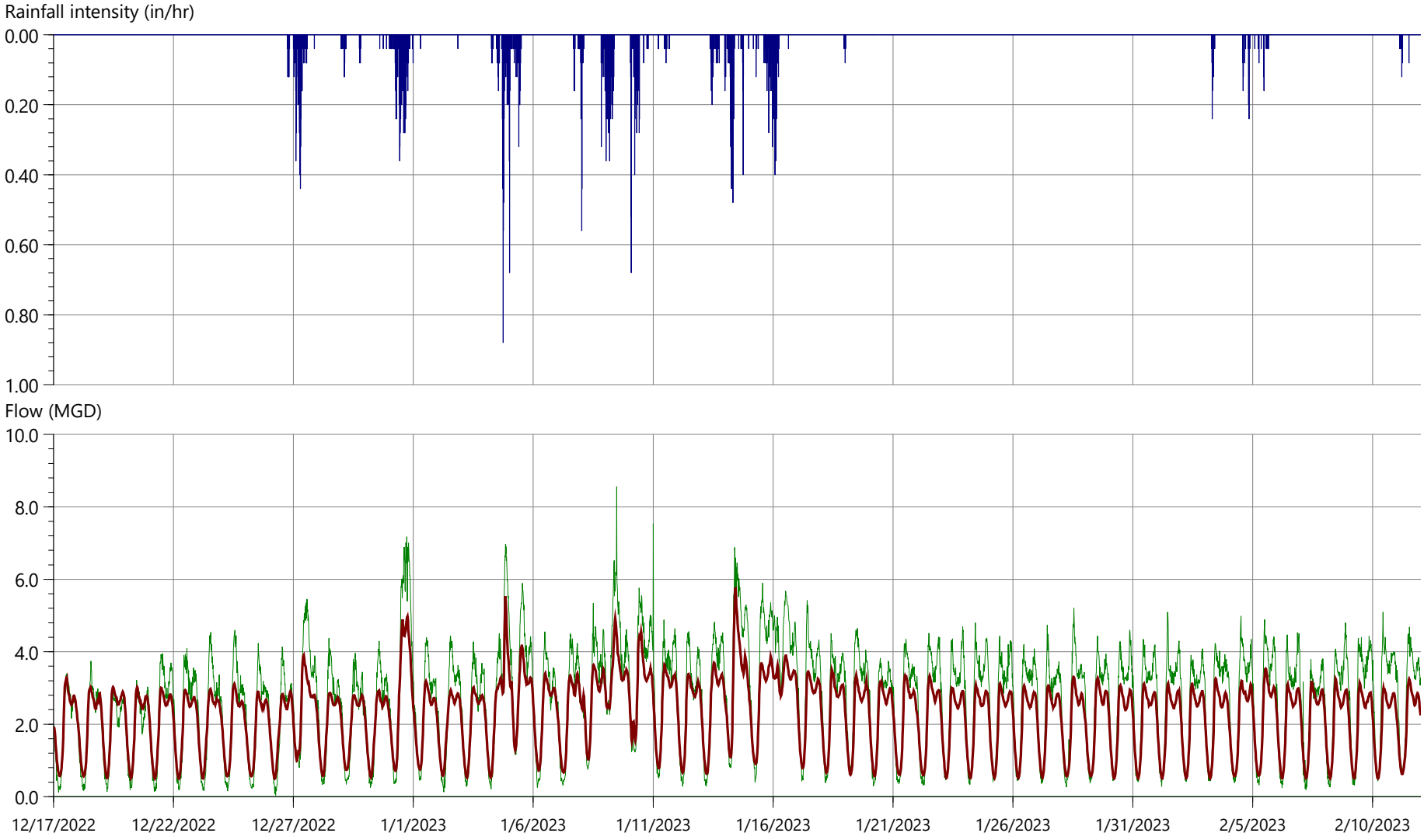
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.299	4.937	91.451
... Data 2023 and 2015				0.376	4.572	100.543

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1, Rainfall Profile: 2



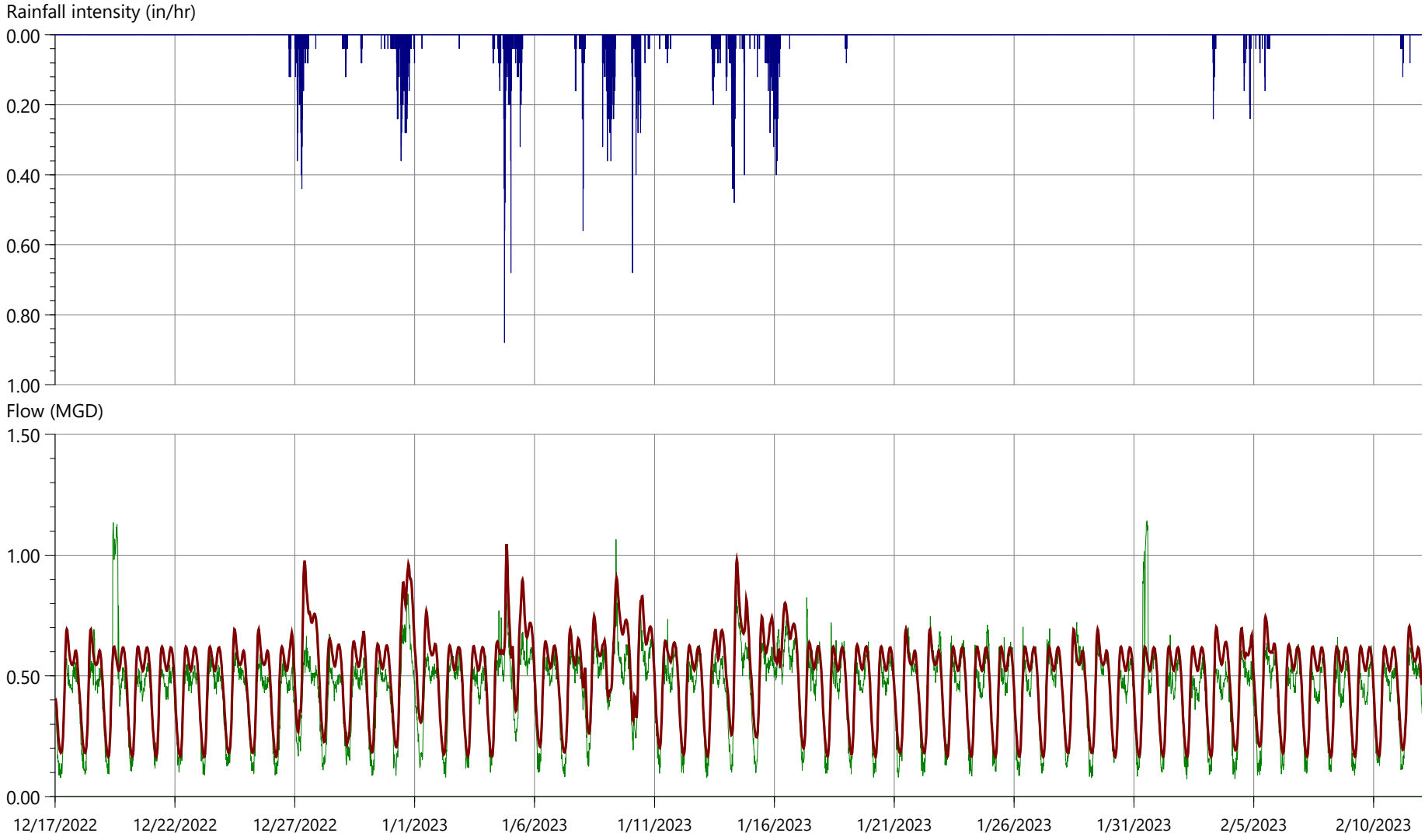
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.000	1.229	10.854
... Data 2023 and 2015				0.380	5.281	106.907

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1, Rainfall Profile: 3



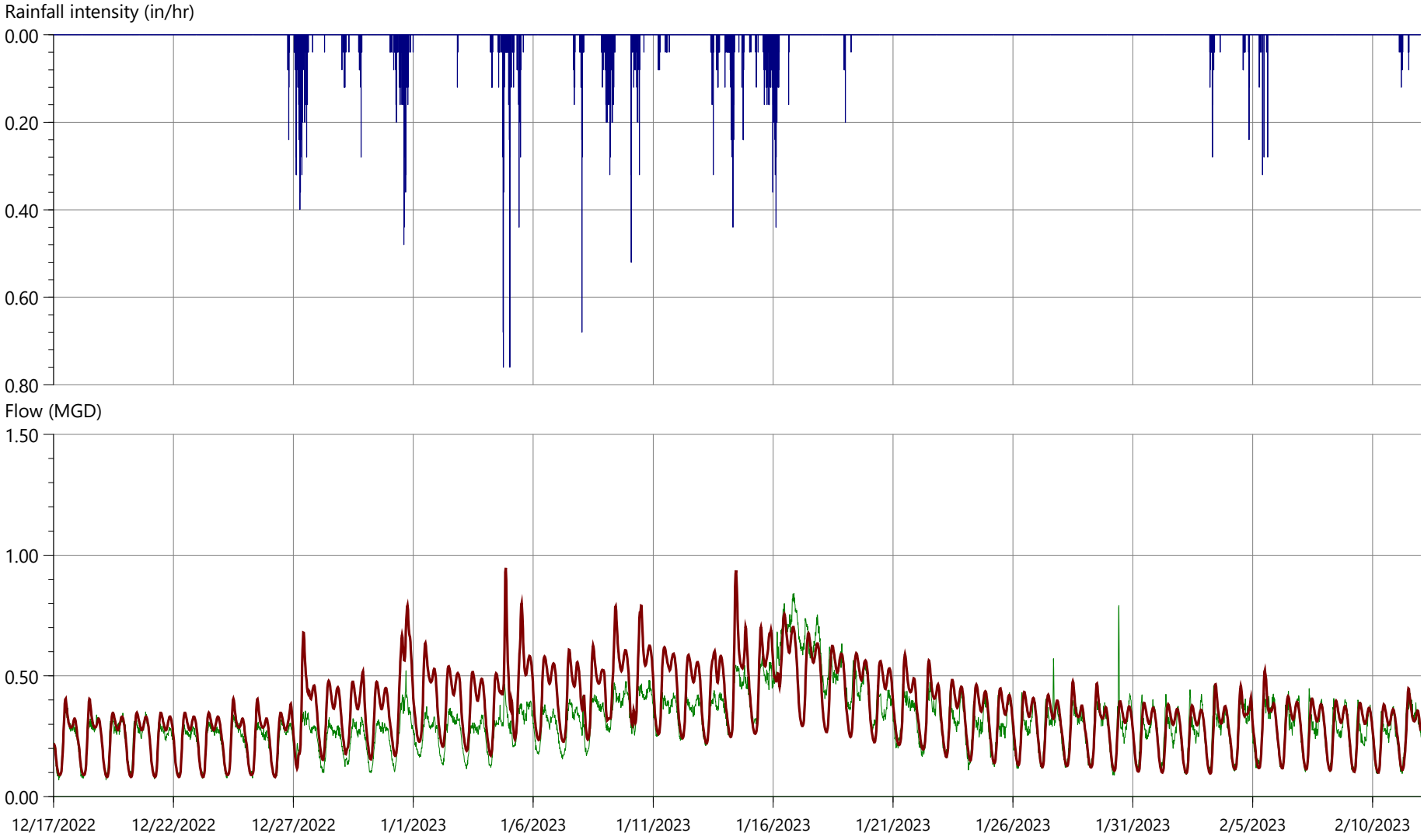
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.039	8.561	156.493
... Data 2023 and 2015				0.496	5.745	130.152

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1, Rainfall Profile: 3



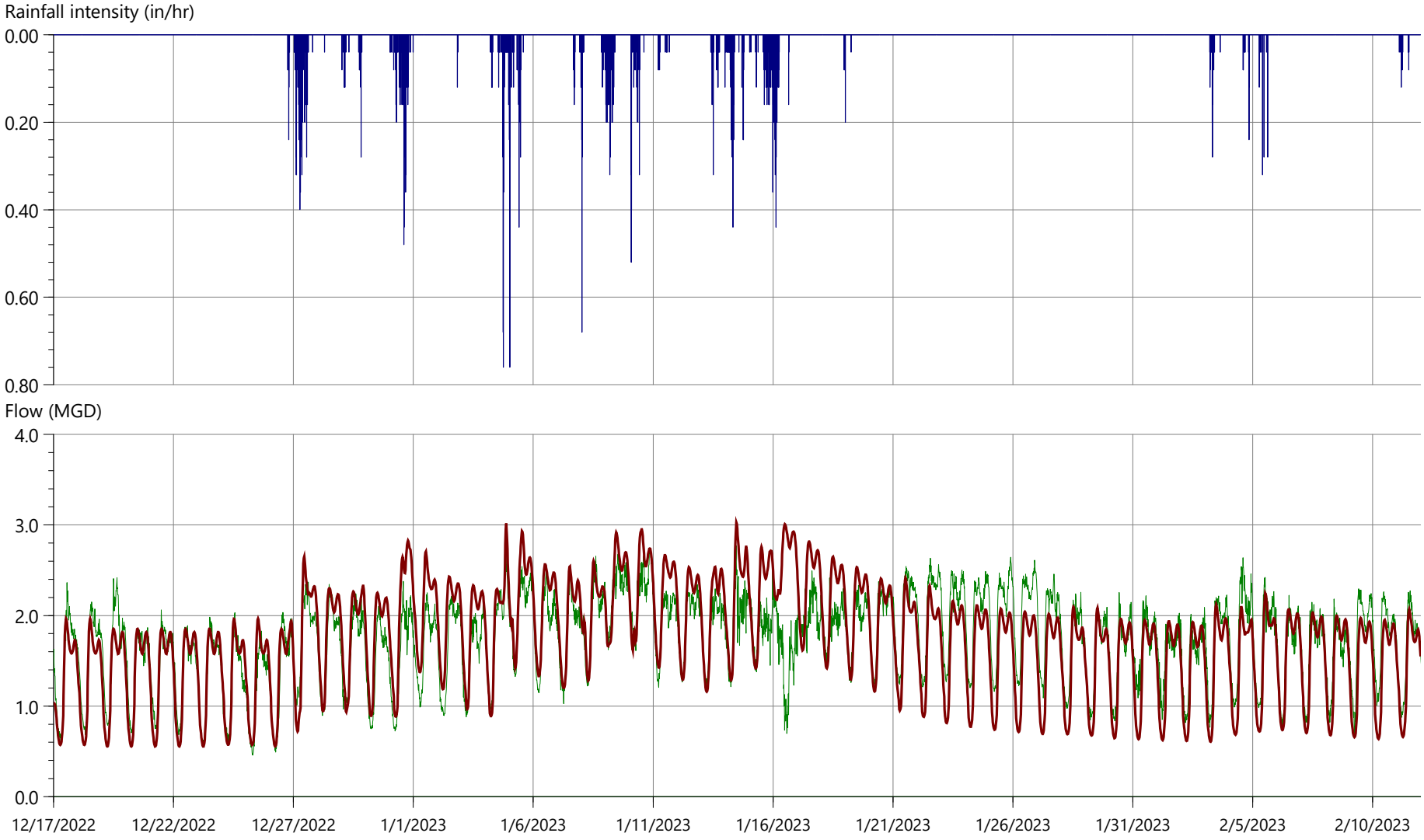
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.072	1.143	24.509
... Data 2023 and 2015				0.165	1.046	28.116

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1, Rainfall Profile: 4



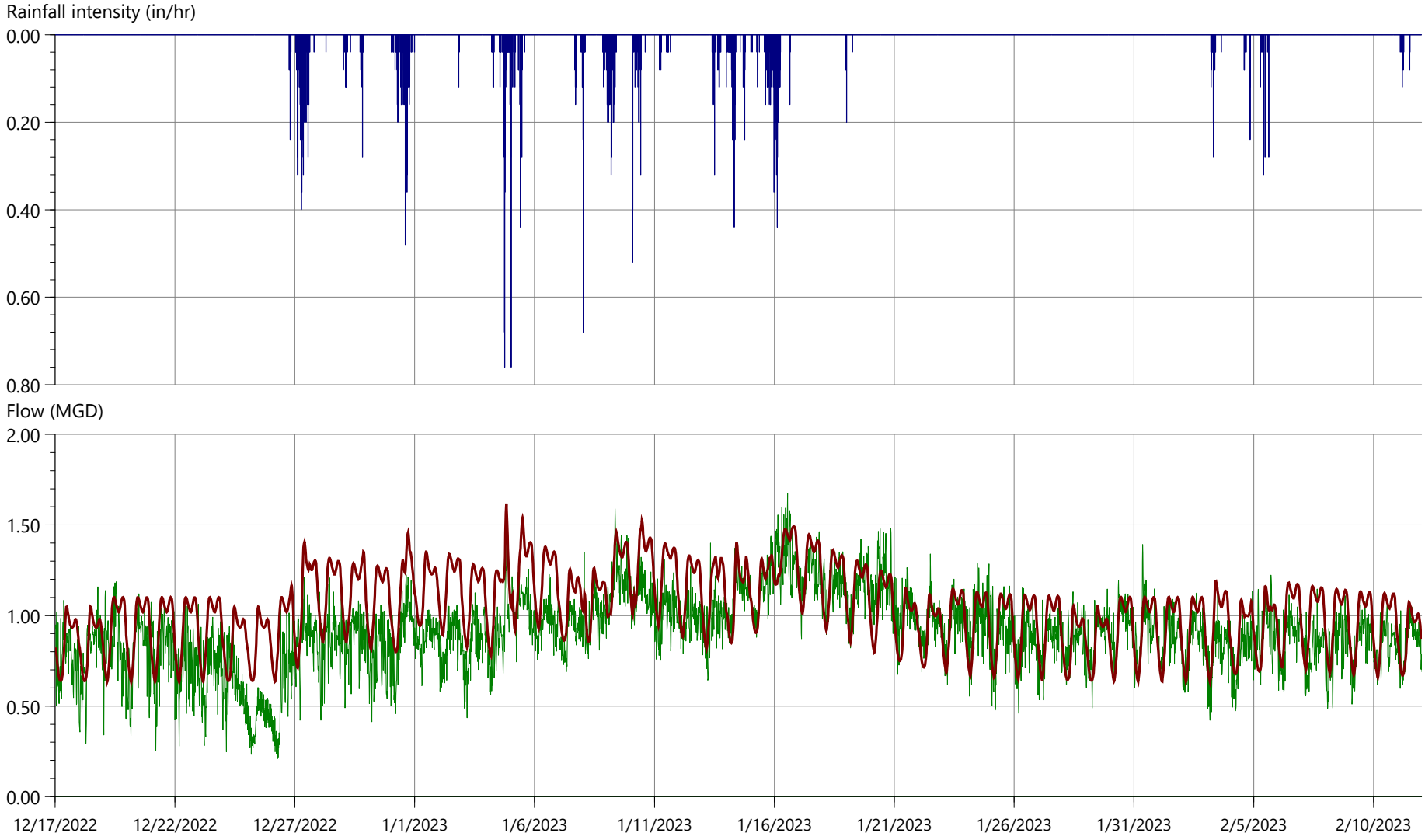
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.068	0.842	17.364
... Data 2023 and 2015				0.081	0.947	20.260

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1, Rainfall Profile: 4



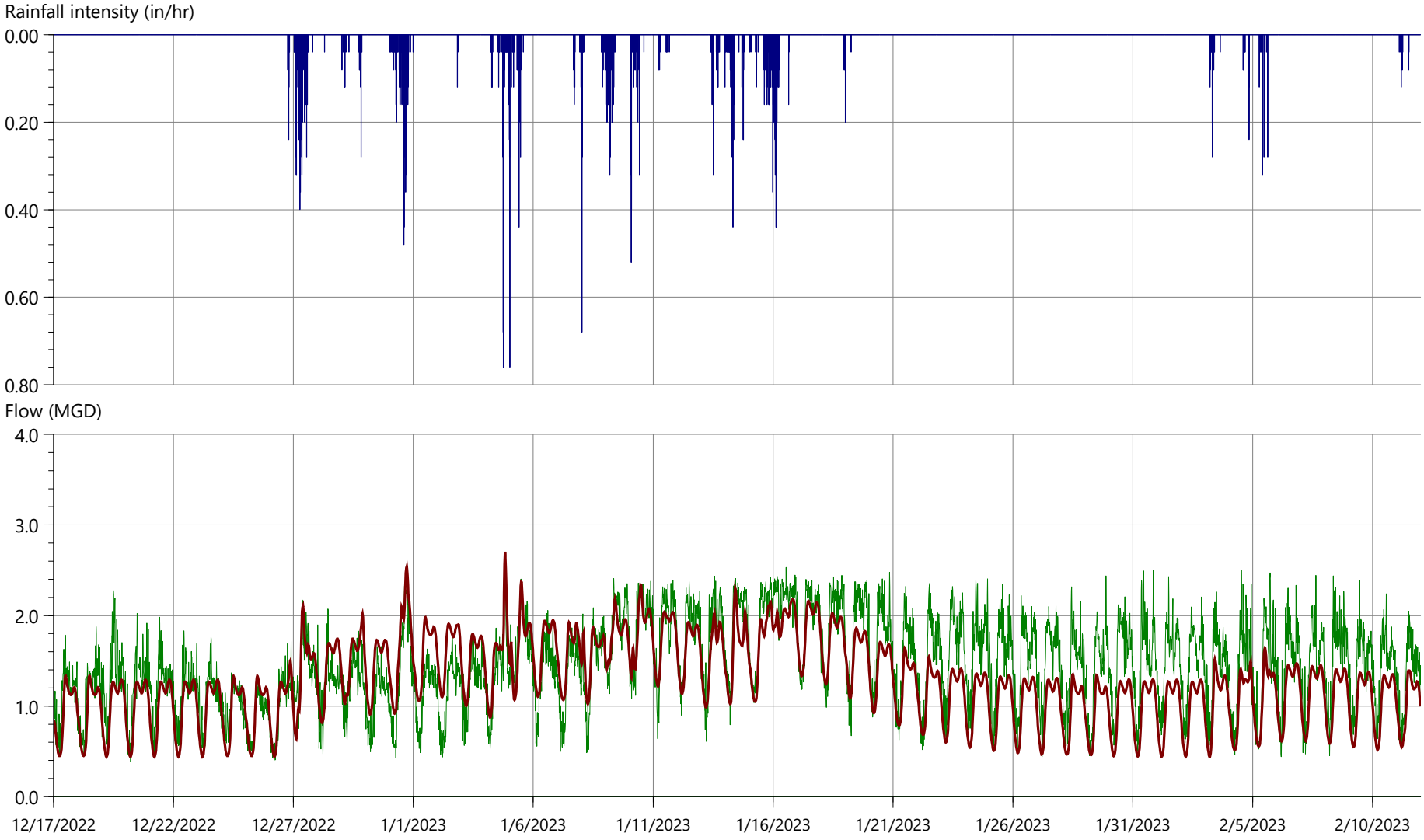
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.459	2.773	98.978
... Data 2023 and 2015				0.555	3.028	99.594

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2, Rainfall Profile: 4



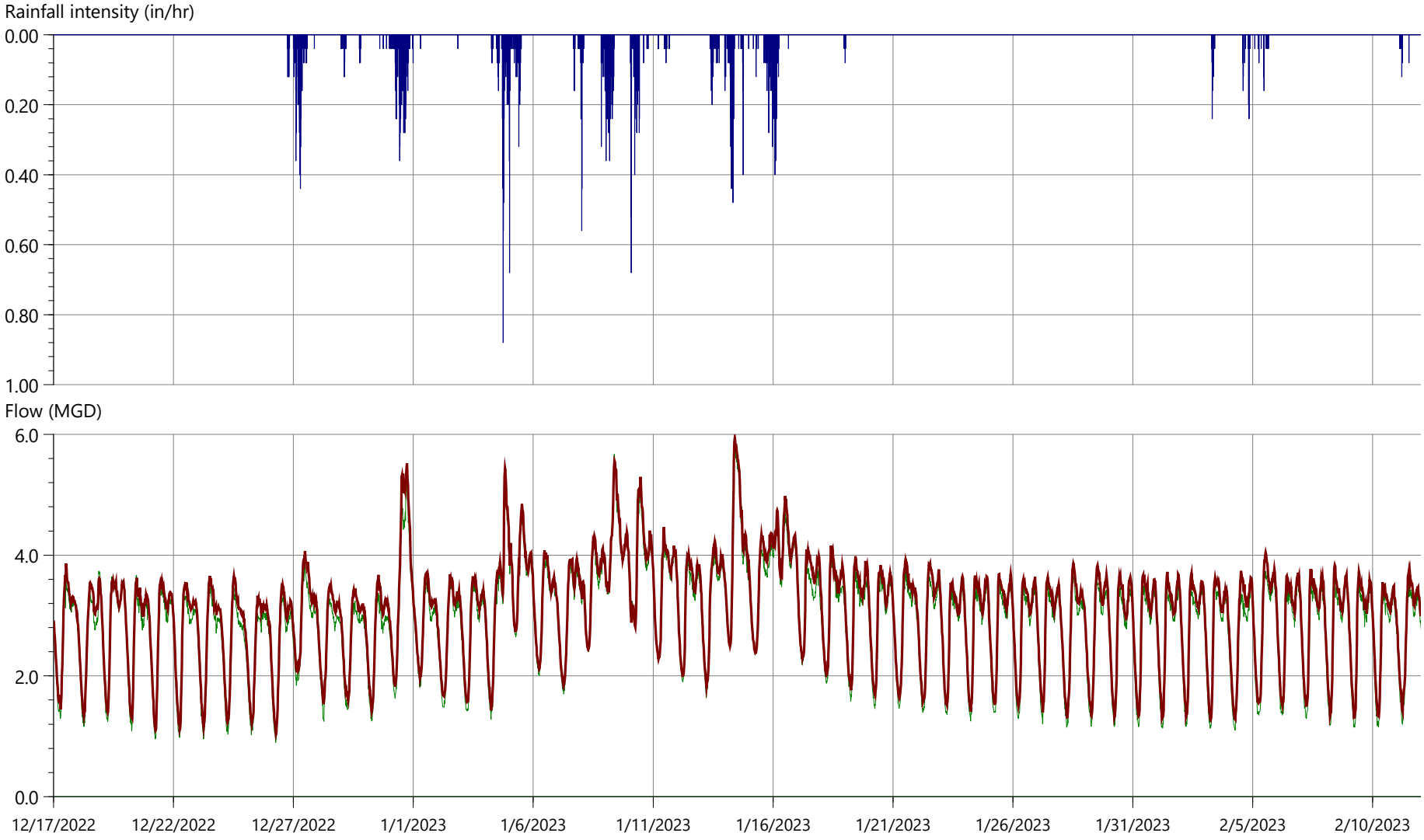
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.210	1.675	51.663
... Data 2023 and 2015				0.632	1.619	59.316

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1, Rainfall Profile: 4



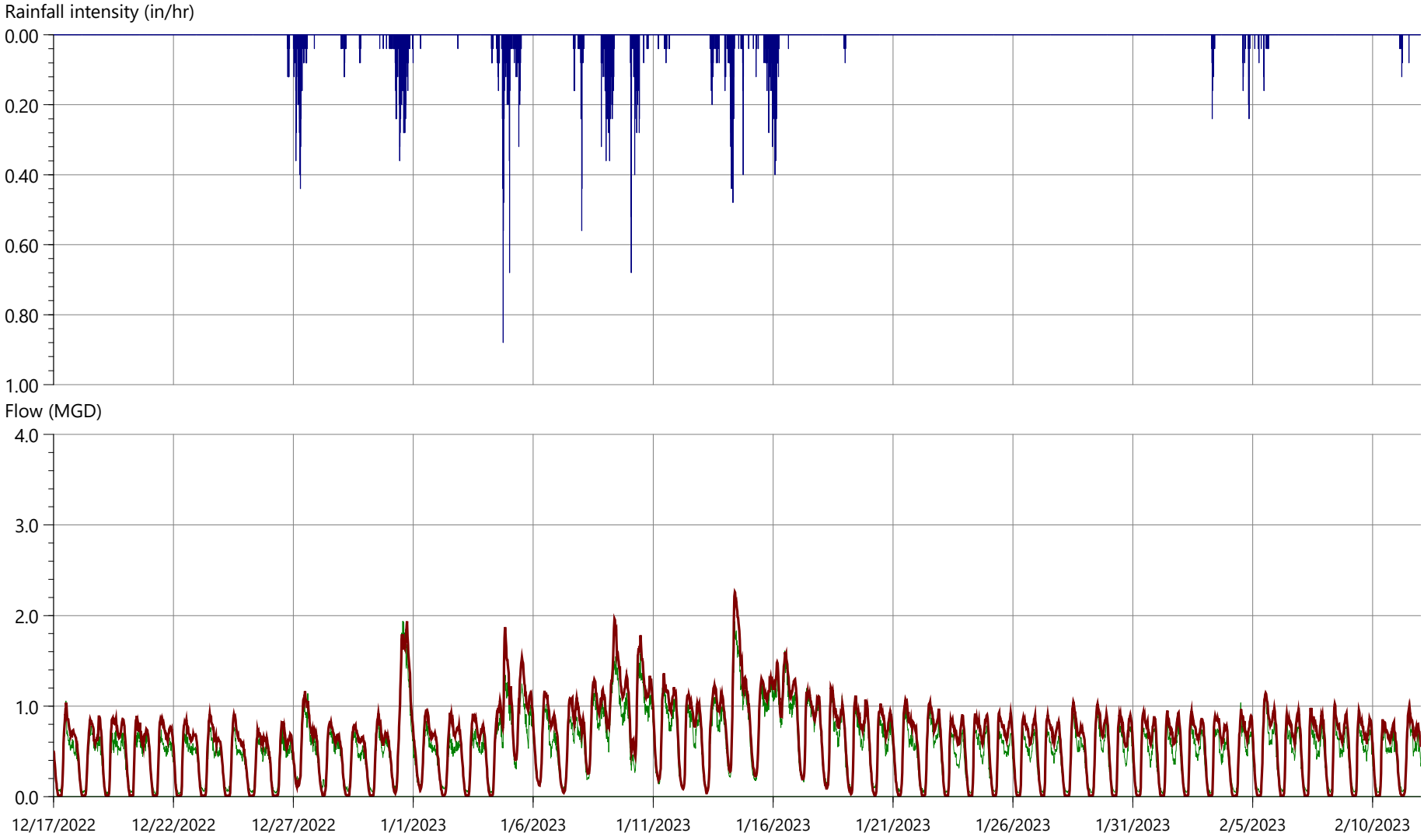
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.385	2.531	82.942
... Data 2023 and 2015				0.440	2.704	73.747

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1, Rainfall Profile: 3



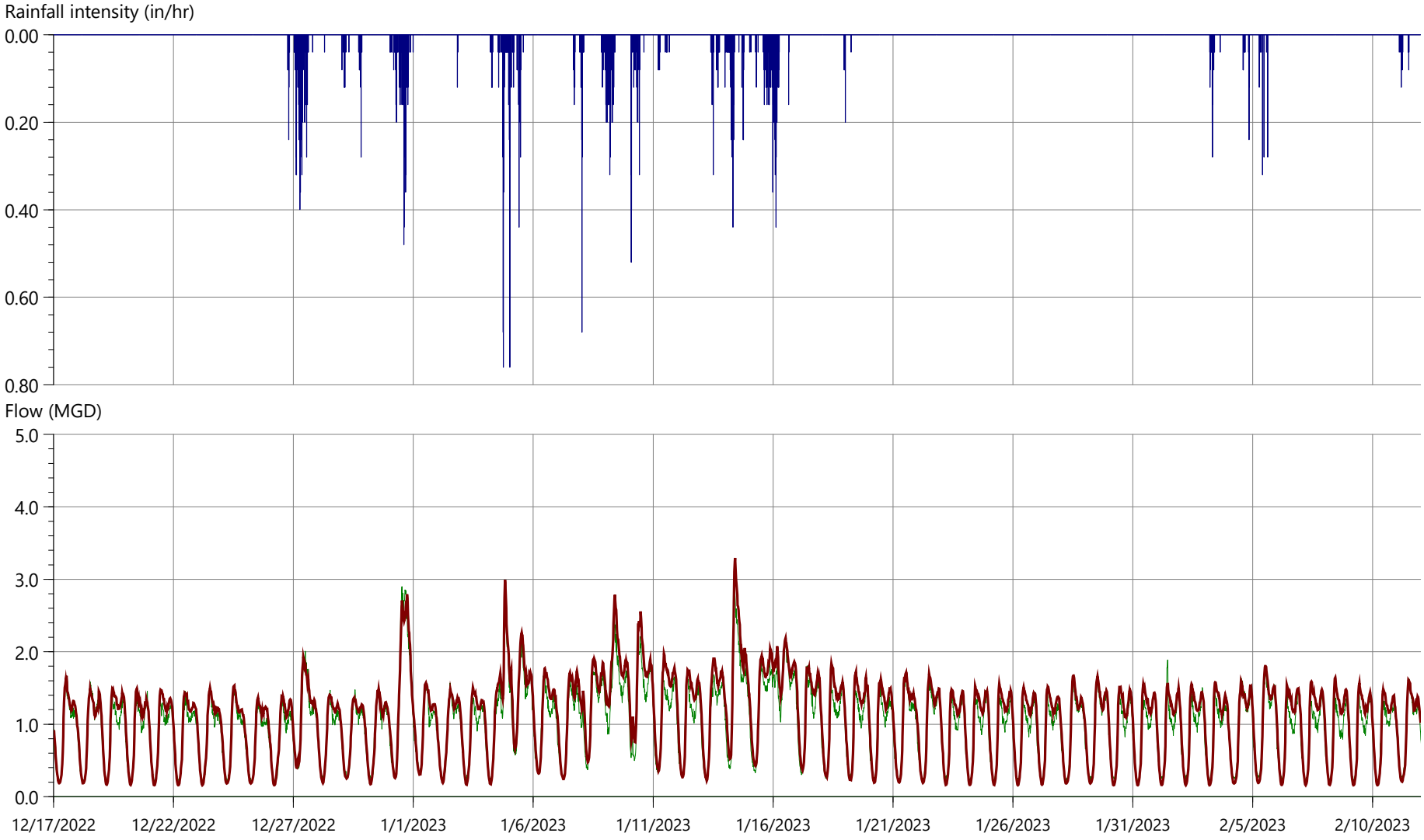
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.899	5.983	166.563
... Data 2023 and 2015				1.039	5.938	175.023

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1, Rainfall Profile: 3



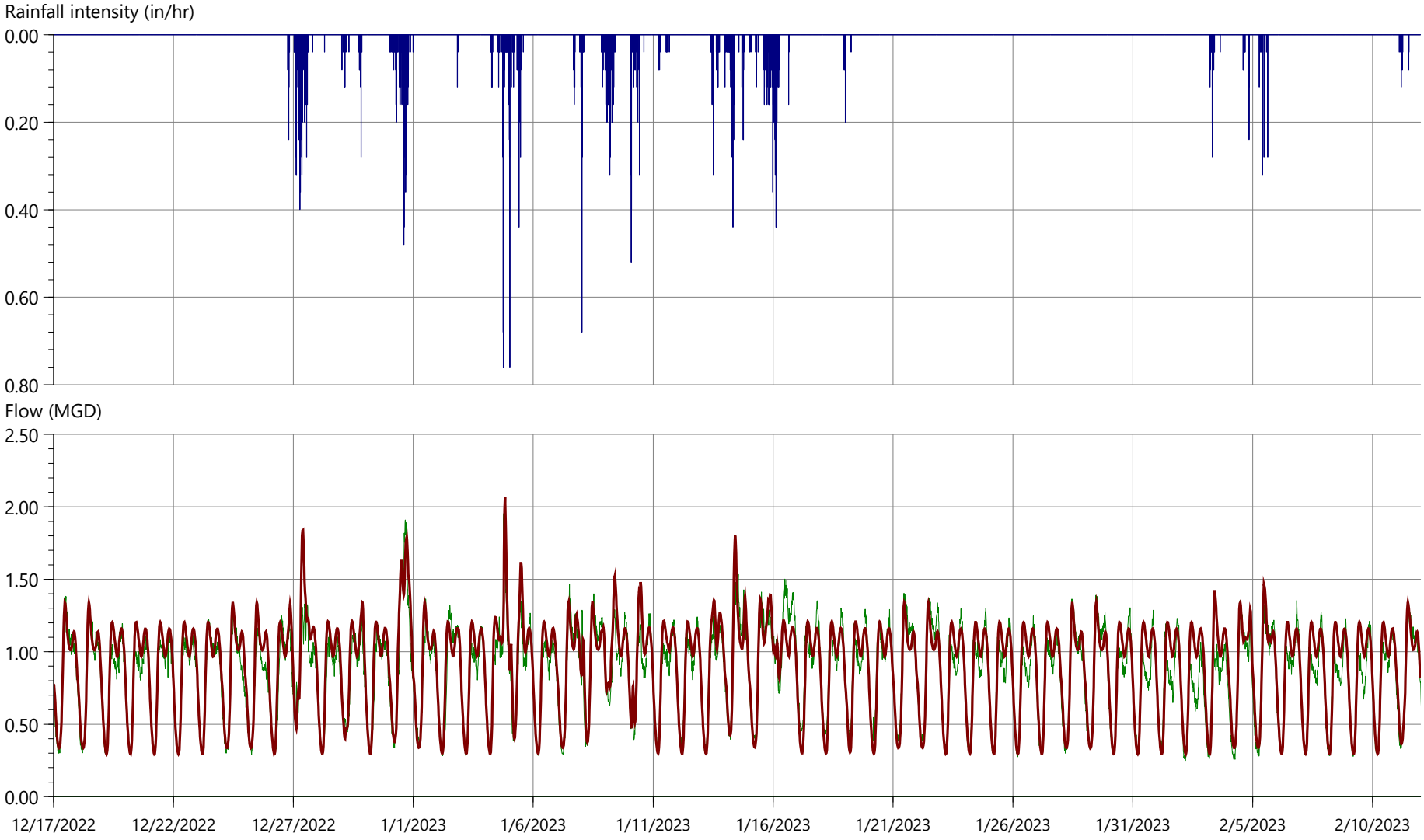
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.022	1.939	30.414
... Data 2023 and 2015				0.009	2.260	35.967

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1, Rainfall Profile: 4



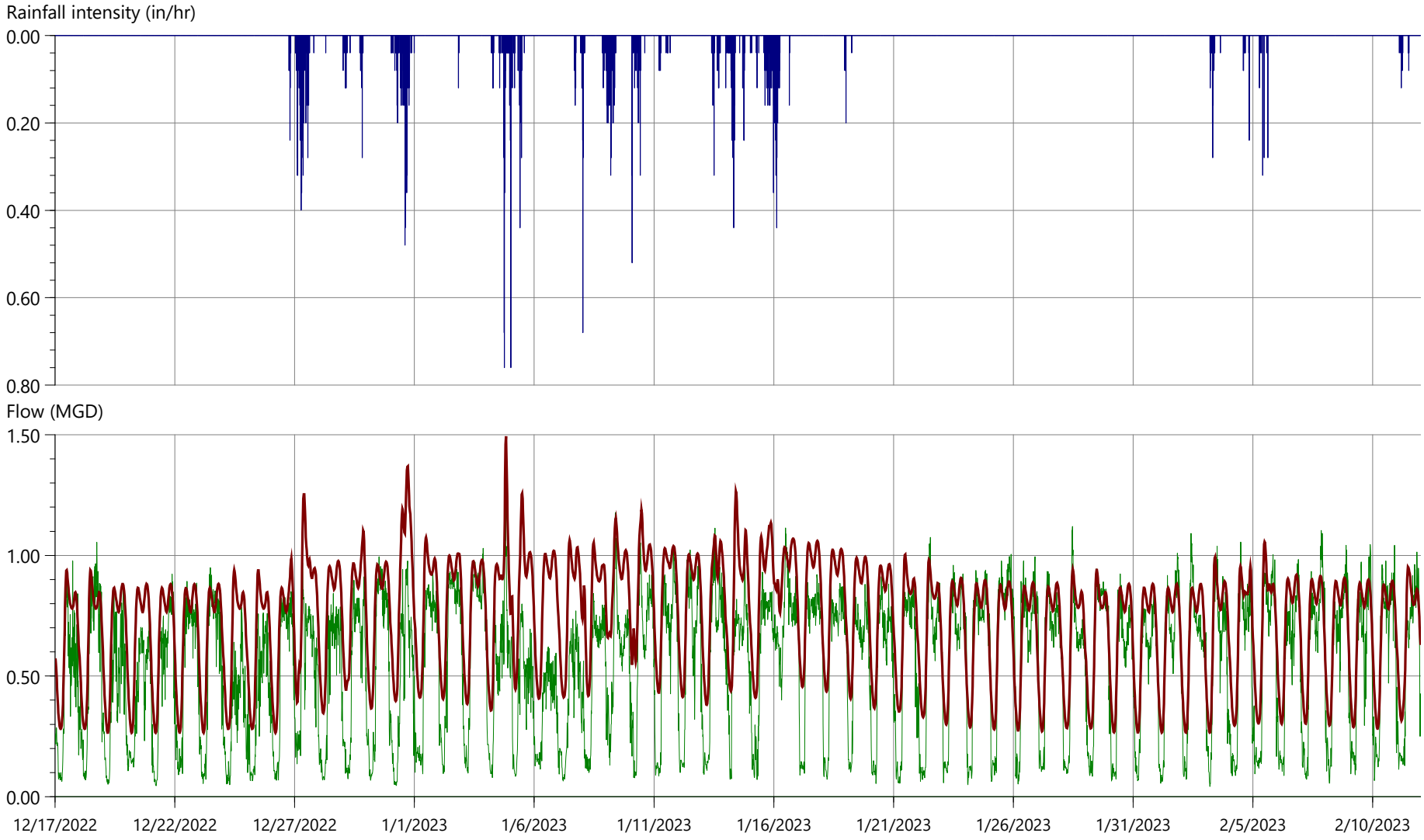
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.199	2.901	57.470
... Data 2023 and 2015				0.158	3.295	62.917

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1, Rainfall Profile: 4



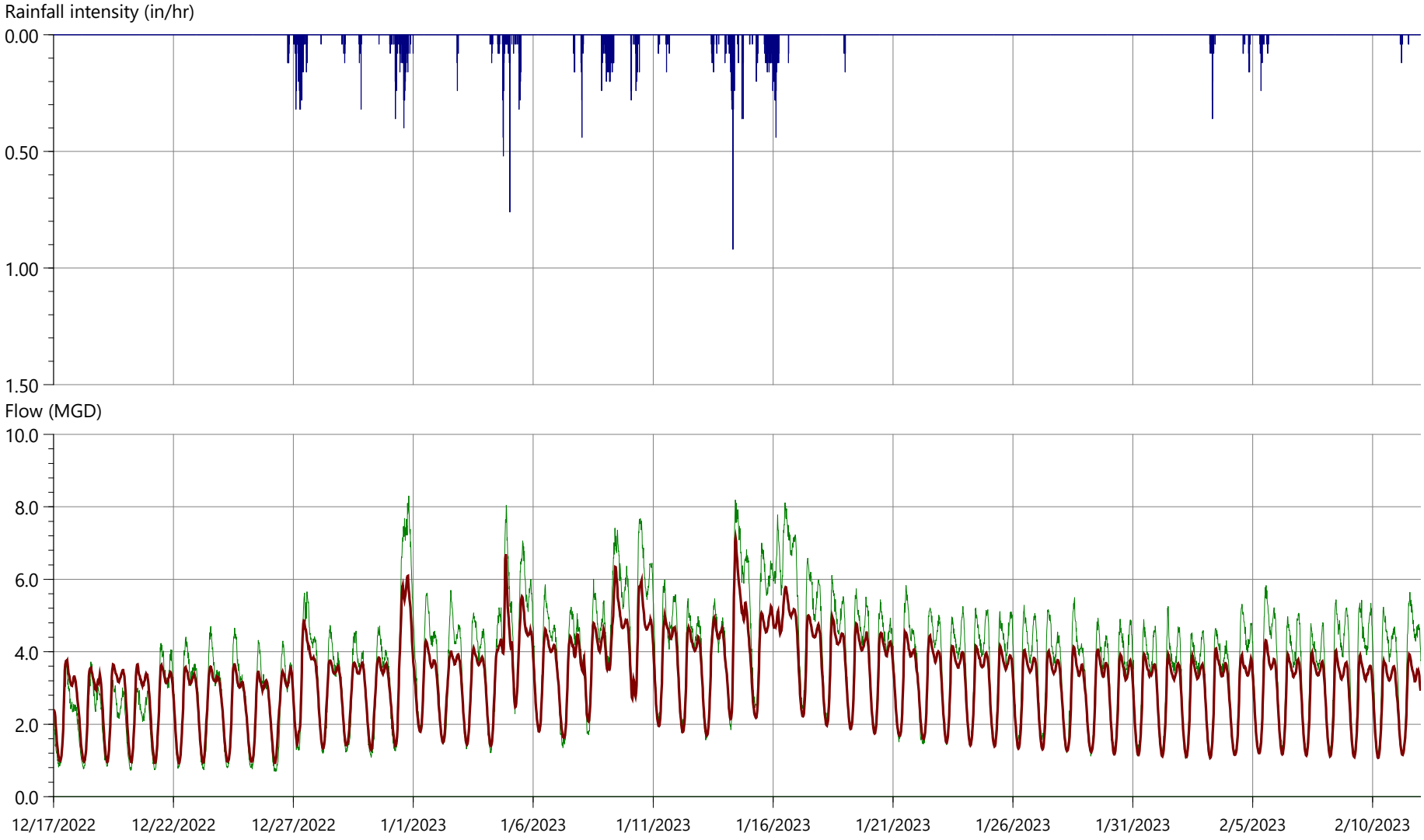
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.249	1.954	48.806
... Data 2023 and 2015				0.294	2.067	51.449

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1, Rainfall Profile: 4



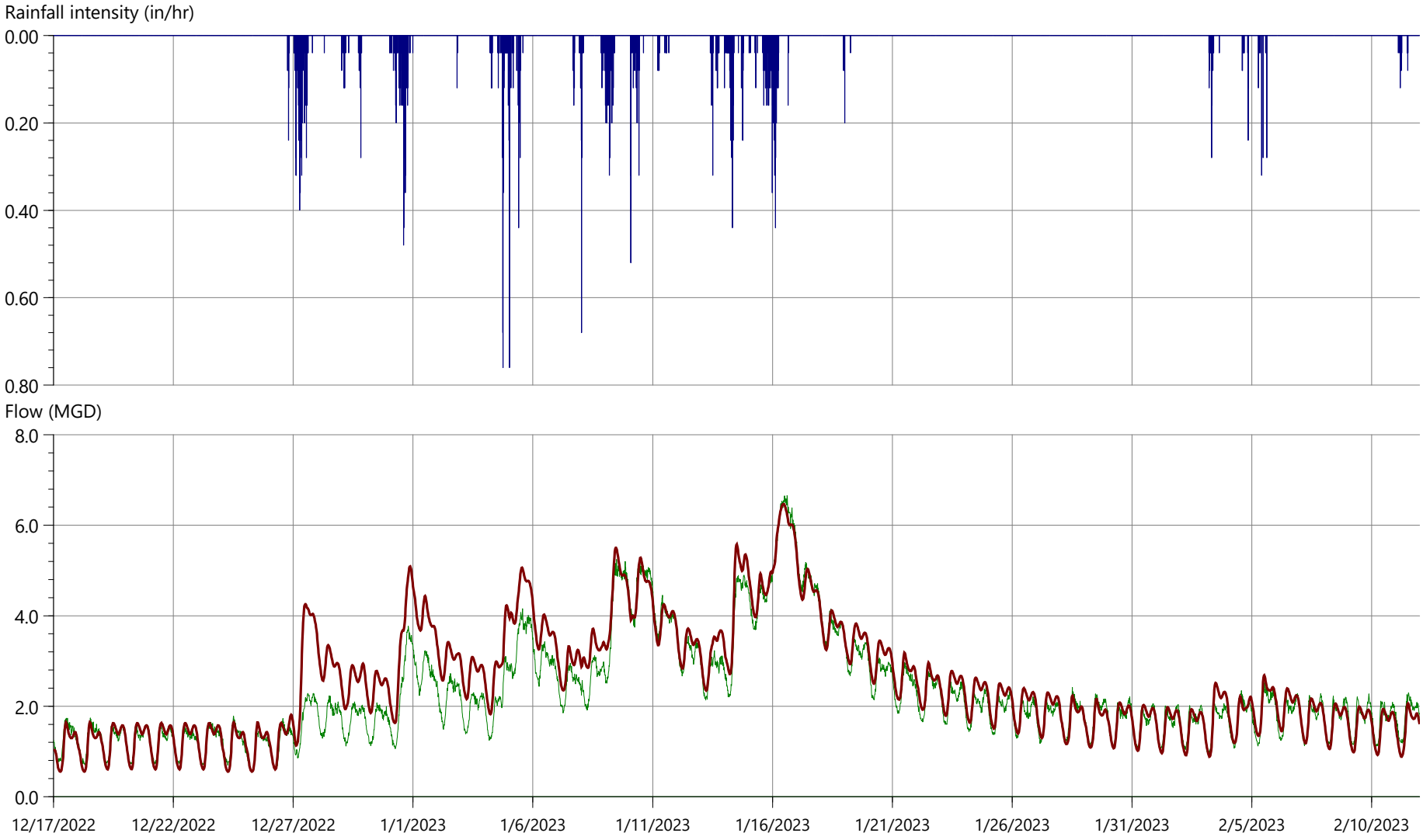
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.043	1.224	31.114
... Data 2023 and 2015				0.265	1.494	42.122

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1, Rainfall Profile: 2



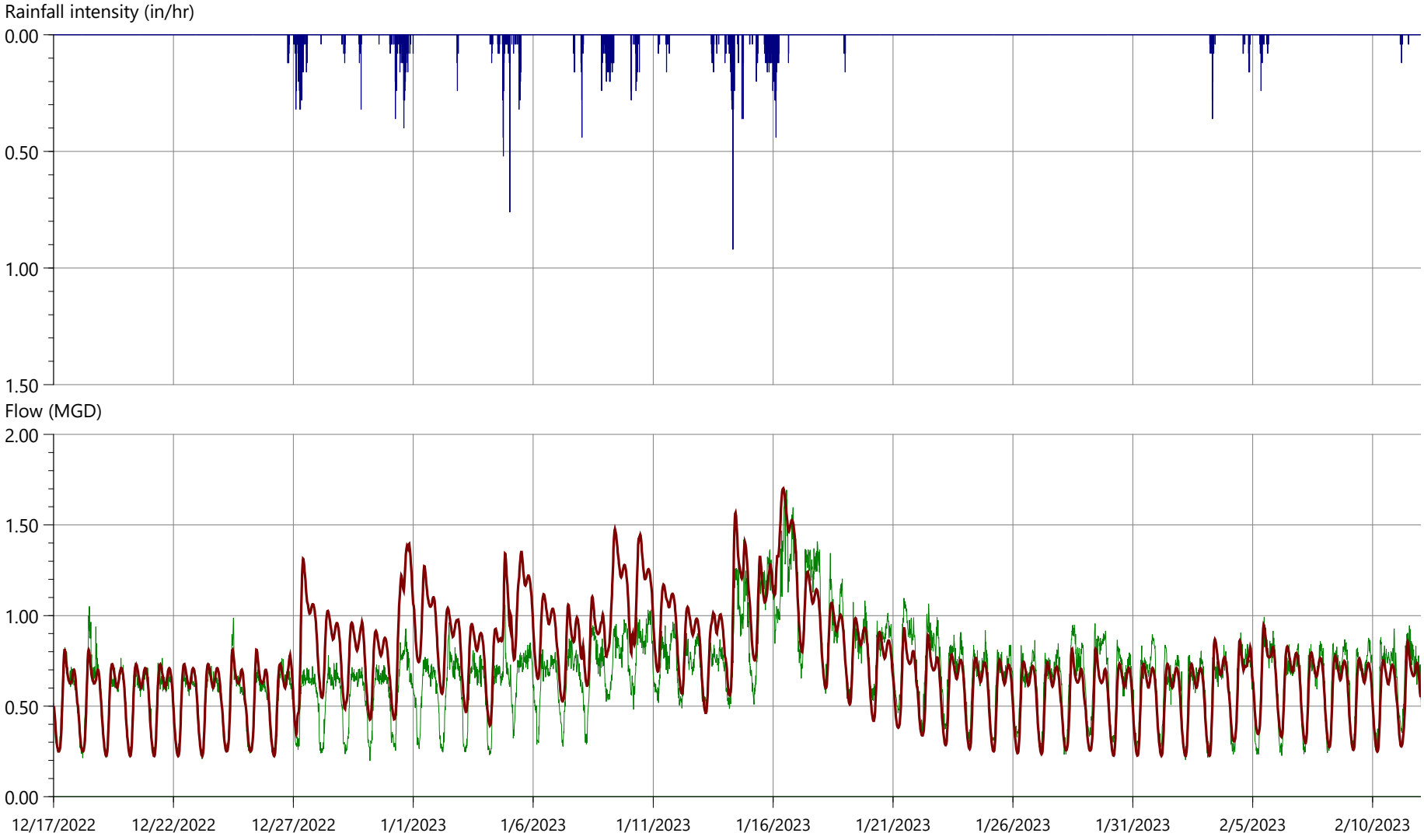
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.701	8.304	207.686
... Data 2023 and 2015				0.928	7.143	182.287

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1, Rainfall Profile: 4



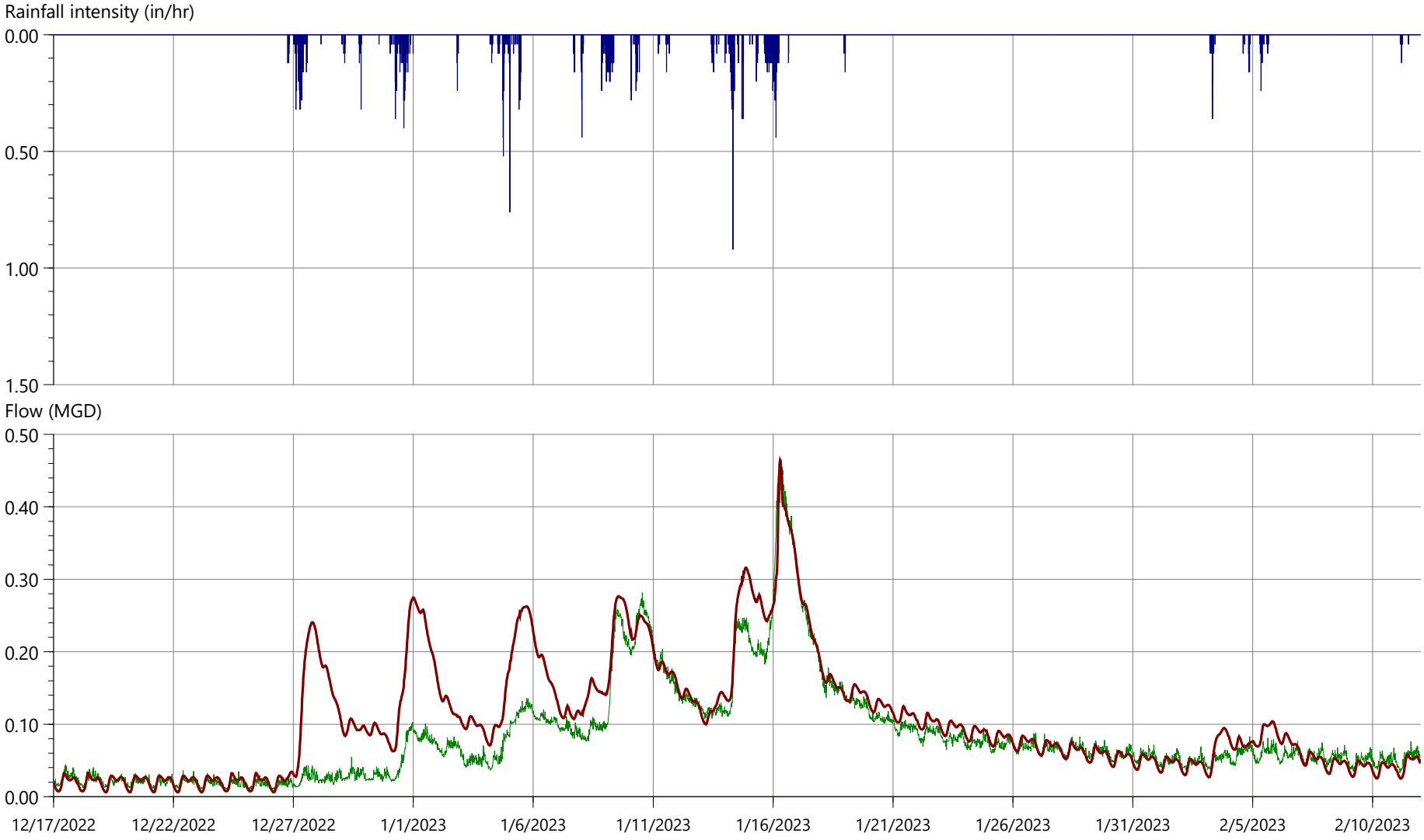
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.540	6.661	130.153
... Data 2023 and 2015				0.555	6.470	144.336

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1, Rainfall Profile: 2



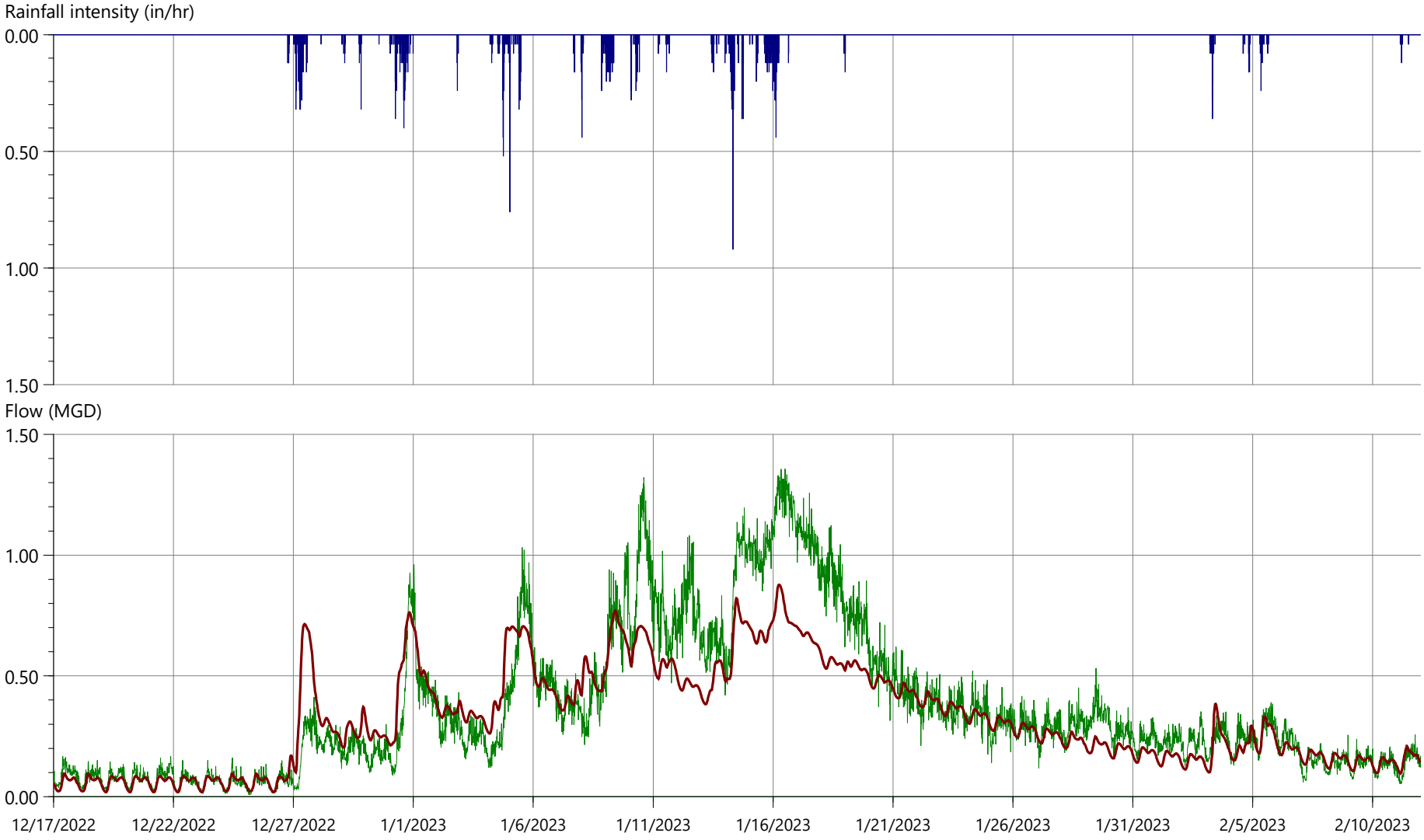
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.200	1.698	38.187
... Data 2023 and 2015				0.224	1.702	41.875

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1, Rainfall Profile: 2



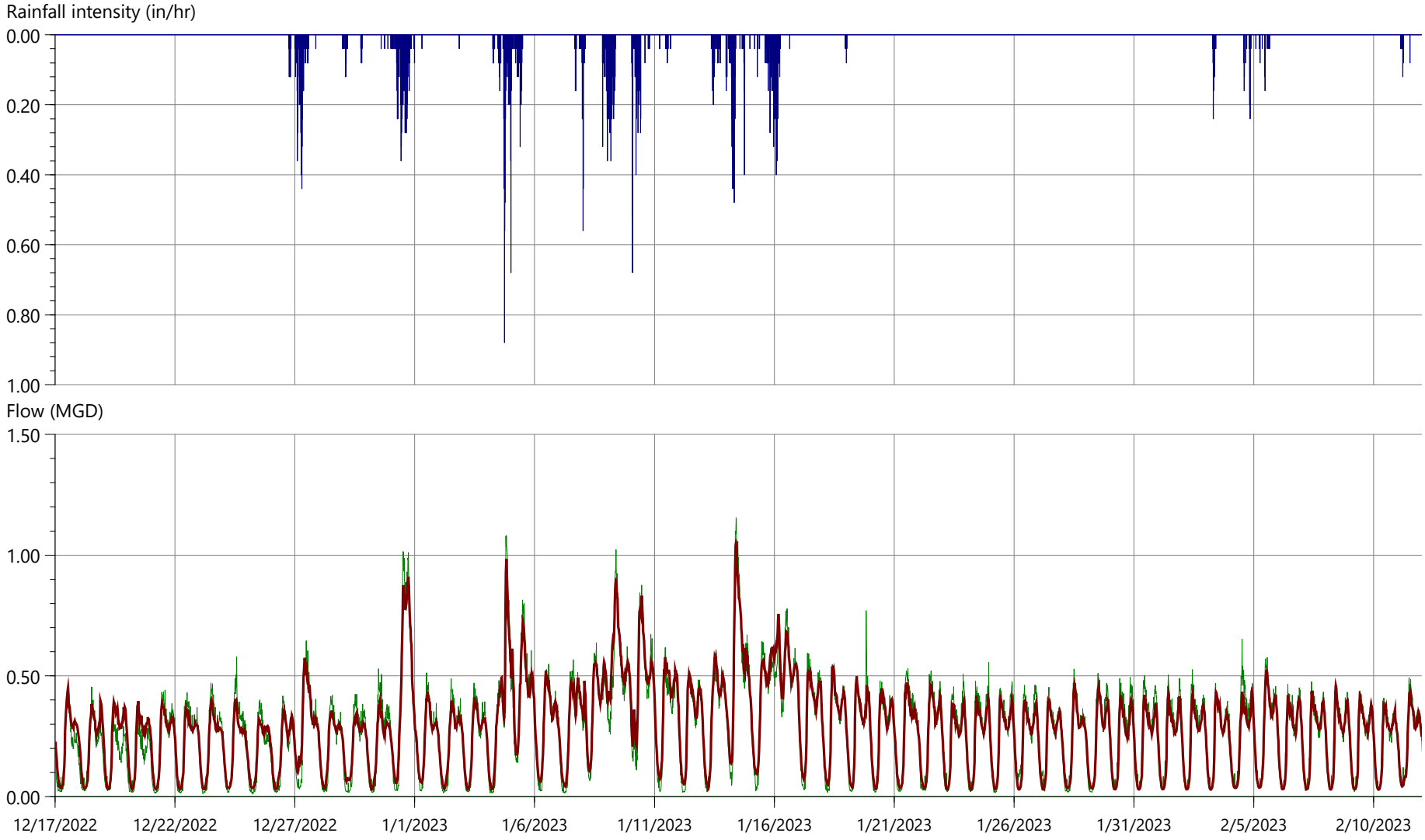
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.009	0.465	4.696
... Data 2023 and 2015				0.006	0.464	5.989

