

APPENDIX G-5

SEWER TECHNICAL MEMORANDUM

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TECHNICAL MEMORANDUM

DOPUDJA & WELLS CONSULTING | 3080 Bristol St. Ste 520 | Costa Mesa, CA 92626

TO: Mark Collier, P.E.
FROM: Pooja Lad, EIT
REVIEW: Jon Wells, P.E.
SUBJECT: Brar Farms Residential Development Collection System Impact Evaluation
DATE: March 18, 2026
CC:

This Technical Memorandum (TM) presents the process used and the results produced for a sanitary sewer hydraulic capacity evaluation completed for the proposed Brar Farms Residential Development (Brar Farms Project) in the City of West Sacramento (City). The City is evaluating the project's potential impacts on the existing sanitary sewer collection system to assess whether the existing sanitary sewer collection system has sufficient capacity to convey projected wastewater flows from the development while adhering to the performance criteria and to identify any infrastructure improvements required to meet the additional flows from the development.

1 BACKGROUND AND SCOPE

The proposed Brar Farms Residential Development is located at the southwest corner of Marshall Road and Otis Avenue in the Southport area of the City. The City has requested Dopudja and Wells Consulting (Dopudja & Wells) to complete a sanitary sewer hydraulic capacity evaluation to confirm that the existing collection system can accommodate the projected flows generated by the development while maintaining compliance with the City's performance criteria.

The objective of this evaluation is to assess the hydraulic impacts of the Brar Farms Project on the City's sanitary sewer collection system under projected future wet weather flow conditions. This includes the development of project-specific wastewater flow projections, confirmation of the proposed connection of the project's local collection system to the City's existing sewer infrastructure, and a detailed hydraulic evaluation of downstream collection system components. The analysis focuses on identifying whether the addition of project flows results in new capacity deficiencies within gravity mains, pump stations, or force mains, and whether infrastructure improvements are required to maintain acceptable system performance.

The evaluation was conducted using the City's InfoWorks ICM (version 2026.3) sanitary sewer hydraulic model. The existing model is skeletonized and does not include all local gravity mains within the collection system. To support a comprehensive evaluation, the model was updated using infrastructure information provided by the project's engineers, further described in section 4. Model updates were focused on the tributary area anticipated to receive flows from the project, which is within the Bridgeway Island Pump Station basin. The project's internal collection system was not fully modeled; instead, projected flows from the development were summed into smaller flow basins and then connected to the City's system.

Hydraulic performance was evaluated by comparing system conditions under existing (status quo) conditions and projected conditions that include flows from the Brar Farms Project. The evaluation considered system performance relative to applicable City criteria for gravity main capacity, pump station operation, and force main performance.

The scope of the hydraulic evaluation includes the following summarized tasks:

TASK 1: Develop flow generation projections using the latest available development information, City design standards, and assumptions from the 2024 Sewer Master Plan Update.

TASK 2: Validate the preliminary sanitary sewer layout and proposed connection configuration to the City's existing sanitary sewer collection system.

TASK 3: Update the City's InfoWorks ICM sanitary sewer model, including the addition of the gravity mains and flow loading within the tributary area anticipated to receive project flows.

TASK 4: Perform a hydraulic evaluation of the collection system to evaluate system performance under existing conditions and projected future conditions that include flows from the Brar Farms development.

2 PROPOSED PROJECT CONNECTION

The proposed connection of the Brar Farms Project to the City's existing sanitary sewer collection system is described in this section.

2.1 EXISTING SYSTEM OVERVIEW

The Brar Farms Project site is located south of Marshall Road within the Bridgeway Island Pump Station drainage basin. The nearest existing City sewer infrastructure is located along Martinique Street, which is located immediately north of the project site. From Martinique Street, wastewater flows north via gravity mains along Oakland Bay Drive and Golden Gate Drive before reaching the Bridgeway Island Pump Station.

The gravity main along this alignment transitions from 8-inch pipe at the development site, at the southern end near Martinique Street, increasing to 10-inch, 12-inch, 15-inch, and ultimately 18-inch

pipe as tributary flows accumulate northward toward the pump station. The project location and existing collection system can be seen on Exhibit 1.

2.2 PRIOR STUDY AND CONNECTION CONFIGURATION

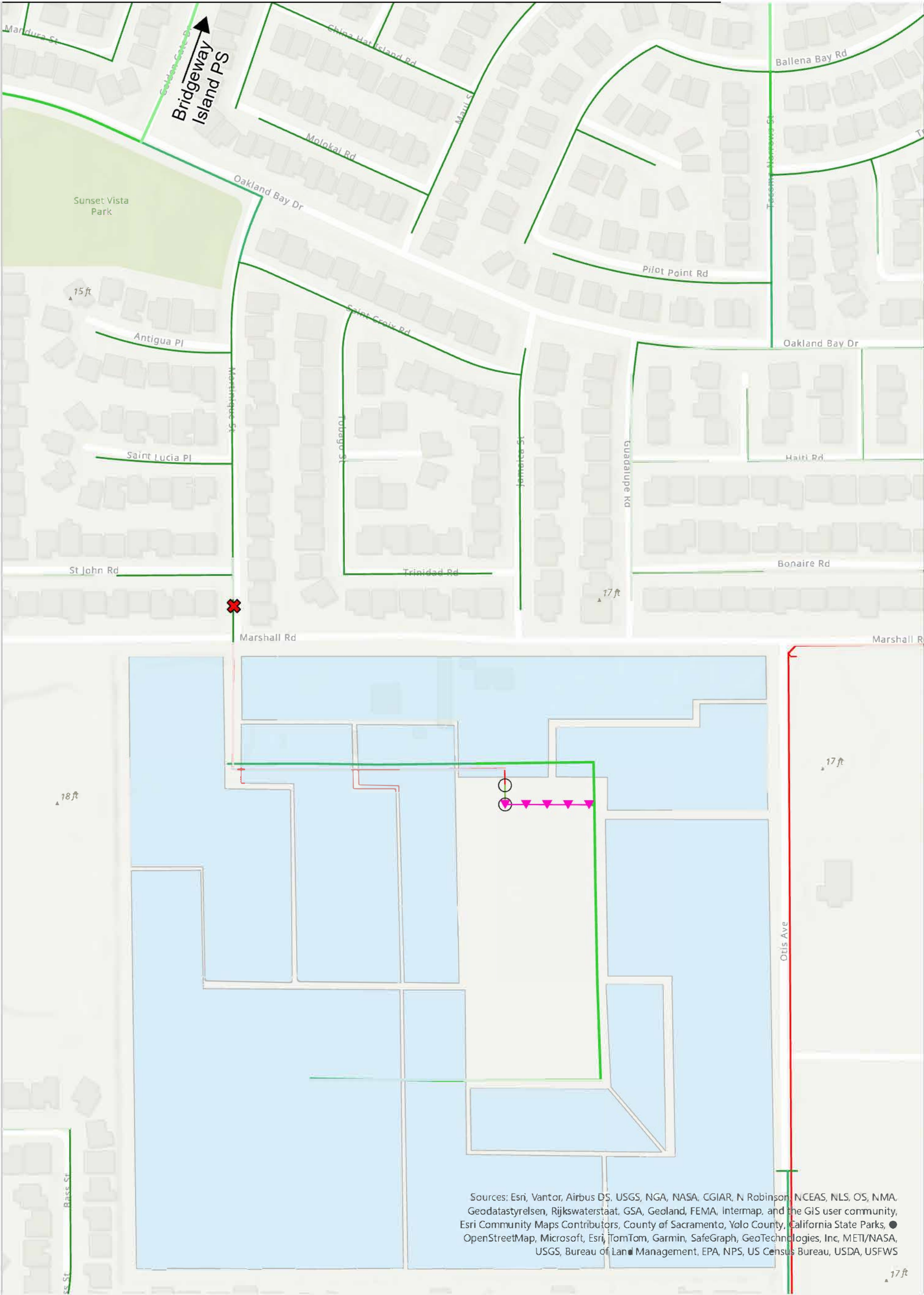
A sewer capacity study prepared by Continental Development Consultants (January 2026) previously evaluated the impact of the proposed 259-unit Brar Farms development on the downstream collection system. That study modeled a single connection at Martinique Street, designated node A1, with project flows routed northward through 11 nodes (A1 through A11) terminating at the Bridgeway Island Pump Station.

