

Technical Memo



Date: 1/30/2023
To: Mark Mueller, PE; Shad Springer, PE
Prepared By: Patricia Parks, EIT
Reviewed By: Joshua Reynolds, PE
Project: Holiday Inn Express Hotel by Lotus Management Inc.
Subject: Sewer Capacity Study

1.0 Summary

The City of Santa Maria (City) has received a development request to construct a 93-room hotel on Roemer Court. This proposed development was not accounted for in the 2012 Utilities Capacity Study. Based on the location, this project could potentially trigger sewer upgrade projects C-4 and D-7, as described in the 2012 Utilities Capacity Study. This Technical Memorandum (TM) evaluates the additional demand posed by the project on the City's existing collections system to determine if the existing system can sufficiently serve the additional demand. The study also deployed sewer flow meters to check flow in the existing sewer near project C-4 to determine if the sewer model developed in the 2012 Utilities Capacity Study is sufficiently accurate for use in evaluating the connection of the 93-room hotel.

Projects C-4 and D-7 identified in the 2012 Utilities Capacity Study, shown in Figure 1 and Figure 2, identified several pipelines downstream of the proposed project that could potentially be capacity constrained. Both projects C-4 and D-7 require upsizing existing 10- or 12-inch mains to 15-inch mains.

WSC understands that the City's sewage flows decreased subsequent to the 2012 Utilities Capacity Study as a result of significant water conservation efforts triggered by sustained drought conditions occurring from 2011 to 2017. As the flow metering will show, existing sewage flows in the C-4 pipeline are lower than anticipated in the 2012 Utilities Capacity Study.

