Appendix F: Sewer Capacity Analysis

November 5, 2018
Job No.: 2725-050

M E M O R A N D U M

TO: Allie Hood, Principal Engineer
City of Santa Clara – Public Works – Engineering

FROM: Colt Alvernaz, PE

CC: Cory Kusich, SCS Development

SUBJECT: Catalina II – Sewer Flow Capacity Study

Purpose

Carlson, Barbee, & Gibson, Inc. (CBG) was asked by the City of Santa Clara to prepare a sanitary sewer pipe capacity analysis to determine the effects of additional flow added to the existing sanitary sewer system by the proposed Catalina II development (Project). This Memo references the results and analysis of "*City of Santa Clara El Camino Civic Center Flow Monitoring Capacity Study"* prepared by V&A for Prometheus Real Estate Group, Inc. dated September 2016. (Report) and the Catalina Sewer Flow Capacity Study, prepared by Carlson, Barbee & Gibson, Inc. dated August, 2017 (Study).

This Memo presents the revised results of the Report prepared by V&A based on the new Catalina II development, including the Catalina development under construction location at 1375 El Camino Real.

Existing and Proposed Conditions

The proposed Project is located at 1434, 1453, 1463, 1483 & 1493 El Camino Real. The site currently consists of an auto repair shop, a car wash and associated parking, and open undeveloped landscape area.

Improvements to the 1.70 AC site includes 39 multifamily condominium units, open space areas, stormwater treatment facilities, private drive aisles with access from Civic Center Drive. 7 of the 39 units have a live work component in the first floor living space with pedestrian access to the live work units from El Camino Real and the proposed development.

The sanitary sewer will have two tie-in locations in Civic Center Drive.

An exhibit showing the surrounding area, proposed development and sanitary sewer pipe has been included as an attachment to this Memo.

Results:

Table 1 updates Table 3-3 from the Report with the proposed 39 condominium units and 7 live work unit data. Using the same Unit Flow Factor as provided in the Report (Appendix B) the revised Peak Flow for the Project is provided in Table 1 below:

Table 1: Revised Table 3-3. Flow Generation from Proposed Development

Type of Development	Unit Flow Factor	Number of Units	Flow Generation (gpm)
Townhouses/Condominiums	175 gpd/DU	39	4.74
Live-Work Units	4,600 gpd/acre	0.065	0.21
		Total	4.95
		Peaking Factor	2.5
		Peak Flow	12.4

Based on the new development site and sewer tie in locations in Civic Center Drive, 100% of the flow will be distributed to Site 1-MH 73. Table 2 presents the revised Q_D, design flow (gpm) based on the updated proposed development peak flow data. Design flow data from the Catalina Development has also been included in this table.

Table 2: Revised Table 3-4. Design Flow Results Summary

Item	Site 1-MH 73
Q_M, Monitored Peak Flow (gpm)	30.2
Q_{WWGWI}, Wet Weather Groundwater Infiltration (gpm)	6.3
Q_{RDI}/I, Rainfall Dependent Infiltration and Inflow (gpm)	9
Q_{PD}, Catalina I Development Peak Flow (gpm)	16.7
Q_{PD}, Proposed Development Peak Flow (gpm)	12.4
Q_D, Design Flow (gpm)	74.6

Per Table 3, it can be concluded that the existing sewer pipeline has the available capacity to support the proposed Catalina II Development.

Table 3: Revised Table 3-5. Pipeline Capacity Results Summary

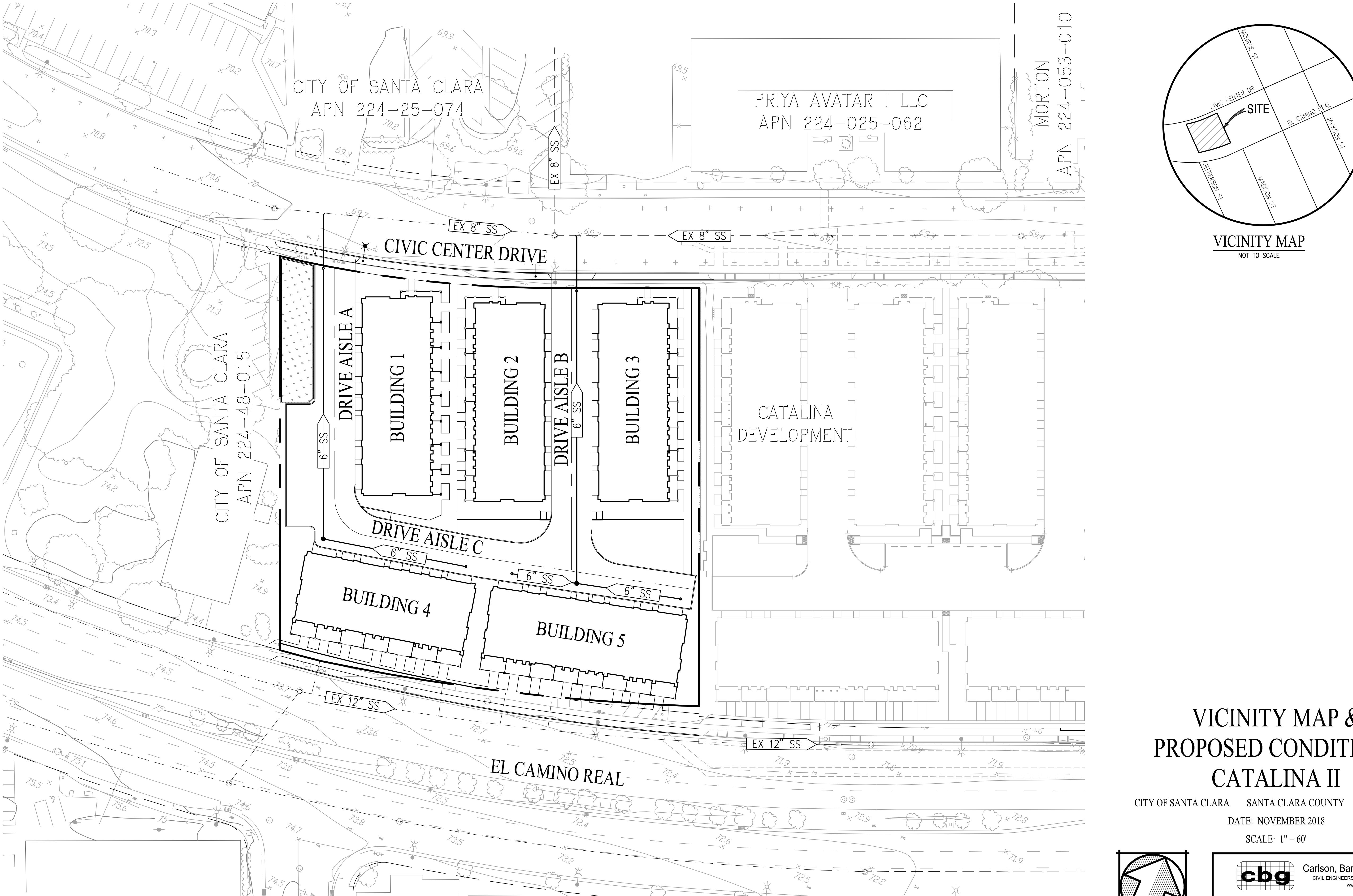
Item	Site 1-MH 73
Estimated 100% Capacity of Pipeline (gpm)	240
City Allowable Peak Flow at 0.75 d/D (gpm)	219
QD, Design Flow (gpm)	74.6
Available Capacity (gpm)	110
Has Capacity?	Yes

Conclusion

In conclusion, based on the results produced in the report prepared by V&A, the Catalina 1 study prepared by Carlson, Barbee & Gibson, Inc., and the new data for the Catalina II project provided in this Memo; the existing sanitary sewer system in Civic Center Drive has sufficient capacity to support the additional flow from the proposed Catalina II development.

Attachments:

1. Vicinity Map and Proposed Conditions Exhibit
2. *"City of Santa Clara El Camino Civic Center Flow Monitoring Capacity Study",* by V&A dated September 2016
3. *"City of Santa Clara El Camino Civic Center Flow Monitoring Capacity Study",* by Carlson, Barbee & Gibson, Inc. dated August 2017



VICINITY MAP & PROPOSED CONDITIONS CATALINA II

CITY OF SANTA CLARA SANTA CLARA COUNTY CALIFORNIA

DATE: NOVEMBER 2018

SCALE: 1" = 60'

cbg Carlson, Barbee & Gibson, Inc.
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City of Santa Clara
El Camino Civic Center
Flow Monitoring Capacity Study

Prepared for: Prometheus Real Estate Group, Inc.
1900 S. Norfolk St., Suite 150
San Mateo, CA 94403

Date: September 2016

Prepared by: V&A

V&A Project No. 16-0134

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APPENDICES

1.0 INTRODUCTION

V&A Consulting Engineers (V&A) was retained by Prometheus Real Estate Group (Prometheus) to perform sanitary sewer flow monitoring and sewer capacity study within the City of Santa Clara, California (City). This study identified the average and peak flows and determined the available capacity of the subject pipelines.

The flow monitoring was performed at two manholes for two weeks from July 29, 2016 to August 12, 2016. The flow monitoring locations are described in Table 1-1 and shown in Figure 1-1. Figure 1-2 illustrates the location of the proposed new development at 1375 El Camino Real and its proximity to the flow monitoring sites.

