MIDWAY CITY SANITARY DISTRICT

SEWER MASTER PLAN

AKM Consulting Engineers

949-753-7333

553 Wald, Irvine, CA 92618

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SEWER MASTER PLAN

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Submitted to:
Midway City Sanitary District
14451 Cedarwood Street
Westminster, CA 92683

Submitted by:
AKM Consulting Engineers
553 Wald
Irvine, California 92618
(949) 753-7333

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6-2 Sewer Analysis for Westminster Mall Redevelopment

SECTION ES
EXECUTIVE SUMMARY

ES-1 General

Midway Sanitary District's (MCSD) previous Sewer Master Plan is dated March 2022. The previous hydraulic model was developed and calibrated to flow monitoring data collected from ADS environmental in 2003. This information is outdated considering the changes in water use. Over the past decade, the State of California has passed several executive orders as follows:

January 2014: Drought State of Emergency Proclamation

April 2017: Drought State of Emergency Terminated

October 2021: Drought State of Emergency Proclamation (San Bernardino County)

March 2023: Drought State of Emergency Provision Update, which included the end of the 15% voluntary water conservation target and the end of agencies' Level 2 drought contingency plans.

The result of the aforementioned executive orders has been conscientious potable water conservation efforts throughout California which has led to a reduction in water use and therefore, a reduction in sewage generation.

The objective of this Sewer Master Plan (SMP) is to evaluate the MCSD's sewer collection system under the existing and future development conditions to provide a framework for undertaking the construction of new and replacement facilities to provide sewer service in a safe and efficient manner. The updated Sewer Master Plan accomplishes the following:

- Develop a new, calibrated, GIS based model of the sewer system
- Develop mapping tools that can assist in operation and maintenance practices and management of assets
- Evaluate the existing sewer system and impact of future development
- Assess the condition and capacity of sewer lift stations
- Review and update sewer system design and performance criteria
- Develop a comprehensive and prioritized Capital Improvement Program (CIP) for both pipelines and lift stations
- Prepare a report summarizing the findings of the project and listing all recommended improvements

ES-2 Study Area

Midway City Sanitary District (MCSD) is located in the northwest portion of Orange County, California. The area to which MCSD provides sewer service encompasses approximately 6,843 acres or 10.7 square miles of residential, commercial, industrial, and institutional land primarily in the City of Westminster and the unincorporated area of Midway City. Neighboring cities include Seal Beach to the west, Fountain Valley and Huntington Beach to the south, Santa Ana to the east, and Garden Grove and Stanton to the north.

The total MCSD service area population is currently estimated at 98,398. The average number of persons per household in the City of Westminster is currently estimated at 3.23 with a vacancy rate of 3.2 percent. MCSD's estimated population was previously 103,000.

ES-3 Flow Monitoring

Flow monitoring data collection and review is essential in developing sewer return ratios, unit flow factors, calibrating the system model, and estimating the ultimate average day and peak flows.

Twenty-six (26) sites, shown on Figure ES-1, were selected for collecting flow data. Each site was monitored between March 1, 2023 and April 11, 2023. Several storm events occurred during and leading up to this time period. It was a particularly wet season for Southern California.

ES-3.1 Base Infiltration

Base infiltration in the context of sewers refers to water entering the collection system from the ground through defective pipes, pipe joints, connections, or manhole walls. It is distinct from inflow and is generally measured during seasonally high groundwater conditions or in areas with consistent high groundwater conditions, such as the MCSD service area. Several of the basins that were flow monitored were found to have significant base infiltration, which are identified in Section 3-4.

ES-3.2 Rainfall Dependent Inflow and Infiltration

Inflow is the surface water that typically gains entry to the sewer system through perforated or unsealed manhole covers during rainfall events that can cause covers to become flooded. Inflow in addition to infiltration is often termed Rainfall Dependent Inflow and Infiltration (RDII). The sewer system design capacity must include allowances for these extraneous water components, which inevitably become a part of the total flow.

An analysis was performed to quantify RDII produced by each basin. RDII is the volume of flow measured above the normal expected dry weather flows due to a rainfall event. The RDII for each basin was “normalized” by dividing it by the rainfall volume (inches) and basin size (feet of pipe). Generally, values > 5 gal/ft/in are considered noteworthy and values > 10 gal/ft/in are considered excessive. Basins with a Normalized Volume RDII greater than 10 gal/ft/in are identified in Section 3-5 along with recommendations for evaluating and possible reducing RDII in the future.

ES-3.3 Peaking Formulas

The adequacy of a sewage collection system is evaluated based upon its ability to convey the peak flows. In a steady state hydraulic model, at any individual point in the system, peak dry weather flow (PDWF) is estimated by converting the total average tributary flow to peak dry weather flow by an empirical peak-to-average relationship. The steady state peaking formula commonly used in sewerage studies is of the following form:

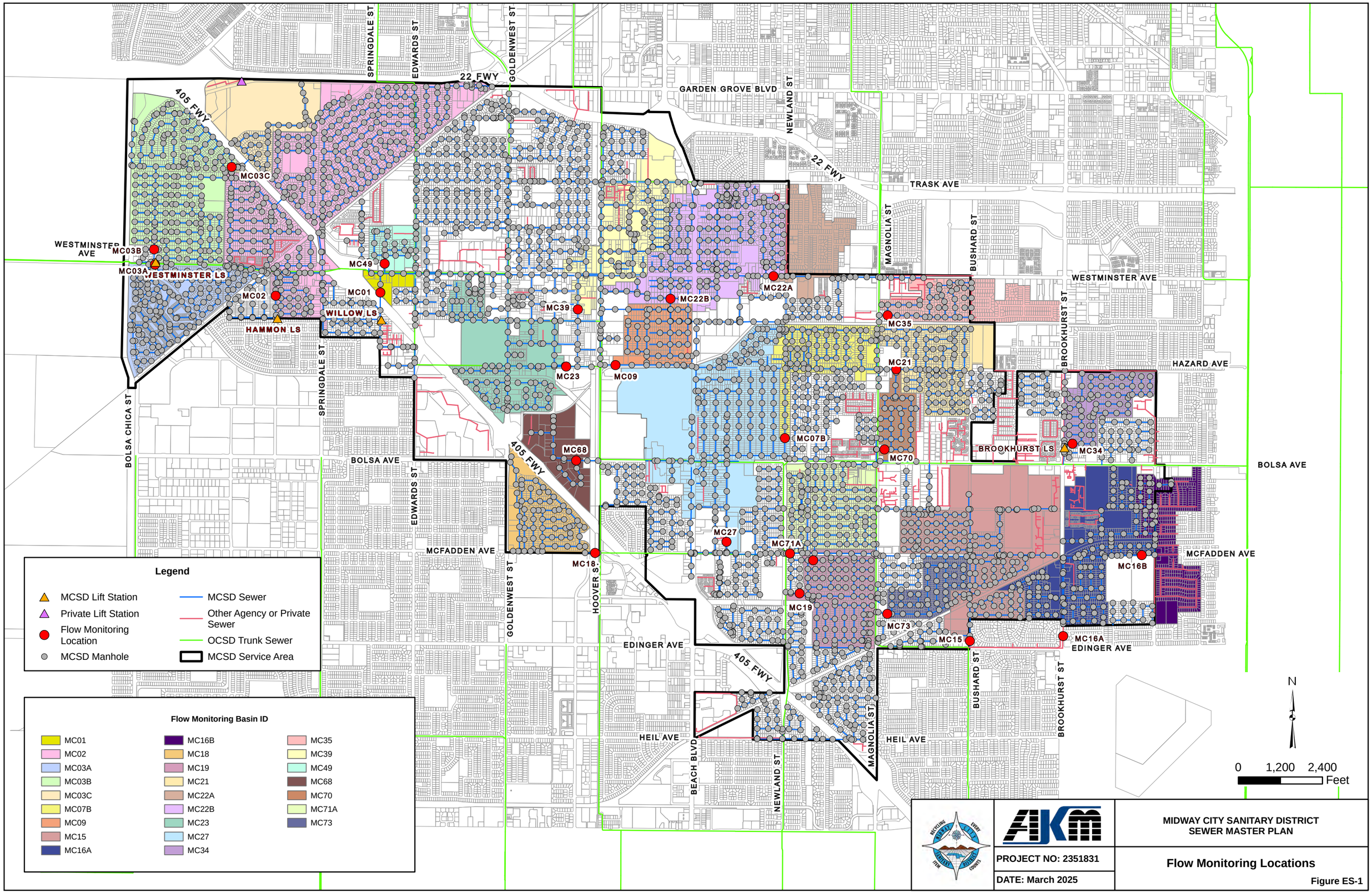
$$\mathbf{PDWF = a \times ADWF^{b}}$$

where PDWF = Peak Dry Weather Flow [mgd]
ADWF = Average Dry Weather Flow [mgd]
a, b = Peaking Formula Coefficients

The following relationships were developed from the 2023 flow monitoring data and used for this study. Details of the development of the peaking formulas are included in Section 3-6.

1. $\mathbf{PDWF = 1.50 \times ADWF^{0.92}}$ when base infiltration is known and/or included
2. $\mathbf{PDWF = 1.70 \times ADWF^{0.92}}$ when base infiltration is unknown and/or excluded

The reason for developing two peaking formulas is because not all areas of the service area were tributary to a flow monitor. When there is constant base infiltration adding to the total sewage flow conveyed in the gravity mains, the peaking coefficient (1.5) is dampened or lower than it normally would be. For the areas without flow monitors, the base infiltration is unknown. The higher peaking coefficient (1.7) is utilized to account for the peak flows that are actually generated within homes and businesses.



MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Flow Monitoring Locations

Figure ES-1

The peak wet weather flow (PWWF) has two components: peak dry weather flow (PDWF) and rainfall dependent inflow and infiltration (RDII) as expressed by the following equation:

PWWF = PDWF + RDII

At minimum peak wet weather flows shall be calculated utilizing the following formula:

Peak wet weather flow (PWWF) = 1.35 x peak dry weather flow (PDWF)

ES-4 Performance Evaluation and Design Criteria

Establishing performance standards is an important part of evaluating the existing sewer collection system, as it forms the basis for most of the system improvement recommendations. These standards include methodology for estimating sewage flows, and minimum design standards for the collection system pipes, lift stations, and force mains. A summary of performance evaluation, design, and service criteria is provided in Table ES-1. Detailed explanations of the sewer system criteria are provided in Section 4.

Sewage load estimates for future development and redevelopment areas were estimated using unit flow factors, as shown in Table ES-2. These factors were developed utilizing water use data, land use information, flow monitoring data and developed sewer return factors.

Table ES-1
Sewer System Criteria

Collection System	
Minimum Pipe Size	8-inch
Minimum Velocity	2.0 fps at average dry weather flow 3.0 fps at peak dry weather flow
Maximum Velocity	6.0 fps at peak dry weather flow for VCP 5.0 fps at peak dry weather flow for PVC
Minimum Slope	Refer to Table ES-3
Maximum Slope	Slope that generates the maximum flow velocity.
Pipe Depth to Diameter Ratio	0.64 at peak dry weather flows for all pipes existing prior to the Sewer Master Plan hydraulic analysis 0.50 at peak dry weather flows for all newly constructed pipes 15-inches and smaller 0.64 at peak dry weather flows for all newly constructed pipes 18-inches and larger 0.82 at peak wet weather flows for all pipes
Lift Station	
Pumps	• Minimum 2 each sized at peak wet weather flow • Minimum solids handling capacity 3”
Wet Wells	• Sized to limit pump cycling to less than 6 times/hr for motor HP up to 20; 4 times/hr up to 50 HP; 3 times/hr up to 75 HP; 2 times/hr 100 HP and above • Provide 30 minutes of storage at peak flow to allow response to a failure • Equipment to be maintained must be accessible without entering the structure
Ventilation	• 15-air change/hour minimum in wet wells operated continuously • 30-air change/hour minimum in wet wells not operated continuously • 15-air changes/hour minimum in dry well
Controls	Redundant system. Ultrasonic level sensor for primary level controls. Float operated back-up controls.
Emergency Power	Stationary source with automatic transfer switch
Telemetry	Dialer system at all pump stations to alert personnel in the event of a station failure
Force Mains	• Minimum velocity 3 fps • Maximum velocity 5 fps • Minimum size 4” • Air/Vacs installed in vaults

Table ES-1 (Continued)
Sewer System Criteria

Inverted Siphons	
Siphon Barrels	• Dual or multiple • Minimum diameters of 8-inches • Minimum velocity of 3 fps ADWF and 4 fps PDWF • Vertical curves, with no sharp horizontal angles or changes of grade • If crossing a waterway, minimum 5 ft between the top of the siphon and the level of possible scour in the waterway • Location away from an outlet of a lateral or a drop manhole • Invert at the outlet structure at least 0.1 ft lower than invert of inlet structure • Material is HDPE or PVC • Maximum angle of downstream leg no more than 15 degrees from horizontal • Maximum angle of upstream leg no more than 30 degrees from horizontal
Access Structures	• Located at each end of siphon, rectangular preferred • Sized to allow for any O&M procedure • Lined, coated, or protected with a suitable corrosion resistant material • Steps, ladders, access frames and covers, gratings and other appurtenances fabricated of 316 stainless steel • Ability to install temporary guard rails
Slide Gates, Stoplogs, Wiers	• Fabricated of 316 stainless steel
Valves	• No valves allowed
Air Jumpers	• Adequately sized between access structures • Minimum 6-inches in diameter • Material is HDPE or PVC • Designed to remove condensate with a minimum slope for drainage; overhead air jumpers that are self-draining to the access structures are preferred • Ability to accommodate inspection and cleaning methods

Table ES-2
Sewer Unit Flow Factors

Land Use Type	Sewer Unit Flow Factor
Single Family Residential	205 gpd/du
Mobile Home	185 gpd/du
Duplex	175 gpd/du
Triplex	130 gpd/du
Condominium	130 gpd/du
Qudruplex	130 gpd/du
MultiFamily	125 gpd/du
Apartment	125 gpd/du
Commercial	1,800 gpd/ac
Industrial	400 gpd/ac
Warehouse	400 gpd/ac
Hotel	125 gpd/room
Elementary School	15 gpd/student
Middle and High School	20 gpd/student
Restaurant	1,000 gpd/tsf
Parks/ Recreation/ Open Space	200 gpd/ac

Design criteria are established to ensure that the sewer collection system can operate effectively under all flow conditions. Each pipe segment must be capable of carrying peak flows without surcharging the system. Low flows must be conveyed at a velocity that will prevent solids from settling and blocking the system.

At a minimum, all pipes shall be 8 inches or larger in diameter and the velocity of flow in the pipe shall be greater than 2 ft/s during average flow conditions. This velocity will prevent deposition of solids in the sewer. A velocity of 3 ft/s is recommended during peak dry weather flow conditions, to resuspend any materials which may have already settled in the pipe. The minimum pipe sizes required by MCSD per the current Design and Construction Requirements for Sanitary Sewers is shown in Table ES-3. If there is insufficient flow to create the minimum velocities, greater slopes than those shown may be required. The peak flow velocity shall be less than 6 feet per second in vitrified clay pipe (VCP) and 5 feet per second in polyvinyl chloride pipe (PVC). The maximum allowable slope shall be the slope which generates these maximum flow velocities.

Table ES-3
Minimum Sewer Slopes

Pipe Size (in)	Minimum Slope
8"	0.0040
10"	0.0028
12"	0.0022
15"	0.0016
18" and larger	0.0012

ES-5 Existing System

The existing sewer system is made up of a network of gravity sewers, pump stations, and force mains made up of the following:

- 863,261 feet (163.5 miles)of gravity sewer pipe, ranging from 6-inches to 18-inches in diameter
- Four (4) sewer lift stations
- Twenty-four (24) inverted siphons
- 10.7 square mile service area
- Total existing average sewer load of about 9.157 mgd

The sewer collection system generally ties into Orange County Sanitation District (OCSD). The majority of the gravity system is an 8-inch diameter vitrified clay pipe. The majority of the system was constructed in the 1950;s and 1960's. A map of the existing sewer system is shown on Figure 5-4 of this report.

ES-6 Future System

The difference between the existing sewer system and the future sewer system is primarily the increase in loads due to infill developments and redevelopment. In general, the gravity sewer facilities will remain the same unless a capacity or condition deficiency is identified and requires the replacement of the pipe(s). At this point in time, there are no plans for the City to expand the system beyond its existing service area.

The areas incorporated into the future system analysis include the following:

1. Approximately 6.64 acres of vacant properties (not included in the future development areas), scattered throughout the service area. The estimated average sewage load from all of the vacant properties is 0.020032 mgd.
2. Three hundred and one (301) permitted accessory dwelling units (ADU). Loads for ADUs were based on an assumption of two persons per ADU and 42 gpd/person. The average sewage load attributed to future ADUs is 25,284 gpd or 0.025284 mgd.

3. Known future development locations based on specific plans and studies developed for the City of Westminster:
    a. 13552 Goldenwest Street – townhomes
    b. Bolsa Row – Multifamily residential, retail, restaurant, and hotel
    c. Moran Street - Multifamily residential, retail, office, and hotel
    d. Westminster Mall – Multifamily residential, entertainment, retail, office, restaurant, and hotel

The known future developments are estimated to generate an average sewage load of 0.856565 mgd.

The total future system average dry weather flow (ADWF) with future developments is estimated at 9.878 mgd.

ES-7 Hydraulic Model

To perform a detailed analysis of the sewer collection system, it is essential to create a mathematical model that is capable of simulating the operating and flow characteristics of the system. The simulations for this study were performed utilizing Aquanuity's Aquatwin Sewer, which is a 64 bit ArcGIS Pro extension application. The program manages and maintains the database that stores the sewer analysis input and output results.

The sewer system is modeled by entering pipe diameters, lengths, invert elevations and pipe roughness coefficients. The sewer model includes all MCSD's existing lift stations, manholes, and sewer pipes (excluding laterals, private sewers, and sewers belonging to other agencies). The model identifies points of connection to regional facilities owned and operated by the Orange County Sanitation District (OCSD) or other adjacent agency sewer systems.

The hydraulic model was created utilizing the following main steps:

1. As a part of the Sewer Master Plan project, a Sewer Geographic Information System (GIS) data was developed for MCSD and then the data was utilized as the basis of the geometry of the hydraulic model.
2. Existing sewer loads were generated by allocating water billing data (provided by the City of Westminster) to the sewer manholes and applying sewer return ratios. The sewer return ratios were adjusted by land use type to match the collected "dry weather" flow monitoring data.
3. Future sewer loads were developed for vacant areas, future ADUs and known future developments and applied to the model for the future scenario.

An existing and future condition scenario was created in the hydraulic model. The primary difference is the sewage loads applied in each scenario. The total existing average dry weather flow (ADWF) is estimated at 9.157 mgd. The total future ADWF is estimated at 9.878 mgd.

The model utilizes the average dry weather flows specified by the user and determines peak flows based upon relationships specified by the user. At the completion of a modeling run, output data is created for viewing on the screen or for printing. Output data for pipes include average and peak flow rate, velocity, pipe design and full capacity, and ratio of flow depth to pipe diameter (d/D).

ES-8 Capacity Analysis

The analysis of the sewer collection system was based upon the calculated existing and future peak dry weather flows. Pipes that exceed the following criteria are considered hydraulically deficient: Peak Dry Weather (PDWF) depth to diameter (d/D) > 0.64.

The total length of existing sewers found to be capacity deficient per the developed criteria is 24,261 feet. This is 2.8 percent (24,261 / 863,261) of the total existing system length.

When the future development loads were applied to the model, it was found that an additional 616 feet of existing sewer would become deficient per the developed criteria. The primary sewer of concern is the 365 foot section 15" pipe downstream of the Westminster Mall. This pipe is undersized based on the sewer loads estimated for the ultimate development conditions.

ES-8.1 Comparison of Flow Monitoring Depths and Model Depths

The flow monitoring depths were compared to the depths of flow predicted by the hydraulic model. It was found that some locations had depths measured higher than what the model predicts even though the model flows are generally conservative. One possible reason might be that the existing sewers have debris and/or grit in the pipes that the model is not simulating. The model utilizes a roughness value of 0.013 to represent vitrified clay pipe, but this does assume that the pipes are cleaned on a regular basis. It is recommended that MCSD clean the pipes in the locations identified in the comments of Table ES-4 and then reconfirm the flow depths. Flow depths can be reconfirmed by re-installing flow monitors in the pipes or by installing depth measurement devices beneath manhole lids (i.e. Smart Covers) that can measure the flow depths in the manholes. Flow monitoring locations are shown on Figure ES-1.

ES-8.2 Lift Stations

The lift stations should be capable of conveying the estimated peak wet weather flows (PWWF). Hammon Lift Station, Willow Lift Station, and Westminster Lift Station are all capable of pumping the estimated existing and future PWWF. Brookhurst Lift Station's pump capacity (210 gpm) does not meet the criterion as the existing and future peak wet weather flow is estimated at 229 gpm. Until the pumps are replaced, it is recommended that MCSD ensure that the pumps are maintained in good working order and are ready for use prior to each rainy season. MCSD should ultimately replace each pump with a minimum capacity of 265 gpm.

ES-9 Capital Improvement Program

The primary goal of the development of the improvement projects is to provide MCSD with a long-range planning tool for implementing its sewer capacity improvements in an orderly manner and a basis for financing these improvements. The projects were developed upon performing a hydraulic analysis of the gravity system and conducting field visits of the lift stations. The recommended improvement projects have been based upon the best information currently available. It should be updated as new information becomes available.

It must be emphasized that many of the as-built plans utilized to develop MCSD's GIS were not available or illegible. Some pipe information was calculated when possible. Some information was obtained from survey of manholes in the system. Flow monitoring is recommended to verify identified deficiencies prior to design and implementation of gravity sewer improvements.

The pipe sizes should be verified during the design of the sewers based on the design slope. The estimated future flow values can be utilized from the hydraulic model. The design engineer should verify that the selected pipe size and slope will meet MCSD's depth to diameter criteria.

The gravity main improvement projects are capacity related only. Condition assessment of the gravity mains will be completed as a separate project by MCSD now that the CCTV inspections were completed.

Table ES-4
Comparison of Flow Monitoring and Model Depths

No.	Location	Meter ID	Manhole ID	Direction of Flow	Pipe ID	U/S Pipe Size (in)	Area (Ac)	Flow Monitoring Data			Model Data			Comments/ Recommendations
								PDWF (mgd)	Depth (in)	PDWF d/D	PDWF (mgd)	Depth (in)	PDWF d/D	
1	1414 Willow Ln	MC01	MH16004	Monitor flow from north	GM15080	8	75	0.1170	5.29	0.66	0.1218	3.00	0.37	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
2	14148 Hammon Pl	MC02	MH11004	Monitor flow from north	GM11004	15	494	1.0870	10.75	0.72	1.0366	8.04	0.53	Capacity Deficiency verified via flow monitoring; Pipe measured as 13.75" diameter in field which may be the cause of higher flow depths in field
3	5120 Westminister Blvd	MC03A	MH04041	Monitor flow from west	GM04048	12	153	0.3290	6.51	0.54	0.3187	4.56	0.38	Pipe measured as 11" in diameter which may be the cause of higher flow depths in field
4	5121 Northwestern Way	MC03B	MH04017	Monitor flow from north	GM04009	12	264	0.6760	6.41	0.53	0.7411	8.28	0.69	Model is conservative; capacity deficiency not measured in field
5	13451 Milan St	MC03C	MH08048	Monitor flow from east	GM08053	12	133	0.3120	4.85	0.40	0.3097	5.52	0.46	
6	14864 Newland St	MC07B	MH54010	Monitor flow from north	GM54008	8	104	0.3440	5.46	0.68	0.2501	65.52	0.54	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
7	7591 Hazard Ave	MC09	MH41044	Monitor flow from east	GM41051	12	78	0.3470	7.53	0.63	0.4861	90.36	0.63	Pipe measured as 11.25" in diameter in field
8	16065 Bushad St	MC15	MH75053	Monitor flow from north	GM75061	18	297	1.1340	5.02	0.28	1.3746	60.24	0.53	
9	15956 Brookhurst St	MC16A	Outside	Monitor flow from north	GM81068	15	230	0.8360	10.42	0.69	0.9474	-	-	Outside Agency Sewer not modeled; Flow compared to GM81068 just upstream of GM81063.
10	10282 W Mcfadden Ave	MC16B	MH86027	Monitor flow from east	GM86032	10	117	0.2770	11.38	1.00	0.2704	136.56	0.53	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
11	7490 Mcfadden Ave	MC18	MH36017	Monitor flow from west	GM36021	10	101	0.2680	6.30	0.63	0.3301	75.6	0.51	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
12	15699 Skylinks Cir.	MC19	MH65075	Monitor flow from southeast	GM66001	12	118	0.4210	5.19	0.43	0.4761	62.28	0.45	
13	8652 Bermuda Ave	MC19A	MH65032	Monitor flow from northeast	GM65022	8	-	0.2360	5.18	0.65	0.1992	62.16	0.54	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
14	9039 Hazard Ave	MC21	MH70035	Monitor flow from east	GM70038	8	135	0.4350	6.08	0.76	0.5269	72.96	1	Capacity Deficiency verified via flow monitoring
15	8446 Westminister Blvd	MC22A	MH51026	Monitor flow from east	GM51037	12	97	0.5390	4.64	0.39	0.3805	55.68	0.45	Pipe measured as 12.75" in diameter which may be the cause of lower flow depths in field
16	7852 15th St	MC22B	MH40042	Monitor outlet flow to south	GM40050	12	261	1.6850	13.36	1.00	1.7477	160.32	1	Capacity Deficiency verified via flow monitoring
17	7351 Hazard Ave	MC23	MH32042	Monitor flow from west	GM32049	15	183	0.3900	5.53	0.37	0.4801	66.36	0.34	
18	15290 Van Buren St	MC27	MH56002	Monitor flow from north	GM55045	18	396	0.9110	7.24	0.40	0.8899	86.88	0.4	
19	10051 Premier Ave	MC34	MH78035	Monitor flow from east	GM78054	8	80	0.2140	4.24	0.53	0.2255	50.88	0.41	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
20	9043 Oasis Ave	MC35	MH60053	Monitor outlet flow to west	GM60079	8	128	0.3440	4.74	0.59	0.3590	56.88	1	Capacity Deficiency in model; reconfirm flow monitoring
21	14161 Olive St	MC39	MH31045	Monitor flow from north	GM31050	12	175	0.5610	5.03	0.42	0.6226	60.36	0.56	
22	13961 Willow Ln	MC49	MH15031	Monitor flow from north	GM15047	8	239	0.1420	3.29	0.41	0.1513	39.48	0.46	
23	7360 Bolsa Ave	MC68	MH35012	Monitor outlet flow to east	GM34018	10	74	0.1430	5.49	0.55	0.1516	65.88	0.36	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
24	9031 Greenville Ave	MC70	MH63044	Monitor flow from east	GM63048	8	50	0.2030	4.92	0.62	0.2156	59.04	0.47	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
25	8501 Mcfadden Ave	MC71A	MH56027	Monitor flow from north	GM56024	10	147	0.1590	2.70	0.27	0.1427	32.4	0.35	
26	9055 Larkspur Dr	MC73	MH66034	Monitor flow from east	GM66040	12	60	0.1190	2.72	0.23	0.1210	32.64	0.25	

**Flow depths can be reconfirmed by re-installing flow monitors in the pipes or by installing Smart Covers beneath manhole lids that can measure the flow depths in the manholes*

ES-9.1 Project Priorities

The sewer improvement projects were selected primarily based upon health and safety concerns and minimizing the possibility of overflows. The projects that will eliminate the capacity deficiencies in the gravity collection system are prioritized based upon the hydraulic analyses conducted during this study. For this study, the gravity sewer projects were prioritized as follows:

1. Facilities identified with capacity deficiencies under existing peak dry weather conditions. **Flow monitoring is recommended prior to project implementation.**
2. Facilities that have calculated future capacity deficiencies but are currently considered adequate under existing peak dry weather conditions. **Flow monitoring is recommended prior to project implementation.** When the measured peak flows exceed the pipe capacity (d/D = 0.64 during peak dry weather conditions), the projects should be reprioritized.
3. The projects were also prioritized based on the d/D at peak dry weather flow and the amount of flow exceeding the design capacity. Pipes with higher d/D estimates are placed at a higher priority. Pipes with more flow exceeding the design capacity are generally placed at a higher priority.

ES-9.2 Project Cost Estimates

The capacity improvement projects are developed based upon the results of the hydraulic analyses and the priorities of Section ES-9.1. The pipe improvement recommendations are typically based on the replacement of the existing pipes in the same alignment. Replacement costs are generally more conservative and will therefore allow MCSD more flexibility for each project.

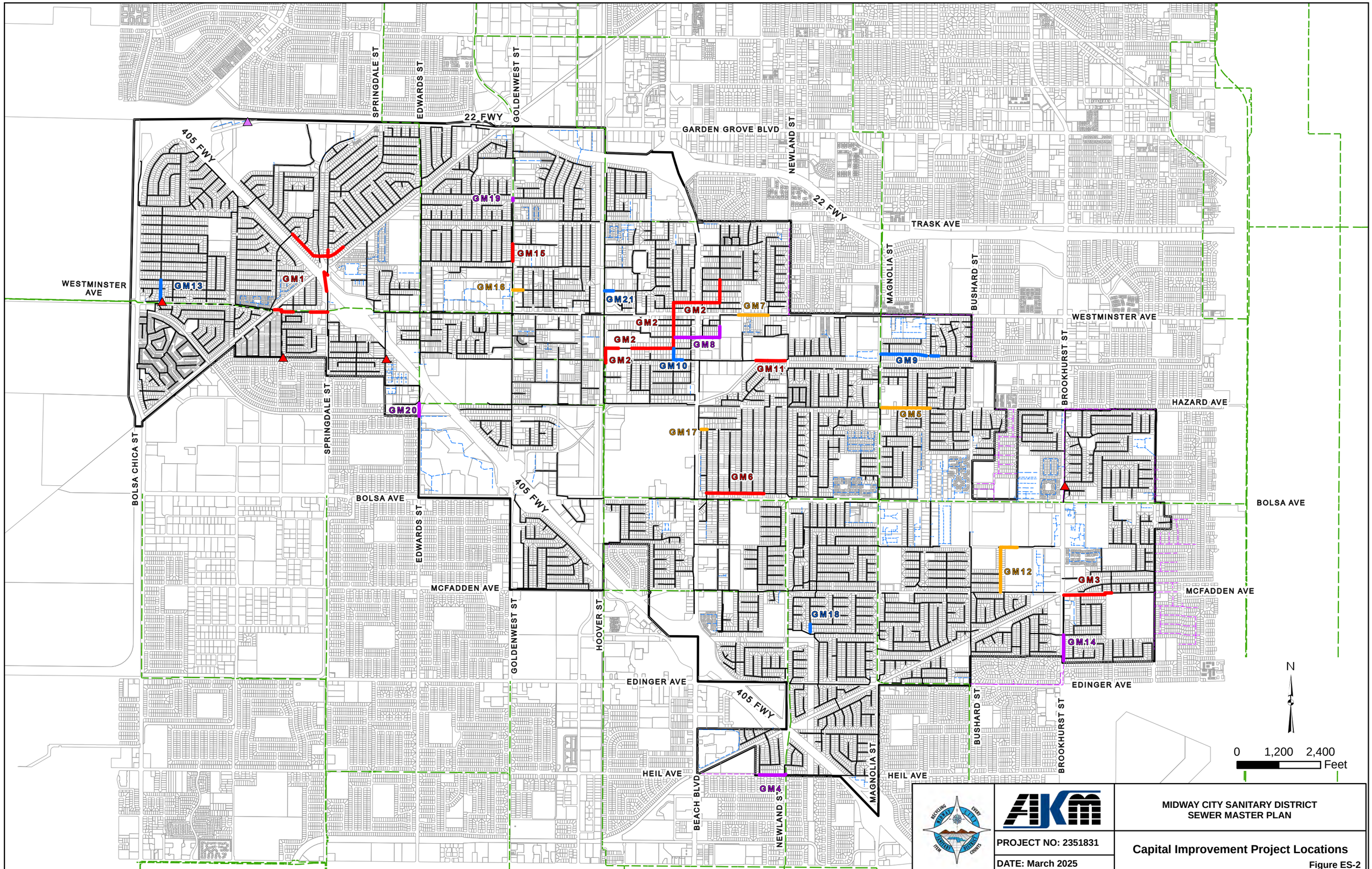
The total project costs include engineering design, administration, construction management and inspection and contingencies. The individual cost components are calculated as follows:

1. The construction costs to replace gravity pipes are based upon:
    a. $130 per diameter inch-foot of pipe for pipes 8-inches to 18-inches
    b. $120 per diameter inch-foot of pipe for pipes larger than 18-inches
2. Gravity Pipe Construction Cost = Pipe Length x Unit Pipe Cost
3. Lift station improvement costs are based on AKM's recent design and construction experience
4. Engineering design, administration, construction management and inspection Cost = 35% of the Construction Cost
5. Contingency Cost = 20% of the Construction Cost

Construction costs are expected to fluctuate as changes occur in the economy. These costs should therefore be reevaluated and updated annually based upon Engineering News Record (ENR) Index for the Los Angeles area (ENRLA), with the base ENRLA Index of 15778.36 for March 2025.

ES-9.3 Gravity Main Capacity Improvement Projects

The recommended gravity main capacity improvement projects are detailed in Table ES-5 and the locations are shown on Figure ES-2. The total estimated cost of the capacity related gravity main improvements is $75,092,464. This cost does not include condition related improvements. Sometimes the recommended CIP projects include system components beyond the calculated capacity deficiencies. This is because while some pipes between two deficient segments may not indicate a calculated deficiency, they need to be increased in size to match the upstream pipe. The projects are listed and numbered in order of priority in Table 9-1.Detailed maps of the project locations are provided in Section 9 of this report. The majority of the projects are intended to be removal and replacement of pipes.


22 FWY
405 FWY
GARDEN GROVE BLVD
TRASK AVE
WESTMINSTER AVE
HAZARD AVE
BOLSA AVE
MCFADDEN AVE
EDINGER AVE
HEIL AVE
SPRINGDALE ST
EDWARDS ST
GOLDENWEST ST
NEWLAND ST
MAGNOLIA ST
BUSHARD ST
BROOKHURST ST
BOLSA CHICA ST
HOOVER ST
BEACH BLVD
GM1
GM2
GM3
GM4
GM5
GM6
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GM10
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GM13
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GM15
GM16
GM17
GM18
GM19
GM20
GM21
N
0 1,200 2,400
Feet
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN
PROJECT NO: 2351831
DATE: March 2025
Capital Improvement Project Locations
Figure ES-2

Table ES-5
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM1	Westminster Blvd, Rancho Rd to Pegg St	GM10060	MH10064	MH10059	8	341	0.0010	12	1,560	531,242	823,426	Conduct study of basin and capacity deficiencies in area for overall solution. At the same time, study siphon at Westminster and Springdale for possible solution to eliminate the siphon and downstream deficiencies.
		GM10058	MH10058	MH10060	12	203	0.0016	15	1,950	396,728	614,928	
		GM10059	MH10060	MH10059	12	57	0.0011	15	1,950	111,150	172,283	
	Sioux Rd, north of Navajo Rd	GM14024	MH14021	MH14028	8	170	0.0010	10	1,300	221,234	342,913	
	Meinhardt Rd, Sioux Rd to northwest of White Cir	GM14030	MH14028	MH09045	8	239	0.0018	10	1,300	310,700	481,585	
		GM09048	MH09045	MH09044	8	172	0.0020	10	1,300	222,963	345,593	
		GM09039	MH09044	MH09027	8	414	0.0020	10	1,300	538,083	834,029	
		GM09030	MH09027	MH09023	8	275	0.0020	10	1,300	357,500	554,125	
		GM09022	MH09023	MH09022	8	176	0.0020	10	1,300	229,138	355,164	
	Navajo Rd, east of Sioux Rd	GM14025	MH14022	MH14029	8	310	0.0020	10	1,300	403,000	624,650	
		GM14033	MH14029	MH14027	8	221	0.0020	10	1,300	286,780	444,509	
	Springdale St at 405 Fwy	GM15023	MH15001	MH15015	8	557	0.0015	10	1,300	723,853	1,121,972	
		GM15001	MH15002	MH15001	8	130	0.0015	10	1,300	168,948	261,869	
	Westminster Blvd, west of Springdale St	GM10084	MH15032	MH10067	8	327	0.0021	10	1,300	424,892	658,583	
		GM10063	MH10067	MH10066	8	172	0.0007	10	1,300	223,561	346,520	
	Springdale Street at Westminster Blvd	GM15050	MH15030	MH15032	8	Double Barrel Siphon				2,500,000	3,875,000	
				Subtotal GM1		**3,763**				**7,649,772**	**11,857,146**	
GM2	Jackson St, 20th St to 18th St	GM50048	MH50027	MH50038	8	328	0.0032	12	1,560	511,680	793,104	Need to check slopes because plans were not clear. Alternative may be to review CCTV inspections and implement rehabilitation projects to reduce infiltration. Then reevaluate the capacity of these sewers.
		GM50060	MH50038	MH51003	8	326	0.0032	12	1,560	508,560	788,268	
	18th St, Jackson St to Pacific Ave	GM51003	MH51003	MH51002	8	20	0.0027	12	1,560	31,200	48,360	
		GM51002	MH51002	MH51001	8	237	0.0040	12	1,560	369,205	572,268	
		GM51001	MH51001	MH40011	8	253	0.0040	12	1,560	393,900	610,545	
		GM40012	MH40011	MH40010	8	338	0.0015	12	1,560	526,500	816,075	
		GM40011	MH40010	MH40009	8	483	0.0030	12	1,560	753,324	1,167,652	
	Pacific Ave, 18th St to 14th St	GM40010	MH40009	MH40020	10	167	0.0030	12	1,560	259,958	402,936	
		GM40023	MH40020	MH40026	10	331	0.0030	12	1,560	515,580	799,149	
		GM40034	MH40026	MH40030	10	168	0.0030	12	1,560	261,300	405,015	
		GM40045	MH40030	MH40043	10	330	0.0030	15	1,950	643,500	997,425	
		GM40051	MH40043	MH40042	10	20	0.0030	15	1,950	39,000	60,450	
		GM40050	MH40042	MH40058	10	305	0.0030	18	2,340	712,624	1,104,567	
	14th St, Pacific Ave to Hoover St	GM40064	MH40058	MH40055	18	592	0.0003	30	3,600	2,131,200	3,303,360	
		GM40062	MH40055	MH40052	18	604	0.0007	30	3,600	2,173,716	3,369,260	
		GM40060	MH40052	MH40051	18	372	0.0018	30	3,600	1,339,200	2,075,760	
		GM40059	MH40051	MH31046	18	375	0.0009	30	3,600	1,350,000	2,092,500	
	Hoover St, Pacific Ave to Main St	GM31064	MH31046	MH32007	18	368	0.0017	30	3,600	1,323,216	2,050,985	
		GM32011	MH32007	VP32001	18	20	0.0065	30	3,600	72,000	111,600	
				Subtotal GM2		**5,633**				**13,915,663**	**21,569,278**	

Table ES-5 (Continued)
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM3	McFadden Ave, Marlborough Cir to Brookhurst St	GM86027	MH86022	MH86020	10	193	0.0012	15	1,950	376,331	583,312	
		GM86026	MH86020	MH86021	10	42	0.0012	15	1,950	81,900	126,945	
		GM86025	MH86021	MH86018	10	350	0.0012	15	1,950	682,500	1,057,875	
		GM80053	MH86018	MH80024	10	350	0.0012	15	1,950	682,500	1,057,875	
		GM80050	MH80024	MH80022	10	142	0.0011	15	1,950	276,900	429,195	
		GM80049	MH80022	MH80021	10	350	0.0012	15	1,950	682,500	1,057,875	
				Subtotal GM3		**1,427**				**2,782,631**	**4,313,077**	
GM4	Heil Ave, Dana Cir to Newland St	GM59033	MH59030	MH59031	8	20	0.0000	-	-	-	-	Existing sewer is 12' deep with minimal slope; In lieu of upsizing, install two Smart Covers to monitor depths continuously
		GM59037	MH59031	MH59033	8	365	0.0002	-	-	-	-	
		GM59039	MH59033	MH59036	8	365	0.0002	-	-	-	-	
		GM59043	MH59036	VP59002	12	35	0.0000	-	-	-	-	
				Subtotal GM4		**784**				**13,000**	**20,150**	
GM5	Hazard Rd, Morgan St to Magnolia St	GM70042	MH70040	MH70039	8	93	0.0019	12	1,560	144,940	224,656	
		GM70041	MH70039	MH70038	8	163	0.0026	12	1,560	253,672	393,191	
		GM70040	MH70038	MH70037	8	117	0.0011	12	1,560	183,128	283,849	
		GM70039	MH70037	MH70036	8	280	0.0020	12	1,560	436,800	677,040	
		GM70038	MH70036	MH70035	8	282	0.0023	12	1,560	439,967	681,949	
		GM61067	MH70035	MH61060	8	266	0.0020	12	1,560	414,866	643,043	
		GM61066	MH61060	MH61059	8	191	0.0020	12	1,560	297,742	461,499	
				Subtotal GM5		**1,392**				**2,171,114**	**3,365,227**	
GM6	Alley north of Bolsa Ave, Wilson St to Adams St	GM54027	MH54020	MH54019	8	330	0.0027	10	1,300	429,182	665,232	
		GM54026	MH54019	MH54018	8	330	0.0027	10	1,300	429,182	665,232	
		GM54025	MH54018	MH54016	8	330	0.0027	10	1,300	429,026	664,990	
		GM54022	MH54016	MH54014	8	330	0.0027	10	1,300	429,026	664,990	
		GM54021	MH54014	MH54013	8	330	0.0027	10	1,300	429,026	664,990	
				Subtotal GM6		**1,650**				**2,145,442**	**3,325,435**	
GM7	Westminster Ave, west of Newland St to Jackson St	GM51026	MH51025	MH51024	12	233	0.0006	15	1,950	454,565	704,575	
		GM51025	MH51024	MH51023	12	121	0.0008	15	1,950	235,716	365,360	
		GM51024	MH51023	MH51022	12	134	0.0012	15	1,950	260,540	403,836	
		GM51023	MH51022	MH51020	12	346	0.0013	15	1,950	674,700	1,045,785	
		GM51021	MH51020	MH51019	12	266	0.0066	15	1,950	518,700	803,985	
		GM51020	MH51019	MH51017	12	266	0.0195	15	1,950	518,700	803,985	
	Jackson St, Westminster Ave to 16th St	GM51034	MH51017	MH51038	12	325	0.0017	15	1,950	633,750	982,313	
				Subtotal GM7		**1,691**				**3,296,670**	**5,109,839**	

Table ES-5 (Continued)
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM8	Jackson St, 16th St to 15th St	GM51052	MH51038	MH51055	12	316	0.0016	15	1,950	616,122	954,989	
	15th St, Jackson St to Pacific Ave	GM51063	MH51055	MH51054	12	243	0.0016	15	1,950	473,538	733,984	
		GM51061	MH51054	MH40049	12	253	0.0015	15	1,950	493,136	764,360	
		GM40058	MH40049	MH40048	12	258	0.0015	15	1,950	502,710	779,201	
		GM40076	MH40048	VP40001	12	45	0.0015	15	1,950	87,594	135,771	
		GM40056	VP40001	MH40046	12	204	0.0015	15	1,950	398,327	617,406	
		GM40054	MH40046	MH40044	12	246	0.0015	15	1,950	479,700	743,535	
		GM40052	MH40044	MH40042	12	37	0.0083	15	1,950	72,150	111,833	
				Subtotal GM8		**1,602**				**3,123,276**	**4,841,078**	
GM9	Oasis Ave, east of Glitter St to Magnolia St	GM69102	MH69088	MH69087	8	230	0.0020	10	1,300	298,935	463,349	
		GM69100	MH69087	MH69086	8	123	0.0030	10	1,300	159,900	247,845	
		GM69099	MH69086	MH69085	8	250	0.0020	10	1,300	324,779	503,407	
		GM69098	MH69085	MH69084	8	271	0.0020	10	1,300	352,040	545,662	
		GM69097	MH69084	MH69083	8	280	0.0019	10	1,300	363,922	564,079	
		GM60080	MH69083	MH60053	8	273	0.0020	10	1,300	354,289	549,148	
		GM60079	MH60053	MH60052	8	240	0.0021	10	1,300	311,961	483,540	
				Subtotal GM9		**1,666**				**2,165,826**	**3,357,030**	
GM10	12th St, east of Pacific Ave	GM41007	MH41007	MH41005	12	250	0.0005	15	1,950	488,456	757,106	
	Pacific Ave, 13th St to 14th St	GM40072	MH41005	MH40059	12	326	0.0006	15	1,950	635,291	984,700	
				Subtotal GM10		**576**				**1,123,746**	**1,741,806**	
GM11	13th St, west of Newland St	GM52014	MH52013	MH52012	10	153	0.0009	12	1,560	238,664	369,930	
		GM52013	MH52012	MH52011	10	350	0.0009	12	1,560	545,501	845,526	
		GM52012	MH52011	MH52010	10	340	0.0008	12	1,560	530,915	822,918	
		GM52011	MH52010	MH52009	10	381	0.0021	12	1,560	594,360	921,258	
				Subtotal GM11		**1,224**				**1,909,440**	**2,959,632**	
GM12	Bishop Pl, east of Swallow Ln	GM79044	MH79008	MH79007	8	229	0.0021	10	1,300	297,700	461,435	
		GM79043	MH79007	MH79006	8	195	0.0020	10	1,300	253,604	393,086	
		GM79042	MH79006	MH79005	8	51	0.0020	10	1,300	66,170	102,564	
	Swallow Ln, Bishop Pl to McFadden Ave	GM79041	MH79005	MH79017	8	67	0.0019	10	1,300	87,009	134,864	
		GM79063	MH79017	MH79023	8	350	0.0020	10	1,300	455,000	705,250	
		GM79086	MH79023	MH79030	8	350	0.0020	10	1,300	455,000	705,250	
		GM80002	MH79030	MH80001	8	262	0.0020	10	1,300	340,691	528,071	
		GM80023	MH80001	MH80011	8	264	0.0020	10	1,300	343,200	531,960	
				Subtotal GM12		**1,768**				**2,298,374**	**3,562,480**	

Table ES-5 (Continued)
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM13	Winthrope St, Harvard Rd to Northwestern Wy	GM04009	MH04003	MH04017	12	250	0.0015	15	1,950	486,798	754,537	
	Yankton Wy, Northwestern Wy to Westminster Blvd	GM04034	MH04017	MH04029	12	350	0.0015	15	1,950	682,500	1,057,875	
				Subtotal GM13		**600**				**1,169,298**	**1,812,412**	
GM14	Brookhurst St, McFadden Ave to Banbury Ave	GM81023	MH81010	MH81032	15	398	0.0003	18	2,340	931,320	1,443,546	Ensure the overflow at MH80021 to westerly 10" sewer is open. These sewers are then not considered deficient.
		GM81041	MH81032	MH81058	15	272	0.0010	18	2,340	636,480	986,544	
		GM81068	MH81058	MH81041	15	66	0.0010	18	2,340	154,440	239,382	
				Subtotal GM14		**736**				**1,722,240**	**2,669,472**	
GM15	Goldenwest St, Fenwax Dr to Humboldt Ave	GM30001	MH29050	MH30007	8	496	0.0030	10	1,300	644,683	999,259	
GM16	Wyoming St, Pine St to Goldenwest St	GM30043	MH30034	VP30001	8	295	0.0040	10	1,300	383,071	593,760	
GM17	Roosevelt Ave, west of Adams St	GM42004	MH42003	MH53011	8	172	0.0010	10	1,300	223,834	346,943	
GM18	Pensacola St, St. Andrews Ave to Palos Verde Ave	GM65079	MH65064	MH66001	8	227	0.0020	10	1,300	294,541	456,539	
GM19	Goldenwest St at Bestel Ave	GM29010	MH29001	MH29006	8	73	0.0004	10	500	36,605	56,738	Confirm slope of pipe
GM20	Edwards St, south of Industry Wy	GM24015	MH24020	VP24001	15	365	0.0010	24	2,880	1,052,525	1,631,413	
GM21	Wyoming St east of Hoover St	GM39046	MH39044	MH30041	8	250	0.0030	10	1,300	325,000	503,750	
					Total	**26,389**			**Total**	**48,446,751**	**75,092,464**	

[1] *Unit costs for construction are based on $130/diameter-inch-ft for 8" thru 18"; $120/diameter-inch-ft for 21" thru 30"*

[2] *Construction cost = length x unit cost*

[3] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

ES-9.4 Lift Station Improvement Projects

The total estimated cost of the lift station improvements is $7,564,000. Detailed descriptions of the lift stations and the developed recommendations are provided in Section 5 of this report. Cost estimates are shown in Table ES-6 through Table ES-9.

The existing lift stations include redundant facilities for their continued operation in case of emergencies. They will be further improved with the implementation of complete dual discharge pipes/forcemains. Therefore, emergency storage facilities are not included in this CIP. MCSD should investigate the feasibility of adding emergency storage at each lift station for possible implementation in the future.

The Brookhurst Lift Station is considered the first priority due to the fact that it is the only station without a dual forcemain and its pumping capacity was identified as being less than the estimated peak wet weather flow with one pump.

It is recommended that the lift station projects will be completed all together at each lift station when the pumps are in need of replacement and/or based on MCSD's budget. The typical pump useful life is 10-15 years.

Table ES-6
Brookhurst Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with grated fall protection	1	$50,000	$50,000	$77,500
2	Replace pumps with new 265 gpm pumps	2	$120,000	$240,000	$372,000
3	Discharge piping/forcemain replacement (6-inches); Add dual forcemain	1	$350,000	$350,000	$542,500
4	Replace wet well piping with 316L SS piping	2	$50,000	$100,000	$155,000
5	Electrical and control system improvements	1	$300,000	$300,000	$465,000
			Total	**$1,040,000**	**$1,612,000**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

Table ES-7
Hammon Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with guard rails and grated fall protection	2	$65,000	$130,000	$201,500
2	Discharge piping replacement	1	$500,000	$500,000	$775,000
3	Replace wet well piping with 316L SS piping	2	$60,000	$120,000	$186,000
4	Electrical and control system improvements	1	$300,000	$300,000	$465,000
5	Replace pumps	2	$150,000	$300,000	$465,000
			Total	**$1,350,000**	**$2,092,500**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

Table ES-8
Westminster Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with guard rails and grated fall protection	2	$70,000	$140,000	$217,000
2	Discharge piping replacement	1	$400,000	$400,000	$620,000
3	Replace wet well piping with 316L SS piping	2	$60,000	$120,000	$186,000
4	Electrical and control system improvements	1	$300,000	$300,000	$465,000
5	Replace pumps with new pumps	2	$150,000	$300,000	$465,000
			Total	**$1,260,000**	**$1,953,000**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

Table ES-9
Willow Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with guard rails and grated fall protection	2	$70,000	$140,000	$217,000
2	Discharge piping replacement	1	$400,000	$400,000	$620,000
3	Replace wet well piping with 316L SS piping	2	$50,000	$100,000	$155,000
4	Install site fencing	1	$50,000	$50,000	$77,500
5	Electrical and control system improvements	1	$300,000	$300,000	$465,000
6	Replace pumps with new pumps	2	$120,000	$240,000	$372,000
			Total	**$1,230,000**	**$1,906,500**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

ES-9.5 SCADA System Upgrades

The Supervisory Control and Data Acquisition (SCADA) system is recommended to be upgraded in the next three (3) years, and switch to fiber optic communication. The estimated base cost for this project is $400,000.

ES-9.6 Condition Assessment

In 2024, MCSD contracted with Empire Pipe Cleaning and Equipment for Closed Circuit Television (CCTV) inspection of all sewer pipes and manholes. The work was completed in January 2025. The work was completed in January 2025. It included CCTV inspection of 851,187 feet of gravity sewer mains and Level 2 inspections of 3,216 manholes, per National Association of Sewer Services Companies (NASSCO) standards.

The next step is to assess the condition of the pipes and manholes based on the CCTV inspections completed. Structural deficiencies will be identified, and repair and replacement projects will be developed. Then the projects will be prioritized along with capacity related projects. This will be done by considering the condition,

capacity, as well as additional criteria identified in the Statewide Waste Discharge Order 2022-0103-DWQ, including:

- Areas that hold a high level of environmental consequences if vulnerable to collapse, failure, blockages, capacity issues, or other system deficiencies.
- Vicinity to surface waters, steep terrain, high groundwater levels, or environmentally sensitive areas.
- Vicinity to receiving waters with bacterial-related impairment.

The estimated cost for the condition assessment project is $250,000

ES-9.7 Repair and Rehabilitation Projects

Repair and rehabilitation projects developed in the condition assessment may include spot repairs, lining and/or full replacement of sewers. It is assumed that repair and rehabilitation projects will need to be completed over time. The annual budget for repair and rehabilitation projects is set at $850,000. The budget for gravity main rehabilitation is $500,000 and the budget for manhole rehabilitation is $350,000.

ES-9.8 Flow Monitoring

Cleaning and follow-up flow monitoring is recommended at nine locations (see Section 8-2 and Table 8-2) to reconfirm flow depths in sewers that were found to have depths higher in the field than what is predicted in the hydraulic model. Follow-up flow monitoring is also recommended to enable post-rehabilitation RDII reduction to be evaluated (see Section 3-5). An annual budget for follow-up flow monitoring is set at $50,000 per year.

ES-9.9 Depth Monitors

It is recommended that depth monitors, such as SmartCovers, be placed in areas with higher normalized RDII and/or areas with possible capacity related concerns (see Section 3-5). The estimated cost for the purchase and installation of one SmartCover is about $10,000. Assuming the installation of twenty SmartCovers in the future, the budget is set at $200,000.

ES-9.10 Manhole Cover Replacements or Improvements

It is recommended to replace manhole covers with new ones with a single vent hole and/or install sufficient plugs in manhole covers to minimize inflow from surface flooding (see Section 3-5). An annual budget for manhole cover replacements or improvements is set at $50,000 per year.

ES-9.11 Capital Improvement Project Cost Summary

The Capital Improvement Project costs are summarized as follows:

1. Gravity Main Capacity Improvements = $31,782,714
2. Lift Station Improvements = $7,564,000
3. SCADA System Upgrades = $400,000
4. Condition Assessment = $250,000
5. Repair and Rehabilitation Projects = $850,000 / year
6. Flow Monitoring = $50,000 / year
7. Depth Monitors = $200,000
8. Manhole Cover Replacements or Improvements = $50,000 / year

The costs provided in this study are based on existing conditions. As previously stated, construction costs are expected to fluctuate as changes occur in the economy. These costs should therefore be reevaluated and

updated annually based upon Engineering News Record (ENR) Index for the Los Angeles area (ENRLA), with the base ENRLA Index of 15778.36 for March 2025.

ES-9.12 High Priority Projects

MCSD will need to evaluate the sewer budget and staff availability annually and determine which projects are feasible to implement. The high priority projects that should be focused on over the next five years are as follows:

1. Condition Assessment ($250,000) – implement within next year
2. Gravity Main Improvement Project GM-1 ($11,857,146) – implement within next three years

   Study of basin and capacity deficiencies in area tributary to Hammon Lift Station. At the same time, study siphon at Westminster and Springdale for possible solution to eliminate the siphon and downstream deficiencies. Implement solution.
3. SCADA System Upgrades ($400,000) – implement within next three years
4. Brookhurst Lift Station Improvements ($1,612,000) – implement within next five years
   a. Replacement of wet well access hatches with grated fall protection
   b. Replacement of pumps
   c. Replacement of discharge piping
   d. Addition of dual forcemain
   e. Replacement of wet well piping
   f. Replacement of electrical control system

SECTION 1
INTRODUCTION

This section provides an overview and outline for the Midway Sanitary District (MCSD) Sewer Master Plan. A brief background description, objectives and scope of work, acknowledgments, and a list of abbreviations used throughout the report are provided.

1-1 Previous Work and Studies Completed

MCSD's previous Sewer Master Plan is dated March 2022. It included engineering evaluation and recommendations pertaining to gravity collection system condition/deficiencies, manhole rehabilitation and maintenance problem areas. A hydraulic model was developed to simulate existing and projected development conditions. Capacity deficient sewer lines were identified and recommended solutions were developed.

The previous hydraulic model was developed and calibrated to flow monitoring data collected from ADS environmental in 2003. This information is outdated considering the changes in water use. Over the past decade, the State of California has passed several executive orders as follows:

January 2014: Drought State of Emergency Proclamation

April 2017: Drought State of Emergency Terminated

October 2021: Drought State of Emergency Proclamation (San Bernardino County)

March 2023: Drought State of Emergency Provision Update, which included the end of the 15% voluntary water conservation target and the end of agencies' Level 2 drought contingency plans.

The result of the aforementioned executive orders has been conscientious potable water conservation efforts throughout California which has led to a reduction in water use and therefore, a reduction in sewage generation.

Non-entry inspection of manholes was conducted in 2003-2004. Manhole conditions were classified, and rehabilitation of manholes was completed in 2004 in cooperation with Orange County Sanitation District (OCSD). Since 2004, District staff visually inspects each manhole every 12 months during routine sewer line cleaning operations.

In 2024, MCSD contracted for the cleaning and closed circuit television (CCTV) inspection of the entire sewer system. This work was completed in January 2025. The next step is to assess the condition of the pipes and manholes based on the CCTV inspections and identify the structural deficiencies in need of repair and replacement.

1-2 Objectives of Sewer Master Plan

The objective of this Sewer Master Plan (SMP) is to evaluate the MCSD's sewer collection system under the existing and future development conditions to provide a framework for undertaking the construction of new and replacement facilities to provide sewer service in a safe and efficient manner. The updated Sewer Master Plan that accomplishes the following:

- Develop a new, calibrated, GIS based model of the sewer system
- Develop mapping tools that can assist in operation and maintenance practices and management of assets

- Evaluate the existing sewer system and impact of future development
- Assess the condition and capacity of sewer lift stations
- Review and update sewer system design and performance criteria
- Develop a comprehensive and prioritized Capital Improvement Program (CIP) for both pipelines and lift stations
- Prepare a report summarizing the findings of the project and listing all recommended improvements

As a planning document, the Master Plan is general in nature and is predicated upon the best information available at this time. The primary sources of information used during the course of this study are as follows:

- MCSD's AutoCAD information the sewer system
- MCSD's Sewer Atlas Maps
- MCSD's Sewer Master Plan, dated March 2022
- The City of Westminster's Geographic Information System (GIS) data for parcels, land use, water meters, etc.
- The City of Westminster's General Plan, dated September 2016
- The City of Westminster's Housing Element, dated February 2023
- Temporary flow monitoring data compiled by ADS Environmental Services, provided March/April 2023
- Data collected by AKM Consulting Engineers and MCSD staff from sewer construction plans

1-3 Statewide General Waste Discharge Requirements

The State Water Resources Control Board (SWRCB), which oversees all wastewater permitting and enforcement, adopted Resolution 2004-80 requiring staff to work with stakeholders in developing a regulatory program that would provide a consistent approach for reducing sewer Spills. To assist in the development of the regulatory program, a statewide Sanitary Sewer Overflow (SSO) Guidance Committee composed of representatives from the Regional Water Quality Control Boards, county environmental health departments, environmental groups, U.S. EPA, local public collection system owners and other collection system experts was formed. SWRCB staff and the SSO Guidance Committee drafted Statewide General Waste Discharge Requirements (WDR) for Sewage Collection System Agencies.

The SWRCB adopted the Statewide General Waste Discharge Requirements (WDR) for sanitary sewer systems and the associated monitoring and reporting program by issuing Order No. 2022-0103 on December 6, 2022.

The WDR and reporting program addresses Spill reporting and proper collection system management and operation necessary to protect the public health, water quality, the environment, and the public's investment in the sewer system infrastructure.

First paragraph of section 5.2 of the WQ 2022-0103-DWQ Order Requirements are:

> "*To facilitate adequate local funding and management of its sanitary sewer system(s), the Enrollee shall develop and implement an updated Sewer System Management Plan. The scale and complexity of the Sewer System Management Plan, and specific elements of the Plan, must match the size, scale and complexity of the Enrollee's sanitary sewer system(s). The Sewer System Management Plan must address, at minimum, the required Plan*

elements in Attachment D (Sewer System Management Plan – Required Elements) of this General Order. To be effective, the Sewer System Management Plan must include procedures for the management, operation, and maintenance of the sanitary sewer system(s). The procedures must: (1) incorporate the prioritization of system repairs and maintenance to proactively prevent spills, and (2) address the implementation of current standard industry practices through available equipment, technology, and strategies."

The Sewer System Management Plan (SSMP) must address the following elements:

1. Sewer System Management Plan Goal And Introduction
2. Organization Structure
3. Legal Authority
4. Operation and Maintenance Program, including a Preventive Maintenance Program and a Rehabilitation and Replacement Program
5. Design and Performance Provisions
6. Spill Emergency Response Plan
7. Sewer Pipe Blockage Control Program
8. System Evaluation and Capacity Assurance Plan (SECAP)
9. Monitoring, Measurement, and Program Modifications
10. Sewer System Management Plan Internal Audits
11. Communication Program

The Waste Discharge Requirements define a sanitary sewer system as, "*A system that is designed to convey sewage, including but not limited to, pipes, pump stations, siphons, wet wells, diversion structures and/or other pertinent infrastructure, upstream of a wastewater treatment plant headworks, including: Laterals owned and/or operated by the Enrollee; Satellite sewer systems; and/or temporary conveyance and storage facilities, including but not limited to temporary piping, vaults, construction trenches, wet wells, impoundments, tanks and diversion structures*."

Enrollees are required to certify that the final SSMP and its constituent subparts are in compliance with the Sanitary Sewer Order. Enrollees are also required to obtain their governing board's approval of the final SSMP prior to certification as complete and in compliance. Enrollees do not send their SSMP to the State or Regional Water Boards for review or approval but need to upload the SSMP to the online CIWQS Sanitary Sewer System Database. MCSD updated its SSMP document in April 2025, and it is available for public review on their website and in their office at any time.

1-4 Report Organization

The Sewer Master Plan presents the documents and information collected and developed, methodology for preparing the hydraulic model, analyses of the existing and future system, and improvement recommendations. A brief outline of the report is as follows:

Section ES: Executive Summary

Section 1: Introduction

Section 2: Study Area

Section 3: *Performance Evaluation & Design Criteria*

Section 4: *Existing System*

Section 5: *Future System*

Section 6: *Hydraulic Sewer Model*

Section 7: *Capacity Analysis*

Section 8: *Capital Improvement Program*

1-5 Abbreviations

To conserve space and improve readability, abbreviations have been used in this report. Each term abbreviated has been spelled out in the text the first time it is used. Subsequent usage of the term is usually by its abbreviation. The abbreviations utilized in this report are contained in Table 1-1.

Table 1-1
Abbreviations

Abbreviation	Explanation
AC, Ac	Acres
ACP, acp	Asbestos Cement Pipe
ADU	Accessory Dwelling Unit
ADWF	Average Dry Weather Flow
amsl	Above Mean Sea Level
Ave	Average
BI	Base Infiltration
CCTV	Closed Circuit Television
cfs	Cubic Feet per Second
CI, cip	Cast Iron Pipe
CIP	Capital Improvement Program
City	City of Westminster
d/D	Depth to Diameter Ratio
DIP, dip	Ductile Iron Pipe
DU, du	Dwelling Unit
D/S	Downstream
ENR	Engineering News-Record
FAR	Floor Area Ratio
fps, ft/s	Feet per Second
ft	Feet
GIS	Geographic Information System
gpcd	Gallons per Capita per Day
GPD, gpd	Gallons per Day
gpm	Gallons per Minute
HDPE	High Density Polyethylene
HGL	Hydraulic Grade Line
HP	Horsepower

Table 1-1 (Continued)
Abbreviations

Abbreviation	Explanation
in	Inch
ID	Identification
I/I	Inflow and Infiltration
JADU	Junior Accessory Dwelling Unit
kW	Kilowatt
LF	Lineal Feet
MACP	Manhole Assessment and Certification Program
Max	Maximum
MCC	Motor Control Center
MCSD	Midway City Sanitary District
MDF	Minimum Daily Total Flow
mg	Million Gallons
MGD, mgd	Million Gallons per Day
MH	Manhole
Min	Minimum
MWD	Metropolitan Water District
NASSCO	National Association of Sewer Service Companies
O&M	Operations and Maintenance
OCFCD	Orange County Flood Control District
OCSD	Orange County Sanitation District
OSHA	Occupational Safety & Health Administration
PACP	Pipeline Assessment and Certification Program
PDWF	Peak Dry Weather Flow
PVC	Polyvinyl Chloride or Plastic Pipe
PWWF	Peak Wet Weather Flow
RDII	Rainfall Dependent Inflow and Infiltration
RPM	Revolutions per Minute
SAMP	Subarea Master Plan
SCADA	Supervisory Control and Data Acquisition
SMP	Sewer Master Plan
SOI	Sphere of Influence
SRF	Sewer Return Factor
SSES	Sanitary Sewer Evaluation Surveys
SSMP	Sewer System Management Plan
SSO	Sanitary Sewer Overflow
SSOERP	Sanitary Sewer Overflow Emergency Response Plan
SWRCB	State Water Resources Control Board
TDH	Total Dynamic Head

Table 1-1 (Continued)
Abbreviations

Abbreviation	Explanation
TSF	Thousand Square Feet
TVSS	Transient Voltage Surge Suppressor
U/S	Upstream
UFF	Unit Flow Factor
UPS	Uninterruptable Power Supply
VCP	Vitrified Clay Pipe
WDR	Waste Discharge Requirements
WDWF	Wet Dry Weather Flow
WSPG	Water Surface Pressure Gradient

1-6 Acknowledgements

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- Robert Housley, General Manager
- Milo Ebrahimi, District Engineer
- Randy Griffith, Lead Maintenance Worker

SECTION 2
STUDY AREA

2-1 Location

Midway City Sanitary District (MCSD) is located in the northwest portion of Orange County, California. MCSD's regional location is depicted on Figure 2-1. The area to which MCSD provides sewer service encompasses approximately 6,843 acres or 10.7 square miles of residential, commercial, industrial, and institutional land primarily in the City of Westminster and the unincorporated area of Midway City. Neighboring cities include Seal Beach to the west, Fountain Valley and Huntington Beach to the south, Santa Ana to the east, and Garden Grove and Stanton to the north.

The City of Garden Grove contributes flow into MCSD's sewer system. Approximately 253 acres of Garden Grove are tributary to MCSD's system from the north and east. These tributary areas are shown on Figure 2-3.

The service area is easily accessible via the 22 Freeway (SR-22) to the north and the 405 Freeway (I-405). The major roads within MCSD include Beach Boulevard, Westminster Boulevard, Bolsa Avenue, and Goldenwest Street.

2-2 Topographical Description

The service area has a relatively flat topography. The area is characterized by gently rolling terrain, with no significant hills or mountains, which contributes to its suburban landscape. The highest ground elevation is approximately 65 feet above mean sea level (amsl) in the eastern portion of the service area. The lowest ground elevation is approximately 25 feet amsl at the southern portion of the service area.

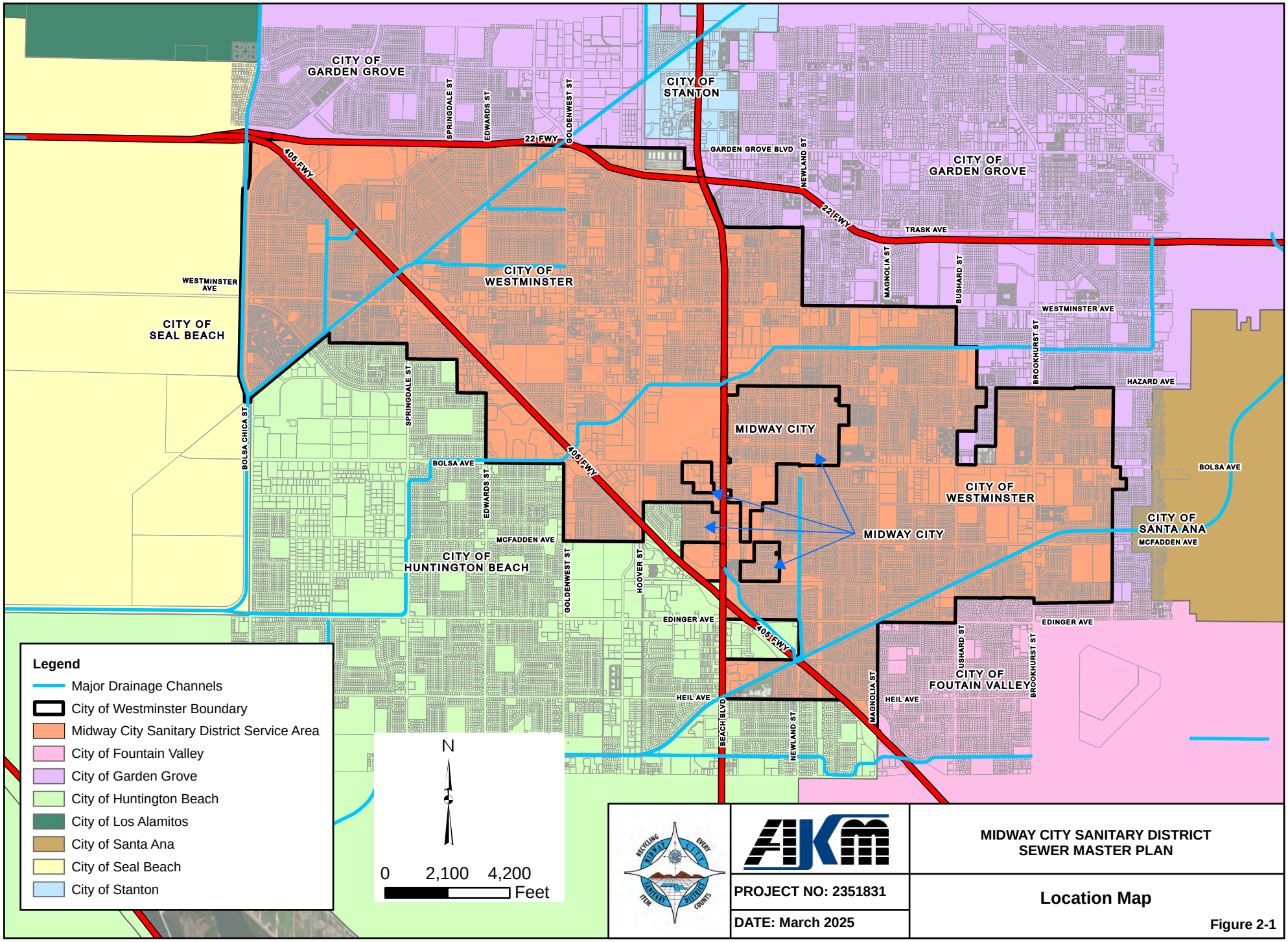
The service area is crossed by several major Orange County Flood Control District (OCFCD) storm channels, which generally drain in a northeast to southwest direction. The general location of these channels can be seen on Figure 2-1.

Floods are considered the most common natural hazard in the service area, caused by heavy rains, localized storm cells, storm channel overflow, Santa Ana River overflow, Prado Dam release, or infrastructure failure. According to the Federal Emergency Management Agency, approximately 50 percent of the service area is designated in Special Flood Hazard Areas subject to inundation by the 100 year flood. (*ref: 2016 Westminster General Plan Update*)

2-3 Geotechnical Information

The geology of the service area is located within the Los Angeles Basin, a large sedimentary basin formed by tectonic activity over millions of years. The majority of the service area consists of young deposits (less than 126,000 years old), primarily alluvial and marine sediments like sands, silts, and clays. These deposits are part of the larger geological formations of the Santa Ana River and the nearby Pacific coastline.

The region has been influenced by seismic activity from nearby fault lines, including the Newport-Inglewood fault, although the service area itself is not directly on a major fault. The service area is susceptible to liquefaction due to the fact that the area consists of loose unconsolidated soils, shallow groundwater, and the potential for strong seismic shaking.



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Location Map

Figure 2-1

2-4 Climate

The climate in the area is typical of Southern California with generally mild temperatures, virtually no days below freezing, and plenty of sunshine throughout the year. Average temperatures in the winter range from the mid-40s to mid-60s Fahrenheit, while summer temperatures typically range from the mid-60s to mid-80s, with occasional heatwaves pushing temperatures into the 90s. Precipitation is concentrated in the winter months, with most rainfall occurring between November and March, while summers are usually dry with little to no rainfall.

2-5 Existing Land Use

The land use information utilized in the preparation of the Sewer Master Plan is primarily based upon the City of Westminster's GIS parcel shapefile with existing landuse designations. This information was supplemented by aerial photographs, specific plans, and field reviews.

Currently, the service areas consist of mostly residential, commercial and industrial land. The predominant land use in the service area is residential, which makes up about 65.8 percent of the total. Commercial uses make up about 12.2 percent of the total, primarily located along major corridors such as Westminster Avenue, Beach Boulevard, Bolsa Avenue, and Brookhurst Street. The Westminster Mall is located north of Bolsa Avenue, between Edwards Street and the 405 Freeway. The remaining land uses include industrial, schools, public facilities, and open space. The locations of the various land uses throughout the service area are shown on Figure 2-2 and the total acreage of each land use type is shown in Table 2-1.

Table 2-1
Existing Land Use

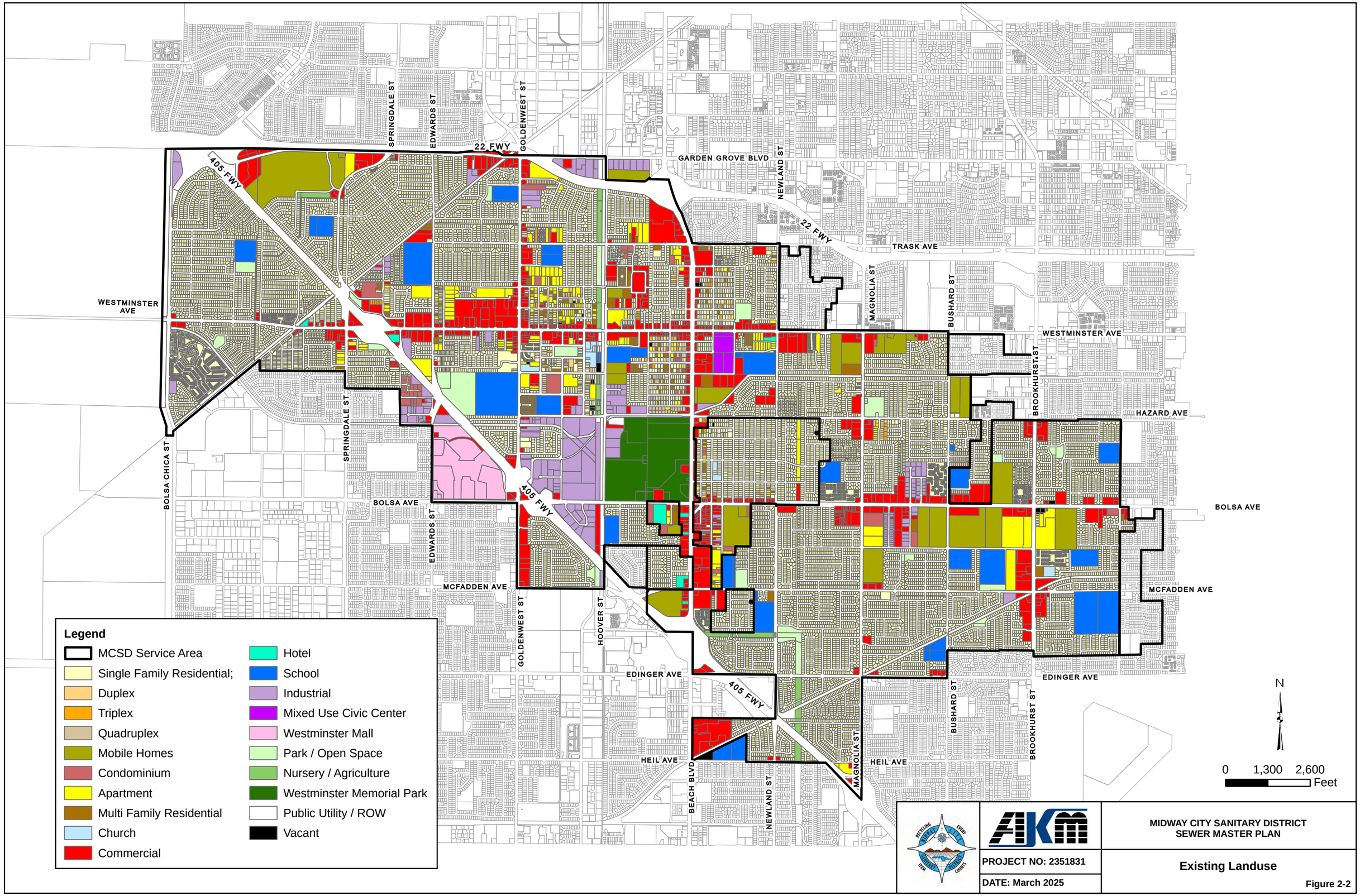
Land Use	Acres (Ac)	%
Residential		
Single Family Residential	2,702.9	52.0
Duplex	23.7	0.5
Triplex	15.8	0.3
Quadruplex	42.3	0.8
Mobile Home Lot	324.0	6.2
Multi Family Residential	65.3	1.3
Condominium	51.4	1.0
Apartment	197.1	3.8
Subtotal	**3,422.5**	**65.8**
Non-Residential		
Church	13.1	0.3
Commercial	634.1	12.2
Hotel	13.4	0.3
Industrial	241.4	4.6
Mixed Use Civic Center	17.1	0.3
Nursery Agriculture	33.7	0.6
Park / Open Space	102.3	2.0
Public Utility / R.O.W.	184.8	3.6
School	305.0	5.9
Vacant	7.7	0.1
Westminster Mall	88.5	1.7
Westminster Memorial Park	134.8	2.6
Subtotal	**1,775.9**	**34.2**
Total Sevice Area	**5,198.4**	**100.0**

2-6 Population

MCSD's service area is made up of the City of Westminster and the unincorporated area of Midway City. Population records for the City of Westminster date back to 1957 when it was incorporated with a population of 3,131. The history of the Midway City population is not known. The 2020 Census information (GIS shapefiles) show the Midway City population was about 8,908 persons in 2020. It was assumed that the population for the Midway City area did not change from 2020 to 2024. Therefore the total MCSD service area population is currently estimated at 98,398 as shown on Figure 2-3.

The average number of persons per household in the City of Westminster is currently estimated at 3.23 with a vacancy rate of 3.2 percent (See Appendix 2-2 California State Department of Finance Table E-5). The historical population increase is depicted on Figure 2-3.

MCSD's estimated population was previously 103,000.



MIDWAY CITY SANITARY DISTRICT
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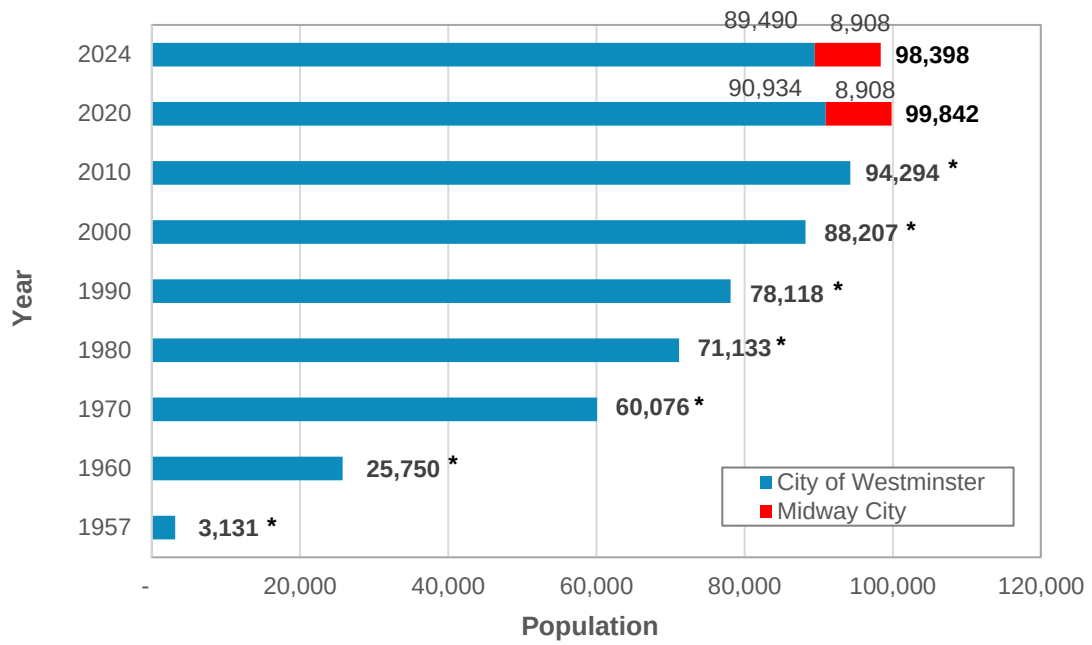
Existing Landuse

Figure 2-2

Figure 2-3
Historical Population Data



Reference:Historical Population data from California State Department of Finance Table E-5
** Midway City population unknown*

SECTION 3
FLOW MONITORING

3-1 General

Flow monitoring data collection and review is essential in developing sewer return ratios, unit flow factors, calibrating the system model, and estimating the ultimate average day and peak flows.

Twenty-six (26) sites were selected for collecting flow data as shown on Figure 3-1. Each site was monitored between March 1, 2023 and April 11, 2023. Several storm events occurred during and leading up to this time period. It was a particularly wet season for Southern California. The final flow monitoring report prepared by ADS Environmental Services is included in Appendix 3-1.

The flow monitoring sites were strategically selected to assist with the model calibration. Sites were selected in an attempt to get a good sampling of data across the study area. At the same time, the tributary areas must generate enough flow so that the field equipment can measure the depths of flow accurately (typically a minimum depth of 2-inches is preferred).

3-2 Flow Monitoring Equipment

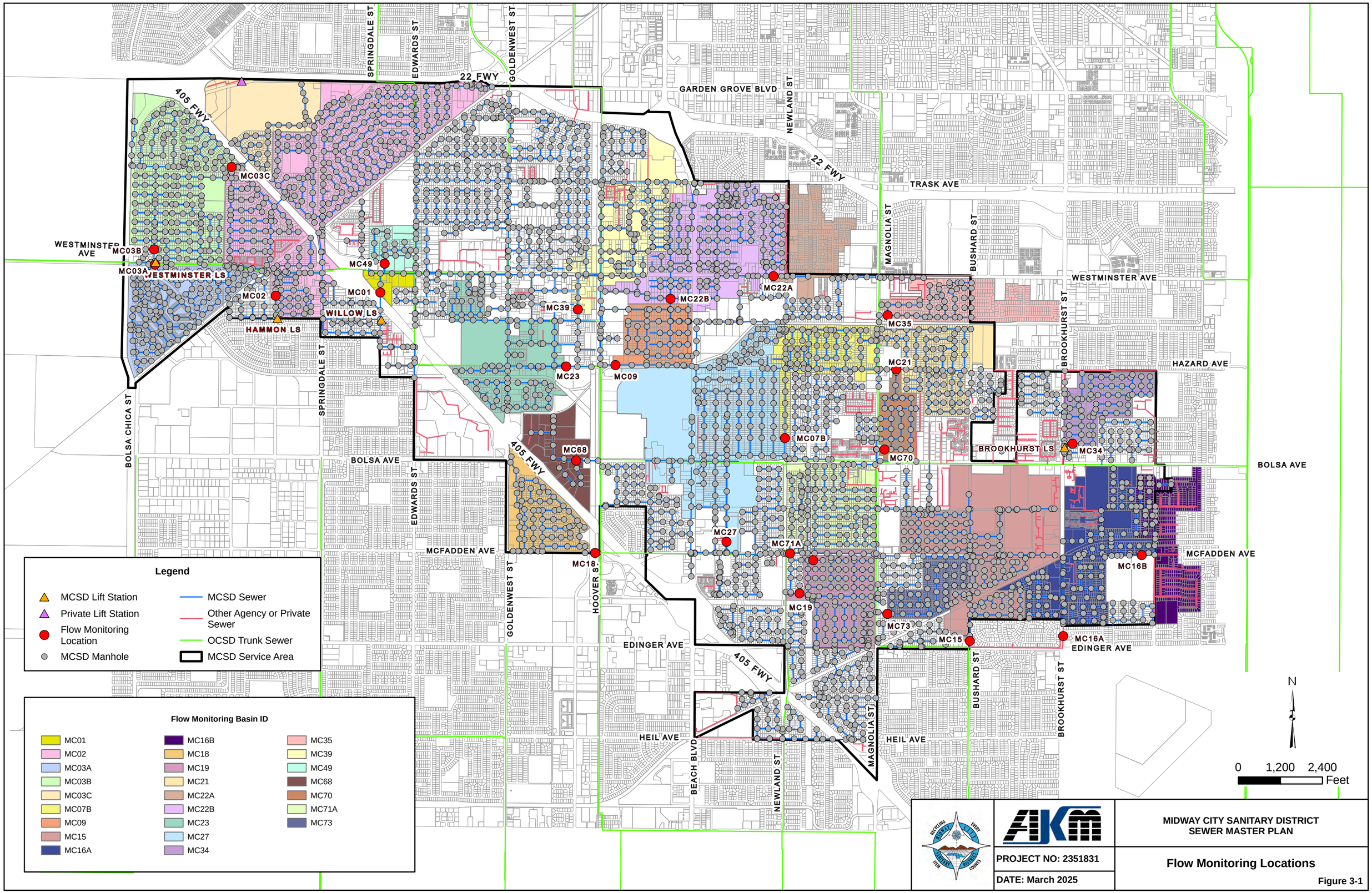
The flow monitoring equipment used was the ADS FlowShark Triton. This flow monitor is an area velocity flow monitor that uses the continuity equation to measure flow. It includes data acquisition sensors and a battery powered microcomputer. The microcomputer has a processor unit, data storage, and a clock to control and synchronize the sensor recordings. For this study, the monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The sensor used in this study is the Peak Combo Sensor, which is installed at the bottom of the pipe. It uses three (3) types of data acquisition technologies: up-looking ultrasonic depth sensor using sound waves from two independent transceivers to measure depth of flow; a piezo-resistive crystal to determine the difference between the hydrostatic and atmospheric pressures to calculate pressure depth; and peak velocity sensor which uses ultrasonic signals to measure the peak flow velocity, which is used to calculate the average velocity and the flow area to calculate the rate of flow.

3-3 Flow Monitoring Results

The flow monitoring results for the entire monitoring period are shown in Table 3-1 and on Figure 3-2. It includes the average, maximum, and minimum depth, velocity, and flow observed at each site, including both dry weather and wet weather data.

The flow monitoring results for a dry period are shown in Table 3-2 and on Figure 3-3. The “dry” period was selected by reviewing all data and selecting a period (preferably 7 days) where there was minimal or no rainfall. It is important to keep in mind that it was raining when the flow monitoring equipment was first installed and the ground was likely already wet from previous storm events. Graphs of the flow at each site during the selected “dry” periods are shown in Appendix 3-2.



AKM

PROJECT NO: 2351831

DATE: March 2025

MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

Flow Monitoring Locations

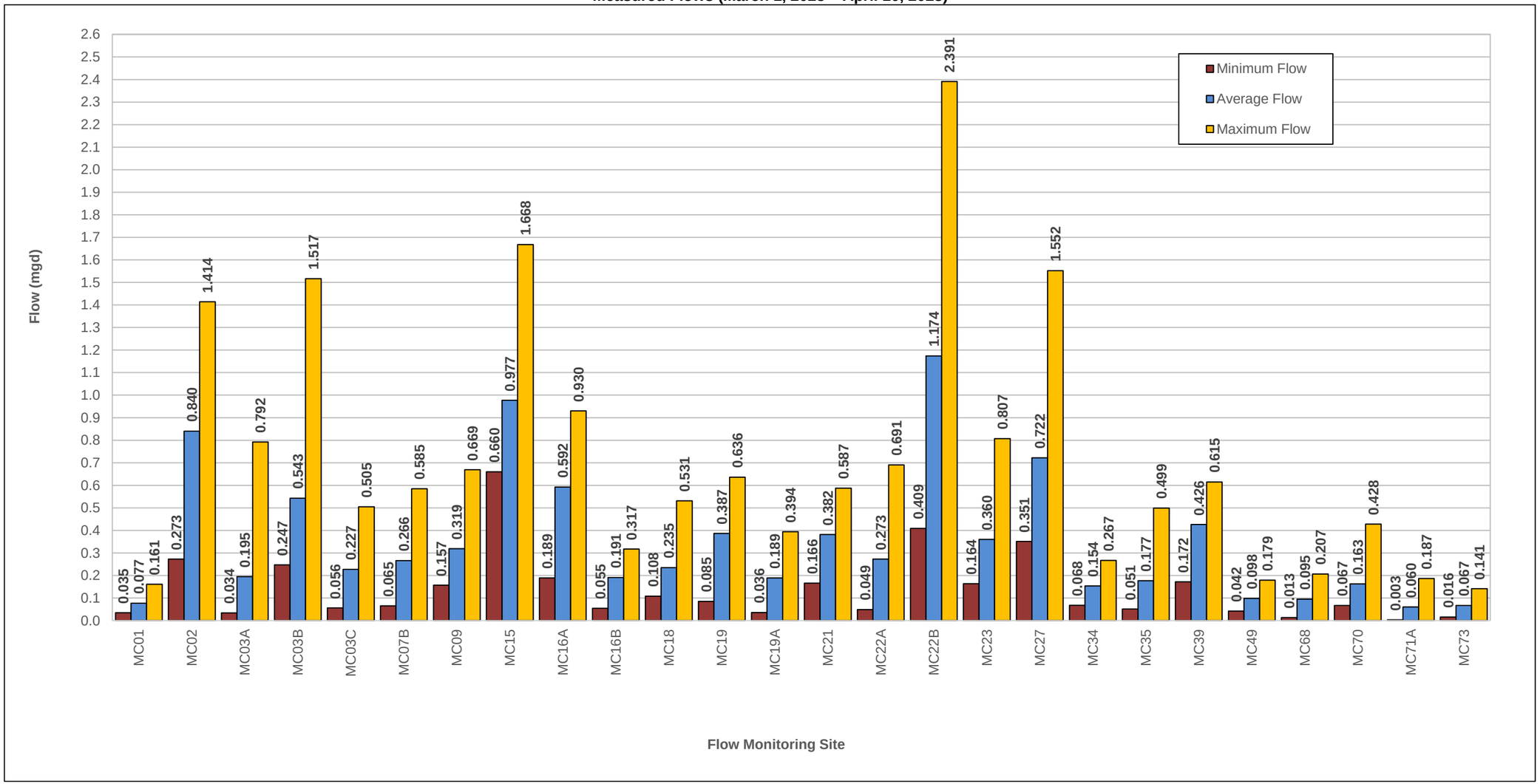
Figure 3-1

Table 3-1
Flow Monitoring Results (March 1, 2023 – April 10, 2023)

No.	Dates	Location	Meter ID	Manhole ID	Direction of Flow	Pipe ID	U/S Pipe Size	Area (Ac)	Depth (in)			Velocity (ft/s)			Flow (mgd)			d/D		
									Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
1	March 1, 2023 - April 10, 2023	1414 Willow Ln	MC01	MH16004	Monitor flow from north	GM15080	8	75	4.02	4.72	6.01	0.5	0.62	0.99	0.035	0.077	0.161	0.50	0.59	0.75
2	March 1, 2023 - April 10, 2023	14148 Hammon Pl	MC02	MH11004	Monitor flow from north	GM11004	13.75	494	3.84	6.53	15.7	0.78	2.79	3.31	0.273	0.840	1.414	0.28	0.47	1.14
3	March 1, 2023 - April 10, 2023	5120 Westminister Blvd	MC03A	MH04041	Monitor flow from west	GM04048	11	153	3.69	5.36	22.04	0.14	1.06	1.98	0.034	0.195	0.792	0.34	0.49	2.00
4	March 1, 2023 - April 10, 2023	5121 Northwestern Way	MC03B	MH04017	Monitor flow from north	GM04009	12	264	2.87	5.62	11.68	0.82	2.42	3.26	0.247	0.543	1.517	0.24	0.47	0.97
5	March 1, 2023 - April 10, 2023	13451 Milan St	MC03C	MH08048	Monitor flow from east	GM08053	12	133	2.31	3.80	8.28	0.77	1.58	2.13	0.056	0.227	0.505	0.19	0.32	0.69
6	March 1, 2023 - April 10, 2023	14864 Newland St	MC07B	MH54010	Monitor flow from north	GM54008	8	104	2.32	5.03	7.67	0.88	1.75	2.63	0.065	0.266	0.585	0.29	0.63	0.96
7	March 1, 2023 - April 10, 2023	7591 Hazard Ave	MC09	MH41044	Monitor flow from east	GM41051	11.25	78	5.65	7.52	12.29	0.69	1	1.5	0.157	0.319	0.669	0.50	0.67	1.09
8	March 1, 2023 - April 10, 2023	16065 Bushad St	MC15	MH75053	Monitor flow from north	GM75061	18	297	3.76	4.62	6.25	3.71	4.26	4.82	0.660	0.977	1.668	0.21	0.26	0.35
9	March 8, 2023 - April 11, 2023	15956 Brookhurst St	MC16A	Outside	Monitor flow from north	GM81068	15	230	5.01	8.47	10.77	0.81	1.27	1.53	0.189	0.592	0.930	0.33	0.56	0.72
10	March 1, 2023 - April 10, 2023	10282 W Mcfadden Ave	MC16B	MH86027	Monitor flow from east	GM86032	10	117	2.20	6.57	19.83	0.3	0.95	1.57	0.055	0.191	0.317	0.22	0.66	1.98
11	March 1, 2023 - April 10, 2023	7490 Mcfadden Ave	MC18	MH36017	Monitor flow from west	GM36021	10	101	4.37	5.83	8.74	0.72	1.09	1.62	0.108	0.235	0.531	0.44	0.58	0.87
12	March 1, 2023 - April 10, 2023	15699 Skylinks Cir.	MC19	MH65075	Monitor flow from southeast	GM66001	12	118	2.70	5.02	7.43	0.94	1.9	3.64	0.085	0.387	0.636	0.23	0.42	0.62
13	March 1, 2023 - April 10, 2023	8652 Bermuda Ave	MC19A	MH65032	Monitor flow from northeast	GM65022	8	-	1.98	4.70	18.77	0.81	1.36	1.81	0.036	0.189	0.394	0.25	0.59	2.35
14	March 1, 2023 - April 10, 2023	9039 Hazard Ave	MC21	MH70035	Monitor flow from east	GM70038	8	135	2.29	7.34	16.11	1.59	2.16	3.29	0.166	0.382	0.587	0.29	0.92	2.01
15	March 1, 2023 - April 10, 2023	8446 Westminister Blvd	MC22A	MH51026	Monitor flow from east	GM51037	12.75	97	1.61	2.83	5.26	1.12	2.78	3.76	0.049	0.273	0.691	0.13	0.22	0.41
16	March 1, 2023 - April 10, 2023	7852 15th St	MC22B	MH40042	Monitor outlet flow to south	GM40050	12	261	9.86	12.40	20.16	0.81	2.33	4.71	0.409	1.174	2.391	0.82	1.03	1.68
17	March 1, 2023 - April 10, 2023	7351 Hazard Ave	MC23	MH32042	Monitor flow from west	GM32049	15	183	3.76	5.35	8.25	1.02	1.4	1.83	0.164	0.360	0.807	0.25	0.36	0.55
18	March 1, 2023 - April 10, 2023	15290 Van Buren St	MC27	MH56002	Monitor flow from north	GM55045	18	396	4.74	6.51	9.37	1.45	1.91	2.58	0.351	0.722	1.552	0.26	0.36	0.52
19	March 1, 2023 - April 10, 2023	10051 Premier Ave	MC34	MH78035	Monitor flow from east	GM78054	8	80	2.47	3.54	4.87	1.13	1.58	1.85	0.068	0.154	0.267	0.31	0.44	0.61
20	March 1, 2023 - April 10, 2023	9043 Oasis Ave	MC35	MH60053	Monitor outlet flow to west	GM60079	8	128	1.66	3.22	9.32	1.03	2.05	2.64	0.051	0.177	0.499	0.21	0.40	1.17
21	March 1, 2023 - April 10, 2023	14161 Olive St	MC39	MH31045	Monitor flow from north	GM31050	12	175	2.85	4.41	5.5	1.79	2.49	2.88	0.172	0.426	0.615	0.24	0.37	0.46
22	March 1, 2023 - April 10, 2023	13961 Willow Ln	MC49	MH15031	Monitor flow from north	GM15047	8	239	1.98	2.75	3.85	0.97	1.41	1.68	0.042	0.098	0.179	0.25	0.34	0.48
23	March 1, 2023 - April 10, 2023	7360 Bolsa Ave	MC68	MH35012	Monitor outlet flow to east	GM34018	10	74	2.70	4.41	6.33	0.14	0.63	0.99	0.013	0.095	0.207	0.27	0.44	0.63
24	March 1, 2023 - April 10, 2023	9031 Greenville Ave	MC70	MH63044	Monitor flow from east	GM63048	8	50	3.39	4.53	7.43	0.75	1.26	2.02	0.067	0.163	0.428	0.42	0.57	0.93
25	March 1, 2023 - April 10, 2023	8501 Mcfadden Ave	MC71A	MH56027	Monitor flow from north	GM56024	10	147	0.71	2.00	4.56	0.21	1.06	2.16	0.003	0.060	0.187	0.07	0.20	0.46
26	March 1, 2023 - April 10, 2023	9055 Larkspur Dr	MC73	MH66034	Monitor flow from east	GM66040	12	60	1.27	2.13	2.94	55	1.04	1.48	0.016	0.067	0.141	0.11	0.18	0.25

**Both dry weather and wet weather data included*

Figure 3-2
Measured Flows (March 1, 2023 – April 10, 2023)

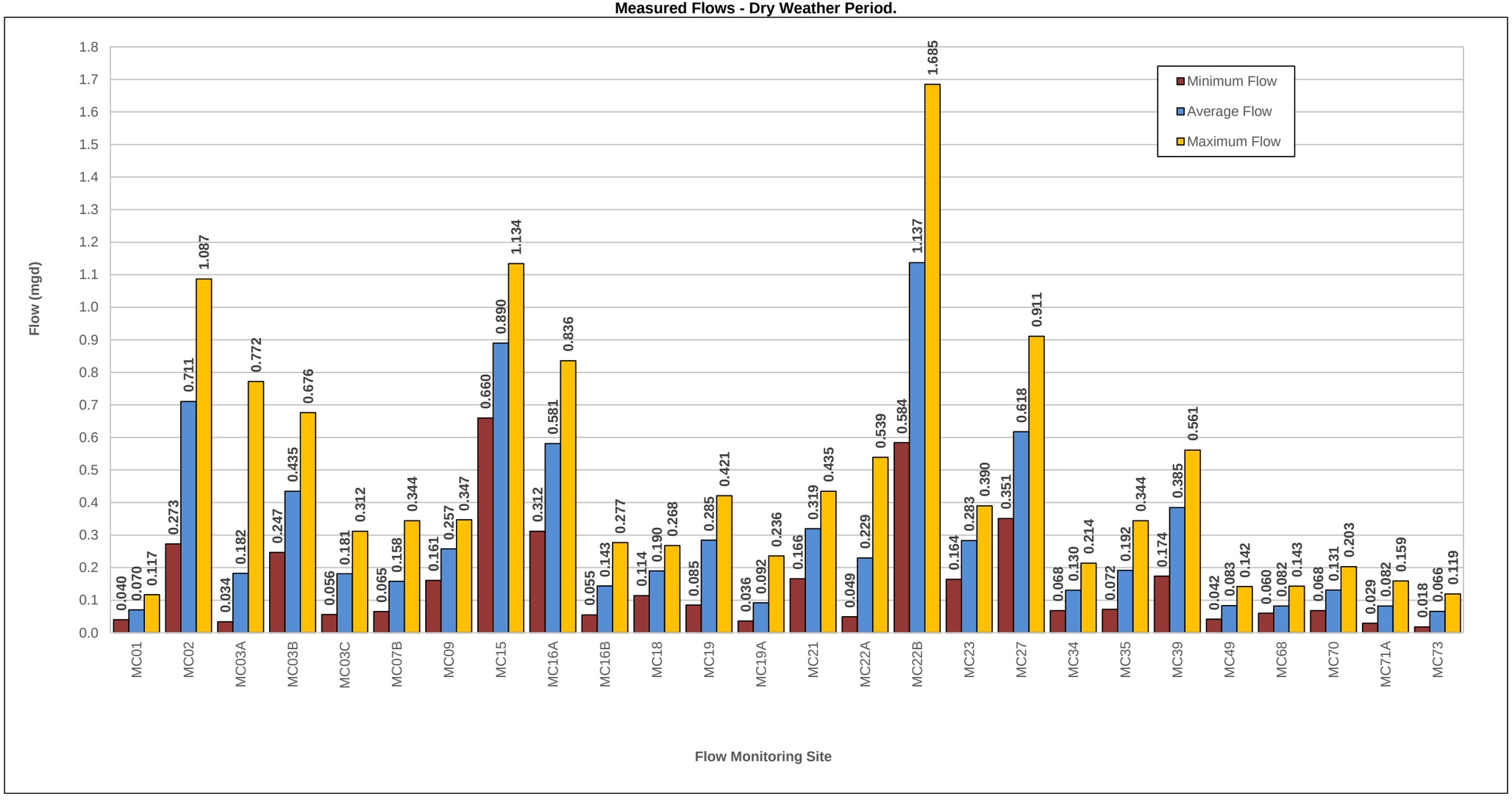


**Both dry weather and wet weather data included*

Table 3-2
Flow Monitoring Results – Dry Weather Period

No.	Dates	Location	Meter ID	Manhole ID	Direction of Flow	Pipe ID	U/S Pipe Size (in)	Area (Ac)	Depth (in)			Velocity (ft/s)			Flow (mgd)			Estimated Base Infiltration (mgd)	d/D		
									Min	Ave	Max	Min	Ave	Max	Min	Ave	Max		Min	Ave	Max
1	March 2, 2023 - March 9, 2023	1414 Willow Ln	MC01	MH16004	Monitor flow from north	GM15080	8	75	4.07	4.54	5.29	0.37	0.60	0.89	0.040	0.070	0.117	0.036	0.51	0.57	0.66
2	March 2, 2023 - March 9, 2023	14148 Hammon Pl	MC02	MH11004	Monitor flow from north	GM11004	12	494	3.84	5.76	10.75	0.81	2.73	3.22	0.273	0.711	1.087	0.152	0.32	0.48	0.90
3	March 2, 2023 - March 9, 2023	5120 Westminister Blvd	MC03A	MH04041	Monitor flow from west	GM04048	12	153	3.86	5.22	6.51	0.29	1.02	1.94	0.034	0.182	0.329	0.021	0.32	0.43	0.54
4	March 2, 2023 - March 9, 2023	5121 Northwestern Way	MC03B	MH04017	Monitor flow from north	GM04009	12	264	2.88	4.63	6.41	1.38	2.52	2.95	0.247	0.435	0.676	0.176	0.24	0.39	0.53
5	April 3, 2023 - April 10, 2023	13451 Milan St	MC03C	MH08048	Monitor flow from east	GM08053	12	133	2.31	3.44	4.85	0.79	1.44	1.97	0.056	0.181	0.312	0.039	0.19	0.29	0.40
6	March 1, 2023 - March 8, 2023	14864 Newland St	MC07B	MH54010	Monitor flow from north	GM54008	8	104	2.32	3.75	5.46	0.90	1.49	2.18	0.065	0.158	0.344	0.049	0.29	0.47	0.68
7	March 3, 2023 - March 10, 2023	7591 Hazard Ave	MC09	MH41044	Monitor flow from east	GM41051	12	78	5.81	6.71	7.53	0.69	0.92	1.11	0.161	0.257	0.347	0.129	0.48	0.56	0.63
8	March 2, 2023 - March 9, 2023	16065 Bushad St	MC15	MH75053	Monitor flow from north	GM75061	18	297	3.76	4.40	5.02	3.71	4.16	4.48	0.660	0.890	1.134	0.485	0.21	0.24	0.28
9	April 2, 2023 - April 9, 2023	15956 Brookhurst St	MC16A	Outside	Monitor flow from north	GM81068	15	230	6.18	8.55	10.42	1.00	1.23	1.48	0.312	0.581	0.836	0.205	0.41	0.57	0.69
10	March 3, 2023 - March 10, 2023	10282 W Mcfadden Ave	MC16B	MH86027	Monitor flow from east	GM86032	10	117	2.20	5.93	11.38	0.37	0.80	1.36	0.055	0.143	0.277	0.041	0.22	0.59	1.00
11	April 7, 2023 - April 9, 2023	7490 Mcfadden Ave	MC18	MH36017	Monitor flow from west	GM36021	10	101	4.37	5.37	6.30	0.73	0.98	1.16	0.114	0.190	0.268	0.093	0.44	0.54	0.63
12	March 2, 2023 - March 9, 2023	15699 Skylinks Cir.	MC19	MH65075	Monitor flow from southeast	GM66001	12	118	2.70	3.98	5.19	0.94	1.88	2.41	0.085	0.285	0.421	0.053	0.23	0.33	0.43
13	March 2, 2023 - March 9, 2023	8652 Bermuda Ave	MC19A	MH65032	Monitor flow from northeast	GM65022	8	-	1.98	3.01	5.18	0.81	1.13	1.50	0.036	0.092	0.236	0.029	0.25	0.38	0.65
14	March 2, 2023 - March 9, 2023	9039 Hazard Ave	MC21	MH70035	Monitor flow from east	GM70038	8	135	2.29	4.42	6.08	2.02	2.56	3.29	0.166	0.319	0.435	0.120	0.29	0.55	0.76
15	March 2, 2023 - March 9, 2023	8446 Westminister Blvd	MC22A	MH51026	Monitor flow from east	GM51037	12	97	1.61	2.66	4.64	1.12	2.52	3.21	0.049	0.229	0.539	0.030	0.13	0.22	0.39
16	April 3, 2023 - April 10, 2023	7852 15th St	MC22B	MH40042	Monitor outlet flow to south	GM40050	12	261	10.57	12.10	13.36	1.23	2.26	3.32	0.584	1.137	1.685	0.329	0.88	1.00	1.00
17	March 2, 2023 - March 9, 2023	7351 Hazard Ave	MC23	MH32042	Monitor flow from west	GM32049	15	183	3.76	4.74	5.53	1.02	1.30	1.53	0.164	0.283	0.390	0.126	0.25	0.32	0.37
18	March 2, 2023 - March 9, 2023	15290 Van Buren St	MC27	MH56002	Monitor flow from north	GM55045	18	396	4.74	6.05	7.24	1.45	1.81	2.12	0.351	0.618	0.911	0.234	0.26	0.34	0.40
19	March 2, 2023 - March 9, 2023	10051 Premier Ave	MC34	MH78035	Monitor flow from east	GM78054	8	80	2.47	3.21	4.24	1.13	1.52	1.80	0.068	0.130	0.214	0.056	0.31	0.40	0.53
20	March 2, 2023 - March 9, 2023	9043 Oasis Ave	MC35	MH60053	Monitor outlet flow to west	GM60079	8	128	2.35	3.52	4.74	1.03	1.97	2.60	0.072	0.192	0.344	0.052	0.29	0.44	0.59
21	March 2, 2023 - March 9, 2023	14161 Olive St	MC39	MH31045	Monitor flow from north	GM31050	12	175	2.85	4.12	5.03	1.81	2.46	2.85	0.174	0.385	0.561	0.116	0.24	0.34	0.42
22	March 2, 2023 - March 9, 2023	13961 Willow Ln	MC49	MH15031	Monitor flow from north	GM15047	8	239	1.98	2.54	3.29	0.97	1.33	1.63	0.042	0.083	0.142	0.036	0.25	0.32	0.41
23	March 2, 2023 - March 9, 2023	7360 Bolsa Ave	MC68	MH35012	Monitor outlet flow to east	GM34018	10	74	4.01	4.33	5.49	0.44	0.56	0.80	0.060	0.082	0.143	0.056	0.40	0.43	0.55
24	March 2, 2023 - March 9, 2023	9031 Greenville Ave	MC70	MH63044	Monitor flow from east	GM63048	8	50	3.40	4.17	4.92	0.77	1.12	1.45	0.068	0.131	0.203	0.056	0.43	0.52	0.62
25	March 2, 2023 - March 9, 2023	8501 Mcfadden Ave	MC71A	MH56027	Monitor flow from north	GM56024	10	147	1.25	1.99	2.70	1.04	1.57	2.08	0.029	0.082	0.159	0.023	0.13	0.20	0.27
26	April 3, 2023 - April 10, 2023	9055 Larkspur Dr	MC73	MH66034	Monitor flow from east	GM66040	12	60	1.36	2.12	2.72	0.55	1.04	1.38	0.018	0.066	0.119	0.014	0.11	0.18	0.23

Figure 3-3
Measured Flows - Dry Weather Period.



3-4 Base Infiltration

Base infiltration in the context of sewers refers to water entering the collection system from the ground through defective pipes, pipe joints, connections, or manhole walls. It is distinct from inflow and is generally measured during seasonally high groundwater conditions or in areas with consistent high groundwater conditions, such as the MCSD service area.

Several of the basins that were flow monitored were found to have significant base infiltration. The base infiltration was calculated for each basin based on the following empirical method, the Stevens/Schutzbach equation:

$$BI = \frac{0.4*MDF}{1-0.6\ (MDF/ADWF)^{\wedge}\ ADWF^{0.7}}.$$

Where, BI = Base Infiltration

MDF = Minimum Daily Total Flow

ADWF = Average Dry Weather Flow

The Stevens/Schutzbach equation is based on traditional residential flow patterns. Reliability of the BI calculation decreases in non-residential basins, in basins where the flow meter measures flow from cycling pump stations, and where there are significantly more than 20,000 feet of pipe upstream. Generally, the BI calculation method carries higher error as the amount of BI (as a % of ADWF) decreases and lower error as BI increases. Estimated BI values below 25% to 30% could represent insignificant BI. BI estimates over 50% of the ADWF are considered more accurate and therefore potentially very significant.

Estimated BI during the “dry weather” period for each flow monitoring site is shown in Table 3-2. It should be noted that BI typically increases during wet weather periods. The flow data for the basins with the highest BI are shown in Figure 3-4 through Figure 3-7. The graphs for the remaining basins are shown in Appendix 3-2.

In the future, the basins with high base infiltration should be considered carefully when evaluating CCTV inspections. If infiltration is seen in the inspections or if there are a multitude of structural defects (i.e. cracks, offset joints) or if encrustation is prevalent at joints, MCSD should consider developing a pipe lining program to combat base infiltration so it does not occupy pipe capacity.

Figure 3-4
Flow Monitor Site MC15
Base Infiltration = 0.485 mgd

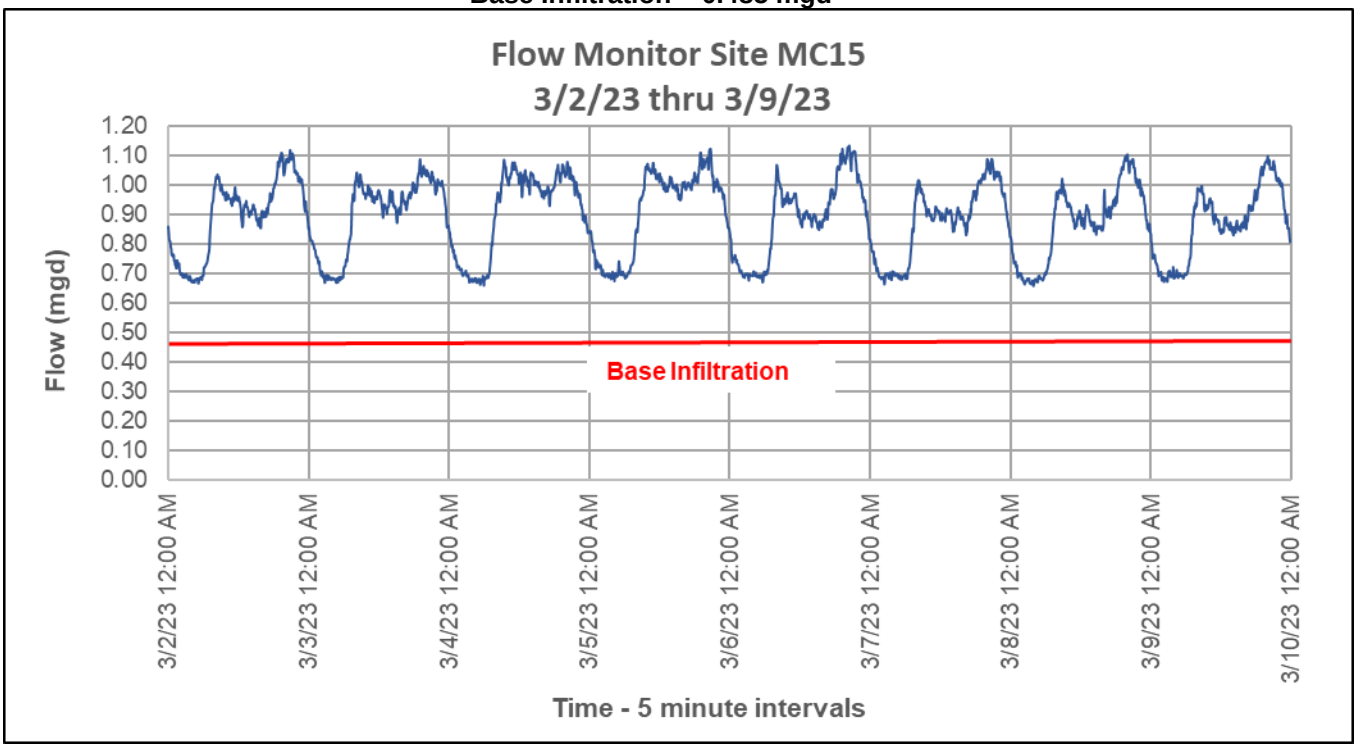


Figure 3-5
Flow Monitor Site MC16A
Base Infiltration = 0.205 mgd

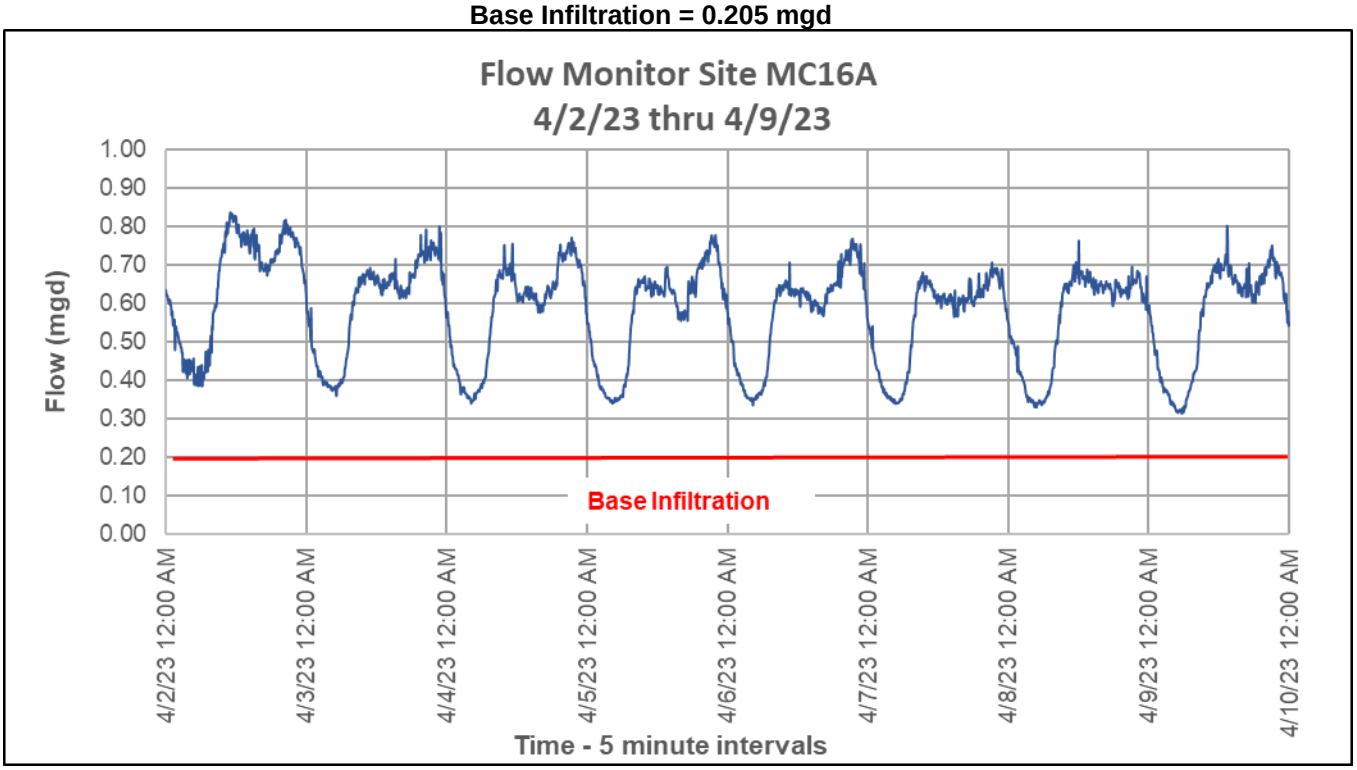


Figure 3-6
Flow Monitor Site MC22B
Base Infiltration = 0.329 mgd

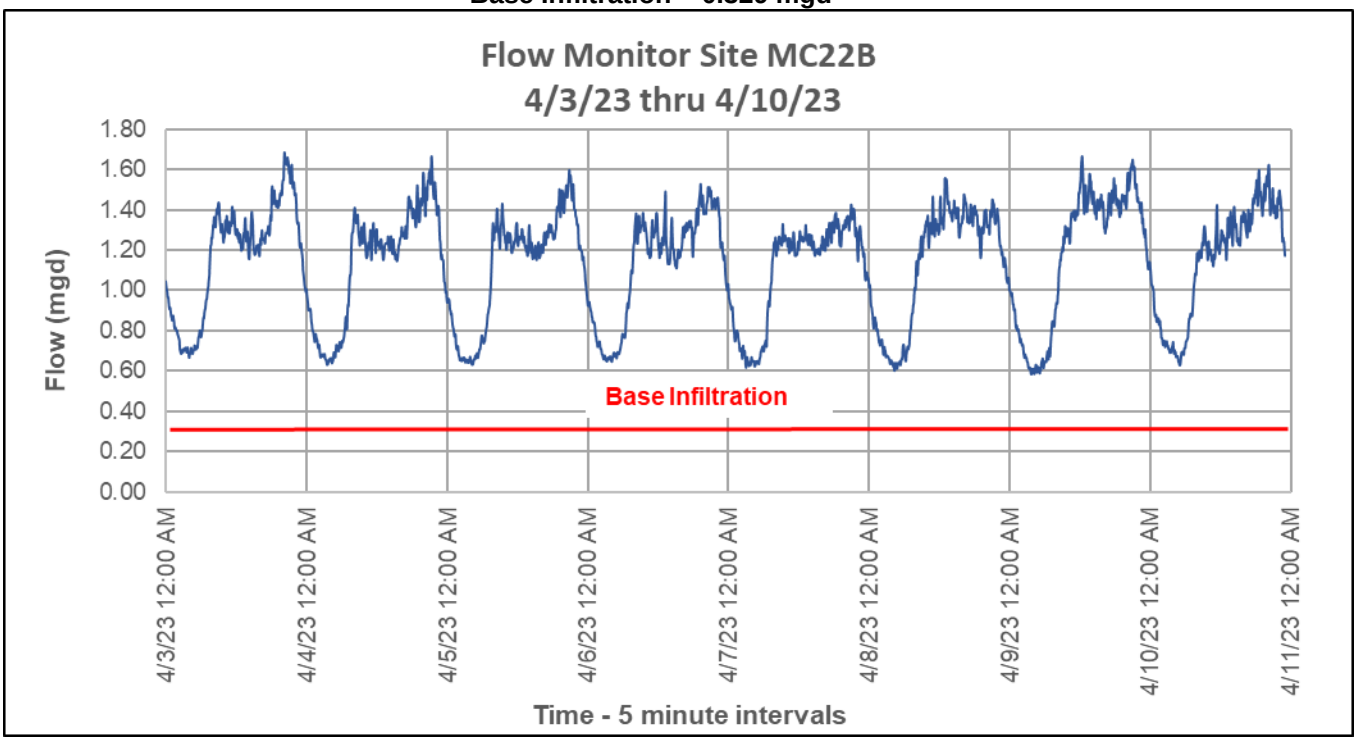
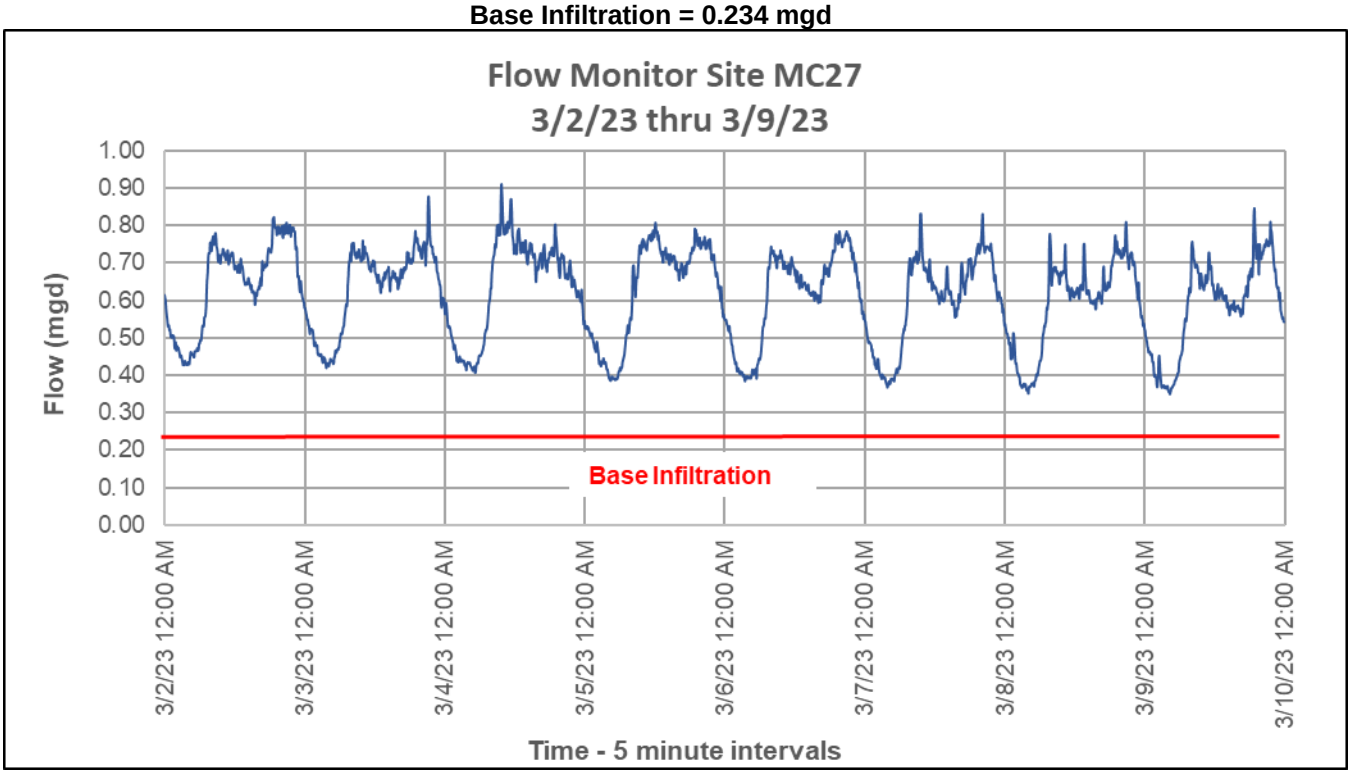


Figure 3-7
Flow Monitor Site MC27
Base Infiltration = 0.234 mgd



3-5 Rainfall Dependent Inflow and Infiltration

Inflow is the surface water that typically gains entry to the sewer system through perforated or unsealed manhole covers during rainfall events that can cause covers to become flooded. Inflow in addition to infiltration is often termed Rainfall Dependent Inflow and Infiltration (RDII). The sewer system design capacity must include allowances for these extraneous water components, which inevitably become a part of the total flow. The amount of RDII that enters the system typically depends upon the availability and location of the storm water drainage facilities, age of structures, materials and methods of construction, manhole cover openings, location of manhole, the elevation of the groundwater table, and the characteristics of the soil.

ADS Environmental Services conducted rainfall monitoring along with the aforementioned flow monitoring. Four significant rain events were captured during the monitoring period as shown in Table 3-3. The most notable storm occurred on March 14, 2023 with about 2 inches of rain over 24 hours.

Table 3-3
Rainfall Events

Storm #	Date	Rainfall (in)			Duration (hours)	Classification
		RG01PS	RG02FS66	RG03MSD		
1	3/10/2023	1.01	1.14	1.04	24	<<1-yr; 24-hr
2	3/14/2023	2.02	2.24	2.04	24	3-yr, 12-hr
3	3/20/2023	1.47	1.88	1.82	24	1-yr; 18-hr
4	3/29/2023	0.66	1.07	0.86	6	<<1-yr; 24-hr

Reference: Midway Sewer Flow Monitoring and RDII Report, ADS Environmental Services, May 2023

An analysis was performed to quantify RDII produced by each basin. RDII is the volume of flow measured above the normal expected dry weather flows due to a rainfall event. The RDII for each basin was "normalized" by dividing it by the rainfall volume (inches) and basin size (feet of pipe). The normalized volume RDII for each basin is shown in Figure 3-8.

Generally, values > 5 gal/ft/in are considered noteworthy and values > 10 gal/ft/in are considered excessive. Basin MC09, MC03C, MC70, MC38, MC21, MC18, MC15, and MC23 were identified with a Normalized Volume RDII greater than 10 gal/ft/in. The hydrograph of Basin MC09, which produced a significant RDII response during the March 14th and 15th rain event, is shown on Figure 3-9. The "Gross I/I" is the RDII volume summed over the duration of the storm event. It can be seen that RDII response occurs for several days after the actual storm event.

Figure 3-8
Normalized Volume RDII (gal/ft/in)

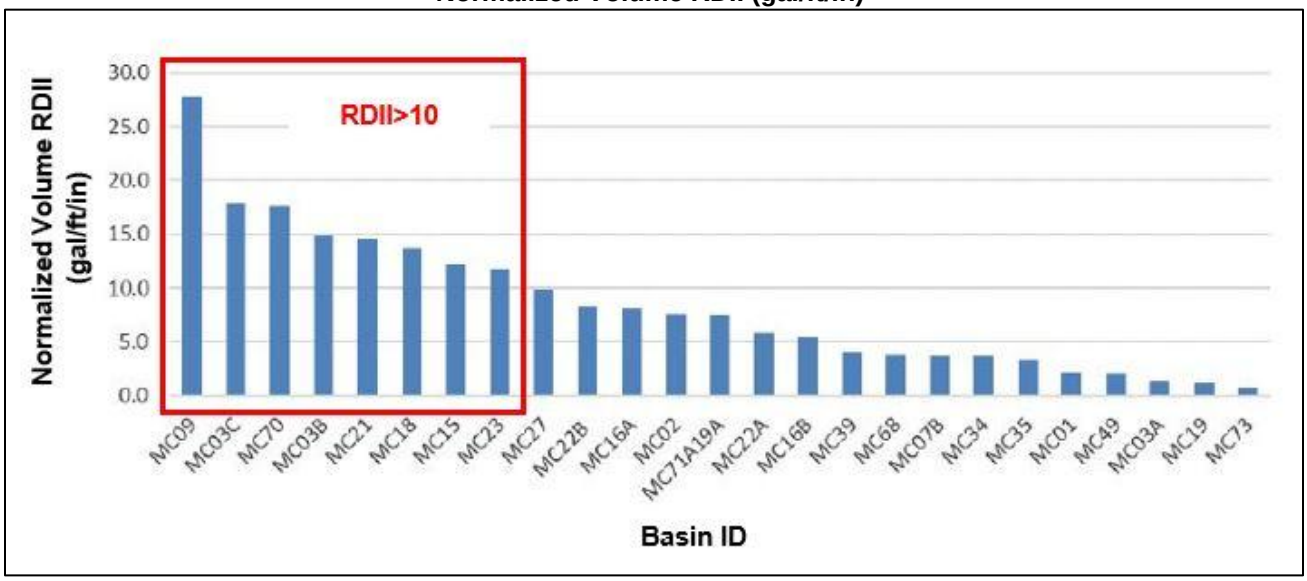
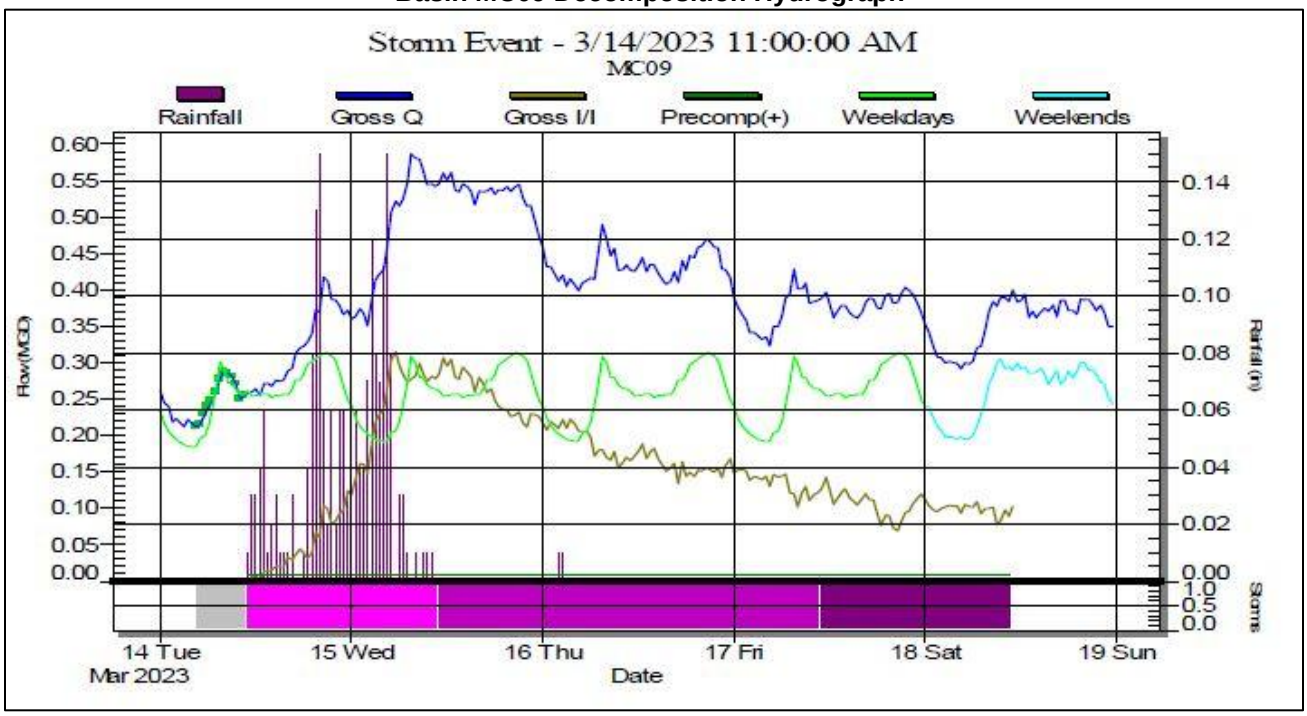


Figure 3-9
Basin MC09 Decomposition Hydrograph



The primary recommendations resulting from the RDII analysis include the following:

1. Conduct Sanitary Sewer Evaluation Surveys (SSES) including manhole inspections and closed circuit television (CCTV) pipe inspections for the following eight basins: MC09, MC03C, MC70, MC03B, MC21, MC18, MC15, and MC23. Any CCTV inspections should be done during early morning hours which is typically the minimum flow period, to get the most unobstructed view of the pipe as possible so that infiltration points might be captured.

2. Investigate possible capacity issues associated with sites MC02, MC03A, MC03B, MC09, MC16B, MC19, MC19A, MC21, MC22B, and MC35. These sites were characterized by surcharges and/or noted backwater occurring during the study.
3. Consider rehabilitation to reduce infiltration in some basins, particularly those where capacity issues are associated. This may include comprehensive lining of pipes, connections and manholes
4. Future follow up flow monitoring is recommended to enable post-rehabilitation RDII reduction to be evaluated.

Additional recommendations for MCSD to consider include the following:

1. Evaluate structural defects found via CCTV inspections in areas with higher normalized RDII (Figure 3-4) and consider the need for a lining program to prevent infiltration into the system.
2. Place depth monitors, such as SmartCovers in areas with higher normalized RDII (Figure 3-4) and/or areas with possible capacity related concerns. Monitor depths during dry and wet weather periods. Consider improving gravity sewer capacity, if high levels and/or sewer spills are identified at these locations.
3. Replace manhole covers with new ones with a single vent hole and install sufficient plugs in manhole covers (adequate venting of the collection system must be provided through the manhole covers) to minimize inflow from surface flooding in areas where it is known to occur. Locations with known stormwater ponding concerns should be given higher priority. Plugs should be reinstalled whenever the manhole cover is opened.
4. Locate and plug connections that have been abandoned, but not properly disconnected at the mainline sewer. For development or redevelopment projects, new sewer connections are added to replace the previous connection. Instead of properly plugging the inactive connection, they can be left in place and become a source of infiltration.

3-6 Peaking Formulas

The steady state peaking formula commonly used in sewerage studies is of the following form:

$$\mathbf{PDWF = a \times ADWF^{b}}$$

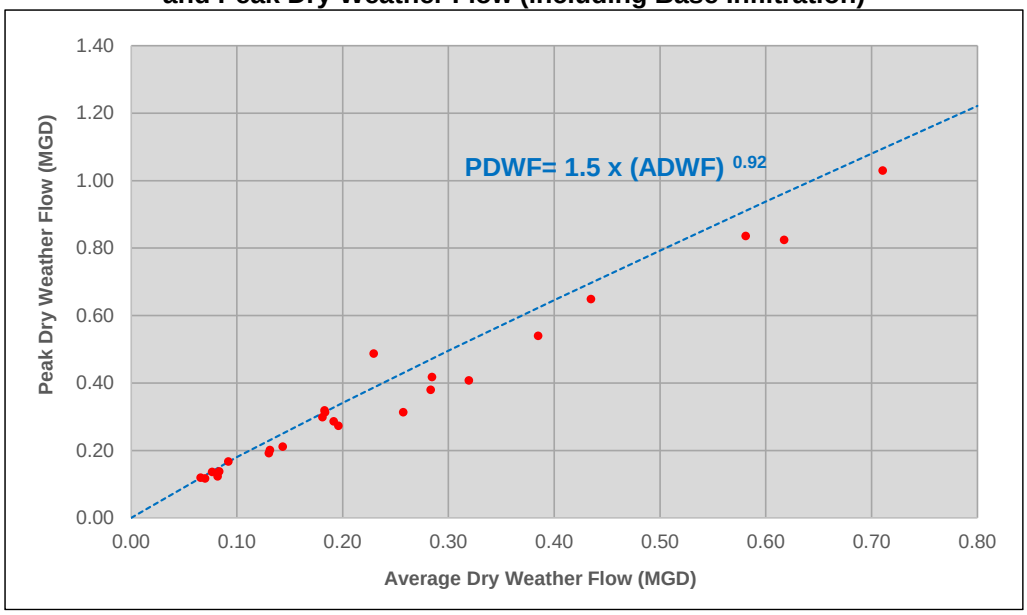
where PDWF = Peak Dry Weather Flow [mgd]
ADWF = Average Dry Weather Flow [mgd]
a, b = Peaking Formula Coefficients

The coefficient “b” factor accounts for smaller tributary areas with smaller ADWF, which generally experience greater PDWF. The change in usage of one customer in a very small tributary area will have a greater effect on its corresponding PDWF than a change in usage of one customer in a very large tributary area. Note that the units of the selected peaking formula are in million gallons per day (mgd).

In order to develop the peaking formula and establish coefficient “a” and “b”, the maximum versus average dry weather flow measured is plotted for each flow monitoring site. The peaking relationship is then based on the best fit line through the data points, as shown on Figure 3-10 and Figure 3-11.

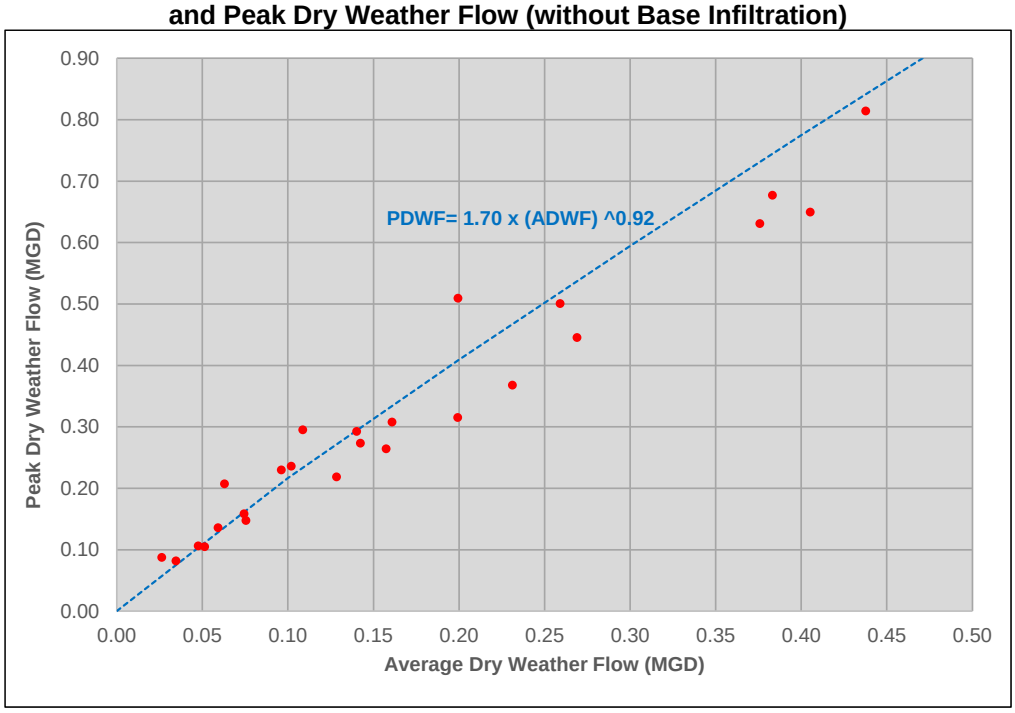
The following relationship was developed from the 2023 flow monitoring data that included base infiltration: $\mathbf{PDWF = 1.50 \times ADWF^{0.92}}$ **.** It should be noted that the coefficient of the best fit line was increased out of conservatism for planning purposes.

Figure 3-10
Relationship between Average Dry Weather and Peak Dry Weather Flow (including Base Infiltration)



The following relationship was developed from the 2023 flow monitoring data for the base loads only (without base infiltration): **PDWF = 1.70 x ADWF $^{0.92}$.**

Figure 3-11
Relationship between Average Dry Weather and Peak Dry Weather Flow (without Base Infiltration)



The reason for developing two peaking formulas is because not all areas of the service area were tributary to a flow monitor. When there is constant base infiltration adding to the total sewage flow conveyed in the gravity mains, the peaking coefficient (1.5) is dampened or lower than it normally would be. For the areas without flow monitors, the base infiltration is unknown. The higher peaking coefficient (1.7) is utilized to account for the peak flows that are actually generated within homes and businesses.

SECTION 4
PERFORMANCE EVALUATION AND DESIGN CRITERIA

4-1 General

Establishing performance standards is an important part of evaluating the existing sewer collection system, as it forms the basis for most of the system improvement recommendations. These standards include methodology for estimating sewage flows, and minimum design standards for the collection system pipes, lift stations, and force mains.

Existing average sewage flows can be reasonably estimated from water billing data, land use designations and their corresponding sewer return ratios. The results are then compared to measured flows. Peaking factors are needed for estimating peak dry weather and peak wet weather flows. Peak wet weather flows include an allowance for inflow and infiltration (I/I).

Future average sewage flows for new development and redevelopment areas can be reasonably estimated from land use and corresponding unit flow factors.

Collection system design standards include minimum pipe size, minimum flow velocity, and depth of flow to pipe diameter ratio (d/D). Lift station criteria include the capacity and number of pumps, wet well and force main sizes, redundancy, emergency power, remote monitoring capabilities, as well as safety and regulatory agency requirements. Finally, facility useful lives are needed for adequately scheduling replacement of the aging infrastructure. .

The average dry weather flows (ADWF) in the existing condition model scenario were allocated using water billing data, adjusted to represent sewage flows recorded at the flow monitoring locations. The sewage allocation methodology is further described in Section 6, Hydraulic Sewer Model.

A summary of performance evaluation, design, and service criteria is provided in Table 4-1.

Table 4-1
Sewer System Criteria

Collection System	
Minimum Pipe Size	8-inch
Minimum Velocity	2.0 fps at average dry weather flow 3.0 fps at peak dry weather flow
Maximum Velocity	6.0 fps at peak dry weather flow for VCP 5.0 fps at peak dry weather flow for PVC
Minimum Slope	Refer to Table 3-5
Maximum Slope	Slope that generates the maximum flow velocity.
Pipe Depth to Diameter Ratio	0.64 at peak dry weather flows for all pipes existing prior to the Sewer Master Plan hydraulic analysis 0.50 at peak dry weather flows for all newly constructed pipes 15-inches and smaller 0.64 at peak dry weather flows for all newly constructed pipes 18-inches and larger 0.82 at peak wet weather flows for all pipes

Table 4-1 (Continued)
Sewer System Criteria

Lift Station	
Pumps	• Minimum 2 each sized at peak wet weather flow • Minimum solids handling capacity 3”
Wet Wells	• Sized to limit pump cycling to less than 6 times/hr for motor HP up to 20; 4 times/hr up to 50 HP; 3 times/hr up to 75 HP; 2 times/hr 100 HP and above • Provide 30 minutes of storage at peak flow to allow response to a failure • Equipment to be maintained must be accessible without entering the structure
Ventilation	• 15-air change/hour minimum in wet wells operated continuously • 30-air change/hour minimum in wet wells not operated continuously • 15-air changes/hour minimum in dry well
Controls	Redundant system. Ultrasonic level sensor for primary level controls. Float operated back-up controls.
Emergency Power	Stationary source with automatic transfer switch
Telemetry	Dialer system at all pump stations to alert personnel in the event of a station failure
Force Mains	• Minimum velocity 3 fps • Maximum velocity 5 fps • Minimum size 4” • Air/Vacs installed in vaults
Inverted Siphons	
Siphon Barrels	• Dual or multiple • Minimum diameters of 8-inches • Minimum velocity of 3 fps ADWF and 4 fps PDWF • Vertical curves, with no sharp horizontal angles or changes of grade • If crossing a waterway, minimum 5 ft between the top of the siphon and the level of possible scour in the waterway • Location away from an outlet of a lateral or a drop manhole • Invert at the outlet structure at least 0.1 ft lower than invert of inlet structure • Material is HDPE or PVC • Maximum angle of downstream leg no more than 15 degrees from horizontal • Maximum angle of upstream leg no more than 30 degrees from horizontal
Access Structures	• Located at each end of siphon, rectangular preferred • Sized to allow for any O&M procedure • Lined, coated, or protected with a suitable corrosion resistant material • Steps, ladders, access frames and covers, gratings and other appurtenances fabricated of 316 stainless steel • Ability to install temporary guard rails
Slide Gates, Stoplogs, Wiers	• Fabricated of 316 stainless steel
Valves	• No valves allowed
Air Jumpers	• Adequately sized between access structures • Minimum 6-inches in diameter • Material is HDPE or PVC • Designed to remove condensate with a minimum slope for drainage; overhead air jumpers that are self-draining to the access structures are preferred • Ability to accommodate inspection and cleaning methods

4-2 Unit Flow Factors

Sewage load estimates for future development and redevelopment areas were estimated using unit flow factors, as shown in Table 4-2. These factors were developed utilizing water use data, land use information, flow monitoring data and developed sewer return factors.

Non-residential land uses typically include a wide variety of businesses and manufacturing processes that cause sewage generation to vary significantly from one customer to another. This is evident in the wide range of water use for different non-residential businesses. For example, warehouses typically use a low amount of water and generate low amounts of sewage. On the other hand, some manufacturing businesses can use large of amounts of water and contribute large amounts of sewage to the sewer system.

When a new development is proposed in the service area, MCSD may require a sewage flow estimate and a hydraulic analysis. Specific data regarding the proposed dwelling units, gross building floor area, and floor to area ratios should be used to develop the sewage flow estimate. Hydraulic analyses are to be conducted to verify available downstream system capacity and ensure that the system can convey the proposed sewage generation.

Table 4-2
Sewer Unit Flow Factors

Land Use Type	Sewer Unit Flow Factor
Single Family Residential	205 gpd/du
Mobile Home	185 gpd/du
Duplex	175 gpd/du
Triplex	130 gpd/du
Condominium	130 gpd/du
Qudruplex	130 gpd/du
MultiFamily	125 gpd/du
Apartment	125 gpd/du
Commercial	1,800 gpd/ac
Industrial	400 gpd/ac
Warehouse	400 gpd/ac
Hotel	125 gpd/room
Elementary School	15 gpd/student
Middle and High School	20 gpd/student
Restaurant	1,000 gpd/tsf
Parks/ Recreation/ Open Space	200 gpd/ac

4-3 Peak Dry Weather Flow

Sewer return factors are used to generate average dry weather flows (ADWF) entering the collection system. However, the adequacy of a sewage collection system is evaluated based upon its ability to convey the peak flows. In a steady state hydraulic model, at any individual point in the system, peak dry weather flow (PDWF) is estimated by converting the total average tributary flow to peak dry weather flow by an empirical peak-to-average relationship.

As discussed in Section 3-6, the steady state peaking formula commonly used in sewerage studies is of the following form:

PDWF = a x ADWF ^{b} where PDWF = Peak Dry Weather Flow [mgd]
ADWF = Average Dry Weather Flow [mgd]
a, b = Peaking Formula Coefficients

The following relationships were developed from the 2023 flow monitoring data:

1. **PDWF = 1.50 x ADWF $^{0.92}$** when base infiltration is known and/or included
2. **PDWF = 1.70 x ADWF $^{0.92}$** when base infiltration is unknown and/or excluded

4-4 Peak Wet Weather Flow

The peak wet weather flow (PWWF) has two components: peak dry weather flow (PDWF) and rainfall dependent inflow and infiltration (RDII) as expressed by the following equation:

PWWF = PDWF + RDII

Peak wet weather flow in a sewer system is dependent on the amount of RDII, which was discussed in Section 3-5, is dependent on the storm water drainage facilities, condition of the sewer system facilities, location of the groundwater table, and characteristics of the soil. It is also highly dependent on the storm frequency experienced and the base infiltration, which can increase as sequential storms occur through a rainy season.

Wet weather flows are not necessarily estimated and modeled for master planning purposes. It is unreasonable or feasible to design or evaluate a sewer system to carry flows from all possible storm scenarios. Instead, the depth to diameter criteria (Section 4-5.1) allows for at least 25 percent of the pipe capacity to be reserved for wet weather flows.

As more wet weather flow monitoring is conducted and basins with high RDII are identified, it is recommended that MCSD concentrate on projects such as the following:

1. Closed circuit television inspections of pipes and manholes
2. Replacement of manhole covers
3. Installation of plugs in manhole covers and sealing manhole cover rims
4. Replacing or relining cracked pipes

4-5 Sewer System Performance Evaluation Criteria

Sewer system performance evaluation criteria are established to ensure that the sewer collection system can operate effectively. Each pipe segment must be capable of carrying peak flows without surcharging the system. Low flows must be conveyed at a velocity that will prevent solids from settling and blocking the system.

4-5.1 Peak Dry Weather Flow Depth to Diameter Ratio

The design capacity of a gravity pipeline is typically the calculated capacity of the pipeline based on the Manning formula with a friction factor of 0.013 for vitrified clay pipe (VCP):

$$Q = 1.486 * A * R^{\frac{2}{3}} \frac{S^{\frac{1}{2}}}{n}$$

where, **Q** = flow in cubic feet per second
R = hydraulic radius in feet = A / P
A = cross-sectional area of the pipe in square feet
P = wetted perimeter in feet
S = slope of pipe in feet of rise per foot of length
n = Manning's friction factor

The design and analysis of sewer pipes is then based upon the depth to diameter ratio (d/D). In this study, **existing** pipes are considered capacity deficient if the d/D is above 0.64 at peak dry weather flows. This d/D ratio was arrived at by taking about 75% of a pipe's maximum stable flow capacity, which is at a d/D of 0.82. The area above a d/D of 0.82 is considered hydraulically unstable. The pipe capacity between the d/D ratio of 0.64 and 0.82 is reserved for inflow and infiltration. This is approximately equivalent to 25% of the pipe's capacity.

The extra pipeline capacity also allows for the possibility that actual sewage flows may be slightly higher than anticipated PDWF. Additionally, the area above the water surface helps to keep the sewage aerated, reducing the possibility of septic conditions and odors.

For **new or future construction**, the design and analysis of gravity sewer pipes shall be based on the following depth to diameter ratios:

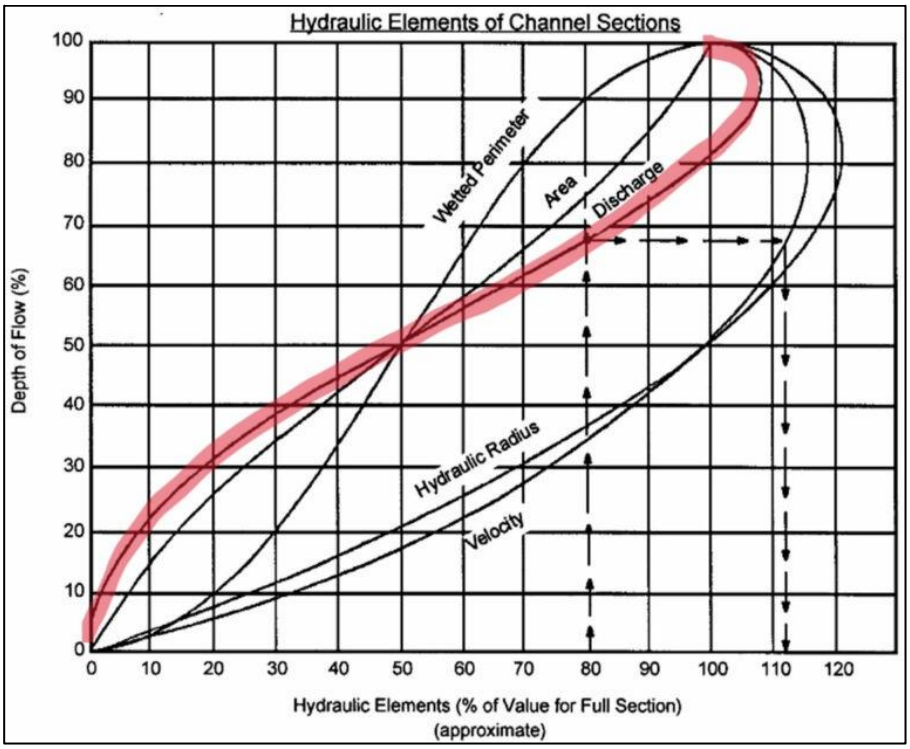
- Pipes **18-inches and smaller** in diameter shall be designed to flow at a maximum **d/D of 0.50** under peak dry weather flows
- Pipes **21-inches and greater** in diameter shall be designed to flow at a maximum **d/D of 0.64** under peak dry weather flows

Although this Sewer Master Plan study defined existing pipes as deficient when the d/D ratio exceeded 0.64 under peak dry weather flows, for all practical purposes the aforementioned design criteria must be adhered to. For instance, if the sewer pipe is 18-inches and smaller and was designed to flow at a maximum PDWF d/D of 0.50 and is now constructed, the maximum PDWF d/D must be maintained at 0.50. Additional future development flow shall not be allowed to contribute to this sewer pipe if the maximum PDWF d/D ratio is going to exceed 0.50.

4-5.2 Peak Wet Weather Flow Depth to Diameter Ratio

Assuming a constant Manning roughness coefficient and slope of a circular pipe, the velocity and flow rate profiles can be plotted against the depth of flow as shown on Figure 4-1. The maximum velocity occurs at about 81.3 percent full (d/D=0.813). The maximum flow rate occurs at about 93.8 percent full (d/D=0.938). Although the maximum flow rate exceeds that of a full pipe by about 8 percent, the difference is somewhat insignificant since pipes operating near full capacity tend to experience slightly unstable flow. The flow rate at

Figure 4-1



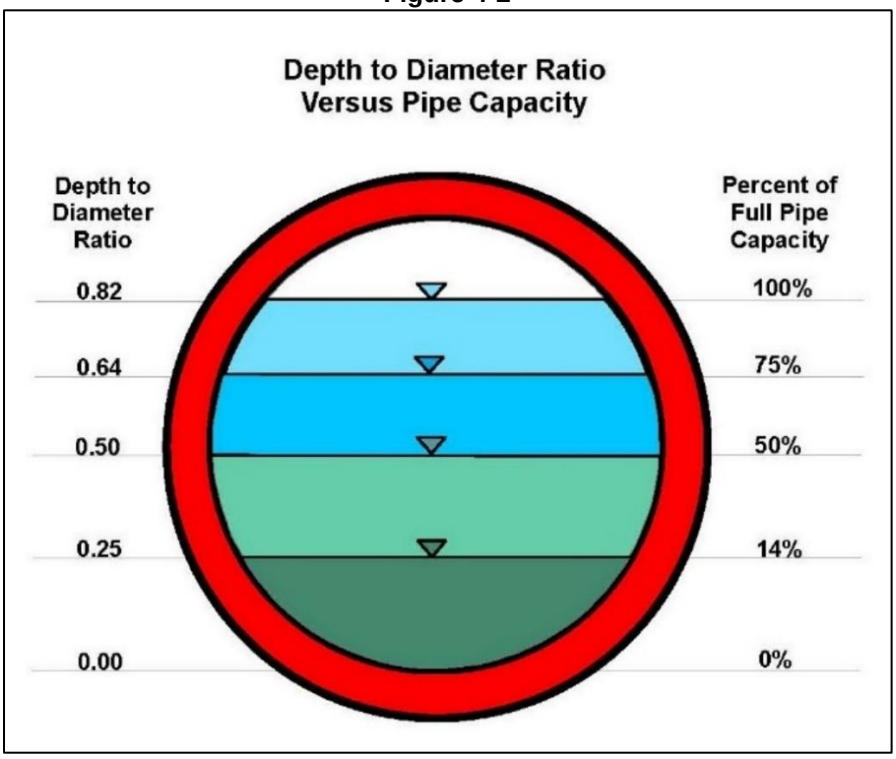
about 0.82 is therefore commonly considered the maximum capacity because it has the same capacity as when the pipe is full.

Sewer agencies have to set d/D criteria that provides enough capacity in the system to avoid backups and sewer spills. At the same time, minimum velocities must be considered so as not to allow debris to settle and create septic conditions that could potentially become a continual operation and maintenance issue. It is also not practical or feasible to size the pipes in a system to convey an excessive amount of wet weather flow.

Setting the peak dry weather flow depth to diameter ratio at 0.50 or 0.64 inherently reserves room in the pipes for wet weather flows. As shown on Figure 4-2, there is an additional 25% available capacity between a d/D of 0.64 and 0.82. There is an additional 50% available capacity between d/D of 0.50 and 0.82.

The remaining capacity in each pipe can be evaluated and utilized as a factor in prioritizing improvement projects. If the remaining capacity is less than 25%, projects to reduce base infiltration and/or rainfall dependent inflow and infiltration should be considered. Projects might include replacing and/or sealing manhole cover rims, installing sufficient plugs in manhole covers to minimize inflow from surface flooding in areas where it is known to occur, and/or replacing or relining cracked pipes to reduce infiltration.

Figure 4-2



4-5.3 Pipe Sizes and Velocities

Design criteria are established to ensure that the sewer collection system can operate effectively under all flow conditions. Each pipe segment must be capable of carrying peak flows without surcharging the system. Low flows must be conveyed at a velocity that will prevent solids from settling and blocking the system.

At a minimum, all pipes shall be 8 inches or larger in diameter and the velocity of flow in the pipe shall be greater than 2 ft/s during average flow conditions. This velocity will prevent deposition of solids in the sewer. A velocity of 3 ft/s is recommended during peak dry weather flow conditions, to resuspend any materials which may have already settled in the pipe. The minimum pipe slopes required by MCSD per the current Design and

Construction Requirements for Sanitary Sewers is shown in Table 4-3. If there is insufficient flow to create the minimum velocities, greater slopes than those shown may be required. The peak flow velocity shall be less than 6 feet per second in vitrified clay pipe (VCP) and 5 feet per second in polyvinyl chloride pipe (PVC). The maximum allowable slope shall be the slope which generates these maximum flow velocities.

It is recognized that the desired minimum slopes and velocities are sometimes not achievable under certain circumstances. On a case by case basis, MCSD may approve sewer designs that do not meet these criteria. More frequent pipe cleaning may be needed in areas with less than the minimum slopes shown in Table 4-3, where velocities are less than the minimums recommended, and/or further reduction in inside water use results in increased solids deposition in the pipelines.

Table 4-3
Minimum Sewer Slopes

Pipe Size (in)	Minimum Slope
8"	0.0040
10"	0.0028
12"	0.0022
15"	0.0016
18" and larger	0.0012

4-6 Sewer Lift Station Performance Evaluation Criteria

It is desirable to develop a sewer collection system with as few lift stations as possible due to the associated cost and maintenance required. The Sewer Master Plan does not recommend any new sewer lift stations. The performance of sewer lift stations is of particular importance since a failure could have far reaching ramifications. Therefore, they must be designed to be reliable, sized with sufficient capacity, and contain redundant equipment, as well as emergency power supply, sufficient storage, and be able to notify the appropriate staff in the event of failure.

The primary components of a sewer lift station are the wet well, pumps, dry well, valve and meter vaults as necessary, force main, and electrical controls.

While lift stations may be necessary to serve portions of MCSD's service area because of topographic requirements, all feasible efforts shall be made to limit the number of lift stations. In evaluating the feasibility of constructing a lift station, a detailed comparison with a gravity alternative shall be made. The service life of each facility, the cost of operation and maintenance, as well as the many problems associated with the development of flows during the first several years shall be carefully considered.

4-6.1 Wet Well

The wet well stores the incoming sewage until a pump is activated to discharge it. It shall be designed with sufficient capacity to prevent short cycles whereby the pumps continually start and stop, yet small enough that it will be regularly evacuated to prevent the sewage from becoming septic.

Generally, the desired number of pump cycles shall be limited to no more than 6 per hour for motors up to 20 horsepower. Motors up to 75 horsepower shall start no more than 4 times per hour. Larger motors shall cycle less frequently. Lift stations that are distant from MCSD's maintenance yard shall also have sufficient volume to store sewage in the event of failures. The wet well shall have sufficient storage for MCSD staff to connect a portable generator in case of commercial power failure where a dedicated standby driver or generator is not provided, or to place a portable pump in operation. A minimum emergency storage of 30 minutes at peak wet weather flow shall be provided. At minimum peak wet weather flows shall be calculated utilizing the following formula:

Peak wet weather flow (PWWF) = 1.35 x peak dry weather flow (PDWF)

Wet wells of sewer lift stations must be ventilated at a minimum of 15 air changes per hour, when provided with continuous ventilation. Where continuous ventilation is not available, the wet well must be ventilated at a minimum of 30 air changes per hour.

4-6.2 Pumps

The pumps shall be sized to efficiently handle peak flows. A minimum of two pumps sized at the peak wet weather flow to the station shall be provided so that sufficient standby capacity is available when one pump is removed for repairs. The pumps shall be able to pass a minimum solid size of 3 inches without clogging. The shafts, seals and impellers shall be constructed of wear resistant material to provide long life. Tungsten Carbide seals, Ni-Hard impellers, and 316 stainless steel pump shafts are recommended. For services where aggressive agents may be found in the sewage, such as at golf courses, complete stainless steel construction is recommended. This includes the pump bowl, shaft, impeller, and motor housing.

4-6.3 Dry Well

The dry well houses the valves, pumps, motors and electrical controls. It must be well ventilated and provide unobstructed access to all equipment. A minimum 3.5-foot clearance from all obstructions shall be provided. Greater clearances may be required for equipment with special maintenance needs. Facilities for equipment removal, including hatches, large door openings, and hoists, shall also be provided.

While submersible lift stations may be utilized for the small flows, the larger lift stations shall be the wet well/dry well type. They shall be designed with easy access to all equipment. The dry well and equipment rooms shall be designed for a ventilation rate of at least 12 air changes per hour. Wet wells and, under certain circumstances dry wells, are considered confined spaces and shall be entered in accordance with the corresponding requirements of Occupational Safety and Health Administration (OSHA).

4-6.4 Force Mains

Force mains shall be selected to operate within a 3 ft/s to 5 ft/s velocity range but shall not be smaller than 4-inches in diameter. The lift stations shall have dual (redundant) force mains, each meeting the design criteria individually.

4-6.5 Telemetry Equipment

All lift stations shall incorporate redundant control systems for operation of the pumps. A float system shall be used as a backup for a primary control system that utilizes two (2) ultrasonic level sensor devices.

Full Supervisory Control and Data Acquisition (SCADA) telemetry equipment, which includes a telephone dialer as a backup, must be provided at all lift stations. When an alarm or failed condition occurs, the dialer shall call pre-programmed telephone numbers in sequence until the call is acknowledged, indicating response will be provided by MCSD staff. If the alarm or failed condition is not corrected within a set time, the dialer will call the pre-programmed numbers again. The dialer can also be used to remotely check the status of the station if desired.

4-6.6 Emergency Power Source

An emergency power source shall be provided to operate the lift station during outages of the primary power source. A standby generator with an automatic transfer switch shall be provided.

4-7 Inverted Siphons Performance Evaluation Criteria

In general, siphons should be avoided when possible. This section describes recommended performance criteria for the design of any future siphons.

General

1. Accessibility of the inlet and outlet structures to minimize traffic control setup.
2. Adequate space for equipment setup and vehicle parking, including a buffer for safety.

Siphon Barrels

1. Dual (or multiple) barrels so that normal flow can be diverted to either barrel when the other barrel is cleaned.
2. Minimum barrel diameters of 8-inches.
3. Minimum barrel velocity of 3 feet per second at average dry weather flow and 4 feet per second at peak dry weather flow.
4. Barrels with vertical curves and with no sharp horizontal angles or changes of grade.
5. For an inverted siphon crossing a stream waterway, a minimum of 5 feet between the top of the siphon and the level of possible scour in the stream or waterway.
6. Location away from an outlet of a lateral or a drop manhole
7. Invert of the barrels at the outlet structure at least 0.2 feet lower than the invert at the inlet structure.
8. Siphon barrels shall be pressure rated HDPE or PVC.
9. The maximum angle of the downstream (rising) leg approaching the outlet structure shall be no more than 15 degrees from horizontal. The maximum angle of the upstream (descending) leg shall be no more than 30 degrees from horizontal.

Access Structures

1. Access structure at each end of siphon. Rectangular access structures are preferred.
2. Access structures sized to allow for any maintenance and operation procedure.
3. The interior surface of the access structures is lined, coated or otherwise protected with a suitable corrosion resistant material.
4. Steps, ladders, access frames and covers, gratings and other appurtenances fabricated of 316 stainless steel.
5. Ability to install temporary guard rails while maintenance work is being conducted.

Slide Gates, Stoplogs, Weirs

1. Slide gates, stoplogs, weirs, and similar devices fabricated of 316 stainless steel.

Valves

1. No valves shall be used for siphons.

Air Jumper

1. Adequately sized air jumper line between access structures
2. Minimum air jumper size of 6-inches in diameter.

The empirical method for determining the cross sectional area of the conduit allocated for gas flow approaching the inverted siphon is as follows:

$$A_A = 2A_S$$

Where, A_A = Cross sectional area of airline

A_S = Flow cross sectional area allocated for gas flow of the approaching conduit

3. Air jumpers made of pressure rated HDPE or PVC.
4. Air jumpers are designed to remove condensate with a minimum slope for drainage. Where practical, overhead air jumpers that are self-draining to the access structures are preferred.
5. Air jumpers are designed to accommodate MCSD's inspection and cleaning methods.

4-8 Criteria for Future Developments

As reasonably determined by MCSD, any party wishing to pursue development or redevelopment of parcels that will increase the sewer flows to MCSD's system will be responsible for evaluating the effect on the capacity of sewer system downstream of the proposed development. This is particularly important in areas that are tributary to sewers identified with capacity deficiencies or potential capacity deficiencies.

The developer's plans for providing adequate sewer service to all users within the proposed development, how the local sewer system will connect to the trunk sewer system, and the impact of the proposed development to the downstream facilities shall be fully described. The private sewers shall be required to meet the sewer design criteria included in this Performance Evaluation & Design Criteria section and all other applicable construction standards set forth by MCSD. At a minimum, sewage flow calculations shall be based upon the unit flow factors contained in Table 4-2. It is recommended that the sewer evaluation include the following:

- Map showing project boundaries and sewershed areas
- Detailed land use description and map
- Sewage flow calculations for the existing/predeveloped condition
- Sewage flow calculations for proposed development/redevelopment
- Comparison of flows from existing/predeveloped to proposed development/redevelopment conditions
- Exhibit showing all proposed sewer facilities and connections to the trunk sewer system, located within private property or the public right-of-way
- Hydraulic calculations meeting all sewer design criteria, demonstrating impact of the proposed development on MCSD's sewer system.

4-9 Service Life of Pipe and Lift Station Equipment

In addition to the design criteria discussed in previous sections, the useful lives for which one can expect relatively trouble-free service is also of great importance when assessing an existing or future sewer system. Once the service life of a facility is exceeded, it becomes subject to failure and is often more expensive to maintain. The determination of useful life can be difficult and depends on many different considerations including the following:

- Type of materials used and recorded performance of similar installations
- Velocities and flow rates expected in the system
- Chemical and biological conditions of the sewage

- Construction methods and installation

However, the values listed in Table 4-4 are generally accepted as prudent planning criteria and are used as benchmarks for replacement recommendations in this study.

Table 4-4
Planning Criteria for Facility Useful Life

Facility	Description	Useful Life (Yrs.)
Gravity Sewers	Cast Iron Pipe (cip)	20
	Plastic Pipe (PVC)	65
	Vitrified Clay Pipe (VCP)	75
Force Mains	Asbestos-Cement Pipe (acp)	40
	Ductile Iron Pipe (dip)	40
	Plastic Pipe	30
Lift Stations	Structure	60
	Piping	30
	Valving	20
	Mechanical	15
	Electrical	15

SECTION 5
EXISTING SYSTEM

5-1 General Description

The Midway City Sanitary District (MCSD) provides sewer collection service to the City of Westminster, the unincorporated area of Orange County known as Midway City. The existing service area consists of approximately 10.7 square miles.

The MCSD's existing sewer collection system is made up of a network of gravity sewers and four (4) sewer lift stations and their forcemains. The gravity system consists of approximately 863,261 feet of pipe and 3,361 manholes. The majority of the gravity sewers are constructed of vitrified clay pipes with sizes ranging from 6-inches to 18-inches in diameter.

Sewage is collected within the service area and conveyed to points of connection with Orange County Sanitation District (OCSD) trunk sewers or adjacent agency sewers.

5-2 Gravity Sewers

The sewer system consists of 863,261 feet (163.5 miles) of gravity sewers that are primarily made of vitrified clay pipe with sizes ranging from 6-inches to 18-inches in diameter. Approximately 86.7 percent of the sewers are 8-inches in diameter. The length of sewer pipe by size is shown on Figure 5-1. The length of gravity sewer by material is shown on Figure 5-2. The length of gravity sewer by decade of construction is shown on Figure 5-3. A map of the existing sewer system is shown on Figure 5-4.

Figure 5-1
Total Length of Gravity Sewer by Pipe Size

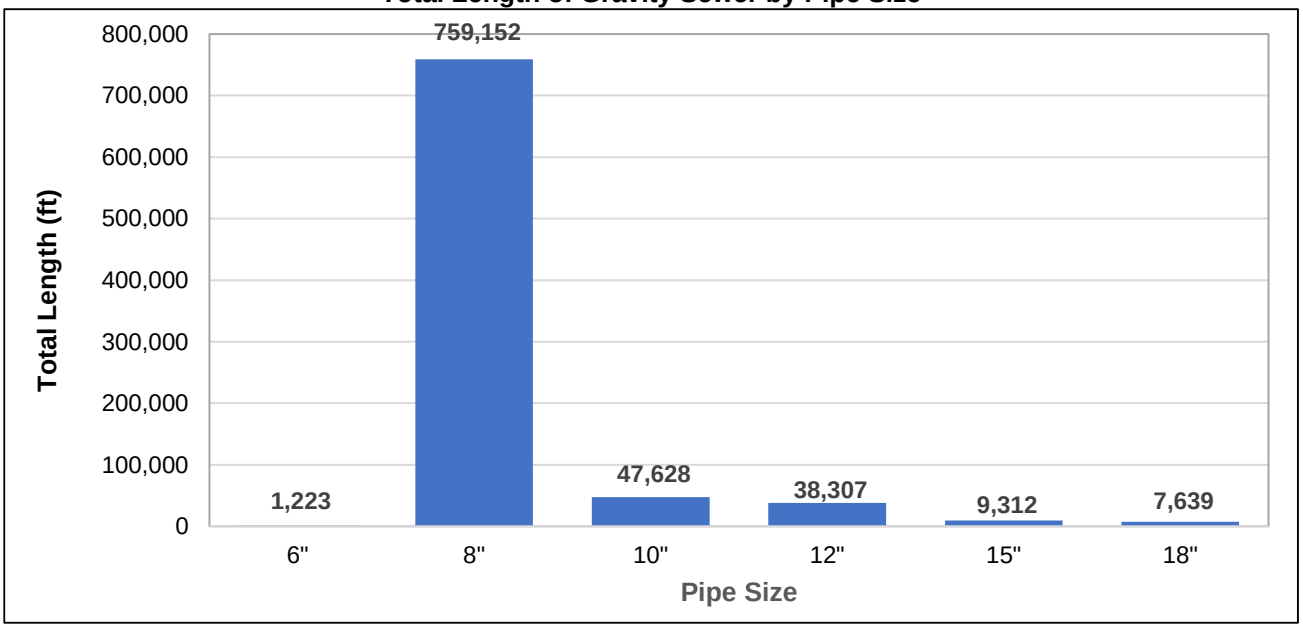


Figure 5-2
Total Length of Gravity Sewer by Pipe Material

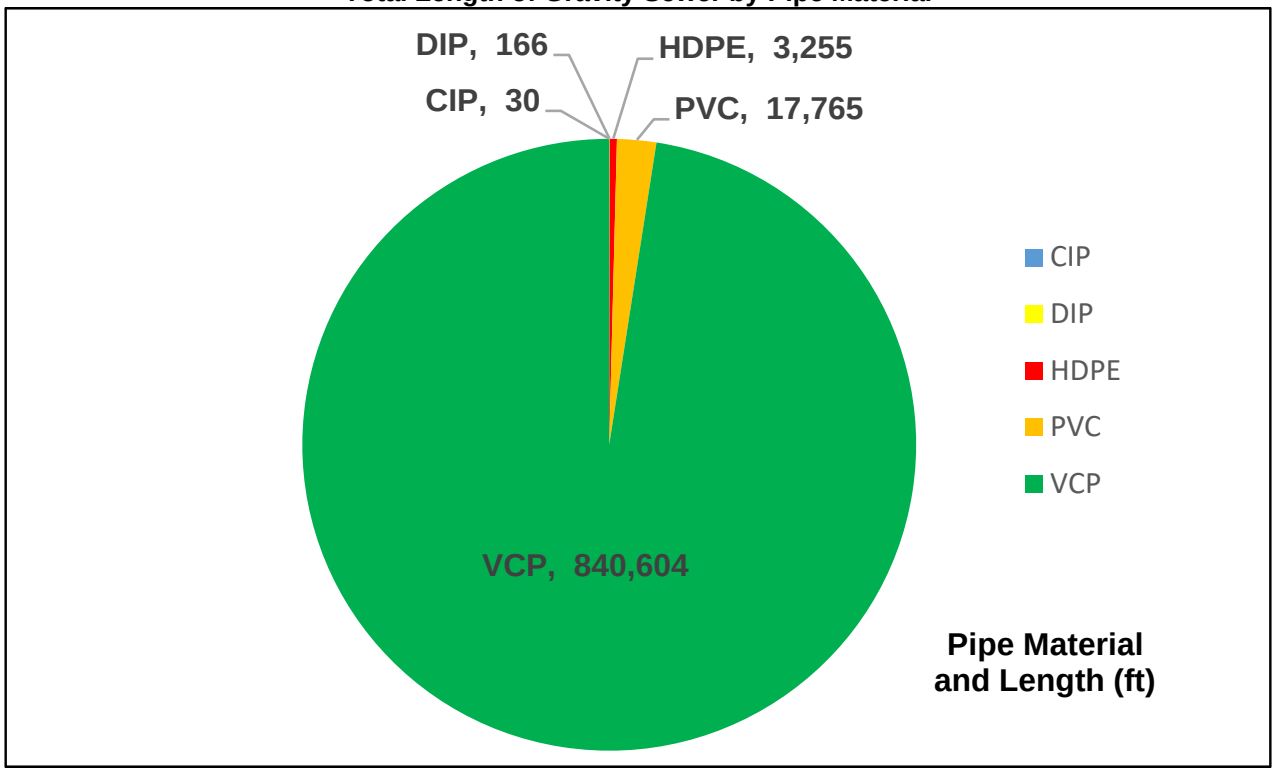
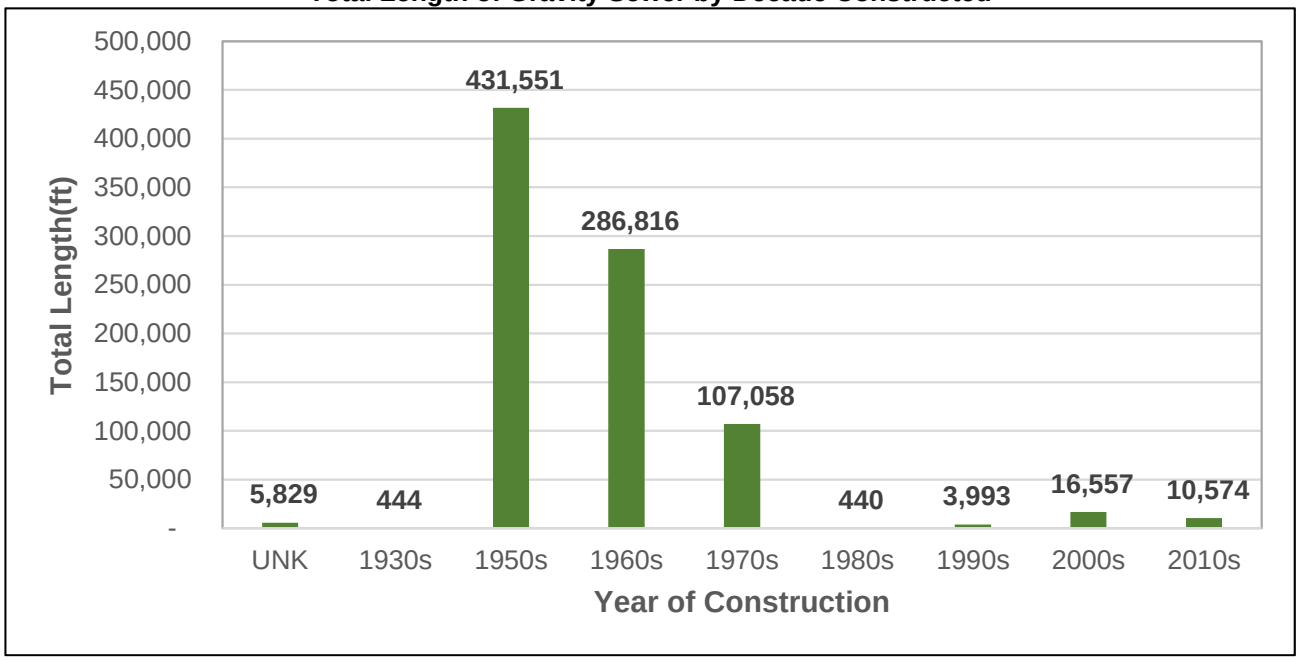
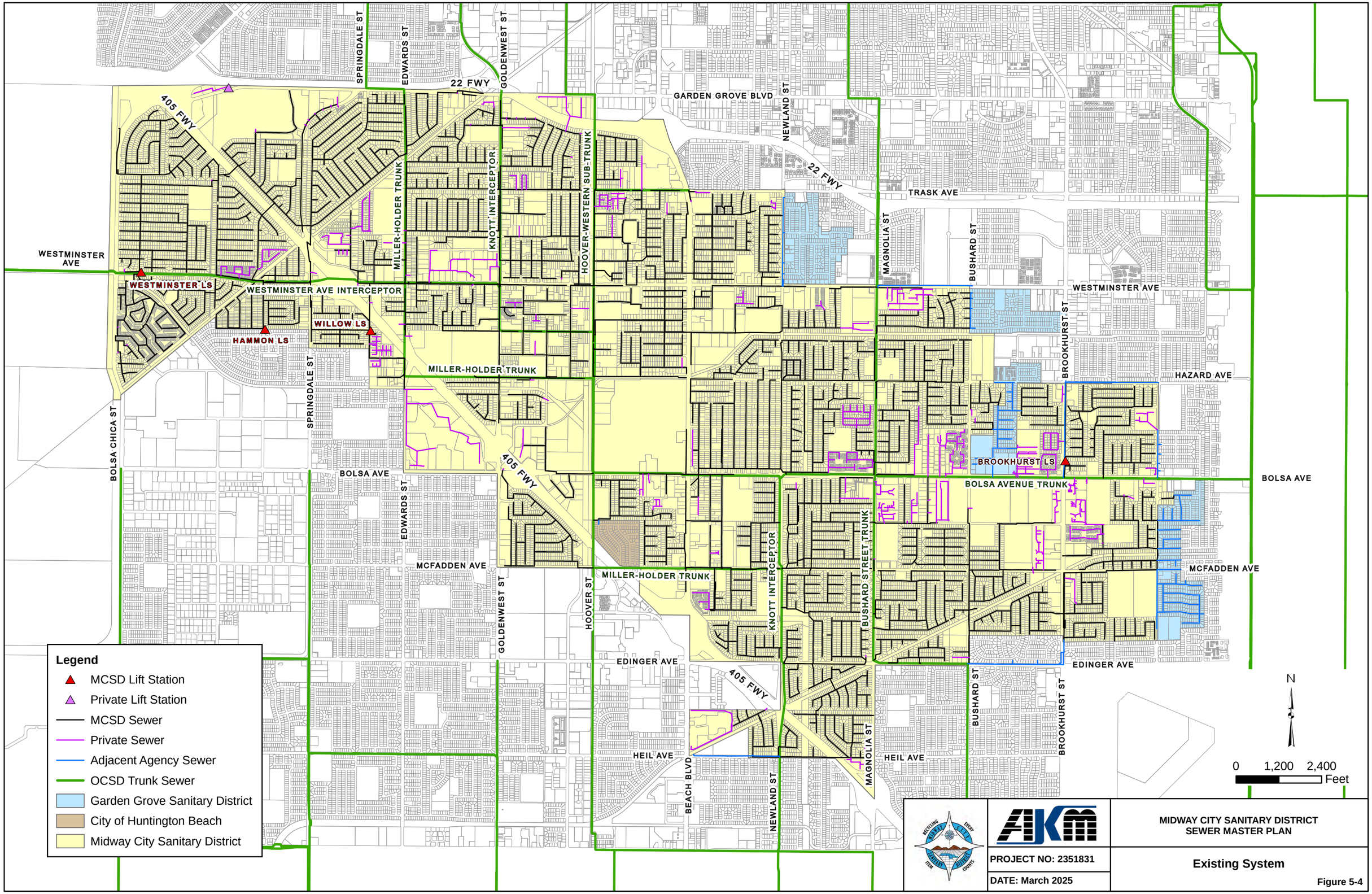


Figure 5-3
Total Length of Gravity Sewer by Decade Constructed




SPRINGDALE ST
EDWARDS ST
GOLDENWEST ST
22 FWY
GARDEN GROVE BLVD
NEWLAND ST
405 FWY
MILLER-HOLDER TRUNK
KNOTT INTERCEPTOR
HOOVER-WESTERN SUB-TRUNK
TRASK AVE
MAGNOLIA ST
BUSHARD ST
WESTMINSTER AVE
WESTMINSTER LS
WESTMINSTER AVE INTERCEPTOR
WILLOW LS
HAMMON LS
BROOKHURST ST
HAZARD AVE
BROOKHURST LS
BOLSA CHICA ST
BOLSA AVE
BOLSA AVENUE TRUNK
MCFADDEN AVE
EDINGER AVE
HEIL AVE
BEACH BLVD
BUSHARD STREET TRUNK
Legend
MCSD Lift Station
Private Lift Station
MCSD Sewer
Private Sewer
Adjacent Agency Sewer
OCSD Trunk Sewer
Garden Grove Sanitary District
City of Huntington Beach
Midway City Sanitary District
N
0 1,200 2,400
Feet
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN
PROJECT NO: 2351831
DATE: March 2025
Existing System
Figure 5-4

5-3 Siphons

The sewer system includes 24 inverted siphons. The primary concern with each siphon is the fact that grease and debris can build up in the siphon requiring frequent maintenance to prevent sewer spills. The existing siphon locations and descriptions are listed in Table 5-1.

There is an existing 8-inch diameter vitrified clay pipe (VCP) sewer that starts at Manhole MH15030, located about 300 feet north of the intersection of Springdale Street and Westminster Boulevard, and terminates at a Manhole MH15032, shown on Figure 5-5. Siphon Site 4, listed in Table 5-1, is the southerly portion of this sewer reach. Until 1970, this sewer existed with a constant slope from Manhole MH15030 to Manhole MH15032. In 1970, the Orange County Sanitation District (OCSD) constructed the 60-inch diameter reinforced concrete Westminster Avenue Interceptor Sewer, which is located approximately 43 feet north of Manhole MH15032 at its crossing of MCSD's 8-inch sewer. OCSD's "As Constructed' plan for the Westminster Avenue Interceptor Sewer shows a 48-inch diameter manhole approximately 8 feet north of the centerline of their interceptor sewer and an inverted siphon with a length of 15 feet. Review of a CCTV recording (from 2014) of the 8-inch MCSD sewer shows a vertical drop of approximately 2 feet. A CCTV recording of the section located on the south side of the interceptor sewer is not available, but it is reasonable to assume that a similar drop exists there as well. The design of this inverted siphon does not meet any industry standard. There are no upstream and downstream manholes, the pipe does not descend and ascend with mild slopes, nor is there an air jumper, which are all essential elements for maintaining the siphon.

Figure 5-5
Springdale Street Siphon at Westminster Boulevard

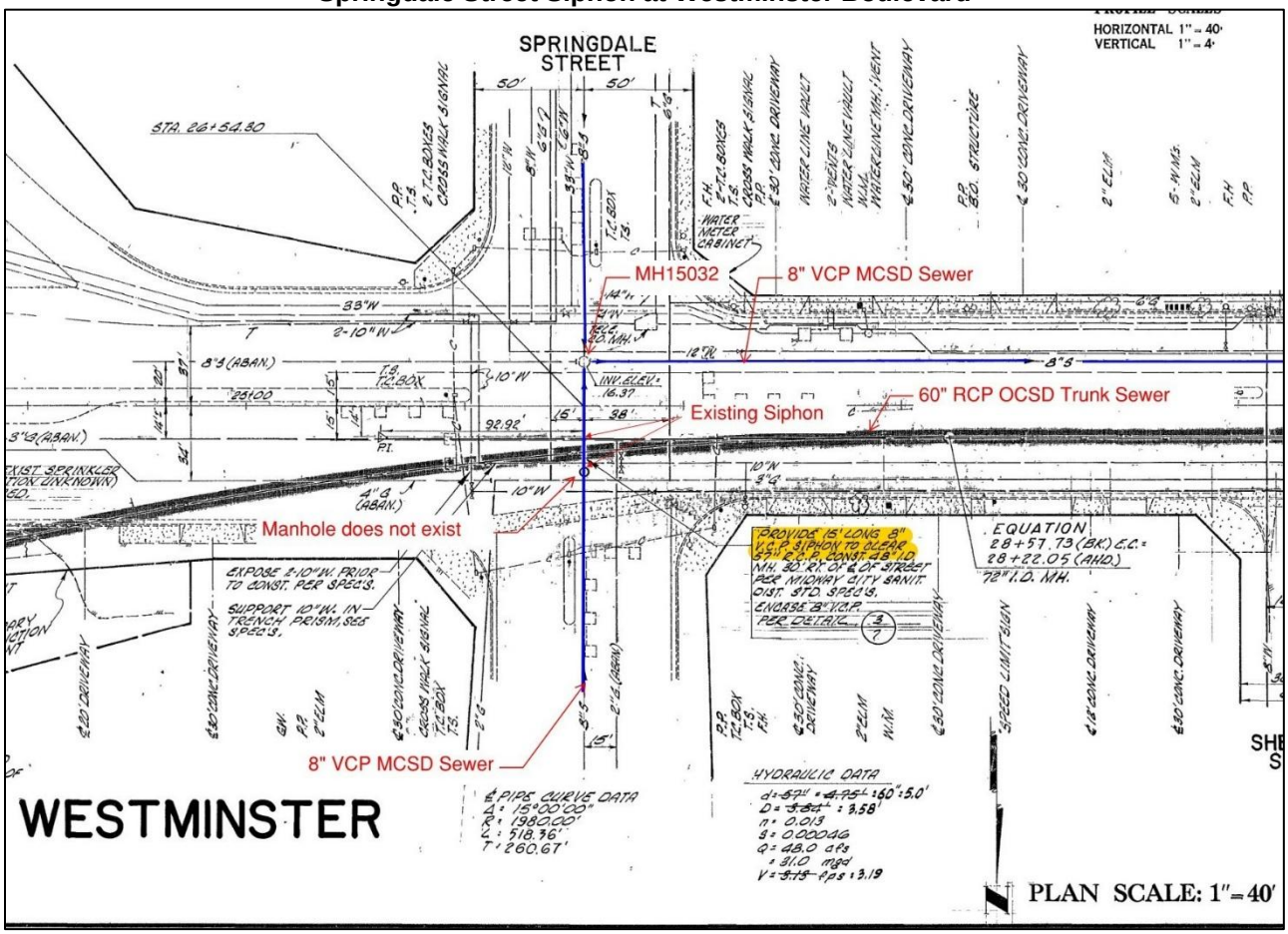


Table 5-1
Siphon Summary

Site	Pipe ID	U/S MH ID	D/S MH ID	Location	Purpose of Siphon	Pipe Size (in)	Length (ft)	Year Installed	Material	U/S Invert (ft)	D/S Invert (ft)	Plan No.	Comments
1	GM10057	MH10056	MH10058	Westminister Blvd at Hammon Pl	Anaheim-Barber City Channel	2-8"	120	1958	VCP	14.90	14.60	S0000023	
2	GM14043	MH14039	MH14050	Sioux Rd at Hefley St	Triple 8'x8' RCB	8	131	1954	VCP	20.79	20.53	1960's 405 fwy as-builts	
3	GM14056	MH14049	MH15002	Sioux Rd at Springdale St	Double 6'x5' RCB	8	96	1954	VCP	20.39	20.16	1960's 405 fwy as-builts	
4	GM15050	MH15030	MH15032	Springdale St at Westminister Blvd	60" RCP (OCSD Trunk Sewer)	8	15	1954	VCP	UNK	17.61	3-14R-00004_Westminster, Springdale St to Bush St	Installed in field by OCSD. No profile provided. U/S MH was never constructed.
5	GM15071	MH15047	MH15046	Ash St at Springdale St	Unknown	8	30	1954	VCP	21.73	22.21	1960's 405 fwy as-builts	Identified on MCSD atlas. No profile provided on plan. Surveyed inverts resulted in adverse condition
6	GM16002	MH16002	MH16001	Springdale St south of Ash St	Unknown	8	40	Unknown	VCP	23.43	23.25	Unknown	Identified on MCSD atlas. Surveyed inverts.
7	GM25007	MH33012	MH25006	Goldenwest St at Sowell Ave	Unknown	8	56	Unknown	VCP	22.26	22.19	Unknown	Identified on MCSD atlas.
8	GM58018	MH58017	MH58018	Woodruff St, southeast of Wells Rd	East Garden Grove - Wintersburg Channel	2-8"	112	1960	VCP	16.23	15.41	S0000080	
9	GM65002	MH65004	MH65001	Thorpe Avenue btw Nantucket St and Purdy St	24" RCP	8	108	1959	VCP	96.97	96.92	S0000266	
10	GM66015	MH66014	MH66013	Magnolia St btw Judith Cir and Trini Cir	Unknown	10	28	Unknown	VCP	30.08	30.15	Unknown	Identified on MCSD atlas. Surveyed inverts resulted in adverse conditions
11	GM66038	MH66033	MH66032	Larkspur Dr at Magnolia St	Unknown	8	35	Unknown	VCP	30.05	29.13	SW-69	Identified on MCSD atlas. Surveyed inverts.
12	GM66068	MH66064	MH66065	Sapphire Ave at Diamond St	Storm Drain Pipe (size unknown)	10	16	1968	VCP	28.31	27.35	S0000041	Surveyed inverts
13	GM66074	MH66069	VP66002	Magnolia St, north of Edinger Ave	Unknown	8	72	Unknown	VCP	28.85	26.70	SW-69	Identified on GGSD Atlas SW-69. Surveyed inverts.
14	GM66076	MH66071	MH66070	Magnolia St, north of Edinger Ave	Unknown	8	22	Unknown	VCP	29.41	29.06	SW-69	Identified on GGSD Atlas SW-69. Surveyed inverts.
15	GM66083	MH66081	MH66080	Edinger Ave west of Magnolia St	48" RCP	8	10	1974	VCP	23.91	23.67	S0000298	
16	GM67011,GM67019, GM67020, GM67021, GM67029	MH67024	MH67010	Adjacent Quartz St, btw Orwell Ave and Brooke Ave	East Garden Grove - Wintersburg Channel	12	106	1976	VCP	17.55	17.22	S0000164	
17	GM74015	MH74015	MH74016	Dalton Cir at Oakcliff Dr	54" RCP	10	30	1968	VCP	32.27	32.13	S0000094	
18	GM74022	MH74021	MH74022	Bushard St, btw Robin Ave and McFadden Ave	60" Storm Drain	10	39	1968	VCP	29.87	29.81	S0000094	
19	GM75010	MH75008	MH75010	Stinson Ln at Bushard St	Storm Drain Pipe (size unknown)	Unk	30	1967	VCP	29.16	29.04	S0000056	Siphon size unknown
20	GM75011, GM75025, GM75026	MH75009	MH75021	Bushard St, btw Stinson Ln and Westwood Dr	East Garden Grove - Wintersburg Channel	2-12"	190	2010	VCP	28.17	27.92	4269 As_Built_Plans	
21	GM80041	MH80018	MH80017	McFadden Ave, east of Dalewood Ln	69" RCP	2-8"	46	1967	VCP	34.25	34.03	S0000366	Surveyed inverts
22	GM81036	MH81031	MH81032	Brookhurst St, south of Margo Ln	Unknown	12	17	Unknown	VCP	30.47	30.55	Unknown	Identified on MCSD atlas. Surveyed inverts resulted in adverse conditions. Pipe size assumed from surrounding pipes
23	GM86001	MH85057	MH86002	Easement btw Nottingham Ave and Cunningham Ave, west of Ward St	East Garden Grove - Wintersburg Channel	2-8"	92	1961	VCP	33.59	32.67	S0000048	
24	GM86006	MH85062	MH86006	Ward St btw Nottingham Ave and Cunningham Ave	East Garden Grove - Wintersburg Channel	2-8"	70	1961	VCP	34.54	34.42	S0000063	

In March 2024, Empire Pipe Cleaning and Equipment, Inc. (Empire) was cleaning the section of the sewer from Manhole MH15032 northerly using a 6-inch skid nozzle, not being aware of the existence of the "siphon". The nozzle dropped into the siphon. Empire retrieved the hose and the nozzle, and observed excessive amounts of gravel, fine material, and broken pipe. Empire then used a 0.5" nozzle without a skid, in an attempt to clear the material. However, the smaller nozzle got stuck in the pipe approximately 40 feet north of Manhole MH15032, which is very close to the interceptor sewer. Empire could not retrieve the nozzle and cut the attached hose at Manhole 15032. It is assumed that the nozzle got stuck at the 90 degree bend at the bottom of the siphon. It is evident that the hose and the nozzle are further plugging the pipes, which results in the sewage backing up in the upstream (northerly) sewer up to Manhole MH14028 (located approximately 1,700 feet north of the siphon) at the intersection of Navajo Street and Sioux Road.

At the time of the writing of this report, the flow was being conveyed westerly and northerly in Meinhardt Road to a crossing of the 405 Freeway between Allison Circle and White Circle, then in Hammon Place to the Hammon Lift Station. MCSD was in the process of preparing plans and hiring a contractor to install manholes upstream and downstream of the siphon, in an attempt to clear the blockage in the siphon and reestablish the flow path. Ultimately, a permanent solution is needed. This might be the design and construction of a new proper siphon parallel to the existing one. Other alternatives to the siphon should also be further investigated.

5-4 Lift Stations

MCSD currently owns and operates four (4) sewer lift stations. A summary of the sewer lift stations is provided in Table 5-2. The Westminster, Hammon and Willow Forcemain Project design was completed in June 2007, adding a dual forcemain system for emergency use and capacity issues that may arise in the future. Improvements were completed in April 2009 at all four lift stations. The Brookhurst Lift Station was rebuilt in 2008 and has a new single forcemain. All four lift stations are submersible stations with dual slide rail screw centrifugal pumps. The pumps were replaced in 2020. MCSD maintains a spare pump for each lift station. The lift station improvement project included a new Supervisory Control and Data Acquisition (SCADA) system for monitoring and controlling the operation of all lift stations.

Field investigations of the four lift stations were conducted on December 1, 2023. The following subsections describe each of the existing sewer lift stations in detail.

5-4.1 Brookhurst Lift Station

General

Brookhurst Lift Station is located on the east side of Brookhurst Street, north of Bolsa Avenue. The tributary area, shown on Figure 5-6, is approximately 150 acres of primarily single family residential land uses. The lift station was constructed in the late 1960's. It was upgraded in 2008 as a submersible lift station with a new wet well, valve vault, manhole flow meter vault and a single short 4-inch Ductile Iron pipe and 6-inch PVC forcemain.

Flows

As shown in Table 5-2, the existing and future peak dry weather (PDWF) and peak wet weather flows (PWWF) are estimated as 0.244 mgd (169 gpm) and 0.329 mgd (229 gpm).

Influent Sewers

The Brookhurst Lift Station has two influent sewers, as shown on Figure 5-7. An 8-inch diameter PVC influent pipe enters the wet well from the south at an invert elevation of 40.77 feet above mean sea level (amsl).

Table 5-2
Sewer Lift Station Summary

Lift Station	Location	Pump Information								Wet Well Dimen-sions	Generator	Force Main				Flow Data											
					Rated Conditions											Existing Condition						Future Condition					
																ADWF[1]		PDWF[2]		PWWF[3]		ADWF[1]		PDWF[2]		PWWF[3]	
		Pump No.	Pump Type	Manufacturer & Model No.	Capacity (gpm)	TDH (ft)	HP	RPM	Year Installed			Size (in)	Mat	Length (ft)	Dual FM?	mgd	gpm	mgd	gpm	mgd	gpm	mgd	gpm	mgd	gpm	mgd	gpm
Brookhurst	14908 Brookhurst St	1	Submer-sible	WEMCO D4K-HS-DEYR6	210	17	3.4	1200	2022	6' L x 6' W x 16.0' H	Portable Generator Connection and Manual Transfer Switch	6"	PVC	24	N	0.1389	96	0.2440	169	0.3294	229	0.1392	97	0.2444	170	0.3300	229
		2	Submer-sible	WEMCO D4K-HS-DEYR6	210	17	3.4	1200	2022																		
Hammon	14240 Hammon Pl	1	Submer-sible	WEMCO F6K-H-FEY57	1300/ 805	41.7/ 27.3	29.5	1149/ 883	2021	16' L x 10' W x 19.1' H	Yes	10"	PVC	1,339	Y	0.6646	462	1.0301	715	1.3906	966	0.6694	465	1.0368	720	1.3997	972
		2	Submer-sible	WEMCO F6K-H-FEY57	1300/ 805	41.7/ 27.3	29.5	1149/ 883	2020			10"	PVC	1,339													
Westminster	5121 Westminster St	1	Submer-sible	WEMCO F6K-H-FEY857	1300/ 805	41.7/ 27.3	29.5	1174/ 890	2024	11'-2" L x 7' W x 20.8' H	Yes	12"	PVC	4,712	Y	0.6318	439	0.9832	683	1.3273	922	0.6332	440	0.9851	684	1.3299	924
		2	Submer-sible	WEMCO F6K-H-FEY857	1300/ 805	41.7/ 27.3	29.5	1174/ 890	2024			12"	PVC	4,712													
Willow	14240 Willow Ln	1	Submer-sible	WEMCO F6K-LFE4A7	770/ 475	35.5/ 22.51	20.1	1163/ 860	2020	10' L x 8' W x 19.6' H	Portable Generator Connection and Manual Transfer Switch	8"	PVC	1,523	Y	0.1237	86	0.2193	152	0.2960	206	0.1247	87	0.2209	153	0.2983	207
		2	Submer-sible	WEMCO F6K-LFE4A7	770/ 475	35.8/ 22.51	20.1	1163/ 860	2020			8"	PVC	1,523													

[1] *ADWF = Average Dry Weather Flow*

[2] *PDWF = Peak Dry Weather Flow = 1.5 x ADWF*$^{0.92}$

[3] *PWWF = Peak Wet Weather Flow = 1.35 x PDWF*

Another 8-inch diameter PVC influent sewer enters the wet well from northwest with an invert elevation of 42.93 feet amsl.

Pumps

The lift station has two (2) 3.4 HP, screw centrifugal submersible pumps as detailed in Table 5-3. The pump capacities are 210 gpm at a total dynamic head of 17 feet. Because the capacity of a single pump is slightly less than the peak wet weather flow, they should be replaced with new pumps of 265 gpm capacity when the electrical and controls improvements are implemented in the next 5 years. This will provide more than the peak wet weather flow and slightly over the minimum required velocity of 3 ft/s.

Wet Well

The wet well, shown in Photograph 5-1, is a PVC (T-Lock) lined 6'x6' precast reinforced concrete structure, approximately 16.0 feet in depth (floor elevation of 36.57 ft amsl).

Table 5-3
Brookhurst Lift Station Pump Summary

Duty Pump #1	
Make	WEMCO
Model	D4K-HS-DEYR6
Rated Flow (gpm)	210
Rated Head (feet)	17
Rotational Speed (rpm)	1200
HP	3.4
Duty Pump #2	
Make	WEMCO
Model	D4K-HS-DEYR6
Rated Flow (gpm)	210
Rated Head (feet)	17
Rotational Speed (rpm)	1200
HP	3.4
Control Set Points	
Start Lag (ft)	4.5
Start Lead (ft)	4.0
Stop Level (ft)	2.0

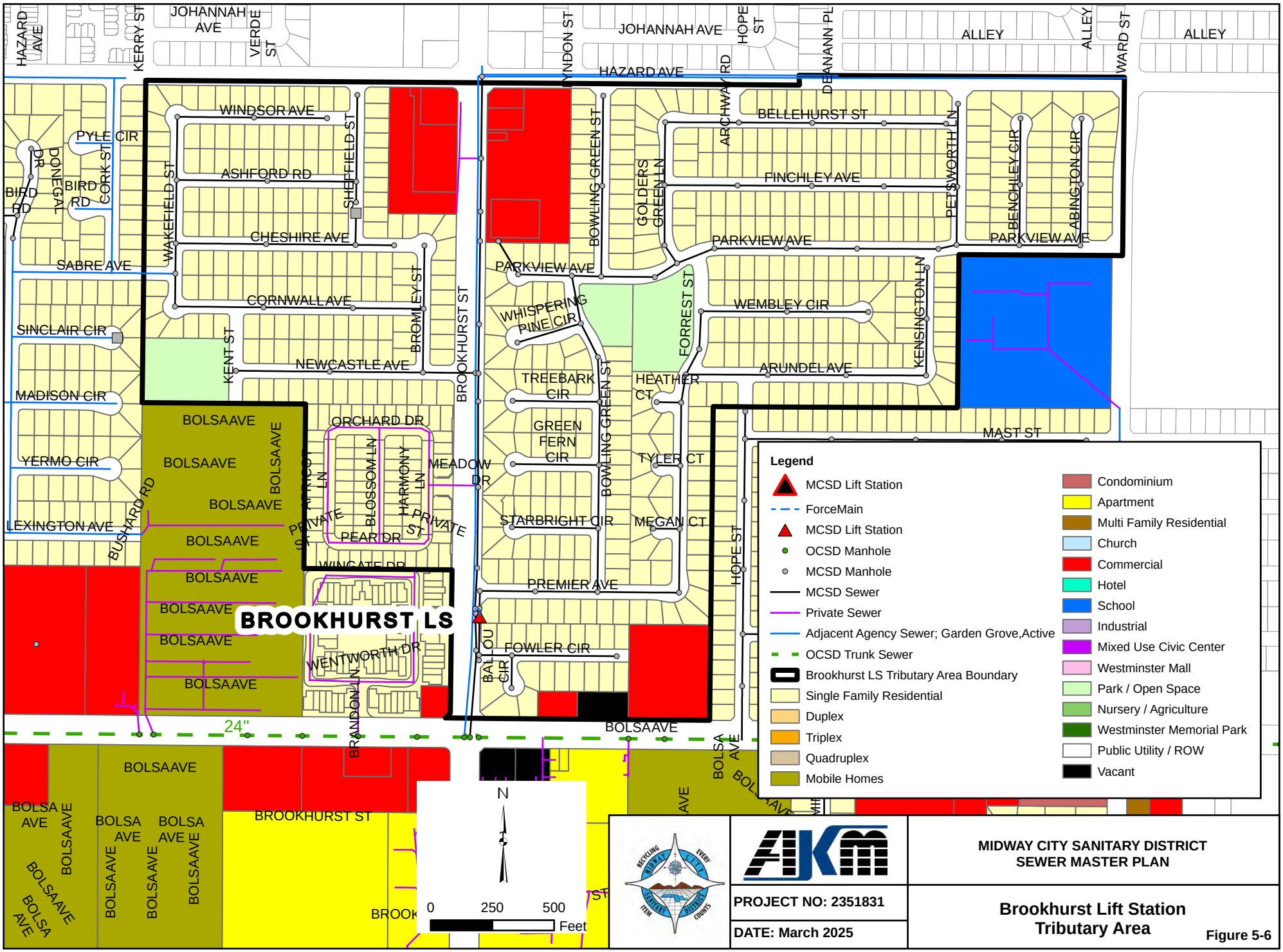
The lead and lag pumps are set to start at wet well levels 4.0 feet (39.57 ft amsl) and 4.5 ft (40.07 ft amsl) above the bottom of the wet well, respectively. Both pumps turn off at a wet well level of 2.0 feet above the bottom of the wet well 38.57 ft amsl.

The lift station has 538 gallons of operational storage within the 2-foot operating band. The 210 gpm capacity pumps would cycle a maximum of 5 times per hour if they are alternated, and the tributary flow was 105 gpm (half the capacity of one pump). This is less than the maximum cycling recommended for a 3.4 HP motor (6 starts per hour).

Discharge Pipe/Forcemain

Each pump has a 4-inch diameter ductile iron discharge pipe within the wet well and through the valve vault, The centerline elevation of the forcemains is 47.13 feet amsl. They confluence at a 4-inch WYE; turn west, and enter the flow meter vault, which is a 4-foot diameter manhole. A 4-inch diameter magnetic flow meter is located in the vault with only a dismantling joint on the downstream side of the flow meter. The forcemain exits the vault, increases to 6-inch PVC and terminates at a manhole in Brookhurst Street (MH78081), where a 10-inch gravity sewer conveys the sewage south to an OCSD trunk sewer in Bolsa Avenue.

Photograph 5-1
Brookhurst Lift Station Wet Well



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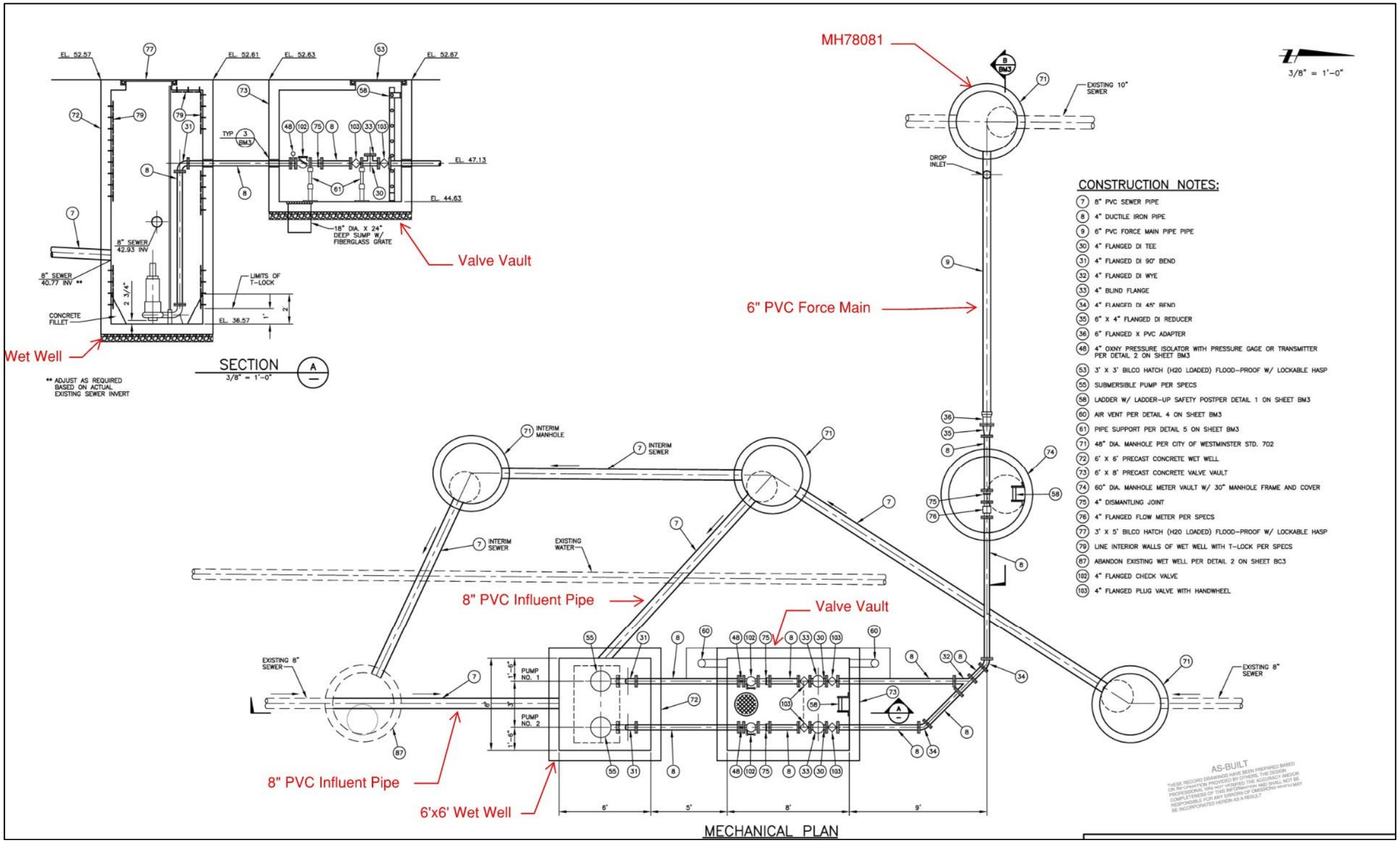
Brookhurst Lift Station Tributary Area

Figure 5-6

Figure 5-7
Brookhurst Lift Station Mechanical Plan



The vertical leg of the bypass pumping tees inside the valve vault do not have isolation plug valves. They should be added for faster response to a bypass pumping need.