The analysis was performed using Autodesk Storm and Sanitary Analysis software and evaluated gravity main performance. The study determined that the existing system had sufficient capacity to accommodate flows from the development, with the pipe link immediately upstream of the pump station (link A10-PUMP) operating at 44.7% capacity under proposed conditions compared to 42.0% under status quo conditions.

An earlier version of the project's on-site sewer layout proposed two separate flow pathways out of the development: one routed north along Martinique Street and a second along Jamaica Street, with both pathways converging at a common downstream node. Upon review and discussion with the City, it was determined that the Jamaica Street segment is very short before turning west and connecting into Martinique Street, such that no existing City sewer infrastructure along Jamaica Street would be materially impacted by the project flows. Because the objective of the two separate flow pathways out of the development was to reduce the hydraulic impact on the City's downstream collection system, the two-pathway configuration was subsequently revised to a single connection point.

2.3 PROPOSED CONNECTION CONFIGURATION

Based on the revised on-site sewer layout provided by the project's engineers, all wastewater flows generated by the Brar Farms Project are proposed to be conveyed via an on-site lift station that pumps flows westward and then northward into Martinique Street; no details about the on-site lift station were provided, and thus this lift station is modeled with a capacity to convey peak flow and typical on/off control in this evaluation. The on-site gravity collection system consists of 8-inch, 10-inch, and 12-inch mains, along with individual property laterals, that collect flows from the northern and southern portions of the development, respectively, before discharging to the on-site lift station. From the lift station, a force main conveys the flow to the connection point on Martinique Street, where it enters the City's gravity collection system. All flows generated from the development are proposed to enter the City's system at a single point on Martinique St. for this evaluation. The proposed on-site sewer layout and connection to the City's system can be seen on Exhibit 2.



City of West Sacramento

PS

Pump Station

Brar Farms On-Site Pump Station

Flap valve

Force Main

Legend

Gravity Main Diameter

6-inches and less

8-inch

10-inch

12-inch

15-inch

18-inch

21-inch and greater

Exhibit 2

Proposed On-Site Sewer

Layout and Connection

to City System

CITY OF WEST SACRAMENTO

Dopudja & Wells

consulting

3 WASTEWATER FLOW DEVELOPMENT

This section summarizes the methodology used to develop project-specific wastewater flow projections for the proposed Brar Farms Project and presents the resulting flow values used in the hydraulic evaluation. Wastewater flows were developed to represent projected future conditions associated with the full buildout of the project during different flow conditions. The following flow conditions were developed:

- Average Dry Weather Flow (ADWF)
- Peak Dry Weather Flow (PDWF)
- Peak Wet Weather Flow (PWWF)

The flows from the development were added to the 2035 Projected Flow Scenario from the 2024 Master Plan Update to confirm that capacity is available in the collection system now and into the future with other projected flows.

3.1 METHODOLOGY

The proposed Brar Farms Residential Development consists of 259 single-family dwelling units on approximately 58 acres. The parcel is currently vacant. Under the land use designations in the City's 2024 Sewer Master Plan Update, this area was zoned as Rural Estates with an assumed density of approximately 0.2 to 0.3 dwelling units per acre, approximated to have fewer than 20 units across the project area in 2035. The proposed development therefore, represents a substantial increase in density relative to master plan assumptions, and project-specific flow projections were developed accordingly.

ADWF projections were developed using a unit flow generation rate of 135 gallons per day per dwelling unit (gpd/du), consistent with the ADWF generation factors established in the 2024 Sewer Master Plan Update. Rather than applying a fixed peaking factor to derive PDWF, the diurnal flow curve developed from Flow Monitoring Site 5 was used directly within the InfoWorks ICM hydraulic model to simulate time-varying flow conditions. Flow Monitoring Site 5 was selected because it monitors the basin into which the Brar Farms development will discharge, and its tributary area consists primarily of single-family residential land uses consistent with the proposed development. This diurnal is provided in Exhibit 3 below. This approach produces a realistic representation of peak flow timing and magnitude than a static peaking factor and ensures that the peaking characteristics applied to the project flows reflect observed conditions from a directly comparable and hydraulically relevant portion of the City's collection system. No groundwater infiltration or inflow (I/I) allowance was applied under dry weather conditions for this evaluation.

Exhibit 3 – Site 5 Diurnal, 2024 Sewer Master Plan Update

0:00	0.88
1:00	0.81
2:00	0.76
3:00	0.71
4:00	0.74
5:00	0.77
6:00	0.92
7:00	1.09
8:00	1.12
9:00	1.10
10:00	1.07
11:00	1.00
12:00	1.00
13:00	1.01
14:00	1.01
15:00	1.00
16:00	1.02
17:00	1.04
18:00	1.06
19:00	1.14
20:00	1.19
21:00	1.25
22:00	1.09
23:00	1.06

PWWF was developed for this evaluation using calibrated R-T-K factors applied to a design storm with a return frequency of 10 years for 24 hours of rainfall accumulation (10-yr 24-hr design storm). This methodology is consistent with that used for the 2024 Master Plan Update.

The flow development methodology used herein and described above differs from the approach used in the prior Continental Development Consultants study. That study applied a per-capita flow rate of 100 gallons per day at 3.0 persons per single-family dwelling unit, a fixed peaking factor of 3.0, and an I/I allowance of 4,000 gallons per inch-diameter per mile per day applied to both sewer mains and laterals per the City's 2015 Sewer Master Plan.

3.2 FLOW PROJECTIONS

To distribute projected flows throughout the InfoWorks ICM model, the development area was divided into subcatchments based on the on-site sewer layout provided by the project's engineers. A total of 10 subcatchments (A, B, C, D, E, G, H, I, J, and K) were delineated, with flows from each

subcatchment assigned to the corresponding model node at the upstream end of the gravity main receiving those flows. The subcatchments, their associated dwelling unit counts, net parcel areas, and resulting ADWF projections are summarized in Exhibit 4 and Exhibit 5.

Exhibit 4 – Summary of Projected ADWF

Subcatchment ID	Subcatchment Area (acres)	Dwelling Unit Count	ADWF (gpd)
Site A	3.333	28	3,780
Site B	2.160	18	2,430
Site C	1.400	12	1,620
Site D	4.827	39	5,265
Site E	2.087	17	2,295
Site G	9.315	62	8,370
Site H	3.281	21	2,835
Site I	1.054	8	1,080
Site J	0.721	5	675
Site K	5.877	48	6,480

The diurnal flow curve developed from Flow Monitoring Site 5 was used to derive time-varying flow conditions within the model, including PDWF. Flow Monitoring Site 5 was selected because it monitors the basin into which the Brar Farms Project will discharge, and because the tributary area at that site consists primarily of single-family residential land uses, which is consistent with the proposed development. This ensures that the peaking characteristics applied to the project flows reflect observed flow patterns from a comparable and directly relevant portion of the City's collection system. The RTK table for Site 5 is provided in Exhibit 6. As can be seen in Exhibit 6, the sum of the response ratios for this basin is 0.015. Stated another way, this ratio indicates that 1.5% of the rain that falls on the basin during a wet weather event enters the collection system as I/I. These values are consistent with the calibration that was performed to storm events captured during flow monitoring for the 2024 Master Plan Update.

Exhibit 6 – Site 5 RTK Values, 2024 Sewer Master Plan Update

	R (Response ratio)	T (hours) (Time to peak)	K (Recession limb ratio)
Short Term	0.005	1	2
Medium Term	0.005	3	1
Long Term	0.005	12	1

4 HYDRAULIC MODEL UPDATE

This section describes the City's hydraulic model and the updates required to use the hydraulic model for this capacity evaluation.