Table 1-1. Flow Monitoring Locations

Site ID	Manhole ID	Location	Pipe Diameter	Inlet
1	MH 73	Warburton Avenue and Monroe Street	8”	South
2	MH 75	Warburton Avenue and Main Street	8”	South

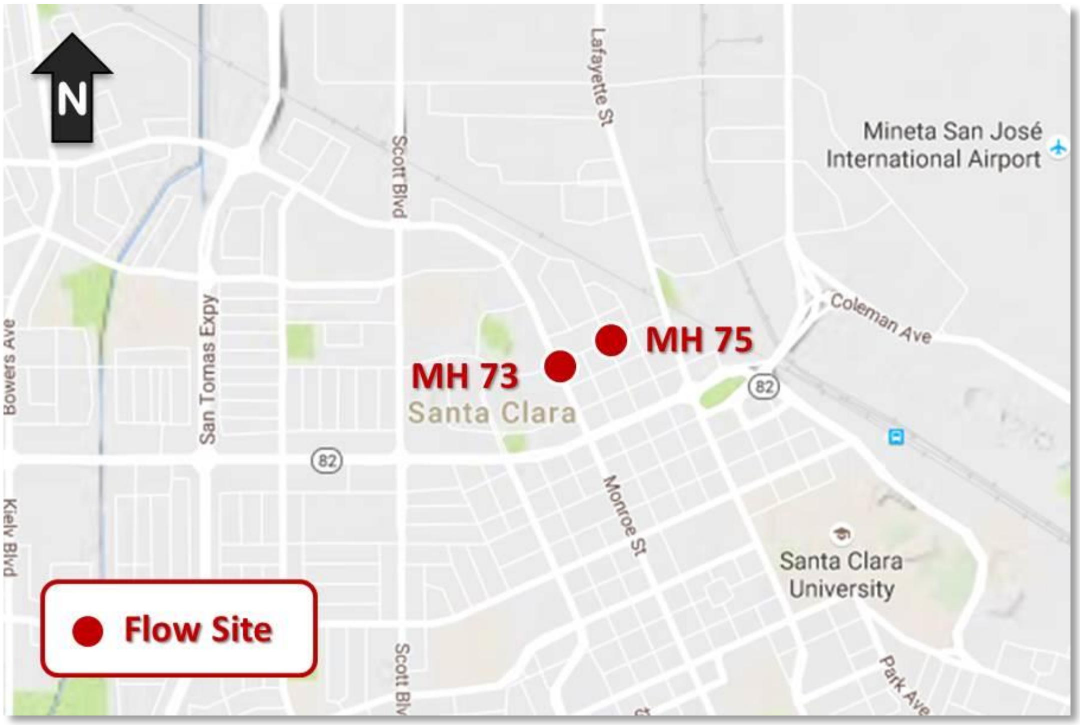


Figure 1-1. Flow Monitoring Locations Overview

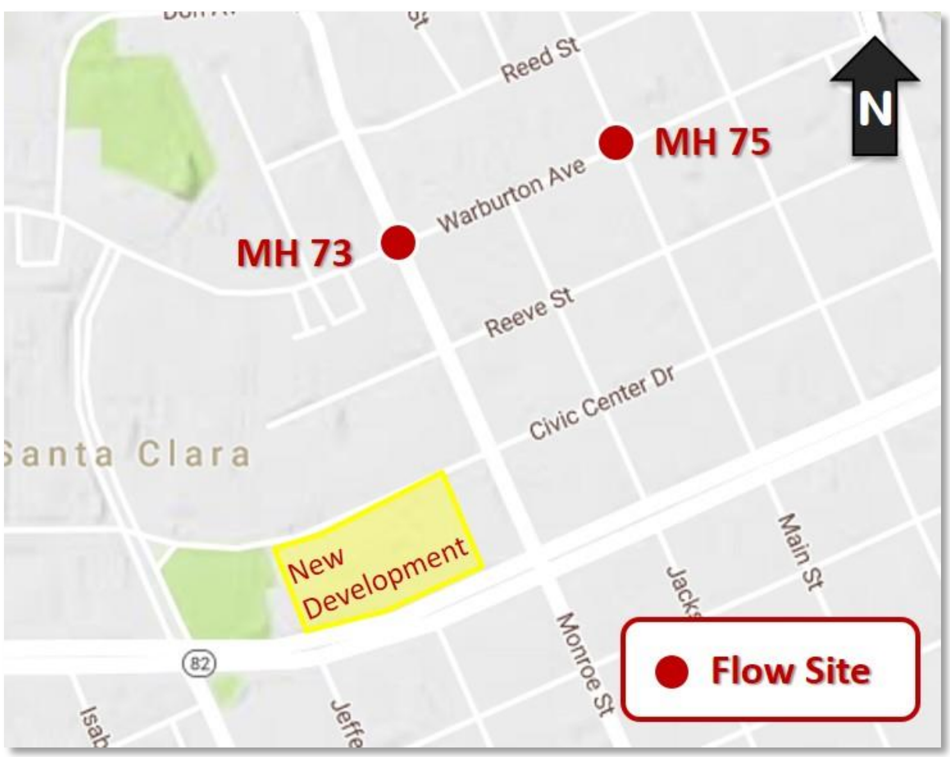


Figure 1-2. Location of New Development at 1375 El Camino Real

2.0 Methods and Procedures

2.1 Confined Space Entry

A confined space (Photo 2-1) is defined as any space that is large enough and so configured that a person can bodily enter and perform assigned work, has limited or restricted means for entry or exit and is not designed for continuous employee occupancy. In general, the atmosphere must be constantly monitored for sufficient levels of oxygen (19.5% to 23.5%), and the absence of hydrogen sulfide (H_2S) gas, carbon monoxide (CO) gas, and lower explosive limit (LEL) levels. A typical confined space entry crew has members with OSHA-defined responsibilities of Entrant, Attendant and Supervisor. The Entrant is the individual performing the work. He or she is equipped with the necessary personal protective equipment needed to perform the job safely, including a personal four-gas monitor (Photo 2-2). If it is not possible to maintain line-of-sight with the Entrant, then more Entrants are required until line-of-sight can be maintained. The Attendant is responsible for maintaining contact with the Entrants to monitor the atmosphere using another four-gas monitor and maintaining records of all Entrants, if there is more than one. The Supervisor is responsible for developing the safe work plan for the job at hand prior to entering.

Photo 2-1. Confined Space Entry

Photo 2-2. Typical Personal Four-Gas Monitor

2.2 Flow Meter Installation

Two Teledyne Isco 2150 meters were installed by V&A in the sewer lines. Isco 2150 meters use submerged sensors with a pressure transducer to collect depth readings and an ultrasonic Doppler sensor to determine the average fluid velocity. The ultrasonic sensor emits high-frequency sound waves, which are reflected by air bubbles and suspended particles in the flow. The sensor receives the reflected signal and determines the Doppler frequency shift, which indicates the estimated average flow velocity. The sensor is typically mounted at a manhole inlet to take advantage of smoother upstream flow conditions. The sensor may be offset to one side to lessen the chances of fouling and sedimentation where these problems are expected to occur. Manual level and velocity measurements were taken during installation of the flow meters and again when they were removed and were compared to simultaneous level and velocity readings from the flow meters to ensure proper calibration and accuracy. The pipe diameter was also verified in order to accurately calculate the flow cross-section. The continuous depth and velocity readings were recorded by the flow meters on 5-minute intervals. Figure 2-1 shows a typical installation for a flow meter with a submerged sensor.

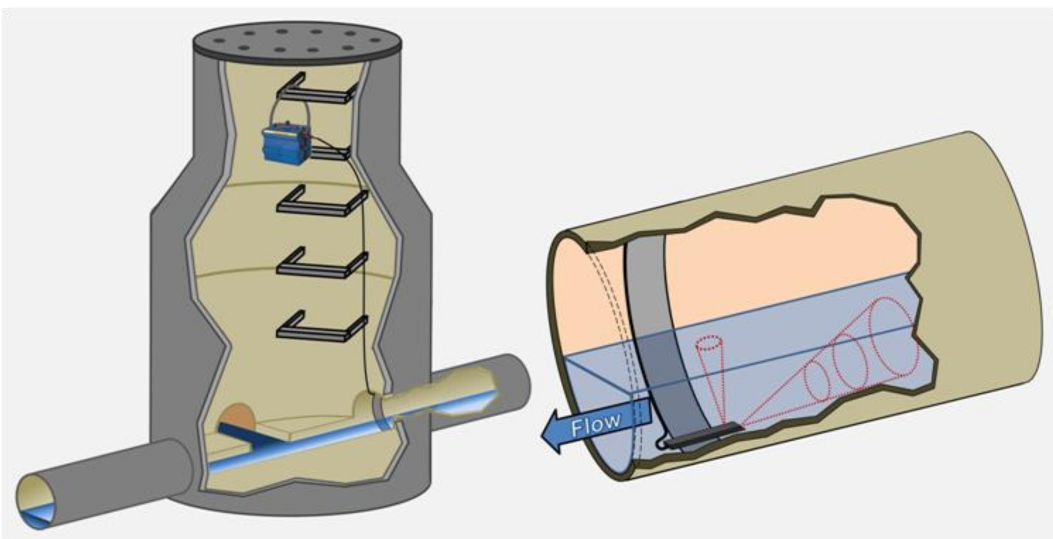


Figure 2-1. Typical Installation for Flow Meter with Submerged Sensor

2.3 Flow Calculation

Data retrieved from the flow meters were placed into a spreadsheet program for analysis. Data analysis includes data comparison to field calibration measurements, as well as necessary geometric adjustments as required for sediment (sediment reduces the pipe's wetted cross-sectional area available to carry flow). Area-velocity flow metering uses the continuity equation,

$$Q = v \cdot A = v \cdot (A_T - A_S)$$

where Q : volume flow rate

v: average velocity as determined by the ultrasonic sensor

A: cross-sectional area available to carry flow

A_T: total cross-sectional area with both wastewater and sediment

A_S: cross-sectional area of sediment.

For circular pipe,

$$A_T = \left[\frac{D^2}{4}\cos^{-1}\left(1-\frac{2d_W}{D}\right)\right]-\left[\left(\frac{D}{2}-d_W\right)\left(\frac{D}{2}\right)\sin\left(\cos^{-1}\left(1-\frac{2d_W}{D}\right)\right)\right]$$

$$A_S = \left[\frac{D^2}{4}\cos^{-1}\left(1-\frac{2d_S}{D}\right)\right]-\left[\left(\frac{D}{2}-d_S\right)\left(\frac{D}{2}\right)\sin\left(\cos^{-1}\left(1-\frac{2d_S}{D}\right)\right)\right]$$

where d_W: distance between wastewater surface level and pipe invert

d_S: depth of sediment

D: pipe diameter

Weekday and weekend flow patterns differ and are separated when determining average dry weather flows (ADWF). The Overall ADWF was determined from:

$$ADWF = \left(ADWF_{Mon-Fri} \times \frac{5}{7}\right) + \left(ADWF_{Sat-Sun} \times \frac{2}{7}\right)$$

3.0 RESULTS AND ANALYSIS

3.1 Design Flow Determination

The flow monitoring design flow determination as defined by the City Standard is as follows:

$$Q_D = Q_M + Q_{WWGWI} + Q_{RD\ I/I} + Q_{PD}$$

Where:

Q_D = Design Flow
Q_M = Monitored Flow
Q_{WWGWI} = Wet Weather Groundwater Infiltration
$Q_{RD\ I/I}$ = Rainfall-Dependent Infiltration and Inflow
Q_{PD} = Proposed Development Peak Flow

3.2 Flow Monitoring Results

Table 3-1 lists the ADWF, peak measured flow and other calculated factors used to determine the pipeline capacity. Detailed graphs of the flow monitoring data are included in *Appendix A*.