The velocity in the 4-inch forcemain is 5.3 ft/s, which is greater than the recommended maximum velocity of 5 ft/s. It is 2.4 ft/s in the 6-inch forcemain which is below the recommended minimum criteria of 3 ft/s. The discharge pipes should be increased to 6-inch diameter when the pumps are replaced to provide more than the peak wet weather flow. A completely redundant discharge pipe/forcemain should be constructed at that time.

Photograph 5-2
Brookhurst Lift Station Switchboard and Motor Control Center

Lift Station Equipment

The lift station's electrical power is provided by a pole mounted transformer and a switchboard on the easterly sidewalk of Brookhurst Street. A generator plug box, manual transfer switch, and the motor control center (MCC), shown in Photograph 5-2 are located north of the switchboard. The MCC houses the power monitor, transient voltage surge suppressor (TVSS), full voltage non-reverse motor starters, uninterruptable power supply (UPS) and its battery, lift station control panel with the programmable logic controller, and a DSL modem.

The lift station's operation is controlled by the sewage level in the wet well, which is measured by two (2) ultrasonic level sensors in the wet well (one redundant). The lift station information, including the status and alarms, is transmitted to MCSD's central SCADA system via the DSL modem and cellular phone service.

Recommended Improvements

The recommended improvements for Brookhurst Lift Station are as follows:

1. The lift station access hatch should be fitted with grated fall protection to meet OSHA 29 CFR1926 (c).
2. The pumps should be replaced with 265 gpm capacity units to provide greater than the estimated peak wet weather flows with one pump.
3. When the pumps are replaced, the discharge piping/forcemain should be increased to 6-inch diameter. The discharge pipes and fittings outside the wet well should be 6-inch diameter 40 mil ceramic epoxy lined Class 53 ductile iron from the wet well to Manhole 78081 in Brookhurst Street including new 6-inch magnetic flow meters, and meter vault. A completely redundant discharge pipe/forcemain should be constructed at that time.
4. The discharge pipe and fittings inside the wet well should be replaced with 316L stainless steel pipe and fittings
5. The electrical and control systems are 17 years old. They should be upgraded in the next five years.

5-4.2 Hammon Lift Station

General

The Hammon Lift Station is located on the east side of Hammon Place at its intersection with Harold Drive (14240 Hammon Place). The tributary area, shown on Figure 5-8, is approximately 557 acres of primarily single family residential land uses. The original lift station was constructed in the early 1950's as a wet well – dry well facility. It was converted to a submersible lift station in 2008.

Flows

As shown in Table 5-2, the existing and future peak wet weather flows (PWWF) are estimated as 966 gpm and 972 gpm (1.39 and 1.4 mgd), respectively.

Influent Sewer

A 10-inch influent pipe enters the wet well from the west at an invert elevation of 13.00 ft amsl, as shown on Figure 5-9.

Pumps

The lift station has two (2) two-speed submersible screw centrifugal pumps as detailed in Table 5-4. The pump capacities are 1300/805 gpm with total dynamic heads of 41.7/27.3 feet at rotational speeds of 1149/883 rpm, respectively. Since the high speed capacity of one pump is greater than the future peak wet weather flow, the existing pumps provide sufficient capacity. The existing pumps were installed in 2020.

Table 5-4
Hammon Lift Station Pump Summary

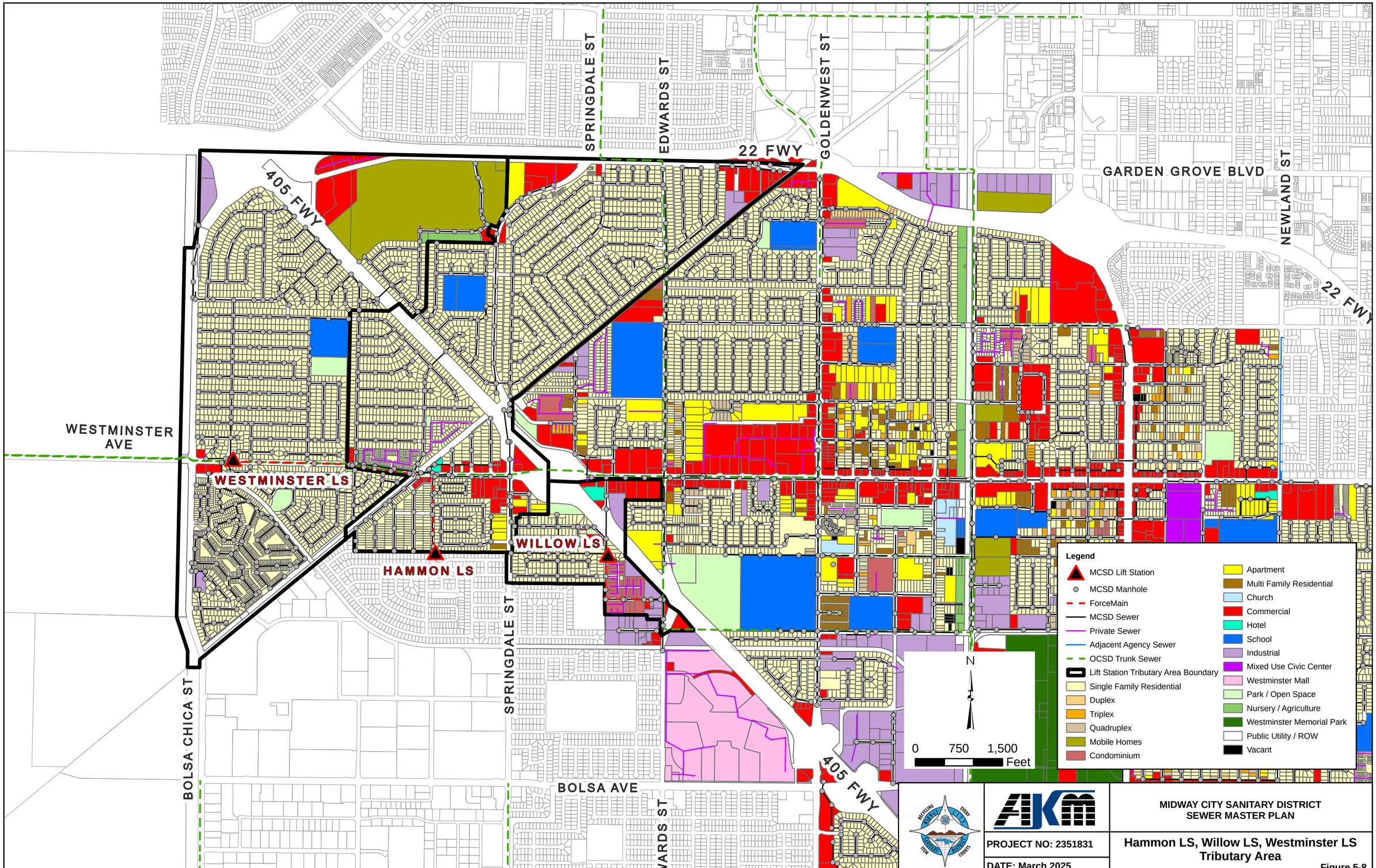
Duty Pump #1	
Make	WEMCO
Model	F6K-H-FEY57
Rated Flow (gpm)	1300/805
Rated Head (feet)	41.7/27.3
Rotational Speed (rpm)	1149/883
HP	29.5
Duty Pump #2	
Make	WEMCO
Model	F6K-H-FEY57
Rated Flow (gpm)	1300/805
Rated Head (feet)	41.7/27.3
Rotational Speed (rpm)	1149/883
HP	29.5
Control Set Points	
Lag High (ft)	6.5
Lead High (ft)	6.0
Lead Low (ft)	5.5
Stop Level (ft)	3.0

Photograph 5-3
Hammon Lift Station Wet Well

Wet Well

The wet well, shown in Photograph 5-3, is a 16'x10' precast concrete rectangular structure, approximately 19.1 feet in depth. The lead pump is set to start at wet well level 5.5 feet above the floor (13.08 ft amsl) at the low speed (883 rpm). Its speed increases to 1150 rpm at a sewage level 6.0 feet above the wet well floor (13.58 ft amsl). The pump stop level is 3.0 feet above the wet well floor (10.58 ft amsl). The lag pump is set to start at a wet well level of 6.5 feet above the wet well floor (14.08 ft amsl) at the high speed.

The lift station has 3,590 gallons of operational storage, with a 3-foot operating band. The 1,300 gpm capacity pumps would cycle a maximum of 2.7 times per hour if they are alternated, and the tributary flow is 650 gpm (half the capacity of one pump), which is less than the recommended maximum of 4 starts per hour for the 29.5 HP motors.



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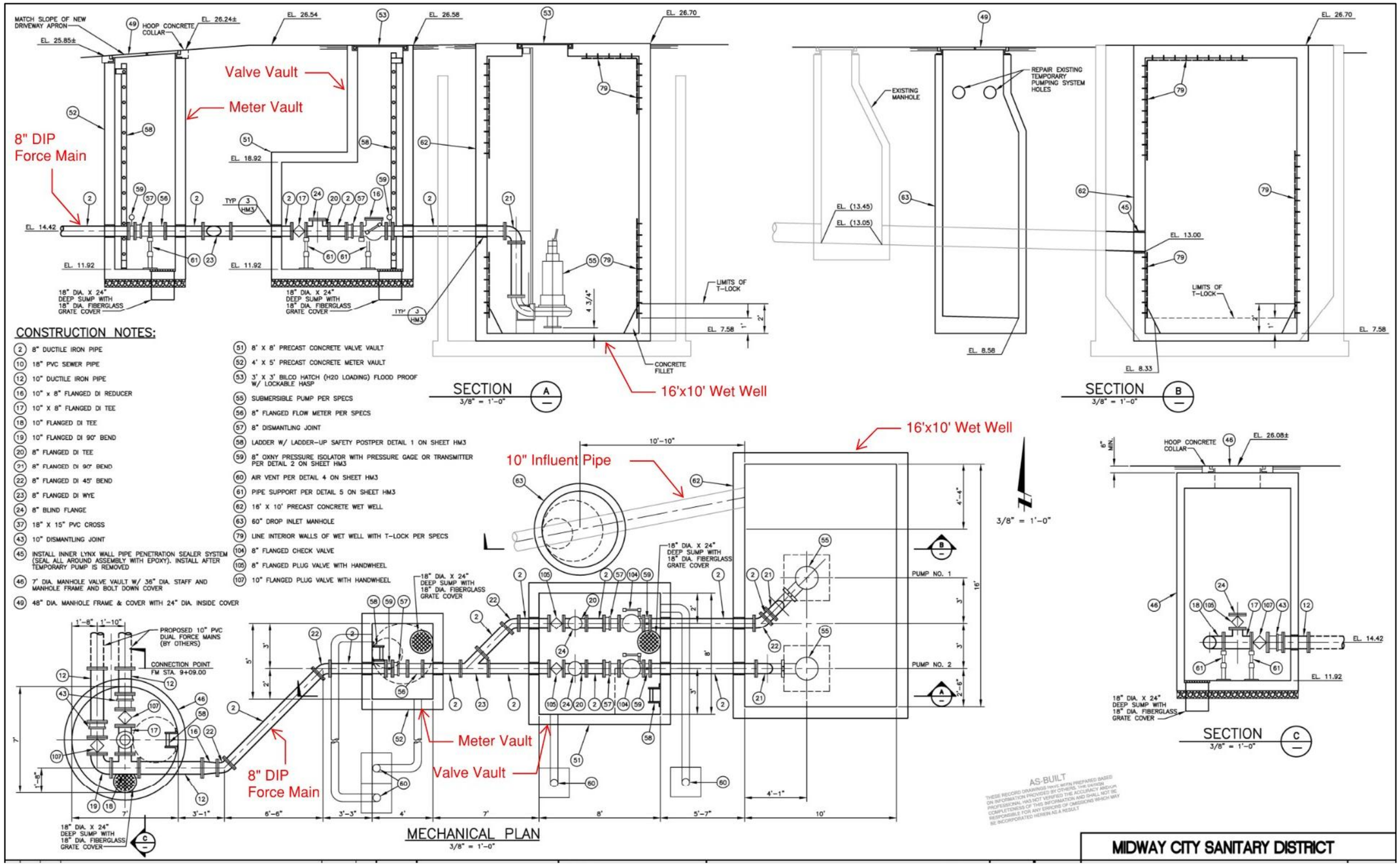
Hammon LS, Willow LS, Westminster LS Tributary Area

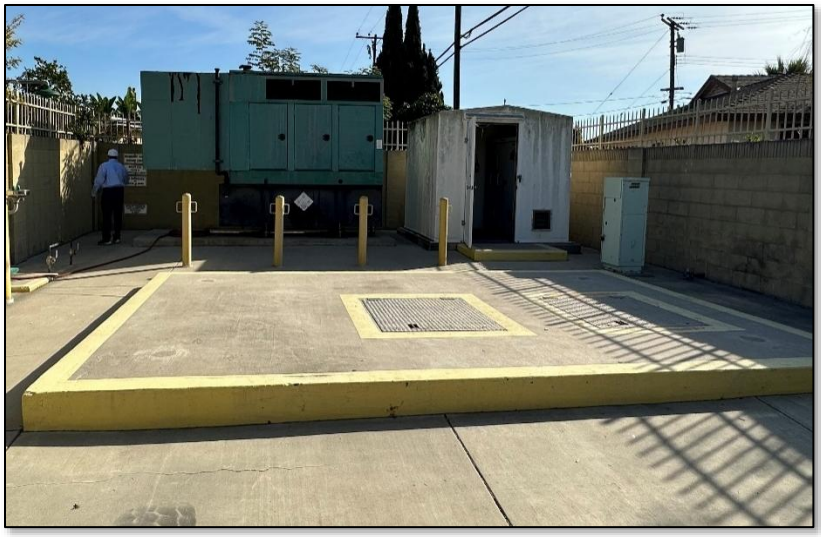
Figure 5-8

Figure 5-9
Hammon Lift Station Mechanical Plan



Discharge Pipe/Forcemain

As shown on Figure 5-9, each pump has an 8-inch ductile iron pipe (DIP) discharge pipe. They extend west to an 8 ft x 8 ft valve vault which houses the check valves, discharge bypass tees, and isolation plug valves. The two discharge pipes confluence at a wye further west of the valve vault, and a single 8-inch DI discharge pipe continues to a 4 ft x 5 ft meter vault. The single 8-inch DIP continues further southwest, increases to 10-inch diameter, and enters a 7 ft diameter second valve vault. The discharge pipe bifurcates into two (2) 10-inch parallel DI pipes with isolation plug valves and a bypass tee connection. The two discharge pipes exit the manhole to its north and transition into polyvinyl chloride (PVC) pipes. The focemains convey sewage north to MH10088 located in Westminster Boulevard at Hammon Place. The use of each forcemain is alternated monthly by opening and closing valves manually.



Photograph 5-4
Hammon Lift Station Generator and Electrical and Controls System Housing, and Switchgear

The vertical leg of the bypass pumping tees inside the valve vault do not have isolation plug valves. They should be added for faster response to a bypass pumping need.

The 8-inch portions of the discharge pipes experience over 8 feet per second (ft/s) velocity with the high speed flow of 1300 gpm, which is significantly greater than the maximum recommended velocity of 5 ft/s. The velocity in the 10-inch forcemains is slightly over 5 ft/s. The discharge piping should be modified as two (2) separate 10-inch diameter pipes from the first valve vault to the second valve vault to provide complete redundancy.

Lift Station Equipment

The lift station has a permanent 75 kW standby generator and a 200A automatic transfer switch to operate the lift station in case of commercial power outages. The generator and the electrical equipment housing are shown in Photograph 5-4. The lift station's operation is controlled by the level of sewage in the wet well. The sewage level is measured by two ultrasonic level transducers (one redundant). Electric service to the lift station is 277/480 volt 3 phase 200 Amps.

The MCC houses the power monitor, transient voltage surge suppressor (TVSS), motor starters, uninterruptable power supply (UPS) and its battery, lift station control panel with the programmable logic controller, and a DSL modem. The lift station information, including the status and alarms, is transmitted to MCSD's central SCADA system via the DSL modem and cellular phone service.

Recommended Improvements

The recommended improvements for Hammon Lift Station are as follows:

1. The lift station access hatches should have guard rails and grated fall protection to meet OSHA 29 CFR1926 (c).

2. The discharge piping outside the wet well should be modified as two complete 10-inch diameter 40 mil ceramic epoxy lined Class 53 DIP and fittings, with new valves, flow meter vault, magnetic flow meters, and appurtenances to provide complete redundancy.
3. The discharge piping and fittings inside the wet well should be replaced with 316L stainless steel pipes and fittings.
4. The electrical and control systems are 17 years old. They should be upgraded in the next five years.
5. The pumps should be replaced when the electrical and control systems are replaced.

5-4.3 Westminster Lift Station

General

Westminster Lift Station is located at 5121 Westminster Boulevard, on the north side of Westminster Boulevard, west of College Street. It was originally constructed in the early 1970s as a wet well – dry well lift station and upgraded in 2008 as a submersible lift station. The tributary area, shown on Figure 5-8, is approximately 643 acres of primarily single family residential and mobile home land uses.

Flows

As shown in Table 5-2, the existing and future peak wet weather flow (PWWF) is estimated as 1.33 mgd (924 gpm).

Influent Sewer

A 15-inch influent pipe enters the wet well from the west at an invert elevation of 7.60 feet , as shown on Figure 5-10.

Pumps

The lift station has two screw centrifugal slide rail submersible pumps as detailed in Table 5-5. The pump capacities are each 1300/805 gpm with total dynamic heads of 41.7/27.3 feet at rotational speeds of 1174/890 rpm. Since the high speed capacity of one pump is greater than the future peak wet weather flow, the existing pumps provide adequate capacity. They were replaced with new pumps in 2020.

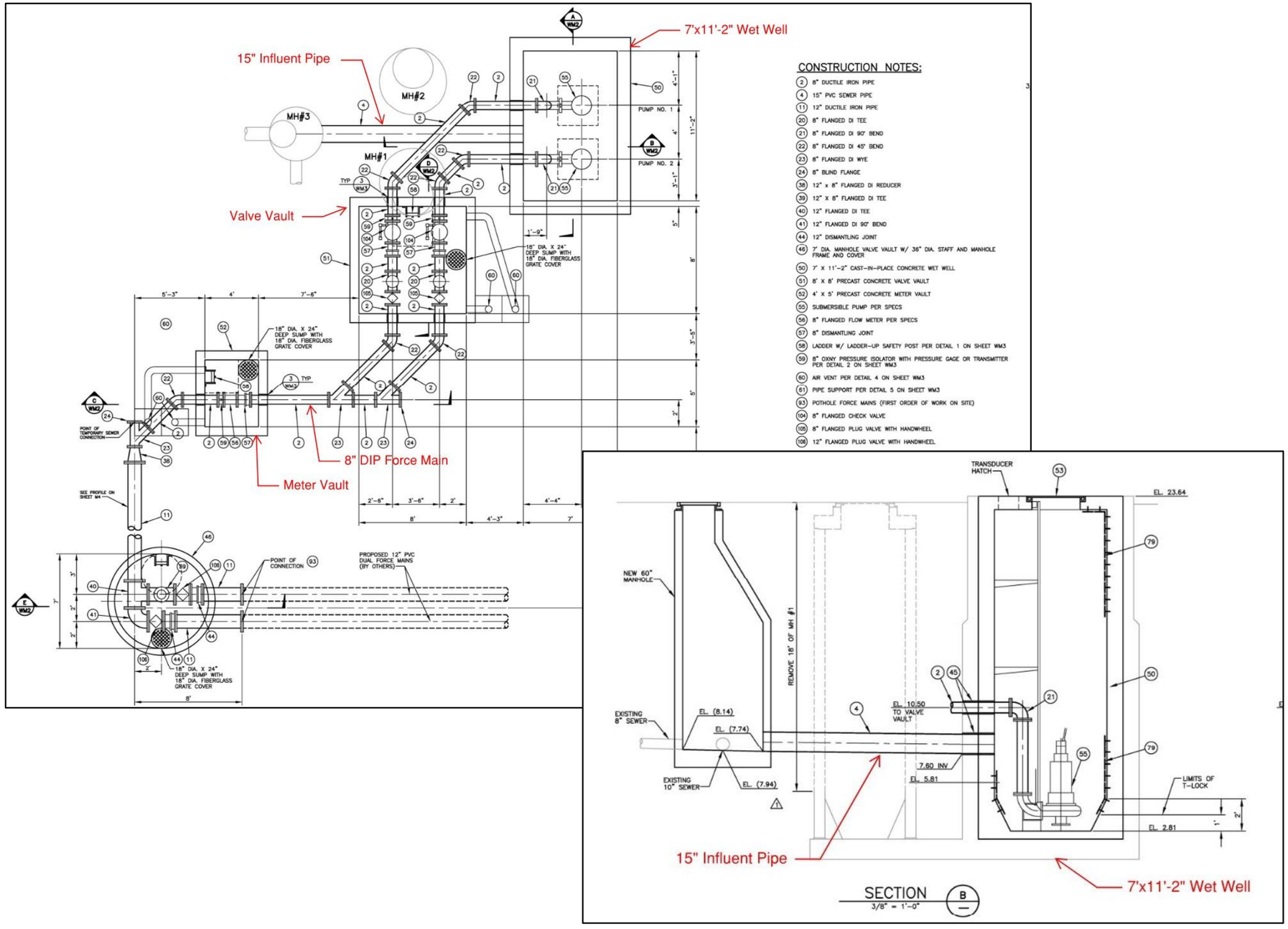
Wet Well

The wet well, shown in Photograph 5-5, is a 7'x11'-2" cast-in-place reinforced concrete structure, approximately 20.8 feet in depth. Its floor elevation is 2.81 ft amsl. The lead pump is set to start at wet well level of 5.5 feet above the floor (8.31 ft amsl) at the low speed of 860 rpm, 6.0 feet (8.81 ft amsl) at the high speed of 1163 rpm, and stop at 3.0 feet (5.81 ft amsl). The lag pump is set to start at wet well level of 6.5 feet (9.31 ft amsl) at the high speed of 1163 rpm

Table 5-5
Westminister Lift Station Pump Summary

Duty Pump #1	
Make	WEMCO
Model	F6K-H-FEY857
Rated Flow (gpm)	1300/805
Rated Head (feet)	41.7/27.3
Rotational Speed (rpm)	1174/890
HP	29.5
Duty Pump #2	
Make	WEMCO
Model	F6K-H-FEY857
Rated Flow (gpm)	1300/805
Rated Head (feet)	41.7/27.3
Rotational Speed (rpm)	1174/890
HP	29.5
Control Set Points	
Lag High (ft)	6.5
Lead High (ft)	6.0
Lead Low (ft)	5.5
Stop Level (ft)	3.0

Figure 5-10
Westminster Lift Station Mechanical Plan



Photograph 5-5
Westminster Lift Station Wet Well

The lift station has 1,754 gallons of operational storage, within a 3-foot operating band. The 1,300 gpm capacity pumps would cycle a maximum of 5.3 times per hour if they are alternated, and the tributary flow is 650 gpm (half the capacity of one pump), which exceeds the pump cycling criteria of 4 starts per hour for pumps with 29.5 HP motors.

Discharge Pipe/Forcemain

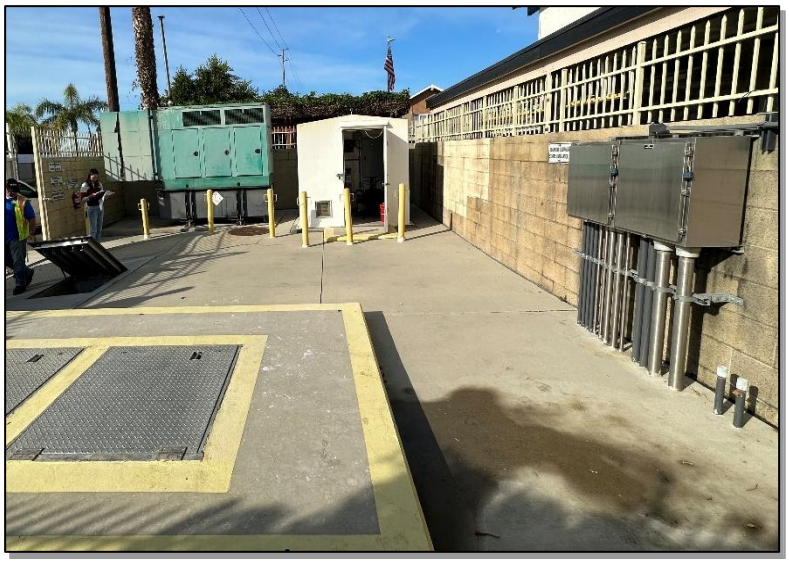
As shown on Figure 5-10, each pump has an 8-inch ductile iron pipe (DIP) discharge pipe that combine together into one 8-inch DIP prior to entering the 4 ft x 5 ft flow meter vault. The single 8-inch pipe then increases to a 12-inch diameter DIP and extends to a 7-foot diameter manhole second valve vault in Westminster Boulevard to the south. The discharge pipe bifurcates at a 12-inch tee in the second valve vault. The two discharge pipes extend easterly in Westminster Boulevard. A 12" x 8" tee on the northerly discharge pipe provides bypass pumping connection. The DI discharge pipes transition to two parallel 12-inch PVC and convey sewage east to MH10086 located in Westminster Boulevard, west of Hammon Place/Rancho Road. The use of each forcemain is alternated monthly by opening and closing the isolation valves manually.

The vertical leg of the bypass pumping tees inside the valve vault do not have isolation plug valves. They should be added for faster response to a bypass pumping need.

The forcemain velocity is about 3.7 ft/s at the high speed flow of 1300 gpm, which is within the recommended criteria of 3 ft/s to 5 ft/s. It is 2.3 ft/s at the low speed flow of 806 gpm, which is acceptable since the active forcemain will experience the higher velocities daily.

Lift Station Equipment

The lift station has a permanent 75 kW standby generator and a 200A automatic transfer switch to operate the lift station during commercial power outages. The generator and the electrical equipment housing are shown in Photograph 5-6. The switchgear is located at the southeast corner of the site, across from the standby generator. The lift station's operation is controlled by the level of sewage in the wet well. The sewage level is measured by two (2) ultrasonic level transducers (one redundant). Electric service to the lift station is 277/480 volt 3 phase 200 Amps.



Photograph 5-6
Westminster Lift Station Generator and Control Panel Enclosure

The MCC houses the power monitor, transient voltage surge suppressor (TVSS), motor starters, uninterruptable

power supply (UPS) and its battery, lift station control panel with the programmable logic controller, and a DSL modem. The lift station information, including the status and alarms, is transmitted to MCSD's central SCADA system via the DSL modem and cellular phone service.

Recommended Improvements

The recommended improvements for Westminster Lift Station are as follows:

1. The lift station access hatches should have guard rails and grated fall protection to meet OSHA 29 CFR1926 (c).
2. The discharge piping outside the wet well should be modified as two complete 12-inch diameter 40 mil ceramic epoxy lined Class 53 DIP and fittings, with new valves, flow meter vault, magnetic flow meters, and appurtenances to provide complete redundancy.
3. The discharge piping and fittings inside the wet well should be replaced with 316L stainless steel pipes and fittings.
4. The electrical and control systems are 17 years old. They should be replaced in the next 5 years.
5. The pumps should be replaced when the electrical and control systems are replaced.

5-4.4 Willow Lift Station

General

Willow Lift Station is located at 14240 Willow Lane on the east side of Willow Lane, north of Willow Circle. The tributary area, shown on Figure 5-8, is approximately 373 acres of primarily single family residential and commercial land uses. It was originally constructed in the mid 1950's as a wet well – dry well facility and was reconstructed as a submersible lift station in 2008.

Flows

As shown in Table 5-6, the existing and future peak wet weather flow (PWWF) is estimated as 0.3 mgd (207 gpm).

Influent Sewer

A 12-inch influent pipe enters the wet well from the west at invert elevation 14.46 feet (3.16 feet above the wet well floor), as shown on Figure 5-11.

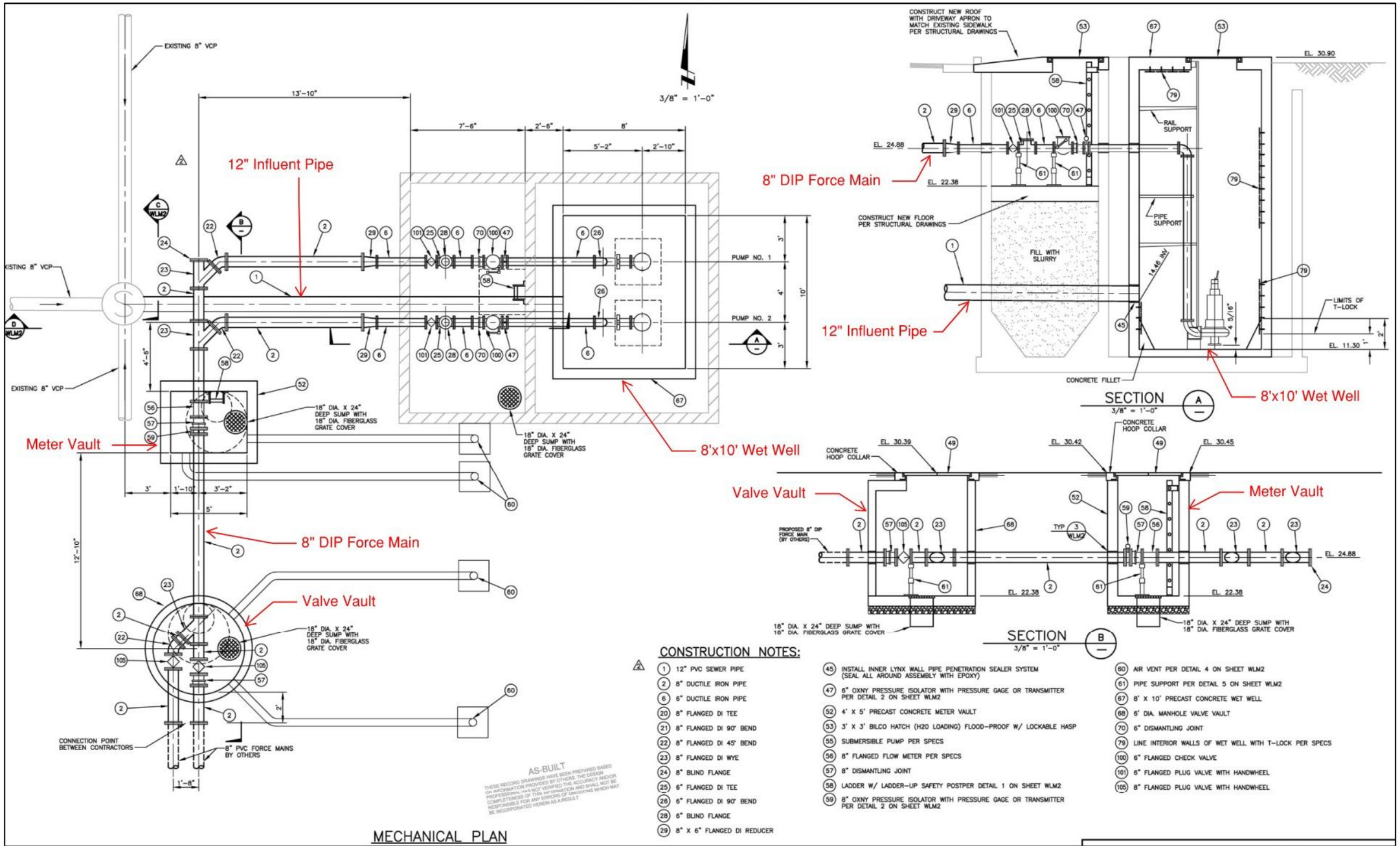
Pumps

The lift station has two 20.1 HP slide rail screw centrifugal submersible pumps as detailed in Table 5-6. The pump capacities are each 770/475 gpm with total dynamic heads of 35.8/22.51 feet at rotational speeds of 1163/860 rpm, respectively. Since the capacity of one pump is greater than the estimated peak wet weather flow, the existing pumps provide adequate capacity.

Table 5-6
Willow Lift Station Pump Summary

Duty Pump #1	
Make	WEMCO
Model	F6K-LFE4A7
Rated Flow (gpm)	770/475
Rated Head (feet)	35.5/22.51
Rotational Speed (rpm)	1163/860
HP	20.1
Duty Pump #2	
Make	WEMCO
Model	F6K-LFE4A7
Rated Flow (gpm)	770/475
Rated Head (feet)	35.8/22.51
Rotational Speed (rpm)	1163/860
HP	20.1
Control Set Points	
Lag High (ft)	5.0
Lead High (ft)	4.5
Lead Low (ft)	4.0
Stop Level (ft)	2.0

Figure 5-11
Willow Lift Station Mechanical Plan



Photograph 5-7
Willow Lift Station Wet Well

Wet Well

The wet well, shown in Photograph 5-7, is an 8'x10' precast concrete structure, approximately 19.6 feet in depth. The lead pump is set to start at wet well level 4.0 feet above the wet well floor at the low speed of 860 rpm (15.5 ft amsl), 4.5 feet at the high speed of 1163 rpm (16.0 ft amsl), and stop at 2.0 feet above the wet well floor (13.5 ft amsl). The lag pump is set to start at wet well level of 5.0 feet above the wet well floor (16.5 ft amsl) at the high speed of 1163 rpm.

The lift station has 1,496 gallons of operational storage, with a 2.5-foot operating band. The 770 gpm capacity pumps would cycle a maximum of 4 times per hour if they are alternated, and the tributary flow is 385 gpm (half the capacity of one pump), which meets the recommended maximum pump cycling criteria for a pump with 20.1 HP motors (6 times per hour).

Discharge Pipe/Forcemain

As shown on Figure 5-11, each pump has a 6-inch ductile iron discharge pipe. They continue through the 7.5 ft x 15 ft valve vault adjacent to the west of the wet well. The valve vault contains pressure sensors, check valves, 6-inch tees for bypass pumping connections, and isolation plug valves. They continue westerly, increase to 8-inch DIP, turn south, and confluence at an 8-inch wye. The single 8-inch DI discharge pipe continues further south, goes through a 4 ft x 5 ft reinforced concrete meter vault, which also includes a pressure sensor, and further extends south to a 6 ft diameter valve vault, where they bifurcate at an 8-inch wye. The two DI pipes exit the vault to its south and transition to parallel 8-inch PVC forcemains. They convey the sewage south in Willow Lane and east to MH17007 located in Maple Avenue, west of Edwards Street. The use of each forcemain is alternated monthly by opening and closing the isolation plug valves manually.

The vertical leg of the bypass pumping tees inside the valve vault do not have isolation plug valves. They should be added for faster response to a bypass pumping need.

The forcemain velocity is about 4.9 ft/s with the high speed flow of 770 gpm, which is less than the recommended maximum velocity of 5.0 ft/s. It is 3 ft per second with the slow speed capacity of 475 gpm, which equals the minimum velocity criteria of 3 ft/s.

Lift Station Equipment

The lift station does not have a permanent standby generator. It has a 150A manual transfer switch and a generator lug connection. The switchgear and MCC are located to the north and south of the wet well, respectively. The lift station's site is shown in Photograph 5-8. There is no fencing on three sides of the site.

Photograph 5-8
Willow Lift Station Control Panel Enclosure

The lift station's operation is controlled by the level of sewage in the wet well. The sewage level is measured by two ultrasonic level transducers (one redundant).

Electric service to the lift station is 277/480 volt 3 phase, 4 wire 200 Amps.

The MCC houses the power monitor, transient voltage surge suppressor (TVSS), motor starters, uninterruptable power supply (UPS) and its battery, lift station control panel with the programmable logic controller, and a DSL modem. The lift station information, including the status and alarms, is transmitted to MCSD's central SCADA system via the DSL modem and cellular phone service.

Recommended Improvements

The recommended improvements for Willow Lift Station are as follows:

1. The lift station access hatches should have guard rails and grated fall protection to meet OSHA 29 CFR1926 (c).
2. The discharge piping outside the wet well should be modified as two complete 8-inch diameter 40 mil ceramic epoxy lined Class 53 DIP and fittings, with new valves, flow meter vault, magnetic flow meters, and appurtenances to provide complete redundancy.
3. The discharge piping and fittings inside the wet well should be replaced with 316L stainless steel pipes and fittings.
4. MCSD should install fencing around the three sides of the site to provide additional security.
5. The electrical and control systems are 17 years old. They should be replaced in the next 5 years.
6. The pumps should be replaced when the electrical and control systems are replaced.

SECTION 6
FUTURE SYSTEM

6-1 General

The difference between the existing sewer system and the future sewer system is primarily the increase in loads due to infill developments and redevelopment. In general, the gravity sewer facilities will remain the same unless a capacity or condition deficiency is identified and requires the replacement of the pipe(s). At this point in time, there are no plans for the City to expand the system beyond its existing service area.

6-2 Vacant Lots

There are approximately 6.64 acres of vacant properties (not included in the future development areas), scattered throughout the service area as shown on Figure 6-1. This is 0.1 percent of the total service area. The estimated load from all of the vacant properties is 0.020032 mgd as shown in Table 6-1.

Table 6-1
Future Loads for Vacant Properties

No.	APN	Future Land Use Description	Area (Ac)	Unit Flow Factor (gpd/ac)	Future Estimated Additional Average Sewage Load (mgd)
1	096-064-08	Residential - High (14.1 - 25.0 du/ac)	0.16	3,500	0.000556
2	096-085-10	Residential - High (14.1 - 25.0 du/ac)	0.15	3,500	0.000533
3	096-091-18	Residential - High (14.1 - 25.0 du/ac)	0.14	3,500	0.000507
4	096-102-41	Residential - Medium (8.1 - 14.0 du/ac)	0.17	3,300	0.000568
5	096-141-25	Residential - Medium (8.1 - 14.0 du/ac)	0.18	3,300	0.000586
6	096-141-27	Residential - Medium (8.1 - 14.0 du/ac)	0.18	3,300	0.000586
7	096-142-16	Residential - Medium (8.1 - 14.0 du/ac)	0.21	3,300	0.000679
8	096-142-17	Residential - Medium (8.1 - 14.0 du/ac)	0.18	3,300	0.000604
9	096-142-18	Residential - Medium (8.1 - 14.0 du/ac)	0.18	3,300	0.000603
10	096-142-20	Residential - Medium (8.1 - 14.0 du/ac)	0.16	3,300	0.000519
11	096-142-29	Residential - Medium (8.1 - 14.0 du/ac)	0.10	3,300	0.000341
12	096-333-01	Residential - High (14.1 - 25.0 du/ac)	0.28	3,500	0.000997
13	097-044-08	Regional Commercial	0.15	1,800	0.000279
14	097-044-09	Regional Commercial	0.15	1,800	0.000279
15	097-044-15	Regional Commercial	0.39	1,800	0.000706
16	097-101-55	Residential - Low (0 - 8.0 du/ac)	0.21	1,400	0.000296
17	099-624-12	Neighborhood Commercial	0.53	1,800	0.000959
18	107-220-68	Residential - Medium (8.1 - 14.0 du/ac)	1.98	3,300	0.006519
19	108-010-06	Mixed Use Little Saigon	0.12	3,500	0.000422
20	108-010-31	Mixed Use Little Saigon	0.09	3,500	0.000304
21	108-010-33	Mixed Use Little Saigon	0.04	3,500	0.000135
22	108-010-35	Mixed Use Little Saigon	0.43	3,500	0.001507
23	108-010-36	Mixed Use Little Saigon	0.44	3,500	0.001548
		Total	**6.64**		**0.020032**

6-3 Accessory Dwelling Units

Future sewage flows may be affected by regulations related to accessory dwelling units (ADU) and junior accessory dwelling units (JADU). ADUs are attached or detached residential dwelling units that provide complete, independent living facilities for one or more persons, and are located on a lot with a proposed or existing primary residence. JADUs are no more than 500 square feet in size.

Since 2016, ADU laws in California have continued to evolve to further lower barriers to the development of more affordable housing as the state works to address the housing crisis. ADUs are, by definition, created in are that are already developed but where land may be underutilized.

Over the years, State ADU Law has been revised to improve its effectiveness in creating more housing units. Major changes in State ADU Law went into effect January 1, 2023, January 1, 2024, and January 1, 2025. Per Government Code section 66323, there are four categories of ADUs and JADUs that must be approved ministerially (*Ref: California Department of Housing and Community Development, Accessory Dwelling Unit Handbook, January 2025*):

1. Single Family Converted ADU – one ADU or JADU per lot is permitted within the converted space of a proposed or existing single-family dwelling or accessory structure
2. Single Family Detached ADU – one detached new construction ADU with maximum unit size of 800 square feet is permitted. The City of Westminster allows for a maximum unit size of 1,200 square feet.
3. Multifamily Converted ADU – ADUs may be created within the portions of existing multifamily structures that are not used as livable space
4. Multifamily Detached ADU – Up to two detached ADUs are allowed on a lot that has a proposed multifamily dwelling, or up to eight detached ADUs are allowed on a lot with an existing multifamily dwelling, not to exceed the number of existing units on the lot.

The City of Westminster has seen 132 ADUs built between January 2020 and December 2024. And there are another 301 permits issued for ADUs but the structures are not yet constructed. The location of the ADUs built and permits issued are shown on Figure 6-1.

Senate Bill 1157 amending California Water Code Section 10609.4, set the residential indoor water use standard at 55 gallons per capita day (gcpd) until January 1, 2025. Now it is lowered to 47 gcpd and will be set to 42 gpcd beginning January 1, 2030. For this reason, the sewage loads for ADU's were estimated by assuming 2 people per ADU and sewage generation of 42 gcpd. This equates to 84 gpd per ADU. With 301 permits issued, the total sewage load attributed to ADUs is 25,284 gpd or 0.025284 mgd.

6-4 Known Future Development Areas

The land use information for future developments, shown in Table 6-2, is generally based upon specific plans and studies developed for the City of Westminster. The locations of future developments are shown on Figure 6-1.

Future sewage loads were estimated from land use data and corresponding unit flow factors shown in Table 4-2. The specific data regarding the proposed dwelling units, gross building floor area, number of hotels, and open space acreage was used with its corresponding unit flow factor.

The Westminster Mall area has been studied recently. The specific plan was adopted in December 2022 and included an infrastructure technical report. This report included sewer generation factors which were utilized in a sewer analysis completed by MCSD in August 2023. These factors were more conservative than what was

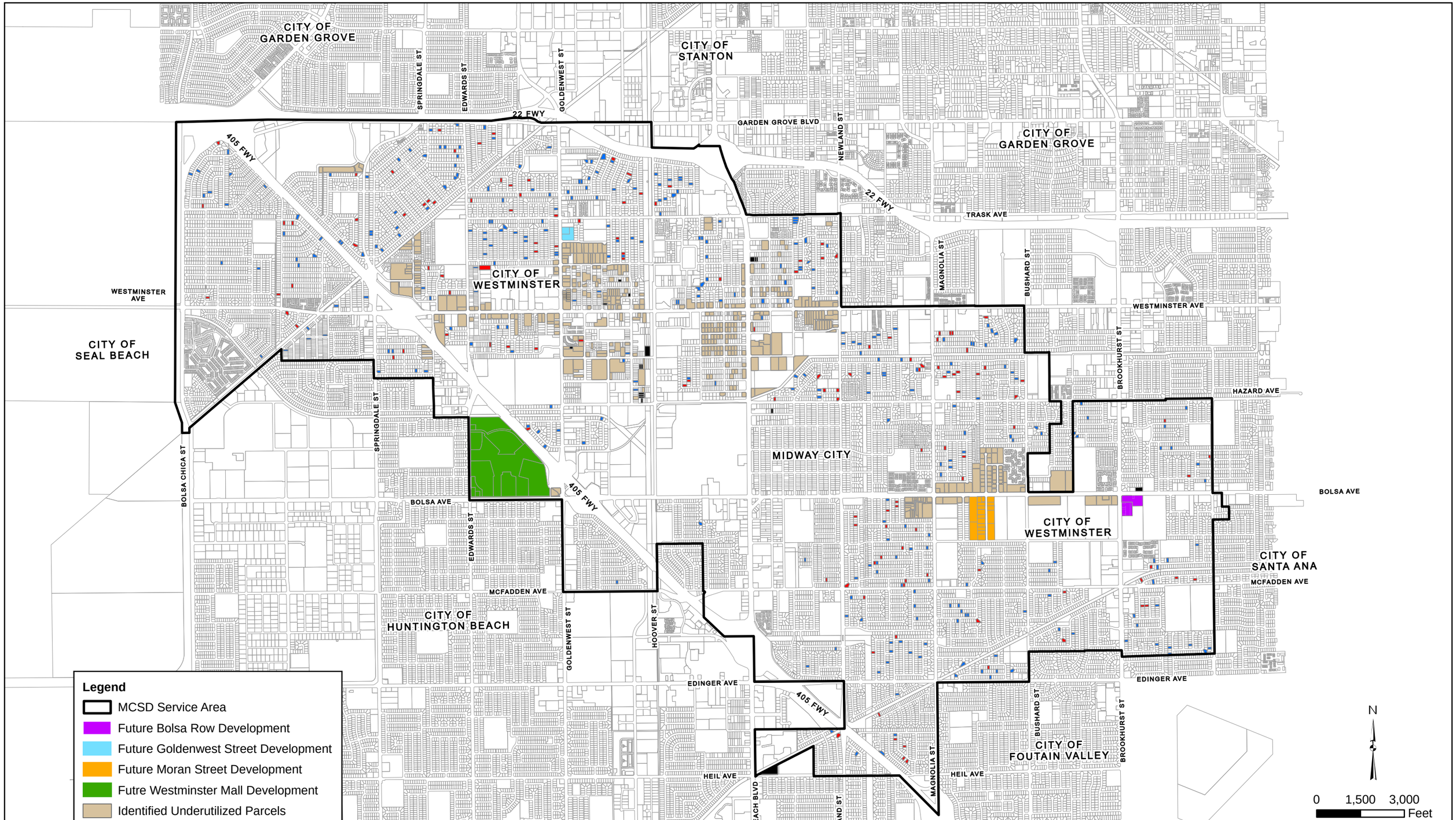
developed for this Sewer Master Plan and are shown in Table 6-2. In order to be consistent with these previous reports and due to the fact that the Westminster Mall Redevelopment is planned to add a significant amount of development, the more conservative sewage flow estimates were utilized in the future model scenario and analysis.

As plans for any additional developments are solidified or as existing plans are updated, the future sewer loads and their effects on the capacity within the downstream sewers should be reevaluated.

6-5 Future Sewage Flows

The Aquatwin Sewer (Aquanuity) hydraulic modeling program was utilized to develop the existing and future hydraulic model scenarios. Water use data and sewer return factors were used to develop the existing average sewer loads, while unit flow factors and land use data were used to develop the future average sewer loads. The peaking formulas, discussed in Section 4-3, were used to convert average flows to peak dry weather flows. The calculated future sewer loads for future developments are shown in Table 6-2. The total is estimated at 0.856565 mgd.

The total existing system ADWF is estimated at 9.157 mgd. The total future system ADWF with future developments is estimated at 9.878 mgd. The total increase is 0.721 mgd, which is less than the total estimated future development load of 0.856 mgd due to the fact that some of the future estimated loads replace existing loads generated by existing buildings.



MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Future Development Areas

Figure 6-1

Table 6-2
Future Developments

Future Development	Specific Plan ID	Location	Sewer MH ID	Gross Area (Ac)	Residential Land Use	Quantity	Units	Average Density (du/Ac)	Assumed FAR	Unit Flow Factor (gpd/unit)	Sewer Load (mgd)	Total Sewer Load (mgd)	Comments
Goldenwest Street[1]	Goldenwest_PA1	13552 Goldenwest Street	29050	1.27	Two story townhomes	20		15.7		175	0.003500	0.003500	
Bolsa Row[2]	BolsaRow_PA1	10052 Bolsa Ave	78074	6.00	MultiFamily Residential	205	du	34.2		125	0.025625	0.048507	Part of Mixed Use Little Saigon area; Up to 650 people maximum attendees; Up to 15 tsf restaurant use
					Retail	30,000	sf		0.65	1,800	0.001907		
					Assembly	20,000	sf		0.65	1,800	0.001271		
					Restaurant	15,000	sf		0.65	1,800	0.000954		
					Hotel	150	rooms			125	0.018750		
Moran Street[3]	MoranSt_PAA	9200 Bolsa Ave	73018	4.80	Retail	135,680	sf		0.65	1,800	0.008626	0.008746	
					Open Space Recreational	0.60	ac			200	0.000120		
	MoranSt_PAB	15041 Moran St	72052	3.60	MultiFamily Residential	50	du	13.9		125	0.006250	0.026463	
					Retail	66,000	sf		0.65	1,800	0.004196		
					Office	16,000	sf		0.65	1,800	0.001017		
					Hotel	120	rooms			125	0.015000		
	MoranSt_PAC	15191 Moran St	73018	2.40	MultiFamily Residential	65	sdu	27.1		125	0.008125	0.010668	
					Retail	40,000	sf		0.65	1,800	0.002543		
	MoranSt_PAD	15072 Moran St	72052	1.80	Retail	33,600	sf		0.65	1,800	0.002136	0.003560	
					Office	22,400	sf		0.65	1,800	0.001424		
	MoranSt_PAE	15200 Moran St	72052/ 73018	4.00	MultiFamily Residential	144	du	36.0		125	-	-	144 Existing Saigon Villa Units. No New Units. No additional sewer load added.
Westminster Mall[4]	WestminsterMall PAA	1025 Westminster Mall	24020	64.43	3-Story Rowtown	300	du	4.7		175.997	0.052799	0.755121	Unit Flow Factors and Estimated Sewer Load based on Westminster Mall Specific Plan Infrastructure Technical Report, dated August 2022 (see Appendix 6-1) and Sewer Analysis for Westminster Mall Redevelopment (see Appendix 6-2)
					4-6 Story Wrap/Mini Podium	1,200	du			155.819	0.186983		
					8-10 Story Podium	1,500	du			135.641	0.203462		
				13.77	Retail	600,000	sf		1.00	2,262	0.031157		
				4.82	Entertainment Retail	210,000	sf		1.00	2,262	0.010905		
				4.82	Restaurant	210	tsf			1,000	0.210000		
				4.13	Office	180,000	sf		1.00	2,262	0.009347		
					Hotel	425	rooms			118.75	0.050469		
			Total	**115.84**						**Total**	**0.856565**	**0.856565**	

[1] *Ref: Information from request for Will Serve Letter dated 2/8/23 (C&V Consulting, Inc)*
[2] *Ref: Bolsa Row Specific Plan (June 2018)*
[3] *Ref: The Moran Street Specific Plan, Hearing Draft (July 2011)*
[4] *Ref: Westminster Mall Specific Plan (December 2022); Westminster Mall Specific Plan Infrastructure Technical Report (August 2022); Sewer Analysis for Westminster Mall Redevelopment (August 2023)*

SECTION 7
HYDRAULIC SEWER MODEL

7-1 General

To perform a detailed analysis of the sewer collection system, it is essential to create a mathematical model that is capable of simulating the operating and flow characteristics of the system. The simulations for this study were performed utilizing Aquanuity's Aquatwin Sewer, which is a 64 bit ArcGIS Pro extension application. The program manages and maintains the database that stores the sewer analysis input and output results.

The sewer system is modeled by entering pipe diameters, lengths, invert elevations and pipe roughness coefficients. The sewer model includes all MCSD's existing lift stations, manholes, and sewer pipes (excluding laterals, private sewers, and sewers belonging to other agencies). The model identifies points of connection to regional facilities owned and operated by the Orange County Sanitation District (OCSD) or other adjacent agency sewer systems.

The model utilizes the average dry weather flows specified by the user and determines peak flows based upon relationships specified by the user. At the completion of a modeling run, output data is created for viewing on the screen or for printing. Output data for pipes include average and peak flow rate, velocity, pipe design and full capacity, and ratio of flow depth to pipe diameter (d/D).

7-2 Construction of Model Geometry

7-2.1 Geographic Information System (GIS)

As a part of the Sewer Master Plan project, a Sewer Geographic Information System (GIS) data was developed for MCSD. The following steps were completed to build the Sewer GIS:

1. MCSD's existing AutoCAD file/system map and atlas maps were initially utilized to develop the basic geometry of the sewer system
2. Available sewer plans were utilized to verify/capture the pipe size and pipe inverts
3. The pipe inverts at approximately 525 sewer manholes were surveyed for areas where as-built plans could not be located or were illegible
4. Some pipe inverts were calculated if the slope was available and either the upstream or downstream invert.
5. The primary tool in checking the pipe data for accuracy was to compare the recorded pipe slope to the slope calculated using the recorded inverts and length of pipe. Connectivity and ownership were reviewed with MCSD staff. Quality control was also conducted while developing the hydraulic model utilizing model software tools.

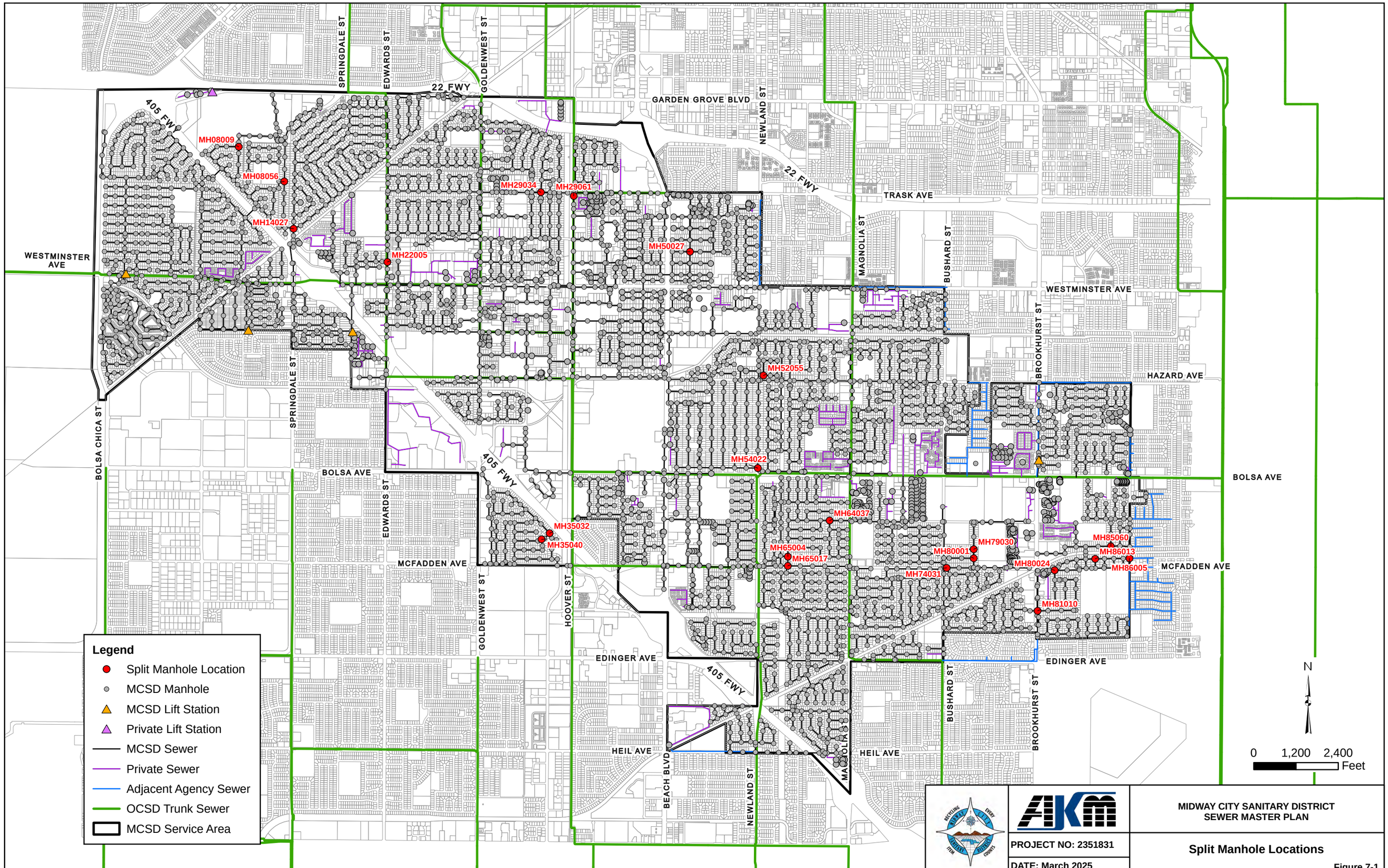
Not all of the pipe inverts in the Sewer GIS are relative to one another. The reason for this is due to datum differences between plan sets and the basis of the survey data conducted as a part of this Sewer Master Plan. The pipe inverts have to be relative to one another in order to run the hydraulic model (Aquatwin Sewer). Therefore, some model pipe inverts had to be adjusted up or down to ensure they were relative to the surrounding pipes. If the inverts were not adjusted, there would be upstream pipes lower in elevation than downstream pipes. This, of course, does not happen in reality. Model inverts will not always match the inverts in the Sewer GIS but the pipe slope was maintained.

7-2.2 Split Manholes

There are 21 “significant” split manholes (two pipes exit the manhole meaning that flow can be split in two directions) in MCSD’s existing sewer system. The split manhole was considered significant if the flow was large enough to make a difference in the downstream sewage depths. The split manhole locations are summarized in Table 7-1 and shown on Figure 7-1. The model was set up to split the flows based on the existing pipe sizes and the invert elevations.

Table 7-1
Split Manhole Summary

Site No.	Manhole ID	Location	Pipe Size (in)	Normal Flow Direction	Overflow Direction
1	MH08009	Norma Dr and Lee Dr	8 8	South	West
2	MH08056	Springdale St and Iroquois Rd	8 12	West	South
3	MH14027	Navajo Rd and Sioux Rd	8 8	North and South	-
4	MH22005	Edwards St and Rochelle Ave	8 8	West and South	-
5	MH29034	Trask Ave and Illinois St	8 8	West and South	-
6	MH35032	Vermont St and Siena Ave	8 8	Southeast	Southwest
7	MH35040	Siena Ave and De Paul St	8 8	Southwest	Southeast
8	MH50027	Jackson St and 20th St	8 8	South	West
9	MH52055	Miami Ave and Riata St	8 8	Southwest	East
10	MH54022	Newland St, north of Bolsa Ave	8 8	West	Southeast
11	MH64037	Natoma Ave and Webster St	8 8	South	West
12	MH65004	Thorpe Ave and Purdy St	8 8	South	West
13	MH65017	McFadden Ave, east of Nantucket	10 8	South	West
14	MH74031	McFadden Ave and Bushard St	10 15	West	South
15	MH79030	Cardinal Ave and Swallow Ln	8 8	South	West
16	MH80001	Robin Ave and Swallow Ln	8 8	South	West
17	MH80024	Horense Dr and McFadden	10 8	West	South
18	MH81010	Margo Ln and Brookhurst St	10 8	West and South	-
19	MH85060	Danborough St and Cunningham Ave	8 8	West	East
20	MH86005	Tampion Ave and Nottingham Ave	12 8	South	West
21	MH86013	Nottingham Ave and Yorkshire St	8 8	South	West


SPRINGDALE ST
EDWARDS ST
GOLDENWEST ST
22 FWY
GARDEN GROVE BLVD
NEWLAND ST
405 FWY
MH08009
MH08056
MH14027
MH29034
MH29061
MH22005
MH50027
TRASK AVE
MAGNOLIA ST
BUSHARD ST
WESTMINSTER AVE
BROOKHURST ST
HAZARD AVE
MH52055
WESTMINSTER AVE
BOLSA CHICA ST
BOLSA AVE
MH54022
MH64037
MH35032
MH35040
MH65004
MH65017
MH79030
MH80001
MH74031
MH80024
MH81010
MH85060
MH86013
MH86005
MCFADDEN AVE
HOOVER ST
EDINGER AVE
HEIL AVE
BEACH BLVD
Legend
Split Manhole Location
MCSD Manhole
MCSD Lift Station
Private Lift Station
MCSD Sewer
Private Sewer
Adjacent Agency Sewer
OCSD Trunk Sewer
MCSD Service Area
N
0 1,200 2,400
Feet
AKM
PROJECT NO: 2351831
DATE: March 2025
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN
Split Manhole Locations
Figure 7-1

7-2.3 Siphons

There are 24 siphons in the existing system as described in Section 4-3. It should be noted that the model is not set up to include a detailed hydraulic analysis of the siphons in the existing sewer system. The model calculates an average slope using the inverts at the upstream and downstream end of the siphon. The hydraulic analysis results are based upon this calculated slope.

Whenever a siphon is in need of replacement or if a new siphon is going to be designed, a detailed hydraulic analysis should be performed during the preliminary design phase of the project to size the siphon and determine the hydraulic grade lines in the adjacent portions of the system.

7-2.4 Lift Stations

Currently, MCSD operates four (4) lift stations: Brookhurst Lift Station, Hammon Lift Station, Westminster Lift Station, and Willow Lift Station. The pumps and forcemains are represented in the hydraulic model at the following location:

1. The Brookhurst Lift Station is located at 14908 Brookhurst Street, north of Bolsa Avenue. This small lift station serves about 150 acres on the east side of the service area. The 6-inch forcemain discharges into Manhole MH78081 located in Brookhurst Street just south of Premier Avenue and across the street from the lift station itself.
2. The Hammon Lift Station is located at 14240 Hammon Place. This lift station serves about 557 acres on the west side of the service area. The parallel 10-inch forcemains discharge into Manhole MH10061 located in Westminster Boulevard at Hammon Place
3. The Westminster Lift Station is located at 5121 Westminster Boulevard. This lift station serves about 643 acres on the west side of the service area. The parallel 12-inch forcemains discharge into Manhole MH10086 located in Westminster Boulevard just west of Hammnon Place.
4. The Willow Lift Station is located at 14240 Willow Lane. This lift station serves about 95 acres on the west side of the service area. The parallel 8-inch forcemains discharge into Manhole MH17007 located in Maple Avenue, west of Edwards Street.

7-3 Existing System Sewer Loads

The total existing average sewer load for the system is estimated 9.157 mgd. This is based upon the developed, calibrated hydraulic model. Existing average sewage flows can be reasonably estimated from water billing data, land use and corresponding sewer return factors. This section describes the process of developing the existing system sewer loads and distributing the loads in the hydraulic model.

7-3.1 Water Billing Meter Data

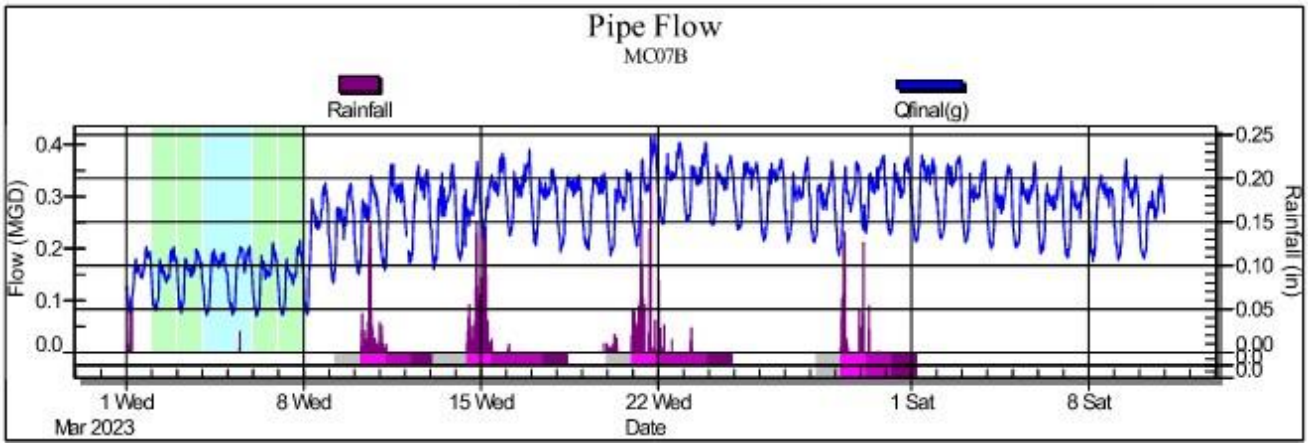
The City of Westminster provided water billing data for its service area for the period of April 2022 through March 2023. This data was linked to the GIS parcels by address for the customers within the City of Westminster. The meter billing data joined to the parcels provides the most accurate spatial distribution of the water use and subsequently sewage generation throughout the system.

7-3.2 Flow Monitoring Data

Flow data was collected by installing twenty-six (26) flow monitors throughout the system between March 1, 2023 and April 11, 2023. There were four rain events during this time period as discussed in Section 3. The rain data was separated out when developing unit flow factors and sewer return factors, which both only relate to the sewage generated within homes and businesses, etc. and should not include inflow and infiltration. For

each flow monitoring site, a “dry weather “ flow period was selected. This period did not have rainfall recorded and the flow patterns were relatively consistent from day to day with similar average flows and the peak flows occurring at about the same time each day. An example is shown in Figure 7-2, which is the flow monitoring data for Site MC07B. The flows prior to the first rain event, between 3/1/24 and 3/8/24 are much lower than the remaining portion of the flow monitoring period. Therefore, the period between 3/1/24 and 3/8/24 was considered the “dry weather” flow period. The data from the “dry weather” flow period was utilized for the calculation of unit flow factors and sewer return factors.

Figure 7-2
Flow Monitoring Site MC07B Rainfall and Flow Data, 3/1/24-4/11/24



7-3.3 Sewer Return Factors

Sewer return factors for each land use type were developed to adjust the water use to equal the average sewage flows recorded at the flow monitoring sites (see Section 3-2). The steps in developing the sewer return factors by land use types are listed below:

1. The water billing data from 2022-2023 was linked to the parcel shapefile.
2. The existing land use was also linked spatially to the parcel shapefile.
3. The flow monitoring tributary areas were overlaid with the parcel shapefile.
4. The water consumption data, land use type, area, and flow monitoring designation were exported to an excel file.
5. Sewer return factors were developed for each land use type in each flow monitoring area. Sewer loading was estimated as the product of the water consumption data and the sewer unit flow factors.
    a. Initially, the commercial and industrial return ratio was set to 90 to 95%. This is based on past planning experience. Commercial and industrial land uses typically do not have a lot of irrigation and most of the water used is returned to the sewer system.
    b. The areas with primarily residential areas were worked on first to develop a sewer return factors for the different types of residential land uses.
    c. Once residential return factors were established, they were applied to other flow monitoring areas and the return factors for land uses such as industrial, schools, public facilities, etc. were determined by trying to match the sewer flow monitoring data in each area.

6. The sewer return factors were adjusted by trial and error. The goal was to match flow monitoring data to approximately 10 percent at all sites.
7. There were some areas where the sewer return factor was larger than one, which is typically not the case because sewage generation should always be less than water use. Some of the reasons for this discrepancy may be error in flow monitoring data or water use readings or high infiltration rates. The model was set up to match the flow monitoring data as close as possible even if water use was lower in the tributary area.
8. For the areas that were not flow monitored, assumptions of sewer return factors were based on similar land uses in adjacent basins that were flow monitored during this Sewer Master Plan study.

7-3.4 Base Loads

Throughout this report, "base loads" are defined as the 24-hour average sewer flow rates applied to the model manholes. Base loads were calculated for each water meter as follows:

Base Load = Water Use x Sewer Return Factor

For the areas located in the City of Garden Grove tributary to the MCSD sewer system, water billing data was not available. Therefore, unit flow factors were utilized to develop the base loads for these areas as follows:

Base Load = Unit Flow Factor (gpd/ac) x Area (ac) or

Base Load = Unit flow Factor (gpd/du) x Number of dwelling units (du)

Initially, the base load at each meter was linked to the nearest manhole in the model. In most cases, the meter was linked to the manhole / sewer in the street directly in front of the parcel. Sometimes, the connection had to be manually adjusted based on the location of the mapped sewer laterals. This often happens when the parcel is located at a corner of two streets or if the sewer lateral does not connect to a sewer directly in front of the parcel. This method of distributing the base loads within the model based on water meter data inherently accounted for any high sewage generators within the existing service area.

The base loads (average dry weather flows) are assigned to each manhole in the "Inflow - DWF" (dry weather flow) table in the Aquatwin Sewer model.

The comparison of the average sewage flows measured in the field versus the calculated flows via water billing data and sewer return factors is shown in Table 7-2. In general, the estimated flows using the water meter data in the model were more conservative than the flow monitoring data. Average flow comparisons were within 5 percent. Peak flow comparisons were within about 11 percent. The peak flows in the model were generally higher than the measured flows due to the fact that a conservative peaking coefficient was utilized in the established peaking formula. For planning purposes, it is prudent to be slightly conservative in the flow estimates.

7-3.5 Base Infiltration

Several of the basins that were flow monitored were found to have significant base infiltration. The base infiltration was calculated for each basin based on the following empirical method, the Stevens/Schutzbach equation:

$$BI = \frac{0.4*MDF}{1-0.6\,(MDF/ADWF)^{\wedge}\,ADWF^{0.7}}.$$

Where, BI = Base Infiltration

MDF = Minimum Daily Total Flow

ADWF = Average Dry Weather Flow

The Stevens/Schutzbach equation is based on traditional residential flow patterns. Reliability of the BI calculation decreases in non-residential basins, in basins where the flow meter measures flow from cycling pump stations, and where there are significantly more than 20,000 feet of pipe upstream. Generally, the BI calculation method carries higher error as the amount of BI (as a % of ADWF) decreases and lower error as BI increases. Estimated BI values below 25% to 30% could represent insignificant BI. BI estimates over 50% of the ADWF are considered more accurate and therefore potentially very significant.

Estimated BI during the "dry weather" period for each flow monitoring site is shown in Table 7-2. It should be noted that BI typically increases during wet weather periods. The infiltration loads are assigned to each manhole in the "Inflow - Direct" (direct flows) table in the Aquatwin Sewer model.

7-4 Future System Sewer Loads

The future system loads include additional loads that are estimated due to known future developments (i.e. defined by specific plans), vacant parcels that potentially could be developed in the future, and accessory dwelling units that have been permitted. The details of the future loads are discussed in Section 6 of this report. The total future average sewage loads added in the hydraulic model are as follows:

1. Future Developments = 0.856565 mgd
2. Vacant Parcels = 0.020032 mgd
3. Accessory Dwelling Units = 0.025284 mgd

The future loads (average dry weather flows) are added or replace the existing loads for each manhole in the "Dry Weather Flow" table in the Aquatwin Sewer model.

7-5 Existing and Future Peak Dry Weather Flows

Peak dry weather flows are calculated in the model by a user defined relationship as discussed in Section 3-6 and Section 4-3. For the existing and future system analyses, the peaking formulas are as follows:

1. **PDWF = 1.50 x ADWF $^{0.92}$** when base infiltration is known and/or included
2. **PDWF = 1.70 x ADWF $^{0.92}$** when base infiltration is unknown and/or excluded

Where PDWF = Peak Dry Weather flow in mgd

ADWF = Average Dry Weather flow in mgd

7-6 Model Scenarios

Two model scenarios were established as follows:

1. Existing Condition
   a. Existing facilities
   b. Existing condition sewage loads
2. Future Condition
   a. Existing facilities
   b. Future condition with all future development sewage loads

i. Existing sewage loads

ii. Loads from existing vacant parcels

iii. Loads from permitted accessory dwelling units

iv. Loads from known future developments

The results of the hydraulic analysis are discussed in Section 8.

Table 7-2
Comparison of Measured Flows and Calculated Flows

Flow Monitoring Site ID	Location	MH ID	Pipe ID	U/S Pipe Size (in)	Base Infiltration (mgd)	Average Flow w/o Base Infiltraion (mgd)	Flow Monitoring Average Flow (mgd)	Model Average Flows with Infiltration	% Difference	Flow Monitoring Peak Flow (mgd)	Model Peak Flows with Infiltration	% Difference	Notes
MC01	1414 Willow Ln	MH16004	GM15080	8	0.0355	0.0345	0.0701	0.0653	6.8%	0.1170	0.1218	4.1%	
MC02	14148 Hammon Pl	MH11004	GM11004	12	0.1522	0.5585	0.7107	0.7115	0.1%	1.0870	0.9946	8.5%	
MC03A	5120 Westminister Blvd	MH04041	GM04048	12	0.0213	0.1609	0.1822	0.1847	1.4%	0.3290	0.3138	4.6%	
MC03C	13451 Milan St	MH08048	GM08053	12	0.0387	0.1424	0.1811	0.1800	0.6%	0.3120	0.3097	0.7%	MC3C is tributary to MC3B
MC03B	5121 Northwestern Way	MH04017	GM04009	12	0.0499	0.3850	0.4349	0.4750	9.2%	0.6760	0.7392	9.3%	
MC09	7591 Hazard Ave	MH41044	GM41051	12	0.1289	0.1285	0.2574	0.2566	0.3%	0.3470	0.4289	23.6%	
MC15	16065 Bushad St	MH75053	GM75061	18	0.4848	0.4052	0.8900	0.9096	2.2%	1.1340	1.3745	21.2%	
MC16B	10282 W Mcfadden Ave	MH86027	GM86032	10	0.0414	0.1020	0.1434	0.1531	6.8%	0.2770	0.2669	3.6%	MC16B is tributary to MC16A
MC16A	15956 Brookhurst St	Outside	GM81068	15	0.2053	0.3757	0.5811	0.6129	5.5%	0.8360	0.9300	11.2%	
MC18	7490 Mcfadden Ave	MH36017	GM36021	10	0.0934	0.0962	0.1896	0.1930	1.8%	0.3230	0.3301	2.2%	
MC21	9039 Hazard Ave	MH70035	GM70038	8	0.1201	0.1993	0.3194	0.3207	0.4%	0.4350	0.5267	21.1%	
MC22A	8446 Westminister Blvd	MH51026	GM51037	12	0.0300	0.1995	0.2295	0.2251	1.9%	0.5390	0.3805	29.4%	MC22A is tributary to MC22B
MC22B	7852 15th St	MH40042	GM40050	12	0.3288	0.8082	1.1370	1.2126	6.7%	1.6850	1.7871	6.1%	
MC23	7351 Hazard Ave	MH32042	GM32049	15	0.1258	0.1575	0.2833	0.2964	4.6%	0.3900	0.4789	22.8%	
MC07B	14864 Newland St	MH54010	GM54008	8	0.0491	0.1087	0.1578	0.1579	0.1%	0.3440	0.2370	31.1%	MC07B is tributary to MC27
MC27	15290 Van Buren St	MH56002	GM55045	18	0.2344	0.3832	0.6175	0.6454	4.5%	0.9110	0.8371	8.1%	
MC34	10051 Premier Ave	MH78035	GM78054	8	0.0559	0.0745	0.1304	0.1212	7.0%	0.2140	0.2156	0.7%	
MC35	9043 Oasis Ave	MH60053	GM60079	8	0.0515	0.1402	0.1918	0.2114	10.2%	0.3440	0.3588	4.3%	
MC39	14161 Olive St	MH31045	GM31050	12	0.1159	0.2690	0.3849	0.3875	0.7%	0.5610	0.6194	10.4%	
MC49	13961 Willow Ln	MH15031	GM15047	8	0.0359	0.0476	0.0835	0.0826	1.0%	0.1420	0.1513	6.6%	
MC68	7360 Bolsa Ave	MH35012	GM34018	10	0.0556	0.0263	0.0819	0.0828	1.1%	0.1430	0.1516	6.0%	
MC70	9031 Greenville Ave	MH63044	GM63048	8	0.0557	0.0755	0.1312	0.1338	2.0%	0.2030	0.2153	6.1%	
MC19A	8652 Bermuda Ave	MH65032	GM65022	8	0.0290	0.0694	0.0919	0.1038	13.0%	0.2360	0.1868	20.9%	MC19A is tributary to MC19
MC19	15699 Skylinks Cir.	MH65075	GM66001	12	0.0534	0.2312	0.2847	0.2949	3.6%	0.4210	0.4856	15.4%	
MC71A	8501 Mcfadden Ave	MH56027	GM56024	10	0.0232	0.0535	0.0824	0.0709	13.9%	0.1590	0.1309	17.6%	
MC73	9055 Larkspur Dr	MH66034	GM66040	12	0.0143	0.0514	0.0657	0.0677	3.0%	0.1190	0.1209	1.6%	
								Average	**4.2%**		**Average**	**11.4%**	

SECTION 8
CAPACITY ANALYSIS

8-1 Gravity System

The analysis of the sewer collection system was based upon the calculated existing and future peak dry weather flows. Pipes that exceed the following criteria are considered hydraulically deficient: Peak Dry Weather (PDWF) depth to diameter (d/D) > 0.64. The hydraulic deficiencies, based upon the criteria above, are listed in Table 8-1. The locations of these deficiencies are shown on Figure 8-1.

The total length of existing sewers found to be capacity deficient per the developed criteria discussed in Section 4 is 24,261 feet. This is 2.8 percent (24,261 **/** 863,261) of the total existing system length.

When the future development loads were applied to the model, it was found that an additional 616 feet of existing sewer would become deficient per the developed criteria. The primary sewer of concern is the 365 foot section 15" pipe downstream of the Westminster Mall. This pipe is undersized based on the sewer loads estimated for the ultimate development conditions.

8-2 Comparison of Flow Monitoring Depths and Model Depths

The flow monitoring depths were compared to the depths of flow predicted by the hydraulic model. It was found that some locations had depths measured higher than what the model predicts even though the model flows are generally conservative. One possible reason might be that the existing sewers have debris and/or grit in the pipes that the model is not simulating. The model utilizes a roughness value of 0.013 to represent vitrified clay pipe, but this does assume that the pipes are cleaned on a regular basis. It is recommended that MCSD clean the pipes in the locations identified in the comments of Table 8-2 and then reconfirm the flow depths. Flow depths can be reconfirmed by re-installing flow monitors in the pipes or by installing depth measurement devices beneath manhole lids (i.e. Smart Covers) that can measure the flow depths in the manholes. Flow monitoring locations are shown on Figure 3-1.

8-3 Lift Stations

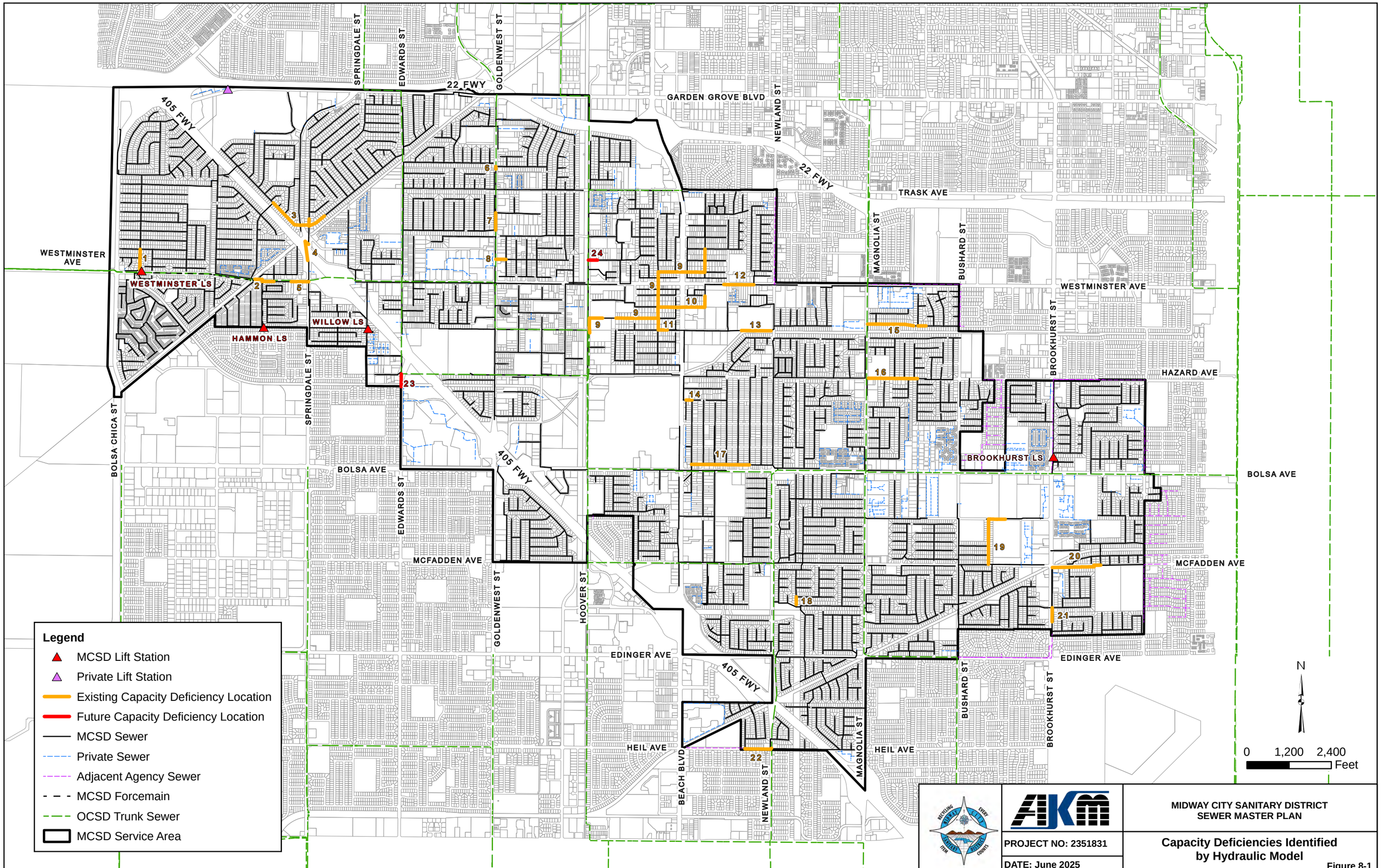
MCSD currently owns four (4) sewer lift stations which are discussed in Section 5-5. The lift stations should be capable of conveying the estimated peak wet weather flows (PWWF) as shown in Table 5-2.

The existing pumps at Brookhurst Lift Station have a capacity of 210 gpm. This is less than the estimated existing and future PWWF of 229 gpm. While the capacities are close and the PWWF, MCSD's criterion is for the lift station to be able to pump the PWWF with the largest pump out. Until the pumps are replaced, it is recommended that MCSD ensure that the pumps are maintained in good working order and are ready for use prior to each rainy season. MCSD should ultimately replace each pump with a minimum capacity of 265 gpm.

The existing pumps at Hammon Lift Station are capable of pumping 1300 gpm on the higher speed setting. This is sufficient capacity to convey the estimated existing PWWF (966 gpm) and future PWWF (972 gpm), which includes the future near-term developments.

The existing pumps at Westminster Lift Station are capable of pumping 1300 gpm. This is sufficient capacity to convey the estimated existing PWWF (922 gpm) and future PWWF (924 gpm), which includes the future near-term developments.

The existing pumps at Willow Lift Station typically pump at 475 gpm on the lower speed setting This is sufficient capacity to convey the estimated existing PWWF (206 gpm) and future PWWF (207 gpm), which includes the future near-term developments.



MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: June 2025

Capacity Deficiencies Identified by Hydraulic Model

Figure 8-1

Table 8-1
Capacity Deficiencies Identified by the Hydraulic Model

									Existing Conditons				Future Conditions					
Capacity Deficiency Location	Existing or Fuure Deficiency	Pipe ID	U/S MH ID	D/S MH ID	Pipe Diameter (in)	Pipe Length (ft)	Slope	Roughness	ADWF (mgd)	PDWF (mgd)	PDWF Depth (ft)	PDWF d/D	ADWF (mgd)	PDWF (mgd)	PDWF Depth (ft)	PDWF d/D	Design Capacity at d/D=0.64 (mgd)	Flow Exceeding Design Capacity (mgd)
1	Existing	GM04009	MH04003	MH04017	12	250	0.0015	0.013	0.4634	0.7393	0.69	0.69	0.4663	0.7434	0.6900	0.69	0.6645	0.0789
		GM04034	MH04017	MH04029	12	350	0.0015	0.013	0.4677	0.8450	0.77	0.77	0.4747	0.8566	0.7800	0.78	0.6628	0.1938
2	Existing	GM10060	MH10064	MH10059	8	341	0.0010	0.013	0.1864	0.3199	0.67	1.00	0.1897	0.3250	0.6700	1.00	0.1873	0.1377
		GM10058	MH10058	MH10060	12	203	0.0016	0.013	0.4314	0.6921	0.64	0.64	0.4371	0.7005	0.6500	0.65	0.6860	0.0145
		GM10059	MH10060	MH10059	12	57	0.0011	0.013	0.4307	0.6911	0.76	0.76	0.4366	0.6998	0.7700	0.77	0.5527	0.1471
3	Existing	GM14024	MH14021	MH14028	8	170	0.0010	0.013	0.1457	0.2549	0.67	1.00	0.1470	0.2570	0.6700	1.00	0.1828	0.0741
		GM14030	MH14028	MH09045	8	239	0.0018	0.013	0.1634	0.2834	0.47	0.71	0.1649	0.2856	0.4700	0.71	0.2482	0.0374
		GM09048	MH09045	MH09044	8	172	0.0020	0.013	0.1749	0.3016	0.48	0.72	0.1764	0.3040	0.4800	0.72	0.2575	0.0465
		GM09039	MH09044	MH09027	8	414	0.0020	0.013	0.1767	0.3045	0.48	0.72	0.1783	0.3070	0.4800	0.73	0.2590	0.0480
		GM09030	MH09027	MH09023	8	275	0.0020	0.013	0.1817	0.3125	0.49	0.74	0.1835	0.3153	0.5000	0.74	0.2587	0.0566
		GM09022	MH09023	MH09022	8	176	0.0020	0.013	0.1840	0.3160	0.49	0.74	0.1861	0.3193	0.5000	0.75	0.2614	0.0579
		GM14025	MH14022	MH14029	8	310	0.0020	0.013	0.1507	0.2629	0.43	0.65	0.1520	0.2650	0.4300	0.65	0.2587	0.0063
		GM14033	MH14029	MH14027	8	221	0.0020	0.013	0.1531	0.2668	0.44	0.66	0.1545	0.2692	0.4400	0.66	0.2584	0.0108
4	Existing	GM15023	MH15001	MH15015	8	557	0.0015	0.013	0.1381	0.2426	0.45	0.68	0.1395	0.2450	0.4500	0.68	0.2247	0.0202
		GM15001	MH15002	MH15001	8	130	0.0015	0.013	0.1385	0.2434	0.46	0.69	0.1400	0.2457	0.4600	0.69	0.2212	0.0245
5	Existing	GM10084	MH15032	MH10067	8	327	0.0021	0.013	0.1672	0.2894	0.45	0.68	0.1692	0.2925	0.4600	0.68	0.2676	0.0250
		GM10063	MH10067	MH10066	8	172	0.0007	0.013	0.1671	0.2892	0.67	1.00	0.1691	0.2925	0.6700	1.00	0.1547	0.1378
6	Existing	GM29010	MH29001	MH29006	8	73	0.0004	0.013	0.1070	0.2176	0.67	1.00	0.1082	0.2198	0.6700	1.00	0.1171	0.1027
7	Existing	GM30001	MH29050	MH30007	8	496	0.0030	0.013	0.1691	0.3315	0.44	0.66	0.1757	0.3432	0.4500	0.68	0.3169	0.0264
8	Existing	GM30043	MH30034	VP30001	8	295	0.0040	0.013	0.1931	0.3745	0.43	0.65	0.1949	0.3776	0.4400	0.65	0.3659	0.0117
9	Existing	GM50048	MH50027	MH50038	8	328	0.0032	0.013	0.2214	0.3747	0.47	0.71	0.2220	0.3755	0.4700	0.71	0.3258	0.0498
		GM50060	MH50038	MH51003	8	326	0.0032	0.013	0.2415	0.4058	0.50	0.75	0.2421	0.4067	0.5000	0.75	0.3283	0.0784
		GM51003	MH51003	MH51002	8	20	0.0027	0.013	0.2716	0.4521	0.67	1.00	0.2722	0.4531	0.6700	1.00	0.2986	0.1545
		GM51002	MH51002	MH51001	8	237	0.0040	0.013	0.2759	0.4588	0.51	0.76	0.2766	0.4598	0.5100	0.76	0.3659	0.0939
		GM51001	MH51001	MH40011	8	253	0.0040	0.013	0.2803	0.4655	0.51	0.77	0.2810	0.4665	0.5100	0.77	0.3677	0.0988
		GM40012	MH40011	MH40010	8	338	0.0015	0.013	0.4021	0.6487	0.67	1.00	0.4031	0.6502	0.6700	1.00	0.2204	0.4297
		GM40011	MH40010	MH40009	8	483	0.0030	0.013	0.4413	0.7068	0.67	1.00	0.4424	0.7083	0.6700	1.00	0.3170	0.3913
		GM40010	MH40009	MH40020	10	167	0.0030	0.013	0.5349	0.8436	0.83	1.00	0.5360	0.8452	0.8300	1.00	0.5731	0.2721
		GM40023	MH40020	MH40026	10	331	0.0030	0.013	0.5739	0.8999	0.83	1.00	0.5755	0.9022	0.8300	1.00	0.5698	0.3324
		GM40034	MH40026	MH40030	10	168	0.0030	0.013	0.5862	0.9177	0.83	1.00	0.5881	0.9204	0.8300	1.00	0.5717	0.3487
		GM40045	MH40030	MH40043	10	330	0.0030	0.013	0.6076	0.9485	0.83	1.00	0.6093	0.9509	0.8300	1.00	0.5731	0.3777
		GM40051	MH40043	MH40042	10	20	0.0030	0.013	0.6805	1.0527	0.83	1.00	0.6869	1.0618	0.8300	1.00	0.5696	0.4923
		GM40050	MH40042	MH40058	10	305	0.0030	0.013	1.1813	1.7485	0.83	1.00	1.1848	1.7533	0.8300	1.00	0.5731	1.1802
		GM40064	MH40058	MH40055	18	592	0.0003	0.013	1.4514	2.1131	1.50	1.00	1.4514	2.1131	1.5000	1.00	0.7988	1.3143
		GM40062	MH40055	MH40052	18	604	0.0007	0.013	1.3889	2.0293	1.50	1.00	1.3942	2.0365	1.5000	1.00	1.3560	0.6805
		GM40059	MH40051	MH31046	18	375	0.0009	0.013	1.3825	2.2901	1.50	1.00	1.3827	2.2904	1.5000	1.00	1.4898	0.8006
		GM31064	MH31046	MH32007	18	368	0.0017	0.013	1.3940	2.3076	1.03	0.69	1.3944	2.3082	1.0300	0.69	2.0955	0.2127
10	Existing	GM51052	MH51038	MH51055	12	316	0.0016	0.013	0.4408	0.7060	0.65	0.65	0.4413	0.7067	0.6500	0.65	0.6911	0.0156
		GM51063	MH51055	MH51054	12	243	0.0016	0.013	0.4440	0.7107	0.66	0.66	0.4445	0.7114	0.6700	0.67	0.6738	0.0376
		GM51061	MH51054	MH40049	12	253	0.0015	0.013	0.4477	0.7161	0.68	0.68	0.4482	0.7168	0.6800	0.68	0.6597	0.0571
		GM40058	MH40049	MH40048	12	258	0.0015	0.013	0.4782	0.7609	0.71	0.71	0.4788	0.7618	0.7100	0.71	0.6626	0.0993
		GM40076	MH40048	VP40001	12	45	0.0015	0.013	0.4801	0.7636	0.71	0.71	0.4807	0.7646	0.7200	0.72	0.6597	0.1049
		GM40056	VP40001	MH40046	12	204	0.0015	0.013	0.4874	0.7743	0.72	0.72	0.4880	0.7753	0.7200	0.72	0.6597	0.1156
		GM40054	MH40046	MH40044	12	246	0.0015	0.013	0.4911	0.7798	0.72	0.72	0.4918	0.7808	0.7200	0.72	0.6606	0.1202
11	Existing	GM41007	MH41007	MH41005	12	250	0.0005	0.013	0.2481	0.4161	0.67	0.67	0.2459	0.4127	0.6700	0.67	0.3881	0.0246
		GM40072	MH41005	MH40059	12	326	0.0006	0.013	0.2305	0.3888	0.63	0.63	0.2956	0.4888	0.7400	0.74	0.4006	0.0882

Table 8-1 (Continued)
Capacity Deficiencies Identified by the Hydraulic Model

									Existing Conditons				Future Conditions					
Capacity Deficiency Location	Existing or Fuure Deficiency	Pipe ID	U/S MH ID	D/S MH ID	Pipe Diameter (in)	Pipe Length (ft)	Slope	Roughness	ADWF (mgd)	PDWF (mgd)	PDWF Depth (ft)	PDWF d/D	ADWF (mgd)	PDWF (mgd)	PDWF Depth (ft)	PDWF d/D	Design Capacity at d/D=0.64 (mgd)	Flow Exceeding Design Capacity (mgd)
12	Existing	GM51026	MH51025	MH51024	12	233	0.0006	0.013	0.3800	0.6158	1.00	1.00	0.3804	0.6165	1.0000	1.00	0.4176	0.1989
		GM51025	MH51024	MH51023	12	121	0.0008	0.013	0.3960	0.6397	0.79	0.79	0.3965	0.6404	0.7900	0.79	0.4898	0.1505
		GM51024	MH51023	MH51022	12	134	0.0012	0.013	0.4120	0.6634	0.70	0.70	0.4124	0.6641	0.7000	0.70	0.5896	0.0745
		GM51023	MH51022	MH51020	12	346	0.0013	0.013	0.4146	0.6672	0.68	0.68	0.4151	0.6680	0.6800	0.68	0.6144	0.0536
13	Existing	GM52014	MH52013	MH52012	10	153	0.0009	0.013	0.1866	0.3629	0.60	0.72	0.1875	0.3644	0.6000	0.72	0.3108	0.0536
		GM52013	MH52012	MH52011	10	350	0.0009	0.013	0.1866	0.3629	0.60	0.72	0.1875	0.3644	0.6000	0.72	0.3111	0.0533
		GM52012	MH52011	MH52010	10	340	0.0008	0.013	0.1866	0.3629	0.61	0.73	0.1875	0.3644	0.6100	0.74	0.3022	0.0622
14	Existing	GM42004	MH42003	MH53011	8	172	0.0010	0.013	0.1079	0.1934	0.45	0.67	0.1083	0.1940	0.4500	0.67	0.1817	0.0123
15	Existing	GM69102	MH69088	MH69087	8	230	0.0020	0.013	0.1534	0.2674	0.44	0.66	0.1535	0.2676	0.4400	0.66	0.2559	0.0116
		GM69099	MH69086	MH69085	8	250	0.0020	0.013	0.1729	0.2985	0.47	0.71	0.1734	0.2992	0.4800	0.71	0.2588	0.0404
		GM69098	MH69085	MH69084	8	271	0.0020	0.013	0.1764	0.3040	0.48	0.72	0.1771	0.3052	0.4800	0.73	0.2583	0.0468
		GM69097	MH69084	MH69083	8	280	0.0019	0.013	0.1817	0.3125	0.50	0.75	0.1824	0.3136	0.5000	0.75	0.2541	0.0595
		GM60080	MH69083	MH60053	8	273	0.0020	0.013	0.1857	0.3187	0.50	0.75	0.1864	0.3198	0.5000	0.76	0.2575	0.0623
		GM60079	MH60053	MH60052	8	240	0.0021	0.013	0.2113	0.3590	0.67	1.00	0.2124	0.3607	0.6700	1.00	0.2641	0.0966
16	Existing	GM70042	MH70040	MH70039	8	93	0.0019	0.013	0.1830	0.3144	0.50	0.75	0.1835	0.3152	0.5000	0.75	0.2546	0.0606
		GM70041	MH70039	MH70038	8	163	0.0026	0.013	0.2144	0.3638	0.50	0.75	0.2152	0.3651	0.5000	0.75	0.2975	0.0676
		GM70040	MH70038	MH70037	8	117	0.0011	0.013	0.2407	0.4047	0.67	1.00	0.2415	0.4059	0.6700	1.00	0.1925	0.2134
		GM70039	MH70037	MH70036	8	280	0.0020	0.013	0.2583	0.4318	0.67	1.00	0.2591	0.4330	0.6700	1.00	0.2587	0.1743
		GM70038	MH70036	MH70035	8	282	0.0023	0.013	0.3207	0.5269	0.67	1.00	0.3221	0.5289	0.6700	1.00	0.2798	0.2491
		GM61067	MH70035	MH61060	8	266	0.0020	0.013	0.3207	0.5971	0.67	1.00	0.3221	0.5994	0.6700	1.00	0.2607	0.3387
		GM61066	MH61060	MH61059	8	191	0.0020	0.013	0.3233	0.6015	0.67	1.00	0.3246	0.6038	0.6700	1.00	0.2615	0.3423
17	Existing	GM54027	MH54020	MH54019	8	330	0.0027	0.013	0.1952	0.3337	0.46	0.69	0.1988	0.3394	0.4600	0.70	0.3020	0.0374
		GM54026	MH54019	MH54018	8	330	0.0027	0.013	0.2165	0.3670	0.49	0.74	0.2201	0.3727	0.5000	0.75	0.3020	0.0707
		GM54025	MH54018	MH54016	8	330	0.0027	0.013	0.2415	0.4058	0.54	0.82	0.2451	0.4113	0.6700	1.00	0.3021	0.1092
		GM54022	MH54016	MH54014	8	330	0.0027	0.013	0.2671	0.4453	0.67	1.00	0.2716	0.4522	0.6700	1.00	0.3021	0.1501
		GM54021	MH54014	MH54013	8	330	0.0027	0.013	0.2817	0.4675	0.67	1.00	0.2857	0.4737	0.6700	1.00	0.3021	0.1716
18	Existing	GM65079	MH65064	MH66001	8	227	0.0020	0.013	0.1504	0.2625	0.43	0.65	0.1519	0.2649	0.4300	0.65	0.2587	0.0062
19	Existing	GM79044	MH79008	MH79007	8	229	0.0021	0.013	0.1610	0.2794	0.45	0.67	0.1609	0.2794	0.4500	0.67	0.2621	0.0173
		GM79043	MH79007	MH79006	8	195	0.0020	0.013	0.1645	0.2851	0.46	0.69	0.1645	0.2850	0.4600	0.69	0.2587	0.0263
		GM79042	MH79006	MH79005	8	51	0.0020	0.013	0.1682	0.2910	0.46	0.70	0.1682	0.2910	0.4600	0.70	0.2587	0.0323
		GM79041	MH79005	MH79017	8	67	0.0019	0.013	0.1756	0.3028	0.49	0.73	0.1756	0.3027	0.4900	0.73	0.2549	0.0478
		GM79063	MH79017	MH79023	8	350	0.0020	0.013	0.1803	0.3102	0.49	0.73	0.1803	0.3101	0.4900	0.73	0.2587	0.0514
		GM79086	MH79023	MH79030	8	350	0.0020	0.013	0.1862	0.3195	0.50	0.75	0.1862	0.3194	0.5000	0.75	0.2587	0.0607
		GM80002	MH79030	MH80001	8	262	0.0020	0.013	0.1916	0.3280	0.52	0.77	0.1916	0.3280	0.5200	0.77	0.2577	0.0704
		GM80023	MH80001	MH80011	8	264	0.0020	0.013	0.1970	0.3365	0.53	0.79	0.1970	0.3365	0.5300	0.79	0.2592	0.0773

Table 8-1 (Continued)
Capacity Deficiencies Identified by the Hydraulic Model

									Existing Conditons				Future Conditions					
Capacity Deficiency Location	Existing or Fuure Deficiency	Pipe ID	U/S MH ID	D/S MH ID	Pipe Diameter (in)	Pipe Length (ft)	Slope	Roughness	ADWF (mgd)	PDWF (mgd)	PDWF Depth (ft)	PDWF d/D	ADWF (mgd)	PDWF (mgd)	PDWF Depth (ft)	PDWF d/D	Design Capacity at d/D=0.64 (mgd)	Flow Exceeding Design Capacity (mgd)
20	Existing	GM86027	MH86022	MH86020	10	193	0.0012	0.013	0.3981	0.6428	0.83	1.00	0.3988	0.6439	0.8300	1.00	0.3625	0.2814
		GM86026	MH86020	MH86021	10	42	0.0012	0.013	0.3999	0.6454	0.83	1.00	0.4005	0.6464	0.8300	1.00	0.3610	0.2855
		GM86025	MH86021	MH86018	10	350	0.0012	0.013	0.4029	0.6499	0.83	1.00	0.4036	0.6509	0.8300	1.00	0.3625	0.2884
		GM80053	MH86018	MH80024	10	350	0.0012	0.013	0.4093	0.6594	0.83	1.00	0.4100	0.6604	0.8300	1.00	0.3625	0.2979
		GM80050	MH80024	MH80022	10	142	0.0011	0.013	0.4125	0.6642	0.83	1.00	0.4132	0.6652	0.8300	1.00	0.3513	0.3139
		GM80049	MH80022	MH80021	10	350	0.0012	0.013	0.4142	0.6666	0.83	1.00	0.4148	0.6676	0.8300	1.00	0.3625	0.3052
21	Existing	GM81023	MH81010	MH81032	15	398	0.0003	0.013	0.3732	0.6057	0.90	0.72	0.3738	0.6066	0.9100	0.72	0.5131	0.0935
22	Existing	GM59033	MH59030	MH59031	8	20	0.0000	0.013	0.0751	0.1571	0.67	1.00	0.0754	0.1576	0.6700	1.00	0.0000	0.1576
		GM59037	MH59031	MH59033	8	365	0.0002	0.013	0.0751	0.1571	0.67	1.00	0.0754	0.1576	0.6700	1.00	0.0856	0.0720
		GM59039	MH59033	MH59036	8	365	0.0002	0.013	0.0751	0.1570	0.67	1.00	0.0754	0.1576	0.6700	1.00	0.0856	0.0719
		GM59043	MH59036	VP59002	12	35	0.0000	0.013	0.0751	0.1570	1.00	1.00	0.0754	0.1575	1.0000	1.00	0.0000	0.1575
23	Future	GM24015	MH24020	VP24001	15	365	0.0010	0.013	0.0375	0.0830	0.21	0.17	0.7551	1.3129	1.2500	1.00	0.9693	0.3436
24	Future	GM39046	MH39044	MH30041	8	250	0.0030	0.013	0.1858	0.3189	0.43	0.64	0.1867	0.3204	0.4300	0.65	0.3169	0.0035
					Total Existing Deficiencies	**23,646**												
					Total Future Deficiencies	**615**												
					Total	**24,261**												

Table 8-2
Comparison of Flow Monitoring and Model Depths

No.	Location	Meter ID	Manhole ID	Direction of Flow	Pipe ID	U/S Pipe Size (in)	Area (Ac)	Flow Monitoring Data			Model Data			Comments/ Recommendations
								PDWF (mgd)	Depth (in)	PDWF d/D	PDWF (mgd)	Depth (in)	PDWF d/D	
1	1414 Willow Ln	MC01	MH16004	Monitor flow from north	GM15080	8	75	0.1170	5.29	0.66	0.1218	3.00	0.37	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
2	14148 Hammon Pl	MC02	MH11004	Monitor flow from north	GM11004	15	494	1.0870	10.75	0.72	1.0366	8.04	0.53	Capacity Deficiency verified via flow monitoring; Pipe measured as 13.75" diameter in field which may be the cause of higher flow depths in field
3	5120 Westminister Blvd	MC03A	MH04041	Monitor flow from west	GM04048	12	153	0.3290	6.51	0.54	0.3187	4.56	0.38	Pipe measured as 11" in diameter which may be the cause of higher flow depths in field
4	5121 Northwestern Way	MC03B	MH04017	Monitor flow from north	GM04009	12	264	0.6760	6.41	0.53	0.7411	8.28	0.69	Model is conservative; capacity deficiency not measured in field
5	13451 Milan St	MC03C	MH08048	Monitor flow from east	GM08053	12	133	0.3120	4.85	0.40	0.3097	5.52	0.46	
6	14864 Newland St	MC07B	MH54010	Monitor flow from north	GM54008	8	104	0.3440	5.46	0.68	0.2501	65.52	0.54	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
7	7591 Hazard Ave	MC09	MH41044	Monitor flow from east	GM41051	12	78	0.3470	7.53	0.63	0.4861	90.36	0.63	Pipe measured as 11.25" in diameter in field
8	16065 Bushad St	MC15	MH75053	Monitor flow from north	GM75061	18	297	1.1340	5.02	0.28	1.3746	60.24	0.53	
9	15956 Brookhurst St	MC16A	Outside	Monitor flow from north	GM81068	15	230	0.8360	10.42	0.69	0.9474	-	-	Outside Agency Sewer not modeled; Flow compared to GM81068 just upstream of GM81063.
10	10282 W Mcfadden Ave	MC16B	MH86027	Monitor flow from east	GM86032	10	117	0.2770	11.38	1.00	0.2704	136.56	0.53	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
11	7490 Mcfadden Ave	MC18	MH36017	Monitor flow from west	GM36021	10	101	0.2680	6.30	0.63	0.3301	75.6	0.51	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
12	15699 Skylinks Cir.	MC19	MH65075	Monitor flow from southeast	GM66001	12	118	0.4210	5.19	0.43	0.4761	62.28	0.45	
13	8652 Bermuda Ave	MC19A	MH65032	Monitor flow from northeast	GM65022	8	-	0.2360	5.18	0.65	0.1992	62.16	0.54	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
14	9039 Hazard Ave	MC21	MH70035	Monitor flow from east	GM70038	8	135	0.4350	6.08	0.76	0.5269	72.96	1	Capacity Deficiency verified via flow monitoring
15	8446 Westminister Blvd	MC22A	MH51026	Monitor flow from east	GM51037	12	97	0.5390	4.64	0.39	0.3805	55.68	0.45	Pipe measured as 12.75" in diameter which may be the cause of lower flow depths in field
16	7852 15th St	MC22B	MH40042	Monitor outlet flow to south	GM40050	12	261	1.6850	13.36	1.00	1.7477	160.32	1	Capacity Deficiency verified via flow monitoring
17	7351 Hazard Ave	MC23	MH32042	Monitor flow from west	GM32049	15	183	0.3900	5.53	0.37	0.4801	66.36	0.34	
18	15290 Van Buren St	MC27	MH56002	Monitor flow from north	GM55045	18	396	0.9110	7.24	0.40	0.8899	86.88	0.4	
19	10051 Premier Ave	MC34	MH78035	Monitor flow from east	GM78054	8	80	0.2140	4.24	0.53	0.2255	50.88	0.41	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
20	9043 Oasis Ave	MC35	MH60053	Monitor outlet flow to west	GM60079	8	128	0.3440	4.74	0.59	0.3590	56.88	1	Capacity Deficiency in model; reconfirm flow monitoring
21	14161 Olive St	MC39	MH31045	Monitor flow from north	GM31050	12	175	0.5610	5.03	0.42	0.6226	60.36	0.56	
22	13961 Willow Ln	MC49	MH15031	Monitor flow from north	GM15047	8	239	0.1420	3.29	0.41	0.1513	39.48	0.46	
23	7360 Bolsa Ave	MC68	MH35012	Monitor outlet flow to east	GM34018	10	74	0.1430	5.49	0.55	0.1516	65.88	0.36	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
24	9031 Greenville Ave	MC70	MH63044	Monitor flow from east	GM63048	8	50	0.2030	4.92	0.62	0.2156	59.04	0.47	Model d/D < Field d/D; Possible debris in sewer; Clean and reconfirm flow depths
25	8501 Mcfadden Ave	MC71A	MH56027	Monitor flow from north	GM56024	10	147	0.1590	2.70	0.27	0.1427	32.4	0.35	
26	9055 Larkspur Dr	MC73	MH66034	Monitor flow from east	GM66040	12	60	0.1190	2.72	0.23	0.1210	32.64	0.25	

**Flow depths can be reconfirmed by re-installing flow monitors in the pipes or by installing Smart Covers beneath manhole lids that can measure the flow depths in the manholes*

SECTION 9
CAPITAL IMPROVEMENT PROGRAM

9-1 General

The primary goal of the development of the capital improvement projects is to provide MCSD with a long-range planning tool for implementing its sewer improvements in an orderly manner and a basis for financing these improvements. The projects were developed upon performing a hydraulic analysis of the gravity sewer system and conducting field visits of the lift stations. The recommended improvement projects have been based upon the best information currently available. They should be updated as new information becomes available.

It must be emphasized that many of the as-built plans utilized to develop MCSD's GIS were not available or illegible. Some pipe information was calculated when possible. Some information was obtained from survey of manholes in the system. Flow monitoring is recommended to verify identified deficiencies prior to design and implementation of gravity sewer improvements.

The pipe sizes should be verified during the design of the sewers based on slopes determined by detailed surveys of the invert and ground elevations. The estimated future flow values can be utilized from the hydraulic model. The design engineer should verify that the selected pipe size and slope will meet MCSD's depth to diameter (d/D) criteria.

The gravity main improvement projects are capacity related only. Condition assessment of the gravity mains will be completed as a separate project by MCSD now that the CCTV inspections were completed.

9-2 Project Priorities

The sewer improvement projects were selected primarily based upon health and safety concerns and minimizing the possibility of overflows. The projects that will eliminate the capacity deficiencies in the gravity collection system are prioritized based upon the hydraulic analyses conducted during this study.

For this study, the gravity sewer projects were prioritized as follows:

1. Facilities identified with capacity deficiencies under existing peak dry weather conditions. **Flow monitoring is recommended prior to project implementation.**
2. Facilities that have calculated future capacity deficiencies but are currently considered adequate under existing peak dry weather conditions. **Flow monitoring is recommended prior to project implementation.** When the measured peak flows exceed the pipe capacity (d/D = 0.64 during peak dry weather conditions), the projects should be reprioritized.
3. The projects were also prioritized based on the d/D at peak dry weather flow and the amount of flow exceeding the design capacity. Pipes with higher d/D estimates are placed at a higher priority. Pipes with more flow exceeding the design capacity are generally placed at a higher priority.

9-3 Project Cost Estimates

The capacity improvement projects are developed based upon the results of the hydraulic analyses and the priorities of Section 9-2. The pipe improvement recommendations are typically based on the replacement of the existing pipes in the same alignment. Replacement costs are generally more conservative and will therefore allow MCSD more flexibility for each project.

The total project costs include engineering design, administration, construction management and inspection and contingencies. The individual cost components are calculated as follows:

1. The construction costs to replace gravity pipes are based upon:
    a. $130 per diameter inch-foot of pipe for pipes 8-inches to 18-inches
    b. $120 per diameter inch-foot of pipe for pipes larger than 18-inches
2. Gravity Pipe Construction Cost = Pipe Length x Unit Pipe Cost
3. Lift station improvement costs are based on AKM's recent design and construction experience
4. Engineering design, administration, construction management and inspection Cost = 35% of the Construction Cost
5. Contingency Cost = 20% of the Construction Cost

Construction costs are expected to fluctuate as changes occur in the economy. These costs should therefore be reevaluated and updated annually based upon Engineering News Record (ENR) Index for the Los Angeles area (ENRLA), with the base ENRLA Index of 15778.36 for March 2025.

9-4 Gravity Main Capacity Improvement Projects

The recommended gravity main capacity improvement projects are detailed in Table 9-1 and the locations are shown on Figure 9-1. Sometimes the recommended improvement projects include system components beyond the calculated capacity deficiencies. This is because while some pipes between two deficient segments may not indicate a calculated deficiency, they need to be increased in size to match the upstream pipe. The projects are listed and numbered in order of priority in Table 9-1. Detailed maps of the project locations are shown on Figure 9-2 through Figure 9-8. The majority of the projects are intended to be removal and replacement of pipes. Several projects require further explanation as follows:

Project GM1

Project GM1 encompasses 3,763 feet of deficient pipe in the area tributary to Hammon Lift Station. There are capacity deficiencies identified north of the 405 Freeway, along Springdale Street and Westminster Boulevard. Although not technically capacity deficient, the sewers in Hammon Place, between the 405 Freeway and Westminster Boulevard are estimated to be flowing at PDWF d/D ratios of 0.50 to 0.64. Basically, many of the main sewers in this basin have high flows.

In addition, the Springdale Street siphon at Westminster Boulevard (discussed in Section 5-3) is currently plugged and forcing sewage to reverse flow north to an overflow pipe located at Sioux Road and Navajo Road. MCSD is currently in the process of preparing plans and hiring a contractor to install manholes upstream and downstream of the siphon, in an attempt to clear the blockage in the siphon and reestablish the flow path, but ultimately a permanent solution is needed. This might be the design and construction of a new proper siphon parallel to the existing one but it is recommended that other alternatives to the siphon also be further investigated.

It is recommended that MCSD conduct a detailed study of the Hammon Lift Station tributary area to develop the most feasible solution to eliminate capacity deficiencies as well as resolve the Springdale Street siphon issue. Possible solutions could include diversion of flows or a new lift station and connection to the OCSD trunk sewer. The worst case scenario would be to redesign and reconstruct the siphon and upsize all pipes that have been identified as capacity deficient. For planning purposes, a conservative cost of about $11.9 Million is included in Table 9-1, assuming replacement of all pipes identified with capacity deficiencies and replacement of the existing siphon.

Project GM2

Project GM2 encompasses 5,633 feet of pipe with existing PDWF d/D ratios ranging from 0.69 to 1.0. It should be noted that for the master plan, an attempt was made to install a flow meter in the 18-inch pipe in 14th Street west of Cedarwood Street. The sewer was cleaned beforehand by MCSD but ADS Environmental reported that there were high flows and a lot of debris in the sewer. They were not able to install the equipment and had to move upstream (Site MC22B). This pipe is therefore known to be flowing at high depths.

Flow Monitoring Site MC22B was located in the 10-inch sewer in Pacific Avenue south of 15th Street (GM40050). The flow depth exceeded 10-inches during average and peak flow conditions. This pipe has therefore been confirmed to be flowing full.

Project GM4

Project GM4 is 784 feet if 8-pipe with minimal slope (0.000 to 0.0002) per the as-built plans (S0000296). The existing sewer is about 12 feet deep. In lieu of upsizing this pipe, it is recommended to install Smart Covers or the like to continuously monitor the depths of the flow and prevent any possible future spills. The cost for two Smart Covers is estimated at $20,150.

Project GM13

Project GM13 encompasses 600 feet of pipe from 12-inches to 15-inches. The existing pipe PDWF d/D ratios range from 0.69 to 0.77.

Flow Monitoring Site MC03B was located in the 12-inch sewer in the easement north of the intersection of Yankton Way and Northwestern Way (GM40009). The d/D ratio under peak dry weather flow conditions was 0.53. The d/D ratio under the peak wet weather conditions (during the March 2023 storm events) reached 0.97. The pipe has therefore been confirmed to flow full under wet weather conditions.

It should be noted that during CCTV inspections, Empire Pipe and Equipment staff had to request that the pumps at the Westminster Lift Station be run continuously to reduce the sewage levels in these pipes so that they could conduct inspections.

Project GM14

Project GM14 encompasses upgrading 736 feet of pipe from 15-inches to 18-inches.

It must be ensured that the overflow pipe connecting MH80021 to MH80020 is open. Per the hydraulic model, this overflow is needed to prevent the westerly 10-inch and easterly 12-inch pipes in Brookhurst Street, south of McFadden Avenue from being deficient.

There is an additional overflow pipe between MH81010 and MH81009 at the intersection of Brookhurst Street and Margo Lane. The hydraulic model shows that the existing PDWF d/D ratio in the pipe between MH81010 and MH81032 is 0.72.

Flow Monitoring Site MC16A was located in the 15-inch sewer in Brookhurst Street south of Stilbite Avenue (City of Fountain Valley). The d/D ratio under peak dry weather flow conditions was 0.69.

Project GM19

Project GM19 is 73 feet of 8-inch pipe in Goldenwest Street at Bestel Avenue. There was no as-built plan available for this pipe. Survey data gathered during Master Plan indicated a 2 foot drop between Manhole MH29001 and MH29006. This would result in a 2.7% slope which is quite steep. The slope of this pipe needs to be confirmed prior to design and construction of a replacement pipe.

Table 9-1
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM1	Westminster Blvd, Rancho Rd to Pegg St	GM10060	MH10064	MH10059	8	341	0.0010	12	1,560	531,242	823,426	Conduct study of basin and capacity deficiencies in area for overall solution. At the same time, study siphon at Westminster and Springdale for possible solution to eliminate the siphon and downstream deficiencies.
		GM10058	MH10058	MH10060	12	203	0.0016	15	1,950	396,728	614,928	
		GM10059	MH10060	MH10059	12	57	0.0011	15	1,950	111,150	172,283	
	Sioux Rd, north of Navajo Rd	GM14024	MH14021	MH14028	8	170	0.0010	10	1,300	221,234	342,913	
	Meinhardt Rd, Sioux Rd to northwest of White Cir	GM14030	MH14028	MH09045	8	239	0.0018	10	1,300	310,700	481,585	
		GM09048	MH09045	MH09044	8	172	0.0020	10	1,300	222,963	345,593	
		GM09039	MH09044	MH09027	8	414	0.0020	10	1,300	538,083	834,029	
		GM09030	MH09027	MH09023	8	275	0.0020	10	1,300	357,500	554,125	
		GM09022	MH09023	MH09022	8	176	0.0020	10	1,300	229,138	355,164	
	Navajo Rd, east of Sioux Rd	GM14025	MH14022	MH14029	8	310	0.0020	10	1,300	403,000	624,650	
		GM14033	MH14029	MH14027	8	221	0.0020	10	1,300	286,780	444,509	
	Springdale St at 405 Fwy	GM15023	MH15001	MH15015	8	557	0.0015	10	1,300	723,853	1,121,972	
		GM15001	MH15002	MH15001	8	130	0.0015	10	1,300	168,948	261,869	
	Westminster Blvd, west of Springdale St	GM10084	MH15032	MH10067	8	327	0.0021	10	1,300	424,892	658,583	
		GM10063	MH10067	MH10066	8	172	0.0007	10	1,300	223,561	346,520	
	Springdale Street at Westminster Blvd	GM15050	MH15030	MH15032	8	Double Barrel Siphon				2,500,000	3,875,000	
				Subtotal GM1		**3,763**				**7,649,772**	**11,857,146**	
GM2	Jackson St, 20th St to 18th St	GM50048	MH50027	MH50038	8	328	0.0032	12	1,560	511,680	793,104	Need to check slopes because plans were not clear. Alternative may be to review CCTV inspections and implement rehabilitation projects to reduce infiltration. Then reevaluate the capacity of these sewers.
		GM50060	MH50038	MH51003	8	326	0.0032	12	1,560	508,560	788,268	
	18th St, Jackson St to Pacific Ave	GM51003	MH51003	MH51002	8	20	0.0027	12	1,560	31,200	48,360	
		GM51002	MH51002	MH51001	8	237	0.0040	12	1,560	369,205	572,268	
		GM51001	MH51001	MH40011	8	253	0.0040	12	1,560	393,900	610,545	
		GM40012	MH40011	MH40010	8	338	0.0015	12	1,560	526,500	816,075	
		GM40011	MH40010	MH40009	8	483	0.0030	12	1,560	753,324	1,167,652	
	Pacific Ave, 18th St to 14th St	GM40010	MH40009	MH40020	10	167	0.0030	12	1,560	259,958	402,936	
		GM40023	MH40020	MH40026	10	331	0.0030	12	1,560	515,580	799,149	
		GM40034	MH40026	MH40030	10	168	0.0030	12	1,560	261,300	405,015	
		GM40045	MH40030	MH40043	10	330	0.0030	15	1,950	643,500	997,425	
		GM40051	MH40043	MH40042	10	20	0.0030	15	1,950	39,000	60,450	
		GM40050	MH40042	MH40058	10	305	0.0030	18	2,340	712,624	1,104,567	
	14th St, Pacific Ave to Hoover St	GM40064	MH40058	MH40055	18	592	0.0003	30	3,600	2,131,200	3,303,360	
		GM40062	MH40055	MH40052	18	604	0.0007	30	3,600	2,173,716	3,369,260	
		GM40060	MH40052	MH40051	18	372	0.0018	30	3,600	1,339,200	2,075,760	
		GM40059	MH40051	MH31046	18	375	0.0009	30	3,600	1,350,000	2,092,500	
	Hoover St, Pacific Ave to Main St	GM31064	MH31046	MH32007	18	368	0.0017	30	3,600	1,323,216	2,050,985	
		GM32011	MH32007	VP32001	18	20	0.0065	30	3,600	72,000	111,600	
				Subtotal GM2		**5,633**				**13,915,663**	**21,569,278**	

Table 9-1 (Continued)
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM3	McFadden Ave, Marlborough Cir to Brookhurst St	GM86027	MH86022	MH86020	10	193	0.0012	15	1,950	376,331	583,312	
		GM86026	MH86020	MH86021	10	42	0.0012	15	1,950	81,900	126,945	
		GM86025	MH86021	MH86018	10	350	0.0012	15	1,950	682,500	1,057,875	
		GM80053	MH86018	MH80024	10	350	0.0012	15	1,950	682,500	1,057,875	
		GM80050	MH80024	MH80022	10	142	0.0011	15	1,950	276,900	429,195	
		GM80049	MH80022	MH80021	10	350	0.0012	15	1,950	682,500	1,057,875	
				Subtotal GM3		**1,427**				**2,782,631**	**4,313,077**	
GM4	Heil Ave, Dana Cir to Newland St	GM59033	MH59030	MH59031	8	20	0.0000	-	-	-	-	Existing sewer is 12' deep with minimal slope; In lieu of upsizing, install two Smart Covers to monitor depths continuously
		GM59037	MH59031	MH59033	8	365	0.0002	-	-	-	-	
		GM59039	MH59033	MH59036	8	365	0.0002	-	-	-	-	
		GM59043	MH59036	VP59002	12	35	0.0000	-	-	-	-	
				Subtotal GM4		**784**				**13,000**	**20,150**	
GM5	Hazard Rd, Morgan St to Magnolia St	GM70042	MH70040	MH70039	8	93	0.0019	12	1,560	144,940	224,656	
		GM70041	MH70039	MH70038	8	163	0.0026	12	1,560	253,672	393,191	
		GM70040	MH70038	MH70037	8	117	0.0011	12	1,560	183,128	283,849	
		GM70039	MH70037	MH70036	8	280	0.0020	12	1,560	436,800	677,040	
		GM70038	MH70036	MH70035	8	282	0.0023	12	1,560	439,967	681,949	
		GM61067	MH70035	MH61060	8	266	0.0020	12	1,560	414,866	643,043	
		GM61066	MH61060	MH61059	8	191	0.0020	12	1,560	297,742	461,499	
				Subtotal GM5		**1,392**				**2,171,114**	**3,365,227**	
GM6	Alley north of Bolsa Ave, Wilson St to Adams St	GM54027	MH54020	MH54019	8	330	0.0027	10	1,300	429,182	665,232	
		GM54026	MH54019	MH54018	8	330	0.0027	10	1,300	429,182	665,232	
		GM54025	MH54018	MH54016	8	330	0.0027	10	1,300	429,026	664,990	
		GM54022	MH54016	MH54014	8	330	0.0027	10	1,300	429,026	664,990	
		GM54021	MH54014	MH54013	8	330	0.0027	10	1,300	429,026	664,990	
				Subtotal GM6		**1,650**				**2,145,442**	**3,325,435**	
GM7	Westminster Ave, west of Newland St to Jackson St	GM51026	MH51025	MH51024	12	233	0.0006	15	1,950	454,565	704,575	
		GM51025	MH51024	MH51023	12	121	0.0008	15	1,950	235,716	365,360	
		GM51024	MH51023	MH51022	12	134	0.0012	15	1,950	260,540	403,836	
		GM51023	MH51022	MH51020	12	346	0.0013	15	1,950	674,700	1,045,785	
		GM51021	MH51020	MH51019	12	266	0.0066	15	1,950	518,700	803,985	
		GM51020	MH51019	MH51017	12	266	0.0195	15	1,950	518,700	803,985	
	Jackson St, Westminster Ave to 16th St	GM51034	MH51017	MH51038	12	325	0.0017	15	1,950	633,750	982,313	
				Subtotal GM7		**1,691**				**3,296,670**	**5,109,839**	

Table 9-1 (Continued)
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM8	Jackson St, 16th St to 15th St	GM51052	MH51038	MH51055	12	316	0.0016	15	1,950	616,122	954,989	
	15th St, Jackson St to Pacific Ave	GM51063	MH51055	MH51054	12	243	0.0016	15	1,950	473,538	733,984	
		GM51061	MH51054	MH40049	12	253	0.0015	15	1,950	493,136	764,360	
		GM40058	MH40049	MH40048	12	258	0.0015	15	1,950	502,710	779,201	
		GM40076	MH40048	VP40001	12	45	0.0015	15	1,950	87,594	135,771	
		GM40056	VP40001	MH40046	12	204	0.0015	15	1,950	398,327	617,406	
		GM40054	MH40046	MH40044	12	246	0.0015	15	1,950	479,700	743,535	
		GM40052	MH40044	MH40042	12	37	0.0083	15	1,950	72,150	111,833	
				Subtotal GM8		**1,602**				**3,123,276**	**4,841,078**	
GM9	Oasis Ave, east of Glitter St to Magnolia St	GM69102	MH69088	MH69087	8	230	0.0020	10	1,300	298,935	463,349	
		GM69100	MH69087	MH69086	8	123	0.0030	10	1,300	159,900	247,845	
		GM69099	MH69086	MH69085	8	250	0.0020	10	1,300	324,779	503,407	
		GM69098	MH69085	MH69084	8	271	0.0020	10	1,300	352,040	545,662	
		GM69097	MH69084	MH69083	8	280	0.0019	10	1,300	363,922	564,079	
		GM60080	MH69083	MH60053	8	273	0.0020	10	1,300	354,289	549,148	
		GM60079	MH60053	MH60052	8	240	0.0021	10	1,300	311,961	483,540	
				Subtotal GM9		**1,666**				**2,165,826**	**3,357,030**	
GM10	12th St, east of Pacific Ave	GM41007	MH41007	MH41005	12	250	0.0005	15	1,950	488,456	757,106	
	Pacific Ave, 13th St to 14th St	GM40072	MH41005	MH40059	12	326	0.0006	15	1,950	635,291	984,700	
				Subtotal GM10		**576**				**1,123,746**	**1,741,806**	
GM11	13th St, west of Newland St	GM52014	MH52013	MH52012	10	153	0.0009	12	1,560	238,664	369,930	
		GM52013	MH52012	MH52011	10	350	0.0009	12	1,560	545,501	845,526	
		GM52012	MH52011	MH52010	10	340	0.0008	12	1,560	530,915	822,918	
		GM52011	MH52010	MH52009	10	381	0.0021	12	1,560	594,360	921,258	
				Subtotal GM11		**1,224**				**1,909,440**	**2,959,632**	
GM12	Bishop Pl, east of Swallow Ln	GM79044	MH79008	MH79007	8	229	0.0021	10	1,300	297,700	461,435	
		GM79043	MH79007	MH79006	8	195	0.0020	10	1,300	253,604	393,086	
		GM79042	MH79006	MH79005	8	51	0.0020	10	1,300	66,170	102,564	
	Swallow Ln, Bishop Pl to McFadden Ave	GM79041	MH79005	MH79017	8	67	0.0019	10	1,300	87,009	134,864	
		GM79063	MH79017	MH79023	8	350	0.0020	10	1,300	455,000	705,250	
		GM79086	MH79023	MH79030	8	350	0.0020	10	1,300	455,000	705,250	
		GM80002	MH79030	MH80001	8	262	0.0020	10	1,300	340,691	528,071	
		GM80023	MH80001	MH80011	8	264	0.0020	10	1,300	343,200	531,960	
				Subtotal GM12		**1,768**				**2,298,374**	**3,562,480**	

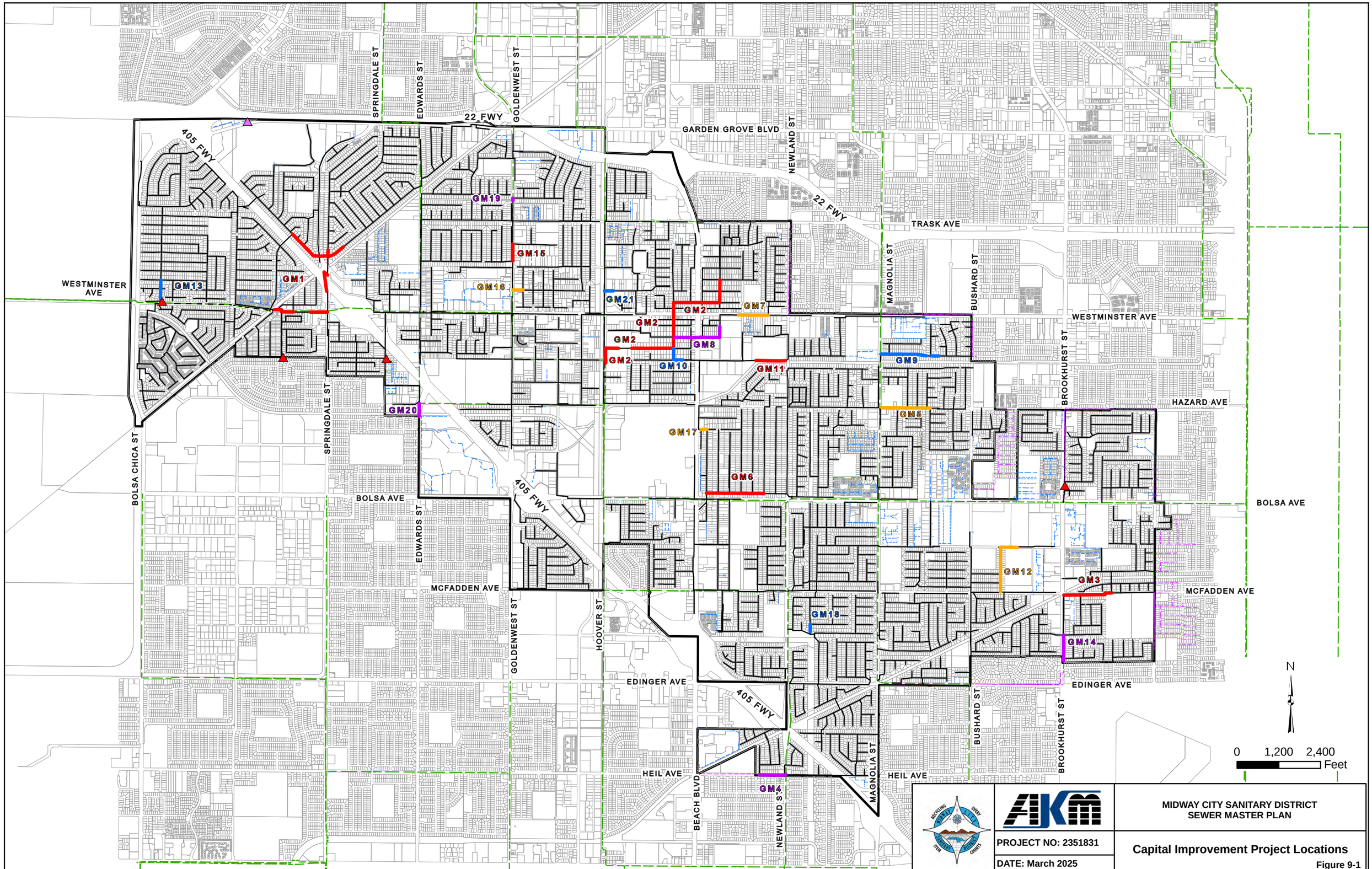
Table 9-1 (Continued)
Gravity Main Capacity Improvement Projects

Capital Improvement Project ID	Location	Pipe ID	U/S MH ID	D/S MH ID	Existing Pipe Diameter (in)	Existing Pipe Length (ft)	Existing Slope	Proposed Pipe Diameter (in)	Unit Cost ($/ft)[1]	Construction Cost ($)[2]	Total Cost ($)[3]	Description
GM13	Winthrope St, Harvard Rd to Northwestern Wy	GM04009	MH04003	MH04017	12	250	0.0015	15	1,950	486,798	754,537	
	Yankton Wy, Northwestern Wy to Westminster Blvd	GM04034	MH04017	MH04029	12	350	0.0015	15	1,950	682,500	1,057,875	
				Subtotal GM13		**600**				**1,169,298**	**1,812,412**	
GM14	Brookhurst St, McFadden Ave to Banbury Ave	GM81023	MH81010	MH81032	15	398	0.0003	18	2,340	931,320	1,443,546	Ensure the overflow at MH80021 to westerly 10" sewer is open. These sewers are then not considered deficient.
		GM81041	MH81032	MH81058	15	272	0.0010	18	2,340	636,480	986,544	
		GM81068	MH81058	MH81041	15	66	0.0010	18	2,340	154,440	239,382	
				Subtotal GM14		**736**				**1,722,240**	**2,669,472**	
GM15	Goldenwest St, Fenwax Dr to Humboldt Ave	GM30001	MH29050	MH30007	8	496	0.0030	10	1,300	644,683	999,259	
GM16	Wyoming St, Pine St to Goldenwest St	GM30043	MH30034	VP30001	8	295	0.0040	10	1,300	383,071	593,760	
GM17	Roosevelt Ave, west of Adams St	GM42004	MH42003	MH53011	8	172	0.0010	10	1,300	223,834	346,943	
GM18	Pensacola St, St. Andrews Ave to Palos Verde Ave	GM65079	MH65064	MH66001	8	227	0.0020	10	1,300	294,541	456,539	
GM19	Goldenwest St at Bestel Ave	GM29010	MH29001	MH29006	8	73	0.0004	10	500	36,605	56,738	Confirm slope of pipe
GM20	Edwards St, south of Industry Wy	GM24015	MH24020	VP24001	15	365	0.0010	24	2,880	1,052,525	1,631,413	
GM21	Wyoming St east of Hoover St	GM39046	MH39044	MH30041	8	250	0.0030	10	1,300	325,000	503,750	
					Total	**26,389**			**Total**	**48,446,751**	**75,092,464**	

[1] *Unit costs for construction are based on $130/diameter-inch-ft for 8" thru 18"; $120/diameter-inch-ft for 21" thru 30"*

[2] *Construction cost = length x unit cost*

[3] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*



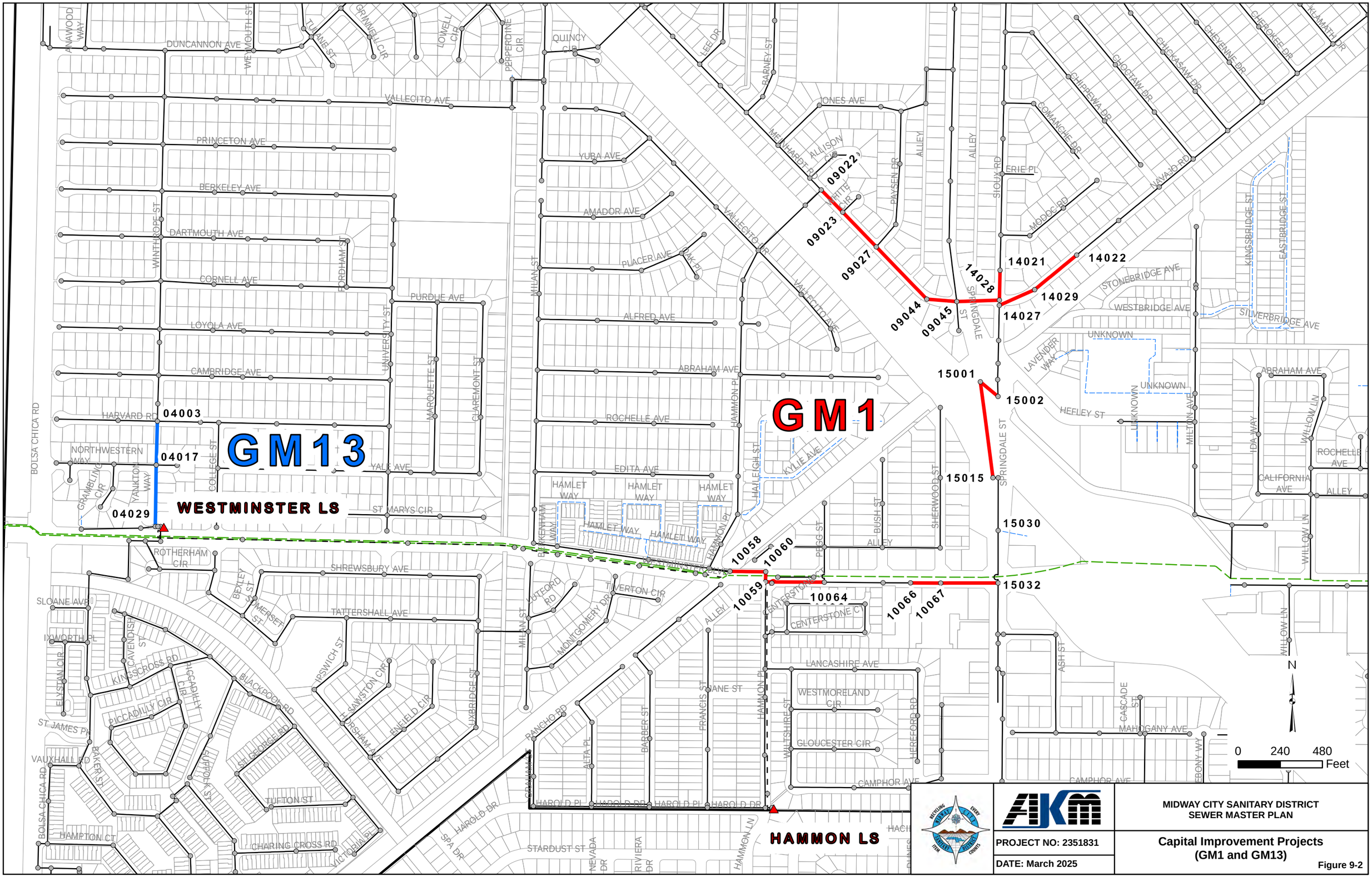
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Project Locations

Figure 9-1



AKM

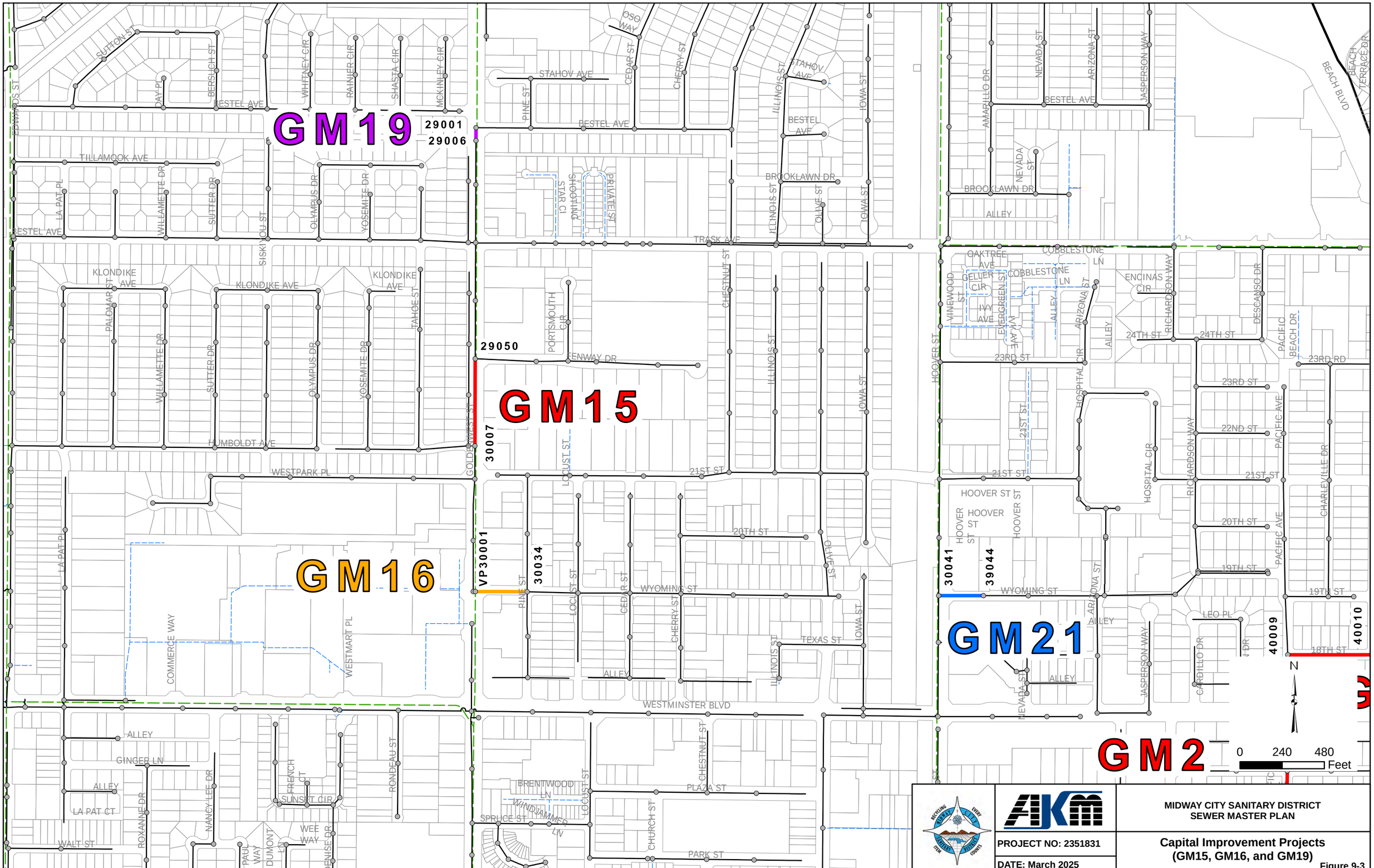
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Projects
(GM1 and GM13)

Figure 9-2



AKM

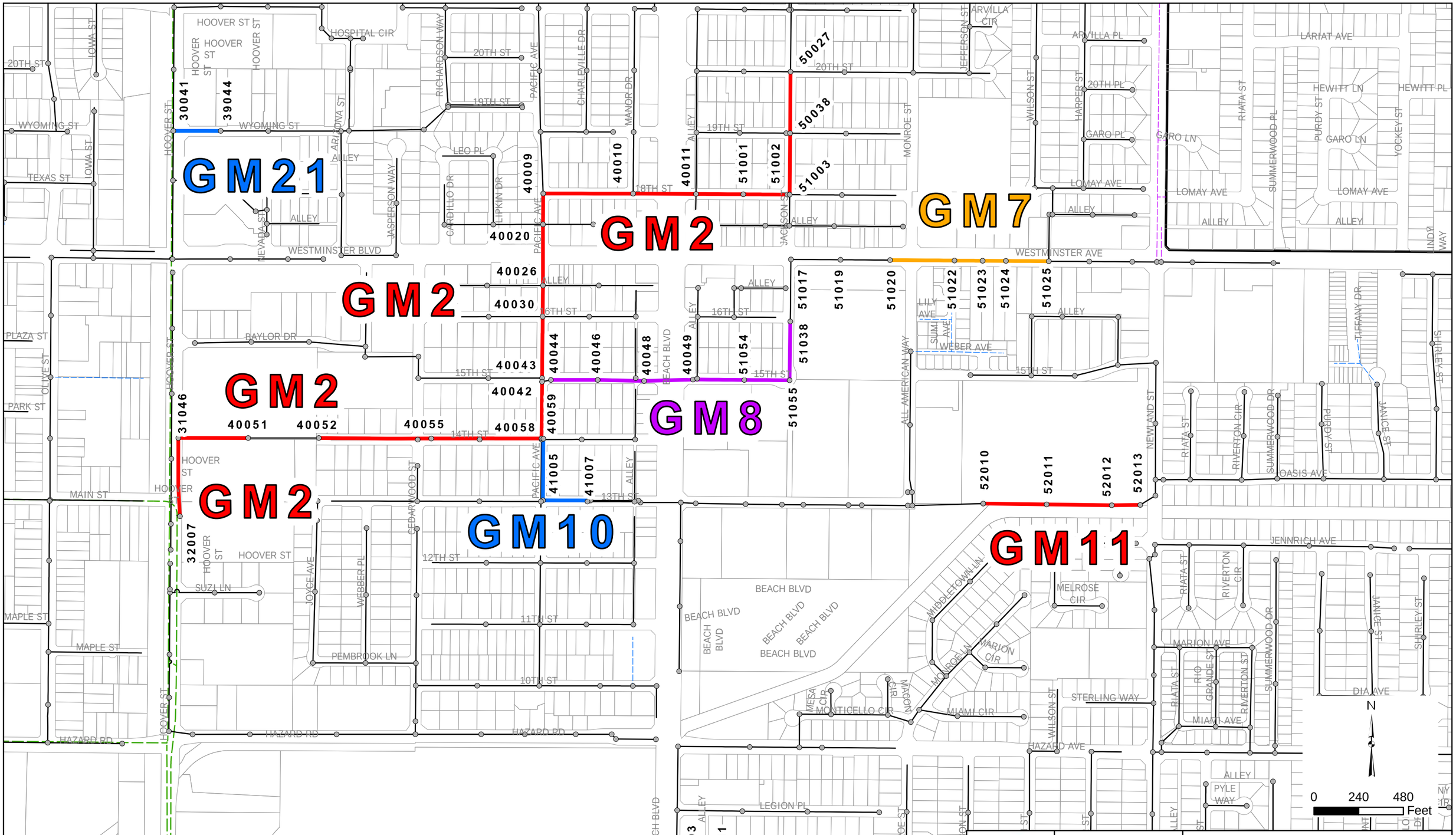
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Projects
(GM15, GM16, and GM19)

Figure 9-3



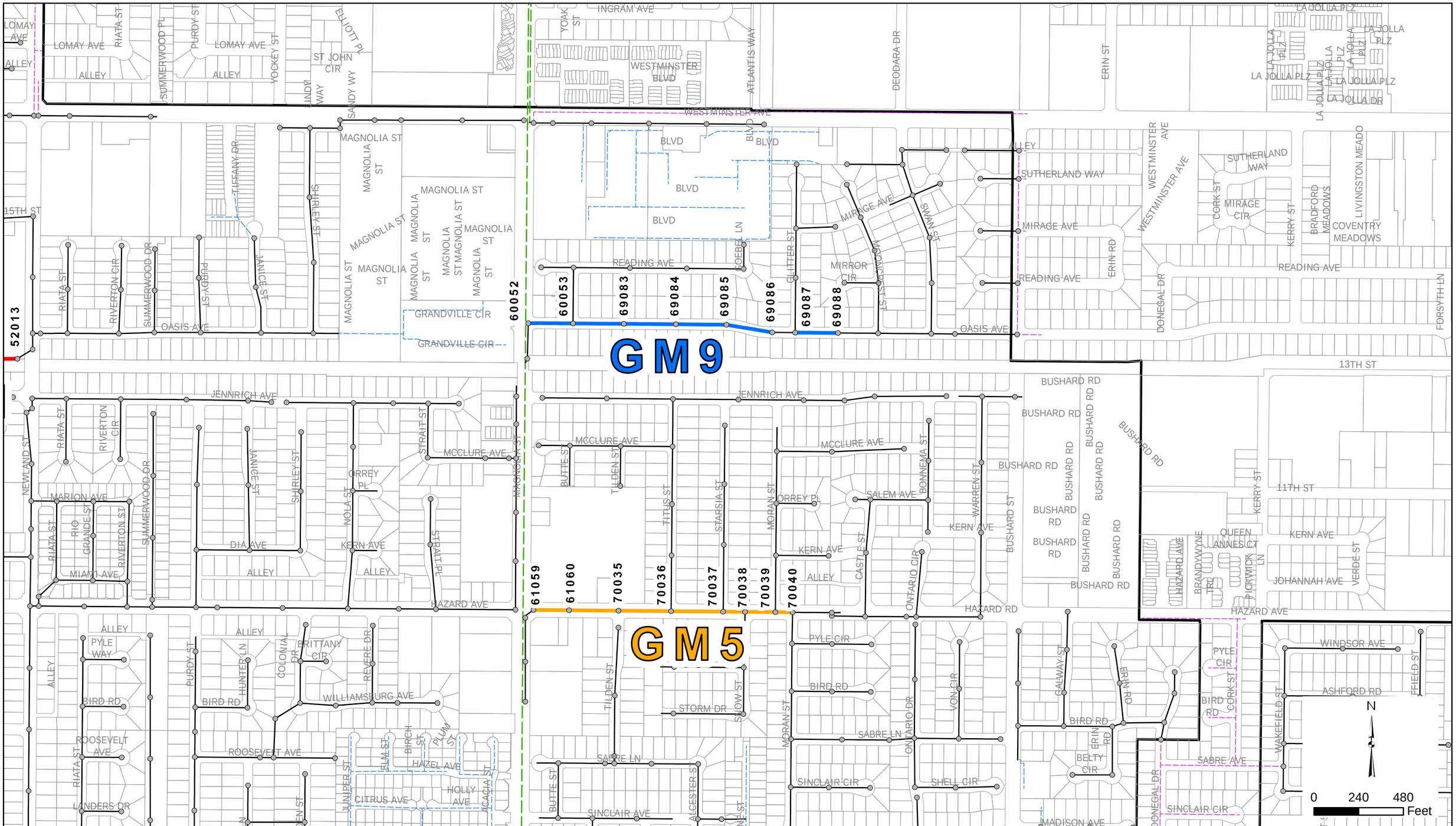
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Projects (GM2, GM7, GM8, GM10, GM11, GM17 and GM21)

Figure 9-4



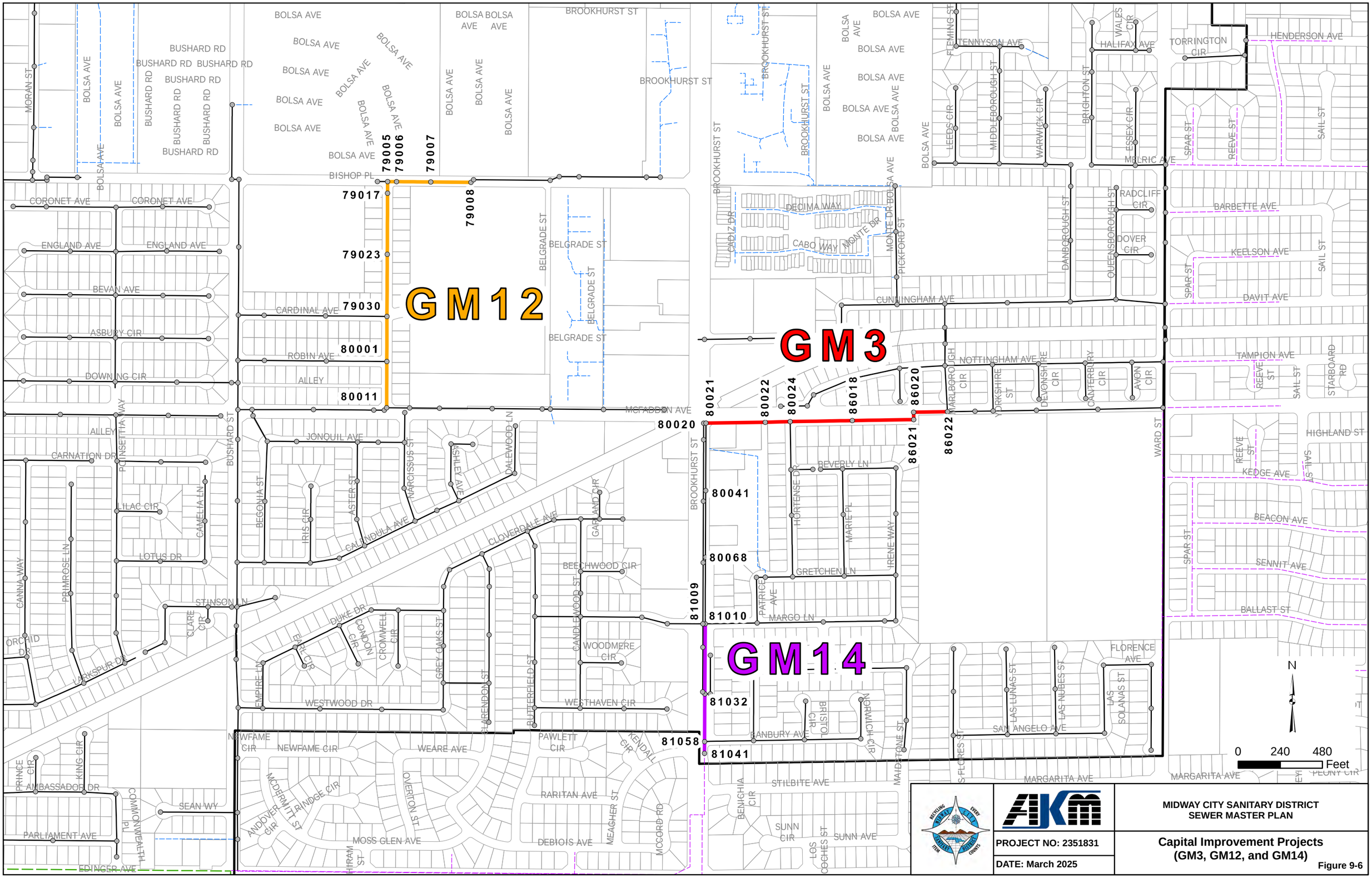
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Projects (GM 5 and GM9)

Figure 9-5



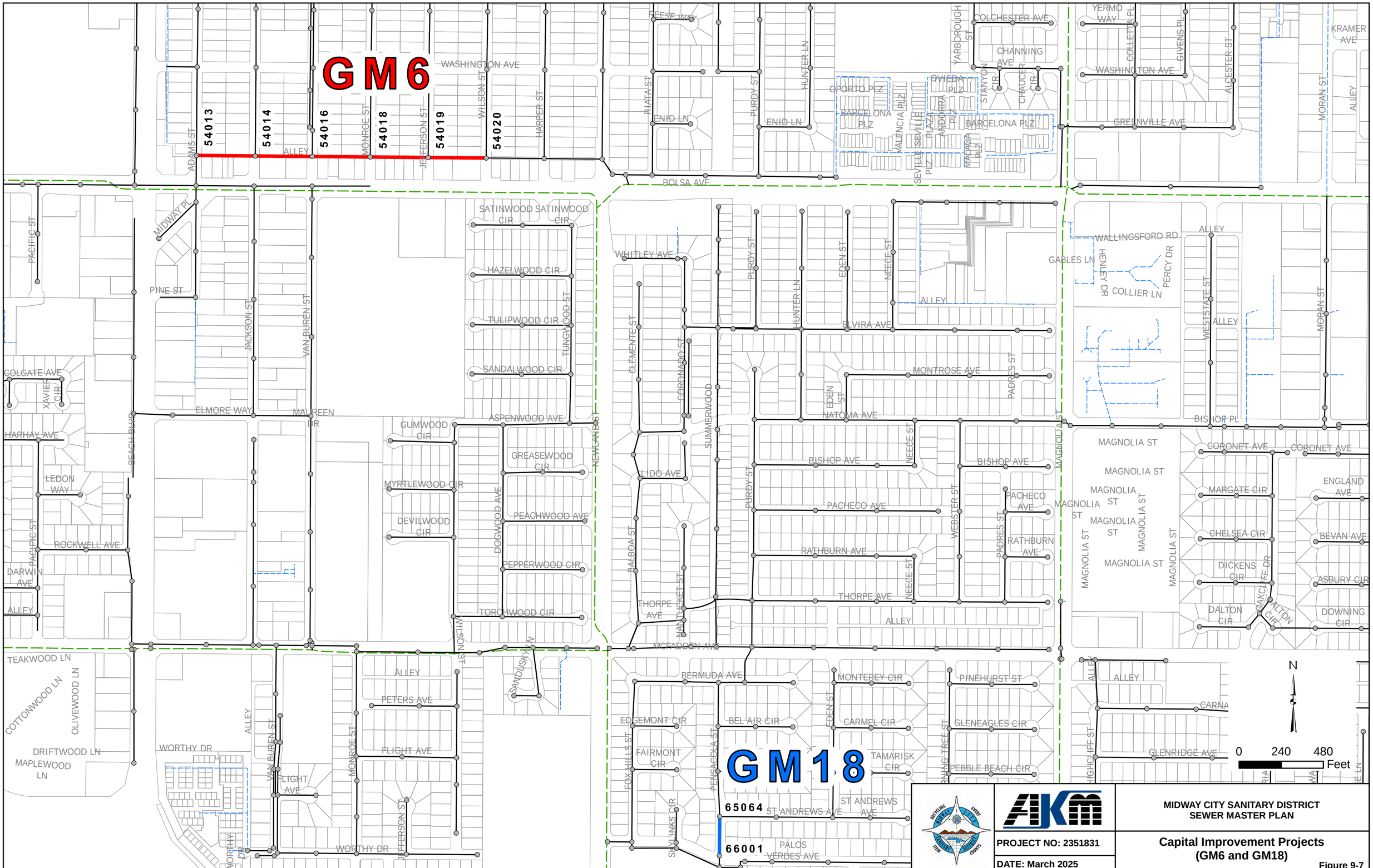
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Projects
(GM3, GM12, and GM14)

Figure 9-6



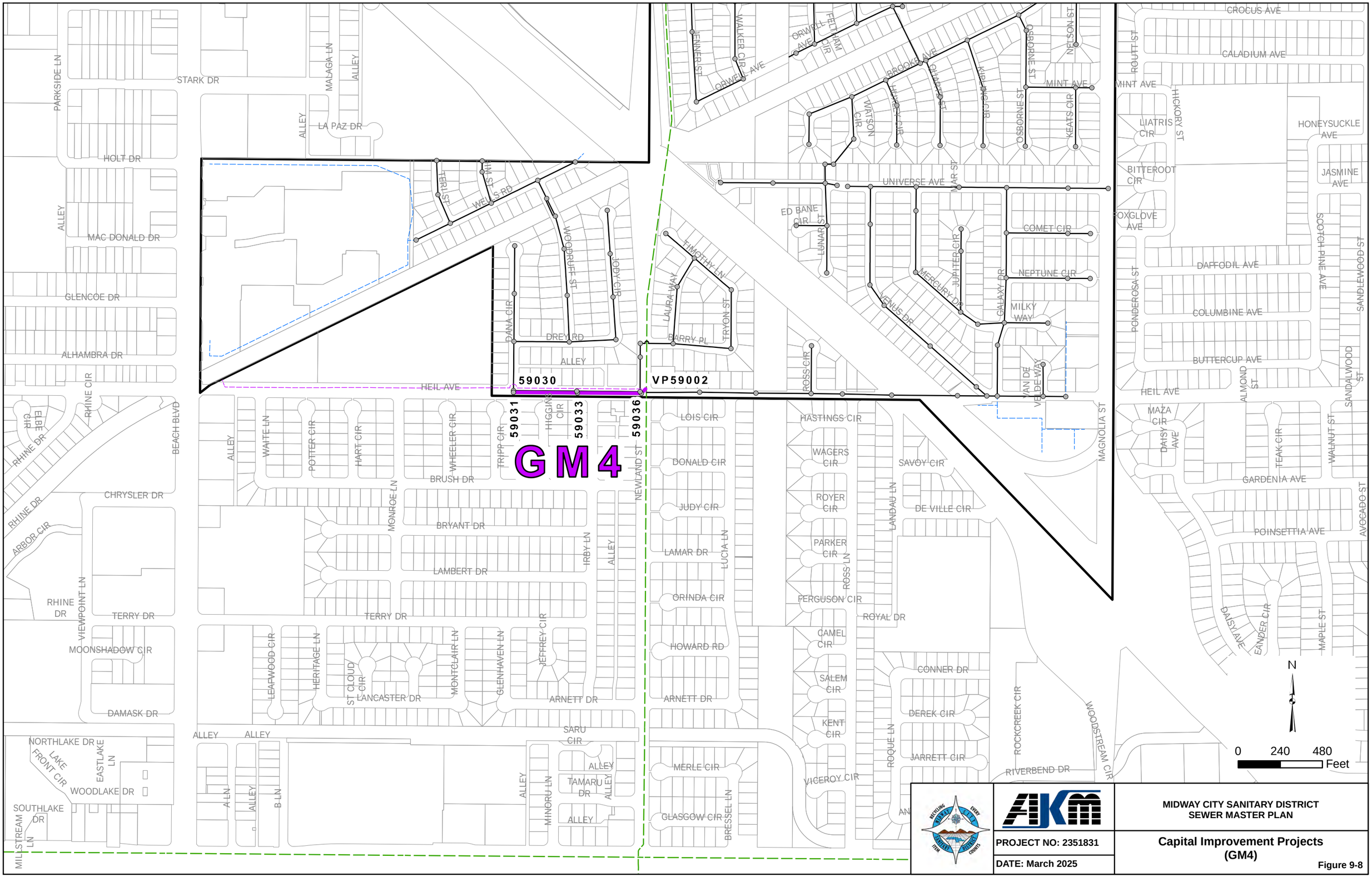
MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Projects (GM6 and GM18)

Figure 9-7



MIDWAY CITY SANITARY DISTRICT
SEWER MASTER PLAN

PROJECT NO: 2351831

DATE: March 2025

Capital Improvement Projects
(GM4)

Figure 9-8

Project GM20

Project GM20 is the replacement of 365 feet of existing 15-inch pipe with 24-inche pipe in Edwards Street south of Industrial Way. This pipe is downstream of the Westminster Mall. MCSD conducted a sewer analysis of this pipe in August 2023. See Appendix 6-2 for a copy of the study conducted.

The ultimate size of the replacement sewer is dependent on the redevelopment of the Westminster Mall area. Based on the current plans for the area and the estimated future average sewage load of about 0.76 mgd (see Table 6-2), it was recommended that the replacement pipe size be 24-inches. If the proposed land uses should change, the replacement pipe should be reanalyzed.

9-5 Lift Station Improvement Projects

The lift station evaluation and recommended improvements are documented in Section 5 of this report. Estimated costs for the improvements are provided in Table 9-2 through Table 9-5. The recommended improvement descriptions are repeated below.

The existing lift stations include redundant facilities for their continued operation in case of emergencies. They will be further improved with the implementation of complete dual discharge pipes/forcemains. Therefore, emergency storage facilities are not included in this CIP. MCSD should investigate the feasibility of adding emergency storage at each lift station for possible implementation in the future.

The Brookhurst Lift Station is considered the first priority due to the fact that it is the only station without a dual forcemain and its pumping capacity was identified as being less than the estimated peak wet weather flow with one pump.

It is recommended that the lift station projects will be completed all together at each lift station when the pumps are in need of replacement and/or based on MCSD's budget. The typical pump useful life is 10-15 years.

9-5.1 Brookhurst Lift Station

The recommended improvements for Brookhurst Lift Station are shown in Table 9-2 and described as follows:

1. The lift station access hatch should be fitted with grated fall protection to meet OSHA 29 CFR1926 (c).
2. The pumps should be replaced with 265 gpm capacity units to provide greater than the estimated peak wet weather flows with one pump.
3. When the pumps are replaced, the discharge piping/forcemain size should be increased to 6-inch diameter. The discharge pipes and fittings outside the wet well should be 6-inch diameter 40 mil ceramic epoxy lined Class 53 ductile iron from the wet well to Manhole 78081 in Brookhurst Street including new 6-inch magnetic flow meters, and meter vault. A completely redundant discharge pipe/forcemain should be constructed at that time.
4. The discharge pipe and fittings inside the wet well should be replaced with 316L stainless steel pipe and fittings
5. The electrical and control systems are 17 years old. They should be upgraded in the next five years.

Table 9-2
Brookhurst Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with grated fall protection	1	$50,000	$50,000	$77,500
2	Replace pumps with new 265 gpm pumps	2	$120,000	$240,000	$372,000
3	Discharge piping/forcemain replacement (6-inches); Add dual forcemain	1	$350,000	$350,000	$542,500
4	Replace wet well piping with 316L SS piping	2	$50,000	$100,000	$155,000
5	Electrical and control system improvements	1	$300,000	$300,000	$465,000
			Total	**$1,040,000**	**$1,612,000**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

9-5.2 Hammon Lift Station

The recommended improvements for Hammon Lift Station are shown in Table 9-3 and described as follows:

1. The lift station access hatches should have guard rails and grated fall protection to meet OSHA 29 CFR1926 (c).
2. The discharge piping outside the wet well should be modified as two complete 10-inch diameter 40 mil ceramic epoxy lined Class 53 DIP and fittings, with new valves, flow meter vault, magnetic flow meters, and appurtenances to provide complete redundancy.
3. The discharge piping and fittings inside the wet well should be replaced with 316L stainless steel pipes and fittings.
4. The electrical and control systems are 17 years old. They should be upgraded in the next five years.
5. The pumps should be replaced when the electrical and control systems are replaced.

Table 9-3
Hammon Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with guard rails and grated fall protection	2	$65,000	$130,000	$201,500
2	Discharge piping replacement	1	$500,000	$500,000	$775,000
3	Replace wet well piping with 316L SS piping	2	$60,000	$120,000	$186,000
4	Electrical and control system improvements	1	$300,000	$300,000	$465,000
5	Replace pumps	2	$150,000	$300,000	$465,000
			Total	**$1,350,000**	**$2,092,500**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

9-5.3 Westminster Lift Station

The recommended improvements for Westminster Lift Station are shown in Table 9-4 and described as follows:

1. The lift station access hatches should have guard rails and grated fall protection to meet OSHA 29 CFR1926 (c).
2. The discharge piping outside the wet well should be modified as two complete 12-inch diameter 40 mil ceramic epoxy lined Class 53 DIP and fittings, with new valves, flow meter vault, magnetic flow meters, and appurtenances to provide complete redundancy.
3. The discharge piping and fittings inside the wet well should be replaced with 316L stainless steel pipes and fittings.
4. The electrical and control systems are 17 years old. They should be replaced in the next 5 years.
5. The pumps should be replaced when the electrical and control systems are replaced.

Table 9-4
Westminster Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with guard rails and grated fall protection	2	$70,000	$140,000	$217,000
2	Discharge piping replacement	1	$400,000	$400,000	$620,000
3	Replace wet well piping with 316L SS piping	2	$60,000	$120,000	$186,000
4	Electrical and control system improvements	1	$300,000	$300,000	$465,000
5	Replace pumps with new pumps	2	$150,000	$300,000	$465,000
			Total	**$1,260,000**	**$1,953,000**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

9-5.4 Willow Lift Station

The recommended improvements for Willow Lift Station are shown in Table 9-5 and described as follows:

1. The lift station access hatches should have guard rails and grated fall protection to meet OSHA 29 CFR1926 (c).
2. The discharge piping outside the wet well should be modified as two complete 8-inch diameter 40 mil ceramic epoxy lined Class 53 DIP and fittings, with new valves, flow meter vault, magnetic flow meters, and appurtenances to provide complete redundancy.
3. The discharge piping and fittings inside the wet well should be replaced with 316L stainless steel pipes and fittings.
4. MCSD should install fencing around the three sides of the site to provide additional security.
5. The electrical and control systems are 17 years old. They should be replaced in the next 5 years.
6. The pumps should be replaced when the electrical and control systems are replaced.

Table 9-5
Willow Lift Station Improvements

No.	Description	Units	Unit Cost ($/ft)	Construction Cost ($)[1]	Total Cost ($)[2]
1	Replace wet well access hatches with guard rails and grated fall protection	2	$70,000	$140,000	$217,000
2	Discharge piping replacement	1	$400,000	$400,000	$620,000
3	Replace wet well piping with 316L SS piping	2	$50,000	$100,000	$155,000
4	Install site fencing	1	$50,000	$50,000	$77,500
5	Electrical and control system improvements	1	$300,000	$300,000	$465,000
6	Replace pumps with new pumps	2	$120,000	$240,000	$372,000
			Total	**$1,230,000**	**$1,906,500**

[1] *Construction cost =number of units x unit cost*

[2] *Total costs include 20% for contingencies and 35% for design, engineering, administration, and construction management*

9-6 Additional Improvement Projects

9-6.1 SCADA System Upgrades

The Midway City Sanitary District's current Supervisory Control and Data Acquisition (SCADA) system consists of the following:

1. Programmable Logic Controllers (PLC) at each sewer lift station which collect the digital and analog signals and controls the operation of the respective lift station
2. Digital Subscriber Line (DSL) modem at each sewer lift station
3. Telephone company hardware and software at the telephone company office
4. DSL modem, ethernet switch, and the central SCADA workstation at the MCSD office. The workstation is directly connected to the SCADA monitor, and to a printer through the ethernet switch.

The PLCs receive digital and analog data from the instruments at each lift station and control the lift station's operation based on set parameters, such as the sewage levels in the wet well. They communicate the data, including status and alarms to the central SCADA through the modems. The SCADA system allows remote control of the lift stations.

A new SCADA system was installed in 2008. MCSD has implemented several upgrades and switched to the current software in 2022. MCSD has experienced problems with data transmission over the telephone lines. The SCADA system should be upgraded in the next three (3) years, and switch to fiber optic communication. The estimated base cost for this project is $400,000.

9-6.2 Condition Assessment

In 2024, MCSD contracted with Empire Pipe Cleaning and Equipment for Closed Circuit Television (CCTV) inspection of all sewer pipes and manholes. The work was completed in January 2025. It included CCTV inspection of 851,187 feet of gravity sewer mains and Level 2 inspections of 3,216 manholes, per National Association of Sewer Services Companies (NASSCO) standards.

The next step is to assess the condition of the pipes and manholes based on the CCTV inspections completed. Structural deficiencies will be identified, and repair and replacement projects will be developed. Then the projects will be prioritized along with capacity related projects. This will be done by considering the condition,

capacity, as well as additional criteria identified in the Statewide Waste Discharge Order 2022-0103-DWQ, including:

- Areas that hold a high level of environmental consequences if vulnerable to collapse, failure, blockages, capacity issues, or other system deficiencies.
- Vicinity to surface waters, steep terrain, high groundwater levels, or environmentally sensitive areas.
- Vicinity to receiving waters with bacterial-related impairment.

The estimated cost for the condition assessment project is $250,000.

9-6.3 Repair and Rehabilitation Projects

Repair and rehabilitation projects developed in the condition assessment may include spot repairs, lining and/or full replacement of sewers. It is assumed that repair and rehabilitation projects will need to be completed over time. The annual budget for repair and rehabilitation projects is set at $850,000. The budget for gravity main rehabilitation is $500,000 and the budget for manhole rehabilitation is $350,000.

9-6.4 Flow Monitoring

Cleaning and follow-up flow monitoring is recommended at nine locations (see Section 8-2 and Table 8-2) to reconfirm flow depths in sewers that were found to have depths higher in the field than what is predicted in the hydraulic model. Follow-up flow monitoring is also recommended to enable post-rehabilitation RDII reduction to be evaluated (see Section 3-5). An annual budget for follow-up flow monitoring is set at $50,000 per year.

9-6.5 Depth Monitors

It is recommended that depth monitors, such as SmartCovers, be placed in areas with higher normalized RDII and/or areas with possible capacity related concerns (see Section 3-5). The estimated cost for the purchase and installation of one SmartCover is about $10,000. Assuming the installation of twenty SmartCovers in the future, the budget is set at $200,000.

9-6.6 Manhole Cover Replacements or Improvements

It is recommended to replace manhole covers with new ones with a single vent hole and/or install sufficient plugs in manhole covers to minimize inflow from surface flooding (see Section 3-5). An annual budget for manhole cover replacements or improvements is set at $50,000 per year.

9-7 Capital Improvement Project Cost Summary

The Capital Improvement Project costs are summarized as follows:

1. Gravity Main Capacity Improvements = $75,092,464
2. Lift Station Improvements = $7,564,000
3. SCADA System Upgrades = $400,000
4. Condition Assessment = $250,000
5. Repair and Rehabilitation Projects = $850,000 / year
6. Flow Monitoring = $50,000 / year
7. Depth Monitors = $200,000
8. Manhole Cover Replacements or Improvements = $50,000 / year

The costs provided in this study are based on existing conditions. As previously stated, construction costs are expected to fluctuate as changes occur in the economy. These costs should therefore be reevaluated and

updated annually based upon Engineering News Record (ENR) Index for the Los Angeles area (ENRLA), with the base ENRLA Index of 15778.36 for March 2025.

9-8 High Priority Projects

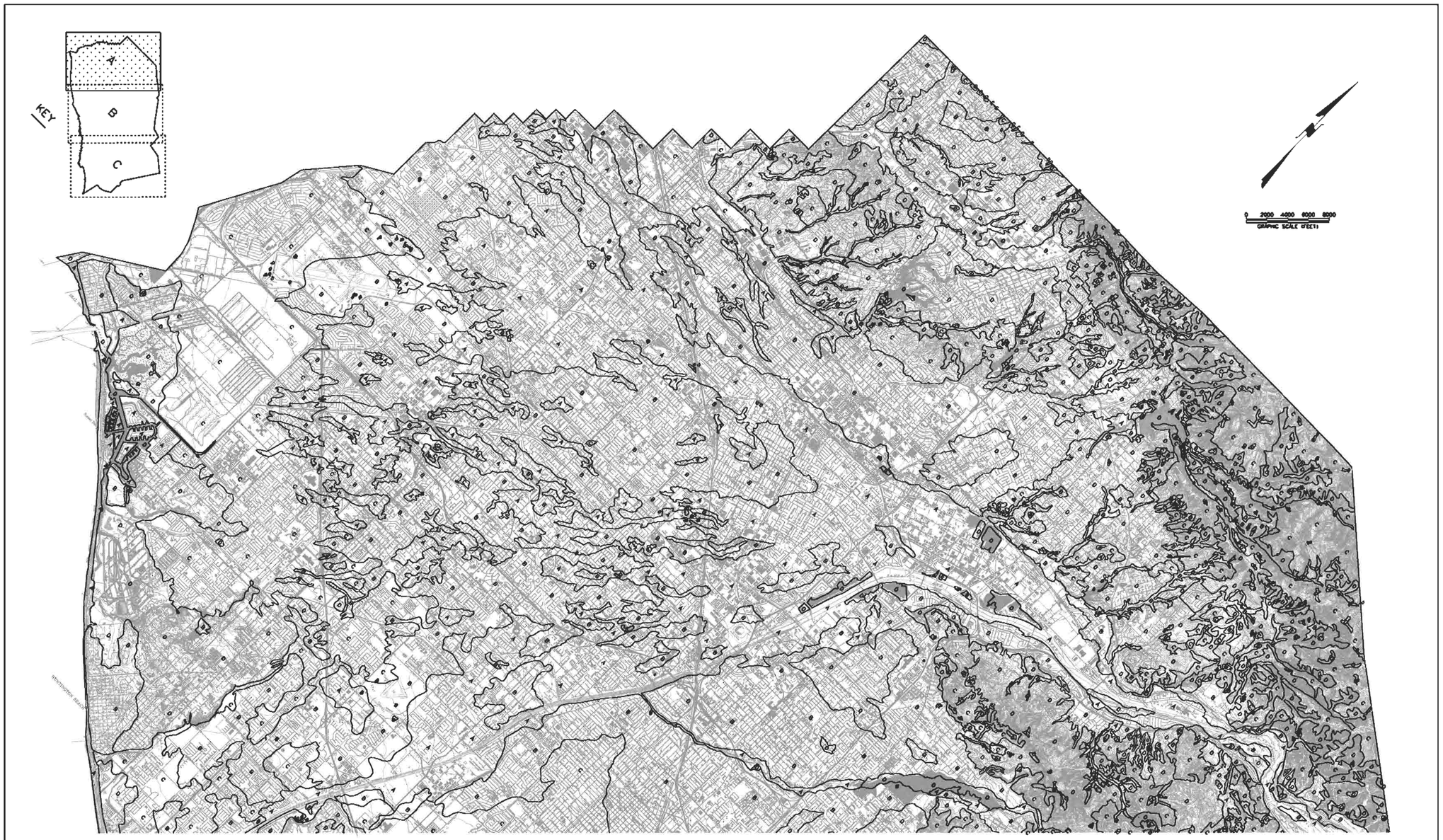
MCSD will need to evaluate the sewer budget and staff availability annually and determine which projects are feasible to implement. The high priority projects that should be focused on over the next five years are as follows:

1. Condition Assessment ($250,000) – implement within next year
2. Gravity Main Improvement Project GM-1 ($11,857,146) – implement within next three years

   Study of basin and capacity deficiencies in area tributary to Hammon Lift Station. At the same time, study siphon at Westminster and Springdale for possible solution to eliminate the siphon and downstream deficiencies. Implement solution.
3. SCADA System Upgrades ($400,000) – implement within next three years
4. Brookhurst Lift Station Improvements ($1,612,000) – implement within next five years
   a. Replacement of wet well access hatches with grated fall protection
   b. Replacement of pumps
   c. Replacement of discharge piping
   d. Addition of dual forcemain
   e. Replacement of wet well piping
   f. Replacement of electrical control system

Appendix 2-1

OC Hydrology Manual Maps



ORANGE COUNTY
HYDROLOGY MANUAL

LEGEND

A B C D	HYDROLOGIC SOIL GROUPS
———	HYDROLOGIC SOIL GROUP BOUNDARY

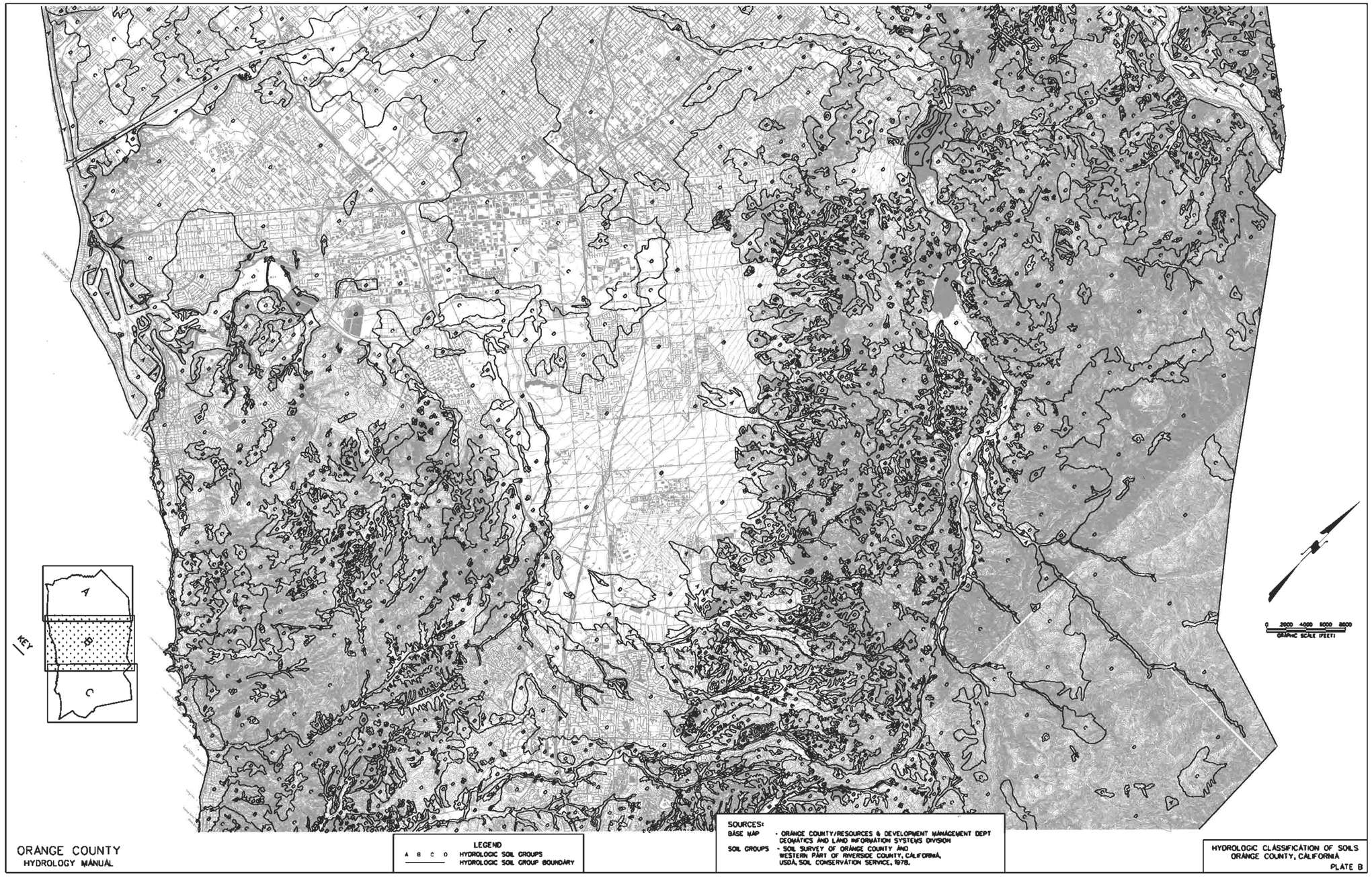
SOURCES:

BASE MAP - ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION

SOIL GROUPS - SOIL SURVEY OF ORANGE COUNTY AND WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA, USDA, SOIL CONSERVATION SERVICE, 1978.

HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA

PLATE A



ORANGE COUNTY
HYDROLOGY MANUAL

LEGEND
A B C D HYDROLOGIC SOIL GROUPS
HYDROLOGIC SOIL GROUP BOUNDARY

SOURCES:
BASE MAP - ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION
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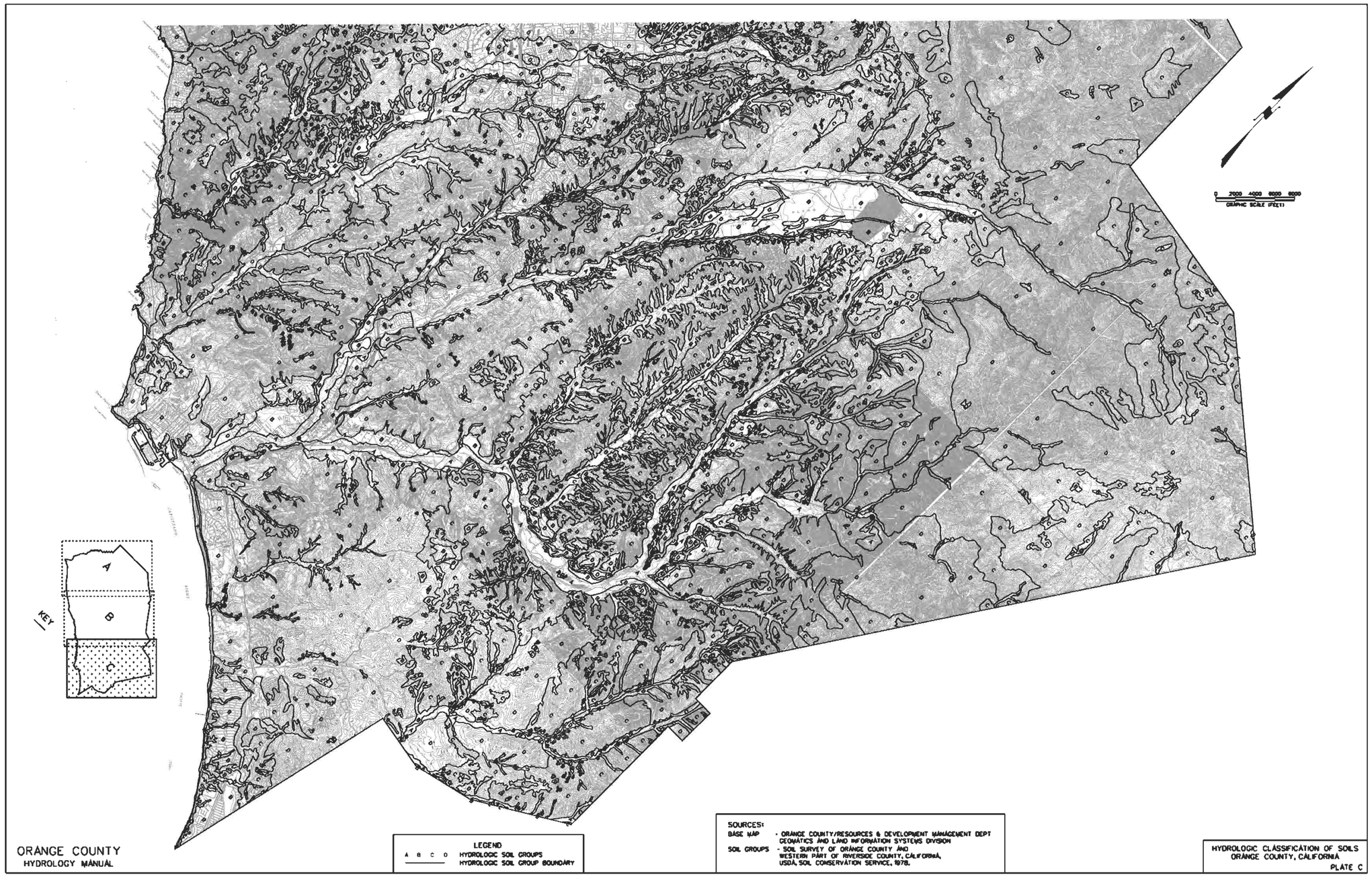
HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA
PLATE B



ORANGE COUNTY
HYDROLOGY MANUAL

HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA

PLATE C

Appendix 2-2

E-5 City/County Population and Housing Estimates

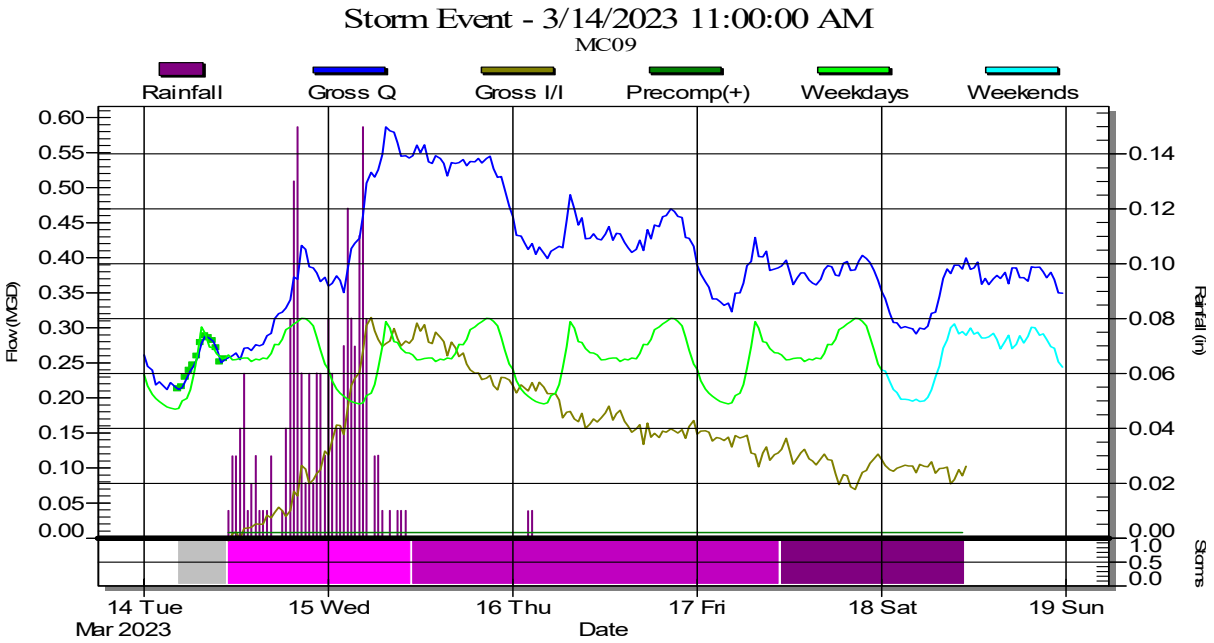
Table 2: E-5 City/County Population and Housing Estimates, 1/1/2024

County / City	POPULATION			HOUSING UNITS							Vacancy Rate	Persons per Household
	Total	Household	Group Quarters	Total	Single Detached	Single Attached	Two to Four	Five Plus	Mobile Homes	Occupied		
Orange County												
Aliso Viejo	50,068	49,607	461	20,189	7,007	5,361	646	7,175	0	19,565	3.1%	2.54
Anaheim	340,160	335,690	4,470	113,172	45,366	11,039	11,228	41,085	4,454	108,407	4.2%	3.10
Brea	47,725	47,583	142	18,711	9,997	1,631	549	5,523	1,011	17,865	4.5%	2.66
Buena Park	82,689	81,702	987	25,999	14,810	2,354	1,741	6,752	342	25,508	1.9%	3.20
Costa Mesa	109,423	106,907	2,516	44,320	17,466	4,652	5,657	15,648	897	42,432	4.3%	2.52
Cypress	49,345	48,832	513	17,088	10,142	3,184	583	2,771	408	16,718	2.2%	2.92
Dana Point	32,596	32,350	246	16,542	8,877	2,254	2,656	2,517	238	14,502	12.3%	2.23
Fountain Valley	56,333	55,886	447	19,961	12,976	2,076	712	3,821	376	19,546	2.1%	2.86
Fullerton	140,311	136,058	4,253	50,704	24,985	5,296	4,063	15,510	850	48,694	4.0%	2.79
Garden Grove	171,024	168,915	2,109	49,972	28,446	4,399	4,263	11,305	1,559	48,714	2.5%	3.47
Huntington Beach	192,503	191,592	911	83,126	39,570	9,915	9,614	21,076	2,951	79,438	4.4%	2.41
Irvine	314,550	295,462	19,088	126,524	50,178	20,529	7,186	47,426	1,205	116,752	7.7%	2.53
Laguna Beach	22,449	22,358	91	13,120	8,598	767	1,534	1,946	275	10,870	17.1%	2.06
Laguna Hills	30,315	29,938	377	11,434	6,465	1,996	570	2,064	339	11,019	3.6%	2.72
Laguna Niguel	64,291	63,858	433	28,136	15,043	5,466	1,432	6,147	48	26,228	6.8%	2.43
Laguna Woods	17,148	16,977	171	13,414	939	3,922	2,231	6,322	0	11,954	10.9%	1.42
La Habra	60,901	60,554	347	20,896	11,163	1,719	1,554	5,603	857	20,333	2.7%	2.98
Lake Forest	86,917	86,391	526	31,993	17,655	5,130	1,517	6,467	1,224	31,110	2.8%	2.78
La Palma	15,071	15,051	20	5,277	3,786	488	129	862	12	5,167	2.1%	2.91
Los Alamitos	11,947	11,699	248	4,552	2,084	383	790	1,190	105	4,437	2.5%	2.64
Mission Viejo	91,304	90,341	963	35,301	24,797	4,515	894	5,046	49	34,382	2.6%	2.63
Newport Beach	82,419	82,008	411	45,110	20,209	7,224	4,995	11,624	1,058	38,481	14.7%	2.13
Orange	138,621	132,107	6,514	48,165	26,704	5,229	4,896	10,152	1,184	46,613	3.2%	2.83
Placentia	52,226	51,881	345	18,127	10,686	2,105	1,376	3,397	563	17,657	2.6%	2.94
Rancho Santa Margarita	46,305	46,303	2	17,606	9,451	3,763	614	3,768	10	17,188	2.4%	2.69
San Clemente	62,297	62,018	279	26,794	15,373	2,719	4,094	4,037	571	24,625	8.1%	2.52
San Juan Capistrano	34,992	34,903	89	12,758	6,978	2,506	827	1,131	1,316	12,272	3.8%	2.84
Santa Ana	310,797	306,488	4,309	83,161	36,232	6,121	7,503	29,435	3,870	80,468	3.2%	3.81
Seal Beach	24,350	24,085	265	14,678	4,802	1,581	1,099	7,047	149	13,366	8.9%	1.80
Stanton	40,297	39,819	478	12,592	3,306	1,990	1,299	4,632	1,365	12,208	3.0%	3.26
Tustin	78,844	78,293	551	28,649	9,975	4,005	3,956	9,849	864	27,678	3.4%	2.83
Villa Park	5,705	5,659	46	2,035	1,995	28	12	0	0	1,958	3.8%	2.89
Westminster	89,490	88,805	685	28,420	15,466	2,200	2,529	5,226	2,999	27,519	3.2%	3.23
Yorba Linda	66,087	65,893	194	23,801	18,267	2,710	846	1,563	415	23,196	2.5%	2.84
Balance Of County	131,335	130,543	792	45,098	33,392	5,497	986	4,601	622	43,399	3.8%	3.01
Incorporated	3,019,500	2,966,013	53,487	1,112,327	539,794	139,257	93,595	308,117	31,564	1,056,870	5.0%	2.81
County Total	3,150,835	3,096,556	54,279	1,157,425	573,186	144,754	94,581	312,718	32,186	1,100,269	4.9%	2.81

Appendix 3-1

Midway Sewer Flow Monitoring and RDII Report

MIDWAY SEWER FLOW MONITORING AND RDII REPORT



May 2023

Prepared For:

Midway City Sanitary District
14451 Cedarwood Avenue
Westminster, CA 92683

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1 EXECUTIVE SUMMARY

ADS Environmental Services was contracted to perform temporary flow monitoring and rainfall monitoring in the Midway City Sanitary District sanitary sewer collection system. This season brought some significant rainfall, enabling a meaningful evaluation of rainfall impacts on the Midway sewer system. The purpose of the study was to determine degree of Rain Dependent Infiltration and Inflow (or Rain Dependent I/I – RDII) in selected tributary areas or basins within the sanitary sewer collection system. This was done by deploying 26 flow monitors (defining 25 isolated basins) and 3 rain gauges throughout the service area. The contracted period of the flow study was 1 month (calendar month of March 2023). The flow monitors were installed in late February (with exception to one location, MC22B, which was installed in March due to hydraulic issues encountered in that part of the collection system) and were removed in early April. This report contains the results of flow monitoring data collected with an RDII analysis and an evaluation of flow monitor site hydraulics during wet and dry weather flow conditions.

1.1 Project Objectives

The objective of this study was to deploy flow and rainfall monitoring devices to enable quantifying the amount of RDII entering specific tributary areas or basins within the collection system. The flow responses in the basins can then be used to prioritize basins on the basis of RDII response. Ultimately, this information is intended to assist in more effectively allocating resources to address the impacts of RDII within the collection system.

1.2 Project Scope of Work

The scope of this study included collecting dry and wet weather flows over a minimum period of 30 days. The scope of work for this Study included the following tasks:

- Obtain flow and rain data from the collection system areas;
- Conduct an RDII analysis of the rainfall and flow data using Sli/icer™ software;
- Evaluate depth of flow and hydraulic performance at each flow monitoring site as applicable (i.e. identify the presence of backwater);
- Quantify RDII basin performance and site-specific hydraulic performance and make recommendations for further action based on the flow monitoring data collected.

1.3 Report Layout

This report presents three (3) aspects of sewer flow hydraulic performance information for each of the evaluated sewer basins:

- General net flow information for each sewer basin including non-rain period dry weather flows;
- Wet weather flow information for each basin including quantification of net volume during each evaluated storm event that were in excess of normal dry period flows (i.e. RDII);

- Pipe capacity information in terms of highest %full pipe based on evaluating ratios of observed peak flow depths (d) to the pipe's diameter (D) or d/D.

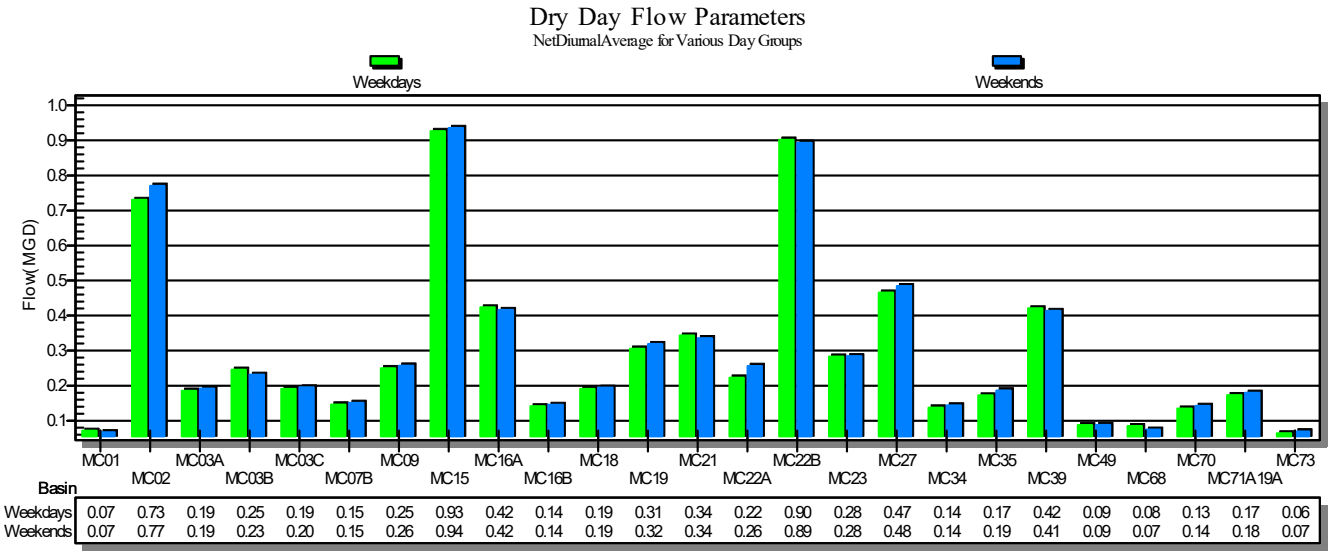
Chapter 1 of this report presents project background information and a summary of the findings of this study. Chapter 2 outlines the project approach, and flow monitoring/rainfall procedures and data collected. Chapter 3 presents dry weather flow information for each evaluated basin and rain data collection. Chapter 4 presents wet weather data and RDII quantification and results. Chapter 5 presents information regarding hydraulic capacity of the lines in which the flow monitors were installed including d/D data and other related pipe hydraulic performance. Chapter 6 presents summary conclusions and recommendations regarding future investigation and monitoring work. Appendix B of this report is a flow data report containing details about the means, methods and field procedures used to obtain flow and rainfall data used to generate this RDII report. The flow data report also includes flow and rainfall monitoring site location details with photos as an appendix thereof.

1.4 Basin Flow Analysis

The flow monitoring study consisted of dividing the collection system into discrete tributary areas or basins and simultaneously monitoring the discharge of each basin during the flow monitoring period using flow monitoring devices to monitor flow in an individual pipe. Each flow monitoring site was identified with a simple alpha-numeric ID – MC01, MC02, etc.; each associated with a basin of the same ID. Rain gauges were also deployed to quantify rainfall associated with each of the defined basins. The rain gauge IDs were based on the locations where they were deployed (e.g. RG01PS at the Hammon pump station and RG02FS66 located at Fire Station 66 - see section 2.4).

AKM Associates divided the collection system into twenty-five (25) basins hydraulically comprised of twenty-six (26) flow monitoring sites (monitored using ADS Model 8000, Triton+ open channel flow monitors). There were 5 basins that relied upon subtracting flow from flow monitors upstream. For example, monitor location MC03C is upstream of basin MC03B, so net flow was determined for MC03B by subtracting flow from MC03C upstream. For basin MC71A19A, net flow was determined by summing flows from monitoring locations MC71A and MC19A. This is discussed in more detail in section 2.1.

The Average Dry Day Flows (ADDF) were calculated for each basin for the dry weather periods. A chart of the net ADDF from each of the basins is presented in Figure 1.1.



Basin	MC01	MC02	MC03A	MC03B	MC03C	MC07B	MC09	MC15	MC16A	MC16B	MC18	MC19	MC21	MC22A	MC22B	MC23	MC27	MC34	MC35	MC39	MC49	MC68	MC70	MC71A	19A
Weekdays	0.07	0.73	0.19	0.25	0.19	0.15	0.25	0.93	0.42	0.14	0.19	0.31	0.34	0.22	0.90	0.28	0.47	0.14	0.17	0.42	0.09	0.08	0.13	0.17	0.06
Weekends	0.07	0.77	0.19	0.23	0.20	0.15	0.26	0.94	0.42	0.14	0.19	0.32	0.34	0.26	0.89	0.28	0.48	0.14	0.19	0.41	0.09	0.07	0.14	0.18	0.07

Figure 1.1 – Net Average Dry Day Flows (ADDF)

1.5 RDII (Wet Weather Response) Analysis

An analysis was performed to quantify Rain Dependent Inflow and Infiltration (RDII) produced by each basin. A chart, sorted from high to low, of "normalized" RDII results measured during the study is summarized in Figure 1.1. The term "normalized" means that the RDII (the volume of flows measured to be above the normal expected dry weather flows) was divided by rainfall volume (inches) and basin size (feet of pipe) to enable an apples-to-apples comparison of results among basins (see section 4.3). The normalized RDII values are in terms of gallons of RDII per foot of pipe per inch of rain. Generally, values > 5 may be considered noteworthy and values >10 may be considered excessive (see section 4.3).

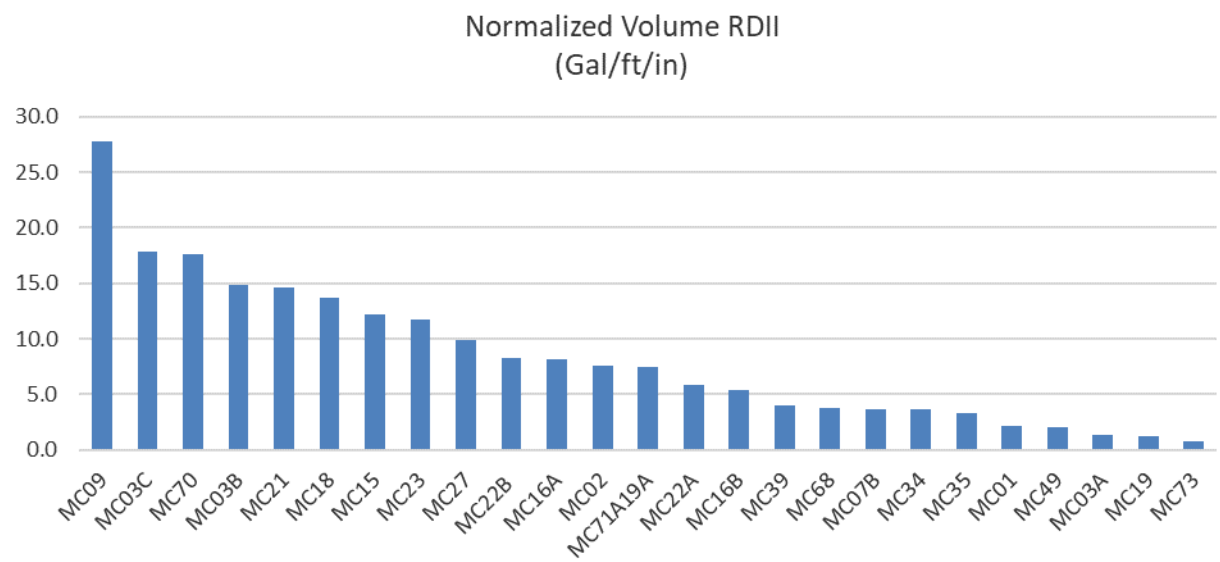


Figure 1.2- RDII Evaluation Summary

1.6 Hydraulic Analysis

A hydraulic analysis was performed at each flow-monitoring site using gross flows to evaluate the pipeline hydraulic conditions at each flow monitoring site. The basis of this evaluation was to compare the ratio of depth-of-flow to the diameter (d/D) of the pipe throughout the study period and evaluate depth & velocity data for the presence of backwater.

The daily peak d/D ratio exceeded 1.0 on at least one occasion at six (6) of the 26 monitoring sites: MC02, MC-09, MC16B, MC19A, MC21, and MC22B. The maximum peak surcharges generally occurred during the larger March 14 and March 21 storm periods. One site, MC22B, was surcharged daily for much of the day.

Eight (8) of the flow monitoring locations exhibited backwater conditions on several occasions during the study period suggesting the presence of a downstream capacity bottleneck in the system at each of these locations: MC02, MC03A, MC03B, MC03C, MC16B, MC19, MC21, and MC35.

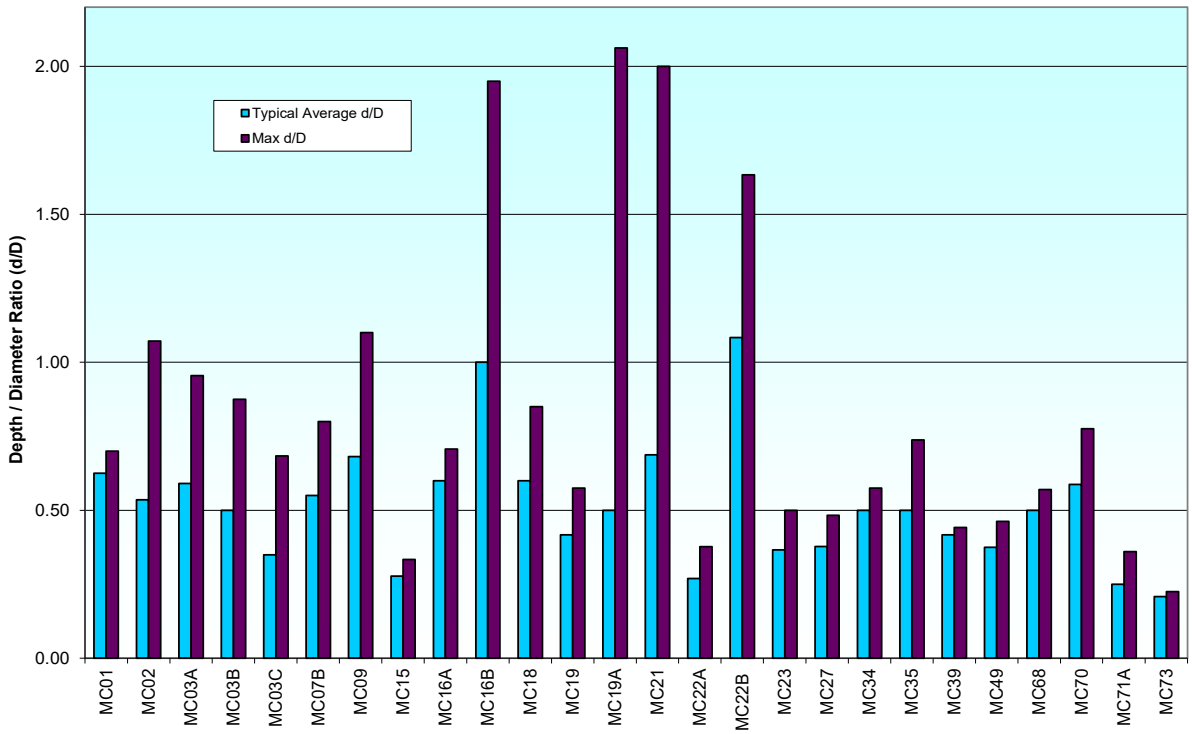


Figure 1.3- Peak to Average Ratio (Typical vs Max Observed)

1.7 Recommendations

The objective in an RDII study was to capture rain events to quantify resulting flow response so that a relationship can be drawn between RDII and volume of rainfall. Rainfall was represented quite well during this study considering the unusually short duration; even capturing an estimated 3-yr, 12-hour duration storm event in mid-March, 2023. Given the results of this study, ADS recommends the following:

- ADS recommends investigation of possible capacity issues (e.g. downstream bottlenecks) associated with sites MC02, MC03A, MC03B, MC03C, MC-09, MC16B, MC19, MC19A, MC21, MC22B and MC35. These sites are characterized by surcharges and/or noted backwater occurring during the study. For example, MC02 surcharging and backwater is likely the result of being immediately upstream of a pump station wet well (i.e. the gravity piping is being used for wastewater storage upstream of the pump station).

