FINAL REPORT | SEPTEMBER 2022

Wastewater Master Plan Update

PREPARED FOR

City of Stockton

Resolution No. 2022-10-18-1502

STOCKTON CITY COUNCIL

RESOLUTION ADOPTING THE 2022 WASTEWATER MASTER PLAN UPDATE FOR THE MUNICIPAL UTILITIES DEPARTMENT

On June 9, 2020, a Professional Services Contract was awarded to West Yost Associates (West Yost) to update the existing Wastewater Master Plan, analyze the existing wastewater collection system, project capacity demand, and identify infrastructure needs based on the Envision Stockton 2040 General Plan; and

West Yost has completed and submitted the Wastewater Master Plan Update and Appendices dated September 2022; attached as Exhibit 1 and Exhibit 2; and

In accordance with the Envision Stockton 2040 General Plan Update, the 2022 Wastewater Master Plan Update includes the recalibration of the City's collection system hydraulic model, addresses potential impacts of near-term and long-term planned growth, and serves as a planning document for the City's wastewater infrastructure requirements; and

The 2022 Wastewater Master Plan Update identifies near-term and long-term Capital Improvement Program projects for wastewater infrastructure including collection system capacity improvements and condition-related improvement projects; now, therefore,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF STOCKTON AS FOLLOWS:

1. The 2022 Wastewater Master Plan Update conforms with the Envision Stockton 2040 General Plan Update.

2. The 2022 Wastewater Master Plan Update, dated September 2022, including appendices, is adopted, copies of which is attached as Exhibits 1 and 2 and are incorporated by reference.

PASSED, APPROVED, and ADOPTED October 18, 2022.

STOCKTON FOUNDED JUNE 1849 ★ INCORPORATED JULY 1850 ★

ATTEST:

ELIZA R. GARZA, CMC
City Clerk of the City of Stockton

KEVIN J. LINCOLN II
Mayor of the City of Stockton

Wastewater Master Plan Update

Prepared for

City of Stockton

Project No. 129-60-20-42

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CIVIL
STATE OF CALIFORNIA

Project Manager: Patrick Johnston	09-07-2022 Date
QA/QC Review: Jeffrey Pelz	09-07-2022 Date

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LIST OF ACRONYMS AND ABBREVIATIONS

AACE	Association for the Advancement of Cost Engineering
ABS	Acrylonitrile Butadiene Styrene
ACP	Asbestos Cement
AV	Area-velocity
CalWater	California Water Service
CCTV	Closed-Circuit Television
CIEMP	Capital Improvement and Energy Management Plan
CIP	Capital Improvement Plan
City	City of Stockton
CIWEM	Chartered Institution of Water and Environmental Management
CIWQS	California Integrated Water Quality System Project
D	Pipe Diameter
d	Flow Depth
DIP	Ductile Iron Pipe
ENR CCI	Engineering News Record Construction Cost Index
fps	Feet per second
FY	Fiscal Year
General Plan	Envision Stockton 2040 General Plan
GIS	Geographic Information System
gpd	Gallons per Day
HGL	Hydraulic Grade Line
I&I	Infiltration and inflow
LIDAR	Laser Imaging, Detection, and Ranging
MH	Maintenance Hole
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic Atmospheric Administration

PE	Polyethylene
PF	Peaking Factor
PS	Pump Station
PVC	Polyvinyl Chloride
Q_a	Average Dry Weather Flow
Q_d	Design Flow
Q_p	Peak Wet Weather Flow
R	Depth-Velocity Correlation
RCM	Reinforced Plastic Mortar
RCP	Reinforced Concrete
RDII	Rainfall-dependent Infiltration and Inflow
RWCF	Regional Wastewater Control Facility
SIUs	Significant Industrial Users
SOI	Sphere of Influence
SSO	Sanitary Sewer Overflow
V	Velocity
VCP	Verified Clay Pipe

ES.1 INTRODUCTION

The purpose of this Wastewater Master Plan Update (Master Plan) for the City of Stockton (City) is to evaluate existing wastewater collection system infrastructure, to address potential impacts of near-term and long-term planned growth, and to develop a comprehensive road map for the City's wastewater system Capital Improvement Program. The City's Municipal Utilities Department operates the City's wastewater collection and treatment systems, which serve customers throughout the City and some outlying areas immediately to the east and south of the City limits.

Completion of the City's Envision Stockton 2040 General Plan (General Plan), in conjunction with changing wastewater generation rates over time, have created a need to reassess the City's wastewater collection capacity and treatment infrastructure needs for existing and future conditions. The primary objectives of this Master Plan are: 1) to evaluate historical and existing wastewater flows; 2) to refine collection system performance and planning criteria; 3) to update and calibrate the City's wastewater collection system hydraulic model; 4) to evaluate the need for new wastewater collection system facilities to meet existing, near-term, and buildout needs; and 5) to update and prioritize the City's Capital Improvement Plan (CIP) for wastewater collection system improvements.

This Master Plan report is organized into the following chapters, which are described briefly in this Executive Summary:

- Chapter 1. Introduction
- Chapter 2. Existing Wastewater Collection System
- Chapter 3. Existing Wastewater Flows
- Chapter 4. Collection System Planning, Design, and Performance Criteria
- Chapter 5. Hydraulic Model Development
- Chapter 6. Analysis of Existing Flow Conditions
- Chapter 7. Analysis of Future Flow Conditions
- Chapter 8. Recommended Wastewater Collection System CIP

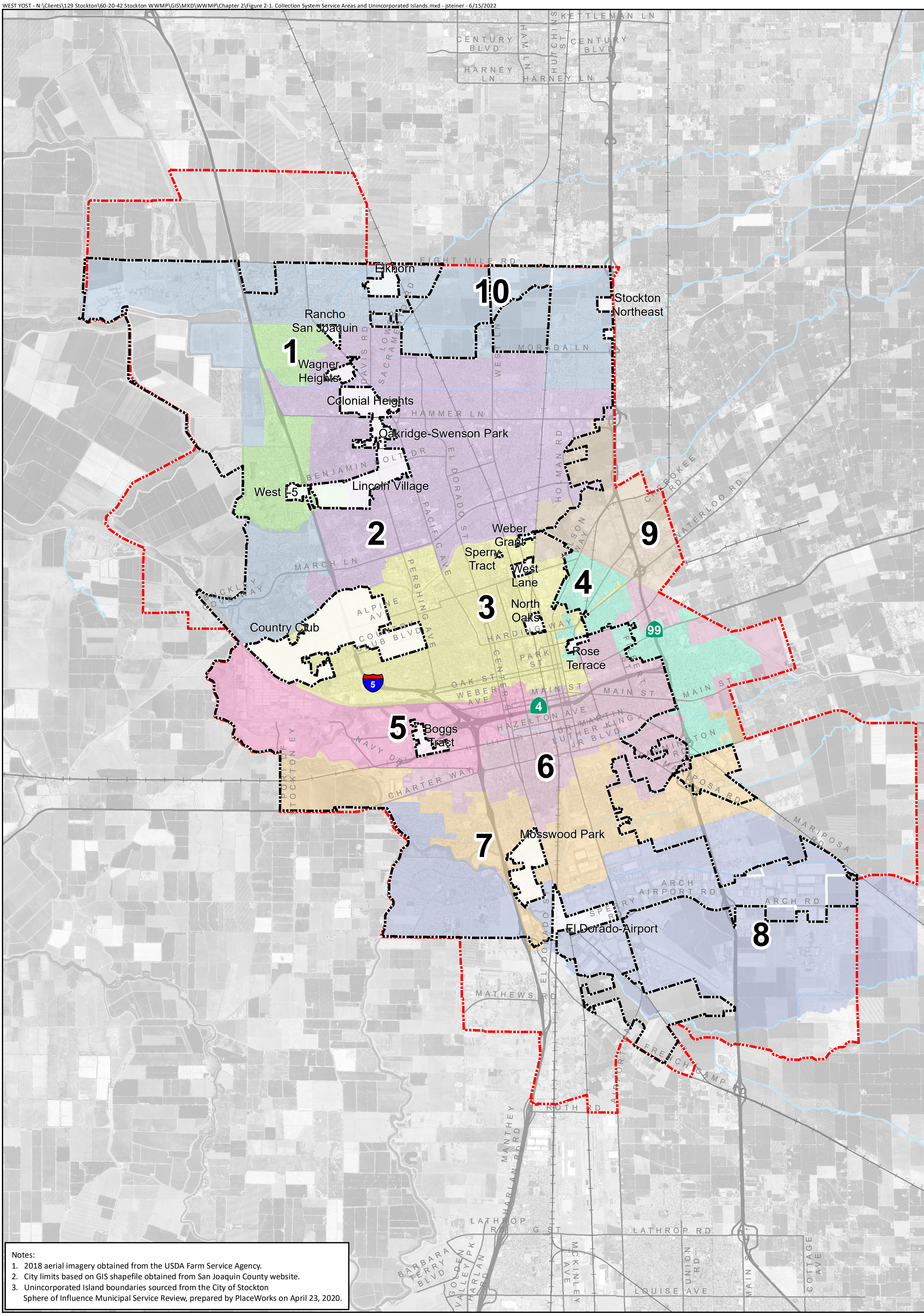
ES.2 EXISTING WASTEWATER COLLECTION SYSTEM

The City of Stockton is the county seat and the largest city in San Joaquin County. According to the California Department of Finance, the population of the City in January 2021 was estimated to be 320,876 residents. The existing City limits encompass an area of 41,777 acres, or approximately 65 square miles. The existing wastewater collection system service area includes residential, commercial, industrial, municipal, and mixed-use areas within the City, as well as 17 unincorporated areas that are partially or fully enclosed by the Stockton City limits boundary and are referred to as "unincorporated islands".

The City's collection system can be separated into 10 existing sub-areas or "systems". The City's wastewater collection system conveys all flows to the Regional Wastewater Control Facility (RWCF), which is located along the San Joaquin River on the south side of Navy Drive at the western edge of the City. The City's wastewater collection system comprises just over 1,000 miles of gravity mains ranging from 4-inch diameter to 84-inch diameter, as well as 35 pump stations and approximately 37 miles of active force mains ranging from 2-inch diameter to 42-inch diameter.

Figure ES-1 shows the existing collection system service areas, City limits, Sphere of Influence, and unincorporated islands. Figure ES-2 shows all 12-inch diameter and larger sewer lines, the locations of all public sanitary sewer pump stations, and the location of the RWCF.

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 2\Figure 2-1. Collection System Service Areas and Unincorporated Islands.mxd - jsteiner - 6/15/2022



Notes:
1. 2018 aerial imagery obtained from the USDA Farm Service Agency.
2. City limits based on GIS shapefile obtained from San Joaquin County website.
3. Unincorporated Island boundaries sourced from the City of Stockton Sphere of Influence Municipal Service Review, prepared by PlaceWorks on April 23, 2020.

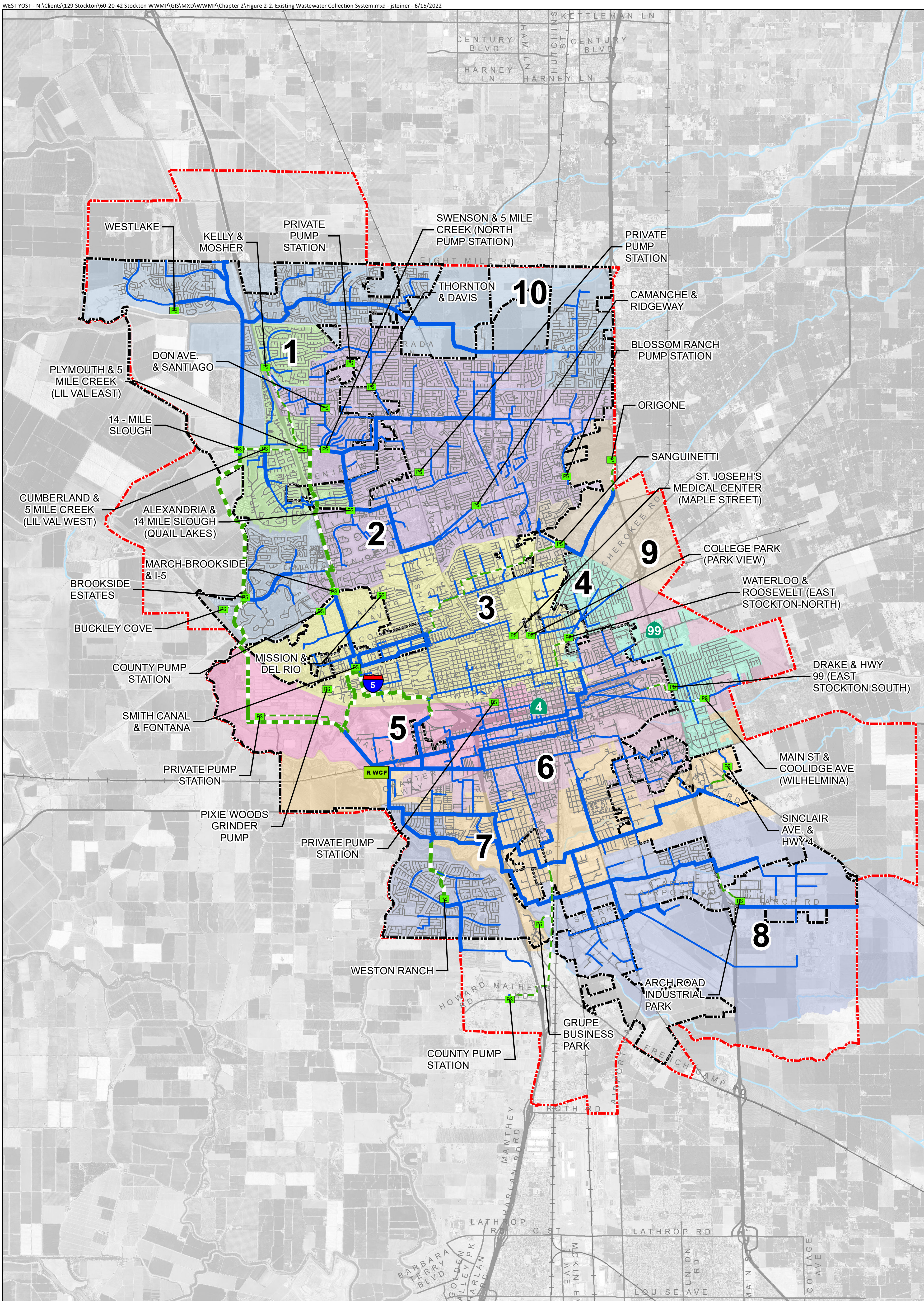
1-10 Collection System Service Areas
Unincorporated Islands
City of Stockton Limits
City of Stockton Sphere of Influence

0 0.75 1.5
Miles

Figure ES-1

Collection System Service Areas and Unincorporated Islands

City of Stockton
Wastewater Master Plan Update



1-10 Collection System Service Areas
City of Stockton Limits
City of Stockton Sphere of Influence
R WCF Regional Wastewater Control Facility
PS Pump Stations

< 12 Inch Gravity Main
12 - 24 Inch Gravity Main
>24 Inch Gravity Main
≤ 24 Inch Force Main
>24 Inch Force Main

N

0 0.75 1.5
Miles

WEST YOST

Figure ES-2

Existing Wastewater Collection System

City of Stockton
Wastewater Master Plan Update

Within Systems 1 through 10, parcels designated as Residential land use account for approximately 90 percent of all parcels by count, and approximately 41 percent of all parcels by area, with the large majority of those having a Low-Density Residential land use designation. Of the non-residential land uses, the Commercial category makes up the largest group by parcel count, and the Industrial category makes up the largest group by parcel area. Among the Industrial land use category, there are 54 Significant Industrial Users.

ES.3 WASTEWATER FLOWS

For this Master Plan, a collection system flow monitoring study was conducted from late October 2020 through mid-March 2021. A total of 25 temporary flow meters were deployed in sewer lines at various locations throughout the collection system, as shown in Figure ES-3 and as detailed in Appendix A.

The flow monitoring data were used to perform an assessment of both dry and wet weather flow conditions throughout the City's collection system. The most significant storm event of the season occurred on January 27–28, 2021, which produced 2.92 inches of rain over 48 hours, and which represents an 8-year return period for a 48-hour duration event. The peak measured flow at the RWCF during this event was 55.4 million gallons per day (mgd).

The flow monitoring program revealed that backwater conditions (i.e., gravity sewer surcharging during periods when flows are well below full-pipe capacity) routinely occur at five of the flow metering locations. These conditions indicate that pumping operations routinely do not keep up with incoming flows at Swenson Pump Station (PS), Waterloo and Roosevelt PS, Cumberland & 5-Mile Creek PS, and 14-Mile Slough PS.

An analysis of collection system flow splits was conducted following field surveys performed in September 2020. The flow split locations are shown in detail in Appendix B, and the field data obtained from the September 2020 surveys are shown in Appendix C. These data were used in the development of the hydraulic model of the City's collection system. The results of the flow split investigation are summarized in Figure ES-4.

ES.4 COLLECTION SYSTEM PLANNING, DESIGN, AND PERFORMANCE CRITERIA

The criteria presented in this Master Plan are considered adjunct to existing City Standards and are not intended to replace or supersede those standards unless specifically stated otherwise. Key criteria addressed in this Master Plan include flow factors for General Plan land use categories, modeling of peak wet weather flow conditions, and capacity assessment of existing facilities.

Proposed flow factors to be used to estimate flow generation for future development are presented in Table ES-1. The flow factors are conservatively estimated using an "upper average" value derived from the flow monitoring data, as described in Chapter 4.

The estimation of peak wet weather flows in the collection system is based on the use of a 10-year, 24-hour storm event, per standard practice. According to the NOAA, the 10-year, 24-hour storm for Stockton has a magnitude of 2.43 inches.

For this analysis, gravity mains are considered undersized if excess surcharging occurs, as defined in Chapter 4. Pump stations are considered undersized if the associated firm capacity (i.e., with the largest pump out of service) is not sufficient to accommodate modeled peak flows. Force mains are considered undersized if the maximum velocity exceeds 8 feet per second (fps) at modeled peak flows.

Table ES-1. Estimated Wastewater Flow Generation Rates by General Plan Land Use Category

Land Use	Parcels w/Non-Zero Water Demands										Notes
	Parcel Count	Area, acres	Average Parcel Size, acres	Winter Water Demand, mgd	Return to Sewer, mgd	Unit Flow by Area, gpd/acre	Unit Flow by Parcel, gpd/parcel	Upper Average, gpd/acre	Upper Average, gpd/parcel	Proposed Flow Factor for Future Growth, gpd/acre	
Residential	**80,724**	**15,155**	**0.19**	**18.334**	**16.500**	**1,089**	**204**	**--**	**--**	**--**	
High Density Residential	1,379	615	0.45	1.687	1.518	2,467	1,101	5,772	n/a	6,000	
Low Density Residential	72,985	13,331	0.18	14.587	13.128	985	180	1,878	310	2,000	City standard = 300 gpd/unit
Medium Density Residential	6,360	1,209	0.19	2.059	1.853	1,533	291	3,230	n/a	3,500	
Residential Estate	0	0	--	0	0	--	--	--	--	2,000	Assumed same as Low Density Res.
Commercial/Industrial/Institutional	**3,556**	**7,595**	**2.14**	**6.317**	**5.685**	**748**	**1,599**	**--**	**--**	**--**	
Administrative Professional	314	335	1.07	0.435	0.391	1,169	1,247	3,497	n/a	3,500	
Commercial	2,050	1,829	0.89	2.107	1.896	1,037	925	2,988	n/a	3,000	
Economic and Education Enterprise	0	0	--	0	0	--	--	--	n/a	1,500	Assumed same as Institutional
Industrial	800	3,302	4.13	2.921	2.629	796	3,286	1,846	n/a	2,000	
Institutional	42	1,853	44.11	0.676	0.608	328	14,480	1,152	n/a	1,500	
Mixed Use	350	277	0.79	0.178	0.160	579	458	1,815	n/a	2,000	
Downtown	**450**	**187**	**0.42**	**0.409**	**0.368**	**1,968**	**819**	**--**	**--**	**--**	
Downtown Commercial	342	160	0.47	0.302	0.271	1,698	794	4,366	n/a	4,500	
Downtown Industrial	10	5	0.53	0.002	0.002	419	221	557	n/a	2,000	Assumed same as Industrial
Downtown High Density Residential	60	17	0.28	0.051	0.046	2,699	765	6,305	n/a	6,500	
Downtown Medium Density Residential	38	5	0.13	0.007	0.006	1,157	154	1,973	n/a	3,500	Assumed same as Medium Density Res.
Other	**847**	**4,248**	**5.02**	**0.048**	**0.043**	**10**	**51**	**--**	**--**	**--**	
Open Space/Agriculture	1	7	7.04	0.00002	0.00001	2	15	2	n/a	0	
Parks and Recreation	46	940	20.42	0.048	0.043	46	934	162	n/a	200	
Not specified	800	3,302	4.13	0	0	0	0	--	n/a	TBD	
TOTAL	**85,577**	**27,186**	**0.32**	**25.059**	**22.553**	**--**	**--**	**--**	**--**	**--**	

Last Saved: 6/15/2022 10:05:39 AM N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 3\Figure 3-1. Flow Metering and Rain Gauge Locations.mxd : jsteiner

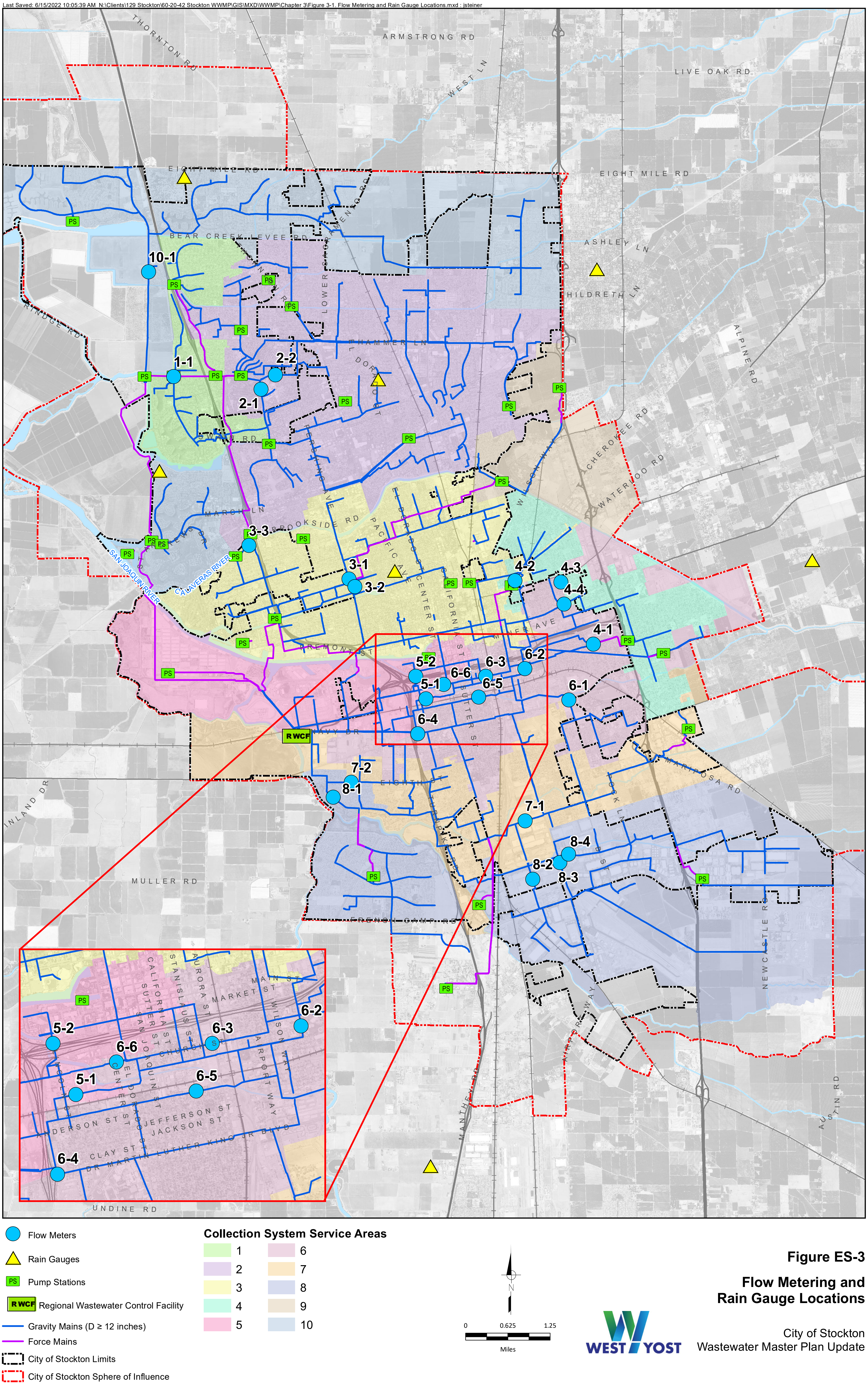
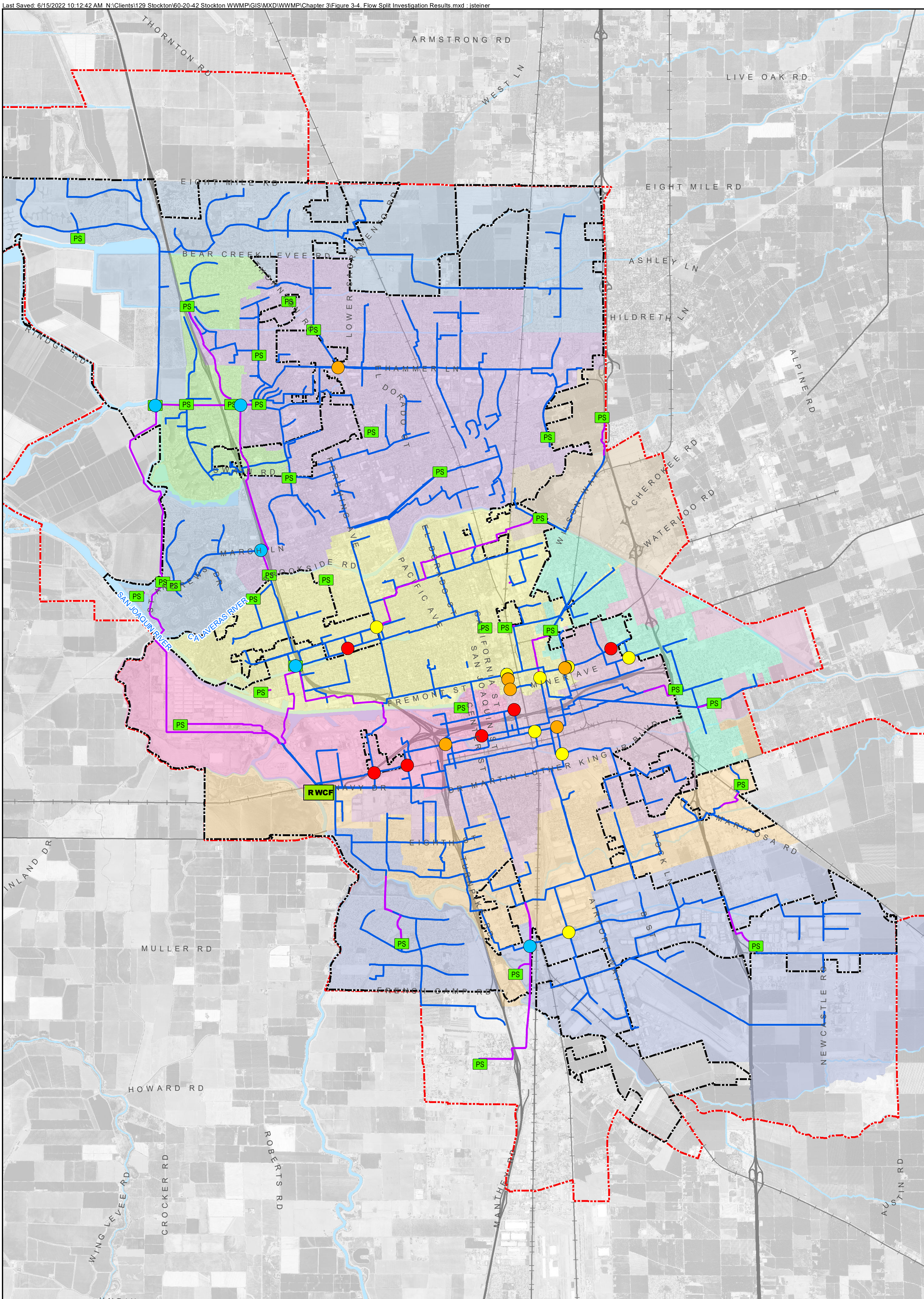


Figure ES-3

Flow Metering and Rain Gauge Locations

City of Stockton
Wastewater Master Plan Update

Last Saved: 6/15/2022 10:12:42 AM N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 3\Figure 3-4. Flow Split Investigation Results.mxd : jsteiner



Flow Split Category

- Confirmed Gravity Main Flow Split
- Confirmed Force Main Flow Split
- Surcharged/High-Flow Condition Flow Split
- No Secondary Outlet Found

System Facilities

- PS Pump Stations
- RWCF Regional Wastewater Control Facility
- Gravity Mains (D ≥ 12 inches)
- Force Mains

Collection System Service Areas

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

City of Stockton Limits

City of Stockton Sphere of Influence

N

0 0.625 1.25

Miles

WEST YOST

Figure ES-4

Flow Split Investigation Results

City of Stockton
Wastewater Master Plan Update

ES.5 HYDRAULIC MODEL DEVELOPMENT

The hydraulic model of the City's collection system was developed using Innovyze InfoSWMM™ software, which is a fully dynamic modeling software package that is well-suited for the City's collection system due to the existence of flow splits throughout the system that direct flows into multiple pathways. The hydraulic model of the collection system includes all gravity mains of 12-inch diameter and larger, plus smaller diameter lines that were previously modeled in and around the Downtown area. The hydraulic model also includes a total of 23 pump stations and their associated force mains. The modeled facilities are shown schematically in Figure ES-5.

Pipe invert elevations are derived from a combination of field survey data and City GIS data, with adjustments applied as described in Chapter 5. Ground surface elevations are derived from a combination of field survey data and LIDAR (Laser Imaging, Detection, and Ranging) data provided by the City.

For existing conditions, flows in the model are generated based on parcel-based water use data from the winter of 2019, with adjustments made to account for return-to-sewer ratios and pandemic shift effects. The model was calibrated first to dry weather conditions and then to wet weather conditions. The dry weather calibration was based on sewer flow data collected from October and November 2020. The wet weather calibration was based on the storm that occurred on January 27–28, 2021, which produced a peak flow at the RWCF of 55.4 mgd, as noted above. As described in Chapter 5, on two occasions since 2012, RWCF influent flows plateaued as high 73.6 mgd for an extended period, indicating that the limits of the influent flow meter were reached and that the actual peak flows were somewhat higher.

The assignment of parcel-based flows to the model, the calibration process, and the analysis of pandemic effects on flow generations are all described in detail in Chapter 5. Comparisons of metered versus modeled dry weather diurnal flow patterns for the 25 metering sites and for the RWCF are presented in Appendix D. Comparisons of the modeled versus metered wet weather flows are presented in Appendix E. Comparisons of the modeled versus metered wet weather flow depths are presented in Appendix F. Modeled collection system pump station results and flow depth monitoring results from the City's existing SmartCover® sites for the January 27–28, 2021 calibration storm are presented in Chapter 5. The model was successfully calibrated such that the simulated flows satisfactorily matched the conditions observed during the flow monitoring period based on calibration guidelines developed by the Chartered Institution of Water and Environmental Management (CIWEM).

ES.6 ANALYSIS OF EXISTING FLOW CONDITIONS

For a simulated 10-year, 24-hour design storm at existing development conditions, the model predicts a peak flow of 78.5 mgd at the RWCF, which is consistent with available RWCF influent data from the past ten years, as discussed above. Modeled peak flow results for existing conditions at the 23 modeled pump stations are summarized in Table ES-2. Firm capacity exceedances are indicated for the Cumberland & 5-Mile Slough PS and the Don Avenue & Santiago PS. The maximum force main velocity criterion of 8 fps is not exceeded at any pump stations.

Theoretical pipe upsizing improvements to eliminate gravity sewer capacity deficiencies are listed in Table ES-3 and are shown schematically in Figure ES-6. The improvements are listed as Priority 1 (indicating the potential surcharging to less than 4 feet from the ground surface), Priority 2 (indicating the potential surcharging of 4 feet to 8 feet of the ground surface), and Priority 3&4 (indicating less severe surcharging than Priorities 1 and 2).

Table ES-2. Modeled Pump Station Results, 10-Year, 24-Hour Design Storm, Existing Development Conditions

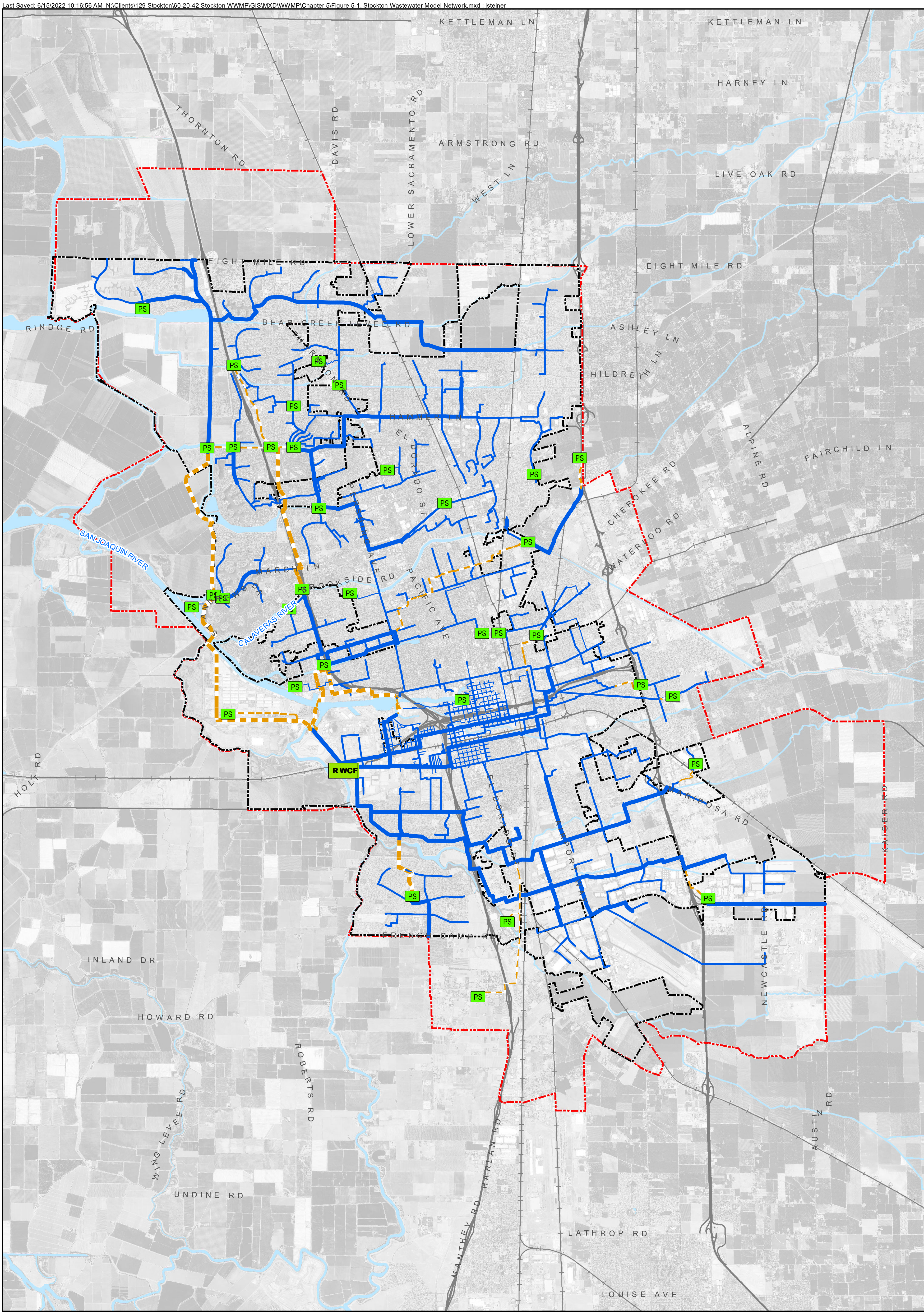
Pump Station	System	Firm Capacity, mgd	Peak Flow, mgd [(a)]	Force Main Diameter, in	Maximum Force Main Velocity, ft/sec
14-Mile Slough	10	(b)	10.59	30	3.3
Alexandria & 14-Mile Slough	2	1.97	1.21	15	1.5
Arch Road	8	8.70	0.55	24	0.3
Blossom Ranch	2	1.30	0.48	8	2.1
Brookside Estates	10	8.64	2.62	20	1.9
Camanche & Ridgeway	2	2.40	0.87	none	--
County Hospital	--	2.16	0.19	dual 10	0.3
Cumberland & 5-Mile Creek	1	4.32	5.73	16	6.3
Don Ave & Santiago	2	0.79	1.31	15	1.7
Drake & Highway 99	4	3.54	3.18	14	4.6
Grupe Business Park	7	0.86	0.036	8	0.2
Kelly & Mosher Slough	1	4.32	1.77	12	3.5
March-Brookside & I-5	2	1.15	0.76	8	3.4
Origone	9	5.18	0.001	16	0.0
Plymouth & 5-Mile Creek	1	1.25	0.49	8	2.2
Sanguinetti	9	15.98	0.24	24	0.1
Sinclair Avenue & Highway 4	7	4.32	0.123	10	0.3
Smith Canal & Fontana	3	37.92	31.34	dual 30	4.9
Swenson (North)	2	20.16	18.42	dual 24	4.5
Thornton & Davis	2	1.22	1.18	8	5.2
Waterloo & Roosevelt	4	2.74	2.59	12	5.1
Weston Ranch	8	15.98	2.60	dual 30	0.4

(a) Exceedances of pump station firm capacity and the force main velocity criterion of 8 ft/sec are highlighted in yellow.
(b) Cannot be calculated due to unknown pump capacities; see Table 2-9.

Table ES-3. Theoretical Upsizing Improvements That Would Alleviate Existing Capacity Deficiencies

ID #	Designation	Priorities	System	GIS Year Constructed	Upstream MH ID	Upstream MH Location	Downstream MH ID	Downstream MH Location	GIS Pipe Dia, in	Upsized Pipe Dia, in	Total Length, ft	No. of Pipe Segments	Depth to Pipe Crown, ft	Maximum Flow, mgd	Maximum Surcharge, ft	Minimum Headspace, ft
Priority 1 Group																
1-1	E. Marsh Street sewer	1,2,4	6	1895–1940	32R072	Olympic Circle	33P105	S. Sierra Nevada Street	18	24	7,406	21	4.0 to 10.4	4.04	5.1	0
1-2	El Dorado Street / S. Center Street sewer	1,2,4	6	1905–1915	37N043	E. 6th Street	36M016	E. Charter Way	16	21,24	2,832	9	10.5 to 12.1	3.54	8.9	0.4
1-3	S. Wilson Way sewer	1,2	6	1947	34P082	E. Worth Street	35P012	Mormon Slough	10,12	21	1,001	5	7.6 to 8.6	2.73	8.1	0
1-4	E. 6th Street sewer	1,2	6	1900	37N034	S. San Joaquin Street	37N043	El Dorado Street	12	18	701	4	10.2 to 10.8	1.89	10.7	0
Priority 2 Group																
2-1	E. Main Street sewer	2,4	6	1910–1984	33S033	Anteros Avenue	33Q014	E. Washington Street	12,16	18	7,605	24	7.6 to 10.3	1.74	6.1	2.1
2-2	W. Washington Street / Port Road 23 sewer	2	5	no data	34J016	west of Port Road 13	36H003	north of Navy Drive	12,15,18	18,21	3,800	9	5.6 to 11.8	2.92	4.9	4.0
2-3	Don Avenue / Meadow Avenue sewer	2	2	1957–1973	20G060	Santiago Way	21G051	Oak Creek Drive	12	15	2,171	10	8.1 to 9.8	1.44	3.7	4.6
2-4	S. El Dorado Street sewer	2,4	6	1900–1910	35N064	E. Worth Street	36N016	E. Charter Way	12	15	2,184	6	8.9 to 11.5	1.13	1.8	7.1
Priority 3&4 Group																
4-1	Market Street sewer	4	5	1900–1920	33M079	S. El Dorado Street	34L002	S. Lincoln Street	16,18	27	2,320	8	11.5 to 16.1	1.82	2.0	11.6
4-2	Church Street / Pershing Avenue sewer	4	5,6	1917	34L022	S. Harrison Street	35L027	S. Pershing Avenue	24	30	3,992	11	9.8 to 15.0	3.30	1.9	9.5
4-3	Waterloo Road sewer	4	3	1920–1984	29Q063	Williams Street	30P039	Hiawatha Avenue	12,15	15,18	1,834	8	21.9 to 23.7	2.30	1.8	20.1

Last Saved: 6/15/2022 10:16:56 AM N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 5\Figure 5-1. Stockton Wastewater Model Network.mxd : jsteiner



Gravity Main by Diameter

- GM < 12"
- GM 12" - 24"
- GM > 24"

Force Main by Diameter

- FM < 12"
- FM 12" - 24"
- FM > 24"

RWCF Regional Wastewater Control Facility

PS Pump Stations

City of Stockton Limits

City of Stockton Sphere of Influence

N

0 0.75 1.5

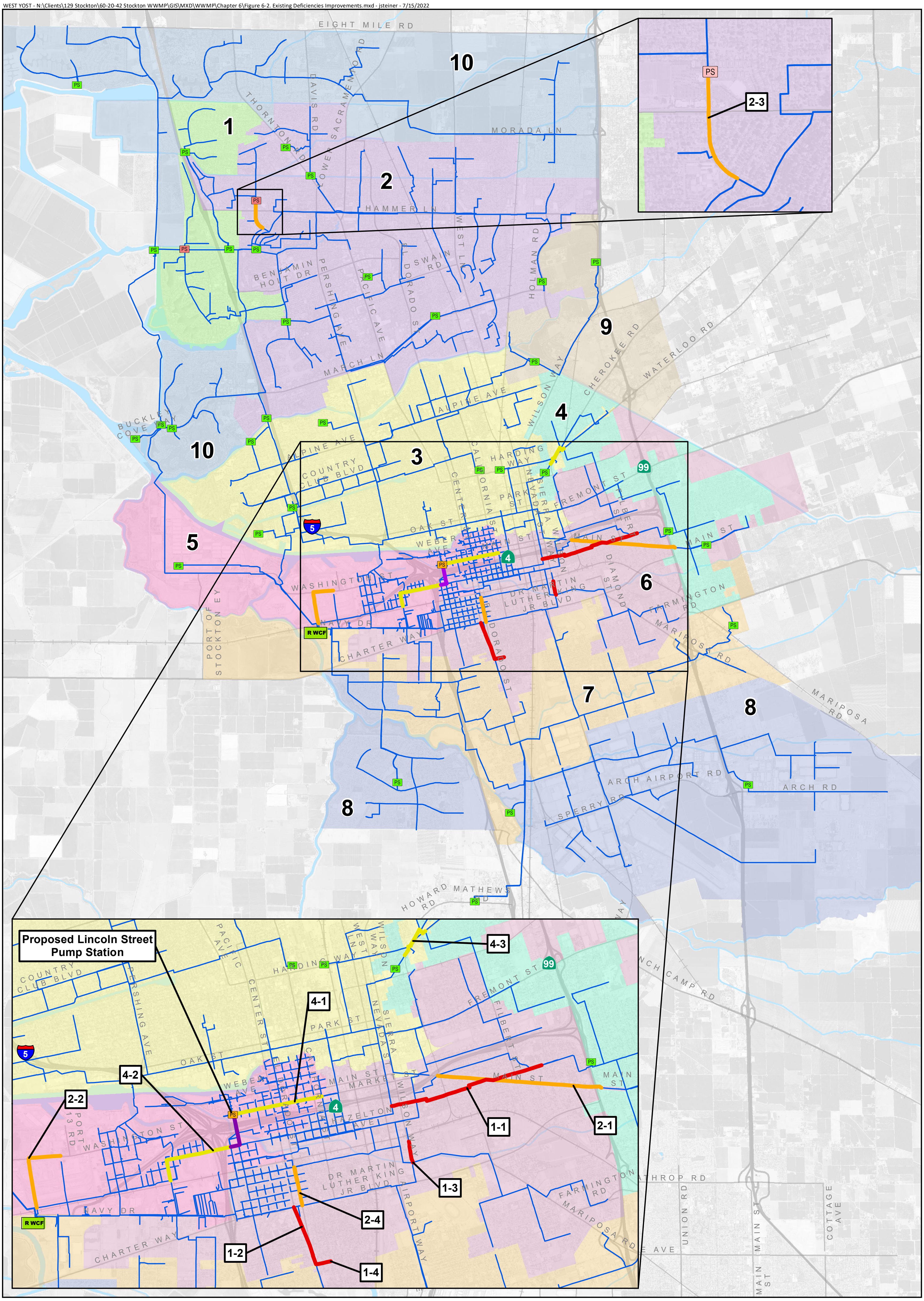
Miles

WEST YOST

Figure ES-5

Modeled Collection System Facilities

City of Stockton
Wastewater Master Plan Update



- Priority 1
- Priority 2
- Priority 3&4
- No Capacity Deficiency
- Proposed Force Main
- X-X Deficiency ID
- R WCF Regional Wastewater Control Facility
- 1-10 Collection System Service Areas
- PS Pump Station - No Capacity Deficiency
- PS Pump Station - Capacity Deficiency
- PS Pump Station - Proposed

N

0 0.625 1.25
Miles

WEST YOST

Figure ES-6

Tentative Improvements to Address Existing Capacity Deficiencies

City of Stockton
Wastewater Master Plan Update

It should be noted that these theoretical improvements do not necessarily equate to a recommendation to proceed forward with design and construction of replacement sewers. In all cases, system geometry (including pipe depths, diameters, and rim elevations) should be confirmed by field surveys. In addition, it is recommended that the City install flow depth monitoring devices (e.g., SmartCovers®) to monitor for possible surcharging at the locations indicated in Table 6-4. It is also recommended that the modeled capacity exceedances at the Cumberland & 5-Mile Slough PS and the Don Avenue & Santiago PS be confirmed through flow metering and/or pump run time logging. In addition, the operational conditions resulting in upstream surcharging at Swenson PS, Waterloo and Roosevelt PS, and 14-Mile Slough PS should be investigated and corrected where appropriate.

In addition to modeled capacity concerns, the City maintains and updates a CIP list that includes recommended collection system rehabilitation improvements to address condition-related deficiencies. Condition-related deficiencies involving pump stations and force mains (designated as P-#) are summarized in Table ES-4. Condition-related deficiencies requiring rehabilitation of gravity sewers (designated as R-#) are summarized in Table ES-5. Both groups are presented schematically in Figure ES-7. It is also recommended that the City undertake a City-wide pump station assessment to determine whether any other pump stations may require modification or rehabilitation.

Table ES-4. City-Identified Pump Stations and Force Mains with Condition-Related Concerns

Designation	Facilities	Priority	City Project No.
P-1	14-Mile Slough PS	High	UW20022/M20022
P-2	5-Mile Slough Force Main	High	M18015
P-3	Lincoln Street PS and Force Main	High	UW24005
P-4	Westside Interceptor Parallel Force Main	High	UW22004
P-5	Swenson (North) PS	High	UW24003
P-6	Brookside Estates PS	Medium	UW23003
P-7	College Park PS	Medium	UW25003
P-8	Don & Santiago PS	Medium	UW13010/M13010
P-8	Drake & Hwy-99 PS	Medium	UW25005
P-10	Kelley & Mosher PS	Medium	UW24004
P-11	Quail Lakes PS	Medium	UW21015/M21015
P-12	Thornton & Davis PS	Medium	UW13009/M13009
P-13	Waterloo & Roosevelt PS	Medium	UW25004
P-14	Camanche & Ridgeway PS	Medium	UW25002
P-15	Plymouth & 5 Mile Creek PS	Medium	UW23001

ES.7 ANALYSIS OF FUTURE FLOW CONDITIONS

Modeled conditions for the 2040 timeframe consist of flows for existing development conditions plus future flows from areas that do not currently discharge to the City's wastewater collection system. These future areas include General Plan Major Development Areas, General Plan Study Areas, additional 2040 development areas, unincorporated islands, and areas within the City limits currently served by septic tanks. The areas in question are shown on Figure ES-8.

Table ES-5. Previously Identified Gravity Sewer Condition-Related Deficiencies

Designation	Name	Extents	Existing Pipe Diameter, in	Approximate Length, LF	Priority	City Project No.
R-1	Church Street/Pershing Avenue trunk sewer	Harrison Street to Navy Drive	24	5,600	High	UW17023/M17023
R-2	Mormon Slough trunk sewer	Jefferson Street to Worth Street	24	2,700	High	UW18030/M18030
R-3	Navy Drive I-5 trunk sewer	Anderson Street to Swift Way	42 & 54	1,700	High	M17026
R-4	Navy Drive parallel trunk sewers	Swift Way to west of Fresno Avenue	24, 30 & 48	8,700	High	M15003
R-5	Oak Street trunk sewer	Wilson Way to Pershing Avenue	21 & 24	11,000	High	UW20016/M20016
R-6	Pershing Avenue sewer	Oak Street to Tuxedo Avenue	24	4,300	High	UW23008
R-7	Ralph Avenue trunk sewer, Phase 1	Mariposa Road to B Street	30	9,200	High	M18024
R-8	Sierra Nevada Street trunk sewer	Hazelton Avenue to Worth Street	36	1,100	High	UW18029/M18029
R-9	Union Street sewer	Harding Way to Oak Street	10 & 12	4,300	High	UW21007/M21007
R-10	Worth Street trunk sewer	Sierra Nevada Street to Anderson Street	36	8,400	High	M18028
R-11	Airport Way trunk sewer	San Joaquin Fairgrounds to Ralph Avenue	30	5,800	Medium	UW21017/M21017
R-12	Alturas Avenue sewer	Quincy Street to Swain Road	12	2,000	Medium	UW23010
R-13	E. Bianchi Street/ Pardee Lane sewer	Townehome Drive to March Lane	12, 15 & 18	6,900	Medium	UW24008
R-14	Harding Way sewer	Wilson Street to Union Street	12	1,500	Medium	UW25008
R-15	Hazelton Avenue trunk sewer	Della Street to Pilgrim Street	24 & 36	1,900	Medium	UW24011
R-16	Lincoln Road trunk sewer	Pershing Avenue to Alexandria Place	36	3,000	Medium	UW21018/M21018
R-17	Longview Avenue sewer	El Dorado Street to Pacific Avenue	12	3,200	Medium	UW23006
R-18	March Lane trunk sewer	I-5 to Brookside Estates PS	24 & 30	8,400	Medium	UW25006
R-19	Ralph Avenue trunk sewer, Phase 2	Airport Way to Perlman Drive	42	2,400	Medium	UW25012
R-20	Rosemarie Lane sewer	Manchester Avenue to Crowne Avenue	12	1,400	Medium	UW23014
R-21	Ryde Avenue trunk sewer	River Drive to Telegraph Avenue	30 & 36	1,400	Medium	UW25009
R-22	Sperry Road/Gibraltar Court sewer	Airport Way to Industrial Drive	24 & 27	6,200	Medium	UW23009
R-23	Tuxedo Avenue sewer	Kensington Way to Orange Street	16	1,900	Medium	UW23007
R-24	Backyard and smaller diameter sewers	Scribner/7th/Howard/Pilgrim Streets	6 & 8	TBD	Medium	various

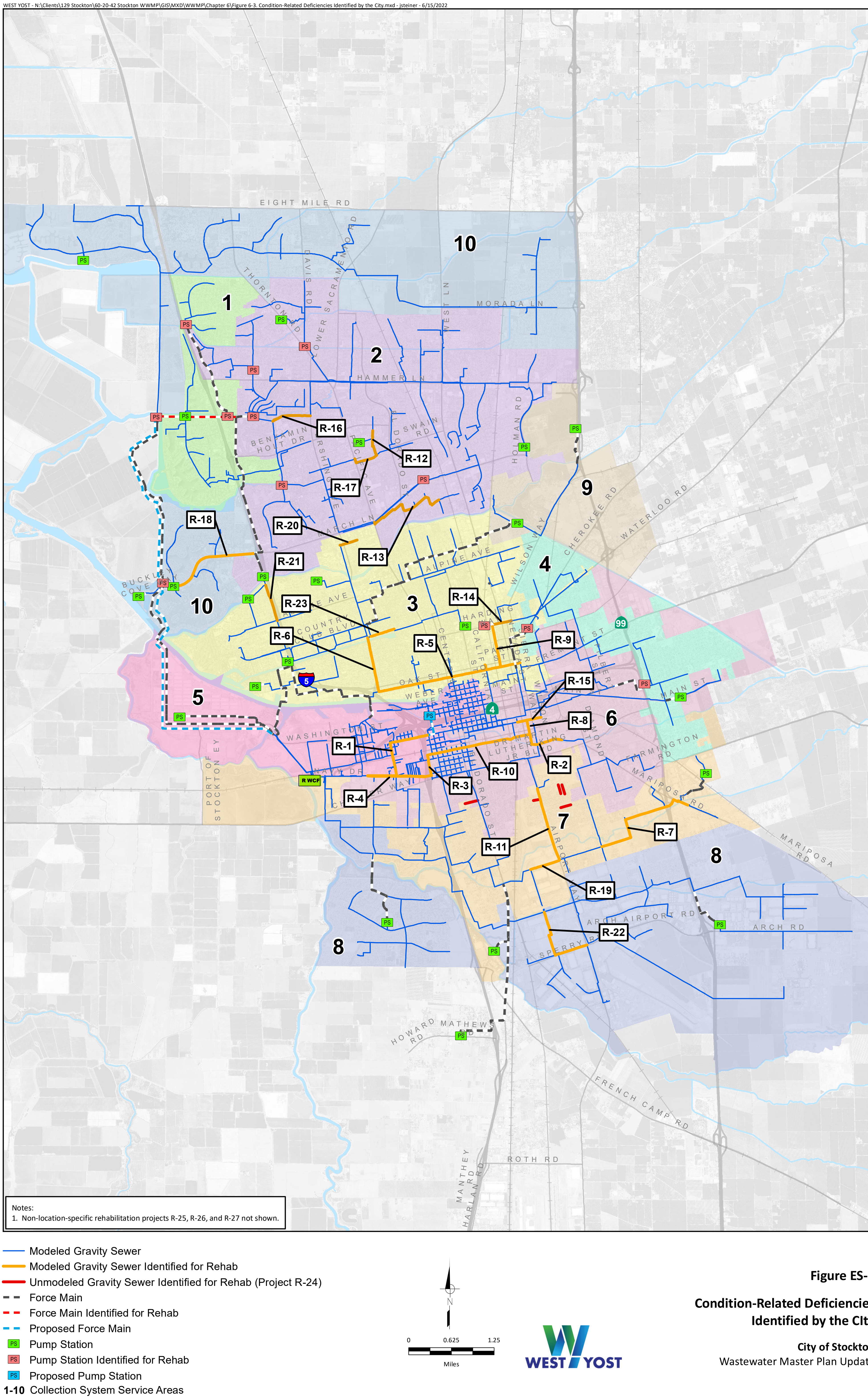
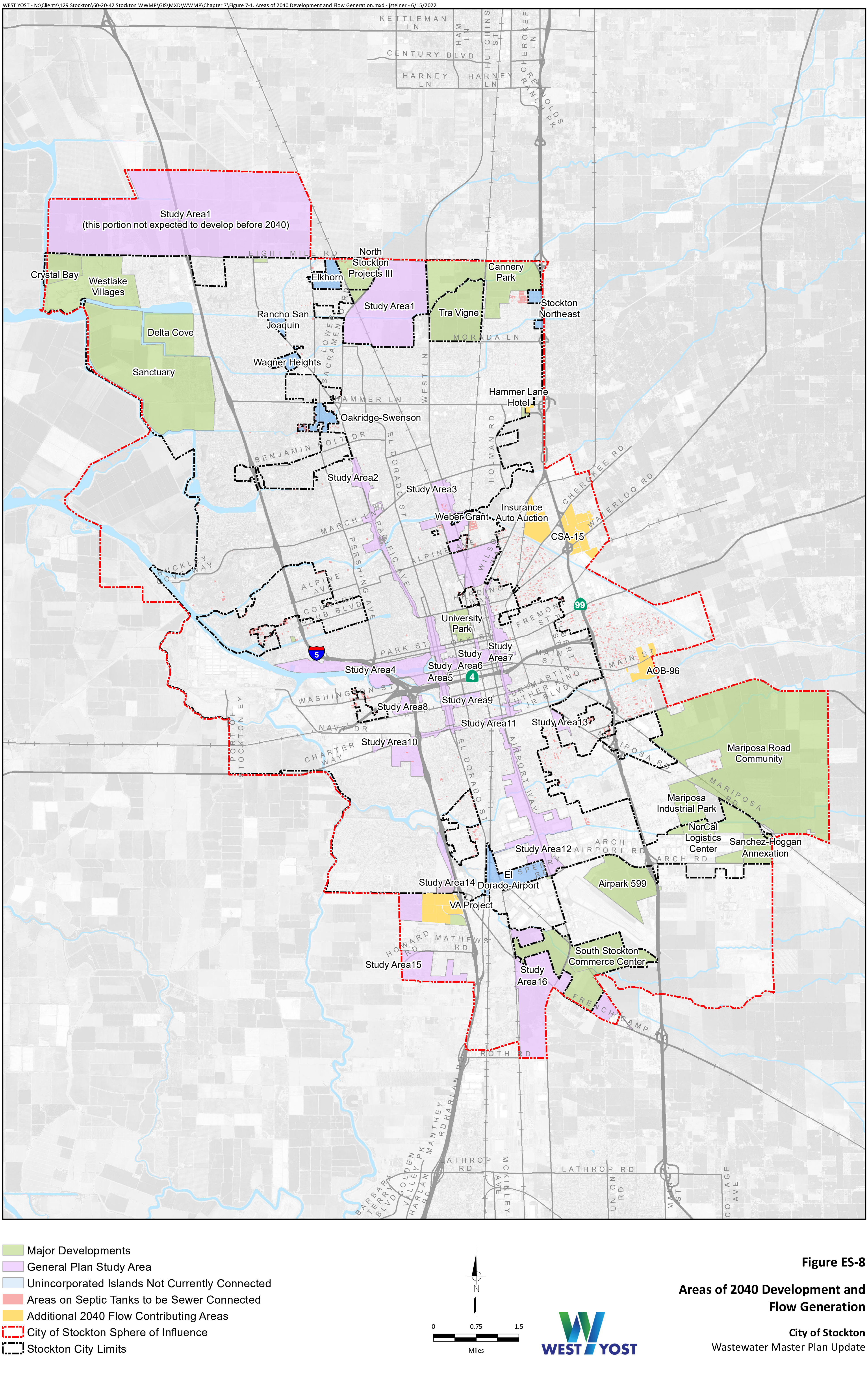


Figure ES-7

Condition-Related Deficiencies Identified by the CIty

City of Stockton
Wastewater Master Plan Update



Major Developments
General Plan Study Area
Unincorporated Islands Not Currently Connected
Areas on Septic Tanks to be Sewer Connected
Additional 2040 Flow Contributing Areas
City of Stockton Sphere of Influence
Stockton City Limits

WEST YOST

Figure ES-8

Areas of 2040 Development and Flow Generation

City of Stockton
Wastewater Master Plan Update

Modeled future system infrastructure, including pump stations, force mains, and gravity sewer pipes of 12-inch diameter and larger, is shown in Figure ES-9. The indicated infrastructure layout is based on preliminary layouts by recent development project proponents, or is based on an analysis of surface topography, critical surface features (such as highways, railroads, and stream channels), and sewer pipe depths. The exact configuration of collection system facilities serving future areas is subject to change as development plans proceed.

Modeled system deficiencies for 2040 conditions are only slightly more severe than those shown above for existing conditions. Gravity sewer deficiencies for 2040 conditions are shown in Table ES-6. Pump station results for 2040 conditions are shown in Table ES-7. As shown in Table ES-6, three additional gravity sewers show either Priority 2 or Priority 3&4 surcharging for modeled 2040 development conditions that did not surcharge under modeled existing peak flow conditions. As shown in Table ES-7, Don Avenue & Santiago PS, Cumberland & 5-Mile Slough PS, and Westlake PS are all over capacity at modeled 2040 peak flow conditions, while the force mains for 14-mile Slough PS and Westlake PS are undersized for modeled 2040 peak flow conditions.

It should be noted that the model may overstate peak flows at the Westlake PS because the tributary development areas have previously been defined to include approximately 87 acres of existing and planned lakes that are designated as Low Density Residential development. Removing such areas from the calculation results in 2040 peak flows much closer to the firm capacities of the pump station and force main.

In addition to evaluating 2040 flow conditions, it is also necessary to consider collection system flows associated with the buildout of the City's Sphere of Influence. The analysis of buildout flow conditions is needed to ensure that any future upsizing of collection system pipes is adequate to accommodate development consistent with planned future land uses through General Plan buildout.

Development of the buildout model requires adding future flow inputs that are not accounted for in the 2040 conditions model, specifically: 1) currently vacant parcels not accounted for in any of the 2040 development areas; and 2) additional flows that may be added to the 2040 development areas after 2040. As shown in Table ES-8, the number of pipes where the model indicates surcharging is substantially greater for buildout than for 2040 conditions. Specifically, the model shows a total of 14 sewer runs where modeled surcharging is indicated for buildout conditions but not for existing or 2040 conditions.

Buildout model results for existing pump stations are presented in Table ES-9. Buildout model results for future pump stations are presented in Table ES-10. In addition to the stations previously identified as being over capacity for 2040 conditions, the Drake & Highway-99 PS, Smith Canal & Fontana PS, Swenson (North) PS, and Waterloo & Roosevelt PS are all shown as over capacity for buildout peak flow conditions. Moreover, in addition to the 14-Mile Slough PS force main and the Westlake PS force main being undersized for buildout peak flow conditions (as also indicated for 2040 conditions), the Sinclair & Highway-4 PS force main is also shown as being undersized for buildout peak flow conditions.

One issue of note involves the pump station location and force main alignment that would serve the Mariposa Road Community development area planned for 2040 and beyond. Previous collection system planning showed the force main alignment along a northerly route through Systems 6 and 5, but this alignment included construction through relatively congested areas. The preferred force main alignment would follow existing major trunk sewer routes either through System 7 or through System 8, as shown in Figure ES-9.

Table ES-6. Modeled Gravity Sewer Capacity Deficiencies, 2040 Development Conditions, 10-Year, 24-Hour Design Storm																
ID #	Designation	Priorities	System	GIS Year Constructed	Upstream MH ID	Upstream MH Location	Downstream MH ID	Downstream MH Location	GIS Pipe Dia, in	Upsized Pipe Dia, in	Total Length, ft	No. of Pipe Segments	Depth to Pipe Crown, ft	Maximum Flow, mgd	Maximum Surcharge, ft	Minimum Headspace, ft
Priority 1 Group																
1-1	E. Marsh Street sewer	1,2,4	6	1895–1940	32R072	Olympic Circle	33P105	S. Sierra Nevada Street	18	24	7,406	21	4.0 to 10.4	4.01	5.3	0
1-2	El Dorado Street / S. Center Street sewer	1,2,4	6	1905–1915	37N043	E. 6th Street	36M016	E. Charter Way	16	21,24	2,832	9	7.4 to 12.1	3.54	8.9	0
1-3	S. Wilson Way sewer	1,2	6	1947	34P082	E. Worth Street	35P012	Mormon Slough	10,12	21	1,001	5	7.6 to 8.6	2.73	8.1	0
1-4	E. 6th Street	1,2	6	1900	37N034	S. San Joaquin Street	37N043	El Dorado Street	12	18	701	4	10.2 to 10.8	1.89	10.7	0
Priority 2 Group																
2-1	E. Main Street sewer	2,4	6	1910–1984	33T029	S. Oro Avenue	33Q014	E. Washington Street	12,16	18	8,756	27	7.6 to 10.3	1.74	6.1	2.1
2-2	W. Washington Street / Port Road 23 sewer	2,3	5	no data	34J016	west of Port Road 13	36H003	north of Navy Drive	12,15,18	18,21	3,800	9	5.6 to 11.8	2.93	4.9	4.0
2-3	Don Avenue / Meadow Avenue sewer	2	2	1957–1973	20G060	Santiago Way	21G051	Oak Creek Drive	12	15	2,171	10	8.1 to 9.8	1.59	5.7	2.6
2-4	S. El Dorado Street sewer	2,4	6	1900–1910	35M031	E. Worth Street	36N016	E. Charter Way	12	15	1,815	5	8.9 to 11.5	1.19	2.0	6.9
2-5	Del Norte Street sewer	2,4	5	1949–1959	34K004	Force main outlet	35K030	W. Scotts Avenue	36	42	4,132	12	4.4 to 9.3	22.06	1.3	4.2
Priority 3&4 Group																
4-1	Market Street sewer	4	5	1900–1920	33M079	S. El Dorado Street	34L002	S. Lincoln Street	12,14,16,18	18,24	2,320	8	12.4 to 16.1	1.94	2.6	11.2
4-2	Church Street/Pershing Avenue sewer	4	5	1917	34L022	S. Harrison Street	36L035	Navy Drive	24	30	5,613	15	9.5 to 15.0	3.73	2.3	9.2
4-3	Waterloo Road sewer	4	3	1920–1984	29Q063	Williams Street	30P039	Hiawatha Avenue	12,15	15,18	1,834	8	21.9 to 23.7	2.30	1.8	20.1
4-4	N. Lincoln Street sewer	4	5	1920	33L036	upstream terminus	33L039	N. Lincoln Street	4	8	161	4	14.0 to 14.8	0.18	2.2	11.8

Table ES-7. Modeled Pump Station Results, 10-Year, 24-Hour Design Storm, 2040 Development Conditions					
Pump Station	System	Firm Capacity, mgd	Peak Flow, mgd [(a)]	Force Main Diameter, in	Maximum Force Main Velocity, ft/sec [(a)]
14-Mile Slough	10	(b)	30.82	30	9.7
Alexandria & 14-Mile Slough	2	1.97	1.21	15	1.5
Arch Road	8	8.70	0.92	24	0.5
Blossom Ranch	2	1.30	0.56	8	2.5
Brookside Estates	10	8.64	2.61	20	1.9
Camanche & Ridgeway	2	2.40	0.94	none	--
County Hospital	--	2.16	0.20	dual 10	0.3
Cumberland & 5-Mile Creek	1	4.32	5.68	16	6.3
Don Ave & Santiago	2	0.79	1.45	15	1.8
Drake & Highway 99	4	3.54	3.39	14	4.9
Grupe Business Park	7	0.86	0.036	8	0.2
Kelly & Mosher Slough	1	4.32	1.96	12	3.9
March-Brookside & I-5	2	1.15	0.76	8	3.4
Origone	9	5.18	0	16	0.0
Plymouth & 5-Mile Creek	1	1.25	0.49	8	2.2
Sanguinetti	9	15.98	4.70	24	2.3
Sinclair Avenue & Highway 4	7	4.32	0.123	10	0.3
Smith Canal & Fontana	3	37.92	37.36	dual 30	5.9
Swenson (North)	2	20.16	18.89	dual 24	4.7
Thornton & Davis	2	1.22	1.13	8	5.0
Waterloo & Roosevelt	4	2.74	2.60	12	5.1
Westlake	10	4.35	5.18	12	10.2
Weston Ranch	8	15.98	5.53	dual 30	0.9

(a) Exceedances of pump station firm capacity and the force main velocity criterion of 8 ft/sec are highlighted in yellow.

(b) Cannot be calculated due to unknown pump capacities; see Table 2-9.

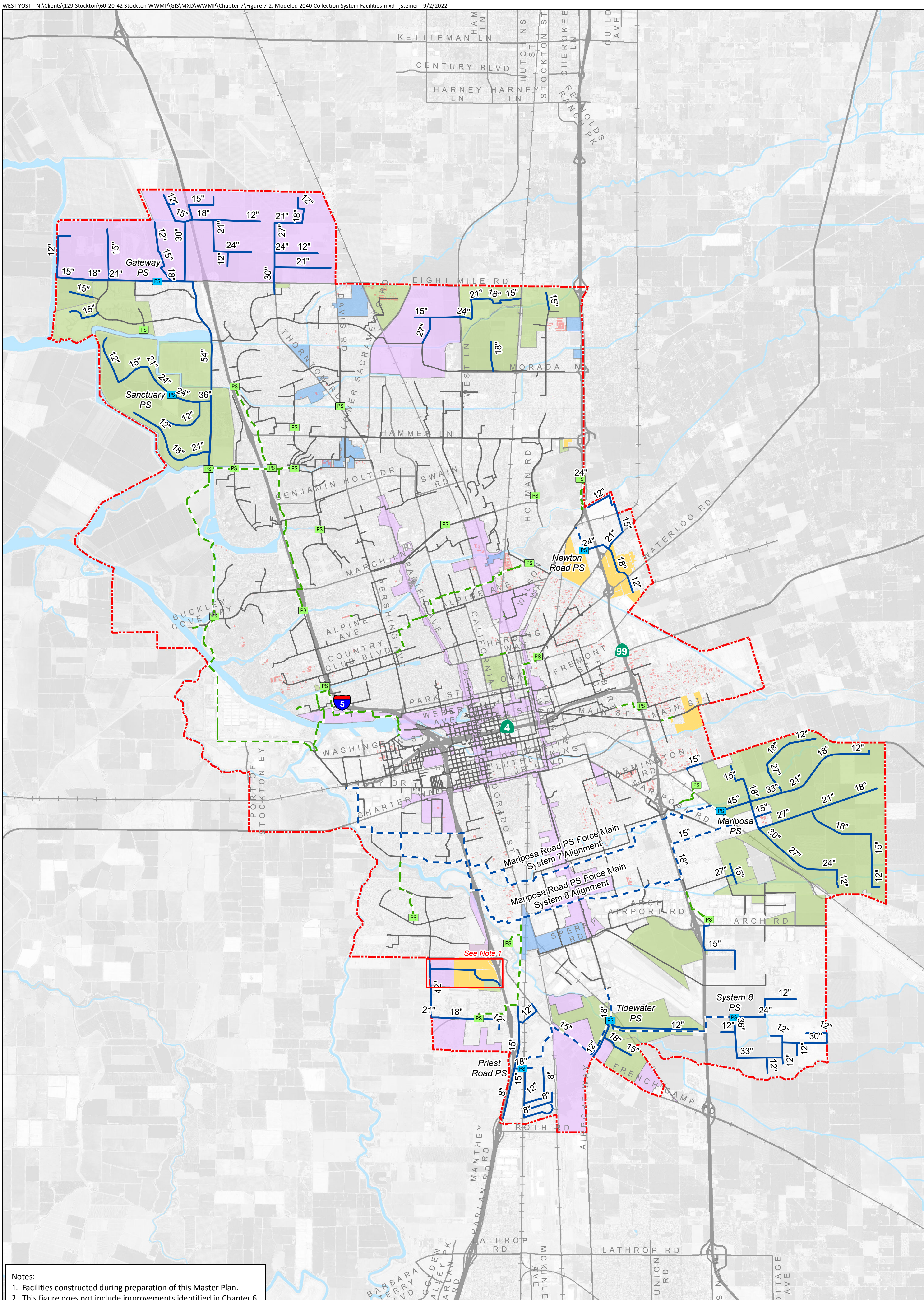
Table ES-8. Modeled Gravity Sewer Capacity Deficiencies, Buildout Development Conditions, 10-Year, 24-Hour Design Storm															
ID #	Designation	Priorities	System	GIS Year Constructed	Upstream MH ID	Upstream MH Location	Downstream MH ID	Downstream MH Location	GIS Pipe Dia, in	Total Length, ft	No. of Pipe Segments	Depth to Pipe Crown, ft	Maximum Flow, mgd	Maximum Surcharge, ft	Minimum Headspace, ft
Priority 1 Group (Ex. And 2040 Conditions)															
1-1	E. Marsh Street sewer	1,2,4	6	1895–1940	32R072	Olympic Circle	33P105	S. Sierra Nevada Street	18	7,406	21	4.0 to 10.4	4.34	5.9	0
1-2	El Dorado Street / S. Center Street sewer	1,2,4	6	1905–1915	37N043	E. 6th Street	36M016	E. Charter Way	16	2,832	9	7.4 to 12.1	3.58	10.0	0
1-3	S. Wilson Way sewer	1,2	6	1947	34P082	E. Worth Street	35P012	Mormon Slough	10,12	1,001	5	7.6 to 8.6	2.97	8.1	0
1-4	E. 6th Street	1,2	6	1900	37N034	S. San Joaquin Street	37N043	El Dorado Street	12	701	4	10.2 to 10.8	1.77	10.7	0
Priority 2 Group (Ex. & 2040 Conditions)															
2-1	E. Main Street sewer	2,4	6	1910–1984	33T029	S. Oro Avenue	33Q014	E. Washington Street	12,16	8,756	27	7.6 to 10.3	1.95	8.2	0
2-2	W. Washington Street / Port Road 23 sewer	2,3	5	no data	34J016	west of Port Road 13	36H003	north of Navy Drive	12,15,18	3,800	9	5.6 to 11.8	2.92	5.2	3.6
2-3	Don Avenue / Meadow Avenue sewer	2	2	1957–1973	20G060	Santiago Way	21G051	Oak Creek Drive	12	2,171	10	8.1 to 9.8	1.75	8.4	0
2-4	S. El Dorado Street sewer	2,4	6	1900–1910	35M031	E. Worth Street	36N016	E. Charter Way	12	1,815	5	8.9 to 11.5	1.20	2.9	6.1
2-5	Del Norte Street sewer	2,4	5	1949–1959	34K004	Force main outlet	35K030	W. Scotts Avenue	36	4,132	12	4.4 to 9.3	21.19	3.3	1.9
Priority 3&4 Group (Ex. & 2040 Conditions)															
4-1	Market Street sewer	4	5	1900–1920	33M079	S. El Dorado Street	34L002	S. Lincoln Street	12,14,16, 18	2,320	8	12.4 to 16.1	1.98	4.1	9.5
4-2	Church Street/Pershing Avenue sewer	4	5	1917	34L022	S. Harrison Street	36L035	Navy Drive	24	5,613	15	9.5 to 15.0	4.62	3.9	8.2
4-3	Waterloo Road sewer	4	3	1920–1984	29Q063	Williams Street	30P039	Hiawatha Avenue	12,15	1,834	8	21.9 to 23.7	2.57	2.9	19.0
4-4	N. Lincoln Street sewer	4	5	1920	33L036	upstream terminus	33L039	N. Lincoln Street	4	161	4	14.0 to 14.8	0.05	1.8	12.4
Buildout-Only Group															
B-1	Sierra Nevada Street sewer	1,2	3,6	1895–1900	32P048	E. Lindsay Street	33P105	E. Sonora Street	18	3,312	9	5.1 to 10.5	3.69	6.2	0
B-2	Church Street trunk sewer	4	5,6	1895–1985	33P105	E. Sonora Street	34L037	S. Harrison Street	27	9,558	27	9.4 to 13.0	7.59	2.5	8.8
B-3	Mormon Slough sewer	2,4	6	1956	34Q037	E. Jefferson Street	34P088	Worth Street	24	2,617	5	4.7 to 18.6	7.08	3.7	1.2
B-4	Worth Street trunk sewer	4	6	1920–1945	34P088	S. Sierra Nevada Street	35L034	W. Anderson Street	36	8,502	17	6.7 to 20.8	14.71	3.0	4.2
B-5	Navy Drive west trunk sewer (42")	1,2,4	5	1997	34G023	San Joaquin River crossing	36H902	RWCF	42	4,602	12	7.8 to 14.2	63.52	13.8	0
B-6	Oak Street trunk sewer	2,4	3	1900–1958	31P131	Grant Street	33K010	McNabb Place	21,24	8,444	25	8.8 to 11.8	4.49	2.2	7.4
B-7	N Pershing Avenue trunk sewer	2,4	3	1958	33K010	Oak Street	31K106	Tuxedo Avenue	20,24	4,260	21	9.1 to 16.2	5.40	1.5	7.7
B-8	Oro Avenue / Horner Avenue	1,2,4	4,6	1984	33T027	E. Main Street	32S052	S. Drake Avenue	12,18	2,817	10	21.5 to 25.8	4.34	10.2	11.3
B-9	Oak Creek Drive / Park Woods Drive	4	2	1957	21G062	Meadow Avenue	22G031	Bonniebrook Drive	12	1,511	8	10.6 to 12.6	1.23	1.3	9.5
B-10	Union Street sewer	2,3	3	1890–1918	30N015	Harding Way	32N016	Oak Street	10,12	3,305	8	6.1 to 10.7	1.00	1.0	5.1
B-11	A.G. Spanos Boulevard sewer	2,4	10	1993–2006	14F017	Thornton Road	16F018	Whistler Way	24	4,399	14	13.7 to 16.9	7.68	5.8	9.4
B-12	Weber Avenue sewer	3,4	5	1920	33L067	Mormon Slough	33L048	N. Lincoln Street	6,8	1,791	7	6.3 to 12.7	0.52	2.0	5.9
B-13	Navy Drive west trunk sewer (30")	2	5	1959	34G016	San Joaquin River crossing	36H007	RWCF	30,36	4,080	9	4.6 to 10.2	24.62	2.2	5.4
B-14	S. Airport Way sewer	1,2,4	8	1974	45R005	S. Longe Street	42R024	Sperry Road	18	5,022	16	7.5 to 12.3	15.20	12.9	0
B-15	Performance Drive	1,2	8	1974	44Q001	Aviation Drive	44R013	S. Airport Way	12	2,073	6	3.6 to 9.4	1.22	8.2	0

Table ES-9. Modeled Pump Station Results, 10-Year, 24-Hour Design Storm, Buildout Development Conditions					
Pump Station	System	Firm Capacity, mgd	Peak Flow, mgd [(a)]	Force Main Diameter, in	Maximum Force Main Velocity, ft/sec [(a)]
14-Mile Slough	10	(b)	60.58	30	19.1
Alexandria & 14-Mile Slough	2	1.97	1.23	15	1.5
Arch Road	8	8.70	4.39	24	2.2
Blossom Ranch	2	1.30	0.66	8	2.9
Brookside Estates	10	8.64	2.72	20	1.9
Camanche & Ridgeway	2	2.40	1.20	none	--
County Hospital	--	2.16	0.89	dual 10	1.3
Cumberland & 5-Mile Creek	1	4.32	6.10	16	6.8
Don Ave & Santiago	2	0.79	1.60	15	2.0
Drake & Highway 99	4	3.54	4.34	14	6.3
Grupe Business Park	7	0.86	0.397	8	1.8
Kelly & Mosher Slough	1	4.32	1.86	12	3.7
March-Brookside & I-5	2	1.15	0.76	8	3.4
Origone	9	5.18	2.16	16	2.4
Plymouth & 5-Mile Creek	1	1.25	0.49	8	2.2
Sanguinetti	9	15.98	8.83	24	4.3
Sinclair Avenue & Highway 4	7	4.32	1.58	10	4.5
Smith Canal & Fontana	3	37.92	44.30	dual 30	7.0
Swenson (North)	2	20.16	20.23	dual 24	5.0
Thornton & Davis	2	1.22	1.20	8	5.3
Waterloo & Roosevelt	4	2.74	3.46	12	6.8
Westlake	10	4.35	5.03	12	9.9
Weston Ranch	8	15.98	10.03	dual 30	1.6

(a) Exceedances of pump station firm capacity and the force main velocity criterion of 8 ft/sec are highlighted in yellow.

(b) Cannot be calculated due to unknown pump capacities; see Table 2-9.

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 7\Figure 7-2. Modeled 2040 Collection System Facilities.mxd - jsteiner - 9/2/2022



Notes:
1. Facilities constructed during preparation of this Master Plan.
2. This figure does not include improvements identified in Chapter 6.

- Modeled Existing Gravity Sewer
- Modeled Existing Force Main
- Future Gravity Sewer
- Future Force Main
- Existing Pump Station
- Future Pump Station
- Major Developments
- General Plan Study Area
- Unincorporated Islands
- Areas on Septic Tanks to be Sewer Connected
- Additional 2040 Developments
- City of Stockton Sphere of Influence

0 0.75 1.5
Miles

WEST YOST

Figure ES-9

Modeled Future Collection System Facilities

City of Stockton
Wastewater Master Plan Update

Table ES-10. New Pump Station and Force Main Facilities Needed to Serve Buildout Development					
Name	Development Area	Peak Flow, mgd	Force Main Length, feet	Force Main Diameter, inches	Peak Flow Velocity, feet/sec
Gateway	Study Area 1	14.88	<10	24	7.3
Mariposa	Mariposa Road Community	25.22	36,100(a)	30	8.0
Newton Road	CSA-15/Insurance Auto Auction	4.50	2,200	14	6.5
Priest Road	South Stockton Commerce Center/Study Area 16	4.52	2,300	14	6.5
Sanctuary	Sanctuary	4.24	<10	14	6.1
System 8	South Stockton Commerce Center/Study Area 16	15.26	4,300	24	7.5
Tidewater	South Stockton Commerce Center	23.71	2,800	30	7.5

(a) System 7 alignment assumed for a force main from the development area to the RWCF. However, it is recommended. that a shorter force main be constructed in the interim that is directed into the existing trunk sewer along the System 8 pathway.

The Mariposa Road Community development area is predicted to produce a peak flow of 14.0 mgd by 2040 and 23.9 mgd by buildout, based on the planning factors presented in Chapter 4. The model indicates that existing gravity trunk sewers could accommodate these flows for an interim period, especially along the System 8 pathway. However, the model also indicates that insufficient gravity flow capacity exists to accommodate buildout flows from this area. Accordingly, the City will need to decide what infrastructure is needed right away to accommodate the Mariposa Road development area and whether some infrastructural requirements can be delayed. For purposes of master planning, it is recommended that the Mariposa Road development area pump station be constructed to allow for future expansion that can accommodate equipment capable of pumping all flows directly to the RWCF, but that a shorter force main be constructed in the interim that is directed into the existing trunk sewer along the System 8 pathway.

ES.8 RECOMMENDED WASTEWATER COLLECTION SYSTEM CIP

Preliminary planning level cost estimates prepared for this Master Plan are considered Class 5 Estimates in accordance with the guidelines of the Association for the Advancement of Cost Engineering (AACE) International. Construction and capital cost estimates are presented in March 2022 dollars. Construction costs were developed based on a combination of data supplied from manufacturers, historical bids on other wastewater facilities design projects built by other public agencies, construction costs previously estimated by West Yost, and standard cost estimating guides. Subsequent preliminary and detailed design efforts will serve to refine and confirm the estimates. The estimates have not been adjusted to account for unusual market conditions occurring in 2022 which may dramatically increase the cost of projects constructed in 2022 and potentially in 2023 or later.

Costs developed in this Master Plan include those for traditional gravity sewer construction, trenchless pipe construction, pump stations, and force main piping. In addition, the total CIP costs include a design and construction contingency of 35 percent, and a project cost allowance of 45 percent (including 15 percent for engineering, 15 percent for construction management, and 15 percent for implementation). It is assumed that the recommended facilities will be developed in public rights-of-way or on public property; therefore, land acquisition costs have not been included. Construction cost estimates do not include costs for annual O&M nor any allowance for project financing costs.

A recommended CIP list is presented in Table ES-11. The City's existing CIP list is included as Appendix G. The major categories shown in Table ES-11 include:

- Pump Station and Force Main Improvements, Existing Conditions (designated as P-#)
- Rehabilitation of Existing Gravity Sewer Facilities (designated as R-#)
- Capacity Improvements to Existing Gravity Sewer Facilities (designated as C-#)
- Future (2040) CIP Facilities (designated as F-#)
- Recommended Studies (designated as S-#)
- Watch List Items (designated as W-#)
- Projects to be Removed from the City's Existing CIP List (designated as X-#)

All of these items except the recommended studies and the projects to be excluded from the City's existing CIP list are shown schematically in Figure ES-10.

There are 17 items shown for the Pump Station and Force Main Improvements category, all but two of which were identified in the City's existing CIP list. The most significant items in the list are the 14-Mile Slough PS improvements (Item P-1), the 5-Mile Slough Force Main investigation and improvements (Item P-2), the Lincoln Street PS and Force Main (Item P-3), the Westside Interceptor Parallel Force Main (Item P-4), and the Swenson PS (Item P-5). The remaining items on the list involve inspecting existing pump station components and/or capacities and determining needed improvements. Item P-17 is a general recommendation to rehabilitate and modernize pump stations not otherwise identified in the City's existing CIP list.

There are 27 items shown for the Rehabilitation of Existing Gravity Sewer Facilities category, all of which were identified in the City's existing CIP list. Items R-1 through R-10 are considered to be high priority and are recommended for completion within a five-year time frame (2027). Items R-11 through R-24 are considered to be medium priority and are recommended for completion within a ten-year time frame (2032). Items R-25 though R-27 are general rehabilitation categories that are not location-specific.

There are nine items shown for the Capacity Improvements to Existing Gravity Sewer Facilities category, only two of which (Items C-5 and C-9) were identified in the City's existing CIP list. Items C-1 through C-9 reflect the items shown in Table ES-6 for the Priority 1 Group and the Priority 2 Group. In all cases, it is recommended that the City proceed with surcharge and/or flow monitoring of the lines in question before proceeding with the design of improvements.

There are four items shown for the Recommended Studies category. Items S-1 and S-2 are existing City CIP projects to perform assessments on all pump stations and force main not otherwise identified in the City's existing CIP list. Additionally, a corrosion and odor control study (S-3) is recommended to assess the effectiveness of existing odor/corrosion control facilities and to identify necessary improvements, and a West Side Interceptor alignment study (S-4) is recommended in advance of Items P-4 above.

There are seven items shown for the Watch List category. Items on this list either show significant surcharging that does not approach outflows under existing conditions, or are modeled as flowing more than 80 percent full and were previously identified in the City's CIP list. For all of these items, either flow metering or remote level monitoring (e.g., SmartCover® or equivalent) is recommended.

Table ES-11. Recommended Capital Improvement Plan

ID	Name	Description	Justification	Time Frame	Quantities	Actions/Notes	Capital Cost, $M	City CIP Project
Pump Station and Force Main Improvements, Existing System								
P-1	14-Mile Slough PS Improvements	Modify existing pump station to address mechanical equipment failures.	Existing pump station suffers from chronic mechanical failures that warrant modifications to accommodate different pumping equipment.	2027 (start by 2023)	Pump station modifications	Proceed with design and construction of station improvements to address short-term operational concerns; conduct evaluation by 2023 to identify long-term capacity needs	3.60	UW20022/M20022
P-2	5-Mile Slough Force Main	Inspect and rehabilitate or replace existing force main piping	Previously identified as needing inspection/rehabilitation	2027 (start by 2023)	Force main modification/ replacement	Proceed with inspection, assessment, and rehabilitation/ replacement	0.3 (City estimate; assessment only)	M18015
P-3	Lincoln Street PS and Force Main	Construct PS and force main; abandon existing siphon; redirect local flow inputs	Existing siphon is over 100 years old and in poor condition; siphon failure would have severe consequences for system operations	2027 (start by 2023)	~4 mgd pump station and ~1,800 LF of force main[(a)]	Update previous design; proceed with construction	8.60	UW24005
P-4	Westside Interceptor Parallel Force Main	Construct new parallel force main serving 14-Mile Slough PS and other tributary pump stations	Existing pump force main sizing not adequate for future flow conditions; condition of existing force main unknown	2027 (start by 2023)	~32,000 LF of 36-inch diameter parallel force main[(a)]	Proceed with design and construction of parallel force main; estimated costs do not include ROW acquisition	51.8	none
P-5	Swenson (North) PS	Assess pump station components, operation, and capacity	Pump station is not keeping up with incoming flows for both wet and dry weather conditions	2027 (start by 2023)	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	2.90	UW24003
P-6	Brookside Estates PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.90	UW23003
P-7	College Park (Park View) PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.80	UW25003
P-8	Don Avenue & Santiago PS	Inspect and rehabilitate existing pump station components; upsize existing PS capacity, as needed	Previously identified as needing inspection/rehabilitation; modeled peak flows exceed station capacity	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement; flow or pump runtime monitoring is recommended to confirm capacity concerns	0.50	UW13010/M13010
P-9	Drake & Hwy-99 PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	1.30	UW25005
P-10	Kelley & Mosher PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.50	UW24004
P-11	Quail Lakes (Alexandria and 14-Mile Slough) PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.60	UW21015/M21015
P-12	Thornton & Davis PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.70	UW13009/M13009
P-13	Waterloo & Roosevelt PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation; pump station is not keeping up with incoming flows for both wet and dry weather conditions	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.60	UW25004
P-14	Camanche & Ridgeway PS	Inspect and rehabilitate existing pump station components	Previously-identified capacity upgrade; no current indication of capacity concerns	2032	--	Assess physical condition and functionality of pump station; address any major defects	0.60	UW25002
P-15	Plymouth & 5 Mile Creek PS	Inspect and rehabilitate existing pump station components	Previously-identified capacity upgrade; no current indication of capacity concerns	2032	--	Assess physical condition and functionality of pump station; address any major defects	2.40	UW23001
P-16	Cumberland & 5-Mile Creek PS	Assess pump station components, operation, and capacity; upsize existing PS capacity, as needed	Modeled peak flows exceed station capacity; pump station is not keeping up with incoming flows for both wet and dry weather conditions	2032	6.6 mgd pump station	Flow or pump runtime monitoring is recommended to confirm capacity concerns; cost estimate assumes a new pump station; however, existing station may be able to accommodate larger pumps	6.0	none
P-17	Pump Station Rehabilitation and Modernization	Implement improvements identified under Recommended Studies Item S-2 below	Aging pump station throughout the City are in need of rehabilitation or replacement	Annual, ongoing	Structural, mechanical, electrical, controls, site and security rehabilitation and modernization	Adjust annual budgeted amount upon completion of Item S-2	2.0/year	none

Table ES-11. Recommended Capital Improvement Plan

ID	Name	Description	Justification	Time Frame	Quantities	Actions/Notes	Capital Cost, $M	City CIP Project
Rehabilitation of Existing Gravity Sewer Facilities								
R-1	Church Street/Pershing Avenue trunk sewer	Replace/realign/upsize existing 24-inch diameter VCP along Church Street and Pershing Avenue from Harrison Street to Navy Drive	Existing VCP line has adverse slopes, is more than 100 years old, and is in advanced state of deterioration	2027	~5,600 LF of 30-inch diameter pipe; ~20 MHs[a]	Finalize existing design; proceed with construction of identified improvements; should be implemented in conjunction with Lincoln Street PS project (see above)	8.50	UW17023/M17023
R-2	Mormon Slough trunk sewer	Upsize/reconfigure ~2,700 LF of 24-inch diameter pipe; Jefferson Street to Worth Street	Identified by City as needing rehabilitation	2027	TBD	Extend design of replacement sewer to Worth Street; proceed with construction	6.80	UW18030/M18030
R-3	Navy Drive I-5 trunk sewer	CIPP line ~1,700 LF of 54-inch and 42-inch diameter pipe	Pipe is in an advanced state of deterioration	2027	Same as existing	Design complete; proceed with construction	1.90	M17026
R-4	Navy Drive parallel trunk sewers	CIPP line ~8,700 LF of 48-inch, 30-inch, and 24-inch diameter pipe	Pipe is in an advanced state of deterioration	2027	Same as existing	Design complete; proceed with construction	2.80	M15003
R-5	Oak Street trunk sewer	Rehabilitate ~11,000 LF of 24-inch and 21-inch diameter pipe; Wilson Way to Pershing Avenue	Identified by City as needing rehabilitation	2027	TBD	Proceed with assessment of existing pipes and design of improvements	11.70	UW20016/M20016
R-6	Pershing Avenue sewer	Rehabilitate ~4,300 LF of 24-inch diameter pipe; Oak Street to Tuxedo Avenue	Identified by City as needing rehabilitation	2027	TBD	Proceed with assessment of existing pipes and design of improvements	1.50	UW23008
R-7	Ralph Avenue trunk sewer, Phase 1	Rehabilitate ~9,200 LF of 30-inch diameter pipe; Mariposa Road to B Street	Identified by City as needing rehabilitation	2027	TBD	Proceed with assessment of existing pipes and design of improvements	1.00	M18024
R-8	Sierra Nevada Street trunk sewer	CIPP line ~1,100 LF of 36-inch diameter pipe	Identified by City as needing rehabilitation	2027	Same as existing	Design complete; proceed with construction	2.10	UW18029/M18029
R-9	Union Street sewer	Upsize/reconfigure existing 10-inch/ 12-inch diameter line; Harding Way to Oak Street	Line is severely damaged, prone to grease/debris accumulation, and subject to SSOs (per City staff); line is approaching full-pipe capacity	2027	~4,300 LF of 15-inch diameter pipe; ~10 MHs[a]	Proceed with design and construction of replacement sewer	4.3	UW21007/M21007
R-10	Worth Street trunk sewer	CIPP line ~8,500 LF of 36-inch diameter pipe	Pipe is in an advanced state of deterioration	2027	Same as existing	Design complete; proceed with construction	4.80	M18028
R-11	Airport Way trunk sewer	Rehabilitate ~5,800 LF of 30-inch diameter pipe; San Joaquin Fairgrounds to Ralph Avenue	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	5.00	UW21017/M21017
R-12	Alturas Avenue sewer	Rehabilitate ~2,000 LF of 12-inch diameter pipe; Quincy Street to Swain Road	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	0.60	UW23010
R-13	E. Bianchi Street/ Pardee Lane sewer	Rehabilitate ~7,000 LF of 12-inch and 15-inch diameter pipe; Quincy Street to Swain Road	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	16.70	UW24008
R-14	Harding Way sewer	Rehabilitate ~1,600 LF of 12-inch diameter pipe; Wilson Street to Union Street	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	1.60	UW25008
R-15	Hazelton Avenue trunk sewer	Rehabilitate ~1,900 LF of 24-inch and 36-inch diameter pipe; Della Street to Pilgrim Street	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	2.10	UW24011
R-16	Lincoln Road trunk sewer	Rehabilitate ~3,000 LF of 36-inch diameter pipe; Pershing Road to Alexandria Place	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	5.90	UW21018
R-17	Longview Avenue sewer	Rehabilitate ~3,200 LF of 12-inch diameter pipe; El Dorado Street to Pacific Avenue	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	1.10	UW23006
R-18	March Lane trunk sewer	Rehabilitate ~8,400 LF of 24-inch and 30-inch diameter pipe; I-5 to Brookside Estates PS	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	6.30	UW25006
R-19	Ralph Avenue trunk sewer, Phase 2	Rehabilitate ~2,400 LF of 42-inch diameter pipe; Airport Way to Perlman Drive	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	2.50	UW25012
R-20	Rosemarie Lane sewer	Rehabilitate ~1,400 LF of 12-inch diameter pipe; Manchester Avenue to Crown Avenue	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	1.60	UW23014
R-21	Ryde Avenue trunk sewer	Rehabilitate ~1,400 LF of 30-inch and 36-inch diameter pipe; River Drive to De Ovan Avenue	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	3.40	UW25009
R-22	Sperry Road/Gibraltar Court sewer	Rehabilitate ~6,200 LF of 24-inch and 27-inch diameter pipe; Airport Way to Industrial Drive	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	4.60	UW23009
R-23	Tuxedo Avenue sewer	Rehabilitate ~1,900 LF of 16-inch diameter pipe; Kensington Way to Orange Street	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	0.50	UW23007
R-24	Backyard and smaller diameter sewers	Replace 6-inch diameter sewers near Scribner/ 7th/ Howard/ Pilgrim Streets	Identified by City as needing rehabilitation	2032	TBD	Proceed with design and construction of replacement sewer	1.9	various
R-25	Sewer Maintenance Hole Rehab	Existing City CIP line item	Identified by City as needing rehabilitation	Ongoing	TBD	As needed	2.10	UW20011/M20011
R-26	Sanitary Sewer Small Diameter Lines Replacement	Existing City CIP line item	Identified by City as needing rehabilitation	Ongoing	TBD	As needed	1.80	UW21016/M21016
R-27	Sanitary Sewer Large Diameter Lines Replacement	Existing City CIP line item	Identified by City as needing rehabilitation	Ongoing	TBD	As needed	4.50	UW20020/M20020

Table ES-11. Recommended Capital Improvement Plan								
ID	**Name**	**Description**	**Justification**	**Time Frame**	**Quantities**	**Actions/Notes**	**Capital Cost, $M**	**City CIP Project**
Capacity Improvements to Existing Gravity Sewer Facilities								
C-1	E. Marsh Street sewer	Upsize existing 18-inch diameter sewer	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~7,400 LF of 24-inch diameter pipe; 22 MHs[a]	Monitor with level sensor and/or flow meter	11.8	none
C-2	El Dorado Street / S. Center Street sewer	Upsize existing 16-inch, 18-inch and 24-inch diameter sewers	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~2,800 LF of 24-inch diameter pipe; 10 MHs[a]	Monitor with level sensor and/or flow meter	4.5	none
C-3	S. Wilson Way sewer	Upsize existing 10-inch and 12-inch diameter sewers	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~1,000 LF of 21-inch diameter pipe; 6 MHs	Monitor with level sensor and/or flow meter	1.5	none
C-4	E. 6th Street	Upsize existing 12-inch diameter sewer	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~700 LF of 18-inch diameter pipe; 5 MHs[a]	Monitor with level sensor and/or flow meter	0.9	none
C-5	E. Main Street sewer	Upsize existing 12-inch and 16-inch diameter sewers	Existing conditions model shows potential for excessive surcharging	2035	~8,700 LF of 18-inch diameter pipe; ~30 MHs[a]	Monitor with level sensor and/or flow meter	10.7	none
C-6	W. Washington Street / Port Road 23 sewer	Upsize existing 12-inch, 15-inch and 18-inch diameter sewers	Existing conditions model shows potential for excessive surcharging	2035	~3,800 LF of 21-inch diameter pipe; 10 MHs[a]	Monitor with level sensor and/or flow meter	5.3	none
C-7	Don Avenue / Meadow Avenue sewer	Upsize existing 12-inch and 16-inch diameter sewers	Existing conditions model shows potential for excessive surcharging	2035	~2,200 LF of 15-inch diameter pipe; 2,200 LF of 21-inch diameter pipe; 18 MHs[a]	Monitor with level sensor and/or flow meter	5.5	none
C-8	S. El Dorado Street sewer	Upsize existing 12-inch diameter sewer	Existing conditions model shows potential for excessive surcharging	2035	~1,800 LF of 15-inch diameter pipe; 6 MHs[a]	Monitor with level sensor and/or flow meter	1.9	none
C-9	Del Norte Street sewer	Upsize existing 36-inch diameter sewer	Existing conditions model shows potential for excessive surcharging	2035	~4,100 LF of 42-inch diameter pipe; ~20 MHs[a]	Monitor with level sensor and/or flow meter	11.4	UW25010
Recommended Studies								
S-1	Asset Condition Assessment for Sanitary Sewer Force Mains	Existing City CIP line item	Pump stations not listed above may have deficiencies; assessments are warranted; power management technologies may reduce operating costs	2027	TBD	Undertake a program to prioritize and assess all City pump stations	1.1 (City estimate)	UW20018/M20018
S-2	Asset Condition Assessment for Sanitary Sewer Pump Stations	Existing City CIP line item	Force mains not listed above may have deficiencies; assessments are warranted; power management technologies may reduce operating costs	2027	TBD	Undertake a program to prioritize and assess all City pump station force mains	0.5 (City estimate)	UW20019/M20019
S-3	Corrosion and Odor Control Study	Evaluate existing and potential future odor control and corrosion control options, including innovative technologies where appropriate	Effectiveness of existing odor/corrosion control facilities should be periodically reassessed for effectiveness	2027	TBD	Perform the study to identify needs and confirm current operations	0.3	none
S-4	West Side Interceptor Alignment Study	Identify and evaluate alternative alignments and costs for parallel force main from 14-Mile Slough PS to the RWCF	An alignment study is needed in advance of force main design	2027	TBD	Perform the alignment study to confirm project costs and provide a basis for design	0.5	none
Watch List Items, Existing Conditions								
W-1	Hammer Lane trunk sewer	UPRR to Pershing Avenue	Existing conditions model shows pipe flowing >80% of gravity capacity; past SSOs at UPRR undercrossing	--	TBD	Monitor this line with level sensor and/or flow meter	--	none
W-2	Market Street sewer	El Dorado Street to Lincoln Street	Existing conditions model shows potential for significant surcharging	--	TBD	Monitor with level sensor and/or flow meter	3.40	M18014
W-3	N. Lincoln Street sewer	Upstream terminus to N. Lincoln Street	Existing conditions model shows potential for significant surcharging	--	TBD	Monitor with level sensor and/or flow meter	--	none
W-4	Ponce De Leon to Etna Street backyard sewer	Ponce De Leon Avenue to Etna Street	Existing conditions model shows pipe flowing >80% of gravity capacity	--	TBD	Monitor this line with level sensor and/or flow meter	1.50	UW23013
W-5	Scotts Avenue trunk sewer	Pershing Avenue to Navy Drive	Existing conditions model shows pipe flowing >80% of gravity capacity	--	TBD	Monitor with level sensor and/or flow meter	0.30	UW24009
W-6	Thornton Road sewer	MacDuff Avenue to Hammer Lane	Existing conditions model shows pipe flowing >80% of gravity capacity	--	TBD	Monitor with level sensor and/or flow meter	4.00	UW25011
W-7	Waterloo Road sewer	Williams Street to Hiawatha Avenue	Existing conditions model shows potential for significant surcharging	--	TBD	Monitor with level sensor and/or flow meter	--	none
Projects to be Excluded from Existing CIP (pending condition assessments)								
X-1	N. El Dorado Street sewer	E. Sonoma Avenue to E. Wyandotte Street	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	1.30	UW23011
X-2	N. El Dorado Street sewer	E. Main Street to E. Oak Street	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	2.50	UW23012; UW24010
X-3	Pershing Avenue trunk sewer	Meadow Avenue to W. Lincoln Road	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	3.30	UW22003
X-4	Wyandotte Street sewer	California Street to Pacific Avenue	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	3.50	UW25007
(a) Sizing based on buildout model results.								

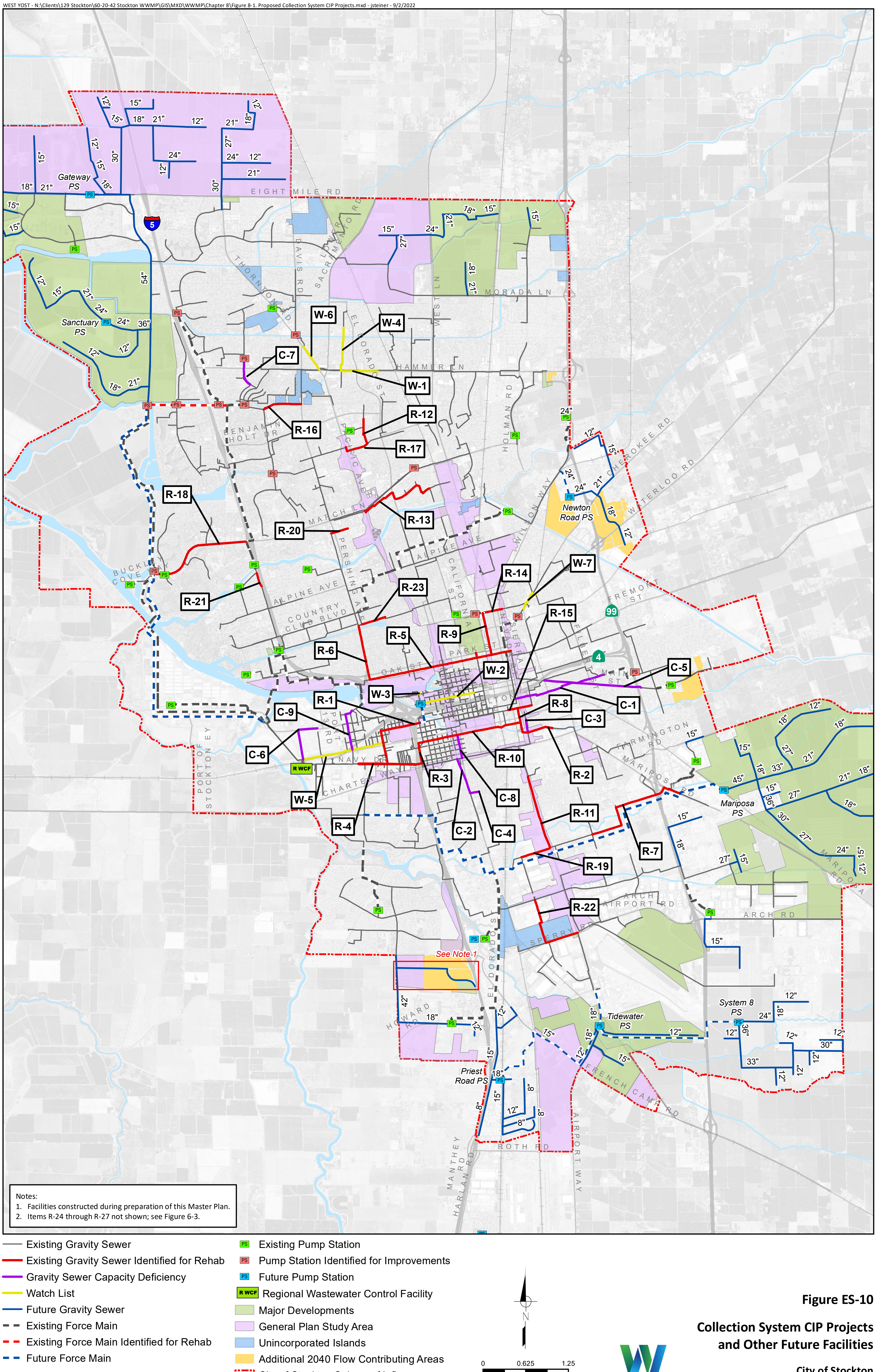


Figure ES-10

Collection System CIP Projects and Other Future Facilities

City of Stockton
Wastewater Master Plan Update

Finally, there are four items shown for the Projects to be Excluded from the City's Existing CIP List category. These items were identified in previous planning as requiring upsizing to accommodate existing or future development conditions. However, due to updated information obtained and modeling performed for this Master Plan, none of the facilities in question appear to be approaching capacity within the time frame of identified 2040 development and, therefore, should not be included in the CIP for capacity reasons. However, if one or more of these facilities are found to be in an advanced state of deterioration, those facilities should remain on the City's CIP list for rehabilitation.

Appendix H provides an analysis of how the conclusions of this Master Plan affect the current rate and connection fees. The most recent rate study was adopted in 2019 and included a capital project list, as well as O&M costs for the wastewater utility. The analysis presented in Appendix H does not replace the adopted rate study, but rather assesses whether the conclusions of the 2019 Rate Study remain valid and whether the planned annual rate increases continue to be supported by anticipated costs. The analysis presented in Appendix H indicates that annual rate increases, consistent with the most recently adopted rate study, will be sufficient to fund the recommended CIP presented in this Master Plan while meeting the other revenue requirements for the wastewater utility. While connection fees may be appropriately used to fund a portion of some improvements needed to serve growth throughout the City, is assumed, for the purposes of the financial review, that connection fee reserves will not be used to meet the predicted revenue requirements of the utility. A review and update of connection fees is being conducted under a separate, ongoing process.

The purpose of this Wastewater Master Plan Update (Master Plan) for the City of Stockton (City) is to evaluate the existing wastewater collection system infrastructure, to address potential impacts of near-term and long-term planned growth, and to develop a comprehensive road map for the City's wastewater system capital improvement program. The City's Municipal Utilities Department operates the City's wastewater collection and treatment systems, which serve customers throughout the City and some outlying areas immediately to the east and south of the City limits. This Master Plan addresses the existing and planned wastewater service areas. The key topics covered in this chapter include:

- Need for the Project
- Master Plan Objectives and Priorities
- Previous and Ongoing Studies
- Report Organization
- Acknowledgements

1.1 NEED FOR THE PROJECT

The City completed its most recent wastewater facilities master plan in 2008. Since that time, the City has completed its Envision Stockton 2040 General Plan (General Plan), which provides an updated framework for future development in the City through 2040. In addition, the severe drought conditions that occurred during the period of 2013 through 2016 led to State-mandated water conservation practices, coupled with new legislation establishing statewide water efficiency standards, which have resulted in reduced per-capita wastewater generation rates.

All of these factors have created a need to reassess the City's wastewater collection capacity and treatment infrastructure needs to support the planning and funding of safe and reliable wastewater facilities serving existing and future residents and businesses.

1.2 MASTER PLAN OBJECTIVES AND PRIORITIES

The primary objectives of this Master Plan are to:

- Evaluate historical and existing wastewater flows to understand recent patterns and trends, and develop future collection system flow projections for General Plan buildout conditions.
- Review and refine performance and planning criteria under which the wastewater system will be evaluated and recommendations for future facilities will be formulated.
- Update and calibrate the City's wastewater collection system hydraulic model to provide an accurate tool for evaluating various collection system development scenarios.
- Evaluate the need for new wastewater collection system facilities (including pipelines and pumping facilities) to meet existing, near-term, and buildout needs.
- Update and prioritize the City's capital improvement program for wastewater collection system improvements.

This Master Plan has been prepared to be consistent with the mission of the City's Municipal Utilities Department:

The City of Stockton Municipal Utilities Department's mission is to provide high-quality drinking water on demand; collect, treat, and dispose of wastewater; and collect and dispose of stormwater, all in accordance with applicable regulations and responsible business practices.

Key priorities for this Master Plan include the following:

- Clearly define long-term wastewater system needs so that collection system infrastructure is properly sized
- Develop an updated hydraulic model that:
  - Accurately represents the wastewater collection system
  - Identifies existing capacity deficiencies
  - Simulates current flows within pipelines scheduled for rehabilitation
  - Allows for accurate assessment of needed infrastructure to serve proposed future development projects, which can be easily updated to evaluate future changes
- Develop an updated Capital Improvement Plan (CIP) to provide a basis for future wastewater rates and connection fees based on current wastewater capacity needs (confirmed through field measurements) and projected future wastewater flows based on proposed development
- Identify applicable regulatory requirements and develop strategies for ongoing compliance with those requirements
- Plan for future extensions of service to areas currently served by onsite treatment and disposal (septic tanks) within the planning boundary
- Produce a Master Plan report that will serve as a user-friendly reference tool both for City staff and for developers

1.3 PREVIOUS AND ONGOING STUDIES

Studies relevant to this Master Plan that have been completed include:

- Wastewater Master Plan, 2008
- City of Stockton Gravity Sanitary Sewer Collection System Asset Management and Master Plan, 2018
- Regional Wastewater Control Facility (RWCF) Capital Improvement and Energy Management Plan, 2011
- RWCF Modifications Project Basis of Design Report, 2019
- Envision Stockton 2040 General Plan, 2018
- Wastewater Cost of Service Rate Study, 2019
- Water Master Plan Update, 2021

Each of these studies is described briefly below.

1.3.1 Wastewater Master Plan, 2008

The City's previous Wastewater Master Plan was completed in 2008 to support future development in accordance with the City's 2035 General Plan. The 2008 Wastewater Master Plan addressed the following:

- Likely collection system capacity constraints under existing and future flow conditions
- The need for additional trunk sewers and pump stations to serve areas of future growth
- The need for documentation of wastewater treatment facility needs and potential future regulatory changes triggering additional improvements
- The need to implement a planned capital improvement program with significant funding to accommodate growth

As noted above, the current Master Plan is a comprehensive update that will be based on extensive flow monitoring data and the results of field investigations that were not available for the 2008 evaluation.

1.3.2 City of Stockton Gravity Sanitary Sewer Collection System Asset Management and Master Plan, 2018

In 2018, HDR Engineering evaluated comprehensive closed-circuit television (CCTV) inspection records for nearly all collection system gravity pipelines, and subsequently prepared the Gravity Sanitary Sewer Collection System Asset Management and Master Plan report. The report provides a prioritized CIP to rehabilitate gravity sewers that have deteriorated due to age and environmental conditions.

1.3.3 RWCF Capital Improvement and Energy Management Plan, 2011

The Capital Improvement and Energy Management Plan (CIEMP), which was completed in August 2011, was a planning-level document identifying a series of improvements needed at the City's RWCF where all wastewater generated within the City's wastewater service area is treated. The CIEMP focused on rehabilitating or replacing major portions of the aging RWCF, and adding or modifying processes to achieve regulatory compliance. The CIEMP considered wind and solar energy production at the RWCF and concluded that the most cost-effective option to reduce outside energy dependence at the plant is to enhance the existing cogeneration system and increase biogas production. When the City began implementation of the CIEMP by initiating design of a new headworks facility, unexpected high costs were estimated for that project, which led to the conclusion that a more detailed evaluation and modified approach to rehabilitating the RWCF was necessary.

1.3.4 RWCF Modifications Project Basis of Design Report, 2019

To control short-term and long-term costs, the City entered into a progressive design-build contract in 2016 to design and construct comprehensive preliminary, primary, secondary, and tertiary treatment system improvements at the RWCF. The initial engineering work for the project was completed in 2018 and resulted in a revised approach to achieving infrastructure rehabilitation and regulatory compliance at the RWCF. The results of this detailed analysis are documented in the Basis of Design Report dated January 3, 2019. Detailed design and construction of the improvements began in 2019 and are expected to be completed in 2023. A portion of the work will add treatment facilities to remove nitrogen from the effluent in order to meet the 2024 regulatory deadline. The project will modernize a substantial portion of the RWCF, thus reducing operating and maintenance costs associated with the existing facilities that are reaching the end of their useful life. Upgrades and capacity improvements to the RWCF are not addressed further in this Master Plan.

1.3.5 Envision Stockton 2040 General Plan, 2018

The Envision Stockton 2040 General Plan (General Plan) was adopted in December 2018. The General Plan process included a comprehensive evaluation of the City's planning boundaries, including the City's Sphere of Influence (SOI).

A key objective of the General Plan was the establishment of a strategy for urban growth that reflected the community's vision and supported the City's Climate Action Plan. This objective was achieved through extensive community outreach and engagement, resulting in a land use plan that emphasizes infill development in the City's core and supports employment and economic development City-wide.

Key achievements of the General Plan are summarized as follows:

1. Increased allowable residential densities and intensity of development downtown and in the greater downtown area, as compared to the previous General Plan. Policies encouraging infill are prevalent, particularly for downtown and South Stockton.
2. Reduced by almost 8,000 acres (12 square miles) the amount of agricultural land that could be converted to urban land uses, as compared to the previous General Plan.
3. Featured a new policy to create an agricultural belt between Stockton and Lodi in collaboration with Lodi, San Joaquin County, and local property owners.
4. Provided guidance for reevaluating the City's public infrastructure, such as roadways and water and sewer distribution systems, which will help the City to determine whether infrastructural capital and maintenance costs can be supported by development projects.

Through the 2040 General Plan Update process, the City evaluated infrastructure capacity in light of land use alternatives considered, and developed recommendations for updating backbone infrastructure plans to reflect the adopted land use plan. The 2040 General Plan Update also included the preparation of an Infrastructure Financing Strategy to address the identified infrastructure needs.

The City is committed to protecting water quality by ensuring adequate collection, treatment, and safe disposal of wastewater. The City is also committed to limiting or reducing per capita wastewater generation rates through water use conservation and reduction measures. General Plan goals, policies, and actions with potential relevance to wastewater service within the City include the following:

- Require water and energy conservation and efficiency in both new construction and retrofits.
- Carefully plan for future development and proactively mitigate potential impacts.
- Ensure that all neighborhoods have access to well-maintained public facilities and utilities that meet community service needs.
- Require new development to install non-potable water infrastructure for irrigation of large, landscaped areas where feasible.
- Investigate and implement code amendments to allow installation of dual plumbing and/or rainwater capture systems to enable use of recycled water and/or captured rainwater generated on-site.

1.3.6 Wastewater Cost of Service Rate Study, 2019

The City prepared a Wastewater Cost of Service Rate Study and adopted a five-year rate plan in 2019. The study reviewed and analyzed updated cost information from administration, collection, treatment, maintenance, capital projects, and debt service coverage. This Master Plan provides a list of recommended wastewater system improvements that may be used to confirm the basis of the Rate Study. The recommended wastewater system improvements address both existing and future system needs. System improvements needed to meet existing system deficiencies are allocated to existing users and are to be funded through rates. System improvements needed to expand the collection and treatment systems to serve future planned development are allocated to future users and are to be funded through wastewater service connection fees.

1.3.7 Water Master Plan Update, 2021

A recent update to the City's Water Master Plan was also prepared by West Yost and was adopted by City Council on February 23, 2021. Where applicable, the data and assumptions used in this Master Plan have conformed with those of the Water Master Plan Update to ensure that the two plans are consistent in their assumptions, projections, and recommendations. In particular, it is important to ensure that land use assumptions are consistent between the two reports, and that water demand projections and wastewater flow projections are consistent so that both facilities within systems are appropriately sized.

1.4 REPORT ORGANIZATION

This Master Plan is organized into the following chapters:

- Chapter 1. Introduction
- Chapter 2. Existing Wastewater Collection System
- Chapter 3. Existing Wastewater Flows
- Chapter 4. Collection System Planning, Design, and Performance Criteria
- Chapter 5. Hydraulic Model Development
- Chapter 6. Analysis of Existing Flow Conditions
- Chapter 7. Analysis of Future Flow Conditions
- Chapter 8. Recommended Wastewater Collection System CIP

The following appendices to this Master Plan contain additional technical information, assumptions, and calculations:

- Appendix A. Collection System Flow Metering Locations
- Appendix B. Collection System Flow Split Locations
- Appendix C. Flow Split Survey Notes
- Appendix D. Modeled vs. Metered Dry Weather Diurnal Flows
- Appendix E. Modeled vs. Metered Wet Weather Flows
- Appendix F. Modeled vs. Metered Wet Weather Flow Depths
- Appendix G. Existing City Wastewater Facilities CIP
- Appendix H. Wastewater Systems Financial Analysis

1.5 ACKNOWLEDGEMENTS

This Master Plan was made possible by the focused involvement and assistance of City staff. In particular, the following staff provided comprehensive information, significant input, and important insights throughout development of this Master Plan:

- Mel Lytle, Director, Municipal Utilities Department
- John Abrew, former Director, Municipal Utilities Department
- Deedee Antypas, Deputy Director, Wastewater Division
- Gemma Biscocho, Senior Civil Engineer, Engineering Division
- Stephen Kenning, former Assistant Municipal Utilities Department Director
- Ali Gharegozloo, Engineering Services Manager, Engineering Division
- Ann Okubo, Senior Civil Engineer, Engineering Division
- Jeff Marasovich, Deputy Director, Collections Division
- Mario Caballero, former Program Manager III, Collections Division
- Matt Diaz, Planning Manager, Community Development Department
- Eric Johnson, Senior Plant Maintenance Supervisor
- Ernesto Lopez, Junior Engineer, Engineering Division
- Michael McDowell, Deputy Director, Planning & Engineering, CDD
- Nicole Moore, Senior Planner, Community Development Department
- Dagmara Saini, Program Manager III, Collections Division

This chapter describes the City's existing wastewater collection system, which is managed by the City of Stockton Municipal Utility Department. The wastewater collection system information presented in this chapter is based on a review of previous studies, design reports, maps, plans, operating records, geographic information system (GIS) data, and discussions with City staff. The following topics are addressed in this chapter:

- Existing Service Area
- Existing Collection System Facilities

2.1 EXISTING SERVICE AREA

Key topics discussed in this section include:

- Service Area Description
- Service Connections and Customers

2.1.1 Service Area Description

The City of Stockton is the county seat and the largest city in San Joaquin County. According to the California Department of Finance, the population of the City in January 2021 was estimated to be 320,876. The City experienced significant growth (approximately 2.3 percent per year) from 2000 to 2008, and more moderate growth (approximately 0.8 percent) since 2008. The existing City limits encompass an area of 41,777 acres, or approximately 65 square miles.

The existing wastewater collection system service area includes residential, commercial, industrial, municipal, and mixed-use areas within the City, as well as surrounding and embedded urbanized but unincorporated county areas that are represented by the following five satellite agencies:

- Country Club Sanitary Maintenance District
- San Joaquin County Maintenance Division
- Port of Stockton
- Northern California Youth Correctional Center
- California Health Care Facility

The City's collection system can be separated into 10 existing sub-areas or "systems". Systems 1 through 7 have been in existence for at least 25 years and encompass most of the City. System 8 serves southern portions of the City and is currently partially developed. System 9 serves the eastern edge of the City along Highway 99, and most of this system is either undeveloped or developed but not connected; however, the backbone trunk sewer and two pump stations for System 9 were completed in 2007. System 10 serves northern portions of the City and is currently partially developed. Four additional systems, designated as Systems 12 through 15, are undeveloped and were previously identified as areas of long-term future growth; however, those areas are no longer planned for significant development based on the recent General Plan update. The total acreages for Systems 1 through 10, including developed and undeveloped portions, are summarized in Table 2-1.

Table 2-1. Collection System Tributary Areas			
System	Tributary area, acres		
	Total	Developed	Undeveloped
1	2,037	2,037	0
2	9,420	9,420	0
3	6,516	6,516	0
4	2,222	2,222	0
5	3,620	3,620	0
6	5,060	3,786	1,274
7	5,351	4,781	570
8	11,500	7,312	4,188
9	2,312	1,272	1,040
10	9,224	5,174	4,050
TOTAL	**57,262**	**46,140**	**11,122**

There are 17 areas that are partially or fully enclosed by the Stockton City limits boundary and are referred to here as unincorporated islands. The islands are partially or fully-developed areas that were never annexed into the City, and are therefore not under City jurisdiction. The water sources for these areas include the City, California Water Service (CalWater), or private wells. Some portions of the unincorporated islands are connected to the City's wastewater collection system, with the remainder served by onsite treatment (septic tanks and leach fields). Some of the areas are under the jurisdiction of a San Joaquin County Maintenance District. Table 2-2 presents a summary of these unincorporated islands and indicates which of the unincorporated islands are currently connected to the City's wastewater collection system and which are served by septic tanks and leach field systems.

The City's wastewater collection system conveys all flows to the RWCF, which is located along the San Joaquin River on the south side of Navy Drive on the western edge of the City. All existing and planned development areas and the unincorporated islands are expected to be served by the RWCF under buildout development conditions, regardless of water source, as a prudent planning assumption for the purposes of the Master Plan; however, this assumption should not be construed to be a commitment or agreement to serve any particular area.

Figure 2-1 shows the existing collection system service areas, City limits, Sphere of Influence, and unincorporated islands. Figure 2-2 shows all 12-inch diameter and larger sewer lines, the locations of all public sanitary sewer pump stations, and the location of the RWCF.

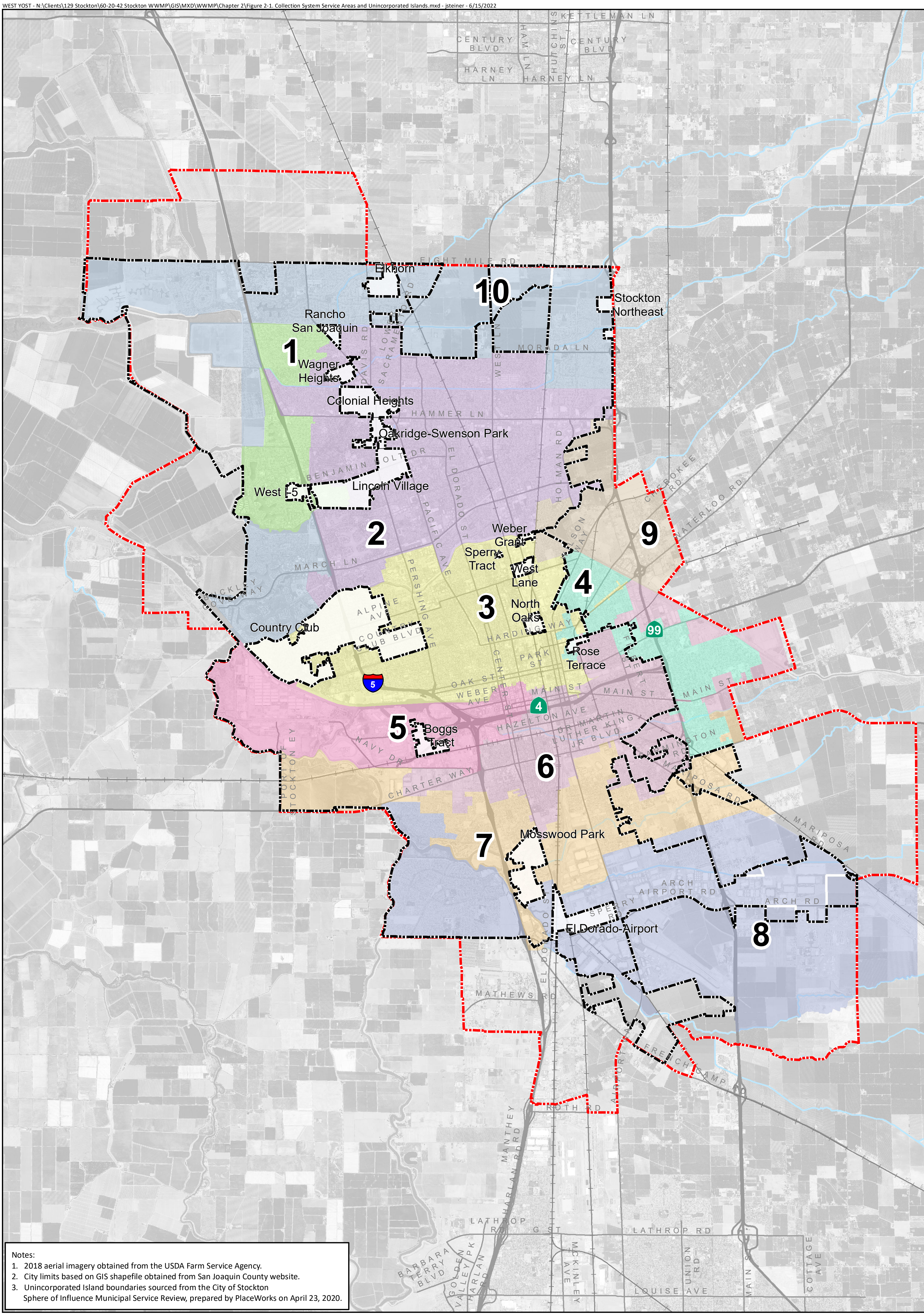
2.1.2 Service Connections and Customers

A summary of land use and parcel information, developed as part of the 2018 General Plan process, is presented in Table 2-3. The results are limited to parcels within Systems 1 through 10, and are presented both in terms of total parcels and parcels with non-zero water demands, the latter of which provides a rough indicator of parcel occupancy.

