SEWER UTILITY STUDY

FOR

5TH AVE.

3774 5th Ave.

San Diego, CA 92103

Prepared for:

City of San Diego

Prepared by:

Labib Funk + Associates

Structural | Shoring | Civil Consulting Engineers

319 Main St.

El Segundo, California 90245

LFA Job # 21814

October 5, 2022

SIGN DATE 10/03/2022

Labib Funk + Associates
Structural | Civil Engineers

TABLE OF CONTENTS

319 Main Street
El Segundo, California 90245
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1.0 Site Description

The existing project site is 0.32 acres and is located at 3774 5th Avenue located in San Diego, CA. The current site is occupied by a one-story commercial building, and three two story mixed-use and residential buildings. The remainder of the site consists of asphalt parking areas and vehicular drive aisles. The project is located at south of the intersection of Robinson Ave and fronts 5th avenue to the east and an alleyway to the west.

2.0 Project Description

The project will consist of construction of new 7 story mixed-use building over one level of underground parking. The proposed project will implement miscellaneous landscape features on podium levels of the development and will provide vehicular access from the Alleyway. The proposed project will provide (42) market rate units, (2) affordable units, and (21) visitor accommodation units totaling approximately 64,008 SF as well as 3,947 sf of commercial use area.

3.0 Existing Sewer Capacity Analysis

Per the available City of San Diego records of the existing sewer infrastructure (22336-5-D, 22336-6-D, 22336-7-D), the project site is near the most upstream manhole on an existing 10" PVC sewer located to the west in the alleyway. The sewer flow from the existing project connects to this 10" sewer gravity sewer main. The existing sewer main characteristics have been evaluated for the existing and proposed capacity to show that there are no impacts to the existing infrastructure based on the proposed project. The capacity of the pipe was analyzed using Bentley FlowMaster V8i. The results of the capacity analysis are shown below in Table 1 and can be found in Appendix C.

Table 1 – Existing Sewer Main Capacity

Existing Sewer Main Capacity						
	Size (in)	Slope (ft/ft)	Material	Max Flow Depth (in)	Max Flow (gpd)	Max Flow (mgd)
Existing	10	0.56	PVC	5	688,765	0.69

*All values shown here have been shown assuming a maximum flow depth of 5 inches or 50% full flow.

*Existing sewer main characteristics were acquired from City of San Diego records.

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4.0 Proposed Flow Generation

The proposed project flow generation was calculated based on the City of San Diego Sewer Design Guide 2015. The estimated sewage flows can be seen below in Table 2. The proposed project will increase the sewage generation from the existing condition by approximately 11,344 GPD.

Table 2 – Sewage Generation

3774 5th Ave								
Existing Site								
Zone/ Land Use	Area (SF)	Area (AC)	Units	Density (DU/AC)	Population Factor (People/Unit)	Equivalent Population	Unit Flow (GPD/Person)	Flow (GPD)
Commercial	7,008	0.16	-	12.50	3.5	87	80	6,992
** Residential	3,906	0.09	12	133.82	3.5	42	80	3,360
Total								**10,352**
Proposed Site								
Commercial	3,947	0.09	-	12.50	3.5	44	80	3,496
*Residential	64,008	1.47	65	44.24	3.5	228	80	18,200
Total	**67,955**							**21,696**
Total Increase								**11,344**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.
** Actual unit count has been estimated.

To verify the existing 10" capacity and flows. The proposed wet weather peak flow has been analyzed. There are a total of 10 lots that are assumed to connect to the existing 10" PVC sewer main between MH 15 and 14. The lots have been estimated for sewage generation by using Table 1-1 of the City of San Diego Sewer Design guide. Commercial lots were estimated by floor count and residential lots were estimated by net area. The results from this study can be found in Appendix B. The sewer between MH numbers 17 and 12 (See As-built plans in Appendix A) has been analyzed for the peak flows assumed to be tributary to this main. See Calculations in Appendix B. The results show that with the proposed project the existing 10" sewer has ample capacity (49.8% full dn/D) within the above-mentioned reach. The studies shown in Appendix B, were analyzed 2 reaches upstream and downstream of the proposed project location. The project peak flow (0.08 cfs) was less than 10% (actual being 7.3%) of the total flow downstream (1.09 cfs). The analysis did not need to continue further past reach 5 (MH 13-12). Results for max velocity, flow, and dn/D results per reach are provided in Appendix B. Slopes and pipe materials were found from as-built records Appendix A.

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5.0 Conclusion

The proposed project at 3774 5th Avenue located in the City of San Diego has been analyzed in this report to identify any potential impacts to the existing infrastructure based on the proposed development. Through the previously mentioned findings and calculations, it is reasonable to conclude that the proposed project will have no potential impact on the existing sewer infrastructure. The 10" main located in the alley between 4th Avenue and 5th Avenue between Robinson Ave and Pennsylvania Avenue is adequately sized for the proposed development and no upgrades would be needed to meet the standards and requirements noted in the City of San Diego Sewer Design Guidelines.

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APPENDIX A
Reference Maps

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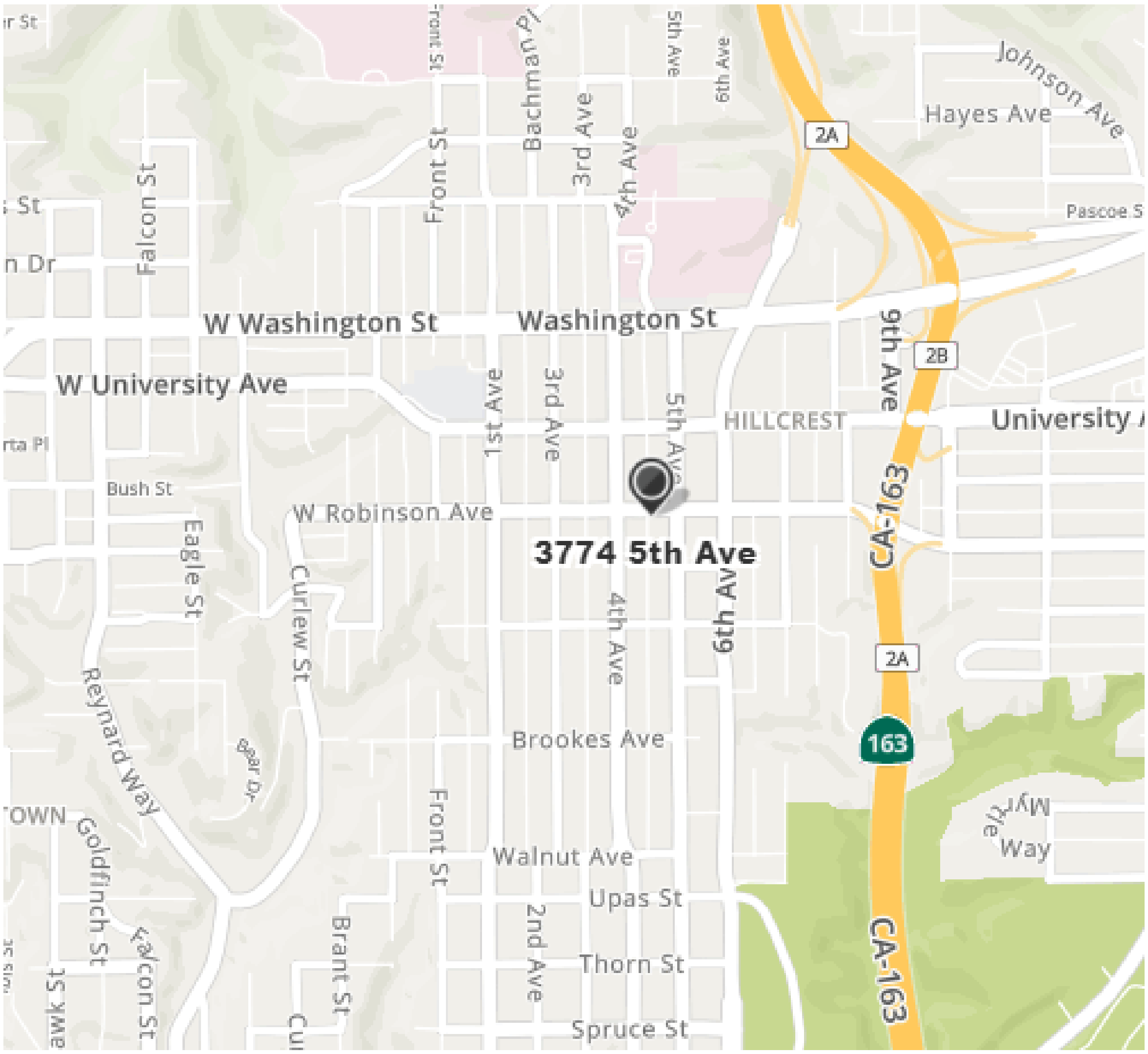
VICINITY MAP