- Based on the results of the RDII analysis or rain impact within each basin, ADS recommends Midway conduct Sanitary Sewer Evaluation Surveys (SSES) including manhole inspections and closed circuit television (CCTV) pipe inspections. This should be done for the eight (8) basins exceeding 10 gallons of RDII per foot of pipe per inch of rain including, in order of ranked performance; MC09, MC03C, MC70, MC03B, MC21, MC18, MC15 and MC23. Any CCTV inspections done should be during early morning hours (typical minimum wastewater flow periods) to get the most unobstructed view of the piping possible and enable recording of live infiltration (i.e. at various pipe joints or lateral connections and manhole joints).

- Consideration should be given to collection system rehabilitation to reduce infiltration in some of the basins, particularly those where capacity issues are associated. This may include comprehensive lining of pipes, connections and manhole junctions.

- Future follow up flow monitoring should be conducted to enable post-rehabilitation RDII reduction to be evaluated. A valid means to quantify such RDII reduction is to use a designated “control” basin as a comparator. For example, basins MC03B and MC03C show similarly poor normalized RDII performance. So, comprehensive lining could be conducted in the smaller MC03C basin, then relative improvement can be determined by comparing future concurrent RDII responses by directly comparing the MC03B basin (with no rehabilitation) to MC03C (with the lining) RDII performance.

2 PROJECT APPROACH

Rain Dependent Inflow and Infiltration (RDII) consists of extraneous water that enters a sanitary sewer system during or just after a storm event. Inflow is typically described as water that directly enters a system through roof leaders, clean-outs, foundation drains, sump pumps, and cellar, yard, and area drains. Infiltration is typically described as water that enters a sewer system from the ground through defective pipes, pipe joints, damaged lateral connections, or manhole walls.

Most collection systems have been designed to convey some quantity of RDII. Although it is not practical to eliminate all RDII from entering a sewer system, removing excessive amounts of RDII can positively impact a collection system in the following ways:

- Increase available collection system capacity;
- Reduce the possibility of sanitary sewer overflows;
- Reduce treatment and transportation costs.

The most cost effective means of identifying, quantifying, and prioritizing RDII entering a collection system is through a comprehensive RDII study comprised of the following major components:

1. Collection system review and Basin identification.
2. Simultaneous flow monitoring and rain gauging.
3. Data analysis and ranking of basins against one another based on normalized units often referred to as basin prioritization.
4. Sanitary Sewer Evaluation Surveys (SSES) including smoke testing, manhole inspection, flow isolation, dye water flooding, closed circuit television, etc.
5. Follow-up or post-rehabilitation flow monitoring after RDII mitigation measures have been conducted.

ADS conducted tasks 1 through 3 of the above RDII study; each of which are discussed in detail in this report.

2.1 Basin Identification

Based on a study of the City's sewer collection system, AKM Associates divided the study area into twenty-five (25) separate basins using twenty-six (26) flow monitors. A map depicting the basin boundaries as well as flow monitor (maroon color points) and rain gauge locations (green triangles) is shown in Figure 2.1.

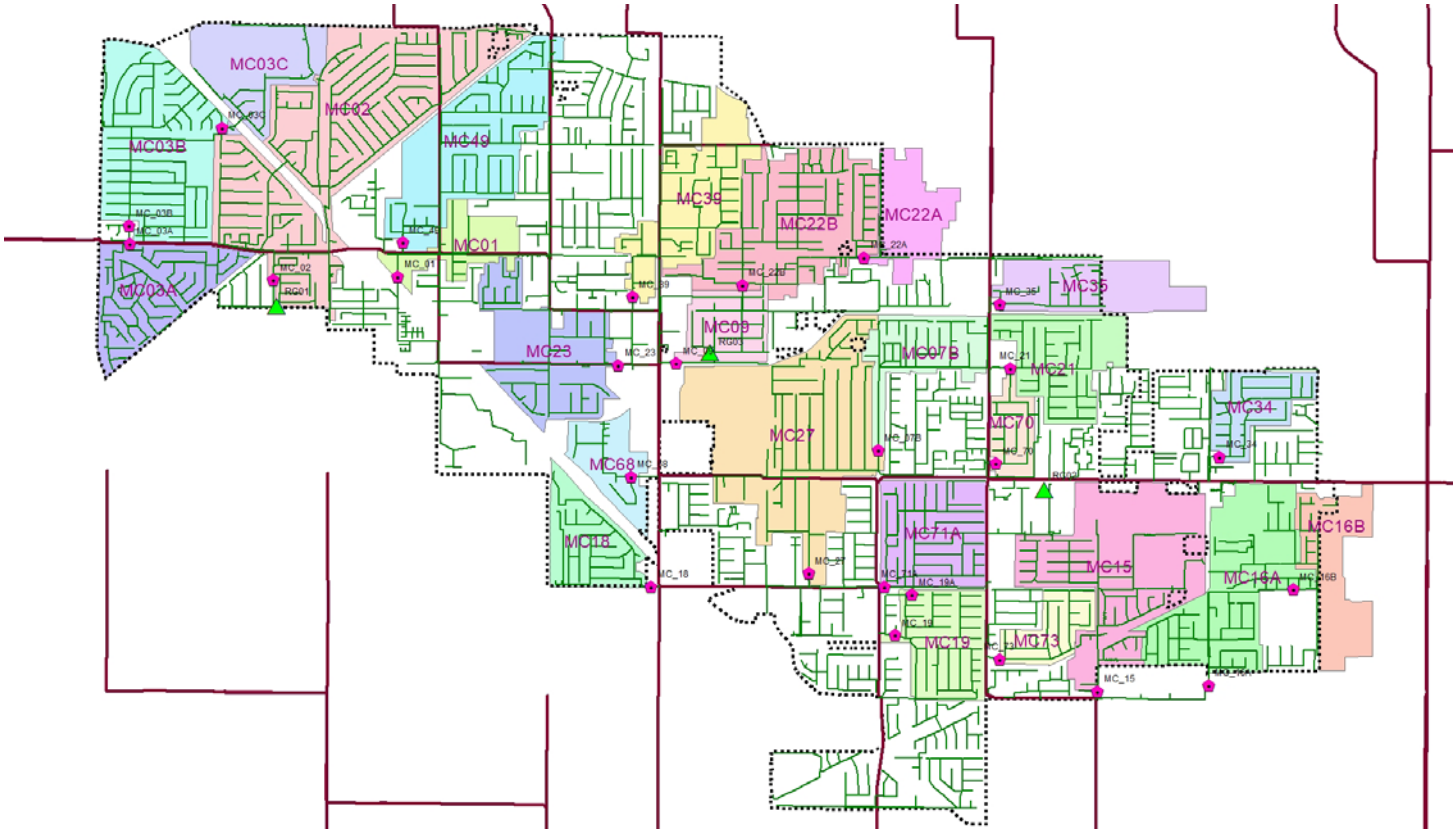


Figure 2.1 – Basin Map

It is noted that flow monitoring sites MC16B, MC22A and MC35 included some tributary flow from outside of the Midway system boundary (shown as a black dashed line in Figure 2.1). Flow sites MC16B and MC22A were also used as subtraction monitors in order to quantify the flow solely from Midway Basins MC16A and MC22B. For basin MC71A19A, net flow was determined by summing flows from monitoring locations MC71A and MC19A since there were two outflow pipes from the associated tributary area (shown as MC71A in Figure 2.1).

The association of flow meter sites to flow basins evaluated in this study is presented in Table 2.1 along with gross and net Average Dry Day Flow (ADDF), total pipe length and area of each basin.

Table 2.1 - Basins Sizes and ADDF

Site/ Basin	Pipe Diameter (in)	Added or Upstream Subtracted FM Sites to Determine Net Basin Flow	Acres	Pipe Length (feet)	Gross ADDF Weekday (mgd)	Net ADDF Weekday (mgd)
MC01	8		75	8316	0.07	0.07
MC02	14		494	88150	0.73	0.73
MC03A	11		153	29270	0.19	0.19
MC03B	12	- (MC03C)	264	44555	0.44	0.25
MC03C	12		133	10740	0.19	0.19
MC07B	8		104	19266	0.15	0.15
MC09	11		78	15137	0.25	0.25
MC15	18		297	33772	0.93	0.93
MC16A	15	- (MC16B)	230	36259	0.56	0.42
MC16B	10		117	23704	0.14	0.14
MC18	10		101	17911	0.19	0.19
MC19	12	- (MC19A)	118	22271	0.40	0.31
MC21	8		135	21165	0.34	0.34
MC22A	13		97	16212	0.22	0.22
MC22B	12	- (MC22A)	261	45791	1.13	0.90
MC23	15		183	25594	0.28	0.28
MC27	18	- (MC07B)	396	42126	0.61	0.47
MC34	8		80	14526	0.14	0.14
MC35	8		128	19012	0.17	0.17
MC39	12		175	25237	0.42	0.42
MC49	8		239	35314	0.09	0.09
MC68	10		74	5878	0.09	0.09
MC70	8		50	8038	0.14	0.14
MC71A19A	10	+ (MC71A) + (MC19A)	147	28733	0.17	0.17
MC73	12		60	11922	0.06	0.06
		Total	4189	648899		7.30

2.2 Flow Monitoring Equipment

The equipment used for flow monitoring during this study period was the ADS model 8000 (Triton+) open-channel flow monitor. Data were retrieved or collected from the monitors, QA checked, and finalized by ADS for use in this evaluation in accordance with ADS' documented procedures. Refer to the Flow Data Report as Appendix B for additional details regarding equipment and field procedures.

2.3 Installation

Typical open channel flow meter installation includes the following steps:

* Site investigation
* Installation of equipment and start-up
* Monitor confirmation and calibration

A typical open channel flow monitor installation is shown in Figure 2.2.

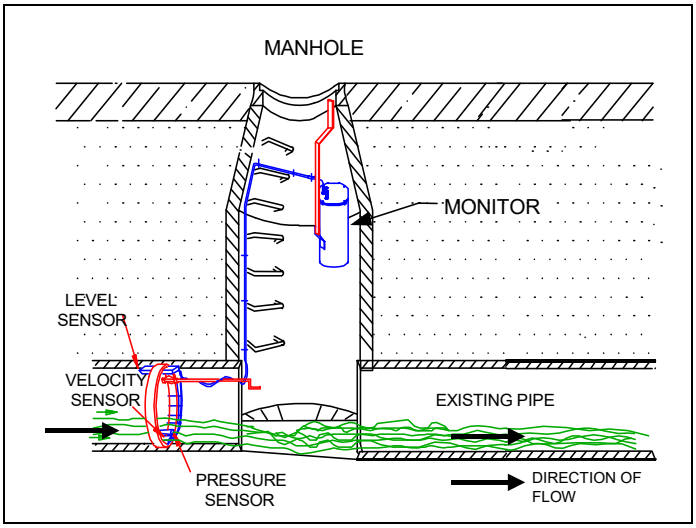


Figure 2.2 – Typical Monitor Installation

The installation presented in Figure 2.2 is typical of the configuration used for this study and is customarily used on circular or oval pipes up to approximately 42 to 60 inches in diameter or height. In this type of installation, depth and velocity sensors are mounted on an expandable ring and installed about one pipe diameter length upstream of the pipe/manhole connection in the incoming sewer pipe. The installation into the incoming pipe reduces the effects of turbulence caused by the manhole.

2.4 Rain Gauges and Rainfall Data

An important part of an RDII study is the collection and analysis of rainfall data (volume and distribution). The rainfall data is the basis for determining the relative RDII response and severity in each basin being studied. A chart of rainfall during the study is presented in Figure 2.3 (showing rainfall recorded at rain gauge RG02FS66).

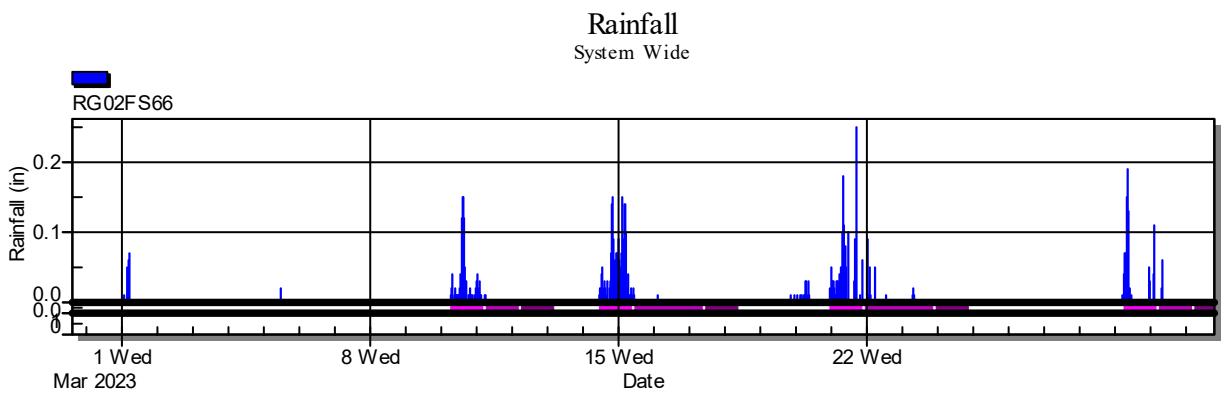


Figure 2.3- Rainfall

Rain events that have historically been significant for an RDII analysis are near or greater than 0.5 inch; and preferably closer to 1.0 inch or more, and lasting more than 4 hours. There were four (4) rain events that occurred during this monitoring that met these criteria. The four (4) rain events that occurred during the study period included events that began on: March 10, March 14, March 20, and March 29, 2023.

It is notable that the March 14 storm approached a 3-yr, 12-hour return frequency storm event.

For this study, three (3) rain gauges were located in the City for the duration of the study period. Rain gauge #1 was located on the pump station building at Harold and Hammon Place. Rain gauge #2 was located at Fire Station #66 near the corner of Bolsa Ave. and Moran Street. Rain gauge #3 was located on the roof of the temporary building at the Midway headquarters at 14451 Cedarwood Street.

Table 2.2 presents a summary of rainfall information for the storms evaluated during this study. The Duration shown in Table 2.2 represents the approximate period of hours during which the significant majority of rainfall occurred. Table 2.3 indicates the rain gauge weighting or relative assignment to each of the basins. The flow monitoring basins were assigned rain gauge weightings that best represented the basin's area according to the inverse distance squared method. For example, the approximate center of basin MC18 is 1.02 mile from rain gauge RG03 and about 2.09 miles from rain gauge RG02; therefore MC18 would be assigned a relative rainfall weighting of 0.96 ($1 \div 1.02^2$) and 0.23 ($1 \div 2.1^2$) or simplifying as 96 and 23 relative weightings, respectively, for rain recorded at RG03 and RG02. This means that rain recorded at the RG03 rain gauge carries about 4 times more weight than RG02 rain gauge for basin MC18.

A rainfall accumulation chart was prepared (called a DDF chart) based on the RG02FS66 gauge data for the four (4) storms. This chart was used to compare captured rainfall to historical rainfall statistics for the area (thin color lines on the DDF chart)[1]. The indicated storms were plotted on a DDF chart to show how they compare to statistical records for the area. For example, the 3/14/23 storm can be classified as a 3-year return frequency, 12-hour event (see Figure 2.4).

Table 2.2
Storm Events Evaluated

Storm #	Date	Rainfall (in)			Duration (hours)	Classification
		RG01PS	RG02FS66	RG03MSD		
1	3/10/2023	1.01	1.14	1.04	24	<<1-yr; 24-hr
2	3/14/2023	2.02	2.24	2.04	24	3-yr, 12-hr
3	3/20/2023	1.47	1.88	1.82	24	1-yr; 18-hr
4	3/29/2023	0.66	1.07	0.86	6	<<1-yr; 24-hr

[1] NOAA Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdsc/pfds), Series Type: Annual Maximum. Station Name: Santa Ana Fire Stn.

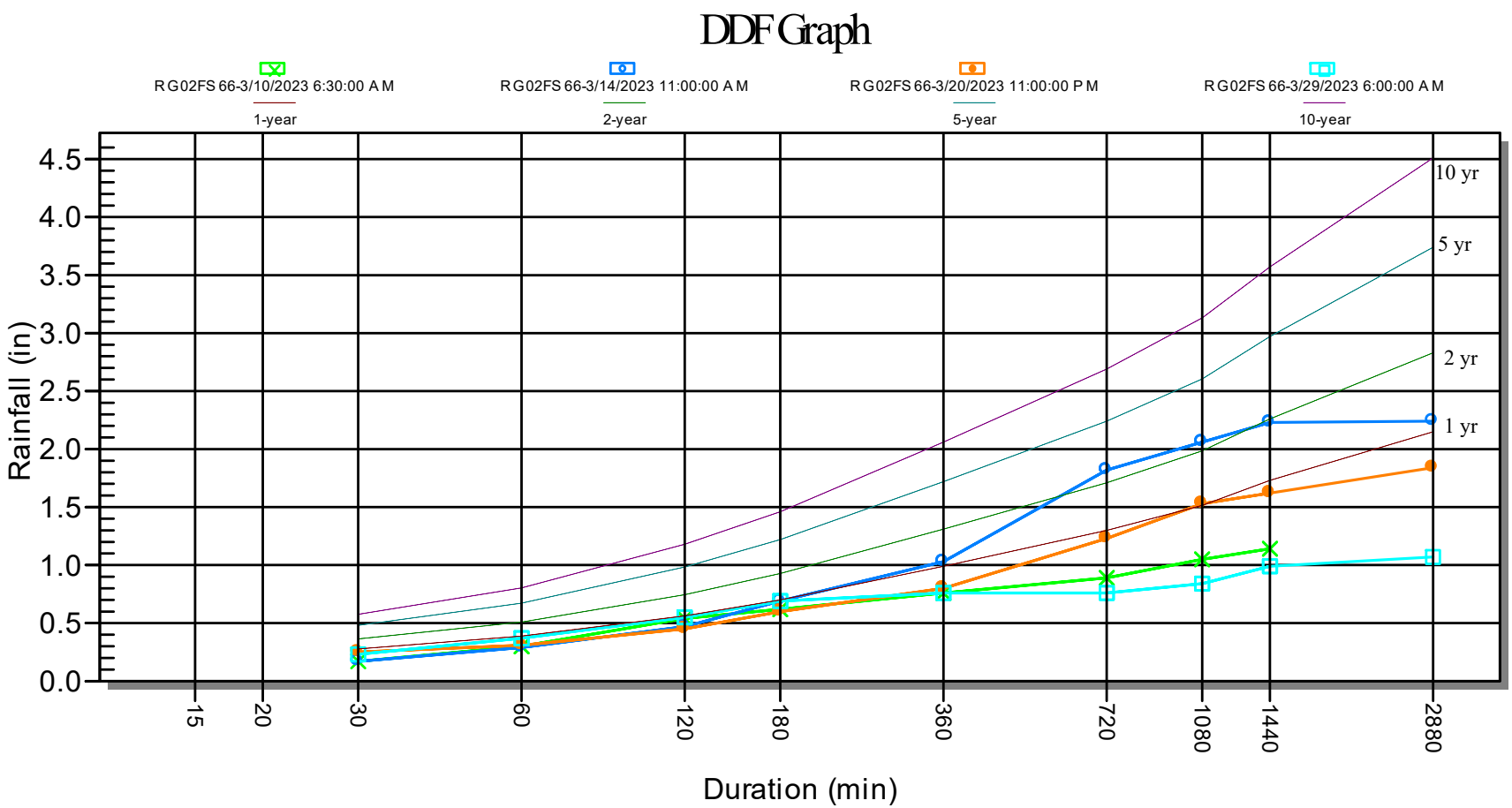


Figure 2.4 – Rainfall Depth Duration Frequency (DDF) Chart

Table 2.3
Rain Gauge Relative Weighting For Each Basin

Basin	RG01PS	RG02FS66	RG03MSD
MC01	129	12	65
MC02	159	8	26
MC03A	310	6	15
MC03B	122	5	14
MC03C	83	6	17
MC07B	12	144	108
MC09	24	38	4965
MC15	6	410	23
MC16A	5	107	15
MC16B	4	53	11
MC18	32	23	96
MC19	9	145	35
MC21	8	276	39
MC22A	12	51	82
MC22B	18	36	204
MC23	65	18	178
MC27	17	72	361
MC34	5	94	16
MC35	7	111	32
MC39	26	23	200
MC49	75	11	48
MC68	35	26	219
MC70	9	1074	50
MC71A19A	10	341	59
MC73	7	247	25

3 BASIN FLOW ANALYSIS

3.1 Net Dry Weather Flows

Net basin flows are those associated only with the basin as monitored by its meter of the same name. For example, for site/basin MC03B, net flows were obtained by subtracting flows coming into the associated basin from upstream site MC03C (Refer to Table 2.1). Dry weather days were selected based on the following set of minimum criteria:

- No rain greater than 0.1 inch over the previous 3 day period.
- Resulting selected days must exhibit average-day flows within 85% - 115% of average-day flows of remaining dry days.
- In addition, those dry days that exhibited unusual flow patterns were not used to generate net dry day flow values for a basin

The result of this evaluation yields several representative dry days with which typical flow patterns for each site/basin are generated and are referred to as the Average Dry Day Flow (ADDF) patterns. These dry days are then classified into weekend days and weekdays since those patterns are typically distinctly different. Figure 3.1 depicts the total (gross) ADDF for site MC03B for weekends and weekdays. These patterns provide a comparison against which elevated storm flows can be compared as discussed in Chapter 4.

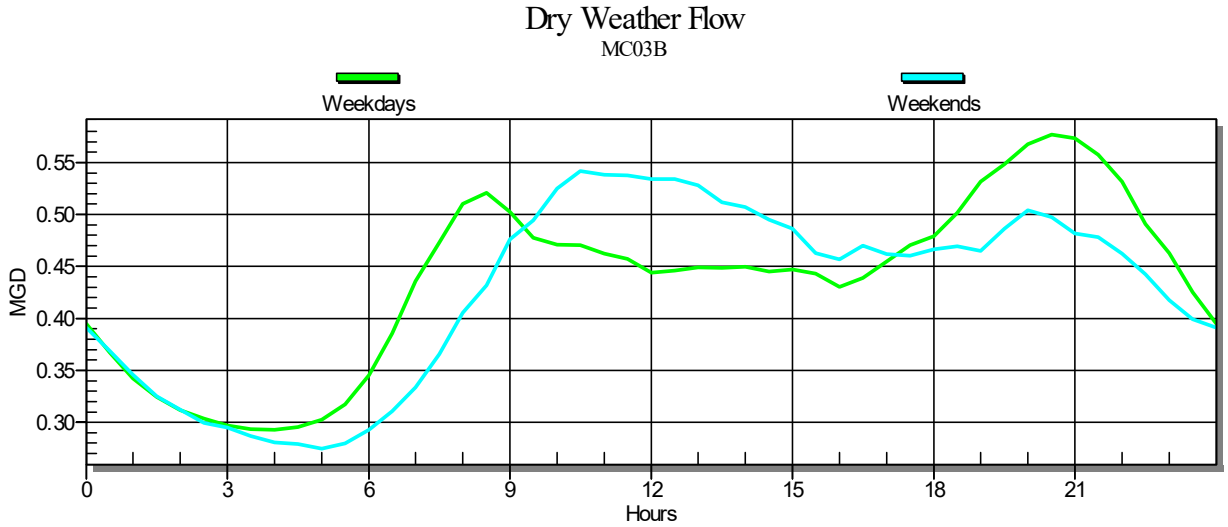
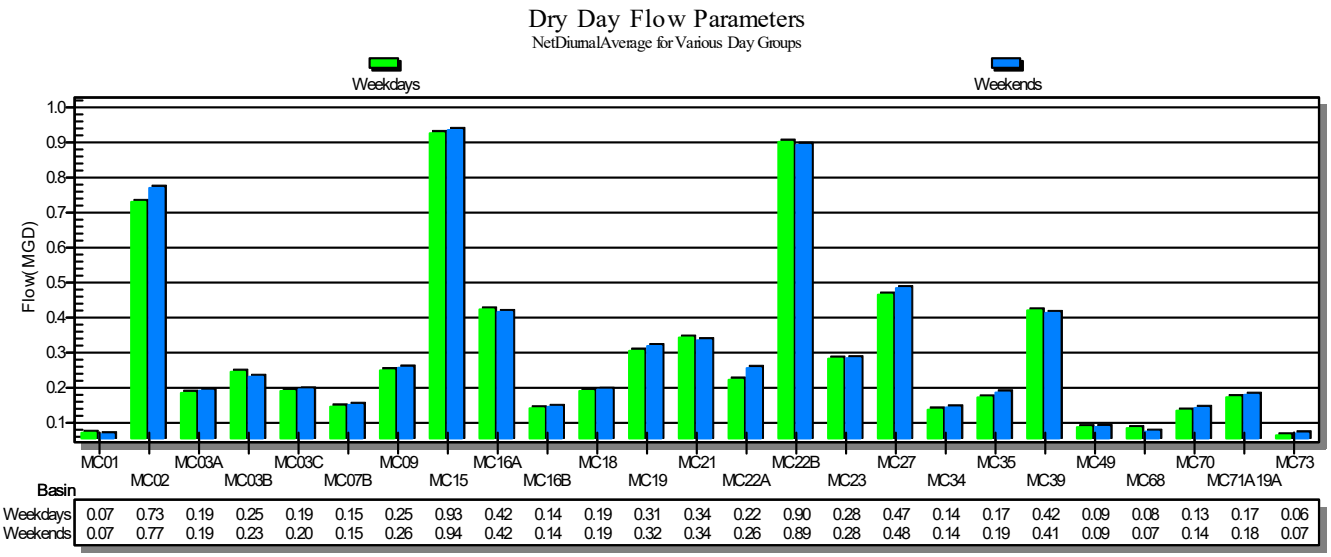


Figure 3.1 – Dry Day Flow Pattern (or ADDF) of Site/Basin MC03B

Figure 3.2 shows a summary of the net ADDF associated with each of the 25 basins. The net ADDF ranged from 0.06 MGD (MC73) up to 0.94 MGD (MC15).



Basin	MC01	MC02	MC03A	MC03B	MC03C	MC07B	MC09	MC15	MC16A	MC16B	MC18	MC19	MC21	MC22A	MC22B	MC23	MC27	MC34	MC35	MC39	MC49	MC68	MC70	MC71A	19A	MC73
Weekdays	0.07	0.73	0.19	0.25	0.19	0.15	0.25	0.93	0.42	0.14	0.19	0.31	0.34	0.22	0.90	0.28	0.47	0.14	0.17	0.42	0.09	0.08	0.13	0.17	0.06	
Weekends	0.07	0.77	0.19	0.23	0.20	0.15	0.26	0.94	0.42	0.14	0.19	0.32	0.34	0.26	0.89	0.28	0.48	0.14	0.19	0.41	0.09	0.07	0.14	0.18	0.07	

Figure 3.2 – Net Average-Day Dry Weather Flows (ADDF)

3.2 Net Base Infiltration

Even in dry weather, not all the flow in the sewer is wastewater. Some of the dry weather flow in most sewers may be comprised of groundwater seepage from the water table or from saturated soils long after a significant rain event (or series of events). ADS separates wastewater production (WWP) from base-infiltration (BI) in dry weather flow as shown in Figure 3.3.

Base Infiltration (BI) is the flow that is left over after Wastewater Production (WWP) is subtracted from average dry day flow. Like Wastewater Production, BI is an estimate. BI can vary throughout the season and is typically correlated to groundwater table elevation and can often increase substantially with each sequential storm through the rainy season.

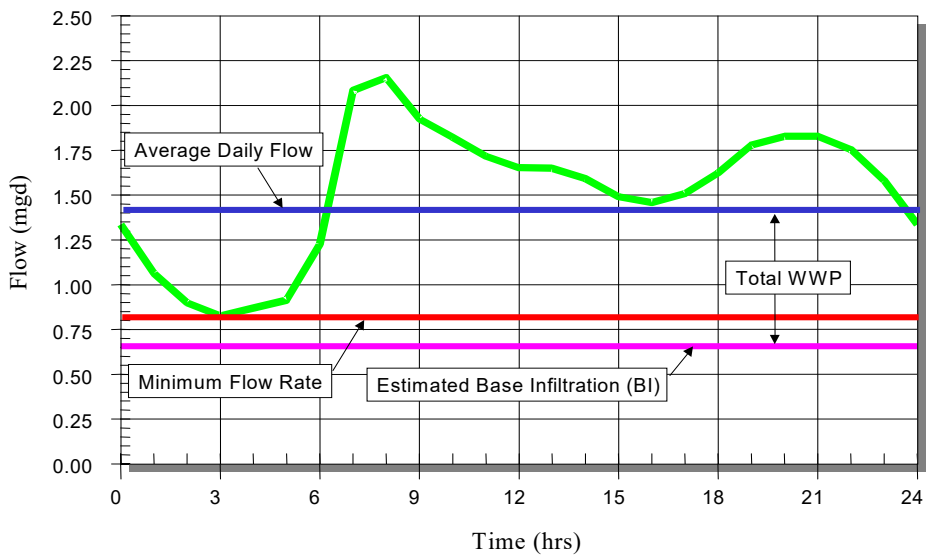


Figure 3.3 – Dry Weather Flow Components

The approach to estimate BI from a hydraulically defined basin is based on the difference between average dry weather flow (ADDF) and minimum daily total flow (MDF). As BI varies over the year, the difference between the average and minimum wastewater (without BI) component of flow is expected to remain constant. But if excessive BI is present, the ratio of total MDF / ADDF will vary or become uncharacteristically high.

An empirical method, the Stevens/Schutzbach equation (equation 3.1), evaluates the MDF and ADDF flow values to estimate BI in the basins strictly on the basis of these measured net flows.

$$\mathbf{BI} = \frac{\mathbf{0.4 * MDF}}{\mathbf{1 - 0.6\,(MDF/ADDF)\ \hat{}\ ADDF^{0.7}}} \qquad (3.1)$$

Equation 3.1 is based on typical average and minimum flows that occur in traditional residential flow patterns. Reliability of the BI calculation decreases in non-residential basins and in basins where the flow meter measures flow from cycling pump stations. Net BI (for a basin) can be determined by subtracting calculated BI at upstream sites from the calculated BI at the downstream (or basin's) meter location. The reliability of this method decreases as basins contain more mixed use or commercial operations and/or have significantly more than 20,000 feet of pipe. However, this method provides a method of conducting a relative comparison between basins of similar overall land uses.

It is important to understand that when only using flow data, BI can only be estimated and that only through more rigorous means of flow isolations (e.g. plugging all lateral connections in isolated small areas of the system and physically measuring continued flow during the plugging period) can actual BI values be determined. Generally, this BI estimation method carries higher error as the amount of BI (as a % of ADDF) decreases and lower error as BI increases. Therefore, estimated BI values below 25% to 30% could represent insignificant BI. However, as

BI estimates exceed 50% of the ADDF, such values are considered more accurate and therefore potentially very significant.

Table 3.1 lists the values of estimated net (basin) BI as well as net BI as a percentage of ADDF for each of the 25 defined basins. BI is calculated based on weekday flows since there are more weekdays to evaluate in determining MDF and ADDF values. The BI (as % ADDF) values from the same basins that were also monitored in 2003 are included in Table 3.1 for reference. Overall, there is a significant increase in estimated BI compared to 2003. This may be partly attributable to the unusually high volume of rainfall experienced this 2022/2023 wet season which may have elevated the groundwater table higher by late season when this study was conducted. Nonetheless, this suggests that BI comprises a significant portion of the sewer carrying capacity in most of the basins monitored.

Table 3.1 - Basin ADDF and BI Summary

Site/ Basin	Pipe Diameter (in)	Acres	Pipe Length (feet)	Net ADDF Weekday (mgd)	Net BI (mgd)	Net BI (% ADDF)	Net BI 2003 (% ADDF)
MC01	8	75	8316	0.07	0.05	69%	48%
MC02	14	494	88150	0.73	0.30	41%	28%
MC03A	11	153	29270	0.19	0.06	31%	19%
MC03B	12	264	44555	0.25	0.17	67%	23%
MC03C	12	133	10740	0.19	0.06	31%	--
MC07B	8	104	19266	0.15	0.06	42%	36%
MC09	11	78	15137	0.25	0.16	63%	27%
MC15	18	297	33772	0.93	0.53	58%	15%
MC16A	15	230	36259	0.42	0.18	43%	23%
MC16B	10	117	23704	0.14	0.06	39%	--
MC18	10	101	17911	0.19	0.12	62%	32%
MC19	12	118	22271	0.31	0.19	62%	27%
MC21	8	135	21165	0.34	0.25	73%	34%
MC22A	13	97	16212	0.22	0.06	28%	--
MC22B	12	261	45791	0.90	0.33	37%	14%
MC23	15	183	25594	0.28	0.14	49%	33%
MC27	18	396	42126	0.47	0.22	47%	34%
MC34	8	80	14526	0.14	0.08	55%	19%
MC35	8	128	19012	0.17	0.08	44%	17%
MC39	12	175	25237	0.42	0.18	43%	23%
MC49	8	239	35314	0.09	0.05	55%	30%
MC68	10	74	5878	0.09	0.07	79%	41%
MC70	8	50	8038	0.14	0.07	53%	--
MC71A19A	10	147	28733	0.17	0.07	39%	--
MC73	12	60	11922	0.06	0.02	31%	--

A basin map showing the base infiltration results categorized by BI as a percent of ADDF is depicted as Figure 3.4.

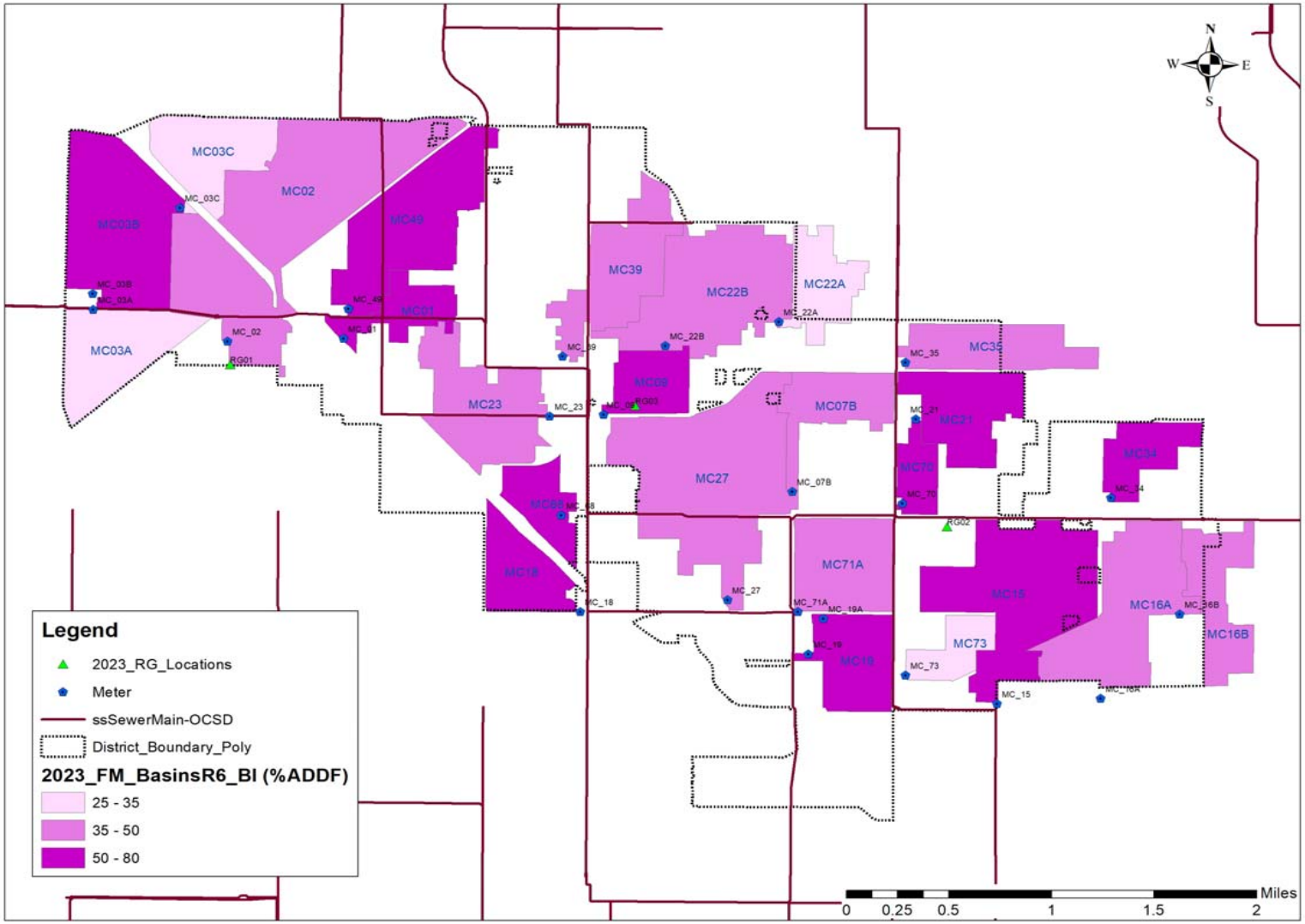
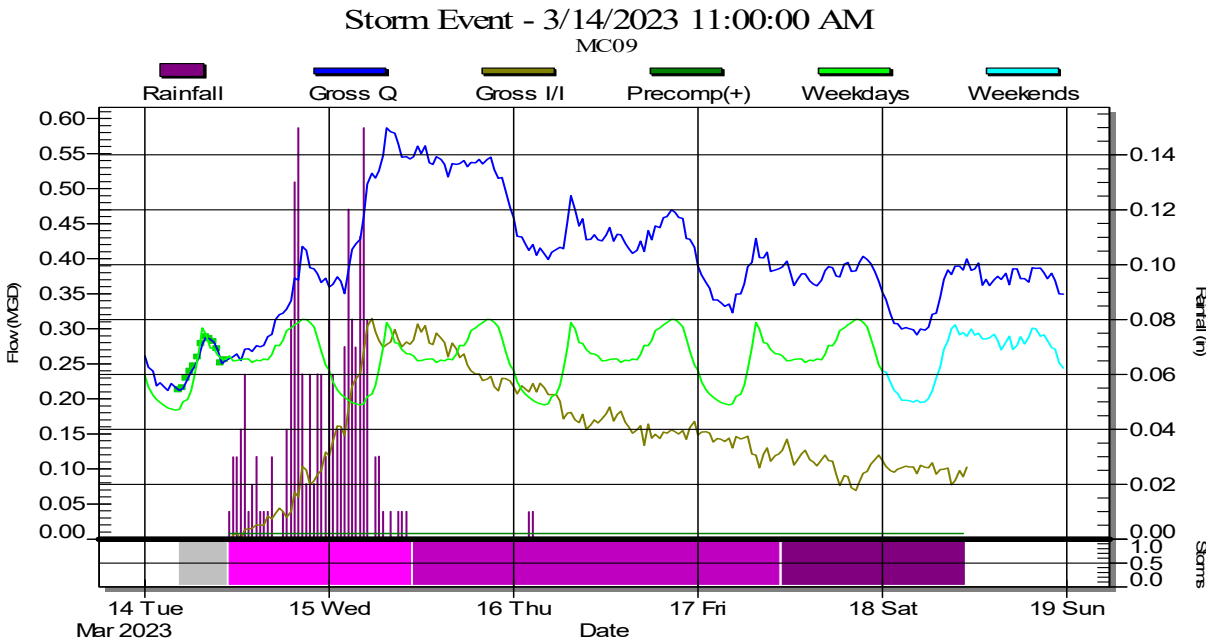


Figure 3.4 – Basin BI Performance Map

4 RDII ANALYSIS

An analysis was performed to determine the quantity of Rain Dependent Inflow and Infiltration (RDII) produced by each Basin in the study. The analysis involved subtracting the net Average Dry Day Flow (ADDF) from the actual net Wet Weather Flow (WWF) taking into consideration weekday or weekend flows and accounting for elevated flows immediately prior to a storm. Compensation for any pre-storm elevated flows is termed "precompensation" (or "Precomp" in Figure 4.1) and involves adjustment to the ADDF pattern (typically upward) so there is little difference between the ADDF pattern and actual flow pattern at the onset of the storm. The process of breaking down the hydraulic impact on a basin associated with only specific rainfall events is termed decomposition. The decomposition hydrograph for site/basin MC09 during the March 14, 2023 storm event is depicted in Figure 4.1.

Figure 4.1
Basin MC09 Decomposition Hydrograph



The RDII volume is determined by taking the difference between the basin's ADDF pattern and the actual measured flow (Gross Q in Figure 4.1); the difference being RDII (or Gross I/I in Figure 4.1). RDII volume is the summation of the Gross I/I volume over the duration of the storm event period. The hydrograph in Figure 4.1 shows that basin MC09 produced a significant gross RDII (or "Gross I/I") response during the actual rain period on March14/15 and for several days afterward. For MC09, the gross RDII (or "Gross I/I" in the above figure) represents only flow from its associated basin tributary. For cases where the net RDII for a basin is determined by subtraction of an upstream flow site (see Table 2.1), the hydrographs also show a "Net I/I" component.

In Figure 4.1, the small gray highlighted time period on March 14, prior to the storm period, is the period during which precompensation was determined for the site during this storm (very little upward adjustment to the ADDF pattern needed in this case). The light purple period is the storm period. The two darker purple periods following the storm period are the recovery periods R1 and R2. The entire period including storm and recovery periods is called the Event period. The entire Event period of each storm is used exclusively for evaluation of RDII in this study. Each of these periods is set at 24 hours in duration unless they are extended or reduced due to factors including longer storm or recovery periods, short duration to subsequent storms, and short duration from previous storms (reduced precompensation period). In this study, the total recovery period was extended to enable accumulating RDII volume associated with this storm by up to 3 days after the predominant rainfall ceased.

The RDII hydrographs for each basin during the evaluated storm events are included in Appendix A.

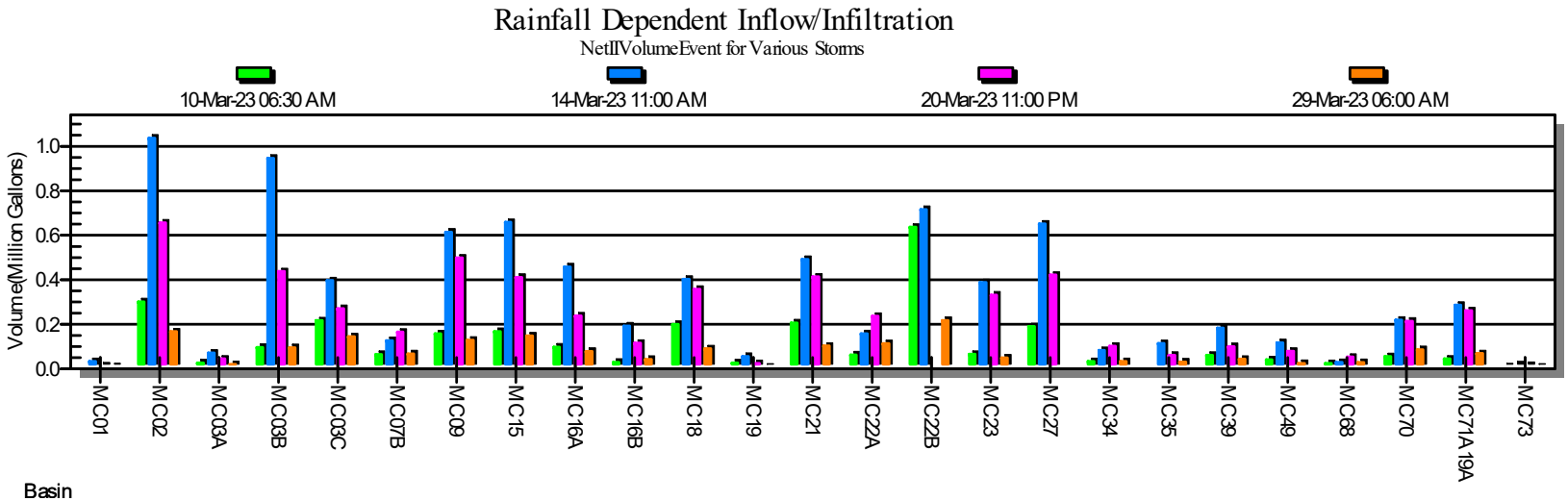
4.1 Net RDII Analysis

Net RDII from each basin was analyzed and quantified during each study period storm event and summarized in Table 4.1.

As expected, Table 4.1 indicates that the largest Storm Event 2 had the greatest impact in terms of sum of net RDII volume. The net RDII values are depicted graphically below in Figure 4.2. Since each basin size varies widely (from 5,878 LF of pipe in MC68 to 88,150 LF of pipe in MC02), the net RDII volumes largely represent the size of the basin and not necessarily the relative RDII severity. To enable comparison of RDII basin performance on a relative basis, the basin sizes need to be normalized either by basin area or pipe footage and also by amount of rainfall that fell in each basin as discussed in the following sections.

Table 4.1
Summary of Net RDII per Storm Event

Basin	Net RDII Storm Event 1 3/10/23 - 1.06" (mg)	Net RDII Storm Event 2 3/14/23 - 2.10" (mg)	Net RDII Storm Event 3 3/20/23 - 1.72" (mg)	Net RDII Storm Event 4 3/29/23 - 0.86" (mg)
MC01	0.00	0.03	0.01	0.01
MC02	0.30	1.04	0.66	0.17
MC03A	0.03	0.07	0.05	0.02
MC03B	0.10	0.95	0.44	0.10
MC03C	0.22	0.40	0.27	0.15
MC07B	0.07	0.13	0.17	0.07
MC09	0.16	0.62	0.50	0.13
MC15	0.17	0.66	0.41	0.15
MC16A	0.10	0.46	0.24	0.08
MC16B	0.03	0.19	0.12	0.04
MC18	0.20	0.40	0.36	0.09
MC19	0.03	0.06	0.02	0.01
MC21	0.21	0.49	0.41	0.10
MC22A	0.06	0.16	0.24	0.11
MC22B	0.64	0.72	n/a	0.22
MC23	0.07	0.39	0.33	0.05
MC27	0.19	0.65	0.42	n/a
MC34	0.03	0.08	0.10	0.03
MC35	0.00	0.11	0.06	0.03
MC39	0.06	0.18	0.10	0.04
MC49	0.04	0.12	0.08	0.03
MC68	0.02	0.03	0.05	0.03
MC70	0.06	0.22	0.22	0.09
MC71A19A	0.05	0.29	0.26	0.07
MC73	0.01	0.02	0.02	0.01
TOTAL	**2.82**	**8.45**	**5.52**	**1.81**



Basin	MC01	MC02	MC03A	MC03B	MC03C	MC07B	MC09	MC15	MC16A	MC16B	MC18	MC19	MC21	MC22A	MC22B	MC23	MC27	MC34	MC35	MC39	MC49	MC68	MC70	MC71A 19A	MC73
10-Mar-23 06:30 AM	0.00	0.30	0.03	0.10	0.22	0.07	0.16	0.17	0.10	0.03	0.20	0.03	0.21	0.06	0.64	0.07	0.19	0.03		0.06	0.04	0.02	0.06	0.04	0.01
14-Mar-23 11:00 AM	0.03	1.04	0.07	0.95	0.40	0.13	0.61	0.66	0.46	0.19	0.40	0.06	0.49	0.16	0.72	0.39	0.65	0.08	0.11	0.18	0.12	0.03	0.22	0.29	0.02
20-Mar-23 11:00 PM	0.01	0.66	0.05	0.44	0.27	0.17	0.50	0.41	0.24	0.12	0.36	0.02	0.41	0.24		0.33	0.42	0.10	0.06	0.10	0.08	0.05	0.21	0.26	0.02
29-Mar-23 06:00 AM	0.01	0.17	0.02	0.10	0.14	0.07	0.13	0.15	0.08	0.04	0.09	0.01	0.10	0.11	0.22	0.05		0.03	0.03	0.04	0.02	0.03	0.09	0.07	0.01

Figure 4.2 – Net RDII Volume from Each Basin

4.2 Q vs i diagrams

There is typically a relationship between rainfall during a storm event and net RDII volume in each Basin. This correlation between net RDII flows in each basin to rainfall can be depicted graphically and is termed a Q vs i (or RDII volume vs. rainfall volume) diagram. The Q vs i diagram for basin MC03C is presented in Figure 4.3.

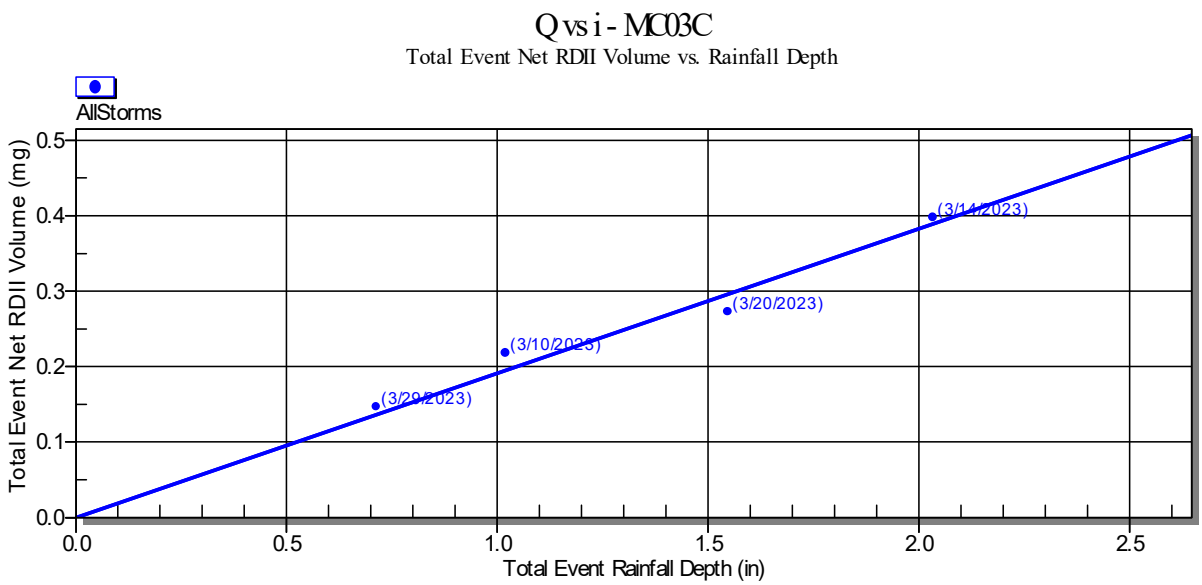


Figure 4.3 – Q vs i Diagram for Basin MC03C

The Q vs i data points describe the relation between RDII volume during a storm event and storm rain volume and serve as an indication of how “leaky” the basin is. In certain cases where the rainfall response in a basin is low, this relationship of increasing RDII with increasing rainfall may be less discernable than that illustrated above. A best fit trend line can then be fitted to the RDII volume and rainfall data points to yield a general rain-normalized RDII response in each basin. In each of the basins in this study, there was a fair to good linear relationship of increasing rainfall to increasing RDII volume on the Q vs i diagrams.

The linear relationship or projection in Figure 4.3 for MC03C indicates that 2.1 inches of rain would yield about 400,000 gallons of excess flow as RDII from this basin; or a rain-normalized projected response of about 190,000 gallons per inch of rain (i.e., the slope of the projection line). The Q vs i diagram can also be a useful tool for determining degree of success of rehabilitation efforts by comparing Q vs i projections before and after such rehabilitation is completed. Q vs i diagrams for each basin are included in Appendix A.

4.3 Normalized RDII Analysis

To enable a comparison of RDII between basins of differing sizes and rain volumes, the RDII for each basin can be normalized. This can be done by dividing each basin's net RDII value by rainfall to yield RDII in units of mg/inch-rain (normalized by rainfall) for each storm or as a projection of all storms as discussed in section 4.2. Then, this rain-normalized RDII can be divided by area of each basin (Acres) yielding RDII values in units of volume net RDII / volume rain (or %rainfall entering the basin collection system). Basin size normalization can also be done based on pipe footage (lineal feet) representing each basin, yielding RDII values in units of gallons of RDII per foot of pipe per inch of rain (or gal/Ft/in). This rain+size normalized evaluation allows a direct comparison of net RDII between basins using these common bases comparison. Charts of the rain+pipe-normalized (in units of gal/Ft/inch) net RDII and a chart of rain+area-normalized RDII (as % Rainfall Ingress) for each basin for each storm event are depicted as Figures 4.4 and 4.5, respectively, sorted high to low by the March 14 storm values.

Summing total RDII volumes (see Table 4.1) during the largest 2 storms for only the 8 basins exceeding 10 gal/Ft/in normalized RDII, those basins comprise nearly 50% of all RDII (and also BI) volumes measured. Yet, those same 8 basins only comprise about 27% of the monitored system by pipe footage. This suggests a significant benefit to prioritizing these basins for RDII source investigation and mitigation.

An alternate method of basin size normalization is to use the rain-normalized best fit trend line from each basin's Q vs i chart as discussed in section 4.2, then divide those slope values or projections by basin size in terms of pipe footage (also in performance units of gal/Ft/in projections). This yields a size-normalized projection of RDII response to enable direct comparison of basins.

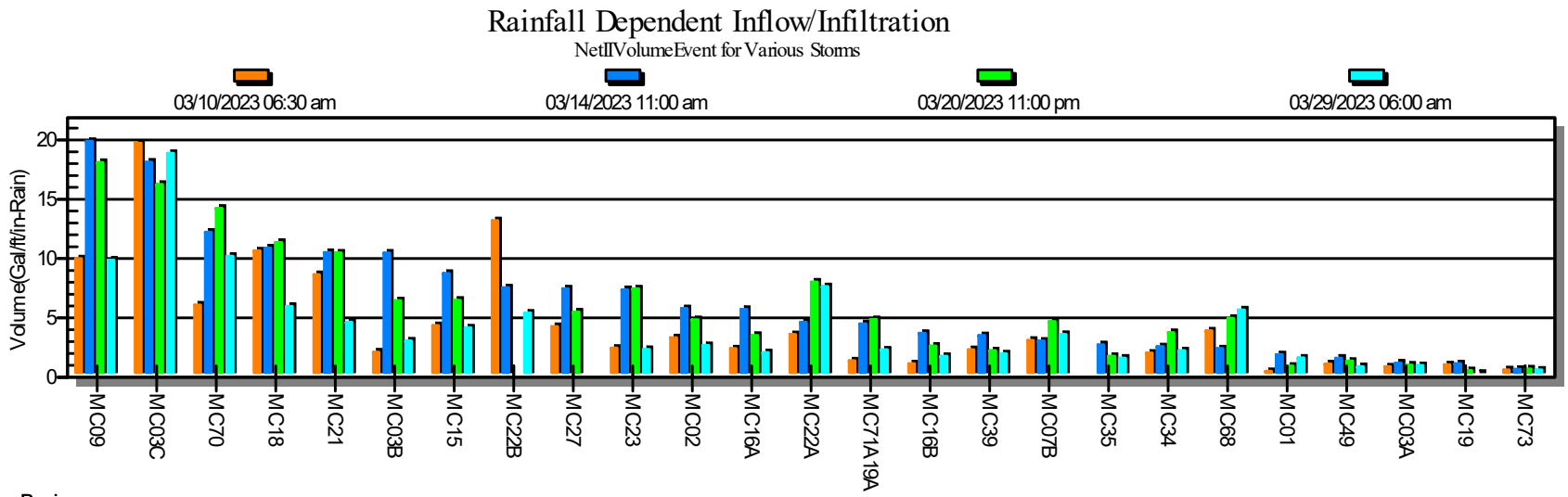
A basin color-map showing the RDII results categorized by pipe(footage)-normalized rainfall response projections is depicted as Figure 4.6. A wastewater generation rate of 5 gallons per day per foot of pipe is considered a reasonable average for a typical medium density residential area. Therefore, excess wet weather flow (RDII) that adds more than 5 gal/ft/in rain to the system suggests the value, 5, is a reasonable lower performance benchmark and values of 10 or more (i.e. adding more than double the normal wastewater generation rate per foot of pipe) would be considered excessive for RDII response.

An additional color-map is provided as Figure 4.7 depicting the area-normalized maximum value of %rainfall ingress recorded (refer to Figure 4.5) among all 4 storms. The color category values are somewhat arbitrary for this map, but based in part on apparent natural breaks in data in the GIS map environment.

A summary of footage-normalized projected RDII and area-normalized maximum values are provided in Table 4.2. Values of area normalized RDII (as %rainfall ingress) from 2003 are also summarized for reference for the same basins where applicable. In most cases, basin performance appears worse since 2003 based on this metric and may be partly attributed to the unusually heavy rain season experienced recently.

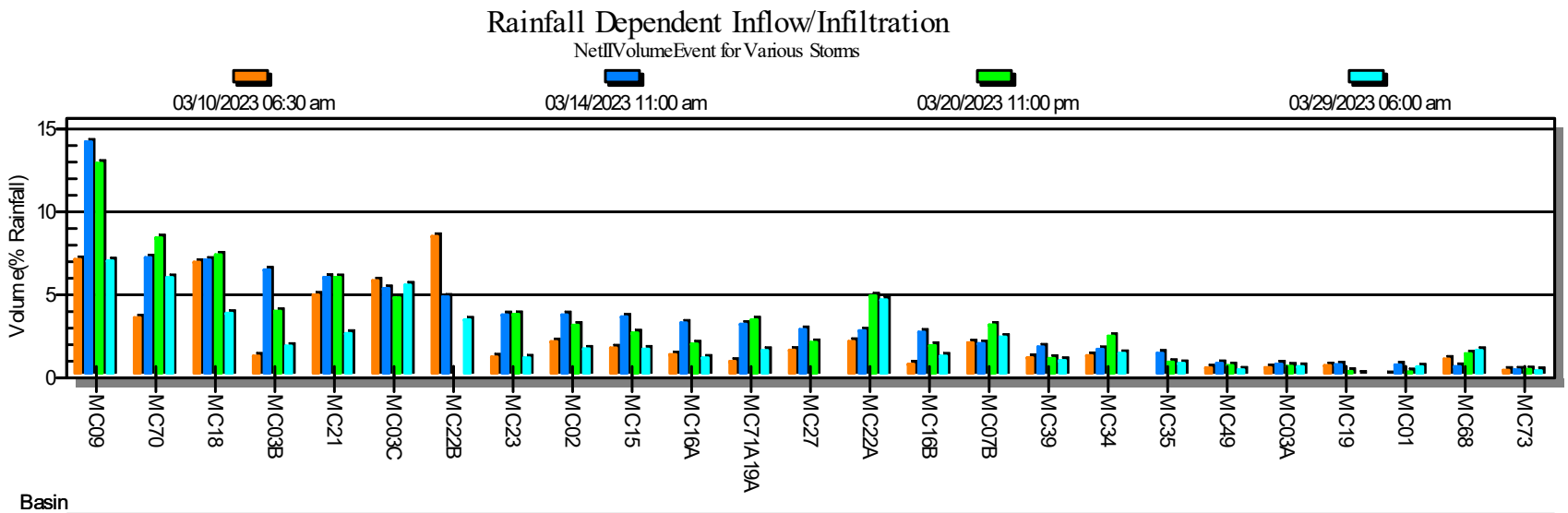
Table 4.2 - Basin RDII Performance Summary

Site/ Basin	Pipe Diameter (in)	Acres	Pipe Length (feet)	Net ADDF Weekday (mgd)	Net RDII Projection (gal/Ft/in)	Max Net RDII (%rain ingress)	Max Net RDII 2003 (%rain ingress)
MC01	8	75	8316	0.07	2.1	0.8	1
MC02	14	494	88150	0.73	7.6	3.8	0.8
MC03A	11	153	29270	0.19	1.3	0.8	0.5
MC03B	12	264	44555	0.25	14.8	6.5	1.3
MC03C	12	133	10740	0.19	17.8	5.9	--
MC07B	8	104	19266	0.15	3.7	3.2	0.3
MC09	11	78	15137	0.25	27.8	14.2	2.3
MC15	18	297	33772	0.93	12.3	3.7	1.9
MC16A	15	230	36259	0.42	8.1	3.3	1.1
MC16B	10	117	23704	0.14	5.4	2.8	--
MC18	10	101	17911	0.19	13.7	7.4	2.6
MC19	12	118	22271	0.31	1.3	0.8	0.5
MC21	8	135	21165	0.34	14.7	6.1	8.5
MC22A	13	97	16212	0.22	5.9	5.0	--
MC22B	12	261	45791	0.90	8.3	8.5	1.7
MC23	15	183	25594	0.28	11.8	3.8	0.9
MC27	18	396	42126	0.47	9.9	2.9	3.7
MC34	8	80	14526	0.14	3.7	2.5	0.6
MC35	8	128	19012	0.17	3.4	1.5	1.9
MC39	12	175	25237	0.42	4.0	1.9	0.8
MC49	8	239	35314	0.09	2.0	0.9	1.6
MC68	10	74	5878	0.09	3.7	1.7	0.2
MC70	8	50	8038	0.14	17.7	8.5	--
MC71A19A	10	147	28733	0.17	7.5	3.5	--
MC73	12	60	11922	0.06	0.8	0.5	--



Basin	MC09	MC03C	MC70	MC18	MC21	MC03B	MC15	MC22B	MC27	MC23	MC02	MC16A	MC22A	MC71A 19A	MC16B	MC39	MC07B	MC35	MC34	MC68	MC01	MC49	MC03A	MC19	MC73
03/10/2023 06:30 am	10.0	19.7	6.1	10.7	8.7	2.1	4.4	13.2	4.3	2.5	3.3	2.4	3.6	1.4	1.1	2.3	3.1		2.0	3.9	0.5	1.1	0.9	1.1	0.6
03/14/2023 11:00 am	19.9	18.1	12.3	10.9	10.5	10.5	8.8	7.6	7.5	7.4	5.8	5.7	4.6	4.5	3.7	3.5	3.1	2.7	2.6	2.4	1.9	1.6	1.2	1.1	0.7
03/20/2023 11:00 pm	18.1	16.3	14.3	11.4	10.5	6.5	6.5		5.5	7.5	4.9	3.5	8.0	4.9	2.6	2.2	4.7	1.8	3.8	5.0	0.9	1.4	1.0	0.6	0.7
03/29/2023 06:00 am	9.9	18.9	10.2	6.0	4.7	3.1	4.2	5.4		2.4	2.7	2.1	7.7	2.3	1.8	2.0	3.6	1.6	2.2	5.7	1.7	0.9	1.0	0.4	0.6

Figure 4.4 – Rain + Pipe Length Normalized Net RDII.



Basin	MC09	MC70	MC18	MC03B	MC21	MC03C	MC22B	MC23	MC02	MC15	MC16A	MC71A 19A	MC27	MC22A	MC16B	MC07B	MC39	MC34	MC35	MC49	MC03A	MC19	MC01	MC68	MC73
03/10/2023 06:30 am	7.1	3.6	7.0	1.3	5.0	5.9	8.5	1.3	2.2	1.8	1.4	1.0	1.7	2.2	0.8	2.1	1.2	1.4		0.6	0.6	0.7	0.2	1.2	0.5
03/14/2023 11:00 am	14.2	7.3	7.1	6.5	6.1	5.4	4.9	3.8	3.8	3.7	3.3	3.2	2.9	2.8	2.8	2.1	1.9	1.7	1.5	0.9	0.8	0.8	0.8	0.7	0.5
03/20/2023 11:00 pm	13.0	8.4	7.4	4.0	6.1	4.8		3.8	3.2	2.7	2.1	3.5	2.2	5.0	2.0	3.2	1.2	2.5	1.0	0.7	0.7	0.4	0.4	1.5	0.5
03/29/2023 06:00 am	7.1	6.0	3.9	1.9	2.7	5.6	3.5	1.2	1.8	1.8	1.2	1.7		4.7	1.3	2.5	1.1	1.5	0.9	0.5	0.7	0.2	0.7	1.7	0.5

Figure 4.5 – Rain + Basin Size Normalized Net RDII (% Rainfall Ingress).

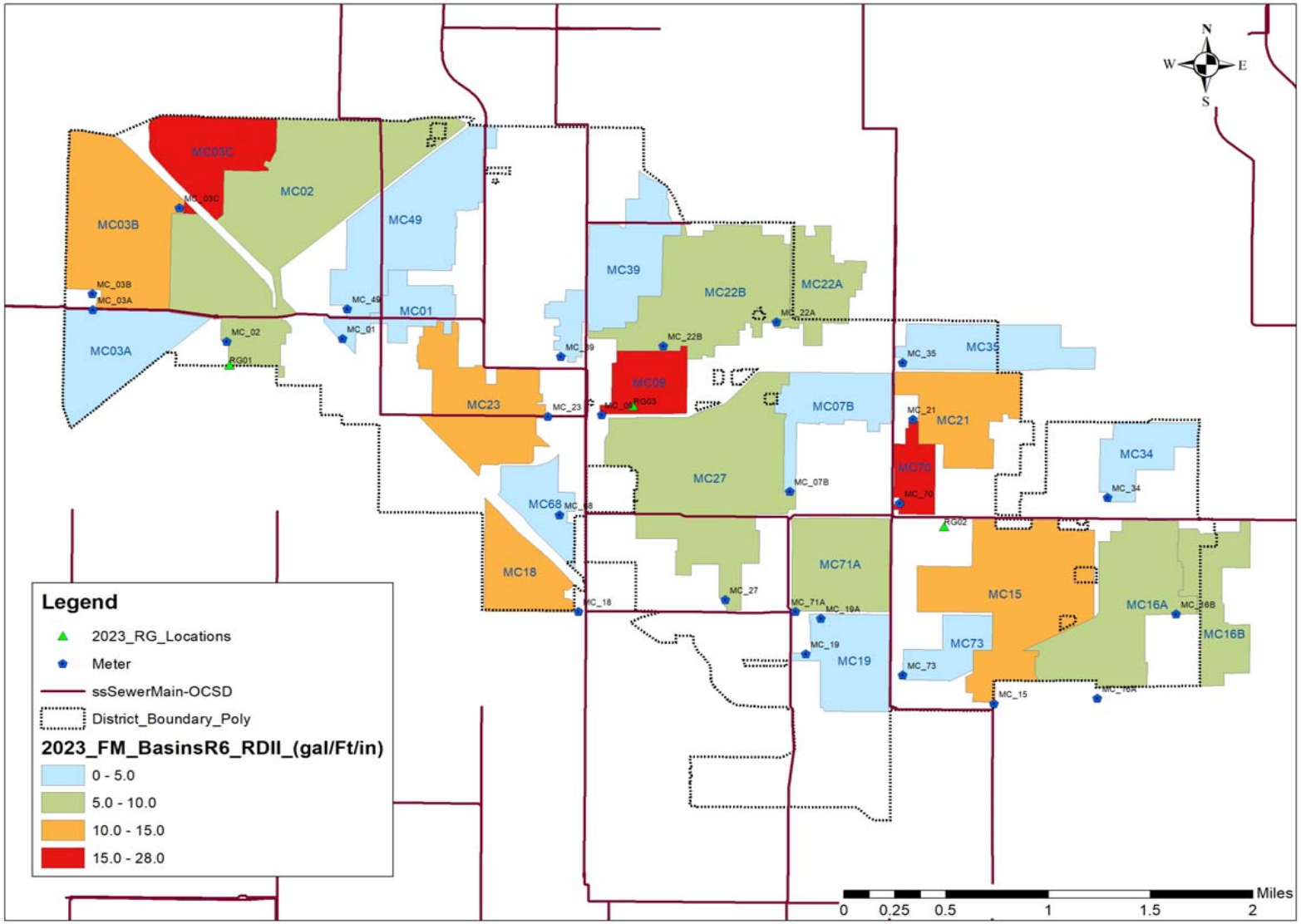


Figure 4.6 – Basin Normalized RDII Performance Map (Projected gallons/ Ft of pipe/ inch rain)

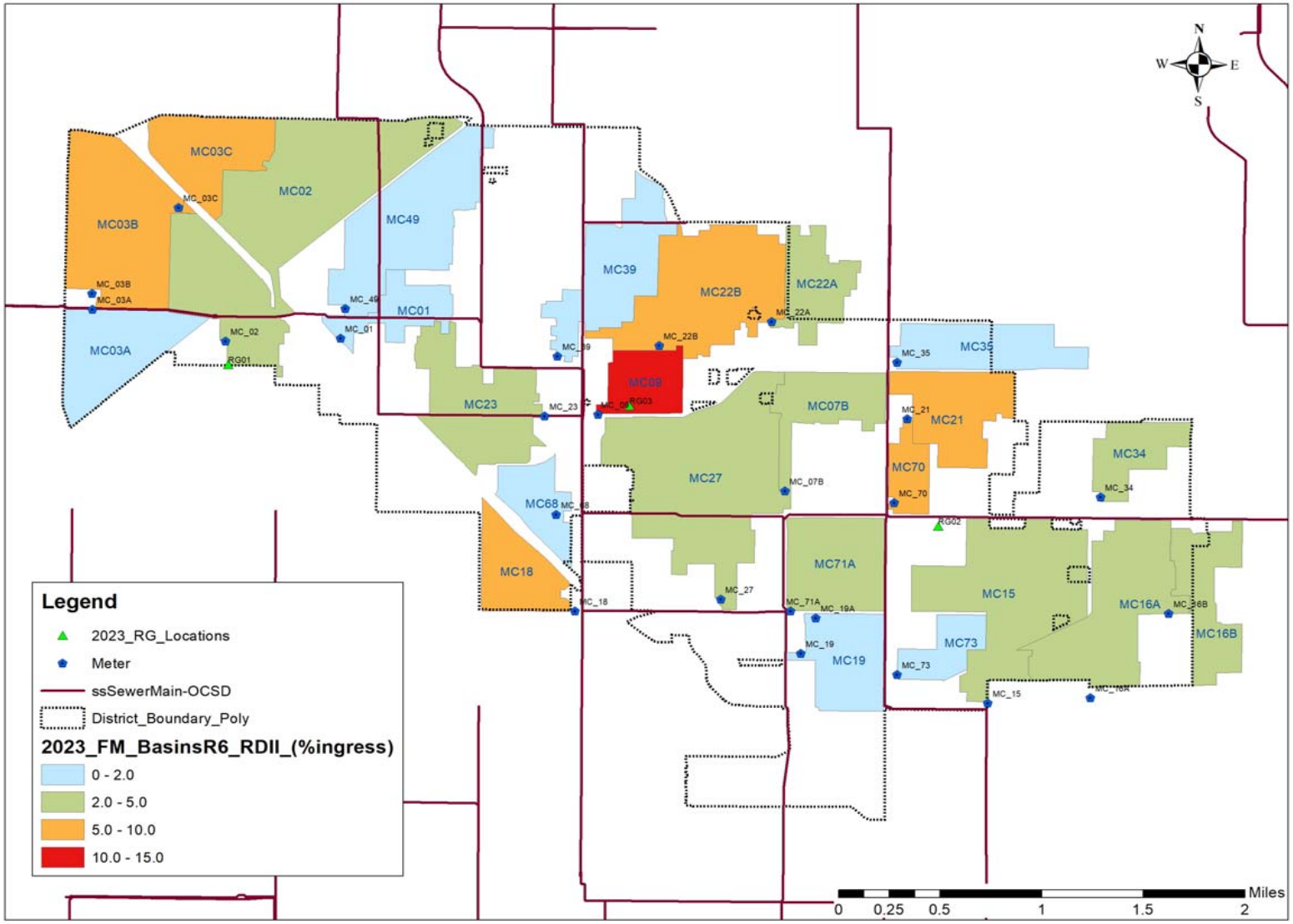


Figure 4.7 – Basin Normalized RDII Performance Map (Max recorded % Rainfall Ingress)

5 MONITORING SITE HYDRAULIC ANALYSIS

A hydraulic analysis was performed at each flow-monitoring site using gross flows to evaluate the pipeline hydraulic conditions at each flow monitoring site. The basis of this evaluation was to compare the ratio of depth-of-flow to the diameter (d/D) of the pipe throughout the study period and evaluate the pipes' dynamic hydraulic performance based on depth & velocity scattergraph analyses.

5.1 d/D Ratio Evaluation

Sewers are commonly designed to handle a depth-of-flow over Diameter-of-pipe (d/D) ratio of 0.5 (for pipe diameters less than 15 in.) to 0.75 at peak flows[2]. To illustrate this, the depth-of-flow hydrograph (hourly averaged data) for flow monitor site MC16B is shown in Figure 5.1.

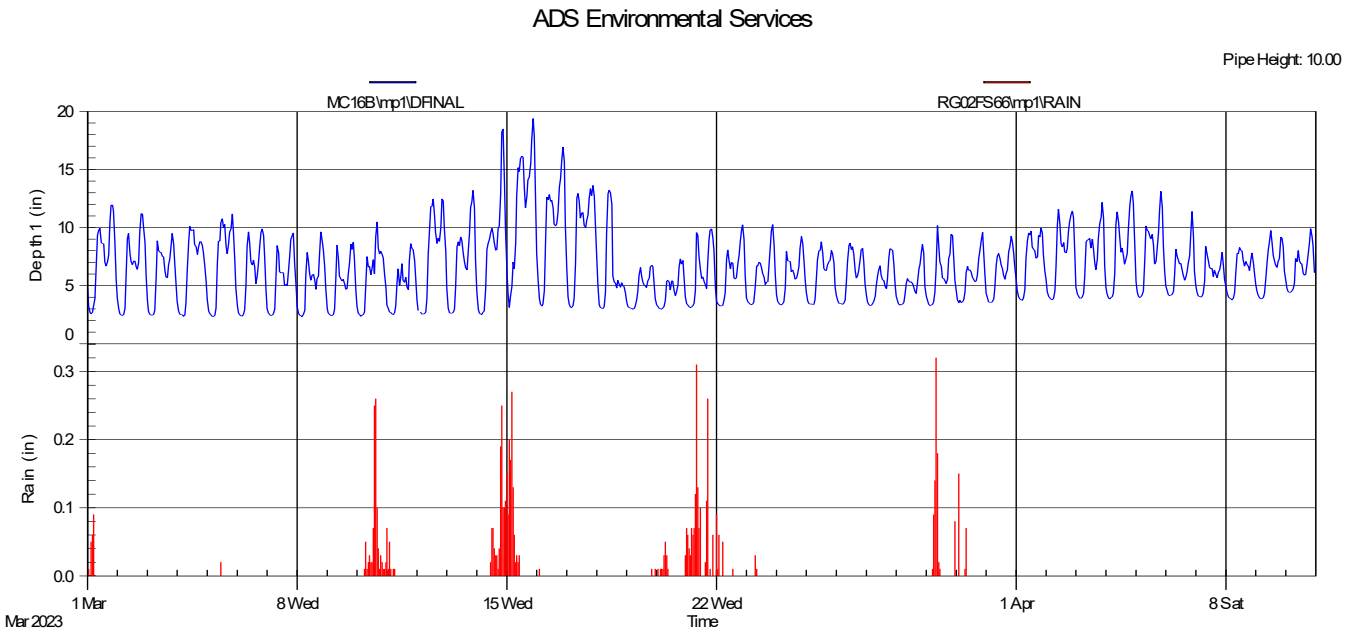


Figure 5.1 - Depth of Flow Hydrograph for Monitoring Site MC16B

The depth-of-flow hydrograph in Figure 5.1 shows that the pipe associated with the monitor at Site MC16B experienced surcharge conditions (>10") on several occasions, particularly following the March 14/15 storm event.

[2] Gravity Sanitary Sewer Design and Construction, 2nd Ed. WEF Manual of Practice FD-5, 2007.

The nominal dry-day peak and observed maximum peak d/D ratios were graphed for each pipeline associated with the monitors and is presented in Figure 5.2. A d/D ratio exceeding 1.0 means the pipeline was briefly in surcharge conditions with wastewater traveling up the manhole.

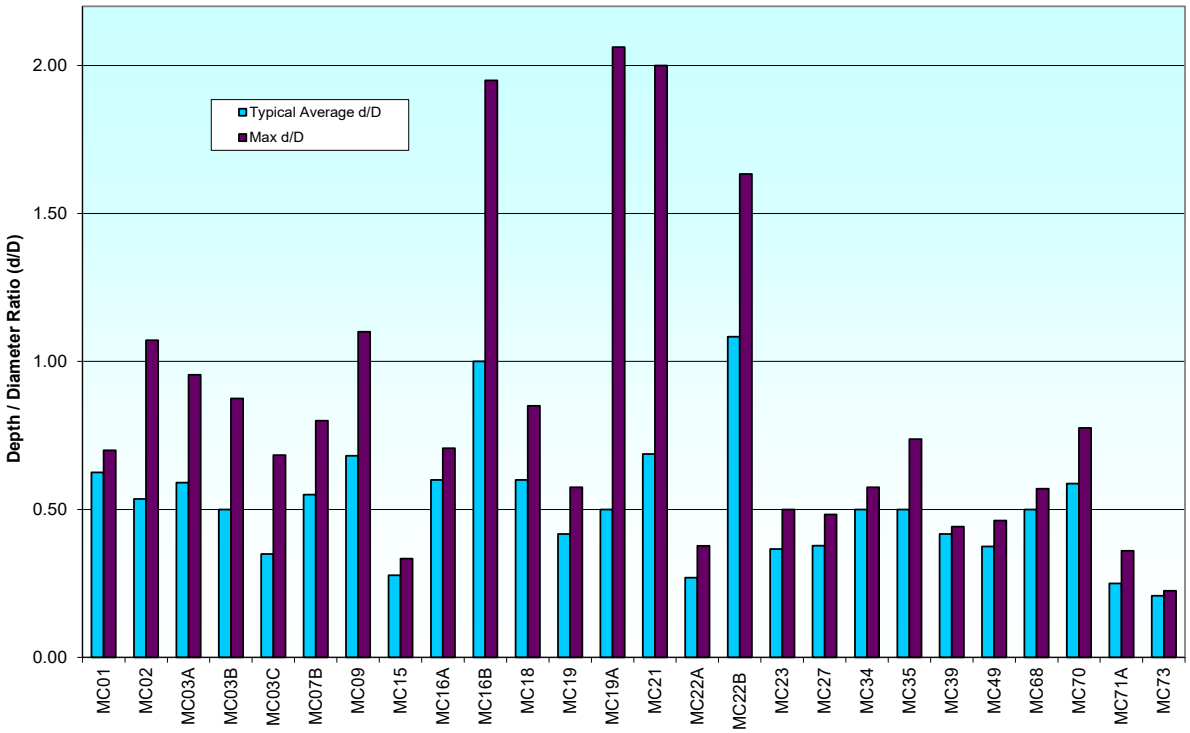


Figure 5.2 - d/D Ratio Vs Full Pipe

The daily peak d/D ratio exceeded 1.0 on at least one occasion at six (6) of the 26 monitoring sites: MC02, MC-09, MC16B, MC19A, MC21, and MC22B. The maximum peak surcharges generally occurred during the larger March 14 and March 21 storm periods. One site, MC22B, was surcharged daily for much of the day. The d/D ratios for each flow monitor location are summarized in Table 5.1.

5.2 Depth versus Velocity Scattergraph Analysis

The flow data for each basin monitor was reviewed for indications of possible hydraulically anomalous behavior caused by flow restrictions. This included a review of scattergraph plots of velocity versus depth data points that are instructive in identifying hydraulic anomalies such as backwater conditions (i.e. signs of downstream obstructions or restrictions).

The scattergraph for Site MC16B is depicted in Figure 5.3. In this data plot, the red curve (or pipe curve) depicts the pipe's theoretical flow depth vs. velocity relationship in ideal open channel flow conditions based on the Manning equation fitted to the actual data points collected from the meter (shown as the Lanfear-Coll or LC curve in the figure). The LC curve uses a Hydraulic Coefficient (C-LC) in place of pipe slope and roughness terms in the Manning equation. The C-LC term is then derived based on actual depth and velocity (free flow) data points. The series of curves extending to the right hand y-axis indicate lines of constant flow rate or Iso-Q lines.

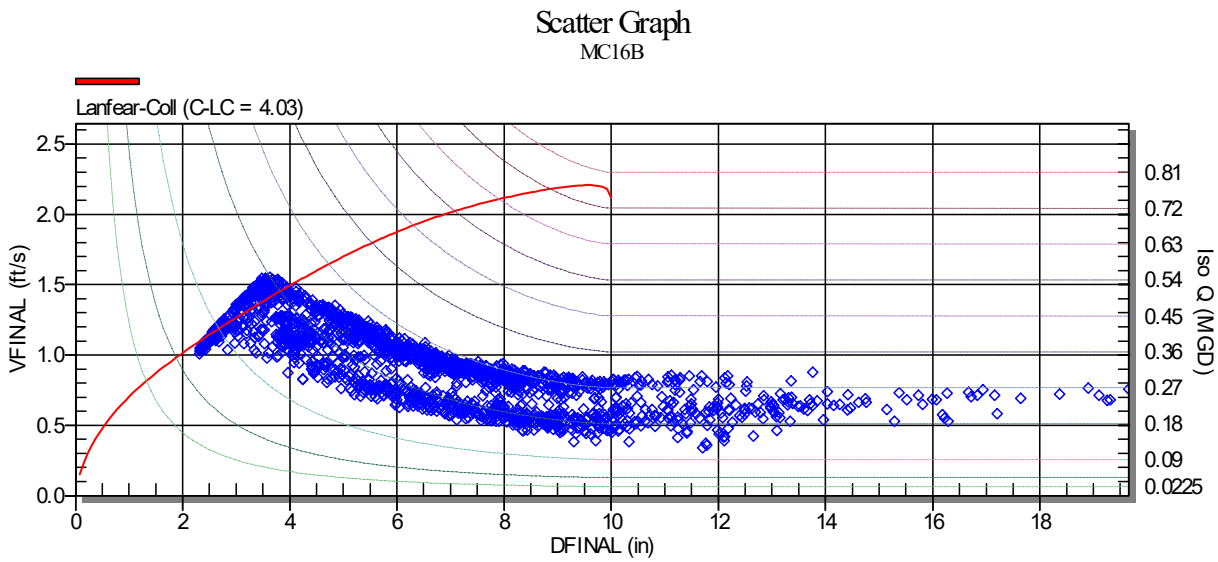


Figure 5.3 – Flow Depth vs. Velocity Scattergraph for Site MC16B

In Figure 5.3, the pipe curve indicates that the pipe would theoretically operate at a velocity (Vfinal on the graph) ranging from about 0 to about 2.2 ft/s from empty to full-pipe at a flow rate of 0 to about 0.75 mgd over the same span of flow depth from empty to full pipe (Dfinal on graph). This site shows the presence of backwater based on the pattern of departure from the pipe curve at depths greater than about 4 inches. This reduces effective capacity to about 0.27 mgd (backwater data follows close to the 0.27 mgd Iso-Q); caused by an apparent downstream system bottleneck. Table 5.1 includes a summary of pipe hydraulic performance based on d/D analysis and an examination of each site's scattergraph. The scattergraphs for each of the monitoring sites are included in Appendix A.

Table 5.1 - Pipe Hydraulic Performance Summary

Site ID	Pipe Diameter Height - (in)	Typical Peak Depth (in)	Max Hourly Peak Depth (in)	Typical Average d/D	Max d/D	Surcharge Notes (date/duration)	Hydraulic Comments based on scattergraph review
MC01	8	5.0	5.6	0.63	0.70		
MC02	14	7.5	15.0	0.54	**1.07**	March 15 for 1.5 hours	Regular backwater when > 8 inches depth
MC03A	11	6.5	10.5	0.59	0.95		Backwater noted during periods of rainfall
MC03B	12	6.0	10.5	0.50	0.88		Regular mild backwater noted
MC03C	12	4.2	8.2	0.35	0.68		Regular backwater when > 4 inches depth
MC07B	8	4.4	6.4	0.55	0.80		
MC09	11	7.5	12.1	0.68	**1.10**	March 21 for 5.5 hours	
MC15	18	5.0	6.0	0.28	0.33		
MC16A	15	9.0	10.6	0.60	0.71		
MC16B	10	10.0	19.5	**1.00**	**1.95**	Frequent surcharging, highest on March 15/16	Regular backwater when > 4 inches depth
MC18	10	6.0	8.5	0.60	0.85		
MC19	12	5.0	6.9	0.42	0.58		Mild backwater when > 4 inches depth
MC19A	8	4.0	16.5	0.50	**2.06**	Daily surcharging from March 21 to 31	
MC21	8	5.5	16.0	0.69	**2.00**	Surcharged continuously for much of March 15 to April 2	Mild backwater when > 3 inches depth
MC22A	13	3.5	4.9	0.27	0.38		
MC22B	12	13.0	19.6	**1.08**	**1.63**	Significant daily surcharging	
MC23	15	5.5	7.5	0.37	0.50		
MC27	18	6.8	8.7	0.38	0.48		
MC34	8	4.0	4.6	0.50	0.58		
MC35	8	4.0	5.9	0.50	0.74		Mild backwater when > 4 inches depth
MC39	12	5.0	5.3	0.42	0.44		
MC49	8	3.0	3.7	0.38	0.46		
MC68	10	5.0	5.7	0.50	0.57		
MC70	8	4.7	6.2	0.59	0.78		
MC71A	10	2.5	3.6	0.25	0.36		
MC73	12	2.5	2.7	0.21	0.23		

Notes:
1) Bold highlighted values in average d/D column are > or = 0.8. Bold highlighted values in Max d/D column are > or = 1.0
2) Diameter shown is based on field measurement rounded to nearest whole number.

6 CONCLUSIONS

6.1 Conclusions

The study was successful and excellent overall data uptime was achieved. The RDII performance in many of the basins evaluated was generally higher than typically desired and may contribute to capacity concerns in some areas of the system. The general nature of the RDII appears to be predominantly infiltration due to the extended number of days of elevated flow after storm events in the basins yielding higher RDII responses in addition to the fact that base infiltration (BI) is significant in many of the system basins.

As a general rule, basins that exhibit less than 5 gal/Ft/in as RDII are considered reasonably tight. Eight (8) basins exceeded 10 gallons of RDII per foot of pipe per inch of rain including, in order of ranked performance; MC09, MC03C, MC70, MC03B, MC21, MC18, MC15 and MC23. Summing the total RDII volumes during the largest 2 storms for those 8 basins yields nearly 50% of all RDII volumes from all the measured basins. Yet, those same 8 basins only comprise about 27% of the monitored system by pipe footage. This suggests a significant benefit to prioritizing these basins for RDII source investigation and mitigation.

The daily peak d/D ratio exceeded 1.0 on at least one occasion at six (6) of the 26 monitoring sites: MC02, MC-09, MC16B, MC19A, MC21, and MC22B. The maximum peak surcharges generally occurred during the larger March 14 and March 21 storm periods. One site, MC22B, was surcharged daily for much of the day.

Eight (8) of the flow monitoring locations exhibited backwater conditions on several occasions during the study period suggesting the presence of a downstream capacity bottleneck in the system at each of these locations: MC02, MC03A, MC03B, MC03C, MC16B, MC19, MC21, and MC35.

Eleven (11) basins exhibit excessive base infiltration (BI) in excess of 50% of the measured average dry day flow (ADDF). These are basins MC01, MC03B, MC09, MC15, MC18, MC19, MC21, MC34, MC49, MC68, and MC70.

6.2 Recommendations

Given the results of this study, ADS recommends the following:

- ADS recommends investigation of possible capacity issues (e.g. downstream bottlenecks) associated with sites MC02, MC03A, MC03B, MC03C, MC-09, MC16B, MC19, MC19A, MC21, MC22B and MC35. These sites are characterized by surcharges and/or noted backwater occurring during the study. For example, MC02 surcharging and backwater is likely the result of being immediately upstream of a pump station wet well (i.e. the gravity piping is being used for wastewater storage upstream of the pump station).

- Based on the results of the RDII analysis or rain impact within each basin, ADS

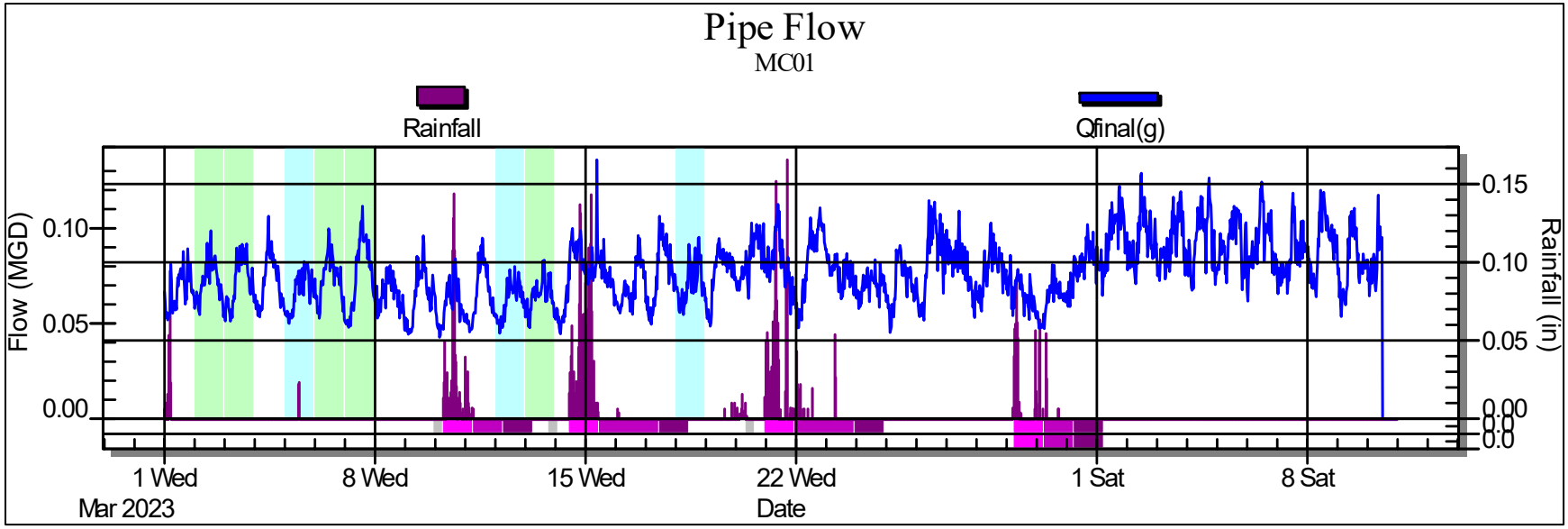
recommends Midway conduct Sanitary Sewer Evaluation Surveys (SSES) including manhole inspections and closed circuit television (CCTV) pipe inspections. This should be done for the eight (8) basins exceeding 10 gallons of RDII per foot of pipe per inch of rain including, in order of ranked performance; MC09, MC03C, MC70, MC03B, MC21, MC18, MC15 and MC23. Any CCTV inspections done should be during early morning hours (typical minimum wastewater flow periods) to get the most unobstructed view of the piping possible and enable recording of live infiltration (i.e. at various pipe joints or lateral connections and manhole joints).

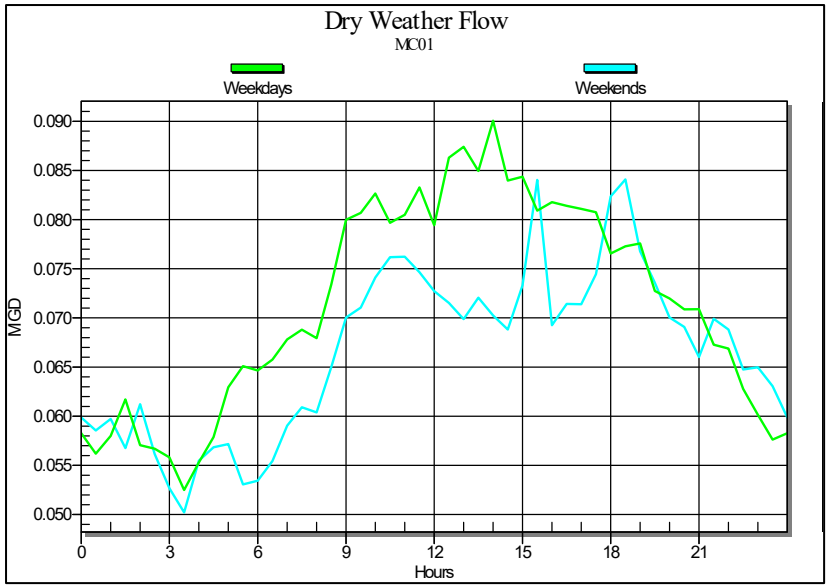
- Consideration should be given to collection system rehabilitation to reduce infiltration in some of the basins, particularly those where capacity issues are associated. This may include comprehensive lining of pipes, connections and manhole junctions.

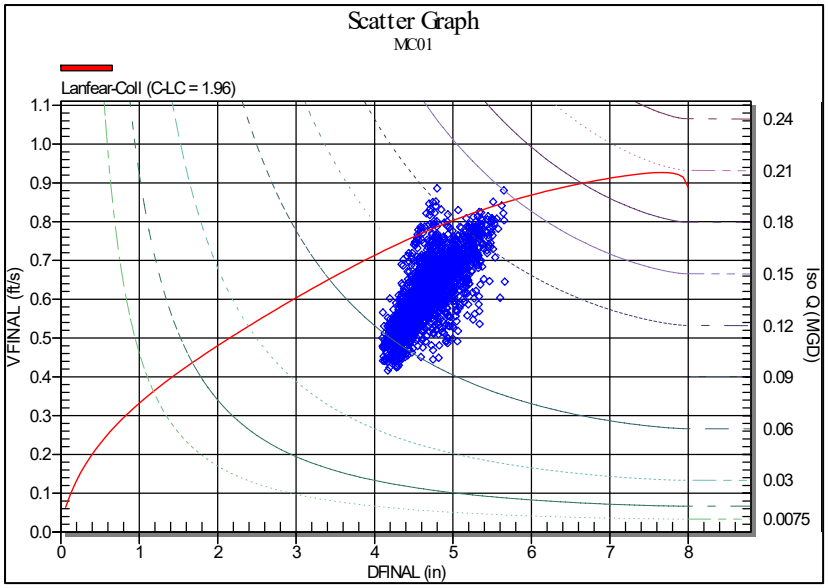
- Future follow up flow monitoring should be conducted to enable post-rehabilitation RDII reduction to be evaluated. A valid means to quantify such RDII reduction is to use a designated “control” basin as a comparator. For example, basins MC03B and MC03C show similarly poor normalized RDII performance. So, comprehensive lining could be conducted in the smaller MC03C basin, then relative improvement can be determined by comparing future concurrent RDII responses by directly comparing the MC03B basin (with no rehabilitation) to MC03C (with the lining) RDII performance.

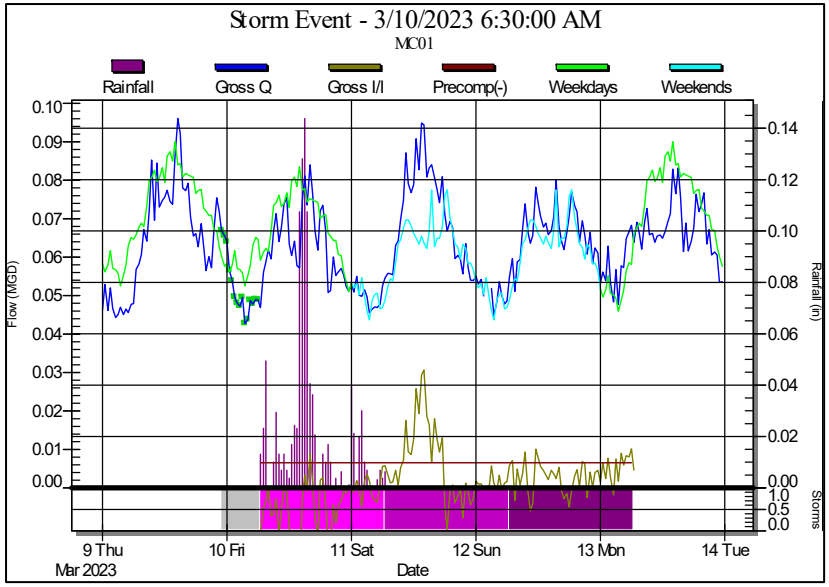
Appendix A

RDII Hydrographs, Dry Day Hydrographs, Scattergraphs, Storm Hydrographs and Q vs i Diagrams


Pipe Flow
MC01
Rainfall
Qfinal(g)
Flow (MGD)
0.10
0.05
0.00
0.15
0.10
0.05
0.00
0.0
Rainfall (in)
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat


Dry Weather Flow
MC01
Weekdays
Weekends
MGD
0.090
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0
3
6
9
12
15
18
21
Hours


Scatter Graph
MC01
Lanfear-Coll (C-LC = 1.96)
VFINAL (ft/s)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
5
6
7
8
DFINAL (in)
0.24
0.21
0.18
0.15
0.12
0.09
0.06
0.03
0.0075
Iso Q (MGD)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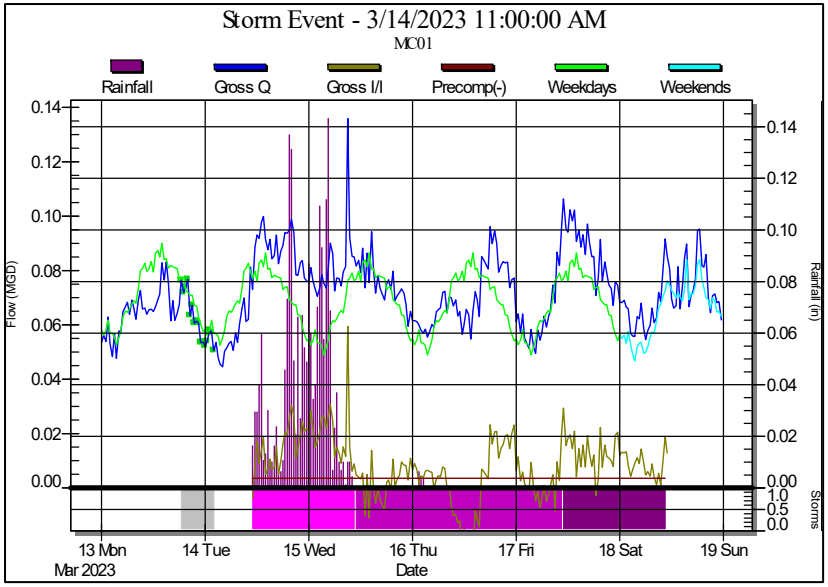
MC01
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date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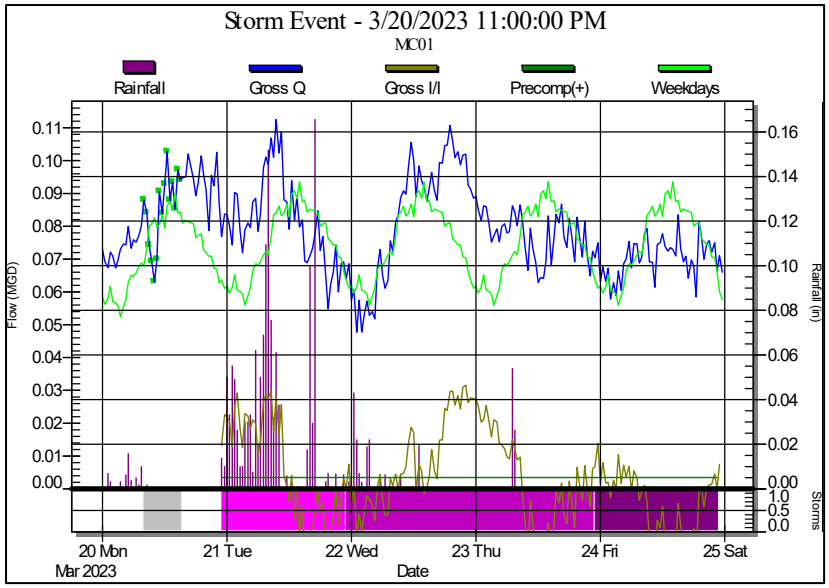
MC01
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date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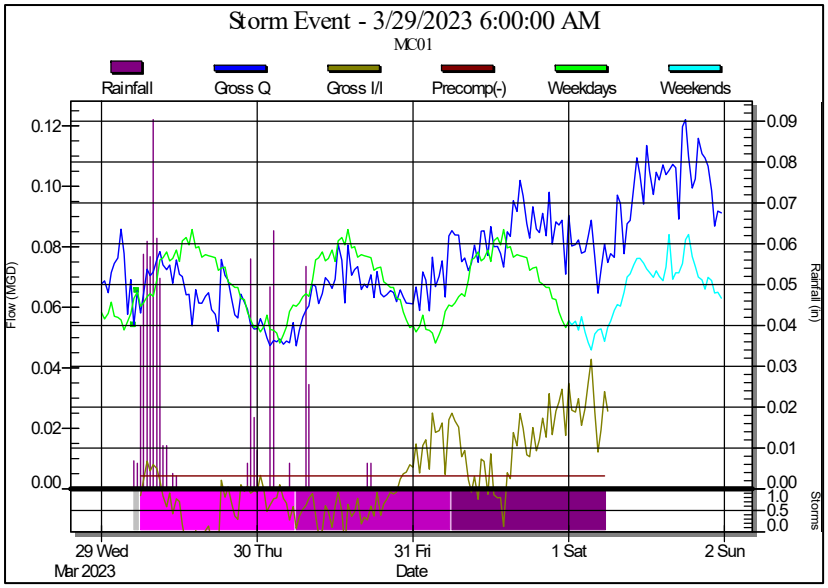
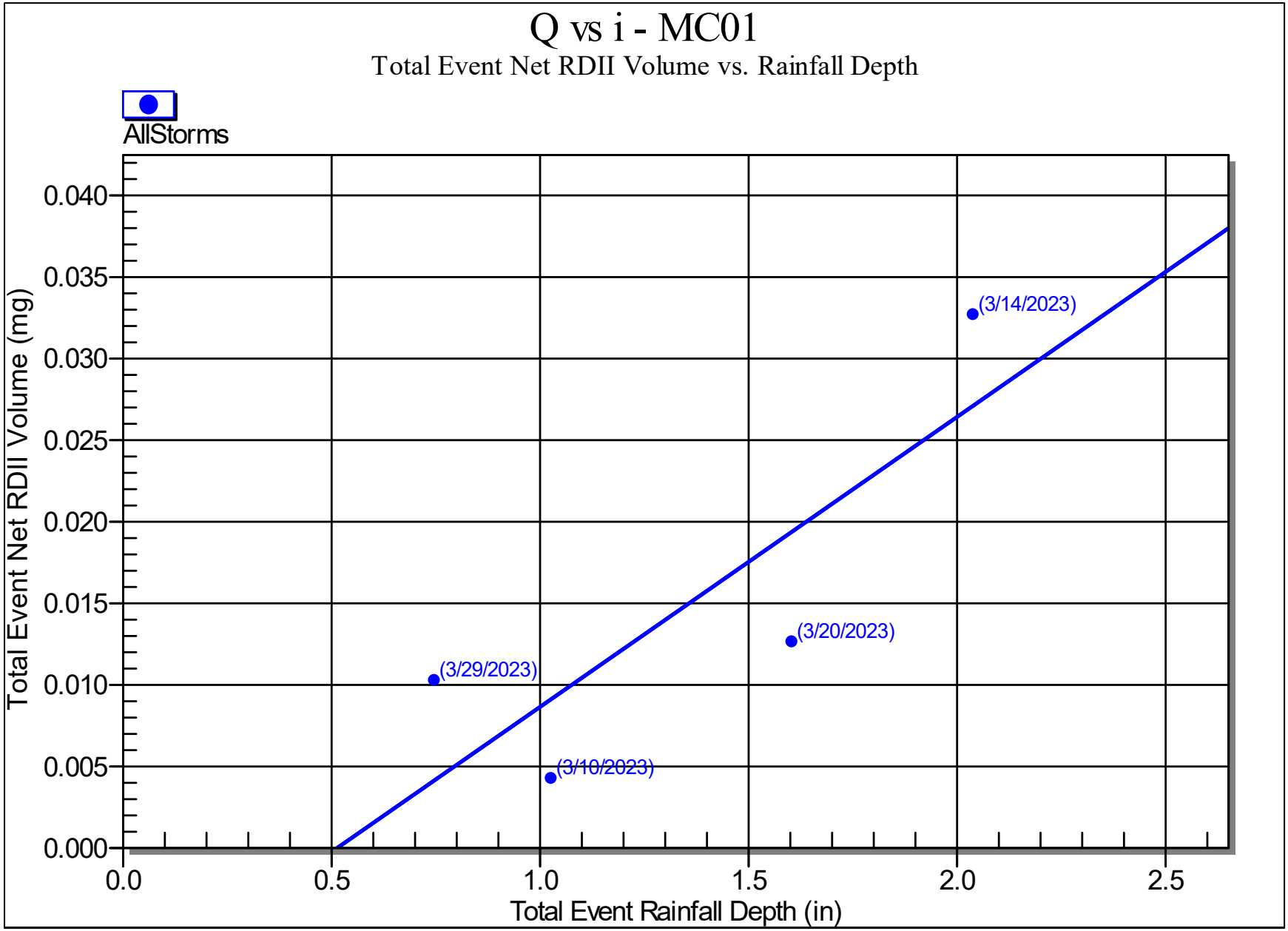
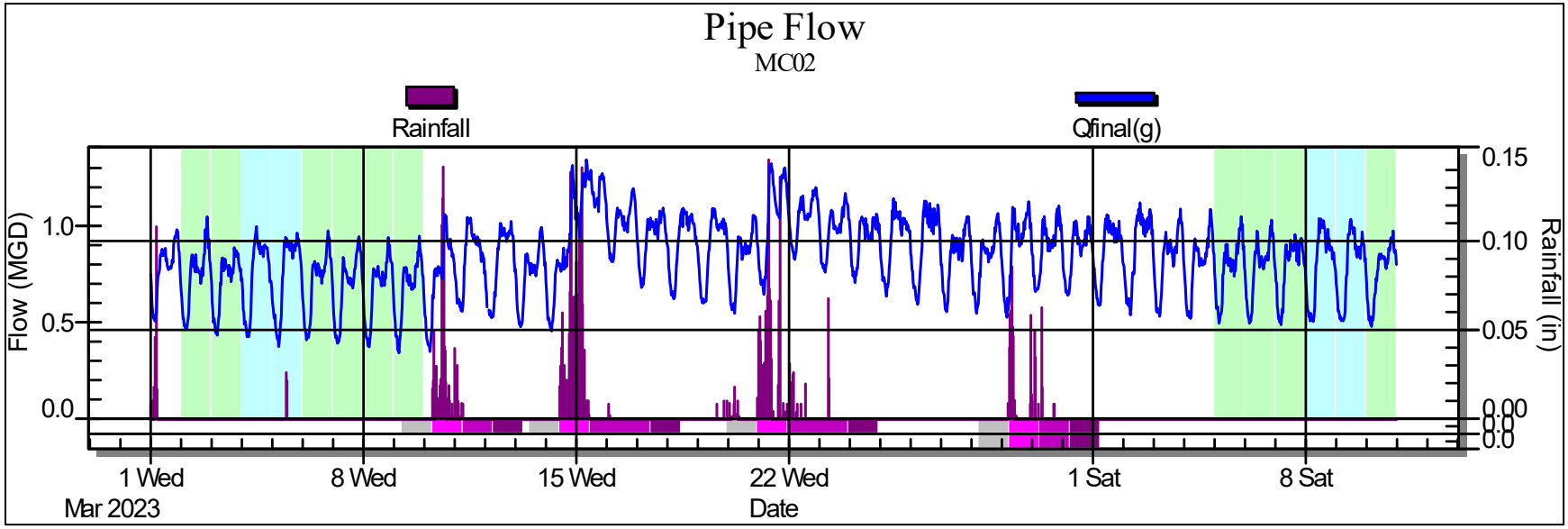
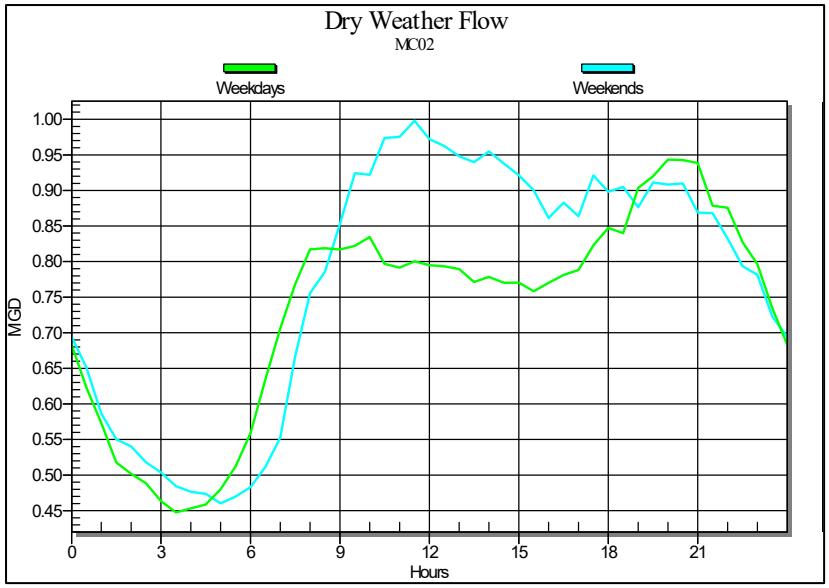
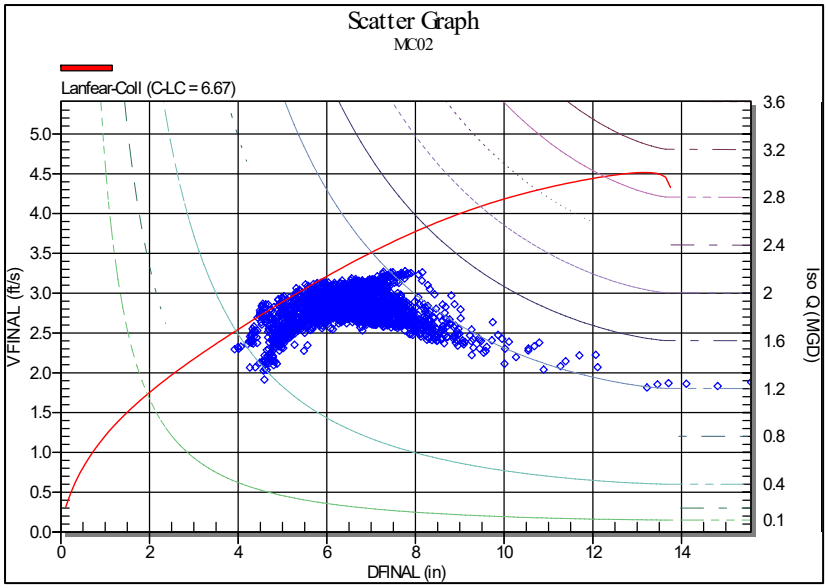
MC01
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Flow (MGD)
Rainfall (in)
Storms
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

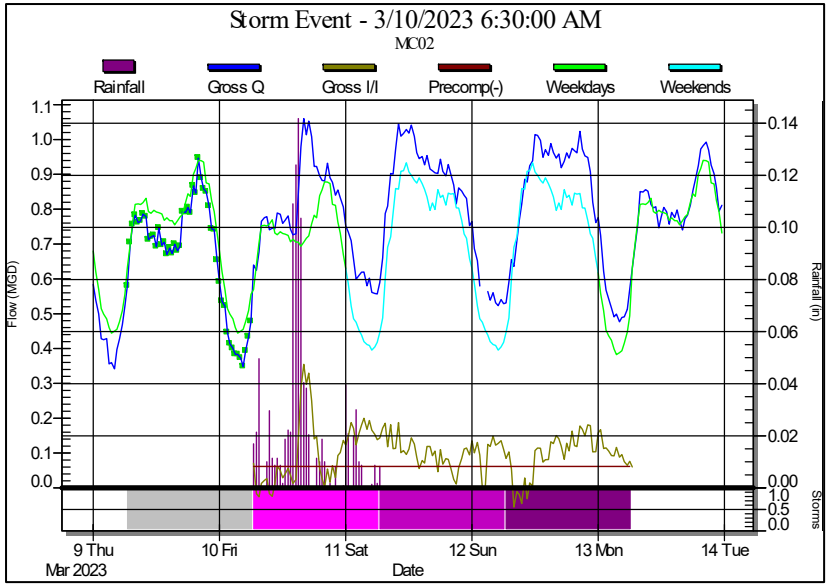

Storm Event - 3/29/2023 6:00:00 AM
MC01
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date


Q vs i - MC01
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/29/2023)
(3/10/2023)


Pipe Flow
MC02
Rainfall
Qfinal(g)
Flow (MGD)
1.0
0.5
0.0
0.15
0.10
0.05
0.00
Rainfall (in)
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat


Dry Weather Flow
MC02
Weekdays
Weekends
MGD
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0
3
6
9
12
15
18
21
Hours


Scatter Graph
MC02
Lanfear-Coll (C-LC = 6.67)
VFINAL (ft/s)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
DFINAL (in)
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0.1
Iso Q (MGD)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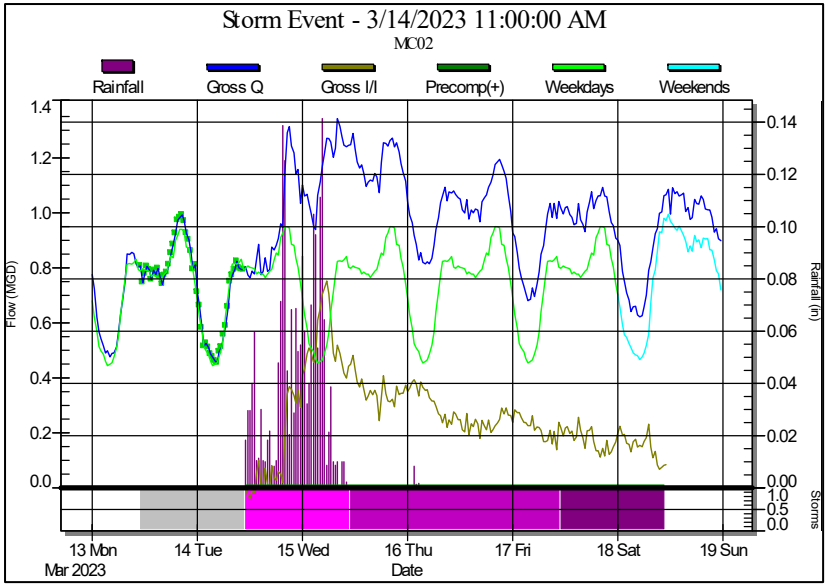
MC02
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date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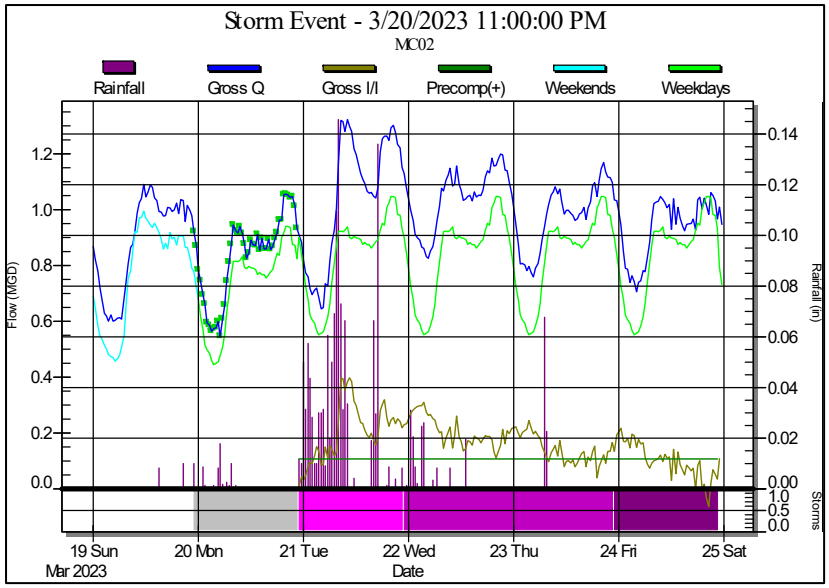
MC02
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date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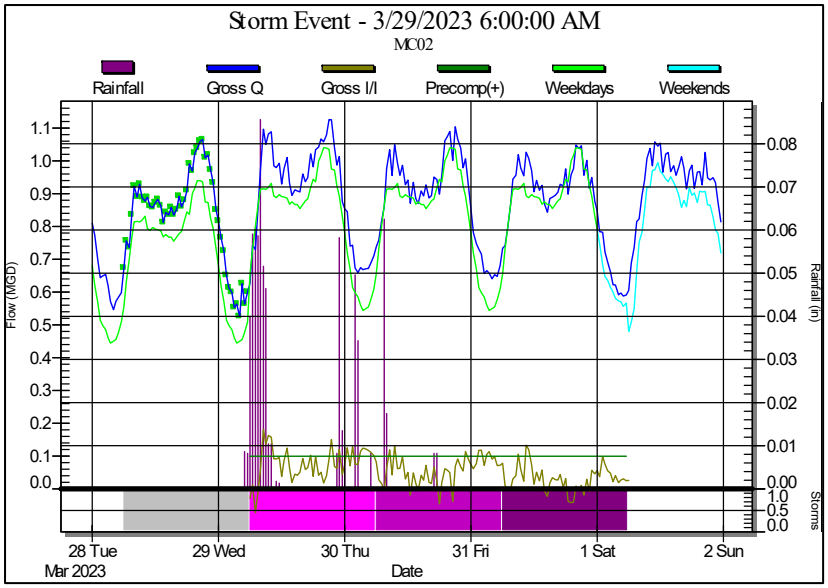
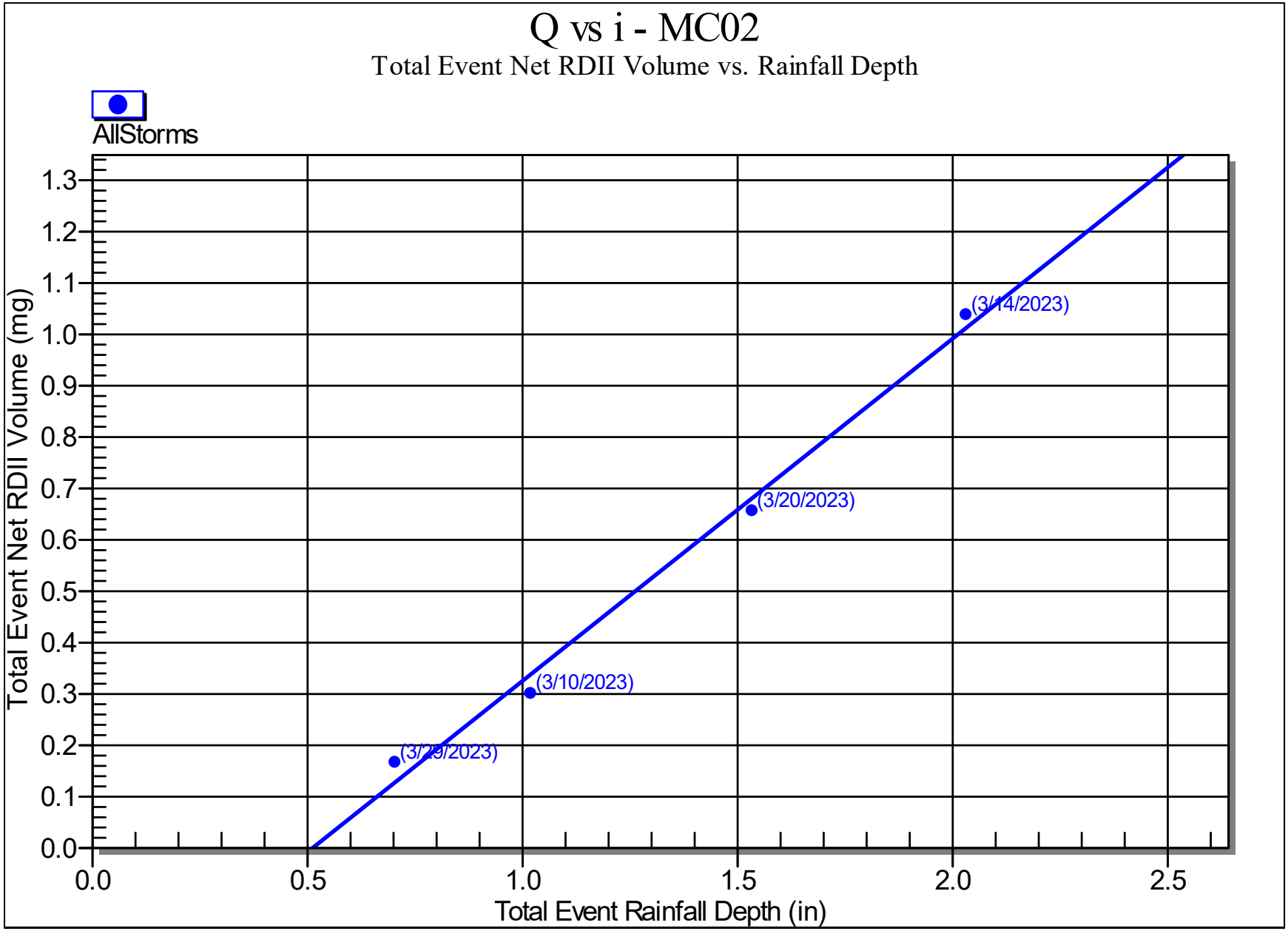
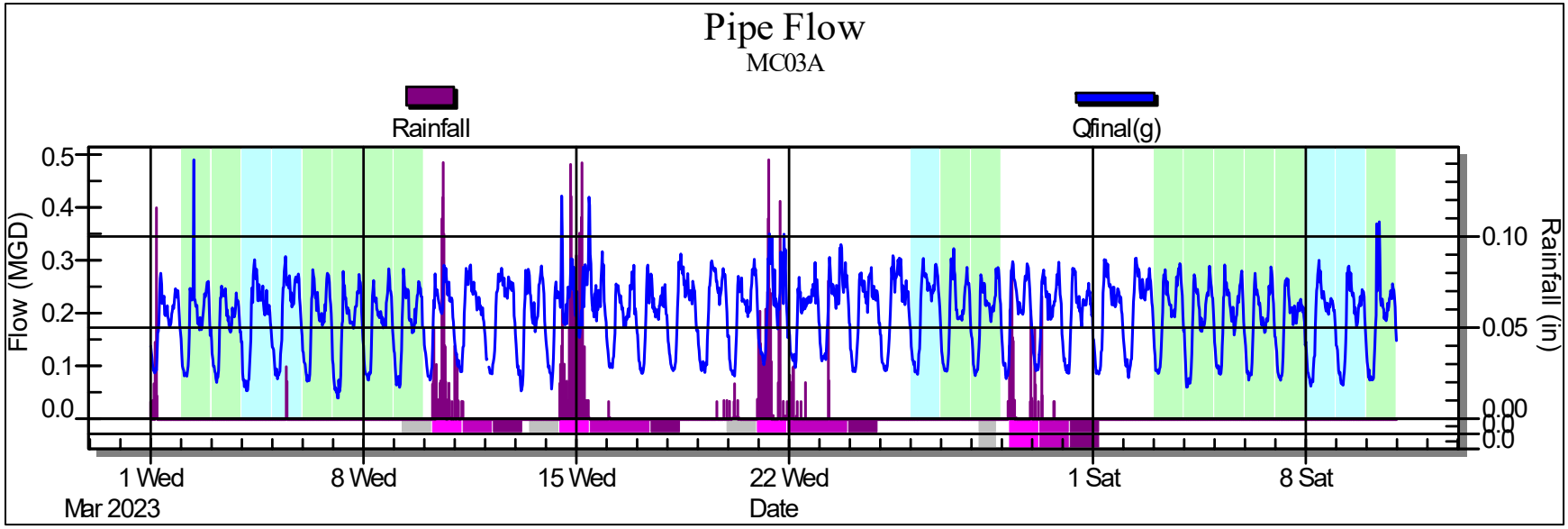
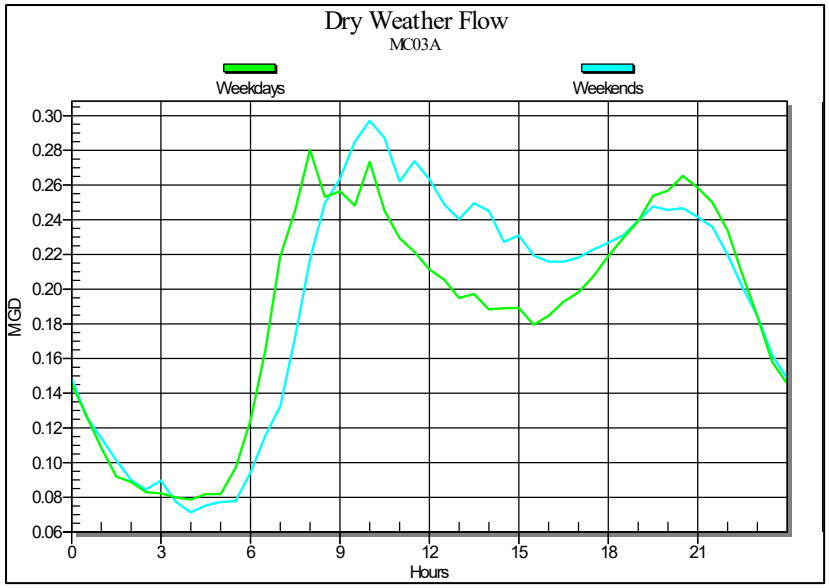
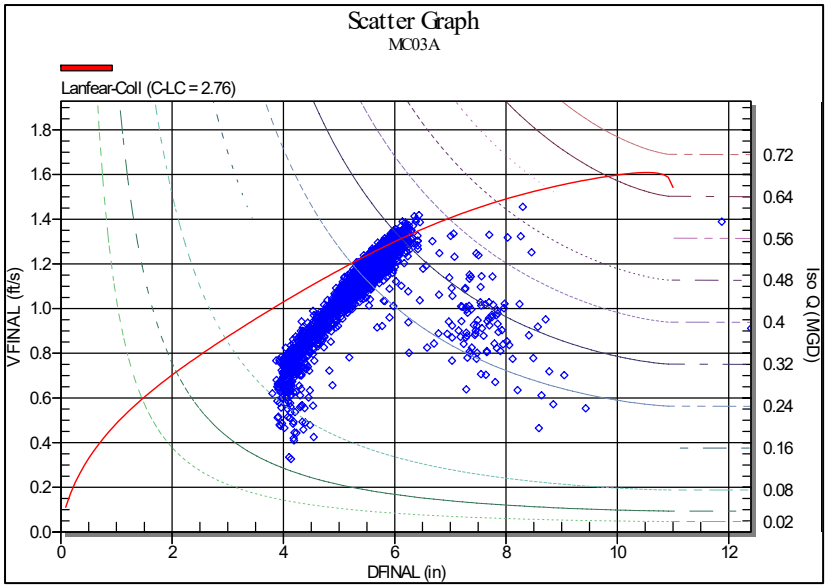
MC02
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

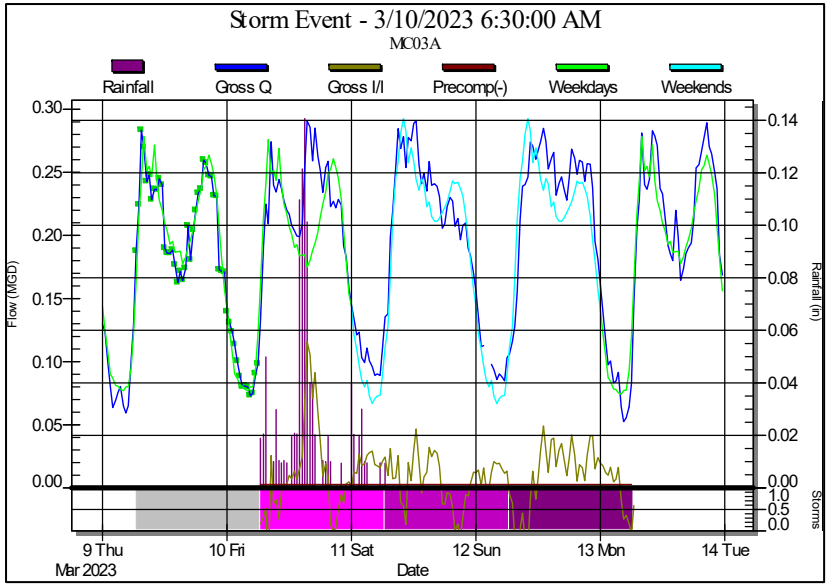

Storm Event - 3/29/2023 6:00:00 AM
MC02
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

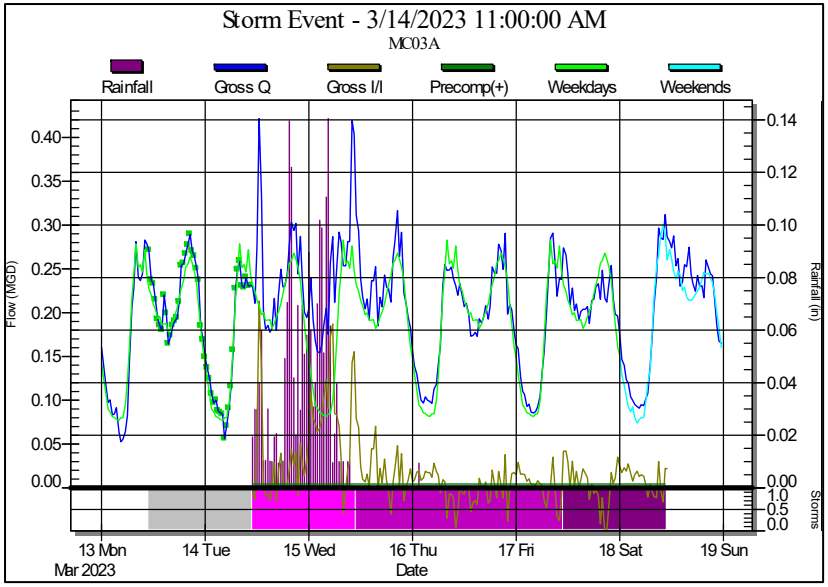

Q vs i - MC02
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
Total Event Rainfall Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
0.0
0.5
1.0
1.5
2.0
2.5
(3/29/2023)
(3/10/2023)
(3/20/2023)
(3/14/2023)

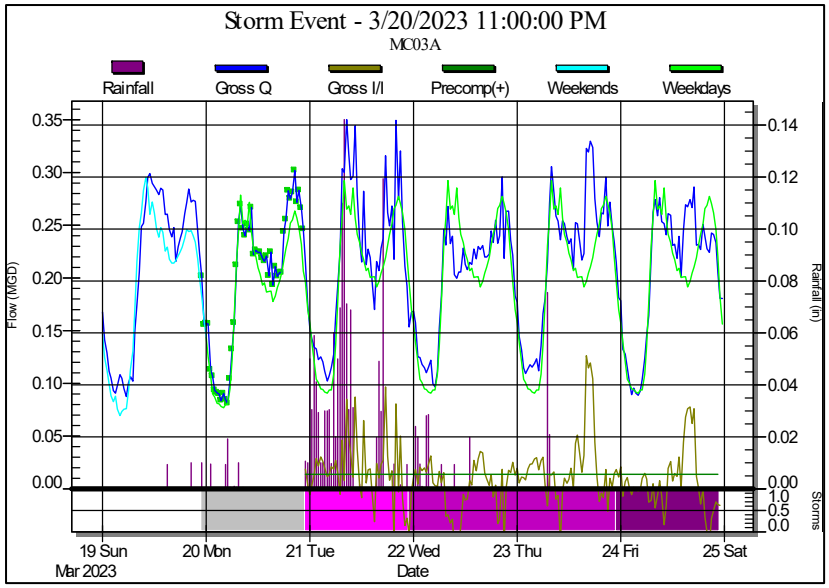

Pipe Flow
MC03A
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.5
0.4
0.3
0.2
0.1
0.0
0.10
0.05
0.00
1 Wed
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Mar 2023
Date


Dry Weather Flow
MC03A
Weekdays
Weekends
MGD
Hours


Scatter Graph
MC03A
Lanfear-Coll (C-LC = 2.76)
VFINAL (ft/s)
DFINAL (in)
Iso Q (MGD)


Storm Event - 3/10/2023 6:30:00 AM
MC03A
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date


Storm Event - 3/14/2023 11:00:00 AM
MC03A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date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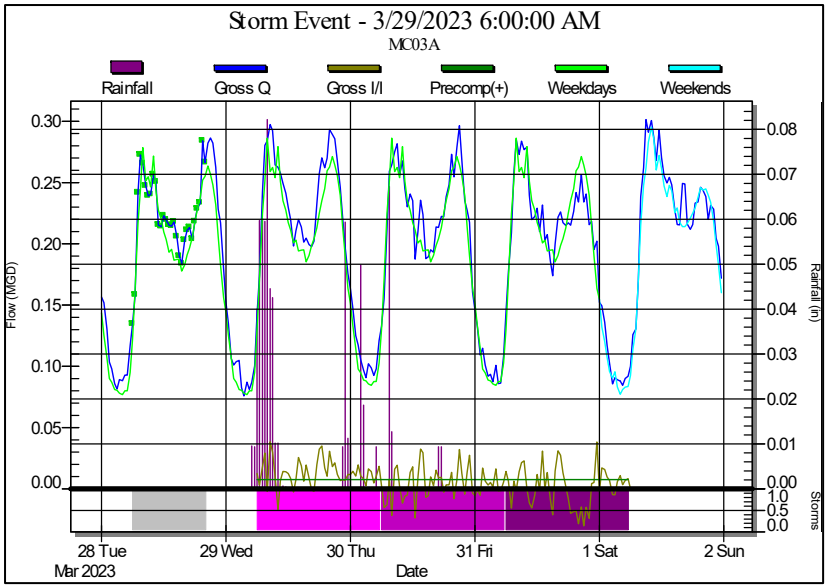
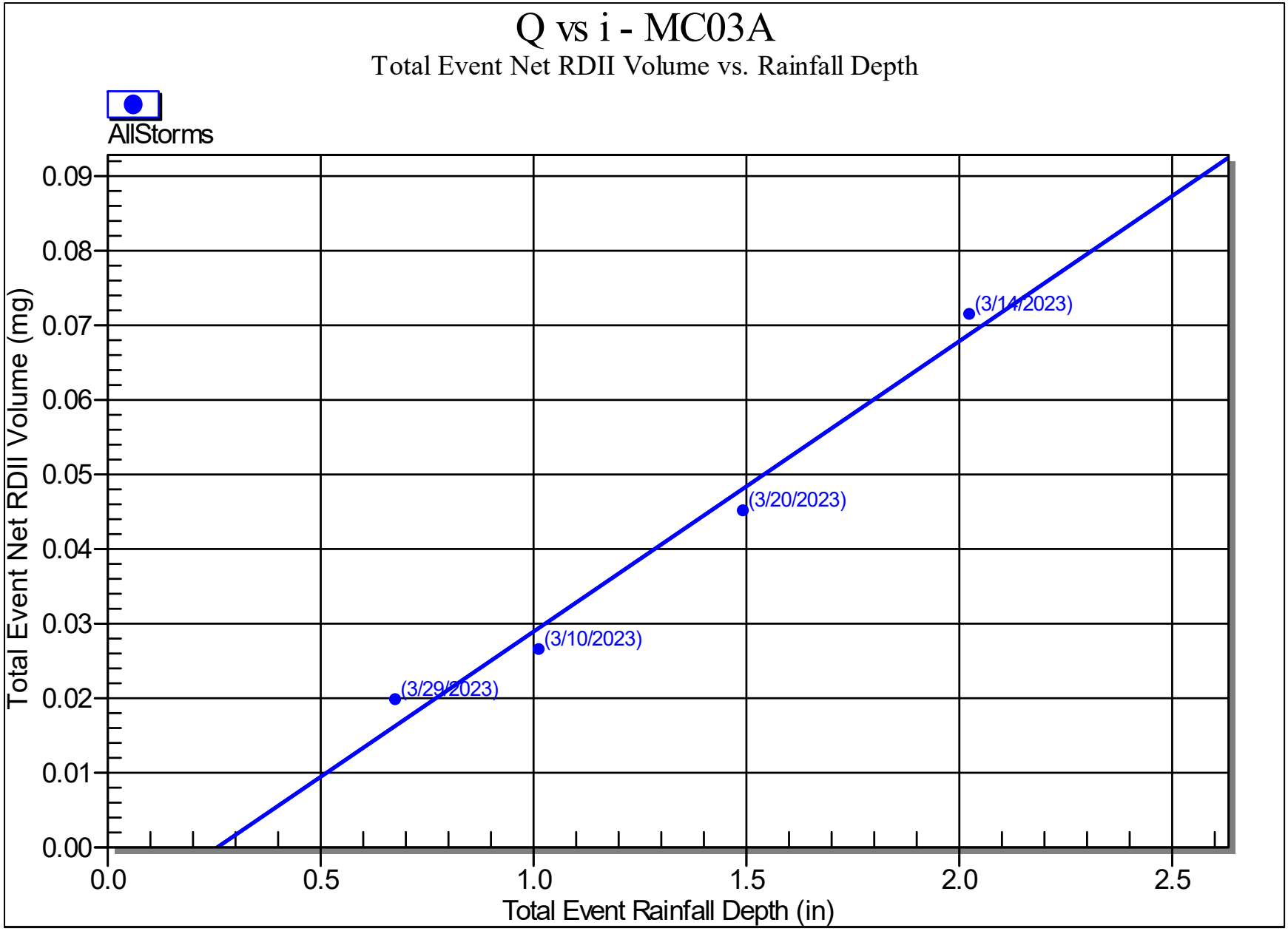
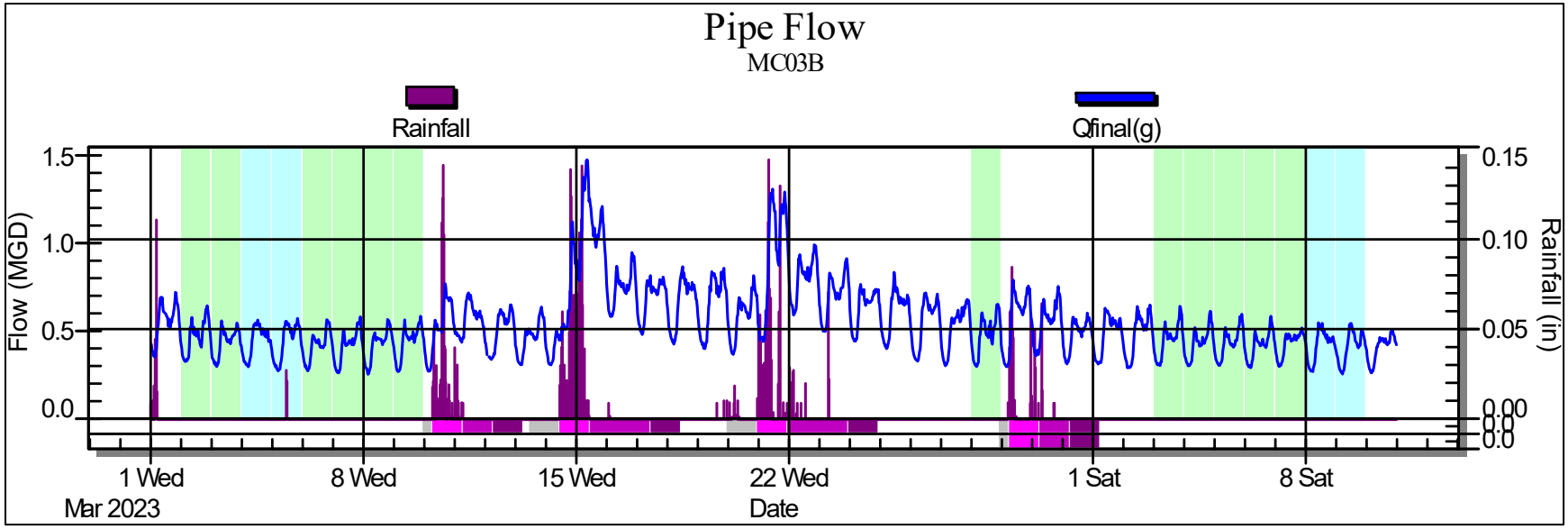
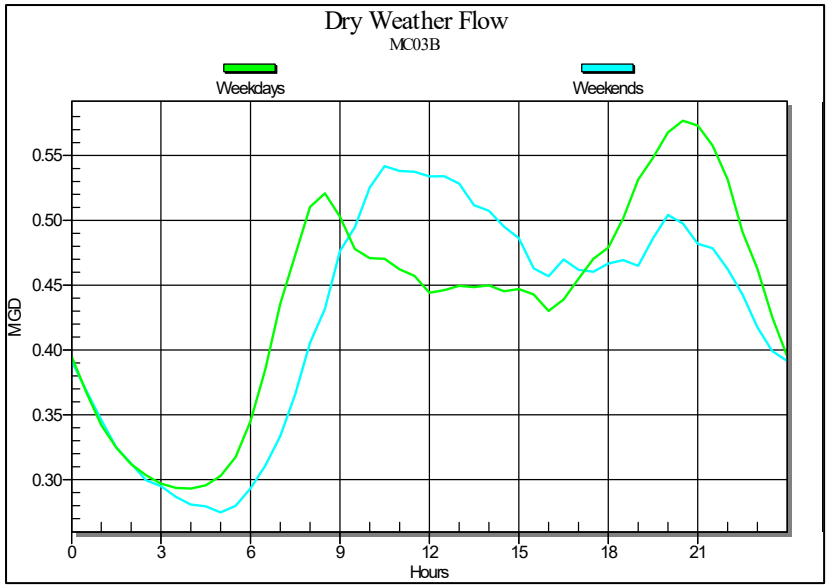
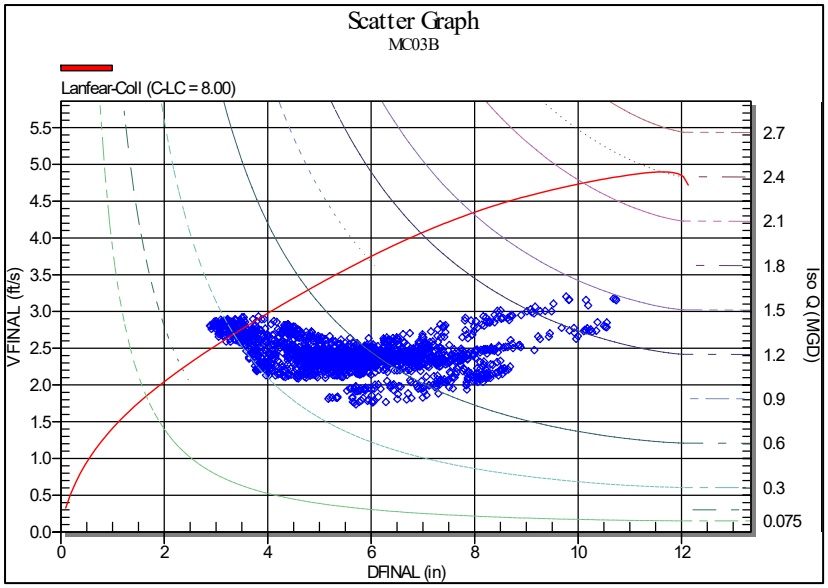
MC03A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

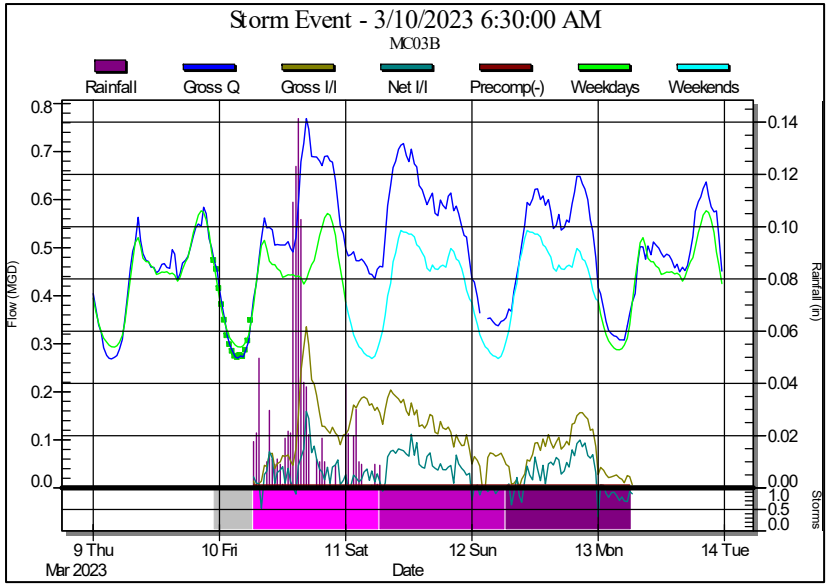

Storm Event - 3/29/2023 6:00:00 AM
MC03A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

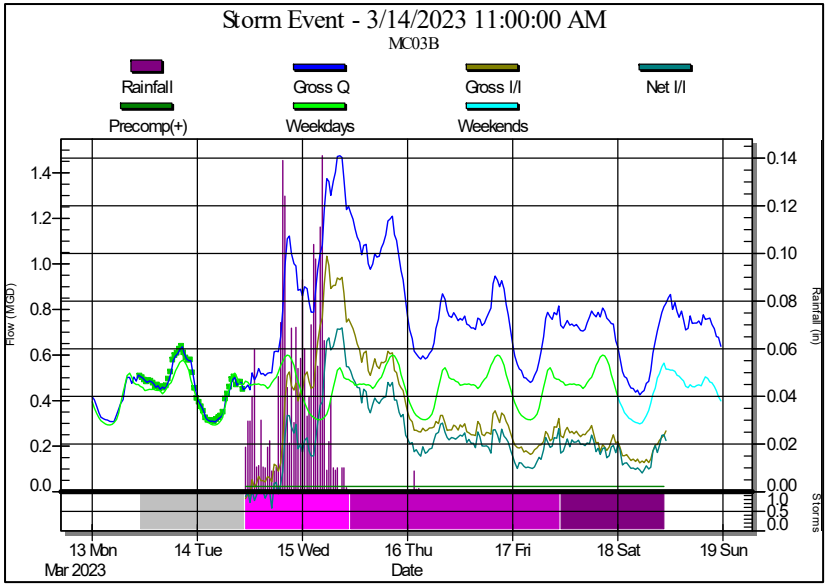

Q vs i - MC03A
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

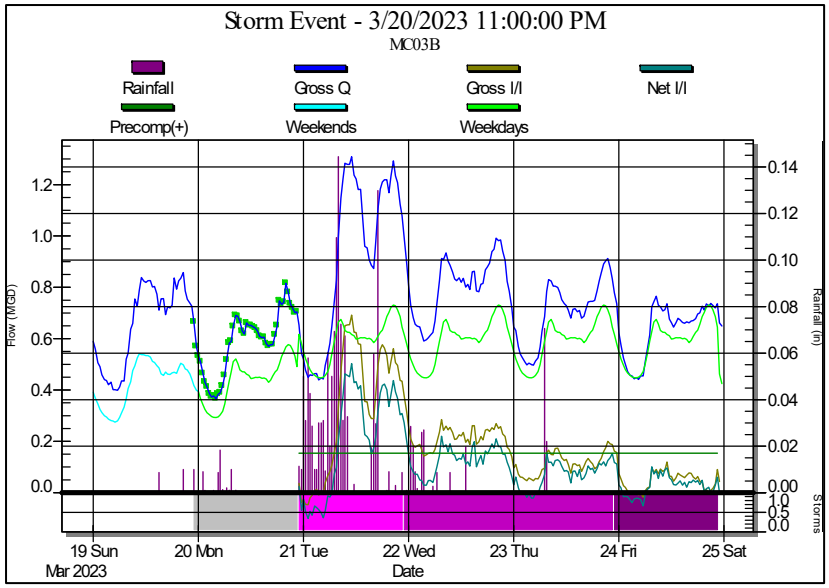

Pipe Flow
MC03B
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
1.5
1.0
0.5
0.0
0.15
0.10
0.05
0.00
1 Wed
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Mar 2023
Date

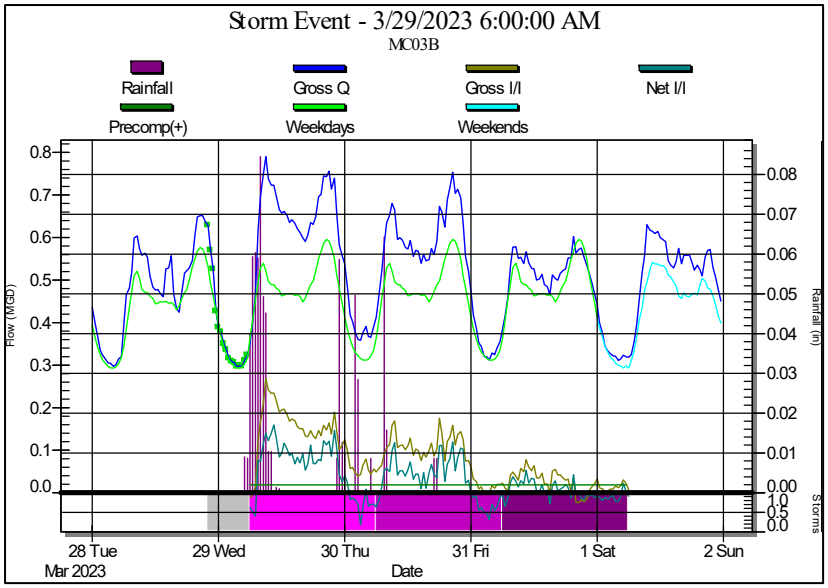

Dry Weather Flow
MC03B
Weekdays
Weekends
MGD
0.55
0.50
0.45
0.40
0.35
0.30
0
3
6
9
12
15
18
21
Hours

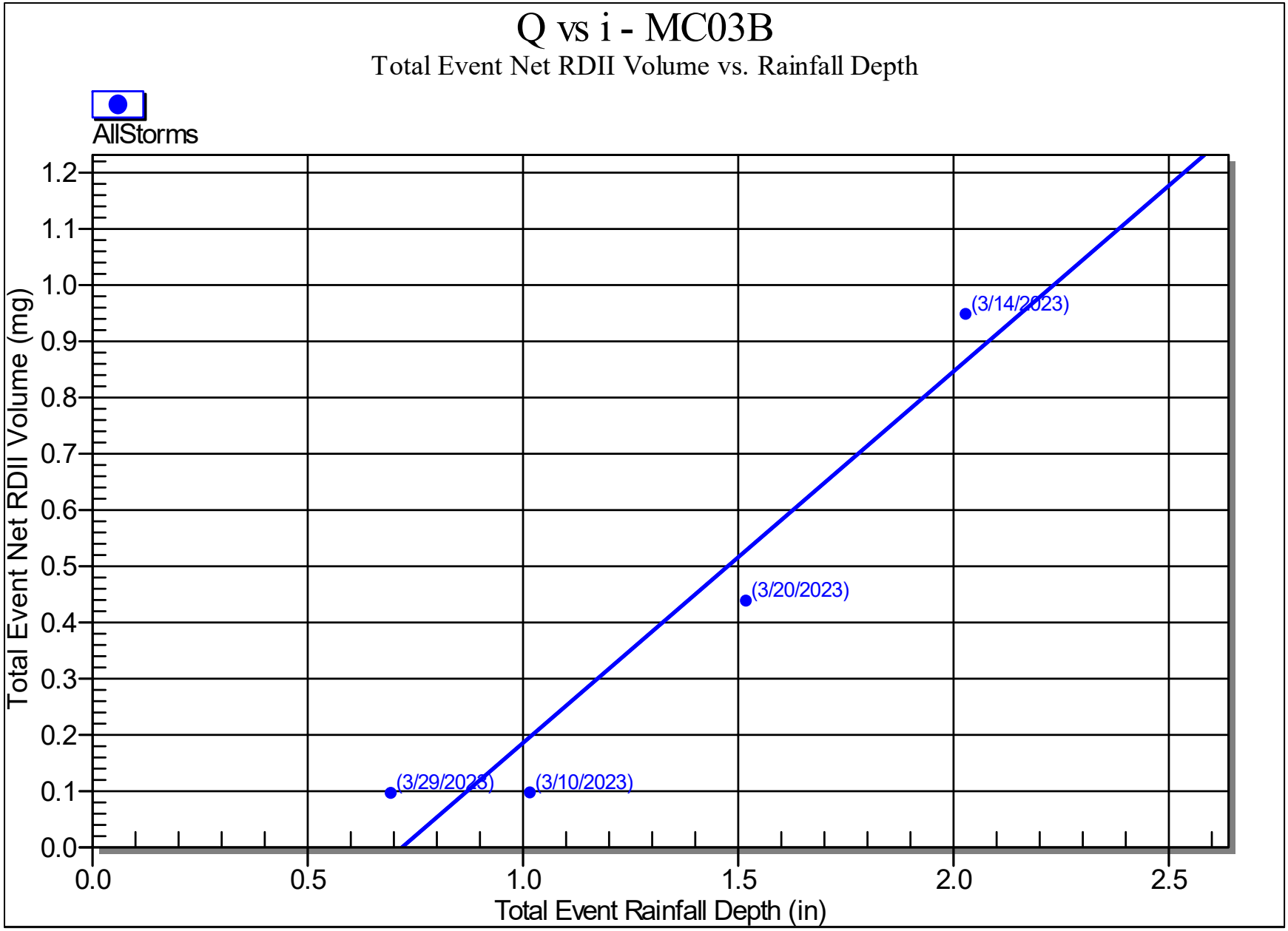

Scatter Graph
MC03B
Lanfear-Coll (C-LC = 8.00)
VFINAL (ft/s)
Iso Q (MGD)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.075
0
2
4
6
8
10
12
DFINAL (in)

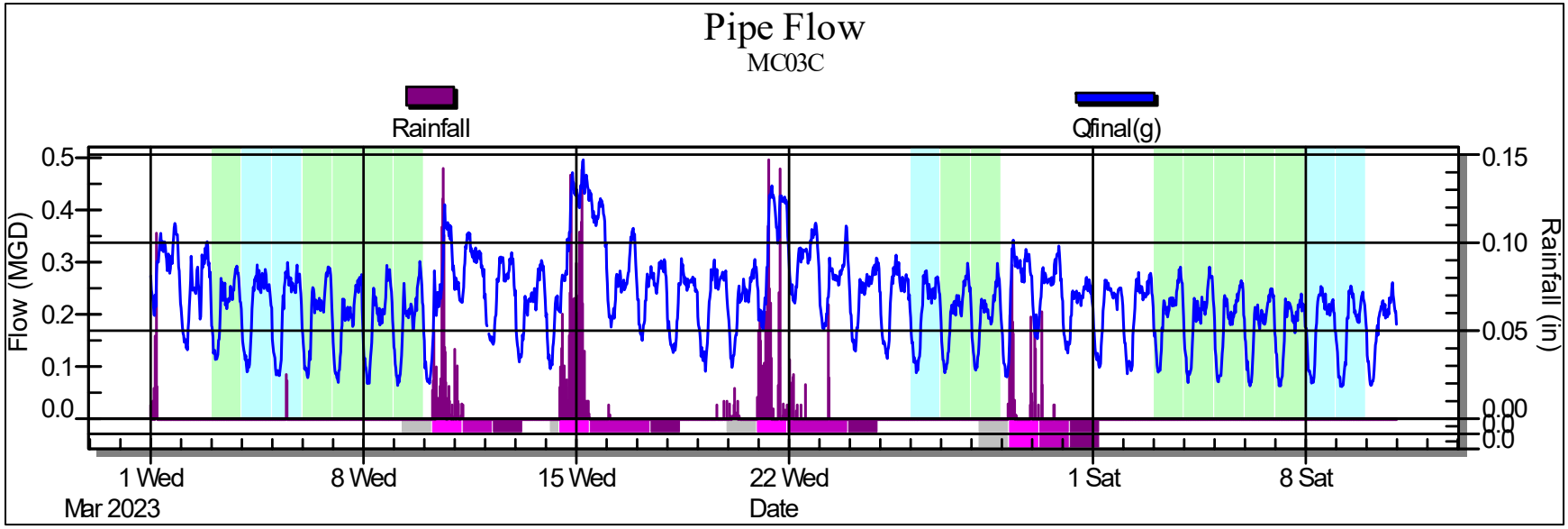

Storm Event - 3/10/2023 6:30:00 AM
MC03B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

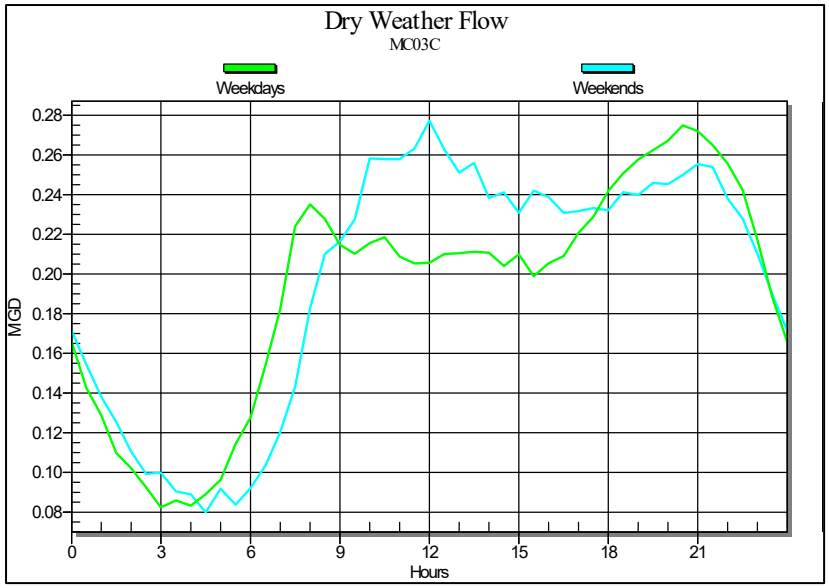

Storm Event - 3/14/2023 11:00:00 AM
MC03B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

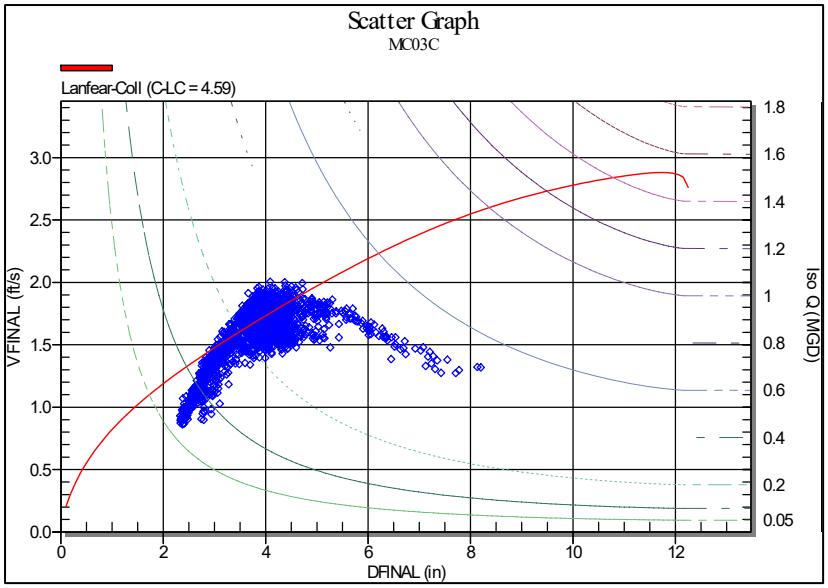

Storm Event - 3/20/2023 11:00:00 PM
MC03B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

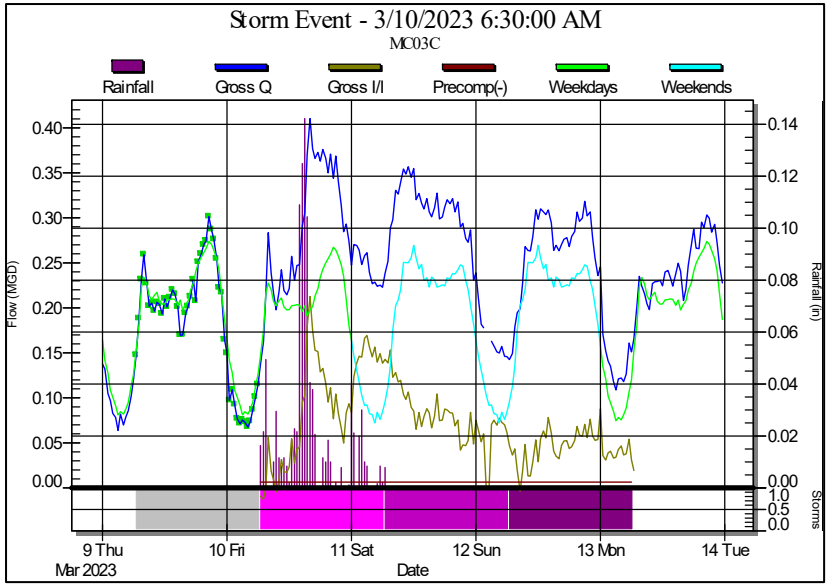

Storm Event - 3/29/2023 6:00:00 AM
MC03B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

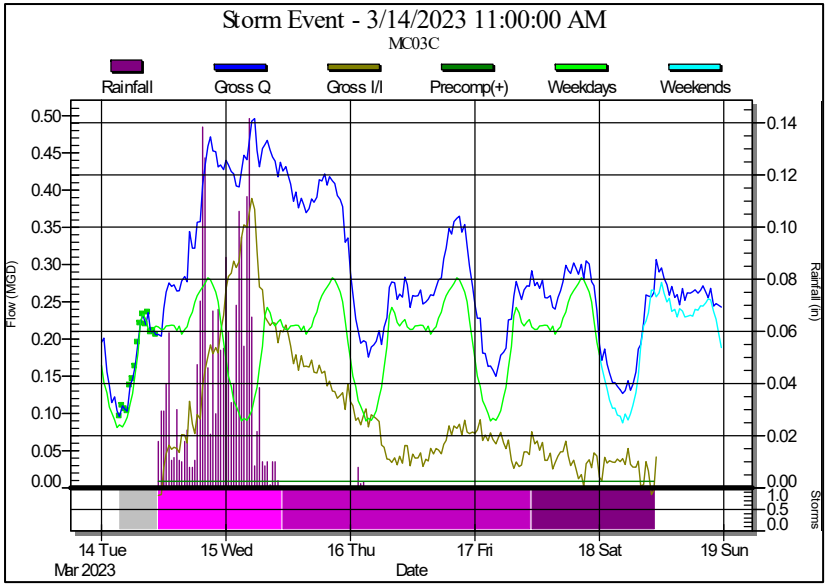

Q vs i - MC03B
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
Total Event Rainfall Depth (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
0.0
0.5
1.0
1.5
2.0
2.5
(3/14/2023)
(3/20/2023)
(3/29/2023)
(3/10/2023)

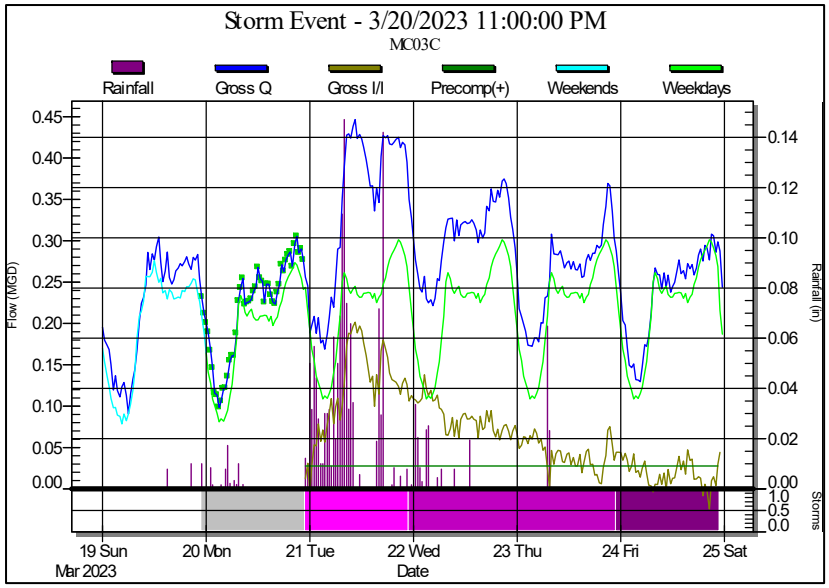

Pipe Flow
MC03C
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.5
0.4
0.3
0.2
0.1
0.0
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

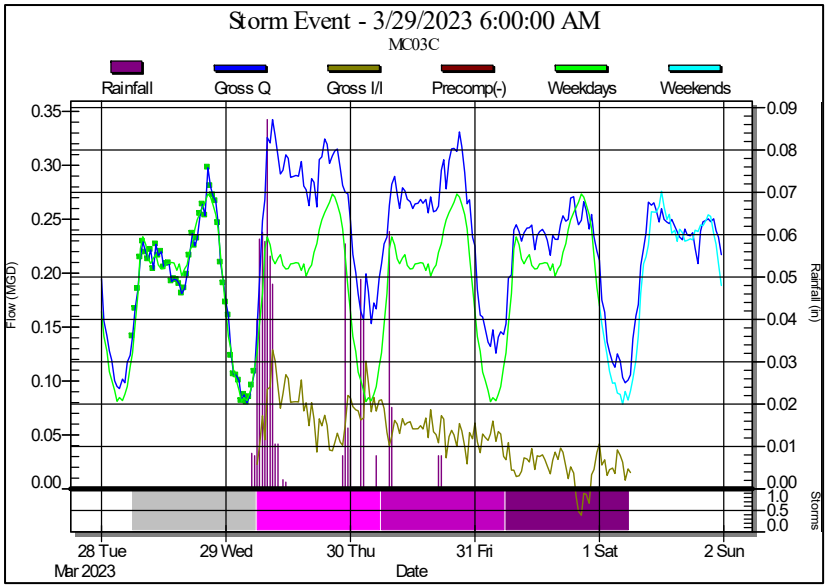

Dry Weather Flow
MC03C
Weekdays
Weekends
MGD
0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0
3
6
9
12
15
18
21
Hours

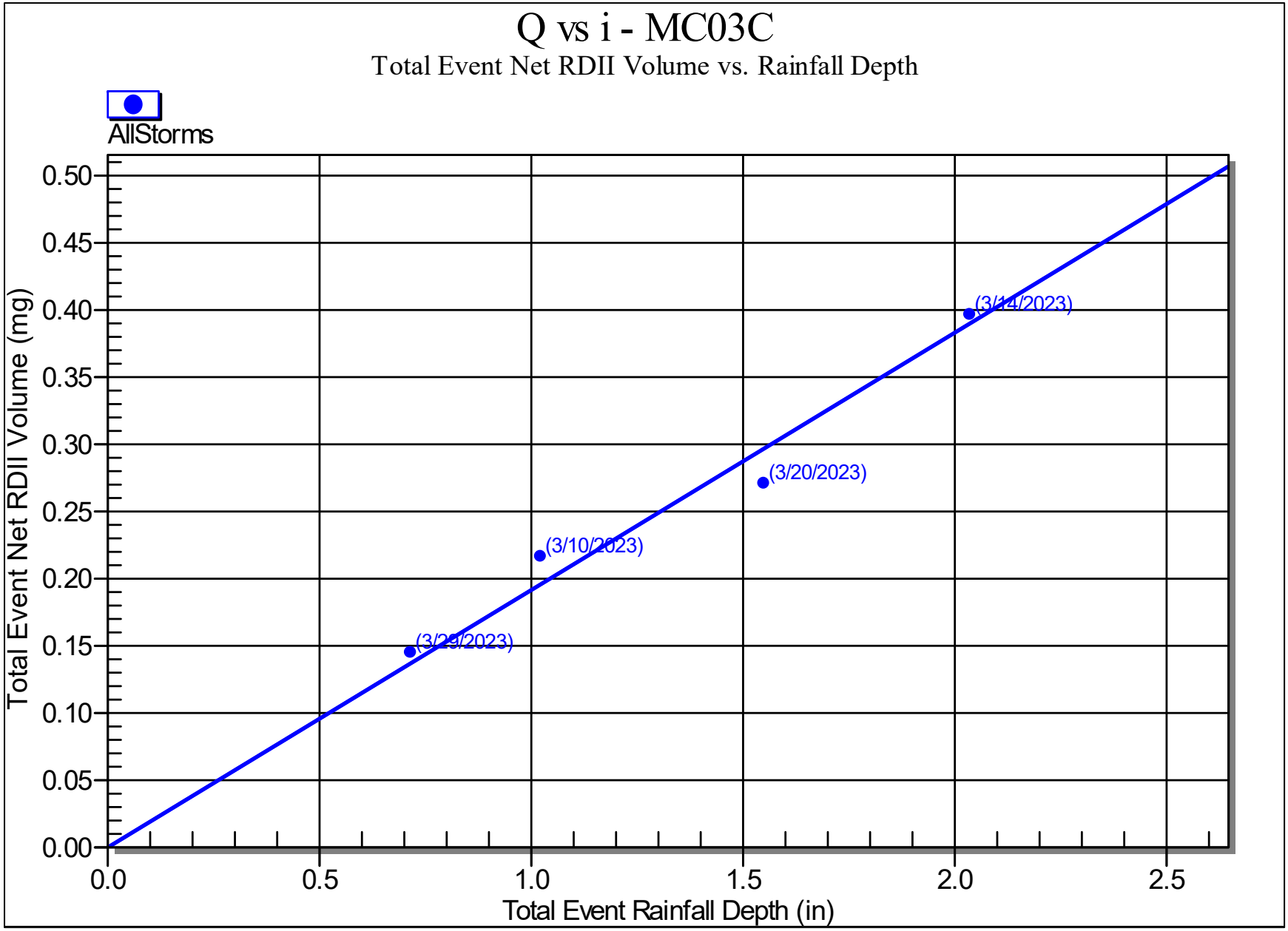

Scatter Graph
MC03C
Lanfear-Coll (C-LC = 4.59)
VFINAL (ft/s)
Iso Q (MGD)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0.05
0
2
4
6
8
10
12
DFINAL (in)

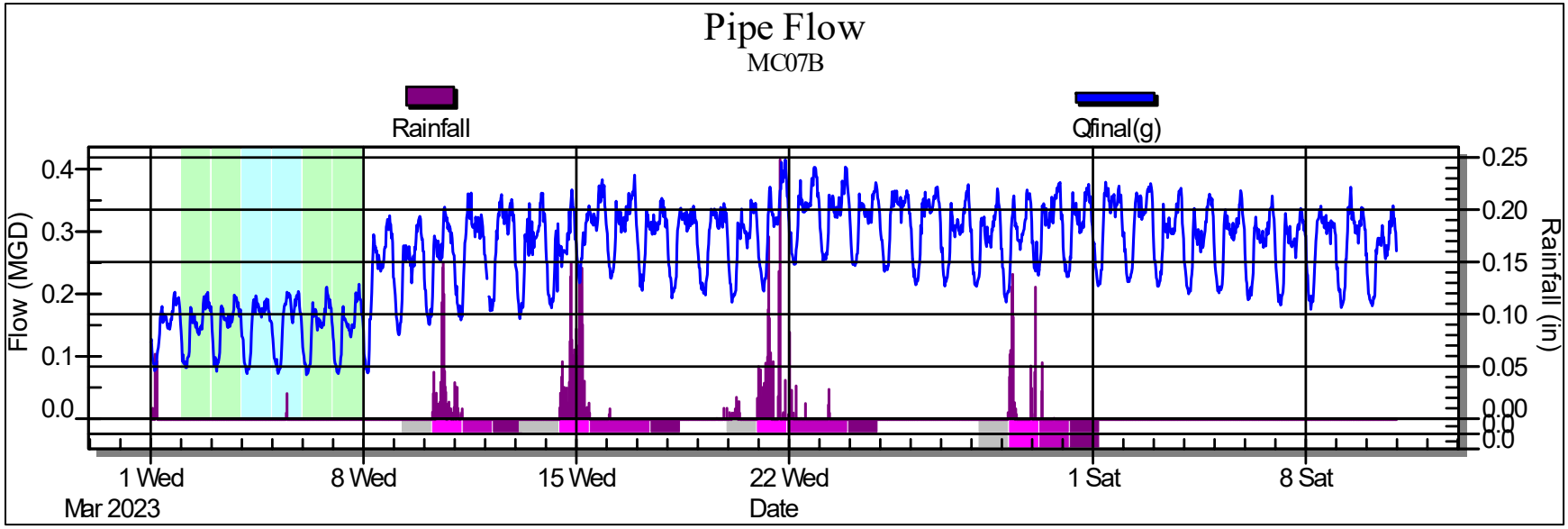

Storm Event - 3/10/2023 6:30:00 AM
MC03C
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

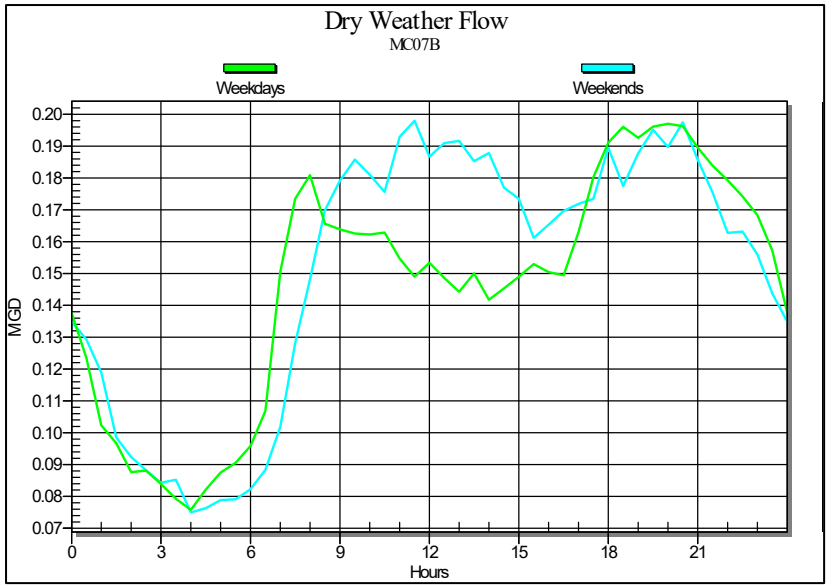

Storm Event - 3/14/2023 11:00:00 AM
MC03C
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

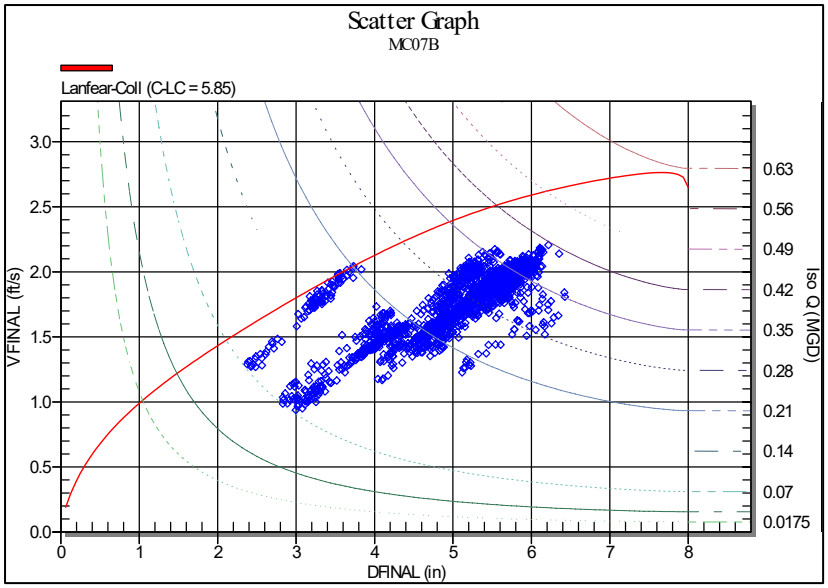

Storm Event - 3/20/2023 11:00:00 PM
MC03C
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

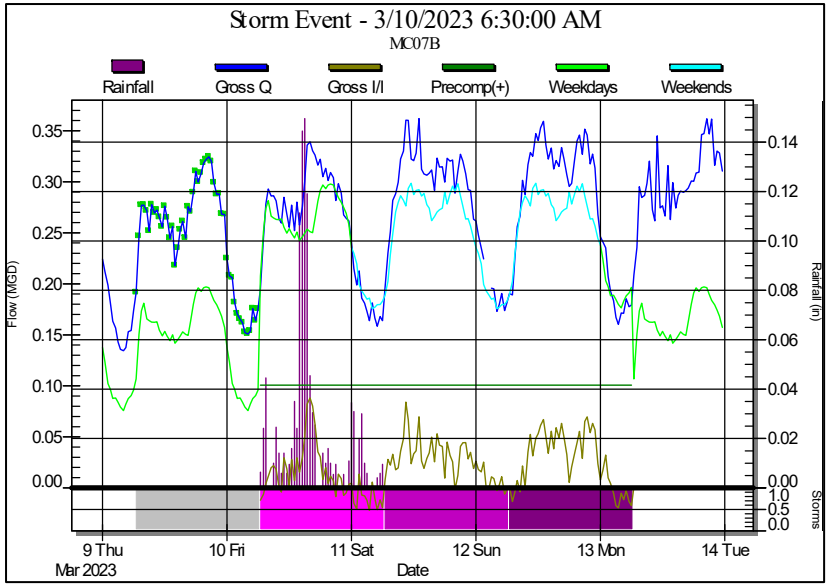

Storm Event - 3/29/2023 6:00:00 AM
MC03C
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

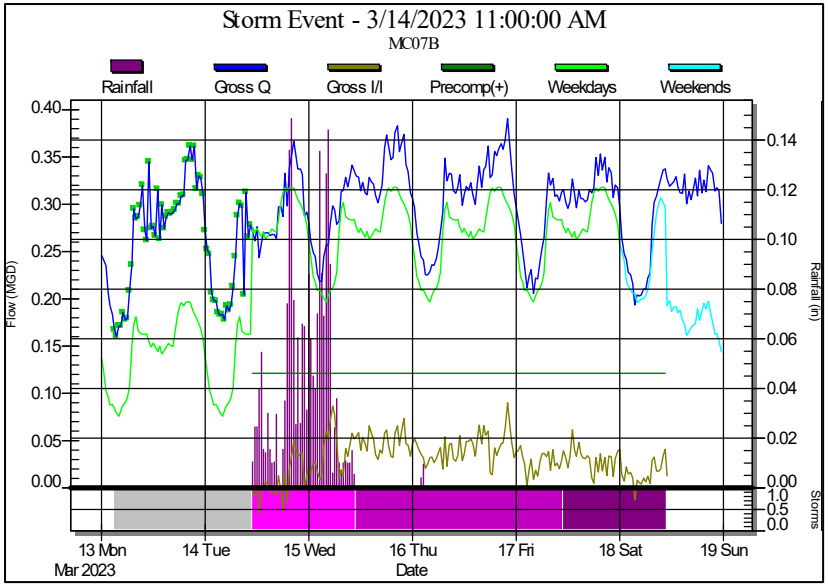

Q vs i - MC03C
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

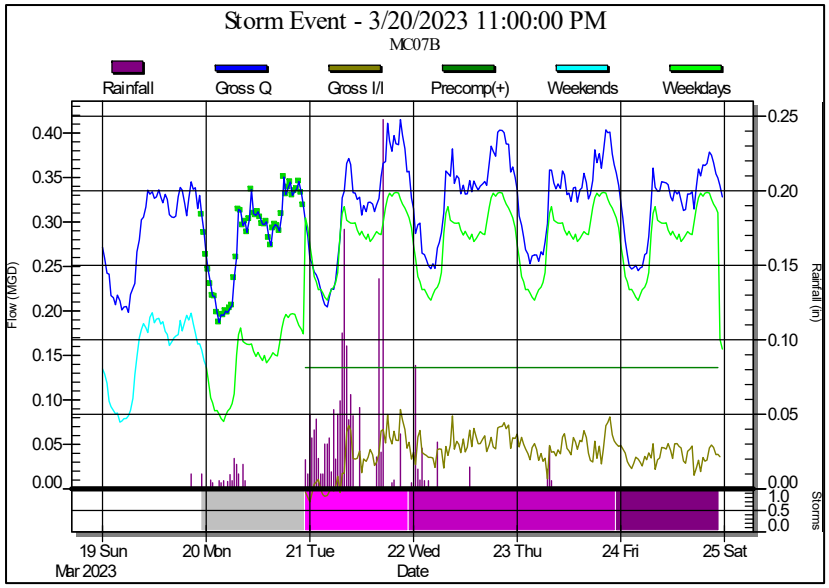

Pipe Flow
MC07B
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.4
0.3
0.2
0.1
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

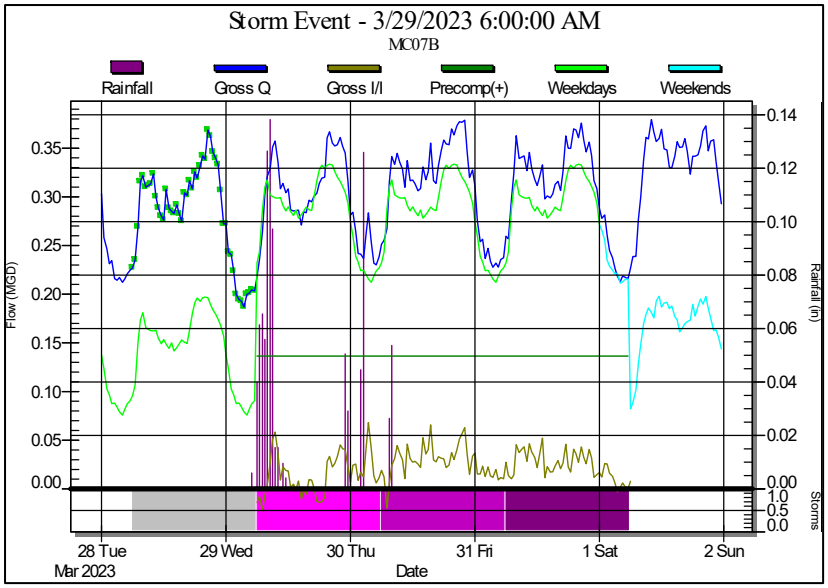

Dry Weather Flow
MC07B
Weekdays
Weekends
MGD
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0
3
6
9
12
15
18
21
Hours

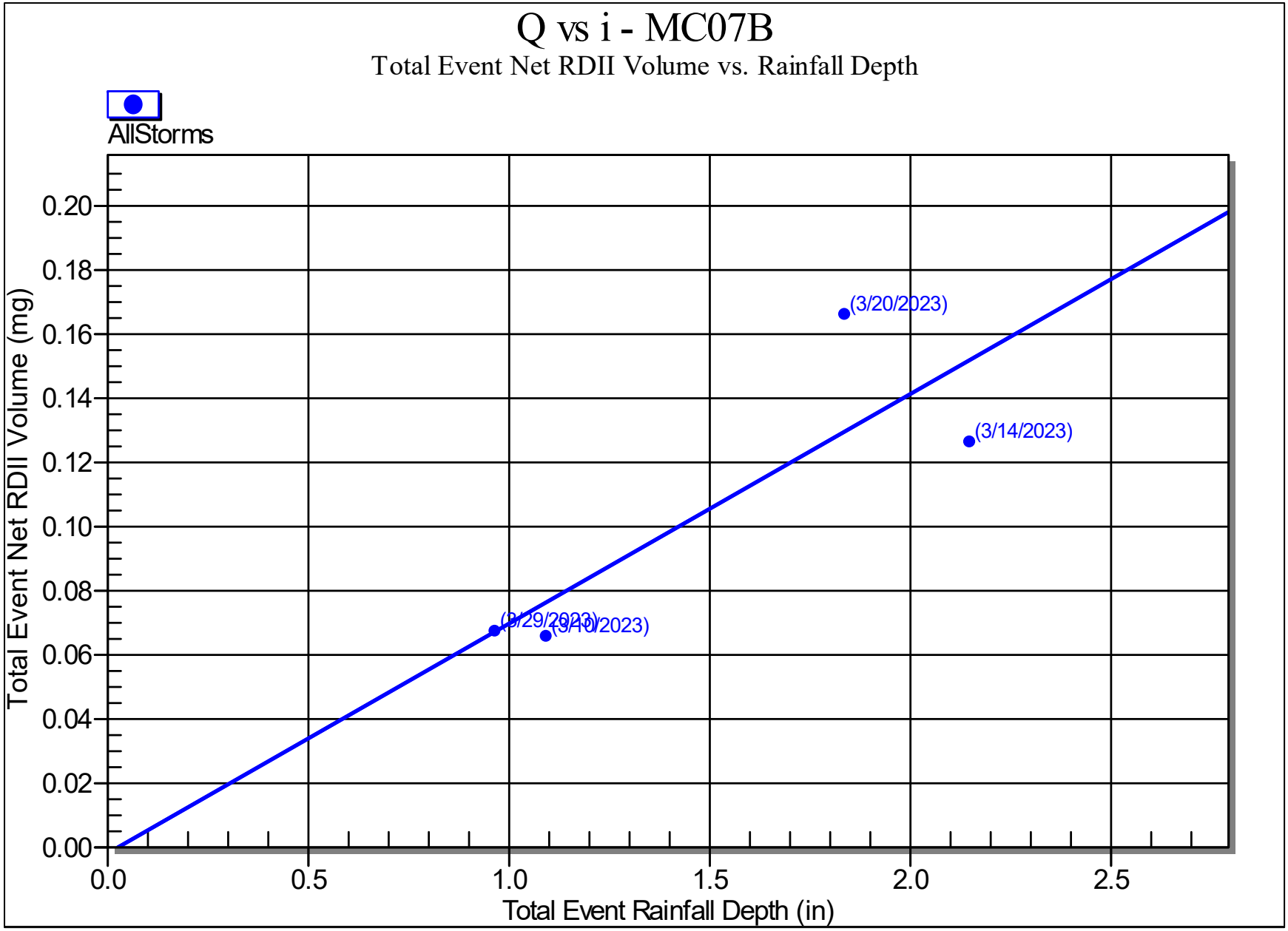

Scatter Graph
MC07B
Lanfear-Coll (C-LC = 5.85)
VFINAL (ft/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8
DFINAL (in)
Iso Q (MGD)
0.63
0.56
0.49
0.42
0.35
0.28
0.21
0.14
0.07
0.0175

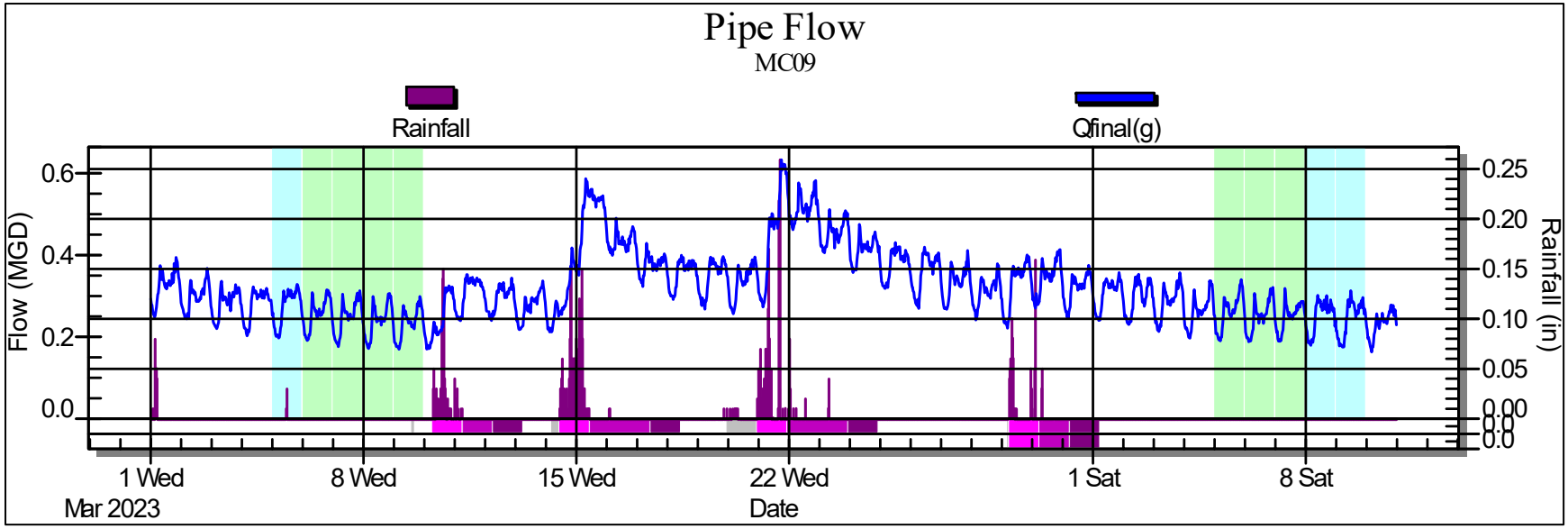

Storm Event - 3/10/2023 6:30:00 AM
MC07B
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

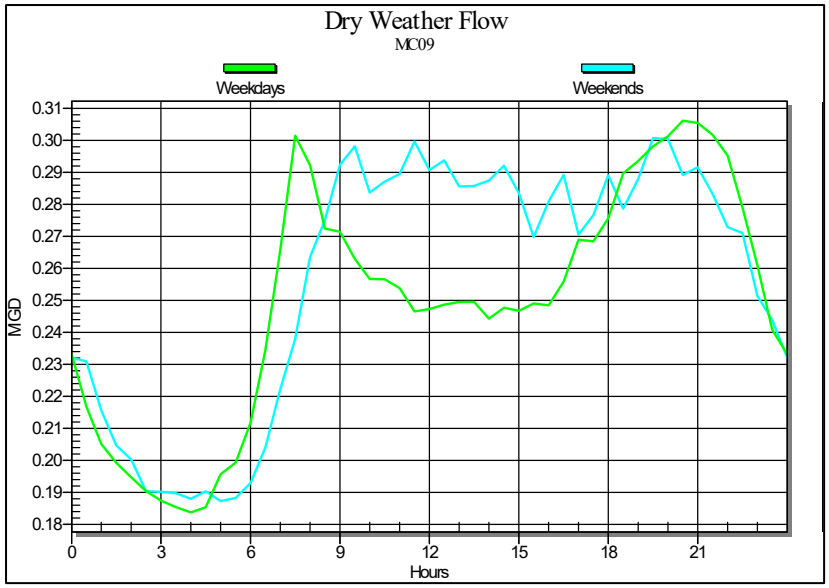

Storm Event - 3/14/2023 11:00:00 AM
MC07B
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

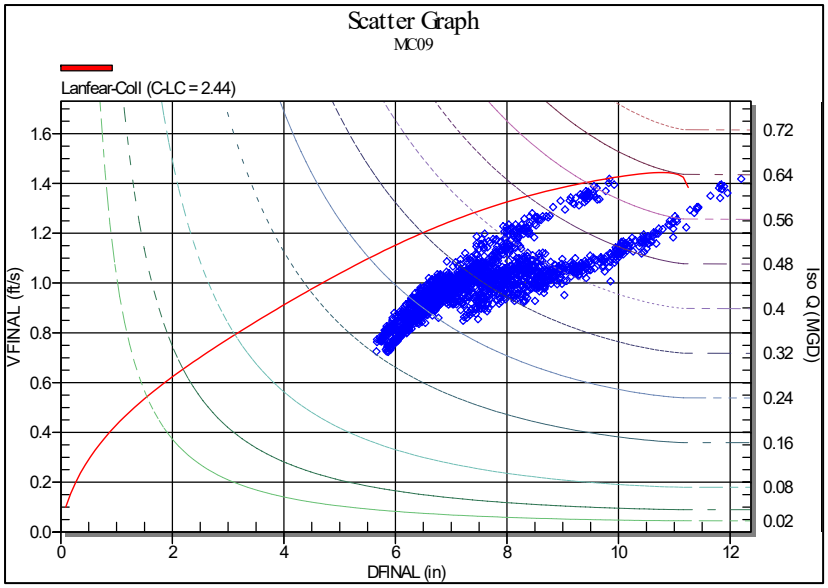

Storm Event - 3/20/2023 11:00:00 PM
MC07B
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

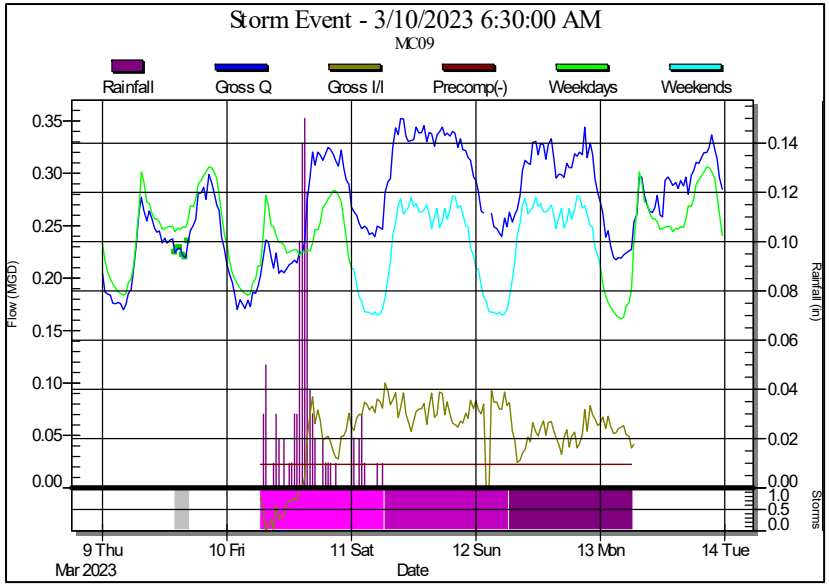

Storm Event - 3/29/2023 6:00:00 AM
MC07B
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

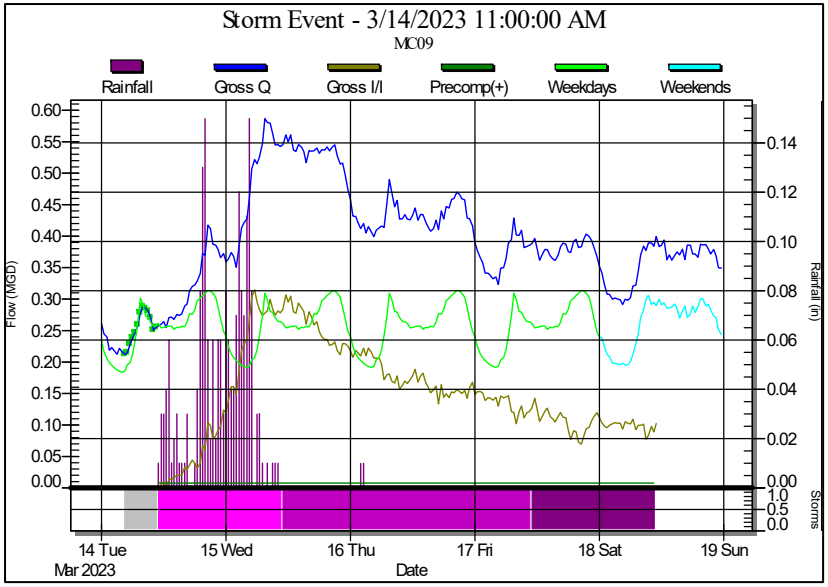

Q vs i - MC07B
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/20/2023)
(3/14/2023)
(3/29/2023)
(3/10/2023)

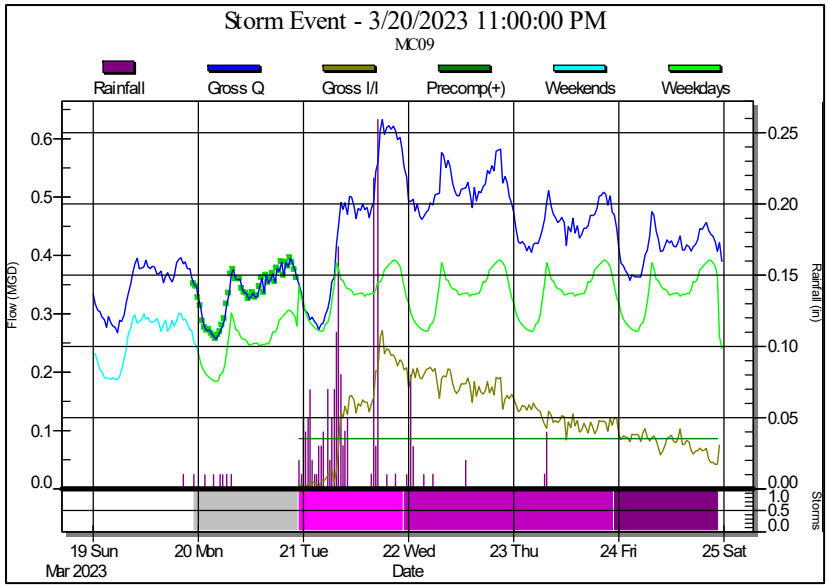

Pipe Flow
MC09
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.6
0.4
0.2
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat

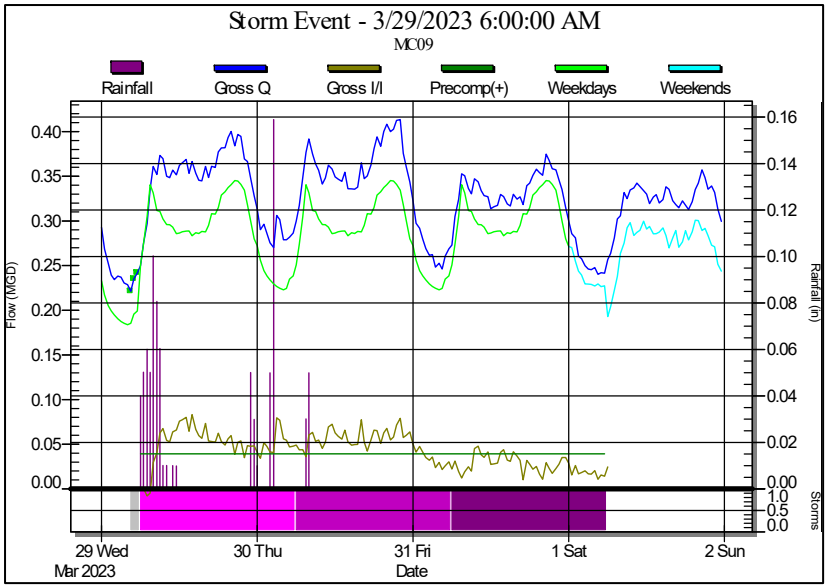

Dry Weather Flow
MC09
Weekdays
Weekends
MGD
0.31
0.30
0.29
0.28
0.27
0.26
0.25
0.24
0.23
0.22
0.21
0.20
0.19
0.18
0
3
6
9
12
15
18
21
Hours

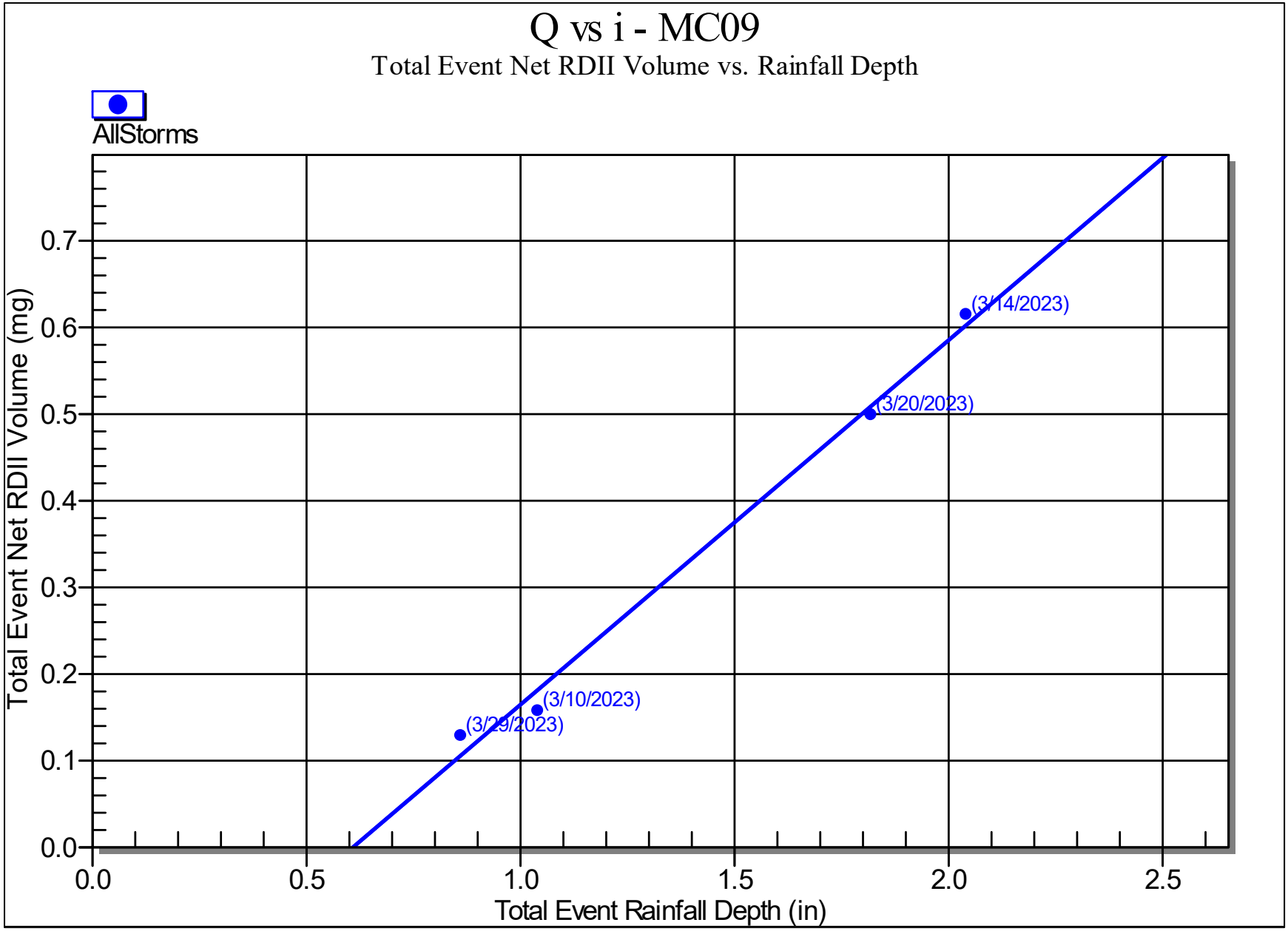

Scatter Graph
MC09
Lanfear-Coll (C-LC = 2.44)
VFINAL (ft/s)
Iso Q (MGD)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.72
0.64
0.56
0.48
0.4
0.32
0.24
0.16
0.08
0.02
0
2
4
6
8
10
12
DFINAL (in)

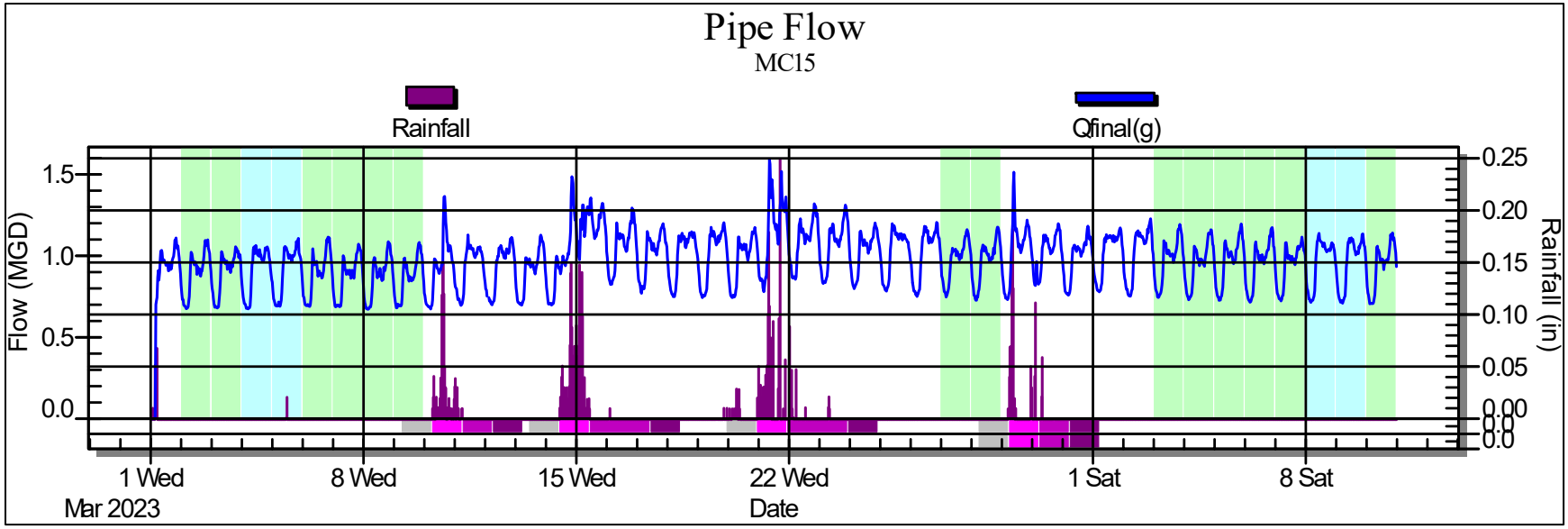

Storm Event - 3/10/2023 6:30:00 AM
MC09
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

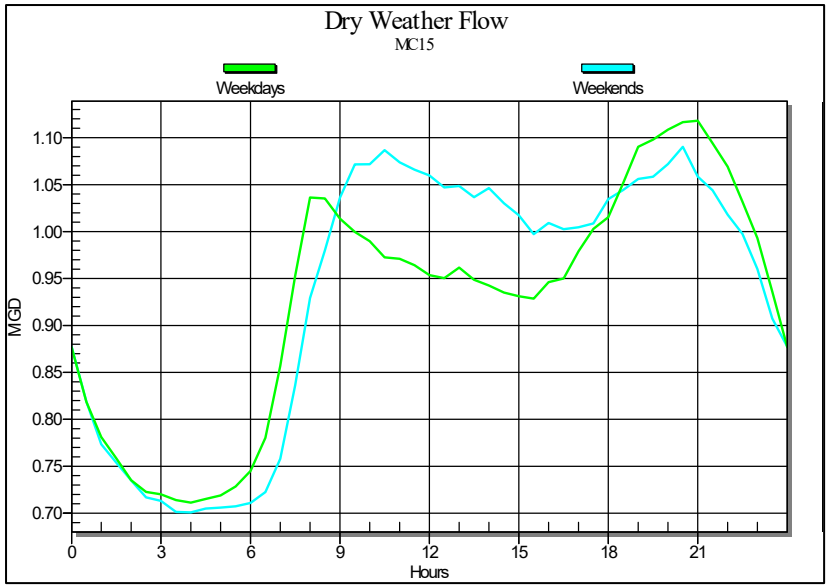

Storm Event - 3/14/2023 11:00:00 AM
MC09
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