Table 2-2. Summary Information for Stockton Unincorporated Islands

LAFCO Area	Area, acres	Population	Sanitary System	Sewer Pipes in GIS?	Potable Water System	Water Meters in GIS?
Stockton Northeast	48.30	161	Septic Tanks	No	Unknown	No
Elkhorn	131.46	251	Septic Tanks	No	Master Meter	No
Rancho San Joaquin	45.79	163	Septic Tanks	No	Master Meter	No
Wagner Heights	68.19	222	Septic Tanks	No	Unknown	Yes, City[(a)]
Colonial Heights	227.47	6,516	City Connection	Yes	Master Meter	No
Lincoln Village	460.46		City Connection	Yes	Master Meter	No
Oakridge-Swenson Park	102.15		Septic Tanks	No	Private Wells	Yes, City[(a)]
West I-5	64.10	347	City Connection	Yes	Master Meter	No
Weber Grant	21.99	21	Septic Tanks	No	Individual Meters	Yes, Cal Water
Sperry Tract	4.16	36	Septic Tanks	Yes	Individual Meters	Yes, Cal Water
West Lane	46.58	488	City Connection	Yes	Individual Meters	Yes, Cal Water
North Oaks	51.73	653	City Connection	Yes	Individual Meters	Yes, Cal Water
Rose Terrace	32.82	254	City Connection	Yes	Individual Meters	Yes, Cal Water
Country Club	1320.80	9,226	City Connection	Yes	Individual Meters	Yes, Cal Water
Boggs Tract	96.91	229	City Connection	Yes	Individual Meters	Yes, Cal Water
Mosswood Park	297.11	1,200	City Connection	Yes	Individual Meters	Yes, Cal Water
El Dorado/Airport	241.91	0	none indicated	No	None	Yes, Cal Water[(a)]

(a) Partial information only.



Notes:
1. 2018 aerial imagery obtained from the USDA Farm Service Agency.
2. City limits based on GIS shapefile obtained from San Joaquin County website.
3. Unincorporated Island boundaries sourced from the City of Stockton Sphere of Influence Municipal Service Review, prepared by PlaceWorks on April 23, 2020.

1-10 Collection System Service Areas
Unincorporated Islands
City of Stockton Limits
City of Stockton Sphere of Influence

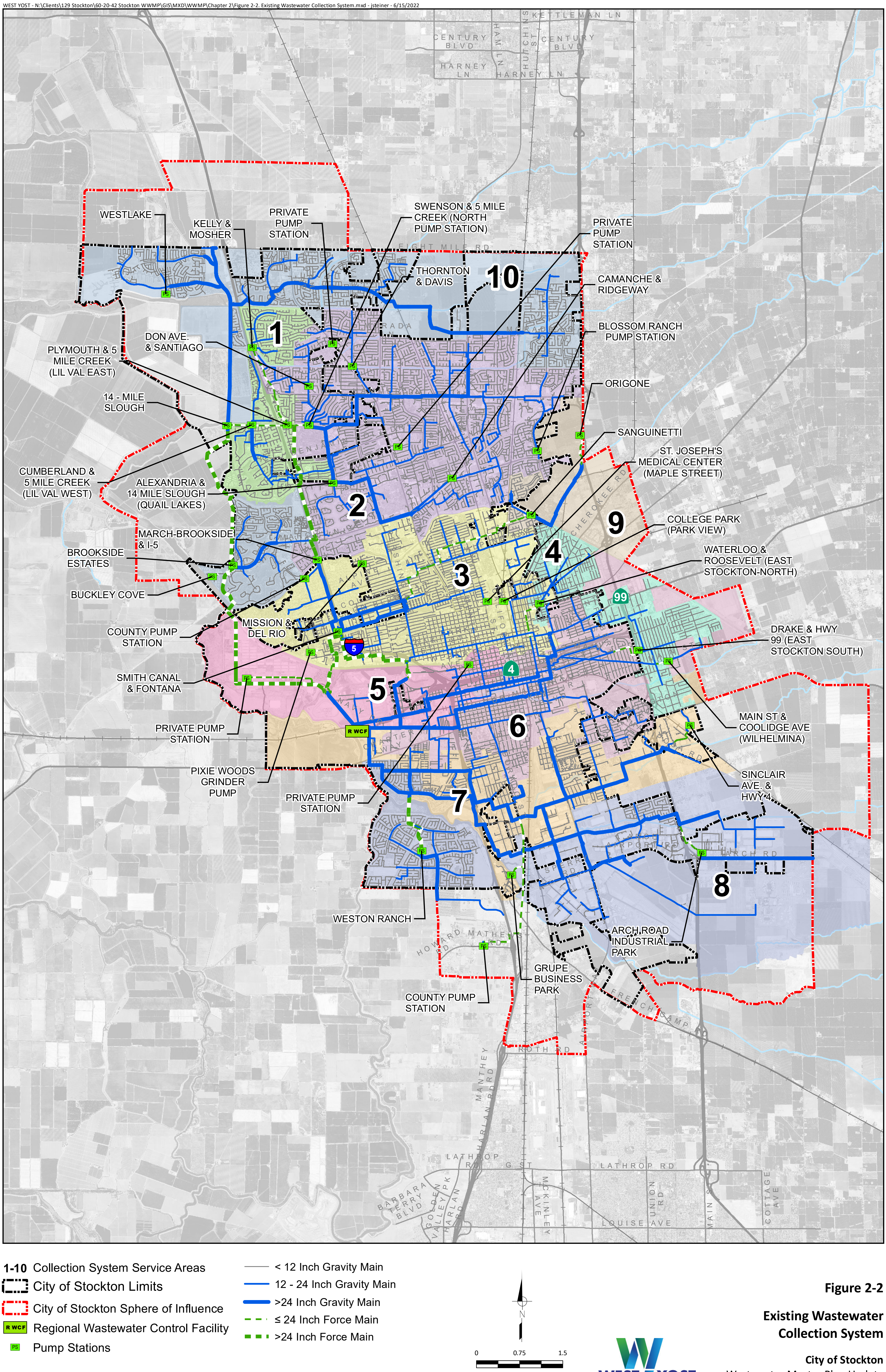
0 0.75 1.5
Miles

WEST YOST

Figure 2-1

Collection System Service Areas and Unincorporated Islands

City of Stockton
Wastewater Master Plan Update



WEST YOST

Figure 2-2

Existing Wastewater Collection System

City of Stockton

Wastewater Master Plan Update

Table 2-3. City of Stockton Land Use and Parcel Information for Systems 1 through 10

Land Use	All Parcels					Parcels w/Non-Zero Water Demands					
	Parcel Count	Area, acres	Average Parcel Size, acres	Portion of Total Count	Portion of Total Area	Parcel Count	Area, acres	Portion of Total Non-Zero Demand Count	Portion of Total Non-Zero Demand Area	Percentage of Parcels Occupied (By Count)[a]	Percentage of Parcels Occupied (By Area)[a]
Residential	90,406	23,143	0.26	89.93%	41.49%	78,639	14,738	94.31%	55.13%	86.98%	63.68%
High Density Residential	3,238	971	0.30	3.22%	1.74%	1,437	630	1.72%	2.35%	44.38%	64.86%
Low Density Residential	79,474	19,892	0.25	79.06%	35.66%	70,829	12,898	84.95%	48.25%	89.12%	64.84%
Medium Density Residential	7,534	1,893	0.25	7.49%	3.39%	6,373	1,210	7.64%	4.53%	84.59%	63.94%
Residential Estate	160	388	2.42	0.16%	0.70%	0	0.0	0%	0%	0%	0%
Commercial/Industrial/Institutional	7,738	20,727	2.68	7.70%	37.16%	3,885	7,742	4.66%	28.96%	50.21%	37.35%
Administrative Professional	874	487	0.56	0.87%	0.87%	314	335	0.38%	1.25%	35.93%	68.77%
Commercial	4,123	3,612	0.88	4.10%	6.48%	2,369	1,970	2.84%	7.37%	57.46%	54.55%
Industrial	2,184	9,705	4.44	2.17%	17.40%	810	3,307	0.97%	12.37%	37.09%	34.08%
Institutional	143	5,627	39.35	0.14%	10.09%	42	1,853	0.05%	6.93%	29.37%	32.93%
Mixed Use	414	1,296	3.13	0.41%	2.32%	350	277	0.42%	1.04%	84.54%	21.36%
Other	2,381	11,906	5.00	2.37%	21.35%	857	4,254	1.03%	15.91%	35.99%	35.73%
Open Space/Agriculture	50	626	12.53	0.05%	1.12%	1	7.0	0.00%	0.03%	2.00%	1.12%
Parks and Recreation	147	1,575	10.71	0.15%	2.82%	46	940	0.06%	3.51%	31.29%	59.65%
Not specified	2,184	9,705	4.44	2.17%	17.40%	810	3,307	0.97%	12.37%	37.09%	34.08%
TOTAL	**100,525**	**55,777**	**0.55**	**100%**	**100%**	**83,381**	**26,733**	**100%**	**100%**	**82.95%**	**47.93%**

(a) As an approximation, it is assumed that all developed and occupied parcels have non-zero water demands.

As indicated in Table 2-3, parcels designated as Residential land use account for approximately 90 percent of all parcels by count, and approximately 41 percent of all parcels by area, with the large majority of those having a Low-Density Residential land use designation. In terms of parcels with non-zero water demands, Residential land use parcels account for approximately 94 percent of all parcels by count and approximately 55 percent of all parcels by area. If non-zero water demands are taken as a measure of parcel occupancy, then approximately 87 percent of Residential parcels are occupied in terms of parcel count and approximately 64 percent are occupied in terms of parcel area. Of the non-residential land uses, the Commercial category makes up the largest group by parcel count (approximately 4,100 parcels), and the Industrial category makes up the largest group by parcel area (approximately 9,700 acres). Among the Industrial land use category, there are 54 Significant Industrial Users (SIUs), which are summarized in Table 2-4.

2.2 EXISTING COLLECTION SYSTEM FACILITIES

The City's existing wastewater collection system consists of gravity sewers, force mains, and pump stations. Information regarding these facilities, as reported in the City's GIS database and provided by City staff, is presented below. City staff have indicated that the existing GIS information is subject to confirmation and/or revision. All pipeline quantities discussed here exclude lines that are indicated as either abandoned or proposed in the City's GIS database.

2.2.1 Gravity Sewers

The City's wastewater collection system comprises just over 1,000 miles of gravity mains ranging from 4-inch diameter to 84-inch diameter. Table 2-5 provides a summary of gravity sewer pipelines by pipe diameter. As shown on Table 2-5, approximately 70 percent of existing gravity sewer pipes are 6-inch and 8-inch diameter. Approximately 1 percent are of unknown diameter or have a reported diameter that is shown as non-standard (e.g., 7-inch) and are therefore possibly misreported.

The gravity main materials are summarized in Table 2-6 and presented on Figure 2-3. The most common pipe materials are vitrified clay pipe (VCP) and polyvinyl chloride (PVC) pipe, which combined account for approximately 77 percent of the system by pipe length. An additional roughly 11 percent of the system is of unidentified pipe materials, with the remainder consisting of various other pipe materials.

The installation years for gravity mains are summarized in Table 2-7 and are presented on Figure 2-4. According to the City's GIS data, approximately 50 percent of the system was constructed between 1970 and 2010, 12 percent of the system has an unknown installation year. The data indicate that less than 1 percent of the lines were constructed since 2010. The remaining approximately 37 percent of the system has an installation date before 1970, with the earliest installation year listed as 1890.

2.2.2 Force Mains

The City's existing wastewater collection system contains approximately 37 miles of active force mains ranging from 2-inch diameter to 42-inch diameter. Force main pipe diameters by pipe length are summarized in Table 2-8.

Table 2-4. Significant Industrial Users, City of Stockton

Significant Industrial User	Address	Maximum Allowable Discharge, MG/month	Average 2019 Discharge, MG/month[(a)]	Comments
Advanced Industrial Coatings, Inc.	950 Industrial Drive	--	--	Discharge limit and monitoring data not provided
Aero Turbines, Inc.	6800 S. Lindbergh Street	--	--	Discharge limit and monitoring data not provided
American Biodiesel	809-C Snedeker Avenue	0.21	--	Monthly discharge not provided
American Building Supply	1488 Tillie Lewis Drive	0.0063	0.0045	Discharge occurs year round
Applied Aerospace Structures Corp	3437 S. Airport Way	0.65	0.2	Discharge occurs year round
Aramark Uniform & Career Apparel, LLC	7679 S. Longe Street	6.93	4.67	Discharge occurs year round
B & C Painting Solutions, Inc	107 Val Dervin Parkway	--	--	Discharge limit and monitoring data not provided
CALAMCO	2323 Port Road	--	--	Discharge limit and monitoring data not provided
California Department of Fish & Wildlife	2109 Arch Airport Road	--	--	Discharge limit and monitoring data not provided
California Tank Lines, Inc.	3105 S. El Dorado Street	1	0.34	Discharge occurs year round
Campbell Soup Supply Company	760 Industrial Drive	65	20.45	Discharge occurs June - October
Cintas Corporation #922	1877 Industrial Drive	3.6	2.65	Discharge occurs year round
City of Stockton Delta WTP	11373 N. Lower Sacramento Road	--	--	Discharge limit and monitoring data not provided
Comtech Rotor Blades, LLC	6700 CE Dixon Street	--	--	Discharge limit and monitoring data not provided
Dameron Hospital - Main Hospital	525 W. Acacia Street	2.2	--	Monitoring data not provided
Diamond Foods	1050 S. Diamond Street	4.7	1.31	Discharge occurs year round
Donaldson Co., Inc.	1641 E. Citation Street	0.027	0.00365	Discharge occurs year round
DTE Stockton, LLC	2526 W. Washington Street	5.5	3.16	Discharge occurs year round
Dupont Market Inc	2716 E. Miner Street	3	1.62	Discharge occurs year round
Duraflame West	1340 W. Washington Street	3.1	0.06	Discharge occurs year round
Foodliner, Inc.	2467 E. Mariposa Road	0.51	0.18	Discharge occurs year round
Heinz North America	6755 CE Dixon Street	0.012	0.007	Discharge occurs year round
Ingredion Incorporated, Stockton Plant	1021 Industrial Drive	6	2.93	Discharge occurs year round
Inland Industrial Tire North, Inc.	3039 Transworld Drive	--	--	Discharge limit and monitoring data not provided
International Paper	3550 Bozzano Road	--	0.037	Discharge limit not provided
Le Tote	3021 Boeing Way	0.35	0.12	Discharge occurs year round
Metal Finishing Solutions	1325 El Pinal Drive	0.15	0.097	Discharge occurs year round
New Stockton Poultry, Inc.	302 S. San Joaquin Street	1.05	0.66	Discharge occurs year round
Niagara Bottling, LLC	1025 Runway Drive	7.5	5.41	Discharge occurs year round
Niagara Bottling, LLC 811 Zephyr St	811 Zephyr Street	7.86	5.18	Discharge occurs year round
Old World Industries, LLC	812 Luce Avenue	0.44	0.12	Discharge occurs year round
Pacific Spray Dry (Vapore Technology)	818 McCloy Avenue	0.6	0.037	Discharge occurs year round
Port City Operating Company, LLC	1800 N. California Street	--	--	Discharge limit and monitoring data not provided
Premier Coatings, Inc.	7910 S. Longe Street	0.05	0.028	Discharge occurs year round
Production Chemical	1000 E. Channel Street	--	--	Discharge limit and monitoring data not provided
S J County General Hospital	500 Hospital Road	1.7	--	Monitoring data not provided
San Joaquin Regional Rail Commission	1020 E. Alpine Avenue	0.1	--	Monitoring data not provided
San Joaquin Regional Transit District	2849 E. Myrtle Street	0.001	--	Monitoring data not provided
Shepard Bros	4407 Giannecchini Lane	0.028	0.019	Discharge occurs year round
Simplot Grower Solutions	4863 E Carpenter Road	--	--	Discharge limit and monitoring data not provided
SJ Co French Camp Complex	1005 W. Mathews Road	51	8.71	Discharge occurs year round
Stockton Sanitary Washrack Group	1505 Navy Drive	0.64	0.15	Discharge occurs year round
Sulfuric Acid Trading Company, Inc.	2829 W. Washington Street	0.048	0.012[(b)]	Discharge occurs year round
Sumiden Wire Products Corp.	1412 El Pinal Drive	2.1	0.49	Discharge occurs year round
Tankerwash USA, Inc.	743 W. Anderson Street	1.3	0.85	Discharge occurs year round
Tiger-Sul Products LLC	65 Stork Road	--	--	Discharge limit and monitoring data not provided
Truck Tub International, Inc.	1707 French Camp Turnpike Road	0.0775	0.054	Discharge occurs year round
UniFirst Corporation	819 N. Hunter Street	3.25	1.93	Discharge occurs year round
Valimet, Inc.	431 Sperry Road	--	--	Discharge limit and monitoring data not provided
Valley Plating	1236 N. Filbert Street	--	--	Discharge limit and monitoring data not provided
Value Products, Inc.	2128 Industrial Drive	0.038	0.017	Discharge occurs year round
Western Square Industries, Inc.	1621 N. Broadway Avenue	0.012	--	Monitoring data not provided
Wilmar Oils and Fats, LLC	2008 Port Road	1	0.24	Discharge occurs year round
Yosemite Foods, Inc.	4221 E. Mariposa Road	5.1	3.7	Discharge occurs year round

(a) Unless otherwise noted, the 2019 average monthly discharge is to reflect pre-pandemic conditions.
(b) The 2020 average monthly discharge is displayed due to lack of 2019 discharge data.

2.2.1 Pump Stations

There are 35 pump stations included in the City's GIS data that are within or tributary to the City's wastewater collection system, as shown on Figure 2-2. Key pump station information, including station name, system number, rated firm capacity, and station type (fixed-speed versus variable speed), are summarized in Table 2-9. The firm capacity is defined as the maximum pumping capacity at the pump station with the largest pump out of service. Information on pump capacities was not available for the privately-owned pump stations shown in Table 2-9.

Table 2-5. Gravity Mains by Diameter[a]

Pipe Diameter, inches	Count	Length, feet	Portion of Total Length, percent
4	694	50,924	0.96
6	7,534	1,576,999	29.7
8	8,265	2,146,339	40.5
10	1,329	358,754	6.8
12	1,482	402,014	7.6
14	21	5,183	0.10
15	367	110,666	2.1
16	98	28,273	0.53
18	310	86,221	1.6
20	42	16,963	0.32
21	55	15,385	0.29
24	365	110,693	2.1
27	117	37,582	0.71
30	186	69,807	1.3
33	41	14,573	0.27
36	124	50,316	0.95
42	117	48,166	0.91
48	142	59,359	1.1
54	17	9,603	0.18
60	4	473	0.009
66	22	9,241	0.17
72	58	25,828	0.49
78	2	166	0.003
84	6	1,989	0.037
Unknown/Non-standard	1,118	68,492	1.3
TOTAL	**22,516**	**5,304,011**	**100**

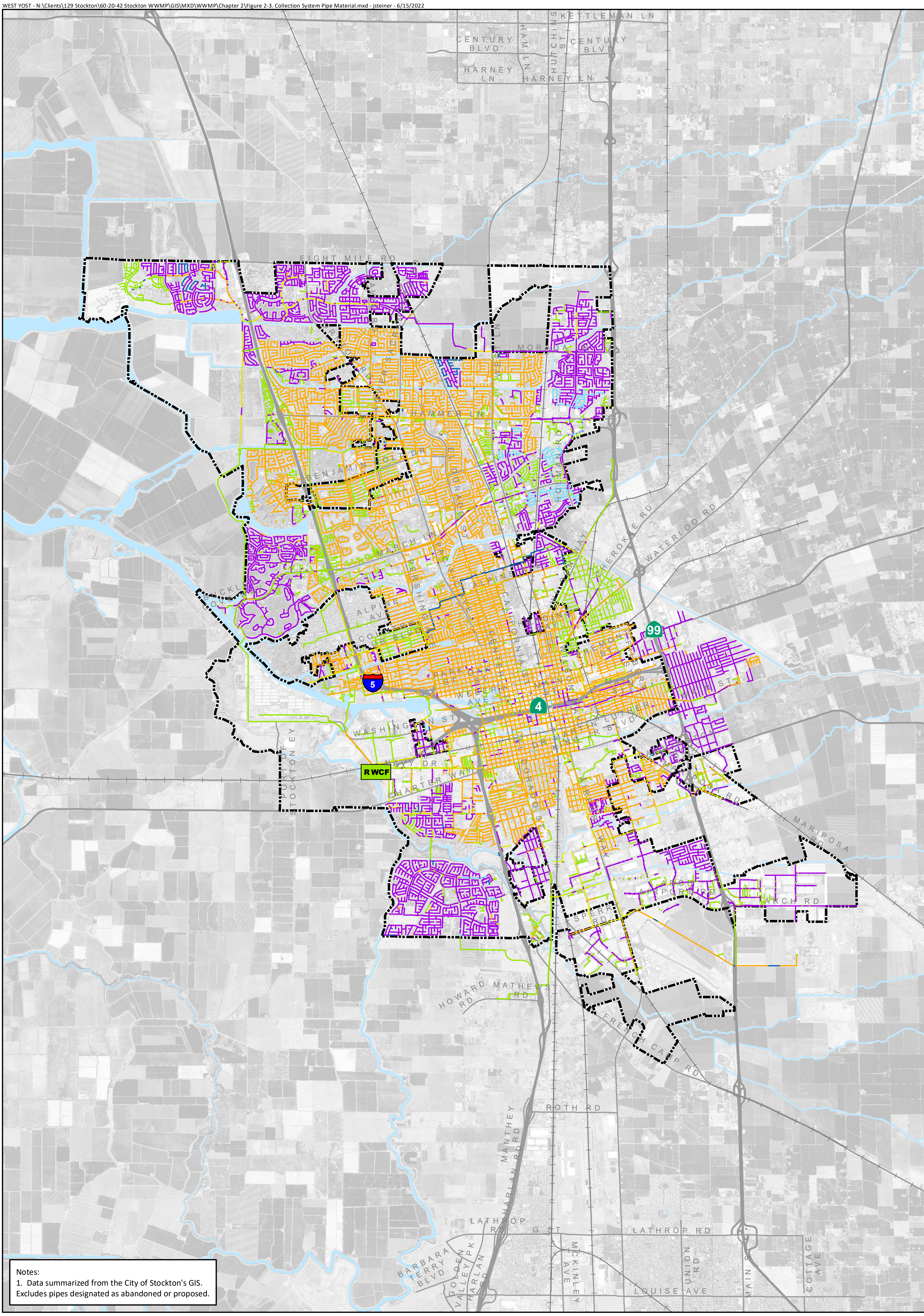
(a) Data summarized from the City of Stockton's GIS sanitary line feature class transmitted, July 2020. Excludes pipes designated as abandoned or proposed.

Table 2-6. Gravity Mains by Pipe Material[a]			
Pipe Material	Count	Length, feet	Portion of Total Length, percent
Vitrified Clay (VCP)	9,253	2,461,957	46.4
Polyvinyl Chloride (PVC)	6,457	1,632,961	30.8
Reinforced Concrete (RCP)	653	246,787	4.7
Reinforced Plastic Mortar (RPM)	447	123,402	2.3
Polyethylene (PE)	239	68,652	1.3
Asbestos Cement Pipe (ACP)	171	46,765	0.9
Acrylonitrile Butadiene Styrene (ABS)	135	35,050	0.7
Ductile Iron Pipe (DIP)	96	22,867	0.4
Unknown	4,708	573,164	10.8
Other Materials	314	77,074	1.5

(a) Data summarized from the City of Stockton's GIS sanitary line feature class transmitted in July 2020. Excludes pipes designated as abandoned or proposed.

Table 2-7.Gravity Mains by Installation Year[a]			
Installation Year	Count	Length, feet	Portion of Total Length, percent
Pre-1910	925	235,948	4.4
1910s	1,059	295,228	5.6
1920s	971	234,904	4.4
1930s	374	90,058	1.7
1940s	1,597	408,097	7.7
1950s	1,540	415,543	7.8
1960s	1,148	288,657	5.4
1970s	2,254	572,240	10.8
1980s	2,214	584,444	11.0
1990s	2,660	657,545	12.4
2000s	2,913	812,125	15.3
2010s	182	48,600	0.9
Unknown	4,679	660,620	12.5

(a) Data summarized from the City of Stockton's GIS sanitary line feature class transmitted in July 2020. Excludes pipes designated as abandoned or proposed.



Notes:
1. Data summarized from the City of Stockton's GIS. Excludes pipes designated as abandoned or proposed.

Pipe by Material

- Asbestos-Cement
- Cast Iron
- Concrete
- Corrugated Metal
- Ductile Iron
- PolyVinyl Chloride
- Polyethylene
- Polypropylene
- Vitrified Clay
- Other

City Limits

RWCF Regional Wastewater Control Facility

N

0 0.75 1.5

Miles

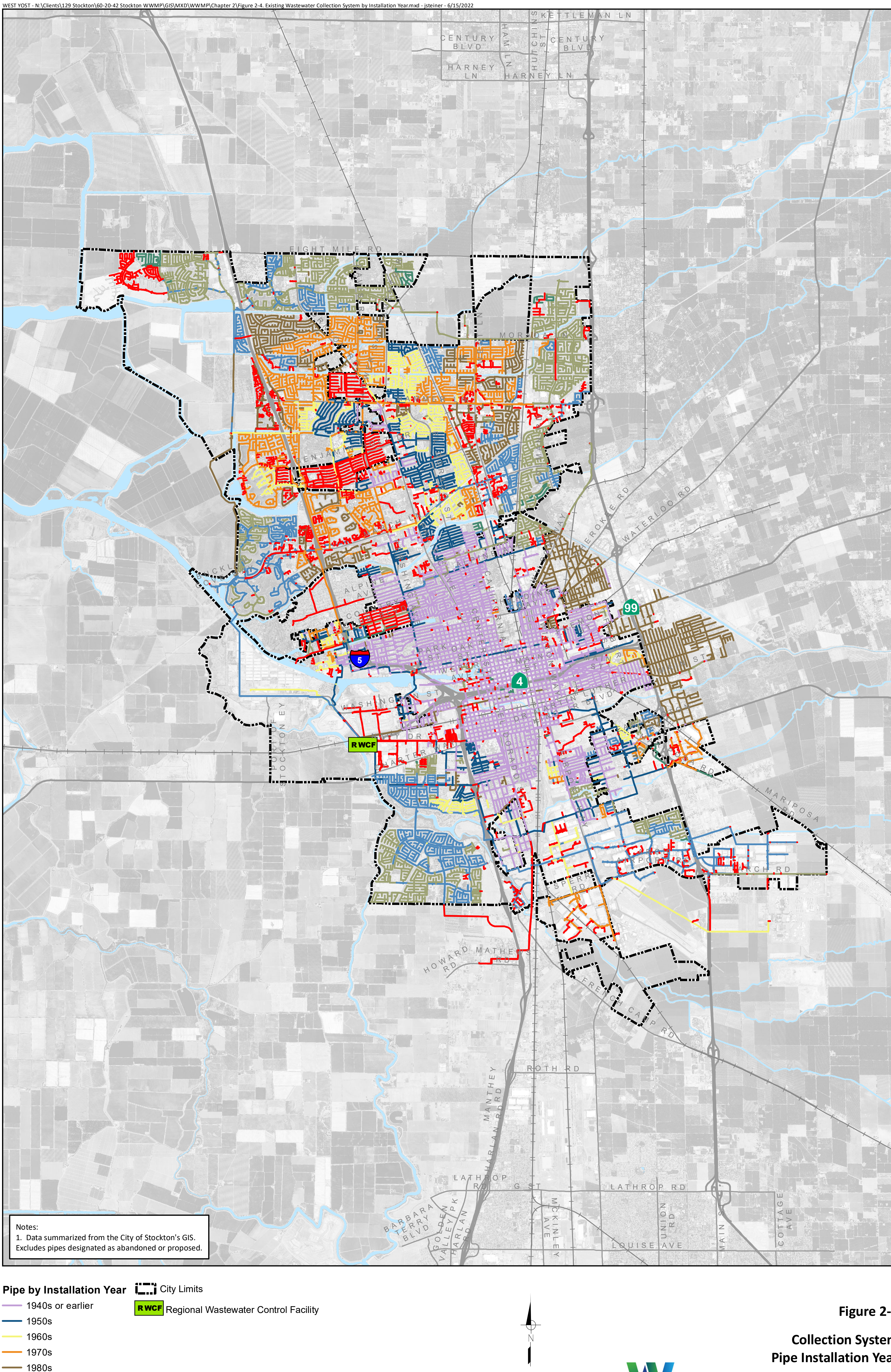
Figure 2-3

Collection System Pipe Material

City of Stockton

Wastewater Master Plan Update

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 2\Figure 2-4. Existing Wastewater Collection System by Installation Year.mxd - jsteiner - 6/15/2022



WEST YOST

Figure 2-4

Collection System Pipe Installation Year

City of Stockton
Wastewater Master Plan Update

Table 2-8. Force Main Quantities by Pipe Diameter[a]		
Pipe Diameter, inches	Segment Count[b]	Length, feet
2	1	785
4	2	225
6	5	2,902
8	28	14,448
10	32	32,429
12	53	26,023
14	2	3,239
15	1	48
16	6	3,211
18	9	432
20	2	433
24	56	32,495
30	60	44,414
33	36	28,624
36	11	2,191
42	5	5,226
unknown	2	176
TOTAL	**311**	**197,301**

(a) Data summarized from the City of Stockton's GIS sanitary line feature class transmitted in July 2020. Excludes pipes designated as abandoned or proposed.

(b) The GIS data is organized such that one force main may consist of multiple segments.

Table 2-9. Wastewater Pump Station Summary Information

Station ID	Name/Location	System	Pump Manufacturer	No. of Pumps	Pump Capacity Ratings, gpm	Firm Capacity, mgd	Pump Speed
22D008	14-Mile Slough	10	Fairbanks Morse/Flygt	4	2000/2000/????/????	(a)	**Variable**
25H013	Alexandria & 14-Mile Slough (Quail Lakes)	10	Vaughan	2	1370/1370	1.97	Constant
42U054	Arch Road	10	Flygt	4	1190/2425/2425/2425	8.70	**Variable**
23P010	Blossom Ranch	10	Vaughan	3	450/450/450	1.30	Constant
28D015	Brookside Estates	10	Fairbanks Morse	4	2000/2000/2000/2000	8.64	**Variable**
29D029	Buckley Cove	10	Flygt	2	205/205	0.30	Constant
24L070	Camanche & Ridgeway	10	Fairbanks Morse	3	835/835/835	2.40	Constant
46M005	County Pump Station (Hospital/Mathews)	10	Aurora	3	750/750/750	2.16	Constant
29G014	County Pump Station (Pacific Garden/Kirk)	10	Flygt	2	600/600	0.86	Constant
22E031	Cumberland & 5-Mile Creek	10	Vaughan	3	1500/1500/1500	4.32	**Variable**
20G059	Don Avenue & Santiago	10	Vaughan	2	550/550	0.79	Constant
32S052	Drake & Highway 99	10	Smith & Loveless Inc.	3	1230/1230/1230	3.54	Constant
43N022	Grupe Business Park	10	Paco	2	600/600	0.86	Constant
18E073	Kelly & Mosher Slough	10	Vaughan/Fairbanks Morse	4	1000/1000/1000/1000	4.32	**Variable**
33T064	Main Street & Coolidge Avenue (Wilhelma)	10	Flygt	2	286/286	0.41	**Variable**
28G078	March-Brookside & I-5	10	Flygt	2	800/800	1.15	Constant
28H040	Mission & Del Rio	10	Vaughan	1	125	0	Constant
22Q001	Origone	10	Flygt	4	1200/1200/1200/1200	5.18	**Variable**
30N047	Parkview (College Park)	10	(a)	2	(a)	(a)	Constant
32G072	Pixie Woods Grinder Pump	10	Liberty	1	(a)	(a)	Constant
22F103	Plymouth & 5-Mile Creek	10	Smith & Loveless Inc.	2	870/870	1.25	Constant
18H049	Private Pump Station (Thorton)	10	(a)	0	(a)	(a)	Constant
23K037	Private Pump Station (Glendora)	10	(a)	0	(a)	(a)	Constant
34E001	Private Pump Station (Ellsberg)	10	(a)	0	(a)	(a)	Constant
33M045	Private Pump Station (Weber)	10	(a)	0	(a)	(a)	Constant
26P045	Sanguinetti	10	Flygt	2	3600/3750	15.98	**Variable**
36U044	Sinclair Avenue & Highway 4 (Duck Creek)	10	Flygt	3	1500/1500/1500	4.32	Constant
31H086	Smith Canal & Fontana	10	Vaughn /Aurora	5	4520/5710/8600/8600/7500	37.92	**Variable**
30M112	St. Joseph's Medical Center	10	Flygt	2	419/419	0.60	Constant
22G053	Swenson & 5-Mile Creek (North Pump Station)	10	Worthington	4	3500/8000/3500/2000	20.16	**Variable**
29E007	Temporary Pump Station - Brookside Estates (Abandoned)	10	(a)	0	(a)	(a)	Constant
19H072	Thornton & Davis (Stonewood)	10	Vaughan	2	850/850	1.22	Constant
30P069	Waterloo & Roosevelt (East Stockton-North)	10	Vaughan	3	950/950/950	2.74	Constant
16B030	Westlake	10	Vaughan	3	1510/1510/1510	4.35	Constant
42K005	Weston Ranch	10	Vaughan/Fairbanks Morse	4	1300/1300/8500/8500	15.98	**1 variable, 3 constant**

(a) Pump make and/or capacity information not available

The purpose of this chapter is to present information on existing dry and wet weather flow conditions in the City of Stockton wastewater collection system. The major topics covered in this chapter include:

- Wastewater Flow Components
- Flow Metering Locations
- Rainfall Results
- Flow Monitoring Results
- Investigation of Flow Splits

3.1 WASTEWATER FLOW COMPONENTS

Key components of wastewater collection system flows include the following:

- Average Dry Weather Flow
- Sanitary Peak Flow
- Infiltration and Inflow
- Peak Wet Weather Flow

3.1.1 Average Dry Weather Flow

Average dry weather flow (Q_a) is a term that describes average wastewater flow conditions that typically occur later in the dry season when groundwater infiltration into the collection system is at a seasonal minimum and prior to the onset of significant rainfall events. Depending on groundwater elevations and system porosity, Q_a may have a component of groundwater infiltration that is present year-round. Otherwise, Q_a represents sanitary flow contributions from residential, commercial, institutional, and industrial dischargers to the collection system.

3.1.2 Sanitary Peak Flow

Sanitary peak flow is defined as the diurnal flow peak during baseline dry weather flow conditions. The timing of sanitary peak flow typically depends on the contributing land use types. Residential dischargers tend to produce higher flows in the morning hours and in the evening hours, while commercial dischargers tend to have steady discharge during business hours but very low discharge outside of business hours. Industrial dischargers have flow patterns that depend upon their individual processes.

3.1.3 Infiltration and Inflow

The term infiltration and inflow (I&I) refers to the portion of wastewater flow that does not come from indoor sanitary flow generating activities, but instead enters the collection system in the form of elevated groundwater infiltration (over and above the year-round groundwater infiltration component that may be present in the Q_a), and/or flows entering the collection system during and immediately after rainfall events. This latter component is referred to as rainfall-dependent I&I, and is defined as storm-induced flow that enters the collection system through porous and/or defective maintenance holes (MHs), sewer mains and service laterals, or illicit connections such as roof leaders that otherwise should be connected to storm drain facilities. The magnitude of rainfall-dependent I&I flows is related to the intensity and duration of the rainfall and the degree of soil saturation and increased groundwater levels arising from antecedent rainfall conditions.

3.1.4 Peak Wet Weather Flow

Peak wet weather flow (Q_p) is composed of sanitary flow plus a combination of groundwater infiltration and rainfall-dependent I&I and is generally defined as the highest flow that occurs during a given storm or wet season. The magnitude of the peak wet weather flow is thus dependent on storm intensity and duration, antecedent rainfall conditions, and the time of day at which the peak I&I occurs. The highest Q_p values are typically associated with large, intense storm events, and tend to be greater following a series of other storm events after soils become saturated. Moreover, a large storm occurring during the day will have a higher Q_p than a similar storm occurring at night due to the elevated sanitary flows that occur during the day.

3.2 FLOW METERING LOCATIONS

For this Master Plan, a collection system flow monitoring study was conducted that covered the period of late October 2020 through mid-March 2021. The flow monitoring study provided the data used to perform an assessment of both dry and wet weather flow conditions throughout the City's collection system.

Under the flow monitoring study, a total of 25 temporary area-velocity (AV) flow meters were deployed in sewer lines at various locations throughout the City in support of this Master Plan. The flow metering locations are depicted on Figure 3-1 and are summarized in Table 3-1. Graphical representations of each flow metering location are presented in Appendix A of this report.

The flow metering locations were chosen through a collaboration of West Yost and City staff and were chosen to satisfy the following goals:

1. Capture a significant portion of all the contributing collection system sub-areas (Systems 1-10).
2. Capture the full range of different land uses throughout the City.
3. Capture both wet and dry weather flows.
4. Determine dry weather baseline flows and peak wet weather flows.
5. Establish flow conditions at areas of concern identified by the City.
6. Repeat previous monitoring locations (where appropriate) to provide continuity of data.

3.3 RAINFALL RESULTS

A total of seven temporary rain gauges were deployed at locations throughout the City in support of the flow monitoring study. The rain gauge locations are depicted on Figure 3-1. Rainfall statistics for the months of October 2020 through March 2021 are summarized in Table 3-2. As indicated in Table 3-2, reported rainfall amounts were highest at the East gauge and lowest at the Northwest gauge.

The total rainfall for the monitoring period, averaged among the seven rain gauges, was 7.20 inches. This result compares with the National Oceanic and Atmospheric Administration (NOAA) long-term average of 13.99 inches over the same period. Thus, the observed rainfall was only about half the long-term average.

The most significant storm event of the season occurred on January 27 and 28, 2021, which produced 2.92 inches of rain over 48 hours when averaged over the seven gauges. The next most significant event occurred on December 13, 2020, which produced 1.04 inches of rain over 24 hours when averaged over the seven gauges.

Table 3-1. Summary of Flow Monitoring Locations

Site ID	MH ID	GIS Pipe D, in	Location	Tributary Area
1-1	22E038	27	Cumberland Place and Stone River Circle	Southern portion of System 1
2-1	23G001	48	Alexandria Place and Lincoln High School	Southern portion of System 2
2-2	22H056	36	West Lincoln Avenue west of Richmond Place	Northeastern portion of System 2
3-1	30K050	24	North Pershing Avenue and Elmwood Avenue	Northeastern portion of System 3
3-2	30K109	30	North Orange Street north of Middlefield Avenue	Southeastern portion of System 3
3-3	29G003	18	Calariva Drive and North Stiles Place	Country Club area of System 3
4-1	32R081	18	East Marsh Street and Burkett Avenue	Southern portion of System 4
4-2	30P060	18	Waterloo Road and Hiawatha Avenue	Northern portion of System 4
4-3	30Q038	10	North Filbert Street and East Anita Street	Flow split within System 4
4-4	31R031	16	East Fremont Street west of North Filbert Street	Flow split within System 4
5-1	35M014	24	West Scotts Avenue and South Van Buren Street	Portions of Systems 4 and 6
5-2	34M018	24	South Lincoln Street and West Washington Street	Portions of Systems 5 and 6
6-1	35R026	24	East Charter Way and Mariposa Road	Southeastern portion of System 6
6-2	33P111	33	Della Street north of East Hazelton Avenue	Portions of Systems 4 and 6
6-3	34N024	27	Church Street and Aurora Street	Portions of Systems 4 and 6
6-4	36M046	24	West Charter Way east of I-5	Southern portion of System 6
6-5	35N004	36	East Worth Street east of South Stanislaus Street	Southeastern portion of System 6
6-6	34M050	27	East Church Street and South Center Street	Portions of Systems 4 and 6
7-1	39P004	42	Ralph Avenue east of Perlman Drive	Eastern portion of System 7
7-2	38K038	72	West 8th Street west of South Fresno Avenue	Portions of Systems 7, 8, and 14
8-1	38J059	48	Houston Avenue south of Tilden Park Street	Western portion of System 8
8-2	42Q007	27	Gibraltar Court south of Industrial Drive	Central portion of System 8
8-3	41Q020	33	South Airport Way south of Industrial Drive	Airport area of System 8
8-4	41R005	42	Industrial Drive east of South Airport Way	Northeastern portion of System 8
10-1	18D012	54	Bear Creek levee south of Otto Drive	System 10

Last Saved: 6/15/2022 10:04:50 AM N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 3\Figure 3-1. Flow Metering and Rain Gauge Locations.mxd : jsteiner

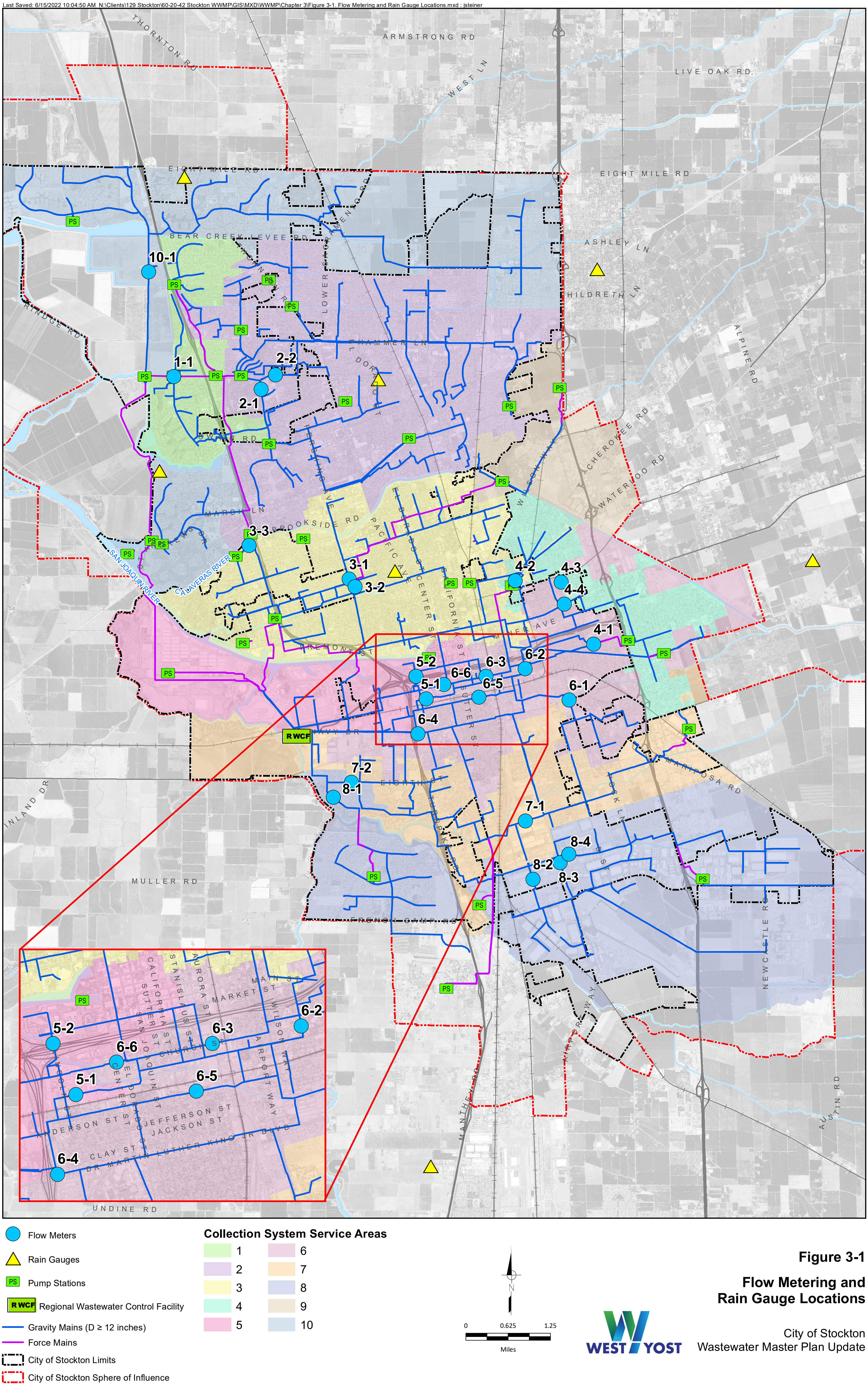


Figure 3-1

Flow Metering and Rain Gauge Locations

WEST YOST

City of Stockton
Wastewater Master Plan Update

Table 3-2. Stockton Temporary Rain Gauge Results, October 2020 through March 2021								
	Temporary Rain Gauge Location							
Month	Northwest	Northeast	Center-North	West	Center	East	South	7-Gauge Avg
October	0	0	0	0	0	0.01	0	0
November	0.40	0.19	0.25	0.20	0.24	0.18	0.06	0.22
December	1.51	2.31	2.17	1.90	2.00	2.55	2.00	2.06
January	2.57	3.49	3.72	2.79	3.19	4.72	4.04	3.50
February	0.73	1.12	0.94	0.73	0.61	1.25	0.88	0.89
March	0.43	0.69	0.58	0.60	0.52	0.43	0.42	0.53
Total	**5.63**	**7.80**	**7.65**	**6.22**	**6.56**	**9.15**	**7.39**	**7.20**
January 27–28	**2.06**	**2.91**	**3.19**	**2.37**	**2.70**	**3.92**	**3.28**	**2.92**

Storm event return period information for the January 27 and 28, 2021 storm event was estimated using NOAA online resources. The estimated return periods (in years) for that event are summarized in Table 3-3. The peak 6-hour, 12-hour, and 24-hour rainfall totals represent return periods in the 1.5-year to 1.7-year range; however, the peak 48-hour rainfall was an 8-year event. Specifically, a 1.5-year, 24-hour event on January 27, 2021 was immediately followed by a 1.1-year, 24-hour event on January 28, 2021, which resulted in an 8-year return period for the 48-hour rainfall total.

Table 3-3. Return Period Information, January 27 and 28, 2021 Storm Event			
Duration	Max Rainfall, in	Start Time	Return Period, years
6-hour	0.88	1/27/2021 13:45	1.7
12-hour	1.12	1/28/2021 10:40	1.5
24-hour	1.55	1/26/2021 21:05	1.5
48-hour	2.92	1/26/2021 23:00	8.0
			Source: NOAA National Weather Service

While event rainfall was substantial, antecedent rainfall preceding the January 27 and 28, 2021 event was minor, with a prior 7-day rainfall of 0.40 inches, a prior 30-day rainfall of 0.66 inches, and a season-to-date rainfall of 2.83 inches. As a result, saturated soils and high groundwater levels, which may contribute significantly to peak I&I conditions, were not present for that event.

3.4 FLOW MONITORING RESULTS

Key flow monitoring results discussed in this section include:

- Flow and I&I Statistics
- Evidence for Backwater Conditions

3.4.1 Flow and I&I Statistics

Flow and I&I at the RWCF influent for the period up to, including, and immediately following the January 27 and 28, 2021 storm event is shown in Figure 3-2. Flow and I&I statistics for the 25 temporary flow metering sites and from the RWCF are presented in Table 3-4. Because Sites 4 3 and 4 4 are both immediately downstream of the same flow split, the results for those two sites are shown in the table both separately and as a combined flow. Key flow and I&I statistics shown in Table 3-4 include:

- **Data Period:** Start and end dates
- **Q_a:** The average dry season flow, typically calculated from flows measured during October and November 2020
- **Q_p:** The maximum observed hourly average flow rate
- **Time:** Peak Flow
- **Peaking Factor (PF):** The peak flow divided by the Qa
- **Maximum Storm I&I:** The maximum calculated I&I rate during rainfall periods
- **Tributary Area:** The total flow-producing parcel acreages for each flow meter
- **Maximum I&I Rate:** The max storm I&I divided by the tributary area

Notable findings from Table 3-4 include the following:

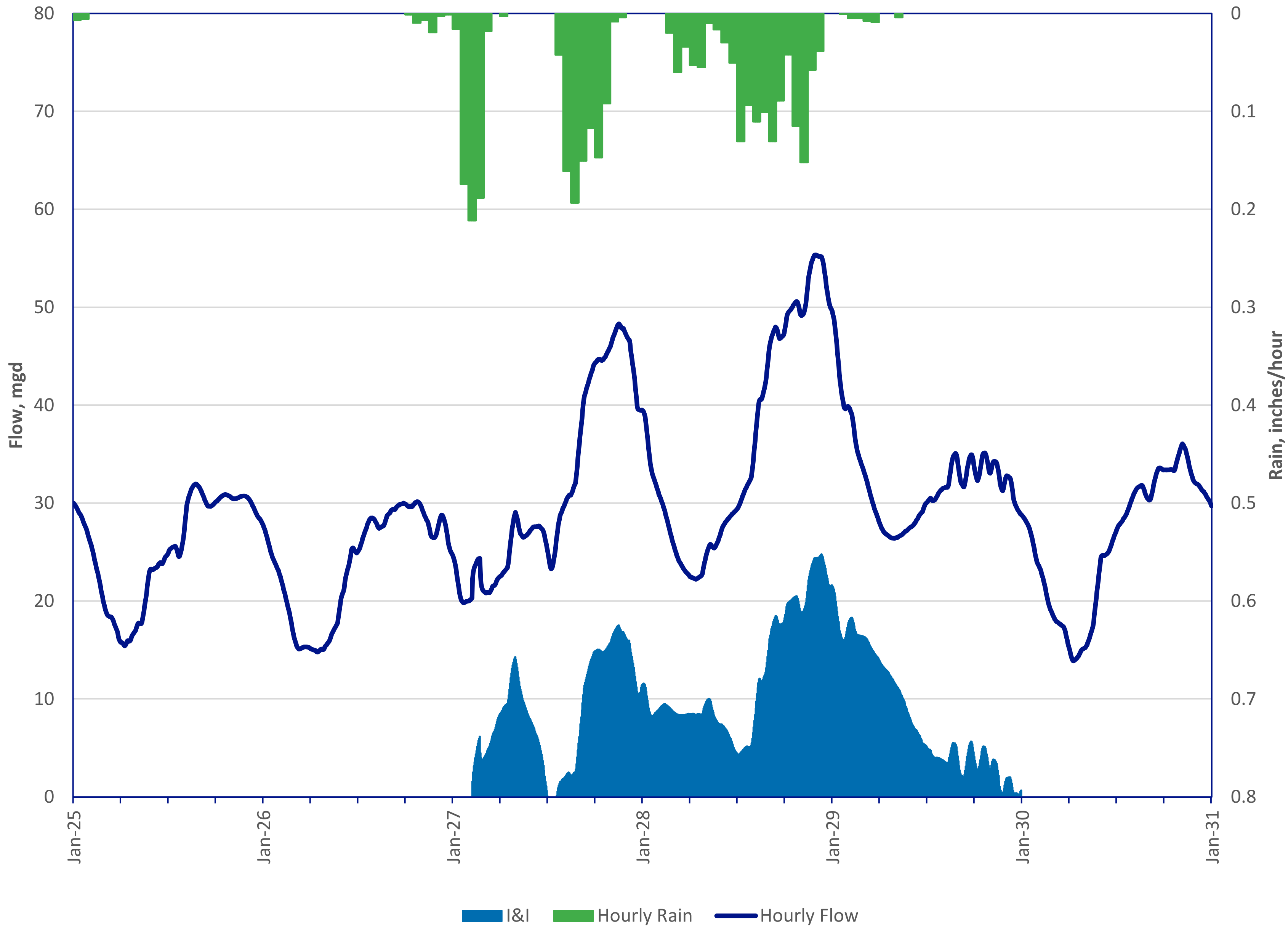
1. Peak flows occurred during the January 27–28, 2021 storm event at all metering sites except 1-1, 2-1, 3-3, 4-2, 4-4, and 10 1, none of which had peak flows associated with significant storm events.
2. The peak flow at the RWCF was 55.35 mgd.
3. The City-wide peak I&I rate during the January 27 and 28, 2021 storm event is approximately 1,000 gallons per day (gpd) per acre.
4. The tributary areas associated with Sites 1-1, 2-1, 3-2, 4-3+4-4, 6-2, 6-3, 6-4, and 7-1 all had maximum I&I rates well in excess of the City-wide total.
5. The tributary areas associated with Sites 8-3 and 10-1 had peak I&I rates well below the City-wide total.
6. I&I rates could not be calculated for Sites 4-3, 4-4, 5-1, 5-2, 6-5 and 6-6 due to the presence of one or more upstream flow splits that make it impossible to define the tributary area for the individual meters.

Table 3-4. Flow and I&I Statistics									
Metering Site	Start Date	End Date	Q_a, mgd	Q_p, mgd	Time of Peak Flow	PF	Max Storm I&I, mgd	Tributary Acreage, acres	Max I&I Rate, gpd/acre[(a)]
1-1	10/20/2020	3/15/2021	0.98	3.91	Nov-19-2020 5:55	4.0	2.04	690	3,000
2-1	10/13/2020	3/15/2021	2.86	9.51	Dec-14-2020 13:20	3.3	6.14	2,080	3,000
2-2	10/13/2020	3/15/2021	3.98	7.35	Jan-27-2021 15:35	1.8	2.58	2,990	900
3-1	10/24/2020	3/15/2021	1.02	2.12	Jan-27-2021 18:05	2.1	0.86	950	900
3-2	10/13/2020	3/15/2021	1.61	4.22	Jan-27-2021 17:45	2.6	2.27	1,120	2,000
3-3	11/3/2020	3/15/2021	0.19	1.19	Nov-3-2020 9:10	6.3	0.27	250	1,100
4-1	10/14/2020	3/15/2021	0.57	1.85	Jan-28-2021 13:40	3.3	1.14	900	1,300
4-2	10/20/2020	3/15/2021	0.53	1.86	Feb-22-2021 10:25	3.5	0.82	550	1,500
4-3	10/20/2020	3/15/2021	0.029	0.39	Jan-28-2021 16:15	13.3	0.37	(b)	(b)
4-4	10/24/2020	3/13/2021	0.094	0.64	Feb-21-2021 18:45	6.8	0.15	(b)	(b)
4-3+4-4	10/24/2020	3/13/2021	0.12	0.57	Jan-28-2021 16:35	4.8	0.42	150	2,800
5-1	11/27/2020	3/15/2021	1.02	2.69	Jan-28-2021 14:50	2.7	1.65	(b)	(b)
5-2	10/14/2020	3/12/2021	0.51	1.59	Jan-28-2021 17:50	3.1	0.93	(b)	(b)
6-1	10/27/2020	3/15/2021	0.41	0.91	Jan-28-2021 18:10	2.2	0.38	300	1,300
6-2	10/14/2020	3/15/2021	0.63	3.46	Jan-28-2021 20:55	5.5	2.60	480	5,400
6-3	10/14/2020	3/15/2021	0.96	3.11	Jan-28-2021 13:15	3.2	1.91	1,010	1,900
6-4	11/14/2020	3/15/2021	0.55	2.75	Jan-28-2021 20:55	5.0	2.00	390	5,100
6-5	10/20/2020	3/15/2021	0.65	3.75	Jan-28-2021 21:10	5.8	2.92	(b)	(b)
6-6	10/14/2020	3/15/2021	1.07	3.95	Jan-28-2021 13:40	3.7	2.62	(b)	(b)
7-1	10/14/2020	3/15/2021	1.29	3.59	Jan-28-2021 14:00	2.8	2.02	930	2,200
7-2	11/14/2020	3/15/2021	3.26	8.04	Jan-28-2021 18:25	2.5	3.75	5,180	700
8-1	11/14/2020	3/15/2021	1.35	2.54	Jan-27-2021 17:20	1.9	0.94	1,080	900
8-2	10/14/2020	3/15/2021	0.40	1.06	Jan-27-2021 16:50	2.6	0.44	420	1,000
8-3	10/14/2020	3/15/2021	0.42	0.85	Jan-25-2021 11:40	2.0	0.37	1,390	300
8-4	10/14/2020	3/15/2021	0.52	1.14	Jan-27-2021 17:55	2.2	0.45	560	800
10-1	10/20/2020	3/15/2021	2.16	3.60	Nov-26-2020 13:00	1.7	0.79	2,340	300
RWCF	**10/1/2020**	**2/28/2021**	**24.01**	**55.35**	**Jan-28-2021 21:59**	**2.3**	**24.80**	**24,970**	**1,000**

(a) Rounded off to the nearest 100 gpd/acre.

(b) Tributary acreage and I&I rate cannot be calculated do to one or more upstream flow splits.

Figure 3-2. RWCF Influent Flows and I&I, January 25 through 30, 2021



3.4.1 Evidence for Backwater Conditions

The temporary flow metering sites use area-velocity meter technology that measures flow depth, flow velocity and flow rate on 5-minute intervals. The measurement of both depth and velocity allow for an assessment of whether a given line is flowing unimpeded, or whether backwater conditions exist. Table 3-5 presents the following relevant information for each metering site:

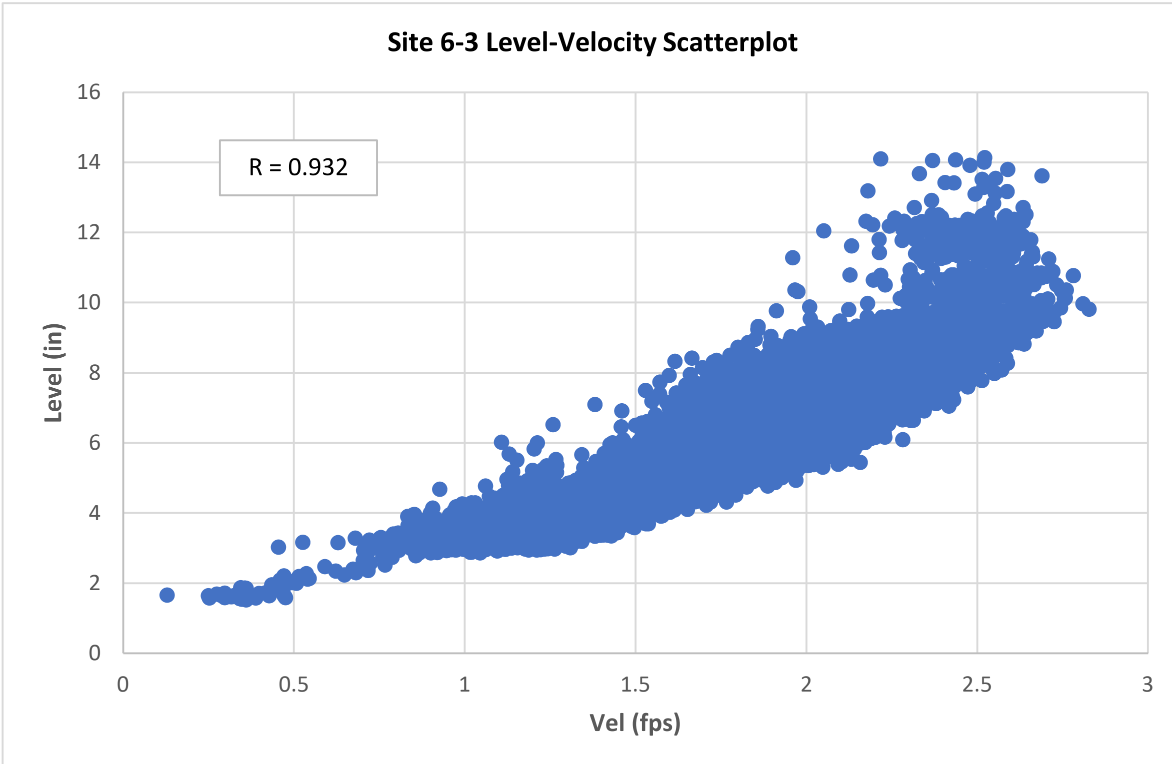
- Pipe Diameter (D)
- Average Flow Depth (d): The long-term average measured pipe flow depth
- Average d/D: The ratio between the average measured flow depth and the pipe diameter
- Maximum Flow Depth (d): The maximum measured pipe flow depth
- Maximum (Max d/D): The maximum ratio between the measured flow depth and the pipe diameter
- Time of Maximum Depth
- Maximum Surcharge: The maximum surcharge (if any) above the pipe crown
- Minimum Headspace: The remaining MH headspace associated with the maximum surcharge
- Average Velocity (Avg V): The long-term average measured pipe flow velocity
- Minimum Velocity (Min V): The minimum instantaneous pipe flow velocity during the data period
- Depth-Velocity Correlation (R): The calculated correlation coefficient between the measured depth and measured velocity readings

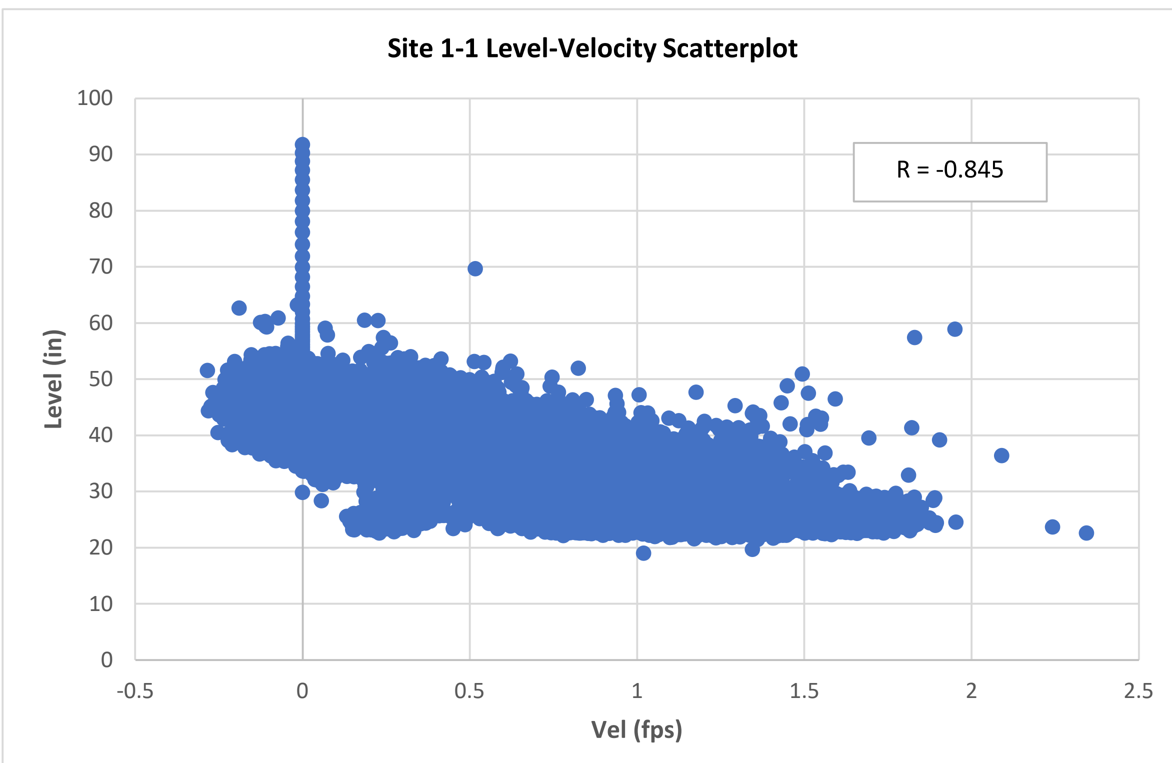
In general, a correlation coefficient above 0.5 indicates unimpeded flow conditions, a correlation coefficient of 0 to 0.5 indicates partially impeded flow conditions, and a negative correlation coefficient indicates significantly impeded flow conditions. For purposes of this analysis, the identification of backwater conditions is accomplished through comparison of maximum flow depths with the given pipe diameter, through visual inspection of depth-velocity scatterplots at each site, and through the consideration of the R-value for each metering location. Figure 3-3 shows scatterplots and associated correlation coefficients for metering Site 6-3 and metering Site 1-1, which represent the highest and lowest R-values, respectively, of the 25 temporary flow metering sites.

It should be noted that a power failure during the January 27 and 28, 2021 storm resulted in certain pump stations being non-operational during that event, which contributed to the observed backwater conditions at metering sites 1-1, 2-1, 2-2, 4-2, and 10-1. However, those sites also routinely exhibit backwater conditions during dry weather flow conditions.

Table 3-5. Flow Depth and Velocity Statistics											
Metering Site	Pipe D, in	Avg Depth (d), in	Avg d/D	Max Depth (d), in	Max d/D	Time of Max Depth	Max Surcharge, ft	Min Headspace, ft	Avg V, ft/sec	Min V, ft/sec	D-V Correlation (R)
1-1	27	37.6	1.39	91.8	3.40	Nov-19 5:50	5.4	11.5	0.401	-0.284	-0.845
2-1	48	34.9	0.73	117.4	2.45	Dec-14 13:05	5.8	8.8	0.500	0.000	-0.370
2-2	36	25.9	0.72	110.0	3.05	Dec-14 13:15	6.2	12.5	1.308	0.121	-0.587
3-1	24	9.1	0.38	13.5	0.56	Jan-28 22:35	--	--	1.444	0.810	0.831
3-2	30	8.2	0.27	14.8	0.49	Jan-28 17:25	--	--	2.045	1.284	0.855
3-3	18	3.1	0.17	9.7	0.54	Nov-3 9:40	--	--	0.974	-1.015	0.901
4-1	18	5.6	0.31	29.5	1.64	Nov-19 7:15	1.0	5.8	1.798	0.029	0.896
4-2	18	22.5	1.25	247.8	13.77	Feb-21 21:25	19.2	7.0	0.731	0.005	-0.292
4-3	10	3.7	0.37	70.9	7.09	Feb-21 20:40	5.1	11.0	0.406	-0.130	0.269
4-4	14	3.3	0.23	8.8	0.63	Jan-28 16:25	--	--	0.701	0.010	0.836
5-1	24	7.3	0.30	29.5	1.23	Jan-28 20:20	0.5	11.8	1.985	0.860	0.637
5-2	24	8.9	0.37	45.9	1.91	Jan-28 18:10	1.8	12.2	0.876	0.210	0.137
6-1	24	7.0	0.29	17.2	0.72	Jan-28 22:00	--	--	0.828	0.240	0.826
6-2	30	8.0	0.27	18.8	0.63	Jan-28 21:25	--	--	0.866	0.264	0.843
6-3	27	6.4	0.24	14.1	0.52	Jan-28 13:40	--	--	1.879	0.129	0.932
6-4	24	9.1	0.38	16.8	0.70	Jan-28 21:05	--	--	0.790	0.108	-0.027
6-5	36	10.5	0.29	70.6	1.96	Jan-28 21:35	2.9	17.3	0.757	0.379	0.315
6-6	27	6.8	0.25	13.5	0.50	Jan-28 14:05	--	--	2.014	0.612	0.930
7-1	42	8.3	0.20	17.7	0.42	Jan-28 14:55	--	--	1.483	0.281	0.263
7-2	72	12.3	0.17	20.2	0.28	Jan-28 22:20	--	--	1.571	0.669	0.838
8-1	48	8.7	0.18	12.2	0.25	Feb-7 13:50	--	--	1.310	0.038	0.576
8-2	27	6.8	0.25	13.7	0.51	Oct-15 10:15	--	--	0.769	0.056	0.307
8-3	33	4.4	0.13	6.8	0.21	Jan-22 15:55	--	--	1.178	0.389	0.732
8-4	42	2.9	0.07	5.1	0.12	Jan-11 12:50	--	--	2.741	1.218	0.447
10-1	54	8.5	0.16	76.3	1.41	Mar-1 23:25	1.9	18.8	2.179	0.000	-0.291

Figure 3-3: Level-Velocity Scatterplots and Correlation Coefficients (R)





Based on a review of the depth-velocity data with consideration of the collection system configuration, the following conclusions have been reached:

- **Site 1-1**: This site has no clear diurnal flow patterns, frequently reports negative flows, and is frequently submerged, with an average d/D value of 1.39. The maximum observed flow depth was approximately 92 inches, which is 3.4 times the pipe diameter, and represents approximately 5.4 feet of surcharging in a MH with a rim to crown depth of 16.7 feet (per the City's GIS) leaving 11.5 feet of additional headspace. The R-value at this site was –0.845, which is the lowest of all 25 sites. The metering location is just upstream of the Cumberland & Five Mile Creek Pump Station (PS) in one of two large diameter inlets of a junction MH, the other inlet of which receives flow from the Kelly & Mosher PS. It therefore appears that the Cumberland & Five Mile Creek PS is either not keeping up with the incoming flows, or the pump set points are such that the upstream sewers frequently surcharge. Moreover, it appears that the operation of the Kelly & Mosher PS pushes flow back up into the flow metered line on a regular basis, resulting in negative flow velocities at the metering location.
- **Site 2-1**: This site had a maximum observed flow depth of approximately 117 inches, which is 2.5 times the pipe diameter, and represents approximately 5.8 feet of surcharging in a MH with a rim to crown depth of 14.5 feet (per the City's GIS) leaving 8.8 feet of additional headspace. The R-value at this site was –0.370, which indicates frequent backwater conditions. The metering location is just upstream of the Swenson (North) PS. It therefore appears that the Swenson PS is either not keeping up with the incoming flows, or the pump set points are such that the upstream sewers frequently surcharge.
- **Site 2-2**: This site had a maximum observed flow depth of approximately 110 inches, which is 3.1 times the pipe diameter, and represents approximately 6.2 feet of surcharging in a MH with a rim to crown depth of 18.7 feet (per the City's GIS), leaving 12.5 feet of additional headspace. The R-value at this site was –0.587, which indicates frequent backwater conditions. The metering location is just upstream of the Swenson PS. It therefore appears that the Swenson PS is either not keeping up with the incoming flows, or the pump set points are such that the upstream sewers frequently surcharge.
- **Site 4-1:** This site had one episode on November 19, 2020 where the depth, velocity, and flow all spiked upward, and the d/D value peaked at 1.64, which equates to a maximum surcharge of 1.0 feet in a MH with a rim to crown depth of 6.7 feet (per the City's GIS). Otherwise, the site operated without surcharging and with unimpeded flows. The site is a relatively short distance downstream of the Drake & Highway 99 PS, which suggests that the pump station ceased operating for a period on November 19, 2020, storing flow in its wet well and possibly the upstream gravity sewers and MHs, and then overloaded the downstream pipe when operations resumed.
- **Site 4-2**: This site has no clear diurnal flow patterns and is frequently submerged, with an average d/D value of 1.25. The maximum observed flow depth was approximately 248 inches, which is 13.8 times the pipe diameter, and represents approximately 19.2 feet of surcharging in a MH with a rim to crown depth of 26.2 feet (per the City's GIS), leaving 7.0 feet of additional headspace. The R-value at this site was –0.292, which indicates frequent backwater conditions. The metering location is just upstream of the Waterloo & Roosevelt PS. It therefore appears that this pump station is either not keeping up with the incoming flows, or the pump set points are such that the upstream sewers frequently surcharge.

- **Site 4-3**: This site is immediately downstream of a flow split, and typically receives less flow than the other flow split outlet (which is captured by Site 4-4). Even though this site is more than a mile upstream of the Waterloo & Roosevelt PS, there is a clear correlation between the flow backups at this site and the more extreme flow backups at Site 4-2. The maximum observed flow depth at this site was approximately 71 inches, which is 7.1 times the pipe diameter and represents approximately 5.1 feet of surcharging in a MH with a rim to crown depth of 16.1 feet (per the City's GIS) leaving 11.0 feet of additional headspace. The R-value was 0.269, which reflects the fact that this site flowed unimpeded in the absence of severe backups at Site 4-2.
- **Site 5-1**: This site surcharged during the January 27 and 28 storm event but did not surcharge at any other time. It appears that the surcharge was a combination of backwater and pressure flow conditions given that flow velocities decreased but did not approach zero during the surcharge period. The maximum observed flow depth was approximately 30 inches in a 24-inch diameter pipe and represents approximately 0.5 feet of surcharging in a MH with a rim to crown depth of 12.3 feet (per the City's GIS) leaving 11.8 feet of additional headspace.
- **Site 5-2**: As with Site 5-1, this site surcharged during the January 27 and 28 storm event but did not surcharge at any other time. It appears that the surcharge was a combination of backwater and pressure flow conditions given that flow velocities decreased but did not approach zero during the surcharge period. The maximum observed flow depth was approximately 46 inches in a 24-inch diameter pipe and represents approximately 1.8 feet of surcharging in a MH with a rim to crown depth of 14.0 feet (per the City's GIS) leaving 12.2 feet of additional headspace.
- **Site 6-4**: This site was the only site that had a negative R-value (–0.027) without ever surcharging. This result indicates that backwater conditions are common, but never enough to generate surcharging at this point in the system.
- **Site 6-5**: This site surcharged during four different storm events, with a maximum surcharge during the January 27 and 28 storm event, but at no other times. Velocities were relatively low but consistent at the site, thereby indicating backwater flow conditions. The maximum observed flow depth was approximately 71 inches in a 36-inch diameter pipe and represents approximately 2.9 feet of surcharging in a MH with a rim to crown depth of 20.2 feet (per the City's GIS) leaving 17.3 feet of additional headspace.
- **Site 10-1**: On three different occasions, this site surcharged, and velocities went to zero. One of these episodes occurred toward the end of the January 27 and 28 storm event, but the other two were not associated with storm events. The maximum observed flow depth was approximately 76 inches (during dry weather conditions), which is 1.4 times the 54-inch pipe diameter, and represents approximately 1.9 feet of surcharging in a MH with a rim to crown depth of 20.7 feet (per the City's GIS) leaving 18.8 feet of additional headspace. The R-value at this site was – 0.291, which is largely due to the three surcharge episodes. In the absence of these three episodes, a positive correlation exists between depth and velocity. The metering location is just upstream of the 14-Mile Slough PS. It therefore appears that this pump station shuts off at certain times while flows build up in the upstream sewer, after which time normal pump station operations resume.

3.5 INVESTIGATION OF FLOW SPLITS

As part of this Master Plan, a special field survey was conducted in September 2020 to evaluate apparent flow splits indicated in the City's sewer GIS data. A flow split is defined as an MH that has two outlet pipes, and therefore has the potential to direct flows along two separate pathways. The September 2020 field survey supplemented earlier survey work performed in 2018. These surveys either confirmed or refuted the existence of the indicated flow splits, while also providing sewer invert and rim elevation data that has been used to confirm or supplement the City's sewer GIS data.

In the September 2020 survey, a total of 18 potential flow splits were investigated, involving surveys of 48 MHs either at or downstream of the suspected flow splits. Two other active flow splits in the downtown area were confirmed in 2018. In addition, five force main flow splits are known to exist, although these splits were not included in any field surveys.

The locations of the 18 flow split locations are presented graphically in Appendix B of this report. The field data sheets obtained from the September 2020 field surveys are presented in Appendix C of this report. As a result of the various surveys and GIS information, the known or suspected flow splits in the system can be categorized as follows:

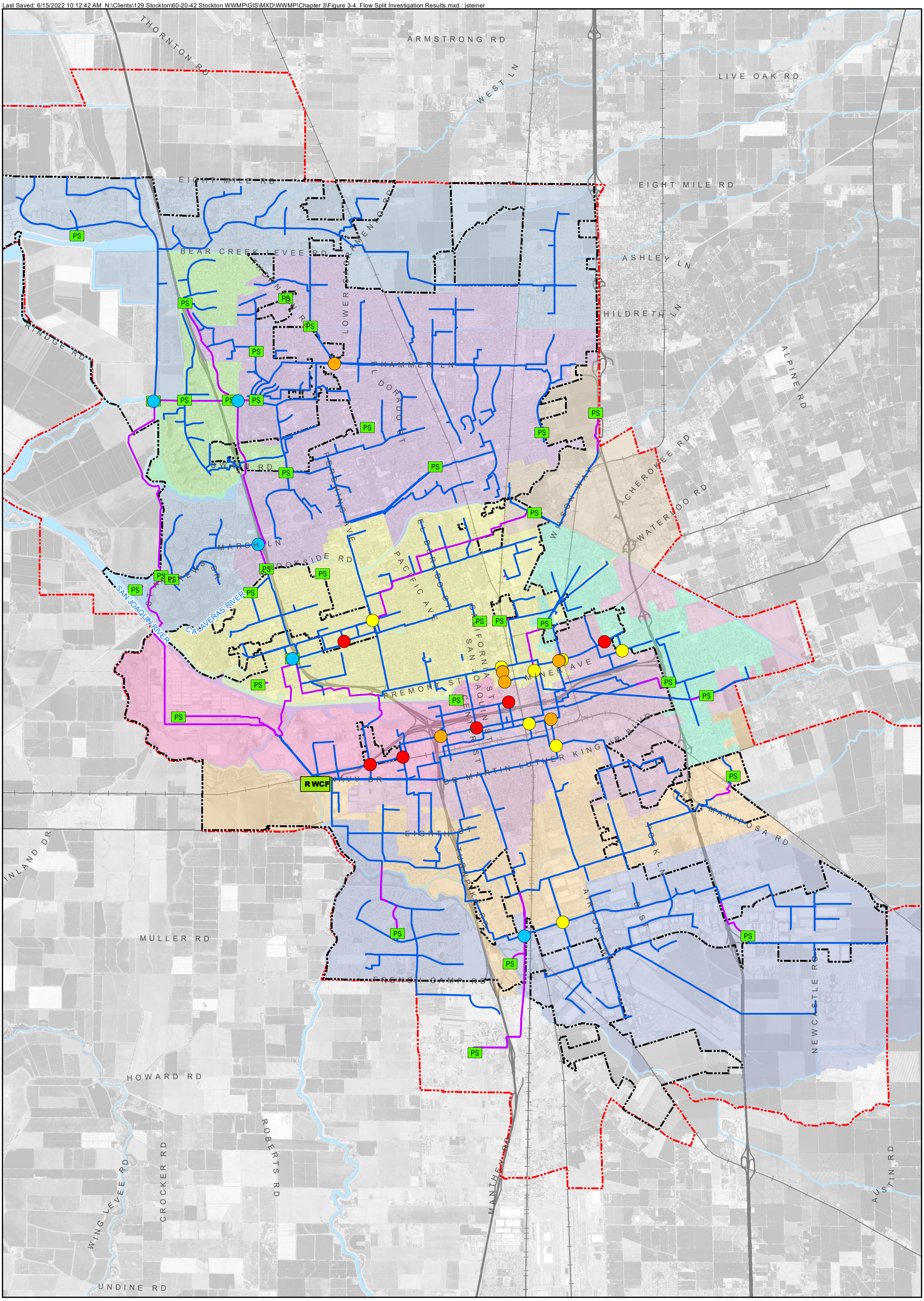
- Confirmed flow split under normal gravity flow conditions (six cases)
- Confirmed force main flow split (five cases)
- Apparent flow split only under peak flow or surcharged conditions (six cases)
- Secondary outlet non-existent, blocked, or not found, i.e., flow split not present or unconfirmed (ten cases)

The various locations of these flow splits are summarized on Figure 3-4. In addition, the City's sewer GIS data indicates that numerous lesser flow splits may exist throughout the collection system. However, for the following reasons, these potential flow splits are not considered to be significant:

1. The suspected split is on a small diameter line and flows entering the split are expected to be minor, thereby having an insignificant effect on the downstream system.
2. The two flow split paths reconverge a short distance downstream of the split.
3. The flow split MH has two outlets and no inlets, which represents a high point in the system.

Accordingly, these lesser flow splits are not shown on Figure 3-4 and are not considered further in this Master Plan.

Last Saved: 6/15/2022 10:12:42 AM N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 3\Figure 3-4. Flow Split Investigation Results.mxd : jsteiner



Flow Split Category

- Confirmed Gravity Main Flow Split
- Confirmed Force Main Flow Split
- Surcharged/High-Flow Condition Flow Split
- No Secondary Outlet Found

System Facilities

- PS Pump Stations
- RWCF Regional Wastewater Control Facility
- Gravity Mains (D ≥ 12 inches)
- Force Mains

Collection System Service Areas

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

- City of Stockton Limits
- City of Stockton Sphere of Influence

N

0 0.625 1.25
Miles

WEST YOST

Figure 3-4

Flow Split Investigation Results

City of Stockton
Wastewater Master Plan Update

The purpose of this chapter is to present planning, design, and performance criteria applicable to the City's wastewater collection system. These criteria are relevant to the analysis of the existing system, as well as to the assessment of future capacity needs. The criteria presented in this chapter serve as the basis for the recommended CIP presented later in this report. Key topics addressed in this chapter include:

- Existing City Planning and Design Standards
- Planning and Assessment Criteria Used in This Analysis

4.1 EXISTING CITY PLANNING AND DESIGN STANDARDS

The criteria presented in this chapter are considered adjunct to existing City Standards and are not intended to replace or supersede those standards unless specifically stated otherwise. The City Standards exist as Standard Specifications and Standard Drawings for sewer, storm drain, water and street utilities/infrastructure.

The Standard Specifications for sewers address pipe materials, maintenance holes, trenching and construction, and related topics. The Standard Drawings include various drawings related to pipe and maintenance hole construction, plus various system criteria that include the following:

- Dry weather flow factors for various land use categories
- Calculation of flow peaking factors
- I&I rates
- Design flow calculations
- Pipe slope, diameter, velocity, and Manning's "n" requirements for pipe sizing
- Pump station and force main design requirements

The pipe, pump station, and force main requirements are not being revised as part of the Master Plan and are assumed to remain in effect. The other standards in the above list are subject to reevaluation in this report.

The City's existing dry weather flow factors for collection system planning and design are summarized in Table 4-1. The values shown in the table are used to calculate Q_a. The City Standards also specify the following formulas, where Q_a is expressed in units of mgd:

$$\text{For } Q_a < 0.5 \text{ mgd: } PF = 2.29 * Q_a^{-0.338}$$

$$\text{For } Q_a = 0.5\text{–}1.8 \text{ mgd: } PF = 2.50 * Q_a^{-0.216}$$

$$\text{For } Q_a > 1.8 \text{ mgd: } PF = 2.37 * Q_a^{-0.124}$$

I&I is calculated by applying a factor of 400 gpd per acre multiplied by the tributary area in acres. The design flow (Q_d) is then calculated by applying the PF value to the sum of the Q_a and the I&I, as follows:

$$Q_d = PF * (Q_a + I\&I)$$

Table 4-1 Existing City of Stockton Collection System Flow Factors			
	Planning Values	Design Values	
Category	gpd/acre	gpd/unit	gpd/1,000 sq. ft.
Residential			
Single-Family	2,100	300	--
Multi-Family	6,800	270	--
Planned Unit Residential Development	3,700	270	--
Commercial			
Office	2,400	--	90
Retail	2,000	--	80
Eating and Drinking	8,600	--	500
Wholesale, Storage	800	--	40
Industrial			
Food processing	--	Special	Special
Light	3,000	--	150
Heavy (low wastewater)	3,000	--	150
Heavy (high wastewater)	--	Special	Special
Schools			
Primary	1,800	0	340
Secondary	1,400	0	310

Source: City of Stockton Standard Drawings, Drawing No. S-1, Sanitary Sewer Design Data, 9/27/2016.

The categories shown in Table 4-1 do not align with the land use categories in the City's General Plan, and therefore cannot be used in conjunction with General Plan land use data to estimate existing and future collection system flows. Moreover, while the flow factors in Table 4-1 may be suitable for design of collection system facilities, they do not reflect current wastewater flow generation trends throughout the City. For the purposes of this Master Plan, it is therefore necessary to develop a set of flow factors for the land use categories identified in the General Plan, as described in the Section 4.2. This Master Plan does not include recommendations for modifying the City Standards shown in Table 4-1, which continue to function as design criteria for sizing of collection system facilities.

4.2 PLANNING AND ASSESSMENT CRITERIA USED IN THIS ANALYSIS

Specific issues not addressed in the existing City Standards that need to be considered in this Master Plan include the following:

- Flow Factors for General Plan Land Use Categories
- Modeling of Peak Wet Weather Flow Conditions
- Capacity Assessment of Existing Facilities

4.2.1 Flow Factors for General Plan Land Use Categories

As described in detail in Chapter 5, winter water demands from February through March 2019 serve as the basis for the development of flow estimates for existing Q_a conditions throughout the City. These demands are also used to determine typical wastewater flow generation rates for each General Plan land use category.

Table 4-2 shows flow generation rates by land use category, assuming a 90 percent return to sewer ratio (defined as the wastewater flow divided by the winter water demands). The results are shown both in terms of flow per acre and flow per parcel. Flow per residential dwelling unit cannot be calculated because the General Plan Land use database does not contain existing and planned future dwelling unit counts. Nevertheless, it is expected that the flow per parcel estimates can still be estimated for the Low-Density Residential category, which would typically have one dwelling unit per parcel.

The land use-based flow factors in Table 4-2 are grouped into the following categories:

- Residential
- Commercial/Industrial/Institutional
- Downtown
- Other

The Downtown category includes both Residential and Commercial/Industrial/Institutional categories but are separated out with the understanding that land uses in the Downtown area may have different flow generation characteristics when compared to other areas of the City.

Table 4-2 also indicates the variation in the results by presenting "upper average" values for the flow per acre and flow per parcel calculations. This upper average is calculated as being the average of all parcel-specific results that exceed the overall average value for the category. For example, the High-Density Residential category shows an average (mean) unit flow of 2,467 gpd/acre. The average of all values above the mean is 5,772 gpd/acre. This latter value provides some sense of the spread in the individual results. The following comparisons can be made between the flow generation rates in Table 4-2 and the City flow factors in Table 4-1:

1. The Low-Density Residential category upper average value of 310 gpd/parcel in Table 4-2 can be compared to the City's existing Single-Family Residential flow factor of 300 gpd/unit in Table 4-1.
2. The High-Density Residential category upper average value of 5,772 gpd/acre in Table 4-2 can be compared to the City's existing Multi-Family Residential flow factor of 6,800 gpd/acre in Table 4-1.
3. The Administrative Professional upper average value of 3,497 gpd/acre in Table 4-2 can be compared to the City's existing Office flow factor of 2,400 gpd/acre in Table 4-1.
4. The Commercial upper average value of 2,988 gpd/acre in Table 4-2 can be compared to the City's existing Retail flow factor of 2,000 gpd/acre and Eating and Drinking flow factor of 8,600 gpd/acre in Table 4-1.
5. The Industrial upper average value of 1,846 gpd/acre in Table 4-2 can be compared to the City's existing Industrial Light and Heavy (low wastewater) flow factors of 3,000 gpd/acre in Table 4-1.

Table 4-2 also shows proposed land use-based dry weather flow factors that are rounded off from the upper average values. These factors would be applied to future growth portion of buildout flows in the model, whereas existing conditions dry weather flows will be based on existing water demands, as described in detail in Chapter 5 of this report.

The Industrial flow factor shown in Table 4-2 may require special attention, as industrial flows can be highly industry specific. Many industrial activities (such as warehouses) are extremely low-flow on a per acre basis, while others (such as canneries) are extremely high-flow. Accordingly, while the use of the proposed 2,000 gpd/acre value may be suitable in some situations, higher and/or lower values may be applicable on a case-by-case basis.

Finally, a flow factor for the Economic and Education Enterprise land use category cannot be estimated directly due to a lack of existing development. The only area zoned for this land use is an approximately 3,800-acre area north of Eight Mile Road. For this analysis, it is assumed that the Institutional flow factor would be reasonable approximation for future flow generation for this category.

4.2.2 Modeling of Peak Wet Weather Flow Conditions

The existing City Standards describe how to perform design flow calculations for collection system facilities. The City Standards do not, however, address flow modeling methodologies and assumptions, such as the simulation of peak wet weather flow (Q_p) conditions throughout the City's wastewater collection system. Design flows and peak wet weather flows are similar; however, whereas design flows are intended for the sizing of new facilities in specific areas of the collection system (such as new areas of development), Q_p values are generally derived for locations throughout the collection system. Also, design flows are used to size gravity sewers such that the sewer pipe must not flow more than 100 percent full, whereas some amount of system surcharging may be considered acceptable for Q_p conditions.

Surcharging occurs when flow exceeds the open channel flow capacity of a gravity flow pipeline, which causes the water level in maintenance holes to begin rising above the adjacent pipe crown elevation. Under surcharged conditions, the pipe flows under pressure and can carry additional flow. Gravity sewers are generally designed to flow partially full, or full without surcharging. However, short periods of surcharging can be accommodated within certain limits without justifying the cost of upsizing an existing pipeline. Such limits are discussed further in Section 4.2.3.

For estimating both design flows and Q_p conditions, a Q_a condition is established first. For design flows, a peaking factor is derived and a constant rate of I&I is assumed, as described above. For Q_p conditions, a hydraulic model is used to apply a diurnal flow pattern to the Q_a condition, and then I&I resulting from a simulated severe storm event is superimposed on the dry weather flow pattern. The diurnal flow patterns used in this analysis are described in Chapter 3.

It is common practice to use a 24-hour storm with a 10-year return period as the basis for the simulation of I&I that produces simulated Q_p conditions. According to the NOAA, the 10-year, 24-hour storm for Stockton has a magnitude of 2.43 inches. The application of the 10-year storm to the collection system is described in Chapter 5.

Table 4-2. Estimated Wastewater Flow Generation Rates by General Plan Land Use Category											
	Parcels w/Non-Zero Water Demands										
Land Use	Parcel Count	Area, acres	Average Parcel Size, acres	Winter Water Demand, mgd	Return to Sewer, mgd	Unit Flow by Area, gpd/acre	Unit Flow by Parcel, gpd/parcel	Upper Average, gpd/acre	Upper Average, gpd/parcel	Proposed Flow Factor for Future Growth, gpd/acre	Notes
Residential	**80,724**	**15,155**	**0.19**	**18.334**	**16.500**	**1,089**	**204**	**--**	**--**	**--**	
High Density Residential	1,379	615	0.45	1.687	1.518	2,467	1,101	5,772	n/a	6,000	
Low Density Residential	72,985	13,331	0.18	14.587	13.128	985	180	1,878	310	2,000	City standard = 300 gpd/unit
Medium Density Residential	6,360	1,209	0.19	2.059	1.853	1,533	291	3,230	n/a	3,500	
Residential Estate	0	0	--	0	0	--	--	--	--	2,000	Assumed same as Low Density Res.
Commercial/Industrial/Institutional	**3,556**	**7,595**	**2.14**	**6.317**	**5.685**	**748**	**1,599**	**--**	**--**	**--**	
Administrative Professional	314	335	1.07	0.435	0.391	1,169	1,247	3,497	n/a	3,500	
Commercial	2,050	1,829	0.89	2.107	1.896	1,037	925	2,988	n/a	3,000	
Economic and Education Enterprise	0	0	--	0	0	--	--	--	n/a	1,500	Assumed same as Institutional
Industrial	800	3,302	4.13	2.921	2.629	796	3,286	1,846	n/a	2,000	
Institutional	42	1,853	44.11	0.676	0.608	328	14,480	1,152	n/a	1,500	
Mixed Use	350	277	0.79	0.178	0.160	579	458	1,815	n/a	2,000	
Downtown	**450**	**187**	**0.42**	**0.409**	**0.368**	**1,968**	**819**	**--**	**--**	**--**	
Downtown Commercial	342	160	0.47	0.302	0.271	1,698	794	4,366	n/a	4,500	
Downtown Industrial	10	5	0.53	0.002	0.002	419	221	557	n/a	2,000	Assumed same as Industrial
Downtown High Density Residential	60	17	0.28	0.051	0.046	2,699	765	6,305	n/a	6,500	
Downtown Medium Density Residential	38	5	0.13	0.007	0.006	1,157	154	1,973	n/a	3,500	Assumed same as Medium Density Res.
Other	**847**	**4,248**	**5.02**	**0.048**	**0.043**	**10**	**51**	**--**	**--**	**--**	
Open Space/Agriculture	1	7	7.04	0.00002	0.00001	2	15	2	n/a	0	
Parks and Recreation	46	940	20.42	0.048	0.043	46	934	162	n/a	200	
Not specified	800	3,302	4.13	0	0	0	0	--	n/a	TBD	
TOTAL	**85,577**	**27,186**	**0.32**	**25.059**	**22.553**	**--**	**--**	**--**	**--**	**--**	

4.2.3 Capacity Assessment of Existing Facilities

The following collection system capacity assessment criteria are used in this Master Plan:

- Gravity mains are considered undersized if the criteria presented in Table 4-3 are not met. Figure 4-1 provides a graphical depiction of the capacity criteria summarized in Table 4-3.
- Pump stations are considered undersized if the associated firm capacity (i.e., capacity with the largest pump out of service) is not sufficient at modeled Q_p conditions.
- Force mains are considered undersized if the maximum velocity exceeds 8 feet per second (fps) at modeled Q_p conditions, which is based on commonly used standards in the industry. A lower maximum velocity may trigger an improvement for very long or large diameter force mains, which will be considered on a case-by-case basis.

In Table 4-3 and Figure 4-1, the hydraulic grade line (HGL) elevation is compared to the ground surface elevation at each MH to assess the severity of surcharging. Surcharging that is predicted to reach an elevation near the ground surface is considered severe and would warrant classification as a high priority (Priority 1) capital improvement under modeled conditions. The nature and location of the improvement will depend on the cause of the surcharging and may not pertain to the same location where severe surcharging is predicted, but instead may be attributable to downstream restrictions.

Table 4-3. Existing Gravity Main Capacity Criteria		
Capacity Category	Criteria [a]	Comments
Priority 1 – Possible Sanitary Sewer Overflows	1. Q_p>Q_{full}; and, 2. HGL within 1 foot of ground surface	These gravity sewers have the potential to produce sanitary sewer overflows during peak wet weather flow events.
Priority 2 – Excessive Surcharging	1. Q_p> Q_{full}; and, 2. HGL from 1 to 4 feet below ground surface	These gravity sewers have the potential to backup into service laterals and drains at low elevations during peak wet weather flow events. There is some apparent risk of overflows.
Priority 3 – Moderate Surcharging	1. Q_p> Q_{full}; and, 2. HGL from 4 to 8 feet below ground surface (or) 3. HGL more than 1 foot above crown in sewers less than 8 feet deep	These gravity sewers have the potential to backup into service laterals and drains at low elevations during severe peak wet weather flow events. There is reduced apparent risk of overflows. Field investigations and flow/surcharge monitoring is warranted if an improvement is not otherwise recommended. Additional flow from new development is not acceptable without improvements.
Priority 4 – Minimal Surcharging/ Reported Adverse Slope	1.Q_p> Q_{full}; and, 2. HGL more than 8 feet below ground surface (or) 3. HGL less than 1 foot above crown in sewers 5 to 8 feet deep (or) 4. Sewer line sloped adversely (negative slope in the direction of flow)	These sewers have an apparently acceptable level of peak flow surcharging. Additional flow from new development is not acceptable without capacity improvements. Sewers with reported adverse slopes should be field investigated to verify invert elevations.
Approaching Full-Pipe Capacity	Q_p ranges between 90-100% of Q_{full};	These sewers do not exceed City design criteria, but should be investigated further with flow monitoring before permitting additional flows from upstream development.

(a) "Q_{full}" is the flow at which no more flow can be accommodated without surcharging.

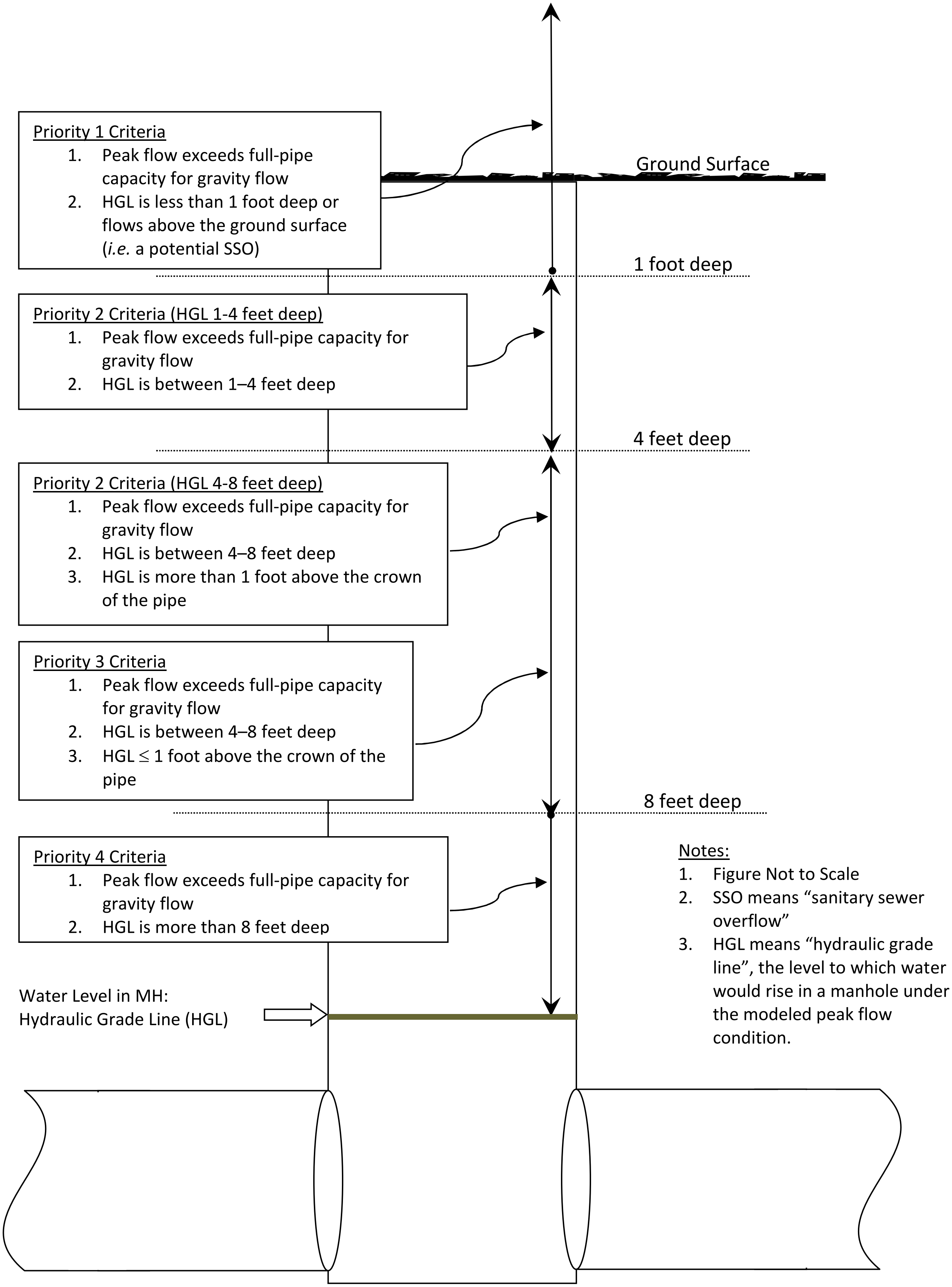


Figure 4-1. Gravity Sewer Capacity Exceedance Criteria

The purpose of this chapter is to present the development of the hydraulic model of the Stockton wastewater collection system. The hydraulic model described in this chapter and used to support this Master Plan is the most comprehensive collection system model ever developed for the City. Past modeling projects were based on very limited flow and system geometry information, whereas the current model development is based on extensive flow information (as described in Chapter 3) and on a detailed analysis of system geometry. The major topics addressed in this chapter include the following:

- Model Construction
- Dry Weather Flow Calibration
- Wet Weather Calibration
- Design Storm Development

5.1 MODEL CONSTRUCTION

The key elements of collection system model construction addressed in this section include the following:

- Modeling Software
- Model Geometry
- Assignment of Parcel-Generated Flows to Model Nodes

5.1.1 Modeling Software

The hydraulic model of the City's collection system was developed using Innovyze InfoSWMM™ software. InfoSWMM is a fully dynamic modeling software package that is especially appropriate for the City's collection due to the existence of flow splits throughout the system that direct flows into multiple pathways. Software that is not fully dynamic is not well-suited for the complex hydraulics of the City's system because such software cannot reliably simulate the effects of these flow splits.

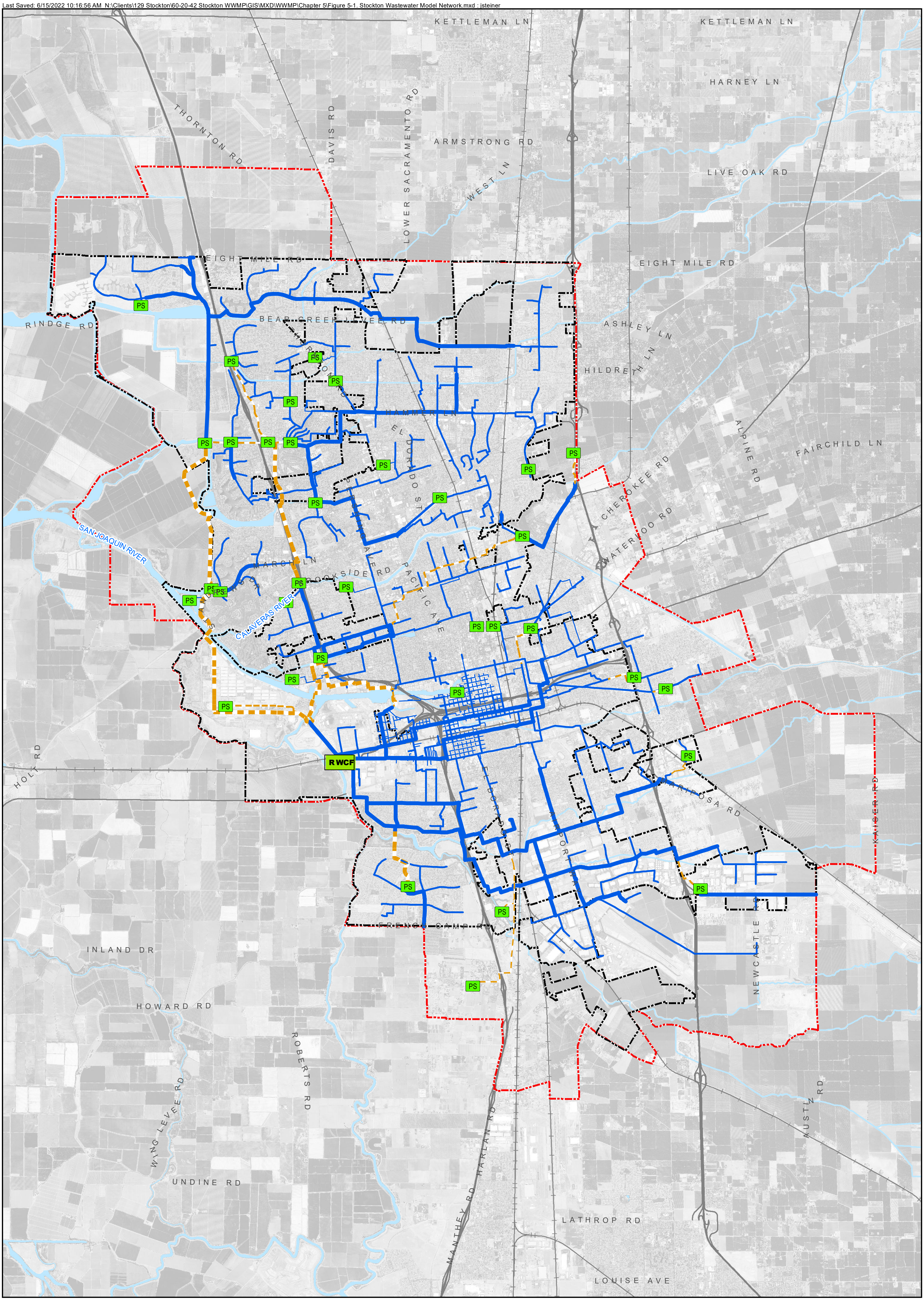
For purposes of this analysis, InfoSWMM is used to simulate periods of both dry and wet weather flow. The model allows for multiple flow inputs at each node/MH, each of which allows for a diurnal flow pattern to be applied, if appropriate. The following flow input categories are included in the collection system model:

- **Residential flows**: Diurnal flow pattern
- **Industrial flows**: Diurnal flow pattern
- **Commercial/institutional flows**: Diurnal flow pattern
- **Groundwater infiltration**: Continuous, nonvarying flow pattern
- **Rainfall-dependent infiltration and inflow (RDII)**: Storm-dependent flow pattern

5.1.2 Model Geometry

The hydraulic model of the collection system includes all gravity mains of 12-inch diameter and larger, plus smaller diameter lines that were previously modeled in and around the Downtown area. The hydraulic model also includes a total of 23 pump stations and their associated force mains. The modeled facilities are shown schematically in Figure 5-1.

Last Saved: 6/15/2022 10:16:56 AM N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 5\Figure 5-1. Stockton Wastewater Model Network.mxd : jsteiner



Gravity Main by Diameter
- GM < 12"
- GM 12" - 24"
- GM > 24"

Force Main by Diameter
- FM < 12"
- FM 12" - 24"
- FM > 24"

- RWCF Regional Wastewater Control Facility
- PS Pump Stations
- City of Stockton Limits
- City of Stockton Sphere of Influence

N

0 0.75 1.5
Miles

WEST YOST

Figure 5-1

Modeled Collection System Facilities

City of Stockton
Wastewater Master Plan Update

The City maintains a GIS database of its collection system facilities, as described in Chapter 2 of this report. Included in the GIS pipe data are fields that define the upstream and downstream invert elevations of any given pipe. However, many of the invert elevation values in the database are shown as zero, which indicates that no data exist for these locations. Approximately 40 percent of the pipes in the model have one or both invert elevations missing from the GIS data.

Collection system rim and invert depths and elevations are available from field surveys performed in 2018 as part of previous collection system analyses (total of 39 MHs), and in 2020 under this Master Plan (total of 48 MHs). Although these surveys represent only about 2 percent of the modeled MHs, the data obtained from these surveys are considered reliable and are assumed to supersede the corresponding invert elevation data in the City's GIS database.

The pipe invert elevations from the City's collection system GIS do not specify what vertical datum is being used. Comparisons between the surveyed inverts and the City GIS data indicate that the GIS data are consistently in the National Geodetic Vertical Datum of 1929 (NGVD 29), whereas the recent MH surveys used the North American Vertical Datum of 1988 (NAVD 88). In the City, the NAVD 88 datum is approximately 1.91 feet higher than the NGVD 29 datum.

Given the various pipe invert data gaps and datum issues, the following procedure was used to determine invert elevations throughout the modeled portion of the collection system:

1. Invert data from the 2018 and 2020 surveys (collected on the NAVD 88 datum) are considered reliable without adjustment.
2. Non-zero invert data from the City GIS are adjusted by 1.91 feet to account for the difference between the NGVD 29 and NAVD 88 datums.
3. Any datum-adjusted City GIS inverts that are clearly inconsistent with the upstream and downstream inverts are not used.
4. If the upstream end of a pipe exiting a MH has no invert value, but one or more pipes entering the same MH have invert values, the exit pipe invert is assumed to equal the known invert of the largest entering pipe. It is thus assumed that there is no drop through the MH.
5. If a pipe entering a MH has no invert value, but the upstream end of the pipe exiting a MH has an invert value, the entering pipe invert is assumed to be the same as the exit pipe invert. It is thus assumed that there is no drop through the MH.
6. If the largest diameter pipe inlet and the pipe outlet in a MH have no invert values, the inverts of the inlet and outlet are assumed to equal each other, and those inverts are linearly interpolated between the nearest known/calculated upstream invert elevation and the nearest known/calculated downstream invert elevation, if such invert values exist.
7. If the upstream end of a series of pipe segments has no invert value, or if the downstream end of a series of pipe segments has no invert value before discharging into a pump station, a standard minimum pipe slope value is assumed.

Except where rim elevation data were collected as part of the collection system surveys performed in 2018 and 2020, MH rim elevations used in the model are generally taken from existing LIDAR (Laser Imaging, Detection, and Ranging) data provided by the City. A comparison of the LIDAR results with those of the rim elevation surveys indicates that the LIDAR data generally provide a reasonable approximation of actual rim elevations.

5.1.3 Assignment of Parcel-Generated Flows to Model Nodes

This section describes how flows are assigned to the appropriate nodes within the collection system model. As described below in sections 5.2 and 5.3, both dry and wet weather flow inputs are assumed to originate at the parcel level. However, it is not always clear how a given parcel connects to the collection system. Moreover, as noted above, not all collection system pipes are included in the model. Accordingly, it was necessary to develop a methodology for assigning parcels to model nodes and to address complications that were encountered. The issues to be addressed in this process and the actions that were taken to address those issues are summarized below:

- **Issue 1**: The City's collection system GIS data does not include private service laterals, so it is not always clear which parcels are actually connected to the collection system.

  Action: A GIS proximity analysis was performed wherein any parcel within 300 feet of a sewer MH is assumed to be connected, while any parcel not within 300 feet of a sewer MH is assumed to be unconnected. The proximity analysis involved all sanitary sewer MHs in the City's GIS whether or not the MH is included in the model.

- **Issue 2**: The collection system model is limited to gravity mains of 12-inch diameter and larger (except for smaller diameter lines that were previously modeled in and around the greater Downtown area).

  Action: All unmodeled MHs are assigned to the nearest downstream modeled MH. This process is accomplished by stepping one pipe at a time downstream from each unmodeled MH until a modeled MH is encountered, and then assigning all flows from the upstream unmodeled MHs to the given modeled MH.

- **Issue 3**: The City's GIS data does not include collection system facilities in the unincorporated island areas described in Chapter 2.

  Action: Flows for the areas known to be connected to the collection system (per Table 2-2 in Chapter 2) are assigned to the nearest model node based on the nearest point of system connection using GIS tools and confirmed through a visual assessment of the GIS data.

- **Issue 4**: Some areas of the City remain on septic tanks even though there are sewer lines in the street.

  Action: City staff provided a GIS point file showing active sewer connection locations. Any parcels designated as Low Density Residential with no sewer account were thus assumed to be on septic. This method was not considered a reliable approach for other land use categories because such categories often occupy multiple parcels. For example, a multi-family apartment complex might occupy five different parcels, but only one of those parcels will show a sewer account. In this example, it would not be logical to assume that the other four parcels are on septic.

The process of tracking unmodeled MHs to the nearest downstream modeled MH revealed numerous GIS disparities that needed to be corrected, including:

1. Pipe segments where the upstream and downstream nodes in the pipe designation were reversed.
2. Pipe segments where the upstream node in the pipe designation did not match the designation of the upstream MH.

3. Pipe segments where the downstream node in the pipe designation did not match the designation of the downstream MH.
4. Pipe segments where an active sewer line was shown to be upstream of an abandoned sewer line or upstream of a planned but not yet constructed sewer line.

5.2 DRY WEATHER FLOW CALIBRATION

Having established the hydraulic model geometry and connectivity, the next step in model development is to calibrate the model to appropriate dry weather flow conditions. The dry weather flow calibration process involves bringing the model dry weather flow generation into conformance with the dry weather flow monitoring results from October and November 2020 that were addressed in Chapter 3 of this report.

The dry weather flow calibration process is complicated by the fact that the collection system flow monitoring program coincided with the pandemic period. The net effect of the pandemic on collection system flows is that flow conditions throughout the City were distorted when compared to pre-pandemic conditions; specifically, residential areas tended to generate higher flows for pandemic conditions than for pre-pandemic conditions, while the reverse was true for many commercial and institutional areas. Accordingly, some consideration of a "pandemic shift" is appropriate when considering baseline dry weather flow conditions. Based on the results presented below, the dry weather model is found to be calibrated to the degree necessary to provide the basis for prudent collection system capacity analysis and planning.

With these considerations in mind, the following topics are addressed in this section:

- Dry Weather Flow Generation
- Pandemic Shift Analysis
- Criteria for Dry Weather Flow Calibration
- Diurnal Flow Patterns
- Metered versus Modeled Dry Weather Flows

5.2.1 Dry Weather Flow Generation

The following two distinct methods were considered for the generation of dry weather flows to be used by the hydraulic model for existing development conditions:

- **Method 1**: Use the dry weather flow monitoring results to generate flow factors for each of the land use categories discussed in Chapter 4 and apply those flow factors to the various land use categories, thus generating modeled baseline dry weather flows.
- **Method 2**: Use winter potable water demands as the basis for the generation of modeled baseline dry weather flows, while applying appropriate adjustments to those demands to bring them into conformance with the dry weather flow monitoring data from October/November 2020.

For this Master Plan, it was determined that Method 2 likely provides a much more reliable estimate of baseline dry weather flow conditions than Method 1. Specifically, Method 2 accurately captures how flows are distributed throughout the City even within the various land use categories, whereas Method 1 uses a City-wide average flow factor for each land use category and therefore does not account for any variability within those categories.

The use of potable water demands as the basis for collection system dry weather flow conditions does, however, introduce the following complications:

1. In the Central Valley of California, potable water demands most closely match baseline dry weather collection system flows during the winter months of a wet year when outdoor irrigation activities are at a minimum. However, collection system flows most closely represent baseline conditions in the fall prior to the onset of any rains. Therefore, baseline collection system flow and baseline (indoor-only) potable water demands do not occur simultaneously.
2. The most recent period of above average rainfall occurred during the months of February and March 2019, which precedes the pandemic, whereas all of the flow monitoring performed for this Master Plan occurred during pandemic conditions.

The first complication can be addressed by assuming that underlying dry weather baseline flows in the collection system did not change significantly between February/March 2019 and October/November 2020. The second complication requires an analysis of the effects of the pandemic on water demands.

5.2.2 Pandemic Shift Analysis

As noted above, the effects of the pandemic on collection system flows are dependent on the area of the City under consideration. Specifically, flows from residential areas tended to increase during the pandemic, while flows from commercial and institutional areas tended to decrease. Therefore, the effects of the pandemic shift must be considered separately for each flow metered area under consideration. Accordingly, the following procedure was used in comparing potable water demands to the collection system flow metering results:

1. February/March 2019 potable water demands from all flow producing parcels are aggregated together for each collection system flow metering area. As noted above, these demands represent a pre-pandemic baseline (minimal outdoor irrigation) condition.
2. October/November 2020 potable water demands from all flow producing parcels are aggregated together for each collection system flow metering area. These demands represent potable water use conditions (indoor and outdoor) coincident with the dry weather collection system flow metering period.
3. October/November 2019 potable water demands from all flow producing parcels are aggregated together for each collection system flow metering area. These demands represent potable water use conditions (indoor and outdoor) that are analogous to the October/November 2020 potable water demand conditions, except that they represent the pre-pandemic period.
4. The difference between the October/November 2020 potable water demands and the October/November 2019 potable water demands is assumed to be solely due to the effects of the pandemic, which assumes that actual irrigation patterns are similar for both periods.

5. The difference between the October/November 2020 potable water demands and the October/November 2019 potable water demands is added to the February/March 2019 potable water demands to produce an adjusted potable water demand baseline (minimal outdoor irrigation) condition. The result is directly comparable to the October/November 2020 collection system flow metering results.
6. For any given collection system flow metering area, October/November 2020 flow metering result is divided by the adjusted baseline potable water demand just discussed to produce a wintertime return-to-sewer ratio. In general, the expectation is that the wintertime return-to-sewer ratio will be around 90 percent and should fall in the range of 85 to 95 percent, consistent with the findings from similar collection systems throughout the region. Return-to-sewer ratios generally fall below 100 percent due to a combination of wintertime irrigation activities and potable water losses from water distribution system leaks.
7. If the calculated wintertime return to sewer ratio is above 95 percent, it is assumed that such a result is due to the presence of groundwater infiltration. Accordingly, the groundwater infiltration value is calculated to be the measured collection system flow minus 90 percent of the adjusted baseline potable water demand; however, the groundwater infiltration cannot be higher than the low point in the diurnal curve and is thus limited accordingly. The resultant groundwater infiltration value is then distributed equally among all of the modeled MHs in the given flow meter tributary area.
8. If the calculated wintertime return to sewer ratio is below 85 percent, it is assumed that such a result is due to the occurrence of “excess irrigation”, which is assumed to reflect higher rates of irrigation during the February/March 2019 baseline and/or in the difference between October/November 2020 and October/November 2019. Accordingly, the excess infiltration value is calculated to be 90 percent of the adjusted baseline potable water minus the measured collection system flow. This excess irrigation value results in a demand reduction that is applied equally among all of the modeled MHs in the given flow meter tributary area.

The results of applying this methodology are summarized in Table 5-1. The results are limited only to those flow meters that do not have major flow splits upstream of them because the existence of an upstream flow split makes it impossible to define the upstream tributary area. The only exceptions are flow meters 4-3 and 4-4, both of which are immediately downstream of a flow split. Accordingly, the results from these two meters are combined together to represent the tributary area upstream of the flow split.

As indicated in Table 5-1, flow meters 8-1 and 10-1 were the only two that had return-to-sewer ratios between 85 and 95 percent. Twelve of the meters showed return-to-sewer ratios above 95 percent, thus indicating the presence of groundwater infiltration in the sewer flow monitoring results. The remaining six sites were calculated to have an excess irrigation component in the water demand results.

In addition to the groundwater infiltration results shown in Table 5-1, a further 0.20 mgd of groundwater infiltration was added to model nodes immediately upstream of flow metering site 5-1 to bring the model into conformance with the flow metering results at that location. As a result, the total estimated dry weather groundwater infiltration entering the collection system is estimated to be 2.8 mgd.

Table 5-1. Pandemic Shift Analysis Results									
Flow Meter ID	Winter 2019 Water Demand, mgd	Oct/Nov 2019 Water Demand, mgd	Oct/Nov 2020 Water Demand, mgd	Pandemic Difference, mgd	Adj. Winter Water Demand, mgd	Metered Dry Weather Flow, mgd	Return-to-Sewer Ratio, percent	Groundwater Infiltration, mgd	Excess Irrigation, mgd
1-1	0.598	1.737	1.586	-0.151	0.447	0.976	218%	0.574	0
2-1	2.788	4.933	4.843	-0.090	2.698	2.863	106%	0.435	0
2-2	3.776	5.878	6.153	0.275	4.050	3.982	98%	0.336	0
3-1	0.952	1.560	1.827	0.267	1.219	1.023	84%	0	0.070
3-2	1.537	2.262	2.716	0.454	1.991	1.611	81%	0	0.180
3-3	0.209	0.338	0.456	0.118	0.327	0.190	58%	0	0.100
4-1	0.664	0.802	1.052	0.250	0.914	0.566	62%	0	0.260
4-2	0.536	0.877	0.791	-0.086	0.451	0.528	117%	0.122	0
4-3/4-4	0.093	0.149	0.164	0.015	0.107	0.120	112%	0.024	0
6-1	0.338	0.498	0.539	0.041	0.380	0.406	107%	0.064	0
6-2	0.606	0.869	1.097	0.229	0.835	0.633	76%	0	0.120
6-3	1.321	1.829	2.029	0.200	1.520	0.962	63%	0	0
6-4	0.611	0.602	0.842	0.240	0.851	0.547	64%	0	0.220
6-5	0.435	0.613	0.689	0.076	0.511	0.649	127%	0.189	0
7-1	0.534	0.878	1.021	0.143	0.677	1.293	191%	0.501	0
8-1	1.153	1.762	2.102	0.340	1.493	1.351	90%	0	0
8-2	0.322	0.465	0.458	-0.007	0.316	0.403	128%	0.119	0
8-3	0.320	0.236	0.206	-0.029	0.290	0.419	144%	0.157	0
8-4	0.569	0.535	0.488	-0.047	0.521	0.521	100%	0.052	0
10-1	1.983	4.249	4.699	0.451	2.434	2.161	89%	0	0

5.2.3 Criteria for Dry Weather Flow Calibration

The criteria used for assessing the accuracy of the dry weather flow calibration are taken from the Chartered Institution of Water and Environmental Management (CIWEM) guidelines, which are summarized as follows:

- The volume of modeled versus metered flow should be in the range of ±10-percent.
- The modeled versus metered peak flow rate should be in the range of ±10-percent.
- The modeled versus metered peak flow depth should be in the range of ±0.5 feet.

In general, for this analysis, the above criteria are viewed as objectives rather than as inviolable standards. If one or more of these criteria are not met, any such deviation is viewed in terms of whether the model maintains acceptable accuracy while remaining adequately conservative in its predictive capabilities, based on professional judgment.

5.2.4 Diurnal Flow Patterns

In establishing diurnal flow patterns throughout the system, the following procedure was followed:

1. In general, for areas tributary to the flow metering locations with no upstream flow splits, the diurnal flow pattern for all flow-producing parcels within the given area was assumed to follow the observed diurnal dry weather flow patterns at the flow meter for that area.
2. Exceptions were made for flow metering areas in which the observed diurnal flow pattern was significantly distorted by downstream pump station operations (specifically meters 1-1 and 4-2), as described in Chapter 3. For these areas, diurnal patterns were used from flow metering areas that are nearby and/or have similar land use characteristics.
3. For areas downstream of the flow meters just discussed, diurnal patterns are assigned by land use type, as follows:
    a. For residential inputs, use the diurnal pattern from meter 3-3, which has a tributary area that is 99 percent residential.
    b. For industrial inputs, use the diurnal pattern from meter 8-2, which has a tributary area that is 88 percent industrial.
    c. For non-residential, non-industrial inputs, use the diurnal pattern from meter 8-3, which has a tributary area that is 77 percent commercial/institutional.
4. If the resultant model diurnal curve has a time lag (due to the effect of long flow travel times), a time offset is applied to the input curve to achieve better agreement between the metered and modeled diurnal flow patterns.
5. If the resultant model diurnal curve is flattened (due to the effect of flow attenuation), an exponential “amplification factor” is applied to the input curve to achieve better agreement between the metered and modeled diurnal flow patterns.

The metered versus modeled diurnal flow patterns for all 25 metering sites and for the RWCF are presented in Appendix D. In general, very close agreement was achieved between the modeled and metered diurnal patterns. Notable disparities include the following:

1. Metering sites 1-1 and 4-2 show significantly different modeled versus metered diurnal patterns. As discussed in Chapter 3, the flow metering pattern is significantly distorted at both of these sites by downstream pump station operations. Specifically, it appears that the Cumberland & Five Mile Creek PS downstream of metering site 1-1 and the Waterloo & Roosevelt PS downstream of metering site 4-2 routinely allow flows to back up into the upstream gravity system, which has the effect of significantly flattening the diurnal flow pattern.
2. Metering sites 4-3 and 4-4, which are located just downstream of the two outlets of a flow split MH, have offsetting disparities where the metered versus modeled combined flow of the two sites almost exactly match. The flows in the two outlet lines are sufficiently low that the individual disparities are not expected to substantially influence peak flow conditions.
3. Metering sites 6-3 and 7-1 show notable differences in magnitude between the modeled and metered flows, as discussed in the next subsection.
4. The modeled diurnal pattern for site 5-2 could not be made to match the metered pattern. This difference is likely due to the complex effects of various upstream flow splits.
5. The metered diurnal pattern for site 8-4 is very erratic and the model could not be made to match it, although the modeled pattern provides an acceptable approximation.

5.2.5 Metered versus Modeled Dry Weather Flows

In this section, modeled versus metered flows are compared to assess the accuracy of the dry weather calibration and to determine where unexplained disparities exist. Modeled versus metered average weekday flows for all 25 flow metering areas are compared in Table 5-2, modeled versus metered peak weekday flows are compared in Table 5-3, and modeled versus metered peak flow depths for weekday flow conditions are compared in Table 5-4. As indicated in the three tables, modeled versus metered dry weather flows compare very well for most metering sites. Notable disparities include the following:

- **Sites 1-1 and 4-2**: As noted in Chapter 3 and in the previous subsection of this chapter, measured peak flows and flow depths at these two locations are distorted by downstream operations of the Cumberland & Five Mile Creek PS and the Waterloo & Roosevelt PS, respectively. However, the modeled versus metered average flows at these sites match to within 2 percent.
- **Sites 2-1 and 2-2**: As noted in Chapter 3 and in the previous subsection of this chapter, measured peak flows and flow depths at these two locations are distorted by downstream operations of the Swenson PS and the Waterloo & Roosevelt PS, respectively. The modeled versus metered average and peak flows are in conformance with the criteria, but modeled flow depths are well below the metered depths, the latter of which indicates prevalent backwater conditions.
- **Site 4-3**: Measured flows at site 4-3 (located immediately downstream of a flow split) behave erratically, and the model does not reproduce these flow irregularities. The observed disparities between metered and modeled flow are small enough (0.011 mgd for average flow and 0.019 mgd for peak flow) that they are not expected to significantly distort the downstream results.

- **Site 4-4**: The modeled peak flows at this site are slightly more than 10 percent below the metered flows, which essentially offsets the disparity at site 4-3. The peak flow disparity is approximately 0.014 mgd, which is not expected to significantly distort any downstream results.
- **Site 6-3**: For this site, the model could not be brought into conformance with the observed results. It should be noted that this site is located downstream of sites 4-1 and 4-2, which have measured average dry weather flows that add up to more than the measured average dry weather flow at site 6-3, plus there are additional flows entering the system downstream of sites 4-1 and 4-2 but upstream of site 6-3. A close review of the flow metering data does not give any indication of anomalous measurements at any of these three sites. It is thus possible that an unidentified flow split exists somewhere between sites 4-1 and 4-2 and site 6-3 that is diverting flows into a different part of the system.
- **Site 6-4**: For this site, the modeled versus metered average and peak flows are in conformance with the criteria, but the model predicts average flow depths that are slightly more the 0.5 feet below the metered flow, which suggests either backwater effects the model does not capture or inaccuracies in the system geometry downstream of the flow meter.
- **Site 7-1**: For this site, the model could not be brought into conformance with the observed results. The totality of demands within the 7-1 tributary area was substantially lower than the dry weather flow metering results. Moreover, the low point in the flow metered diurnal curve precluded assuming a high enough amount of groundwater infiltration to bring the model into conformance with the metering results. A close review of the flow metering data does not give any indication of anomalous results. It is thus possible that an unidentified flow split exists somewhere upstream of site 7-1 that is diverting flows from other tributary areas into that part of the system.