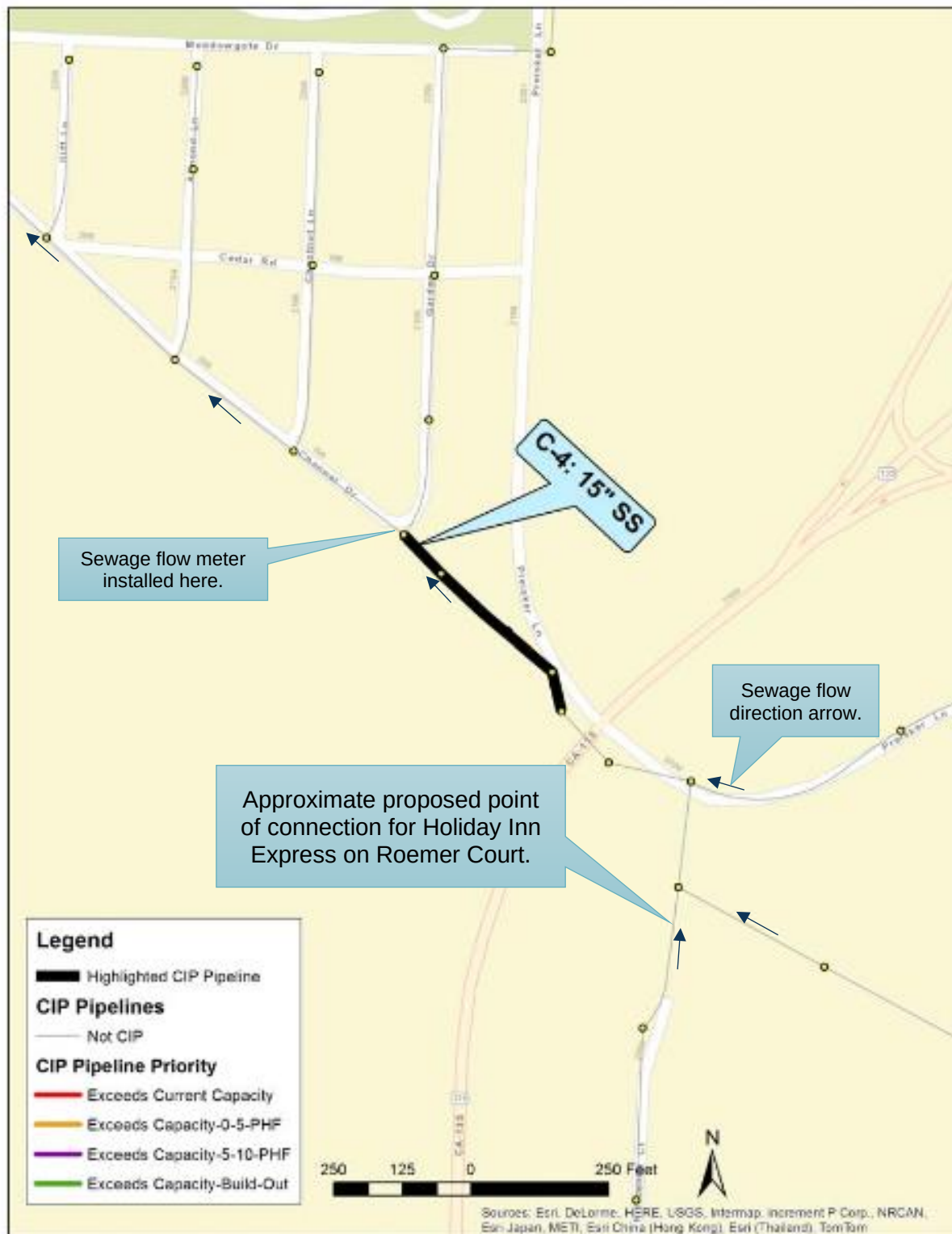


Figure 1. Project C-4

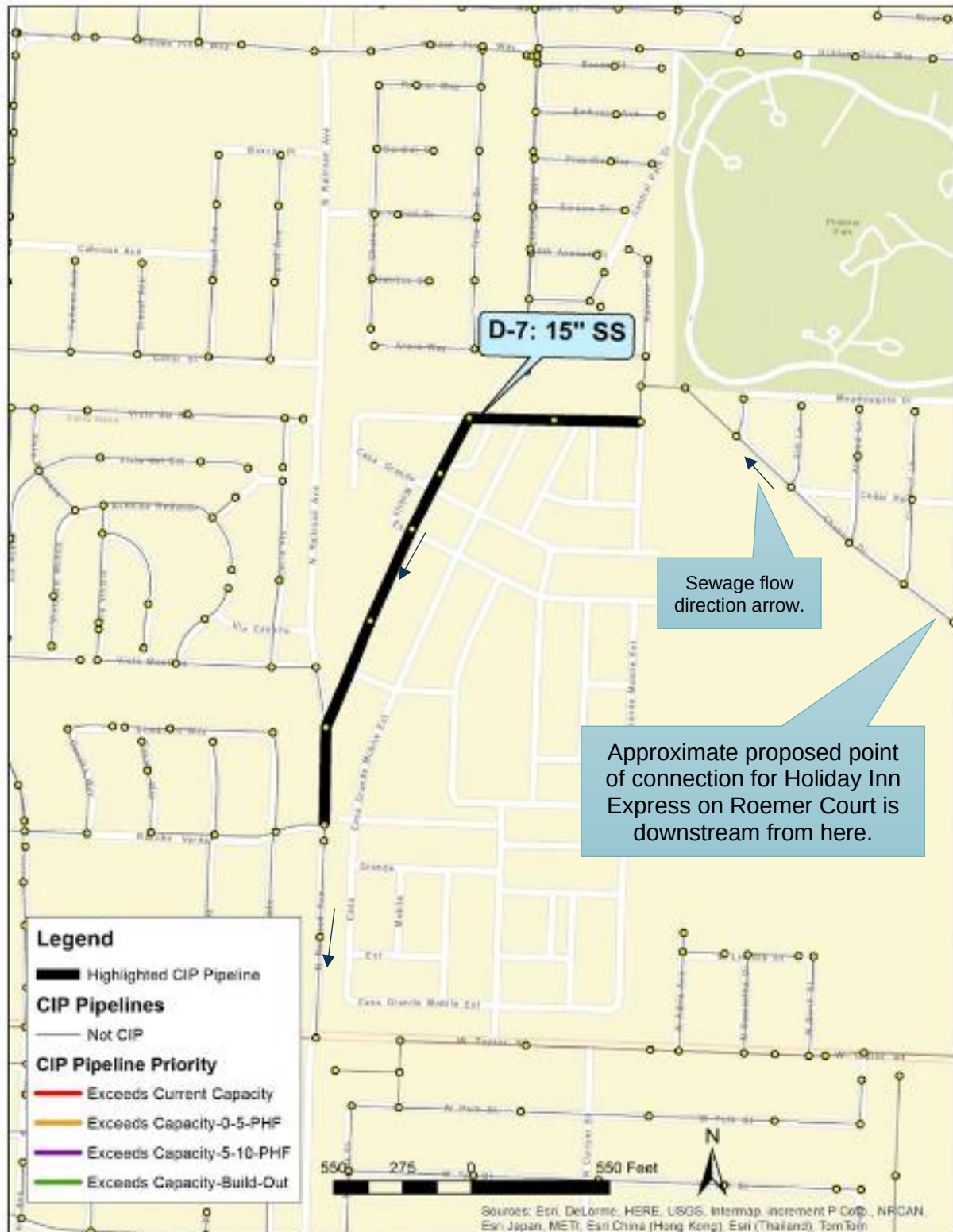


Figure 2. Project D-7

1.1 Flow Monitoring

The sewer system was evaluated using the City's sewer collection system hydraulic model in Bentley's SewerGEMS modeling software. To verify model accuracy, flow monitoring was conducted between 12/13/2022 through 12/21/2022 near the project location (see Figure 1) to obtain one-week of data on flow, velocity, and level within the manhole located at the intersection of Channel Drive and Garden Drive. The results of the flow monitoring are summarized in Table 1 and included in Appendix A.

Table 1. Average Velocity, Level, and Flow Data from Flow Monitoring Period

	Velocity, feet per second	Level, inch	Average Flow, gallons per minute	Average Flow, gallons per day
Average	2.069	3.025	87.6	126,147

The data obtained from flow monitoring was compared to the loading in the existing model for the 0-5 Average Daily Flow (ADF) and 5-10 ADF scenario. The model predicts greater flow than the flow monitoring data under both scenarios without the additional Project demand, as shown in Table 2. The model yields a conservative estimate of conditions; therefore, no changes to the loading in the model were made.

Table 2. Comparison of Flow Monitoring Data with Model Output (Pipe ID 5814)

Flow Monitoring Average Flow, gpd	Model Output Average Flow, gpd	Model Scenario
126,147	193,785	0-5 ADF
	275,981	5-10 ADF

1.2 Flow Projection

This project is planned to be constructed on an undeveloped parcel. This area had previously been identified as future commercial development in the 2012 Utilities Capacity Study and anticipated lower wastewater generation (approximately 4,800 gpd total). The proposed project sewer generation is based on an estimated wastewater generation factor of 70 gallons per day per room. The resulting sewer generation from the project is 6,510 gpd under ADF conditions.

By applying a peaking factor of 2.49, the estimated peak hour demand for the project is 16,210 gpd. The peaking factor used for this study was also used in the 2012 Utilities Capacity Study.

2.0 Evaluation Criteria

The new flow from the proposed development was added to the collection system at the anticipated point of connection and evaluated using the evaluation criteria described below. Capacity was evaluated under Peak Hour Flow (PHF) conditions. This flow generation of the proposed project was added to the existing City model for this analysis.

The sewer collection system was evaluated using the criteria presented in Table 5-2 of the 2012 Utilities Capacity Study. The primary criteria used was the depth of flow to diameter of pipe ratio (d/D). For sewer pipelines of 10-inch diameter or less, the allowable d/D is 0.6. For sewer pipelines 12-inch diameter and larger, the allowable d/D is 0.75.

3.0 Results

The proposed project was modeled in the City's existing hydraulic model under the 0-5 Year PHF, 5-10 Year PHF, and buildout (BO) scenarios. Results of the hydraulic analysis are provided in Table 3, including anticipated BO conditions with and without the project. One pipeline downstream of the proposed Project indicates capacity issues and does not meet the d/D criteria under the PHF scenario with estimated demands in the 2012 Utilities Capacity Study 5-10 year development scenario. The pipelines that exceed the design criteria are highlighted in orange and indicate that the proposed Project will trigger capacity constraints in one segment of Project D-7 (in the 5-10 year development scenario). The project is not expected to trigger Project C-4. The relation of the downstream mains from the proposed Project to Projects C-4 and D-7 are shown in Figure 3 and Figure 4. BO conditions are also provided in Table 3 and Figures 5 and 6.

Table 3. Model Results

Pipe Figure Label	Model ID	Label	Length, feet	Diameter, Inch	0-5 PHF	5-10 PHF	BO PHF	BO PHF with Project Demand
					d/D, %	d/D, %	d/D, %	d/D, %
1	5213	SP00364-M3B	195	8	37.56	46.29	52.49	53.36
2	4846	SP00551-M3B	154	12	43.67	53.36	61.59	62.01
3	4595	SP00552-M3B	127	12	46.78	56.52	64.58	64.95
4	4286	SP00549-M3B	74	12	39.25	47.83	54.82	55.12
5	6108	SP01124-M3B	272	12	36.22	45.03	52.27	52.58
6	4415	SP00550-M3B	99	12	40.04	49.23	57.02	57.37
7	5814	SP00548-M3B	252	12	41.09	51.20	60.47	60.82
8	6147	SP00012-M2C	273	12	42.92	56.50	69.55	69.93
9	6639	SP00002-M2C	322	12	43.20	58.10	72.26	72.62
10	6396	SP00131-M2C	298	12	41.26	55.00	67.74	68.06
11	6246	SP00001-M2C	282	12	37.31	48.97	58.99	59.22
12	5038	SP00073-M2D	178	12	38.66	50.92	63.01	63.35
13	8267	SePipes_Updated1 51	143	12	45.53	61.15	78.64	79.19
14	6846	SP00074-M2D	346	12	47.80	64.47	82.38	82.88
15	6805	SP00075-M2D	340	12	41.32	54.57	67.51	67.83
16	5803	SP00076-M2D	251	12	41.37	54.66	76.81	76.91
17	5778	SP00072-M2D	249	12	47.79	64.46	100	100
18	7348	SP00119-M2D	403	12	51.58	69.32	100	100
19	7648	SP00097-M3A	459	12	57.85	76.70	100	100
20	7207	SP00098-M3A	393	12	50.94	64.76	78.71	78.79
21	4248	SP00067-M3A	64	15	40.08	48.41	55.87	56.05
22	7140	SP00106-M3A	384	15	46.29	56.41	65.97	66.21
23	7353	SP00107-M3A	404	15	46.44	56.62	66.34	66.58
24	7190	SP00062-M3A	391	15	47.37	57.86	67.85	68.10