Table 3-1. Flow Monitoring Summary

	Site 1	Site 2
Location	MH 73	MH 75
Diameter (in.)	8	8
Weekday ADWF (gpm)	9.26	20.72
Weekend ADWF (gpm)	9.16	20.99
Overall ADWF (gpm)	9.23	20.80
Peak Flow (gpm)	30.22	51.72
Peak Level (in)	1.99	1.96
d/D Ratio	0.25	0.25

The following information should be noted:

- There was no rainfall during the flow monitoring period. The impact of inflow and infiltration was not evaluated as this is a dry weather study. Under wet weather flow conditions, the available capacity may be less due to inflow and infiltration.

3.3 Pipeline Capacity Analysis

The pipeline capacity was estimated by using the Manning equation:

$$Q = \frac{669 \times R^{2/3} \times S^{1/2} \times A}{n}$$

where

A: Cross-sectional area of flow (ft^2)
R: hydraulic radius (ft), calculated from flow level *d* and pipe diameter *D*
S: Pipeline slope (ft/ft)
n: Roughness coefficient (unitless)
Q: Flow rate (ft^3/s)

The following factors were selected to determine the pipeline capacity.

- **Roughness coefficients:** 0.013 for VCP pipe as a widely accepted number for sanitary sewer design.
- **Pipeline Slopes:** Because the pipeline slopes were not available at the time of this study, the pipeline capacity was estimated based on the measured data from the flow monitoring sites. The metered flow data was plotted over the Manning formula flow curve and was extrapolated to a full-flow scenario. The stage curves shown in Figure 3-1 and Figure 3-2 were used to estimate the maximum capacity of the pipes. The estimated maximum capacity values for the two pipelines are 240 gpm for Site 1 and 525 gpm for Site 2.

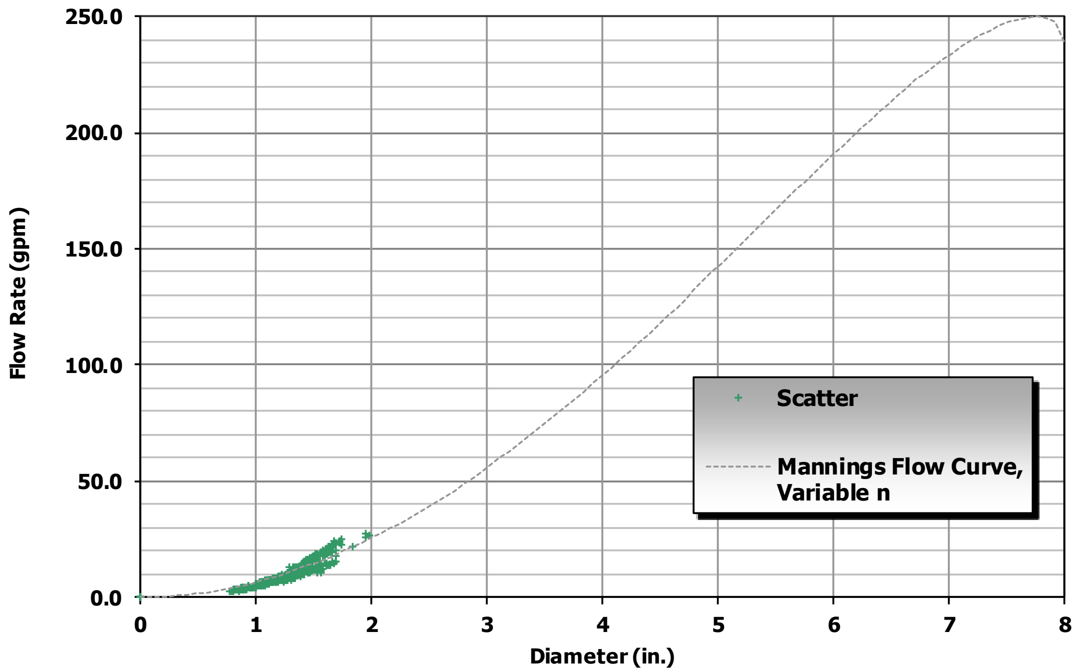


Figure 3-1. Site 1 Stage Curve

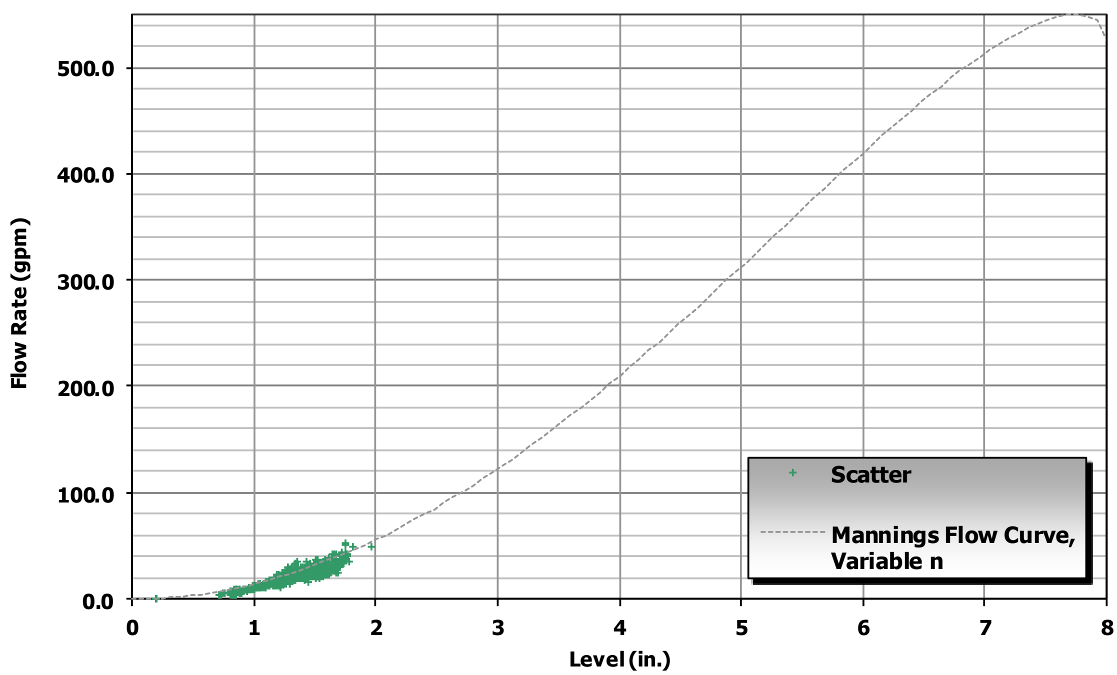


Figure 3-2. Site 2 Stage Curve

Table 3-2 summarizes the capacity analysis.

Table 3-2. Pipeline Capacity Summary

	Site 1	Site 2
Capacity		
Manhole ID	MH 73	MH 75
Pipe Diameter (inch)	8	8
Full-Pipe Capacity (gpm)	240	525
Flow Measurement		
Overall ADWF (gpm)	9.23	20.80
Measured Peak Flow (gpm)	30.22	51.72

Per the City's Standards for the flow monitoring design flow determination, the monitored flow (Q_M) is the greater of the following:

$Q_{M\ Site\ 1}$ = Monitored Peak Flow = 30.22 gpm

OR

$Q_{M\ Site\ 1}$ = 2.5 X Monitored Average Flow = 2.5 x 9.23 gpm = 23.1 gpm

THEREFORE,

$Q_{M\ Site\ 1}$ **= 30.2 gpm**

$Q_{M\ Site\ 2}$ = Monitored Peak Flow = 51.72 gpm

OR

$Q_{M\ Site\ 2}$ = 2.5 X Monitored Average Flow = 2.5 x 20.80 gpm = 52.0 gpm

THEREFORE,

$Q_{M\ Site\ 2}$ **= 52.0 gpm**

3.4 Derived Flow Results

3.4.1 Proposed Development Flows

The proposed development is a mix of residential apartments, retail space and mixed used live/work spaces. The peak development flow is calculated in Table 3-3. The Base Wastewater Unit Flow Factors established by the City can be found in Appendix B.

Table 3-3. Flow Generation from Proposed Development

Type of Development	Unit Flow Factor	Number of Units	Flow Generation (gpm)
Apartments – 1 Bedroom	154 gpd/DU	158	16.9
Apartments – 2 Bedroom	175 gpd/DU	109	13.2
Retail	0.1 gpd/ft²	6690	0.46
Live-Work Units	4600 gpd/acre	0.35	1.12
		Total	31.7
		Peaking Factor	2.5
		Peak Flow	79.3

The connection points for this development can flow through either of the two manholes monitored for this study. Per request of Prometheus, for the purposes of calculating the impact on capacity, the flows will be distributed 80% to Site 1 (MH 73) and 60% to Site 2 (MH 75).

$Q_{PD\ Site\ 1}$ = 79.3 gpm x 0.8 = 63.5 gpm

$Q_{PD\ Site\ 1}$ = 63.5 gpm

$Q_{PD\ Site\ 2}$ = 79.6 gpm x 0.6 = 47.6 gpm

$Q_{PD\ Site\ 2}$ = 47.6 gpm

3.4.2 Wet Weather Groundwater Infiltration (Q_{WWGWI})

The wet weather groundwater infiltration (Q_{WWGWI}) is derived from multiplying the wet weather groundwater infiltration (factor) by the tributary area served by the sanitary sewer main being monitored. The tributary areas upstream of monitored Site 1 and Site 2 are shown in Figure 3-3. The project site is located within the tributary area M_15 (Appendix B). The factor for this area is 700 gpd/acre established by the City Standard as shown in Appendix B.