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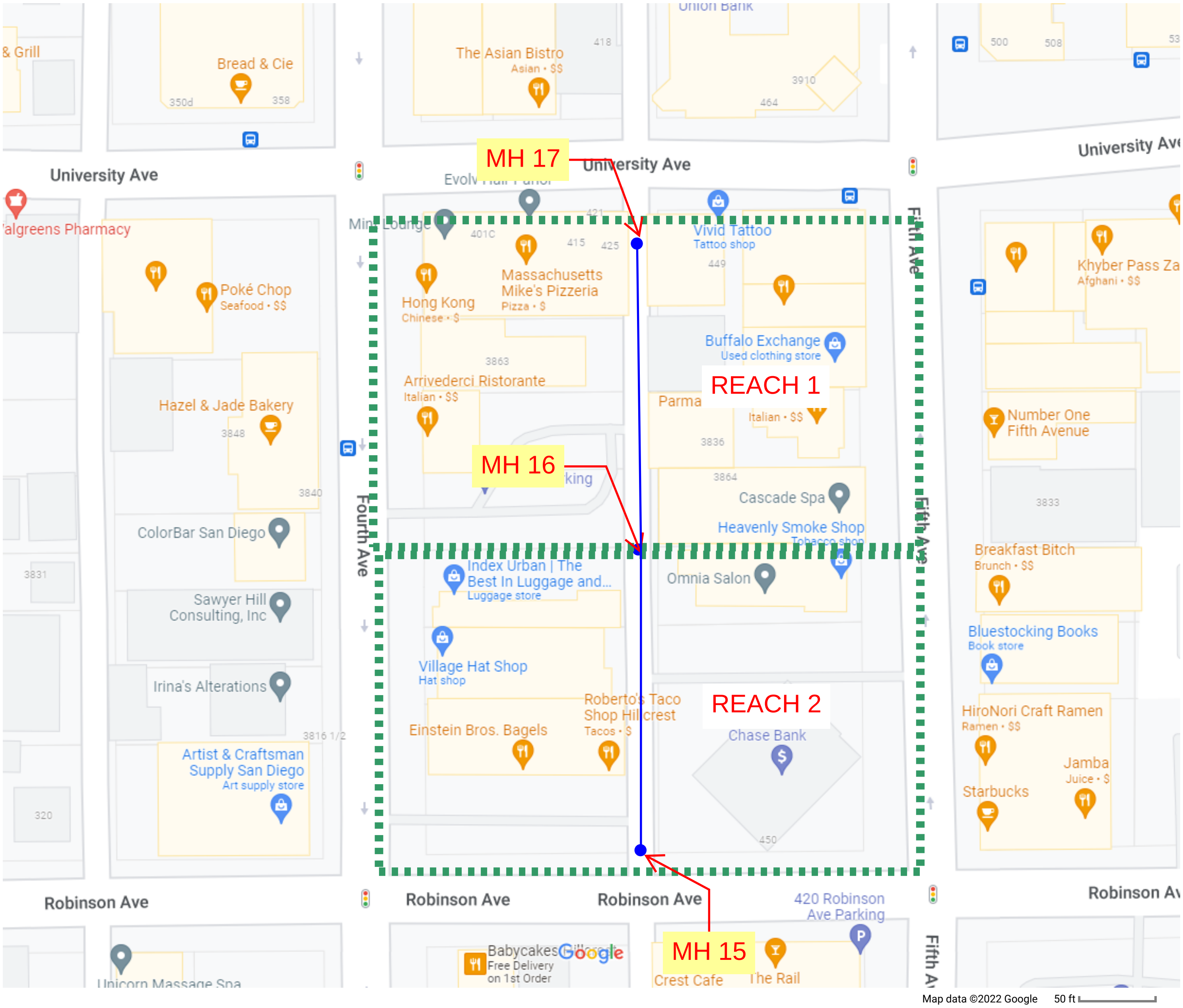
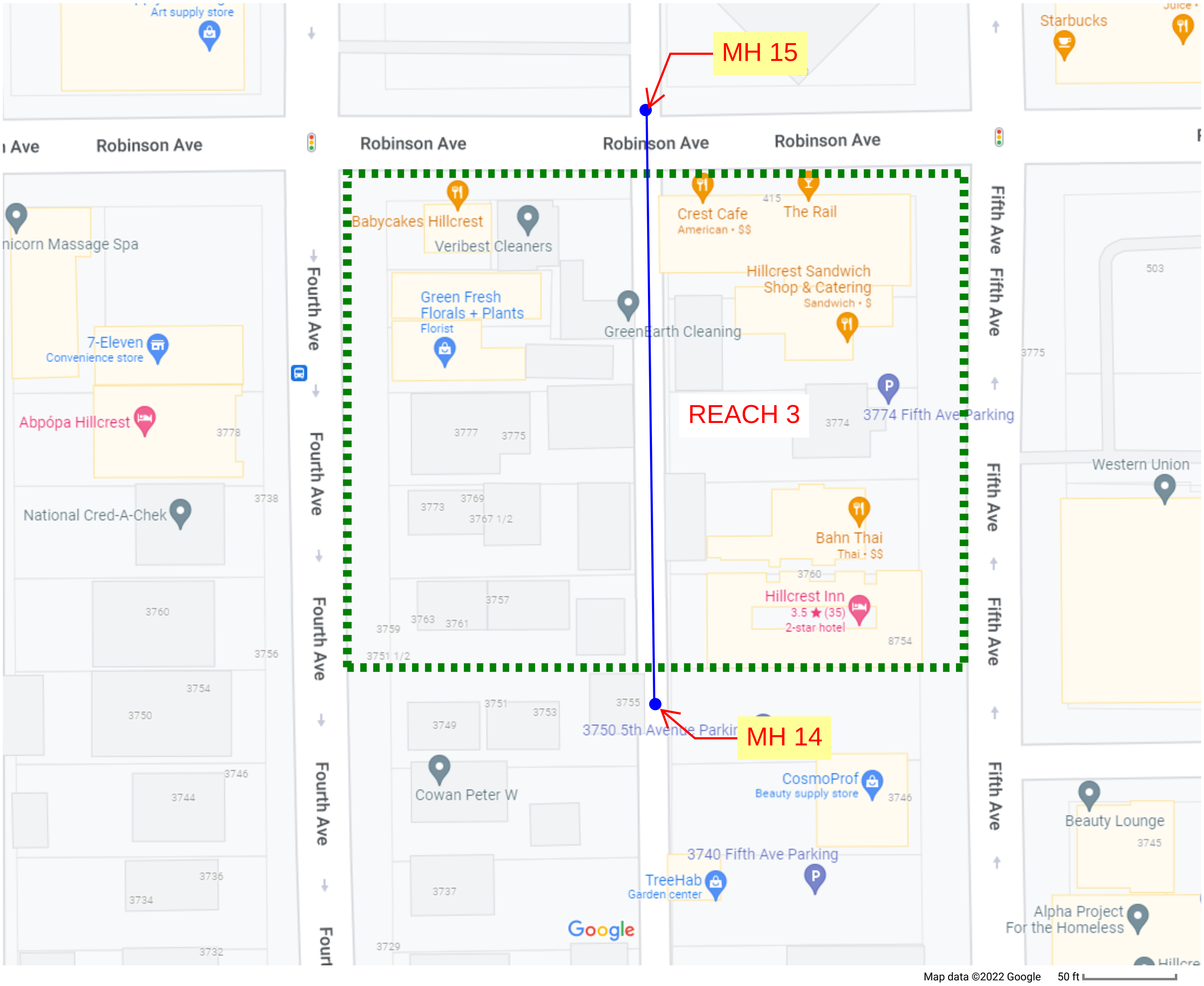
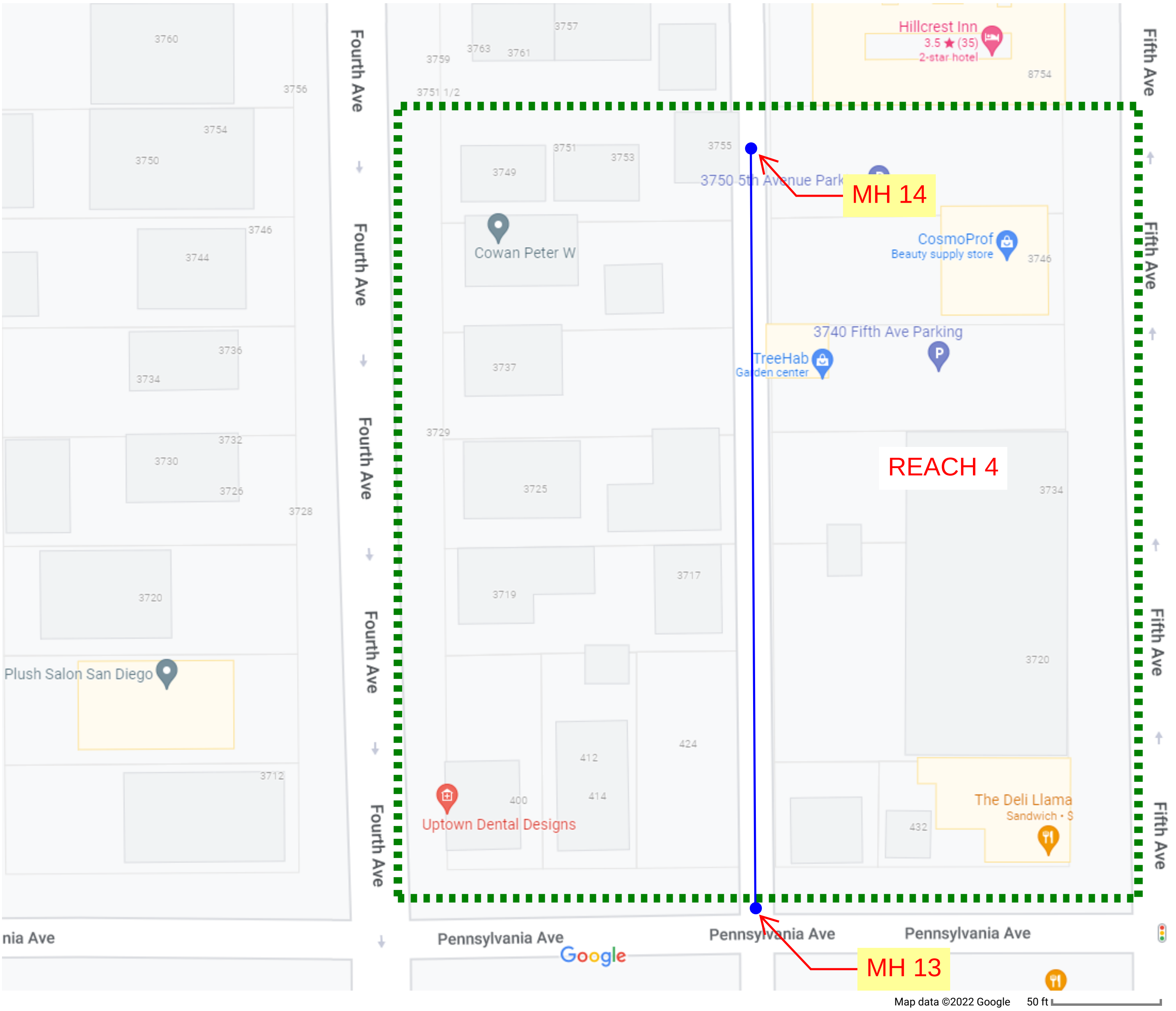