Figure 3. 5-10 Year PHD Modeled Pipelines and Relation to Project C-4



Figure 4. 5-10 Year PHD Modeled Pipelines and Relation to Project D-7

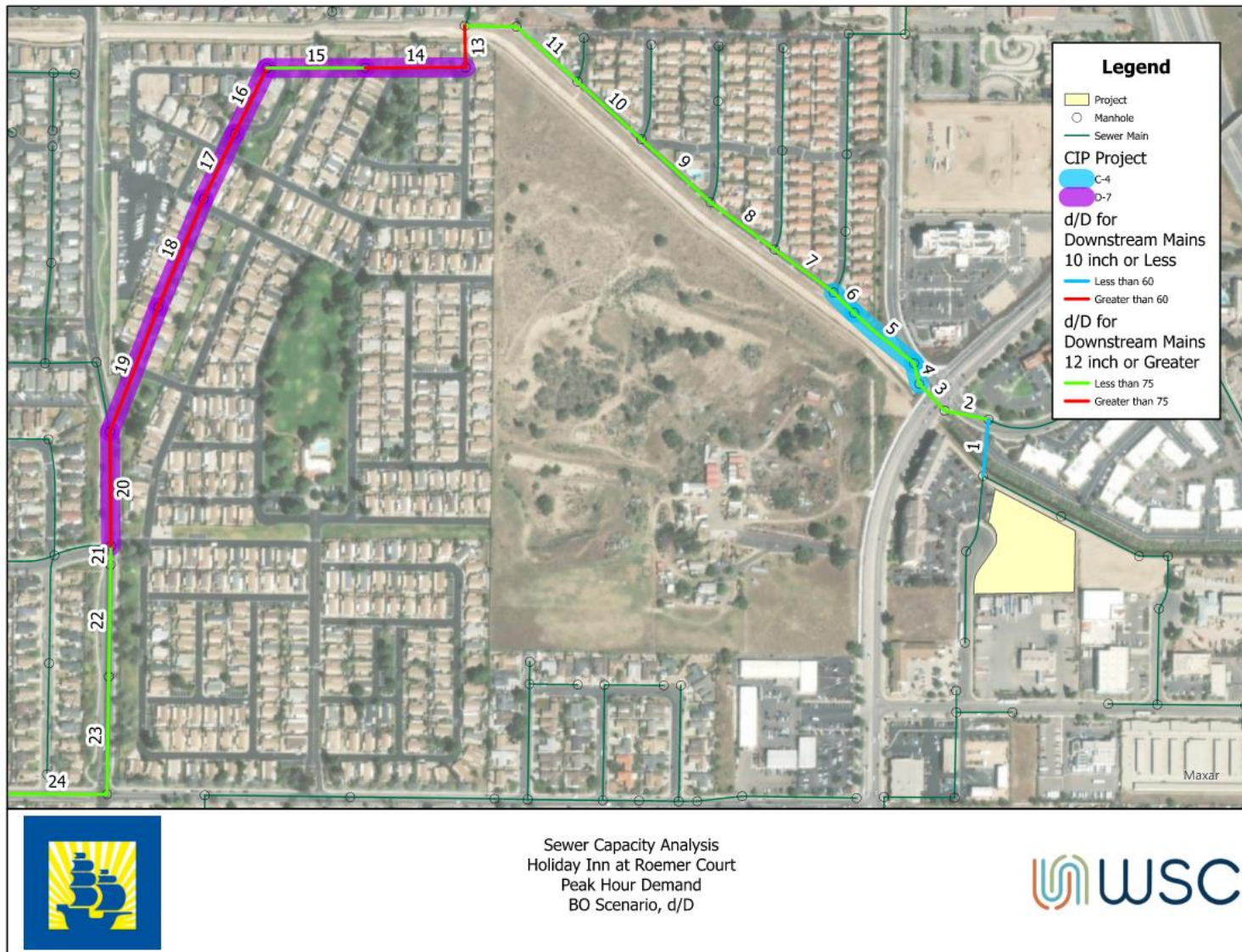


Figure 5. Modeled Buildout PHF Pipelines and Relation to CIP Projects

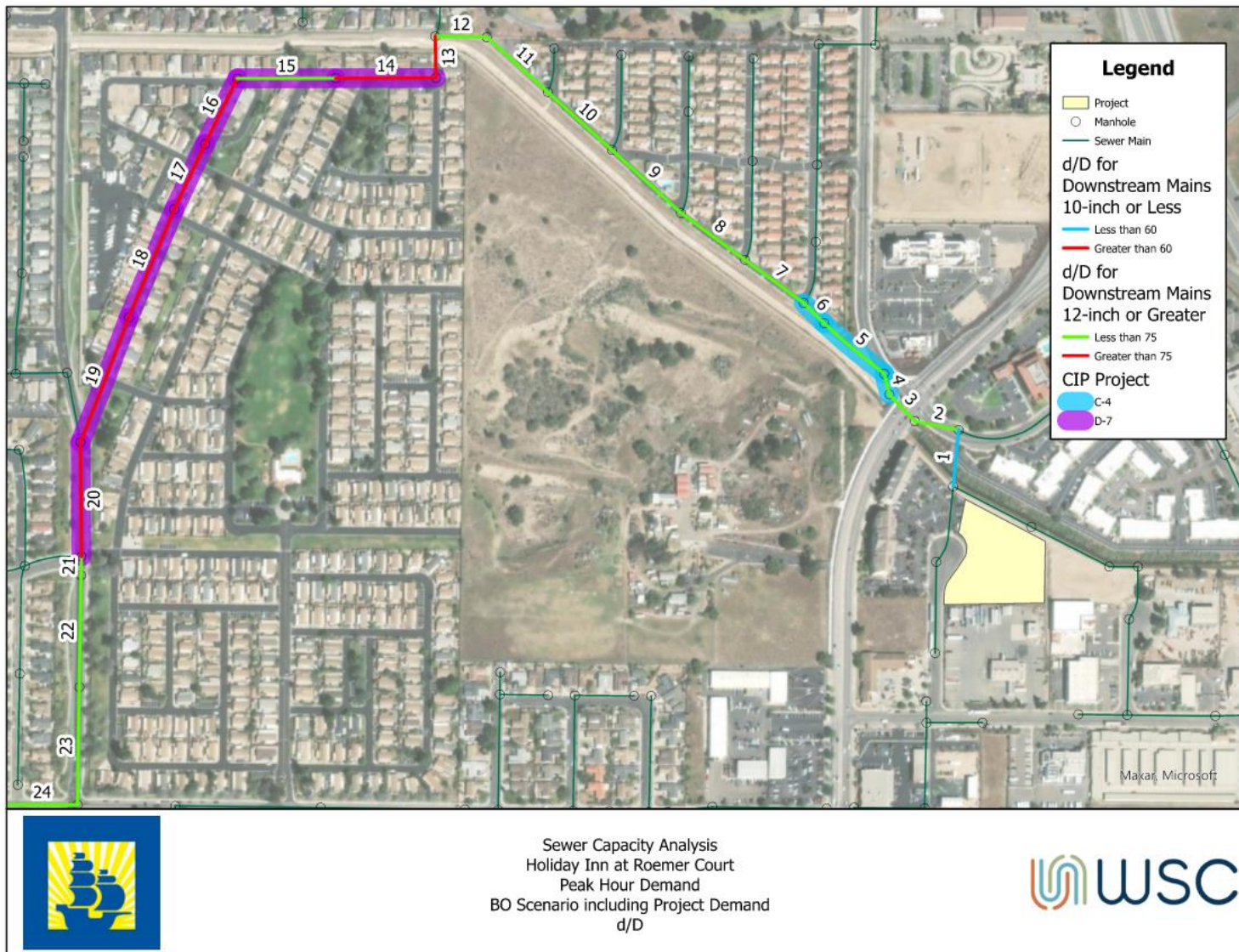


Figure 6. Modeled Buildout PHF and Project Demand Pipelines and Relation to CIP Projects.

The results of the impacts to the proposed CIP projects under various loading scenarios are summarized in Table 4.

Table 4. Impacts to CIP Projects Summary

Proposed Project	Status At:			
	Existing Flow (0-5 PHF)	5-10 PHF	Buildout PHF	Buildout PHF + Project
C-4	OK	OK	OK	OK
D-7	OK	1 segment over capacity	7 segments over capacity	7 segments over capacity

3.1 Conclusion

Based on the analysis completed in this TM, the City currently has capacity for the proposed project. The proposed project is not expected to trigger capacity constrained projects C-4 and D-7 identified in the 2012 Utilities Capacity Study.