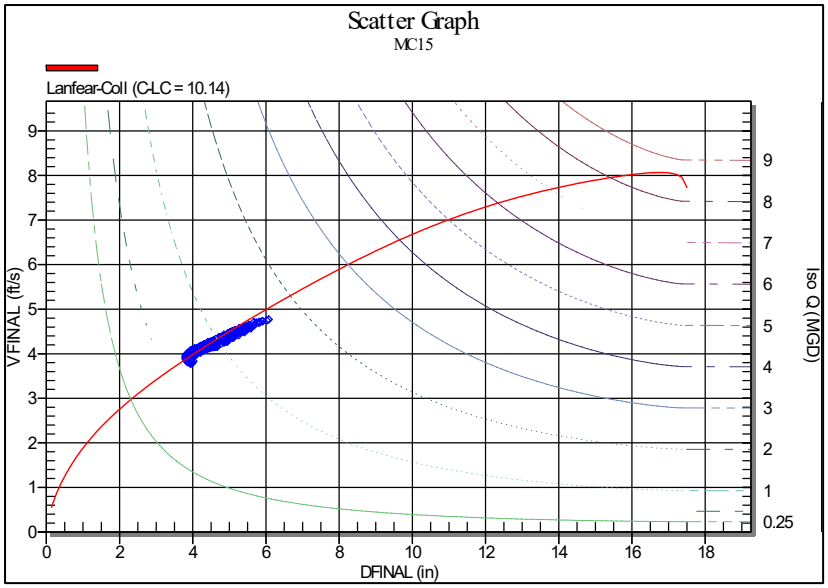

Storm Event - 3/20/2023 11:00:00 PM
MC09
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

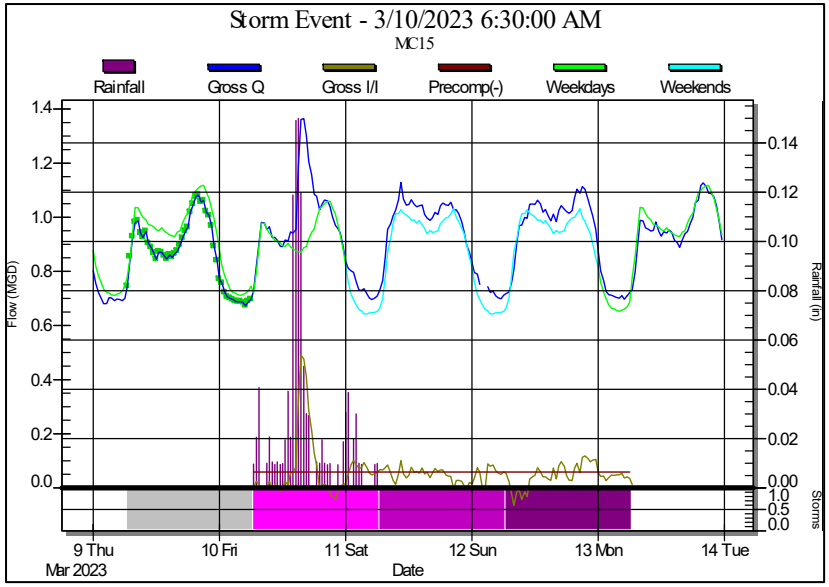

Storm Event - 3/29/2023 6:00:00 AM
MC09
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

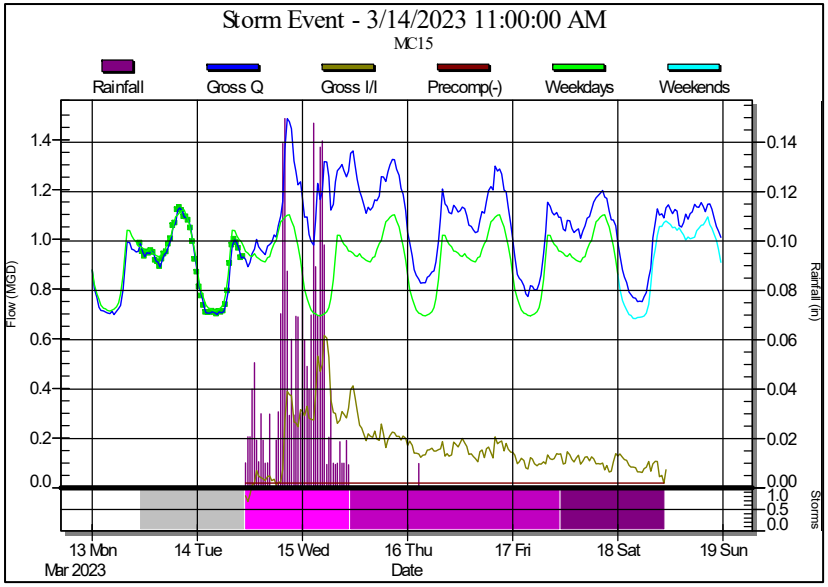

Q vs i - MC09
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

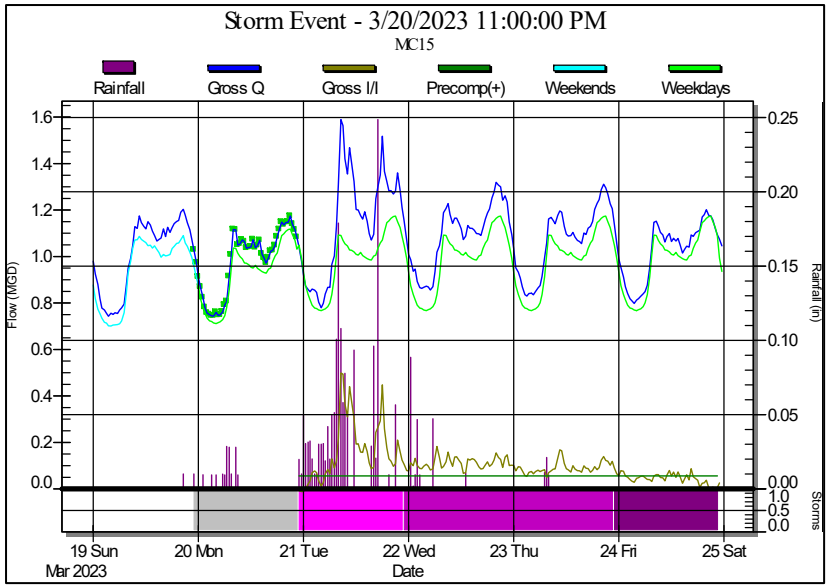

Pipe Flow
MC15
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
1.5
1.0
0.5
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat

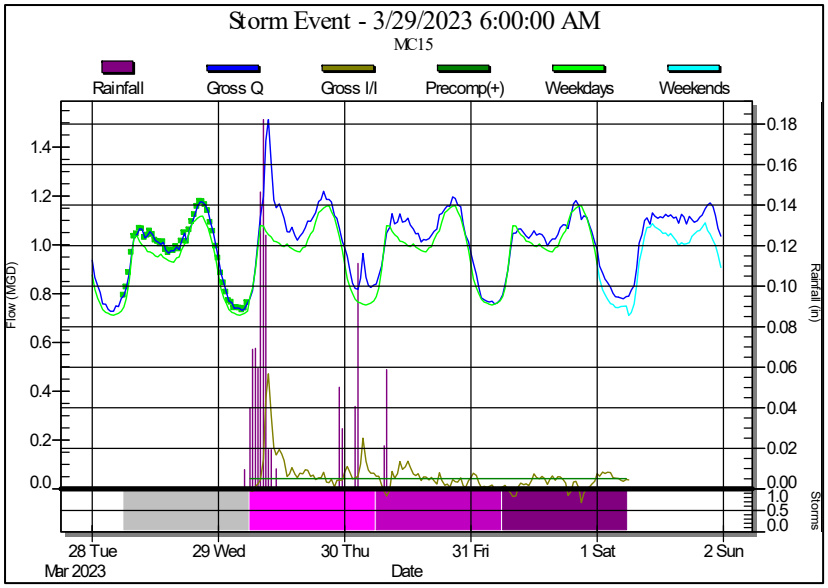

Dry Weather Flow
MC15
Weekdays
Weekends
MGD
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0
3
6
9
12
15
18
21
Hours

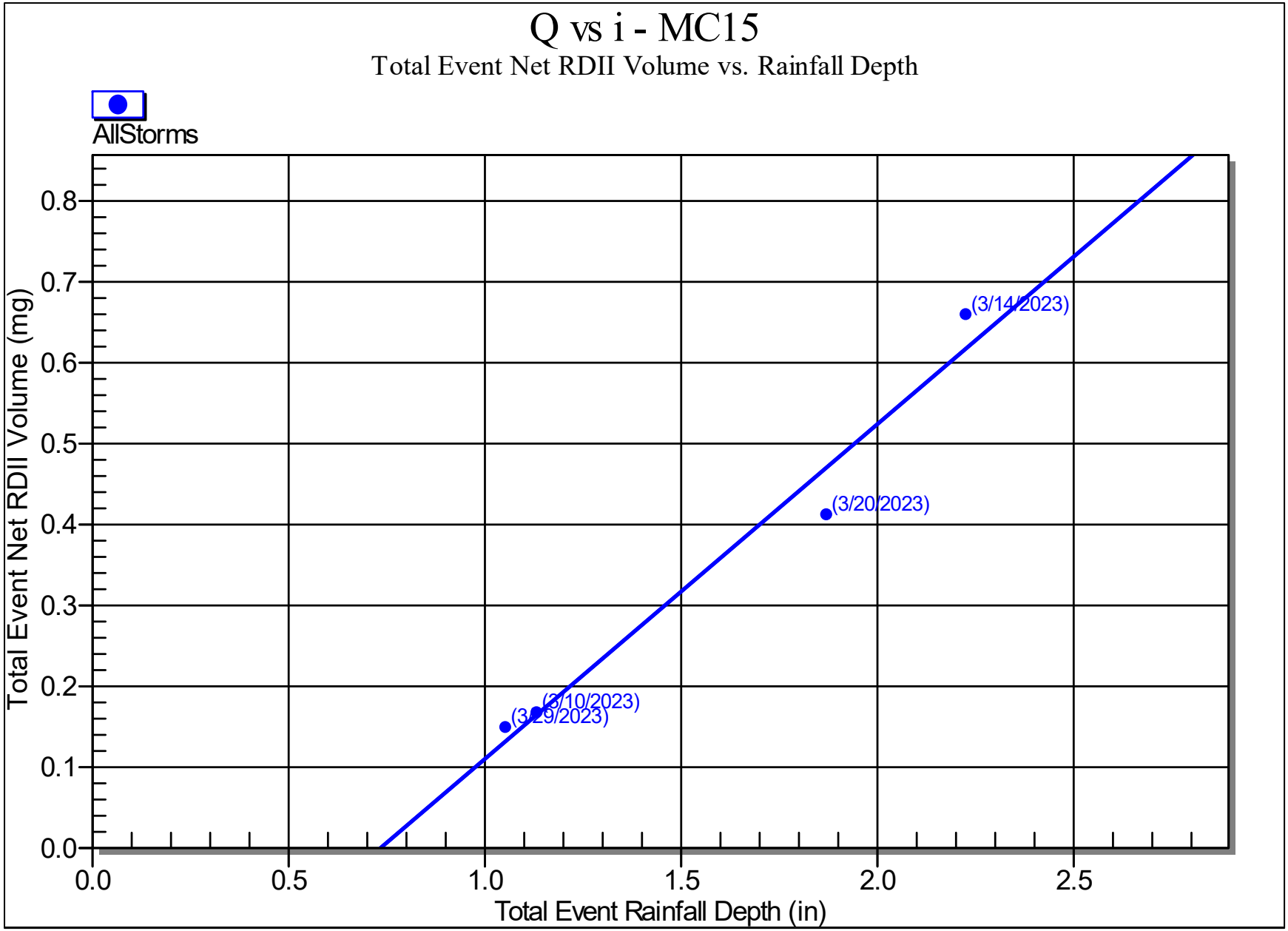

Scatter Graph
MC15
Lanfear-Coll (C-LC = 10.14)
VFINAL (ft/s)
Iso Q (MGD)
DFINAL (in)
0
2
4
6
8
10
12
14
16
18
0.25

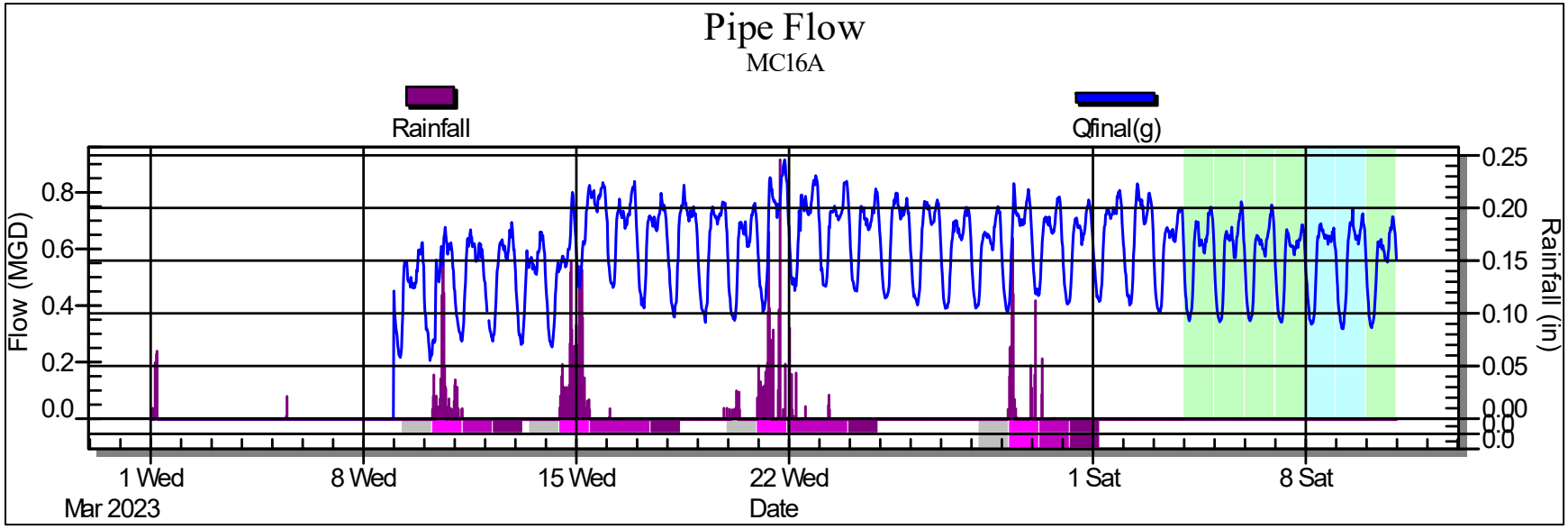

Storm Event - 3/10/2023 6:30:00 AM
MC15
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

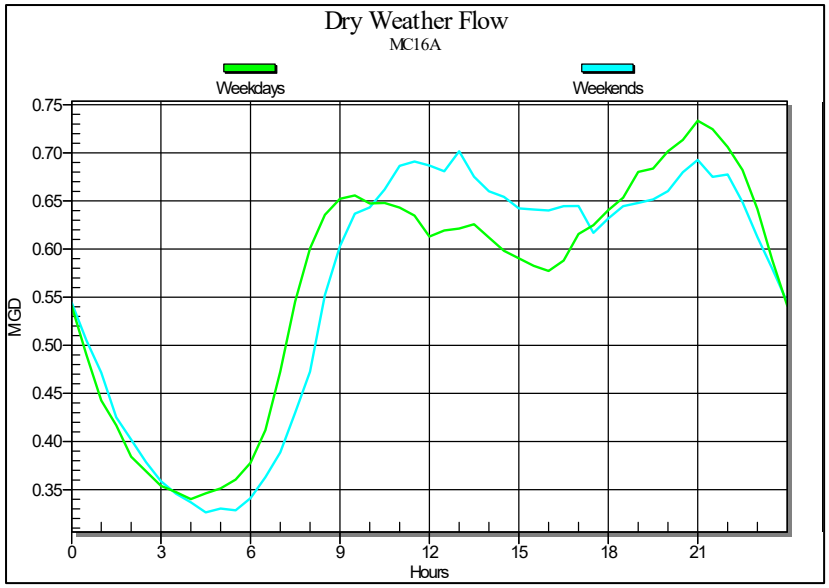

Storm Event - 3/14/2023 11:00:00 AM
MC15
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

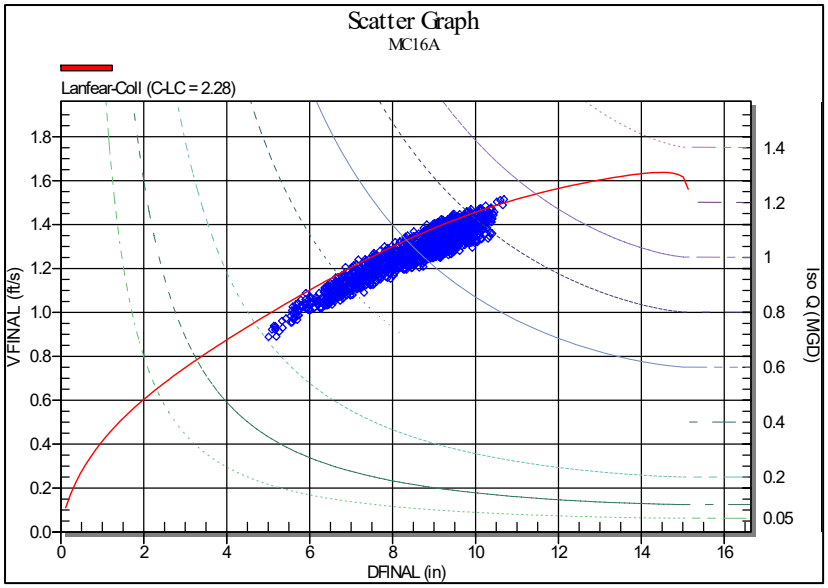

Storm Event - 3/20/2023 11:00:00 PM
MC15
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

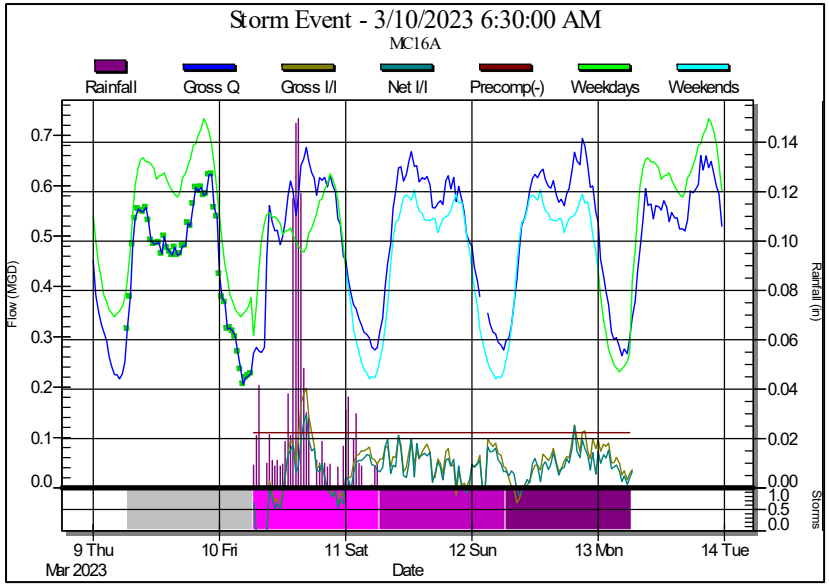

Storm Event - 3/29/2023 6:00:00 AM
MC15
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

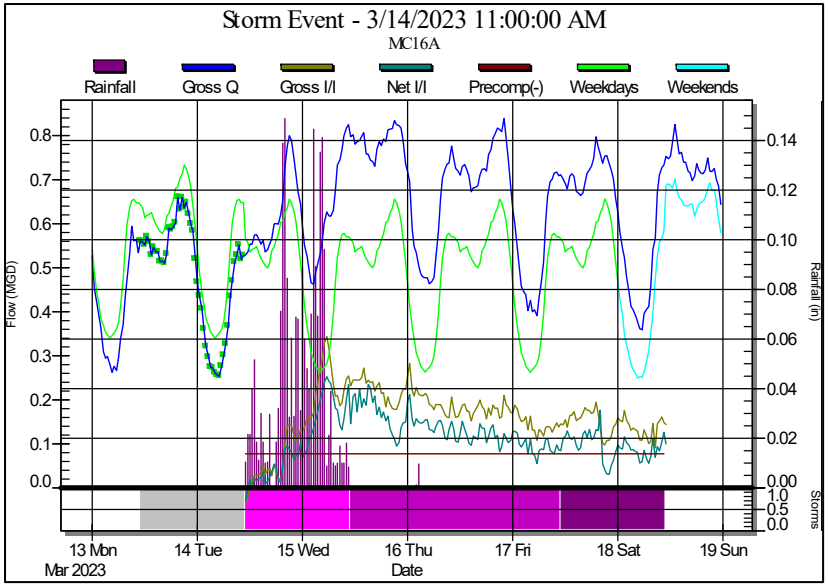

Q vs i - MC15
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

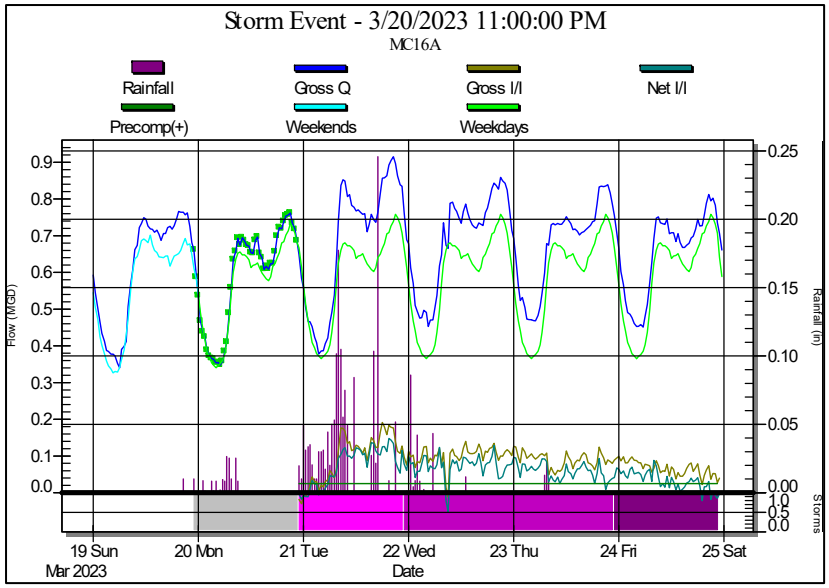

Pipe Flow
MC16A
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.8
0.6
0.4
0.2
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

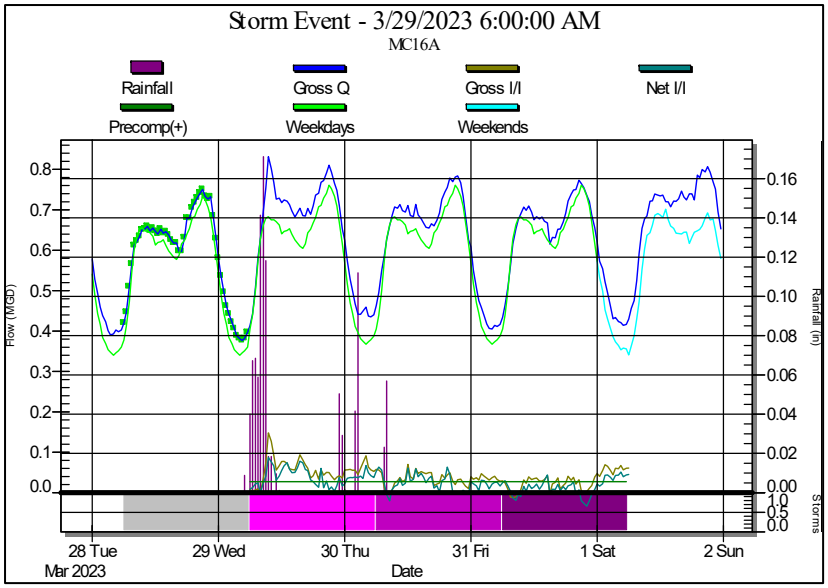

Dry Weather Flow
MC16A
Weekdays
Weekends
MGD
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0
3
6
9
12
15
18
21
Hours

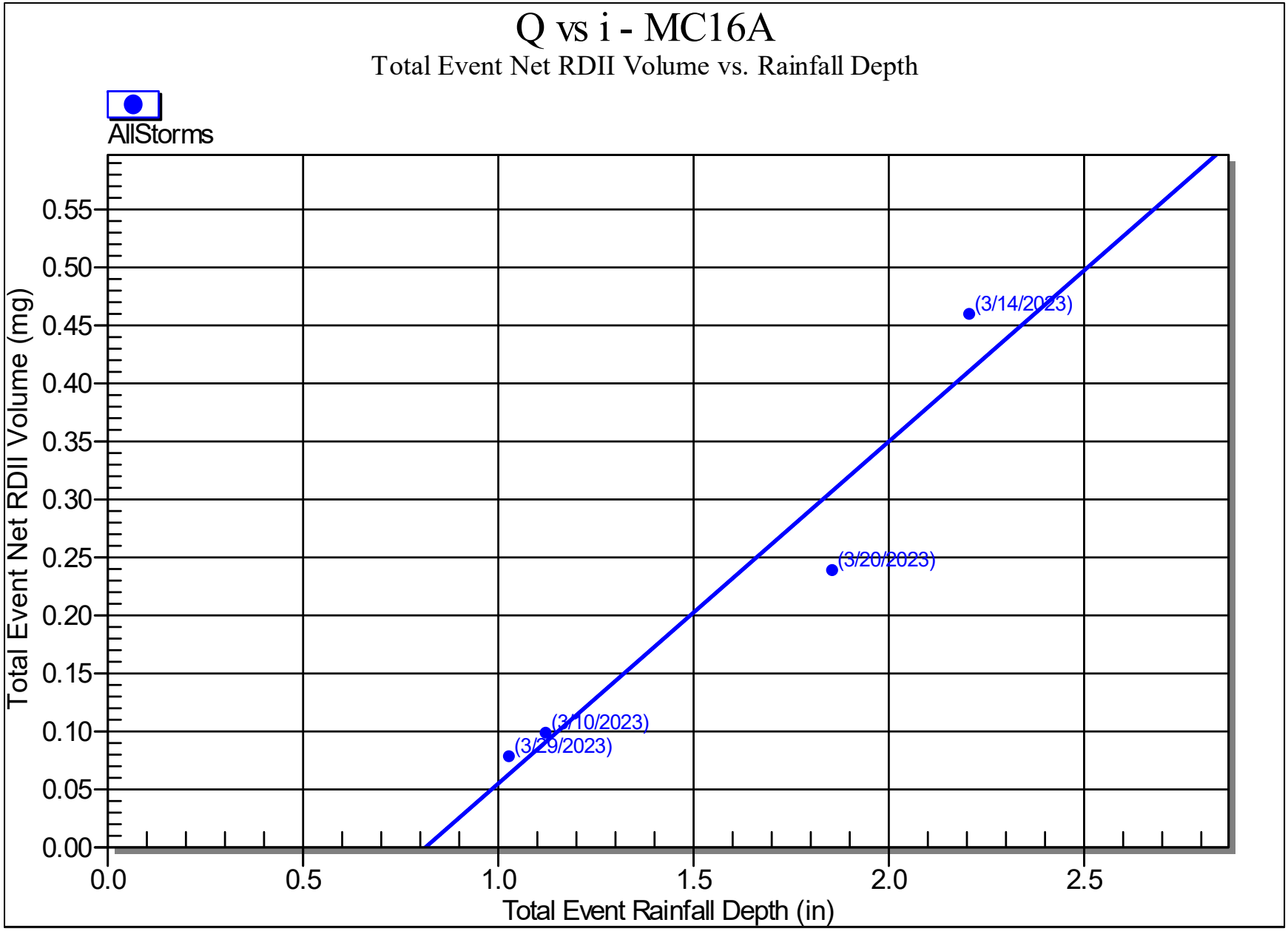

Scatter Graph
MC16A
Lanfear-Coll (C-LC = 2.28)
VFINAL (ft/s)
Iso Q (MGD)
DFINAL (in)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1.4
1.2
1
0.8
0.6
0.4
0.2
0.05
0
2
4
6
8
10
12
14
16

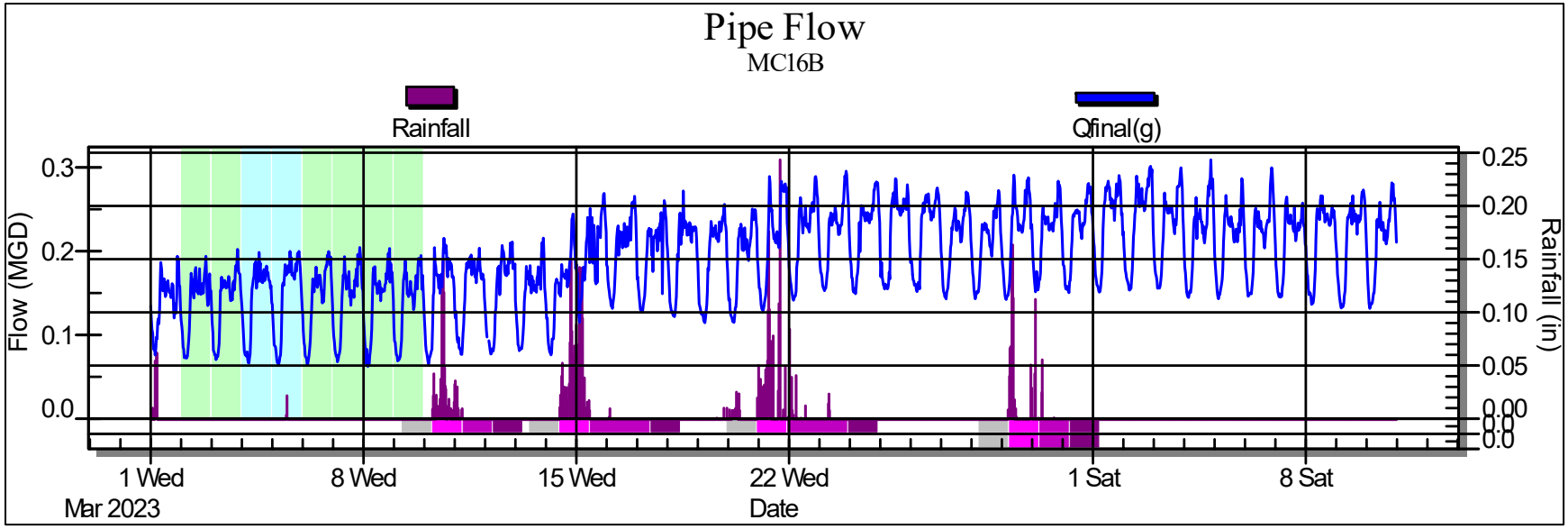

Storm Event - 3/10/2023 6:30:00 AM
MC16A
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

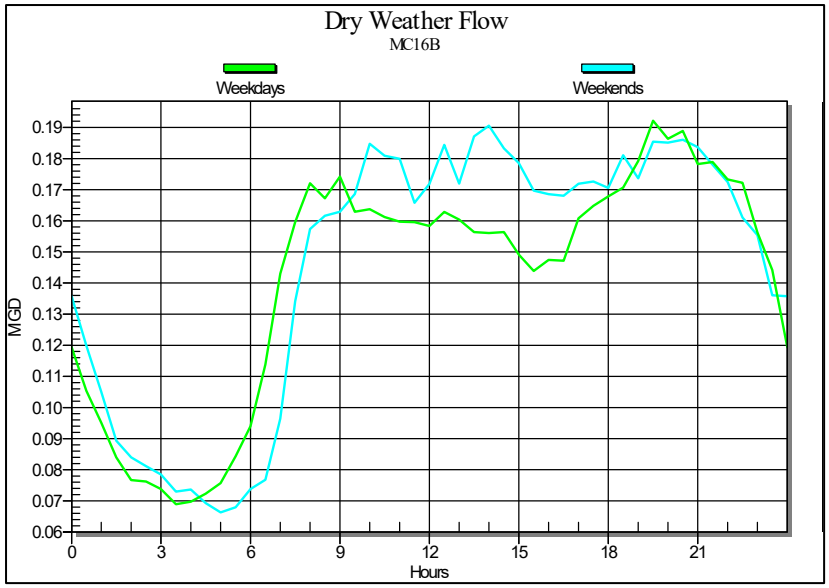

Storm Event - 3/14/2023 11:00:00 AM
MC16A
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

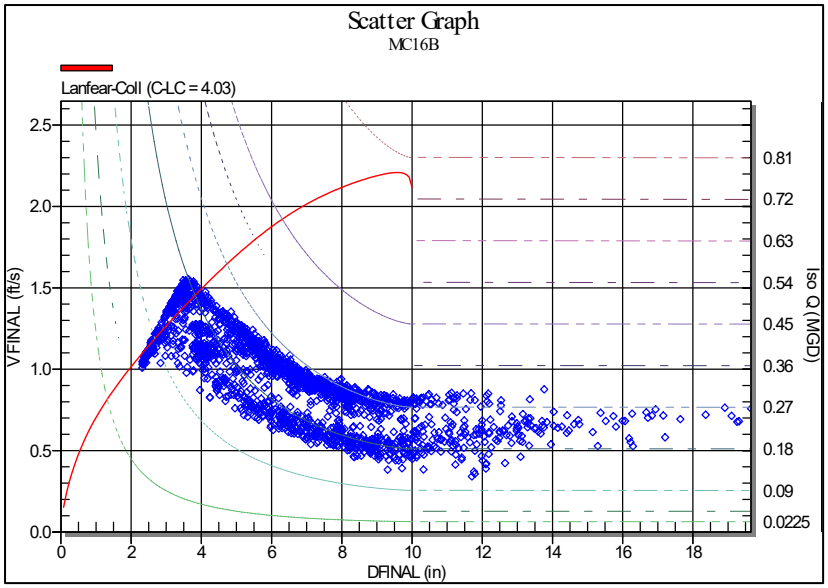

Storm Event - 3/20/2023 11:00:00 PM
MC16A
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

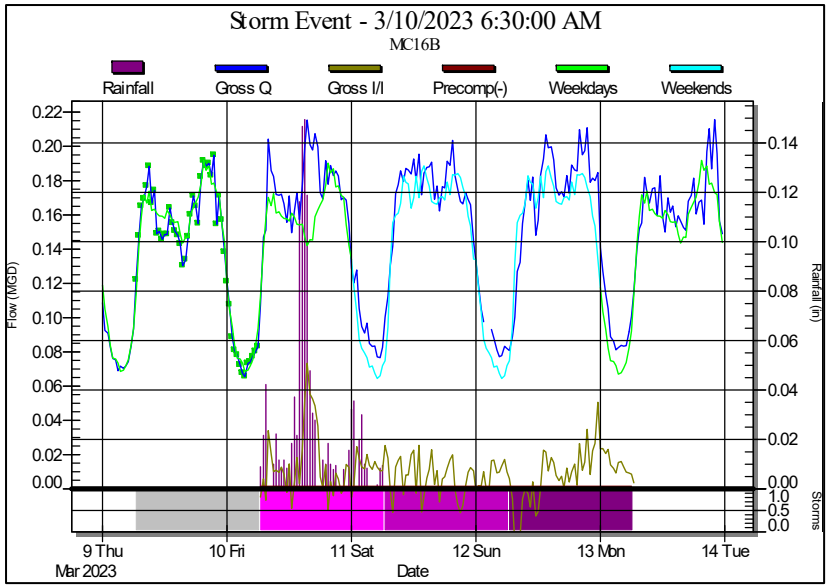

Storm Event - 3/29/2023 6:00:00 AM
MC16A
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

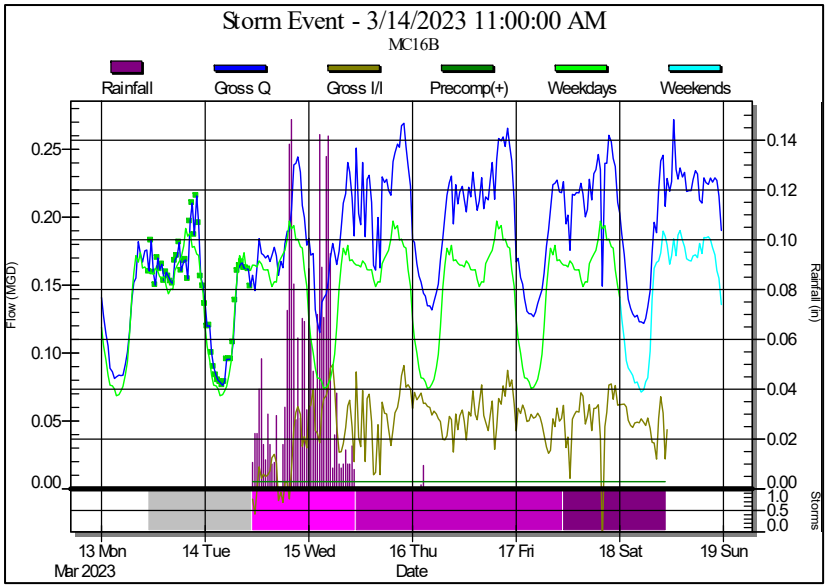

Q vs i - MC16A
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

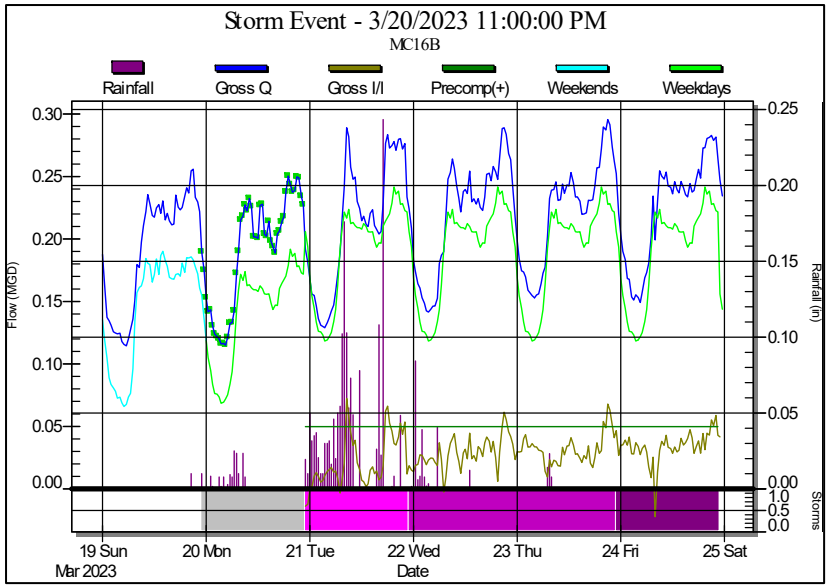

Pipe Flow
MC16B
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.3
0.2
0.1
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Mar 2023
Date

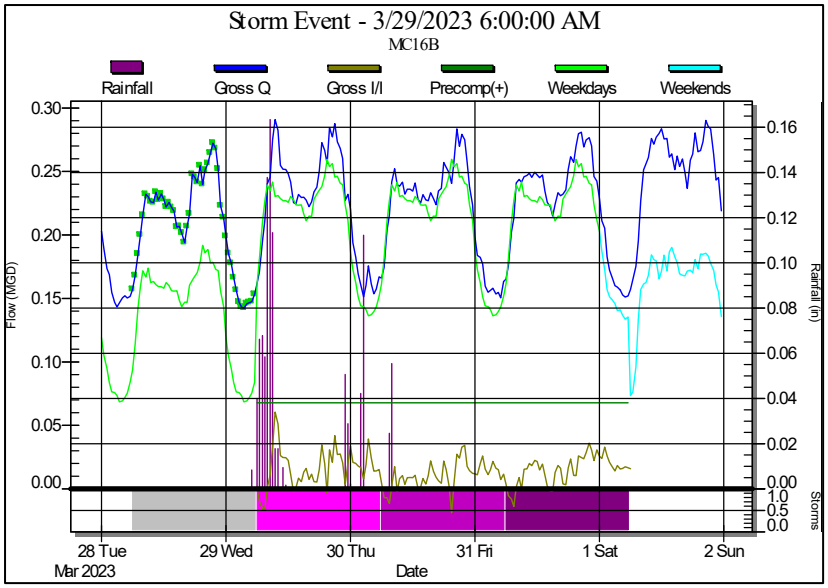

Dry Weather Flow
MC16B
Weekdays
Weekends
MGD
Hours

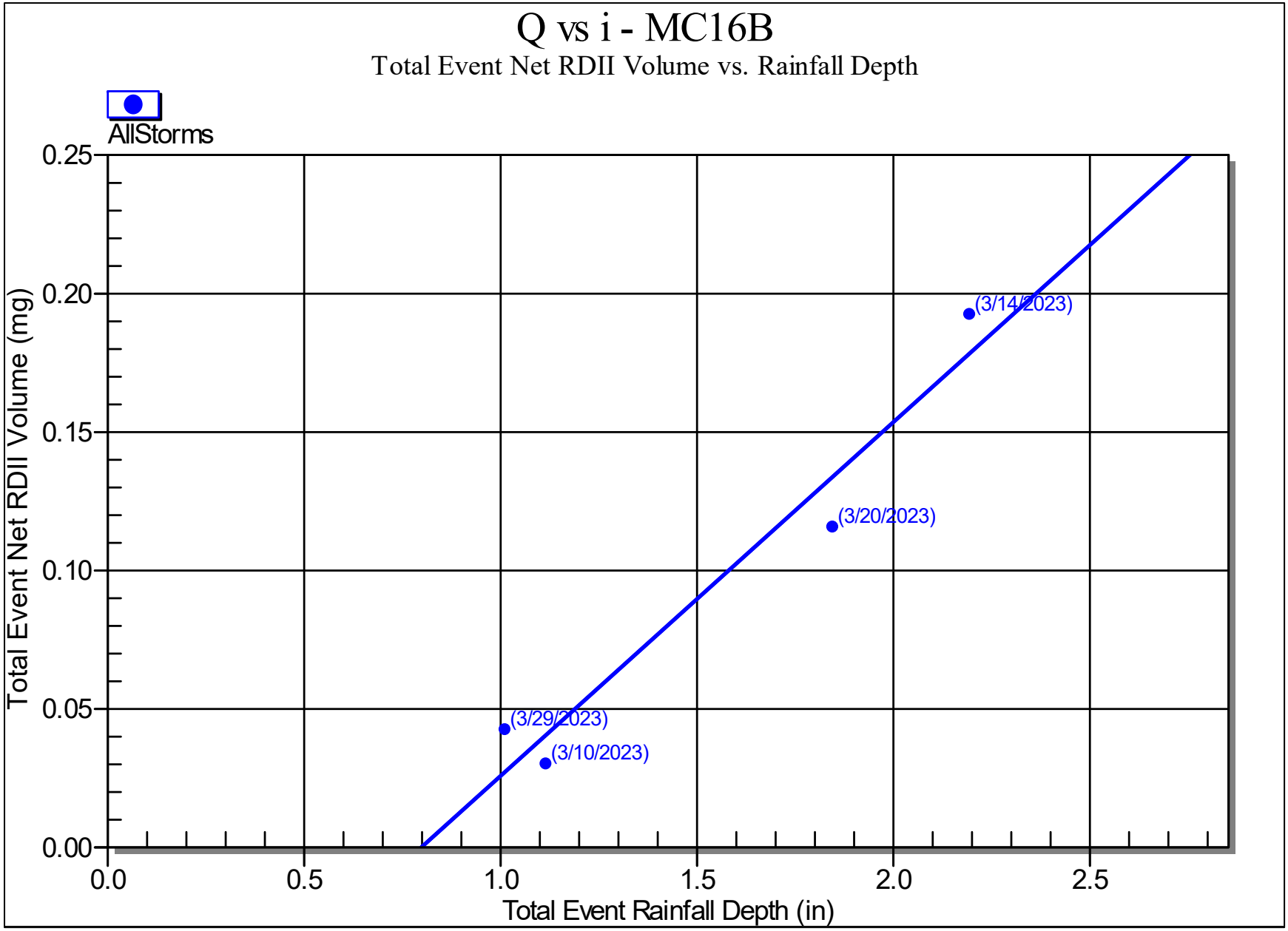

Scatter Graph
MC16B
Lanfear-Coll (C-LC = 4.03)
VFINAL (ft/s)
DFINAL (in)
Iso Q (MGD)

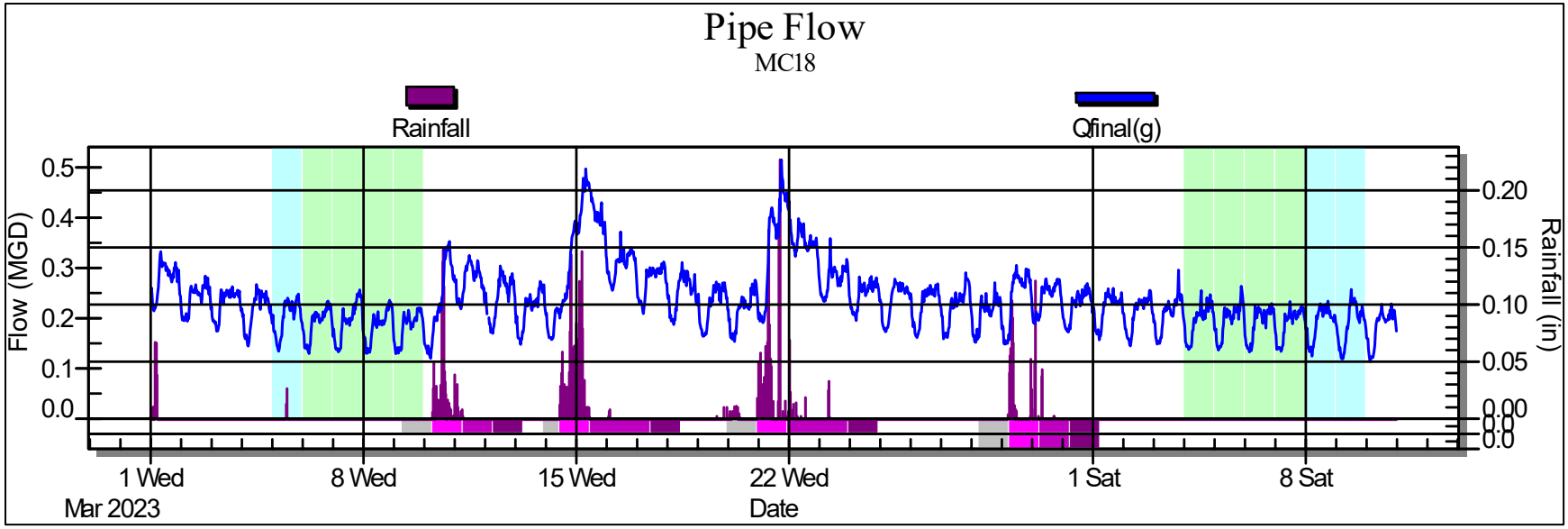

Storm Event - 3/10/2023 6:30:00 AM
MC16B
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

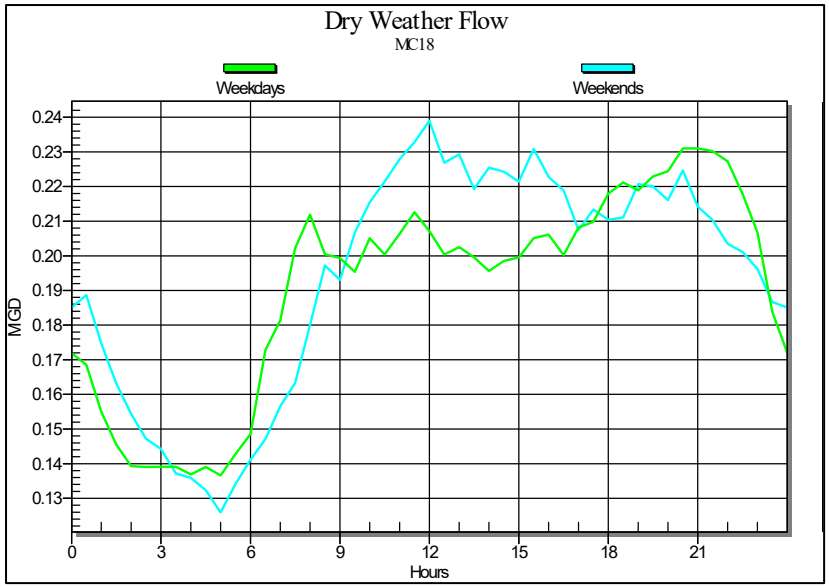

Storm Event - 3/14/2023 11:00:00 AM
MC16B
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

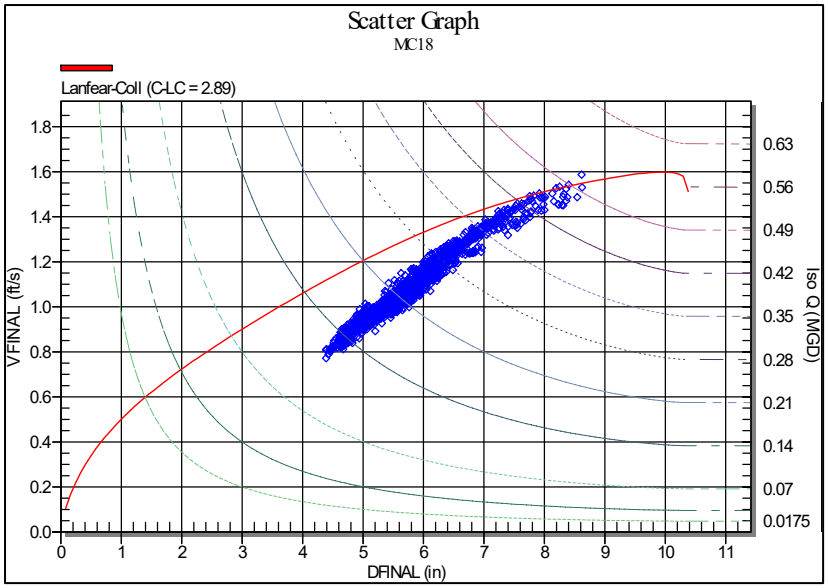

Storm Event - 3/20/2023 11:00:00 PM
MC16B
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

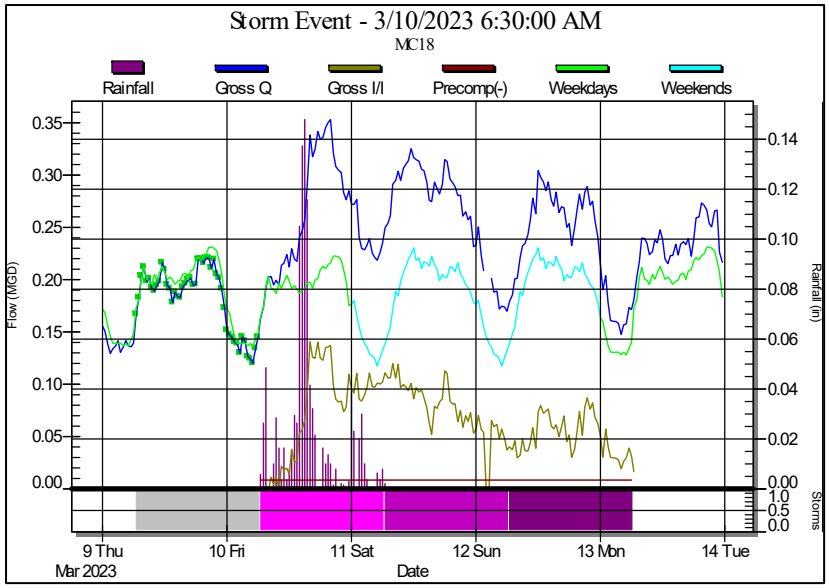

Storm Event - 3/29/2023 6:00:00 AM
MC16B
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

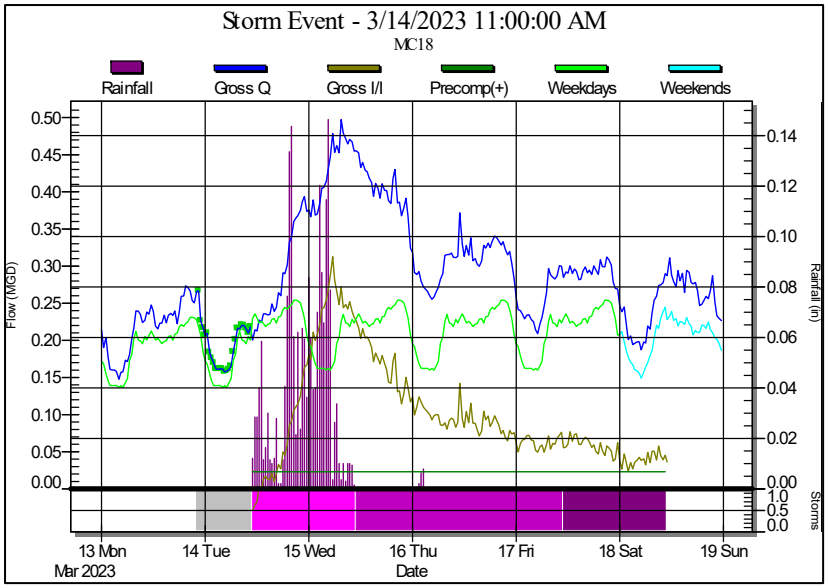

Q vs i - MC16B
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/29/2023)
(3/10/2023)

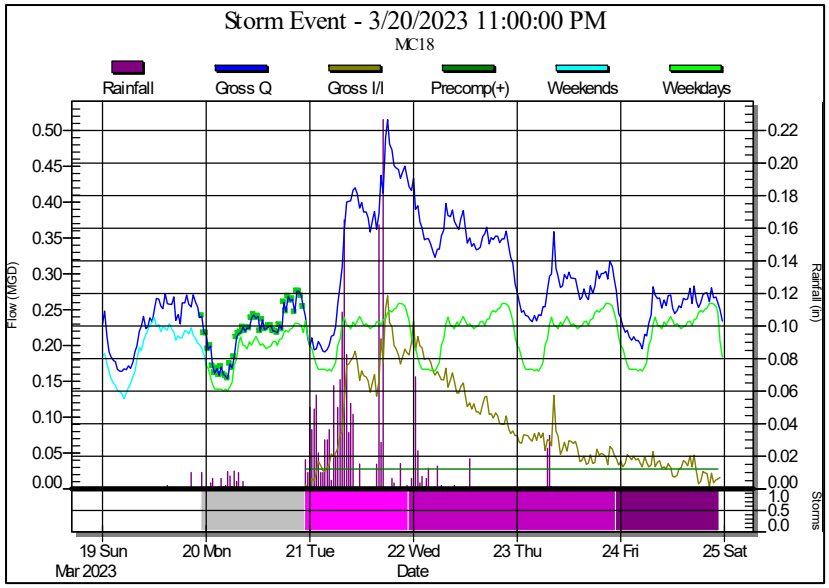

Pipe Flow
MC18
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.5
0.4
0.3
0.2
0.1
0.0
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

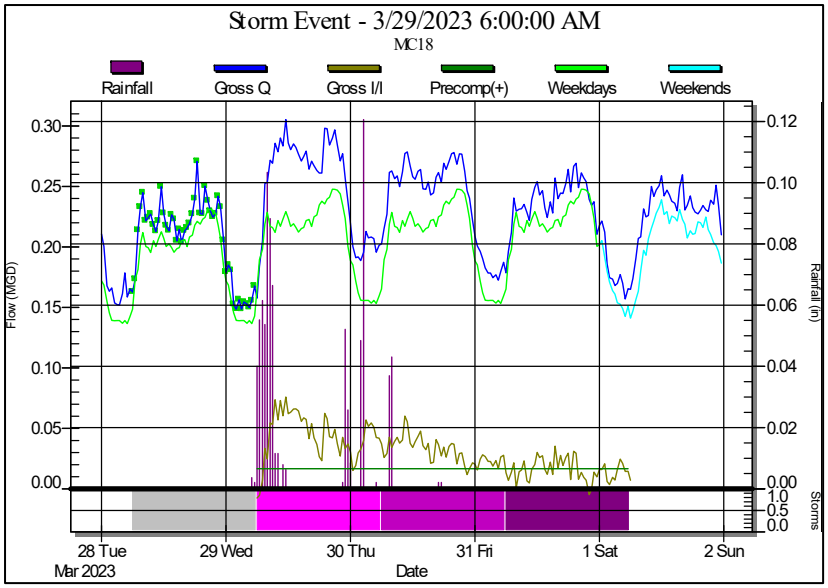

Dry Weather Flow
MC18
Weekdays
Weekends
MGD
0.24
0.23
0.22
0.21
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0
3
6
9
12
15
18
21
Hours

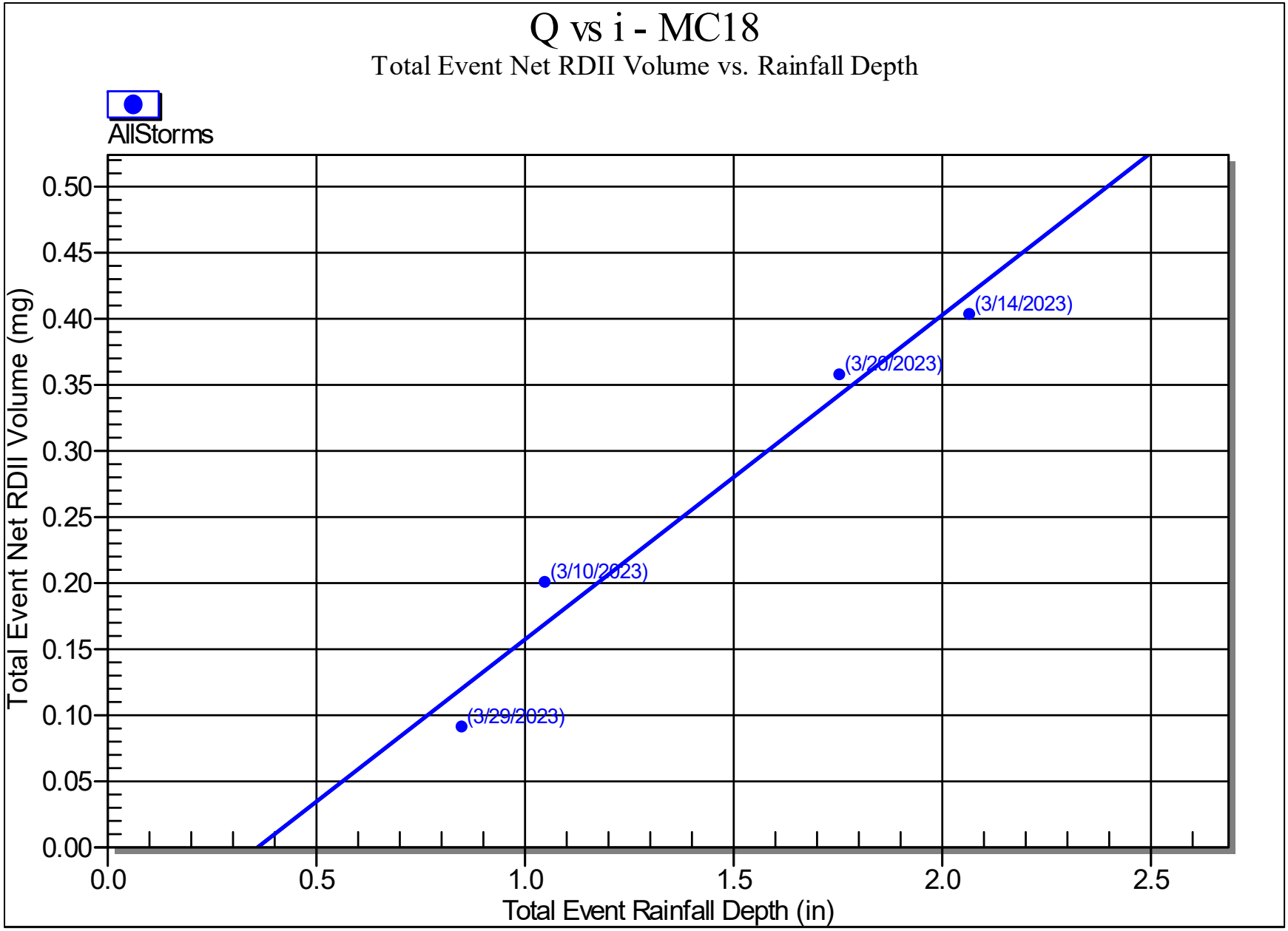

Scatter Graph
MC18
Lanfear-Coll (C-LC = 2.89)
VFINAL (ft/s)
Iso Q (MGD)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.63
0.56
0.49
0.42
0.35
0.28
0.21
0.14
0.07
0.0175
0
1
2
3
4
5
6
7
8
9
10
11
DFINAL (in)

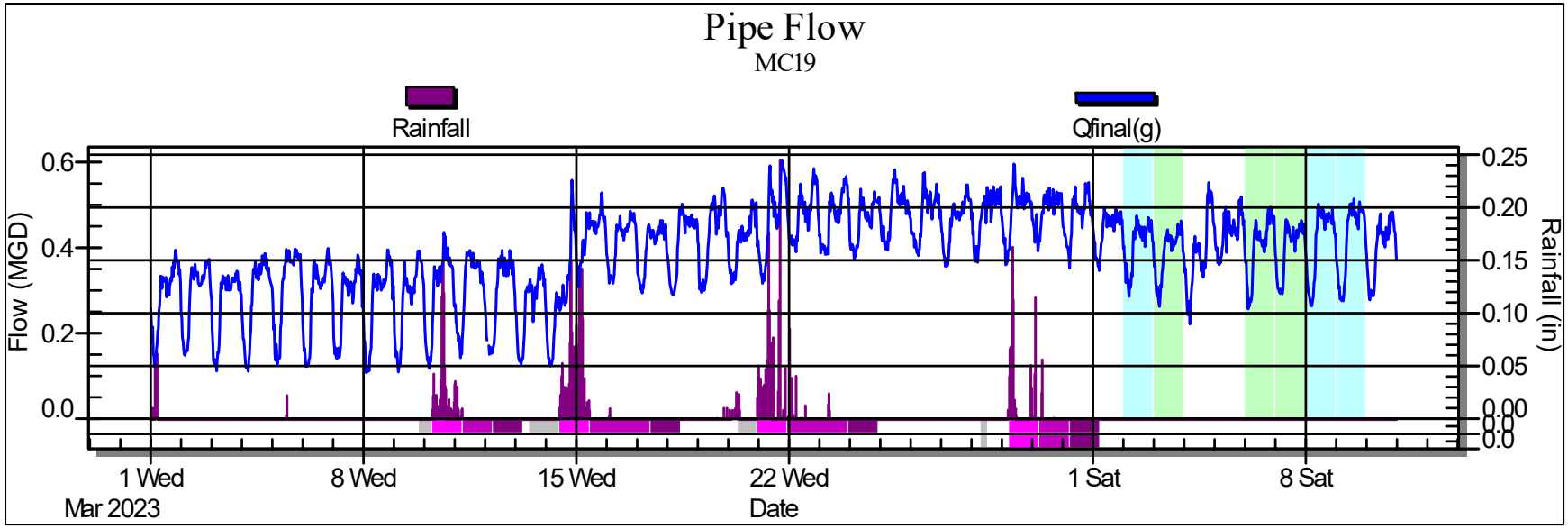

Storm Event - 3/10/2023 6:30:00 AM
MC18
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

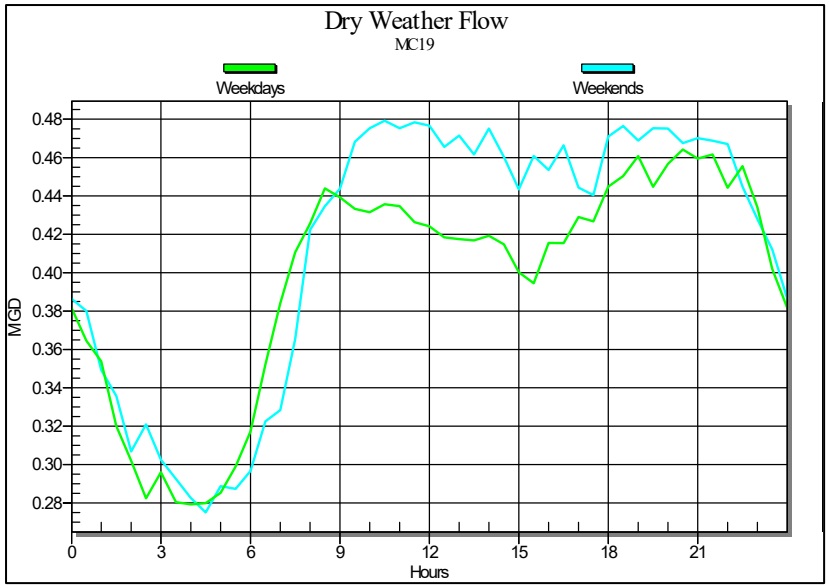

Storm Event - 3/14/2023 11:00:00 AM
MC18
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

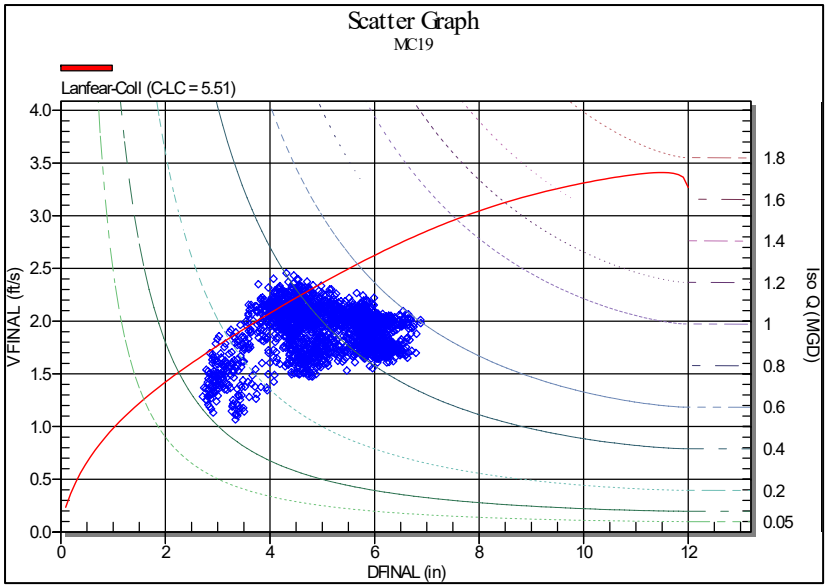

Storm Event - 3/20/2023 11:00:00 PM
MC18
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

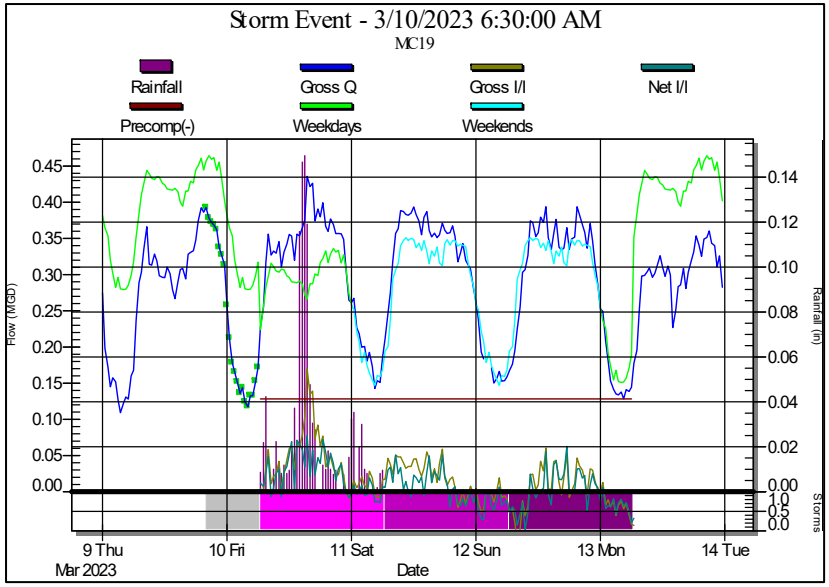

Storm Event - 3/29/2023 6:00:00 AM
MC18
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

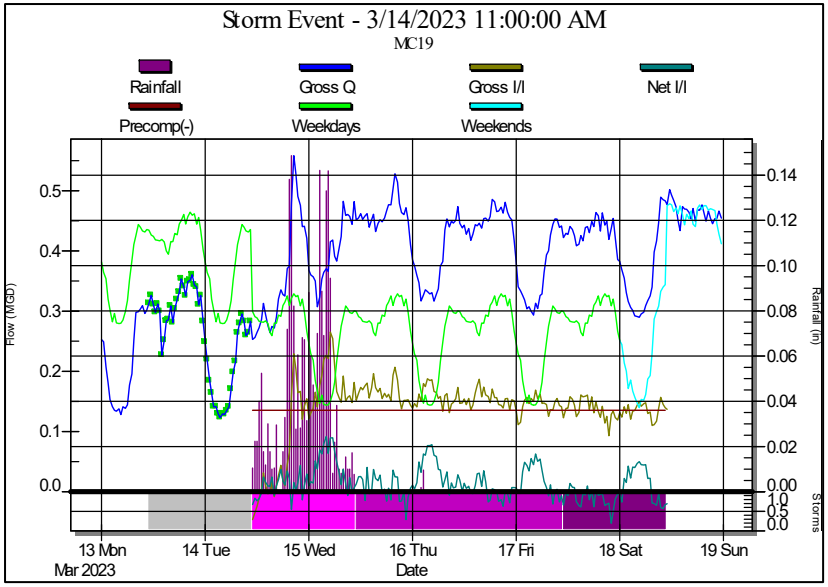

Q vs i - MC18
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

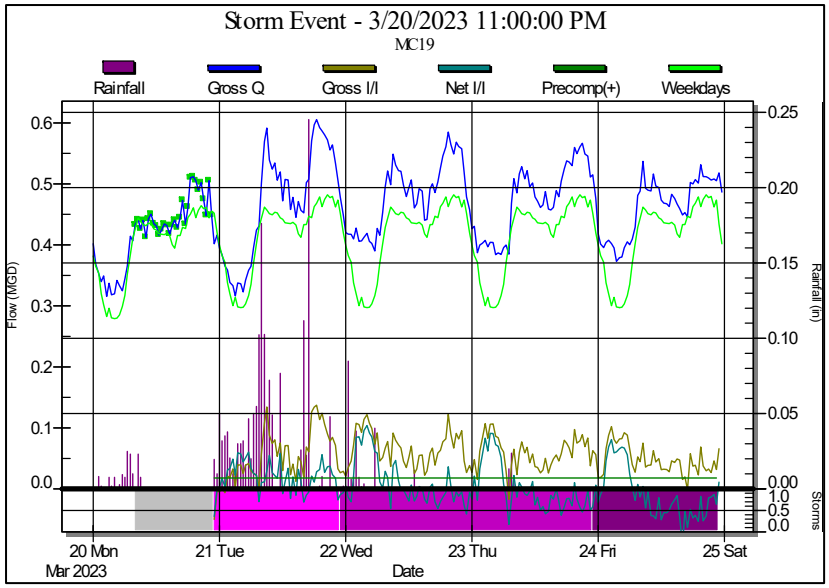

Pipe Flow
MC19
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.6
0.4
0.2
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

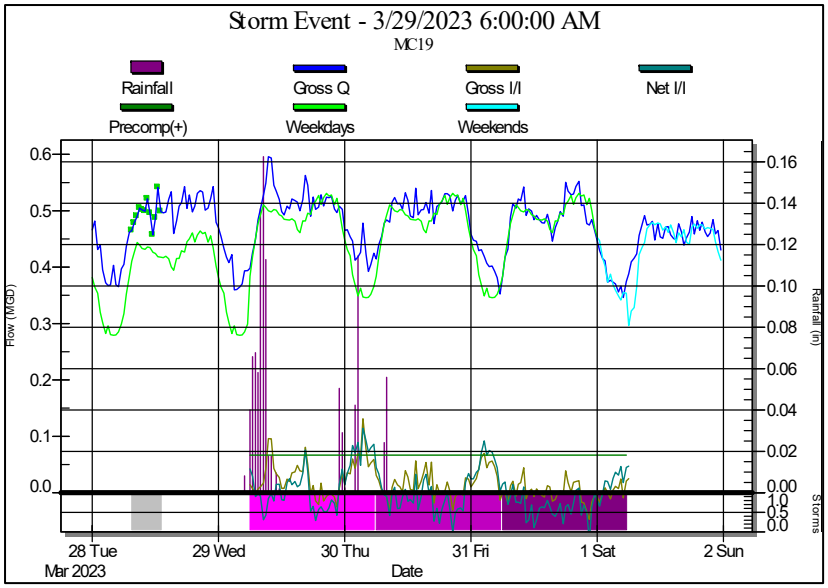

Dry Weather Flow
MC19
Weekdays
Weekends
MGD
0.48
0.46
0.44
0.42
0.40
0.38
0.36
0.34
0.32
0.30
0.28
0
3
6
9
12
15
18
21
Hours

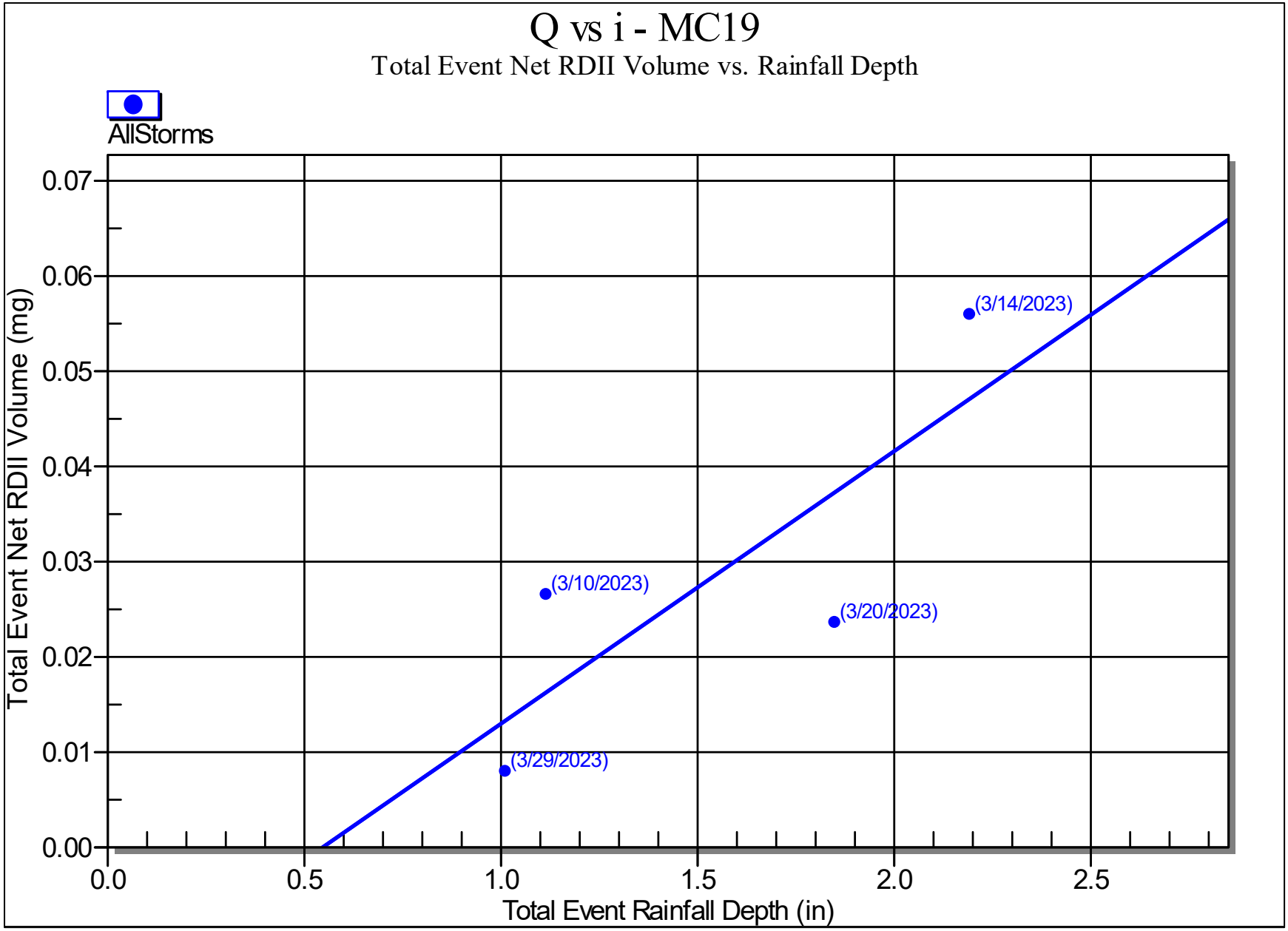

Scatter Graph
MC19
Lanfear-Coll (C-LC = 5.51)
VFINAL (ft/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
DFINAL (in)
Iso Q (MGD)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0.05

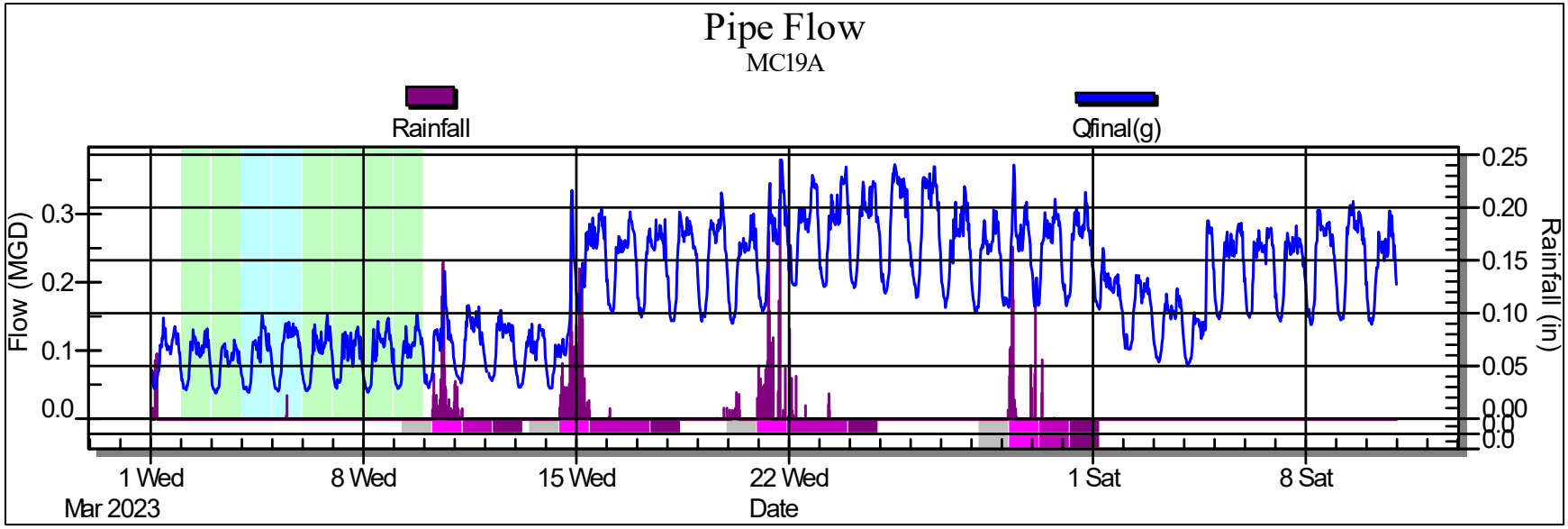

Storm Event - 3/10/2023 6:30:00 AM
MC19
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
Mar 2023
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Date

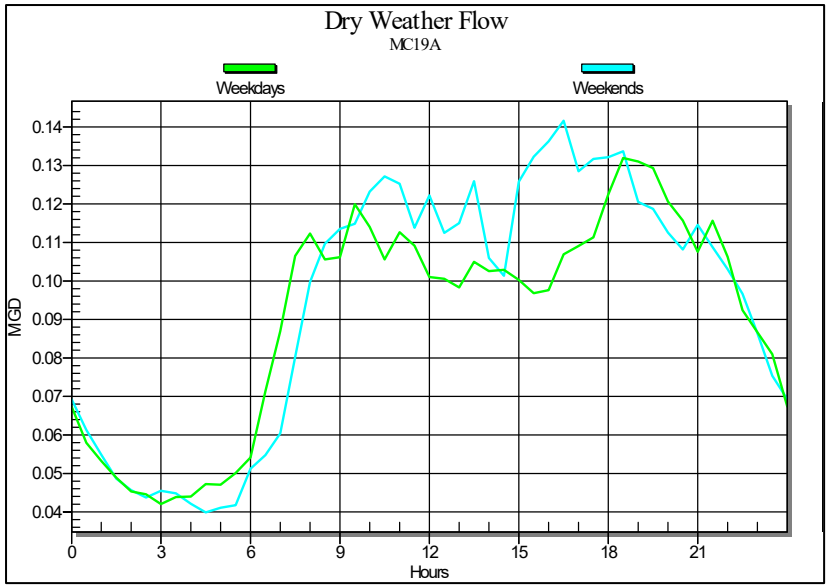

Storm Event - 3/14/2023 11:00:00 AM
MC19
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
Mar 2023
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Date

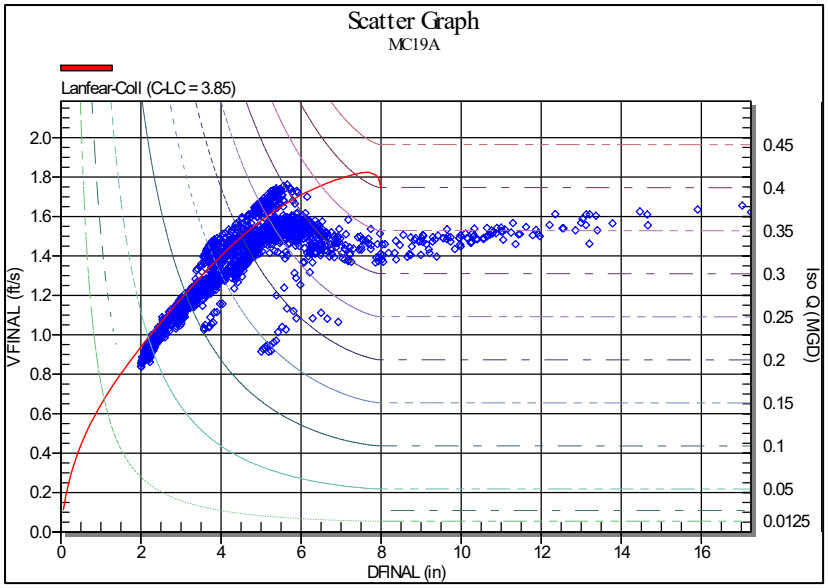

Storm Event - 3/20/2023 11:00:00 PM
MC19
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekdays
Flow (MGD)
Rainfall (in)
Storms
20 Mon
Mar 2023
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Date

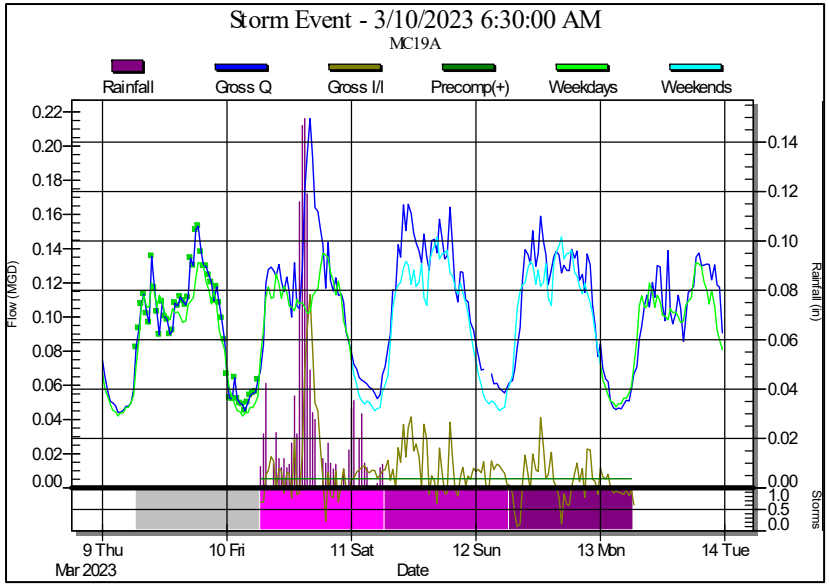

Storm Event - 3/29/2023 6:00:00 AM
MC19
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
Mar 2023
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Date

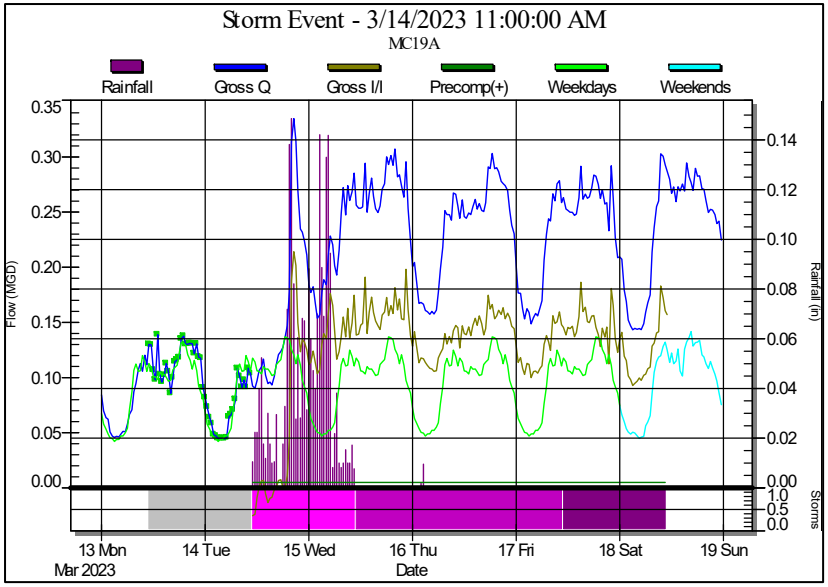

Q vs i - MC19
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/10/2023)
(3/20/2023)
(3/29/2023)

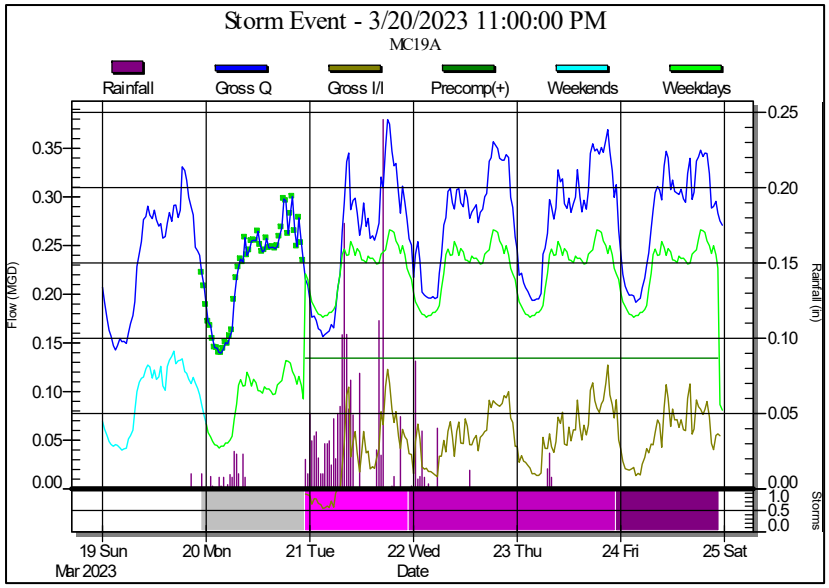

Pipe Flow
MC19A
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.3
0.2
0.1
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

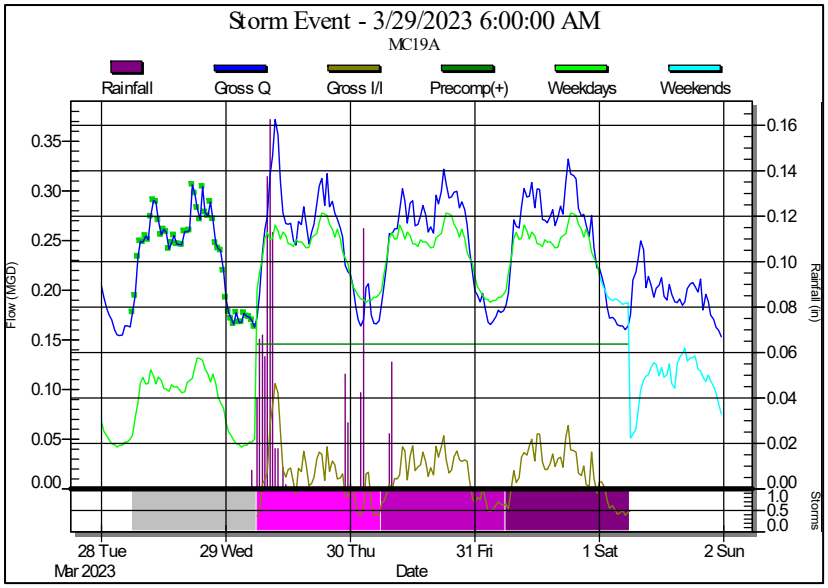

Dry Weather Flow
MC19A
Weekdays
Weekends
MGD
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0
3
6
9
12
15
18
21
Hours

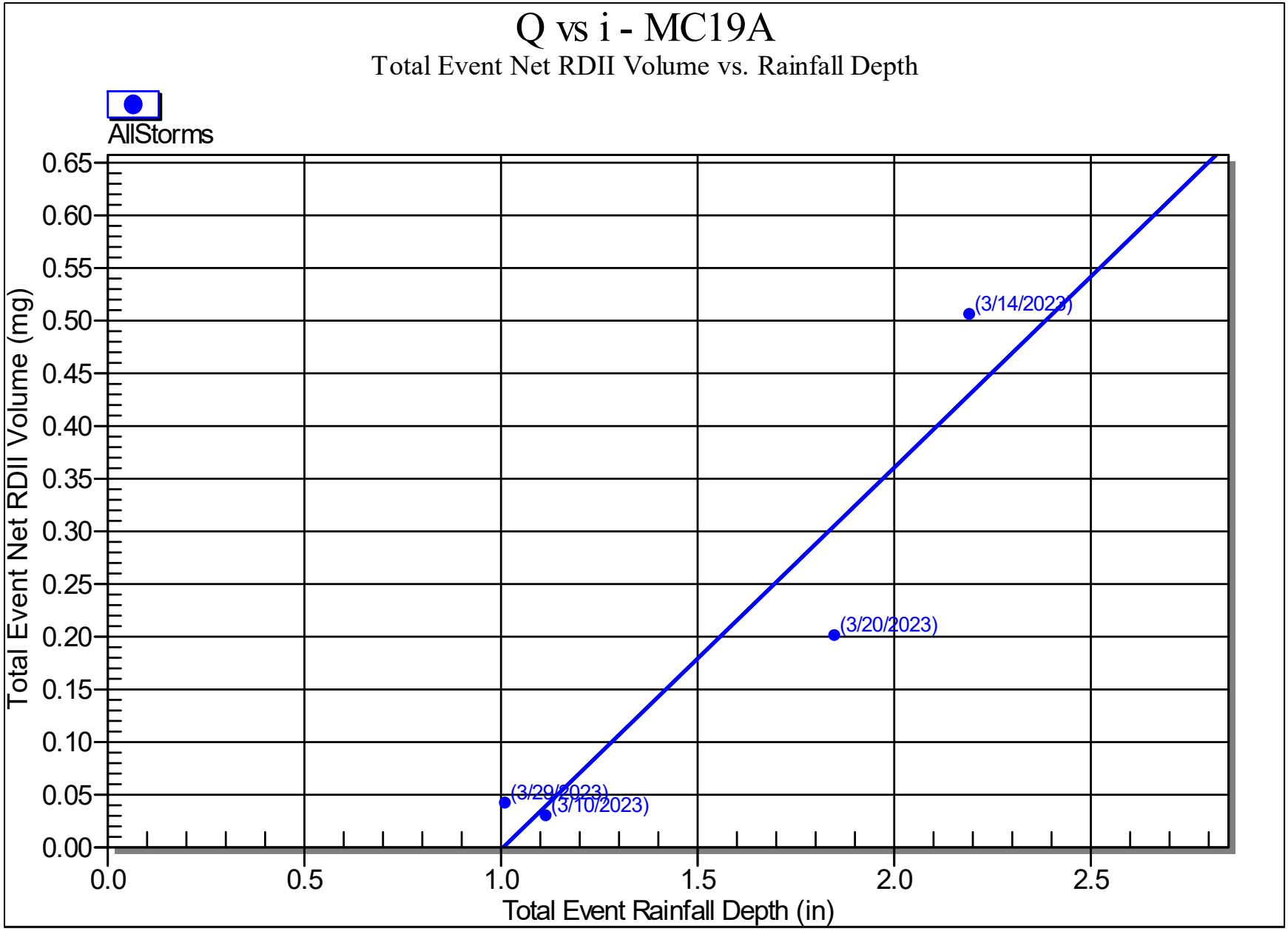

Scatter Graph
MC19A
Lanfear-Coll (C-LC = 3.85)
VFINAL (ft/s)
Iso Q (MGD)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0.0125
0
2
4
6
8
10
12
14
16
DFINAL (in)

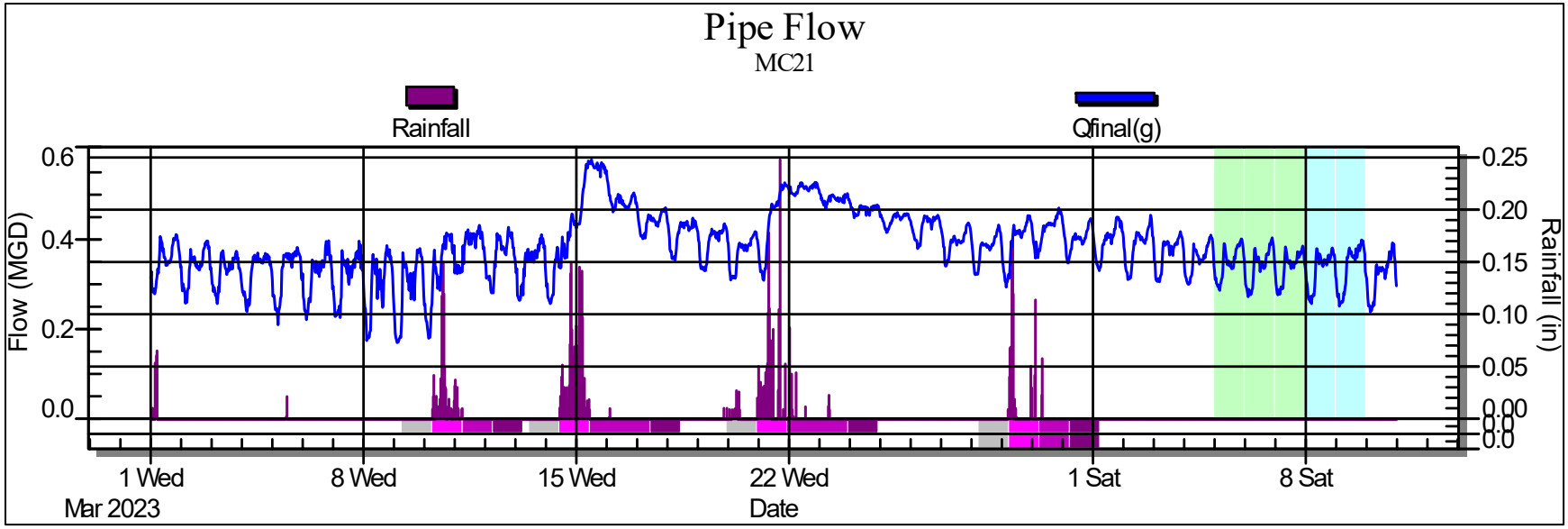

Storm Event - 3/10/2023 6:30:00 AM
MC19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

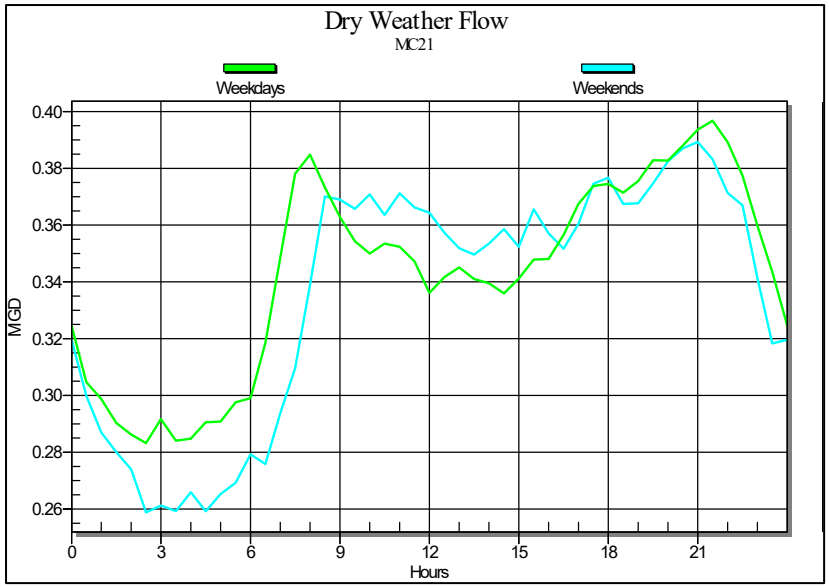

Storm Event - 3/14/2023 11:00:00 AM
MC19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

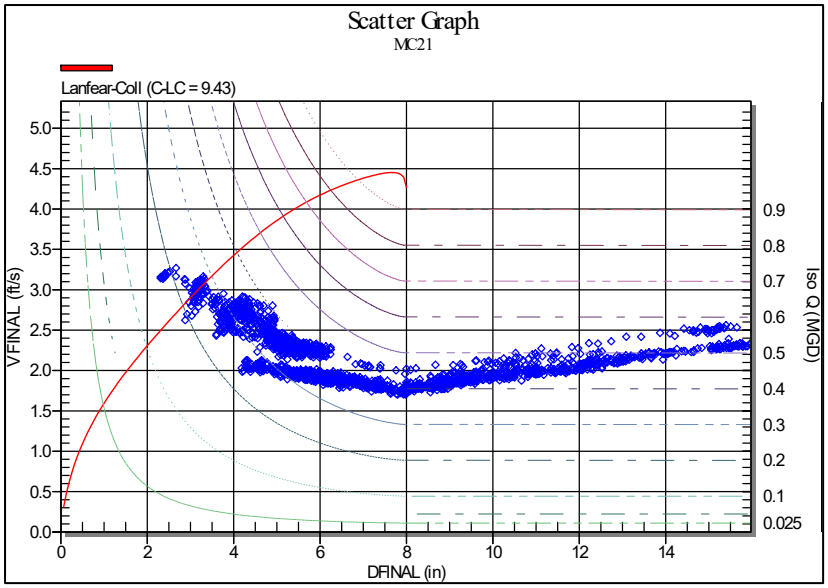

Storm Event - 3/20/2023 11:00:00 PM
MC19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

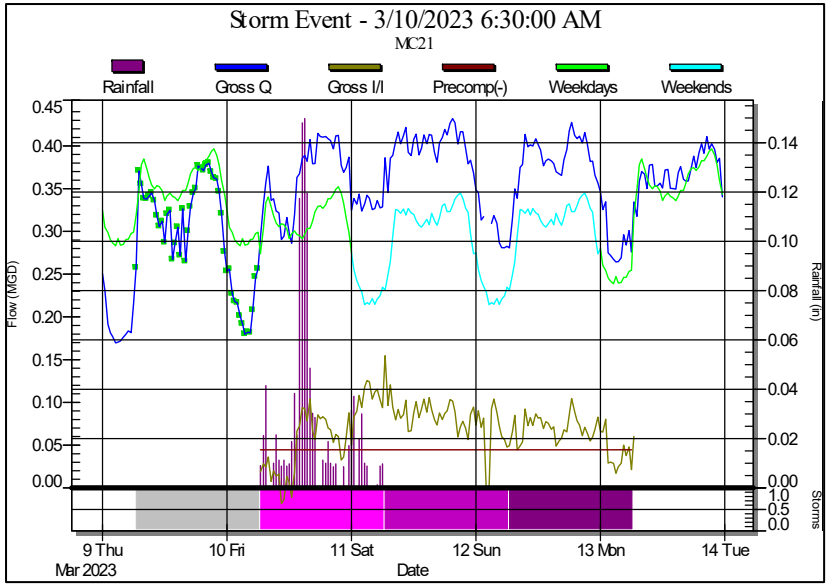

Storm Event - 3/29/2023 6:00:00 AM
MC19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

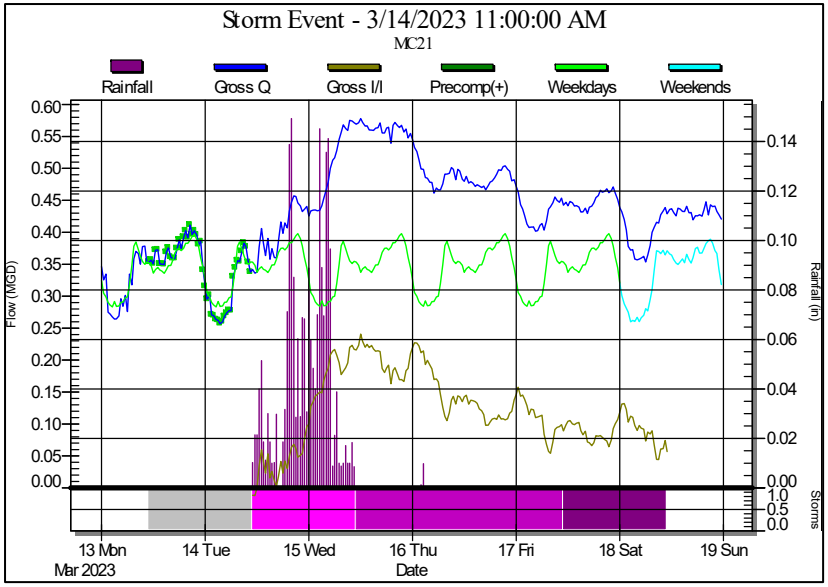

Q vs i - MC19A
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/29/2023)
(3/10/2023)

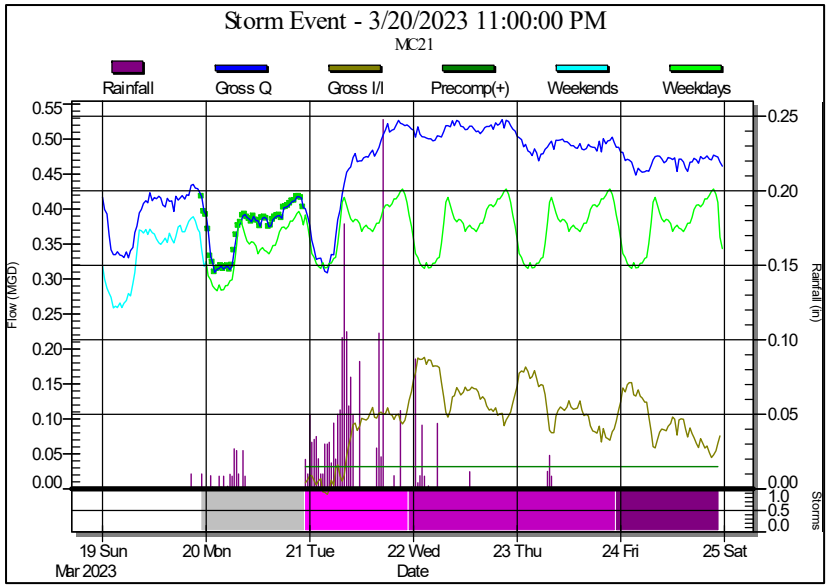

Pipe Flow
MC21
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.6
0.4
0.2
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

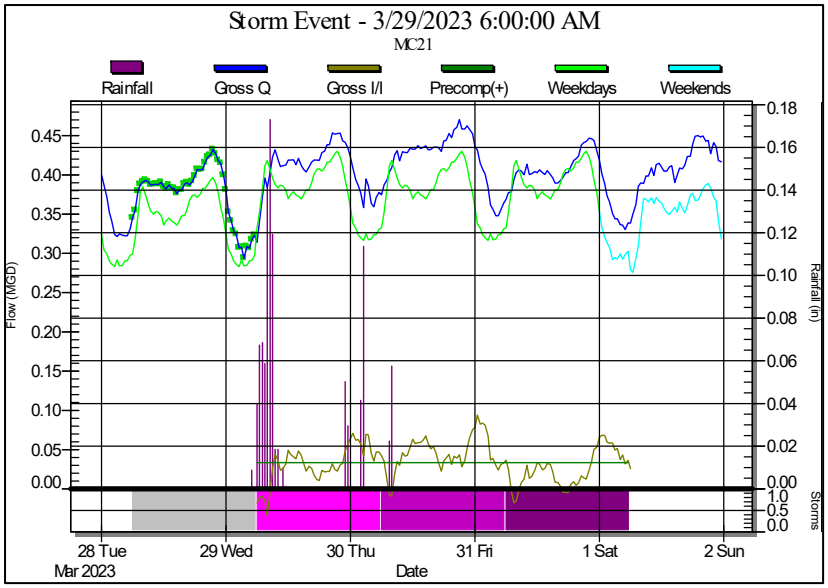

Dry Weather Flow
MC21
Weekdays
Weekends
MGD
0.40
0.38
0.36
0.34
0.32
0.30
0.28
0.26
0
3
6
9
12
15
18
21
Hours

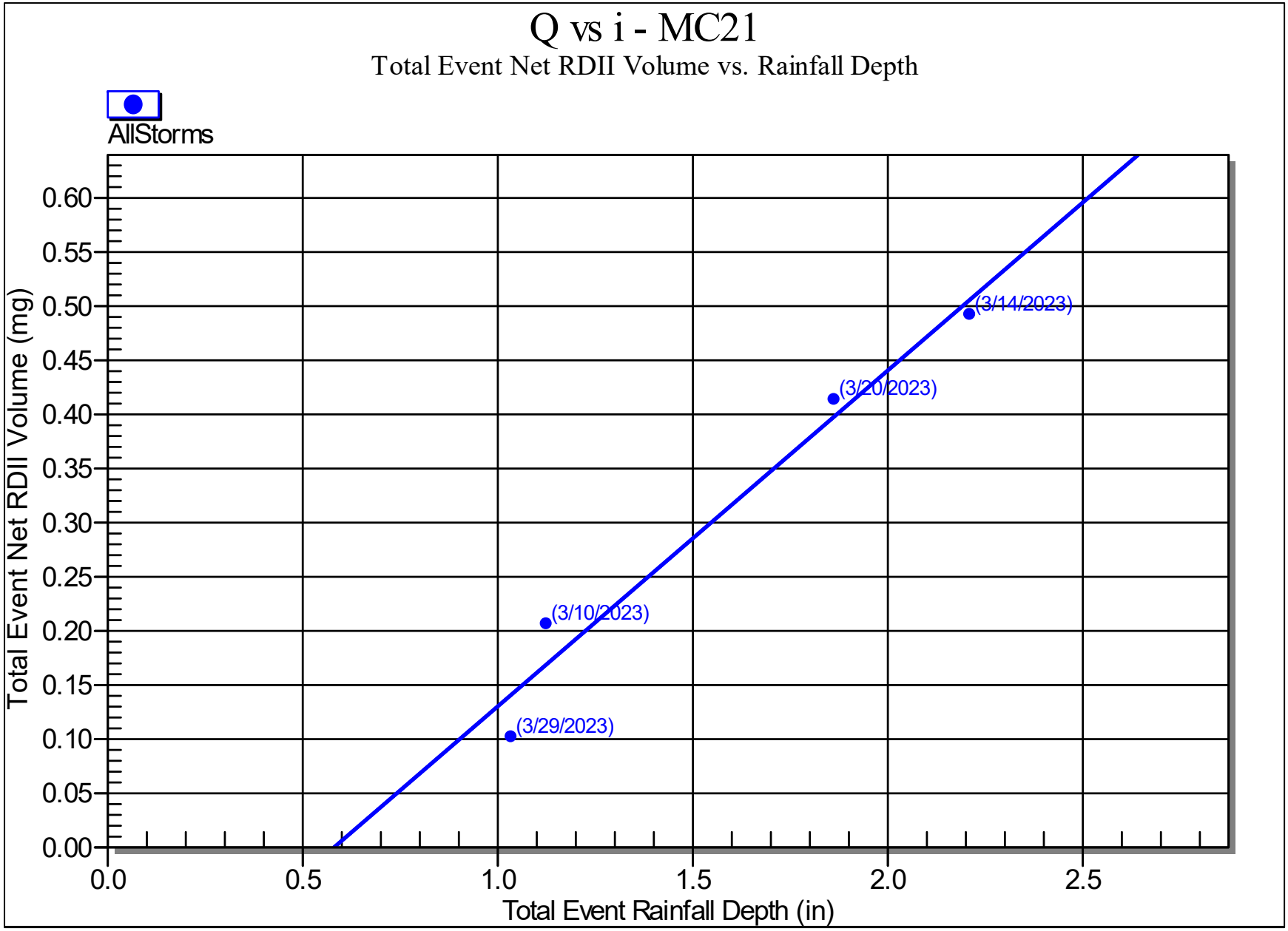

Scatter Graph
MC21
Lanfear-Coll (C-LC = 9.43)
VFINAL (ft/s)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
DFINAL (in)
Iso Q (MGD)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.025

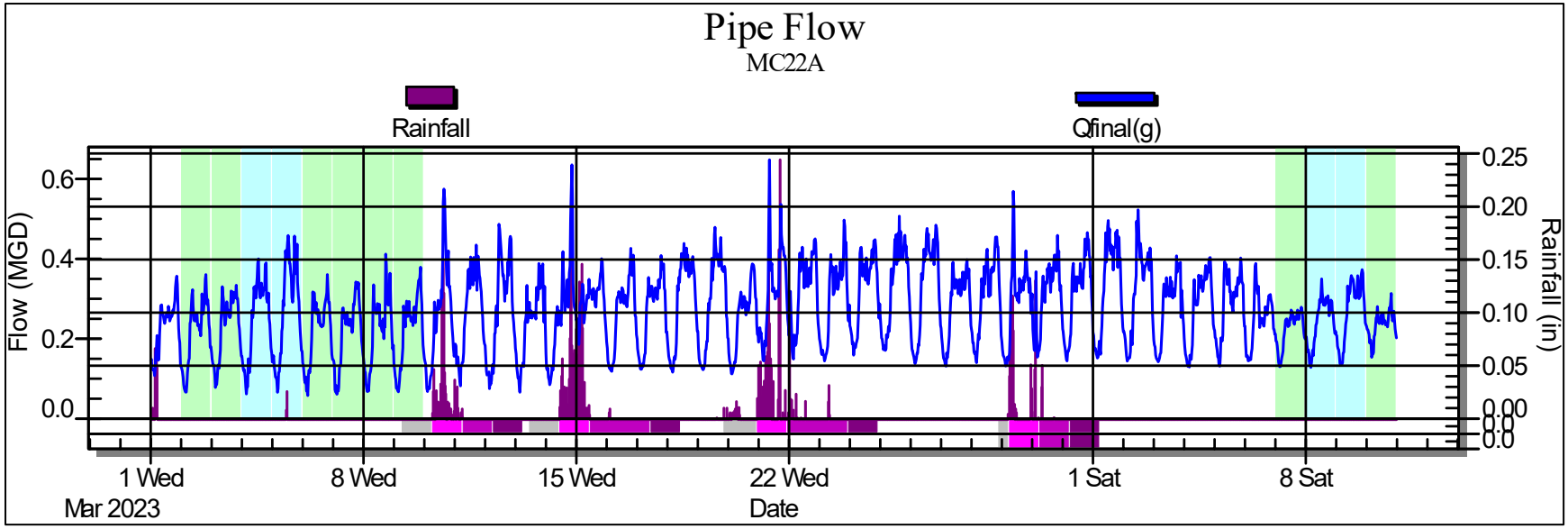

Storm Event - 3/10/2023 6:30:00 AM
MC21
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

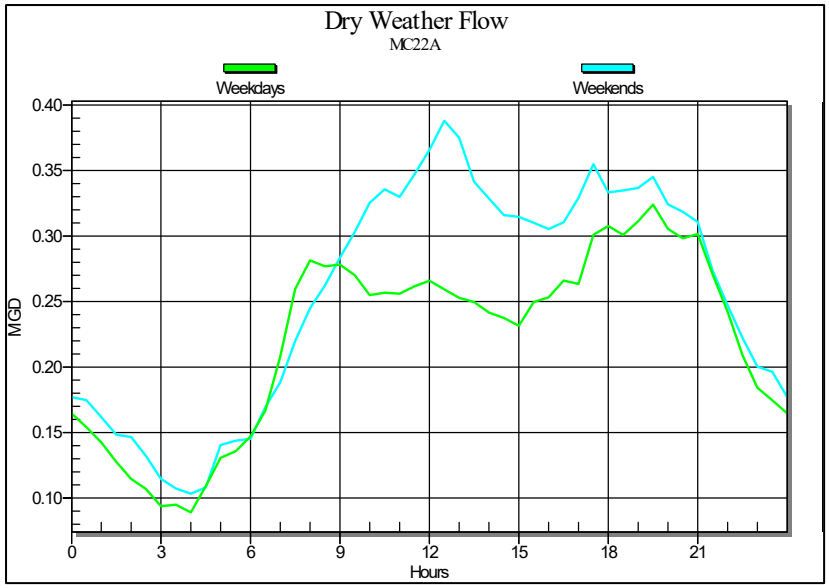

Storm Event - 3/14/2023 11:00:00 AM
MC21
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

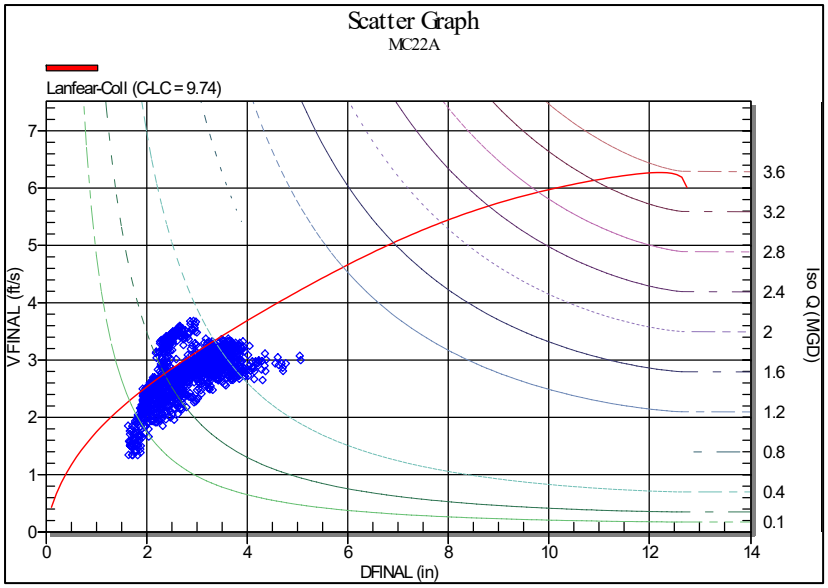

Storm Event - 3/20/2023 11:00:00 PM
MC21
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

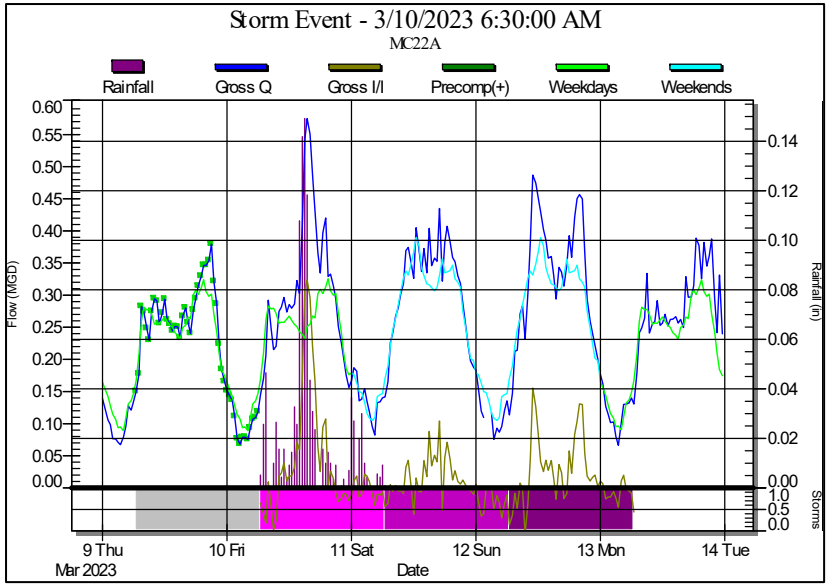

Storm Event - 3/29/2023 6:00:00 AM
MC21
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

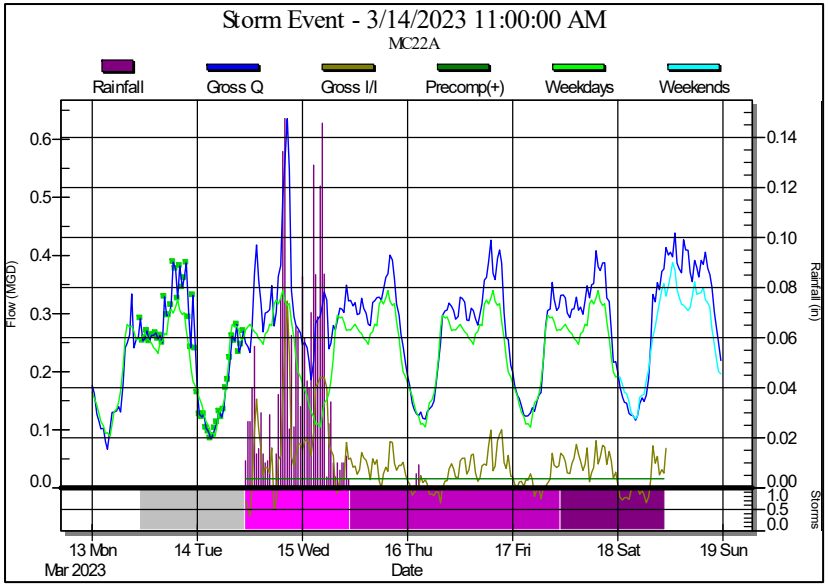

Q vs i - MC21
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

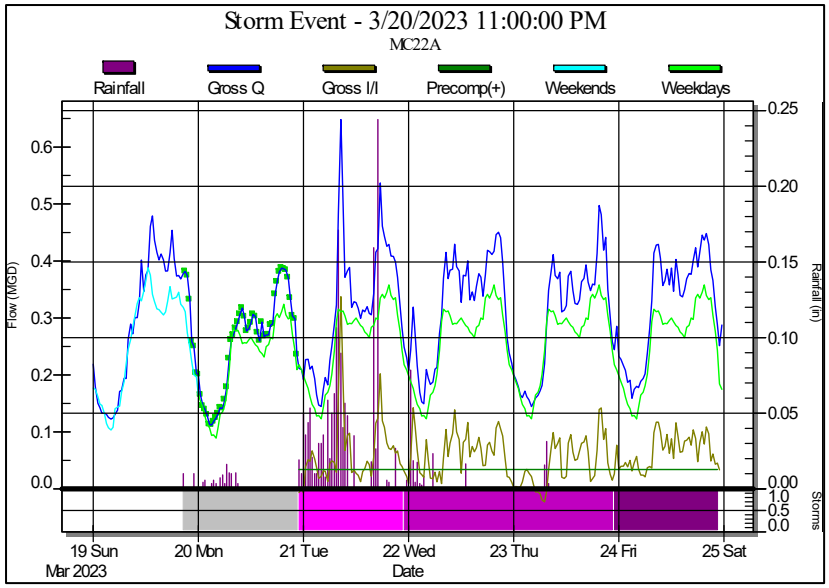

Pipe Flow
MC22A
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.6
0.4
0.2
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

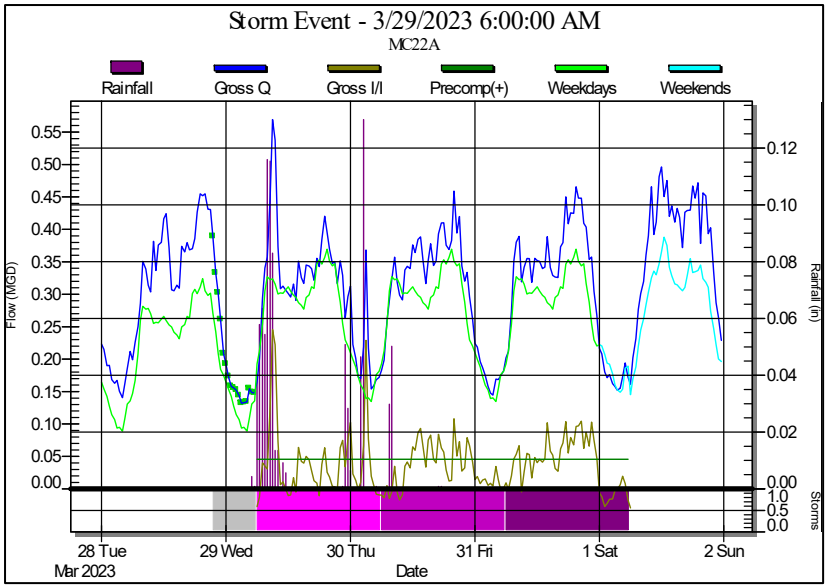

Dry Weather Flow
MC22A
Weekdays
Weekends
MGD
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0
3
6
9
12
15
18
21
Hours

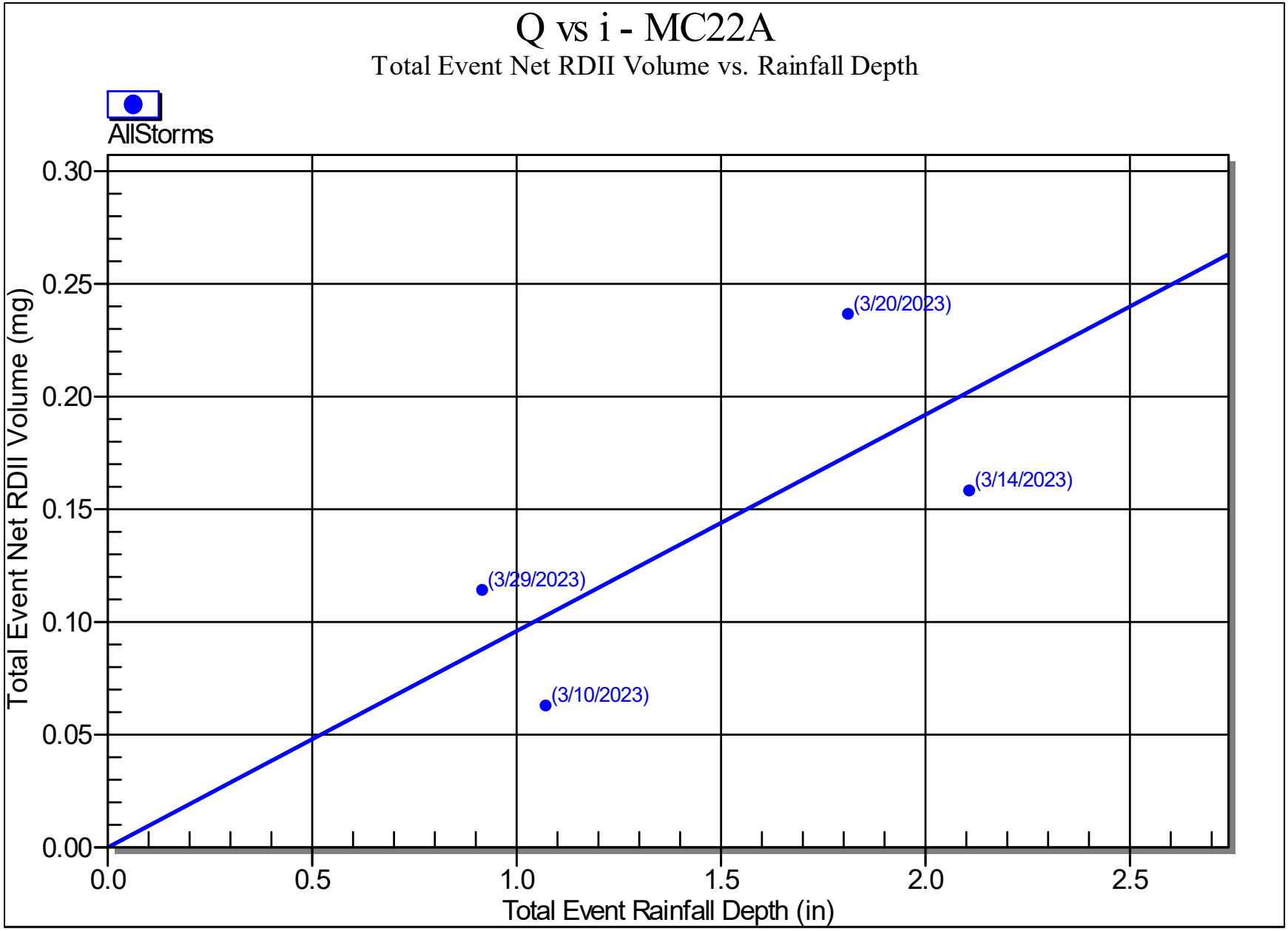

Scatter Graph
MC22A
Lanfear-Coll (C-LC = 9.74)
VFINAL (ft/s)
Iso Q (MGD)
DFINAL (in)
0
1
2
3
4
5
6
7
0
2
4
6
8
10
12
14
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0.1

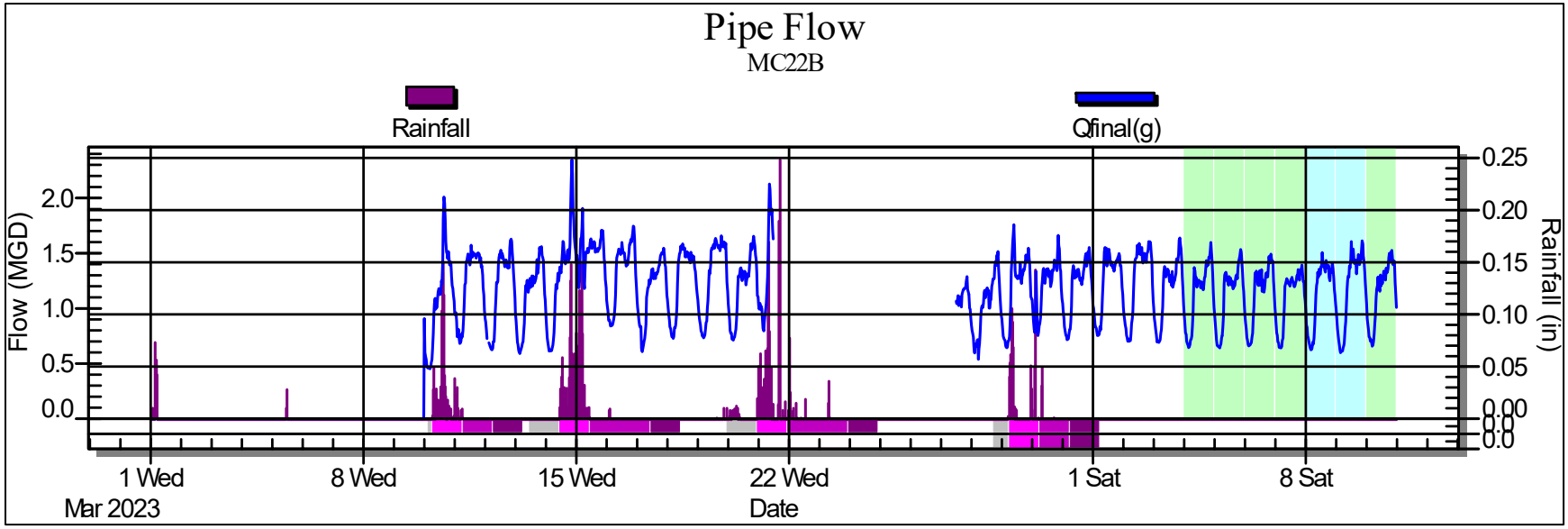

Storm Event - 3/10/2023 6:30:00 AM
MC22A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

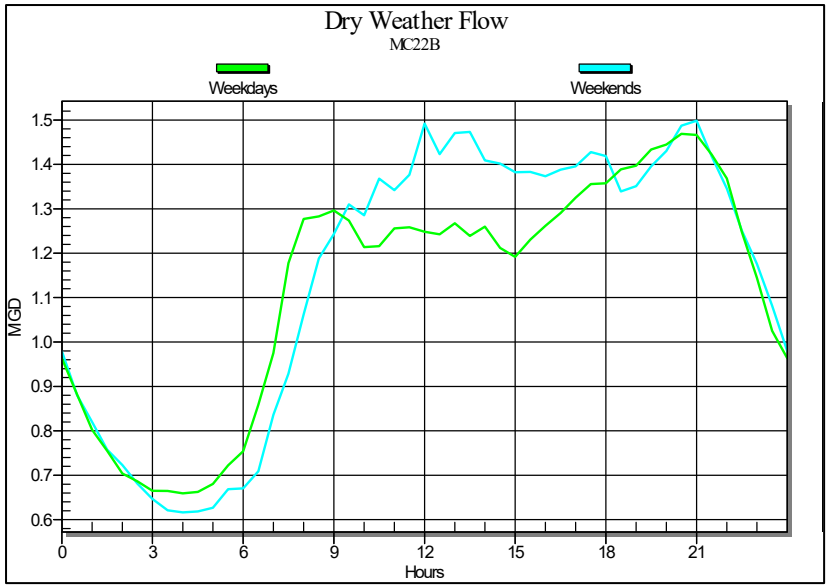

Storm Event - 3/14/2023 11:00:00 AM
MC22A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

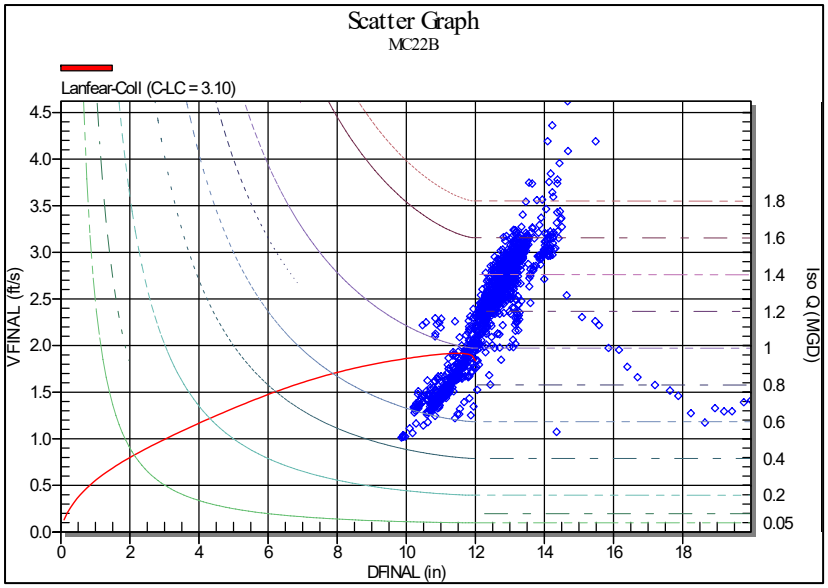

Storm Event - 3/20/2023 11:00:00 PM
MC22A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

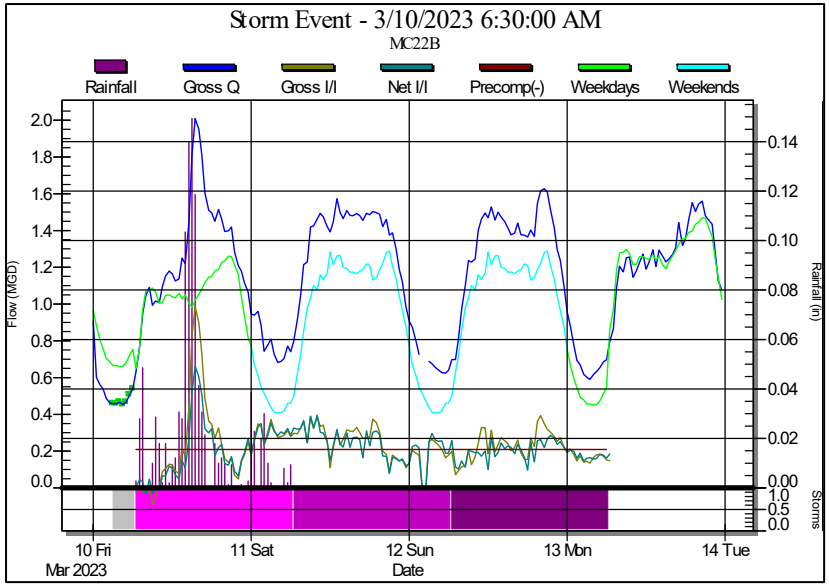

Storm Event - 3/29/2023 6:00:00 AM
MC22A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

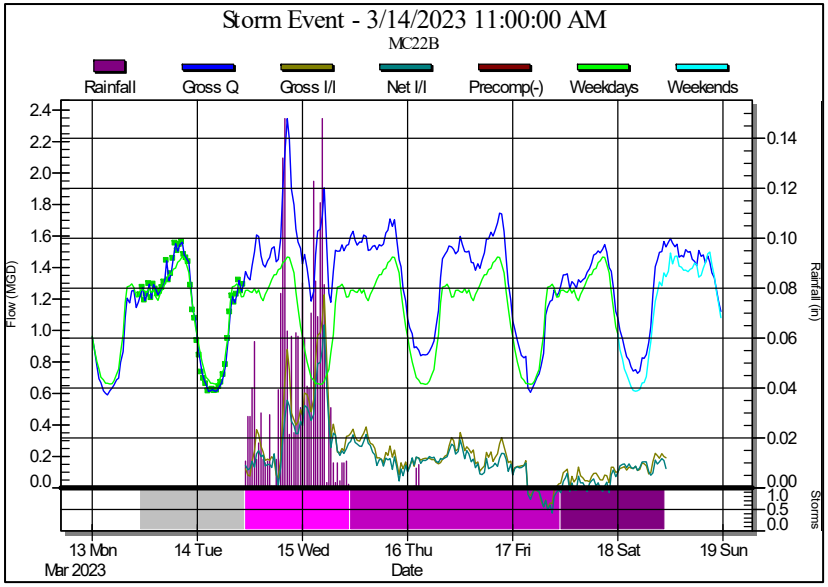

Q vs i - MC22A
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/20/2023)
(3/14/2023)
(3/29/2023)
(3/10/2023)

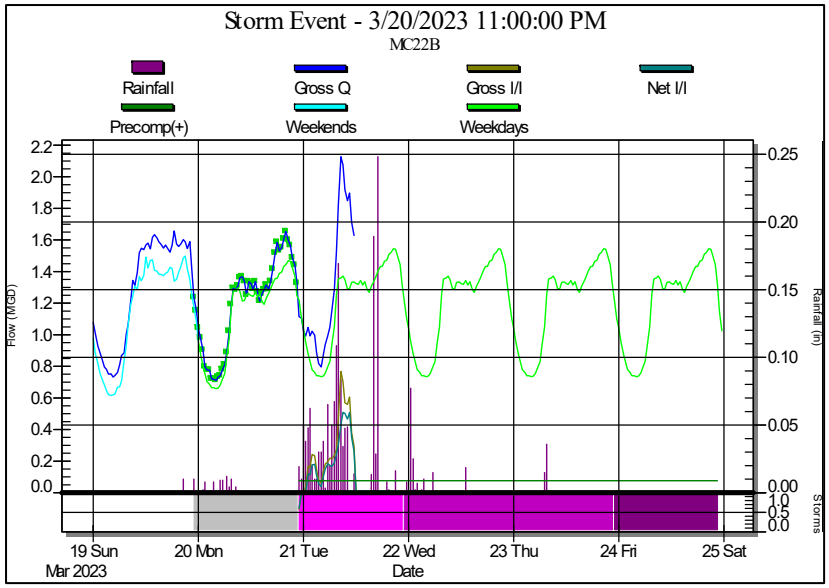

Pipe Flow
MC22B
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
2.0
1.5
1.0
0.5
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

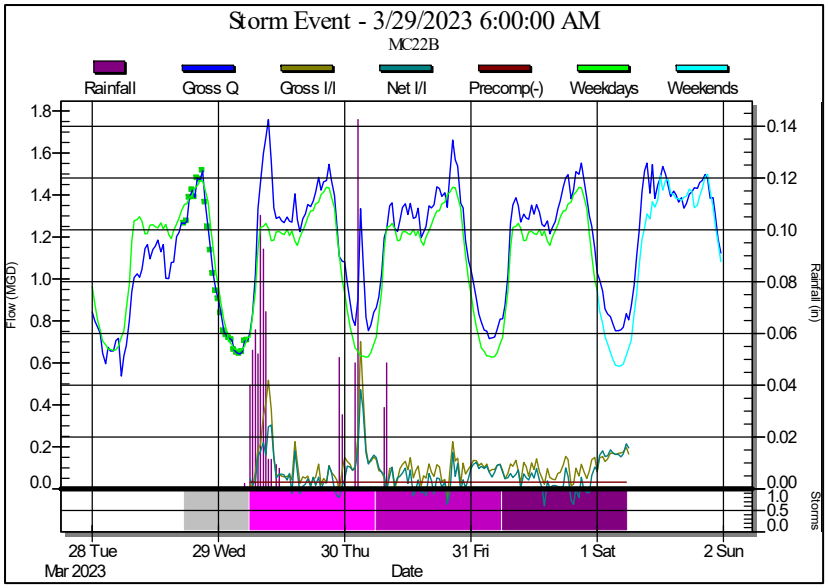

Dry Weather Flow
MC22B
Weekdays
Weekends
MGD
Hours

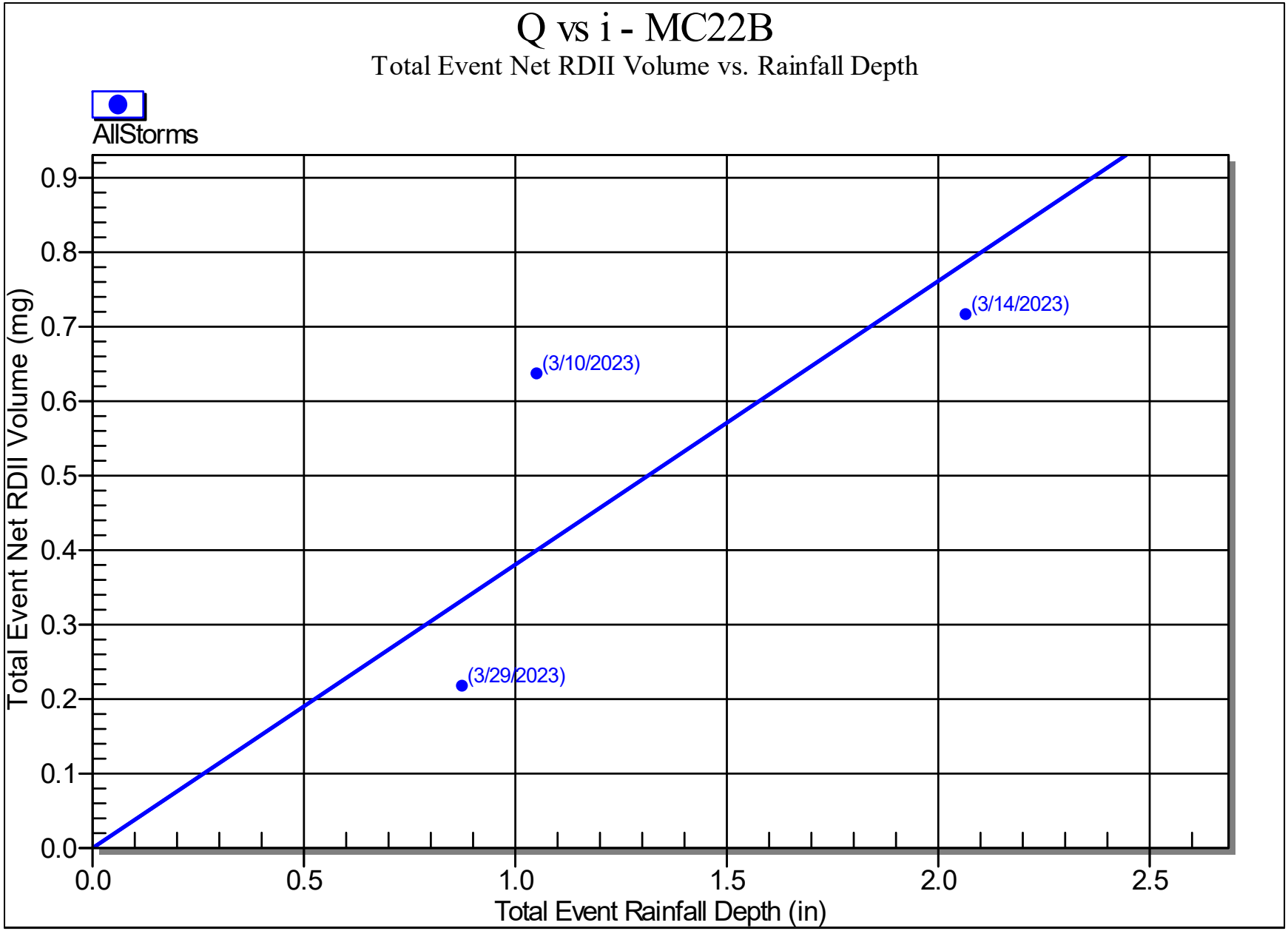

Scatter Graph
MC22B
Lanfear-Coll (C-LC = 3.10)
VFINAL (ft/s)
DFINAL (in)
Iso Q (MGD)

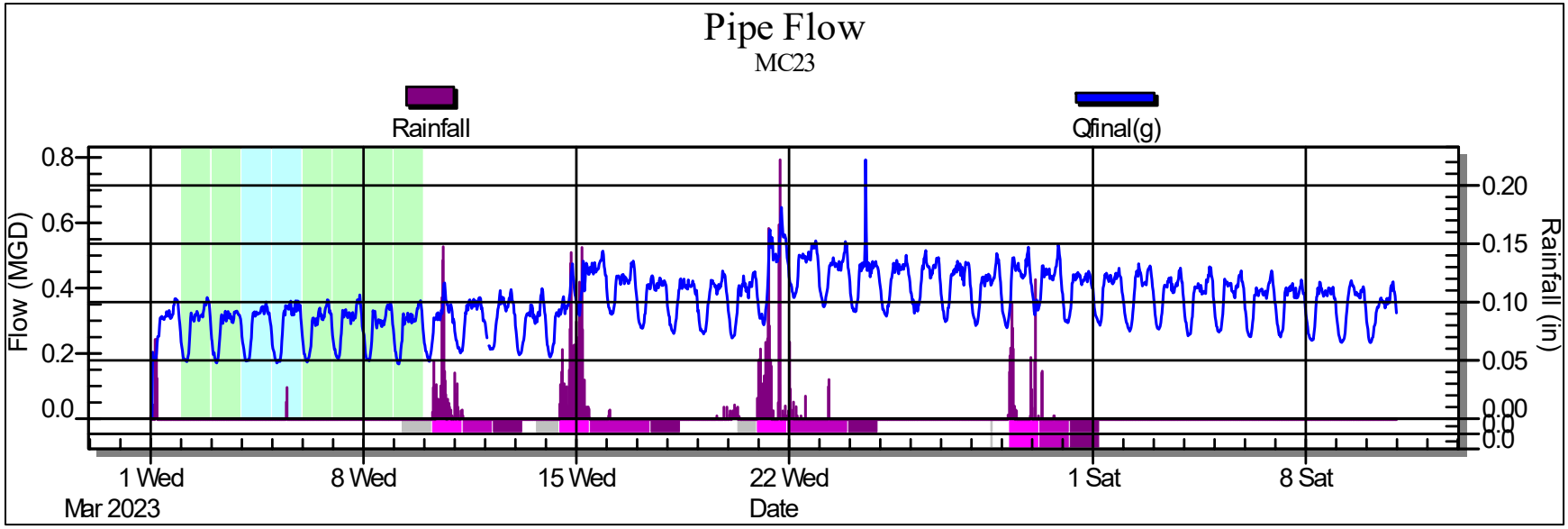

Storm Event - 3/10/2023 6:30:00 AM
MC22B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

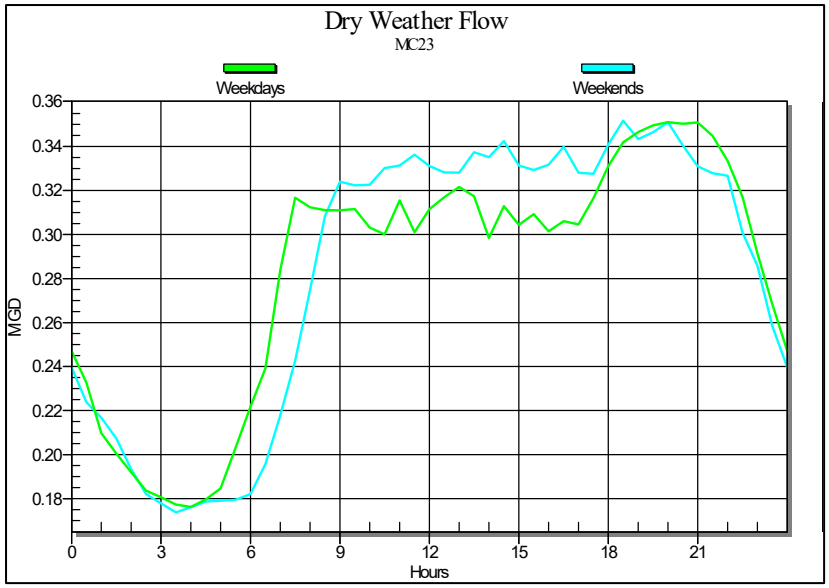

Storm Event - 3/14/2023 11:00:00 AM
MC22B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

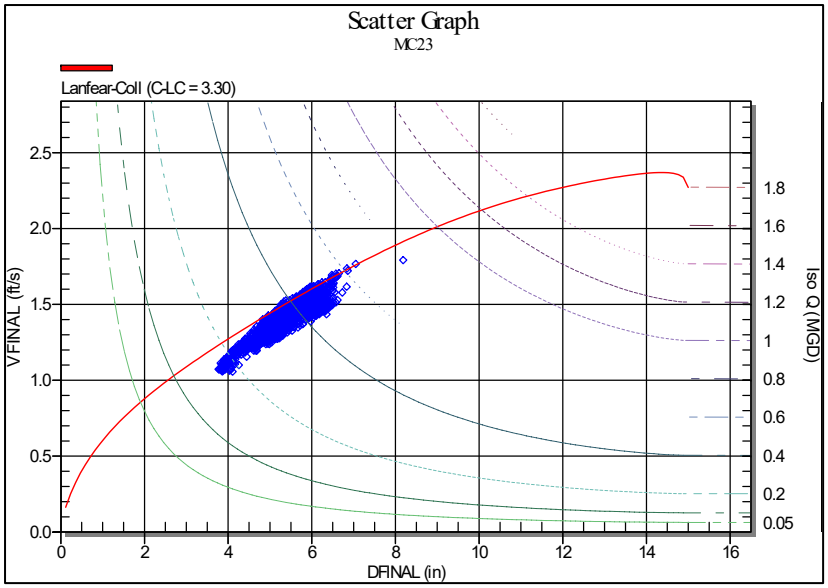

Storm Event - 3/20/2023 11:00:00 PM
MC22B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

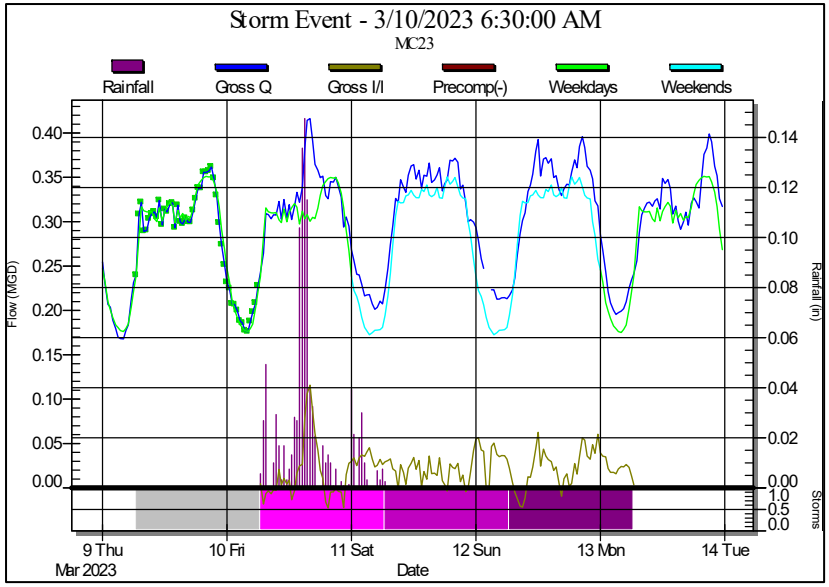

Storm Event - 3/29/2023 6:00:00 AM
MC22B
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

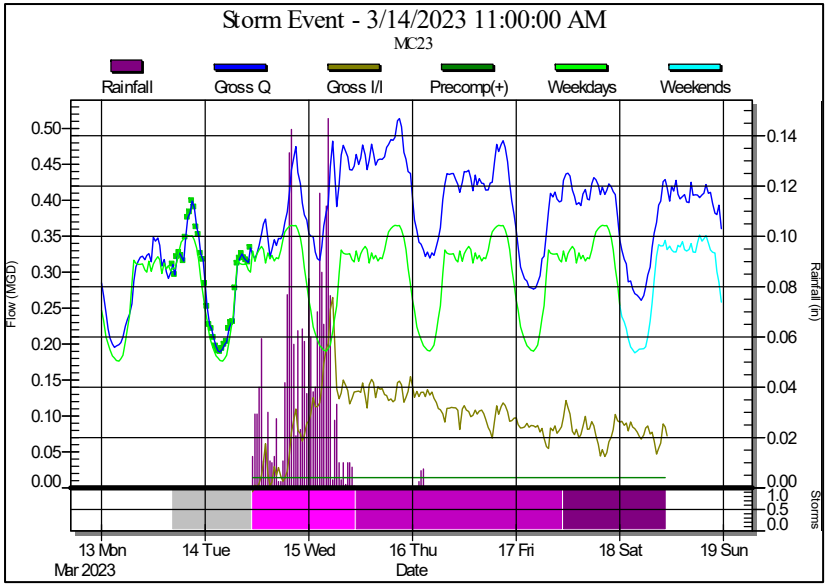

Q vs i - MC22B
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
(3/14/2023)
(3/10/2023)
(3/29/2023)
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)

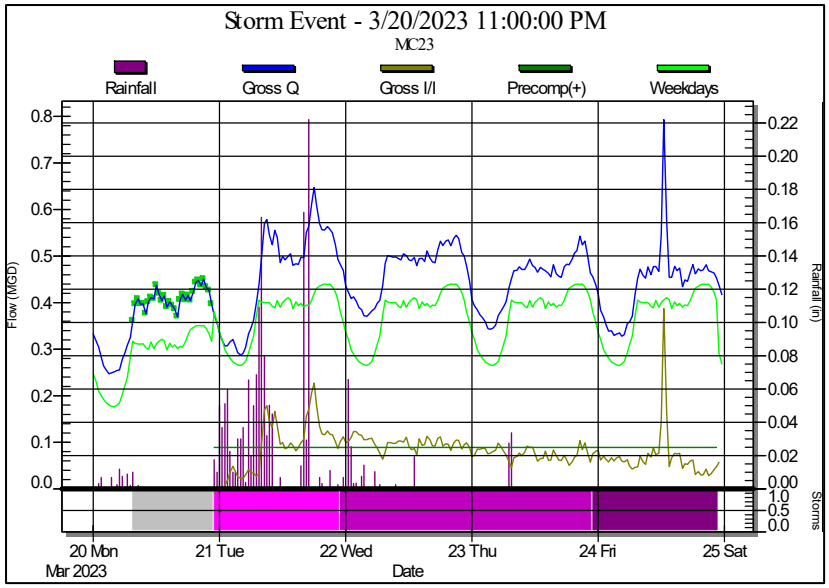

Pipe Flow
MC23
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.8
0.6
0.4
0.2
0.0
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

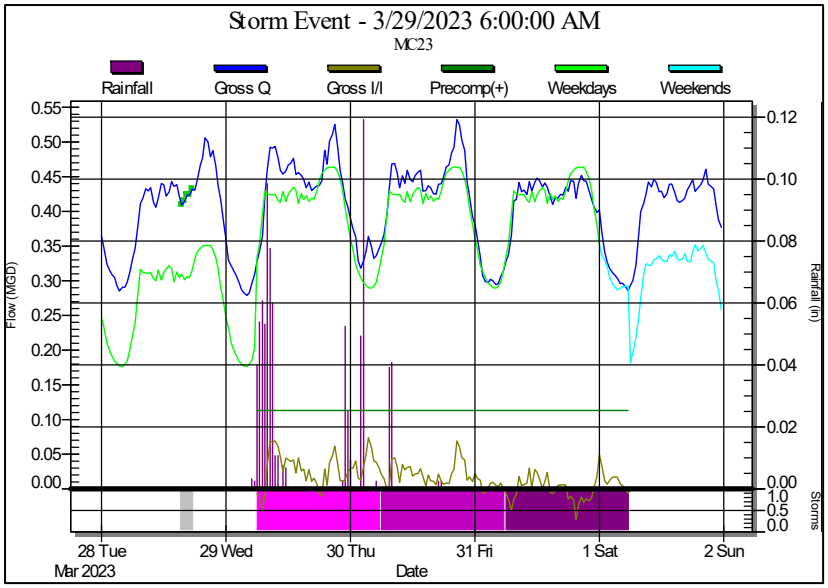

Dry Weather Flow
MC23
Weekdays
Weekends
MGD
0.36
0.34
0.32
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0
3
6
9
12
15
18
21
Hours

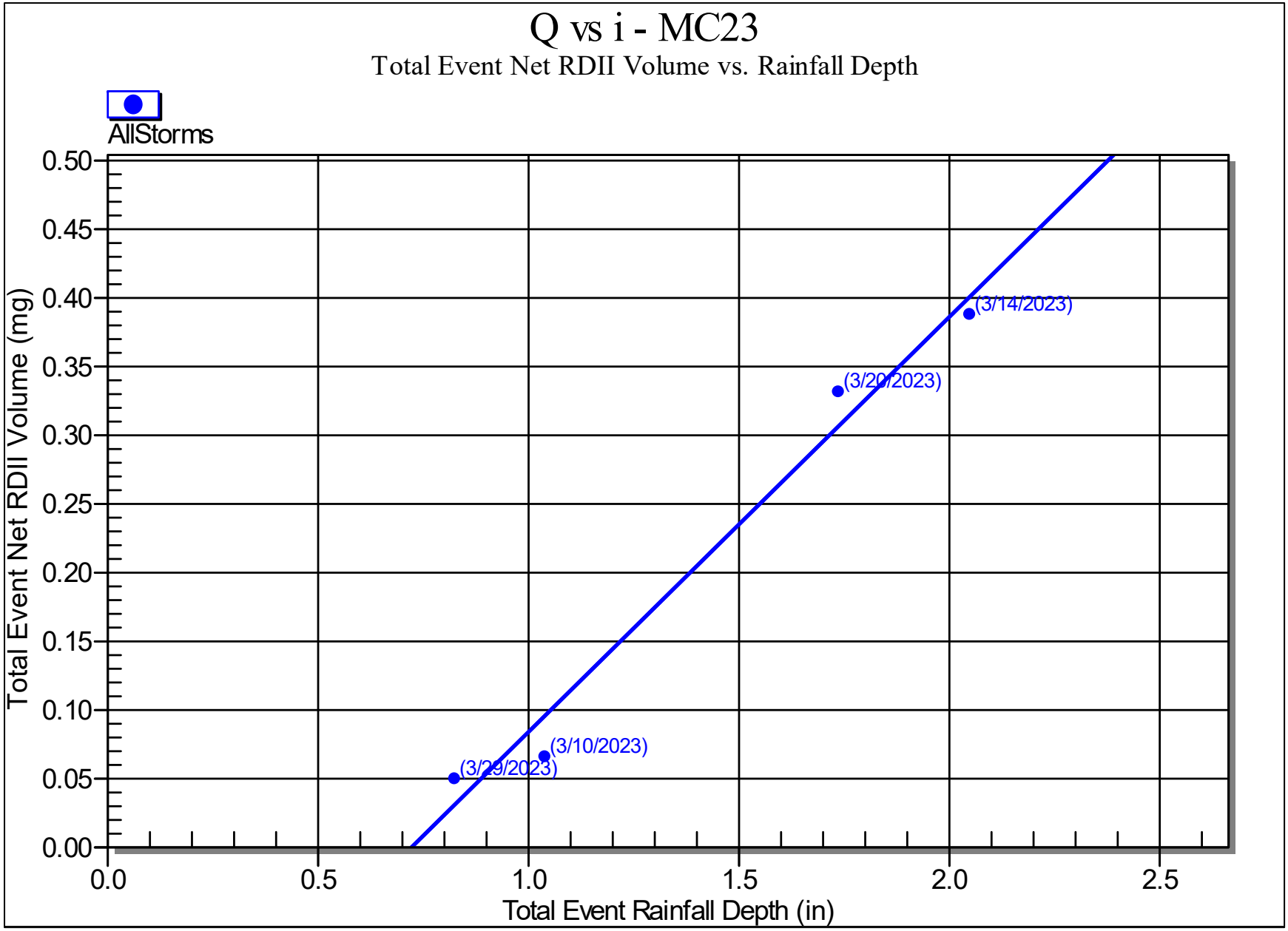

Scatter Graph
MC23
Lanfear-Coll (C-LC = 3.30)
VFINAL (ft/s)
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
DFINAL (in)
Iso Q (MGD)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0.05

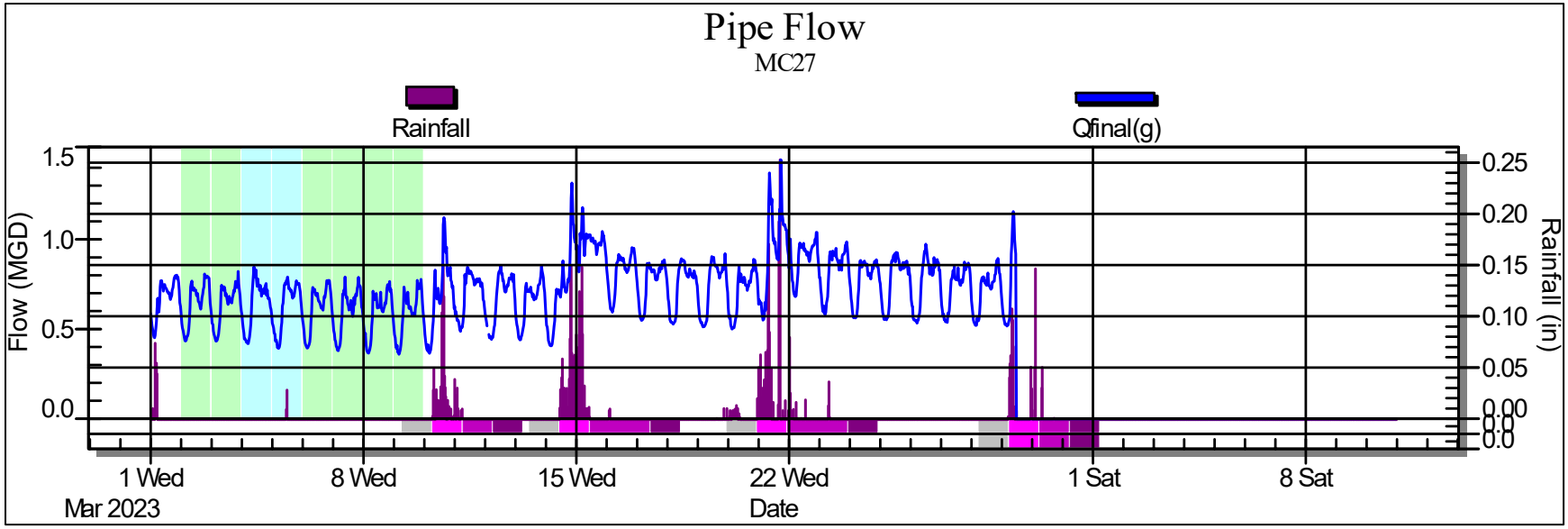

Storm Event - 3/10/2023 6:30:00 AM
MC23
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

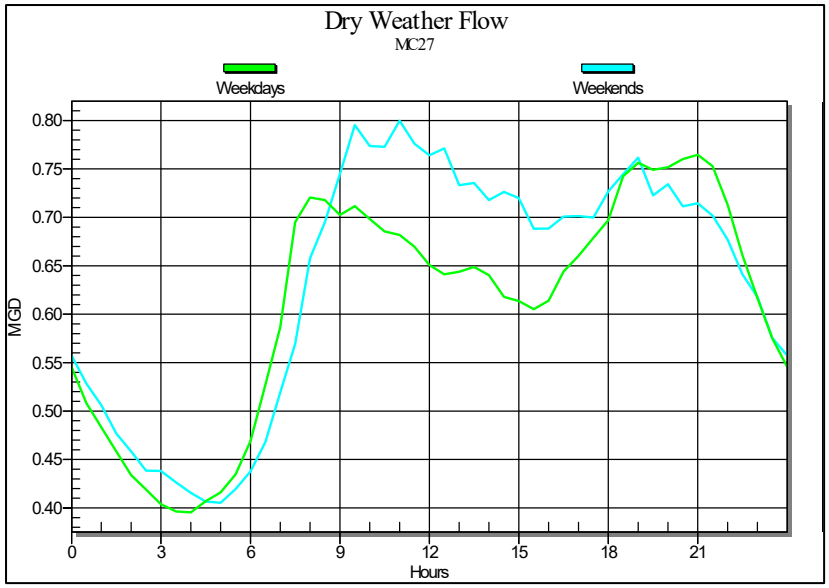

Storm Event - 3/14/2023 11:00:00 AM
MC23
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

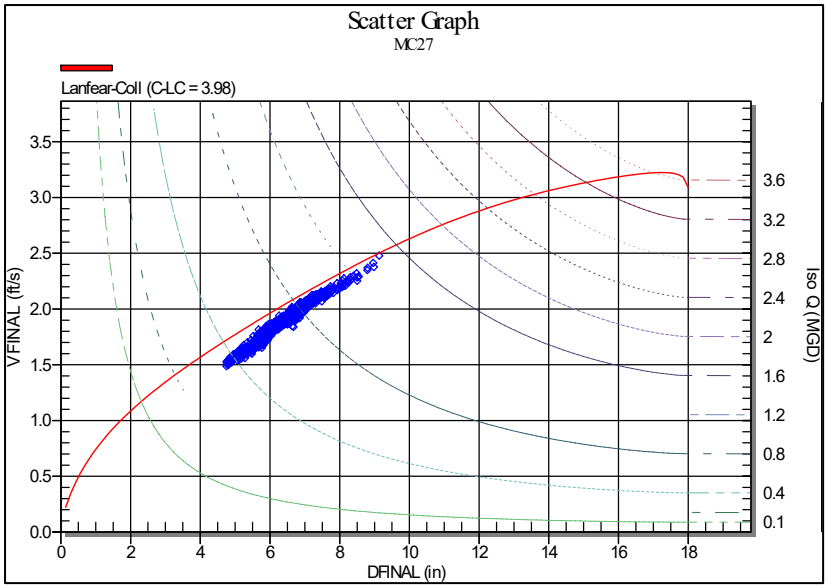

Storm Event - 3/20/2023 11:00:00 PM
MC23
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Flow (MGD)
Rainfall (in)
Storms
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

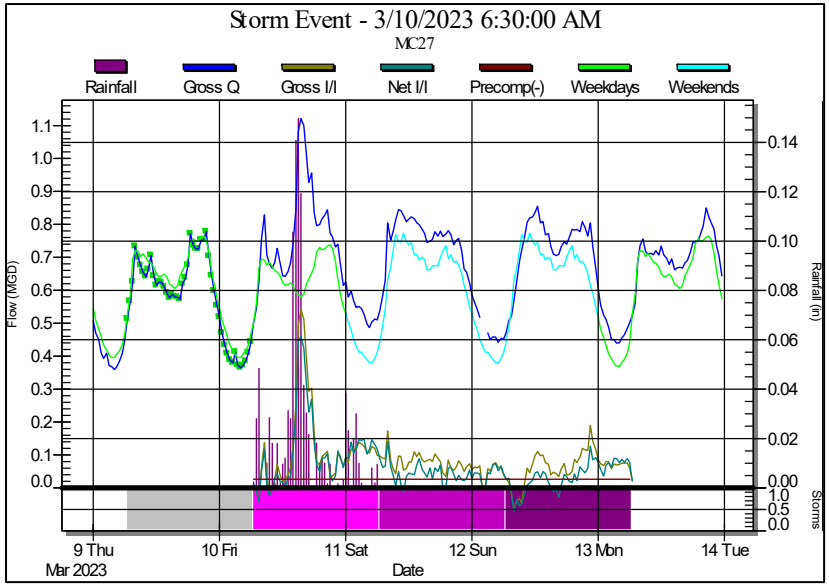

Storm Event - 3/29/2023 6:00:00 AM
MC23
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

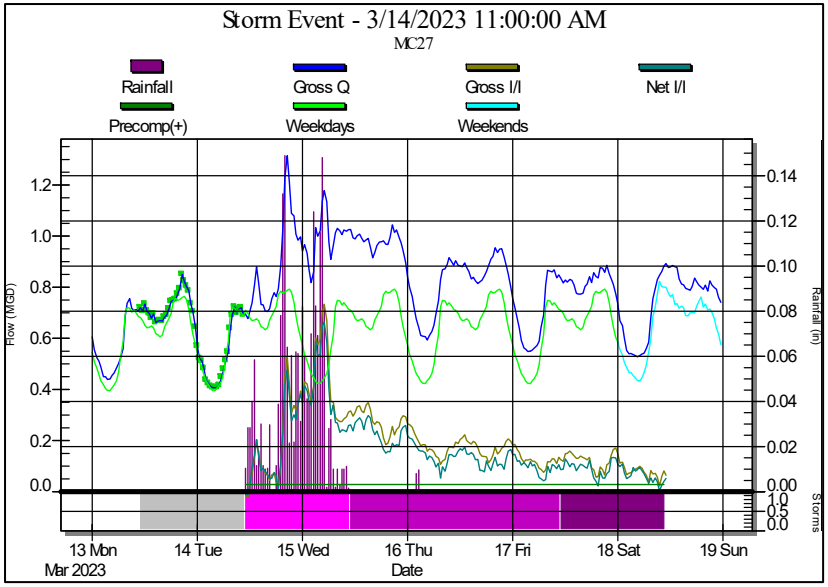

Q vs i - MC23
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

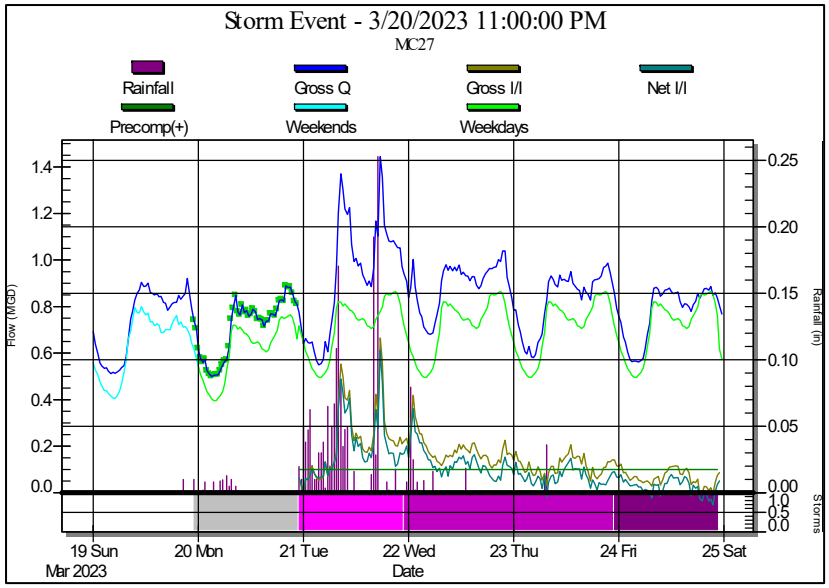

Pipe Flow
MC27
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
1.5
1.0
0.5
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

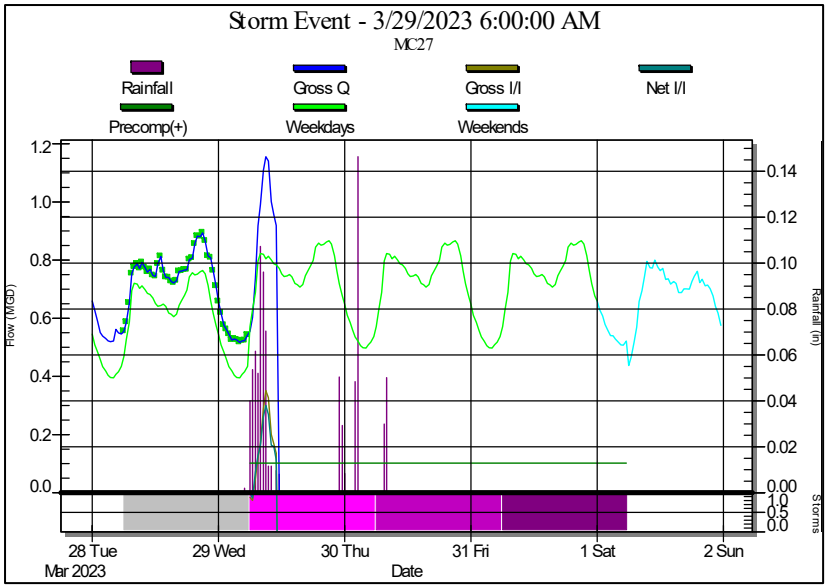

Dry Weather Flow
MC27
Weekdays
Weekends
MGD
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0
3
6
9
12
15
18
21
Hours

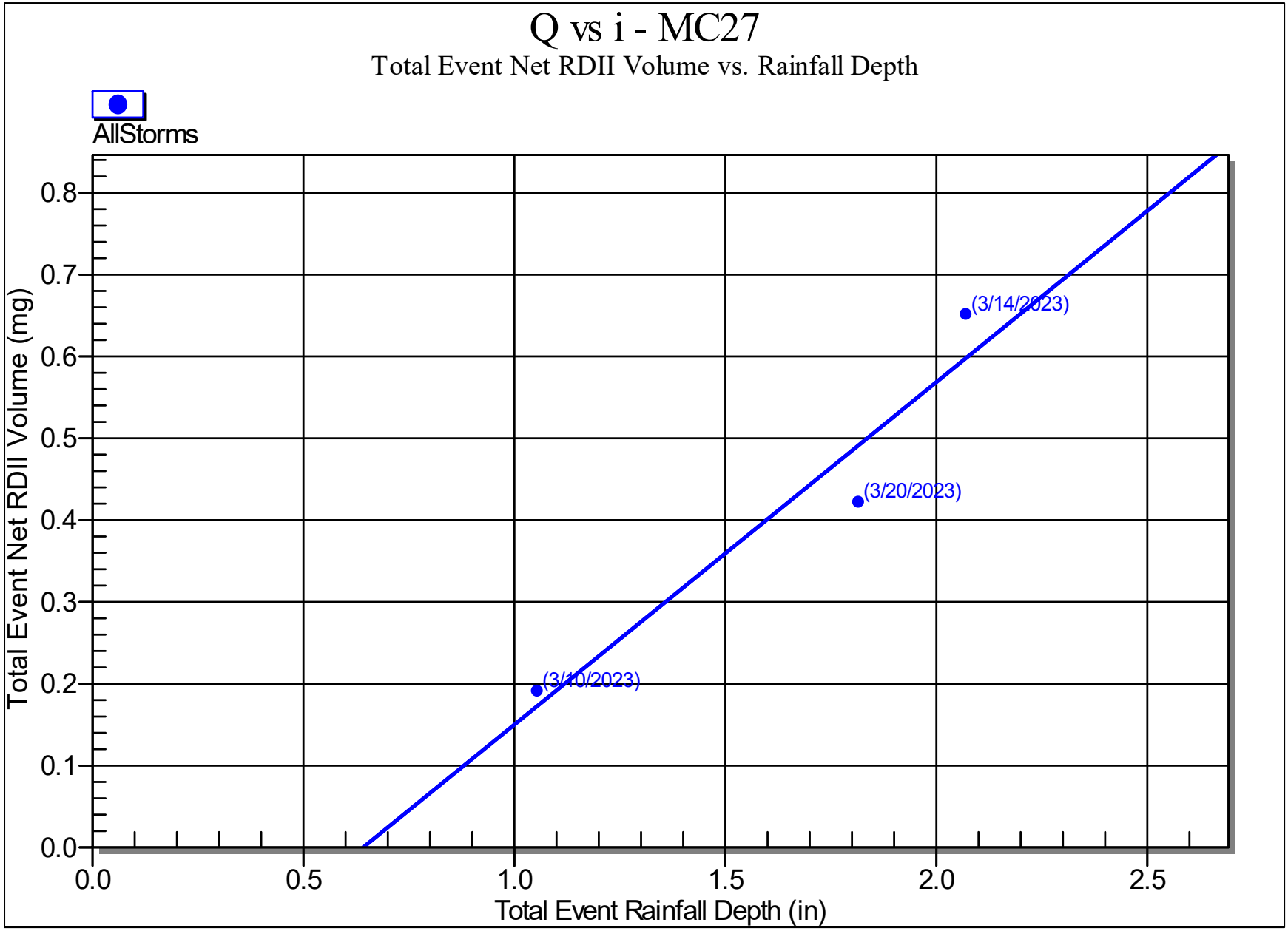

Scatter Graph
MC27
Lanfear-Coll (C-LC = 3.98)
VFINAL (ft/s)
Iso Q (MGD)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0.1
0
2
4
6
8
10
12
14
16
18
DFINAL (in)

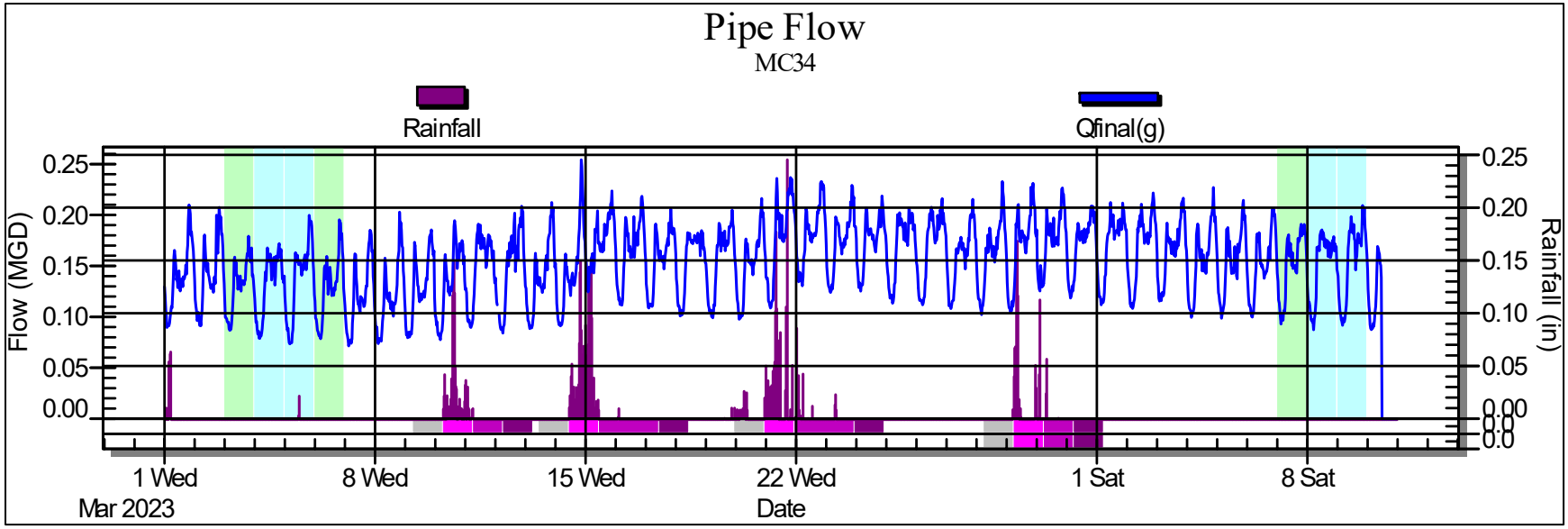

Storm Event - 3/10/2023 6:30:00 AM
MC27
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

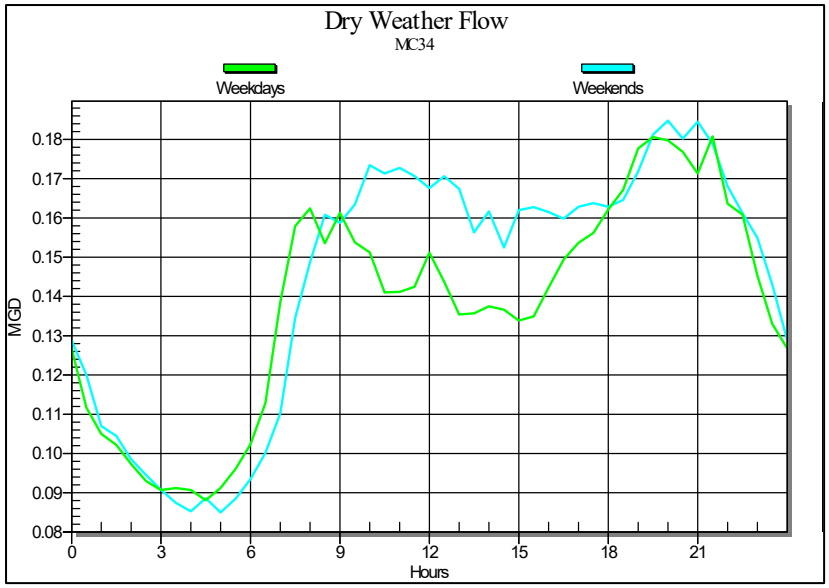

Storm Event - 3/14/2023 11:00:00 AM
MC27
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

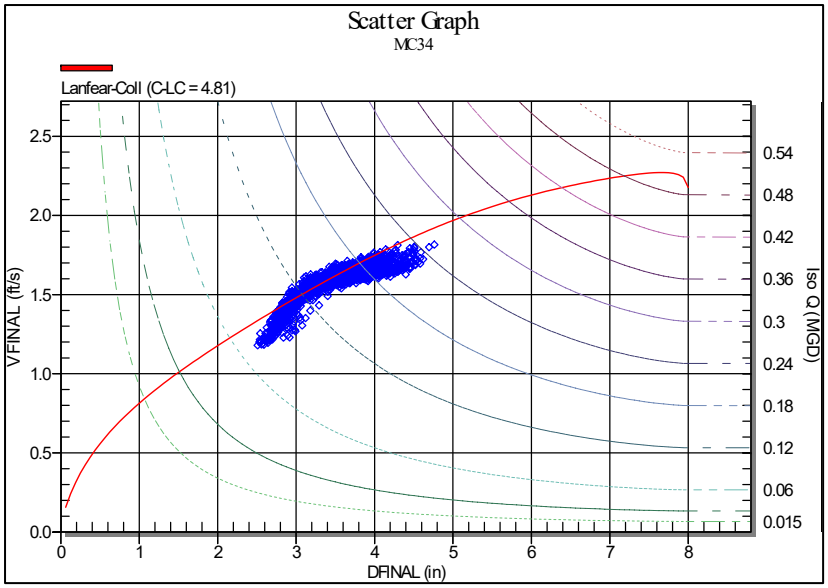

Storm Event - 3/20/2023 11:00:00 PM
MC27
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

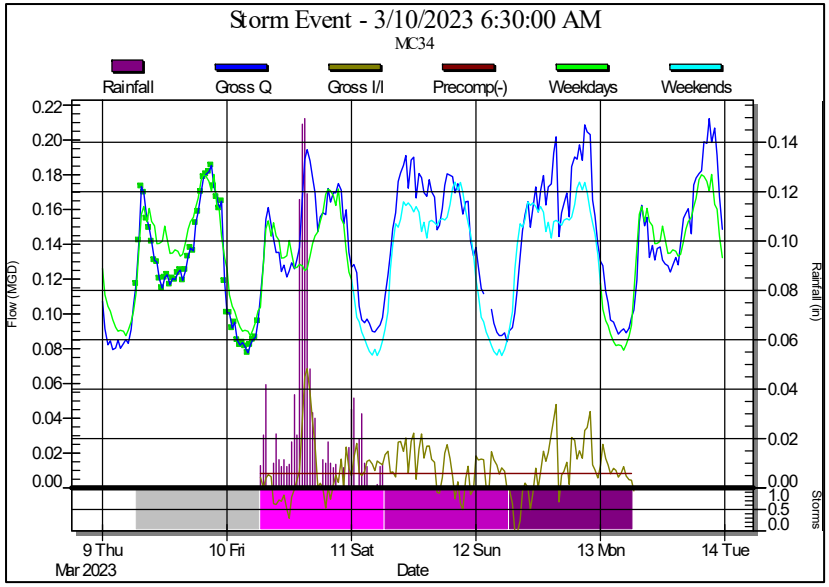

Storm Event - 3/29/2023 6:00:00 AM
MC27
Rainfall
Gross Q
Gross I/I
Net I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

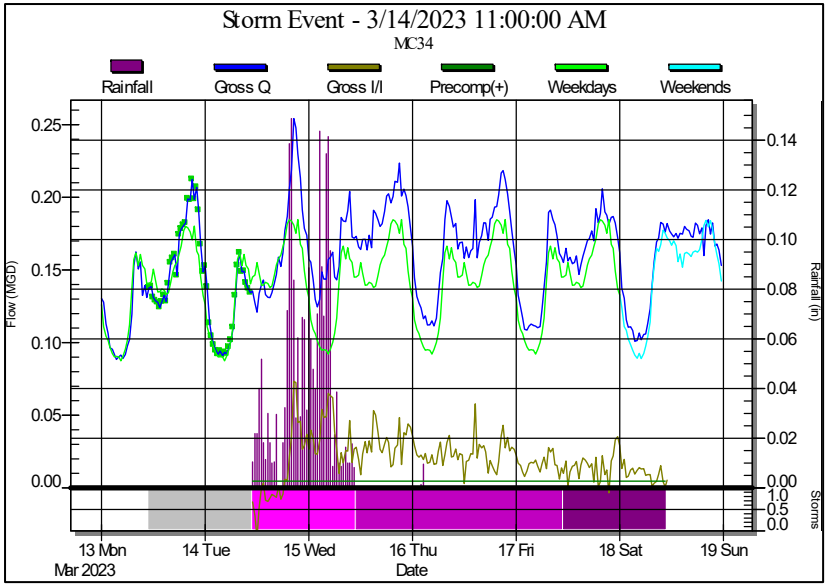

Q vs i - MC27
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
(3/14/2023)
(3/20/2023)
(3/10/2023)
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)

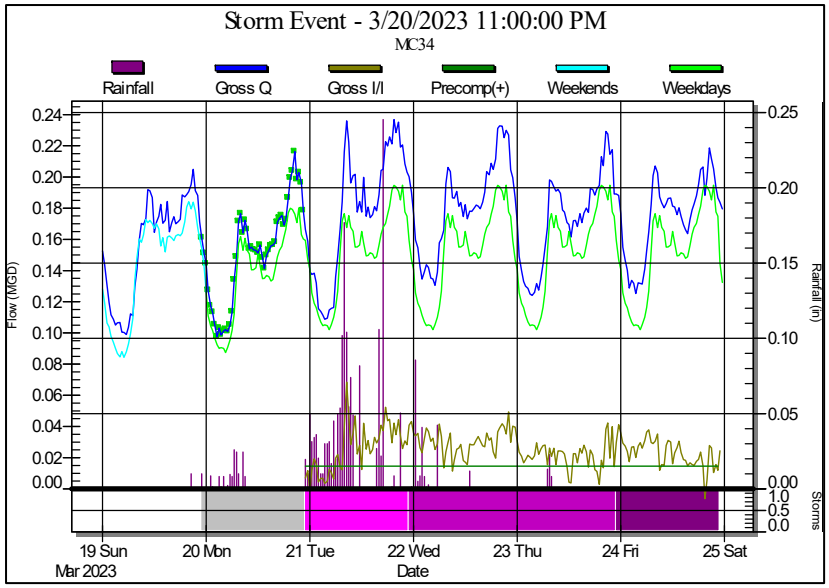

Pipe Flow
MC34
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.25
0.20
0.15
0.10
0.05
0.00
0.0
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat

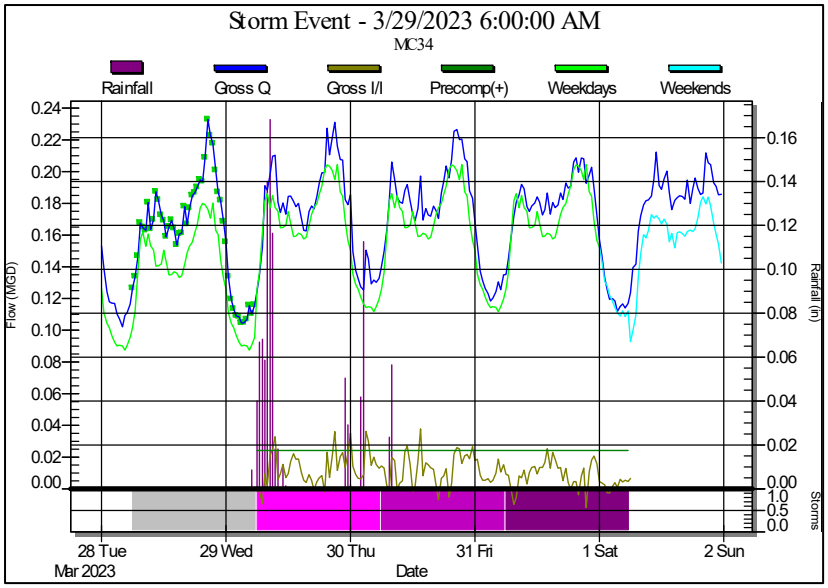

Dry Weather Flow
MC34
Weekdays
Weekends
MGD
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0
3
6
9
12
15
18
21
Hours

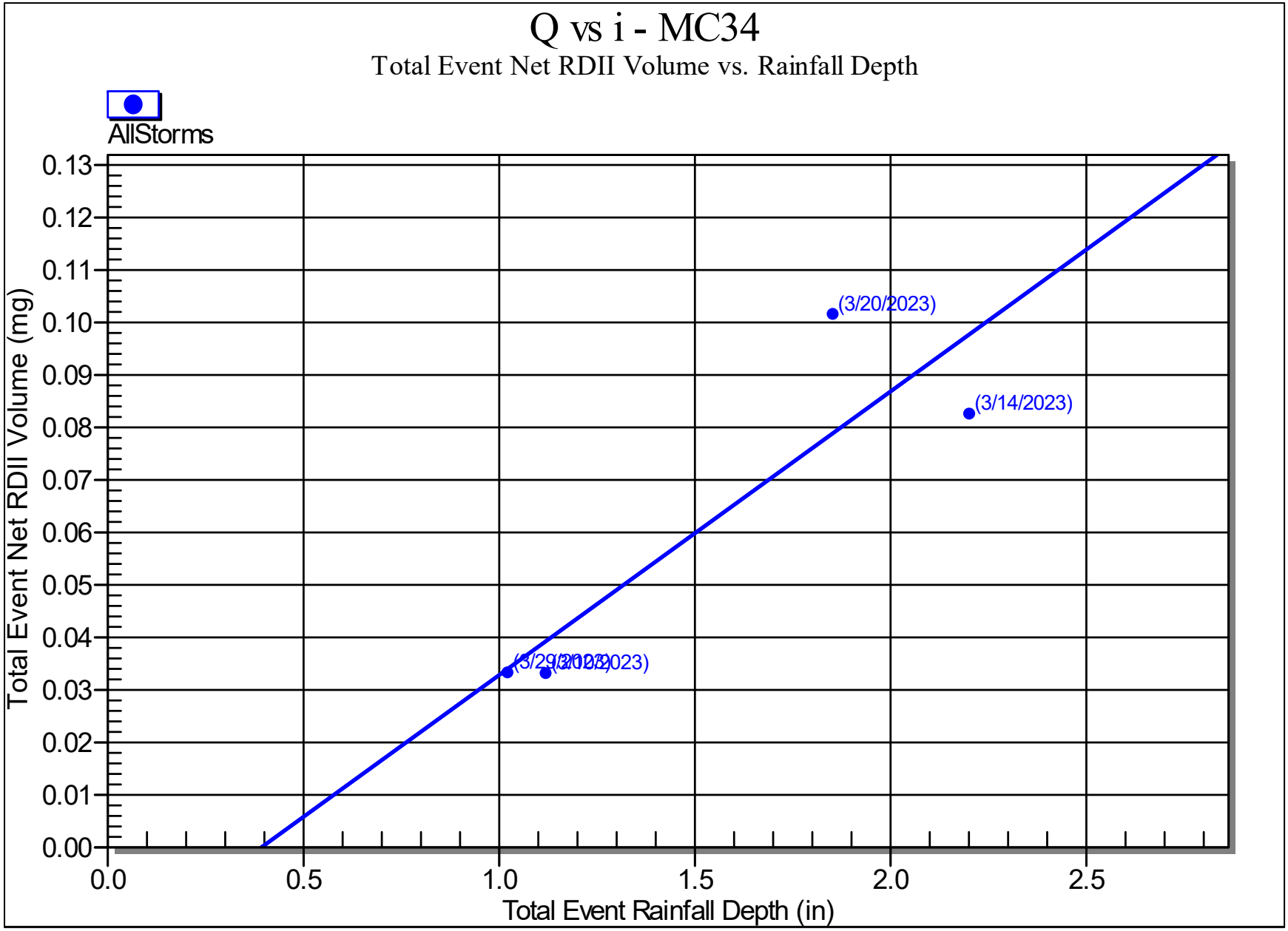

Scatter Graph
MC34
Lanfear-Coll (C-LC = 4.81)
VFINAL (ft/s)
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8
DFINAL (in)
Iso Q (MGD)
0.54
0.48
0.42
0.36
0.3
0.24
0.18
0.12
0.06
0.015

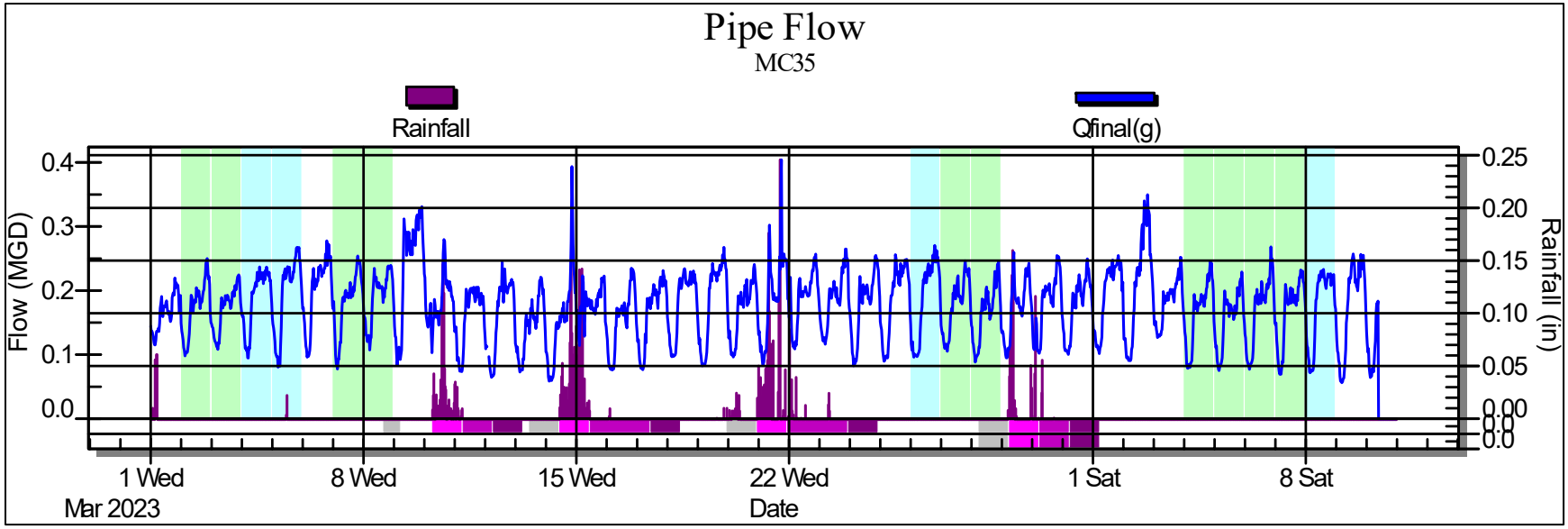

Storm Event - 3/10/2023 6:30:00 AM
MC34
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

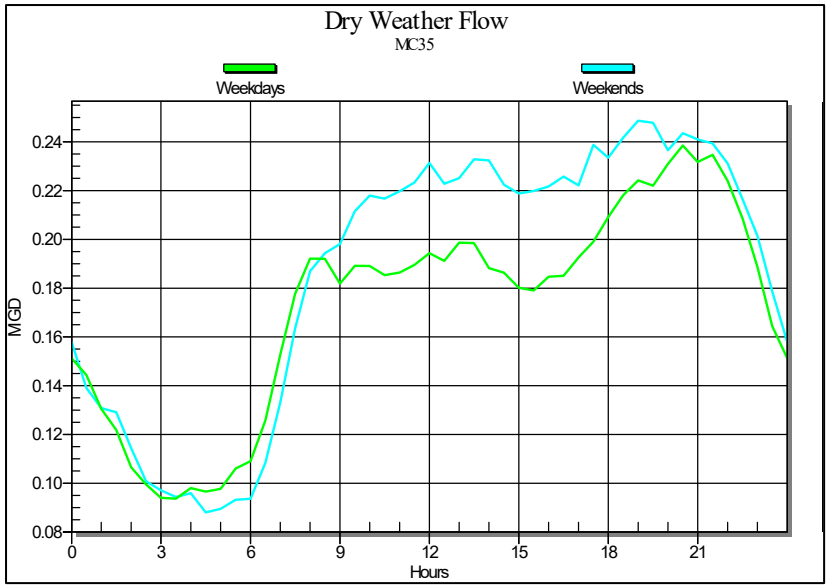

Storm Event - 3/14/2023 11:00:00 AM
MC34
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

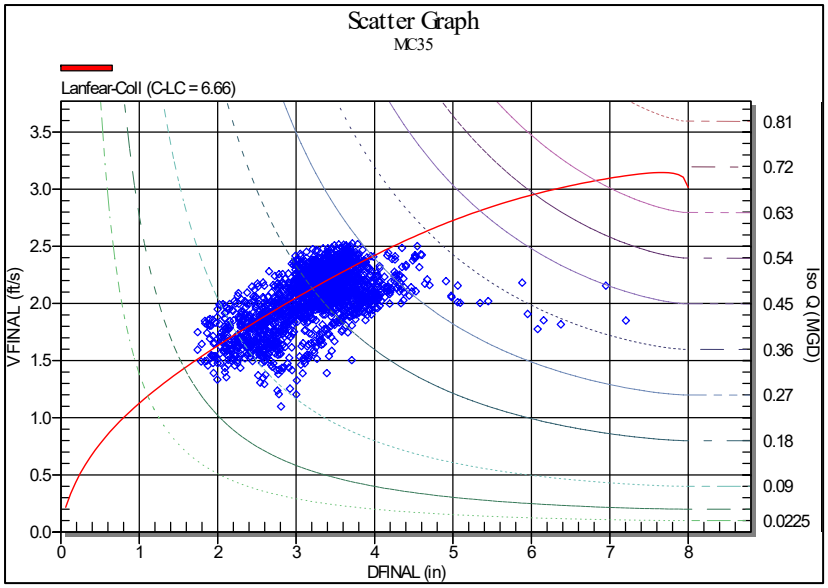

Storm Event - 3/20/2023 11:00:00 PM
MC34
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

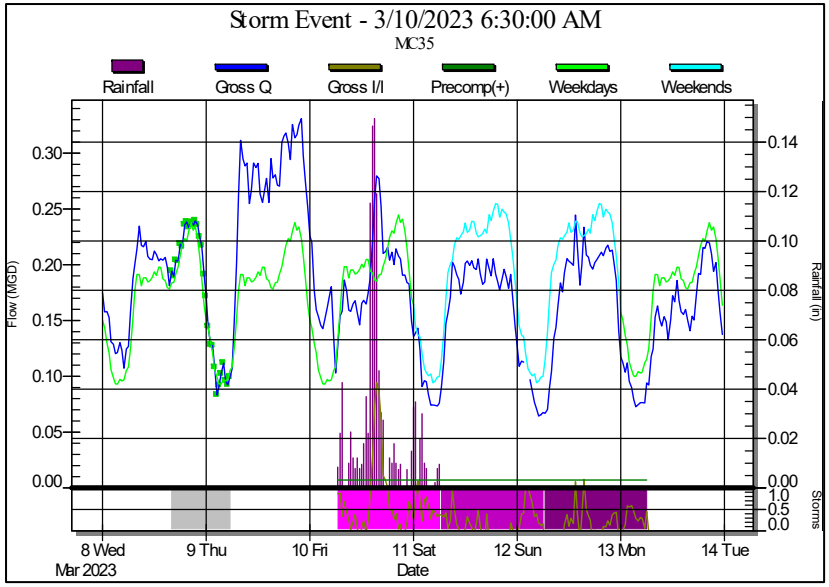

Storm Event - 3/29/2023 6:00:00 AM
MC34
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

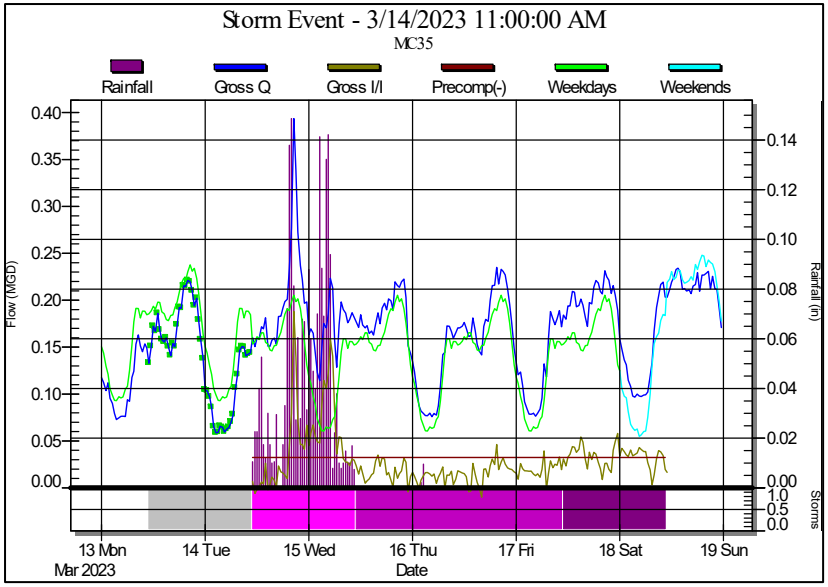

Q vs i - MC34
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/20/2023)
(3/14/2023)
(3/29/2023)
(3/02/2023)

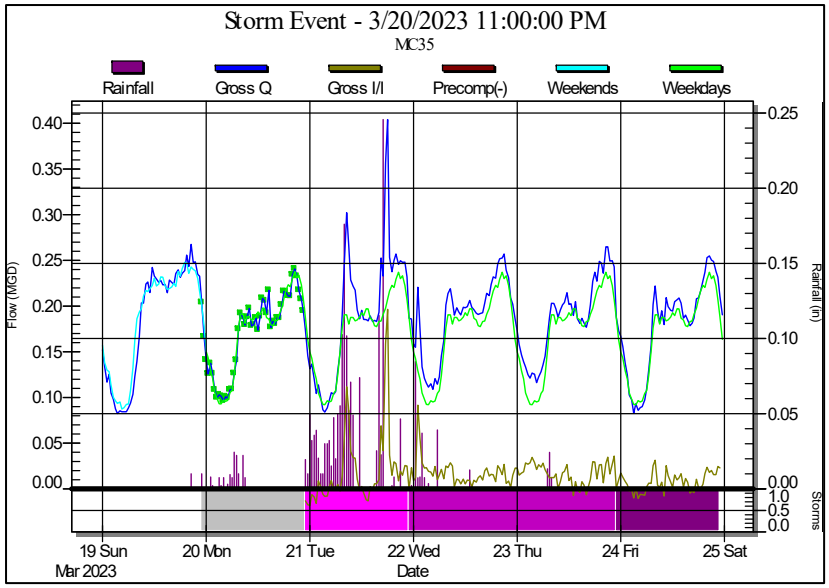

Pipe Flow
MC35
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.4
0.3
0.2
0.1
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

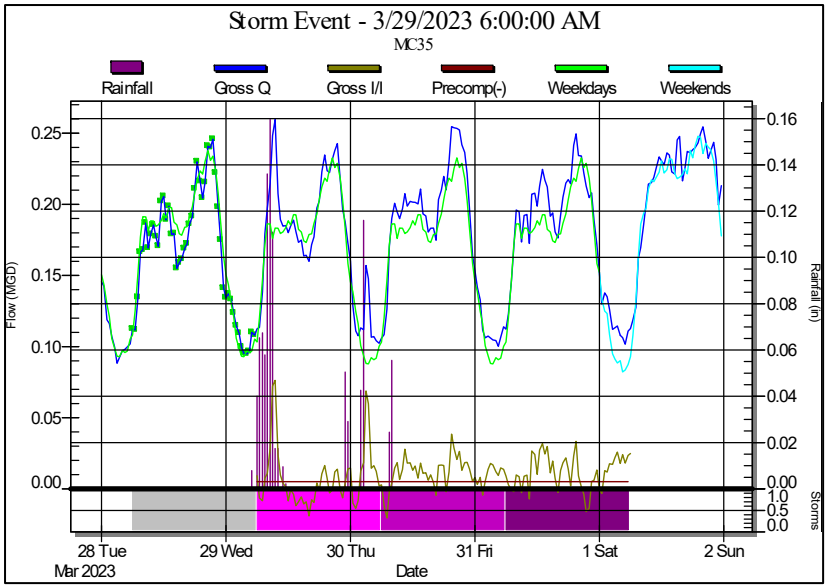

Dry Weather Flow
MC35
Weekdays
Weekends
MGD
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0
3
6
9
12
15
18
21
Hours

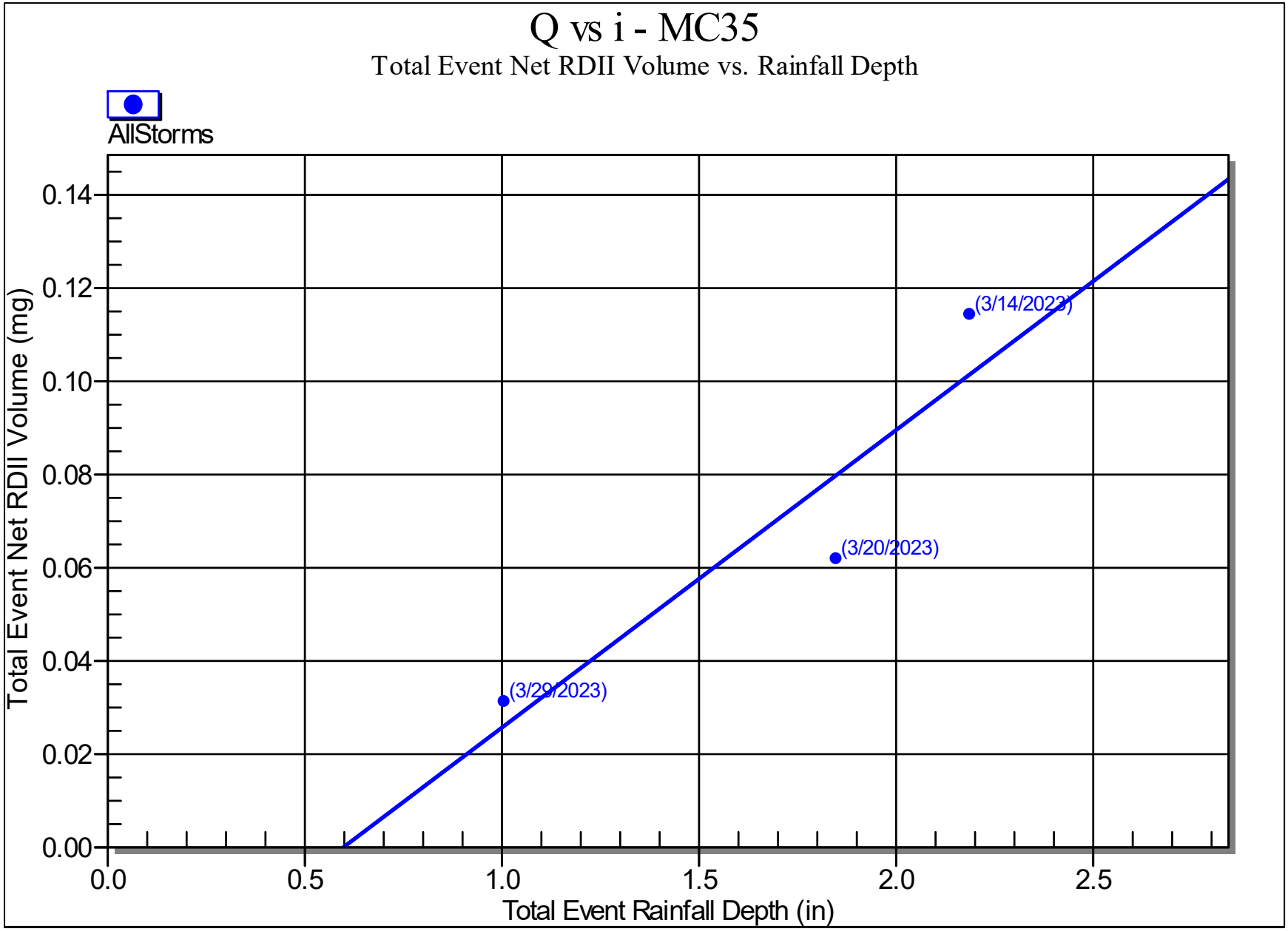

Scatter Graph
MC35
Lanfear-Coll (C-LC = 6.66)
VFINAL (ft/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8
DFINAL (in)
Iso Q (MGD)
0.81
0.72
0.63
0.54
0.45
0.36
0.27
0.18
0.09
0.0225