$Q_{WWGWI\ Site\ 1}$ = WWGWI x Tributary Area
= 700 gpd/acre x 13 acres = 9100 gpd or 6.32 gpm

$Q_{WWGWI\ Site\ 1}$ = 6.3 gpm

$Q_{WWGWI\ Site\ 2}$ = WWGWI x Tributary Area
= 700 gpd/acre x 13.6 acres = 9520 gpd or 6.61 gpm

$Q_{WWGWI\ Site\ 2}$ = 6.6 gpm

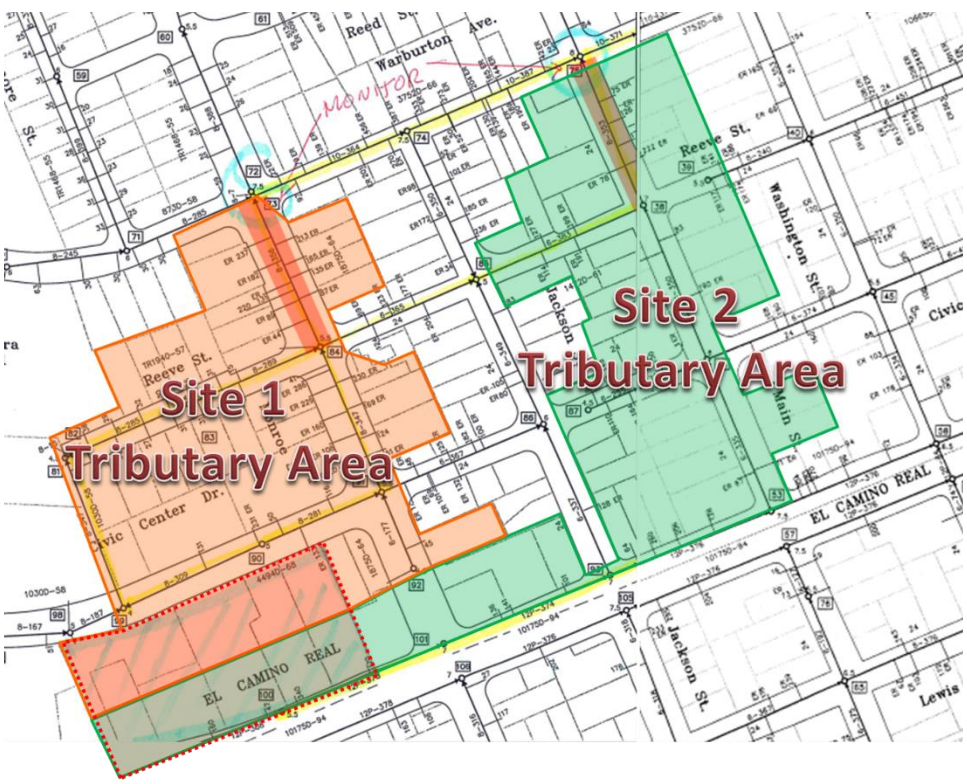


Figure 3-3. Approximate Tributary Area of Monitored Sites

3.4.3 Rainfall-Dependent Infiltration and Inflow ($Q_{RDI/I}$)

The rainfall-dependent infiltration and inflow ($Q_{RDI/I}$) is derived the same way as the wet weather groundwater infiltration. Per City Standards, 1,000 gpd/acre is used for $Q_{RDI/I}$ flow determination.

$Q_{RDI/I\ Site\ 1}$ = RDI/I x Tributary Area
= 1,000 gpd/acre x 13 acres = 13,000 gpd or 9.0 gpm

$Q_{RDI/I\ Site\ 1}$ = 9.0 gpm

$Q_{RDI/I\ Site\ 2}$ = RDI/I x Tributary Area
= 1,000 gpd/acre x 13.6 acres = 13,600 gpd or 9.4 gpm

$Q_{RDI/I\ Site\ 2}$ = 9.4 gpm

3.4.4 Design Flow (Q_D)

Table 3-4 shows the summary of the design flow results including both monitored flow results and derived flow results.

Table 3-4. Design Flow Results Summary

Item	Site 1 – MH 73	Site 2 – MH 75
Q_M, Monitored Peak Flow (gpm)	30.2	52.0
Q_{WWGWI}, Wet Weather Groundwater Infiltration (gpm)	6.3	6.6
$Q_{RDI/I}$, Rainfall Dependent Infiltration and Inflow (gpm)	9.0	9.4
Q_{PD}, Proposed Development Peak Flow (gpm)	63.5	47.6
Q_D, Design Flow (gpm)	109.0	115.6

$Q_{D\ Site\ 1}$= 109.0 gpm

$Q_{D\ Site\ 2}$= 115.6 gpm

3.4.5 Estimated Pipeline Capacity

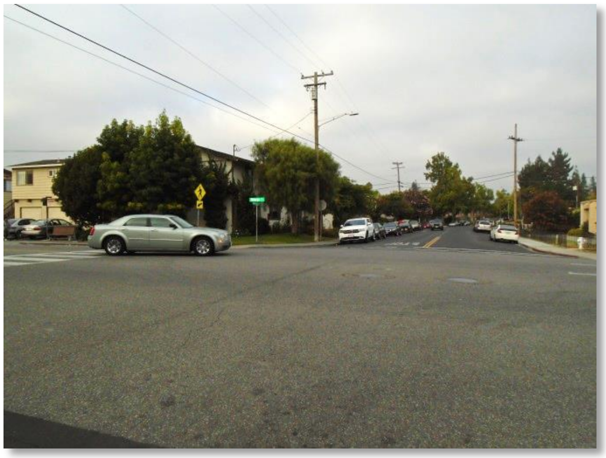
Table 3-5 summarizes the capacity analysis for the pipelines that would be affected by the proposed development area. The affected pipelines have adequate capacity to convey additional post-development peak flows per the City's peak allowable flow standards.

Table 3-5. Pipeline Capacity Results Summary

Item	Site 1 – MH 73	Site 2 – MH 75
Estimated 100% Capacity of Pipeline (gpm)	240	525
City Allowable Peak Flow at 0.75 d/D (gpm)	219	479
Q_D, Design Flow (gpm)	109	115.6
Available Capacity (gpm)	110	363.4
Has Capacity?	Yes	Yes