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1, Rainfall Profile: 2



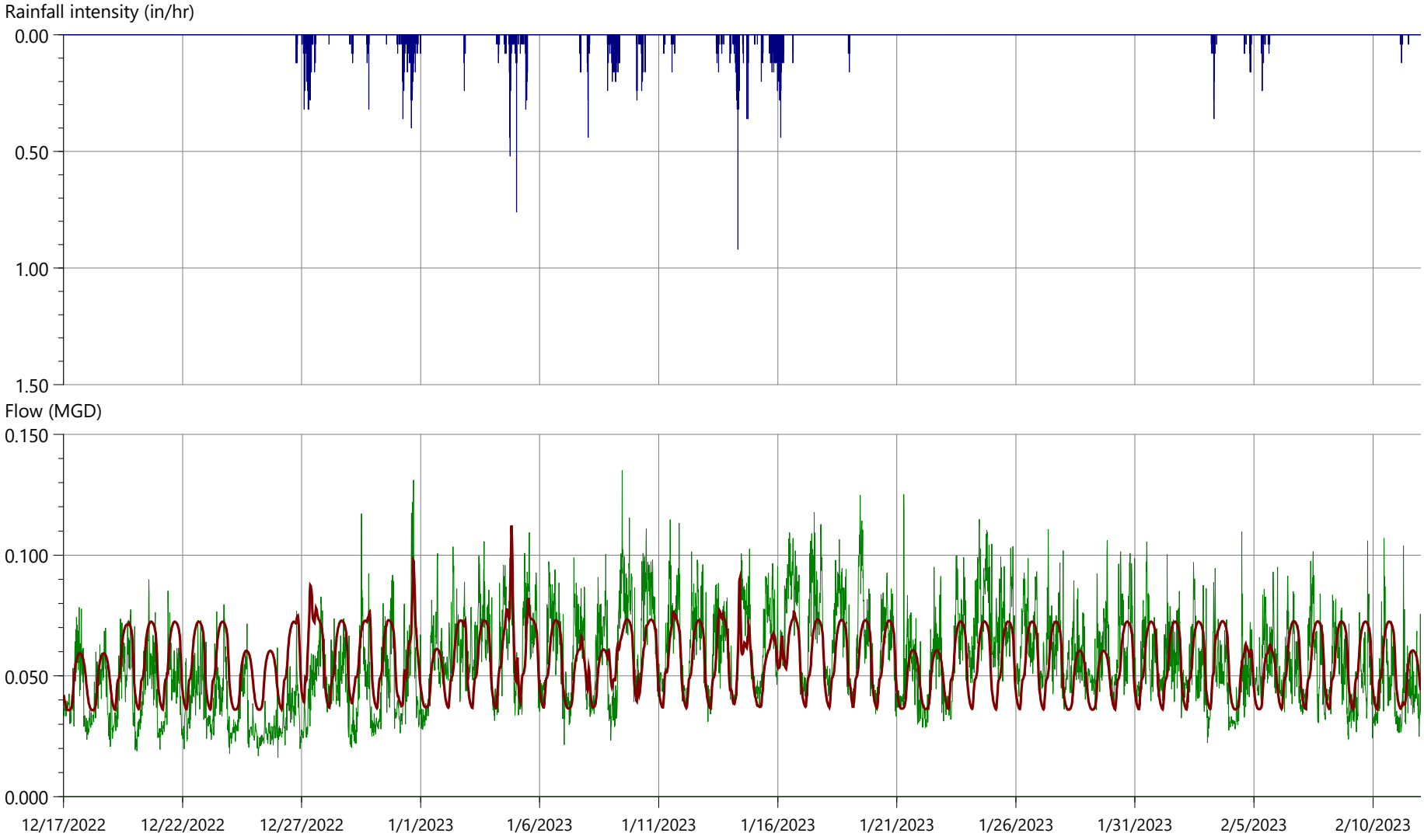
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.009	1.357	21.009
... Data 2023 and 2015				0.019	0.877	18.369

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1, Rainfall Profile: 3



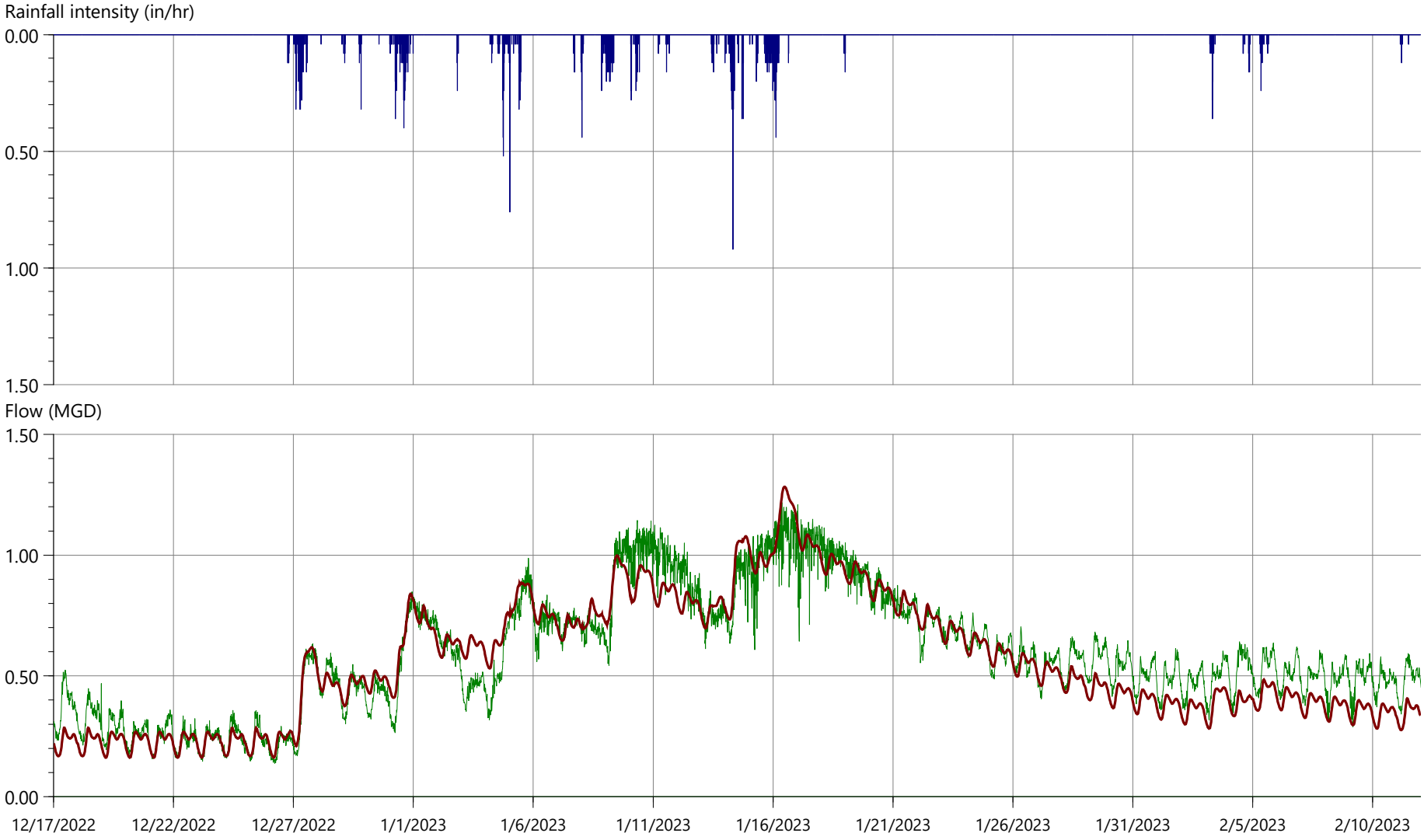
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.010	1.155	16.332
... Data 2023 and 2015				0.030	1.052	16.361

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.016	0.135	3.157
... Data 2023 and 2015				0.036	0.112	3.179

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1, Rainfall Profile: 2



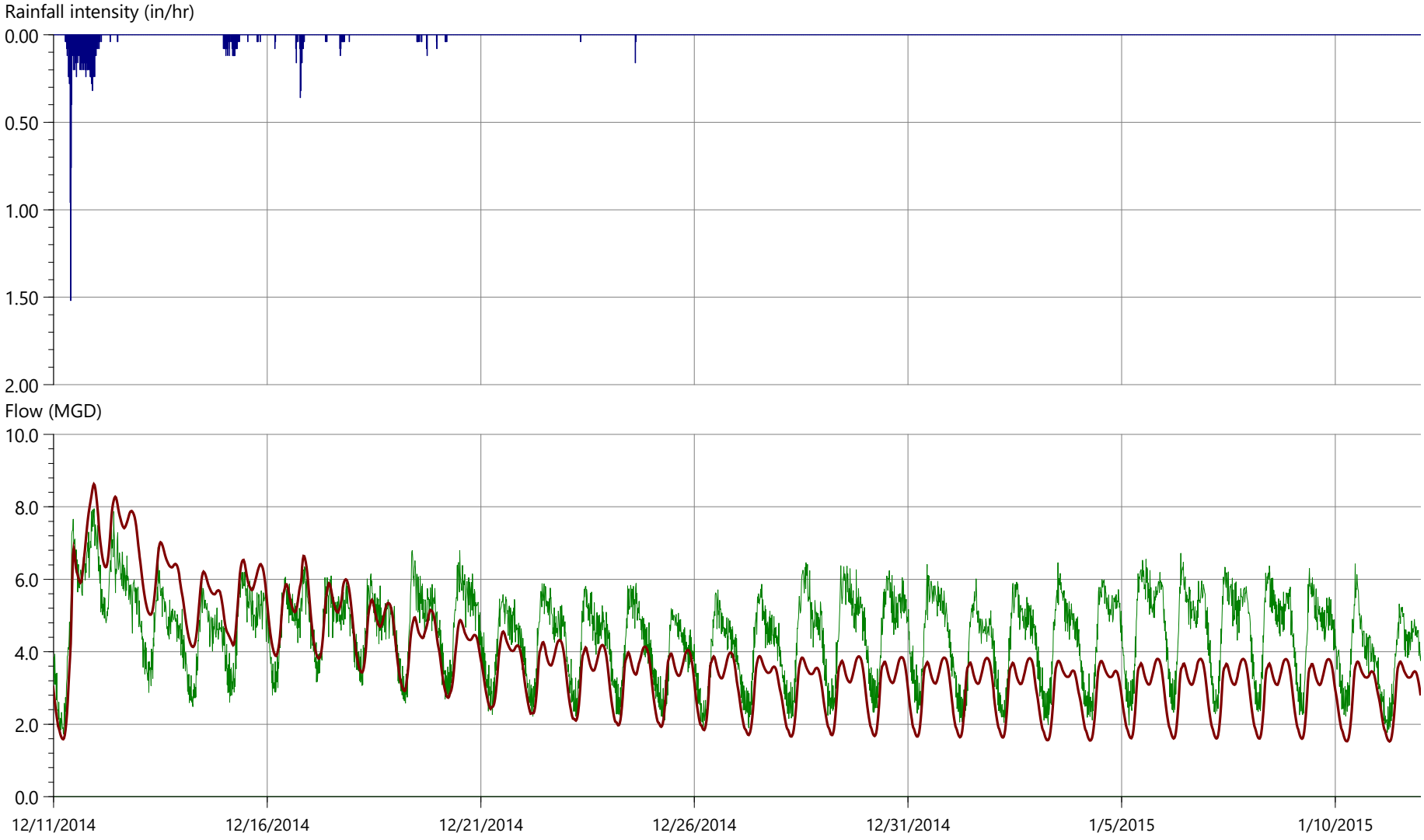
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.138	1.227	33.687
... Data 2023 and 2015				0.162	1.283	31.984

Wet Weather Flow Calibration Plots
Modeled vs. 2014-2015 Metered Flows

(*assumes normal settings at Homestead/Lawrence gate structure*)

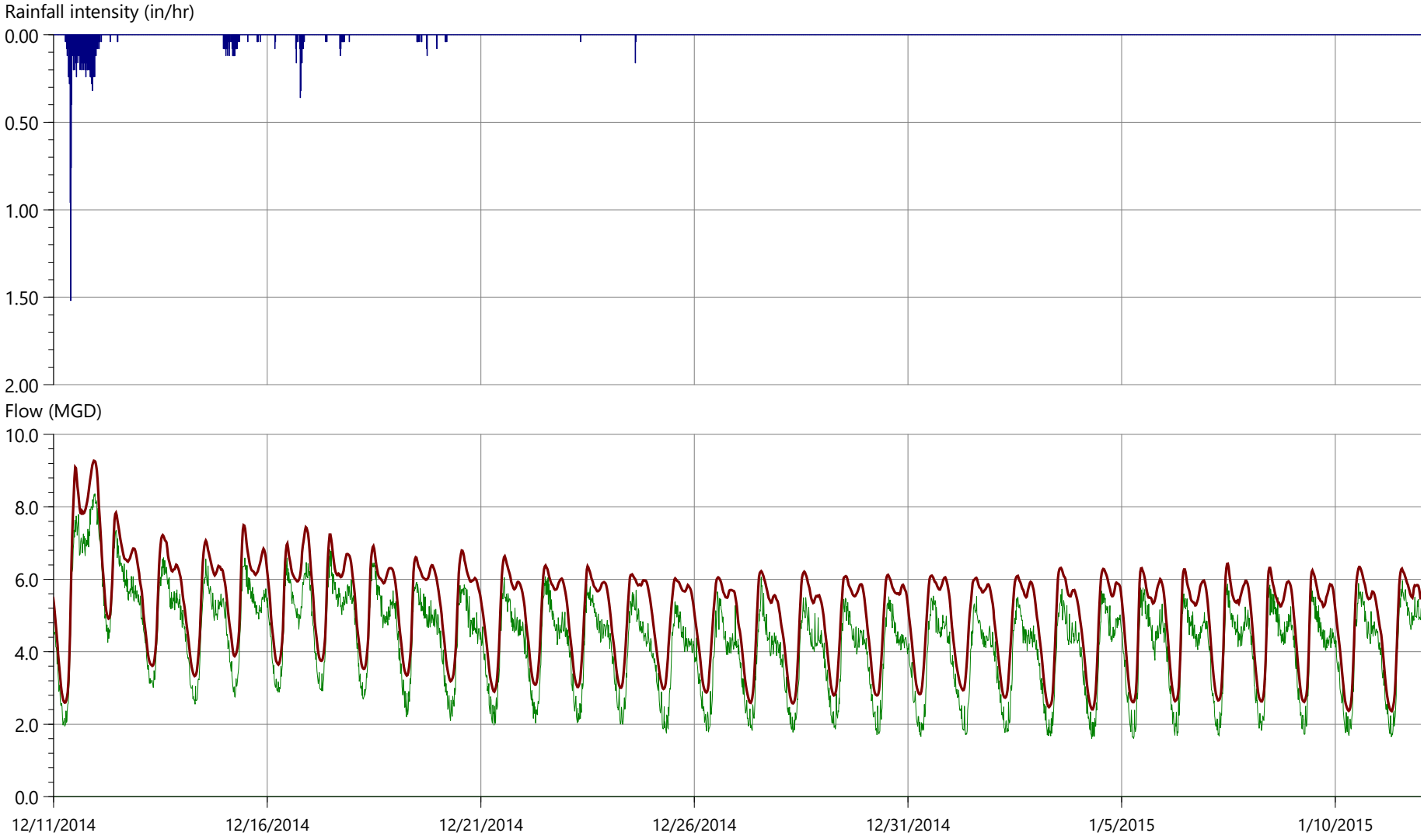
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1, Rainfall Profile: 1



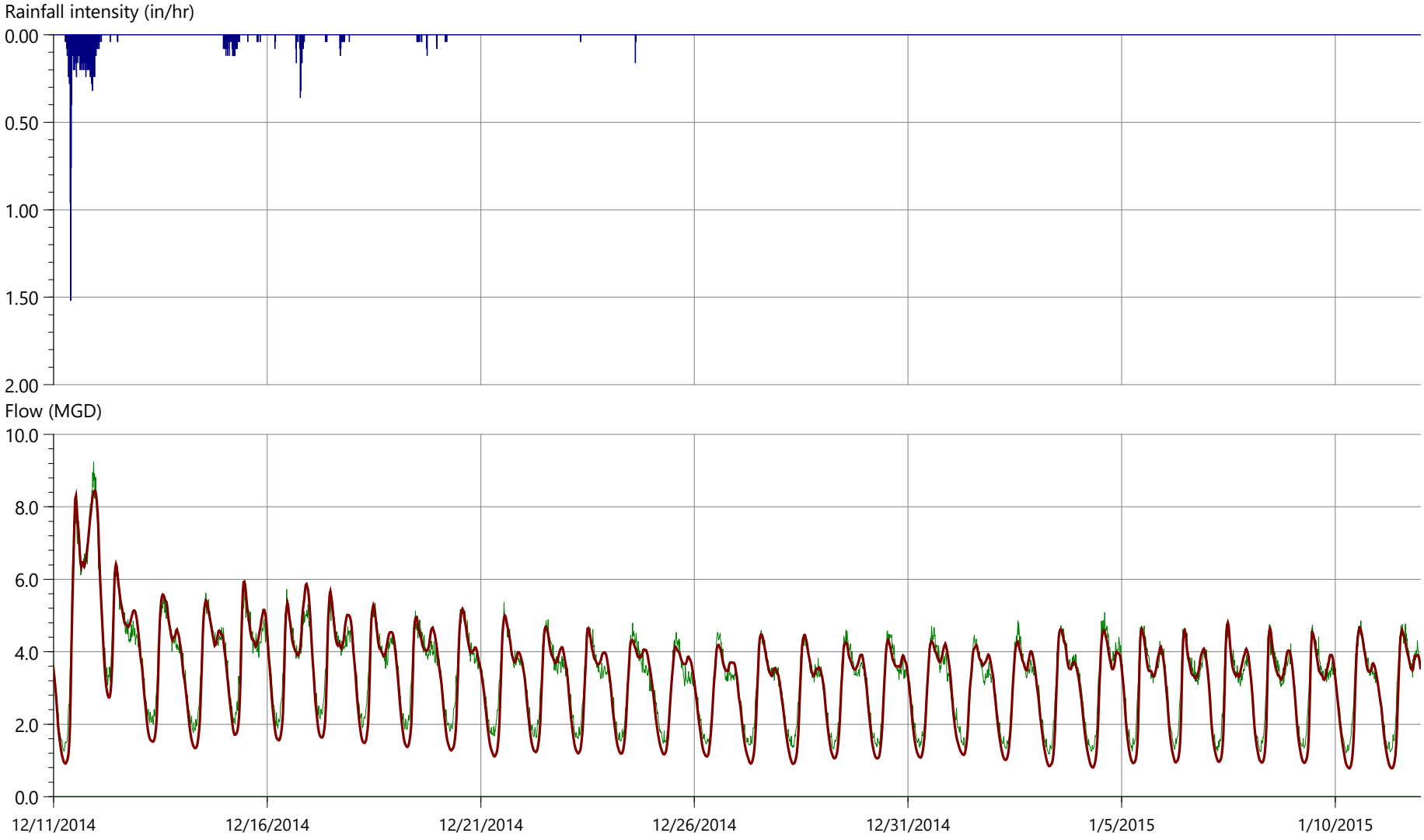
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				1.726	7.950	144.336
... Data 2023 and 2015				1.525	8.628	119.999

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1, Rainfall Profile: 1



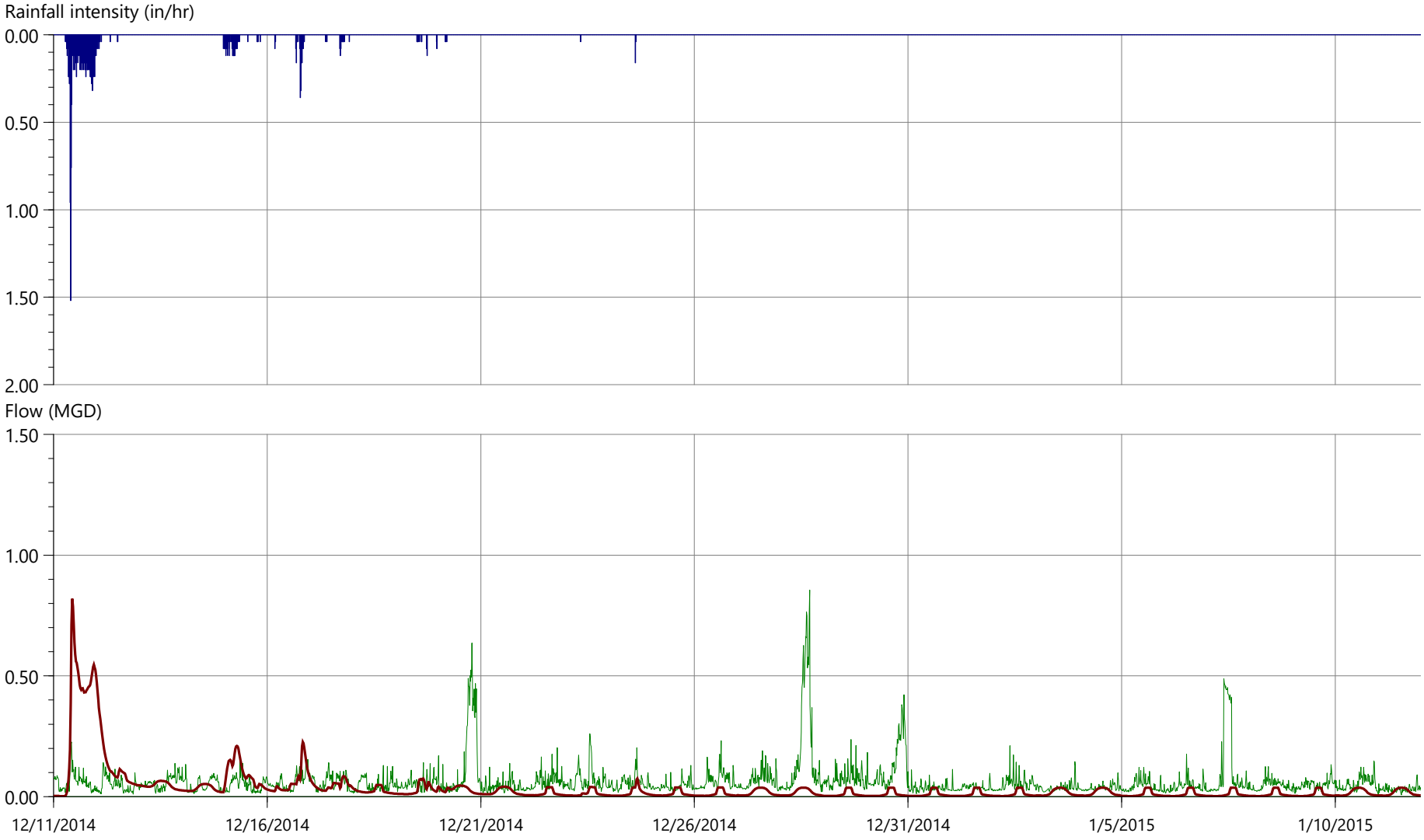
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				1.605	8.363	135.825
... Data 2023 and 2015				2.362	9.269	164.340

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1, Rainfall Profile: 1



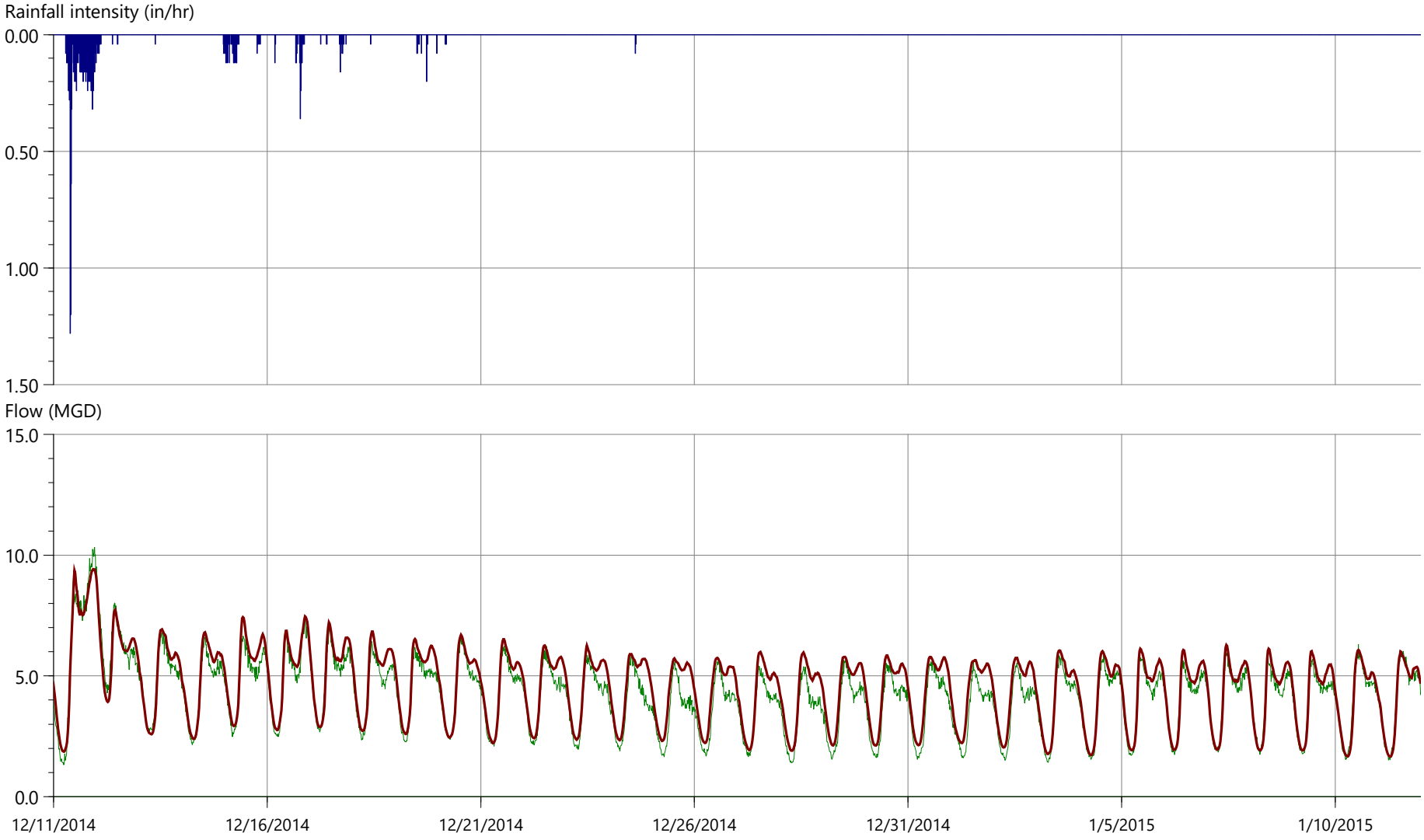
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				1.179	9.236	108.117
... Data 2023 and 2015				0.782	8.445	103.228

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1, Rainfall Profile: 1



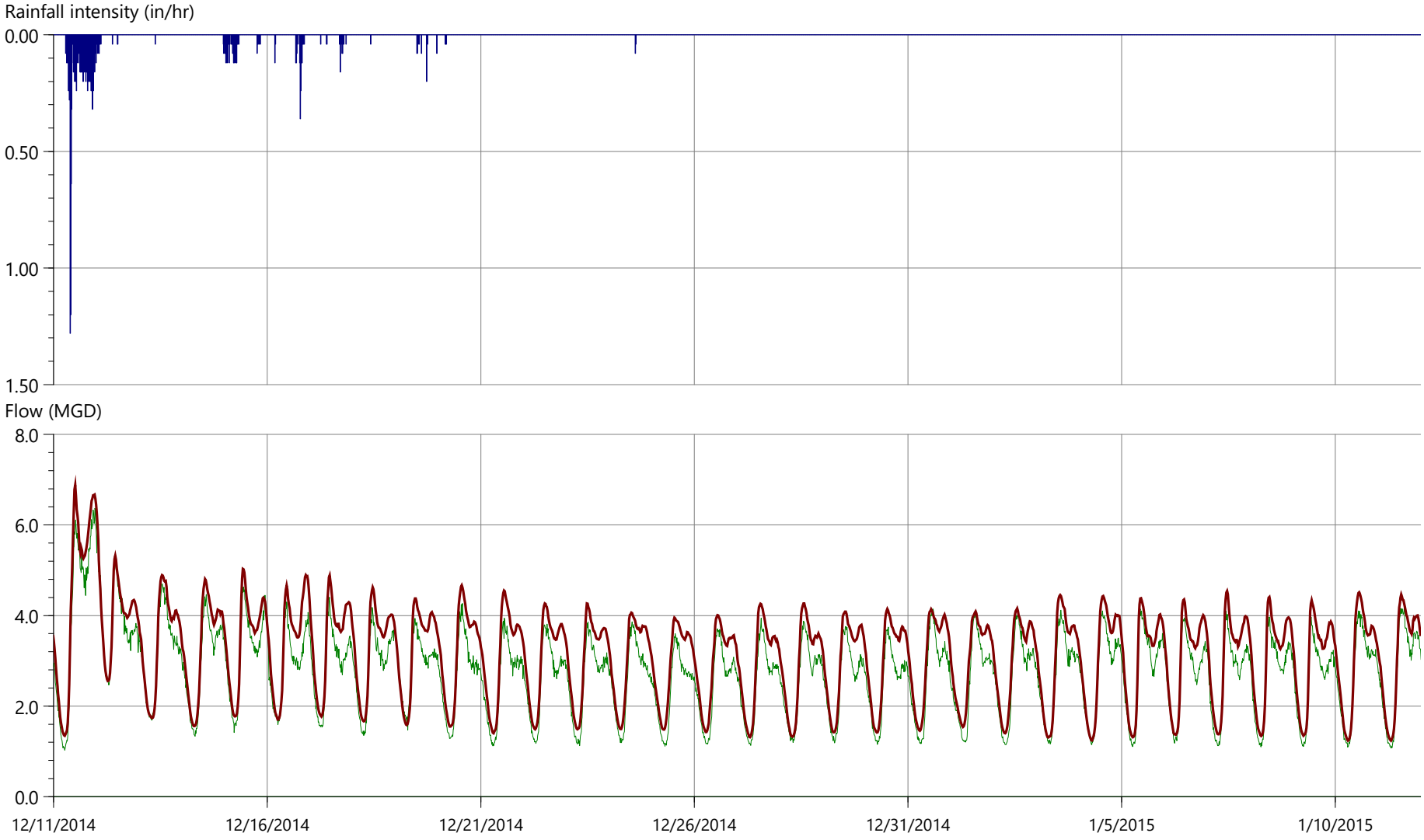
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				0.007	0.856	2.021
... Data 2023 and 2015				0.003	0.819	1.125

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1, Rainfall Profile: 2



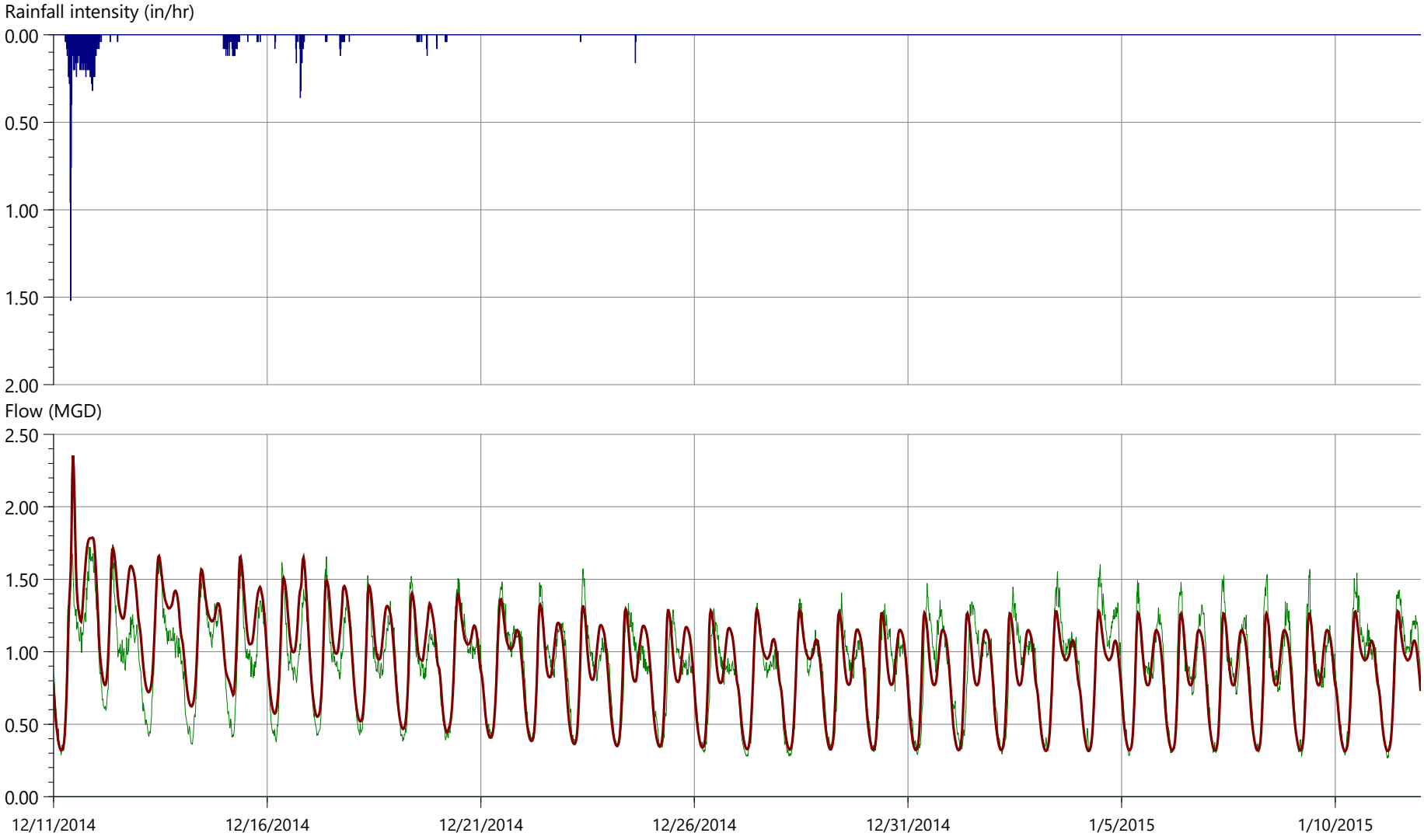
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				1.319	10.323	135.549
... Data 2023 and 2015				1.658	9.423	148.110

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1, Rainfall Profile: 2



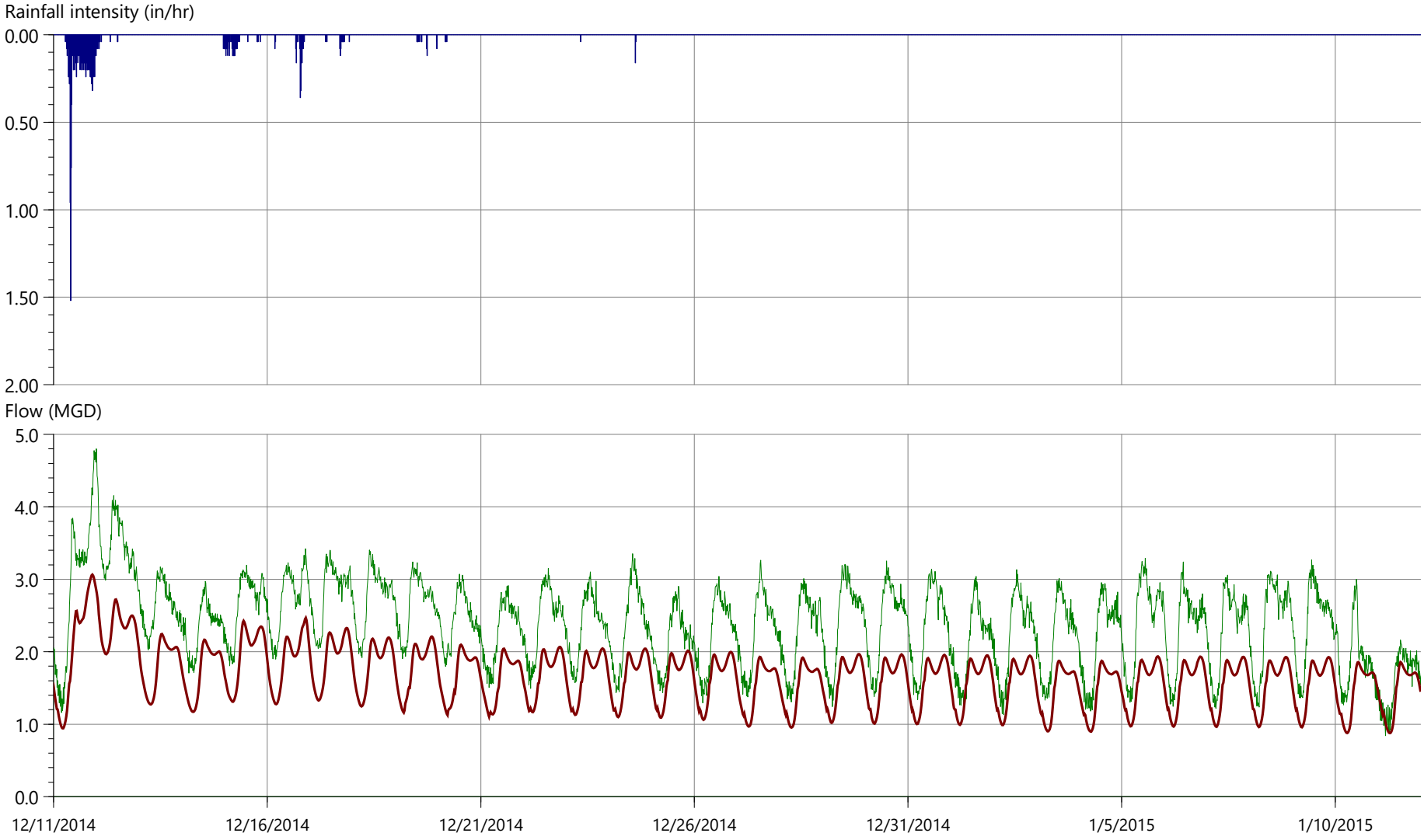
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				1.026	6.367	88.800
... Data 2023 and 2015				1.234	6.879	102.203

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1, Rainfall Profile: 1



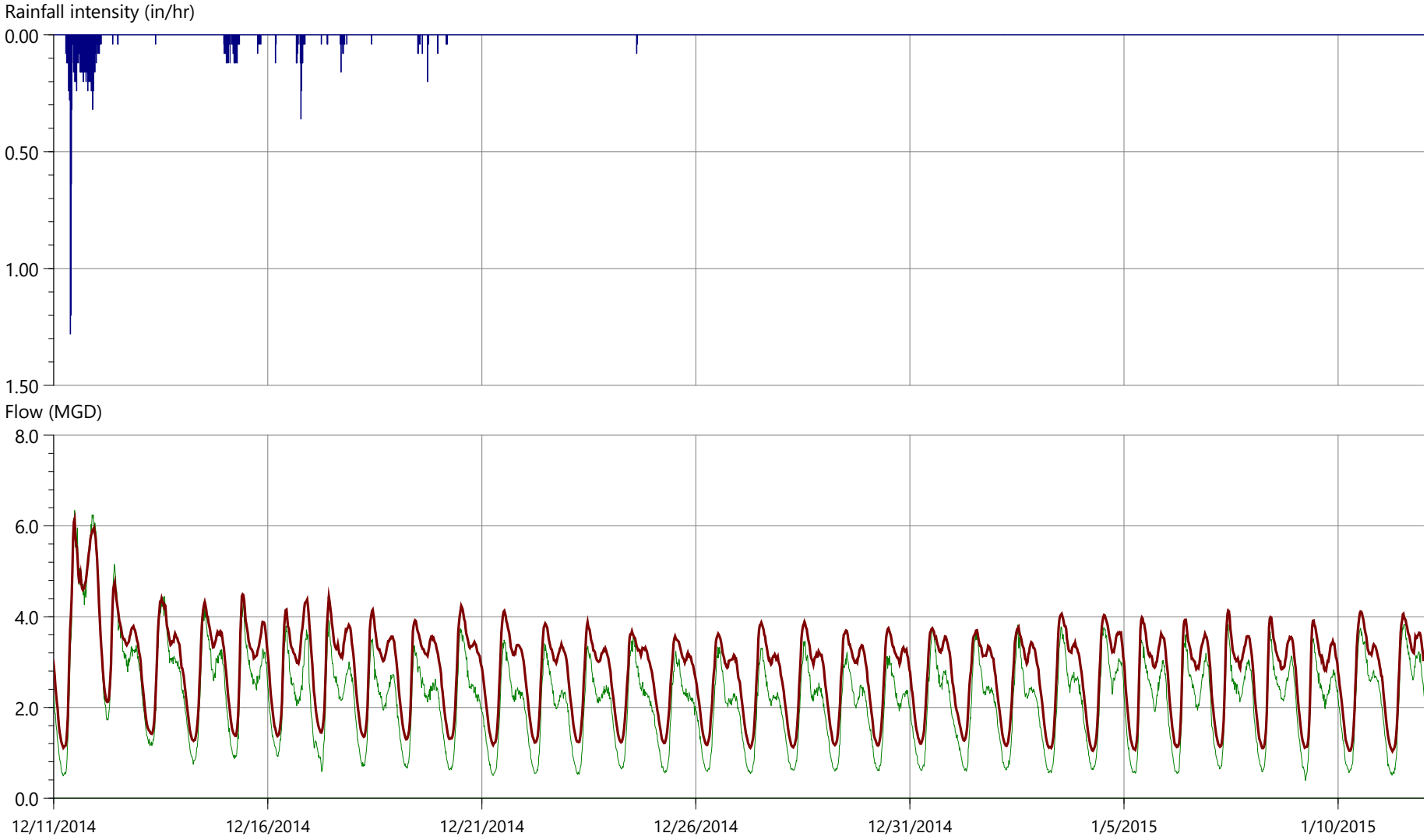
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				0.266	1.740	29.016
... Data 2023 and 2015				0.315	2.354	29.534

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1, Rainfall Profile: 1



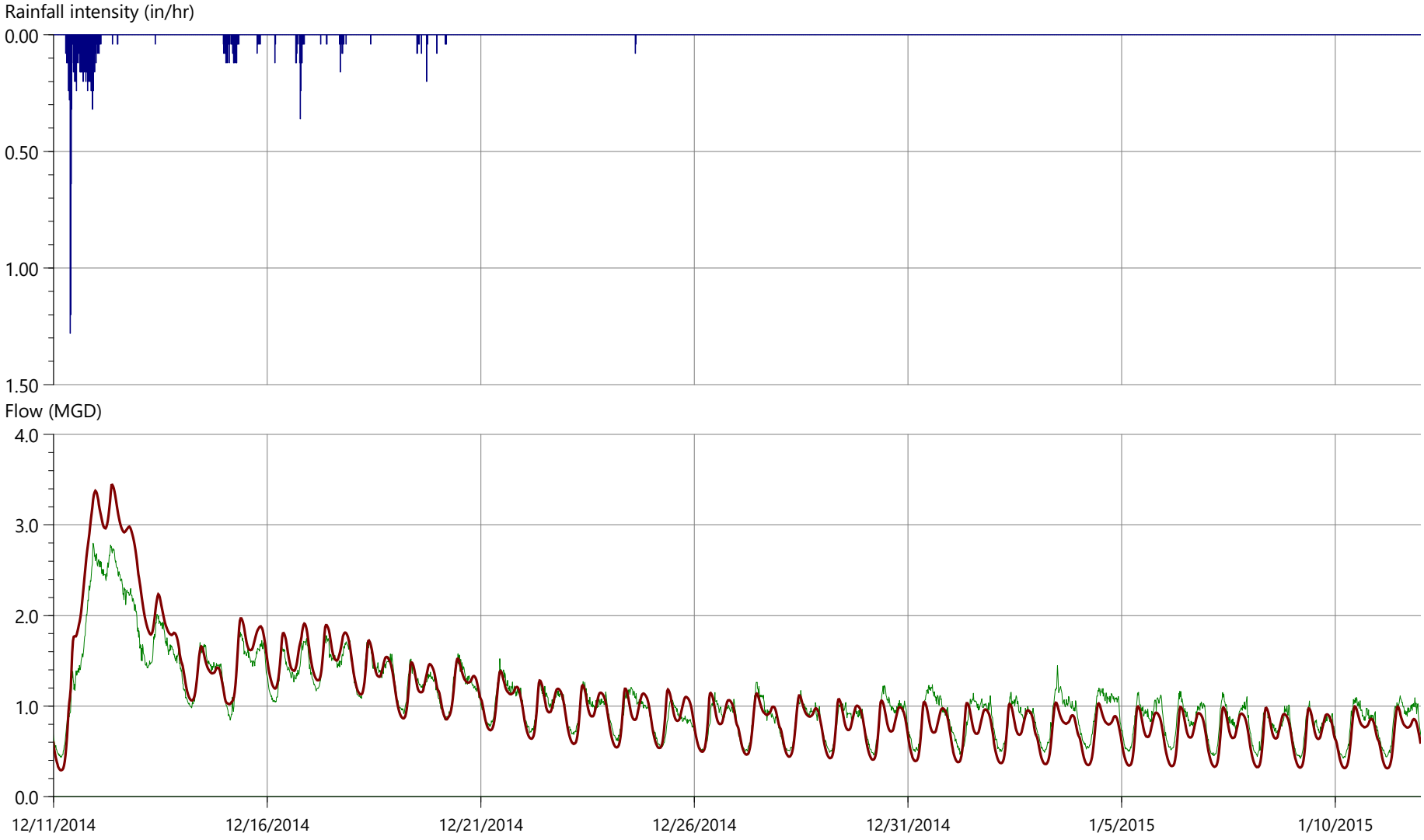
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				0.840	4.800	76.804
... Data 2023 and 2015				0.877	3.064	53.414

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S62-48.1, Rainfall Profile: 2



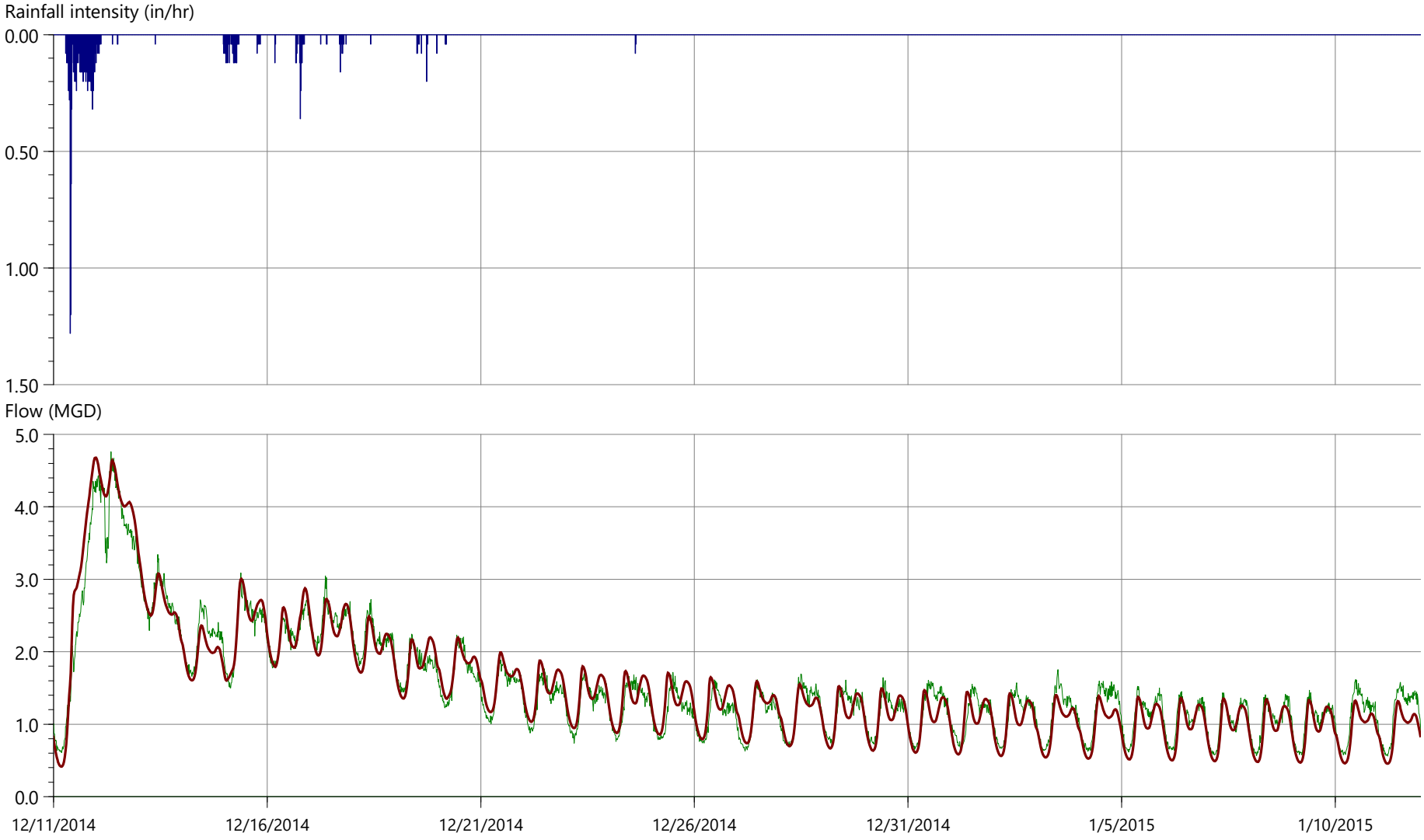
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.388	6.343	70.300
... Data 2023 and 2015				1.034	6.151	90.221

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1, Rainfall Profile: 2



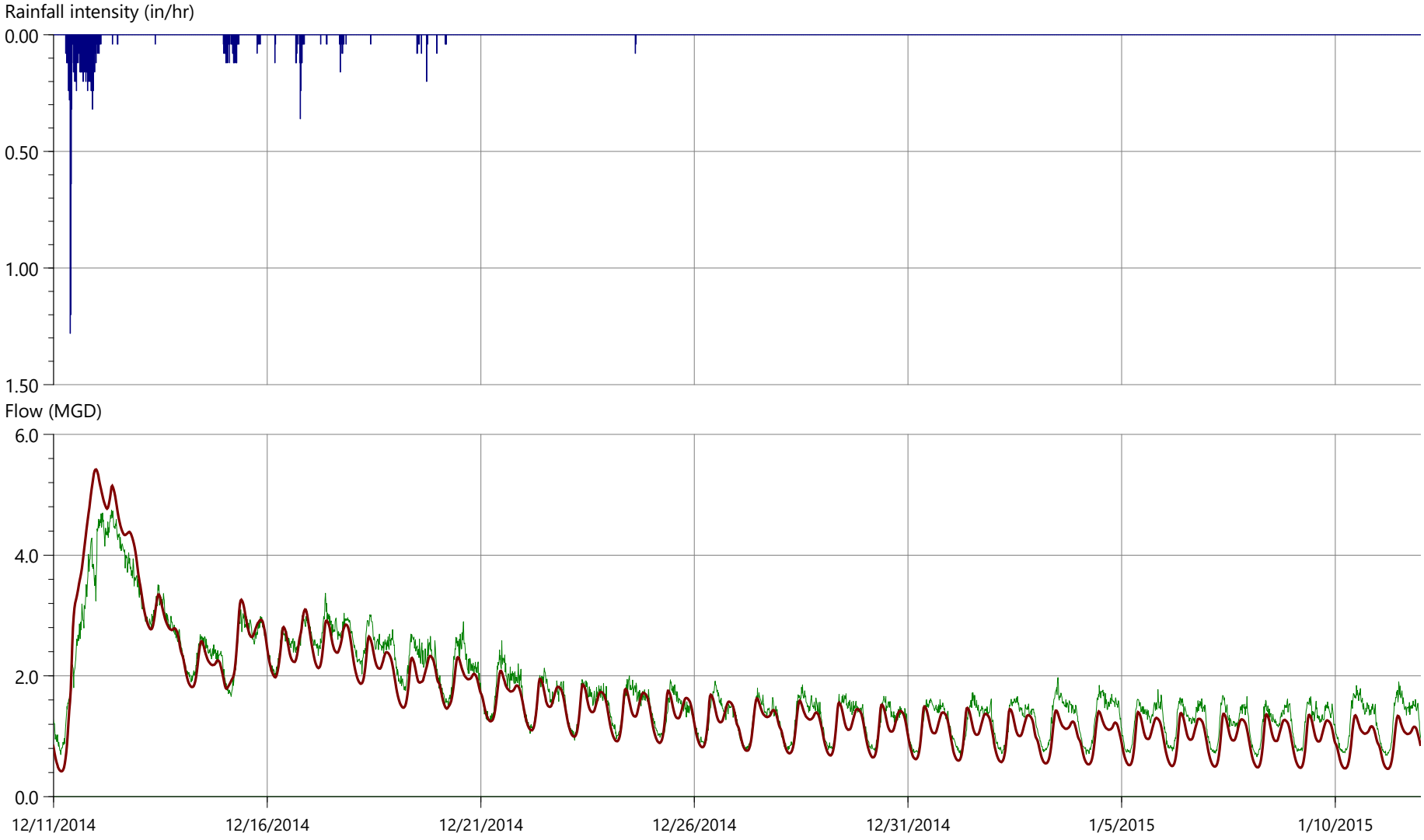
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.423	2.798	33.900
... Data 2023 and 2015				0.292	3.444	33.611

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1, Rainfall Profile: 2



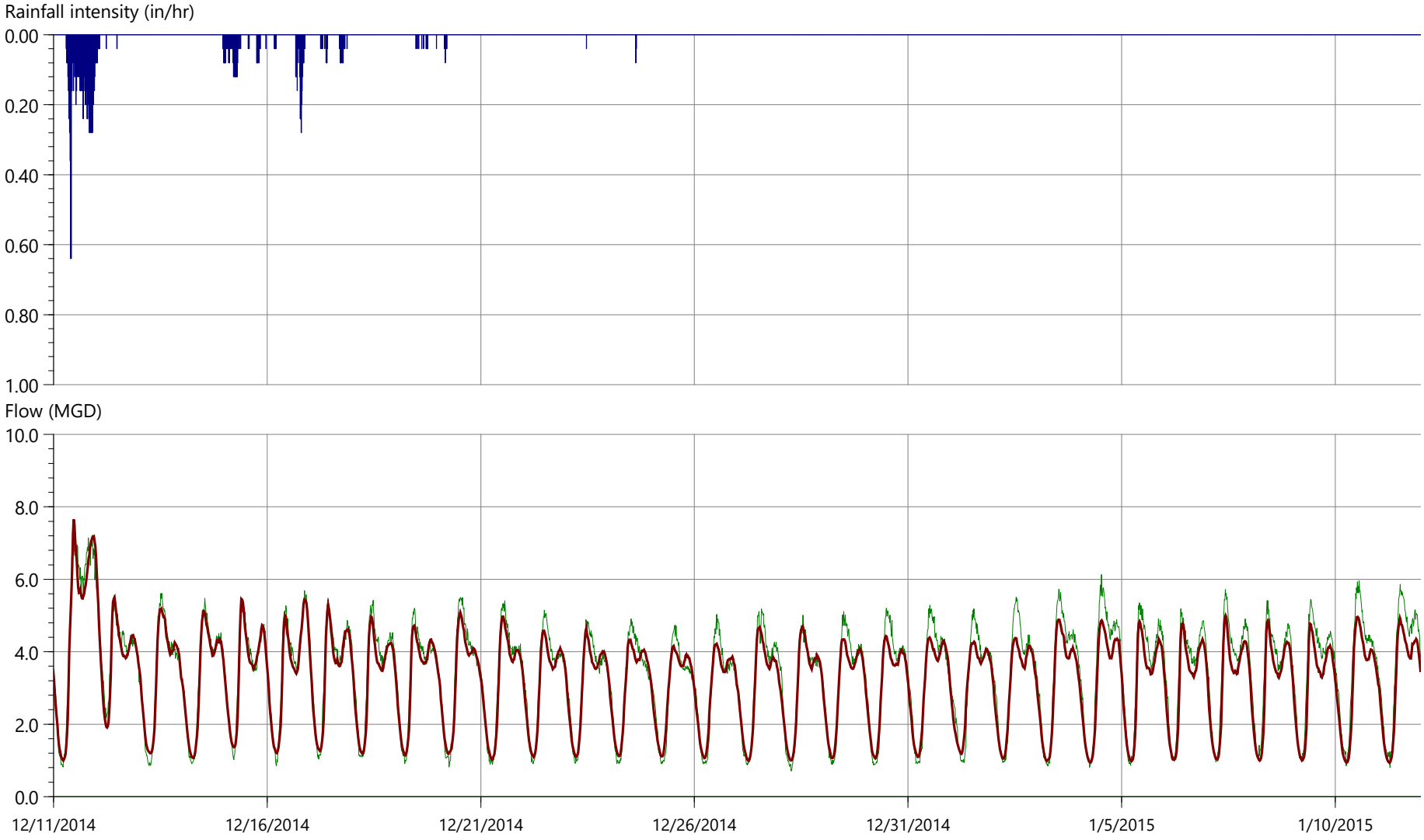
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.558	4.760	49.282
... Data 2023 and 2015				0.415	4.679	48.633

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1, Rainfall Profile: 2



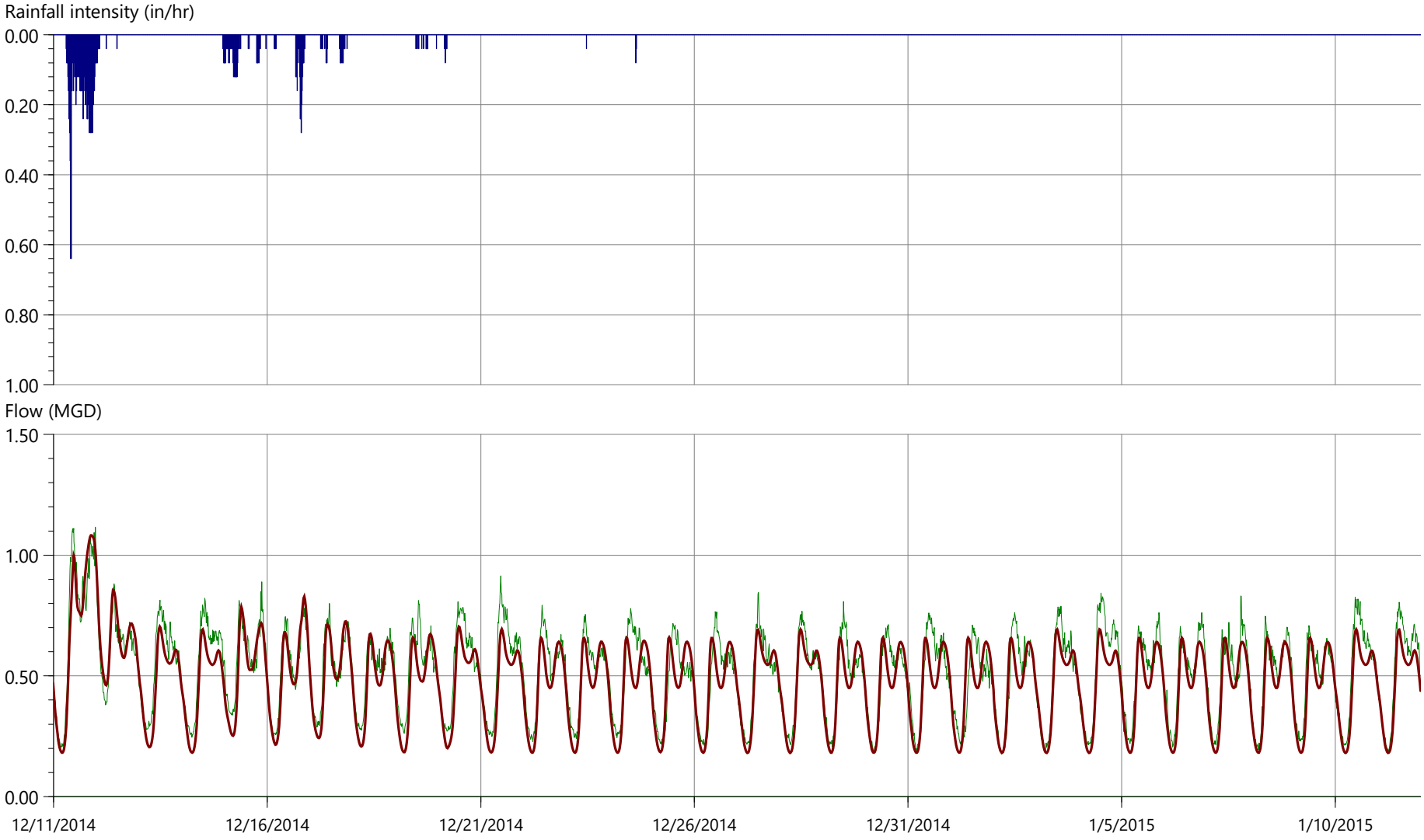
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.660	4.744	55.973
... Data 2023 and 2015				0.420	5.417	51.478

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1, Rainfall Profile: 3



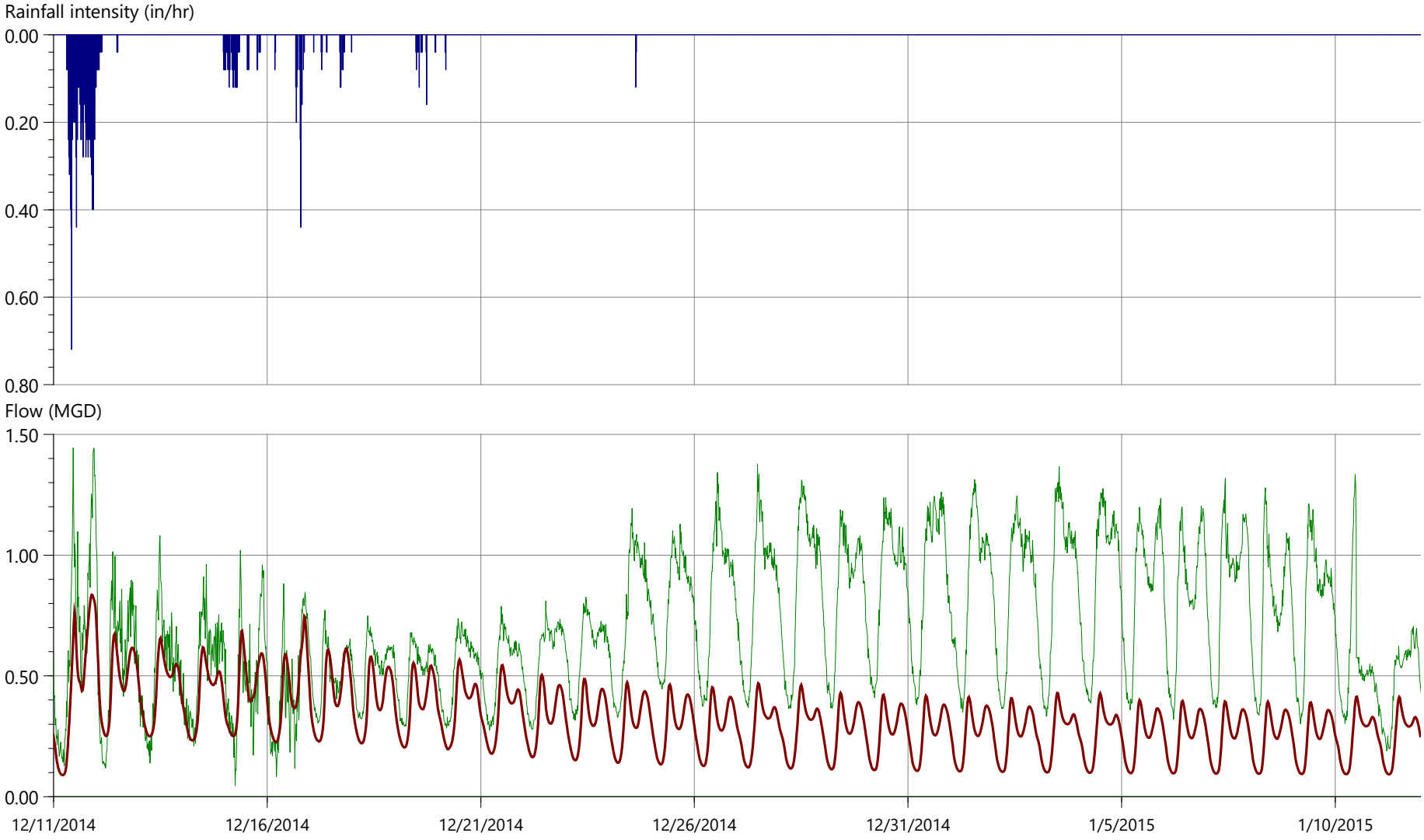
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.709	7.220	110.750
... Data 2023 and 2015				0.932	7.651	103.773