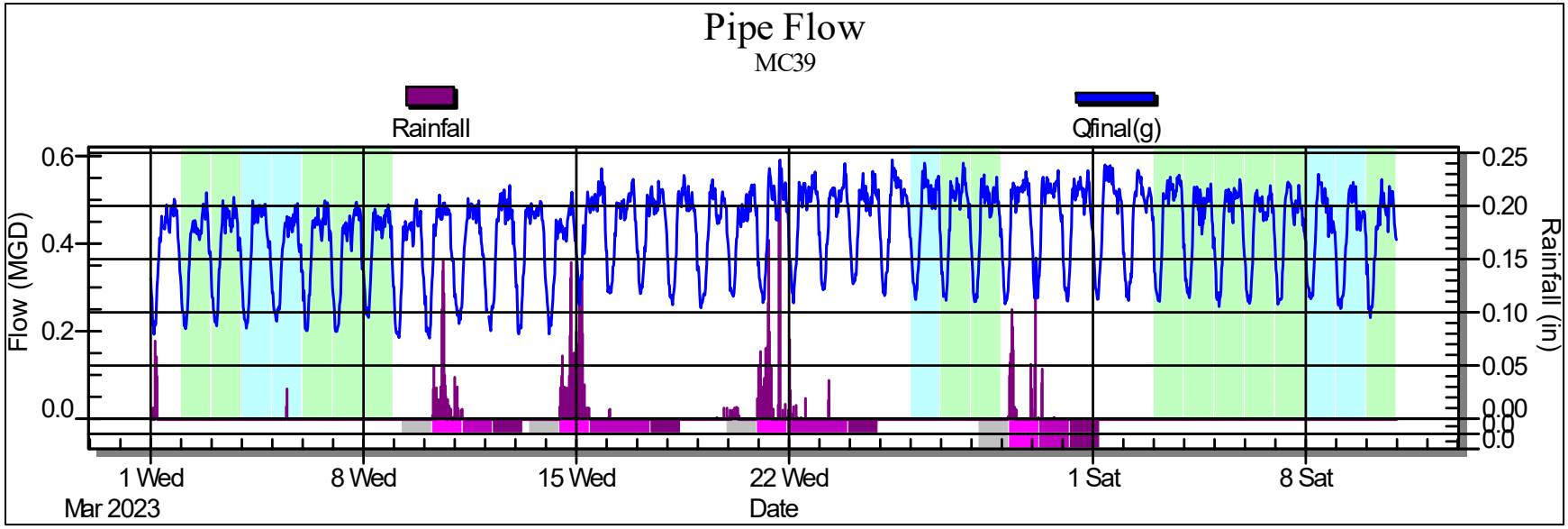

Storm Event - 3/10/2023 6:30:00 AM
MC35
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
8 Wed
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

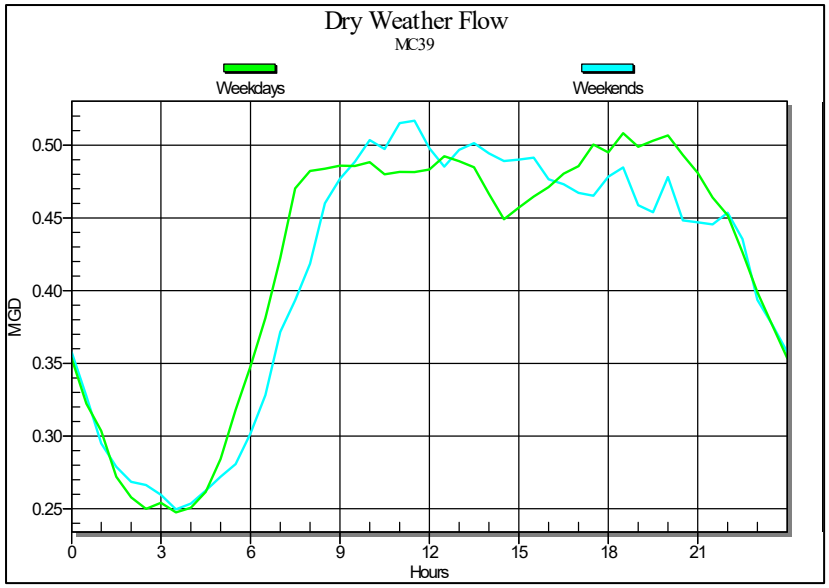

Storm Event - 3/14/2023 11:00:00 AM
MC35
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

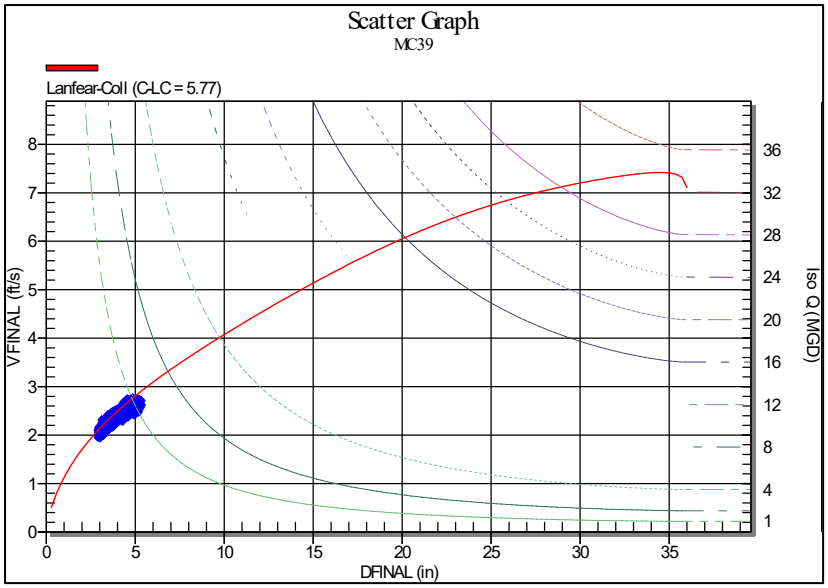

Storm Event - 3/20/2023 11:00:00 PM
MC35
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

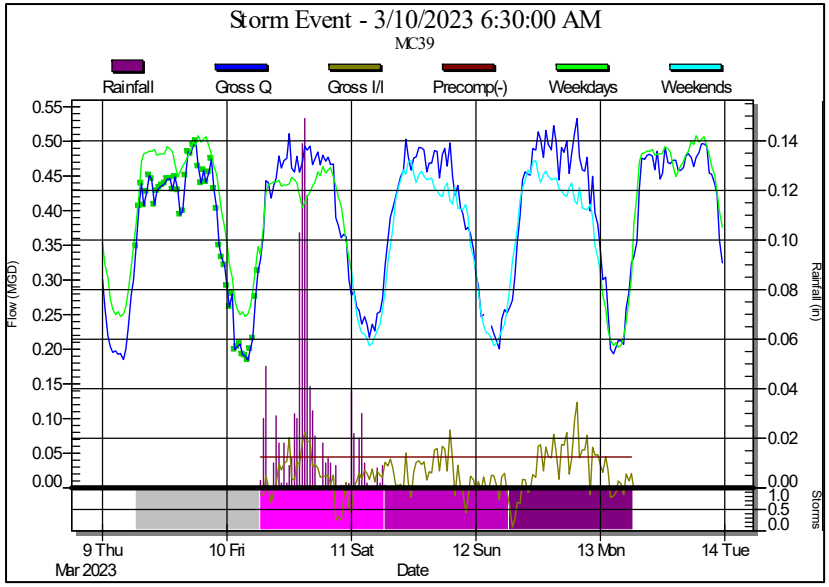

Storm Event - 3/29/2023 6:00:00 AM
MC35
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

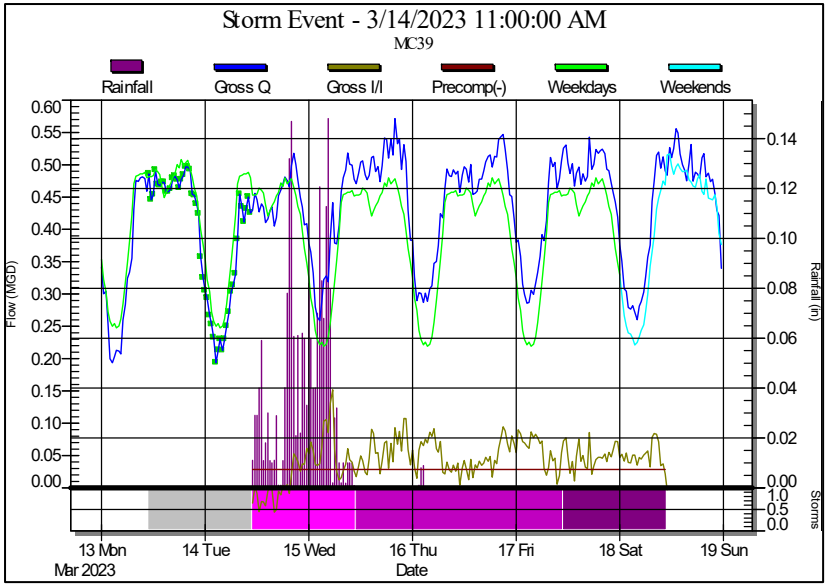

Q vs i - MC35
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/29/2023)

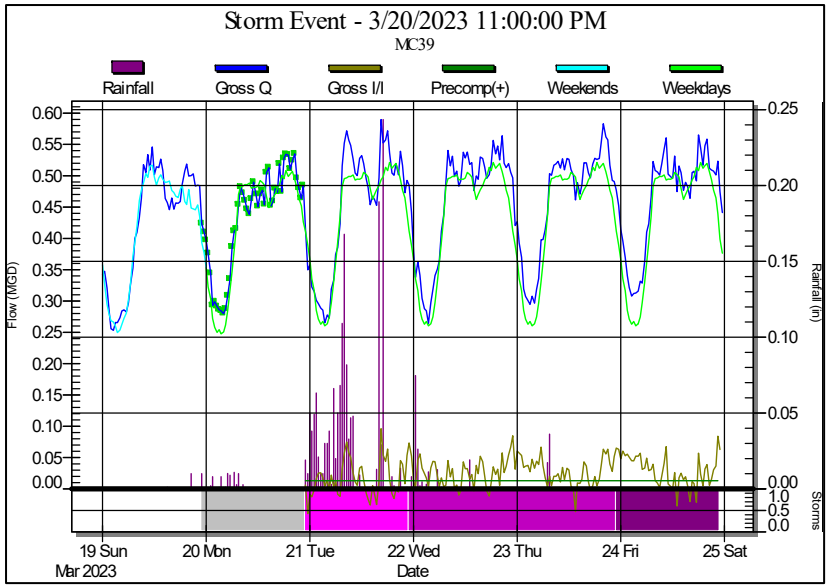

Pipe Flow
MC39
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.6
0.4
0.2
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

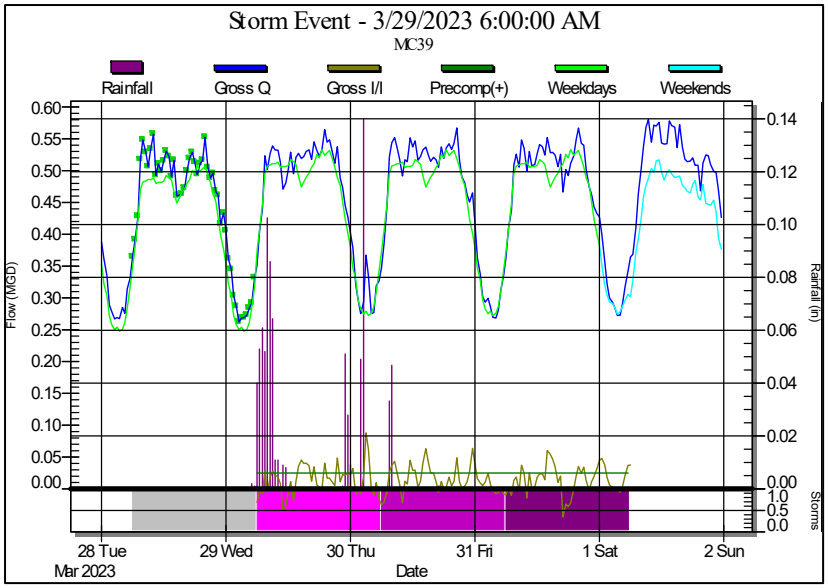

Dry Weather Flow
MC39
Weekdays
Weekends
MGD
0.50
0.45
0.40
0.35
0.30
0.25
0
3
6
9
12
15
18
21
Hours

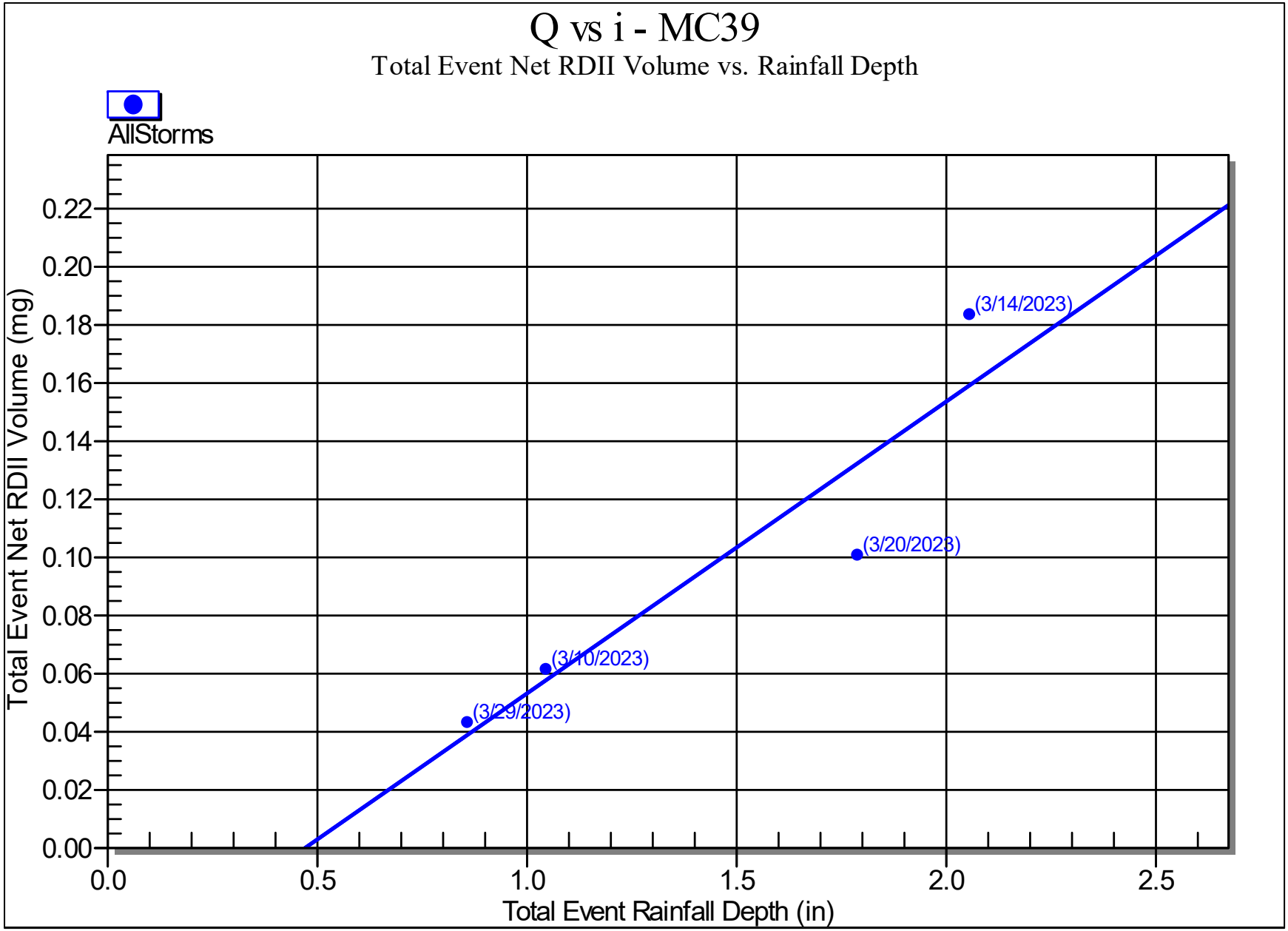

Scatter Graph
MC39
Lanfear-Coll (C-LC = 5.77)
VFINAL (ft/s)
Iso Q (MGD)
DFINAL (in)
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
8
4
8
12
16
20
24
28
32
36

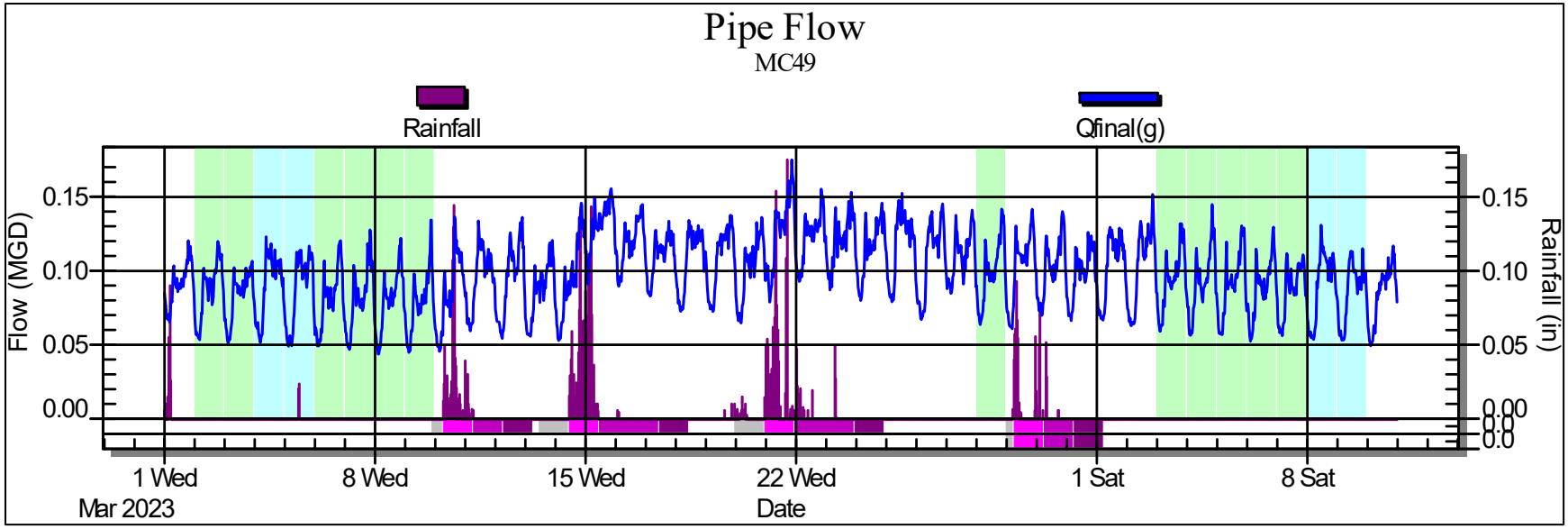

Storm Event - 3/10/2023 6:30:00 AM
MC39
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

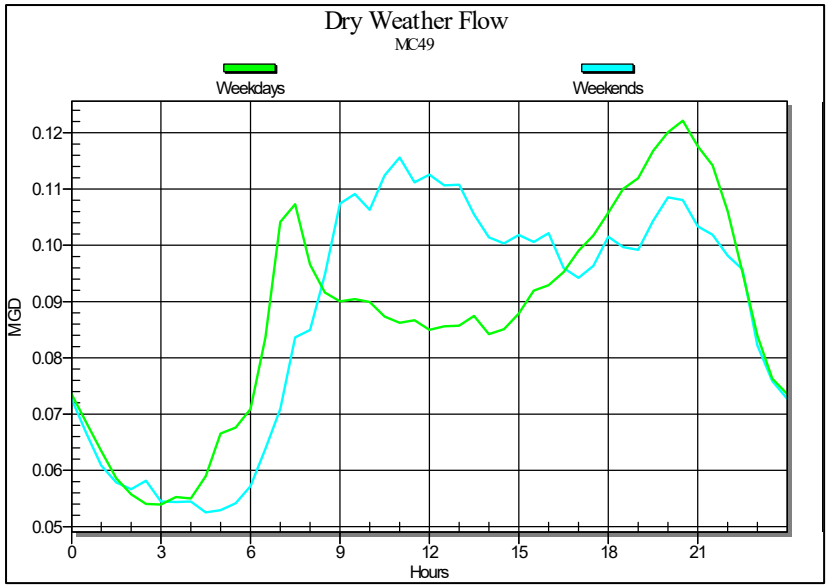

Storm Event - 3/14/2023 11:00:00 AM
MC39
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

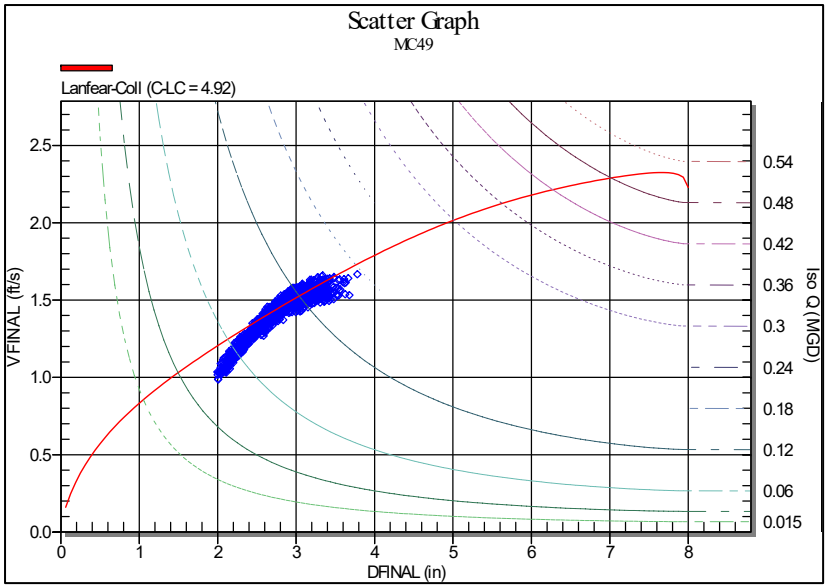

Storm Event - 3/20/2023 11:00:00 PM
MC39
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

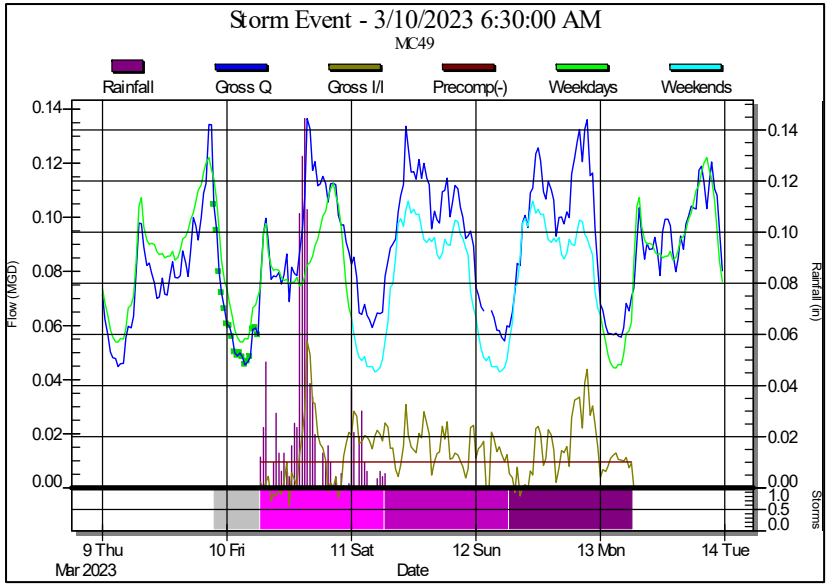

Storm Event - 3/29/2023 6:00:00 AM
MC39
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

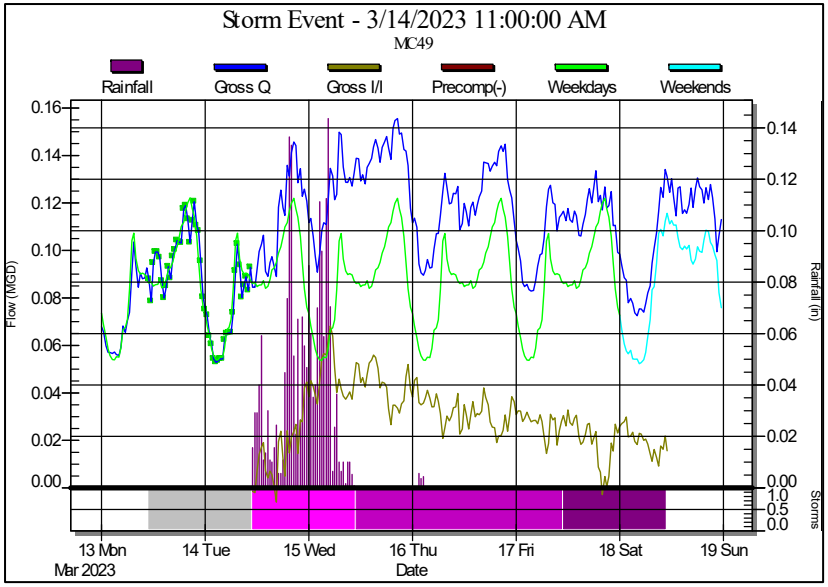

Q vs i - MC39
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(3/29/2023)

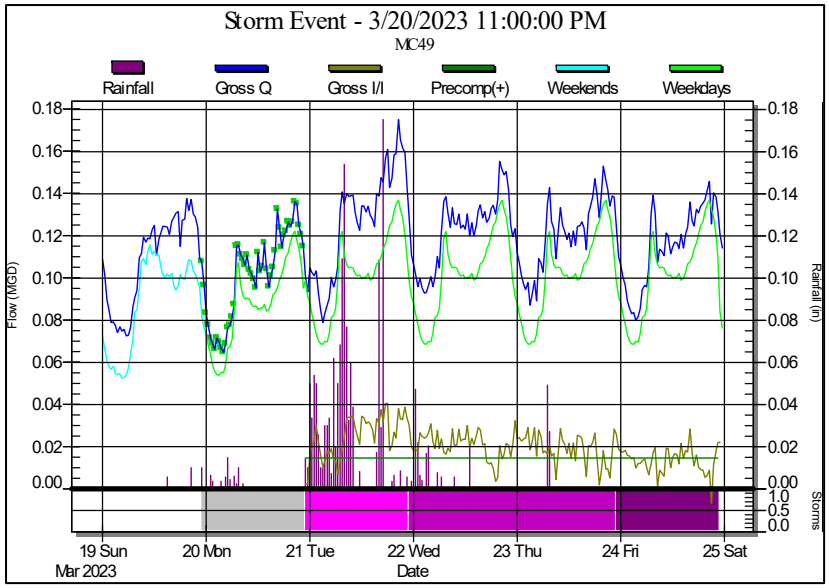

Pipe Flow
MC49
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat

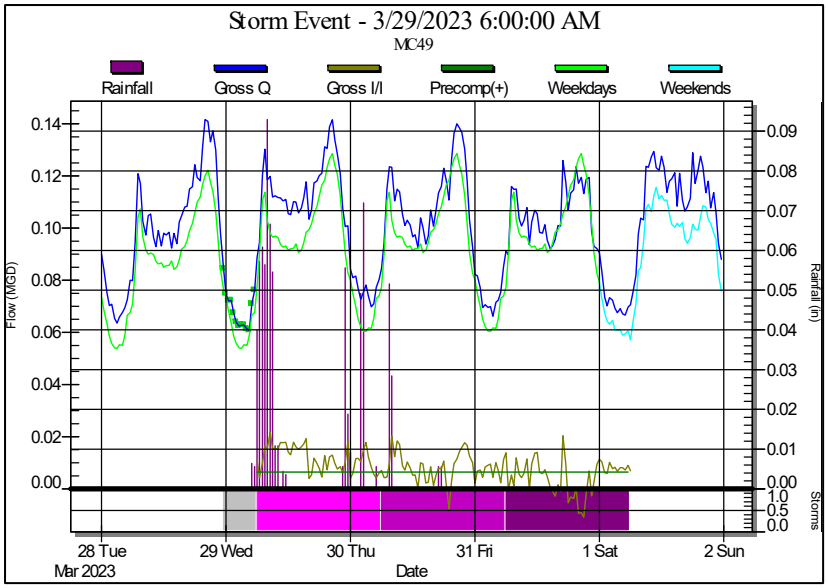

Dry Weather Flow
MC49
Weekdays
Weekends
MGD
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0
3
6
9
12
15
18
21
Hours

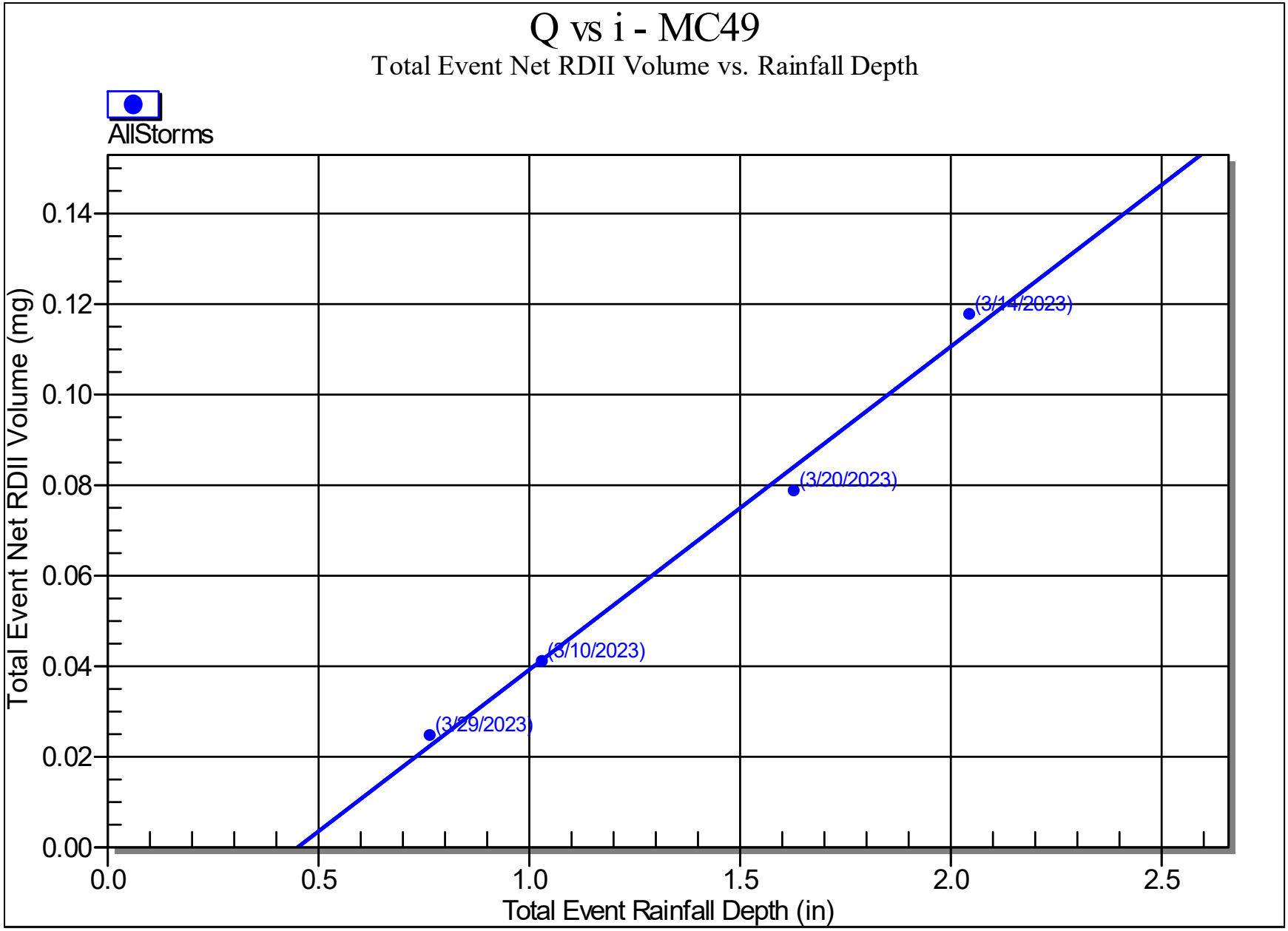

Scatter Graph
MC49
Lanfear-Coll (C-LC = 4.92)
VFINAL (ft/s)
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8
DFINAL (in)
Iso Q (MGD)
0.54
0.48
0.42
0.36
0.3
0.24
0.18
0.12
0.06
0.015

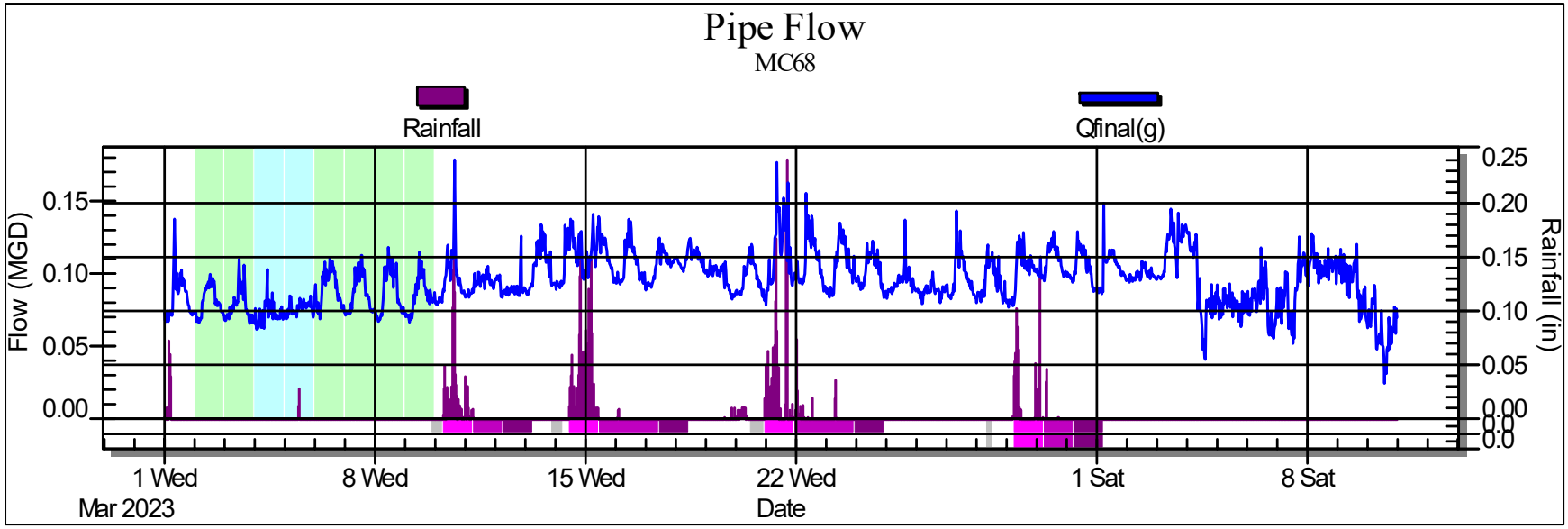

Storm Event - 3/10/2023 6:30:00 AM
MC49
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

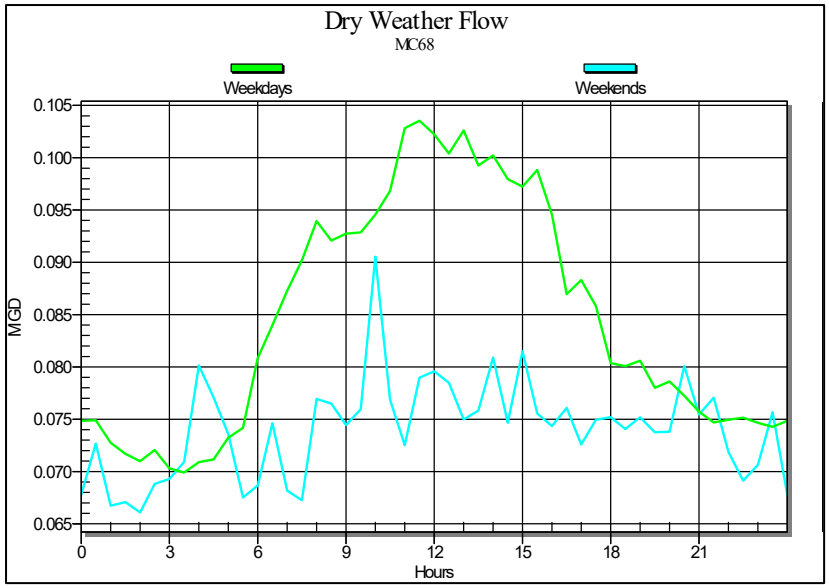

Storm Event - 3/14/2023 11:00:00 AM
MC49
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

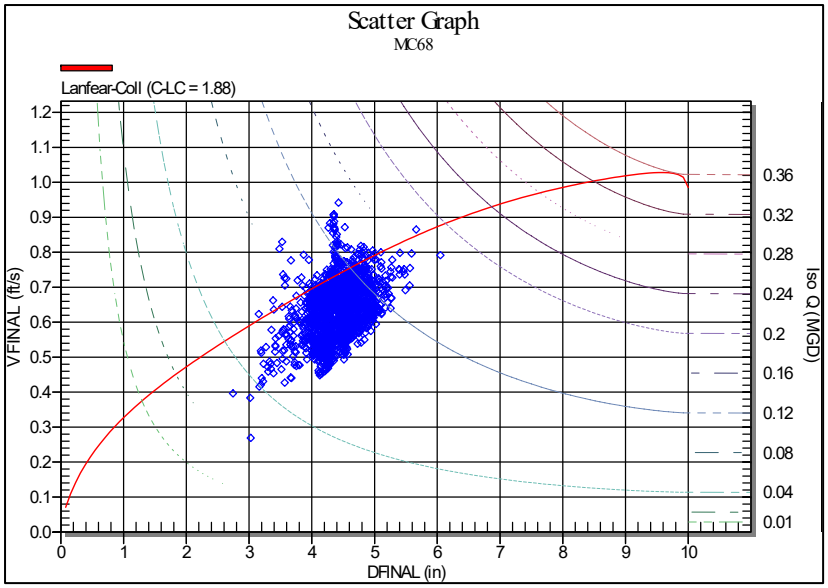

Storm Event - 3/20/2023 11:00:00 PM
MC49
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

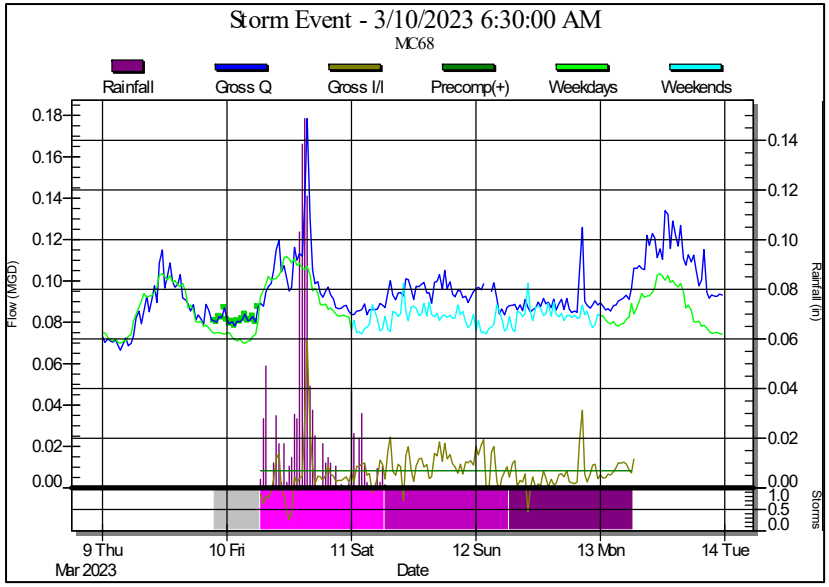

Storm Event - 3/29/2023 6:00:00 AM
MC49
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

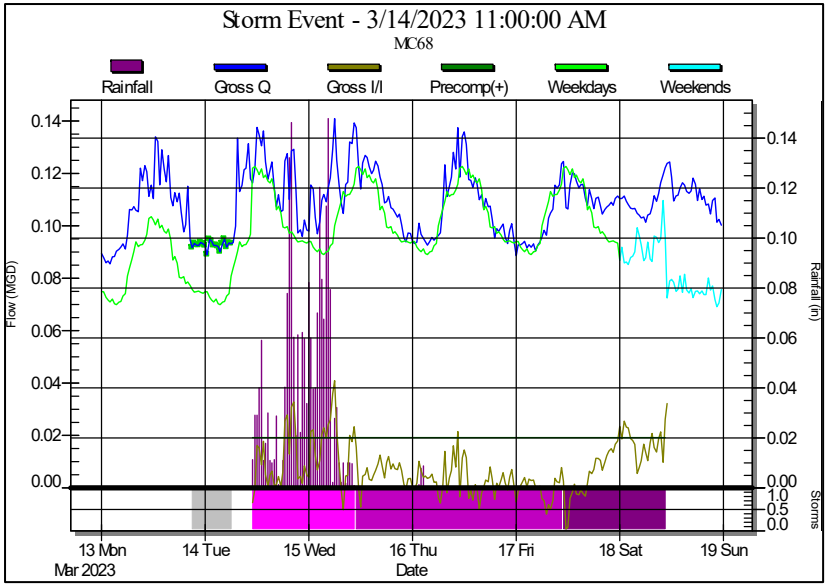

Q vs i - MC49
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/29/2023)
(3/10/2023)
(3/20/2023)
(3/14/2023)

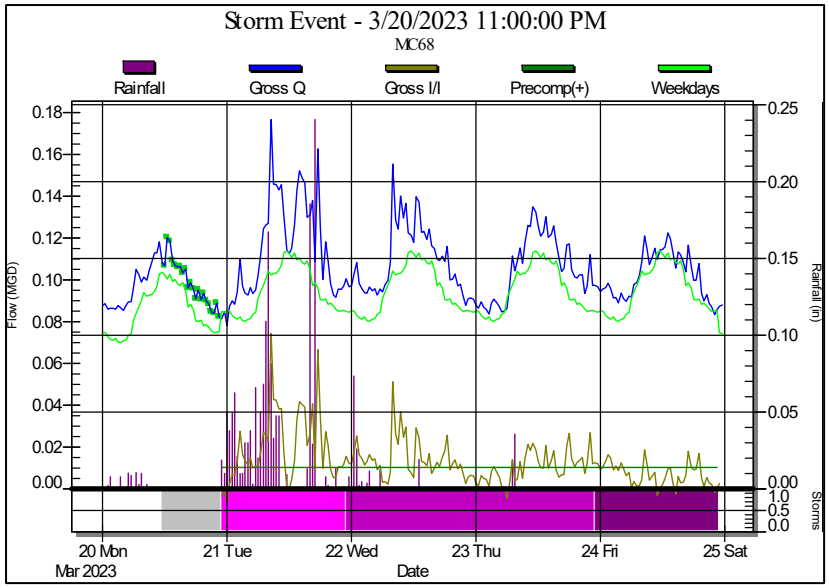

Pipe Flow
MC68
Rainfall
Qfinal(g)
Flow (MGD)
0.15
0.10
0.05
0.00
Rainfall (in)
0.25
0.20
0.15
0.10
0.05
0.00
0.0
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat

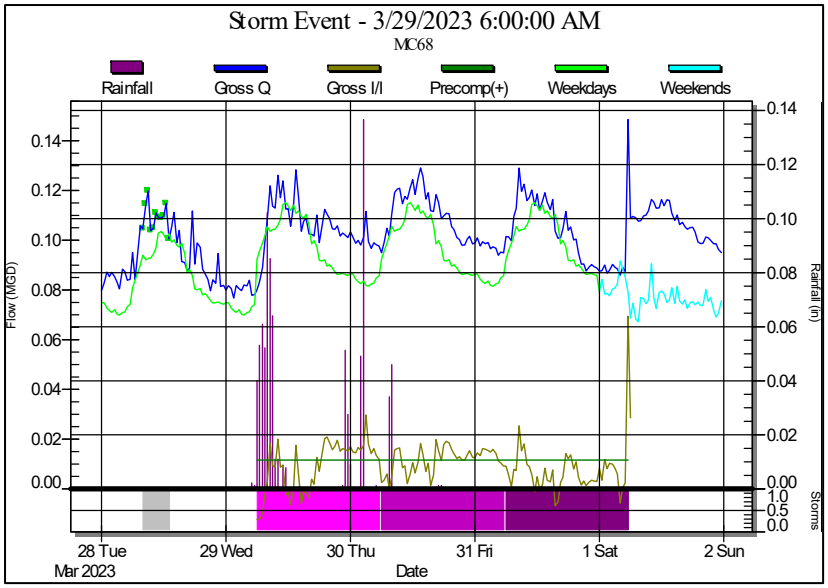

Dry Weather Flow
MC68
Weekdays
Weekends
MGD
0.105
0.100
0.095
0.090
0.085
0.080
0.075
0.070
0.065
0
3
6
9
12
15
18
21
Hours

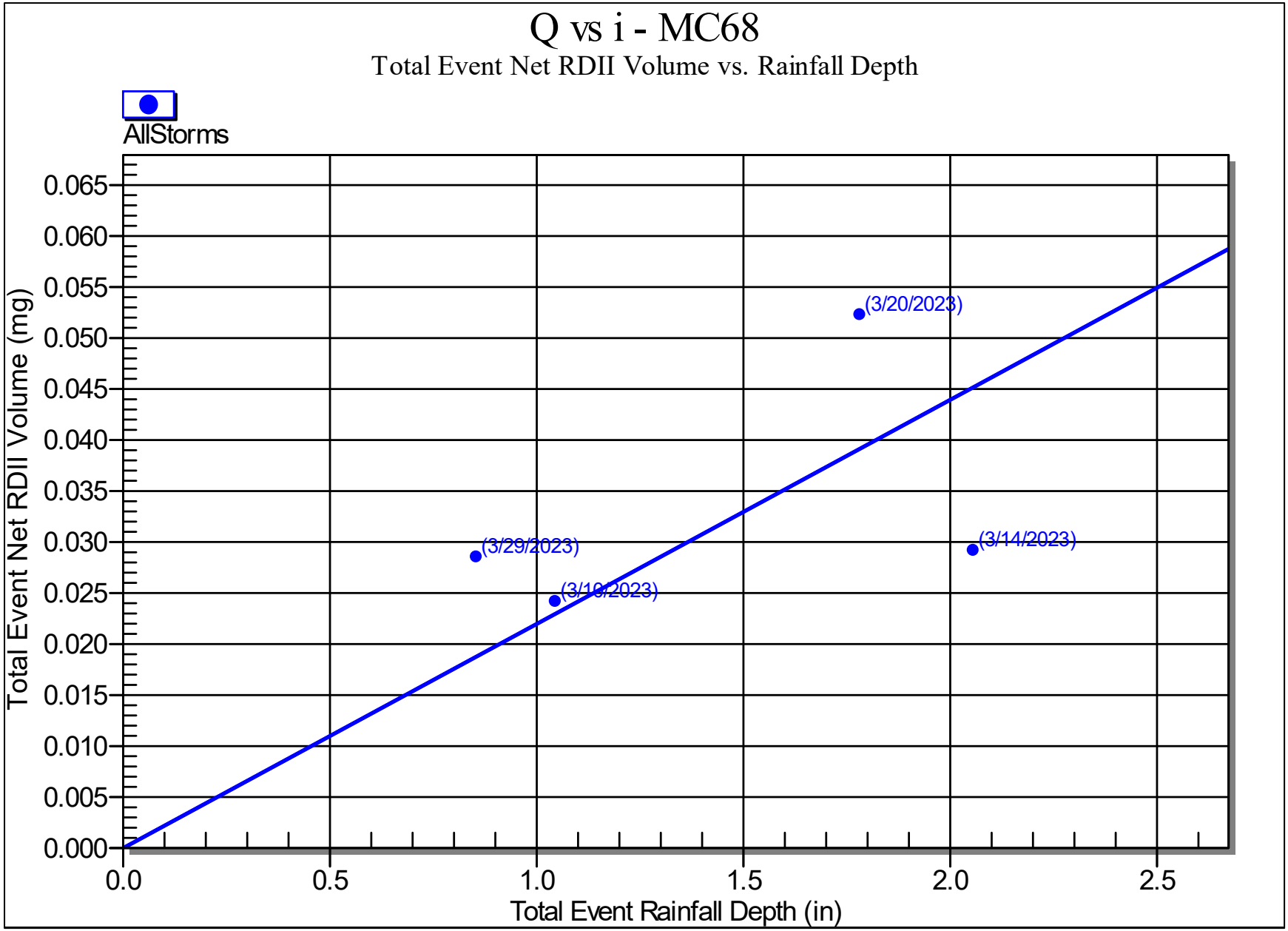

Scatter Graph
MC68
Lanfear-Coll (C-LC = 1.88)
VFINAL (ft/s)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Iso Q (MGD)
0.36
0.32
0.28
0.24
0.2
0.16
0.12
0.08
0.04
0.01
0
1
2
3
4
5
6
7
8
9
10
DFINAL (in)

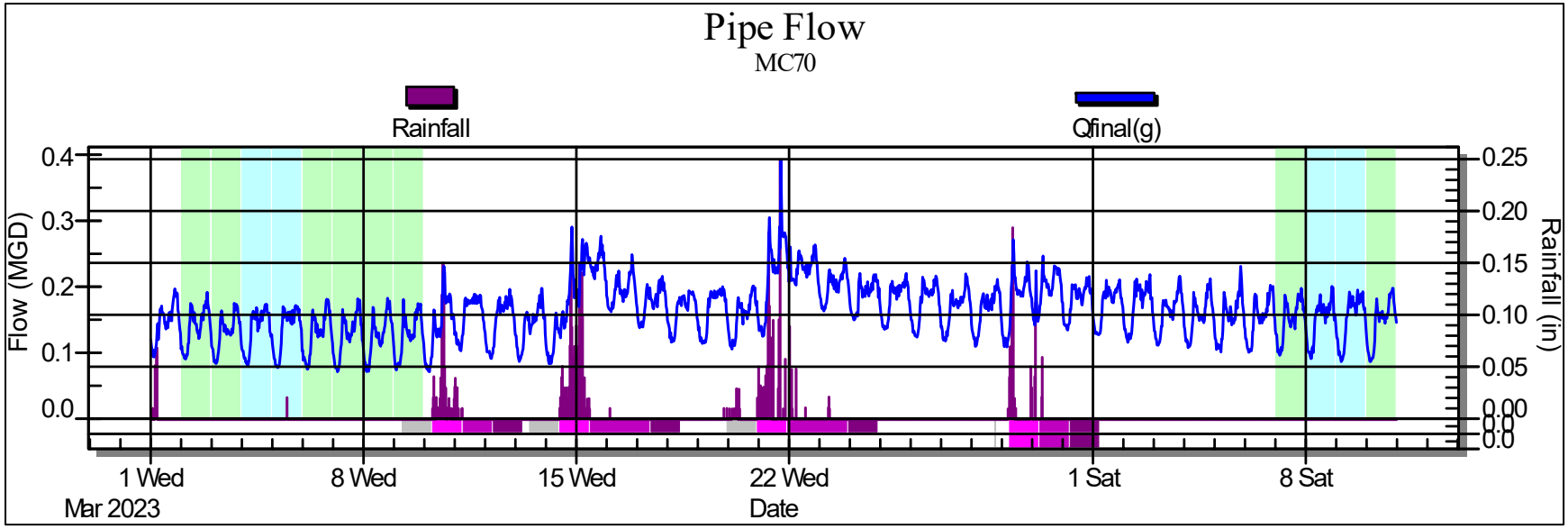

Storm Event - 3/10/2023 6:30:00 AM
MC68
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

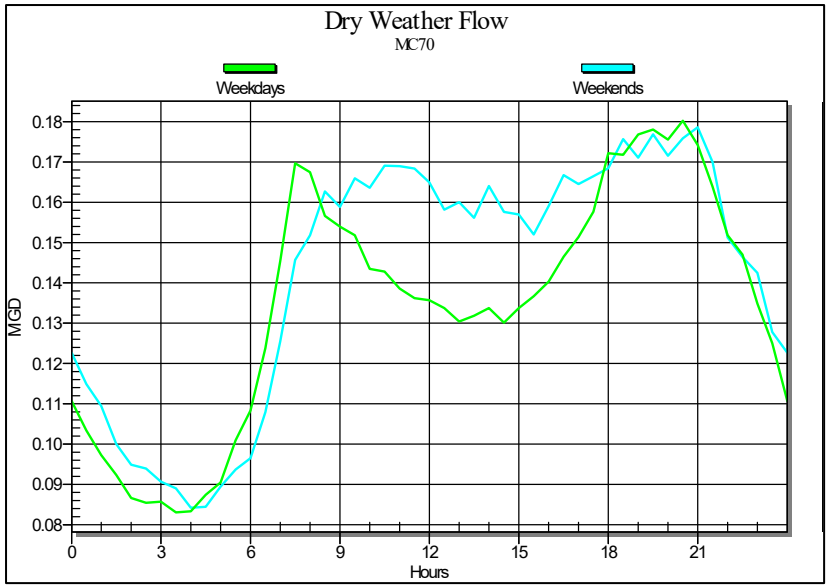

Storm Event - 3/14/2023 11:00:00 AM
MC68
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

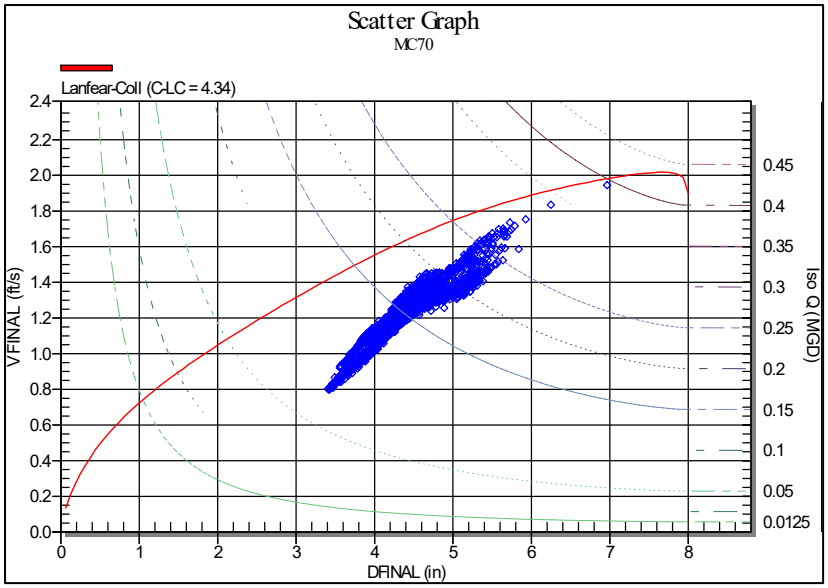

Storm Event - 3/20/2023 11:00:00 PM
MC68
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Flow (MGD)
Rainfall (in)
Storms
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

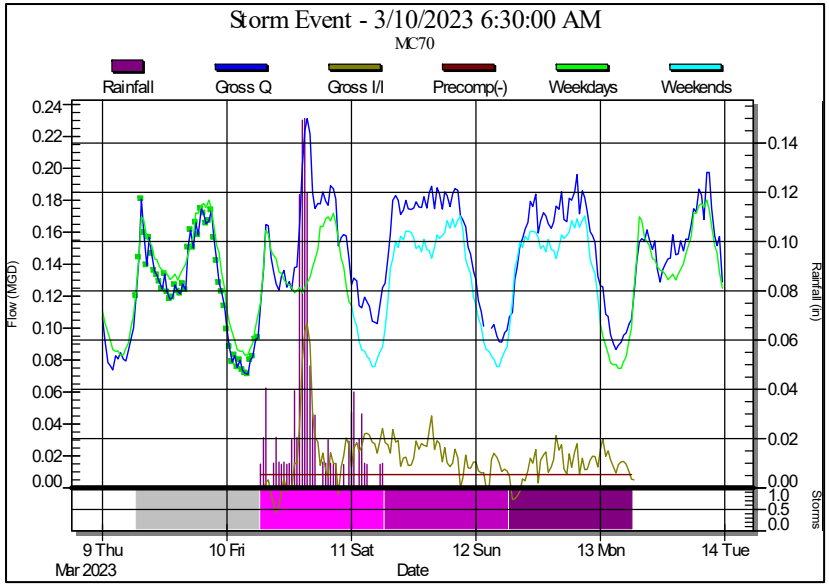

Storm Event - 3/29/2023 6:00:00 AM
MC68
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

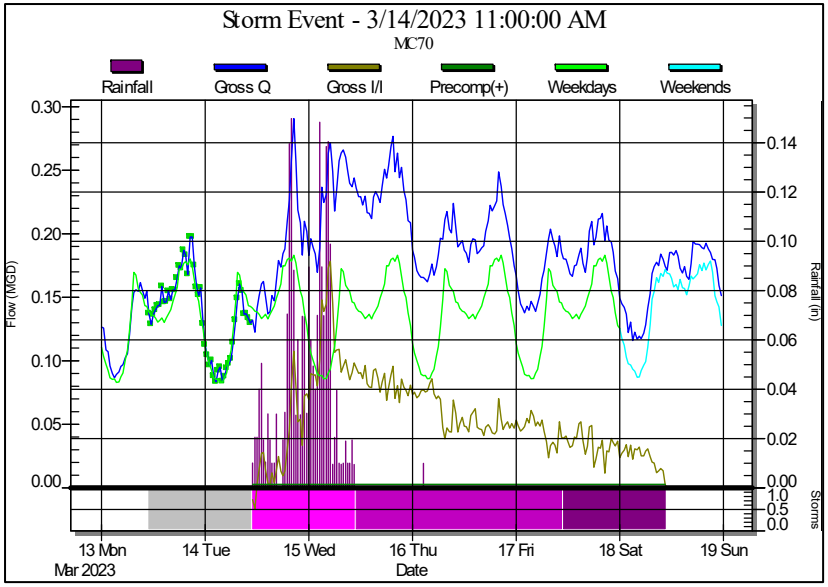

Q vs i - MC68
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
(3/20/2023)
(3/29/2023)
(3/14/2023)
(3/16/2023)
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)

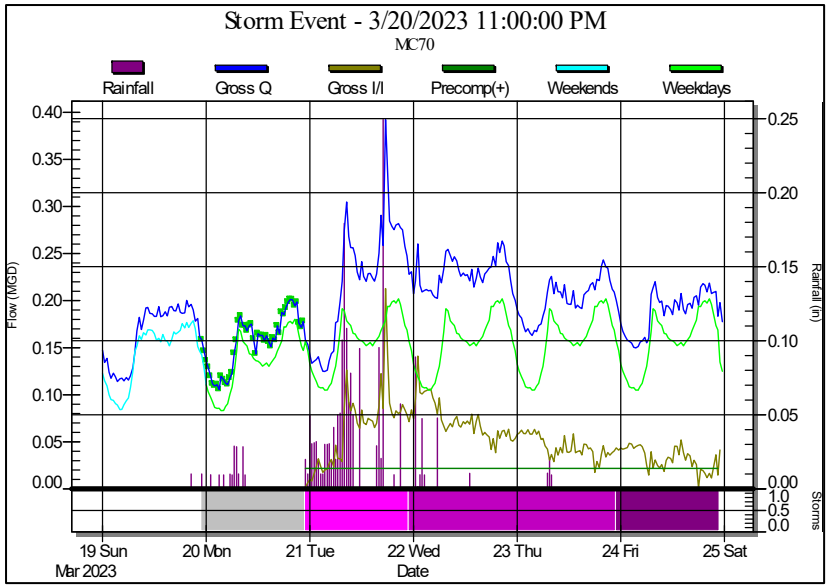

Pipe Flow
MC70
Rainfall
Qfinal(g)
Flow (MGD)
Rainfall (in)
0.4
0.3
0.2
0.1
0.0
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

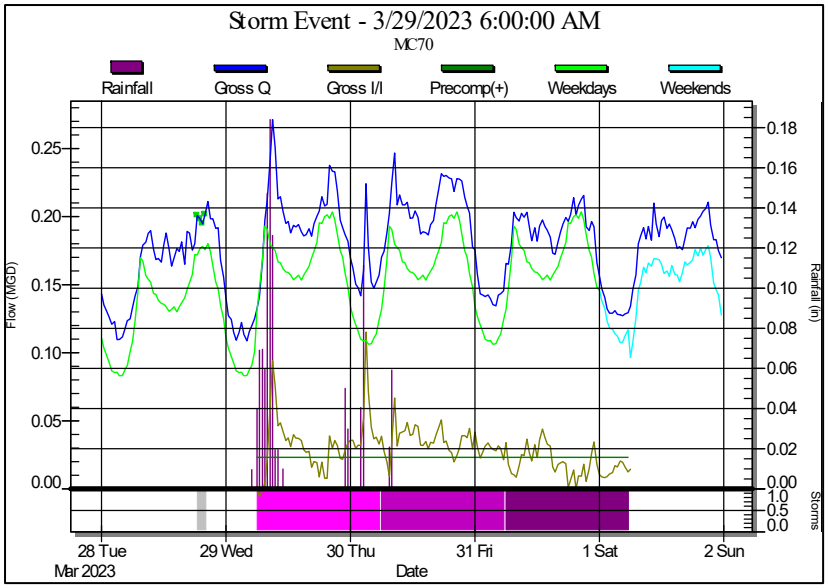

Dry Weather Flow
MC70
Weekdays
Weekends
MGD
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0
3
6
9
12
15
18
21
Hours

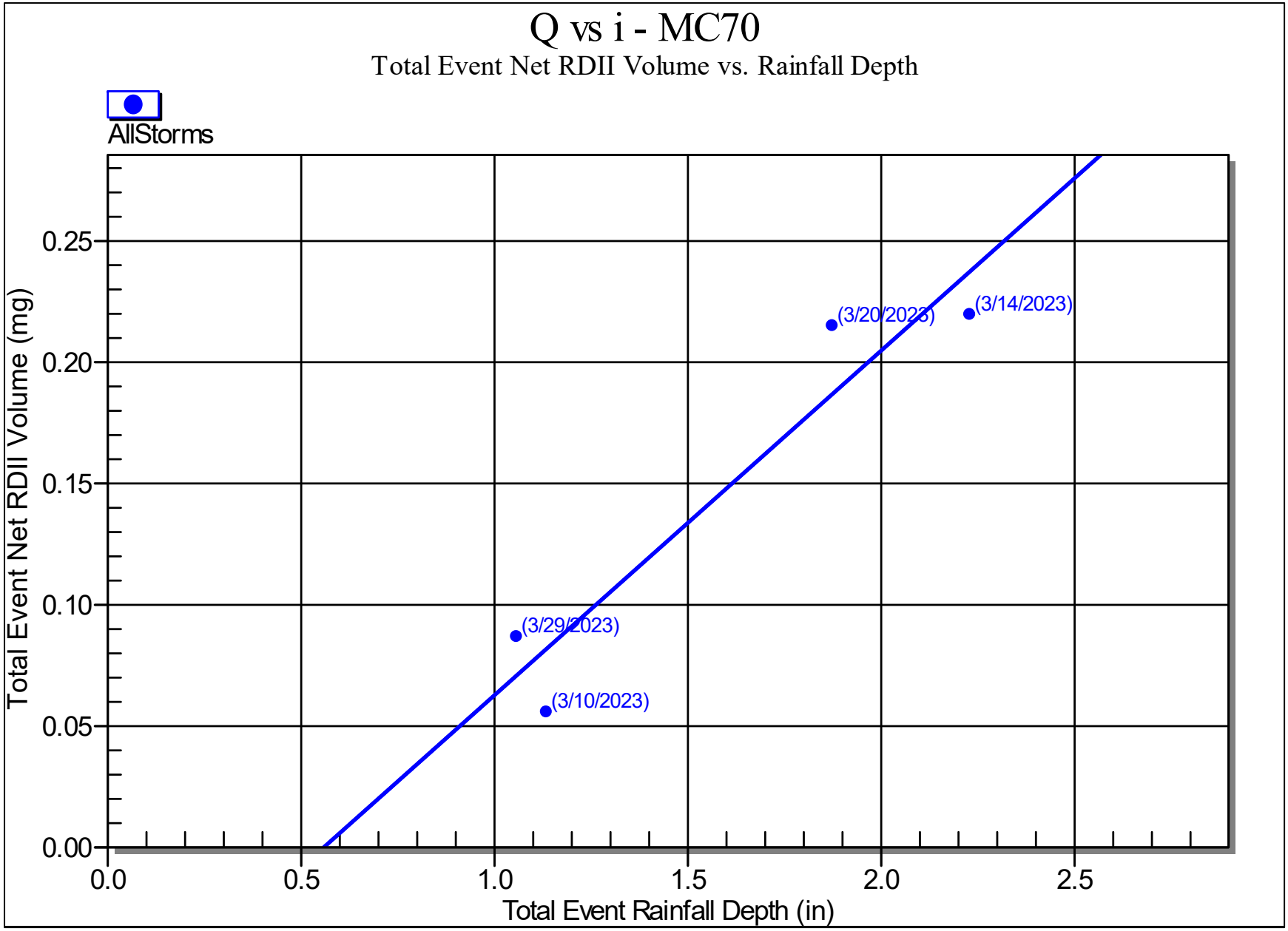

Scatter Graph
MC70
Lanfear-Coll (C-LC = 4.34)
VFINAL (ft/s)
Iso Q (MGD)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0.0125
0
1
2
3
4
5
6
7
8
DFINAL (in)

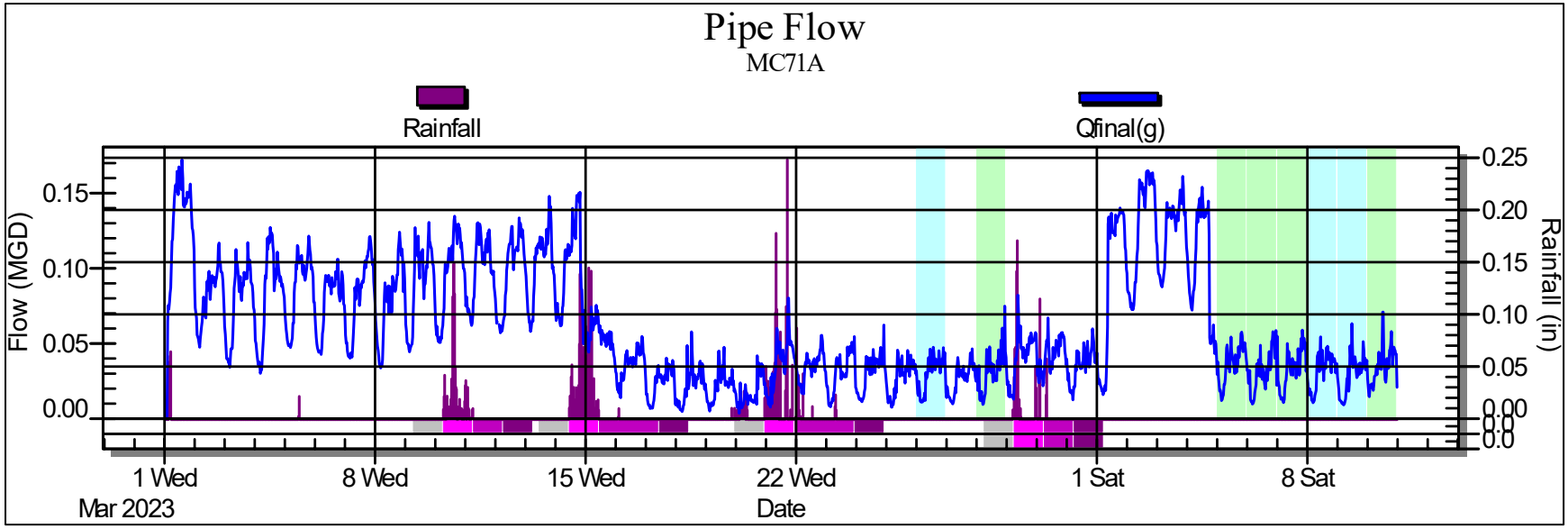

Storm Event - 3/10/2023 6:30:00 AM
MC70
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

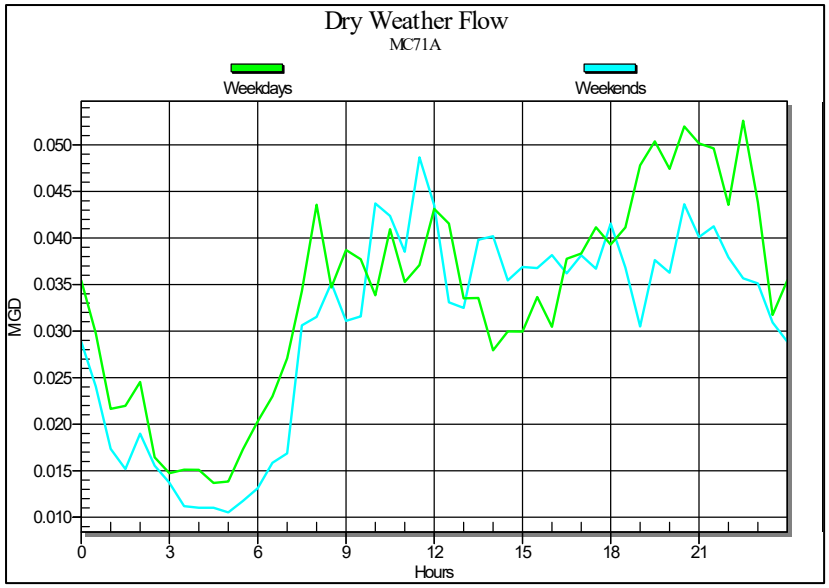

Storm Event - 3/14/2023 11:00:00 AM
MC70
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

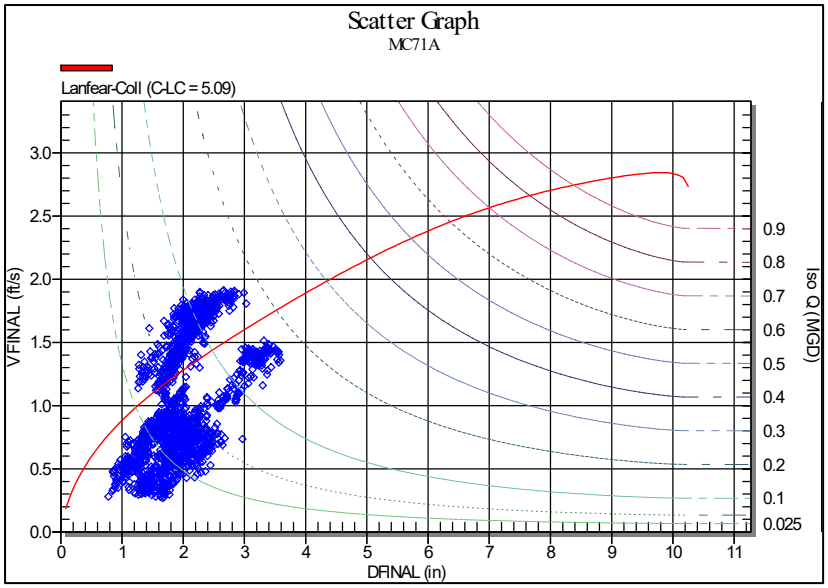

Storm Event - 3/20/2023 11:00:00 PM
MC70
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

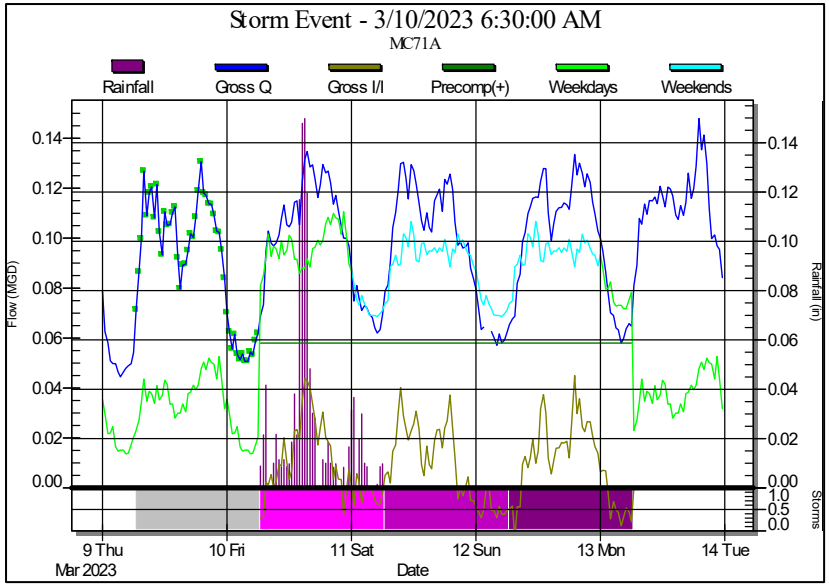

Storm Event - 3/29/2023 6:00:00 AM
MC70
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

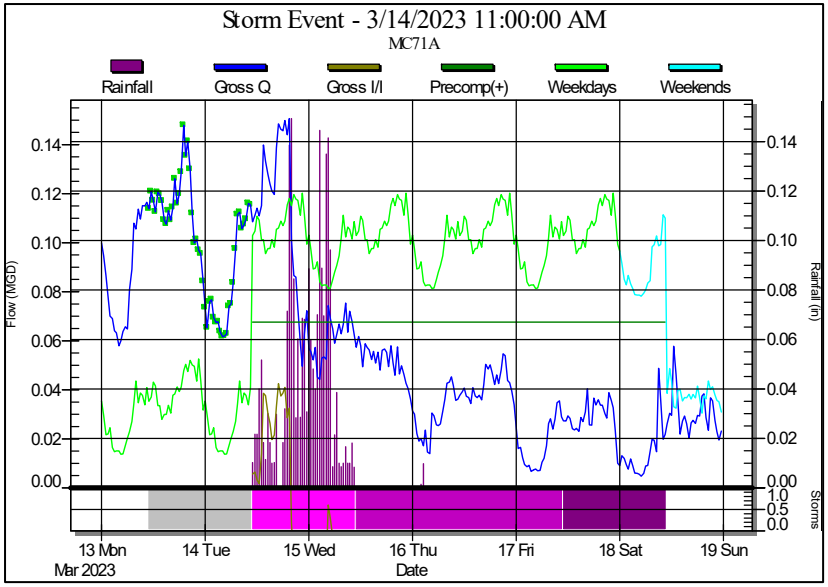

Q vs i - MC70
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.05
0.10
0.15
0.20
0.25
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/20/2023)
(3/14/2023)
(3/29/2023)
(3/10/2023)

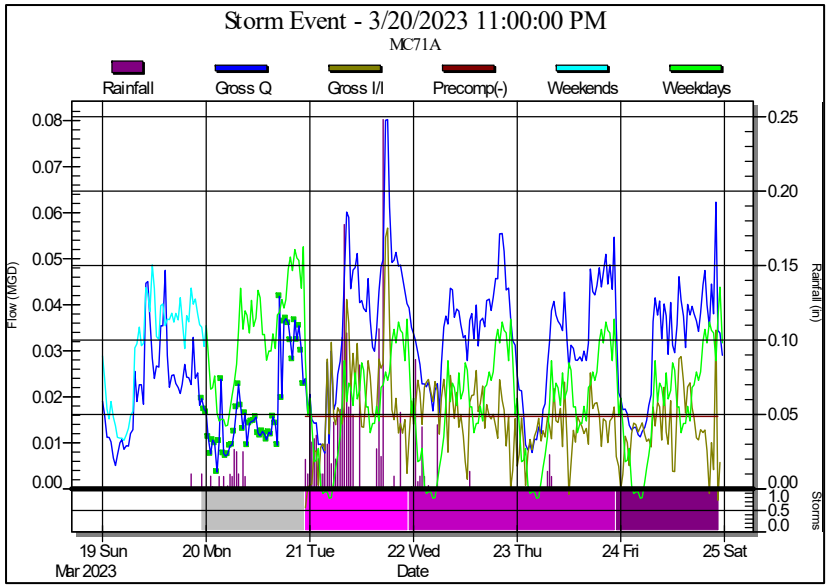

Pipe Flow
MC71A
Rainfall
Qfinal(g)
Flow (MGD)
0.15
0.10
0.05
0.00
Rainfall (in)
0.25
0.20
0.15
0.10
0.05
0.00
0.0
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat

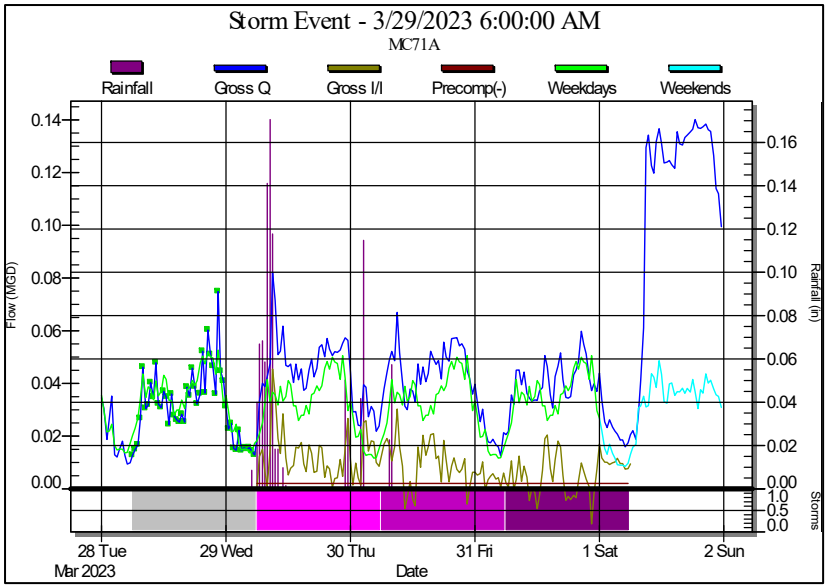

Dry Weather Flow
MC71A
Weekdays
Weekends
MGD
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0
3
6
9
12
15
18
21
Hours

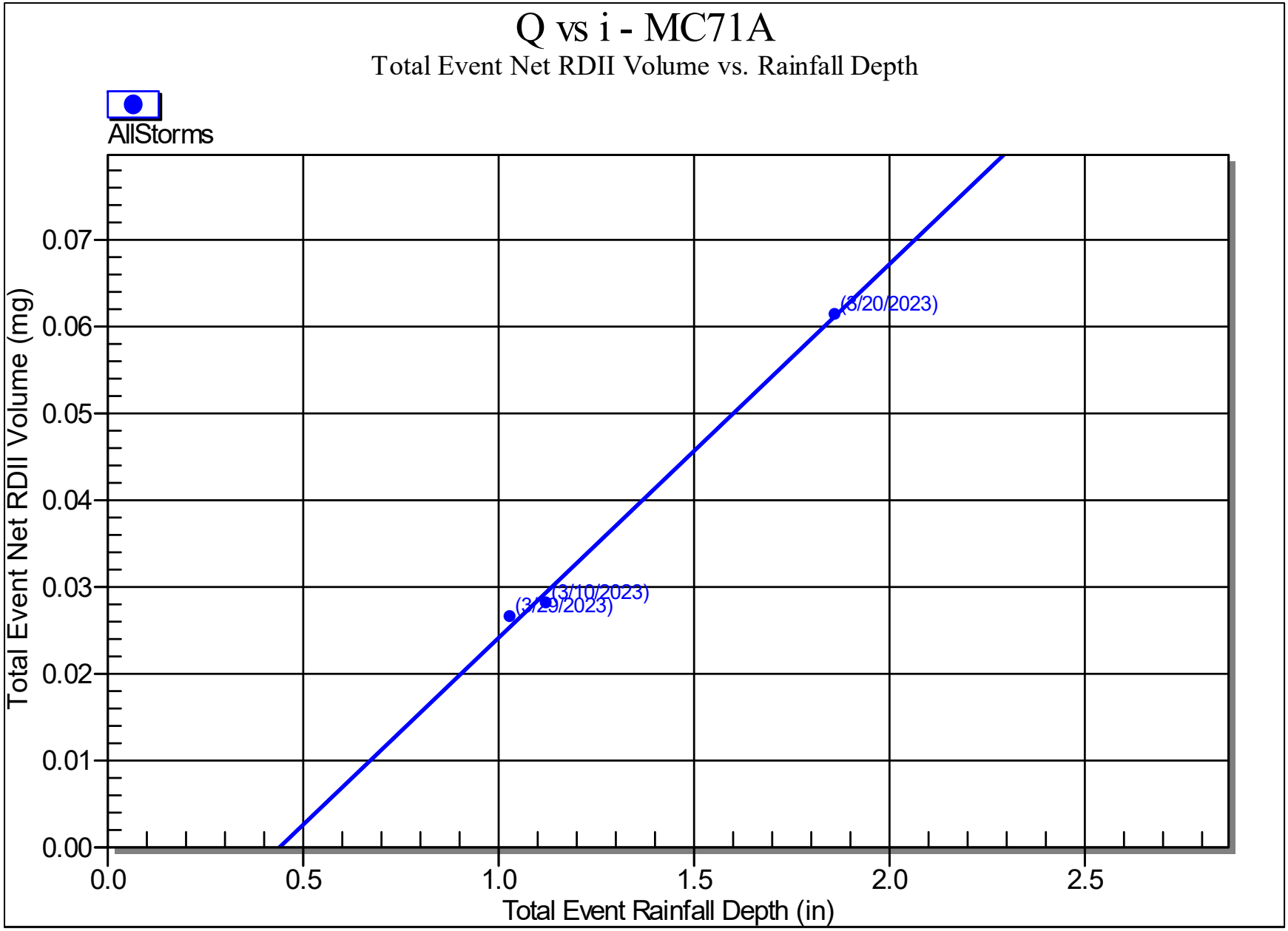

Scatter Graph
MC71A
Lanfear-Coll (C-LC = 5.09)
VFINAL (ft/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8
9
10
11
DFINAL (in)
Iso Q (MGD)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.025

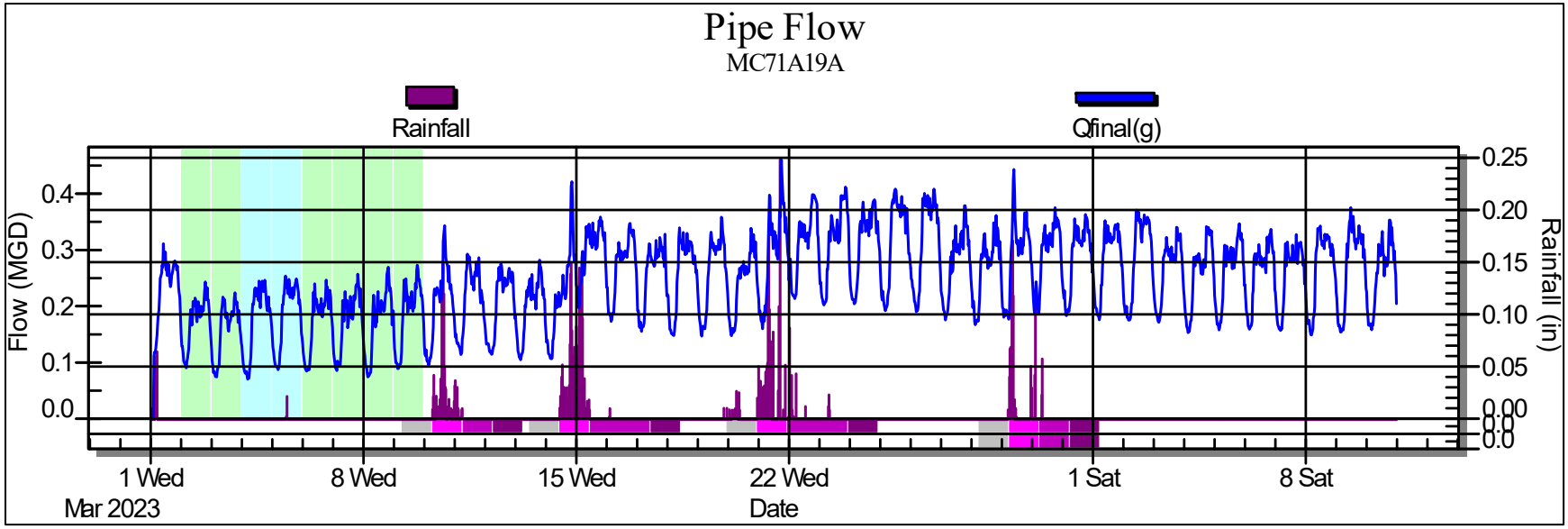

Storm Event - 3/10/2023 6:30:00 AM
MC71A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

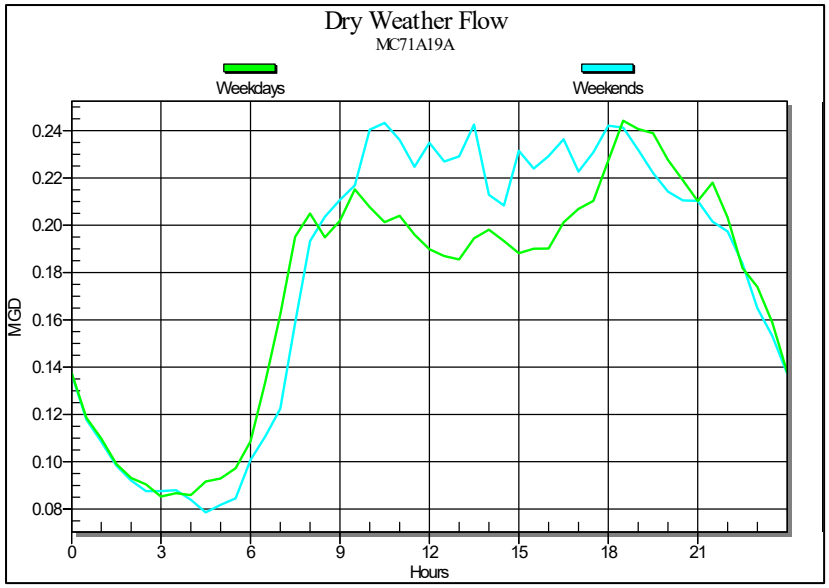

Storm Event - 3/14/2023 11:00:00 AM
MC71A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

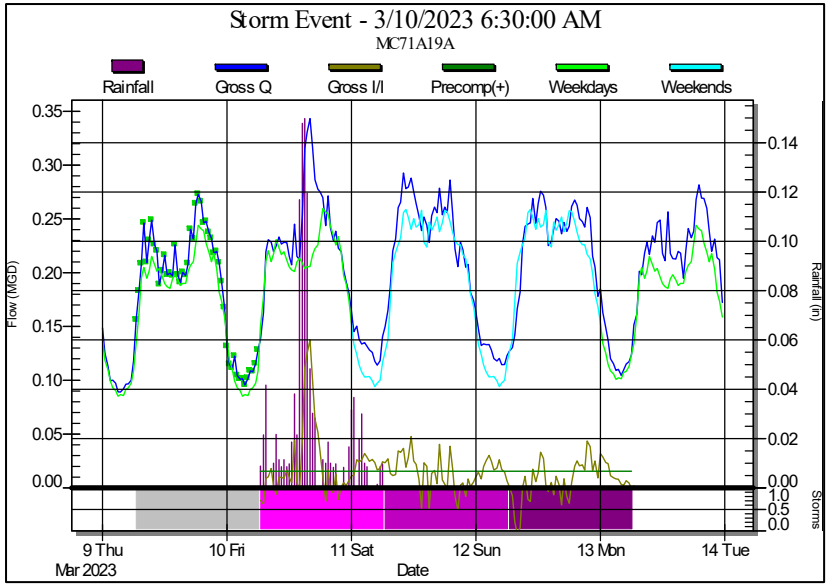

Storm Event - 3/20/2023 11:00:00 PM
MC71A
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

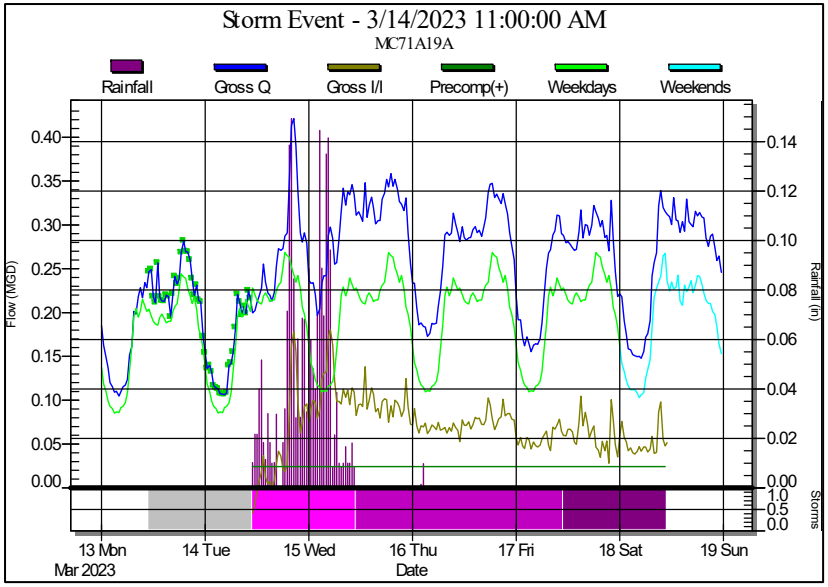

Storm Event - 3/29/2023 6:00:00 AM
MC71A
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

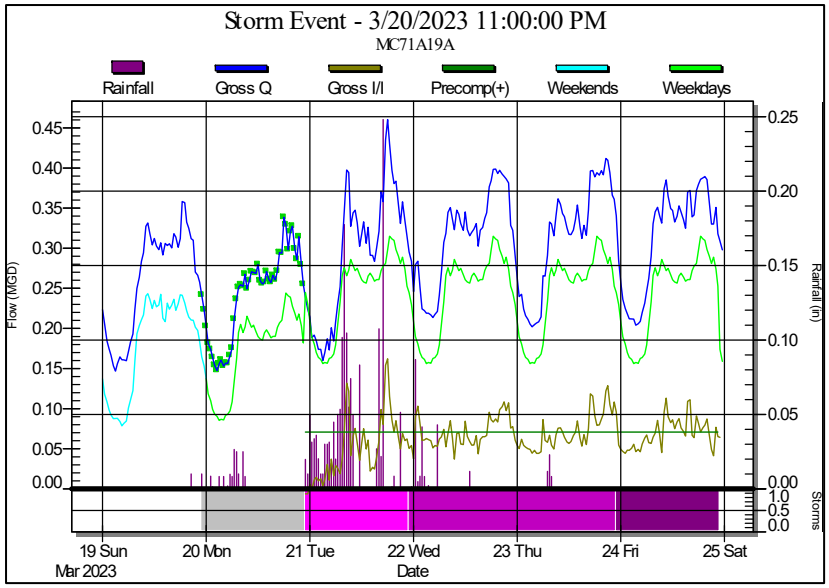

Q vs i - MC71A
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/20/2023)
(3/10/2023)
(3/29/2023)

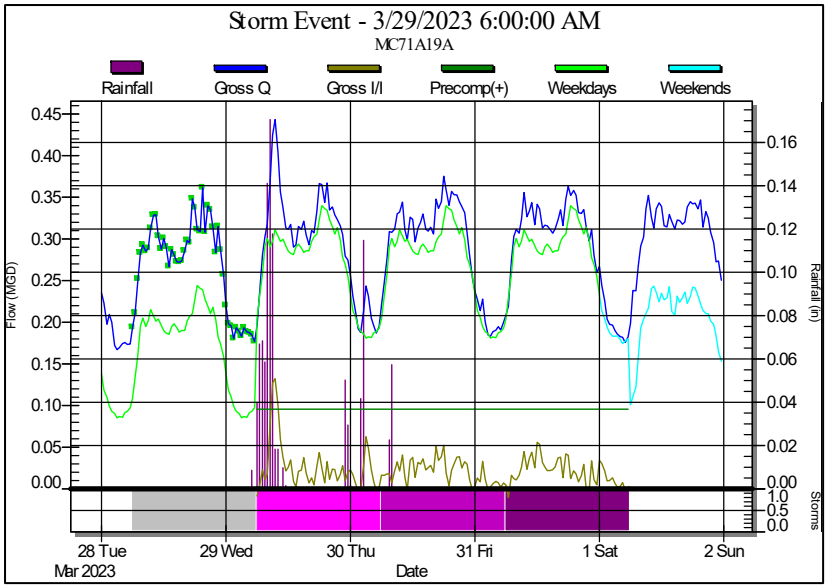

Pipe Flow
MC71A19A
Rainfall
Qfinal(g)
Flow (MGD)
0.4
0.3
0.2
0.1
0.0
Rainfall (in)
0.25
0.20
0.15
0.10
0.05
0.00
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
1 Sat
8 Sat
Date

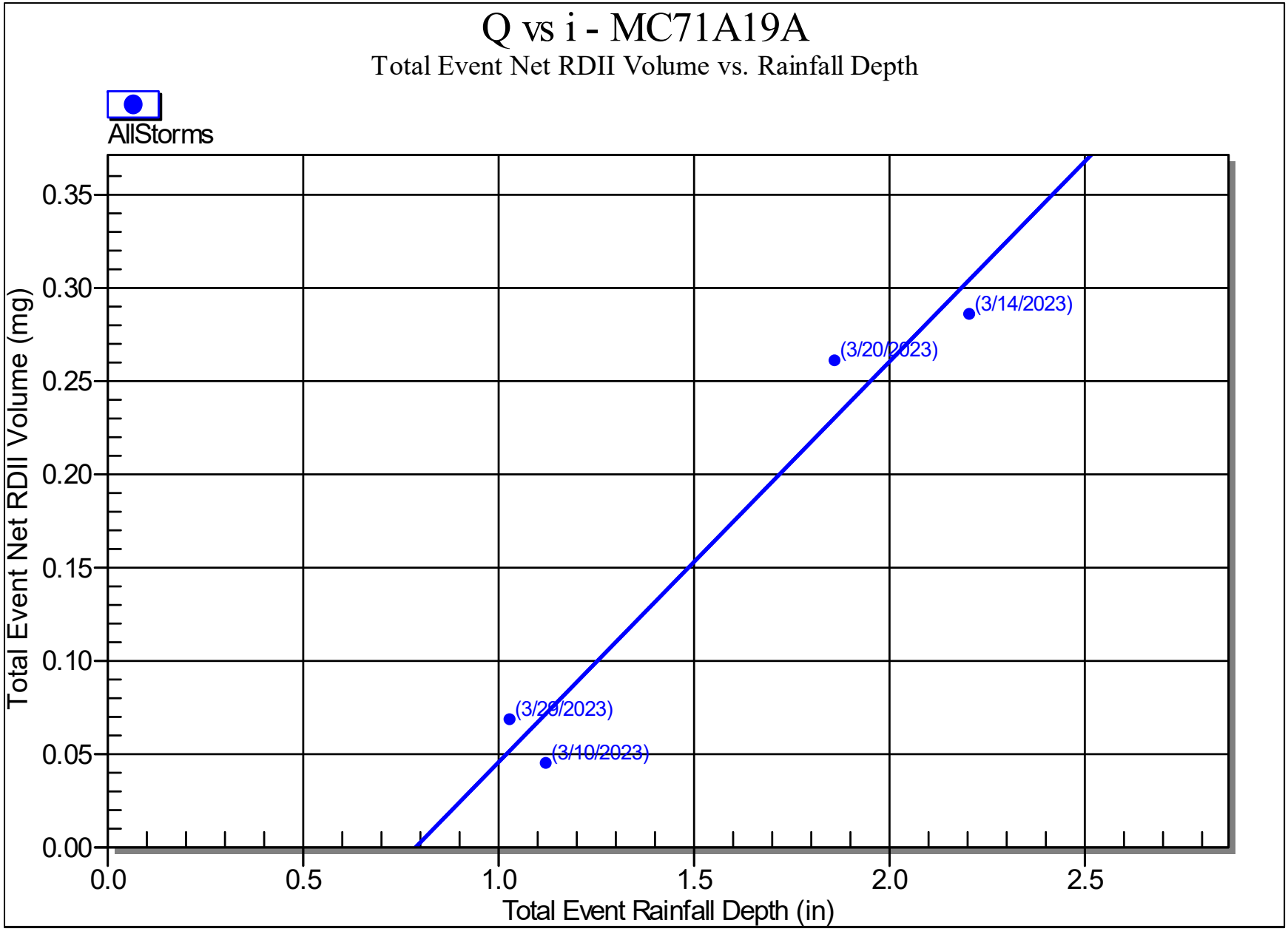

Dry Weather Flow
MC71A19A
Weekdays
Weekends
MGD
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0
3
6
9
12
15
18
21
Hours

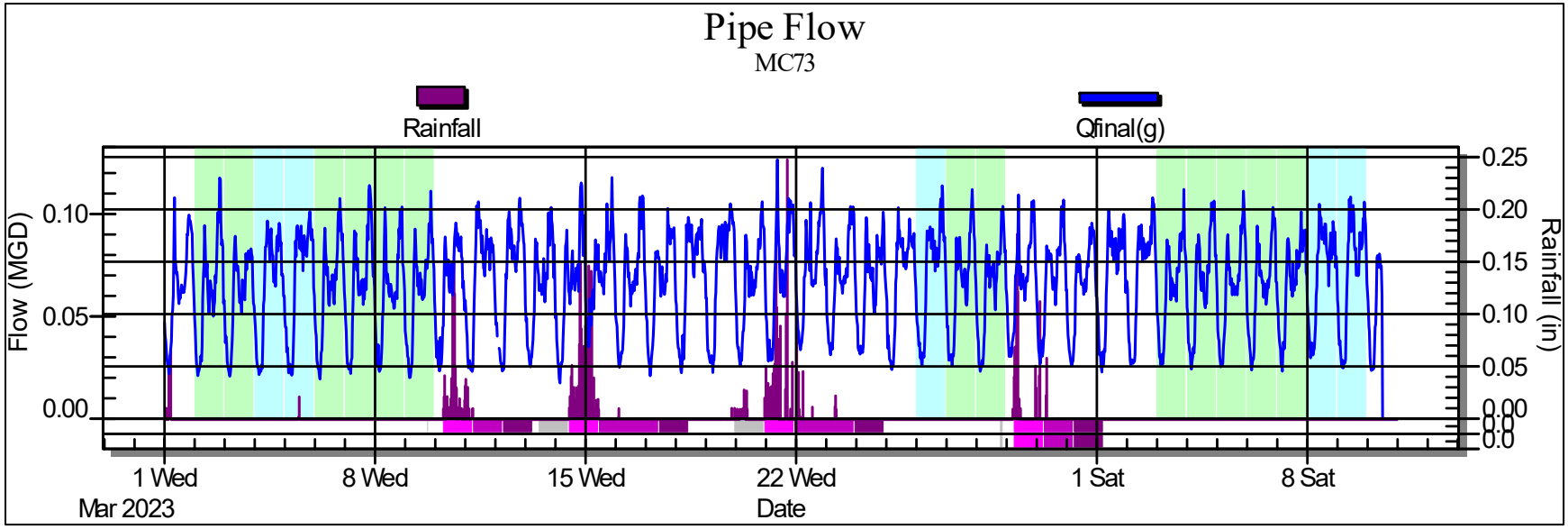

Storm Event - 3/10/2023 6:30:00 AM
MC71A19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date

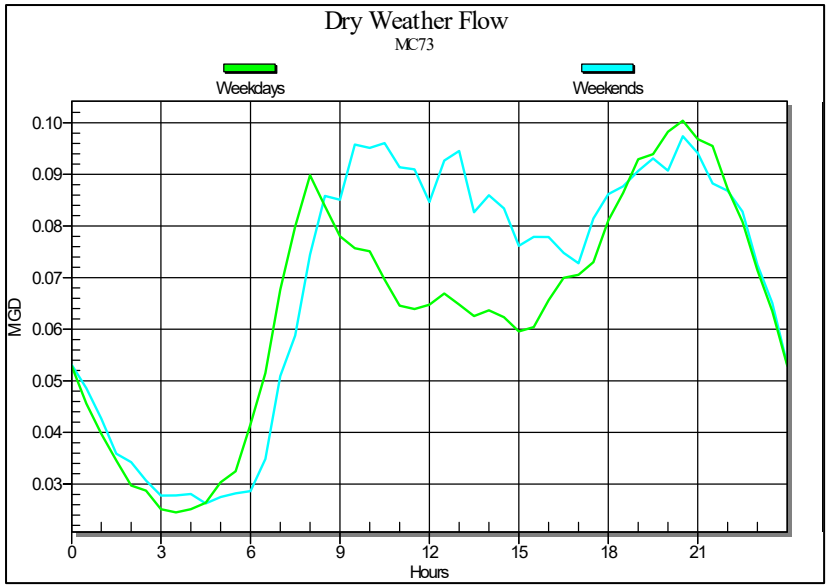

Storm Event - 3/14/2023 11:00:00 AM
MC71A19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date

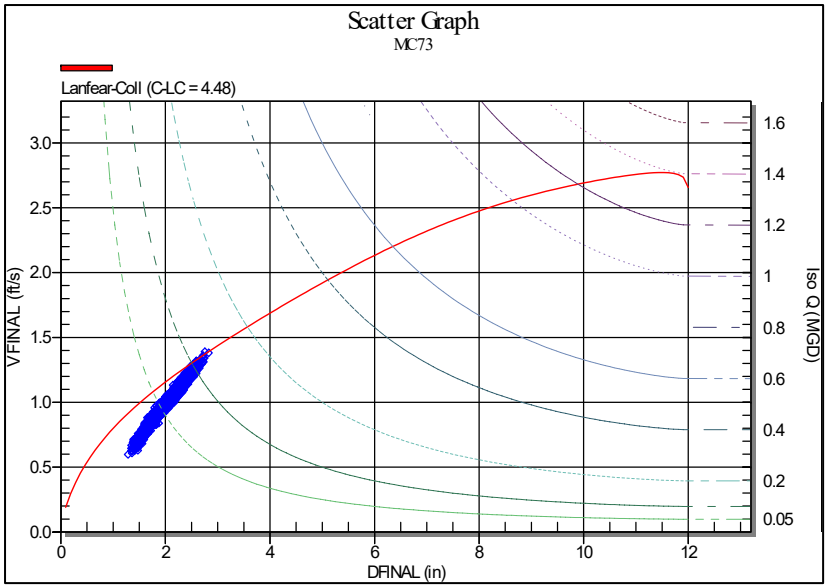

Storm Event - 3/20/2023 11:00:00 PM
MC71A19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date

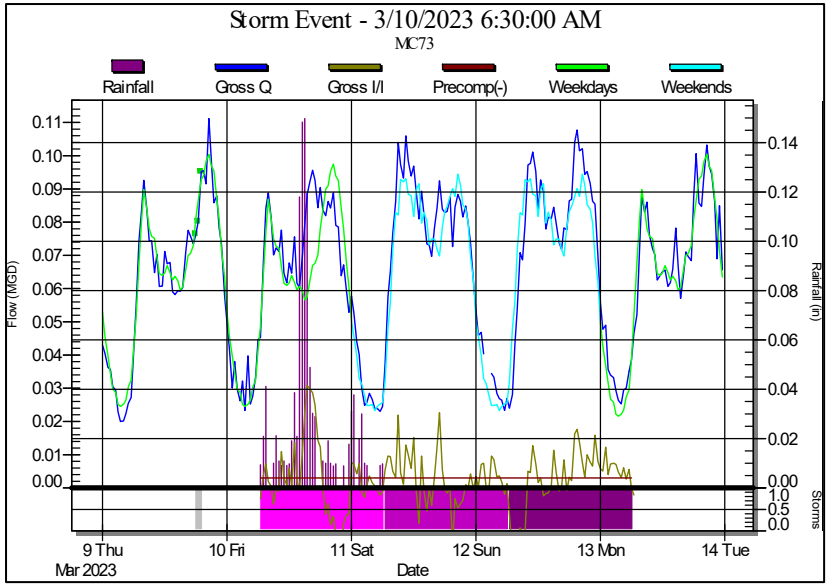

Storm Event - 3/29/2023 6:00:00 AM
MC71A19A
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date

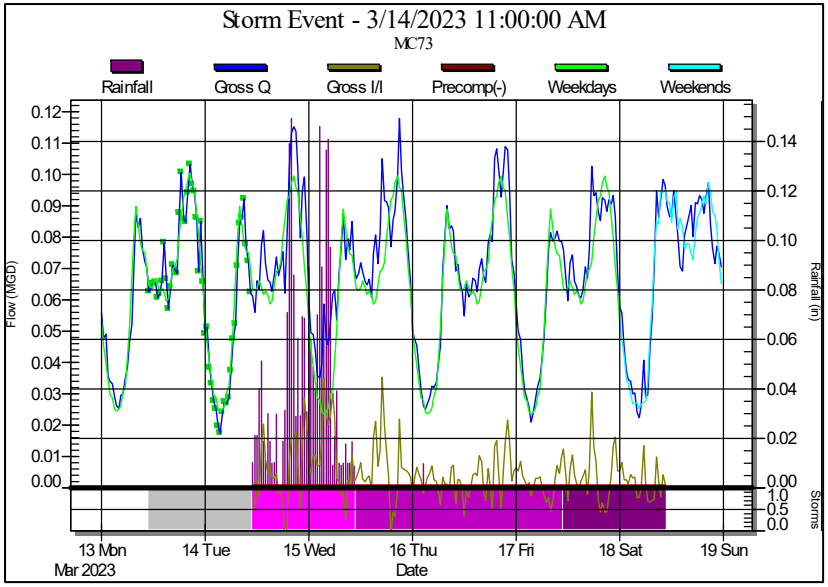

Q vs i - MC71A19A
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/28/2023)
(3/10/2023)

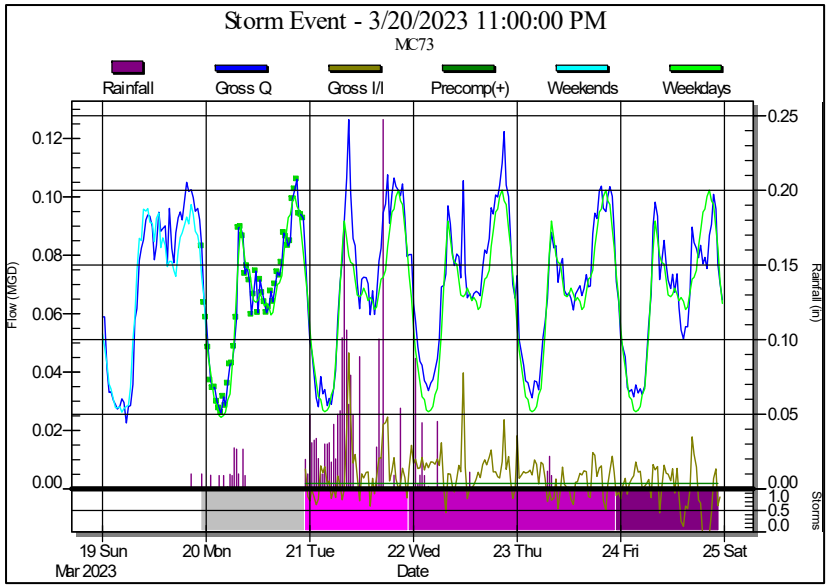

Pipe Flow
MC73
Rainfall
Qfinal(g)
Flow (MGD)
0.10
0.05
0.00
Rainfall (in)
0.25
0.20
0.15
0.10
0.05
0.00
0.0
1 Wed
Mar 2023
8 Wed
15 Wed
22 Wed
Date
1 Sat
8 Sat

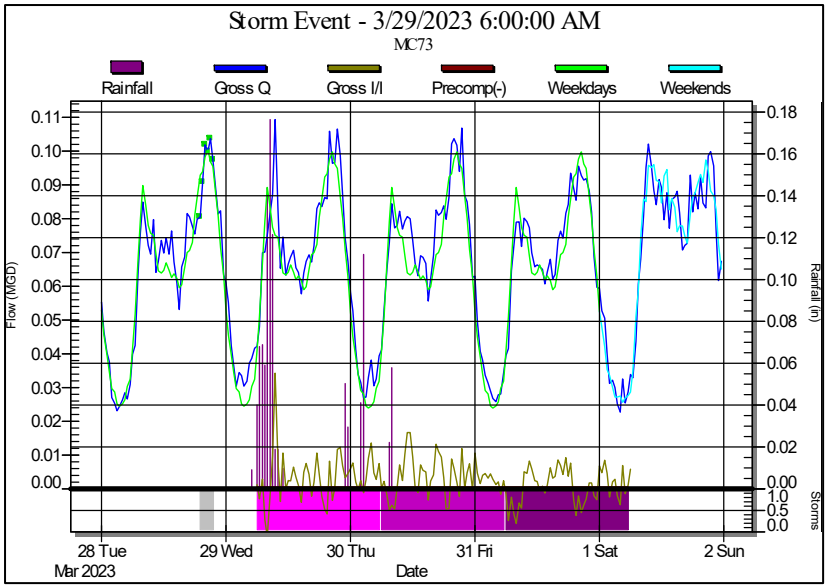

Dry Weather Flow
MC73
Weekdays
Weekends
MGD
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0
3
6
9
12
15
18
21
Hours

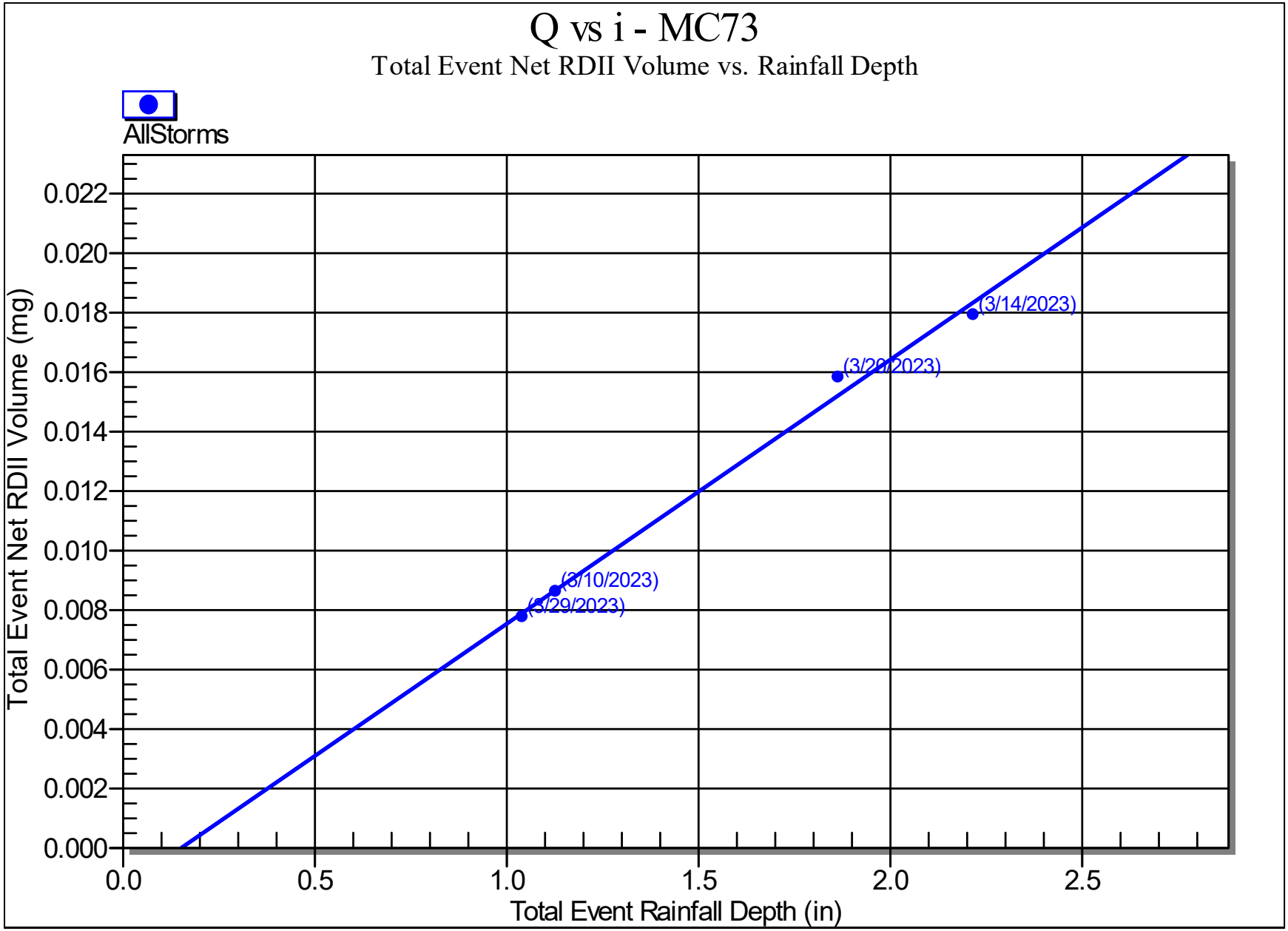

Scatter Graph
MC73
Lanfear-Coll (C-LC = 4.48)
VFINAL (ft/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Iso Q (MGD)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0.05
0
2
4
6
8
10
12
DFINAL (in)


Storm Event - 3/10/2023 6:30:00 AM
MC73
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
9 Thu
10 Fri
11 Sat
12 Sun
13 Mon
14 Tue
Mar 2023
Date


Storm Event - 3/14/2023 11:00:00 AM
MC73
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
13 Mon
14 Tue
15 Wed
16 Thu
17 Fri
18 Sat
19 Sun
Mar 2023
Date


Storm Event - 3/20/2023 11:00:00 PM
MC73
Rainfall
Gross Q
Gross I/I
Precomp(+)
Weekends
Weekdays
Flow (MGD)
Rainfall (in)
Storms
19 Sun
20 Mon
21 Tue
22 Wed
23 Thu
24 Fri
25 Sat
Mar 2023
Date


Storm Event - 3/29/2023 6:00:00 AM
MC73
Rainfall
Gross Q
Gross I/I
Precomp(-)
Weekdays
Weekends
Flow (MGD)
Rainfall (in)
Storms
28 Tue
29 Wed
30 Thu
31 Fri
1 Sat
2 Sun
Mar 2023
Date


Q vs i - MC73
Total Event Net RDII Volume vs. Rainfall Depth
AllStorms
Total Event Net RDII Volume (mg)
0.022
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0.0
0.5
1.0
1.5
2.0
2.5
Total Event Rainfall Depth (in)
(3/14/2023)
(3/20/2023)
(3/10/2023)
(5/29/2023)

Appendix B

Flow Data Report

Master Plan Sewer Flow Monitoring, Midway, CA 2023

Final Report Submitted to **AKM Consulting Engineers**
May 11, 2023

ADS ENVIRONMENTAL SERVICES

340 The Bridge Street, Suite 204
Huntsville, AL 35806

800-633-7246
www.adsenv.com

Master Plan Sewer Flow Monitoring, Midway, CA 2023

Prepared For:

Diann Pay, PE
AKM Consulting Engineers
553 Wald
Irvine, CA, 92618

Prepared By:

ADS, LLC
15201 Springdale Street
Huntington Beach, CA 92649

April 28, 2023

Diann Pay, PE
AKM Consulting Engineers
553 Wald
Irvine, CA, 92618

SUBJECT: Master Plan Sewer Flow Monitoring, Midway, CA 2023

Dear Diann Pay,

ADS is pleased to submit the report for the **Master Plan Sewer Flow Monitoring, Midway, CA 2023** completed on behalf of AKM Consulting Engineers. The metering was conducted at twenty-six (26) locations. The study was conducted during the period of Wednesday, 01 March 2023 to Monday, 10 April 2023.

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

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Paul Mitchell at 714.920.5518.

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

Sincerely,
ADS ENVIRONMENTAL SERVICES

Tyler Bui
Hydraulic Data Analyst

Scope and Methodology

Introduction

AKM Consulting Engineers entered into an agreement with ADS Environmental Services to conduct flow monitoring at (26) twenty-six locations in the Midway, CA Sanitary Collection System. The study was scheduled for a period of (30) thirty days. An extended period of data through April 10, as available, is provided as a courtesy to AKM. Once in place, the flow monitoring equipment was to be used to measure depth, velocity, and to quantify flows. The objective of this study was to confirm flows for master planning purposes.

Project Scope

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

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

Equipment installation was completed on February 28, 2023. The monitoring period began on March 1, 2023, and was completed on April 10, 2023. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment

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

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

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

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

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

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

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

Installation

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

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

Data Collection, Confirmation, and Quality Assurance

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

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

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

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

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

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

Flow Quantification Methods

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

Continuity Equation

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

$$Q = A * V$$

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

Data Analysis and Presentation

Data Analysis

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

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

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

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

Data Presentation

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

DEPTH - Final calculated depth measurement (in inches)

QUANTITY - Final calculated flow rate (in MGD)

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

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

MC01

Site Commentary

SITE INFORMATION

Pipe	Round (8 in H)
Silt	1.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	4.72	0.62	0.077
Minimum	4.02	0.35	0.035
Maximum	6.01	0.99	0.161
Min Time	03/29/2023 11:00:00 PM	03/30/2023 3:35:00 AM	03/30/2023 4:20:00 AM
Max Time	04/04/2023 10:30:00 AM	04/06/2023 11:40:00 AM	04/06/2023 11:40:00 AM

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

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

DATA UPTIME

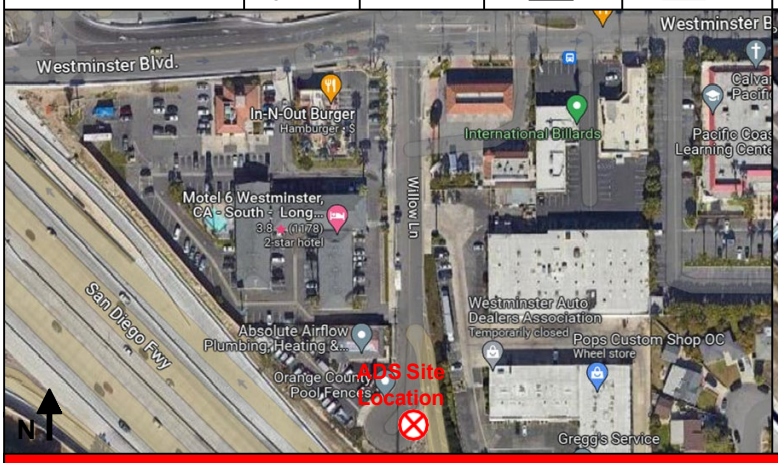
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC01	**Install Date:** 2/25/2023	**Monitor Type**	Peak Doppler
Address/Location: 1414 Willow Ln.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	1054
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	8.00 "



Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 3:30am
Site Hydraulics:	Slow straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	4.50 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	0.00 fps
Silt:	1 Inches

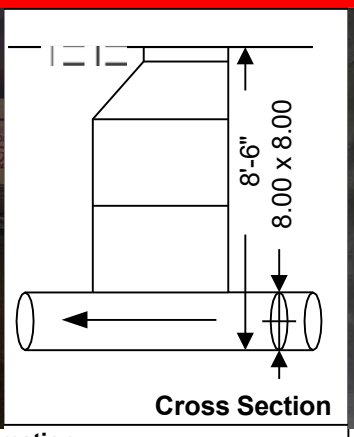
Manhole Information:

Manhole Depth:	8'-6"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [ ]	Commercial [x]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

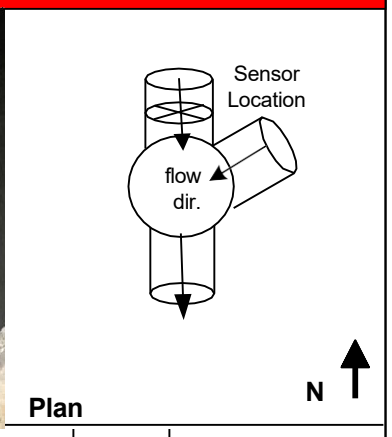
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[x]	[ ]	
WWTP	[ ]	[x]	[ ]	
Other	[ ]	[x]	[ ]	

Additional Site Information / Comments:

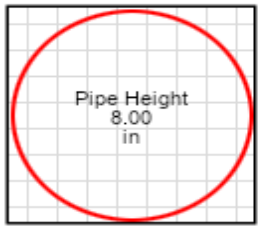
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC01

Flow Monitor

MC01

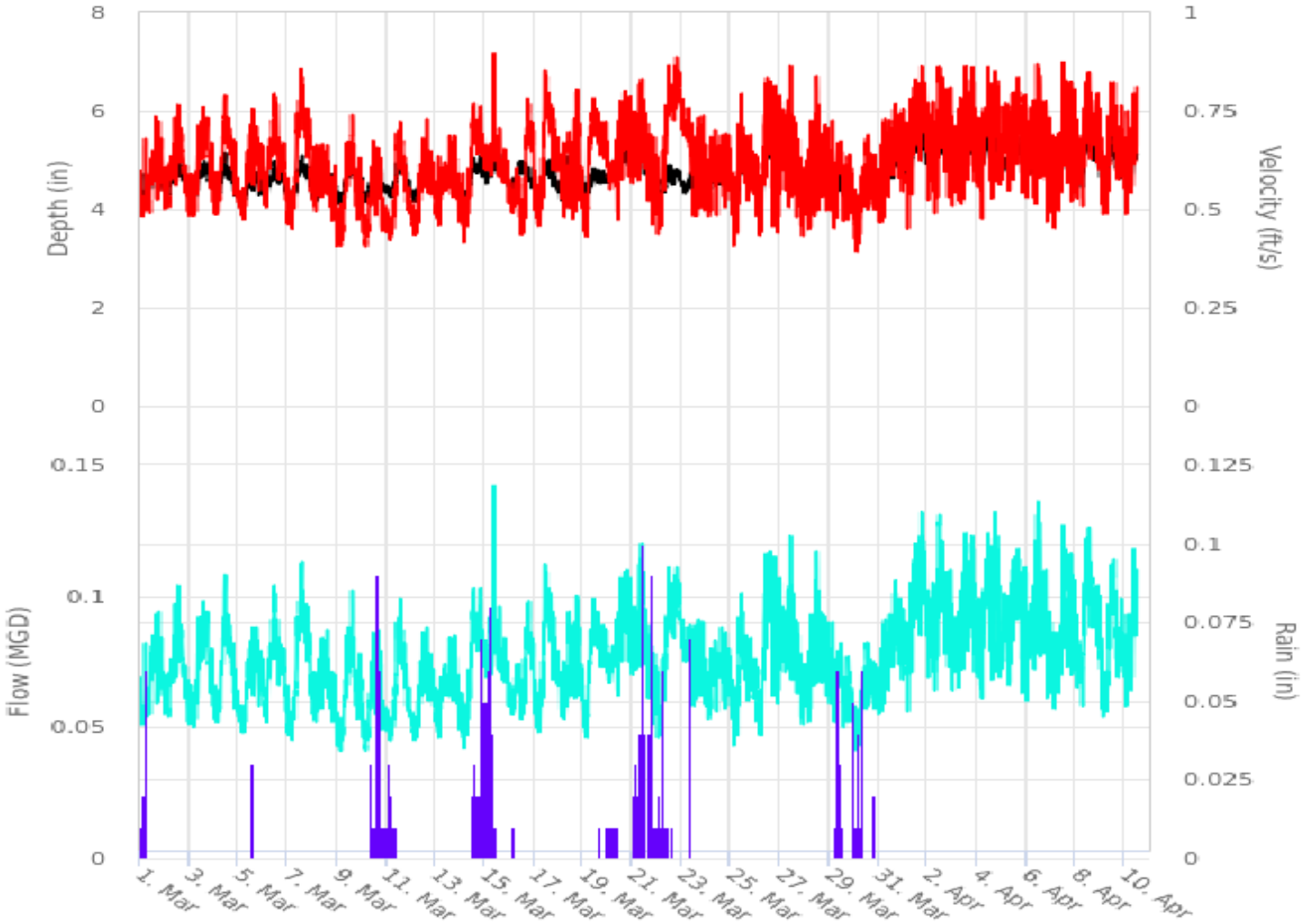


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC01

Flow Monitor

MC01

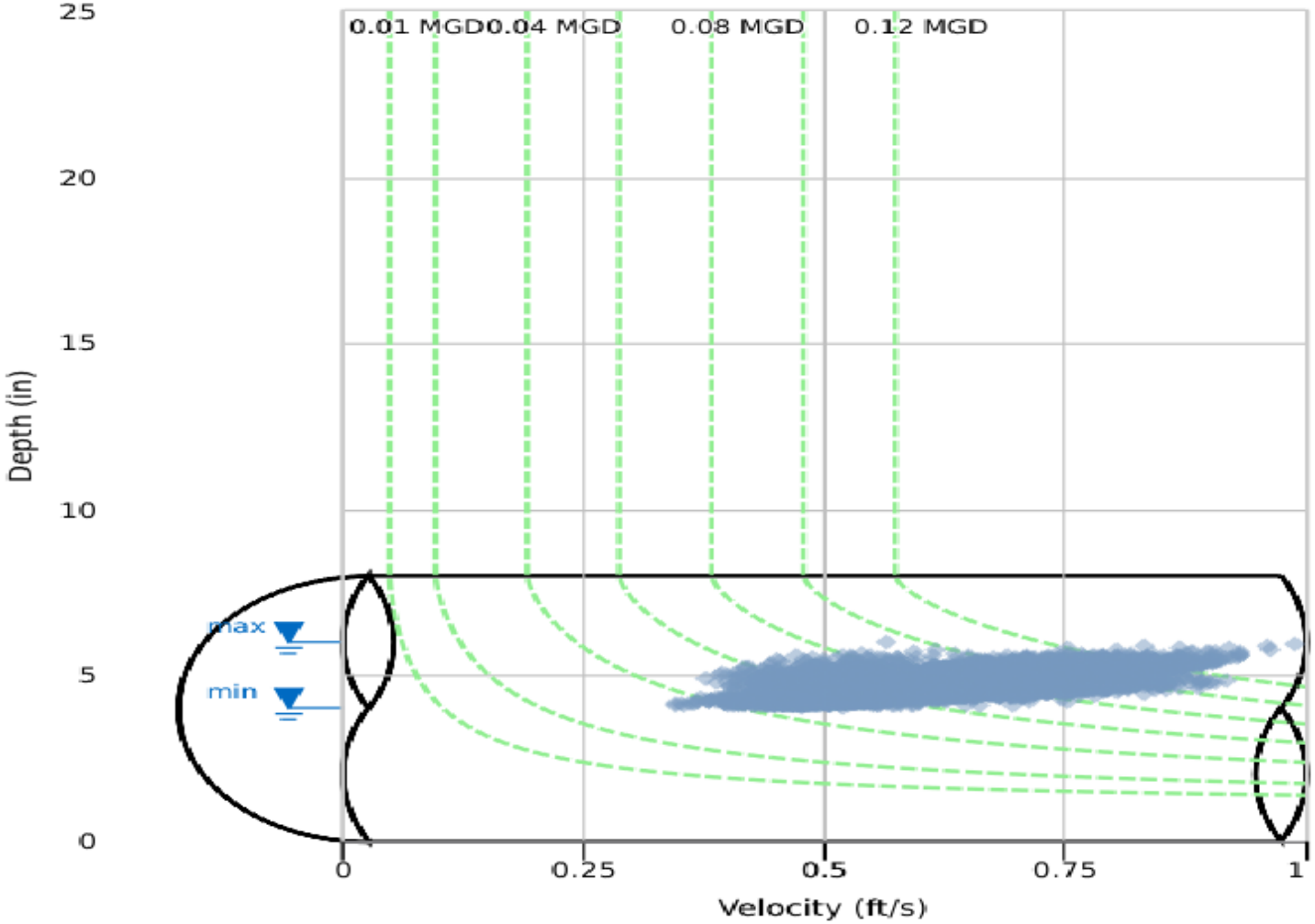
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC01Pipe: Round (8 in H), Silt1.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:00	4.22	18:25	5.21	4.55	01:40	0.46	18:30	0.78	0.58	01:40	0.049	18:30	0.105	0.067	0.067	0.24
03/02/2023	23:25	4.24	15:35	5.23	4.61	23:20	0.48	10:10	0.83	0.60	23:20	0.051	10:10	0.111	0.072	0.072	-
03/03/2023	00:45	4.17	15:05	5.02	4.58	00:45	0.46	14:05	0.79	0.61	00:45	0.047	14:05	0.102	0.072	0.072	-
03/04/2023	04:00	4.22	10:50	5.20	4.54	02:55	0.47	11:20	0.82	0.62	02:55	0.049	11:20	0.114	0.072	0.072	-
03/05/2023	03:55	4.08	15:55	4.79	4.42	05:25	0.46	14:15	0.86	0.59	05:25	0.047	14:15	0.100	0.066	0.066	0.05
03/06/2023	04:05	4.12	11:50	5.00	4.55	23:55	0.46	11:50	0.82	0.63	23:55	0.048	11:50	0.109	0.074	0.074	-
03/07/2023	03:20	4.07	14:15	5.12	4.55	01:00	0.43	21:10	0.89	0.64	01:00	0.043	14:15	0.117	0.075	0.075	-
03/08/2023	04:10	4.16	22:35	5.29	4.51	23:45	0.39	01:45	0.77	0.56	23:45	0.041	11:30	0.091	0.065	0.065	-
03/09/2023	02:50	4.10	14:50	5.21	4.55	05:15	0.37	14:50	0.76	0.55	03:35	0.040	14:50	0.106	0.065	0.065	-
03/10/2023	04:00	4.14	16:05	5.03	4.49	03:40	0.40	11:30	0.70	0.52	04:05	0.041	16:05	0.091	0.060	0.060	0.86
03/11/2023	04:30	4.22	14:15	5.17	4.59	03:45	0.40	13:55	0.74	0.55	04:25	0.042	13:55	0.101	0.065	0.065	0.15
03/12/2023	03:35	4.15	11:40	4.87	4.45	03:35	0.42	15:45	0.76	0.55	03:35	0.043	15:45	0.092	0.062	0.062	-
03/13/2023	03:25	4.10	15:00	4.89	4.48	03:30	0.45	18:50	0.73	0.57	03:30	0.045	14:00	0.093	0.065	0.065	-
03/14/2023	04:00	4.10	20:30	5.16	4.62	04:00	0.40	20:30	0.79	0.61	04:00	0.040	20:30	0.108	0.073	0.073	1.04
03/15/2023	23:20	4.44	09:10	5.90	4.79	23:15	0.49	09:10	0.96	0.63	23:15	0.056	09:10	0.156	0.078	0.078	0.97
03/16/2023	01:20	4.38	11:15	5.06	4.67	11:45	0.40	18:10	0.83	0.58	11:45	0.050	18:10	0.104	0.070	0.070	0.01
03/17/2023	04:35	4.20	19:50	5.18	4.59	04:25	0.43	11:10	0.87	0.64	04:40	0.045	11:10	0.115	0.076	0.076	-
03/18/2023	03:30	4.18	10:40	5.12	4.62	13:55	0.41	16:00	0.87	0.60	06:05	0.050	16:00	0.104	0.071	0.071	-
03/19/2023	04:10	4.31	09:45	4.89	4.58	03:40	0.39	10:25	0.81	0.65	03:40	0.042	09:45	0.104	0.076	0.076	0.03
03/20/2023	00:55	4.55	19:15	5.33	4.93	10:25	0.45	19:25	0.87	0.65	10:25	0.058	19:25	0.123	0.084	0.084	0.07
03/21/2023	19:50	4.36	10:45	5.42	4.79	19:50	0.42	09:30	0.88	0.65	19:50	0.046	09:30	0.128	0.081	0.081	1.20
03/22/2023	02:15	4.23	13:20	4.94	4.57	02:10	0.38	19:15	0.92	0.70	02:10	0.040	19:15	0.117	0.083	0.083	0.15
03/23/2023	03:15	4.32	16:00	5.19	4.63	17:55	0.38	00:00	0.81	0.65	17:55	0.049	14:20	0.104	0.077	0.077	0.10
03/24/2023	03:00	4.33	15:00	4.92	4.57	17:25	0.44	15:10	0.76	0.60	03:15	0.048	15:10	0.098	0.070	0.070	-
03/25/2023	03:45	4.23	11:20	5.08	4.59	03:40	0.38	11:10	0.80	0.60	03:50	0.040	11:10	0.107	0.071	0.071	-
03/26/2023	05:55	4.27	14:40	5.52	4.88	21:35	0.39	14:25	0.89	0.65	05:35	0.043	14:25	0.131	0.084	0.084	-
03/27/2023	21:45	4.53	11:50	5.41	4.90	22:35	0.41	09:30	0.89	0.63	22:35	0.048	09:30	0.126	0.081	0.081	-
03/28/2023	03:20	4.50	12:35	5.51	4.90	05:15	0.39	11:55	0.85	0.61	03:55	0.047	10:50	0.121	0.078	0.078	-
03/29/2023	23:00	4.02	18:35	4.85	4.50	14:20	0.40	03:25	0.77	0.58	14:20	0.042	03:25	0.096	0.066	0.066	0.50
03/30/2023	12:00	4.09	13:10	4.95	4.45	03:35	0.35	12:40	0.77	0.55	04:20	0.035	12:40	0.094	0.062	0.062	0.18
03/31/2023	00:50	4.58	16:50	5.17	4.83	03:30	0.44	15:40	0.83	0.63	00:50	0.051	21:15	0.112	0.080	0.080	-
04/01/2023	01:30	4.64	18:15	5.62	5.08	05:00	0.43	18:20	0.93	0.70	05:00	0.053	18:20	0.143	0.095	0.095	-
04/02/2023	23:30	4.49	11:35	5.75	5.14	17:25	0.45	11:40	0.93	0.69	07:35	0.058	11:40	0.145	0.095	0.095	-
04/03/2023	06:50	4.72	10:50	5.68	5.11	06:30	0.41	17:05	0.91	0.68	06:30	0.052	17:20	0.135	0.092	0.092	-
04/04/2023	04:10	4.51	10:30	6.01	5.09	04:30	0.40	17:40	0.97	0.69	04:30	0.048	17:40	0.152	0.094	0.094	-
04/05/2023	20:05	4.53	15:05	5.53	5.03	00:50	0.43	13:40	0.89	0.69	20:00	0.054	11:40	0.129	0.093	0.093	-
04/06/2023	00:40	4.46	11:40	5.93	5.09	13:30	0.41	11:40	0.99	0.68	00:35	0.053	11:40	0.161	0.092	0.092	-
04/07/2023	02:30	4.60	19:45	5.51	4.97	14:35	0.41	12:00	0.91	0.65	09:35	0.054	12:00	0.136	0.086	0.086	-
04/08/2023	07:05	4.43	13:20	5.56	5.02	07:05	0.44	12:30	0.89	0.69	07:05	0.050	11:25	0.131	0.092	0.092	-
04/09/2023	03:45	4.23	13:25	5.52	4.80	03:25	0.39	13:50	0.87	0.65	03:25	0.042	13:15	0.126	0.081	0.081	-
04/10/2023	06:10	4.55	08:35	5.55	4.89	06:05	0.47	08:30	0.87	0.64	06:30	0.057	08:30	0.130	0.083	0.041	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			3.102	5.55
Average	4.72	0.62	0.077	

MC02

Site Commentary

SITE INFORMATION

Pipe	Round (13.75 in H)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. Brief periods of backwater and surcharge conditions were experienced at this location.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	6.53	2.79	0.840
Minimum	3.84	0.78	0.273
Maximum	15.70	3.31	1.414
Min Time	03/10/2023 5:00:00 AM	03/29/2023 7:00:00 AM	03/09/2023 4:05:00 AM
Max Time	03/15/2023 9:40:00 PM	03/15/2023 6:00:00 AM	03/21/2023 10:10:00 AM

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

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

DATA UPTIME

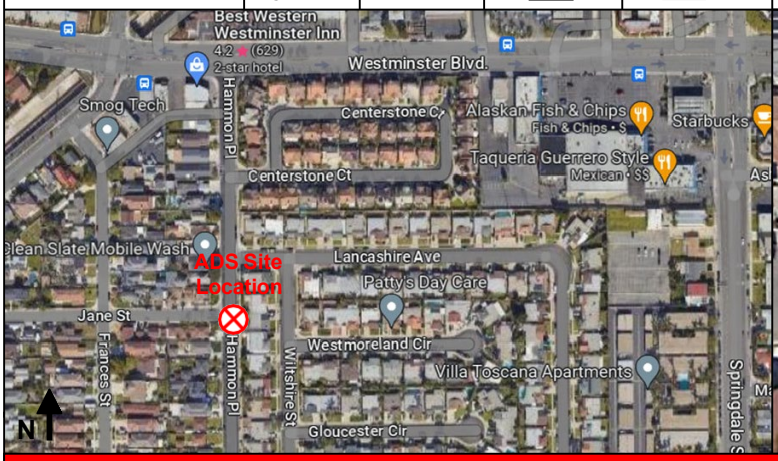
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

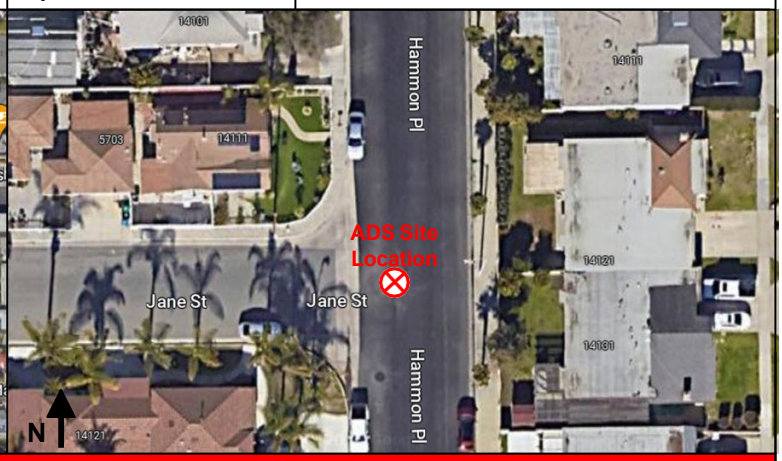
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC02	**Install Date:** 2/24/2023	**Monitor Type**	Peak Doppler
Address/Location: 14148 Hammon Pl		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	978
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	13.75 "
		Pipe Width:	13.75 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 3:54am
Site Hydraulics:	Slow straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	5.63 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	3.11 fps
Silt:	0 Inches

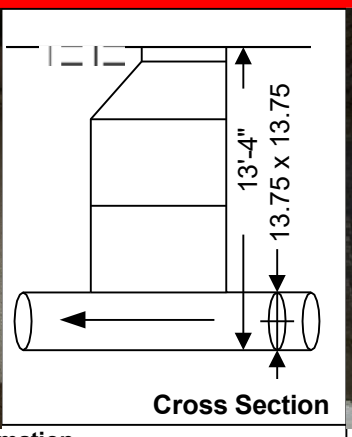
Manhole Information:

Manhole Depth:	13'-4"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

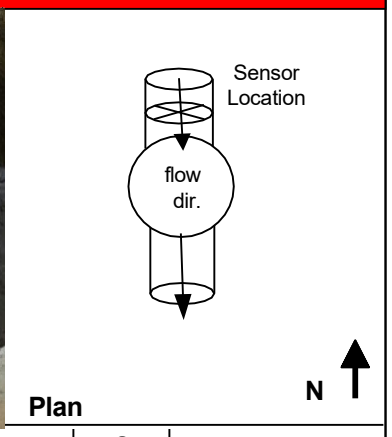
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

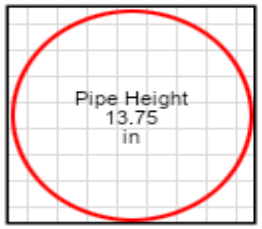
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC02

Flow Monitor

MC02

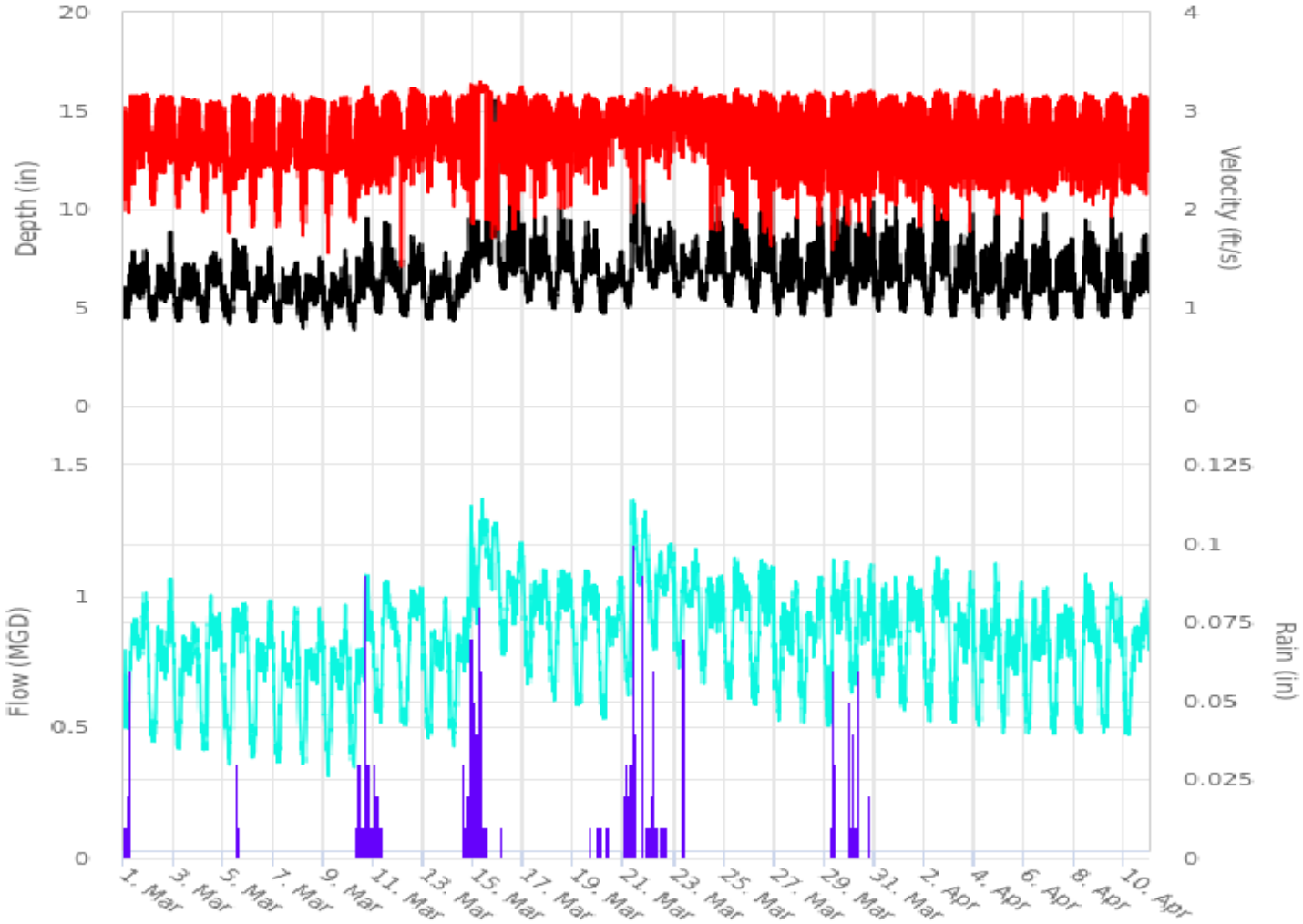


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC02

Flow Monitor

MC02

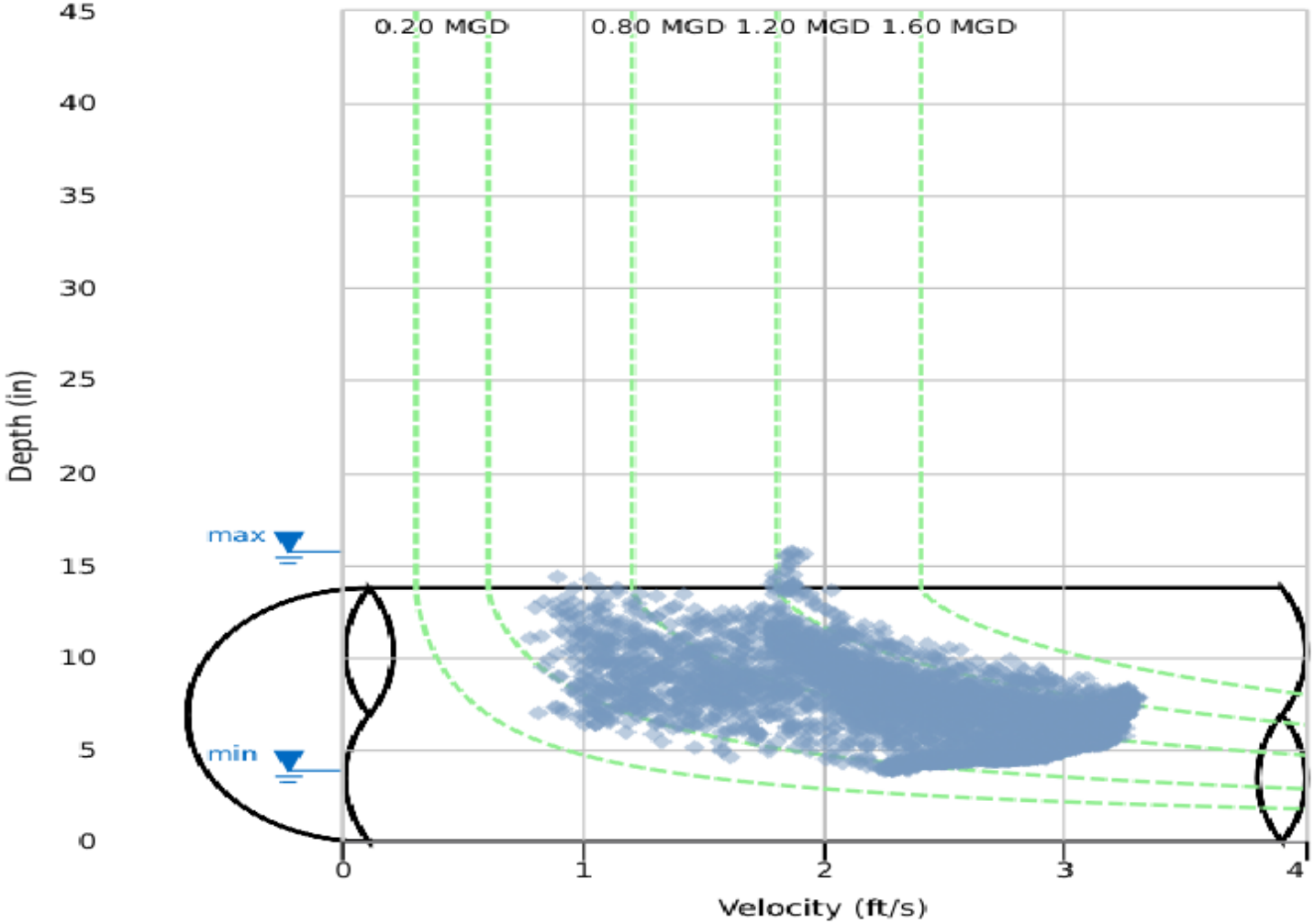
Pipe Height
13.75
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC02Pipe: Round (13.75 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:15	4.42	08:30	10.02	6.09	02:20	0.98	12:30	3.21	2.83	02:20	0.398	20:35	1.032	0.782	0.782	0.24
03/02/2023	04:05	4.32	20:35	10.40	5.88	01:55	1.03	13:15	3.18	2.78	04:35	0.376	20:40	1.087	0.739	0.739	-
03/03/2023	04:55	4.29	13:30	9.78	5.74	03:15	1.01	08:20	3.16	2.76	07:30	0.324	18:20	0.948	0.713	0.713	-
03/04/2023	04:30	4.22	13:40	10.19	5.94	06:50	1.04	11:00	3.14	2.73	04:05	0.358	11:40	1.025	0.745	0.745	-
03/05/2023	05:15	4.11	10:00	10.75	5.99	04:20	0.90	09:55	3.19	2.72	05:05	0.313	12:00	1.027	0.748	0.748	0.05
03/06/2023	03:05	4.26	19:35	10.00	5.73	03:20	0.88	09:55	3.22	2.74	03:20	0.317	20:15	1.019	0.706	0.706	-
03/07/2023	03:50	4.11	07:45	8.94	5.60	02:25	1.02	18:05	3.21	2.73	03:55	0.317	20:05	0.964	0.687	0.687	-
03/08/2023	04:35	3.92	19:50	9.18	5.60	02:50	0.92	18:30	3.19	2.71	03:35	0.313	19:50	1.016	0.678	0.678	-
03/09/2023	03:25	3.84	20:05	9.95	5.55	04:05	0.81	20:25	3.22	2.70	04:05	0.273	20:25	1.014	0.670	0.670	-
03/10/2023	04:50	3.84	16:50	11.96	6.00	02:10	1.00	16:45	3.26	2.67	02:55	0.317	16:45	1.091	0.724	0.724	0.86
03/11/2023	06:00	4.65	13:50	11.73	6.36	06:45	0.90	13:00	3.23	2.83	06:45	0.410	13:05	1.066	0.828	0.828	0.15
03/12/2023	06:55	4.51	11:45	10.68	6.25	03:30	1.23	14:35	3.25	2.79	06:00	0.441	20:30	1.046	0.805	0.805	-
03/13/2023	02:35	4.39	21:40	10.29	5.79	05:20	1.22	20:05	3.22	2.86	04:00	0.398	20:15	1.024	0.754	0.754	-
03/14/2023	04:15	4.32	21:55	13.96	6.49	14:50	0.95	20:35	3.29	2.73	04:30	0.364	20:50	1.390	0.798	0.798	1.04
03/15/2023	02:45	6.28	21:40	15.70	8.65	17:45	1.36	06:00	3.31	2.86	03:10	0.714	08:25	1.383	1.176	1.176	0.97
03/16/2023	04:35	5.92	09:10	11.98	7.34	14:15	1.20	20:35	3.27	2.88	04:05	0.650	20:55	1.212	1.014	1.014	0.01
03/17/2023	03:35	5.23	10:15	11.15	6.91	10:15	1.37	13:10	3.20	2.86	04:25	0.569	12:30	1.111	0.937	0.937	-
03/18/2023	06:00	4.93	12:10	11.94	6.81	12:10	1.17	11:50	3.23	2.84	05:10	0.553	11:50	1.109	0.913	0.913	-
03/19/2023	03:45	4.78	21:05	10.93	6.65	21:05	1.25	13:40	3.19	2.83	02:55	0.525	11:40	1.107	0.886	0.886	0.03
03/20/2023	04:55	4.49	05:25	9.42	6.22	05:25	0.84	21:20	3.19	2.88	05:25	0.409	11:20	1.120	0.837	0.837	0.07
03/21/2023	04:20	4.97	09:15	13.60	7.76	05:40	1.48	22:15	3.25	2.81	04:35	0.557	10:10	1.414	1.051	1.051	1.20
03/22/2023	04:35	5.97	09:50	10.30	7.19	04:15	1.65	21:20	3.28	2.99	04:45	0.718	21:20	1.209	1.043	1.043	0.15
03/23/2023	04:15	5.48	21:35	9.59	6.82	04:35	1.65	20:25	3.26	3.00	04:35	0.623	20:25	1.186	0.980	0.980	0.10
03/24/2023	04:20	5.20	20:55	13.03	7.00	17:30	0.92	20:35	3.20	2.86	17:30	0.587	18:20	1.103	0.936	0.936	-
03/25/2023	06:00	5.03	11:25	13.71	7.20	11:25	0.96	12:20	3.24	2.77	05:15	0.462	10:40	1.164	0.928	0.928	-
03/26/2023	05:45	4.76	11:35	14.27	7.17	18:20	0.88	11:20	3.22	2.76	02:45	0.490	12:55	1.152	0.917	0.917	-
03/27/2023	03:35	4.60	20:10	12.61	6.68	16:45	0.96	16:05	3.23	2.77	04:30	0.450	20:25	1.085	0.845	0.845	-
03/28/2023	04:00	4.57	19:15	11.85	6.60	05:55	1.02	15:25	3.25	2.77	04:10	0.455	20:05	1.133	0.832	0.832	-
03/29/2023	03:10	4.53	09:25	14.38	7.06	07:00	0.78	21:30	3.23	2.73	04:05	0.419	19:50	1.168	0.887	0.887	0.50
03/30/2023	04:15	5.12	21:50	13.26	7.09	18:05	0.88	21:40	3.24	2.74	02:00	0.469	08:35	1.149	0.891	0.891	0.18
03/31/2023	03:50	4.81	12:00	12.22	6.88	12:00	0.94	15:55	3.23	2.77	01:20	0.519	20:10	1.125	0.873	0.873	-
04/01/2023	05:40	4.73	12:40	13.19	6.87	12:40	0.93	09:50	3.21	2.75	04:00	0.454	13:35	1.159	0.871	0.871	-
04/02/2023	05:40	4.58	15:10	13.52	7.08	09:10	0.91	14:50	3.23	2.72	05:45	0.455	13:05	1.171	0.885	0.885	-
04/03/2023	02:35	4.53	21:35	12.22	6.55	16:10	0.92	10:50	3.23	2.77	04:50	0.438	21:10	1.099	0.829	0.829	-
04/04/2023	03:40	4.48	19:25	12.49	6.41	16:15	1.01	20:50	3.23	2.76	05:20	0.435	20:50	1.131	0.805	0.805	-
04/05/2023	03:35	4.41	21:40	12.74	6.39	08:40	0.83	22:20	3.20	2.72	03:55	0.395	21:15	1.067	0.783	0.783	-
04/06/2023	04:15	4.40	20:50	12.45	6.31	18:45	0.91	21:15	3.20	2.74	03:30	0.397	10:15	1.074	0.786	0.786	-
04/07/2023	04:50	4.36	16:25	11.63	6.28	02:45	0.96	12:25	3.19	2.76	04:40	0.362	15:40	1.056	0.785	0.785	-
04/08/2023	05:15	4.40	11:05	12.38	6.44	11:05	0.94	10:40	3.19	2.73	03:35	0.413	13:45	1.108	0.800	0.800	-
04/09/2023	04:45	4.47	12:45	11.92	6.29	04:00	1.01	13:10	3.23	2.75	04:00	0.389	11:50	1.110	0.790	0.790	-
04/10/2023	05:05	4.39	18:45	11.22	6.05	09:00	1.05	09:30	3.19	2.77	03:40	0.384	20:55	1.015	0.756	0.755	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			34.410	5.55
Average	6.53	2.78	0.839	

MC03A

Site Commentary

SITE INFORMATION

Pipe	Round (11 in H)
Silt	1.25 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. Brief periods of backwater and surcharge conditions were experienced at this location.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	5.36	1.06	0.195
Minimum	3.69	0.14	0.034
Maximum	22.04	1.98	0.792
Min Time	03/13/2023 5:15:00 AM	03/15/2023 9:55:00 AM	03/07/2023 4:40:00 AM
Max Time	03/14/2023 12:25:00 PM	03/14/2023 12:30:00 PM	03/14/2023 12:30:00 PM

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

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

DATA UPTIME

Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC03A	**Install Date:** 2/22/2023	**Monitor Type**	Peak Doppler
Address/Location: 5120 Westminster Blvd		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	838
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	11.00 "
		Pipe Width:	11.00 "

Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 4:00am
Site Hydraulics:	Slow curve flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	4.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	0.62 fps
Silt:	1.25 Inches

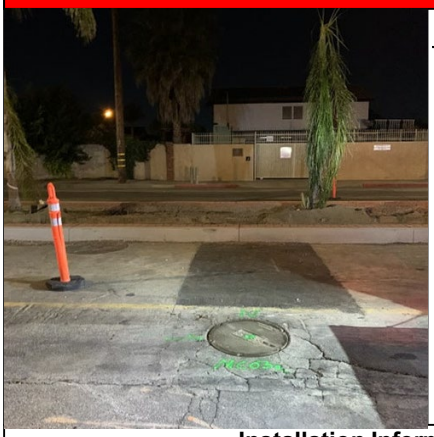
Manhole Information:

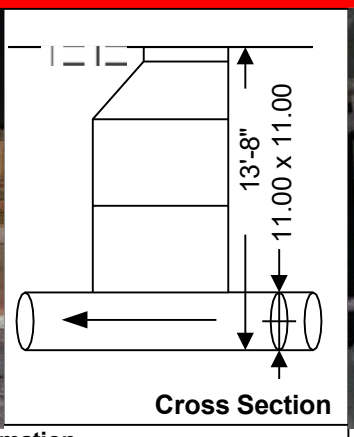
Manhole Depth:	13'-8"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

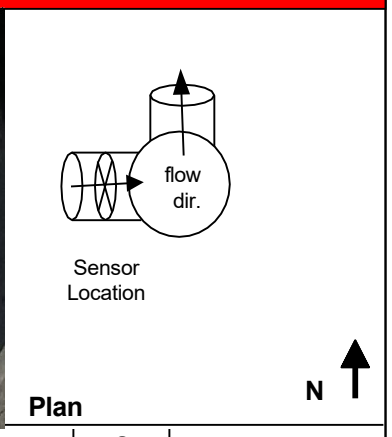
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

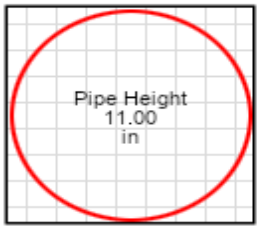
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC03A

Flow Monitor

MC03A

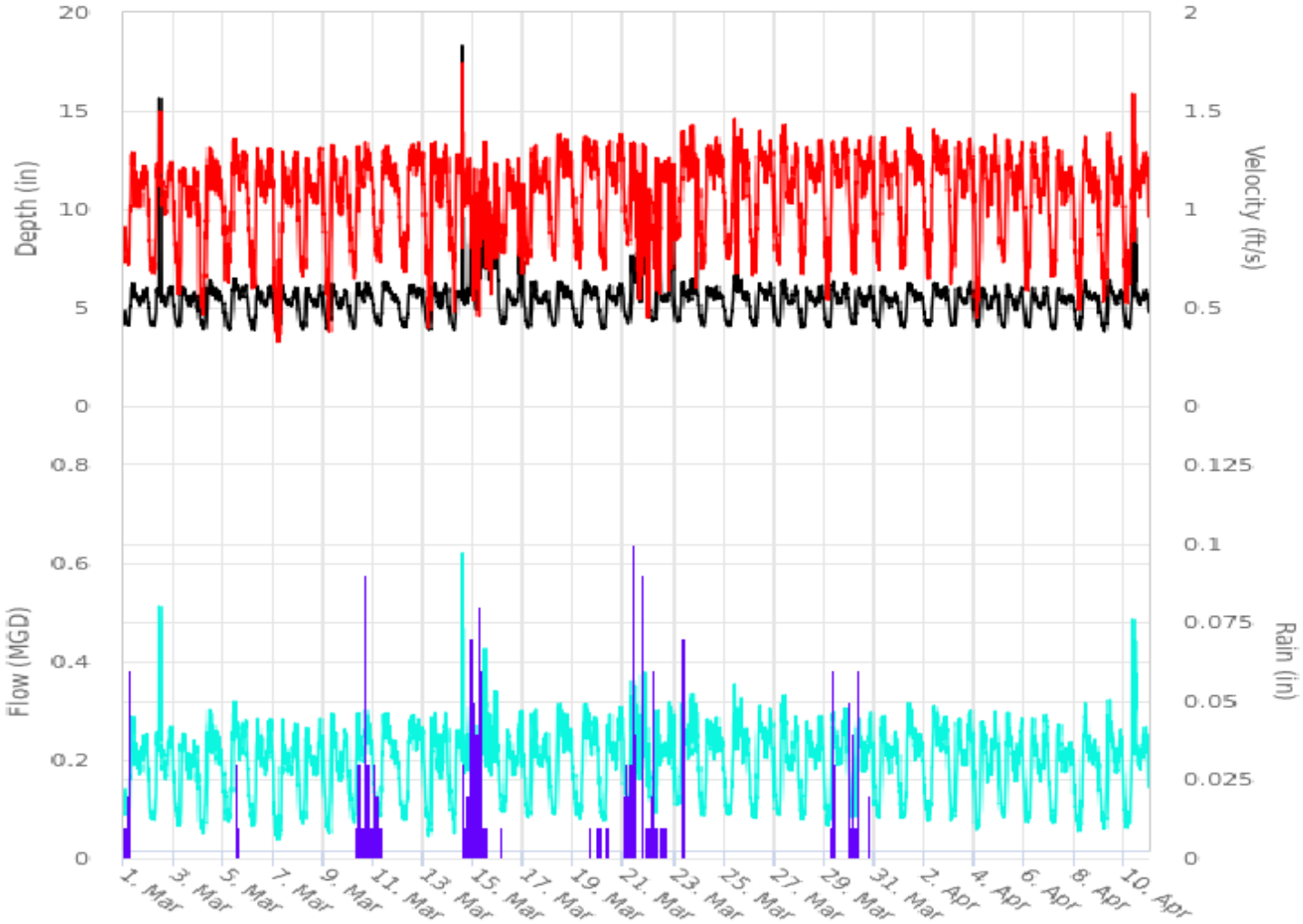


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC03A

Flow Monitor

MC03A

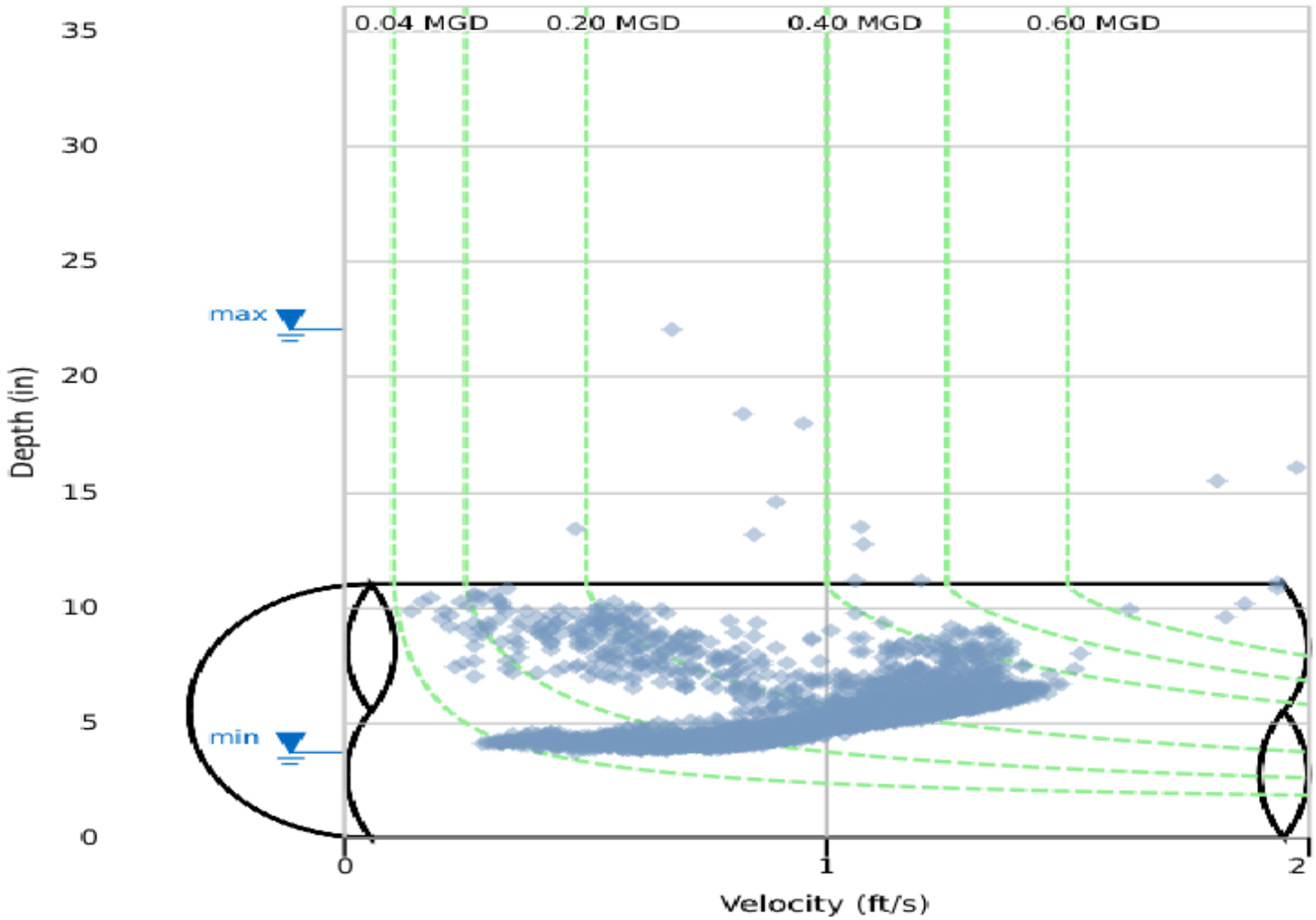
Pipe Height
11.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC03APipe: Round (11 in H), Silt1.25 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:55	4.08	08:25	6.64	5.25	02:15	0.66	08:30	1.34	1.04	02:15	0.081	08:25	0.322	0.186	0.186	0.24
03/02/2023	04:55	4.04	10:05	18.00	5.35	05:30	0.64	10:15	1.94	1.02	04:50	0.074	10:15	0.772	0.187	0.187	-
03/03/2023	03:55	4.03	10:55	6.35	5.18	04:10	0.53	10:30	1.33	1.00	04:10	0.062	10:55	0.289	0.176	0.176	-
03/04/2023	04:05	3.90	10:15	6.48	5.28	03:35	0.43	10:15	1.36	0.99	04:50	0.048	10:15	0.318	0.184	0.184	-
03/05/2023	05:15	3.86	10:30	6.51	5.31	06:10	0.54	10:30	1.39	1.07	06:10	0.061	10:30	0.329	0.198	0.198	0.05
03/06/2023	04:55	3.86	08:15	6.14	5.17	03:35	0.55	20:50	1.38	1.05	03:35	0.060	20:50	0.301	0.185	0.185	-
03/07/2023	03:40	4.06	08:15	6.18	5.16	04:40	0.29	08:05	1.33	0.95	04:40	0.034	08:05	0.292	0.169	0.169	-
03/08/2023	04:00	3.87	20:25	6.17	5.13	03:45	0.62	20:10	1.34	1.03	04:25	0.068	20:30	0.293	0.179	0.179	-
03/09/2023	02:55	3.90	07:55	6.23	5.17	05:05	0.35	07:50	1.35	1.02	05:05	0.047	07:50	0.300	0.180	0.180	-
03/10/2023	04:35	3.92	15:50	6.33	5.27	04:50	0.62	15:50	1.35	1.06	04:50	0.069	15:50	0.307	0.192	0.192	0.86
03/11/2023	05:30	4.06	09:05	6.47	5.30	04:50	0.69	12:10	1.36	1.08	04:50	0.083	12:10	0.308	0.197	0.197	0.15
03/12/2023	05:20	3.99	10:40	6.24	5.28	05:30	0.54	18:55	1.37	1.10	05:30	0.063	12:30	0.302	0.200	0.200	-
03/13/2023	05:15	3.69	10:25	6.28	5.22	04:20	0.37	20:30	1.39	1.05	04:35	0.042	10:20	0.310	0.190	0.190	-
03/14/2023	04:55	3.82	12:25	22.04	5.92	20:50	0.24	12:30	1.98	1.01	04:45	0.044	12:30	0.792	0.202	0.202	1.04
03/15/2023	02:45	4.89	08:00	10.79	7.07	09:55	0.14	10:20	1.38	0.95	09:55	0.053	10:15	0.464	0.239	0.239	0.97
03/16/2023	03:00	4.15	19:40	8.96	5.44	19:40	0.60	20:10	1.35	1.03	02:55	0.093	20:25	0.383	0.191	0.191	0.01
03/17/2023	04:30	3.96	08:40	6.58	5.24	03:30	0.69	08:45	1.38	1.08	04:25	0.082	08:45	0.327	0.193	0.193	-
03/18/2023	04:05	4.07	10:40	6.39	5.31	05:35	0.70	10:40	1.40	1.11	05:35	0.085	10:40	0.322	0.203	0.203	-
03/19/2023	05:15	4.00	11:00	6.39	5.31	05:35	0.65	11:05	1.38	1.12	05:35	0.074	11:05	0.317	0.206	0.206	0.03
03/20/2023	03:40	3.90	10:45	6.56	5.23	05:05	0.66	10:50	1.40	1.12	05:05	0.073	10:45	0.315	0.200	0.200	0.07
03/21/2023	04:20	4.18	17:20	10.56	6.34	19:55	0.16	07:45	1.40	1.00	19:55	0.062	17:55	0.468	0.217	0.217	1.20
03/22/2023	03:15	4.31	07:55	10.08	5.95	19:45	0.45	22:05	1.41	1.00	05:05	0.088	19:15	0.418	0.200	0.200	0.15
03/23/2023	02:15	4.28	21:10	9.81	5.58	21:45	0.57	16:00	1.45	1.15	05:15	0.105	21:50	0.423	0.220	0.220	0.10
03/24/2023	04:30	4.03	17:20	6.22	5.31	04:35	0.62	17:10	1.40	1.13	04:35	0.081	17:15	0.298	0.205	0.205	-
03/25/2023	05:20	4.05	11:40	8.74	5.40	11:35	0.64	10:20	1.49	1.12	05:00	0.088	10:20	0.362	0.209	0.209	-
03/26/2023	04:45	4.06	19:40	6.33	5.38	05:40	0.54	10:20	1.41	1.11	05:40	0.068	10:20	0.314	0.208	0.208	-
03/27/2023	03:55	4.06	10:05	6.46	5.27	05:10	0.56	10:05	1.45	1.09	05:10	0.075	10:05	0.339	0.197	0.197	-
03/28/2023	02:55	3.96	21:25	6.15	5.22	03:10	0.45	20:35	1.38	1.11	03:10	0.054	20:35	0.297	0.198	0.198	-
03/29/2023	04:25	4.00	08:55	6.45	5.30	03:30	0.46	08:40	1.38	1.11	03:30	0.058	09:00	0.311	0.204	0.204	0.50
03/30/2023	04:25	4.12	21:20	6.13	5.24	04:30	0.48	09:00	1.39	1.12	04:30	0.062	21:20	0.300	0.200	0.200	0.18
03/31/2023	04:45	3.98	08:20	6.12	5.18	05:10	0.55	10:05	1.40	1.11	05:10	0.071	10:05	0.298	0.195	0.195	-
04/01/2023	04:20	3.97	09:15	6.27	5.24	02:50	0.67	09:20	1.46	1.11	02:55	0.080	09:20	0.328	0.199	0.199	-
04/02/2023	03:55	4.07	10:20	6.34	5.31	03:50	0.56	09:45	1.44	1.13	03:50	0.066	09:45	0.317	0.207	0.207	-
04/03/2023	02:55	4.08	21:05	6.36	5.27	01:45	0.48	10:35	1.39	1.11	01:45	0.062	21:00	0.317	0.200	0.200	-
04/04/2023	02:50	4.01	20:05	6.15	5.16	02:10	0.38	20:00	1.40	1.05	02:10	0.051	20:05	0.302	0.186	0.186	-
04/05/2023	04:50	3.97	08:05	6.49	5.15	03:50	0.71	08:15	1.40	1.08	04:55	0.080	08:10	0.324	0.189	0.189	-
04/06/2023	03:30	3.99	20:40	6.13	5.11	03:10	0.32	20:35	1.39	1.07	03:10	0.041	20:40	0.302	0.184	0.184	-
04/07/2023	04:05	3.89	10:00	6.00	5.15	02:25	0.50	09:10	1.32	1.04	02:25	0.060	09:20	0.277	0.182	0.182	-
04/08/2023	04:40	3.84	10:30	6.44	5.21	04:20	0.36	10:35	1.39	1.03	04:20	0.044	10:35	0.322	0.184	0.184	-
04/09/2023	05:15	3.78	09:50	6.47	5.18	04:00	0.43	09:50	1.43	1.02	04:00	0.050	09:50	0.335	0.182	0.182	-
04/10/2023	03:10	3.95	08:55	13.42	5.33	02:50	0.37	08:15	1.94	1.03	02:50	0.047	08:15	0.776	0.190	0.190	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			8.012	5.55
Average	5.36	1.06	0.195	

MC03B

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12.13 in H x 11.63 in W)
Silt	0.00 (in)

OBSERVATIONS

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

This site is located downstream of site MC03C. A normal net flow was recorded between the sites.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	5.62	2.42	0.543
Minimum	2.87	0.82	0.247
Maximum	11.68	3.26	1.517
Min Time	04/09/2023 5:30:00 AM	03/14/2023 12:25:00 PM	03/08/2023 3:40:00 AM
Max Time	03/14/2023 12:25:00 PM	03/15/2023 5:40:00 AM	03/15/2023 8:55:00 AM

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

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

DATA UPTIME

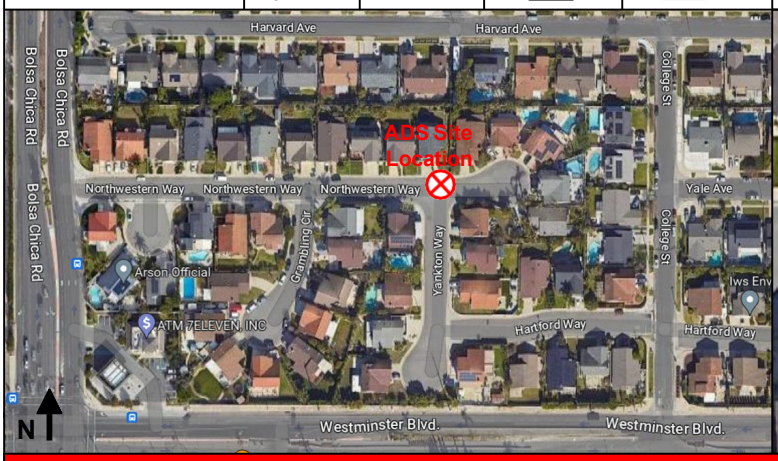
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

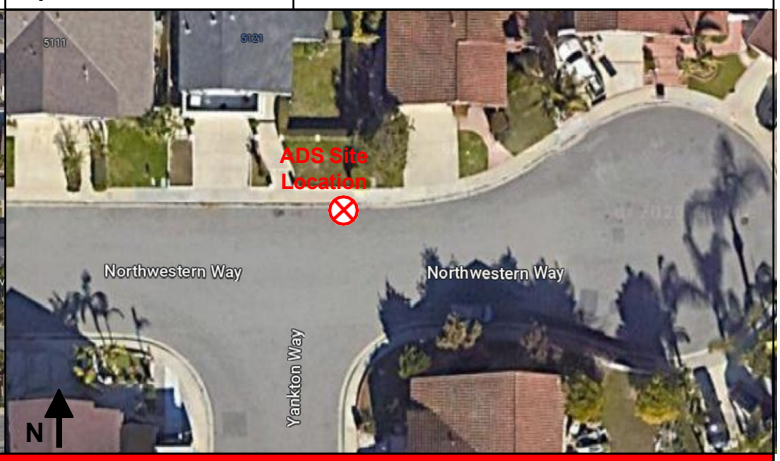
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC03B	**Install Date:** 2/23/2023	**Monitor Type**	Peak Doppler
Address/Location: 5121 Northwestern Way		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	152
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.13 "
		Pipe Width:	11.63 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 4:06am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	3.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	3.12 fps
Silt:	0 Inches

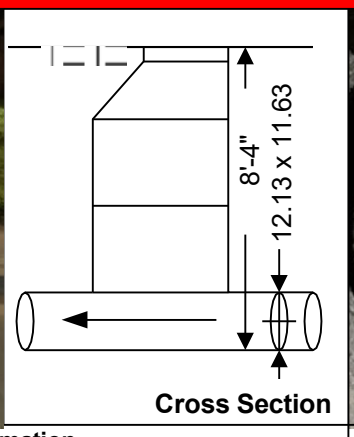
Manhole Information:

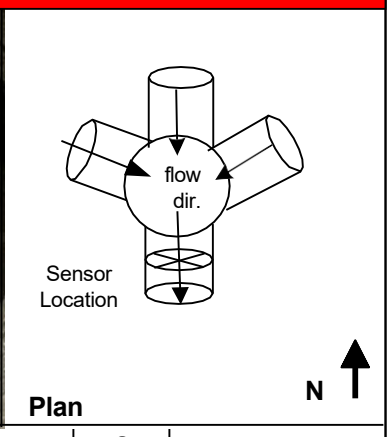
Manhole Depth:	8'-4"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:





Installation Information	
Installation Type:	Outlet
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

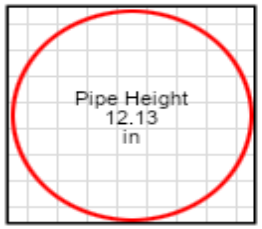
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC03B

Flow Monitor

MC03B

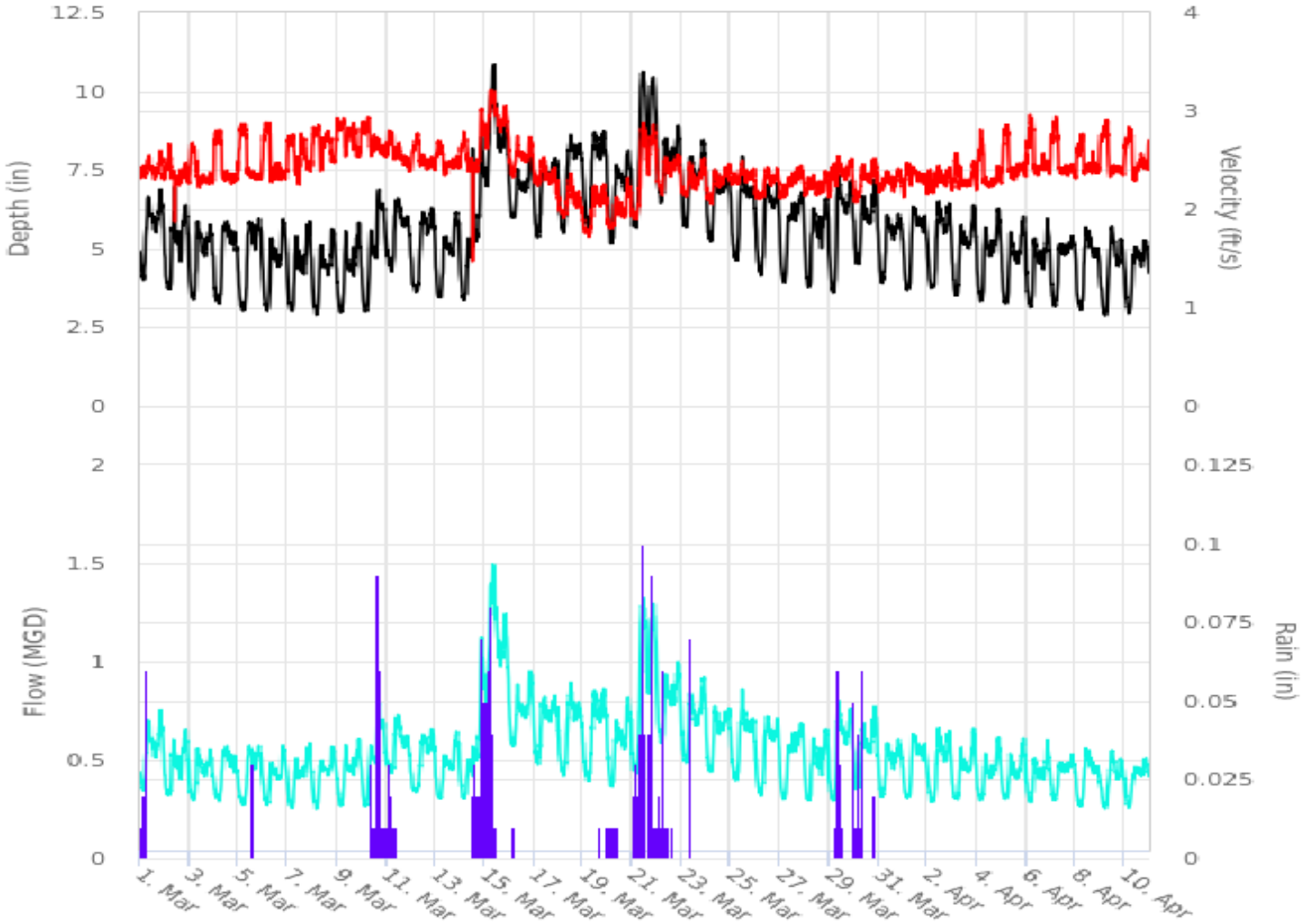


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC03B

Flow Monitor

MC03B

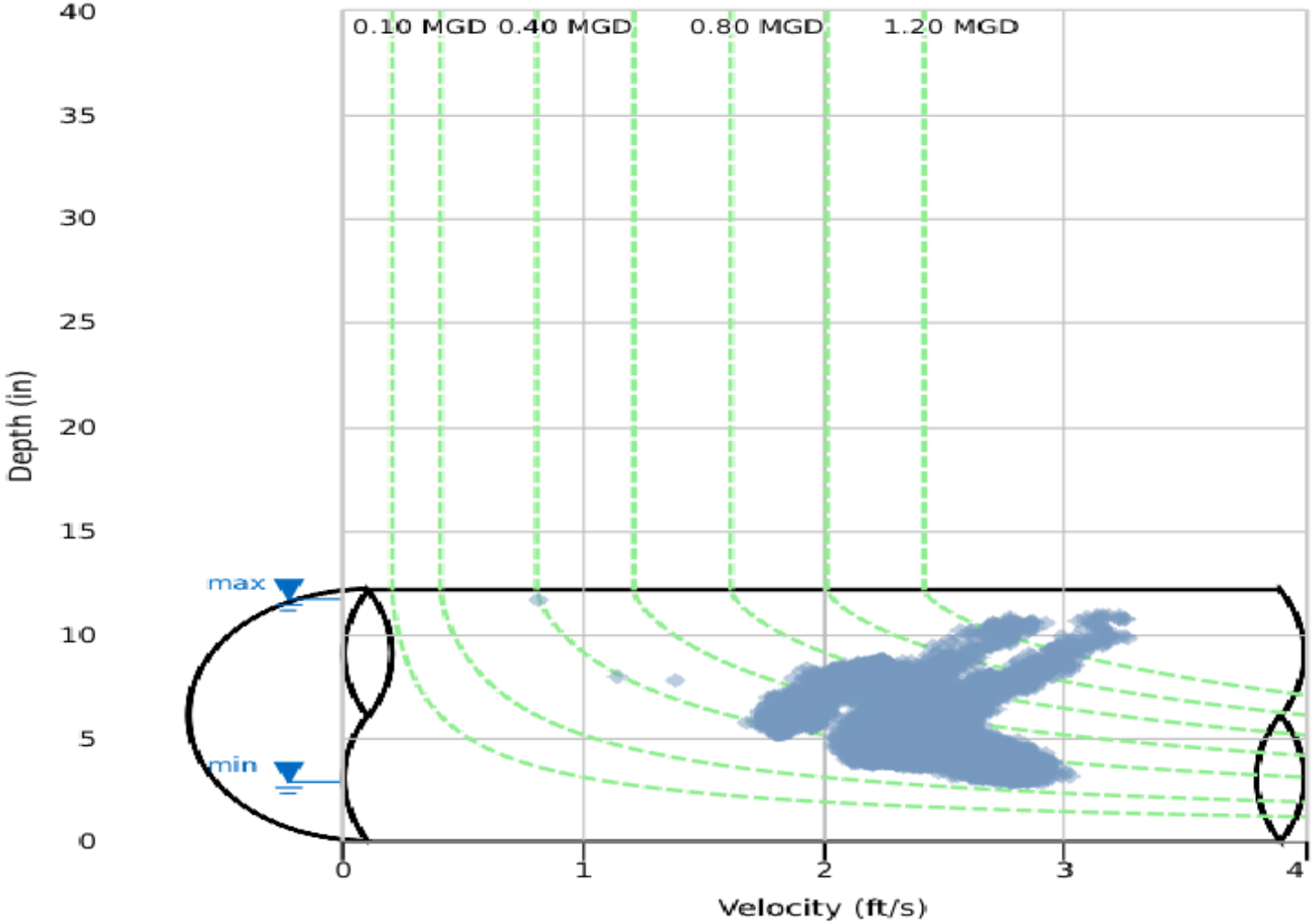
Pipe Height
12.13
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC03BPipe: Elliptical (12.13 in H x 11.63 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:40	3.98	20:00	6.92	5.68	14:15	2.25	19:55	2.68	2.41	03:35	0.339	20:00	0.773	0.553	0.553	0.24
03/02/2023	05:15	3.70	10:10	7.87	5.11	10:05	1.38	04:25	2.71	2.36	03:30	0.321	10:10	0.676	0.468	0.468	-
03/03/2023	04:35	3.36	08:10	5.89	4.83	10:10	2.20	03:15	2.71	2.38	04:10	0.293	08:10	0.568	0.436	0.436	-
03/04/2023	05:20	3.24	12:45	5.88	4.77	17:20	2.21	05:40	2.83	2.46	05:25	0.290	12:45	0.574	0.441	0.441	-
03/05/2023	04:30	3.03	20:15	5.98	4.72	15:25	2.25	06:45	2.91	2.49	04:50	0.266	10:55	0.586	0.439	0.439	0.05
03/06/2023	04:25	3.01	19:25	6.02	4.52	08:40	2.25	05:40	2.92	2.50	04:20	0.267	19:25	0.594	0.417	0.417	-
03/07/2023	04:00	3.02	21:40	5.94	4.41	11:15	2.04	13:00	2.84	2.57	04:55	0.255	21:40	0.603	0.417	0.417	-
03/08/2023	03:40	2.88	19:10	5.70	4.31	08:20	2.35	01:10	2.88	2.67	03:40	0.247	19:15	0.581	0.422	0.422	-
03/09/2023	03:35	2.97	21:20	5.83	4.36	08:50	2.51	00:35	2.95	2.74	03:35	0.266	21:25	0.611	0.440	0.440	-
03/10/2023	03:30	2.99	17:00	6.99	4.94	09:10	2.50	06:40	2.96	2.70	03:30	0.259	17:00	0.816	0.512	0.512	0.86
03/11/2023	05:35	4.25	11:30	6.68	5.53	22:15	2.36	04:35	2.84	2.57	05:35	0.430	11:20	0.738	0.567	0.567	0.15
03/12/2023	05:05	3.61	20:30	6.34	5.10	00:00	2.38	06:25	2.81	2.53	05:10	0.333	20:30	0.676	0.500	0.500	-
03/13/2023	04:55	3.45	20:15	6.19	4.86	09:10	2.30	03:20	2.72	2.49	04:15	0.302	20:50	0.658	0.463	0.463	-
03/14/2023	04:10	3.35	12:25	11.68	5.35	12:25	0.82	21:20	3.05	2.58	04:05	0.304	21:20	1.134	0.551	0.551	1.04
03/15/2023	02:25	6.97	09:20	10.92	8.66	23:45	2.57	05:40	3.26	2.93	02:15	0.771	08:55	1.517	1.111	1.111	0.97
03/16/2023	03:20	5.98	20:40	8.04	6.94	04:05	2.28	08:15	2.84	2.54	04:05	0.560	20:15	0.967	0.748	0.748	0.01
03/17/2023	03:55	5.33	20:55	7.94	6.95	23:45	2.07	08:20	2.55	2.34	04:35	0.475	20:55	0.849	0.689	0.689	-
03/18/2023	05:25	5.48	12:05	8.68	7.37	05:20	1.89	12:00	2.39	2.09	05:20	0.413	12:05	0.902	0.663	0.663	-
03/19/2023	05:00	5.56	11:20	8.74	7.51	05:55	1.68	20:00	2.27	2.00	05:55	0.387	20:35	0.862	0.655	0.655	0.03
03/20/2023	03:10	5.16	20:15	8.13	6.90	02:25	1.77	20:10	2.37	2.00	04:20	0.364	20:10	0.836	0.589	0.589	0.07
03/21/2023	04:35	5.63	10:35	10.84	8.53	01:25	1.85	11:05	2.92	2.45	04:35	0.425	11:05	1.343	0.929	0.929	1.20
03/22/2023	03:40	6.40	20:35	8.97	7.75	05:30	2.10	20:30	2.60	2.39	03:35	0.580	20:30	1.018	0.804	0.804	0.15
03/23/2023	04:35	5.66	21:05	8.49	7.16	12:25	2.09	21:55	2.56	2.30	04:30	0.481	20:50	0.938	0.706	0.706	0.10
03/24/2023	04:50	5.22	08:35	7.50	6.64	05:45	1.96	22:35	2.49	2.28	05:45	0.420	08:30	0.782	0.637	0.637	-
03/25/2023	05:15	4.60	11:25	8.02	6.29	14:55	2.20	11:30	2.53	2.34	05:15	0.393	11:25	0.879	0.610	0.610	-
03/26/2023	05:40	4.14	21:10	7.09	5.92	01:55	2.06	11:25	2.47	2.26	05:35	0.316	11:25	0.736	0.551	0.551	-
03/27/2023	04:15	3.90	22:00	6.85	5.64	03:45	2.09	20:30	2.49	2.27	03:45	0.294	20:30	0.699	0.519	0.519	-
03/28/2023	03:45	3.77	21:20	6.60	5.39	00:45	2.11	20:40	2.42	2.24	04:20	0.290	20:40	0.668	0.481	0.481	-
03/29/2023	04:00	3.60	09:05	7.38	5.84	00:00	2.09	09:00	2.56	2.38	03:50	0.290	09:05	0.805	0.567	0.567	0.50
03/30/2023	05:00	4.48	20:30	7.23	5.87	03:25	2.04	20:30	2.55	2.30	03:25	0.343	20:30	0.788	0.553	0.553	0.18
03/31/2023	03:40	3.89	19:45	6.12	5.30	03:15	2.15	20:40	2.45	2.29	03:35	0.309	19:45	0.614	0.480	0.480	-
04/01/2023	04:15	3.67	09:45	6.38	5.27	00:45	2.11	05:25	2.55	2.33	04:35	0.301	09:45	0.644	0.483	0.483	-
04/02/2023	03:25	3.74	11:05	6.53	5.25	03:10	2.12	11:00	2.45	2.30	04:30	0.277	11:05	0.669	0.477	0.477	-
04/03/2023	03:55	3.51	21:05	6.40	5.00	00:10	2.16	04:10	2.60	2.32	05:20	0.297	21:05	0.673	0.448	0.448	-
04/04/2023	03:50	3.32	20:35	6.30	4.81	15:25	2.20	03:50	2.86	2.37	03:35	0.292	20:50	0.623	0.433	0.433	-
04/05/2023	03:55	3.25	21:35	6.04	4.66	00:00	2.25	04:30	2.97	2.48	03:45	0.301	21:35	0.613	0.433	0.433	-
04/06/2023	04:05	3.14	20:35	5.98	4.51	08:30	2.31	03:50	3.02	2.53	03:05	0.284	20:35	0.608	0.421	0.421	-
04/07/2023	03:20	3.17	21:05	5.43	4.57	23:30	2.30	04:55	3.01	2.52	03:10	0.295	21:10	0.531	0.427	0.427	-
04/08/2023	05:35	3.04	10:25	5.69	4.52	00:30	2.28	16:50	2.81	2.48	05:50	0.261	10:15	0.564	0.417	0.417	-
04/09/2023	05:20	2.87	11:35	5.71	4.41	09:45	2.30	06:10	2.93	2.53	05:20	0.249	11:30	0.556	0.410	0.410	-
04/10/2023	04:00	2.93	19:05	5.28	4.33	08:15	2.19	04:10	2.89	2.54	03:55	0.256	20:35	0.512	0.402	0.402	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			22.266	5.55
Average	5.62	2.42	0.543	

MC03C

Site Commentary

SITE INFORMATION

Pipe	Round (12.25 in H)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location. Brief periods of backwater conditions were experienced on February 05, March 14, and March 21 at this location.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.80	1.58	0.227
Minimum	2.31	0.77	0.056
Maximum	8.28	2.13	0.505
Min Time	04/10/2023 4:15:00 AM	03/09/2023 3:20:00 AM	04/09/2023 4:30:00 AM
Max Time	03/15/2023 5:30:00 AM	03/02/2023 11:10:00 PM	03/15/2023 5:25:00 AM

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

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

DATA UPTIME

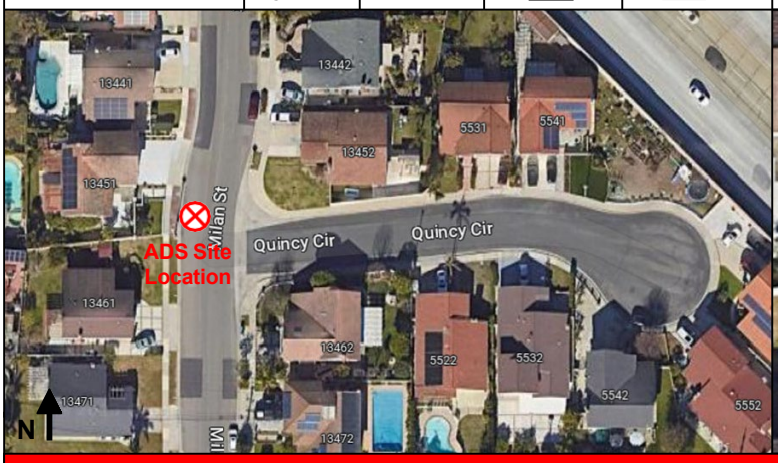
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

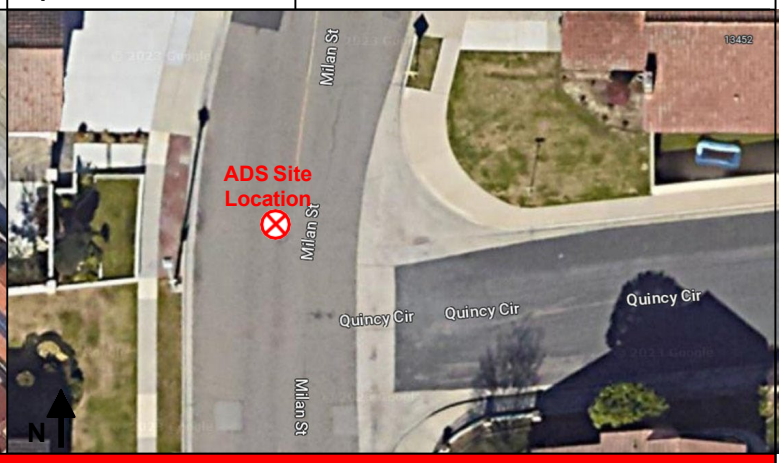
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC03C	**Install Date:** 2/24/2023	**Monitor Type**	Peak Doppler
Address/Location: 13451 Milan St		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	250
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.25 "
		Pipe Width:	12.25 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 4:12am
Site Hydraulics:	Good curve flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	3.50 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.73 fps
Silt:	0 Inches

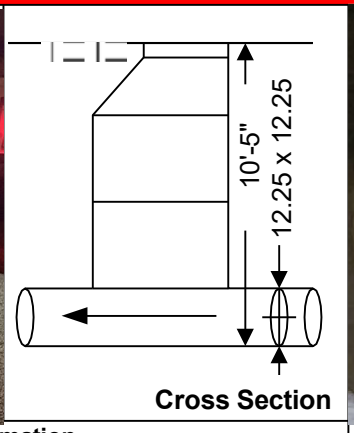
Manhole Information:

Manhole Depth:	10'-5"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

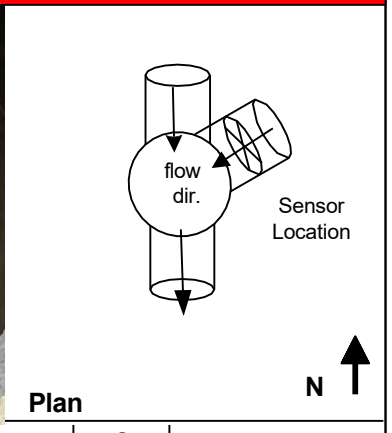
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

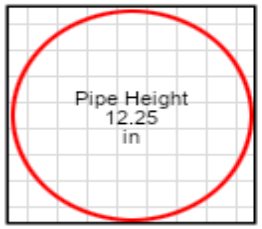
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC03C

Flow Monitor

MC03C

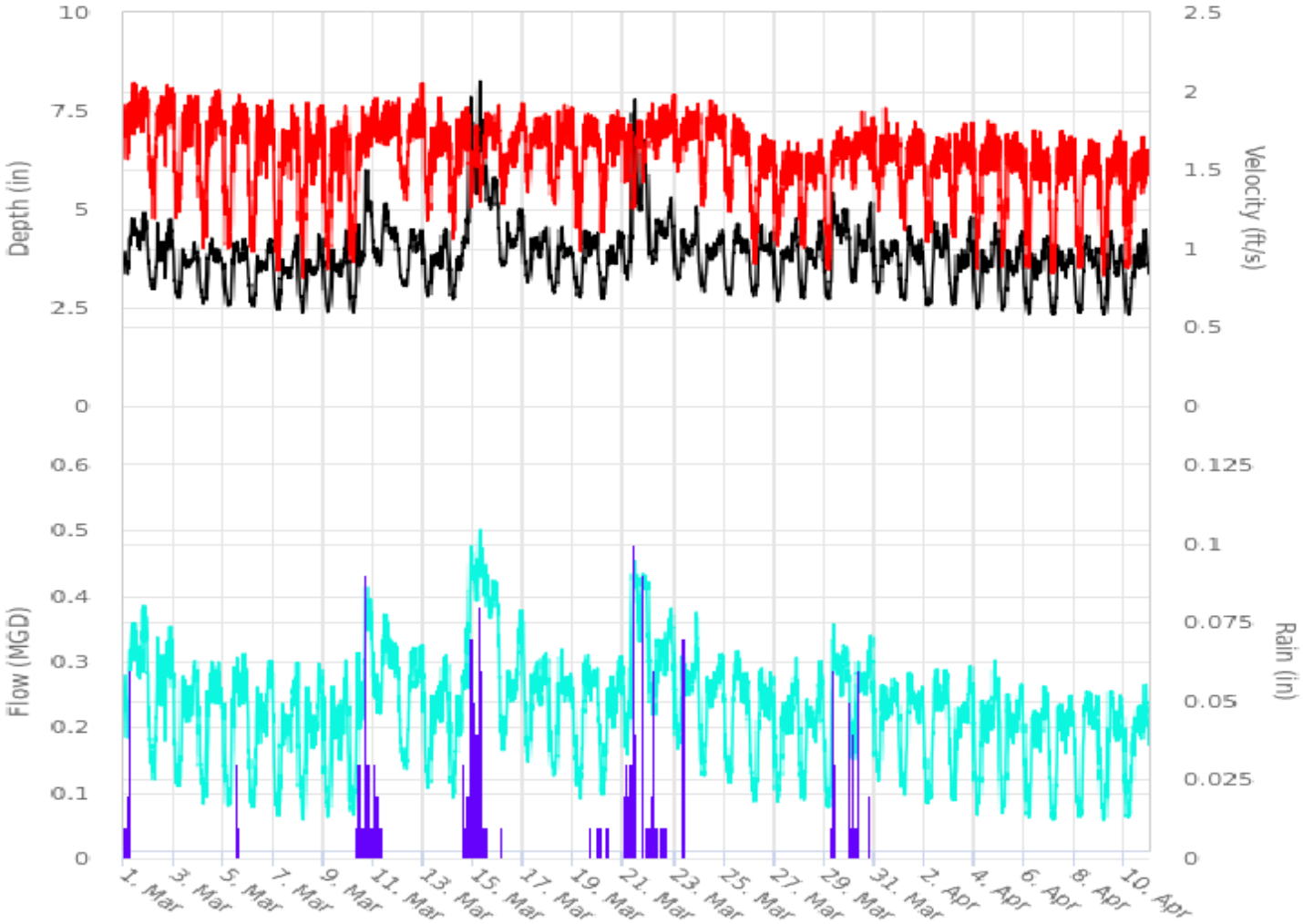


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC03C

Flow Monitor

MC03C

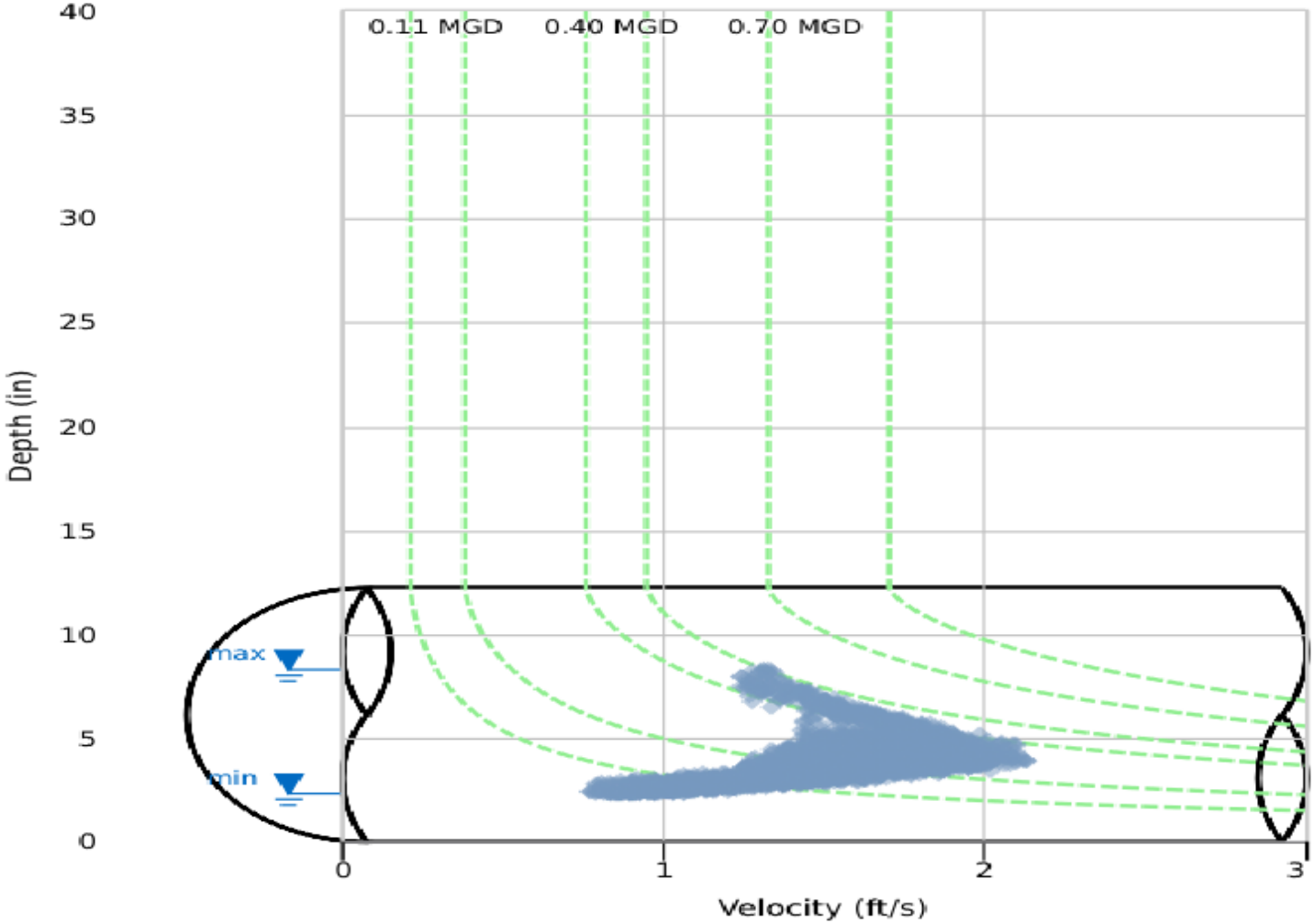
Pipe Height
12.25
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC03CPipe: Round (12.25 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:05	3.34	19:35	4.94	4.20	03:00	1.50	19:15	2.10	1.87	03:00	0.177	19:30	0.397	0.301	0.301	0.24
03/02/2023	04:40	2.96	20:20	4.78	3.73	05:10	0.92	23:10	2.13	1.75	05:10	0.094	20:30	0.379	0.242	0.242	-
03/03/2023	04:20	2.74	19:35	4.18	3.54	02:20	1.18	21:20	2.13	1.66	04:25	0.106	20:20	0.318	0.215	0.215	-
03/04/2023	04:45	2.58	12:20	4.31	3.51	04:35	0.89	16:55	2.12	1.64	04:35	0.073	18:35	0.316	0.212	0.212	-
03/05/2023	03:30	2.55	19:35	4.40	3.49	04:45	0.91	16:30	2.10	1.59	04:45	0.073	19:35	0.332	0.206	0.206	0.05
03/06/2023	04:15	2.53	20:50	4.28	3.45	03:40	0.94	22:10	2.09	1.60	03:55	0.075	20:50	0.334	0.201	0.201	-
03/07/2023	04:15	2.43	22:35	4.35	3.36	01:40	0.79	17:15	1.99	1.53	04:10	0.059	22:35	0.305	0.186	0.186	-
03/08/2023	03:35	2.36	18:40	4.41	3.36	04:30	0.77	09:15	2.02	1.54	04:30	0.056	18:50	0.303	0.188	0.188	-
03/09/2023	03:25	2.37	20:55	4.53	3.38	03:20	0.77	20:15	1.99	1.50	03:20	0.056	21:00	0.316	0.186	0.186	-
03/10/2023	04:10	2.36	16:15	6.01	3.87	04:15	0.84	23:00	2.08	1.54	04:15	0.060	16:10	0.418	0.235	0.235	0.86
03/11/2023	05:00	3.55	10:55	5.25	4.24	23:35	1.45	01:30	2.02	1.79	23:35	0.209	10:05	0.381	0.292	0.292	0.15
03/12/2023	06:30	3.04	21:00	4.52	3.80	06:55	1.16	22:05	2.10	1.69	06:55	0.121	19:55	0.337	0.241	0.241	-
03/13/2023	03:40	2.77	20:35	4.52	3.65	03:10	1.14	14:50	2.01	1.61	03:10	0.104	20:40	0.320	0.217	0.217	-
03/14/2023	03:30	2.68	20:40	7.94	4.25	03:40	1.03	08:00	1.95	1.55	03:40	0.091	21:25	0.482	0.258	0.258	1.04
03/15/2023	23:40	4.48	05:30	8.28	5.89	05:35	1.28	23:25	1.99	1.68	23:20	0.306	05:25	0.505	0.417	0.417	0.97
03/16/2023	03:25	3.55	19:50	5.02	4.21	03:45	1.25	23:40	1.99	1.63	03:45	0.161	19:50	0.398	0.265	0.265	0.01
03/17/2023	03:30	3.13	21:45	4.55	3.91	04:10	1.33	20:50	1.94	1.69	04:10	0.144	21:25	0.323	0.248	0.248	-
03/18/2023	05:25	2.86	12:30	4.62	3.69	06:10	1.24	19:10	2.06	1.64	04:40	0.119	12:15	0.326	0.224	0.224	-
03/19/2023	06:00	2.74	10:40	4.50	3.69	06:05	0.80	12:55	2.01	1.59	06:05	0.071	13:00	0.332	0.219	0.219	0.03
03/20/2023	03:25	2.72	19:20	4.47	3.66	03:10	1.05	15:05	2.08	1.62	03:10	0.093	21:00	0.328	0.220	0.220	0.07
03/21/2023	03:50	3.20	10:40	7.87	5.25	08:35	1.24	13:40	1.89	1.60	03:55	0.153	10:40	0.460	0.343	0.343	1.20
03/22/2023	03:45	3.59	21:15	5.33	4.39	05:05	1.46	02:45	2.05	1.79	05:05	0.197	21:30	0.396	0.305	0.305	0.15
03/23/2023	03:25	3.19	21:15	5.10	3.97	02:50	1.41	22:50	1.96	1.74	02:50	0.159	21:10	0.385	0.261	0.261	0.10
03/24/2023	04:40	2.89	21:40	4.49	3.77	03:45	1.16	15:45	2.02	1.69	03:45	0.117	21:25	0.316	0.238	0.238	-
03/25/2023	05:35	2.82	13:00	4.64	3.78	05:45	1.18	00:25	1.98	1.61	05:45	0.109	12:40	0.327	0.228	0.228	-
03/26/2023	04:30	2.79	12:40	4.64	3.77	05:50	0.87	23:30	1.89	1.44	04:45	0.081	10:25	0.299	0.206	0.206	-
03/27/2023	03:15	2.66	21:25	4.80	3.71	01:55	0.90	14:00	1.79	1.43	03:20	0.085	21:25	0.309	0.199	0.199	-
03/28/2023	03:30	2.73	20:50	4.76	3.67	04:20	0.97	17:10	1.82	1.43	04:20	0.086	20:50	0.310	0.194	0.194	-
03/29/2023	04:15	2.72	08:35	5.44	4.17	04:10	0.82	09:20	1.98	1.47	04:10	0.072	09:20	0.421	0.244	0.244	0.50
03/30/2023	02:45	3.13	21:15	5.18	4.06	04:10	1.27	12:55	1.94	1.64	04:10	0.138	21:05	0.353	0.252	0.252	0.18
03/31/2023	03:00	2.87	19:10	4.22	3.69	04:15	1.09	10:50	1.99	1.60	04:15	0.103	08:00	0.307	0.217	0.217	-
04/01/2023	05:10	2.69	10:00	4.59	3.63	05:10	1.09	18:50	1.85	1.54	05:10	0.094	10:50	0.291	0.206	0.206	-
04/02/2023	03:20	2.55	10:35	4.70	3.66	03:20	1.02	23:45	1.87	1.48	03:20	0.081	12:25	0.312	0.203	0.203	-
04/03/2023	03:50	2.58	21:30	4.85	3.58	03:10	1.00	15:45	1.96	1.52	03:10	0.082	21:00	0.299	0.200	0.200	-
04/04/2023	03:15	2.47	20:30	4.68	3.50	03:15	0.84	14:20	1.88	1.48	03:15	0.064	20:25	0.312	0.191	0.191	-
04/05/2023	03:00	2.42	21:40	4.48	3.45	02:05	0.81	07:40	1.87	1.46	03:00	0.064	21:10	0.275	0.184	0.184	-
04/06/2023	04:10	2.33	21:45	4.34	3.39	05:20	0.82	15:00	1.88	1.42	04:00	0.059	19:20	0.272	0.176	0.176	-
04/07/2023	04:05	2.32	08:00	4.08	3.36	03:10	0.80	11:45	1.97	1.42	04:05	0.057	11:00	0.256	0.173	0.173	-
04/08/2023	04:55	2.36	12:15	4.36	3.43	06:25	0.86	22:45	1.80	1.42	04:55	0.062	21:35	0.266	0.179	0.179	-
04/09/2023	03:55	2.33	11:35	4.46	3.38	04:30	0.79	22:40	1.85	1.39	04:30	0.056	11:00	0.284	0.173	0.173	-
04/10/2023	04:15	2.31	20:20	4.52	3.39	02:50	0.84	18:05	1.76	1.39	03:15	0.060	20:35	0.274	0.173	0.173	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			9.317	5.55
Average	3.80	1.58	0.227	