5.3 WET WEATHER CALIBRATION

As described in Chapter 3 of this report, the most significant storm event of the 2020/2021 wet season occurred on January 27–28, 2021, and produced 2.92 inches of rain over 48 hours when averaged over the seven gauges. This storm event provides the basis for wet weather calibration of the collection system model.

Based on the results presented below, the model is calibrated to a degree adequate to provide the basis for sound collection system capacity analysis and planning. It should be understood, however, that the collection system response to major storm events may be highly variable, based on such factors as total event rainfall, peak storm intensity, antecedent rainfall, and possibly other factors. It is therefore appropriate in collection system planning to use an adequately conservative design storm condition that considers such uncertainties, as discussed in section 5.4 below. The following topics are addressed in this section:

- RTK Method
- Criteria for Wet Weather Flow Calibration
- Metered versus Modeled Wet Weather Flows
- Smart Cover Results
- Pump Station Results

Table 5-2. Metered versus Modeled Average Dry Weather Weekday Flows				
Flow Meter ID	Metered Weekday Flow, mgd	Modeled Weekday Flow, mgd	Disparity, mgd	Disparity, percent
1-1	0.97	0.98	0.010	1.1
2-1	2.87	2.87	0.006	0.2
2-2	3.99	4.00	0.007	0.2
3-1	1.03	1.05	0.022	2.1
3-2	1.62	1.64	0.016	1.0
3-3	0.19	0.20	0.006	3.0
4-1	0.56	0.57	0.005	0.9
4-2	0.53	0.54	0.010	1.8
4-3	0.019	0.030	0.011	46.2
4-4	0.096	0.091	-0.005	-5.5
4-3/4-4	0.12	0.12	0.001	1.2
5-1	1.03	1.03	0.000	0.0
5-2	0.53	0.50	-0.028	-5.5
6-1	0.41	0.41	0.001	0.3
6-2	0.66	0.67	0.016	2.4
6-3	0.95	1.23	0.274	25.1
6-4	0.55	0.54	-0.012	-2.2
6-5	0.65	0.68	0.033	4.9
6-6	1.07	1.10	0.034	3.1
7-1	1.35	1.17	-0.177	-14.0
7-2	3.40	3.61	0.203	5.8
8-1	1.34	1.34	0.001	0.0
8-2	0.46	0.47	0.010	2.2
8-3	0.44	0.45	0.005	1.1
8-4	0.55	0.55	-0.003	-0.5
10-1	2.14	2.20	0.055	2.5
RWCF	**24.05**	**25.99**	**1.939**	**7.7%**

Table 5-3. Metered versus Modeled Peak Dry Weather Weekday Flows				
Flow Meter ID	Metered Weekday Flow, mgd	Modeled Weekday Flow, mgd	Disparity, mgd	Disparity, percent
1-1	1.08	1.14	0.058	5.2
2-1	3.53	3.39	-0.149	-4.3
2-2	4.90	4.80	-0.108	-2.2
3-1	1.30	1.42	0.119	8.7
3-2	2.21	2.21	-0.002	-0.1
3-3	0.25	0.25	0.003	1.2
4-1	0.82	0.88	0.054	6.4
4-2	0.62	0.70	0.085	12.9
4-3	0.024	0.043	0.019	55.6
4-4	0.13	0.12	-0.014	-11.8
4-3/4-4	0.16	0.16	0.000	-0.2
5-1	1.26	1.31	0.044	3.4
5-2	0.67	0.72	0.043	6.2
6-1	0.57	0.54	-0.026	-4.7
6-2	0.92	0.91	-0.001	-0.1
6-3	1.37	1.75	0.378	24.3
6-4	0.81	0.79	-0.025	-3.1
6-5	0.83	0.84	0.008	1.0
6-6	1.48	1.50	0.023	1.5
7-1	1.80	1.49	-0.315	-19.1
7-2	4.51	4.58	0.076	1.7
8-1	1.73	1.70	-0.036	-2.1
8-2	0.64	0.66	0.018	2.9
8-3	0.58	0.57	-0.015	-2.6
8-4	0.78	0.71	-0.067	-8.9
10-1	2.77	2.97	0.194	6.8
RWCF	**31.05**	**31.63**	**0.576**	**1.8%**

Table 5-4. Metered versus Modeled Peak Dry Weather Flow Depths				
Flow Meter ID	Pipe D, in	Metered Max Depth, in	Modeled Max Depth, in	Disparity, in
1-1	27	38.7	7.9	-30.8
2-1	48	36.3	14.2	-22.1
2-2	36	28.9	14.7	-14.1
3-1	24	10.4	7.5	-2.9
3-2	30	10.3	9.0	-1.2
3-3	18	3.5	3.7	0.2
4-1	18	6.6	6.1	-0.5
4-2	18	14.9	6.2	-8.7
4-3	10	2.4	1.5	-0.9
4-4	14	3.7	3.3	-0.5
5-1	24	8.0	8.6	0.6
5-2	24	10.4	8.4	-2.1
6-1	24	8.0	4.8	-3.2
6-2	30	9.3	6.6	-2.8
6-3	27	7.8	9.4	1.6
6-4	24	11.8	5.3	-6.5
6-5	36	11.2	6.0	-5.1
6-6	27	7.9	10.3	2.3
7-1	42	10.1	9.2	-0.9
7-2	72	14.1	12.6	-1.4
8-1	48	9.5	7.6	-1.9
8-2	27	9.6	5.1	-4.4
8-3	33	5.3	5.0	-0.3
8-4	42	3.4	4.4	1.0
10-1	54	9.1	9.0	-0.2

5.3.1 RTK Method

This analysis makes use of the RTK method for wet weather calibration of the InfoSWMM model. The RTK parameters are defined as follows:

- **R:** The portion of total rainfall within the tributary area that enters the collection system in the form of I&I.
- **T:** The time from the onset of rainfall to the peak of the I&I response.
- **K:** The ratio of the time-to-recession to the time-to-peak of the hydrograph, where the time-to-recession is defined as the time from the peak to the point in time where there is no longer any appreciable I&I response.

The RTK parameters are derived for each flow-metered area for which applicable peak flow data exist, including areas downstream of the meters used in the flow monitoring program but upstream of the RWCF. The resultant RTK parameters established through calibration are then applied to the collection system model using the 10-year, 24-hour design storm for both existing and buildout development conditions. RTK values for future development areas are conservatively approximated from those developed in the wet weather calibration process.

5.3.2 Criteria for Wet Weather Flow Calibration

The criteria used for assessing the accuracy of the wet weather flow calibration are taken from CIWEM guidelines noted previously, and are summarized as follows:

- The modeled versus metered peak flow rate should be in the range of –15 percent to +25 percent.
- The volume of modeled versus metered flow during and following the calibration storm should be in the range of –10 percent to +20 percent.
- The modeled versus metered non-surcharged flow depth should be in the range of ±0.5 feet.
- The modeled versus metered depth of surcharge should be in the range –0.5 feet to +1.6 feet.

As with the dry weather calibration, these criteria should be viewed as objectives rather than as inviolable standards. If one or more of these criteria are not met, any such deviation should be viewed in terms of whether the model is adequately conservative in its predictive capabilities. Of the above criteria, agreement between modeled and metered peak flows is considered the most important criterion, given that peak flows are what define the sizing needs of existing and future collection system facilities.

Major rains came to an end late on the 28th or early on the 29th, but the effects of rainfall dependent I&I continued for 24 to 48 hours afterward. Accordingly, in assessing the comparison of flow volumes, the 4-day period of January 27–30, 2021 is used for the calculation.

5.3.3 Metered versus Modeled Wet Weather Flows

In this section, modeled versus metered flows are compared to assess the accuracy of the wet weather calibration and to determine where unexplained disparities exist. Modeled versus metered peak flows are compared in Table 5-5, modeled versus metered flow volumes are compared in Table 5-6, and modeled versus metered peak flow depths for weekday flow conditions are compared in Table 5-7. Graphical comparisons of the modeled versus metered wet weather flows are presented in Appendix E. Graphical comparisons of the modeled versus metered wet weather flow depths are presented in Appendix F. Notable disparities in the wet weather calibration results are summarized as follows:

- **Sites 1-1, 2-1, 2-2, 4-2, and 10-1**: All of these sites show maximum flow depths well below those that were observed during the flow metering. As noted previously, this result indicates that the various pump station facilities located immediately downstream of these sites did not keep up with the incoming flows during the January 27–28, 2021 storm event, due either to a power failure during the event, or due to operational issues that routinely cause flows to back up into the upstream pipes.

Table 5-5. Metered versus Modeled Peak Wet Weather Flows				
Flow Meter ID	Metered Peak Flow, mgd	Modeled Peak Flow, mgd	Disparity, mgd	Disparity, percent
1-1	3.03	2.93	-0.10	-3.4
2-1	6.11	5.81	-0.30	-5.0
2-2	7.35	6.97	-0.38	-5.3
3-1	2.12	2.26	0.15	6.6
3-2	4.22	3.90	-0.32	-7.9
3-3	0.49	0.48	-0.01	-2.2
4-1	1.85	1.90	0.05	2.8
4-2	1.42	1.60	0.17	11.6
4-3	0.39	0.22	-0.17	-54.3
4-4	0.24	0.30	0.06	23.2
4-3/4-4	0.57	0.53	-0.05	-8.7
5-1	2.69	2.49	-0.21	-8.1
5-2	1.59	1.39	-0.20	-13.6
6-1	0.91	0.94	0.03	2.9
6-2	3.46	3.29	-0.17	-4.9
6-3	3.11	3.91	0.80	22.9
6-4	2.75	2.96	0.21	7.2
6-5	3.75	4.13	0.38	9.7
6-6	3.95	3.61	-0.34	-8.9
7-1	3.59	3.53	-0.05	-1.5
7-2	8.04	7.88	-0.16	-2.0
8-1	2.54	2.34	-0.20	-8.0
8-2	1.06	0.97	-0.09	-8.9
8-3	0.80	0.70	-0.11	-14.1
8-4	1.14	1.07	-0.08	-7.0
10-1	3.43	3.39	-0.04	-1.2
RWCF	**55.35**	**56.43**	**1.08**	**1.9%**

Table 5-6. Metered versus Modeled Wet Weather Flow Volumes				
Flow Meter ID	Metered Flow Volume, Mgal	Modeled Flow Volume, Mgal	Disparity, Mgal	Disparity, percent
1-1	4.67	5.01	0.35	7.1
2-1	14.00	14.27	0.27	1.9
2-2	18.09	18.37	0.28	1.5
3-1	4.70	5.11	0.41	8.3
3-2	7.25	7.94	0.69	9.1
3-3	1.14	1.12	-0.02	-2.0
4-1	2.86	2.99	0.13	4.6
4-2	2.65	2.93	0.29	10.3
4-3	0.48	0.37	-0.11	-25.8
4-4	0.33	0.44	0.11	28.3
4-3/4-4	0.82	0.81	0.00	-0.2
5-1	6.00	5.22	-0.78	-14.0
5-2	3.15	3.08	-0.07	-2.3
6-1	1.93	2.03	0.10	4.9
6-2	3.83	4.26	0.43	10.5
6-3	5.03	6.81	1.78	30.1
6-4	3.07	3.33	0.25	7.9
6-5	4.74	5.31	0.58	11.5
6-6	5.39	5.88	0.49	8.8
7-1	7.41	6.79	-0.62	-8.7
7-2	18.03	18.38	0.35	1.9
8-1	6.03	6.01	-0.02	-0.3
8-2	2.23	2.09	-0.14	-6.4
8-3	1.95	1.93	-0.02	-1.1
8-4	2.38	2.48	0.10	3.9
10-1	7.90	9.46	1.55	17.9
RWCF	**126.64**	**134.51**	**7.87**	**6.0%**

Table 5-7. Metered versus Modeled Peak Wet Weather Flow Depths						
Flow Meter ID	Pipe Diameter, in	Metered Flow Depth, in	Modeled Flow Depth, in	Disparity, in	Meter d/D	Model d/D
1-1	27	54.0	24.1	-29.9	2.00	0.89
2-1	48	84.0	21.6	-62.5	1.75	0.45
2-2	36	79.5	21.4	-58.2	2.21	0.59
3-1	24	13.5	10.5	-3.0	0.56	0.44
3-2	30	14.8	13.8	-1.0	0.49	0.46
3-3	18	8.1	5.9	-2.2	0.45	0.33
4-1	18	12.5	11.1	-1.4	0.69	0.62
4-2	18	40.2	11.1	-29.1	2.23	0.62
4-3	10	7.3	4.0	-3.4	0.73	0.40
4-4	14	8.8	6.2	-2.6	0.63	0.44
5-1	24	29.5	13.2	-16.3	1.23	0.55
5-2	24	45.9	13.1	-32.8	1.91	0.55
6-1	24	17.2	7.2	-10.1	0.72	0.30
6-2	30	18.8	13.8	-5.0	0.63	0.46
6-3	27	14.1	16.9	2.8	0.52	0.63
6-4	24	16.8	10.5	-6.3	0.70	0.44
6-5	36	70.6	16.1	-54.5	1.96	0.45
6-6	27	13.5	18.8	5.3	0.50	0.70
7-1	42	17.7	15.7	-2.0	0.42	0.37
7-2	72	20.2	18.2	-2.0	0.28	0.25
8-1	48	12.0	10.2	-1.8	0.25	0.21
8-2	27	11.0	7.1	-3.9	0.41	0.26
8-3	33	6.7	6.6	-0.1	0.20	0.20
8-4	42	4.9	6.1	1.2	0.12	0.14
10-1	54	61.7	10.9	-50.8	1.14	0.20

- **Sites 4-3 and 4-4**: The model was unable to reproduce the behavior of the flow split upstream from these two sites. The model directs too much flow down the site 4-3 route in dry weather and not enough in wet weather. For purposes of this analysis, it was determined that the metered peak wet weather flow at site 4-3 (0.39 mgd) was small enough relative to the full-pipe capacity of that line (0.70 mgd) that there is no expectation this line will reach its full-pipe capacity under peak wet weather conditions.
- **Sites 5-1, 5-2, and 6-5**: These sites, which are located toward the downstream end of the system, all surcharged during the January 27–28, 2021 storm event, whereas the model does not reproduce such surcharging. City staff have indicated that chronic grease and debris accumulation occurs in various lines downstream of these meters due to substandard or adverse pipe slopes, thus resulting in system flow restrictions. In addition, the model moderately underpredicts flow volume; however, this disparity is considered an acceptable deviation provided the peak flows meet the criteria.
- **Sites 6-1 and 6-4**: These sites show greater flow depths than indicated in the model, although neither of them surcharged during the January 27–28, 2021 storm event. The disparities may be attributable to a combination of imperfect pipe invert information (i.e., flatter actual pipe slopes than those in the model) or to the effects of backwater further downstream, which affected sites 5-1, 5-2, and 6-5, as just noted.
- **Site 6-3**: This site meets the requisite peak flow and flow depth criteria, but the model generates approximately 30 percent more total volume than was observed at the flow meter. As noted above in the dry weather calibration results, questions exist about this site because it includes the flows from sites 4-1 and 4-2, but the dry weather flows for site 6-3 added up to less than the sum of the flows from those two sites. For purposes of this analysis, the excessive volume at site 6-3 is considered an acceptable deviation provided the peak flows meet the criteria.
- **Site 10-1**: The site could not be brought into conformance with the criterion for flow volume. However, t site is located just upstream of a pump station (14-Mile Slough) that stopped pumping during the later period of the storm. Eventually, the backed-up flows were drawn down, but it appears that the velocities were lower than the detection limits of the flow meter. Therefore, the flow meter likely under-reported flow volumes during the drawdown period, which suggests that the model is actually in line with the true flow volumes.

5.3.4 Smart Cover Results

The City deploys SmartCover™ devices at multiple locations throughout the City. A SmartCover is an ultrasonic water level sensing device installed within a MH to measure flow depths. For this study, City staff provided SmartCover results for 22 collection system locations, as summarized in Table 5-8. The table shows the street address closest to the MH, the system number, the pipe diameter, the maximum depth of flow during the January 27–28, 2021 storm (if available), the MH ID number, and whether the sewer line in question is included in the modeled portion of the collection system.

As indicated in Table 5-8, all but four of the SmartCover devices are located in Systems 2 and 3, and all but six of them are on smaller diameter lines that are not included in the collection system model. Seven sites either had bad data (negative depths) or no data at all during the January 27–28, 2021 storm event. Two other devices reported results in inches below the sensor without a clear indication of the sensor height, thus making it impossible to assess flow depth, although neither device indicated wet weather results substantially different from those obtained during dry weather.

Table 5-8. SmartCover Results, January 27–28, 2021					
Address	System	Pipe D, in	MH ID	Maximum Depth, in[(a)]	Modeled Line?
7102 Richland Way	1	10	22F055	21.7	no
105 Edan Avenue	2	6	21K159	bad data (<0)	no
238 Lincoln Court	2	6	22K050	no storm data	no
405 Pardee Lane	2	15	26K018	29.0	YES
417 Jill Circle	2	8	21L007	8.4	no
4550 Shelley Court	2	6	26L023	6.0	no
4703 Greensboro Way	2	10	25M049	2.9	no
6410 Kermit Lane	2	6	22L062	no storm data	no
6808 Villa Drive	2	6	22L010	bad data (<0)	no
7011 Leesburg Place	2	6	22H105	no storm data	no
Carnelian Drive and Pleasant Court	2	10	23M038	5.1	no
Hammer Lane and Albany Drive	2	33	21L096	66.1	YES
March Lane and Palm Plaza	2	15	24M148	26 (into deadband)	YES
1205 Brookside Road	3	8	28J007	11.6 below sensor (depth unclear)	no
1440 N. Hunter Street	3	6	30M096	3.0	no
1810 Allston Way	3	6	30L120	bad data (<0)	no
2204 Kensington Way	3	16	30L109	18.6	YES
4404 Manchester Avenue	3	8	27K065	13.7 below sensor (depth unclear)	no
Brookside Road and Crown Avenue	3	18	28J016	no storm data	YES
9007 Sherill Court	5	8	18H067	3.8	no
S. American Street and E. 8th Street	6	8	37P058	7.9	no
2203 Georgia Avenue	7	12	38L053	0.8	YES

(a) Yellow highlighting denotes evidence of surcharging.

A total of five SmartCover devices show indications of system surcharging during the January 27–28, 2021 storm event. The results and the possible causes are summarized as follows:

1. The device at 7102 Richland Way in System 1 measured a depth of 21.7 inches, thus surcharging to 11.7 inches above the crown of the 10-inch diameter pipe. The model does not show capacity restrictions in the area, but the site is located a short distance upstream of the Plymouth & 5-Mile Creek PS, which may have undergone a power failure during the storm. Moreover, the SmartCover data indicate that this site routinely surcharges, even during dry weather conditions, thus suggesting that the pump station setpoints allow flows to back up into the upstream gravity system.
2. The device at 405 Pardee Lane in System 2 measured a depth of 29.0 inches, thus surcharging to 14 inches above the crown of the 15-inch diameter pipe. The model does not show capacity restrictions in the area; however, the data indicate that this line routinely surcharges to a similar degree during dry weather as well. The MH in question is located upstream of the Swenson PS, which has been shown not to keep up with incoming flows during both wet and dry weather flow conditions.
3. The device at Hammer Lane and Albany Drive in System 2 measured a depth of 66 inches, thus surcharging to 33 inches above the crown of the 33-inch diameter pipe and routinely shows surcharged or near-surcharged conditions during dry weather flow conditions. The MH in question is located upstream of the Swenson PS, which has a rated firm capacity well above the predicted flows, but has been shown to allow flow to rise above the incoming sewer during both wet and dry weather flow conditions.
4. The device at March Lane and Palm Plaza in System 1 measured a depth of more than 26 inches (which entered the deadband of the device), thus surcharging to at least 11 inches above the crown of the 15-inch diameter pipe. The model does not show capacity restrictions in the area, but the site is located a short distance upstream of the Camanche & Ridgeway PS, which may have undergone a power failure during the storm.
5. The device at 2204 Kensington Way in System 3 measured a depth of 18.6 inches, thus surcharging to 2.6 inches above the crown of the 16-inch diameter pipe. The model confirms minor capacity restrictions and surcharging in this line for peak wet weather flow conditions.

5.3.5 Pump Station Results

The modeled pump station peak flow results for the January 27–28, 2021 storm event are summarized in Table 5-9. The information includes pump station firm capacity (as presented in Chapter 2 of this report), modeled peak flows, dry weather average flows, peaking factors (defined as the peak flow divided by the dry weather average flow), force main diameters, and calculated maximum force main velocities.

For the calibration storm condition, a slight exceedance of pump station firm capacity is indicated at the Don Avenue & Santiago PS, but not at any other pump stations. The maximum force main velocity criterion of 8 feet per second (discussed in Chapter 4 of this report) is not exceeded at any pump stations, and 14 of the 23 pump stations show maximum force main velocities of less than 2 feet per second.

Table 5-9. Modeled Pump Station Results, January 27–28, 2021 Calibration Storm							
Lift Station	System	Firm Capacity, mgd	Dry Weather Average Flow, mgd	Peak Flow, mgd	Peaking Factor	Force Main Diameter, in	Max Force Main Velocity, ft/sec
14-Mile Slough	10	(a)	3.87	7.96	2.1	30	2.5
Alexandria & 14-Mile	2	1.97	0.37	0.87	2.4	15	1.1
Arch	8	8.70	0.20	0.48	2.3	24	0.2
Blossom Ranch	2	1.30	0.22	0.39	1.7	8	1.7
Brookside Estates	10	8.64	0.42	1.61	3.8	20	1.1
Camanche & Ridgeway	2	2.40	0.36	0.68	1.9	none	--
County Hospital	--	2.16	0.014	0.12	8.7	dual 10	0.2
Cumberland & 5-Mile	1	4.32	1.17	3.14	2.7	16	3.5
Don Ave & Santiago	2	0.79	0.41	0.90	2.2	15	1.1
Drake & Hwy-99	4	3.54	0.55	1.91	3.5	14	2.8
Grupe	7	0.86	0.008	0.037	4.6	8	0.2
Kelly & Mosher	1	4.32	0.51	1.21	2.4	12	2.4
March-Brookside	2	1.15	0.30	0.57	1.9	8	2.5
Origone	9	5.18	0	0	--	16	0
Plymouth & 5-Mile	1	1.25	0.16	0.34	2.2	8	1.5
Sanguinetti	9	15.98	0.086	0.18	2.1	24	0.1
Sinclair & Hwy-4	7	4.32	0.033	0.094	2.8	6	0.7
Smith Canal & Fontana	3	37.92	10.38	13.08	1.3	dual 30	2.1
Swenson (North)	2	20.16	7.14	7.14	1.0	dual 24	1.8
Thornton & Davis	2	1.22	0.53	0.96	1.8	8	4.3
Waterloo & Roosevelt	4	2.74	0.61	1.73	2.8	12	3.4
Westlake	10	4.35	0.016	0.025	1.6	8	0.1
Weston Ranch	8	15.98	1.29	1.12	0.9	dual 30	0.2

(a) Firm capacity not known; see Table 2-9.

5.4 DESIGN STORM DEVELOPMENT

As noted in Chapter 4 of this report, the 10-year, 24-hour storm in Stockton has a magnitude of 2.43 inches. The rainfall distribution pattern used for this analysis is consistent with that being used in ongoing stormwater master planning being performed by the City. Specifically, stormwater master planning analyses make use of a 10-year, 24-hour design storm pattern based on the NOAA California Type III distribution. A plot of that distribution is shown on Figure 5-2.

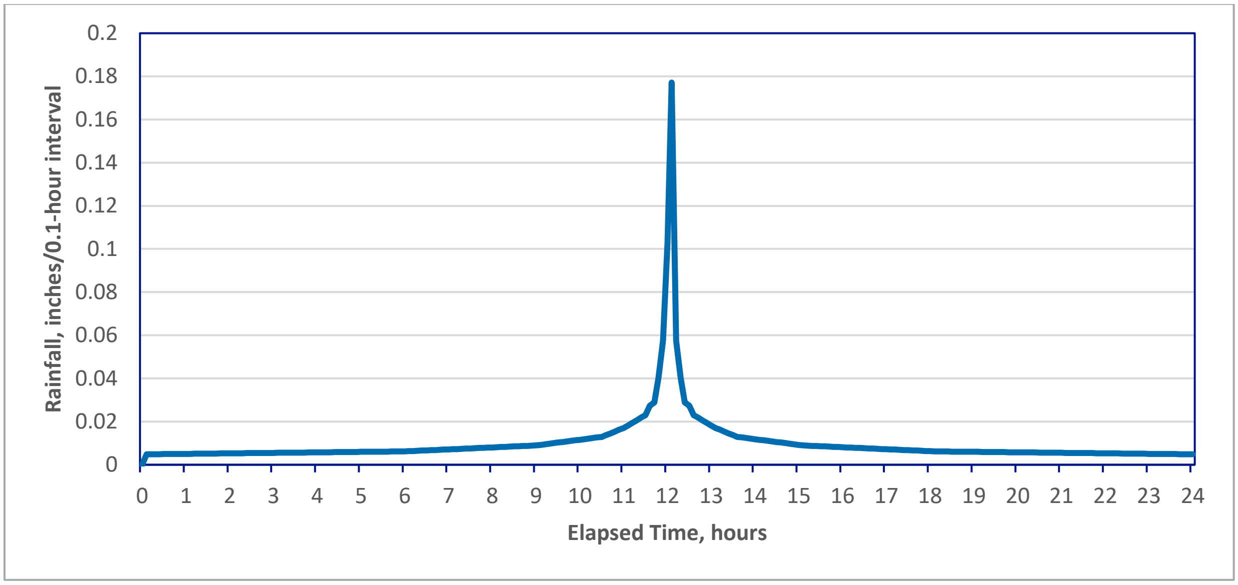


Figure 5-2. NOAA Type III Rainfall Distribution, City of Stockton 10-Year Storm, 24-Hour Storm

It is expected that for existing development conditions, the modeled 10-year, 24-hour design storm should produce peak flows at the RWCF that are consistent with historical results. Table 5-10 shows the top ten daily influent flow totals at the RWCF since the 2010/2011 wet season (11 years total), as taken from the California Integrated Water Quality System Project (CIWQS). As indicated in the table, the high daily flow total of 53.3 mgd occurred on January 10, 2017. This total contrasts with a CIWQS-reported daily flow total of 38.7 mgd on January 28, 2021 (also shown in Table 5-9), which was the highest of the 2020/2021 wet season.

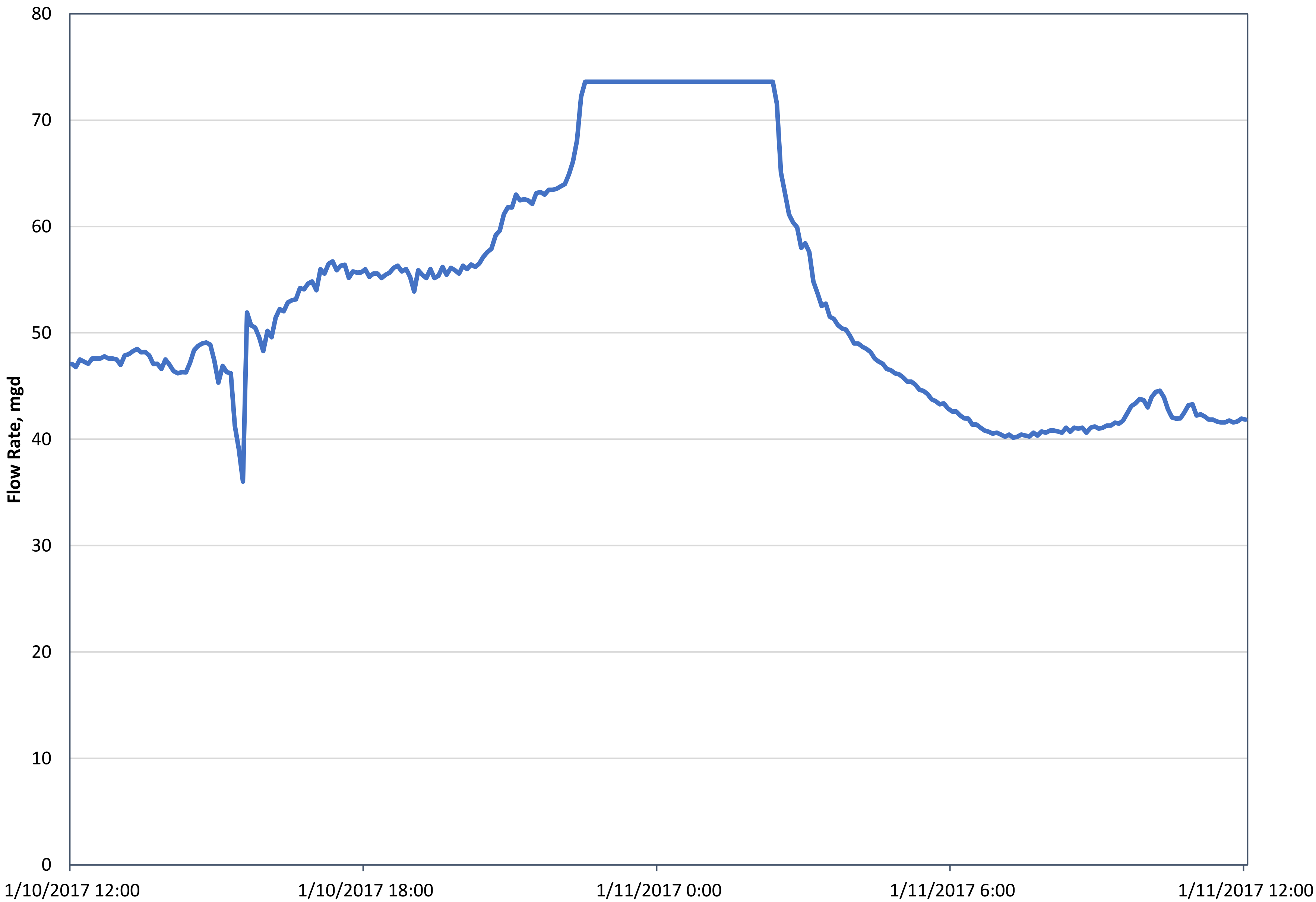
A review of 5-minute influent flow data provided by City staff indicates that the highest instantaneous flow during the period of 2011 to 2021 occurred on December 2, 2012 and on January 10, 2017 (coinciding with the two highest daily flow totals), when influent flows reached a peak of 73.6 mgd on both occasions. The January 10, 2017 flow plateaued at the peak value for nearly four hours, as shown on Figure 5-3, whereas no such plateau occurred on December 2, 2012. The January 10, 2017 peak flow plateau indicates either that the RWCF influent pumping reached its hydraulic limit, which did not allow any additional flows to enter the plant, or that the limits of the flow measuring device were reached. In either case, the actual peak flows were likely higher than indicated. Because the flows in question represent the highest in the past eleven wet seasons, it is reasonable to suppose that for a 10-year, 24-hour storm event, peak influent flows at the RWCF would likely be on the order of 80 mgd or higher. The modeled peak wet weather flows for existing development conditions are presented in Chapter 6 of this report.

Table 5-10. Top Ten RWCF Influent Daily Flow Totals, 2011–2021

Rank	Daily Flow Total, mgd[a]	Peak Hour Flow, mgd	Date of Occurrence
1	53.3	73.6	1/10/2017
2	52.3	73.6	12/2/2012
3	51.3	63.8	2/20/2017
4	48.3	65.4	12/12/2014
5	47.9	67.4	2/10/2017
6	45.4	not requested	2/13/2019
7	44.9	not requested	11/30/2012
8	44.3	54.4	2/9/2017
9	44.1	54.3	2/21/2017
10	44.0	60.0	1/22/2017
Calibration Storm	38.7	55.4	1/28/2021

(a) Source: CIWQS

Figure 5-3. RWCF Influent Flows, January 10–11, 2017



The purpose of this chapter is to present the results of the hydraulic model of the Stockton wastewater collection system for existing development conditions and to present recommended actions to address existing system deficiencies. The major sections of this chapter include:

- Model Results for Existing Conditions
- Modeled Capacity Deficiencies
- Improvements to Address Existing Capacity Deficiencies
- Previously Identified System Condition Deficiencies

6.1 MODEL RESULTS FOR EXISTING CONDITIONS

Model results for existing conditions at the RWCF and at the 25 collection system flow metering sites are summarized in Table 6-1. The table shows modeled weekday dry weather average flows, modeled peak flows from the January 27–28, 2021 calibration storm, and modeled peak flows from the 10-year, 24-hour design storm described in Chapter 5. The peaking factors for the January 27–28, 2021 calibration storm and the 10-year, 24-hour design storm flow condition (defined as the peak flow divided by the modeled dry weather average flow) are also shown. Because flow meters 4-3 and 4-4 are located immediately downstream of a flow split, those results are shown both together and separately, as discussed in Chapters 3 and 5.

As shown in Table 6-1, the model indicates a peak flow of 78.48 mgd at the RWCF for the 10-year, 24-hour design storm, which is consistent with available RWCF influent data from the past 11 years, as discussed in Chapter 5. The peaking factor associated with this result is 2.9. Nine of the flow metering locations indicate peaking factors below the RWCF value of 2.9, and 16 meters indicate peaking factors above the RWCF value. In general, the lowest peaking factors are associated with the northernmost and southernmost areas of the City (predominantly Systems 2, 8, and 10), while the highest peaking factors are associated with Systems 4 and 6.

Peak flow results for the 10-year, 24-hour design storm at the 23 modeled pump stations are summarized in Table 6-2. The information includes pump station firm capacity (as presented in Chapter 2 of this report), modeled peak flows, force main diameters, and calculated maximum force main velocities. For purposes other than the calibration modeling, the model treats pump stations as passing all incoming flows regardless of station capacity such that the capacities of the pump stations and downstream gravity lines can be properly evaluated.

For the 10-year, 24-hour design storm condition, exceedances of pump station firm capacity are indicated at two pump stations: the Cumberland & 5-Mile Creek PS and the Don Avenue & Santiago PS. The maximum force main velocity criterion of 8 fps (discussed in Chapter 4 of this report) is not exceeded at any pump stations. The highest indicated force main velocity is 6.3 fps at the Cumberland & 5-Mile Creek PS. In addition, 11 of the 23 modeled pump stations show maximum force main velocities of less than 2 fps.

Table 6-1. Modeled Average and Peak Flows for Existing Development Conditions					
	Modeled Flows, mgd			Peaking Factors	
Flow Meter ID	Weekday Dry Weather Average	January 27–28, 2021 Peak	10-Year, 24-Hour Design Storm Peak	January 27–28, 2021 Peak	10-Year, 24-Hour Design Storm Peak
1-1	0.98	2.89	6.10	2.9	6.2
2-1	2.79	5.50	7.47	2.0	2.7
2-2	4.06	7.26	8.45	1.8	2.1
3-1	1.05	2.26	3.13	2.2	3.0
3-2	1.64	3.90	5.55	2.4	3.4
3-3	0.20	0.48	0.69	2.4	3.5
4-1	0.57	1.90	3.20	3.4	5.7
4-2	0.57	1.60	2.36	2.8	4.2
4-3	0.059	0.22	0.31	3.8	5.3
4-4	0.061	0.30	0.44	5.0	7.3
4-3/4-4	0.12	0.53	0.75	4.4	6.3
5-1	1.00	3.23	3.44	3.2	3.4
5-2	0.58	1.45	2.34	2.5	4.0
6-1	0.41	0.94	1.00	2.3	2.4
6-2	0.64	3.32	5.54	5.1	8.6
6-3	1.25	3.91	6.10	3.1	4.9
6-4	0.54	2.96	5.83	5.5	10.9
6-5	0.68	4.07	8.05	6.0	11.8
6-6	1.05	3.64	6.07	3.5	5.8
7-1	1.17	3.53	4.44	3.0	3.8
7-2	3.82	7.86	9.48	2.1	2.5
8-1	1.34	2.34	2.53	1.7	1.9
8-2	0.47	0.97	1.19	2.1	2.6
8-3	0.45	0.70	0.83	1.6	1.9
8-4	0.55	1.07	1.21	1.9	2.2
10-1	2.20	3.39	3.93	1.5	1.8
RWCF	**27.20**	**56.02**	**78.48**	**2.1**	**2.9**

Table 6-2. Modeled Pump Station Results, 10-Year, 24-Hour Design Storm, Existing Development Conditions

Pump Station	System	Firm Capacity, mgd	Peak Flow, mgd [(a)]	Force Main Diameter, in	Maximum Force Main Velocity, ft/sec
14-Mile Slough	10	(b)	10.59	30	3.3
Alexandria & 14-Mile Slough	2	1.97	1.21	15	1.5
Arch Road	8	8.70	0.55	24	0.3
Blossom Ranch	2	1.30	0.48	8	2.1
Brookside Estates	10	8.64	2.62	20	1.9
Camanche & Ridgeway	2	2.40	0.87	none	--
County Hospital	--	2.16	0.19	dual 10	0.3
Cumberland & 5-Mile Creek	1	4.32	5.73	16	6.3
Don Ave & Santiago	2	0.79	1.31	15	1.7
Drake & Highway 99	4	3.54	3.18	14	4.6
Grupe Business Park	7	0.86	0.036	8	0.2
Kelly & Mosher Slough	1	4.32	1.77	12	3.5
March-Brookside & I-5	2	1.15	0.76	8	3.4
Origone	9	5.18	0.001	16	0.0
Plymouth & 5-Mile Creek	1	1.25	0.49	8	2.2
Sanguinetti	9	15.98	0.24	24	0.1
Sinclair Avenue & Highway 4	7	4.32	0.123	10	0.3
Smith Canal & Fontana	3	37.92	31.34	dual 30	4.9
Swenson (North)	2	20.16	18.42	dual 24	4.5
Thornton & Davis	2	1.22	1.18	8	5.2
Waterloo & Roosevelt	4	2.74	2.59	12	5.1
Weston Ranch	8	15.98	2.60	dual 30	0.4

(a) Exceedances of pump station firm capacity and the force main velocity criterion of 8 ft/sec are highlighted in yellow.

(b) Cannot be calculated due to unknown pump capacities; see Table 2-9.

6.2 MODELED CAPACITY DEFICIENCIES

A schematic of modeled gravity sewer and pump station capacity deficiencies for 10-year, 24-hour design storm conditions is presented in Figure 6-1. The highlighted gravity lines are shown as belonging to the following categories, which are based on the standards presented in Chapter 4 of this report:

- **Priority 1 – Near-Surface Surcharging:** Peak flow exceeds full-pipe capacity, with a risk of sanitary sewer overflow (SSO) or surcharging to within 1 foot of the MH rim
- **Priority 2 – Significant Surcharging with Lower SSO Risk:** Peak flow exceeds full-pipe capacity, with surcharging to within 1 to 4 feet of the MH rim *or* to within 4 to 8 feet of the MH rim when surcharging exceeds 1 foot above the pipe crown
- **Priority 3 – Minor Surcharging in Shallow Sewers:** Peak flow exceeds full-pipe capacity, with surcharging to within 4 to 8 feet of the MH rim when surcharging is less than 1 foot above the pipe crown
- **Priority 4 – Other Minor Surcharging:** Peak flow exceeds full-pipe capacity, with surcharging that is not within 8 feet of the MH rim
- **Backwater-Induced SSO** (trigger for high priority improvements downstream): Peak flow does not exceed full-pipe capacity, but downstream restrictions result in an upstream SSO or surcharging to within 1 foot of the MH rim
- **Backwater-Induced Surcharging** (trigger for lower priority improvements downstream): Peak flow does not exceed full-pipe capacity, but downstream restrictions result in surcharging that is not within 1 foot of the MH rim
- **Sewer Pipe Flowing >80% Full**: Peak flow exceeds 80 percent of full-pipe capacity with no significant surcharging

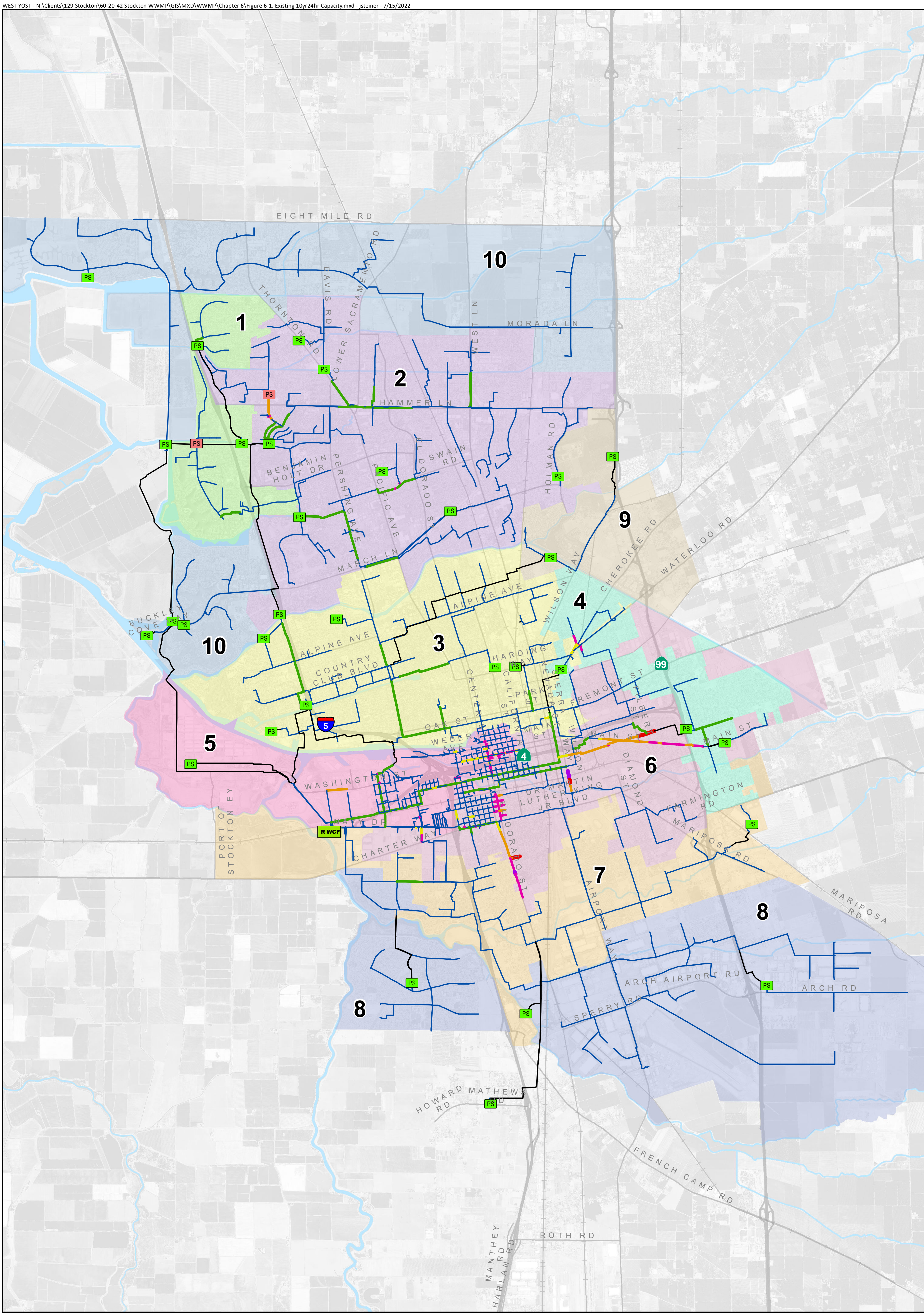
6.3 IMPROVEMENTS TO ADDRESS EXISTING CAPACITY DEFICIENCIES

Theoretical pipe upsizing improvements to eliminate gravity sewer capacity deficiencies are listed in Table 6-3 and are shown schematically in Figure 6-2. As indicated in the table, improvements are grouped by priority, with Priority 3 and 4 improvements combined in a single category. The improvements are sized to accommodate modeled buildout peak flow conditions.

It should be noted that these theoretical improvements do not necessarily equate to a recommendation to proceed forward with design and construction of replacement sewers. While the model indicates potential for surcharging and/or SSOs in the indicated lines during peak flow conditions, most of the identified pipes were not directly flow metered, but rather the peak flows are inferred from downstream flow measurements based on the model calibration process described in Chapter 5 of this report. Moreover, the collection system geometry (especially pipe diameters, pipe invert elevations, and surface elevations) have not generally been confirmed by field surveys.

Notes and recommendations for the deficiencies identified in Table 6-3 are presented in Table 6-4. In all cases, system geometry (including pipe depths, diameters, and rim elevations) should be confirmed by field surveys. In addition, it is recommended that the City install flow depth monitoring devices to monitor for possible surcharging at the locations indicated in Table 6-4. It is also recommended that the modeled capacity exceedances at the Cumberland & 5-Mile Creek PS and the Don Avenue & Santiago PS be confirmed through flow metering and/or pump run time logging.

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 6\Figure 6-1. Existing 10yr24hr Capacity.mxd - jsteiner - 7/15/2022



Modeled Sewer Lines

- Priority 1
- Priority 2
- Priority 3&4
- Backwater-Induced SSO
- Backwater-Induced Surcharging
- >80% Full, No Surcharging
- <80% Full, No Surcharging
- Force Main

RWCF Regional Wastewater Control Facility
PS Pump Station - No Capacity Deficiency
PS Pump Station - Capacity Deficiency
1-10 Collection System Service Areas

N

0 0.625 1.25
Miles

WEST YOST

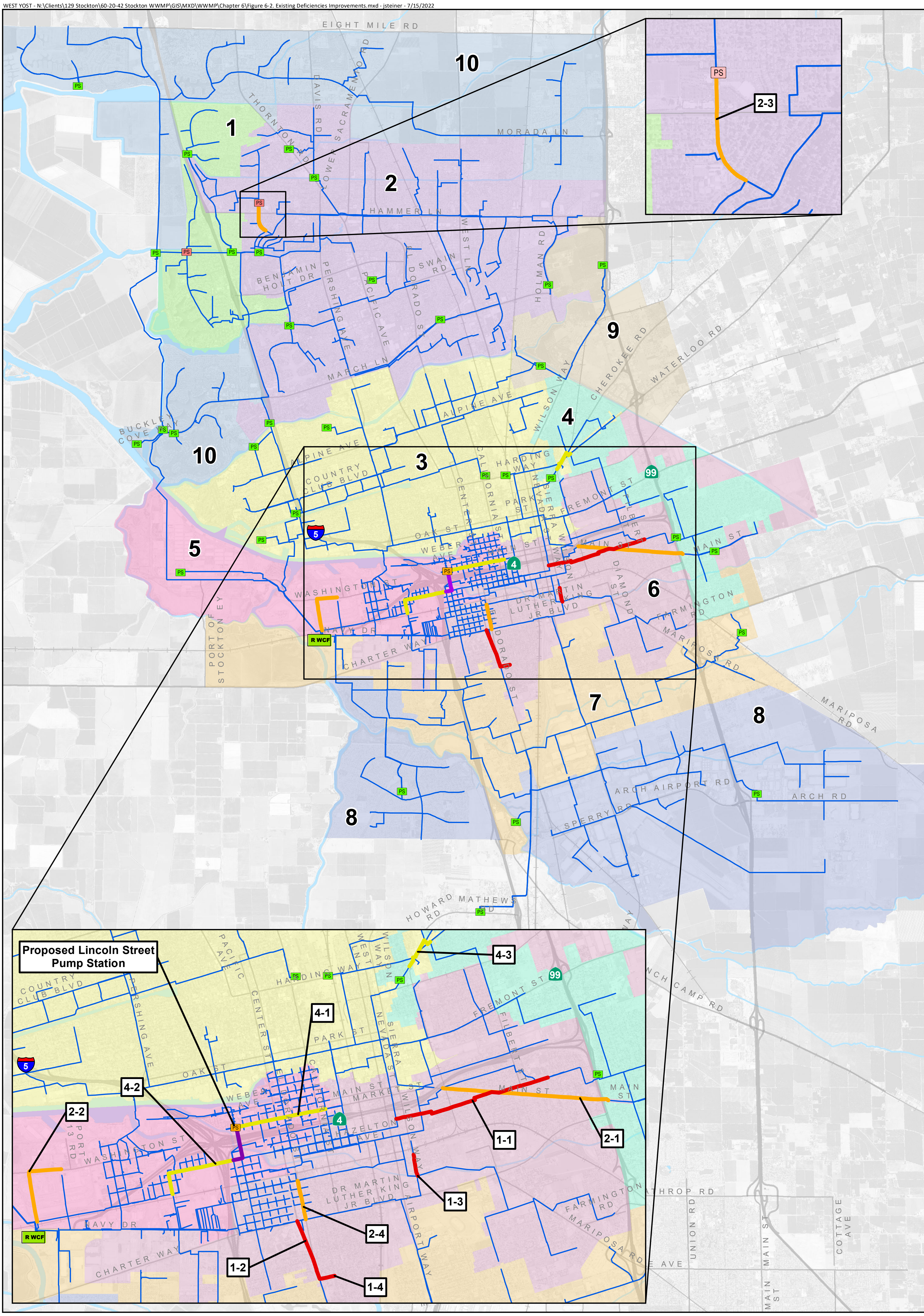
Figure 6-1

Modeled Capacity Deficiencies
10-Year, 24-Hour Storm
Existing Development Conditions

City of Stockton
Wastewater Master Plan Update

Table 6-3. Theoretical Upsizing Improvements That Would Alleviate Existing Capacity Deficiencies

ID #	Designation	Priorities	System	GIS Year Constructed	Upstream MH ID	Upstream MH Location	Downstream MH ID	Downstream MH Location	GIS Pipe Dia, in	Upsized Pipe Dia, in	Total Length, ft	No. of Pipe Segments	Depth to Pipe Crown, ft	Maximum Flow, mgd	Maximum Surcharge, ft	Minimum Headspace, ft
Priority 1 Group																
1-1	E. Marsh Street sewer	1,2,4	6	1895–1940	32R072	Olympic Circle	33P105	S. Sierra Nevada Street	18	24	7,406	21	4.0 to 10.4	4.04	5.1	0
1-2	El Dorado Street / S. Center Street sewer	1,2,4	6	1905–1915	37N043	E. 6th Street	36M016	E. Charter Way	16	21,24	2,832	9	10.5 to 12.1	3.54	8.9	0.4
1-3	S. Wilson Way sewer	1,2	6	1947	34P082	E. Worth Street	35P012	Mormon Slough	10,12	21	1,001	5	7.6 to 8.6	2.73	8.1	0
1-4	E. 6th Street sewer	1,2	6	1900	37N034	S. San Joaquin Street	37N043	El Dorado Street	12	18	701	4	10.2 to 10.8	1.89	10.7	0
Priority 2 Group																
2-1	E. Main Street sewer	2,4	6	1910–1984	33S033	Anteros Avenue	33Q014	E. Washington Street	12,16	18	7,605	24	7.6 to 10.3	1.74	6.1	2.1
2-2	W. Washington Street / Port Road 23 sewer	2	5	no data	34J016	west of Port Road 13	36H003	north of Navy Drive	12,15,18	18,21	3,800	9	5.6 to 11.8	2.92	4.9	4.0
2-3	Don Avenue / Meadow Avenue sewer	2	2	1957–1973	20G060	Santiago Way	21G051	Oak Creek Drive	12	15	2,171	10	8.1 to 9.8	1.44	3.7	4.6
2-4	S. El Dorado Street sewer	2,4	6	1900–1910	35N064	E. Worth Street	36N016	E. Charter Way	12	15	2,184	6	8.9 to 11.5	1.13	1.8	7.1
Priority 3&4 Group																
4-1	Market Street sewer	4	5	1900–1920	33M079	S. El Dorado Street	34L002	S. Lincoln Street	16,18	27	2,320	8	11.5 to 16.1	1.82	2.0	11.6
4-2	Church Street / Pershing Avenue sewer	4	5,6	1917	34L022	S. Harrison Street	35L027	S. Pershing Avenue	24	30	3,992	11	9.8 to 15.0	3.30	1.9	9.5
4-3	Waterloo Road sewer	4	3	1920–1984	29Q063	Williams Street	30P039	Hiawatha Avenue	12,15	15,18	1,834	8	21.9 to 23.7	2.30	1.8	20.1



Priority 1
Priority 2
Priority 3&4
No Capacity Deficiency
Proposed Force Main
X-X Deficiency ID
RWCF Regional Wastewater Control Facility
1-10 Collection System Service Areas
PS Pump Station - No Capacity Deficiency
PS Pump Station - Capacity Deficiency
PS Pump Station - Proposed

0 0.625 1.25
Miles

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Figure 6-2

Tentative Improvements to Address Existing Capacity Deficiencies

City of Stockton
Wastewater Master Plan Update

Table 6-4. Notes and Recommendations for Addressing Identified Capacity Deficiencies, Existing Development Conditions

ID #	Designation	Notes	Recommendations	Preferred SmartCover MH	Preferred SmartCover Location	Alternate MHs
Priority 1 Group						
1-1	E. Marsh Street sewer	The model shows potential outflows at the upstream end of this line, but capacity deficiencies exist throughout	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology	32R072	E. Marsh Street and Olympic Circle	32R081, 33R001, 33R006, 33R027
1-2	El Dorado Street / S. Center Street sewer	The model shows potential backwater-driven outflows at the upstream end of this line, but capacity deficiencies exist throughout	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology	38N073	El Dorado Street and McKinley Park	38N063, 38N038, 38N029, 38N026, 38N011
1-3	S. Wilson Way sewer	The model assumed very high I&I from this line due to a large flow difference between flow meters 6-1 and 6-5, but it is possible that another large I&I source exists elsewhere, such as one or more downstream MHs located in Mormon Slough	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology; line/seal downstream MHs in Mormon Slough	34P082	S. Wilson Way and E. Worth Street	34P054, 34P068, 34P089
1-4	E. 6th Street sewer	This line is tributary to the El Dorado Street / S. Center Street sewer (see above); upsizing of that sewer could partially alleviate severe surcharging in this line	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology	37N034	E. 6th Street and S. San Joaquin Street	37N035, 37N038, 37N032
Priority 2 Group						
2-1	E. Main Street sewer	The model shows Priority 2 surcharging and capacity deficiencies throughout this line; the line crosses the Marsh Street sewer, so opportunities may exist to combine flows, although a careful analysis of downstream impacts would be necessary	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology	33R050	E. Main Street sewer west of S. Filbert Avenue	33R057, 33R056, 33R054, 33R046, 33R043, 33R039
2-2	W. Washington Street / Port Road 23 sewer	The model shows Priority 2 surcharging and capacity deficiencies throughout this line	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology	34J016	W. Washington Street just east of Port Road 14	34J017, 35J001
2-3	Don Avenue / Meadow Avenue sewer	The line in question is located immediately downstream of the Don Avenue and Santiago PS; peak flow conditions should be confirmed	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology; flow meter the lift station, if possible	20G060	Don Avenue and Santiago Way	20G063, 20G077, 20G073, 21G007
2-4	S. El Dorado Street sewer	The model shows capacity deficiencies in this line that trigger backwater-induced surcharging in multiple tributary lines; the surcharging becomes Priority 1 for modeled 2040 conditions; any upsizing of this line should consider reconfiguring various parallel sewers to discharge directly into this line, thus potentially eliminating the parallel sewers	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology; reconfigure parallel sewers if improvements are made	35N076	Lateral sewer at S. Hunter Street and E. Jackson Street	35N060, 35N064, 35N079
Priority 3&4 Group						
4-1	Market Street sewer	The model shows Priority 4 surcharging and capacity deficiencies throughout this line	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology	33M079	Market Street west of California Street	33N066, 33N070, 33N076, 33N083, 33M075, 33M079
4-2	Church Street / Pershing Avenue sewer	Significant portions of this line are known to be severely deteriorated and is a high priority for replacement. 30 percent design drawings were submitted in April 2021.	Construct the upstream invert of the replacement sewer at a higher elevation to improve velocities if feasible, concurrent or prior to completing the Lincoln Street Pump Station and Force Main project.	none	none	none
4-3	Waterloo Road sewer	The model shows Priority 4 surcharging and capacity deficiencies throughout this line, but the line is very deep, so any improvements would be a low priority based on capacity and depth of surcharging.	Confirm system geometry; monitor the upstream end of this line with SmartCover or equivalent technology	29P054	Waterloo Road and Sanguinetti Lane	29Q058, 29Q062, 29P070
Pump Station Capacity Improvements						
--	Cumberland & 5-Mile Slough PS	Station is modeled as being over capacity at peak flow conditions	Verify the need for pump station capacity improvements through flow metering and/or pump runtime logging	none	none	none
--	Don Avenue & Santiago PS	Station is modeled as being over capacity at peak flow conditions	Verify the need for pump station capacity improvements through flow metering and/or pump runtime logging	none	none	none

6.4 PREVIOUSLY IDENTIFIED SYSTEM CONDITION DEFICIENCIES

The City maintains and updates a CIP list to address existing system deficiencies and future needs for City wastewater collection system facilities. The projects on the CIP list are based on previous studies and address both capacity-related deficiencies and condition-related deficiencies. The capacity-related deficiencies are generally superseded by the recommendations of this Master Plan. The condition-related deficiencies, however, are not subject to reevaluation under this Master Plan, but nevertheless are assumed to remain applicable.

Condition-related deficiencies requiring rehabilitation of gravity sewers (designated as R-#) are summarized in Table 6-5. Condition-related deficiencies involving pump stations and force mains (designated as P-#) are summarized in Table 6-6. Both groups are presented schematically in Figure 6-3. Gravity sewer projects are considered a high priority if design of improvements is already complete or in progress, or if such projects are otherwise considered by City staff to be an urgent need. Items P-1 through P-5 in Table 6-6 are considered a high priority based on longstanding need and a high consequence of system failure. All of the other listed gravity sewer and pump station projects are considered to be medium priority.

Improvements to the 14-Mile Slough PS (Project P-1) have long been identified as necessary to address operational concerns. In addition, the long-term capacity needs of the station need to be identified so that the facility can be appropriately upsized to accommodate future development.

The 5-Mile Slough force main (Project P-2) interconnects the 14-Mile Slough PS, Swenson PS, Cumberland & 5-Mile Creek PS, and Plymouth & 5-Mile Creek PS. Investigation of the force main and identification of rehabilitation measures/improvements is considered a high priority to ensure that force main operations remain uninterrupted.

The Lincoln Street PS and force main (Project P-3) have long been identified as being necessary to maintain system operations and to address a critical deficiency where the Market Street trunk sewer turns south and crosses Mormon Slough through an inverted siphon that is over 100 years old. According to City staff, the siphon is believed to be impacted by accumulated debris, and it is difficult or impossible to maintain properly due to its age and deteriorated condition. Some risk exists that the siphon could fail, which would entail prolonged bypass pumping and an emergency repair.

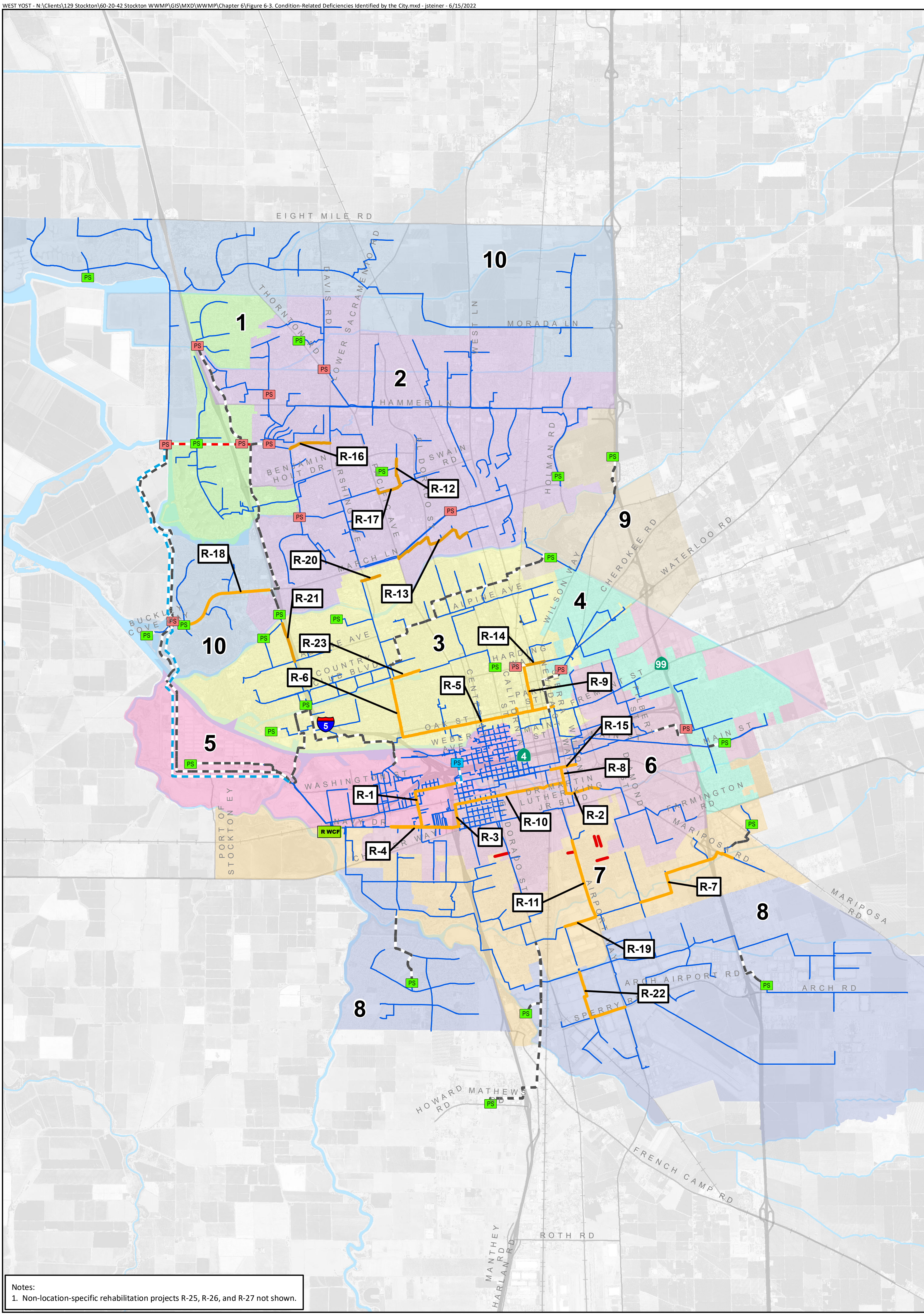
A parallel force main to serve the 14-Mile Slough PS and other pump stations in the northern part of the City (Project P-4) is considered to be an important need for long-term system resiliency. The length of the existing force main and suspected poor soil conditions along the alignment raises concerns about differential settlement or instabilities that could impact force main operation. Figure 6-3 shows a route identical to the existing force main. Alternative routes should be evaluated during a preliminary engineering phase based on relative cost and exposure to unstable soils, seismic hazards, or other environmental factors.

Finally, the Swenson PS (Project P-5) is currently listed in the City's CIP as in need of a capacity upgrade. While the collection system model does not show this station to be capacity-limited, flow metering data from upstream gravity sewer locations indicate that this station allows incoming flows to back up into the upstream sewers during both wet and dry weather flow conditions. It is unclear whether the upstream surcharging is related to deteriorated condition of the pumps, operational settings, pump capacities being lower than currently reported, or some combination of these factors. Accordingly, this station has been added to the list of pump stations in Table 6-5 requiring attention.

Table 6-5. Previously Identified Gravity Sewer Condition-Related Deficiencies

Designation	Name	Extents	Existing Pipe Diameter, in	Approximate Length, LF	Priority	City Project No.
R-1	Church Street/Pershing Avenue trunk sewer	Harrison Street to Navy Drive	24	5,600	High	UW17023/M17023
R-2	Mormon Slough trunk sewer	Jefferson Street to Worth Street	24	2,700	High	UW18030/M18030
R-3	Navy Drive I-5 trunk sewer	Anderson Street to Swift Way	42 & 54	1,700	High	M17026
R-4	Navy Drive parallel trunk sewers	Swift Way to west of Fresno Avenue	24, 30 & 48	8,700	High	M15003
R-5	Oak Street trunk sewer	Wilson Way to Pershing Avenue	21 & 24	11,000	High	UW20016/M20016
R-6	Pershing Avenue sewer	Oak Street to Tuxedo Avenue	24	4,300	High	UW23008
R-7	Ralph Avenue trunk sewer, Phase 1	Mariposa Road to B Street	30	9,200	High	M18024
R-8	Sierra Nevada Street trunk sewer	Hazelton Avenue to Worth Street	36	1,100	High	UW18029/M18029
R-9	Union Street sewer	Harding Way to Oak Street	10 & 12	4,300	High	UW21007/M21007
R-10	Worth Street trunk sewer	Sierra Nevada Street to Anderson Street	36	8,400	High	M18028
R-11	Airport Way trunk sewer	San Joaquin Fairgrounds to Ralph Avenue	30	5,800	Medium	UW21017/M21017
R-12	Alturas Avenue sewer	Quincy Street to Swain Road	12	2,000	Medium	UW23010
R-13	E. Bianchi Street/ Pardee Lane sewer	Townehome Drive to March Lane	12, 15 & 18	6,900	Medium	UW24008
R-14	Harding Way sewer	Wilson Street to Union Street	12	1,500	Medium	UW25008
R-15	Hazelton Avenue trunk sewer	Della Street to Pilgrim Street	24 & 36	1,900	Medium	UW24011
R-16	Lincoln Road trunk sewer	Pershing Avenue to Alexandria Place	36	3,000	Medium	UW21018/M21018
R-17	Longview Avenue sewer	El Dorado Street to Pacific Avenue	12	3,200	Medium	UW23006
R-18	March Lane trunk sewer	I-5 to Brookside Estates PS	24 & 30	8,400	Medium	UW25006
R-19	Ralph Avenue trunk sewer, Phase 2	Airport Way to Perlman Drive	42	2,400	Medium	UW25012
R-20	Rosemarie Lane sewer	Manchester Avenue to Crowne Avenue	12	1,400	Medium	UW23014
R-21	Ryde Avenue trunk sewer	River Drive to Telegraph Avenue	30 & 36	1,400	Medium	UW25009
R-22	Sperry Road/Gibraltar Court sewer	Airport Way to Industrial Drive	24 & 27	6,200	Medium	UW23009
R-23	Tuxedo Avenue sewer	Kensington Way to Orange Street	16	1,900	Medium	UW23007
R-24	Backyard and smaller diameter sewers	Scribner/7th/Howard/Pilgrim Streets	6 & 8	TBD	Medium	various

Table 6-6. City-Identified Pump Stations and Force Mains with Condition-Related Concerns			
Designation	Facilities	Priority	City Project No.
P-1	14-Mile Slough PS	High	UW20022/M20022
P-2	5-Mile Slough Force Main	High	M18015
P-3	Lincoln Street PS and Force Main	High	UW24005
P-4	Westside Interceptor Parallel Force Main	High	UW22004
P-5	Swenson (North) PS	High	UW24003
P-6	Brookside Estates PS	Medium	UW23003
P-7	College Park PS	Medium	UW25003
P-8	Don & Santiago PS	Medium	UW13010/M13010
P-8	Drake & Hwy-99 PS	Medium	UW25005
P-10	Kelley & Mosher PS	Medium	UW24004
P-11	Quail Lakes PS	Medium	UW21015/M21015
P-12	Thornton & Davis PS	Medium	UW13009/M13009
P-13	Waterloo & Roosevelt PS	Medium	UW25004
P-14	Camanche & Ridgeway PS	Medium	UW25002
P-15	Plymouth & 5 Mile Creek PS	Medium	UW23001



- Modeled Gravity Sewer
- Modeled Gravity Sewer Identified for Rehab
- Unmodeled Gravity Sewer Identified for Rehab (Project R-24)
- Force Main
- Force Main Identified for Rehab
- Proposed Force Main
- PS Pump Station
- PS Pump Station Identified for Rehab
- PS Proposed Pump Station
- **1-10** Collection System Service Areas

0 0.625 1.25
Miles

WEST YOST

Figure 6-3

Condition-Related Deficiencies Identified by the CIty

City of Stockton
Wastewater Master Plan Update

The purpose of this chapter is to present the results of the hydraulic model of the wastewater collection system for 2040 development conditions. The major sections of this chapter include:

- 2040 Development and Flow Generation Areas
- Analysis of 2040 Flow Conditions
- Analysis of Buildout Flow Conditions

7.1 2040 DEVELOPMENT AND FLOW GENERATION AREAS

Modeled conditions for the 2040 timeframe consist of flows for existing development conditions, as described in Chapter 6, plus future flows from the following areas that do not currently discharge to the City's wastewater collection system:

- General Plan Major Development Areas
- General Plan Study Areas
- Additional 2040 Development Areas
- Unincorporated County Islands
- Areas on Septic Tanks

7.1.1 General Plan Major Development Areas

Major development areas identified as part of the City's General Plan process include the areas summarized in Table 7-1. The major development areas in excess of 50 acres of developable area are shown on Figure 7-1. The two largest such areas are Mariposa Road Community and the Sanctuary, each of which has a planned developable area in excess of 1,000 acres.

One area of note in the major development areas list is the Open Window project. This area is planned to include mixed-use high-rise buildings in the downtown area. Although there are only 10.9 developable acres involved, a special flow factor of 24,400 gpd per acre is used. This flow factor was developed in a September 2019 technical memorandum titled "Near-Term Development and Downtown Wastewater Collection System Capacity".

7.1.2 General Plan Study Areas

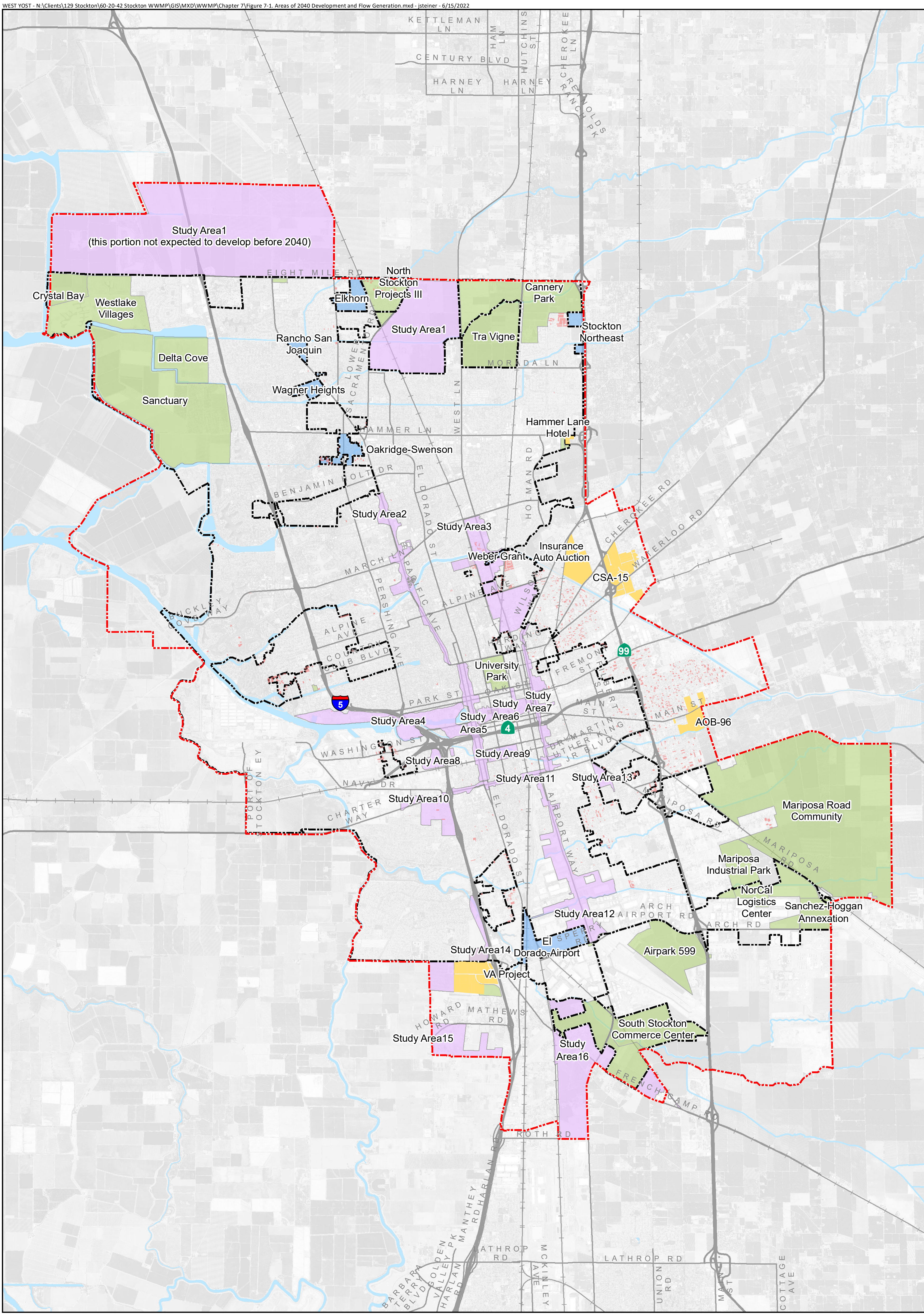
In addition to the major development areas, the City's General Plan also includes a total of sixteen study areas throughout the City. The areas in question are shown on Figure 7-1 and development information for these areas is presented in Table 7-2. Study Areas 15 and 16 are designated entirely as Open Space/Agriculture land use in the 2040 General Plan, but are nevertheless included on Figure 7-1 and in Table 7-2 for completeness.

7.1.3 Additional 2040 Development Areas

Five additional development areas were added to the 2040 modeling analysis to account for known or likely additional flow contributions. The areas in question are summarized in Table 7-3 and are shown on Figure 7-1. In all cases, the General Plan land use designations are used.

Table 7-1. Major Development Areas, 2040 General Plan Conditions

Development	Planned 2040 Development Area, acres						
	Low Density Residential	Medium Density Residential	Commercial	Industrial	Open Window	Parks and Recreation	**Total Area**
Mariposa Road Community	939.0	585.0	150.0	0	0	206.3	**1,880.3**
Sanctuary	1,026.0	67.4	35.5	0	0	193.0	**1,321.9**
South Stockton Commerce Center	0	0	20.3	792.0	0	17.2	**829.5**
Westlake Villages	680.0	0	0	0	0	12.8	**692.8**
Cannery Park	272.0	16.0	104.0	0	0	0	**392.0**
North Stockton Projects III	355.0	0	0	0	0	0	**355.0**
NorCal Logistics Center	0	0	0	325.0	0	0	**325.0**
Tra Vigne	260.7	11.7	10.4	0	0	20.4	**303.2**
Airpark 599	0	0	5.4	259.7	0	0	**265.1**
Delta Cove	132.7	47.6	2.6	0	0	57.7	**240.6**
Mariposa Industrial Park	0	0	0	203.5	0	0	**203.5**
Sanchez-Hoggan Annexation	0	0	0	169.8	0	0	**169.8**
Crystal Bay	19.4	78.7	0	0	0	10.0	**108.1**
University Park	10.1	11.0	30.9	0	0	0	**52.0**
Weston Town Ranch	0	0	41.5	0	0	0	**41.5**
Veterans Affairs Clinic	0	0	37.0	0	0	0	**37.0**
Open Window	0	0	0	0	10.9	0	**10.9**
CarMax Superstore	0	0	10.6	0	0	0	**10.6**
Tuscany Cove	0	4.3	0	0	0	0	**4.3**
Thornton and Eight Mile Road	0	0	2.1	0	0	0	**2.1**
Airport Way and Sperry Road Commercial	0	0	2.0	0	0	0	**2.0**



Major Developments
General Plan Study Area
Unincorporated Islands Not Currently Connected
Areas on Septic Tanks to be Sewer Connected
Additional 2040 Flow Contributing Areas
City of Stockton Sphere of Influence
Stockton City Limits

0 0.75 1.5
Miles

Figure 7-1

Areas of 2040 Development and Flow Generation

City of Stockton
Wastewater Master Plan Update

Table 7-2. Study Areas, 2040 General Plan Conditions

Development	Planned 2040 Study Area, acres						
	Low Density Residential	Medium Density Residential	Commercial	Industrial	Open Window	Parks and Recreation	**Total Area**
Study Area 1 – Eight Mile Road Area	232.1	73.2	0.6	0	0	157.0	**462.9**
Study Area 2 – Pacific Avenue Corridor	0	4.7	3.6	0	0	0	**8.3**
Study Area 3 – West Lane and Alpine Road Area	59.8	21.7	6.2	0	0	0	**87.7**
Study Area 4 – Port / Waterfront	11.2	26.7	2.9	5.6	0	3.4	**49.9**
Study Area 5 – El Dorado Street / Center Street Corridor	0	17.2	1.8	0	0	0	**19.0**
Study Area 6 – Miner Avenue / Weber Avenue Corridor	0	18.0	3.4	0	0	0	**21.3**
Study Area 7 – Wilson Way Corridor	0	6.8	5.1	0	0	0	**12.0**
Study Area 8 – I-5 / Highway-4 Interchange	0	38.0	0.9	0	0	0	**38.9**
Study Area 9 – Railroad Corridor at California Street	0	19.3	1.5	0	0	0	**20.7**
Study Area 10 – I-5 and Charter Way Area	57.9	4.2	2.6	2.7	0	0	**67.4**
Study Area 11 – Charter Way / MLK Jr Boulevard Corridor	0	7.7	0.4	0	0	0	**8.2**
Study Area 12 – Airport Way Corridor	0	4.7	10.2	13.1	0	0	**28.0**
Study Area 13 – Mariposa Road and Charter Way Area	0	0	1.5	0	0	0	**1.5**
Study Area 14 – East Weston Ranch	0	0	14.8	0	0	0	**14.8**
Study Area 15 – South of French Camp Road	0	0	0	0	0	0	**0**
Study Area 16 – E. French Camp Road Area	0	0	0	0	0	0	**0**

Table 7-3. Additional 2040 Development Areas		
Designation	System ID	Area, acres
VA Project	8	195.6
CSA-15	9	189.5
Insurance Auto Auction	9	139.0
AOB-96	6	101.9
Hammer Lane Hotel	2	15.5

7.1.4 Unincorporated County Islands

As discussed in Chapter 2 of this report, there exist a series of unincorporated County areas (referred to as "islands") that are technically not within the Stockton City limits, but which are located inside or adjacent to the outmost City limits boundary. A total of 17 such areas have been identified, of which the following seven areas (shown on Figure 7-1) are either known to be on septic tanks or have no known connection to the City's wastewater collection system:

1. Stockton Northeast
2. Elkhorn
3. Rancho San Joaquin
4. Wagner Heights
5. Oakridge-Swenson
6. Weber Grant
7. El Dorado/Airport

For purposes of this analysis, it is assumed all of the currently unconnected areas will be connected to the wastewater collection system by 2040. While no specific timeline exists for establishing such connections, this assumption is a conservative approach to estimating future flow conditions. The 2040 demands for these areas are estimated by applying the flow factors described in Chapter 4 to the relevant land use quantities established in the City's General Plan.

7.1.5 Areas on Septic Tanks

As discussed in Chapter 6 of this report, there are areas of the City where sewer lines exist in the street, but some parcels are on septic tanks and were never connected to the adjacent sewers. These areas are shown on Figure 7-1. The areas in question are generally small and are located in older areas of the City.

As with the unincorporated islands, no specific timeline exists for connecting these parcels to the adjacent sewers; however, assuming that such connections will occur represents a conservative approach to estimating future flow conditions. As noted in Chapter 6, the parcels in question are generally limited to those designated as Low Density Residential in the City's General Plan land use database. The 2040 demands for these areas are estimated by applying the Low Density Residential flow factor developed in Chapter 4 to the relevant parcels.

7.2 ANALYSIS OF 2040 CONDITIONS

The following topics are addressed in this section:

- System Infrastructure to Serve Future Development
- Model Results for 2040 Conditions
- Improvements to Address 2040 Capacity Deficiencies

7.2.1 System Infrastructure to Serve Future Development

Modeled future system infrastructure, including pump stations, force mains, and gravity sewers 12-inch diameter and larger, is shown in Figure 7-2. The indicated infrastructure layout is either based on a preliminary layout by a recent development project proponent, or on an analysis of surface topography, critical surface features (such as highways, railroads, and stream channels), and sewer pipe depths.

The exact configuration of collection system facilities serving future areas is subject to change as development proceeds. For modeled future flow conditions, all existing infrastructure is assumed to remain unchanged. Moreover, as with modeled existing flow conditions, the model treats pump stations as passing all incoming flows regardless of station capacity such that the capacities of pump stations and downstream gravity lines can be properly evaluated.

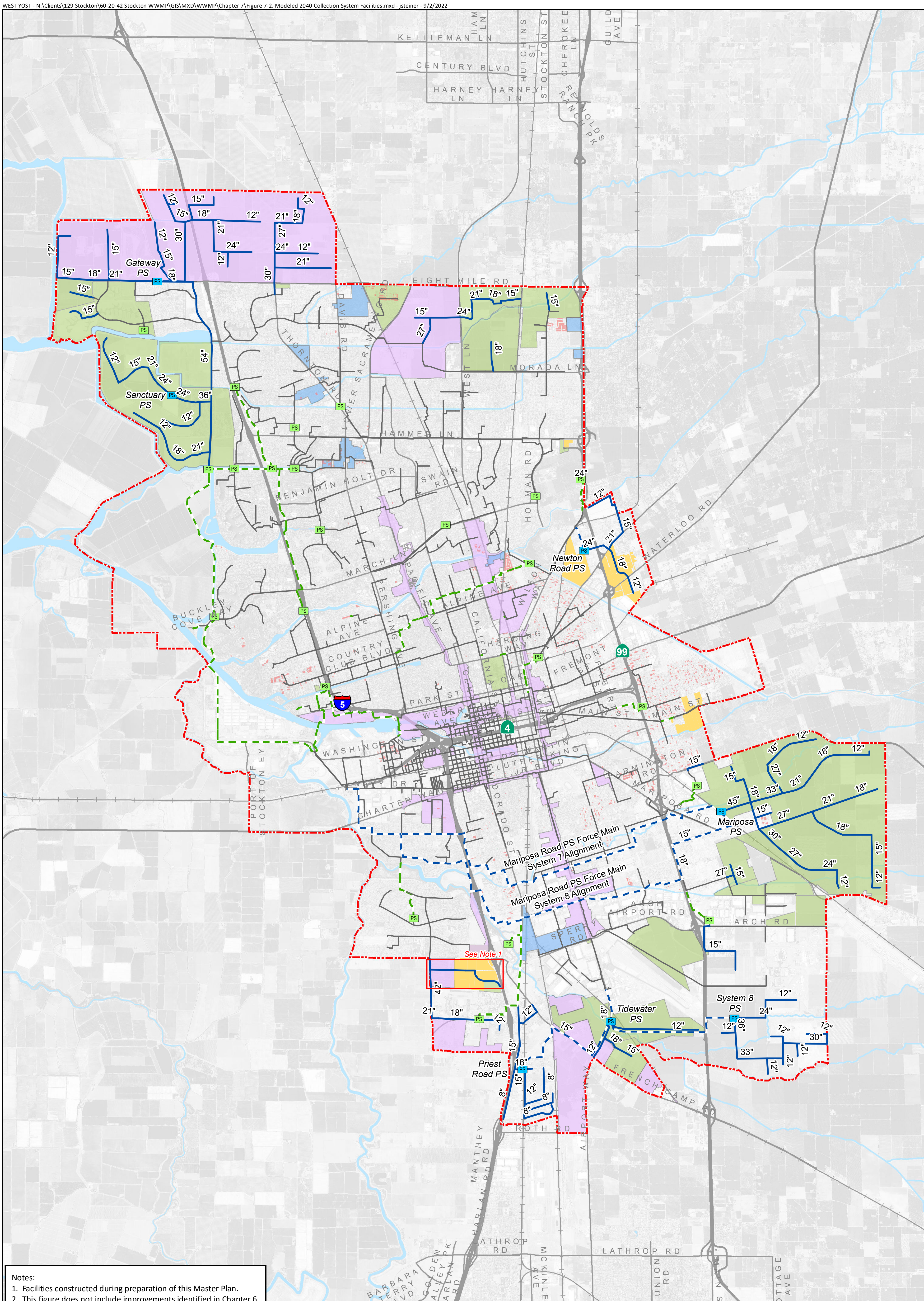
Past planning analyses assumed that the Mariposa Road development area would be served by a new pump station that would connect directly to the RWCF via a 43,000-foot force main with an alignment primarily through Systems 6 and 5. This Master Plan has identified alternatives to that previous theoretical alignment that would reduce the amount of construction through congested areas and would minimize work on Navy Drive. It is assumed that the force main for the pump station serving the Mariposa Road Community development area would be aligned through either System 7 or System 8, as shown on Figure 7-2. Issues related to connecting the Mariposa Road Community development area to the existing system are discussed in Section 0 below.

7.2.2 Model Results for 2040 Conditions

Modeled surcharge results for the 10-year, 24-hour design storm under 2040 development conditions are shown on Figure 7-3. Each location where pipe surcharging is indicated by the model are summarized in Table 7-4, along with the recommended diameter if the pipeline were to be replaced. The modeled system deficiencies for 2040 conditions are only slightly more severe than those described for existing conditions, but not fundamentally different. In addition, no additional Priority 1 surcharged lines are indicated for modeled 2040 conditions (as compared to those in Chapter 6); however, three additional lines show either Priority 2 or Priority 3&4 surcharging for modeled 2040 development conditions that did not surcharge under modeled existing peak flow conditions.

Additional surcharged lines under modeled 2040 conditions that did not surcharge under modeled existing peak flow conditions include:

- The Del Norte Street sewer from the Smith Canal and Fontana PS force main outlet to West Scotts Avenue
- The S. Airport Way sewer from South Longe Street spur to Sperry Road
- The North Lincoln Street sewer from its upstream terminus to North Lincoln Street



Notes:
1. Facilities constructed during preparation of this Master Plan.
2. This figure does not include improvements identified in Chapter 6.

- Modeled Existing Gravity Sewer
- Modeled Existing Force Main
- Future Gravity Sewer
- Future Force Main
- PS Existing Pump Station
- PS Future Pump Station
- Major Developments
- General Plan Study Area
- Unincorporated Islands
- Areas on Septic Tanks to be Sewer Connected
- Additional 2040 Developments
- City of Stockton Sphere of Influence

0 0.75 1.5
Miles

WEST YOST

Figure 7-2

Modeled Future Collection System Facilities

City of Stockton
Wastewater Master Plan Update

Peak flow results for the 10-year, 24-hour design storm at the 23 modeled existing pump stations are summarized in Table 7-5. As indicated, the Cumberland & 5-Mile Slough PS, Don Avenue & Santiago PS, and Westlake PS are all over capacity at modeled 2040 buildout peak flow conditions. In addition, the force mains for 14-mile Slough PS and Westlake PS are undersized for modeled 2040 peak flow conditions. It should be noted that the model may overstate peak flows at the Westlake PS because the development areas discussed in Section 7.1.1 and shown in Table 7-1 include approximately 87 acres of existing and planned lakes that are designated as Low Density Residential development. Removing such areas from the calculation results in 2040 peak flows much closer to the firm capacities of the pump station and force main.

Modeled results for 2040 conditions at the future pump station facilities are summarized in Table 7-6. All estimated future force main sizes are the smallest diameters at which the lines flow less than 8 feet per second for modeled buildout peak flow conditions. As indicated in the table, the Gateway PS, System 8 PS, and Priest Road PS are expected to have zero flow at 2040 conditions.

7.2.3 Improvements to Address 2040 Capacity Deficiencies

Improvements to address capacity deficiencies for modeled 2040 conditions include all improvements identified in Chapter 6, plus the following items:

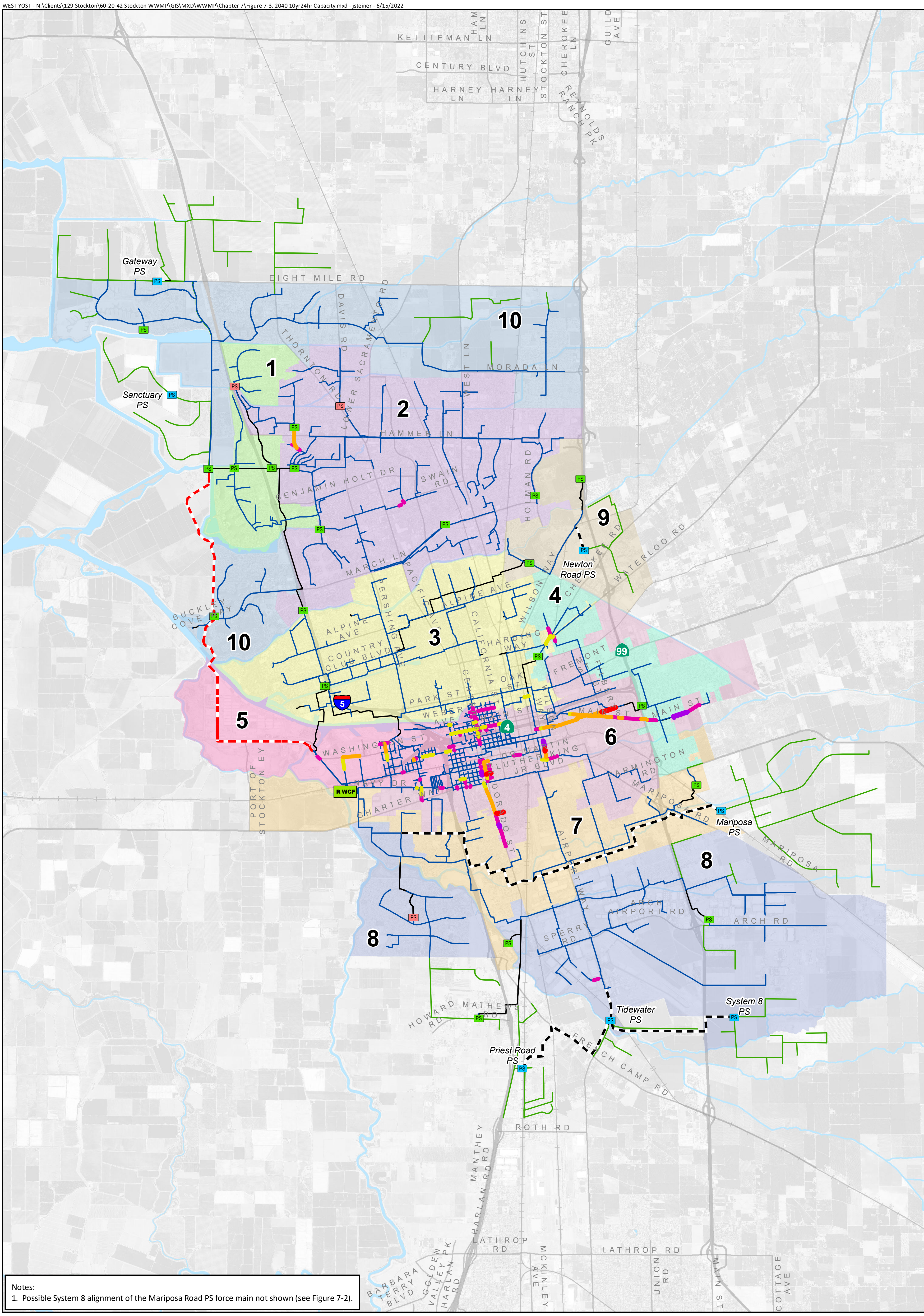
1. Gravity sewer facilities to serve 2040 General Plan development, as illustrated on Figure 7-2.
2. Pump station and force main facilities needed to serve 2040 General Plan development, as illustrated on Figure 7-2.
3. Capacity-deficient gravity sewers, as shown in Table 7-4.
4. Capacity-deficient pump stations and force mains, as shown in Table 7-5.

One issue of concern for the City involves the pump station location and force main alignment that would serve the planned Mariposa Road Community development area. As noted above, previous collection system planning showed the force main alignment along a northerly route through Systems 6 and 5, but this alignment is no longer considered preferable. Instead, as shown in Figure 7-2 above, it would be more suitable to have a force main alignment either through System 7 or through System 8.

The Mariposa Road Community development area is predicted to produce a peak flow of 13.7 mgd by 2040 and 25.2 mgd by buildout, based on the planning factors presented in Chapter 4. As shown in Table 7-7, the model shows available gravity flow capacity within the existing gravity sewers of both systems through 2040 and beyond. (The two pathways share a common alignment from Fresno Avenue to Navy Drive.) Specifically, the existing gravity trunk sewers could accommodate flows from the Mariposa Road Community development area for an interim period, especially along the System 8 pathway. However, the model indicates that insufficient gravity flow capacity exists to accommodate the Mariposa Road Community development area flows under buildout conditions.

Accordingly, the City will need to decide what infrastructure is needed right away to accommodate the Mariposa Road development area and whether some infrastructural requirements can be delayed. For purposes of master planning, it is recommended that the Mariposa Road development area pump station be constructed to allow for future expansion that can accommodate equipment capable of pumping all flows directly to the RWCF, but that a shorter force main be constructed in the interim that is directed into the System 8 pathway.

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 7\Figure 7-3. 2040 10yr24hr Capacity.mxd - jsteiner - 6/15/2022



Modeled Sewer Lines

- Priority 1
- Priority 2
- Priority 3&4
- Backwater-Induced SSO
- Backwater-Induced Surcharging
- No Surcharging
- Force Main
- Capacity-Deficient Force Main
- Future Gravity Main
- Future Force Main

- PS Pump Station - No Capacity Deficiency
- PS Pump Station - Capacity Deficiency
- PS Future Pump Stations
- R WCF Regional Wastewater Control Facility
- 1-10 Collection System Service Areas

0 0.75 1.5
Miles

WEST YOST

Figure 7-3

Modeled Capacity Deficiencies
10-Year, 24-Hour Storm
2040 Development Conditions

City of Stockton
Wastewater Master Plan Update

Table 7-4. Modeled Gravity Sewer Capacity Deficiencies, 2040 Development Conditions, 10-Year, 24-Hour Design Storm

ID #	Designation	Priorities	System	GIS Year Constructed	Upstream MH ID	Upstream MH Location	Downstream MH ID	Downstream MH Location	GIS Pipe Dia, in	Upsized Pipe Dia, in	Total Length, ft	No. of Pipe Segments	Depth to Pipe Crown, ft	Maximum Flow, mgd	Maximum Surcharge, ft	Minimum Headspace, ft
Priority 1 Group																
1-1	E. Marsh Street sewer	1,2,4	6	1895–1940	32R072	Olympic Circle	33P105	S. Sierra Nevada Street	18	24	7,406	21	4.0 to 10.4	4.01	5.3	0
1-2	El Dorado Street / S. Center Street sewer	1,2,4	6	1905–1915	37N043	E. 6th Street	36M016	E. Charter Way	16	21,24	2,832	9	7.4 to 12.1	3.54	8.9	0
1-3	S. Wilson Way sewer	1,2	6	1947	34P082	E. Worth Street	35P012	Mormon Slough	10,12	21	1,001	5	7.6 to 8.6	2.73	8.1	0
1-4	E. 6th Street	1,2	6	1900	37N034	S. San Joaquin Street	37N043	El Dorado Street	12	18	701	4	10.2 to 10.8	1.89	10.7	0
Priority 2 Group																
2-1	E. Main Street sewer	2,4	6	1910–1984	33T029	S. Oro Avenue	33Q014	E. Washington Street	12,16	18	8,756	27	7.6 to 10.3	1.74	6.1	2.1
2-2	W. Washington Street / Port Road 23 sewer	2,3	5	no data	34J016	west of Port Road 13	36H003	north of Navy Drive	12,15,18	18,21	3,800	9	5.6 to 11.8	2.93	4.9	4.0
2-3	Don Avenue / Meadow Avenue sewer	2	2	1957–1973	20G060	Santiago Way	21G051	Oak Creek Drive	12	15	2,171	10	8.1 to 9.8	1.59	5.7	2.6
2-4	S. El Dorado Street sewer	2,4	6	1900–1910	35M031	E. Worth Street	36N016	E. Charter Way	12	15	1,815	5	8.9 to 11.5	1.19	2.0	6.9
2-5	Del Norte Street sewer	2,4	5	1949–1959	34K004	Force main outlet	35K030	W. Scotts Avenue	36	42	4,132	12	4.4 to 9.3	22.06	1.3	4.2
Priority 3&4 Group																
4-1	Market Street sewer	4	5	1900–1920	33M079	S. El Dorado Street	34L002	S. Lincoln Street	12,14,16,18	18,24	2,320	8	12.4 to 16.1	1.94	2.6	11.2
4-2	Church Street/Pershing Avenue sewer	4	5	1917	34L022	S. Harrison Street	36L035	Navy Drive	24	30	5,613	15	9.5 to 15.0	3.73	2.3	9.2
4-3	Waterloo Road sewer	4	3	1920–1984	29Q063	Williams Street	30P039	Hiawatha Avenue	12,15	15,18	1,834	8	21.9 to 23.7	2.30	1.8	20.1
4-4	N. Lincoln Street sewer	4	5	1920	33L036	upstream terminus	33L039	N. Lincoln Street	4	8	161	4	14.0 to 14.8	0.18	2.2	11.8

Table 7-5. Modeled Pump Station Results, 10-Year, 24-Hour Design Storm, 2040 Development Conditions					
Pump Station	System	Firm Capacity, mgd	Peak Flow, mgd [(a)]	Force Main Diameter, in	Maximum Force Main Velocity, ft/sec [(a)]
14-Mile Slough	10	(b)	30.82	30	9.7
Alexandria & 14-Mile Slough	2	1.97	1.21	15	1.5
Arch Road	8	8.70	0.92	24	0.5
Blossom Ranch	2	1.30	0.56	8	2.5
Brookside Estates	10	8.64	2.61	20	1.9
Camanche & Ridgeway	2	2.40	0.94	none	--
County Hospital	--	2.16	0.20	dual 10	0.3
Cumberland & 5-Mile Creek	1	4.32	5.68	16	6.3
Don Ave & Santiago	2	0.79	1.45	15	1.8
Drake & Highway 99	4	3.54	3.39	14	4.9
Grupe Business Park	7	0.86	0.036	8	0.2
Kelly & Mosher Slough	1	4.32	1.96	12	3.9
March-Brookside & I-5	2	1.15	0.76	8	3.4
Origone	9	5.18	0	16	0.0
Plymouth & 5-Mile Creek	1	1.25	0.49	8	2.2
Sanguinetti	9	15.98	4.70	24	2.3
Sinclair Avenue & Highway 4	7	4.32	0.123	10	0.3
Smith Canal & Fontana	3	37.92	37.36	dual 30	5.9
Swenson (North)	2	20.16	18.89	dual 24	4.7
Thornton & Davis	2	1.22	1.13	8	5.0
Waterloo & Roosevelt	4	2.74	2.60	12	5.1
Westlake	10	4.35	5.18	12	10.2
Weston Ranch	8	15.98	5.53	dual 30	0.9

(a) Exceedances of pump station firm capacity and the force main velocity criterion of 8 ft/sec are highlighted in yellow.

(b) Cannot be calculated due to unknown pump capacities; see Table 2-9.

Table 7-6. Model Results for 2040 Conditions at Future Pump Station Facilities					
Name	Development Area	Peak Flow, mgd	Force Main Length, feet	Force Main Diameter, inches [a]	Peak Flow Velocity, feet/sec
Gateway	Study Area 1 north of Eight Mile Road	0 [c]	<10	24	0 [c]
Mariposa	Mariposa Road Community	14.03	36,100 [b]	30	4.4
Newton Road	CSA-15/Insurance Auto Auction	2.60	2,200	14	3.8
Priest Road	Areas southwest of Stockton Municipal Airport	0 [c]	2,300	14	0 [c]
Sanctuary	Sanctuary	4.85	<10	14	7.0
System 8	Areas south of Arch Road and east of Highway-99	0 [c]	4,300	24	0 [c]
Tidewater	South Stockton Commerce Center	1.51	2,800	30	0.5

(a) Sized for buildout conditions.
(b) System 7 alignment assumed.
(c) No flow at 2040 conditions; required for buildout.

Table 7-7. Available Flow Capacity in Systems 7 and 8					
System 7 Pathway	Available Qp Capacity, mgd			Existing Pipes	
	Existing	2040	Buildout	Diameter, in	Length, LF
Mariposa Road to Ralph Ave	9.1	8.5	5.7	30	11,800
Ralph Ave to El Dorado St.	7.7	7.0	2.1	42	6,200
El Dorado St. to Fresno Ave	10.4	9.7	4.0	48	13,500
Fresno Ave to Houston Ave [a]	44.9	37.0	11.6	72	2,500
Houston Ave to Navy Drive [a]	43.1	32.5	0.8	72	6,100
System 8 Pathway	Available Qp Capacity, mgd			Existing Pipes	
	Existing	2040	Buildout	Diameter, in	Length, LF
Marfargoa Road to Airport Way	21.5	17.1	12.7	42	14,200
Airport Way to El Dorado St.	35.5	28.6	14.1	66	5,600
El Dorado St. to Fresno Ave	51.3	44.0	25.3	72	17,100
Fresno Ave to Houston Ave [a]	44.9	37.0	11.6	72	2,500
Houston Ave to Navy Drive [a]	43.1	32.5	0.8	72	6,100
Development Area	Modeled Qp, mgd				
	Existing	2040	Buildout		
Mariposa Road Community	0	14.0	25.2		

(a) The System 7 and System 8 pathways are converged from Fresno Avenue to Navy Drive.

7.3 ANALYSIS OF BUILDOUT FLOW CONDITIONS

In addition to evaluating 2040 flow conditions, it is also necessary to consider collection system flows associated with the buildout of the City's Sphere of Influence. The analysis of buildout flow conditions is needed to ensure that any future upsizing of collection system pipes is adequate to accommodate development consistent with planned future land uses through General Plan buildout. Accordingly, the following topics are addressed in this section:

- Buildout Model Flow Assumptions
- Buildout Model Results

7.3.1 Buildout Model Flow Assumptions

Development of the buildout model requires adding future flow inputs that are not accounted for in the 2040 conditions model. Additional flow inputs fall into two categories:

1. Currently vacant parcels not accounted for in any of the 2040 development areas.
2. Additional flows that may be added to the 2040 development areas after 2040.

In the latter case, the development quantities associated with the various development areas do not necessarily reflect full buildout of those areas. As an example, the difference between the 2040 development quantities and the buildout quantities for Study Area 1 are shown in Table 7-8. As indicated in the table, a significant amount of additional development is assumed to occur in Study Area 1 between 2040 and buildout. Similar results exist for other 2040 development areas.

Table 7-8. Study Area 1 Development Quantities, 2040 vs. Buildout

Land Use Category	Parcel Area, acres	
	2040 [(a)]	Buildout
Economic and Education Enterprise	0	3,784.1
Low Density Residential	232.1	647.3
Medium Density Residential	73.2	143.0
High Density Residential	0	53.5
Commercial	0.6	17.2
Institutional	0	39.0
Parks and Recreation	157.0	153.6
TOTAL	**462.9**	**4,837.7**

(a) All 2040 development expected to occur south of Eight Mile Road.

Figure 7-4 illustrates the difference between existing, 2040, and buildout conditions in terms of flow generation. Specifically, the figure shows the following four categories of parcels with regard to the generation of future flow:

- Flow producing parcels that are assumed to remain unchanged from existing conditions
- 2040 areas of development and flow generation (as shown in Figure 7-1)
- Currently vacant parcels assumed to produce flows at buildout (but not by 2040)
- Parcels with non-flow-producing land uses

7.3.2 Buildout Model Results

Buildout model system surcharging results are presented in Figure 7-5. Sewer runs where surcharging is indicated are summarized in Table 7-9. The number of pipes where the model indicates surcharging is substantially greater than for 2040 conditions. Specifically, Table 7-9 shows a total of 14 sewer runs where modeled surcharging is indicated for buildout conditions but not for existing or 2040 conditions.

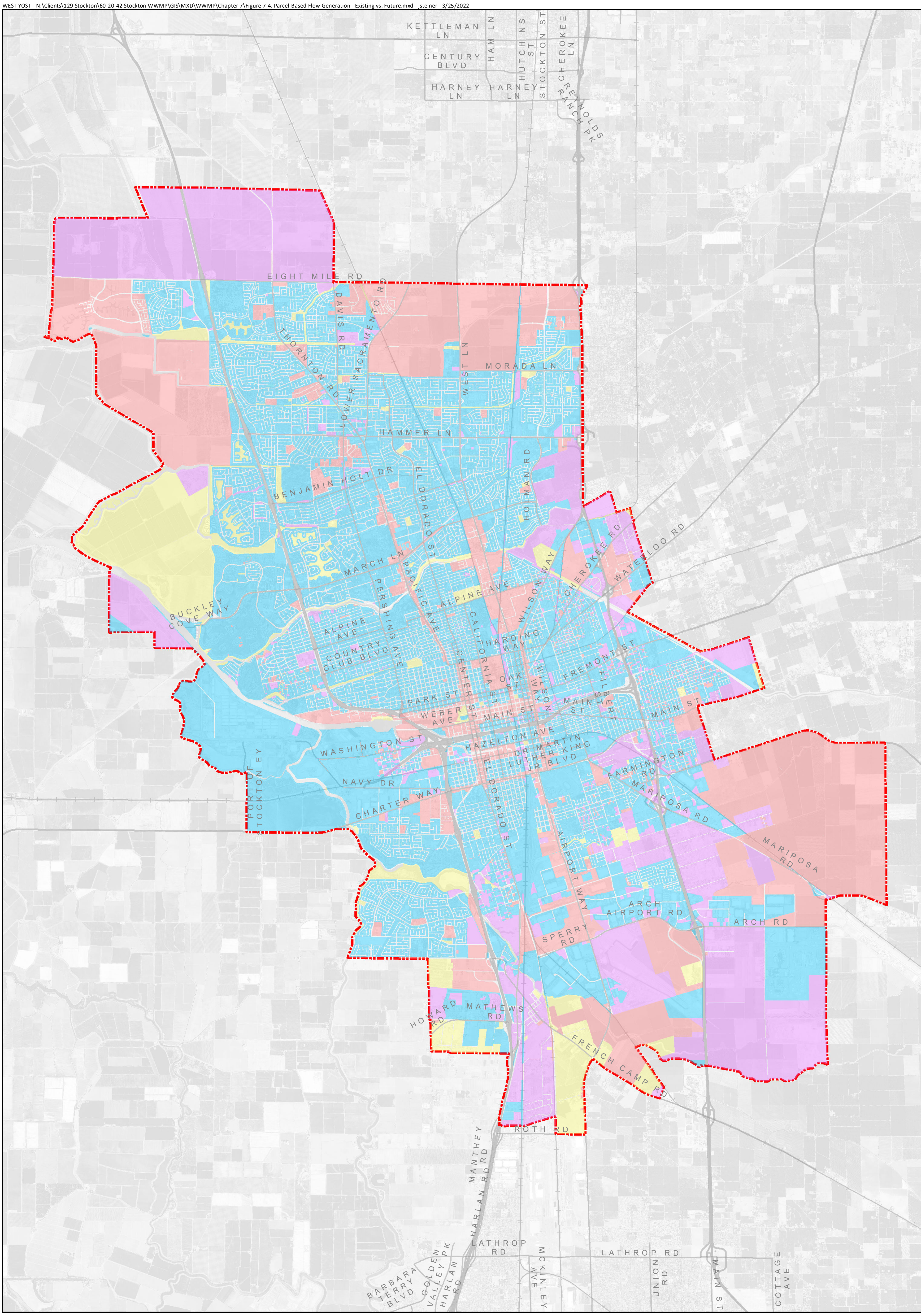
Buildout model results for existing pump stations are presented in Table 7-10. Buildout model results for future pump stations are presented in Table 7-11. In addition to the stations previously identified as being over capacity for 2040 conditions, the Drake & Highway-99 PS, Smith Canal & Fontana PS, Swenson (North) PS, and Waterloo & Roosevelt PS are all shown as over capacity for buildout peak flow conditions. Moreover, in addition to the 14-Mile Slough PS force main and the Westlake PS force main being undersized for buildout peak flow conditions (as also indicated for 2040 conditions), the Sinclair & Highway-4 PS force main is also shown as being undersized for buildout peak flow conditions.

For this analysis, a line that is modeled as surcharging at buildout conditions but not at existing or 2040 conditions is not considered adequate justification to trigger an improvement, due to the uncertainty of when and if such a flow condition will ever occur. If, however, the need for a condition-related improvement has already been identified for the line in question, then an upsizing of that line is justified if either of the following two conditions are met:

1. Surcharging under buildout conditions is expected to be severe enough that the risk of future outflows exists.
2. It has already been determined for other reasons that the pipe in question needs to be dug and replaced.

The application of this approach is presented in Chapter 8 of this report.

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\WWMP\Chapter 7\Figure 7-4. Parcel-Based Flow Generation - Existing vs. Future.mxd - jsteiner - 3/25/2022



City of Stockton Parcels

- Unchanged from Existing Conditions
- Flow Producing After 2040
- 2040 Flow Generation Area
- Non-Flow-Producing Land Use
- City of Stockton Sphere of Influence

0 0.75 1.5
Miles

WEST YOST

Figure 7-4

Parcel-Based Flow Generation Existing vs. Future

City of Stockton
Wastewater Master Plan Update

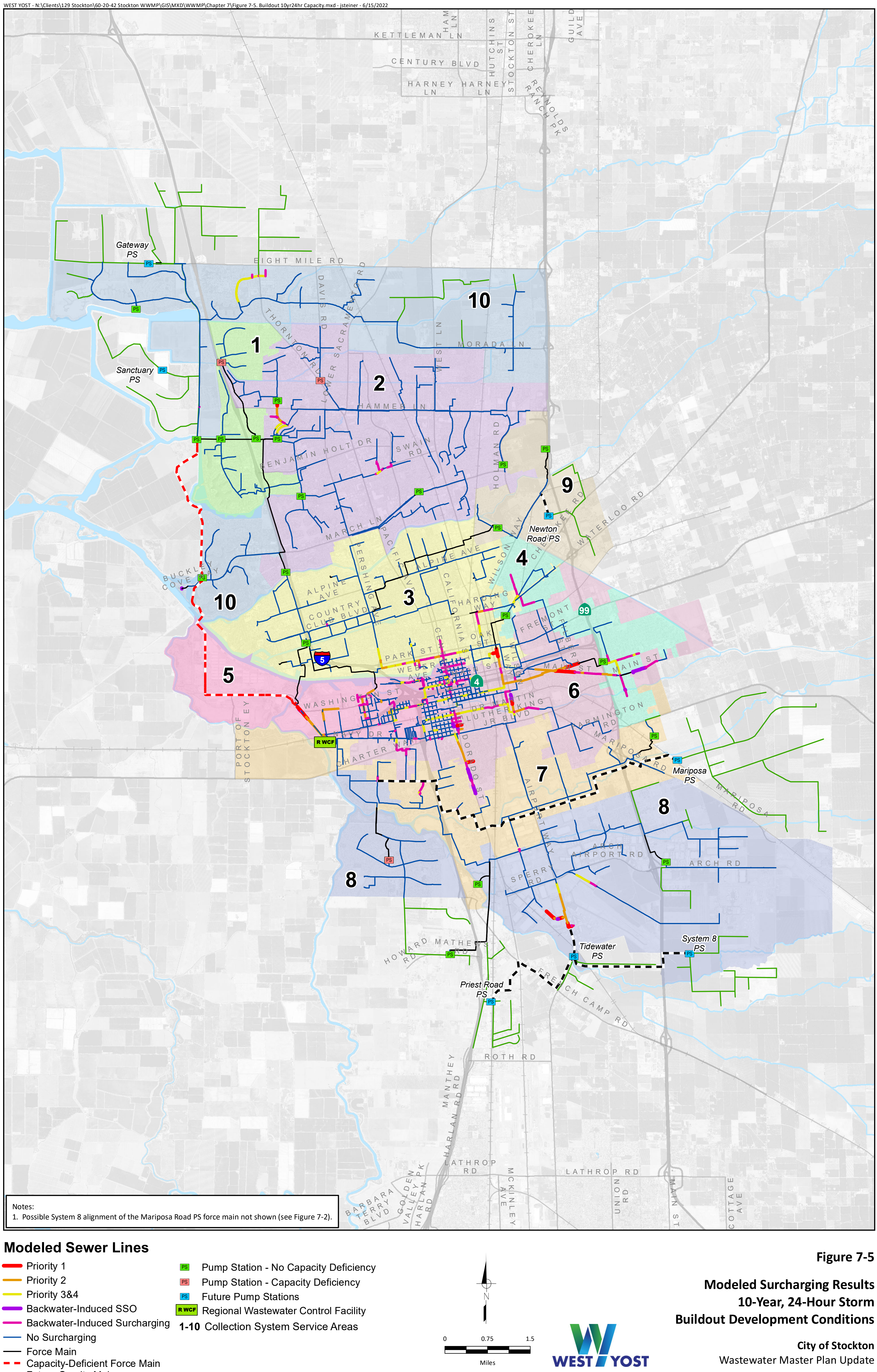


Figure 7-5

Modeled Surcharging Results
10-Year, 24-Hour Storm
Buildout Development Conditions

City of Stockton
Wastewater Master Plan Update

Table 7-9. Modeled Gravity Sewer Capacity Deficiencies, Buildout Development Conditions, 10-Year, 24-Hour Design Storm															
ID #	Designation	Priorities	System	GIS Year Constructed	Upstream MH ID	Upstream MH Location	Downstream MH ID	Downstream MH Location	GIS Pipe Dia, in	Total Length, ft	No. of Pipe Segments	Depth to Pipe Crown, ft	Maximum Flow, mgd	Maximum Surcharge, ft	Minimum Headspace, ft
Priority 1 Group (Ex. And 2040 Conditions)															
1-1	E. Marsh Street sewer	1,2,4	6	1895–1940	32R072	Olympic Circle	33P105	S. Sierra Nevada Street	18	7,406	21	4.0 to 10.4	4.34	5.9	0
1-2	El Dorado Street / S. Center Street sewer	1,2,4	6	1905–1915	37N043	E. 6th Street	36M016	E. Charter Way	16	2,832	9	7.4 to 12.1	3.58	10.0	0
1-3	S. Wilson Way sewer	1,2	6	1947	34P082	E. Worth Street	35P012	Mormon Slough	10,12	1,001	5	7.6 to 8.6	2.97	8.1	0
1-4	E. 6th Street	1,2	6	1900	37N034	S. San Joaquin Street	37N043	El Dorado Street	12	701	4	10.2 to 10.8	1.77	10.7	0
Priority 2 Group (Ex. & 2040 Conditions)															
2-1	E. Main Street sewer	2,4	6	1910–1984	33T029	S. Oro Avenue	33Q014	E. Washington Street	12,16	8,756	27	7.6 to 10.3	1.95	8.2	0
2-2	W. Washington Street / Port Road 23 sewer	2,3	5	no data	34J016	west of Port Road 13	36H003	north of Navy Drive	12,15,18	3,800	9	5.6 to 11.8	2.92	5.2	3.6
2-3	Don Avenue / Meadow Avenue sewer	2	2	1957–1973	20G060	Santiago Way	21G051	Oak Creek Drive	12	2,171	10	8.1 to 9.8	1.75	8.4	0
2-4	S. El Dorado Street sewer	2,4	6	1900–1910	35M031	E. Worth Street	36N016	E. Charter Way	12	1,815	5	8.9 to 11.5	1.20	2.9	6.1
2-5	Del Norte Street sewer	2,4	5	1949–1959	34K004	Force main outlet	35K030	W. Scotts Avenue	36	4,132	12	4.4 to 9.3	21.19	3.3	1.9
Priority 3&4 Group (Ex. & 2040 Conditions)															
4-1	Market Street sewer	4	5	1900–1920	33M079	S. El Dorado Street	34L002	S. Lincoln Street	12,14,16, 18	2,320	8	12.4 to 16.1	1.98	4.1	9.5
4-2	Church Street/Pershing Avenue sewer	4	5	1917	34L022	S. Harrison Street	36L035	Navy Drive	24	5,613	15	9.5 to 15.0	4.62	3.9	8.2
4-3	Waterloo Road sewer	4	3	1920–1984	29Q063	Williams Street	30P039	Hiawatha Avenue	12,15	1,834	8	21.9 to 23.7	2.57	2.9	19.0
4-4	N. Lincoln Street sewer	4	5	1920	33L036	upstream terminus	33L039	N. Lincoln Street	4	161	4	14.0 to 14.8	0.05	1.8	12.4
Buildout-Only Group															
B-1	Sierra Nevada Street sewer	1,2	3,6	1895–1900	32P048	E. Lindsay Street	33P105	E. Sonora Street	18	3,312	9	5.1 to 10.5	3.69	6.2	0
B-2	Church Street trunk sewer	4	5,6	1895–1985	33P105	E. Sonora Street	34L037	S. Harrison Street	27	9,558	27	9.4 to 13.0	7.59	2.5	8.8
B-3	Mormon Slough sewer	2,4	6	1956	34Q037	E. Jefferson Street	34P088	Worth Street	24	2,617	5	4.7 to 18.6	7.08	3.7	1.2
B-4	Worth Street trunk sewer	4	6	1920–1945	34P088	S. Sierra Nevada Street	35L034	W. Anderson Street	36	8,502	17	6.7 to 20.8	14.71	3.0	4.2
B-5	Navy Drive west trunk sewer (42")	1,2,4	5	1997	34G023	San Joaquin River crossing	36H902	RWCF	42	4,602	12	7.8 to 14.2	63.52	13.8	0
B-6	Oak Street trunk sewer	2,4	3	1900–1958	31P131	Grant Street	33K010	McNabb Place	21,24	8,444	25	8.8 to 11.8	4.49	2.2	7.4
B-7	N Pershing Avenue trunk sewer	2,4	3	1958	33K010	Oak Street	31K106	Tuxedo Avenue	20,24	4,260	21	9.1 to 16.2	5.40	1.5	7.7
B-8	Oro Avenue / Horner Avenue	1,2,4	4,6	1984	33T027	E. Main Street	32S052	S. Drake Avenue	12,18	2,817	10	21.5 to 25.8	4.34	10.2	11.3
B-9	Oak Creek Drive / Park Woods Drive	4	2	1957	21G062	Meadow Avenue	22G031	Bonniebrook Drive	12	1,511	8	10.6 to 12.6	1.23	1.3	9.5
B-10	Union Street sewer	2,3	3	1890–1918	30N015	Harding Way	32N016	Oak Street	10,12	3,305	8	6.1 to 10.7	1.00	1.0	5.1
B-11	A.G. Spanos Boulevard sewer	2,4	10	1993–2006	14F017	Thornton Road	16F018	Whistler Way	24	4,399	14	13.7 to 16.9	7.68	5.8	9.4
B-12	Weber Avenue sewer	3,4	5	1920	33L067	Mormon Slough	33L048	N. Lincoln Street	6,8	1,791	7	6.3 to 12.7	0.52	2.0	5.9
B-13	Navy Drive west trunk sewer (30")	2	5	1959	34G016	San Joaquin River crossing	36H007	RWCF	30,36	4,080	9	4.6 to 10.2	24.62	2.2	5.4
B-14	S. Airport Way sewer	1,2,4	8	1974	45R005	S. Longe Street	42R024	Sperry Road	18	5,022	16	7.5 to 12.3	15.20	12.9	0
B-15	Performance Drive	1,2	8	1974	44Q001	Aviation Drive	44R013	S. Airport Way	12	2,073	6	3.6 to 9.4	1.22	8.2	0

Table 7-10. Modeled Pump Station Results, 10-Year, 24-Hour Design Storm, Buildout Development Conditions					
Pump Station	System	Firm Capacity, mgd	Peak Flow, mgd [(a)]	Force Main Diameter, in	Maximum Force Main Velocity, ft/sec [(a)]
14-Mile Slough	10	(b)	60.58	30	19.1
Alexandria & 14-Mile Slough	2	1.97	1.23	15	1.5
Arch Road	8	8.70	4.39	24	2.2
Blossom Ranch	2	1.30	0.66	8	2.9
Brookside Estates	10	8.64	2.72	20	1.9
Camanche & Ridgeway	2	2.40	1.20	none	--
County Hospital	--	2.16	0.89	dual 10	1.3
Cumberland & 5-Mile Creek	1	4.32	6.10	16	6.8
Don Ave & Santiago	2	0.79	1.60	15	2.0
Drake & Highway 99	4	3.54	4.34	14	6.3
Grupe Business Park	7	0.86	0.397	8	1.8
Kelly & Mosher Slough	1	4.32	1.86	12	3.7
March-Brookside & I-5	2	1.15	0.76	8	3.4
Origone	9	5.18	2.16	16	2.4
Plymouth & 5-Mile Creek	1	1.25	0.49	8	2.2
Sanguinetti	9	15.98	8.83	24	4.3
Sinclair Avenue & Highway 4	7	4.32	1.58	10	4.5
Smith Canal & Fontana	3	37.92	44.30	dual 30	7.0
Swenson (North)	2	20.16	20.23	dual 24	5.0
Thornton & Davis	2	1.22	1.20	8	5.3
Waterloo & Roosevelt	4	2.74	3.46	12	6.8
Westlake	10	4.35	5.03	12	9.9
Weston Ranch	8	15.98	10.03	dual 30	1.6

(a) Exceedances of pump station firm capacity and the force main velocity criterion of 8 ft/sec are highlighted in yellow.

(b) Cannot be calculated due to unknown pump capacities; see Table 2-9.

Table 7-11. Model Results for Buildout Conditions at Future Pump Station Facilities					
Name	Development Area	Peak Flow, mgd	Force Main Length, feet	Force Main Diameter, inches	Peak Flow Velocity, feet/sec
Gateway	Study Area 1	14.88	<10	24	7.3
Mariposa	Mariposa Road Community	25.22	36,100 [a]	30	8.0
Newton Road	CSA-15/Insurance Auto Auction	4.50	2,200	14	6.5
Priest Road	South Stockton Commerce Center/Study Area 16	4.52	2,300	14	6.5
Sanctuary	Sanctuary	4.24	<10	14	6.1
System 8	South Stockton Commerce Center/Study Area 16	15.26	4,300	24	7.5
Tidewater	South Stockton Commerce Center	23.71	2,800	30	7.5

(a) System 7 alignment assumed.

The purpose of this chapter is to present a recommended CIP for the City's wastewater collection system. The recommended CIP presented here includes collection system capacity improvements, as well as condition-related improvements previously identified by the City, as discussed in Chapter 6. The City's existing CIP list is included as Appendix G. The major topics addressed in this chapter include:

- Cost Estimating Assumptions
- Recommended Capital Improvements
- Review of Potential Impacts on Rates and Fees
- Conclusions and Recommendations

8.1 COST ESTIMATING ASSUMPTIONS

Cost estimates prepared for this Master Plan are developed in accordance with the guidelines of the Association for the Advancement of Cost Engineering (AACE) International for a Class 5 Estimate. AACE International defines a Class 5 Estimate in the following manner:

> *Class 5 Estimate: This estimate is prepared based on limited information, where little more than proposed plant type, its location, and the capacity are known. Strategic planning purposes include, but are not limited to, market studies, assessment of viability, evaluation of alternate schemes, project screening, location and evaluation of resource needs and budgeting, and long-range capital planning. Examples of estimating methods used would include cost/capacity curves and factors, scale-up factors, and parametric and modeling techniques. The expected accuracy ranges for this class estimate are -20 to -50 percent on the low side and +30 to +100 percent on the high side.*

Construction and capital cost estimates are presented in March 2022 dollars corresponding to an Engineering News Record Construction Cost Index (ENR CCI) of 15,126.84 (San Francisco). Construction costs were developed based on a combination of data supplied from manufacturers, bids on other wastewater facilities design projects built by other public agencies, construction costs previously estimated by West Yost, and standard cost estimating guides. Subsequent preliminary and detailed design efforts will serve to refine and confirm the estimates presented herein.

Total CIP costs include mark-ups equal to 80 percent of base construction costs, and are listed below:

- Design and Construction Contingency: 35 percent
- Project Cost Allowances: 45 percent
  - Engineering: 15 percent
  - Construction Management: 15 percent
  - Implementation: 15 percent

It is assumed that the recommended facilities will be developed in public rights-of-way or on public property; therefore, land acquisition costs have not been included. Construction cost estimates do not include costs for annual O&M nor any allowance for project financing costs.

The development of capital cost estimates for this recommended CIP involves the following cost estimation methods and assumptions:

1. All of the capital cost estimates presented in this chapter are expressed in current (March 2022) dollars. Escalation should be considered in the financial analysis for projects occurring in future years.
2. Where the basis for costs was previously estimated, those earlier estimates are escalated to the current ENR CCI value for March 2022. Costs based on existing City estimates were taken from the 2021 CIP list and have not been escalated.
3. For open-cut gravity sewer construction projects, a unit cost of $35 per inch-diameter lineal-foot is assumed, plus $15,000 per manhole. These costs are assumed to include excavation/backfill, sheeting and shoring, pipe construction, dewatering, lateral/sewer main connection, repaving, and mobilization/demobilization.
4. For cured-in-place pipe installation or pipe-bursting methods for rehabilitation, an assumed cost of $20 per inch-diameter lineal-foot is used, plus $2,500 per service lateral reinstatement, and $10,000 per epoxy-lined manhole.
5. For future pump station facilities, construction costs are capacity-based estimates using published cost curves, supplemented with cost information from pump station projects in California and Oregon. The estimates are representative of average site conditions and normal difficulty of construction.
6. For pump station force main piping, an assumed unit cost of $25 per inch-diameter lineal-foot is used. These costs are assumed to include excavation/backfill, sheeting and shoring, pipe construction, dewatering, repaving, and mobilization/demobilization.