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1, Rainfall Profile: 3



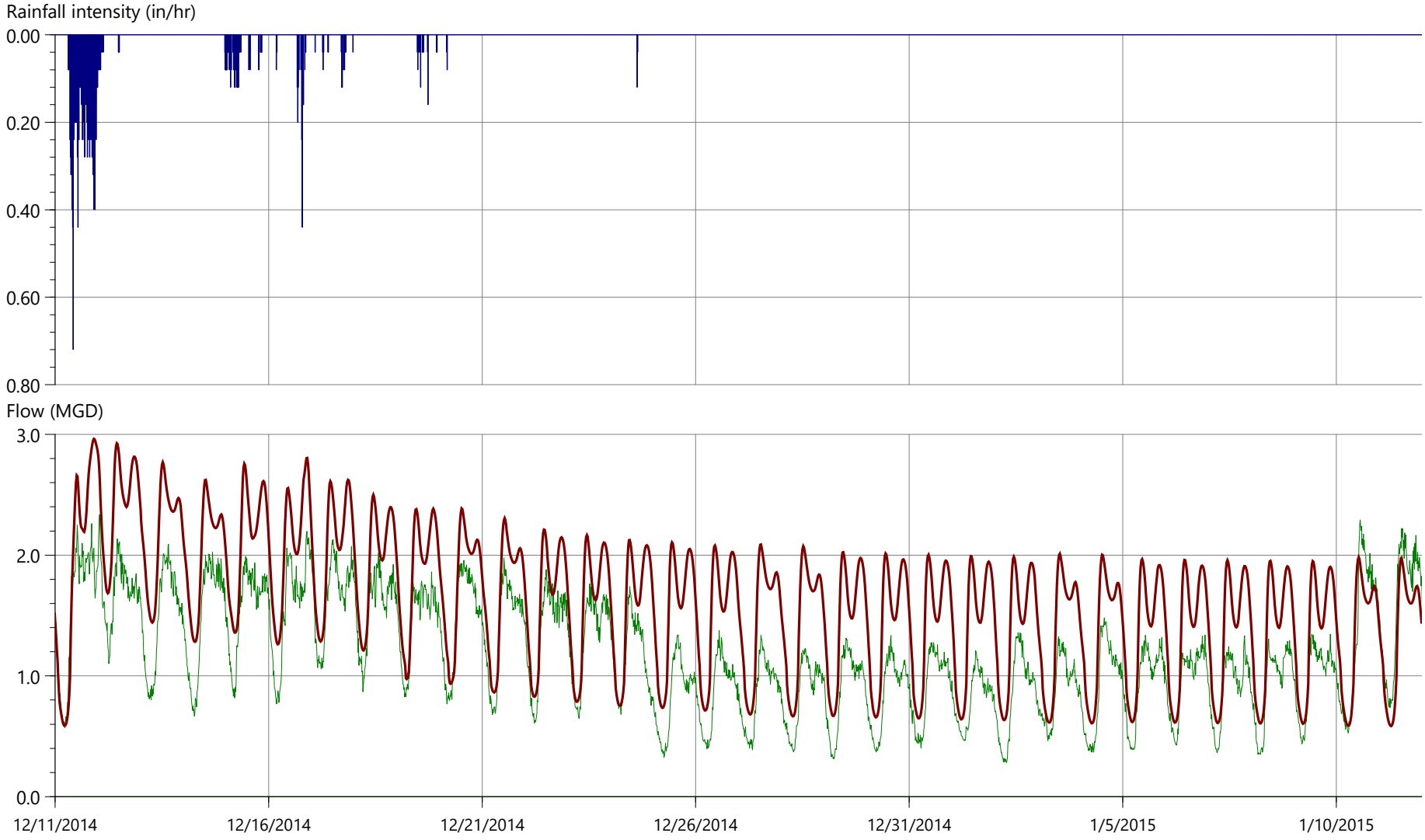
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.176	1.116	16.638
... Data 2023 and 2015				0.181	1.082	15.366

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1, Rainfall Profile: 4



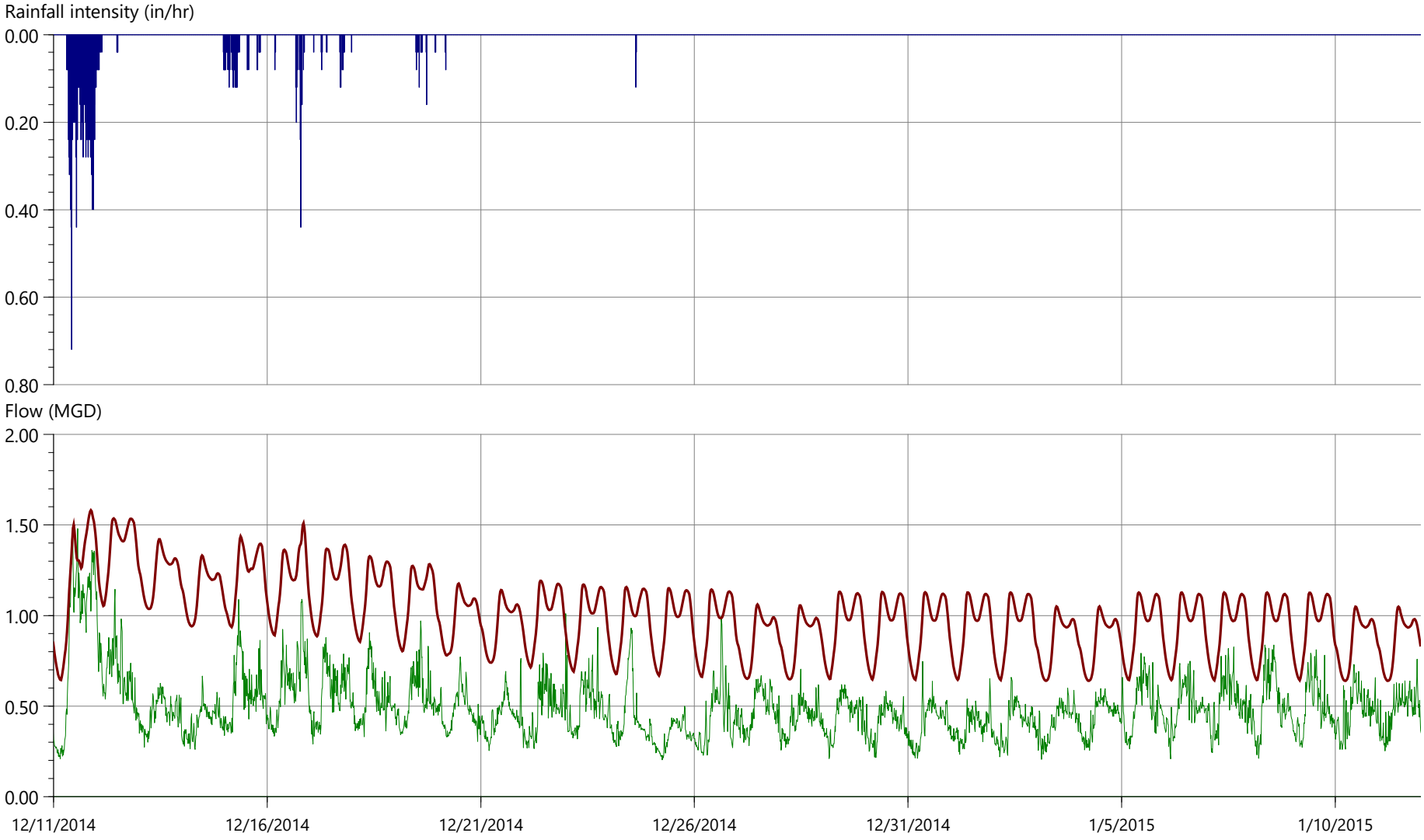
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.045	1.444	22.418
... Data 2023 and 2015				0.089	0.836	10.376

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1, Rainfall Profile: 4



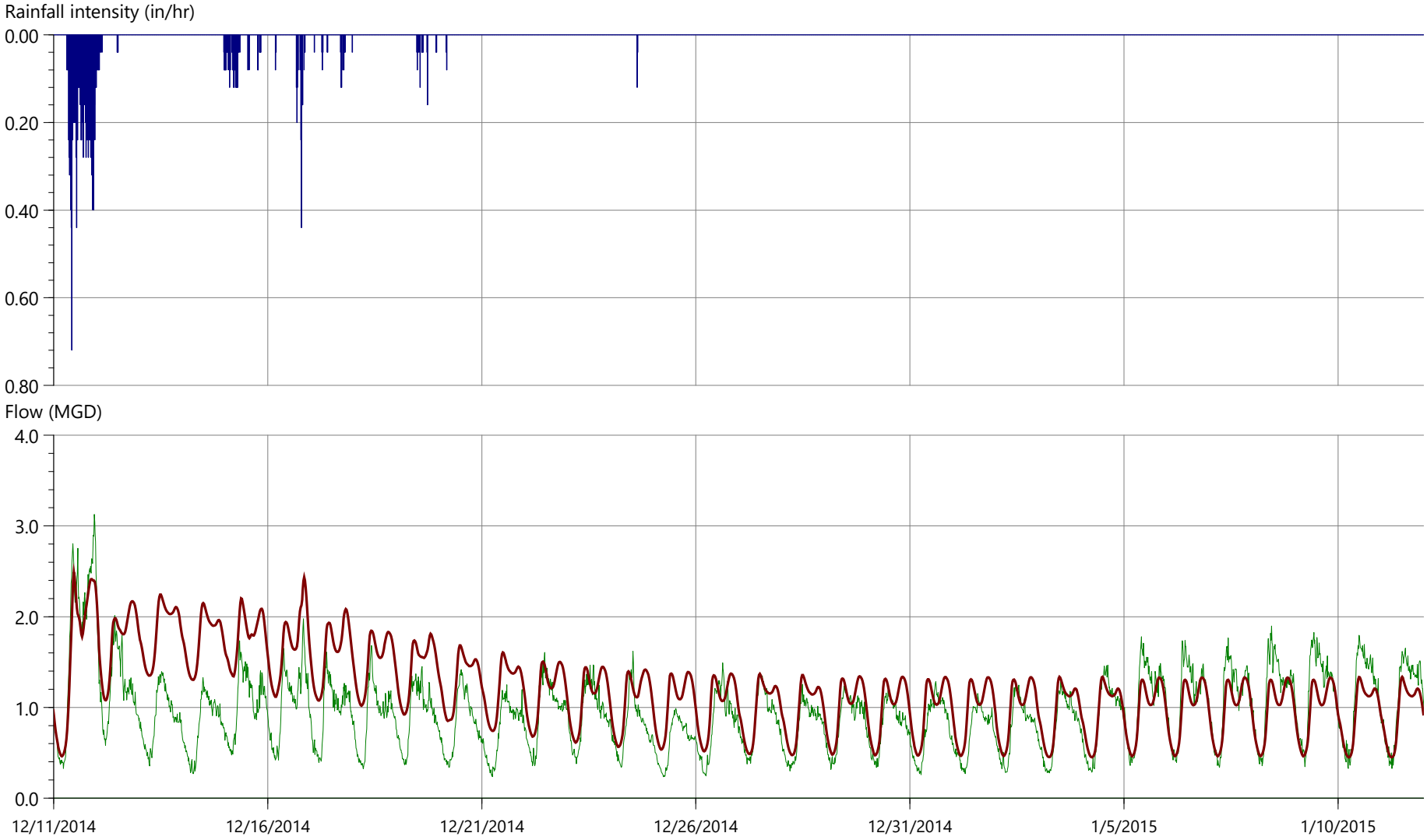
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.283	2.337	37.855
... Data 2023 and 2015				0.586	2.963	52.355

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2, Rainfall Profile: 4



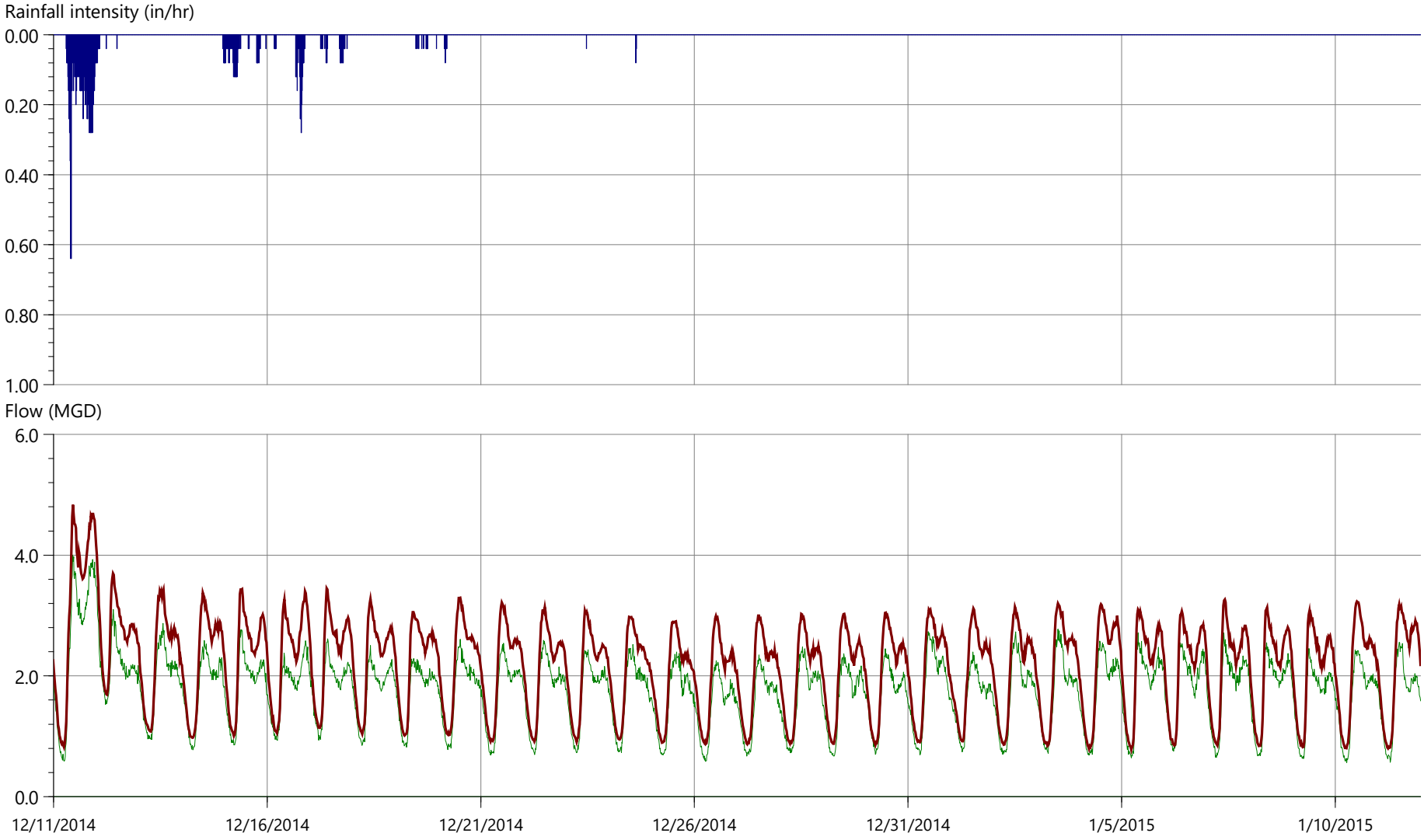
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.203	1.480	15.720
... Data 2023 and 2015				0.639	1.581	32.173

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1, Rainfall Profile: 4



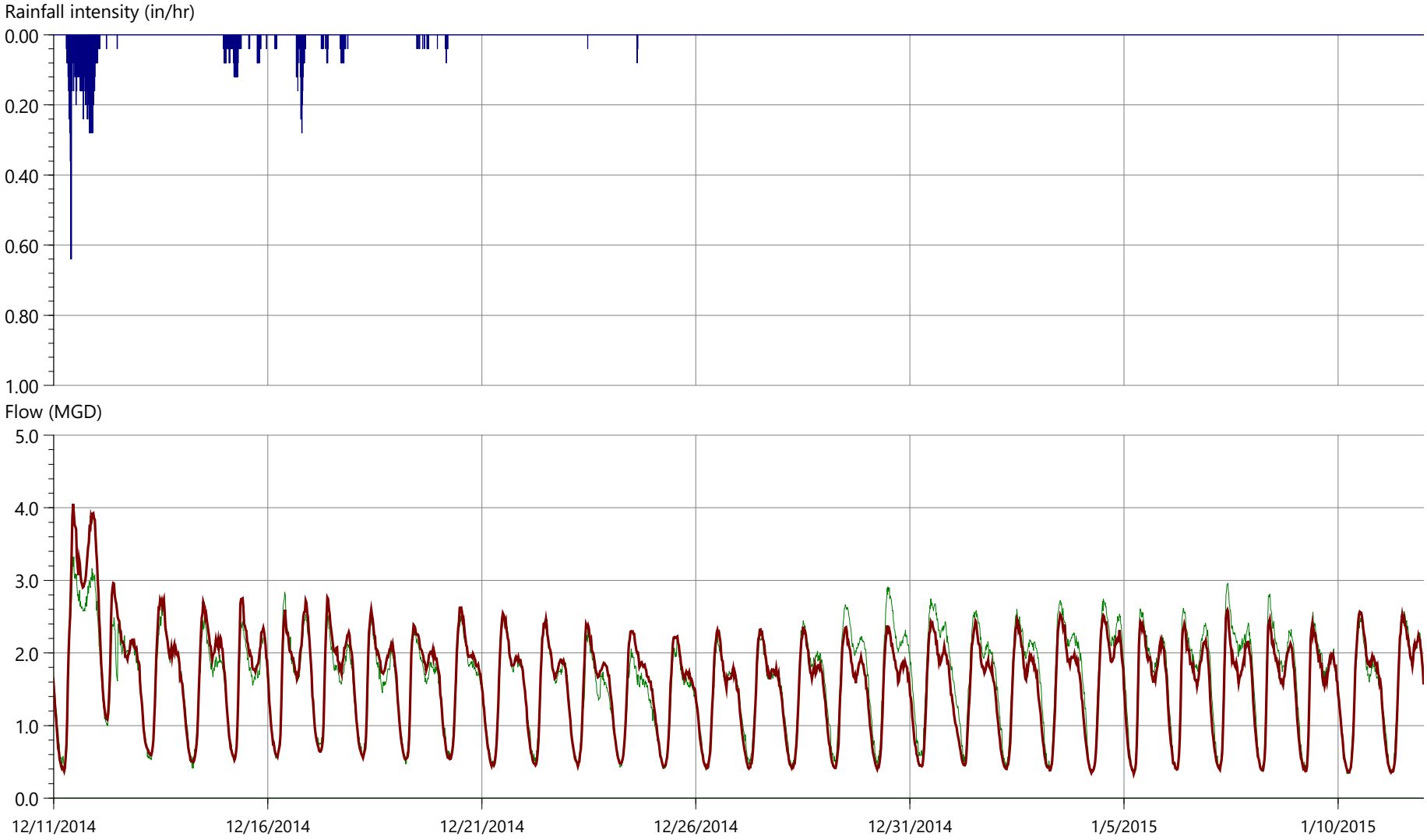
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.236	3.126	30.382
... Data 2023 and 2015				0.450	2.489	38.534

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1, Rainfall Profile: 3



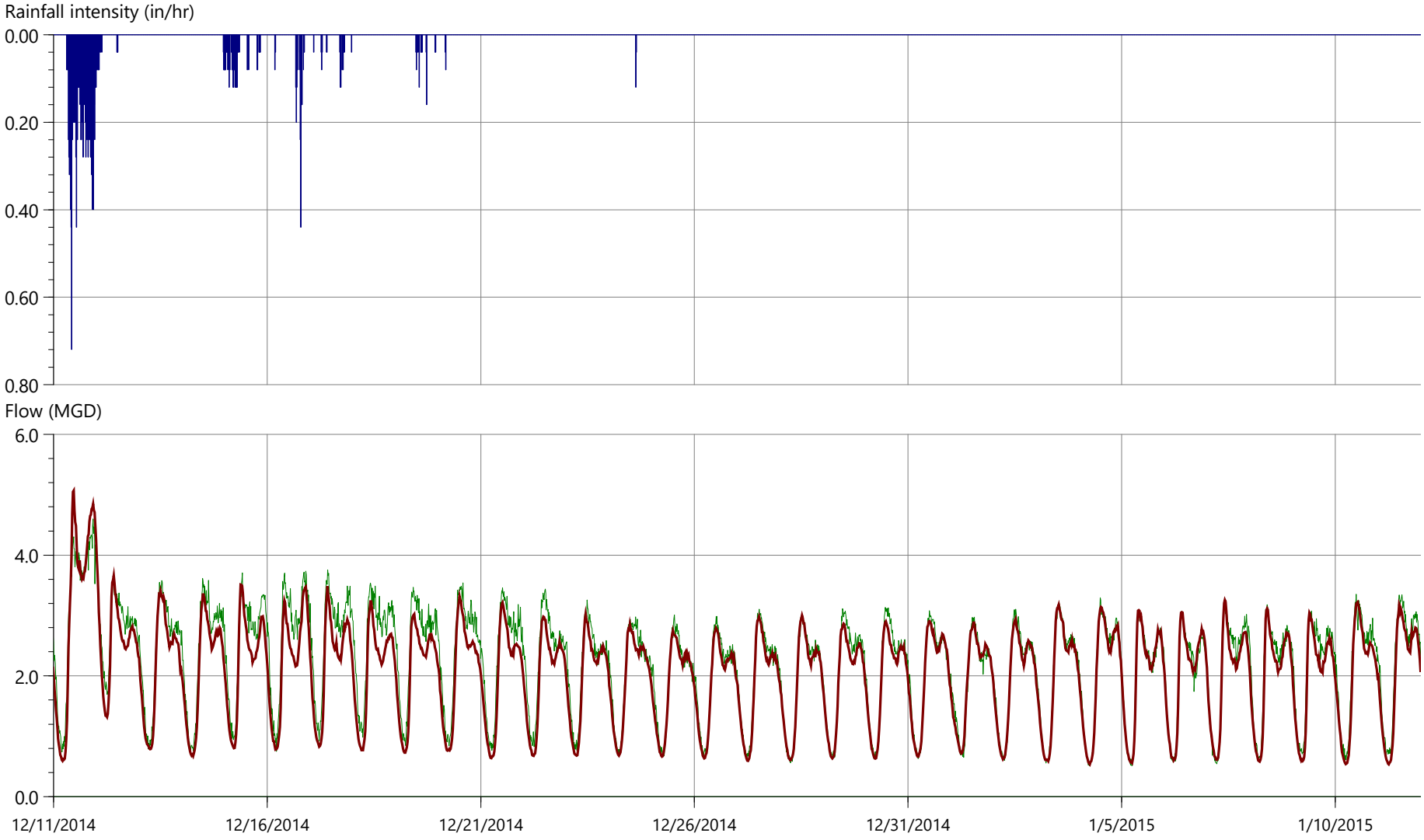
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.564	4.003	56.266
... Data 2023 and 2015				0.772	4.835	70.665

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1, Rainfall Profile: 3



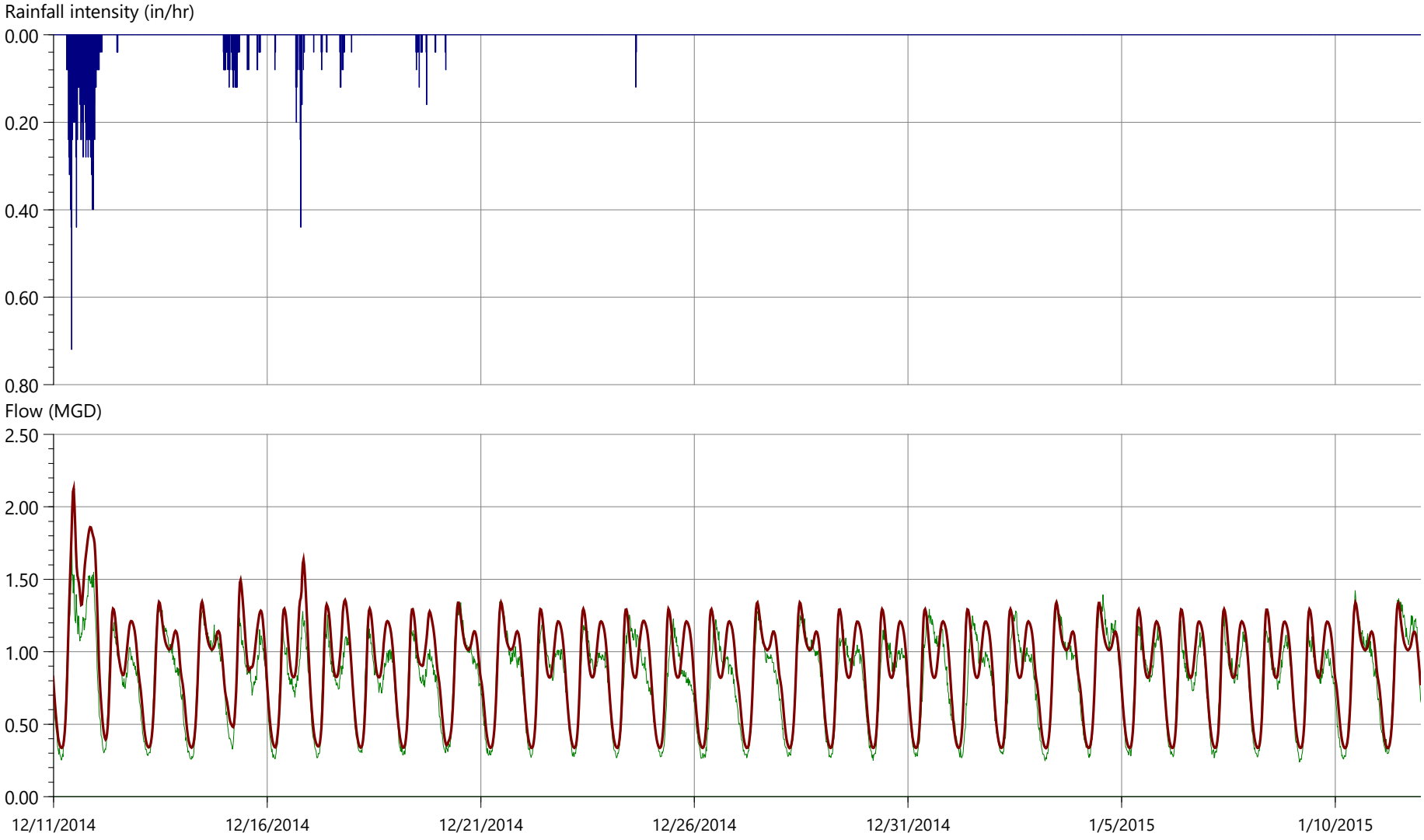
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.335	3.327	52.396
... Data 2023 and 2015				0.334	4.053	51.122

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1, Rainfall Profile: 4



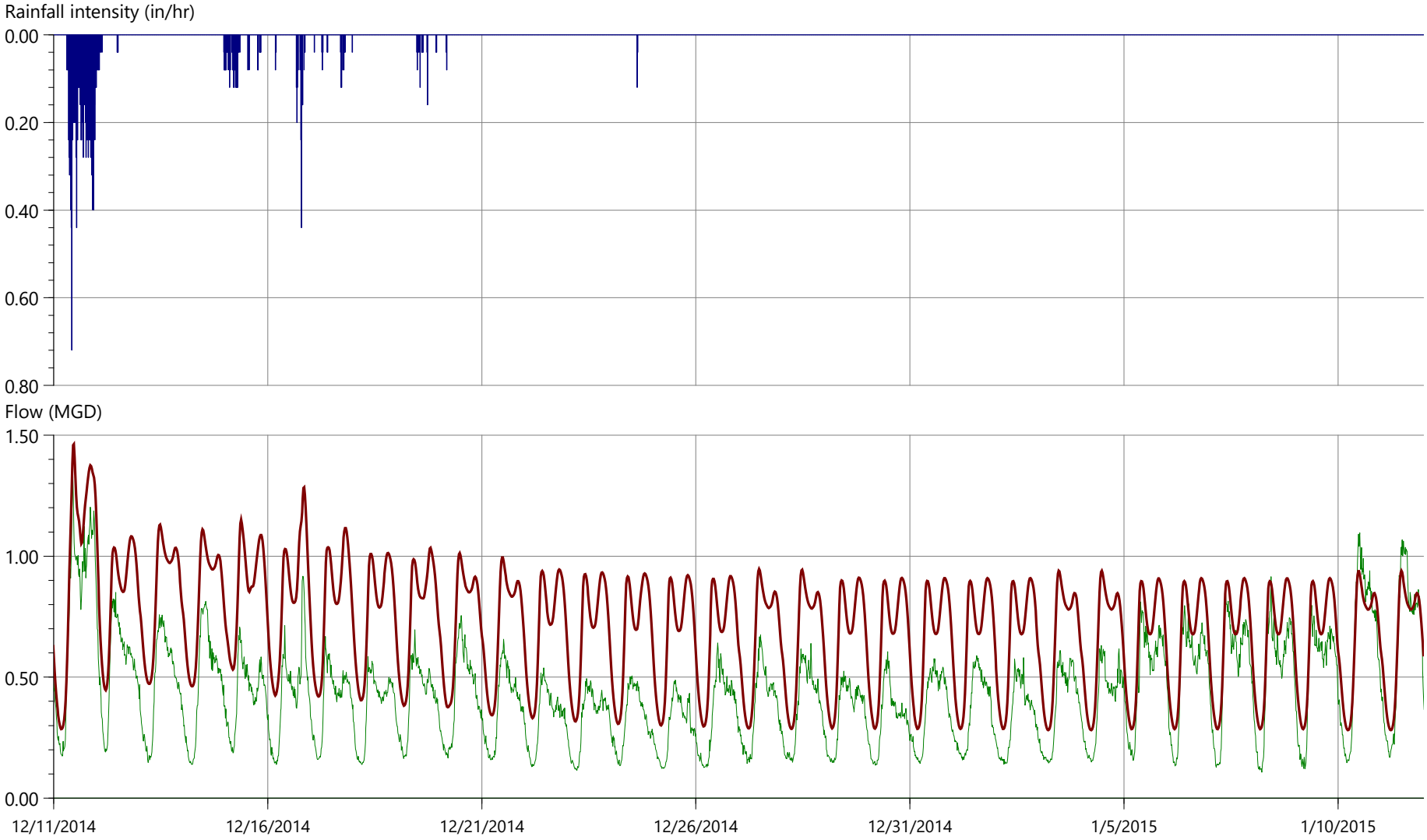
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.511	4.598	72.002
... Data 2023 and 2015				0.535	5.069	65.968

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1, Rainfall Profile: 4



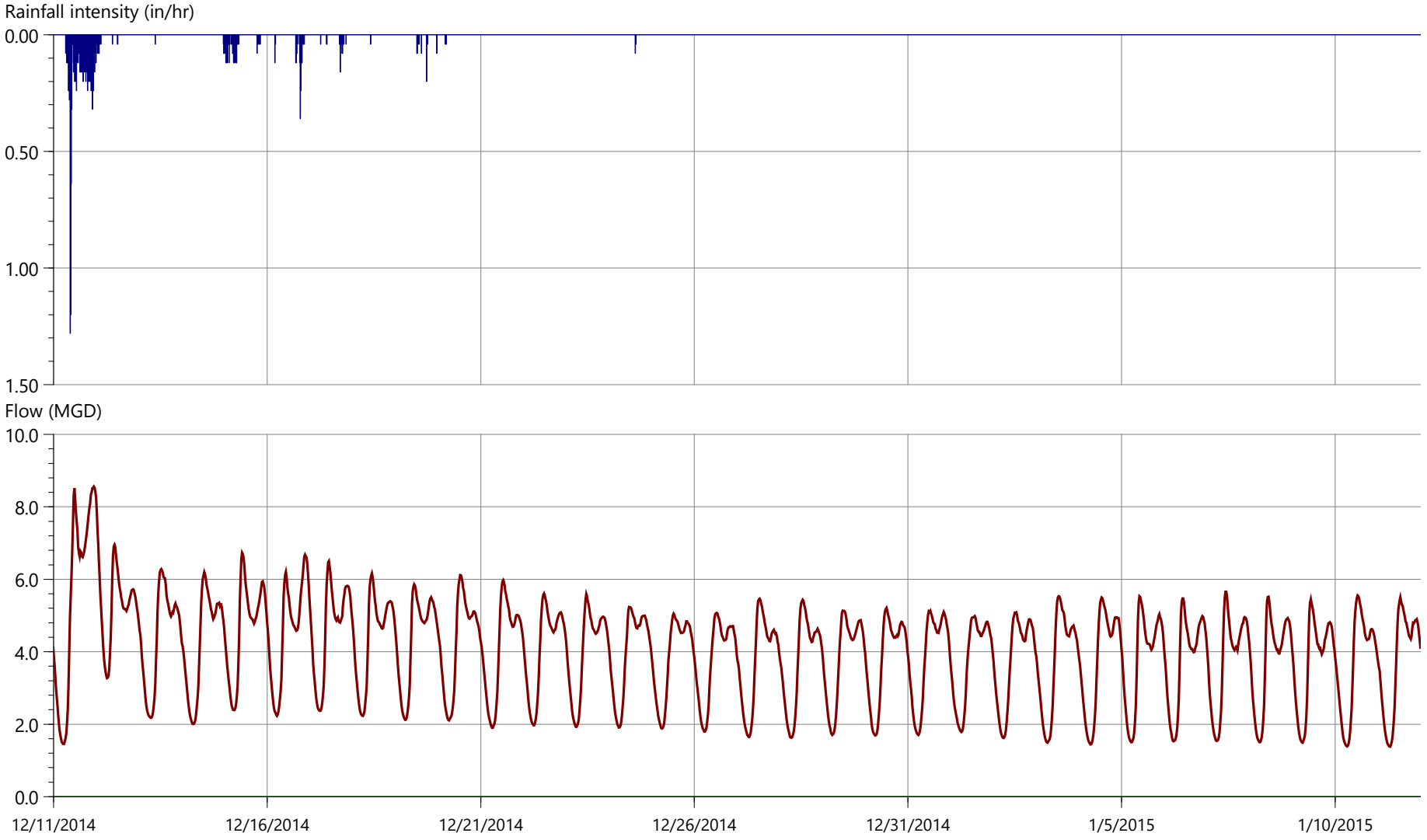
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.239	1.805	26.012
... Data 2023 and 2015				0.335	2.125	28.494

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1, Rainfall Profile: 4



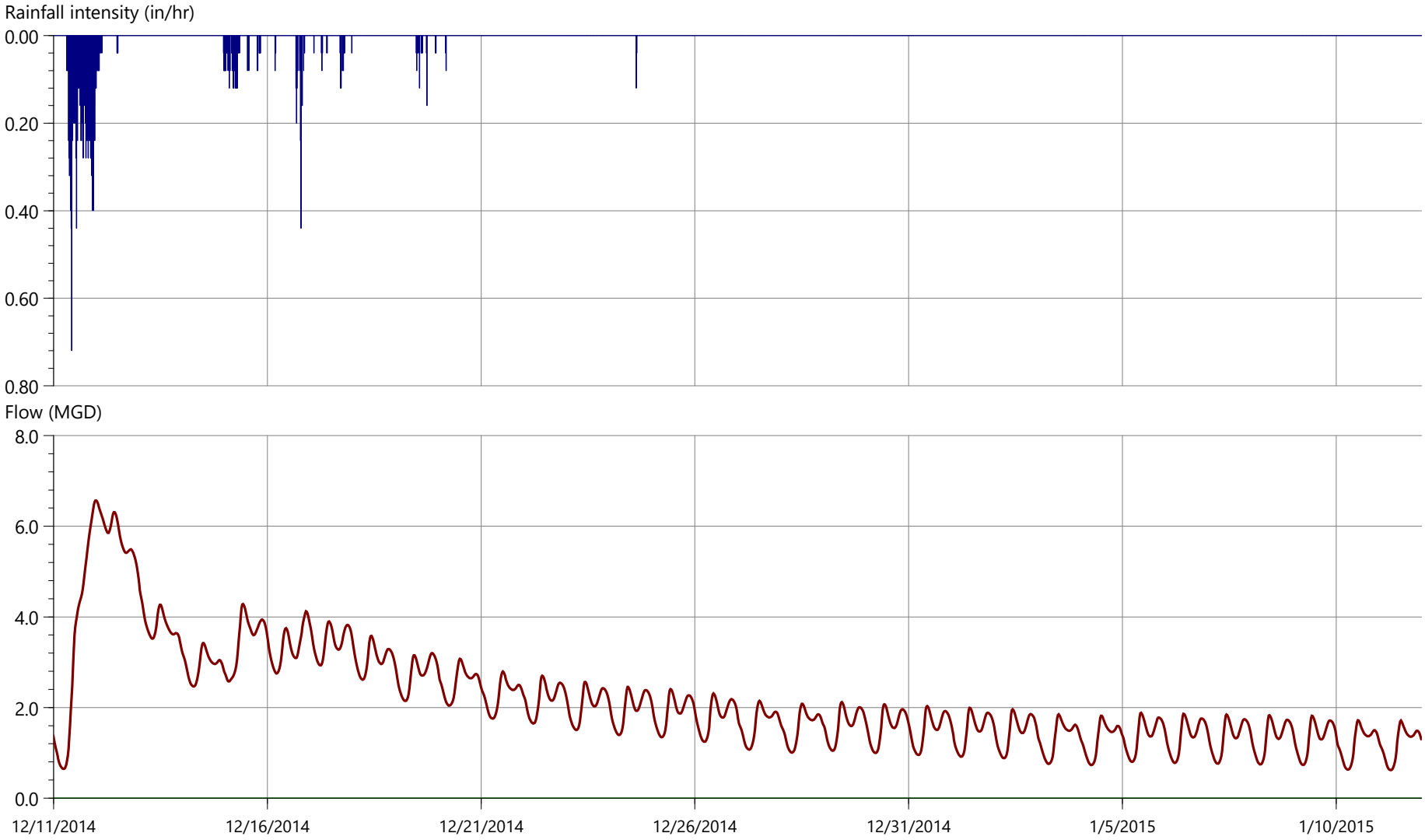
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.107	1.328	13.863
... Data 2023 and 2015				0.281	1.463	22.889

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1, Rainfall Profile: 2



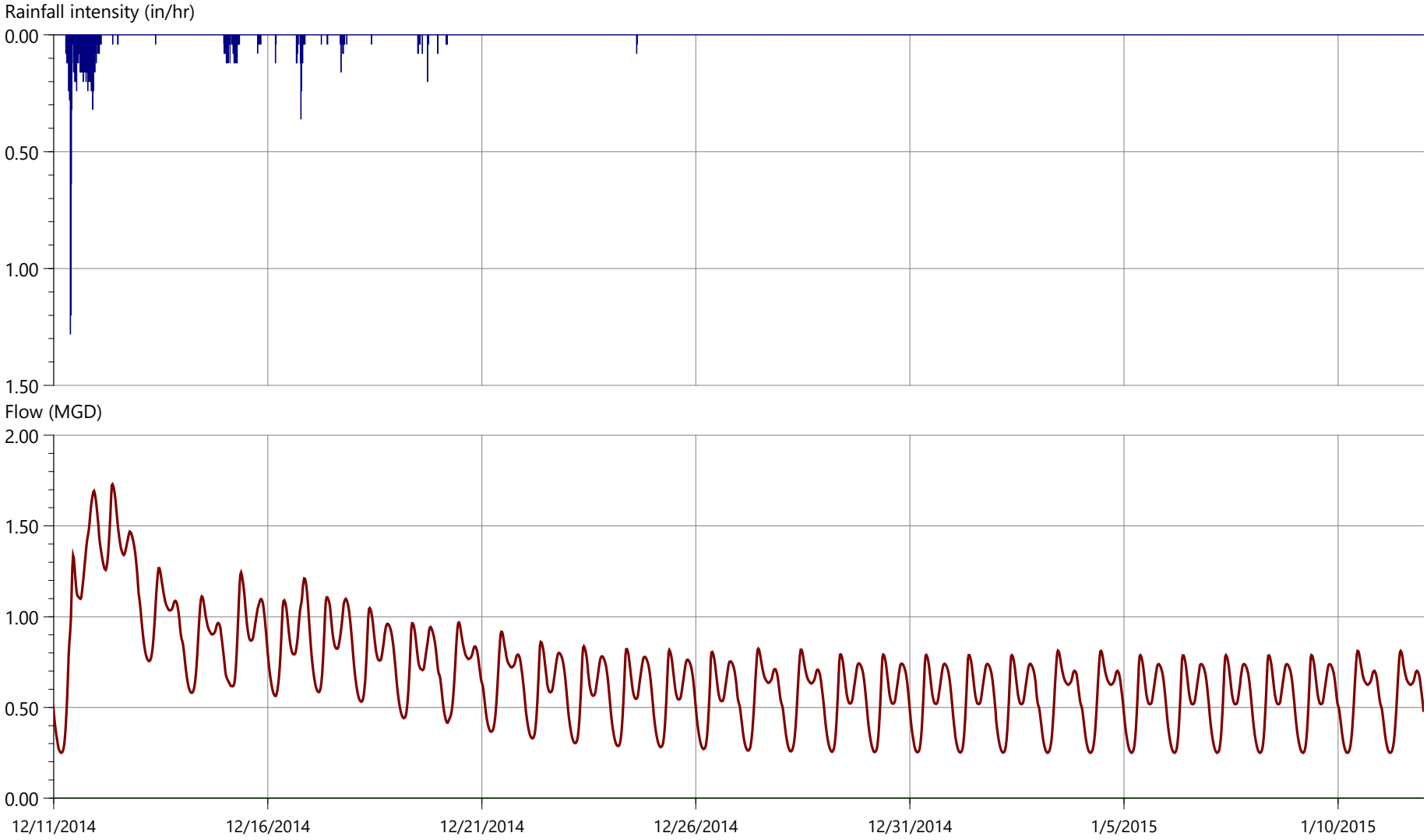
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				1.379	8.556	130.203

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1, Rainfall Profile: 4



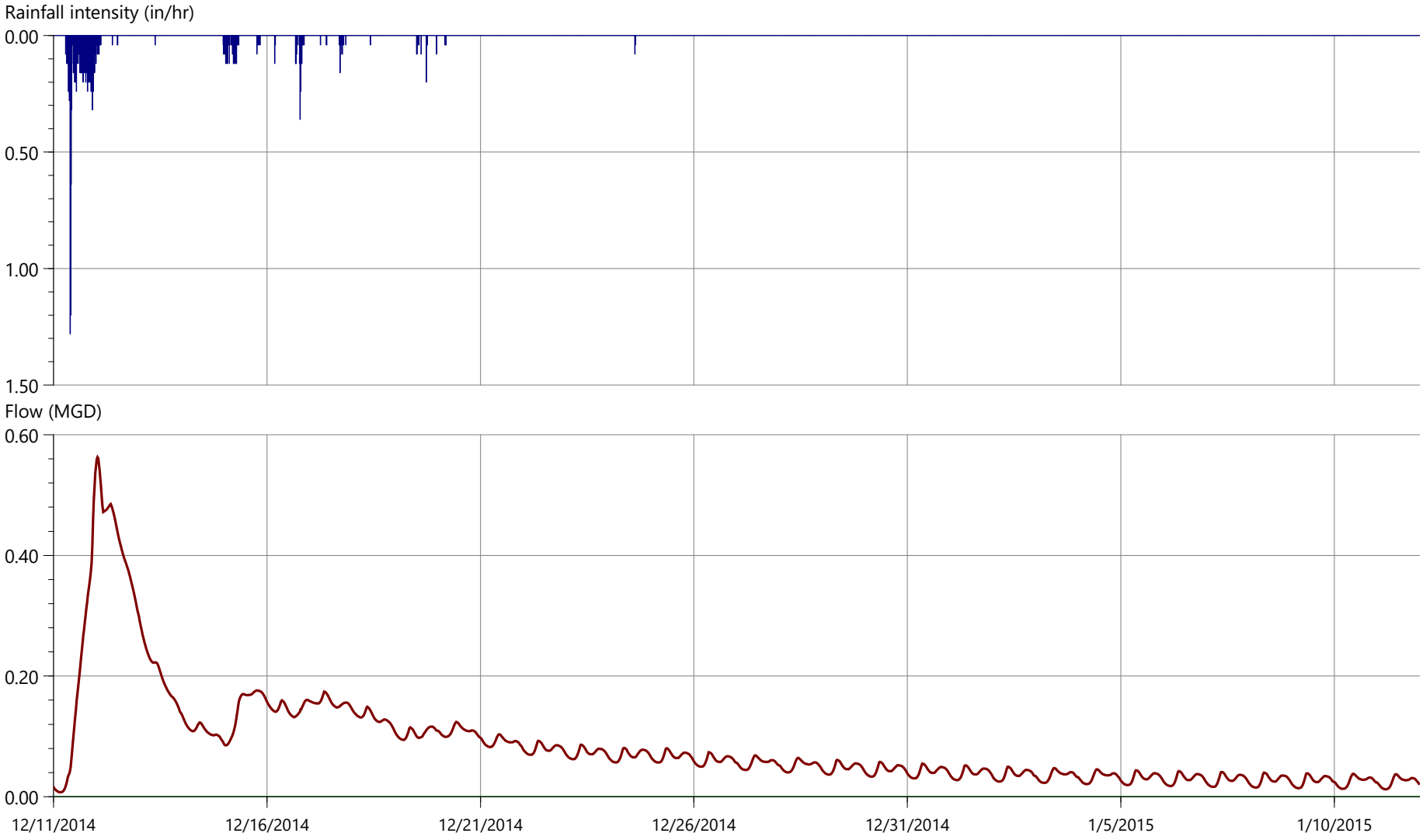
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.620	6.569	69.782

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1, Rainfall Profile: 2



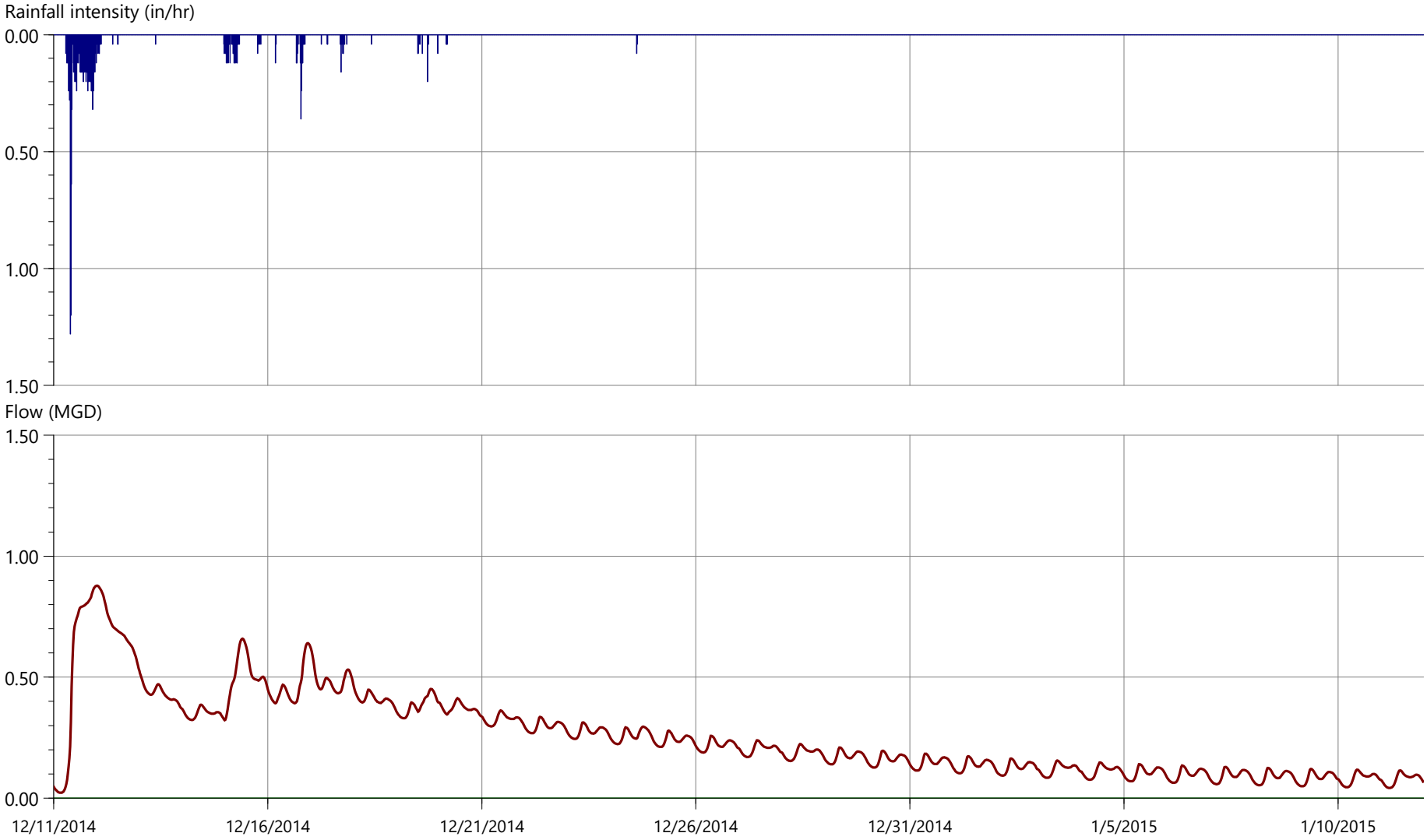
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.249	1.729	21.528

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1, Rainfall Profile: 2



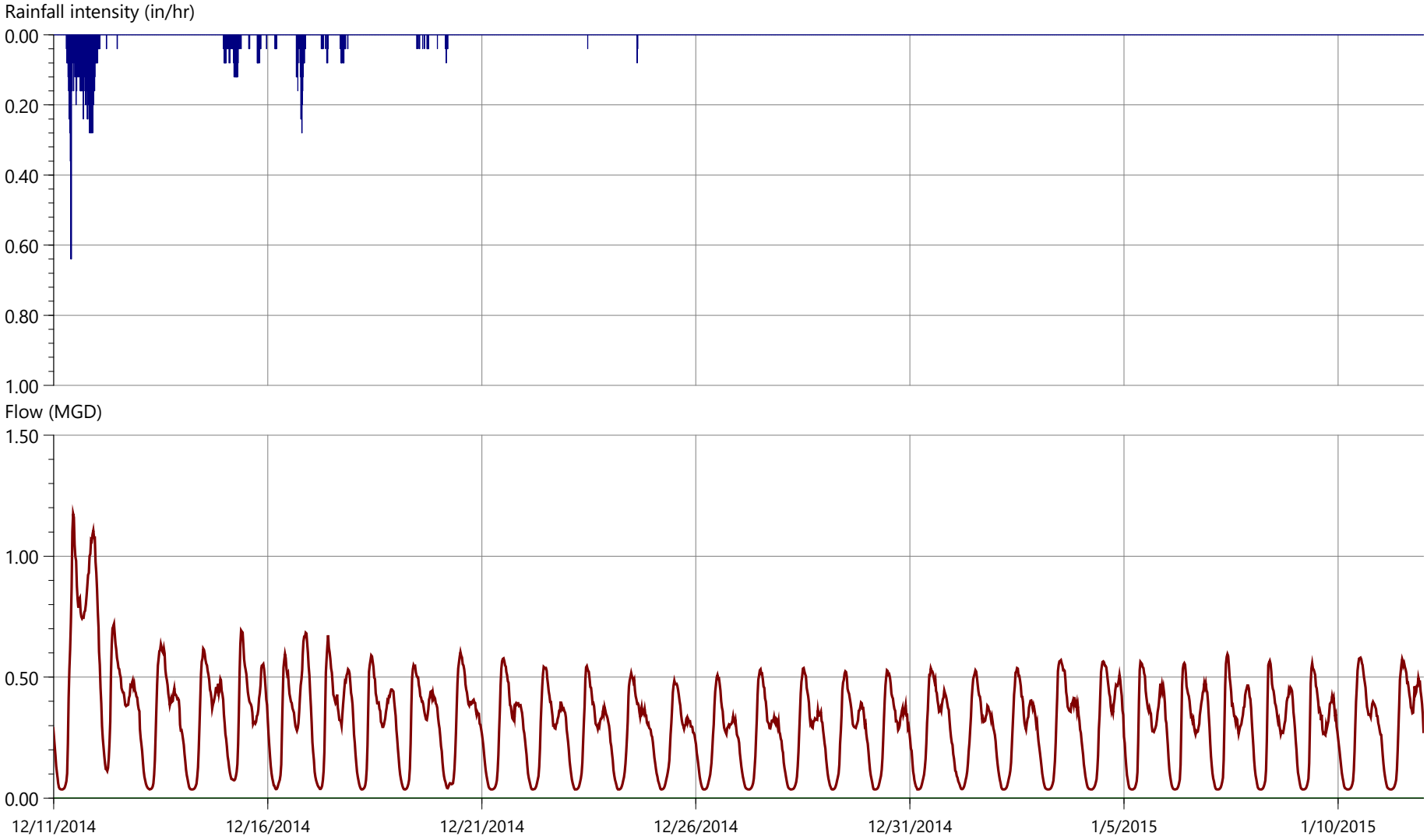
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.007	0.563	2.735

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1, Rainfall Profile: 2



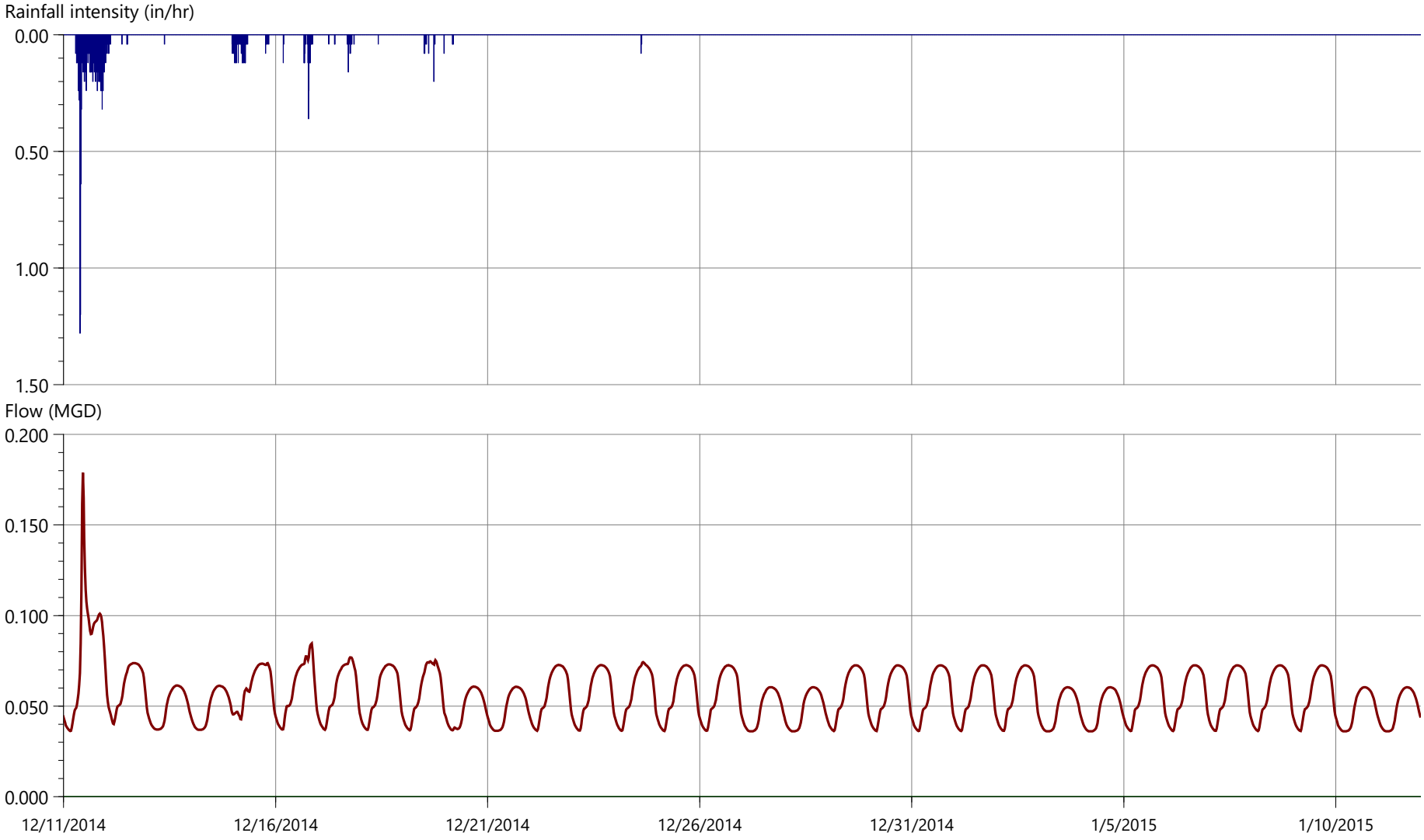
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.022	0.878	8.229

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1, Rainfall Profile: 3



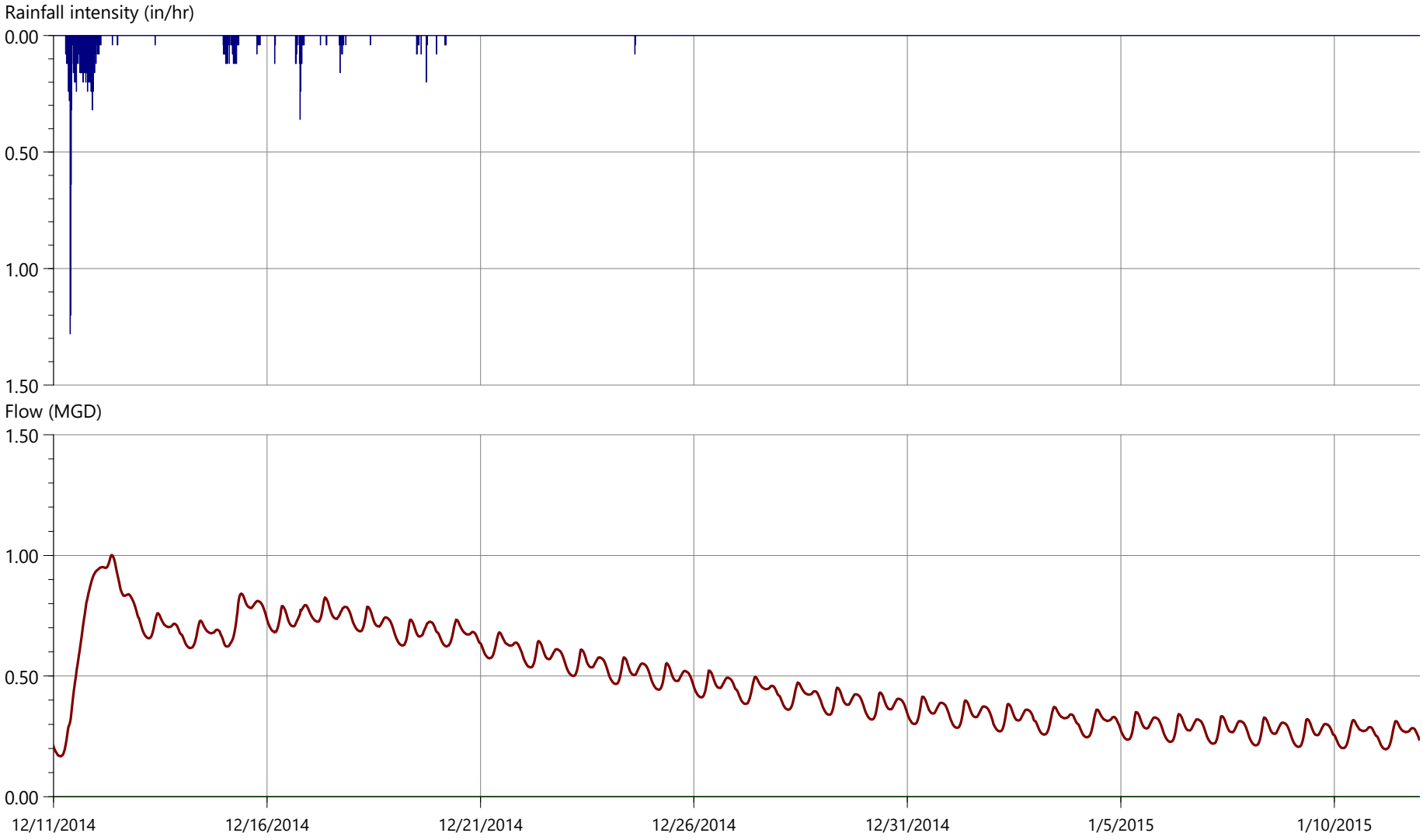
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.036	1.175	9.810

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.036	0.179	1.780

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.168	1.001	15.500

APPENDIX F: SIPHON LINING ASSUMPTIONS

Appendix A: City of Santa Clara Sanitary Sewer Siphons and Lining Assumptions

USNODE	USNODE_FLAG	SUFFIX	DSNODE	DSNODE_FLAG	ASSETID	ASSETID_FLAG	MATERIAL	MATERIAL_FLAG	FUTURE LINING?	WIDTH_EXISTING	WIDTH_FLAG_EXISTING	WIDTH_LINED	WIDTH_FLAG_LINED	2024 CCTV_Structural Quick Rating
S103-19	SPH2	1	S103-16		103-00008	SPH2	VCP	GIS	Yes	24	RD	22.808	RN	
S103-19	SPH2	2	S103-16		103-00049	SPH2	VCP	GIS	Yes	12	RD	11.406	RN	
S103-20	SPH3	1	S103-18		103-00007	SPH3	VCP	GIS	No	17.3	RE24	17.3	RE24	
S103-20	SPH3	2	S103-18		103-00047	SPH3	VCP	GIS	No	23.2	RE24	23.2	RE24	
S103-20	SPH3	3	S103-18		103-00048	SPH3	VCP	GIS	No	22.4	RE24	22.4	RE24	
S14-61	SPH1	1	S14-62		14-00027	GIS	VCP	GIS	Yes	8	RD	7.406	RN	4132
S14-65	SPH1	1	S15-62		15-00061	GIS	CIP	RN	Yes	8	RN	7.406	RN	4331
S20-16(2)	SPH1	2	S20-17(2)		20-00032	GIS	PE	GIS	No	13.49	RN	13.49	RN	
S20-26D1	SPH2	1	S20-26D3		20-00059	GIS	PE	GIS	No	20.23	RN	20.23	RN	
S20-26D2	SPH2	2	S20-26D4		20-00058	GIS	PE	GIS	No	20.23	RN	20.23	RN	
S22-64	SPH1	2	S22-102		22-00114	GIS	CIP	RN	Yes	8	RN	7.406	RN	
S23-15	SPH2	1	S23-14		23-00023	GIS	VCP	GIS	Yes	8	RN	7.406	RN	
S23-15	SPH2	2	S23-14		23-00094	GIS	VCP	GIS	Yes	12	MU	11.406	RN	
S31-24	SPH1	1	S31-25		31-00029	SPH1	DIP	RN	Yes	24	MU	22.808	RN	
S32-2	SPH2	1	S32-102		32-00118	GIS	PVC	RN	No	10	RD	10	RD	0000
S32-2	SPH2	2	S32-102		32-00120	GIS	PVC	RN	No	8	RN	8	RN	0000
S33-9	SPH1	1	S33-10		33-00059	SPH1	CIP	RN	Yes	8	MU	7.406	RN	
S42-30	SPH1	2	S42-31		42-00051	GIS	CIP	RN	Yes	6	M2	5.406	RN	
S46-114	SPH2	1	S46-115	SPH2	46-00132	GIS	HDPE	RD	No	5.35	RN	5.35	RN	0000
S46-114W	SPH2	1	S46-115	SPH2			HDPE	RD	No	5.35	RN	5.35	RN	0000
S52-116	SPH2	1	S52-119		52-00146	GIS	HDPE	RN	No	10.29	RN	10.29	RN	
S52-116	SPH2	2	S52-119		52-00147	GIS	HDPE	RN	No	10.29	RN	10.29	RN	
S52-123	SPH2	1	S52-124		52-00136	GIS	HDPE	RN	No	6.96	RN	6.96	RN	2700
S52-123	SPH2	2	S52-124		52-00137	GIS	HDPE	RN	No	6.96	RN	6.96	RN	2700
S52-3	SPH1	1	S52-5 (SiphonOutlet)		52-00028	GIS	VCP	GIS	Yes	8	GIS	7.406	RN	
S54-79	SPH2	1	S54-78		54-00044	SPH2	VCP	GIS	Yes	10	MU	9.406	RN	4231
S54-79	SPH2	2	S54-78		54-00094	SPH2	VCP	GIS	Yes	10	MU	9.406	RN	4231
S54-94	SPH2	1	S54-95		54-00092	GIS	HDPE	RN	No	15.17	RN	15.17	RN	
S54-94	SPH2	2	S54-95		54-00093	GIS	HDPE	RN	No	15.17	RN	15.17	RN	
S55-51	SPH2	2	S55-52		55-00056	GIS	HDPE	RN	No	17.5	RN	17.5	RN	2B00
S55-51	SPH2	1	S55-52		55-00055	GIS	HDPE	RN	No	17.5	RN	17.5	RN	2B00
S56-58	SPH2	2	S56-59		56-00062	GIS	HDPE	RN	No	17.51	RN	17.51	RN	2500
S56-58	SPH2	1	S56-59		56-00061	GIS	HDPE	RN	No	17.51	RN	17.51	RN	2500
S62-7D	SPH2	2	S62-12		62-00063	GIS	VCP	GIS	Yes	8	GIS	7.406	RN	
S62-7D!	SPH2	1	S62-12		62-00027	GIS	VCP	GIS	Yes	10	GIS	9.406	RN	
S62-9	SPH1	1	S62-11	RD	62-00025	GIS	DIP	RN	Yes	16	RD	15.108	RN	
S64-34	SPH2	2	S64-36		64-00045	GIS	VCP	GIS	Yes	15	RD	14.108	RN	2900
S64-34	SPH2	1	S64-36		64-00015	SPH1	VCP	GIS	Yes	8	RD	7.406	RN	2900
S67-21	SPH2	1	S67-29	SPH2	67-00015	SPH2	DIP	RD	No	23.17	RN	23.17	RN	3600
S67-21	SPH2	2	S67-29	SPH2	67-00035	SPH2	DIP	RD	No	23.17	RN	23.17	RN	3600
S68-10	SPH2	1	D_S68-7		68-00002	GIS	VCP	GIS	No	23.3	GIS	23.3	GIS	
S68-10	SPH2	2	S68-7		68-00025	GIS	VCP	GIS	No	14.4	GIS	14.4	GIS	
S68-15	SPH1	1	S68-12		68-00012	SPH1	VCP	GIS	No	23.6	RD	23.6	RD	3C00
S68-15	SPH1	2	S68-16		68-00013	SPH1	VCP	GIS	No	23.5	RD	23.5	RD	3C00
S68-9	SPH2	1	D_S68-6		68-00018	GIS	VCP	GIS	No	23.3	GIS	23.3	GIS	
S68-9	SPH2	2	S68-6		68-00026	GIS	VCP	GIS	No	14.5	GIS	14.5	GIS	
S72-12	SPH2	1	S72-11		72-00018	SPH2	CIP	GIS	Yes	20	RD	19.008	RN	
S72-12	SPH2	2	S72-11		72-00051	SPH2	CIP	GIS	Yes	20	SV	19.008	RN	
S85-86	SPH1	1	S85-85		85-00068	GIS	HDPE	RN	No	15.17	RN	15.17	RN	0000
S93-50	SPH2	1	S93-48		93-00014	GIS	VCP	GIS	Yes	12	RD	11.406	RN	3124
S93-50	SPH2	2	S93-48		93-00070	GIS	VCP	GIS	Yes	24	RD	22.808	RN	3124

Appendix A: City of Santa Clara Sanitary Sewer Siphons and Lining Assumptions

USNODE	USNODE_FLAG	SUFFIX	DSNODE	DSNODE_FLAG	ASSETID	ASSETID_FLAG	MATERIAL	MATERIAL_FLAG	FUTURE LINING?	WIDTH_EXISTING	WIDTH_FLAG_EXISTING	WIDTH_LINED	WIDTH_FLAG_LINED	2024 CCTV_Structural Quick Rating
S93-51	SPH3	1	S93-49	SPH3	93-00061	GIS	RCP	RE24	No	22.8	RE24	22.8	RE24	
S93-51	SPH3	2	S93-49	SPH3	93-00069	GIS	VCP	GIS	No	16.8	RE24	16.8	RE24	
S93-51	SPH3	3	S93-49	SPH3	93-00071	GIS	RCP	RE24	No	22.8	RE24	22.8	RE24	
S95-45	SPH3	1	S95-44		95-00067	GIS	VCP	GIS	No	17	RE24	17	RE24	3C22
S95-45	SPH3	2	S95-44		95-00150	GIS	VCP	GIS	No	14.3	RE24	14.3	RE24	3C22
S95-45	SPH3	3	S95-44		95-00151	GIS	VCP	GIS	No	17	RE24	17	RE24	3C22
S96-14	SPH2	1	S96-13		96-00014	SPH2	HDPE	RN	No	12.3	RN	12.3	RN	2300
S96-14	SPH2	2	S96-13		96-00090	SPH2	HDPE	RN	No	8.68	RN	8.68	RN	2300

FLAG	Description
SPH1	Single barrel siphon.
SPH2	Twin barrel siphon.
SPH3	Triple barrel siphon.
GIS	Data originated from City's GIS (2023).
RN	Refer to note.
RD	Data originated from record drawing.
RE24	Data originated from Condition Assessment Repairs [CIPP Liners] (data sent by Craig).
MU	Data originated from original Mike Urban model.
SV	Data was surveyed.
M2	Data originated from 2007 Mike Urban model.