Appendix A Flow Monitoring Results

Methods & Procedures & Equipment

Methods and Procedures

Utility Systems Science & Software provided Water Systems Consulting with an off the shelf, non-proprietary flow monitoring solution that included one state of the art Hach Flo-Dar® AV Sensor system. The project course of action is listed below. The US³ team:

- Assessed traffic control at the site on Garden Dr in Santa Maria, CA.
- Installed and removed traffic control in accord with site specific California Temporary Traffic Control Handbook (CATTCH) requirements for the installation, calibration and removal of equipment.
- Validated the site for suitability for sewer flow monitoring.
 - The Garden Dr MH had moderate open channel hydraulics with some turbulence due to inflow from lateral entering from the north. Monitored the downstream line to get total flow.
- Installed and calibrated the flow monitoring equipment at the site per manufacturer recommendations on 12/13/2022.
 - Follow-up on the installation confirmed equipment was reading properly.
 - Collected 15-minute interval depth and velocity data points over the entire monitoring period.
- Removed the equipment on 12/21/2022 and validated the data.
 - All of the equipment went through diagnostic testing before and after the study with less than a 1% deviation between manual and meter level readings and less than a 5% deviation between manual and meter velocity readings.
 - Equipment calibration was verified in accordance with manufacturer specifications.
- Prepared the data reports.
 - The table below contains a summary of the average (Avg) and maximum (Max) velocities (Vel) and levels (Lev) collected during this study as well as the calculated flow rates (Flow) and depth versus diameter ratios (d/D).

Pipe Size (in)	Avg Vel (fps)	Max Vel (fps)	Avg Lev (in)	Max Lev (in)	Avg Flow (gpm)	Max Flow (gpm)	Avg d/D	Max d/D
12	2.07	2.68	2.01	3.14	86.60	185.21	0.17	0.26

Equipment

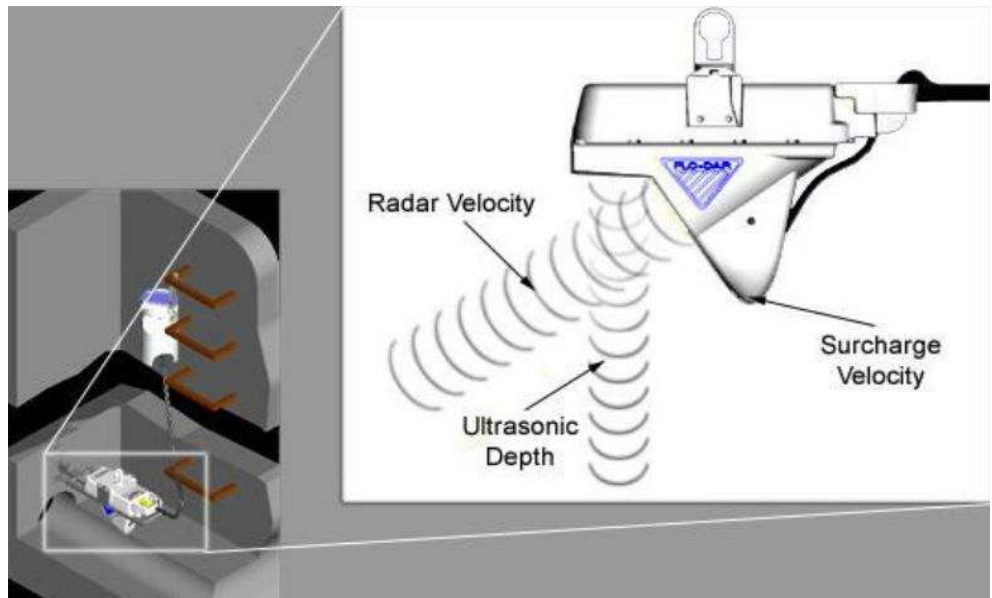


Figure above: Equipment installed for the Sewer Flow Monitoring Study



Figure above: Web-Enabled Flo-Dar® AV Sensor, Radar-Based Velocity/Area Flow Meter

FloDar® AV Sensor Specifications:

- **Enclosure**
 - IP68 Waterproof rating, Polystyrene
- **Dimensions**
 - 160.5 W x 432.2 L x 297 D mm (6.32 x 16.66 x 11.7 in.),
 - With SVS, D = 387 mm (15.2 in.)
- **Weight**
 - 4.8 kg (10.5 lbs.)
- **Operating Temperature**
 - -10 to 50°C (14 to 122°F)
- **Storage Temperature**
 - -40 to 60°C (-40 to 140°F)
- **Power Requirements**
 - Supplied by FL900 Flow Logger, Flo-Logger, or Flo-Station
- **Interconnecting Cable**
 - Disconnect available at both sensor and logger or Flo-Station
 - Polyurethane, 0.400 (±0.015) in. diameter; IP68
 - Standard length 9 m (30 ft), maximum 305 m (1000 ft)
- **Cables – available in two styles:**
 - connectors at both ends
 - connector from sensor with open leads to desiccant hub, desiccant hub with connector to logger. A potting/sealant kit will be included. This can be used to run the cable through conduit.
- **Certification**
 - Certified to: FCC Part 15.245: FCC ID: VIC-FLODAR24
 - Industry Canada Spec. RSS210. v7: IC No.: 6149A-FLODAR24

SURCHARGE DEPTH MEASUREMENT

- Auto zero function maintains zero error below 0.5 cm (0.2 in.)
- **Method**
 - Piezo-resistive pressure transducer with stainless steel diaphragm
- **Range**
 - 3.5 m (138 in.), overpressure rating 2.5 x full scale

VELOCITY MEASUREMENT

- **Method**
 - Radar
- **Range**
 - 0.23 to 6.10 m/s (0.75 to 20 ft/s)

- **Frequency Range**
 - 24.075 to 24.175 GHz, 15.2 mW (max.)
- **Accuracy**
 - $\pm 0.5\%$; ± 0.03 m/s (± 0.1 ft/s)

DEPTH MEASUREMENT

- **Method**
 - Ultrasonic
- **Standard Operating Range from Flo-Dar® Housing to Liquid**
 - 0 to 152.4 cm (0 to 60 in.)
- **Optional Extended Level Operating Range from Transducer Face to Liquid**
 - 0 to 6.1 m (0 to 20 ft.) with 43.18 cm (17 in.) dead band, temperature compensated.
- **Accuracy**
 - $\pm 1\%$; ± 0.25 cm (± 0.1 in.)

FLOW MEASUREMENT

- **Method**
 - Based on Continuity Equation
- **Accuracy**
 - $\pm 5\%$ of reading typical where flow is in a channel with uniform flow conditions and is not surcharged, $\pm 1\%$ full scale max.

SURCHARGE CONDITIONS DEPTH/VELOCITY DEPTH (Std with Flo-Dar® Sensor)

- **Surcharge depth supplied by Flo-Dar® sensor.**

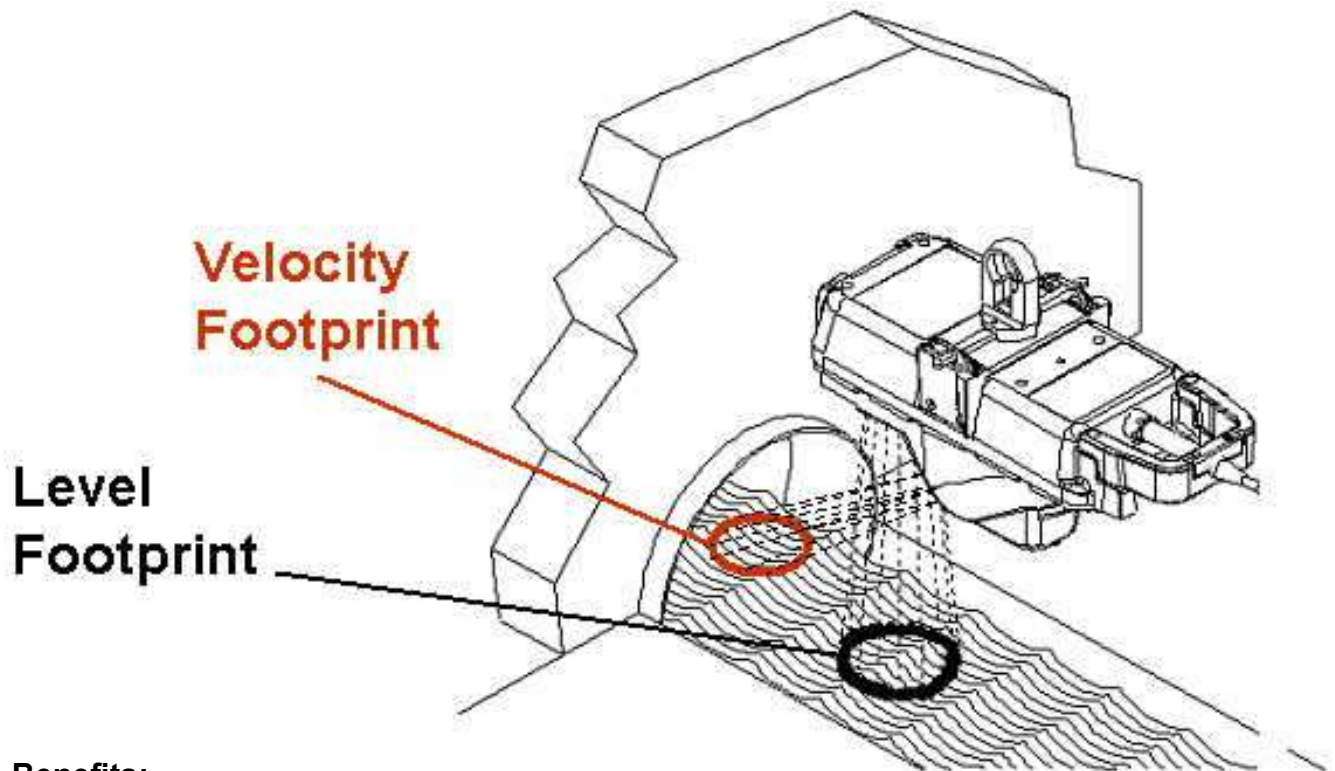
VELOCITY (Optional Surcharge Velocity Sensor)