MC07B

Site Commentary

SITE INFORMATION

Pipe	Round (8 in H)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	5.03	1.75	0.266
Minimum	2.32	0.88	0.065
Maximum	7.67	2.63	0.585
Min Time	03/08/2023 3:05:00 AM	03/14/2023 9:25:00 AM	03/08/2023 4:35:00 AM
Max Time	03/14/2023 9:30:00 AM	03/14/2023 9:30:00 AM	03/14/2023 9:30:00 AM

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

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

DATA UPTIME

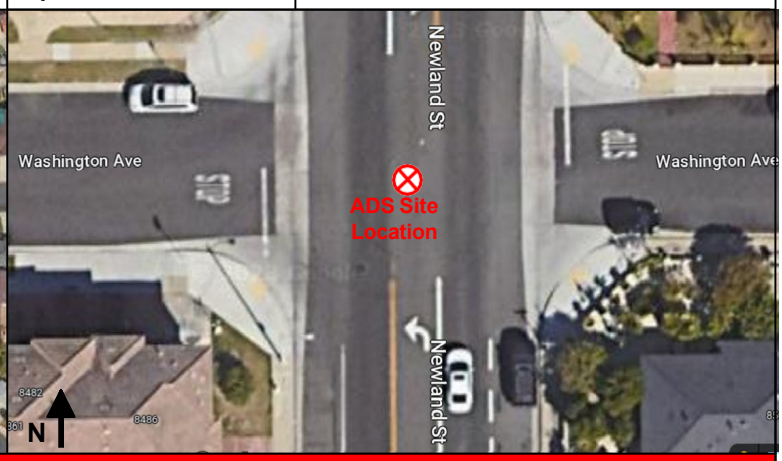
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Midway	**Agency:** Midway	**FM Initials:** VM
Site Name: MC07B	**Install Date:** 2/22/2023	**Monitor Type**	Peak Doppler
Address/Location: 14864 Newland St.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	2224
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	8.00 "



Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 1:43am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	1.63 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.08 fps
Silt:	0 Inches

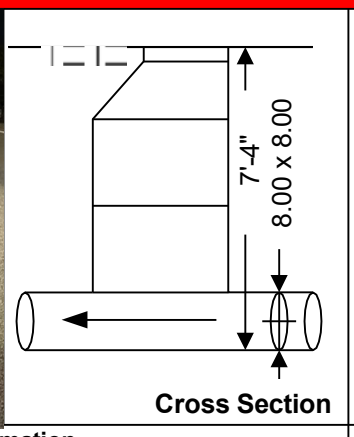
Manhole Information:

Manhole Depth:	7'-4"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

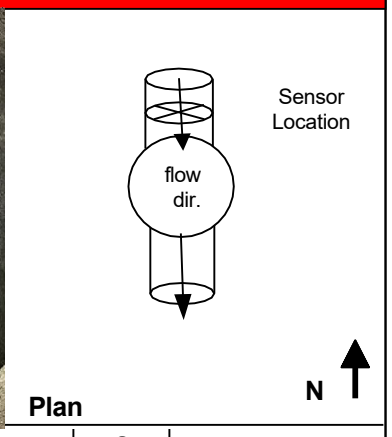
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

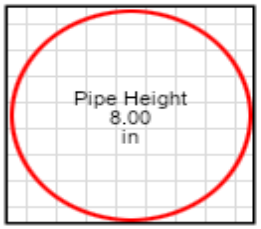
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC07B

Flow Monitor

MC07B

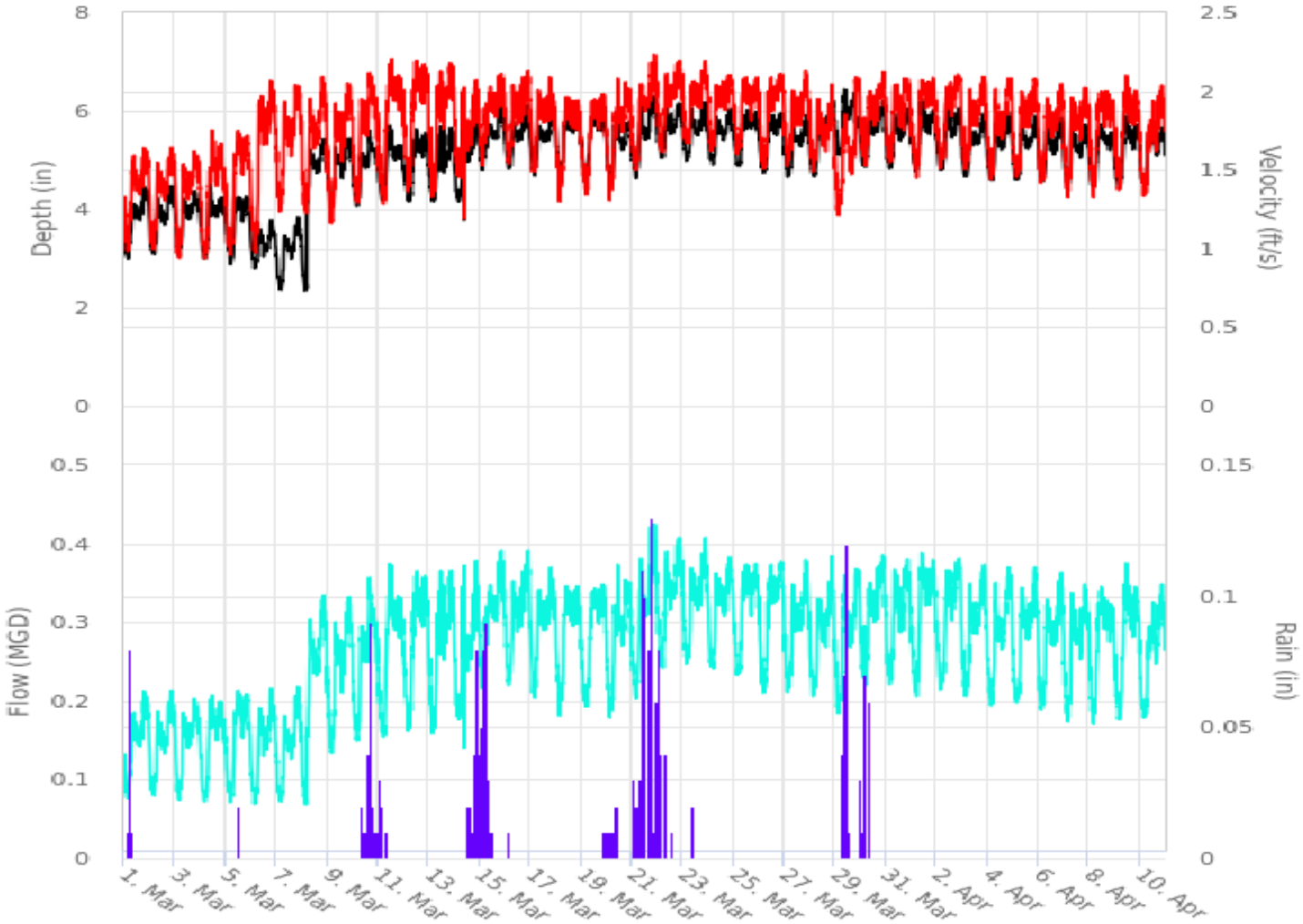


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC07B

Flow Monitor

MC07B

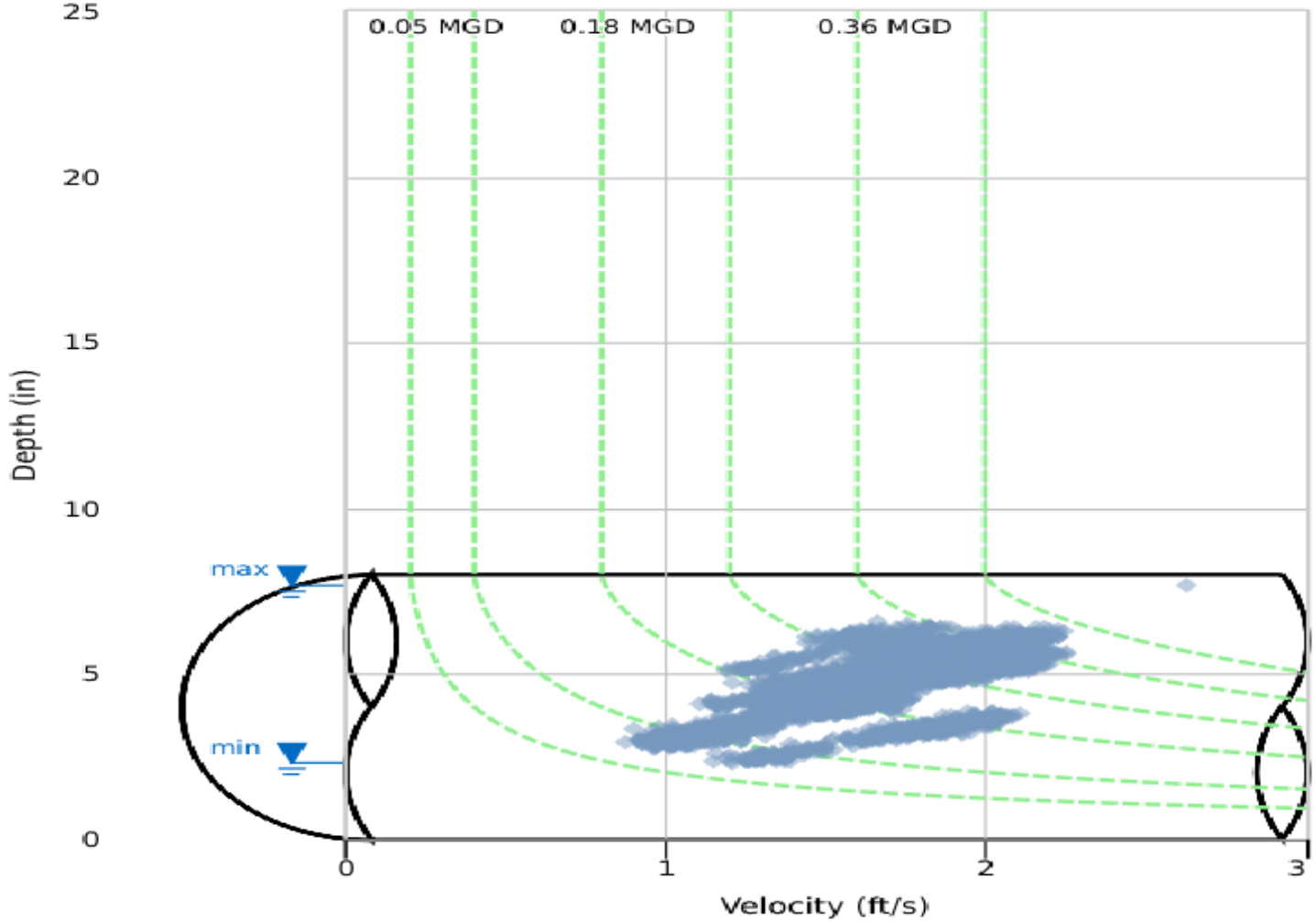
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC07BPipe: Round (8 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:45	2.99	18:55	4.56	3.82	03:20	0.96	20:50	1.66	1.38	03:20	0.074	19:00	0.217	0.149	0.149	0.21
03/02/2023	05:00	3.08	20:20	4.53	3.82	03:40	0.97	21:10	1.68	1.36	03:40	0.078	21:10	0.220	0.147	0.147	-
03/03/2023	04:20	3.03	18:25	4.53	3.86	02:00	0.90	18:25	1.67	1.37	04:20	0.072	18:25	0.220	0.150	0.150	-
03/04/2023	04:20	2.97	09:30	4.58	3.80	04:10	0.92	11:20	1.76	1.38	04:20	0.071	11:20	0.212	0.149	0.149	-
03/05/2023	04:50	2.88	11:50	4.40	3.74	04:35	0.93	11:45	1.77	1.43	04:35	0.068	11:50	0.222	0.152	0.152	0.02
03/06/2023	03:25	2.75	07:15	3.81	3.28	03:05	0.95	18:55	2.09	1.64	03:25	0.066	19:25	0.217	0.145	0.145	-
03/07/2023	04:15	2.36	20:50	3.89	3.15	03:20	1.19	20:45	2.11	1.70	04:45	0.068	20:45	0.225	0.143	0.143	-
03/08/2023	03:05	2.32	20:50	5.46	4.49	04:35	1.15	19:25	2.18	1.70	04:35	0.065	19:25	0.344	0.228	0.228	-
03/09/2023	04:05	4.03	20:25	5.52	4.85	03:40	1.11	19:20	2.08	1.69	03:40	0.129	20:25	0.340	0.244	0.244	-
03/10/2023	03:40	4.06	15:50	5.69	4.87	04:40	1.26	17:05	2.14	1.76	04:20	0.146	15:50	0.366	0.256	0.256	0.98
03/11/2023	04:55	4.16	10:50	5.76	4.95	05:15	1.14	13:15	2.26	1.84	05:15	0.136	13:20	0.385	0.273	0.273	0.16
03/12/2023	05:55	4.13	19:20	5.67	4.98	04:15	1.34	11:35	2.23	1.89	05:55	0.157	11:35	0.376	0.282	0.282	-
03/13/2023	03:35	4.15	13:15	5.97	4.93	03:20	1.30	20:40	2.21	1.84	03:25	0.157	13:15	0.390	0.271	0.271	-
03/14/2023	09:25	2.95	09:30	7.67	5.04	09:25	0.88	09:30	2.63	1.76	09:25	0.066	09:30	0.585	0.266	0.266	1.06
03/15/2023	02:45	4.79	20:55	6.28	5.50	02:00	1.50	18:15	2.13	1.88	03:00	0.214	20:55	0.401	0.311	0.311	1.17
03/16/2023	03:35	4.82	19:20	6.21	5.47	03:40	1.51	17:55	2.15	1.87	03:35	0.217	19:20	0.398	0.309	0.309	0.01
03/17/2023	04:00	4.68	21:30	5.98	5.41	02:45	1.39	18:35	2.14	1.82	02:45	0.195	19:35	0.381	0.296	0.296	-
03/18/2023	03:45	4.74	20:50	5.97	5.47	03:45	1.21	10:20	2.00	1.75	03:45	0.169	21:00	0.352	0.289	0.289	-
03/19/2023	06:20	4.78	11:40	6.31	5.46	05:25	1.32	11:45	2.03	1.74	06:25	0.188	11:45	0.373	0.287	0.287	0.02
03/20/2023	03:35	4.64	10:45	6.07	5.31	03:20	1.26	10:50	2.14	1.76	03:20	0.174	10:50	0.387	0.282	0.282	0.19
03/21/2023	04:10	4.63	18:10	6.42	5.53	03:15	1.46	21:05	2.24	1.88	04:15	0.198	21:05	0.426	0.315	0.315	1.59
03/22/2023	04:15	5.03	20:10	6.20	5.66	05:15	1.58	20:45	2.22	1.94	05:15	0.238	21:05	0.412	0.333	0.333	0.22
03/23/2023	03:20	4.96	21:30	6.23	5.61	06:10	1.61	20:40	2.20	1.94	03:15	0.244	21:30	0.415	0.329	0.329	0.04
03/24/2023	04:35	4.90	21:00	6.10	5.52	03:50	1.59	20:30	2.16	1.92	03:50	0.238	20:30	0.396	0.320	0.320	-
03/25/2023	04:00	4.87	13:15	6.12	5.54	03:20	1.58	13:20	2.14	1.90	03:20	0.229	13:20	0.389	0.319	0.319	-
03/26/2023	04:20	4.73	20:05	6.06	5.47	04:15	1.48	11:55	2.17	1.88	04:15	0.207	11:55	0.397	0.311	0.311	-
03/27/2023	03:10	4.66	21:30	5.96	5.35	02:55	1.48	20:25	2.15	1.85	02:55	0.207	20:25	0.386	0.297	0.297	-
03/28/2023	04:05	4.67	20:50	6.38	5.48	03:10	1.45	20:50	2.07	1.74	03:10	0.202	20:50	0.399	0.287	0.287	-
03/29/2023	03:35	5.09	19:10	6.58	5.80	03:35	1.19	22:15	2.14	1.63	03:35	0.180	22:15	0.374	0.288	0.288	0.85
03/30/2023	05:10	4.85	18:20	6.28	5.55	05:05	1.48	22:05	2.14	1.86	05:05	0.213	21:25	0.397	0.312	0.312	0.23
03/31/2023	03:45	4.84	08:10	6.08	5.50	03:50	1.53	17:40	2.14	1.86	03:50	0.219	20:40	0.383	0.308	0.308	-
04/01/2023	04:30	4.75	10:00	6.32	5.56	05:30	1.39	10:55	2.13	1.85	05:30	0.196	10:55	0.394	0.312	0.312	-
04/02/2023	03:40	4.79	11:15	6.16	5.50	03:35	1.47	19:05	2.12	1.87	03:35	0.208	21:40	0.385	0.311	0.311	-
04/03/2023	04:00	4.65	21:50	6.01	5.32	03:50	1.47	20:30	2.16	1.84	03:50	0.201	20:30	0.380	0.294	0.294	-
04/04/2023	03:15	4.58	19:15	6.01	5.29	03:50	1.39	20:00	2.09	1.79	03:50	0.186	20:00	0.373	0.285	0.285	-
04/05/2023	02:50	4.60	21:00	6.00	5.28	03:35	1.42	20:25	2.16	1.81	03:35	0.193	21:05	0.374	0.287	0.287	-
04/06/2023	03:45	4.55	21:50	5.91	5.25	02:55	1.38	21:50	2.10	1.76	02:55	0.184	21:50	0.375	0.278	0.278	-
04/07/2023	04:25	4.51	07:55	5.93	5.18	04:15	1.28	20:00	2.08	1.75	04:15	0.169	20:00	0.357	0.273	0.273	-
04/08/2023	04:15	4.45	12:15	5.79	5.21	04:20	1.30	16:20	2.07	1.79	04:20	0.169	12:10	0.357	0.280	0.280	-
04/09/2023	04:30	4.42	11:20	5.98	5.23	05:20	1.28	11:40	2.15	1.77	05:20	0.164	11:40	0.384	0.280	0.280	-
04/10/2023	04:45	4.49	21:00	5.69	5.16	03:55	1.28	19:55	2.06	1.70	03:55	0.170	21:00	0.351	0.264	0.264	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			10.915	6.75
Average	5.03	1.75	0.266	

MC09

Site Commentary

SITE INFORMATION

Pipe	Elliptical (11.25 in H x 11.25 in W)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. Brief periods of surcharge conditions were experienced on March 21 and March 22 at this location.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	7.52	1.00	0.319
Minimum	5.65	0.69	0.157
Maximum	12.29	1.50	0.669
Min Time	04/10/2023 4:35:00 AM	03/09/2023 4:15:00 AM	04/10/2023 4:10:00 AM
Max Time	03/21/2023 5:55:00 PM	03/21/2023 5:55:00 PM	03/21/2023 5:55:00 PM

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

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

DATA UPTIME

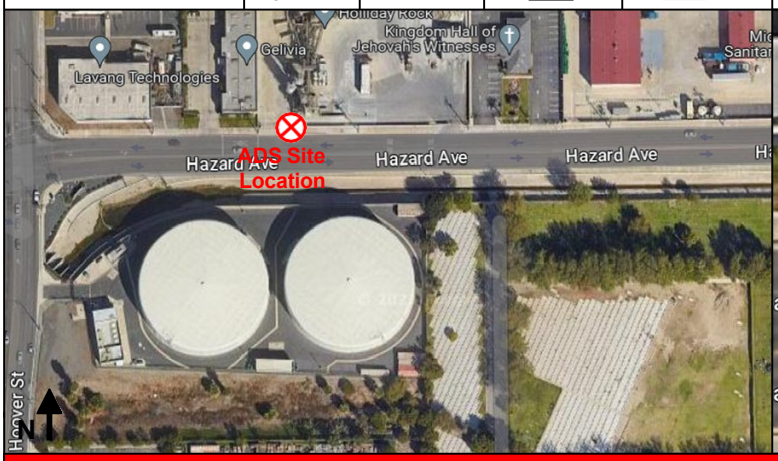
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

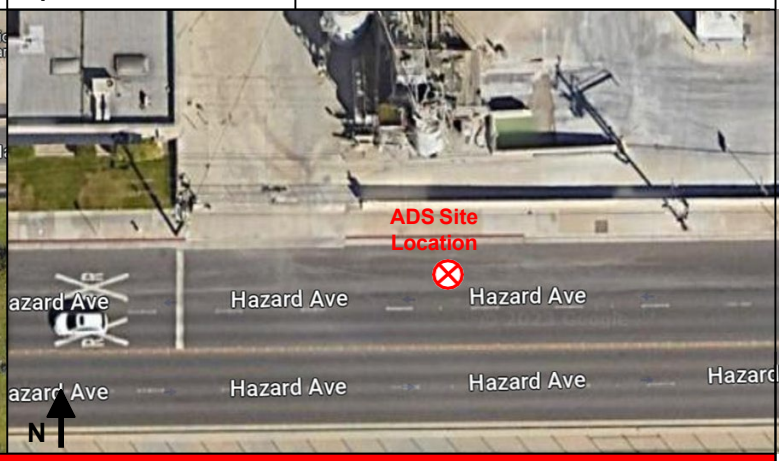
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC09	**Install Date:** 2/28/2023	**Monitor Type**	Peak Doppler
Address/Location: 7591 Hazard Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	1983
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	11.25 "
		Pipe Width:	11.25 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 3:00am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	6.50 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.08 fps
Silt:	0 Inches

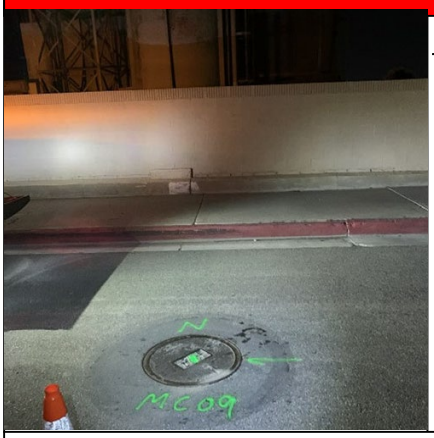
Manhole Information:

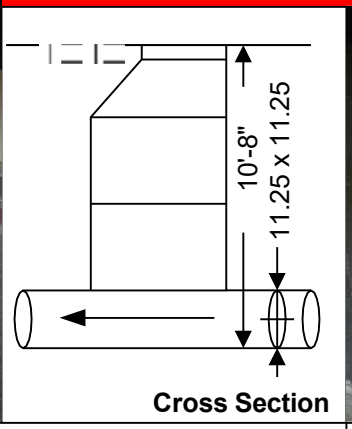
Manhole Depth:	10'-8"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	PVC/Good			
Land Use:	Residential [ ]	Commercial [ ]	Industrial [X]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

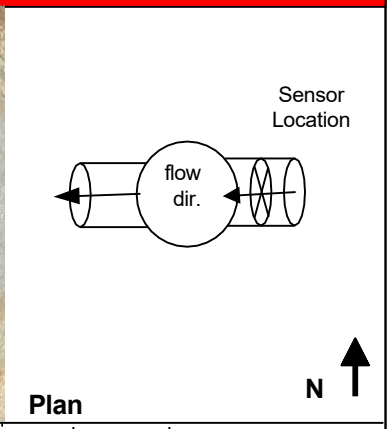
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:







Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

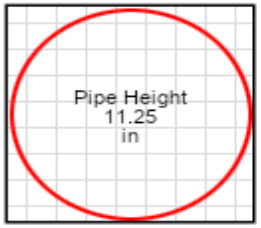
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC09

Flow Monitor

MC09

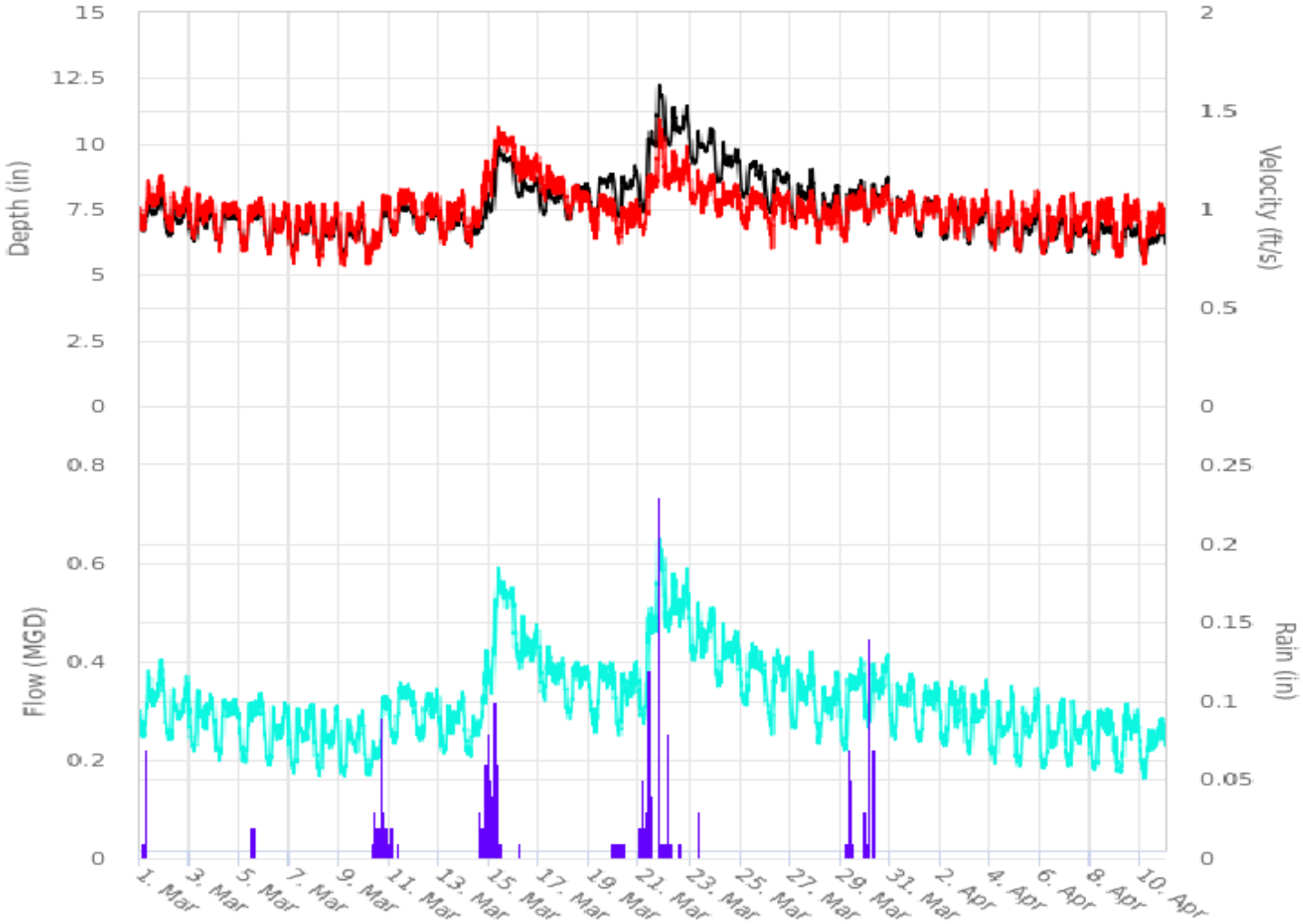


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC09

Flow Monitor

MC09

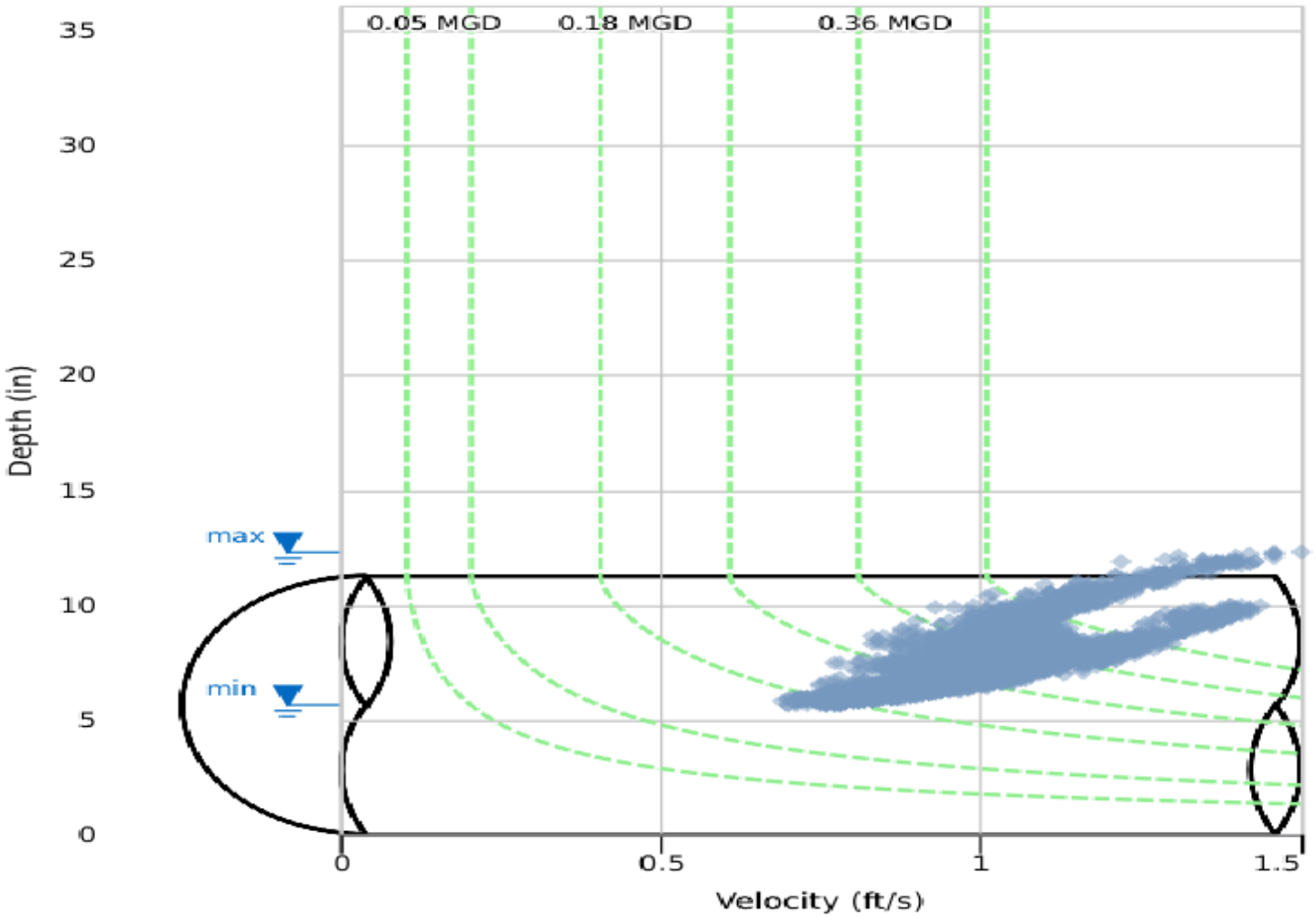
Pipe Height
11.25
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC09Pipe: Elliptical (11.25 in H x 11.25 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:55	6.66	20:15	8.11	7.39	02:20	0.87	20:25	1.19	1.04	03:10	0.242	20:25	0.409	0.325	0.325	0.22
03/02/2023	03:35	6.48	20:50	7.89	7.08	06:20	0.84	20:40	1.16	1.01	06:20	0.230	20:40	0.386	0.298	0.298	-
03/03/2023	04:50	6.26	08:10	7.53	6.95	02:30	0.81	08:00	1.09	0.98	02:30	0.213	08:00	0.344	0.283	0.283	-
03/04/2023	04:00	6.20	09:15	7.47	6.97	04:10	0.76	19:15	1.10	0.96	04:10	0.192	19:15	0.341	0.279	0.279	-
03/05/2023	05:20	6.10	19:50	7.52	6.93	06:10	0.76	19:15	1.09	0.94	04:55	0.191	19:50	0.339	0.274	0.274	0.04
03/06/2023	04:20	6.04	19:55	7.33	6.73	03:55	0.75	07:40	1.06	0.92	03:55	0.184	07:40	0.322	0.257	0.257	-
03/07/2023	04:15	5.90	21:10	7.32	6.63	04:05	0.70	19:15	1.07	0.91	04:05	0.167	19:15	0.320	0.249	0.249	-
03/08/2023	04:20	5.85	20:55	7.22	6.53	03:45	0.71	20:55	1.08	0.89	04:20	0.166	20:55	0.327	0.242	0.242	-
03/09/2023	04:25	5.83	20:55	7.01	6.42	04:15	0.69	20:45	1.05	0.88	04:15	0.161	20:45	0.305	0.234	0.234	-
03/10/2023	03:50	5.81	19:35	7.48	6.54	02:05	0.70	20:15	1.11	0.89	03:50	0.165	19:15	0.347	0.241	0.241	0.90
03/11/2023	04:05	6.54	10:15	7.71	7.24	04:45	0.84	13:30	1.14	1.01	03:50	0.226	09:55	0.370	0.308	0.308	0.14
03/12/2023	05:05	6.56	21:15	7.67	7.08	05:15	0.83	21:05	1.11	0.99	05:15	0.225	21:10	0.356	0.294	0.294	-
03/13/2023	04:25	6.30	22:00	7.38	6.85	04:20	0.78	21:30	1.11	0.97	04:20	0.202	21:30	0.343	0.276	0.276	-
03/14/2023	03:05	6.19	20:45	8.14	6.85	05:20	0.77	20:40	1.26	1.00	05:25	0.197	20:40	0.435	0.285	0.285	1.01
03/15/2023	00:20	7.37	08:00	9.96	9.07	02:05	1.03	07:55	1.44	1.32	02:05	0.323	07:55	0.601	0.507	0.507	1.01
03/16/2023	04:05	7.95	07:40	8.85	8.32	15:55	1.04	07:35	1.32	1.22	15:55	0.362	07:40	0.497	0.433	0.433	0.02
03/17/2023	03:40	7.27	07:35	8.31	7.85	04:45	0.97	07:35	1.24	1.13	04:45	0.297	07:35	0.438	0.376	0.376	-
03/18/2023	03:05	7.09	21:00	8.51	7.96	14:05	0.87	11:00	1.14	1.05	04:40	0.276	11:00	0.404	0.355	0.355	-
03/19/2023	04:45	7.16	20:00	8.86	8.18	05:30	0.81	10:15	1.09	1.00	05:30	0.243	19:55	0.410	0.347	0.347	0.02
03/20/2023	04:05	7.20	19:25	9.21	8.25	04:20	0.80	08:15	1.10	0.95	04:20	0.242	08:15	0.410	0.335	0.335	0.09
03/21/2023	03:35	7.37	17:55	12.29	9.81	02:45	0.82	17:55	1.50	1.13	03:45	0.260	17:55	0.669	0.460	0.460	1.59
03/22/2023	04:30	9.93	20:35	11.44	10.58	14:40	1.01	20:25	1.36	1.19	14:40	0.435	20:25	0.607	0.516	0.516	0.15
03/23/2023	03:50	9.21	20:00	10.59	9.86	12:00	0.93	08:00	1.21	1.10	12:00	0.386	08:00	0.524	0.455	0.455	0.05
03/24/2023	03:05	8.51	07:55	10.09	9.24	22:35	0.90	03:00	1.16	1.05	03:10	0.337	07:45	0.482	0.413	0.413	-
03/25/2023	03:30	7.93	14:15	9.34	8.74	06:00	0.86	12:15	1.12	1.02	06:00	0.297	12:15	0.440	0.379	0.379	-
03/26/2023	05:20	7.35	10:50	9.05	8.38	06:35	0.77	11:25	1.14	1.01	06:35	0.242	11:25	0.437	0.360	0.360	-
03/27/2023	04:30	6.98	21:05	9.06	7.93	22:00	0.87	21:00	1.13	0.99	04:25	0.259	21:00	0.433	0.332	0.332	-
03/28/2023	04:15	6.69	21:40	8.44	7.62	03:30	0.78	09:25	1.12	0.97	03:30	0.222	20:35	0.384	0.311	0.311	-
03/29/2023	04:35	6.41	20:00	8.61	7.72	01:40	0.80	19:45	1.13	1.00	04:35	0.218	20:00	0.410	0.328	0.328	0.56
03/30/2023	02:35	6.91	22:00	8.76	7.88	15:40	0.90	18:55	1.14	1.03	02:45	0.262	22:00	0.425	0.345	0.345	0.30
03/31/2023	04:15	6.65	20:45	8.20	7.52	04:35	0.86	20:45	1.12	1.00	04:35	0.236	20:45	0.390	0.319	0.319	-
04/01/2023	04:35	6.46	20:00	7.99	7.36	04:40	0.87	19:50	1.09	0.99	04:40	0.231	19:50	0.366	0.306	0.306	-
04/02/2023	04:30	6.35	11:30	8.01	7.28	14:55	0.81	11:25	1.10	0.97	04:05	0.227	11:25	0.371	0.296	0.296	-
04/03/2023	04:00	6.17	20:45	7.86	7.04	04:00	0.80	20:35	1.12	0.97	04:00	0.200	20:35	0.371	0.286	0.286	-
04/04/2023	03:40	6.00	20:30	7.69	6.76	04:30	0.74	20:20	1.11	0.94	04:30	0.179	20:25	0.360	0.264	0.264	-
04/05/2023	04:35	5.87	21:15	7.51	6.68	03:50	0.75	21:00	1.11	0.94	03:50	0.178	21:00	0.349	0.262	0.262	-
04/06/2023	04:25	5.83	22:10	7.34	6.53	03:05	0.75	21:50	1.09	0.93	03:05	0.177	22:10	0.330	0.252	0.252	-
04/07/2023	02:45	5.86	07:45	7.17	6.50	02:25	0.77	07:40	1.10	0.93	02:25	0.182	07:40	0.329	0.251	0.251	-
04/08/2023	04:15	5.76	09:50	7.01	6.48	23:10	0.75	19:40	1.08	0.94	03:40	0.176	10:00	0.310	0.251	0.251	-
04/09/2023	05:25	5.72	12:00	7.12	6.41	05:00	0.71	11:25	1.10	0.93	05:00	0.163	11:25	0.323	0.246	0.246	-
04/10/2023	04:15	5.65	21:05	6.82	6.24	04:05	0.70	19:05	1.05	0.91	04:10	0.157	21:05	0.294	0.231	0.231	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			13.060	6.10
Average	7.52	1.00	0.319	

MC15

Site Commentary

SITE INFORMATION

Pipe	Elliptical (17.5 in H x 17.5 in W)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	4.62	4.26	0.977
Minimum	3.76	3.71	0.660
Maximum	6.25	4.82	1.668
Min Time	03/08/2023 2:15:00 AM	03/10/2023 3:45:00 AM	03/08/2023 4:00:00 AM
Max Time	03/21/2023 8:55:00 AM	03/21/2023 8:55:00 AM	03/21/2023 8:55:00 AM

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

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

DATA UPTIME

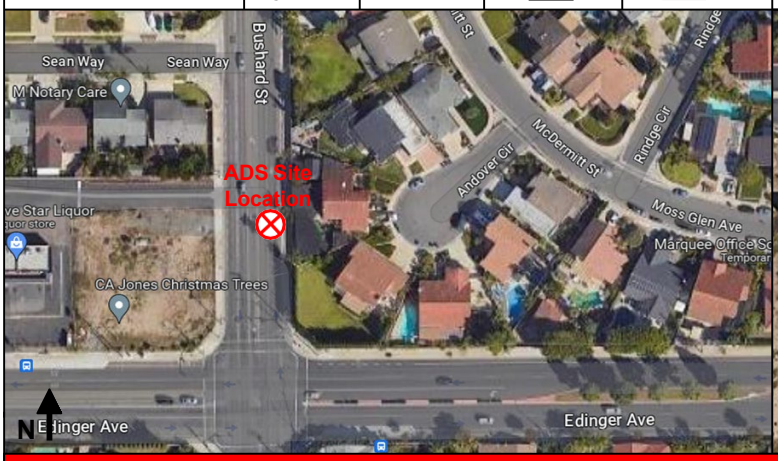
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name:	Midway.AKM.TFM.CA22	**City:**	Fountain Valley	**Agency:** Midway	**FM Initials:** VM
Site Name:	MC15	**Install Date:**	3/01/2023	**Monitor Type**	Peak Doppler
Address/Location:	16065 Bushard St			**Monitor Model**	Triton +
				Data Acquisition	Manual/Wireless Collect
				Manhole ID	3212
Access: Drive	**Type of System:**	Sanitary [X]	Storm [ ]	Combined [ ]	**Pipe Height:** 17.50 "
					Pipe Width: 17.50 "



Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 12:54 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	4.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	4.35 fps
Silt:	0 Inches

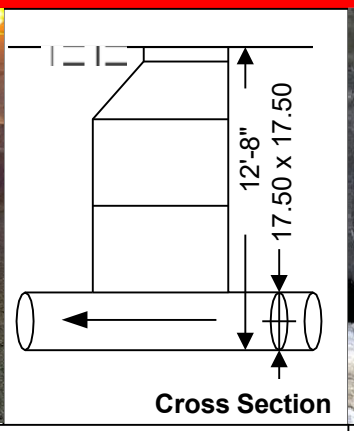
Manhole Information:

Manhole Depth:	12'-8"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	PVC/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

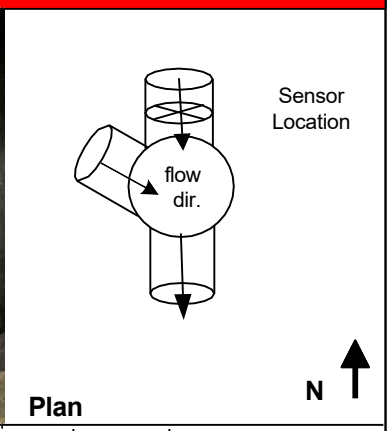
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

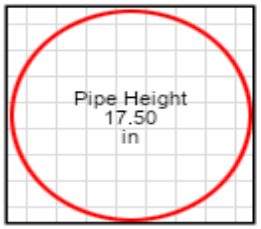
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC15

Flow Monitor

MC15

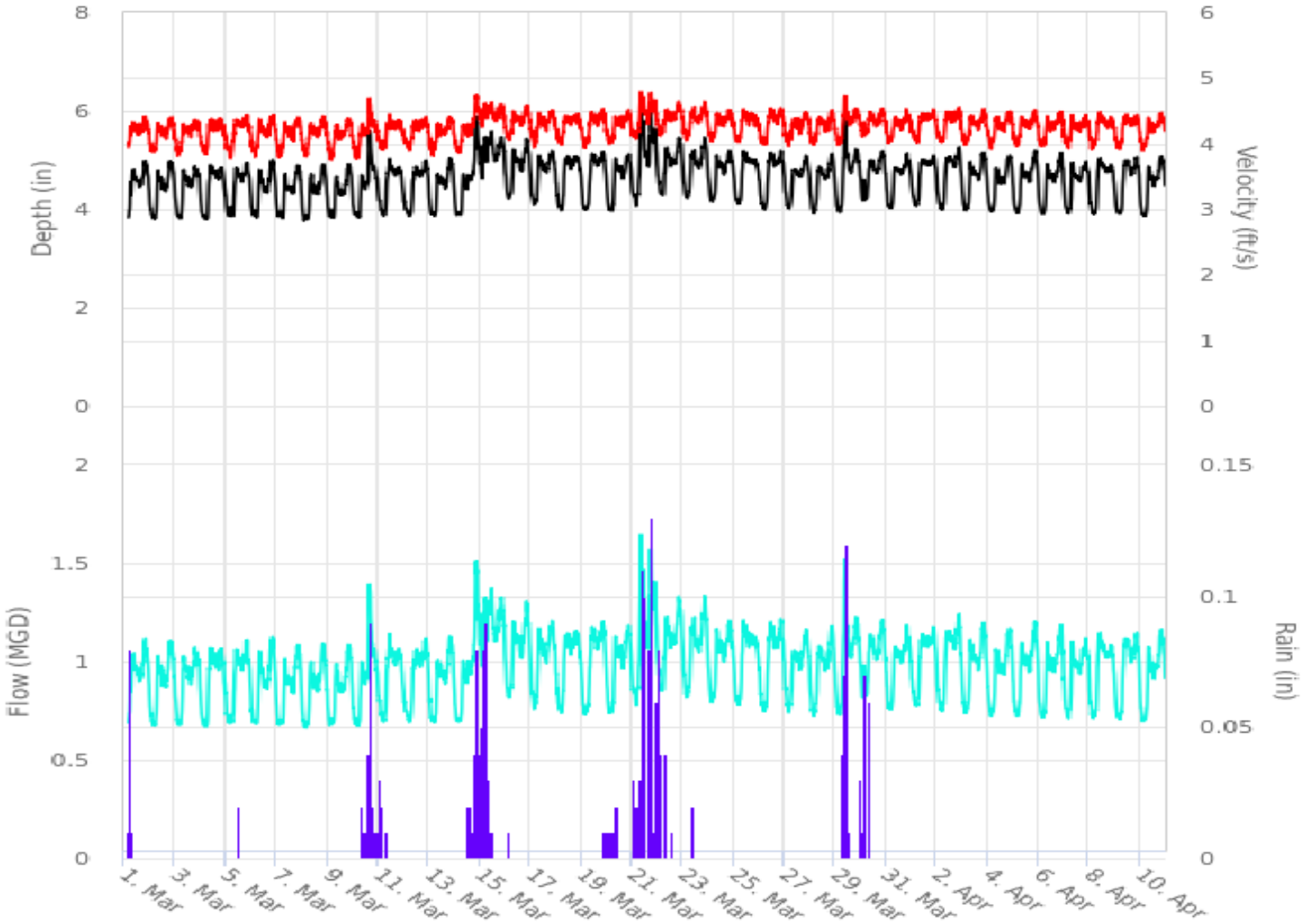


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC15

Flow Monitor

MC15

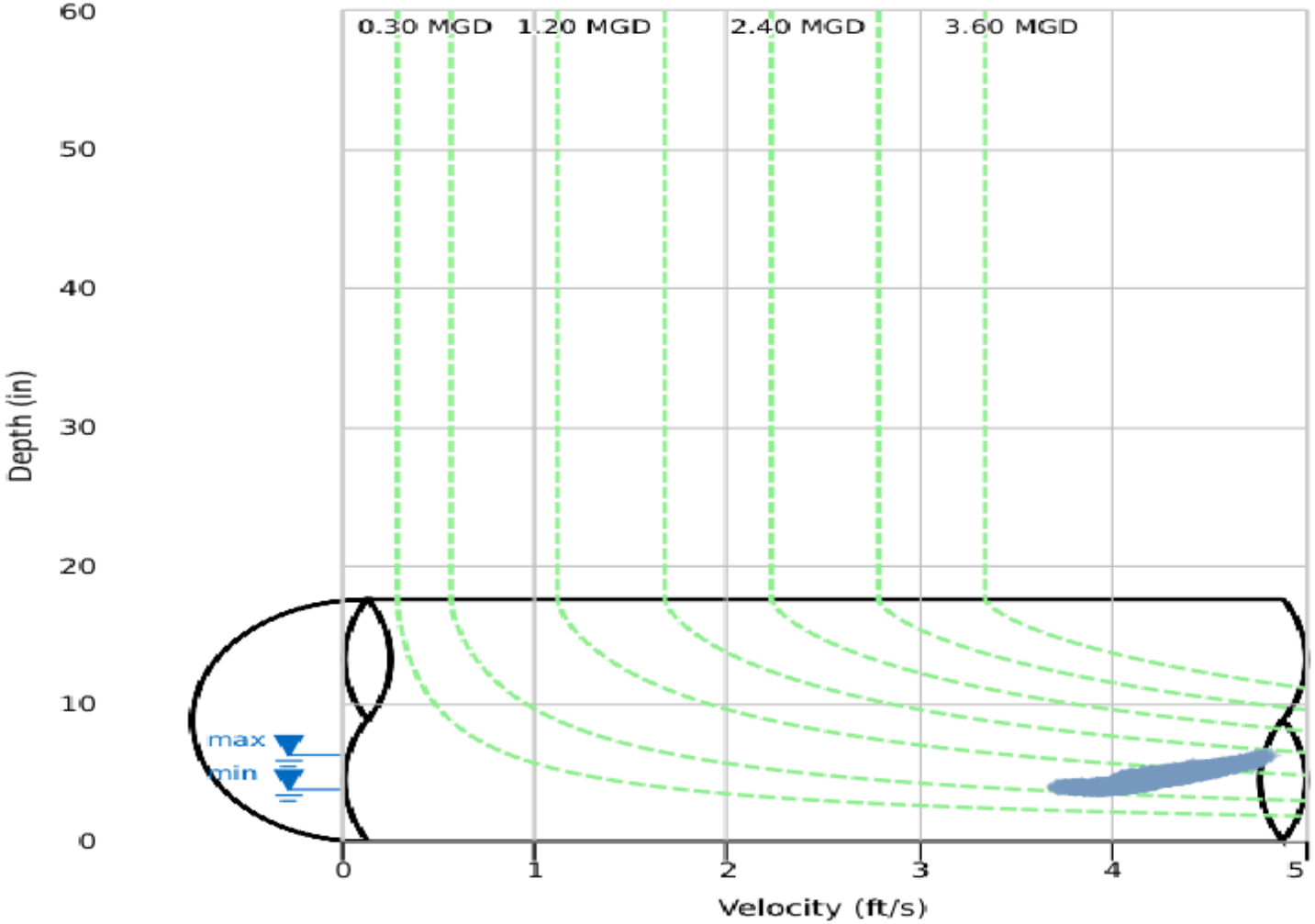
Pipe Height
17.50
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC15Pipe: Elliptical (17.5 in H x 17.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	04:05	3.83	19:55	4.98	4.59	04:05	3.94	18:55	4.44	4.23	04:05	0.688	20:00	1.124	0.957	0.794	0.21
03/02/2023	04:25	3.80	19:20	4.98	4.43	03:30	3.84	20:50	4.46	4.16	05:10	0.668	20:50	1.119	0.897	0.897	-
03/03/2023	04:40	3.81	19:00	4.89	4.43	02:45	3.75	19:05	4.41	4.16	02:45	0.670	19:05	1.088	0.899	0.899	-
03/04/2023	05:05	3.80	09:30	4.91	4.45	05:20	3.80	18:40	4.42	4.17	06:00	0.661	09:25	1.086	0.909	0.909	-
03/05/2023	06:30	3.84	20:40	4.97	4.45	04:20	3.73	20:35	4.48	4.18	04:20	0.676	20:45	1.123	0.912	0.912	0.02
03/06/2023	05:40	3.82	20:30	5.02	4.40	04:00	3.76	21:20	4.46	4.16	05:40	0.672	20:30	1.134	0.890	0.890	-
03/07/2023	06:10	3.81	20:50	4.90	4.36	02:35	3.74	21:00	4.43	4.15	02:30	0.665	20:50	1.089	0.874	0.874	-
03/08/2023	02:15	3.76	19:45	4.91	4.34	04:00	3.79	20:05	4.46	4.15	04:00	0.660	20:05	1.104	0.871	0.871	-
03/09/2023	05:35	3.82	20:05	4.93	4.35	03:35	3.71	21:05	4.41	4.13	02:20	0.673	20:05	1.098	0.869	0.869	-
03/10/2023	05:50	3.83	15:45	5.59	4.51	03:45	3.71	15:50	4.70	4.17	05:10	0.666	15:50	1.396	0.926	0.926	0.98
03/11/2023	05:35	3.86	10:45	5.04	4.52	05:00	3.86	10:40	4.47	4.19	05:00	0.687	10:45	1.150	0.930	0.930	0.16
03/12/2023	05:15	3.86	20:10	4.99	4.50	05:50	3.85	21:20	4.43	4.20	05:50	0.686	21:20	1.124	0.928	0.928	-
03/13/2023	05:30	3.85	19:55	5.05	4.46	01:50	3.75	19:35	4.44	4.17	05:15	0.679	19:55	1.146	0.908	0.908	-
03/14/2023	02:15	3.88	20:55	5.89	4.59	04:05	3.83	21:35	4.78	4.22	04:05	0.692	21:00	1.519	0.963	0.963	1.06
03/15/2023	02:50	4.62	11:35	5.59	5.20	02:55	4.22	05:15	4.65	4.47	02:55	0.962	11:35	1.376	1.202	1.202	1.17
03/16/2023	03:35	4.21	20:20	5.44	4.85	02:25	4.00	20:25	4.62	4.33	04:05	0.809	20:25	1.322	1.060	1.060	0.01
03/17/2023	03:35	4.09	20:30	5.19	4.73	03:35	3.84	19:00	4.52	4.29	03:35	0.737	20:30	1.212	1.016	1.016	-
03/18/2023	05:10	3.98	19:25	5.09	4.70	05:35	3.93	19:25	4.49	4.29	05:35	0.731	19:25	1.172	1.005	1.005	-
03/19/2023	03:25	4.00	20:20	5.17	4.70	03:40	3.88	20:45	4.54	4.29	03:40	0.721	20:25	1.208	1.007	1.007	0.02
03/20/2023	05:20	3.97	21:05	5.12	4.63	03:25	3.96	21:10	4.53	4.27	03:25	0.731	21:10	1.192	0.981	0.981	0.19
03/21/2023	04:20	4.06	08:55	6.25	5.04	04:15	4.05	08:55	4.82	4.42	04:15	0.772	08:55	1.668	1.150	1.150	1.59
03/22/2023	05:15	4.28	20:10	5.46	4.91	02:35	4.08	20:10	4.65	4.39	04:00	0.851	20:10	1.337	1.094	1.094	0.22
03/23/2023	04:30	4.22	20:30	5.46	4.86	03:15	4.03	20:35	4.65	4.36	03:15	0.816	20:35	1.337	1.072	1.072	0.04
03/24/2023	03:55	4.15	20:15	5.20	4.76	03:30	3.97	20:15	4.54	4.31	03:30	0.783	20:15	1.220	1.026	1.026	-
03/25/2023	04:35	4.11	09:35	5.19	4.75	03:40	4.00	09:40	4.53	4.31	05:20	0.776	09:40	1.214	1.026	1.026	-
03/26/2023	05:20	3.99	20:50	5.19	4.71	06:40	3.93	20:50	4.56	4.31	04:20	0.743	20:50	1.222	1.015	1.015	-
03/27/2023	04:45	4.00	20:30	5.09	4.61	04:15	3.89	20:45	4.52	4.27	04:15	0.728	20:45	1.176	0.974	0.974	-
03/28/2023	04:00	3.92	21:30	5.13	4.59	03:25	3.96	21:20	4.53	4.27	04:00	0.715	21:25	1.192	0.968	0.968	-
03/29/2023	04:35	3.94	09:35	5.93	4.75	02:55	3.92	09:45	4.75	4.32	04:50	0.725	09:40	1.524	1.033	1.033	0.85
03/30/2023	02:50	4.17	21:00	5.19	4.73	02:00	4.07	21:00	4.57	4.33	02:40	0.805	21:00	1.225	1.021	1.021	0.23
03/31/2023	04:35	4.02	20:25	5.14	4.64	02:30	3.93	20:05	4.54	4.28	02:30	0.746	20:15	1.192	0.987	0.987	-
04/01/2023	05:05	4.06	21:30	5.10	4.71	06:10	3.94	21:15	4.53	4.32	06:10	0.764	21:35	1.179	1.017	1.017	-
04/02/2023	05:40	3.99	21:30	5.27	4.71	05:15	3.98	21:20	4.56	4.31	05:45	0.737	21:30	1.249	1.015	1.015	-
04/03/2023	03:35	3.98	20:40	5.18	4.61	03:30	3.92	20:50	4.54	4.27	03:30	0.726	20:45	1.205	0.975	0.975	-
04/04/2023	04:00	3.96	21:05	5.10	4.56	03:45	3.85	19:55	4.51	4.25	03:45	0.711	21:05	1.175	0.956	0.956	-
04/05/2023	04:00	3.93	21:00	5.20	4.59	03:50	3.93	21:00	4.54	4.26	03:50	0.718	21:00	1.220	0.966	0.966	-
04/06/2023	04:15	3.90	21:30	5.15	4.56	02:20	3.91	20:30	4.51	4.24	04:05	0.709	21:30	1.193	0.953	0.953	-
04/07/2023	04:50	3.91	21:10	4.97	4.54	04:50	3.86	08:15	4.47	4.23	04:50	0.695	21:10	1.121	0.945	0.945	-
04/08/2023	05:00	3.90	10:30	5.04	4.58	02:35	3.85	10:20	4.49	4.24	04:00	0.707	10:40	1.150	0.961	0.961	-
04/09/2023	05:20	3.90	21:25	5.07	4.58	03:45	3.87	21:40	4.48	4.24	03:45	0.699	21:20	1.157	0.960	0.960	-
04/10/2023	05:20	3.86	20:30	5.08	4.51	02:45	3.85	19:10	4.48	4.22	02:45	0.691	20:30	1.163	0.933	0.932	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			39.889	6.75
Average	4.62	4.26	0.977	

MC16A

Site Commentary

SITE INFORMATION

Pipe	Elliptical (15.13 in H x 15 in W)
Silt	0.00 (in)

OBSERVATIONS

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

This site is located downstream of site MC16B. A normal net flow was recorded between the sites.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 08 March 2023 to Tuesday, 11 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	8.47	1.27	0.592
Minimum	5.01	0.81	0.189
Maximum	10.77	1.53	0.930
Min Time	03/10/2023 5:10:00 AM	03/08/2023 4:50:00 AM	03/08/2023 4:50:00 AM
Max Time	03/21/2023 9:00:00 PM	03/21/2023 8:25:00 PM	03/21/2023 8:55:00 PM

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

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

DATA UPTIME

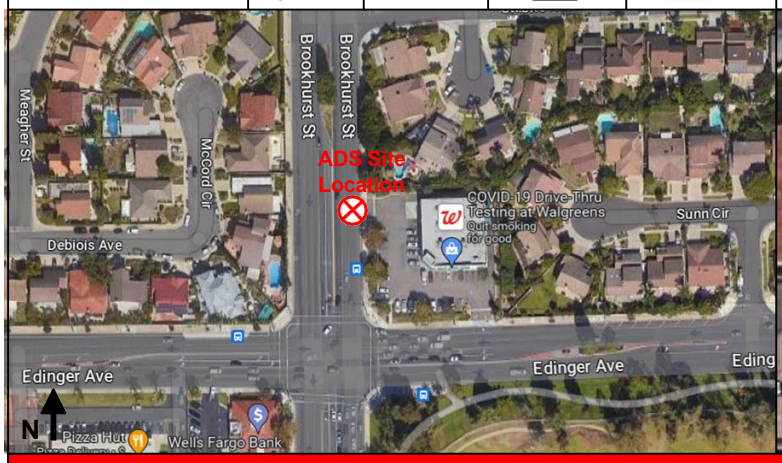
Data uptime observed during **Wednesday, 08 March 2023 to Tuesday, 11 April 2023** is provided in the following table:

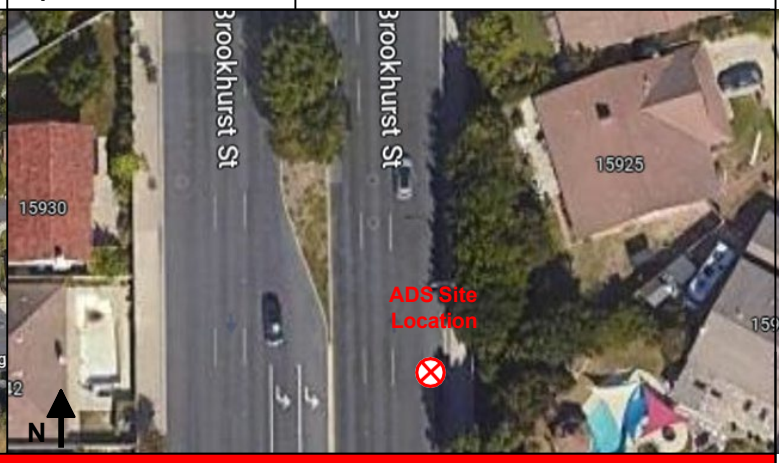
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name:	Midway.AKM.TFM.CA22	**City:**	Fountain Valley	**Agency:** Midway	**FM Initials:** VM
Site Name:	MC16A	**Install Date:**	2/28/2023	**Monitor Type**	Peak Doppler
Address/Location:	15956 Brookhurst St			**Monitor Model**	Triton +
				Data Acquisition	Manual/Wireless Collect
				Manhole ID	Unknown
Access: Drive	**Type of System:**	Sanitary [X]	Storm [ ]	Combined [ ]	**Pipe Height:** 15.13 "
					Pipe Width: 15.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 12:45 am
Site Hydraulics:	Good curve flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	5.25 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.19 fps
Silt:	0 Inches

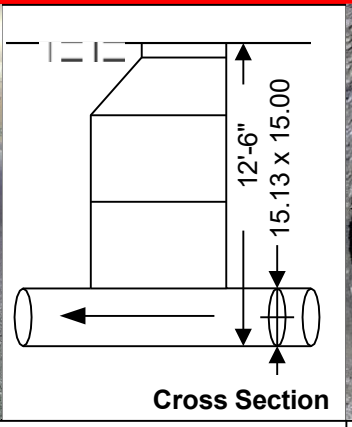
Manhole Information:

Manhole Depth:	12'-6"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

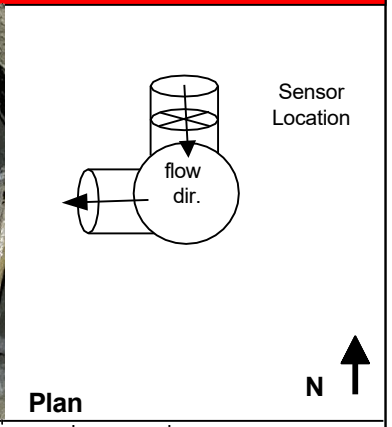
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

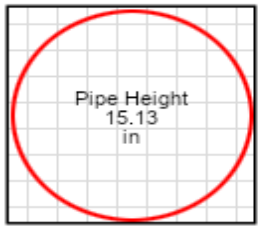
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC16A

Flow Monitor

MC16A

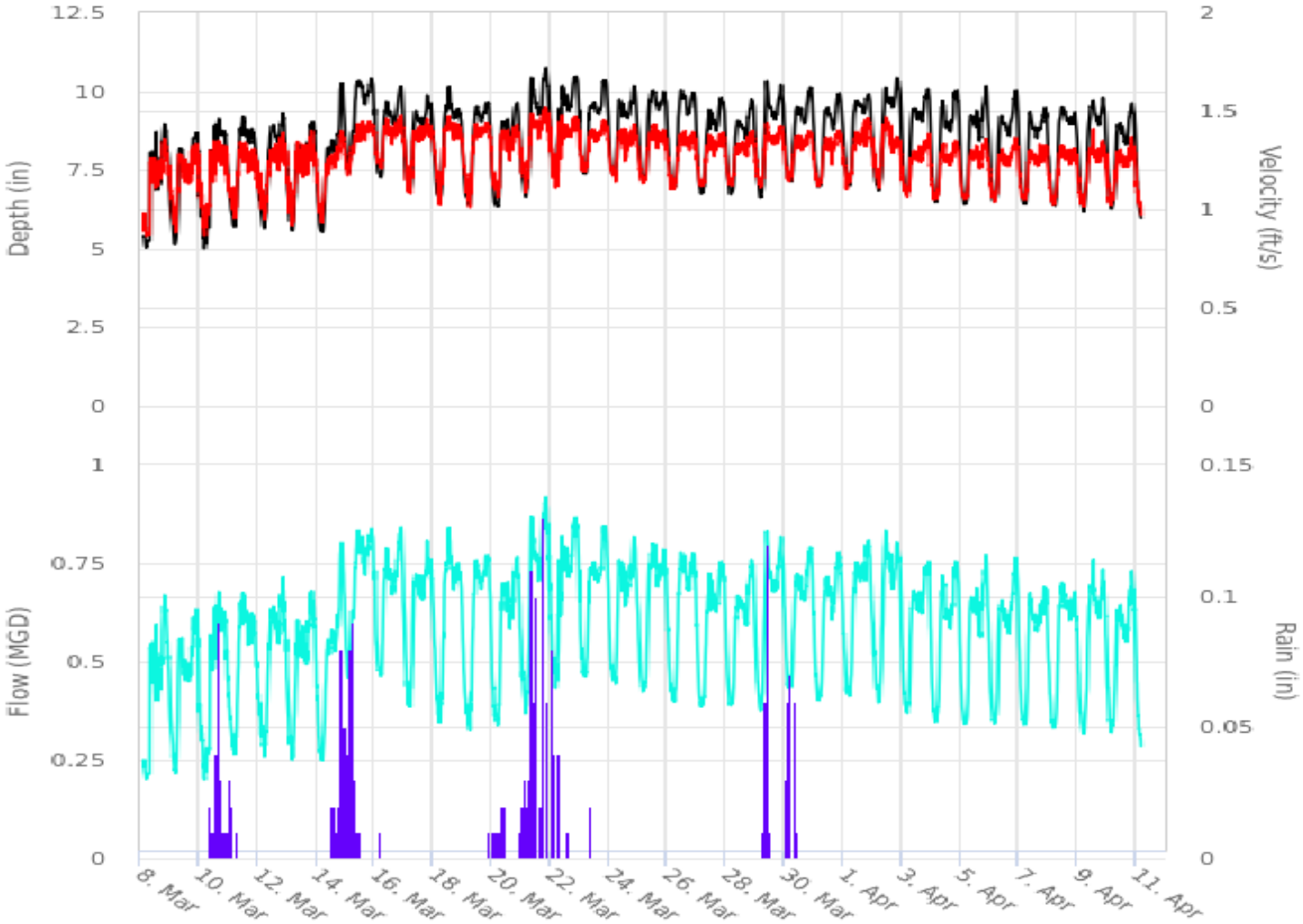


Report Period

03/08/2023
To
04/11/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC16A

Flow Monitor

MC16A

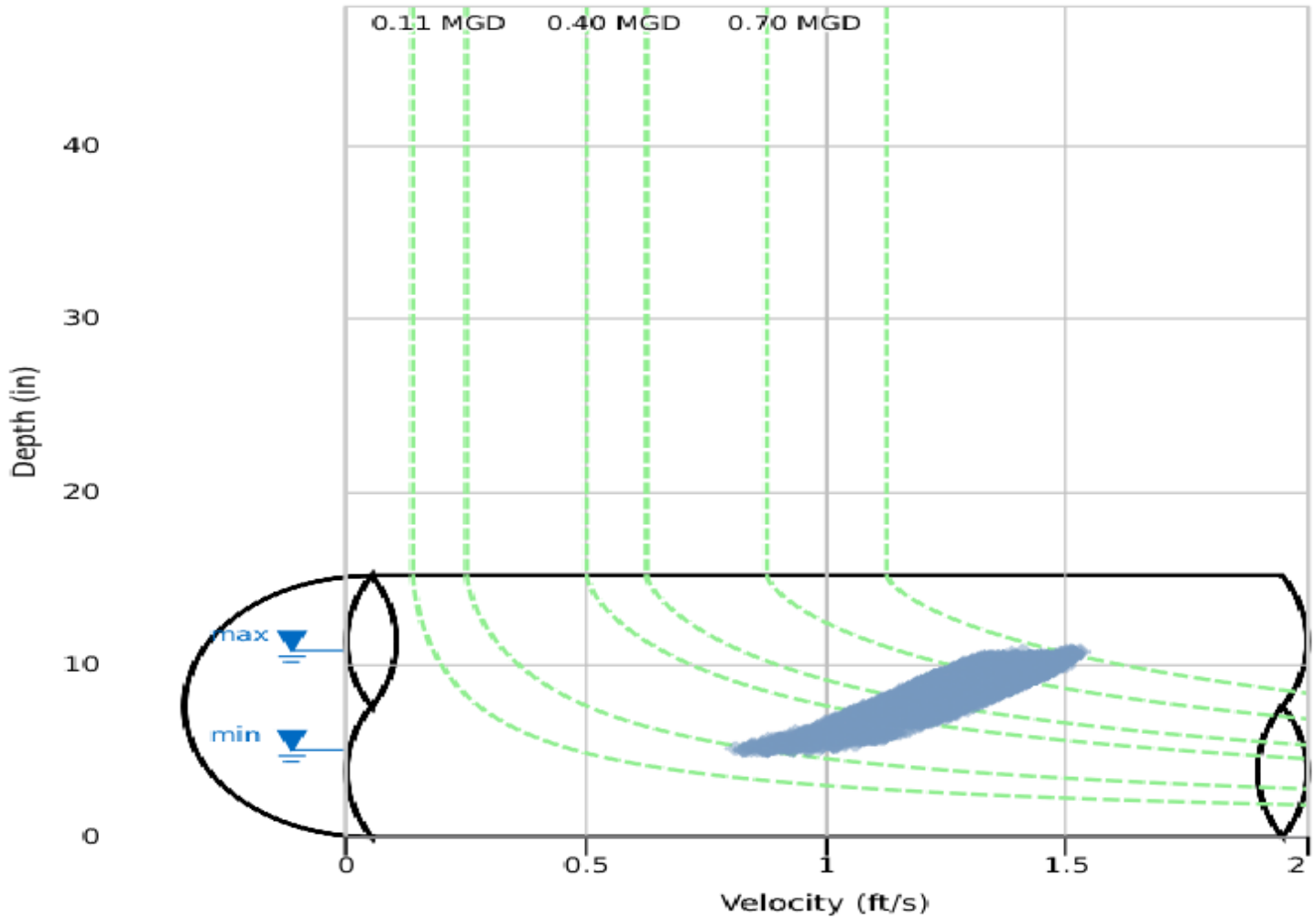
Pipe Height
15.13
in

Report Period

03/08/2023
To
04/11/2023

Legend

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



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Daily Tabular Report

03/08/2023 00:00 - 04/11/2023 23:59
MC16APipe: Elliptical (15.13 in H x 15 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/08/2023	05:05	5.02	13:25	9.79	7.30	04:50	0.81	20:10	1.37	1.15	04:50	0.189	13:25	0.718	0.452	0.387	-
03/09/2023	04:40	5.13	22:05	8.68	7.28	05:20	0.84	22:20	1.39	1.17	05:00	0.204	22:20	0.660	0.454	0.454	-
03/10/2023	04:30	5.01	13:55	10.30	7.38	04:35	0.84	19:25	1.40	1.17	04:35	0.194	14:15	0.772	0.466	0.466	0.98
03/11/2023	06:05	5.68	12:55	9.20	7.79	06:05	0.91	13:05	1.42	1.20	06:05	0.249	13:05	0.718	0.504	0.504	0.16
03/12/2023	05:55	5.64	21:05	9.38	7.79	06:10	0.90	20:20	1.44	1.20	06:10	0.244	20:20	0.737	0.507	0.507	-
03/13/2023	04:40	5.52	21:05	9.05	7.67	04:50	0.88	19:35	1.42	1.20	04:50	0.239	19:35	0.705	0.496	0.496	-
03/14/2023	05:15	5.53	21:20	10.26	7.81	04:25	0.91	21:10	1.42	1.20	04:30	0.243	21:30	0.820	0.512	0.512	1.06
03/15/2023	02:40	7.39	21:20	10.41	9.43	01:55	1.13	14:15	1.50	1.35	02:40	0.450	14:15	0.851	0.711	0.711	1.17
03/16/2023	05:20	7.26	22:10	10.16	8.92	05:55	1.14	21:55	1.50	1.37	05:55	0.440	21:55	0.849	0.675	0.675	0.01
03/17/2023	05:00	6.84	19:25	9.89	8.62	03:40	1.04	19:05	1.47	1.34	04:50	0.368	19:25	0.814	0.634	0.634	-
03/18/2023	05:15	6.62	13:05	10.15	8.57	04:30	1.01	13:00	1.48	1.33	05:30	0.342	13:00	0.844	0.629	0.629	-
03/19/2023	06:00	6.38	20:55	9.66	8.42	06:20	1.00	11:35	1.45	1.31	06:20	0.321	21:30	0.778	0.608	0.608	0.02
03/20/2023	05:20	6.33	21:15	9.64	8.27	05:10	1.01	21:20	1.46	1.30	05:10	0.322	21:20	0.784	0.588	0.588	0.19
03/21/2023	03:55	6.64	21:00	10.77	9.03	04:45	1.02	20:25	1.53	1.37	04:45	0.351	20:55	0.930	0.689	0.689	1.59
03/22/2023	04:40	7.41	10:25	10.62	9.19	04:45	1.08	09:35	1.49	1.35	04:45	0.422	21:05	0.878	0.691	0.691	0.22
03/23/2023	04:30	7.38	21:25	10.36	9.08	01:50	1.16	20:05	1.47	1.35	05:10	0.458	20:05	0.855	0.679	0.679	0.04
03/24/2023	04:20	7.34	20:45	10.17	8.97	05:50	1.11	12:20	1.47	1.32	05:50	0.432	20:50	0.823	0.655	0.655	-
03/25/2023	04:10	7.17	12:30	10.05	8.95	04:10	1.12	13:55	1.45	1.31	04:10	0.418	13:55	0.805	0.650	0.650	-
03/26/2023	05:50	6.95	11:30	10.04	8.86	03:20	1.05	11:15	1.41	1.29	05:00	0.392	11:15	0.789	0.631	0.631	-
03/27/2023	04:00	6.74	10:25	9.89	8.56	05:15	1.10	10:25	1.50	1.28	03:55	0.383	10:25	0.832	0.604	0.604	-
03/28/2023	03:50	6.73	21:05	9.74	8.45	03:15	1.09	22:35	1.42	1.28	03:15	0.384	21:05	0.762	0.593	0.593	-
03/29/2023	04:15	6.62	09:45	10.37	8.79	04:35	1.10	21:10	1.46	1.31	04:35	0.371	09:45	0.847	0.637	0.637	0.85
03/30/2023	05:15	7.13	21:20	10.13	8.83	04:40	1.12	12:25	1.46	1.30	04:40	0.427	21:20	0.797	0.632	0.632	0.23
03/31/2023	03:55	6.95	20:55	9.94	8.71	03:55	1.11	20:50	1.41	1.28	03:55	0.398	20:55	0.786	0.616	0.616	-
04/01/2023	05:30	7.00	21:20	9.91	8.86	03:10	1.06	20:00	1.47	1.32	06:00	0.403	21:20	0.816	0.646	0.646	-
04/02/2023	05:35	6.84	20:35	10.42	8.95	06:15	1.07	12:00	1.48	1.32	06:15	0.384	11:00	0.836	0.652	0.652	-
04/03/2023	04:30	6.77	21:45	10.07	8.73	05:10	1.03	23:00	1.47	1.24	05:10	0.358	22:45	0.800	0.596	0.596	-
04/04/2023	04:20	6.47	21:05	10.02	8.59	02:25	1.02	11:15	1.44	1.23	04:10	0.338	21:20	0.770	0.580	0.580	-
04/05/2023	04:00	6.41	21:30	10.16	8.49	04:20	1.04	21:15	1.37	1.23	04:20	0.338	21:55	0.777	0.572	0.572	-
04/06/2023	04:00	6.50	21:40	10.03	8.49	04:20	1.01	22:40	1.41	1.22	04:20	0.333	21:20	0.768	0.571	0.571	-
04/07/2023	04:55	6.42	21:50	9.48	8.35	02:35	1.04	17:20	1.37	1.22	04:40	0.338	21:10	0.706	0.555	0.555	-
04/08/2023	05:40	6.35	11:40	9.51	8.36	04:45	1.01	12:00	1.45	1.22	04:45	0.328	12:00	0.763	0.558	0.558	-
04/09/2023	05:15	6.18	21:05	9.80	8.42	05:50	1.00	13:20	1.48	1.22	05:35	0.312	13:20	0.800	0.564	0.564	-
04/10/2023	03:45	6.27	21:00	9.62	8.21	04:05	1.00	20:50	1.38	1.21	04:05	0.313	20:50	0.738	0.543	0.543	-
04/11/2023	04:30	5.98	00:00	8.13	6.72	04:30	0.97	00:00	1.23	1.07	04:30	0.285	00:00	0.539	0.370	0.071	-

03/08/2023 00:00 - 04/11/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			20.155	6.52
Average	8.47	1.27	0.592	

MC16B

Site Commentary

SITE INFORMATION

Pipe	Round (10 in H)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. Backwater conditions were experienced throughout the month at this location. Brief periods of surcharge conditions were experienced at this location.

This site is located upstream of site MC16A. A normal net flow was recorded between the sites.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	6.57	0.95	0.191
Minimum	2.20	0.30	0.055
Maximum	19.83	1.57	0.317
Min Time	03/08/2023 2:20:00 AM	03/01/2023 6:55:00 PM	03/08/2023 2:20:00 AM
Max Time	03/15/2023 9:50:00 PM	03/20/2023 7:20:00 AM	04/04/2023 9:05:00 PM

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

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

DATA UPTIME

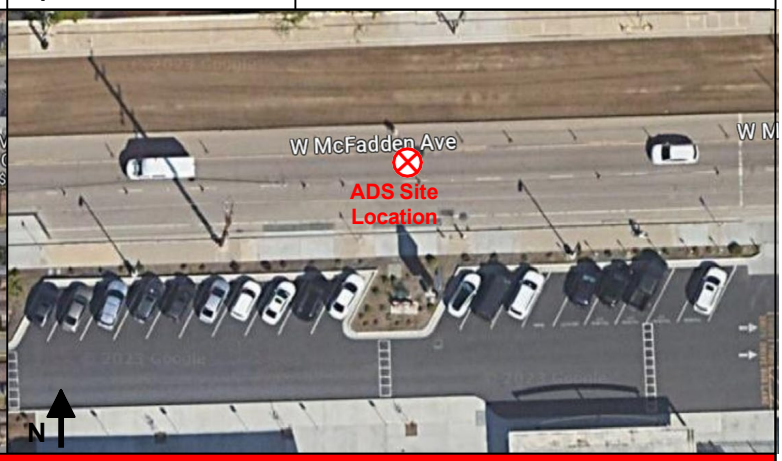
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC16B	**Install Date:** 2/28/2023	**Monitor Type**	Peak Doppler
Address/Location: 10282 W Mcfadden Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	3410
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	10.00 "
		Pipe Width:	10.00 "



Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 12:38 am
Site Hydraulics:	Good Straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.50 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.32 fps
Silt:	0 Inches

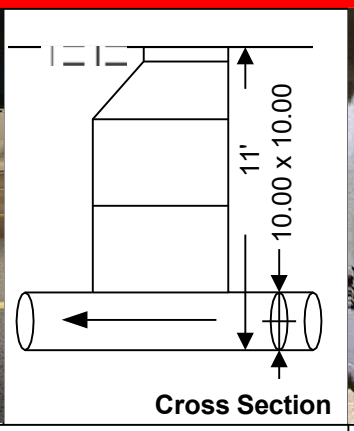
Manhole Information:

Manhole Depth:	11'			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [ ]	Commercial [ ]	Industrial [ ]	Other [X]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

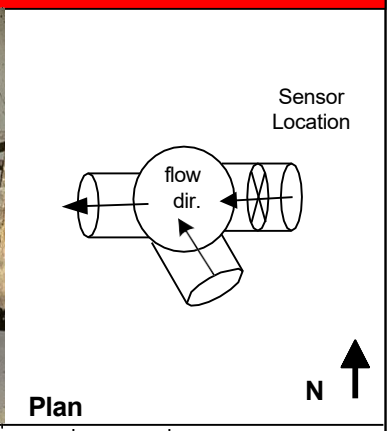
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

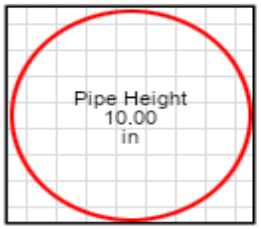
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC16B

Flow Monitor

MC16B

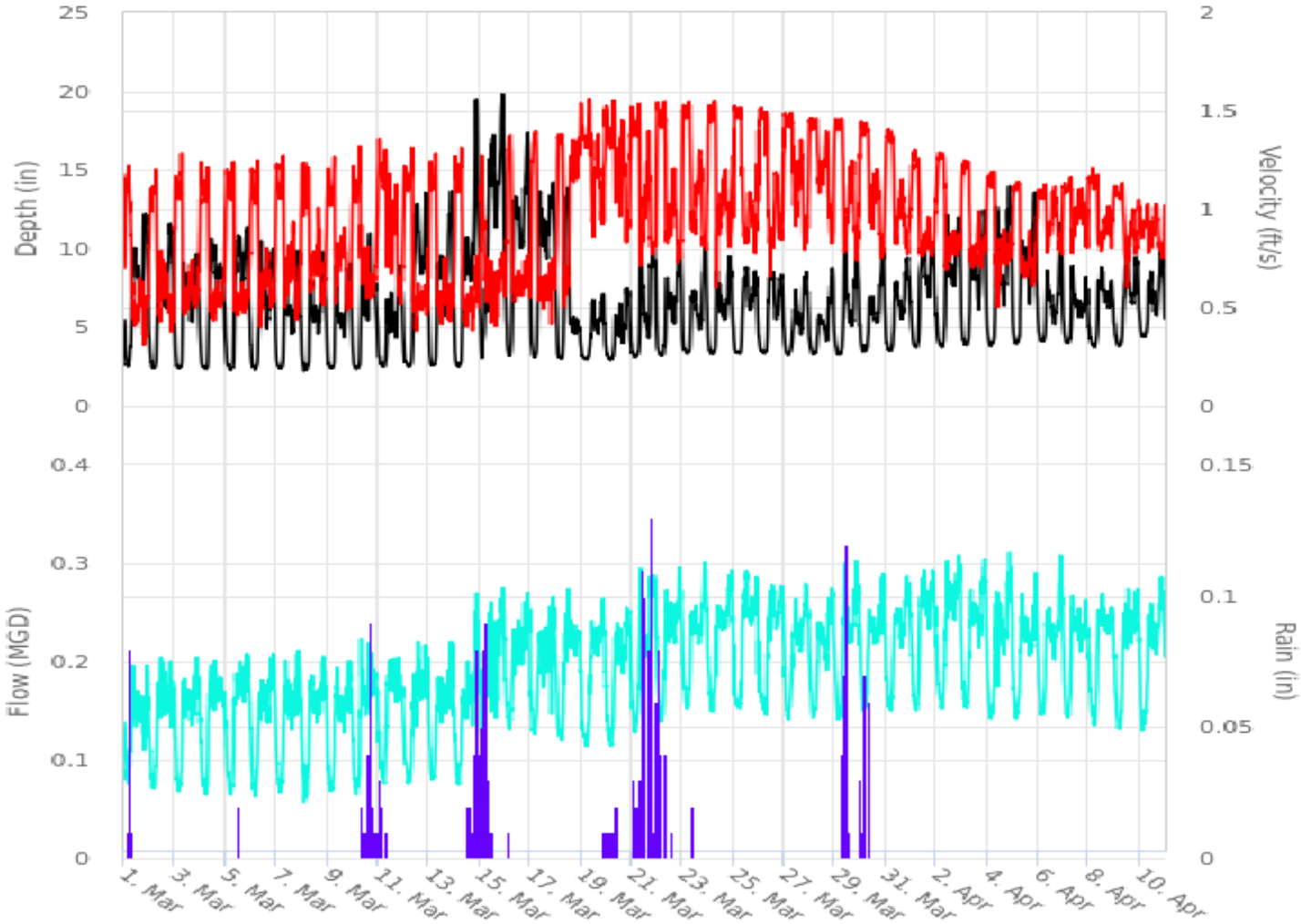


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC16B

Flow Monitor

MC16B

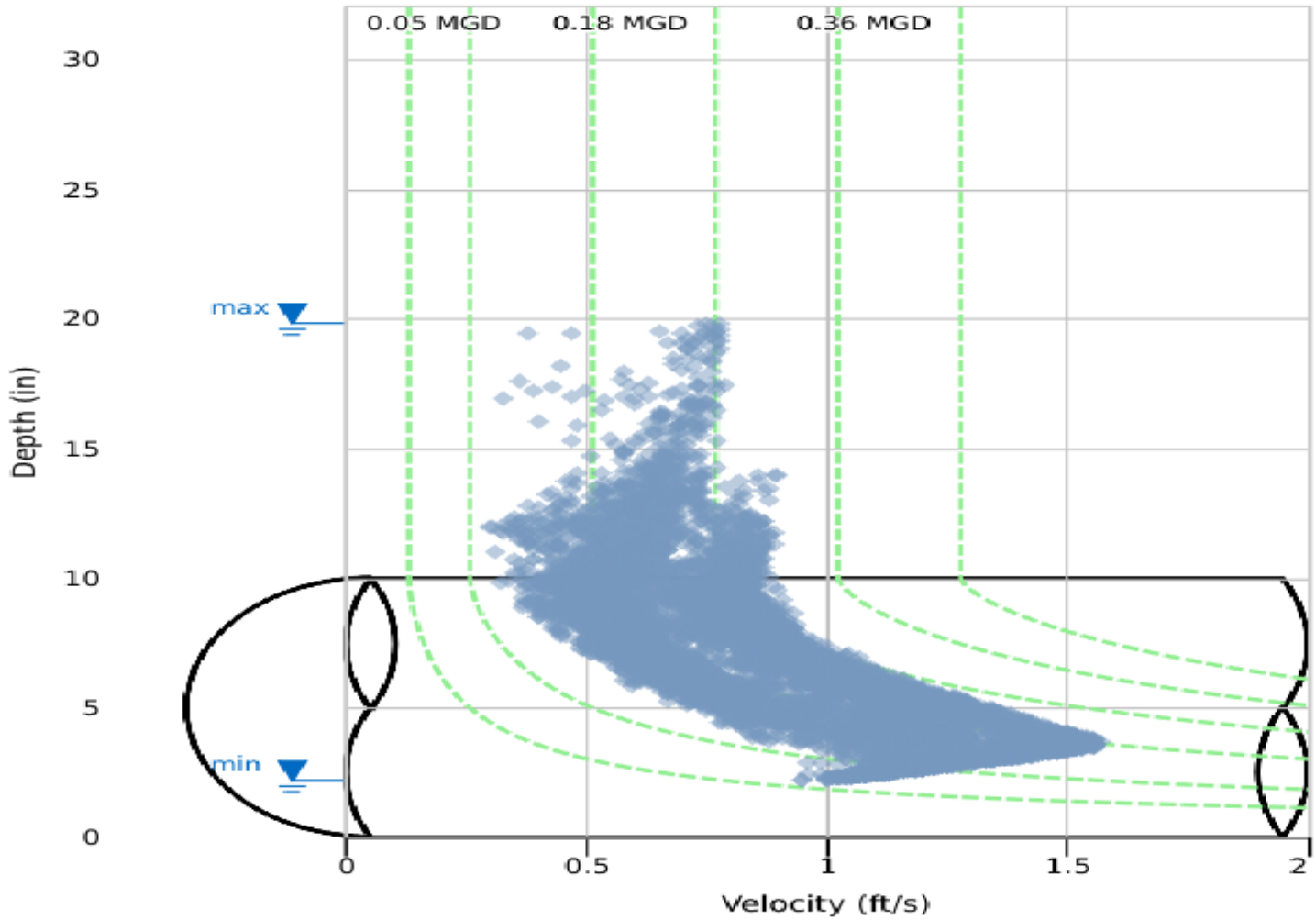
Pipe Height
10.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC16BPipe: Round (10 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:50	2.50	19:45	12.31	7.19	18:55	0.30	04:40	1.23	0.67	03:45	0.073	08:05	0.289	0.139	0.139	0.21
03/02/2023	04:25	2.40	19:25	11.65	6.53	21:15	0.35	05:55	1.22	0.71	04:30	0.070	11:50	0.259	0.139	0.139	-
03/03/2023	03:45	2.38	20:40	9.72	5.97	08:50	0.41	06:35	1.30	0.76	03:45	0.067	20:30	0.211	0.141	0.141	-
03/04/2023	05:15	2.35	10:35	10.64	6.48	11:50	0.41	00:55	1.30	0.75	05:30	0.065	10:25	0.254	0.143	0.143	-
03/05/2023	05:05	2.32	20:35	11.38	6.86	11:00	0.40	07:15	1.25	0.75	05:10	0.064	20:25	0.212	0.147	0.147	0.02
03/06/2023	03:50	2.30	09:30	10.47	6.04	09:20	0.37	06:40	1.28	0.78	03:50	0.062	20:00	0.213	0.143	0.143	-
03/07/2023	03:45	2.37	21:20	9.90	5.56	19:15	0.37	06:30	1.31	0.83	04:00	0.066	09:05	0.225	0.143	0.143	-
03/08/2023	02:20	2.20	19:40	9.86	5.42	21:10	0.43	02:45	1.30	0.83	02:20	0.055	20:30	0.210	0.141	0.141	-
03/09/2023	03:25	2.40	21:45	9.15	5.30	18:45	0.46	06:40	1.28	0.84	03:05	0.064	09:15	0.277	0.139	0.139	-
03/10/2023	03:40	2.33	16:20	11.03	5.80	16:55	0.51	06:55	1.36	0.83	03:35	0.064	08:05	0.256	0.150	0.150	0.98
03/11/2023	05:15	2.49	19:15	9.03	5.12	21:20	0.49	01:10	1.37	0.94	05:10	0.074	13:10	0.210	0.152	0.152	0.16
03/12/2023	04:35	2.51	20:55	13.65	7.47	11:40	0.35	08:00	1.34	0.77	04:30	0.075	23:55	0.265	0.151	0.151	-
03/13/2023	03:15	2.61	21:35	13.72	7.12	12:25	0.37	06:30	1.29	0.73	03:15	0.080	22:40	0.233	0.148	0.148	-
03/14/2023	04:15	2.50	21:05	19.52	8.26	11:45	0.31	06:55	1.33	0.73	04:15	0.074	21:20	0.271	0.155	0.155	1.06
03/15/2023	02:35	3.03	21:50	19.83	11.87	10:50	0.33	02:10	1.28	0.71	02:35	0.113	20:25	0.278	0.201	0.201	1.17
03/16/2023	04:45	3.19	22:00	17.48	10.12	12:40	0.48	05:20	1.38	0.78	04:45	0.131	20:10	0.271	0.203	0.203	0.01
03/17/2023	04:25	3.07	21:45	14.29	9.27	20:00	0.38	04:35	1.40	0.80	04:25	0.125	21:50	0.271	0.197	0.197	-
03/18/2023	05:35	3.01	12:20	13.97	6.21	08:40	0.42	23:45	1.52	1.11	05:30	0.119	12:40	0.303	0.198	0.198	-
03/19/2023	05:25	2.95	21:05	7.14	4.67	11:45	0.81	08:00	1.56	1.24	05:25	0.114	21:00	0.269	0.191	0.191	0.02
03/20/2023	04:35	2.94	18:45	7.56	4.70	18:50	0.81	07:20	1.57	1.24	04:40	0.113	12:55	0.274	0.191	0.191	0.19
03/21/2023	03:25	3.09	08:45	11.68	6.03	08:20	0.67	00:00	1.54	1.12	03:25	0.127	08:45	0.303	0.214	0.214	1.59
03/22/2023	03:45	3.23	21:35	10.31	6.10	19:45	0.64	06:10	1.56	1.11	03:50	0.139	20:55	0.303	0.220	0.220	0.22
03/23/2023	04:20	3.34	21:10	10.63	5.85	22:15	0.77	06:00	1.56	1.16	04:00	0.151	21:05	0.303	0.223	0.223	0.04
03/24/2023	04:35	3.32	20:20	9.57	5.85	08:25	0.52	05:50	1.56	1.15	04:35	0.148	22:05	0.301	0.225	0.225	-
03/25/2023	05:15	3.37	11:55	8.88	5.92	20:35	0.75	01:45	1.54	1.13	07:40	0.136	12:25	0.296	0.224	0.224	-
03/26/2023	05:10	3.35	11:05	9.37	5.94	10:50	0.57	01:25	1.53	1.14	07:20	0.130	21:55	0.282	0.224	0.224	-
03/27/2023	03:30	3.25	21:15	8.54	5.36	19:00	0.74	01:25	1.51	1.20	04:20	0.140	21:15	0.285	0.214	0.214	-
03/28/2023	03:15	3.29	21:40	8.79	5.10	20:50	0.81	01:50	1.48	1.23	03:10	0.139	22:25	0.282	0.209	0.209	-
03/29/2023	03:35	3.26	09:35	10.79	5.92	20:50	0.70	06:30	1.48	1.14	03:25	0.139	20:25	0.312	0.222	0.222	0.85
03/30/2023	02:45	3.45	21:50	10.07	5.75	19:35	0.71	01:15	1.45	1.14	02:55	0.149	21:45	0.310	0.221	0.221	0.23
03/31/2023	05:05	3.51	21:05	9.46	6.10	21:10	0.71	01:35	1.41	1.08	05:05	0.149	20:30	0.296	0.223	0.223	-
04/01/2023	05:25	3.72	20:40	10.31	7.09	09:50	0.74	03:50	1.32	0.97	05:25	0.148	12:25	0.302	0.233	0.233	-
04/02/2023	05:10	3.74	10:05	12.16	7.65	10:00	0.63	05:00	1.30	0.96	04:50	0.150	21:35	0.314	0.236	0.236	-
04/03/2023	04:35	3.87	21:20	12.48	7.36	18:15	0.62	01:25	1.26	0.94	04:30	0.150	21:55	0.307	0.228	0.228	-
04/04/2023	03:30	3.82	21:05	14.00	7.93	10:05	0.42	06:10	1.20	0.90	03:30	0.141	21:05	0.317	0.221	0.221	-
04/05/2023	03:15	3.94	20:55	13.67	7.77	18:25	0.58	04:25	1.15	0.85	03:15	0.141	21:55	0.296	0.214	0.214	-
04/06/2023	03:40	4.10	21:25	11.73	6.41	22:15	0.73	07:05	1.14	0.97	02:30	0.143	21:25	0.314	0.217	0.217	-
04/07/2023	04:25	3.98	08:40	8.97	5.90	08:40	0.72	06:55	1.17	1.01	04:20	0.142	08:50	0.278	0.213	0.213	-
04/08/2023	05:15	3.74	11:50	8.83	6.15	11:25	0.74	03:35	1.28	0.99	04:30	0.135	13:00	0.276	0.215	0.215	-
04/09/2023	04:10	3.82	12:50	10.51	6.53	12:35	0.48	08:05	1.15	0.94	05:35	0.129	15:55	0.281	0.214	0.214	-
04/10/2023	03:25	4.39	20:30	10.38	6.51	22:05	0.71	15:15	1.04	0.90	02:40	0.124	21:10	0.297	0.212	0.211	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			7.832	6.75
Average	6.57	0.95	0.191	

MC18

Site Commentary

SITE INFORMATION

Pipe	Elliptical (10.38 in H x 10 in W)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	5.83	1.09	0.235
Minimum	4.37	0.72	0.108
Maximum	8.74	1.62	0.531
Min Time	04/09/2023 4:50:00 AM	03/10/2023 5:00:00 AM	03/10/2023 5:00:00 AM
Max Time	03/15/2023 7:50:00 AM	03/15/2023 8:50:00 AM	03/21/2023 6:15:00 PM

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

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

DATA UPTIME

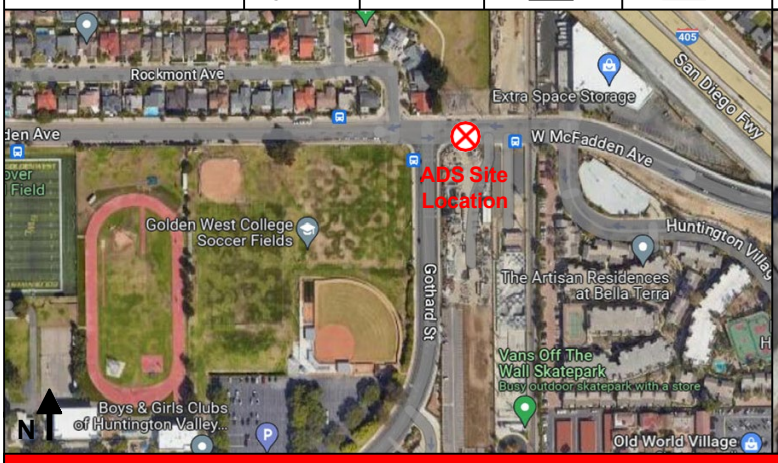
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

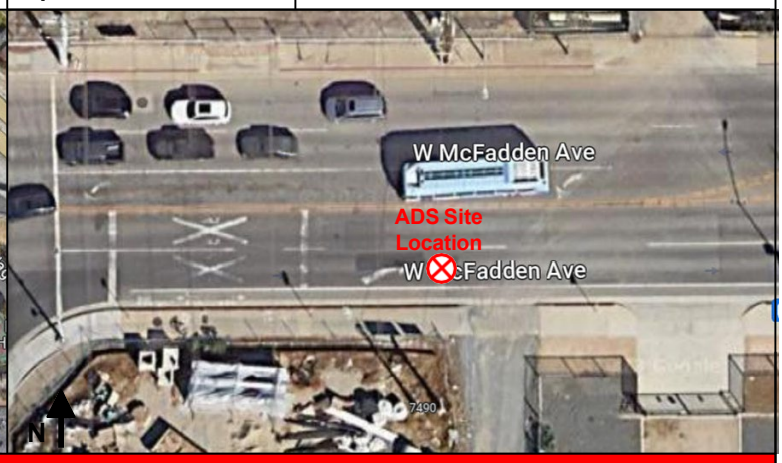
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC18	**Install Date:** 2/27/2023	**Monitor Type**	Peak Doppler
Address/Location: 7490 Mcfadden Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	2470
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	10.38 "
		Pipe Width:	10.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 3:25 am
Site Hydraulics:	Good Straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	5.50 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.11 fps
Silt:	0 Inches

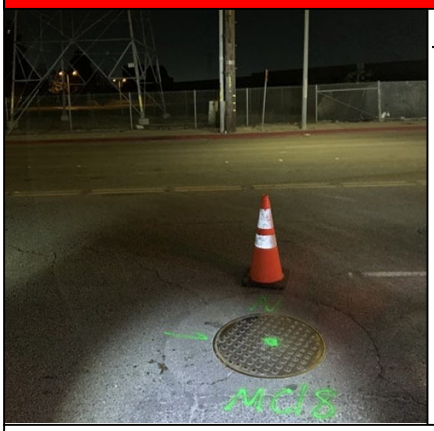
Manhole Information:

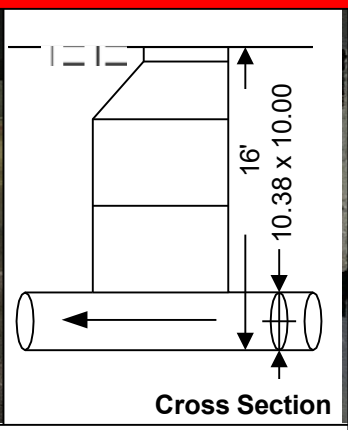
Manhole Depth:	16'			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [ ]	Commercial [ ]	Industrial [ ]	Other [X]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

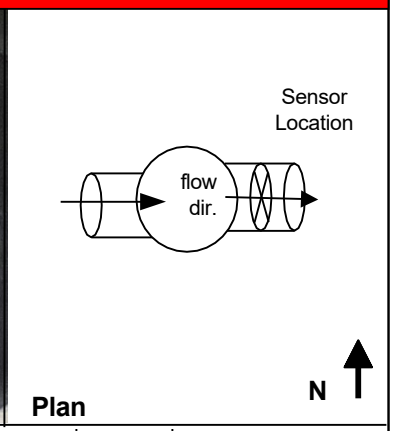
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Outlet
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

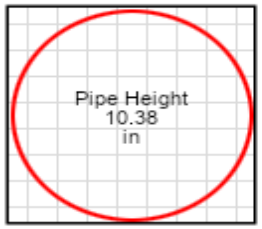
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC18

Flow Monitor

MC18

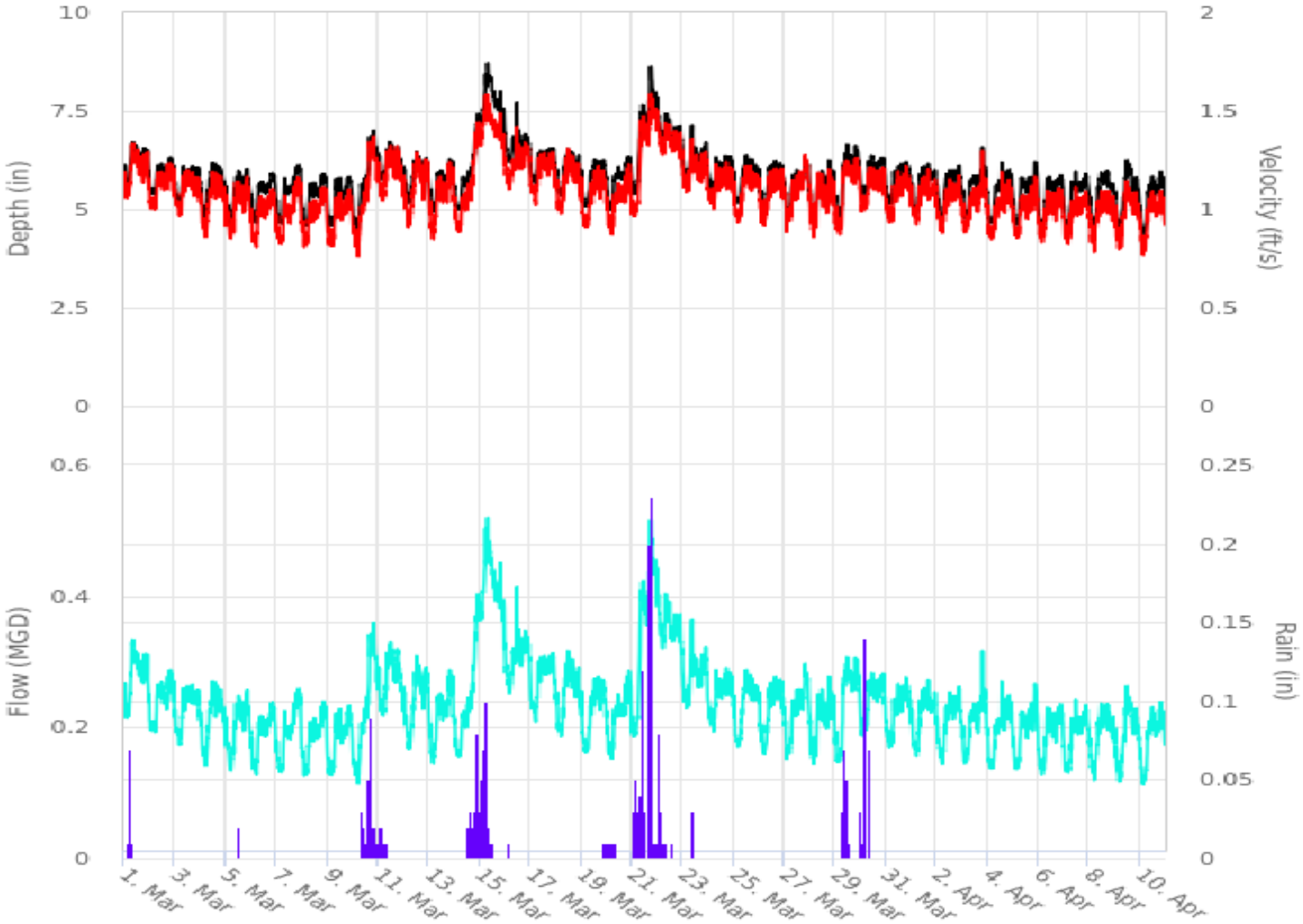


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC18

Flow Monitor

MC18

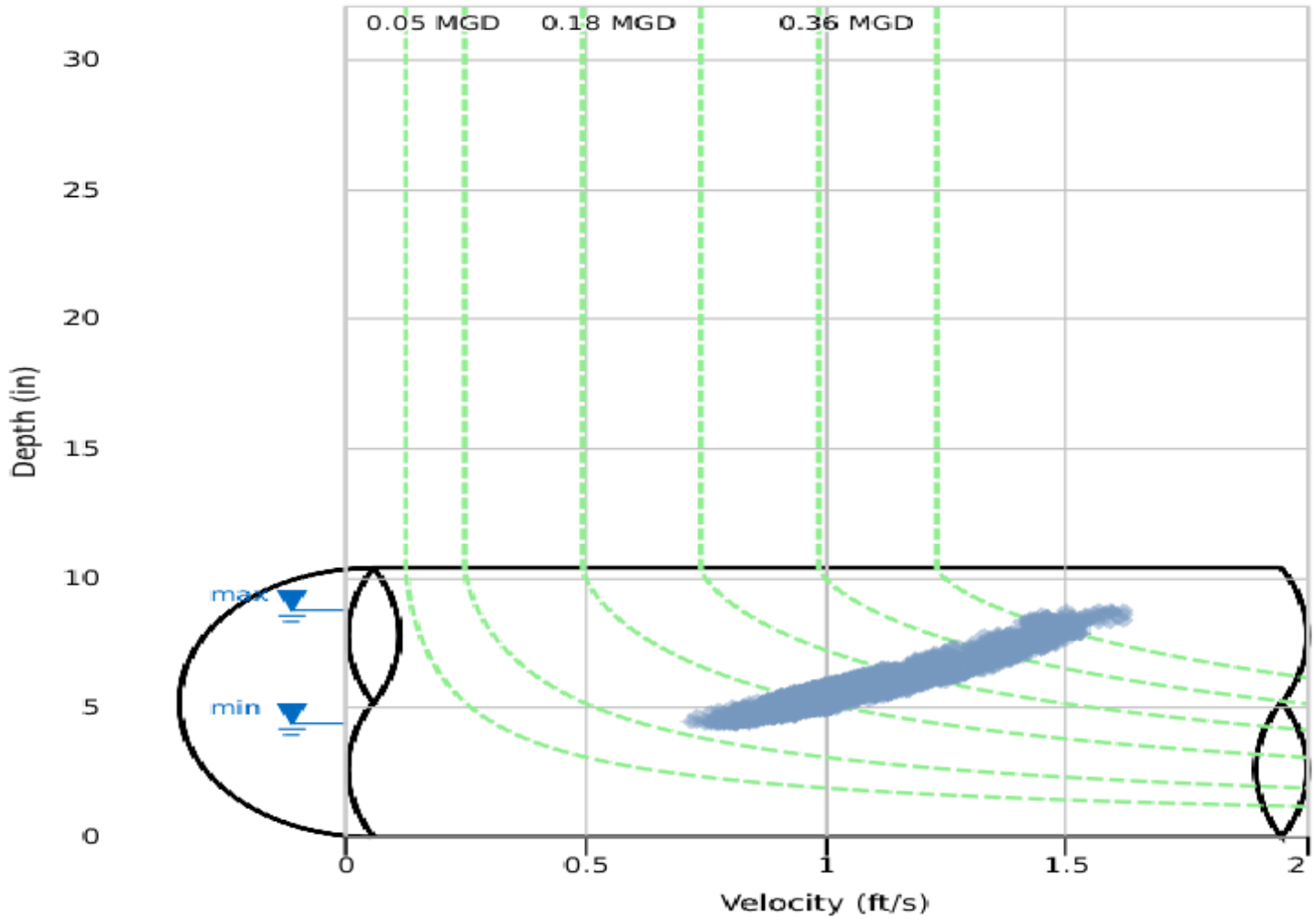
Pipe Height
10.38
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC18Pipe: Elliptical (10.38 in H x 10 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:50	5.62	08:20	6.71	6.26	02:30	1.03	08:10	1.37	1.20	02:30	0.208	08:10	0.343	0.277	0.277	0.22
03/02/2023	05:20	5.37	20:00	6.32	5.87	06:10	0.97	19:10	1.28	1.12	06:10	0.188	19:10	0.298	0.240	0.240	-
03/03/2023	05:10	5.09	16:45	6.11	5.75	03:50	0.96	12:05	1.24	1.10	05:10	0.171	12:55	0.273	0.230	0.230	-
03/04/2023	05:05	4.79	11:50	6.20	5.63	04:30	0.83	13:35	1.21	1.06	04:30	0.138	13:35	0.275	0.215	0.215	-
03/05/2023	05:15	4.61	20:35	6.05	5.47	05:00	0.84	12:15	1.18	1.02	05:00	0.133	20:35	0.261	0.202	0.202	0.04
03/06/2023	05:25	4.64	20:40	5.94	5.41	04:55	0.78	19:05	1.11	0.98	04:55	0.126	20:15	0.239	0.191	0.191	-
03/07/2023	04:50	4.63	21:10	6.13	5.45	04:25	0.81	20:35	1.18	0.99	04:45	0.128	21:25	0.263	0.194	0.194	-
03/08/2023	03:15	4.58	20:25	5.91	5.33	02:25	0.78	20:25	1.13	0.98	02:25	0.123	20:25	0.243	0.186	0.186	-
03/09/2023	03:55	4.54	11:55	5.86	5.30	01:45	0.79	20:10	1.13	0.96	01:45	0.123	20:10	0.239	0.183	0.183	-
03/10/2023	05:00	4.45	20:05	7.01	5.73	05:00	0.72	19:55	1.40	1.08	05:00	0.108	19:55	0.366	0.229	0.229	0.90
03/11/2023	05:20	5.71	10:50	6.73	6.24	03:00	1.00	18:05	1.35	1.19	03:00	0.210	10:55	0.334	0.275	0.275	0.14
03/12/2023	05:25	5.16	12:15	6.47	5.89	04:30	0.90	12:20	1.30	1.12	06:05	0.164	12:20	0.311	0.242	0.242	-
03/13/2023	04:15	4.93	19:50	6.30	5.68	04:15	0.82	19:50	1.25	1.06	04:15	0.140	19:50	0.290	0.219	0.219	-
03/14/2023	04:40	5.00	23:00	7.44	5.91	04:40	0.84	22:50	1.46	1.10	04:40	0.147	22:50	0.408	0.241	0.241	1.01
03/15/2023	23:55	6.92	07:50	8.74	7.77	23:35	1.22	08:50	1.62	1.42	23:40	0.318	07:50	0.526	0.417	0.417	1.01
03/16/2023	04:50	6.19	11:15	8.02	6.66	04:10	1.08	11:15	1.45	1.24	04:10	0.248	11:15	0.440	0.307	0.307	0.02
03/17/2023	05:05	5.63	22:10	6.59	6.23	04:55	1.02	13:30	1.32	1.19	05:00	0.207	22:10	0.321	0.274	0.274	-
03/18/2023	05:05	5.35	11:45	6.55	6.00	05:05	0.96	15:45	1.33	1.14	05:05	0.183	11:45	0.321	0.251	0.251	-
03/19/2023	05:45	5.06	21:30	6.29	5.78	05:25	0.88	21:00	1.26	1.07	05:25	0.157	16:35	0.284	0.226	0.226	0.02
03/20/2023	05:15	4.97	20:00	6.35	5.73	05:20	0.85	19:45	1.27	1.05	05:20	0.148	21:20	0.294	0.218	0.218	0.09
03/21/2023	01:30	5.38	18:10	8.71	7.00	01:30	0.94	17:45	1.62	1.31	01:30	0.180	18:15	0.531	0.351	0.351	1.59
03/22/2023	23:55	6.26	00:05	7.84	7.00	20:50	1.21	00:15	1.50	1.35	23:55	0.279	00:15	0.445	0.355	0.355	0.15
03/23/2023	03:30	5.79	08:40	7.66	6.28	03:15	1.07	08:45	1.48	1.20	03:15	0.226	08:40	0.417	0.278	0.278	0.05
03/24/2023	05:15	5.41	16:20	6.38	6.01	05:20	0.98	17:25	1.25	1.13	05:20	0.189	17:25	0.294	0.249	0.249	-
03/25/2023	04:30	5.16	11:35	6.40	5.87	04:25	0.92	11:45	1.28	1.10	04:25	0.167	11:45	0.297	0.237	0.237	-
03/26/2023	05:10	4.96	15:45	6.24	5.74	02:00	0.90	11:40	1.25	1.09	05:10	0.155	11:40	0.283	0.228	0.228	-
03/27/2023	02:45	4.88	19:45	6.30	5.63	02:05	0.83	19:50	1.29	1.10	02:05	0.142	19:50	0.300	0.224	0.224	-
03/28/2023	05:15	4.83	18:40	6.43	5.52	03:55	0.78	18:40	1.29	1.05	03:55	0.130	18:40	0.307	0.209	0.209	-
03/29/2023	02:25	4.75	11:40	6.67	5.89	03:15	0.85	11:00	1.30	1.11	03:15	0.141	11:35	0.314	0.241	0.241	0.56
03/30/2023	02:15	5.29	10:35	6.37	5.93	01:10	0.98	16:45	1.26	1.12	02:10	0.185	11:10	0.294	0.243	0.243	0.30
03/31/2023	03:30	5.14	19:40	6.22	5.75	06:20	0.91	19:20	1.25	1.08	03:30	0.166	19:20	0.284	0.225	0.225	-
04/01/2023	05:10	4.87	16:20	6.19	5.66	05:15	0.91	16:20	1.24	1.07	05:15	0.153	16:20	0.282	0.219	0.219	-
04/02/2023	05:40	4.74	21:15	6.11	5.58	03:20	0.86	21:20	1.21	1.04	05:45	0.142	21:20	0.271	0.210	0.210	-
04/03/2023	03:10	4.76	19:35	6.59	5.55	03:00	0.85	19:35	1.32	1.03	03:00	0.140	19:35	0.323	0.208	0.208	-
04/04/2023	03:25	4.65	13:25	6.32	5.43	04:30	0.82	13:25	1.26	1.00	04:30	0.133	13:25	0.294	0.195	0.195	-
04/05/2023	03:20	4.59	21:10	6.23	5.44	05:55	0.81	21:05	1.20	1.01	04:20	0.132	21:05	0.273	0.197	0.197	-
04/06/2023	03:35	4.52	21:25	5.89	5.36	03:30	0.80	19:45	1.16	0.99	03:30	0.123	19:45	0.245	0.191	0.191	-
04/07/2023	01:30	4.59	11:30	5.98	5.35	04:25	0.77	11:35	1.12	0.99	04:25	0.123	11:35	0.244	0.189	0.189	-
04/08/2023	05:05	4.50	16:45	5.99	5.40	03:50	0.73	13:25	1.15	0.99	05:10	0.114	16:45	0.243	0.191	0.191	-
04/09/2023	04:45	4.37	12:10	6.30	5.36	06:35	0.78	12:05	1.16	0.98	04:45	0.116	12:05	0.268	0.189	0.189	-
04/10/2023	03:10	4.38	19:50	5.97	5.29	03:15	0.75	12:15	1.11	0.96	03:15	0.110	19:50	0.240	0.182	0.182	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			9.628	6.10
Average	5.83	1.09	0.235	

MC19

Site Commentary

SITE INFORMATION

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

OBSERVATIONS

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location. A hydraulic shift (increase) was observed here on March 14 and also seen at the upstream site MC19A.

This site is located downstream of site MC19A. A normal net flow was recorded between the sites.

Average flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	5.02	1.90	0.387
Minimum	2.70	0.94	0.085
Maximum	7.43	3.64	0.636
Min Time	03/04/2023 5:15:00 AM	03/09/2023 5:05:00 AM	03/03/2023 4:15:00 AM
Max Time	04/05/2023 8:30:00 AM	04/05/2023 8:35:00 AM	03/23/2023 9:40:00 AM

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

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

DATA UPTIME

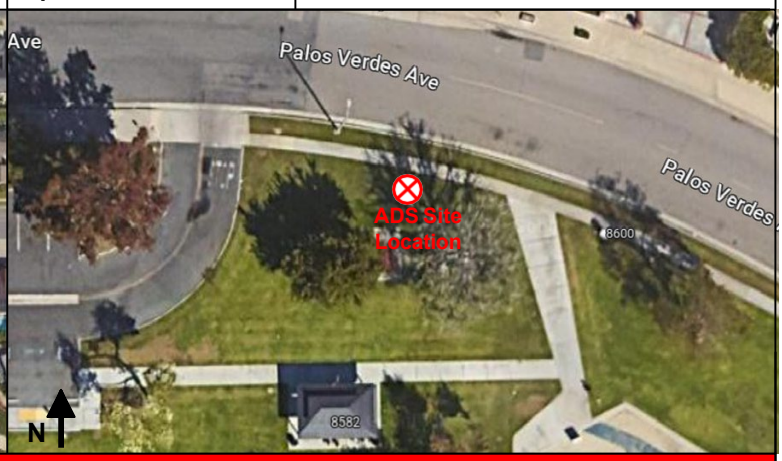
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC19	**Install Date:** 2/23/2023	**Monitor Type**	Peak Doppler
Address/Location: 15699 Skylinks Cir.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	2922
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.00 "
		Pipe Width:	12.00 "



Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 1:11 am
Site Hydraulics:	Good Straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	3.75 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.63 fps
Silt:	0 Inches

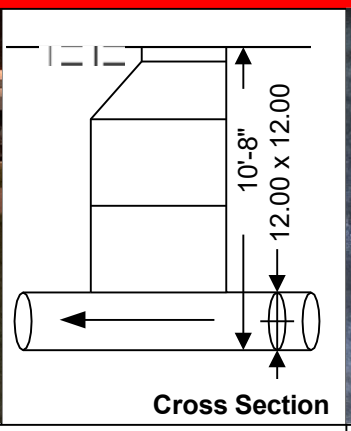
Manhole Information:

Manhole Depth:	10'-8"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

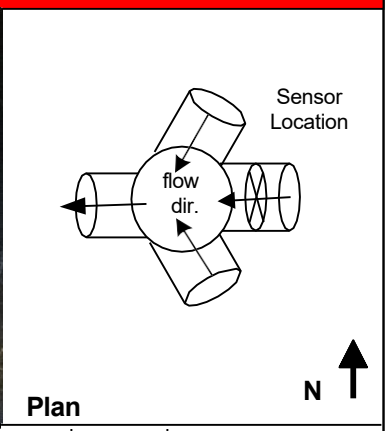
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

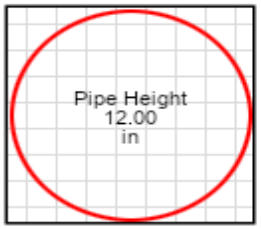
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC19

Flow Monitor

MC19

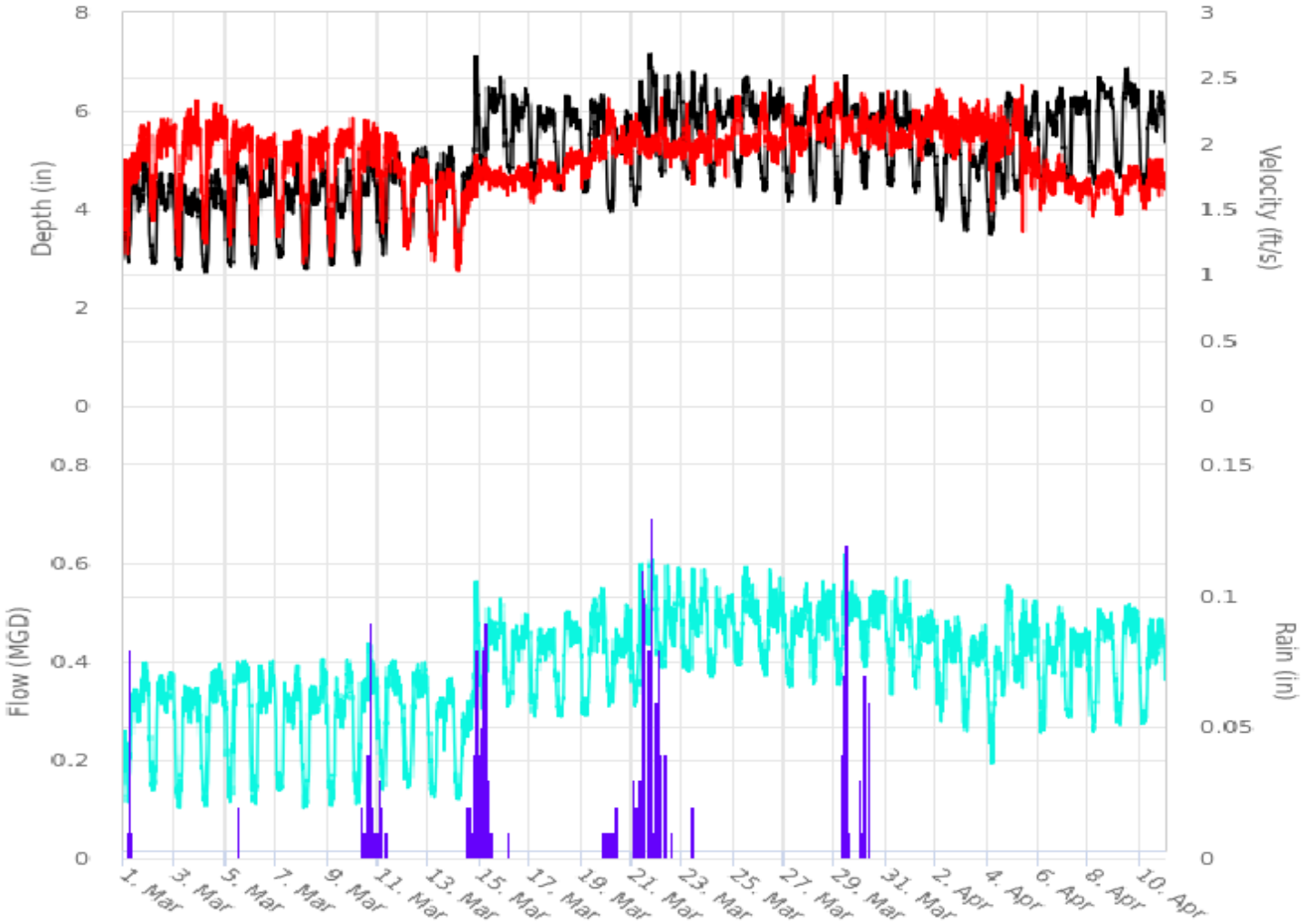


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC19

Flow Monitor

MC19

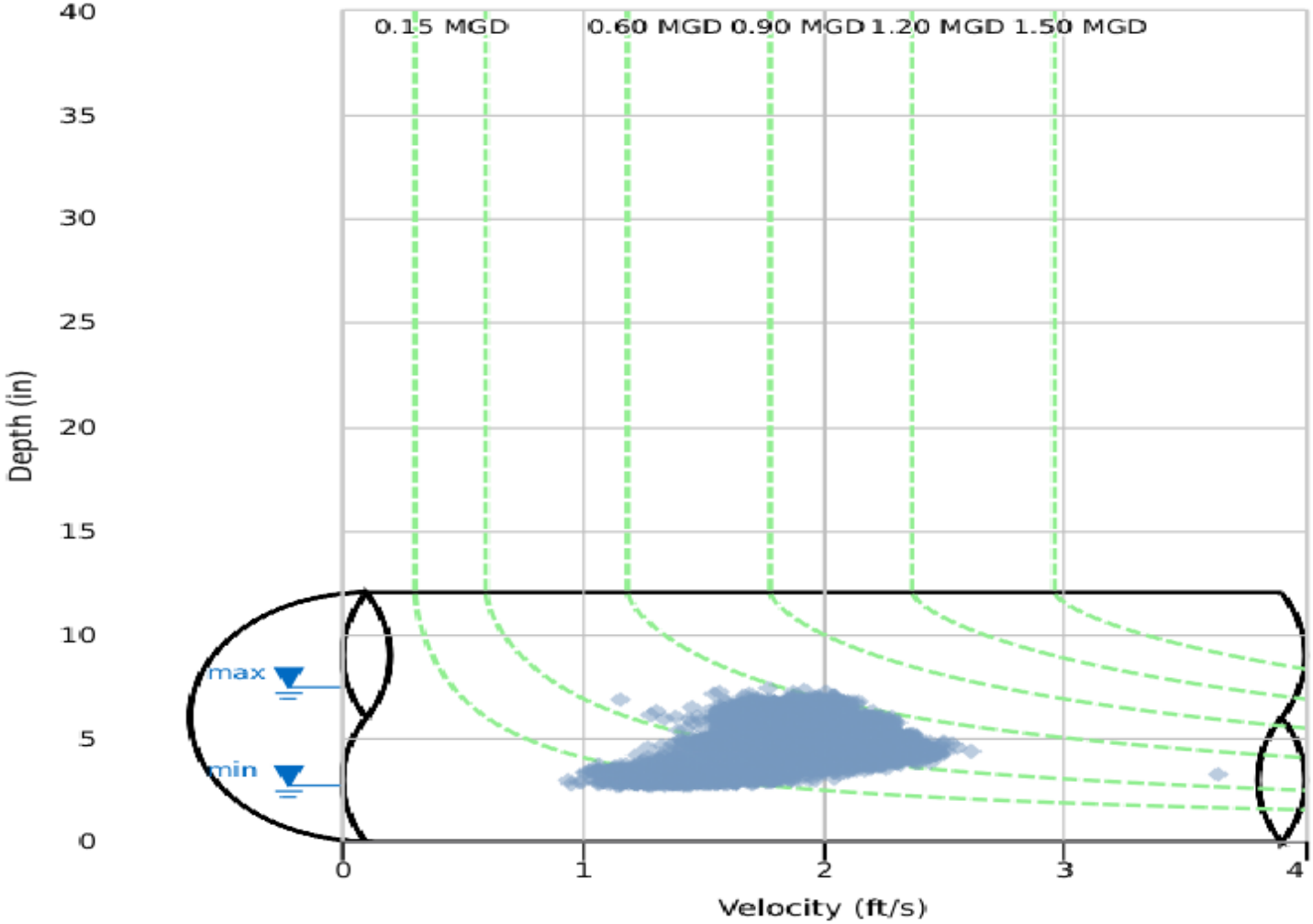
Pipe Height
12.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC19Pipe: Round (12 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	04:05	2.89	19:40	5.06	4.11	03:05	1.04	17:10	2.29	1.84	03:05	0.103	20:25	0.413	0.289	0.289	0.21
03/02/2023	04:15	2.87	10:55	4.85	3.96	03:00	1.15	17:00	2.30	1.96	03:00	0.114	20:05	0.401	0.291	0.291	-
03/03/2023	03:45	2.77	09:20	4.54	3.79	04:15	0.95	20:20	2.41	1.93	04:15	0.085	10:25	0.380	0.273	0.273	-
03/04/2023	04:45	2.70	16:25	5.04	3.89	05:15	1.14	20:00	2.35	1.94	05:15	0.097	18:20	0.409	0.286	0.286	-
03/05/2023	05:20	2.82	18:50	5.07	4.13	04:20	1.18	00:05	2.32	1.93	04:20	0.109	18:25	0.421	0.307	0.307	0.02
03/06/2023	03:30	2.78	20:10	5.19	4.07	02:50	1.16	22:15	2.12	1.83	02:50	0.108	20:10	0.408	0.286	0.286	-
03/07/2023	03:05	3.01	19:50	5.14	4.03	16:20	1.22	16:35	2.24	1.80	03:40	0.134	20:05	0.403	0.277	0.277	-
03/08/2023	04:05	2.78	08:20	5.08	4.01	02:25	0.99	21:20	2.22	1.81	02:25	0.092	19:30	0.418	0.277	0.277	-
03/09/2023	04:00	2.86	19:00	5.18	3.97	05:05	0.94	17:00	2.35	1.86	05:05	0.091	19:00	0.413	0.280	0.280	-
03/10/2023	04:05	2.84	16:20	5.58	4.16	03:50	1.14	11:35	2.22	1.85	03:50	0.106	15:35	0.446	0.298	0.298	0.98
03/11/2023	05:15	3.05	11:45	5.31	4.31	03:05	1.05	08:20	2.14	1.83	03:05	0.121	11:40	0.412	0.306	0.306	0.16
03/12/2023	06:05	3.36	20:00	5.33	4.43	01:25	1.07	20:30	1.97	1.66	03:50	0.141	19:30	0.410	0.290	0.290	-
03/13/2023	03:35	3.23	13:30	5.62	4.33	04:10	1.07	18:30	1.83	1.57	04:10	0.121	13:30	0.380	0.265	0.265	-
03/14/2023	02:55	3.31	20:15	7.24	4.59	03:50	1.01	20:45	1.92	1.53	03:50	0.117	20:35	0.572	0.283	0.283	1.06
03/15/2023	02:10	4.59	20:15	6.77	5.86	08:30	1.59	05:35	1.92	1.76	02:15	0.298	20:15	0.543	0.433	0.433	1.17
03/16/2023	04:55	4.68	07:55	7.13	5.73	02:25	1.55	21:55	1.87	1.74	02:25	0.298	07:55	0.531	0.418	0.418	0.01
03/17/2023	04:10	4.57	08:45	6.20	5.54	00:50	1.48	09:15	1.92	1.74	04:15	0.280	22:40	0.482	0.401	0.401	-
03/18/2023	05:35	4.36	10:10	6.58	5.49	00:35	1.61	14:55	1.99	1.82	05:25	0.281	10:10	0.524	0.415	0.415	-
03/19/2023	03:25	4.32	19:40	6.42	5.44	01:40	1.48	23:45	2.16	1.92	01:40	0.260	19:45	0.567	0.431	0.431	0.02
03/20/2023	04:15	3.92	19:30	6.07	5.07	18:00	1.75	01:00	2.39	2.05	02:35	0.297	18:55	0.534	0.417	0.417	0.19
03/21/2023	04:20	4.04	17:45	7.30	5.59	07:55	1.83	04:10	2.30	2.04	03:10	0.295	18:45	0.627	0.470	0.470	1.59
03/22/2023	03:50	4.63	09:20	7.04	5.78	13:05	1.74	04:20	2.41	2.00	02:35	0.373	09:20	0.635	0.481	0.481	0.22
03/23/2023	04:30	4.59	09:40	7.17	5.71	09:50	1.45	04:10	2.34	1.99	05:10	0.337	09:40	0.636	0.473	0.473	0.04
03/24/2023	04:00	4.43	08:30	6.52	5.60	00:45	1.70	05:00	2.29	1.99	00:45	0.347	08:35	0.563	0.462	0.462	-
03/25/2023	05:00	4.42	12:35	6.72	5.69	07:50	1.86	02:55	2.44	2.06	06:20	0.376	11:40	0.603	0.486	0.486	-
03/26/2023	05:15	4.33	10:20	6.66	5.60	23:15	1.76	04:20	2.43	2.07	06:35	0.357	10:15	0.588	0.477	0.477	-
03/27/2023	04:00	4.13	19:55	6.51	5.42	08:10	1.66	02:45	2.40	2.09	05:50	0.338	21:00	0.577	0.462	0.462	-
03/28/2023	03:35	4.14	20:45	6.34	5.41	19:00	1.77	04:05	2.61	2.15	03:30	0.331	20:45	0.574	0.476	0.476	-
03/29/2023	03:40	4.10	09:30	6.76	5.52	19:15	1.87	02:30	2.54	2.15	04:15	0.344	10:00	0.627	0.485	0.485	0.85
03/30/2023	04:50	4.37	20:00	6.54	5.55	07:25	1.84	01:55	2.49	2.13	04:55	0.380	13:40	0.565	0.486	0.486	0.23
03/31/2023	03:55	4.40	19:25	6.58	5.52	05:30	1.81	02:45	2.47	2.09	05:30	0.311	20:30	0.581	0.473	0.473	-
04/01/2023	05:35	4.28	09:55	6.05	5.13	09:45	1.81	23:40	2.38	2.13	05:15	0.330	19:10	0.523	0.441	0.441	-
04/02/2023	04:45	3.74	10:50	5.93	4.86	18:45	1.78	02:40	2.48	2.13	04:30	0.271	10:30	0.498	0.408	0.408	-
04/03/2023	04:20	3.53	21:55	5.77	4.63	08:45	1.80	16:10	2.42	2.14	04:30	0.244	21:55	0.490	0.387	0.387	-
04/04/2023	03:25	3.48	19:30	6.48	4.75	04:50	1.38	17:15	2.56	2.06	04:50	0.180	19:30	0.570	0.386	0.386	-
04/05/2023	08:35	3.27	08:30	7.43	5.46	08:00	1.16	08:35	3.64	1.96	03:45	0.329	08:30	0.584	0.436	0.436	-
04/06/2023	03:20	4.29	21:05	6.50	5.58	02:55	1.46	20:20	1.98	1.73	02:50	0.247	20:20	0.526	0.403	0.403	-
04/07/2023	03:55	4.48	20:45	6.43	5.72	15:30	1.48	22:55	1.81	1.67	03:55	0.282	22:55	0.484	0.400	0.400	-
04/08/2023	04:45	4.51	09:45	6.73	5.85	04:00	1.33	22:00	1.83	1.67	04:00	0.240	09:45	0.527	0.413	0.413	-
04/09/2023	04:45	4.61	12:15	6.90	5.90	07:30	1.40	21:40	1.88	1.68	05:25	0.264	14:05	0.527	0.419	0.419	-
04/10/2023	04:20	4.43	10:55	6.57	5.58	05:20	1.45	19:50	1.96	1.72	02:35	0.263	18:25	0.506	0.399	0.399	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			15.845	6.75
Average	5.02	1.90	0.386	

MC19A

Site Commentary

SITE INFORMATION

Pipe	Elliptical (8 in H x 8.13 in W)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. Surcharge conditions were experienced throughout March 14 to March 31.

This site is located upstream of site MC19. A normal net flow was recorded between the sites.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	4.70	1.36	0.189
Minimum	1.98	0.81	0.036
Maximum	18.77	1.81	0.394
Min Time	03/04/2023 5:40:00 AM	03/07/2023 2:15:00 AM	03/03/2023 4:00:00 AM
Max Time	03/21/2023 6:25:00 PM	04/08/2023 3:50:00 PM	03/21/2023 6:30:00 PM

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

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

DATA UPTIME

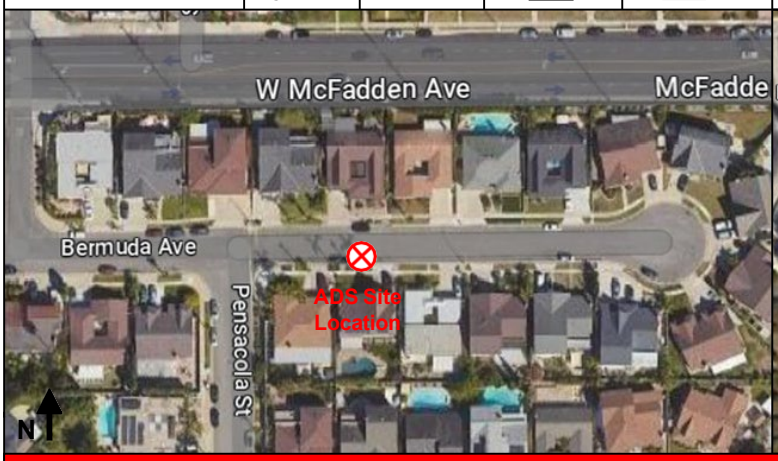
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

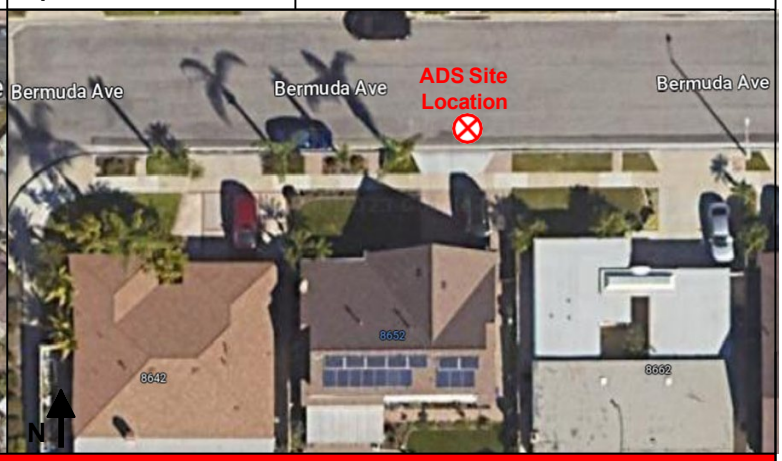
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC19A	**Install Date:** 2/23/2023	**Monitor Type**	Peak Doppler
Address/Location: 8652 Bermuda Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	2950
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	8.13 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 1:31 am
Site Hydraulics:	Good curve flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	3.13 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.62 fps
Silt:	0 Inches

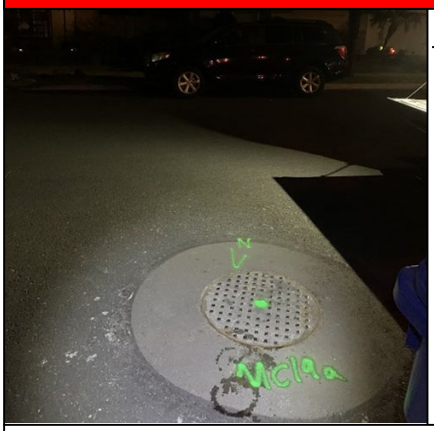
Manhole Information:

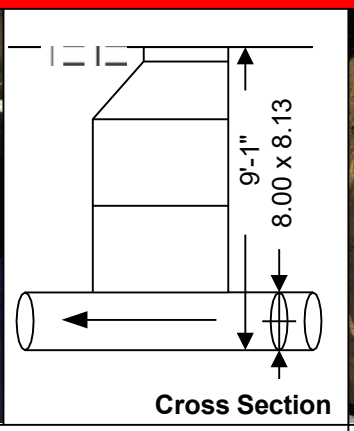
Manhole Depth:	9'-1"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

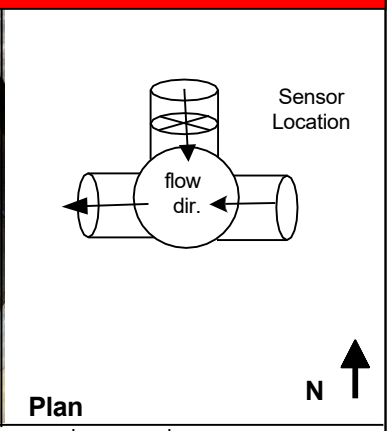
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

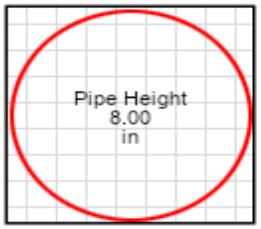
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC19A

Flow Monitor

MC19A

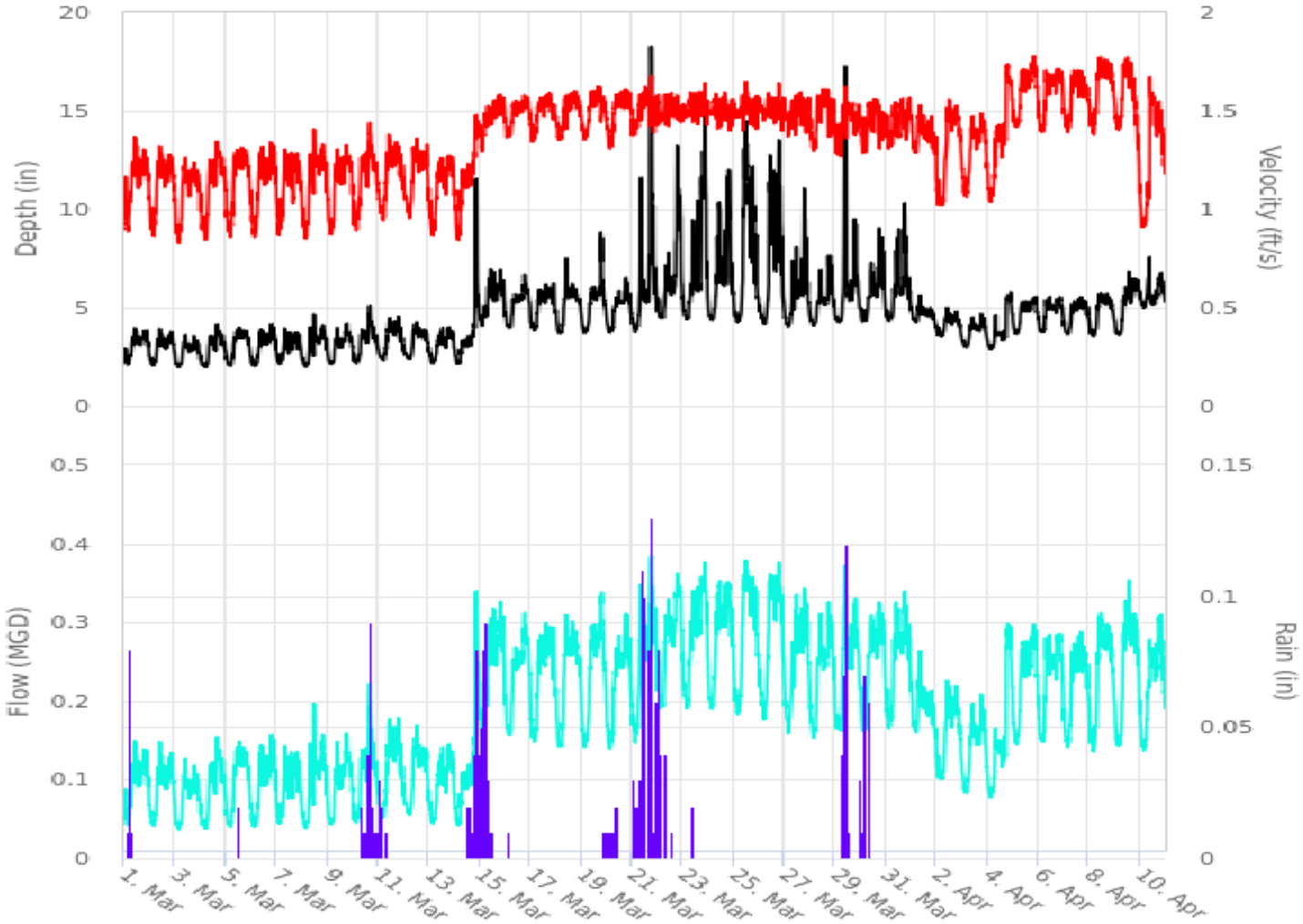


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC19A

Flow Monitor

MC19A

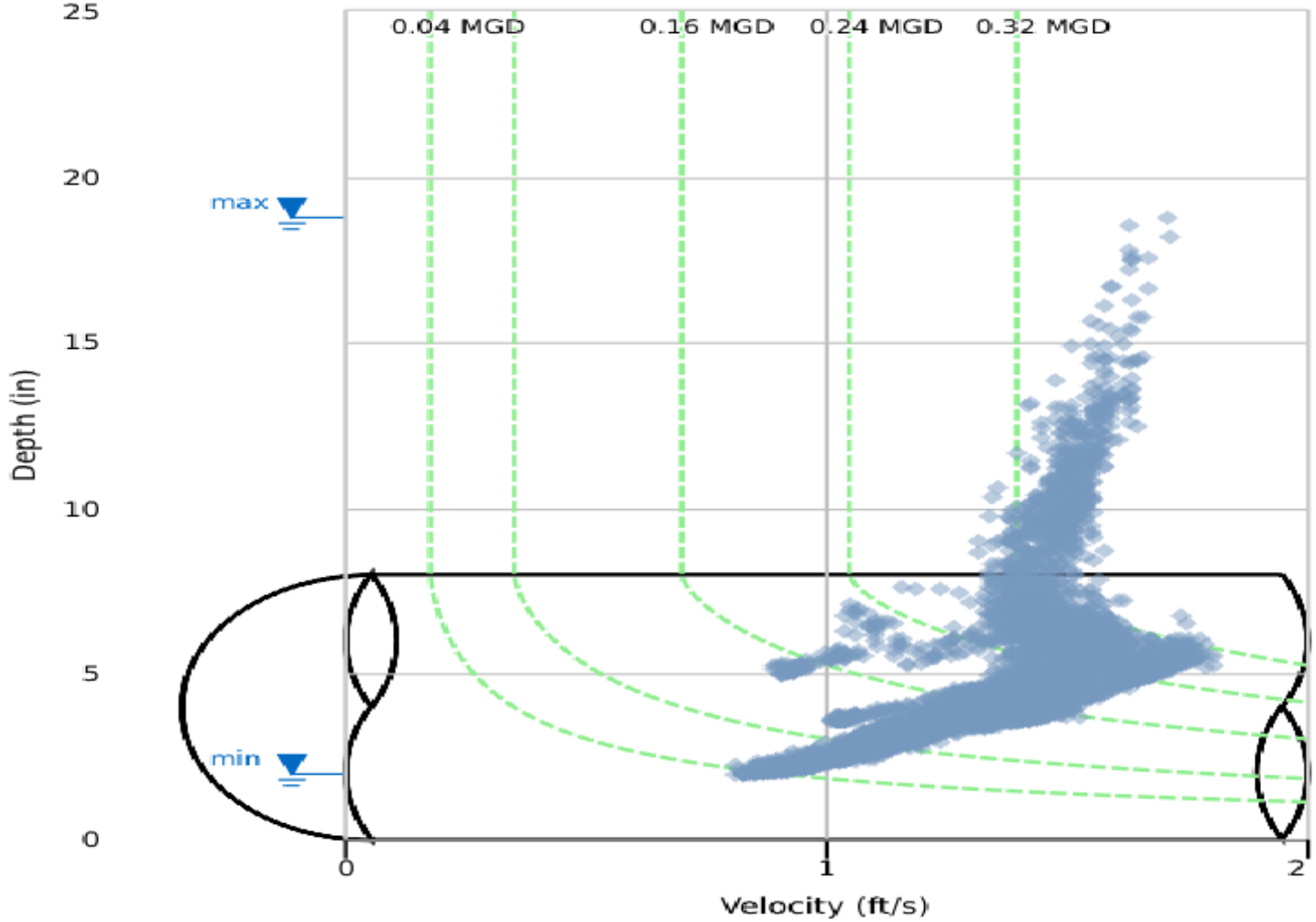
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC19APipe: Elliptical (8 in H x 8.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:55	2.11	10:10	4.06	3.09	03:55	0.87	10:10	1.44	1.15	03:55	0.042	10:10	0.168	0.096	0.096	0.21
03/02/2023	04:15	2.08	09:30	4.22	2.97	04:15	0.85	09:35	1.37	1.13	04:15	0.040	09:35	0.163	0.090	0.090	-
03/03/2023	03:35	1.99	10:15	3.67	2.78	04:00	0.81	10:20	1.31	1.09	04:00	0.036	10:20	0.134	0.079	0.079	-
03/04/2023	05:40	1.98	16:15	4.16	2.97	04:30	0.83	15:15	1.37	1.12	05:35	0.037	16:25	0.158	0.091	0.091	-
03/05/2023	04:55	2.03	13:05	4.39	3.12	04:30	0.84	10:05	1.36	1.15	04:55	0.039	13:05	0.166	0.099	0.099	0.02
03/06/2023	03:15	2.04	19:40	4.30	3.04	03:20	0.85	09:40	1.37	1.13	03:20	0.039	19:45	0.167	0.094	0.094	-
03/07/2023	03:00	2.13	07:55	4.99	3.01	02:15	0.81	08:00	1.38	1.13	02:15	0.042	07:55	0.202	0.091	0.091	-
03/08/2023	03:45	2.00	11:15	5.18	3.07	03:45	0.84	11:15	1.50	1.14	03:45	0.038	11:15	0.236	0.096	0.096	-
03/09/2023	03:30	2.13	18:45	4.25	3.10	03:15	0.87	09:30	1.42	1.13	03:15	0.043	09:30	0.167	0.096	0.096	-
03/10/2023	03:50	2.16	16:15	5.22	3.31	03:30	0.88	15:10	1.51	1.16	03:50	0.044	16:15	0.233	0.108	0.108	0.98
03/11/2023	05:15	2.30	19:00	4.72	3.39	04:45	0.93	10:10	1.45	1.18	05:10	0.051	19:00	0.194	0.112	0.112	0.16
03/12/2023	05:25	2.37	12:25	4.58	3.29	05:40	0.94	12:30	1.48	1.17	05:25	0.055	12:30	0.191	0.106	0.106	-
03/13/2023	04:05	2.18	21:55	4.09	3.14	04:00	0.86	21:50	1.34	1.12	04:00	0.044	21:50	0.156	0.096	0.096	-
03/14/2023	03:55	2.15	20:45	12.27	3.72	03:55	0.82	20:00	1.51	1.15	03:55	0.041	20:45	0.342	0.120	0.120	1.06
03/15/2023	02:00	4.06	09:10	7.85	5.42	02:15	1.27	18:40	1.60	1.48	02:15	0.151	09:10	0.358	0.245	0.245	1.17
03/16/2023	03:55	3.97	18:35	6.69	5.19	01:30	1.33	18:15	1.59	1.49	04:20	0.156	18:35	0.317	0.235	0.235	0.01
03/17/2023	03:30	3.83	15:00	6.31	5.12	03:50	1.29	16:20	1.60	1.49	03:50	0.143	15:05	0.304	0.233	0.233	-
03/18/2023	03:00	3.73	10:00	8.16	5.15	03:00	1.34	15:40	1.64	1.50	03:00	0.140	10:00	0.323	0.234	0.234	-
03/19/2023	03:25	3.69	18:55	9.39	5.22	03:25	1.34	15:35	1.64	1.51	03:25	0.138	18:40	0.353	0.237	0.237	0.02
03/20/2023	03:20	3.72	18:40	6.61	4.97	03:30	1.28	18:00	1.62	1.50	03:30	0.136	20:05	0.313	0.225	0.225	0.19
03/21/2023	03:30	3.69	18:25	18.77	6.45	00:45	1.34	18:30	1.72	1.51	03:25	0.143	18:30	0.394	0.259	0.259	1.59
03/22/2023	03:45	4.46	18:40	13.52	6.73	00:10	1.36	00:50	1.60	1.51	02:35	0.187	18:40	0.367	0.279	0.279	0.22
03/23/2023	04:00	4.42	21:05	15.75	7.16	22:25	1.39	21:05	1.65	1.52	03:35	0.189	21:05	0.378	0.284	0.284	0.04
03/24/2023	03:55	4.35	19:40	12.23	6.72	09:10	1.38	15:35	1.61	1.51	04:00	0.188	15:50	0.362	0.282	0.282	-
03/25/2023	04:15	4.27	11:45	15.16	7.82	09:05	1.36	11:25	1.66	1.52	04:05	0.182	11:25	0.381	0.288	0.288	-
03/26/2023	05:45	4.16	19:00	13.63	7.51	21:50	1.38	18:45	1.65	1.51	05:45	0.176	18:45	0.378	0.286	0.286	-
03/27/2023	03:40	4.02	07:55	11.31	5.79	04:00	1.26	15:35	1.63	1.50	04:00	0.146	11:35	0.358	0.251	0.251	-
03/28/2023	03:25	4.08	18:15	7.96	5.28	03:55	1.29	12:20	1.62	1.48	03:55	0.152	17:45	0.348	0.236	0.236	-
03/29/2023	03:55	4.24	09:40	17.78	6.24	04:20	1.26	09:45	1.64	1.44	04:20	0.158	09:45	0.376	0.249	0.249	0.85
03/30/2023	02:15	4.26	20:40	9.61	5.77	02:25	1.28	13:55	1.58	1.44	02:20	0.160	16:45	0.336	0.250	0.250	0.23
03/31/2023	03:00	4.30	18:05	10.43	5.91	02:50	1.30	16:15	1.58	1.44	03:00	0.163	17:45	0.348	0.252	0.252	-
04/01/2023	23:45	4.00	08:40	5.66	4.67	23:30	1.23	08:40	1.54	1.38	23:45	0.144	08:40	0.267	0.193	0.193	-
04/02/2023	23:55	3.55	10:15	5.11	4.15	01:40	1.01	11:50	1.59	1.31	05:30	0.100	10:25	0.230	0.159	0.159	-
04/03/2023	04:05	2.98	18:20	4.78	3.76	04:25	1.05	18:25	1.54	1.30	04:25	0.082	18:25	0.217	0.140	0.140	-
04/04/2023	03:10	2.87	21:50	6.13	3.91	02:05	1.03	19:15	1.76	1.36	03:10	0.076	21:50	0.313	0.158	0.158	-
04/05/2023	03:55	3.65	21:55	5.63	4.72	02:20	1.41	19:50	1.78	1.61	03:55	0.144	19:55	0.298	0.228	0.228	-
04/06/2023	04:05	3.73	11:10	5.95	4.78	03:55	1.37	17:45	1.74	1.59	03:55	0.144	11:10	0.313	0.229	0.229	-
04/07/2023	04:00	3.64	16:30	5.53	4.71	04:05	1.39	09:35	1.72	1.58	04:05	0.141	16:30	0.289	0.223	0.223	-
04/08/2023	04:00	3.55	11:05	5.94	4.79	04:30	1.36	15:50	1.81	1.62	04:30	0.135	11:10	0.323	0.234	0.234	-
04/09/2023	04:20	3.64	13:55	7.22	5.14	23:55	1.03	12:40	1.81	1.56	04:25	0.142	13:50	0.360	0.242	0.242	-
04/10/2023	04:10	4.97	09:30	7.62	5.72	02:10	0.89	09:50	1.70	1.27	04:10	0.136	20:20	0.316	0.223	0.223	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			7.727	6.75
Average	4.70	1.36	0.188	

MC21

Site Commentary

SITE INFORMATION

Pipe	Round (8 in H)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. Continuous backwater and brief periods of surcharge conditions were experienced at this location.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	7.34	2.16	0.382
Minimum	2.29	1.59	0.166
Maximum	16.11	3.29	0.587
Min Time	03/09/2023 3:00:00 AM	03/20/2023 8:25:00 AM	03/09/2023 2:55:00 AM
Max Time	03/22/2023 10:25:00 AM	03/09/2023 6:10:00 AM	03/15/2023 12:15:00 PM

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

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

DATA UPTIME

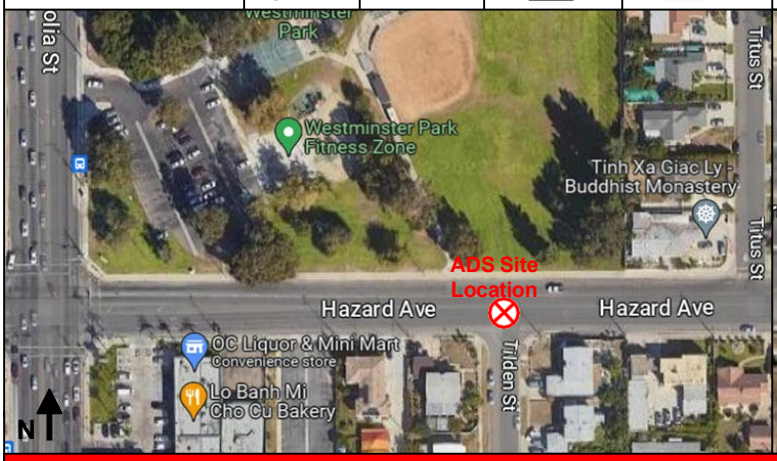
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

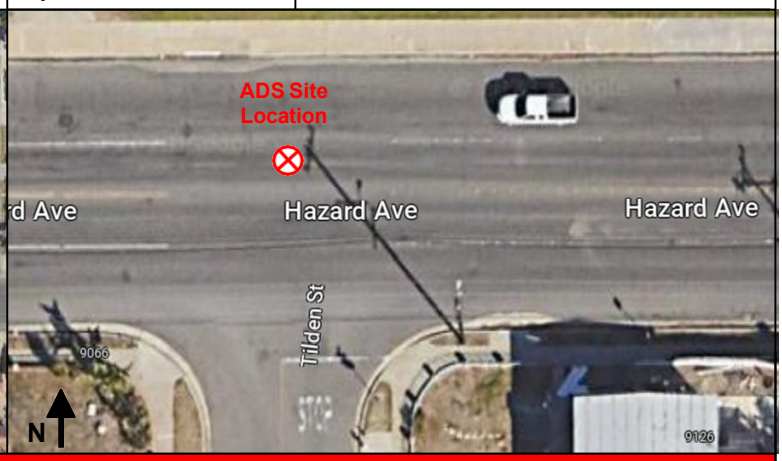
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC21	**Install Date:** 2/23/2023	**Monitor Type**	Peak Doppler
Address/Location: 9039 Hazard Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	3748
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	8.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 2:03 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.38 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	3.09 fps
Silt:	0 Inches

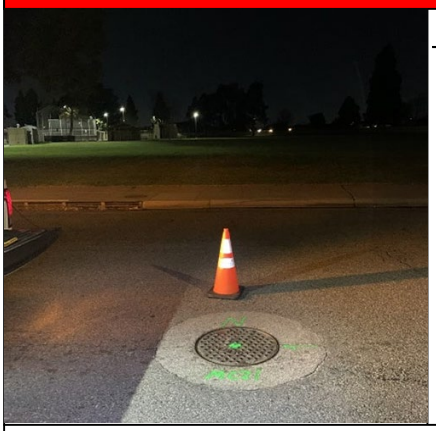
Manhole Information:

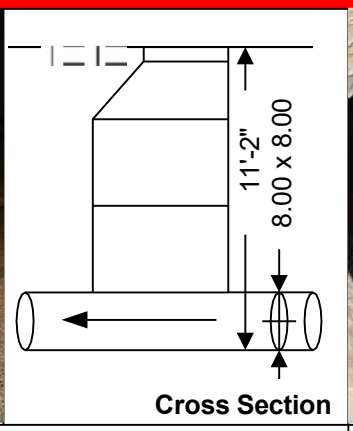
Manhole Depth:	11'-2"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

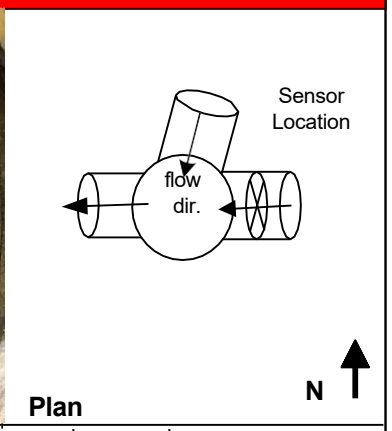
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

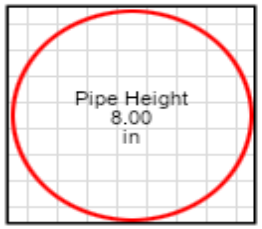
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC21

Flow Monitor

MC21

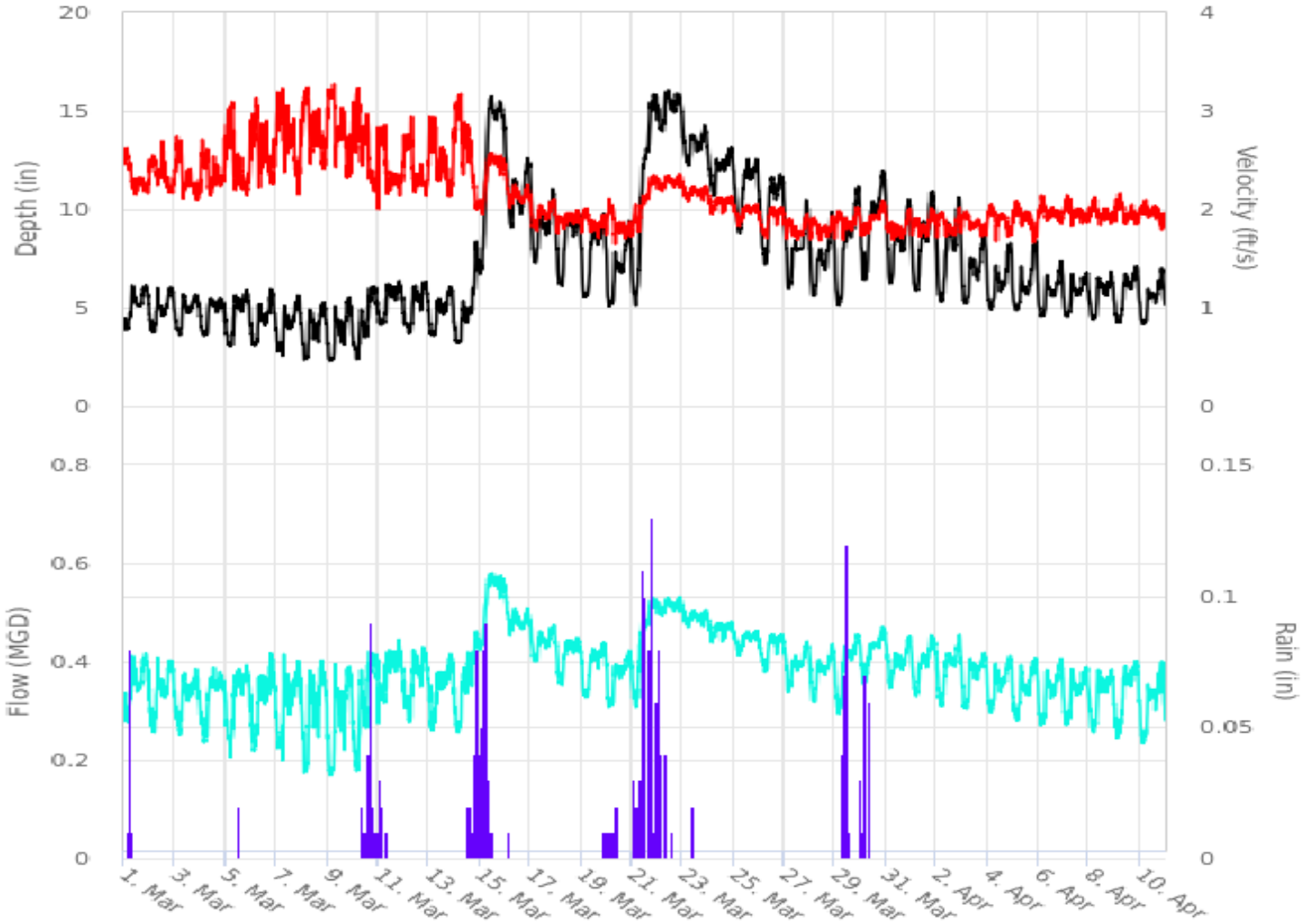


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC21

Flow Monitor

MC21

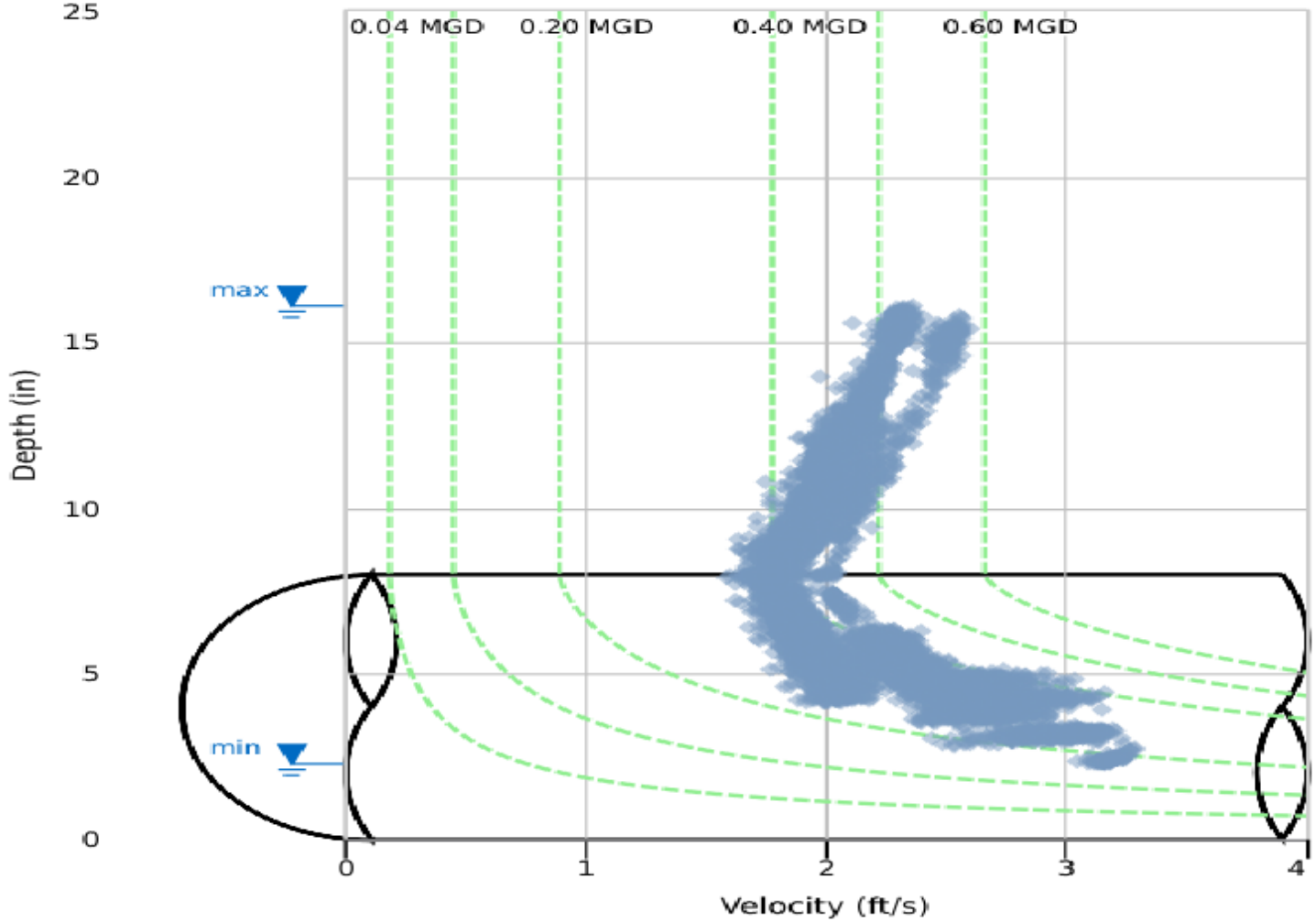
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC21Pipe: Round (8 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	01:30	3.85	20:25	6.16	5.16	11:00	2.09	00:45	2.73	2.33	03:15	0.271	20:25	0.425	0.355	0.355	0.21
03/02/2023	04:40	3.70	07:50	6.08	4.91	19:30	2.13	12:15	2.79	2.36	04:40	0.247	19:05	0.409	0.339	0.339	-
03/03/2023	04:40	3.36	19:55	5.80	4.85	07:55	2.02	02:00	2.78	2.33	04:40	0.231	19:55	0.396	0.329	0.329	-
03/04/2023	03:55	3.54	18:55	5.67	4.74	09:50	2.10	23:30	2.91	2.37	03:55	0.231	12:45	0.420	0.327	0.327	-
03/05/2023	04:10	3.02	20:00	5.94	4.61	20:25	2.07	06:25	3.12	2.50	04:45	0.192	11:15	0.407	0.326	0.326	0.02
03/06/2023	04:10	3.07	18:45	5.99	4.35	07:50	2.17	05:10	3.16	2.62	03:20	0.215	18:45	0.433	0.322	0.322	-
03/07/2023	05:45	2.50	21:00	5.72	4.18	21:05	2.10	05:55	3.26	2.72	05:45	0.192	07:20	0.435	0.319	0.319	-
03/08/2023	02:35	2.33	19:15	5.32	3.90	21:00	2.34	05:45	3.25	2.80	02:20	0.172	18:40	0.415	0.300	0.300	-
03/09/2023	03:00	2.29	20:45	5.68	3.82	18:40	2.21	06:10	3.29	2.81	02:55	0.166	07:15	0.417	0.291	0.291	-
03/10/2023	04:05	2.37	17:40	6.14	4.39	19:25	2.11	05:00	3.24	2.65	04:10	0.177	17:35	0.438	0.324	0.324	0.98
03/11/2023	02:35	4.11	20:00	6.37	5.39	00:30	1.85	03:15	3.00	2.41	00:30	0.250	19:35	0.459	0.383	0.383	0.16
03/12/2023	04:45	3.67	18:25	6.33	5.13	10:40	2.11	07:20	3.00	2.43	04:45	0.269	18:35	0.433	0.364	0.364	-
03/13/2023	04:10	3.26	20:05	6.13	4.83	18:35	2.08	01:10	3.11	2.49	04:10	0.245	20:35	0.426	0.348	0.348	-
03/14/2023	02:35	3.21	20:45	8.57	4.98	21:45	1.96	06:10	3.21	2.59	03:25	0.241	20:50	0.462	0.358	0.358	1.06
03/15/2023	00:20	6.68	11:30	15.80	13.10	03:10	1.92	12:15	2.60	2.39	00:20	0.421	12:15	0.587	0.534	0.534	1.17
03/16/2023	06:05	9.04	00:00	13.77	11.00	05:05	1.97	00:00	2.46	2.16	05:05	0.444	00:00	0.555	0.488	0.488	0.01
03/17/2023	04:40	7.26	00:05	11.25	9.19	06:55	1.76	22:25	2.14	1.96	03:25	0.394	22:25	0.483	0.441	0.441	-
03/18/2023	06:15	6.11	21:05	10.00	8.43	02:05	1.73	00:00	2.00	1.90	06:20	0.349	00:00	0.451	0.414	0.414	-
03/19/2023	02:55	5.45	21:40	10.02	7.84	16:35	1.63	03:00	2.02	1.87	06:15	0.322	21:50	0.440	0.393	0.393	0.02
03/20/2023	02:50	5.04	21:30	9.52	7.08	08:25	1.59	02:55	2.12	1.85	03:35	0.303	21:40	0.429	0.373	0.373	0.19
03/21/2023	04:05	5.08	20:40	15.95	11.14	05:50	1.72	20:45	2.38	2.08	04:05	0.304	20:45	0.537	0.444	0.444	1.59
03/22/2023	05:05	13.91	10:25	16.11	15.13	21:05	2.11	09:20	2.38	2.28	21:05	0.476	09:20	0.537	0.514	0.514	0.22
03/23/2023	05:50	12.14	20:40	14.36	13.29	19:30	1.98	00:00	2.27	2.17	19:30	0.447	00:00	0.512	0.491	0.491	0.04
03/24/2023	05:10	10.66	21:55	13.27	12.10	13:15	1.89	00:30	2.16	2.07	13:15	0.426	00:30	0.487	0.468	0.468	-
03/25/2023	05:55	8.70	21:45	12.69	11.14	05:15	1.80	13:55	2.11	1.97	05:15	0.406	13:55	0.476	0.445	0.445	-
03/26/2023	06:00	7.15	20:15	11.83	10.12	07:40	1.69	11:25	2.04	1.91	05:30	0.371	11:25	0.460	0.429	0.429	-
03/27/2023	03:50	5.95	20:45	10.58	8.12	02:15	1.67	21:50	1.96	1.81	03:15	0.330	21:50	0.442	0.396	0.396	-
03/28/2023	04:00	5.59	21:15	9.95	7.52	10:00	1.60	08:55	1.94	1.81	03:00	0.312	21:40	0.438	0.381	0.381	-
03/29/2023	03:45	5.08	21:50	11.27	8.25	00:15	1.66	21:25	2.07	1.88	03:50	0.287	21:25	0.467	0.393	0.393	0.85
03/30/2023	02:45	6.36	21:25	12.13	9.36	01:35	1.70	21:20	2.10	1.90	02:45	0.348	21:20	0.474	0.422	0.422	0.23
03/31/2023	04:15	6.21	21:55	10.69	8.44	10:35	1.65	22:50	2.01	1.83	04:05	0.339	22:50	0.453	0.402	0.402	-
04/01/2023	04:45	5.83	20:20	11.07	8.42	14:40	1.66	19:05	2.04	1.85	05:15	0.320	19:05	0.460	0.399	0.399	-
04/02/2023	04:50	5.28	20:45	10.94	7.88	00:40	1.68	21:45	2.03	1.85	03:35	0.304	21:45	0.458	0.387	0.387	-
04/03/2023	03:15	5.22	21:15	8.91	6.90	18:45	1.70	04:25	2.00	1.85	05:00	0.302	21:20	0.422	0.372	0.372	-
04/04/2023	03:50	4.85	21:30	8.30	6.37	08:20	1.62	03:55	2.07	1.90	03:05	0.288	21:15	0.413	0.357	0.357	-
04/05/2023	03:20	4.84	21:30	8.48	6.23	19:35	1.64	03:15	2.12	1.90	04:20	0.274	18:55	0.411	0.349	0.349	-
04/06/2023	02:35	4.54	21:45	7.47	5.82	12:10	1.78	03:10	2.18	1.96	02:40	0.264	22:00	0.411	0.341	0.341	-
04/07/2023	03:55	4.50	21:45	6.80	5.73	07:50	1.81	03:25	2.16	1.97	02:05	0.268	21:45	0.394	0.338	0.338	-
04/08/2023	04:40	4.38	20:40	6.91	5.68	10:50	1.73	05:40	2.14	1.96	05:50	0.248	21:05	0.390	0.333	0.333	-
04/09/2023	04:10	4.23	21:25	7.16	5.75	22:00	1.78	02:10	2.22	1.97	02:55	0.236	20:25	0.407	0.337	0.337	-
04/10/2023	04:00	4.17	20:50	7.04	5.44	19:40	1.68	05:50	2.11	1.97	03:10	0.227	20:50	0.404	0.319	0.319	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			15.647	6.75
Average	7.33	2.16	0.382	

MC22A

Site Commentary

SITE INFORMATION

Pipe	Round (12.75 in H)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.83	2.78	0.273
Minimum	1.61	1.12	0.049
Maximum	5.26	3.76	0.691
Min Time	03/07/2023 4:45:00 AM	03/04/2023 4:05:00 AM	03/06/2023 4:10:00 AM
Max Time	03/21/2023 8:30:00 AM	04/09/2023 7:40:00 PM	03/21/2023 8:25:00 AM

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

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

DATA UPTIME

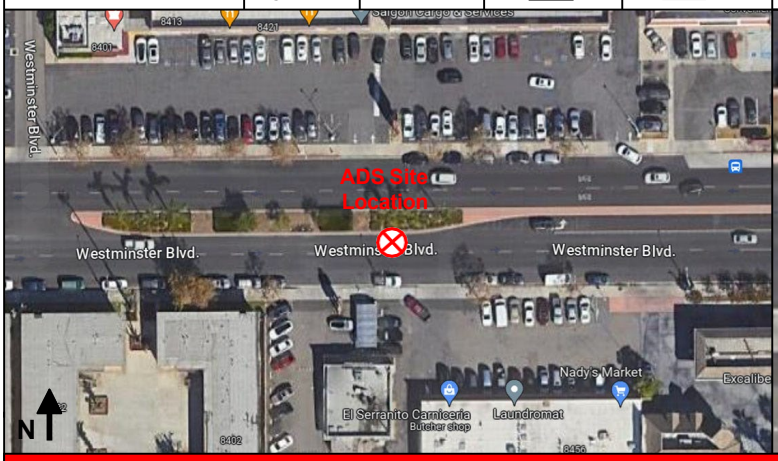
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

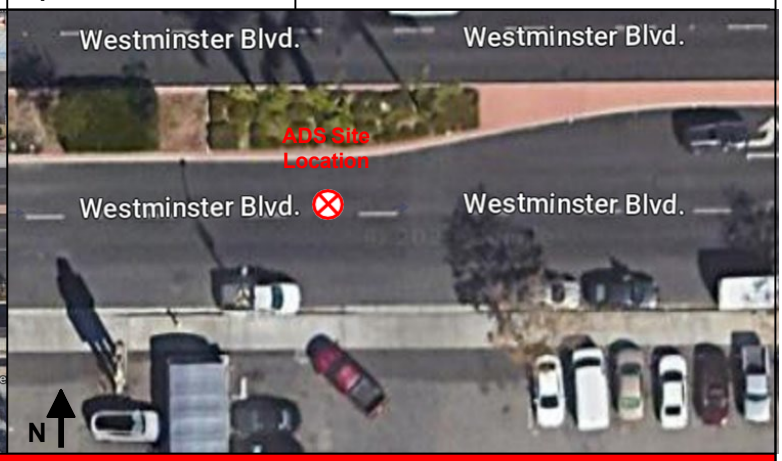
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC22A	**Install Date:** 2/23/2023	**Monitor Type**	Peak Doppler
Address/Location: 8446 Westminster Blvd.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	5196
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.75 "
		Pipe Width:	12.75 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 2:24 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	2.47 fps
Silt:	0 Inches

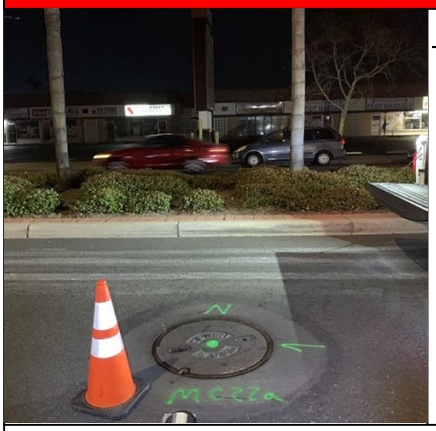
Manhole Information:

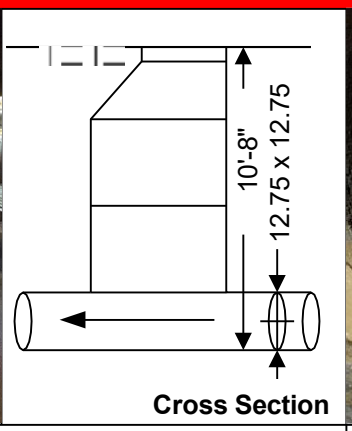
Manhole Depth:	10'-8"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	PVC/Good			
Land Use:	Residential [ ]	Commercial [X]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

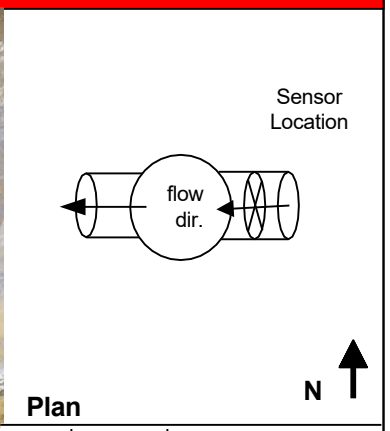
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

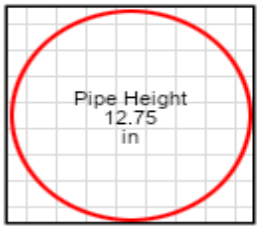
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC22A

Flow Monitor

MC22A

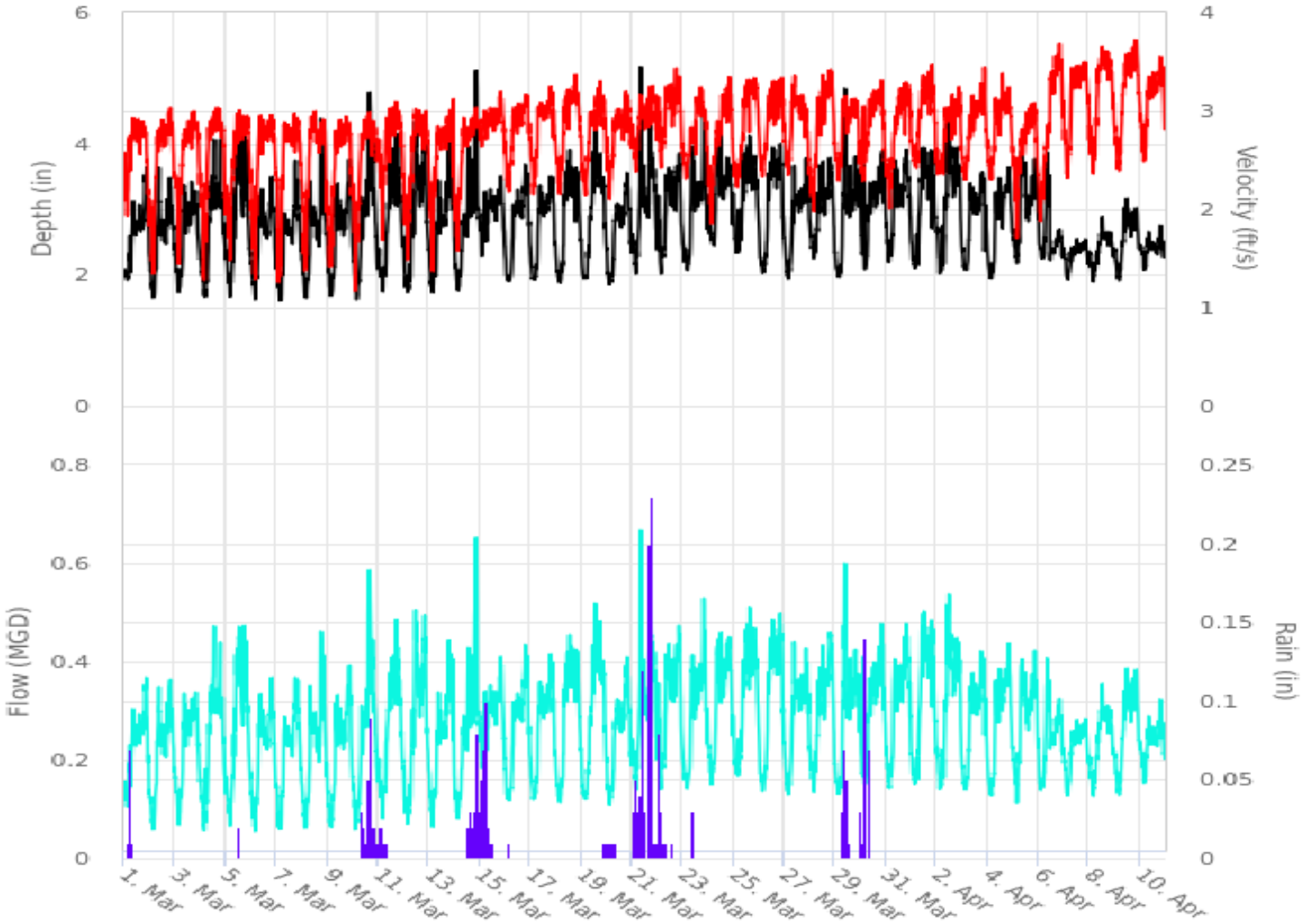


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC22A

Flow Monitor

MC22A

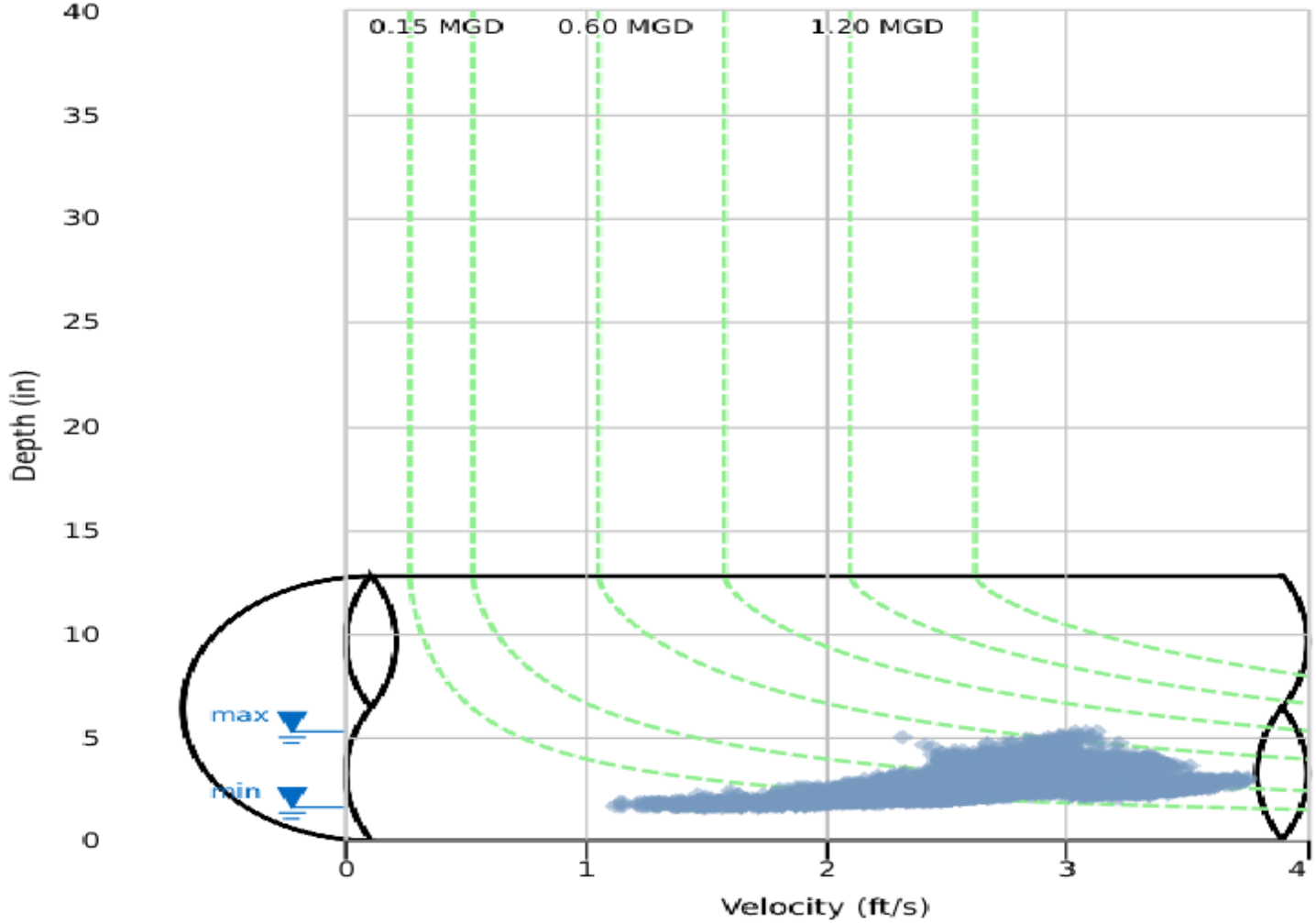
Pipe Height
12.75
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC22APipe: Round (12.75 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:10	1.91	21:15	3.69	2.65	23:40	1.60	08:25	3.06	2.60	03:15	0.102	20:20	0.373	0.229	0.229	0.22
03/02/2023	03:30	1.64	09:05	3.78	2.57	03:30	1.25	19:40	3.08	2.50	03:30	0.054	16:55	0.394	0.217	0.217	-
03/03/2023	03:25	1.71	15:40	3.70	2.62	03:35	1.35	18:15	3.07	2.56	03:35	0.063	19:50	0.387	0.226	0.226	-
03/04/2023	04:00	1.64	19:00	4.29	2.74	04:05	1.12	13:05	3.21	2.55	04:05	0.049	13:05	0.539	0.245	0.245	-
03/05/2023	04:15	1.66	19:40	4.35	2.93	04:00	1.29	13:15	3.04	2.54	04:00	0.060	19:35	0.487	0.269	0.269	0.04
03/06/2023	04:05	1.62	10:30	3.67	2.56	04:10	1.15	09:05	3.02	2.52	04:10	0.049	19:40	0.401	0.217	0.217	-
03/07/2023	03:30	1.61	18:10	3.96	2.56	02:05	1.22	17:20	3.00	2.52	03:20	0.055	19:00	0.414	0.217	0.217	-
03/08/2023	04:15	1.63	17:45	4.64	2.61	02:50	1.34	17:40	3.09	2.50	04:15	0.059	17:40	0.479	0.221	0.221	-
03/09/2023	03:05	1.67	20:55	3.77	2.65	03:10	1.29	18:10	2.96	2.47	03:10	0.058	21:10	0.395	0.223	0.223	-
03/10/2023	03:35	1.62	15:50	4.79	2.83	02:15	1.14	15:55	3.06	2.51	02:15	0.058	15:55	0.600	0.255	0.255	0.90
03/11/2023	04:55	1.72	17:20	4.50	2.85	04:55	1.53	17:20	3.21	2.69	04:55	0.071	17:20	0.581	0.268	0.268	0.14
03/12/2023	03:50	1.73	19:30	4.49	2.94	03:55	1.42	11:40	3.09	2.55	03:55	0.066	11:40	0.537	0.272	0.272	-
03/13/2023	03:50	1.72	18:55	4.27	2.74	03:45	1.32	23:15	3.21	2.54	03:45	0.062	18:55	0.470	0.240	0.240	-
03/14/2023	03:40	1.75	20:30	5.12	2.87	03:20	1.39	20:40	3.10	2.58	03:20	0.071	20:40	0.664	0.264	0.264	1.01
03/15/2023	02:20	2.27	10:15	3.80	2.99	02:00	2.59	20:10	3.22	2.91	02:00	0.182	10:15	0.430	0.299	0.299	1.01
03/16/2023	04:15	1.90	19:10	4.01	2.77	03:40	2.11	19:20	3.20	2.80	03:40	0.114	19:10	0.488	0.265	0.265	0.02
03/17/2023	04:25	1.91	19:10	3.55	2.77	02:55	2.10	19:15	3.30	2.84	02:55	0.117	19:15	0.423	0.269	0.269	-
03/18/2023	04:25	1.84	13:15	4.02	2.91	04:25	2.11	18:50	3.43	2.87	04:25	0.108	13:20	0.479	0.296	0.296	-
03/19/2023	03:05	1.94	13:40	4.62	2.94	04:35	2.08	17:10	3.33	2.81	04:35	0.118	13:35	0.531	0.293	0.293	0.02
03/20/2023	03:20	1.85	19:40	3.70	2.70	03:15	2.07	18:30	3.22	2.77	03:20	0.107	19:45	0.419	0.253	0.253	0.09
03/21/2023	04:10	2.01	08:30	5.26	3.10	17:40	2.32	19:55	3.32	2.90	04:05	0.137	08:25	0.691	0.322	0.322	1.59
03/22/2023	03:30	2.01	20:45	3.87	3.04	03:35	2.41	17:50	3.49	3.00	03:35	0.140	20:20	0.484	0.320	0.320	0.15
03/23/2023	04:05	2.06	19:55	4.47	3.04	02:50	2.28	16:50	3.30	2.78	04:05	0.139	19:55	0.543	0.300	0.300	0.05
03/24/2023	04:55	2.43	09:20	4.22	3.22	03:15	1.81	20:20	3.37	2.77	03:15	0.147	09:15	0.474	0.322	0.322	-
03/25/2023	02:40	2.32	12:55	4.29	3.19	03:40	2.17	19:30	3.45	2.90	02:40	0.165	15:10	0.541	0.335	0.335	-
03/26/2023	03:30	2.03	14:30	4.20	3.09	04:00	2.29	21:45	3.40	2.93	04:00	0.136	20:15	0.510	0.326	0.326	-
03/27/2023	03:40	1.94	20:25	3.99	2.88	04:10	2.26	09:45	3.40	2.89	03:45	0.126	09:20	0.466	0.287	0.287	-
03/28/2023	03:35	2.23	19:15	3.95	3.01	04:10	1.80	19:50	3.51	2.89	04:10	0.123	19:10	0.492	0.307	0.307	-
03/29/2023	03:00	1.97	09:25	4.89	2.95	03:30	2.24	09:40	3.20	2.83	03:30	0.129	09:35	0.613	0.294	0.294	0.56
03/30/2023	04:20	2.08	21:05	4.00	3.04	02:35	2.26	20:00	3.35	2.89	04:25	0.150	20:10	0.487	0.309	0.309	0.30
03/31/2023	03:20	2.17	08:15	4.24	3.09	03:45	1.86	17:40	3.38	2.84	03:45	0.133	19:40	0.485	0.313	0.313	-
04/01/2023	04:00	2.09	13:05	4.04	3.10	05:15	2.36	19:50	3.53	2.97	03:35	0.149	12:10	0.518	0.331	0.331	-
04/02/2023	03:05	2.01	12:05	4.60	3.13	06:55	2.20	14:20	3.30	2.82	03:00	0.138	11:20	0.554	0.317	0.317	-
04/03/2023	04:00	2.06	08:00	3.77	2.86	03:35	2.25	21:45	3.49	2.85	03:35	0.136	21:25	0.435	0.281	0.281	-
04/04/2023	03:30	1.94	11:45	3.69	2.84	04:20	2.26	14:20	3.43	2.85	04:20	0.125	20:20	0.441	0.279	0.279	-
04/05/2023	04:05	2.17	07:55	4.06	3.06	04:00	1.47	09:00	3.13	2.66	04:00	0.097	11:45	0.457	0.287	0.287	-
04/06/2023	11:25	2.05	10:55	4.39	2.62	02:30	1.60	20:20	3.70	2.92	02:30	0.118	10:55	0.503	0.248	0.248	-
04/07/2023	03:55	1.93	12:50	2.57	2.31	03:10	2.29	12:45	3.56	3.12	03:50	0.127	12:45	0.292	0.223	0.223	-
04/08/2023	04:20	1.89	12:40	2.97	2.40	04:10	2.26	12:30	3.72	3.18	04:10	0.123	12:40	0.363	0.242	0.242	-
04/09/2023	04:25	1.91	12:05	3.62	2.57	04:30	2.36	19:40	3.76	3.18	04:35	0.128	12:05	0.465	0.269	0.269	-
04/10/2023	04:30	2.06	19:20	2.85	2.40	04:00	2.39	19:40	3.65	3.12	04:00	0.151	19:20	0.337	0.235	0.235	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			11.187	6.10
Average	2.83	2.78	0.273	

MC22B

Site Commentary

SITE INFORMATION

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

OBSERVATIONS

This site operates at surcharge conditions most of the day. Poor hydraulic conditions delayed installation of this location until March 9.

This site is located downstream of site MC22A. A normal net flow was recorded between the sites.

5-min flow depth, velocity, and quantity data observed during **Thursday, 09 March 2023 to Thursday, 13 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	12.40	2.33	1.174
Minimum	9.86	0.81	0.409
Maximum	20.16	4.71	2.391
Min Time	03/10/2023 4:50:00 AM	03/28/2023 6:00:00 AM	03/28/2023 6:00:00 AM
Max Time	03/28/2023 5:25:00 AM	03/14/2023 8:50:00 PM	03/14/2023 8:50:00 PM

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

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

DATA UPTIME

Downtime from March 21 through March 27 due to heavy debris pushed ring and sensor further in the pipe.