Legend for "2024 CCTV_Structural Quick Rating"

Severity grade goes from 1 to 5 with 5 being most severe.

5 – Most significant defect grade. Needs immediate attention. Possible failure within 5 years.

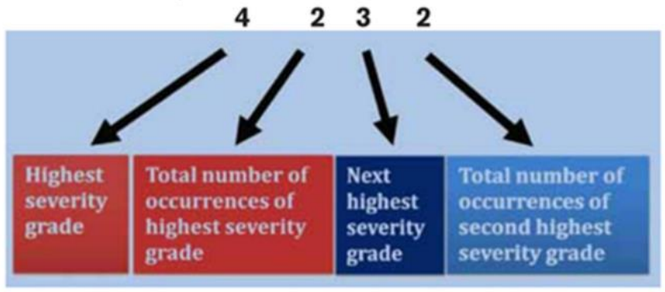
4 – Significant defect grade. Possible failure within 5 to 10 years. Will likely progress to 5 if not addressed.

3 – Moderate defect

2 – Minor to moderate defect

1 – Minor defect grade

PACP Quick Rating



APPENDIX G: SEWER CAPACITY CIP PROJECT COST ESTIMATES, MAPS, AND PROFILES

Appendix G: Sewer Capacity CIP Cost Estimates, Maps, and Profiles

Capital Improvement Project Summary Table

Project No.[1]	Project ID	Project Location	Pre-Project Pipe Diameter(s)[2]	Project Description	Priority[3]	Flow Confidence Level[4]	Loads Trigger[5]	Design Flow Trigger[5]	Physical Network Trigger[5]	Project Cost[6]
1	**Agilent**	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd	10 to 22.8-inch	12313 LF of 15 to 27-inch diameter pipe	7	N/A	LTFL (entitlement)	DWF	UMN	**$26,942,000**
2	**Homestead Road**	N Homestead Trunk from Swallow Wy to Saratoga Creek	18 to 30-inch	6407 LF of 24 to 33-inch diameter pipe	3	3	LTFL	WWF	UMN	**$17,156,000**
3	**Kiely Boulevard**	Orthello Wy to S of El Sobrante St	8-inch	266 LF of 10-inch diameter pipe	6	4	LTFL	WWF	UMN	**$513,000**
4	**Victoria Avenue**	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave	8-inch	764 LF of 10-inch diameter pipe	6	3	LTFL	WWF	UMN	**$1,337,000**
5	**Cabrillo Avenue**	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy	8-inch	Flow Diversion Weirs only. No pipe	1	3	EL	WWF	UMN	**$154,000**
6	**CMC Basin**	Santa Maria Ave & Francis Ave; Amethyst Dr	8 to 12-inch	3655 LF of 12 to 15-inch diameter pipe	1	1 & 2	EL	WWF	UMN	**$7,263,000**
7	**Bowers Avenue**	Bowers Ave from Chromite Dr to Walsh Ave	25.7-inch	2605 LF of 30-inch diameter pipe	4	5	LTFL	WWF	LMN	**$8,047,000**
8	**Calabazas Trunk**	Calabazas Creek from S of Agate Dr to Central Expwy	22.8 to 27-inch	2791 LF of 18 to 27-inch diameter pipe	2	5	EL	WWF	LMN	**$8,731,000**
9	**Freedom Circle**	Mission College Blvd from Freedom Cir to west of Great America Pkwy	12 to 15-inch	1886 LF of 15-inch diameter pipe	5	N/A	LTFL (specific development)	DWF	UMN	**$3,830,000**
12	**GAP West Trunk**	S of West Tasman Dr to Lafayette St	28.5 to 35.7-inch	4810 LF of 36 to 42-inch diameter pipe	3	2	LTFL	WWF	UMN	**$17,781,000**
13	**GAP East Trunk**	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr	31.4-inch	231 LF of 39-inch diameter pipe	4	2	LTFL	WWF	LMN	**$1,002,000**
14	**Bunker Hill Lane East**	E of Great America Pkwy	6-inch	107 LF of 8-inch diameter pipe	7	N/A	LTFL (entitlement)	WWF	UMN	**$301,000**
15	**Lafayette Street**	N of Calle del Mundo to S of Great America Wy	34.2 to 40.3-inch	2290 LF of 42 to 48-inch diameter pipe	3	2	LTFL	WWF	UMN	**$7,515,000**
									CIP Total:	**$100,572,000**

[1]Projects are numbered from upstream to downstream. Table does not include Project Nos. 10 (Patrick Henry Drive) and 11 (Mission Point) because project costs will be paid for by the developers.

[2]Pre-project pipe diameters include future lining assumptions.

[3]Projects are prioritized based on wastewater flow, design flow, and physical network triggers as well as assumed structural condition.

[4]Rating assigned to validate the need for the project through review of flow monitoring data and reported surcharging and operational issues, and compatibility between flow meter data and the model. Descriptions of the flow confidence levels are as follows: N/A = Not assigned because project would be triggered by entitlement flow or specific development; 1 = Flow meter on or very near to the project reach surcharged during metered storm; 2 = Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm; 3 = Flow meter near the project reach (upstream or downstream) confirms flow; 4 = No flow meter near the project reach to confirm flow; 5 = Conflicting flow between meter and model.

[5]EL = Existing Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flow; WWF = Wet Weather Flow; UMN = Unlined Model Network; LMN = Lined Model Network.

[6]Costs are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area and are Class 5 estimates (planning level).

Total Cost by Priority Category

Priority	# of Projects	Estimated Capital Cost	%
1	2	$ 7,417,000	7%
2	1	$ 8,731,000	9%
3	3	$ 42,452,000	42%
4	2	$ 9,049,000	9%
5	1	$ 3,830,000	4%
6	2	$ 1,850,000	2%
7	2	$ 27,243,000	27%
Total	13	**$ 100,572,000**	

Project 1: Agilent

PROJECT DESCRIPTION

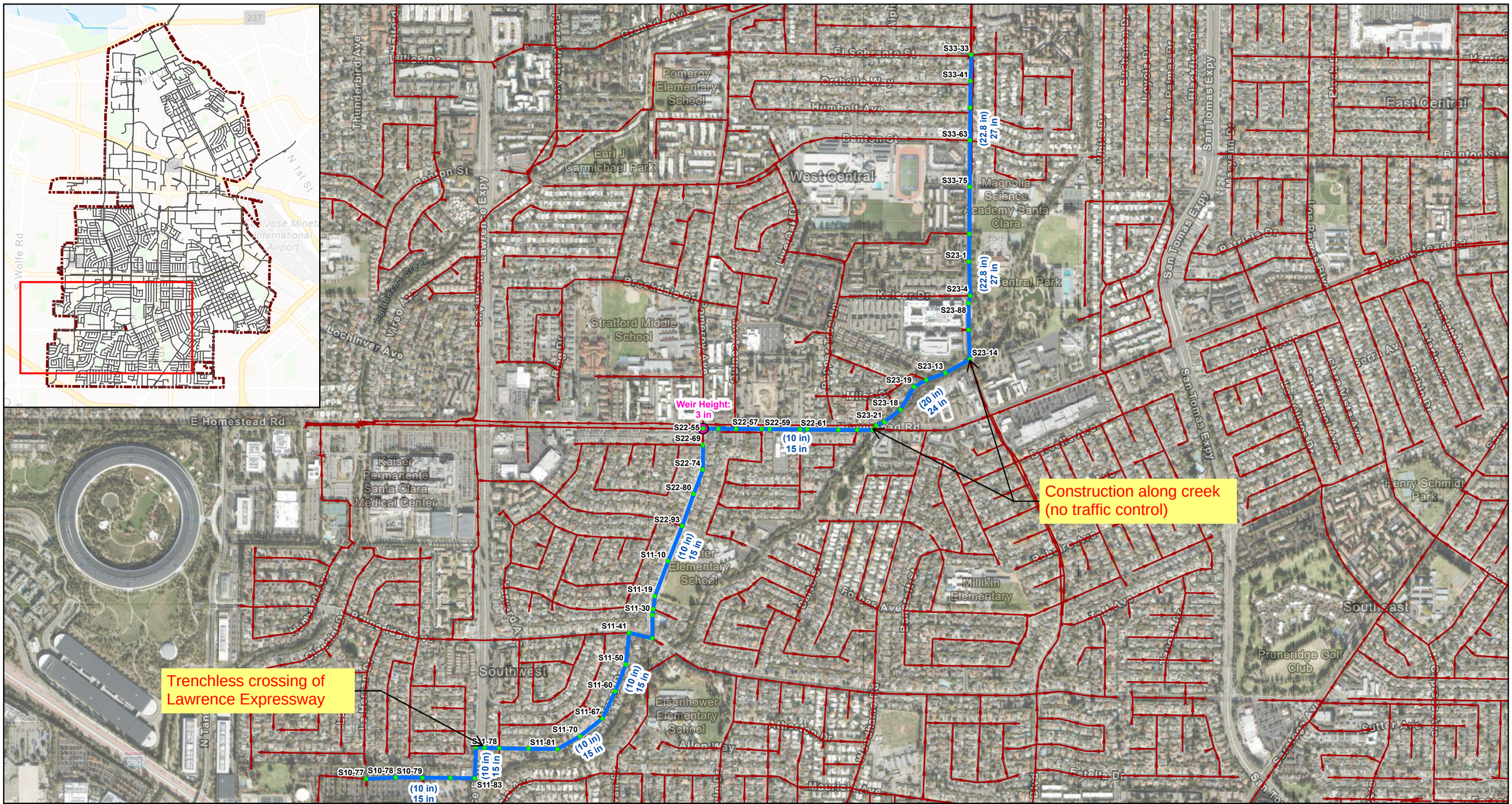
Project No.	1
Project ID	Agilent
Project Location	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd
Description	12313 LF of 15 to 27-inch diameter pipe
Priority	7
Flow Confidence Level	N/A
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Dry Weather Flow (DWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$26,942,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project also includes installation of a weir at manhole S22-55 to divert the influent flows from Homestead Rd (S Trunk) and Pomeroy Ave sewers to Homestead Rd (S Trunk).
	(iv) Deficiency would be caused by Agilent Technologies historic entitlement flow (0.95 mgd). Project should be implemented before parcel begins to discharge its entitled flow.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S10-79	S10-80	10	15	305	0.16	11	0.56	1.66	1.46	1.49	3.06	$804			$804	$ 244,898
S10-80	S11-83	10	15	264	0.31	9	0.78	2.31	1.46	1.49	3.55	$804			$804	$ 212,497
S11-83	S11-76	10	15	337	0.47	9	0.97	2.85	1.46	1.49	3.45	$804			$804	$ 270,787
S11-76	S11-77	10	15	93	0.51	10	1.01	2.97	1.46	1.49	3.52	$804			$804	$ 74,450
S11-77	S11-78	10	15	164	0.44	9	0.94	2.77	1.46	1.49	3.85	$804	PTGAB	30.00	$1,922	$ 314,514
S11-78	S11-80	10	15	319	0.48	7	0.98	2.88	1.47	1.49	3.80	$804	PTGAB	30.00	$1,922	$ 612,687
S11-80	S11-81	10	15	316	0.55	7	1.05	3.08	1.47	1.49	3.85	$804			$804	$ 253,903
S11-81	S11-70	10	15	283	0.87	8	1.32	3.89	1.47	1.49	4.51	$804			$804	$ 227,532
S11-70	S11-67	10	15	311	1.21	8	1.56	4.59	1.47	1.50	4.15	$804			$804	$ 249,883
S11-67	S11-60	10	15	325	0.70	8	1.18	3.49	1.48	1.51	3.08	$804			$804	$ 261,139
S11-60	S11-50	10	15	319	0.31	8	0.79	2.34	1.48	1.51	3.44	$804			$804	$ 256,315
S11-50	S11-41	10	15	346	0.42	8	0.92	2.70	1.48	1.51	3.87	$804			$804	$ 278,104
S11-41	S11-42	10	15	260	0.27	9	0.73	2.17	1.53	1.59	3.91	$804			$804	$ 209,281
S11-42	S11-30	10	15	257	0.50	9	1.00	2.96	1.53	1.59	3.10	$804			$804	$ 206,950
S11-30	S11-29	10	15	65	0.48	8	0.98	2.88	1.53	1.59	3.91	$804			$804	$ 52,421
S11-29	S11-19	10	15	142	0.64	9	1.13	3.34	1.53	1.59	3.48	$804			$804	$ 114,168
S11-19	S11-10	10	15	405	1.00	9	1.41	4.16	1.54	1.60	4.80	$804			$804	$ 325,700
S11-10	S22-93	10	15	414	1.09	10	1.48	4.35	1.54	1.60	4.81	$804			$804	$ 332,534
S22-93	S22-80	10	15	372	0.51	11	1.01	2.97	1.62	1.69	3.82	$804			$804	$ 299,249
S22-80	S22-74	10	15	284	0.52	10	1.02	3.02	1.62	1.69	2.71	$804			$804	$ 227,934
S22-74	S22-69	10	15	269	0.21	10	0.65	1.92	1.62	1.70	3.42	$804			$804	$ 216,115
S22-55	S22-53	15	15	9	0.95	11	8.92	4.07	2.20	2.28	5.14	$804			$804	$ 7,075
S22-53	S22-56	10	15	159	0.95	11	1.93	4.07	2.20	2.28	4.37	$804			$804	$ 127,595
S22-56	S22-57	10	15	195	0.62	11	1.12	3.30	2.20	2.28	4.41	$804			$804	$ 157,102
S22-57	S22-58	10	15	278	0.64	11	1.13	3.33	2.20	2.28	4.02	$804			$804	$ 223,190
S22-58	S22-59	10	15	89	0.55	11	1.05	3.10	2.21	2.29	3.74	$804			$804	$ 71,556
S22-59	S22-60	10	15	332	0.42	10	0.92	2.71	2.21	2.29	3.33	$804			$804	$ 266,526
S22-60	S22-61	10	15	79	0.16	10	0.57	1.69	2.22	2.31	4.48	$804			$804	$ 63,757
S22-61	S22-62	10	15	339	0.47	9	0.97	2.85	2.22	2.31	3.91	$804			$804	$ 272,315
S22-62	S22-63	10	15	205	0.47	9	0.97	2.86	2.22	2.31	3.86	$804			$804	$ 164,820
S22-63	S22-64	10	15	168	0.45	9	0.95	2.79	2.23	2.32	4.47	$804			$804	$ 135,152
S22-52	S23-21	20	24	96	0.68	15	7.36	12.03	7.62	7.83	5.16	$1,039			$1,039	$ 99,744
S23-21	S23-18	20	24	223	0.45	15	6.02	9.84	7.62	7.83	5.40	$1,039			$1,039	$ 231,801
S23-18	S23-19	20	24	289	0.52	15	6.42	10.50	7.62	7.83	5.77	$1,039			$1,039	$ 300,375
S23-19	S23-12	20	24	154	0.68	15	7.36	12.03	7.62	7.83	5.38	$1,039			$1,039	$ 159,590
S23-12	S23-13	20	24	221	0.49	15	6.25	10.22	7.63	7.85	5.78	$1,039			$1,039	$ 229,619
S23-13	S23-14	20	24	307	0.63	15	7.07	11.56	7.63	7.85	4.93	$1,039			$1,039	$ 319,181
S23-14	S23-6	23	27	322	0.33	15	7.36	11.55	8.40	8.95	4.40	$1,089			$1,089	$ 350,222
S23-6	S23-88	23	27	290	0.25	15	6.44	10.09	8.43	9.00	4.90	$1,089			$1,089	$ 316,028
S23-88	S23-4	23	27	84	0.25	15	6.43	10.09	8.48	9.04	5.64	$1,089			$1,089	$ 91,040
S23-4	S23-1	23	27	371	0.51	15	9.09	14.25	8.56	9.14	5.76	$1,089			$1,089	$ 404,019
S23-1	S33-79	23	27	305	0.62	14	10.02	15.71	8.56	9.14	5.66	$1,089			$1,089	$ 332,363
S33-79	S33-75	23	27	511	0.51	14	9.07	14.23	8.67	9.26	5.46	$1,089			$1,089	$ 556,370
S33-75	S33-63	23	27	507	0.45	14	8.54	13.39	8.67	9.26	5.04	$1,089			$1,089	$ 552,341
S33-63	S33-50	23	27	359	0.40	14	8.12	12.73	9.12	9.85	5.42	$1,089			$1,089	$ 390,624
S33-50	S33-41	23	27	289	0.42	14	8.30	13.01	9.12	9.85	5.76	$1,089			$1,089	$ 314,394
S33-41	S33-33	23	27	286	0.52	14	9.21	14.44	9.12	9.85	4.98	$1,089			$1,089	$ 311,890

Total Baseline Pipe Construction Cost	$	10,762,552
Total Trenchless Installation Cost	$	927,201
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (1)	$	45,000
Lateral Reconnection Cost (Approx. 130)	$	65,000
Modify Existing Manholes Cost (Approx. 22)	$	385,000
Baseline Construction Cost:	**$**	**12,184,753**
Dewatering	$	415,215
Bypass Pumping	$	1,168,975
Remove & Replace Factor	$	584,488
Traffic Control (10%)	$	1,168,975
Pavement Restoration (T-trench)	$	267,617
Subtotal:	**$**	**15,790,023**
Mobilization/Demobilization (5% of subtotal)	$	789,501.14
Estimated Construction Cost Subtotal:	**$**	**16,579,524**
Contingencies (30% of construction subtotal)	$	4,973,857.21
Estimated Construction Cost:	**$**	**21,553,381**
Engineering and Inspection (25% of construction cost)	$	5,388,345
Estimated Capital Improvement Cost:	**$**	**26,942,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 1
Agilent

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Proposed Weir
- Project Sewers
- Other Modeled Sewers

(8-in) (Existing Diameter)
10-in Proposed Diameter

0 0.13 0.25 0.5 Miles

N

Woodard & Curran

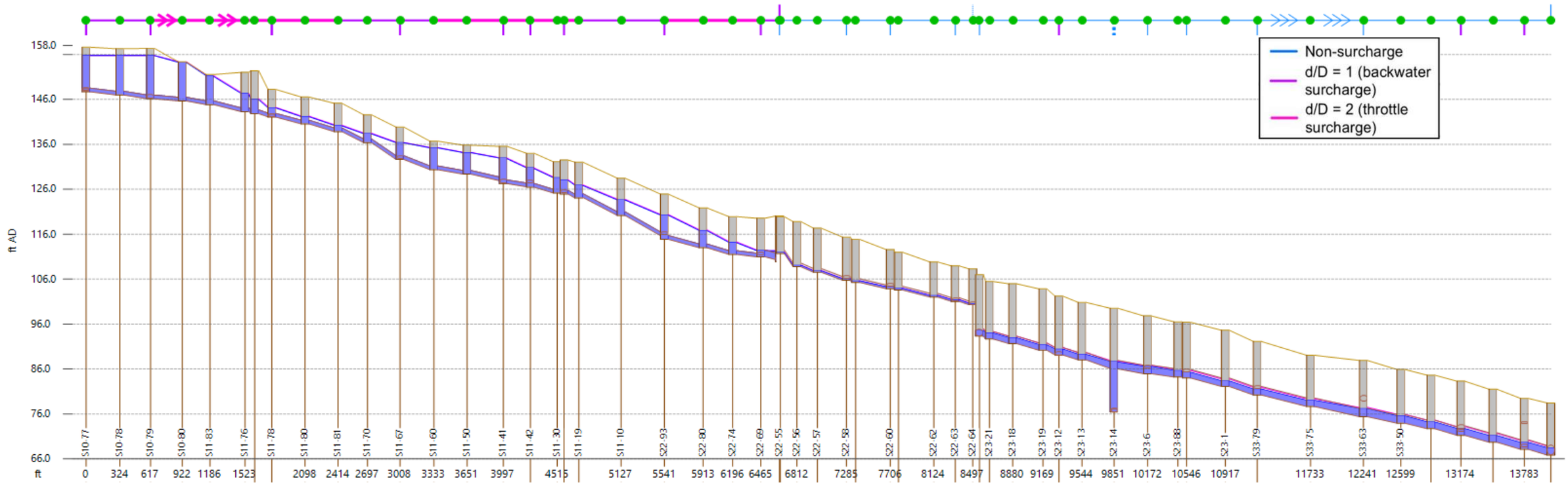
Project #: 0012307.00
Map Created: July 2024

Figure Exported: 7/17/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 1: Agilent

Capacity Deficiency Profile View

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



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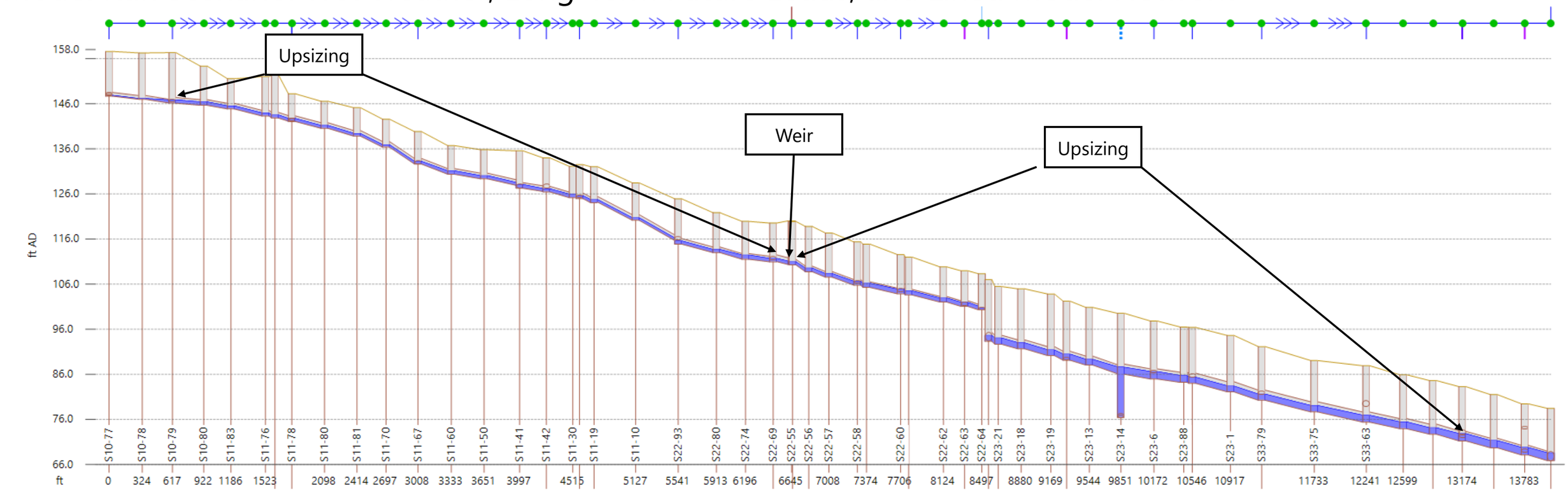
Project 1: Agilent

Project Solution Profile View

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



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Project 2: Homestead Road

PROJECT DESCRIPTION

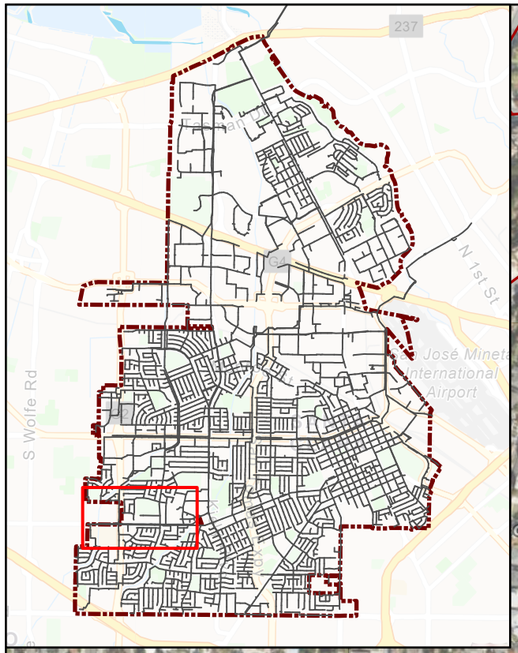
Project No.	2
Project ID	Homestead Road
Project Location	N Homestead Trunk from Swallow Wy to Saratoga Creek
Description	6407 LF of 24 to 33-inch diameter pipe
Priority	3
Flow Confidence Level	3
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$17,156,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project also includes installation of a weir at manhole S20-16 to divert as much flow as possible to maximize capacity within upsized Homestead Rd (S Trunk). See Agilent project.
	(iv) Project would not include improvements to siphon between manholes S20-26 and S20-18. Per City records, siphon is unlined and made of polyethylene (internal diameter 20.2-inch).
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S20-9	S20-13	26	30	111	0.40	12	11.06	16.79	11.65	11.65	5.91	$1,139			$1,139	$ 126,315
S20-13	S20-37	26	30	49	0.40	12	11.07	16.79	11.65	11.65	6.14	$1,139			$1,139	$ 55,469
S20-37	S20-15	26	30	409	0.58	13	13.25	20.10	11.69	11.72	6.48	$1,139			$1,139	$ 465,851
S20-15	S20-26	27	30	33	0.51	14	-23.81	18.96	11.69	11.72	6.03	$1,139		16.00	$1,139	$ 37,815
S20-18	S20-19	30	33	22	0.23	16	12.56	16.20	11.96	11.99	4.17	$1,189		16.00	$1,189	$ 26,515
S20-19	S20-12	29	33	25	0.20	19	10.35	15.29	11.96	11.99	4.10	$1,219		16.00	$1,219	$ 30,475
S20-12	S20-21	29	33	386	0.20	19	10.41	15.37	11.96	11.99	3.72	$1,219			$1,219	$ 470,412
S20-21	S20-23	29	33	473	0.08	14	6.65	9.82	11.96	11.99	5.28	$1,189			$1,189	$ 562,040
S20-23	S20-10	29	33	45	0.11	13	7.71	11.39	11.96	11.99	5.99	$1,189			$1,189	$ 53,505
00_Gate_2	S21-43	29	33	372	0.30	13	12.58	18.59	5.74	5.75	4.61	$1,189	PTGAB	42.00	$2,531	$ 941,840
S21-43	S21-44	18	24	291	0.65	13	5.49	11.82	5.77	5.79	5.74	$1,039			$1,039	$ 302,765
S21-44	S21-45	18	24	399	0.69	14	5.65	12.17	5.79	5.81	5.87	$1,039			$1,039	$ 414,873
S21-45	S21-46	18	24	315	0.73	15	5.80	12.49	5.80	5.82	5.79	$1,039			$1,039	$ 327,701
S21-46	S21-47	18	24	113	0.67	16	5.55	11.95	5.80	5.82	5.80	$1,039			$1,039	$ 117,511
S21-47	S21-48	18	24	427	0.68	16	5.58	12.01	5.80	5.82	5.49	$1,039			$1,039	$ 443,861
S21-48	S21-9	18	24	189	0.59	15	5.19	11.19	5.80	5.82	5.37	$1,039			$1,039	$ 196,059
S21-9	S22-45	18	24	237	0.55	15	5.05	10.86	5.81	5.84	5.40	$1,039			$1,039	$ 246,035
S22-45	S22-46	18	24	312	0.73	16	5.79	12.47	5.82	5.84	5.66	$1,039			$1,039	$ 323,649
S22-46	S22-47	18	24	337	0.63	16	5.38	11.59	5.82	5.85	5.67	$1,039			$1,039	$ 350,039
S22-47	S22-48	18	24	31	0.66	15	5.51	11.87	5.82	5.85	5.78	$1,039			$1,039	$ 31,897
S22-48	S22-49	18	24	315	0.69	15	5.62	12.10	5.92	5.95	5.85	$1,039			$1,039	$ 327,701
S22-49	S22-50	18	24	367	0.68	15	5.58	12.02	5.92	5.95	5.77	$1,039			$1,039	$ 380,897
S22-50	S22-51	18	24	361	0.65	15	5.48	11.80	5.92	5.96	5.73	$1,039			$1,039	$ 375,495
S22-51	S22-52	20	24	469	0.64	16	7.17	11.72	5.92	5.96	4.37	$1,039			$1,039	$ 487,187
S22-52	S23-21	20	24	96	0.68	15	7.36	12.03	7.62	7.83	5.16	$1,039			$1,039	$ 99,744
S23-21	S23-18	20	24	223	0.45	15	6.02	9.84	7.62	7.83	5.40	$1,039			$1,039	$ 231,801

Total Baseline Pipe Construction Cost	$	6,485,611
Total Trenchless Installation Cost	$	941,840
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (1)	$	45,000
Lateral Reconnection Cost (Approx. 21)	$	10,500
Modify Existing Manholes Cost (Approx. 26)	$	455,000
Baseline Construction Cost:	**$**	**7,937,951**
Dewatering	$	103,446
Bypass Pumping	$	742,745
Remove & Replace Factor	$	371,373
Traffic Control (10%)	$	742,745
Pavement Restoration (T-trench)	$	156,576
Subtotal:	**$**	**10,054,836**
Mobilization/Demobilization (5% of subtotal)	$	502,741.80
Estimated Construction Cost Subtotal:	**$**	**10,557,578**
Contingencies (30% of construction subtotal)	$	3,167,273.35
Estimated Construction Cost:	**$**	**13,724,851**
Engineering and Inspection (25% of construction cost)	$	3,431,213
Estimated Capital Improvement Cost:	**$**	**17,156,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Golden State Dr
Butcher Dr
Brockdale Dr
Curtis Ave
Bonetta Dr
Live Oak Dr
Lawrence Expy
Lawrence Expy
Burbank Dr
Ring Dr
Stratford Middle School
Pomeroy Ave
Quince Ave
Pepper Tree Ln
Apollo Pl
Miles Dr
Lochinvar Ave
Lorne Way
Homestead Rd
Princeton Way
Yale Ln
Ridge Rd
Alexander Ave
Ryan Ave
Homeridge Park
Kenyon Dr
Forbes Ave
Kaiser Permanente Santa Clara Medical Center

S20-9 S20-37 S20-13 S20-15 S20-16 S20-26 S20-18 S20-19 S20-21 S20-23 S20-10 S21-43 S21-44 S21-45 S21-46 S21-48 S21-9 S22-45 S22-46 S22-48 S22-49 S22-50 S22-51 S22-52

(25.7 in) 30 in

Weir Height: 6 in

(28.5 in) 33 in

(18 in) 24 in

Trenchless crossing of Lawrence Expressway

(20 in) 24 in

Project 2
Homestead Rd

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter
- Proposed Weir
- Other Modeled Sewers

0 0.03 0.05 0.1 Miles

N

Project #: 0012307.00
Map Created: July 2024

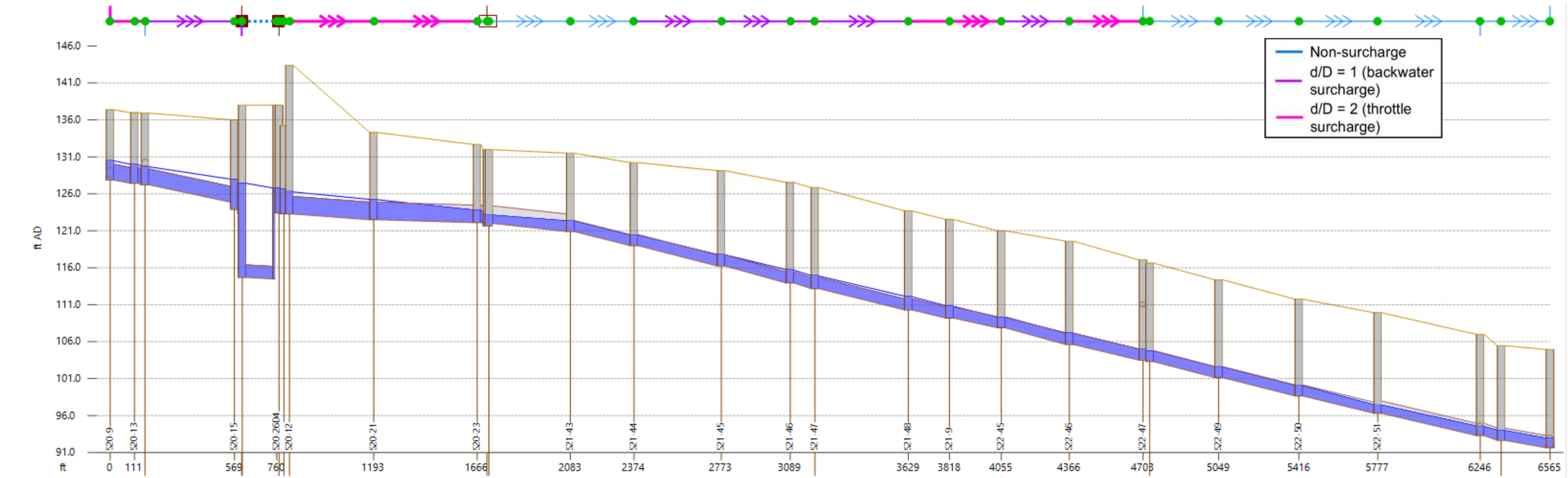
Woodard & Curran

Figure Exported: 7/17/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 2: Homestead Rd

Capacity Deficiency Profile View

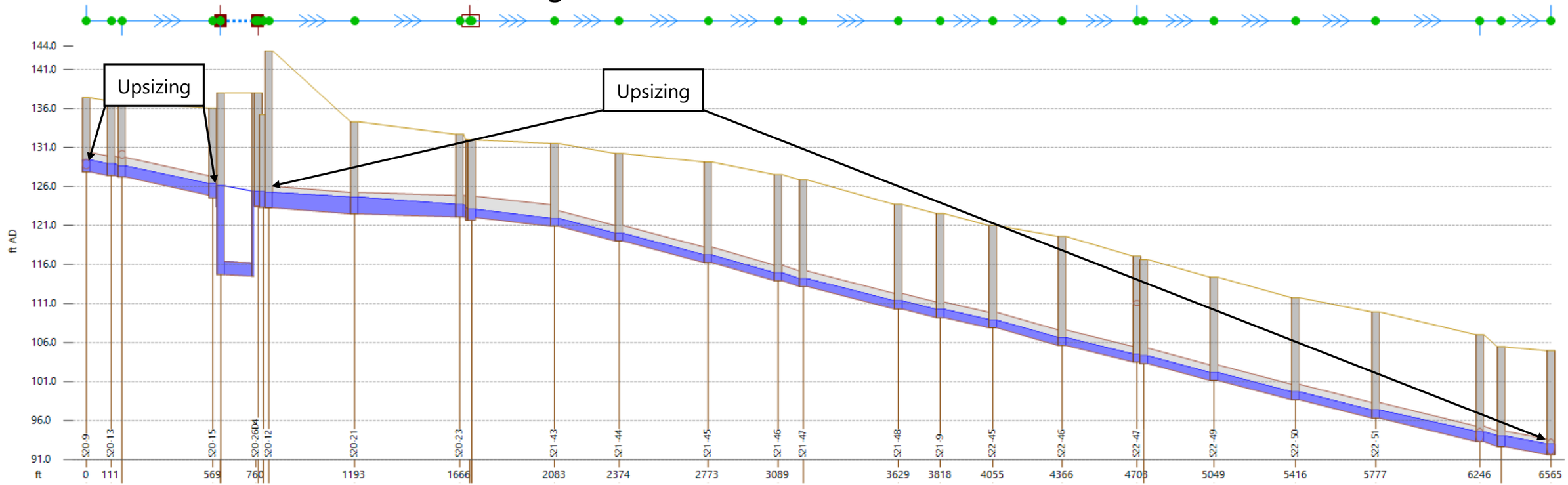
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	-	-	S20-37.1	-	S20-12.1	S20-21.1	00_Gate_2.1	S21-43.1	S21-44.1	S21-45.1	-	S21-47.1	-	S21-9.1	S22-45.1	S22-46.1	S22-48.1	S22-49.1	S22-50.1	S22-51.1	-	S23-21.1
Conduit mate	RCP	-	RCP	PE	RCP	RCP	RCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP	-	RCP
width (in)	25.7	-	25.7	20.2	28.5	28.5	28.5	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	20.0	-	20.0
length (ft)	-	-	409.0	158.0	385.9	472.7	372.1	291.4	399.3	315.4	-	427.2	188.7	236.8	311.5	336.9	315.4	366.6	361.4	468.9	-	223.1
pfc (MGD)	-	-	13.25	3.38	10.41	6.65	12.58	5.49	5.65	5.80	5.55	5.58	5.19	5.05	5.79	5.38	5.62	5.58	5.48	7.17	-	6.02
us inv (ft AD)	-	-	127.220	-	123.270	122.490	122.000	120.900	118.996	116.233	-	113.175	110.293	109.189	107.882	105.617	103.299	101.140	98.663	96.310	-	92.650
ds inv (ft AD)	-	-	124.870	-	122.490	122.100	120.900	118.996	116.233	113.931	-	110.293	109.189	107.882	105.617	103.502	101.140	98.663	96.310	93.300	-	91.640
surc	2.00	-	1.00	2.00	2.00	2.00	0.60	0.94	1.00	1.00	1.00	1.00	2.00	2.00	1.00	2.00	0.97	0.95	0.90	0.77	-	0.78
DS flow (MGD)	-	-	11.1434	5.8906	11.7801	11.7800	5.4006	5.4260	5.4089	5.4081	-	5.4073	5.4083	5.4184	5.4201	5.4208	5.5272	5.5265	5.5283	5.5273	-	5.7408
DS velocity (ft/s)	-	-	6.025	4.083	3.957	5.362	3.646	5.450	5.558	5.324	-	4.975	4.911	5.516	5.210	5.253	5.388	5.312	5.961	5.043	-	4.885

Node	S20-37	S20-15	-	S20-12	S20-21	S20-23	-	S21-43	S21-44	S21-45	S21-46	S21-47	S21-48	S21-9	S22-45	S22-46	-	-	S22-49	S22-50	S22-51	S22-52	-	-
ground (ft AD)	136.920	136.020	-	-	134.280	132.680	-	131.500	130.220	129.130	-	126.840	123.690	-	121.000	119.590	-	-	114.370	111.750	109.910	106.990	-	-
flood dep (ft)	-7.194	-8.084	-	-	-9.040	-8.884	-8.860	-9.163	-9.817	-11.337	-11.797	-11.895	-11.539	-11.668	-11.731	-12.398	-	-	-11.774	-11.703	-12.480	-12.416	-	-

Project 2: Homestead Rd
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	-	-	S20-37.1	-	S20-12.1	S20-21.1	00_Gate_2.1	S21-43.1	S21-44.1	S21-45.1	-	S21-47.1	-	S21-9.1	S22-45.1	S22-46.1	S22-48.1	S22-49.1	S22-50.1	S22-51.1	-	S23-21.1
Conduit mate	RCP	-	RCP	PE	RCP	RCP	RCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP	-	RCP
width (in)	30.0	-	30.0	20.2	33.0	33.0	33.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	-	24.0
length (ft)	-	-	409.0	158.0	385.9	472.7	372.1	291.4	399.3	315.4	-	427.2	188.7	236.8	311.5	336.9	315.4	366.6	361.4	468.9	-	223.1
pfc (MGD)	-	-	20.10	3.38	15.37	9.82	18.59	11.82	12.17	12.49	-	12.01	11.19	10.86	12.47	11.59	12.10	12.02	11.80	11.72	-	9.84
us inv (ft AD)	-	-	127.220	-	123.270	122.490	122.000	120.900	118.996	116.233	-	113.175	110.293	109.189	107.882	105.617	103.299	101.140	98.663	96.310	-	92.650
ds inv (ft AD)	-	-	124.870	-	122.490	122.100	120.900	118.996	116.233	113.931	-	110.293	109.189	107.882	105.617	103.502	101.140	98.663	96.310	93.300	-	91.640
surc	0.61	-	0.59	2.00	0.78	0.78	0.38	0.50	0.49	0.50	0.50	0.52	0.53	0.52	0.51	0.51	0.50	0.51	0.51	0.65	-	0.68
DS flow (MGD)	-	-	11.7184	5.9957	11.9855	11.9851	5.7539	5.7937	5.8074	5.8194	-	5.8206	5.8226	5.8367	5.8431	5.8455	5.9542	5.9539	5.9554	5.9556	-	7.8279
DS velocity (ft/s)	-	-	6.470	4.156	3.721	5.286	4.613	5.749	5.877	5.799	-	5.495	5.373	5.409	5.668	5.677	5.857	5.772	5.739	4.251	-	5.417

Node			S20-37	S20-15		-	S20-12	S20-21	S20-23	-	S21-43	S21-44	S21-45	S21-46	S21-47	S21-48	S21-9	S22-45	S22-46	-	-	S22-49	S22-50	S22-51	S22-52	-	-
ground (ft AD)			136.920	136.020		-	-	134.280	132.680	-	131.500	130.220	129.130	-	126.840	123.690	-	121.000	119.590	-	-	114.370	111.750	109.910	106.990	-	-
flood dep (ft)			-8.311	-9.674		-	-	-9.640	-9.011	-8.912	-9.608	-10.245	-11.932	-12.608	-12.677	-12.363	-12.288	-12.149	-12.961	-	-	-12.229	-12.075	-12.583	-12.389	-	-

Project 3: Kiely Boulevard

PROJECT DESCRIPTION

Project No.	3
Project ID	Kiely Boulevard
Project Location	Orthello Wy to S of El Sobrante St
Description	266 LF of 10-inch diameter pipe
Priority	6
Flow Confidence Level	4
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$513,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii)
	(iv)
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S33-42	S33-35	8	10	266	0.32	8	0.44	0.80	0.31	0.36	2.63	$704			$704	$ 187,053

Total Baseline Pipe Construction Cost	$	187,053
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 6)	$	3,000
Modify Existing Manholes Cost (Approx. 2)	$	35,000
Baseline Construction Cost:	**$**	**225,053**
Dewatering	$	23,913
Bypass Pumping	$	18,705
Remove & Replace Factor	$	9,353
Traffic Control (10%)	$	18,705
Pavement Restoration (T-trench)	$	5,021
Subtotal:	**$**	**300,750**
Mobilization/Demobilization (5% of subtotal)	$	15,037.51
Estimated Construction Cost Subtotal:	**$**	**315,788**
Contingencies (30% of construction subtotal)	$	94,736.34
Estimated Construction Cost:	**$**	**410,524**
Engineering and Inspection(25% ofconstruction cost)	$	102,631
Estimated Capital Improvement Cost:	**$**	**513,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 3
Kiely Blvd

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

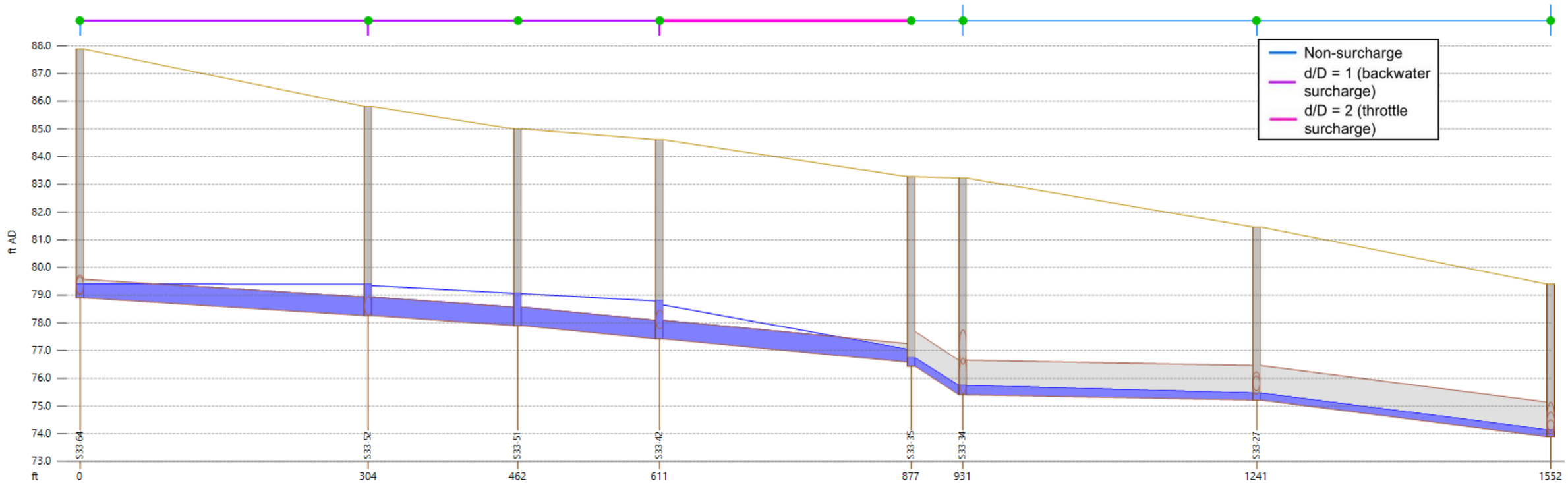
0 0.03 0.05 0.1 Miles

N

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 7/17/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

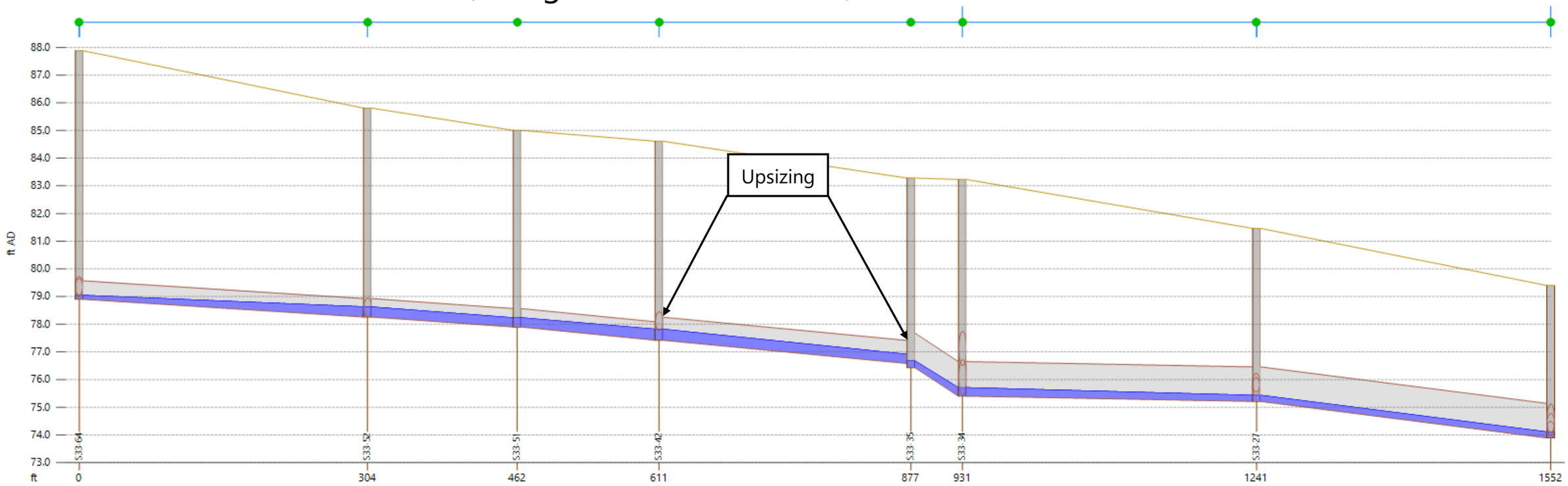
Project 3: Kiely Blvd
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S33-64.1	S33-52.1	S33-51.1	S33-42.1	S33-35.1	S33-34.2	S33-27.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	8.0	15.0	15.0	15.0
length (ft)	303.8	157.9	149.6	265.7	54.2	310.3	310.1
pfc (MGD)	0.36	0.37	0.44	0.44	5.76	1.03	2.72
us inv (ft AD)	78.900	78.260	77.900	77.420	76.430	75.400	75.210
ds inv (ft AD)	78.260	77.900	77.420	76.580	75.400	75.210	73.890
surc	1.00	1.00	1.00	2.00	0.27	0.27	0.20
DS flow (MGD)	0.0293	0.3206	0.3212	0.5881	0.5881	0.1644	0.2187
DS velocity (ft/s)	0.238	1.897	1.341	3.578	3.412	1.488	2.059

Node	S33-64	S33-52	S33-51	S33-42	S33-35	S33-34	S33-27	S33-17
ground (ft AD)	87.881	85.808	85.004	84.610	83.280	83.230	81.460	79.400
flood dep (ft)	-8.483	-6.414	-5.942	-5.823	-6.553	-7.493	-6.003	-5.270

Project 3: Kiely Blvd
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S33-64.1	S33-52.1	S33-51.1	S33-42.1	S33-35.1	S33-34.2	S33-27.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	10.0	15.0	15.0	15.0
length (ft)	303.8	157.9	149.6	265.7	54.2	310.3	310.1
pfc (MGD)	0.36	0.37	0.44	0.80	5.76	1.03	2.72
us inv (ft AD)	78.900	78.260	77.900	77.420	76.430	75.400	75.210
ds inv (ft AD)	78.260	77.900	77.420	76.580	75.400	75.210	73.890
surc	0.55	0.54	0.60	0.48	0.24	0.24	0.18
DS flow (MGD)	0.0299	0.2076	0.2081	0.3562	0.3562	0.1334	0.1687
DS velocity (ft/s)	0.337	1.864	1.487	2.740	2.373	1.426	1.828

Node	S33-64	S33-52	S33-51	S33-42	S33-35	S33-34	S33-27	S33-17
ground (ft AD)	87.881	85.808	85.004	84.610	83.280	83.230	81.460	79.400
flood dep (ft)	-8.838	-7.182	-6.774	-6.793	-6.606	-7.525	-6.030	-5.293

Project 4: Victoria Avenue

PROJECT DESCRIPTION

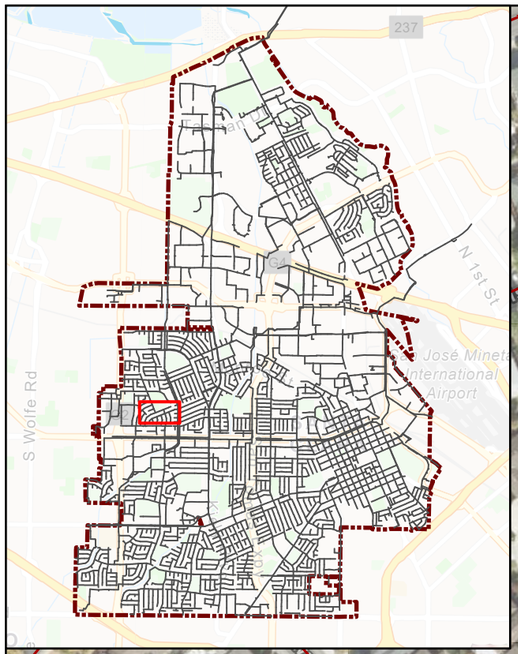
Project No.	4
Project ID	Victoria Avenue
Project Location	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave
Description	764 LF of 10-inch diameter pipe
Priority	6
Flow Confidence Level	3
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$1,337,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project would also would include abandonment 255 LF of existing 8-inch sewer between Fowler Avenue and Victoria Avenue (from manhole S42-48 to S42-36), which crosses through an easement underneath single-family residential parcels
	(iv) Two pipe segments between manholes S42-113 and S41-53 would have sufficient capacity and therefore were not included in the proposed project. However, considering these pipe segments are located between the proposed project and the recently upsized section downstream of manhole S41-53, the City may wish to consider expanding the project to include these pipes during preliminary design.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S42-48	S42-47	8	10	253	0.36	8	0.48	0.84	0.31	0.38	2.13	$704			$704	$ 178,042
S42-47	S42-46	8	10	261	0.36	11	0.66	0.84	0.32	0.40	2.11	$704			$704	$ 183,814
S42-46	S42-113	N/A	10	250	0.36	12	N/A	0.85	0.33	0.43	2.21	$704			$704	$ 176,211

Total Baseline Pipe Construction Cost	$	538,067
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 14)	$	7,000
Modify Existing Manholes Cost (Approx. 4)	$	70,000
Baseline Construction Cost:	**$**	**615,067**
Dewatering	$	46,026
Bypass Pumping	$	36,186
Remove & Replace Factor	$	18,093
Traffic Control (10%)	$	53,807
Pavement Restoration (T-trench)	$	14,444
Subtotal:	**$**	**783,622**
Mobilization/Demobilization (5% of subtotal)	$	39,181.12
Estimated Construction Cost Subtotal:	**$**	**822,803**
Contingencies (30% of construction subtotal)	$	246,841.03
Estimated Construction Cost:	**$**	**1,069,644**
Engineering and Inspection(25% ofconstruction cost)	$	267,411
Estimated Capital Improvement Cost:	**$**	**1,337,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 4
Victoria Ave

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Modeled Sewers Included in the Project
- Other Modeled Sewers
- Pipe to be Abandoned

(8-in) (Existing Diameter)
10-in Proposed Diameter

0 0.03 0.05 0.1 Miles

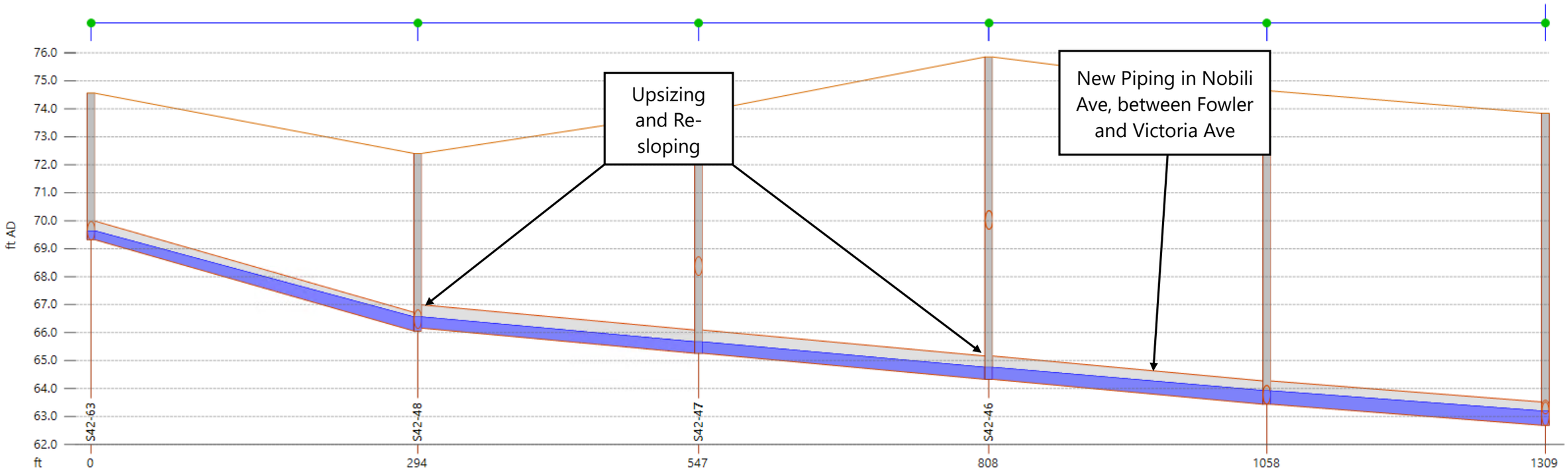
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 8/29/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023.aprx

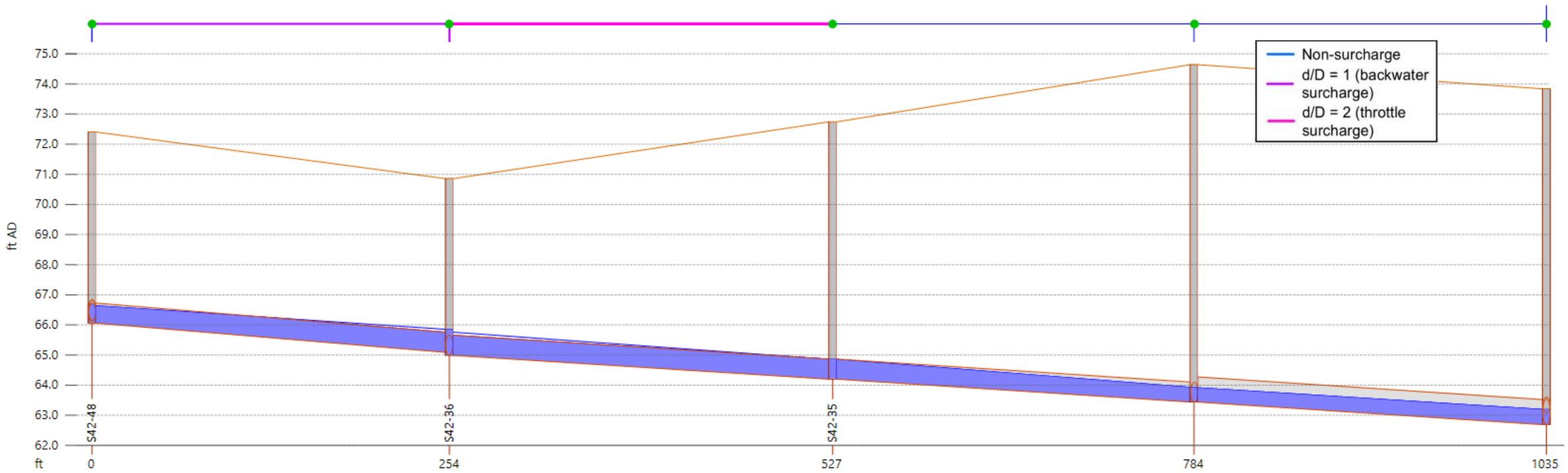
Project 4: Victoria Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S42-63.1	S42-48.1	S42-47.1	S42-46.2	S42-113.1
Conduit mate	VCP	VCP	VCP	UNKN	VCP
width (in)	8.0	10.0	10.0	10.0	10.0
length (ft)	294.1	252.9	261.1	250.3	250.8
pfc (MGD)	0.82	0.84	0.84	0.85	0.77
us inv (ft AD)	69.320	66.160	65.260	64.331	63.440
ds inv (ft AD)	66.060	65.260	64.331	63.440	62.690
surc	0.75	0.49	0.51	0.58	0.61
DS flow (MGD)	0.3530	0.3807	0.3958	0.4253	0.4726
DS velocity (ft/s)	1.954	2.231	2.194	1.997	2.111

Node	S42-63	S42-48	S42-47	S42-46	S42-113	S41-55
ground (ft AD)	74.557	72.405	73.900	75.851	74.640	73.840
flood dep (ft)	-4.926	-5.848	-8.234	-11.096	-10.713	-10.644

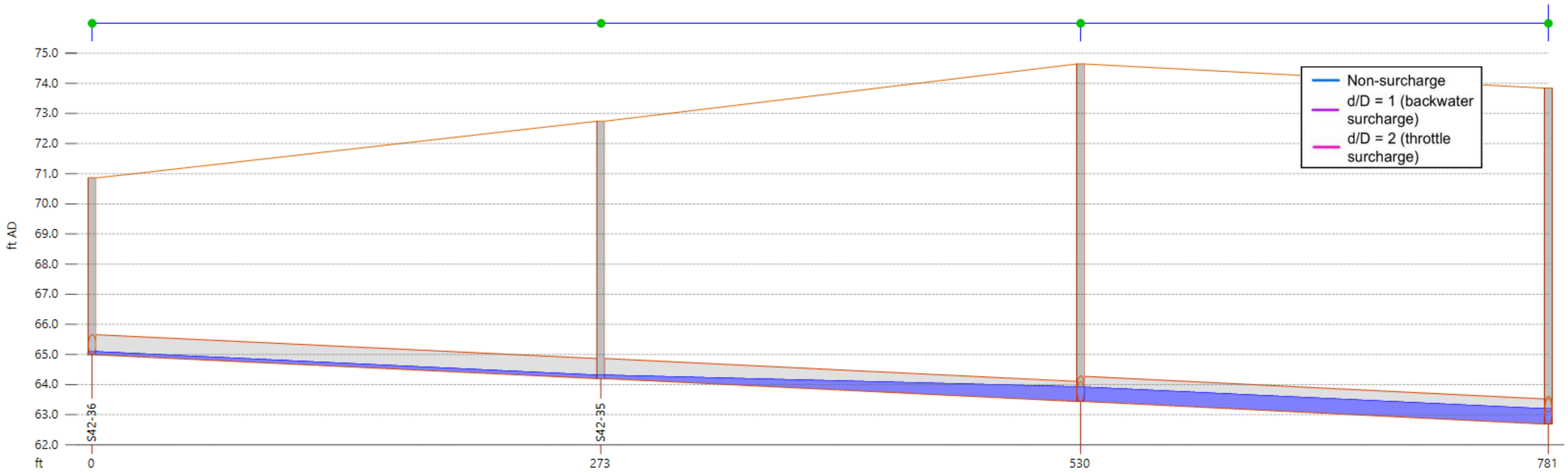
Project 4: Victoria Ave
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S42-48.1	S42-36.1	S42-35.1	S42-113.1
Conduit mate	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	10.0
length (ft)	254.4	272.7	257.1	250.8
pfc (MGD)	0.48	0.42	0.42	0.77
us inv (ft AD)	66.060	64.990	64.200	63.440
ds inv (ft AD)	65.090	64.200	63.440	62.690
surc	1.00	2.00	0.99	0.60
DS flow (MGD)	0.4240	0.4403	0.4452	0.4695
DS velocity (ft/s)	2.636	2.081	2.517	2.109

Node	S42-48	S42-36	S42-35	S42-113	S41-55
ground (ft AD)	72.405	70.858	72.742	74.640	73.840
flood dep (ft)	-5.724	-5.010	-7.879	-10.715	-10.647

Project 4: Victoria Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S42-36.1	S42-35.1	S42-113.1
Conduit mate	VCP	VCP	VCP
width (in)	8.0	8.0	10.0
length (ft)	272.7	257.1	250.8
pfc (MGD)	0.42	0.42	0.77
us inv (ft AD)	64.990	64.200	63.440
ds inv (ft AD)	64.200	63.440	62.690
surc	0.17	0.73	0.61
DS flow (MGD)	0.0178	0.0227	0.4726
DS velocity (ft/s)	0.698	0.138	2.111

Node	S42-36	S42-35	S42-113	S41-55
ground (ft AD)	70.858	72.742	74.640	73.840
flood dep (ft)	-5.767	-8.429	-10.713	-10.644