8.2 RECOMMENDED CAPITAL IMPROVEMENTS

A recommended CIP list is presented in Table 8-1. The information presented in the table includes:

- An ID number assigned to the improvement
- Name of the improvement
- Description of the improvement
- Justification for the improvement
- Estimated time frame for construction/execution
- Replacement quantities involved
- Actions/notes
- Estimated capital cost
- City CIP Project ID No. (where applicable)

Existing City cost estimates are shown, where available. Otherwise, costs are estimated using the methods described above in Section 8.1.

Table 8-1. Recommended Capital Improvement Plan

ID	Name	Description	Justification	Time Frame	Quantities	Actions/Notes	Capital Cost, $M	City CIP Project
Pump Station and Force Main Improvements, Existing System								
P-1	14-Mile Slough PS Improvements	Modify existing pump station to address mechanical equipment failures.	Existing pump station suffers from chronic mechanical failures that warrant modifications to accommodate different pumping equipment.	2027 (start by 2023)	Pump station modifications	Proceed with design and construction of station improvements to address short-term operational concerns; conduct evaluation by 2023 to identify long-term capacity needs	3.60	UW20022/M20022
P-2	5-Mile Slough Force Main	Inspect and rehabilitate or replace existing force main piping	Previously identified as needing inspection/rehabilitation	2027 (start by 2023)	Force main modification/ replacement	Proceed with inspection, assessment, and rehabilitation/ replacement	0.3 (City estimate; assessment only)	M18015
P-3	Lincoln Street PS and Force Main	Construct PS and force main; abandon existing siphon; redirect local flow inputs	Existing siphon is over 100 years old and in poor condition; siphon failure would have severe consequences for system operations	2027 (start by 2023)	~4 mgd pump station and ~1,800 LF of force main[a]	Update previous design; proceed with construction	8.60	UW24005
P-4	Westside Interceptor Parallel Force Main	Construct new parallel force main serving 14-Mile Slough PS and other tributary pump stations	Existing pump force main sizing not adequate for future flow conditions; condition of existing force main unknown	2027 (start by 2023)	~32,000 LF of 36-inch diameter parallel force main[a]	Proceed with design and construction of parallel force main; estimated costs do not include ROW acquisition	51.8	none
P-5	Swenson (North) PS	Assess pump station components, operation, and capacity	Pump station is not keeping up with incoming flows for both wet and dry weather conditions	2027 (start by 2023)	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	2.90	UW24003
P-6	Brookside Estates PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.90	UW23003
P-7	College Park (Park View) PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.80	UW25003
P-8	Don Avenue & Santiago PS	Inspect and rehabilitate existing pump station components; upsize existing PS capacity, as needed	Previously identified as needing inspection/rehabilitation; modeled peak flows exceed station capacity	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement; flow or pump runtime monitoring is recommended to confirm capacity concerns	0.50	UW13010/M13010
P-9	Drake & Hwy-99 PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	1.30	UW25005
P-10	Kelley & Mosher PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.50	UW24004
P-11	Quail Lakes (Alexandria and 14-Mile Slough) PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.60	UW21015/M21015
P-12	Thornton & Davis PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.70	UW13009/M13009
P-13	Waterloo & Roosevelt PS	Inspect and rehabilitate existing pump station components	Previously identified as needing inspection/rehabilitation; pump station is not keeping up with incoming flows for both wet and dry weather conditions	2027	TBD	Proceed with inspection, assessment, and rehabilitation/ replacement	0.60	UW25004
P-14	Camanche & Ridgeway PS	Inspect and rehabilitate existing pump station components	Previously-identified capacity upgrade; no current indication of capacity concerns	2032	--	Assess physical condition and functionality of pump station; address any major defects	0.60	UW25002
P-15	Plymouth & 5 Mile Creek PS	Inspect and rehabilitate existing pump station components	Previously-identified capacity upgrade; no current indication of capacity concerns	2032	--	Assess physical condition and functionality of pump station; address any major defects	2.40	UW23001
P-16	Cumberland & 5-Mile Creek PS	Assess pump station components, operation, and capacity; upsize existing PS capacity, as needed	Modeled peak flows exceed station capacity; pump station is not keeping up with incoming flows for both wet and dry weather conditions	2032	6.6 mgd pump station	Flow or pump runtime monitoring is recommended to confirm capacity concerns; cost estimate assumes a new pump station; however, existing station may be able to accommodate larger pumps	6.0	none
P-17	Pump Station Rehabilitation and Modernization	Implement improvements identified under Recommended Studies Item S-2 below	Aging pump station throughout the City are in need of rehabilitation or replacement	Annual, ongoing	Structural, mechanical, electrical, controls, site and security rehabilitation and modernization	Adjust annual budgeted amount upon completion of Item S-2	2.0/year	none

Table 8-1. Recommended Capital Improvement Plan

ID	Name	Description	Justification	Time Frame	Quantities	Actions/Notes	Capital Cost, $M	City CIP Project
Rehabilitation of Existing Gravity Sewer Facilities								
R-1	Church Street/Pershing Avenue trunk sewer	Replace/realign/upsize existing 24-inch diameter VCP along Church Street and Pershing Avenue from Harrison Street to Navy Drive	Existing VCP line has adverse slopes, is more than 100 years old, and is in advanced state of deterioration	2027	~5,600 LF of 30-inch diameter pipe; ~20 MHs[(a)]	Finalize existing design; proceed with construction of identified improvements; should be implemented in conjunction with Lincoln Street PS project (see above)	8.50	UW17023/M17023
R-2	Mormon Slough trunk sewer	Upsize/reconfigure ~2,700 LF of 24-inch diameter pipe; Jefferson Street to Worth Street	Identified by City as needing rehabilitation	2027	TBD	Extend design of replacement sewer to Worth Street; proceed with construction	6.80	UW18030/M18030
R-3	Navy Drive I-5 trunk sewer	CIPP line ~1,700 LF of 54-inch and 42-inch diameter pipe	Pipe is in an advanced state of deterioration	2027	Same as existing	Design complete; proceed with construction	1.90	M17026
R-4	Navy Drive parallel trunk sewers	CIPP line ~8,700 LF of 48-inch, 30-inch, and 24-inch diameter pipe	Pipe is in an advanced state of deterioration	2027	Same as existing	Design complete; proceed with construction	2.80	M15003
R-5	Oak Street trunk sewer	Rehabilitate ~11,000 LF of 24-inch and 21-inch diameter pipe; Wilson Way to Pershing Avenue	Identified by City as needing rehabilitation	2027	TBD	Proceed with assessment of existing pipes and design of improvements	11.70	UW20016/M20016
R-6	Pershing Avenue sewer	Rehabilitate ~4,300 LF of 24-inch diameter pipe; Oak Street to Tuxedo Avenue	Identified by City as needing rehabilitation	2027	TBD	Proceed with assessment of existing pipes and design of improvements	1.50	UW23008
R-7	Ralph Avenue trunk sewer, Phase 1	Rehabilitate ~9,200 LF of 30-inch diameter pipe; Mariposa Road to B Street	Identified by City as needing rehabilitation	2027	TBD	Proceed with assessment of existing pipes and design of improvements	1.00	M18024
R-8	Sierra Nevada Street trunk sewer	CIPP line ~1,100 LF of 36-inch diameter pipe	Identified by City as needing rehabilitation	2027	Same as existing	Design complete; proceed with construction	2.10	UW18029/M18029
R-9	Union Street sewer	Upsize/reconfigure existing 10-inch/ 12-inch diameter line; Harding Way to Oak Street	Line is severely damaged, prone to grease/debris accumulation, and subject to SSOs (per City staff); line is approaching full-pipe capacity	2027	~4,300 LF of 15-inch diameter pipe; ~10 MHs[(a)]	Proceed with design and construction of replacement sewer	4.3	UW21007/M21007
R-10	Worth Street trunk sewer	CIPP line ~8,500 LF of 36-inch diameter pipe	Pipe is in an advanced state of deterioration	2027	Same as existing	Design complete; proceed with construction	4.80	M18028
R-11	Airport Way trunk sewer	Rehabilitate ~5,800 LF of 30-inch diameter pipe; San Joaquin Fairgrounds to Ralph Avenue	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	5.00	UW21017/M21017
R-12	Alturas Avenue sewer	Rehabilitate ~2,000 LF of 12-inch diameter pipe; Quincy Street to Swain Road	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	0.60	UW23010
R-13	E. Bianchi Street/ Pardee Lane sewer	Rehabilitate ~7,000 LF of 12-inch and 15-inch diameter pipe; Quincy Street to Swain Road	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	16.70	UW24008
R-14	Harding Way sewer	Rehabilitate ~1,600 LF of 12-inch diameter pipe; Wilson Street to Union Street	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	1.60	UW25008
R-15	Hazelton Avenue trunk sewer	Rehabilitate ~1,900 LF of 24-inch and 36-inch diameter pipe; Della Street to Pilgrim Street	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	2.10	UW24011
R-16	Lincoln Road trunk sewer	Rehabilitate ~3,000 LF of 36-inch diameter pipe; Pershing Road to Alexandria Place	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	5.90	UW21018
R-17	Longview Avenue sewer	Rehabilitate ~3,200 LF of 12-inch diameter pipe; El Dorado Street to Pacific Avenue	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	1.10	UW23006
R-18	March Lane trunk sewer	Rehabilitate ~8,400 LF of 24-inch and 30-inch diameter pipe; I-5 to Brookside Estates PS	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	6.30	UW25006
R-19	Ralph Avenue trunk sewer, Phase 2	Rehabilitate ~2,400 LF of 42-inch diameter pipe; Airport Way to Perlman Drive	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	2.50	UW25012
R-20	Rosemarie Lane sewer	Rehabilitate ~1,400 LF of 12-inch diameter pipe; Manchester Avenue to Crown Avenue	Identified by City as needing rehabilitation	2032	TBD	Assess physical condition of line; address any major defects	1.60	UW23014
R-21	Ryde Avenue trunk sewer	Rehabilitate ~1,400 LF of 30-inch and 36-inch diameter pipe; River Drive to De Ovan Avenue	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	3.40	UW25009
R-22	Sperry Road/Gibraltar Court sewer	Rehabilitate ~6,200 LF of 24-inch and 27-inch diameter pipe; Airport Way to Industrial Drive	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	4.60	UW23009
R-23	Tuxedo Avenue sewer	Rehabilitate ~1,900 LF of 16-inch diameter pipe; Kensington Way to Orange Street	Identified by City as needing rehabilitation	2032	TBD	Proceed with assessment of existing pipes and design of improvements	0.50	UW23007
R-24	Backyard and smaller diameter sewers	Replace 6-inch diameter sewers near Scribner/ 7th/ Howard/ Pilgrim Streets	Identified by City as needing rehabilitation	2032	TBD	Proceed with design and construction of replacement sewer	1.9	various
R-25	Sewer Maintenance Hole Rehab	Existing City CIP line item	Identified by City as needing rehabilitation	Ongoing	TBD	As needed	2.10	UW20011/M20011
R-26	Sanitary Sewer Small Diameter Lines Replacement	Existing City CIP line item	Identified by City as needing rehabilitation	Ongoing	TBD	As needed	1.80	UW21016/M21016
R-27	Sanitary Sewer Large Diameter Lines Replacement	Existing City CIP line item	Identified by City as needing rehabilitation	Ongoing	TBD	As needed	4.50	UW20020/M20020

Table 8-1. Recommended Capital Improvement Plan

ID	Name	Description	Justification	Time Frame	Quantities	Actions/Notes	Capital Cost, $M	City CIP Project
Capacity Improvements to Existing Gravity Sewer Facilities								
C-1	E. Marsh Street sewer	Upsize existing 18-inch diameter sewer	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~7,400 LF of 24-inch diameter pipe; 22 MHs[(a)]	Monitor with level sensor and/or flow meter	11.8	none
C-2	El Dorado Street / S. Center Street sewer	Upsize existing 16-inch, 18-inch and 24-inch diameter sewers	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~2,800 LF of 24-inch diameter pipe; 10 MHs[(a)]	Monitor with level sensor and/or flow meter	4.5	none
C-3	S. Wilson Way sewer	Upsize existing 10-inch and 12-inch diameter sewers	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~1,000 LF of 21-inch diameter pipe; 6 MHs	Monitor with level sensor and/or flow meter	1.5	none
C-4	E. 6th Street	Upsize existing 12-inch diameter sewer	Existing conditions model shows potential for severe surcharging and/or SSOs	2035	~700 LF of 18-inch diameter pipe; 5 MHs[(a)]	Monitor with level sensor and/or flow meter	0.9	none
C-5	E. Main Street sewer	Upsize existing 12-inch and 16-inch diameter sewers	Existing conditions model shows potential for excessive surcharging	2035	~8,700 LF of 18-inch diameter pipe; ~30 MHs[(a)]	Monitor with level sensor and/or flow meter	10.7	none
C-6	W. Washington Street / Port Road 23 sewer	Upsize existing 12-inch, 15-inch and 18-inch diameter sewers	Existing conditions model shows potential for excessive surcharging	2035	~3,800 LF of 21-inch diameter pipe; 10 MHs[(a)]	Monitor with level sensor and/or flow meter	5.3	none
C-7	Don Avenue / Meadow Avenue sewer	Upsize existing 12-inch and 16-inch diameter sewers	Existing conditions model shows potential for excessive surcharging	2035	~2,200 LF of 15-inch diameter pipe; 2,200 LF of 21-inch diameter pipe; 18 MHs[(a)]	Monitor with level sensor and/or flow meter	5.5	none
C-8	S. El Dorado Street sewer	Upsize existing 12-inch diameter sewer	Existing conditions model shows potential for excessive surcharging	2035	~1,800 LF of 15-inch diameter pipe; 6 MHs[(a)]	Monitor with level sensor and/or flow meter	1.9	none
C-9	Del Norte Street sewer	Upsize existing 36-inch diameter sewer	Existing conditions model shows potential for excessive surcharging	2035	~4,100 LF of 42-inch diameter pipe; ~20 MHs[(a)]	Monitor with level sensor and/or flow meter	11.4	UW25010
Recommended Studies								
S-1	Asset Condition Assessment for Sanitary Sewer Force Mains	Existing City CIP line item	Pump stations not listed above may have deficiencies; assessments are warranted; power management technologies may reduce operating costs	2027	TBD	Undertake a program to prioritize and assess all City pump stations	1.1 (City estimate)	UW20018/M20018
S-2	Asset Condition Assessment for Sanitary Sewer Pump Stations	Existing City CIP line item	Force mains not listed above may have deficiencies; assessments are warranted; power management technologies may reduce operating costs	2027	TBD	Undertake a program to prioritize and assess all City pump station force mains	0.5 (City estimate)	UW20019/M20019
S-3	Corrosion and Odor Control Study	Evaluate existing and potential future odor control and corrosion control options, including innovative technologies where appropriate	Effectiveness of existing odor/corrosion control facilities should be periodically reassessed for effectiveness	2027	TBD	Perform the study to identify needs and confirm current operations	0.3	none
S-4	West Side Interceptor Alignment Study	Identify and evaluate alternative alignments and costs for parallel force main from 14-Mile Slough PS to the RWCF	An alignment study is needed in advance of force main design	2027	TBD	Perform the alignment study to confirm project costs and provide a basis for design	0.5	none
Watch List Items, Existing Conditions								
W-1	Hammer Lane trunk sewer	UPRR to Pershing Avenue	Existing conditions model shows pipe flowing >80% of gravity capacity; past SSOs at UPRR undercrossing	--	TBD	Monitor this line with level sensor and/or flow meter	--	none
W-2	Market Street sewer	El Dorado Street to Lincoln Street	Existing conditions model shows potential for significant surcharging	--	TBD	Monitor with level sensor and/or flow meter	3.40	M18014
W-3	N. Lincoln Street sewer	Upstream terminus to N. Lincoln Street	Existing conditions model shows potential for significant surcharging	--	TBD	Monitor with level sensor and/or flow meter	--	none
W-4	Ponce De Leon to Etna Street backyard sewer	Ponce De Leon Avenue to Etna Street	Existing conditions model shows pipe flowing >80% of gravity capacity	--	TBD	Monitor this line with level sensor and/or flow meter	1.50	UW23013
W-5	Scotts Avenue trunk sewer	Pershing Avenue to Navy Drive	Existing conditions model shows pipe flowing >80% of gravity capacity	--	TBD	Monitor with level sensor and/or flow meter	0.30	UW24009
W-6	Thornton Road sewer	MacDuff Avenue to Hammer Lane	Existing conditions model shows pipe flowing >80% of gravity capacity	--	TBD	Monitor with level sensor and/or flow meter	4.00	UW25011
W-7	Waterloo Road sewer	Williams Street to Hiawatha Avenue	Existing conditions model shows potential for significant surcharging	--	TBD	Monitor with level sensor and/or flow meter	--	none
Projects to be Excluded from Existing CIP (pending condition assessments)								
X-1	N. El Dorado Street sewer	E. Sonoma Avenue to E. Wyandotte Street	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	1.30	UW23011
X-2	N. El Dorado Street sewer	E. Main Street to E. Oak Street	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	2.50	UW23012; UW24010
X-3	Pershing Avenue trunk sewer	Meadow Avenue to W. Lincoln Road	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	3.30	UW22003
X-4	Wyandotte Street sewer	California Street to Pacific Avenue	Identified in the 2008 Wastewater Master Plan; current modeling shows no current or future capacity issues	--	--	Assess physical condition of line; address any major defects	3.50	UW25007

(a) Sizing based on buildout model results.

The major categories shown in Table 8-1 include:

- Pump Station and Force Main Improvements, Existing System (designated as P-#)
- Rehabilitation of Existing Gravity Sewer Facilities (designated as R-#)
- Capacity Improvements to Existing Gravity Sewer Facilities (designated as C-#)
- Recommended Studies (designated as S-#)
- Watch List Items (designated as W-#)
- Projects to be Excluded from the City's Existing CIP List (designated as X-#)

All of these categories except the recommended studies and the projects to be excluded from the City's existing CIP list are shown schematically in Figure 8-1. In addition Figure 8-1 depicts additional facilities needed to serve future development areas.

8.2.1 Pump Station and Force Main Improvements, Existing System

There are 17 items shown for this category, all but two of which were identified in the City's existing CIP list. The most significant items in the list are the 14-Mile Slough PS improvements (Item P-1), the 5-Mile Slough Force Main investigation and improvements (Item P-2), the Lincoln Street PS and Force Main (Item P-3), the Westside Interceptor Parallel Force Main (Item P-4), and the Swenson PS (Item P-5). The remaining items on the list involve inspecting existing pump station components and/or capacities and determining needed improvements.

The 14 Mile Slough PS improvements are needed to address chronic mechanical failure of the pumping equipment. Investigation to fully diagnose the problems, followed by likely replacement of the pumping equipment and related structural and/or control system and valving modifications, are needed. Failure of the pump station would require costly and prolonged emergency operations.

The 5-Mile Slough force main interconnects the 14-Mile Slough PS, Swenson PS, Cumberland & 5-Mile Creek PS, and Plymouth & 5-Mile Creek PS. Investigation of the force main and identification of rehabilitation measures/improvements is considered a high priority to ensure that force main operations remain uninterrupted.

The construction and operation of the Lincoln Street PS and force main would enable the elimination of the siphon and associated gravity sewers at the Mormon Slough crossing. The siphon and gravity sewers on the existing alignment are more than 100 years old (per City GIS data) and are in an advanced state of deterioration. A failure of any portion of the existing facilities would require costly and prolonged emergency operations.

The Westside Interceptor Parallel Force Main is needed to address a lack of redundancy in the system in the event the existing force main fails. The existing force main is approximately 6½ miles long, so the construction of a parallel force main will be an extensive and costly improvement. The cost estimate shown in Table 8-1 does not include any allowances for acquisition of rights-of-way.

While the model indicates that the capacity of the Swenson PS is adequate to address existing and future peak flow conditions, flow monitoring conducted in from October 2020 to March 2021 indicates that this pump station does not keep up with incoming flows under both wet and dry weather conditions, thus resulting in backwater-induced surcharging in upstream gravity sewers. The inability of the station to keep up with incoming flows may have been a factor in past SSOs upstream in the system along Hammer Lane.

Item P-17 is intended as an annual budget for as-yet undefined pump station projects, given that many of the City's wastewater pump stations are relatively old and may rehabilitation or replacement. Item S-2 (described below) will generate and prioritize a list of pump station rehabilitation projects. The annual budget for Item P-17 should be adjusted in the future upon completion of the study under Item S-2.

8.2.2 Rehabilitation of Existing Gravity Sewer Facilities

There are 27 items shown for this category, all of which were identified in the City's existing CIP list. Items R-1 through R-10 are considered to be high priority and are recommended for completion within a five-year time frame (2027). Items R-11 through R-24 are considered to be medium priority and are recommended for completion within a ten-year time frame (2032). Items R-25 though R-27 are general rehabilitation categories that are not location-specific.

8.2.3 Capacity Improvements to Existing Gravity Sewer Facilities

There are nine items shown for this category, only two of which (Items C-5 and C-9) were identified in the City's existing CIP list. Items C-1 through C-9 reflect the items shown in Table 7-4 for the Priority 1 Group and the Priority 2 Group. In all cases, it is recommended that the City proceed with surcharge and/or flow monitoring of the lines in question before proceeding with the design of improvements.

8.2.4 Recommended Studies

The following four studies are recommended for inclusion on the CIP list:

- S-1: Asset Condition Assessment for Sanitary Sewer Force Mains
- S-2: Asset Condition Assessment for Sanitary Sewer Pump Stations
- S-3: Corrosion and odor control study
- S-4: West Side Interceptor alignment study

Items S-1 and S-2 are general recommendations to inspect all other City sewer pump stations and force mains (over and above those identified above) to assess all aspects of their existing pump stations, including structural, mechanical, electrical, and operational elements, and the need for flow metering, SCADA connection, and data archiving. In addition, Item S-3 is based on City maintenance staff expressing concerns about existing collection system corrosion and odor control facilities.

Item P-4 above addresses the need to design and construct a parallel force main to serve the 14-Mile Slough PS and other pump stations that discharge into the existing force main running from 14-Mile Slough PS to Navy Drive. It is unclear, however, if the alignment of the existing force main is also suitable for a parallel force main or if other alignments will need to be considered. Item S-4 would entail a separate study to address this issue.

8.2.5 Watch List Items

There are seven items shown for this category, all of which either show significant surcharging that does not approach outflows under existing conditions, or are modeled as flowing more than 80 percent full and were previously identified in the City's CIP list. For all of these items, either flow metering or remote level monitoring (e.g., SmartCover® or equivalent) is recommended.

8.2.6 Projects to be Excluded from the City's Existing CIP List

Items X-1 through X-4 in Table 8-1 were identified in previous planning as requiring upsizing to accommodate existing or future development conditions. However, the Master Plan incorporates significant, new information, including the following:

1. There is a greatly improved understanding of how flows are distributed throughout the collection system as a result of recent collection system flow metering.
2. Wastewater flow generation rates on a per capita basis have dropped dramatically throughout the region since the late 2000s.
3. Development plans from the early and mid-2000s were significantly curtailed reflecting changes to the City's General Plan.

As a result of these changes, none of the facilities in question appear to be approaching capacity within the time frame of identified 2040 development and, therefore, should not be included in the CIP for capacity reasons. However, if one or more of these facilities are found to be in an advanced state of deterioration, those facilities should remain on the City's CIP list for rehabilitation. Periodic updates of this Master Plan will determine if and when these projects (or others) later need to be added into the CIP.

8.2.7 Additional Items Not Included in This Analysis

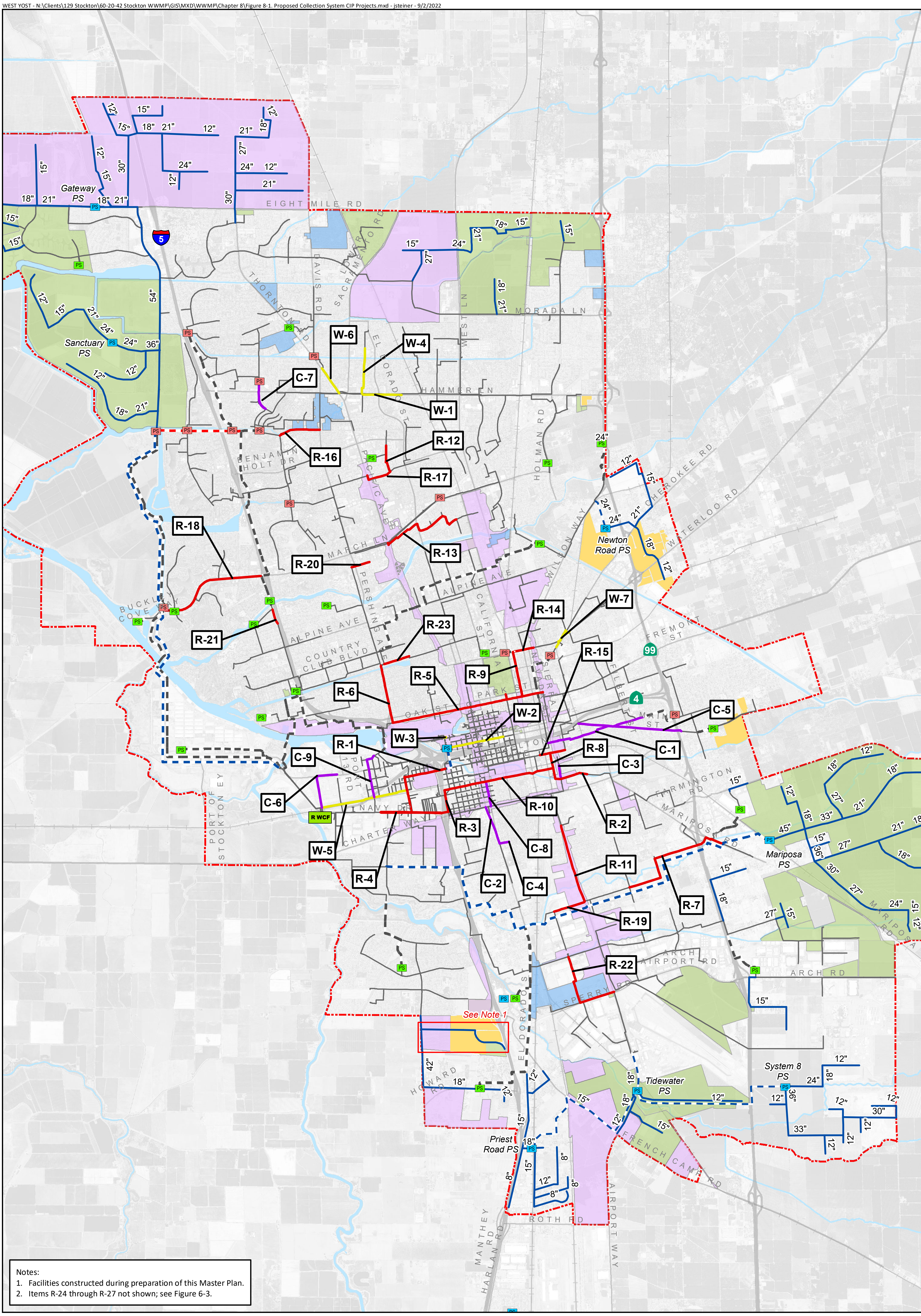
Certain items on the City's existing CIP list are not included in this discussion because they are not relevant to the collection system or because they are peripheral items not requiring attention in this Master Plan. In general, these items fall into the following categories:

- RWCF-related projects
- Stormwater pump stations with sewer line connections
- Other minor/miscellaneous improvements

8.3 REVIEW OF POTENTIAL IMPACTS ON RATES AND FEES

Appendix H provides an analysis of how the conclusions of this Master Plan affect the current wastewater rates and connection fees. The most recent rate study was adopted in 2019 and included a capital project list as well as O&M costs for the wastewater utility. The analysis presented in Appendix H does not replace the adopted rate study, but rather assesses whether the conclusions of the 2019 rate study remain valid and whether the planned annual rate increases are adequate and remain consistent with anticipated costs.

All development impact fees/connection fees (including wastewater connection fees) are currently under review under a separate City effort. The analysis presented in Appendix H acknowledges the connection fee reserves as a potential revenue source for some capital improvements. It is possible that through future analysis certain capital projects or portions of the capital projects included in the CIP may be appropriately funded from connection fee reserves. However, as a conservative assumption, the analysis in Appendix H assumes that none of the capital improvements identified in this chapter will be funded out of the connection fee reserve. Therefore, Appendix H assumes that the connection fee reserve will be used for selected future projects to the extent the reserves are sufficient, and that the connection fee revenues will be structured to keep pace with the revenue requirements for connection fee funded improvements. In accordance with existing City policy, wastewater infrastructure associated with future development projects will generally be developer funded.



Notes:
1. Facilities constructed during preparation of this Master Plan.
2. Items R-24 through R-27 not shown; see Figure 6-3.

- Existing Gravity Sewer
- Existing Gravity Sewer Identified for Rehab
- Gravity Sewer Capacity Deficiency
- Watch List
- Future Gravity Sewer
- Existing Force Main
- Existing Force Main Identified for Rehab
- Future Force Main
- PS Existing Pump Station
- PS Pump Station Identified for Improvements
- PS Future Pump Station
- R WCF Regional Wastewater Control Facility
- Major Developments
- General Plan Study Area
- Unincorporated Islands
- Additional 2040 Flow Contributing Areas
- City of Stockton Sphere of Influence

0 0.625 1.25
Miles

WEST YOST

Figure 8-1

Collection System CIP Projects and Other Future Facilities

City of Stockton
Wastewater Master Plan Update

Based on the findings of Appendix H, annual rate increases will continue to be necessary, as previously anticipated, and the annual increase will need to be between 6.0 and 6.5 percent through fiscal year (FY) 2028. Smaller rate increases are indicated from FY 2029 through FY 2035. These findings are subject to a variety of assumptions about future growth and cost escalation, and are reasonable based on current information but subject to change over time. An updated formal rate study will be needed in 2024.

8.4 CONCLUSIONS AND RECOMMENDATIONS

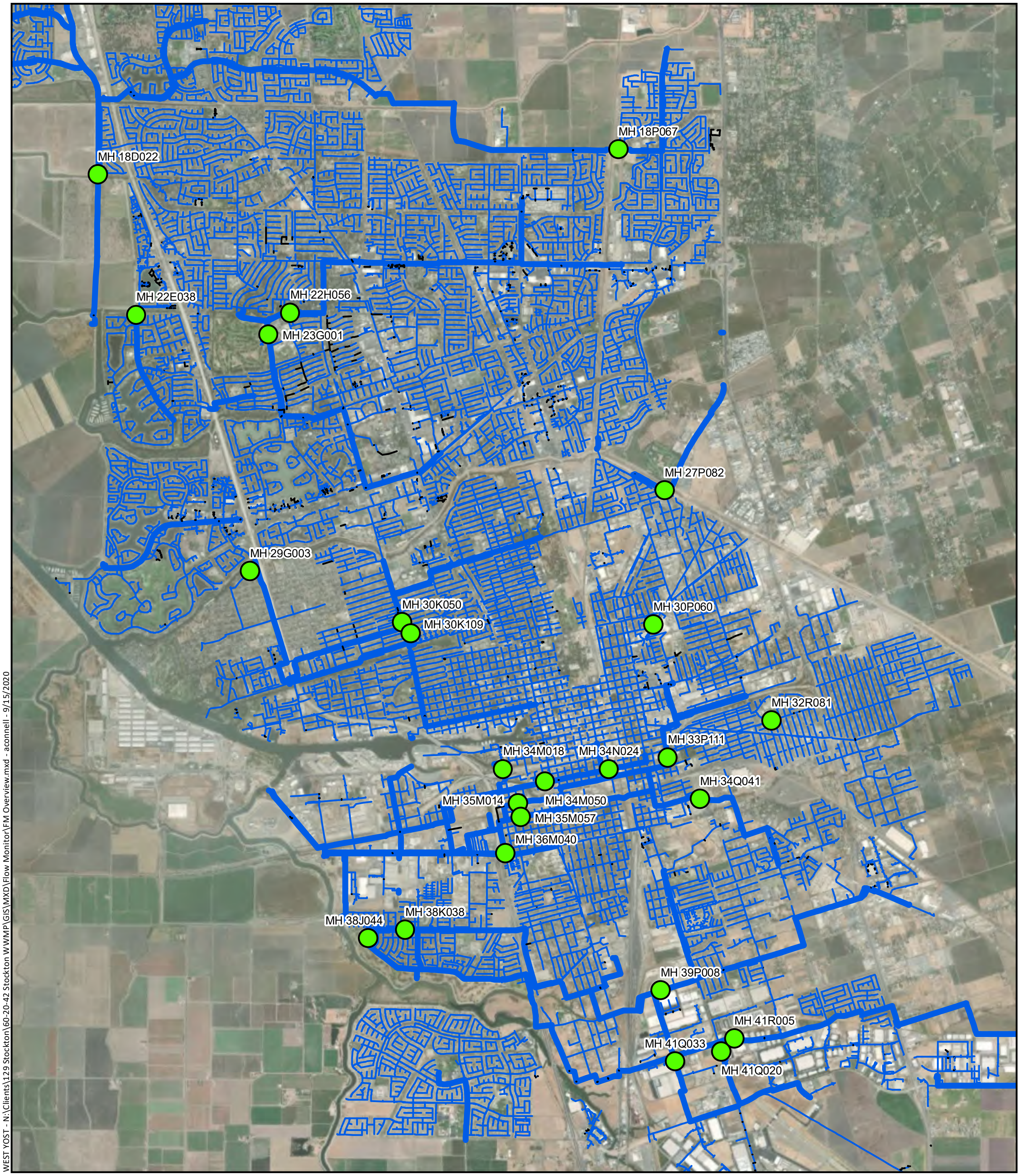
Key conclusions and recommendations from the development of the recommended CIP include:

1. The cost estimates presented in this chapter are planning level estimates suitable for financial planning and subject to refinement as preliminary and final design engineering is performed.
2. It is recommended that the City address the pump station and force main improvements identified in Items P-1 through P-17 of Table 8-1, as follows:
    a. The 14-Mile Slough PS improvements (Item P-1) are considered a high priority due to the potential consequences of ongoing mechanical failures. It is recommended that the City proceed expeditiously with the design and implementation of improvements.
    b. The 5-Mile Slough Force Main (Item P-2) is considered a high priority due to the potential of force main failure. It is recommended that the City proceed expeditiously with the identification and implementation of improvements.
    c. The Lincoln Street PS and force main (Item P-3) is considered a high priority due to the potential for failure of the Mormon Slough siphon and associated gravity sewers. It is recommended that the City proceed expeditiously with the design and construction of this project.
    d. The Westside Interceptor Parallel Force Main (Item P-4) is considered a high priority due to the potentially high consequences in the event of failure of the existing force main. It is also needed to accommodate anticipated future projected flows. It is recommended that the City proceed expeditiously with determining the best approach for providing redundancy and then proceed with the design of the project.
    e. The Swenson and 5-Mile Slough PS (Item P-5) is considered a high priority due to chronic flow backups and the potential for upstream SSOs. It is recommended that the City proceed expeditiously with the identification and implementation of pump station improvements.
    f. Items P-6 through P-16 are considered moderate priority based on previous City findings regarding the condition of these facilities. It is recommended that the City proceed with the identification and implementation of improvements.
    g. It is recommended that the City proceed with an annual budget for as yet undefined pump station projects (Item P-17) based on the knowledge that many of the City's wastewater pump stations are relatively old, and all pump stations require periodic rehabilitation. Item S-2 (described below) will generate and prioritize a list of pump station rehabilitation projects. The annual budget for Item P-17 should be adjusted in the future, upon completion of study under Item S-2.

3. It is recommended that the City address the gravity sewer rehabilitation improvements identified in Items R-1 through R-27 of Table 8-1, as follows:
    a. Items R-1 through R-10 are considered to be a high priority. It is recommended that the City proceed with construction of these improvements by 2027.
    b. Items R-11 through R-24 are considered to be a medium priority. It is recommended that the City proceed with planning, design, and construction of improvements by 2032.
    c. Items R-25 though R-27 are general rehabilitation categories that are not location-specific. It is recommended that the City proceed with such activities on an ongoing basis.
4. It is recommended that the City undertake flow metering and/or surcharge monitoring to confirm modeled capacity exceedances for Items C-1 though C-9.
5. It is recommended that the City undertake the following studies in support of future collection system improvements:
    a. A full assessment of all City-owned sewer pump stations to evaluate all structural, mechanical, electrical, and operational elements, as well as the need for flow metering, SCADA connection, and data archiving.
    b. A full assessment of all City-owned sewer pump station force mains to evaluate pipe integrity and the need for rehabilitation/improvements.
    c. A West Side Interceptor alignment study to determine the appropriate alignment for construction of a parallel force main under Item P-1 described above.
    d. A corrosion and odor control study to assess the need for improvements to the City's corrosion and odor control facilities.
6. It is recommended that the various Watch List items identified in this chapter be either flow metered or monitored with remote level telemetry devices to confirm the extent of any capacity limitations.
7. It is recommended that items X-1 through X-4 be excluded from the City's current CIP list unless one or more of these facilities are found to be in an advanced state of deterioration, in which case they should remain on the City's CIP list for rehabilitation.
8. It is recommended that the City implement rate increases consistent with the adopted 2019 Rate Study to maintain adequate funding for the wastewater utility.

Appendix A

Collection System Flow Metering Locations



WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM Overview.mxd - aconnell - 9/15/2020

Symbology

Proposed Flow Meter

Gravity Main Size

Unknown

Less than 24

24 and Greater

N

0 3,500 7,000

Scale in Feet

CITY OF STOCKTON

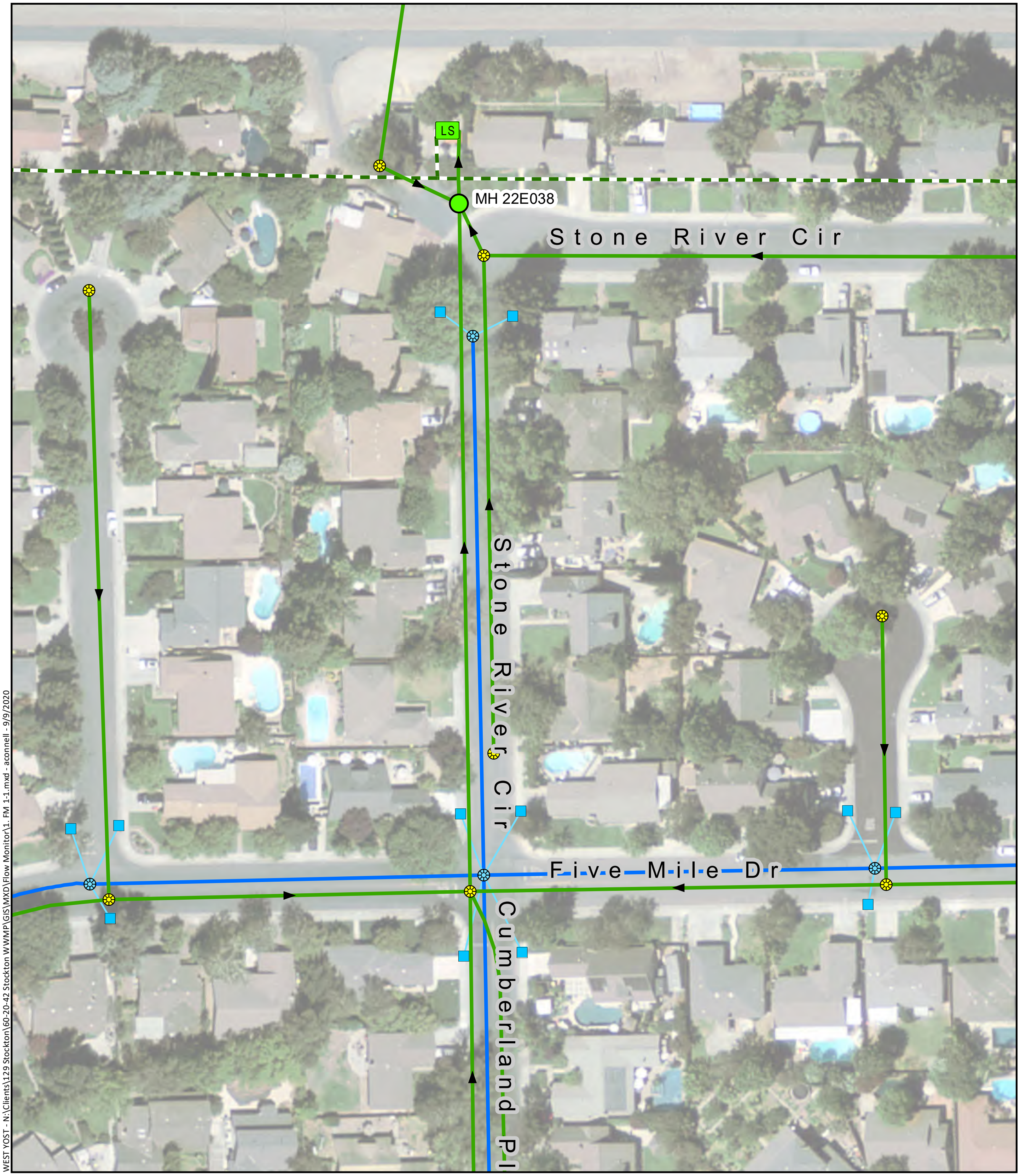
WEST YOST

Figure X

Proposed Flow Meter Location Overview

City of Stockton

Wastewater Master Plan



WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\1. FM 1-1.mxd - aconnell - 9/9/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

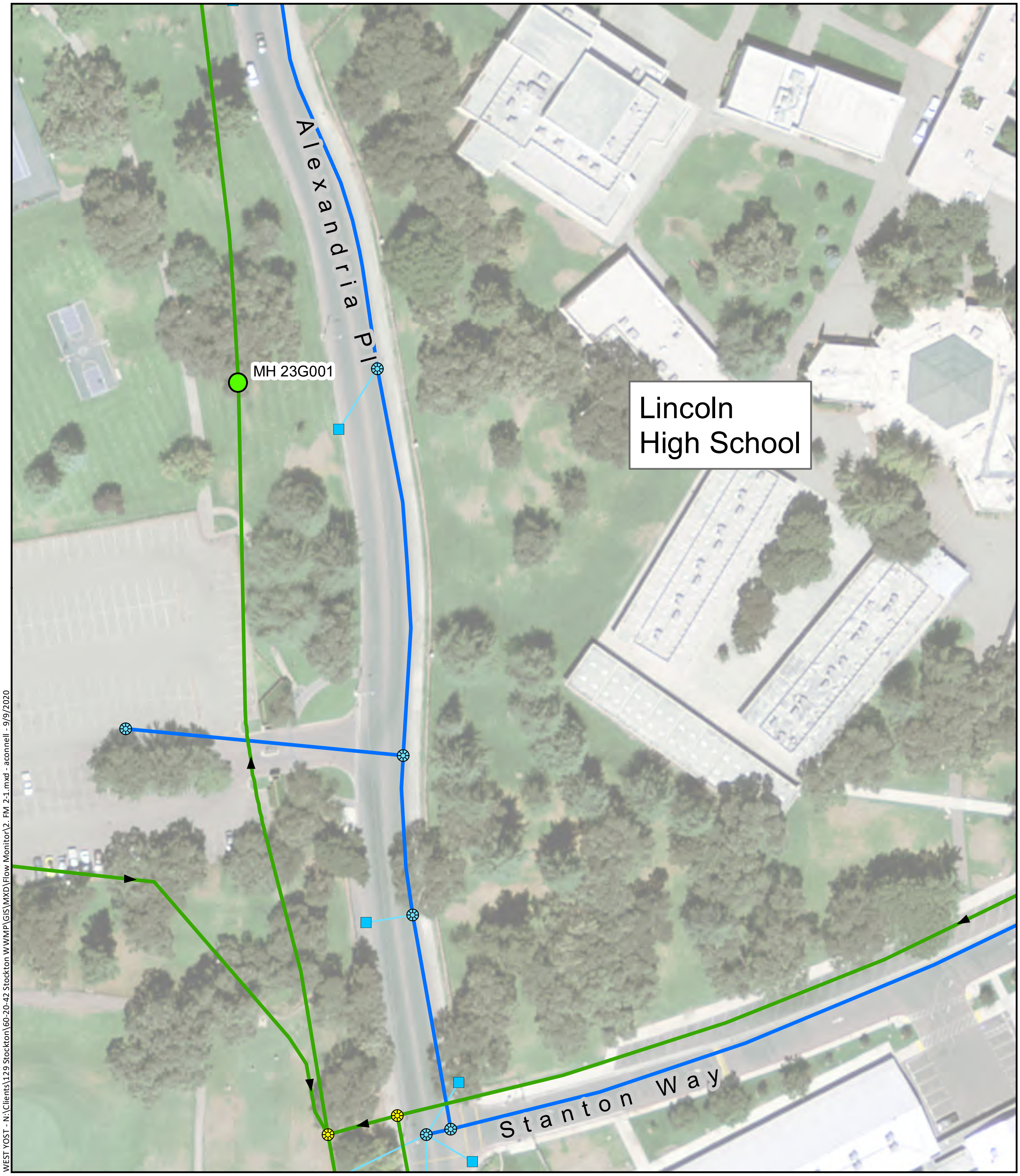
CITY OF STOCKTON

WEST YOST

Figure 1

Flow Meter 1-1
MH ID 22E038
Basin 1

City of Stockton
Wastewater
Master Plan



WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\2. FM 2-1.mxd - aconnell - 9/9/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 2

Flow Meter 2-1
MH ID 23G001

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 3

Flow Meter 2-2
MH ID 22H056
Basin 2

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM Potrait.mxd - aconnell - 9/8/2020

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/9/2020

Symbology

- Proposed Flow Meter
- Sewer Lift Station (LS)
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 4

Flow Meter 3-1
MH ID 30K050
Basin 3

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 5

Flow Meter 3-2
MH ID 30K109
Basin 3

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/8/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

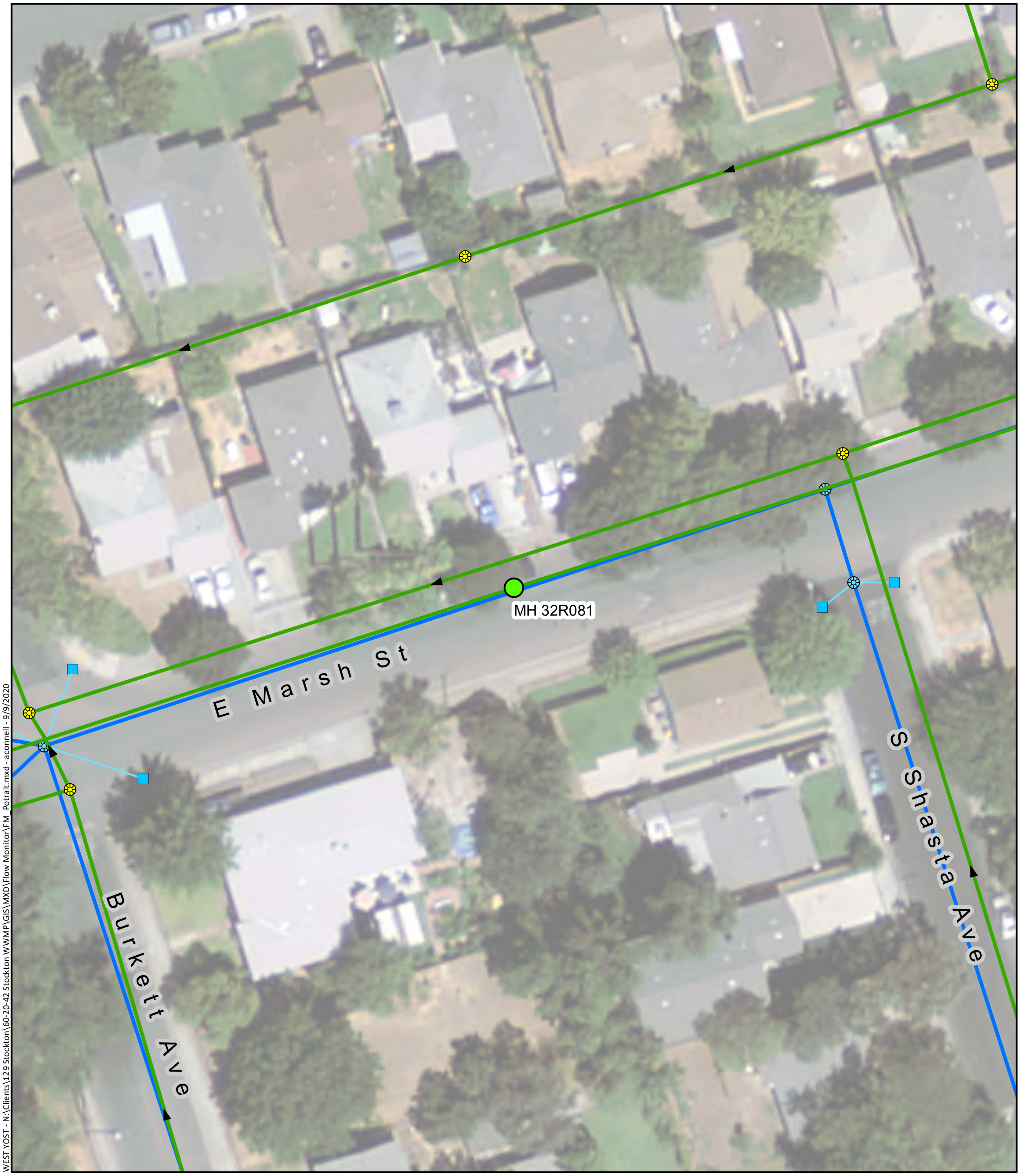
CITY OF STOCKTON

WEST YOST

Figure 6

Flow Meter 3-3
MH ID 29G003
Basin 3

City of Stockton
Wastewater
Master Plan



Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 25 50
Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 7

Flow Meter 4-1
MH ID 32R081
Basin 4

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/9/2020

Symbology

- Proposed Flow Meter
- Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 8

Flow Meter 4-2
MH ID 30P060
Basin 4

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/9/2020

Symbology

- Proposed Flow Meter
- Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 25 50

Scale in Feet

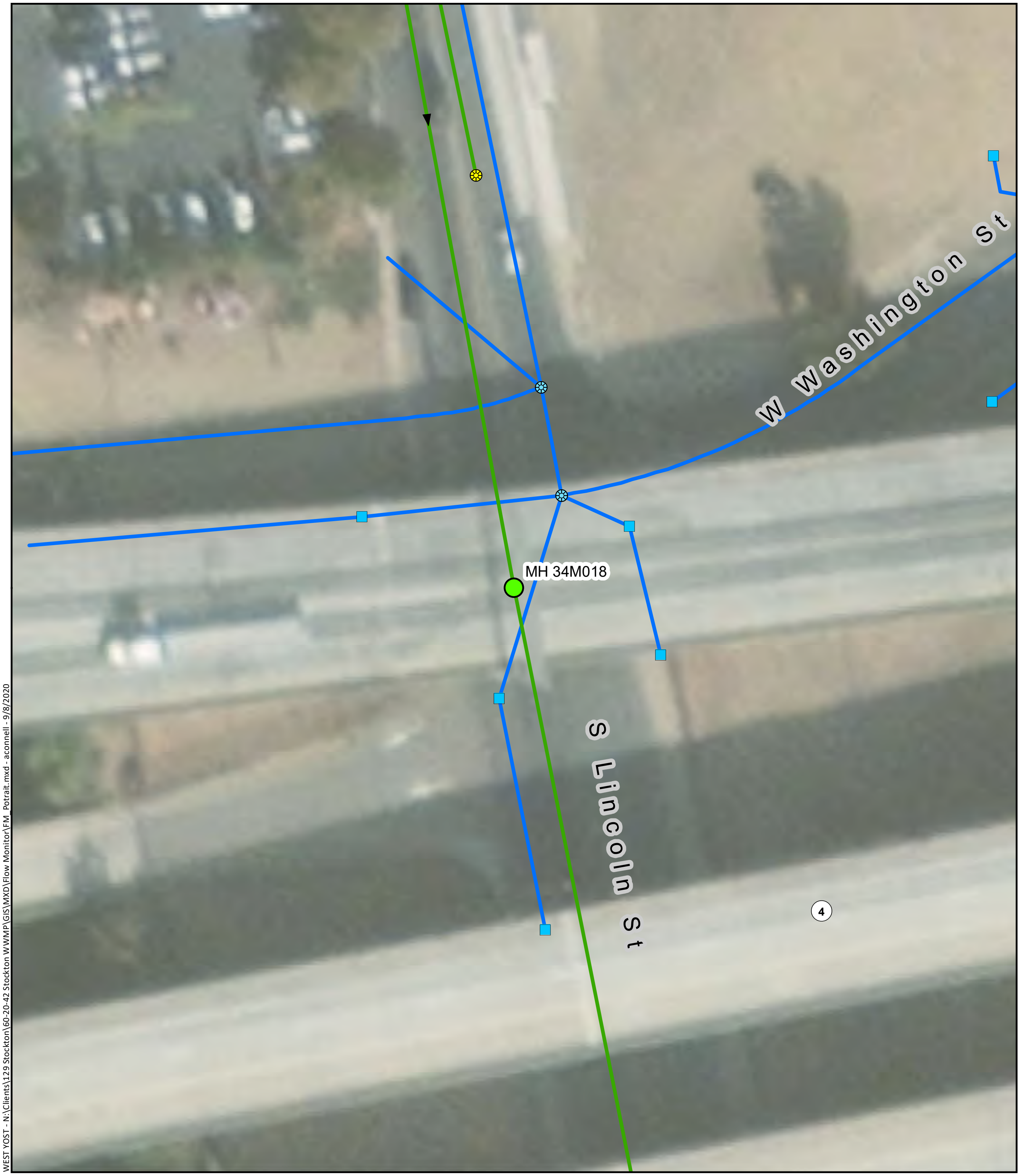
CITY OF STOCKTON

WEST YOST

Figure 9

Flow Meter 5-1
MH ID 35M014
Basin 5

City of Stockton
Wastewater
Master Plan



WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/8/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 10

Flow Meter 5-2
MH ID 34M018
Basin 5

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

CITY OF STOCKTON

WEST YOST

Figure 11

Flow Meter 6-1
MH ID 34Q041

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/9/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 12

Flow Meter 6-2
MH ID 33P111
Basin 6

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/9/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

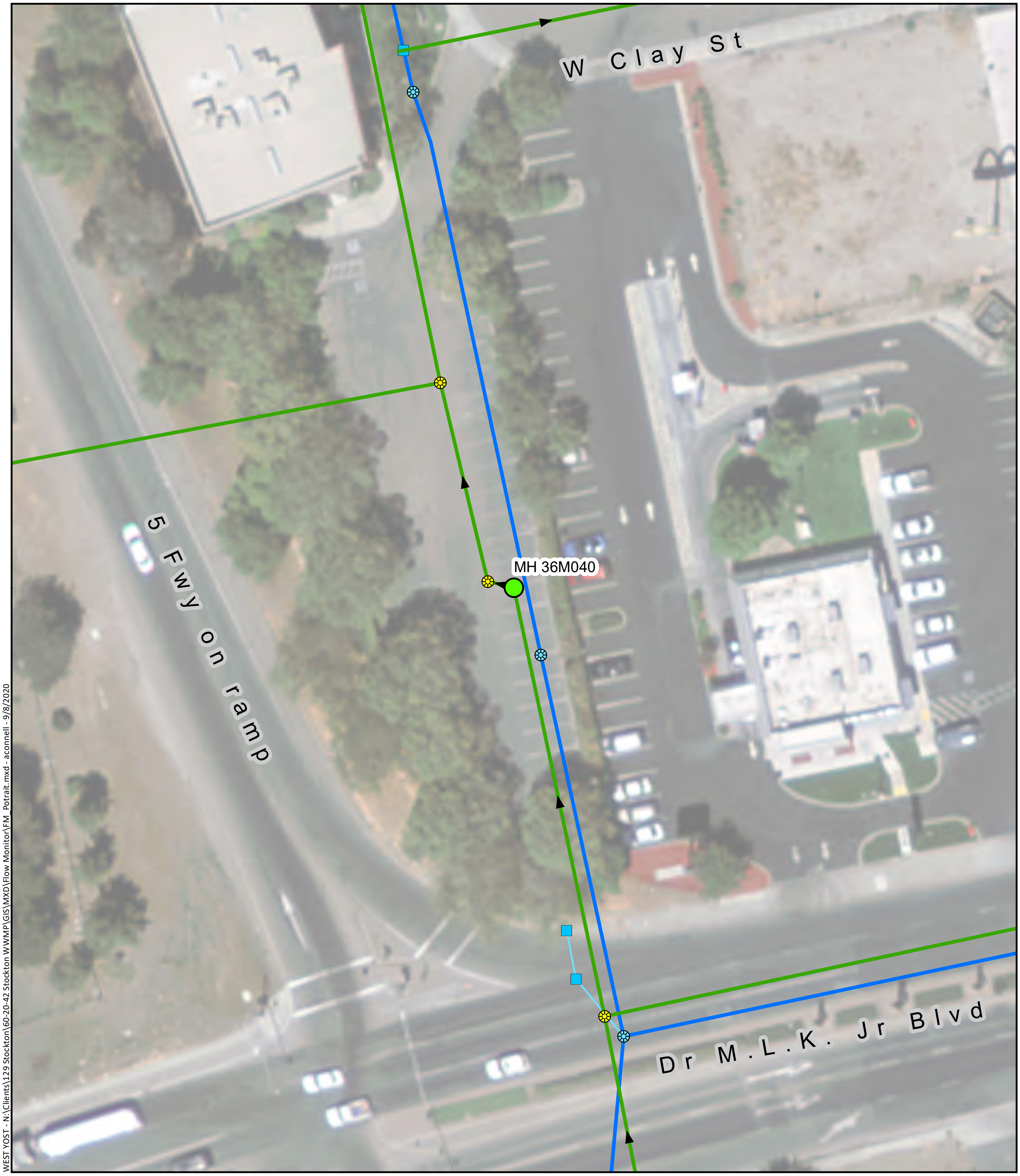
0 25 50

Scale in Feet

Figure 13

Flow Meter 6-3
MH ID 34N024
Basin 6

City of Stockton
Wastewater
Master Plan



WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/8/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 14

Flow Meter 6-4
MH ID 36M040
Basin 6

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 25 50

Scale in Feet

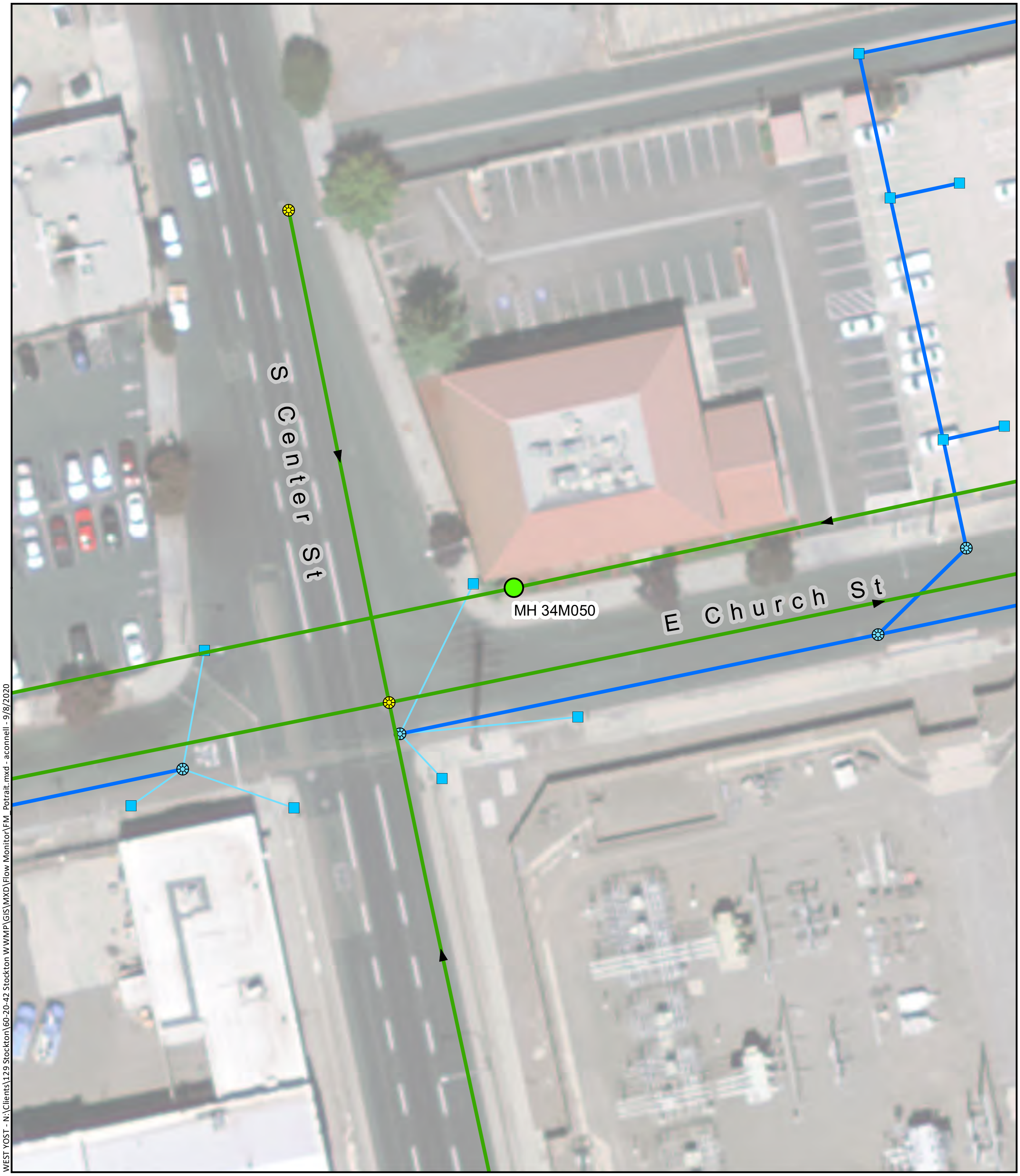
CITY OF STOCKTON

WEST YOST

Figure 15

Flow Meter 6-5
MH ID 35M057
Basin 6

City of Stockton
Wastewater
Master Plan



WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Monitor\FM_Potrait.mxd - aconnell - 9/8/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 16

Flow Meter 6-6
MH ID 34M050
Basin 6

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

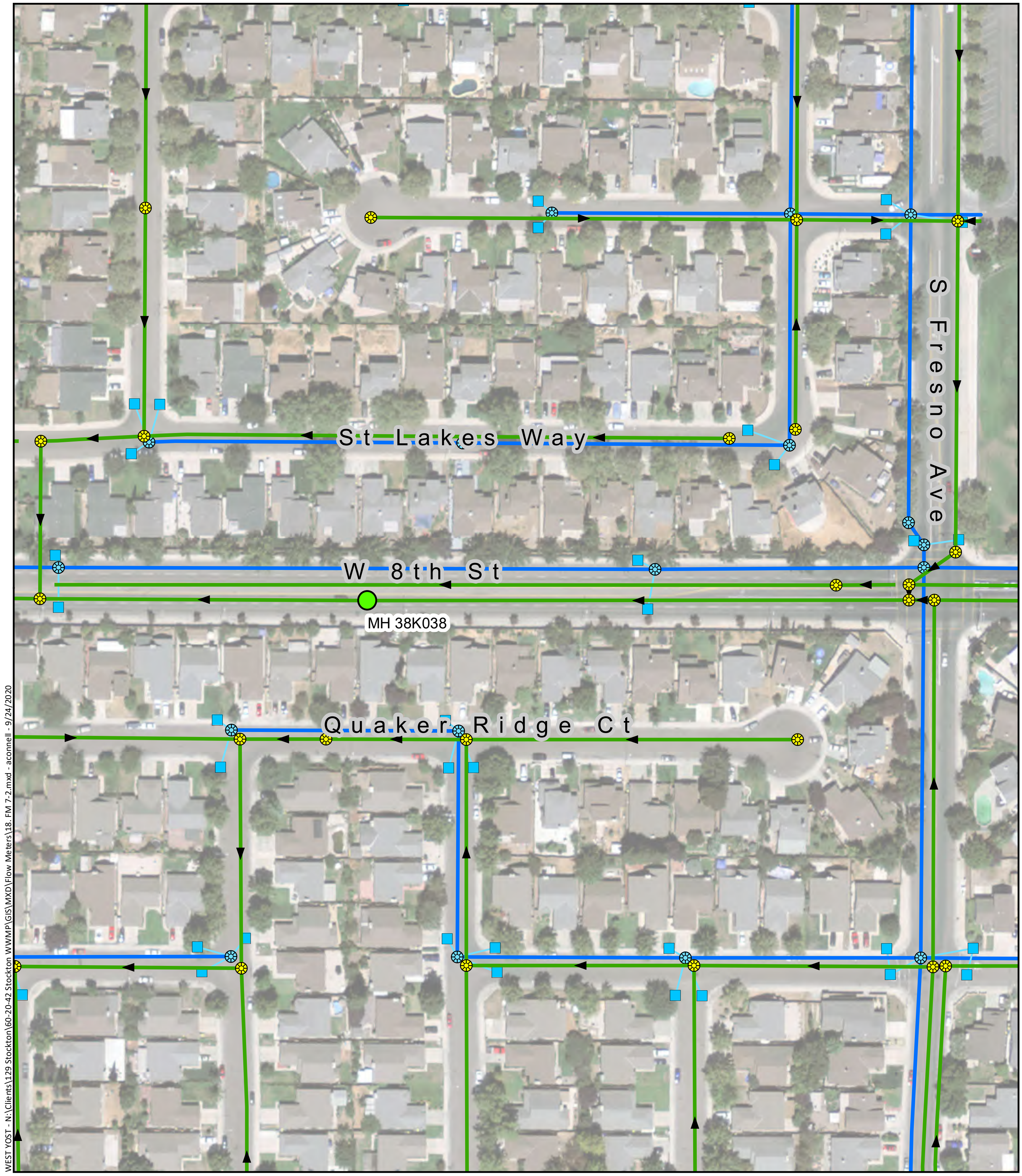
CITY OF STOCKTON

WEST YOST

Figure 17

Flow Meter 7-1
MH ID 39P008
Basin 7

City of Stockton
Wastewater
Master Plan



Symbology

- Proposed Flow Meter
- Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Storm Pump Station
- Catch Basin Line
- Storm Drain Line

0 75 150

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 18

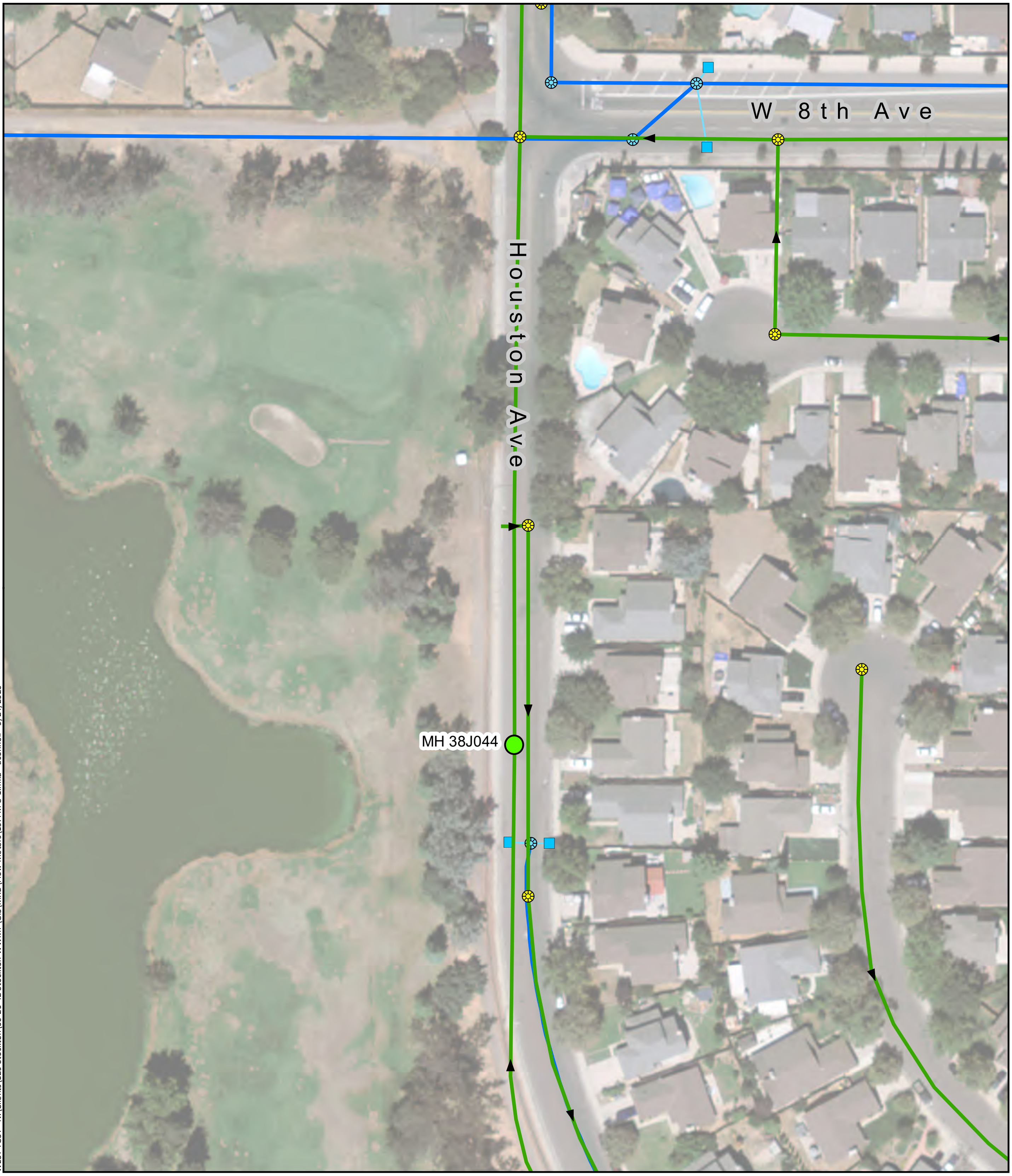
Flow Meter 7-2

MH ID 38K038

City of Stockton

Wastewater

Master Plan



WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Meters\19. FM 8-1.mxd - aconnell - 9/24/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 19

Flow Meter 8-1
MH ID 38J044

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Meters\FM_Potrait.mxd - aconnell - 9/24/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100
Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 20

Flow Meter 8-2
MH ID 41Q033
Basin 8

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 75 150

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 21

Flow Meter 8-3
MH ID 41Q020
Basin 8

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Meters\21. FM 8-3.mxd - aconnell - 9/24/2020

Figure 22

Flow Split 8-4
MH ID 41R005

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 75 150

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 23

Flow Meter 9-1
MH ID 27P082
Basin 9

City of Stockton
Wastewater
Master Plan

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 75 150

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 24

Flow Meter 10-1
MH ID 18D022
Basin 10

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Meters\FM_Potrait.mxd - aconnell - 9/24/2020

Symbology

- Proposed Flow Meter
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

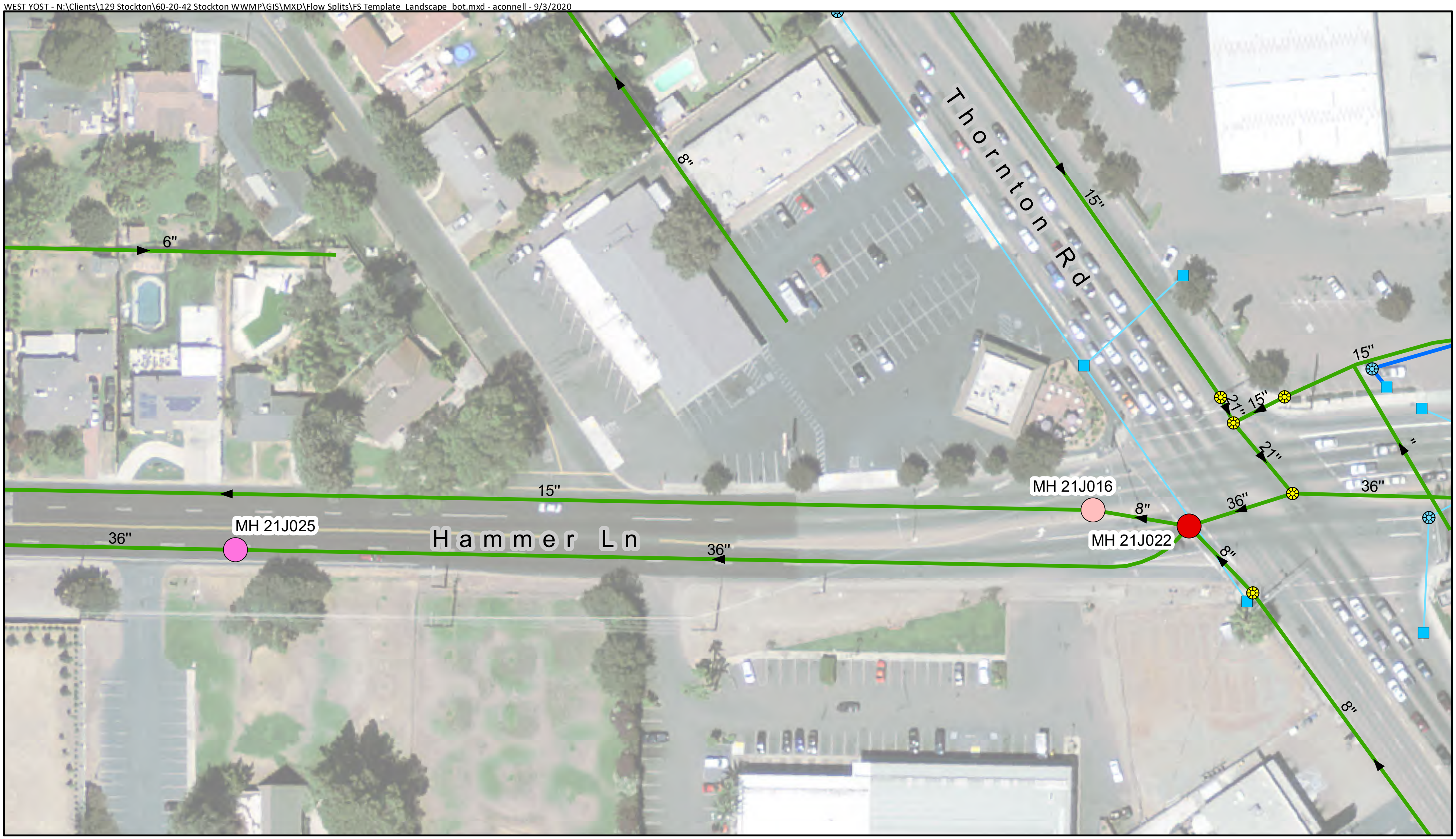
Figure 25

Flow Meter 10-2
MH ID 18P067
Basin 10

City of Stockton
Wastewater
Master Plan

Appendix B

Collection System Flow Split Locations



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

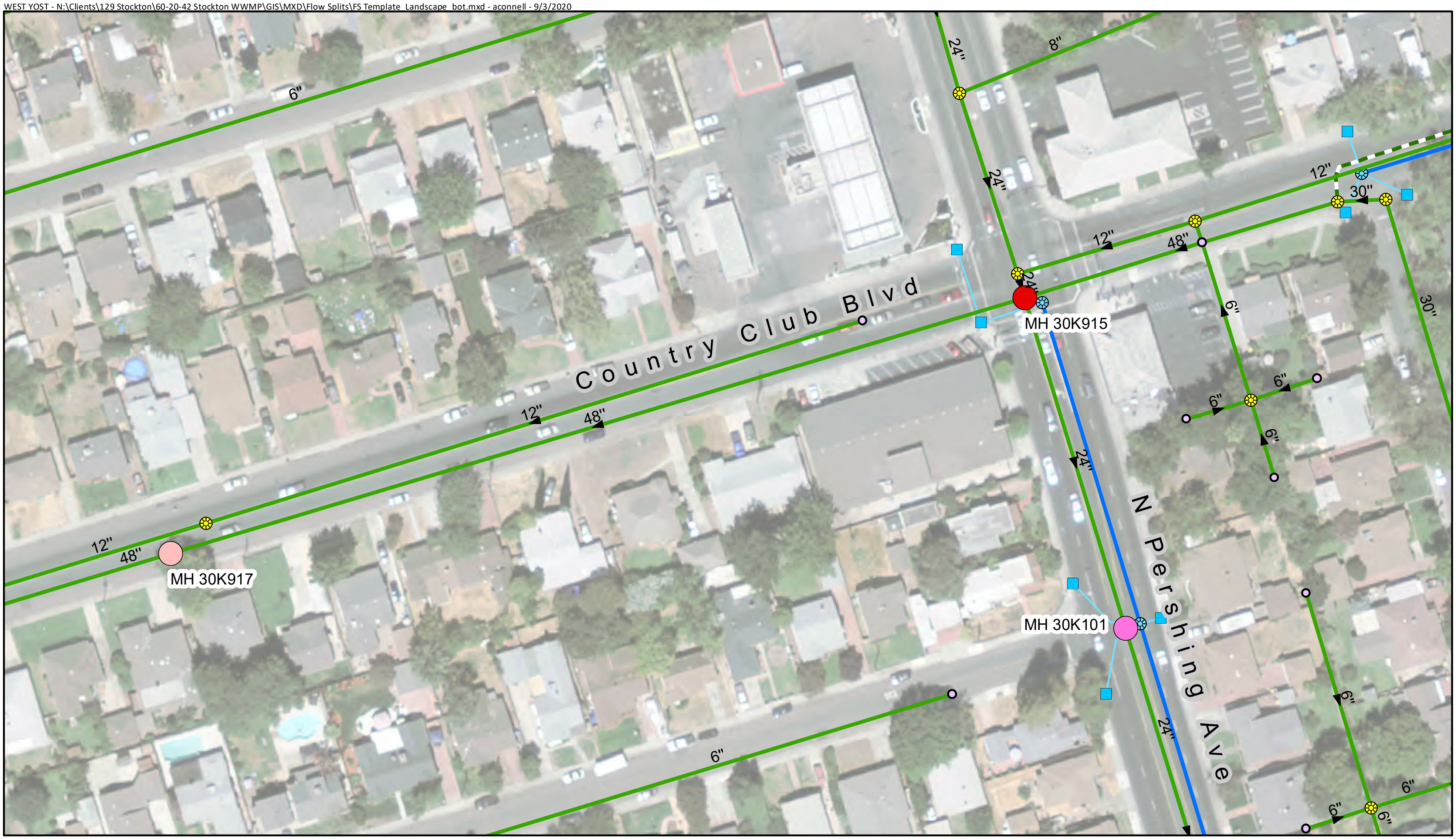
WEST YOST

Figure 1

Flow Split 2-1
MH ID 21J022

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/3/2020



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 2

Flow Split 3-1
MH ID 30K915

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/3/2020

Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 3

Flow Split 3-2
MH ID 31K915

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\4. FS 3-3.mxd - aconnell - 9/4/2020

Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 50 100
Scale in Feet

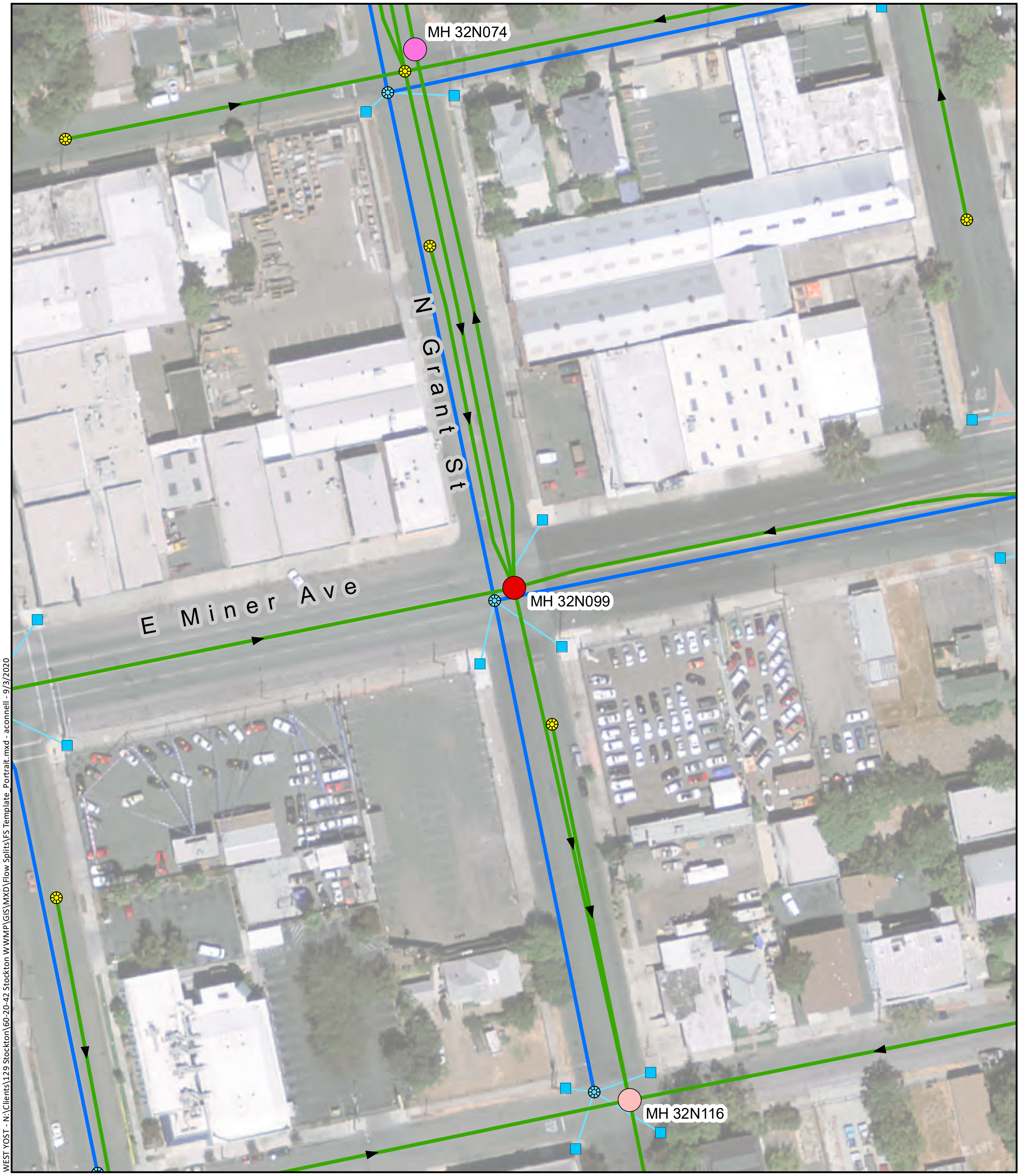
CITY OF STOCKTON

WEST YOST

Figure 4

Flow Split 3-3
MH ID 32N037

City of Stockton
Wastewater
Master Plan



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 5

Flow Split 3-4
MH ID 32N099

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Portrait.mxd - aconnell - 9/3/2020

Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 6

Flow Split 3-5
MH ID 32N056

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/3/2020

Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- Sewer Lift Station (LS)
- Sewer MH
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

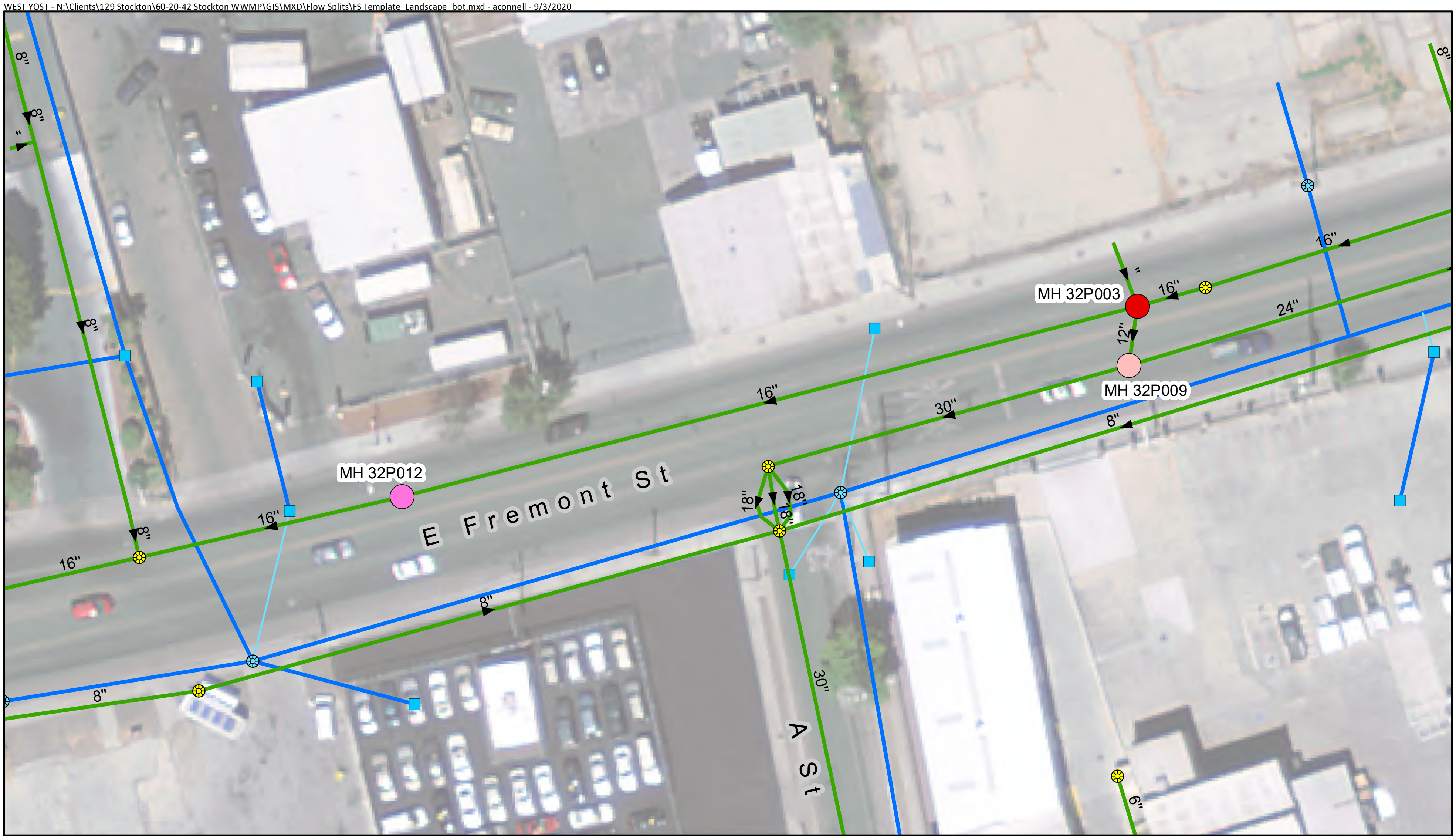
WEST YOST

Figure 7

Flow Split 3-6
MH ID 32P067

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/3/2020



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 8

Flow Split 3-7
MH ID 32P003

City of Stockton
Wastewater
Master Plan

Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Manhole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 50 100

Scale in Feet

CITY OF STOCKTON

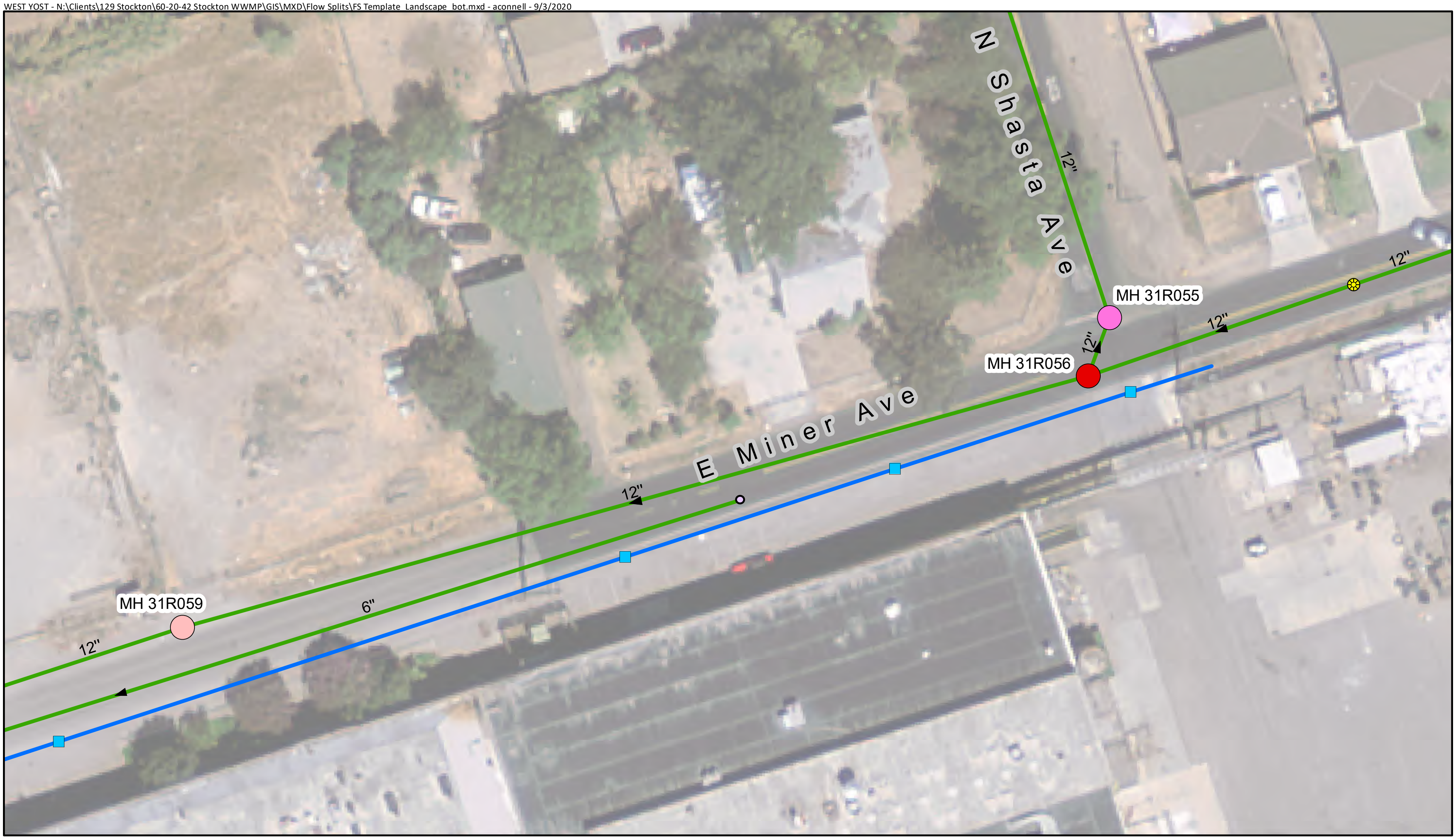
WEST YOST

Figure 9

Flow Split 4-1
MH ID 31R030

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/3/2020



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 25 50
Scale in Feet

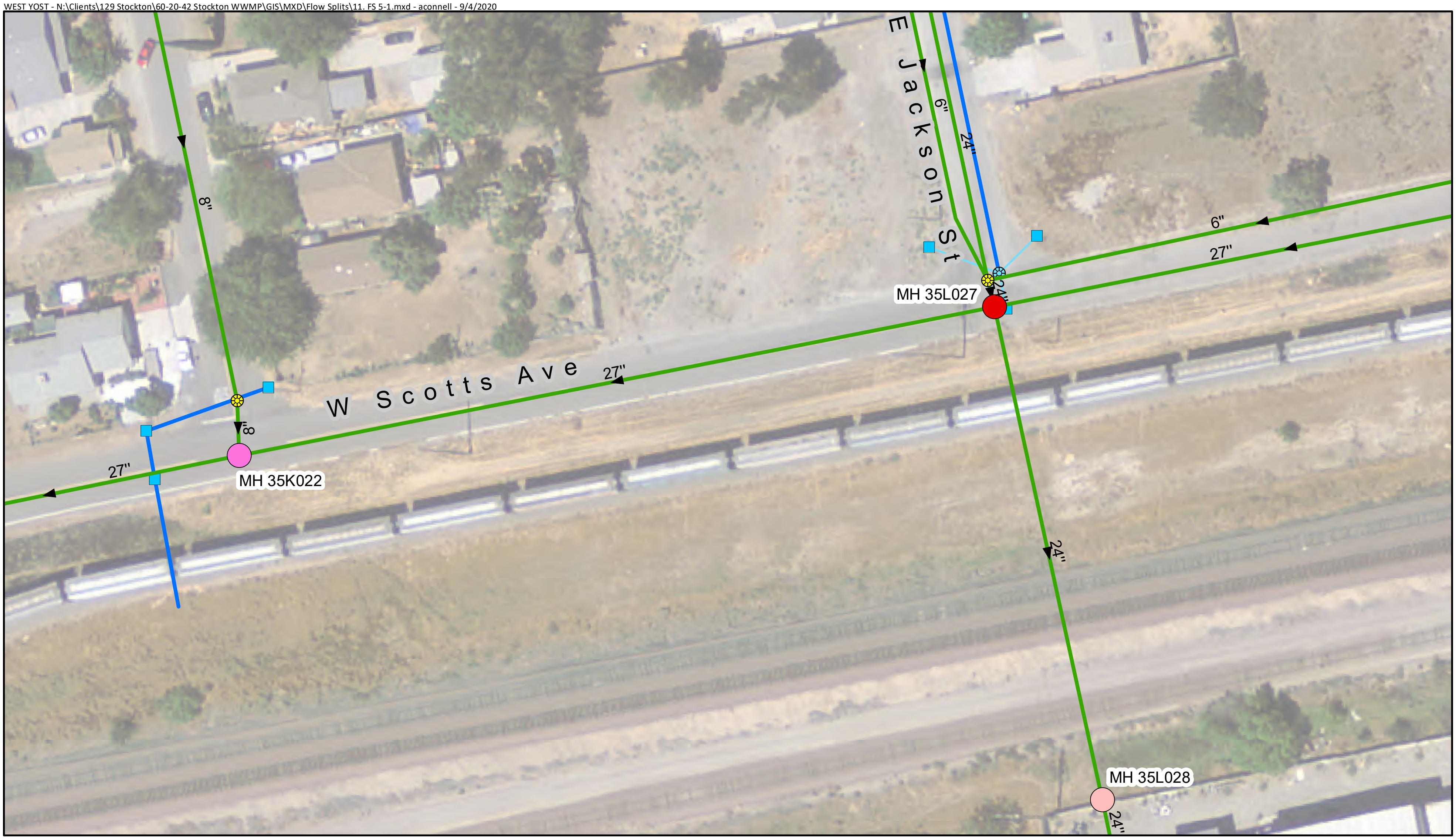
CITY OF STOCKTON

WEST YOST

Figure 10

Flow Split 4-2
MH ID 31R056

City of Stockton
Wastewater
Master Plan



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 37.5 75

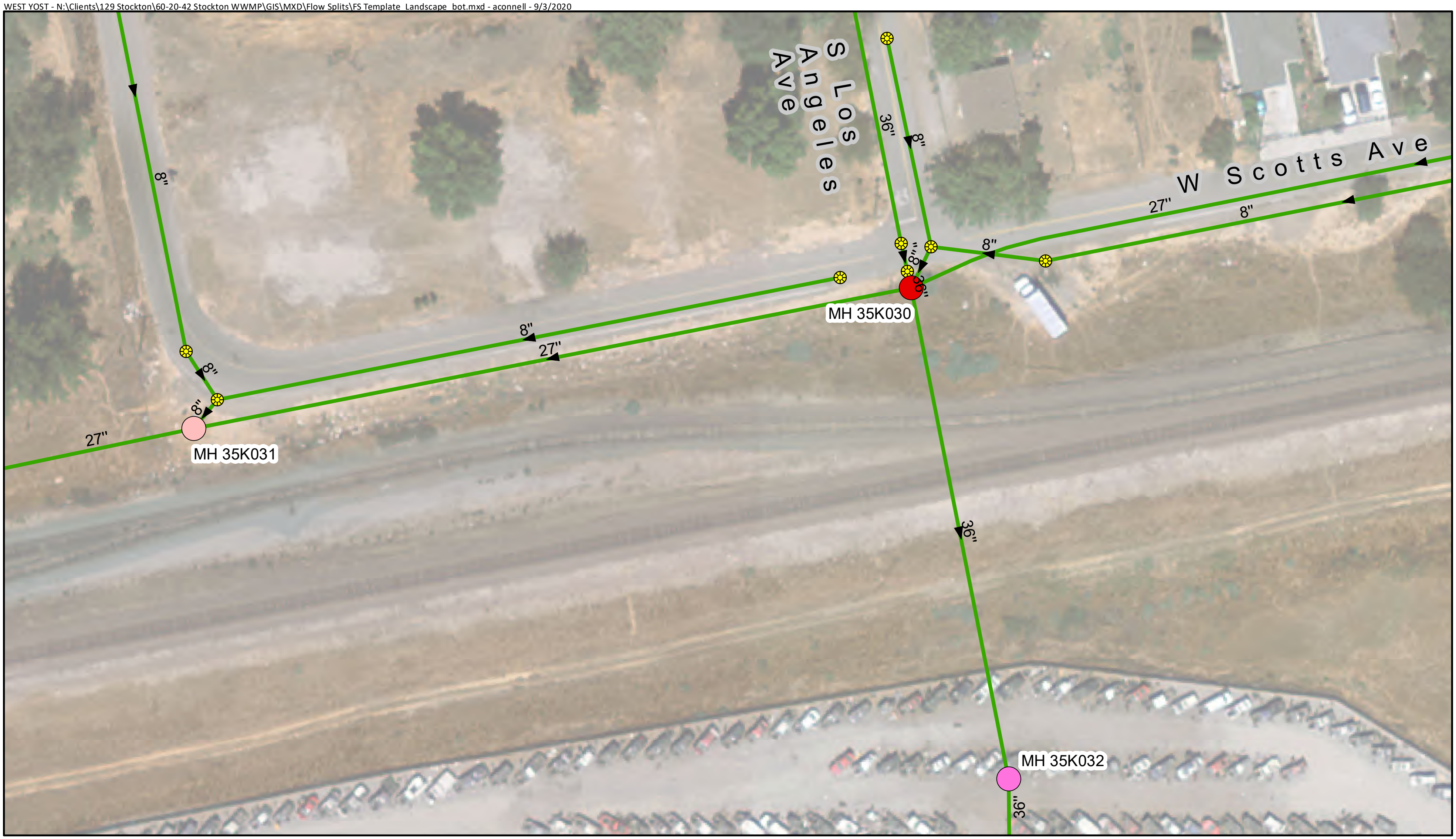
Scale in Feet

Figure 11

Flow Split 5-1
MH ID 35L027

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/3/2020



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

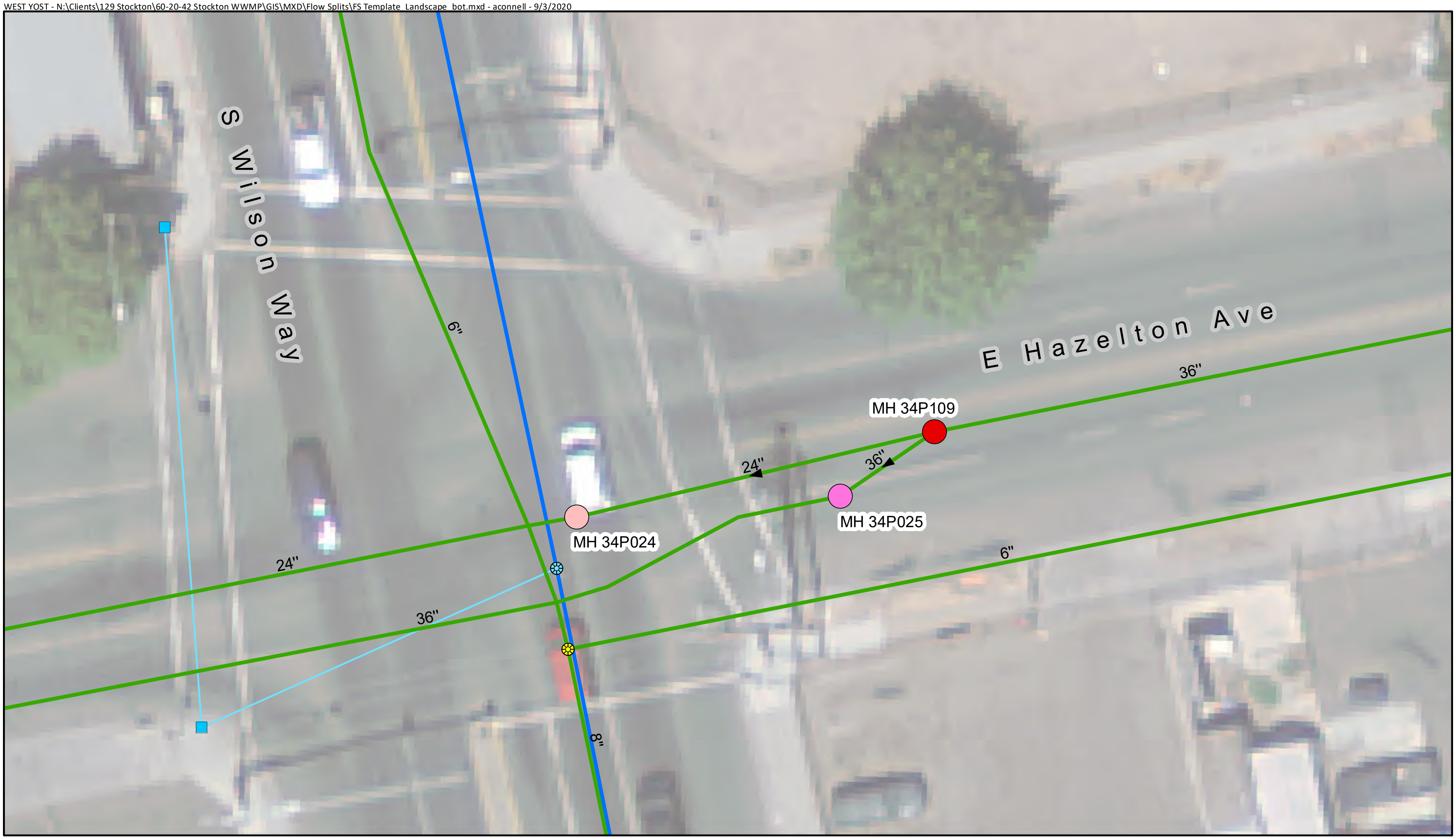
0 37.5 75
Scale in Feet

Figure 12

Flow Split 5-2
MH ID 34P109

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/3/2020



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 12.5 25
Scale in Feet

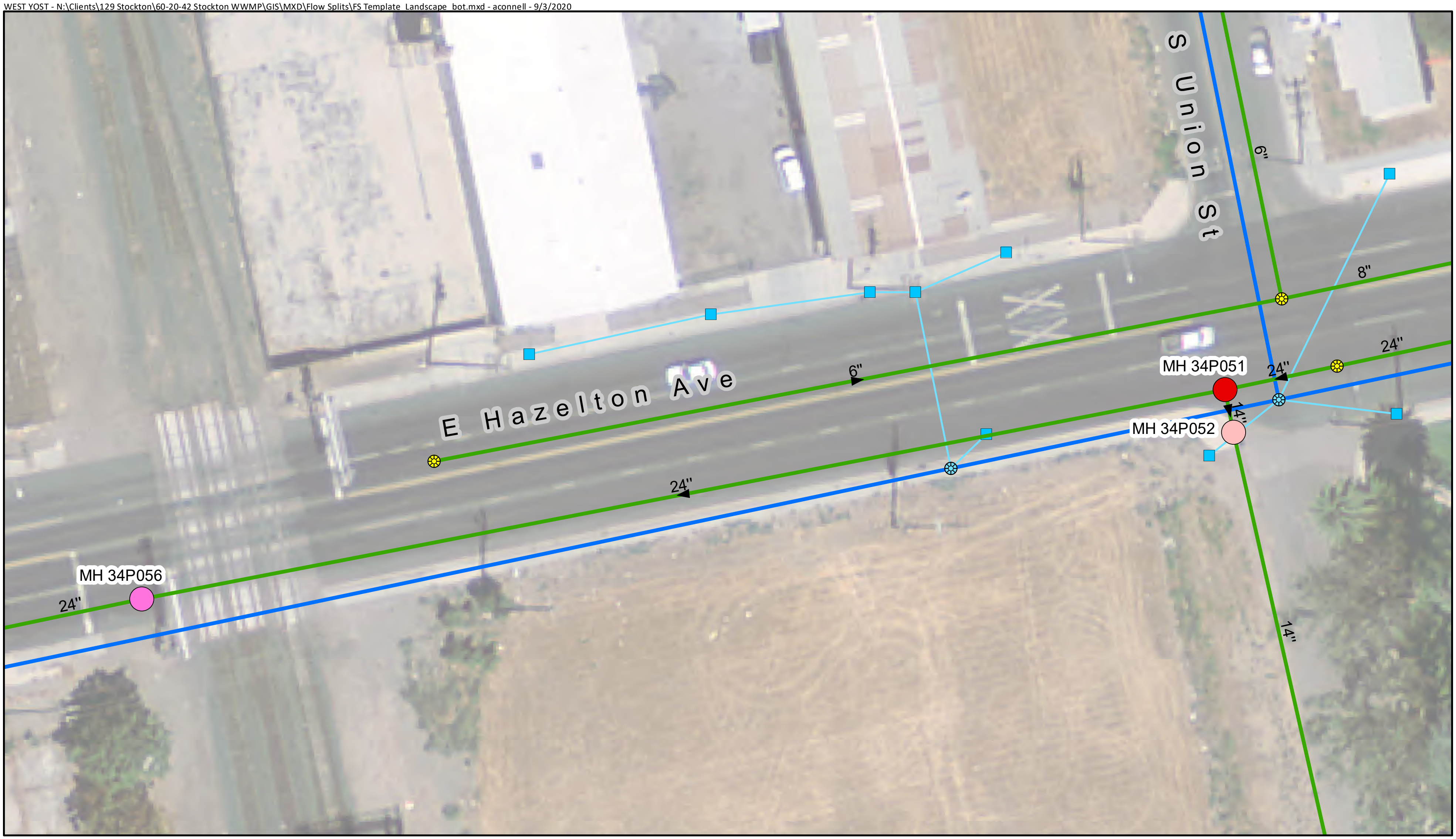
CITY OF STOCKTON

WEST YOST

Figure 13

Flow Split 6-1
MH ID 34P109

City of Stockton
Wastewater
Master Plan



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- LS Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 14

Flow Split 6-2
MH ID 34P051

City of Stockton
Wastewater
Master Plan

Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 50 100
Scale in Feet

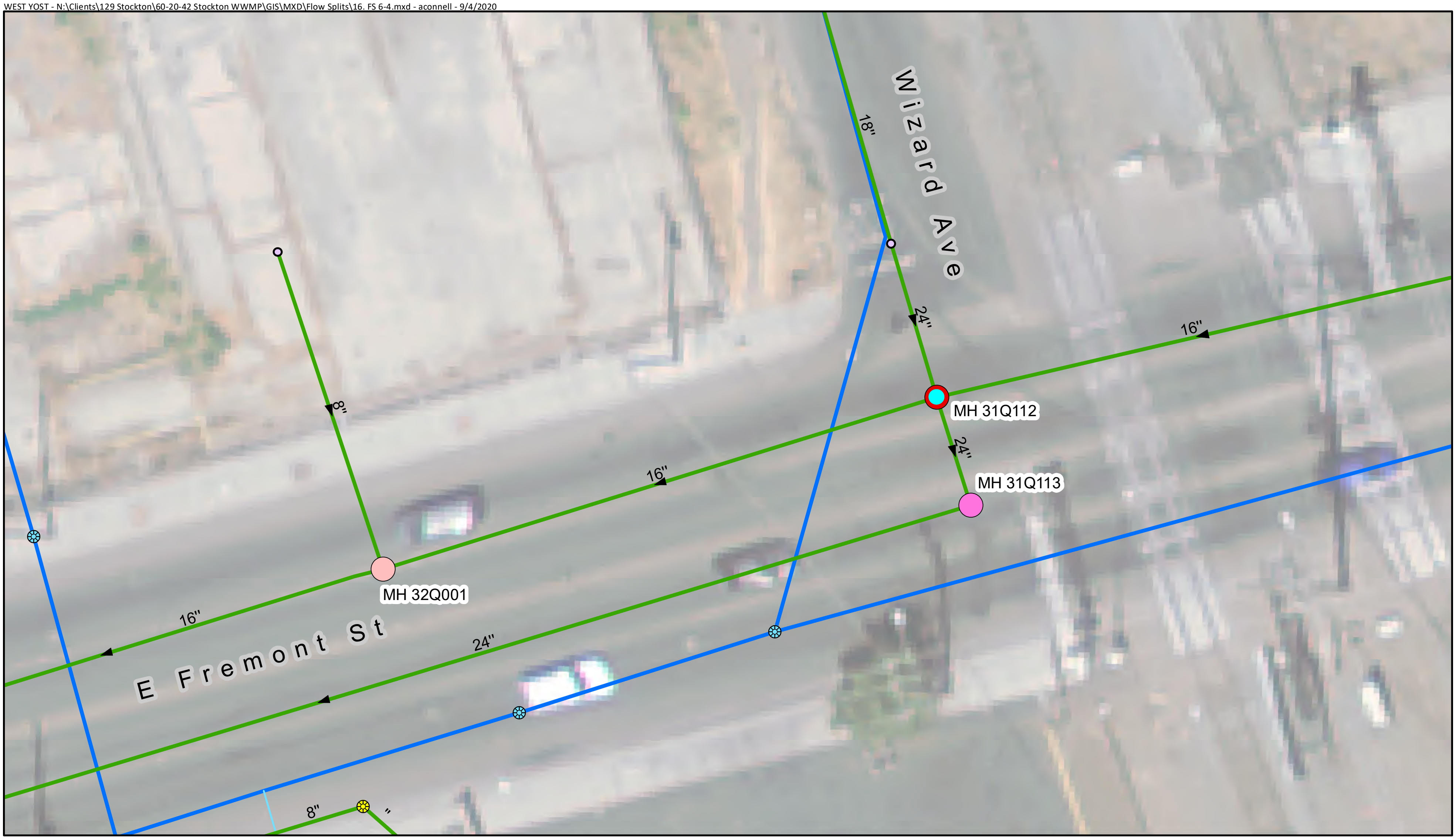
CITY OF STOCKTON

WEST YOST

Figure 15

Flow Split 6-3
MH ID 31Q112

City of Stockton
Wastewater
Master Plan



Symbology

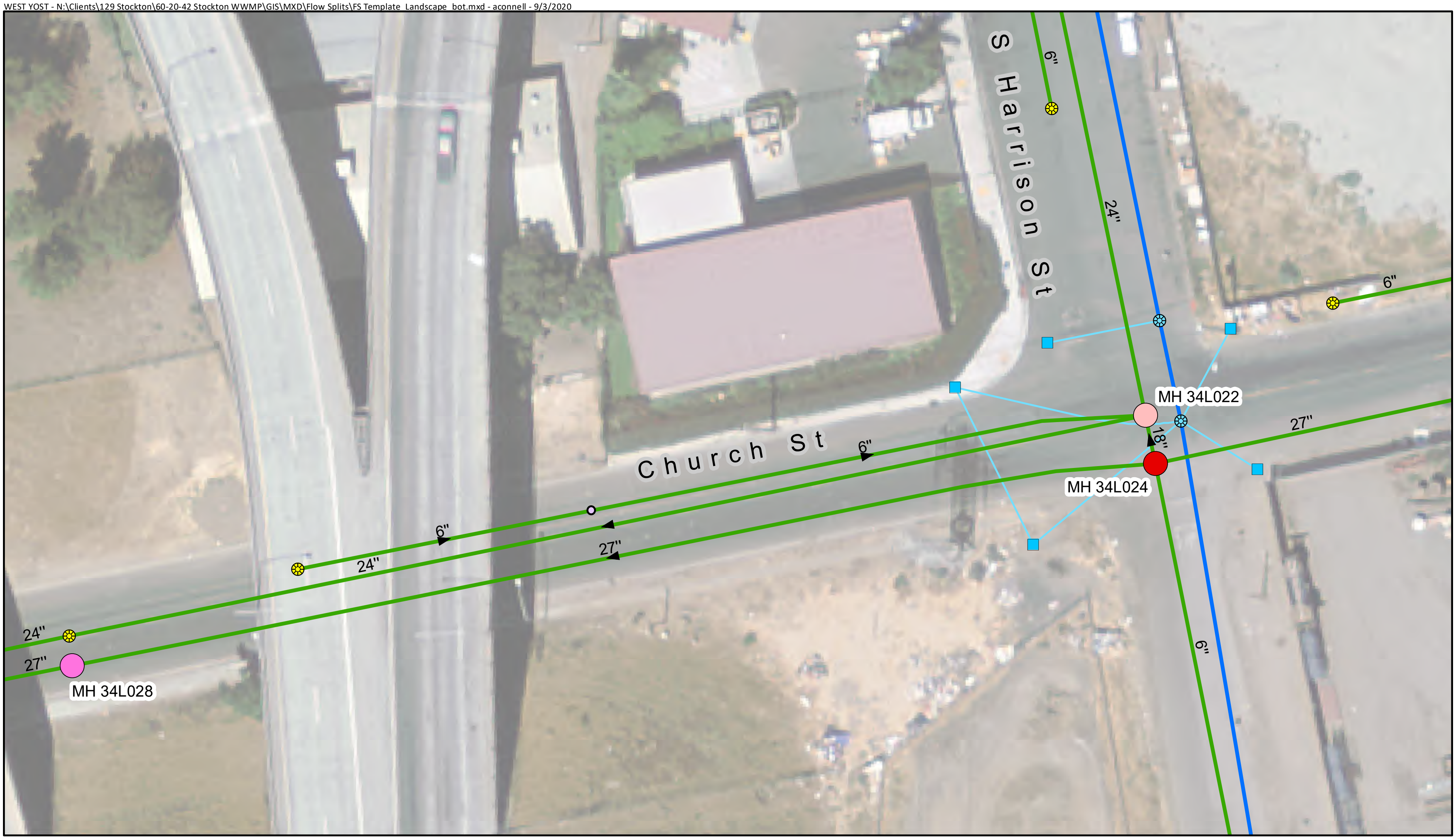
- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 12.5 25
Scale in Feet

Figure 16

Flow Split 6-4
MH ID 31Q112

City of Stockton
Wastewater
Master Plan



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

0 25 50
Scale in Feet

CITY OF STOCKTON

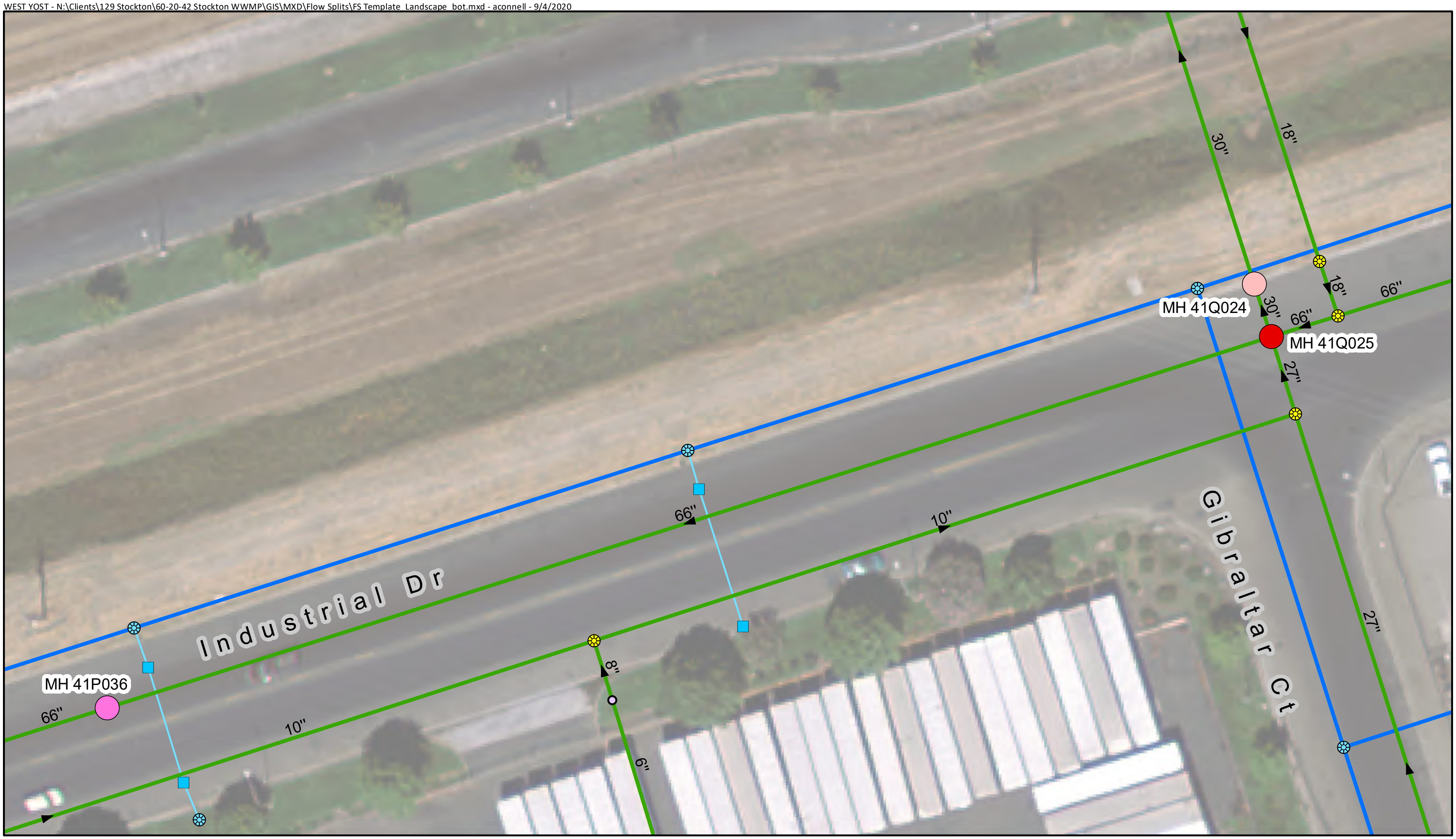
WEST YOST

Figure 17

Flow Split 6-5
MH ID 34L024

City of Stockton
Wastewater
Master Plan

WEST YOST - N:\Clients\129 Stockton\60-20-42 Stockton WWMP\GIS\MXD\Flow Splits\FS Template_Landscape_bot.mxd - aconnell - 9/4/2020



Symbology

- Flow Split MH
- Downstream MH 1
- Downstream MH 2
- Sewer Lift Station
- Sewer MH
- Lamphole
- Gravity Main
- Force Main
- Inlet or Catch Basin
- Storm Drain MH
- Catch Basin Line
- Storm Drain Line

N

0 25 50

Scale in Feet

CITY OF STOCKTON

WEST YOST

Figure 18

Flow Split 8-1
MH ID 41Q025

City of Stockton
Wastewater
Master Plan

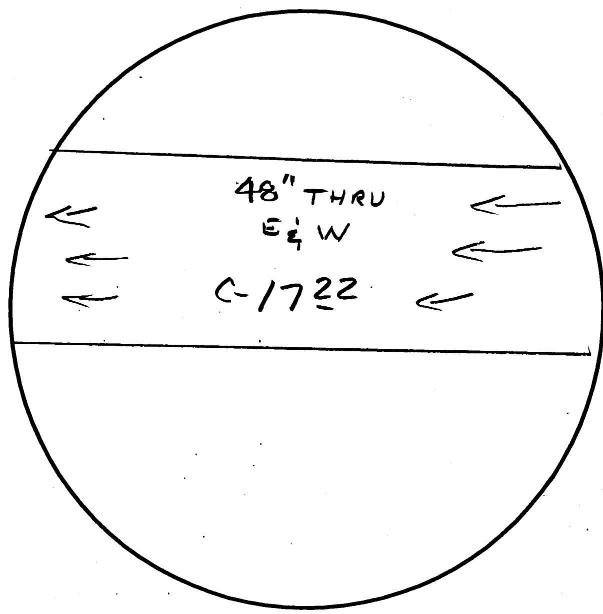
Appendix C

Flow Split Survey Notes

JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-23-2020
PT. NUMBER: 5000
SSMH NO: MH 21J025
EX. RIM ELEV: 14.72
STREET INTERSECTION: HAMMER LANE, E. OF THORNTON

SCALE N.T.S.

• BRICK & MORTAR BARREL • GOOD CONDITION
• HEAVY FLOW WEST



EL-2.52

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620 12th Street Modesto, CA 95354
(209) 524-3525 Phone (209) 524-3526 Fax

SEWER MANHOLE NO. ______________

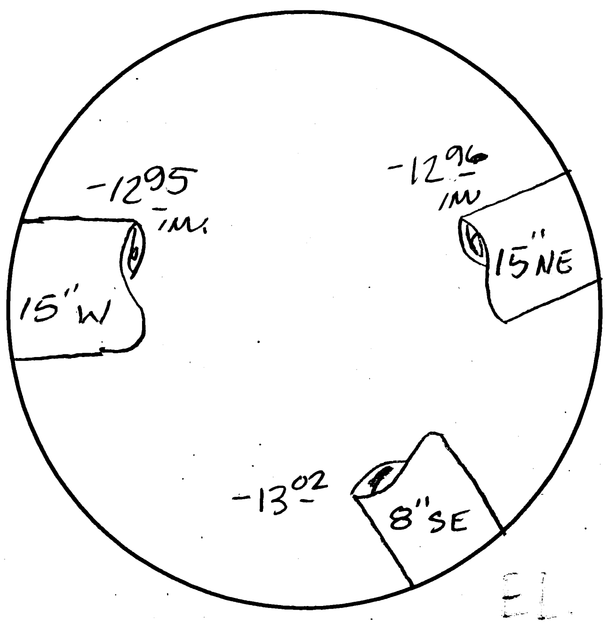
CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-23-2020
PT. NUMBER: 5001
SSMH NO: MH 21J016
EX. RIM ELEV: 14.61
STREET INTERSECTION: HAMMER @ THORNTON

SCALE N N.T.S.

STAGNANT
LID IS LABELED "STORM"
CONCRETE BARREL GOOD CONDITION



GIS Shows flow entering from east and existing west. Only two pipes in GIS. I think 15" NE is abandoned coming from MH21J008

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SEWER MANHOLE NO. ____________

CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5002

SSMH NO: MH 21J022

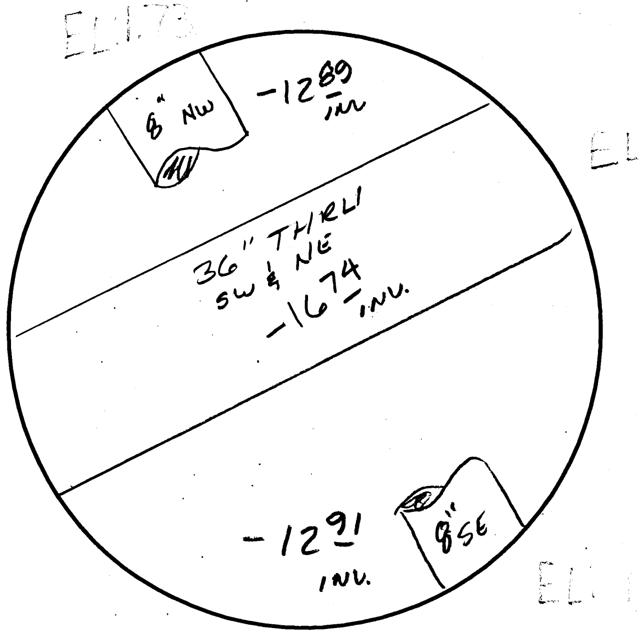
EX. RIM ELEV: 14.62

STREET INTERSECTION: HAMMER & THORNTON

SCALE N.T.S.

CONCRETE BARREL GOOD CONDITION

HEAVY FLOW WESTERLY



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(209) 524-3525 Phone (209) 524-3526 Fax

SEWER MANHOLE NO. ______________

CITY OF STOCKTON

SEWER MANHOLE ASBUILT

STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5003

SSMH NO: MH 30K917

EX. RIM ELEV: 7.15

STREET INTERSECTION: COUNTRY CLUB @ W. OF PERSHING

SCALE N.T.S.