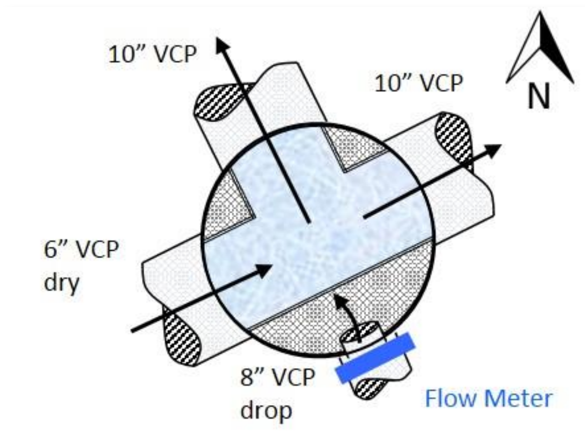
APPENDIX A. FLOW MONITORING SITES: DATA, GRAPHS , INFORMATION

MH 73: Satellite View



MH 73: Street View

MH 73: Sanitary Sewer Map



MH 73: Flow Diagram

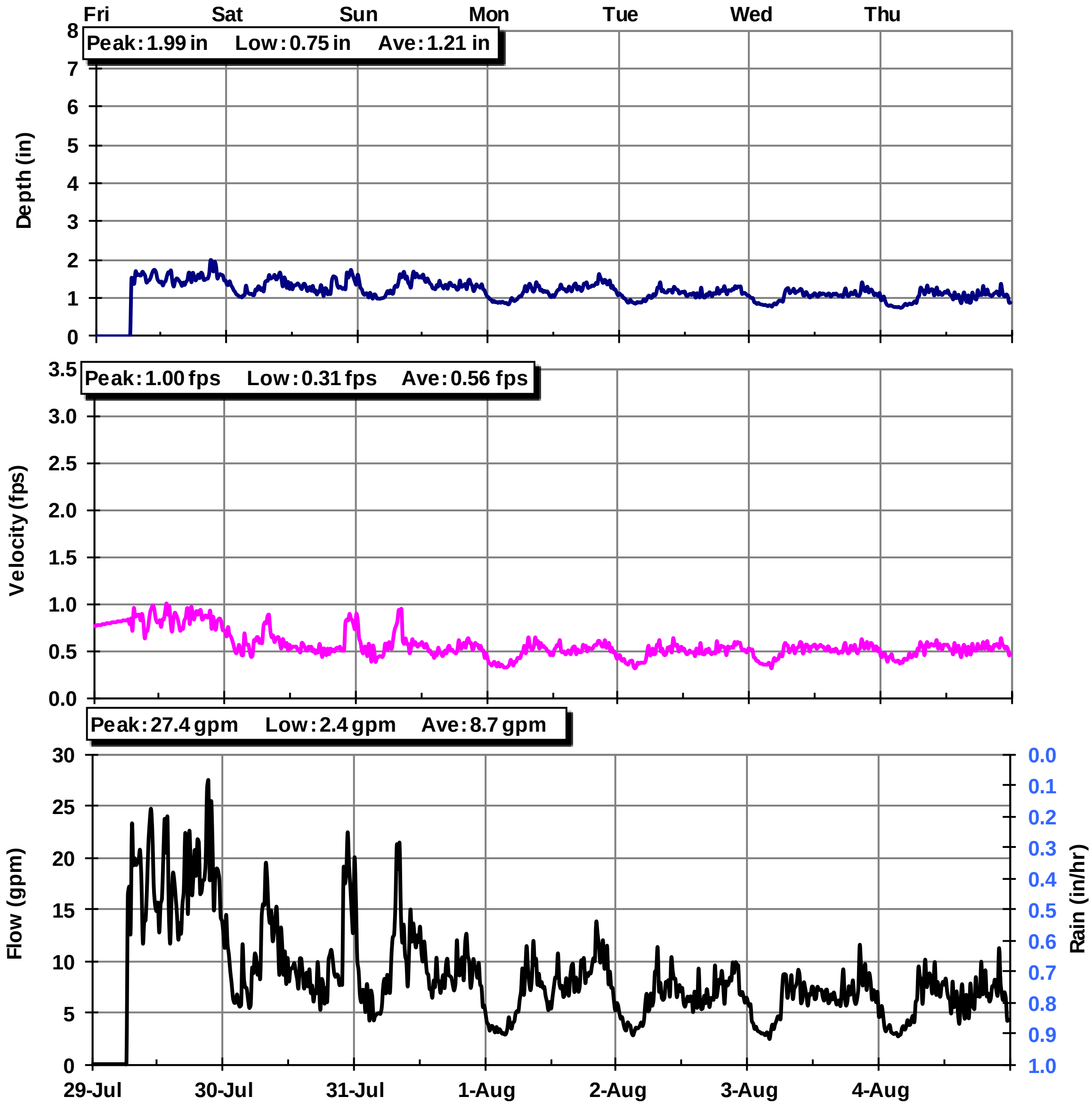
MH 73: Plan View

MH 73: East Effluent Pipe

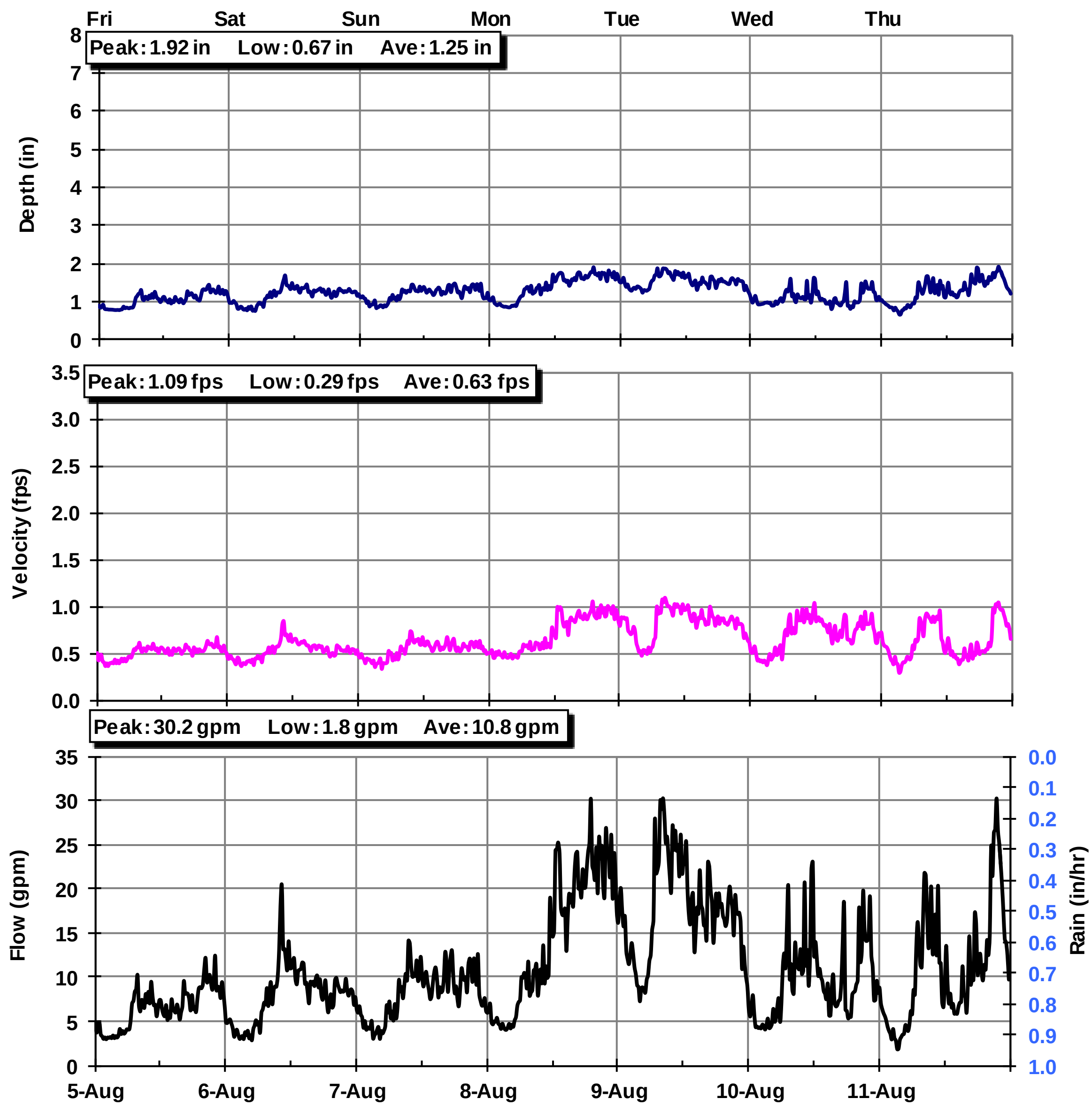
MH 73: South Influent Pipe

MH 73: West Influent Pipe

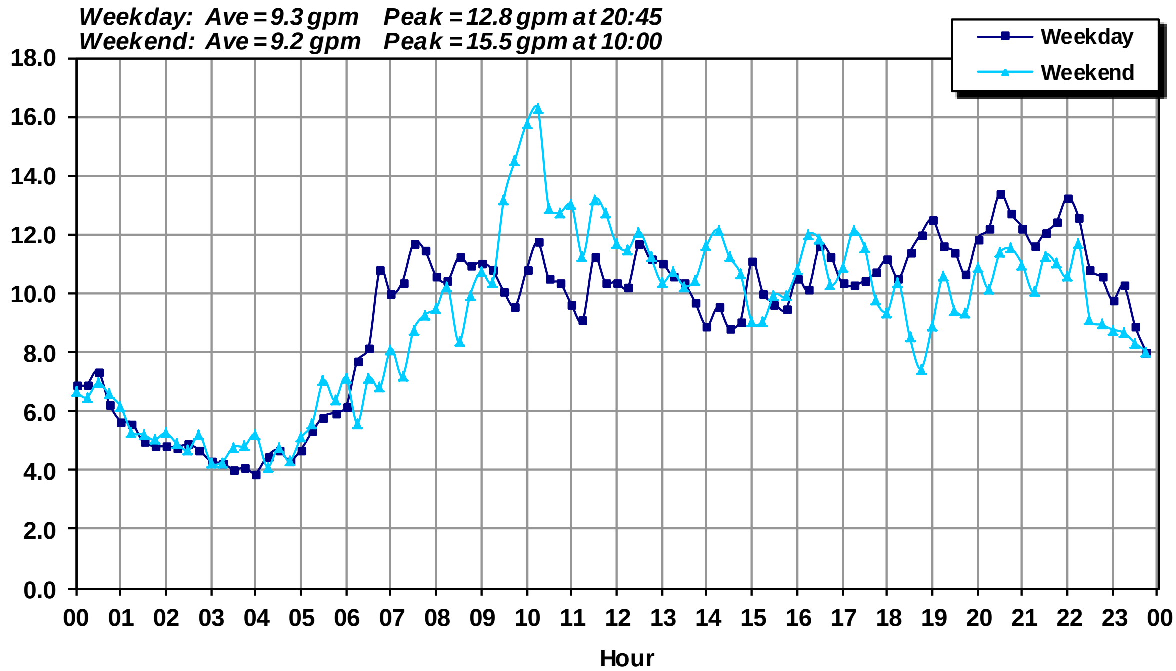
MH 73: North Effluent



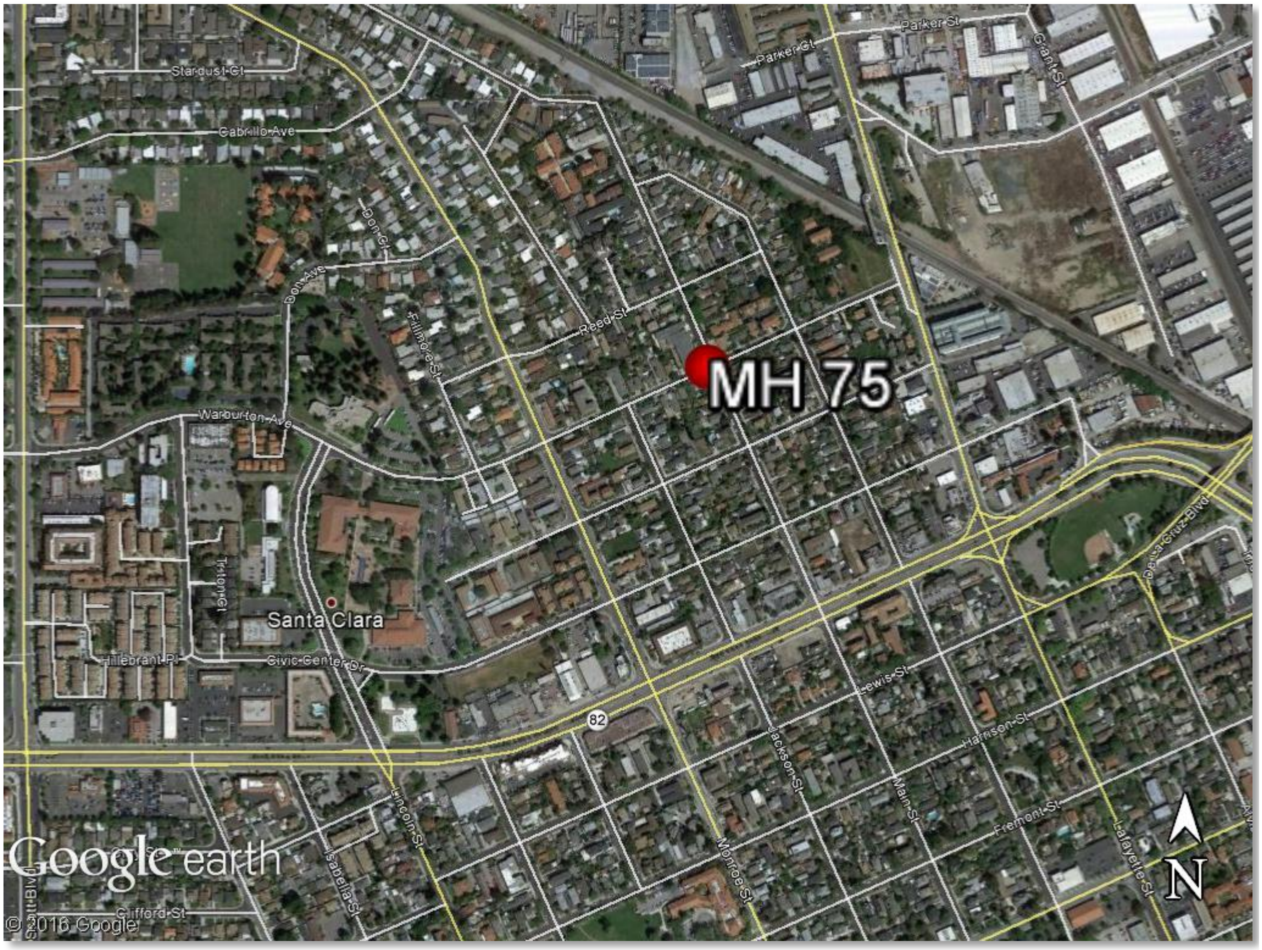
MH 73: Flow Monitoring Details (7/29/16 to 8/4/16)