Project 5: Cabrillo Avenue

PROJECT DESCRIPTION

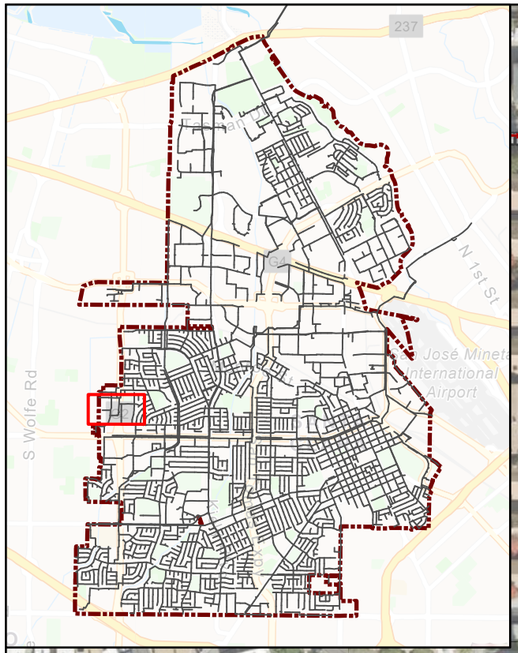
Project No.	5
Project ID	Cabrillo Avenue
Project Location	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy
Description	Flow Diversion Weirs only. No pipe replacement.
Priority	1
Flow Confidence Level	3
Loads Trigger	Existing Loads (EL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$154,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Project would include installation of two weirs at manholes S40-16 and S41-38 to divert flow away from capacity deficient sewers along Cabrillo Ave and maximize use of available capacity within existing adjacent sewers. Weirs would be installed at the intersection of Halford Ave and Buckley St and Lawrence Expwy and Saint Lawrence Dr. (iv) Two pipe segments between manholes S42-113 and S41-53 would have sufficient capacity and therefore were not included in the proposed project. However, considering these pipe segments are located between the proposed project and the recently upsized section downstream of manhole S41-53, the City may wish to consider expanding the project to include these pipes during preliminary design. (v) (vi)
Assumptions	(i) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR. (ii)
Alternatives	Upsize existing 8-inch pipes to 12-inch along Cabrillo Avenue from manhole S41-13 to S41-20.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
															$0	$ -

Total Baseline Pipe Construction Cost	$	-
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (2)	$	90,000
Lateral Reconnection Cost (Approx. 0)	$	-
Modify Existing Manholes Cost (Approx. 0)	$	-
Baseline Construction Cost:	**$**	**90,000**
Dewatering	$	-
Bypass Pumping	$	-
Remove & Replace Factor	$	-
Traffic Control (N/A)	$	-
Pavement Restoration	$	-
Subtotal:	**$**	**90,000**
Mobilization/Demobilization (5% of subtotal)	$	4,500.00
Estimated Construction Cost Subtotal:	**$**	**94,500**
Contingencies (30% of construction subtotal)	$	28,350.00
Estimated Construction Cost:	**$**	**122,850**
Engineering and Inspection(25% ofconstruction cost)	$	30,713
Estimated Capital Improvement Cost:	**$**	**154,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 5
Cabrillo Ave

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Proposed Weir
- Manholes Within the Project Area
- Pipes within the Project Area (not Part of the Project)
- Other Modeled Sewers

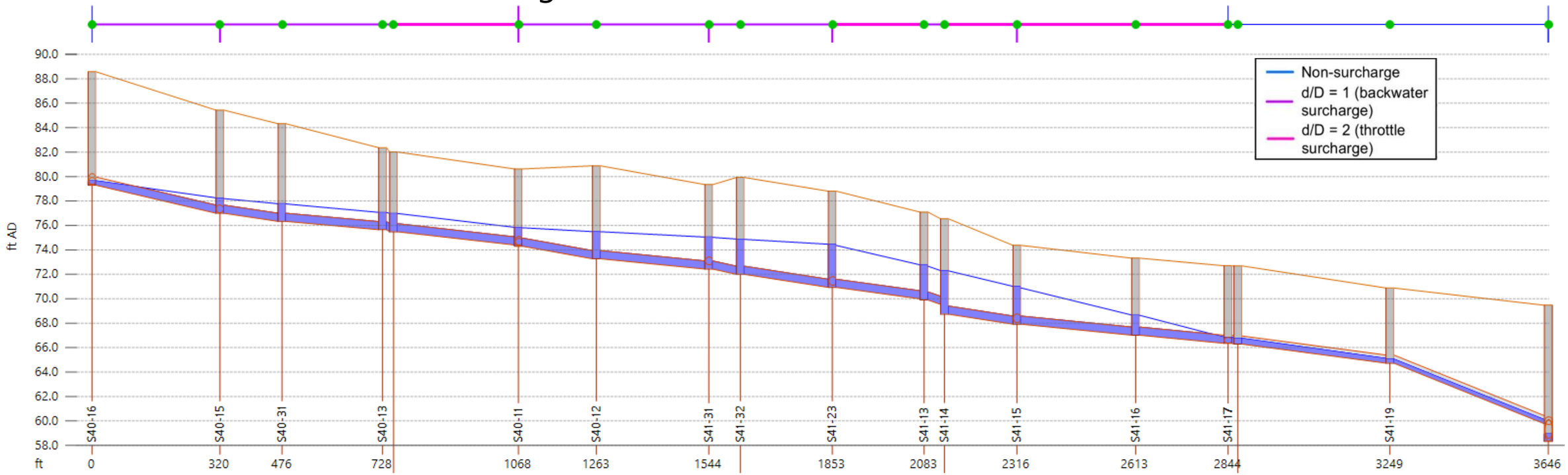
0 0.03 0.05 0.1 Miles

N

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 10/20/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wipC. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

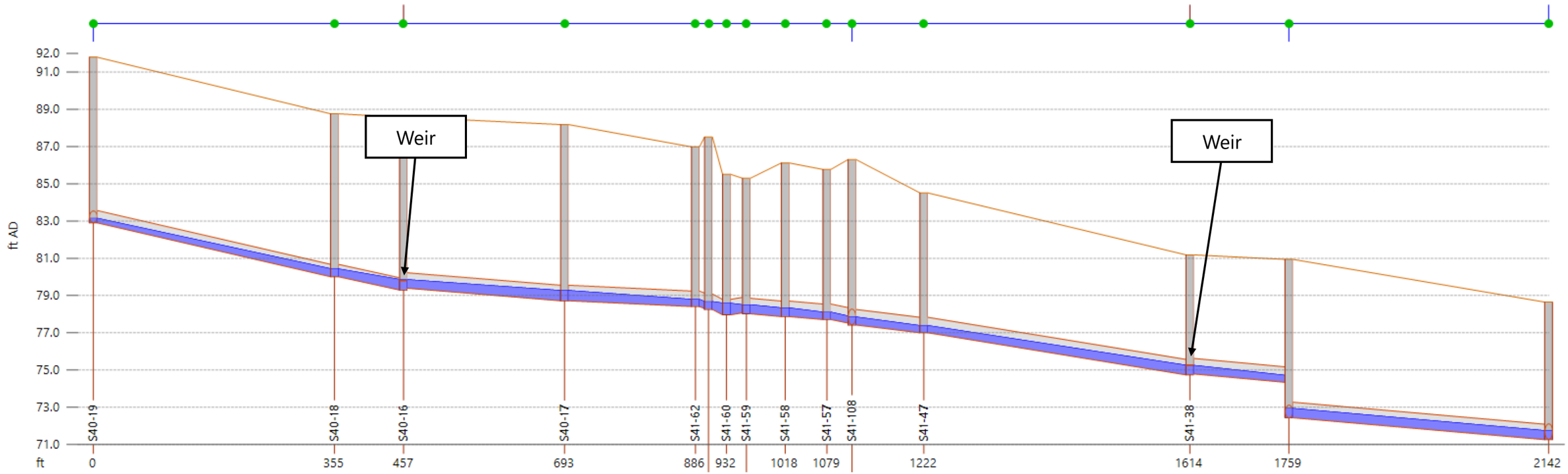
Project 5: Cabrillo Ave
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S40-16.1	S40-15.1	S40-31.1	S40-30.1	S40-11.2	S40-12.1	-	S41-32.1	S41-23.1	-	S41-14.1	S41-15.1	S41-16.1	S41-18.1	S41-19.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	-	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
length (ft)	320.4	155.4	251.7	312.6	195.2	281.4	79.0	230.0	230.1	-	181.3	297.3	231.3	380.7	396.5
pfc (MGD)	0.66	0.51	0.41	0.46	0.57	0.43	0.58	0.53	0.50	-	0.53	0.43	0.42	0.50	0.87
us inv (ft AD)	79.290	77.000	76.330	75.480	74.300	73.270	-	72.000	70.930	-	68.740	67.920	67.020	66.290	64.730
ds inv (ft AD)	77.000	76.330	75.650	74.400	73.270	72.430	-	70.930	69.990	-	67.920	67.020	66.350	64.730	59.770
surc	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	2.00	-	2.00	2.00	2.00	0.70	0.50
DS flow (MGD)	0.3525	0.4006	0.4006	0.4989	0.3167	0.3134	-	0.4026	0.6401	-	0.6429	0.6674	0.6720	0.4138	0.4214
DS velocity (ft/s)	2.110	1.984	2.468	3.272	2.006	2.006	-	1.649	3.368	-	2.527	2.759	3.687	3.099	3.717

Node	S40-16	S40-15	S40-31	S40-13	S40-30	S40-11	S40-12	S41-31	S41-32	S41-23	S41-13	-	S41-15	S41-16	-	S41-18	S41-19	S41-20
ground (ft AD)	88.574	85.436	84.320	82.361	82.009	80.620	80.880	79.342	79.921	78.804	77.090	-	74.370	73.320	72.700	72.690	70.880	69.470
flood dep (ft)	-8.928	-7.182	-6.543	-5.291	-5.025	-4.784	-5.385	-4.293	-5.037	-4.342	-4.331	-	-3.355	-4.656	-5.842	-5.930	-5.818	-10.524

Project 5: Cabrillo Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



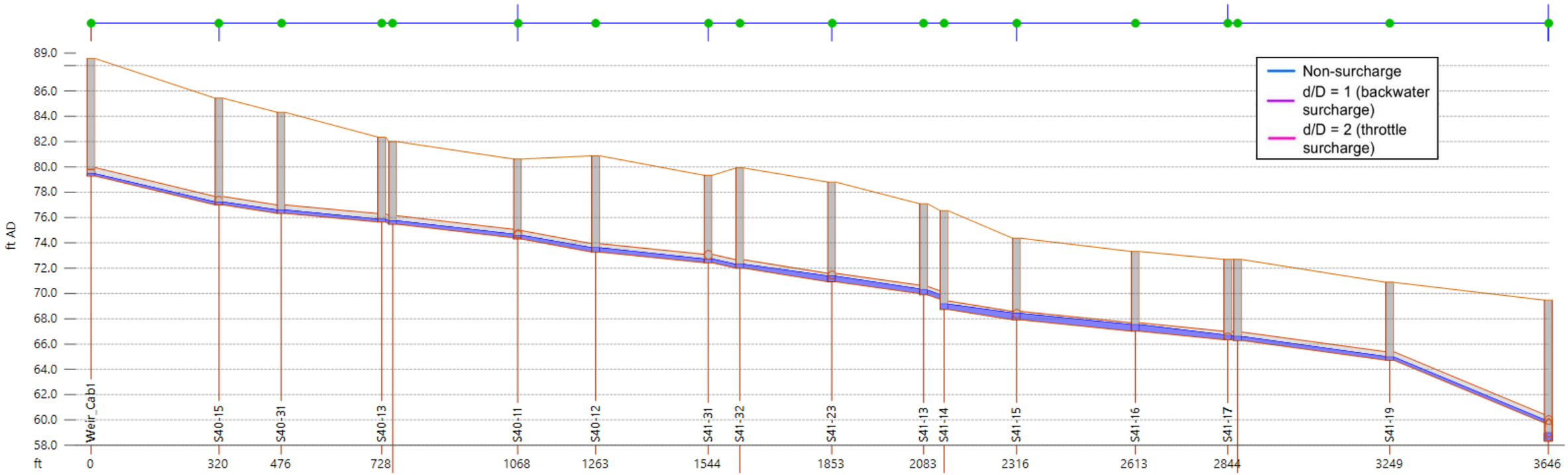
Link	S40-19.1	S40-18.1	S40-16.2	S40-17.1	-	-	-	-	-	-	S41-108.1	S41-47.1	S41-38.2	S41-39.1
Conduit mate	VCP	VCP	VCP	VCP	-	-	-	VCP	VCP	-	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	10.0	10.0	-	-	-	10.0	10.0	-	10.0	10.0	10.0	10.0
length (ft)	354.9	101.8	236.8	192.7	-	-	-	57.1	61.3	-	105.7	391.5	145.6	382.2
pfc (MGD)	0.70	0.66	0.75	0.57	-	-	-	0.72	0.73	-	0.89	1.08	0.79	0.79
us inv (ft AD)	82.900	80.010	79.390	78.720	-	-	-	-	77.870	-	77.420	77.000	74.790	72.440
ds inv (ft AD)	80.010	79.290	78.720	78.410	-	-	-	-	77.710	-	77.000	74.740	74.340	71.260
surc	0.64	0.85	0.65	0.65	-	-	-	0.57	0.55	-	0.51	0.62	0.55	0.60
DS flow (MGD)	0.4327	0.4954	0.4377	0.4526	-	-	-	-	0.4525	-	0.4525	0.4525	0.4516	0.5192
DS velocity (ft/s)	2.841	2.427	1.792	2.879	-	-	-	2.257	2.778	-	2.854	1.984	2.962	2.439

Node	S40-19	S40-18	S40-16	S40-17	S41-62			-	-	-	-	S41-47	S41-38	S41-39	S41-40
ground (ft AD)	91.798	88.761	88.574	88.180	86.984			-	-	-	-	84.510	81.184	80.945	78.649
flood dep (ft)	-8.652	-8.326	-8.723	-8.914	-8.193			-	-	-	-	-7.127	-5.932	-8.007	-6.904

Project 5: Cabrillo Ave

Project Solution Profile View 1 of 2 (*Sewers Along Cabrillo Avenue*)

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



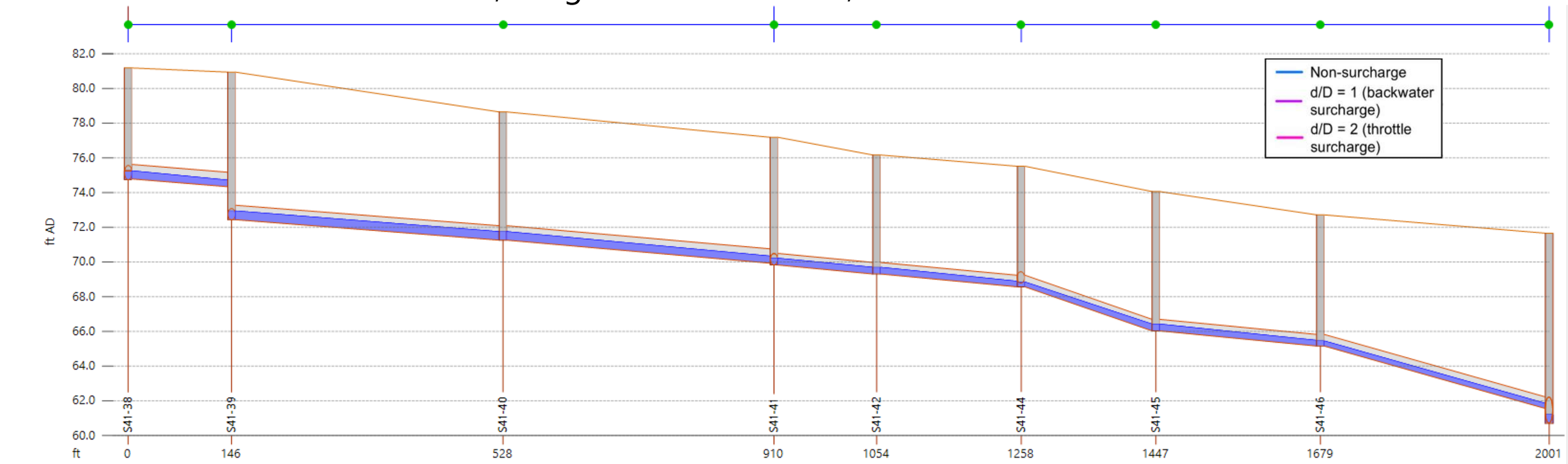
Link	Weir_Cab1.1	S40-15.1	S40-31.1	S40-30.1	S40-11.2	S40-12.1	-	S41-32.1	S41-23.1	-	S41-14.1	S41-15.1	S41-16.1	S41-18.1	S41-19.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	-	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
length (ft)	320.4	155.4	251.7	312.6	195.2	281.4	79.0	230.0	230.1	-	181.3	297.3	231.3	380.7	396.5
pfc (MGD)	0.66	0.51	0.41	0.46	0.57	0.43	0.58	0.53	0.50	-	0.53	0.43	0.42	0.50	0.87
us inv (ft AD)	79.290	77.000	76.330	75.480	74.300	73.270	-	72.000	70.930	-	68.740	67.920	67.020	66.290	64.730
ds inv (ft AD)	77.000	76.330	75.650	74.400	73.270	72.430	-	70.930	69.990	-	67.920	67.020	66.350	64.730	59.770
surc	0.33	0.39	0.39	0.42	0.50	0.50	0.44	0.66	0.63	-	0.78	0.76	0.76	0.45	0.35
DS flow (MGD)	0.0733	0.1219	0.1219	0.2209	0.2021	0.2021	-	0.2029	0.3520	-	0.3548	0.3797	0.3844	0.2067	0.2145
DS velocity (ft/s)	1.138	1.500	1.921	2.488	1.808	2.225	-	1.316	2.919	-	1.894	2.056	3.023	2.427	3.019

Node	-	S40-15	S40-31	S40-13	S40-30	S40-11	S40-12	S41-31	S41-32	S41-23	S41-13	-	S41-15	S41-16	-	S41-18	S41-19	S41-20
ground (ft AD)	88.574	85.436	84.320	82.361	82.009	80.620	80.880	79.342	79.921	78.804	77.090	-	74.370	73.320	72.700	72.690	70.880	69.470
flood dep (ft)	-9.121	-8.215	-7.730	-6.495	-6.273	-6.036	-7.279	-6.629	-7.627	-7.435	-6.833	-	-5.927	-5.792	-6.022	-6.098	-5.919	-10.503

Project 5: Cabrillo Ave

Project Solution Profile View 2 of 2 (*Sewers Downstream of Proposed Diversions*)

Model Run Scenario: Wet Weather, Long-Term Future Load, and Lined Model Network



Link	S41-38.2	S41-39.1	S41-40.1	S41-41.2	S41-42.1	S41-44.1	S41-45.1	S41-46.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP
width (in)	10.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0
length (ft)	145.6	382.2	381.7	144.6	203.5	189.7	231.6	322.2
pfc (MGD)	0.79	0.79	0.84	0.47	0.47	0.90	0.48	0.83
us inv (ft AD)	74.790	72.440	71.260	69.830	69.310	68.570	66.030	65.160
ds inv (ft AD)	74.340	71.260	69.930	69.310	68.570	66.030	65.160	61.560
surc	0.55	0.60	0.58	0.57	0.57	0.58	0.57	0.43
DS flow (MGD)	0.4516	0.5192	0.5302	0.2798	0.2809	0.2893	0.2937	0.3008
DS velocity (ft/s)	2.962	2.439	3.123	2.101	2.699	2.146	2.740	3.236

Node	-	S41-39	S41-40	S41-41	S41-42	S41-44	S41-45	S41-46	S41-37
ground (ft AD)	81.184	80.945	78.649	77.188	76.168	75.517	74.060	72.718	71.660
flood dep (ft)	-5.932	-8.007	-6.904	-6.978	-6.478	-6.679	-7.645	-7.274	-10.461

Project 6: CMC Basin

PROJECT DESCRIPTION

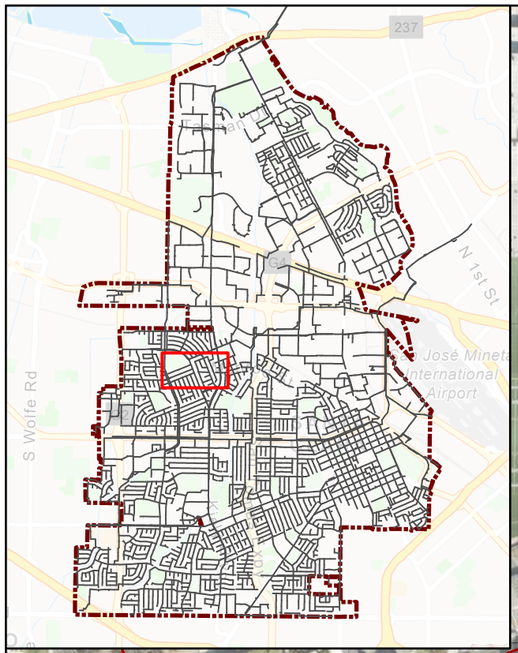
Project No.	6
Project ID	CMC Basin
Project Location	Santa Maria Ave & Francis Ave; Amethyst Dr
Description	3655 LF of 12 to 15-inch diameter pipe
Priority	1
Flow Confidence Level	1 & 2
Loads Trigger	Existing Loads (EL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$7,263,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) It is recommended that the City conduct infiltration and inflow (I/I) investigations prior to project implementation to attempt to pinpoint and eliminate significant sources of excessive I/I within the CMC Basin, if possible. (iv) Model runs show that the proposed upsizing project would be needed to meet the City's depth to diameter (d/D) ratio criteria. However, it would not meet the City's velocity design criteria under PDWF (i.e., minimum of 2 feet per second) within the upsized 12-inch pipe segments between manholes S43-14 and S53-103 on Amethyst Dr and within the upsized 15-inch pipe segments between manholes S52-104 and S53-74 on Santa Maria Ave. (v) (vi)
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	Eliminate significant sources of excessive I/I. However, model runs show that the rainfall dependent I/I would need to be reduced by at least 50-60% to eliminate the capacity deficiency.

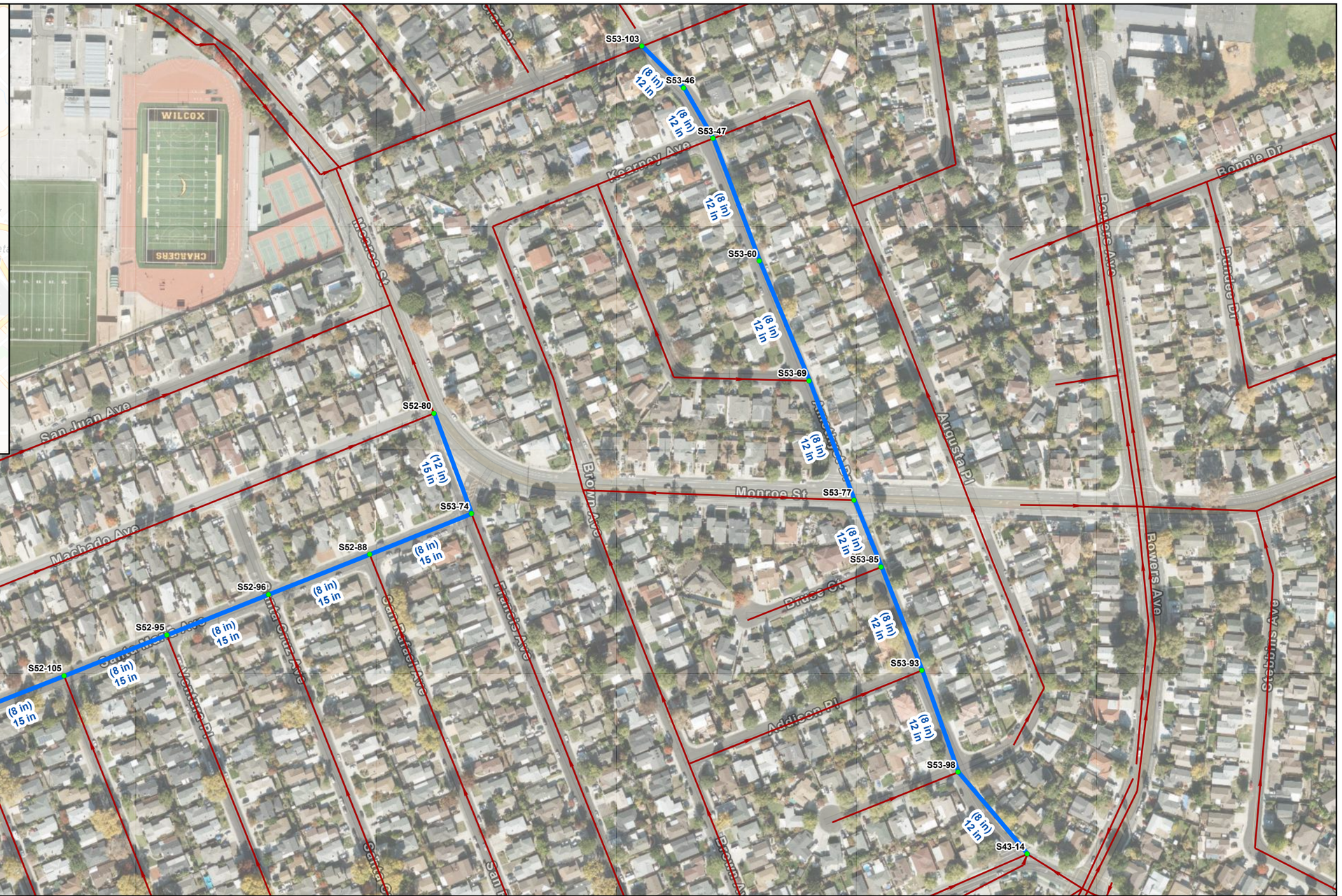
PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S52-104	S52-105	8	15	252	0.38	9	0.48	2.57	0.09	0.44	1.30	$804			$804	$ 202,447
S52-105	S52-95	8	15	260	0.42	9	0.50	2.69	0.10	0.57	1.30	$804			$804	$ 208,638
S52-95	S52-96	8	15	257	0.35	9	0.46	2.46	0.11	0.68	1.25	$804			$804	$ 206,628
S52-96	S52-88	8	15	256	0.33	9	0.45	2.38	0.13	0.95	0.74	$804			$804	$ 205,422
S52-88	S53-74	8	15	257	0.53	10	0.57	3.03	0.15	1.10	0.56	$804			$804	$ 206,708
S53-74	S52-80	12	15	252	0.75	11	1.99	3.61	0.19	1.57	2.23	$804			$804	$ 202,206
S43-14	S53-98	8	12	251	0.35	8	0.46	1.36	0.04	0.55	1.00	$754			$754	$ 189,556
S53-98	S53-93	8	12	254	0.35	8	0.46	1.36	0.05	0.61	0.97	$754			$754	$ 191,214
S53-93	S53-85	8	12	261	0.31	8	0.43	1.28	0.06	0.70	1.43	$754			$754	$ 196,643
S53-85	S53-77	8	12	169	0.37	8	0.47	1.39	0.06	0.76	1.45	$754			$754	$ 127,652
S53-77	S53-69	8	12	300	0.33	9	0.45	1.32	0.06	0.80	1.22	$754			$754	$ 225,898
S53-69	S53-60	8	12	304	0.37	8	0.47	1.39	0.07	0.84	1.21	$754			$754	$ 229,291
S53-60	S53-47	8	12	308	0.32	8	0.44	1.30	0.07	0.88	1.05	$754			$754	$ 232,157
S53-47	S53-46	8	12	137	0.35	7	0.46	1.36	0.10	1.14	1.72	$754			$754	$ 103,223
S53-46	S53-103	8	12	139	0.35	7	0.46	1.36	0.10	1.14	1.72	$754			$754	$ 104,655

Total Baseline Pipe Construction Cost	$	2,832,339
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 69)	$	34,500
Modify Existing Manholes Cost (Approx. 16)	$	280,000
Baseline Construction Cost:	**$**	**3,146,839**
Dewatering	$	328,932
Bypass Pumping	$	283,234
Remove & Replace Factor	$	141,617
Traffic Control (10%)	$	283,234
Pavement Restoration (T-trench)	$	72,880
Subtotal:	**$**	**4,256,736**
Mobilization/Demobilization (5% of subtotal)	$	212,836.82
Estimated Construction Cost Subtotal:	**$**	**4,469,573**
Contingencies (30% of construction subtotal)	$	1,340,871.96
Estimated Construction Cost:	**$**	**5,810,445**
Engineering and Inspection (25% of construction cost)	$	1,452,611
Estimated Capital Improvement Cost:	**$**	**7,263,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)





Project 6
CMC Basin

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.03 0.05 0.1 Miles

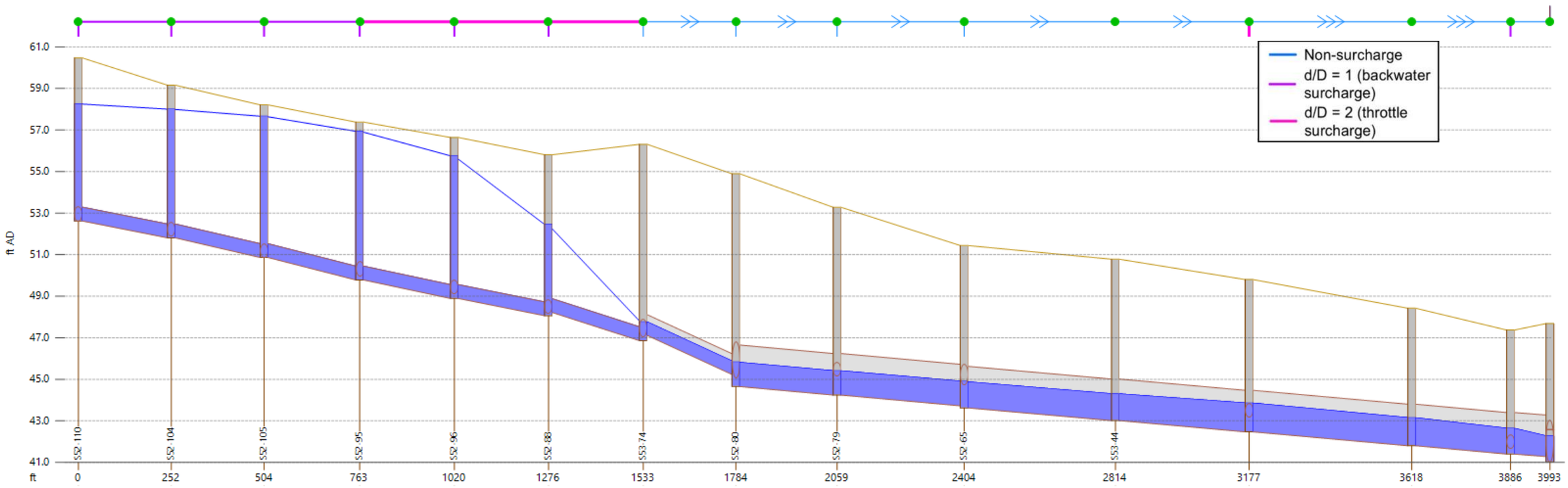
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 7/16/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023.aprx

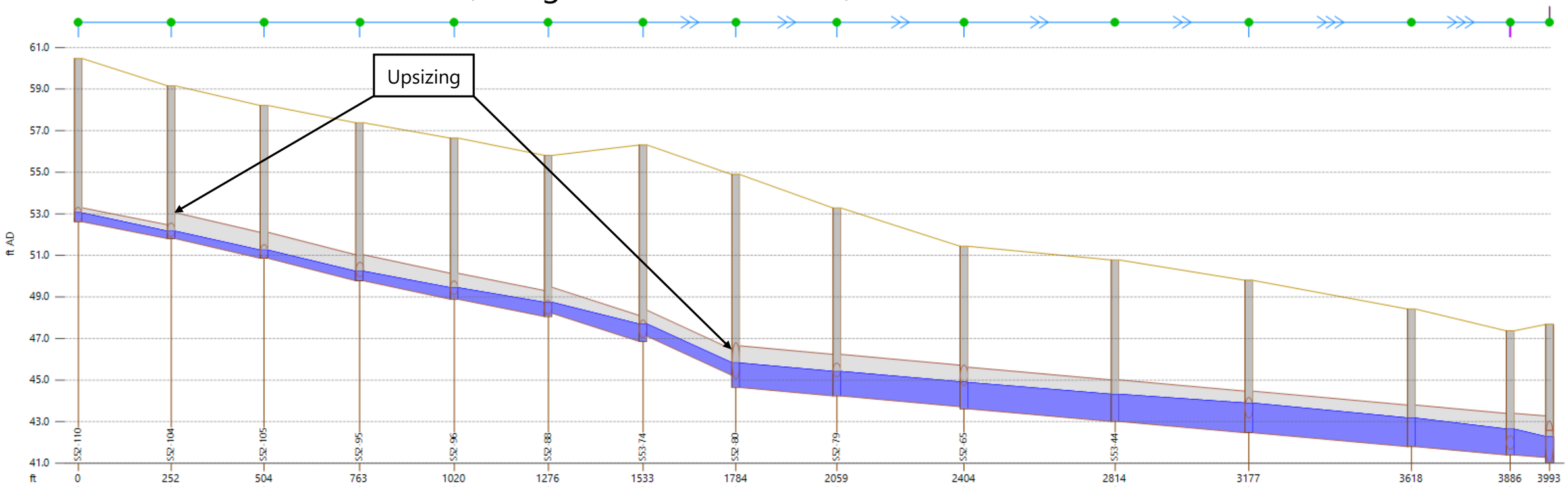
Project 6: CMC Basin - Santa Maria Avenue
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S52-110.1	S52-104.1	S52-105.1	S52-95.1	S52-96.1	S52-88.1	S53-74.1	S52-80.1	S52-79.1	S52-65.1	S53-44.1	S53-103.1	S53-9.1	-
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE	PE	PE	PE	PE
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	12.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
length (ft)	252.0	251.8	259.5	257.0	255.5	257.1	251.5	274.5	344.7	410.4	362.7	441.5	267.9	106.9
pfc (MGD)	0.44	0.48	0.50	0.46	0.45	0.57	1.99	5.65	5.68	5.64	5.64	5.70	5.65	4.90
us inv (ft AD)	52.620	51.810	50.860	49.780	48.890	48.210	47.110	44.650	44.240	43.620	43.010	42.470	41.800	41.400
ds inv (ft AD)	51.810	50.860	49.780	48.890	48.060	46.860	45.230	44.240	43.720	43.010	42.470	41.800	41.400	41.280
surc	1.00	1.00	1.00	2.00	2.00	2.00	0.65	0.58	0.59	0.65	0.69	0.69	0.67	0.62
DS flow (MGD)	0.2889	0.3774	0.4747	0.5709	0.8616	1.0161	1.4822	3.5628	3.5951	3.9762	3.9797	4.6972	4.7003	5.0382
DS velocity (ft/s)	1.704	1.872	1.809	2.081	3.244	4.307	4.259	2.891	2.882	2.871	2.675	3.222	3.553	4.990

Node	-	S52-104	S52-105	S52-95	S52-96	S52-88	S53-74	S52-80	S52-79	S52-65	S53-44	S53-103	S53-9	S53-40	-
ground (ft AD)	60.470	59.160	58.210	57.380	56.640	55.810	56.310	54.890	53.280	51.440	50.780	49.800	48.420	47.370	-
flood dep (ft)	-2.210	-1.154	-0.547	-0.441	-0.883	-3.359	-8.542	-9.064	-7.872	-6.534	-6.480	-5.943	-5.271	-4.730	-

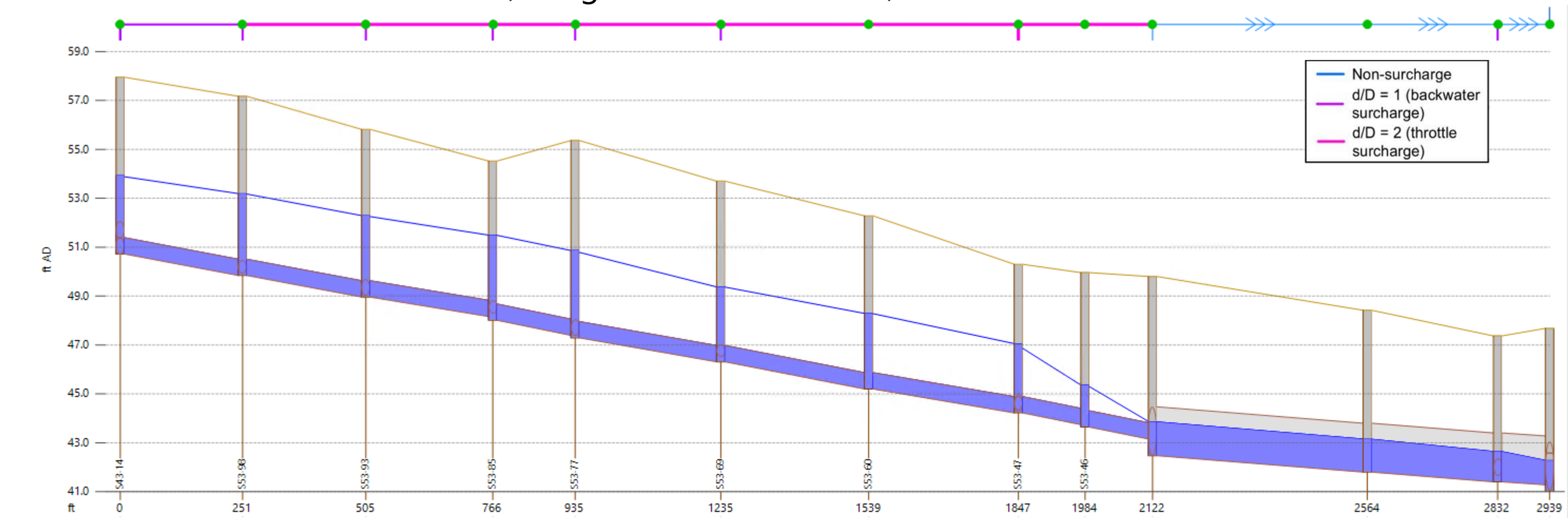
Project 6: CMC Basin - Santa Maria Avenue
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S52-110.1	S52-104.1	S52-105.1	S52-95.1	S52-96.1	S52-88.1	S53-74.1	S52-80.1	S52-79.1	S52-65.1	S53-44.1	S53-103.1	S53-9.1	-
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE	PE	PE	PE	PE
width (in)	8.0	15.0	15.0	15.0	15.0	15.0	15.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
length (ft)	252.0	251.8	259.5	257.0	255.5	257.1	251.5	274.5	344.7	410.4	362.7	441.5	267.9	106.9
pfc (MGD)	0.44	2.57	2.69	2.46	2.38	3.03	3.61	5.65	5.68	5.64	5.64	5.70	5.65	4.90
us inv (ft AD)	52.620	51.810	50.860	49.780	48.890	48.210	47.110	44.650	44.240	43.620	43.010	42.470	41.800	41.400
ds inv (ft AD)	51.810	50.860	49.780	48.890	48.060	46.860	45.230	44.240	43.720	43.010	42.470	41.800	41.400	41.280
surc	0.63	0.31	0.36	0.44	0.54	0.67	0.48	0.59	0.60	0.65	0.71	0.71	0.68	0.62
DS flow (MGD)	0.3220	0.4411	0.5672	0.6812	0.9465	1.1017	1.5691	3.5805	3.6129	3.9946	3.9983	4.8694	4.8723	5.0473
DS velocity (ft/s)	2.668	2.098	2.201	2.026	2.171	1.965	4.357	2.892	2.873	2.876	2.683	3.272	3.677	4.993

Node	-	S52-104	S52-105	S52-95	S52-96	S52-88	S53-74	S52-80	S52-79	S52-65	S53-44	S53-103	S53-9	S53-40	-
ground (ft AD)	60.470	59.160	58.210	57.380	56.640	55.810	56.310	54.890	53.280	51.440	50.780	49.800	48.420	47.370	-
flood dep (ft)	-7.419	-6.998	-6.961	-7.149	-7.200	-7.076	-8.619	-9.059	-7.867	-6.527	-6.464	-5.907	-5.246	-4.728	-

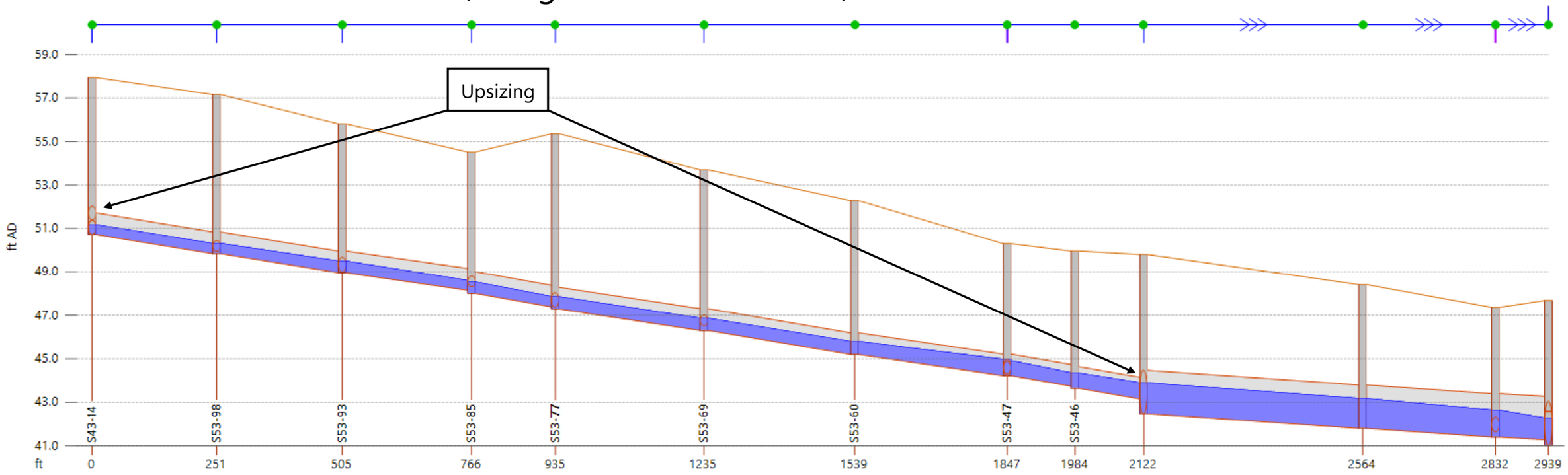
Project 6: CMC Basin - Amethyst Drive
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S43-14.1	S53-98.1	S53-93.1	S53-85.1	S53-77.1	S53-69.1	S53-60.1	S53-47.1	S53-46.1	S53-103.1	S53-9.1	S53-40.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	24.0	24.0	24.0
length (ft)	251.4	253.6	260.8	169.3	299.6	304.1	307.9	136.9	138.8	441.5	267.9	106.9
pfc (MGD)	0.46	0.46	0.43	0.47	0.45	0.47	0.44	0.46	0.46	5.70	5.65	4.90
us inv (ft AD)	50.720	49.840	48.960	48.010	47.290	46.310	45.200	44.220	43.640	42.470	41.800	41.400
ds inv (ft AD)	49.840	48.960	48.160	47.390	46.310	45.200	44.220	43.740	43.153	41.800	41.400	41.280
surc	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	0.69	0.67	0.62
DS flow (MGD)	0.4121	0.4642	0.5388	0.5911	0.5330	0.4722	0.4964	0.8055	0.8055	4.6970	4.7001	5.0379
DS velocity (ft/s)	1.997	1.823	3.057	2.709	2.211	2.095	2.033	3.333	4.069	3.222	3.553	4.990

Node	S43-14	S53-98	S53-93	S53-85	S53-77	S53-69	S53-60	S53-47	S53-46	S53-103	S53-9	S53-40	-
ground (ft AD)	57.950	57.169	55.816	54.522	55.360	53.697	52.281	50.300	49.960	49.800	48.420	47.370	-
flood dep (ft)	-4.024	-3.980	-3.527	-3.029	-4.498	-4.324	-3.991	-3.246	-4.604	-5.943	-5.271	-4.730	-

Project 6: CMC Basin - Amethyst Drive
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S43-14.1	S53-98.1	S53-93.1	S53-85.1	S53-77.1	S53-69.1	S53-60.1	S53-47.1	S53-46.1	S53-103.1	S53-9.1	-
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	24.0	24.0
length (ft)	251.4	253.6	260.8	169.3	299.6	304.1	307.9	136.9	138.8	441.5	267.9	106.9
pfc (MGD)	1.36	1.36	1.28	1.39	1.32	1.39	1.30	1.36	1.36	5.70	5.65	4.90
us inv (ft AD)	50.720	49.840	48.960	48.010	47.290	46.310	45.200	44.220	43.640	42.470	41.800	41.400
ds inv (ft AD)	49.840	48.960	48.160	47.390	46.310	45.200	44.220	43.740	43.153	41.800	41.400	41.280
surc	0.47	0.54	0.53	0.53	0.56	0.60	0.75	0.70	0.74	0.71	0.68	0.62
DS flow (MGD)	0.5531	0.6086	0.7036	0.7568	0.7994	0.8433	0.8759	1.1428	1.1424	4.8693	4.8723	5.0473
DS velocity (ft/s)	2.351	2.192	3.246	3.218	2.729	2.650	2.133	3.570	3.738	3.272	3.677	4.993

Node	S43-14	S53-98	S53-93	S53-85	S53-77	S53-69	S53-60	S53-47	S53-46	S53-103	S53-9	S53-40	-
ground (ft AD)	57.950	57.169	55.816	54.522	55.360	53.697	52.281	50.300	49.960	49.800	48.420	47.370	-
flood dep (ft)	-6.782	-6.858	-6.319	-5.984	-7.494	-6.826	-6.481	-5.327	-5.608	-5.907	-5.246	-4.728	-

Project 7: Bowers Avenue

PROJECT DESCRIPTION

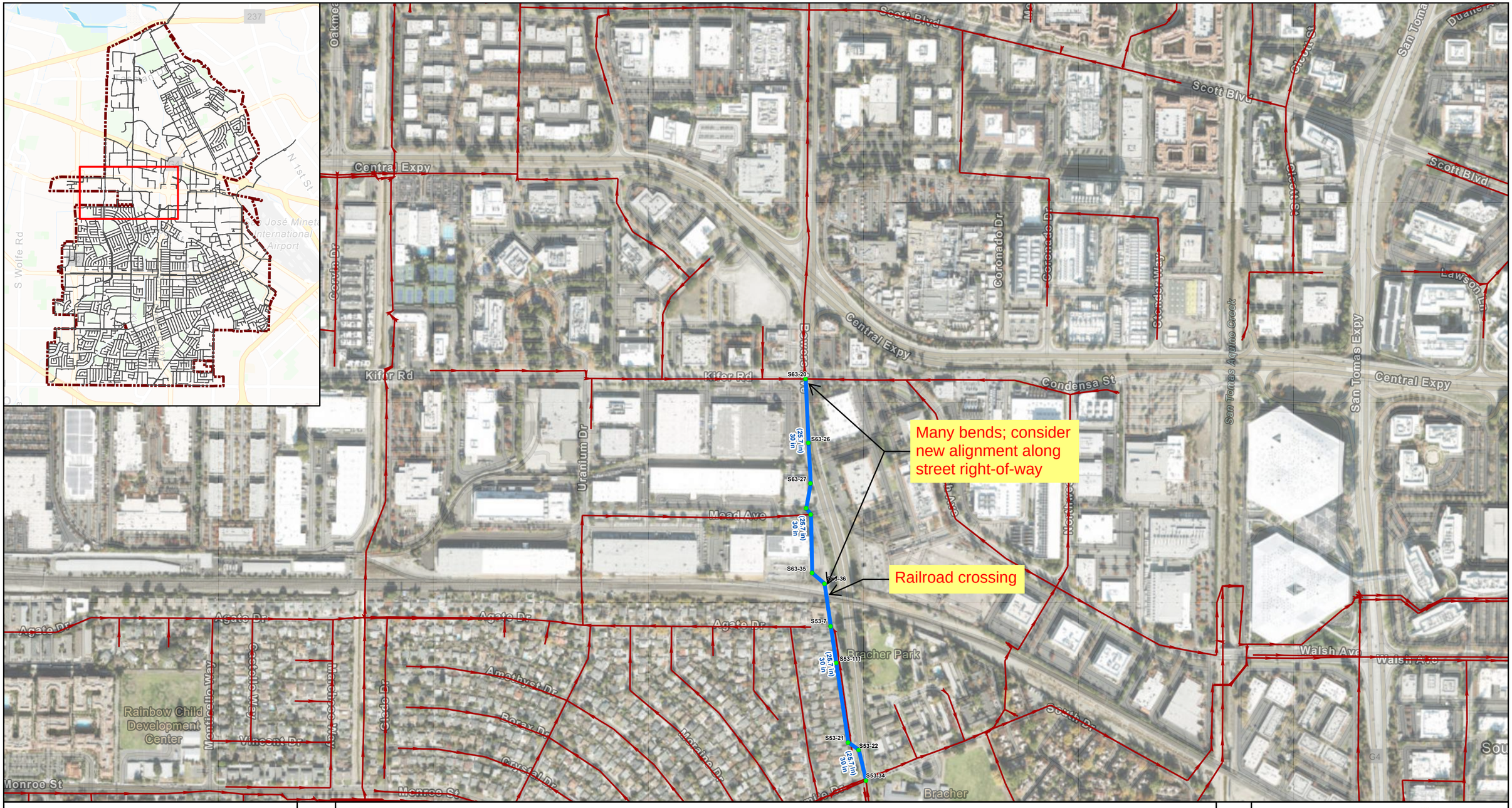
Project No.	7
Project ID	Bowers Avenue
Project Location	Bowers Ave from Chromite Dr to Walsh Ave
Description	2605 LF of 30-inch diameter pipe
Priority	4
Flow Confidence Level	5
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Lined Model Network (LMN)
Estimated Capital Improvement Cost	$8,047,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Project would be required due to assumed future lining of Bowers Ave trunk sewer. (iv) Downstream-most pipe segment included in the proposed project (from manhole S63-26 to S63-20) would exceed the City's 0.75 maximum d/D design criterion under PWWF; however, the pipe was not upsized because the resulting d/D ratio was still less than 1 and the City preferred to keep diameters consistent rather than upsize one isolated pipe segment just to meet the d/D design criterion. (v) (vi)
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S53-34	S53-22	26	30	197	0.38	14	10.71	16.24	10.68	11.68	5.95	$1,139			$1,139	$ 224,611
S53-22	S53-21	26	30	80	0.65	15	14.09	21.38	10.68	11.68	5.63	$1,139			$1,139	$ 91,120
S53-21	S53-111	26	30	501	0.41	15	11.16	16.93	10.68	11.68	5.24	$1,139			$1,139	$ 570,753
S53-111	S53-7	26	30	231	0.41	15	11.16	16.93	10.68	11.68	5.95	$1,139			$1,139	$ 263,109
S53-7	S63-36	26	30	269	0.45	16	11.72	17.78	10.69	11.70	5.06	$1,169	PTGAB	42.00	$2,511	$ 676,001
S63-36	S63-35	26	30	102	0.26	17	8.84	13.42	10.69	11.70	5.95	$1,169			$1,169	$ 118,654
S63-35	S63-33	26	30	366	0.53	16	12.69	19.26	10.69	11.70	4.92	$1,139			$1,139	$ 416,532
S63-33	S63-32	26	30	48	0.31	16	9.79	14.86	11.03	12.38	5.35	$1,139			$1,139	$ 54,444
S63-32	S63-27	26	30	158	0.39	17	10.87	16.50	11.03	12.38	5.83	$1,169			$1,169	$ 184,118
S63-27	S63-26	26	30	253	0.46	18	11.84	17.97	11.04	12.39	6.02	$1,169			$1,169	$ 295,173
S63-26	S63-20	26	30	401	0.55	18	12.91	19.59	11.04	12.36	4.45	$1,169			$1,169	$ 468,886

Total Baseline Pipe Construction Cost	$	2,687,399
Total Trenchless Installation Cost	$	676,001
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 3)	$	1,500
Modify Existing Manholes Cost (Approx. 12)	$	210,000
Baseline Construction Cost:	**$**	**3,574,900**
Dewatering	$	234,414
Bypass Pumping	$	336,340
Remove & Replace Factor	$	168,170
Traffic Control (10%)	$	336,340
Pavement Restoration (T-trench)	$	66,196
Subtotal:	**$**	**4,716,360**
Mobilization/Demobilization (5% of subtotal)	$	235,817.98
Estimated Construction Cost Subtotal:	**$**	**4,952,178**
Contingencies (30% of construction subtotal)	$	1,485,653.28
Estimated Construction Cost:	**$**	**6,437,831**
Engineering and Inspection (25% of construction cost)	$	1,609,458
Estimated Capital Improvement Cost:	**$**	**8,047,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 7
Bowers Ave

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter
- Other Modeled Sewers
- Manholes

0 0.05 0.1 0.2 Miles

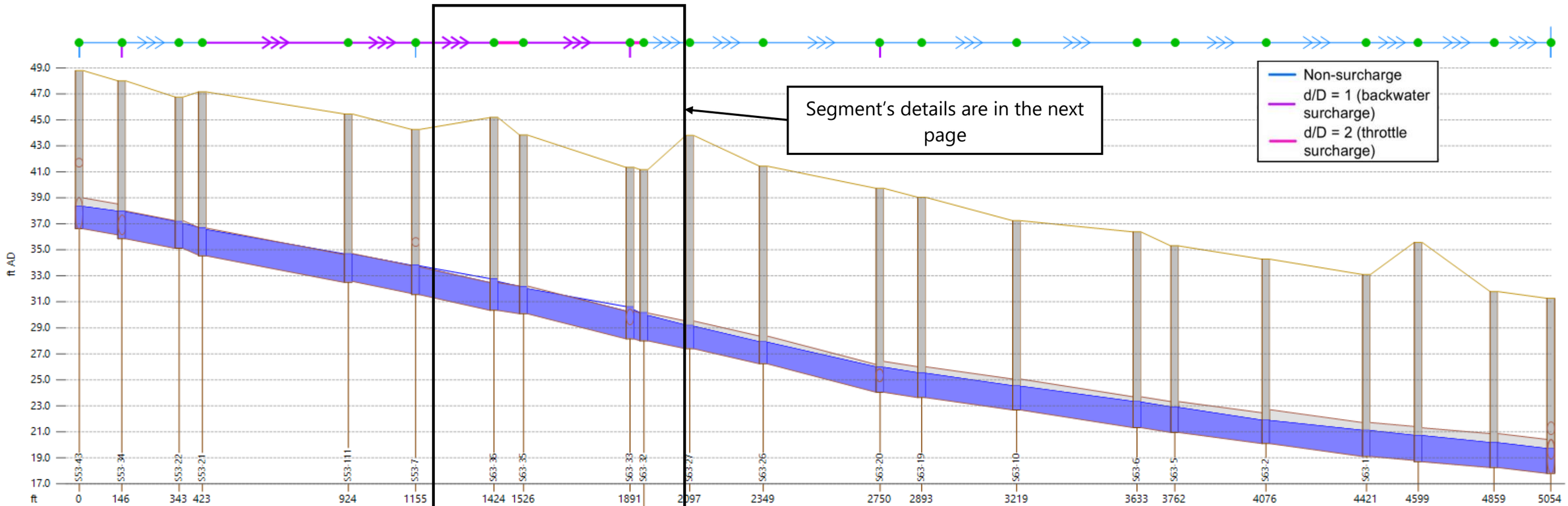
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 7: Bowers Ave
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



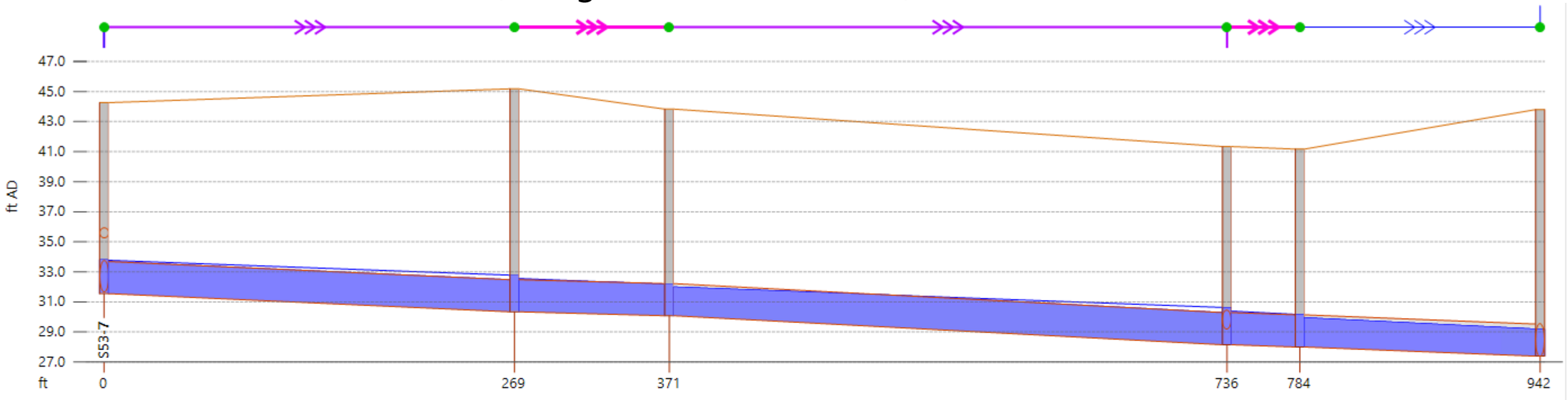
Link	-	S53-34.1	-	S53-21.1	S53-111.1	S53-7.1	-	S63-35.1	-	S63-32.1	S63-27.1	S63-26.1	-	S63-19.1	S63-10.1	-	S63-5.1	S63-2.1	S63-1.1	S63-1A.1	S73-35.1
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	25.7	25.7	25.7	25.7	25.7	25.7	25.7	-	25.7	25.7	25.7	28.5	28.5	28.5	28.5	28.5	31.4	31.4	31.4	31.4
length (ft)	145.7	197.2	80.0	501.1	231.0	269.2	101.5	365.7	-	157.5	252.5	401.1	142.8	326.2	413.3	129.9	313.0	345.4	177.8	260.4	194.8
pfc (MGD)	13.14	10.71	-	11.16	11.16	11.72	8.84	12.69	-	10.87	11.84	12.91	12.40	12.49	13.28	12.35	12.13	15.98	12.34	12.34	14.34
us inv (ft AD)	36.620	35.850	-	34.534	32.577	31.550	-	30.080	-	28.000	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.695	18.250
ds inv (ft AD)	36.150	35.110	-	32.491	31.635	30.340	-	28.150	-	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.796	18.250	17.800
surc	0.76	0.97	1.00	1.00	1.00	1.00	2.00	1.00	-	0.91	0.81	0.91	0.80	0.79	0.84	0.82	0.80	0.77	0.76	0.77	0.73
DS flow (MGD)	10.6088	10.5883	-	10.5524	10.5416	10.5511	-	10.5422	-	11.5446	11.5584	11.5548	11.9672	11.9660	11.9633	-	12.1433	12.1470	12.1464	12.1453	12.3499
DS velocity (ft/s)	5.890	5.583	-	5.069	5.678	4.604	5.396	4.380	-	5.596	5.997	5.249	4.871	5.045	4.700	4.767	5.246	4.260	4.456	4.477	4.585

Node	-	S53-34	-	S53-21	S53-111	S53-7	S63-36	S63-35	S63-33	-	S63-27	S63-26	S63-20	S63-19	S63-10	S63-6	S63-5	S63-2	S63-1	S63-1A	S73-35	-
ground (ft AD)	-	48.000	-	47.150	45.451	44.260	45.180	43.830	41.340	-	43.800	41.440	39.730	39.040	37.240	36.380	35.300	34.280	33.100	35.572	31.790	-
flood dep (ft)	-	-10.042	-	-10.444	-10.763	-10.451	-12.418	-11.671	-10.726	-	-14.617	-13.527	-13.755	-13.510	-12.712	-13.061	-12.402	-12.403	-11.998	-14.859	-11.629	-

Project 7: Bowers Ave

Capacity Deficiency Profile View (*Zoomed-in section*)

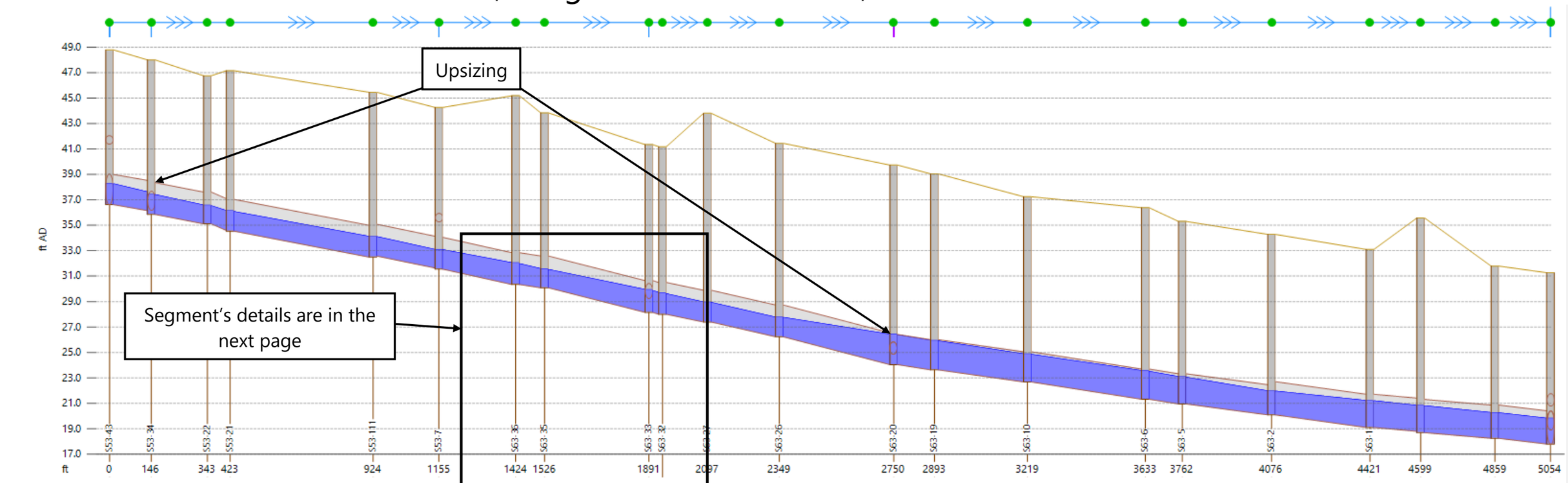
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S53-7.1	S63-36.1	S63-35.1	S63-33.1	S63-32.1
Conduit mate	RCP	RCP	RCP	RCP	RCP
width (in)	25.7	25.7	25.7	25.7	25.7
length (ft)	269.2	101.5	365.7	47.8	157.5
pfc (MGD)	11.72	8.84	12.69	9.79	10.87
us inv (ft AD)	31.550	30.340	30.080	28.150	28.000
ds inv (ft AD)	30.340	30.080	28.150	28.000	27.390
surc	1.00	2.00	1.00	2.00	0.91
DS flow (MGD)	10.5511	10.5484	10.5422	11.5444	11.5446
DS velocity (ft/s)	4.604	5.396	4.380	4.960	5.596

Node	S53-7	S63-36	S63-35	S63-33	S63-32	S63-27
ground (ft AD)	44.260	45.180	43.830	41.340	41.170	43.800
flood dep (ft)	-10.451	-12.418	-11.671	-10.726	-11.018	-14.617

Project 7: Bowers Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



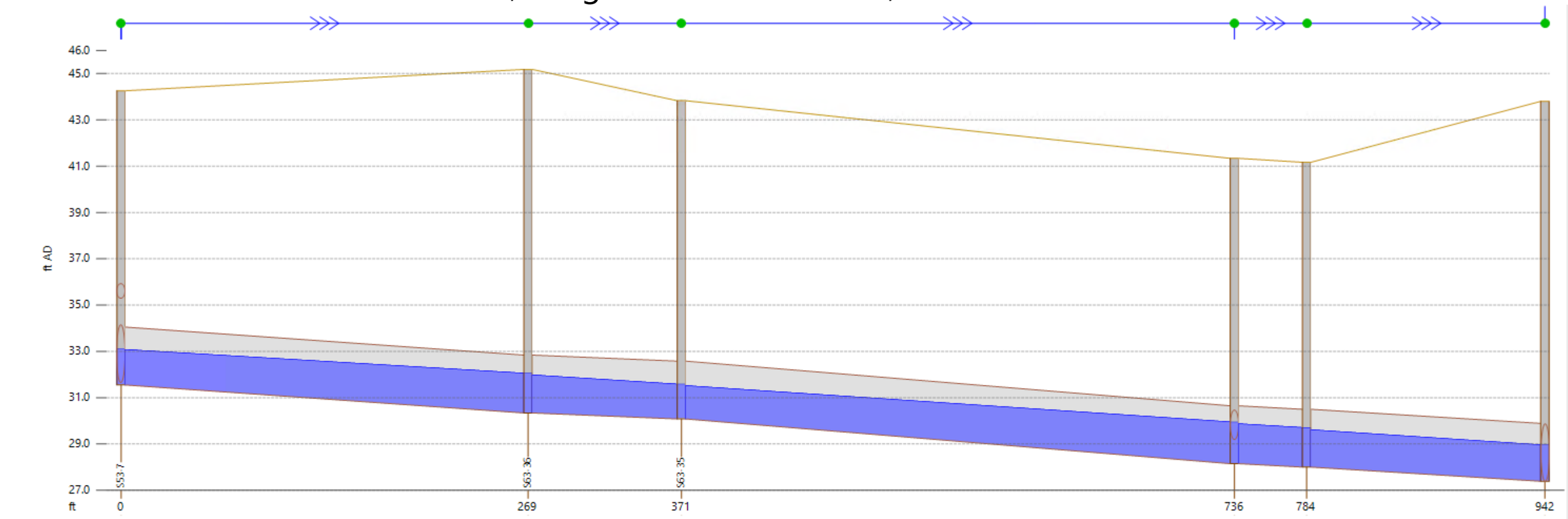
Link	-	S53-34.1	-	S53-21.1	S53-111.1	S53-7.1	-	S63-35.1	-	S63-32.1	S63-27.1	S63-26.1	-	S63-19.1	S63-10.1	-	S63-5.1	S63-2.1	S63-1.1	S63-1A.1	S73-35.1
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	-	30.0	30.0	30.0	28.5	28.5	28.5	28.5	28.5	31.4	31.4	31.4	31.4
length (ft)	145.7	197.2	80.0	501.1	231.0	269.2	101.5	365.7	-	157.5	252.5	401.1	142.8	326.2	413.3	129.9	313.0	345.4	177.8	260.4	194.8
pfc (MGD)	13.14	16.24	-	16.93	16.93	17.78	13.42	19.26	-	16.50	17.97	19.59	12.39	12.48	13.26	12.34	12.12	15.98	12.34	12.34	14.34
us inv (ft AD)	36.620	35.850	-	34.534	32.577	31.550	-	30.080	-	28.000	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.695	18.250
ds inv (ft AD)	36.150	35.110	-	32.491	31.635	30.340	-	28.150	-	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.796	18.250	17.800
surc	0.69	0.62	0.62	0.65	0.61	0.68	0.65	0.72	-	0.64	0.61	0.95	0.99	0.95	0.94	0.92	0.88	0.81	0.80	0.81	0.77
DS flow (MGD)	11.6816	11.6813	-	11.6839	11.6842	1.6968	-	11.6961	-	12.3812	12.3896	12.3625	12.6729	12.6664	12.6614	-	12.8125	12.8131	12.8101	12.8045	12.9957
DS velocity (ft/s)	6.292	6.073	-	5.375	6.128	5.066	5.935	4.816	-	5.941	6.239	4.503	4.887	5.062	4.720	4.792	5.282	4.293	4.484	4.525	4.651