4.1 MODEL DESCRIPTION

The hydraulic evaluation was performed using Autodesk's InfoWorks ICM. The City's sanitary sewer collection system model (originally developed for the 2017 Sewer Master Plan) was updated as part of the 2024 Sewer Master Plan Update using InfoWorks ICM version 2023. For this evaluation, the model was received from the City as an ICM transfer file and updated to InfoWorks ICM version 2026.3. The existing model is skeletonized, as is typical for master plan-level collection system models and does not include all local gravity mains within the system. The model was calibrated using flow monitoring data as part of the 2024 Sewer Master Plan Update, and thus the model was considered up-to-date; simulations performed for this evaluation used flow conditions consistent with that calibration.

The hydraulic evaluation focused on the collection system infrastructure within the Bridgeway Island Pump Station basin, which is the basin that will receive flows from the Brar Farms development. System performance was evaluated by comparing results under status quo 2035 projected flow conditions and projected future conditions that include flows from the development.

4.2 MODEL UPDATES

Prior to performing the hydraulic evaluation, the City's ICM model was updated to include all of the infrastructure in the collection system that would be impacted by the Brar Farms Project. After this update, it was possible to introduce projected flows from the Brar Farms Project at the appropriate locations. Model updates were limited to the Bridgeway Island Pump Station basin and are described below.

INFRASTRUCTURE ADDITIONS

The on-site sewer infrastructure for the Brar Farms development was added to the model based on the preliminary sewer layout provided by the project's engineers. This included the addition of new gravity mains, manholes, a lift station with wet well, and a force main representing the proposed on-site collection system. The on-site gravity mains collect flows from individual property laterals and convey them to the on-site lift station, which pumps flows via force main westward and

northward to the connection point on Martinique Street. The locations and sizes for the added infrastructure are summarized in Exhibit 7.

SUBCATCHMENT REVISIONS – EXISTING DEVELOPMENT AREA

In the original master plan model, the area immediately north of the project site and within the existing Bridgeway Island subdivision was represented as a single aggregated subcatchment (Subcatchment 8), with flows loaded to a single manhole in the hydraulic model. To support a more comprehensive representation of the collection system in this area, additional nodes and gravity mains were added to the model corresponding to the existing infrastructure present in the field. Subcatchment 8 was accordingly subdivided into four micro-subcatchments (8.1, 8.2, 8.3, and 8.4), each assigned to the appropriate new model node.

Flow loading for each micro-subcatchment was developed using two components. First, residential wastewater flow was calculated at 135 gpd/du based on the dwelling unit count within each micro-subcatchment, consistent with the methodology applied on the 2024 Sewer Master Plan Update and to the Brar Farms flows. Second, the original flow component already attributed to the original subcatchment 8 in the master plan model was split across the four new micro-subcatchments in proportion to their respective contributing areas. The resulting assignments are summarized in Exhibit 8.

SUBCATCHMENT REVISIONS – PROJECT AREA

The large master plan subcatchment (Subcatchment 269) that previously encompassed the majority of the project site was revised to reflect only the non-Brar Farms portion of its original area, corresponding to the existing development already present within that subcatchment boundary. No flow values or properties associated with Subcatchment 269 were modified other than the adjustment to its geographic boundary.

Projected flows from the Brar Farms Project were introduced to the model at the new subcatchment added for the on-site collection system, as described in Section 3. Flow loading at each subcatchment was based on the subcatchment delineation described in Section 3.2, with ADWF assigned at 135 gpd/du and time-varying flow patterns applied using the diurnal curve from Flow Monitoring Site 5.