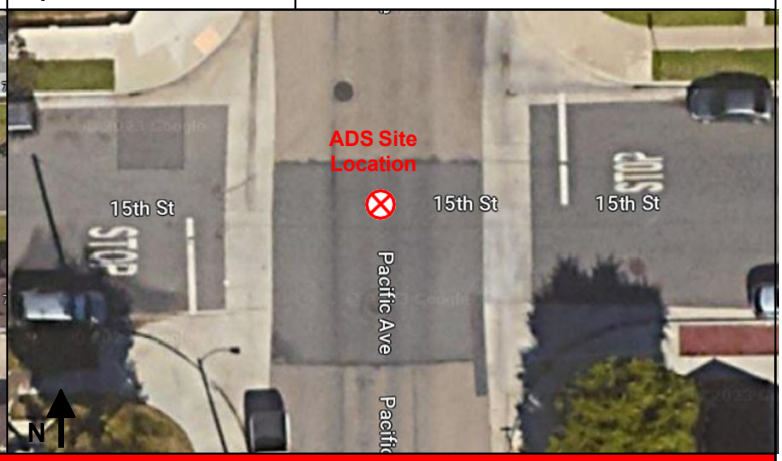
Data uptime observed during **Thursday, 09 March 2023 to Thursday, 13 April 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	80.035
VFINAL (ft/s)	80.035
QFINAL (MGD - Total MG)	80.035

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC22B	**Install Date:** 3/09/2023	**Monitor Type**	Peak Doppler
Address/Location: 7852 15th St.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	4-08
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.00 "
		Pipe Width:	12.00 "



Investigation Information:

Date/Time of Investigation:	03/09/2023 @ 8:00 am
Site Hydraulics:	Bad flow with heavy debris
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	11.63" +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	2.08 fps
Silt:	0 Inches

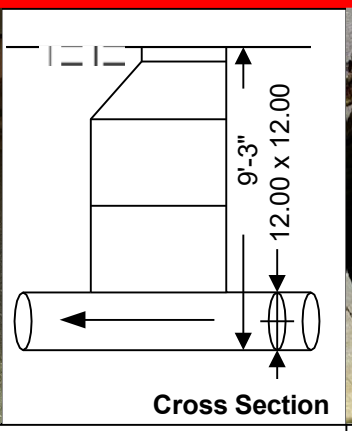
Manhole Information:

Manhole Depth:	9'-3"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	PVC/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

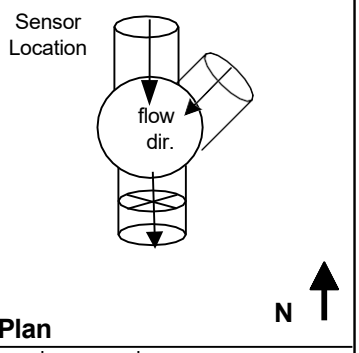
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Outlet
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

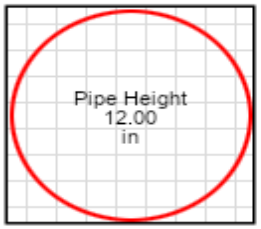
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC22B

Flow Monitor

MC22B

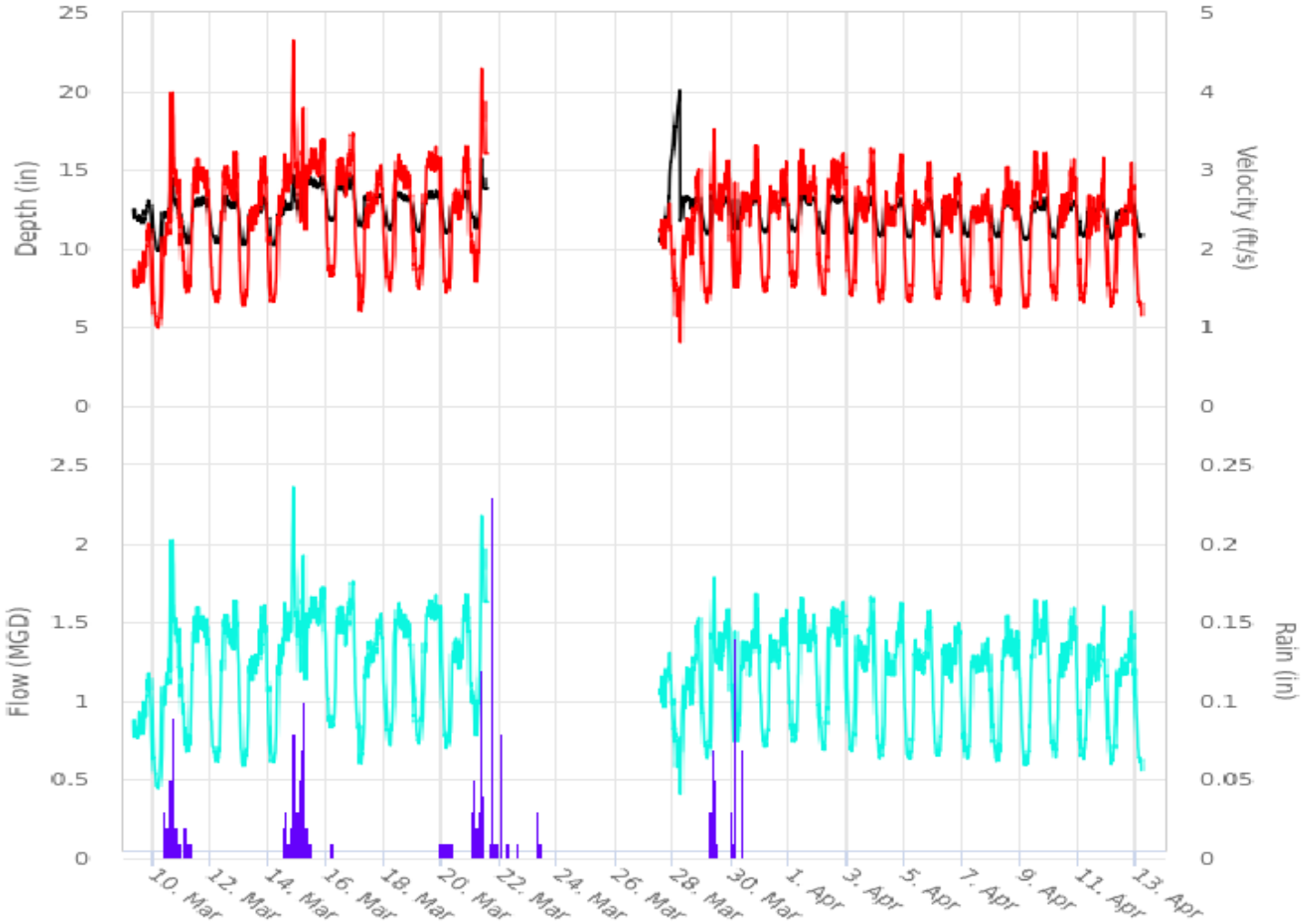


Report Period

03/09/2023
To
04/13/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC22B

Flow Monitor

MC22B

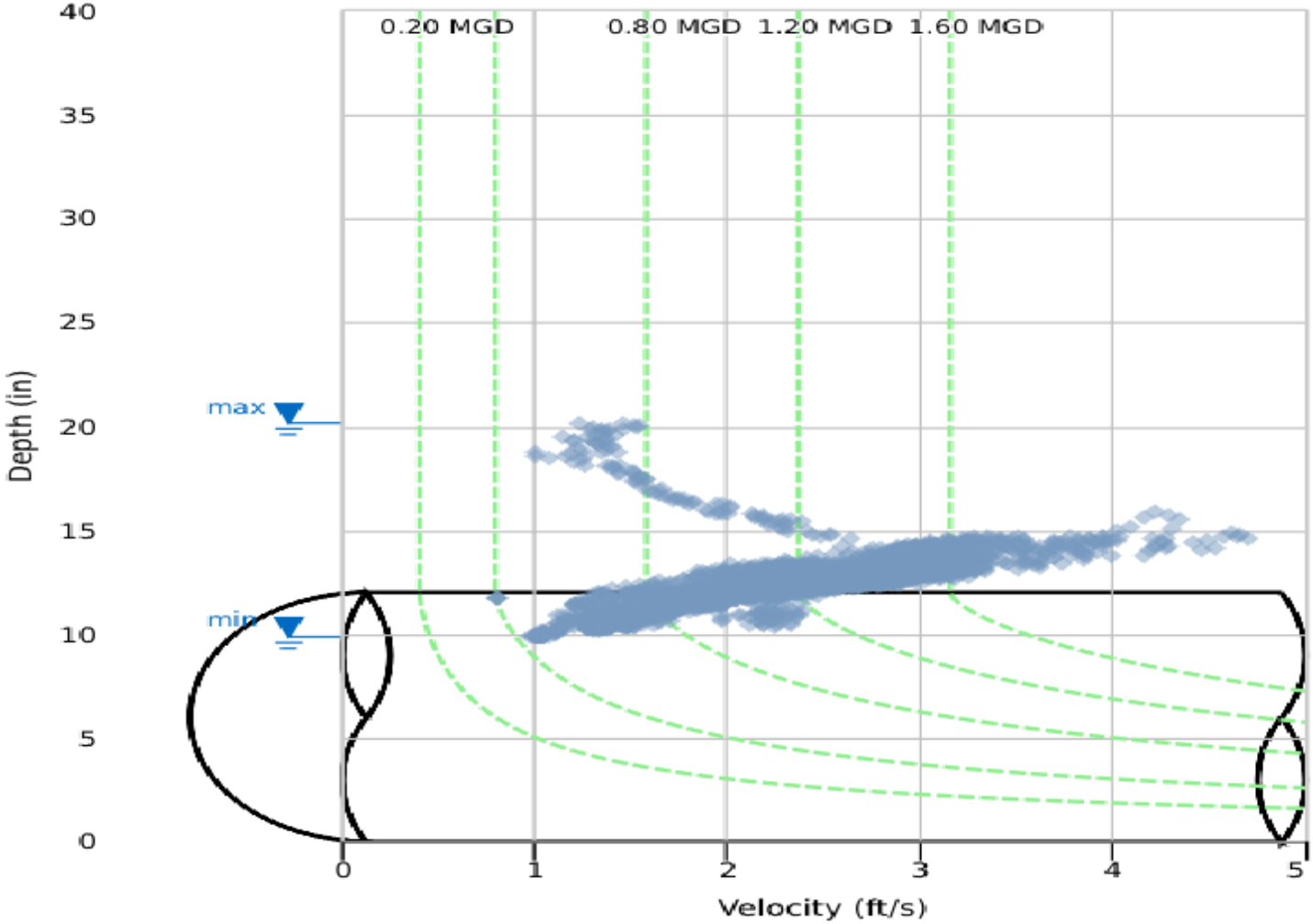
Pipe Height
12.00
in

Report Period

03/09/2023
To
04/13/2023

Legend

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



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Daily Tabular Report

03/09/2023 00:00 - 04/13/2023 23:59
MC22BPipe: Round (12 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/09/2023	23:55	11.13	20:40	13.15	12.14	23:55	1.37	19:50	2.35	1.81	23:55	0.673	19:50	1.193	0.916	0.595	-
03/10/2023	04:30	9.86	15:40	14.68	11.91	04:35	0.97	15:45	4.02	2.15	04:35	0.433	15:45	2.041	1.074	1.074	0.90
03/11/2023	04:50	10.32	17:30	13.35	12.15	04:10	1.43	13:10	3.18	2.42	04:10	0.671	13:10	1.614	1.214	1.214	0.14
03/12/2023	05:35	10.33	20:30	13.70	12.09	05:20	1.31	20:30	3.35	2.32	05:35	0.609	20:30	1.701	1.166	1.166	-
03/13/2023	03:30	10.22	20:35	13.34	11.87	02:55	1.27	20:35	3.21	2.23	03:35	0.585	20:35	1.629	1.117	1.117	-
03/14/2023	04:25	10.20	20:40	14.88	12.10	02:55	1.30	20:50	4.71	2.54	02:55	0.599	20:50	2.391	1.274	1.274	1.01
03/15/2023	02:20	11.95	20:00	14.65	13.77	06:35	2.18	05:15	3.95	2.98	06:35	1.107	05:15	2.005	1.511	1.511	1.01
03/16/2023	03:20	11.78	20:55	14.67	13.31	02:55	1.62	21:00	3.54	2.62	04:55	0.820	21:00	1.797	1.328	1.328	0.02
03/17/2023	04:15	11.40	19:05	13.62	12.75	04:15	1.20	20:40	3.09	2.30	04:15	0.598	20:40	1.569	1.167	1.167	-
03/18/2023	04:50	11.16	12:00	13.70	12.65	04:55	1.43	12:00	3.25	2.47	04:55	0.704	12:00	1.650	1.250	1.250	-
03/19/2023	05:00	11.05	18:50	13.74	12.61	04:50	1.48	15:30	3.31	2.54	05:00	0.724	15:30	1.680	1.282	1.282	0.02
03/20/2023	03:25	10.96	20:30	13.76	12.42	03:35	1.41	20:05	3.39	2.37	03:35	0.686	20:05	1.721	1.199	1.199	0.09
03/21/2023	04:10	11.27	08:45	15.90	12.76	04:00	1.57	08:55	4.35	2.56	04:00	0.778	08:55	2.208	1.298	0.626	1.59
03/22/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.15
03/23/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05
03/24/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/25/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/26/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/27/2023	12:45	10.38	23:55	16.52	12.73	23:50	1.71	20:25	2.66	2.23	23:50	0.868	20:25	1.350	1.110	0.555	-
03/28/2023	05:40	10.64	05:25	20.16	14.20	05:45	0.81	21:20	3.06	2.03	05:45	0.409	21:20	1.553	1.030	1.030	-
03/29/2023	04:05	10.90	09:35	14.32	12.46	04:10	1.30	09:40	3.56	2.34	04:10	0.630	09:40	1.807	1.180	1.180	0.56
03/30/2023	02:35	11.19	20:30	13.77	12.52	02:35	1.49	20:25	3.35	2.39	02:35	0.734	20:25	1.701	1.208	1.208	0.30
03/31/2023	04:05	11.01	21:10	13.49	12.35	04:00	1.44	21:20	3.17	2.35	04:00	0.703	21:20	1.609	1.185	1.185	-
04/01/2023	04:25	11.06	10:35	13.67	12.49	03:50	1.48	10:35	3.36	2.43	03:50	0.727	10:35	1.706	1.229	1.229	-
04/02/2023	04:45	10.97	13:40	13.40	12.46	05:35	1.38	20:00	3.33	2.47	05:35	0.672	20:00	1.690	1.246	1.246	-
04/03/2023	03:55	10.98	20:20	13.36	12.23	04:00	1.37	20:15	3.32	2.32	04:00	0.667	20:15	1.685	1.171	1.171	-
04/04/2023	04:25	10.80	21:15	13.24	12.16	03:30	1.31	21:20	3.28	2.25	03:30	0.632	21:20	1.665	1.134	1.134	-
04/05/2023	04:20	10.72	20:55	13.29	12.15	04:15	1.32	20:50	3.15	2.22	04:20	0.632	20:50	1.599	1.118	1.118	-
04/06/2023	04:15	10.74	20:35	13.14	12.12	03:15	1.35	19:15	3.01	2.24	04:05	0.647	19:15	1.528	1.127	1.127	-
04/07/2023	04:35	10.76	20:10	12.80	12.01	03:00	1.28	20:55	2.81	2.18	03:00	0.618	20:55	1.426	1.097	1.097	-
04/08/2023	04:20	10.72	13:05	13.09	12.07	04:20	1.26	12:55	3.07	2.24	04:20	0.603	12:55	1.558	1.128	1.128	-
04/09/2023	04:05	10.57	21:05	13.31	12.03	03:40	1.23	12:20	3.28	2.33	03:40	0.584	12:20	1.665	1.171	1.171	-
04/10/2023	04:55	10.65	19:50	13.15	12.00	05:00	1.32	20:10	3.20	2.27	05:00	0.629	20:10	1.624	1.145	1.145	-
04/11/2023	04:15	10.74	20:50	13.14	12.05	03:30	1.31	21:10	3.17	2.16	04:15	0.628	21:10	1.609	1.088	1.088	-
04/12/2023	03:10	10.61	20:50	12.90	11.97	03:20	1.24	20:35	3.14	2.12	03:20	0.589	20:35	1.594	1.068	1.068	-
04/13/2023	03:35	10.72	00:00	11.81	11.06	04:45	1.12	00:10	1.82	1.40	04:45	0.542	00:10	0.920	0.685	0.143	-

03/09/2023 00:00 - 04/13/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			33.828	5.84
Average	12.40	2.33	1.173	

MC23

Site Commentary

SITE INFORMATION

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

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	5.35	1.40	0.360
Minimum	3.76	1.02	0.164
Maximum	8.25	1.83	0.807
Min Time	03/09/2023 4:05:00 AM	03/06/2023 5:25:00 AM	03/09/2023 3:25:00 AM
Max Time	03/24/2023 12:40:00 PM	03/24/2023 1:00:00 PM	03/24/2023 1:00:00 PM

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

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

DATA UPTIME

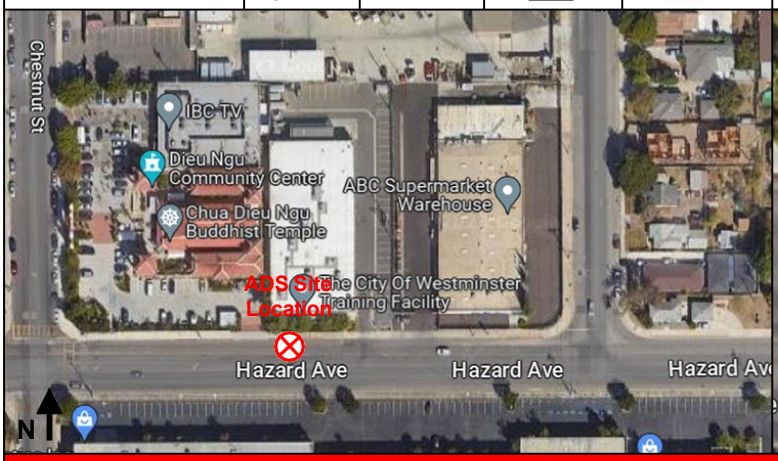
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

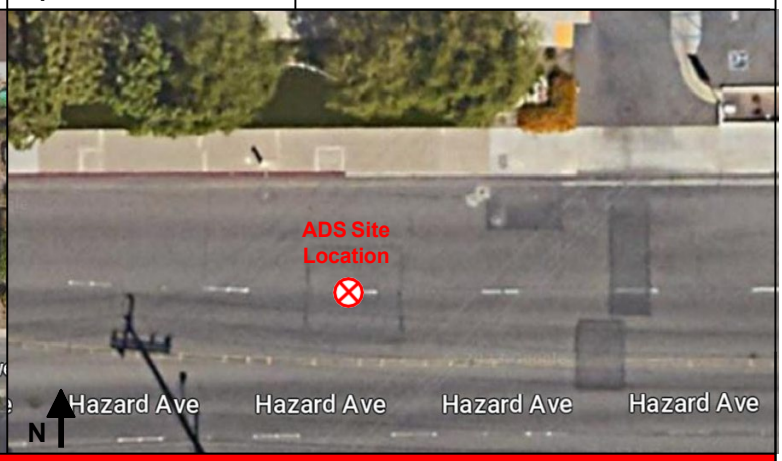
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC23	**Install Date:** 3/01/2023	**Monitor Type**	Peak Doppler
Address/Location: 7351 Hazard Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	1944
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	15.00 "
		Pipe Width:	15.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 2:51 am
Site Hydraulics:	Good slow straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	4.50 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.10 fps
Silt:	0 Inches

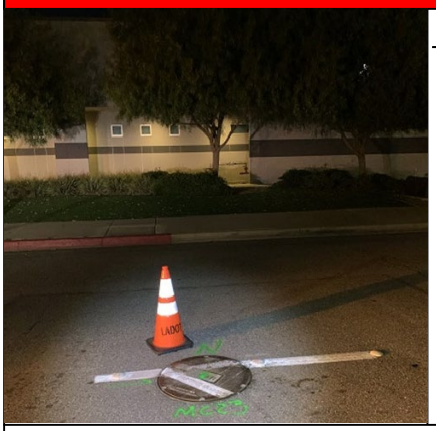
Manhole Information:

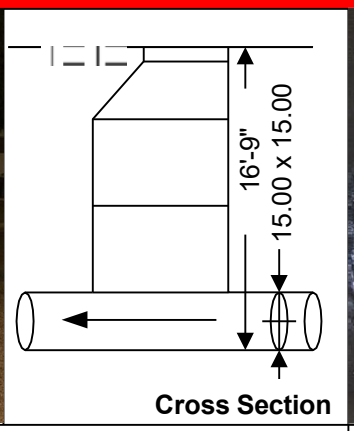
Manhole Depth:	16'-9"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [ ]	Commercial [X]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

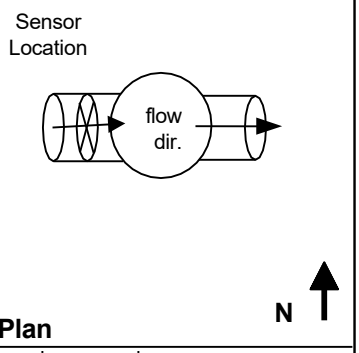
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

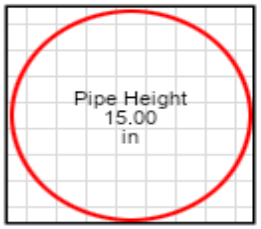
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC23

Flow Monitor

MC23

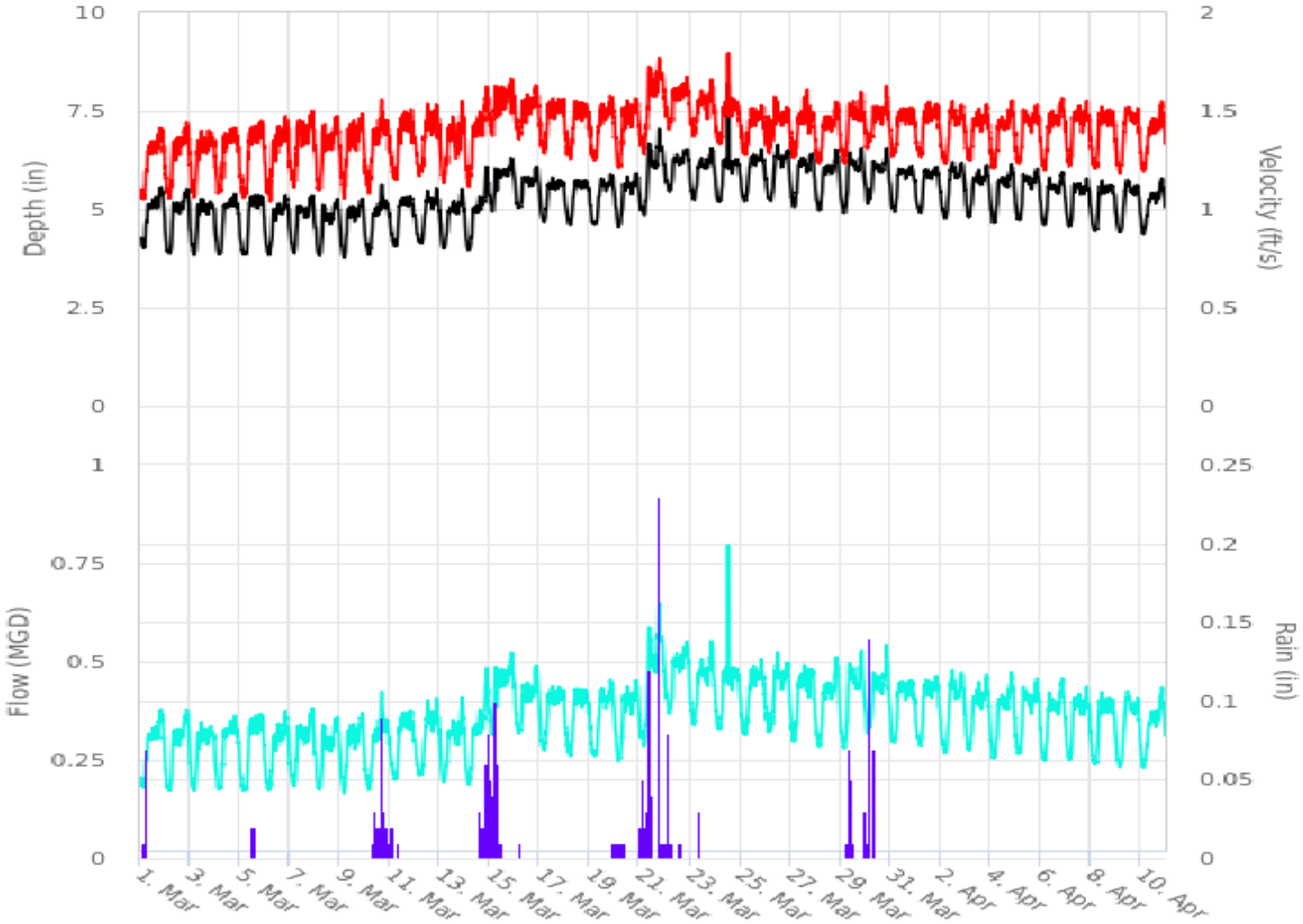


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC23

Flow Monitor

MC23

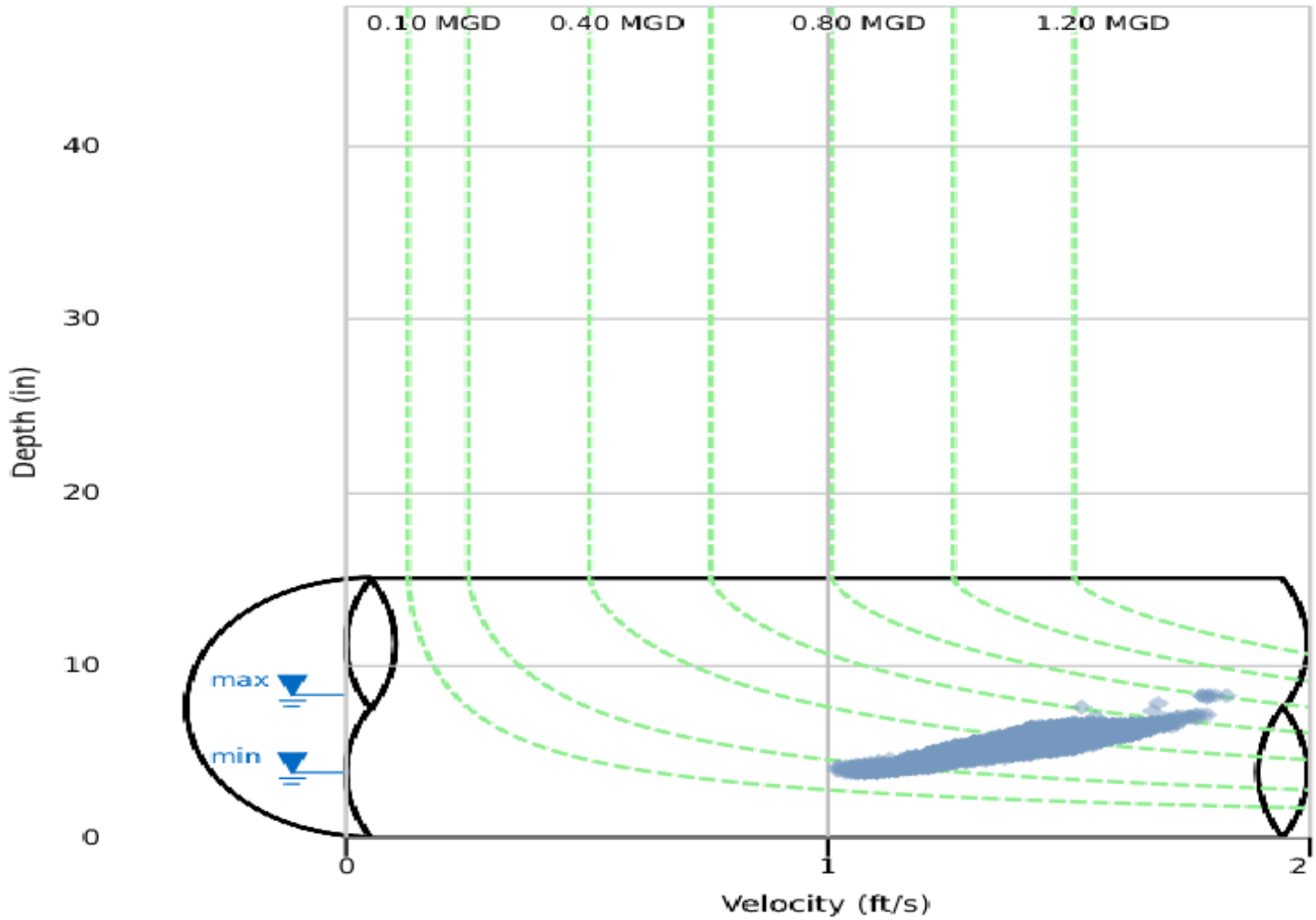
Pipe Height
15.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC23Pipe: Elliptical (15 in H x 15 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:55	4.01	20:25	5.58	4.96	02:05	1.04	18:55	1.49	1.28	03:50	0.178	19:35	0.381	0.295	0.276	0.22
03/02/2023	04:40	3.87	21:10	5.53	4.82	03:45	1.02	22:05	1.52	1.28	03:45	0.168	22:05	0.387	0.286	0.286	-
03/03/2023	03:55	3.84	11:05	5.27	4.77	03:30	1.05	11:05	1.46	1.27	03:50	0.170	11:05	0.363	0.280	0.280	-
03/04/2023	03:35	3.86	19:25	5.40	4.76	02:50	1.06	18:45	1.45	1.28	03:50	0.174	19:25	0.373	0.282	0.282	-
03/05/2023	03:45	3.85	14:50	5.38	4.76	03:40	1.03	17:00	1.46	1.29	03:40	0.166	18:40	0.372	0.285	0.285	0.04
03/06/2023	03:40	3.84	20:00	5.37	4.72	05:25	1.02	20:00	1.49	1.30	02:45	0.171	20:00	0.380	0.281	0.281	-
03/07/2023	04:30	3.87	21:20	5.37	4.75	04:00	1.06	21:20	1.53	1.33	04:00	0.176	21:20	0.390	0.291	0.291	-
03/08/2023	04:30	3.82	21:55	5.30	4.68	04:00	1.08	19:00	1.51	1.31	04:30	0.173	19:00	0.366	0.280	0.280	-
03/09/2023	04:05	3.76	21:10	5.30	4.68	03:25	1.04	19:30	1.52	1.32	03:25	0.164	21:10	0.378	0.281	0.281	-
03/10/2023	03:55	3.84	16:05	5.63	4.77	03:55	1.06	16:05	1.57	1.34	03:55	0.170	16:05	0.427	0.294	0.294	0.90
03/11/2023	04:35	4.06	15:10	5.35	4.85	06:05	1.13	12:25	1.53	1.36	04:35	0.198	19:30	0.384	0.305	0.305	0.14
03/12/2023	06:00	4.13	20:30	5.53	4.88	04:30	1.12	12:00	1.56	1.37	04:30	0.202	20:30	0.412	0.310	0.310	-
03/13/2023	03:15	4.01	21:00	5.53	4.82	03:25	1.11	21:00	1.57	1.34	03:25	0.189	21:00	0.417	0.297	0.297	-
03/14/2023	03:30	3.94	20:50	6.08	4.92	03:50	1.11	20:55	1.64	1.38	03:50	0.186	20:55	0.495	0.318	0.318	1.01
03/15/2023	02:40	4.94	20:20	6.30	5.77	01:30	1.35	20:10	1.67	1.55	02:30	0.310	20:30	0.527	0.439	0.439	1.01
03/16/2023	03:25	5.02	20:55	6.11	5.59	04:00	1.34	19:45	1.64	1.50	04:00	0.315	20:55	0.495	0.407	0.407	0.02
03/17/2023	04:05	4.67	12:05	5.82	5.40	05:50	1.24	12:45	1.59	1.46	03:10	0.269	12:05	0.447	0.378	0.378	-
03/18/2023	04:50	4.60	16:45	5.76	5.34	02:10	1.23	10:35	1.56	1.44	05:00	0.256	16:45	0.438	0.367	0.367	-
03/19/2023	04:40	4.61	19:40	5.89	5.34	04:35	1.24	19:50	1.59	1.43	04:40	0.257	19:50	0.460	0.365	0.365	0.02
03/20/2023	03:30	4.54	21:10	5.92	5.37	03:15	1.18	13:30	1.58	1.43	03:15	0.240	19:55	0.456	0.367	0.367	0.09
03/21/2023	04:10	4.84	18:10	7.08	5.97	04:10	1.27	18:15	1.79	1.56	04:10	0.281	18:15	0.659	0.465	0.465	1.59
03/22/2023	04:30	5.45	19:20	6.52	6.08	02:25	1.37	21:00	1.68	1.56	03:50	0.361	21:00	0.555	0.471	0.471	0.15
03/23/2023	03:55	5.23	20:40	6.57	5.96	03:20	1.36	20:40	1.68	1.52	04:05	0.335	20:40	0.561	0.447	0.447	0.05
03/24/2023	03:55	5.19	12:40	8.25	5.98	04:55	1.30	13:00	1.83	1.48	04:55	0.319	13:00	0.807	0.440	0.440	-
03/25/2023	04:15	5.20	20:40	6.54	5.96	03:50	1.27	21:45	1.62	1.43	05:15	0.311	20:40	0.508	0.421	0.421	-
03/26/2023	05:45	5.20	12:05	6.65	5.99	06:10	1.26	09:15	1.65	1.44	06:10	0.310	12:05	0.526	0.427	0.427	-
03/27/2023	03:40	5.04	20:45	6.41	5.89	03:40	1.24	15:20	1.65	1.43	03:40	0.290	13:25	0.517	0.415	0.415	-
03/28/2023	03:45	4.97	20:05	6.53	5.81	03:40	1.22	20:30	1.57	1.40	03:45	0.280	20:10	0.517	0.401	0.401	-
03/29/2023	04:10	4.89	21:05	6.56	5.86	04:40	1.21	20:15	1.61	1.43	04:15	0.274	21:20	0.531	0.415	0.415	0.56
03/30/2023	02:35	5.14	21:00	6.57	5.89	01:35	1.30	21:00	1.64	1.46	02:10	0.315	21:00	0.548	0.423	0.423	0.30
03/31/2023	04:25	4.93	20:50	6.10	5.70	02:25	1.25	20:40	1.54	1.43	04:25	0.291	20:40	0.463	0.396	0.396	-
04/01/2023	05:25	4.90	20:55	6.08	5.64	05:55	1.25	13:45	1.60	1.43	05:55	0.282	20:55	0.467	0.392	0.392	-
04/02/2023	05:10	4.75	12:20	6.20	5.63	05:35	1.22	12:15	1.58	1.41	05:10	0.265	12:15	0.488	0.387	0.387	-
04/03/2023	03:20	4.80	21:00	6.13	5.56	05:50	1.22	20:10	1.56	1.41	04:15	0.272	21:05	0.473	0.379	0.379	-
04/04/2023	03:20	4.65	20:15	6.15	5.50	03:10	1.20	21:20	1.57	1.40	03:20	0.251	20:15	0.478	0.370	0.370	-
04/05/2023	04:00	4.72	21:10	6.04	5.49	03:05	1.23	21:05	1.54	1.41	03:55	0.264	21:05	0.459	0.373	0.373	-
04/06/2023	03:50	4.60	21:25	5.96	5.37	04:15	1.18	21:30	1.59	1.41	04:15	0.244	21:30	0.466	0.362	0.362	-
04/07/2023	04:05	4.57	20:50	5.79	5.31	04:05	1.21	20:50	1.56	1.42	04:05	0.247	20:50	0.441	0.359	0.359	-
04/08/2023	05:15	4.45	11:40	5.74	5.23	03:40	1.20	16:20	1.54	1.40	04:50	0.238	11:20	0.428	0.347	0.347	-
04/09/2023	04:15	4.42	11:45	5.75	5.19	04:50	1.17	12:30	1.56	1.39	04:50	0.229	12:10	0.431	0.343	0.343	-
04/10/2023	03:20	4.36	21:05	5.79	5.13	03:20	1.18	20:30	1.57	1.37	03:20	0.226	21:05	0.443	0.332	0.332	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			14.749	6.10
Average	5.34	1.40	0.360	

MC27

Site Commentary

SITE INFORMATION

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

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	6.51	1.91	0.722
Minimum	4.74	1.45	0.351
Maximum	9.37	2.58	1.552
Min Time	03/09/2023 4:40:00 AM	03/08/2023 4:05:00 AM	03/09/2023 4:20:00 AM
Max Time	03/21/2023 5:45:00 PM	03/21/2023 5:45:00 PM	03/21/2023 5:45:00 PM

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

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

DATA UPTIME

Downtime from March 29 through April 10 due to monitor malfunction.

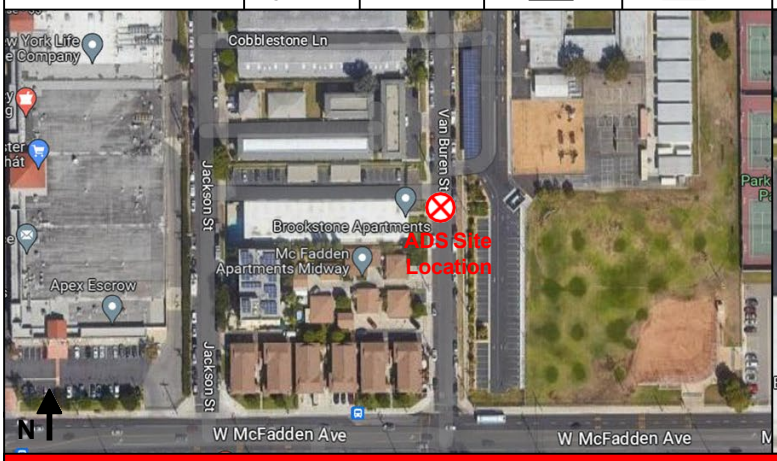
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

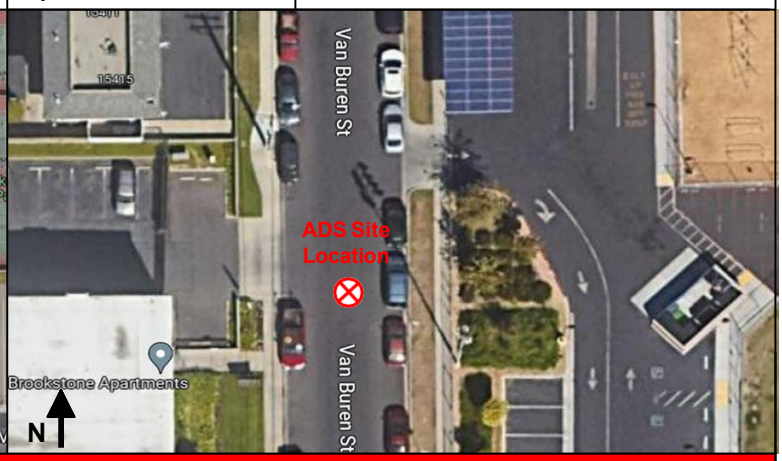
Percent Uptime	
DFINAL (in)	69.334
VFINAL (ft/s)	69.334
QFINAL (MGD - Total MG)	69.334

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Midway	**Agency:** Midway	**FM Initials:** VM
Site Name: MC27	**Install Date:** 2/27/2023	**Monitor Type**	Peak Doppler
Address/Location: 15290 Van Buren St.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	2582
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	18.00 "
		Pipe Width:	18.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 1:36 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	6.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	2.03 fps
Silt:	0 Inches

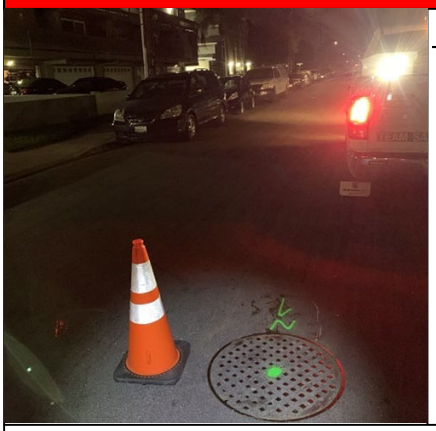
Manhole Information:

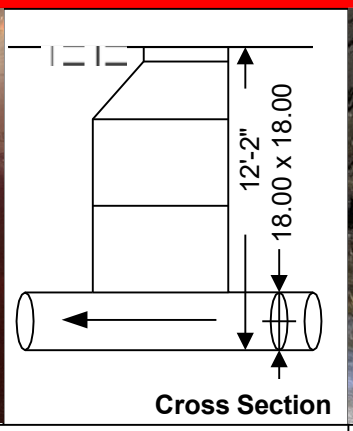
Manhole Depth:	12'-2"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

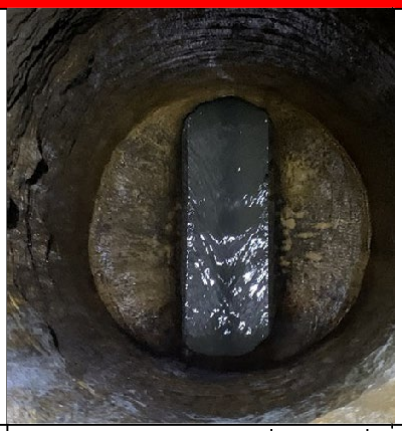
2 man crew required and one blower is to be operated at all times.

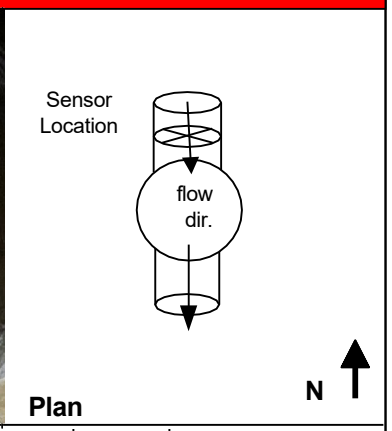
Other Information:





Cross Section





Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

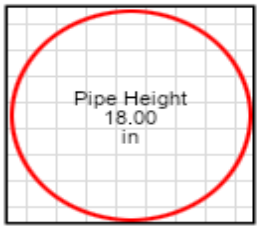
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC27

Flow Monitor

MC27

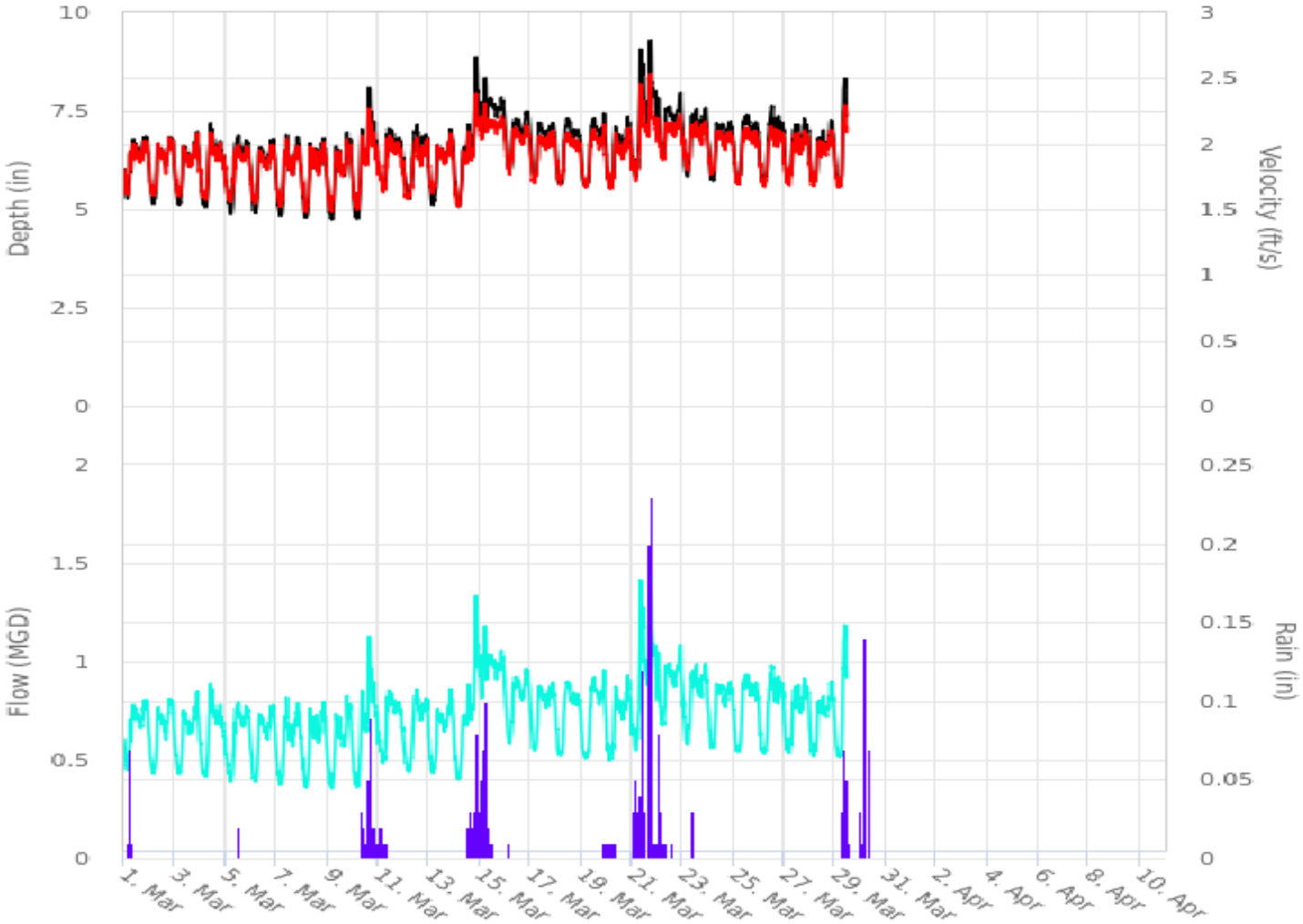


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC27

Flow Monitor

MC27

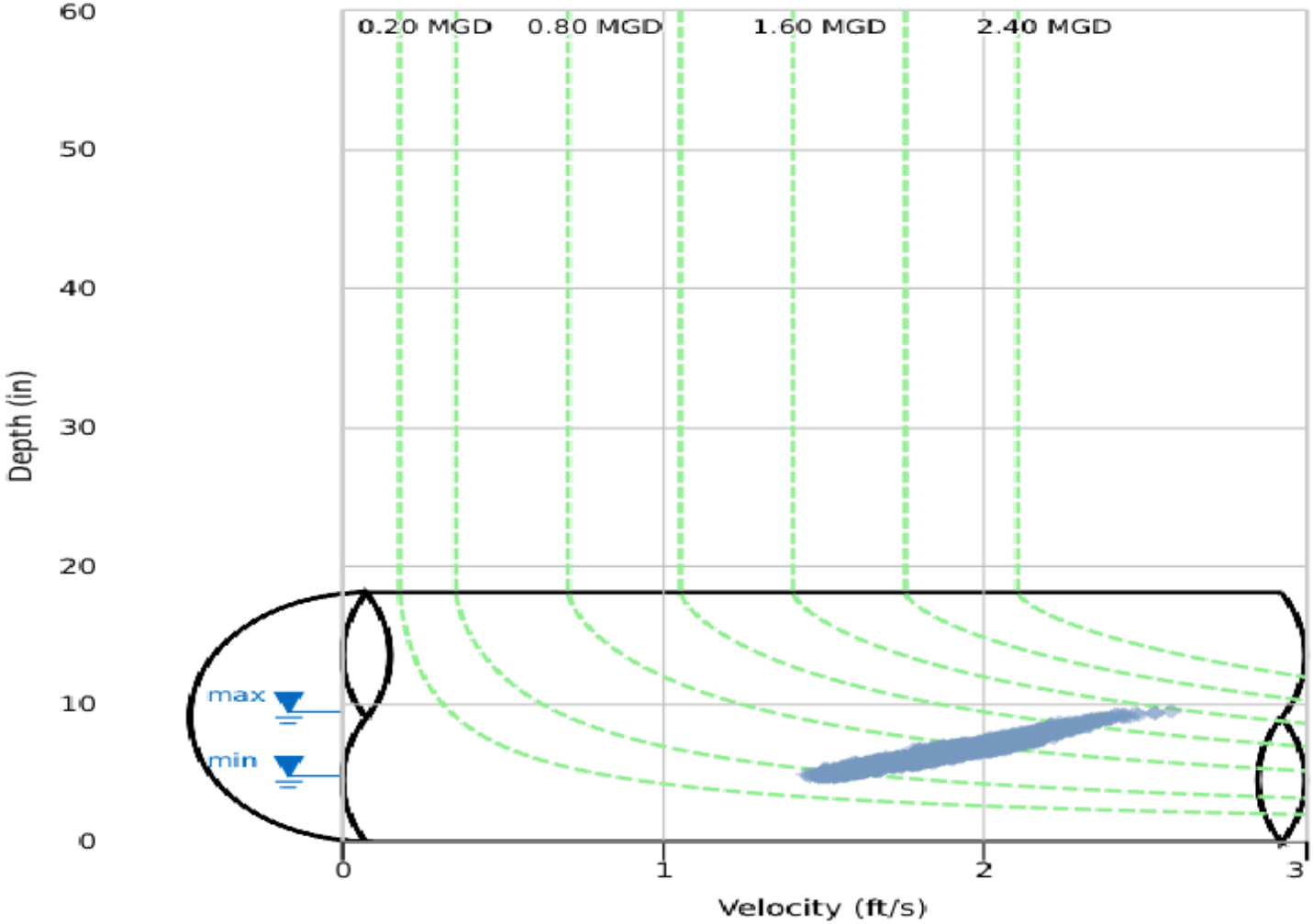
Pipe Height
18.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC27Pipe: Round (18 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:45	5.27	20:50	6.86	6.31	02:45	1.60	19:30	2.05	1.88	02:45	0.446	19:30	0.818	0.674	0.674	0.22
03/02/2023	04:10	5.12	18:45	6.86	6.16	03:10	1.59	18:35	2.08	1.85	03:10	0.429	18:45	0.824	0.646	0.646	-
03/03/2023	03:55	5.10	21:15	7.05	6.12	03:45	1.56	21:15	2.12	1.84	03:45	0.421	21:15	0.879	0.635	0.635	-
03/04/2023	04:50	5.04	09:45	7.24	6.14	03:45	1.55	09:45	2.12	1.84	05:15	0.408	09:45	0.911	0.640	0.640	-
03/05/2023	04:25	4.87	12:15	6.88	6.12	02:30	1.55	18:55	2.04	1.82	04:25	0.387	12:10	0.809	0.629	0.629	0.04
03/06/2023	04:20	4.90	21:25	6.79	6.04	05:30	1.51	19:05	2.00	1.81	03:30	0.386	19:40	0.786	0.615	0.615	-
03/07/2023	03:55	4.82	09:35	6.94	5.96	03:55	1.50	09:40	2.06	1.80	03:55	0.369	09:40	0.833	0.600	0.600	-
03/08/2023	04:05	4.79	20:50	6.83	5.93	04:05	1.45	20:50	2.04	1.78	04:05	0.353	20:50	0.811	0.591	0.591	-
03/09/2023	04:15	4.74	18:45	7.01	5.90	04:20	1.46	18:50	2.07	1.77	04:20	0.351	18:50	0.847	0.585	0.585	-
03/10/2023	04:10	4.75	15:30	8.12	6.26	03:50	1.48	15:50	2.28	1.86	04:25	0.359	15:50	1.135	0.675	0.675	0.90
03/11/2023	04:45	5.49	11:55	7.09	6.43	04:05	1.62	08:15	2.09	1.89	05:05	0.479	12:00	0.870	0.697	0.697	0.14
03/12/2023	05:10	5.26	12:50	7.17	6.34	03:20	1.56	12:35	2.06	1.84	05:10	0.433	12:40	0.867	0.668	0.668	-
03/13/2023	04:10	5.09	20:35	7.05	6.18	03:30	1.59	21:05	2.11	1.86	04:00	0.429	20:35	0.867	0.653	0.653	-
03/14/2023	04:10	5.06	20:30	8.88	6.52	03:00	1.50	20:40	2.40	1.89	04:35	0.397	20:35	1.341	0.723	0.723	1.01
03/15/2023	02:20	6.86	05:20	8.34	7.60	01:40	2.01	04:55	2.32	2.15	02:20	0.809	04:55	1.189	0.987	0.987	1.01
03/16/2023	04:45	5.96	20:10	7.50	6.91	04:50	1.73	20:00	2.15	2.01	04:50	0.571	20:10	0.963	0.816	0.816	0.02
03/17/2023	04:50	5.81	08:15	7.21	6.71	03:50	1.67	21:30	2.12	1.95	03:50	0.537	21:30	0.904	0.763	0.763	-
03/18/2023	05:00	5.64	11:15	7.34	6.61	04:30	1.64	10:50	2.10	1.93	04:30	0.508	10:50	0.905	0.742	0.742	-
03/19/2023	04:15	5.60	21:50	7.49	6.58	05:05	1.66	21:50	2.16	1.93	04:15	0.506	21:50	0.973	0.737	0.737	0.02
03/20/2023	03:25	5.53	20:20	7.39	6.51	03:00	1.63	21:20	2.15	1.90	03:00	0.486	20:20	0.938	0.713	0.713	0.09
03/21/2023	04:05	5.82	17:45	9.37	7.41	04:00	1.71	17:45	2.58	2.08	04:00	0.546	17:45	1.552	0.941	0.941	1.59
03/22/2023	05:05	6.29	22:00	8.05	7.22	05:55	1.84	22:05	2.24	2.08	05:55	0.669	22:00	1.105	0.894	0.894	0.15
03/23/2023	04:30	5.82	13:00	7.62	6.92	05:05	1.77	13:05	2.19	2.03	04:20	0.573	13:05	1.001	0.827	0.827	0.05
03/24/2023	05:00	5.72	21:05	7.24	6.71	02:55	1.75	08:05	2.12	1.99	02:55	0.556	21:05	0.906	0.776	0.776	-
03/25/2023	04:05	5.81	12:55	7.41	6.76	05:20	1.66	20:25	2.14	1.97	05:20	0.531	13:05	0.940	0.779	0.779	-
03/26/2023	05:00	5.80	12:30	7.69	6.72	04:20	1.65	11:00	2.15	1.95	04:20	0.528	12:10	0.988	0.765	0.765	-
03/27/2023	05:05	5.79	18:50	7.35	6.59	05:00	1.67	09:30	2.13	1.92	05:00	0.534	18:50	0.927	0.733	0.733	-
03/28/2023	03:40	5.67	20:20	7.28	6.50	03:30	1.66	21:15	2.12	1.91	03:30	0.513	21:15	0.907	0.715	0.715	-
03/29/2023	04:25	5.65	09:30	8.34	6.50	04:15	1.65	09:15	2.30	1.89	04:15	0.508	09:20	1.188	0.720	0.333	0.56
03/30/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30
03/31/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/01/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/02/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/03/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/04/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/05/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/06/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/07/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/08/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/09/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/10/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			20.548	6.10
Average	6.51	1.91	0.722	

MC34

Site Commentary

SITE INFORMATION

Pipe	Round (8 in H)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.54	1.58	0.154
Minimum	2.47	1.13	0.068
Maximum	4.87	1.85	0.267
Min Time	03/07/2023 3:20:00 AM	03/07/2023 4:05:00 AM	03/07/2023 3:15:00 AM
Max Time	03/14/2023 8:50:00 PM	03/14/2023 8:50:00 PM	03/14/2023 8:50:00 PM

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

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

DATA UPTIME

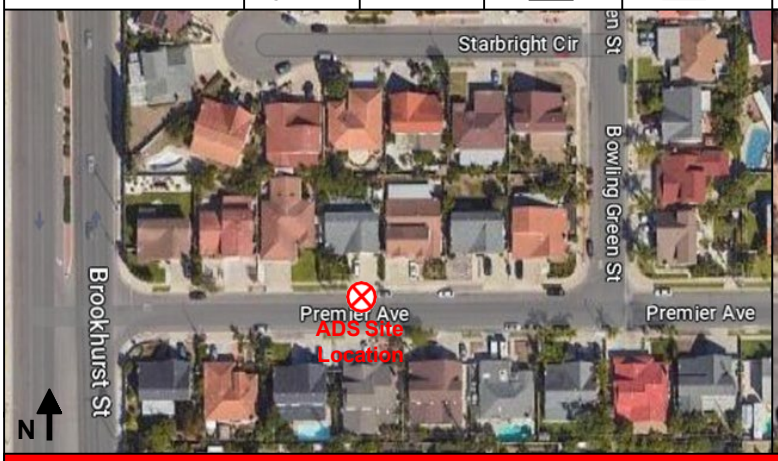
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

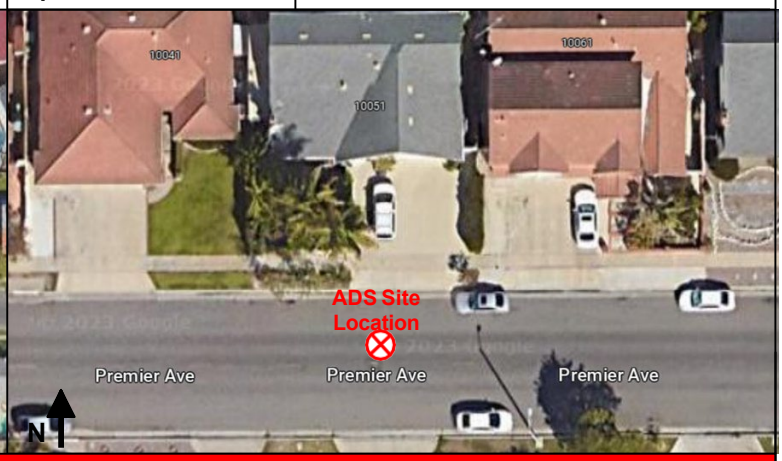
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC34	**Install Date:** 2/24/2023	**Monitor Type**	Peak Doppler
Address/Location: 10051 Premier Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	4996
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	8.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 12:29 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.50 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.50 fps
Silt:	0 Inches

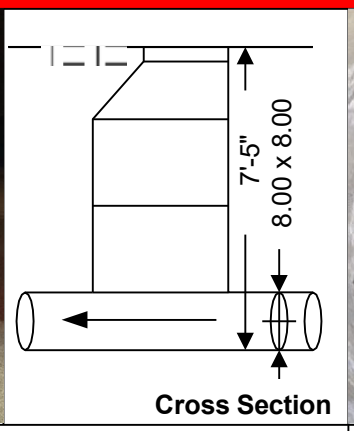
Manhole Information:

Manhole Depth:	7'-5"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

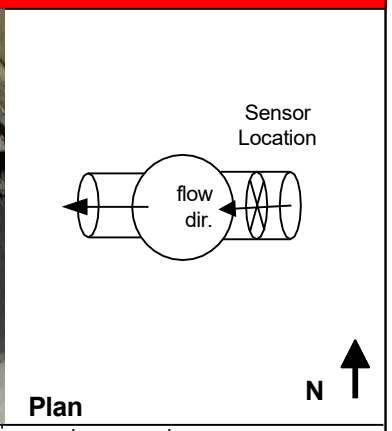
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

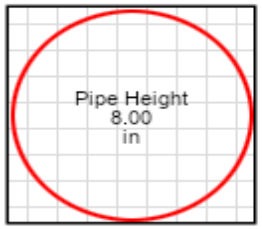
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC34

Flow Monitor

MC34

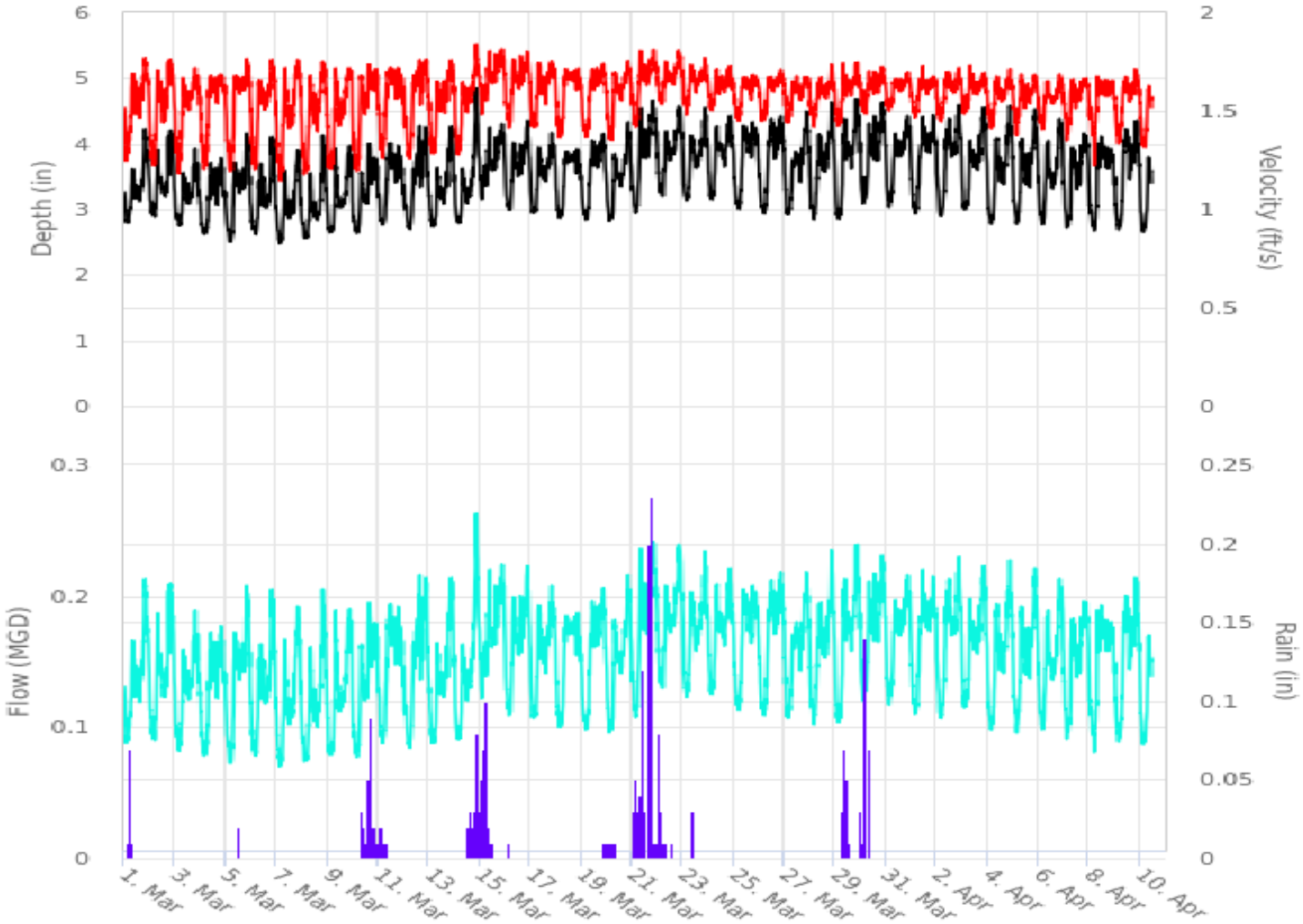


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC34

Flow Monitor

MC34

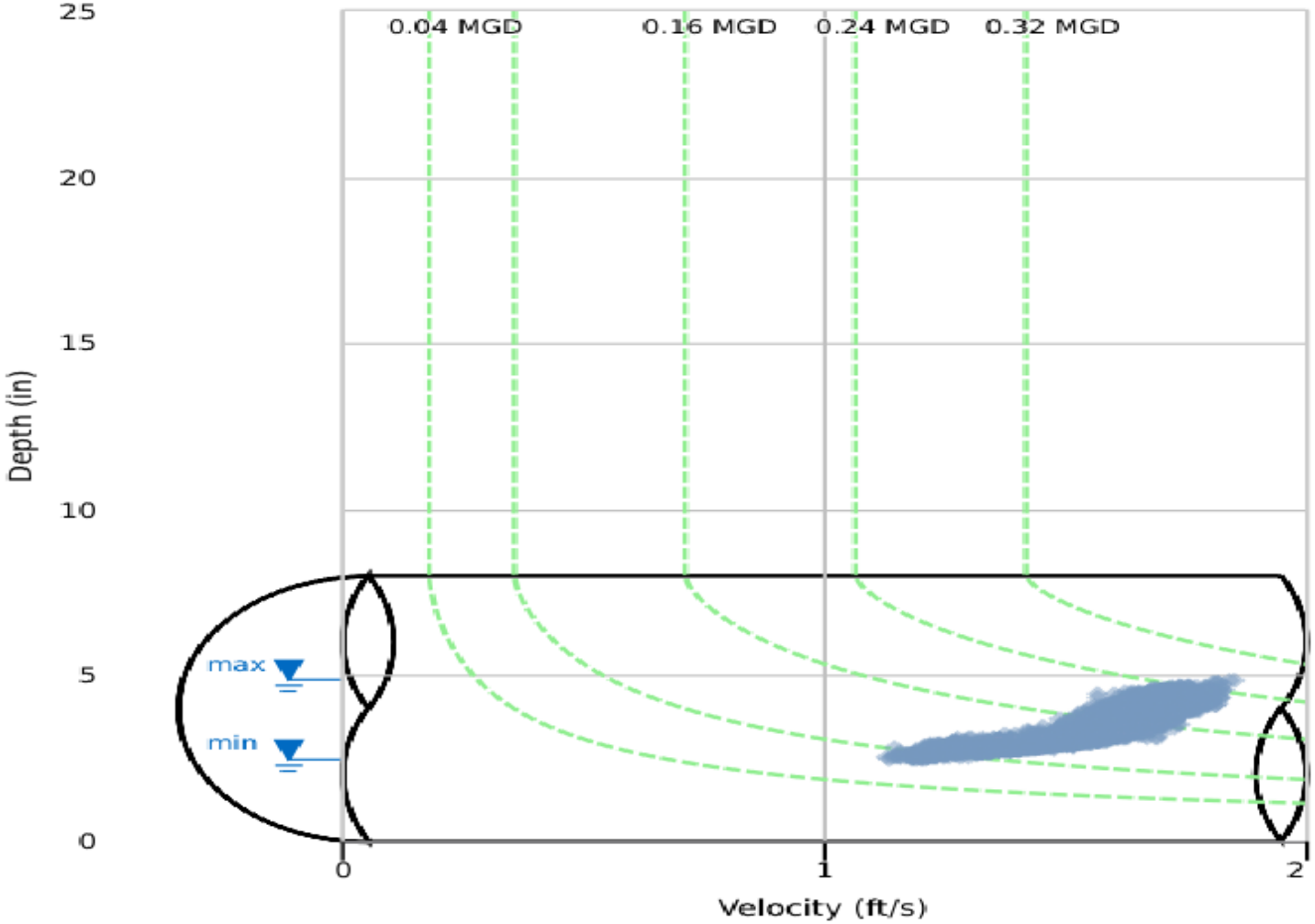
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC34Pipe: Round (8 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:55	2.78	19:55	4.23	3.35	02:10	1.22	19:50	1.78	1.55	02:10	0.087	19:50	0.216	0.140	0.140	0.22
03/02/2023	05:05	2.87	20:05	4.22	3.42	05:00	1.21	19:35	1.77	1.52	05:00	0.088	19:35	0.213	0.142	0.142	-
03/03/2023	04:50	2.74	19:20	3.93	3.22	03:45	1.15	19:25	1.73	1.52	03:45	0.081	19:25	0.190	0.131	0.131	-
03/04/2023	03:50	2.62	19:55	3.97	3.20	03:50	1.20	19:50	1.70	1.54	03:50	0.077	19:55	0.188	0.132	0.132	-
03/05/2023	04:00	2.50	19:45	4.23	3.28	05:45	1.18	20:00	1.78	1.54	05:20	0.072	19:45	0.214	0.137	0.137	0.04
03/06/2023	04:45	2.60	20:00	4.14	3.19	03:35	1.17	19:50	1.80	1.52	04:45	0.076	19:50	0.210	0.130	0.130	-
03/07/2023	03:20	2.47	20:25	3.93	3.08	04:05	1.13	20:20	1.77	1.49	03:15	0.068	20:25	0.195	0.122	0.122	-
03/08/2023	02:55	2.55	19:40	4.24	3.08	02:25	1.15	19:40	1.76	1.49	02:25	0.072	19:40	0.214	0.121	0.121	-
03/09/2023	02:20	2.64	21:10	4.04	3.20	03:45	1.18	20:15	1.74	1.50	03:45	0.077	21:10	0.195	0.129	0.129	-
03/10/2023	04:10	2.61	16:05	4.04	3.27	03:55	1.16	15:45	1.75	1.53	04:10	0.076	15:40	0.199	0.135	0.135	0.90
03/11/2023	04:25	2.76	19:00	4.08	3.45	04:50	1.25	12:00	1.74	1.57	04:50	0.087	18:55	0.200	0.148	0.148	0.14
03/12/2023	06:05	2.69	15:40	4.39	3.43	06:10	1.24	15:40	1.80	1.56	06:15	0.083	15:40	0.229	0.147	0.147	-
03/13/2023	04:05	2.73	21:15	4.33	3.35	05:30	1.26	21:20	1.77	1.54	05:30	0.086	21:15	0.219	0.140	0.140	-
03/14/2023	04:20	2.79	20:50	4.87	3.42	03:20	1.27	20:50	1.85	1.55	03:20	0.089	20:50	0.267	0.146	0.146	1.01
03/15/2023	02:30	3.14	09:45	4.45	3.75	02:25	1.48	21:15	1.83	1.67	02:25	0.122	09:45	0.234	0.175	0.175	1.01
03/16/2023	03:50	2.98	21:30	4.38	3.64	03:50	1.39	14:45	1.82	1.64	03:50	0.107	21:35	0.227	0.166	0.166	0.02
03/17/2023	03:05	2.93	20:10	4.17	3.54	05:30	1.40	07:40	1.77	1.62	03:05	0.106	20:10	0.209	0.157	0.157	-
03/18/2023	04:05	2.86	20:40	3.93	3.53	03:45	1.36	09:55	1.73	1.60	04:05	0.099	20:40	0.190	0.155	0.155	-
03/19/2023	04:50	2.83	20:55	4.18	3.55	04:45	1.36	20:10	1.75	1.59	05:30	0.098	21:00	0.207	0.156	0.156	0.02
03/20/2023	02:55	2.81	20:40	4.38	3.50	05:20	1.33	20:40	1.80	1.59	02:55	0.096	20:40	0.227	0.152	0.152	0.09
03/21/2023	03:35	2.95	19:55	4.69	3.85	04:00	1.41	08:40	1.83	1.65	03:25	0.107	08:40	0.244	0.179	0.179	1.59
03/22/2023	05:15	3.18	20:15	4.59	3.88	04:20	1.52	20:15	1.83	1.67	05:15	0.128	20:15	0.245	0.182	0.182	0.15
03/23/2023	03:35	3.13	20:45	4.58	3.79	03:25	1.44	20:45	1.79	1.64	03:25	0.119	20:45	0.239	0.174	0.174	0.05
03/24/2023	03:45	3.14	20:50	4.43	3.83	03:40	1.48	20:40	1.74	1.63	03:40	0.122	20:50	0.222	0.175	0.175	-
03/25/2023	05:15	3.00	18:10	4.40	3.78	05:10	1.42	09:10	1.71	1.60	05:10	0.110	18:10	0.215	0.169	0.169	-
03/26/2023	05:00	2.94	20:45	4.46	3.77	02:55	1.41	20:45	1.73	1.61	04:55	0.108	20:45	0.223	0.169	0.169	-
03/27/2023	03:45	2.92	21:00	4.49	3.65	02:40	1.43	11:50	1.70	1.59	03:50	0.106	21:10	0.221	0.160	0.160	-
03/28/2023	04:10	2.82	20:40	4.68	3.68	04:15	1.39	20:40	1.76	1.59	04:15	0.099	20:40	0.241	0.162	0.162	-
03/29/2023	03:45	2.84	21:20	4.70	3.76	03:10	1.40	07:50	1.77	1.60	03:10	0.101	21:20	0.242	0.169	0.169	0.56
03/30/2023	02:30	3.08	20:40	4.64	3.86	05:15	1.43	20:15	1.74	1.62	02:35	0.118	20:15	0.234	0.175	0.175	0.30
03/31/2023	03:15	3.02	20:50	4.43	3.80	03:15	1.49	21:05	1.72	1.61	03:15	0.116	20:45	0.218	0.171	0.171	-
04/01/2023	03:55	2.93	20:50	4.44	3.78	03:50	1.46	11:05	1.75	1.61	03:55	0.110	11:05	0.223	0.169	0.169	-
04/02/2023	04:35	2.89	21:25	4.64	3.77	04:30	1.43	21:25	1.74	1.60	04:30	0.106	21:25	0.236	0.168	0.168	-
04/03/2023	02:15	2.98	20:50	4.58	3.71	02:10	1.46	08:05	1.77	1.60	02:15	0.112	20:50	0.229	0.165	0.165	-
04/04/2023	03:55	2.78	21:25	4.59	3.62	03:55	1.40	21:15	1.72	1.58	03:55	0.097	21:25	0.230	0.157	0.157	-
04/05/2023	03:40	2.76	21:10	4.58	3.59	03:40	1.36	08:05	1.71	1.57	03:40	0.094	21:05	0.228	0.155	0.155	-
04/06/2023	04:00	2.76	20:20	4.39	3.55	03:55	1.38	20:15	1.73	1.56	04:00	0.095	20:15	0.219	0.153	0.153	-
04/07/2023	03:10	2.71	19:00	4.19	3.52	03:10	1.34	21:50	1.69	1.56	03:10	0.090	19:00	0.200	0.151	0.151	-
04/08/2023	05:05	2.66	11:30	4.12	3.52	05:00	1.16	07:45	1.68	1.56	05:00	0.077	11:30	0.196	0.150	0.150	-
04/09/2023	04:10	2.67	21:35	4.38	3.59	04:10	1.31	20:05	1.73	1.56	04:10	0.086	20:05	0.218	0.155	0.155	-
04/10/2023	03:05	2.65	08:15	3.84	3.13	05:10	1.30	08:55	1.63	1.46	03:10	0.087	08:15	0.173	0.122	0.056	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			6.226	6.10
Average	3.54	1.58	0.154	

MC35

Site Commentary

SITE INFORMATION

Pipe	Round (8 in H)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. Brief periods of backwater and surcharge conditions were experienced on a few days at this location.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.22	2.05	0.177
Minimum	1.66	1.03	0.051
Maximum	9.32	2.64	0.499
Min Time	04/09/2023 5:15:00 AM	03/07/2023 3:50:00 AM	04/09/2023 5:15:00 AM
Max Time	03/21/2023 6:00:00 PM	03/29/2023 9:30:00 PM	03/21/2023 6:00:00 PM

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

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

DATA UPTIME

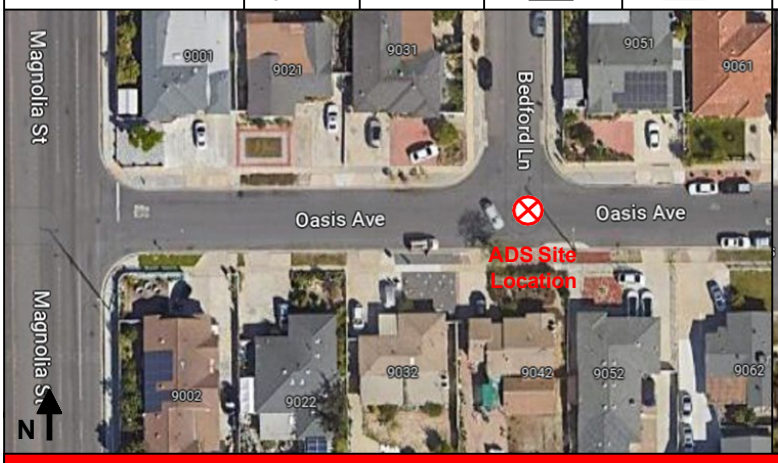
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

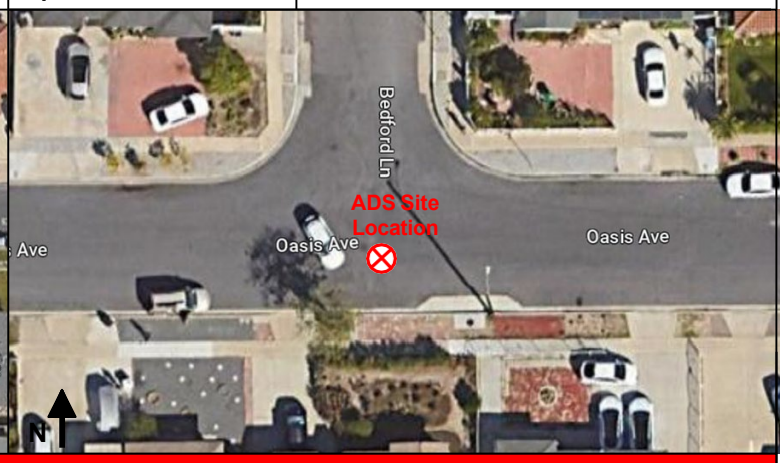
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC35	**Install Date:** 2/27/2023	**Monitor Type**	Peak Doppler
Address/Location: 9043 Oasis Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	4961
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	8.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 2:16 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	3.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	2.45 fps
Silt:	0 Inches

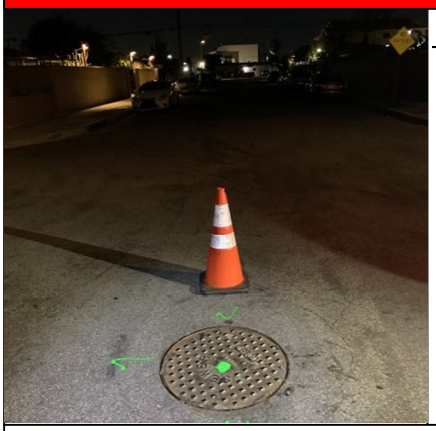
Manhole Information:

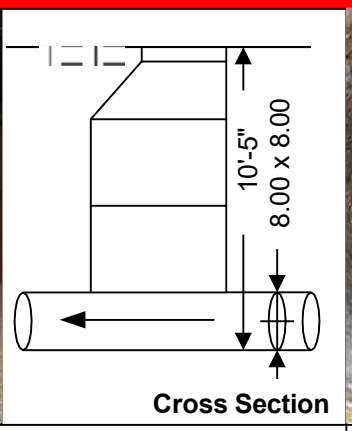
Manhole Depth:	10'-5"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

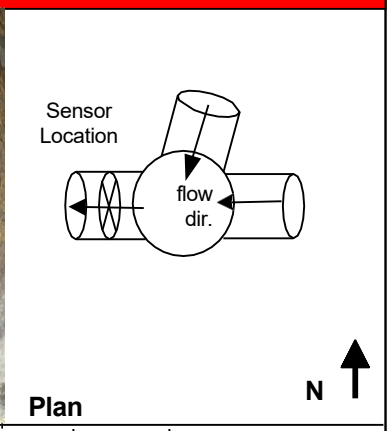
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Outlet
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

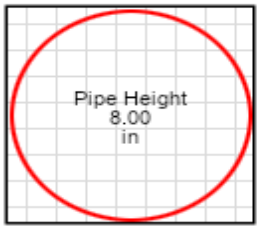
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC35

Flow Monitor

MC35

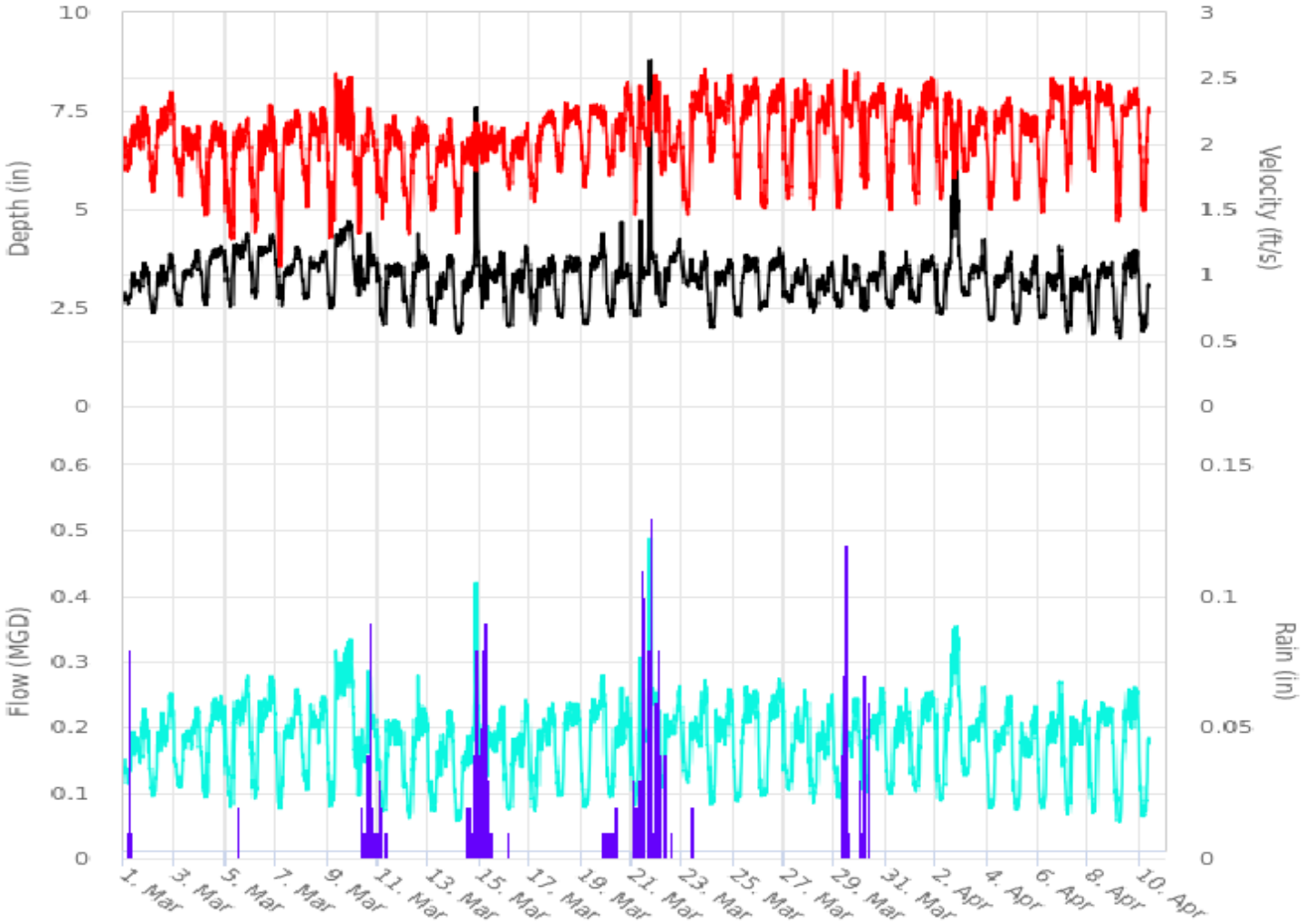


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC35

Flow Monitor

MC35

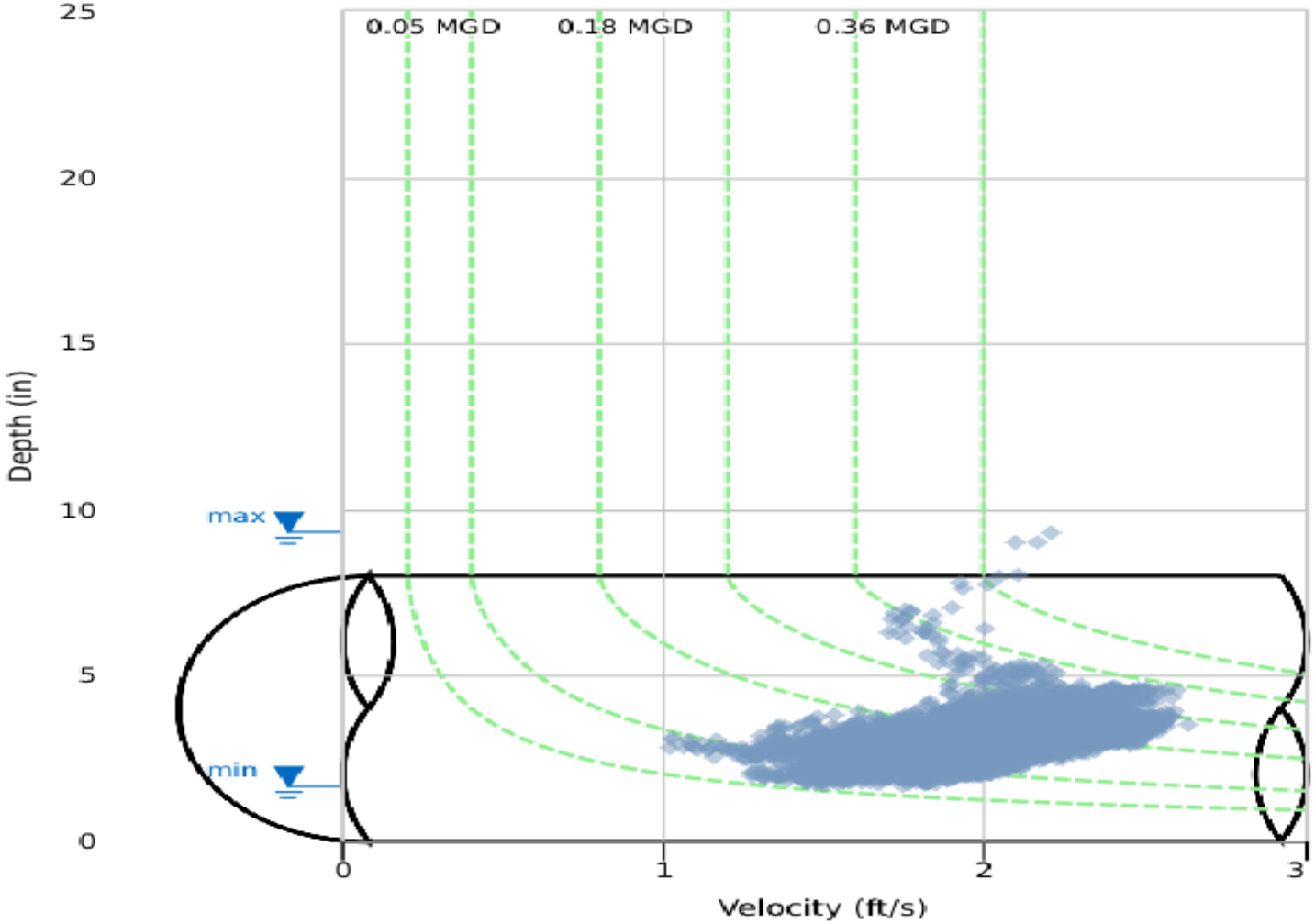
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC35Pipe: Round (8 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	03:30	2.58	19:20	3.68	3.09	02:50	1.76	18:05	2.32	2.05	03:55	0.113	19:20	0.234	0.166	0.166	0.21
03/02/2023	03:50	2.35	20:00	3.89	3.13	03:15	1.54	20:50	2.47	2.07	03:15	0.092	20:50	0.259	0.173	0.173	-
03/03/2023	05:15	2.52	20:55	4.05	3.28	06:15	1.54	12:25	2.19	1.96	05:15	0.106	20:55	0.237	0.172	0.172	-
03/04/2023	05:35	2.54	19:25	4.09	3.56	05:00	1.36	14:25	2.20	1.90	05:00	0.088	19:30	0.252	0.187	0.187	-
03/05/2023	04:45	2.50	20:00	4.40	3.68	06:20	1.22	19:30	2.27	1.86	04:45	0.075	19:30	0.285	0.194	0.194	0.02
03/06/2023	04:40	2.73	20:05	4.50	3.73	03:30	1.26	18:25	2.35	1.89	03:30	0.086	19:15	0.286	0.200	0.200	-
03/07/2023	05:15	2.50	19:05	4.12	3.41	03:50	1.03	19:30	2.28	1.94	03:50	0.073	19:05	0.267	0.182	0.182	-
03/08/2023	03:10	2.69	21:50	3.95	3.46	05:15	1.41	20:30	2.31	2.02	05:15	0.098	21:00	0.254	0.191	0.191	-
03/09/2023	03:20	2.47	19:55	4.74	3.90	02:35	1.15	22:15	2.60	2.09	02:35	0.072	22:15	0.344	0.236	0.236	-
03/10/2023	05:50	2.77	15:45	4.45	3.48	05:55	1.29	15:05	2.31	1.93	05:50	0.091	15:45	0.292	0.184	0.184	0.98
03/11/2023	05:25	2.04	17:20	3.70	3.13	04:15	1.40	15:20	2.26	1.91	05:25	0.071	15:20	0.216	0.160	0.160	0.16
03/12/2023	07:15	2.00	13:50	4.51	3.12	05:30	1.27	15:55	2.25	1.88	05:30	0.059	13:50	0.292	0.159	0.159	-
03/13/2023	05:40	2.03	20:00	3.89	2.99	05:00	1.48	19:45	2.21	1.85	05:30	0.071	20:00	0.237	0.145	0.145	-
03/14/2023	04:40	1.84	20:55	7.97	3.10	02:30	1.28	19:50	2.21	1.84	03:40	0.055	20:55	0.461	0.154	0.154	1.06
03/15/2023	02:30	2.47	20:25	3.96	3.32	23:45	1.80	05:30	2.18	2.01	02:30	0.109	22:00	0.240	0.179	0.179	1.17
03/16/2023	03:30	2.01	19:30	4.10	3.03	04:30	1.61	21:35	2.19	1.92	04:30	0.074	19:35	0.245	0.154	0.154	0.01
03/17/2023	04:35	2.05	20:50	3.89	3.10	03:30	1.51	19:45	2.34	2.01	04:30	0.072	20:45	0.242	0.167	0.167	-
03/18/2023	06:00	2.24	13:05	3.86	3.20	03:25	1.76	09:30	2.33	2.10	03:30	0.094	13:05	0.244	0.180	0.180	-
03/19/2023	05:35	2.07	20:40	4.49	3.21	03:30	1.58	11:45	2.34	2.11	03:30	0.074	20:35	0.290	0.183	0.183	0.02
03/20/2023	04:00	2.27	14:35	7.07	3.08	02:55	1.72	20:30	2.49	2.10	04:00	0.092	14:35	0.401	0.171	0.171	0.19
03/21/2023	02:40	2.27	18:00	9.32	3.35	03:25	1.42	22:05	2.57	2.12	03:25	0.079	18:00	0.499	0.192	0.192	1.59
03/22/2023	04:55	2.48	20:00	4.30	3.43	04:55	1.72	01:10	2.57	2.03	04:55	0.102	21:20	0.267	0.188	0.188	0.22
03/23/2023	23:50	2.92	20:45	4.01	3.32	04:55	1.44	21:10	2.59	2.11	04:55	0.113	20:40	0.276	0.188	0.188	0.04
03/24/2023	05:10	1.98	20:35	3.74	3.04	03:05	1.84	21:35	2.57	2.24	03:05	0.081	20:00	0.261	0.179	0.179	-
03/25/2023	06:15	2.24	19:25	3.97	3.19	03:55	1.56	20:50	2.52	2.17	03:35	0.085	19:25	0.274	0.186	0.186	-
03/26/2023	02:30	2.38	19:25	4.03	3.25	05:30	1.48	22:20	2.52	2.11	02:30	0.087	19:15	0.275	0.187	0.187	-
03/27/2023	07:00	2.58	19:15	3.76	3.13	05:15	1.56	19:20	2.52	2.12	05:15	0.100	19:20	0.261	0.176	0.176	-
03/28/2023	03:25	2.36	21:40	3.74	3.01	03:20	1.46	21:40	2.55	2.10	03:20	0.082	21:40	0.263	0.166	0.166	-
03/29/2023	04:00	2.50	09:30	3.93	3.07	04:45	1.47	21:30	2.64	2.13	03:50	0.091	09:25	0.284	0.173	0.173	0.85
03/30/2023	01:30	2.40	21:25	3.99	3.11	04:45	1.61	19:45	2.49	2.17	05:15	0.101	19:30	0.273	0.180	0.180	0.23
03/31/2023	05:25	2.48	19:45	3.95	3.14	04:40	1.45	13:20	2.46	2.12	03:25	0.094	19:20	0.266	0.177	0.177	-
04/01/2023	07:15	2.60	19:50	3.89	3.29	05:20	1.52	22:15	2.55	2.15	05:15	0.099	20:10	0.262	0.192	0.192	-
04/02/2023	05:35	2.32	19:25	6.95	3.67	04:55	1.51	11:45	2.44	2.05	04:15	0.087	19:25	0.369	0.209	0.209	-
04/03/2023	03:20	2.78	21:25	4.25	3.31	03:15	1.76	17:35	2.32	2.05	03:15	0.123	21:25	0.264	0.182	0.182	-
04/04/2023	04:45	2.16	21:50	3.98	3.05	03:30	1.49	20:35	2.38	2.05	03:15	0.075	21:50	0.253	0.166	0.166	-
04/05/2023	03:35	2.06	21:45	3.86	2.97	04:00	1.50	20:25	2.36	2.01	04:00	0.072	20:25	0.245	0.157	0.157	-
04/06/2023	04:55	2.23	20:20	4.28	3.00	03:40	1.42	13:20	2.53	2.12	03:40	0.074	20:20	0.280	0.169	0.169	-
04/07/2023	03:50	1.84	21:30	3.60	2.87	04:10	1.56	21:30	2.56	2.24	04:10	0.064	21:30	0.252	0.168	0.168	-
04/08/2023	03:30	1.79	14:05	3.75	3.00	05:15	1.75	09:45	2.51	2.22	03:30	0.067	12:00	0.246	0.176	0.176	-
04/09/2023	05:15	1.66	18:05	4.24	3.03	04:05	1.31	21:05	2.45	2.13	05:15	0.051	18:05	0.281	0.174	0.174	-
04/10/2023	03:00	1.87	08:55	3.22	2.36	04:05	1.46	09:00	2.36	1.86	03:10	0.060	08:55	0.199	0.107	0.041	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			7.165	6.75
Average	3.22	2.05	0.177	

MC39

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12 in H x 12 in W)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	4.41	2.49	0.426
Minimum	2.85	1.79	0.172
Maximum	5.50	2.88	0.615
Min Time	03/09/2023 4:20:00 AM	03/10/2023 2:55:00 AM	03/10/2023 2:55:00 AM
Max Time	03/21/2023 6:05:00 PM	03/31/2023 8:30:00 PM	03/26/2023 11:30:00 AM

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

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

DATA UPTIME

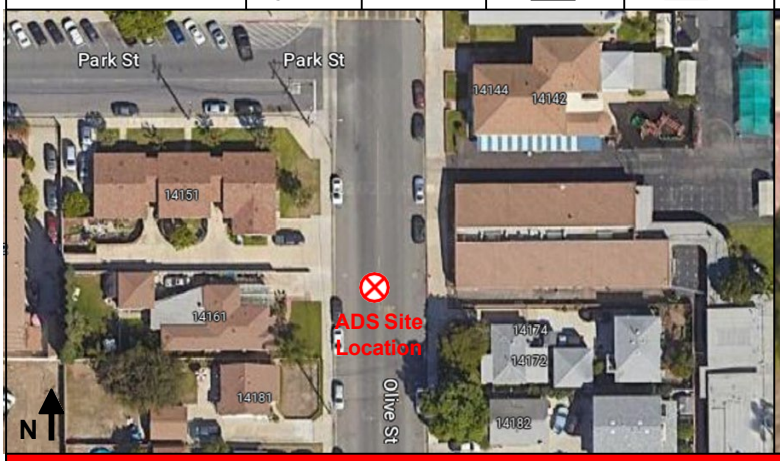
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

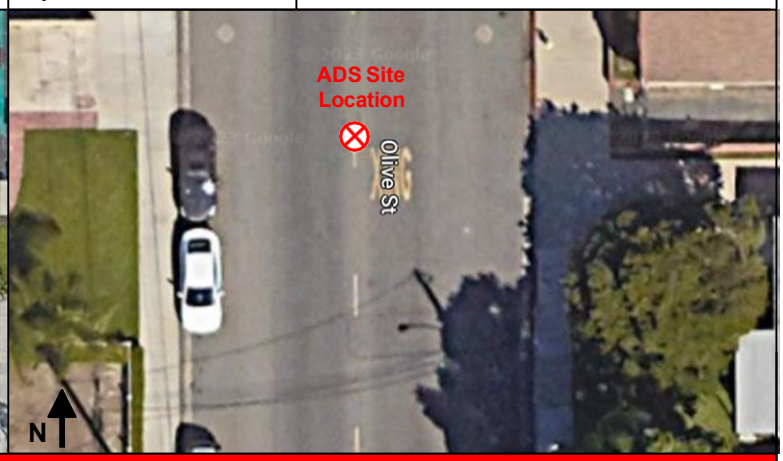
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC39	**Install Date:** 2/28/2023	**Monitor Type**	Peak Doppler
Address/Location: 14161 Olive St.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	1954
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.00 "
		Pipe Width:	12.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 2:45 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	4.13 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	2.64 fps
Silt:	0 Inches

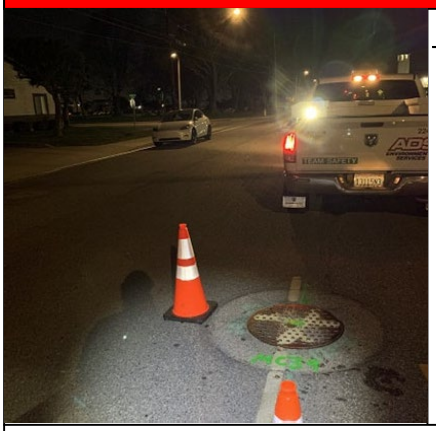
Manhole Information:

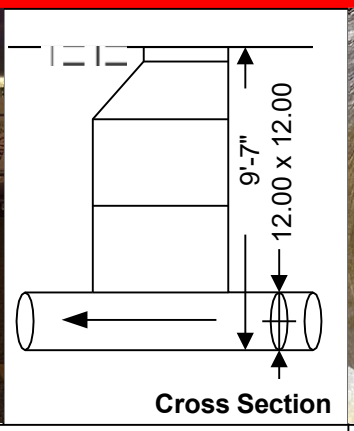
Manhole Depth:	9'-7"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

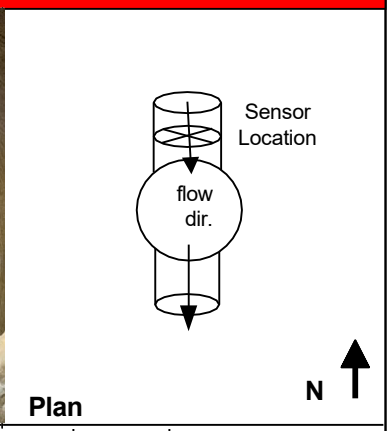
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

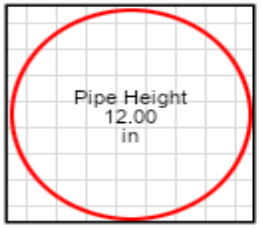
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC39

Flow Monitor

MC39

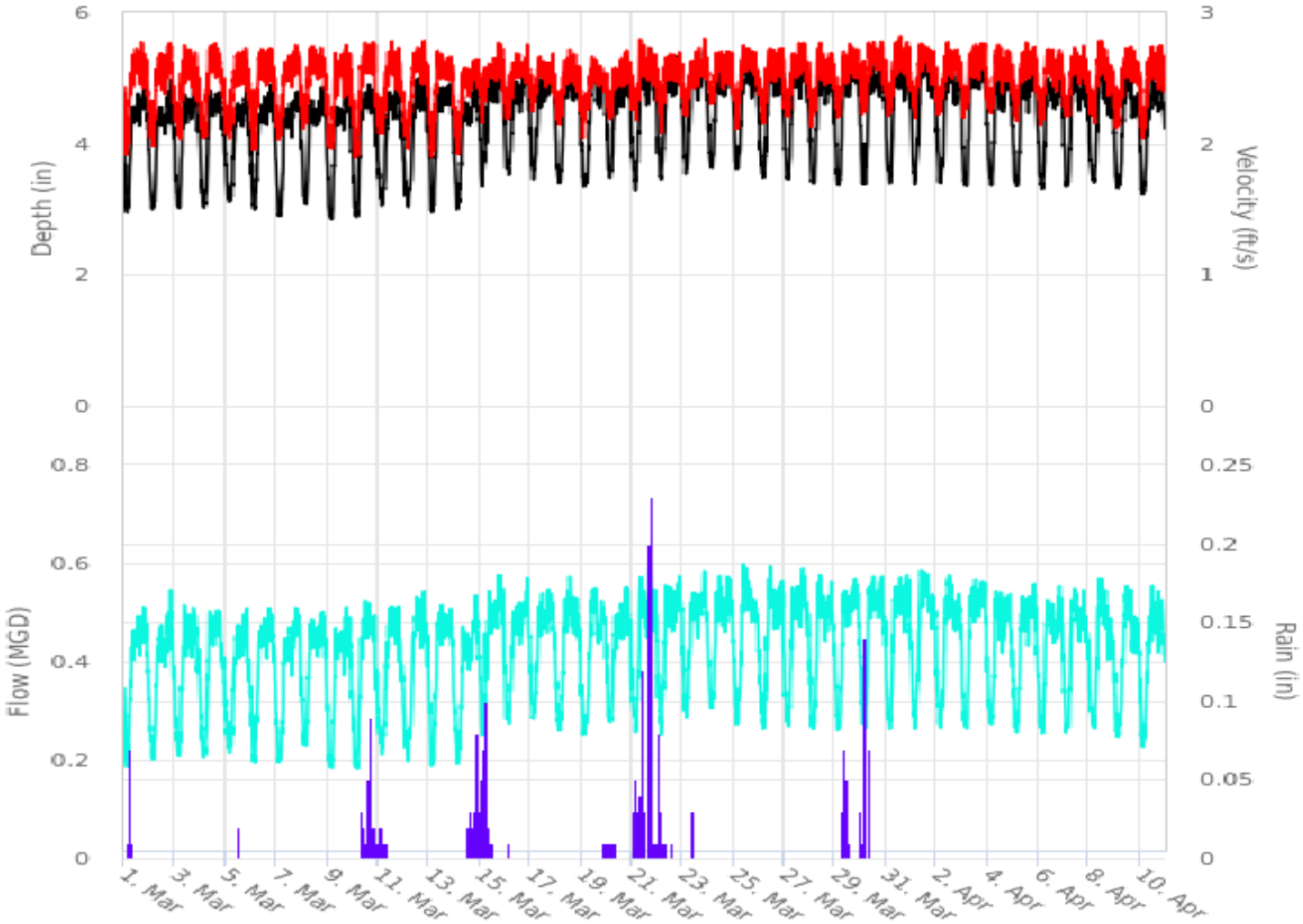


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC39

Flow Monitor

MC39

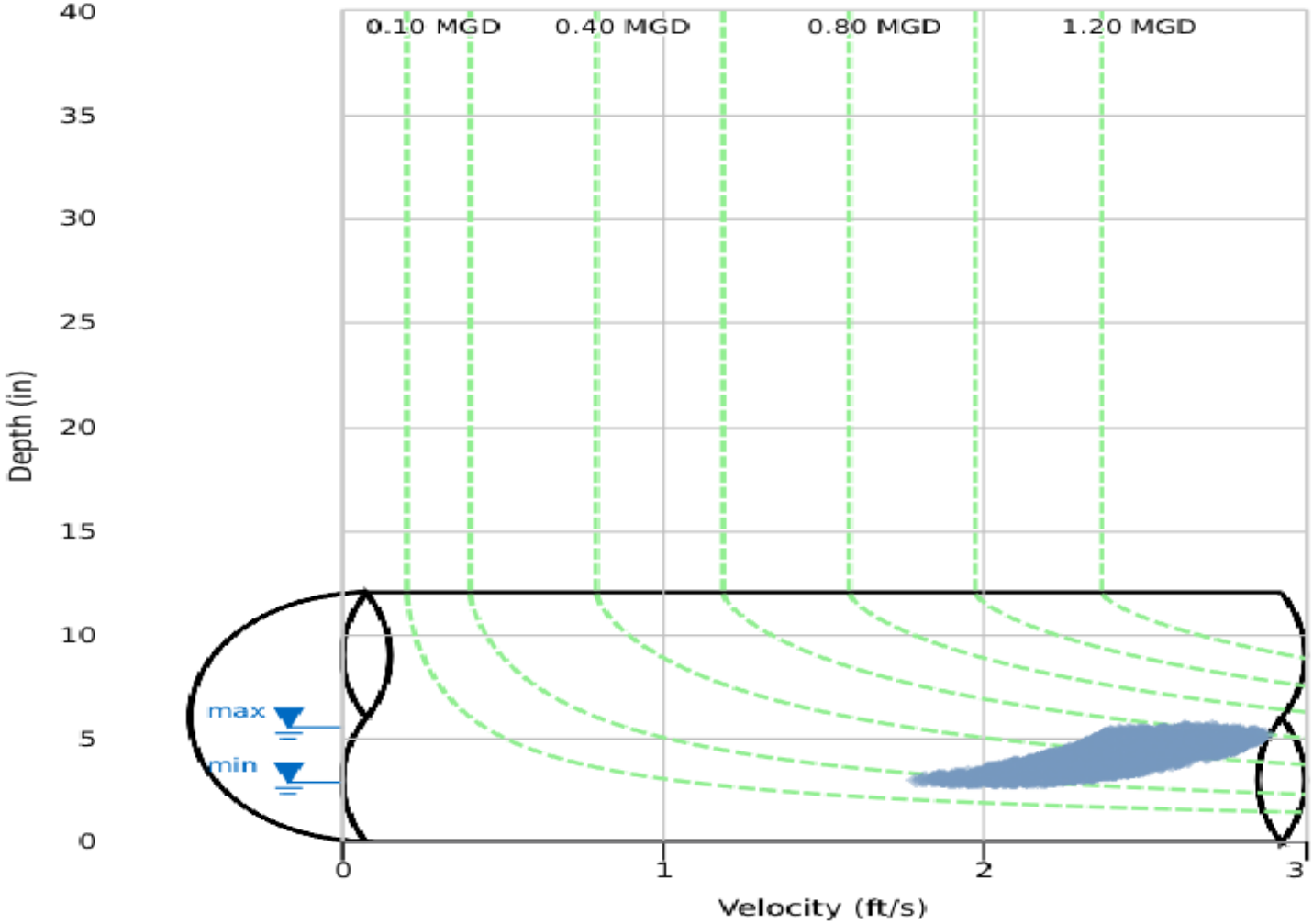
Pipe Height
12.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC39Pipe: Elliptical (12 in H x 12 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:50	2.95	19:10	4.99	4.16	02:50	1.85	16:15	2.80	2.47	02:50	0.179	18:05	0.525	0.392	0.392	0.22
03/02/2023	02:45	2.98	20:10	5.00	4.11	03:55	1.94	20:00	2.85	2.46	02:45	0.193	20:00	0.561	0.385	0.385	-
03/03/2023	03:50	3.00	18:00	4.95	4.17	03:10	1.96	18:35	2.81	2.46	04:00	0.198	09:10	0.540	0.392	0.392	-
03/04/2023	03:35	3.02	08:55	4.88	4.12	04:40	1.87	13:45	2.80	2.47	04:40	0.190	08:55	0.531	0.387	0.387	-
03/05/2023	03:35	3.11	20:20	5.03	4.06	03:50	1.86	15:25	2.78	2.45	03:50	0.195	20:20	0.529	0.376	0.376	0.04
03/06/2023	02:55	2.97	19:50	4.93	4.14	04:05	1.81	19:05	2.80	2.45	04:05	0.179	17:20	0.530	0.388	0.388	-
03/07/2023	02:30	2.88	19:00	4.88	4.09	04:35	1.84	18:30	2.80	2.45	04:35	0.185	18:50	0.526	0.382	0.382	-
03/08/2023	04:05	3.06	18:55	5.00	4.16	02:00	2.01	09:55	2.77	2.49	04:15	0.214	19:30	0.529	0.395	0.395	-
03/09/2023	04:00	2.85	18:10	4.93	4.08	01:30	1.88	07:30	2.78	2.42	04:20	0.174	18:10	0.534	0.375	0.375	-
03/10/2023	03:20	2.87	15:25	4.99	4.13	02:55	1.79	12:05	2.82	2.43	02:55	0.172	15:25	0.557	0.385	0.385	0.90
03/11/2023	03:40	3.04	16:55	4.89	4.15	04:50	1.99	19:05	2.80	2.46	03:35	0.205	16:55	0.535	0.389	0.389	0.14
03/12/2023	04:40	3.00	12:25	5.07	4.19	04:35	1.82	19:35	2.82	2.45	04:35	0.183	12:25	0.563	0.395	0.395	-
03/13/2023	02:30	2.95	20:15	5.02	4.26	02:30	1.84	08:20	2.78	2.43	02:30	0.178	10:05	0.533	0.400	0.400	-
03/14/2023	02:40	2.98	20:30	5.12	4.19	04:15	1.86	08:25	2.74	2.41	02:50	0.185	20:35	0.551	0.386	0.386	1.01
03/15/2023	02:45	3.34	08:55	5.32	4.57	02:25	2.05	21:10	2.85	2.51	02:25	0.238	17:50	0.590	0.450	0.450	1.01
03/16/2023	03:45	3.51	19:30	5.21	4.52	03:25	2.09	21:20	2.83	2.50	03:45	0.266	21:20	0.585	0.440	0.440	0.02
03/17/2023	03:05	3.43	11:30	5.26	4.57	02:25	2.15	21:35	2.83	2.49	02:25	0.274	17:00	0.561	0.445	0.445	-
03/18/2023	03:30	3.38	13:25	5.23	4.50	01:25	2.09	14:25	2.79	2.46	04:25	0.256	13:25	0.586	0.433	0.433	-
03/19/2023	02:45	3.32	11:50	5.17	4.45	02:10	2.03	11:50	2.74	2.44	02:40	0.244	11:50	0.573	0.422	0.422	0.02
03/20/2023	03:35	3.41	20:45	5.27	4.49	03:00	2.09	19:40	2.80	2.47	03:35	0.271	18:35	0.589	0.432	0.432	0.09
03/21/2023	03:35	3.27	18:05	5.50	4.58	04:35	2.11	08:05	2.81	2.52	03:40	0.246	16:45	0.597	0.453	0.453	1.59
03/22/2023	03:45	3.38	19:00	5.36	4.65	03:35	2.05	08:00	2.86	2.51	03:35	0.247	08:00	0.604	0.459	0.459	0.15
03/23/2023	02:45	3.54	19:50	5.43	4.67	04:10	2.10	20:20	2.83	2.51	03:20	0.276	20:25	0.592	0.463	0.463	0.05
03/24/2023	03:55	3.61	18:15	5.30	4.66	02:30	2.17	13:55	2.84	2.52	02:30	0.290	20:10	0.585	0.463	0.463	-
03/25/2023	02:50	3.60	11:15	5.39	4.65	02:50	2.05	19:55	2.84	2.53	02:50	0.262	09:50	0.611	0.464	0.464	-
03/26/2023	04:00	3.43	11:30	5.50	4.60	04:25	2.05	21:40	2.87	2.52	04:00	0.251	11:30	0.615	0.457	0.457	-
03/27/2023	04:05	3.42	17:40	5.29	4.60	01:55	2.09	19:50	2.82	2.53	04:15	0.259	17:45	0.602	0.457	0.457	-
03/28/2023	04:00	3.38	09:55	5.27	4.52	01:50	2.07	10:20	2.82	2.52	03:05	0.257	09:45	0.586	0.445	0.445	-
03/29/2023	03:40	3.33	19:10	5.29	4.58	04:25	2.10	19:15	2.85	2.53	04:25	0.252	19:15	0.611	0.456	0.456	0.56
03/30/2023	02:30	3.35	20:30	5.36	4.59	01:45	2.12	16:45	2.86	2.56	04:40	0.260	12:30	0.587	0.463	0.463	0.30
03/31/2023	04:00	3.39	09:10	5.20	4.60	04:50	2.16	20:30	2.88	2.53	04:10	0.259	20:30	0.600	0.457	0.457	-
04/01/2023	03:35	3.35	09:20	5.33	4.63	04:20	2.13	16:55	2.85	2.56	04:15	0.260	11:45	0.605	0.467	0.467	-
04/02/2023	04:05	3.39	11:35	5.29	4.56	04:00	2.07	09:05	2.83	2.53	04:00	0.244	11:25	0.592	0.451	0.451	-
04/03/2023	03:50	3.33	18:50	5.27	4.58	01:55	2.10	15:10	2.86	2.54	03:40	0.255	20:20	0.589	0.457	0.457	-
04/04/2023	04:05	3.36	08:30	5.04	4.47	03:40	2.06	18:30	2.85	2.53	03:40	0.251	18:30	0.568	0.440	0.440	-
04/05/2023	03:50	3.33	20:15	5.10	4.47	03:40	2.11	19:45	2.83	2.53	03:40	0.249	20:25	0.567	0.440	0.440	-
04/06/2023	03:45	3.29	09:10	5.13	4.45	02:15	2.13	13:30	2.83	2.51	04:00	0.251	20:15	0.569	0.434	0.434	-
04/07/2023	02:20	3.33	19:05	5.10	4.46	00:40	2.17	17:10	2.81	2.51	02:20	0.252	11:55	0.561	0.436	0.436	-
04/08/2023	05:00	3.40	10:30	5.15	4.42	01:20	2.12	09:35	2.85	2.50	04:30	0.259	12:35	0.581	0.428	0.428	-
04/09/2023	03:25	3.28	10:45	5.17	4.35	02:15	2.03	14:15	2.80	2.48	03:25	0.240	11:45	0.568	0.417	0.417	-
04/10/2023	02:45	3.22	18:40	5.10	4.36	03:25	1.98	18:05	2.85	2.49	02:55	0.219	18:05	0.565	0.420	0.420	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			17.476	6.10
Average	4.40	2.49	0.426	

MC49

Site Commentary

SITE INFORMATION

Pipe	Round (8 in H)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.75	1.41	0.098
Minimum	1.98	0.97	0.042
Maximum	3.85	1.68	0.179
Min Time	03/09/2023 3:20:00 AM	03/08/2023 3:05:00 AM	03/08/2023 2:50:00 AM
Max Time	03/25/2023 12:35:00 PM	03/15/2023 8:25:00 PM	03/21/2023 8:50:00 PM

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

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

DATA UPTIME

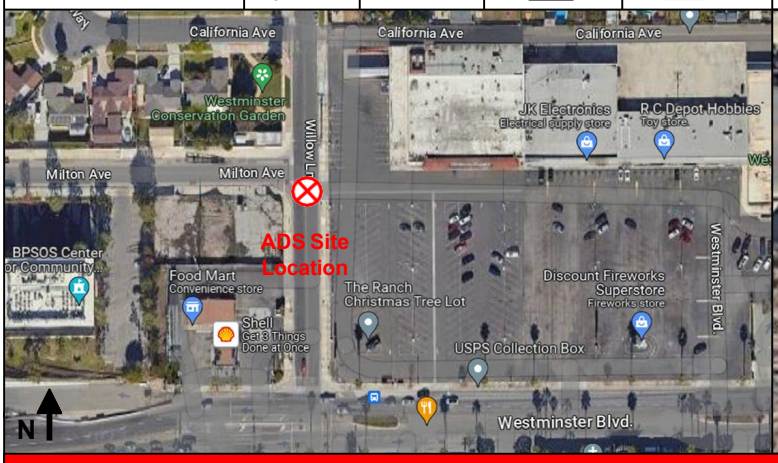
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

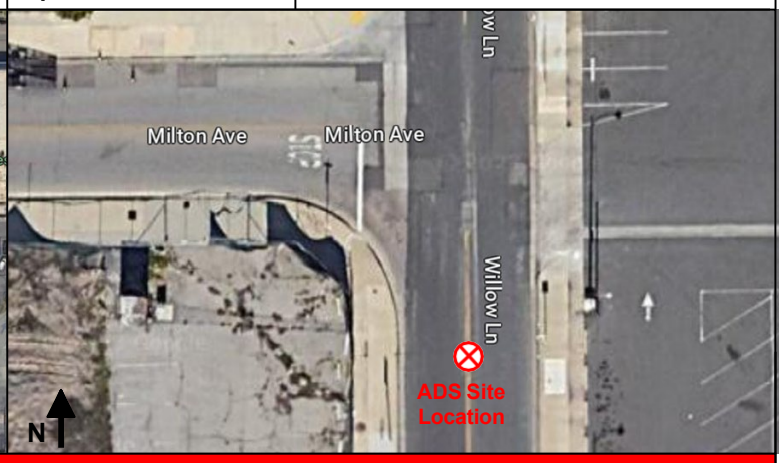
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC49	**Install Date:** 2/28/2023	**Monitor Type**	Peak Doppler
Address/Location: 13961 Willow Ln.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	1050
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	8.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 3:41 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.25 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.46 fps
Silt:	0 Inches

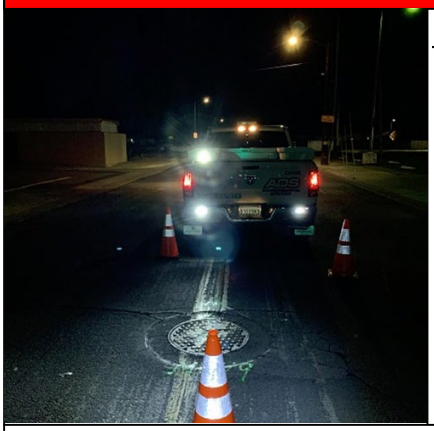
Manhole Information:

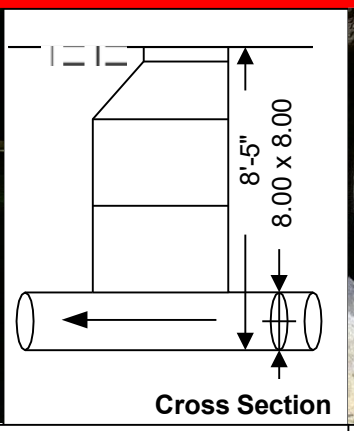
Manhole Depth:	8'-5"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

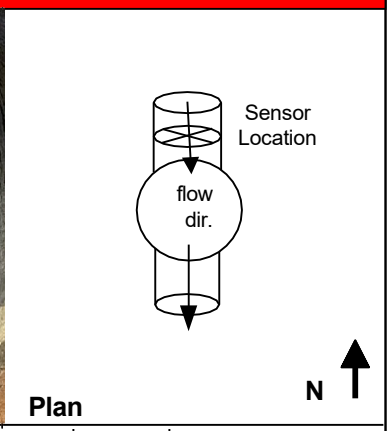
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

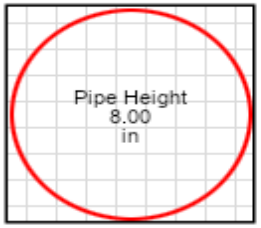
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC49

Flow Monitor

MC49

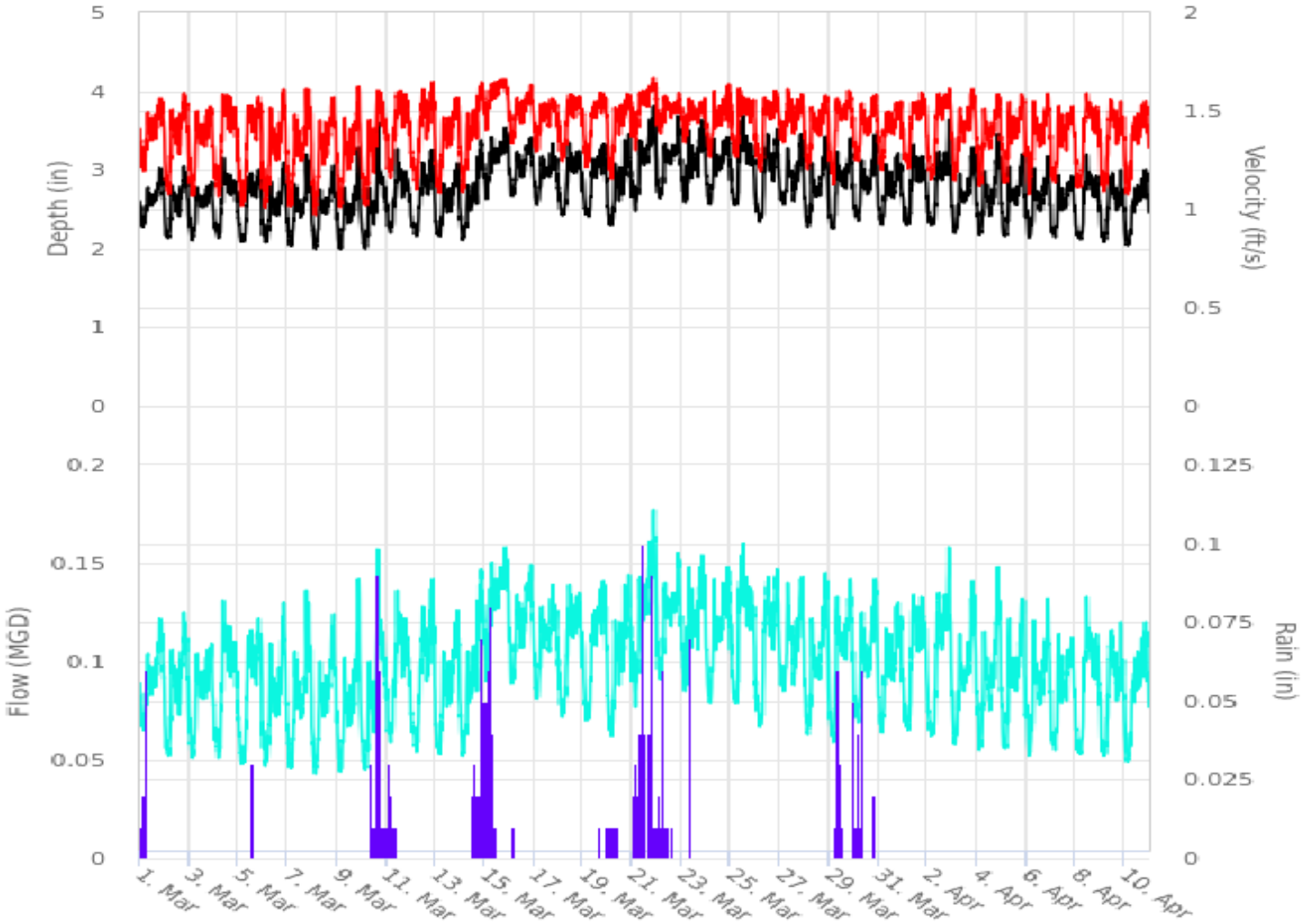


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC49

Flow Monitor

MC49

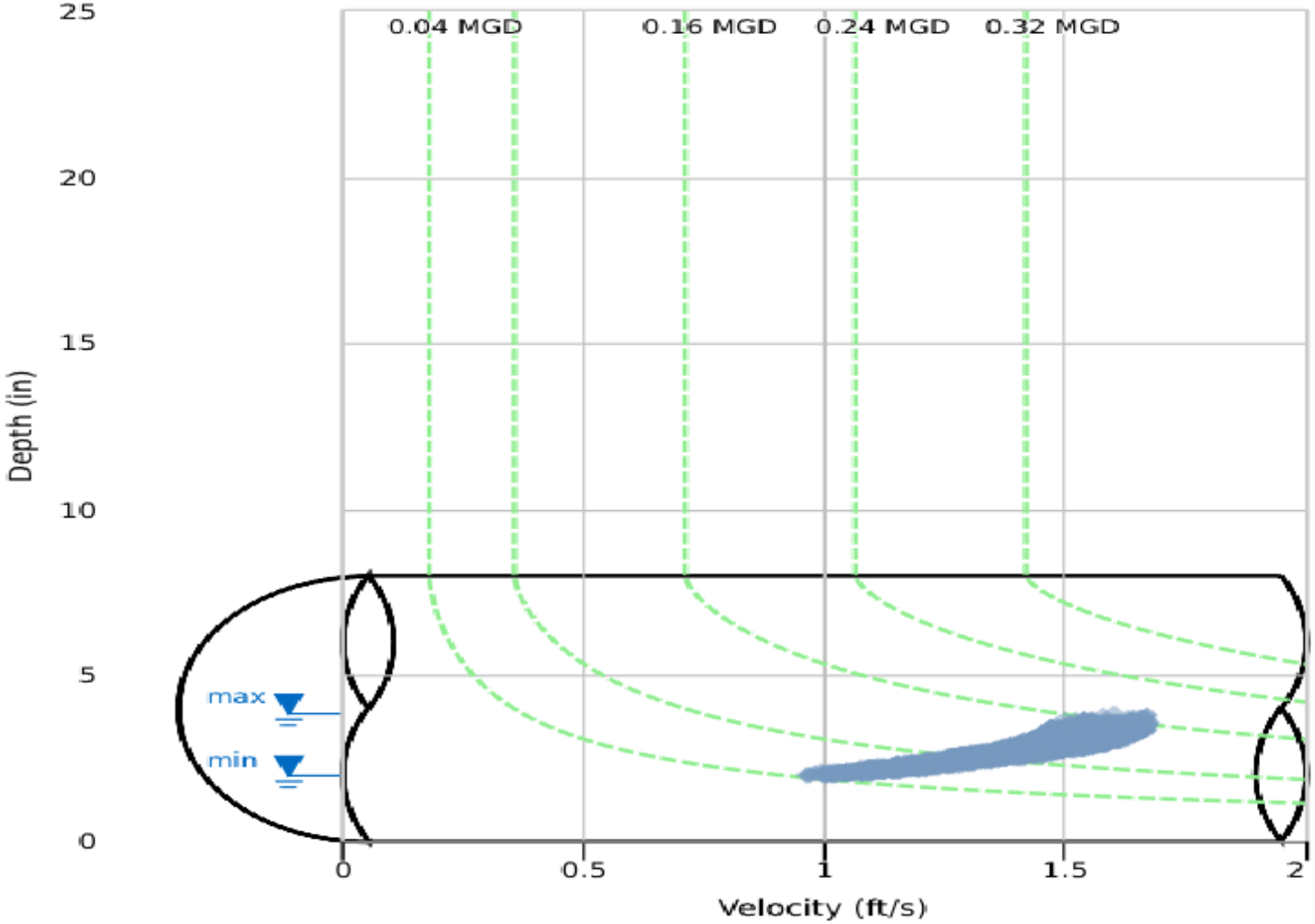
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Huntsville, AL 35806

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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC49Pipe: Round (8 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:55	2.27	19:15	3.04	2.63	02:25	1.14	19:10	1.60	1.40	02:25	0.062	19:10	0.125	0.091	0.091	0.24
03/02/2023	03:35	2.12	18:50	3.08	2.57	04:05	1.06	18:45	1.62	1.37	04:05	0.051	18:45	0.127	0.087	0.087	-
03/03/2023	03:20	2.10	22:05	2.87	2.53	03:50	1.03	20:35	1.54	1.34	03:25	0.050	22:10	0.111	0.083	0.083	-
03/04/2023	04:45	2.13	09:15	3.27	2.62	04:45	1.06	09:05	1.63	1.37	04:45	0.051	09:05	0.135	0.090	0.090	-
03/05/2023	05:45	2.08	13:10	3.03	2.58	03:10	1.00	19:55	1.59	1.35	05:50	0.047	19:55	0.124	0.087	0.087	0.05
03/06/2023	03:05	2.08	20:25	3.12	2.52	02:20	0.98	20:20	1.62	1.31	02:20	0.046	20:20	0.132	0.081	0.081	-
03/07/2023	03:55	2.02	18:20	3.21	2.53	02:30	1.01	20:35	1.63	1.31	02:30	0.046	18:20	0.138	0.082	0.082	-
03/08/2023	02:50	1.99	20:45	3.09	2.50	03:05	0.97	19:45	1.61	1.30	02:50	0.042	20:45	0.125	0.080	0.080	-
03/09/2023	03:20	1.98	20:50	3.29	2.48	03:15	1.00	20:55	1.63	1.29	03:20	0.044	20:55	0.142	0.079	0.079	-
03/10/2023	03:45	1.99	15:50	3.61	2.55	04:15	1.01	15:55	1.68	1.34	03:45	0.044	15:55	0.165	0.085	0.085	0.86
03/11/2023	04:15	2.20	10:50	3.26	2.68	03:10	1.12	10:35	1.64	1.42	04:15	0.058	10:45	0.141	0.095	0.095	0.15
03/12/2023	05:40	2.14	20:10	3.38	2.67	05:35	1.09	21:30	1.65	1.40	05:40	0.053	20:10	0.147	0.094	0.094	-
03/13/2023	04:25	2.14	21:35	3.09	2.59	04:20	1.07	19:40	1.58	1.36	04:25	0.052	21:35	0.126	0.087	0.087	-
03/14/2023	02:35	2.09	21:15	3.39	2.67	02:35	1.08	21:15	1.65	1.40	02:35	0.051	21:15	0.150	0.094	0.094	1.04
03/15/2023	02:00	2.62	20:20	3.55	3.16	02:00	1.40	20:25	1.68	1.58	02:00	0.090	20:25	0.162	0.132	0.132	0.97
03/16/2023	03:05	2.66	20:30	3.44	3.05	04:40	1.31	21:30	1.66	1.50	04:40	0.087	21:30	0.151	0.119	0.119	0.01
03/17/2023	03:20	2.55	18:35	3.35	2.94	03:20	1.28	11:15	1.61	1.46	03:20	0.079	18:30	0.140	0.110	0.110	-
03/18/2023	04:10	2.41	10:45	3.38	2.88	04:10	1.19	19:40	1.62	1.46	04:10	0.068	10:50	0.142	0.108	0.108	-
03/19/2023	03:30	2.40	20:50	3.36	2.89	03:30	1.18	16:20	1.63	1.46	03:30	0.067	19:45	0.144	0.108	0.108	0.03
03/20/2023	02:05	2.29	16:30	3.66	2.79	04:00	1.14	21:30	1.60	1.43	04:05	0.061	16:30	0.155	0.101	0.101	0.07
03/21/2023	03:25	2.47	20:50	3.84	3.14	03:20	1.29	20:45	1.67	1.54	03:20	0.077	20:50	0.179	0.128	0.128	1.20
03/22/2023	03:05	2.63	20:10	3.69	3.11	03:40	1.32	21:20	1.60	1.51	03:40	0.087	20:20	0.157	0.122	0.122	0.15
03/23/2023	03:30	2.58	07:25	3.72	3.12	03:25	1.32	22:40	1.67	1.48	03:25	0.083	20:05	0.159	0.121	0.121	0.10
03/24/2023	03:35	2.56	18:55	3.45	3.04	03:50	1.26	16:00	1.67	1.46	03:50	0.078	20:35	0.152	0.115	0.115	-
03/25/2023	04:45	2.54	12:35	3.85	3.06	03:30	1.25	09:50	1.67	1.46	03:30	0.078	12:35	0.172	0.117	0.117	-
03/26/2023	04:00	2.33	21:05	3.54	2.93	05:00	1.17	19:15	1.61	1.43	03:50	0.066	21:05	0.149	0.109	0.109	-
03/27/2023	01:00	2.55	21:50	3.49	2.92	03:55	1.27	07:35	1.66	1.47	03:55	0.079	21:50	0.147	0.110	0.110	-
03/28/2023	03:15	2.24	20:25	3.46	2.77	03:15	1.17	20:25	1.62	1.42	03:15	0.061	20:25	0.151	0.100	0.100	-
03/29/2023	04:00	2.24	20:50	3.43	2.81	04:20	1.09	19:05	1.62	1.43	04:25	0.057	20:55	0.143	0.103	0.103	0.50
03/30/2023	04:30	2.34	20:40	3.46	2.82	04:30	1.22	21:40	1.60	1.43	04:30	0.067	20:40	0.144	0.102	0.102	0.18
03/31/2023	03:40	2.29	17:10	3.26	2.75	03:35	1.17	17:05	1.61	1.41	03:35	0.063	17:15	0.136	0.098	0.098	-
04/01/2023	03:50	2.30	10:15	3.37	2.80	05:15	1.18	21:10	1.61	1.43	05:15	0.064	10:15	0.138	0.102	0.102	-
04/02/2023	03:20	2.30	20:50	3.66	2.81	03:20	1.14	20:20	1.62	1.42	03:20	0.061	20:50	0.159	0.103	0.103	-
04/03/2023	02:30	2.19	19:55	3.39	2.68	02:30	1.13	19:50	1.63	1.40	02:30	0.057	19:55	0.147	0.094	0.094	-
04/04/2023	02:35	2.17	20:20	3.49	2.67	02:55	1.12	21:45	1.60	1.38	02:35	0.055	20:20	0.151	0.093	0.093	-
04/05/2023	03:25	2.14	19:45	3.23	2.64	03:25	1.13	19:25	1.60	1.38	03:25	0.055	19:45	0.135	0.091	0.091	-
04/06/2023	02:40	2.13	20:55	3.18	2.61	03:40	1.06	20:45	1.60	1.37	02:40	0.052	20:55	0.133	0.089	0.089	-
04/07/2023	04:25	2.12	08:00	2.96	2.58	04:25	1.12	21:25	1.54	1.37	04:25	0.054	08:00	0.116	0.087	0.087	-
04/08/2023	05:30	2.10	11:10	3.21	2.62	03:00	1.08	11:05	1.59	1.37	03:00	0.052	11:05	0.134	0.090	0.090	-
04/09/2023	04:00	2.08	12:05	3.02	2.55	04:35	1.08	11:30	1.58	1.36	04:00	0.051	20:20	0.120	0.086	0.086	-
04/10/2023	02:50	2.03	20:35	3.03	2.53	03:10	1.00	21:55	1.56	1.35	03:10	0.046	21:55	0.122	0.084	0.084	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			4.035	5.55
Average	2.75	1.41	0.098	

MC68

Site Commentary

SITE INFORMATION

Pipe	Round (10 in H)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	4.41	0.63	0.095
Minimum	2.70	0.14	0.013
Maximum	6.33	0.99	0.207
Min Time	04/10/2023 3:20:00 PM	04/10/2023 2:45:00 PM	04/10/2023 2:45:00 PM
Max Time	03/27/2023 8:10:00 AM	04/03/2023 7:25:00 PM	04/01/2023 5:40:00 AM

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

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

DATA UPTIME

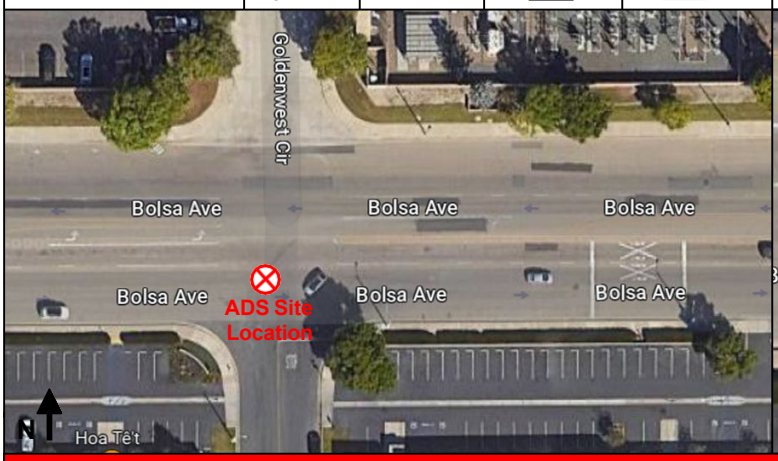
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

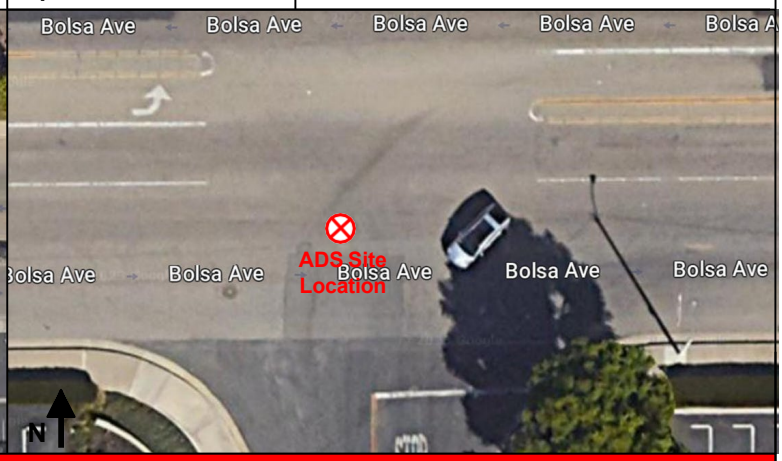
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC68	**Install Date:** 2/28/2023	**Monitor Type**	Peak Doppler
Address/Location: 7360 Bolsa Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	2717
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	10.00 "
		Pipe Width:	10.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 3:16 am
Site Hydraulics:	Slow straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	4.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	0.81 fps
Silt:	0 Inches

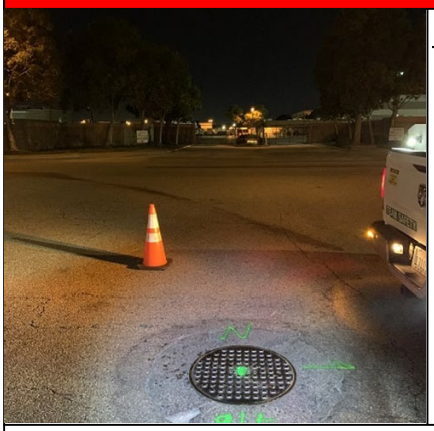
Manhole Information:

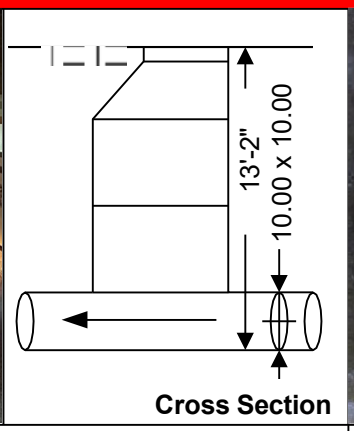
Manhole Depth:	13'-2"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [ ]	Commercial [X]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

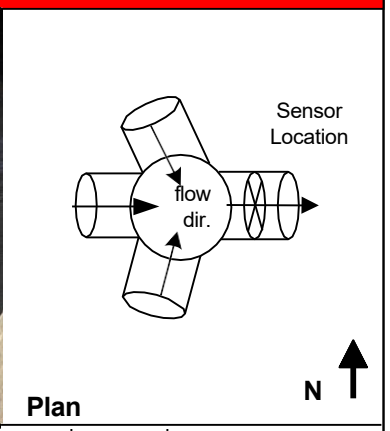
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Outlet
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

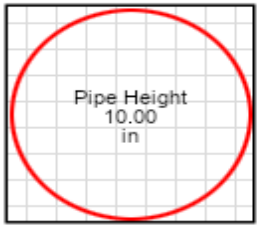
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC68

Flow Monitor

MC68

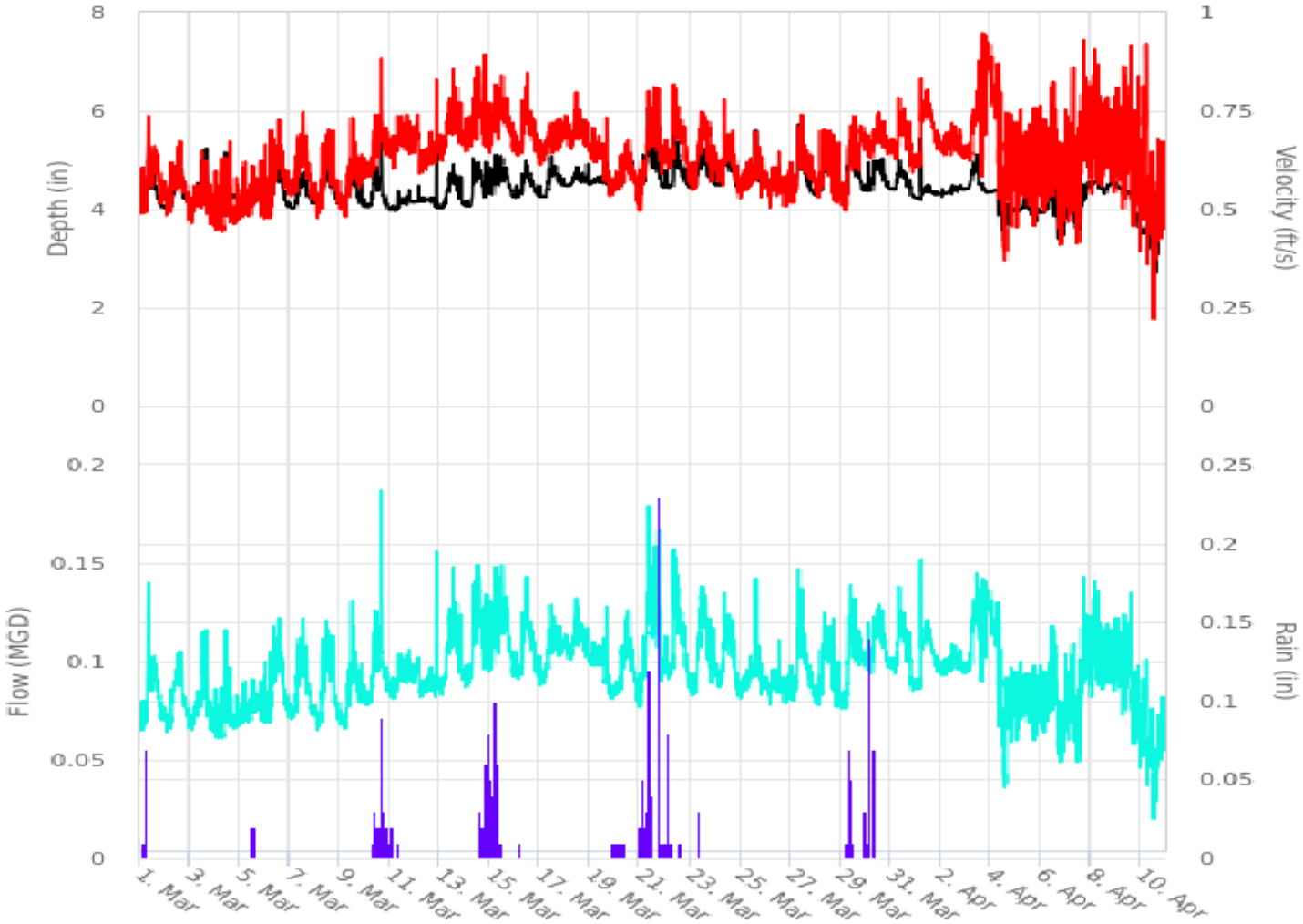


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC68

Flow Monitor

MC68

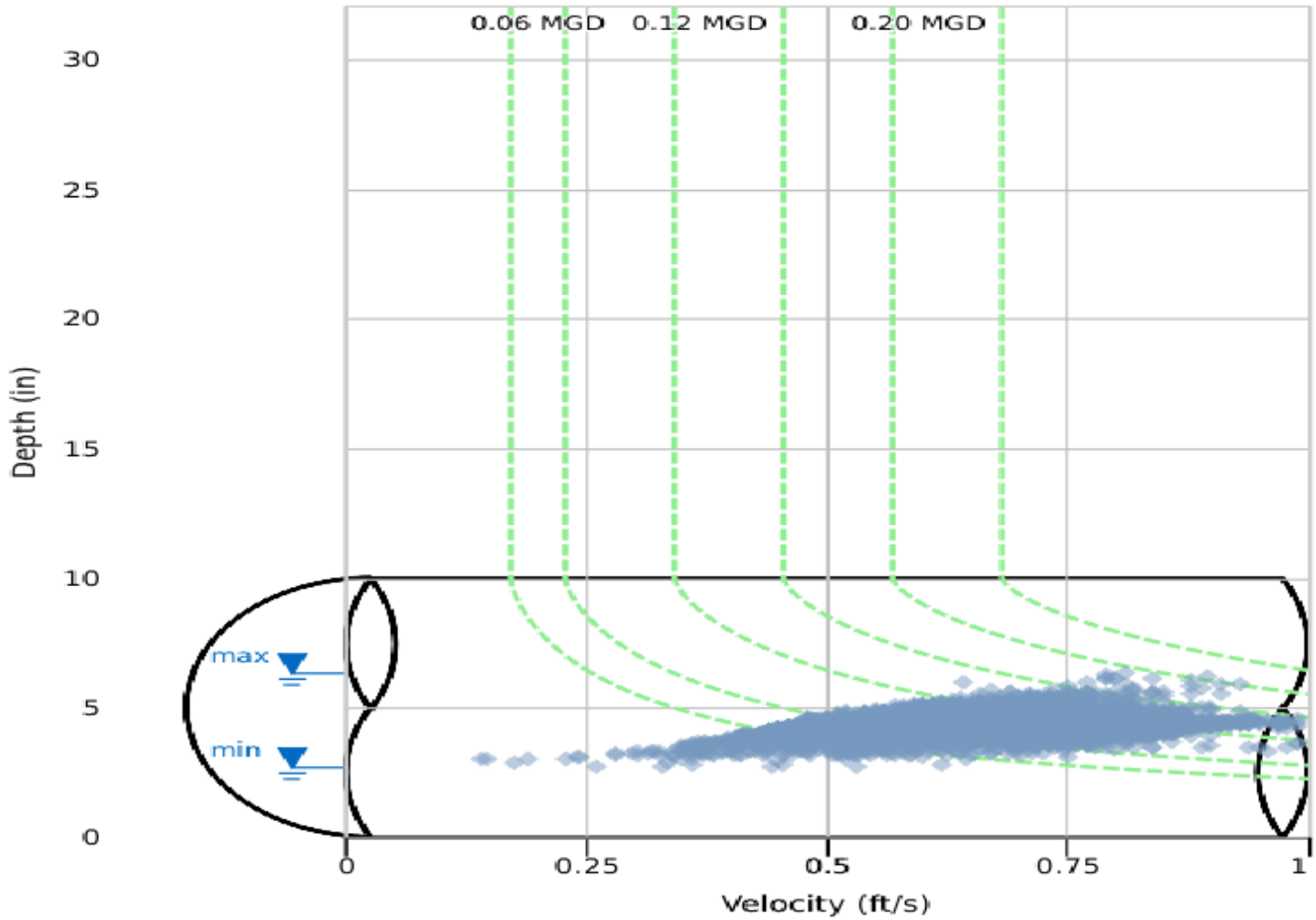
Pipe Height
10.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC68Pipe: Round (10 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	01:20	3.99	08:15	5.33	4.31	05:50	0.48	08:15	0.77	0.57	03:05	0.064	08:15	0.147	0.084	0.084	0.22
03/02/2023	01:30	4.02	15:55	4.83	4.29	03:30	0.46	14:35	0.71	0.56	03:30	0.061	14:35	0.113	0.081	0.081	-
03/03/2023	02:20	4.15	15:50	5.25	4.38	20:00	0.45	11:30	0.69	0.52	01:20	0.063	15:45	0.123	0.078	0.078	-
03/04/2023	02:00	4.10	10:10	5.49	4.25	01:35	0.44	08:45	0.75	0.50	01:50	0.060	10:10	0.139	0.072	0.072	-
03/05/2023	01:45	4.24	12:20	4.38	4.28	00:45	0.46	04:25	0.75	0.53	01:45	0.065	04:25	0.109	0.076	0.076	0.04
03/06/2023	23:55	4.05	12:05	5.03	4.45	04:00	0.46	14:05	0.77	0.59	04:00	0.066	14:05	0.131	0.090	0.090	-
03/07/2023	01:40	4.01	13:30	4.77	4.30	20:35	0.51	13:25	0.78	0.59	00:45	0.069	13:25	0.129	0.086	0.086	-
03/08/2023	03:00	4.11	10:30	4.97	4.38	03:15	0.45	10:30	0.73	0.58	03:15	0.061	10:30	0.128	0.087	0.087	-
03/09/2023	22:15	4.05	11:35	5.06	4.32	03:50	0.46	11:30	0.80	0.58	03:50	0.063	11:30	0.143	0.085	0.085	-
03/10/2023	22:15	3.99	15:40	5.91	4.34	01:30	0.55	15:40	0.93	0.66	01:30	0.073	15:40	0.202	0.097	0.097	0.90
03/11/2023	00:25	3.97	18:25	4.40	4.13	03:20	0.58	07:25	0.81	0.68	03:20	0.078	07:25	0.118	0.093	0.093	0.14
03/12/2023	22:05	4.02	20:25	6.25	4.18	04:40	0.57	20:30	0.91	0.65	05:35	0.079	20:30	0.197	0.091	0.091	-
03/13/2023	00:00	4.02	12:50	4.95	4.34	00:50	0.62	12:45	0.87	0.71	00:50	0.082	12:50	0.150	0.105	0.105	-
03/14/2023	03:45	4.06	07:45	5.07	4.45	11:00	0.55	19:10	0.92	0.72	03:40	0.086	12:25	0.156	0.110	0.110	1.01
03/15/2023	23:50	4.25	05:55	5.26	4.58	00:00	0.63	11:20	0.89	0.72	22:00	0.092	06:00	0.159	0.114	0.114	1.01
03/16/2023	01:20	4.22	10:45	5.05	4.48	01:55	0.62	10:45	0.90	0.70	05:20	0.090	10:45	0.161	0.107	0.107	0.02
03/17/2023	00:30	4.25	10:50	5.08	4.55	00:10	0.60	10:50	0.74	0.68	00:10	0.086	10:50	0.133	0.106	0.106	-
03/18/2023	02:30	4.47	22:00	4.93	4.59	22:10	0.61	11:05	0.87	0.70	06:15	0.096	11:05	0.144	0.110	0.110	-
03/19/2023	20:45	4.44	15:55	5.07	4.57	18:40	0.50	03:40	0.79	0.62	19:40	0.077	15:50	0.141	0.097	0.097	0.02
03/20/2023	00:00	4.44	12:45	5.36	4.72	23:10	0.49	10:20	0.70	0.59	23:10	0.076	12:50	0.132	0.097	0.097	0.09
03/21/2023	22:10	4.44	08:35	6.11	4.93	00:05	0.48	17:40	0.88	0.66	00:05	0.074	17:40	0.196	0.115	0.115	1.59
03/22/2023	03:45	4.43	08:15	5.59	4.71	23:45	0.56	08:10	0.88	0.67	23:45	0.085	08:10	0.176	0.109	0.109	0.15
03/23/2023	00:05	4.44	10:50	5.25	4.73	01:55	0.53	11:25	0.79	0.64	01:55	0.080	11:25	0.147	0.105	0.105	0.05
03/24/2023	21:45	4.45	13:50	5.12	4.73	22:20	0.52	08:45	0.93	0.62	22:20	0.079	08:45	0.158	0.101	0.101	-
03/25/2023	00:25	4.47	15:05	5.64	4.61	00:05	0.50	14:55	0.77	0.59	00:05	0.077	14:55	0.147	0.094	0.094	-
03/26/2023	15:15	4.50	13:20	4.90	4.57	04:55	0.48	13:20	0.67	0.56	04:55	0.074	13:20	0.115	0.088	0.088	-
03/27/2023	23:25	4.28	08:10	6.33	4.66	03:45	0.49	08:10	0.81	0.61	03:45	0.076	08:10	0.191	0.098	0.098	-
03/28/2023	00:00	4.29	18:55	5.17	4.62	21:05	0.48	06:00	0.91	0.59	21:05	0.072	06:00	0.138	0.095	0.095	-
03/29/2023	03:25	4.37	10:20	5.43	4.69	05:30	0.48	13:30	0.88	0.62	02:05	0.073	13:30	0.157	0.101	0.101	0.56
03/30/2023	02:15	4.37	16:50	5.07	4.65	05:40	0.62	14:25	0.78	0.68	05:40	0.092	14:25	0.135	0.109	0.109	0.30
03/31/2023	22:00	4.24	08:40	5.04	4.53	21:35	0.58	08:40	0.82	0.67	21:35	0.083	08:40	0.146	0.104	0.104	-
04/01/2023	05:25	4.18	05:40	6.22	4.35	04:00	0.58	05:45	0.91	0.70	04:00	0.082	05:40	0.207	0.103	0.103	-
04/02/2023	02:10	4.24	12:15	4.50	4.38	18:25	0.61	12:10	0.76	0.67	02:10	0.090	12:10	0.117	0.099	0.099	-
04/03/2023	21:10	4.33	11:10	5.14	4.55	15:40	0.50	19:25	0.99	0.75	19:20	0.077	14:00	0.152	0.118	0.118	-
04/04/2023	14:35	3.17	06:55	4.41	4.02	14:15	0.28	08:10	0.98	0.67	14:25	0.027	08:10	0.146	0.090	0.090	-
04/05/2023	17:20	3.66	08:30	4.22	4.00	22:40	0.41	14:20	0.86	0.60	20:35	0.050	08:55	0.120	0.079	0.079	-
04/06/2023	21:25	3.37	14:50	4.43	3.96	16:45	0.35	11:30	0.91	0.61	17:15	0.037	15:00	0.134	0.080	0.080	-
04/07/2023	13:45	3.56	22:35	4.56	4.08	13:35	0.36	19:25	0.98	0.64	13:35	0.041	17:30	0.148	0.088	0.088	-
04/08/2023	13:50	4.31	06:05	4.58	4.49	13:35	0.47	13:40	0.99	0.69	13:35	0.068	22:10	0.155	0.106	0.106	-
04/09/2023	23:00	3.62	00:55	4.54	4.21	23:05	0.36	22:25	0.99	0.67	23:05	0.042	01:40	0.148	0.095	0.095	-
04/10/2023	15:20	2.70	23:40	3.88	3.48	14:45	0.14	05:45	0.98	0.55	14:45	0.013	05:45	0.108	0.061	0.061	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			3.905	6.10
Average	4.41	0.63	0.095	

MC70

Site Commentary

SITE INFORMATION

Pipe	Elliptical (8 in H x 7.75 in W)
Silt	0.00 (in)

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	4.53	1.26	0.163
Minimum	3.39	0.75	0.067
Maximum	7.43	2.02	0.428
Min Time	03/10/2023 4:15:00 AM	03/10/2023 3:15:00 AM	03/10/2023 3:15:00 AM
Max Time	03/21/2023 5:45:00 PM	03/21/2023 5:45:00 PM	03/21/2023 5:45:00 PM

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

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

DATA UPTIME

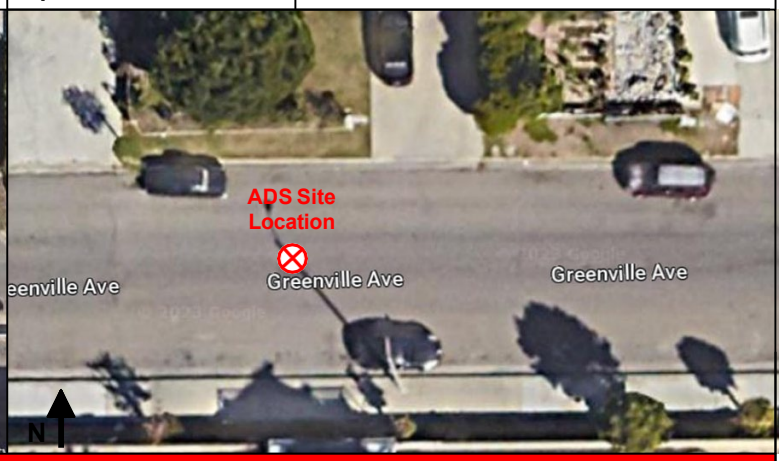
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC70	**Install Date:** 2/25/2023	**Monitor Type**	Peak Doppler
Address/Location: 9031 Greenville Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	3792
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	8.00 "
		Pipe Width:	7.75 "



Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 3:41 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.63 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.15 fps
Silt:	0 Inches

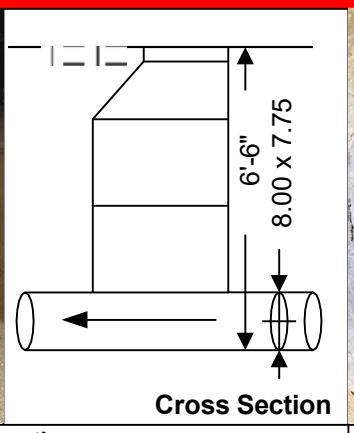
Manhole Information:

Manhole Depth:	6'-6"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

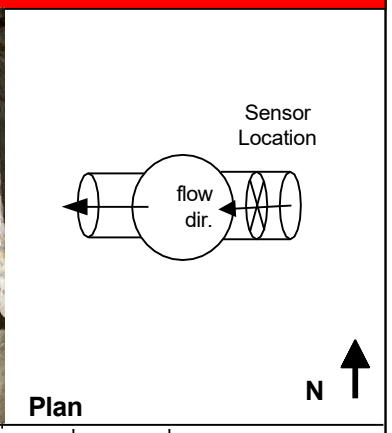
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

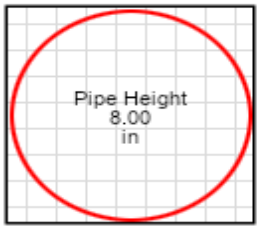
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC70

Flow Monitor

MC70

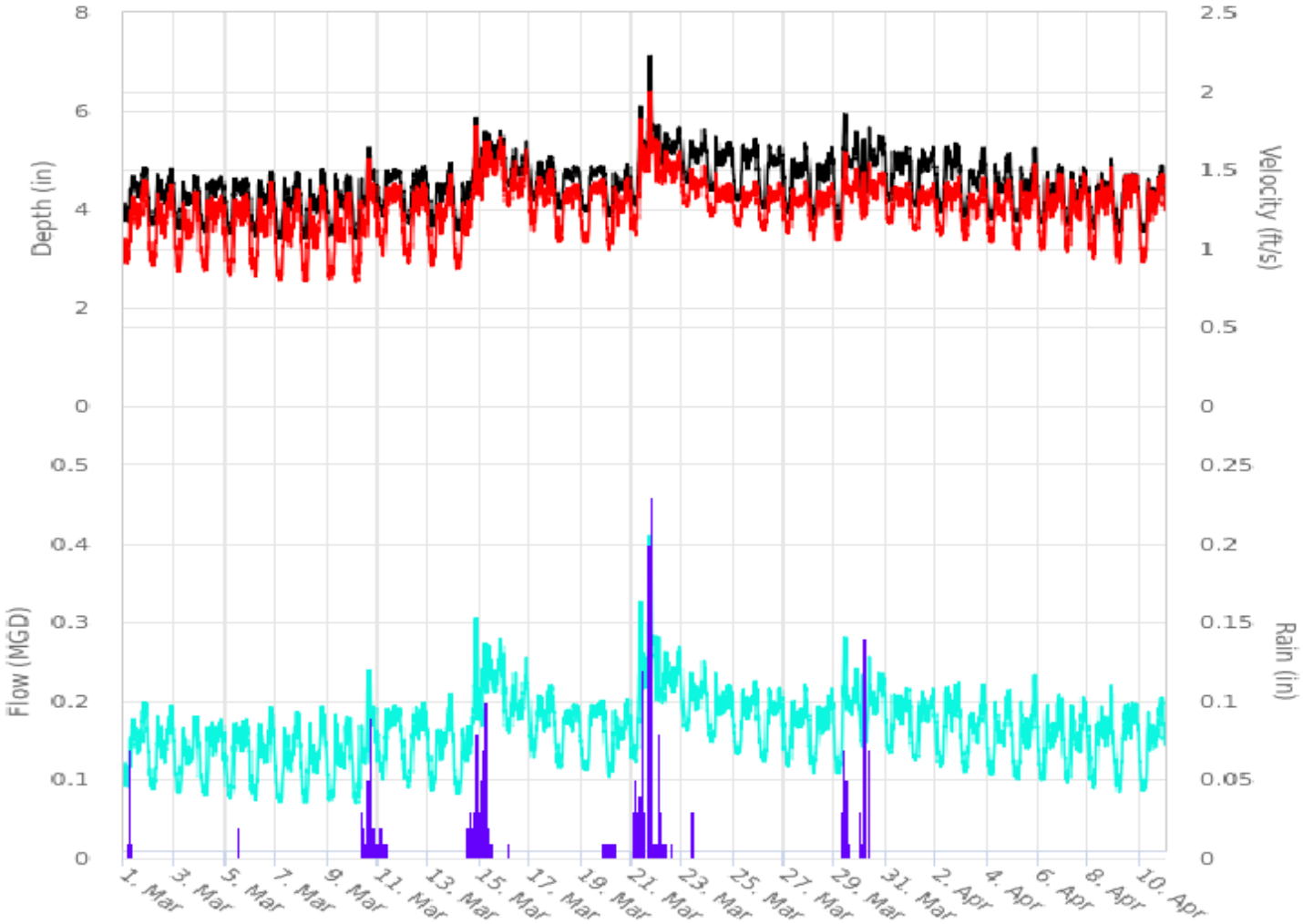


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC70

Flow Monitor

MC70

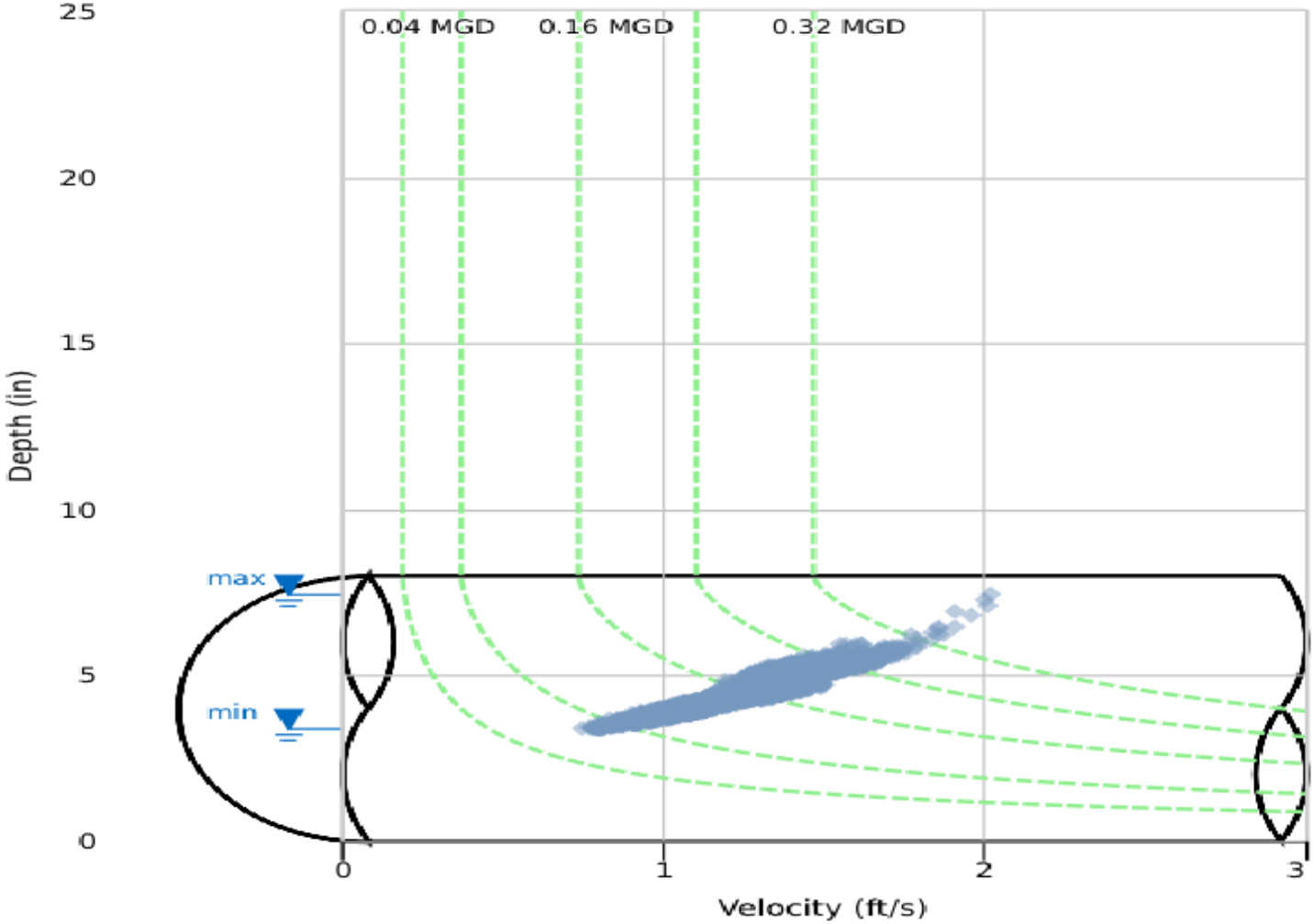
Pipe Height
8.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC70Pipe: Elliptical (8 in H x 7.75 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:50	3.73	18:55	4.87	4.36	02:50	0.89	18:55	1.46	1.19	02:50	0.089	18:55	0.203	0.146	0.146	0.22
03/02/2023	03:25	3.67	20:50	4.84	4.27	03:50	0.86	20:40	1.43	1.16	03:50	0.086	20:40	0.197	0.139	0.139	-
03/03/2023	03:50	3.60	18:10	4.71	4.18	03:15	0.83	20:25	1.39	1.12	03:15	0.081	20:25	0.185	0.131	0.131	-
03/04/2023	04:35	3.52	09:30	4.72	4.22	04:10	0.85	19:00	1.37	1.14	04:35	0.079	19:00	0.183	0.135	0.135	-
03/05/2023	04:25	3.48	20:25	4.68	4.20	05:40	0.80	19:25	1.38	1.14	04:25	0.074	19:25	0.183	0.134	0.134	0.04
03/06/2023	04:20	3.43	19:30	4.83	4.15	04:20	0.81	19:05	1.45	1.12	04:20	0.073	19:05	0.196	0.130	0.130	-
03/07/2023	03:45	3.40	21:10	4.86	4.12	03:50	0.78	21:15	1.41	1.10	03:50	0.069	21:15	0.194	0.127	0.127	-
03/08/2023	04:25	3.40	19:00	4.91	4.12	04:30	0.77	19:00	1.44	1.09	04:30	0.068	19:00	0.203	0.126	0.126	-
03/09/2023	02:10	3.46	07:40	4.92	4.13	02:20	0.80	07:45	1.44	1.10	02:20	0.072	07:45	0.201	0.127	0.127	-
03/10/2023	04:10	3.39	15:30	5.33	4.25	03:15	0.75	15:30	1.59	1.16	03:15	0.067	15:30	0.246	0.140	0.140	0.90
03/11/2023	05:05	3.85	15:05	4.85	4.46	04:50	0.93	15:35	1.44	1.25	04:50	0.098	15:35	0.199	0.157	0.157	0.14
03/12/2023	04:30	3.70	19:50	4.90	4.36	04:20	0.90	19:20	1.44	1.20	04:30	0.089	19:20	0.201	0.148	0.148	-
03/13/2023	03:05	3.64	21:00	4.98	4.29	02:55	0.88	20:50	1.50	1.17	03:10	0.085	21:05	0.213	0.141	0.141	-
03/14/2023	04:20	3.56	20:35	5.87	4.36	02:40	0.86	20:35	1.79	1.21	02:40	0.081	20:35	0.308	0.151	0.151	1.01
03/15/2023	02:20	4.55	04:55	5.64	5.19	02:20	1.29	19:55	1.73	1.55	02:20	0.166	19:50	0.283	0.233	0.233	1.01
03/16/2023	03:50	4.46	20:10	5.43	4.83	03:05	1.26	20:15	1.67	1.41	03:45	0.158	20:15	0.263	0.195	0.195	0.02
03/17/2023	03:05	4.17	19:00	5.13	4.67	03:05	1.10	19:05	1.54	1.33	03:05	0.127	19:00	0.227	0.177	0.177	-
03/18/2023	04:00	3.99	18:05	4.90	4.55	03:10	1.01	18:10	1.45	1.27	03:10	0.111	18:10	0.203	0.164	0.164	-
03/19/2023	05:10	3.94	19:40	4.91	4.52	03:45	1.01	19:40	1.47	1.28	03:45	0.109	19:40	0.207	0.164	0.164	0.02
03/20/2023	03:10	3.85	19:10	4.94	4.43	03:05	0.98	18:30	1.48	1.25	03:05	0.102	19:10	0.210	0.157	0.157	0.09
03/21/2023	03:15	4.05	17:45	7.43	5.11	04:00	1.05	17:45	2.02	1.49	04:00	0.118	17:45	0.428	0.223	0.223	1.59
03/22/2023	05:05	4.84	01:00	5.88	5.25	16:25	1.33	01:00	1.73	1.50	05:05	0.194	01:00	0.298	0.229	0.229	0.15
03/23/2023	03:45	4.53	19:55	5.70	5.04	03:05	1.25	19:55	1.55	1.38	03:45	0.160	19:55	0.258	0.201	0.201	0.05
03/24/2023	03:15	4.37	07:15	5.58	4.94	03:20	1.20	07:20	1.53	1.33	03:20	0.147	07:20	0.246	0.188	0.188	-
03/25/2023	03:45	4.17	20:35	5.45	4.88	05:35	1.11	20:35	1.45	1.29	03:00	0.132	20:35	0.230	0.181	0.181	-
03/26/2023	05:00	4.02	09:40	5.39	4.75	03:35	1.11	09:45	1.43	1.29	05:00	0.122	09:40	0.222	0.175	0.175	-
03/27/2023	03:30	3.91	19:35	5.36	4.63	03:55	1.08	19:35	1.45	1.27	04:00	0.115	19:35	0.226	0.168	0.168	-
03/28/2023	03:20	3.80	20:50	5.27	4.58	03:45	1.04	20:50	1.43	1.26	03:45	0.107	20:50	0.218	0.165	0.165	-
03/29/2023	02:25	3.78	09:15	5.95	4.78	02:25	1.04	09:15	1.62	1.31	02:25	0.106	09:15	0.282	0.181	0.181	0.56
03/30/2023	02:15	4.25	08:35	5.69	4.99	02:10	1.17	08:40	1.57	1.36	02:10	0.138	08:40	0.260	0.196	0.196	0.30
03/31/2023	03:55	4.16	21:10	5.29	4.82	02:25	1.14	20:25	1.43	1.31	03:50	0.132	21:10	0.219	0.180	0.180	-
04/01/2023	04:00	4.06	20:55	5.33	4.73	05:55	1.09	21:00	1.42	1.28	04:50	0.124	21:00	0.220	0.173	0.173	-
04/02/2023	03:40	3.93	18:20	5.42	4.68	03:40	1.07	20:55	1.49	1.28	03:40	0.114	18:25	0.228	0.171	0.171	-
04/03/2023	03:25	3.82	20:50	5.27	4.53	03:30	1.03	20:45	1.46	1.26	03:30	0.106	20:55	0.222	0.162	0.162	-
04/04/2023	04:25	3.78	20:45	5.19	4.45	04:25	1.02	20:45	1.47	1.24	04:25	0.104	20:45	0.221	0.157	0.157	-
04/05/2023	05:05	3.74	20:45	5.29	4.38	05:15	0.96	20:45	1.57	1.25	05:15	0.097	20:45	0.241	0.154	0.154	-
04/06/2023	03:25	3.71	20:10	4.99	4.33	04:00	0.97	20:10	1.50	1.26	03:25	0.097	20:10	0.215	0.153	0.153	-
04/07/2023	03:35	3.67	18:20	4.89	4.28	02:55	0.96	18:15	1.50	1.25	03:35	0.094	18:15	0.207	0.150	0.150	-
04/08/2023	04:35	3.59	20:45	5.10	4.26	04:05	0.92	20:45	1.54	1.24	04:35	0.087	20:45	0.226	0.149	0.149	-
04/09/2023	04:30	3.52	17:05	4.76	4.27	04:25	0.89	17:25	1.50	1.25	04:25	0.083	21:15	0.203	0.151	0.151	-
04/10/2023	02:45	3.55	21:00	4.98	4.21	03:05	0.91	20:45	1.50	1.24	03:05	0.085	20:45	0.206	0.146	0.146	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			6.678	6.10
Average	4.53	1.26	0.163	

MC71A

Site Commentary

SITE INFORMATION

Pipe	Elliptical (10.25 in H x 10.38 in W)
Silt	0.00 (in)

OBSERVATIONS

This site functioned under normal conditions during the study period. No surcharge conditions were experienced at this location. This site experienced hydraulic shifts on March 15 and April 2.

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.00	1.06	0.060
Minimum	0.71	0.21	0.003
Maximum	4.56	2.16	0.187
Min Time	03/20/2023 3:20:00 AM	03/28/2023 1:40:00 AM	03/20/2023 3:05:00 AM
Max Time	03/15/2023 2:15:00 PM	03/01/2023 4:50:00 PM	03/01/2023 11:35:00 AM

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

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

DATA UPTIME

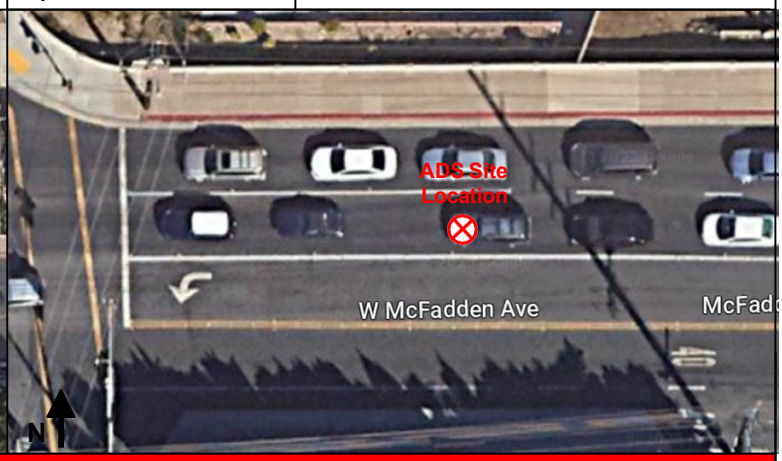
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

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

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC71A	**Install Date:** 3/02/2023	**Monitor Type**	Peak Doppler
Address/Location: 8501 McFadden Ave.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	2695
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	10.25 "
		Pipe Width:	10.38 "



Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 1:21 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.38 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.38 fps
Silt:	0 Inches

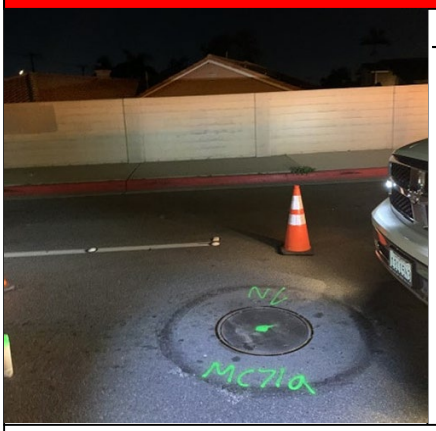
Manhole Information:

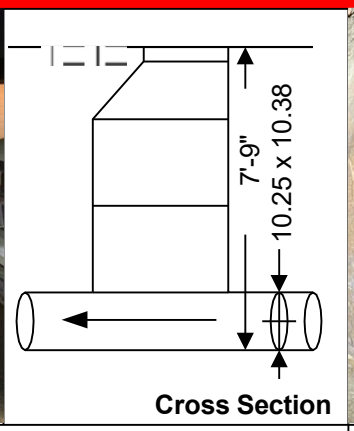
Manhole Depth:	7'-9"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

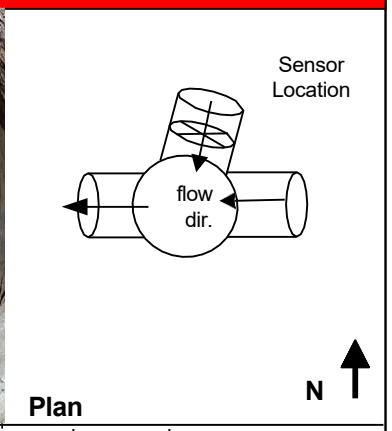
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

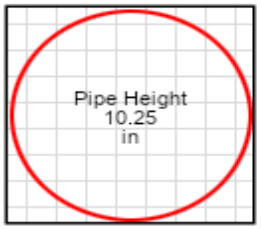
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC71A

Flow Monitor

MC71A

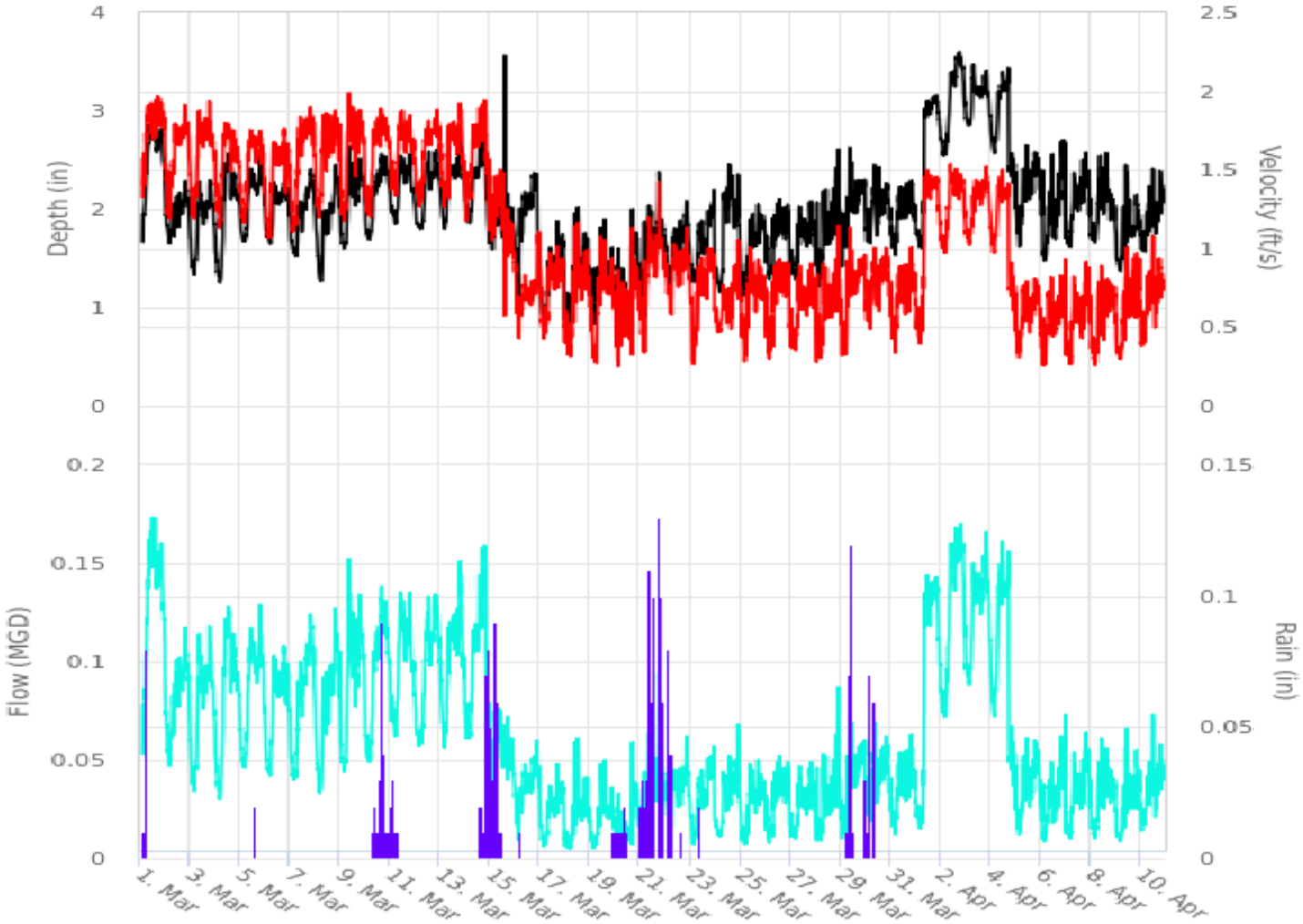


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Huntsville, AL 35806

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Scattergraph Report

MC71A

Flow Monitor

MC71A

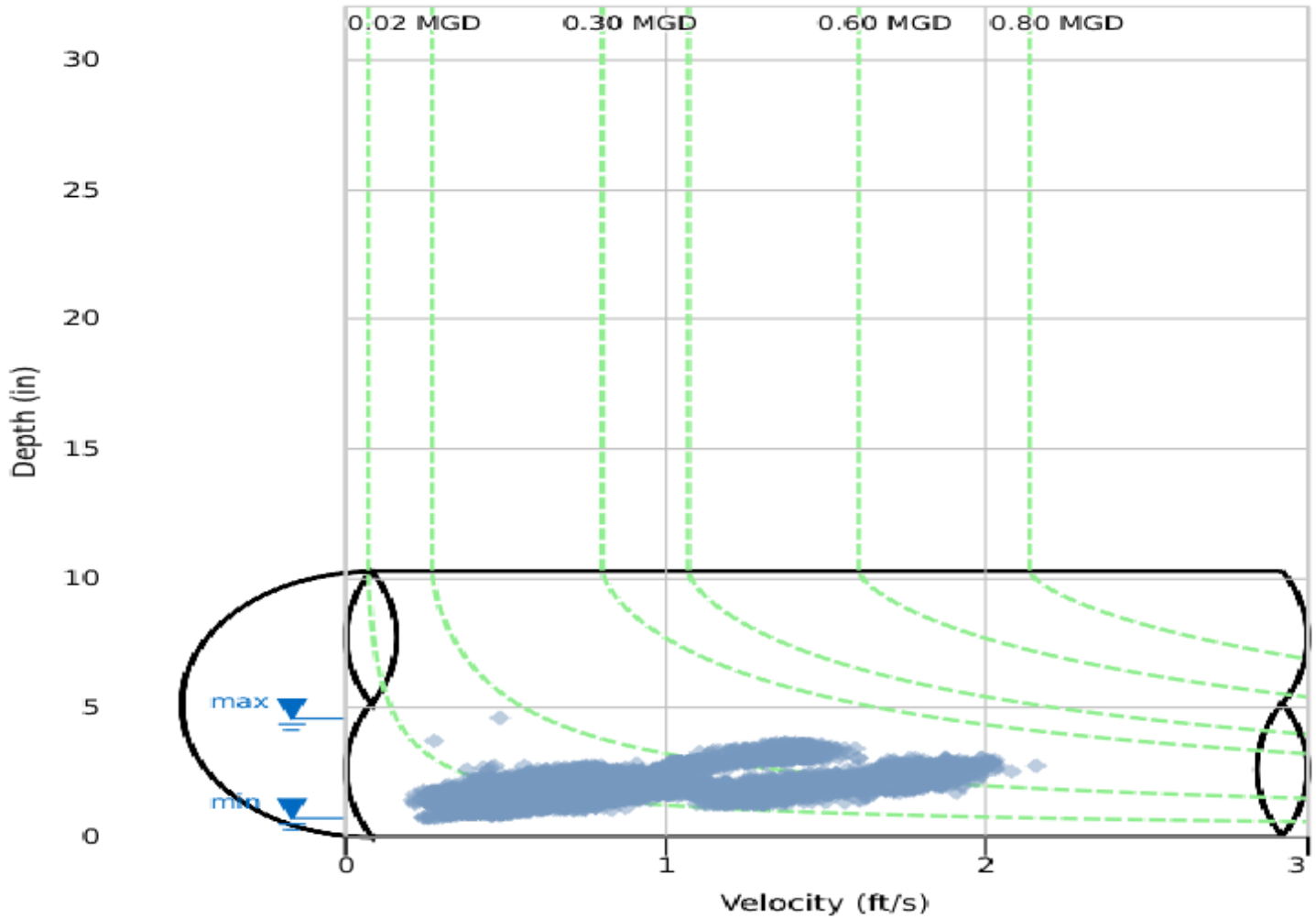
Pipe Height
10.25
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC71APipe: Elliptical (10.25 in H x 10.38 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	02:40	1.67	11:35	3.06	2.59	02:40	1.33	16:50	2.16	1.80	02:40	0.053	11:35	0.187	0.136	0.120	0.21
03/02/2023	04:20	1.65	19:10	2.31	1.98	05:05	1.13	19:40	1.94	1.61	04:20	0.046	19:10	0.121	0.082	0.082	-
03/03/2023	04:10	1.33	09:15	2.31	1.88	01:50	1.15	18:30	1.97	1.61	04:10	0.034	18:35	0.120	0.078	0.078	-
03/04/2023	04:45	1.25	12:50	2.57	1.99	04:45	1.10	10:00	1.83	1.55	04:45	0.029	12:45	0.131	0.083	0.083	-
03/05/2023	03:35	1.67	19:25	2.62	2.11	04:55	1.13	10:10	1.78	1.53	04:55	0.045	19:25	0.131	0.087	0.087	0.02
03/06/2023	05:10	1.65	09:00	2.33	2.02	03:25	1.04	18:05	1.79	1.47	05:25	0.041	18:05	0.111	0.078	0.078	-
03/07/2023	06:05	1.52	20:00	2.42	1.96	02:35	1.09	19:50	1.93	1.59	04:05	0.040	20:00	0.128	0.082	0.082	-
03/08/2023	05:25	1.27	19:25	2.46	1.88	03:50	1.17	19:15	1.94	1.61	04:30	0.033	19:20	0.130	0.078	0.078	-
03/09/2023	03:40	1.59	08:25	2.70	2.09	03:20	1.16	08:15	2.08	1.61	03:40	0.044	08:20	0.159	0.091	0.091	-
03/10/2023	04:00	1.69	15:50	2.57	2.16	05:05	1.10	15:40	1.94	1.62	05:05	0.046	15:45	0.141	0.096	0.096	0.98
03/11/2023	05:20	1.85	19:25	2.58	2.22	06:00	1.27	09:55	1.94	1.63	06:00	0.060	09:55	0.140	0.099	0.099	0.16
03/12/2023	05:25	1.79	20:25	2.61	2.20	04:10	1.26	21:20	1.91	1.61	04:25	0.056	19:05	0.138	0.097	0.097	-
03/13/2023	08:15	1.10	08:20	2.75	2.27	08:15	0.63	19:10	1.99	1.63	08:15	0.014	19:15	0.155	0.102	0.102	-
03/14/2023	22:55	1.63	17:20	2.81	2.25	22:55	1.09	17:15	1.99	1.59	22:55	0.042	18:35	0.163	0.100	0.100	1.06
03/15/2023	02:30	1.58	14:15	4.56	1.89	14:20	0.28	09:40	1.54	1.18	23:55	0.034	08:50	0.080	0.056	0.056	1.17
03/16/2023	04:00	1.08	21:30	2.48	1.92	04:20	0.39	22:35	1.14	0.74	04:00	0.009	21:30	0.069	0.036	0.036	0.01
03/17/2023	05:40	0.83	16:30	1.90	1.35	03:45	0.42	10:55	1.05	0.76	03:50	0.006	16:30	0.050	0.024	0.024	-
03/18/2023	05:15	0.83	09:10	2.47	1.34	03:50	0.30	09:10	1.38	0.71	05:25	0.004	09:10	0.096	0.023	0.023	-
03/19/2023	03:20	0.82	14:35	1.90	1.37	03:50	0.26	10:15	1.12	0.69	03:30	0.004	14:30	0.051	0.022	0.022	0.02
03/20/2023	03:20	0.71	17:00	2.12	1.26	02:55	0.24	17:00	1.28	0.62	03:05	0.003	17:00	0.072	0.018	0.018	0.19
03/21/2023	04:55	0.88	17:50	2.41	1.66	04:55	0.30	17:55	1.46	0.88	04:55	0.005	17:55	0.098	0.037	0.037	1.59
03/22/2023	04:55	1.21	20:30	2.10	1.66	06:25	0.54	20:30	1.18	0.86	04:55	0.014	20:30	0.065	0.035	0.035	0.22
03/23/2023	03:30	1.25	22:45	2.21	1.66	03:30	0.22	11:05	1.10	0.73	03:30	0.006	22:50	0.059	0.030	0.030	0.04
03/24/2023	04:45	1.15	16:55	2.56	1.82	04:45	0.45	22:05	1.09	0.66	04:45	0.010	22:05	0.071	0.031	0.031	-
03/25/2023	01:40	1.01	17:15	2.08	1.61	04:20	0.28	09:10	1.05	0.69	04:25	0.007	17:15	0.056	0.028	0.028	-
03/26/2023	04:05	1.28	14:00	2.14	1.72	04:00	0.25	14:00	0.98	0.69	04:00	0.007	14:00	0.056	0.030	0.030	-
03/27/2023	00:30	1.28	20:35	2.11	1.68	02:15	0.33	08:55	0.96	0.63	05:15	0.009	18:55	0.052	0.027	0.027	-
03/28/2023	03:45	1.20	22:40	3.09	1.81	01:40	0.21	22:40	1.43	0.67	05:55	0.006	22:40	0.136	0.032	0.032	-
03/29/2023	02:10	1.38	10:55	2.68	2.04	05:40	0.30	09:20	1.16	0.74	02:15	0.010	10:55	0.089	0.041	0.041	0.85
03/30/2023	05:35	1.64	09:15	2.48	2.03	05:25	0.47	09:15	1.06	0.78	05:25	0.019	09:15	0.074	0.042	0.042	0.23
03/31/2023	05:20	1.53	20:50	2.30	1.95	05:00	0.33	20:50	1.03	0.69	05:00	0.012	20:50	0.065	0.036	0.036	-
04/01/2023	06:30	1.47	20:40	3.17	2.57	05:25	0.37	11:45	1.54	1.09	05:25	0.014	11:50	0.146	0.091	0.091	-
04/02/2023	03:25	2.53	18:50	3.60	3.13	04:20	0.96	10:05	1.57	1.29	04:20	0.070	19:50	0.172	0.128	0.128	-
04/03/2023	03:10	2.85	08:00	3.47	3.14	04:15	1.01	20:30	1.59	1.28	04:15	0.086	20:30	0.172	0.126	0.126	-
04/04/2023	23:55	2.12	17:30	3.45	2.88	23:50	0.49	09:55	1.53	1.13	23:50	0.028	11:55	0.166	0.101	0.101	-
04/05/2023	03:55	1.62	11:15	2.68	2.20	03:40	0.29	19:40	0.85	0.59	03:55	0.011	19:40	0.064	0.037	0.037	-
04/06/2023	04:10	1.44	11:50	2.76	2.04	02:50	0.22	10:40	0.90	0.56	04:10	0.007	23:05	0.064	0.031	0.031	-
04/07/2023	05:15	1.57	00:00	2.83	2.10	05:50	0.24	00:05	0.97	0.58	05:15	0.009	00:00	0.077	0.034	0.034	-
04/08/2023	04:55	1.65	09:50	2.69	2.03	05:00	0.24	08:55	0.94	0.59	05:00	0.010	10:35	0.066	0.032	0.032	-
04/09/2023	05:15	1.37	10:15	2.57	1.79	05:40	0.27	20:40	1.12	0.63	05:15	0.009	11:30	0.074	0.029	0.029	-
04/10/2023	05:05	1.43	12:10	2.52	1.95	04:30	0.27	12:10	1.18	0.70	01:10	0.011	12:10	0.085	0.036	0.036	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			2.464	6.75
Average	2.00	1.06	0.060	

MC73

Site Commentary

SITE INFORMATION

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

OBSERVATIONS

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

5-min flow depth, velocity, and quantity data observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.13	1.04	0.067
Minimum	1.27	0.55	0.016
Maximum	2.94	1.48	0.141
Min Time	03/14/2023 3:45:00 AM	04/07/2023 4:30:00 AM	03/14/2023 3:50:00 AM
Max Time	03/22/2023 11:45:00 AM	03/21/2023 9:05:00 AM	03/21/2023 9:05:00 AM

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

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

DATA UPTIME

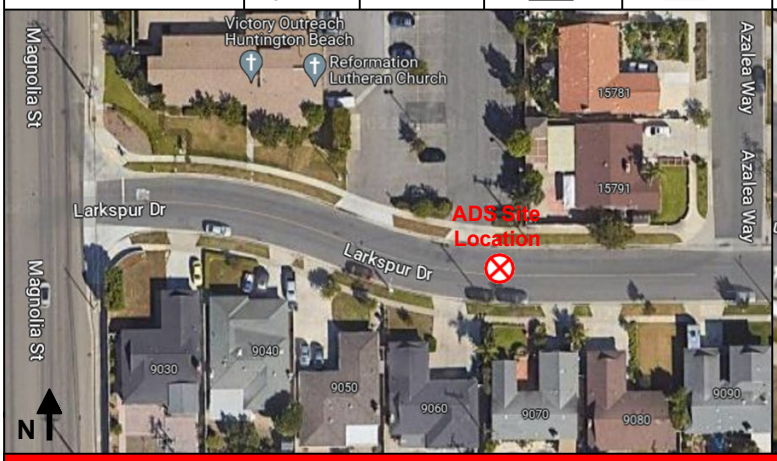
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

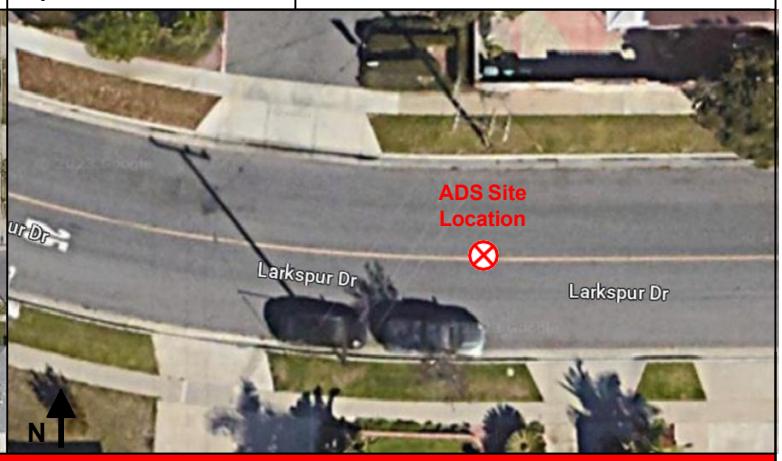
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: MC73	**Install Date:** 2/28/2023	**Monitor Type**	Peak Doppler
Address/Location: 9055 Larkspur Dr.		**Monitor Model**	Triton +
		Data Acquisition	Manual/Wireless Collect
		Manhole ID	4862
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.00 "
		Pipe Width:	12.00 "





Investigation Information:

Date/Time of Investigation:	02/10/2023 @ 1:21 am
Site Hydraulics:	Good straight flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	2.25 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.49 fps
Silt:	0 Inches

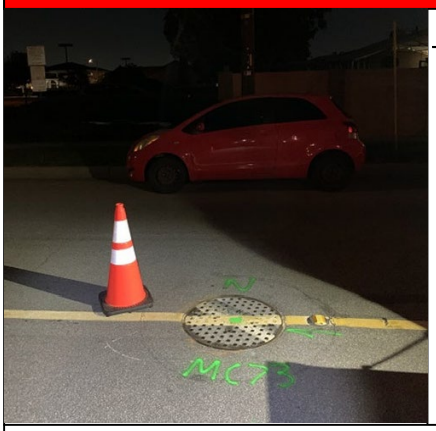
Manhole Information:

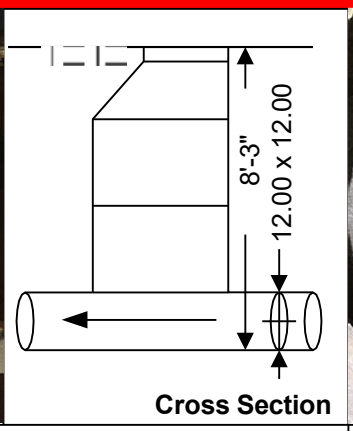
Manhole Depth:	8'-3"			
Manhole Material / Condition	Precast/Good			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Other [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

Safety Notes:

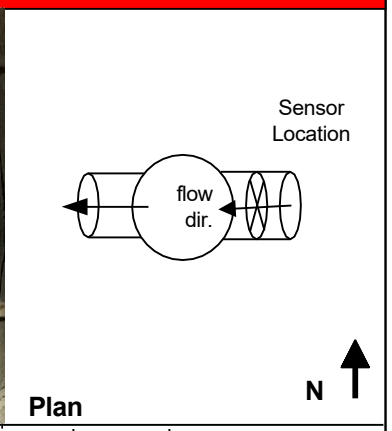
2 man crew required and one blower is to be operated at all times.

Other Information:





Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

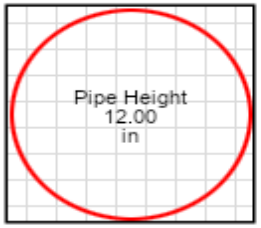
Standard Traffic Control with No Safety Concerns

Hydrograph Report

MC73

Flow Monitor

MC73

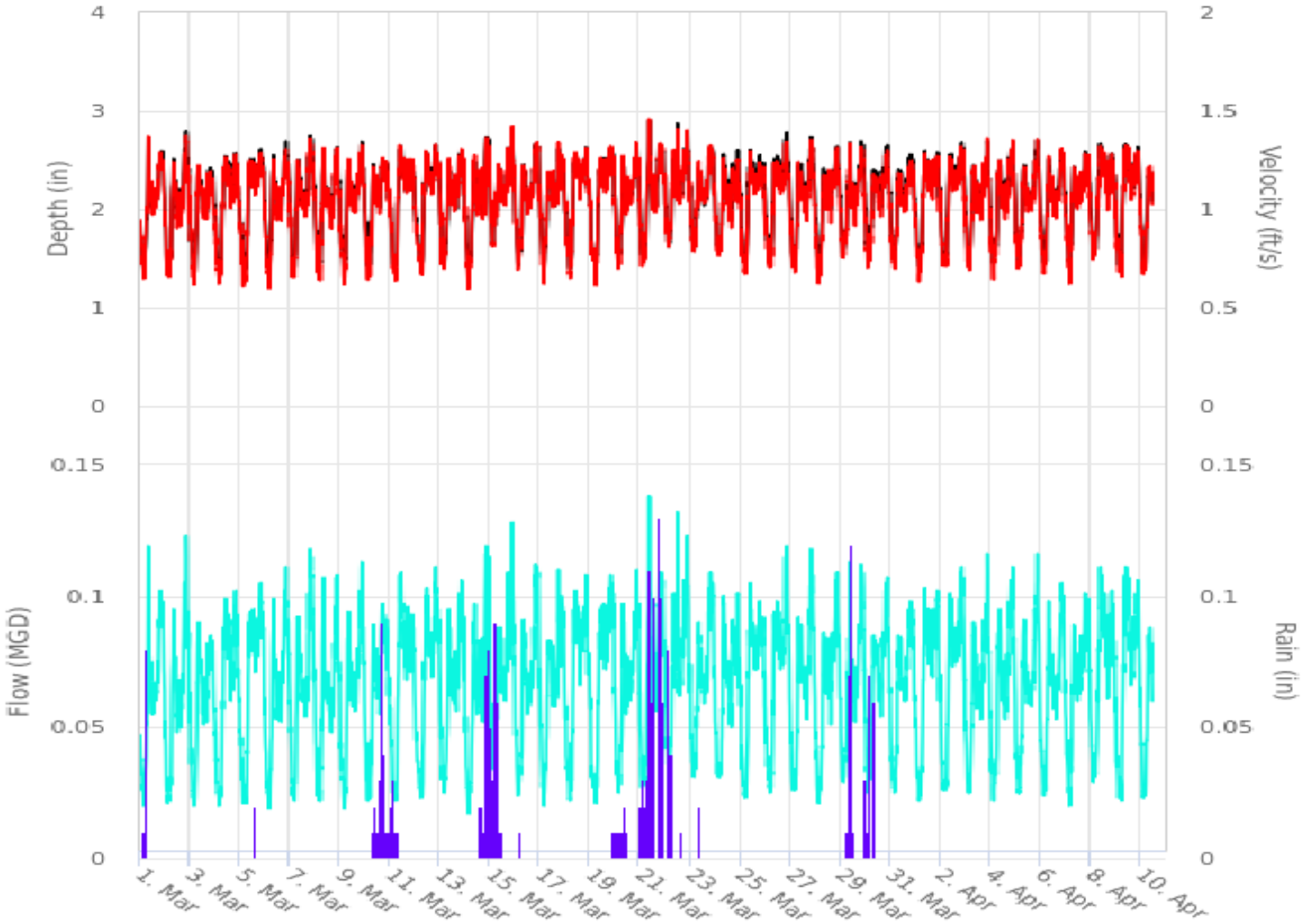


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Scattergraph Report

MC73

Flow Monitor

MC73

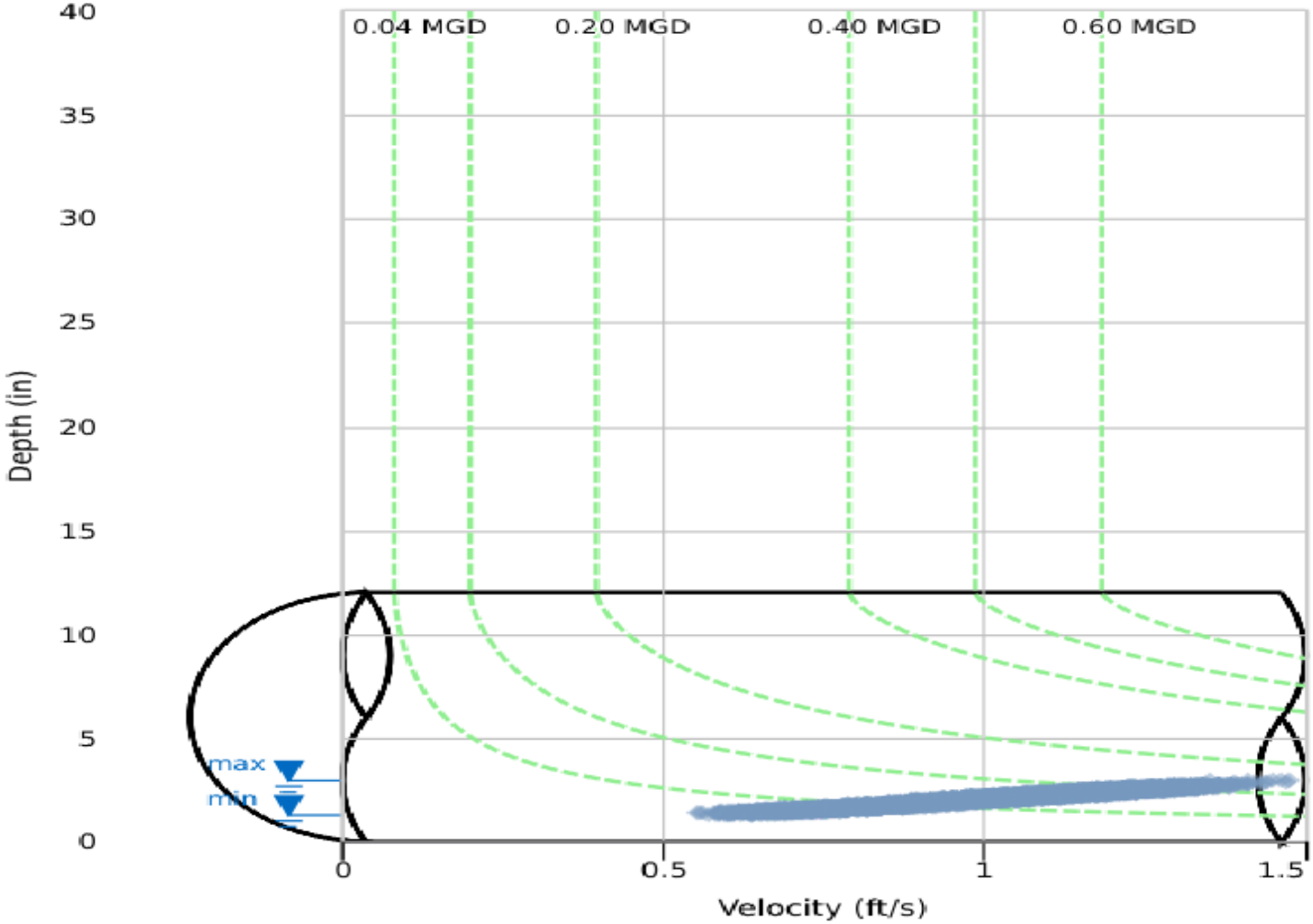
Pipe Height
12.00
in

Report Period

03/01/2023
To
04/10/2023

Legend

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



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
MC73Pipe: Round (12 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/01/2023	04:10	1.33	08:05	2.74	2.07	04:05	0.64	08:00	1.39	1.04	04:05	0.020	08:05	0.121	0.064	0.064	0.21
03/02/2023	02:40	1.33	20:25	2.79	2.07	04:00	0.61	20:20	1.40	1.01	02:40	0.020	20:20	0.125	0.062	0.062	-
03/03/2023	04:15	1.35	19:30	2.45	2.04	04:05	0.61	08:25	1.24	1.00	04:05	0.019	08:45	0.091	0.060	0.060	-
03/04/2023	04:00	1.37	20:05	2.58	2.11	03:55	0.60	20:05	1.31	1.02	03:55	0.019	20:05	0.105	0.065	0.065	-
03/05/2023	05:20	1.37	19:55	2.63	2.14	03:20	0.59	19:55	1.32	1.04	05:45	0.020	19:55	0.109	0.068	0.068	0.02
03/06/2023	04:15	1.34	20:20	2.70	2.10	04:10	0.58	20:10	1.32	1.02	04:10	0.018	20:15	0.112	0.064	0.064	-
03/07/2023	04:45	1.40	19:25	2.76	2.12	04:40	0.64	19:25	1.39	1.03	04:50	0.021	19:25	0.122	0.065	0.065	-
03/08/2023	03:55	1.38	21:35	2.65	2.07	05:05	0.61	08:15	1.36	1.01	05:05	0.021	08:15	0.110	0.062	0.062	-
03/09/2023	04:10	1.32	20:50	2.69	2.07	03:30	0.59	20:40	1.37	1.02	04:10	0.018	20:40	0.116	0.063	0.063	-
03/10/2023	02:35	1.40	17:00	2.54	2.10	02:35	0.62	17:05	1.28	1.03	02:35	0.020	16:55	0.099	0.064	0.064	0.98
03/11/2023	05:05	1.42	10:50	2.65	2.14	06:00	0.62	09:15	1.35	1.06	05:35	0.022	10:50	0.110	0.069	0.069	0.16
03/12/2023	05:50	1.41	19:50	2.66	2.15	06:40	0.63	19:50	1.35	1.06	06:40	0.022	19:50	0.113	0.069	0.069	-
03/13/2023	04:15	1.45	20:35	2.62	2.09	03:15	0.67	20:35	1.33	1.04	03:45	0.025	20:35	0.109	0.064	0.064	-
03/14/2023	03:45	1.27	23:20	2.92	2.09	03:50	0.57	23:25	1.41	1.04	03:50	0.016	23:20	0.129	0.065	0.065	1.06
03/15/2023	02:30	1.64	17:10	2.90	2.20	03:10	0.77	21:25	1.47	1.10	03:10	0.033	21:25	0.137	0.071	0.071	1.17
03/16/2023	03:10	1.42	20:00	2.70	2.12	02:40	0.66	21:40	1.38	1.05	03:00	0.024	19:55	0.116	0.066	0.066	0.01
03/17/2023	03:50	1.38	17:45	2.67	2.12	03:40	0.59	17:45	1.38	1.05	03:45	0.020	17:45	0.116	0.066	0.066	-
03/18/2023	04:55	1.38	20:30	2.66	2.15	05:00	0.56	20:30	1.37	1.07	05:00	0.019	20:30	0.115	0.069	0.069	-
03/19/2023	05:45	1.42	20:00	2.63	2.17	05:50	0.59	20:00	1.34	1.07	05:50	0.020	20:00	0.110	0.071	0.071	0.02
03/20/2023	03:45	1.44	21:15	2.68	2.12	03:20	0.68	20:20	1.37	1.05	03:45	0.023	21:15	0.114	0.066	0.066	0.19
03/21/2023	02:15	1.53	09:05	2.92	2.18	02:00	0.69	09:05	1.48	1.09	02:00	0.026	09:05	0.141	0.072	0.072	1.59
03/22/2023	03:40	1.62	11:45	2.94	2.20	03:45	0.78	11:50	1.46	1.10	03:45	0.032	11:50	0.141	0.073	0.073	0.22
03/23/2023	03:40	1.57	19:35	2.64	2.16	03:45	0.74	19:35	1.35	1.08	03:45	0.029	19:35	0.111	0.069	0.069	0.04
03/24/2023	03:15	1.58	21:40	2.62	2.14	03:15	0.73	08:00	1.28	1.04	03:15	0.029	21:40	0.103	0.066	0.066	-
03/25/2023	05:00	1.42	09:45	2.62	2.16	05:00	0.63	09:45	1.33	1.04	05:00	0.021	09:45	0.109	0.068	0.068	-
03/26/2023	04:45	1.46	20:45	2.80	2.20	06:00	0.67	20:45	1.38	1.06	04:45	0.024	20:45	0.124	0.071	0.071	-
03/27/2023	02:30	1.51	20:25	2.79	2.13	04:40	0.65	20:25	1.43	1.03	04:40	0.025	20:25	0.129	0.066	0.066	-
03/28/2023	03:25	1.42	20:30	2.67	2.12	03:15	0.61	20:30	1.34	1.02	03:20	0.021	20:30	0.113	0.064	0.064	-
03/29/2023	02:20	1.55	20:15	2.70	2.16	02:10	0.70	09:35	1.35	1.05	02:10	0.028	09:35	0.115	0.067	0.067	0.85
03/30/2023	02:35	1.48	21:45	2.69	2.17	02:35	0.68	21:40	1.32	1.04	02:35	0.025	21:40	0.112	0.067	0.067	0.23
03/31/2023	04:15	1.46	20:10	2.58	2.13	04:15	0.65	20:45	1.28	1.02	04:15	0.023	20:10	0.101	0.064	0.064	-
04/01/2023	04:35	1.35	09:50	2.61	2.17	04:55	0.59	17:40	1.31	1.05	04:55	0.020	09:30	0.105	0.069	0.069	-
04/02/2023	03:10	1.47	21:05	2.69	2.19	03:10	0.67	21:00	1.37	1.06	03:10	0.024	21:00	0.116	0.071	0.071	-
04/03/2023	03:30	1.45	21:35	2.71	2.11	04:50	0.66	21:35	1.38	1.04	03:30	0.024	21:35	0.119	0.065	0.065	-
04/04/2023	03:35	1.42	21:55	2.64	2.13	03:35	0.63	21:55	1.36	1.04	03:35	0.021	21:55	0.113	0.066	0.066	-
04/05/2023	03:00	1.44	21:25	2.72	2.11	03:00	0.67	21:20	1.38	1.03	03:00	0.023	21:20	0.119	0.065	0.065	-
04/06/2023	05:30	1.36	20:40	2.62	2.11	03:45	0.65	20:35	1.33	1.03	03:45	0.023	20:40	0.109	0.064	0.064	-
04/07/2023	04:30	1.38	19:15	2.60	2.13	04:30	0.55	19:15	1.30	1.04	04:30	0.018	19:15	0.106	0.066	0.066	-
04/08/2023	03:05	1.54	09:55	2.71	2.20	02:35	0.71	09:55	1.35	1.08	02:35	0.028	09:55	0.116	0.071	0.071	-
04/09/2023	06:40	1.37	10:45	2.70	2.18	06:40	0.64	10:40	1.35	1.06	06:40	0.021	10:40	0.115	0.071	0.071	-
04/10/2023	05:00	1.40	10:00	2.41	1.91	04:05	0.61	09:45	1.24	0.94	04:05	0.021	10:00	0.089	0.052	0.025	-

03/01/2023 00:00 - 04/10/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			2.692	6.75
Average	2.13	1.04	0.066	

Midway_RG01-PS

Site Commentary

SITE INFORMATION

RainGauge	8" tipping bucket type
Silt	0.00 (in)

OBSERVATIONS

A review of the hydrograph indicates Midway_RG01-PS functioned under normal conditions during the study period.

The total rainfall recorded during the study period was 5.55 in.

DATA UPTIME

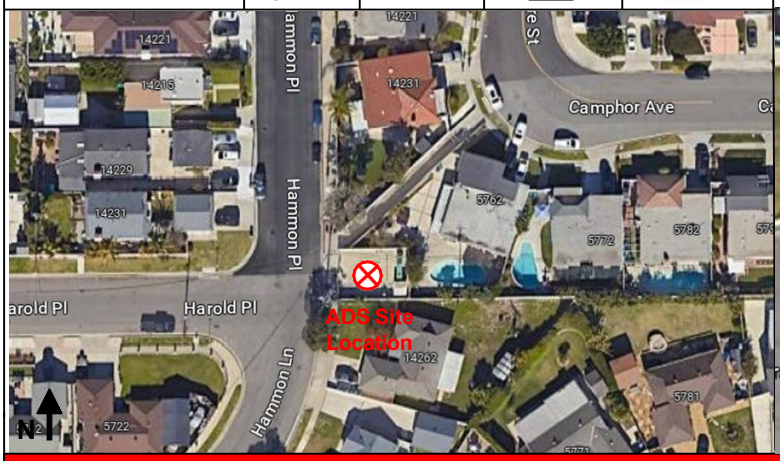
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

Percent Uptime	
RAINFINAL (in)	100

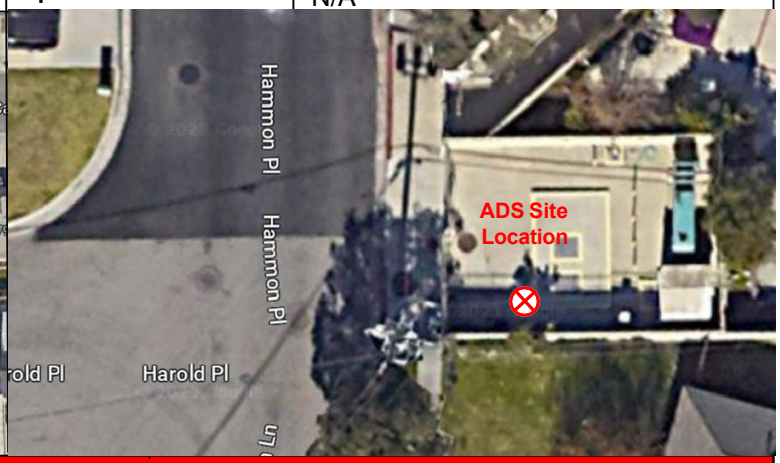
ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Huntington Beach	**Agency:** Midway	**FM Initials:** VM
Site Name: RG01	**Install Date:** 02/22/2023	**Monitor Type**	Rain Gauge Data Logger
Address/Location:	14262 Hammon Ln	**Monitor Model**	9000
		Data Acquisition	Manual Collect
		Manhole ID	N/A
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	N/A "
		Pipe Width:	N/A "

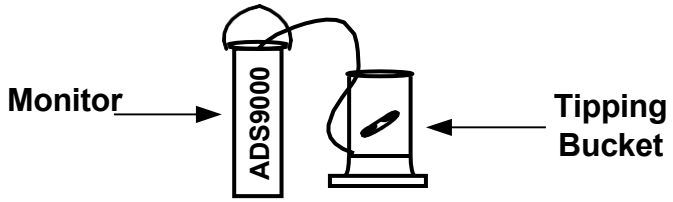


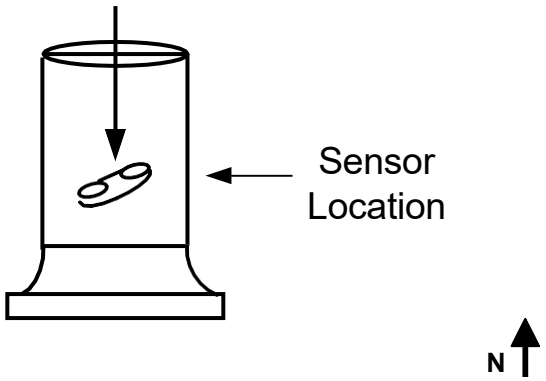
Rain Gauge Area



Rain Gauge Photo

Other Information:





Installation Information	
Installation Type:	Rain Gauge
Sensors Devices:	Tipping Bucket
Increments of Rain Fall:	0.01"
Test Tips:	Ten Test Tips, Site OK

Additional Site Information / Comments:

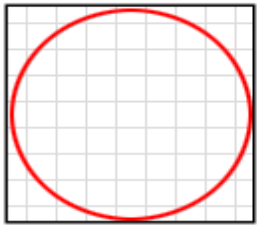
Standard Traffic Control with No Safety Concerns

Hydrograph Report

Midway_RG01-PS

Rain Gauge

Midway_RG01-PS

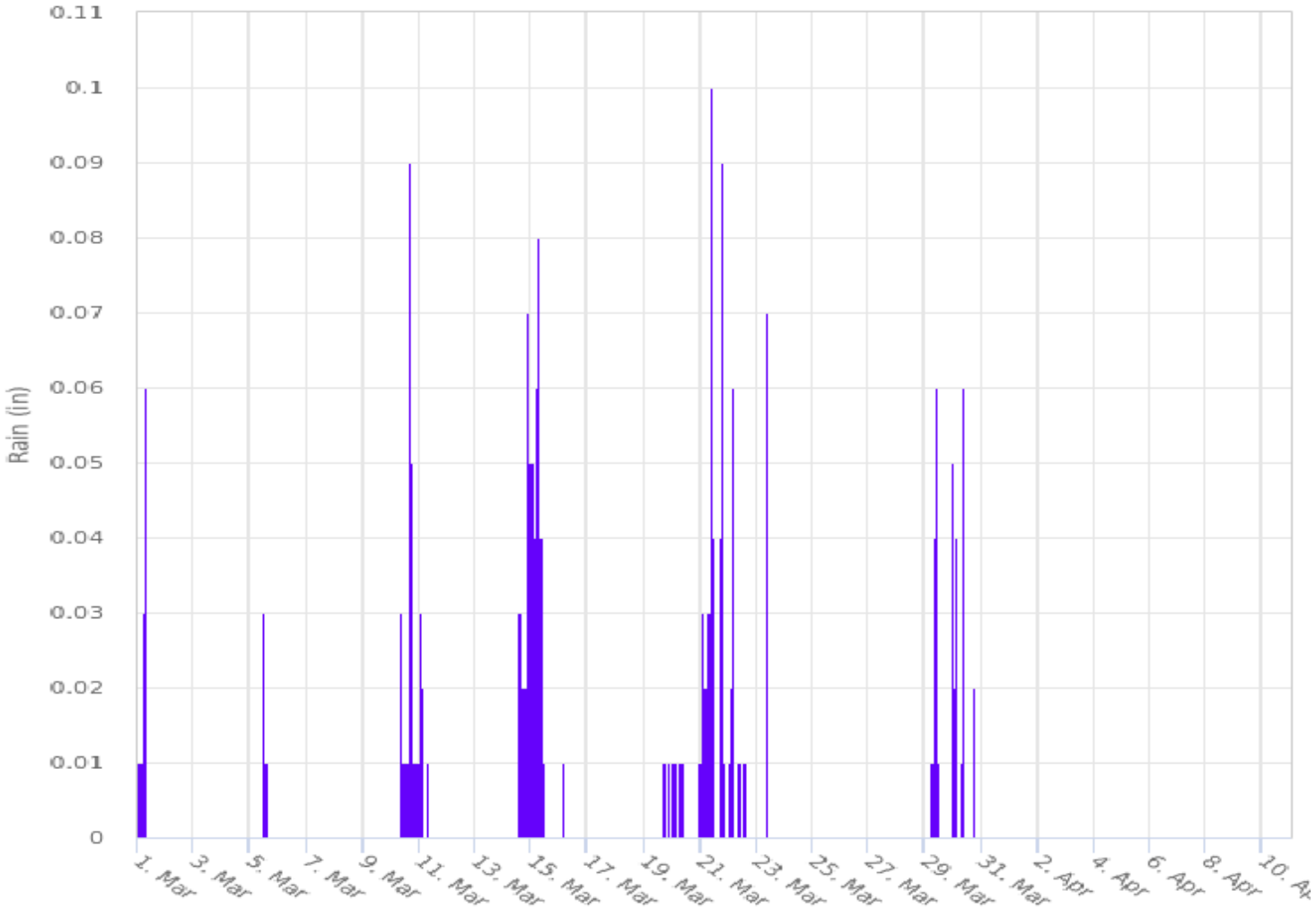


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
Midway_RG01-PSRainGauge: Unknown (0 H x 0 W), Silt0.00

	RAIN FINAL (in)
Date	Total
03/01/2023	0.24
03/02/2023	-
03/03/2023	-
03/04/2023	-
03/05/2023	0.05
03/06/2023	-
03/07/2023	-
03/08/2023	-
03/09/2023	-
03/10/2023	0.86
03/11/2023	0.15
03/12/2023	-
03/13/2023	-
03/14/2023	1.04
03/15/2023	0.97
03/16/2023	0.01
03/17/2023	-
03/18/2023	-
03/19/2023	0.03
03/20/2023	0.07
03/21/2023	1.20
03/22/2023	0.15
03/23/2023	0.10
03/24/2023	-
03/25/2023	-
03/26/2023	-
03/27/2023	-
03/28/2023	-
03/29/2023	0.50
03/30/2023	0.18
03/31/2023	-
04/01/2023	-
04/02/2023	-
04/03/2023	-
04/04/2023	-
04/05/2023	-
04/06/2023	-
04/07/2023	-
04/08/2023	-
04/09/2023	-
04/10/2023	-

03/01/2023 00:00 - 04/10/2023 23:59

	RAIN FINAL (in)
Total	5.55
Average	

Midway_RG02-FS66

Site Commentary

SITE INFORMATION

RainGauge	8" tipping bucket type
Silt	0.00 (in)

OBSERVATIONS

A review of the hydrograph indicates Midway_RG02-FS66 functioned under normal conditions during the study period.