- **Method**
 - Electromagnetic
- **Range**
 - ± 4.8 m/s (± 16 ft/s)
- **Accuracy**
 - ± 0.15 ft/s or 4% of reading, whichever is greater.
- **Zero Stability**
 - ± 0.05 ft/s

The Flo-Dar® Open Channel Flow Meters provide an innovative approach to open channel flow monitoring. Combining digital Doppler radar velocity sensing with ultrasonic pulse echo level sensing Flo-Dar® provides accurate open channel flow monitoring without the fouling problems associated with submerged sensors.

Perfect Solution for Difficult Flow Conditions:

- Flows with High Solids Content
- High Temperature Flows
- Caustic Flows
- Large Man-Made Channel
- High Velocities
- Shallow Flows



Benefits:

1. Personnel have no contact with the flow during installation.
2. Maintenance caused by sensor fouling is eliminated
3. Field Replaceable/Interchangeable Sensors and Monitors

How It Works

Flo-Dar® transmits a digital Doppler radar beam that interacts with the fluid and reflects back signals at a different frequency than that which was transmitted. These reflected signals are compared with the transmitted frequency. The resulting frequency shift provides an accurate measure of the velocity and the direction of the flow. Level is detected by ultrasonic pulse echo. Flow is then calculated based on the Continuity Equation:

$$Q = V \times A, \text{ Where } Q = \text{Flow}, V = \text{Average Velocity and } A = \text{Area}$$

Accurate Flow Measurements

Flo-Dar® provides the user with highly accurate flow measurements under a wide range of flows and site conditions. By measuring the velocity of the fluid from above, Flo-Dar® eliminates accuracy problems inherent with submerged sensors including sensor disturbances, high solids content and distribution of reflectors.