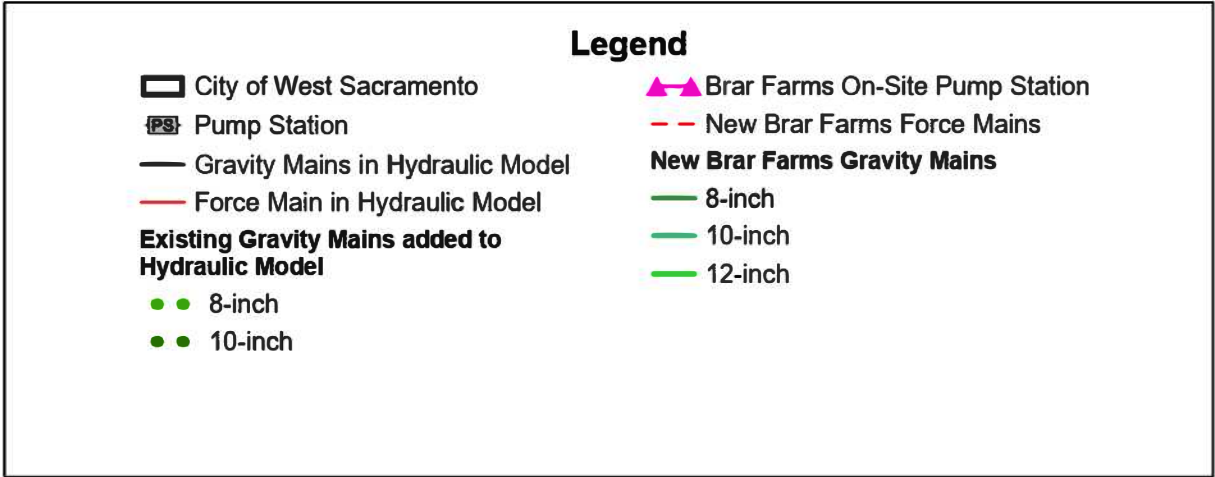
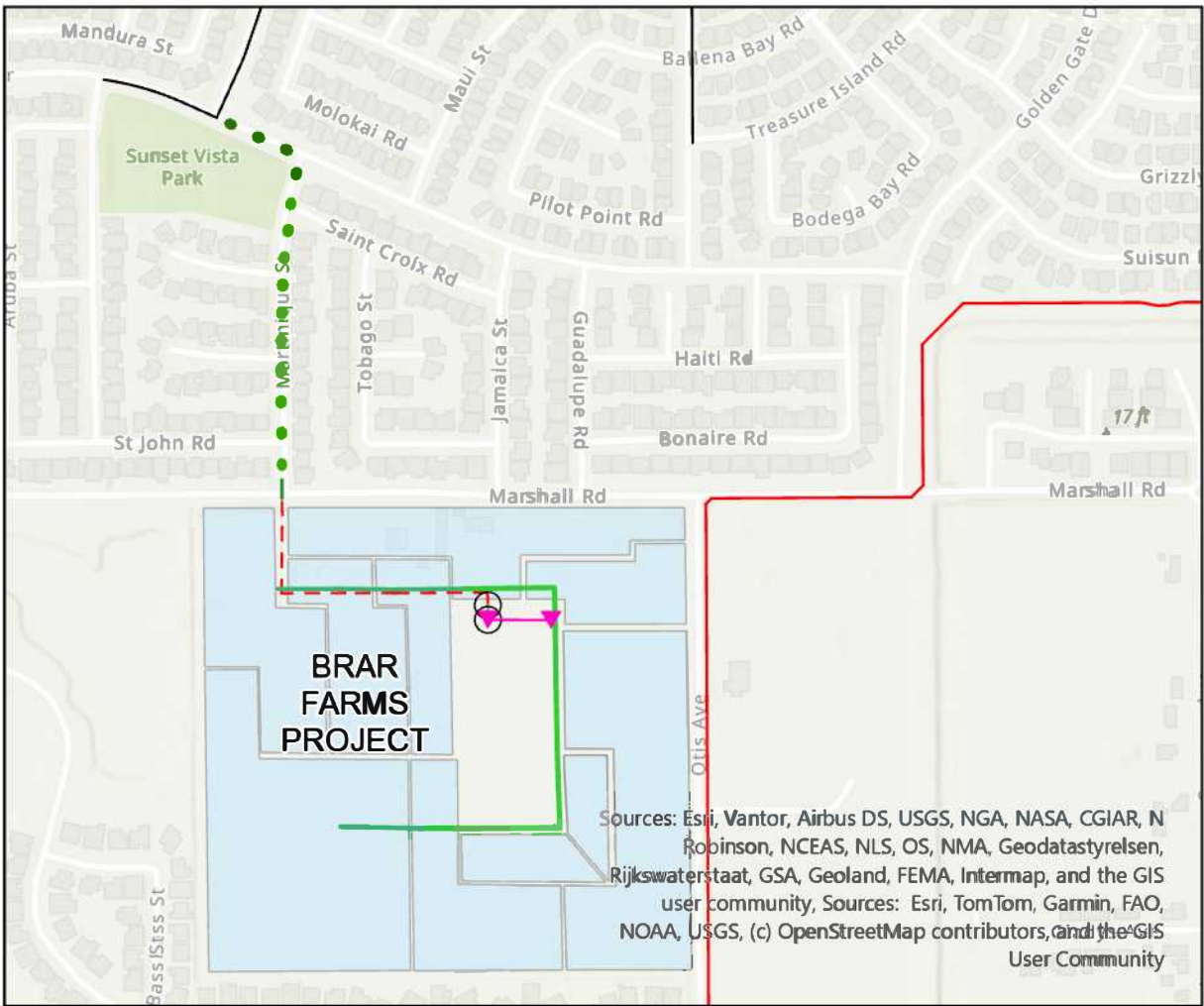
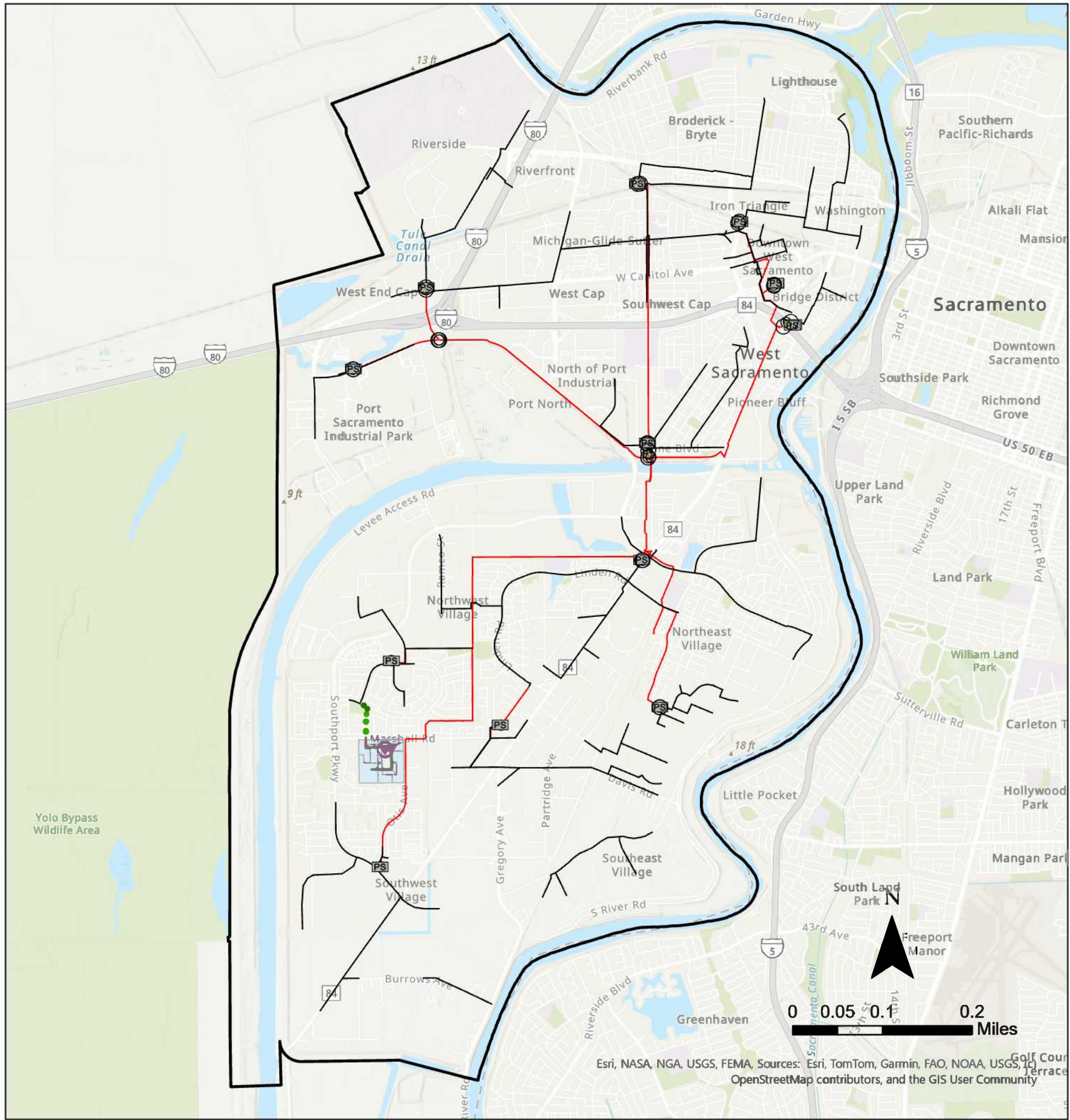
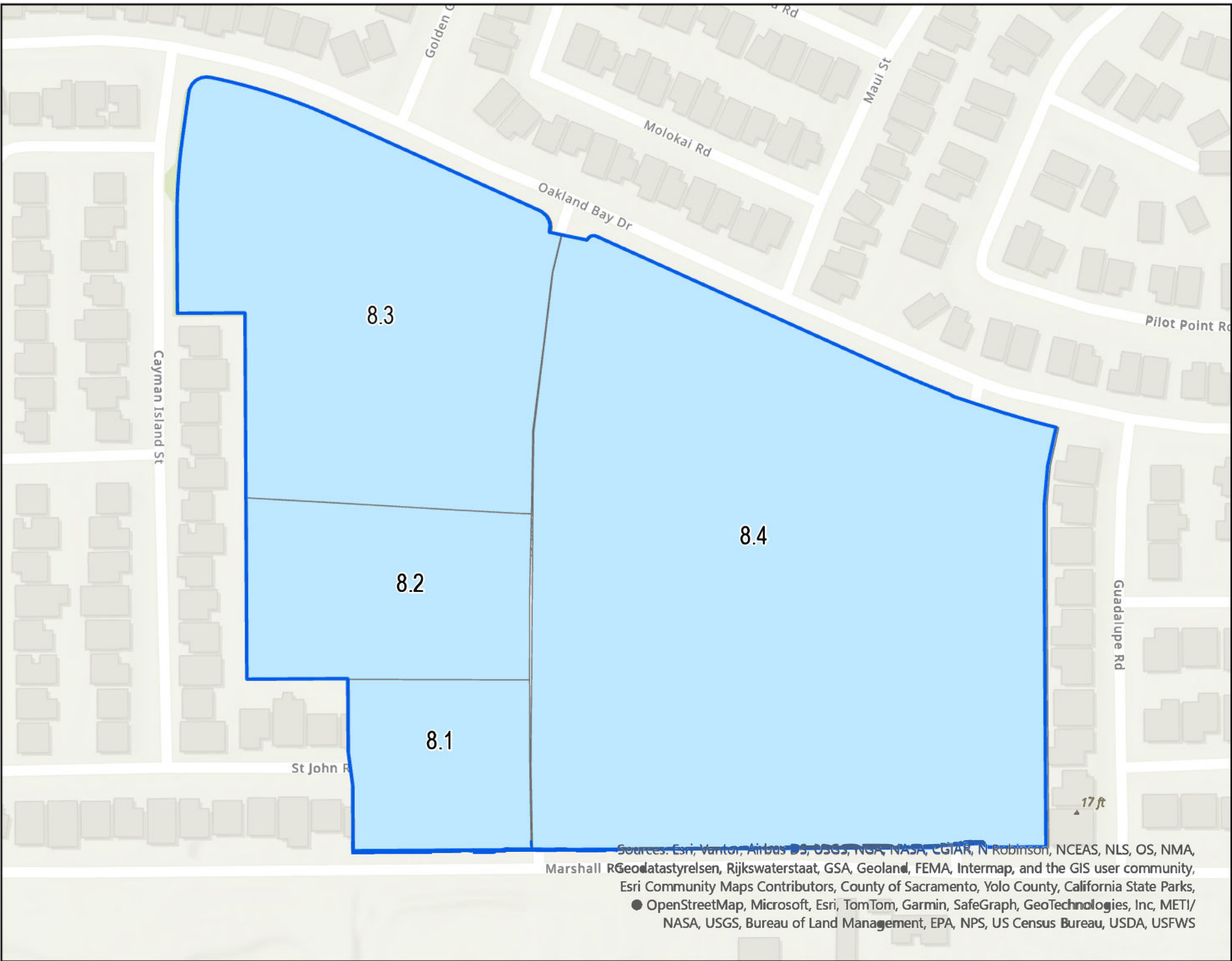