The total rainfall recorded during the study period was 6.75 in.

DATA UPTIME

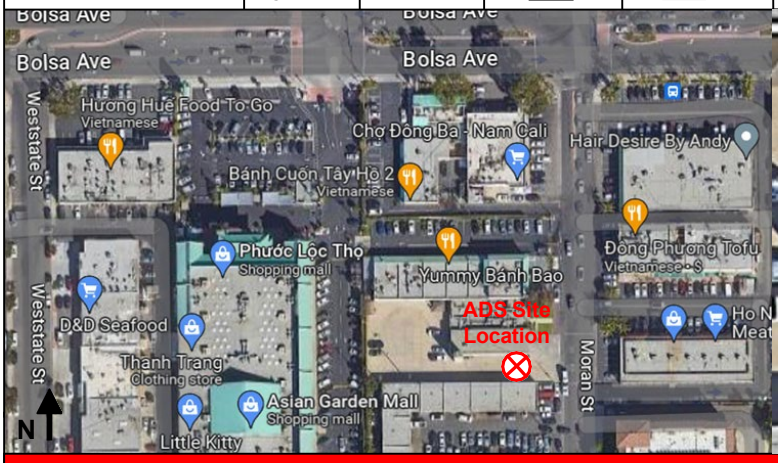
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

Percent Uptime	
RAINFINAL (in)	100

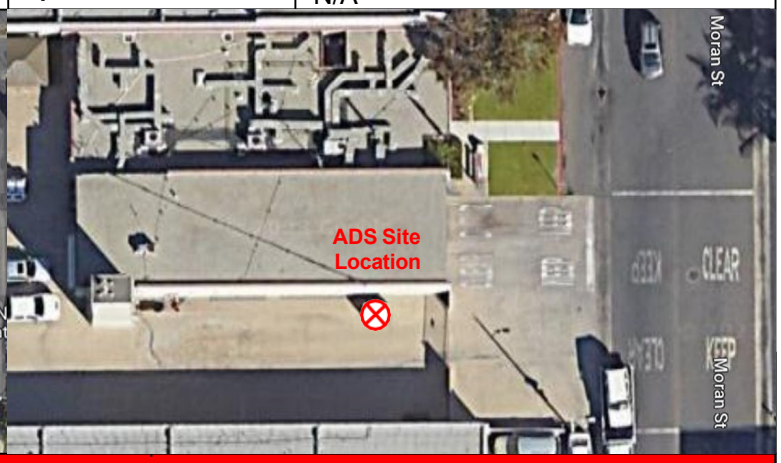
ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: RG02	**Install Date:** 02/22/2023	**Monitor Type**	Rain Gauge Data Logger
Address/Location:	15061 Moran St	**Monitor Model**	9000
		Data Acquisition	Manual Collect
		Manhole ID	N/A
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	N/A "
		Pipe Width:	N/A "

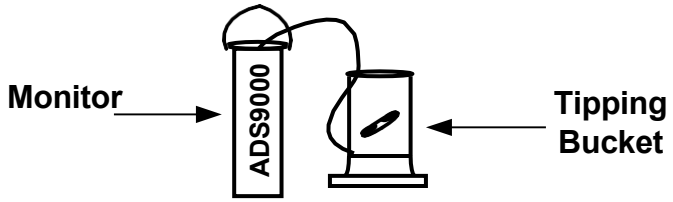


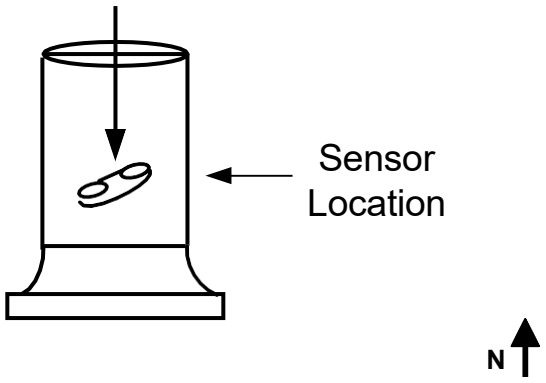
Rain Gauge Area



Rain Gauge Photo

Other Information:





Installation Information	
Installation Type:	Rain Gauge
Sensors Devices:	Tipping Bucket
Increments of Rain Fall:	0.01"
Test Tips:	Ten Test Tips, Site OK

Additional Site Information / Comments:

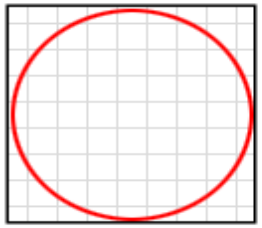
Standard Traffic Control with No Safety Concerns

Hydrograph Report

Midway_RG02-FS66

Rain Gauge

Midway_RG02-FS66

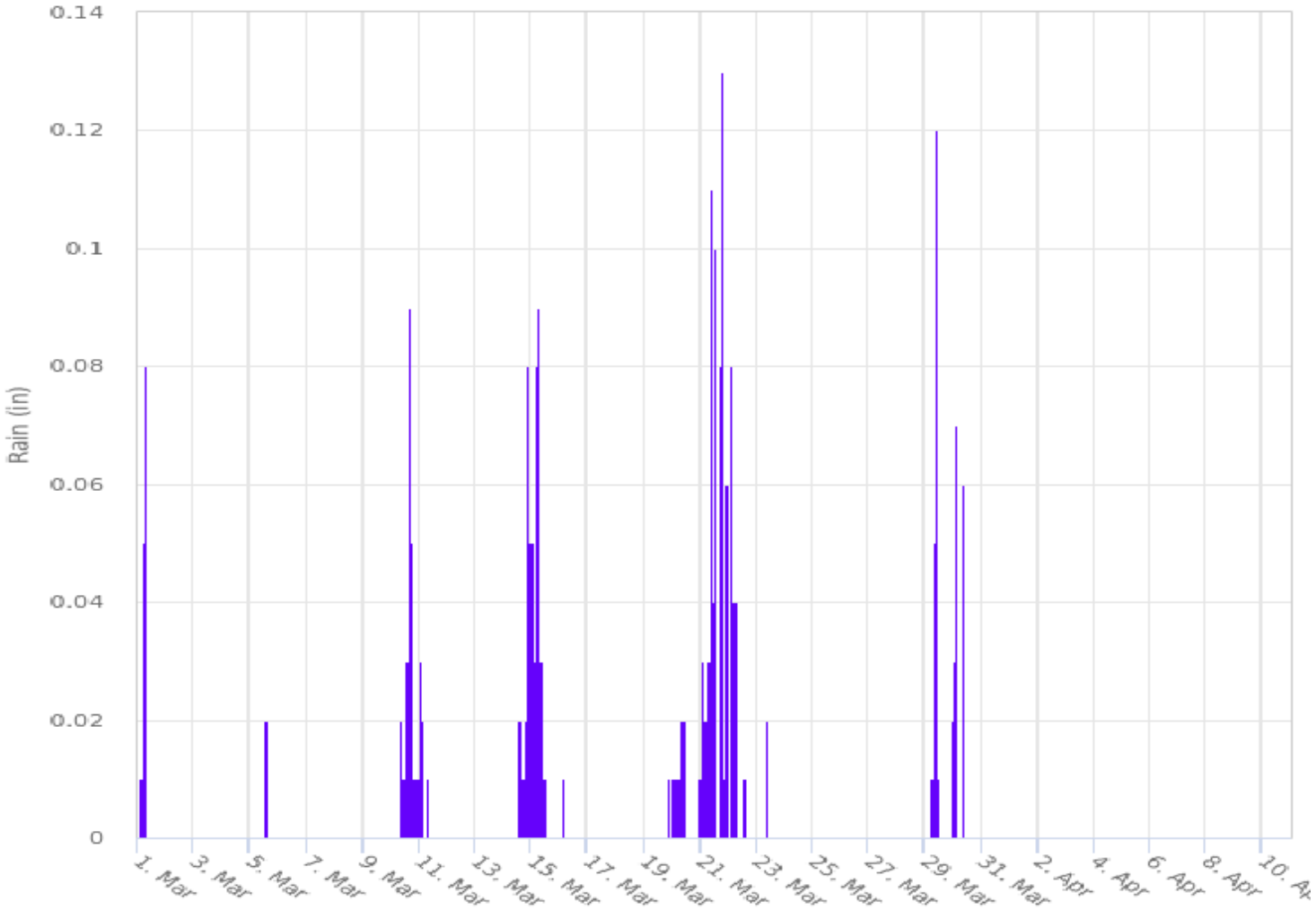


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
Midway_RG02-FS66RainGauge: Unknown (0 H x 0 W), Silt0.00

	RAIN FINAL (in)
Date	Total
03/01/2023	0.21
03/02/2023	-
03/03/2023	-
03/04/2023	-
03/05/2023	0.02
03/06/2023	-
03/07/2023	-
03/08/2023	-
03/09/2023	-
03/10/2023	0.98
03/11/2023	0.16
03/12/2023	-
03/13/2023	-
03/14/2023	1.06
03/15/2023	1.17
03/16/2023	0.01
03/17/2023	-
03/18/2023	-
03/19/2023	0.02
03/20/2023	0.19
03/21/2023	1.59
03/22/2023	0.22
03/23/2023	0.04
03/24/2023	-
03/25/2023	-
03/26/2023	-
03/27/2023	-
03/28/2023	-
03/29/2023	0.85
03/30/2023	0.23
03/31/2023	-
04/01/2023	-
04/02/2023	-
04/03/2023	-
04/04/2023	-
04/05/2023	-
04/06/2023	-
04/07/2023	-
04/08/2023	-
04/09/2023	-
04/10/2023	-

03/01/2023 00:00 - 04/10/2023 23:59

	RAIN FINAL (in)
Total	6.75
Average	

Midway_RG03-MSD

Site Commentary

SITE INFORMATION

RainGauge	8" tipping bucket type
Silt	0.00 (in)

OBSERVATIONS

A review of the hydrograph indicates Midway_RG03-MSD functioned under normal conditions during the study period.

The total rainfall recorded during the study period was 6.1 in.

DATA UPTIME

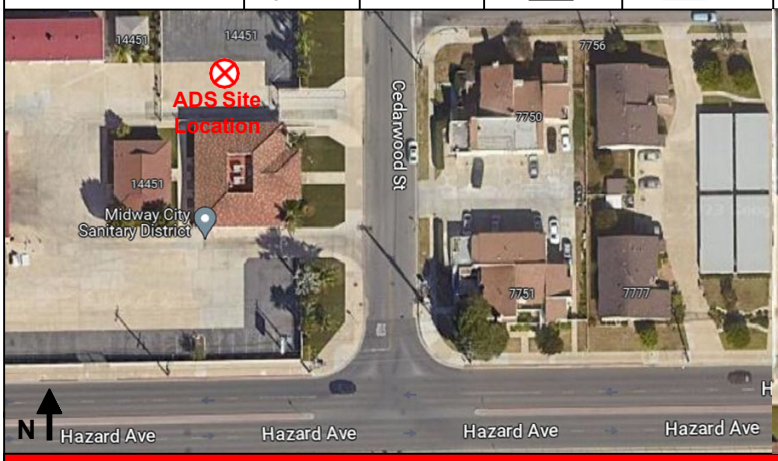
Data uptime observed during **Wednesday, 01 March 2023 to Monday, 10 April 2023** is provided in the following table:

Percent Uptime	
RAINFINAL (in)	100

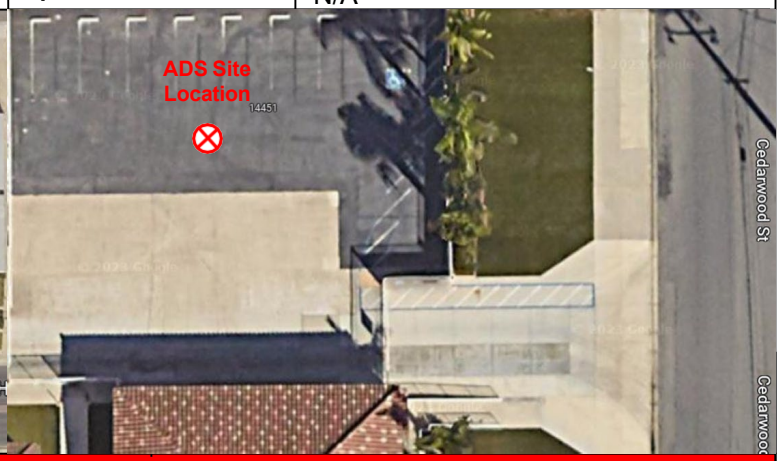
ADS Site Report

Quality Form

Project Name: Midway.AKM.TFM.CA22	**City:** Westminster	**Agency:** Midway	**FM Initials:** VM
Site Name: RG03	**Install Date:** 02/22/2023	**Monitor Type**	Rain Gauge Data Logger
Address/Location: 14451 Cedarwood St.		**Monitor Model**	9000
		Data Acquisition	Manual Collect
		Manhole ID	N/A
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	N/A "
		Pipe Width:	N/A "

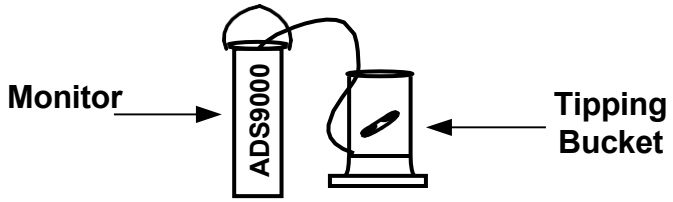


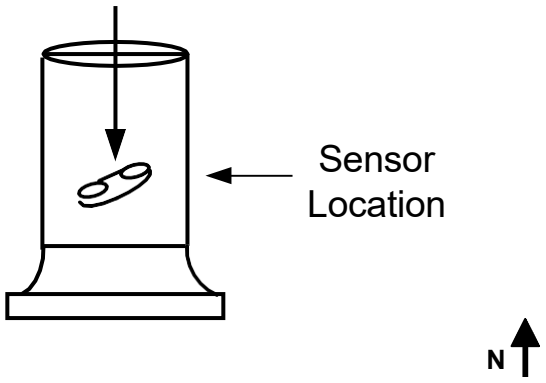
Rain Gauge Area



Rain Gauge Photo

Other Information:





Installation Information	
Installation Type:	Rain Gauge
Sensors Devices:	Tipping Bucket
Increments of Rain Fall:	0.01"
Test Tips:	Ten Test Tips, Site OK

Additional Site Information / Comments:

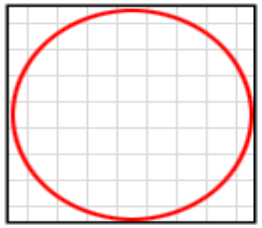
Standard Traffic Control with No Safety Concerns

Hydrograph Report

Midway_RG03-MSD

Rain Gauge

Midway_RG03-MSD

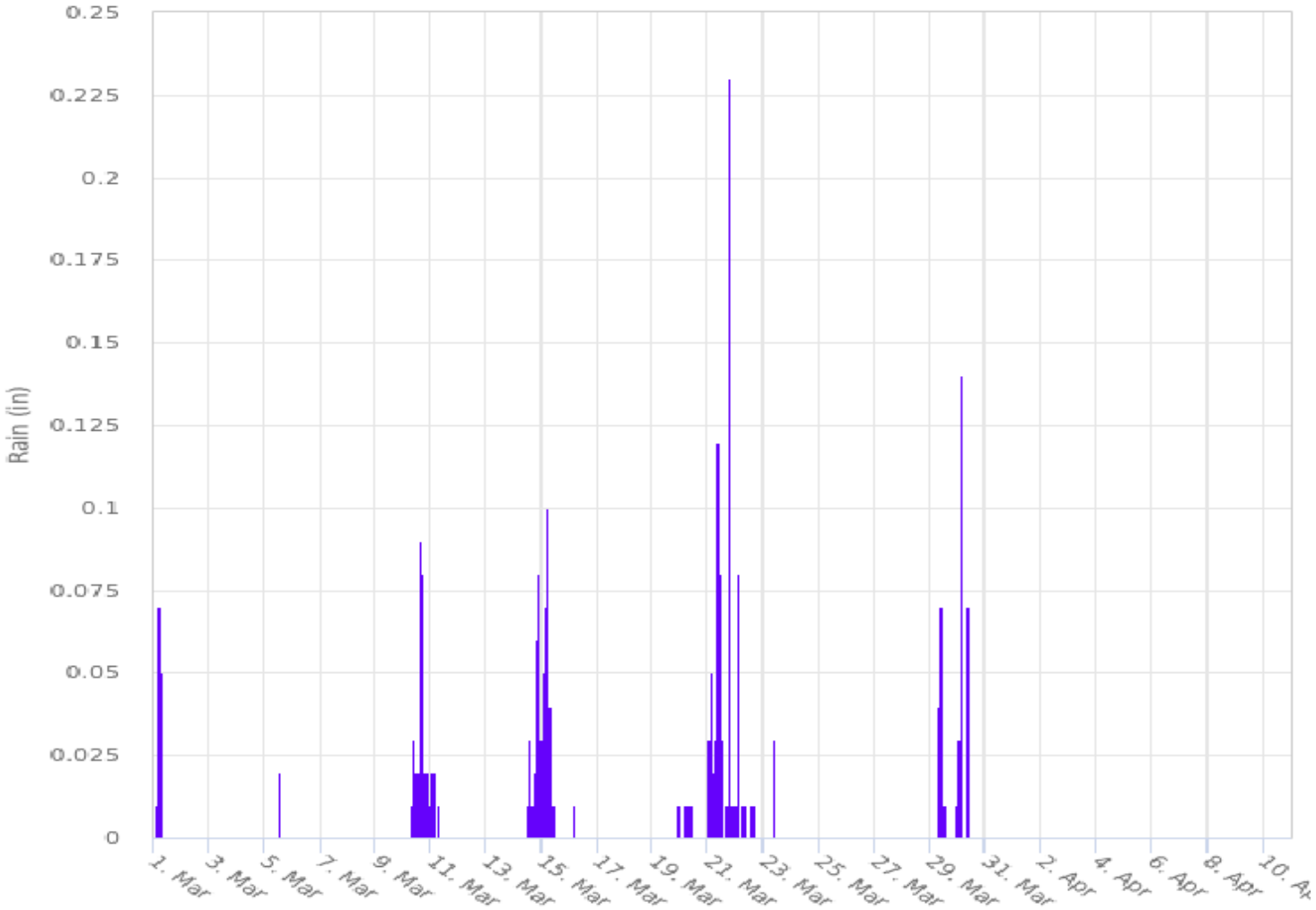


Report Period

03/01/2023
To
04/10/2023

Legend

- DFINAL
- VFINAL
- QFINAL
- RAIN FINAL



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Daily Tabular Report

03/01/2023 00:00 - 04/10/2023 23:59
Midway_RG03-MSDRainGauge: Unknown (0 H x 0 W), Silt0.00

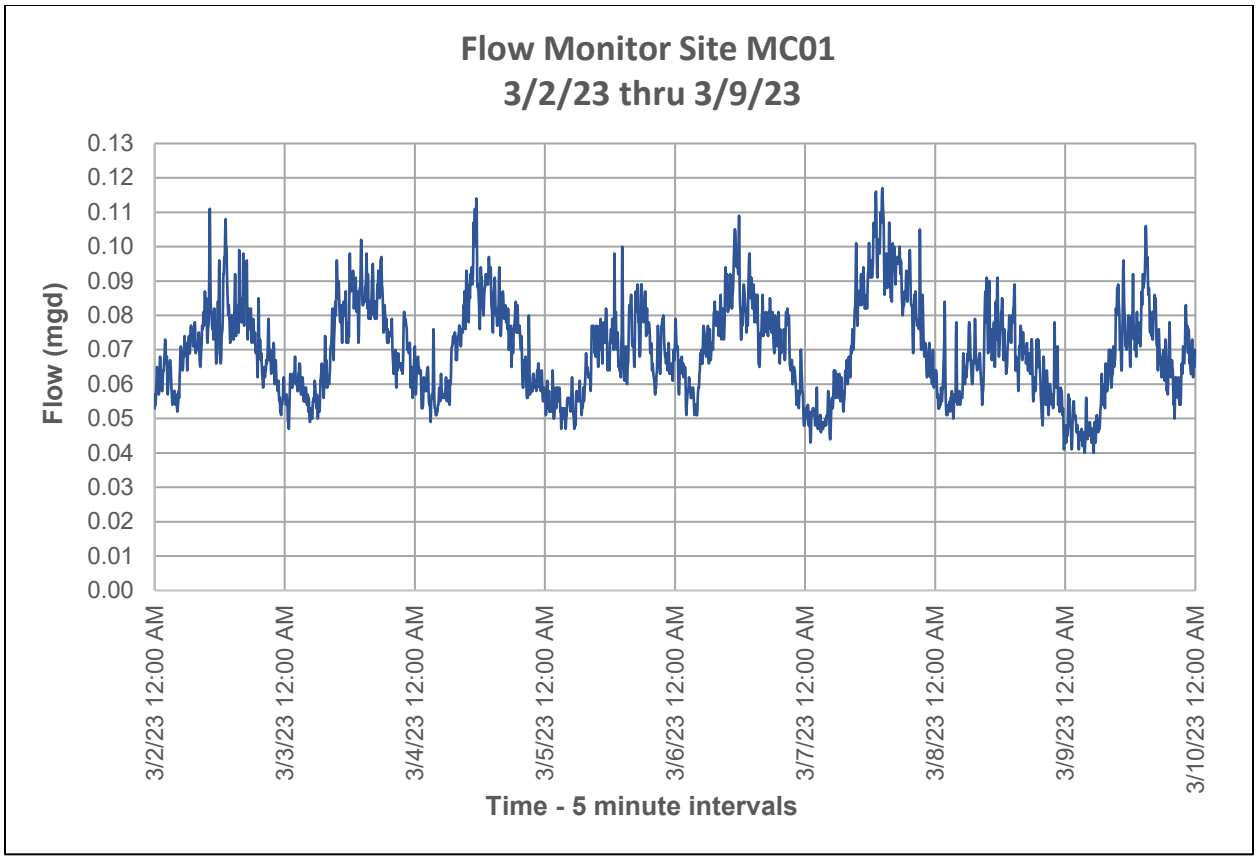
	RAIN FINAL (in)
Date	Total
03/01/2023	0.22
03/02/2023	-
03/03/2023	-
03/04/2023	-
03/05/2023	0.04
03/06/2023	-
03/07/2023	-
03/08/2023	-
03/09/2023	-
03/10/2023	0.90
03/11/2023	0.14
03/12/2023	-
03/13/2023	-
03/14/2023	1.01
03/15/2023	1.01
03/16/2023	0.02
03/17/2023	-
03/18/2023	-
03/19/2023	0.02
03/20/2023	0.09
03/21/2023	1.59
03/22/2023	0.15
03/23/2023	0.05
03/24/2023	-
03/25/2023	-
03/26/2023	-
03/27/2023	-
03/28/2023	-
03/29/2023	0.56
03/30/2023	0.30
03/31/2023	-
04/01/2023	-
04/02/2023	-
04/03/2023	-
04/04/2023	-
04/05/2023	-
04/06/2023	-
04/07/2023	-
04/08/2023	-
04/09/2023	-
04/10/2023	-

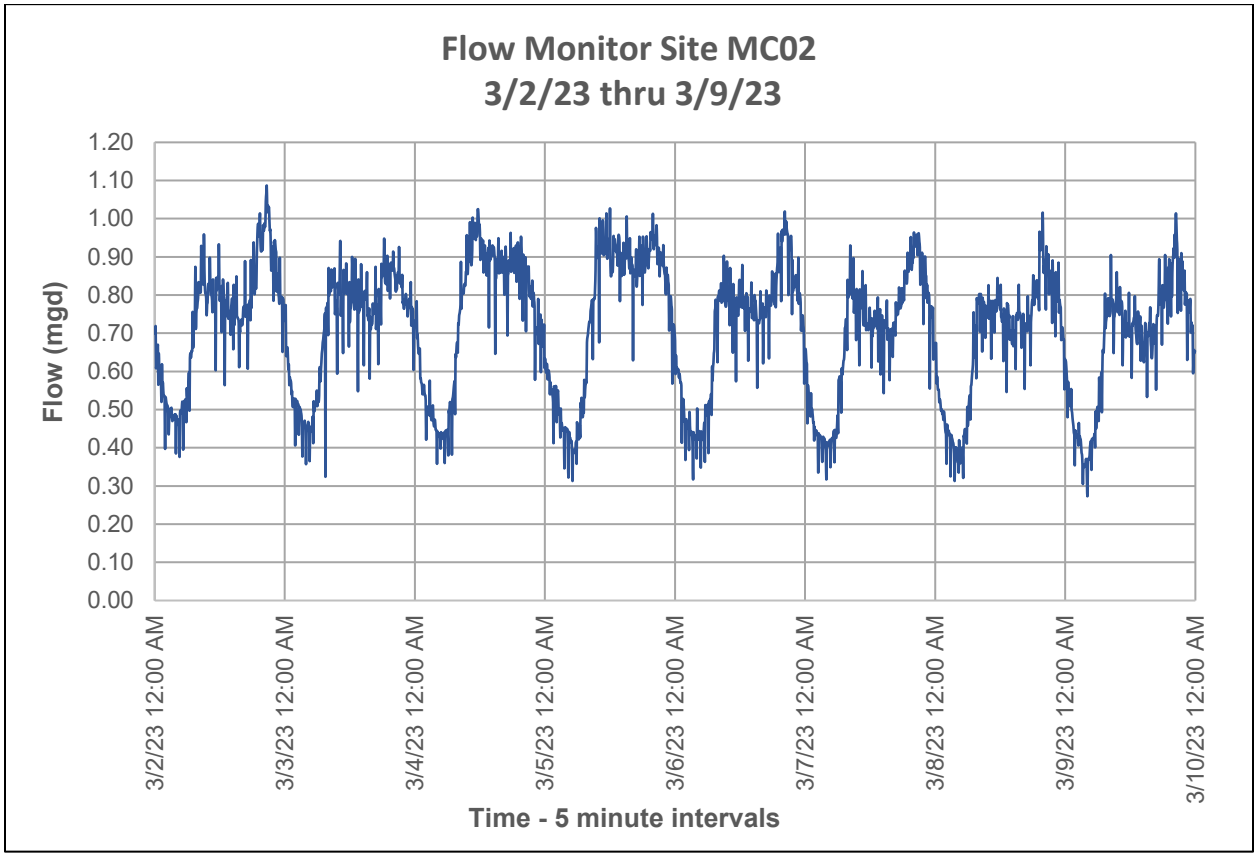
03/01/2023 00:00 - 04/10/2023 23:59

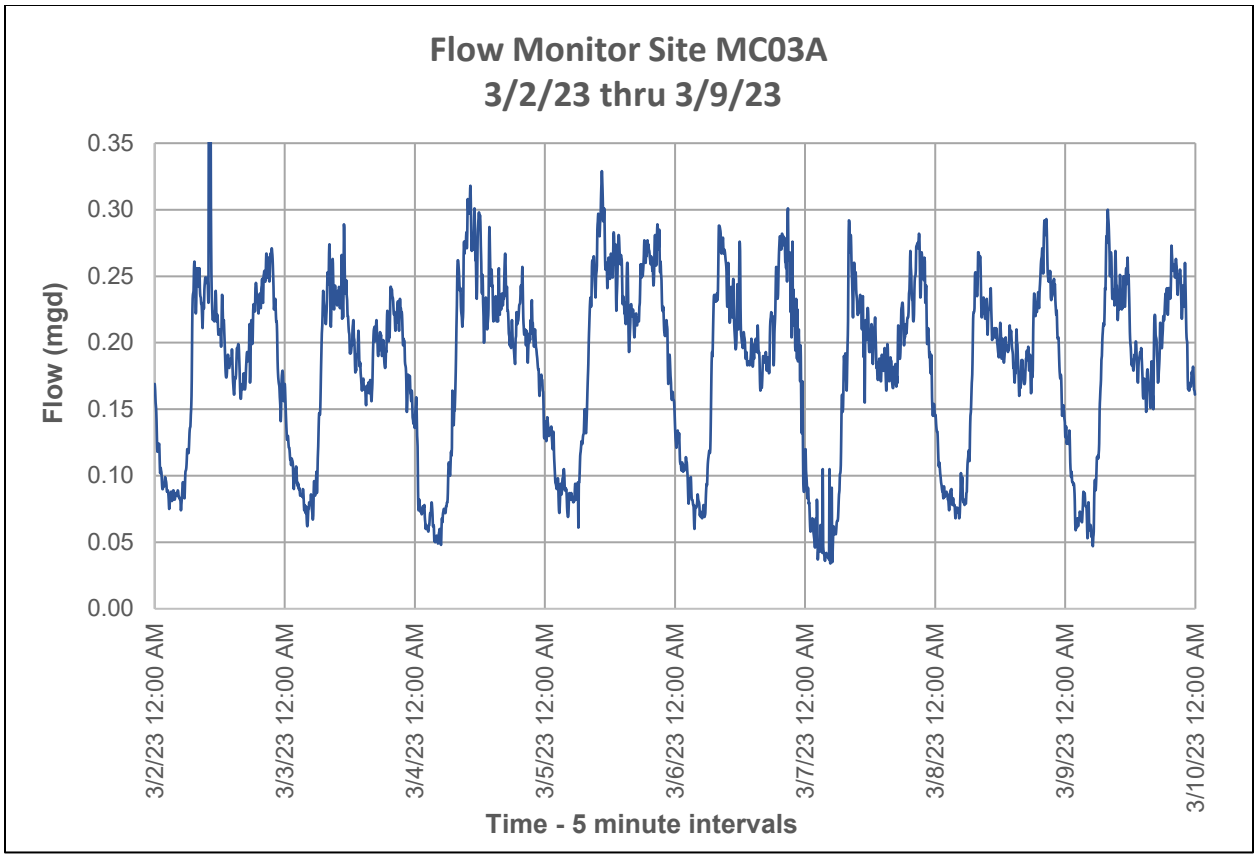
	RAIN FINAL (in)
Total	6.10
Average	

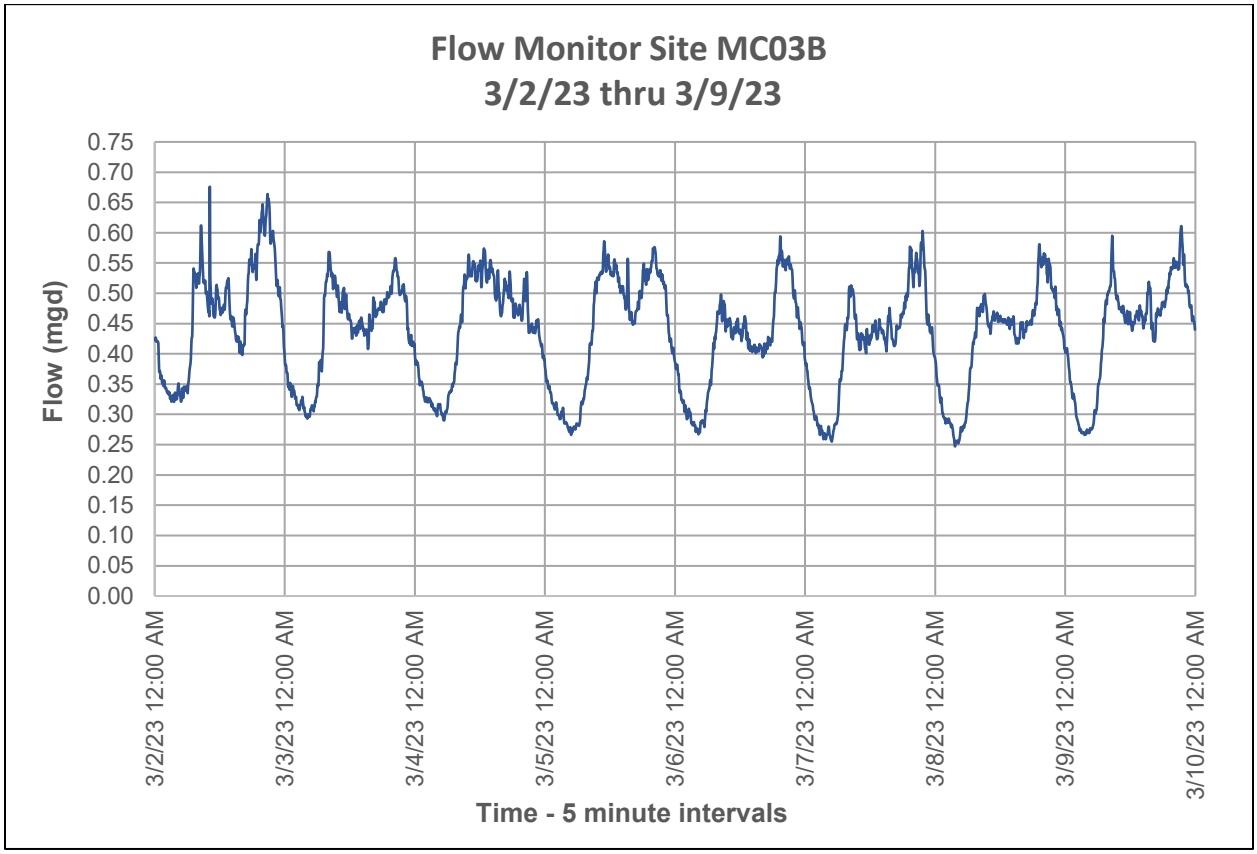
Appendix 3-2

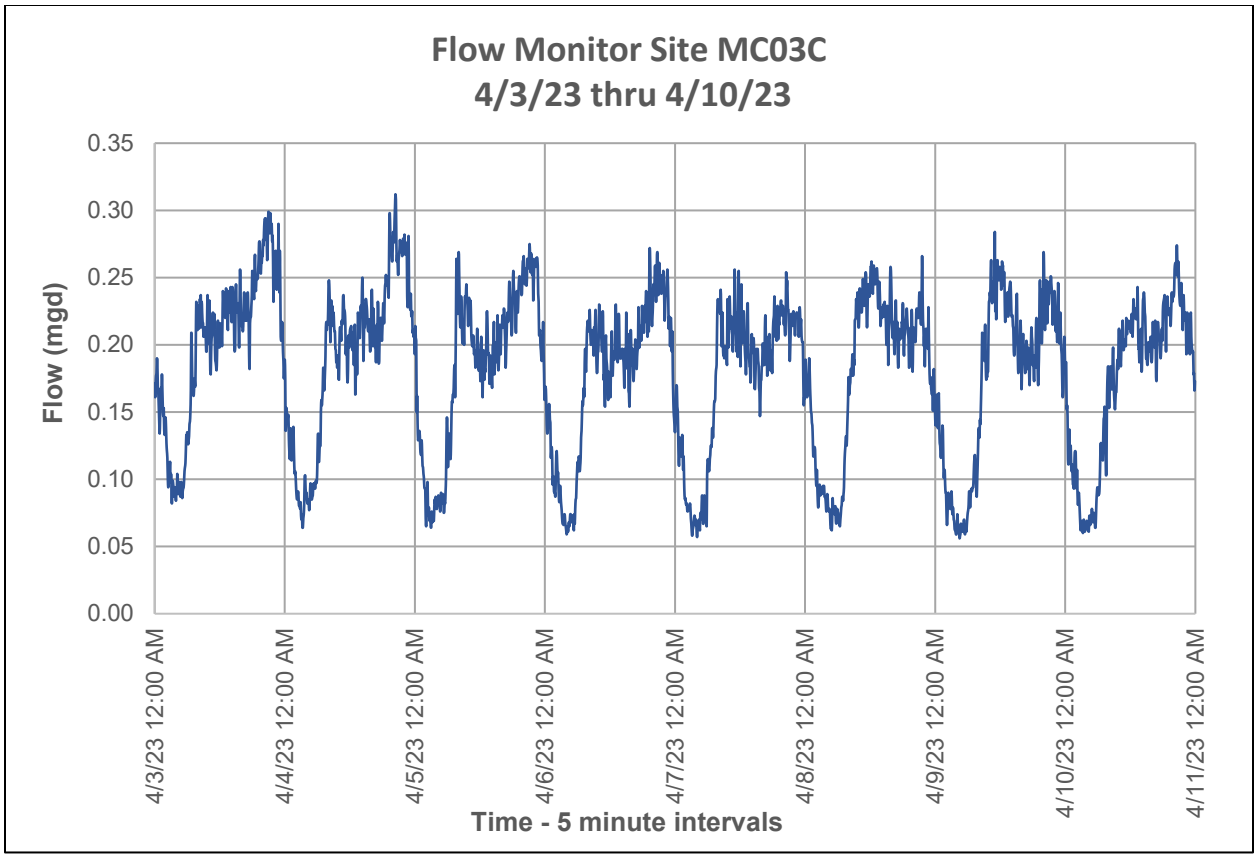
Flow Monitoring Charts

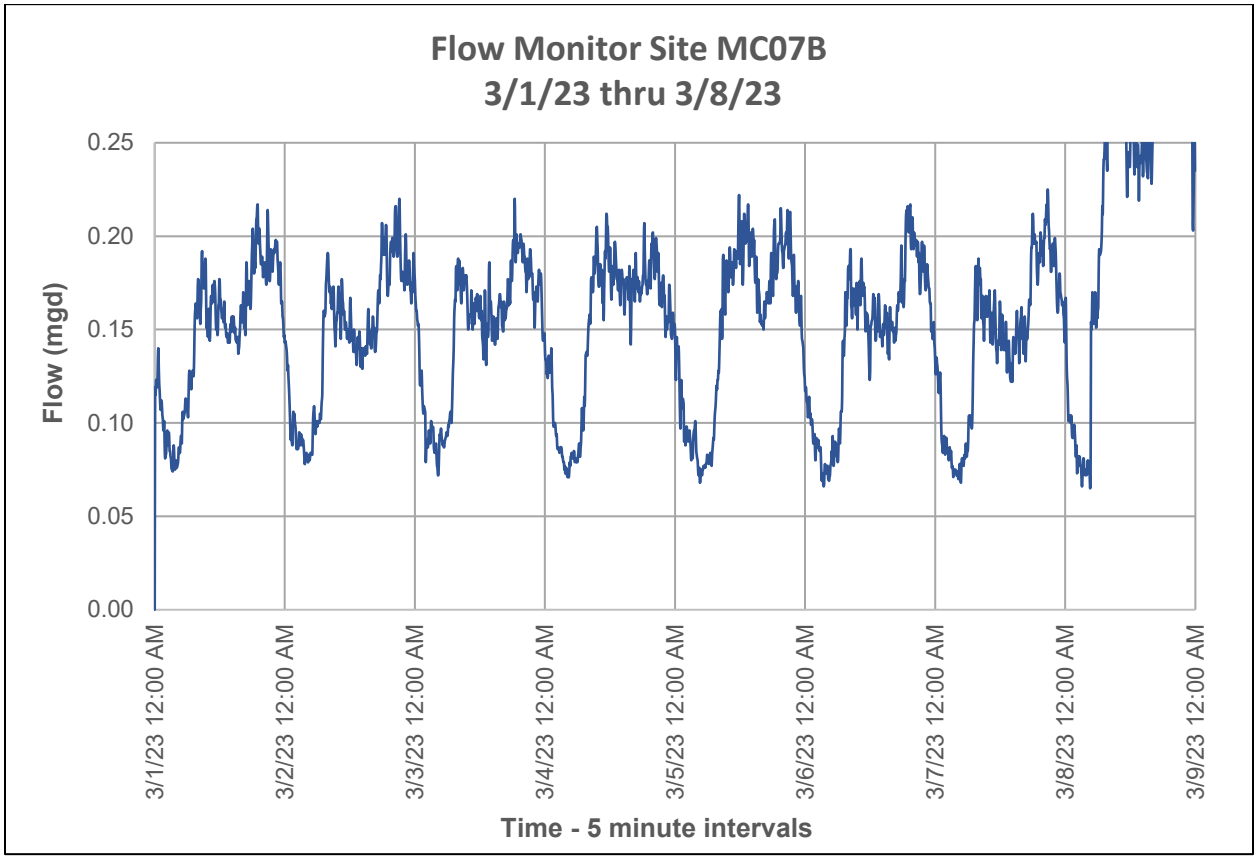

Flow Monitor Site MC01
3/2/23 thru 3/9/23
Flow (mgd)
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

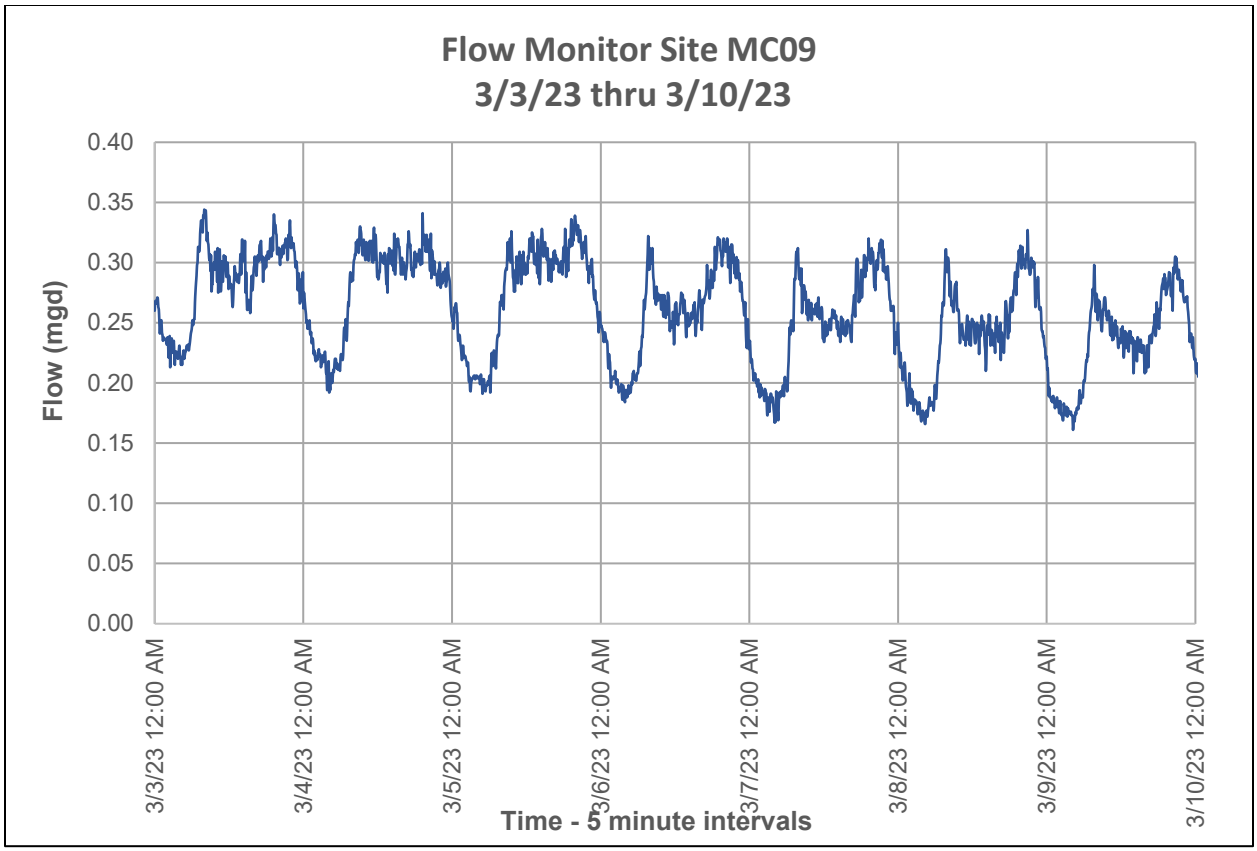

Flow Monitor Site MC02
3/2/23 thru 3/9/23
Flow (mgd)
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

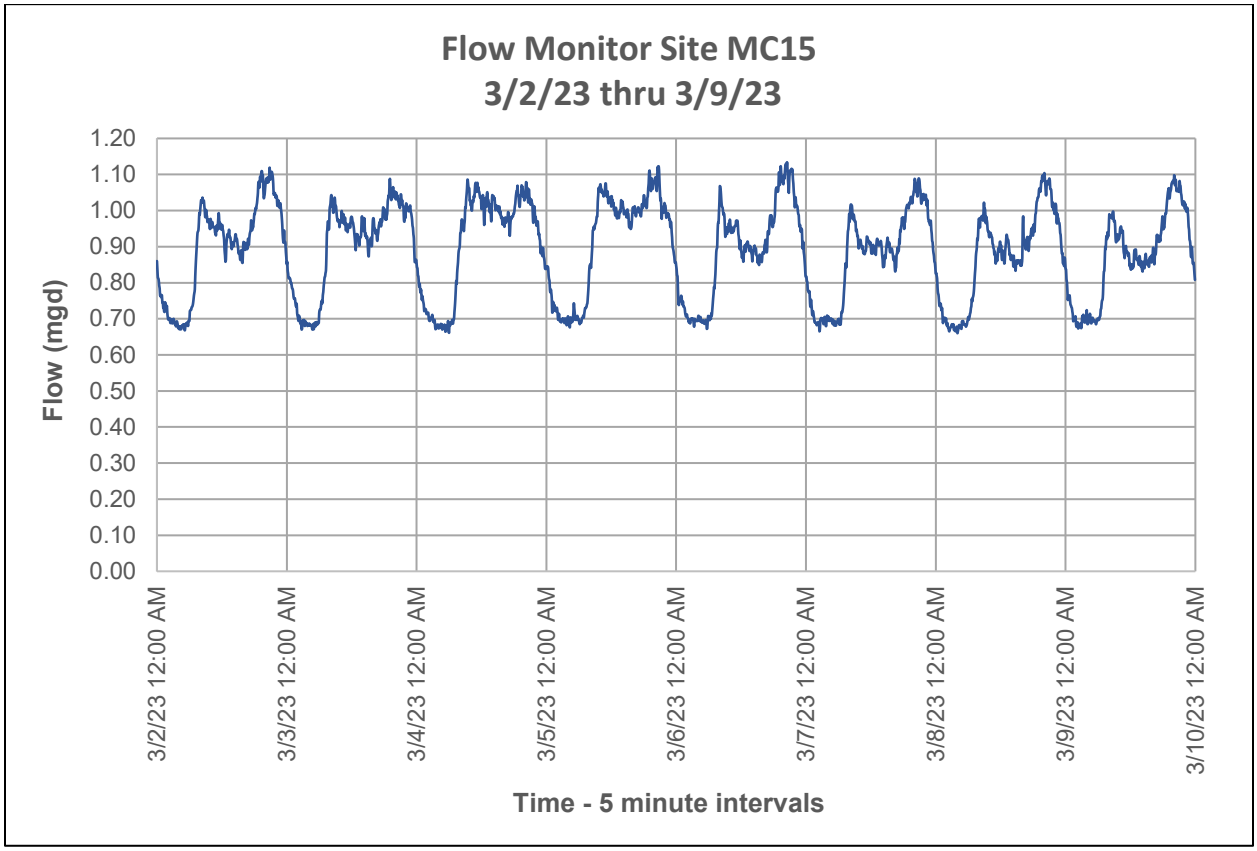

Flow Monitor Site MC03A
3/2/23 thru 3/9/23
Flow (mgd)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

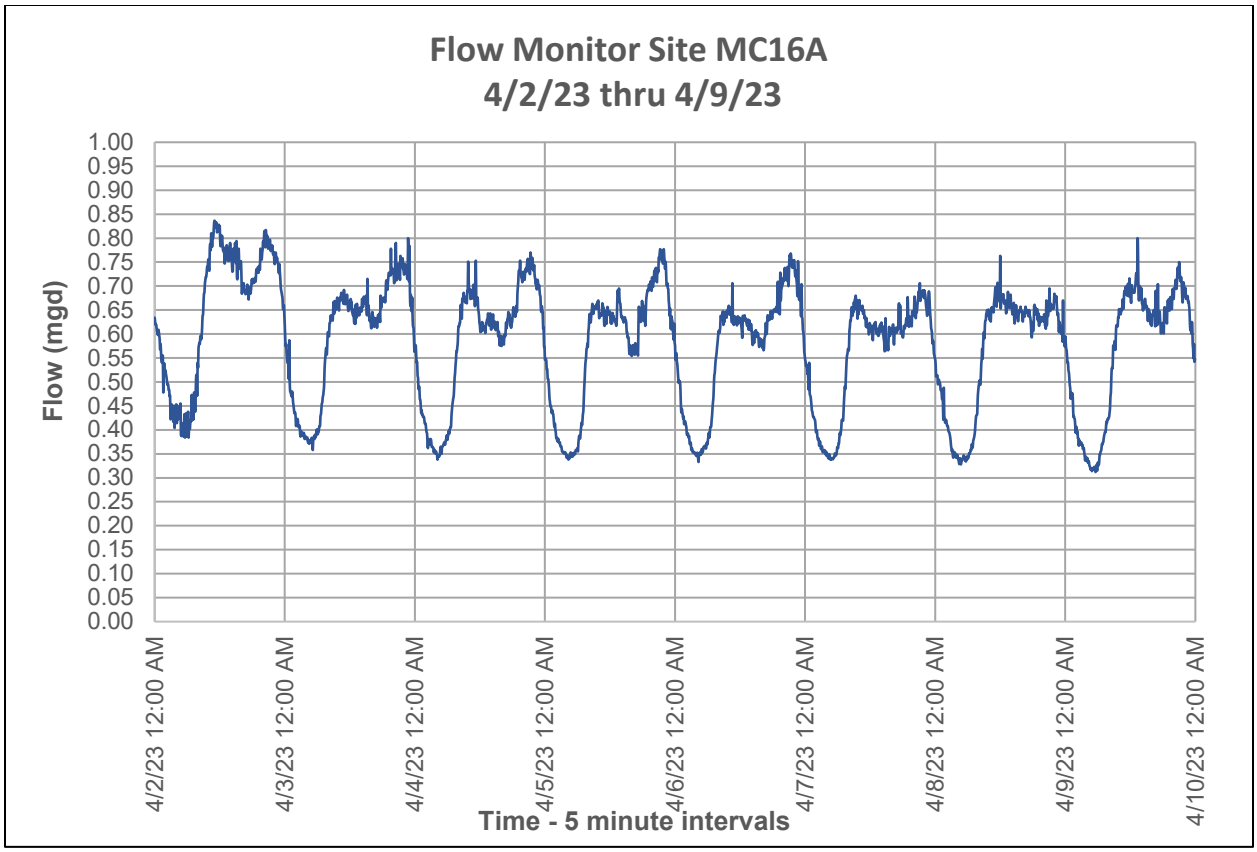

Flow Monitor Site MC03B
3/2/23 thru 3/9/23
Flow (mgd)
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

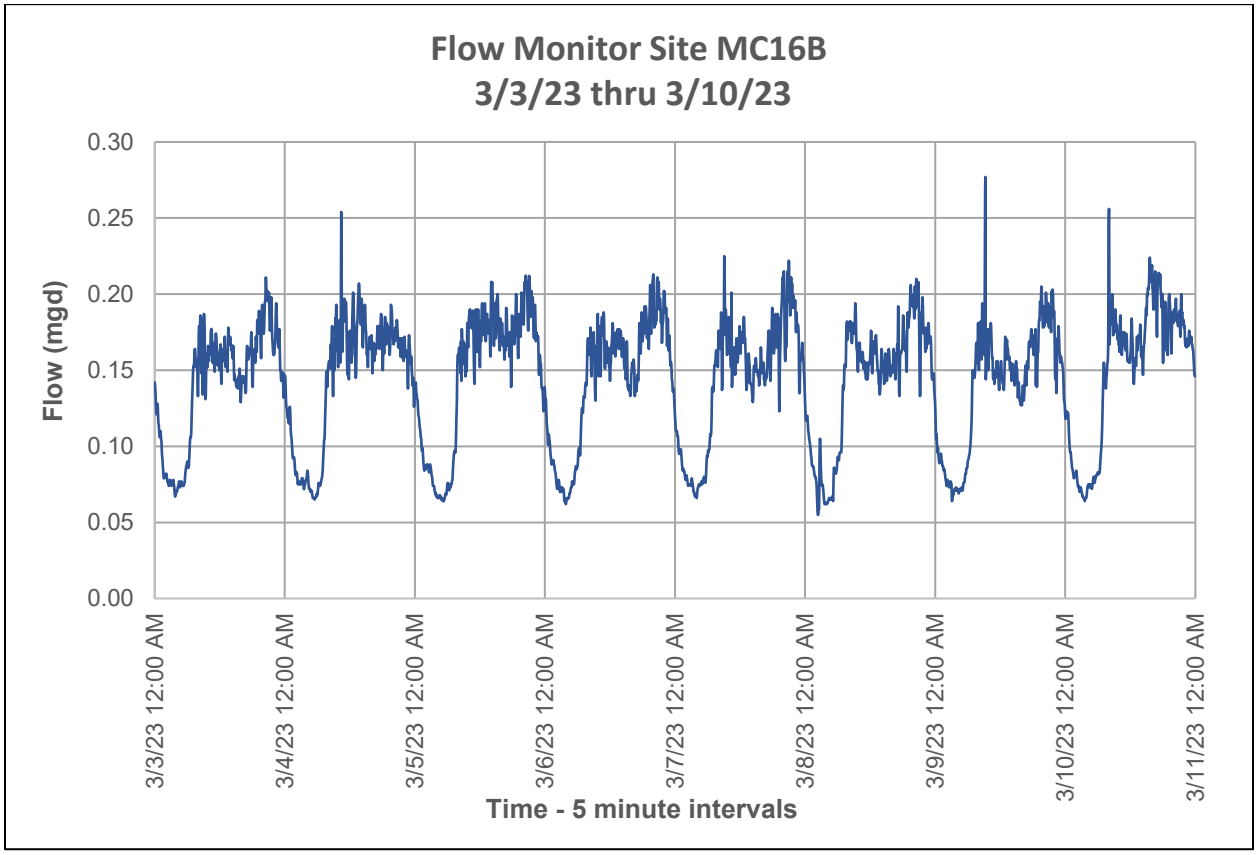

Flow Monitor Site MC03C
4/3/23 thru 4/10/23
Flow (mgd)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
4/3/23 12:00 AM
4/4/23 12:00 AM
4/5/23 12:00 AM
4/6/23 12:00 AM
4/7/23 12:00 AM
4/8/23 12:00 AM
4/9/23 12:00 AM
4/10/23 12:00 AM
4/11/23 12:00 AM
Time - 5 minute intervals

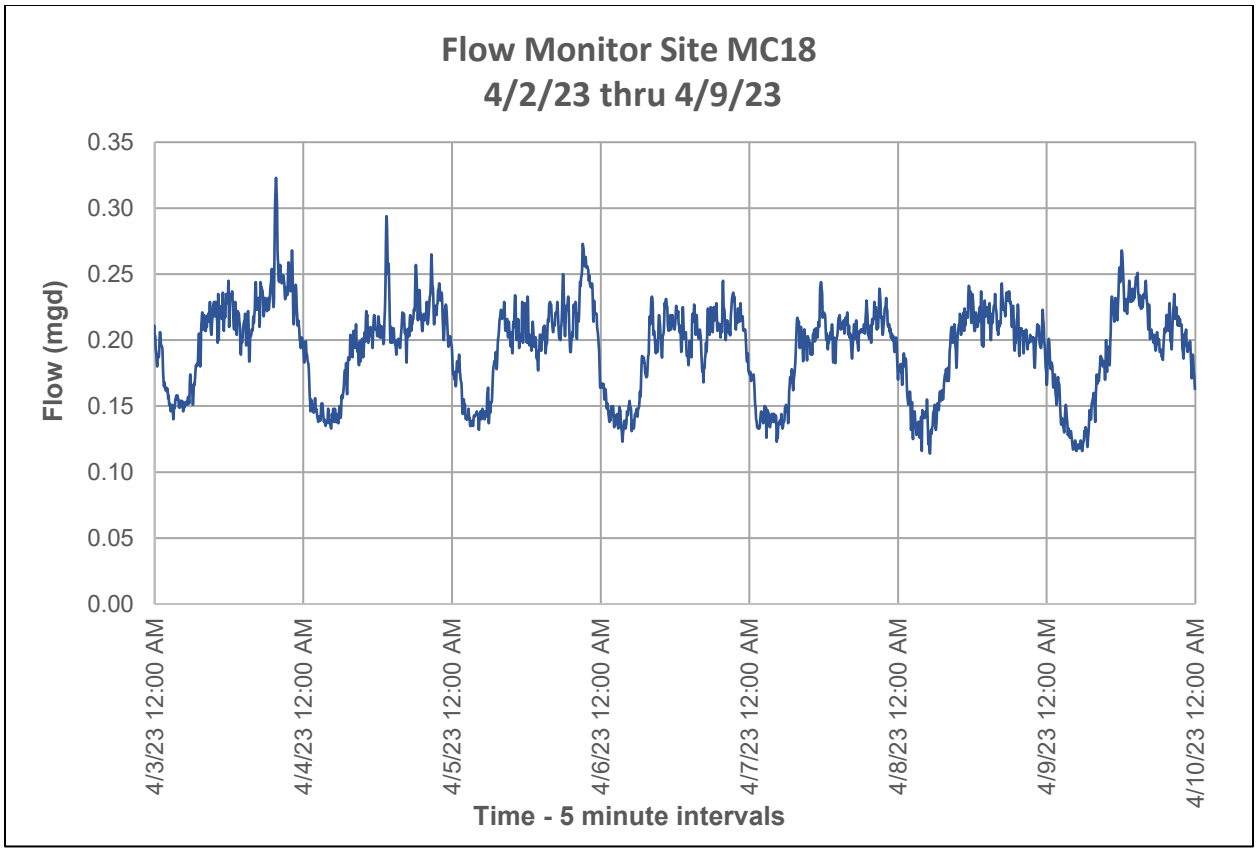

Flow Monitor Site MC07B
3/1/23 thru 3/8/23
Flow (mgd)
0.25
0.20
0.15
0.10
0.05
0.00
3/1/23 12:00 AM
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
Time - 5 minute intervals

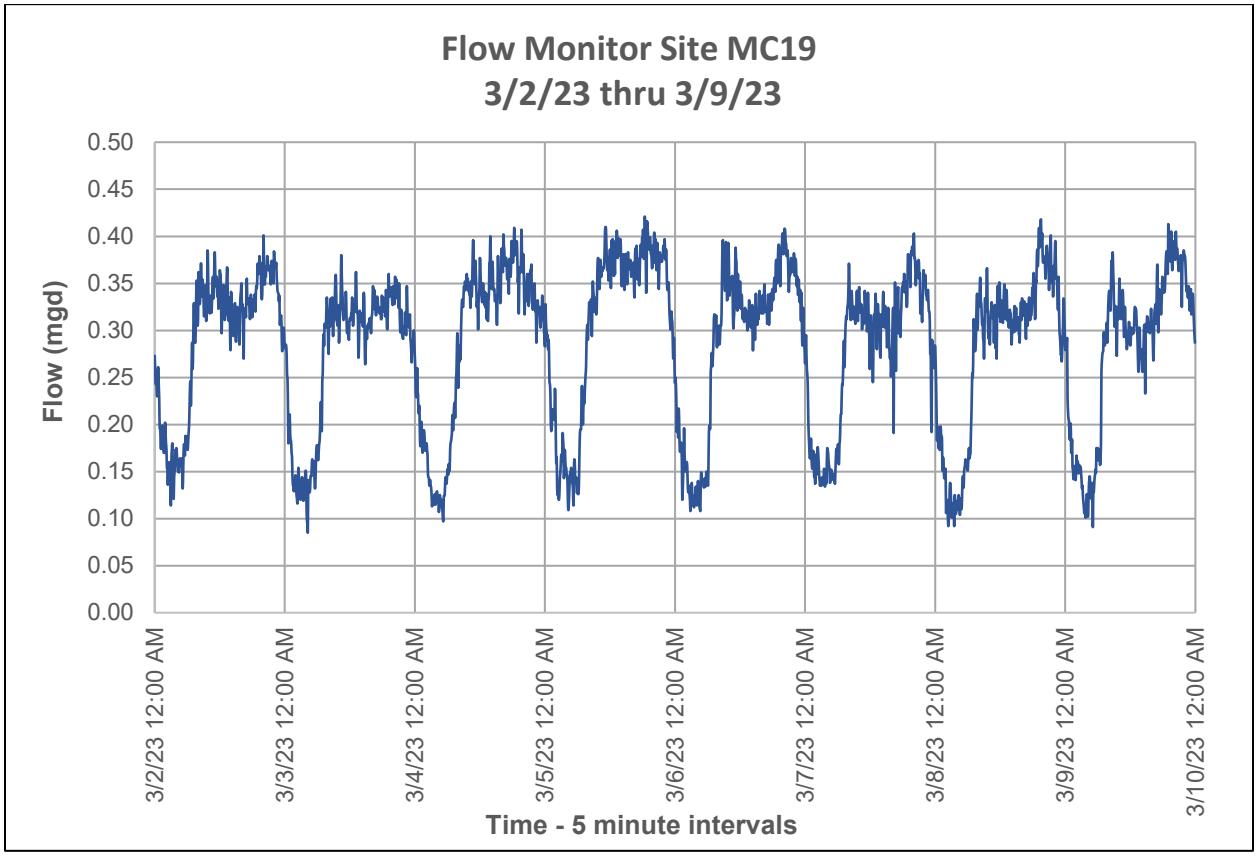

Flow Monitor Site MC09
3/3/23 thru 3/10/23
Flow (mgd)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

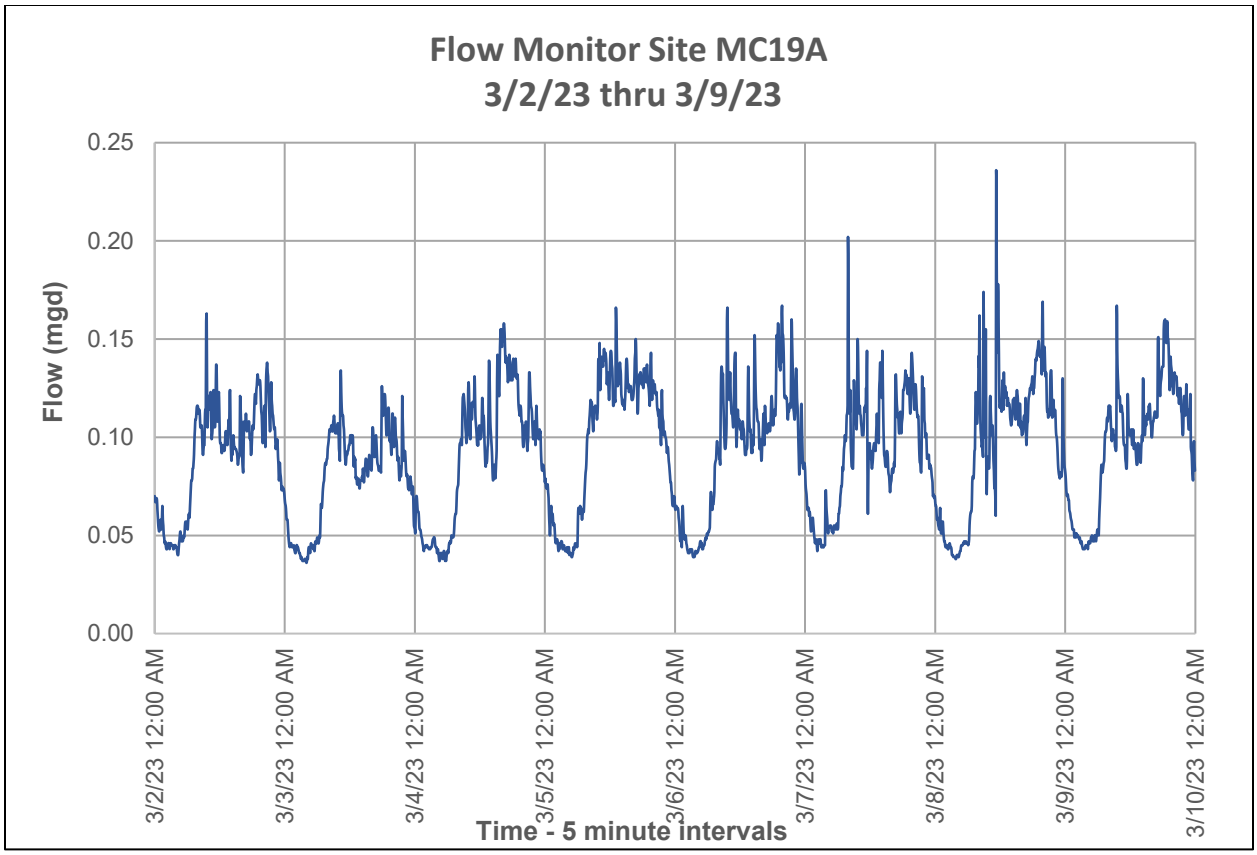

Flow Monitor Site MC15
3/2/23 thru 3/9/23
Flow (mgd)
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

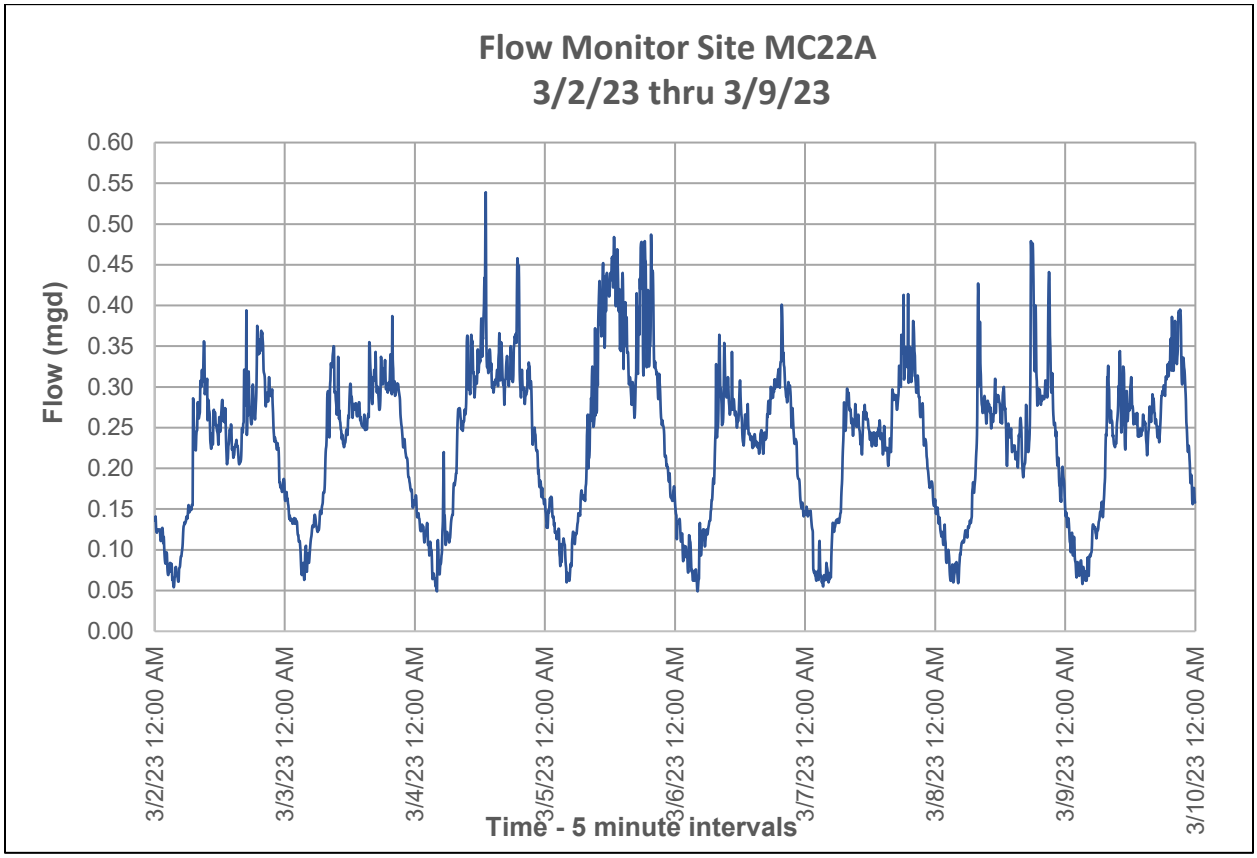

Flow Monitor Site MC16A
4/2/23 thru 4/9/23
Flow (mgd)
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
4/2/23 12:00 AM
4/3/23 12:00 AM
4/4/23 12:00 AM
4/5/23 12:00 AM
4/6/23 12:00 AM
4/7/23 12:00 AM
4/8/23 12:00 AM
4/9/23 12:00 AM
4/10/23 12:00 AM
Time - 5 minute intervals

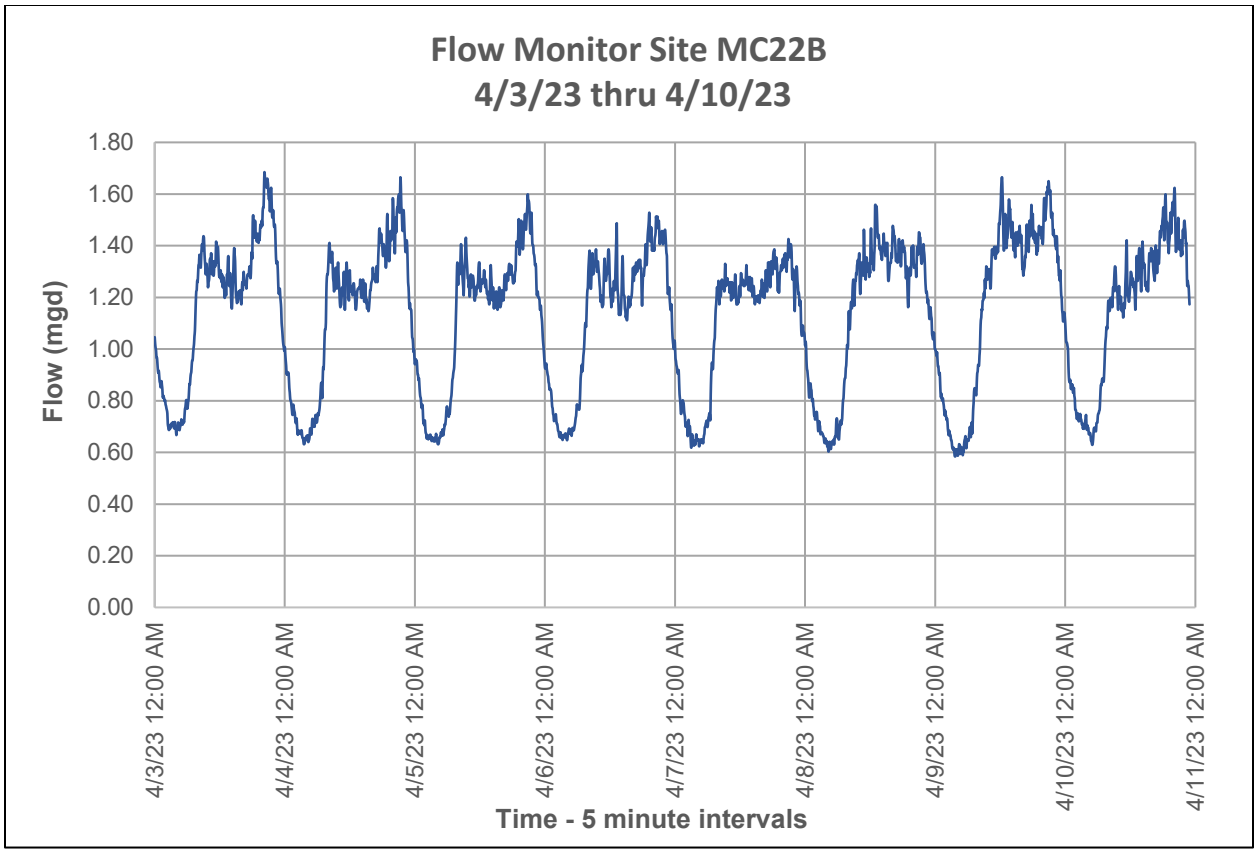

Flow Monitor Site MC16B
3/3/23 thru 3/10/23
Flow (mgd)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
3/11/23 12:00 AM
Time - 5 minute intervals

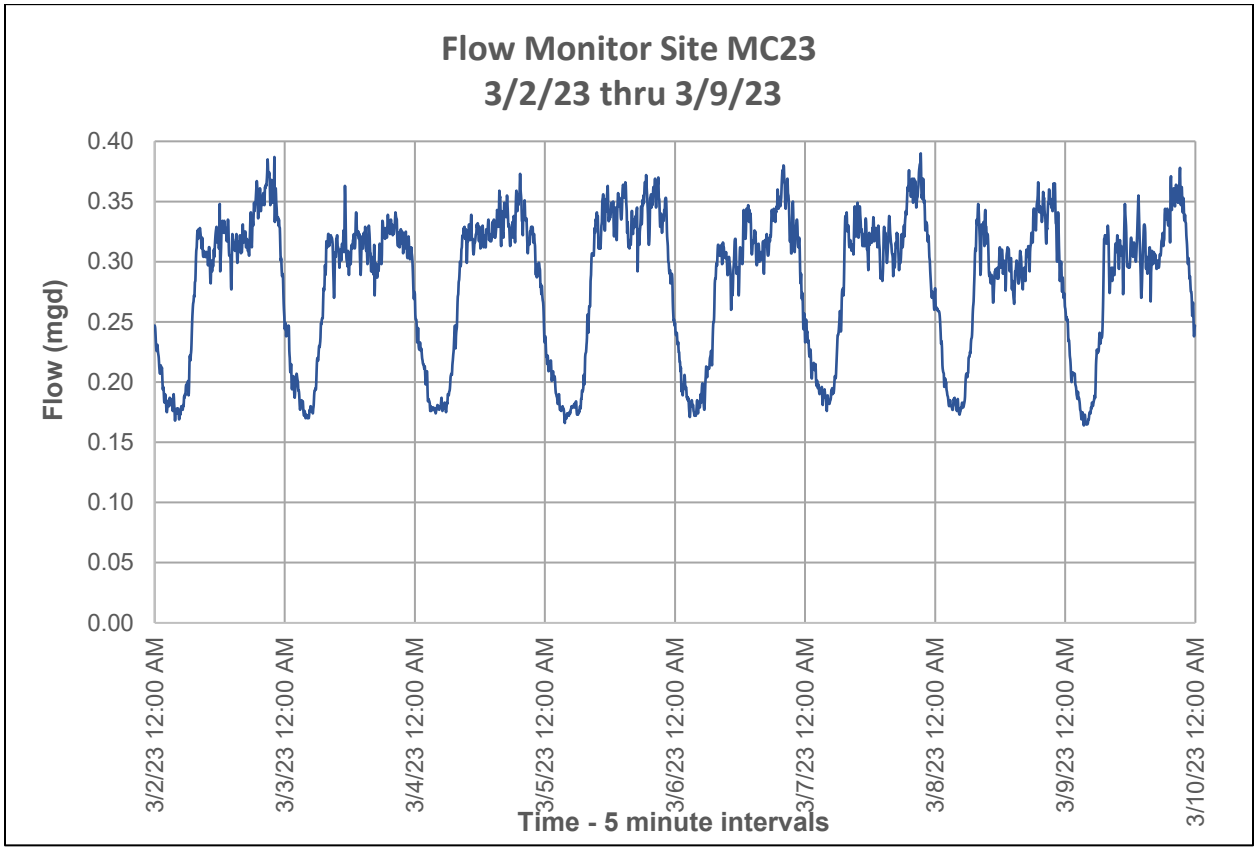

Flow Monitor Site MC18
4/2/23 thru 4/9/23
Flow (mgd)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
4/3/23 12:00 AM
4/4/23 12:00 AM
4/5/23 12:00 AM
4/6/23 12:00 AM
4/7/23 12:00 AM
4/8/23 12:00 AM
4/9/23 12:00 AM
4/10/23 12:00 AM
Time - 5 minute intervals

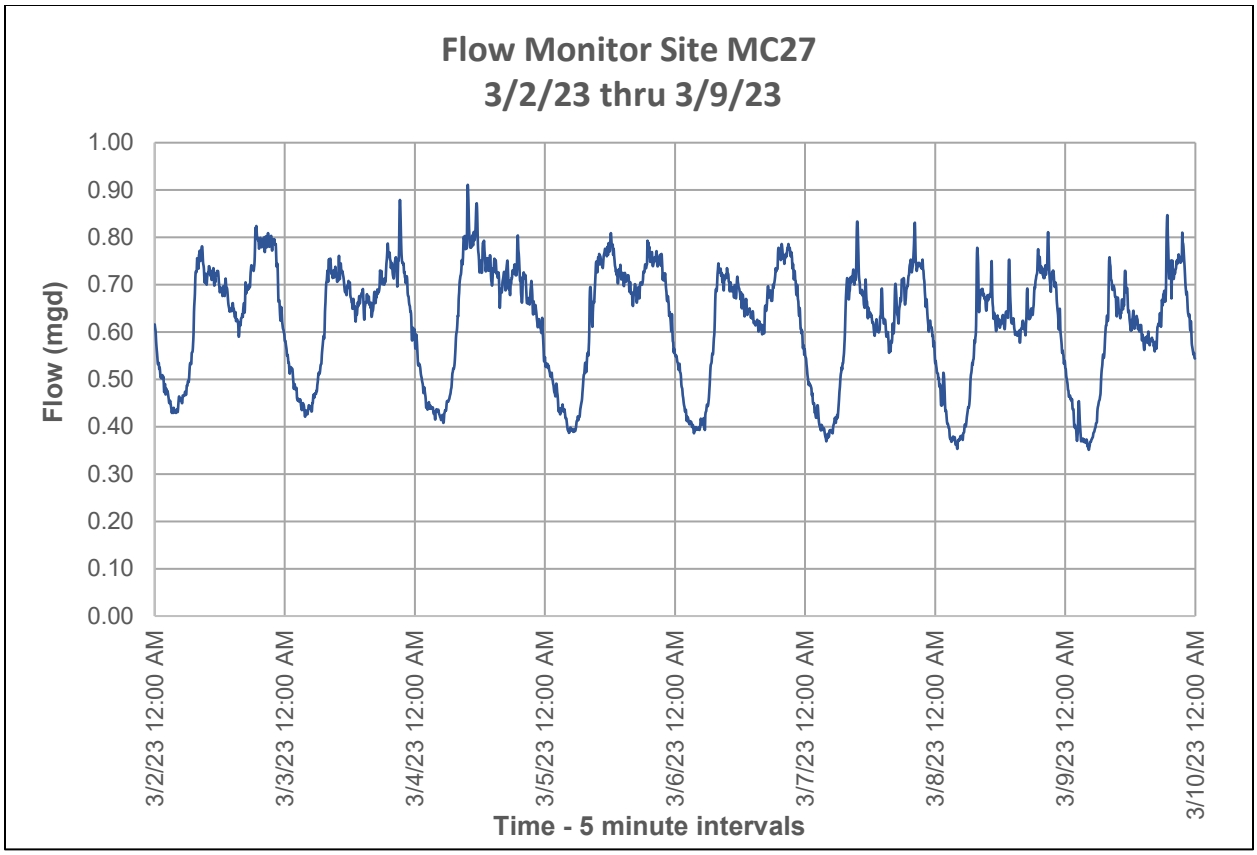

Flow Monitor Site MC19
3/2/23 thru 3/9/23
Flow (mgd)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

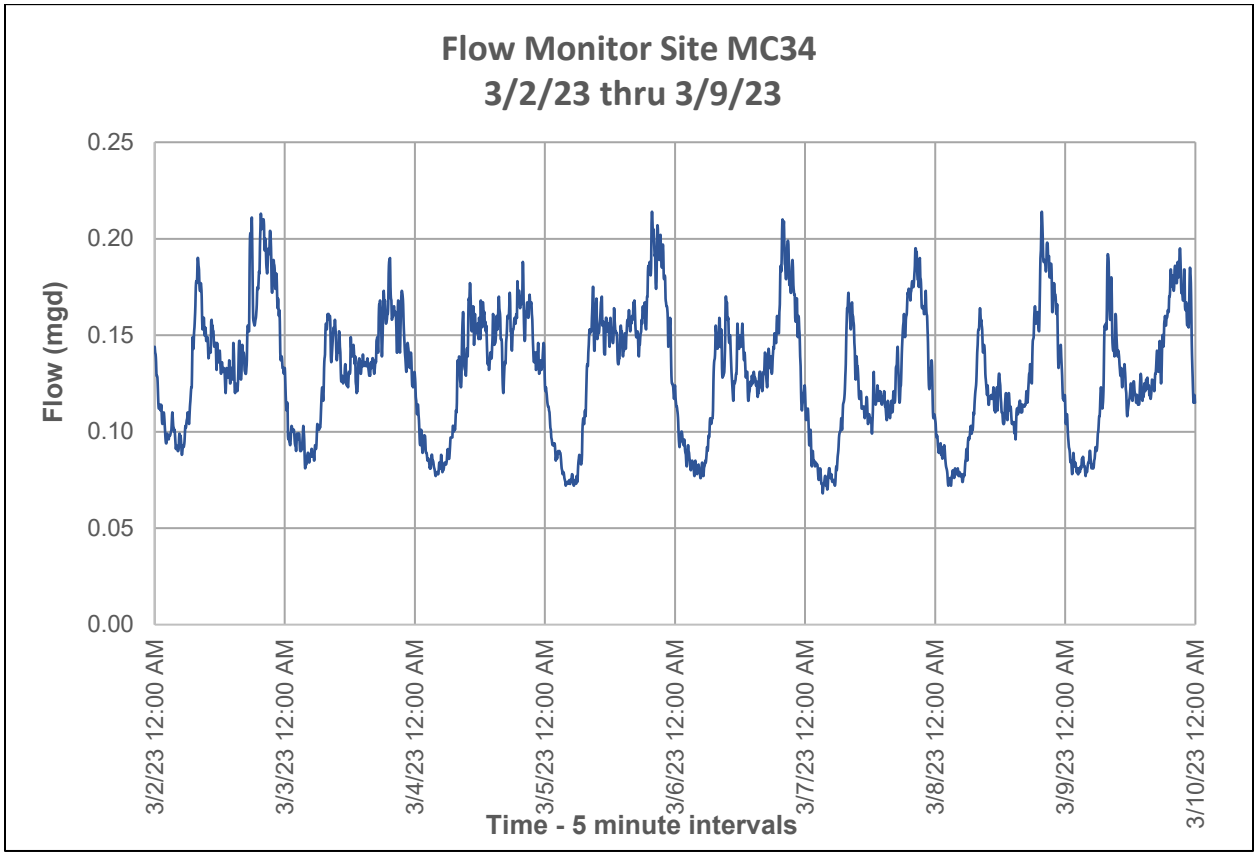

Flow Monitor Site MC19A
3/2/23 thru 3/9/23
Flow (mgd)
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

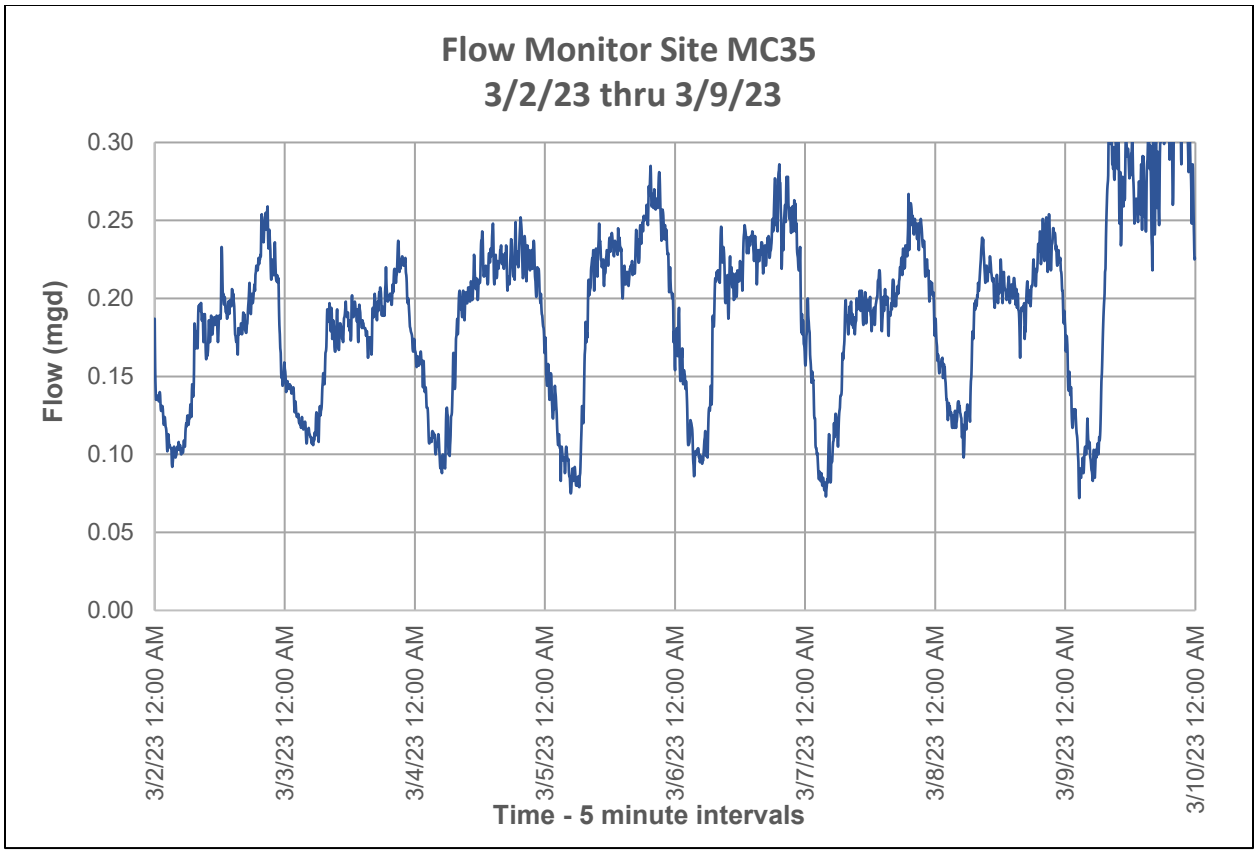

Flow Monitor Site MC22A
3/2/23 thru 3/9/23
Flow (mgd)
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals

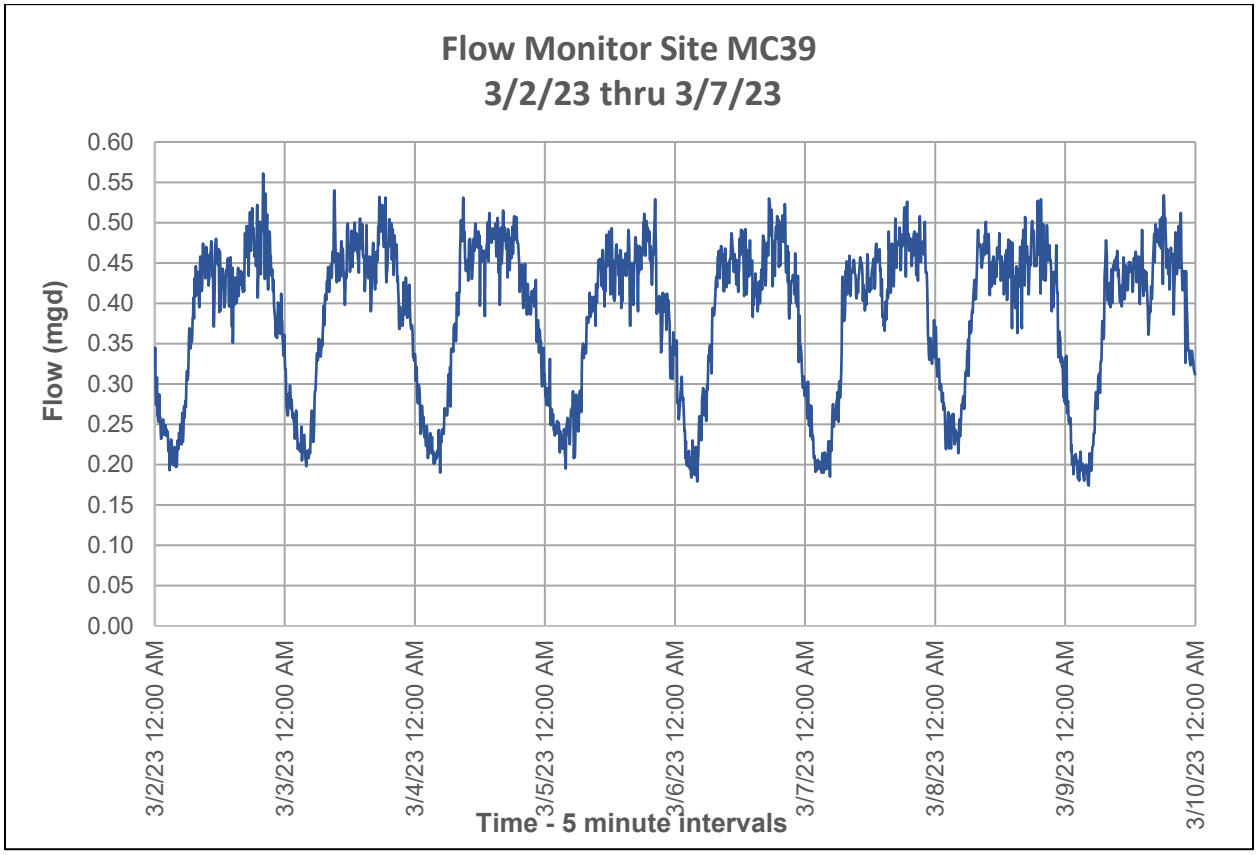

Flow Monitor Site MC22B
4/3/23 thru 4/10/23
Flow (mgd)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
4/3/23 12:00 AM
4/4/23 12:00 AM
4/5/23 12:00 AM
4/6/23 12:00 AM
4/7/23 12:00 AM
4/8/23 12:00 AM
4/9/23 12:00 AM
4/10/23 12:00 AM
4/11/23 12:00 AM
Time - 5 minute intervals

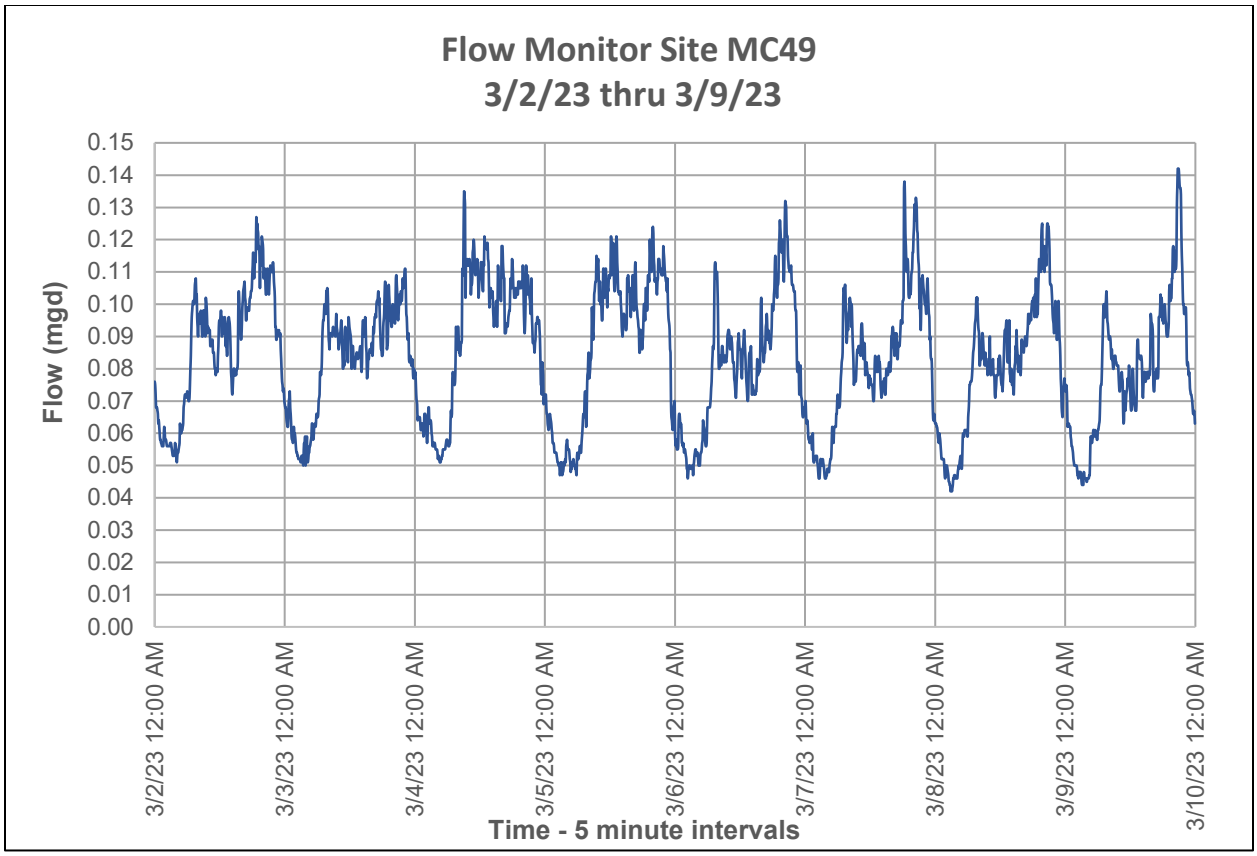

Flow Monitor Site MC23
3/2/23 thru 3/9/23
Flow (mgd)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC27
3/2/23 thru 3/9/23
Flow (mgd)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC34
3/2/23 thru 3/9/23
Flow (mgd)
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC35
3/2/23 thru 3/9/23
Flow (mgd)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC39
3/2/23 thru 3/7/23
Flow (mgd)
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC49
3/2/23 thru 3/9/23
Flow (mgd)
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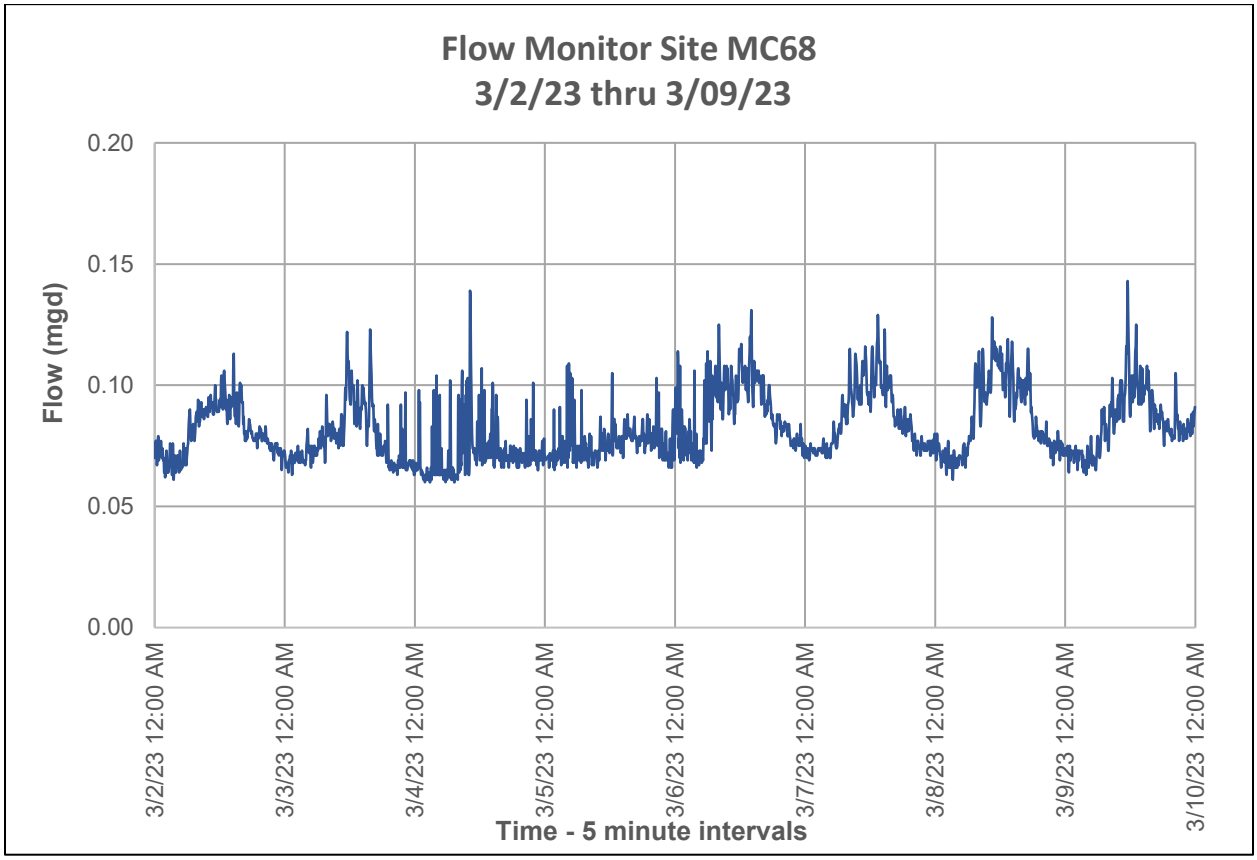
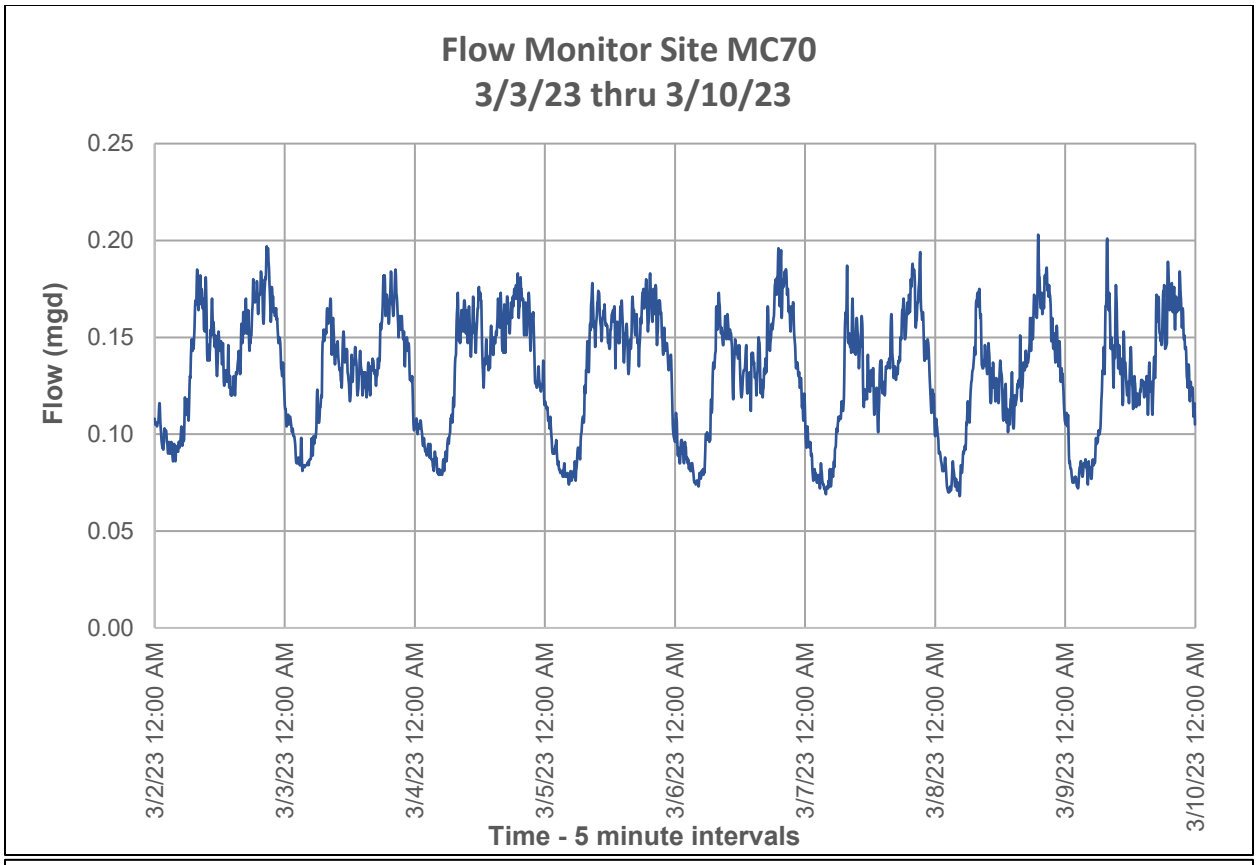
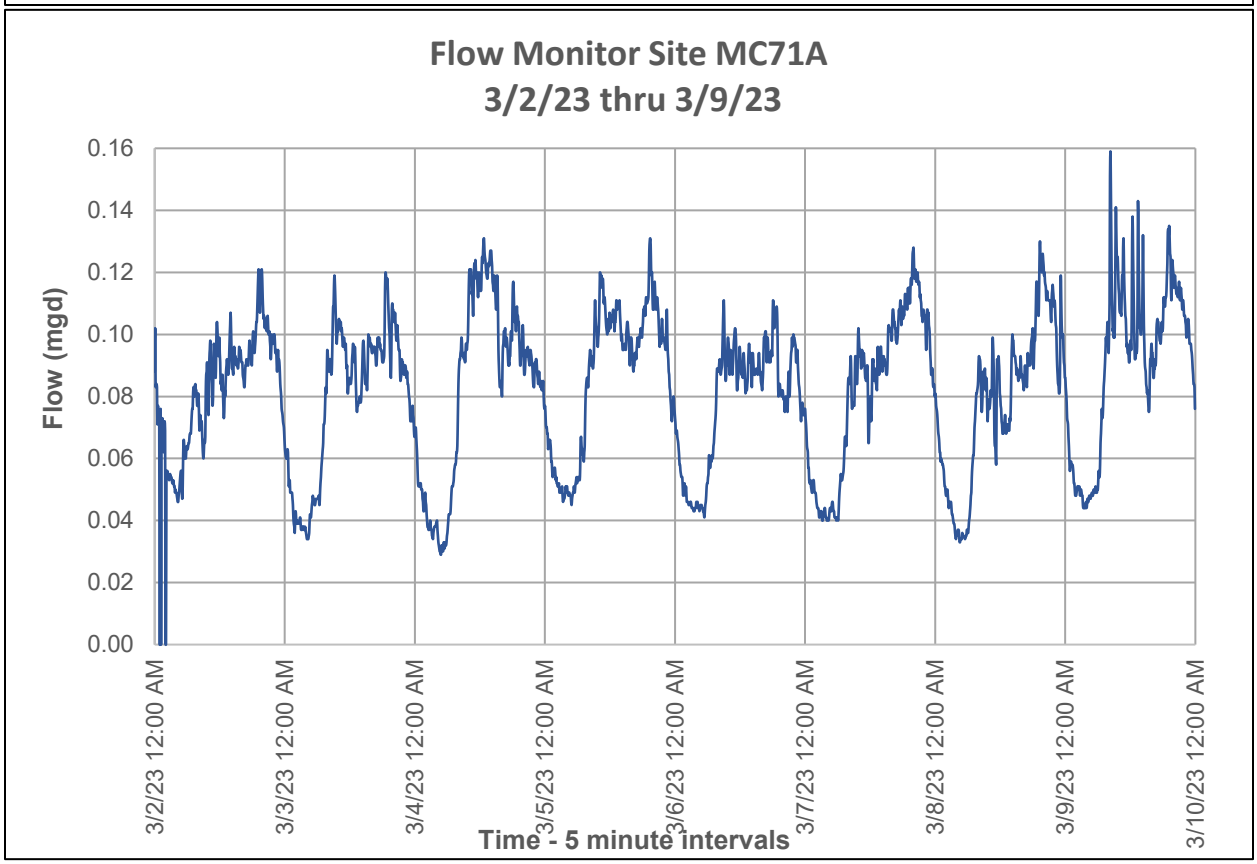
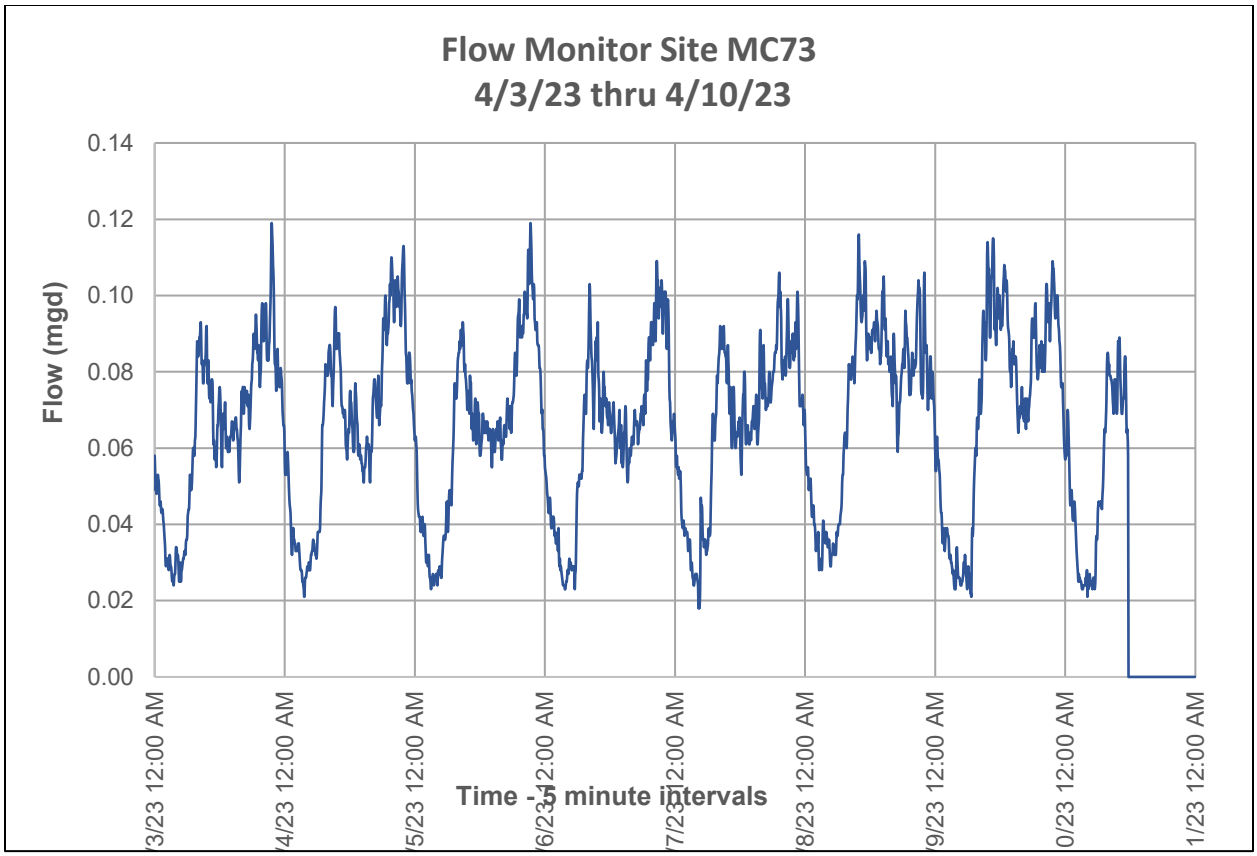
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC68
3/2/23 thru 3/09/23
Flow (mgd)
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC70
3/3/23 thru 3/10/23
Flow (mgd)
0.25
0.20
0.15
0.10
0.05
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC71A
3/2/23 thru 3/9/23
Flow (mgd)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
3/2/23 12:00 AM
3/3/23 12:00 AM
3/4/23 12:00 AM
3/5/23 12:00 AM
3/6/23 12:00 AM
3/7/23 12:00 AM
3/8/23 12:00 AM
3/9/23 12:00 AM
3/10/23 12:00 AM
Time - 5 minute intervals


Flow Monitor Site MC73
4/3/23 thru 4/10/23
Flow (mgd)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
3/23 12:00 AM
4/23 12:00 AM
5/23 12:00 AM
6/23 12:00 AM
7/23 12:00 AM
8/23 12:00 AM
9/23 12:00 AM
0/23 12:00 AM
1/23 12:00 AM
Time - 5 minute intervals

Appendix 6-1

Westminster Mall Specific Plan Infrastructure Technical Report

Appendix 5.10-1 Infrastructure Technical Report

Appendices

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FUSCOE ENGINEERING

WESTMINSTER MALL SPECIFIC PLAN

INFRASTRUCTURE TECHNICAL REPORT FOR HYDROLOGY, SEWER, WATER, & WATER QUALITY

Prepared For:
PLACEWORKS
3 MacArthur Place, Suite 1100
Santa Ana, CA 92707
714.966.9220

Prepared By:
FUSCOE ENGINEERING, INC.
16795 Von Karman, Suite 100
Irvine, California 92606
949.474.1960
www.fuscoe.com

PROJECT MANAGER
Stephanie Castle Zinn

DATE PREPARED: February 14, 2020
DATE REVISED: April 10, 2020

PROJECT NUMBER: 511-33-01

full circle thinking®

CITY OF WESTMINSTER
WESTMINSTER MALL SPECIFIC PLAN

INFRASTRUCTURE TECHNICAL REPORT FOR HYDROLOGY, SEWER, WATER, AND WATER QUALITY

CITY OF WESTMINSTER
COUNTY OF ORANGE, CALIFORNIA

PREPARED FOR:

PLACEWORKS
3 MacArthur Pl, Suite 1100
Santa Ana, CA 92707

PREPARED BY:

FUSCOE ENGINEERING, INC.
16795 Von Karman, Suite 100
Irvine, CA 92606
949.474.1960
www.fuscoe.com

FIRST SUBMITTAL:

FEBRUARY 14, 2020

REVISED:

APRIL 10, 2020

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ACRONYMS & ABBREVIATIONS

ATS	Active Treatment System
BAT	Best Available Technology Economically Available
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practice
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CWA	Clean Water Act
DAMP	Drainage Area Management Plan
DCV	Design Capture Volume
DU	Dwelling Units
EIR	Environmental Impact Report
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GCP	General Construction Permit
GIS	Geographic Information Systems
gpd	gallons per day
IRWMP	Integrated Regional Water Management Plan
LF	Linear Feet
LID	Low Impact Development
LIP	Local Implementation Plan
MCSD	Midway City Sanitation District
MGD	Millions of Gallons per Day
MS4	Municipal Separate Storm Sewer Systems
MWD	Metropolitan Water District of Southern California
MWDOC	Municipal Water District of Orange County
NOC	North Orange County
NOI	Notice of Intent
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
OCFCD	Orange County Flood Control District
OCWD	Orange County Water District
OCSD	Orange County Sanitation District
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way

RWQCB	Regional Water Quality Control Board
SF	Square Feet
SFHA	Special Flood Hazard Area
SOI	Sphere of Influence
SWPPP	Storm Water Pollution Prevention Program
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TGD	Technical Guidance Document
TMDL	Total Maximum Daily Load
UWMP	Urban Water Management Plan
WDID	Waste Discharge Identification Number
WDR	Waste Discharge Requirement
WQMP	Water Quality Management Plan
WQO	Water Quality Objective

1. INTRODUCTION & BACKGROUND

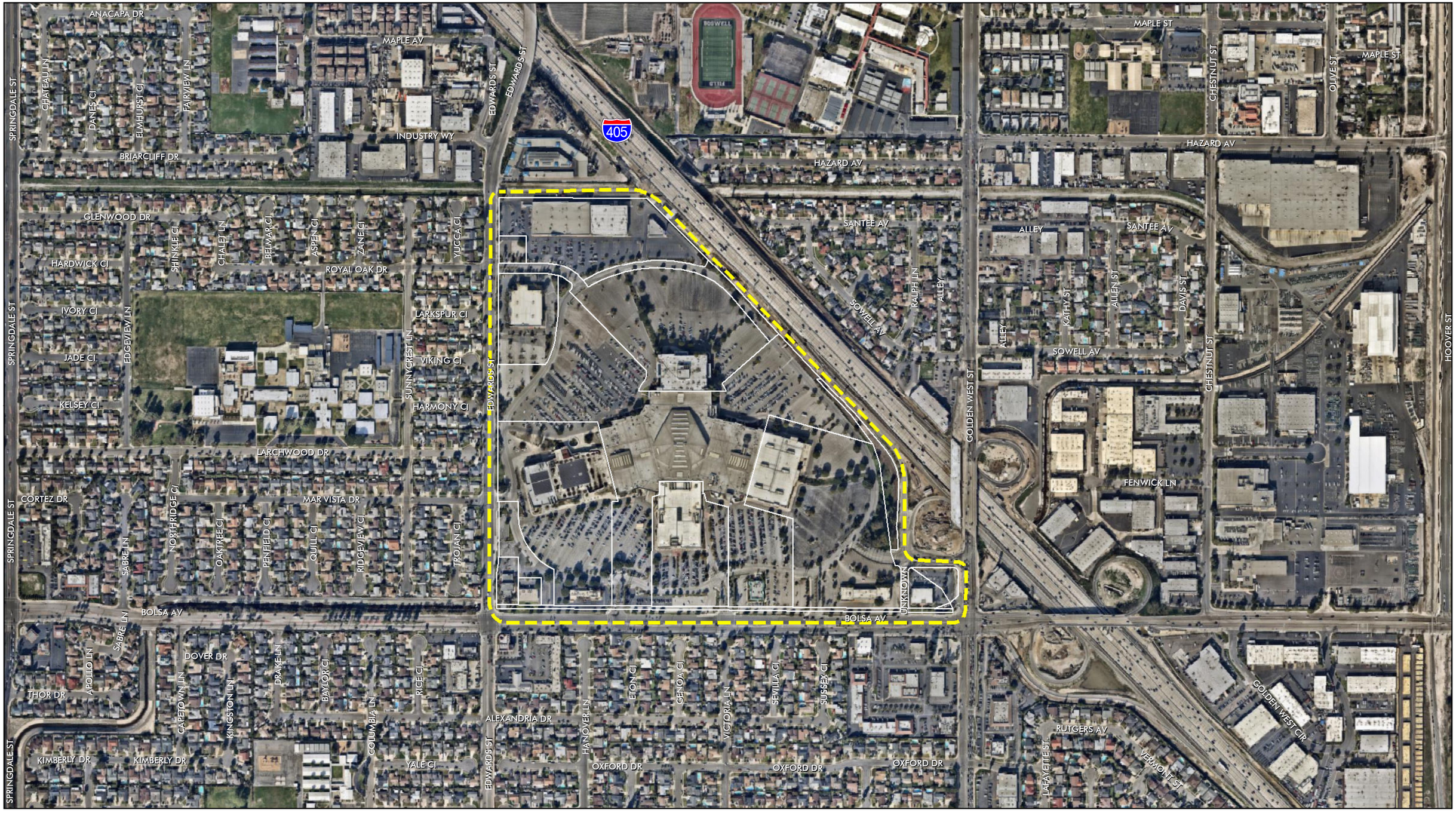
The Westminster Mall Specific Plan ("Specific Plan" or "WMSP") is located in the southwestern portion of the City of Westminster ("City") in Orange County. The City is proposing the Specific Plan to encourage redevelopment and revitalization of the City's Westminster Mall area to support mixed-use residential and commercial needs through new land use and development framework. The Specific Plan area extends to the I-405 Freeway to the north and northeast, Edwards Street to the west, Bolsa Avenue to the south, and Goldenwest Avenue to the southeast. Interior drive aisles and parking run throughout the Specific Plan area.

The Specific Plan area encompasses approximately 103 acres and is currently used entirely for commercial/retail uses and associated parking. The WMSP proposes a variety of land use changes within the Specific Plan boundary. The proposed land use changes are summarized below in Table 1.

Table 1 Specific Plan Proposed Land Use

Land Use Designation	Square Footage	Units
Retail	600,000	--
Entertainment Retail	210,000	--
Restaurant	210,000	--
Office	180,000	--
Hotel	--	425 Rooms
3-Story Downtown Residential	--	300 DU
4-6 Story Wrap/Mini Podium Residential	--	1,200 DU
8-10 Story Podium Residential	--	1,500 DU
Total	**1,200,000 SF**	**3,000 DU**

See Figure 1 for an aerial overview of the Specific Plan area.



Aerial Date: 1/18/2020

Aerial Extent - Westminster Mall Specific Plan

Figure 1

2/12/2020

Westminster Mall Specific Plan

FUSCOE ENGINEERING
full circle thinking

Specific Plan Boundary

500 250 0 500 Feet

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This report analyzes the proposed land use changes within the Specific Plan area and how these changes may impact the existing infrastructure that lies within or immediately downstream. For those areas where the land use changes may impact the existing infrastructure, measures will include a review of the Master Plans of Drainage, Water, and Wastewater systems, as well as the existing drainage (storm drain systems), sewer systems, water systems, and water quality systems currently in place. Measures to reduce potential impacts to surface water quality as a result of post-construction operations will be addressed within this report. This includes structural Best Management Practices (BMPs) and Low Impact Development (LID) strategies for post-construction water quality protection and water conservation strategies. Additional details on water quality will occur during the site planning process through the City of Westminster and the development of site-specific (e.g. project-specific) Water Quality Management Plans (WQMPs).

2. ENVIRONMENTAL SETTING

2.1 HYDROLOGY

The purpose of the hydrology evaluation is to evaluate the existing status of the storm drain system based on best available information (Master Plan of Drainage, specific studies within the Specific Plan study area, Capital Improvement Projects, public works staff, etc.) and determine if the system can accommodate the proposed land use changes. Where applicable, storm drain system improvements will be identified to support the proposed land plan based on the most current Master Plan of Drainage and supporting studies.

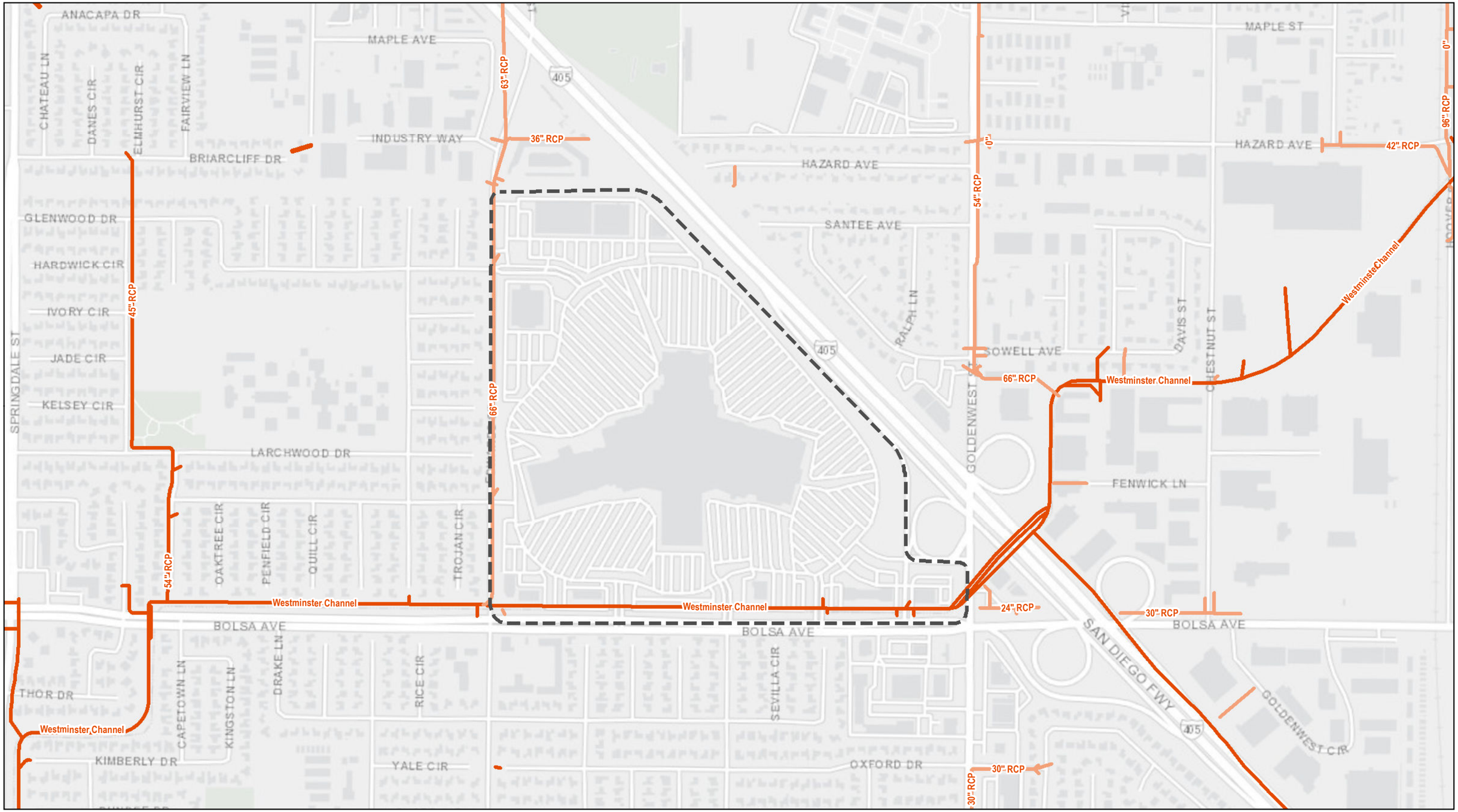
2.1.1 Watershed Setting and Existing Drainage Facilities

The WMSP site resides within the Anaheim Bay Huntington Harbour Watershed within the regional Santa Ana River Watershed. The Anaheim Bay-Huntington Harbor Watershed is located in northern Orange County, approximately 25 miles south of Los Angeles and 85 miles north of San Diego. The Anaheim Bay-Huntington Harbor Watershed is composed of a number of channels, none of which is a dominant river for the watershed, with each draining a substantial portion of the watershed. The Specific Plan area drains to the Westminster Channel (OCFCD C04) through City and County storm drain lines and confluences with Bolsa Chica Channel (OCFCD C02) (see Figure 2). The Westminster Channel is concrete-lined and serves entirely urbanized subwatershed.

The WMSP area is served by three primary flood control and drainage systems.

1) Private Storm Drain lines ranging from 10″ to 30″ in diameter currently serve the WMSP site. Flows drain from the northeast of the site to the southwest, and connect to both City and Orange County Flood Control District (OCFCD) infrastructure.
2) The City operates and maintains the adjacent storm drain system including catch basins and a pipeline that runs along Edwards Street that ranges from 63″ to 66″ in diameter as it runs downstream.
3) OCFCD operates and maintains the Westminster Channel which runs along Bolsa Avenue to the south of the WMSP area.

Runoff from the WMSP area generally sheet flows across impervious surfaces, prior to draining to on-site storm drain infrastructure through grate inlets and catch basins. Under existing conditions, the WMSP area is estimated to be approximately 90% impervious, using the OC hydrology manual criteria. Flows drain to the Westminster Channel either through City infrastructure or directly from the site to the Channel. Flows ultimately drain to Anaheim Bay, Huntington Harbour and the Pacific Ocean. See Figure 2 for existing storm drain facilities within and surrounding the WMSP boundary.



Existing Storm Drain Systems

Westminster Mall Specific Plan

Figure 2

4/9/2020

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Specific Plan Boundary — City Storm Drain Lines — OCFCD Storm Drain Lines

500 250 0 500 Feet

5.10-1-11

X:\Projects\511\33\MXD\2_WestminsterMall_StormDrain_200212.mxd

2.1.2 Existing Floodplain Mapping

The National Flood Insurance Act (1968) established the National Flood Insurance Program, which is based on the minimal requirements for flood plain management and is designed to minimize flood damage within Special Flood Hazard Areas. The Federal Emergency Management Agency (FEMA) is the agency that administrates the National Flood Insurance Program. Special Flood Hazard Areas (SFHA) are defined as areas that have a 1 percent chance of flooding within a given year, also referred to as the 100-year flood. Flood Insurance Rate Maps (FIRMs) were developed to identify areas of flood hazards within a community.

The WMSP area is split between two FIRMs. The northerly 8-acres is covered under Firm map No. 06059C0119J and is designated as flood zone "X" (shaded). The balance of the WMSP area is covered under FIRM map No. 06059C0232J and is designated with two flood zones. The most southerly 270 feet, adjacent to the north side of Bolsa Avenue, is designated as flood zone "A" and is a special flood hazard area subject to inundation by the 1% annual chance flood. The portion north of the flood zone "A" is designated as flood zone "X" (shaded). Flood zone "X" is defined by FEMA as those areas subject to a 0.2% chance of flooding; areas of 1% annual chance of flooding with average depths of less than 1-foot or with drainage areas less than 1-square mile; and areas protected by levees from a 1% annual chance flood. Flood zone "A" is a special flood hazard area and has no base flood elevation determined. See Figure 3 below for flood zones within and adjacent to the Specific Plan area.

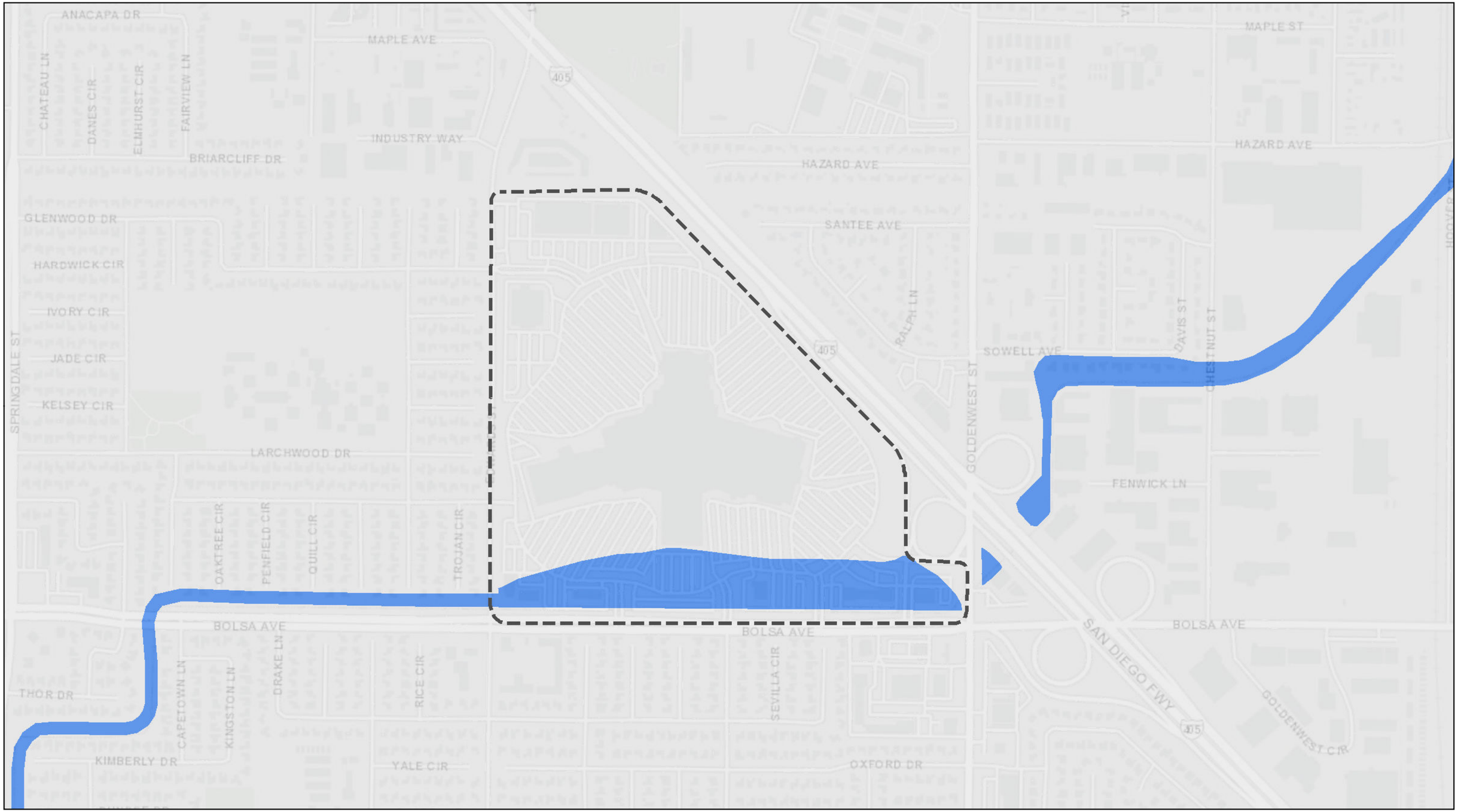
2.1.3 2004 City of Westminster Master Plan of Drainage Update

City of Westminster Modeled Stormwater System

The 2004 Stormwater Master Plan includes hydrologic modeling for the City of Westminster storm drain lines to determine existing capacity. The Master Plan divided the City into 93 major basins that discharge into County storm drains and mapped 151,184 lineal feet of the City's storm drain system with pipe diameters that equal to or greater than 24" in diameter. Of the 134,959 feet of modeled drains, 95.7% were pipe sections, 1.7% were Box sections with the remaining 2.6% being open channel sections. The analysis included computation of the 2-, 5-, 10-, 25-, 50- and 100-year storm events and the flow capacity of the existing storm drain systems to determine where improvements are recommended.

The analysis returned a number of deficient segments in need of improvement and areas susceptible to localized flooding. However, none of these areas were within the boundary or immediate vicinity of the Specific Plan area and would not have any impact on the existing or proposed conditions of the WMSP.

Deficient segments and areas in need of improvement are added to the City's long-term capital improvement list. Any deficient segments found within the WMSP area in the future will be added to the City's improvement list or will be improved as part of redevelopment activities and agreements associated with the Specific Plan.



FEMA Flood Zones

Westminster Mall Specific Plan

Figure 3

2/12/2020

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full circle thinking

Specific Plan Boundary

FEMA Flood Zones

A

X

5.10-1-13

500 250 0 500 Feet

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2.2 SEWER & WASTEWATER INFRASTRUCTURE

The purpose of the sewer/wastewater evaluation is to determine if the existing sewer system can accommodate the proposed land use changes at the Specific Plan level. In order to determine that, a program level analysis of the existing sewer and water systems are required. The analysis is based on information provided by the City of Westminster, Midway City Sanitation District (MCSD) and Orange County Sanitation District (OCSD).

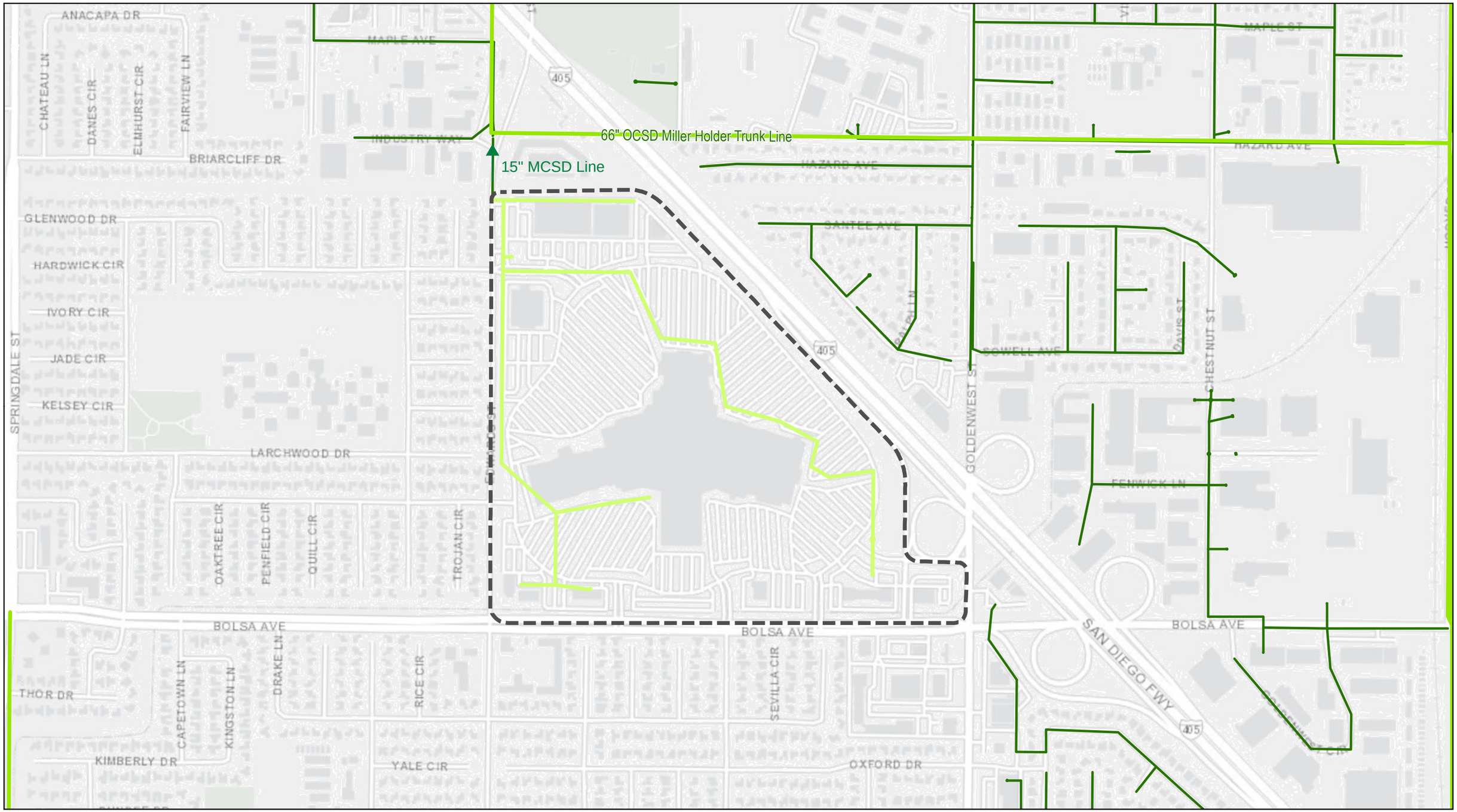
2.2.1 Existing Sewer System and Facilities

The sewer infrastructure system in the City is maintained by primarily MCSD. MCSD sewer infrastructure ultimately ties into the OCSD regional trunk lines for wastewater treatment. The MCSD services a population of approximately 100,000 people over 10.4 square miles. The MCSD sewer system is comprised of approximately 174 miles of gravity flow sewer lines ranging in size from 6"-8", approximately 1.12 miles of force main sewer lines ranging in size from 8"-18" and four lift stations. OCSD is a public agency that provides wastewater collection, treatment, and disposal services for approximately 2.5 million people in central and northwest Orange County. OCSD sewer trunk lines range from 15"-95" throughout the City of Westminster.

Under existing conditions, the WMSP area is served by a series of private 12" to 15" vitrified clay pipes (VCP) with 6" laterals[1]. These flow from on-site buildings towards the north and west, before connecting with a 15" MCSD line. After connecting through MCSD infrastructure, flows ultimately tie to the 66" OCSD Miller-Holder trunk line. Flows within the Miller-Holder trunk line drain to OCSD Reclamation Plant No. 2 for treatment. However, flows can be diverted to either Reclamation Plant No.1 or Reclamation Plant No. 2 based on available plant capacities and modeled inflows.

Figure 4 shows the existing sewer infrastructure surrounding the Specific Plan Area.

[1] Per 1973 As-Built plans for the Westminster Mall site



Existing Sewer Systems

Westminster Mall Specific Plan

Figure 4

2/14/2020

FUSCOE ENGINEERING

Specific Plan Boundary — MCSD Sewer Lines — OCSD — Private Sewer Lines (6"-15")

500 250 0 500 Feet

5.10-1-15

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2.2.2 Existing Sewer Flows

For each land use within the WMSP boundary, sewer generation was estimated to provide a baseline condition and to allow for comparisons against proposed land use changes under the Specific Plan. Footprints of the existing development (i.e. retail and restaurant.) were utilized along with their corresponding flow/generation factors to develop existing condition flow rates. Sewer generation factors from the OCSD Design Construction Requirements for Sanitary Sewers were used for estimating commercial sewer flows based on existing land use[2].

Table 2 provides a summary of the existing wastewater flows for the WMSP area. Details and calculations are provided in Appendix A.

Table 2 Existing Condition Average Daily Sewer Flows

Specific Plan Area	*Acreage*	*Number of Dwelling Units*	*Non-Residential SF[1]*	*Average Sewer Flow (GPD)*
Westminster Mall	103	0	1,360,000	70,623

Notes:
GPD gallons per day SF square feet
[1] *Non Residential includes commercial, retail, and restaurant land uses*

Under the existing conditions, average daily sewer flows are estimated at 0.07 million gallons per day (MGD) for the Specific Plan area. As mentioned, the WMSP flows connect to a 15" MCSD sewer main, flowing north within Edwards Street before connecting to the OCSD Holder-Miller trunk line. Determination of the existing condition average daily sewer flows will allow for comparison against the proposed land use average daily sewer flows in Section 3.2.1.

2.2.3 Existing Sewer Capacity Assessment

MCSD Sewer Master Plan

The MCSD Sewer System Master Plan (April, 2015) highlights capital improvements that have been previously made to the sewer system and calculated flow rates from a hydraulic model to determine the adequacy of the existing backbone sewer system to convey existing and ultimate sewer loadings. The sewer system currently has a capacity of 18 million gallons per day (MGD) and was operating at 5 MGD signifying sufficient capacity for existing land uses and future development. Approximately 10 regional improvements have been made to the sewer system from 2003-2010, however none of these were in or adjacent to the WMSP area. In addition, MCSD staff confirmed there were no deficiencies with the existing 15" MCSD sewer line that connects the Specific Plan sewer flows to the OCSD Miller-Holder trunk line[3].

OCSD Capital Improvement Program

The OCSD Capital Improvement Program (CIP) highlights OCSD's continuous effort to keep its facilities operating at optimal levels. The 2019-20 CIP lists several projects within their regional sewer conveyance system. There are currently no distribution system projects within the Specific Plan area.

[2] OCSD. 2017. Final Report and Recommendations on Wastewater Rates, Fees, and Charges. Available at: https://www.ocsd.com/Home/ShowDocument?id=23431
[3] Meeting with MCSD Staff; 2/5/2020.

OCSD has a 10-Year Net CIP outlay which allocates the available budget to various projects throughout its service area. The majority of the budget (58%) is allocated to the reclamation plants. Approximately 23% is allocated to the existing collections/distribution system.

OCSD's 2006 Facilities Master Plan noted that a 2030 improvement project was anticipated for the Holder-Miller trunk line serving the WMSP area. As of the 2009 Facilities Master Plan, the project was recommended to be delayed due to estimated cost increases[4]. However, after additional discussion with OCSD staff, it has been confirmed that there are no existing capacity issues with the regional sewer infrastructure that serves the WMSP area.[5]

[4] Orange County Sanitation District. 2009 Facilities Master Plan.
[5] Email correspondence with OCSD staff; 2/20/2020.

2.3 EXISTING WATER DISTRIBUTION SYSTEM

The purpose of the water system evaluation is to describe and evaluate the existing status of the water distribution system and identify any known deficiencies or improvements required to support existing and future uses. The analysis is based on information provided by the City of Westminster.

2.3.1 Existing Water System

The City of Westminster is the water service provider and distributes water to the City's residents and businesses including the Specific Plan area. Westminster receives water from two main sources: imported water from Metropolitan Water District (MWD)and groundwater pumped and treated from city-owned wells. The City has a 16-million-gallon reservoir facility that was constructed in 2003 and consists of two 8 million gallon storage tanks, four booster pumps and a 2,800-gallon per minute (gpm) well. Approximately 75% of the City's water supply is from ten city-owned groundwater wells that are located within the City's boundaries.

Per inspection of the 1973 as-built plans for the Westminster Mall site, the WMSP area is currently served by a single loop water distribution network. A 12" ductile iron pipe (DIP) serves the north, east, and south side tied to a 10" DIP on the west side, completing the loop. On-site water systems are fed by a 12" City line on Bolsa Avenue. See Figure 5 for locations of the existing water facilities. See Figure 5 for existing water systems serving the WMSP area.

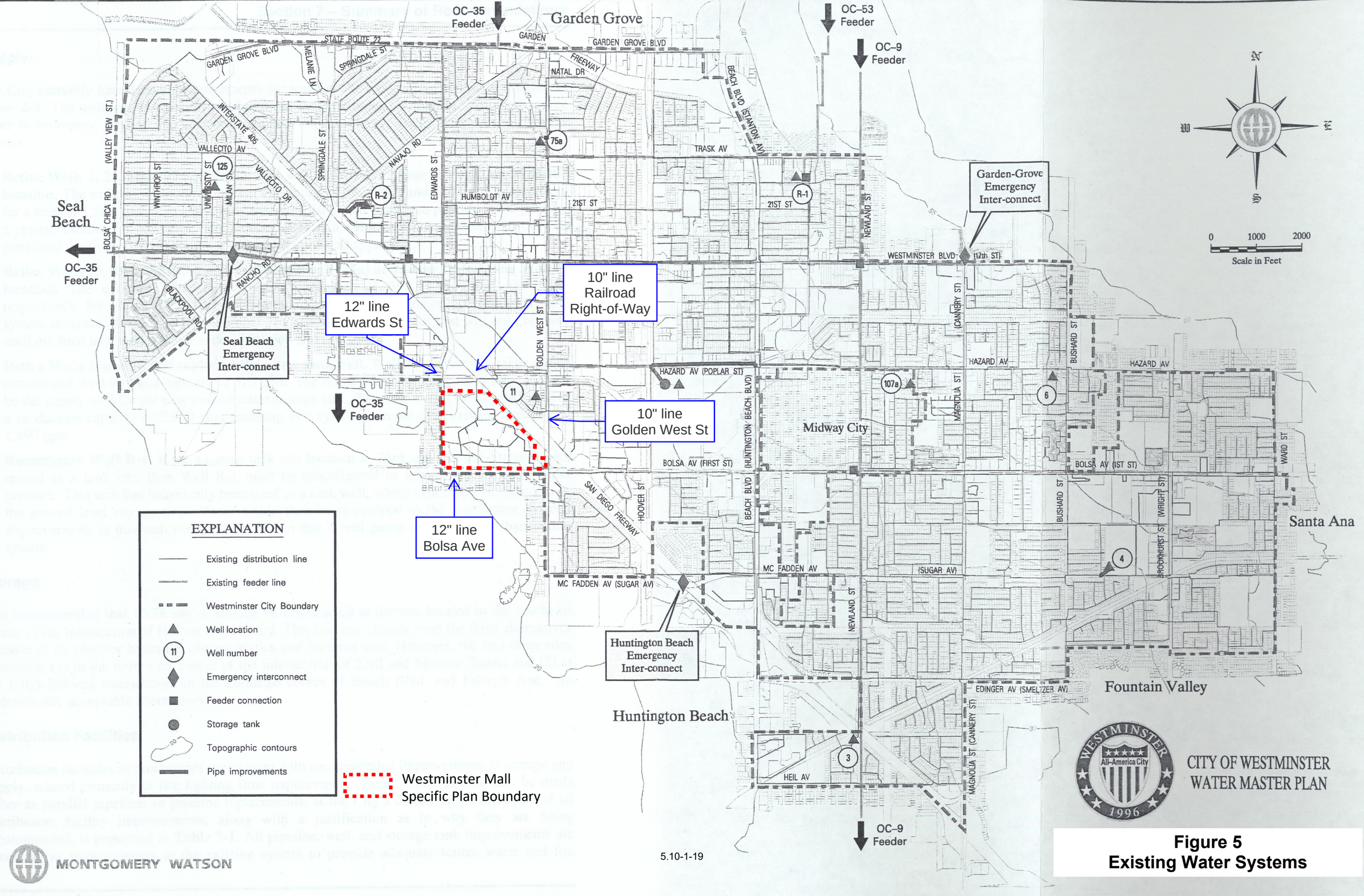


Figure 5
Existing Water Systems

2.3.2 Existing Water Demand

Similar to the sewer/wastewater analysis, acreages of development (i.e., commercial, retail, etc.) and number of dwelling units for existing and proposed conditions were utilized along with their corresponding demand factors to identify potential changes in water demand under implementation of the Specific Plan. Water demand factors were supplied from the 2019 City of Westminster Water Master Plan Update. Water usage for landscaping was estimated using the Estimated Total Water Use (ETWU) methodology. Table 3 provides a summary of the existing conditions water demand for each area subject to land use changes. Detailed calculations are provided in Appendix B.

Table 3 Existing Condition Average Water Demand

Specific Plan Area	*Acreage*	*Number of Dwelling Units*	*Non-Residential SF[1]*	*Landscaped Area[2]*	*Average Water Demand (GPD)*
Westminster Mall	103	0	1,360,000	319,614	70,150

Notes:
GPD gallons per day SF square feet
[1] *Non Residential includes commercial, retail, and restaurant land uses*
[2] *Existing landscaped area estimates based on aerial imagery.*
*Demands based on Estimated Annual Water Use equation: (Eto*plant factor*landscaped area* 0.62)/irrigation efficiency. Utilizing CIMIS Reference Evapotranspiration Zones Map ET of 49.7 in/yr; and conservative plant factor of 0.7 and irrigation efficiency of 0.81 for existing condition.*

Under the existing conditions, average daily demands are estimated at 0.07 MGD. Determination of the existing condition average daily water demands will allow for comparison against the proposed land use average daily water demands in Section 3.3.1.

2.3.3 Existing Water System Analysis

2019 Water Master Plan Update

The 2019 Water Master Plan Update (WMPU) serves as the guiding document that outlines the capacity and improvements required to the City's water distribution facilities to meet the needs of current and future development, through project build-out conditions. The analysis includes the development of a hydraulic model to determine the capacity of the existing water distribution system and analysis under a "built-out" demand scenario to determine any impacts to the system. The report also identifies capital improvements to the City's distribution and storage facilities based on results from the analysis. The results of hydraulic model determine areas in need of improvements under existing conditions.

The WMPU identified that no pressure improvements were required throughout the City, and that all distribution lines had adequate pressure. In addition, less than 0.01% of the total distribution system was found to achieve high pipeline velocity during peak hours, however no improvements were necessary to these high velocity segments. Finally, water mains were analyzed for providing adequate fire flows. Approximately 20,063 linear feet of main replacements were identified, to be reviewed and addressed on a case-by-case basis. None of these limited pipelines were located in the vicinity of the WMSP.

In addition to identifying improvement areas throughout the City's water system, the WMPU identified existing high demand water users and planned areas of demand increase per the City's General Plan buildout scenarios. Among existing individual water users, the Westminster Mall area was ranked second highest in the City. Proposed Westminster Mall area buildout demands anticipated an additional 0.40 MGD over existing subarea conditions.

2015 Urban Water Management Plan

The 2015 City of Westminster Urban Water Management Plan (UWMP) was released in June 2016 and was produced as a result of an ongoing 5-year comprehensive planning process that produces reports every 5 years. These plans estimate water supplies and demand for 25 years into the future. The 2015 UWMP evaluates the status of the existing water supply system, impacts of future growth conditions, and identifies opportunities to expand recycled water service areas. The 2015 UWMP concluded sufficient water supplies to meet water demands in an ultimate build out scenario through 2040 based on data produced by the Center for Demographic Research, California State University, Fullerton 2015.

2.4 WATER QUALITY

2.4.1 Regulatory Framework

Basin Plan for the Santa Ana Region

In addition to its permitting programs, the State Water Resources Control Board (SWRCB), through its nine Regional Water Quality Control Boards (RWQCBs), developed Regional Water Quality Control Plans (or Basin Plans) that designate beneficial uses and water quality objectives for California's surface waters and groundwater basins, as mandated by both the Clean Water Act (CWA) and the State's Porter-Cologne Water Quality Control Act. Water quality standards are thus established in these Basin Plans and provide the foundation for the regulatory programs implemented by the state. The Santa Ana RWQCB's Basin Plan, which covers the WMSP area, specifically (i) designates beneficial uses for surface waters and ground waters, (ii) sets narrative and numerical objectives that must be met in order to protect the beneficial uses and conform to the state's antidegradation policy, and (iii) describes implementation programs to protect all waters in the Region. In other words, the Santa Ana RWQCB Basin Plan provides all relevant information necessary to carry out federal mandates for the antidegradation policy, 303(d) listings of impaired waters, and related Total Maximum Daily Loads (TMDLs), and provides information relative to National Pollutant Discharge Elimination System (NPDES) and Waste Discharge Requirement (WDR) permit limits.

Total Maximum Daily Loads (TMDLs)

Under Section 303(d) of the Clean Water Act (CWA), states are required to identify water bodies that do not meet their water quality standards. Once a water body has been listed as impaired on the 303(d) list, a TMDL for the constituent of concern (pollutant) must be developed for that water body. A TMDL is an estimate of the daily load of pollutants that a water body may receive from point sources, non-point sources, and natural background conditions (including an appropriate margin of safety), without exceeding its water quality standard. Those facilities and activities that are discharging into a water body, collectively, must not exceed the TMDL. In general terms, Municipal Separate Storm Sewer Systems (MS4) and other dischargers within each watershed are collectively responsible for meeting the required reductions and other TMDL requirements by the assigned deadline.

The 303(d) listed impairments for the water bodies shown in Table 4 have not yet been established and are pending approval for TMDL establishments for 2019 to 2025.

Table 4 List of 303(d) Impairments and TMDLs

Water Body/Channel	List of 303(d) Impairments	TMDL
Westminster Channel	None	None
Bolsa Chica Channel	Ammonia, Indicator Bacteria, pH,	Estimated 2021 TMDL establishment for Ammonia, Indicator Bacteria, and pH.
Anaheim Bay	Nickel, PCBs, Toxicity	Estimated 2019 TMDL establishment for Nickel, PCBs, and Toxicity
Huntington Harbor	Chlordane, Copper, Indicator Bacteria, PCBs, Toxicity	Estimated 2019 TMDL establishment for Chlordane, Copper, Indicator Bacteria, and PCBs Estimated 2025 TMDL establishment for Toxicity

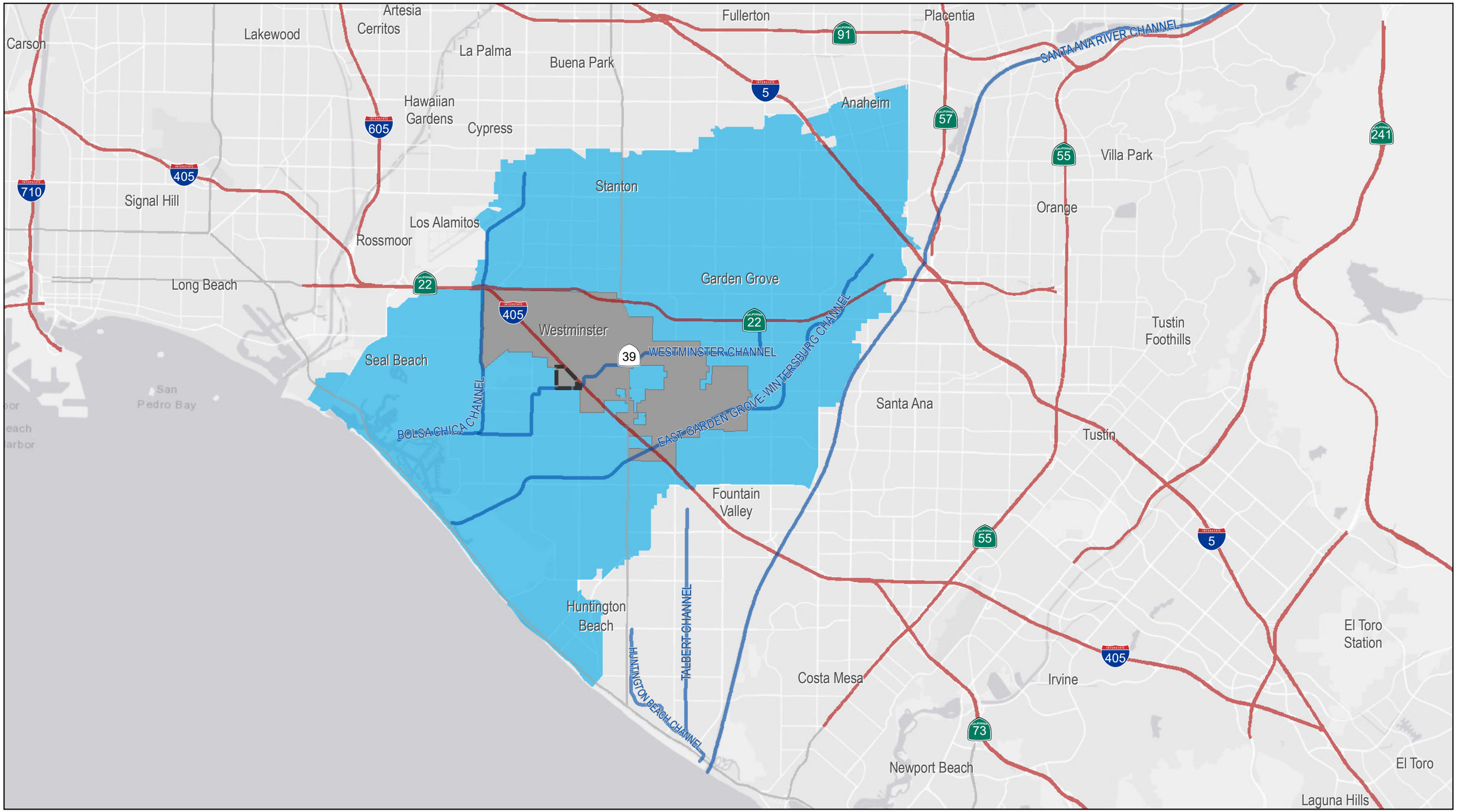
Source: 2014-16 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report) – Statewide. Found here: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014-16.shtml

County of Orange MS4 Permit, Drainage Area Management Plan (DAMP) & Local Implementation Plans (LIP)

In May 2009, the Santa Ana RWQCB re-issued the North Orange County MS4 Storm Water Permit as WDR Order R8-2009-0030 (NPDES Permit No. CAS618030) to the County of Orange, the incorporated cities of Orange County, and the Orange County Flood Control District within the Santa Ana Region. Pursuant to this "Fourth-Term" MS4 Permit, the Co-permittees were required to update and implement the Drainage Area Management Plan (DAMP) for its jurisdiction, as well as Local Implementation Plans (LIPs), which describe the Co-permittees' urban runoff management programs for their local jurisdictions.

Under the City's LIP, land development policies pertaining to hydromodification and low impact development (LID) are regulated for new developments and significant redevelopment projects. The term "hydromodification" refers to the changes in runoff characteristics from a watershed caused by changes in land use condition. More specifically, hydromodification refers to "the change in the natural watershed hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and sediment transport." The use of LID Best Management Practices (BMPs) in project planning and design is to preserve a site's predevelopment hydrologic condition by minimizing the loss of natural hydrologic processes such as infiltration, evapotranspiration, and runoff detention. LID BMPs try to offset these losses by introducing structural and non-structural design components that restore these water quality functions into the project's land plan. These land development requirements are detailed in the County-wide Model Water Quality Management Plan (WQMP) and Technical Guidance Document (TGD), approved in May 2011, which cities have incorporated into their discretionary approval processes for new development and redevelopment projects.

The LID hierarchy requires new developments and re-developments to implement BMPs under the LID hierarchy as described in the TGD. The LID hierarchy requires new projects to first infiltrate, then harvest and reuse, then biofilter stormwater runoff from their project site depending on site constraints. New projects and redevelopments within the City will follow the set hierarchy of BMP selection, and more runoff throughout the City will be effectively treated as development occurs.



Anaheim Bay-Huntington Harbor Watershed

Westminster Mall Specific Plan

Figure 6

2/14/2020

FUSCOE ENGINEERING

Specific Plan Boundary

City of Westminster

Anaheim Bay-Huntington Harbour Watershed

10,000 5,000 0 10,000 Feet

5.10-1-25

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General Construction Permit and Storm Water Pollution Prevention Plans (SWPPPs)

The Construction General Permit (CGP), Order No. 2012-0006-DWQ, NPDES Permit No. CAS000002, last updated by the SWRCB in July 2012, regulates storm water and non-storm water discharges associated with construction activities disturbing at least 1 acre of soil. Construction sites that qualify must submit a Notice of Intent (NOI) to gain permit coverage or otherwise be in violation of the CWA and California Water Code.

The CGP requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for each individual construction project greater than or equal to 1 acre of disturbed soil area (regardless of the site's Risk Level). The SWPPP must list Best Management Practices (BMPs) that the discharger will use to control sediment and other pollutants in storm water and non-storm water runoff; the BMPs must meet the Best Available Technology (BAT) and Best Conventional Pollutant Control Technology (BCT) performance standards. Additionally, the SWPPP must contain a visual monitoring inspection program; a chemical monitoring program for sediment and other "non-visible" pollutants to be implemented based on the Risk Level of the site, as well as inspection, reporting, training and record-keeping requirements. Section XVI of the CGP describes the elements that must be contained in a SWPPP.[6] Any proposed projects (new development or redevelopment) greater or equal to 1 acre within the WMSP area will be subject to the CGP and SWPPP requirements.

2.4.2 Existing Groundwater Conditions

Regional Groundwater Conditions

The Specific Plan area lies within the Orange County Groundwater Basin (OC Basin). The OC Basin is the source of approximately 60 to 70 percent of the water supply for 2.3 million people. OCWD is responsible for managing the OC Basin. To maintain groundwater quality, OCWD conducts an extensive monitoring program that serves to manage the OC Basin's groundwater production, control groundwater contamination, and comply with all required laws and regulations. A network of nearly 700 wells provides OCWD a source for samples, which are tested for a variety of purposes. OCWD collects 600 to 1,700 samples each month to monitor Basin water quality. These samples are collected and tested according to approved federal and state procedures as well as industry-recognized quality assurance and control protocols.

The OC Basin also has prescribed beneficial uses and water quality objectives as stated in the Santa Ana RWQCB Basin Plan that are described below.

Local Groundwater Conditions

The WMSP area is located on an area of shallow groundwater, approximately 5 to 10 feet below ground surface per the Orange County Technical Guidance document. Despite the presence of Type B soils and a lack of groundwater contamination within the immediate vicinity, infiltration for the project site is likely infeasible due to shallow groundwater. Site specific borings and percolation testing will be required as a part of project-level analysis as described in more detail in Section 3.4.2.

[6] California State Water Resources Control Board. (2008). Storm Water Program: Construction Program. Retrieved January 27, 2020, from http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml

3. PROPOSED BUILDOUT CONDITIONS

The purpose of the proposed conditions evaluation is to determine potential impacts related to the proposed land use zoning associated with the WMSP. The proposed Specific Plan consists of land use changes that will intensify and increase existing land uses within the WMSP area, including the development of multi-family homes and apartments, hotels, and commercial retail uses. Based on the proposed land use changes, runoff is anticipated to decrease overall while sewer and water demands are anticipated to increase. Additional details are provided below for hydrology, sewer, and water as well as water quality.

3.1 HYDROLOGY

The purpose of the proposed conditions evaluation is to evaluate impacts associated with the proposed land use changes at a Specific Plan level, characterize changes as compared to the existing runoff conditions and identify if additional storm drain facilities are anticipated to manage runoff flow quantities.

3.1.1 Proposed Drainage Conditions

Under existing conditions, the WMSP area is entirely developed, consisting of a large commercial center with smaller satellite buildings, parking lots, and minimal landscaping throughout. Under the proposed conditions, significant changes in land use will occur across the 103 acre Specific Plan Area. Table 5 provides a breakdown of the major land use changes in the WMSP area.

Table 5 Existing and Proposed Land Uses and Associated Runoff Coefficients

Area	*Acreage*	*Existing Imperviousness[1]*	*Proposed Land Use Change[2]*	*Proposed Imperviousness[1]*
Westminster Mall	103	90%	+3,000 MFR DUs -160,000 SF Commercial/ Retail	80%-85%

Notes:
[1]Based on Orange County Hydrology Manual impervious cover estimates for Multi Family Residences and Commercial Properties
[2]Source: Specific Plan Land Use Data Provided by Placeworks, 2020

As shown above, an increase of 3,000 DUs is proposed under the WMSP as well as a decrease of 160,000 SF of commercial/retail area. Existing impervious conditions throughout the WMSP area as shown in Table 5 are estimated to be 90%, based on the Orange County Hydrology Manual methodology. The Orange County Hydrology Manual estimates impervious cover for multi-family residences (apartments, etc.) as 65-80% and commercial/mixed use land use imperviousness as 90%[7]. Therefore, as 3,000 multi-family DUs are proposed within the WMSP, while a large portion of the existing commercial land use will remain. The proposed impervious percentage for the WMSP is estimated to be 80-85%. Therefore, it is anticipated that runoff

[7] Los Angeles County Department of Public Works. 2006. *Hydrology Manual*

from the WMSP area will ultimately decrease in the proposed condition as compared to the existing condition and that on-site detention for flood control will not be required. This will be confirmed with the City and OCFCD during the final design phases of the Specific Plan.

Existing on-site storm drain infrastructure is likely to be removed as part of project-specific buildout. New storm drains will be appropriately located and sized to convey flows respective to their tributary area for the design storm required by City and County requirements. Infrastructure will connect to either the 66" City of Westminster line on Edwards Avenue or the Westminster Channel and discharge to Anaheim Bay-Huntington Harbor as under existing conditions. Any noted deficiencies as a result of infrastructure improvements will be corrected on an as-needed basis.

3.2 SEWER & WASTEWATER INFRASTRUCTURE

3.2.1 Proposed Wastewater System Flows

Under the proposed condition, sewer flows will increase significantly due to the increase in multi-family residential and commercial-restaurant land uses. A total increase of 3,000 DUs, and approximately 1,200,000 sf of non-residential uses are proposed under the ultimate build out condition. Using the same commercial flow methodology as the existing conditions (Section 2.2.2), proposed sewer demand flows are provided in Table 6. Residential sewer flows were calculated using residential water demand factors multiplied by a 0.95 sewer flow factor. See Appendix A for additional details.

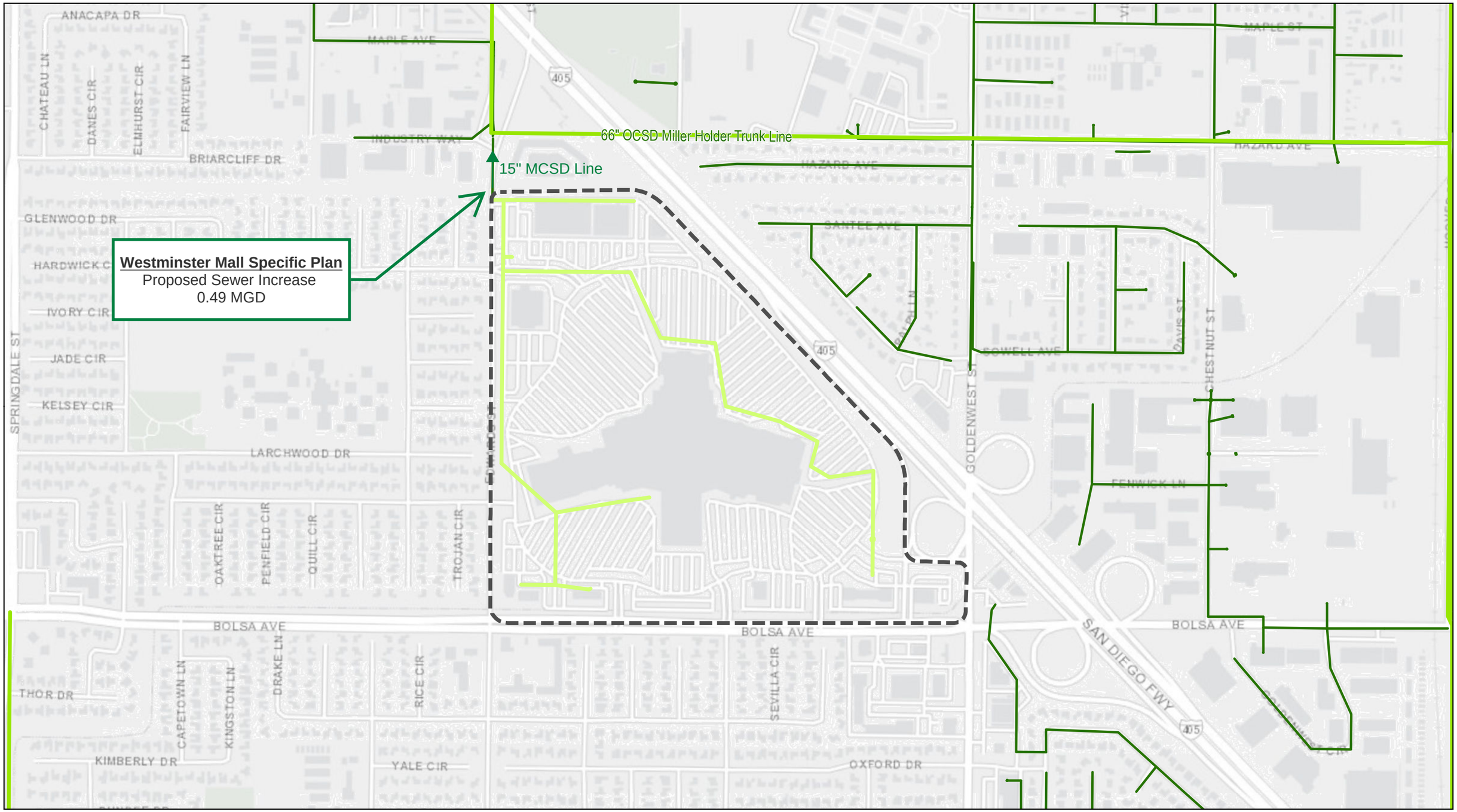
Table 6 Proposed Condition Average Daily Sewer Flows

Area	*Number of Dwelling Units*	*Non-Residential SF[1]*	*Proposed Average Daily Flow (GPD)*	*Existing Average Daily Flow (GPD)*	*Change in Sewer Flows (GPD)*	*% Increase*
Westminster Mall	3,000	1,200,000	556,026	70,623	485,403	687

1. Non-Residential includes commercial, retail and mixed land uses

Notes:
GPD gallons per day SF square feet

Full implementation of the land use changes has the potential to increase sewer flows by 0.49 MGD within the Specific Plan area. Figure 7 highlights areas that will experience increased sewer flows from land use changes. The increased sewer flows will connect through an existing 15" MCSD line before connecting to the OCSD Miller-Holder trunk line north of the Specific Plan boundary. The Miller-Holder trunk line drains to OCSD Regional Treatment Plant No.2. The proposed increases in sewer flows could also impact OCSD sewer trunk lines downstream of the Specific Plan Boundary.



Proposed Sewer Demands

Westminster Mall Specific Plan

Figure 7

2/14/2020

Specific Plan Boundary — MCSD Sewer Lines — OCSD — Private Sewer Lines (6"-15")

500 250 0 500 Feet

FUSCOE ENGINEERING

full circle thinking

5.10-1-30

X:\Projects\511\33\MXD\7_WestminsterMall_PropSewer_200214.mxd

3.2.2 Proposed Sewer/Wastewater System

As mentioned in Section 2.2.3, there are no MCSD segments identified as having capacity issues within or adjacent to the Specific Plan area, per the MCSD Sewer System Master Plan (April 2015). In addition, the MCSD Sewer System Master Plan found that the system for the entire service area has a capacity of 18 MGD and existing operating flows of 5 MGD. The proposed increase of 0.49 MGD will not exceed the available regional capacity of MCSD's system.

Under proposed WMSP buildout, all on-site sewer infrastructure is anticipated to be demolished with new infrastructure sized for the proposed land uses. Proposed sewer infrastructure will continue to tie into the existing 15" MCSD line. While the 15" line is currently in good condition with no capacity issues noted, a project-specific sewer study will be required to model impacts from the proposed project buildout to determine if any new deficiencies will occur. In the case of noted deficiencies or potential deficiencies, MCSD has processes in place to work with developers of the WMSP to upsize the deficient segments.[8] .

MCSD utilizes development fees for new connections and proposed flow increases to improve existing low capacity sewer lines and upsize existing lines. While development fees come through MCSD, the MCSD works with OCSD to finalize fees for new sewer connections[9]. Any future development in the Specific Plan area will be required to pay additional fees associated with the increase in wastewater flows.

Correspondence with OCSD staff concluded that the proposed increases in sewer flows from the WMSP would cause no regional sewer capacity issues.[10] Although OCSD has no deficient lines serving the Specific Plan area, it utilizes development fees to cover associated costs with providing any incremental expansions in service or infrastructure as a result of new development that increases the quantity or flow rate of wastewater discharge[11]. Potential impacts to OCSD facilities and associated OCSD review requirements and connection fees will need to be analyzed on a project by project basis.

[8] On-site Meeting with MCSD Staff, 2/5/2020
[9] Ibid.
[10] Email correspondence with OCSD staff; 2/20/2020.
[11] OCSD. Sewer Fees. Available at: https://www.ocsd.com/residents/sewer-fees

3.3 WATER INFRASTRUCTURE

3.3.1 Proposed Water Demand

Under the proposed condition, water demands will increase significantly due to the increase in multi-family residential, commercial, and mixed land uses. A total increase of 3,000 DUs, and a total of approximately 1,200,000 sf of non-residential uses are proposed under the ultimate build out condition, plus an estimated increase of 10 acres of landscaping. Table 7 shows the changes in water demands based on the proposed land use changes within the WMSP area, using the same commercial methodology as for the existing conditions. Residential per capita demand factors were supplied from the 2019 Water Master Plan Update, while residents per DU were supplied by Placeworks as part of the Specific Plan buildout estimates. Detailed calculations and associated exhibits are included in Appendix B.

Table 7 Proposed Condition Average Daily Water Demand

Area	*Number of Dwelling Units*	*Non-Residential SF[1]*	*Proposed Landscaping[2]*	*Proposed Water Demand (GPD)*	*Existing Water Demand (GPD)*	*Change in Demand (GPD)*	*% Increase*
Westminster Mall	3,000	1,200,000	755,214	588,827	70,150	518,677	739

Notes:
GPD gallons per day SF square feet
[1] *Non Residential includes commercial, retail, and mixed land uses*
[2]*Estimated landscaping based on existing landscaped estimates plus an additional 10 acres of landscaped areas under proposed conditions.*
*Demands based on Estimated Annual Water Use equation: (Eto*plant factor*landscaped area* 0.62)/irrigation efficiency. Utilizing CIMIS Reference Evapotranspiration Zones Map ET of 49.7 in/yr; and conservative plant factor of 0.7; and irrigation efficiency of 0.81 for proposed condition.*

Full implementation of the land use changes has the potential to increase water demand by 0.52 MGD (581 acre-feet per year (AFY)) within the Specific Plan area. Like increases in sewer flows, water demands will primarily come from the additional 3,000 dwelling units and 142,000 sf of proposed restaurant space.

The anticipated increases in water demands are greater than the estimated increases of 0.4 MGD for the WMSP area reported in the 2019 WMPU. This difference can be attributed to the additional dwelling units proposed under the WMSP as compared to what was anticipated during the City's general planning efforts. In addition, conservative demand factors were utilized for this water demand analysis.

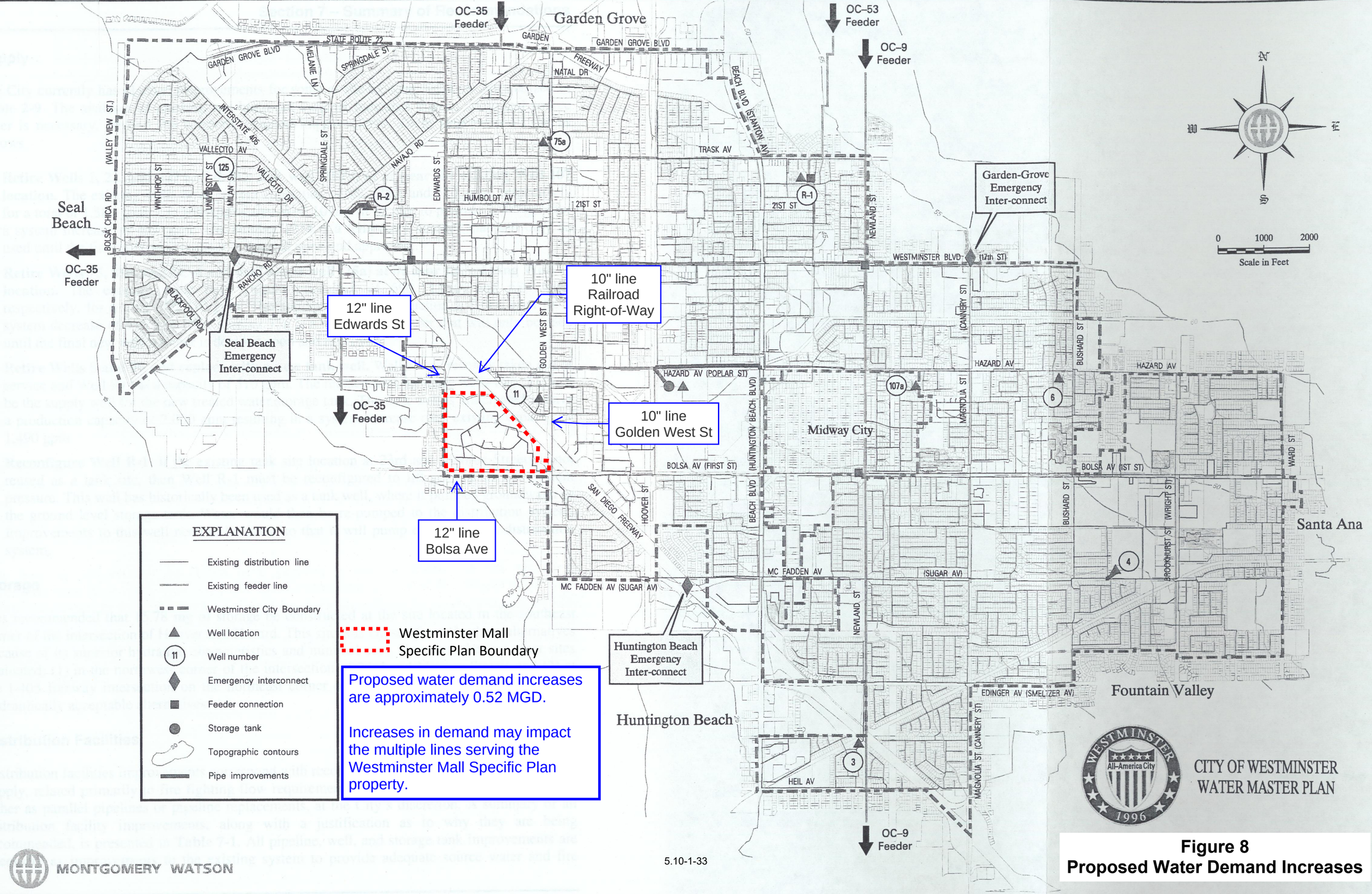


Figure 8
Proposed Water Demand Increases

MONTGOMERY WATSON

3.3.2 Proposed Water System

The WMSP is not located in an area with any deficient segments or improvement projects, per the 2019 WMPU. However, per electronic correspondence with City staff dated January 22, 2020, all existing waterlines within the WMSP area will most likely require relocation and upsizing, based on demand scenarios. In addition, the existing 10" and 12" water lines located within the railroad right-of-way to north of the WMSP area will require relocation/upsizing. '

Once the proposed land use is finalized for the Specific Plan, the City will run their hydraulic model to determine any deficiencies within City water lines serving the property. In the case where there are deficiencies identified, the developer will be required to upgrade the City infrastructure to serve the Specific Plan land uses. The City will work closely with the developer to design and approve of any upgrades.

3.4 WATER QUALITY

Throughout construction, buildout, and operation of the WMSP, BMPs will be employed in order to protect local water resources and limit impacts from stormwater pollution. During construction, BMPs will aim to reduce sediment mobilization and prevent sediment from entering the storm drain system. Post-construction BMPs will be designed to reduce pollutants from on-going, longer term operations based on site-specific analysis. Sections 3.4.1 and 3.4.2 below describe the proposed water quality measures in more detail.

3.4.1 Construction Activities

Clearing, grading, excavation and construction activities associated with the proposed project may impact water quality due to sheet flow erosion of exposed soils and subsequent deposition of particulates in local drainage conveyance facilities. Grading activities, in particular, lead to exposed areas of loose soil, as well as sediment stockpiles, that are susceptible to uncontrolled sheet flow. Although erosion occurs naturally in the environment, primarily from weathering by water and wind action, improperly managed construction activities can lead to substantially accelerated rates of erosion that are considered detrimental to the environment.

Construction General Permit

Prior to the issuance of grading permits, the project applicants shall provide evidence that the development of the projects one acre or greater of soil disturbance shall comply with the most current Construction General Permit (CGP) and associated local National Pollutant Discharge Elimination System (NPDES) regulations to ensure that the potential for soil erosion is minimized on a project by project basis.

Construction Best Management Practices (BMPs)

The CGP requires that a construction SWPPP must be prepared and implemented at all construction projects with 1 acre or greater of soil disturbance, and revised as necessary as administrative or physical conditions change. The SWPPP must be made available for review upon request, and shall describe construction BMPs that address pollutant source reduction, and provide measures/controls necessary to mitigate potential pollutant sources. These include, but are not limited to: erosion controls, sediment controls, tracking controls, non-storm water management, materials & waste management, and good housekeeping practices[12].

Prior to commencement of construction activities within the Specific Plan area, the project-specific SWPPP(s) will be prepared in accordance with the site-specific sediment risk analyses based on the grading plans, with erosion and sediment controls proposed for each phase of construction for the individual project. The phases of construction will define the maximum amount of soil disturbed, the appropriate sized sediment basins and other control measures to accommodate all active soil disturbance areas and the appropriate monitoring and sampling plans.

[12] California Stormwater Quality Association. (2003, January). *Stormwater Best Management Practices Handbook for New Development and Redevelopment*. Retrieved January 27, 2018, from http://www.cabmphandbooks.com

3.4.2 Post-Construction Activities

With the proposed land use changes, development resulting from the WMSP may result in long-term impacts to the quality of storm water and urban runoff, subsequently impacting downstream water quality. Developments similar to the proposed project can potentially create new sources for runoff contamination through changing land uses. As a consequence, the Specific Plan may have the potential to increase the post-construction pollutant loadings of certain constituent pollutants associated with the proposed land uses and their associated features, such as landscaping, roadways and residential uses.

To help prevent long-term impacts associated with land use changes and in accordance with the requirements of the City of Westminster LIP and consistency with OC DAMP and Fourth-Term MS4 permit, new development and significant redevelopment projects must incorporate LID/site design and source control BMPs to address post-construction storm water runoff management. In addition, projects that are identified as Priority Projects are required to implement site design/LID and source control BMPs applicable to their specific priority project categories, as well as implement treatment control BMPs where necessary. Selection of LID and additional treatment control BMPs is based on the pollutants of concern for the specific project site and the BMP's ability to effectively treat those pollutants, in consideration of site conditions and constraints. Further, both Priority projects must develop a project-specific Water Quality Management Plan (WQMP) that describes the menu of BMPs chosen for the project, as well as include operation and maintenance requirements for all structural and any treatment control BMPs.

Since the Specific Plan area does not include a specific or detailed development plan, and the Specific Plan will likely consist of multiple phases of development, a project-specific WQMP will not be developed for the Specific Plan at this time. Future project-specific WQMPs, preliminary and/or final, will be prepared consistent with the prevailing terms and conditions of the City's LIP, OC DAMP, and Model WQMP at the time of project application. Moreover, LID and water quality treatment solutions prescribed in project specific WQMPs shall be designed to support or enhance the regional BMPs and efforts implemented by the City as part of their City-wide efforts to improve water quality.

Unlike flood control measures that are designed to handle peak storm flows, LID BMPs and treatment control BMPs are designed to retain, filter or treat more frequent, low-flow runoff or the "first-flush" runoff from storm events. In accordance with the Fourth-Term MS4 Permit for North Orange County, the LID BMPs shall be sized and designed to ensure on-site retention of the volume of runoff produced from a 24-hour 85th percentile storm event, as determined from the County of Orange's 85th Percentile Precipitation Map.[13] This is termed the "design capture volume", or DCV. The 2011 Model WQMP and its companion Technical Guidance Document provides design criteria, hydrologic methods and calculations for combining use of infiltration, retention, and biofiltration BMPs to meet the required design capture volume.

In accordance with the MS4 Permit and Technical Guidance Document, the use of LID features will be consistent with the prescribed hierarchy of treatment provided in the Permit: infiltration, evapotranspiration, harvest/reuse and biotreatment. As the WMSP project site is located in an

[13] Figure XVI-1 in the Technical Guidance Document (County of Orange, May 19, 2011).

area of shallow groundwater, infiltration will likely be infeasible. However, site-specific studies will be conducted during final design to confirm feasibility. If infiltration is confirmed infeasible, harvest and reuse of stormwater will undergo a feasibility analysis as part of project-level planning. If both infiltration and harvest and reuse are found to be infeasible, biofiltration will be used to treat on-site runoff.

4. CONCLUSION

The proposed land use changes under the Westminster Mall Specific Plan will increase the demand of potable water and sewer flows over existing conditions while largely maintaining existing runoff conditions. No deficiencies under existing conditions were noted for sewer, water, and storm drain infrastructure. The City of Westminster, MCSD, OCSD, and OCFCD each have methods in place for prioritizing, funding, and correcting deficient infrastructure. In all cases, project specific analyses will be required during final design to evaluate individual storm drain, water and sewer facilities related to the individual projects.

Based on the existing built out condition and the proposed land use changes under the WMSP including the implementation of low impact development features, no substantial additional sources of pollutants or significant increases in runoff for the 85th percentile storm event are anticipated. Based on the findings of this technical study, the incorporation of site design/LID features, and infiltration/biotreatment BMPs as required under the MS4 Permit and local LID requirements, the individual projects will adequately reduce project related impacts to hydrology and water quality to a level less than significant.

5. TECHNICAL APPENDICES

Appendix A Sewer Demand Calculations

Appendix B Water Demand Calculations

APPENDIX A

SEWER DEMAND CALCULATIONS

Westminster Mall Specific Plan Existing Condition Sewer Flows

	Building(s)		Parcel	Demand	Unit of Measure	Total Demand
	Units	Square Feet	Acres	GPD		GPD
WMSP						
Residential						
Single Family Home	-	--	--	206	/Unit	0
3-Story Rowtown	-	--	--	185.26	/DU	0
4-6 Story Wrap/Mini Podium	-	--	--	164.02	/DU	0
8-10 Story Podium	-	--	--	142.78	/DU	0
Residential Total	**-**	--	**0.00**	--	--	**0**
Commercial						
Commercial	--	-	0.00	2262	/acre	0
Hotel & Motels	--	-	0.00	100	/room	0
Office Buildings	-	-	0.00	2262	/acre	0
Parking Lots (Commercial Use Properties)	-	-	0.00	2262	/acre	0
Professional Buildings	-	-	0.00	2262	/acre	0
Restaurant	-	68,000	1.56	2262	/acre	3,531
Retail	-	1,292,000	29.66	2262	/acre	67,091
Wholesale & Manufacturing Outlets	--	-	0.00	2262	/acre	0
Commercial Total	**-**	**1,360,000**	**31.22**	--	--	**70,623**
Government						
Government Parcel	--	--	0.00	176.3	/1000 sf	0
Government Total	--	--	**0.00**	--	--	**0**
Institutional						
Churches	--	-	0.00	210	/1000 sf	0
Schools (Private)	--	-	0.00	180.4	/1000 sf	0
Institutional Total	**-**	**-**	**0.00**	--	--	**0**
Total	**-**	**1,360,000**	**31.22**	--	--	**70,623**

* Commercial sewer flow factors based on the OCSD Design Construction Requirements for Sanitary Sewers

Westminster Mall Specific Plan Proposed Condition Sewer Flows

	Building(s)		Parcel	Demand	Unit of Measure	Total Flow
	Units	Square Feet	Acres	GPD		GPD
	WMSP					
Residential						
Single Family Home	-	--	--	206	/Unit	0
3-Story Rowtown	300	--	--	175.997	/DU	52,799
4-6 Story Wrap/Mini Podium	1,200	--	--	155.819	/DU	186,983
8-10 Story Podium	1,500	--	--	135.641	/DU	203,462
Residential Total	**3,000**	--	**--**	**--**	**--**	**443,243**
Commercial						
Retail	--	600,000	13.77	2262	/acre	31,157
Entertainment Retail	-	210,000	4.82	2262	/acre	10,905
Hotel	425	-	0.00	118.75	/room	50,469
Restaurant	-	210,000	4.82	2262	/acre	10,905
Office	-	180,000	4.13	2262	/acre	9,347
Professional Buildings	-		0.00	2262	/acre	0
Store Combination	-		0.00	2262	/acre	0
Stores	-		0.00	2262	/acre	0
Wholesale & Manufacturing Outlets	--		0.00	2262	/acre	0
Commercial Total		**1,200,000**	27.55	--	--	**112,783**
Total	**3,000**	**1,200,000**	**27.55**	**--**	**--**	**556,026**

*Residential and hotel sewer flows based on water demand factors multiplied by a 0.95 sewer flow factor

** Commercial sewer flow factors based on the OCSD Design Construction Requirements for Sanitary Sewers

APPENDIX B

WATER DEMAND CALCULATIONS

Westminster Mall Specific Plan Existing Condition Water Demands

	Building(s)		Parcel	Demand	Unit of Measure	Total Demand
	Units	Square Feet	Acres	GPD		GPD
WMSP						
Residential						
Single Family Home	-	--	--	206	/Unit	0
3-Story Rowtown	-	--	--	185.26	/DU	0
4-6 Story Wrap/Mini Podium	-	--	--	164.02	/DU	0
8-10 Story Podium	-	--	--	142.78	/DU	0
Residential Total	**-**	--	**0.00**	--	--	**0**
Commercial						
Commercial	--	-	0.00	1500	/acre	0
Hotel & Motels	--	-	0.00	125	/room	0
Office Buildings	-	-	0.00	1500	/acre	0
Parking Lots (Commercial Use Properties)	-	-	0.00	1500	/acre	0
Professional Buildings	-	-	0.00	1500	/acre	0
Restaurant	-	68,000	1.56	1500	/acre	2,342
Retail	-	1,292,000	29.66	1500	/acre	44,490
Wholesale & Manufacturing Outlets	--	-	0.00	1500	/acre	0
Commercial Total	**-**	**1,360,000**	**31.22**	--	--	**46,832**
Landscaping						
Landscaped Area	-	319,614	7.34		ETWU Method	23,318
Total	**-**	**1,679,614**	**38.56**	--	--	**70,150**

* Commercial water demands based on 2019 City of Westminster Water Master Plan Update

Westminster Mall Specific Plan Proposed Condition Water Demands

	Building(s)		Parcel	Demand	Unit of Measure	Total Flow
	Units	Square Feet	Acres	GPD		GPD
WMSP						
Residential						
Single Family Home	-	--	--	206	/Unit	0
3-Story Rowtown	300	--	--	185.26	/DU	55,578
4-6 Story Wrap/Mini Podium	1,200	--	--	164.02	/DU	196,824
8-10 Story Podium	1,500	--	--	142.78	/DU	214,170
Residential Total	**3,000**	--	**--**	**--**	**--**	**466,572**
Commercial						
Retail	--	600,000	13.77	1500	/acre	20,661
Entertainment Retail	-	210,000	4.82	1500	/acre	7,231
Hotel	425	-	0.00	125	/room	53,125
Restaurant	-	210,000	4.82	1500	/acre	7,231
Office	-	180,000	4.13	1500	/acre	6,198
Professional Buildings	-		0.00	1500	/acre	0
Store Combination	-		0.00	1500	/acre	0
Stores	-		0.00	1500	/acre	0
Wholesale & Manufacturing Outlets	--		0.00	1500	/acre	0
Commercial Total		**1,200,000**	27.55	--	--	**94,447**
Landscaping						
Landscaped Area	-	381,147	8.75		ETWU Method	27,807
Total	**-**	**1,581,147**	**36.30**	**--**	**--**	**588,827**

*Residential water demand calculated based on an assumption of 59 GPCD, based on the 2019 Water Master Plan Update

**Per Westminster Mall Specific Plan, resident per unit assumtions are as follows: 3-Story Rowtown - 3.14, 4-6 Story Wrap - 2.78, 8-10 Story Podium - 2.42

*** Commercial water demands based on 2019 City of Westminster Water Master Plan Update

Appendix 6-2

Westminster Mall Sewer Analysis

AKM Consulting Engineers
553 Wald
Irvine, CA 92618
Telephone: 949.753.7333
Facsimile: 949.753.7320
www.akmce.com

Water Resources
Infrastructure
Construction Management

August 7, 2023

Midway City Sanitary District
14451 Cedarwood Avenue
Westminster, CA 92683

Attention: Mr. Robert Housley
General Manager

Subject: Sewer Analysis for Westminster Mall Redevelopment

Dear Mr. Housley:

AKM Consulting Engineers is pleased to submit this hydraulic analysis for the proposed development in the existing Westminster Mall area.

1.0 Background and Understanding

The existing Westminster Mall area is planned for redevelopment. The proposed land uses are established in the Westminster Mall Specific Plan, dated April 10, 2020. The area will be developed in phases depending on various proposals from developers. Currently, there are three developments proposed by True Life Companies and Shopoff. The Tentative Tracts Map areas proposed for development are shown on Figure 1 and include TTM 19268, TTM 19269, and TTM 19277.

The onsite sewer infrastructure will change as areas are redeveloped but ultimately the sewage will continue to tie into the existing Midway City Sanitary District's (MCSD) sewer system at Manhole 1084 located in Edwards Street, south of Industry Way. The sewage will then be conveyed by the existing 15" sewer in Edwards Street, north to Industry Way, where it ties into the existing 66" Orange County Sanitation District (OCSD) Miller Holder Trunk sewer.

MCSD would like to verify if the existing sewer has the capacity to convey the proposed development flows.

2.0 Existing Water Use

The City of Westminster provided water use data for April 2022 through March 2023. Sixteen water meters were identified as providing indoor water to the businesses located in the mall area which are tributary to the existing 15" sewer in Edwards Street, south of Industry Way. The existing average water use for the businesses in the mall area is calculated to be about 119,422 gpd (0.119422 mgd).

Figure 1
Proposed Westminster Mall Development Areas as

The three businesses that will be replaced by the Proposed True Life Companies and Shopoff development are Sears Department Store (currently closed), Macy's Department Store, and Dave's Appliance Warehouse. The total average water use calculated for these three businesses is 50,519 gpd (0.050519 mgd)

3.0 Existing Sewage Flows

MCSD contracted with ADS Environmental Services to install a flow meter downstream of the existing Westminster Mall to determine the existing sewage flow. The flow meter was installed at Manhole 1084 located in Edwards Street, south of Industry Way. This location is immediately upstream of the existing 15" sewer that is being evaluated in this study. A summary of the flow monitoring data is shown in Table 1.

The average flow generated by the businesses in the Westminster Mall area is 0.113 mgd. Based on flow monitoring and water use data, the sewage to water ratio for the existing Westminster Mall businesses is 0.95 (0.113 mgd/ 0.119422 mgd), which is a typical value for commercial land use types.

The sewage estimated to be generated by Sears Department Store (currently closed), Macy's Department Store, and Dave's Appliance Warehouse is therefore 0.047993 mgd (0.95 x 0.050519 mgd). The remaining businesses therefore generate a total average sewage flow of 0.065097 mgd (0.113 – 0.047993).

Table 1
Sewer Flow Monitoring Data

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	6.22	0.43	0.113
Minimum	5.32	0.30	0.068
Maximum	8.06	0.60	0.180
Min Time	06/02/2023 2:15:00 AM	06/04/2023 9:50:00 AM	06/02/2023 2:00:00 AM
Max Time	06/03/2023 9:10:00 PM	06/03/2023 7:45:00 PM	06/08/2023 7:20:00 PM

Flow data was collected from June 2, 2023 through June 8, 2023. ADS reported that the site functioned under "poor hydraulic conditions" during the study period. The accuracy of the flow monitoring data is lower than typical due to the slow flow and sediment present in the pipes.

ADS crews reported that there was 1.5" to 2" of sediment found in the pipe. This is likely due to the low flow and slow velocities but it may also be the reason the depth of flow was measured as high as 8.06" which is over 50 percent full. By calculation the pipe should only be about 25 percent full at the peak flow of 0.180 mgd.

4.0 Sewer System Criteria

MCSD is currently updating its Sewer System Master Plan. Flow monitoring was conducted at 26 locations throughout the system. The data will be utilized to establish a peaking formula that can be used to evaluate the capacity of the system.

The peaking formula commonly used in sewerage studies is of the following form:

$PDWF = a \times ADWF^{b}$ where PDWF = Peak Dry Weather Flow [mgd]

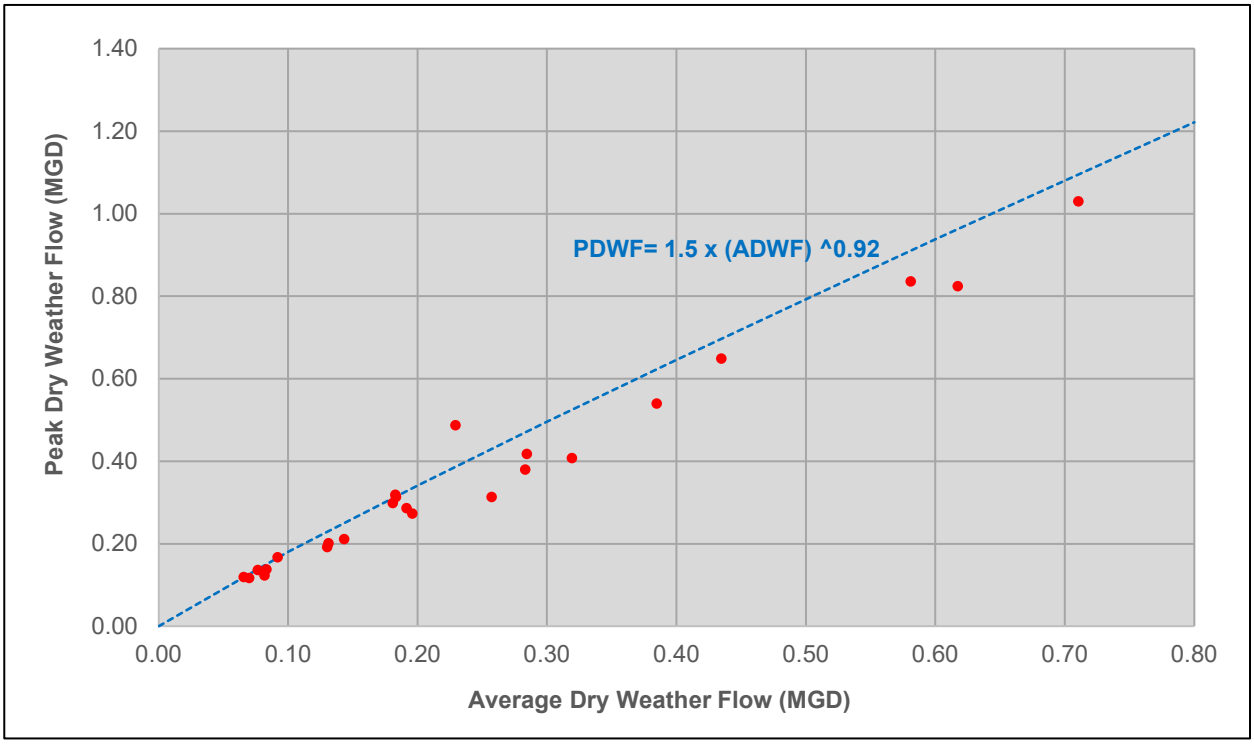
ADWF = Average Dry Weather Flow [mgd]

a, b = Peaking Formula Coefficients

The coefficient "b" factor accounts for smaller tributary areas with smaller ADWF, which generally experience greater PDWF. The change in usage of one customer in a very small tributary area will have a greater effect on its corresponding PDWF than a change in usage of one customer in a very large tributary area. Note that the units of the selected peaking formula are in million gallons per day (mgd).

In order to develop the peaking formula and establish coefficient "a" and "b", the maximum versus average flow measured from the flow monitoring effort was plotted for each flow monitoring site as shown in Figure 2. Although the average coefficient "a" was calculated to be 1.36, a more conservative factor of 1.5 was selected for planning purposes and for capacity analysis. The peaking formula used for this study is therefore as follows: $PDWF = 1.5 \times ADWF^{0.92}$

Figure 2
Peak Dry Weather Flow versus Average Dry Weather Flow



MCSD's design criteria requires the depth to diameter (d/D) ratio to be equal to or less than 0.50 for 8" to 18" diameter pipes. Although not explicitly stated in the sewer master plan, it is assumed that this d/D criteria applies to PDWF and the remainder of the pipe capacity is reserved for wet weather flows.

5.0 Proposed Sewage Estimation

Proposed Sewage Flow for TTM 19268, 19269, & 19277 Only

The calculation of the sewage flow expected to be generated by the TTM 19268, 19269, and 19277 developments is shown in Table 2. The total average sewage generation or average dry weather flow (ADWF) is calculated to be 0.231 mgd.

Proposed Sewage Flow for Entire Development

The calculation of the sewage flow expected to be generated by the entire proposed development is shown in Table 3. The restaurant unit flow factor was increased to 1,000 gallons per day (gpd) per thousand square foot (tsf) of building space, as it is a more typical factor used for planning purposes. The original factor of 2262 gpd/acre equated to about 52 gpd/tsf and was considered extremely low for restaurant uses..

The total average sewage generation or average dry weather flow (ADWF) for the entire development is calculated to be 0.755 mgd.

6.0 Hydraulic Analysis

The 15" sewer in Edwards Street has a slope of 0.0010 per Plan S0000292. A 15" pipe with a slope of 0.0010 has a full capacity of 1.320 mgd. At the design criteria (d/D = 0.50), the capacity of the existing 15" pipe is 0.660 mgd. Therefore, when the generated peak dry weather flow exceeds 0.660 mgd, the existing pipe will need to be upsized. The provided capacity assumes that the pipe is cleaned regularly and kept clear of debris and sediment.

A peak flow of 0.660 mgd would be generated by an average flow of about 0.409 mgd (using the aforementioned peaking formula of PDWF = 1.5 x ADWF $^{0.92}$).

Hydraulic Analysis for TTM 19268, 19269, & 19277 Only

The average future sewage flow to be generated by TTM 19268, 19269, & 19277 is estimated at 0.231180 mgd as shown in Table 2.

The hydraulic calculations are as follows:

TTM 19268, 19269, & 19277 proposed sewage flow = 0.231180 mgd

Remaining businesses average sewage flow = 0.065097 mgd

Total average sewage flow with True Life and Shopoff Developments = 0.231180 + 0.065097 = 0.296277 mgd

Total peak sewage flow = 1.5 x $0.296277^{0.92}$ = 0.489839 mgd

Peak d/D in 15" pipe with slope of 0.0010 = 0.42

The peak d/D is less MCSD's criteria of peak d/D = 0.50.

Table 2

TTM 19268, 19269, & 19277 Proposed Land Uses and Sewage Generation

TTM	Current Use	Proposed Land Use Designation	Acres	Proposed DU	Proposed Square Footage	Proposed Hotel Rooms	Proposed Employ-ment	Proposed Population	Sewage Factor		Proposed Average Sewage Generation (gpd)	Total Proposed Average Sewage Generation (gpd)	Total Proposed Average Sewage Generation (mgd)
19268	Sears	Townhomes	4.52	102				320	56	gpd/person[1]	17,936	82,839	0.082839
19268		5 Story Wrap	4.02	350				976	56	gpd/person[1]	54,644		
19268		Retail			5,000		10		52	gpd/tsf[1]	260		
19268		Restaurant (Food Hall)			10,000		29		1,000	gpd/tsf[2]	10,000		
19269	Macy's	5 Story Wrap	8.30	715				1,988	56	gpd/person[1]	111,311	132,690	0.132690
19269		Retail			11,500		23		52	gpd/tsf[1]	598		
19269		Hotel			111,500	175			118.75	gpd/room[3]	20,781		
19277	Dave's Warehouse	Townhomes	3.62	89				279	56	gpd/person[1]	15,650	15,650	0.015650
		Total	**20.46**	**1,256**	**138,000**	**175**	**62**	**3,563**			**231,180**	**231,180**	**0.231180**

[1] *Sewage Factor calculated using Westminster Mall Specific Plan data shown in Table 1*

[2] *Sewage Factor from Los Angeles County Sanitation District Table 1, Loadings for Each Land Use; considered a* typical planning factor or restaurants

[3] *Sewer Factor from Westminster Mall Specific Plan*

Table 3

Westminster Mall Specific Plan - Proposed Land Uses and Sewage Generation

Land Use Designation	Acres	Proposed DU	Proposed Square Footage	Proposed Hotel Rooms	Proposed Employment	Proposed Population	Sewage Factor		Proposed Average Sewage Generation (gpd)	Proposed Average Sewage Generation (mgd)
Residential Uses										
3-Story Rowtown	64.43	300				942	175.997	gpd/du	52,799	0.052799
4-6 Story Wrap/Mini Podium		1,200				3,336	155.819	gpd/du	186,983	0.186983
8-10 Story Podium		1,500				4,095	135.641	gpd/du	203,462	0.203462
Commercial Uses										
Retail	13.77		600,000		1,200		2,262	gpd/ac	31,157	0.031157
Entertainment Retail	4.82		210,000		420		2,262	gpd/ac	10,905	0.010905
Restaurant	4.82		210,000		600		1,000	gpd/tsf[1]	210,000	0.210000
Office	4.13		180,000		600		2,262	gpd/ac	9,347	0.009347
Hotel				425			118.75	gpd/room	50,469	0.050469
Total	**91.97**	**3,000**	**1,200,000**	**425**	**2,820**	**8,373**			**755,122**	**0.755122**

[1] *Sewage Factor from Los Angeles County Sanitation District Table 1, Loadings for Each Land Use; considered a typical planning factor or restaurants*

Hydraulic Analysis for Entire Development

The future sewage flow to be generated by the entire development is estimated at 0.755122 mgd as shown in Table 3.

The hydraulic calculations are as follows:

Estimated future average sewage flow = 0.755122 mgd

Peak sewage flow = $1.5 \times 0.755122^{0.92} = 1.158423$ mgd

Peak d/D in 15" pipe with slope of 0.0010 = 0.73

The peak d/D is greater than MCSD's criteria of peak d/D = 0.50.

Utilizing the same slope of 0.0010 as the existing pipe, it is calculated that a 24" pipe would be able to convey about 2.31 mgd with a d/D of 0.50. The estimated future flow would result in a peak d/D of about 0.34 in the 24" pipe.

7.0 Conclusion and Recommendations

Based on the hydraulic analysis, the existing 15" MCSD sewer downstream of the proposed development for TTM 19268, 19269, and 19277 has sufficient capacity to convey the peak dry weather flows from these three developments to the connection with OCSD's trunk sewer. The existing sewer is calculated to flow at a peak d/D of 0.42 during dry weather conditions.

This conclusion is based on the assumption that the pipe is cleaned regularly and kept clear of debris and sediment. It is recommended that MCSD add the existing 15" pipe in Edwards Street, south of Industry Way to its monthly cleaning locations to ensure that the pipe stays clear of sediment and flows as designed.

There is not enough capacity in the existing 15" sewer to convey all the expected sewage flow when the Westminster Mall area is fully developed per the Westminster Mall Specific Plan, dated April 2020. It is recommended that the existing sewer be replaced with a minimum 24" diameter pipe prior to the full development of the area. If the proposed land uses should change, the replacement pipe size should be reanalyzed.

It should also be noted that the unit flow factors used in this study were primarily taken from the Westminster Mall Specific Plan dated April 2020. MCSD is currently working on its Sewer Master Plan. Once completed, the recommended replacement pipe size should be reanalyzed using the MCSD established unit flow factors.

Sincerely,

AKM Consulting Engineers

Diann Pay

Diann Pay, P.E.

Principal