MH 17
REACH 1
MH 16
REACH 2
MH 15
University Ave
Robinson Ave
Fourth Ave
Fifth Ave
The Asian Bistro
Asian · $$
Bread & Cie
Union Bank
Walgreens Pharmacy
Poké Chop
Seafood · $$
Hazel & Jade Bakery
ColorBar San Diego
Sawyer Hill
Consulting, Inc
Irina's Alterations
Artist & Craftsman
Supply San Diego
Art supply store
Hong Kong
Chinese · $
Massachusetts
Mike's Pizzeria
Pizza · $
Arrivederci Ristorante
Italian · $$
Vivid Tattoo
Tattoo shop
Buffalo Exchange
Used clothing store
Parma
Italian · $$
Cascade Spa
Heavenly Smoke Shop
Tobacco shop
Index Urban | The
Best In Luggage and...
Luggage store
Omnia Salon
Village Hat Shop
Hat shop
Roberto's Taco
Shop Hillcrest
Tacos · $
Einstein Bros. Bagels
Chase Bank
Khyber Pass Za
Afghani · $$
Number One
Fifth Avenue
Breakfast Bitch
Brunch · $$
Bluestocking Books
Book store
HiroNori Craft Ramen
Ramen · $$
Jamba
Juice · $
Starbucks
420 Robinson
Ave Parking
Babycakes
Free Delivery
on 1st Order
Crest Cafe
The Rail
Unicorn Massage Spa
Map data ©2022 Google
50 ft

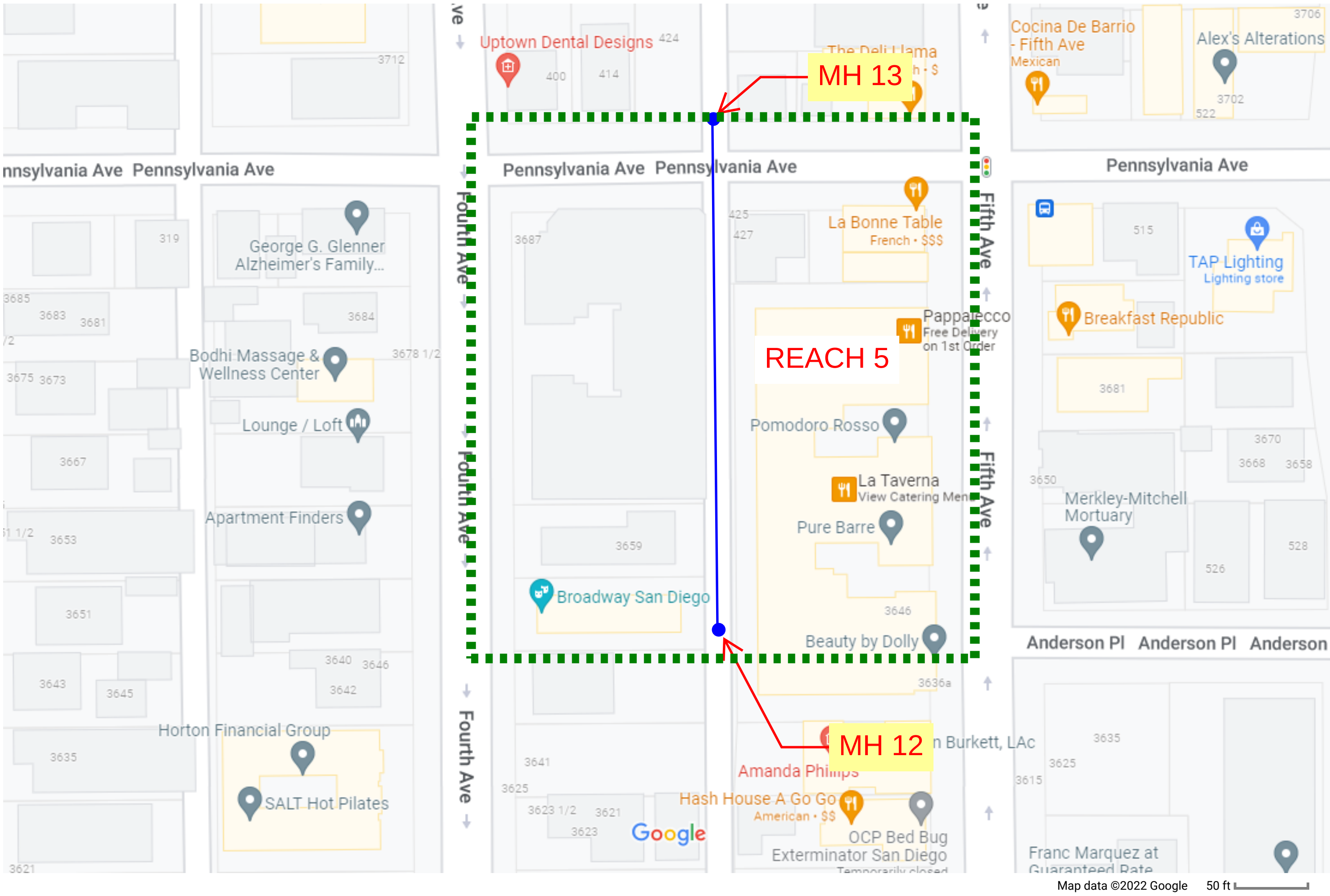


MH 15
MH 14
REACH 3
Robinson Ave
Fourth Ave
Fifth Ave
Art supply store
Starbucks
Babycakes Hillcrest
Veribest Cleaners
Crest Cafe
American • $$
The Rail
Hillcrest Sandwich Shop & Catering
Sandwich • $
Green Fresh Florals + Plants
Florist
GreenEarth Cleaning
7-Eleven
Convenience store
Abpópa Hillcrest
National Cred-A-Chek
3774 Fifth Ave Parking
Western Union
Bahn Thai
Thai • $$
Hillcrest Inn
3.5 ★ (35)
2-star hotel
3750 5th Avenue Parking
CosmoProf
Beauty supply store
Cowan Peter W
3740 Fifth Ave Parking
TreeHab
Garden center
Beauty Lounge
Alpha Project For the Homeless
Google
Map data ©2022 Google
50 ft



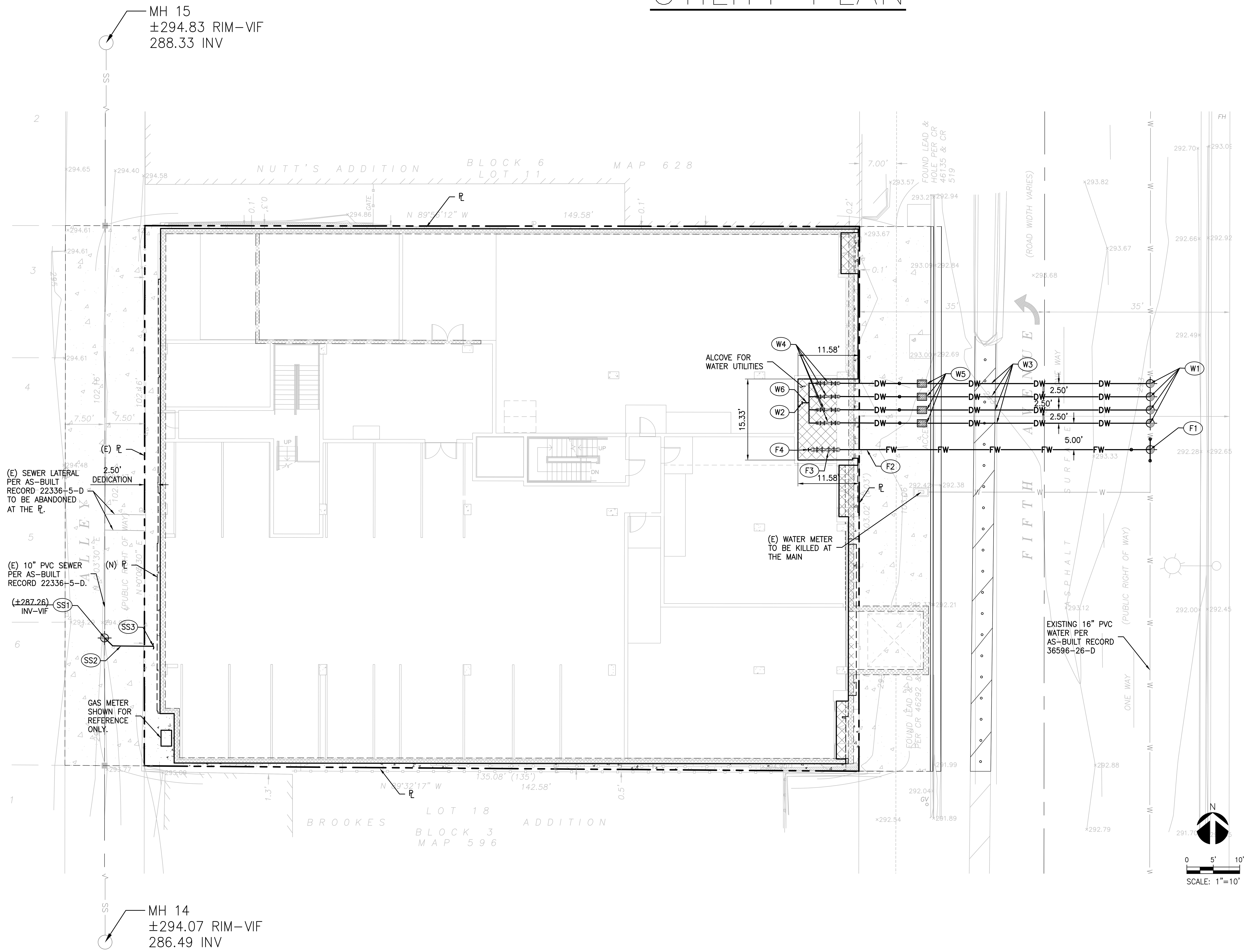
MH 14
REACH 4
MH 13
Fourth Ave
Fifth Ave
Pennsylvania Ave
Hillcrest Inn
3.5 ★ (35)
2-star hotel
3750 5th Avenue Park
CosmoProf
Beauty supply store
3740 Fifth Ave Parking
TreeHab
Garden center
Cowan Peter W
Plush Salon San Diego
Uptown Dental Designs
The Deli Llama
Google
Map data ©2022 Google
50 ft