Exhibit 7
Skeletonized Model and
Added Infrastructure





Legend

- Original Subcatchment 8 Boundary
- Subcatchment 8 Subboundaries

Exhibit 8
Subcatchment 8
Subdivision



5 HYDRAULIC EVALUATION

The performance criteria and evaluation methods used for this hydraulic evaluation are described in this section of the TM.

5.1 PERFORMANCE CRITERIA

The hydraulic evaluation was performed in accordance with the performance criteria established in the City's 2024 Sewer Master Plan Update. The applicable criteria are summarized in Exhibit 9 and described below.

Exhibit 9 – Summary of Performance Criteria for the City of West Sacramento

Primary Performance Criteria	
Peak Wet Weather Flow Depth to Pipe Diameter Ratio (d/D)	
8-inch and under:	0.70
10-inch and greater:	HGL must remain more than 3 feet below ground surface under PWWF
Secondary Performance Criteria	
Force Main Maximum Velocity	8 fps

Gravity mains in the collection system are classified as either collection mains or conveyance mains. Collection mains include all gravity mains 8-inches in diameter and smaller that are not typically included in the hydraulic model as part of the conveyance system. Collection mains are considered hydraulically deficient when the Design PWWF depth-to-diameter (d/D) ratio exceeds 0.70. Conveyance mains include all gravity mains 10-inches in diameter and larger, as well as selected 8-inch mains included in the hydraulic model. Conveyance mains are considered deficient if the Design PWWF results in a hydraulic grade line (HGL) within three feet of the ground surface.

Pump stations are considered deficient if the firm capacity of the pump station (the capacity with the largest pump out of service) is not sufficient to convey the Design PWWF. Force mains are considered deficient if the maximum velocity exceeds 8 feet per second (fps) under design PWWF conditions.

5.2 MODELING APPROACH

Hydraulic simulations were performed for two scenarios: dry weather and wet weather flow conditions for status quo conditions and projected future conditions with the added Brar Farms Project flows.

It should be noted that the City’s collection system exhibits a strong response to wet weather events, as described in the 2024 Master Plan Update. As a result, pump station wet wells are often allowed to surcharge back into the collection system under PWWF conditions because of limited wet well

volume. Such surcharging is seen in the field and in hydraulic model simulations as well. Because this surcharging makes it difficult to evaluate the capacity of the collection system gravity mains, simulation scenarios were run to eliminate the surcharging to allow for a clear evaluation of gravity main capacity for this evaluation.

5.3 DRY WEATHER FLOW CAPACITY EVALUATION

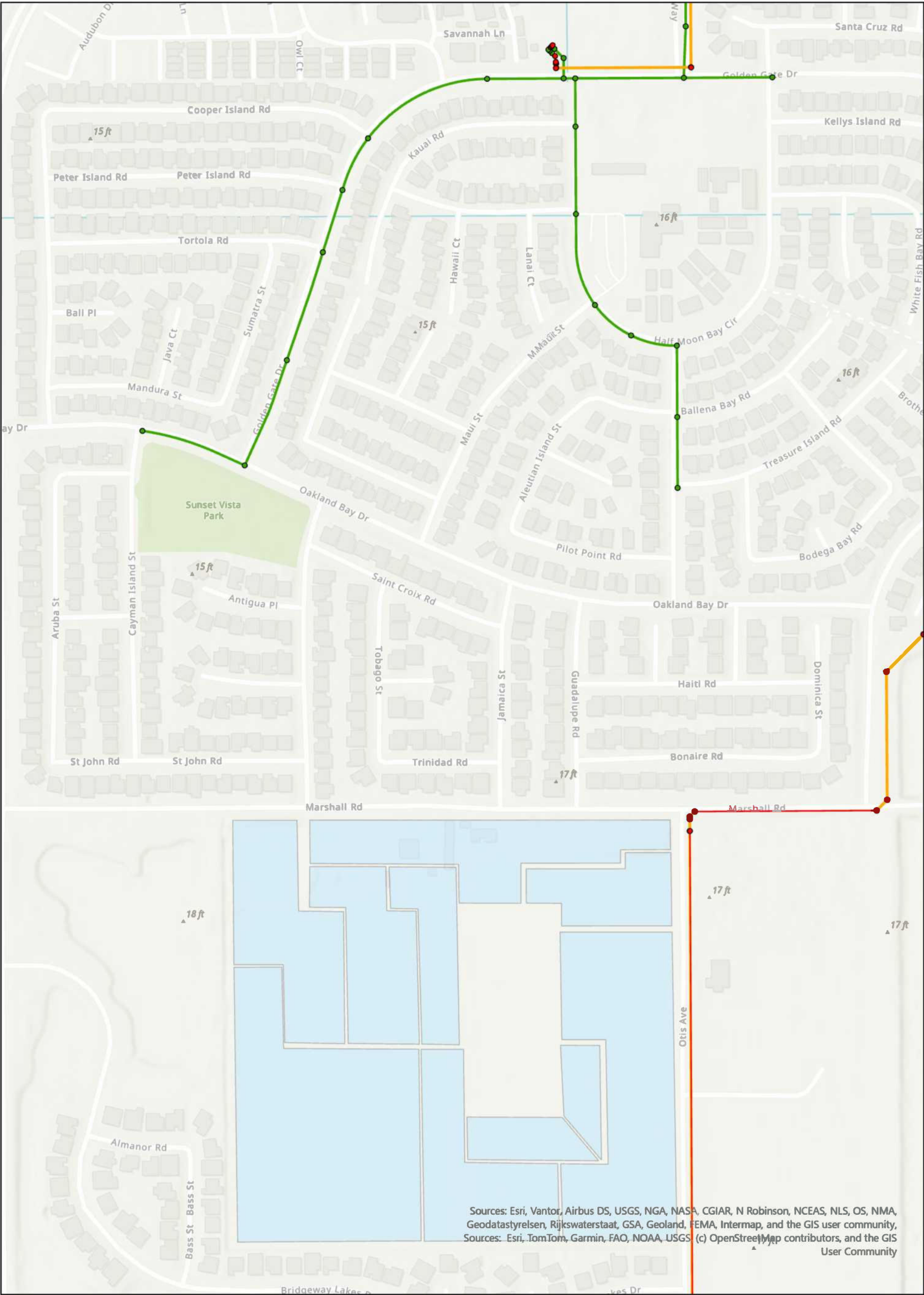
The City does not utilize dry weather performance criteria, as described in the section above. Although the collection system is designed for wet weather flow, on a majority of days the system will experience dry weather conditions, and it is therefore important to confirm that the system operates well under PDWF conditions. PDWF scenarios were considered, and the results are provided below.

GRAVITY MAINS

Under dry weather conditions, all gravity mains in the study area perform well within applicable capacity thresholds under both status quo and Brar Farms Project conditions. In the existing downstream collection system, all links show sufficient capacity under both status quo and Brar Farms Project scenarios, with d/D ratios increasing slightly under Brar Farms Project conditions relative to status quo, consistent with the addition of project flows to the system.