- CONCRETE BARREL - GOOD CONDITION
- HEAVY FLOW WESTERLY

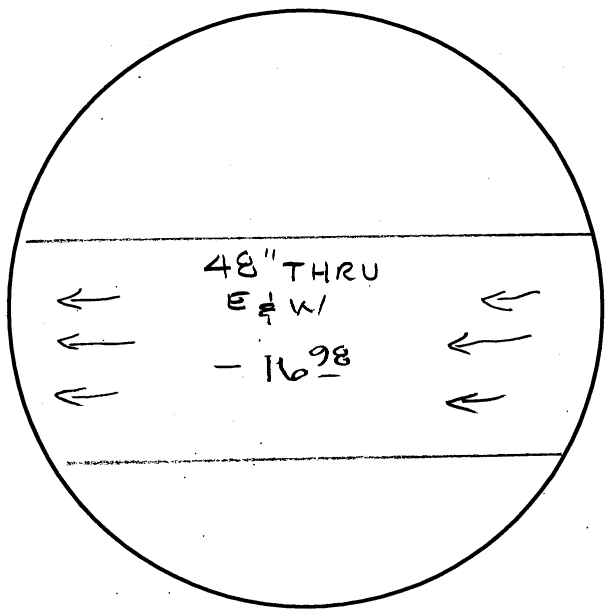

PHOTO FILE NO: ____________________

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(209) 524-3525 Phone (209) 524-3526 Fax

SEWER MANHOLE NO. ____________

CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

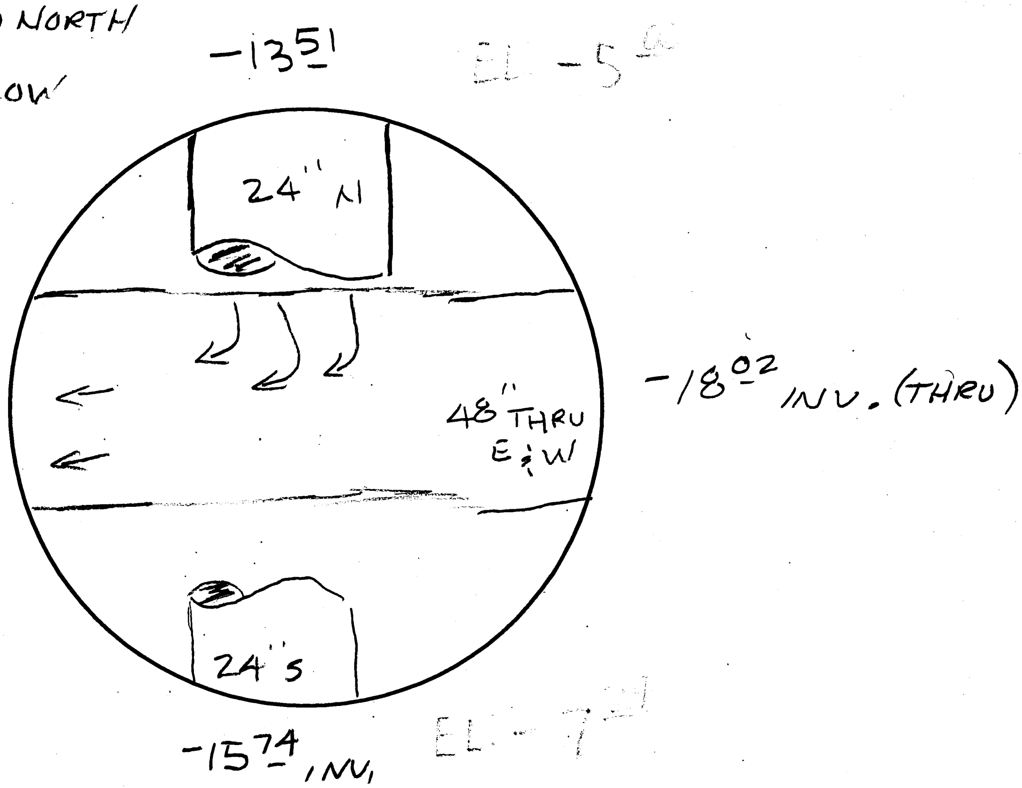
JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-23-2020
PT. NUMBER: 5004
SSMH NO: MH 30K915
EX. RIM ELEV: 8.45
STREET INTERSECTION: COUNTRY CLUB & PERSHING

SCALE N.T.S.

- BARREL CONCRETE - GOOD CONDITION
- HEAVY FLOW FROM NORTH
- LITTLE TO ZERO FLOW FROM SOUTH



Can not confirm southern flow direction in GIS

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SEWER MANHOLE NO. ____________

CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	OF

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5005

SSMH NO: MH 30R101

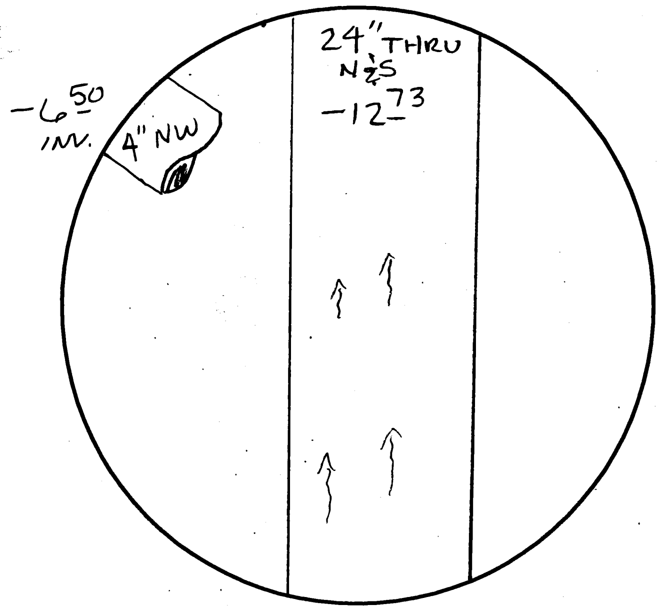
EX. RIM ELEV: 7.92

STREET INTERSECTION: PERSHING @ S. OF COUNTRY CLUB

SCALE N.T.S.

• BRICK & MORTAR BARREL GOOD CONDITION

• SLOW FLOW NORTHERLY



GIS shows reversed flow

PHOTO FILE NO: ______________

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(209) 524-3525 Phone (209) 524-3526 Fax

SEWER MANHOLE NO. ______________

CITY OF STOCKTON

SEWER MANHOLE ASBUILT

STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5006

SSMH NO: MH 31J082

EX. RIM ELEV: 5.68

STREET INTERSECTION: MISSION @ N. OF TUXEDO

SCALE N.T.S.

CONCRETE BARREL - GOOD CONDITION

HEAVY FLOW NORTHERLY

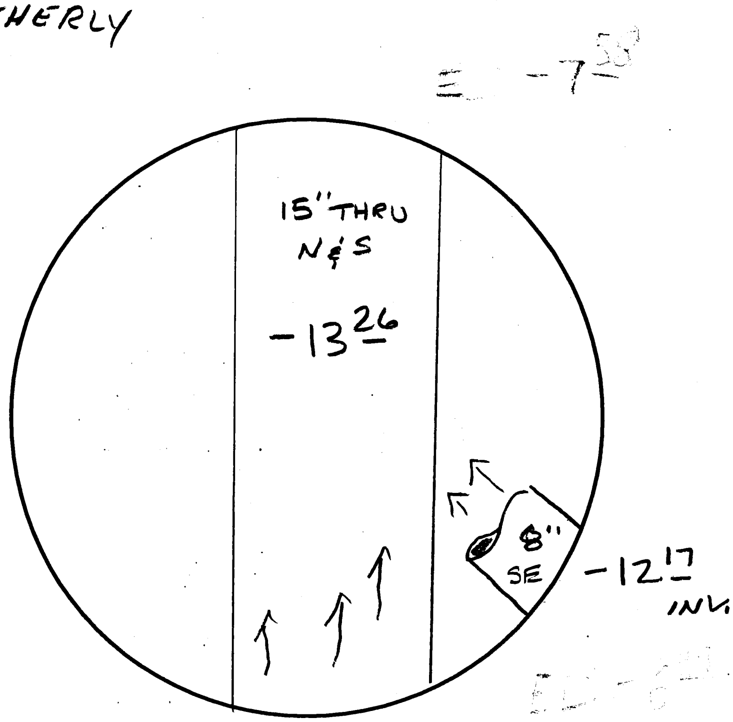

PHOTO FILE NO: ____________________

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SEWER MANHOLE NO. ____________

CITY OF STOCKTON
SEWER MANHOLE ASBUILT

STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5007

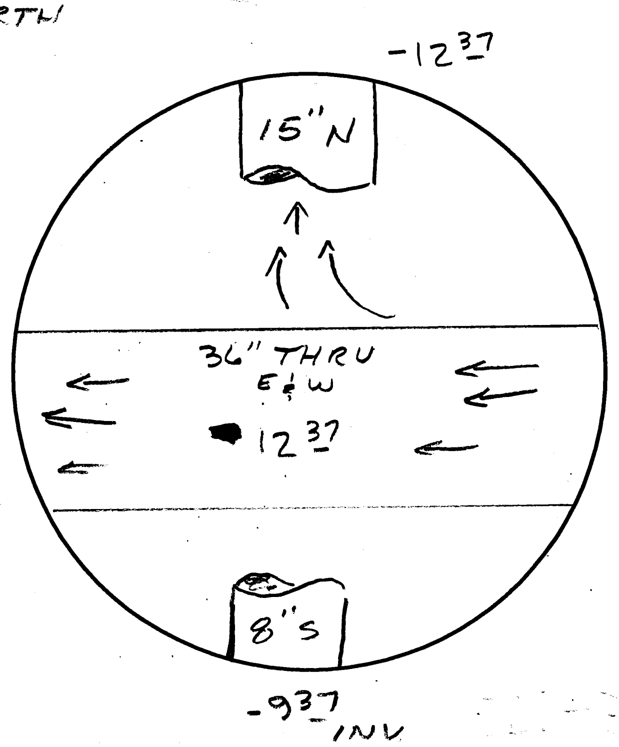
SSMH NO: MH 31J018

EX. RIM ELEV: 5.38

STREET INTERSECTION: S. TUXEDO @ MISSION RD.

SCALE N.T.S.

- CONCRETE BARREL · GOOD CONDITION
- HEAVY FLOW WEST
- HEAVY FLOW NORTH



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SEWER MANHOLE NO. ____________________

CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5008

SSMH NO: MH 31J083

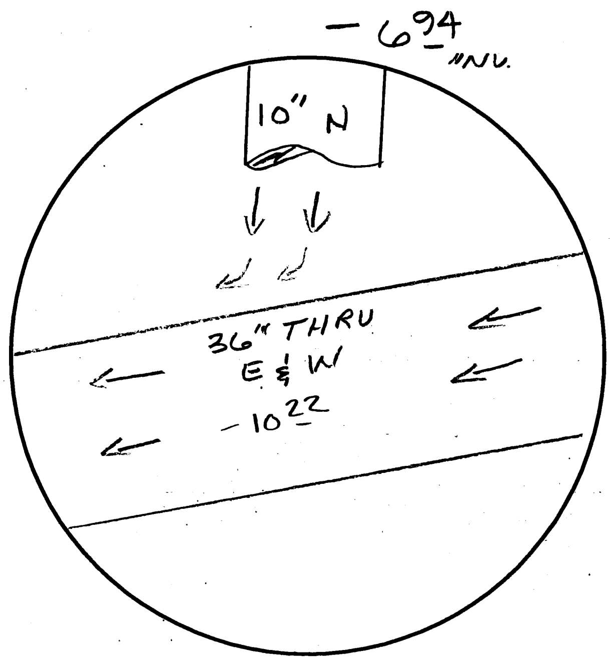
EX. RIM ELEV: 2.89

STREET INTERSECTION: LAKE DRIVE CUL-DE-SAC

SCALE N.T.S.

• CONCRETE BARREL CONDITION = GOOD

• HEAVY FLOW WESTELY



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SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	OF

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DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5000

SSMH NO: MH 35K030

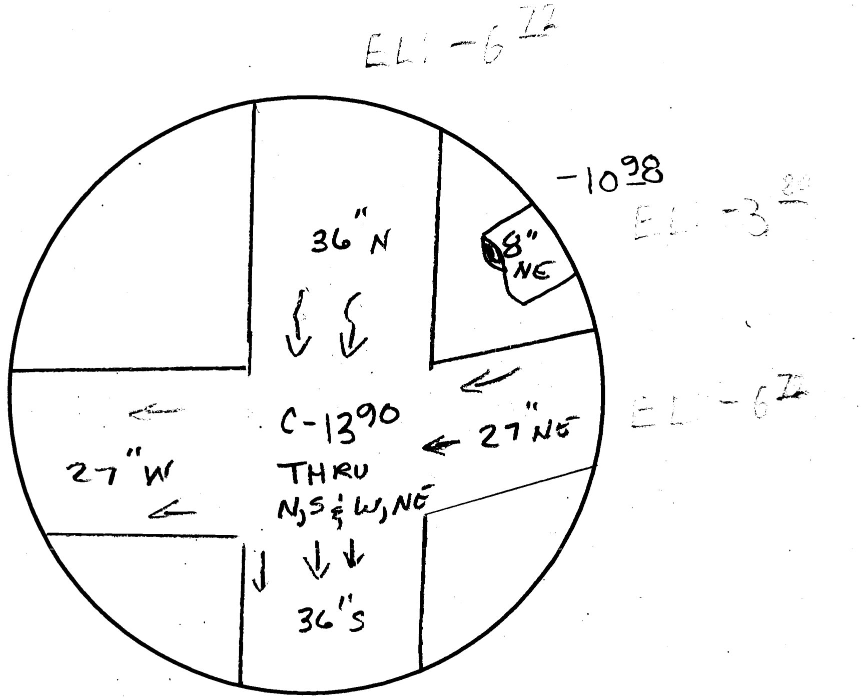
EX. RIM ELEV: 7.18

STREET INTERSECTION: W. SCOTTS @ NOMINAL & DEL NORTE ST

SCALE N.T.S.

CONCRETE BARREL GOOD CONDITION

HEAVY FLOW SOUTH & WEST



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SHEET	OF

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5010

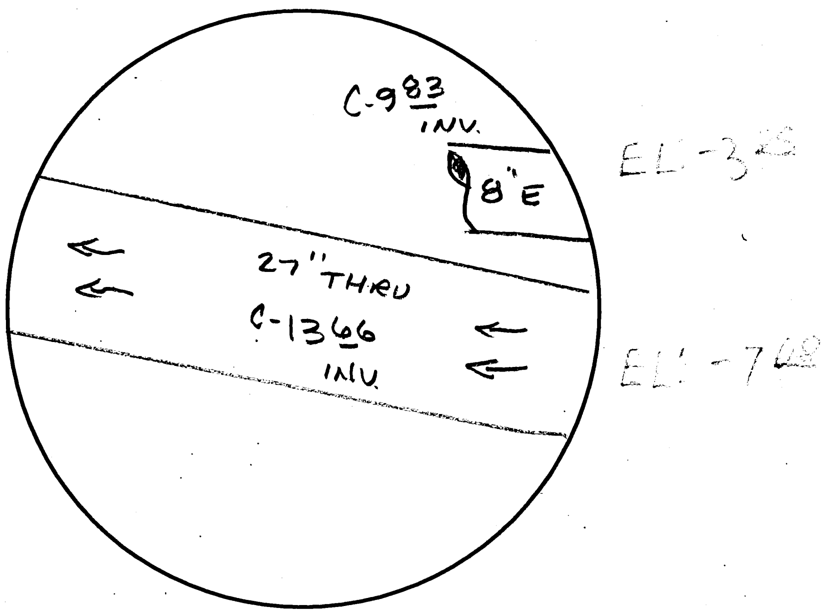
SSMH NO: MH 35K031

EX. RIM ELEV: 6.58

STREET INTERSECTION: W. SCOTTS AVE KNUCKLE

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- HEAVY FLOW WEST



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SHEET	
OF	

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5012

SSMH NO: MH 35L028

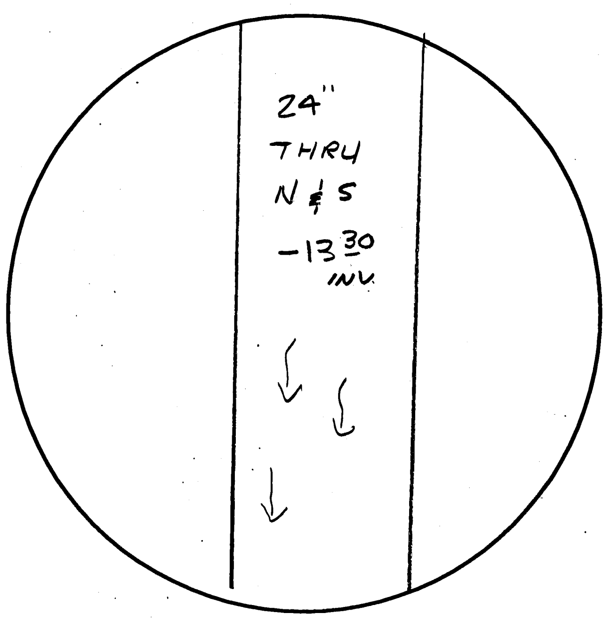
EX. RIM ELEV:

STREET INTERSECTION: OHI PROPERTY NW CORNER

SCALE N.T.S.

BRICK & MORTAR FAIR CONDITION (OLD)

FLOWING SOUTH



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DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JG

DATE: 9-23-2020

PT. NUMBER: 5013

SSMH NO: MH 352027

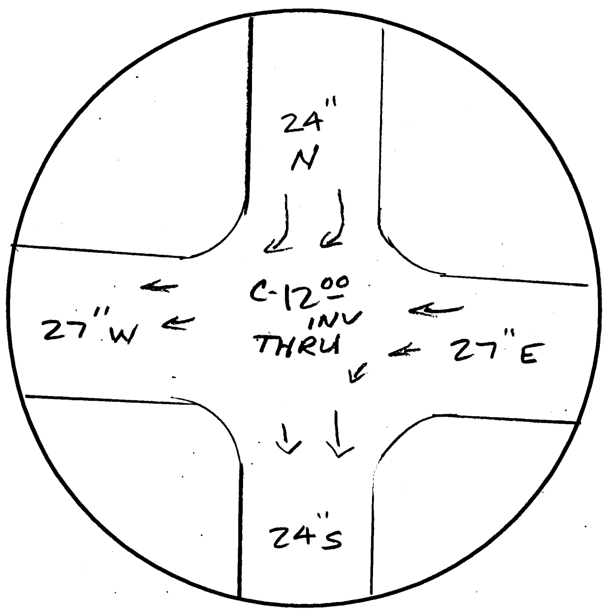
EX. RIM ELEV: 6.68

STREET INTERSECTION: SCOTTS AVE @ PERSHING AVE

SCALE N.T.S.

• BRICK & MORTAR FAIR/OLD CONDITION

• FLOWING SOUTH & WEST



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5014

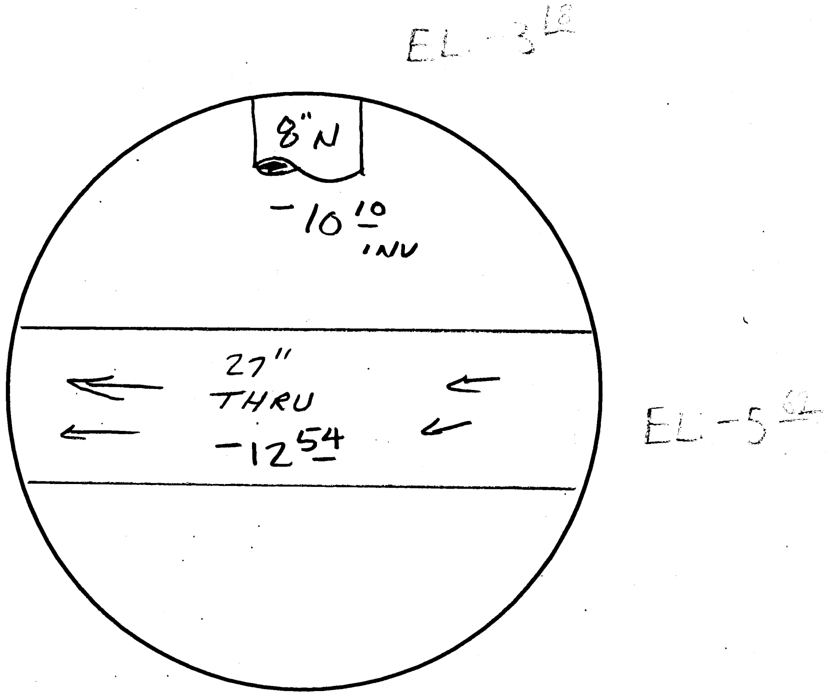
SSMH NO: MH 35K022

EX. RIM ELEV: 6.92

STREET INTERSECTION: MODESTO AVE @ SCOTTS AVE

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- FLOWING WEST



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-20

PT. NUMBER: 5015

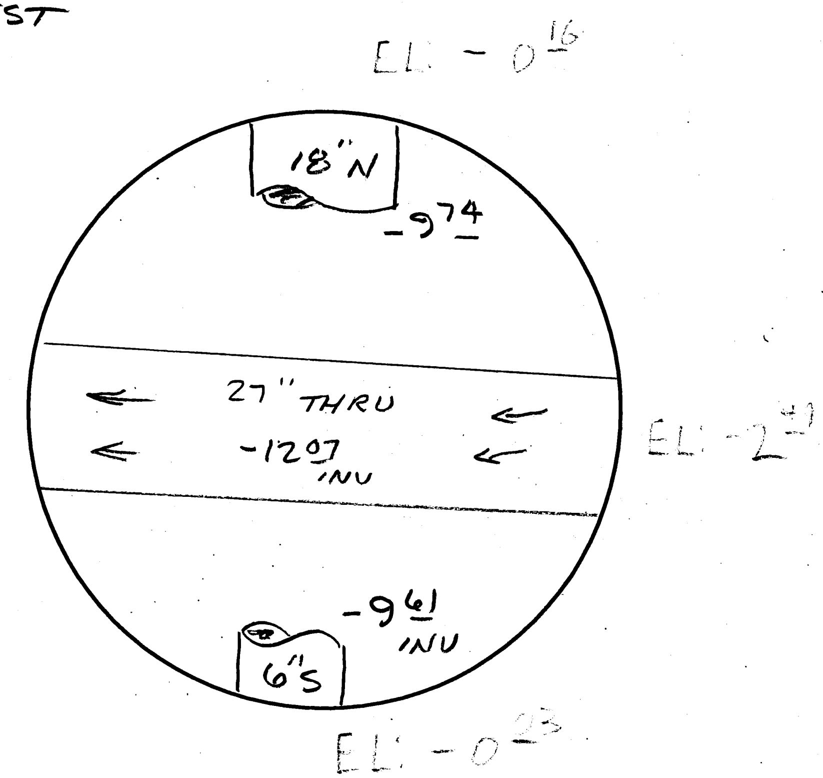
SSMH NO: MH 34L024

EX. RIM ELEV: 9.58

STREET INTERSECTION: HARRISON @ CHURCH

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- FLOWING WEST



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JOB:	J20-260
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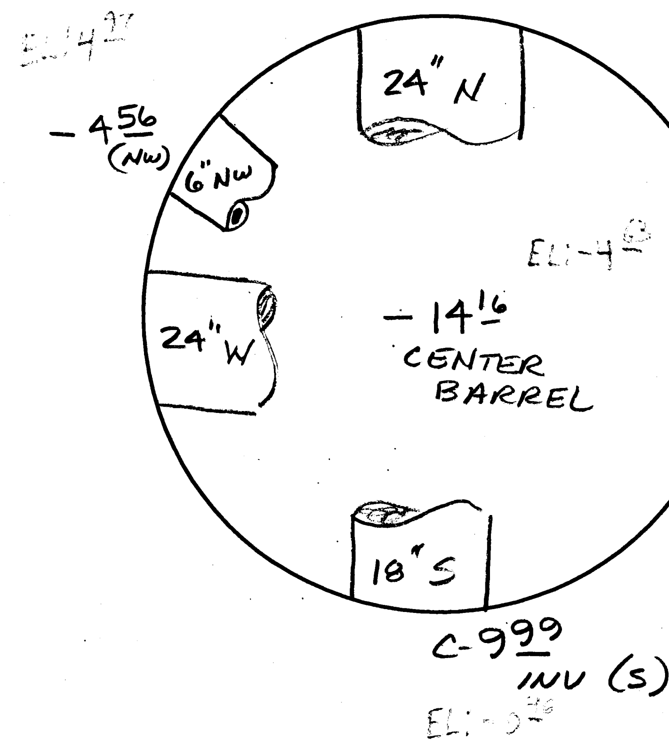
JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-23-2020
PT. NUMBER: 5016
SSMH NO: MH 342022
EX. RIM ELEV: 9.53
STREET INTERSECTION: HARRISON @ CHURCH

SCALE N.T.S.

BRICK & MORTAR BARREL
STAGNANT/STILL ± 24" DEEP



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JOB NUMBER: J20-2649

SURVEY CREW: JR/DS

DATE: 9-23-2020

PT. NUMBER: 5017

SSMH NO: MH34L028

EX. RIM ELEV: 12.16

STREET INTERSECTION: CHURCH W. OF HARRISON

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- STAGNANT/FULL OF DEBRIS 4'± DEEP

FULL OF DEBRIS

-10^{60}

CENTER OF BARREL

EL. 11^{50}

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JOB:	J20-260
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DESIGN:	
CHK'D:	
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OF	

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5018

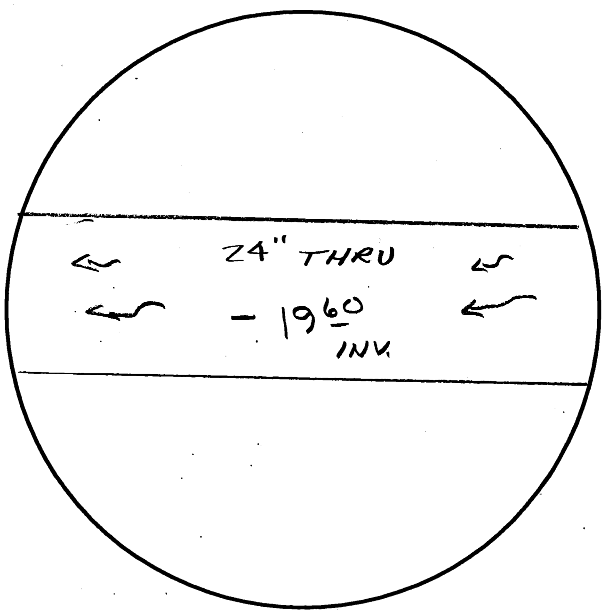
SSMH NO: MH 34P056

EX. RIM ELEV: 21.83

STREET INTERSECTION: HAZELTON W. OF UNION

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- FLOWING WEST



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OF	

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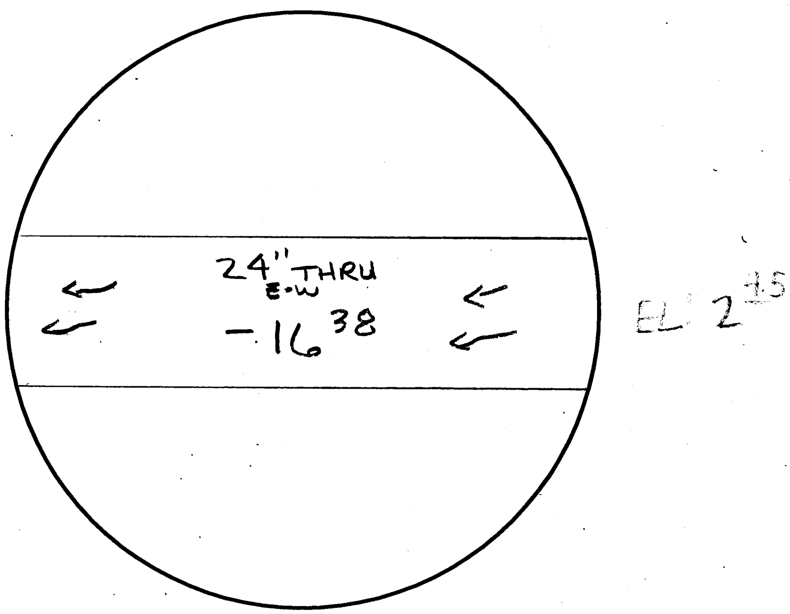
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649
SURVEY CREW: JR / JS
DATE: 9-23-2020
PT. NUMBER: 5019
SSMH NO: MH 34P051
EX. RIM ELEV: 18.83
STREET INTERSECTION: HAZELTON @ UNION

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- FLOWING WEST



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JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
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OF	

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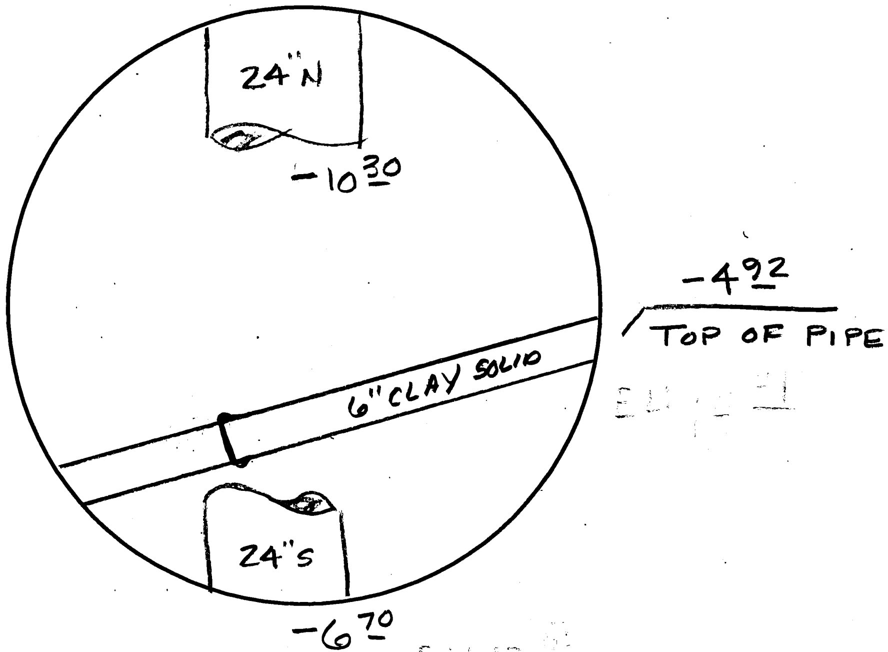
JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-23-20
PT. NUMBER: 5026
SSMH NO: MH 34P052
EX. RIM ELEV: 19.33
STREET INTERSECTION: HAZELTON @ UNION

SCALE N.T.S.

• CONCRETE BARREL GOOD CONDITION
• DRY / EMPTY



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JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5021

SSMH NO: MH 34P109

EX. RIM ELEV: 19.43

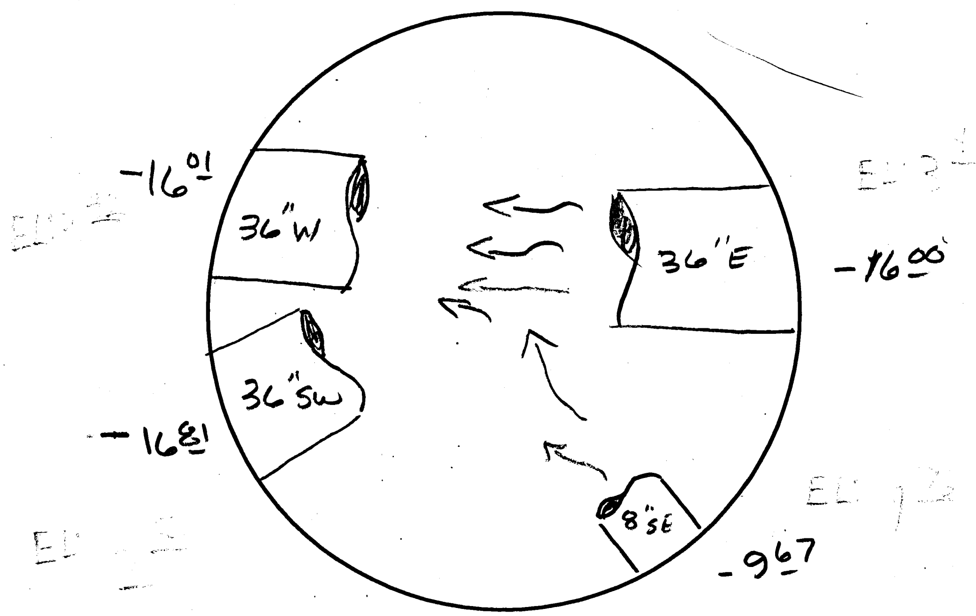
STREET INTERSECTION: WILSON WY @ E. HAZELTON

SCALE N.T.S.

CONCRETE BARREL GOOD CONDITION

FLOWING WEST

ZERO FLOW SW



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

PT. NUMBER: 5022

SSMH NO: MH 34P025

EX. RIM ELEV: 19.46

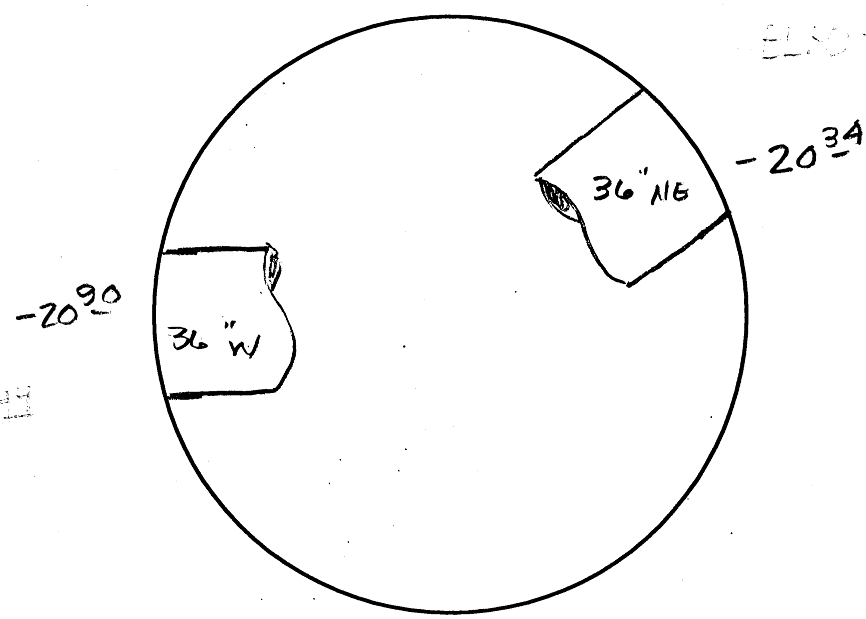
STREET INTERSECTION: WILSON WY @ E. HAZELTON

SCALE N.T.S.

• CONCRETE BARREL

• SOME DEBRIS/SLUDGE • 50'± DEEP

• SLOW FLOWING WEST



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OF	

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-23-2020

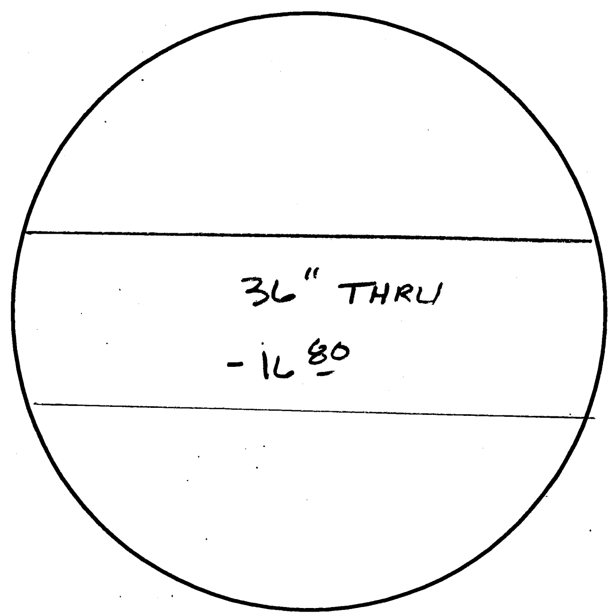
PT. NUMBER: 5023

SSMH NO: MH 34P024

EX. RIM ELEV: 20.13

STREET INTERSECTION: WILSON WY @ E. HAZELTON

- BRICK & MORTAR BARREL FAIR CONDITION (OLD)
- FLOWING WEST



SCALE N.T.S.

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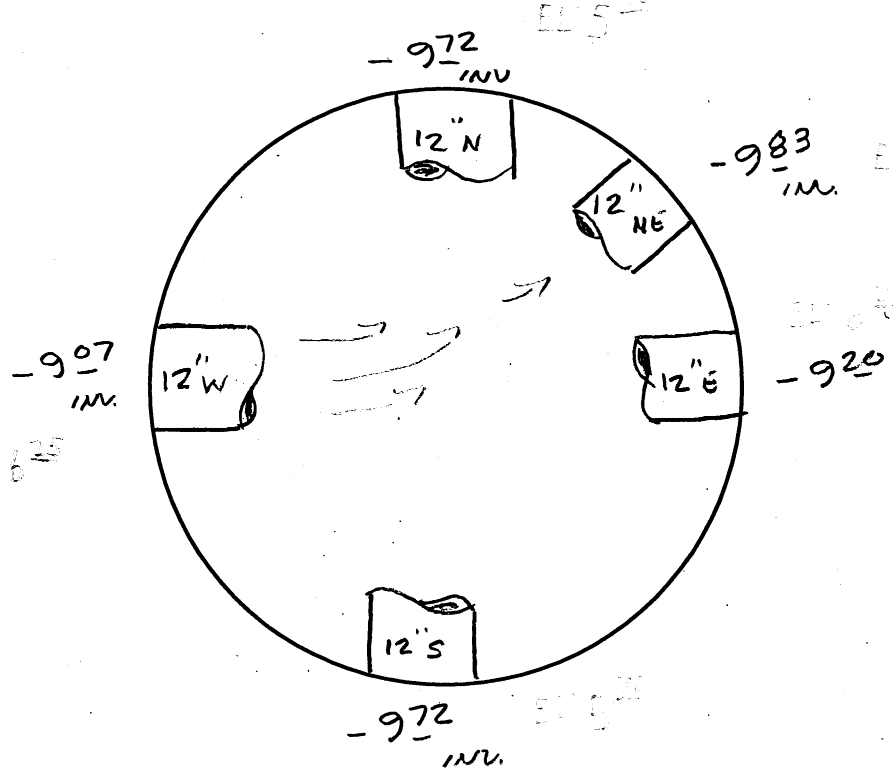
JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-24-2020
PT. NUMBER: 5024
SSMH NO: MH 32N058
EX. RIM ELEV: 15.42
STREET INTERSECTION: GRANT ST & FREMONT

SCALE N.T.S.

CONCRETE BARREL - GOOD CONDITION
FLOWING NW



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5025

SSMH NO: MH 32N056

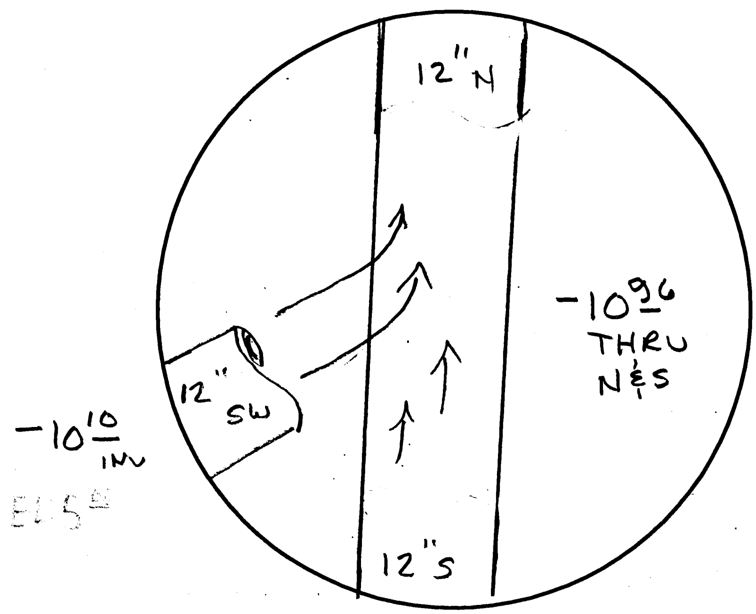
EX. RIM ELEV: 15.16

STREET INTERSECTION: FREMONT & GRANT

SCALE N.T.S.

CONCRETE BARREL · GOOD CONDITION

FLOW NORTHERLY



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OF	

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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5026

SSMH NO: MH 32N037

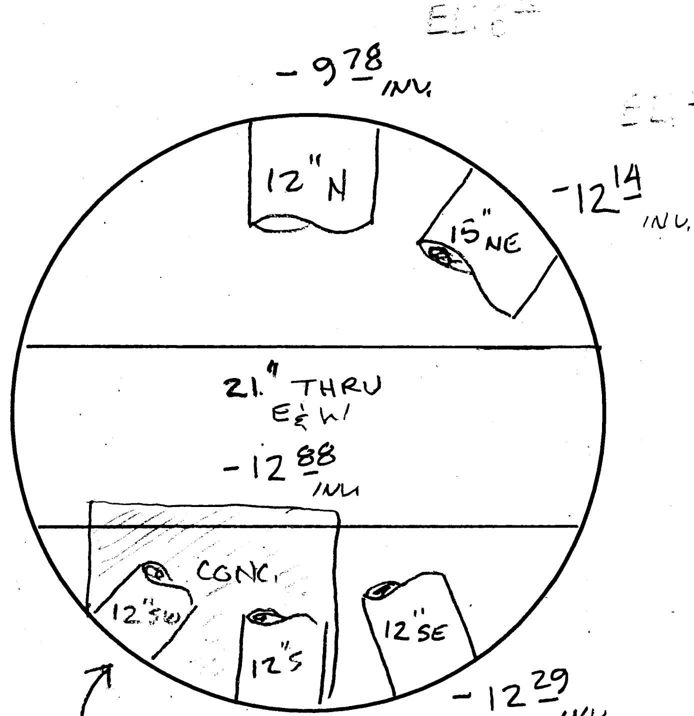
EX. RIM ELEV: 16.18

STREET INTERSECTION: OAK & GRANT

SCALE N.T.S.

CONCRETE BARREL GOOD CONDITION

FLOWING WEST



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* NOT VERIFIED *

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JOB: J20-260

DATE: 9/23/2020

SCALE: NTS

DRAWN:

DESIGN:

CHK'D:

SHEET

OF

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5027

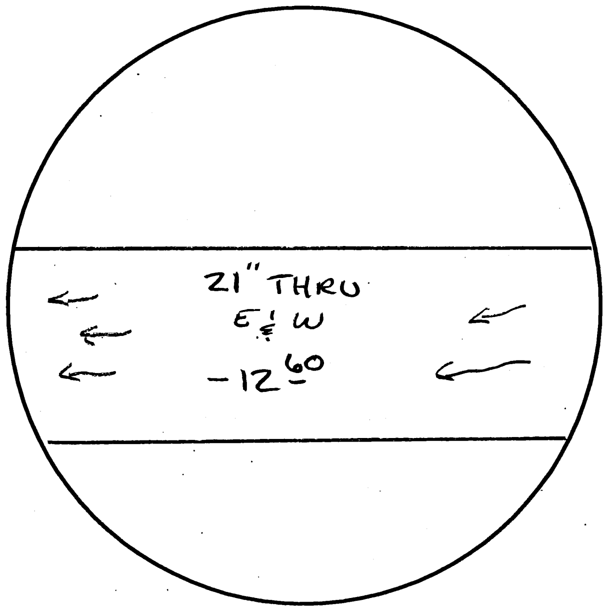
SSMH NO: MH 32N040

EX. RIM ELEV: 15.27

STREET INTERSECTION: OAK & STANISLAUS

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- FLOWING WEST



EL 2.97

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CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	OF

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5028

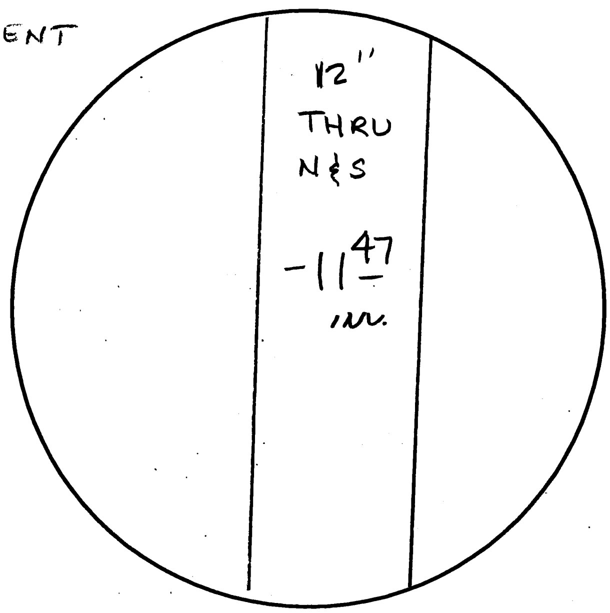
SSMH NO: MH 32N074

EX. RIM ELEV: 16.12

STREET INTERSECTION: LINDSAY & GRANT

SCALE N.T.S.

- CONCRETE BARREL - GOOD CONDITION
- STAGNANT
- MINIMAL FLOW
- 3" ± DEEP SEDIMENT IN TROUGH



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OF	

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5029

SSMH NO: MH 32N099

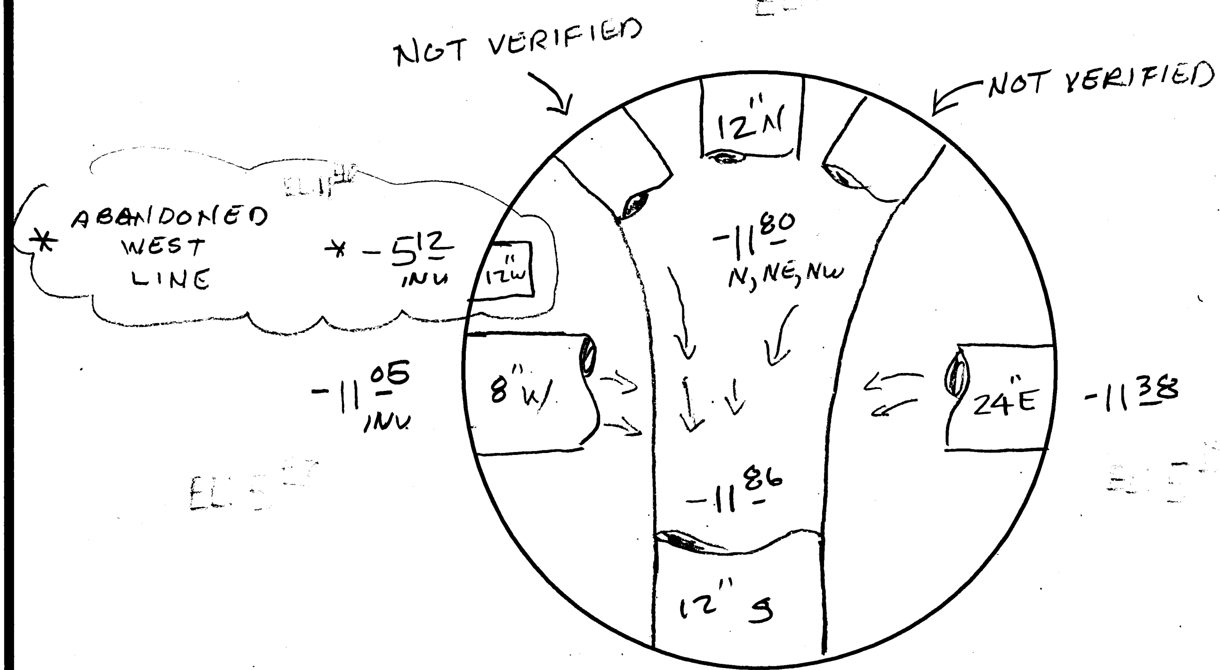
EX. RIM ELEV: 16.52

STREET INTERSECTION: GRANT ST & MINER

SCALE N.T.S.

• CONCRETE BARREL GOOD CONDITION

• FLOWING SLOW SOUTH



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-20

PT. NUMBER: 5030

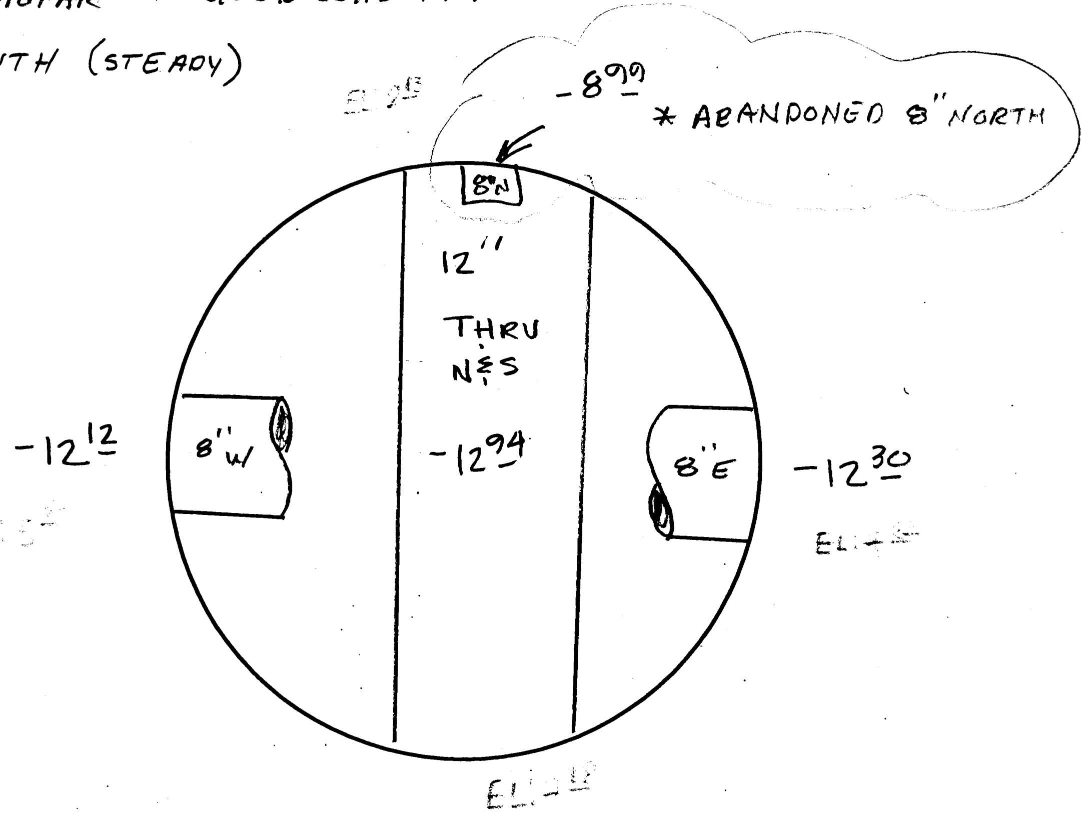
SSMH NO: MH32N116

EX. RIM ELEV: 17.12

STREET INTERSECTION: GRANT & CHANNEL

SCALE N.T.S.

- BRICK & MOTAR - GOOD CONDITION
- FLOW SOUTH (STEADY)



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5031

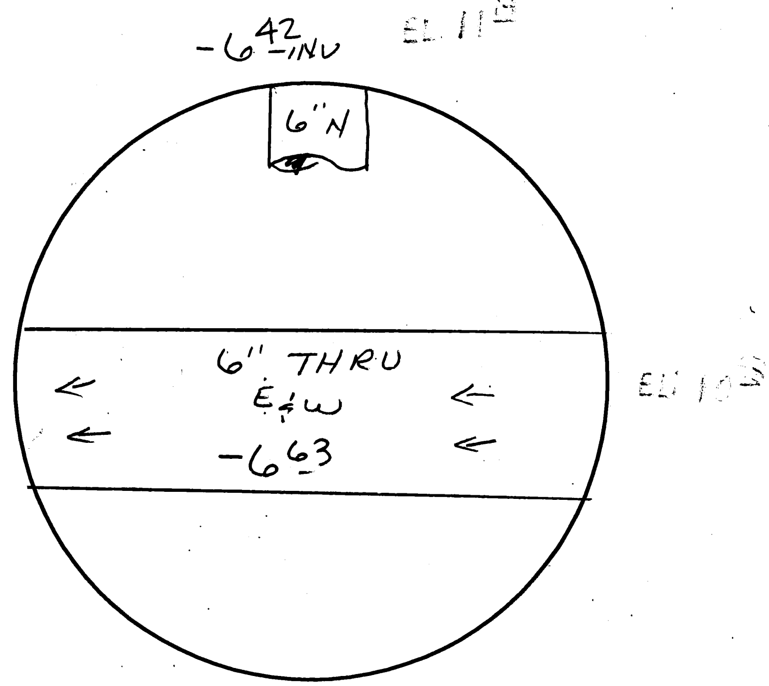
SSMH NO: MH 32P071

EX. RIM ELEV: 17.56

STREET INTERSECTION: LINDSAY & AIRPORT

SCALE N.T.S.

- BRICK & MORTAR - GOOD CONDITION
- SLOW FLOW WEST



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5032

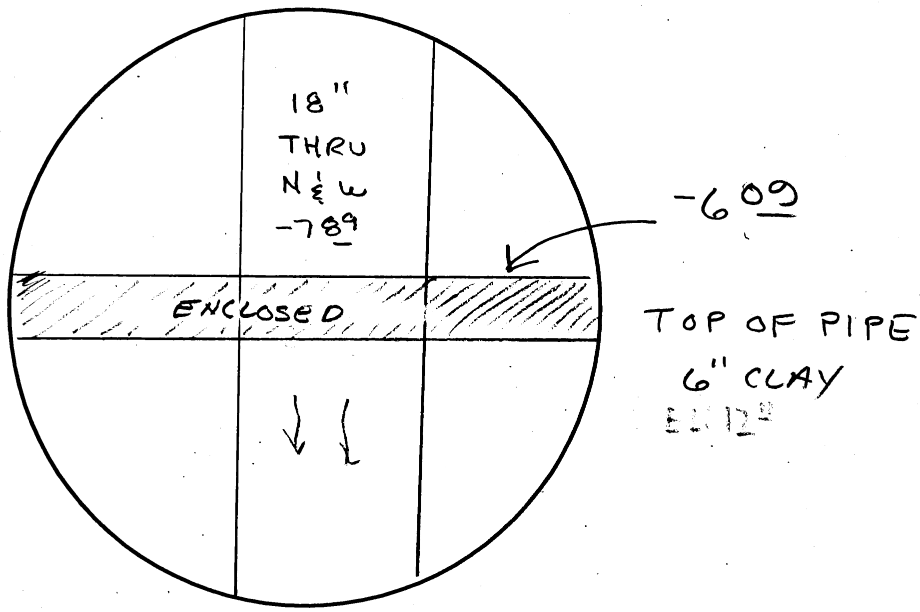
SSMH NO: MH 32P067

EX. RIM ELEV: 18.70

STREET INTERSECTION: SIERRA NEVADA & LINDSAY

SCALE N.T.S.

- CONCRETE BARREL • GOOD CONDITION
- SLOW FLOW SOUTH



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5033

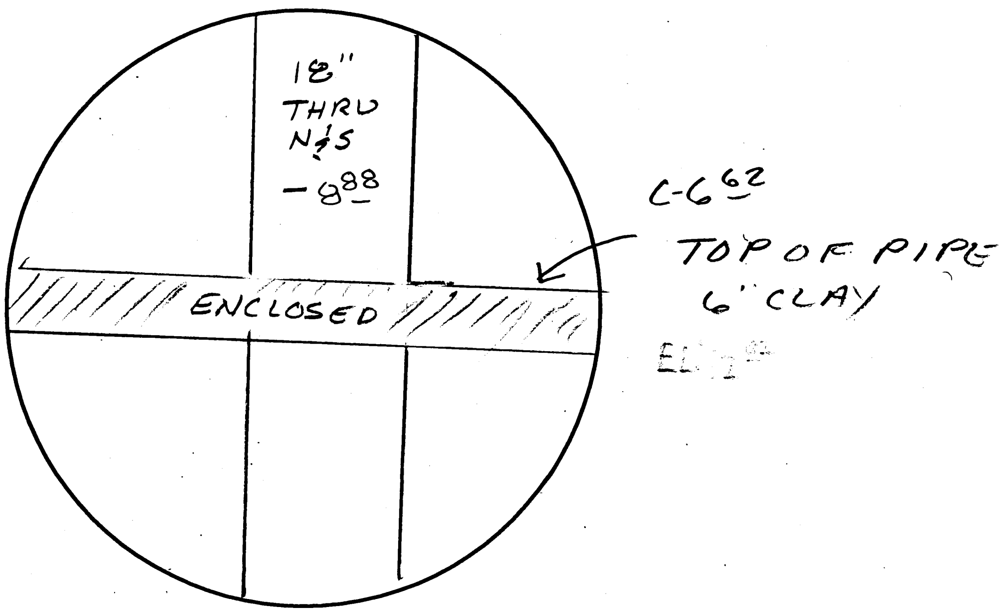
SSMH NO: MH32P090

EX. RIM ELEV: 19.20

STREET INTERSECTION: MINER & SIERRA NEVADA

SCALE N.T.S.

- CONCRETE GOOD CONDITION
- HEAVY FLOW SOUTH



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5034

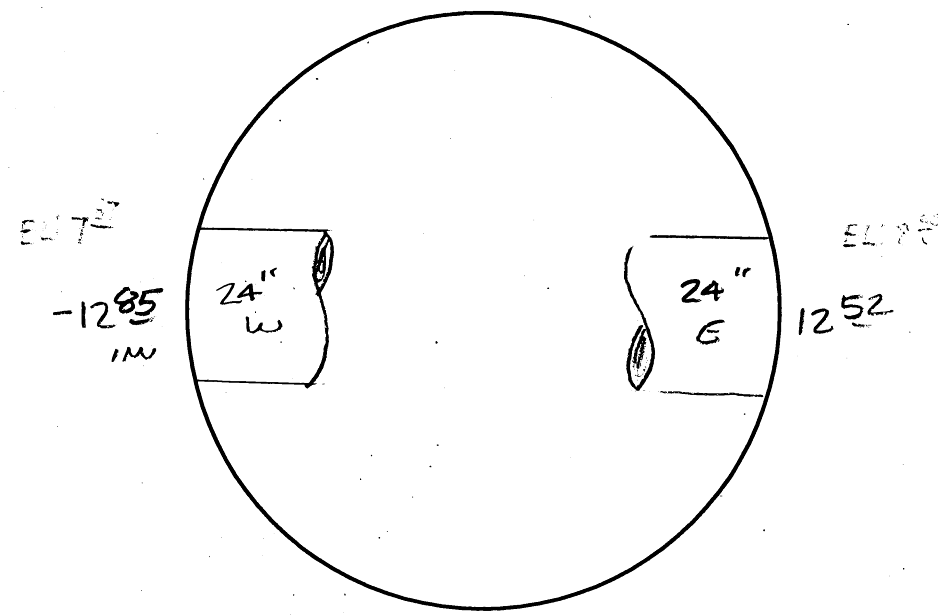
SSMH NO: MH 32P012

EX. RIM ELEV: 20.52

STREET INTERSECTION: FREMONT @ WEST OF "A" ST.

SCALE N.T.S.

- BRICK & MORTAR BARREL - GOOD CONDITION
- STAGNANT - NO FLOW (APPARENT)
- HEAVY SEDIMENT - 3"± DEEP



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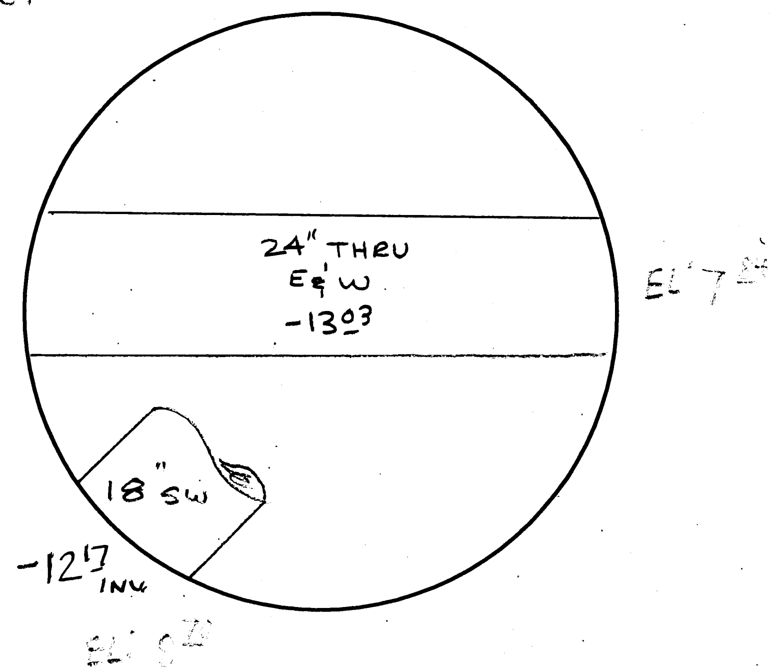
JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-24-2020
PT. NUMBER: 5035
SSMH NO: MHP003
EX. RIM ELEV: 20.87
STREET INTERSECTION: FREMONT @ EAST OF "A" ST

SCALE N.T.S.

- BRICK & MORTAR GOOD CONDITION
- NO APPARENT FLOW
- DEBRIS 6" ± DEEP



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SHEET	OF

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DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5036

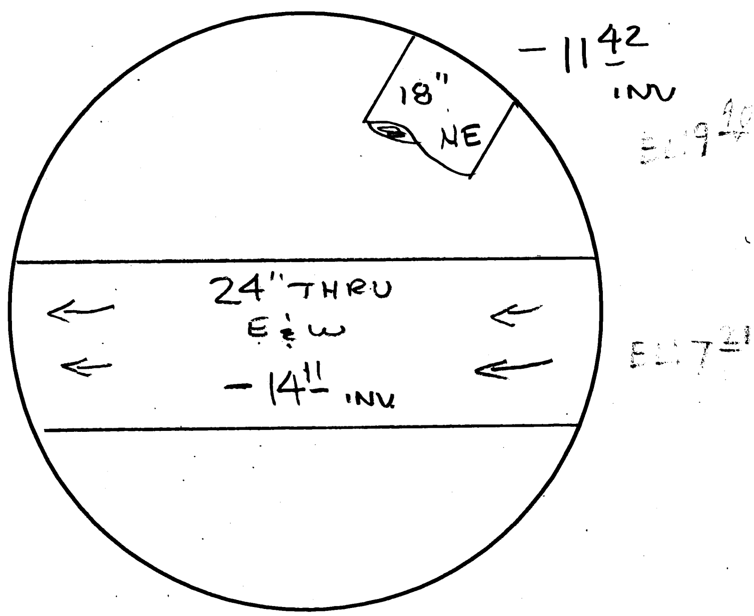
SSMH NO: MH 32P009

EX. RIM ELEV: 21.33

STREET INTERSECTION: FREMONT EAST OF "A" ST.

SCALE N.T.S.

- CONCRETE BARREL GOOD CONDITION
- GOOD FLOW WEST



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5037

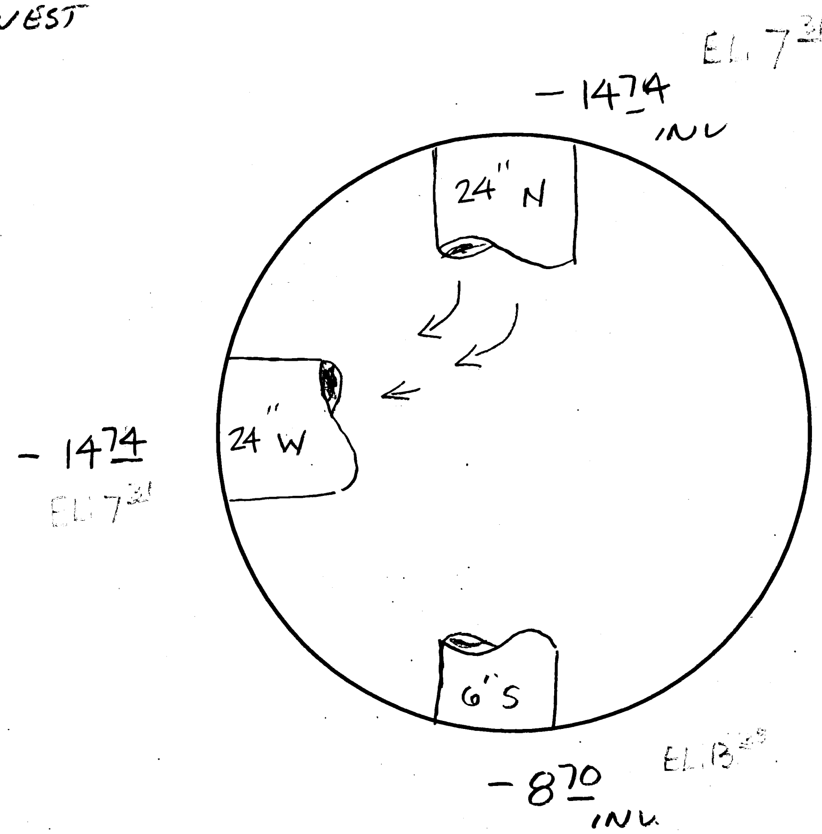
SSMH NO: MH 31Q113

EX. RIM ELEV: 22.05

STREET INTERSECTION: FREMONT @ WIZARD

SCALE N.T.S.

- BRICK & MORTAR BARREL - GOOD CONDITION
- FLOW WEST



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SHEET	OF

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-20

PT. NUMBER: 5038

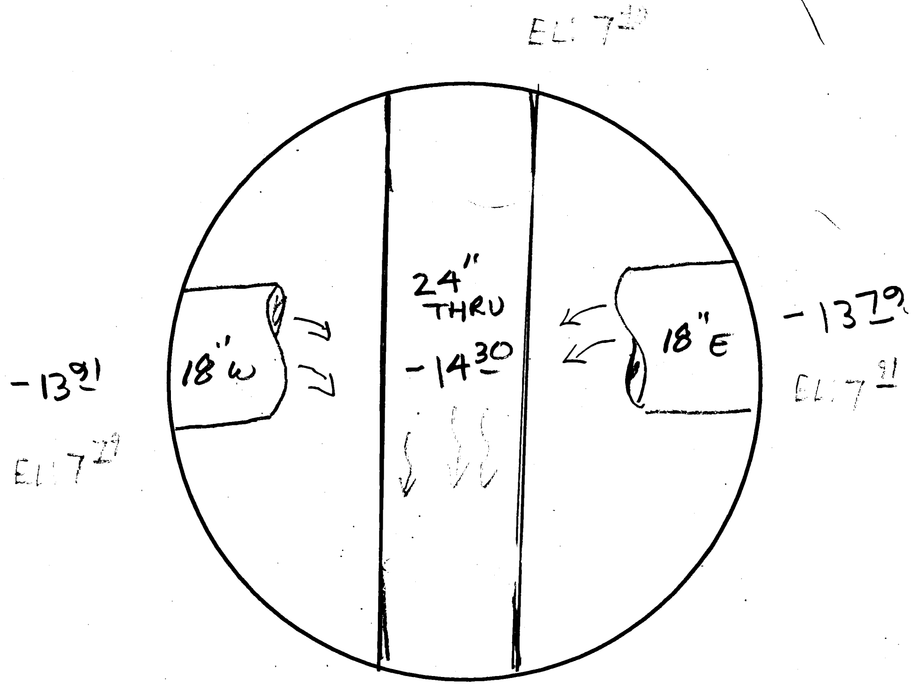
SSMH NO: MH 31 Q112

EX. RIM ELEV: 21.70

STREET INTERSECTION: WIZARD & FREMONT

SCALE N.T.S.

- CONCRETE BARREL
- GOOD CONDITION
- FLOWING SOUTH



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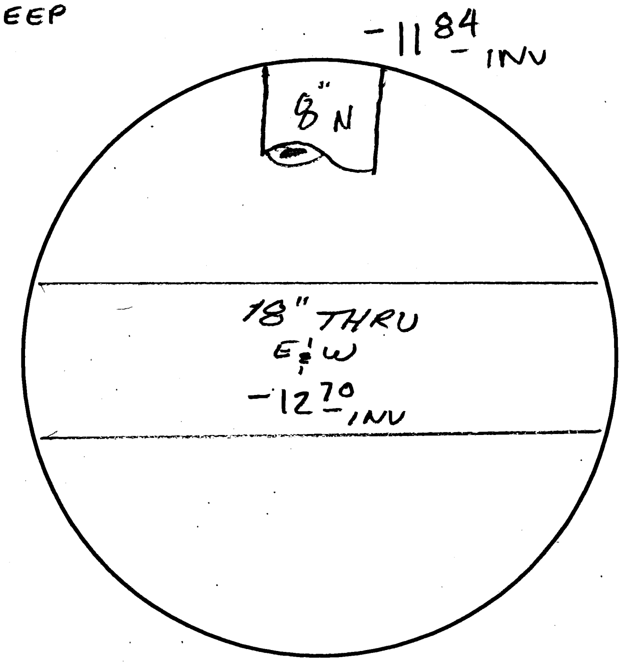
SHEET	OF

JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-24-2020
PT. NUMBER: 5039
SSMH NO: MH 32 Q001
EX. RIM ELEV: 20.86
STREET INTERSECTION: FREMONT @ WEST OF WIZARD

SCALE N.T.S.

- CONCRETE BARREL - GOOD CONDITION
- NO APPARENT FLOW
- SEDIMENT 3"± DEEP



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PLOTTED: 09/18/20 13:50 PLOTTED BY: hpuryear
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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5640

SSMH NO: MH 31R031

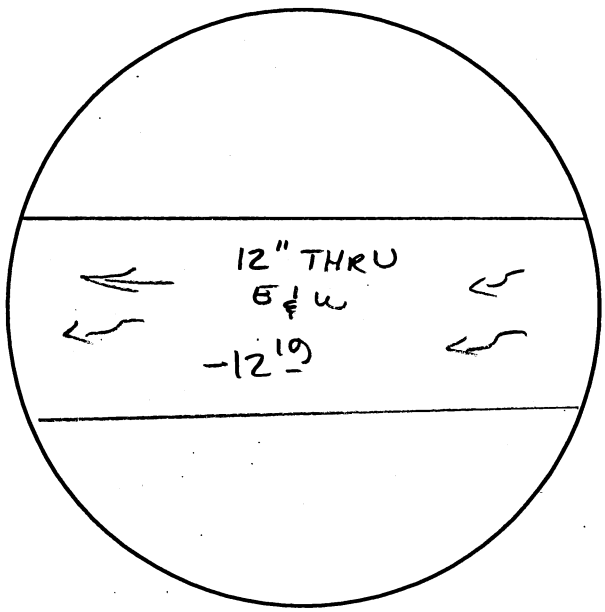
EX. RIM ELEV: 22.68

STREET INTERSECTION: FREMONT @ E OF FILBERT

SCALE N.T.S.

• CONCRETE BARREL GOOD CONDITION

• FLOWING WEST



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9·24·2020

PT. NUMBER: 5041

SSMH NO: MH 31R030

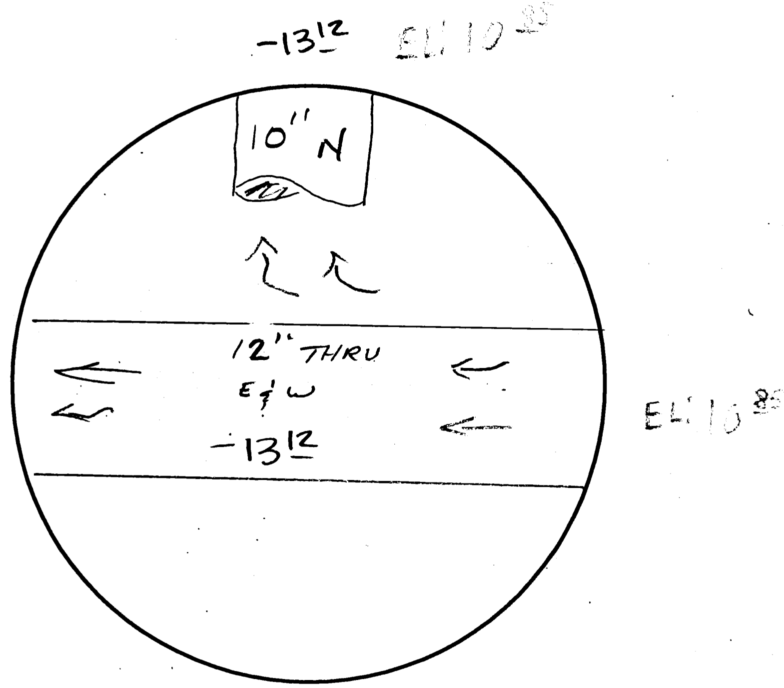
EX. RIM ELEV: 23.97

STREET INTERSECTION: FREMONT & FILBERT

SCALE N.T.S.

• CONCRETE BARREL • GOOD CONDITION

• FLOWING WEST & NORTHERLY



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5042

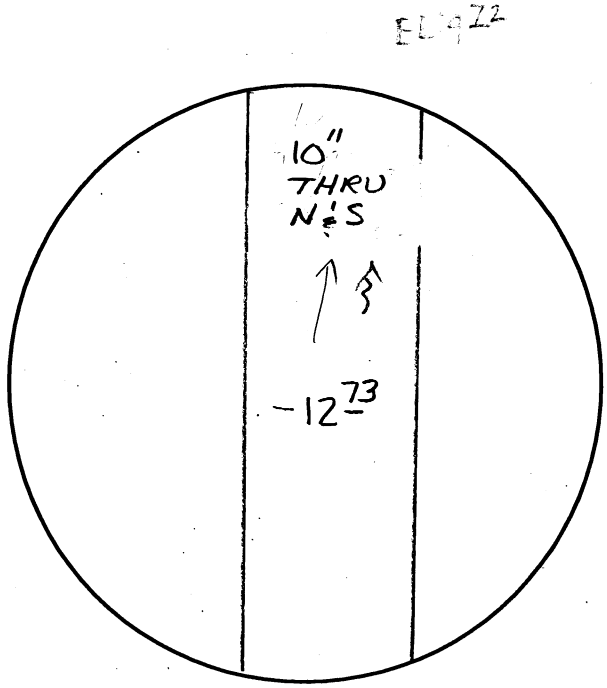
SSMH NO: MH 31R005

EX. RIM ELEV: 22.45

STREET INTERSECTION: FILBERT @ N OF FREMONT

SCALE N.T.S.

- CONC BARREL - GOOD CONDITION
- FLOWING NORTH



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9-24-2020

PT. NUMBER: 5043

SSMH NO: MH 31R055

EX. RIM ELEV: 23.35

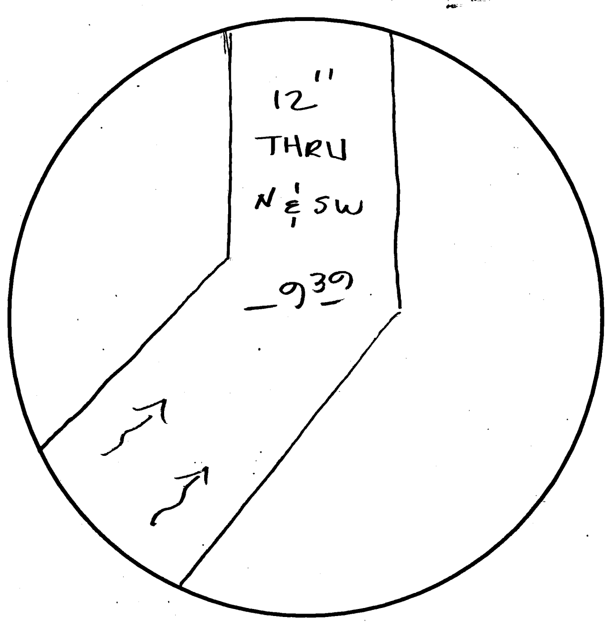
STREET INTERSECTION: SHASTA & MINER

SCALE N.T.S.

• CONCRETE BARREL - GOOD CONDITION

• SLOW FLOW NORTHERLY

EL 13



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JOB NUMBER: J20-2649

SURVEY CREW: >R DS

DATE: 9-24-2020

PT. NUMBER: 5044

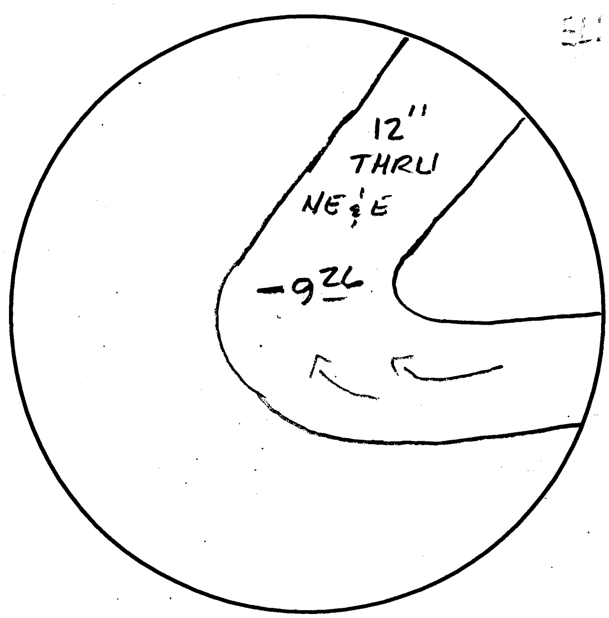
SSMH NO: MH 31R056

EX. RIM ELEV: 23.34

STREET INTERSECTION: SHASTA & MINER

SCALE N.T.S.

- CONCRETE BARREL - GOOD CONDITION
- FLOWING NORTHERLY
- NO WEST PIPE



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JOB NUMBER: J20-2649

SURVEY CREW: JR/JS

DATE: 9.24.2020

PT. NUMBER: 5046

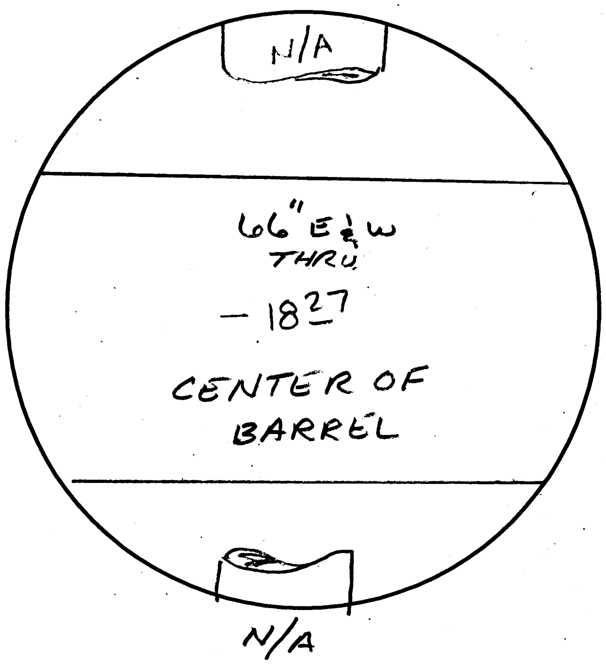
SSMH NO: MH 41Q025

EX. RIM ELEV: 18.73

STREET INTERSECTION: INDUSTRIAL DR @ GIBRALTAR

SCALE N.T.S.

- CONCRETE BARREL · GOOD CONDITION
- FLOWING NORTH & WEST
- INVERTS NORTH & SOUTH NOT ATTAINABLE



EL: 0.46

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DATE: 9/23/2020

SCALE: NTS

DRAWN:

DESIGN:

CHK'D:

SHEET

OF

JOB NUMBER: J20-2649

SURVEY CREW: JR/DS

DATE: 9-24-2020

PT. NUMBER: 5047

SSMH NO: MH 41Q024

EX. RIM ELEV: 18.12

STREET INTERSECTION: INDUSTRIAL & GIBRALTAR

SCALE N.T.S.

- CONCRETE BARREL FAIR CONDITION - SOME SPACKLE FLAKING
- STAGNANT - 12" ± DEEP STILL WATER
- NO APPARENT FLOW

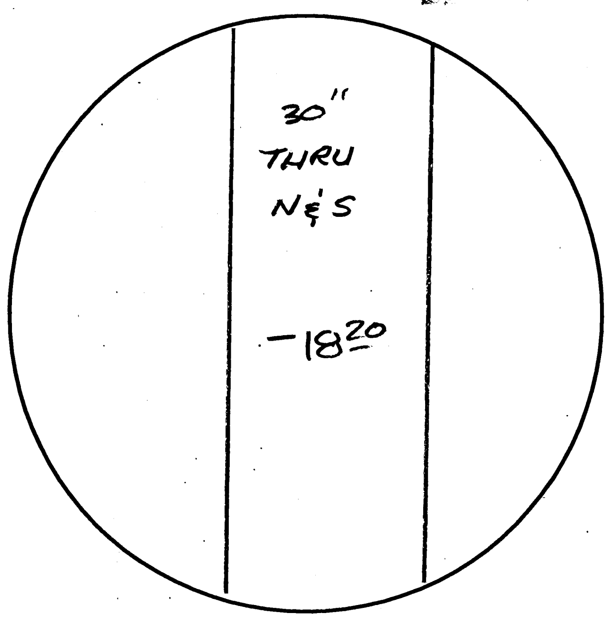

PHOTO FILE NO: ______

NorthStar Engineering Group, Inc.
• CIVIL ENGINEERING • SURVEYING • PLANNING •
620 12th Street Modesto, CA 95354
(209) 524-3525 Phone (209) 524-3526 Fax

SEWER MANHOLE NO. ______

CITY OF STOCKTON

SEWER MANHOLE ASBUILT

STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	OF

PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-24-2020
PT. NUMBER: 5048
SSMH NO: MH 41P036
EX. RIM ELEV: 18.66
STREET INTERSECTION: INDUSTRIAL @ WEST OF GIBRALTAR

SCALE N.T.S.

- CONCRETE BARREL - GOOD CONDITION
- HEAVY FLOW WEST

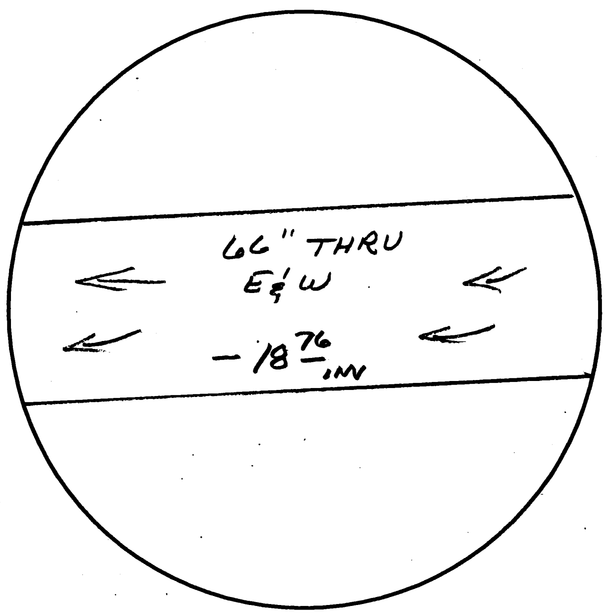

PHOTO FILE NO: ____________

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620 12th Street Modesto, CA 95354
(209) 524-3525 Phone (209) 524-3526 Fax

SEWER MANHOLE NO. ____________

CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

JOB NUMBER: J20-2649
SURVEY CREW: JR/JS
DATE: 9-24-2020
PT. NUMBER: 5049
SSMH NO: MH 35P012
EX. RIM ELEV: 17.40
STREET INTERSECTION: WILSON WAY @ N. OF JACKSON ST.

SCALE N.T.S.

- CONCRETE BARREL - GOOD CONDITION
- FLOWING WEST

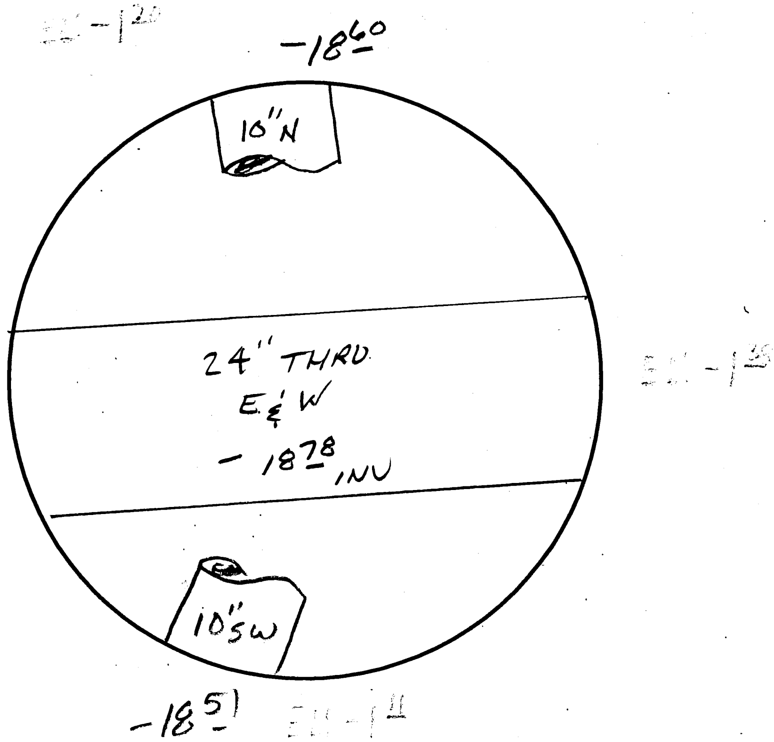

PHOTO FILE NO: ____________________

NorthStar Engineering Group, Inc.
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620 12th Street Modesto, CA 95354
(209) 524-3525 Phone (209) 524-3526 Fax

SEWER MANHOLE NO. ____________

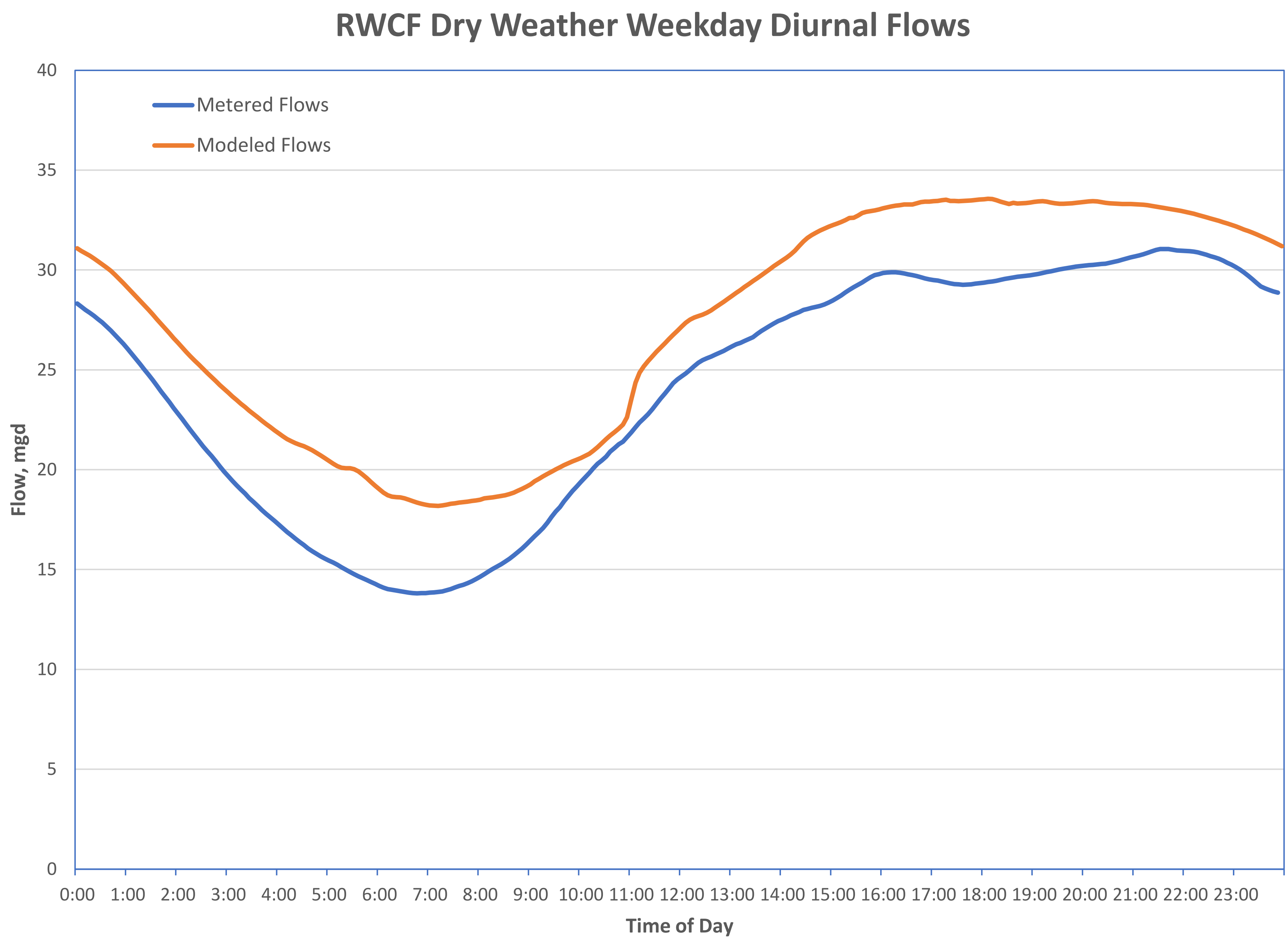
CITY OF STOCKTON
SEWER MANHOLE ASBUILT
STOCKTON, CALIFORNIA

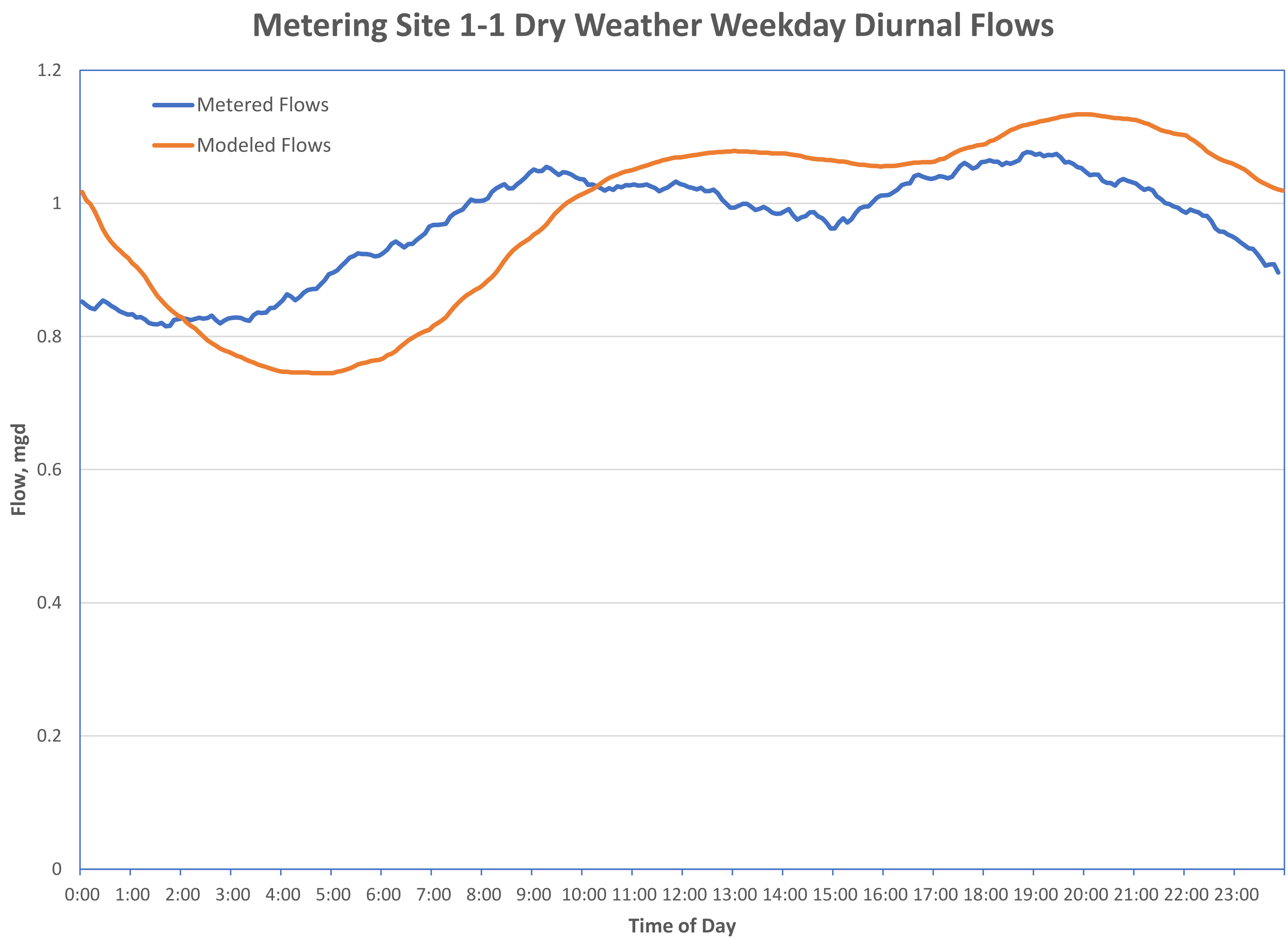
JOB:	J20-260
DATE:	9/23/2020
SCALE:	NTS
DRAWN:	
DESIGN:	
CHK'D:	
SHEET	
OF	

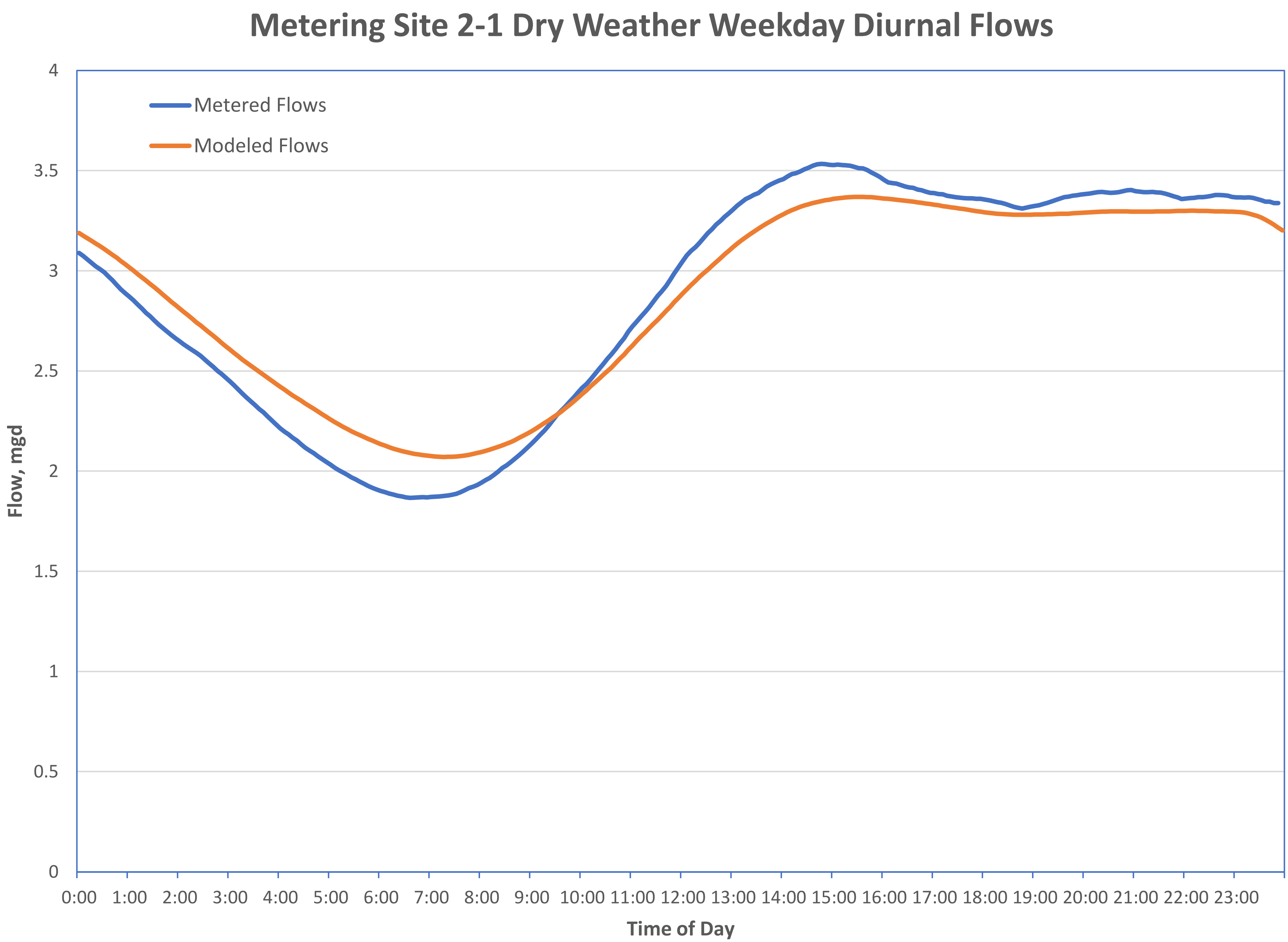
PLOTTED: 09/18/20 13:50 PLOTTED BY: Hpuryear
DWG NAME: K:\J20-2649 Stockton Manhole Survey\DWG_Field\manhole template.dwg

Appendix D

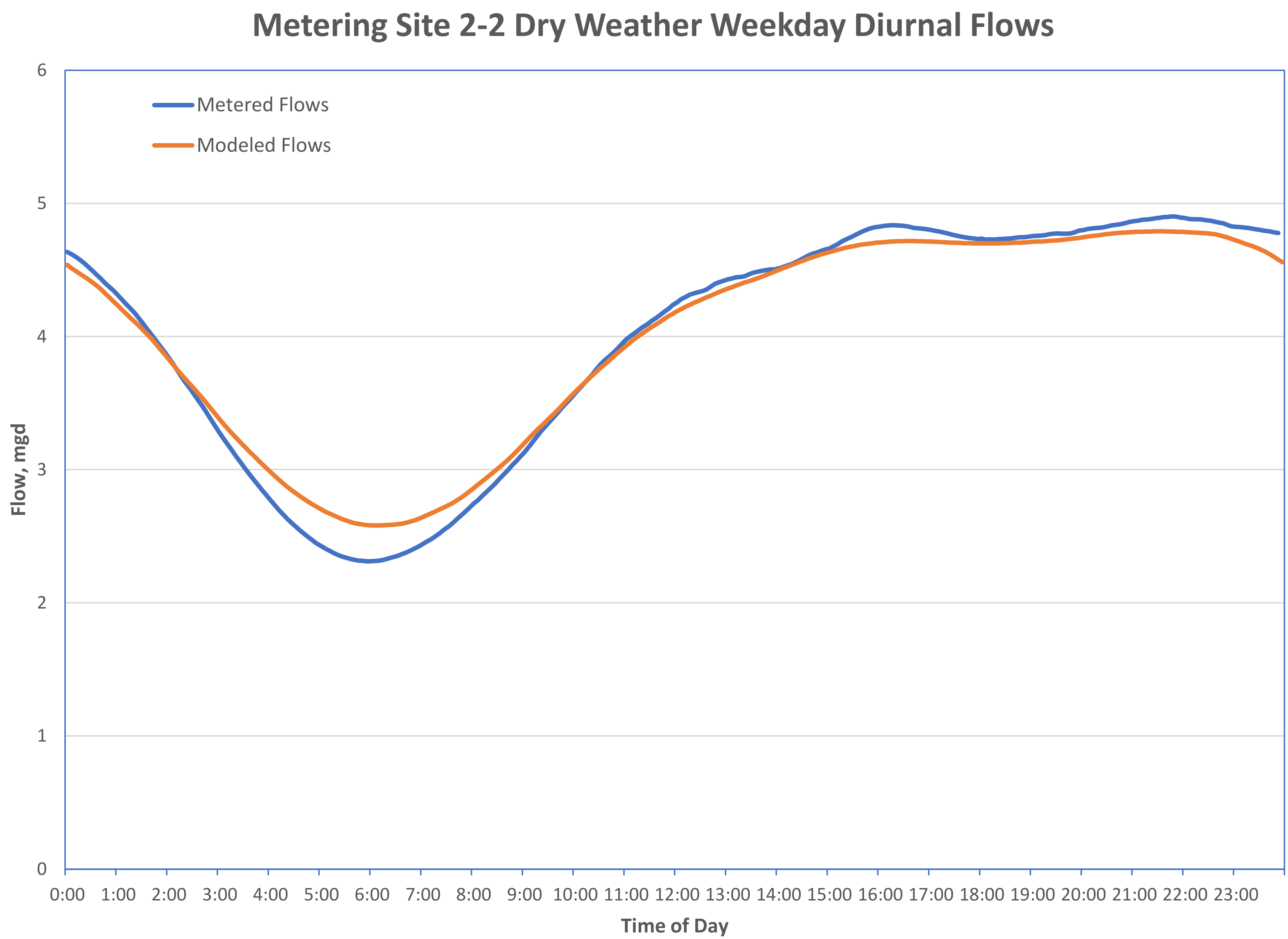
Modeled vs. Metered Dry Weather Diurnal Flows

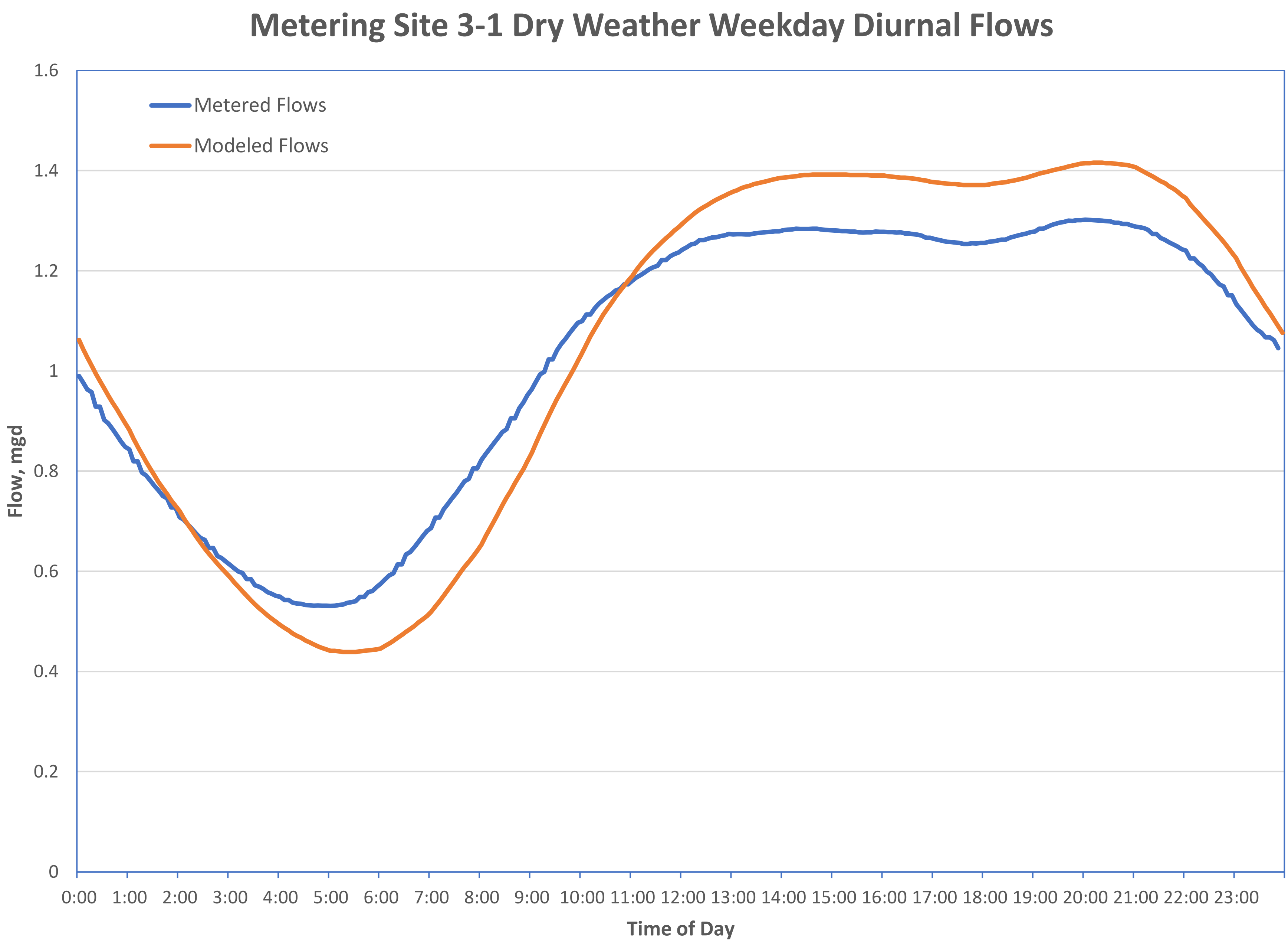

RWCF Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
Time of Day
0
5
10
15
20
25
30
35
40
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

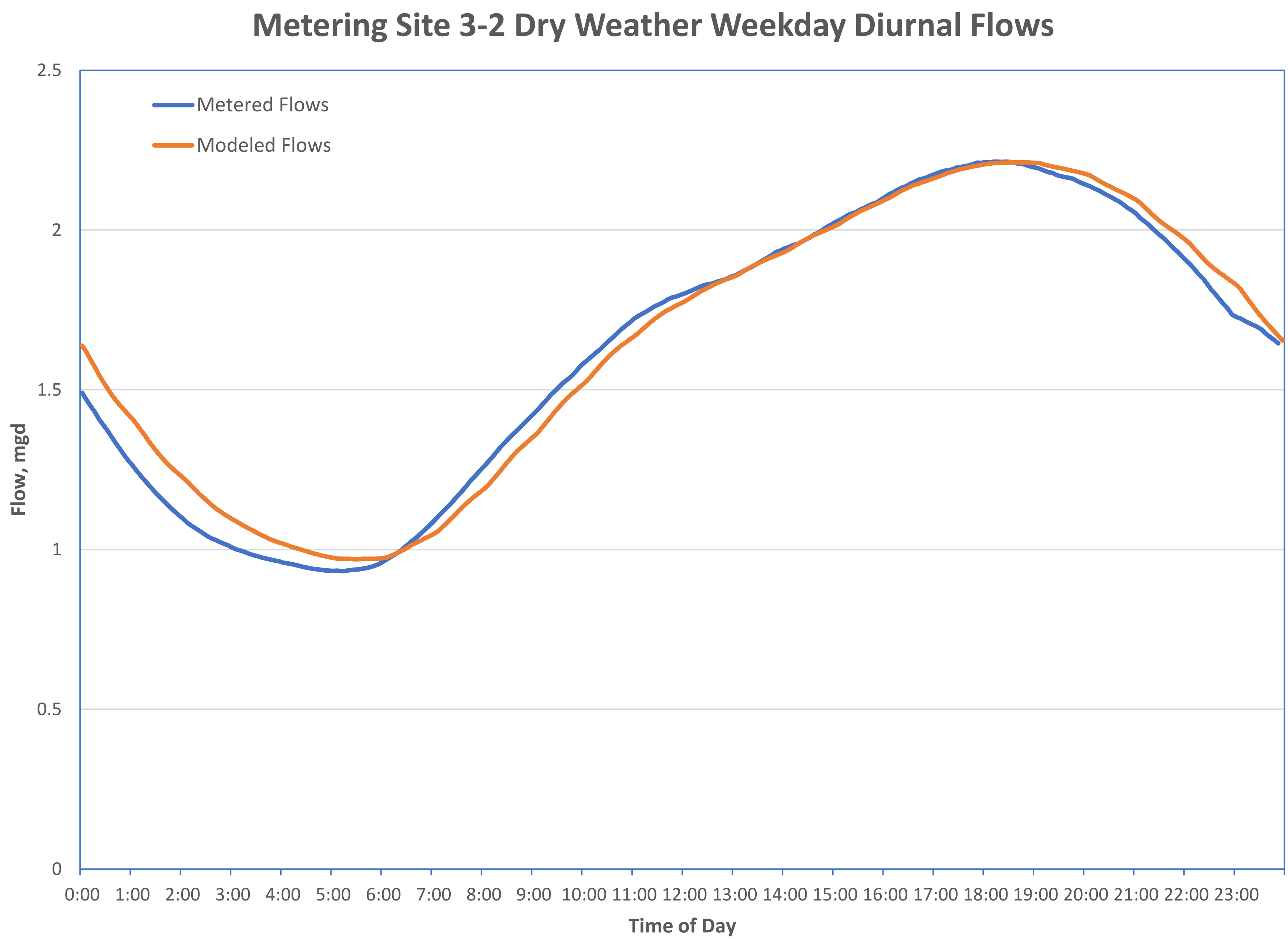

Metering Site 1-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
1.2
1
0.8
0.6
0.4
0.2
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day



Metering Site 2-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.5
1
1.5
2
2.5
3
3.5
4
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day


Metering Site 2-2 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
1
2
3
4
5
6
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day


Metering Site 3-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day


Metering Site 3-2 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
Time of Day
0
0.5
1
1.5
2
2.5
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
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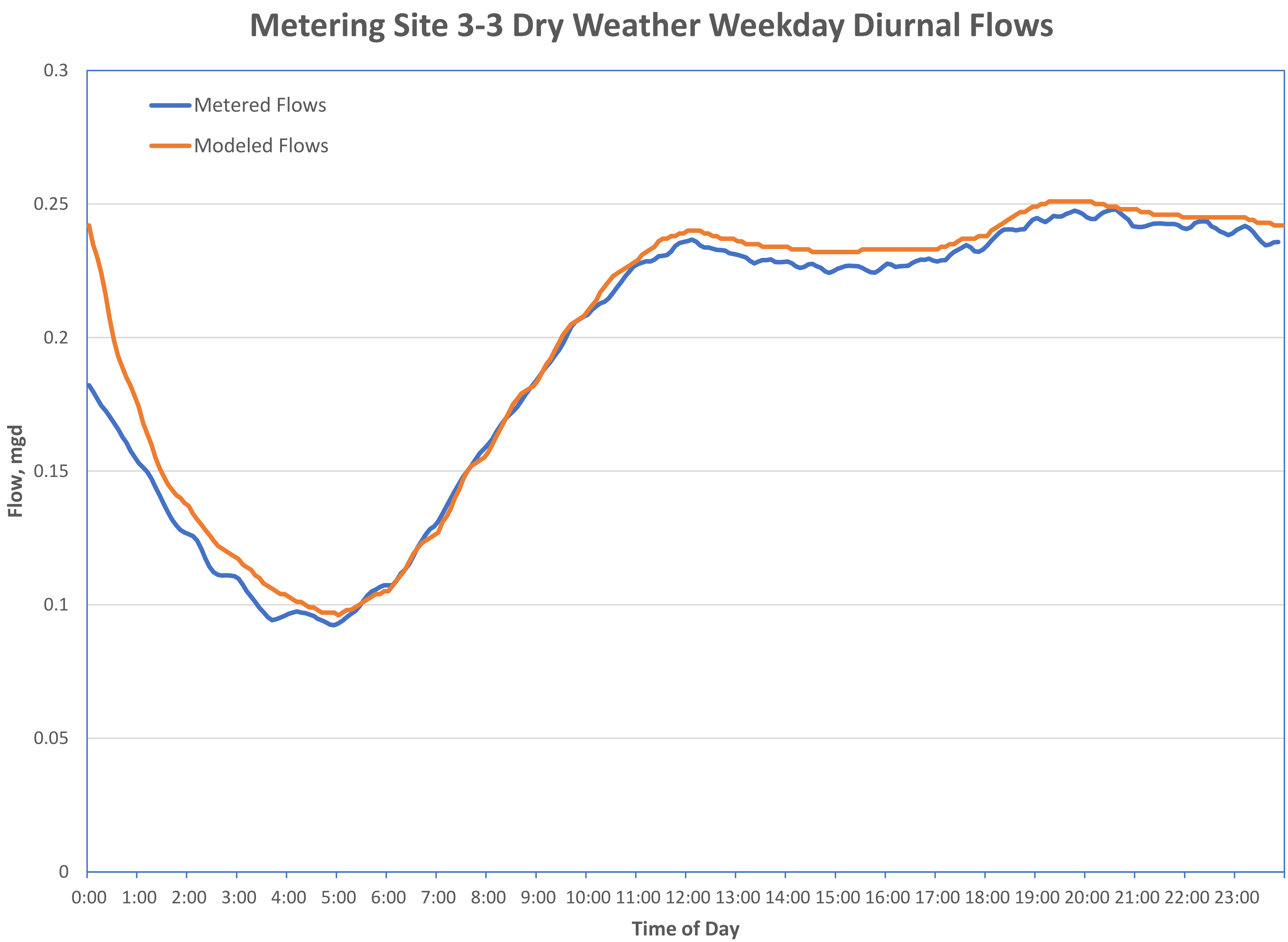
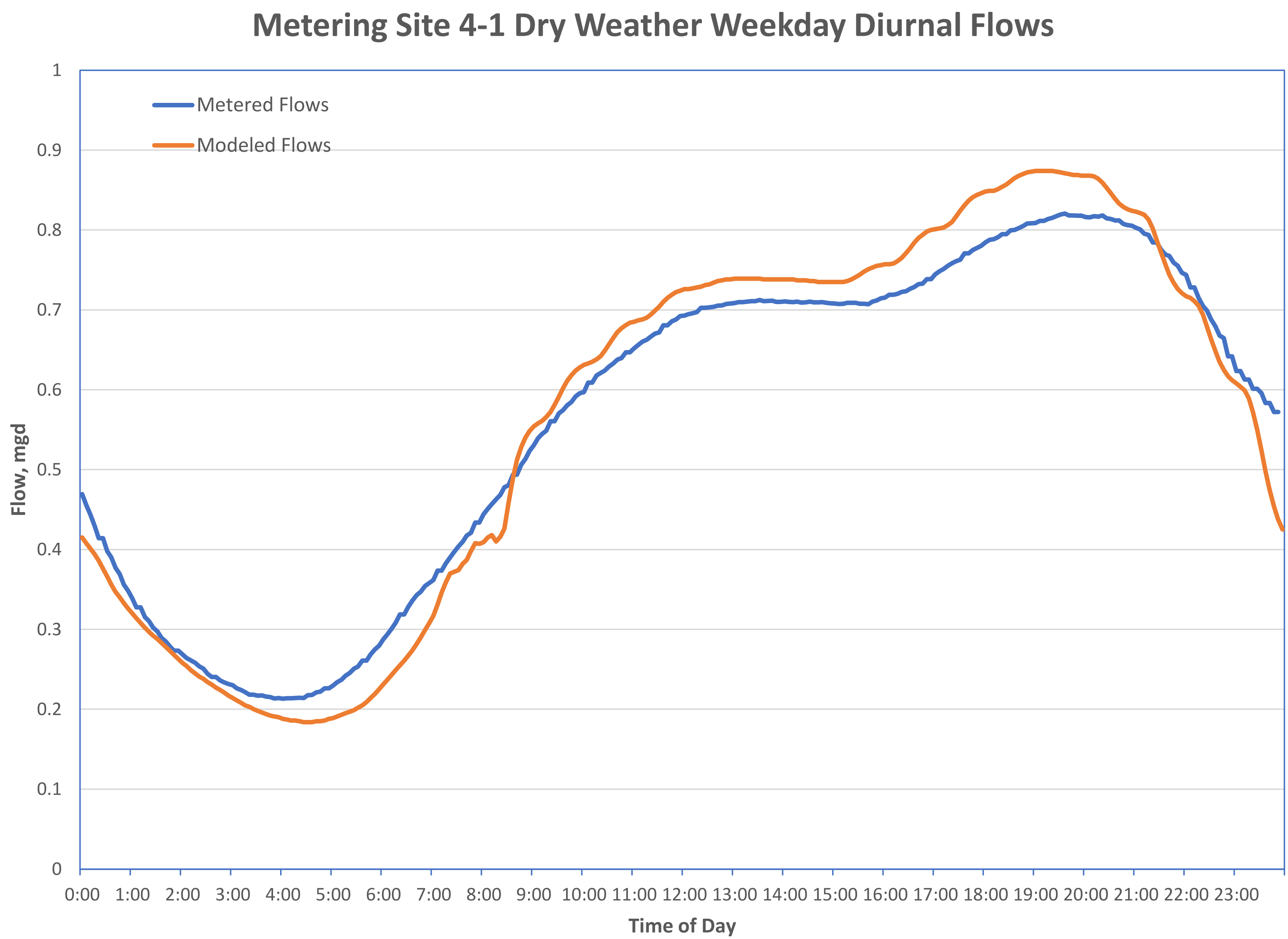
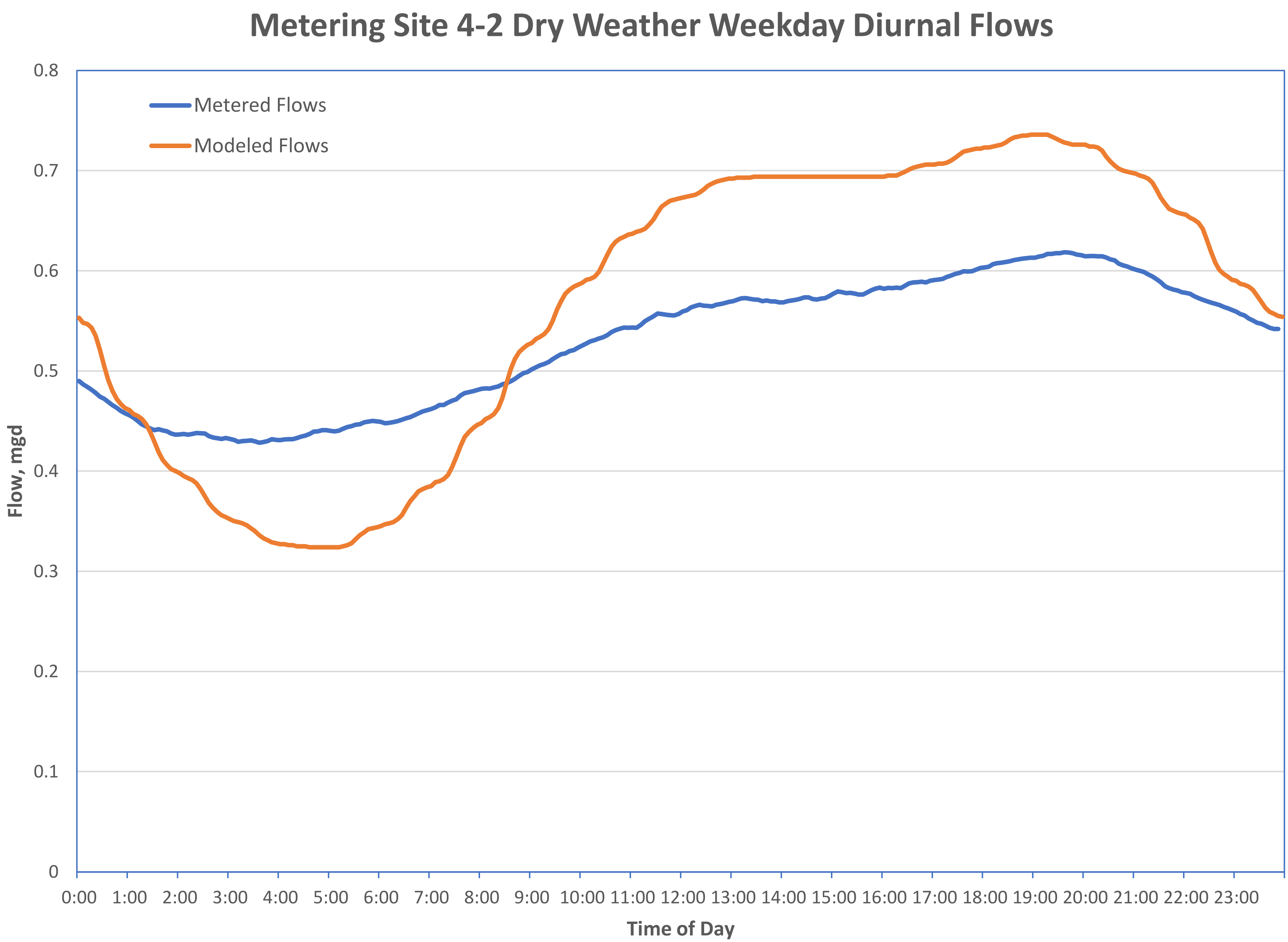
18:00
19:00
20:00
21:00
22:00
23:00

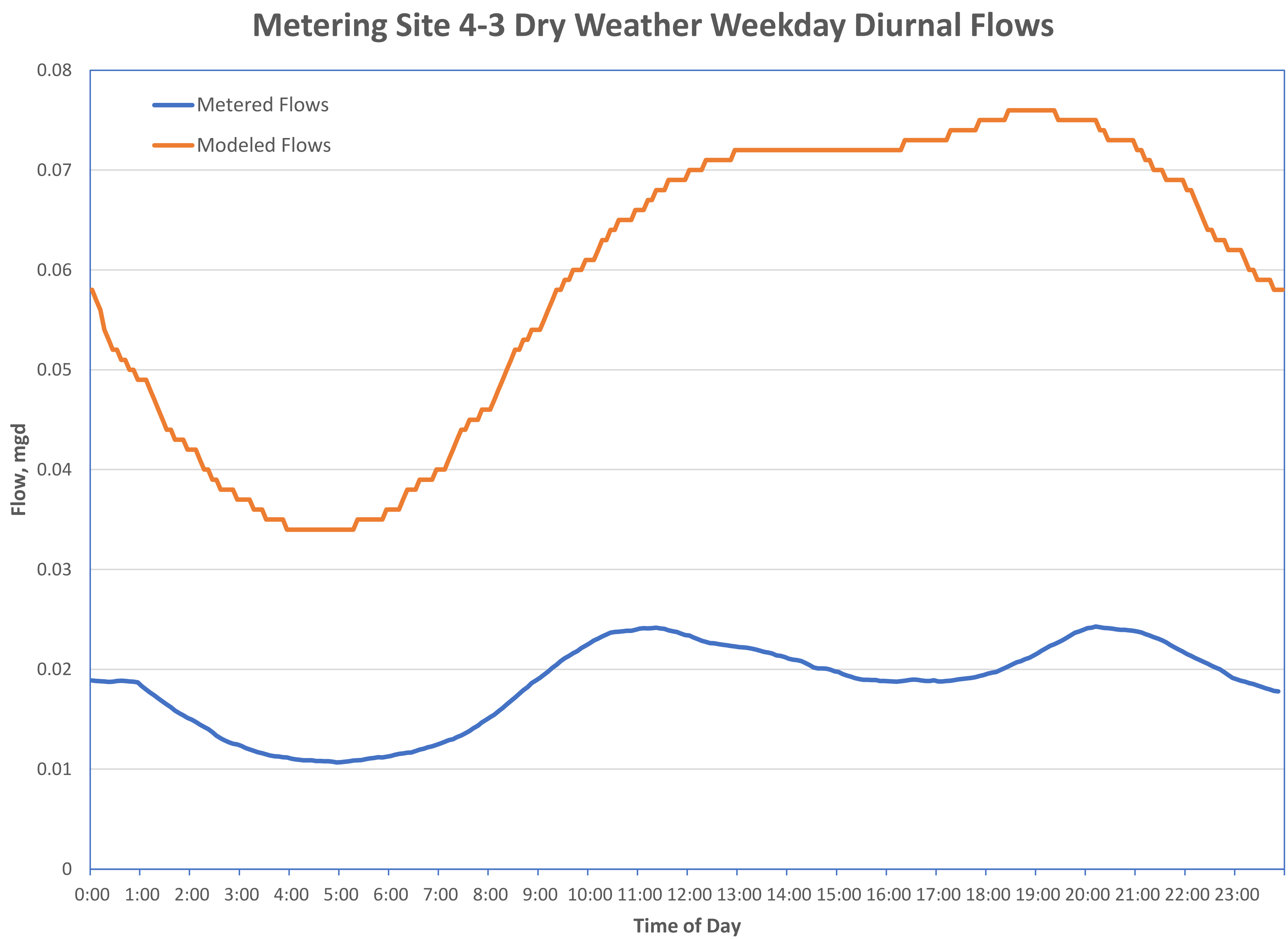

Metering Site 3-3 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.05
0.1
0.15
0.2
0.25
0.3
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day



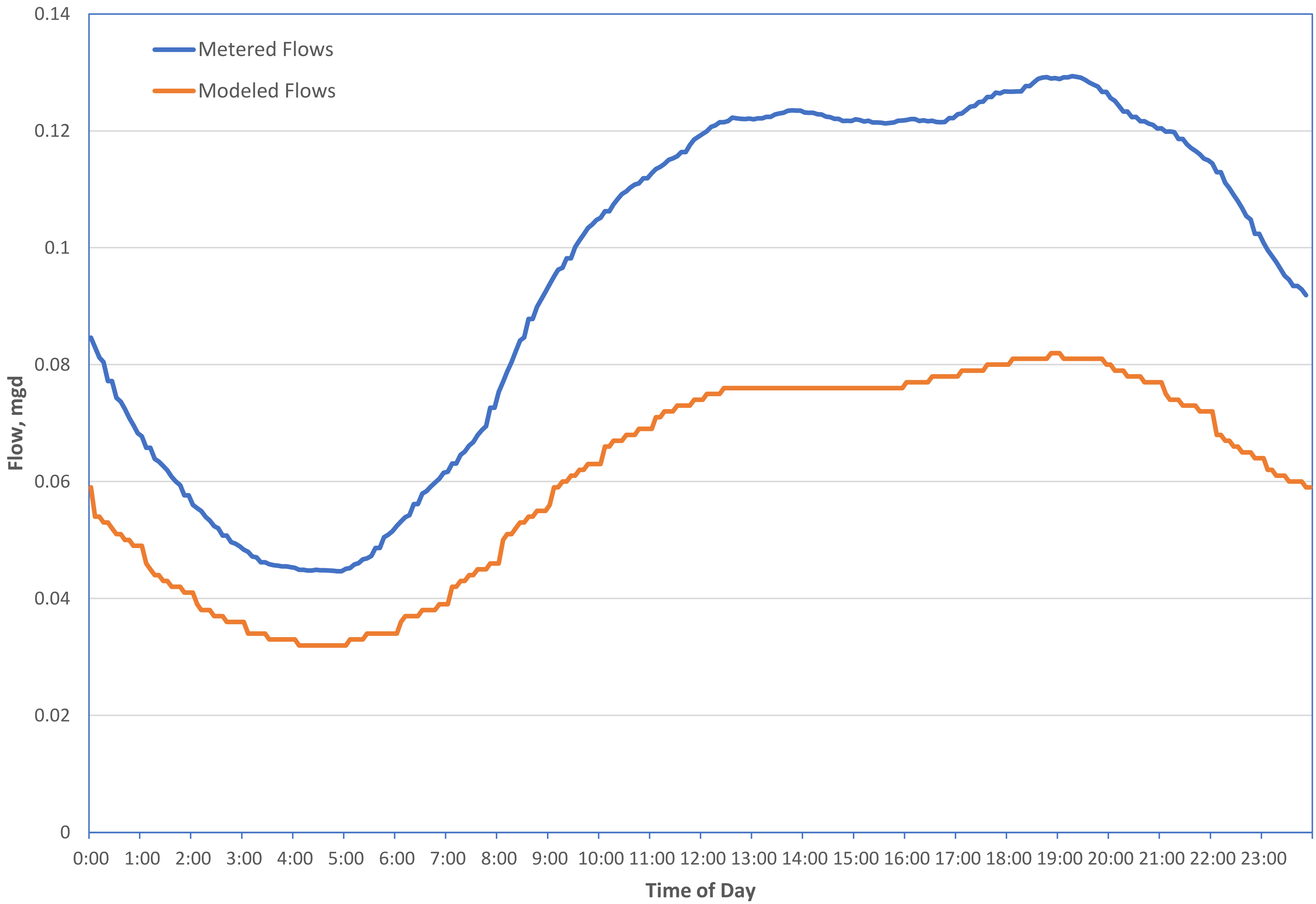
Metering Site 4-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day