Node	-	S53-34	-	S53-21	S53-111	S53-7	S63-36	S63-35	S63-33	-	S63-27	S63-26	S63-20	S63-19	S63-10	S63-6	S63-5	S63-2	S63-1	S63-1A	S73-35	-
ground (ft AD)	-	48.000	-	47.150	45.451	44.260	45.180	43.830	41.340	-	43.800	41.440	39.730	39.040	37.240	36.380	35.300	34.280	33.100	35.572	31.790	-
flood dep (ft)	-	-10.580	-	-11.011	-11.342	-11.175	-13.137	-12.258	-11.402	-	-14.348	-13.676	-13.311	-13.100	-12.365	-12.821	-12.212	-12.312	-11.888	-14.751	-11.526	-

Project 7: Bowers Ave

Project Solution Profile View (*Zoomed-in section*)

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S53-7.1	S63-36.1	S63-35.1	S63-33.1	S63-32.1
Conduit mate	RCP	RCP	RCP	RCP	RCP
width (in)	30.0	30.0	30.0	30.0	30.0
length (ft)	269.2	101.5	365.7	47.8	157.5
pfc (MGD)	17.78	13.42	19.26	14.86	16.50
us inv (ft AD)	31.550	30.340	30.080	28.150	28.000
ds inv (ft AD)	30.340	30.080	28.150	28.000	27.390
surc	0.68	0.65	0.72	0.69	0.64
DS flow (MGD)	11.6968	11.6968	11.6961	12.3807	12.3812
DS velocity (ft/s)	5.066	5.935	4.816	5.386	5.941

Node	S53-7	S63-36	S63-35	S63-33	S63-32	S63-27
ground (ft AD)	44.260	45.180	43.830	41.340	41.170	43.800
flood dep (ft)	-11.175	-13.137	-12.258	-11.402	-11.476	-14.848

Project 8: Calabazas Trunk

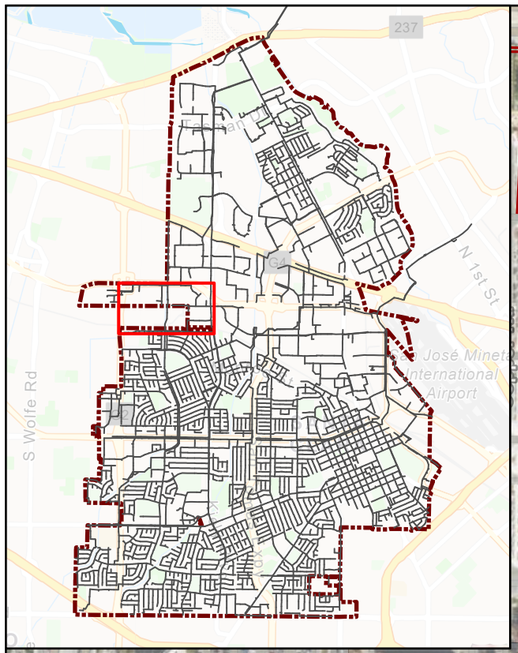
PROJECT DESCRIPTION	
Project No.	8
Project ID	Calabazas Trunk
Project Location	Calabazas Creek from S of Agate Dr to Central Expwy
Description	2791 LF of 18 to 27-inch diameter pipe
Priority	2
Flow Confidence Level	5
Loads Trigger	Existing Loads (EL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Lined Model Network (LMN)
Estimated Capital Improvement Cost	$8,731,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Recommended project includes pipe segments that are already lined between manhole S62-51 and S62-32. (iv) The Lined Model Network assumes existing, unlined 27-inch pipes would be lined in the future resulting in a diameter of 25.7-inch. (v) Roughly 750 LF of pipe between manhole S62-31 and S62-10 of the 2,000 LF that would be upsized to 27-inch would also be re-sloped. In addition to upsizing and re-sloping, the project includes installation of a new 18-inch pipe between manhole S62-37 and S62-38 that runs parallel to the existing sewer to relieve the capacity restriction at that location due to a storm drain crossing north of Kifer Road. (vi) Calabazas Trunk project solution would eliminate the Agate Drive capacity deficiency by eliminating the overflow diversion from the Calabazas Trunk into the Agate Drive sewers at manhole S52-4, which is located just upstream of Agate Drive siphon crossing.
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S52-4	S62-53	23	27	136	0.17	15	5.25	8.24	7.52	7.85	5.09	$1,089	PTGAB	42.00	$2,431	$ 329,907
S62-53	S62-52	23	27	282	0.41	14	8.15	12.78	7.52	7.85	4.85	$1,089	PTGAB	42.00	$2,431	$ 685,584
S62-52	S62-51	23	27	240	0.26	13	6.54	10.26	7.52	7.85	5.48	$1,089			$1,089	$ 261,360
S62-51	S62-48	23	27	503	0.72	13	10.96	16.94	7.52	7.85	4.74	$1,089			$1,089	$ 547,767
S62-48	S62-40	23	27	307	0.33	13	7.40	11.43	7.52	7.85	5.48	$1,089			$1,089	$ 334,323
S62-40	S62-39	23	27	55	0.69	15	10.63	16.64	7.52	7.85	6.26	$1,089			$1,089	$ 59,895
S62-39	S62-37	23	27	66	0.68	16	10.55	16.53	7.52	7.85	5.69	$1,089			$1,089	$ 71,874
S62-37	S62-38	N/A	18	60	0.12	16	N/A	2.33	2.59	2.70	2.48	$854			$854	$ 50,813
S62-38	S62-34	23	27	343	0.32	17	7.24	11.34	7.52	7.85	5.31	$1,119			$1,119	$ 383,817
S62-34	S62-33	23	27	14	0.50	17	9.04	14.16	7.52	7.85	5.39	$1,119			$1,119	$ 15,666
S62-33	S62-32	23	27	40	0.33	17	7.29	11.41	7.52	7.85	5.42	$1,119			$1,119	$ 44,760
S62-32	S62-31	23	27	14	0.71	18	10.80	16.92	7.52	7.85	5.20	$1,119			$1,119	$ 15,666
S62-31	S62-29	27	27	386	0.33	18	4.32	11.44	7.52	7.85	4.72	$1,119			$1,119	$ 431,934
S62-29	S62-10	27	27	346	0.33	18	16.00	11.44	7.52	7.85	5.44	$1,119			$1,119	$ 387,174

Total Baseline Pipe Construction Cost	$	2,605,049
Total Trenchless Installation Cost	$	1,015,491
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 0)	$	-
Modify Existing Manholes Cost (Approx. 16)	$	280,000
Baseline Construction Cost:	**$**	**3,900,540**
Dewatering	$	251,208
Bypass Pumping	$	356,973
Remove & Replace Factor	$	178,486
Traffic Control (10%)	$	362,054
Pavement Restoration (T-trench)	$	67,625
Subtotal:	**$**	**5,116,886**
Mobilization/Demobilization (5% of subtotal)	$	255,844.30
Estimated Construction Cost Subtotal:	**$**	**5,372,730**
Contingencies (30% of construction subtotal)	$	1,611,819.09
Estimated Construction Cost:	**$**	**6,984,549**
Engineering and Inspection (25% of construction cost)	$	1,746,137
Estimated Capital Improvement Cost:	**$**	**8,731,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



S62-10
S62-29
(27 in) 27 in
Pipes will be re-sloped
S62-31
S62-33
S62-34
Consider eliminating bend with new alignment, if possible.
(22.8 in) 27 in
S62-38
New Pipe 18 in
S62-39
S62-40
S62-48
(22.9 in) 27 in
S62-51
S62-52
(22.8 in) 27 in
Railroad crossings
S62-53
S52-4

Central Expy
Oakmead Village Dr
Oakmead Village Ct
Bowers Ave
Millikin Pl
Eichers Pl
Pancoast Pl
Corvin Dr
Calabazas Creek
Noyce Pl
Feliz Rd
Sanor Pl
Kifer Rd
Lawrence Expy
Lawrence Station Rd
Uranium Dr
Mead Ave
Agate Dr

Project 8
Calabazas Trunk

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

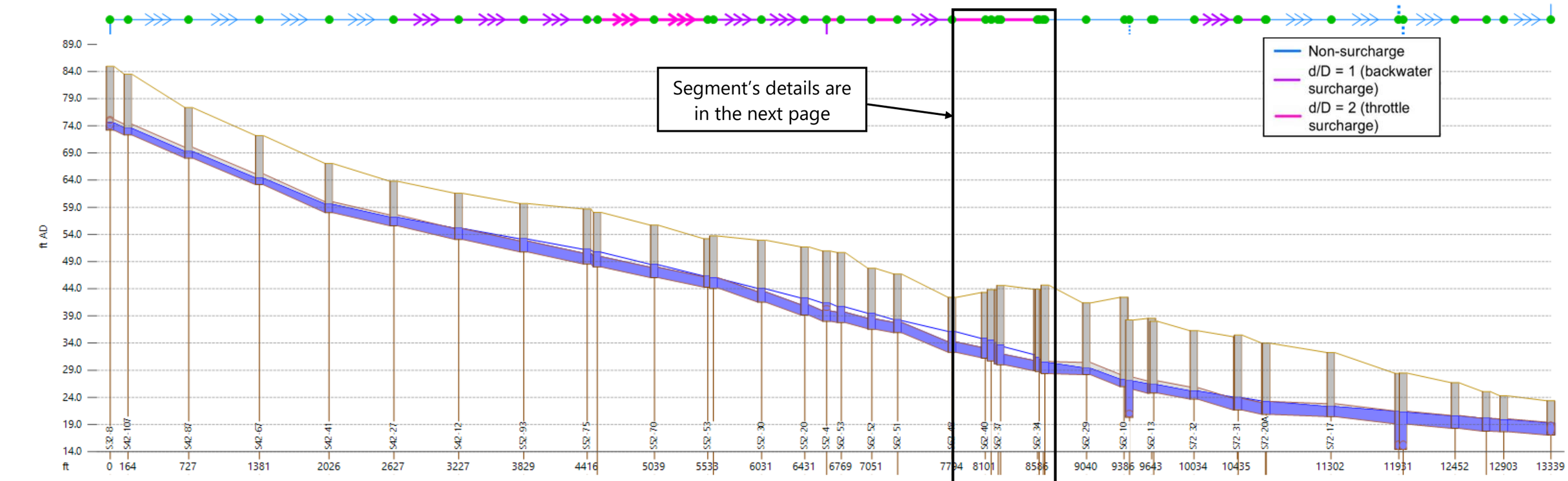
0 0.04 0.07 0.15 Miles

N

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 8: Calabazas Trunk
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



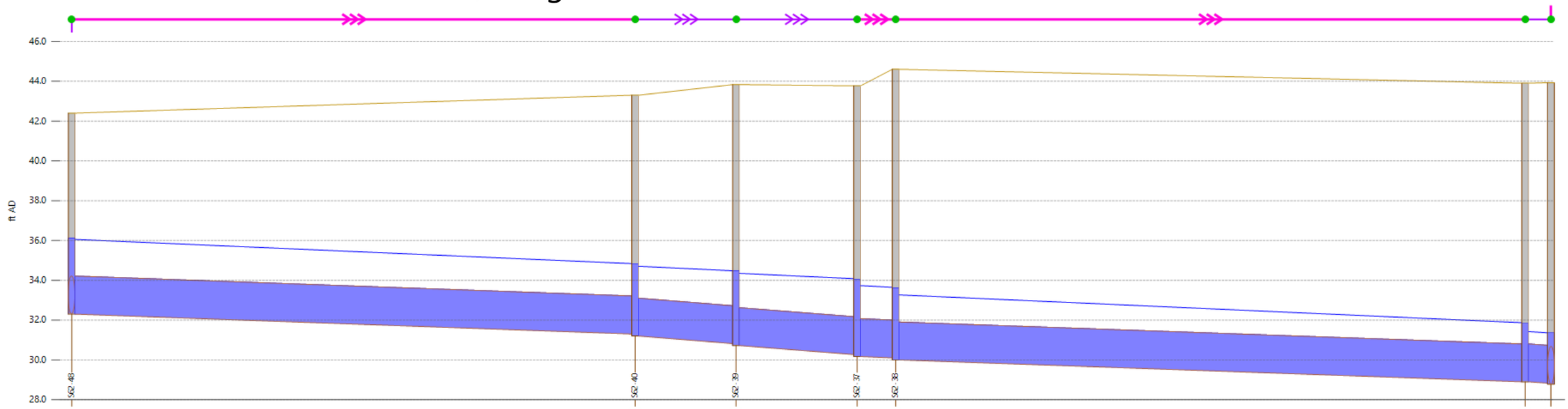
Link	-	S42-107.1	S42-87.1	S42-67.1	S42-41.1	S42-27.1	S42-12.1	S52-93.1	-	S52-113.1	S52-70.1	S52-52.1	-	-	-	-	-	S62-51.1	-	-	-	-	-	-	-	-	S72-20.1	S72-17.1	S72-11.1	-	-	S72-6.1
Conduit mate	-	VCP	VCP	VCP	VCP	VCP	VCP	VCP	-	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	HDPE	HDPE	PVC	HDPE	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP
width (in)	-	24.0	24.0	24.0	24.0	24.0	24.0	24.0	-	22.8	22.8	22.8	22.8	-	-	22.8	22.8	22.9	22.9	22.8	27.0	27.0	-	27.0	25.7	25.7	28.5	28.5	28.5	28.5	-	28.5
length (ft)	-	563.0	654.0	645.0	601.0	600.0	602.0	587.0	-	530.0	494.0	446.2	399.9	-	-	282.0	-	503.0	307.0	343.0	386.0	346.0	-	373.0	401.0	-	598.0	629.0	481.0	288.8	-	436.0
pfc (MGD)	-	12.74	12.64	13.08	9.28	9.46	9.02	9.03	-	7.78	7.62	9.86	9.85	-	-	8.15	6.54	10.96	7.40	7.24	4.32	16.00	-	11.02	12.34	9.81	6.02	10.68	9.32	9.91	-	8.73
us inv (ft AD)	-	72.325	68.055	63.165	58.005	55.585	53.075	50.785	-	48.015	46.045	44.190	41.530	-	-	-	-	35.900	-	30.000	28.365	28.185	-	24.795	23.665	-	20.865	20.460	19.070	-	-	17.680
ds inv (ft AD)	-	68.055	63.165	58.005	55.585	53.075	50.785	48.545	-	46.045	44.285	41.530	39.150	-	-	-	-	32.300	-	28.900	28.185	25.975	-	23.665	21.665	-	20.460	19.120	18.290	-	-	17.060
surc	-	0.61	0.60	0.78	0.78	1.00	1.00	1.00	-	2.00	2.00	1.00	1.00	-	-	1.00	2.00	1.00	2.00	2.00	0.89	0.59	-	0.67	1.00	1.00	0.98	0.96	0.95	1.00	-	0.93
DS flow (MGD)	-	8.4056	8.4053	8.4048	8.4032	8.3582	8.2538	8.2362	-	8.2542	8.2534	8.2523	8.2522	-	-	-	-	8.1322	-	8.1322	8.1321	8.1322	-	8.5649	8.5571	-	8.5410	8.5256	8.5208	-	-	8.5156
DS velocity (ft/s)	-	6.506	6.624	4.939	5.145	4.935	4.917	5.015	-	4.668	4.988	5.752	5.148	-	-	4.578	-	4.574	5.650	4.222	5.644	5.562	-	5.203	3.805	-	3.987	3.385	3.439	3.136	-	3.352

| Node | - | S42-87 | S42-67 | S42-41 | S42-27 | S42-12 | S52-93 | - | - | S52-70 | - | - | S52-30 | - | - | - | - | - | - | - | -

Project 8: Calabazas Trunk

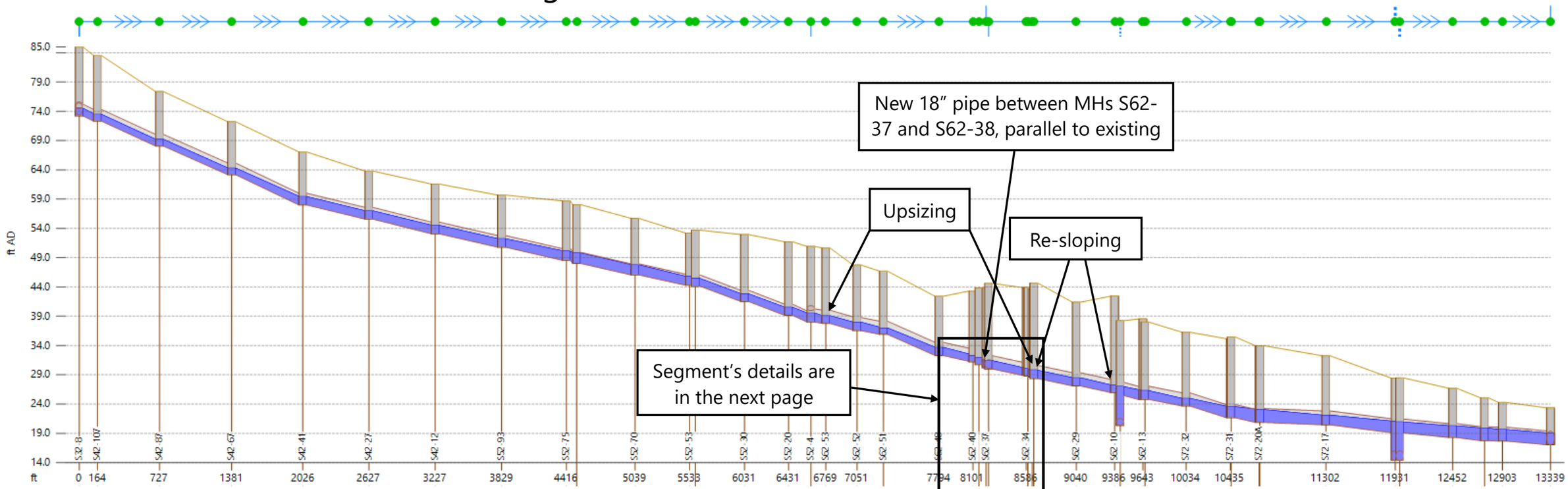
Capacity Deficiency Profile View (*Zoomed-in section*)

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



| ft | 0 | | |

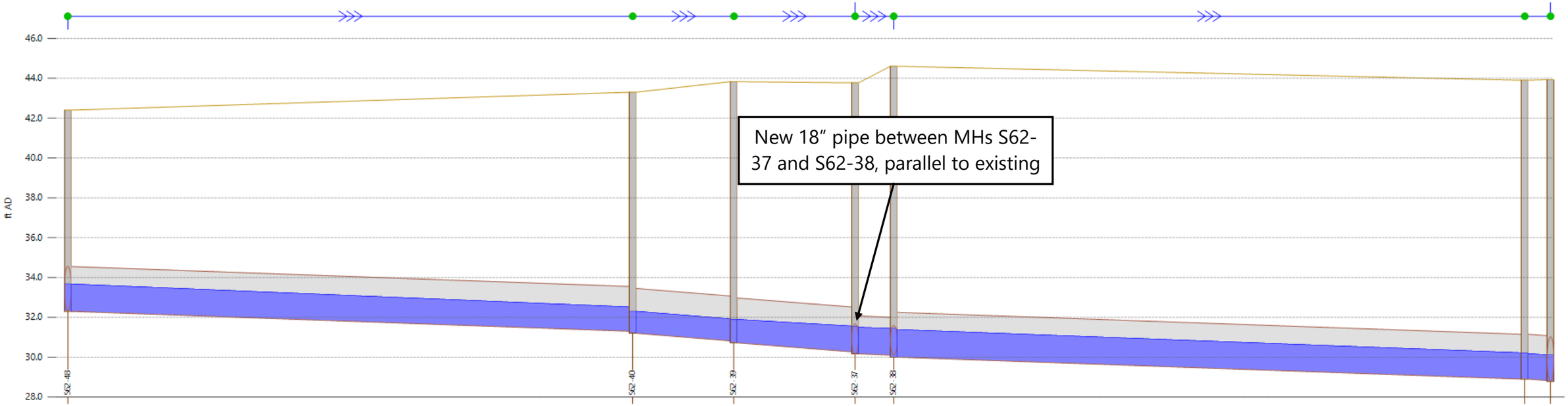
Project 8: Calabazas Trunk
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	-	S42-107.1	S42-87.1	S42-67.1	S42-41.1	S42-27.1	S42-12.1	S52-93.1	-	S52-113.1	S52-70.1	S52-52.1	-	-	-	-	-	S62-51.1	-	-	-	-	-	-	-	S72-20.1	S72-17.1	S72-11.1	-	-	S72-6.1
Conduit mate	-	VCP	VCP	VCP	VCP	VCP	VCP	VCP	-	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	HDPE	HDPE	PVC	HDPE	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP
width (in)	-	24.0	24.0	24.0	24.0	24.0	24.0	24.0	-	22.8	22.8	22.8	22.8	-	-	27.0	27.0	27.0	27.0	27.0	27.0	27.0	-	27.0	27.0	27.0	28.5	28.5	28.5	28.5	-	28.5
length (ft)	-	563.0	654.0	645.0	601.0	600.0	602.0	587.0	-	530.0	494.0	446.2	399.9	-	-	282.0	-	503.0	307.0	343.0	386.0	346.0	-	373.0	401.0	-	598.0	629.0	481.0	288.8	-	436.0
pfc (MGD)	-	12.74	12.64	13.08	9.28	9.46	9.02	9.03	-	7.78	7.62	9.86	9.85	-	-	12.78	-	16.94	11.43	11.34	11.44	11.44	-	11.02	14.14	-	6.02	10.68	9.32	9.91	-	8.73
us inv (ft AD)	-	72.325	68.055	63.165	58.005	55.585	53.075	50.785	-	48.015	46.045	44.190	41.530	-	-	-	-	35.900	-	30.000	28.365	27.105	-	24.795	23.665	-	20.865	20.460	19.070	-	-	17.680
ds inv (ft AD)	-	68.055	63.165	58.005	55.585	53.075	50.785	48.545	-	46.045	44.285	41.530	39.150	-	-	-	-	32.300	-	28.900	27.105	25.975	-	23.665	21.665	-	20.460	19.120	18.290	-	-	17.060
surc	-	0.57	0.57	0.72	0.70	0.72	0.72	0.80	-	0.92	0.89	0.68	0.71	-	-	0.60	0.63	0.61	0.61	0.61	0.61	0.61	-	0.64	0.86	0.99	0.91	0.83	0.83	0.90	-	0.84
DS flow (MGD)	-	7.6901	7.6902	7.6895	7.6893	7.6884	7.6878	7.6785	-	7.6866	7.6845	7.6843	7.6837	-	-	-	-	7.8481	-	7.8470	7.8468	7.8460	-	8.2851	8.2807	-	8.2735	8.2572	8.2358	-	-	8.2116
DS velocity (ft/s)	-	6.407	6.489	4.895	5.087	4.894	4.894	5.016	-	4.658	4.952	5.782	5.477	-	-	4.884	-	4.787	5.558	5.334	4.754	5.427	-	5.501	3.808	-	3.978	3.392	3.450	3.131	-	3.361

| Node | - | S42-87 | S42-67 | S42-41 | S42-27 | S42-12 | S52-93 | - | - | S52-70 | - | - | S52-30 | - | - | - | - | - | - | -

Project 8: Calabazas Trunk
Project Solution Profile View (*Zoomed-in section*)
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



| | | |

Project 9: Freedom Circle

PROJECT DESCRIPTION

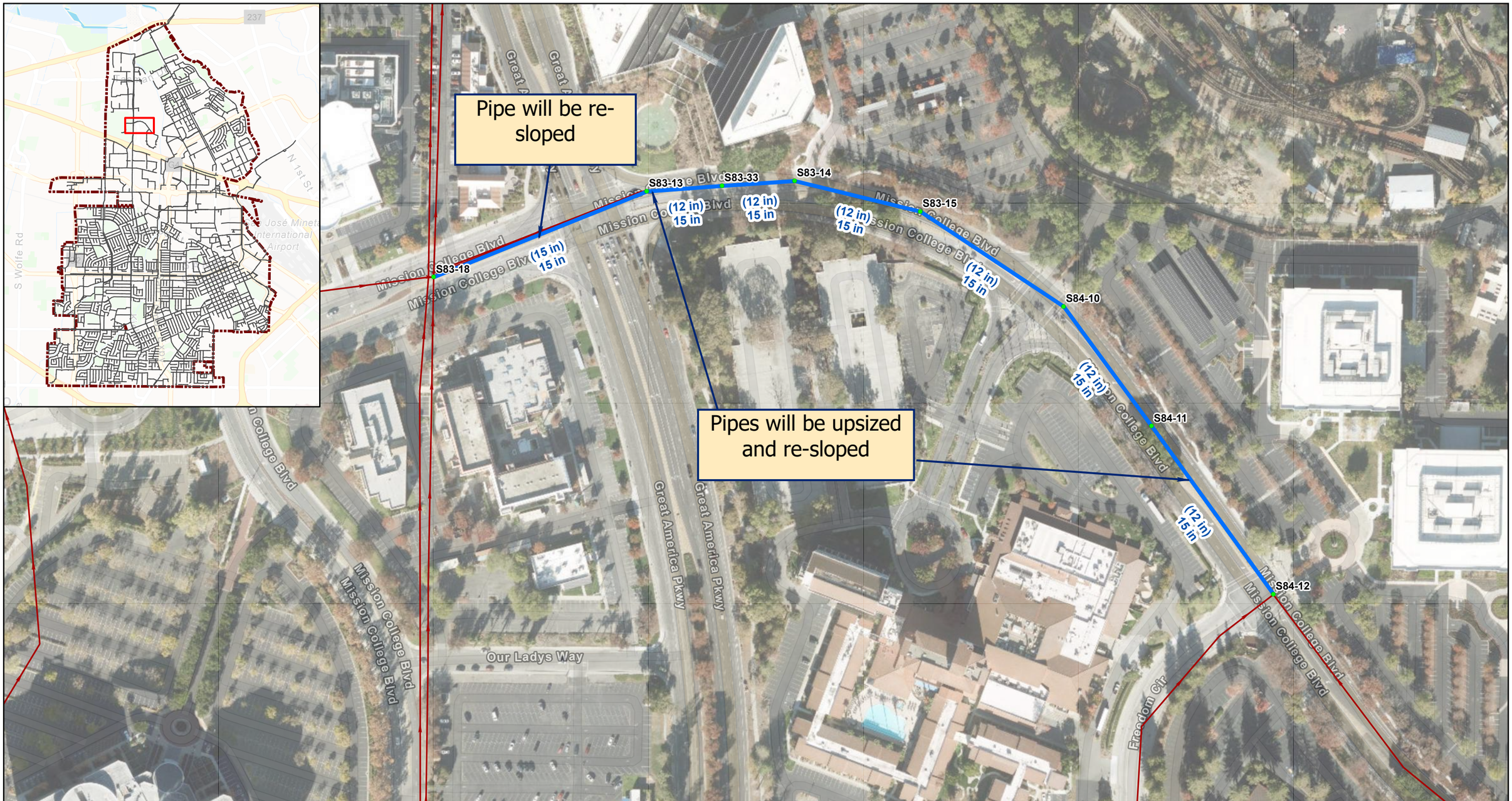
Project No.	9
Project ID	Freedom Circle
Project Location	Mission College Blvd from Freedom Cir to west of Great America Pkwy
Description	1886 LF of 15-inch diameter pipe
Priority	5
Flow Confidence Level	N/A
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Dry Weather Flow (DWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$3,830,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Project would be required due to increased flows from the Freedom Circle Focus Area specific development project that would discharge into the City's sewers along Freedom Circle Drive and Mission College Boulevard. The recommended project is a slight modification of the project identified during the development review process and includes re-sloping to meet the City's design criteria d/D (maximum of 0.75 during PWWF). (iv) Downstream-most pipe segment included in the proposed project (from manhole S63-26 to S63-20) would exceed the City's 0.75 maximum d/D design criterion under PWWF; however, the pipe was not upsized because the resulting d/D ratio was still less than 1 and the City preferred to keep diameters consistent rather than upsize one isolated pipe segment just to meet the d/D design criterion. (v) (vi)
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S84-12	S84-11	12	15	378	0.18	7	1.98	1.77	1.21	1.24	2.28	$804			$804	$ 303,832
S84-11	S84-10	12	15	270	0.18	7	2.00	1.77	1.28	1.31	2.21	$804			$804	$ 217,402
S84-10	S83-15	12	15	313	0.18	7	1.87	1.77	1.48	1.57	2.44	$804			$804	$ 251,572
S83-15	S83-14	12	15	236	0.18	7	1.80	1.77	1.48	1.57	2.44	$804			$804	$ 189,583
S83-14	S83-33	12	15	132	0.18	7	2.18	1.77	1.48	1.57	2.47	$804			$804	$ 106,369
S83-33	S83-13	12	15	138	0.18	7	2.33	1.77	1.47	1.57	2.48	$804			$804	$ 110,872
S83-13	S83-18	15	15	418	0.18	8	1.87	1.77	1.47	1.57	3.87	$804			$804	$ 336,313

Total Baseline Pipe Construction Cost	$	1,515,942
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 3)	$	1,500
Modify Existing Manholes Cost (Approx. 8)	$	140,000
Baseline Construction Cost:	**$**	**1,657,442**
Dewatering	$	169,695
Bypass Pumping	$	151,594
Remove & Replace Factor	$	75,797
Traffic Control (10%)	$	151,594
Pavement Restoration (T-trench)	$	38,705
Subtotal:	**$**	**2,244,827**
Mobilization/Demobilization (5% of subtotal)	$	112,241.36
Estimated Construction Cost Subtotal:	**$**	**2,357,068**
Contingencies (30% of construction subtotal)	$	707,120.54
Estimated Construction Cost:	**$**	**3,064,189**
Engineering and Inspection (25% of construction cost)	$	766,047
Estimated Capital Improvement Cost:	**$**	**3,830,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 9
Freedom Circle

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.01 0.03 0.05 Miles

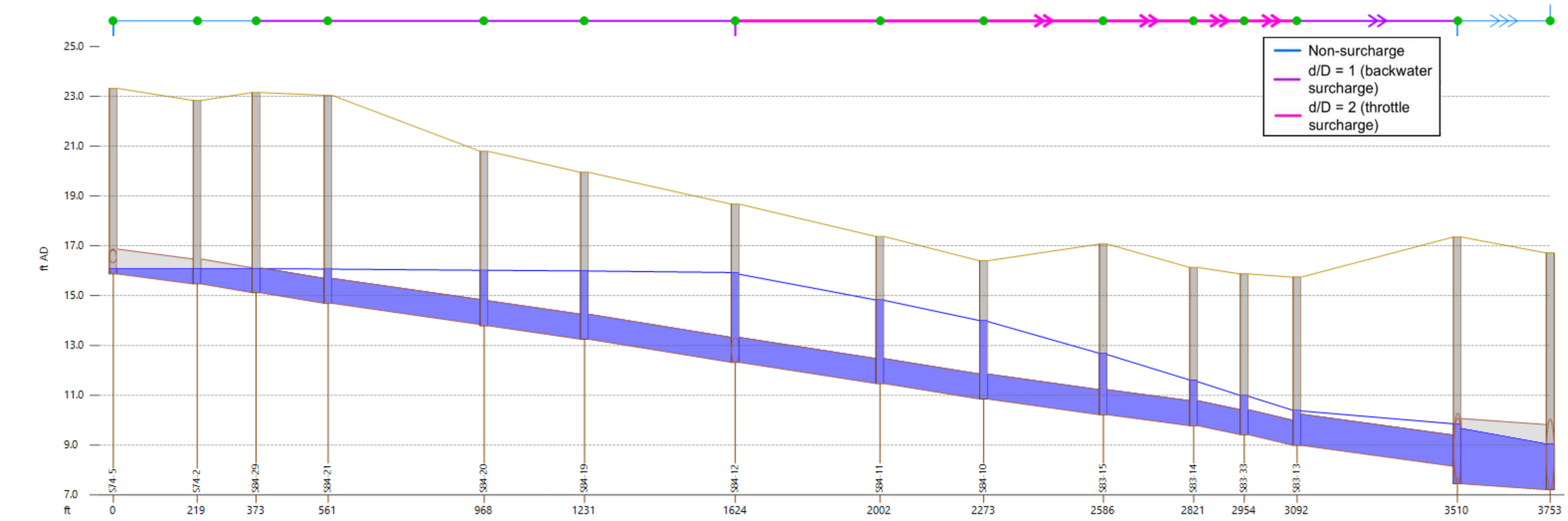
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

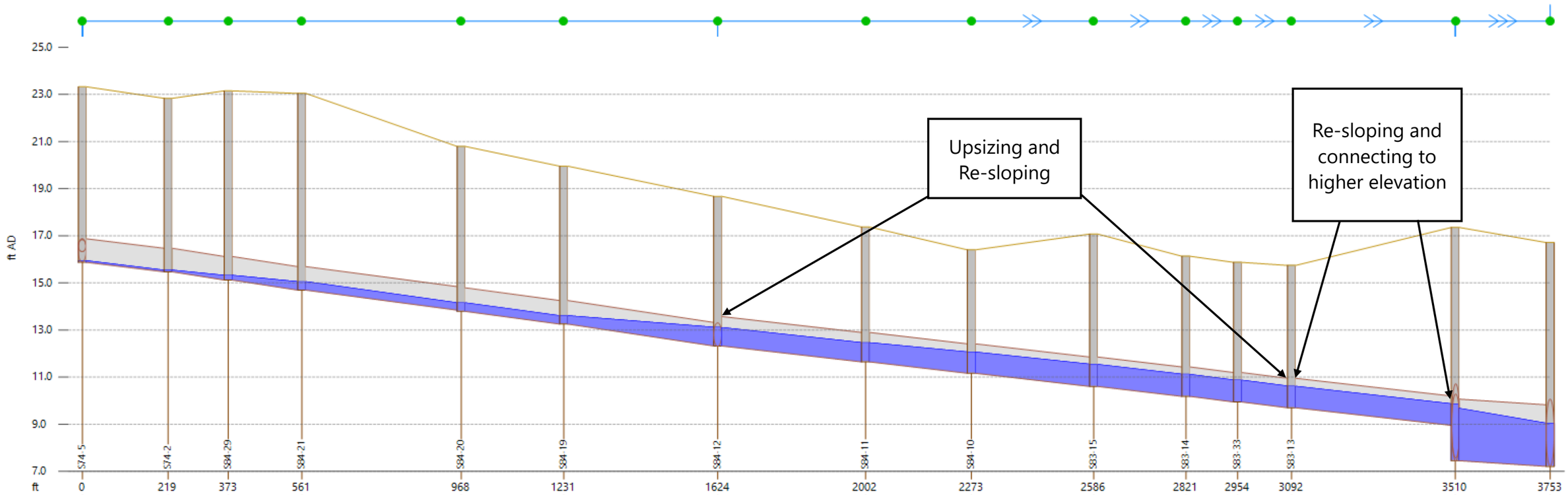
Project 9: Freedom Circle
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S74-5.1	S74-2.1	S84-29.1	S84-21.1	S84-20.1	S84-19.1	S84-12.1	S84-11.1	S84-10.1	S83-15.1	S83-14.1	S83-33.1	S83-13.1	S83-18.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	15.0	31.4
length (ft)	218.9	154.0	188.0	407.5	262.3	393.7	377.9	270.4	312.9	235.8	132.3	137.9	418.3	243.0
pfc (MGD)	0.98	1.10	1.10	1.05	1.05	1.12	1.09	1.10	1.03	0.99	1.20	1.29	1.87	9.38
us inv (ft AD)	15.870	15.470	15.118	14.690	13.790	13.250	12.320	11.470	10.850	10.220	9.780	9.420	8.990	7.450
ds inv (ft AD)	15.470	15.118	14.690	13.840	13.250	12.320	11.470	10.850	10.220	9.780	9.420	8.990	8.150	7.210
surc	0.61	0.96	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	0.85
DS flow (MGD)	0.0101	0.0210	0.2770	0.2766	0.2584	0.3163	1.1959	1.2819	1.5473	1.5473	1.5472	1.5472	1.5467	13.2916
DS velocity (ft/s)	0.065	0.068	1.705	2.077	1.680	0.628	2.307	2.318	2.844	2.891	2.914	3.044	3.020	5.148

Node	S74-5	S74-2	S84-29	S84-21	S84-20	S84-19	S84-12	S84-11	S84-10	S83-15	S83-14	S83-33	S83-13	S83-18	S83-12
ground (ft AD)	-	22.832	23.148	23.040	20.790	19.950	18.670	17.370	16.400	17.070	16.130	15.870	15.740	17.350	16.710
flood dep (ft)	-	-6.752	-7.068	-6.974	-4.772	-3.962	-2.743	-2.548	-2.408	-4.392	-4.526	-4.881	-5.353	-7.503	-7.675

Project 9: Freedom Circle
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network

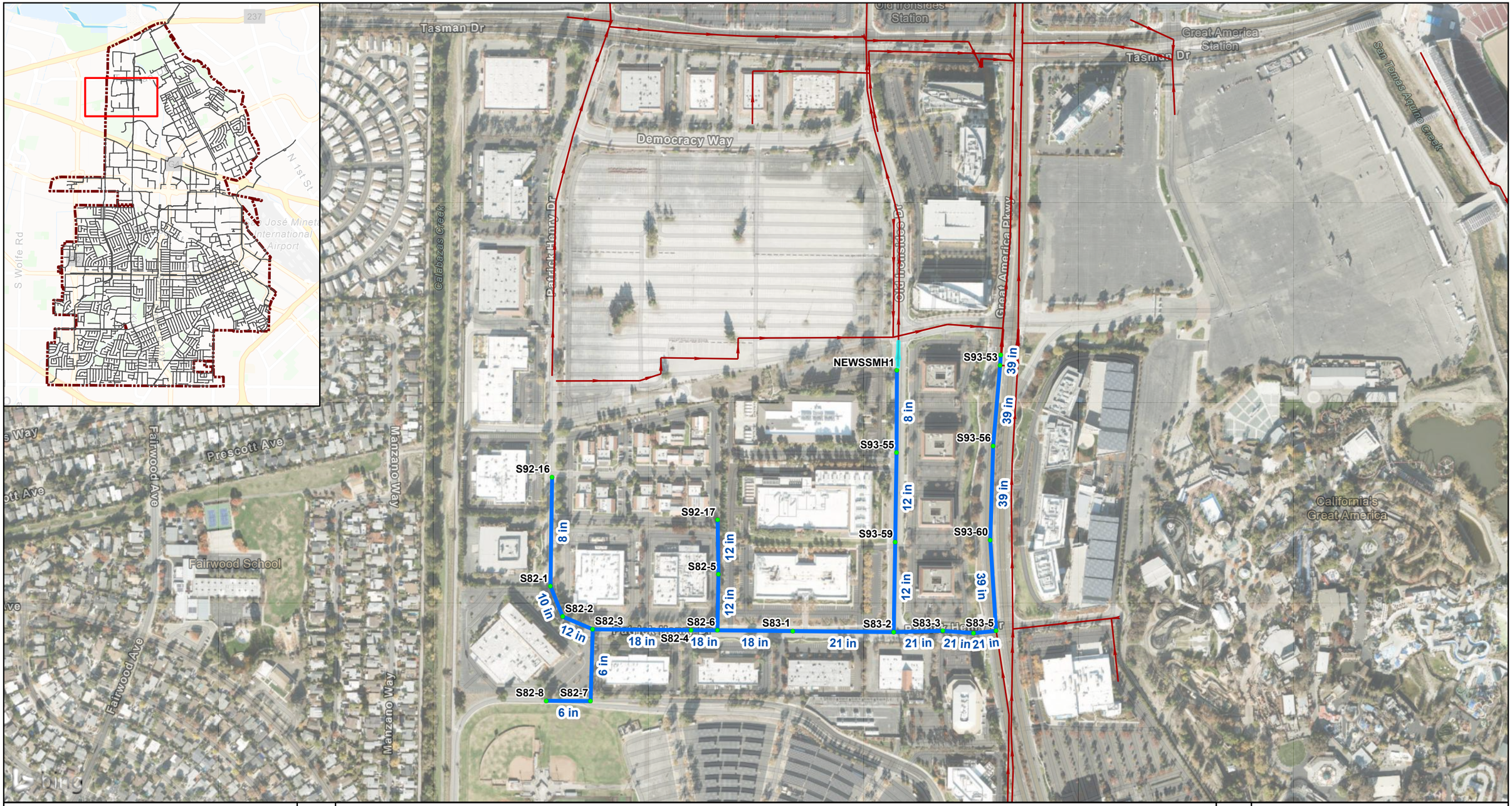


Link	S74-5.1	S74-2.1	S84-29.1	S84-21.1	S84-20.1	S84-19.1	S84-12.1	S84-11.1	S84-10.1	S83-15.1	S83-14.1	S83-33.1	S83-13.1	S83-18.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	31.4
length (ft)	218.9	154.0	188.0	407.5	262.3	393.7	377.9	270.4	312.9	235.8	132.3	137.9	418.3	243.0
pfc (MGD)	0.98	1.10	1.10	1.05	1.05	1.12	1.77	1.77	1.77	1.77	1.77	1.77	1.77	9.38
us inv (ft AD)	15.870	15.470	15.118	14.690	13.790	13.250	12.320	11.645	11.161	10.602	10.181	9.944	9.698	7.450
ds inv (ft AD)	15.470	15.118	14.690	13.840	13.250	12.320	11.645	11.161	10.602	10.181	9.944	9.698	8.950	7.210
surc	0.07	0.20	0.36	0.36	0.36	0.79	0.65	0.72	0.75	0.75	0.74	0.74	0.73	0.85
DS flow (MGD)	-0.0000	-0.0002	0.2770	0.2779	0.2778	0.3288	1.2383	1.3075	1.5729	1.5729	1.5729	1.5728	1.5725	13.3632
DS velocity (ft/s)	-0.000	-0.004	1.705	2.091	1.744	0.767	2.280	2.210	2.454	2.463	2.493	2.515	3.915	5.161

Node	S74-5	S74-2	S84-29	S84-21	S84-20	S84-19	S84-12	S84-11	S84-10	S83-15	S83-14	S83-33	S83-13	S83-18	S83-12
ground (ft AD)	-	22.832	23.148	23.040	20.790	19.950	18.670	17.370	16.400	17.070	16.130	15.870	15.740	17.350	16.710
flood dep (ft)	-	-7.296	-7.832	-7.993	-6.642	-6.348	-5.556	-4.913	-4.339	-5.527	-5.012	-4.999	-5.124	-7.493	-7.674

Project 10: Patrick Henry Drive

Cost estimate not included because project will be paid for by the developer.



Project 10
Patrick Henry Drive

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- PHD Manholes
- Other Modeled Sewers
- PHD Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.05 0.1 0.2 Miles

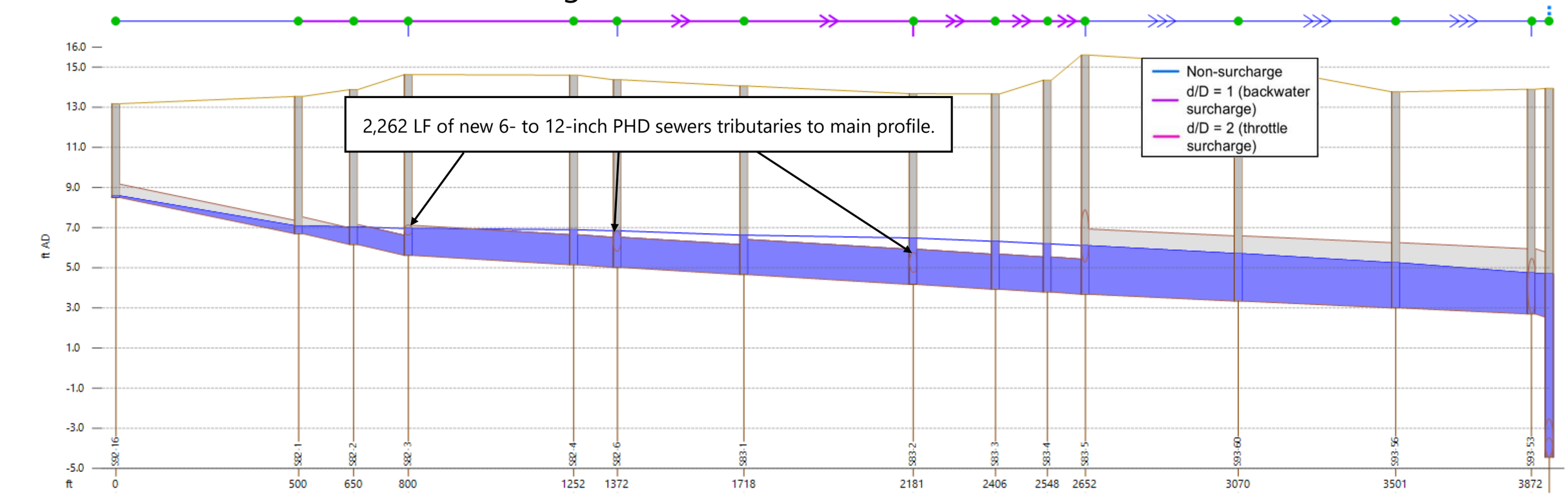
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/2/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 10: Patrick Henry Drive
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S92-16.1	S82-1.1	S82-2.1	S82-3.1	S82-4.1	S82-6.1	S83-1.1	S83-2.2	S83-3.1	-	S83-5.1	S93-60.1	S93-56.1	-
Conduit mate	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	-
width (in)	8.0	10.0	12.0	18.0	18.0	18.0	21.0	21.0	21.0	21.0	39.0	39.0	39.0	-
length (ft)	500.0	150.0	150.0	452.0	120.0	346.0	463.0	225.3	142.0	104.0	418.0	431.0	371.0	-
pfc (MGD)	0.47	0.85	1.38	2.19	2.23	2.19	3.33	3.34	3.22	3.33	15.22	14.99	15.18	-
us inv (ft AD)	8.500	6.700	6.160	5.620	5.150	5.020	4.660	4.170	3.930	3.790	3.680	3.340	3.000	-
ds inv (ft AD)	6.700	6.160	5.620	5.150	5.020	4.660	4.170	3.930	3.790	3.680	3.340	3.000	2.700	-
surc	0.59	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.74	0.73	0.69	-
DS flow (MGD)	0.1486	0.2963	0.5975	0.9243	1.3644	1.8146	1.9345	2.8987	3.0675	3.0664	14.3167	14.4272	14.5425	-
DS velocity (ft/s)	1.661	1.694	1.526	1.105	1.522	1.953	1.345	1.882	1.943	1.932	3.417	3.660	4.367	-

Node	S92-16	S82-1	S82-2	S82-3	S82-4	S82-6	S83-1	S83-2	S83-3	S83-4	S83-5	S93-60	S93-56	S93-53
ground (ft AD)	13.180	13.540	13.880	14.630	14.600	14.370	14.060	13.680	13.667	14.354	15.600	15.150	13.770	13.900
flood dep (ft)	-4.600	-6.446	-6.847	-7.670	-7.703	-7.523	-7.432	-7.194	-7.344	-8.154	-9.491	-9.438	-8.519	-9.152

Project 11: Mission Point

Cost estimate not included because project will be paid for by the developer.

Project 11
Mission Point
(Revised Option 2A)

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Mission Point Manholes
- Other Modeled Sewers
- Mission Point Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.05 0.1 0.2 Miles

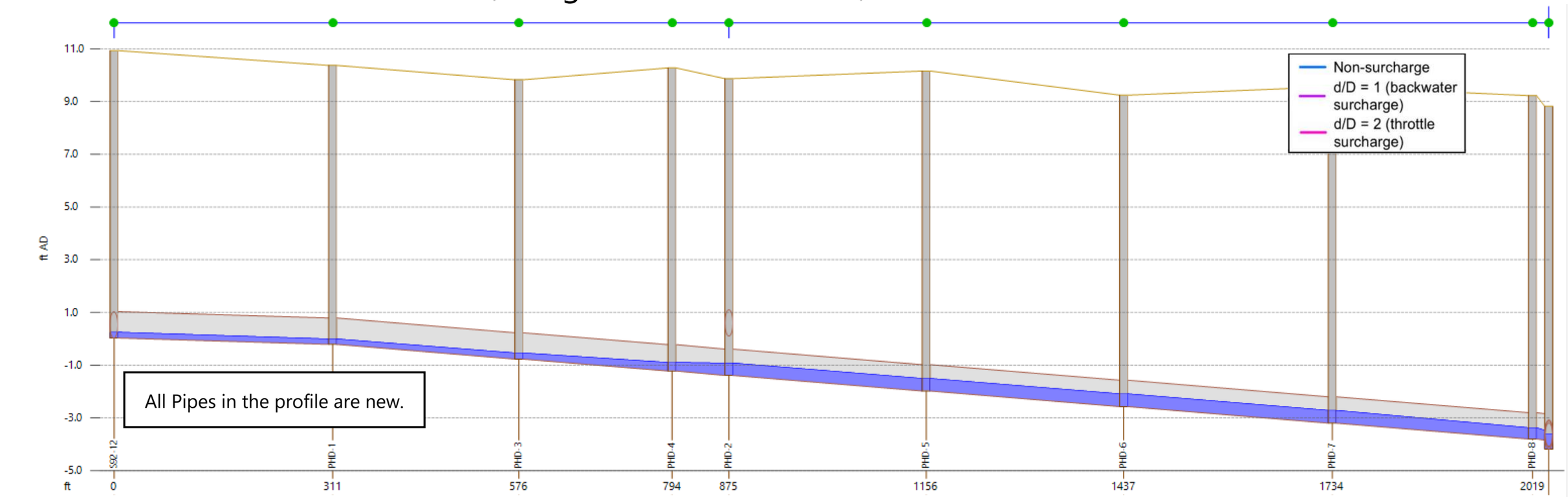
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

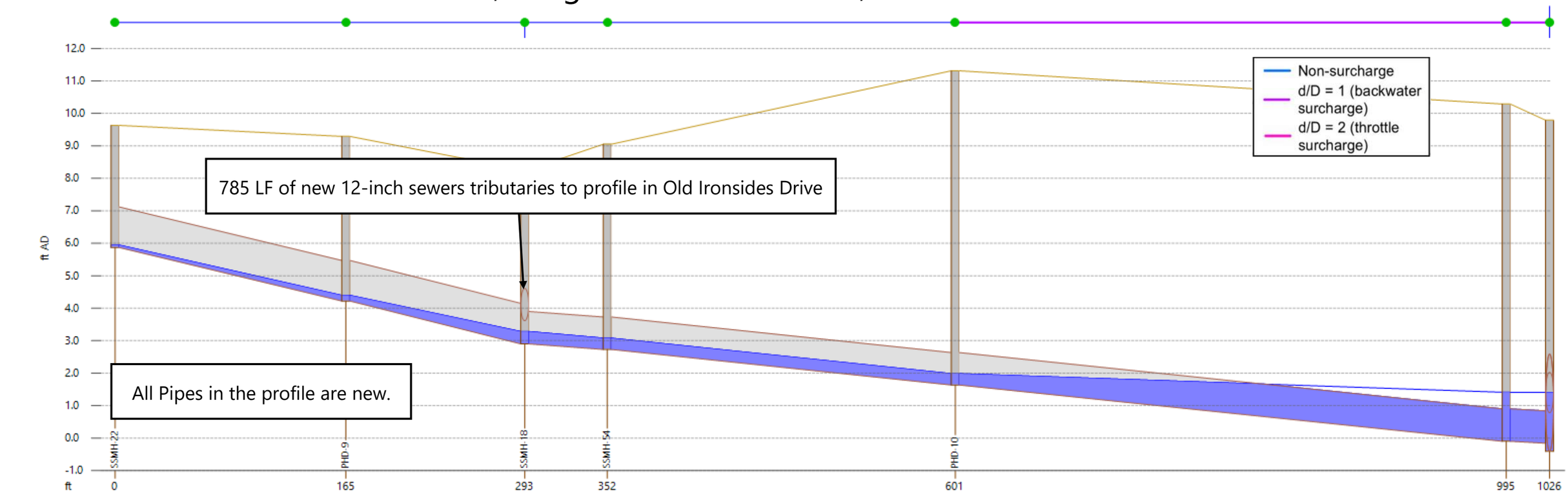
Project 11: Mission Point
Project Solution Profile View 1 of 3
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S92-12.1	PHD-1.1	PHD-3.1	PHD-4.1	PHD-2.1	PHD-5.1	PHD-6.1	PHD-7.1	-
Conduit mate	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	-
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	-
length (ft)	311.0	265.0	218.0	81.0	281.0	281.0	297.0	285.0	-
pfc (MGD)	0.64	1.06	1.05	1.06	1.06	1.06	1.06	1.06	-
us inv (ft AD)	0.030	-0.210	-0.770	-1.220	-1.390	-1.980	-2.570	-3.200	-
ds inv (ft AD)	-0.210	-0.770	-1.220	-1.390	-1.980	-2.570	-3.200	-3.800	-
surc	0.21	0.23	0.32	0.46	0.47	0.48	0.48	0.48	-
DS flow (MGD)	0.0775	0.1064	0.1122	0.1123	0.4524	0.4787	0.4787	0.4786	-
DS velocity (ft/s)	1.082	1.239	0.894	0.489	1.940	2.007	2.004	2.362	-

Node	S92-12	PHD-1	PHD-3	PHD-4	PHD-2	PHD-5	PHD-6	PHD-7	PHD-8
ground (ft AD)	10.930	10.370	9.826	10.274	9.869	10.156	9.241	9.556	9.225
flood dep (ft)	-10.686	-10.381	-10.370	-11.178	-10.796	-11.668	-11.334	-12.279	-12.604

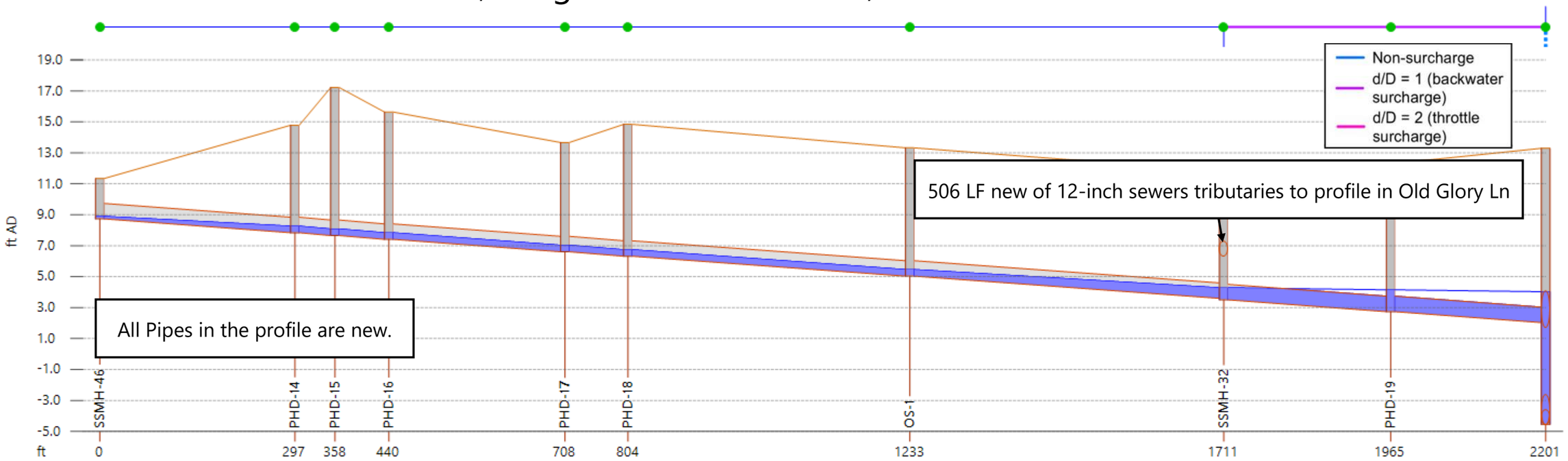
Project 11: Mission Point
Project Solution Profile View 2 of 3
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	SSMH-22.1	PHD-9.1	SSMH-18.1	SSMH-54.1	PHD-10.1	-
Conduit mate	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN
width (in)	15.0	15.0	12.0	12.0	12.0	12.0
length (ft)	165.0	128.0	59.0	249.0	394.0	31.0
pfc (MGD)	4.18	4.24	1.24	1.53	1.53	1.02
us inv (ft AD)	5.870	4.220	2.900	2.730	1.634	-0.099
ds inv (ft AD)	4.220	2.900	2.730	1.634	-0.099	-0.160
surc	0.14	0.31	0.38	0.35	1.00	1.00
DS flow (MGD)	0.0908	0.0908	0.3863	0.3863	0.3867	0.3867
DS velocity (ft/s)	1.342	0.441	2.449	2.443	0.728	0.727

Node	SSMH-22	PHD-9	SSMH-18	SSMH-54	PHD-10	PHD-11	-
ground (ft AD)	9.630	9.291	8.270	9.050	11.313	10.288	-
flood dep (ft)	-3.684	-4.896	-4.987	-5.971	-9.329	-8.877	-

Project 11: Mission Point
Project Solution Profile View 3 of 3
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	SSMH-46.1	-	-	PHD-16.1	-	PHD-18.1	OS-1.1	SSMH-32.1	PHD-19.1
Conduit mate	UNKN	-	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
length (ft)	297.0	61.0	82.0	268.0	96.0	429.0	478.0	254.0	236.0
pfc (MGD)	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
us inv (ft AD)	8.730	7.839	7.656	7.410	6.606	6.318	5.031	3.500	2.738
ds inv (ft AD)	7.839	7.656	7.410	6.606	6.318	5.031	3.597	2.738	2.030
surc	0.42	0.42	0.42	0.42	0.42	0.42	0.68	1.00	1.00
DS flow (MGD)	0.4552	-	0.4550	0.4549	0.4549	0.4548	0.4992	0.5503	0.5499
DS velocity (ft/s)	2.244	2.244	2.244	2.244	2.243	2.222	2.863	1.744	1.031

Node	SSMH-46	PHD-14	-	PHD-16	PHD-17	PHD-18	OS-1	SSMH-32	PHD-19	S93-48
ground (ft AD)	11.340	14.785	-	15.636	13.668	14.842	13.320	11.810	12.312	13.290
flood dep (ft)	-2.449	-6.525	-	-7.805	-6.641	-8.103	-7.865	-7.532	-8.160	-9.263

Project 12: GAP West Trunk

PROJECT DESCRIPTION

Project No.	12
Project ID	GAP West Trunk
Project Location	S of West Tasman Dr to Lafayette St
Description	4810 LF of 36 to 42-inch diameter pipe
Priority	3
Flow Confidence Level	2
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$17,781,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Project would not include improvements to siphon between manholes S103-19 and S103-16. Siphon is unlined but was assumed to be lined in the future in the Lined Model Network. (iv) Project does not include the GAP West Trunk improvements associated with the PHD development. The cost to upsize the GAP West Trunk from the PHD specific development project's discharge point to the Bay Division pipelines crossing (from manhole S83-5 to S93-53) is to be paid by the developers as discussed in Section 2.2; therefore, this portion of the project is not included the City's CIP. (v) Two pipe segments between manholes S93-48 and S93-42 that are downstream of the PHD project and the GAP West project are not included in the proposed project because they would still have capacity based on the City's capacity criteria of no surcharge; however, the City may wish to consider expanding the project to include them during preliminary design. (vi)
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	City may wish to consider evaluating alternatives during preliminary design that would replace or remove this siphon that crosses under the San Tomas Aquino Creek, if feasible.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S93-42	S93-36	29	36	401	0.13	14	8.41	15.67	10.16	10.57	3.71	$1,239			$1,239	$ 496,839
S93-36	S93-21	29	36	452	0.16	13	9.51	17.09	10.79	11.33	3.91	$1,239	PTGAB	48.00	$2,805	$ 1,267,788
S93-21	S93-4	29	36	451	0.18	13	10.17	18.27	10.88	11.43	3.47	$1,239			$1,239	$ 558,789
S93-4	S103-22	29	36	447	0.09	14	7.36	13.22	11.00	11.55	5.28	$1,239			$1,239	$ 553,337
S103-22	S103-19	29	42	388	0.05	20	5.55	15.14	12.48	12.85	5.21	$1,399			$1,399	$ 542,113
S103-16	S103-14	31	42	245	0.12	23	10.45	22.77	12.48	12.85	3.37	$1,399			$1,399	$ 342,335
S103-14	S103-9	31	42	101	0.20	20	13.28	28.95	12.48	12.85	3.25	$1,399			$1,399	$ 141,159
S103-9	S103-10	32	42	375	0.09	19	9.38	19.87	13.21	13.70	3.46	$1,369			$1,369	$ 513,375
S103-10	S103-12	32	42	468	0.10	17	9.53	20.17	13.20	13.70	3.49	$1,369			$1,369	$ 640,281
S103-12	S104-24	32	42	468	0.10	16	9.53	20.17	13.20	13.70	3.58	$1,369			$1,369	$ 640,144
S104-24	S104-26	32	42	477	0.09	19	9.43	19.98	13.20	13.70	3.91	$1,369			$1,369	$ 652,739
S104-26	S104-23	31	42	423	0.10	17	9.18	20.00	13.20	13.69	5.68	$1,369			$1,369	$ 579,087
S104-23	S104-51	31	42	62	0.71	16	25.20	54.92	13.20	13.69	5.68	$1,369			$1,369	$ 84,467
S104-51	S104-19	36	42	54	0.80	17	37.62	58.03	13.20	13.69	4.46	$1,369			$1,369	$ 73,926

Total Baseline Pipe Construction Cost	$	5,818,593
Total Trenchless Installation Cost	$	1,267,788
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 6)	$	3,000
Modify Existing Manholes Cost (Approx. 16)	$	280,000
Baseline Construction Cost:	**$**	**7,369,380**
Dewatering	$	432,855
Bypass Pumping	$	708,638
Remove & Replace Factor	$	354,319
Traffic Control (20%)	$	1,417,276
Pavement Restoration (T-trench)	$	138,352
Subtotal:	**$**	**10,420,820**
Mobilization/Demobilization (5% of subtotal)	$	521,041.02
Estimated Construction Cost Subtotal:	**$**	**10,941,861**
Contingencies (30% of construction subtotal)	$	3,282,558.41
Estimated Construction Cost:	**$**	**14,224,420**
Engineering and Inspection (25% of construction cost)	$	3,556,105
Estimated Capital Improvement Cost:	**$**	**17,781,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 12
GAP West Trunk

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.05 0.1 0.2 Miles

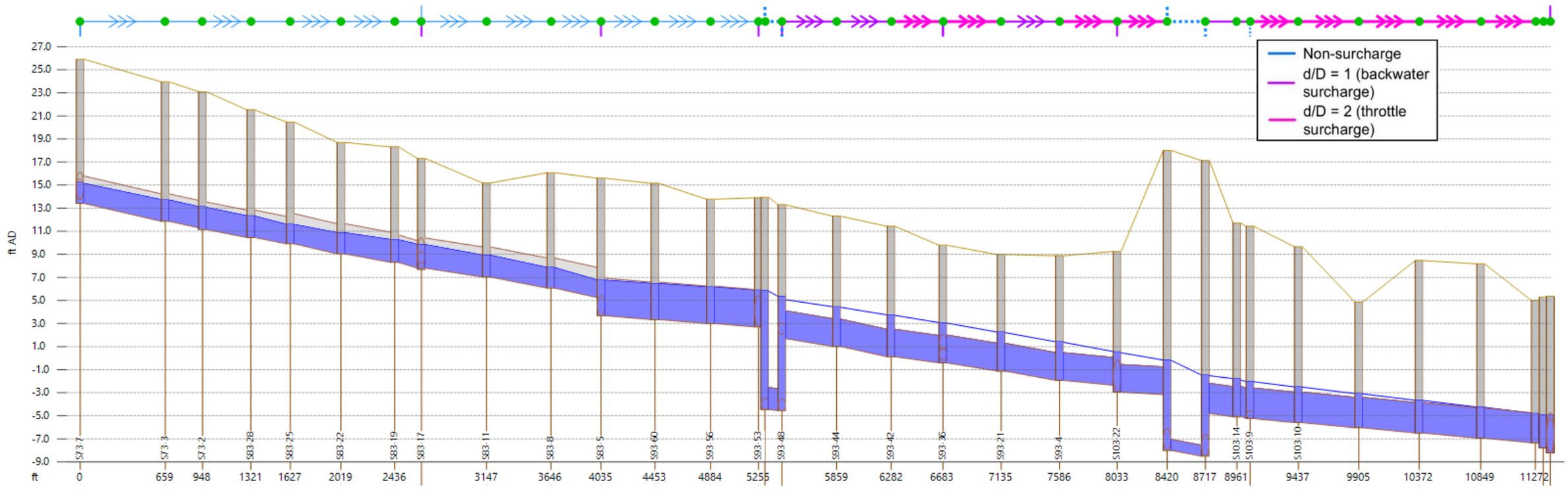
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/3/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wipIC: GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