Specifically during the Brar Farms Project scenario, the d/D ratios range from approximately 0.14 to 0.54 for the gravity mains downstream of the Brar Farms project and 0.10 to 0.15 for the internal Brar Farms gravity mains. The largest increases are observed at links 8373, 8393, and 8394, where d/D ratios increase from approximately 0.27 under status quo conditions to 0.33 to 0.35 with project flow conditions, remaining below the 0.70 performance criterion by the City.

All node flood depths remain well below the 3-foot HGL criterion under both conditions, ranging from approximately -3.8 to -11.5 feet below the ground surface for project nodes and -4.3 to -4.8 feet for existing downstream nodes. No dry weather capacity deficiencies are identified either without or with the Brar Farms Project flows. The results for the dry weather gravity main performance is illustrated in Exhibits 10 and 11. It should be noted that pipelines can be seen on these figures with d/D values greater than 1.0 (surcharged). These pipelines are force mains and designed to operate under surcharge or pressure conditions.



Legend

FloodDepth (ft AD)

- Less than -3
- Greater than -3

Main d/D

- Less than 0.7
- Between 0.7 and 1
- Greater than 1

 Brar Farms Project Site

Exhibit 10

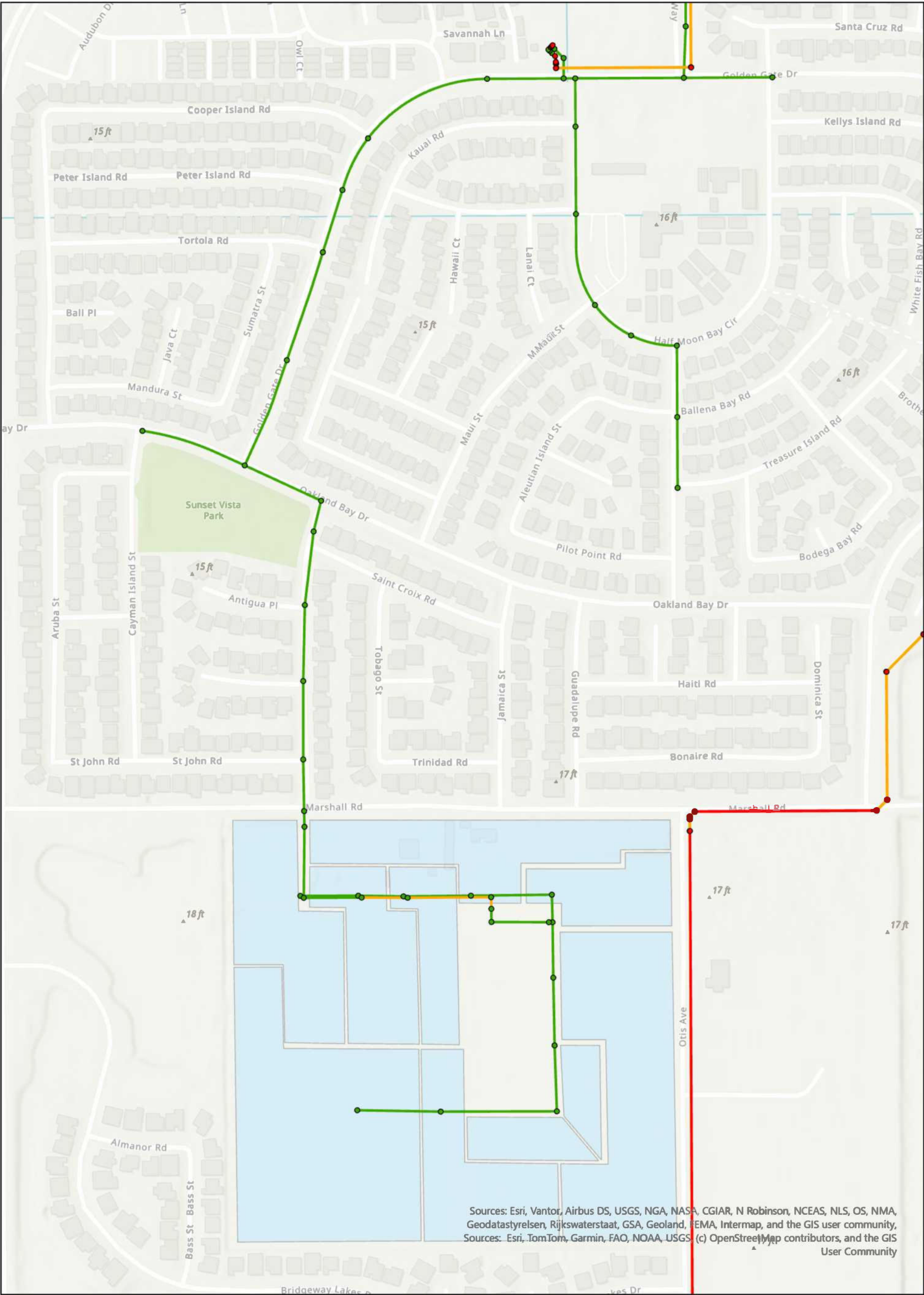
Dry Weather Capacity

Results with Brar

Farms Development

 CITY OF WEST SACRAMENTO

 Dopudja & Wells consulting



Flood Depth (ft AD)

●

Less than -3

●

Greater than -3

Main d/D

—

Less than 0.7

—

Between 0.7 and 1

—

Greater than 1

■

Brar Farms Project Site

Exhibit 11

Dry Weather Flow

System Capacity,

Status Quo 2035

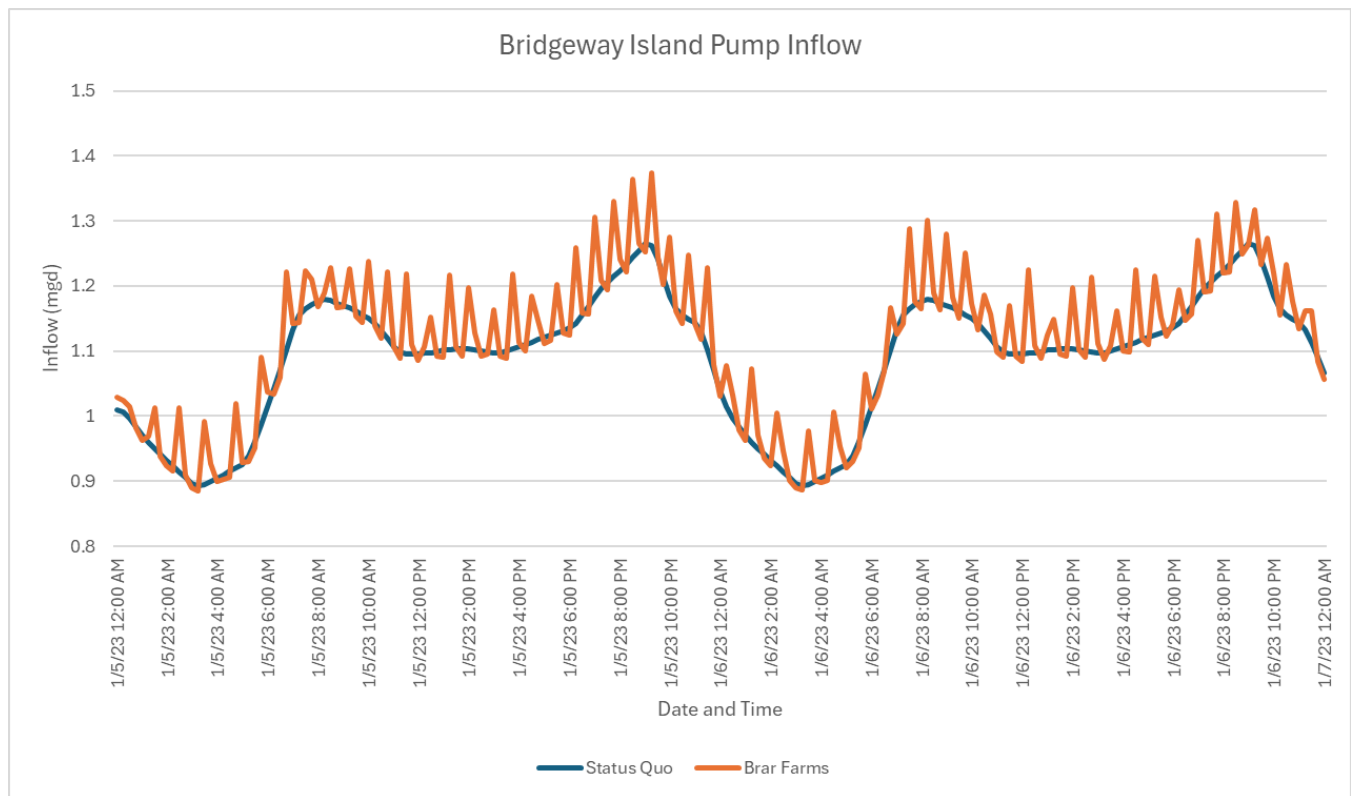
CITY OF WEST SACRAMENTO

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BRIDGEWAY ISLAND PUMP STATION RESULTS