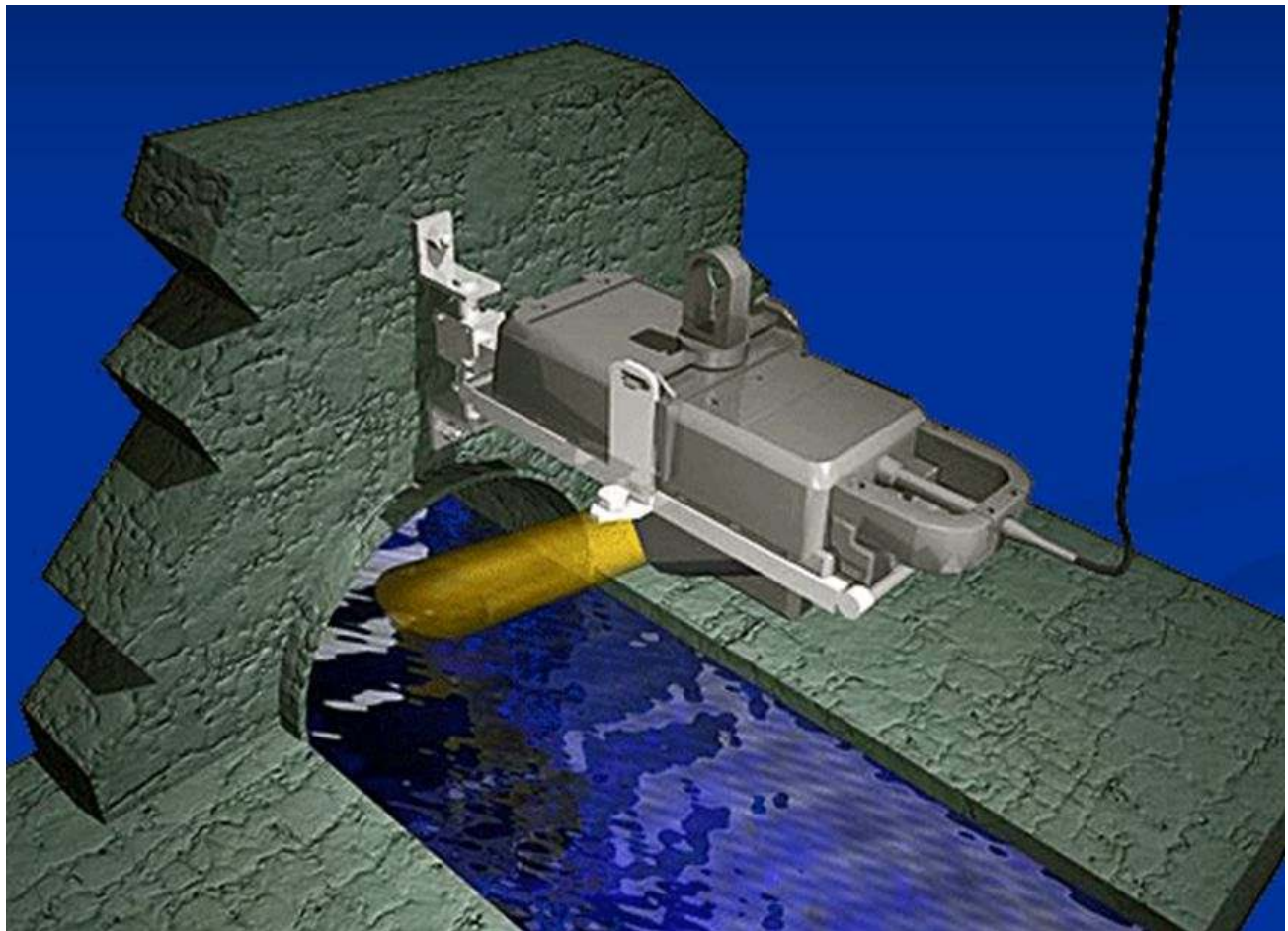


Figure above: US³ utilizes exclusively Hach March-McBirney Flo-Dar® Meters

US³ Company Information

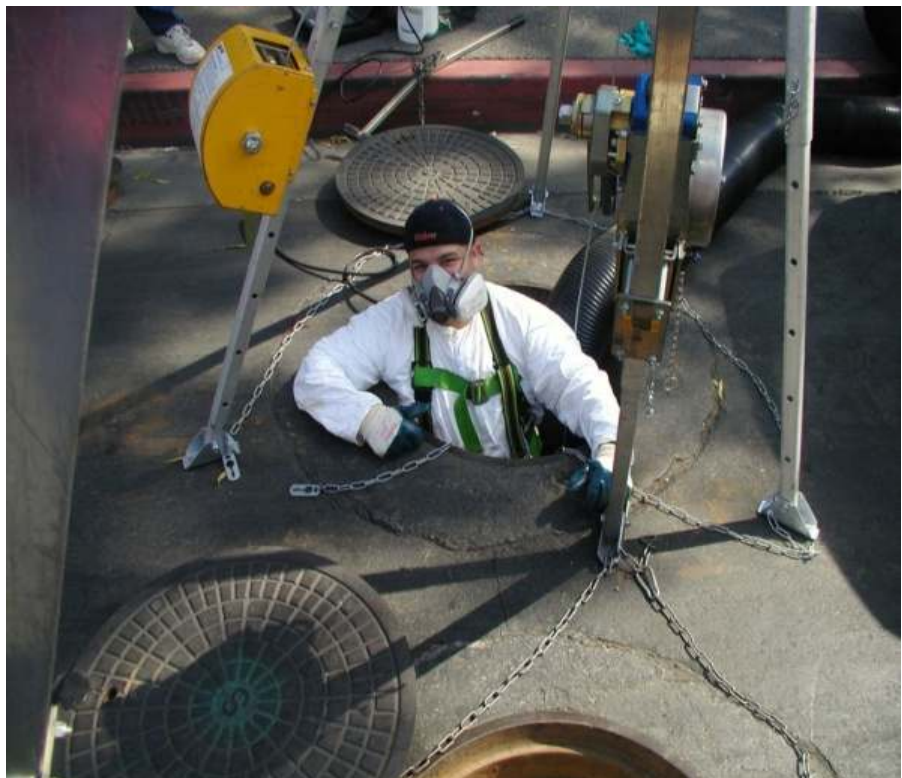
US³ is a California Corporation **Federal ID No. 33-0729605** and qualifies as a Minority Business Enterprise. US³ has certified as an MBE with the California Public Utility Commission's authorized clearinghouse, **Verification Number: 97ES0008**.

US³ is a specialty service company for the Water & Waste Water industry, providing monitoring and control for Utilities since 1996. US³ is in the forefront of this industry by taking the proven technological approaches developed in other high-tech industries and applying them to protect one of our most precious natural resources - our water.

US³ engineers and technical personnel have applied advanced instrumentation system technology to water/wastewater open channel flow monitoring, pipeline evaluation, engineering, and data analysis, all coupled to the power of the Internet. This unique integrated systems approach allows the company to bring greater insight and intelligence to gathering information about water/wastewater system performance of our clients, and in turn, to support the fulfillment of their commitments to manage and cost effectively design, operate, and maintain these systems.

Moreover, **US³** supports Municipalities, Consulting Engineering firms and other water/waste water systems integrators by providing temporary technical services for engineering, software programming and technical site maintenance and calibration site support work, primarily in the Water and Waste Water industries.

Figure at right: All US³ technicians are certified for Confined Space Entry.



Key Personnel Assigned

US³ provided the necessary resources to fully implement this project. Primary in support of this effort were the following personnel:

Mr. Mark Serres: Mr. Serres is a degreed electrical engineer with over 25 years of experience with fresh/wastewater systems, project management, and systems integration in relation to complex industrial systems. This includes experience in industrial automation and water/wastewater industries. Mr. Serres is responsible for assuring client satisfaction and marshalling the required resources to meet the project requirements.

Mr. Thomas Williams: Mr. Williams is an Engineering Manager with over 20 years of experience in complex systems development for wastewater monitoring. This experience includes hydraulic compatibility, instrumentation, communications and analysis. Mr. Williams is responsible for assuring that the required equipment is designed and calibrated to meet the project requirements.

Darlene Szczublewski, PE: Mrs. Szczublewski is a licensed Civil Engineer in multiple states. She has over 15 years of engineering experience with stormwater/wastewater related projects. She assisted in the completion of several Sanitary Sewer Evaluation Surveys and Capacity Analysis projects to meet Consent Decrees as well as completing numerous Infiltration and Inflow (I&I) studies for other clients. Mrs. Szczublewski has developed numerous flow data analysis techniques to present a clear informative picture of flow in a monitored system. Her work also includes the development of training programs for clients describing I&I and capacity analysis methodologies. Mrs. Szczublewski is responsible for analyzing the data as well as the data collection process and assuring that the reports meet the project requirements.

Name, title, address and telephone number of persons to contact regarding this US³ project.

Darlene Szczublewski, PE
Senior Civil Engineer
darlene.szczublewski@uscubed.com

1300 Hill Street
El Cajon, CA 92020
619-546-4281 (work)
619-246-5304 (cell)

Tom Williams
Engineering Manager
tom.williams@uscubed.com

1300 Hill Street
El Cajon, CA 92020
619-546-4281 (work)
619-398-7799 (cell)



Water Systems Consulting

2022.12 Garden MH

MH at ~2124 Garden Dr

Santa Maria, CA 93458

MH # unknown

Access:

MH at intersection of Channel Dr & Garden Dr, west of address

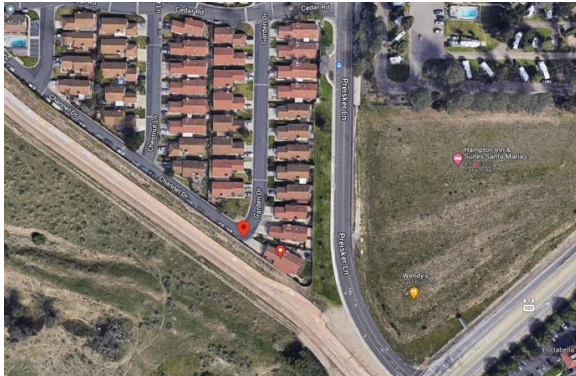
System Type:

Sanitary ☒

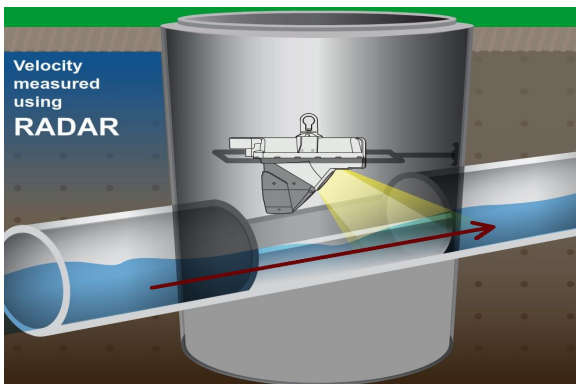
Storm ☐

Install Date: 12/13/2022

Map



Technology



Traffic Control



Flow Meter

Meter Depth: 80.3"

MH Coordinates: 34.979771, -120.435987

Moderate open channel hydraulics with some turbulence due to inflow from lateral

Avg Velocity	Avg Measured Level	Multiplier
2.1 fps	2.0"	1.0

Gas

O2	H2S	CO	LEL
20.9	0	0	0

Notes

Pipes entering from north & east; monitored the downstream line to get total flow.

Traffic Safety

Used arrow board, cones & signs in accord w/site-specific CATTCH requirements.

Land Use

Residential	Commercial	Industrial	Trunk
X			

Manhole Depth	98.5"
Monitored Pipe Size	12"
Inner Pipe Size (In/Out)	12"/12"
Pipe Shape	Round
Pipe Condition	Good
Manhole Material	Concrete
Silt	None observed
Velocity Profile Data	Passed
Velocity Profile Taken	0.4 2-D
Sensor Offset	18.2"
Sensor Dist. to Crown	6.2"
Sensor Direction	Downstream
Flow Heading	West



Meter Site Document

2022.12 Garden MH

MH at ~2124 Garden Dr

Santa Maria, CA 93458

Site



Manhole Before Install



Installation Process



Installed



Downstream



Downstream Pipe Size



Temporary Flow Study

Water Systems Consulting

2022.12 Garden MH

Meter Start Date		From	12/13/2022
Meter Stop Date		To	12/21/2022
Velocity (fps)		Level (in)	Flow (mgd)
Average	2.077	2.042	0.128
Maximum	2.680	3.140	0.267
Minimum	1.600	0.440	0.010
Pipe Size		12.000	
Estimated Capacity (mgd)		Not Calculated	
Capacity Used		Not Calculated	
Sensor Type		Hach - Flodar	