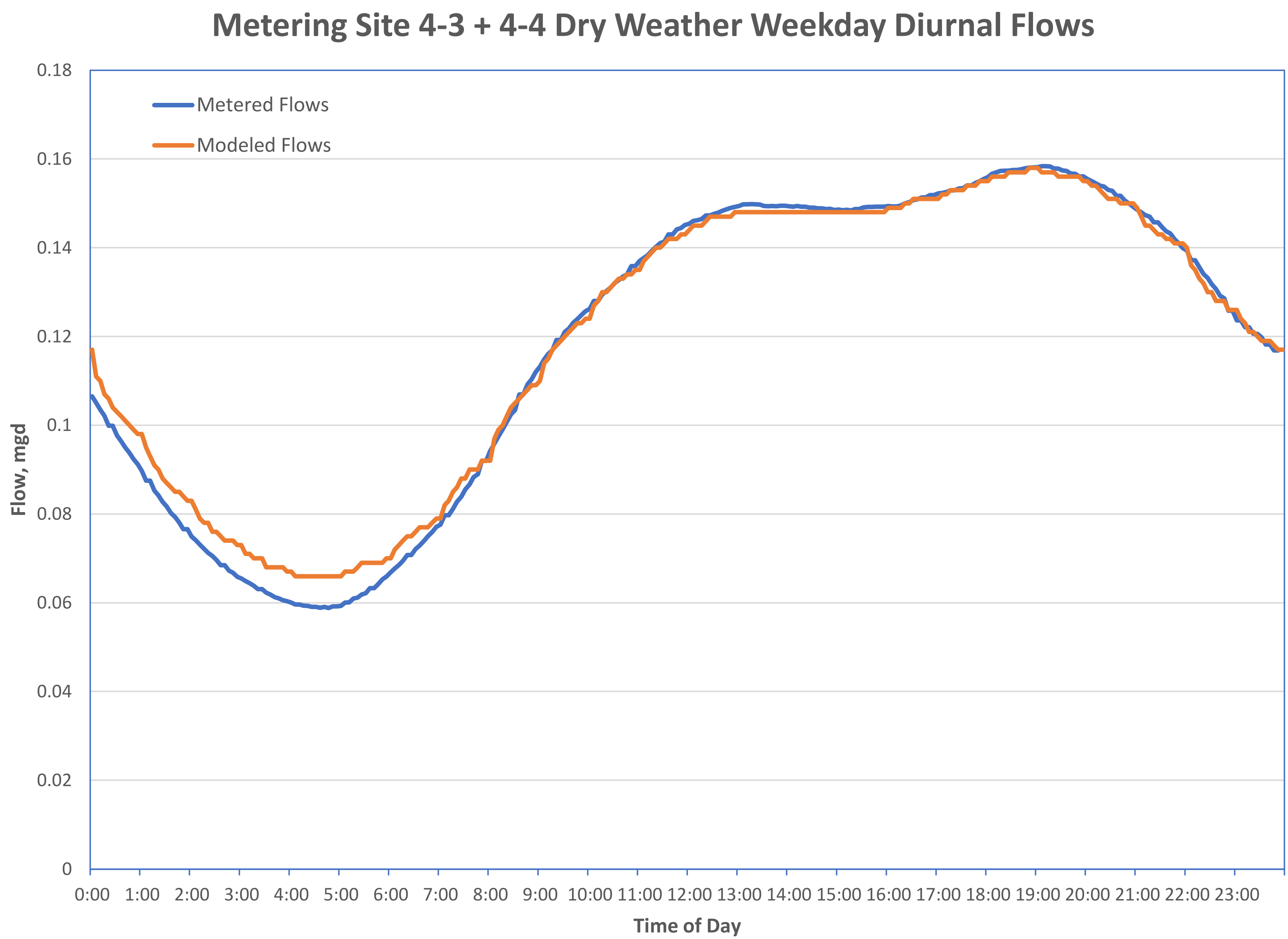


Metering Site 4-2 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day

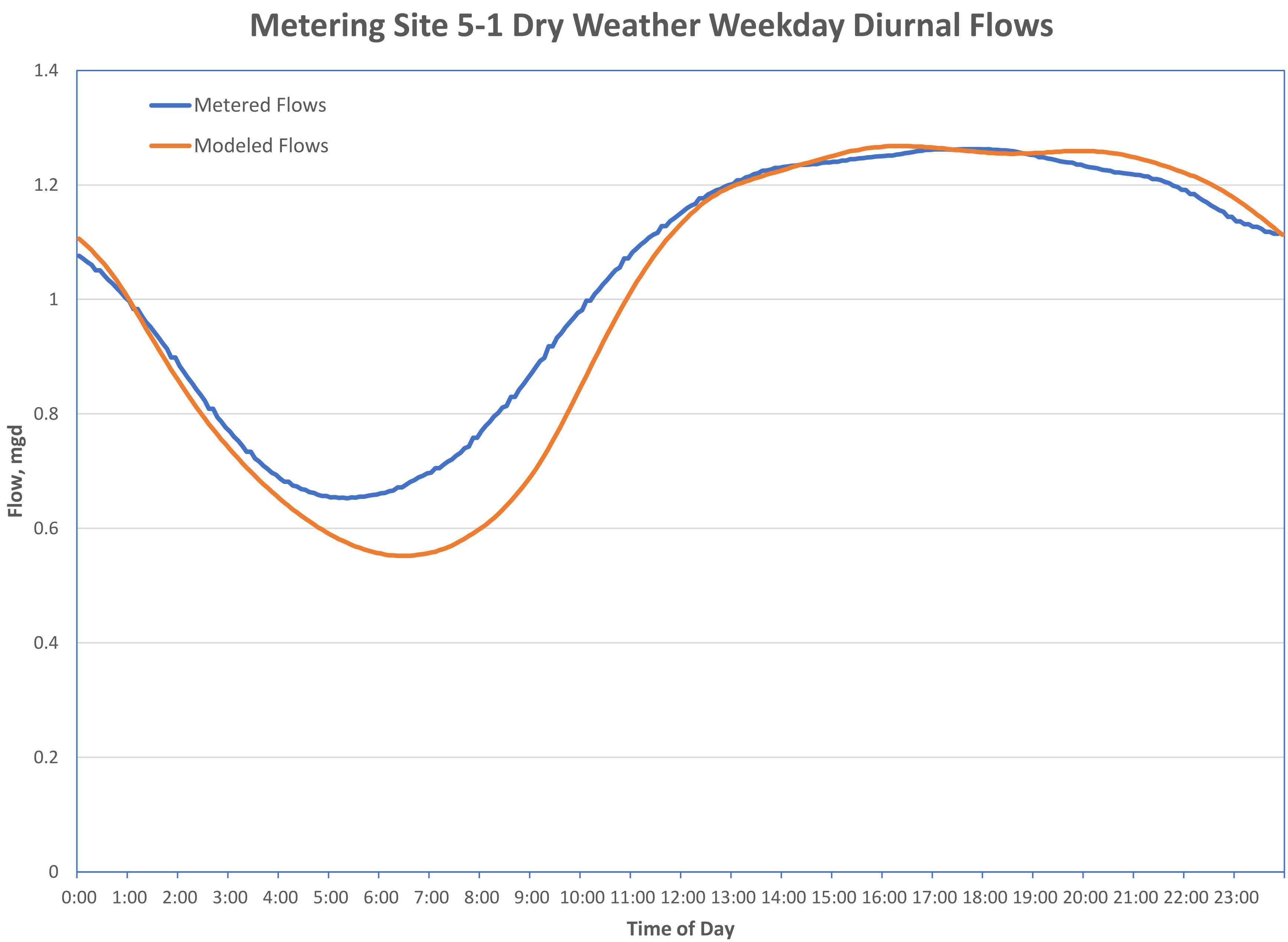

Metering Site 4-3 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day

Metering Site 4-4 Dry Weather Weekday Diurnal Flows

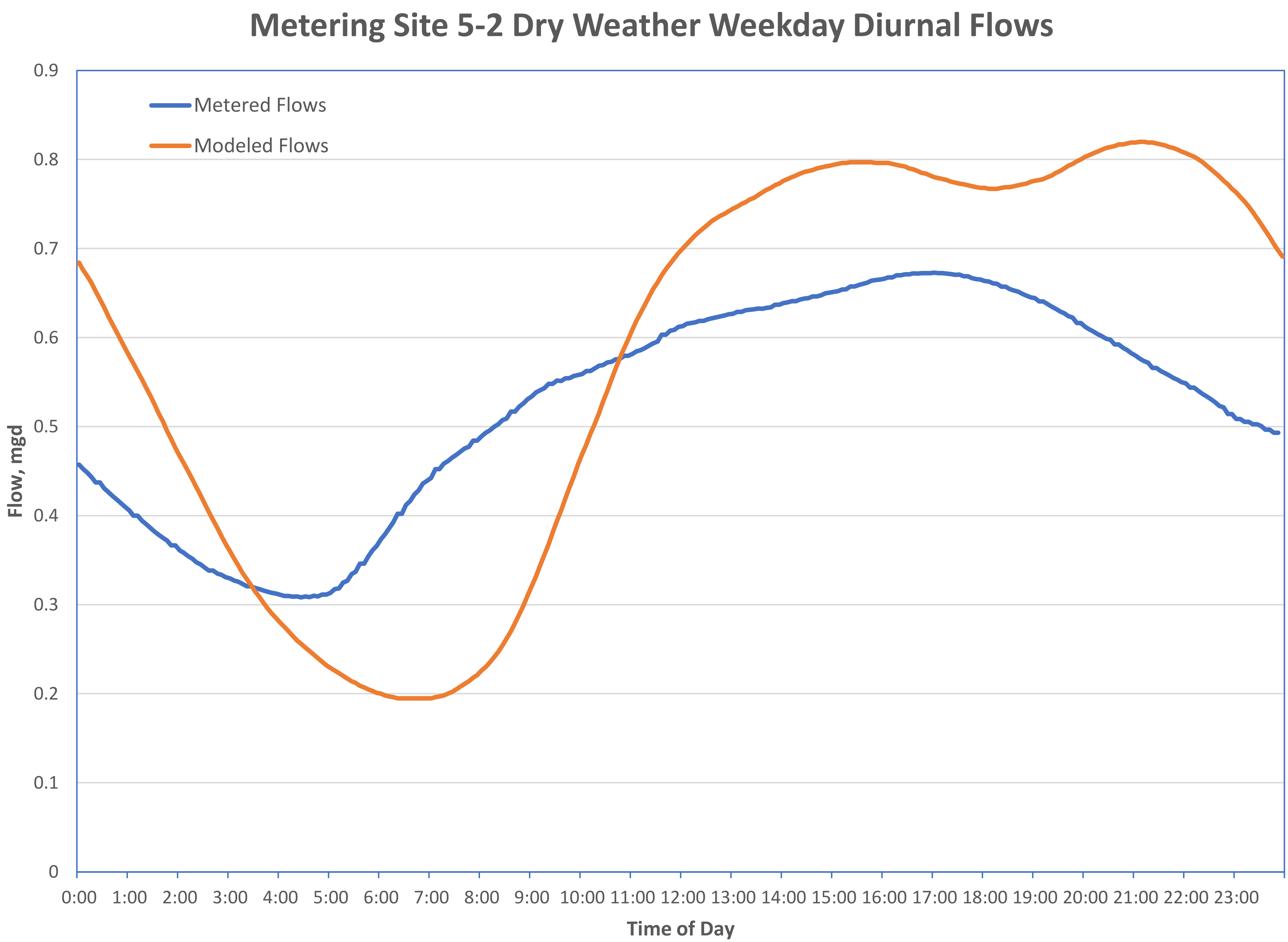


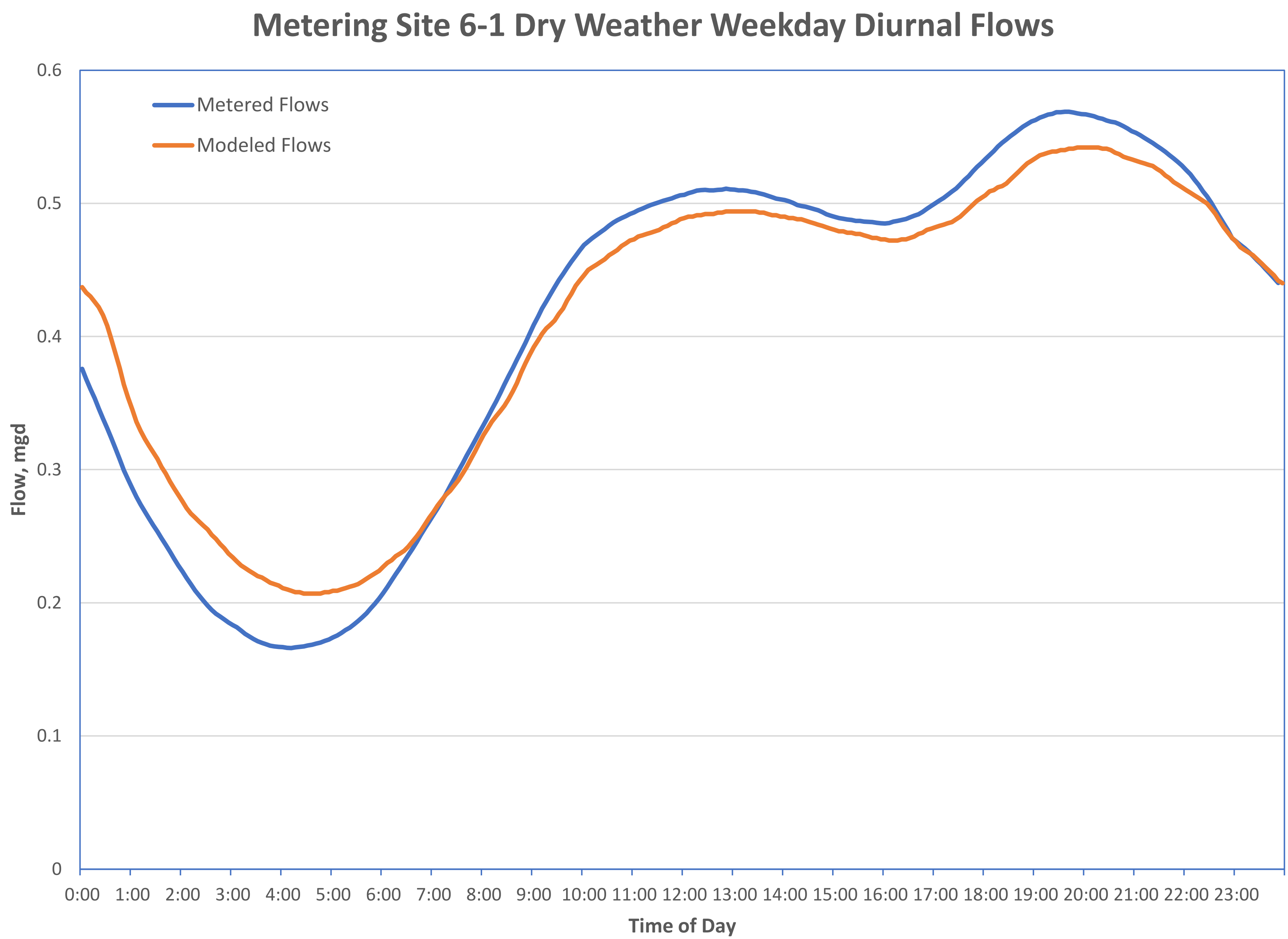


Metering Site 4-3 + 4-4 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day

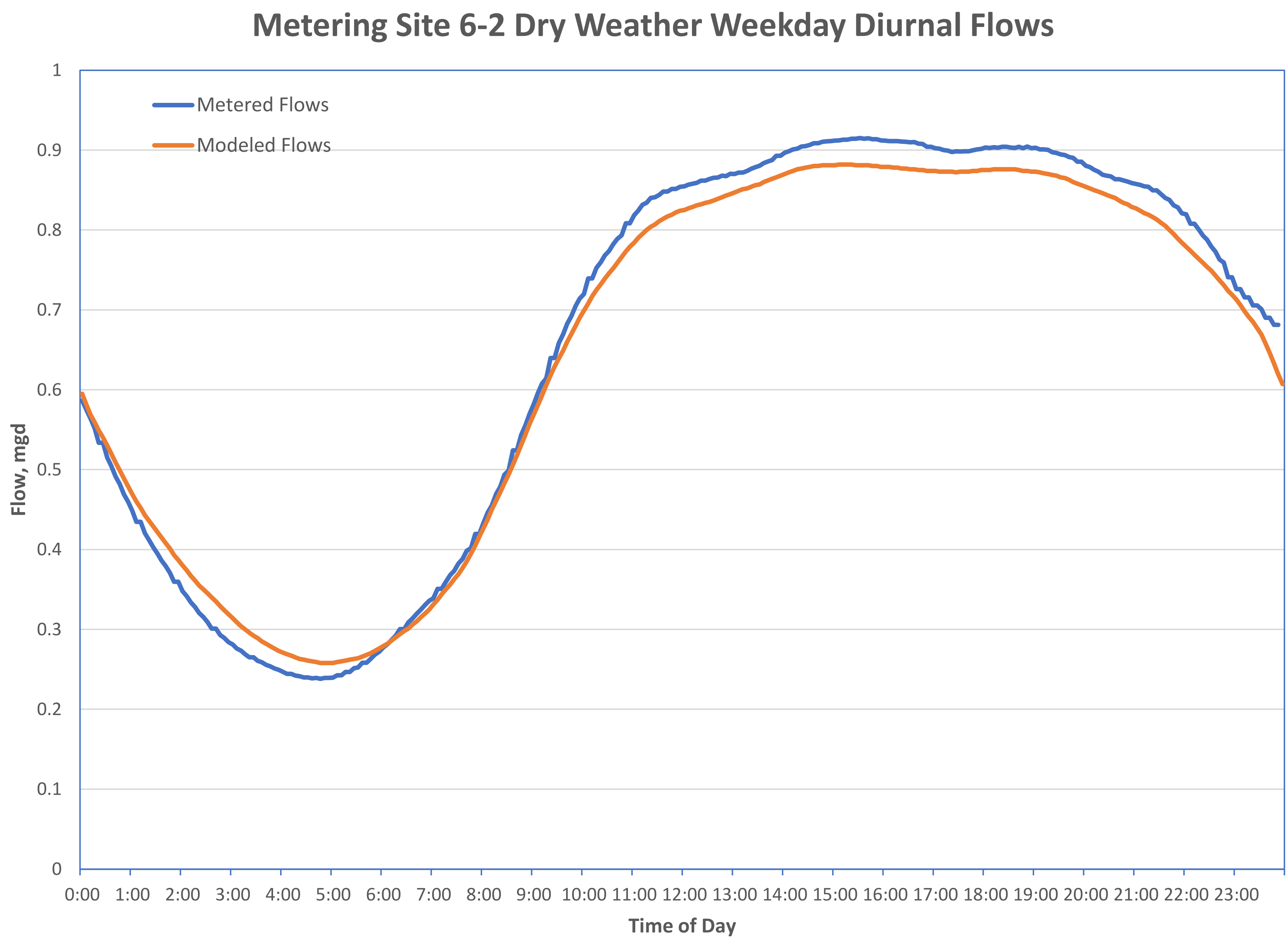


Metering Site 5-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day


Metering Site 5-2 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day



Metering Site 6-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.1
0.2
0.3
0.4
0.5
0.6
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day



Metering Site 6-2 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
Time of Day
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
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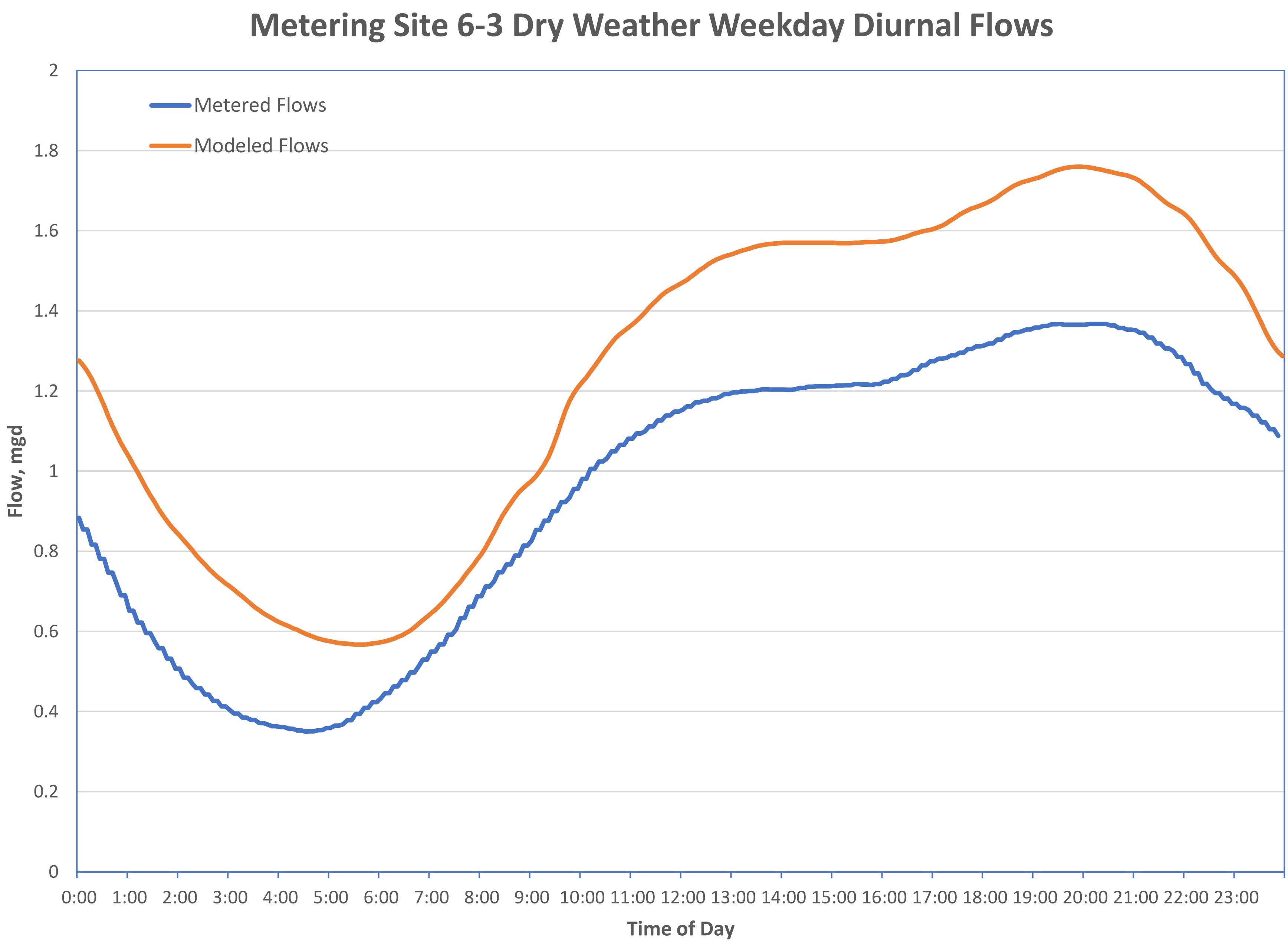
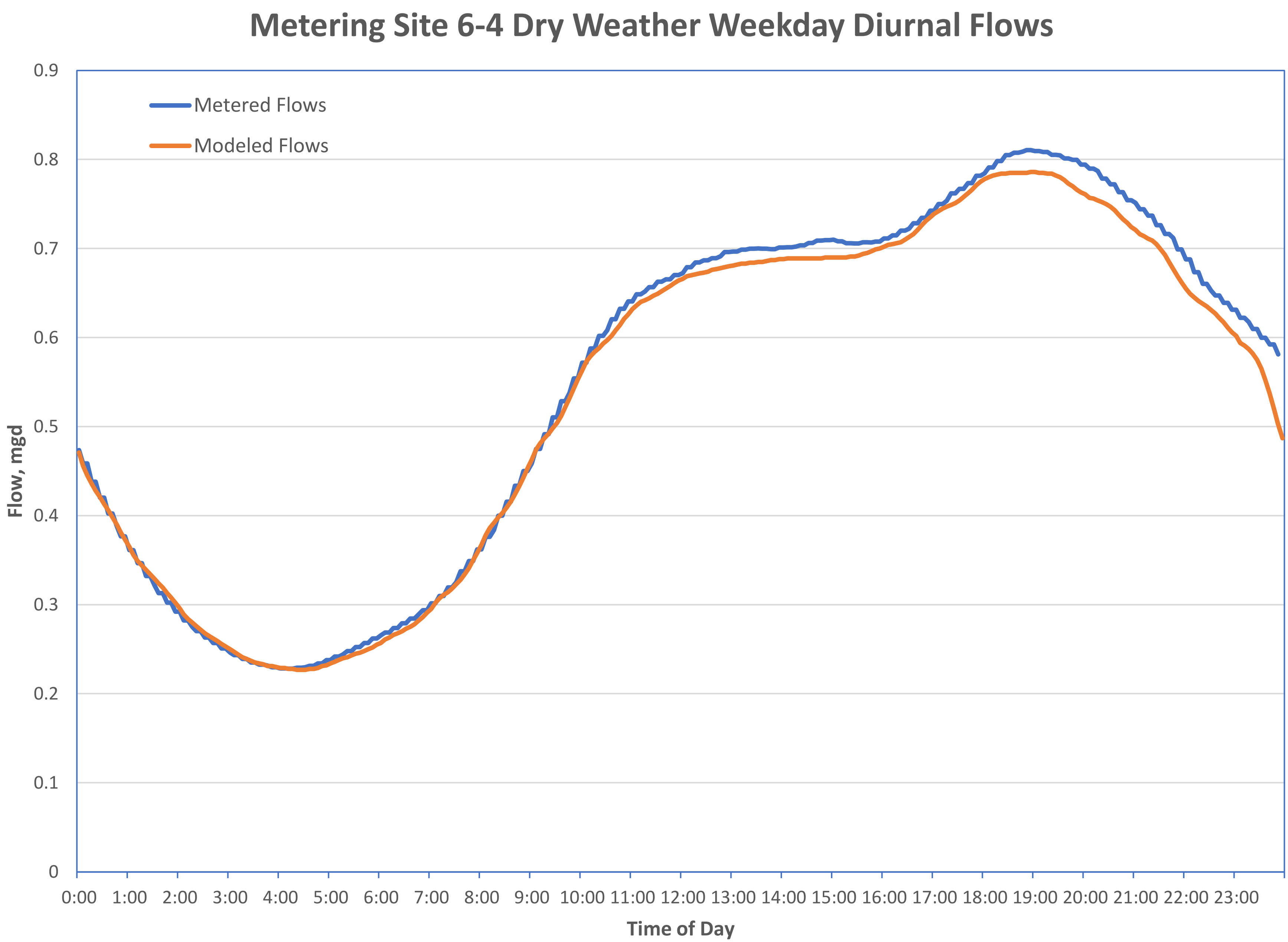
21:00
22:00
23:00



Metering Site 6-3 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day


Metering Site 6-4 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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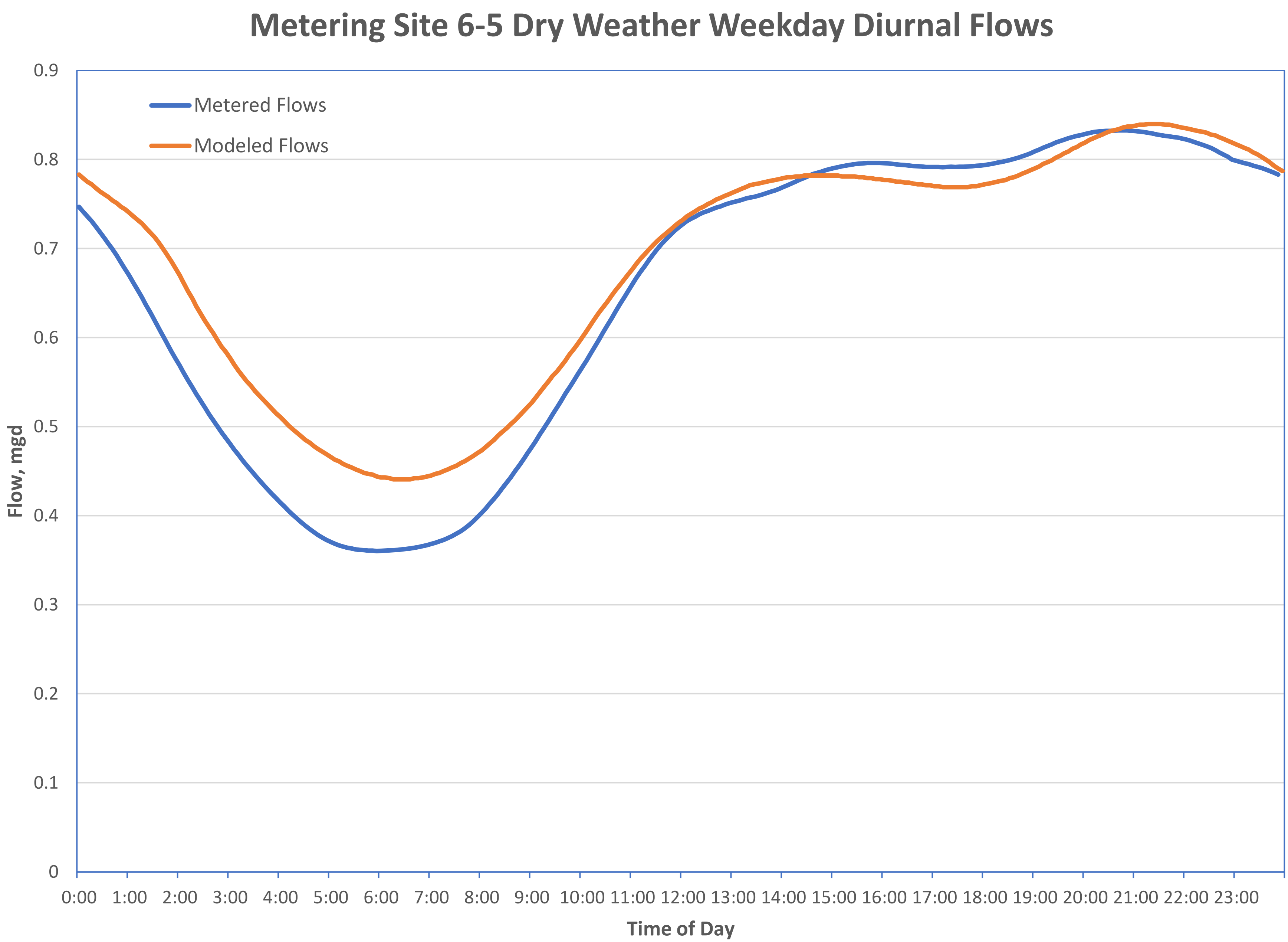
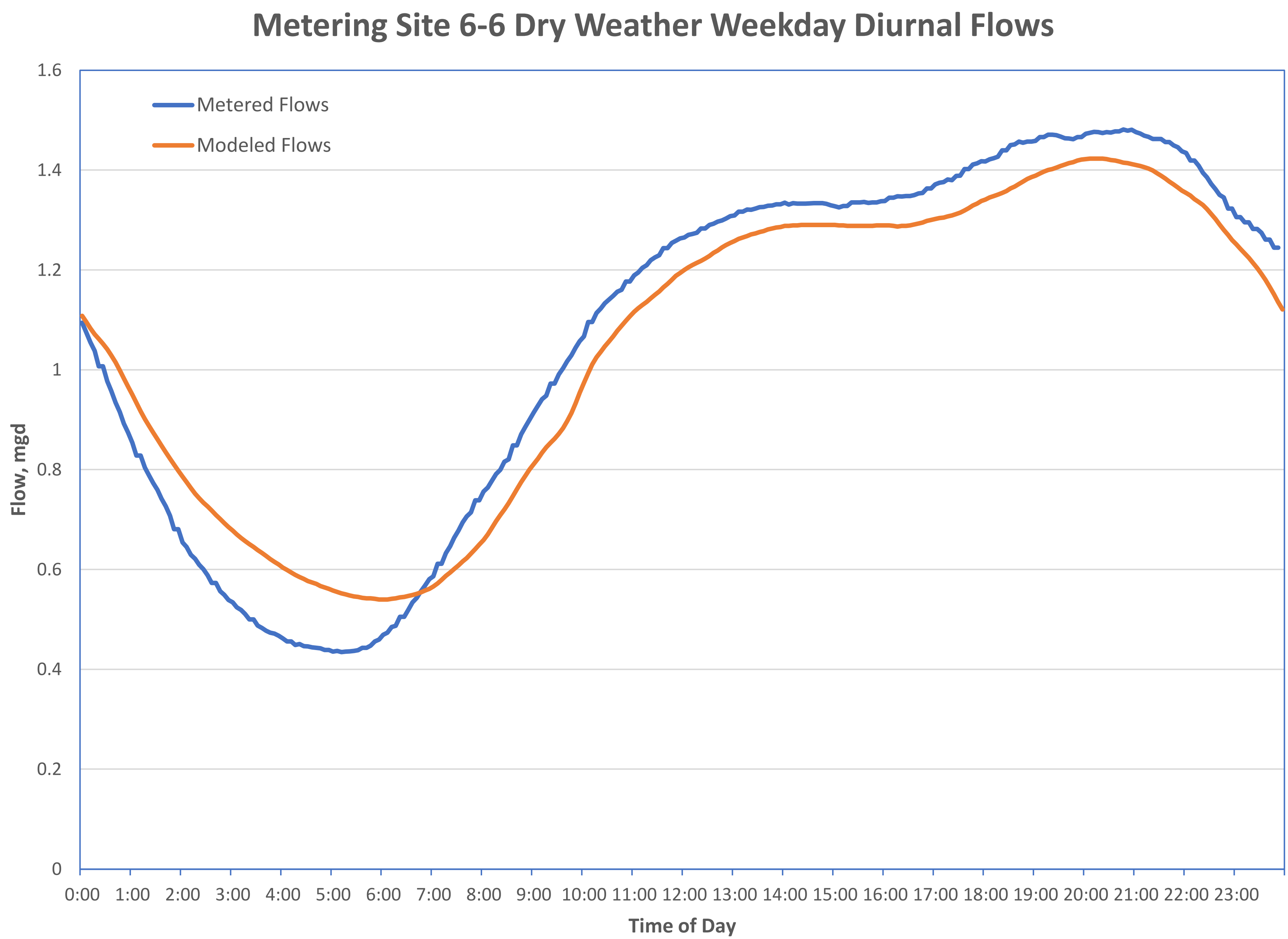
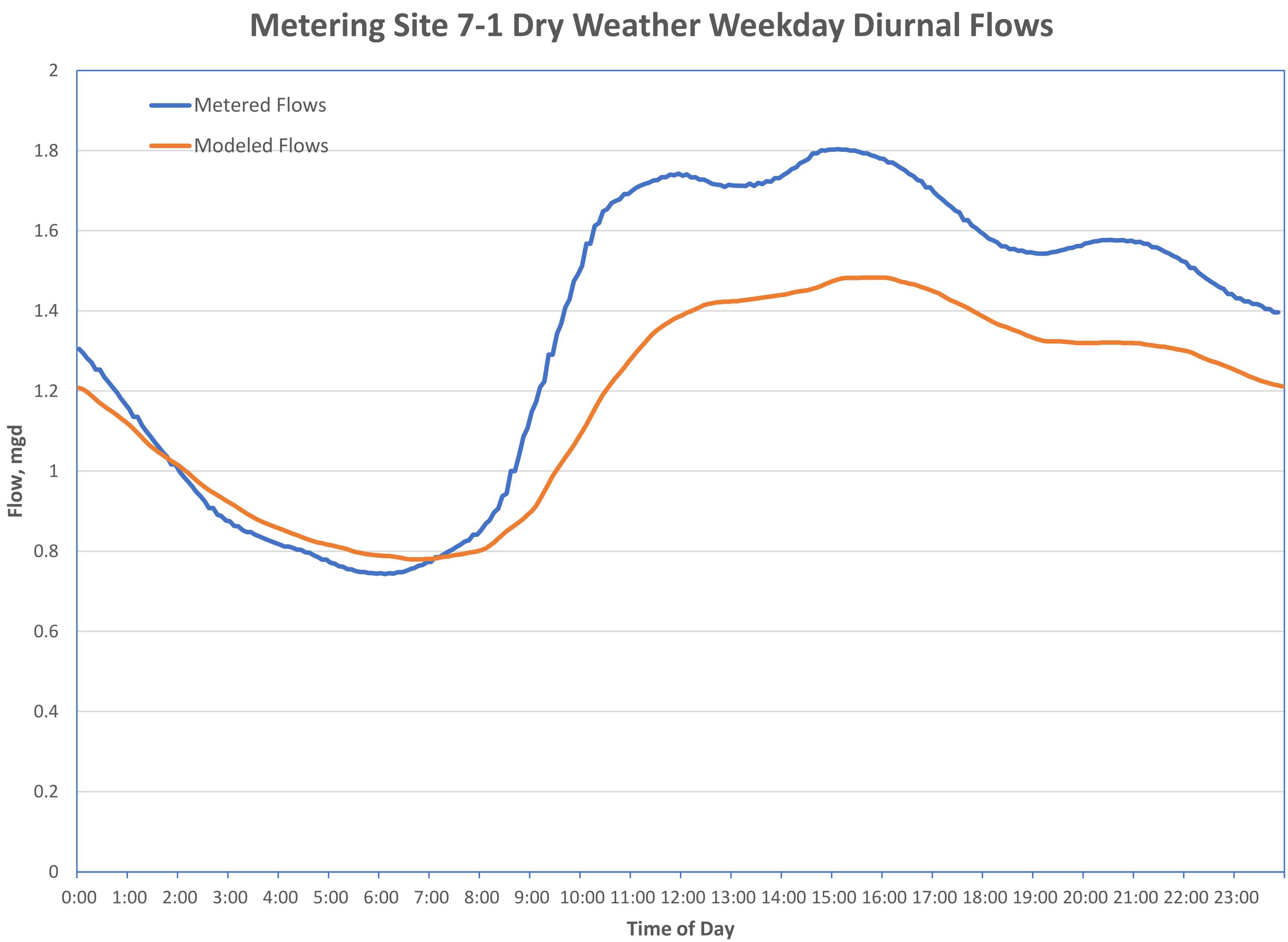
22:00
23:00
Time of Day



Metering Site 6-5 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day



Metering Site 6-6 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day



Metering Site 7-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
Time of Day
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
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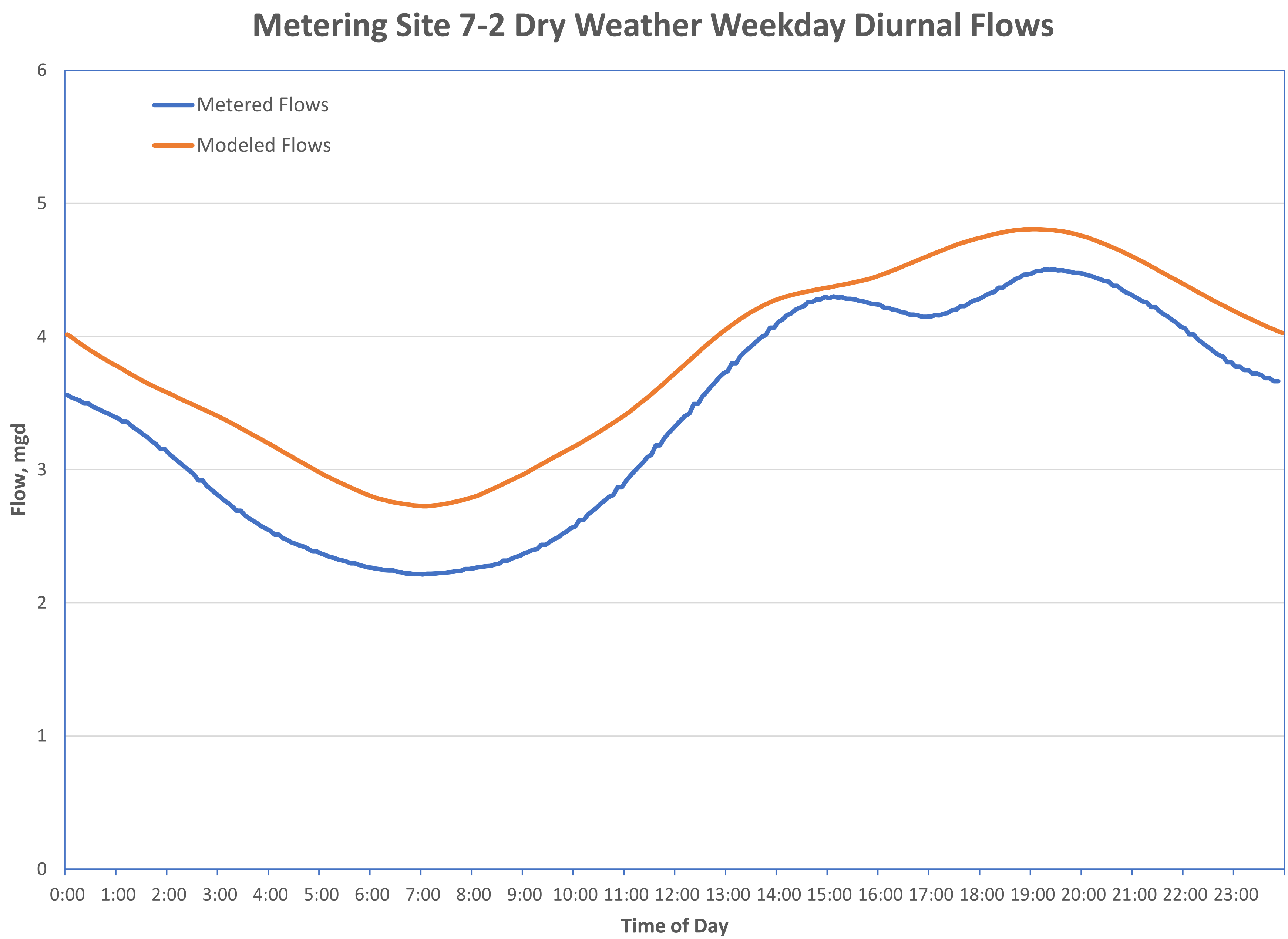
21:00
22:00
23:00


Metering Site 7-2 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
Time of Day
0
1
2
3
4
5
6
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
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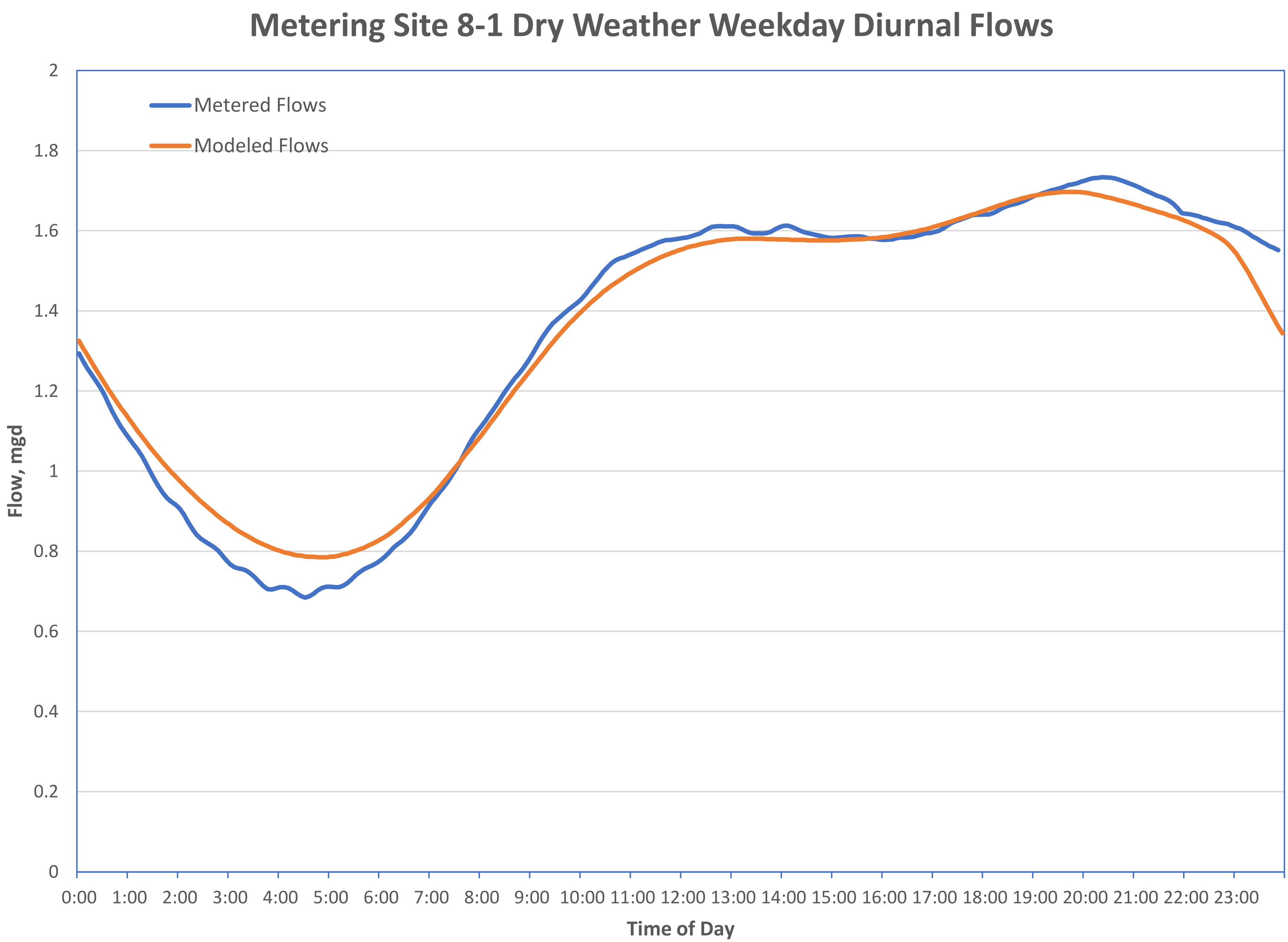
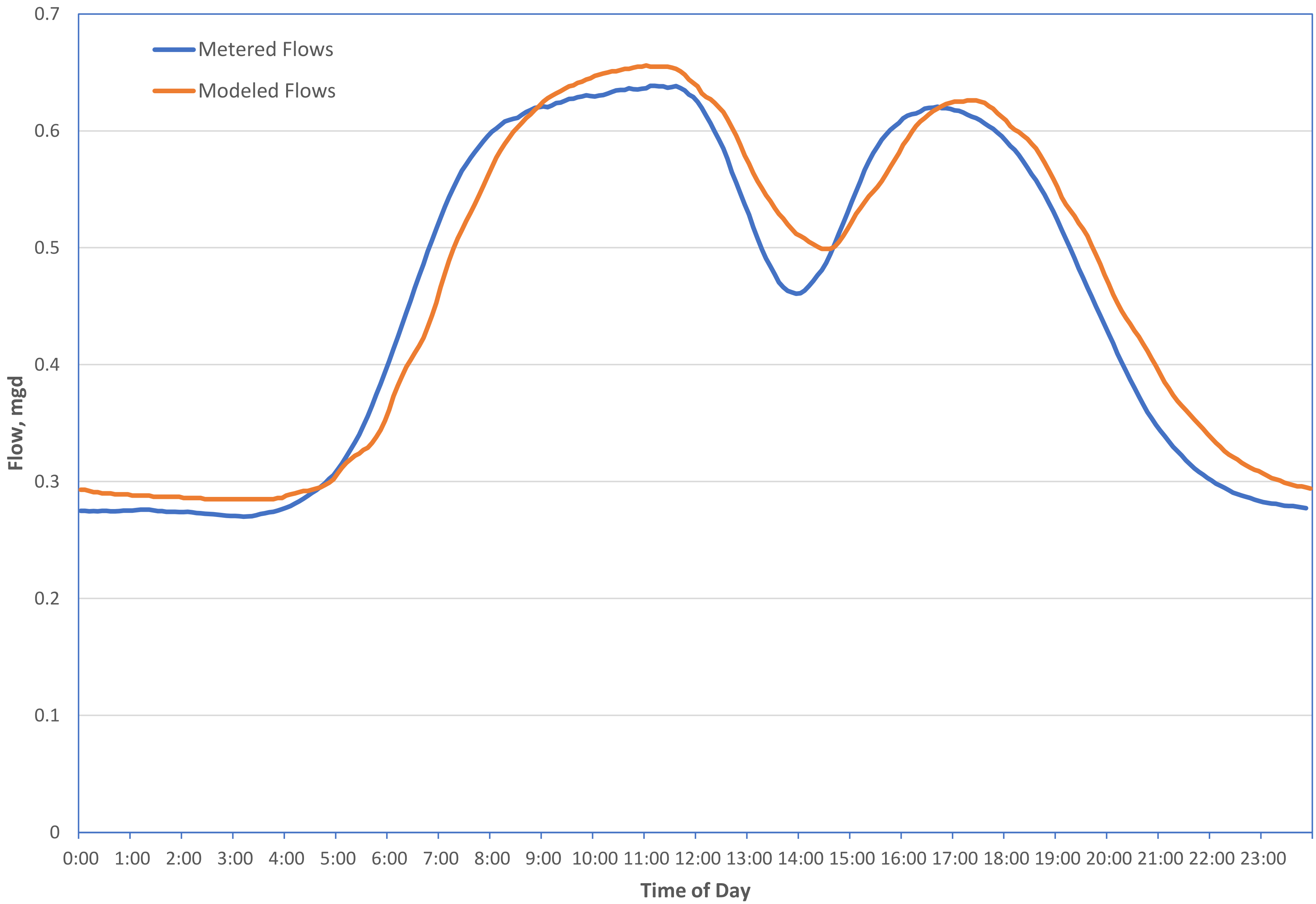
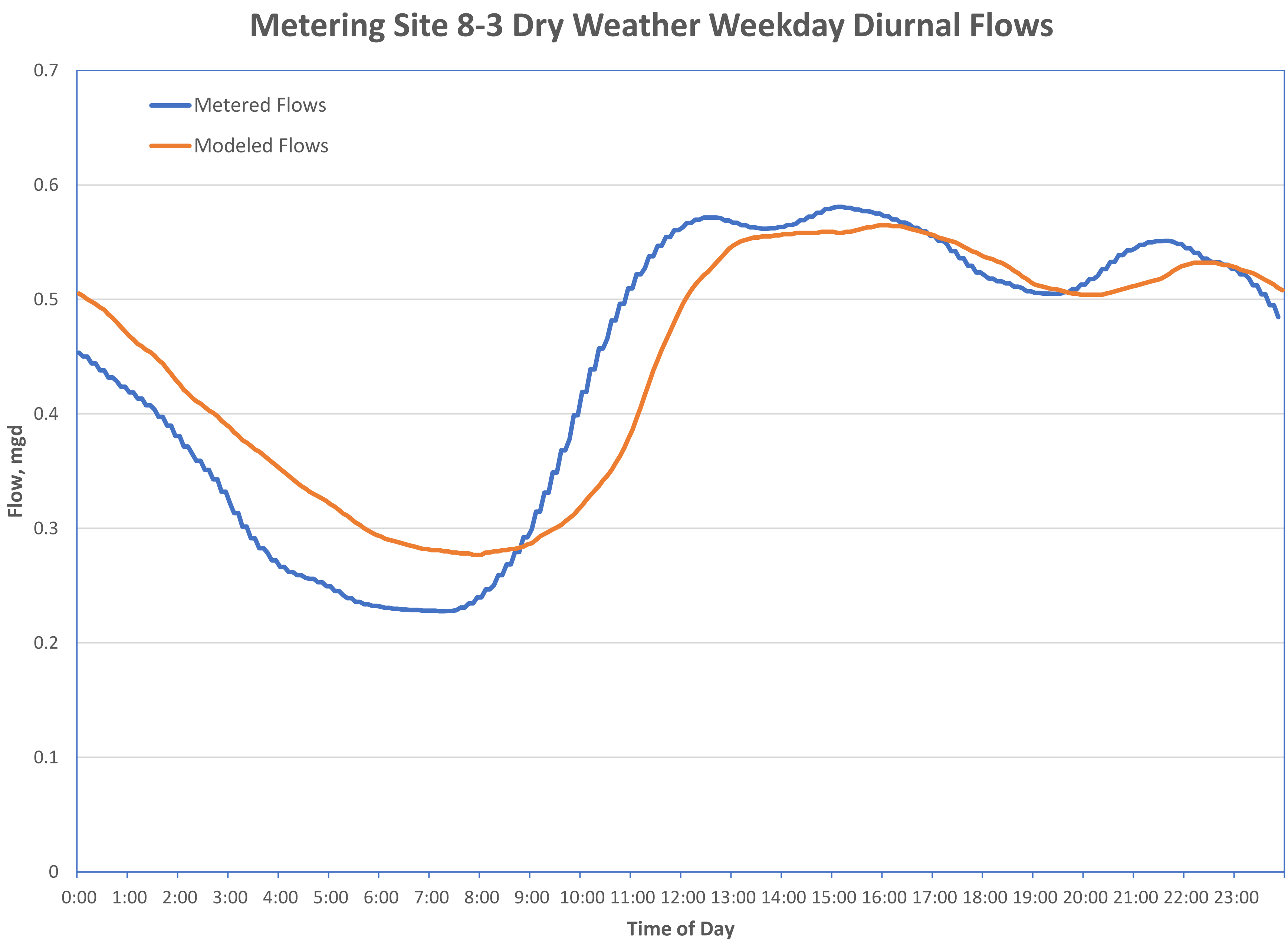
21:00
22:00
23:00



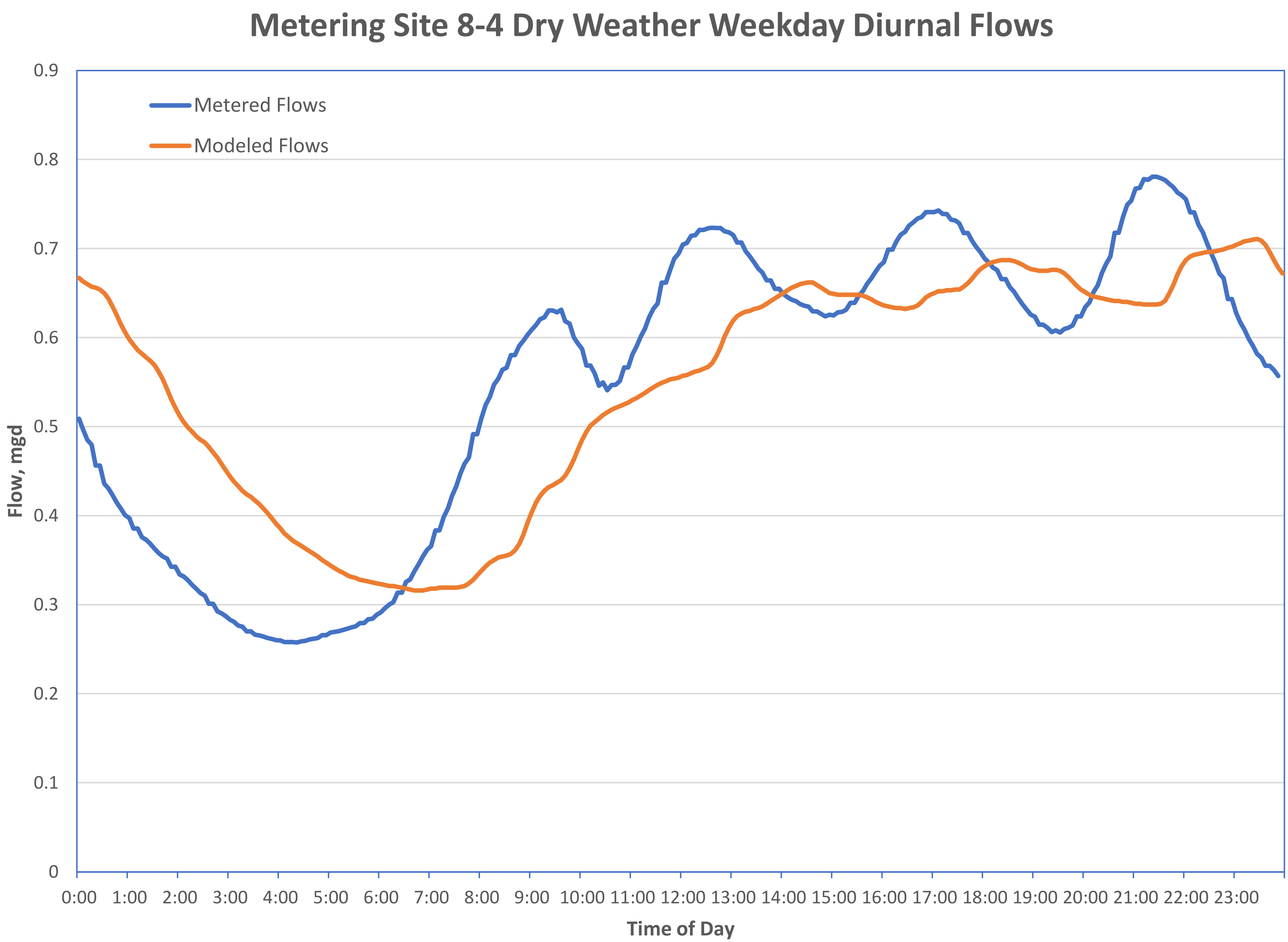
Metering Site 8-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day

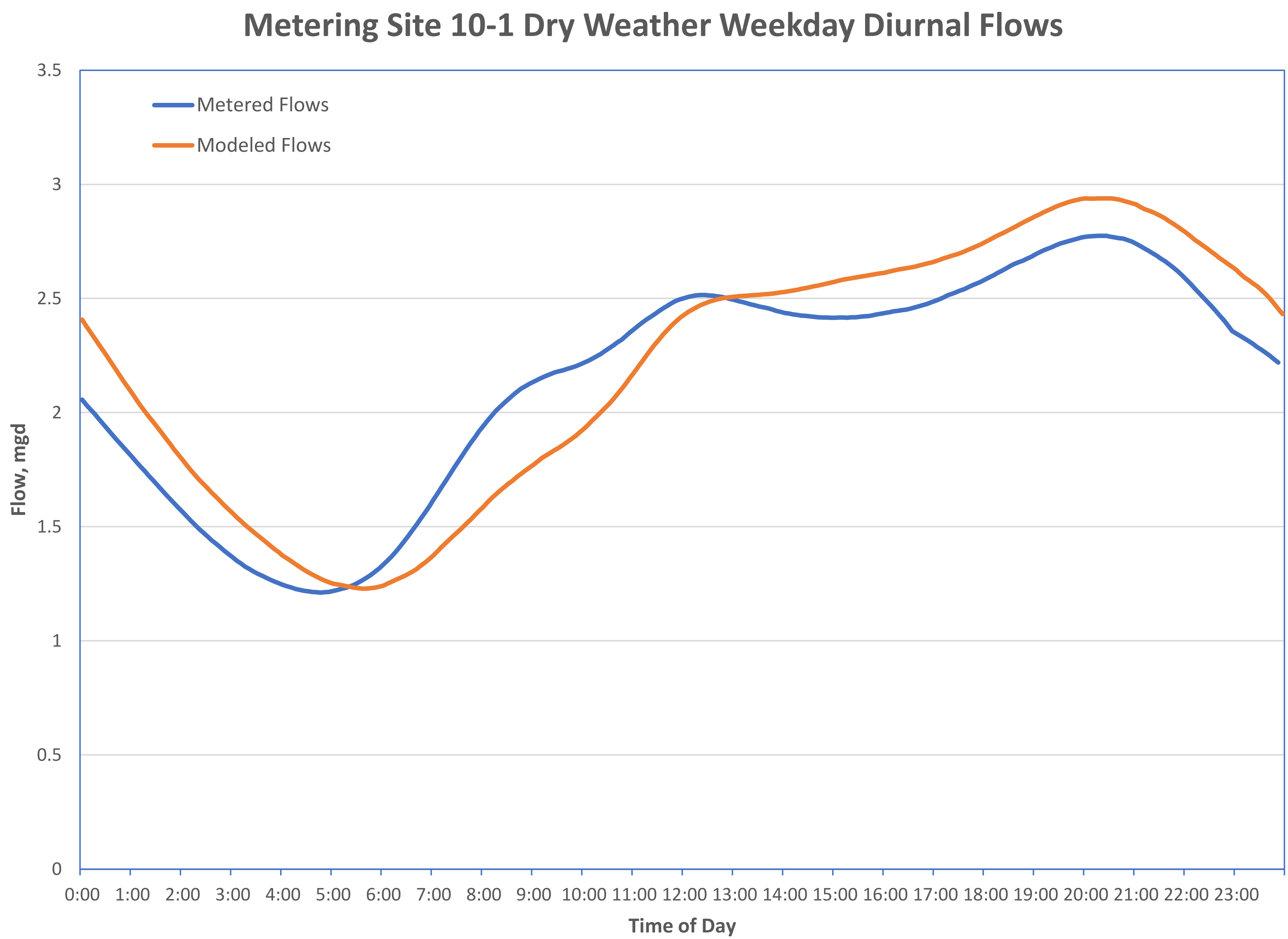
Metering Site 8-2 Dry Weather Weekday Diurnal Flows





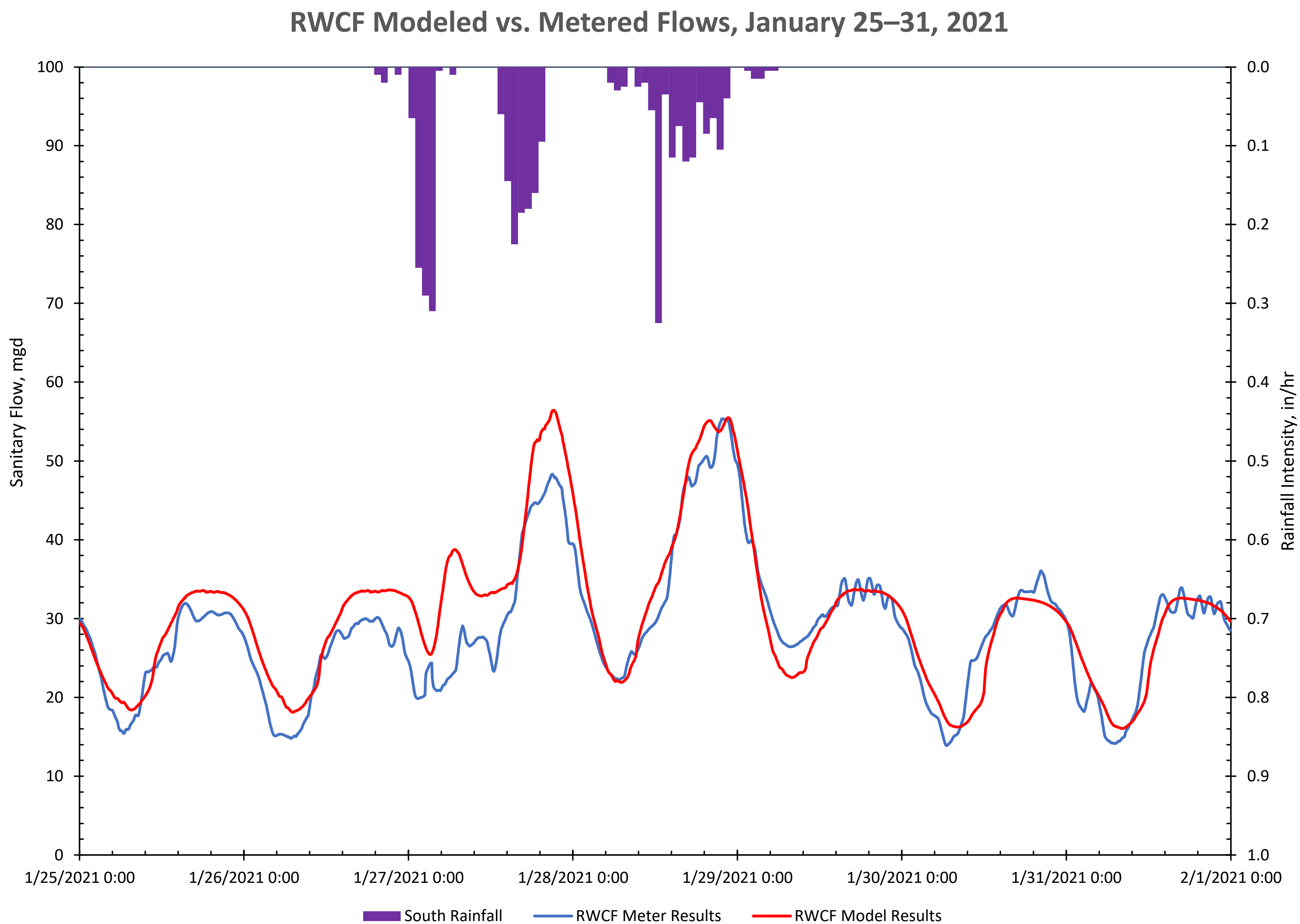
Metering Site 8-3 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day


Metering Site 8-4 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Time of Day

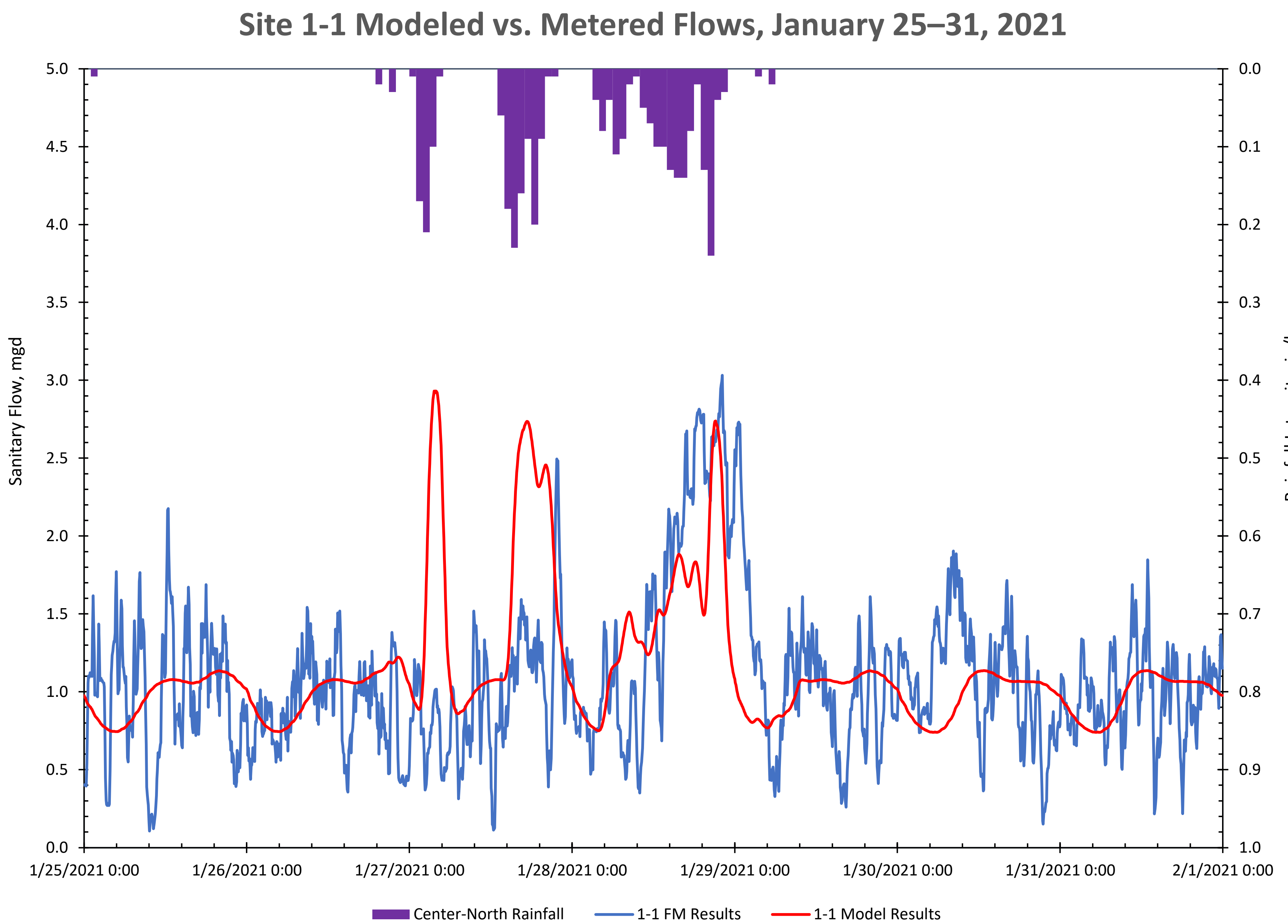

Metering Site 10-1 Dry Weather Weekday Diurnal Flows
Metered Flows
Modeled Flows
Flow, mgd
3.5
3
2.5
2
1.5
1
0.5
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time of Day

Appendix E

Modeled vs. Metered Wet Weather Flows

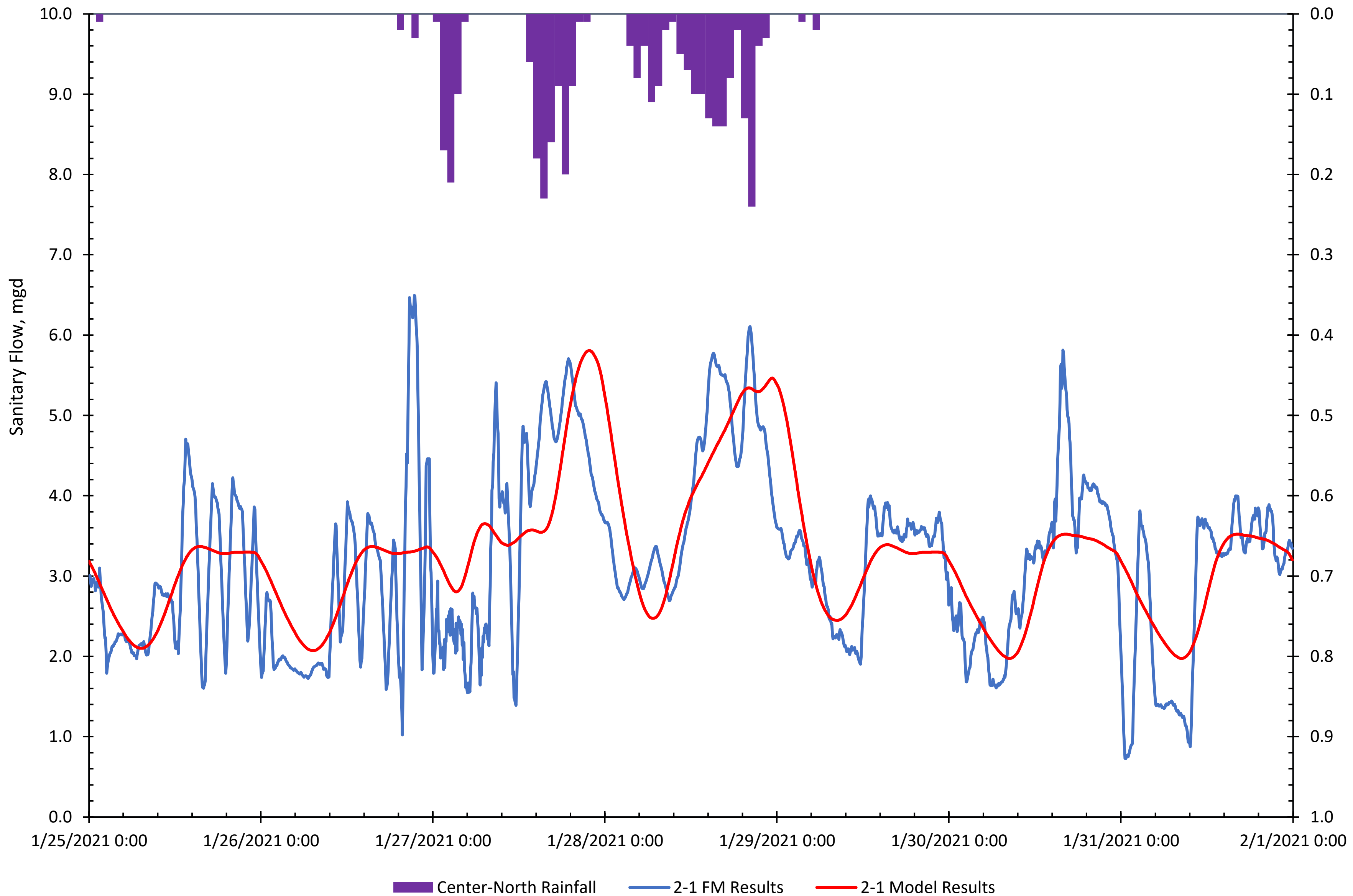


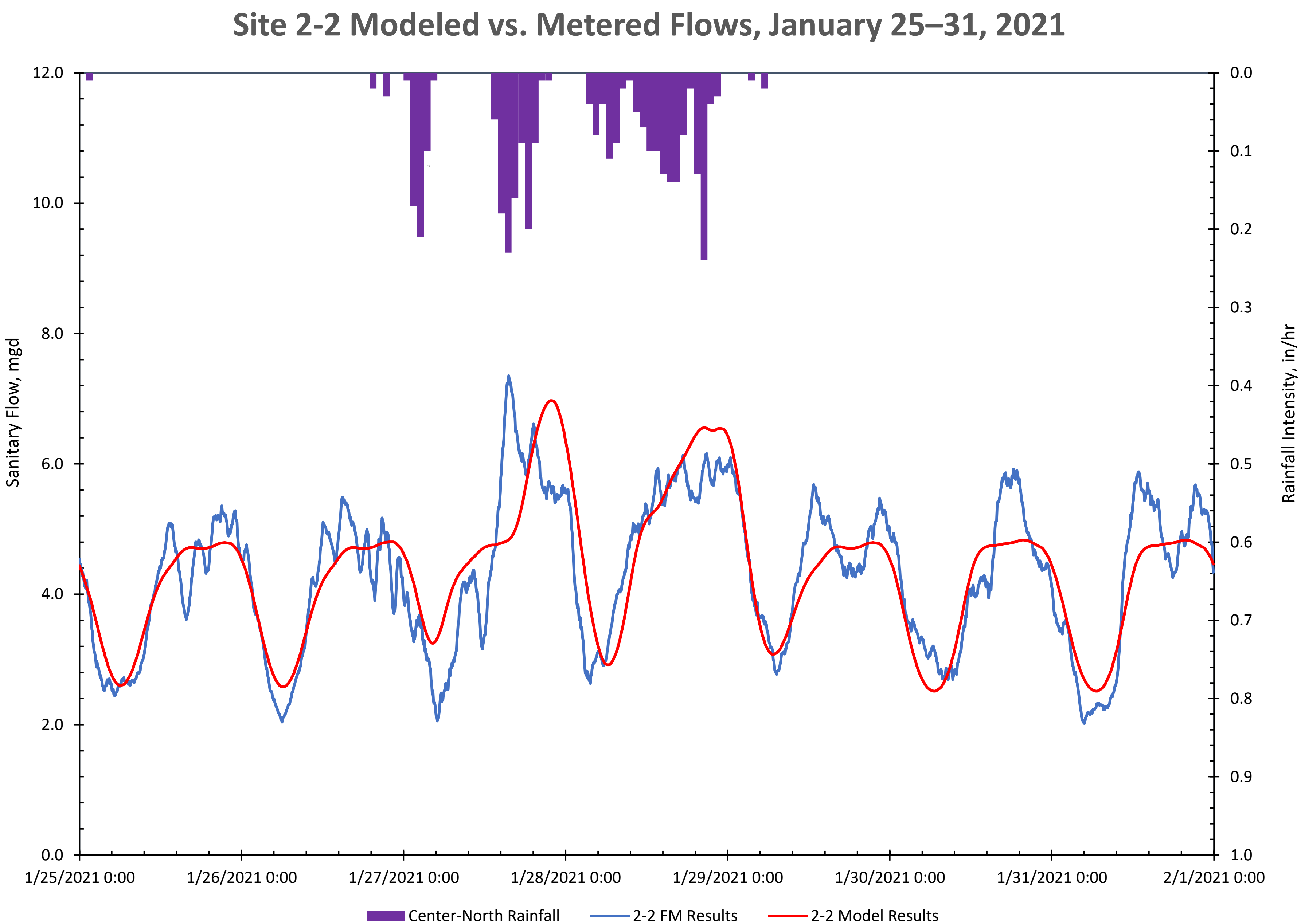
RWCF Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
0
10
20
30
40
50
60
70
80
90
100
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
South Rainfall
RWCF Meter Results
RWCF Model Results

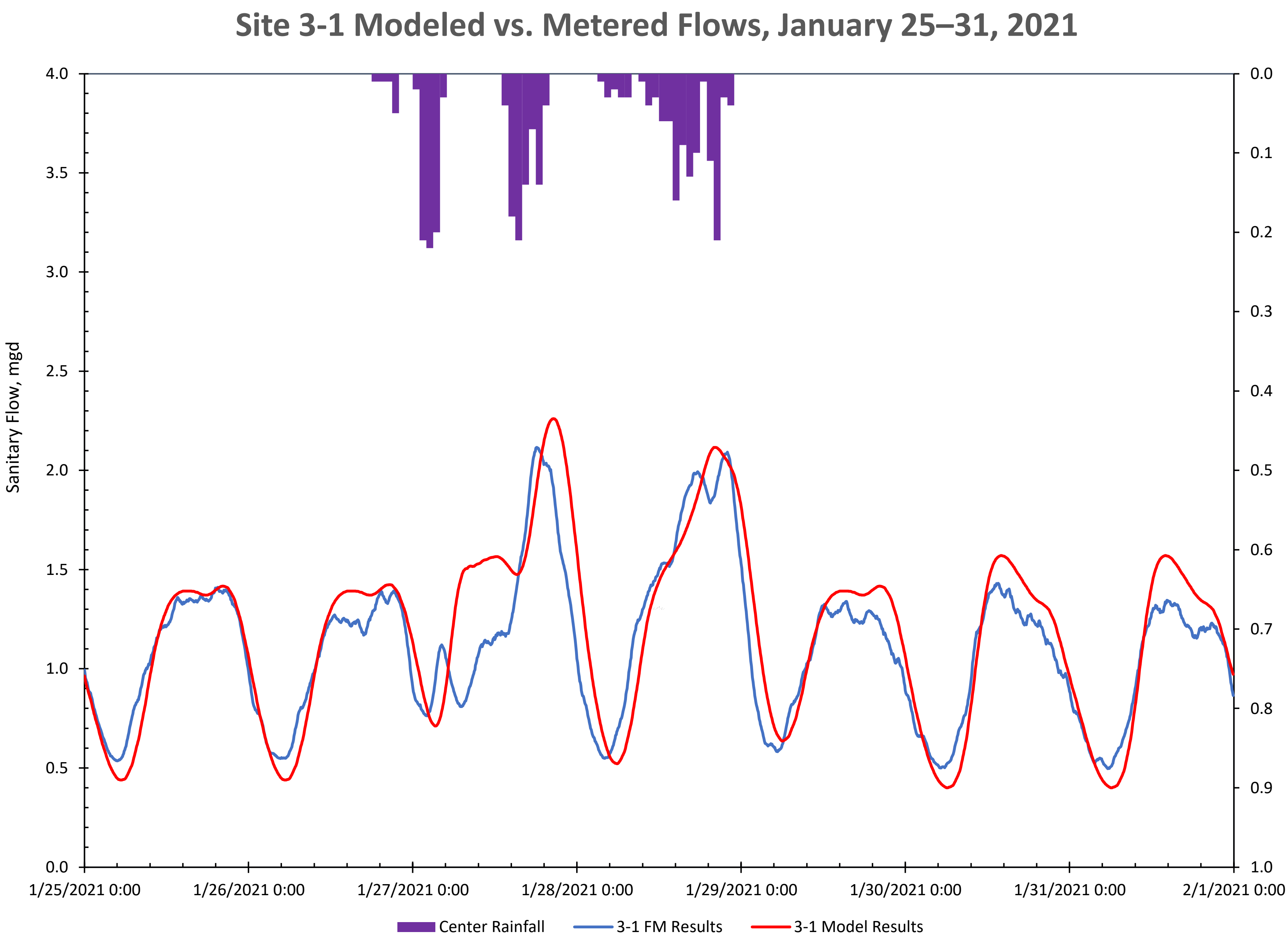


Site 1-1 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center-North Rainfall
1-1 FM Results
1-1 Model Results

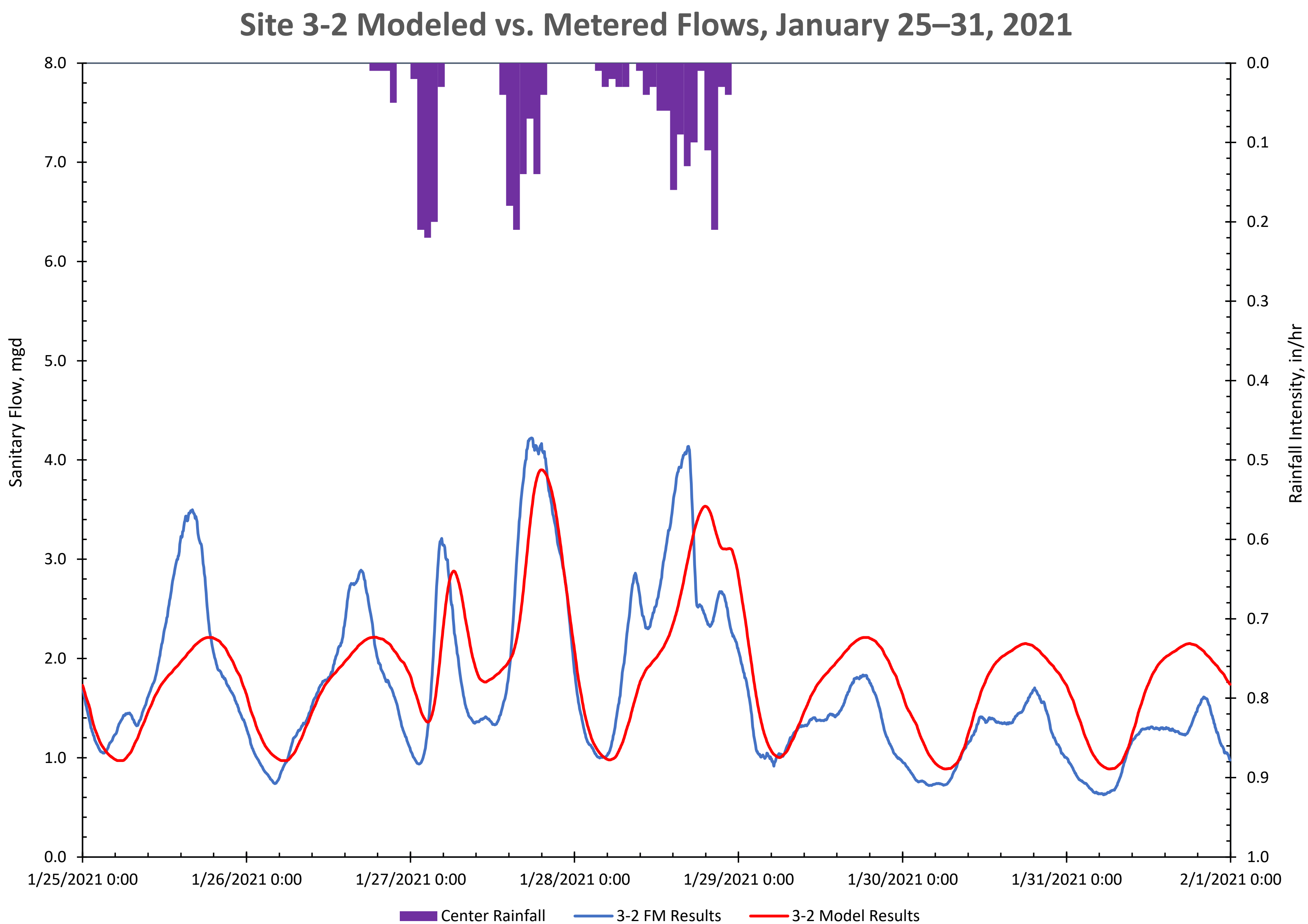
Site 2-1 Modeled vs. Metered Flows, January 25–31, 2021




Site 2-2 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center-North Rainfall
2-2 FM Results
2-2 Model Results

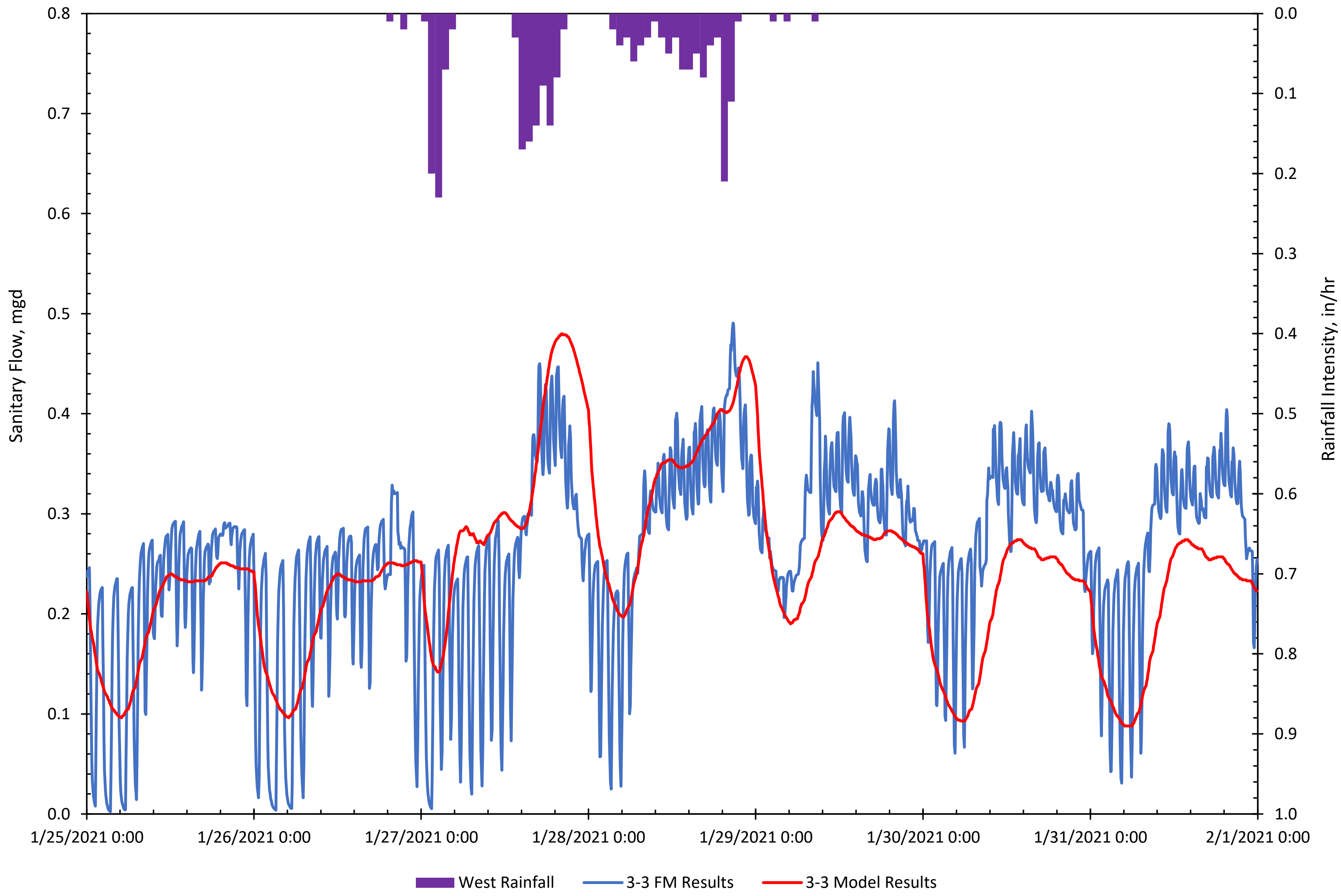


Site 3-1 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
3-1 FM Results
3-1 Model Results

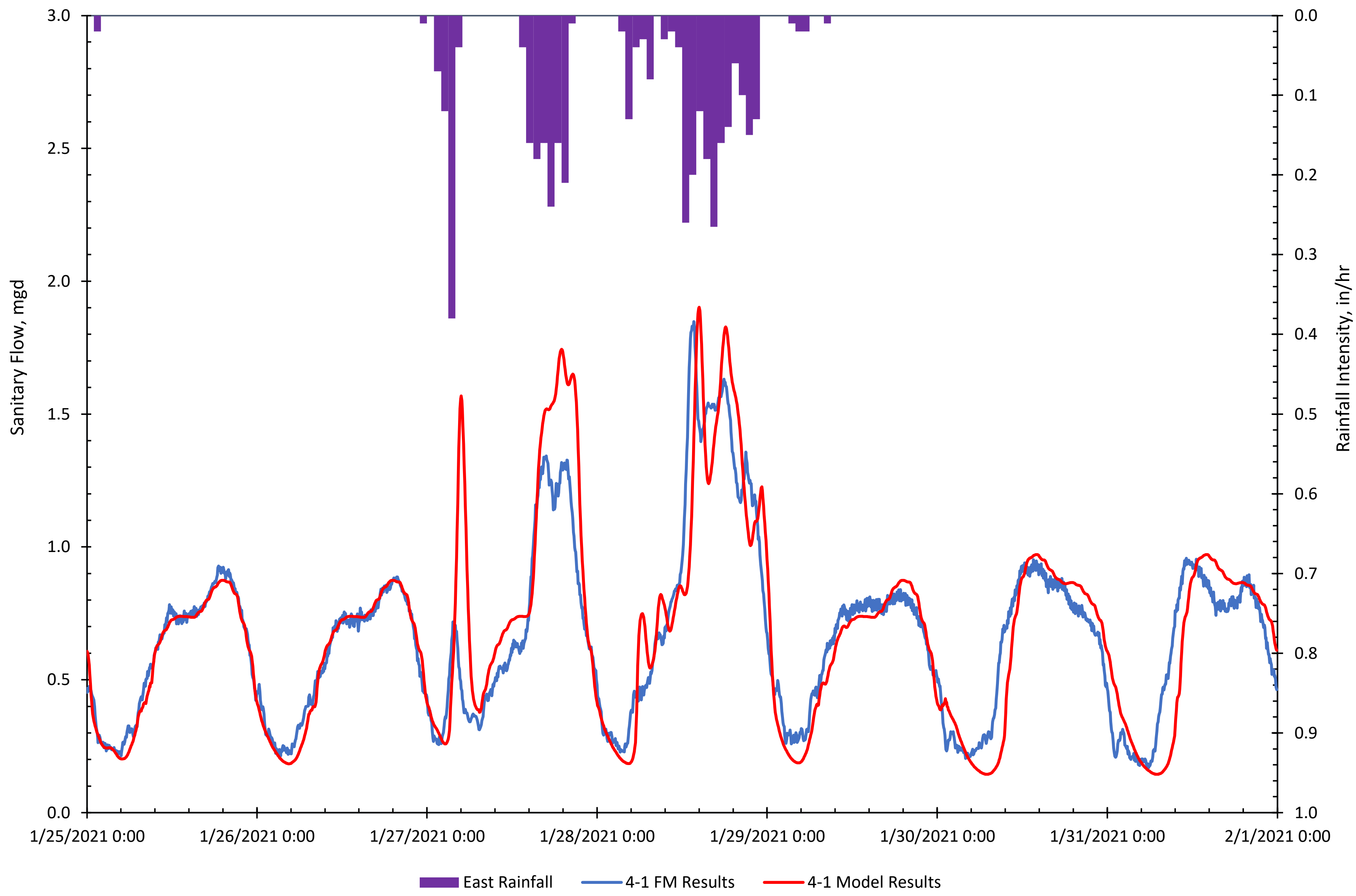


Site 3-2 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
3-2 FM Results
3-2 Model Results

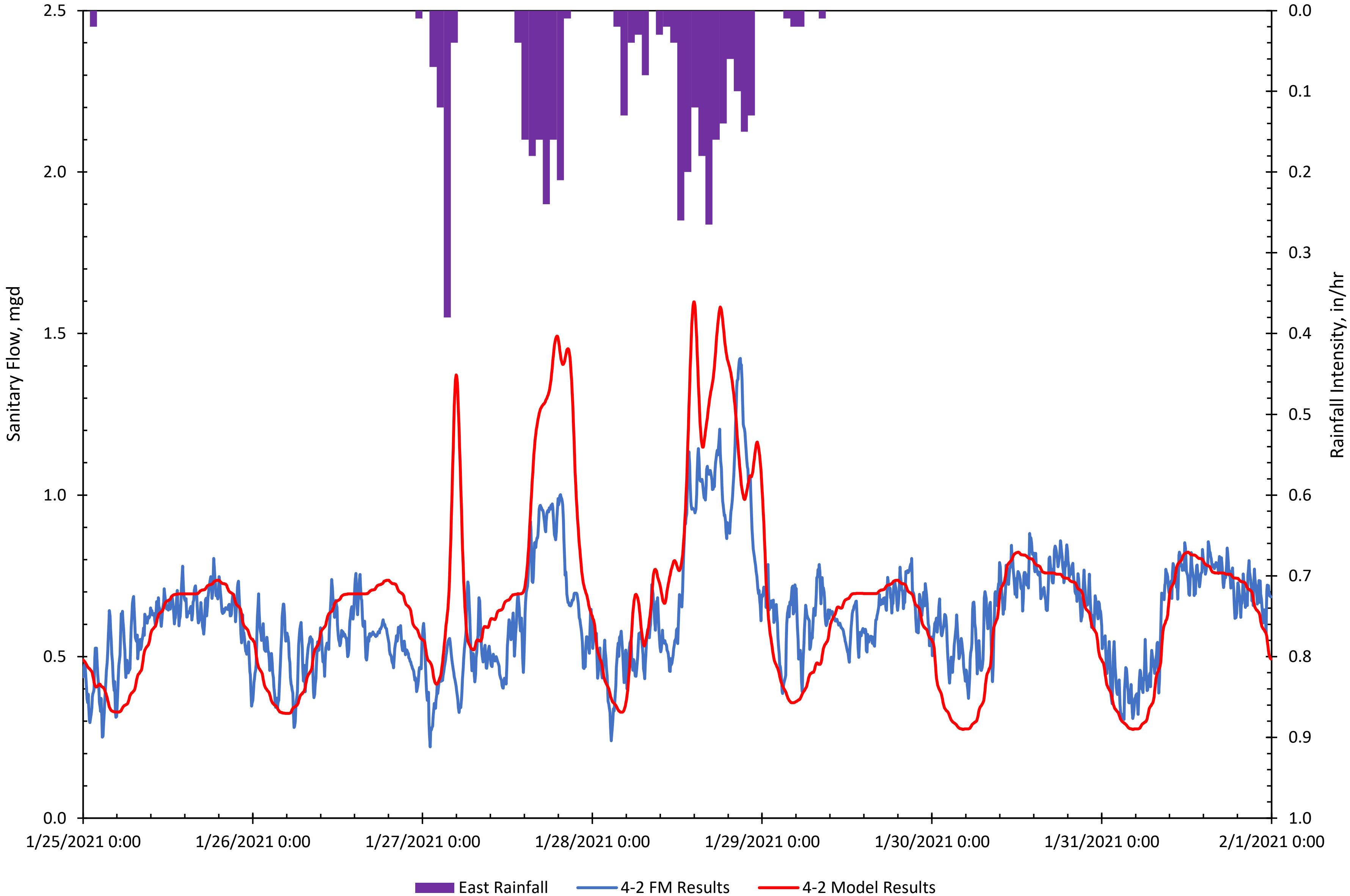
Site 3-3 Modeled vs. Metered Flows, January 25–31, 2021

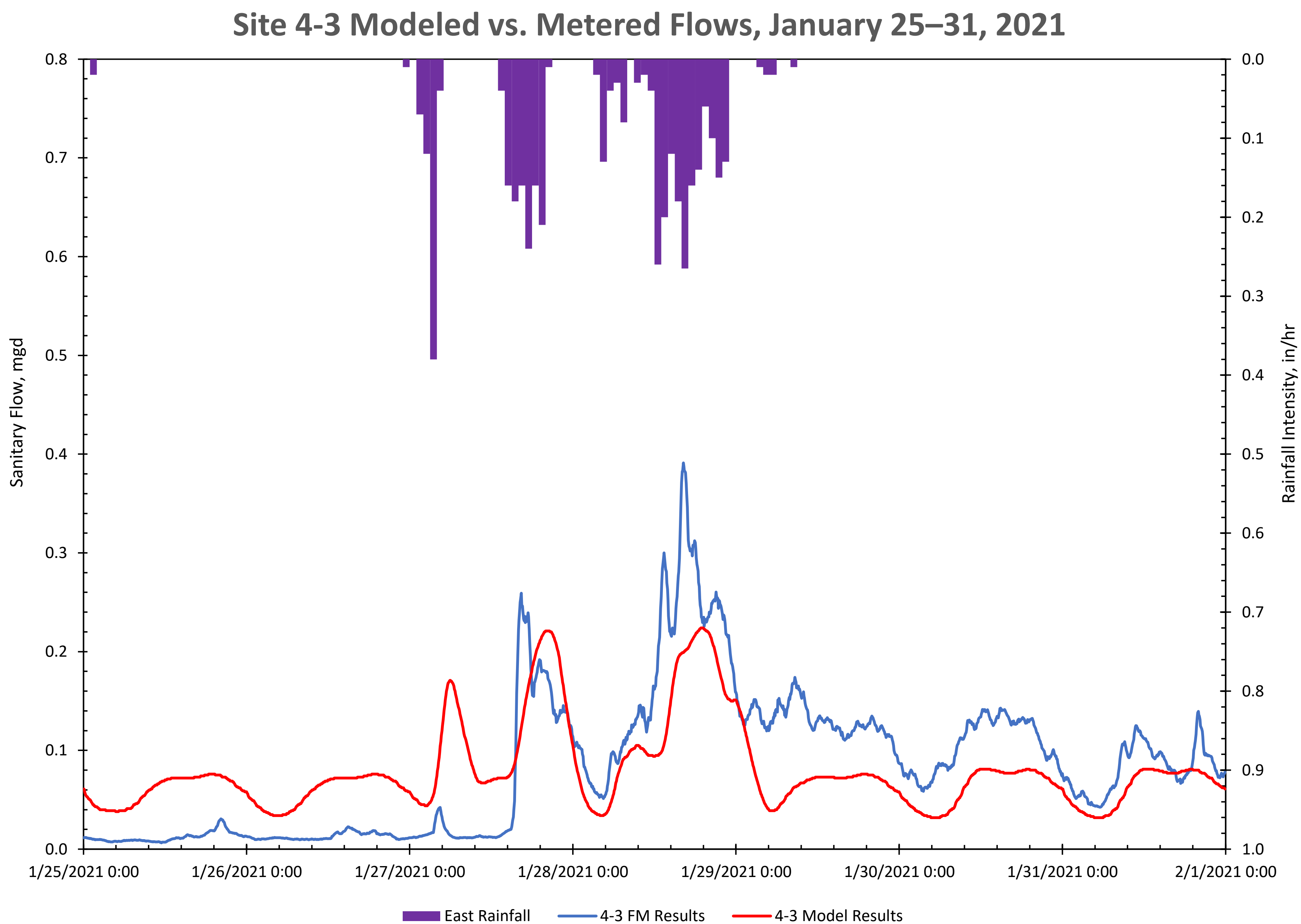


Site 4-1 Modeled vs. Metered Flows, January 25–31, 2021



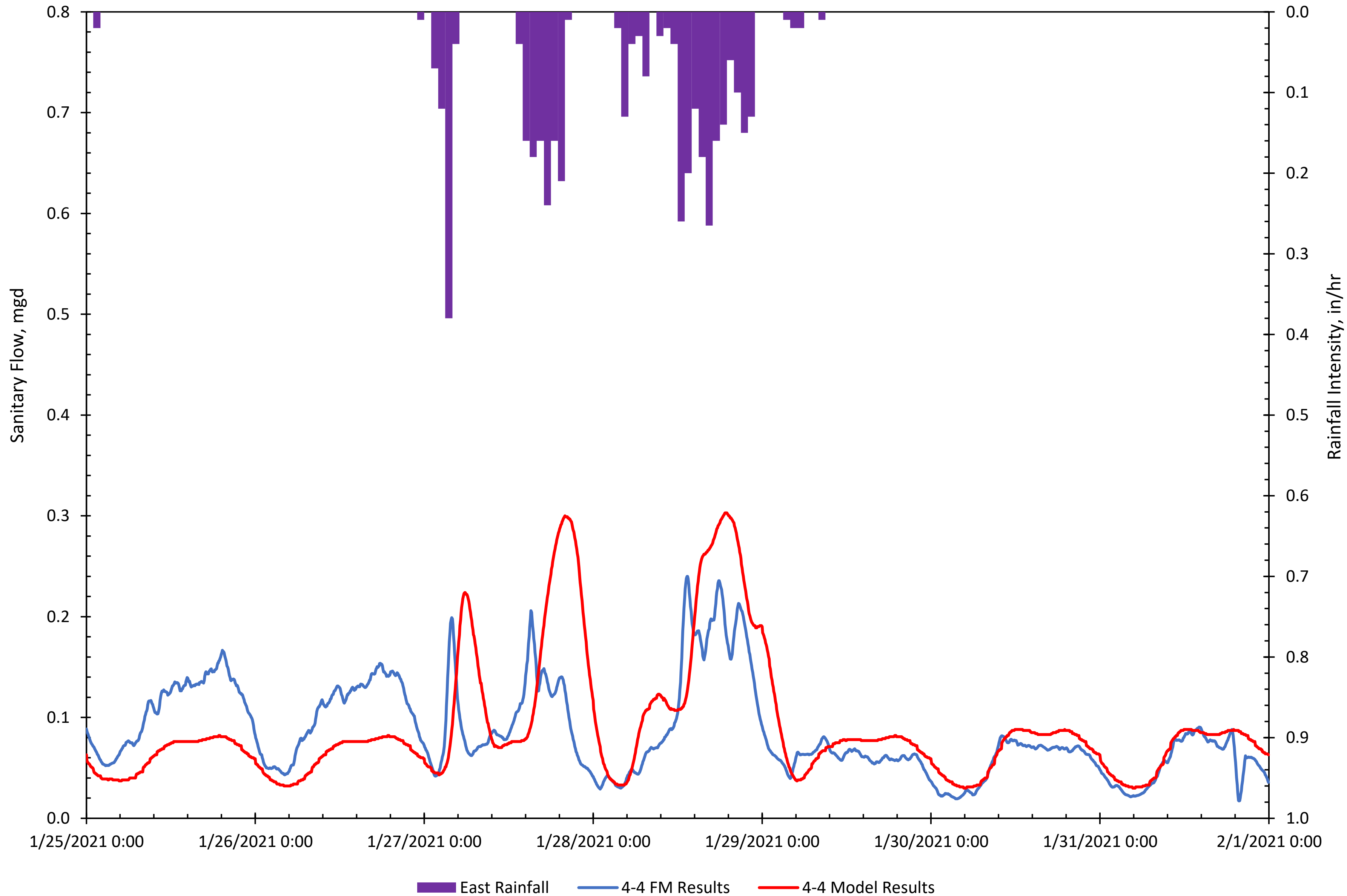
Site 4-2 Modeled vs. Metered Flows, January 25–31, 2021



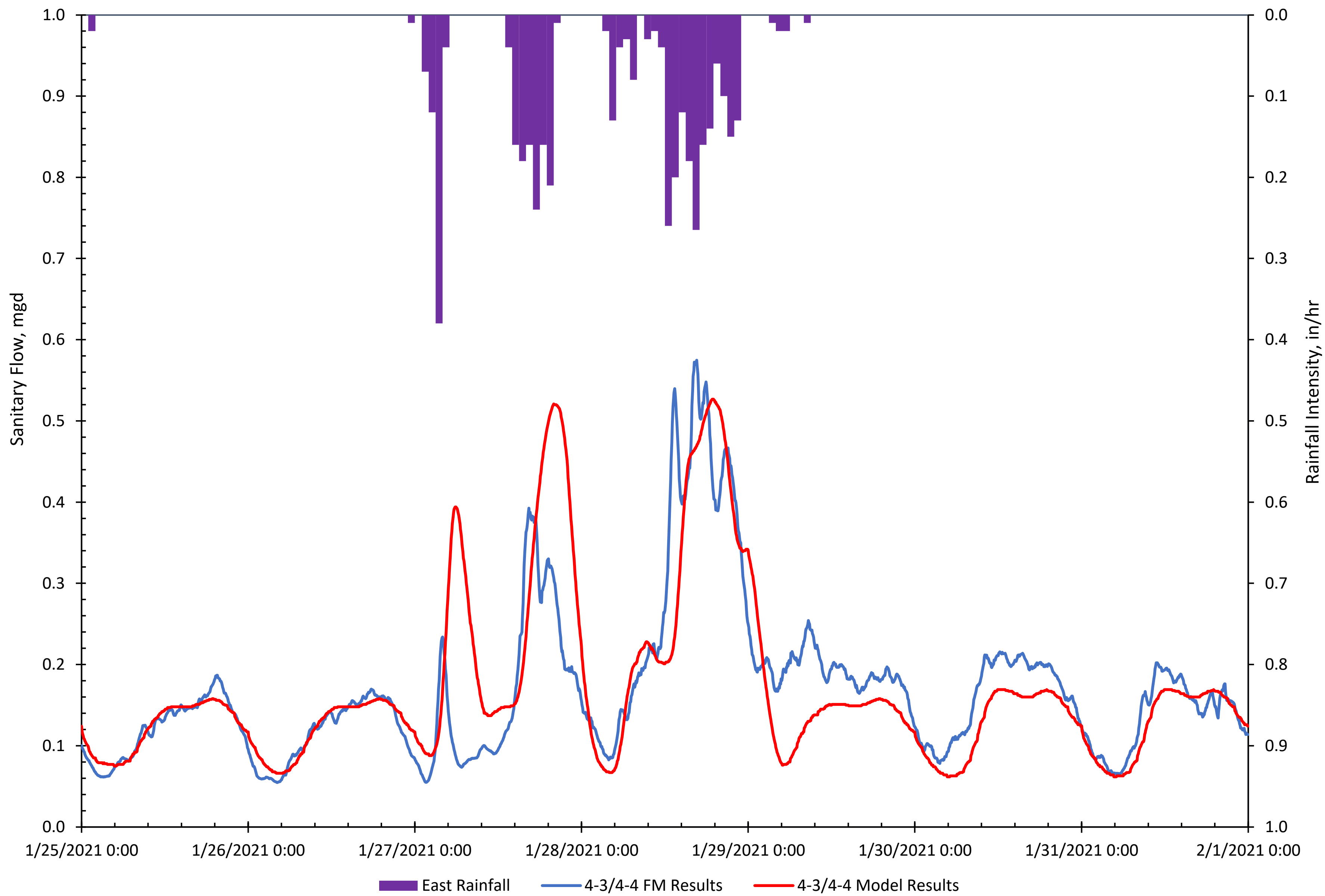


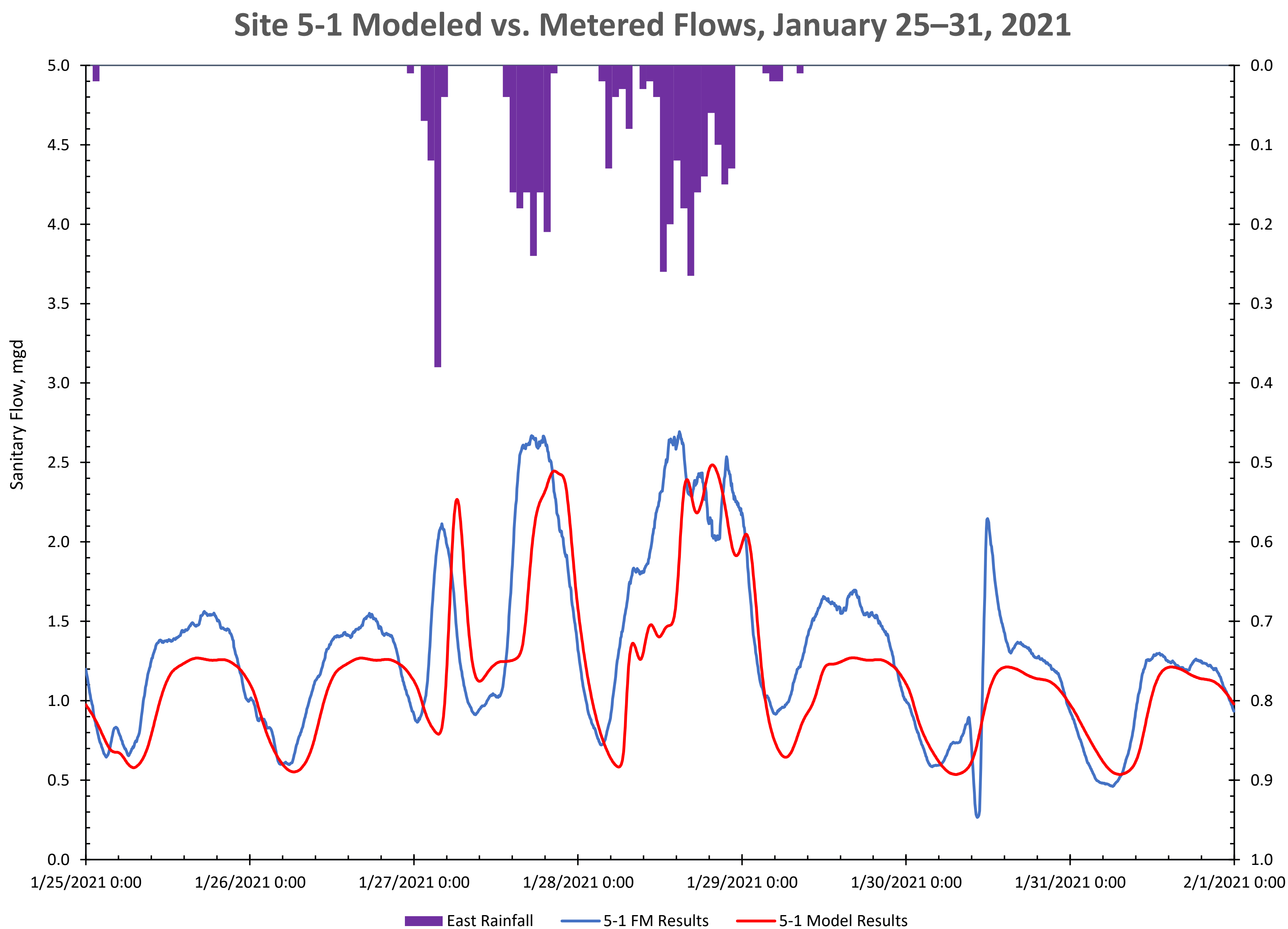
Site 4-3 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
4-3 FM Results
4-3 Model Results

Site 4-4 Modeled vs. Metered Flows, January 25–31, 2021

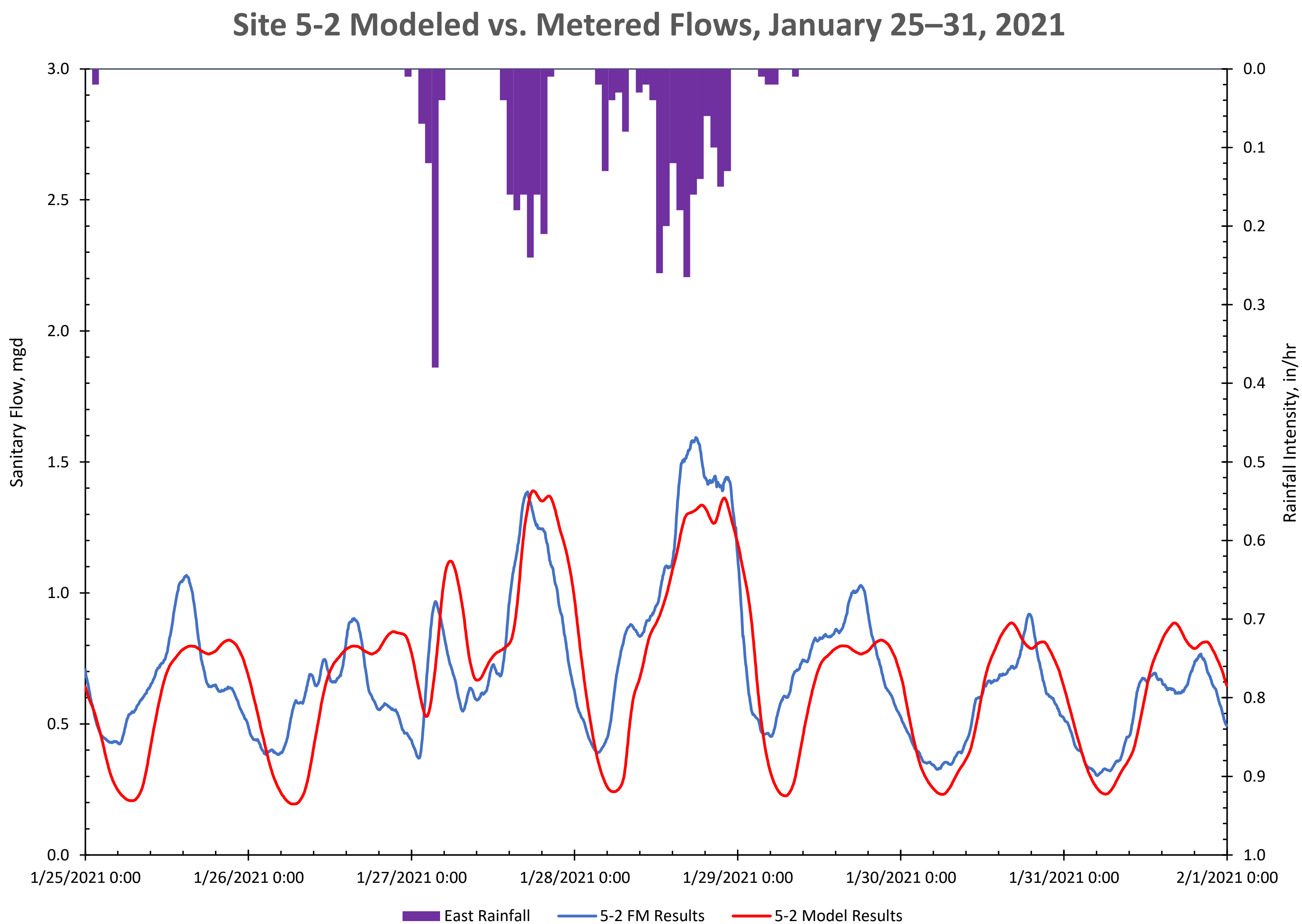


Site 4-3+4-4 Modeled vs. Metered Flows, January 25–31, 2021

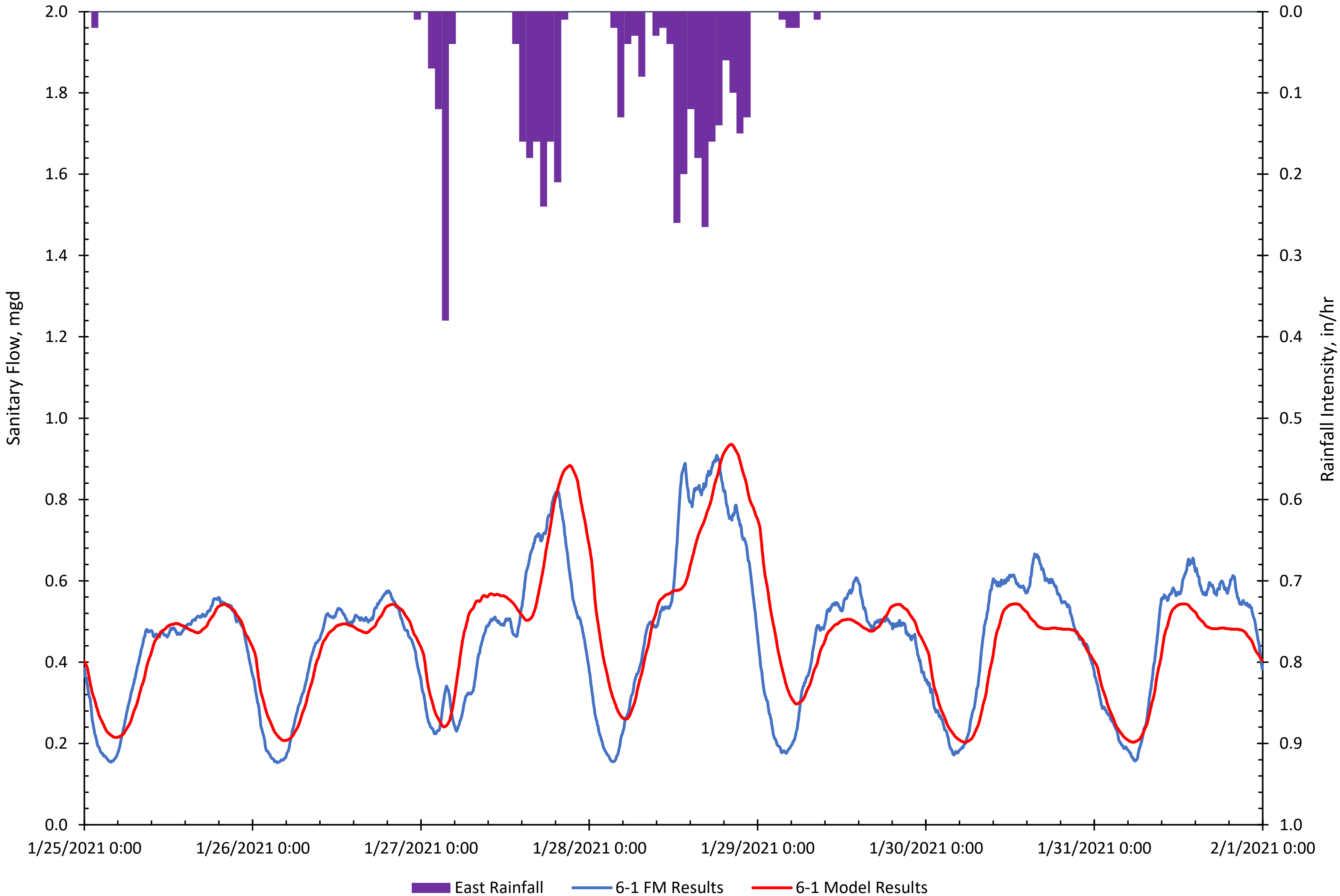




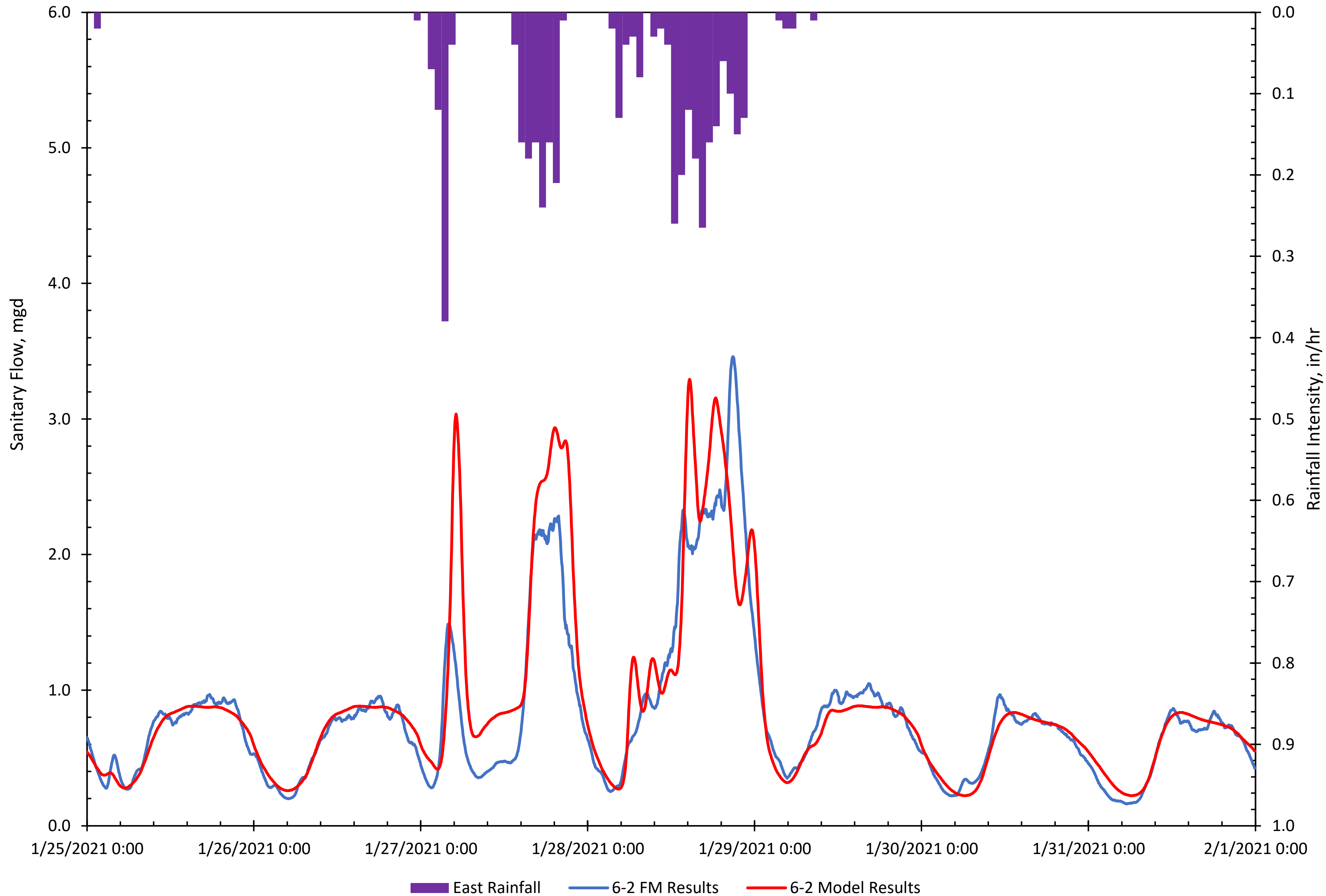
Site 5-1 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
5-1 FM Results
5-1 Model Results

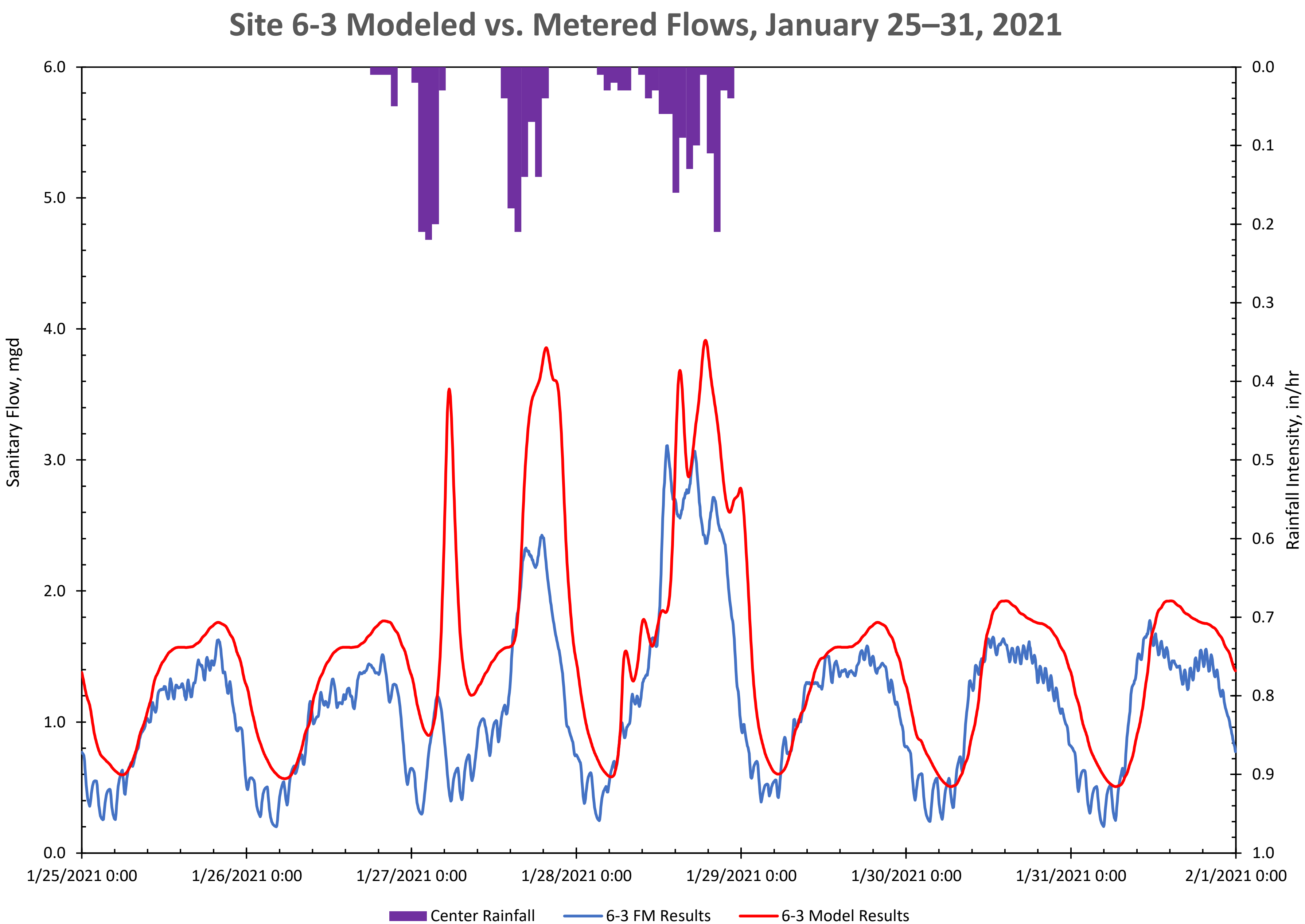

Site 5-2 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
5-2 FM Results
5-2 Model Results