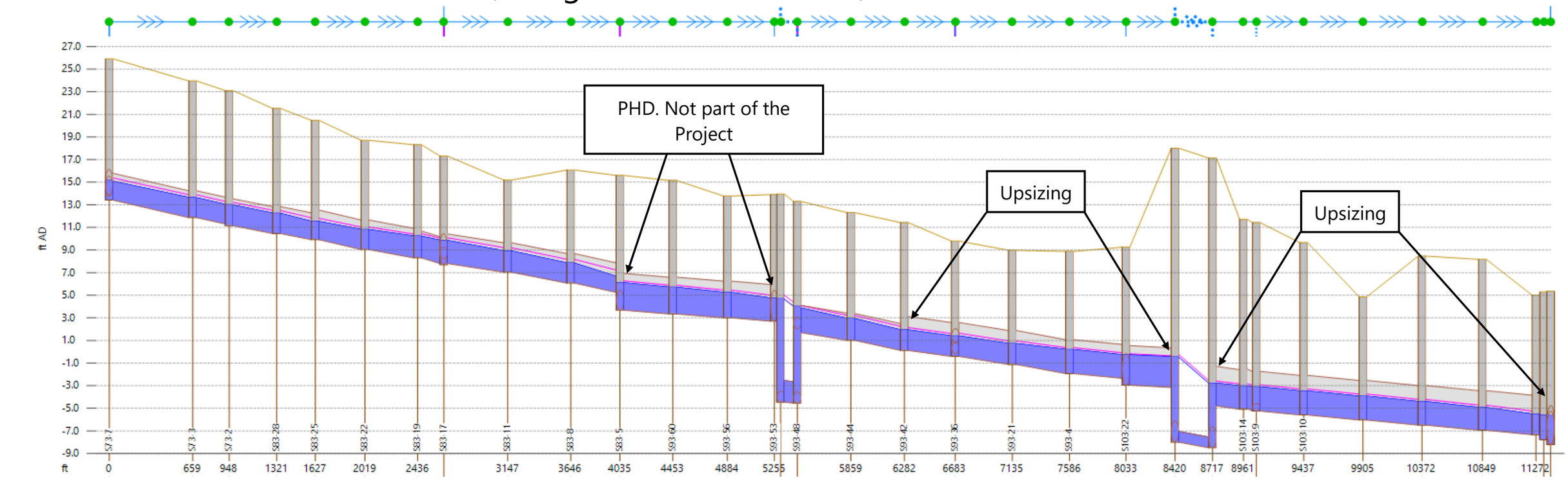
Project 12: GAP West Trunk
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S73-7.1	-	S73-2.1	-	S83-25.1	S83-22.1	-	S83-17.1	S83-11.1	S83-8.1	S83-5.1	S93-60.1	S93-56.1	-	S93-48.1	S93-44.1	S93-42.1	S93-36.1	S93-21.1	S93-4.1	-	-	-	-	S103-9.1	S103-10.1	S103-12.1	S104-24.1	S104-26.1
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	UNKN	UNKN	UNKN	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	VCP	RCP	-	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	28.5	28.5	28.5	31.4	31.4	28.5	31.4	31.4	31.4	39.0	39.0	39.0	-	28.9	28.5	28.5	28.9	28.9	28.9	28.8	11.4	31.4	-	31.7	31.7	31.7	31.7	31.4
length (ft)	658.7	288.9	373.8	305.7	392.1	416.7	-	503.0	499.0	389.0	418.0	431.0	371.0	-	423.0	423.0	401.0	452.0	451.0	446.6	387.5	296.2	244.7	-	375.0	467.7	467.6	476.8	423.0
pfc (MGD)	11.23	10.19	9.94	9.82	14.06	12.58	-	11.68	13.09	13.70	15.22	14.99	15.18	-	9.62	10.62	8.41	9.51	10.17	7.36	5.55	0.83	10.45	-	9.38	9.53	9.53	9.43	9.18
us inv (ft AD)	13.410	11.860	11.150	10.460	9.910	9.040	-	7.800	7.030	6.070	3.680	3.340	3.000	-	1.690	1.010	0.120	-0.410	-1.120	-1.930	-2.950	-8.000	-	-	-5.240	-5.590	-6.040	-6.490	-6.940
ds inv (ft AD)	11.860	11.300	10.460	9.910	9.040	8.300	-	7.030	6.070	5.250	3.340	3.000	2.700	-	1.010	0.120	-0.410	-1.120	-1.930	-2.350	-3.160	-8.500	-	-	-5.590	-6.040	-6.490	-6.940	-7.340
surc	0.79	0.78	0.80	0.78	0.70	0.75	0.87	0.78	0.72	0.67	0.96	0.97	0.98	-	1.00	1.00	2.00	2.00	1.00	2.00	2.00	2.00	1.00	-	2.00	2.00	2.00	2.00	2.00
DS flow (MGD)	9.7231	9.7229	9.7228	9.8966	9.8990	9.9069	-	11.4763	11.4885	11.4882	14.0521	14.1030	14.1700	-	9.2138	9.2112	9.2087	9.9604	10.0619	10.1861	9.6615	1.3291	-	-	10.5776	10.5764	10.5734	10.5684	10.5626
DS velocity (ft/s)	4.037	4.198	4.018	4.568	3.862	3.675	-	4.261	4.563	6.010	3.291	3.503	4.242	-	3.821	3.416	3.531	3.718	3.505	5.518	5.567	2.898	2.978	-	3.210	3.175	3.288	3.581	5.569

Node	S73-7	S73-3	S73-2	-	S83-25	S83-22	-	S83-17	S83-11	S83-8	S83-5	S93-60	S93-56	-	-	S93-44	S93-42	S93-36	S93-21	S93-4	S103-22	-	-	-	-	S103-10	S103-12	S104-24	S104-26	-
ground (ft AD)	-	23.950	-	21.520	20.470	18.700	-	17.300	15.180	16.070	15.600	15.150	13.770	-	-	12.310	11.420	9.790	8.980	8.870	9.250	18.000	-	-	-	9.650	4.860	8.460	8.170	-
flood dep (ft)	-	-10.225	-9.985	-9.192	-8.879	-7.827	-	-7.449	-6.255	-8.216	-8.835	-8.683	-7.612	-	-	-7.860	-7.677	-6.712	-6.727	-7.455	-8.703	-	-	-	-	-12.148	-7.938	-12.116	-12.413	-

Project 12: GAP West Trunk
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S73-7.1	-	S73-2.1	-	S83-25.1	S83-22.1	-	S83-17.1	S83-11.1	S83-8.1	S83-5.1	S93-60.1	S93-56.1	-	S93-48.1	S93-44.1	S93-42.1	S93-36.1	S93-21.1	S93-4.1	-	-	-	-	S103-9.1	S103-10.1	S103-12.1	S104-24.1	S104-26.1
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	UNKN	UNKN	UNKN	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	VCP	RCP	-	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	28.5	28.5	28.5	31.4	31.4	28.5	31.4	31.4	31.4	39.0	39.0	39.0	-	28.9	28.5	36.0	36.0	36.0	36.0	42.0	11.4	42.0	-	42.0	42.0	42.0	42.0	42.0
length (ft)	658.7	288.9	373.8	305.7	392.1	416.7	-	503.0	499.0	389.0	418.0	431.0	371.0	-	423.0	423.0	401.0	452.0	451.0	446.6	387.5	296.2	244.7	-	375.0	467.7	467.6	476.8	423.0
pfc (MGD)	11.23	10.19	9.94	9.82	14.06	12.58	-	11.68	13.09	13.70	15.22	14.99	15.18	-	9.62	10.62	15.67	17.09	18.27	13.22	15.14	0.83	22.77	-	19.87	20.17	20.17	19.98	20.00
us inv (ft AD)	13.410	11.860	11.150	10.460	9.910	9.040	-	7.800	7.030	6.070	3.680	3.340	3.000	-	1.690	1.010	0.120	-0.410	-1.120	-1.930	-2.950	-8.000	-	-	-5.240	-5.590	-6.040	-6.490	-6.940
ds inv (ft AD)	11.860	11.300	10.460	9.910	9.040	8.300	-	7.030	6.070	5.250	3.340	3.000	2.700	-	1.010	0.120	-0.410	-1.120	-1.930	-2.350	-3.160	-8.500	-	-	-5.590	-6.040	-6.490	-6.940	-7.340
surc	0.75	0.74	0.77	0.75	0.68	0.74	0.87	0.78	0.72	0.67	0.74	0.73	0.69	-	0.90	0.81	0.60	0.62	0.71	0.71	0.77	2.00	0.59	-	0.61	0.61	0.60	0.59	0.57
DS flow (MGD)	9.2880	9.2876	9.2868	9.4393	9.4382	9.4361	-	11.5037	11.5150	11.5148	14.3152	14.4257	14.5411	-	10.5705	10.5699	10.5684	11.3273	11.4285	11.5526	12.8451	1.7651	-	-	13.7047	13.7036	13.7017	13.6982	13.6922
DS velocity (ft/s)	4.027	4.203	3.985	4.519	3.792	3.508	-	4.263	4.566	6.014	3.417	3.660	4.367	-	4.173	4.494	3.704	3.912	3.474	5.296	5.190	3.853	3.366	-	3.476	3.505	3.578	3.866	5.626

Node	S73-7	S73-3	S73-2	-	S83-25	S83-22	-	S83-17	S83-11	S83-8	S83-5	S93-60	S93-56	-	-	S93-44	S93-42	S93-36	S93-21	S93-4	S103-22	-	-	-	-	S103-10	S103-12	S104-24	S104-26	-
ground (ft AD)	-	23.950	-	21.520	20.470	18.700	-	17.300	15.180	16.070	15.600	15.150	13.770	-	-	12.310	11.420	9.790	8.980	8.870	9.250	18.000	-	-	-	9.650	4.860	8.460	8.170	-
flood dep (ft)	-	-10.308	-	-9.261	-8.936	-7.883	-	-7.445	-6.252	-8.218	-9.491	-9.438	-8.520	-	-	-9.360	-9.483	-8.387	-8.251	-8.664	-9.519	-	-	-	-	-13.118	-8.790	-12.866	-13.102	-

Project 13: GAP East Trunk

PROJECT DESCRIPTION

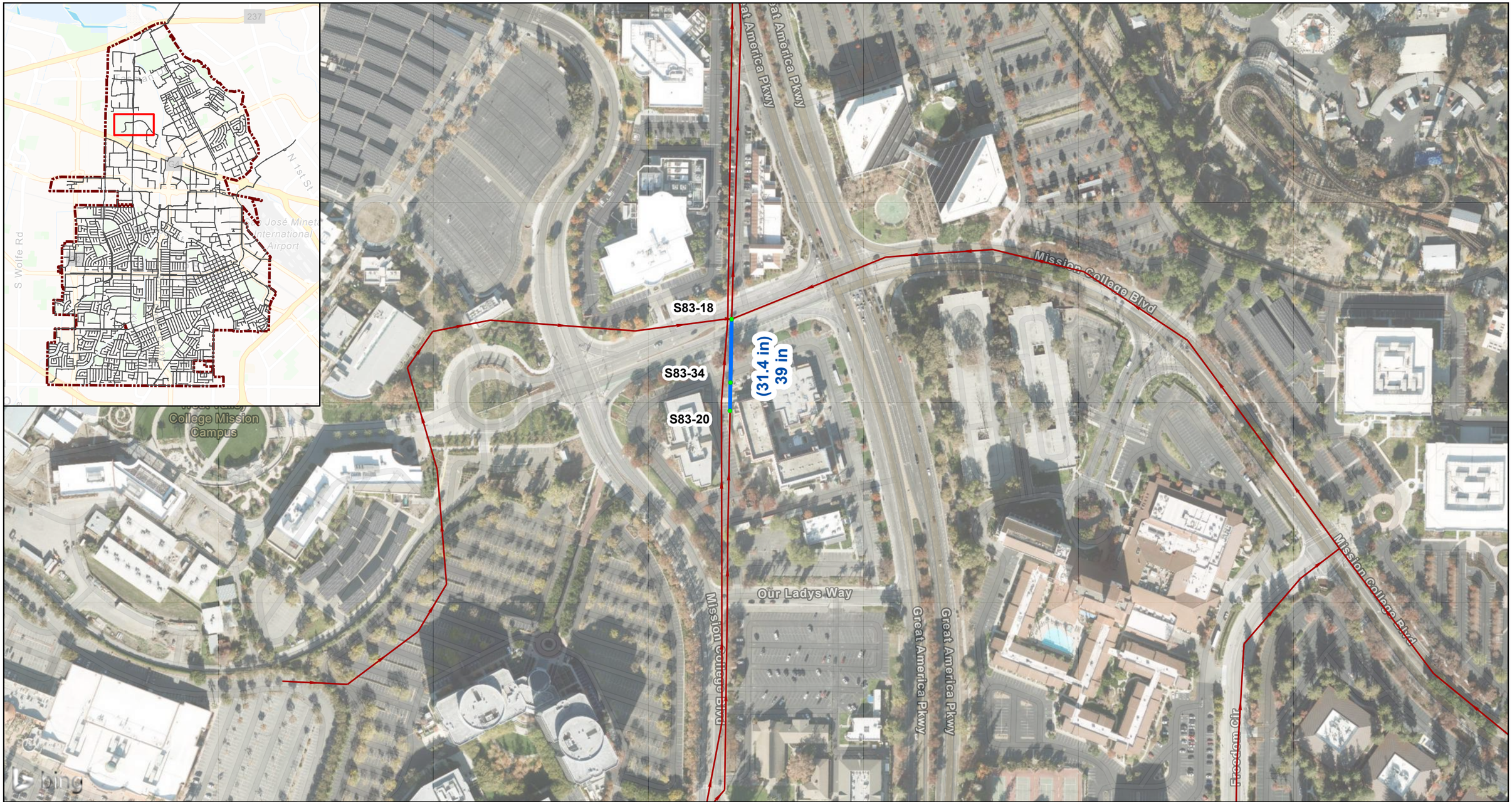
Project No.	13
Project ID	GAP East Trunk
Project Location	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr
Description	231 LF of 39-inch diameter pipe
Priority	4
Flow Confidence Level	2
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Lined Model Network (LMN)
Estimated Capital Improvement Cost	$1,002,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project would not include improvements to the two siphons along the GAP E Trunk that cross Hetch Hetchy and San Tomas Aquino Creeks because the upstream sewers are not deficient based on the City's no surcharge capacity deficiency criteria. Both of these siphons have already been lined by the City; therefore, the lining is reflected in both the Unlined Model Network and Lined Model Network.
	(iv) Project would be required due to assumed future lining of GAP E Trunk sewer and other trunk sewers upstream.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	City may wish to consider evaluating alternatives during preliminary design that would replace or remove the siphons crossing under Hetch Hetchy and San Tomas Aquino Creek, if feasible.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S83-20	S83-34	31	39	71	0.21	14	13.68	24.47	12.45	13.84	3.20	$1,289			$1,289	$ 91,906
S83-34	S83-18	31	39	160	0.09	14	9.14	16.35	12.45	13.83	3.19	$1,289			$1,289	$ 205,982

Total Baseline Pipe Construction Cost	$	297,888
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 1)	$	500
Modify Existing Manholes Cost (Approx. 9)	$	157,500
Baseline Construction Cost:	**$**	**455,888**
Dewatering	$	20,799
Bypass Pumping	$	29,789
Remove & Replace Factor	$	14,894
Traffic Control (20%)	$	59,578
Pavement Restoration (T-trench)	$	6,551
Subtotal:	**$**	**587,499**
Mobilization/Demobilization (5% of subtotal)	$	29,374.94
Estimated Construction Cost Subtotal:	**$**	**616,874**
Contingencies (30% of construction subtotal)	$	185,062.11
Estimated Construction Cost:	**$**	**801,936**
Engineering and Inspection(25% ofconstruction cost)	$	200,484
Estimated Capital Improvement Cost:	**$**	**1,002,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 13
GAP East Trunk

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter
- Other Modeled Sewers

0 0.04 0.07 0.14 Miles

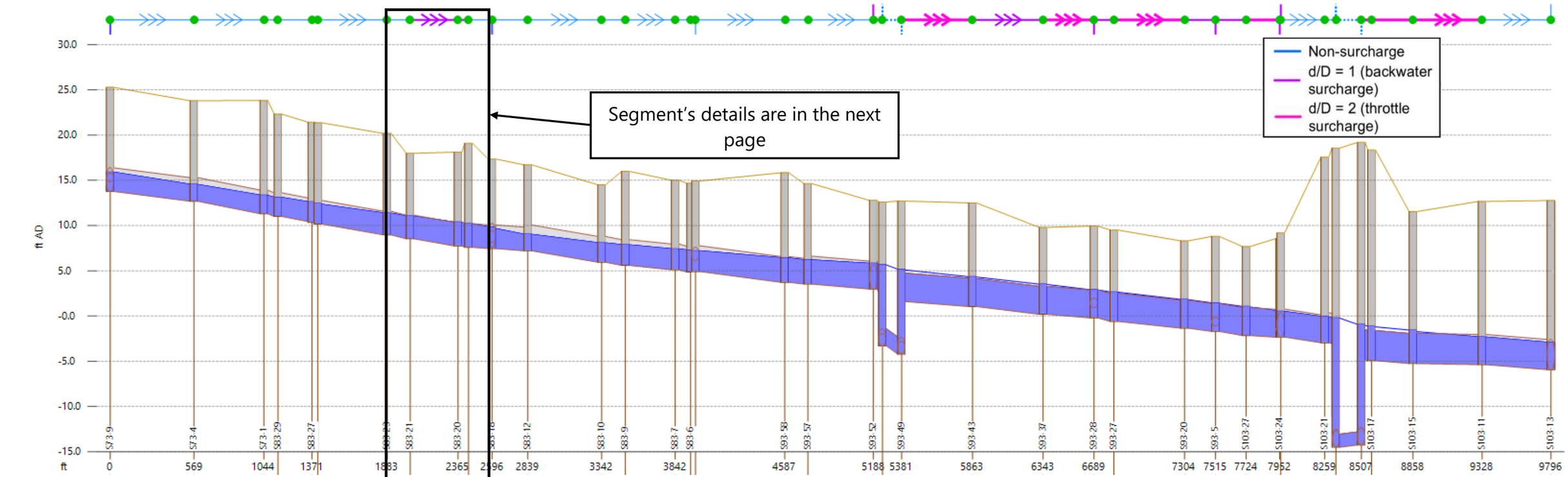
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 10/15/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wipC. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 13: GAP East Trunk
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



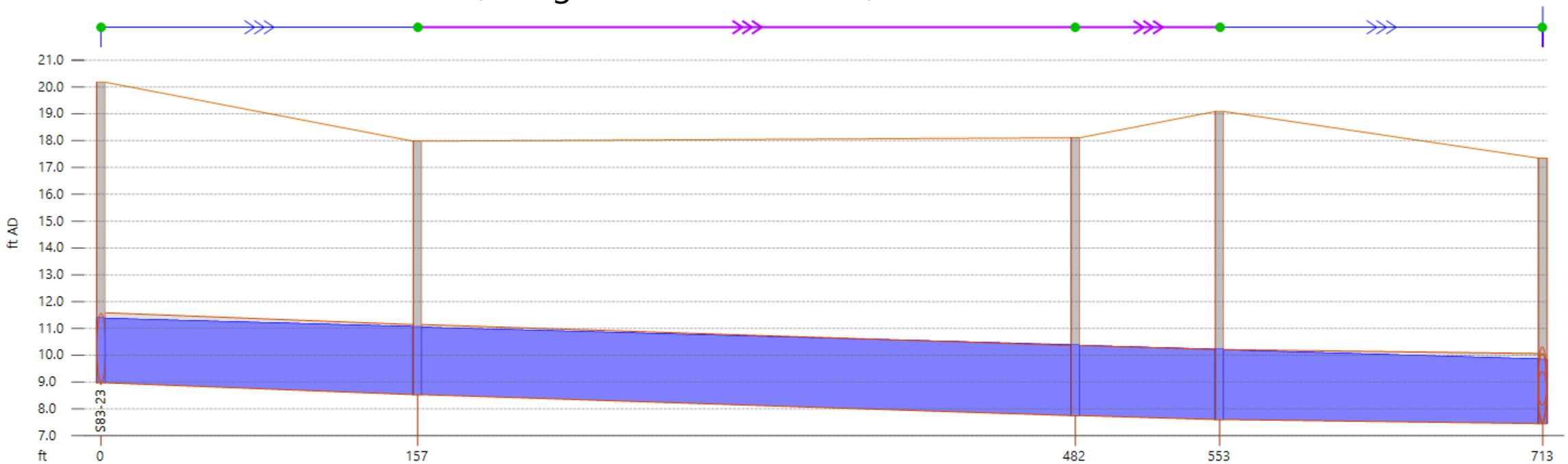
Link	S73-9.1	S73-4.1	-	-	S83-26.1	-	S83-21.1	-	-	-	S83-12.1	-	S83-9.1	-	S83-30.1	-	S93-57.1	-	S93-49.1	S93-43.1	S93-37.1	-	S93-27.1	-	-	-	-	-	-	-	S103-15.1	S103-11.1
Conduit mate	RCP	RCP	-	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	-	VCP	-	RCP	RCP	RCP
width (in)	31.4	31.4	-	31.4	31.4	31.4	31.4	-	31.4	31.4	34.2	34.2	34.2	-	34.2	34.2	37.1	-	37.6	37.1	37.1	-	37.1	37.1	37.1	37.1	37.1	-	17.3	-	39.9	40.1	40.1
length (ft)	569.4	474.9	-	230.4	471.3	-	325.4	-	-	243.0	503.0	-	339.0	-	607.0	-	444.0	-	482.0	480.0	346.0	-	480.0	211.0	208.9	227.6	299.4	-	-	-	281.3	469.9	468.2
pfc (MGD)	13.00	16.03	-	14.71	15.06	-	14.61	-	9.14	9.38	18.83	-	14.16	-	16.66	-	16.39	-	16.35	19.72	15.84	-	18.41	19.24	21.86	13.10	21.37	-	-	-	19.14	9.56	19.52
us inv (ft AD)	13.760	12.680	-	-	10.170	-	8.530	-	-	7.450	7.210	-	5.590	-	4.920	-	3.530	-	1.600	1.050	0.190	-	-0.590	-	-	-2.160	-2.320	-	-	-	-4.930	-5.250	-5.380
ds inv (ft AD)	12.680	11.310	-	-	8.970	-	7.750	-	-	7.210	5.950	-	5.110	-	3.730	-	2.980	-	1.050	0.190	-0.210	-	-1.340	-	-	-2.340	-2.950	-	-	-	-5.250	-5.380	-5.920
surc	0.82	0.79	-	0.84	0.93	0.97	1.00	-	0.99	0.85	0.76	0.81	0.82	-	0.95	0.94	0.92	-	2.00	1.00	2.00	-	2.00	1.00	1.00	2.00	0.94	-	1.00	-	2.00	2.00	0.92
DS flow (MGD)	13.3174	13.3081	-	-	13.2931	-	13.3136	-	-	-	13.3034	-	13.2770	-	13.4917	-	13.3924	-	18.9698	18.9485	18.9299	-	18.9708	-	-	-	19.8493	-	-	-	19.8406	19.8297	19.8143
DS velocity (ft/s)	5.006	4.843	-	5.118	4.520	-	3.796	-	-	5.149	4.171	-	4.091	-	4.008	-	5.604	-	4.344	4.221	4.636	-	4.392	4.388	4.254	4.868	5.807	-	-	-	3.416	3.909	3.938

Node	S73-9	S73-4	S73-1	-	-	-	S83-23	-	-	-	-	S83-12	S83-10	-	-	S83-30	S93-58	S93-57	-	S93-49	S93-43	S93-37	-	S93-27	S93-20	-	-	-	-	-	-	-	S103-15	S103-11	-
ground (ft AD)	-	23.790	-	-	-	-	20.180	-	-	-	-	16.710	14.500	-	-	14.920	15.830	14.630	-	12.700	12.500	9.790	-	9.510	8.310	-	-	-	-	-	-	-	11.540	12.660	-
flood dep (ft)	-9.338	-9.227	-	-	-	-	-8.788	-	-	-	-	-7.671	-6.398	-	-	-7.694	-9.389	-8.413	-	-7.531	-8.158	-6.269	-	-6.843	-6.472	-	-	-	-	-	-	-	-13.100	-14.964	-

Project 13: GAP East Trunk

Capacity Deficiency Profile View (*Zoomed-in section*)

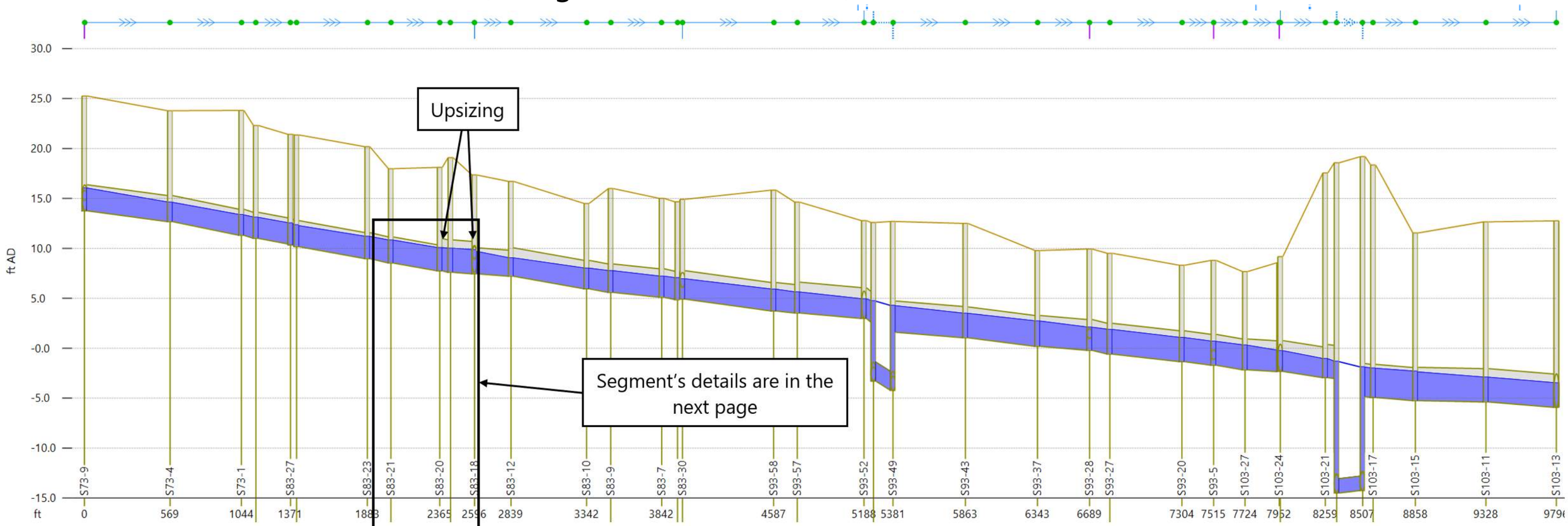
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S83-23.1	S83-21.1	S83-20.1	S83-34.1
Conduit mate	RCP	RCP	RCP	RCP
width (in)	31.4	31.4	31.4	31.4
length (ft)	156.6	325.4	71.3	159.8
pfc (MGD)	15.82	14.61	13.68	9.14
us inv (ft AD)	8.970	8.530	7.750	7.600
ds inv (ft AD)	8.530	7.750	7.600	7.450
surc	0.97	1.00	1.00	0.99
DS flow (MGD)	13.2986	13.3136	13.3133	13.3125
DS velocity (ft/s)	4.195	3.796	3.807	3.993

Node	S83-23	S83-21	S83-20	S83-34	S83-18
ground (ft AD)	20.180	17.980	18.110	19.090	17.350
flood dep (ft)	-8.788	-6.921	-7.723	-8.872	-7.498

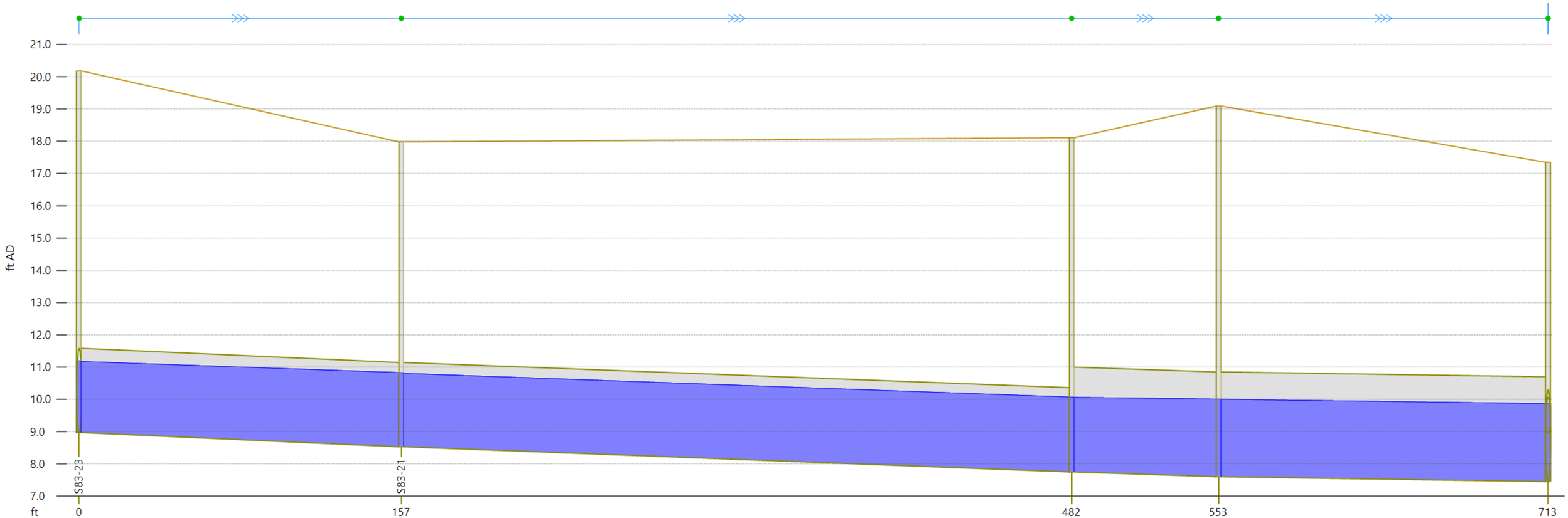
Project 13: GAP East Trunk
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S73-9.1	S73-4.1	-	-	S83-26.1	-	S83-21.1	-	-	S83-12.1	-	S83-9.1	-	S83-30.1	-	S93-57.1	-	S93-49.1	S93-43.1	S93-37.1	-	S93-27.1	-	-	-	-	-	-	-	S103-15.1	S103-11.1
Conduit mate	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	-	VCP	RCP	RCP	RCP
width (in)	31.4	31.4	-	31.4	31.4	-	31.4	-	31.4	34.2	34.2	34.2	-	34.2	-	37.1	-	37.6	37.1	37.1	-	37.1	37.1	37.1	37.1	37.1	-	17.3	39.9	40.1	40.1
length (ft)	569.4	474.9	-	230.4	471.3	-	325.4	-	243.0	503.0	-	339.0	-	607.0	-	444.0	-	482.0	480.0	346.0	-	480.0	211.0	208.9	227.6	299.4	-	-	281.3	469.9	468.2
pfc (MGD)	13.00	16.03	-	14.71	15.06	-	14.61	-	9.38	18.83	-	14.16	-	16.66	-	16.39	-	21.97	27.53	22.11	-	25.71	19.24	21.86	13.10	21.37	-	-	31.31	15.44	19.52
us inv (ft AD)	13.760	12.680	-	-	10.170	-	8.530	-	7.450	7.210	-	5.590	-	4.920	-	3.530	-	1.600	1.050	0.190	-	-0.590	-	-	-	-2.320	-	-	-4.930	-5.250	-5.380
ds inv (ft AD)	12.680	11.310	-	-	8.970	-	7.750	-	7.210	5.950	-	5.110	-	3.730	-	2.980	-	1.050	0.190	-0.210	-	-1.340	-	-	-	-2.950	-	-	-5.250	-5.380	-5.920
surc	0.86	0.79	-	0.81	0.85	-	0.88	-	0.85	0.72	0.76	0.75	-	0.76	-	0.67	-	0.84	0.82	0.81	-	0.79	0.77	0.80	0.79	0.66	-	1.00	0.89	0.85	0.74
DS flow (MGD)	13.8302	13.8255	-	-	13.8155	-	13.8355	-	-	13.3619	-	13.3605	-	13.6553	-	13.6550	-	17.9248	17.9215	17.9195	-	18.0107	-	-	-	17.3783	-	-	-	17.3735	17.3714
DS velocity (ft/s)	5.034	4.867	-	5.121	4.712	-	4.285	-	5.159	4.183	-	4.120	-	4.079	-	5.673	-	4.346	4.225	4.652	-	4.460	4.494	4.425	5.227	5.799	-	-	3.304	3.871	3.905

Node	S73-9	S73-4	S73-1	-	-	-	-	S83-23	-	-	-	-	S83-12	S83-10	-	-	S83-30	S93-58	-	-	-	S93-43	S93-37	-	-	S93-20	-	-	-	-	-	-	S103-15	S103-11	-
ground (ft AD)	-	23.790	-	-	-	-	-	20.180	-	-	-	-	16.710	14.500	-	-	14.920	15.830	14.630	-	-	12.700	12.500	9.790	-	9.510	8.310	-	-	-	-	-	-	11.540	12.660	-
flood dep (ft)	-	-9.175	-	-	-	-	-	-8.993	-	-	-	-	-7.674	-6.487	-	-	-7.976	-9.929	-9.010	-	-	-8.422	-9.012	-7.070	-	-7.635	-7.246	-	-	-	-	-	-	-13.851	-15.571	-

Project 13: GAP East Trunk
Project Solution Profile View (*Zoomed-in section*)
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S83-23.1	S83-21.1	S83-20.1	S83-34.1
Conduit mate	RCP	RCP	RCP	RCP
width (in)	31.4	31.4	39.0	39.0
length (ft)	156.6	325.4	71.3	159.8
pfc (MGD)	15.82	14.61	24.47	16.35
us inv (ft AD)	8.970	8.530	7.750	7.600
ds inv (ft AD)	8.530	7.750	7.600	7.450
surc	0.88	0.88	0.74	0.74
DS flow (MGD)	13.8205	13.8355	13.8351	13.8341
DS velocity (ft/s)	4.508	4.285	3.322	3.318

Node	S83-23	S83-21	S83-20	S83-34	S83-18
ground (ft AD)	20.180	17.980	18.110	19.090	17.350
flood dep (ft)	-8.993	-7.160	-8.049	-9.090	-7.492

Project 14: Bunker Hill Lane East

PROJECT DESCRIPTION

Project No.	14
Project ID	Bunker Hill Lane East
Project Location	E of Great America Pkwy
Description	107 LF of 8-inch diameter pipe
Priority	7
Flow Confidence Level	N/A
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network
Estimated Capital Improvement Cost	$301,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Deficiency would be caused by historic entitlement flows held by parcel APNs 104-55-012 and 104-55-013 . Project should be implemented before parcels begin to discharge entitled flows.
	(iv) Prior to project implementation, the City should verify the inverts of sewers along the project alignment and at the downstream connection to the GAP East trunk sewer.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S93-10	S93-7	6	8	107	0.71	10	0.31	0.66	0.40	0.40	3.04	$654			$654	$ 69,651

Total Baseline Pipe Construction Cost	$	69,651
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (1)	$	45,000
Lateral Reconnection Cost (Approx. 10)	$	5,000
Modify Existing Manholes Cost (Approx. 2)	$	35,000
Baseline Construction Cost:	**$**	**154,651**
Dewatering	$	9,585
Bypass Pumping	$	-
Remove & Replace Factor	$	3,483
Traffic Control (10%)	$	6,965
Pavement Restoration (T-trench)	$	1,943
Subtotal:	**$**	**176,627**
Mobilization/Demobilization (5% of subtotal)	$	8,831.35
Estimated Construction Cost Subtotal:	**$**	**185,458**
Contingencies (30% of construction subtotal)	$	55,637.48
Estimated Construction Cost:	**$**	**241,096**
Engineering and Inspection(25% ofconstruction cost)	$	60,274
Estimated Capital Improvement Cost:	**$**	**301,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 14
Bunker Hill Lane East

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.01 0.02 0.04 Miles

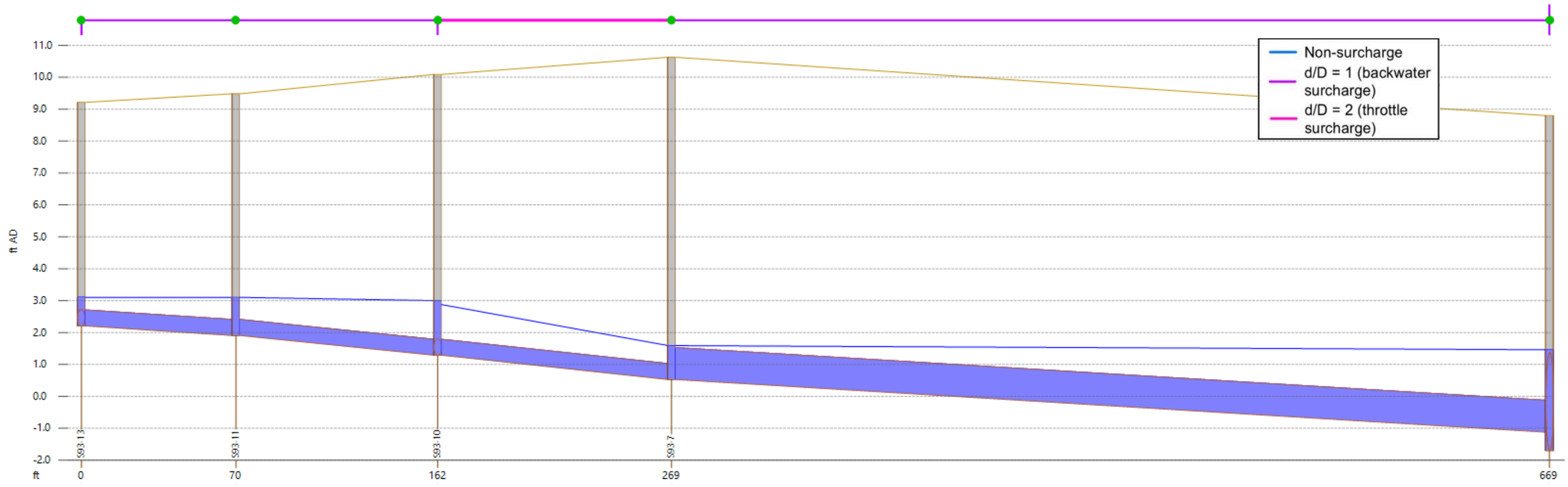
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 9/3/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TM\Figures.aprx

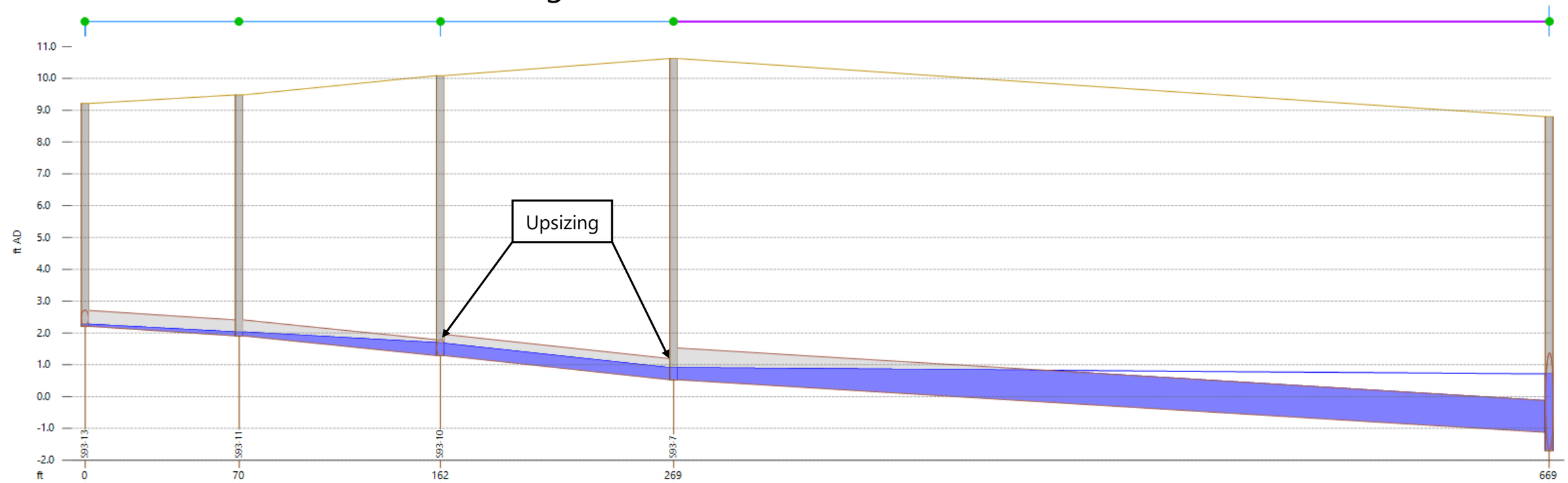
Project 14: Bunker Hill Lane East
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S93-13.1	S93-11.1	S93-10.1	S93-7.1
Conduit mate	VCP	VCP	VCP	VCP
width (in)	6.0	6.0	6.0	12.0
length (ft)	70.4	91.8	106.5	399.8
pfc (MGD)	0.24	0.30	0.31	1.48
us inv (ft AD)	2.210	1.910	1.290	0.530
ds inv (ft AD)	1.910	1.290	0.530	-1.120
surc	1.00	1.00	2.00	1.00
DS flow (MGD)	-0.0063	0.1826	0.4080	0.4641
DS velocity (ft/s)	-0.047	1.335	3.654	1.822

Node	S93-13	S93-11	S93-10	S93-7	S93-5
ground (ft AD)	9.213	9.481	10.089	10.627	8.800
flood dep (ft)	-6.108	-6.377	-7.090	-9.035	-7.341

Project 14: Bunker Hill Lane East
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S93-13.1	S93-11.1	S93-10.1	S93-7.1
Conduit mate	VCP	VCP	VCP	VCP
width (in)	6.0	6.0	8.0	12.0
length (ft)	70.4	91.8	106.5	399.8
pfc (MGD)	0.24	0.30	0.66	1.48
us inv (ft AD)	2.210	1.910	1.290	0.530
ds inv (ft AD)	1.910	1.290	0.530	-1.120
surc	0.24	0.81	0.58	1.00
DS flow (MGD)	-0.0000	0.1784	0.4023	0.4496
DS velocity (ft/s)	-0.000	1.619	3.051	1.870

Node	S93-13	S93-11	S93-10	S93-7	S93-5
ground (ft AD)	9.213	9.481	10.089	10.627	8.800
flood dep (ft)	-6.938	-7.450	-8.396	-9.717	-8.084

Project 15: Lafayette Street

PROJECT DESCRIPTION

Project No.	15
Project ID	Lafayette Street
Project Location	N of Calle del Mundo to S of Great America Wy
Description	2290 LF of 42 to 48-inch diameter pipe
Priority	3
Flow Confidence Level	2
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$7,515,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project would also include some re-sloping of the existing pipe segments from manhole S104-22 to S104-14; per record information, the existing slope is minimal at approximately 0.02 percent.
	(iv) Lined model network includes assumed future lining of Lafayette Trunk.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S104-29	S104-28	34	42	416	0.19	16	16.51	28.53	10.57	14.33	3.11	$1,369			$1,369	$ 568,956
S104-28	S104-22	34	48	436	0.15	16	14.53	35.86	10.56	14.33	2.12	$1,419			$1,419	$ 618,400
S104-22	S104-17	40	48	426	0.09	16	8.18	27.69	21.18	25.41	3.82	$1,389			$1,389	$ 591,714
S104-17	S104-16	40	48	435	0.09	15	8.18	27.69	21.17	25.40	3.91	$1,389			$1,389	$ 604,215
S104-16	S104-14	40	48	428	0.09	17	22.17	27.69	21.17	25.40	4.16	$1,419			$1,419	$ 607,332
S104-14	S104-8	40	48	150	0.09	17	22.70	27.69	21.17	25.40	4.72	$1,419			$1,419	$ 212,850

Total Baseline Pipe Construction Cost	$	3,203,468
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 1)	$	500
Modify Existing Manholes Cost (Approx. 7)	$	122,500
Baseline Construction Cost:	**$**	**3,326,468**
Dewatering	$	206,136
Bypass Pumping	$	320,347
Remove & Replace Factor	$	160,173
Traffic Control (10%)	$	320,347
Pavement Restoration (T-trench)	$	70,897
Subtotal:	**$**	**4,404,368**
Mobilization/Demobilization (5% of subtotal)	$	220,218.40
Estimated Construction Cost Subtotal:	**$**	**4,624,586**
Contingencies (30% of construction subtotal)	$	1,387,375.90
Estimated Construction Cost:	**$**	**6,011,962**
Engineering and Inspection (25% of construction cost)	$	1,502,991
Estimated Capital Improvement Cost:	**$**	**7,515,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 15
Lafayette St

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.04 0.07 0.15 Miles

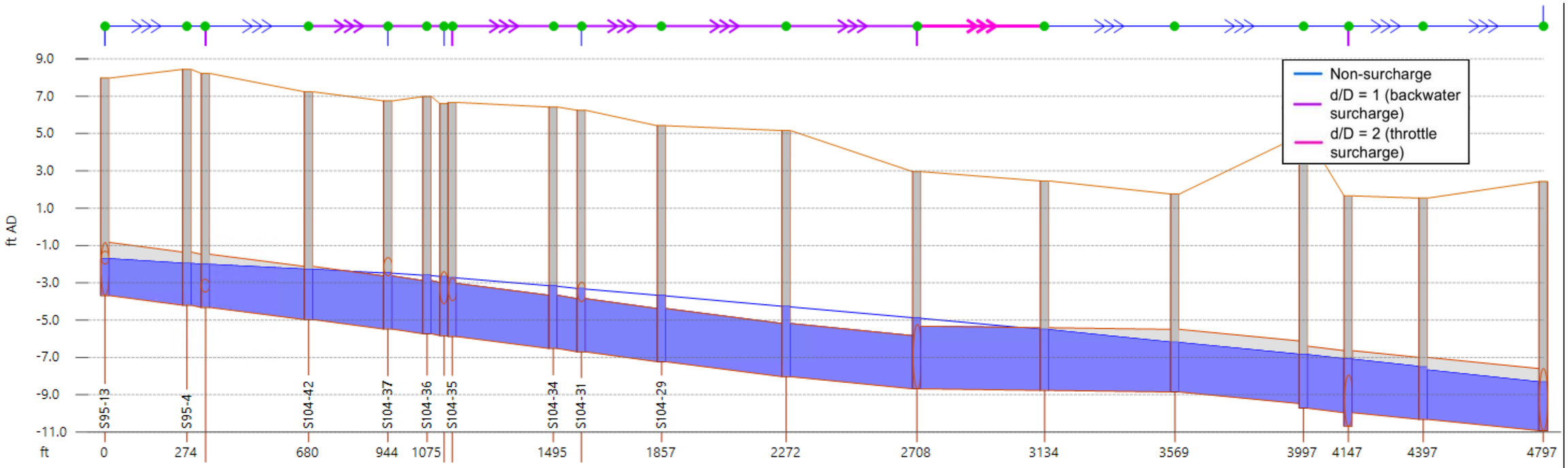
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

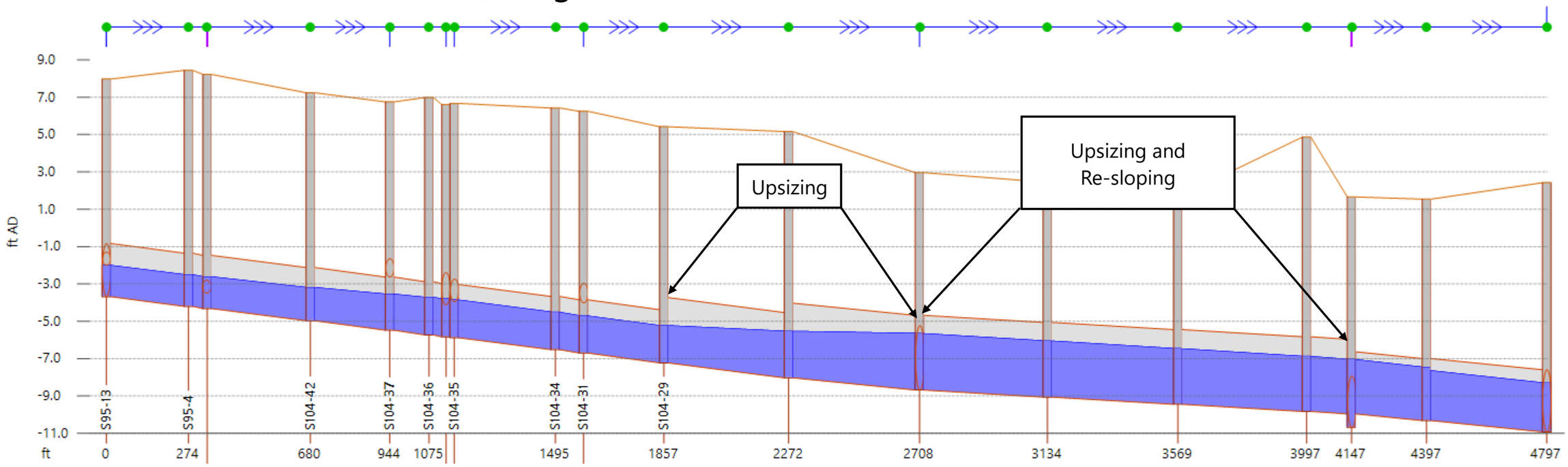
Project 15: Lafayette Street
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S95-13.1	-	S95-1.1	S104-42.1	-	-	S104-35.1	-	S104-31.1	S104-29.1	S104-28.1	S104-22.1	S104-17.1	S104-16.1	-	S104-8.1	S114-13.1
Conduit mate	RCP	-	RCP	RCP	RCP	-	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	34.2	-	34.2	34.2	34.2	-	34.2	-	34.2	34.2	34.2	40.3	40.3	40.3	39.9	39.9	39.9
length (ft)	273.5	-	343.7	263.9	131.1	-	336.8	-	267.7	415.6	435.8	426.0	435.0	428.0	150.0	250.0	400.0
pfc (MGD)	16.39	-	16.36	16.53	16.47	-	16.38	-	16.75	16.51	14.53	8.18	8.18	22.17	22.70	21.53	21.98
us inv (ft AD)	-3.681	-	-4.320	-4.970	-	-	-5.882	-	-6.700	-7.230	-8.030	-8.680	-8.764	-8.850	-9.720	-9.960	-10.320
ds inv (ft AD)	-4.200	-	-4.970	-5.479	-	-	-6.520	-	-7.230	-8.030	-8.680	-8.764	-8.850	-9.470	-9.960	-10.320	-10.920
surc	0.79	-	0.95	1.00	1.00	-	1.00	-	1.00	1.00	1.00	2.00	0.97	0.79	0.87	0.86	0.79
DS flow (MGD)	10.3970	-	10.4451	10.4600	-	-	13.7705	-	13.8106	14.3059	14.3057	21.2761	21.2757	21.2754	-	21.5626	21.5625
DS velocity (ft/s)	3.969	-	3.805	3.466	3.501	-	4.007	-	3.715	3.329	3.330	3.733	4.422	5.133	4.223	4.234	4.570

Node	-	-	S95-1	S104-42	-	-	-	-	-	S104-29	S104-28	S104-22	S104-17	S104-16	S104-14	S104-8	S114-13	-
ground (ft AD)	-	8.440	8.220	7.240	6.750	-	6.670	6.420	6.250	5.420	5.160	2.960	2.460	1.760	4.860	1.660	1.540	2.420
flood dep (ft)	-	-	-	-9.510	-9.219	-	-9.386	-9.577	-9.554	-9.089	-9.418	-7.832	-7.952	-7.946	-11.693	-8.737	-9.042	-

Project 15: Lafayette Street
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S95-13.1	-	S95-1.1	S104-42.1	-	-	S104-35.1	-	S104-31.1	S104-29.1	S104-28.1	S104-22.1	S104-17.1	S104-16.1	-	S104-8.1	S114-13.1
Conduit mate	RCP	-	RCP	RCP	RCP	-	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	34.2	-	34.2	34.2	34.2	-	34.2	-	34.2	42.0	48.0	48.0	48.0	48.0	48.0	39.9	39.9
length (ft)	273.5	-	343.7	263.9	131.1	-	336.8	-	267.7	415.6	435.8	426.0	435.0	428.0	150.0	250.0	400.0
pfc (MGD)	16.39	-	16.36	16.53	16.47	-	16.38	-	16.75	28.53	35.86	27.69	27.69	27.69	27.69	21.53	21.98
us inv (ft AD)	-3.681	-	-4.320	-4.970	-	-	-5.882	-	-6.700	-7.230	-8.030	-8.680	-9.059	-9.446	-9.827	-9.960	-10.320
ds inv (ft AD)	-4.200	-	-4.970	-5.479	-	-	-6.520	-	-7.230	-8.030	-8.680	-9.059	-9.446	-9.827	-9.960	-10.320	-10.920
surc	0.60	-	0.62	0.68	0.71	-	0.71	-	0.70	0.71	0.76	0.75	0.75	0.74	0.73	0.87	0.80
DS flow (MGD)	10.4065	-	10.4578	10.4735	-	-	13.7963	-	13.8367	14.3339	14.3304	25.4071	25.4049	25.4030	-	21.7524	21.7518
DS velocity (ft/s)	4.062	-	3.879	3.548	3.671	-	4.443	-	4.705	3.424	2.448	3.882	3.947	4.168	4.742	4.237	4.579

Node	-	-	S95-1	S104-42	-	-	-	-	-	S104-29	S104-28	S104-22	S104-17	S104-16	S104-14	S104-8	S114-13	-
ground (ft AD)	-	8.440	8.220	7.240	6.750	-	6.670	6.420	6.250	5.420	5.160	2.960	2.460	1.760	4.860	1.660	1.540	2.420
flood dep (ft)	-	-	-	-10.431	-	-	-	-10.926	-	-10.655	-10.695	-8.611	-8.508	-8.222	-11.740	-8.699	-9.011	-

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Appendix K
Sewer Utility Budget

Water and Sewer Utilities Department Description

The Water and Sewer Utilities Department provides planning, design, construction, maintenance, and operation of the City's water distribution system, sewer collection system, and recycled water system. The three utilities, water, sewer, and recycled water, operate independently and charge rates to recover the costs of providing these services to Santa Clara residents and businesses, including capital investment in City infrastructure and funding of needed reserves.

In 2024, the Water Utility produced and distributed 6.9 billion gallons of water to approximately 26,000 service connections, delivered through approximately 335 miles of water main. Of the total water supply, 50% is obtained from the City's wells and 30% is treated water purchased from two wholesale potable water agencies. Approximately 20% of the City's water supply is met with recycled water delivered through the South Bay Water Recycling system. The Department oversees:

- Design, construction, distribution, metering, quality monitoring, and system operation and system maintenance for both potable and recycled water.
- Collection and conveyance of wastewater for approximately 26,000 accounts and assessment, maintenance, or repair for more than 288 miles of sewer mains as required.
- Construction, operation, and maintenance of the recycled water system within the Santa Clara city limits. This recycled water system distributes highly treated wastewater for non-potable use.
- Review and conditioning of planning applications, building permits, and encroachment permits for new development projects to mitigate impacts on the existing water, recycled water and sewer systems and to provide safe and reliable services to the new developments.

Other activities include:

- Long-term planning for the replacement and/or upsizing of existing and future water and recycled water systems.
- Maintain high water quality through routine and special bacteriological sampling and testing.
- Annual replacement of existing water mains using internal City forces.
- Promote water conservation and environmental sustainability through outreach to the community.
- Manage contracts for the construction of new South Bay Recycled Water pipelines.
- Coordinate planning efforts for the future expansions of recycled water systems in Santa Clara County (County).
- Maintain compliance with State regulations through development plan reviews and site inspections.
- Annual testing of all backflows and maintenance of meters.
- Respond to customer inquiries, service leaks and main breaks 24 hours a day.

The Sewer Utility operates and maintains a sanitary sewage collection system that collects and conveys wastewater to the jointly owned San José-Santa Clara Regional Wastewater Facility (RWF) for treatment and disposal. The Sewer Utility maintains seven sewer pump stations and the sewer collection pipelines and manholes, and assists the Department of Public Works in the operation and maintenance of 21 stormwater pump stations to ensure reliable service. Additional services include: installing property line clean-outs for access to maintain residential sewer laterals; assisting the industrial waste inspectors from the RWF with investigations of City industries; processing the City of San José wastewater discharge permits and implementing the Sanitary Sewer Management Plan as submitted to the State and Regional Water Quality Control Board.

Bonds are issued to mitigate rate increases while allowing for the repair and replacement of critical infrastructure. Proceeds from debt were used to pay for repairs and rehabilitation of the Trimble Road Sanitary Sewer main trunk line and capital improvements for the RWF, with these being repaid over the next six years and the next 23 years respectively.

Divisions and Services

The Water and Sewer Utilities Department is organized into five Divisions: Solar Utility; Water Construction, Maintenance, Operations; Water Engineering; Recycled Water Program; and Sewer.

The overall Mission of the Department is to provide the City's community with high-quality, reliable, economical, and environmentally sustainable water, wastewater and recycled water services in a manner that protects these resources for future generations. The Department's vision is to ensure clean water and a sustainable future for generations to come through innovation and environmental management of resources while providing an exceptional level of customer and community service.

Solar Utility Division Mission	Provide installation and maintenance of solar heating systems for commercial, residential, and pool water heating.
Division Objectives	Maintain more than 119 swimming pool systems.
	Maintain seven domestic solar hot water systems.

Water Construction, Maintenance, Operations Division Mission	Operate and maintain the Water Utility in a sustainable, cost effective, efficient manner and ensure that the approved levels of service are met.
Division Objectives	Increase reliability of the water system through the replacement of mains and appurtenances at the end of their useful life.
	Complete the construction, and installation of approximately 10,000 linear feet of water main.
	Construct, repair, and/or rehabilitate at least two groundwater wells each budget cycle to continue to provide reliable water service.

Water Engineering, Compliance, Conservation Division Mission	Provide Engineering services that improve and protect the water supply and distribution system while planning for future expansion and upgrades to infrastructure to ensure future reliability.
Division Objectives	Continue to improve the seismic safety of the water utility system.
	Continue the use of innovative technology to optimize the management of City water assets and appurtenances.
	Support citywide development through plan check review and inspection.
	Undertake engineering studies of the condition and reliability of water system assets.

Recycled Water Program Division Mission	Provide for the safe, efficient, cost effective, and reliable distribution of sustainable and high-quality recycled water which meets all requirements of State regulations and local codes. Deliver services in a cost effective and efficient manner with a focus on outstanding customer service.
Division Objectives	Increase connection of recycled water services for landscape irrigation of commercial and industrial sites, City parks, and school fields.
	Increase the use of recycled water for approved uses.
	Coordinate planning efforts with South Bay Water Recycling (SBWR) for the future expansions of recycled water systems in the County, and coordinate and compile annual site inspections as required by the State.
	Maintain compliance with State regulations through development plan reviews and site inspections.
	Design, construct, and maintain recycled water pipelines.

Sewer Division Mission	Collect, treat, and dispose of wastewater in an efficient, cost-effective, and environmentally safe manner. Provide for maintenance of stormwater pump stations. Deliver services at approved levels in a cost effective and efficient manner with a focus on outstanding customer service.
Division Objectives	Install property line clean-outs for access for the provision of a courtesy service of maintaining lower laterals for residential sewer customers.
	Maintain seven sanitary sewer and twenty-one stormwater pump stations to ensure reliable service.
	Assist the pre-treatment program staff from the RWF with investigations of City industries.
	Implement Sewer System Management Plan (SSMP) as submitted to the State and Regional Water Quality Control Board.
	Clean, conduct condition assessment, and repair or rehabilitate sanitary sewer collection system.

Significant Accomplishments

- Substantially completed the One Water/Sustainable Water Master Plan and Asset Management Plan.
- Updated Mission and Vision Statements utilizing a workshop that involved staff from throughout the Department.
- Finalized the update to the Water Use Rules and Regulations, including revisions to the potable and recycled water use regulations, adoption of State Model Water Efficient Landscape Ordinance (MWELO) goals as they relate to State regulations, and adoption of portions of Valley Water's Water Conservation Ordinances.
- Completed sewer condition assessment projects via closed-circuit television (CCTV), which is used to rate infrastructure and inform the capital improvement program (CIP). Notably, began CCTV of the City's force mains that deliver wastewater to the Regional Wastewater Facility. Approximately 184,000 linear feet of CCTV assessments were completed.
- Completed and coordinated major CIP projects for both the Water ($7 million) and Sewer ($7.7 million) Utilities as well as RWF projects that amounted to approximately $10 million.
- Continued to work and negotiate with Valley Water and the City of San José regarding the Purified Water Project Expansion to be located at the RWF and continued to work with San José and San Francisco on a proposed design for the South Bay Purified Water Project.
- Continued to meet monthly and work with the Bay Area Water Supply and Conservation Agency (BAWSCA), City of San José and San Francisco regarding securing permanent status with San Francisco Public Utilities Commission (SFPUC) for water supply by 2028.
- Finalized work and negotiations on the Tier 2 Allocation Plan, which is being updated by BAWSCA for use during a drought when potable water cutbacks are required per the amended City of San Francisco Water Supply Agreement (WSA). As a result of negotiations, Santa Clara is now being treated equally with drought cutbacks as compared to other permanent SFPUC customers. Santa Clara will now have reduced cutbacks during a drought as a result of the new negotiated allocations.
- Initiated a joint project with Valley Water to switch the City's 21 well sites to Advance Meter Infrastructure (AMI). This project with Valley Water was initiated to improve billing accuracies and reduce manual meter reading by Santa Clara and Valley Water staff.
- Initiated an AMI pilot program and leak detection pilot to test water meter technologies for residential and commercial properties. The Department will setup 30 site locations to test the technology and will work with the Finance Department and Silicon Valley Power (SVP) to leverage existing technology and infrastructure installed by SVP and explore current capabilities of the billing system in order to accept the remote reads. Once the proof of concept is complete, a phased full-scale project will be planned. The pilot project will be completed in 2025.
- Completed Phase 2 of the Supervisory Control and Data Acquisition (SCADA) CIP implementation and fiber connectivity for Water and Sewer Utilities at remote water and sewer sites. This past year, 10 sites received Remote Terminal Unit (RTU) hardware upgrades for a total of 34 sites now with the upgrade. In partnership with SVP, five new sites received fiber optic connectivity, bringing the total number of sites with fiber to 30. Only four fiber sites remain for installation in 2025.
- Completed the Water, Sewer and Recycled Water Rate Study with Council approval in FY 2024/25.
- Continued to maintain full compliance with all water quality regulations, protect public health and water quality, and enhance potable water quality in the distribution system. Completed additional public outreach on water quality.
- Met the goal of rehabilitating two groundwater wells per year. Well 34 and Well 18 were rehabilitated and will be back online. In addition, an assessment of Well 32 was completed.
- Completed installation of 17,500 linear feet of replacement water main, exceeding the annual goal of 10,000 linear feet of water main replacement.
- Completed recertification of sewer operations staff for sewer pipeline, manhole and lateral condition assessment (PACP, MACP, LACP).