Google Maps



MH 13
REACH 5
MH 12
Pennsylvania Ave
Fourth Ave
Fifth Ave
Anderson Pl
Uptown Dental Designs
The Deli Llama
Cocina De Barrio - Fifth Ave
Mexican
Alex's Alterations
La Bonne Table
French · $$$
Pappalecco
George G. Glenner Alzheimer's Family...
TAP Lighting
Lighting store
Breakfast Republic
Bodhi Massage & Wellness Center
Lounge / Loft
Pomodoro Rosso
La Taverna
Apartment Finders
Pure Barre
Merkley-Mitchell Mortuary
Broadway San Diego
Beauty by Dolly
Horton Financial Group
Amanda Phillips
SALT Hot Pilates
Hash House A Go Go
American · $$
OCP Bed Bug Exterminator San Diego
Franc Marquez at Guaranteed Rate
Map data ©2022 Google
50 ft

UTILITY PLAN



FOR REFERENCE ONLY

LEGEND

- PROPERTY LINE
- CONCRETE PAVING
- PLANTER AREA
- BASEMENT BUILDING WALL
- RETAINING WALL (PER STRUCTURAL PLANS)
- POINT OF CONNECTION
- COORDINATION POINT
- BACKFLOW ASSEMBLY
- WATER METER BOX
- WATER VALVE

CONSTRUCTION NOTES

DOMESTIC WATER

(W1) WET TAP TO EXISTING WATER MAIN. CONTRACTOR TO FIELD VERIFY LOCATION OF PIPE. CONTRACTOR TO COORDINATE INSTALLATION WITH CITY OF SAN DIEGO WATER DEPARTMENT. SHOWN FOR COORDINATION PURPOSES ONLY.

(W2) POINT OF CONNECTION 5' FROM BUILDING FACE. SEE PLUMBING DRAWINGS FOR CONTINUATION, DETAIL AND SPECIFICATION.

(W3) INSTALL 2" WATER PIPE.

(W4) INSTALL 2" REDUCED PRESSURE BACKFLOW PREVENTER WITH METER. SIZE TO BE CONFIRMED BY PLUMBING DESIGNER.

(W5) INSTALL DOMESTIC WATER METER AND METER BOX. INSTALLATION PER CITY OF SAN DIEGO WATER DEPARTMENT. CONTRACTOR TO COORDINATE INSTALLATION WITH CITY OF SAN DIEGO WATER DEPARTMENT.

(W6) INSTALL 4" WATER PIPE.

FIRE WATER

(F1) CONTRACTOR TO ORDER FIRE WATER SERVICE AND CUT IN TEE TO CONNECT TO EXISTING WATER MAIN. SIZE PER FIRE SPRINKLER DESIGN PLANS.

(F2) 6" FIRE WATER PIPE. SIZE PER FIRE SPRINKLER DESIGN PLANS.

(F3) INSTALL 6" REDUCED PRESSURE BACKFLOW ASSEMBLY WITH METER. SIZE TO BE CONFIRMED BY PLUMBING DESIGNER.

(F4) POINT OF CONNECTION TO BUILDING. SEE FIRE SPRINKLER PLANS FOR CONTINUATION.

SANITARY SEWER

(SS1) CONNECT TO EXISTING SANITARY SEWER PIPE PER CITY OF SAN DIEGO STANDARD DRAWING. CONTRACTOR TO VERIFY HORIZONTAL AND VERTICAL LOCATION OF PIPE PRIOR TO CONNECTION.

(SS2) 6" PVC SANITARY SEWER PIPE PER CITY OF SAN DIEGO STANDARD DRAWINGS. TRENCH PER STANDARD CITY OF SAN DIEGO STANDARD DRAWING.

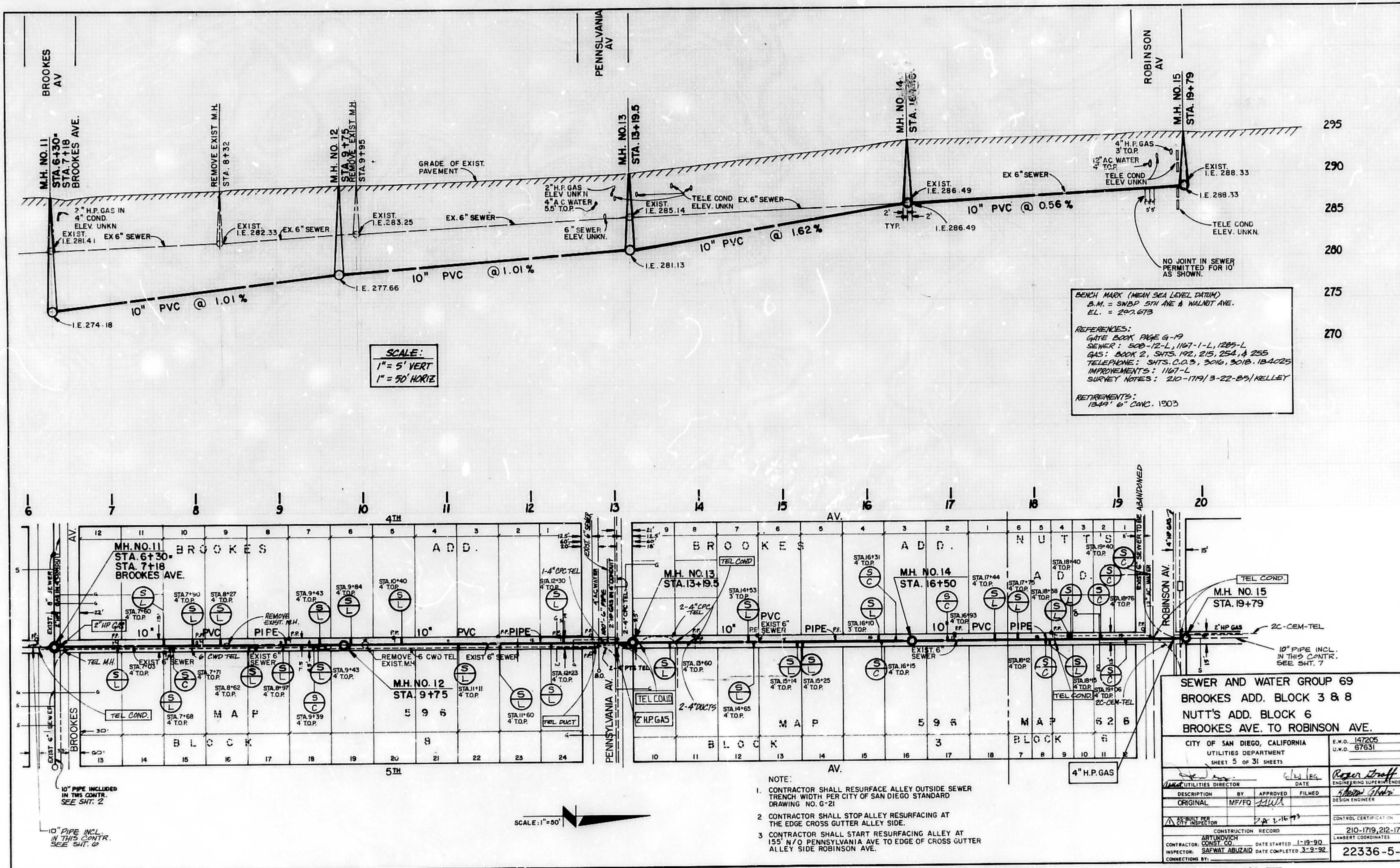
(SS3) POINT OF CONNECTION 5' FROM BUILDING FACE. REFER TO PLUMBING DRAWINGS FOR CONTINUATION, DETAIL, AND SPECIFICATIONS.

NOTE:

1. ALL PROPOSED PUBLIC DOMESTIC WATER SERVICE LINE DIAMETERS ARE PROVIDED FOR CLARITY OF INTENT ONLY. ACTUAL SERVICE LINE DIAMETERS WILL BE BASED UPON THE PROJECTS APPROVED WATER METER DATA CARD.

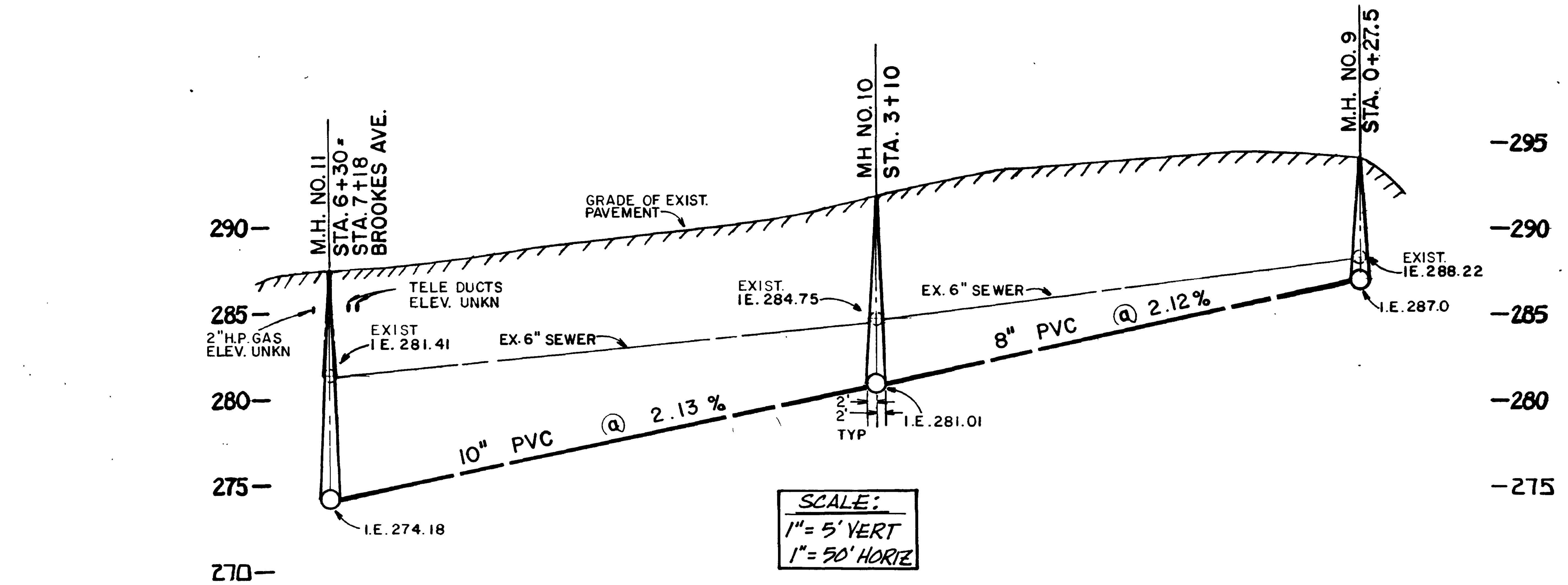
2. THE APPROVAL OF THE PRIVATE VAULT AND WATER METERS WILL BE FINALIZED DURING THE MINISTERIAL REVIEW.