Under dry weather conditions, the Bridgeway Island Pump Station inflow follows a smooth diurnal pattern consistent with the expected residential dry weather flow behavior. Status quo condition inflows at the pump station range from approximately 0.89 to 1.27 mgd over the simulation period, with a peak occurring in the early evening hours. Future condition inflows with Brar Farms flows range from approximately 0.88 to 1.37 mgd, with the peak increase of approximately 8% due to the new sewer generation from the Brar Farms development. Both peak flow values are well below the firm capacity of the pump station, identified as 4.68 mgd (3,250 gpm) in the 2024 Master Plan Update. Pump station inflow under dry weather conditions is illustrated in Exhibit 12.

Exhibit 12. Bridgeway Island Pump Inflow Dry Weather Conditions



5.4 WET WEATHER FLOW CAPACITY EVALUATION

The capacity evaluation of the City's collection system is based on the PWWF performance criteria described in Section 5.1. The design PWWF event represents the critical flow condition for which the system must demonstrate sufficient capacity, as it produces the highest flows in the collection system and is therefore the controlling scenario for identifying capacity deficiencies with the City's collection system. PWWF scenarios were evaluated for both status quo and Brar Farms Project conditions and the results are summarized below.

GRAVITY MAINS

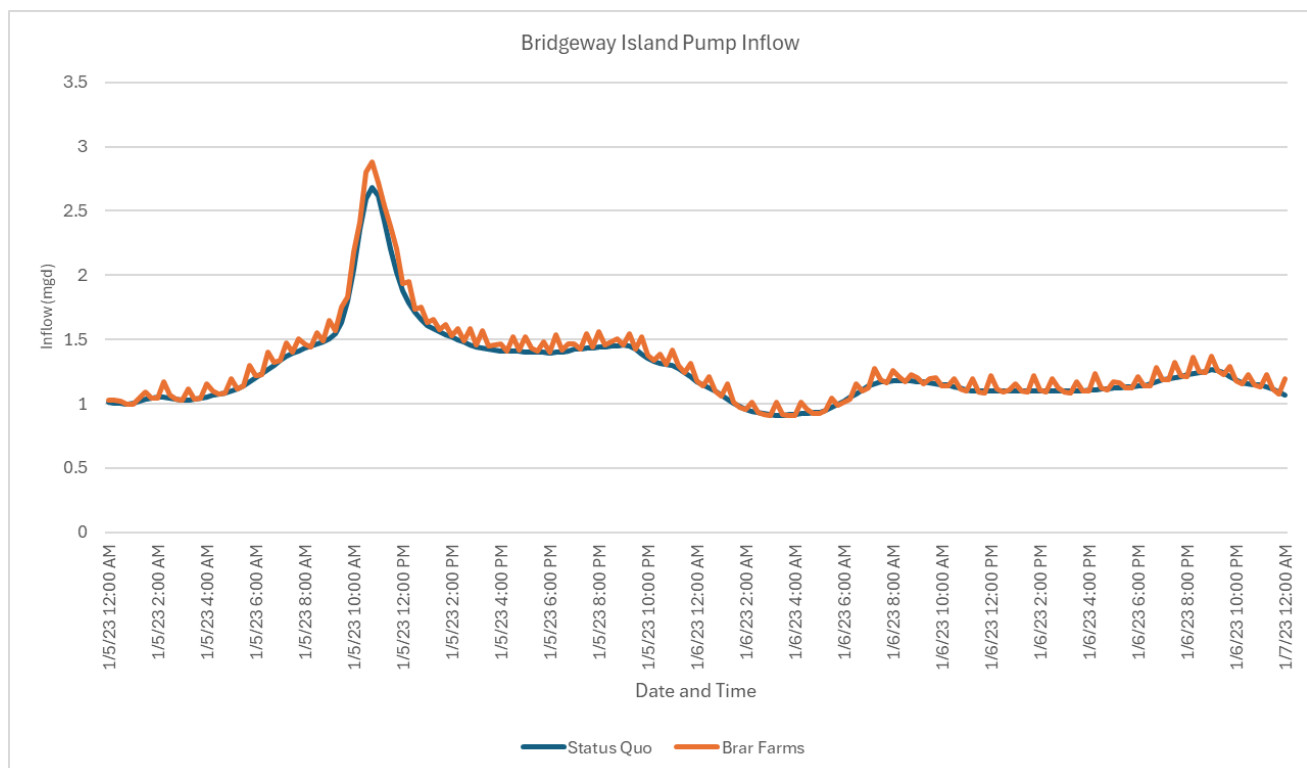
Under wet weather conditions, the gravity main results are consistent with the dry weather findings. All Brar Farms on-site and connection links exhibit sufficient capacity in the gravity mains, with d/D ratios ranging from approximately 0.13 to 0.23 for the internal Brar Farms gravity mains and range from approximately 0.22 to 0.62 for the links downstream of the Brar Farms project .

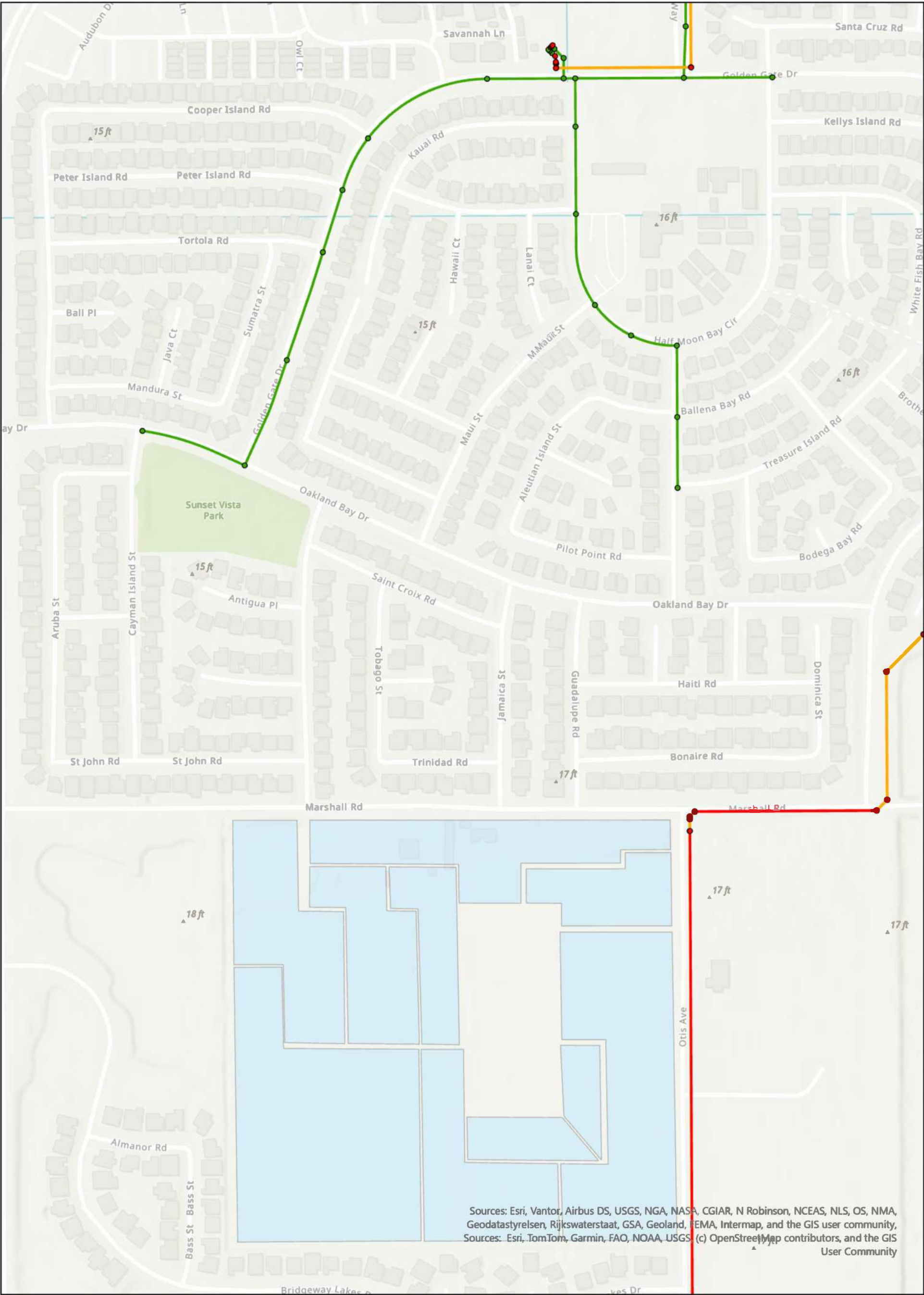
All node flood depths remain well below the 3-foot HGL criterion under both wet weather conditions, ranging from approximately -3.8 to -11.5 feet below the ground surface for project nodes and -4.1 to -4.7 feet for existing downstream nodes. No wet weather capacity deficiencies are identified either without or with the Brar Farms Project flows. The results for the wet weather gravity main performance are illustrated in Exhibits 13 and 14. As mentioned in the dry weather section, it should be noted that pipelines can be seen on these figures with d/D values greater than 1.0 (surcharged). These pipelines are force mains and designed to operate under surcharge or pressure conditions.