- Completed annual testing of approximately 3,900 backflow preventors within the City.
- Completed the Federal and State Lead and Copper Rule customer service line inventory survey by October 16, 2024, including reporting the results to the State Department of Drinking Water. No customer lead service lines were identified during the survey.
- Continued to implement State water use efficiency requirements to keep Santa Clara's residential gallon per capita per day (gpcd) below 55 gpcd. Santa Clara met the requirement with a 51.8 gpcd for 2024. Conservation rebate programs, increased outreach and partnering with Valley Water and BAWSCA continue to assist the City in lowering its gpcd.
- Finalized negotiations on Approval/Acceptance Letter from the Division of Drinking Water (DDW) for Related Santa Clara Development Operations and Maintenance Plan for Phase 1. DDW has approved the Operations and Maintenance Program, and the City has received the Acceptance Letter from DDW. The City may now proceed with the final design of the water system infrastructure.
- Completed design of Phase 3 of the Citywide Generator Replacement project consisting of two water sites and one sewer site.
- Received the California Water Environment Association's (CWEA) Collection System of the Year 2024 award for a medium-sized utility in the field of wastewater.
- Continued work to increase the use of recycled water in Santa Clara by promoting use in new developments. Recycled water usage is now over 3.5 million gallons per day.
- Expanded use of recycled water infrastructure through new development, by constructing 268 linear feet (lf) and connecting 1,900 lf of recycled water main in Tasman East and conditioning the use of recycled water on 19 projects/facilities.
- Completed 1,236 plan reviews that included 738 building permits and 498 encroachment permits with 92.7% of the reviews completed on time.
- Completed Environmental Protection Agency (EPA) Risk and Resilience Assessment (RRA) and Emergency Response Plan (ERP) updates.
- Department staff were awarded the Merit Award and the Customer Service Award from the American Public Works Association (APWA).
- Received Project of the Year Award from the APWA for the Bassett Street Emergency Recycled Water Repair and Installation of Curbside Recycled Water Fill Station.

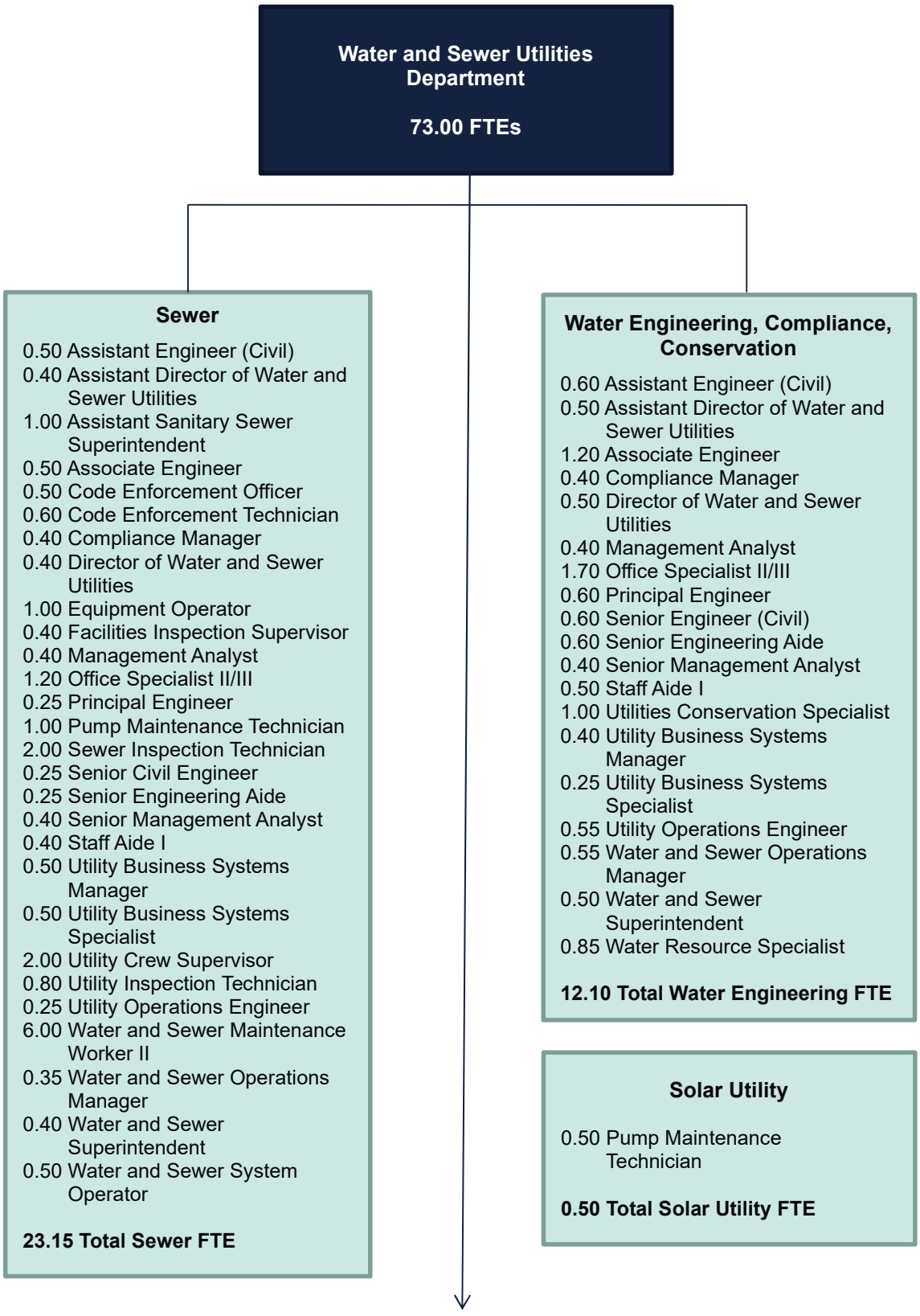
Significant Objectives

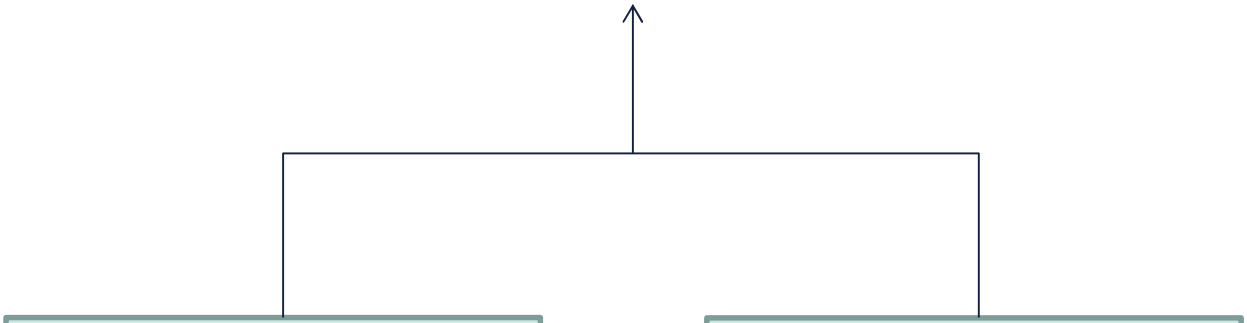
- Implement updated State water use efficiency requirements to bring Santa Clara's residential gpcd below 47 gpcd (previously 55 gpcd) for 2025 through December 31, 2029.
- Continue to work and negotiate with Valley Water and the City of San José regarding the Purified Water Project Expansion to be located at the RWF and continue to work with San José and San Francisco on a proposed design for the South Bay Purified Water Project.
- Continue to meet monthly and work with the BAWSCA, City of San José and San Francisco regarding securing permanent status with SFPUC for water supply.
- Coordinate negotiations for amendments to the SFPUC water supply agreement regarding SFPUC decisions regarding permanent customer status.
- Initiate the Accela Module upgrade from TruePoint to enable specific development project information related to recycled water, portable hydrant meters, development impact analyses, water supply agreements, and the Cross Connection Control Program to be tracked.
- Complete rehabilitation of three groundwater wells per year.

- Complete at least 10,000 linear feet of water main replacement per year.
- Complete jetting and CCTV condition assessment of 300,000 linear feet of sewer collection pipe per year.
- Complete and coordinate major CIP City projects for both water and sewer infrastructure improvements including RWF CIP projects.
- Complete the pilot project to field test the upgrade of 30 existing water meters to AMI and plan for a full-scale AMI program.
- Comply with water use efficiency regulations regarding indoor residential water use to support Making Conservation a California Way of Life.
- Finalize the One Water/Sustainability Water Supply Master Plan including the Asset Management Plan and implement recommended CIP projects to manage risks in the utilities.
- Continue Phase 3 SCADA system improvements that include: testing of and training with the Remote Terminal Unit (RTU) module, SCADA Cybersecurity and password protection program, and generator monitoring.
- Develop and implement the Cross Connection Control Policy Handbook (Standards and Principles for California's Public Water Systems) State regulations.
- Complete the update to the Sanitary Sewer Management Plan (SSMP) in 2025 and present to City Council for final approval.
- Substantially complete the State required 2025 Urban Water Management Plan that needs to be approved by Council by July 1, 2026.
- Complete the Report on Water Relative to Public Health Goals as required every three years by the State water quality regulations. Council will need to approve the report in 2025.
- Complete outreach to properties for new development and existing commercial, industrial, institutional (CII) and homeowners' associations properties regarding the State Urban Water Use Efficiency Guidelines, Valley Water Ordinances, and City's Rules and Regulations. New requirements include future prohibitions using drinking water for ornamental grass at all CII sites.
- Continue expansion of recycled water infrastructure and demand to supplant potable water use.
- Complete preliminary evaluation of a new recycled water storage tank.
- Coordinate with the City of San José on a new master meter project for recycled water lines.

Budget Highlights

- The budget reflects updates to the City of Santa Clara's contribution to the Regional Wastewater Facility, co-owned with the City of San José, as well as revised revenues and costs to continue to effectively deliver water, recycled water, and sewer services.
- This budget also reflects the resources necessary to comply with regulations that affect all three utilities and changing climate conditions as well as the commitment of the Department and the City to long term sustainability, both environmental and fiscal.


Water and Sewer Utilities Department
73.00 FTEs
Sewer
0.50 Assistant Engineer (Civil)
0.40 Assistant Director of Water and Sewer Utilities
1.00 Assistant Sanitary Sewer Superintendent
0.50 Associate Engineer
0.50 Code Enforcement Officer
0.60 Code Enforcement Technician
0.40 Compliance Manager
0.40 Director of Water and Sewer Utilities
1.00 Equipment Operator
0.40 Facilities Inspection Supervisor
0.40 Management Analyst
1.20 Office Specialist II/III
0.25 Principal Engineer
1.00 Pump Maintenance Technician
2.00 Sewer Inspection Technician
0.25 Senior Civil Engineer
0.25 Senior Engineering Aide
0.40 Senior Management Analyst
0.40 Staff Aide I
0.50 Utility Business Systems Manager
0.50 Utility Business Systems Specialist
2.00 Utility Crew Supervisor
0.80 Utility Inspection Technician
0.25 Utility Operations Engineer
6.00 Water and Sewer Maintenance Worker II
0.35 Water and Sewer Operations Manager
0.40 Water and Sewer Superintendent
0.50 Water and Sewer System Operator
23.15 Total Sewer FTE
Water Engineering, Compliance, Conservation
0.60 Assistant Engineer (Civil)
0.50 Assistant Director of Water and Sewer Utilities
1.20 Associate Engineer
0.40 Compliance Manager
0.50 Director of Water and Sewer Utilities
0.40 Management Analyst
1.70 Office Specialist II/III
0.60 Principal Engineer
0.60 Senior Engineer (Civil)
0.60 Senior Engineering Aide
0.40 Senior Management Analyst
0.50 Staff Aide I
1.00 Utilities Conservation Specialist
0.40 Utility Business Systems Manager
0.25 Utility Business Systems Specialist
0.55 Utility Operations Engineer
0.55 Water and Sewer Operations Manager
0.50 Water and Sewer Superintendent
0.85 Water Resource Specialist
12.10 Total Water Engineering FTE
Solar Utility
0.50 Pump Maintenance Technician
0.50 Total Solar Utility FTE



Recycled Water Program

0.10 Assistant Director of Water and Sewer Utilities
0.30 Assistant Engineer (Civil)
0.50 Assistant Water Superintendent
0.30 Associate Engineer
0.20 Code Enforcement Officer
0.30 Code Enforcement Technician
0.20 Compliance Manager
0.10 Director of Water and Sewer Utilities
0.20 Facilities Inspection Supervisor
0.20 Management Analyst
0.10 Office Specialist III
0.15 Principal Engineer
0.15 Senior Civil Engineer
0.15 Senior Engineering Aide
0.20 Senior Management Analyst
0.10 Staff Aide I
0.10 Utility Business Systems Manager
0.25 Utility Crew Supervisor
0.40 Utility Inspection Technician
0.20 Utility Operations Engineer
0.10 Water and Sewer Operations Manager
0.10 Water and Sewer Superintendent
0.15 Water Resource Specialist
0.50 Water Service Technician II

5.05 Total Recycled Water Program FTE

Water Construction, Maintenance, Operations

0.60 Assistant Engineer (Civil)
1.50 Assistant Water Superintendent
0.30 Code Enforcement Officer
0.10 Code Enforcement Technician
4.00 Equipment Operator
0.40 Facilities Inspection Supervisor
1.50 Pump Maintenance Technician
0.25 Utility Business Systems Specialist
4.75 Utility Crew Supervisor
0.80 Utility Inspection Technician
13.00 Water and Sewer Maintenance Worker II
0.50 Water and Sewer System Operator
4.50 Water Service Technician II

32.20 Total Water Construction, Maintenance, Operations FTE

Budget Summary

		FY 2023/24 Actual	FY 2024/25 Adopted	FY 2025/26 Proposed	FY 2025/26 Change %	FY 2026/27 Proposed	FY 2026/27 Change %
Dollars by Division / Program							
Solar Utility Division							
1532	Solar – System Maintenance	185,662	273,552	122,921	(55.1%)	130,213	5.9%
Total Solar Utility Division		**185,662**	**273,552**	**122,921**	**(55.1%)**	**130,213**	**5.9%**
Water Construction, Maintenance, Operations Division							
1422	Water System Maintenance	2,971,255	2,058,038	2,701,366	31.3%	2,772,084	2.6%
1423	Water Construction	2,278,191	4,095,260	4,579,001	11.8%	4,761,219	4.0%
1424	Water System Operations	12,652,759	11,126,551	12,747,078	14.6%	13,372,723	4.9%
Total Water Construction, Maintenance, Operations Division		**17,902,205**	**17,279,849**	**20,027,445**	**15.9%**	**20,906,026**	**4.4%**
Water Engineering, Compliance, Conservation Division							
1411	Administration Design	3,397,701	8,172,951	9,620,000	17.7%	9,021,197	(6.2%)
1412	Water Quality	382,400	584,784	618,710	5.8%	633,395	2.4%
1413	Water Resources	33,123,300	35,410,351	41,931,264	18.4%	46,476,993	10.8%
Total Water Engineering, Compliance, Conservation Division		**36,903,401**	**44,168,086**	**52,169,974**	**18.1%**	**56,131,585**	**7.6%**
Recycled Water Program Division							
1522	System Maintenance	6,191,951	8,449,995	9,917,568	17.4%	11,017,949	11.1%
1523	System Construction	920	251	50,000	19820.3%	50,000	0.0%
1525	South Bay Water Recycling Maintenance	1,151,513	896,008	972,487	8.5%	1,010,522	3.9%
Total Recycled Water Program Division		**7,344,384**	**9,346,254**	**10,940,055**	**17.1%**	**12,078,471**	**10.4%**
Sewer Division							
1511	System Administration	5,041,158	5,435,865	5,792,229	6.6%	6,101,216	5.3%
1512	System Maintenance	2,339,525	2,386,389	2,700,010	13.1%	2,818,448	4.4%
1514	Operations	5,815,682	14,507,373	17,444,576	20.2%	11,077,465	(36.5%)
1515	San José-Santa Clara Water Pollution Control Plant	23,121,078	25,756,931	29,273,912	13.7%	33,439,696	14.2%
1516	Storm Pump Maintenance	113,613	164,571	171,794	4.4%	178,323	3.8%
Total Sewer Division		**36,431,056**	**48,251,129**	**55,382,521**	**14.8%**	**53,615,148**	**(3.2%)**
Total by Division / Program		**98,766,708**	**119,318,870**	**138,642,916**	**16.2%**	**142,861,443**	**3.0%**

Budget Summary

	FY 2023/24 Actual	FY 2024/25 Adopted	FY 2025/26 Proposed	FY 2025/26 Change %	FY 2026/27 Proposed	FY 2026/27 Change %
Dollars by Fund						
Water Utility Fund	54,983,063	61,955,133	72,320,343	16.7%	77,167,824	6.7%
Water Recycling Program Fund	7,348,020	9,307,540	10,940,055	17.5%	12,078,471	10.4%
Sewer Utility Fund	36,435,625	48,056,197	55,382,521	15.2%	53,615,148	(3.2%)
Total by Fund	**98,766,708**	**119,318,870**	**138,642,919**	**16.2%**	**142,861,443**	**3.0%**
Dollars by Category						
Salary and Benefits						
Salary	6,234,536	9,204,413	9,764,922	6.1%	10,386,581	6.4%
As-Needed	144,372	254,929	260,954	2.4%	267,189	2.4%
Overtime	373,789	289,174	299,295	3.5%	309,770	3.5%
Retirement	2,767,036	3,232,890	3,431,195	6.1%	3,336,106	(2.8%)
Health Allocation	871,677	1,325,631	1,551,183	17.0%	1,670,176	7.7%
Medicare	112,287	137,647	149,254	8.4%	157,567	5.6%
Social Security	451,180	584,237	605,261	3.6%	631,777	4.4%
Other Benefits	469,331	446,348	588,466	31.8%	631,320	7.3%
Total Salary and Benefits	**11,424,208**	**15,475,269**	**16,650,530**	**7.6%**	**17,390,486**	**4.4%**
Non-Personnel						
Materials/Services/Supplies	11,259,965	10,074,008	11,218,269	11.4%	11,786,215	5.1%
Resource/Production	62,977,271	68,582,130	79,722,346	16.2%	86,239,900	8.2%
Interfund Services	7,961,055	8,098,380	10,098,183	24.7%	10,310,557	2.1%
Capital Outlay	769,323	150,000	153,000	2.0%	156,060	2.0%
Transfers to Other Funds	4,374,886	16,939,083	20,800,591	22.8%	16,978,225	(18.4%)
Total Non-Personnel	**87,342,500**	**103,843,601**	**121,992,389**	**17.5%**	**125,470,957**	**2.9%**
Total by Category	**98,766,708**	**119,318,870**	**138,642,919**	**16.2%**	**142,861,443**	**3.0%**

Position Summary

	FY 2023/24 Adopted	FY 2024/25 Adopted	FY 2025/26 Proposed	FY 2025/26 Change	FY 2026/27 Proposed
Positions by Division / Program					
Solar Utility Division					
1532 Solar – System Maintenance	1.50	1.50	0.50	(1.00)	0.50
Total Solar Utility Division	**1.50**	**1.50**	**0.50**	**(1.00)**	**0.50**
Water Construction, Maintenance, Operations Division					
1422 Water System Maintenance	7.00	7.00	5.60	(1.40)	5.60
1423 Water Construction	13.45	13.45	13.95	0.50	13.95
1424 Water System Operations	11.85	11.85	12.65	0.80	12.65
Total Water Construction, Maintenance, Operations Division	**32.30**	**32.30**	**32.20**	**(0.10)**	**32.20**
Water Engineering, Compliance, Conservation Division					
1411 Administration Design	11.75	11.75	10.85	(0.90)	10.85
1412 Water Quality	0.85	0.85	0.85	0.00	0.85
1413 Water Resources	0.25	0.25	0.40	0.15	0.40
Total Water Engineering, Compliance, Conservation Division	**12.85**	**12.85**	**12.10**	**(0.75)**	**12.10**
Recycled Water Program Division					
1522 System Maintenance	1.45	1.45	1.40	(0.05)	1.40
1525 South Bay Water Recycling Maintenance	2.65	2.65	3.65	1.00	3.65
Total Recycled Water Program Division	**4.10**	**4.10**	**5.05**	**0.95**	**5.05**
Sewer Division					
1511 System Administration	6.25	6.25	6.60	0.35	6.60
1512 System Maintenance	10.15	10.15	9.85	(0.30)	9.85
1514 Operations	4.85	4.85	5.65	0.80	5.65
1515 SJSC Water Pollution Control Plant	0.10	0.10	0.20	0.10	0.20
1516 Storm Pump Maintenance	0.90	0.90	0.85	(0.05)	0.85
Total Sewer Division	**22.25**	**22.25**	**23.15**	**0.90**	**23.15**
Total by Division / Program	**73.00**	**73.00**	**73.00**	**0.00**	**73.00**

Position Summary

	FY 2023/24 Adopted	FY 2024/25 Adopted	FY 2025/26 Proposed	FY 2025/26 Change	FY 2026/27 Proposed
Positions by Fund					
Water Utility Fund	46.65	46.65	44.80	(1.85)	44.80
Water Recycling Program Fund	4.10	4.10	5.05	0.95	5.05
Sewer Utility Fund	22.25	22.25	23.15	0.90	23.15
Total by Fund	**73.00**	**73.00**	**73.00**	**0.00**	**73.00**
Position Classification					
Assistant Director of Water & Sewer Utility	1.00	1.00	1.00	0.00	1.00
Assistant Engineer (Civil)	2.00	2.00	2.00	0.00	2.00
Assistant Sanitary Sewer Superintendent	1.00	1.00	1.00	0.00	1.00
Assistant Water Superintendent	2.00	2.00	2.00	0.00	2.00
Associate Engineer	2.00	2.00	2.00	0.00	2.00
Code Enforcement Officer	1.00	1.00	1.00	0.00	1.00
Code Enforcement Technician	1.00	1.00	1.00	0.00	1.00
Compliance Manager	1.00	1.00	1.00	0.00	1.00
Director of Water & Sewer Utility	1.00	1.00	1.00	0.00	1.00
Equipment Operator	5.00	5.00	5.00	0.00	5.00
Facilities Inspection Supervisor	1.00	1.00	1.00	0.00	1.00
Facilities Technician	2.00	2.00	0.00	(2.00)	0.00
Management Analyst	2.00	2.00	1.00	(1.00)	1.00
Office Specialist II/III	3.00	3.00	3.00	0.00	3.00
Principal Engineer	1.00	1.00	1.00	0.00	1.00
Pump Maintenance Technician	3.00	3.00	3.00	0.00	3.00
Senior Civil Engineer	1.00	1.00	1.00	0.00	1.00
Senior Engineering Aide	1.00	1.00	1.00	0.00	1.00
Senior Management Analyst	0.00	0.00	1.00	1.00	1.00
Sewer Inspection Technician	2.00	2.00	2.00	0.00	2.00
Staff Aide I	1.00	1.00	1.00	0.00	1.00
Utilities Conservation Specialist	1.00	1.00	1.00	0.00	1.00
Utility Business Systems Manager	1.00	1.00	1.00	0.00	1.00
Utility Business Systems Specialist	1.00	1.00	1.00	0.00	1.00
Utility Crew Supervisor	7.00	7.00	7.00	0.00	7.00
Utility Inspection Technician	0.00	0.00	2.00	2.00	2.00
Utility Operations Engineer	1.00	1.00	1.00	0.00	1.00

Position Summary

	FY 2023/24 Adopted	FY 2024/25 Adopted	FY 2025/26 Proposed	FY 2025/26 Change	FY 2026/27 Proposed
Position Classification					
Water & Sewer Maintenance Worker II	19.00	19.00	19.00	0.00	19.00
Water & Sewer Operations Manager	0.00	0.00	1.00	1.00	1.00
Water & Sewer Superintendent	2.00	2.00	1.00	(1.00)	1.00
Water & Sewer System Operator	1.00	1.00	1.00	0.00	1.00
Water Resource Specialist	1.00	1.00	1.00	0.00	1.00
Water Service Technician II	5.00	5.00	5.00	0.00	5.00
Total Positions	**73.00**	**73.00**	**73.00**	**0.00**	**73.00**

Budget Reconciliation

	Positions	Expenditures (All Funds)
Prior Year Budget	73.00	119,318,870
FY 2025/26 Base Budget Adjustments		
One-Time Cost Adjustments		
Net increase in transfers to the capital improvement program		3,861,508
Ongoing Cost Adjustments		
Salary and benefits adjustments		1,175,261
Reclassifications of the following positions:		
2.0 Facilities Technicians to 2.0 Utility Inspection Technicians	0.00	
1.0 Management Analyst to 1.0 Senior Management Analyst	0.00	
1.0 Water and Sewer Superintendent to 1.0 Water and Sewer Operations Manager	0.00	
Adjustments to resource and production costs		
Water Utility		6,604,900
Sewer Utility		3,209,416
Water Recycling		1,325,900
Net increase in various internal service fund allocations		1,999,803
Non-personnel adjustments		585,776
Adjustments to right of way		561,485
Total FY 2025/26 Base Budget Adjustments	**0.00**	**19,324,049**
Total FY 2025/26 Base Budget	**73.00**	**138,642,919**
Total FY 2025/26 Proposed Budget	**73.00**	**138,642,919**

Budget Reconciliation

	Positions	Expenditures (All Funds)
FY 2026/27 Base Budget Adjustments		
One-Time Cost Adjustments		
Net decrease in transfers to the capital improvement program		(3,822,366)
Ongoing Cost Adjustments		
Salary and benefit adjustments		739,956
Adjustments to resource and production costs		
Water Utility		4,654,800
Water Recycling		1,025,900
Sewer Utility		836,854
Adjustments to right of way		481,940
Net increase in various internal service fund allocations		212,374
Non-personnel adjustments		89,066
Total FY 2026/27 Base Budget Adjustments	**0.00**	**4,218,524**
Total FY 2026/27 Base Budget	**73.00**	**142,861,443**
Total FY 2026/27 Proposed Budget	**73.00**	**142,861,443**

Performance and Workload Measures

Solar Utility Division

Workload Measures

	Strategic Pillar	2022/23 Actual	2023/24 Actual	2024/25 Target	2024/25 Estimate	2025/26 Target	2026/27 Target
Number of systems provided with semi-annual winterization service		38	36	40	40	40	40
Number of requests for solar system repairs		87	55	80	60	60	60

Water Construction, Maintenance, Operations Division

Performance Measures

	Strategic Pillar	2022/23 Actual	2023/24 Actual	2024/25 Target	2024/25 Estimate	2025/26 Target	2026/27 Target
Maintain an industry standard for unaccounted water of 8% or less		6.3%	9%	8% or less	8%	8% or less	8% or less

Workload Measures

Number of responses to water customer service requests		1,903	1,688	1,600	1,500	1,500	1,500
Number of backflow prevention devices tested		2,083	3,900	3,900	3,900	3,900	3,900
Number of linear feet of water mains installed		10,430	17,500	10,000	12,000	10,000	10,000
Number of underground utility locates performed		13,869	8,625	10,000	7,000	10,000	10,000
Number of mainline water valves tested and exercised		552	535	2,500	1,500	2,000	2,500
Water Line Flushing for Water Quality		N/A	55	50	90	120	150

Performance and Workload Measures

Water Engineering, Compliance, Conservation Division

Performance Measures

	Strategic Pillar	2022/23 Actual	2023/24 Actual	2024/25 Target	2024/25 Estimate	2025/26 Target	2026/27 Target
Complete review of plans by the required due dates		80%	92.7%	90%	90%	90%	90%
Residential water use measured in Gallons per Capita per Day		53	51.8	55	46.4	47	47
Overall City water use measured in Gallons per Capita per Day		110	114.7	117	118	117	117

Workload Measures

Number of plans reviewed		788	1,236	900	1,000	1,000	1,000
Number of water quality samples processed		2,933	1,236	3,000	3,100	3,000	3,000
Promote water conservation at public events		9	12	10	12	12	12

Recycled Water Program Division

Performance Measures

	Strategic Pillar	2022/23 Actual	2023/24 Actual	2024/25 Target	2024/25 Estimate	2025/26 Target	2026/27 Target
Citywide use of recycled water (measured in million gallons per day)		3.1	3.5	3.5	3.5	3.7	3.9

Workload Measures

Number of recycled water plans reviewed		N/A	186	250	120	250	250

Performance and Workload Measures

Sewer Division							
Performance Measures							
	Strategic Pillar	**2022/23 Actual**	**2023/24 Actual**	**2024/25 Target**	**2024/25 Estimate**	**2025/26 Target**	**2026/27 Target**
Percentage of food service establishments found to be in compliance with Fats, Oil and Grease regulations		N/A	97%	100%	97%	100%	100%
Workload Measures							
Number of linear feet of mainlined jetted		310,000	372,238	300,000	400,000	300,000	300,000
Number of reportable Sanitary Sewer Overflows		1	4	0	2	2	2
Number of responses to Sewer customer services requests		1,328	1,040	1,500	1,000	1,000	1,000
Number of linear feet of sewer mains inspected using CCTV		62,670	184,676	300,000	200,000	300,000	300,000
Number of inspections of food serving establishments for compliance with Fats, Oils and Grease regulations		N/A	78	150	33	150	150

Appendix L
Performance Measure Data Sheets (Lucity)

Work Order Number: 2025-05-01-017

5/29/2025 8:39 AM

Category: Mains **Status:** New Work Order

Problem: **Supervisor:** Felipe Carrillo

Main Task: Inspection **Related:** swHotspot Siphon Inspect - Monthly

Work Order Start Date: 5/1/2025 **Work Order End Date:**

Comments To / From Crew

Siphon Inspection

Employee Number	Employee Name	Date	Hours

Equipment Code	Equipment Description	Units

Asset List (Sewer Pipes)

US / DS	Address / General Location		Diameter	Length	Material	Comment / Completion Date
14-61	165 SARATOGA AV	165 SARATOGA AV	10	113.6	Vitrified Clay Pipe	
14-62	165 SARATOGA AV	165 SARATOGA AV				
Special instructions -						
14-65	273 SARATOGA AV	273 SARATOGA AV	10	91.9	Vitrified Clay Pipe	
15-62	273 SARATOGA AV	273 SARATOGA AV				
Special instructions -						
20-16		HOMESTEAD RD	15	164.3	Vitrified Clay Pipe	
20-17		HOMESTEAD RD				
Special instructions -						
20-26			24	168.7	Polyethylene	
20-18						
Special instructions -						
20-26		HOMSTEAD RD	24	170.9	Polyethylene	
20-18		HOMESTEAD ROAD				
Special instructions -						
22-64			12	120.5	Vitrified Clay Pipe	
22-102						
Special instructions -						
23-15	830 KIELY BL	830 KIELY BL	12	85.7	Vitrified Clay Pipe	
23-14	830 KIELY BL	830 KIELY BL				
Special instructions -						

23-15 23-14			8	84.8	Vitrified Clay Pipe
Special instructions -					
31-24	3405 BENTON ST	3405 BENTON ST	24	115.2	Cast Iron
31-25	1144 POMEROY AV	1144 POMEROY AV			
Special instructions -					
32-2	3180 EL CAMINO REAL	3180 EL CAMINO REAL	10	71.1	PolyVinyl Chloride
32-102	3180 EL CAMINO REAL	3180 EL CAMINO REAL			
Special instructions -					
32-2	3180 EL CAMINO REAL	3180 EL CAMINO REAL	8	72.9	PolyVinyl Chloride
32-102	3180 EL CAMINO REAL	3180 EL CAMINO REAL			
Special instructions -					
33-9	2632 EL CAMINO REAL	2632 EL CAMINO REAL	8	102.8	Vitrified Clay Pipe
33-10	2570 EL CAMINO REAL	2570 EL CAMINO REAL			
Special instructions -					
42-30	3155 COLFAX CT	3155 COLFAX CT	6	93.0	Vitrified Clay Pipe
42-31	1947 CALABAZAS BL	1947 CALABAZAS BL			
Special instructions -					
46-113 46-114			12	15.0	Vitrified Clay Pipe
Special instructions -					
52-3	2637 MARCHESE WY	2637 MARCHESE WY	8	67.2	Cast Iron
52-5	3289 AGATE DR	3289 AGATE DR			
Special instructions -					
52-123 52-124			8	334.8	Polyethylene
Special instructions -					
52-123 52-124			8	340.7	Polyethylene
Special instructions -					
52-116 52-119			12	304.0	Polyethylene
Special instructions -					
54-79	2195 HOOVER DR	2195 HOOVER DR	10	134.2	Vitrified Clay Pipe
54-78	2414 MARMON CT	2414 MARMON CT			
Special instructions -					
54-79 54-78			10	133.1	Vitrified Clay Pipe
Special instructions -					
54-94	2400 WALSH AV	2400 WALSH AV	18	270.0	Vitrified Clay Pipe
54-95	2398 WALSH AV	2398 WALSH AV			
Special instructions -					
54-94	2400 WALSH AV	2400 WALSH AV	18	271.8	Vitrified Clay Pipe
54-95	2398 WALSH AV	2398 WALSH AV			
Special instructions -					
55-51	2746 SCOTT BL	2746 SCOTT BL	20	176.8	Vitrified Clay Pipe
55-52	2735 SCOTT BL	2735 SCOTT BL			
Special instructions -					

55-51	2746 SCOTT BL	2746 SCOTT BL	20	180.3	Vitrified Clay Pipe
55-52	2735 SCOTT BL	2735 SCOTT BL			
Special instructions -					
56-58	901 WALSH AV	901 WALSH AV	20	120.6	Vitrified Clay Pipe
56-59	2710 LAFAYETTE ST	2710 LAFAYETTE ST			
Special instructions -					
56-58	901 WALSH AV	901 WALSH AV	20	121.6	Vitrified Clay Pipe
56-59	2710 LAFAYETTE ST	2710 LAFAYETTE ST			
Special instructions -					
62-7	3300 CENTRAL EX	3300 CENTRAL EX	10	145.5	Vitrified Clay Pipe
62-12	3300 CENTRAL EX	3300 CENTRAL EX			
Special instructions -					
62-7			8	144.6	Vitrified Clay Pipe
62-12					
Special instructions -					
62-9	3300 CENTRAL EX	3300 CENTRAL EX	15	112.2	Vitrified Clay Pipe
62-11	3300 CENTRAL EX	3300 CENTRAL EX			
Special instructions -					
64-34		WALSH AVE	15	130.6	Vitrified Clay Pipe
64-36		EASEMENT THROUGH SAN TOMA			
Special instructions -					
64-34		WALSH AVE	8	130.4	Vitrified Clay Pipe
64-36		EASEMENT THROUGH SAN TOMA			
Special instructions -					
67-21		DE LA CRUZ BL	24	23.0	Ductile Iron Pipe
67-29		DE LA CRUZ BL			
Special instructions -					
67-21			24	22.8	Ductile Iron Pipe
67-29					
Special instructions -					
68-15		DE LA CRUZ BL	24	61.8	Vitrified Clay Pipe
68-12	460 GIANNI ST	460 GIANNI ST			
Special instructions -					
68-15		DE LA CRUZ BL	24	67.4	Vitrified Clay Pipe
68-16	460 GIANNI ST	460 GIANNI ST			
Special instructions -					
68-9			15	354.8	Vitrified Clay Pipe
68-6					
Special instructions -					
68-9	3165 DE LA CRUZ BL	3165 DE LA CRUZ BL	24	350.7	Vitrified Clay Pipe
68-6	3165 DE LA CRUZ BL	3165 DE LA CRUZ BL			
Special instructions -					
68-10	3165 DE LA CRUZ BL	3165 DE LA CRUZ BL	24	491.2	Vitrified Clay Pipe
68-7	3165 DE LA CRUZ BL	3165 DE LA CRUZ BL			
Special instructions -					
68-10			15	477.3	Vitrified Clay Pipe
68-7					
Special instructions -					

72-12	3500	GARRETT DR	3500 GARRETT DR		20	38.7	Reinforced Concrete
72-11			CALABAZAS CREEK NEAR TANNE				
Special instructions -							
72-12					20	38.3	Reinforced Concrete
72-11							
Special instructions -							
85-86	2320	FALLING WATER CT	2320 FALLING WATER CT		18	97.4	PolyVinyl Chloride
85-85	2270	RIVER BED CT	2270 RIVER BED CT				
Special instructions -							
93-50	4699	OLD IRONSIDES DR	4699 OLD IRONSIDES DR		12	124.1	Vitrified Clay Pipe
93-48	4880	GREAT AMERICA PY	4880 GREAT AMERICA PY				
Special instructions -							
93-50	4699	OLD IRONSIDES DR	4699 OLD IRONSIDES DR		24	122.2	Vitrified Clay Pipe
93-48	4880	GREAT AMERICA PY	4880 GREAT AMERICA PY				
Special instructions -							
93-51	4699	OLD IRONSIDES DR	4699 OLD IRONSIDES DR		24	106.5	Vitrified Clay Pipe
93-49	4880	GREAT AMERICA PY	4880 GREAT AMERICA PY				
Special instructions -							
93-51	4699	OLD IRONSIDES DR	4699 OLD IRONSIDES DR		18	107.6	Vitrified Clay Pipe
93-49	4880	GREAT AMERICA PY	4880 GREAT AMERICA PY				
Special instructions -							
93-51	4699	OLD IRONSIDES DR	4699 OLD IRONSIDES DR		24	107.5	Vitrified Clay Pipe
93-49	4880	GREAT AMERICA PY	4880 GREAT AMERICA PY				
Special instructions -							
95-45	2196	FAIRWAY GLEN DR	2196 FAIRWAY GLEN DR		15	88.8	Vitrified Clay Pipe
95-44	2198	AVE DE LAS FLORES	2198 AVE DE LAS FLORES				
Special instructions -							
95-45					18	88.4	Vitrified Clay Pipe
95-44							
Special instructions -							
95-45					18	87.3	Vitrified Clay Pipe
95-44							
Special instructions -							
96-14	4751	LICK MILL BL	4751 LICK MILL BL		10	205.5	Polyethylene
96-13	4751	LICK MILL BL	4751 LICK MILL BL				
Special instructions -							
96-14	4751	LICK MILL BL	4751 LICK MILL BL		15	203.2	Polyethylene
96-13	4751	LICK MILL BL	4751 LICK MILL BL				
Special instructions -							
103-19	5251	GREAT AMERICA PY	5251 GREAT AMERICA PY		24	306.4	Vitrified Clay Pipe
103-16	5350	GREAT AMERICA PY	5350 GREAT AMERICA PY				
Special instructions -							
103-19					12	305.0	Vitrified Clay Pipe
103-16							
Special instructions -							
103-20	5251	GREAT AMERICA PY	5251 GREAT AMERICA PY		24	181.6	Vitrified Clay Pipe
103-18	5353	GREAT AMERICA PY	5353 GREAT AMERICA PY				
Special instructions -							

103-20	5251	GREAT AMERICA PY	5251	GREAT AMERICA PY	24	181.3	Vitrified Clay Pipe
103-18	5353	GREAT AMERICA PY	5353	GREAT AMERICA PY			
Special instructions -							
103-20	5251	GREAT AMERICA PY	5251	GREAT AMERICA PY	18	180.0	Vitrified Clay Pipe
103-18	5353	GREAT AMERICA PY	5353	GREAT AMERICA PY			
Special instructions -							
57 Pipes				9,007.6 Total Length			

Work Order Number: 2025-05-01-016

5/29/2025
8:40 AM

Category: Mains
Status: New Work Order
Problem:
Supervisor: Felipe Carrillo
Main Task: Jet
Related: swHotspot Main Jetting - Monthly

Work Order Start Date: 5/1/2025
Work Order End Date:

Comments To / From Crew

Employee Number	Employee Name	Date	Hours

Equipment Code	Equipment Description	Units

Asset List (Sewer Pipes)

US / DS	Address / General Location		Diameter	Length	Material	Comment / Completion Date
2-30	3038 MCKINLEY DR	3038 MCKINLEY DR	8	230.4	Vitrified Clay Pipe	
2-27	3080 MCKINLEY DR	3080 MCKINLEY DR				
Special instructions -						
2-32	4477 STEVENS CREEK BL	4477 STEVENS CREEK BL	8	351.9	Vitrified Clay Pipe	
2-30	3038 MCKINLEY DR	3038 MCKINLEY DR				
Special instructions -						
25-82	566 LOS OLIVOS DR	566 LOS OLIVOS DR	8	259.6	Vitrified Clay Pipe	
25-74	596 LOS OLIVOS DR	596 LOS OLIVOS DR				
Special instructions -						
28-1	281 WASHINGTON ST	281 WASHINGTON ST	8	361.2	Vitrified Clay Pipe	
28-92	910 POPLAR ST	910 POPLAR ST				
Special instructions -						
30-20	1068 WOOD DUCK AV	1068 WOOD DUCK AV	8	295.8	Vitrified Clay Pipe	
30-17	3701 SWALLOW WY	3701 SWALLOW WY				
Special instructions -						
30-21	1048 WOOD DUCK AV	1048 WOOD DUCK AV	8	68.1	Vitrified Clay Pipe	
30-20	1068 WOOD DUCK AV	1068 WOOD DUCK AV				
Special instructions -						
30-36	3700 BENTON ST	3700 BENTON ST	8	184.5	Vitrified Clay Pipe	
30-21	1048 WOOD DUCK AV	1048 WOOD DUCK AV				
Special instructions -						

32-34	1353 CALABAZAS CT	1353 CALABAZAS CT	6	119.7	Vitrified Clay Pipe	
32-39	1373 CALABAZAS BL	1373 CALABAZAS BL				
Special instructions -						
32-35	1370 VIA DONDERA	1370 VIA DONDERA	6	52.1	Vitrified Clay Pipe	
32-36	1360 VIA DONDERA	1360 VIA DONDERA				
Special instructions -						
32-36	1360 VIA DONDERA	1360 VIA DONDERA	6	315.3	Vitrified Clay Pipe	
32-48	3216 EL SOBRANTE ST	3216 EL SOBRANTE ST				
Special instructions -						
32-39	1373 CALABAZAS BL	1373 CALABAZAS BL	6	202.9	Vitrified Clay Pipe	
32-35	1370 VIA DONDERA	1370 VIA DONDERA				
Special instructions -						
32-4	3180 EL CAMINO REAL	3180 EL CAMINO REAL	10	34.5	Vitrified Clay Pipe	
32-5	3180 EL CAMINO REAL	3180 EL CAMINO REAL				
Special instructions -						
46-2	2119 MAIN ST	2119 MAIN ST	10	106.4	Vitrified Clay Pipe	
56-47	2119 MAIN ST	2119 MAIN ST				
Special instructions -						
46-87	1597 JACKSON ST	1597 JACKSON ST	6	253.6	Vitrified Clay Pipe	
47-44	1596 MAIN ST	1596 MAIN ST				
Special instructions -						
52-15	2632 MEADOWBROOK DR	2632 MEADOWBROOK DR	10	333.5	Vitrified Clay Pipe	
62-23	3069 AGATE DR	3069 AGATE DR				
Special instructions -						
52-17	2999 AGATE DR	2999 AGATE DR	8	249.2	Vitrified Clay Pipe	
52-16	3049 AGATE DR	3049 AGATE DR				
Special instructions -						
53-2	2949 AGATE DR	2949 AGATE DR	8	255.9	Vitrified Clay Pipe	
52-17	2999 AGATE DR	2999 AGATE DR				
Special instructions -						
53-3	2899 AGATE DR	2899 AGATE DR	8	256.3	Vitrified Clay Pipe	
53-2	2949 AGATE DR	2949 AGATE DR				
Special instructions -						
53-4	2859 AGATE DR	2859 AGATE DR	8	258.7	Vitrified Clay Pipe	
53-3	2899 AGATE DR	2899 AGATE DR				
Special instructions -						
56-32	1160 RICHARD AV	1160 RICHARD AV	10	237.4	Vitrified Clay Pipe	
56-26	1161 RICHARD AV	1161 RICHARD AV				
Special instructions -						
56-34	1255 MEMOREX DR	1255 MEMOREX DR	10	390.4	Vitrified Clay Pipe	
56-32	1160 RICHARD AV	1160 RICHARD AV				
Special instructions -						
56-35	1255 MEMOREX DR	1255 MEMOREX DR	10	40.3	Vitrified Clay Pipe	
56-34	1255 MEMOREX DR	1255 MEMOREX DR				
Special instructions -						
56-39	1330 MEMOREX DR	1330 MEMOREX DR	10	227.1	Vitrified Clay Pipe	
56-35	1255 MEMOREX DR	1255 MEMOREX DR				
Special instructions -						

56-47	2119 MAIN ST	2119 MAIN ST	10	318.2	Vitrified Clay Pipe
56-39	1330 MEMOREX DR	1330 MEMOREX DR			
Special instructions -					
57-21	518 ROBERT AV	518 ROBERT AV	6	106.4	Vitrified Clay Pipe
57-17	527 ROBERT AV	527 ROBERT AV			
Special instructions -					
57-16	585 ROBERT AV	585 ROBERT AV	10	203.9	Vitrified Clay Pipe
57-17	527 ROBERT AV	527 ROBERT AV			
Special instructions -					
57-17	527 ROBERT AV	527 ROBERT AV	10	113.9	Vitrified Clay Pipe
57-18	508 ROBERT AV	508 ROBERT AV			
Special instructions -					
57-18	508 ROBERT AV	508 ROBERT AV	10	356.4	Vitrified Clay Pipe
57-19	426 ROBERT AV	426 ROBERT AV			
Special instructions -					
57-19	426 ROBERT AV	426 ROBERT AV	10	247.3	Vitrified Clay Pipe
58-17	2362 DE LA CRUZ BL	2362 DE LA CRUZ BL			
Special instructions -					
62-23	3069 AGATE DR	3069 AGATE DR	10	290.4	Vitrified Clay Pipe
62-50		AGATE DR			
Special instructions -					
85-30	4316 FILLMORE ST	4316 FILLMORE ST	6	434.9	Vitrified Clay Pipe
85-17	2169 2ND ST	2169 2ND ST			
Special instructions -					
86-18	930 CLYDE AV	930 CLYDE AV	8	65.5	Vitrified Clay Pipe
86-36	941 CLYDE AV	941 CLYDE AV			
Special instructions -					
86-23	1030 CLYDE AV	1030 CLYDE AV	8	134.0	Vitrified Clay Pipe
86-21	1010 CLYDE AV	1010 CLYDE AV			
Special instructions -					
87-25	791 CLYDE AV	791 CLYDE AV	10	184.1	Vitrified Clay Pipe
87-13	791 CLYDE AV	791 CLYDE AV			
Special instructions -					
95-14	4993 STARS AND STRIPES	4993 STARS AND STRIPES DR	8	42.0	Vitrified Clay Pipe
95-13	4993 STARS AND STRIPES	4993 STARS AND STRIPES DR			
Special instructions -					
95-3	5095 LAFAYETTE ST	5095 LAFAYETTE ST	8	43.7	Vitrified Clay Pipe
95-1	5095 LAFAYETTE ST	5095 LAFAYETTE ST			
Special instructions -					
36 Pipes			7,625.7 Total Length		

Work Order Number: 2025-05-01-015

5/29/2025 8:42 AM

Category: Mains **Status:** New Work Order

Problem: **Supervisor:** Felipe Carrillo

Main Task: Flush **Related:** swHotspot Main Flush - Monthly

Work Order Start Date: 5/1/2025 **Work Order End Date:**

Comments To / From Crew

Employee Number	Employee Name	Date	Hours

Equipment Code	Equipment Description	Units

Asset List (Sewer Pipes)

US / DS	Address / General Location		Diameter	Length	Material	Comment / Completion Date
5-12	3565 STEVENS CREEK BL	3565 STEVENS CREEK BL	6	482.3	Vitrified Clay Pipe	
5-14	265 CYPRESS AV	265 CYPRESS AV				
Special instructions -						
5-16	265 TYLER AV	265 TYLER AV	6	409.0	Vitrified Clay Pipe	
5-14	265 CYPRESS AV	265 CYPRESS AV				
Special instructions -	DO NOT JET - ISSUE AT 15' - USE SMALL HEAD - NO SKID					
21-80	3555 LEHIGH DR	3555 LEHIGH DR	8	205.2	Vitrified Clay Pipe	
21-75	681 HARVARD AV	681 HARVARD AV				
Special instructions -						
23-7	2620 PATRICIA DR	2620 PATRICIA DR	8	180.8	Vitrified Clay Pipe	
24-17	906 LAS PALMAS DR	906 LAS PALMAS DR				
Special instructions -						
27-19	1295 MANCHESTER DR	1295 MANCHESTER DR	6	552.7	Vitrified Clay Pipe	
27-10	1301 JONATHAN ST	1301 JONATHAN ST				
Special instructions -						
28-28	720 HILMAR ST	720 HILMAR ST	6	187.2	Vitrified Clay Pipe	
28-20	2407 PARK AV	2407 PARK AV				
Special instructions -						
39-17	1224 SHERWOOD AV	1224 SHERWOOD AV	8	124.5	Vitrified Clay Pipe	
39-27	1227 SHERWOOD AV	1227 SHERWOOD AV				
Special instructions -						

39-23	1224 SHERWOOD AV	1224 SHERWOOD AV	8	224.8	Vitrified Clay Pipe	
39-17		1202 SHERWOOD AV				
Special instructions -						
39-24	2222 THE ALAMEDA	2222 THE ALAMEDA		212.1	Vitrified Clay Pipe	
39-23						
Special instructions -						
45-86	1610 LONG ST	1610 LONG ST	6	309.5	Vitrified Clay Pipe	
45-85	2125 BRAY AV	2125 BRAY AV				
Special instructions -						
45-85	2125 BRAY AV	2125 BRAY AV	6	240.4	Vitrified Clay Pipe	
45-84	2165 BRAY AV	2165 BRAY AV				
Special instructions -						
45-84	2165 BRAY AV	2165 BRAY AV	6	239.6	Vitrified Clay Pipe	
45-83	2228 BRAY AV	2228 BRAY AV				
Special instructions -						
45-83	2228 BRAY AV	2228 BRAY AV	6	234.8	Vitrified Clay Pipe	
45-82	2268 BRAY AV	2268 BRAY AV				
Special instructions -						
45-82	2268 BRAY AV	2268 BRAY AV	6	121.4	Vitrified Clay Pipe	
45-81	2278 BRAY AV	2278 BRAY AV				
Special instructions -						
45-81	2278 BRAY AV	2278 BRAY AV	6	161.4	Vitrified Clay Pipe	
45-80	1648 LOS PADRES BL	1648 LOS PADRES BL				
Special instructions -						
46-86	1590 JACKSON ST	1590 JACKSON ST	6	348.5	Vitrified Clay Pipe	
46-85	1708 JACKSON ST	1708 JACKSON ST				
Special instructions -						
48-22	1450 COLEMAN AV	1450 COLEMAN AV	8	406.6	Vitrified Clay Pipe	
48-21	1601 COLEMAN AV	1601 COLEMAN AV				
Special instructions -						
88-23	3575 VICTOR ST	3575 VICTOR ST	12	364.3	Vitrified Clay Pipe	
78-27	431 NELO ST	431 NELO ST				
Special instructions -						
103-33	5490 GREAT AMERICA PY	5490 GREAT AMERICA PY	12	260.1	Vitrified Clay Pipe	
103-34		GREAT AMERICA WAY				
Special instructions -						
103-34		GREAT AMERICA WAY	12	361.8	Vitrified Clay Pipe	
103-35	2900 OLD MOUNTAIN VIEW	2900 OLD MOUNTAIN VIEW				
Special instructions -						
103-35	2900 OLD MOUNTAIN VIEW	2900 OLD MOUNTAIN VIEW	12	428.8	Vitrified Clay Pipe	
113-2	2600 GREAT AMERICA WY	2600 GREAT AMERICA WY				
Special instructions -						
113-2	2600 GREAT AMERICA WY	2600 GREAT AMERICA WY	12	344.8	Vitrified Clay Pipe	
113-3	2600 GREAT AMERICA WY	2600 GREAT AMERICA WY				
Special instructions -						
114-20		GREAT AMERICA WAY	12	147.9	Polyethylene	
114-21	5599 LAFAYETTE ST	5599 LAFAYETTE ST				
Special instructions -						

114-21	5599 LAFAYETTE ST	5599 LAFAYETTE ST	12	216.2	Vitrified Clay Pipe	
114-22	5599 LAFAYETTE ST	5599 LAFAYETTE ST				
Special instructions -						
113-3	2600 GREAT AMERICA WY	2600 GREAT AMERICA WY	12	271.7	Vitrified Clay Pipe	
114-20		GREAT AMERICA WAY				
Special instructions -						
25 Pipes		7,036.4 Total Length				

Work Order Number: 2025-05-01-014

5/29/2025
8:43 AM

Category: Mains
Status: New Work Order
Problem:
Supervisor: Felipe Carrillo
Main Task: Inspection
Related: swHotspot Main Inspection - Monthly

Work Order Start Date: 5/1/2025
Work Order End Date:

Comments To / From Crew

MAINS

Employee Number	Employee Name	Date	Hours

Equipment Code	Equipment Description	Units

Asset List (Sewer Pipes)

US / DS	Address / General Location		Diameter	Length	Material	Comment / Completion Date
10-75	3818 HANCOCK DR	3818 HANCOCK DR	8	233.5	Vitrified Clay Pipe	
10-76	3798 HANCOCK DR	3798 HANCOCK DR				
Special instructions -						
10-76	3798 HANCOCK DR	3798 HANCOCK DR	8	277.2	Vitrified Clay Pipe	
10-77	259 LA HERRAN DR	259 LA HERRAN DR				
Special instructions -						
10-77	259 LA HERRAN DR	259 LA HERRAN DR	8	323.8	Vitrified Clay Pipe	
10-78	300 MONTCLAIR DR	300 MONTCLAIR DR				
Special instructions -						
10-78	300 MONTCLAIR DR	300 MONTCLAIR DR	8	293.6	Vitrified Clay Pipe	
10-79	3678 MAGELLAN AV	3678 MAGELLAN AV				
Special instructions -						
10-79	3678 MAGELLAN AV	3678 MAGELLAN AV	8	304.6	Vitrified Clay Pipe	
10-80	3638 MAGELLAN AV	3638 MAGELLAN AV				
Special instructions -						
11-76	283 LA SALLE AV	283 LA SALLE AV	10	92.6	Vitrified Clay Pipe	
11-77	250 CALVERT DR	250 CALVERT DR				
Special instructions -						
11-77	250 CALVERT DR	250 CALVERT DR	10	163.6	Vitrified Clay Pipe	
11-78	241 CALVERT CT	241 CALVERT CT				
Special instructions -						

13-98	100 SERENA WY	100 SERENA WY		8	133.5	Vitrified Clay Pipe
13-97	100 SERENA WY	100 SERENA WY				
Special instructions -						
13-99	2753 MAURICIA AV	2753 MAURICIA AV		8	123.1	Vitrified Clay Pipe
13-98	100 SERENA WY	100 SERENA WY				
Special instructions -						
23-89				12	124.8	Vitrified Clay Pipe
23-5						
Special instructions -						
23-11	2900 MILES DR	2900 MILES DR		8	177.7	Vitrified Clay Pipe
23-12	2900 MILES DR	2900 MILES DR				
Special instructions -						
26-39	400 CALIFORNIA ST	400 CALIFORNIA ST		6	250.2	Vitrified Clay Pipe
26-35	469 CALIFORNIA ST	469 CALIFORNIA ST				
Special instructions -						
26-35	469 CALIFORNIA ST	469 CALIFORNIA ST		6	257.5	Vitrified Clay Pipe
26-28	1945 BELLOMY ST	1945 BELLOMY ST				
Special instructions -						
26-89	1803 HENNING PL	1803 HENNING PL		10	220.0	Vitrified Clay Pipe
26-32	575 WINCHESTER BL	575 WINCHESTER BL				
Special instructions -						
26-38	1802 HENNING PL	1802 HENNING PL		10	38.5	Vitrified Clay Pipe
26-89	1803 HENNING PL	1803 HENNING PL				
Special instructions -						
33-35	1293 KIELY BL	1293 KIELY BL		15	54.2	Vitrified Clay Pipe
33-34	1270 KIELY BL	1270 KIELY BL				
Special instructions -						
33-22	2644 EL CAMINO REAL	2644 EL CAMINO REAL		8	210.3	Vitrified Clay Pipe
33-23	2620 EL CAMINO REAL	2620 EL CAMINO REAL				
Special instructions -						
33-23	2620 EL CAMINO REAL	2620 EL CAMINO REAL		8	111.2	Vitrified Clay Pipe
33-24	1400 WHITE DR	1400 WHITE DR				
Special instructions -						
33-24	1400 WHITE DR	1400 WHITE DR		8	260.2	Vitrified Clay Pipe
33-14	2610 EL CAMINO REAL	2610 EL CAMINO REAL				
Special instructions -						
33-14	2610 EL CAMINO REAL	2610 EL CAMINO REAL		8	266.4	Vitrified Clay Pipe
33-9	2632 EL CAMINO REAL	2632 EL CAMINO REAL				
Special instructions -						
39-1	518 CHAPMAN CT	518 CHAPMAN CT		8	95.3	Vitrified Clay Pipe
39-19	2221 THE ALAMEDA	2221 THE ALAMEDA				
Special instructions -						
41-14		LAWRENCE EX & 3584 CABRILLO A\		8	181.3	Vitrified Clay Pipe
41-15	3573 CABRILLO AV	3573 CABRILLO AV				
Special instructions -						
41-15	3573 CABRILLO AV	3573 CABRILLO AV		8	297.3	Vitrified Clay Pipe
41-16	3513 CABRILLO AV	3513 CABRILLO AV				
Special instructions -						

46-1	2124 MAIN ST	2124 MAIN ST	10	142.4	Vitrified Clay Pipe
56-46	2125 MAIN ST	2125 MAIN ST			
Special instructions -					
41-16	3513 CABRILLO AV	3513 CABRILLO AV	8	231.3	Vitrified Clay Pipe
41-17	3502 CABRILLO AV	3502 CABRILLO AV			
Special instructions -					
41-17	3502 CABRILLO AV	3502 CABRILLO AV	8	24.5	Vitrified Clay Pipe
41-18	3499 CABRILLO AV	3499 CABRILLO AV			
Special instructions -					
46-85	1708 JACKSON ST	1708 JACKSON ST	8	394.2	Vitrified Clay Pipe
47-38	1100 REEVE ST	1100 REEVE ST			
Special instructions -					
46-93	1205 EL CAMINO REAL	1205 EL CAMINO REAL	8	335.8	Vitrified Clay Pipe
46-86	1590 JACKSON ST	1590 JACKSON ST			
Special instructions -					
55-22	2299 PASETTA DR	2299 PASETTA DR	12	332.0	Vitrified Clay Pipe
55-15	2230 MARTIN AV	2230 MARTIN AV			
Special instructions -					
55-15	2230 MARTIN AV	2230 MARTIN AV	12	219.2	Vitrified Clay Pipe
55-11	2250 MARTIN AV	2250 MARTIN AV			
Special instructions -					
57-2	785 WALSH AV	785 WALSH AV	15	342.9	Vitrified Clay Pipe
57-3	672 WALSH AV	672 WALSH AV			
Special instructions -					
57-38		MATHEW ST	18	207.9	Vitrified Clay Pipe
57-35	525 MATHEW ST	525 MATHEW ST			
Special instructions -					
57-38			24	344.4	Vitrified Clay Pipe
57-58					
Special instructions -					
65-14	3023 SCOTT BL	3023 SCOTT BL	12	335.7	Vitrified Clay Pipe
65-11	3033 SCOTT BL	3033 SCOTT BL			
Special instructions -					
66-41	1451 WALSH AV	1451 WALSH AV	10	207.6	Vitrified Clay Pipe
66-40		WALSH			
Special instructions -					
66-40		WALSH	12	338.5	Vitrified Clay Pipe
66-38	2841 SCOTT BL	2841 SCOTT BL			
Special instructions -					
36 Pipes			7,946.7 Total Length		

Appendix M
SSMP Audit Checklist

City of Santa Clara
Sewer System Management Plan (SSMP)
Audit Report

The purpose of the Annual SSMP Audit is to evaluate the effectiveness of the City of Santa Clara's SSMP and to identify deficiencies, if any, and steps to correct them. The audit is submitted pursuant to the San Francisco Bay Regional Water Quality Control Board's Sewer System Management Plan Development Guide, July 2005.

Directions: Please check **YES** or **NO** for each question. If **NO** is answered for any question, describe the updates/changes needed and the timeline to complete those changes in the "*Description of Scheduled Updates/Changes to the SSMP"* section on Page 5 of this form.

		YES	NO
ELEMENT 1 – GOAL AND INTRODUCTION			
A.	Are the goals stated in the SSMP still appropriate and accurate?	☐	☐
ELEMENT 2 -- ORGANIZATION			
A.	Is the Utilities Key Staff Telephone List current?	☐	☐
B.	Is the Sanitary Sewer Overflow Responder Telephone List current?	☐	☐
C.	Is the "City Organization Chart," in the SSMP current?	☐	☐
D.	Are the position descriptions an accurate portrayal of staff responsibilities?	☐	☐
E.	Is the "Chain of Communication for Reporting and Responding to SSOs," table accurate and up-to-date?	☐	☐
ELEMENT 3 – LEGAL AUTHORITY			
Does the SSMP contain excerpts from the current City of Santa Clara Municipal Code documenting the City's legal authority to:			
A.	Prevent illicit discharges?	☐	☐
B.	Require proper design and construction of sewers and connections?	☐	☐
C.	Ensure access for maintenance, inspection, or repairs for portions of the lateral owned or maintained by the City?	☐	☐
D.	Limit discharges of fats, oil and grease?	☐	☐
E.	Enforce any violation of its sewer ordinances?	☐	☐

		YES	NO
ELEMENT 4 – OPERATION & MAINT**ENANCE PROGRAM**			
	Collection System Maps		
A.	Does the SSMP reference the current process and procedures for maintaining the City's wastewater collection system maps?	☐	☐
B.	Are the City's wastewater collection system maps complete, current, and sufficiently detailed?	☐	☐
	Resources and Budget		
C.	Does the City allocate sufficient funds for the effective operation, maintenance and repair of the wastewater collection system and is the current budget structure documented in the SSMP?	☐	☐
	Prioritized Preventive Maintenance		
D.	Does the SSMP describe current preventive maintenance activities and the system for prioritizing the cleaning of sewer lines?	☐	☐
E.	Based upon information in the Annual SSO Report, are the City's preventive maintenance activities sufficient and effective in minimizing SSOs and blockages?	☐	☐
	Scheduled Inspections and Condition Assessments		
F.	Is there an ongoing condition assessment program sufficient to develop a capital improvement plan addressing the proper management and protection of infrastructure assets? Are the current components of this program documented in the SSMP?	☐	☐
	Contingency Equipment and Replacement Inventory		
G.	Does the SSMP list the major equipment currently used in the operation and maintenance of the collection system and document the procedures of inventory management?	☐	☐
H.	Are contingency equipment and replacement parts sufficient to respond to emergencies and properly conduct regular maintenance?	☐	☐
	Training		
I.	Is the training calendar current?	☐	☐
J.	Does the SSMP document current training expectations and programs within the City's Sewer Division?	☐	☐
	Outreach to Plumbers and Building Contractors		
K.	Does the SSMP document current outreach efforts to plumbers and building contractors?	☐	☐

		YES	NO
ELEMENT 5 – DESIGN AND PERFORMANCE PROVISIONS			
A.	Does the SSMP contain current design and construction standards for the installation of new sanitary sewer systems, pump stations and other appurtenances and for the rehabilitation and repair of existing sanitary sewer systems?	☐	☐
B.	Does the SSMP document current procedures and standards for inspecting and testing the installation of new sewers, pumps, and other appurtenances and the rehabilitation and repair of existing sewer lines?	☐	☐
ELEMENT 6 – SPILL EMERGENCY RESPONSE PLAN			
A.	Does the City's Sanitary Sewer Overflow and Backup Response Plan establish procedures for the emergency response, notification, and reporting of sanitary sewer overflows (SSOs)?	☐	☐
B.	Are Wastewater Division staff and contractor personnel appropriately trained on the procedures of the Sanitary Sewer Overflow and Backup Response Plan?	☐	☐
C.	Considering performance indicator data in the Annual SSO Report, is the Sanitary Sewer Overflow and Backup Response Plan effective in handling SSOs in order to safeguard public health and the environment?	☐	☐
ELEMENT 7 – SEWER PIPE BLOCKAGE CONTROL PROGRAM			
A.	Does the Fats, Oils, and Grease (FOG) Control Program include efforts to educate the public on the proper handling and disposal of FOG?	☐	☐
B.	Does the City's FOG Control Program identify sections of the collection system subject to FOG blockages, establish a cleaning schedule and address source control measures to minimize these blockages?	☐	☐
C.	Are requirements for grease removal devices, best management practices (BMP), record keeping and reporting established in the City's FOG Control Program?	☐	☐
D.	Does the City have sufficient legal authority to implement and enforce the FOG Control Program?	☐	☐
E.	Is the current FOG program effective in minimizing blockages of sewer lines resulting from discharges of FOG to the system	☐	☐
ELEMENT 8 – SYSTEM EVALUATION, CAPACITY ASSURANCE, CAPITAL IMPROVEMENT			
A.	Does the City's Sanitary Sewer Master Plan evaluate hydraulic deficiencies in the system, establish sufficient design criteria and recommend both short and long term capacity enhancement and improvement projects?	☐	☐
B.	Does the City's Capital Improvement Plan (CIP) establish a schedule of approximate completion dates for both short and long-term improvements and is the schedule reviewed and updated to reflect current budgetary capabilities and activity accomplishment?	☐	☐

		YES	NO
ELEMENT 9 – MONITORING, MEASUREMENT, PROGRAM MODIFICATIONS			
A.	Does the SSMP accurately portray the methods of tracking and reporting selected performance indicators?	☐	☐
B.	Is the City able to sufficiently evaluate the effectiveness of SSMP elements based on relevant information?	☐	☐
ELEMENT 10 – SSMP PROGRAM AUDITS			
A.	Will the SSMP Audit be submitted to the Regional Water Board by May 2, 2014?	☐	☐
ELEMENT 11 – COMMUNICATION PROGRAM			
A.	Does the City effectively communicate with the public and other agencies about the development and implementation of the SSMP and continue to address any feedback?	☐	☐

Description of Scheduled Updates/Changes to the SSMP

Directions: For each NO answer, please describe the planned revision and indicate the date the revision will be completed. Reference the SSMP element and question number with each explanation.