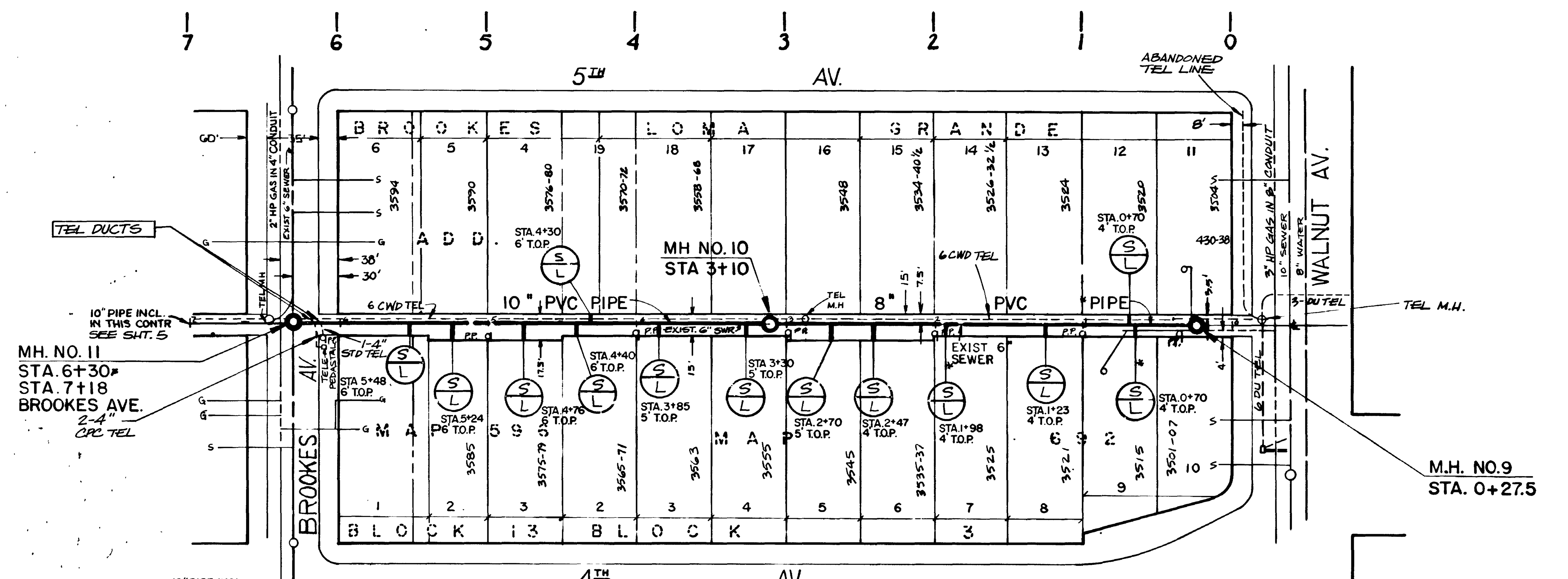
ALLEY WEST OF 5TH AVE.



AS-BUILT

ALLEY WEST OF 5TH AVE.





NOTE:
CONTRACTOR SHALL RESURFACE ALLEY OUTSIDE SEWER TRENCH WIDTH PER CITY OF SAN DIEGO STANDARD DRAWING NO. G-21.
CONTRACTOR SHALL START RESURFACING ALLEY, AT EDGE OF CROSS GUTTER ALLEY SIDE TO 100' SOUTH OF BROOKES AVE.

BENCH MARK (MEAN SEA LEVEL DATUM)
B.M. = SWBP 5TH AVE. & WALNUT AVE.
EL. = 290.673

REFERENCES:
GATE BOOK PAGE G-19
SEWER: 508-12-L, 1197-1-L
GAS: BOOK 2, SHTS. 147 & 192
TELEPHONE: SHT. 5018
IMPROVEMENTS: 1197-L, 576-B
SURVEY NOTES: 210-1719/ 3-22-85/ KELLEY

RETIREMENTS:
603' 6" CONC. 1903

SEWER AND WATER GROUP 69
BROOKES ADD. BLOCK 13 AND
LOMA GRANDE BLOCK 3
BROOKES AVE. TO WALNUT AVE.

CITY OF SAN DIEGO, CALIFORNIA
UTILITIES DEPARTMENT
SHEET 6 OF 31 SHEETS

E.W.O. 147205
U.W.O. 67631

UTILITIES DIRECTOR — DATE 6/21/85
ENGINEERING SUPERINTENDENT
DESIGN ENGINEER

DESCRIPTION	BY	APPROVED	FILMED
ORIGINAL	MF/FQ		
AS-BUILT PER CITY INSPECTOR		2-16-93	

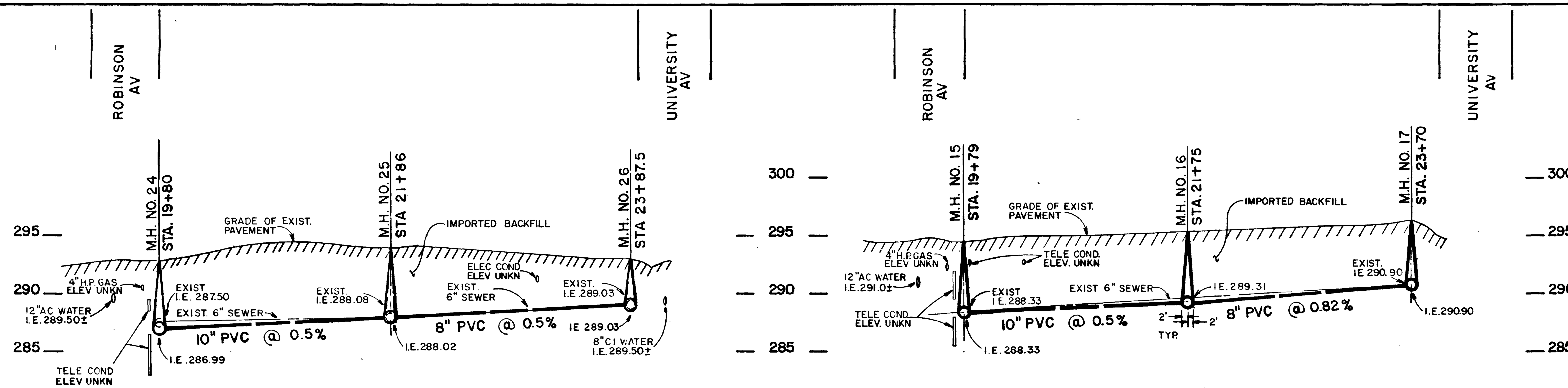
CONSTRUCTION RECORD
CONTRACTOR: ARTUKOVICH CONST CO — DATE STARTED 1-19-90
INSPECTOR: SAFWAT ABUZAID — DATE COMPLETED 3-9-92
CONNECTIONS BY:

CONTROL CERTIFICATION
210-1719
LAMBERT COORDINATES

22336-6-D

AS-BUILT

ALLEYS WEST OF 5TH AVE. & 4TH AVE.



BENCH MARK (MEAN SEA LEVEL DATUM)
B.M. = NWBP 5TH AVE. & WALNUT AVE.
EL. = 288.441

REFERENCES:
GATE BOOK PAGE G-19
SEWER: 508-12-L, 1163-L
GAS: BOOK 2, SHTS. 250 & 291
TELEPHONE: SHTS. C.O.3 & C.O.4
IMPROVEMENTS: 1163-L
SURVEY NOTES: 210-1719/3-20-85/KELLEY