Site 6-1 Modeled vs. Metered Flows, January 25–31, 2021

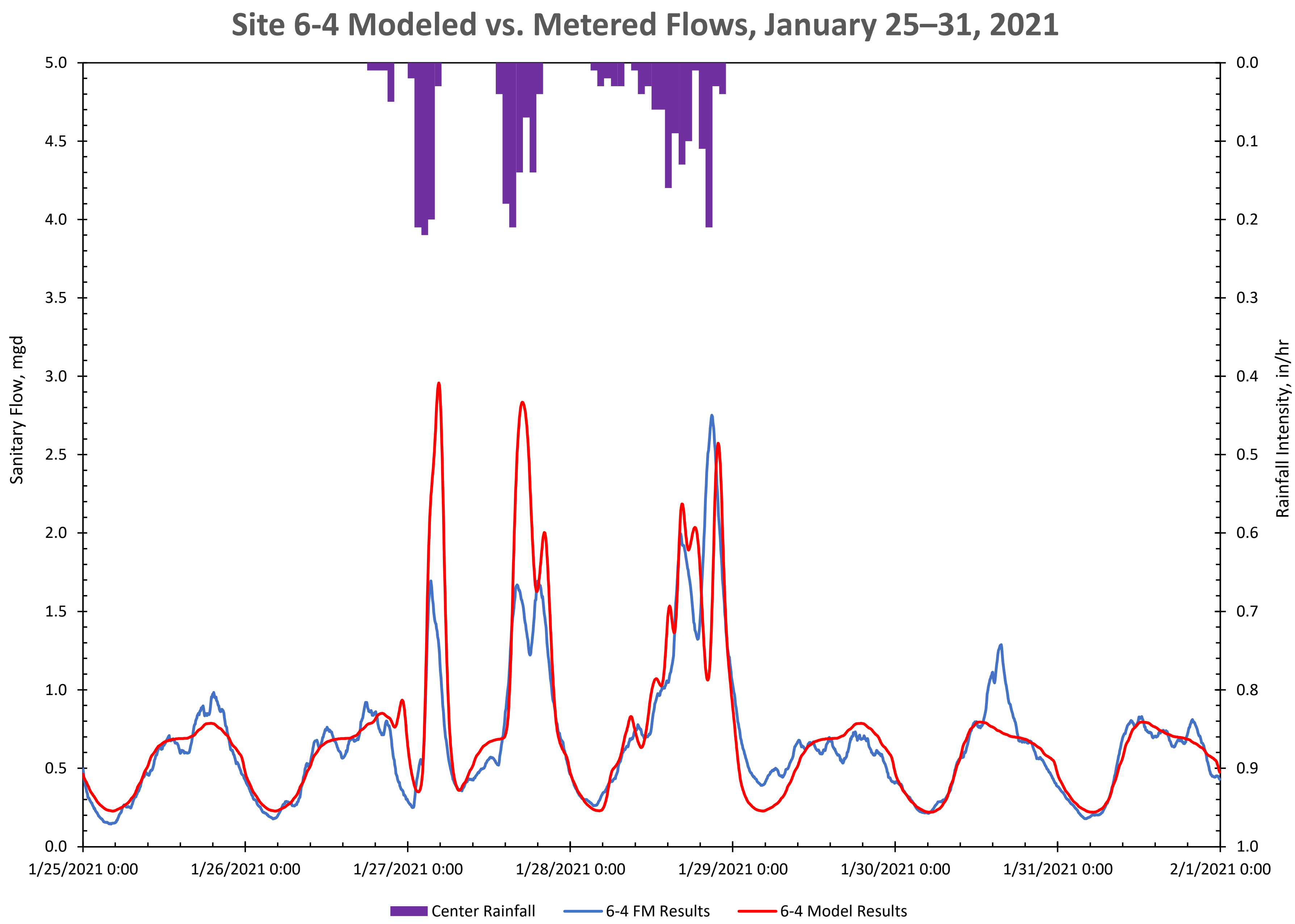


Site 6-2 Modeled vs. Metered Flows, January 25–31, 2021

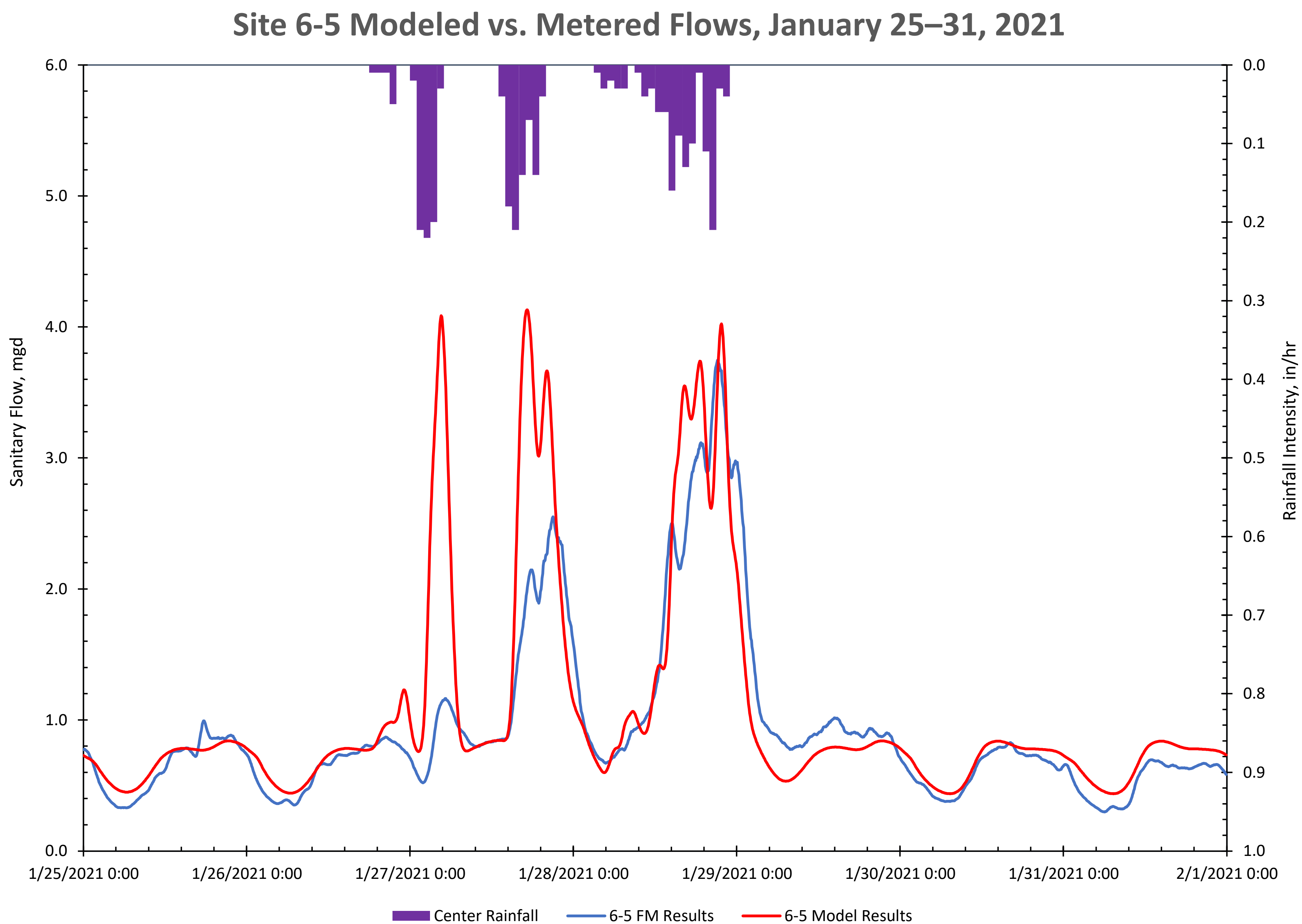




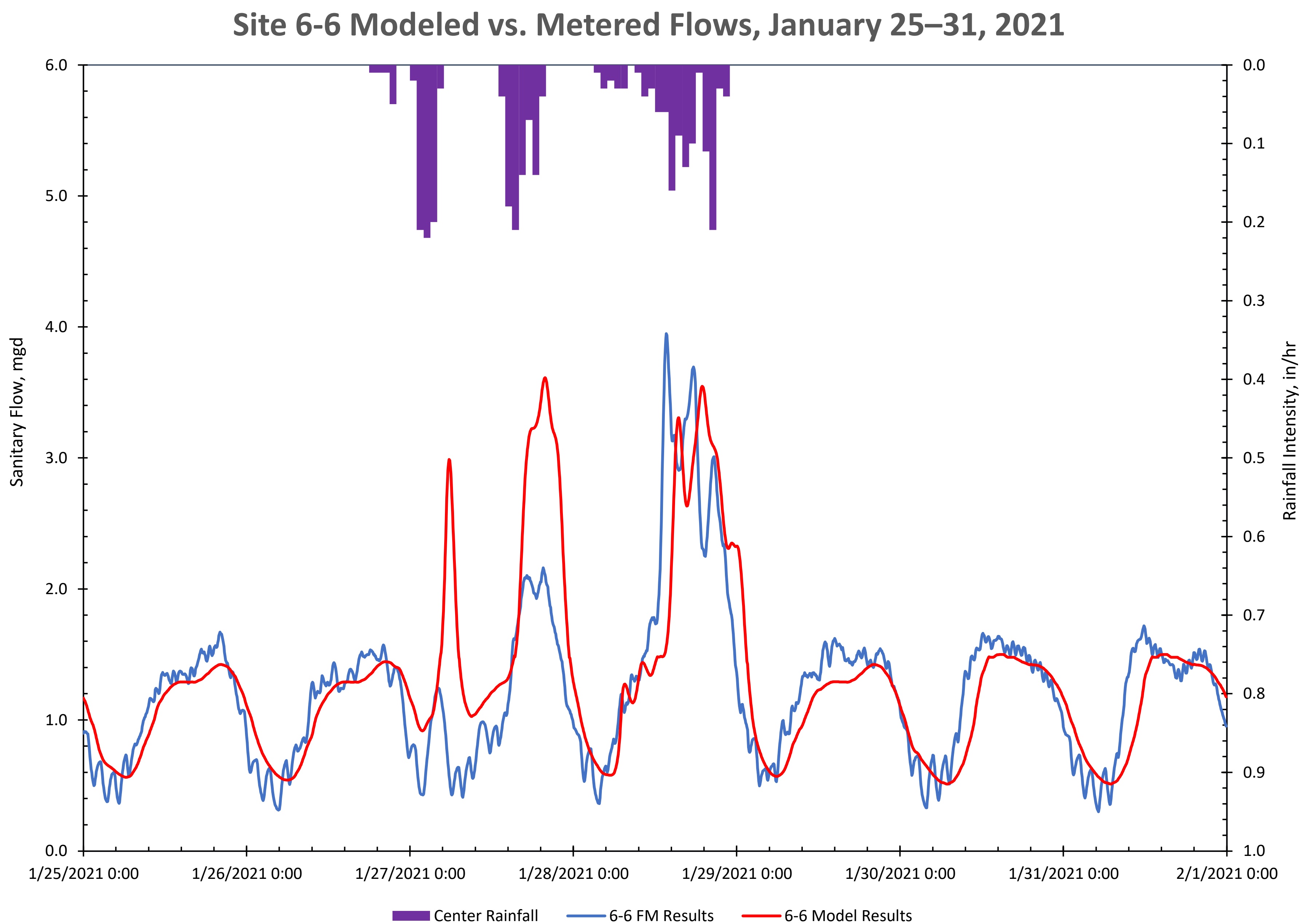
Site 6-3 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
6-3 FM Results
6-3 Model Results



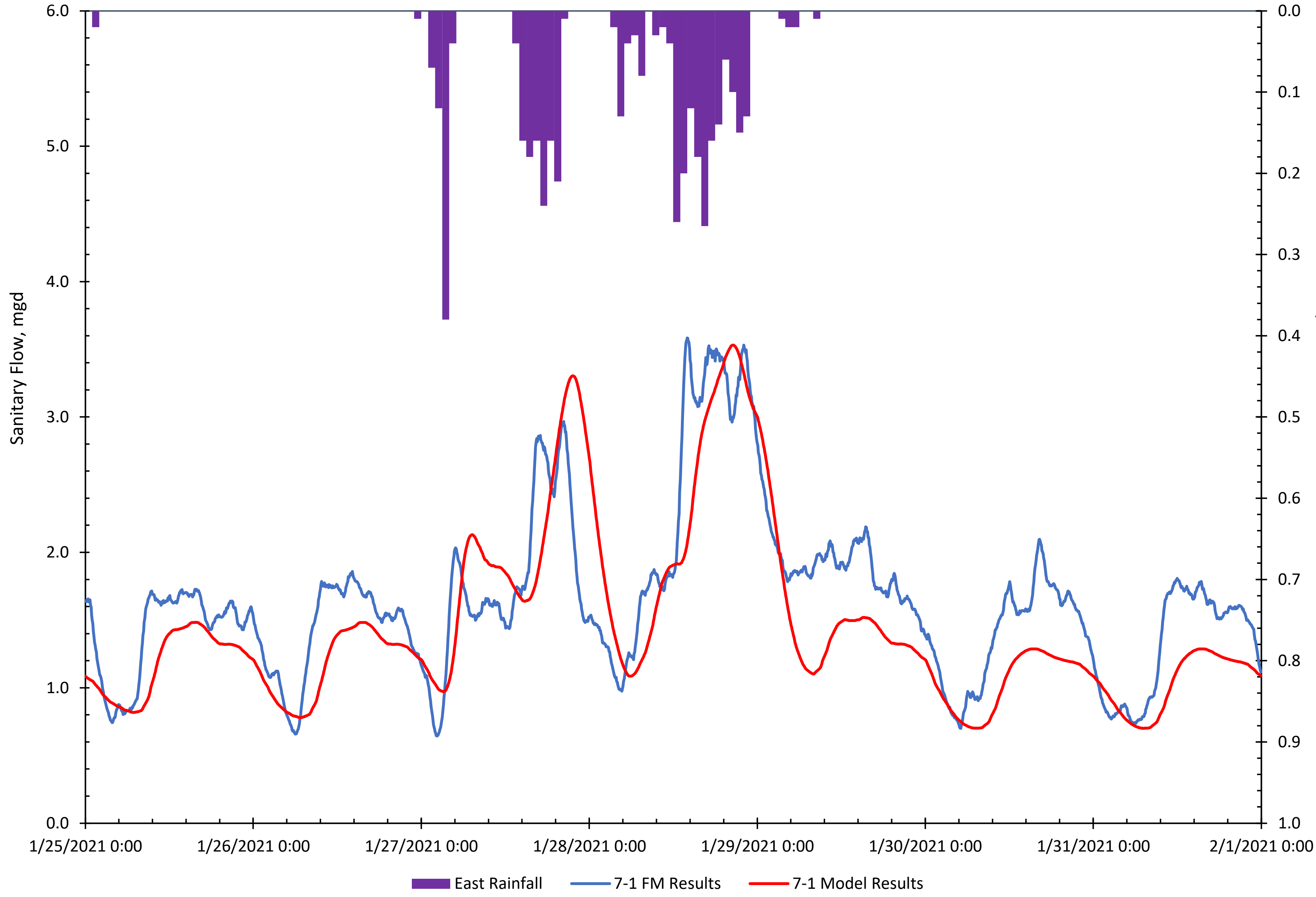
Site 6-4 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
6-4 FM Results
6-4 Model Results

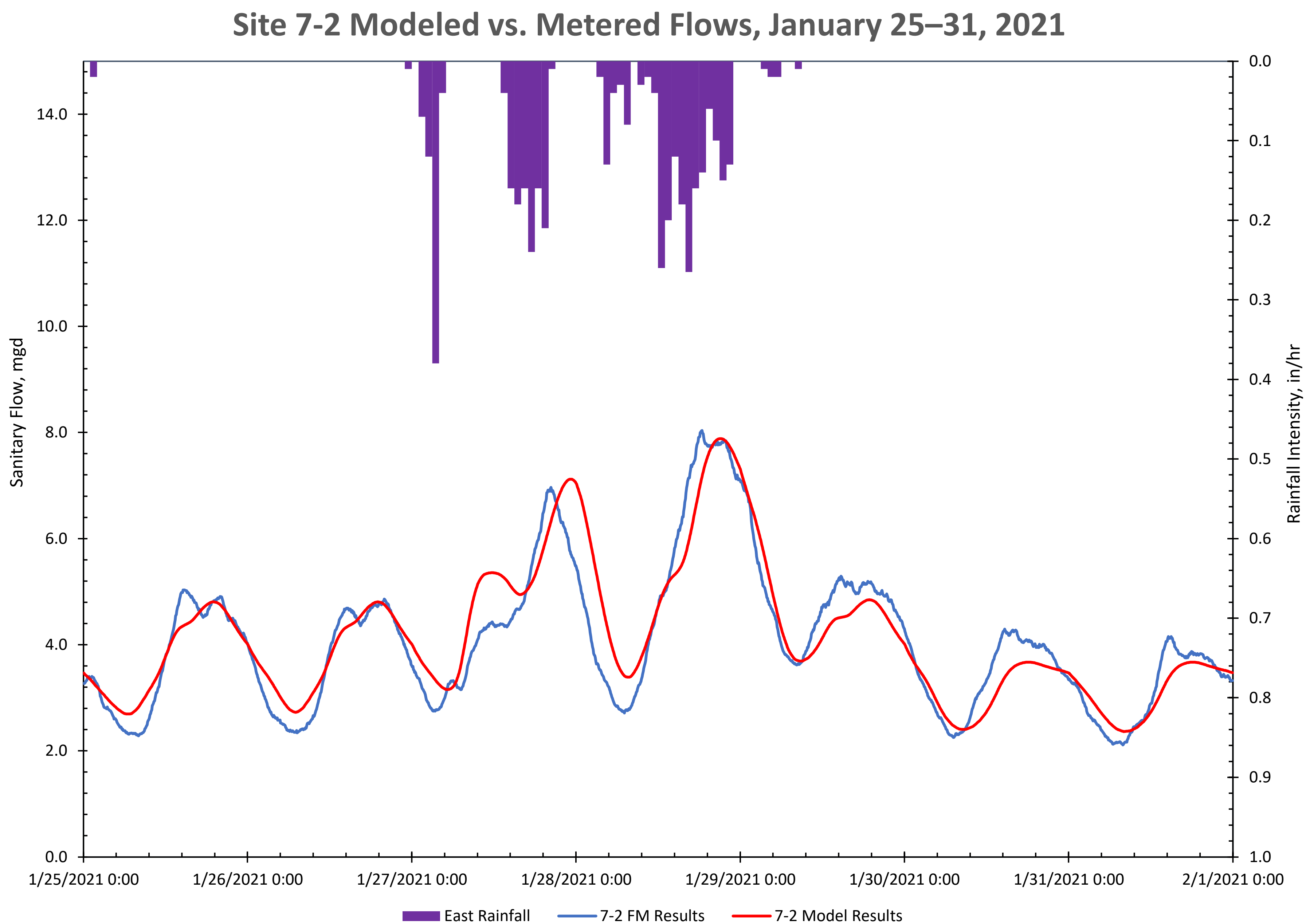


Site 6-5 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
6-5 FM Results
6-5 Model Results

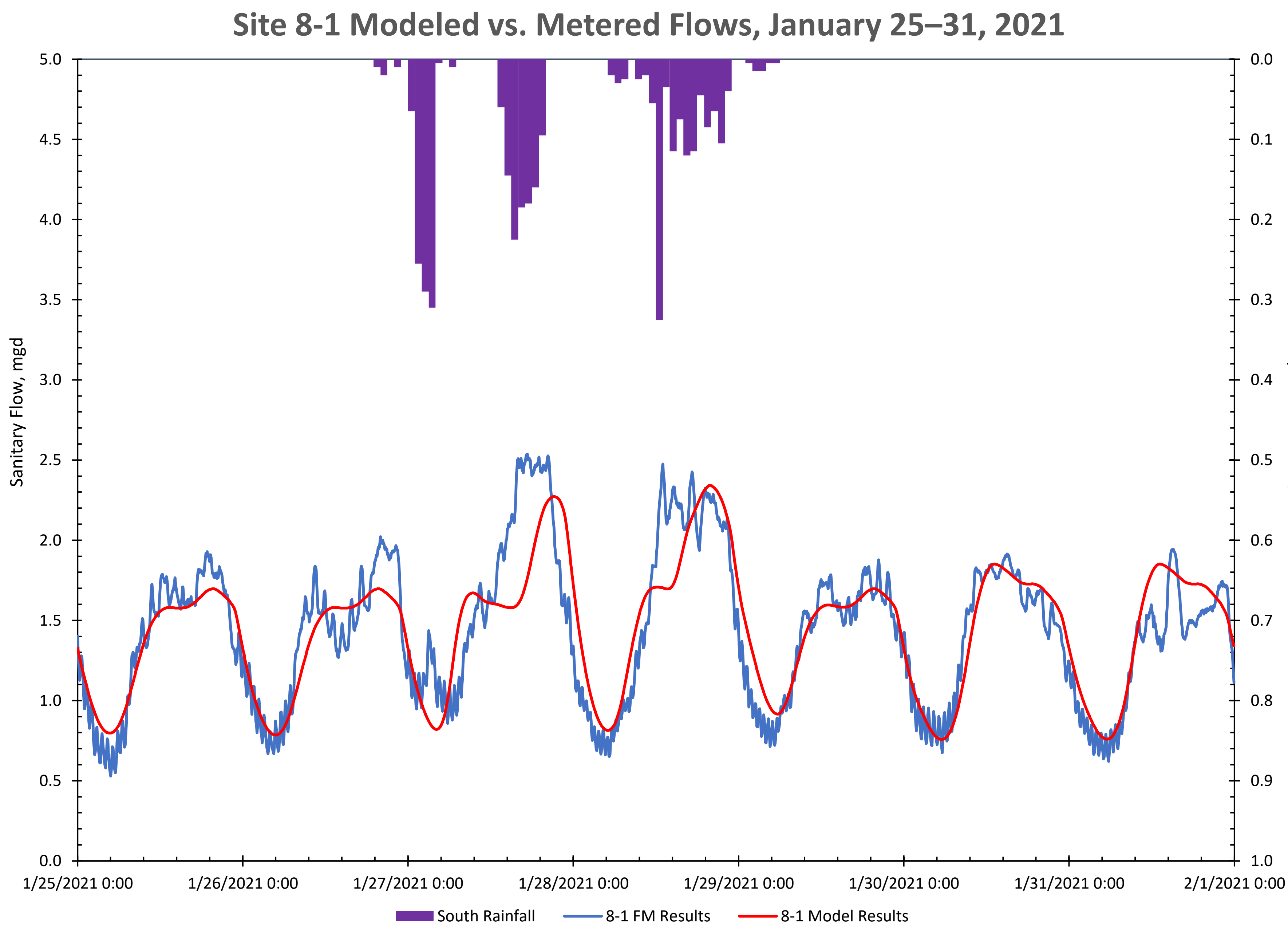

Site 6-6 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
6-6 FM Results
6-6 Model Results

Site 7-1 Modeled vs. Metered Flows, January 25–31, 2021

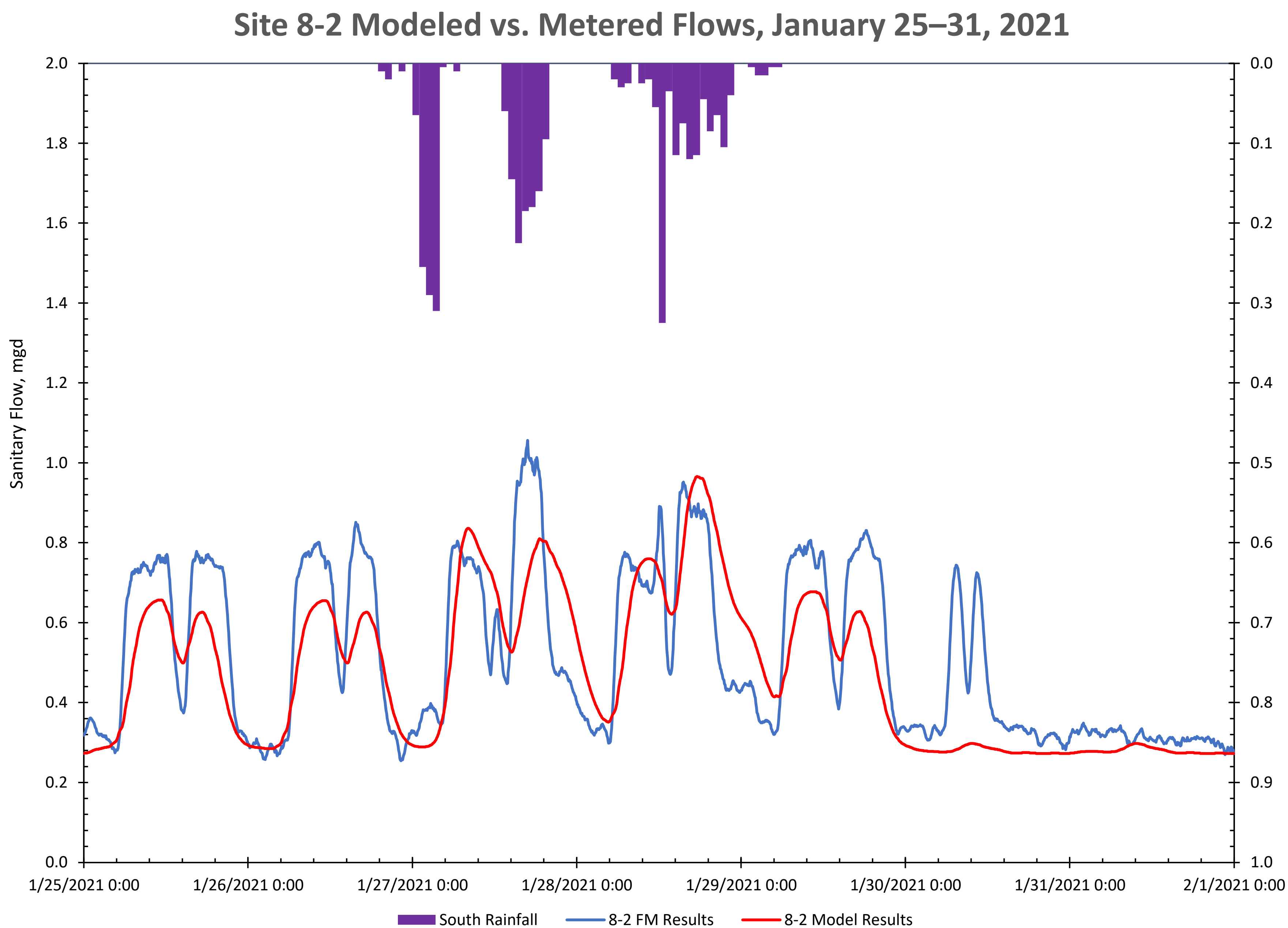




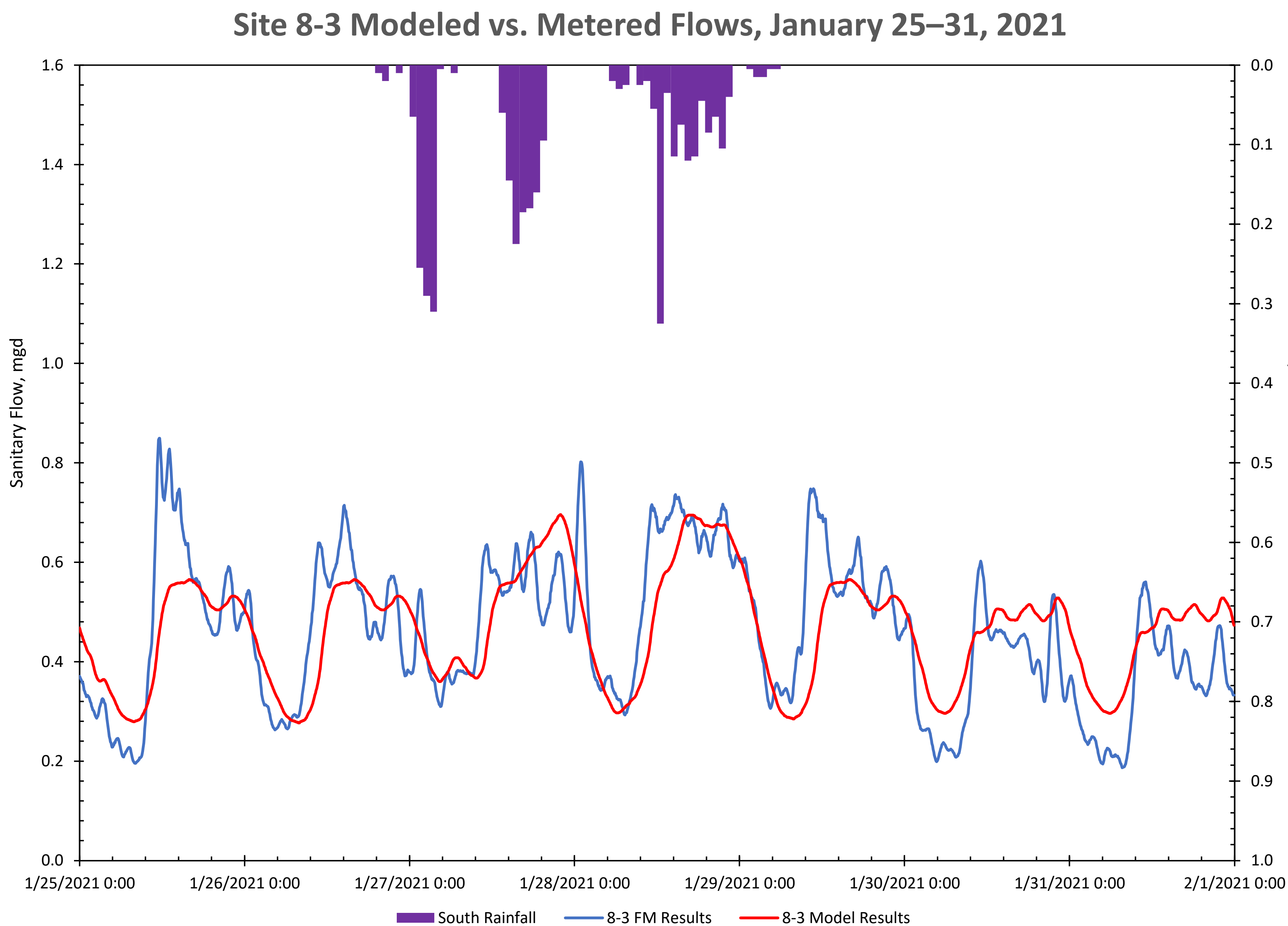
Site 7-2 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
7-2 FM Results
7-2 Model Results



Site 8-1 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
South Rainfall
8-1 FM Results
8-1 Model Results

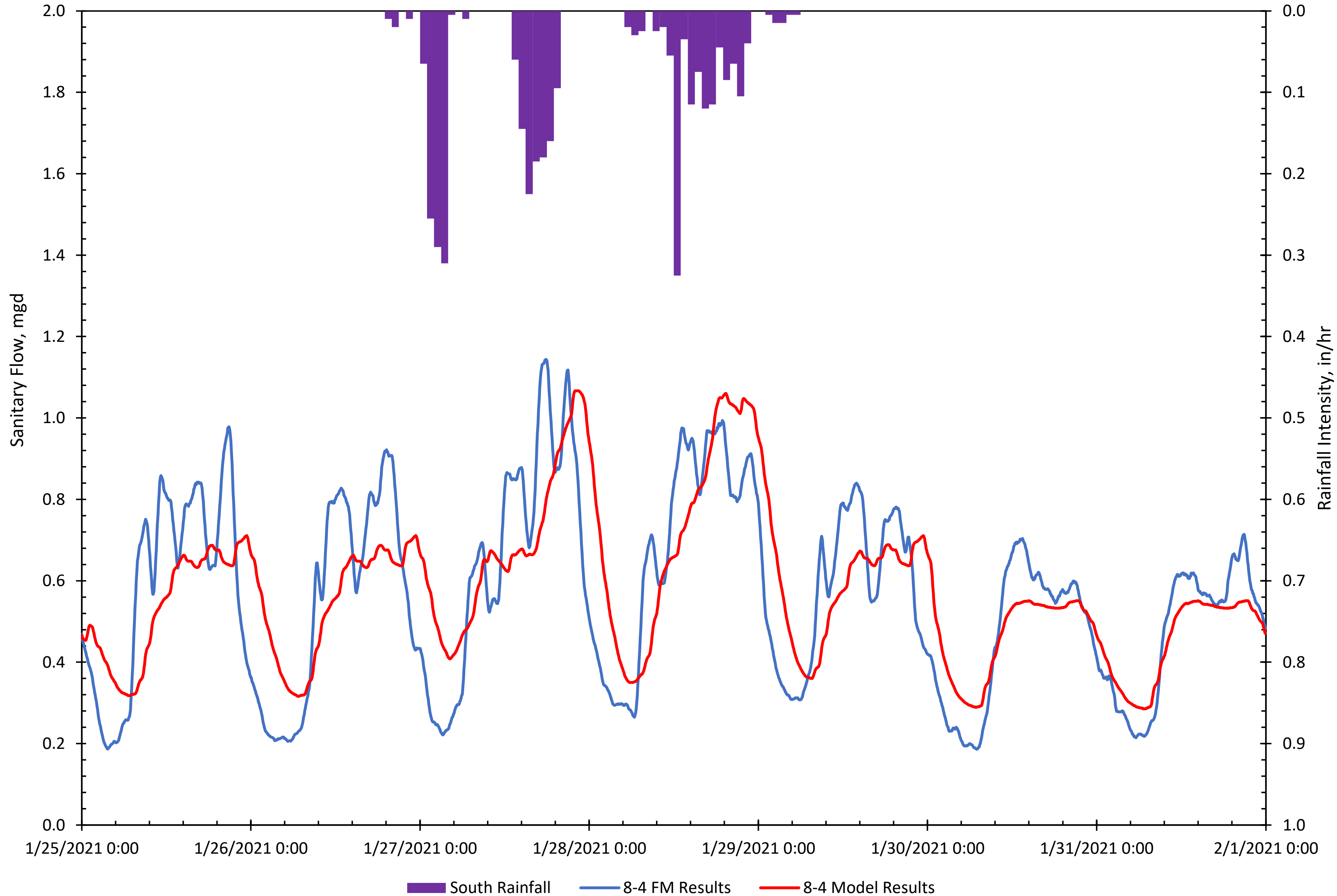


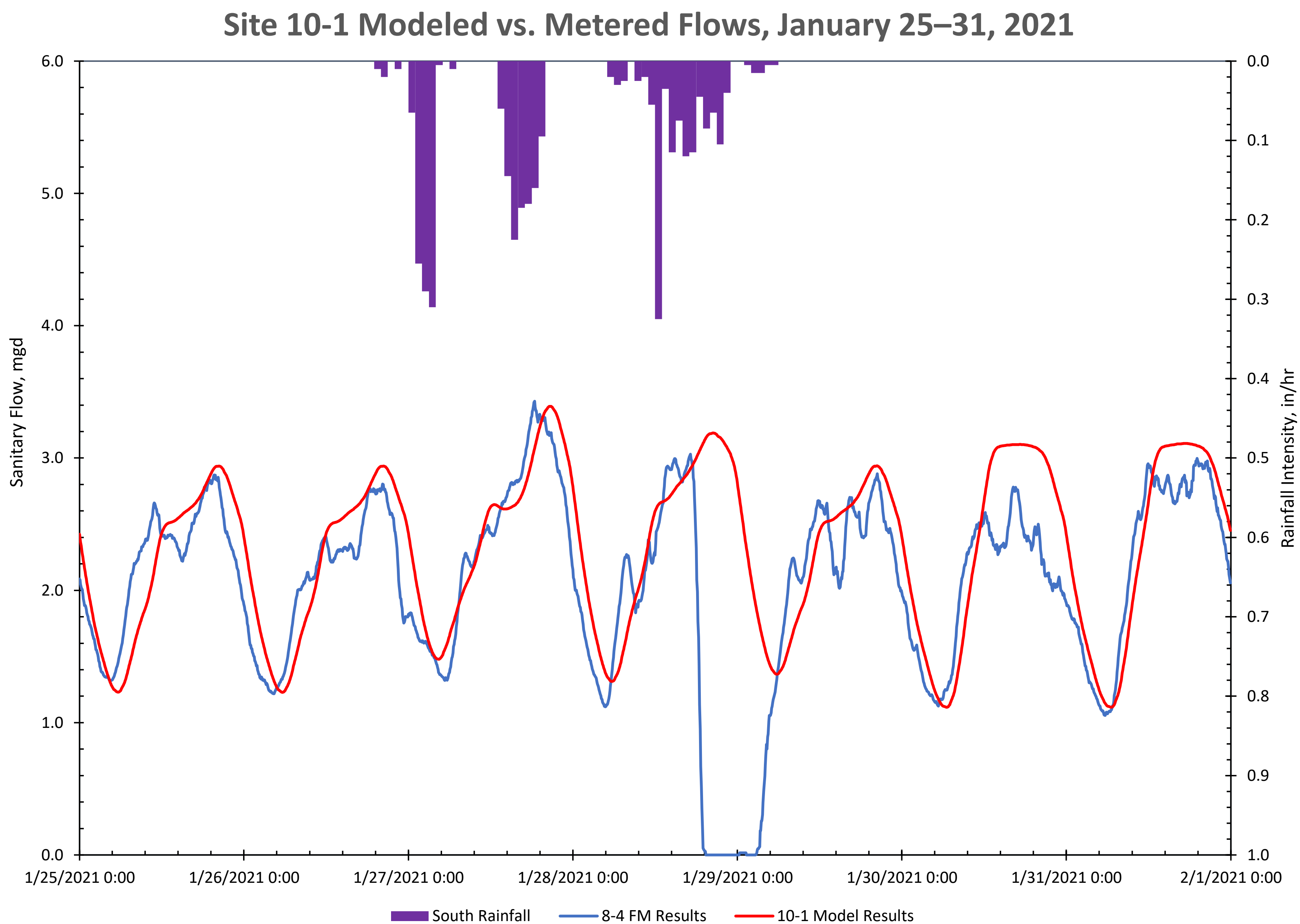
Site 8-2 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
South Rainfall
8-2 FM Results
8-2 Model Results



Site 8-3 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
rainfall Inetnsity, in/hr
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
0.1
0.3
0.5
0.7
0.9
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
South Rainfall
8-3 FM Results
8-3 Model Results

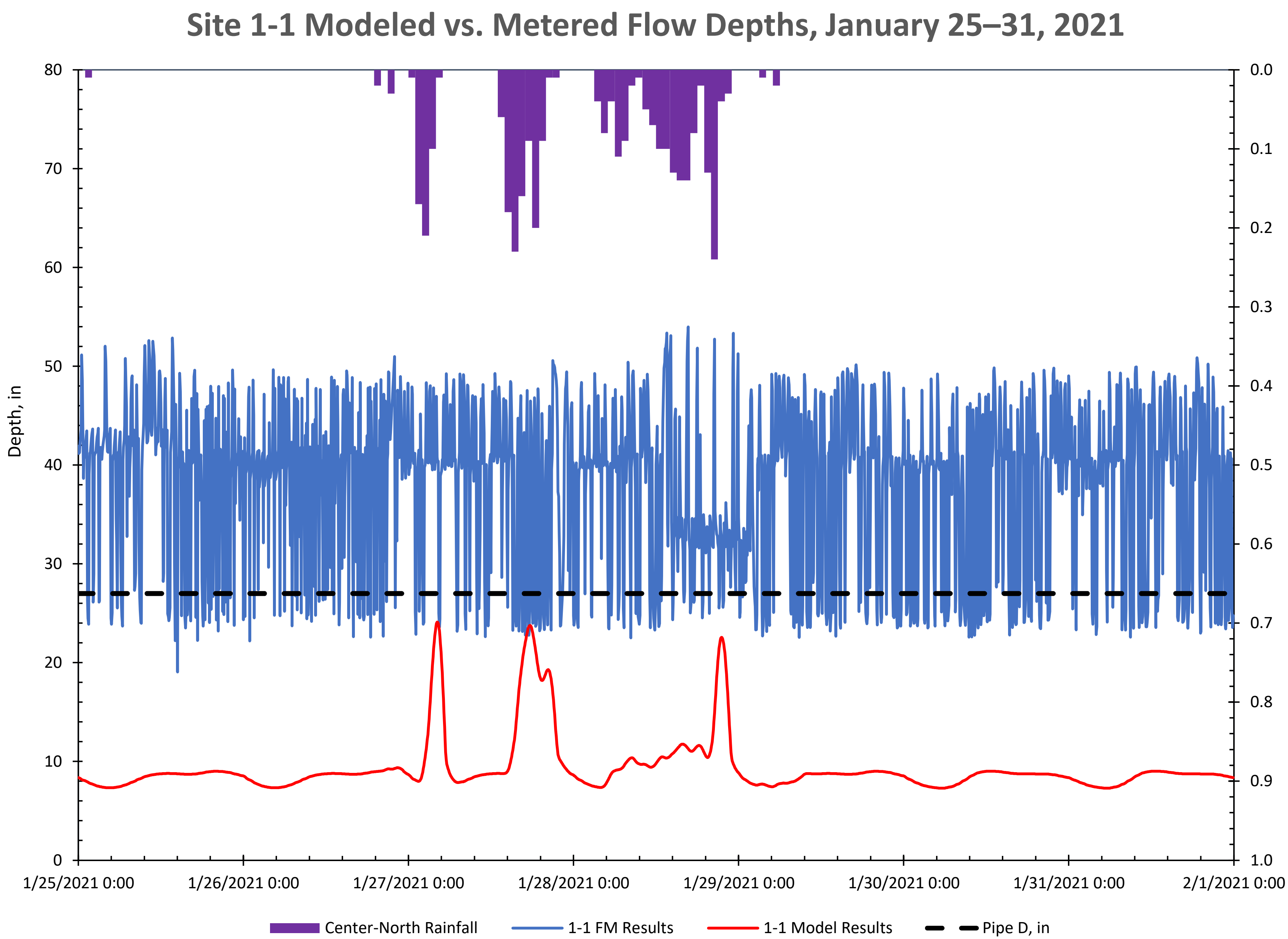
Site 8-4 Modeled vs. Metered Flows, January 25–31, 2021



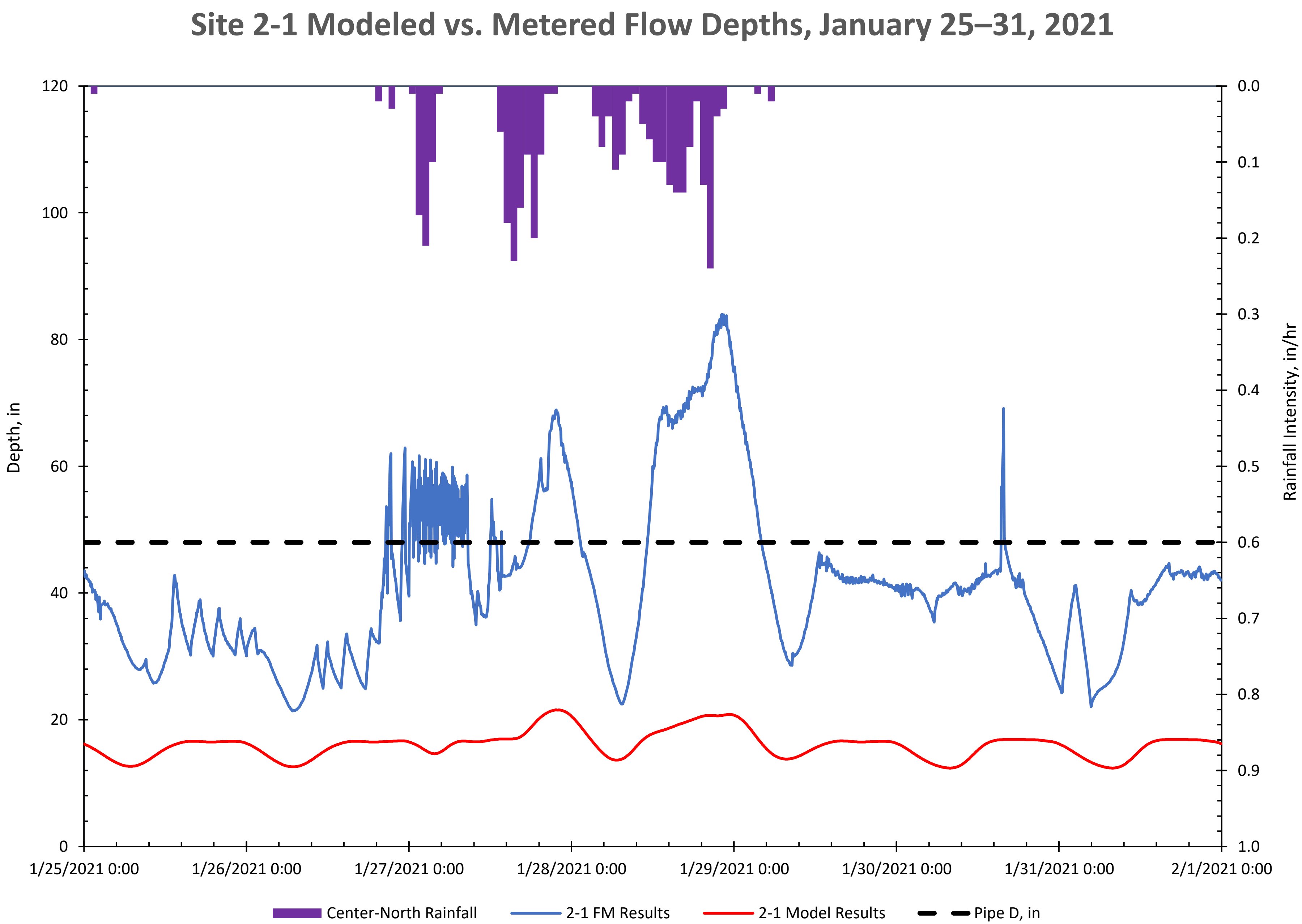

Site 10-1 Modeled vs. Metered Flows, January 25–31, 2021
Sanitary Flow, mgd
Rainfall Intensity, in/hr
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
South Rainfall
8-4 FM Results
10-1 Model Results

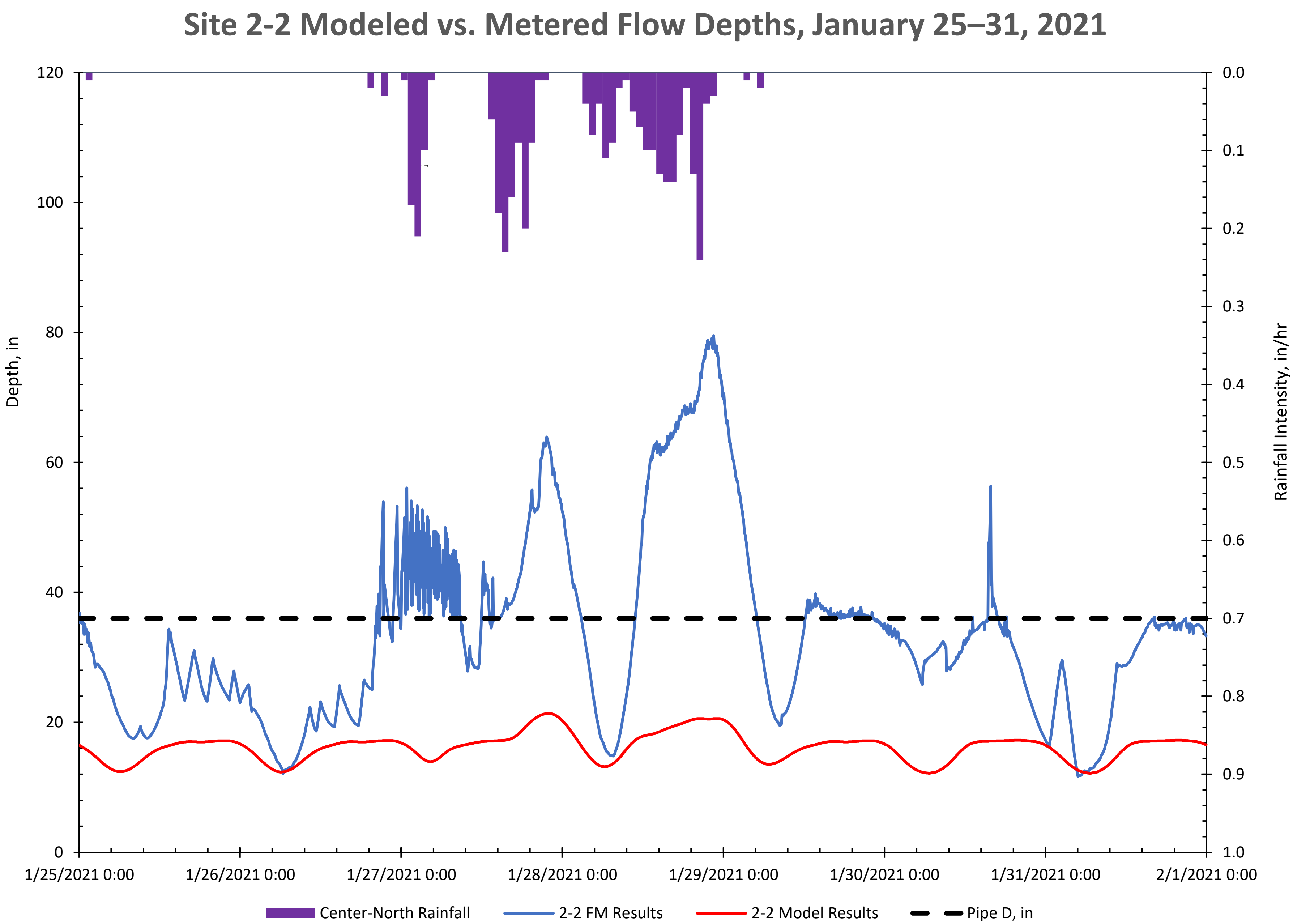
Appendix F

Modeled vs. Metered Wet Weather Flow Depths



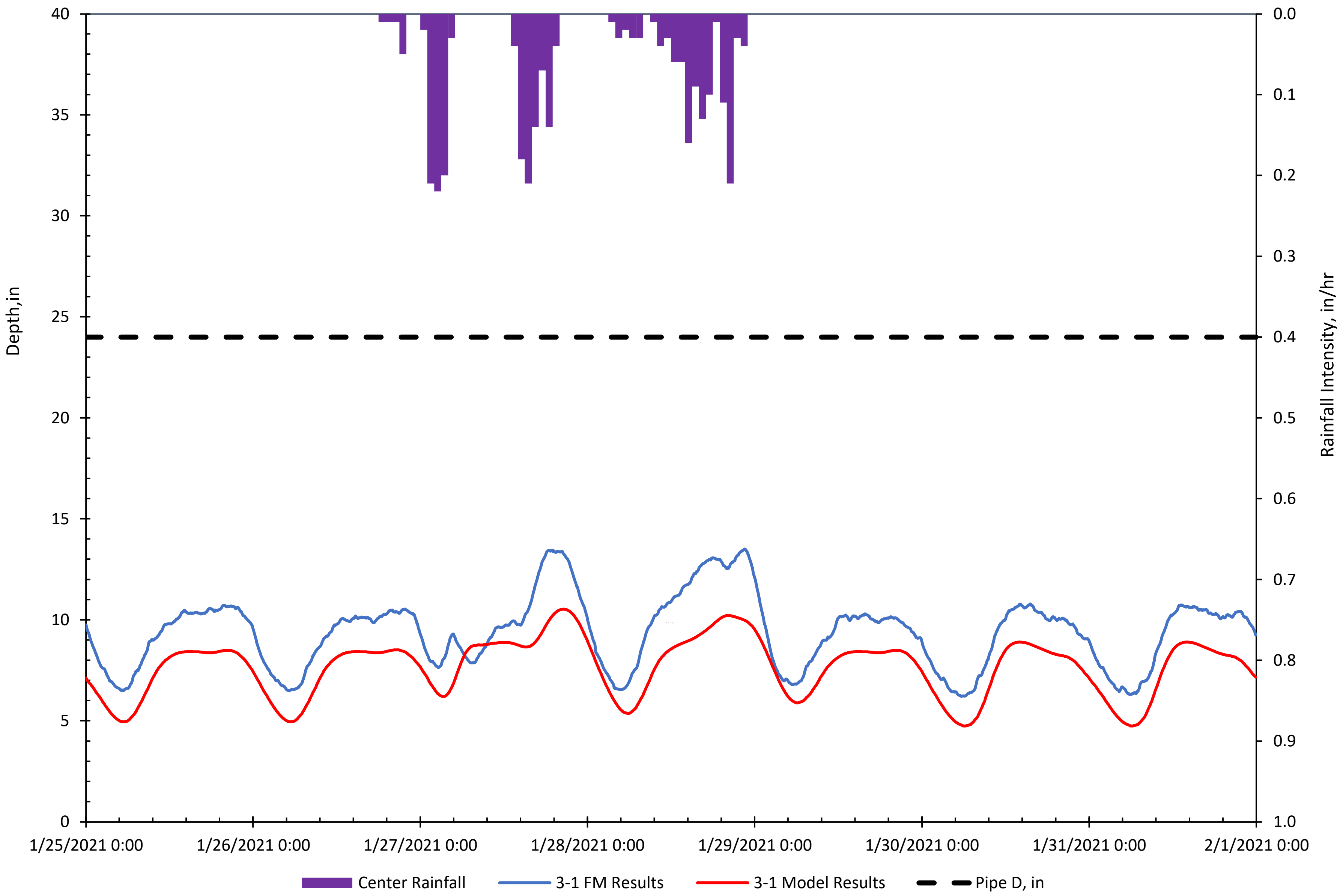
Site 1-1 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth, in
Rainfall Intensity, in/hr
0
10
20
30
40
50
60
70
80
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center-North Rainfall
1-1 FM Results
1-1 Model Results
Pipe D, in

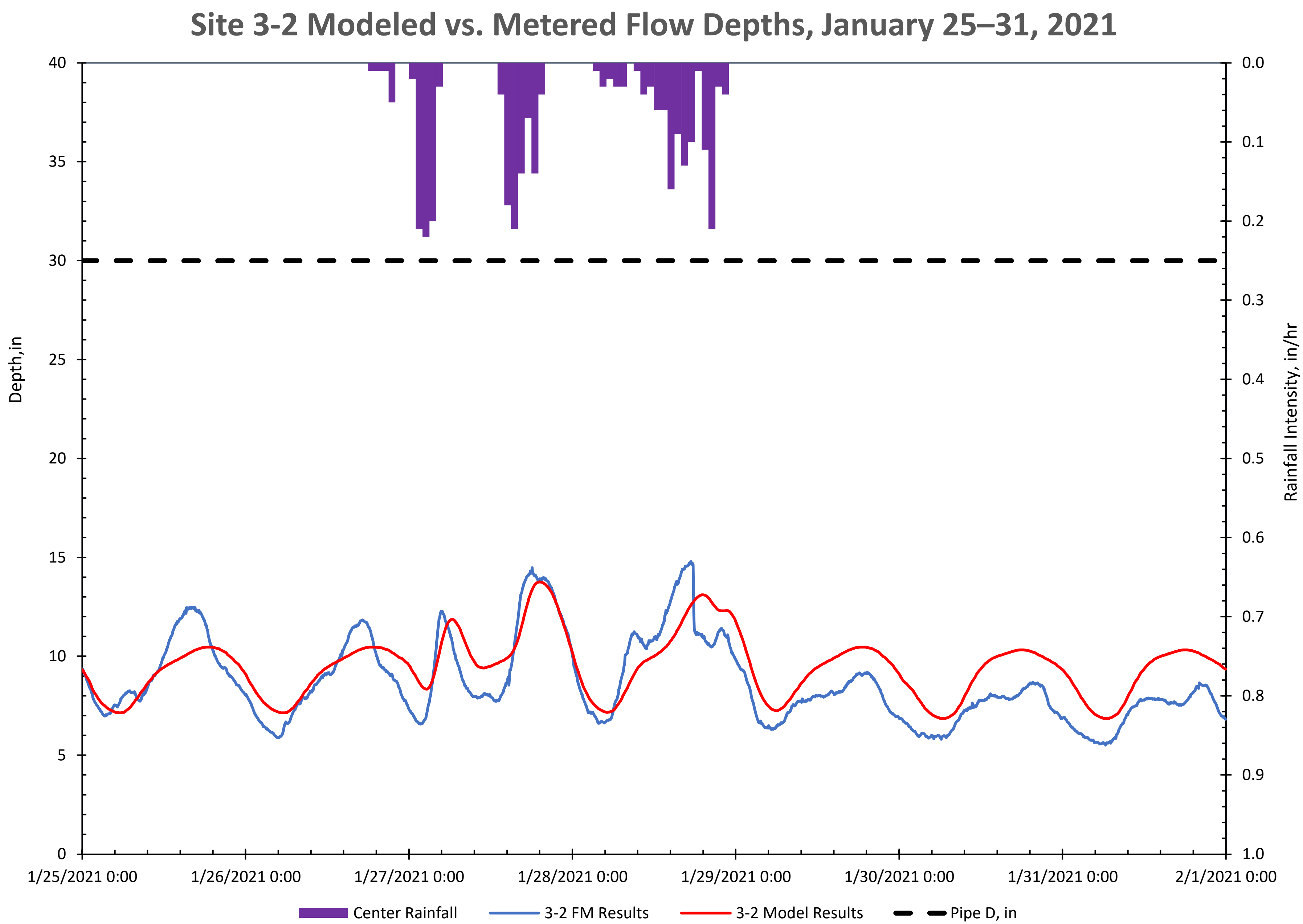

Site 2-1 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth, in
Rainfall Intensity, in/hr
120
100
80
60
40
20
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center-North Rainfall
2-1 FM Results
2-1 Model Results
Pipe D, in



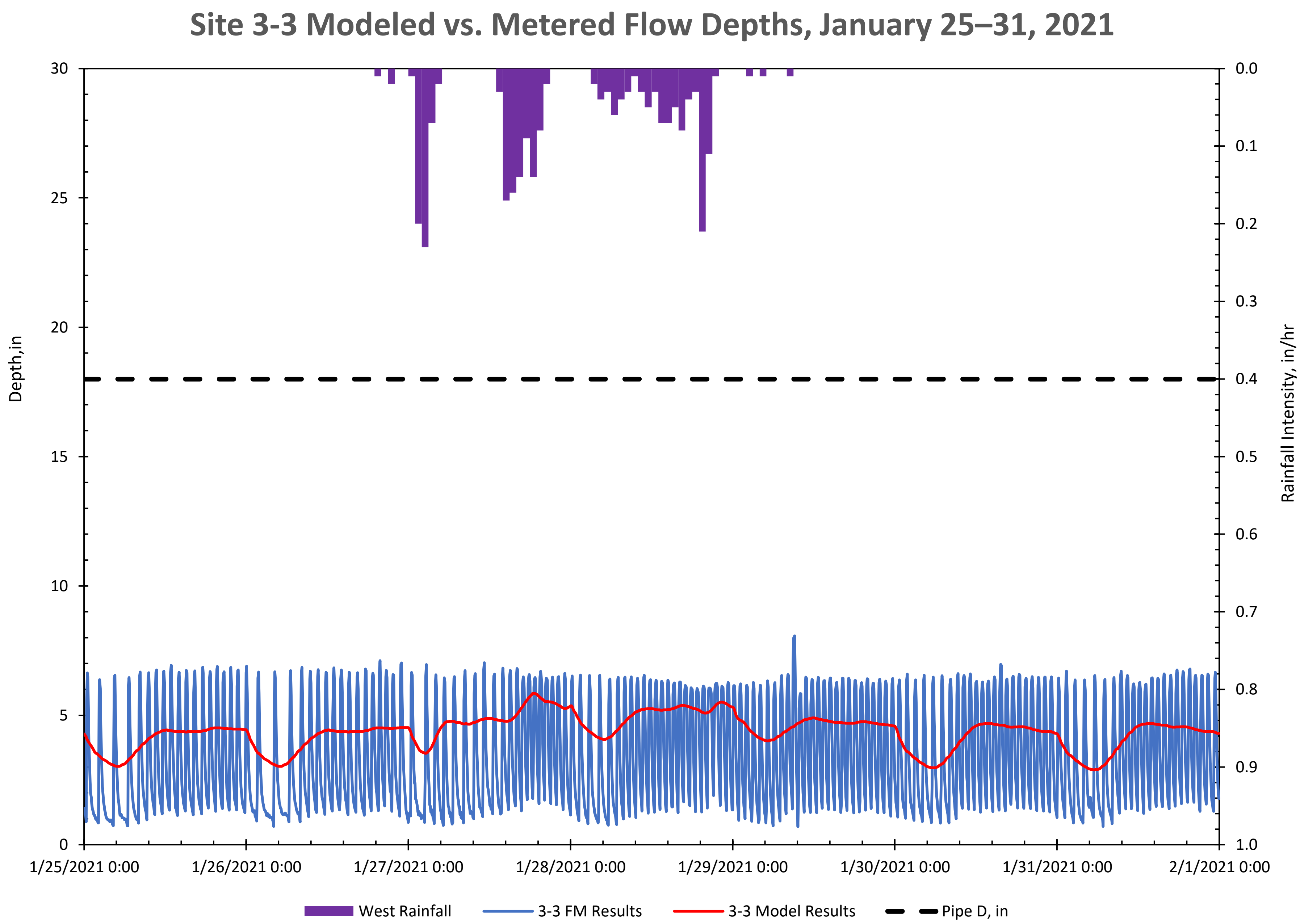
Site 2-2 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth, in
Rainfall Intensity, in/hr
120
100
80
60
40
20
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center-North Rainfall
2-2 FM Results
2-2 Model Results
Pipe D, in

Site 3-1 Modeled vs. Metered Flow Depths, January 25–31, 2021

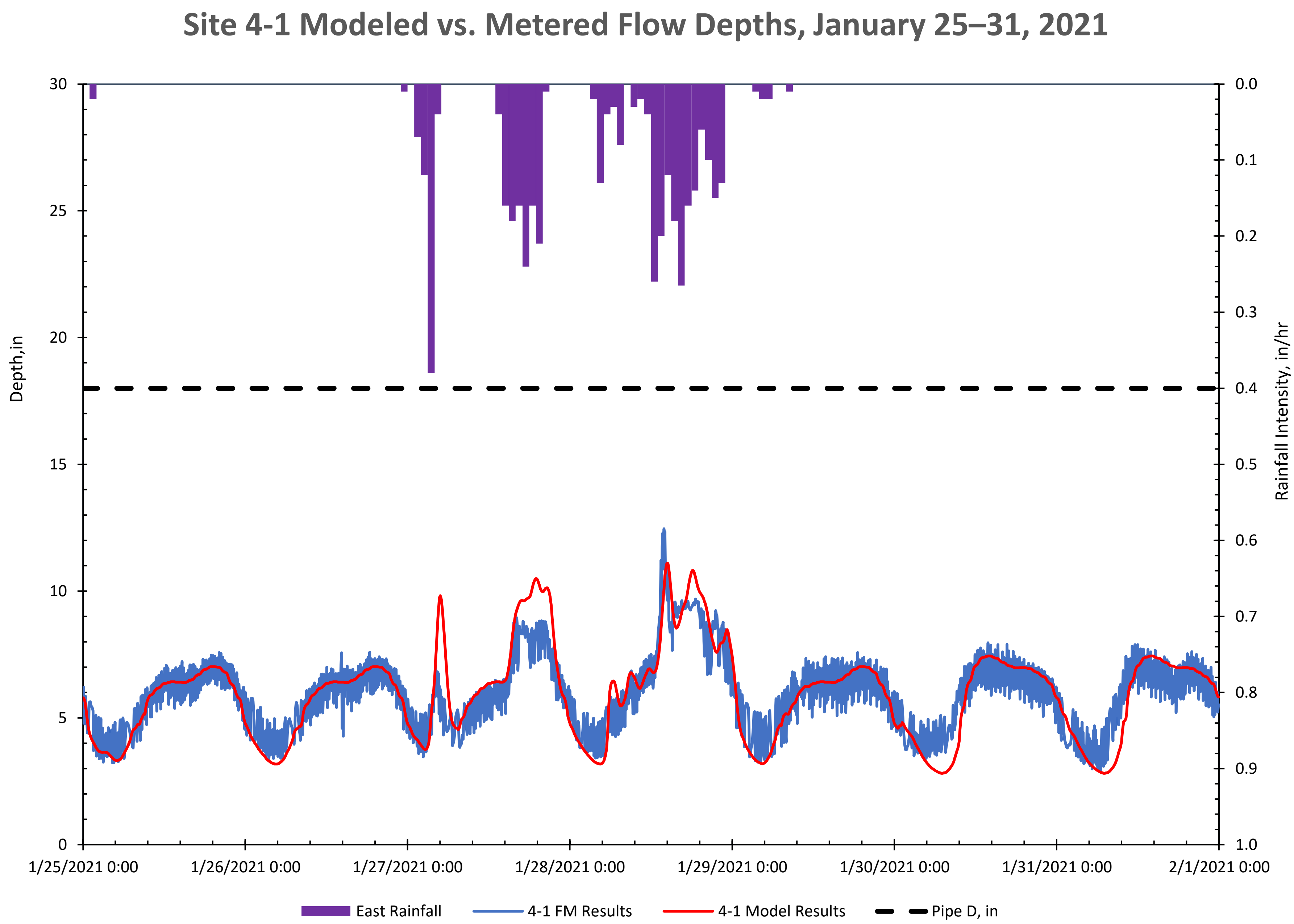




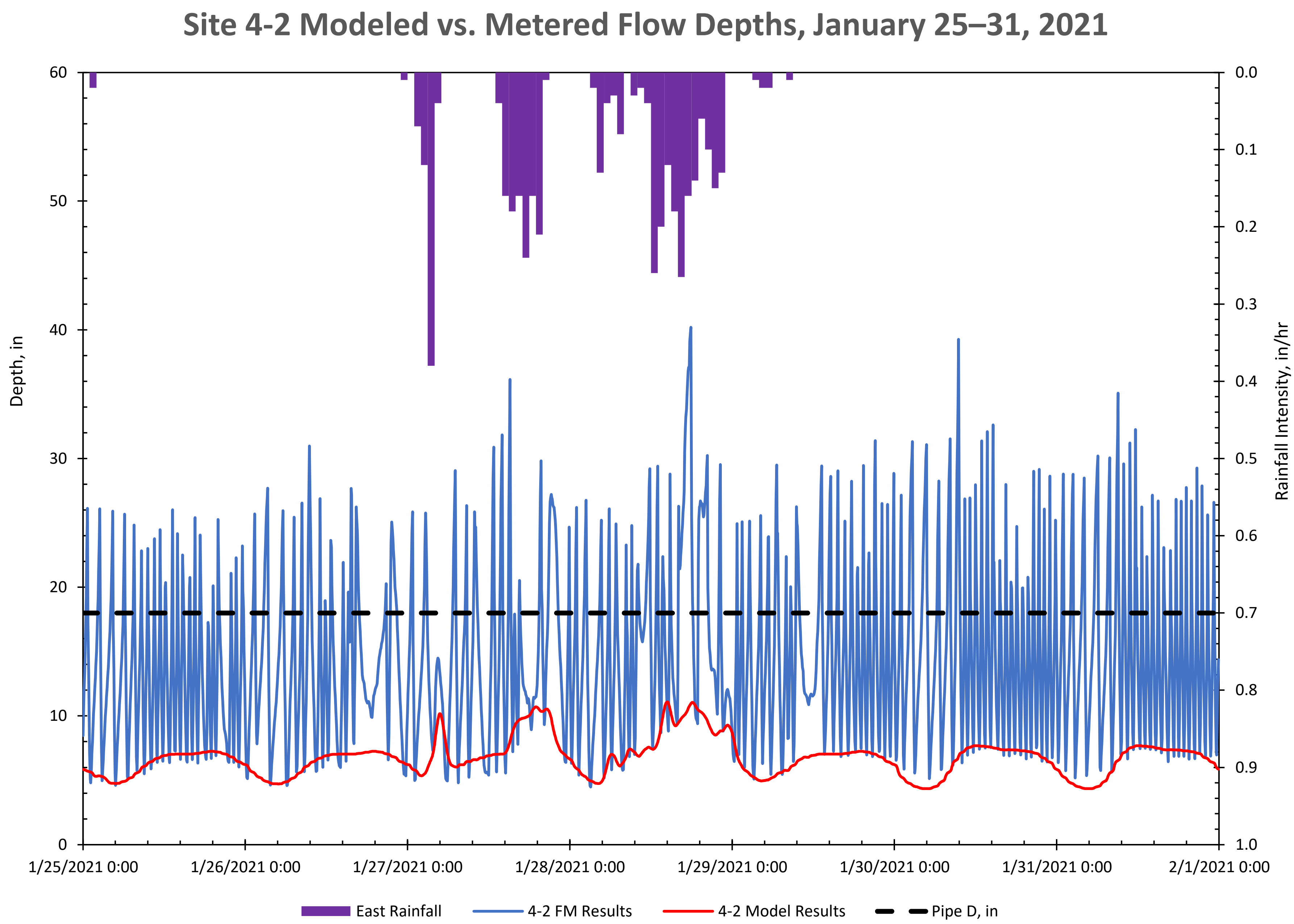
Site 3-2 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
0
5
10
15
20
25
30
35
40
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
3-2 FM Results
3-2 Model Results
Pipe D, in



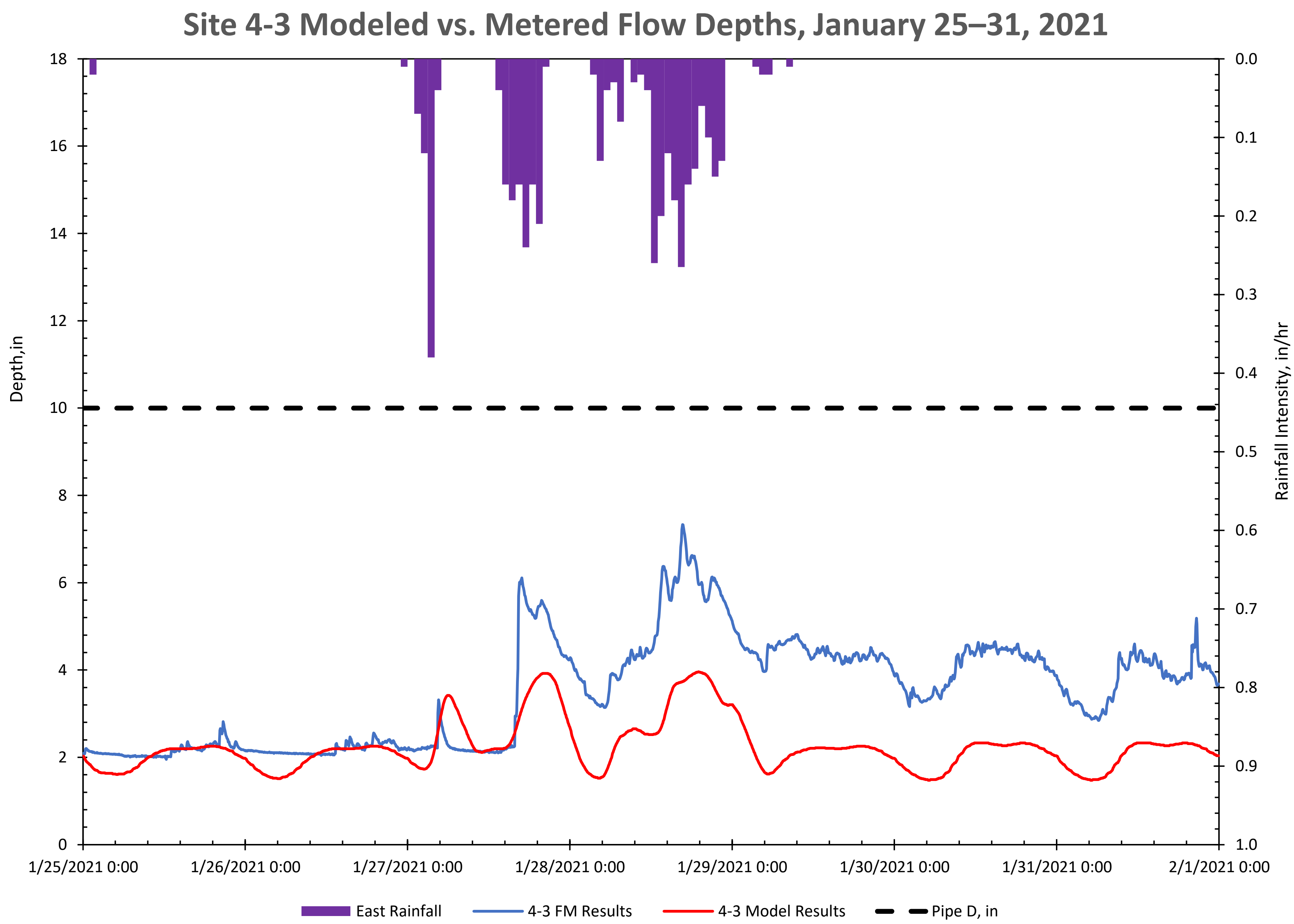
Site 3-3 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
30
25
20
15
10
5
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
West Rainfall
3-3 FM Results
3-3 Model Results
Pipe D, in



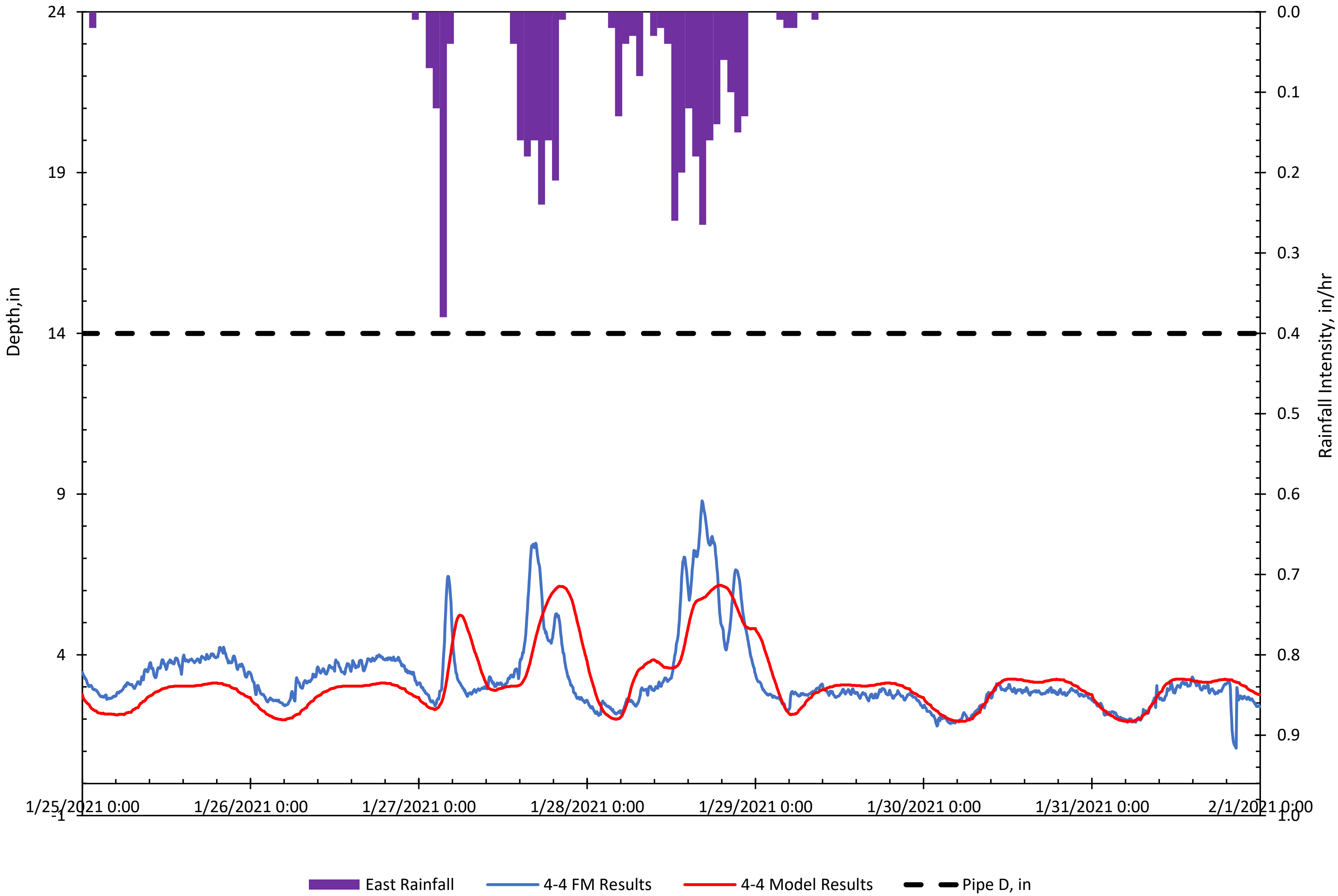
Site 4-1 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
30
25
20
15
10
5
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
4-1 FM Results
4-1 Model Results
Pipe D, in

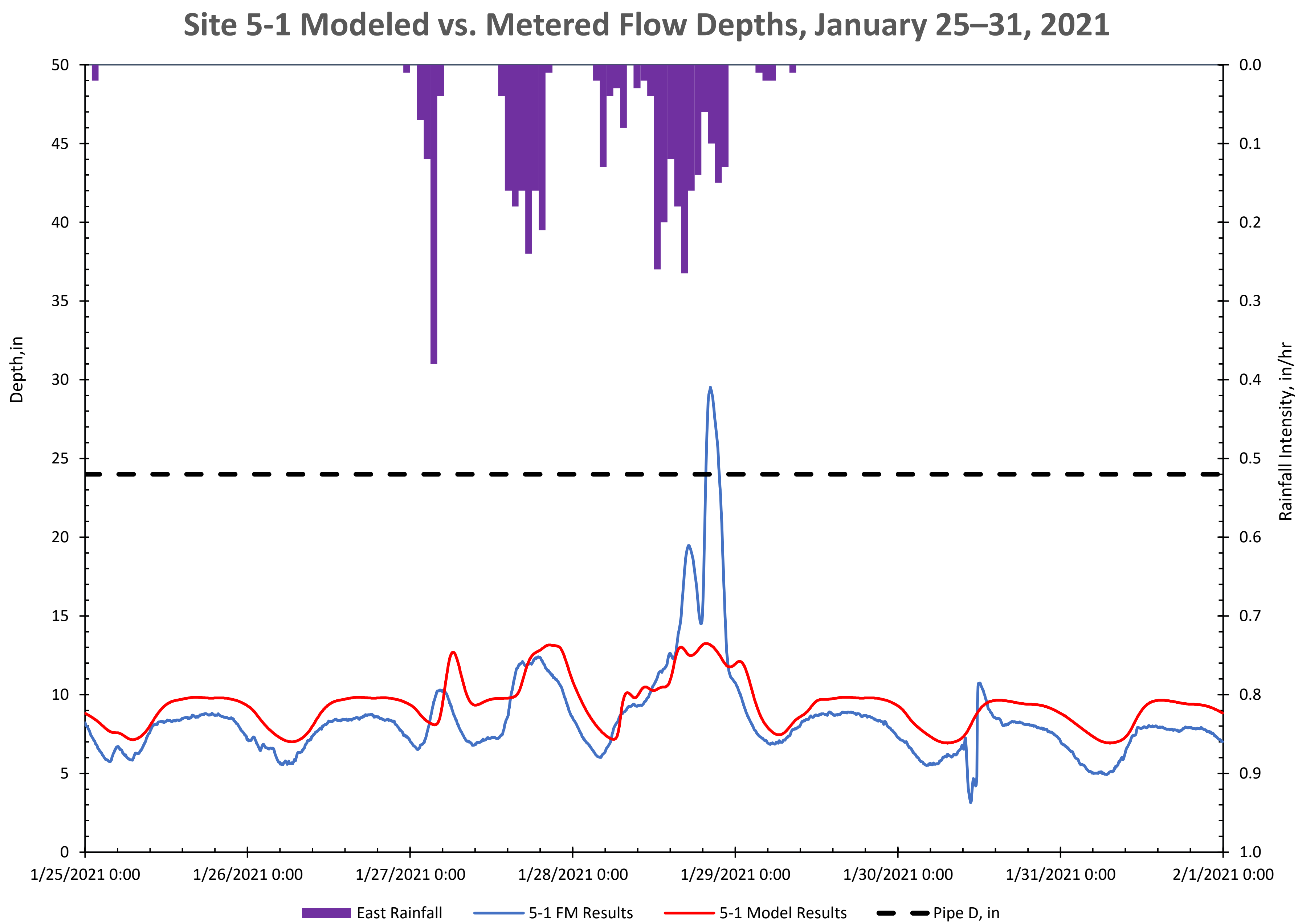


Site 4-2 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth, in
Rainfall Intensity, in/hr
0
10
20
30
40
50
60
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
4-2 FM Results
4-2 Model Results
Pipe D, in

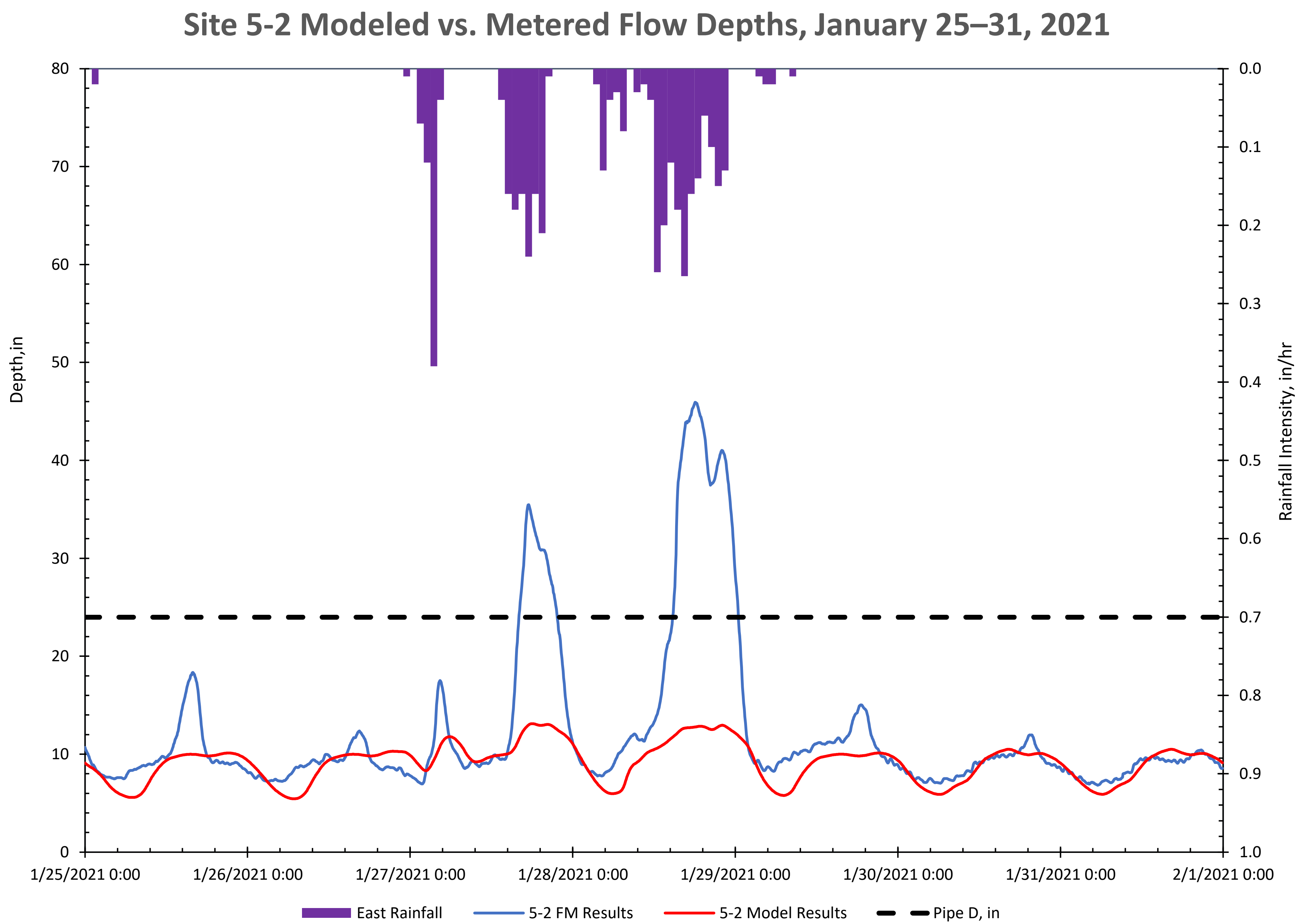

Site 4-3 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
18
16
14
12
10
8
6
4
2
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
4-3 FM Results
4-3 Model Results
Pipe D, in

Site 4-4 Modeled vs. Metered Flow Depths, January 25–31, 2021

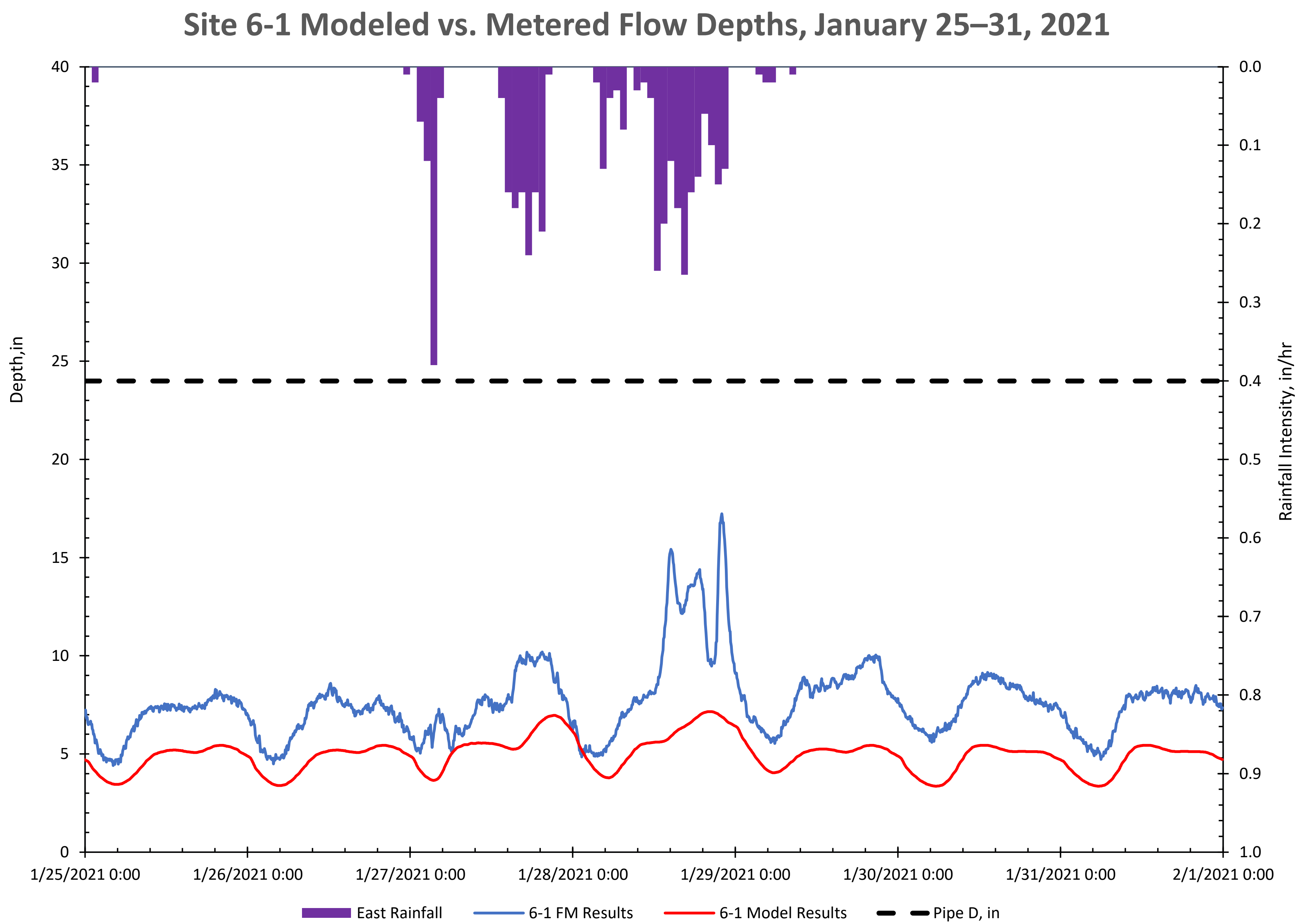




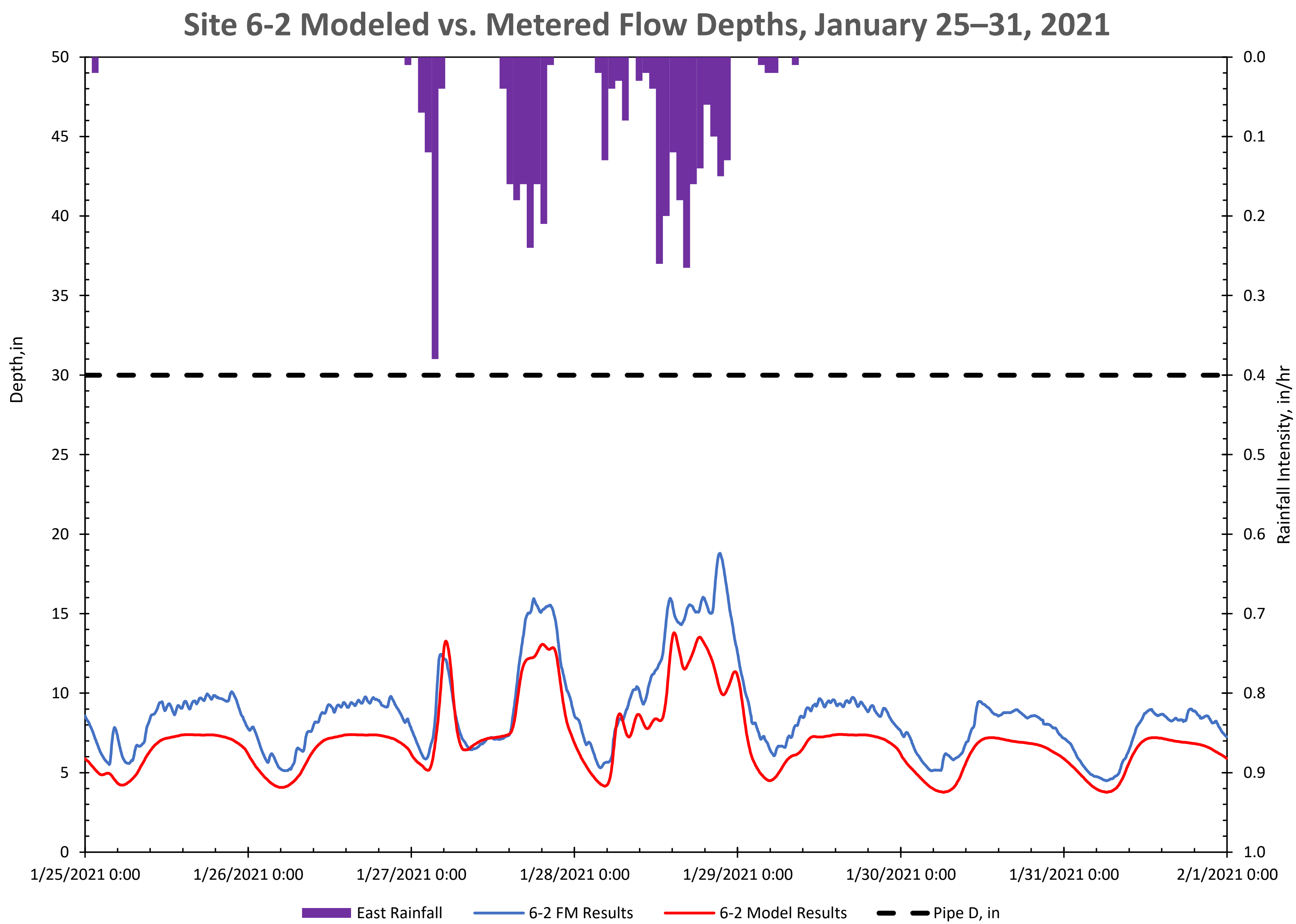
Site 5-1 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
0
5
10
15
20
25
30
35
40
45
50
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
5-1 FM Results
5-1 Model Results
Pipe D, in



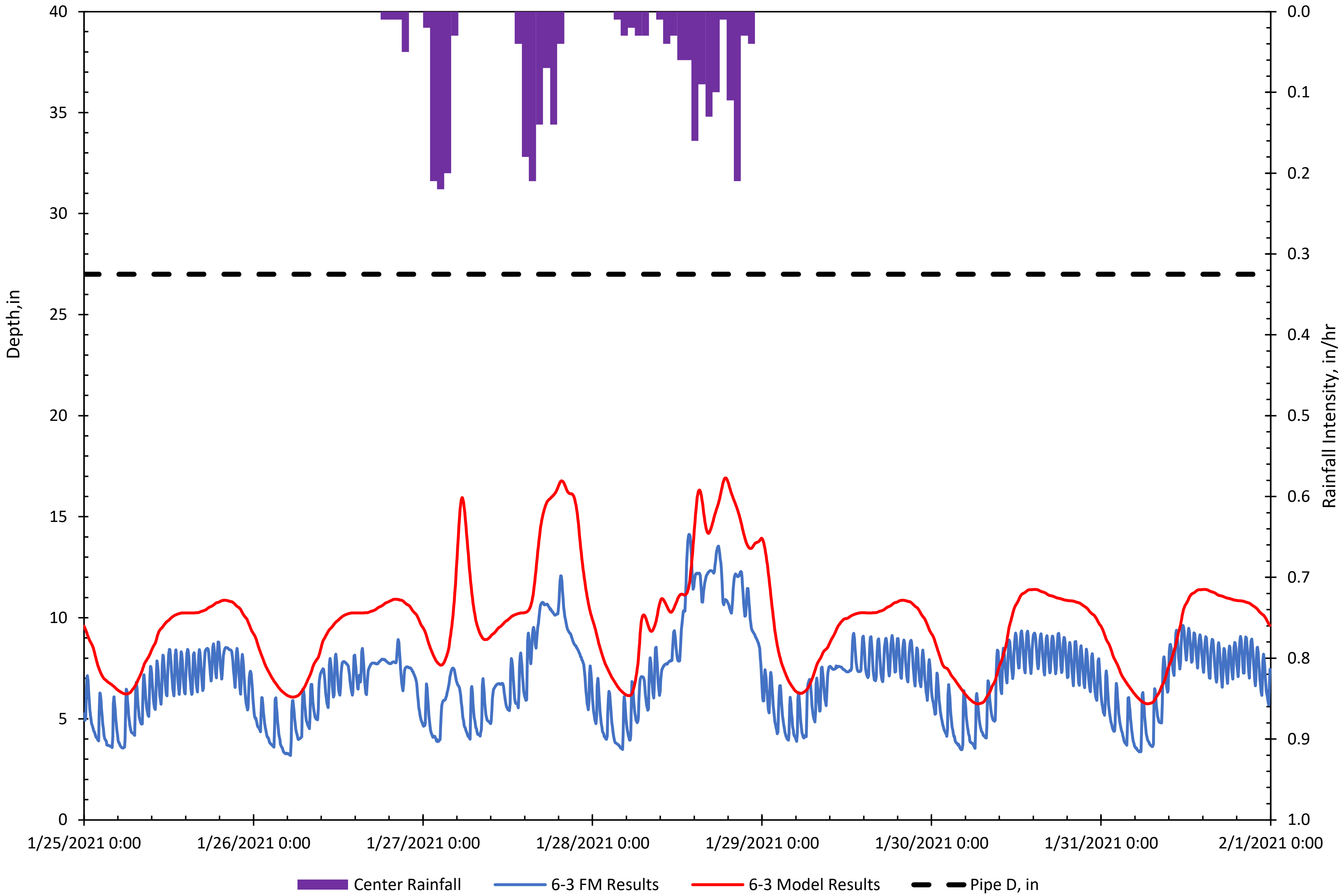
Site 5-2 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
0
10
20
30
40
50
60
70
80
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
5-2 FM Results
5-2 Model Results
Pipe D, in



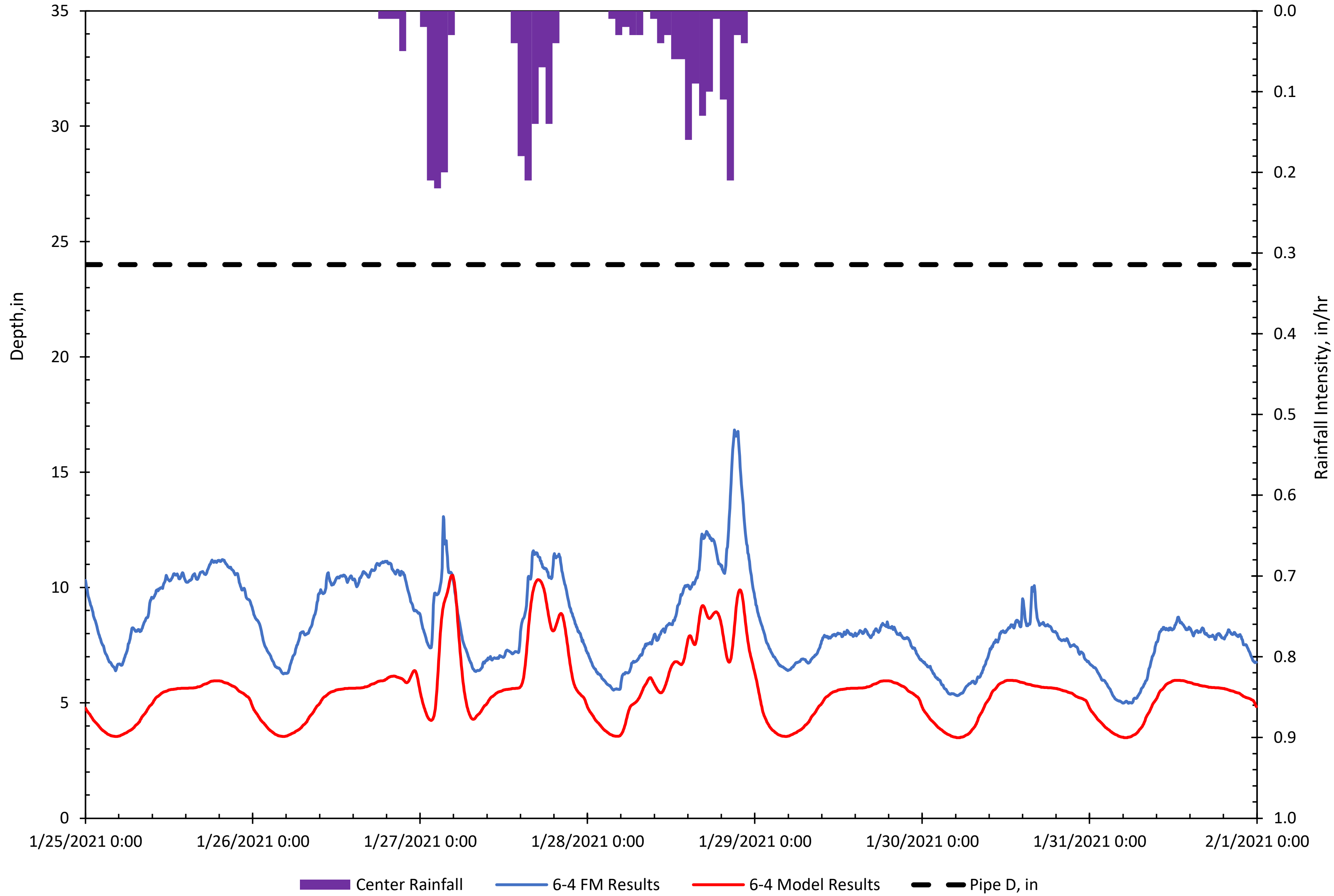
Site 6-1 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
40
35
30
25
20
15
10
5
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
6-1 FM Results
6-1 Model Results
Pipe D, in


Site 6-2 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
50
45
40
35
30
25
20
15
10
5
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
6-2 FM Results
6-2 Model Results
Pipe D, in

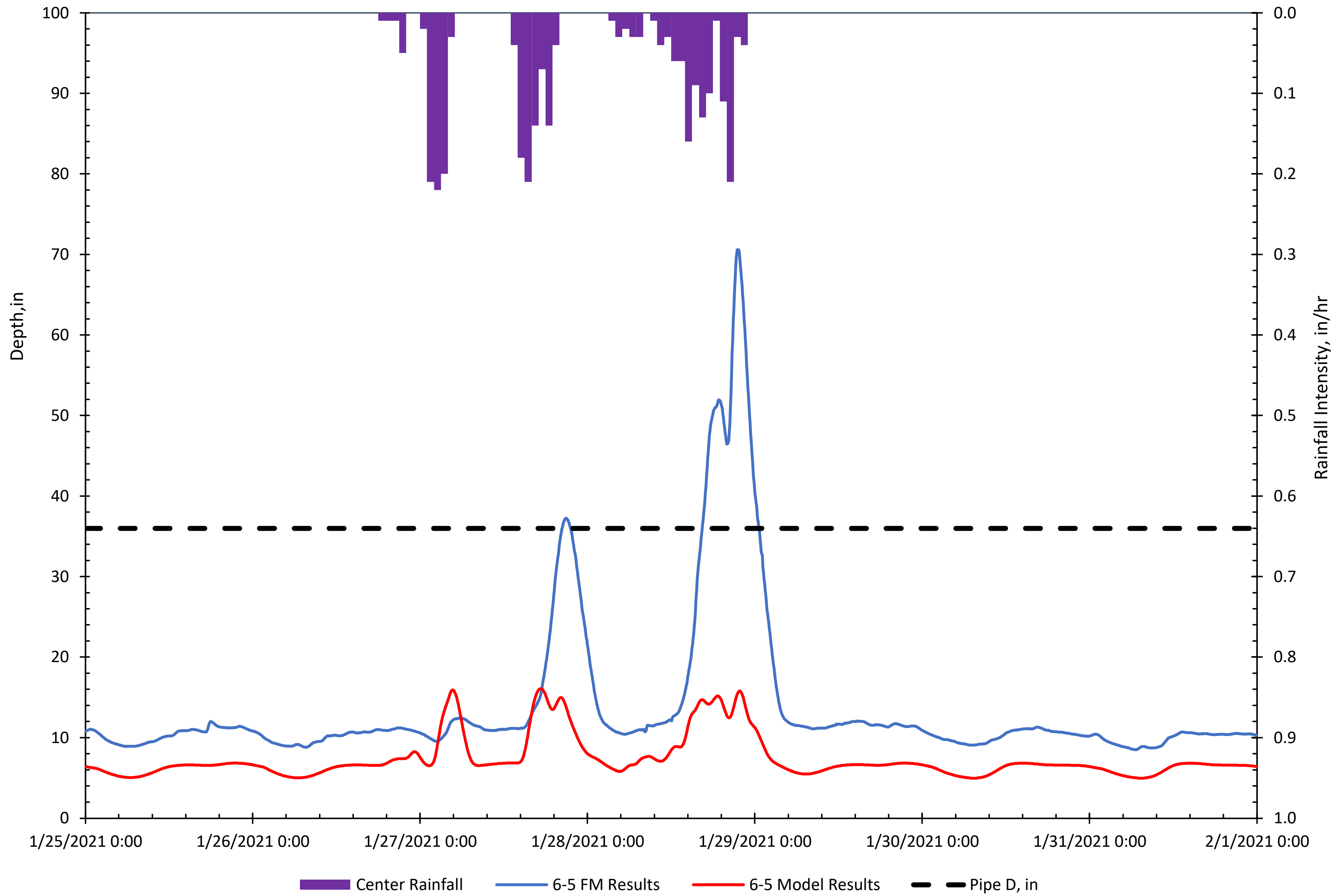
Site 6-3 Modeled vs. Metered Flow Depths, January 25–31, 2021

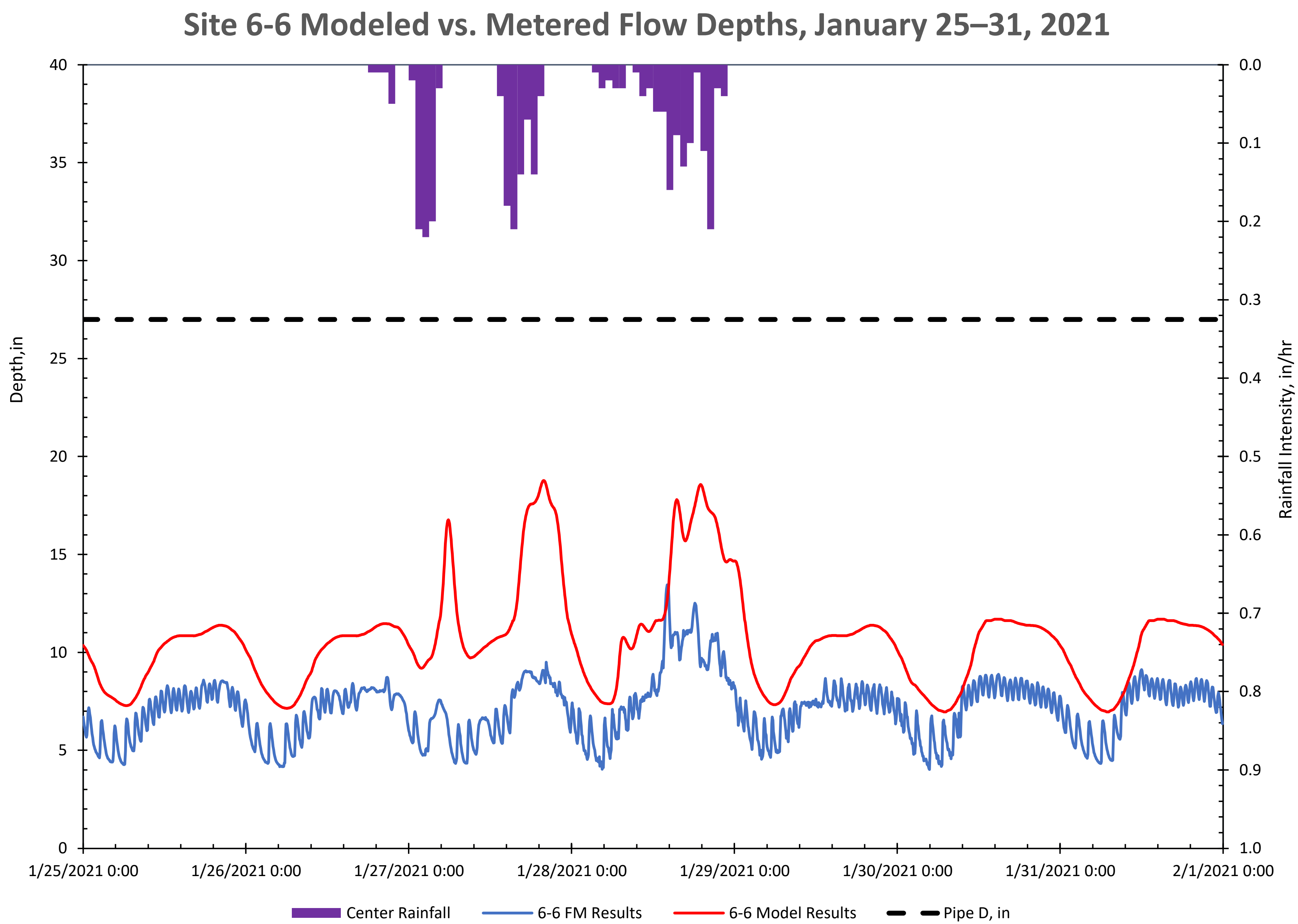


Site 6-4 Modeled vs. Metered Flow Depths, January 25–31, 2021



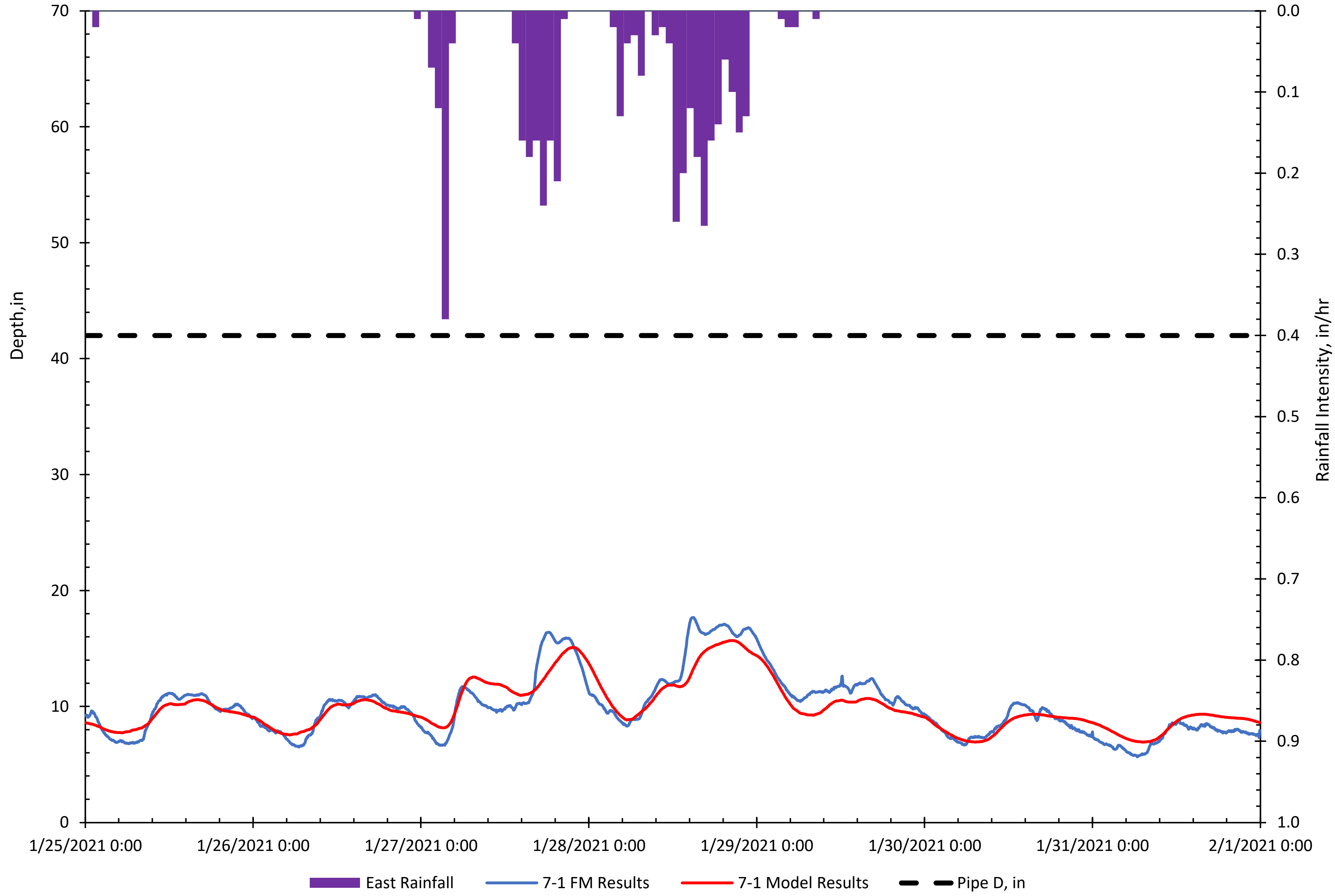
Site 6-5 Modeled vs. Metered Flow Depths, January 25–31, 2021

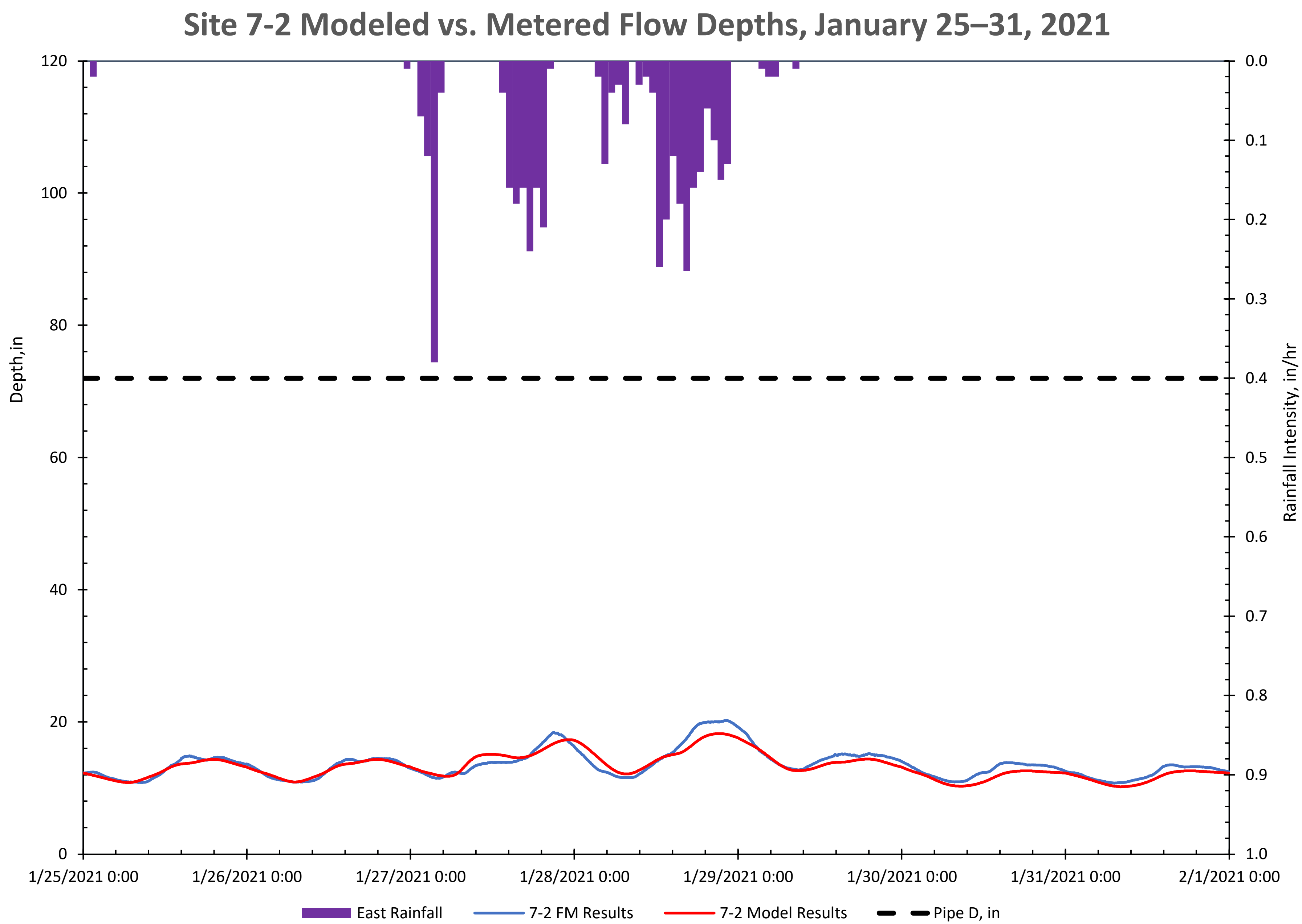




Site 6-6 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
40
35
30
25
20
15
10
5
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
Center Rainfall
6-6 FM Results
6-6 Model Results
Pipe D, in

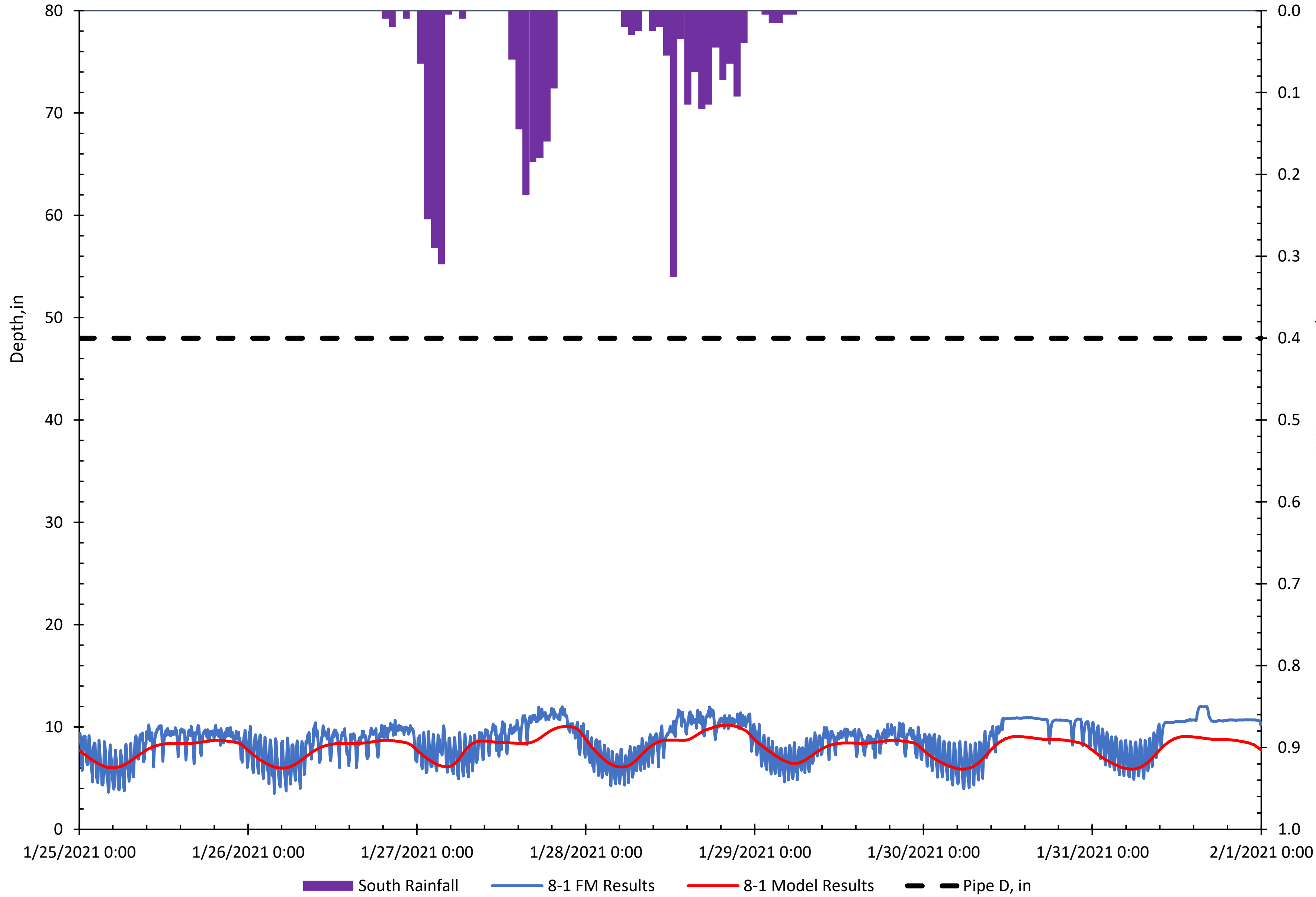
Site 7-1 Modeled vs. Metered Flow Depths, January 25–31, 2021

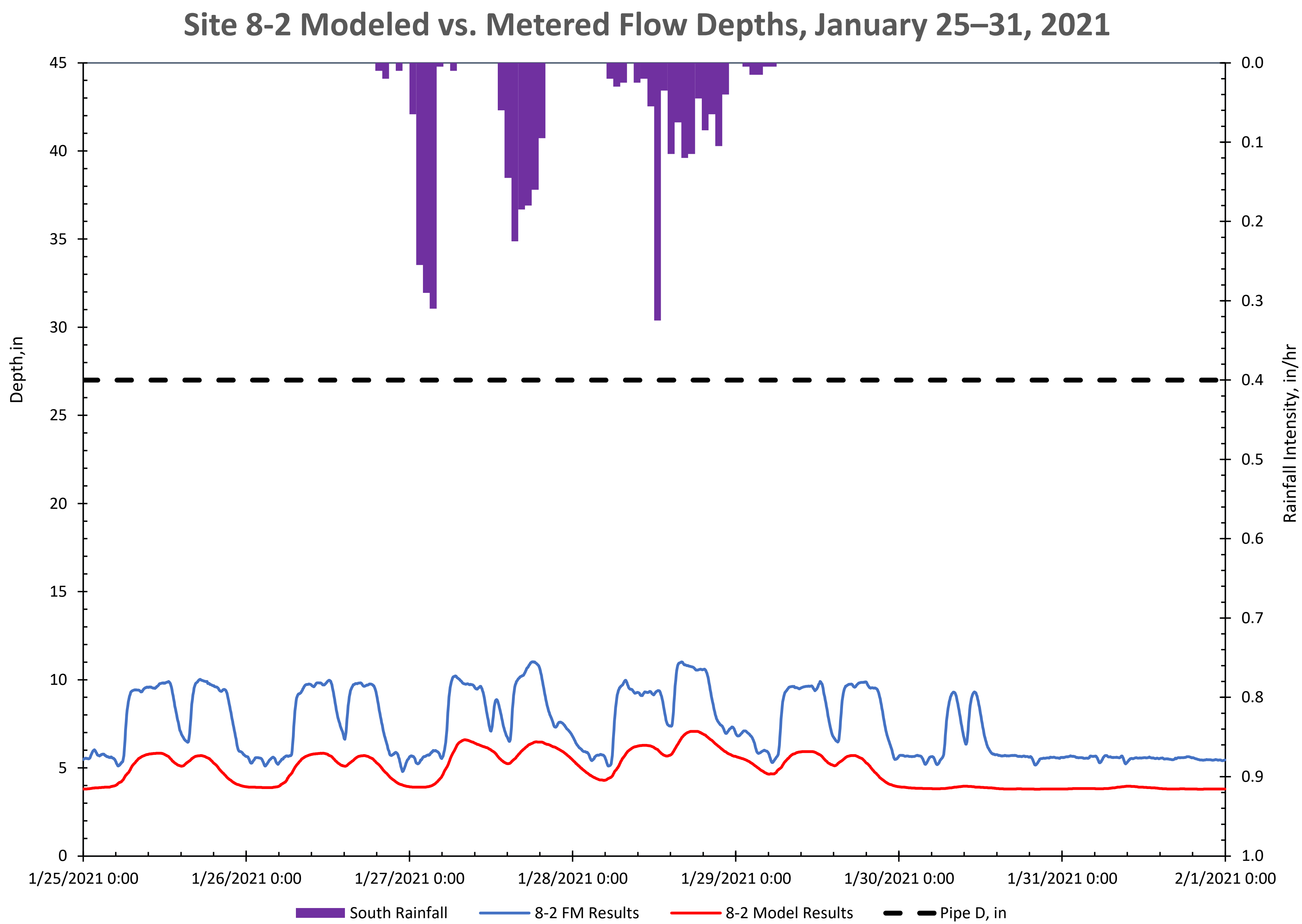




Site 7-2 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
0
20
40
60
80
100
120
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
East Rainfall
7-2 FM Results
7-2 Model Results
Pipe D, in

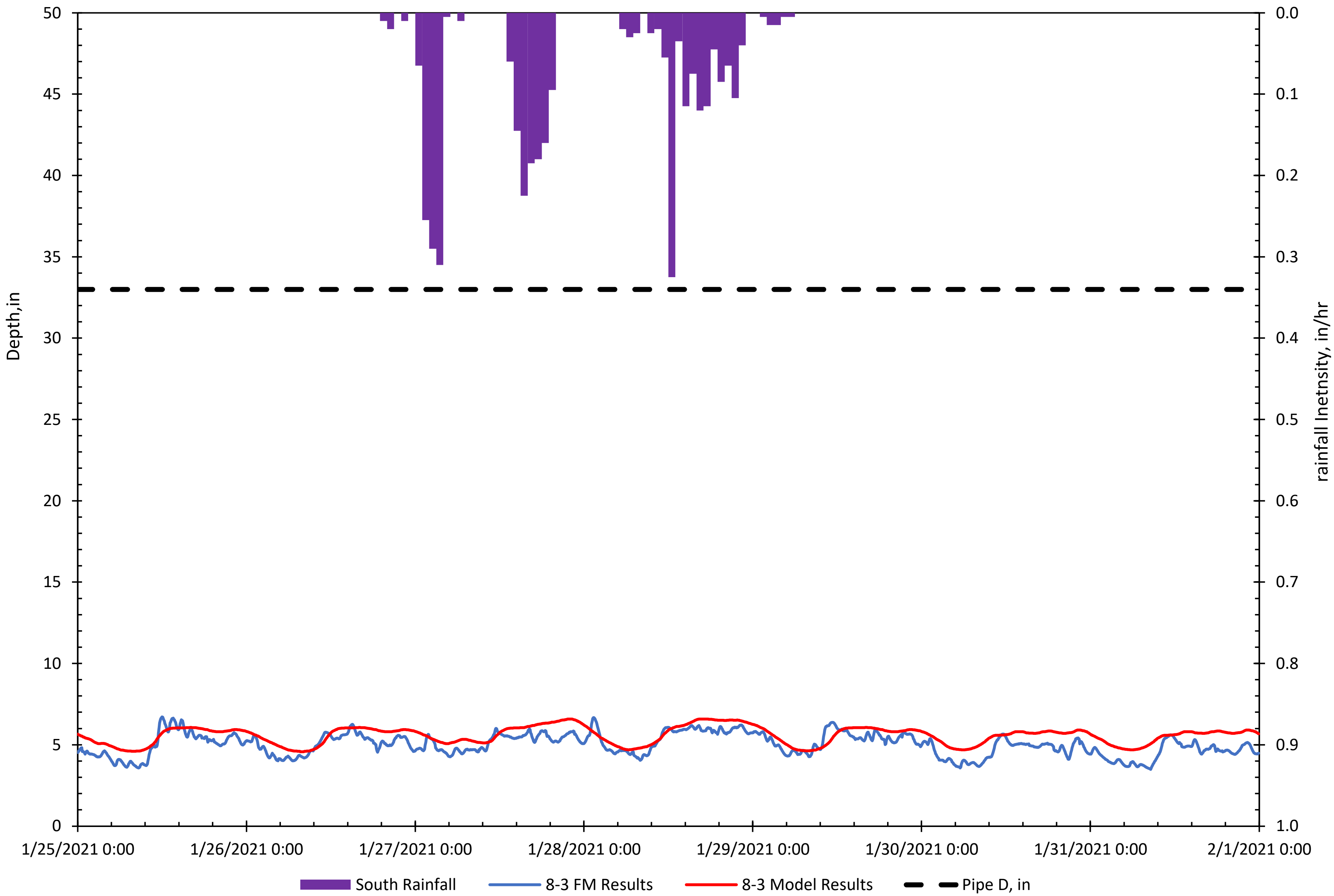
Site 8-1 Modeled vs. Metered Flow Depths, January 25–31, 2021