Utility Systems, Science and Software

1300 Hill St
El Cajon, CA 92020

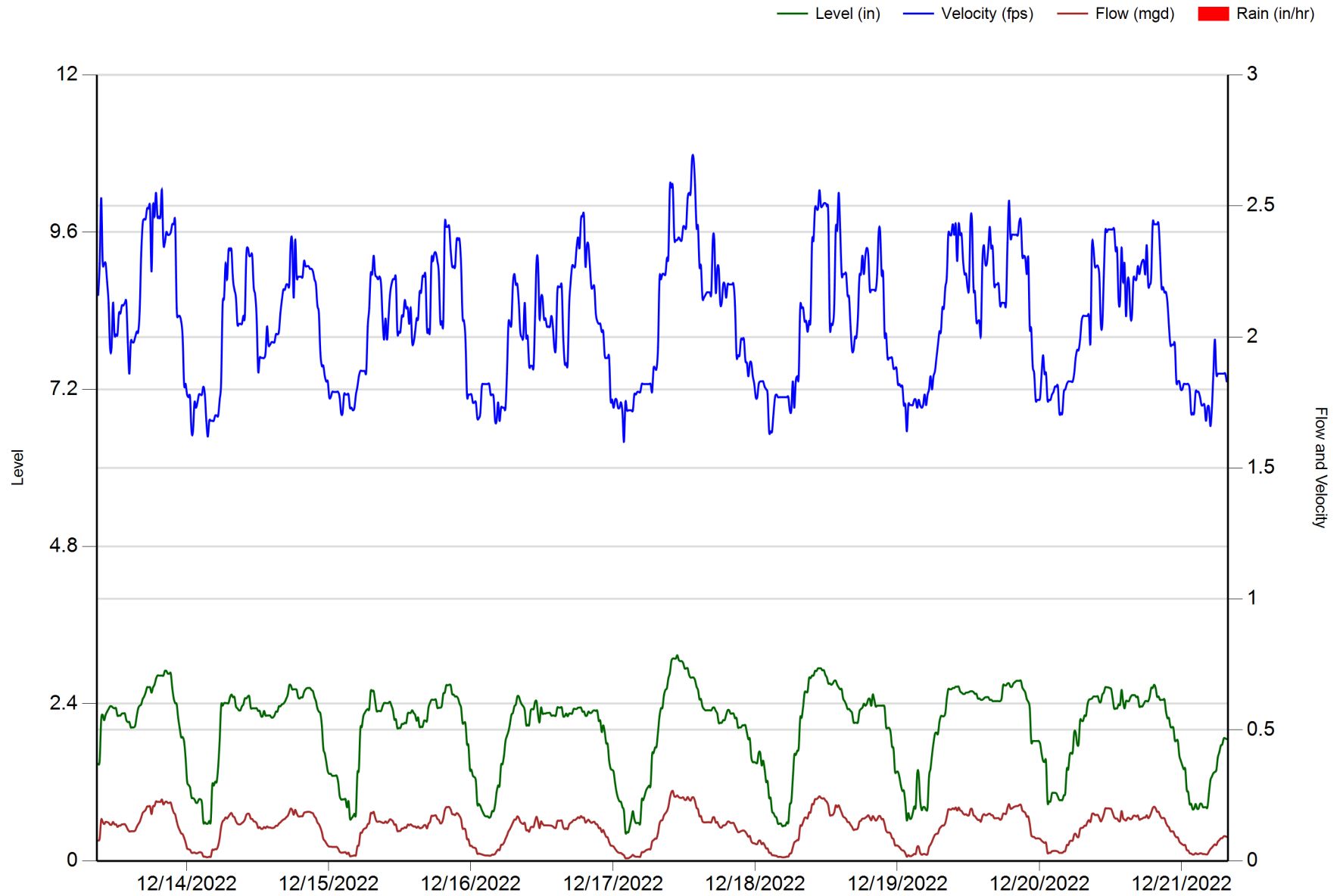
601 N. Parkcenter Dr, Suite 209
Santa Ana, CA 92705



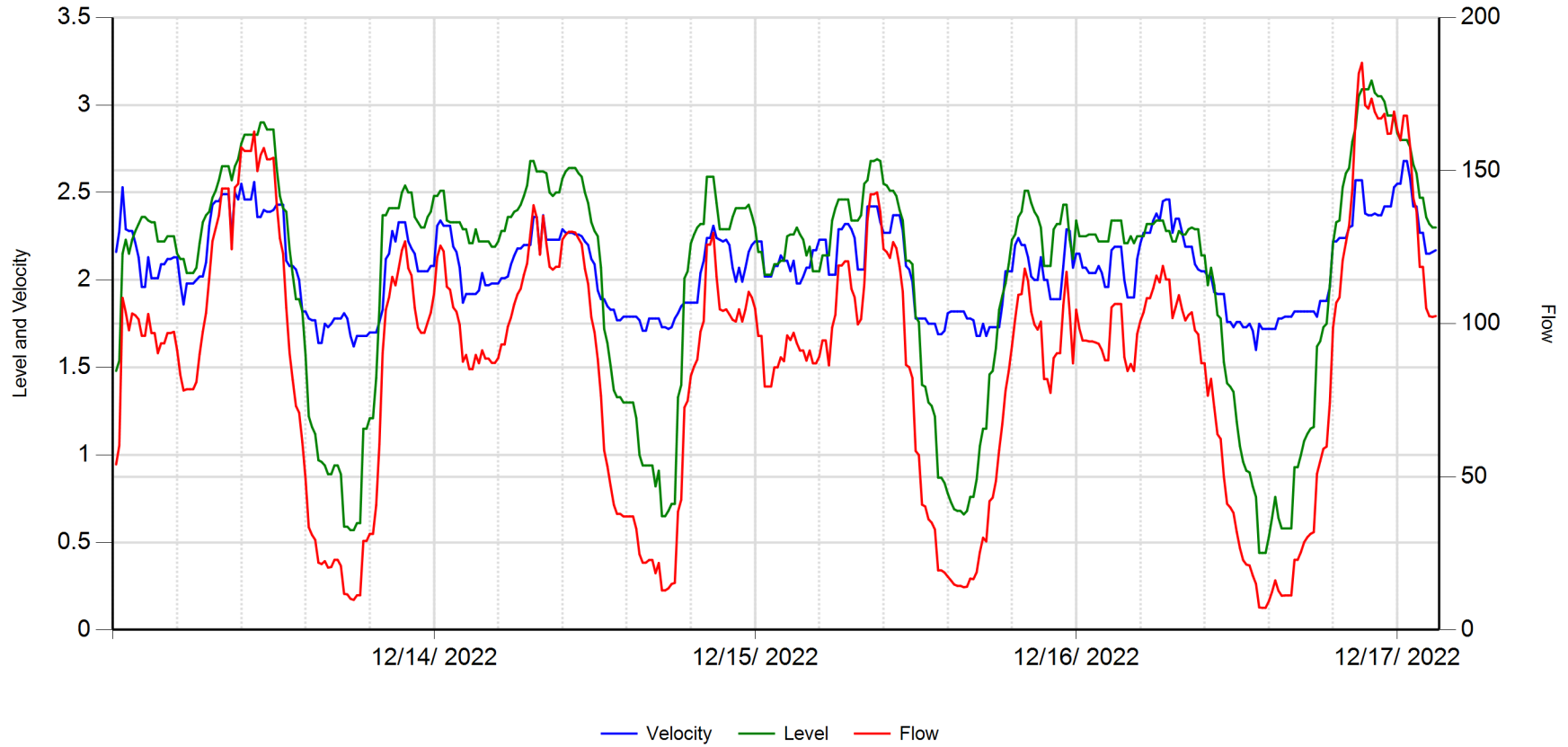


2022.12 Garden MH:
12/13/2022 thru 12/21/2022

Report Date: 12/22/2022
Customer: Water Systems Consulting
Group: Santa Maria Sewer FM
Site: 2022.12 Garden MH