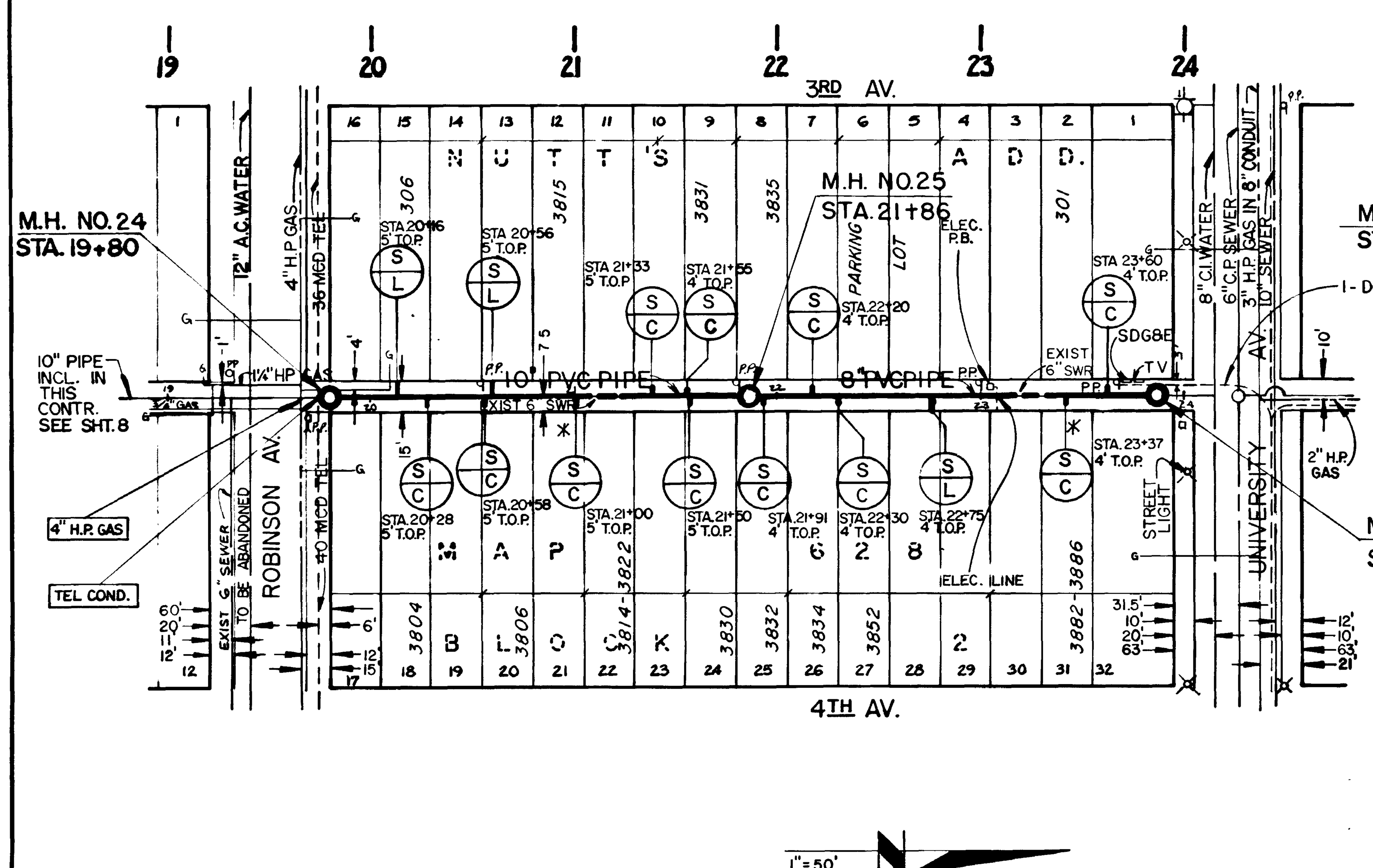
RETIREMENTS:
408' 6" CONC.

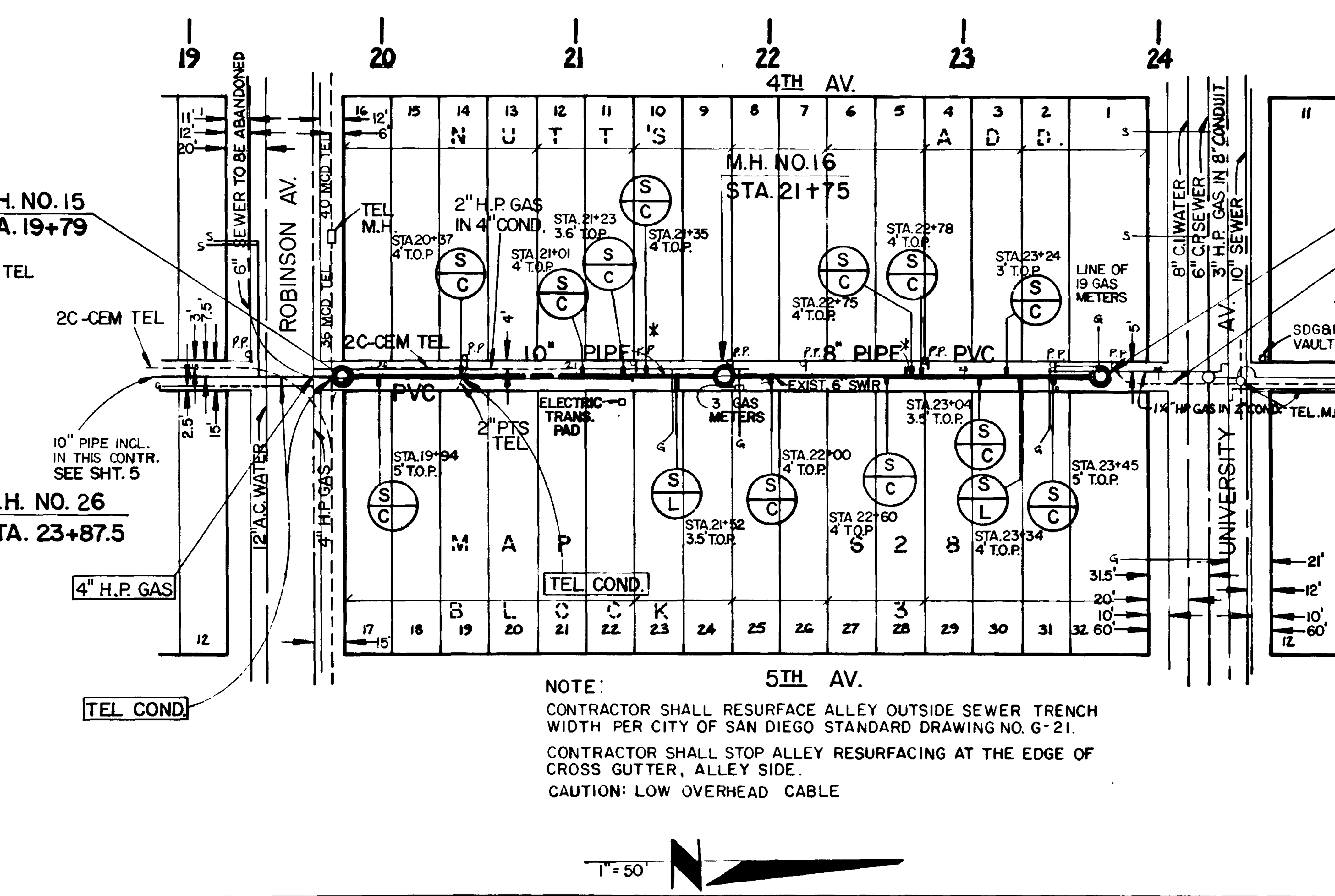
SCALE:
1" = 5' VERT
1" = 50' HORIZ

BENCH MARK (MEAN SEA LEVEL DATUM)
B.M. = SWBP 5TH AVE. & WALNUT AVE.
EL. = 290.679

REFERENCES:
GATE BOOK PAGE G-19
SEWER: 508-12-L, 1167-1-L
GAS: BOOK 2, SHT. 255
TELEPHONE: SHTS. C.O.3 & C.O.4
IMPROVEMENTS: 576-B
SURVEY NOTES: 210-1719/3-22-85/KELLEY

RETIREMENTS:
391' 6" CONC. 1903





NOTE:
CONTRACTOR SHALL RESURFACE ALLEY OUTSIDE SEWER TRENCH WIDTH PER CITY OF SAN DIEGO STANDARD DRAWING NO. G-21.
CONTRACTOR SHALL STOP ALLEY RESURFACING AT THE EDGE OF CROSS GUTTER, ALLEY SIDE.
CAUTION: LOW OVERHEAD CABLE

SEWER AND WATER GROUP 69
NUTT'S ADD. BLOCKS 2 & 3
ROBINSON AVE. TO UNIVERSITY AVE.

CITY OF SAN DIEGO, CALIFORNIA
UTILITIES DEPARTMENT
SHEET 7 OF 31 SHEETS

E.W.O. 147205
U.W.O. 67631

UTILITIES DIRECTOR — DATE 6/4/85
ENGINEERING SUPERINTENDENT
DESIGN ENGINEER

DESCRIPTION	BY	APPROVED	FILMED
ORIGINAL	MF/FQ		
AS-BUILT PER CITY INSPECTOR		2-16-93	

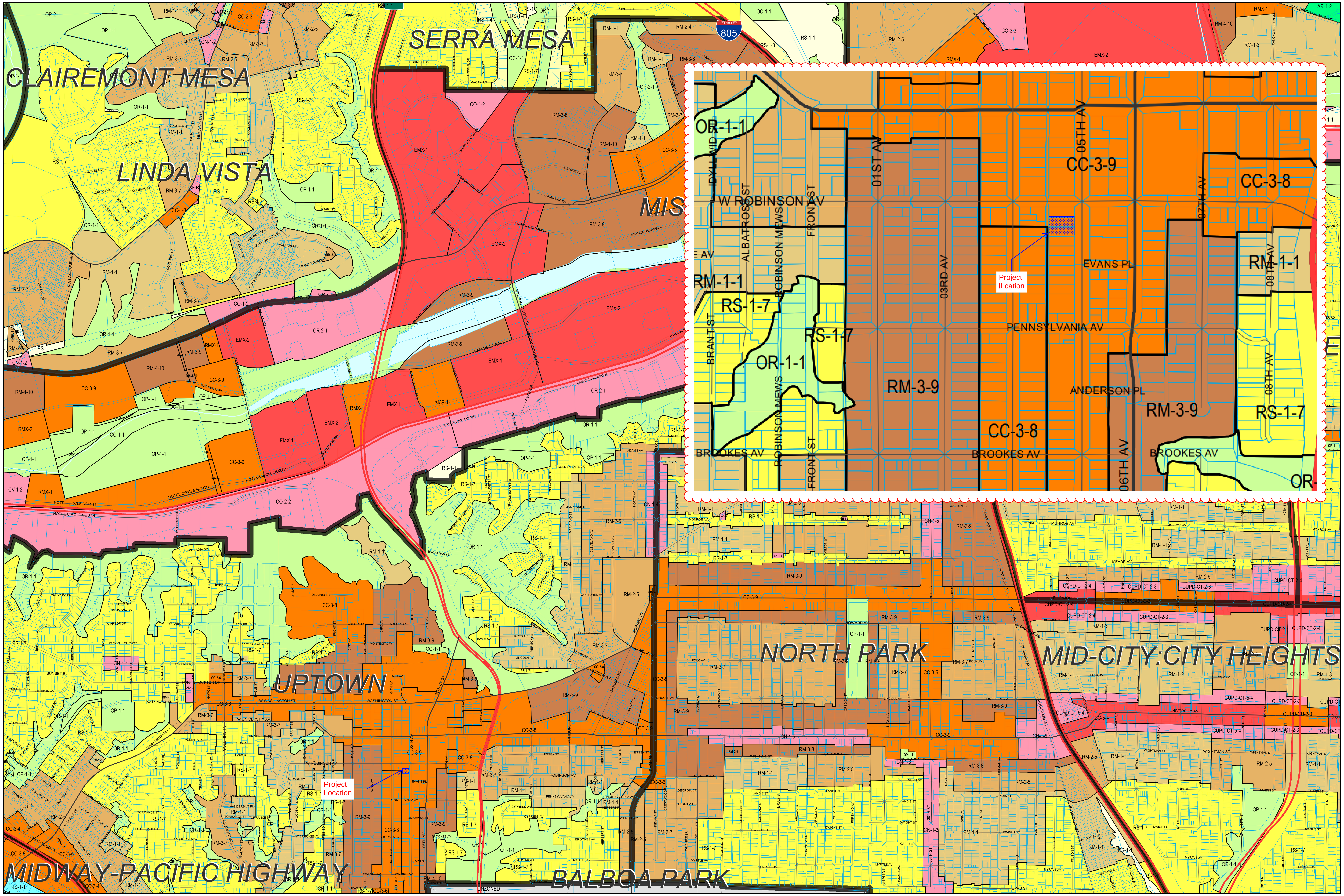
CONTROL CERTIFICATION 212-1719
LAMBERT COORDINATES

CONSTRUCTION RECORD
CONTRACTOR: ARTUKOVICH CONST. CO. — DATE STARTED 1-19-90
INSPECTOR: SAFWAT ABUZAID — DATE COMPLETED 3-9-92
CONNECTIONS BY:

22336-7-D

AS-BUILT

Official Zoning Map



Legend

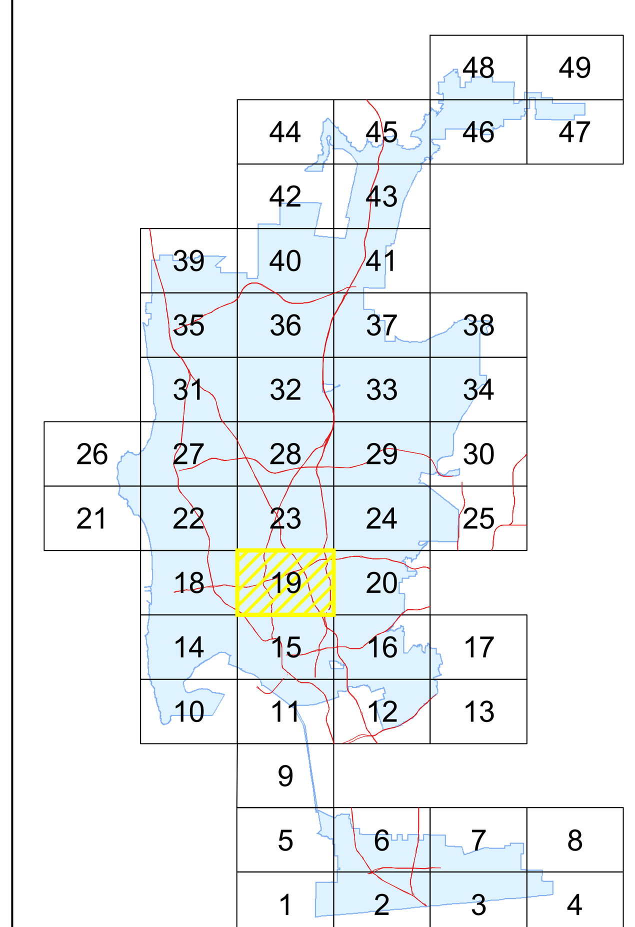
- City of San Diego Boundary
- Community Plan Areas
- Parcels

Zoning

ZONE_NAME

AR-1-2, CC-1-3, CC-2-3, CC-3-4, CC-3-5, CC-3-6, CC-3-7, CC-3-8, CC-3-9, CC-5-4, CN-1-1, CN-1-2, CN-1-3, CN-1-4, CN-1-5, CO-1-2, CO-2-2, CO-3-3, CR-2-1, CUPD-CT-2-3, CUPD-CT-2-4, CUPD-CT-3-3, CUPD-CT-5-4, CUPD-CU-2-3, CUPD-CU-2-4, CUPD-CU-3-3, CV-1-2, EMX-1, EMX-2, IL-2-1, IS-1-1, OC-1-1, OF-1-1, OP-1-1, OP-2-1, OR-1-1, RM-1-1, RM-1-2, RM-1-3, RM-2-4, RM-2-5, RM-3-7, RM-3-8, RM-3-9, RM-4-10, RMX-1, RMX-2, RS-1-1, RS-1-14, RS-1-3, RS-1-4, RS-1-7, UNZONED

Index Map



SanGIS Basemap Accuracy

SanGIS Land (Lot) basemap data for the City of San Diego tested 20.7' horizontal accuracy at the 95% confidence level.

This data meets the ASPRS Standard for Class 1 Map Accuracy at a scale of 1:12,000 (1"=1,000').

This assessment assumes utilization of the data on a citywide basis. Localized data may exceed or fail to meet this accuracy with errors in excess of 100' possible.

City of San Diego
Development Services Department

0 800 1,600 2,400 Feet

GRID TILE: 19

GRID SCALE: 800

DATE: 2/25/2021 10:28:42 AM

APPENDIX B
Sewer Hydraulic Calculations

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Existing

Table 3 - Existing 8" Sewer Main Hydraulics

Hydraulics of Existing 8" Sewer Main (MH 17-16: STA. 23+70 - STA. 21+75) Reach 1																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line Dus	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
435 University Ave	Commercial	18,450	0.42	12.5	5	3.5	19	87	6992	4.00	1	27968	0.027968	0.043	0.043	8	0.82	0.0902	0.1353
3867 4th Ave	Commercial	5,808	0.13	12.5	2	3.5	6	44	3496	4.00	1	13984	0.013984	0.022	0.065	8	0.82	0.1102	0.1653
3845 4th Ave	Commercial	2,026	0.05	12.5	1	3.5	2	44	3496	4.00	1	13984	0.013984	0.022	0.087	8	0.82	0.1269	0.19035
441 University Ave	Commercial	6,062	0.14	12.5	2	3.5	6	87	6992	3.00	1	20976	0.020976	0.033	0.119	8	0.82	0.1484	0.2226
3880 5th Ave	Commercial	11,652	0.27	12.5	3	3.5	12	131	10488	3.00	1	31464	0.031464	0.049	0.168	8	0.82	0.1766	0.2649
3872 5th Ave	Commercial	2,277	0.05	12.5	1	3.5	2	44	3496	3.00	1	10488	0.010488	0.016	0.184	8	0.82	0.1848	0.2772
3862 5th Ave	Commercial	8,103	0.19	12.5	2	3.5	8	44	3496	3.00	1	10488	0.010488	0.016	0.200	8	0.82	0.1932	0.2898
3858 5th Ave	Commercial	5,588	0.13	12.5	2	3.5	6	87	6992	2.75	1	19228	0.019228	0.030	0.230	8	0.82	0.2075	0.31125
3850 5th Ave	Commercial	4,120	0.09	12.5	1	3.5	4	87	6992	2.75	1	19228	0.019228	0.030	0.260	8	0.82	0.2211	0.33165
3838 5th Ave	Commercial	6,657	0.15	12.5	2	3.5	7	44	3496	2.75	1	9614	0.009614	0.015	0.275	8	0.82	0.228	0.342
Cumulative		70,743	1.62		20		71	699	55936	2.75		**177422**	**0.177**	**0.275**	**0.275**			**0.228**	**0.342**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 2.61 ft/s

Existing

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 16-15: STA. 21+75 - STA. 19+79) Reach 2																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line DUs	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1	Commercial	70,743	1.62	12.5	20	3.5	71	699	55936	2.75	1	177422	0.177	0.275	0.275	8	0.82	0.228	0.342
3833 4th Ave	Commercial	3,322	0.08	12.5	1	3.5	3	44	3496	2.75	1	9614	0.009614	0.015	0.290	10	0.5	0.2443	0.29316
3821 4th Ave	Commercial	5,140	0.12	12.5	1	3.5	5	44	3496	2.75	1	9614	0.009614	0.015	0.305	10	0.5	0.2507	0.30084
420 Robinson Ave	Commercial	6,468	0.15	12.5	2	3.5	6	44	3496	2.75	1	9614	0.009614	0.015	0.320	10	0.5	0.257	0.3084
3828 5th Ave	Commercial	8,744	0.20	12.5	3	3.5	9	87	6992	2.60	1	18179	0.018179	0.028	0.348	10	0.5	0.2687	0.32244
3800 5th Ave	Commercial	12,284	0.28	12.5	4	3.5	12	87	6992	2.50	1	17480	0.01748	0.027	0.375	10	0.5	0.279	0.3348
Cumulative		106,701	2.45		31		107	1005	80408	2.50		**241923**	**0.242**	**0.375**	**0.375**			**0.279**	**0.3348**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 2.34 ft/s