BRIDGEWAY ISLAND PUMP STATION RESULTS

Under wet weather conditions, the Bridgeway Island Pump Station shows a sharp spike in flows coincident with the design storm rainfall. Status quo condition PWWF is approximately 2.60 mgd at the pump station. PWWF with Brar Farms Project flow added is approximately 2.90 mgd. Both peak flow values are well below the firm capacity of the pump station, identified as 4.68 mgd (3,250 gpm) in the 2024 Master Plan Update. Pump station inflow under wet weather conditions is illustrated in Exhibit 15.

Exhibit 15. Bridgeway Island Pump Inflow Wet Weather Conditions





Legend

Flood Depth (ft AD)

- Less than -3
- Greater than -3

Main d/D

- Less than 0.7
- Between 0.7 and 1
- Greater than 1

Brar Farms Project Site

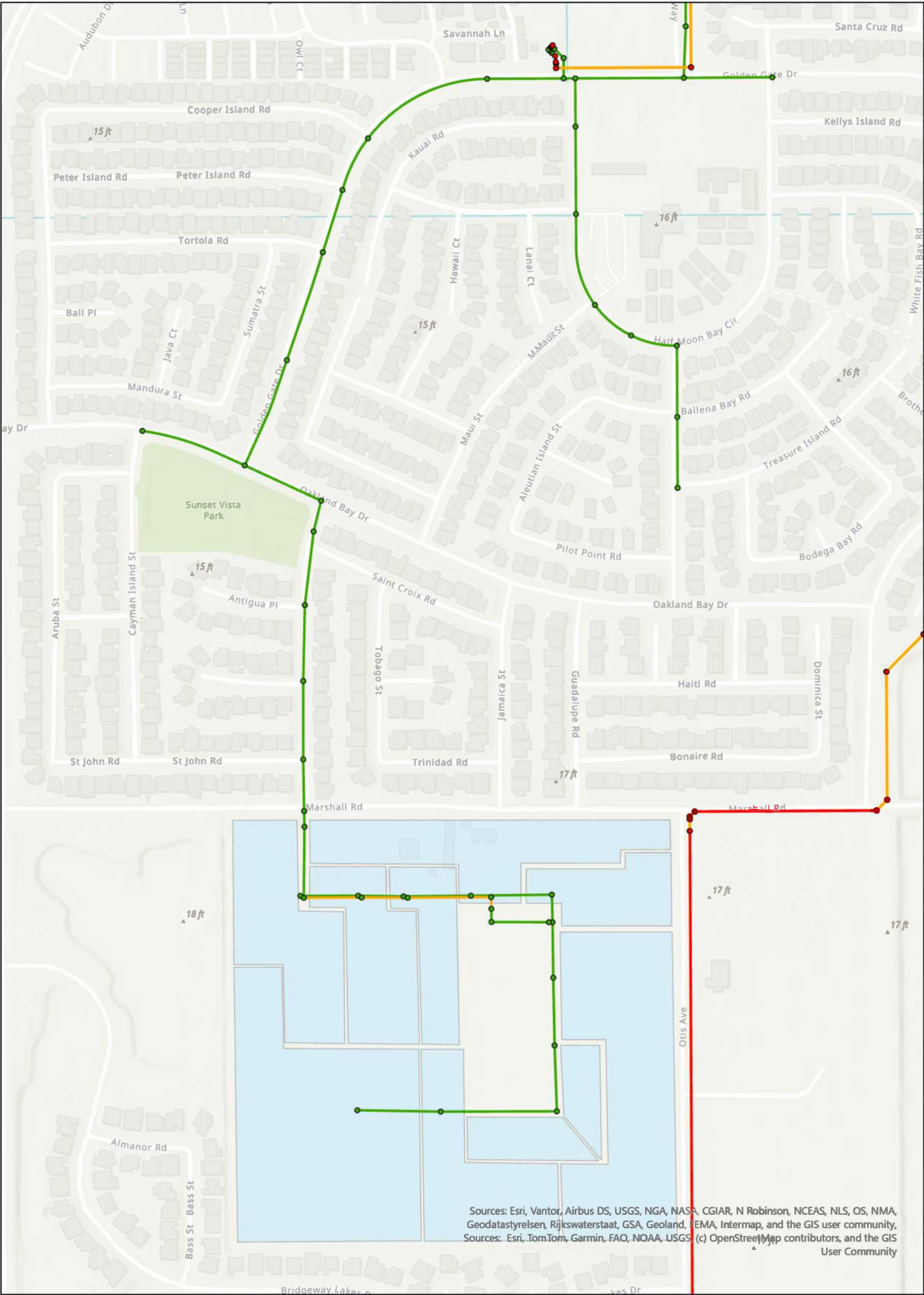
Exhibit 13

Wet Weather Flow

System Capacity,

Status Quo 2035

CITY OF WEST SACRAMENTO



Flood Depth (ft AD)

●

Less than -3

●

Greater than -3

Main d/D

—

Less than 0.7

—

Between 0.7 and 1

—

Greater than 1

■

Brar Farms Project Site

Exhibit 14

Wet Weather Flow

System Capacity,

Status Quo 2035

CITY OF WEST SACRAMENTO

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6 CONCLUSIONS

The Brar Farms Project has proposed a potential connection point for this project to the City's existing collection system. Hydraulic evaluation using the City's collection system hydraulic model indicates that the gravity mains along the flow path downstream of the connection point have sufficient capacity for the new flows from this development under both PDWF and PWWF conditions. Further, the evaluation indicates that the Bridgeway Island Pump Station, to which the Brar Farms Project is tributary, has sufficient capacity to convey flows from the project.

The hydraulic evaluation summarized herein relies on the projected 2035 Flow Projections developed for the 2024 Master Plan Update. As such, the evaluation indicates that there is sufficient future capacity based upon projected development for the Brar Farms Development in addition to sufficient capacity under existing flow conditions.