MH 73: Flow Monitoring Details (8/5/16 to 8/11/16)

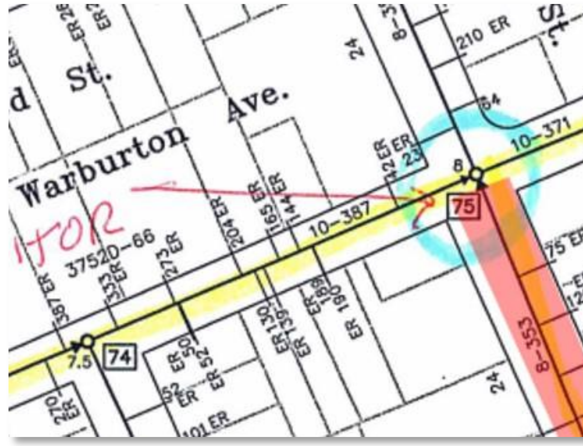


MH 73: Average Dry Weather Flow Curves

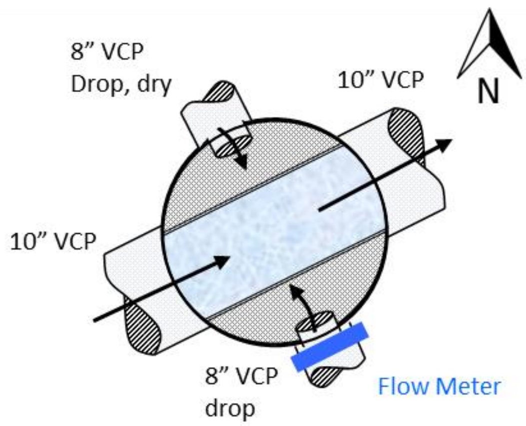


MH 75: Satellite View

MH 75: Site View



MH 75: Sanitary Sewer Map



MH 75: Flow Diagram

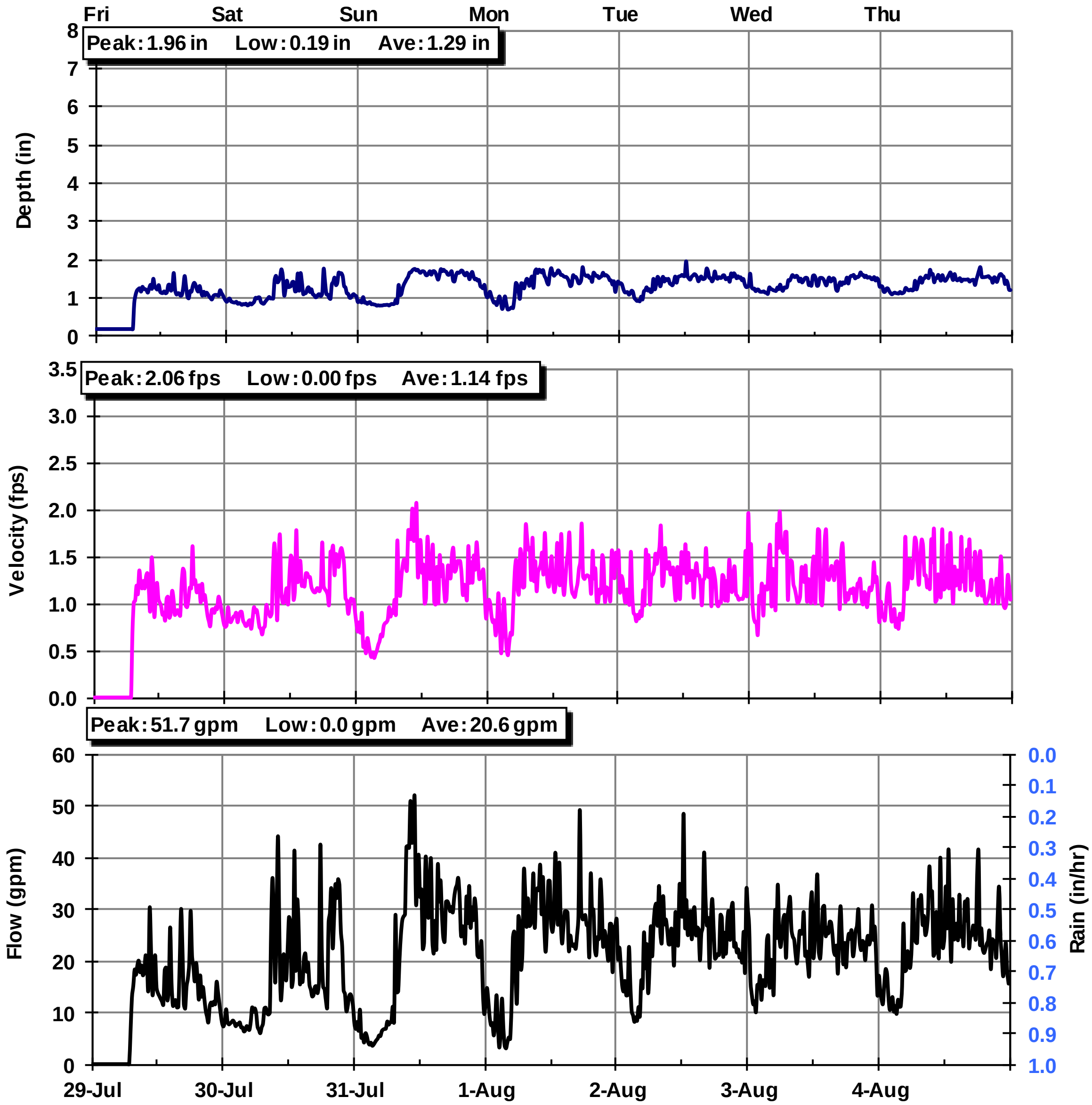
MH 75: Plan View

MH 75: East Effluent Pipe

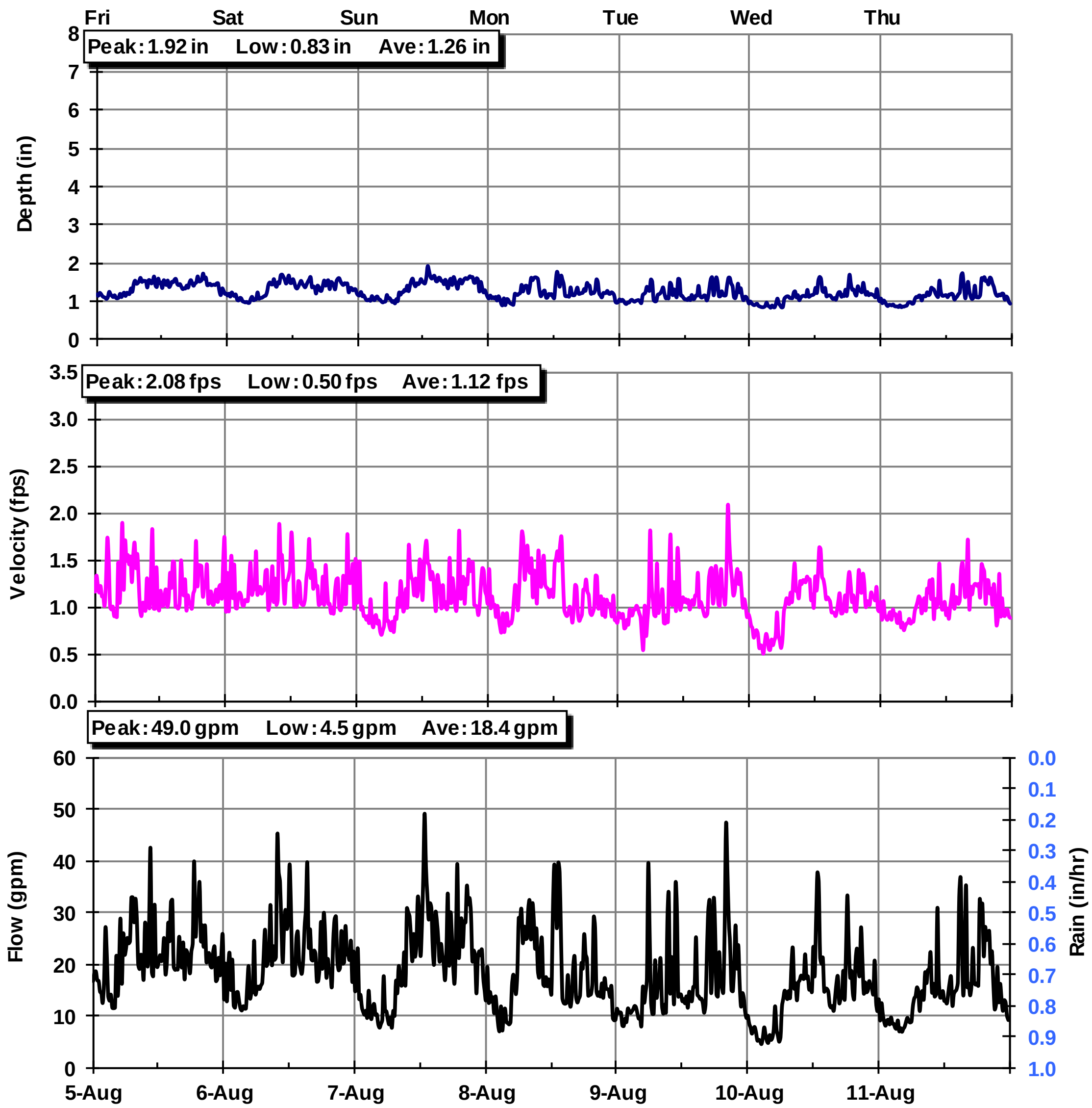
MH 75: South Influent Pipe

MH 75: West Influent Pipe

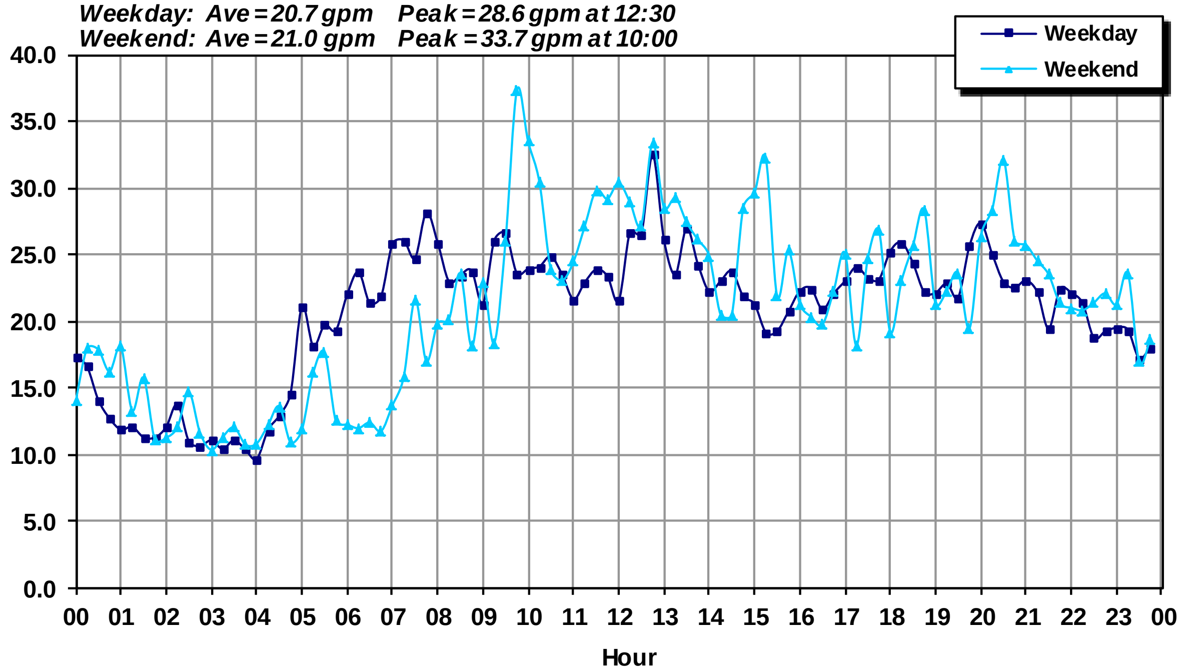
MH 75: North Influent Pipe



MH 75: Flow Monitoring Details (7/29/16 to 8/4/16)



MH 75: Flow Monitoring Details (8/5/16 to 8/11/16)



MH 75: Average Dry Weather Flow Curves

Appendix B. City of Santa Clara: Sanitary Sewer Capacity Assessment Standards

DESIGN CRITERIA

for Improvements in Public Right-of-Ways and City Easements

City of Santa Clara

Public Works Department

September 2014

Prior to any flow monitoring work, the proposed monitoring location(s) shall be reviewed and approved by the Director of Public Works/City Engineer. Flow monitoring measurements to determine average and peak flows, in existing pipes, shall be done over a period of at least seven (7) consecutive days with continuous mechanical/electronic measurements in a manner acceptable to the Director of Public Works/City Engineer.

An Encroachment Permit (EP) is required to allow developer to monitor the sanitary sewer flows.

. Design flow determination shall be as follows:

$Q_D = Q_M + Q_{WWGWI} + Q_{RDI/I} + Q_{PD}$

Where:

Q	=	Flow
D	=	Design
M	=	Monitored
WWGWI	=	Wet Weather Groundwater Infiltration
RDI/I	=	Rainfall-Dependent Infiltration and Inflow
PD	=	Proposed Development

Q_D	=	Design Flow
Q_M	=	The Monitored Peak Flow or 2.5 times the Monitored Average Flow, whichever is greater.
Q_{WWGWI}	=	The gpd/acre value is obtained by using Figure 3-3 on page 3-5 (see Exhibit "D" of this Design Criteria) and Table 3-2 on page 3-11 (see Exhibit "E" of this Design Criteria) of the Sanitary Sewer Capacity Assessment Report, May 2007. Multiply the factor by the Tributary Area served by the sanitary sewer main being monitored.
$Q_{RDI/I}$	=	Same as Q_{WWGWI} above. For now, use 1,000 gpd/acre.
Q_{PD}	=	Proposed Development Peak Flow.