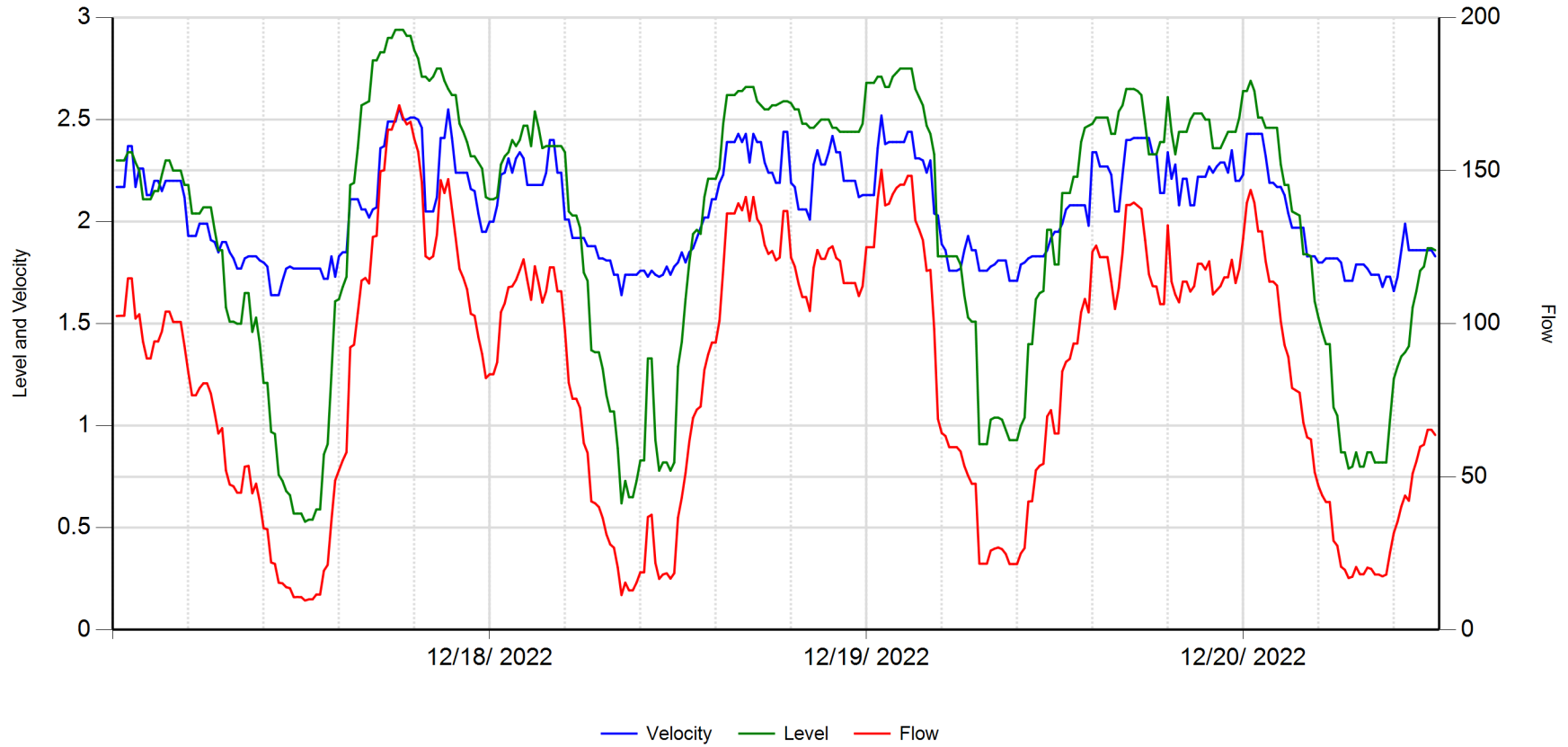


2022.12 Garden MH



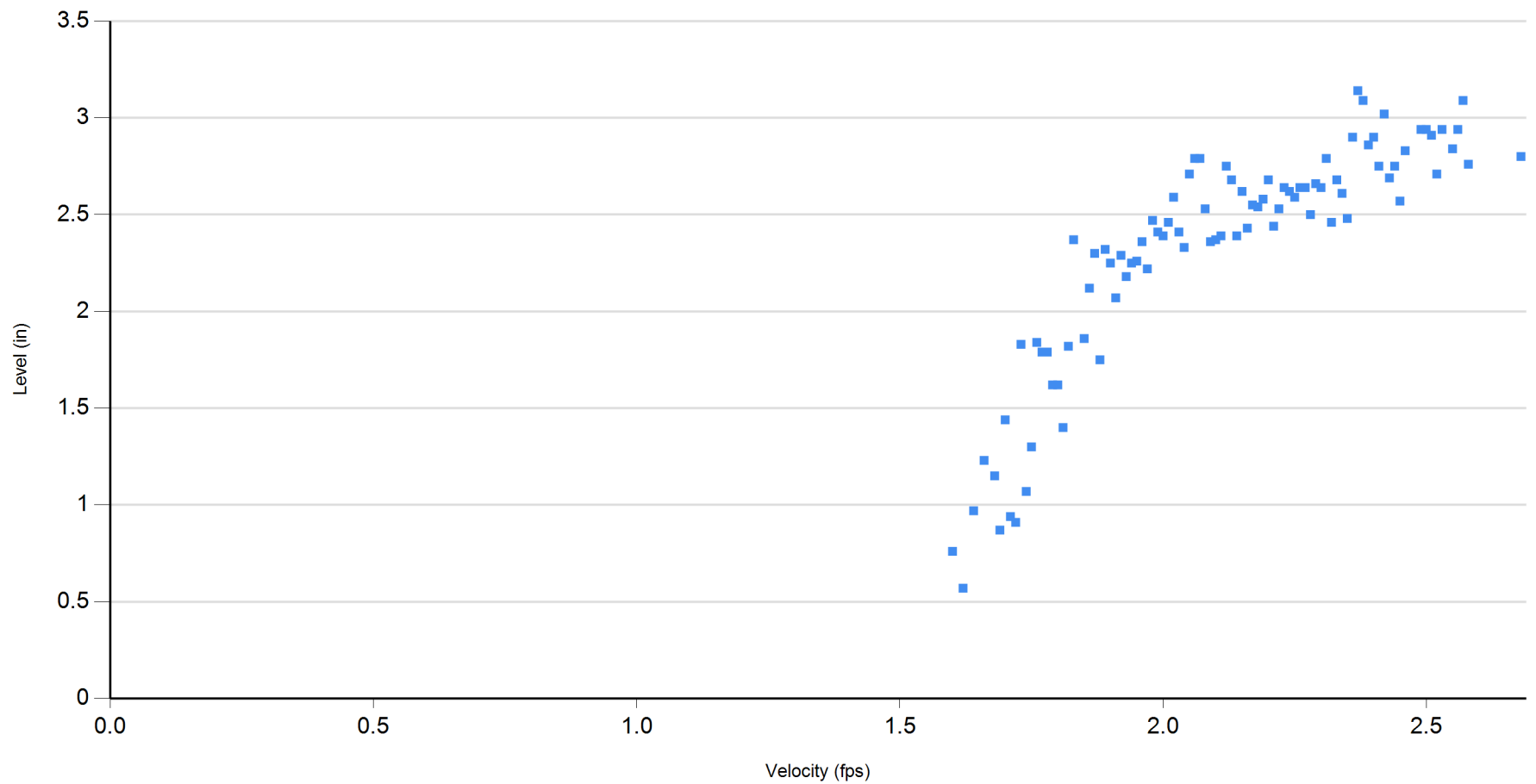
	Velocity (fps)	Level (in)	Flow (gpm)			
Average	2.069	2.025	87.602	RainFall	Inches	
Maximum	2.680	3.140	185.210			
Minimum	1.600	0.440	7.212			
					12/22/2022	

2022.12 Garden MH



	Velocity (fps)	Level (in)	Flow (gpm)			
Average	2.061	1.987	85.418	RainFall	Inches	
Maximum	2.560	2.940	171.331			
Minimum	1.640	0.530	9.588			
					12/22/2022	

2022.12 Garden MH



12/13/2022 thru 12/21/2022



12/22/2022 11:32:09 AM