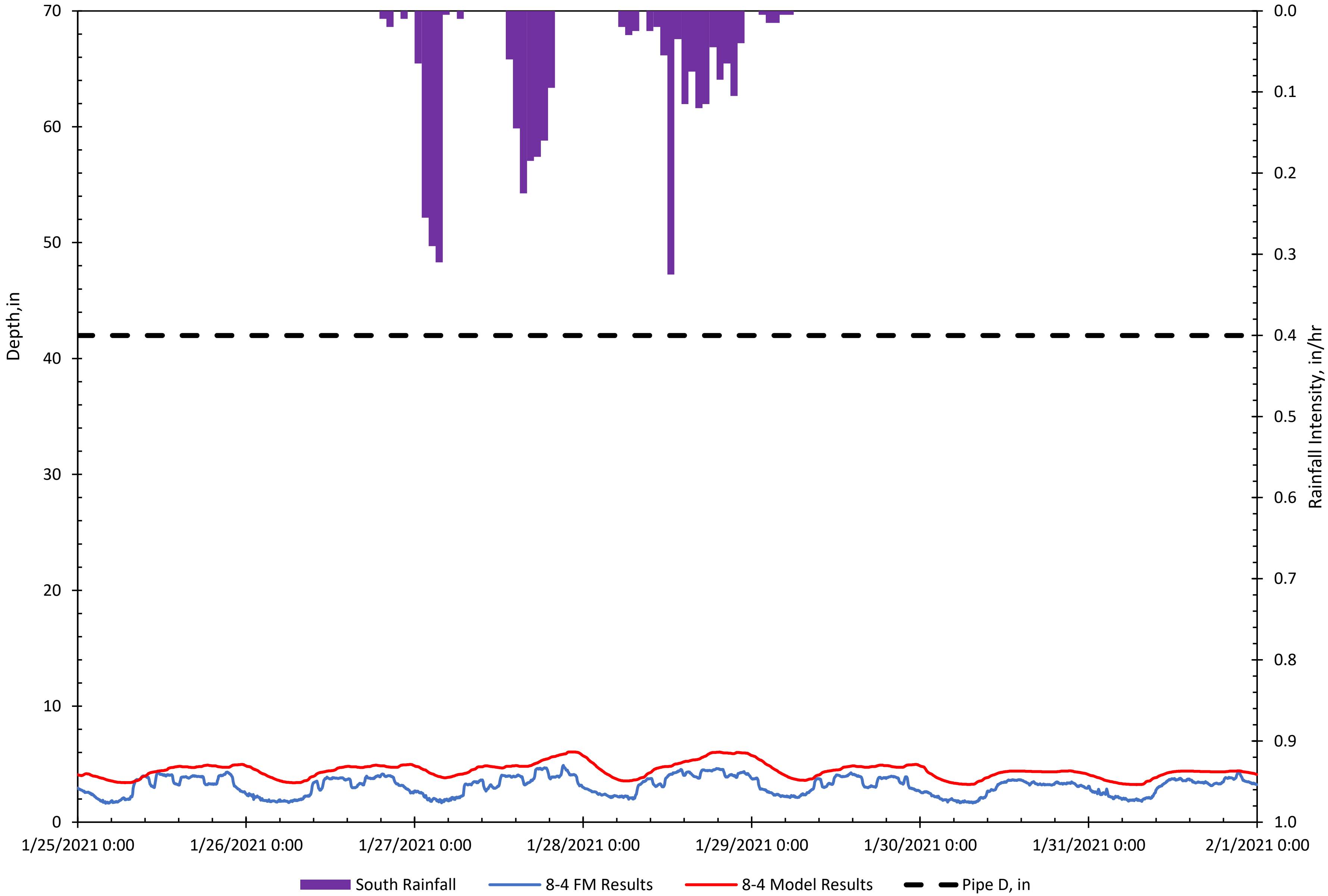


Site 8-2 Modeled vs. Metered Flow Depths, January 25–31, 2021
Depth,in
Rainfall Intensity, in/hr
45
40
35
30
25
20
15
10
5
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1/25/2021 0:00
1/26/2021 0:00
1/27/2021 0:00
1/28/2021 0:00
1/29/2021 0:00
1/30/2021 0:00
1/31/2021 0:00
2/1/2021 0:00
South Rainfall
8-2 FM Results
8-2 Model Results
Pipe D, in

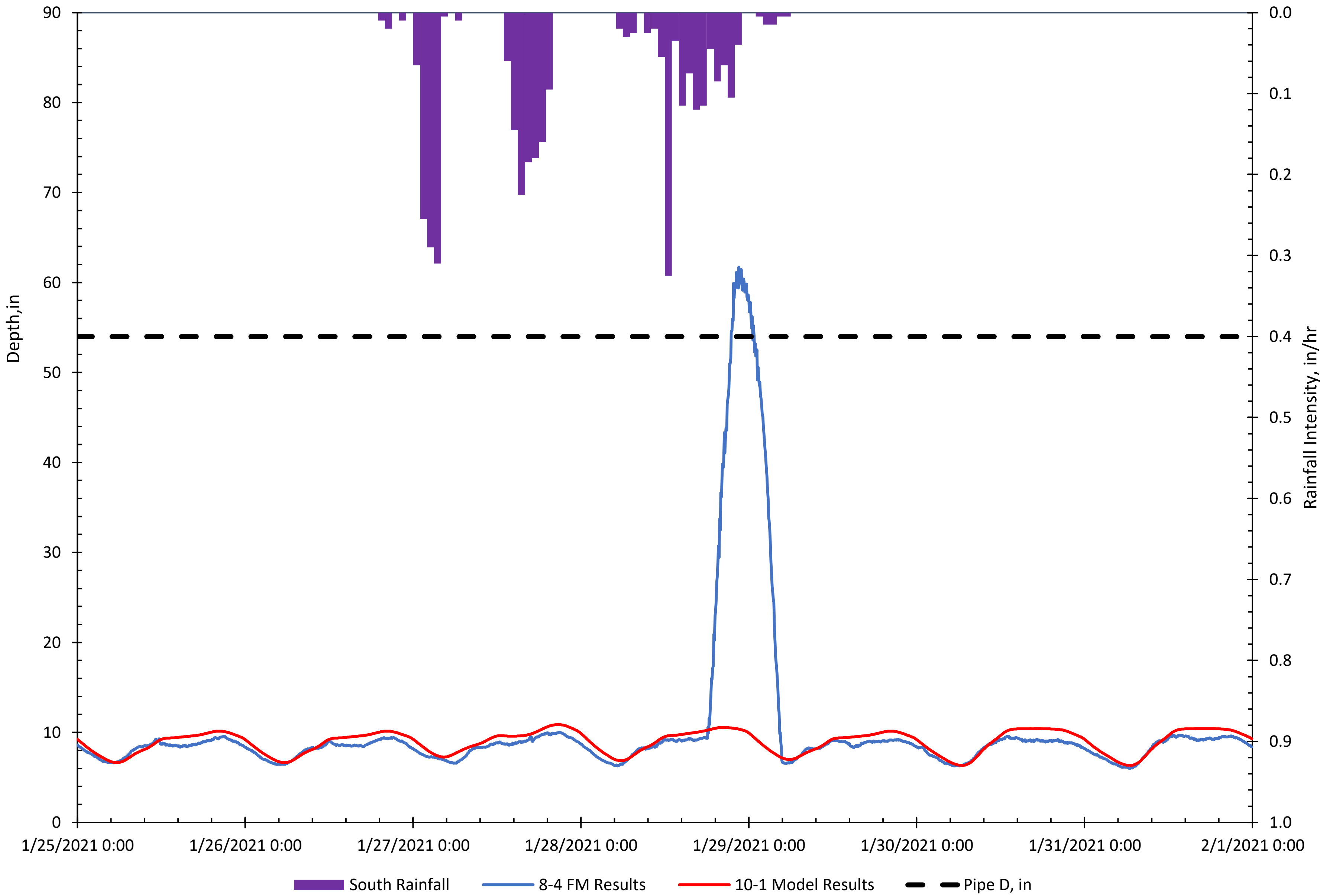
Site 8-3 Modeled vs. Metered Flow Depths, January 25–31, 2021



Site 8-4 Modeled vs. Metered Flow Depths, January 25–31, 2021



Site 10-1 Modeled vs. Metered Flow Depths, January 25–31, 2021



Appendix G

Existing City Wastewater Facilities CIP

No.	Project No.	CIP Project No.	Project Name	Account No.	Total Project Cost	Available Budget	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	Notes	Location	Description	Justification	Projected Date Range
1	**UW22001**	**MXXXXX**	Metro Drive ARV Vaults Replacement	437-7785	$120,000	$0	$0	$120,000	*$0*	*$0*	*$0*	$0		Metro Drive	This project provides funding to replace the existing air relief valve (ARV) vaults for the 24-inch sanitary sewer force main along Metro Drive.	The existing vaults housing the ARVs may fail and cause damage to the ARVs. The replacement would produce a more stable structure to house the ARVs.	7/1/2018-6/30/2023
3	**UW20022**	**M20022**	Fourteen Mile Slough Sanitary Pump Station Assessment	437-7785	$3,552,851	$429,641		$970,000	$2,153,210					N/A	The project is to assess the operation of the pump station to determine cause of pump failure.	Failure of the existing pumps increases maintenance and reduces reliability of the pump station.	7/1/2021-6/30/2022
4	**UW21015**	**M21015**	Quail Lakes Sanitary Sewer Lift Station Upgrade/Rehabilitation	437-7785	$799,250	$191,395	$0		$607,855				Push construction budget out by 1-year and verify scope w/ Maintenance. Update estimate if needed	N/A	This project will rehabilitate the existing sanitary sewer pump station by replacing all problematic mechanical and electrical equipment and install a 50-foot high monopole.	The rehabilitation of the pump station will minimize the potential for station failure and sewer backup and spillage caused by pump station shut downs. Installation of the monopole will improve SCADA transmission, preventing loss of data.	7/1/2022-6/30/2023
5	**UW23001**	**MXXXXX**	Plymouth & 5 Mile Creek Sanitary Sewer Pump Station (source: 2008 Master Plan)	437-7785	$2,441,000	$0	*$0*		$99,000	$2,342,000			Push previous budget out by 1-year	7078 Plymouth Rd	A new sanitary sewer pump station will be constructed replacing the existing Plymouth Road & Five Mile Creek sanitary sewer pump station to increase pumping capacity.	A new sanitary sewer pump station is required to accommodate increased wastewater flows from future development. The current Wastewater Master Plan anticipates wastewater flows at a 2035 build out will greatly exceed the current pump station capacity.	7/1/2022-6/30/2024
6	**UW23002**	**MXXXXX**	Bianchi and Calaveras River Storm Station New Sanitary Sewerline Installation	437	$378,400	$0	$0	$0	$378,400	$0	$0	$0		SW Corner of Bianchi Rd & N. El Dorado St (adjacent to 4 W Bianchi Rd Pump)	This project provides funding for the installation of a sanitary sewer line at a storm pump station facility for the purpose of dewatering the facility in the event of contamination.	The installation of a sanitary sewer line at a storm pump station facility will prevent the potential of discharging contaminated waters into a natural waterway.	7/1/2022-06/30/2023
7	**UW23003**	**MXXXXX**	Brookside Estates Sanitary Sewer Pump Station		$391,000				$391,000					2921 Brookside Rd	Rehabilitate existing sanitary sewer pump station and improve reliability by replacing all problematic components, such as sluice gates, scrubber, pumps, and liner in the wet well.	As the existing facility ages, it is necessary to replace components to ensure the pump station operates without service interruptions to customers.	7/1/2022-6/30/2023
8	**UW24001**	**MXXXXX**	West Lane and Calaveras River South Storm Station New Sanitary Sewer	437	$946,000	$0	$0	$0	$0	$135,000	$811,000	$0		N West Lane (adjacent to 4250 West Lane)	This project provides funding for the installation of sanitary sewer line at a storm pump station facility for the purpose of dewatering the facility in the event of contamination.	The installation of a sanitary sewer line at a storm pump station facility will prevent the potential of discharging contaminated waters into a natural waterway.	7/1/2023-6/30/2025
9	**UW24002**	**MXXXXX**	West Lane and Calaveras River North Storm Station New Sanitary Sewer Line Installation	437	$946,000	$0	$0	$0	$0	$135,000	$811,000	*$0*		S West Lane (adjacent to 4404 Woodbine Dr & 4407 Woodbine Dr)	This project provides funding for the installation of sanitary sewer line at a storm pump station facility for the purpose of dewatering the facility in the event of contamination.	The installation of a sanitary sewer line at a storm pump station facility will prevent the potential of discharging contaminated waters into a natural waterway.	7/1/2023-06/30/2025
10	**UW24003**	**MXXXXX**	Swenson Road & 5 Mile Creek Sanitary Sewer Pump Station (source: 2008 Master Plan)		$2,929,000					$87,900	$2,841,100		Push previous budget out by 2-years	6803 Alexandria Place	The pumps and controls will be replaced at the Swenson & Five Mile Creek sanitary sewer pump station to increase pumping capacity.	New pumps and controls are required to accommodate increased wastewater flows from future development. The current Wastewater Master Plan anticipates wastewater flows at the 2035 build out will exceed the current pump station capacity.	7/1/2023-06/30/2025
11	**UW24004**	**MXXXXX**	Kelley and Mosher Slough Sanitary Sewer Pump Station		$929,000					$929,000			Push previous budget out by 1-year	9213 Kelly Dr	This project will rehabilitate the existing sanitary sewer pump station by replacing all problematic mechanical and controls equipment.	The rehabilitation of the pump station will minimize the potential for sewer backups and spillage caused by pump station failure.	7/1/2023-06/30/2024
12	**UW24005**	**MXXXXX**	Lincoln Street Sanitary Sewer Pump Station and Forcemain	437	$8,590,200	$0	$0	$0	$0	$602,800	$3,993,700	$3,993,700	Push previous budget out by 1-year	Pump Station: Lincoln Street and Mormon Slough Forcemain: Church Street from Mormon Slough to Pershing Avenue	Installation of a sewer pump station at Lincoln St. and the Mormon slough. Install a forcemain in the existing deficient gravity sewer line along Church St. from the Mormon Slough to Pershing Ave.	Installation of appropriate sanitary pump station and forcemain will ensure adequate capacity and reliable system demands.	7/1/2023-6/30/2026
13	**UW25001**	**MXXXXX**	Brookside and I-5 Pump Station Emergency Power	437-7785	$237,000	$0	$0	$0	$0		$237,000			2781 Brookside Rd	This project provides for the installation of an emergency generator at the existing sanitary pump station to ensure continuous services.	The installation of this emergency generator is necessary to ensure the continuous operation of SS Pump Station during the power outage.	7/1/2024-06/30/2025
14	**UW24006**	**MXXXXX**	French Camp Sewer and Lift Station	437-7785	$12,001,000	$0	$0	$0	*$0*	$5,001,000	$1,000,000	$6,000,000	Need new estimate. Cost shown in based on 2019 WW Rate Study. Also, need to verify scope/need for project	East of I-5 and south of Arch Airport Rd between El Dorado St and French Camp Road	This is a new CIP project to provide for the construction of a new lift station and its sewer system.	The purpose of this new lift station and its sewer system is to meet the City's build-out capacity.	7/1/2023-06/30/2026
15	**UW25002**	**MXXXXX**	Camanche Sanitary Sewer Pump Station Rehabilitation (2008 MP)	437-7785	$550,000	$0	$0	$0	*$0*	*$0*	$550,000		Need new estimate. Cost shown in based on 2019 WW Rate Study	Camanche Ln (between Ridgeway Ave & Holiday Dr)	This project provides to replace existing pumps and controls.	To replace the existing pumps and controls are necessary to ensure the continuous operation of this pump station.	7/1/2024-06/30/2025
16	**UW25003**	**MXXXXX**	College Park Sanitary Sewer Pump Station Rehabilitation	437-7785	$750,000	$0	$0	$0	*$0*	*$0*	$750,000	*$0*	Need new estimate. Cost shown in based on 2019 WW Rate Study. Consult with Eric Johnson in MUD Maintenance	1502 Palm Ave	This project is to rehabilitate the existing pump station.	This is a very old pump station that needs to be rehabilitated.	7/1/2024-6/30/2025
17	**UW25004**	**MXXXXX**	Waterloo Sanitary Sewer Pump Station Rehabilitation	437-7785	$1,303,000	$0	$0	$0	*$0*	*$0*	$1,303,000	*$0*	Need new estimate. Cost shown in based on 2019 WW Rate Study. Consult with Eric Johnson in MUD Maintenance	1105 Waterloo Rd	This project is to rehabilitate the existing pump station.	This is a very old pump station that needs to be rehabilitated.	7/1/2024-6/30/2025
18	**UW25005**	**MXXXXX**	Drake Sanitary Sewer Pump Station Rehabilitation	437-7785	$1,303,000	$0	$0	$0	*$0*	*$0*	$1,303,000	*$0*	Need new estimate. Cost shown in based on 2019 WW Rate Study. Consult with Eric Johnson in MUD Maintenance	Adjacent to 626 Drake Ave	This project is to rehabilitate the existing pump station.	This is a very old pump station that needs to be rehabilitated.	7/1/2024-6/30/2025
19	**UW16022**	**M16022**	RWCF Modifications Project - Progressive Design Build	437	$223,554,079	$48,840,047	$60,273,645	$81,793,924	$28,518,223	$4,128,240			Highlighted changes show movement of $10M to FY2021, taking $5M each from FY22 and FY23	N/A			
20	**UW18011**	**M18011**	RWCF Pond No. 1 Cleaning	437-7709	$11,124,000	$1,000,000	$0	$1,000,000	$2,281,000	$2,281,000	$2,281,000	$2,281,000	Push previous budget out by 1-year	N/A	Cleaning of Pond No.1 at the Regional Wastewater Control Facility to restore treatment capacity.	Accumulated sludge in Pond No.1 has reduced its capacity treatment.	7/1/2021-6/30/2026
21	**UW20023**	**M20023**	RWCF New Outfall	437-7709	$10,457,000	$3,110,617	$0	$2,075,608	$5,195,247	$75,528			Verify estimated cost for possible savings (if No New Outfall is Req'd). Possibly advance other projects if so.	N/A	The project is to replace the existing outfall at the Tertiary site (western side) of San Joaquin River.	Technical Memorandum by RBI - RBI 641—NPDES Compliance Support, Task 25 • Eliminating construction of approximately 2,000 feet of large diameter (72”) pipeline along the western edge of the San Joaquin River; • Allowing gravity discharge through a new outfall for more than 90% of the time; and • Condensing all operations on the main plant thereby eliminating permanent staffing at the T-Plant.	7/1/2021-6/30/2024
22	**UW22002**	**MXXXXX**	RWCF Sludge Day Tank Mixing Rehabiltation		$320,000			$162,000	$158,000					RWCF - 2500 Navy Drive	The project will provide funding to add mechanical mixers to the sludge day tanks located at the Regional Water Control Facility (RWCF). The addition of mixers to the sludge day tanks will keep the sludge homogenous and prevent suspended solids from settling inside the day tanks.	The sludge day tanks hold sludge prior to a dewatering process which extracts water from the sludge. The dewatering process is more efficient and easier to manage if the sludge is homogenous and has a consistent density. The new mixers will maintain the sludge in a homogenous state with a consistent density.	7/1/2021-6/30/2023

No.	Project No.	CIP Project No.	Project Name	Account No.	Total Project Cost	Available Budget	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	Notes	Location	Description	Justification	Projected Date Range
23	**UW23004**	**MXXXXX**	RWCF Facility Main Plant Switchgear Upgrade with Load Shedding	437-7709	$340,000	$0	$0	$0	$117,000	$111,500	$111,500	$0		RWCF - 2500 Navy Drive	To replace the current method of manual load shedding to prevent interruption of power to critical facilities at RWCF.	To replace the current method of manual load shedding to prevent interruption of power to critical facilities at RWCF.	7/1/2022-06/30/2025
24	**UW23005**	**MXXXXX**	RWCF Cogeneration Engine No. 1 Rebuild	437-7709	$802,000	$0	$0	$0	$802,000	*$0*	*$0*	*$0*		RWCF - 2500 Navy Drive	The project is to overhaul Cogeneration Engine No.1 including source testing and submittal of test report to demonstrate compliance with the requirements of the air permit issued by SJVAPCD.	Cogeneration Engines at the RWCF provide heat for the wastewater digestion process, 1/3 of the plant's electrical demand, and disposal of gas generated as a byproduct of the wastewater process. The Cogeneration Engine manufacturer has recommended that a complete engine overhaul is done every 40,000 run-hours.	7/1/2022-6/30/2023
25	**UW09006**	**M09006**	RWCF Rehabilitate Digesters A & B for Sludge Storage	437-7709	$4,434,860	$454,164	$0	$0	$0	$1,990,348	$1,990,348		Close current project and move previous budget to outer years	N/A	Evaluate and rehabilitate Digester A and B to use as sludge feed storage for the belt presses.	Reduce the amount of accumlated solids in the digesters and evaluate the condition of the digesters.	7/1/2023-6/30/2025
26	**UW24007**	**MXXXXX**	RWCF Cogeneration Engine No. 4 Rebuild	437-7709	$760,000	$0	*$0*	*$0*	$0	$760,000	$0	*$0*		RWCF - 2500 Navy Drive	The project is to overhaul Cogeneration Engine No.4 including source testing and submittal of test report to demonstrate compliance with the requirements of the air permit issued by SJVAPCD.	Cogeneration Engines at the RWCF provide heat for the wastewater digestion process, 1/3 of the plant's electrical demand, and disposal of gas generated as a byproduct of the wastewater process. The Cogeneration Engine manufacturer has recommended that a complete engine overhaul is done every 40,000 run-hours.	7/1/2023-6/30/2024
27	**UW26001**	**MXXXXX**	RWCF Cogeneration Engine No. 3 Rebuild	437-7709	$760,000	$0	$0	$0	*$0*	*$0*	**$0**	*$760,000*	Need new estimate. Cost shown in based on 2019 WW Rate Study	RWCF - 2500 Navy Drive	The project is to overhaul Cogeneration Engine No.3 including source testing and submittal of test report to demonstrate compliance with the requirements of the air permit issued by SJVAPCD.	Cogeneration Engines at the RWCF provide heat for the wastewater digestion process, 1/3 of the plant's electrical demand, and disposal of gas generated as a byproduct of the wastewater process. The Cogeneration Engine manufacturer has recommended that a complete engine overhaul is done every 40,000 run-hours.	7/1/2025-6/30/2026
28	**UW21020**	**M21020**	FY2021 Sanitary Sewer Street Improvements Reimbursements (S.J. County)		$850,340	$166,000		$84,340	$150,000	$150,000	$150,000	$150,000	Update Estimate to add FY26 and account for any updates from SJ County	N/A			
29	**N/A**	**PW1903, PW1916, PW1914, PW2103, PW2106, PW1809**	FY2021 Sanitary Sewer Street Improvements Reimbursements (COS PW) - *Budget in PW Projects, refer to Estimate for details . For reference only*		$319,000	-$34,000	$278,000	$75,000					Update estimate to account for any info from PW, plus what's already listed in Reimbursement Spreadsheet. If no data available, then use assumption for estimate and placeholder based on prior data	N/A			
30	**UW20017**	**M20017**	FY2019 Sanitary Sewer Street Improvements Reimbursements (COS PW)		$90,700	$90,700								N/A			
31	**UW16006**	**M16006**	2016 Sanitary Sewer Rehabilitation Project		$1,029,935	$729,935		$300,000						N/A			
32	**UW17023**	**M17023**	Pershing Avenue Sewer Trunk Rehabilitation (Church Street to Navy Drive)	437-7787	$6,473,217	$2,350,117		$0	$4,123,100					N/A			
33	**UW18029**	**M18029**	Sierra Nevada Street Sanitary Sewer Line Rehabilitation		$1,985,159	$1,585,159		$400,000						N/A	This project will address capacity deficiencies and corrosion problems. This project will rehabilitate the existing 36-inch sanitary sewer line along Sierra Nevada Street between Hazelton Avenue and Worth Street due to severe corrosion and potential consequences of structural failure.	This project eliminates restrictions and pipeline collapses in the City's sanitary sewer collection system, and allows continuous sewer service within the service area.	
34	**UW18030**	**M18030**	Mormon Slough Sanitary Sewer Line Rehabilitation		$3,147,724	$2,060,274		$0	$1,087,450					N/A			
35	**N/A**	**PW1805**	California Street Road Diet Sanitary Sewer Rehabilitation		$665,000	$78,000		*$587,000*						N/A	A 6" sewer line upsized to 8" (approximately 300')		
36	**UW20011**	**M20011**	Sanitary Sewer Maintenance Hole Rehabilitation Project		$1,900,164	$400,164		$300,000	$300,000	$300,000	$300,000	$300,000	Need estimate for outer years, or assume same amount each year ($300K per year)	N/A			
37	**UW20016**	**M20016**	Oak Street Trunk Rehabilitation (Wilson Wy to Pershing Avenue)		$1,409,454	$909,454			$500,000				Update cost estimate based on CCTV & revised scope for possible Savings	N/A			
38	**UW20020**	**M20020**	Sanitary Sewer Large Diameter Lines Replacement per AMMP		$3,991,661	$1,840,826		$368,846	$834,995	$946,994				N/A			
39	**UW21007**	**M21007**	Union Street Rehabilitation between Harding and Acacia (ID#R3R, 2008 MP)		$1,372,852	$194,252		$1,178,600						N/A			
40	**UW21016**	**M21016**	Sanitary Sewer Small Diameter Lines Replacement per AMMP		$1,847,066	$375,466		$1,471,600	*$0*	*$0*				N/A			
41	**UW21017**	**M21017**	Airport Way Sewer Trunk Rehabilitation (San Joaquin Farigrounds to Ralph Ave.)		$4,981,903	$609,463		$4,372,440					Project may need to be put on hold, pending updated Estimates for M18024 & M20016. Potential Savings can	N/A			
42	**UW21018**	**M21018**	Lincoln Road Sanitary Sewer Line Rehab between Pershing Ave. and Alexandria Place		$4,198,608	$579,108				$3,619,500			Project may need to be put on hold, pending updated Estimates for M18024 & M20016. Potential Savings can	N/A			
43	**UW23006**	**MXXXXX**	Longview Avenue Sewer Rehabilitation north of Longview through PUE, south of Swain from Pacific to El Dorado (ID#R2L, 2008 MP)		$1,086,000				$108,600	$977,400				Longview Ave (between Pacific Ave and El Dorado St)	Upsize 12" VCP pipe to 18" within Longview Avenue sewer easement from Pacific Ave to El Dorado Ave per WWMP.	Project will upsize the existing sewer pipe to alleviate full pipes in the collection system. Project will add capacity to the collection system in accordance with the current sewer master plan.	7/1/2022-6/30/2024
44	**UW23007**	**MXXXXX**	South Tuxedo Avenue Sewer Trunk Rehabilitation		$512,000				$512,000					South Tuxedo Avenue (between Kensington Way and Orange Street)	This project would rehabilitate the existing sewer trunk line along South Tuxedo Avenue between Kensington Way and Orange Street due to crack and potential consequences of structural failure.	This project eliminates restrictions and pipeline collapses in the City's sanitary sewer collection system, and allows continuous sewer service within the service area.	7/1/2022-6/30/2023
45	**UW23008**	**MXXXXX**	Pershing Avenue Sewer Trunk Rehabilitation (Oak Street to Tuxedo Avenue)		$1,598,000				$93,943	$1,504,057				Pershing Avenue (Oak Street to Tuxedo Avenue)	This project would rehabilitate the existing sewer trunk line along Pershing Avenue between Oak Street and South Tuxedo Avenue due to cracks and potential consequences of structural failure.	The project will eliminate restrictions and pipeline collapse and allow for continuous sewer service to the service area.	7/1/2022-6/30/2024
46	**UW23009**	**MXXXXX**	Sperry Road/Gibraltar Court Sanitary Sewer Rehabilitation		$4,622,000				$555,000	$4,067,000				Sperry Road/Gibraltar Court	Project will address capacity deficiencies and corrosion problems. This project will rehabilitate existing 24/27-inch sanitary sewer line along Sperry Road and Gibraltar Court between Airport Way and Industrial Drive due to severe corrosion and potential consequences of structural failure.	These projects eliminate restrictions and pipeline collapses in the City's sanitary sewer collection systems, and allow for continuous sewer service within the service area.	7/1/2022-6/30/2024
47	**UW23010**	**MXXXXX**	Swain Road and Alturas Avenue Sewer Rehabilitation (ID#R2M, 2008 MP)		$573,000				$57,300	$515,700				Swain Road and Alturas Avenue	Upsizing of 12" sewer line to 15" along PUE from Swain Road just north of Longview Avenue northward to Alturas Avenue and along Alturas Avenue to Quincy Street.	Project will upsize the existing sewer pipe to alleviate full pipes in the collection system. Project will add capacity to collection system in accordance with the current sewer master plan.	7/1/2022-6/30/2024
48	**UW23011**	**MXXXXX**	El Dorado Street (Alpine to Wyandotte) Rehabilitation - (ID#R3I, 2008 MP) - Alpine to Wyandotte		$1,348,000				$229,000	$1,119,000				El Dorado Street (Alpine to Wyandotte)	Upsizing of 12" sewer line to 15" and 18" along El Dorado Street from East Sonoma Ave to Wyandotte St.	This section of pipe is identified in the Master Plan for upsizing.	7/1/2022-6/30/2024

No.	Project No.	CIP Project No.	Project Name	Account No.	Total Project Cost	Available Budget	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	Notes	Location	Description	Justification	Projected Date Range
49	**UW23012**	**MXXXXX**	El Dorado Street (Fremont to Oak Street) Rehabilitation - (ID#R5H, 2008 MP) - Fremont to Oak		$617,890				$98,000	$519,890				El Dorado Street (Fremont to Oak Street)	This project will rehabilitate an existing 12-inch sanitary sewer line that is located below El Dorado Street between Fremont Street and Oak Street. This replacement line will be upsized to a 33-inch HDPE sanitary sewer line which will provide additional capacity for future demand as required by the Wastewater Master Plan.	The City's adopted 2035 Wastewater Master Plan identifies several sanitary sewer lines that need replacement to support the growth of commercial and industrial development in Stockton.	7/1/2022-6/30/2024
50	**UW25006**	**MXXXXX**	March Lane Sewer Trunk Rehabilitation (I-5 to Brookside Sewer Pump Station)		$6,311,000						$720,000	$5,591,000	Push previous budget out by 1-year	March Lane (I-5 to Brookside)	Rehabilitate the existing 24-inch and 30-inch sewer main line on March Lane between Interstate 5 and the Brookside Road Sewer Pump Station.	The pipeline is experiencing rapid deterioration and has the potential for structural failure.	7/1/2024-6/30/2026
51	**UW23013**	**MXXXXX**	Etna Street Rehabilitation - (ID#R2A, 2008 MP) - North of Hammer Lane along Etna to the north		$1,500,000				*$500,000*	$1,000,000			Push previous budget out by 1-year	Etna Street - North of Hammer Lane along Etna to the north	Upsize 12" VCP pipe to 18" on Etna (just north of Hammer) to 4000LF north per the Waste Water Master Plan.	Upsizing is necessary due to increased sewer flows from the development of surrounding areas.	7/1/2022-6/30/2024
52	**UW24008**	**MXXXXX**	Pardee Lane Rehabilitation - (ID#R2AD, 2008 MP) - Pacific and Bianchi		$16,710,000					$897,000	$15,813,000			Pardee Lane (Pacific and Bianchi)	Upsize existing sewer pipe to recommended size on Pardee Lane per Wastewater Master Plan.	Upsizing is necessary due to increased sewer flows from the development of surrounding areas.	7/1/2023-6/30/2025
53	**UW24009**	**MXXXXX**	Scotts Avenue Rehabilitation (ID#R5B, 2008 MP)		$312,750					$312,750				Scotts Avenue (between Pershing Avenue and Del Norte Street and between Del Norte Street and Navy Drive)	Upsize the existing 27-inch sewer trunk main on Scotts Avenue to 30-inches between Pershing Avenue and Del Norte Street and to 42-inches between Del Norte Street and Navy Drive.	Project will upsize the existing sewer trunk to alleviate full pipes in the collection system and accommodate future growth. Project will add capacity to the collection system in accordance with the current sewer master plan.	7/1/2023-6/30/2024
54	**UW24010**	**MXXXXX**	El Dorado Street (Market to Fremont) Rehabilitation - (ID#R5H, 2008 MP)- Market to Fremont		$1,867,910					$1,867,910				El Dorado Street (Market to Fremont)	This project will rehabilitate an existing 12-inch and 18-inch sanitary sewer line that is located below El Dorado Street between Market Street and Fremont Street. The replacement line will be upsized to a 24-inch, 27-inch, or 30-inch HDPE sanitary sewer line which will provide additional capacity for future demand as required by the Wastewater Master Plan.	The City's adopted 2035 Wastewater Master Plan identifies several sanitary sewer lines that need replacement to support the growth of commercial and industrial development in Stockton.	7/1/2023-6/30/2024
55	**UW24011**	**MXXXXX**	Hazelton Avenue Sewer Trunk Rehabilitation (Della to Pilgrim Streets)		$2,147,000					$2,147,000				Hazelton Avenue (Della to Pilgrim Streets)	Rehabilitate the existing 24-inch sewer main on Hazelton Avenue between Pilgrim Street and Wilson Way, and the 36-inch sewer main on Hazelton Avenue between Sierra Nevada Street and Della Street.	The sewer main pipeline is experiencing rapid deterioration and has the potential for structural failure.	7/1/2023-6/30/2024
56	**UW23014**	**MXXXXX**	Rosemarie Lane Sewer Rehabilitation (ID#R3O, 2008 MP) between Manchester and Crown Avenues		$1,630,549				$234,000	*$1,396,549*			Advance previous budget by 1-year	Rosemarie Lane (Manchester to Crown Avenues)	The project will upsize the existing 12-inch sanitary sewer line to a 15-inch line along Rosemarie Lane between Manchester and Crown Avenues using trenchless methods.	Upsizing of the sewer line is necessary due to increased sewer flows and deterioration resultant of development of surrounding areas.	7/1/2022-6/30/2024
57	**UW25007**	**MXXXXX**	Wyandotte St Sewer Rehabilitation (ID#R3H, 2008 MP) between California St and Pacific Ave		$3,482,000						$3,482,000			Wyandotte St (California St and Pacific Ave)	The project will provide funding to upsize the existing sanitary sewer line along Wyandotte Street between California Street and Pacific Avenue. Approximately 1,614 feet of existing 12-inch sewer will be upsized to an 18- inch line and approximately 1,293 feet of existing 16-inch sewer will be upsized to a 21-inch line.	Upsizing is necessary for increased sewer flows due to development of surrounding areas.	7/1/2024-6/30/2025
58	**UW25008**	**MXXXXX**	Harding Way Sewer Rehabilitation - (ID#R3Q, 2008 MP) - Between Wilson and Union Street		$1,572,000						$1,572,000			Harding Way Sewer (Wilson and Union Street)	The project will provide funding to upsize the existing sanitary sewer line along Harding Way between Wilson Way and Union Street. Approximately 771 feet of existing 12-inch sewer will be upsized to an 15-inch line and approximately 765 feet of existing 12-inch sewer will be upsized to an 18-inch line.	Upsizing is necessary due to increased sewer flows due to development of surrounding areas.	7/1/2024-6/30/2025
59	**UW25009**	**MXXXXX**	Ryde Avenue Sewer Rehabilitation (ID#R3C, 2008 MP) between River Dr and De Ovan Ave		$3,390,000						$3,390,000			Ryde Avenue (River Dr and De Ovan Ave)	The project will provide funding to upsize the existing sanitary sewer line along Ryde Avenue between River Drive and De Ovan Avenue. Approximately 289 feet of existing 30-inch sewer will be upsized to a 42-inch line and approximately 1,086 feet of existing 36-inch sewer will be upsized to a 42-inch line.	Upsizing is necessary due to increased sewer flows due to development of surrounding areas.	7/1/2024-6/30/2025
60	**UW25010**	**MXXXXX**	Del Norte Street Sewer Rehabilitation - (ID#R5A, 2008 MP) between Scotts St and Main St		$8,333,000						$8,333,000			Del Norte St (Scotts St and Main St)	The project will provide funding to upsize the existing sanitary sewer line along Del Norte Street between Scotts Street and Main Street. Approximately 2,805 feet of existing 36-inch sewer will be upsized to a 48-inch line.	Upsizing is necessary due to increased sewer flows due to development of surrounding areas.	7/1/2024-6/30/2025
61	**UW25012**	**MXXXXX**	Ralph Avenue Sewer Trunk Rehabilitation - Phase III (Airport Way to Perlman Drive)		$2,515,000						$254,000	$2,261,000	Need new estimate. Cost shown in based on 2019 WW Rate Study	Ralph Avenue (Airport Way to Perlman Drive)	This project would rehabilitate the existing sewer trunk line along Ralph Avenue approximately 1570 feet West of Airport Way to corrosion and potential consequences of structural failure.	This project will eliminate restrictions and pipeline collapses in the City's sanitary sewer collection systems, and allows for continuous sewer service within our service area.	7/1/2024-6/30/2026
62	**UW22003**	**MXXXXX**	Pershing Avenue sewer Trunk Rehabilitation (Lincoln Rd to Meadow Avenue)		$3,280,081	$1		$527,000	*$2,753,080*				Need new estimate. Cost shown in based on 2019 WW Rate Study	Pershing Avenue (Lincoln Road to Meadow Ave)	Upsize the existing 36-inch sewer trunk main on North Pershing Avenue between West Lincoln Road and Meadow Avenue to a 42-inch sewer trunk main.	Project will upsize the existing sewer trunk to alleviate full pipes in the collection system and accommodate future growth. Project will add capacity to collection system in accordance with the current Wastewater Master Plan.	7/1/2021-6/30/2023
63	**UW22004**	**MXXXXX**	System 10 Sewer Relief Forcemain		$7,676,000			$100,000	*$777,000*	*$6,799,000*			Need new estimate. Cost shown in based on 2019 WW Rate Study. Refer to 2018-23 Master CIP Budget for more info	City Wide	A total of three new pump stations will be required to serve various areas within System 15. The Thomson Pump Station will convey wastewater into existing System 10 trunks. The Gateway Pump Station and System 15 East Pump Station will pump flow via force mains directly to the 14 Mile Slough Pump Station.	The segment of force main downstream of the System 15 East Pump Station along Eight Mile Road to Trinity Parkway will be twinned to accommodate lower flows in early years while maintaining adequate velocities, and to facilitate maintenance of the force mains in the future.	7/1/2022-6/30/2024
64	**UW25011**	**MXXXXX**	Thornton and MacDuff Avenue Sewer Rehabilitation (ID#R2AC, 2008 MP)		$4,040,000						$486,000	*$3,554,000*	Need new estimate. Cost shown in based on 2019 WW Rate Study. Refer to 2018-23 Master CIP Budget for more info	Thronton Road & MacDuff Ave	Upsize 2269LF of 15-inch VCP pipe to 21-inch on MacDuff from Roxburgh Way to Thornton Road up to Hammer Lane per WWMP.	Upsizing is necessary due to increased sewer flows from development of surrounding areas.	7/1/2024-6/30/2026
65	**UW26003**	**MXXXXX**	Waterloo East Eastment at Wizard Avenue Sanitary Sewer Rehabiliation (ID#R6A, 2008 MP)		$584,000							*$584,000*	Need new estimate. Cost shown in based on 2019 WW Rate Study. Refer to 2018-23 Master CIP Budget for more info.	Waterloo at Wizard Ave	Upsize 424 linear feet of 18" pipe to 21" within easement south of Waterloo Road and East of Wizard Avenue per the 2008 Wastewater Master Plan .	Upsizing is necessary due to increased sewer flows from the development of surrounding areas.	7/1/2025-6/30/2026

No.	Tyler Project No.	MUD Project No.	Project Name	Project Description	Project Justification	Total Approved Budget	Initiated By	Performed By	Project Status	Project Notes
1	UW20018	M20018	Asset Condition Assessment for Sanitary Sewer Forcemains	The project will provide a condition assessment of approximately thirty (30) miles of forcemains. Findings from the assessment will be used to develop a risk model and a priority list for future capital improvement projects.	Assessment of forcemains is necessary to prioritize the necessary improvements or replacements to ensure reliable and uninterrupted service.	**$1,076,000.00**		MUD	N/A	
2	UW20019	M20019	Asset Condition Assessment for Sanitary Sewer Pump Stations	The project will provide a condition assessment of 27 sanitary sewer pump stations. Findings from the assessment will be used to develop a risk model and a priority project list for future capital improvement projects.	Assessment of pump stations is necessary to prioritize the necessary improvements or replacements to ensure reliable and uninterrupted service.	**$519,000.00**		MUD	N/A	
3	UW14030	M14030	Clean Water State Revolving Fund Program Assistance			**$231,509.00**	**Financial Assistance Application for RWCF Modf Project**	MUD	N/A	
4	UW21015	M21015	Quail Lakes Sanitary Sewer Lift Station Upgrade / Rehab	This project will rehabilitate the existing sanitary sewer pump station by replacing all problematic mechanical and electrical equipment and install a 50-foot high monopole.	The rehabilitation of the pump station will minimize the potential for station failure and sewer backup and spillage caused by pump station shut downs. Installation of the monopole will improve SCADA transmission, preventing loss of data.	**$191,395.00**	**2008 MP**	MUD	Existing capacity adequate for buildout	FY 22/23
5	UW21020	M21020	FY2021 Sanitary Sewer Street Improvements Reimbursements (SJ County)	This ongoing project provides funding for the repair and modification to the City's sanitary sewer collection system as a result of street improvement projects administered by the Public Works Department and other agencies. Funding for City street improvement projects is included in the individual Public Works projects. In FY2021 the following projects will contain budget for sewer system improvement reimbursements: PW1610, PW1721, PW1723, PW1727, PW1809, PW1914, PW1916, PW2103, PW2106, OM20-064, OM21-001.	During the construction of street improvement projects, it is often necessary to modify or repair sanitary sewer pipeline and maintenance holes. The project provides for the funding of such improvements.	**$250,340.00**		MUD	N/A	
6	UW20022	M20022	Fourteen Mile Pump Station Assessment & Repair	The project is to assess the operation of the pump station to determine cause of pump failure.	Failure of the existing pumps increases maintenance and reduces reliability of the pump station.	**$970,000.00**		MUD	27 mgd capacity needed to serve all 2040 development areas south of Eight Mile Road, per current Master Plan model	On hold, pending completion of 2021 Master Plan
7	UW13010	M13010	Sanitary Sewer Pump Station at 2414 Santiago Wy & Don Ave	Rehabilitate existing sanitary sewer pump station by replacing all problematic mechanical and electrical equipment, which will improve reliability.	This rehabilitation project will minimize pump station failure, overflows and ensures that the pump station capacity is adequate and reliable.	**$453,000.00**	**2008 MP**	MUD	Model indicates firm capacity is not adequate but total capacity is adequate; PS firm capacity = (550 gpm) 0.8 mgd; total capacity ~1.6 mgd; modeled flows: 1.3 mgd (2021), 1.4 mgd (2040), 1.6 mgd (buildout)	After contract with Siegfried is complete, notify Finance for FAOF. The cost should be split 50/50 with M13009.
8	UW13009	M13009	Sanitary Sewer Pump Station at SEC Thornton & Davis Roads	Rehabilitate existing sanitary sewer pump station by replacing all problematic mechanical and electrical equipment, which will improve reliability.	This rehabilitation project will minimize pump station failure, sewer overflow and ensure that the pump station capacity is adequate and reliable.	**$694,000.00**	**2008 MP**	MUD	Model indicates firm capacity is adequate; PS firm capacity = (850 gpm) 1.22 mgd; total capacity ~2.4 mgd; modeled flows: 1.18 mgd (2021), 1.19 mgd (2040), 1.20 mgd (buildout)	After contract with Siegfried is complete, notify Finance for FAOF. The cost should be split 50/50 with M13010.
9	UW24006	MXXXXX	French Camps Sewer and Lift Station	This is a new CIP project to provide for the construction of a new lift station and its sewer system.	The purpose of this new lift station and its sewer system is to meet the City's build-out capacity.	**$0.00**	**2008 MP**	MUD	TBD pending reconfiguration of Tidewater PS and Grupe; separate discussion required	FY 23/24 & 24/25
10	UW24005	MXXXXX	Lincoln Street Sanitary Sewer Pump Station and Forcemain	Installation of a sewer pump station at Lincoln St. and the Mormon slough. Install a forcemain in the existing deficient gravity sewer line along Church St. from the Mormon Slough to Pershing Ave.	Installation of appropriate sanitary pump station and forcemain will ensure adequate capacity and reliable system demands.	**$0.00**	**2008 MP**	MUD	~4 mgd pump station and ~1,800 LF of force main, per 2021 Master Plan CIP	FY 23/24, 24/25 & 25/26
11	UW24004	MXXXXX	Kelley and Mosher Slough Sanitary Sewer Pump Station	This project will rehabilitate the existing sanitary sewer pump station by replacing all problematic mechanical and controls equipment.	The rehabilitation of the pump station will minimize the potential for sewer backups and spillage caused by pump station failure.	**$0.00**	**2008 MP**	MUD	No upsizing needed; PS firm capacity = (3000 gpm) 4.3 mgd; modeled existing and future peak flow ~2 mgd	FY 23/24
12	UW23001	MXXXXX	Plymouth & 5 Mile Creek Sanitary Sewer Pump Station (source: 2008 Master Plan)	A new sanitary sewer pump station will be constructed replacing the existing Plymouth Road & Five Mile Creek sanitary sewer pump station to increase pumping capacity.	A new sanitary sewer pump station is required to accommodate increased wastewater flows from future development. The current Wastewater Master Plan anticipates wastewater flows at a 2035 build out will greatly exceed the current pump station capacity.	**$0.00**	**2008 MP**	MUD	No upsizing needed; PS firm capacity = (870 gpm) 1.25 mgd; modeled existing and future peak flow ~ 0.5 mgd	FY 22/23, FY 23/24
13	UW24003	MXXXXX	Swenson Road & 5 Mile Creek Sanitary Sewer Pump Station (source: 2008 Master Plan)	The pumps and controls will be replaced at the Swenson & Five Mile Creek sanitary sewer pump station to increase pumping capacity.	New pumps and controls are required to accommodate increased wastewater flows from future development. The current Wastewater Master Plan anticipates wastewater flows at the 2035 build out will exceed the current pump station capacity.	**$0.00**	**2008 MP**	MUD	Existing capacity appears adequate; ex. firm capacity = 20.2 mgd; modeled peak flow: 18.4 mgd (2021), 18.8 mgd (2040), 20.2 mgd (buildout)	FY 23/24, FY24/25

No.	Tyler Project No.	MUD Project No.	Project Name	Project Description	Project Justification	Total Approved Budget	Initiated By	Performed By	Project Status	Project Notes
14		MXXXXX	Brookside Estates Sanitary Sewer Pump Station	Rehabilitate existing sanitary sewer pump station to improve reliability by replacing all problematic components, such as sluice gates, scrubber, pumps, and liner in the wet well.	As the existing facility ages, it is necessary to replace components to ensure the pump station operates without service interruptions to customers.	**$0.00**		MUD	No upsizing needed; PS firm capacity = 8.6 mgd; modeled existing and future peak flow ~ 2.8 mgd	FY22/23
15	UW23002	MXXXXX	Bianchi and Calaveras River Storm Station New Sanitary Sewerline Installation	This project provides funding for the installation of a sanitary sewer line at a storm pump station facility for the purpose of dewatering the facility in the event of contamination.	The installation of a sanitary sewer line at a storm pump station facility will prevent the potential of discharging contaminated waters into a natural waterway.	**$0.00**		MUD	N/A	Not active. Budget in FY23
16	437-7785	M18015	Five Mile Slough Force Main Assessment	This project will perform an assessment/evaluation for the existing sanitary sewer force that crosses Five Mile Slough.	This assessment is required due to age and recent failure of the existing infrastructure. In addition, this force main is critical in the conveyance of sewage to Fourteen Mile Pump Station.	**$316,589.53**		MUD	N/A	
17	UW16006	M16006	2016 Sanitary Sewer Rehabilation Project	This project provides rehabilitation to the City's deteriorating Sanitary Sewer lines. Fiscal Year 2017/2018 will provide construction at eight locations using two rehab methods. The trenchless method (pipe bursting) will be used at Elmwood Avenue, Harding Way, El Monte Street and Phelps Street. The open cut method will be used at Commerce Street, Third Street, Worth Street and Grant Street.	Rehabilitation of these aging and deteriorating sewer lines are necessary to avoid catastrophic failure and ensure that they continue to operate without service interruption to customers.	**$1,603,000.00**		PW	Awaiting info from Ann and Ali re: trenchless repairs; open cut repairs are all adequate as is	On hold, pending completion of 2021 Master Plan
18	UW17018	M17018	Downtown Sewer Collection System	This project is to evaluate the existing downtown sewer collection system, redesign a larger sewer system to accept more flow, and replace undersized pipes.	The Downtown Sewer Collection System is the oldest part of the City's system. Little to no engineering data is available. This project will evaluate existing system and will identify a master plan that can be used to prioritize new construction of pipes. All deficient pipes will be replaced with this project. Future funding will be used to improve other needed improvement in the downtown area.	**$621,235.00**		PW	Not needed as described; superseded by 2021 CIP list	On hold, pending completion of 2021 Master Plan
19	UW18029	M18029	Sierra Nevada Street Sanitary Sewer Line Rehabilitation	This project will address capacity deficiencies and corrosion problems. This project will rehabilitate the existing 36-inch sanitary sewer line along Sierra Nevada Street between Hazelton Avenue and Worth Street due to severe corrosion and potential consequences of structural failure.	This project eliminates restrictions and pipeline collapses in the City's sanitary sewer collection system, and allows continuous sewer service within the service area.	**$2,126,000.00**		PW	Capacity adequate for buildout; moving forward as is	100% design. Advertise fall 2021, award contract January, 2022, start construction May 2022.
20	UW20011	M20011	FY20/21 - Sanitary Sewer Maintenance Hole Rehabilitation Project	Ongoing rehabilitation of various existing sewer maintenance holes throughout the City of Stockton due to concerns over the corrosion condition and potential consequences of structural failure.	Rehabilitation of deteriorating maintenance holes are important to ensure that they continue to operate without service interruptions to customers.	**$900,000.00**	**O&M**	PW	N/A	Work will start in July 2021 and comnpleted in June 2022.
21	UW20020	M20020	Sanitary Sewer Large Diameter Lines Replacement per AMMP	The project is to rehabilitate the existing large diameter sewer lines at the following locations: -659 W. Anderson St. 24" VCP -Lincoln St. S at 545 W. Sonora St. 24" VCP -Harrison St. N at 548 W. Oak St. 16" VCP The pipeline are experiencing corrosion and cracks and have scored high in recent risk assessment.	The project is to rehabilitate the existing large diameter sewer lines at the following locations: -659 W. Anderson St. 24" VCP -Lincoln St. S at 545 W. Sonora St. 24" VCP -Harrison St. N at 548 W. Oak St. 16" VCP The pipeline are experiencing corrosion and cracks and have scored high in recent risk assessment.	**$2,210,151.00**	**AMMP**	PW	No capacity issues indicated; condition-based repairs only	Coordinate with Collections and provide scope to PW.
22	UW21007	M21007	Union Street Rehabilitation between Harding and Acacia (ID#R3R, 2008 MP)	The project will provide funding to upsize the gravity sanitary sewer pipeline on Union Street between Harding Avenue and Acacia Street. The sewer pipeline will be upsized from 12-inch pipe to 18-inch pipe.	Project will upsize the existing sewer trunk to alleviate full pipes in the collection system and accommodate future growth. Project will add capacity to the collection system in accordance with the sewer master plan.	**$1,378,000.00**	**2008 MP**	PW	Replace/upsize line from Harding to Oak: ~4,300 LF of 15-inch diameter pipe; ~10 MHs, per 2021 Master Plan CIP	Corrdinate with Stephen to determine to proceed or not. Design contract awarded to Siegfried on 3-9-21. start design April 2021. Complete design estimated March 2022. Start construction July 2022 estimated
23	UW21016	M21016	Sanitary Sewer Small Diameter Lines Replacement per AMMP	The project is to replace existing small diameter sewer lines with a larger size at the following locations: -Wilson Way (31P0380 - 31P0570) -Wilson Way (31P0280 - 31P0210) -Victoria Avenue (32J0370 - 32J0570) -Sonora Street (33P1060 - 33P1090) -Worth Street (35N0220 - 350260) - Flora Street (31P0730 - 31P0760) - The easement line between Howard St. & W 6th St. (37M0670 - 37M0700)	Replacement of sewer lines will avoid catastrophic failure and sewer overflow and ensures continuous service to the service area. The pipelines are experiencing corrosion and cracks and have scored high in a recent risk assessment.	**$1,849,120.00**	**AMMP**	PW	All lines are unmodeled 6" diameter pipes; proceed with upsizing to 8" diameter, per existing plans	Coordinate with Collections and modify scope. Preparing RFP for design. MUD staff to provide segments for line replacement.
24	UW21017	M21017	Airport Way Sewer Trunk Rehabilitation (San Joaquin Farigrounds to Ralph Ave.)	Rehabilitate the existing 30-inch and 42-inch sewer main line on Airport Way between the San Joaquin County Fairgrounds and Ralph Avenue.	The pipeline is experiencing rapid deterioration and has the potential for structural failure.	**$4,985,000.00**	**AMMP**	PW	No capacity issues indicated; condition-based repairs only	Preparing RFP for design. MUD staff to provide segments for line replacement.

No.	Tyler Project No.	MUD Project No.	Project Name	Project Description	Project Justification	Total Approved Budget	Initiated By	Performed By	Project Status	Project Notes
25	UW21020	PW1721, PW1610, PW1705, PW1723, PW1727, PW1808, PW1903, PW1916, PW1914, PW2103, PW2106, PW1809	Sanitary Sewer Street Improvements Reimbursements	This ongoing project provides funding for the repair and modification to the City's sanitary sewer collection system as a result of street improvement projects administered by the Public Works Department and other agencies.	During the construction of street improvement projects, it is often necessary to modify or repair sanitary sewer pipeline and maintenance holes. The project provides for the funding of such improvements.	**$353,000.00**	**Public Works**	PW	N/A	PW 1721 – Finalizing Plans, likely Advertise March, open bids April, Award July, Start Const. Sept. PW 1610 – Complete. PW 1705 – Awarded construction contract Feb. 2. Begin construction in March. PW 1723 – Finalizing plans. Likely advertise April, Open bids May, Award August. PW 1727 – Construction Contract awarded Dec. 2020. Start construction March 2021. PW 1808 – PS&E 90%. Advertise June, Open bids July, award October 2021, start spring 2022
26	UW22003	MXXXXX	Pershing Avenue Sewer Trunk Rehabilitation (Lincoln Rd to Meadow Avenue)	Upsize the existing 36-inch sewer trunk main on North Pershing Avenue between West Lincoln Road and Meadow Avenue to a 42-inch sewer trunk main.	Project will upsize the existing sewer trunk to alleviate full pipes in the collection system and accommodate future growth. Project will add capacity to collection system in accordance with the current Wastewater Master Plan.	**$527,000.00**	**2008 MP**	PW	Current modeling shows no current or future capacity issues on these two segments	Not active. Design funds to be approved in fiscal year 21-22? No work started yet.
27	UW22004	MXXXXX	System 10 Sewer Relief Forcemain	A total of three new pump stations will be required to serve various areas within System 15. The Thomson Pump Station will convey wastewater into existing System 10 trunks. The Gateway Pump Station and System 15 East Pump Station will pump flow via force mains directly to the 14 Mile Slough Pump Station.	The segment of force main downstream of the System 15 East Pump Station along Eight Mile Road to Trinity Parkway will be twinned to accommodate lower flows in early years while maintaining adequate velocities, and to facilitate maintenance of the force mains in the future.	**$100,000.00**	**2008 MP**	PW	Facilities needed to serve future development in Study Area 1; not needed until then	Not active. We don't have this project
28	N/A	PW1805	California Street Road Diet Sanitary Sewer Rehabilitation	The California Street Road Diet extends from Alpine Ave. to El Dorado Street (South). This corridor is intended to function as Stockton's bicycle spine that would connect North and Central Stockton through the downtown with South Stockton. This north/south facility would connect seven east/west backbone facilities throughout Stockton. ATP Cycle 4 has increased funding to extend the California lane reduction and add bike lanes between Miner Avenue and 8th Street.	This is one of the highest priority projects from the Bicycle Master Plan due to its ability to promote spatial equity and socio-economic equity throughout the City by connecting multiple disadvantaged neighborhoods to each other, as well as to jobs, schools, recreation, and many other daily amenities. The project will complete a road diet that provides a safer and more accessible bicycle experience for users of all ages and abilities.	**$665,000.00**		PW	N/A	Design approximately 50% complete. Anticipate design completion Fall 2021. construction spring/summer 2022
29		MXXXXX	West Lane and Calaveras River North Storm Station New Sanitary Sewer Line Installation	This project provides funding for the installation of a sanitary sewer line at a storm pump station facility for the purpose of dewatering the facility in the event of contamination.	The installation of a sanitary sewer line at a storm pump station facility will prevent the potential of discharging contaminated waters into a natural waterway.	**$0.00**		PW	N/A	Not active. FY 23/24, FY 24/25
30		MXXXXX	West Lane and Calaveras River South Storm Station New Sanitary Sewer	This project provides funding for the installation of a sanitary sewer line at a storm pump station facility for the purpose of dewatering the facility in the event of contamination.	The installation of a sanitary sewer line at a storm pump station facility will prevent the potential of discharging contaminated waters into a natural waterway.	**$0.00**		PW	N/A	Not active. FY 23/24, FY 24/25
31		M15003	Navy Drive 24-, 30- & 48 -Inch Sewer Rehabilitation (M15003)	Rehabilitation of the existing sanitary sewer trunk line along Navy Drive between I-5 and Fresno Ave. The existing sewer line shows signs of deterioration.	The pipeline is experiencing sever corrosion and has the potential for structural failure. Rehabilitation of this sewer line will avoid catastrophic failure and ensures uninterrupted service to customers.	**$2,828,007.00**		PW	Model shows no surcharging for existing or future conditions; CIPP adequate UNLESS Mariposa Road flows are added; need separate meeting to discuss w/Jeff and Mel	CIPP Design 100%. Bids came higher than budget. On hold. Need more budget for construction. Pending completion of 2021 Master Plan.
32		M17023	Pershing Avenue Sewer Trunk Rehab (Church To Navy)	This project would rehabilitate the existing 24-inch sanitary sewer main line along Pershing Avenue between Church Street and Navy Drive and along Church Street between Orange Street to Pershing Avenue.	The entire pipeline crown is experiencing cracking and has the potential for structural failure.	**$2,286,000.00**		PW	Finalize existing design; proceed with construction of identified improvements UNLESS Mariposa flows are added; should be implemented in conjunction with Lincoln Street PS project	30% Design. Anticipate completion of design in calendar year 2021. construction spring 2022
33		M17026	Navy Drive At I-5 Sewer Trunk Line	This project will address capacity deficiencies and corrosion problems at the 54 inch crossing under I-5 and 42 inch parallel and east of I-5 at Navy Drive.	This project eliminates restrictions and pipeline collapses in the City's sanitary sewer collection system and allows continuous sewer service within the service area.	**$1,889,360.00**		PW	Adverse sloped line slated for CIPP; proceed with planned rehab UNLESS Mariposa flows are added; project could be elminated by redirecting Worth Street flows west along Anderson Street then south along Stockton Street	100% Design. Advertise June 17, 2021 and award contract September 14, 2021. Start construction in Fall.
34		M18030	Mormon Slough Sanitary Sewer Line Rehabilitation	This project will address capacity deficiencies and corrosion problems. This project will rehabilitate the existing 24-inch sanitary sewer line along Mormon Slough at Jefferson Street due to severe corrosion and potential consequences of structural failure.	This project eliminates restrictions and pipeline collapses in the City's sanitary sewer collection system, and allows continuous sewer service within the service area.	**$1,544,000.00**		PW	Need to see existing KSN design drawings to assess vertical alignments	Working on 30% design and environmental documentation. Constructiion expected summer 2022.
35		M20003	Zephyr Road Water Main	Installation of 1,250 feet of 16-inch water main on Zephyr Road between Pock Lane and B Street. Requires acquisition of 15-feet easement through private property (from end of the cul-de-sac on Zephyr Road to Pock Lane).	This large diameter water main is necessary to convey large volumes of water efficiently over long distances. Water mains provide the water backbone for subdivisions, water wells and reservoir sites.	**$719,387.00**		PW	N/A	Proposals are received and Siegfried is selected. Award and start design in fall 2021.

No.	Tyler Project No.	MUD Project No.	Project Name	Project Description	Project Justification	Total Approved Budget	Initiated By	Performed By	Project Status	Project Notes
36		M18031	Howard Street Sewer Rehab	This project provides for the replacement of an existing 6-inch sanitary sewer line due to multiple fractures and breaks in the pipeline.	As the existing sanitary sewer system ages, it is necessary to continually repair, rehabilitate or replace deteriorated infrastructure in order to ensure that the collection system operates without service interruptions to customers or sanitary sewer overflows.	**$117,520.00**		PW	If dig and replace or pipe burst, should be replaced with 8-inch; may already be in construction, per Gemma	Open bids on June 17, 2021. NTP in fall 2021.
37		M18024	Ralph Avenue Sewer Trunk Rehabilitation	This project would rehabilitate the existing sewer trunk line along Ralph Avenue between B Street and Pock Lane, along Pock Lane to Loomis Road public utilities easement to Mariposa Road to Munford Avenue due to corrosion and potential consequences of structural failure.	This project will eliminate restrictions and pipeline collapses in the City's sanitary sewer collection systems, and allows for continuous sewer service within our service area.	**$1,037,000.00**		PW	West Yost awarded design services contract Fall 2021, per Gemma	Proposals are received and West Yost is selected. Award and start design in fall 2021.
38		M18032	Pilgrim St And Union St Sewer Rehab	This project provides for the replacement of an existing 6-inch sanitary sewer line due to multiple fractures and breaks in the pipeline.	As the existing sanitary sewer system ages, it is necessary to continually repair, rehabilitate or replace deteriorated infrastructure to ensure that the collection system operates without service interruptions to customers or sanitary sewer overflows.	**$476,000.00**		PW	Unmodeled lines; no capacity issues anticipated; if dig and replace or pipe burst, should be replaced with 8-inch	Open bids on June 17, 2021. NTP in fall 2021.
39		M18028	Worth Street Sewer Trunk Rehab	This project will address capacity deficiencies and corrosion problems. This project will rehabilitate the existing 36-inch sanitary sewer line along Worth Street between Harrison Street and Sierra Nevada Street due to severe corrosion and potential consequences of structural failure.	This project eliminates restrictions and pipeline collapse in the City's sanitary sewer collection system, and allows continuous sewer service within the service area.	**$4,846,500.00**		PW	Status TBD; some sucharging at buildout; the need for upsizing may be influenced by decisions re: Mariposa Road and Diamond Grade	90% design stage. 100% planse being prepared by West Yost. Permit documents being prepared (CVFPB).
40		M20016	Oak Street Sewer Trunk Rehabilitation (Wilson Way to Pershing Avenue)	This project will address capacity deficiencies and corrosion problems. This project will rehabilitate an existing sewer trunk line along Oak Street between Wilson Way and Pershing Avenue due to cracks, roots, and potential consequences of structural failure.	This project eliminates restrictions and pipeline collapses and allows for continuous sewer service to the service area.	**$949,000.00**		PW	West Yost design project; upsizing may be warranted; decision to be made in design	Design approximately 25% complete. Anticipate fall 2021 completion. Spring 2022 construction
41		M18045	Rose Street Storm Drain System Upsize	This project upsizes storm drainage infrastructure to eliminate flooding and reduce overflows of stormwater into the sanitary collection system.	This project addresses deficiencies in the storm drainage system on Rose Street. By upsizing the storm line, stormwater flooding decreases, and overflows into the sanitary collection system are prevented, thereby reducing the cost of wastewater treatment.	**$436,000.00**		PW	N/A	In Construction. Complete construction by October 2021.
42		M21018	Lincoln Road Sewer Trunk Rehabilitation	Upsize the existing 36-inch sewer trunk main on Lincoln Road between Pershing Avenue and Alexandria Place to a 42-inch sewer trunk main.	Project will upsize the existing sewer trunk to alleviate full pipes in the collection system and accommodate future growth. Project will add capacity to the collection system in accordance with the current sewer master plan.	**$4,204,000.00**	AMMP	PW	42-inch is adequate for buildout per 2021 Master Plan model	NTP for design is issed to Siegfried in May. Waiting for direction from MUD pending completion of 2021 Master Plan.
43		M20011	2020-2021 Maintenance Hole Rehab	Ongoing rehabilitation of various existing sewer maintenance holes throughout the City of Stockton due to concerns over the corrosion condition and potential consequences of structural failure.	Rehabilitation of deteriorating maintenance holes are important to ensure that they continue to operate without service interruptions to customers.	**$300,000.00**		PW	N/A	Coordinate with Collections. MUD to provide a list of MH's to PW.
44	434-7713	M18014	Market Street Sanitary Sewer Upsize	This project will address capacity deficiencies and corrosion problems. This project will upsize or parallel the existing sanitary sewer pipeline which has deficient capacity problems or is too old to continue to serve their existing service area. Project will eliminate restrictions to the collection system.	These projects eliminate restrictions and pipeline collapses in the City's sanitary sewer collection systems, and allow for continuous sewer service within the service area.	**$3,425,139.29**		PW	Buildout surcharging would be partially mitigated by Lincoln St PS; minor surcharging expected at buildout; if rehabilitation is planned, and if dig and replace is preferred, upsizing diameter may be justified	Not active

Appendix H

Wastewater Systems Financial Analysis

Technical Memorandum

Date:	09/26/2022
Project:	City of Stockton Wastewater Financial Analysis
To:	Jeff Pelz, West Yost
From:	Shawn Koorn, HDR
Subject:	City of Stockton 2022 Master Plan Financial Analysis

Introduction

Introduction

The effective implementation of the Wastewater Master Plan (Plan) is dependent on development of a wastewater rate revenue transition plan to support the operating and capital needs to maintain and expand the wastewater system to meet demands, state and local regulatory requirements, and provide the flexibility for the City of Stockton (City) to deal with unforeseen changes in the future. In general, the wastewater financial plan uses the annual operating expenses as well as the identified capital needs from the Plan to determine if the current wastewater rate revenues are sufficient to maintain and operate the City's wastewater utility. As necessary, the wastewater financial plan will also develop a rate transition plan to fully fund the wastewater utility.

Key Assumptions

The City's adopted Fiscal Year (FY) 2022 budget was used as the basis for the development of the projection of O&M expenses. Unique escalation factors were then developed which are based on historical inflationary factors for the City and the local area, as well as related to overall individual industry trends. These escalation factors were applied to the budgeted O&M expenses to project future annual O&M expenses over the projected time period.

The financial plan is predicated on the following:

- Projected rate revenue adjustments are implemented,
- The timing and magnitude of the capital improvements are maintained, and
- Customer characteristics remain similar for rate revenue generating purposes

There is also no assumed additional staffing (i.e., full-time equivalents [FTEs]) needed and no new O&M expenses were added for the wastewater financial plan.

Historical Review

The first step in reviewing the financial health of the City's wastewater utility is to gain an understanding from prior financial performance. To do this, the analysis starts with the previous 5-year period of FY 2017 to FY 2021. The City's wastewater proforma which details historical costs by category as well as budget figures going forward was used as the basis for the analysis. Given this information, one can assess the wastewater utility past financial health and gauge any trends that may be occurring. The information from the historical review helped in the development of the assumptions for the financial plan as well as in gaining an understanding of the wastewater utility's operations. A summary of the historical operating revenues and expenses is shown in Table 1.

Table 1
Historical Revenue Requirement

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Revenues	**$66,980,583**	**$68,263,685**	**$72,606,768**	**$81,661,938**	**$71,491,891**
Expenses					
O&M	$41,347,565	$42,756,889	$42,320,681	$45,274,767	$48,153,636
Debt Services	2,537,403	2,398,769	2,813,733	4,274,405	8,157,015
Total Expenses	**$43,884,968**	**$45,155,658**	**$45,134,414**	**$49,549,172**	**$56,310,651**
Bal. / (Def.) of Funds	*$23,095,615*	*$23,108,027*	*$27,472,354*	*$32,112,766*	*$15,181,240*

As can be seen from the historical review, the City's wastewater utility has maintained adequate funding for annual operation and maintenance as well as funding capital improvements during this historical time period. Given the balance of funds, it is assumed that the City will use those funds for funding current and future wastewater capital improvement needs. Capital funding could be accomplished through annual funding, often referred to as rate funded capital or pay-as-you-go, or through funding reserves in initial years to fund large projects in the future. In years where the utility is deficient, it is likely indicating a use of reserve funds for capital improvement projects. In Summary form, this table provides a comparison from year to year using available historical data.

Development of the Wastewater Financial Plan

The wastewater financial plan was developed to determine the City's ability to fund its wastewater system capital improvements, as developed in this Wastewater Master Plan, as well as the projected O&M needs over the review period. The analysis also took into consideration prudent financial management criteria such as adequate funding of capital through rates, the planned capital funding approach, maintaining required debt service coverage (DSC) ratios, and operating and capital fund balances (i.e., reserve levels). The financial plan developed the projected wastewater utility revenues and expenses for FY 2022 through FY 2035. The development of the projection was based on the projected year end for FY 2022 provided by the City. The costs were then escalated through FY 2035, by applying previously mentioned escalation factors to reflect future cost inflation ranging from 2.0% percent to 7.0%, annually, depending on the expense category. The range in inflationary factors is based on historical trends in the different types of costs incurred by the City.

The following sections describe the key components of the financial plan. Worksheets showing the financial analysis are provided in the Appendix of this summary document.

Revenues

The first component in developing the financial plan is a review of the sources of revenue for the City's wastewater utility. The starting point was the projected year end revenues for FY 2022. The following revenues are received from the City's wastewater customers and operations:

- Rate revenues - annual rate revenues received based on current adopted rate levels

- Other revenues - permit fees, fines and penalties, interest income, rental income, and other miscellaneous sources

The City's wastewater rate revenues are anticipated to be approximately $76.4 million for FY 2022. Assumed customer growth is conservative at a rate of 1.0% per year. It is important to note that the rate revenues projected are prior to any rate adjustments either previously adopted or proposed. With the impact of assumed customer growth, wastewater rate revenues are anticipated to increase to approximately $84.3 million by FY 2035. Other, or miscellaneous, revenues are projected to be approximately $110.7 million in FY 2022. It is important that this figure contains proceeds of approximately $108.0 million from long-term debt issuance and therefore, will not continue at this level. Other revenues decline as available fund balance is utilized to fund capital improvements and interest revenues decline. After this, in FY 2024, other revenues are anticipated to increase slightly annually over the review period and total approximately $2.4 million by FY 2035. In total – including both rate and other revenues - the City's wastewater utility is anticipated to have received $187.1 million in FY 2022 (including the $108.0 million in WIFIA proceeds) or approximately $79.1 million at current rate levels without the bond proceeds. Total revenues are projected to increase, less the long-term debt proceeds, through FY 2035 to approximately $86.8 million, prior to any rate revenue adjustments based on growth projections. Provided in Table 3 is a summary of the current, and projected, rate and other revenues.

Operations and Maintenance

The next component of the financial plan for the City wastewater utility was to project the O&M expenses incurred to provide service to its customers. As noted, the projection of future O&M expenses is based on the City's adopted FY 2022 wastewater utility budget. The budgeted figures were then escalated annually through FY 2035 using the assumed inflationary factors described previously.

The O&M expenses in FY 2022 are anticipated at $45.8 million. For FY 2023, the budgeted O&M is $62.9 million. Based on the increase in O&M over the period and the assumed inflationary factors, O&M expense levels are expected to increase to $113.0 million by FY 2035. This assumes no significant additions or changes made to the O&M practices during the projected period. The forecast of O&M expenses is shown as a summary in Table 3.

Capital Funding Plan

A major component of the City's planning process, and a focal point of this financial planning analysis, is the funding of the City's wastewater CIP. For purposes of financial planning the CIP, as presented in detail in the Plan, which is shown in 2022 dollars, is increased annually by 2.7% to reflect the future escalation of costs due to inflationary impacts. For the City to maintain the existing wastewater system and level of service to its customers, it is important to reinvest in the system at a level at least equal to depreciation. It is prudent, therefore, to have a level of annual capital projects funded by rates greater than this target level. This is because the replacement cost of the system will continue to increase as a result of inflation and the annual depreciation for the wastewater utility may actually be the lower threshold of targeted funding. Depreciation expense for the wastewater utility was reported at $12.5 million in FY 2021. Following prudent financial practices of 1.5 to 2.0 times depreciation, this would result in the need for the City to invest at least $18.8 million annually to sustain its wastewater capital facilities. The financial plan projects that the rate-funded capital will increase over the review period from $17.2 million in FY 2022 to $25.1 million by FY 2035 and averaging $21.4 million.

The CIP includes capital projects that fluctuate from year to year and averages $43.9 million annually, with a range of $29.2 million to $74.5 million per year. The total capital project funding from FY 2022 through FY 2035 is $614.6 million. Funding for the capital projects comes from several sources:

- The first source of funding for capital projects is through the ***rate funded capital*** line item, which is established at $17.2 million in FY 2022 and increases – annually - to a maximum of $25.1 million in FY 2035 for a total funding of $299.9 million over the period or roughly 42.5% of the capital funding analysis. This funding source is a critical component for the annual renewal and replacement of the system, which as mentioned, should be targeted at a level greater than annual depreciation. As mentioned previously, the annual depreciation for FY 2021, which is the target minimum funding, was approximately $12.5 million. During the projected period, the level of rate funded capital for the City's wastewater utility reaches approximately 2.2 times depreciation.
- The second source of funding is from available ***reserves***. For purposes of capital funding, the City's wastewater financial plan utilized three reserves: operating reserve, connection fee reserve, and a reserve holding long-term debt proceeds. The City will likely transfer funds in years of surplus – which can happen for a number of reasons - into the operating fund which can then be used for funding capital projects in the future. Over the review period, it is assumed that the City will use approximately $85.5 million of operating reserves. The connection fee reserve – as the name implies – is a reserve designated to hold connection fee revenues and be used towards either growth related long-term debt service or growth related capital projects. It is important to note that the projects and funding related to the connection fee fund will only happen if the projected development (i.e., growth) materializes. If the growth does not occur and/or the funding is not available it is assumed that the projects will not be completed until sufficient funds are available, or additional long-term debt is issued to fund growth related capital. At this time, no connection fee reserves are being utilized to fund the capital improvements. Over the review period, $14.0 million of capital reserves are used to fund projects. Finally, approximately $64.8 million in capital projects are funded by operating reserves. It is important to note that the use of reserves from year to year may fluctuate greatly depending on the actual level of capital projects for the City as well as what type of project is it. The financial model assumes that if there is more capital funding available in a given year then there are planned capital projects, the excess funds will be moved to reserves in order to be saved and available to be used for future capital expenses.
- The final source of funding for wastewater capital projects is from ***long-term debt***. This comes in the form of low-interest loans (SRF and WIFIA) as well as municipal revenue bonds. This source not only allows the City to secure funding for large one-time projects, but it also serves as a tool to equitably spread the costs of projects to the future beneficiaries, even though they are not connected to the system yet. For this review, it is assumed that the City will need to issuing approximately $219.7 million in long-term debt to fund the identified capital projects.

Table 1 shows a summary of the capital projects by type and the various funding sources.

Table 2
Capital Improvement Projects Summary ($000)

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 3033	FY 2034	FY 2035
Total RWCF	$0	$8,085	$13,356	$5,018	$2,816	$3,474	$4,693	$4,820	$4,950	$5,084	$5,221	$5,362	$5,507	$5,656
Total Capacity Improv. to Existing Gravity Sewer	0	0	0	0	0	0	0	0	0	0	21,276	17,561	17,484	16,118
Total Rehab of Existing Gravity Sewer Facilities	0	2,876	5,063	4,333	9,456	18,280	10,912	11,448	22,482	25,885	18,491	0	0	0
Total PS & Force Main Improv.	0	2,054	5,906	20,852	21,415	21,993	20,827	2,892	743	7,626	0	0	0	0
Total Other Future System Improv.	0	0	0	0	0	0	11,733	12,050	12,376	12,710	13,053	13,405	13,767	14,139
RWCF Modification Project	74,576	49,912	4,324	0	0	0	0	0	0	0	0	0	0	0
Future Capital Improv	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trans to LTD Proceeds Fund	0	0	0	0	0	0	26,210	0	0	45,770	0	0	10,813	0
Transfer to Operating Fund	0	0	0	0	0	8,653	0	0	0	0	0	0	0	0
Total Capital Improv. Proj.	**$74,576**	**$62,926**	**$28,650**	**$30,203**	**$33,686**	**$52,400**	**$74,376**	**$31,210**	**$40,550**	**$97,074**	**$58,042**	**$36,328**	**$47,571**	**$35,913**
Less: Other Funding														
Operating Fund (431)	$18,522	$2,906	$14,927	$13,728	$14,742	$0	$0	$0	$0	$0	$0	$0	$0	$0
Connection Fee Fund (434)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capital Fund - Sewer	14,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Long-Term Debt Proceeds	24,854	0	0	0	0	0	0	9,010	17,200	0	34,342	11,428	0	10,813
Low Interest Loans	0	46,800	0	0	0	30,000	0	0	0	0	0	0	0	0
Revenue Bonds	0	0	0	0	0	0	50,176	0	0	70,474	0	0	22,271	0
Total Other Funding	**$57,376**	**$49,706**	**$14,927**	**$13,728**	**$14,742**	**$30,000**	**$50,176**	**$9,010**	**$17,200**	**$70,474**	**$34,342**	**$11,428**	**$22,271**	**$10,813**
Total Rate Funded Capital	**$17,200**	**$14,350**	**$14,250**	**$16,800**	**$19,500**	**$22,400**	**$24,200**	**$22,200**	**$23,350**	**$26,600**	**$23,700**	**$24,900**	**$25,300**	**$25,100**

Debt Service

The City's wastewater utility currently has several outstanding debt issuances with an annual debt service payment of approximately $7.8 million for FY 2023. This includes the 2014 revenue bond as well as the recently issued WIFIA loan. As mentioned in the capital funding section, it is projected that the City has planned to issue additional long-term debt through WIFIA, SRF, and municipal revenue bonds to fund the planned capital improvement projects. Including the existing and future long-term debt, the annual debt service increased to approximately $19.3 million by FY 2035.

An important metric used in the analysis of debt is the DSC ratio. The DSC ratio is a comparison of revenues available to fund annual debt service payments after deducting O&M expenses from the total available revenues. The City has a DSC ratio target of 1.0 on all debt less connection fee revenue, and 1.25 when including connection fee revenue. This number is often looked at by rating agencies and can affect the terms of financing for future long-term debt issuances. As a result, the City's analysis has planned for a DSC ratio greater than 1.25 over the time period so that unforeseen circumstances do not impact the wastewater utility financial health and ability to issue long-term debt in the future. During the projected time period, the DSC ratio is above the target minimum and reflects prudent long-term financial planning targets.

Reserve Funds

The City, as mentioned earlier, has an operating reserve which serves a variety of purposes, but the three primary purposes are one or all of the following:

- To supply adequate liquidity and cash flow to cover the operating costs of the wastewater utility until revenues are collected for services rendered
- To provide funds for a catastrophic event resulting in a large capital funds need or loss of revenue
- To maintain surplus revenues to disburse in a deficit year, thereby reducing needed rate increases and resulting in smoother rate transition over time

The minimum target is set at 90 days of O&M expenses, which reflects general industry standard levels. For the City's wastewater utility, this figure would be approximately $22.9 million for FY 2022. The beginning balances, based on those provided by the City for the operating reserve, total $101.1 million in FY 2022; this figure contains significant funds that are earmarked for capital projects. Over the review period, reserves are used for various reasons, such as to fund the CIP and annual debt service payments, thereby minimizing rate adjustments. In FY 2035 it is projected that the ending reserve balance will be approximately $48.9 million. Given this the City should continue to monitor reserve levels annually to maintain adequate ending reserves balances.

Summary of the Financial Plan

The individual components discussed above are used to develop the financial plan. The summation of the annual O&M expenses, rate funded capital, debt service payments, and reserve funding is generally known as a revenue requirement. This analysis is used to compare the City's current wastewater rate revenues and operating and capital expenses, to assess the sufficiency of the existing wastewater rates. If there is a deficiency, and depending on the magnitude, timing, etc., a rate revenue adjustment may be recommended to maintain adequate funding for the operational and capital needs of the wastewater utility. Shown in Table 3 is a summary of the wastewater revenue requirement that was prepared for the City's as part of this Wastewater Master Plan.

Table 3
Revenue Requirement Summary ($000)

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 3033	FY 2034	FY 2035
Revenues														
Rate Revenues	$76,418	$74,877	$75,626	$76,382	$77,146	$77,917	$78,696	$79,483	$80,278	$81,081	$81,892	$82,711	$83,538	$84,373
Other Revenues	110,723	2,302	2,698	2,741	2,494	2,156	2,262	2,281	2,301	2,324	2,349	2,372	2,397	2,426
Total Revenues	**$187,141**	**$77,179**	**$78,323**	**$79,123**	**$79,639**	**$80,074**	**$80,958**	**$81,765**	**$82,579**	**$83,405**	**$84,241**	**$85,083**	**$85,935**	**$86,799**
Expenses														
Total O&M Expenses	$45,820	$62,925	$66,071	$69,375	$72,844	$76,486	$80,310	$84,325	$88,542	$92,969	$97,617	$102,498	$107,623	$113,004
Rate Funded Capital	17,200	14,350	14,250	16,800	19,500	22,400	24,200	22,200	23,350	26,600	23,700	24,900	25,300	25,100
Net Debt Service	124,064	4,669	7,638	7,819	7,781	7,750	9,644	12,693	12,657	10,249	14,542	14,507	14,473	15,806
To / (From) Reserves	57	(272)	(289)	149	223	283	267	308	315	627	421	471	648	768
Total Expenses	**$187,141**	**$81,672**	**$87,671**	**$94,142**	**$100,348**	**$106,919**	**$114,421**	**$119,526**	**$124,863**	**$130,445**	**$136,280**	**$142,376**	**$148,044**	**$154,678**
Bal. / (Def.) of Funds	$0	($4,493)	($9,347)	($15,019)	($20,708)	($26,845)	($33,462)	($37,762)	($42,284)	($47,040)	($52,039)	($57,294)	($62,109)	($67,879)
Bal as a % of Rate Adj	0.0%	6.0%	12.4%	19.7%	26.8%	34.5%	42.5%	47.5%	52.7%	58.0%	63.5%	69.3%	74.3%	80.5%
Proposed Rate Adj.	**0.0%**	**6.0%**	**6.0%**	**6.5%**	**6.0%**	**6.0%**	**6.0%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.0%**	**3.5%**
Add'l Rev w/ Rate Adj	$0	$4,493	$9,347	$15,019	$20,708	$26,845	$33,462	$37,762	$42,284	$47,040	$52,039	$57,294	$62,109	$67,879
Total Bal. / (Def.)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

As noted in Table 3, the City's wastewater utility would need to adjust overall wastewater rate revenues over the time period in order to fully fund the operating and capital needs through FY 2035. Key drivers in the financial plan results are the projection of O&M costs and the funding of the proposed CIP from the Plan. Any future rate transition plan should aim to provide steady and predictable rate adjustments over time. The proposed rate adjustments should be designed to fund the wastewater utility as identified in this financial plan and in doing this will help to maintain a strong financial position for the City to fully fund the operational and capital needs of the wastewater utility.

Connection Fees

The City has a number of funding sources available to offset capital costs of which many were discussed above. Another source which was not described in detail is from connection fees received from new wastewater connections. New wastewater connections are assessed a connection fee as a way to recover part or all of the cost of providing the infrastructure necessary to service the new connection (e.g., customer). The intent is that all new system customers will pay an equitable share of (or 'buy' into) the cost of the wastewater system improvements needed to accommodate growth. The calculation typically includes a value of the existing wastewater system assets and then adds in the anticipated future capital associated with providing capacity for new wastewater customers. This total cost is then reviewed on an incremental approach, that is, a calculation is performed to look at what the costs related to adding an additional single family equivalent unit is. Given this calculation, the schedule of connection fees can be updated. The revenues from these fees can then be utilized to pay directly for capital projects or for long-term debt service related to growth or capacity expansion. Additionally, a portion of the revenue from connection fees may be eligible to offset existing long-term debt payments to the extent they funded growth and expansion related capital infrastructure.

The City currently has in place fees that serve this purpose, the wastewater connection fee. This fee reflects the investment in infrastructure (capacity) for the collection system in place as well as to the wastewater treatment plant infrastructure (capacity) available to new customers. In order to update the wastewater connection fee, the starting point would be the capital improvements as outlined in this Wastewater Master Plan, along with the City's existing wastewater infrastructure. The available capacity in the existing system, plus the growth or expansion related capital projects, would be utilized in the analysis to develop an updated wastewater connection fee. This would provide a fee that reflects the value of the capacity necessary to serve new customers connecting to the City's wastewater system.

Summary

The financial plan presented in this chapter is based on several assumptions: the level of growth in the system, inflation amounts, and the level of debt financing at certain terms. Should these assumptions change (e.g., growth increases, slows down, or does not occur) the level of balance or deficiency and, therefore, rate adjustments required will be affected. Likewise, if costs escalate faster or slower than indicated in this plan, the projected balance or deficiency would also be affected.

Technical Appendix

City of Stockton
Wastewater Rate Study
Summary of the Revenue Requirement
Exhibit 1

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035
Revenues														
Rate Revenues	$76,417,720	$74,876,870	$75,625,639	$76,381,895	$77,145,714	$77,917,171	$78,696,343	$79,483,306	$80,278,139	$81,080,921	$81,891,730	$82,710,647	$83,537,754	$84,373,131
Miscellaneous Revenues	110,723,267	2,302,421	2,697,697	2,741,294	2,493,774	2,156,403	2,261,876	2,281,199	2,301,139	2,324,412	2,348,881	2,371,925	2,397,381	2,425,952
Total Revenues	**$187,140,987**	**$77,179,291**	**$78,323,336**	**$79,123,189**	**$79,639,488**	**$80,073,574**	**$80,958,219**	**$81,764,505**	**$82,579,278**	**$83,405,333**	**$84,240,611**	**$85,082,572**	**$85,935,135**	**$86,799,083**
Expenses														
Total O&M Expenses	$45,819,898	$62,924,981	$66,071,230	$69,374,792	$72,843,531	$76,485,708	$80,309,993	$84,325,493	$88,541,767	$92,968,856	$97,617,299	$102,498,163	$107,623,072	$113,004,225
Rate Funded Capital	17,200,000	14,350,000	14,250,000	16,800,000	19,500,000	22,400,000	24,200,000	22,200,000	23,350,000	26,600,000	23,700,000	24,900,000	25,300,000	25,100,000
Net Debt Service	124,063,808	4,668,651	7,638,463	7,818,878	7,781,229	7,750,011	9,643,762	12,693,274	12,656,584	10,248,735	14,541,541	14,507,474	14,473,067	15,805,580
To / (From) Reserves	57,281	(271,729)	(289,029)	148,797	223,110	283,279	266,955	307,670	315,096	627,330	420,816	470,822	647,961	767,943
Total Revenue Requirement	**$187,140,987**	**$81,671,903**	**$87,670,665**	**$94,142,467**	**$100,347,869**	**$106,918,998**	**$114,420,710**	**$119,526,436**	**$124,863,447**	**$130,444,921**	**$136,279,655**	**$142,376,460**	**$148,044,099**	**$154,677,748**
Bal. / (Def.) of Funds	$0	($4,492,612)	($9,347,329)	($15,019,278)	($20,708,381)	($26,845,423)	($33,462,491)	($37,761,931)	($42,284,169)	($47,039,588)	($52,039,044)	($57,293,887)	($62,108,964)	($67,878,665)
Proposed Rate Adjustment	**0.0%**	**6.0%**	**6.0%**	**6.5%**	**6.0%**	**6.0%**	**6.0%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.0%**	**3.5%**
Add'l Revenue with Rate Adj	$0	$4,492,612	$9,347,329	$15,019,278	$20,708,381	$26,845,423	$33,462,491	$37,761,931	$42,284,169	$47,039,588	$52,039,044	$57,293,887	$62,108,964	$67,878,665
Bal. / (Def.) After Rate Adj	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Average Residential Customer Bill														
Customer Bill on Proposed Adj.	$49.56	$52.53	$55.69	$59.31	$62.86	$66.64	$70.63	$73.11	$75.66	$78.31	$81.05	$83.89	$86.41	$89.43
Bill Difference - Monthly		2.97	3.15	3.62	3.56	3.77	4.00	2.47	2.56	2.65	2.74	2.84	2.52	3.02
Cumulative Bill Difference		2.97	6.13	9.75	13.30	17.08	21.07	23.55	26.10	28.75	31.49	34.33	36.85	39.87
Debt Service Coverage Ratio (all debt) - No Connection Fees														
Before Rate Adjustment	1.10	1.83	1.14	0.89	0.62	0.33	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
After Proposed Rate Adjustment	1.10	2.41	2.00	2.25	2.50	2.77	2.64	2.20	2.27	2.75	2.15	2.22	2.25	2.16
Debt Service Coverage Ratio (all debt) - Plus Connection Fees														
Before Rate Adjustment	1.13	2.23	1.43	1.18	0.91	0.62	0.30	0.05	0.00	0.00	0.00	0.00	0.00	0.00
After Proposed Rate Adjustment	1.13	2.81	2.29	2.54	2.79	3.06	2.89	2.41	2.48	3.00	2.34	2.41	2.45	2.34
Ending Fund Balance	**$104,622,606**	**$101,576,757**	**$86,537,713**	**$73,181,457**	**$58,887,334**	**$68,050,989**	**$68,547,661**	**$69,087,345**	**$69,636,775**	**$70,500,783**	**$71,160,643**	**$71,872,901**	**$72,764,710**	**$73,778,941**
Target Minimum - 6 mo. of O&M	*$22,909,949*	*$31,462,491*	*$33,035,615*	*$34,687,396*	*$36,421,766*	*$38,242,854*	*$40,154,997*	*$42,162,746*	*$44,270,884*	*$46,484,428*	*$48,808,649*	*$51,249,082*	*$53,811,536*	*$56,502,113*

City of Stockton
Wastewater Rate Study
Escalation Factors
Exhibit 2

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035	*Notes*
Revenues															
Customer Growth	Calculated	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	
Misc / Other Revenues	Budget	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	
Expenses															
Labor	Budget	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	
Benefits - Medical	Budget	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
Benefits - Retirement	Budget	7.0%	4.9%	5.9%	4.3%	1.8%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
Benefits - Other	Budget	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	
Professional Services	Budget	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
Materials & Supplies	Budget	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
Equipment	Budget	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
Chemicals	Budget	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
Utilities	Budget	4.0%	4.0%	4.0%	4.0%	4.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	
Insurance	Budget	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
Miscellaneous	Budget	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	
Interest	0.5%	0.6%	0.8%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	
New Debt Service Assumptions															
Revenue Bond															
Term in Years	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
Rate	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	
Low Interest Loan															
Term in Years	20	20	20	20	20	20	20	20	20	20	20	20	20	20	
Rate	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	

City of Stockton
Wastewater Rate Study
Revenue Requirement
Exhibit 3

	YTD	Budget	Projected												
	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035	Notes
Revenues															
Rate Revenues	$76,417,720	$74,876,870	$75,625,639	$76,381,895	$77,145,714	$77,917,171	$78,696,343	$79,483,306	$80,278,139	$81,080,921	$81,891,730	$82,710,647	$83,537,754	$84,373,131	As Customer Growth
Total Rate Revenues	**$76,417,720**	**$74,876,870**	**$75,625,639**	**$76,381,895**	**$77,145,714**	**$77,917,171**	**$78,696,343**	**$79,483,306**	**$80,278,139**	**$81,080,921**	**$81,891,730**	**$82,710,647**	**$83,537,754**	**$84,373,131**	
Other Revenues															
Fines and Penalties	$1,322,871	$995,230	$1,005,182	$1,015,234	$1,025,386	$1,035,640	$1,045,997	$1,056,457	$1,067,021	$1,077,691	$1,088,468	$1,099,353	$1,110,347	$1,121,450	As Misc / Other Revenues
Interest Income	1,103,896	1,010,691	1,393,050	1,423,600	1,162,903	812,224	904,255	910,002	916,229	925,653	936,135	945,051	956,239	970,398	Calculated on Reserves
Lien Admin Fees	200,000	200,000	202,000	204,020	206,060	208,121	210,202	212,304	214,427	216,571	218,737	220,924	223,134	225,365	As Misc / Other Revenues
Fats,Oils,Grease Inspectn	45,000	45,000	45,450	45,905	46,364	46,827	47,295	47,768	48,246	48,729	49,216	49,708	50,205	50,707	As Misc / Other Revenues
Misc Other Revenues	28,000	28,000	28,280	28,563	28,848	29,137	29,428	29,723	30,020	30,320	30,623	30,929	31,239	31,551	As Misc / Other Revenues
Permit Center Operations	23,500	23,500	23,735	23,972	24,212	24,454	24,699	24,946	25,195	25,447	25,702	25,959	26,218	26,480	As Misc / Other Revenues
WIFIA Proceeds	108,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Other Revenues	**$110,723,267**	**$2,302,421**	**$2,697,697**	**$2,741,294**	**$2,493,774**	**$2,156,403**	**$2,261,876**	**$2,281,199**	**$2,301,139**	**$2,324,412**	**$2,348,881**	**$2,371,925**	**$2,397,381**	**$2,425,952**	
Total Revenues	**$187,140,987**	**$77,179,291**	**$78,323,336**	**$79,123,189**	**$79,639,488**	**$80,073,574**	**$80,958,219**	**$81,764,505**	**$82,579,278**	**$83,405,333**	**$84,240,611**	**$85,082,572**	**$85,935,135**	**$86,799,083**	
Expenses															
Administration	$5,238,106	$5,604,463	$5,884,686	$6,178,920	$6,487,866	$6,812,260	$7,152,873	$7,510,516	$7,886,042	$8,280,344	$8,694,362	$9,129,080	$9,585,534	$10,064,810	As Labor
Customer Service	3,162,114	3,320,581	3,486,610	3,660,941	3,843,988	4,036,187	4,237,996	4,449,896	4,672,391	4,906,010	5,151,311	5,408,877	5,679,320	5,963,286	As Labor
Operations and Maintenance	37,419,678	53,999,937	56,699,934	59,534,931	62,511,677	65,637,261	68,919,124	72,365,080	75,983,334	79,782,501	83,771,626	87,960,207	92,358,218	96,976,128	As Labor
Additional O&M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Expenses	**$45,819,898**	**$62,924,981**	**$66,071,230**	**$69,374,792**	**$72,843,531**	**$76,485,708**	**$80,309,993**	**$84,325,493**	**$88,541,767**	**$92,968,856**	**$97,617,299**	**$102,498,163**	**$107,623,072**	**$113,004,225**	
Total Operations & Maintenance	**$45,819,898**	**$62,924,981**	**$66,071,230**	**$69,374,792**	**$72,843,531**	**$76,485,708**	**$80,309,993**	**$84,325,493**	**$88,541,767**	**$92,968,856**	**$97,617,299**	**$102,498,163**	**$107,623,072**	**$113,004,225**	
Taxes & Transfers															
Taxes & Transfers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Total Taxes & Transfers	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Rate Funded Capital	**$17,200,000**	**$14,350,000**	**$14,250,000**	**$16,800,000**	**$19,500,000**	**$22,400,000**	**$24,200,000**	**$22,200,000**	**$23,350,000**	**$26,600,000**	**$23,700,000**	**$24,900,000**	**$25,300,000**	**$25,100,000**	FY 2021 Depr Exp = $12,481,751
Debt Service															
2014 Revenue Bond	$6,487,625	$6,487,500	$6,486,375	$6,698,250	$6,692,375	$6,693,250	$6,695,000	$6,696,875	$6,693,250	$0	$0	$0	$0	$0	Exhibit 5
2019 BANS	120,169,140	0	0	0	0	0	0	0	0	0	0	0	0	0	Exhibit 5
WIFIA	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000	5,614,797	5,614,797	5,614,797	5,614,797	5,614,797	Exhibit 5
Assumed Low Interest Loan	0	0	3,002,086	3,002,086	3,002,086	3,002,086	4,926,499	4,926,499	4,926,499	4,926,499	4,926,499	4,926,499	4,926,499	4,926,499	Calc'd @ 2.5% for 20 yrs
Assumed Revenue Bond	0	0	0	0	0	0	0	3,080,374	3,080,374	3,080,374	7,406,909	7,406,909	7,406,909	8,774,173	Calc'd @ 4.5% for 30 yrs
Total Debt Service	$127,952,765	$7,783,500	$10,784,461	$10,996,336	$10,990,461	$10,991,336	$12,917,499	$15,999,749	$15,996,124	$13,621,670	$17,948,205	$17,948,205	$17,948,205	$19,315,469	
Less: Debt Service Funding															
Connection Fees (434 Fund)	$3,888,957	$3,114,849	$3,145,997	$3,177,457	$3,209,232	$3,241,324	$3,273,738	$3,306,475	$3,339,540	$3,372,935	$3,406,664	$3,440,731	$3,475,138	$3,509,890	
Bond Defeasance (431 Fund)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bond Defeasance (434 Fund)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Less Debt Service Funding	$3,888,957	$3,114,849	$3,145,997	$3,177,457	$3,209,232	$3,241,324	$3,273,738	$3,306,475	$3,339,540	$3,372,935	$3,406,664	$3,440,731	$3,475,138	$3,509,890	
Net Debt Service	**$124,063,808**	**$4,668,651**	**$7,638,463**	**$7,818,878**	**$7,781,229**	**$7,750,011**	**$9,643,762**	**$12,693,274**	**$12,656,584**	**$10,248,735**	**$14,541,541**	**$14,507,474**	**$14,473,067**	**$15,805,580**	

City of Stockton
Wastewater Rate Study
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Exhibit 3

	YTD	*Budget*	*Projected*												
	FY 2022	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**FY 2030**	**FY 2031**	**FY 2032**	**FY 2033**	**FY 2034**	**FY 2035**	*Notes*
To / (From) Reserves															
Operating Fund (610-000)	$57,281	($271,729)	($289,029)	$148,797	$223,110	$283,279	$266,955	$307,670	$315,096	$627,330	$420,816	$470,822	$647,961	$767,943	
Captial Fund (610-612)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rate Stabilization Fund (610-611)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Long-Term Debt Proceeds Fund (610-614)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Connection Fee Fund (610-615)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total To / (From) Reserves	**$57,281**	**($271,729)**	**($289,029)**	**$148,797**	**$223,110**	**$283,279**	**$266,955**	**$307,670**	**$315,096**	**$627,330**	**$420,816**	**$470,822**	**$647,961**	**$767,943**	
Total Revenue Requirement	**$187,140,987**	**$81,671,903**	**$87,670,665**	**$94,142,467**	**$100,347,869**	**$106,918,998**	**$114,420,710**	**$119,526,436**	**$124,863,447**	**$130,444,921**	**$136,279,655**	**$142,376,460**	**$148,044,099**	**$154,677,748**	
Bal. / (Def.) of Funds	$0	($4,492,612)	($9,347,329)	($15,019,278)	($20,708,381)	($26,845,423)	($33,462,491)	($37,761,931)	($42,284,169)	($47,039,588)	($52,039,044)	($57,293,887)	($62,108,964)	($67,878,665)	
Bal as a % of Rate Adj	0.0%	6.0%	12.4%	19.7%	26.8%	34.5%	42.5%	47.5%	52.7%	58.0%	63.5%	69.3%	74.3%	80.5%	
Proposed Rate Adjustment	**0.0%**	**6.0%**	**6.0%**	**6.5%**	**6.0%**	**6.0%**	**6.0%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.0%**	**3.5%**	
Add'l Revenue with Rate Adj	$0	$4,492,612	$9,347,329	$15,019,278	$20,708,381	$26,845,423	$33,462,491	$37,761,931	$42,284,169	$47,039,588	$52,039,044	$57,293,887	$62,108,964	$67,878,665	
Bal. / (Def.) After Rate Adj	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Total Balance as a % of Rates	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	
Average Residential Customer Bill	**$49.56**														
Customer Bill on Proposed Adj.	$49.56	$52.53	$55.69	$59.31	$62.86	$66.64	$70.63	$73.11	$75.66	$78.31	$81.05	$83.89	$86.41	$89.43	
Bill Difference - Monthly		2.97	3.15	3.62	3.56	3.77	4.00	2.47	2.56	2.65	2.74	2.84	2.52	3.02	
Cumulative Bill Difference		2.97	6.13	9.75	13.30	17.08	21.07	23.55	26.10	28.75	31.49	34.33	36.85	39.87	
Debt Service Coverage Ratio *(all debt)* **- No Connection Fees**															
Before Rate Adjustment	1.10	1.83	1.14	0.89	0.62	0.33	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Target 1.00
After Proposed Rate Adjustment	1.10	2.41	2.00	2.25	2.50	2.77	2.64	2.20	2.27	2.75	2.15	2.22	2.25	2.16	Target 1.00
Debt Service Coverage Ratio *(all debt)* **- Plus Connection Fees**															
Before Rate Adjustment	1.13	2.23	1.43	1.18	0.91	0.62	0.30	0.05	0.00	0.00	0.00	0.00	0.00	0.00	Target 1.25
After Proposed Rate Adjustment	1.13	2.81	2.29	2.54	2.79	3.06	2.89	2.41	2.48	3.00	2.34	2.41	2.45	2.34	Target 1.25
Debt Service Coverage Ratio *(all debt)* **- Plus Conn Fees & Rate Stabilization**															
Before Rate Adjustment	1.24	3.89	2.63	2.37	2.12	1.84	1.35	0.90	0.70	0.57	0.23	0.01	0.00	0.00	Target 1.25
After Proposed Rate Adjustment	1.24	4.47	3.50	3.73	4.00	4.28	3.94	3.26	3.34	4.02	3.13	3.21	3.25	3.09	Target 1.25

City of Stockton
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	YTD	*Budget*						*Projected*							
	FY 2022	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**FY 2030**	**FY 2031**	**FY 2032**	**FY 2033**	**FY 2034**	**FY 2035**	*Notes*
Cash Reserves															
Beginning Reserve Balances	**$161,832,041**	**$104,622,606**	**$101,576,757**	**$86,537,713**	**$73,181,457**	**$58,887,334**	**$68,050,989**	**$94,758,058**	**$86,287,807**	**$69,636,775**	**$116,270,558**	**$82,588,867**	**$71,872,901**	**$83,577,528**	
Operating Fund (610-000)															
Beginning Balance	**$101,100,000**	**$82,635,374**	**$79,457,601**	**$64,241,605**	**$50,662,388**	**$36,143,073**	**$45,079,286**	**$45,346,241**	**$45,653,910**	**$45,969,006**	**$46,596,336**	**$47,017,152**	**$47,487,975**	**$48,135,935**	
Plus: Additions	57,281	0	0	148,797	223,110	8,936,213	266,955	307,670	315,096	627,330	420,816	470,822	647,961	767,943	
Repayment to 434	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Less: Bond Defeasance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Less: Uses of Funds	(18,521,907)	(3,177,773)	(15,215,997)	(13,728,014)	(14,742,424)	0	0	0	0	0	0	0	0	0	
Ending Balance	**$82,635,374**	**$79,457,601**	**$64,241,605**	**$50,662,388**	**$36,143,073**	**$45,079,286**	**$45,346,241**	**$45,653,910**	**$45,969,006**	**$46,596,336**	**$47,017,152**	**$47,487,975**	**$48,135,935**	**$48,903,879**	
Captial Fund (610-612)															
Beginning Balance	**$14,000,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Plus: Additions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Less: Uses of Funds	(14,000,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ending Balance	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Target Minimum - 6 mo. of O&M	**$22,909,949**	**$31,462,491**	**$33,035,615**	**$34,687,396**	**$36,421,766**	**$38,242,854**	**$40,154,997**	**$42,162,746**	**$44,270,884**	**$46,484,428**	**$48,808,649**	**$51,249,082**	**$53,811,536**	**$56,502,113**	50.0% O&M
Target Ending Bal. / (Def.)	*$59,725,425*	*$47,995,111*	*$31,205,990*	*$15,974,992*	*($278,693)*	*$6,836,432*	*$5,191,244*	*$3,491,164*	*$1,698,123*	*$111,909*	*($1,791,497)*	*($3,761,107)*	*($5,675,600)*	*($7,598,234)*	
Long-Term Debt Proceeds Fund (610-614)															
Beginning Balance	**$24,854,198**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$26,210,397**	**$17,200,462**	**$0**	**$45,769,775**	**$11,428,224**	**$0**	**$10,812,818**	
Plus: Additions	0	0	0	0	0	0	26,210,397	0	0	45,769,775	0	0	10,812,818	0	
Less: Uses of Funds	(24,854,198)	0	0	0	0	0	0	(9,009,935)	(17,200,462)	0	(34,341,551)	(11,428,224)	0	(10,812,818)	
Ending Balance	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$26,210,397**	**$17,200,462**	**$0**	**$45,769,775**	**$11,428,224**	**$0**	**$10,812,818**	**$0**	
Rate Stabilization Fund (610-611)															
Beginning Balance	**$12,873,782**	**$12,938,151**	**$13,015,780**	**$13,119,906**	**$13,251,105**	**$13,383,616**	**$13,517,452**	**$13,652,627**	**$13,789,153**	**$13,927,045**	**$14,066,315**	**$14,206,978**	**$14,349,048**	**$14,492,539**	
Plus: Additions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Plus Interest Earned	64,369	77,629	104,126	131,199	132,511	133,836	135,175	136,526	137,892	139,270	140,663	142,070	143,490	144,925	
Less: Uses of Funds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ending Balance	**$12,938,151**	**$13,015,780**	**$13,119,906**	**$13,251,105**	**$13,383,616**	**$13,517,452**	**$13,652,627**	**$13,789,153**	**$13,927,045**	**$14,066,315**	**$14,206,978**	**$14,349,048**	**$14,492,539**	**$14,637,464**	
Connection Fee Fund (610-615)															
Beginning Balance	**$9,004,061**	**$9,049,081**	**$9,103,376**	**$9,176,203**	**$9,267,965**	**$9,360,644**	**$9,454,251**	**$9,548,793**	**$9,644,281**	**$9,740,724**	**$9,838,131**	**$9,936,513**	**$10,035,878**	**$10,136,237**	
Capacity Fees	3,888,957	3,114,849	3,145,997	3,177,457	3,209,232	3,241,324	3,273,738	3,306,475	3,339,540	3,372,935	3,406,664	3,440,731	3,475,138	3,509,890	As Customer Growth
Plus Interest Earned	45,020	54,294	72,827	91,762	92,680	93,606	94,543	95,488	96,443	97,407	98,381	99,365	100,359	101,362	
Repayment from 431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bond Defeasance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Less: Uses of Funds	($3,888,957)	($3,114,849)	($3,145,997)	($3,177,457)	($3,209,232)	($3,241,324)	($3,273,738)	($3,306,475)	($3,339,540)	($3,372,935)	($3,406,664)	($3,440,731)	($3,475,138)	($3,509,890)	
Ending Balance	**$9,049,081**	**$9,103,376**	**$9,176,203**	**$9,267,965**	**$9,360,644**	**$9,454,251**	**$9,548,793**	**$9,644,281**	**$9,740,724**	**$9,838,131**	**$9,936,513**	**$10,035,878**	**$10,136,237**	**$10,237,599**	
Total Ending Balance	**$104,622,606**	**$101,576,757**	**$86,537,713**	**$73,181,457**	**$58,887,334**	**$68,050,989**	**$94,758,058**	**$86,287,807**	**$69,636,775**	**$116,270,558**	**$82,588,867**	**$71,872,901**	**$83,577,528**	**$73,778,941**	

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035	Total	Notes
RWCF																
Rehab Digester A & B for sludge storage Design (Evaluate per M20021)	$0	$0	$2,098,911	$2,155,581	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,254,492	
RWCF 60kV Transformer Replacement	0	821,600	0	0	0	0	0	0	0	0	0	0	0	0	821,600	
RWCF Cogeneration Engine No. 1 Rebuild	0	256,750	263,682	270,802	278,113	0	0	0	0	0	0	0	0	0	1,069,347	
RWCF Cogeneration Engine No. 3 Rebuild	0	0	0	0	0	868,292	0	0	0	0	0	0	0	0	868,292	
RWCF Cogeneration Engine No. 4 Rebuild	0	0	791,047	0	0	0	0	0	0	0	0	0	0	0	791,047	
RWCF Facility Main Plant Switchgear Upgrade with Load Shedding	0	120,159	118,130	121,319	0	0	0	0	0	0	0	0	0	0	359,608	
RWCF New Outfall	0	4,108,000	0	0	0	0	0	0	0	0	0	0	0	0	4,108,000	
RWCF Pond No. 1 Cleaning	0	0	2,405,837	2,470,794	2,537,506	2,606,019	0	0	0	0	0	0	0	0	10,020,156	
RWCF Sludge Day Tank Mixing Rehabiltation	0	82,160	84,378	0	0	0	0	0	0	0	0	0	0	0	166,538	
RWCF Floodwall Ph 1 Project	0	1,797,250	6,328,374	0	0	0	0	0	0	0	0	0	0	0	8,125,624	
RWCF 60-KV Transformer Station Relocation Project	0	898,625	1,054,729	0	0	0	0	0	0	0	0	0	0	0	1,953,354	
RWCF Large Diameter Pipe Inspection	0	0	210,946	0	0	0	0	0	0	0	0	0	0	0	210,946	
Unidentified	0	0	0	0	0	0	4,693,347	4,820,067	4,950,209	5,083,865	5,221,129	5,362,100	5,506,876	5,655,562	41,293,155	
Total RWCF	**$0**	**$8,084,544**	**$13,356,033**	**$5,018,497**	**$2,815,619**	**$3,474,311**	**$4,693,347**	**$4,820,067**	**$4,950,209**	**$5,083,865**	**$5,221,129**	**$5,362,100**	**$5,506,876**	**$5,655,562**	**$74,042,158**	
Capacity Improv. to Existing Gravity Sewer																
E. Marsh Street sewer	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,402,331	$0	$0	$0	$15,402,331	*Fund 434*
El Dorado Street / S. Center Street sewer	0	0	0	0	0	0	0	0	0	0	5,873,770	0	0	0	5,873,770	*Fund 434*
S. Wilson Way sewer	0	0	0	0	0	0	0	0	0	0	0	2,010,787	0	0	2,010,787	*Fund 434*
E. 6th Street	0	0	0	0	0	0	0	0	0	0	0	1,206,472	0	0	1,206,472	*Fund 434*
E. Main Street sewer	0	0	0	0	0	0	0	0	0	0	0	14,343,616	0	0	14,343,616	*Fund 434*
W. Washington Street / Port Road 23 sewer	0	0	0	0	0	0	0	0	0	0	0	0	7,296,611	0	7,296,611	*Fund 434*
Don Avenue / Meadow Avenue sewer	0	0	0	0	0	0	0	0	0	0	0	0	7,571,955	0	7,571,955	*Fund 434*
S. El Dorado Street sewer	0	0	0	0	0	0	0	0	0	0	0	0	2,615,766	0	2,615,766	*Fund 434*
Del Norte Street sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	16,118,351	16,118,351	*Fund 434*
Cumberland & 5-Mile Slough PS inlet sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*Fund 434*
Total Capacity Improv. to Existing Gravity Sewer	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$21,276,101**	**$17,560,876**	**$17,484,332**	**$16,118,351**	**$72,439,660**	

City of Stockton
Wastewater Rate Study
Capital Improvement Plan
Exhibit 4

Inflation = 2.7%

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035	Total	*Notes*
Rehab of Existing Gravity Sewer Facilities																
Navy Drive parallel trunk sewers	$0	$2,875,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,875,600	
Worth Street trunk sewer	0	0	5,062,699	0	0	0	0	0	0	0	0	0	0	0	5,062,699	
Navy Drive I-5 trunk sewer	0	0	0	2,058,093	0	0	0	0	0	0	0	0	0	0	2,058,093	
Sierra Nevada Street trunk sewer	0	0	0	2,274,734	0	0	0	0	0	0	0	0	0	0	2,274,734	
Church Street/Pershing Avenue trunk sewer	0	0	0	0	9,455,853	0	0	0	0	0	0	0	0	0	9,455,853	
Oak Street trunk sewer	0	0	0	0	0	13,367,127	0	0	0	0	0	0	0	0	13,367,127	
Ralph Avenue trunk sewer, Phase 1	0	0	0	0	0	0	1,173,337	0	0	0	0	0	0	0	1,173,337	
Pershing Avenue sewer	0	0	0	0	0	0	1,760,005	0	0	0	0	0	0	0	1,760,005	
Mormon Slough trunk sewer	0	0	0	0	0	0	7,978,690	0	0	0	0	0	0	0	7,978,690	
March Lane trunk sewer	0	0	0	0	0	0	0	7,591,606	0	0	0	0	0	0	7,591,606	
Sperry Road/Gibraltar Court sewer	0	0	0	0	0	0	0	0	5,692,740	0	0	0	0	0	5,692,740	
Airport Way trunk sewer	0	0	0	0	0	0	0	0	0	6,354,831	0	0	0	0	6,354,831	
Union Street sewer	0	0	0	0	0	4,912,705	0	0	0	0	0	0	0	0	4,912,705	
Ralph Avenue trunk sewer, Phase 2	0	0	0	0	0	0	0	0	0	0	3,263,206	0	0	0	3,263,206	
Tuxedo Avenue sewer	0	0	0	0	0	0	0	0	0	635,483	0	0	0	0	635,483	
Hazelton Avenue trunk sewer	0	0	0	0	0	0	0	2,530,535	0	0	0	0	0	0	2,530,535	
Backyard and smaller diameter sewers	0	0	0	0	0	0	0	0	2,351,349	0	0	0	0	0	2,351,349	
Sewer Maintenance Hole Rehab	0	0	0	0	0	0	0	0	2,598,860	0	0	0	0	0	2,598,860	
Sanitary Sewer Small Diameter Lines Replc	0	0	0	0	0	0	0	0	0	2,287,739	0	0	0	0	2,287,739	
Sanitary Sewer Large Diameter Lines Replc	0	0	0	0	0	0	0	0	0	0	5,873,770	0	0	0	5,873,770	
Longview Avenue sewer	0	0	0	0	0	0	0	1,325,518	0	0	0	0	0	0	1,325,518	
Ryde Avenue trunk sewer	0	0	0	0	0	0	0	0	4,207,678	0	0	0	0	0	4,207,678	
Lincoln Road Trunk sewer	0	0	0	0	0	0	0	0	0	7,498,700	0	0	0	0	7,498,700	
Alturas Avenue sewer	0	0	0	0	0	0	0	0	742,531	0	0	0	0	0	742,531	
E. Bianchi Street/ Pardee Lane sewer	0	0	0	0	0	0	0	0	6,889,041	7,075,045	7,266,071	0	0	0	21,230,157	
Rose Marie Lane sewer	0	0	0	0	0	0	0	0	0	2,033,546	0	0	0	0	2,033,546	
Harding Way sewer	0	0	0	0	0	0	0	0	0	0	2,088,452	0	0	0	2,088,452	
Total Rehab of Existing Gravity Sewer Facilities	**$0**	**$2,875,600**	**$5,062,699**	**$4,332,827**	**$9,455,853**	**$18,279,832**	**$10,912,031**	**$11,447,660**	**$22,482,199**	**$25,885,344**	**$18,491,499**	**$0**	**$0**	**$0**	**$129,225,544**	
Pump Station and Force Main Improv.																
Westside Interceptor Parallel Force Main	$0	$0	$0	$14,027,527	$14,406,270	$14,795,239	$15,194,710	$0	$0	$0	$0	$0	$0	$0	$58,423,746	
Lincoln Street PS and Force Main	0	0	0	4,657,789	4,783,549	0	0	0	0	0	0	0	0	0	9,441,338	
14-Mile Slough PS Improvements	0	0	3,797,024	0	0	0	0	0	0	0	0	0	0	0	3,797,024	
5-Mile Slough Force Main	0	0	0	0	0	342,747	0	0	0	0	0	0	0	0	342,747	
Brookside Estates PS	0	0	0	0	0	1,028,241	0	0	0	0	0	0	0	0	1,028,241	
College Park PS	0	0	0	0	0	913,992	0	0	0	0	0	0	0	0	913,992	
Don Avenue & Santiago PS	0	0	0	0	0	571,245	0	0	0	0	0	0	0	0	571,245	
Drake and Hwy-99 PS	0	0	0	0	0	1,485,236	0	0	0	0	0	0	0	0	1,485,236	
Kelley & Mosher PS	0	0	0	0	0	571,245	0	0	0	0	0	0	0	0	571,245	
Quail Lakes PS	0	0	0	0	0	0	704,002	0	0	0	0	0	0	0	704,002	
Thornton & Davis PS	0	0	0	0	0	0	821,336	0	0	0	0	0	0	0	821,336	
Waterloo & Roosevelt PS	0	0	0	0	0	0	704,002	0	0	0	0	0	0	0	704,002	
Swenson and 5-Mile Slough PS	0	0	0	0	0	0	3,402,676	0	0	0	0	0	0	0	3,402,676	
Cumberland and 5-Mile Slough PS	0	0	0	0	0	0	0	0	0	7,625,797	0	0	0	0	7,625,797	*Fund 434*
Pump Station Rehabilitation and Modernization	0	2,054,000	2,109,458	2,166,413	2,224,907	2,284,979	0	0	0	0	0	0	0	0	10,839,757	
Plymouth & 5 Mile Creek PS	0	0	0	0	0	0	0	2,892,040	0	0	0	0	0	0	2,892,040	
Camanche PS	0	0	0	0	0	0	0	0	742,531	0	0	0	0	0	742,531	
Total Pump Station and Force Main Improv.	**$0**	**$2,054,000**	**$5,906,482**	**$20,851,729**	**$21,414,725**	**$21,992,923**	**$20,826,727**	**$2,892,040**	**$742,531**	**$7,625,797**	**$0**	**$0**	**$0**	**$0**	**$104,306,955**	

City of Stockton
Wastewater Rate Study
Capital Improvement Plan
Exhibit 4

Inflation = 2.7%

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035	Total	*Notes*
Other Future System Improvements																
Capital Projects	$0	$0	$0	$0	$0	$0	$11,733,367	$12,050,168	$12,375,523	$12,709,662	$13,052,823	$13,405,249	$13,767,191	$14,138,905	$103,232,886	*Fund 434*
Total Other Future System Improvements	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$11,733,367**	**$12,050,168**	**$12,375,523**	**$12,709,662**	**$13,052,823**	**$13,405,249**	**$13,767,191**	**$14,138,905**	**$103,232,886**	
Recommended Studies																
Asset Condition Assessment for Sanitary Sewer Force Mains	$0	$1,129,700	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,129,700	
Asset Condition Assessment for Sanitary Sewer Pump Stations	0	0	0	0	556,227	0	0	0	0	0	0	0	0	0	556,227	
Corrosion and Odor Control Study	0	0	0	324,962	0	0	0	0	0	0	0	0	0	0	324,962	
West Side Interceptor Alignment Study	0	0	527,365	0	0	0	0	0	0	0	0	0	0	0	527,365	
Total Recommended Studies	**$0**	**$1,129,700**	**$527,365**	**$324,962**	**$556,227**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,538,253**	
RWCF Modification Project	**$74,576,105**	**$49,912,200**	**$4,324,389**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$128,812,694**	
Future Capital Improvements	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Transfer to Long-Term Debt Proceeds Fund	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$26,210,397**	**$0**	**$0**	**$45,769,775**	**$0**	**$0**	**$10,812,818**	**$0**	**$82,792,990**	
Transfer to Operating Fund	**$0**	**$0**	**$0**	**$0**	**$0**	**$8,652,934**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$8,652,934**	
Total Capital Improvement Projects	**$74,576,105**	**$64,056,044**	**$29,176,968**	**$30,528,014**	**$34,242,424**	**$52,400,000**	**$74,375,869**	**$31,209,935**	**$40,550,462**	**$97,074,443**	**$58,041,551**	**$36,328,224**	**$47,571,217**	**$35,912,818**	**$706,044,075**	
Less: Other Funding Sources																
Operating Fund (610-000)	$18,521,907	$2,906,044	$14,926,968	$13,728,014	$14,742,424	$0	$0	$0	$0	$0	$0	$0	$0	$0	$64,825,357	Input
Connection Fee Fund (610-615)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Fund 434
Captial Fund (610-612)	14,000,000	0	0	0	0	0	0	0	0	0	0	0	0	0	14,000,000	Input
Long-Term Debt Proceeds Fund (610-614)	24,854,198	0	0	0	0	0	0	9,009,935	17,200,462	0	34,341,551	11,428,224	0	10,812,818	107,647,188	Input
Low Interest Loans	0	46,800,000	0	0	0	30,000,000	0	0	0	0	0	0	0	0	76,800,000	Input
Revenue Bonds	0	0	0	0	0	0	50,175,869	0	0	70,474,443	0	0	22,271,217	0	142,921,529	Calculated
Total Other Funding Sources	**$57,376,105**	**$49,706,044**	**$14,926,968**	**$13,728,014**	**$14,742,424**	**$30,000,000**	**$50,175,869**	**$9,009,935**	**$17,200,462**	**$70,474,443**	**$34,341,551**	**$11,428,224**	**$22,271,217**	**$10,812,818**	**$406,194,074**	
Rate Funded Capital	**$17,200,000**	**$14,350,000**	**$14,250,000**	**$16,800,000**	**$19,500,000**	**$22,400,000**	**$24,200,000**	**$22,200,000**	**$23,350,000**	**$26,600,000**	**$23,700,000**	**$24,900,000**	**$25,300,000**	**$25,100,000**	**$299,850,000**	

City of Stockton
Wastewater Rate Study
Debt
Exhibit 5

Year	2014 Revenue Bond	2019 BANS	WIFIA	Total
FY 2022	$6,487,625	$120,169,140	$1,296,000	**$127,952,765**
FY 2023	6,487,500	0	1,296,000	**7,783,500**
FY 2024	6,486,375	0	1,296,000	**7,782,375**
FY 2025	6,698,250	0	1,296,000	**7,994,250**
FY 2026	6,692,375	0	1,296,000	**7,988,375**
FY 2027	6,693,250	0	1,296,000	**7,989,250**
FY 2028	6,695,000	0	1,296,000	**7,991,000**
FY 2029	6,696,875	0	1,296,000	**7,992,875**
FY 2030	6,693,250	0	1,296,000	**7,989,250**
FY 2031	0	0	5,614,797	**5,614,797**
FY 2032	0	0	5,614,797	**5,614,797**
FY 2033	0	0	5,614,797	**5,614,797**
FY 2034	0	0	5,614,797	**5,614,797**
FY 2035	0	0	5,614,797	**5,614,797**
FY 2036	0	0	5,614,797	**5,614,797**
FY 2037	0	0	5,614,797	**5,614,797**
FY 2038	0	0	5,614,797	**5,614,797**
FY 2039	0	0	5,614,797	**5,614,797**
FY 2040	0	0	5,614,797	**5,614,797**
FY 2041	0	0	5,614,797	**5,614,797**
FY 2042	0	0	5,614,797	**5,614,797**
FY 2043	0	0	5,614,797	**5,614,797**
FY 2044	0	0	5,614,797	**5,614,797**
FY 2045	0	0	5,614,797	**5,614,797**
FY 2046	0	0	5,614,797	**5,614,797**
FY 2047	0	0	5,614,797	**5,614,797**
FY 2048	0	0	5,614,797	**5,614,797**
FY 2049	0	0	5,614,797	**5,614,797**
FY 2050	0	0	5,614,797	**5,614,797**
FY 2051	0	0	5,614,797	**5,614,797**
FY 2052	0	0	0	**0**
FY 2053	0	0	0	**0**
FY 2054	0	0	0	**0**
FY 2055	0	0	0	**0**
FY 2056	0	0	0	**0**
FY 2057	0	0	0	**0**
	$59,630,500	**$120,169,140**	**$129,574,731**	**$309,374,371**