5.5 At all changes of direction, a drop in flow line shall be installed equal to the velocity head times the ratio of angular change to 90 degrees.

$$\frac{V^2}{2g} \quad x \quad \frac{A^o}{90^o} \quad = \text{ Head Loss } = \text{ drop in flow line*}$$

EXHIBIT D

Figure 3-3 of Sanitary Sewer Capacity Assessment Report, May 2007

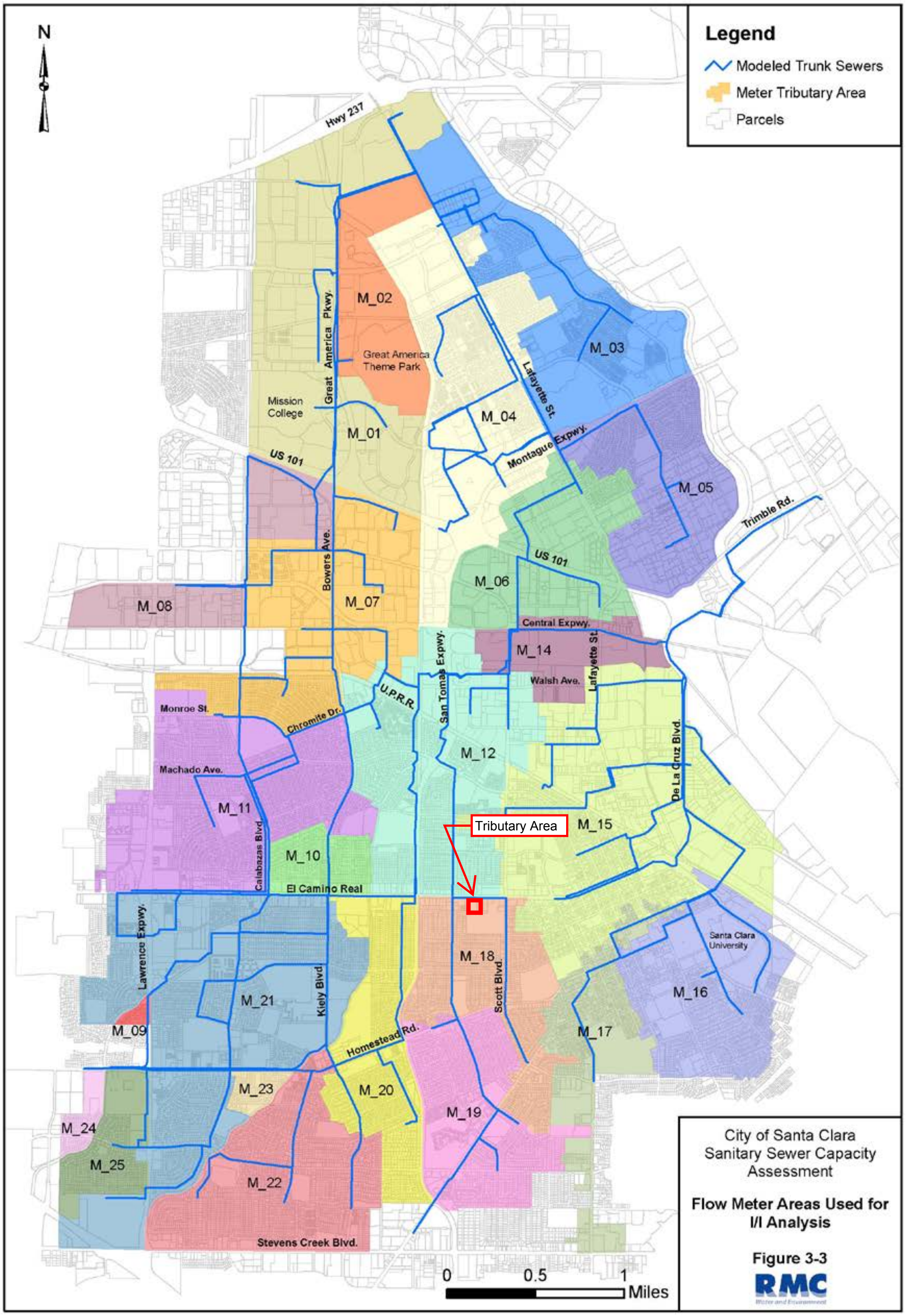


EXHIBIT E

Table 3-2 of Sanitary Sewer Capacity Assessment Report, May 2007

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

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

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

City of Santa Clara Water & Sewer Utility

Sewer System Management Plan

Approved by City Council: Resolution # [TBA]

Table 2-5 Base Wastewater Flow Unit Flow Factors

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

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

2.3.3 Diurnal Base Wastewater Flow Patterns

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

APPENDIX K

2009 SANITARY SEWER CAPACITY ASSESSMENT

Table 2-1: Base Wastewater Unit Flow Factors

Land Use	Unit Flow Factor	Basis
Low Density Residential	245 gpd/DU[a]	2007 Capacity Assessment
Medium Density Residential	154 gpd/DU	2007 Capacity Assessment
High Density Residential	154 gpd/DU	2007 Capacity Assessment
Retail & Residential [b]	154 gpd/DU	2007 Capacity Assessment
Commercial [c]	0.1 gpd/sq. ft.[d]	2007 Capacity Assessment
Hotel	0.48 gpd/sq. ft.	Standard Unit Flow Factor per SJ/SC WPCP[e]
Industrial/Office/R&D[f] (higher intensity)	0.15 gpd/sq. ft.	2007 Capacity Assessment
Warehouse Manufacturing	0.052 gpd/sq. ft.	Standard Unit Flow Factor per SJ/SC WPCP
Public/Institutional	0.15 gpd/sq.ft	Assumed to be similar to Office/R&D uses
Parks/Recreation	--	Assumed to generate little or no flow

a. gpd/DU = gallons per day per dwelling unit
b. Flow assumed to be primarily residential
c. Including neighborhood and regional commercial services, retail, office, and auto sales
d. gpd/sq. ft. = gallons per day per square foot of building floor space
e. SJ/SC WPCP = San Jose / Santa Clara Water Pollution Control Plant
f. R&D = Research & Development

In some cases, the demolition of existing development was identified by City staff. In these cases, the estimated flow from the existing development was subtracted out from the model baseline flow.

In general, the BWF generated by a development parcel was calculated as follow:

BWF = (Size of New Development x Unit Flow Factor) – (Demolition of Existing Development x Unit Flow Factor)

A table of the computed BWF for each sewer subbasin can be found in **Appendix B**.

Table 2-2 shows the estimated average dry weather flow (ADWF), peak dry weather flow (PDWF), and peak wet weather flow (PWWF) for each of the three General Plan Update phases. As per the 2007 Capacity Assessment, flows from Cupertino Sanitary District were included in the model up to the District's contracted maximum capacity in the City's sewer system.

Table 2-2: Summary of Wastewater Flow Estimates

Scenario	ADWF [a] (MGD)	PDWF [a] (MGD)	PWWF [b] (MGD)
Phase 1	26.8	34.9	53.5
Phase 2	28.7	37.2	56.0
Phase 3	30.6	39.5	57.8

a. ADWF and PDWF represent a non-rainfall wintertime condition and include groundwater infiltration.
b. PWWF represents peak flow for a 10-year frequency design storm.

Carlson, Barbee & Gibson, Inc.
CIVIL ENGINEERS • SURVEYORS • PLANNERS

August 28, 2017
Job No.: 2725-000

M E M O R A N D U M

TO: Ramon Santos, Senior Engineer
City of Santa Clara – Public Works – Engineering

FROM: Colt Alvernaz, PE

CC: Cory Kusich, SCS Development

SUBJECT: Catalina – Sewer Flow Capacity Study

Purpose

Carlson, Barbee, & Gibson, Inc. (CBG) was asked by the City of Santa Clara to prepare a sanitary sewer pipe capacity analysis to determine the effects of additional flow added to the existing sanitary sewer system by the proposed Catalina development (Project). This Memo references the results and analysis of "*City of Santa Clara El Camino Civic Center Flow Monitoring Capacity Study*" prepared by V&A for Prometheus Real Estate Group, Inc. dated September 2016. (Report)

This Memo presents the revised results of the Report prepared by V&A based on the new Catalina development.

Existing and Proposed Conditions

The proposed Project is located at 1375, 1385, & 1399 El Camino Real. The site currently consists of multiple auto repair shops and associated parking.

Improvements to the 2.23 AC site includes 53 multifamily condominium units, open space areas, stormwater treatment facilities, private drive aisles with access from Civic Center Drive. 8 of the 53 units have a live work component in the first floor living space with pedestrian access to the live work units from El Camino Real and the proposed development.

The sanitary sewer will have two tie-in locations in Civic Center Drive.

An exhibit showing the surrounding area, proposed development and sanitary sewer pipe has been included as an attachment to this Memo.

Results:

Table 1 updates Table 3-3 from the Report with the proposed 53 condominium units and 8 live work unit data. Using the same Unit Flow Factor as provided in the Report (Appendix B) the revised Peak Flow for the Project is provided in Table 1 below:

Table 1: Revised Table 3-3. Flow Generation from Proposed Development

Type of Development	Unit Flow Factor	Number of Units	Flow Generation (gpm)
Townhouses/Condominiums	175 gpd/DU	53	6.44
Live-Work Units	4,600 gpd/acre	0.075	0.24
		Total	6.68
		Peaking Factor	2.5
		Peak Flow	16.7

Based on the new development site and sewer tie in locations in Civic Center Drive, 100% of the flow will be distributed to Site 1-MH 73. Table 2 presents the revised Q_D, design flow (gpm) based on the updated proposed development peak flow data.

Table 2: Revised Table 3-4. Design Flow Results Summary

Item	Site 1-MH 73
Q_M, Monitored Peak Flow (gpm)	30.2
Q_{WWGWI}, Wet Weather Groundwater Infiltration (gpm)	6.3
Q_{RDI}/I, Rainfall Dependent Infiltration and Inflow (gpm)	9
Q_{PD}, Proposed Development Peak Flow (gpm)	16.7
Q_D, Design Flow (gpm)	62.2

Per Table 3, it can be concluded that the existing sewer pipeline has the available capacity to support the proposed Catalina Development.

Table 3: Revised Table 3-5. Pipeline Capacity Results Summary

Item	Site 1-MH 73
Estimated 100% Capacity of Pipeline (gpm)	240
City Allowable Peak Flow at 0.75 d/D (gpm)	219
QD, Design Flow (gpm)	62.2
Available Capacity (gpm)	110
Has Capacity?	Yes

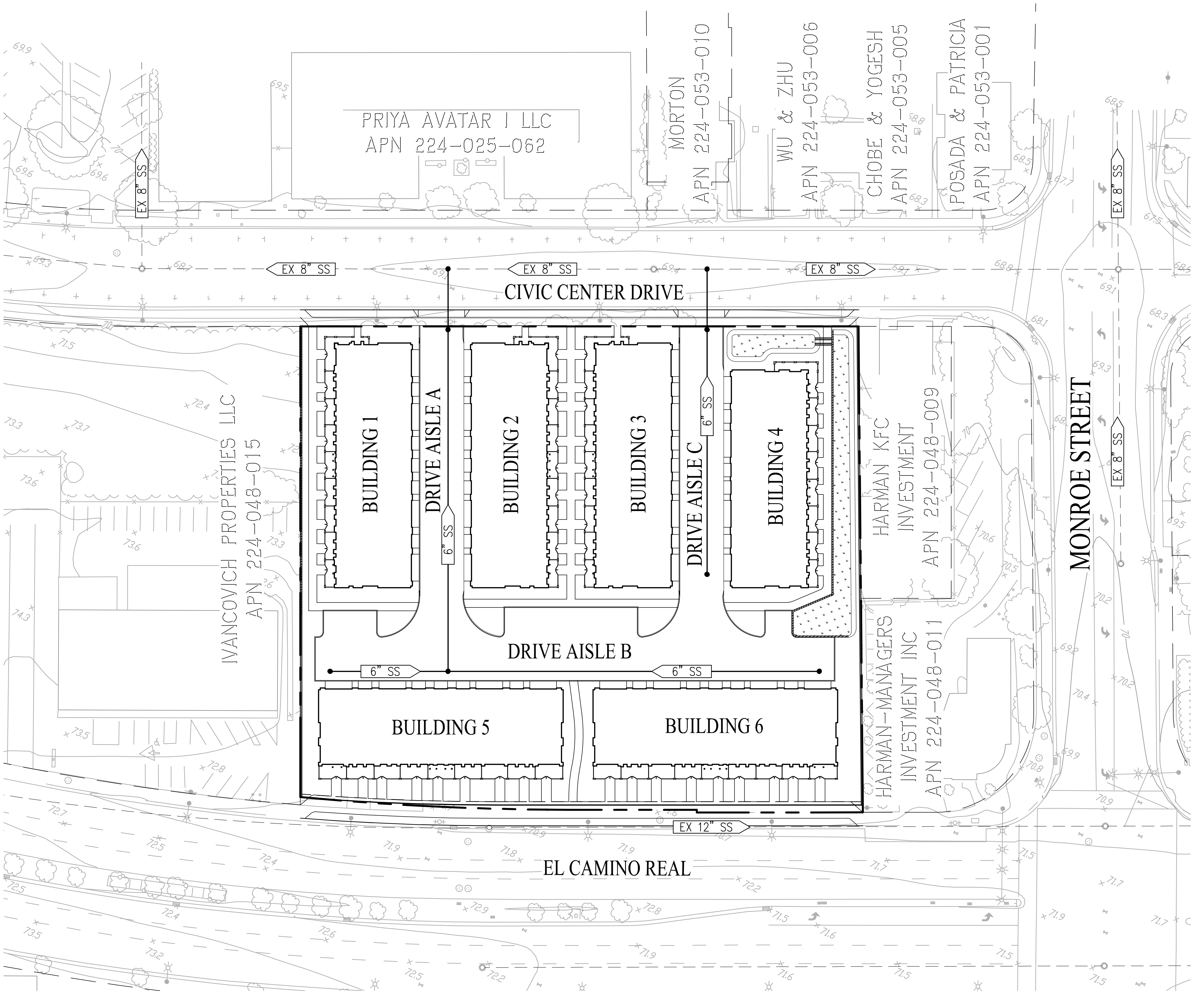
Conclusion

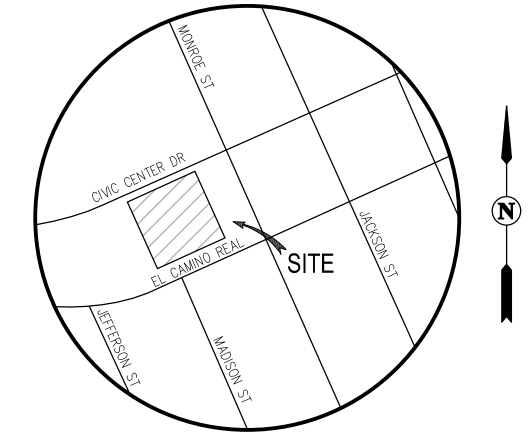
In conclusion, based on the results produced in the report prepared by V&A and the new data for the Catalina project provided in this Memo; the existing sanitary sewer system in Civic Center Drive has sufficient capacity to support the additional flow from the proposed Catalina development.

Attachments:

1. Vicinity Map and Proposed Conditions Exhibit

2. *"City of Santa Clara El Camino Civic Center Flow Monitoring Capacity Study"*, by V&A dated September 2016





VICINITY MAP
NOT TO SCALE

VICINITY MAP & PROPOSED CONDITIONS CATALINA

CITY OF SANTA CLARA SANTA CLARA COUNTY CALIFORNIA

DATE: AUGUST 2017

SCALE: 1" = 60'

cbg Carlson, Barbee & Gibson, Inc.
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