Existing

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 15-14: STA. 19+79 - STA. 16+50) Reach 3																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line D.U.'s	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1-2	Commercial	106,701	2.45	12.5	31	3.5	107	1005	80408	2.50	1	241923	0.242	0.375	0.375	10	0.5	0.2709	0.3348
419 Robinson Ave	Commercial	2,355	0.05	12.5	1	3.5	2	44	3496	2.50	1	8740	0.00874	0.014	0.389	10	0.56	0.2762	0.33144
3795 4th Ave	Commercial	969	0.02	12.5	0	3.5	1	44	3496	2.47	1	8635	0.008635	0.013	0.402	10	0.56	0.2813	0.33756
3787 4th Ave	Commercial	3,930	0.09	12.5	1	3.5	4	87	6992	2.45	1	17130	0.01713	0.027	0.428	10	0.56	0.2906	0.34872
3785 4th Ave	Commercial	2,808	0.06	12.5	1	3.5	3	44	3496	2.43	1	8495	0.008495	0.013	0.442	10	0.56	0.2956	0.35472
3775 4th Ave	Residential	8,374	0.19	109	21	1.8	38	38	3017	2.43	1	7332	0.007332	0.011	0.453	10	0.56	0.2996	0.35952
3765 4th Ave	Residential	5,643	0.13	109	14	1.8	25	25	2033	2.43	1	4941	0.004941	0.008	0.461	10	0.56	0.3024	0.36288
3757-3763 4th Ave	Residential	3,792	0.09	109	9	1.8	17	17	1366	2.40	1	3279	0.003279	0.005	0.466	10	0.56	0.3042	0.36504
3796 5th Ave	Commercial	6,204	0.14	12.5	2	3.5	6	44	3496	2.40	1	8390	0.00839	0.013	0.479	10	0.56	0.308	0.37008
3774 5th Ave	*Residential	3,906	0.09	134	12	3.5	42	42	3360	2.40	1	8064	0.008064	0.012	0.491	10	0.56	0.313	0.37524
3774 5th Ave	Commercial	7,008	0.16	12.5	2	3.5	7	87	6992	2.38	1	16641	0.016641	0.026	0.517	10	0.56	0.321	0.38556
3766 5th Ave	Commercial	3,524	0.08	12.5	1	3.5	4	44	3496	2.36	1	8251	0.008251	0.013	0.530	10	0.56	0.326	0.3912
3754 5th Ave	Hotel	17,421	0.40	12.5	5	3.5	17	131	10488	2.34	1	24542	0.024542	0.038	0.568	10	0.56	0.339	0.40632
Cumulative		172,635	3.96		100		274	1652	132137	2.34	1	**366364**	**0.366**	**0.568**	**0.568**			**0.3386**	**0.4063**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 2.73 ft/s

Existing

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 14-13: STA. 16+50 - STA. 13+19.5) Reach 4																			
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line DU's	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1-3	Mixed	172,635	3.96	Varies	100	Varies	274	1652	132137	2.34	1	366364	0.366	0.568	0.568	10	0.56	0.339	0.40632
3749-3755 4th Ave	Residential	3,960	0.09	109	10	1.8	18	18	1427	2.34	1	3339	0.003339	0.005	0.573	10	1.62	0.256	0.30756
3745 4th Ave	Commercial	2,344	0.05	12.5	1	3.5	2	44	3496	2.33	1	8146	0.008146	0.013	0.586	10	1.62	0.259	0.31116
3737 4th Ave	Commercial	1,495	0.03	12.5	0	3.5	2	44	3496	2.32	1	8111	0.008111	0.013	0.598	10	1.62	0.262	0.31452
3725 4th Ave	Residential	7,754	0.18	109	19	1.8	35	35	2794	2.32	1	6482	0.006482	0.010	0.608	10	1.62	0.264	0.31728
3717-3719 4th Ave	Residential	6,286	0.14	109	16	1.8	28	28	2265	2.31	1	5232	0.005232	0.008	0.616	10	1.62	0.266	0.31956
3703 4th Ave	Commercial	1,416	0.03	12.5	0	3.5	1	44	3496	2.3	1	8041	0.008041	0.012	0.629	10	1.62	0.269	0.32256
412-424 Pennsylvania Ave	Residential	2,031	0.05	109	5	1.8	9	9	732	2.3	1	1683	0.001683	0.003	0.631	10	1.62	0.269	0.32316
426-432 Pennsylvania Ave	Residential	2,970	0.07	109	7	1.8	13	13	1070	2.3	1	2461	0.002461	0.004	0.635	10	1.62	0.270	0.32424
3702-3704 5th Ave	Commercial	2,749	0.06	12.5	1	3.5	3	44	3496	2.29	1	8006	0.008006	0.012	0.648	10	1.62	0.273	0.32772
3720 5th Ave	Commercial	11,142	0.26	12.5	3	3.5	11	44	3496	2.29	1	8006	0.008006	0.012	0.660	10	1.62	0.276	0.33096
3740 5th Ave	Commercial	6,685	0.15	12.5	2	3.5	7	44	3496	2.27	1	7936	0.007936	0.012	0.672	10	1.62	0.278	0.33396
3750 5th Ave	Commercial	4,974	0.11	12.5	1	3.5	5	87	6992	2.27	1	15872	0.015872	0.025	0.697	10	1.62	0.284	0.34092
		226,441	5.20		166		408	2105	168393	2.27		**449679**	**0.450**	**0.697**	**0.697**			**0.284**	**0.3409**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 4.25 ft/s

Existing

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 13-12: STA. 13+19.5 - STA. 9+75) Reach 5																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line DU's	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1-4	Mixed	226,441	5.20	Varies	166	Varies	408	2105	168393	2.27	1	449679	0.450	0.697	0.697	10	1.62	0.284	0.34092
3696 5th Ave	Commercial	1771	0.04	12.5	1	3.5	2	44	3496	2.27	1	7936	0.007936	0.012	0.709	10	1.01	0.3254	0.39048
3690 5th Ave	Commercial	1235	0.03	12.5	0	3.5	1	87	6992	2.25	1	15732	0.015732	0.024	0.734	10	1.01	0.3315	0.3978
3646 5th Ave	Commercial	27,870	0.64	12.5	8	3.5	28	44	3496	2.24	1	7831	0.007831	0.012	0.746	10	1.01	0.3345	0.4014
	Residential	139,350	3.20	109	349	1.8	628	628	50212	2.14	1	107454	0.107454	0.167	0.912	10	1.01	0.3736	0.44832
425 Pennsylvania Ave	Residential	3,644	0.08	109	9	1.8	16	16	1313	2.14	1	2810	0.00281	0.004	0.917	10	1.01	0.3748	0.44976
3687 4th Ave	Residential	84,276	1.93	109	211	1.8	380	380	30367	2.10	1	63771	0.063771	0.099	1.016	10	1.01	0.3975	0.477
3659 4th Ave	Residential	5,536	0.13	109	14	1.8	25	25	1995	2.10	1	4189	0.004189	0.006	1.022	10	1.01	0.3989	0.47868
3651 4th Ave	Commercial	7,752	0.18	12.5	2	3.5	8	131	10488	2.10	1	22025	0.022025	0.034	1.056	10	1.01	0.4065	0.4878
		497,875	11.43		760		1496	3459	276752			**681427**	**0.681**	**1.056**	**1.056**			**0.4065**	**0.4878**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 4.00 ft/s

SEWER STUDY SUMMARY

EXISTING

SHEET 1 OF 1
DATE: ______
REFER TO PLAN SHEET C400

FOR: ______
BY: ______

WBS NO. ______

Line	From	To	Population Per D.U.'s	In-Line D.U.'s	Population Served		Sewage Per Capita Per Day (gpd)	Average Dry Weather Flow	Dry Weather Peaking Factor (1)	Peak Dry Weather Flow	Wet Weather Peaking Factor (2)	Peak Wet Weather Flow (Design Flow)		Line Diameter (D) (in)	Design Slope (%)	dn (ft)	dn/D	Velocity (ft/s)	Remarks
					In-Line	Cumulative Total						mgd	cfs						
1	MH 17	16	3.5	20	71	699	177,442	55,936	2.75	177,442	1	0.177	0.275	8	0.82	0.228	0.342	2.61	
2	MH 16	15	3.5	31	107	1,005	241,923	80,408	2.50	241,923	1	0.242	0.375	10	0.5	0.279	0.335	2.34	
3	MH 15	14	3.5	100	274	1,652	366,364	132,137	2.34	336,364	1	0.366	0.568	10	0.56	0.339	0.406	2.73	
4	MH 14	13	3.5	166	408	2,105	449,679	168,393	2.27	449,679	1	0.450	0.697	10	1.62	0.284	0.341	4.25	
5	MH 13	12	3.5	760	1,496	3,459	681,427	276,752	2.10	681,427	1	0.681	1.056	10	1.01	0.407	0.488	4.00	

Note 1: Sewer Design Guide, Refer to Subsection 1.3.2.2 for definition of Dry Weather Peaking Factor.
Note 2: Sewer Design Guide, Refer to Subsection 1.3.2.2 for definition of Wet Weather Peaking Factor.

SEWER STUDY SUMMARY
FIGURE 1-2

Existing Reach 1 8" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.82000	%
Diameter	8.00	in
Discharge	0.2750	cfs

Results

Normal Depth	0.2280	ft
Flow Area	0.11	ft²
Wetted Perimeter	0.83	ft
Hydraulic Radius	0.1267	ft
Top Width	0.63	ft
Critical Depth	0.24	ft
Percent Full	34.2	%
Critical Slope	0.00649	ft/ft
Velocity	2.61	ft/s
Velocity Head	0.11	ft
Specific Energy	0.33	ft
Froude Number	1.13	
Maximum Discharge	1.18	ft³/s
Discharge Full	1.09	ft³/s
Slope Full	0.00052	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	34.20	%
Downstream Velocity	Infinity	ft/s

Existing Reach 1 8" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.2280	ft
Critical Depth	0.24	ft
Channel Slope	0.82000	%
Critical Slope	0.00649	ft/ft

Existing Reach 2 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.50000	%
Diameter	10.00	in
Discharge	0.3750	cfs

Results

Normal Depth	0.2790	ft
Flow Area	0.16	ft²
Wetted Perimeter	1.03	ft
Hydraulic Radius	0.1557	ft
Top Width	0.79	ft
Critical Depth	0.27	ft
Percent Full	33.5	%
Critical Slope	0.00597	ft/ft
Velocity	2.34	ft/s
Velocity Head	0.09	ft
Specific Energy	0.36	ft
Froude Number	0.92	
Maximum Discharge	1.67	ft³/s
Discharge Full	1.55	ft³/s
Slope Full	0.00029	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	33.48	%
Downstream Velocity	Infinity	ft/s

Existing Reach 2 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.2790	ft
Critical Depth	0.27	ft
Channel Slope	0.50000	%
Critical Slope	0.00597	ft/ft

Existing Reach 3 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.56000	%
Diameter	10.00	in
Discharge	0.5680	cfs

Results

Normal Depth	0.3386	ft
Flow Area	0.21	ft²
Wetted Perimeter	1.15	ft
Hydraulic Radius	0.1806	ft
Top Width	0.82	ft
Critical Depth	0.33	ft
Percent Full	40.6	%
Critical Slope	0.00610	ft/ft
Velocity	2.73	ft/s
Velocity Head	0.12	ft
Specific Energy	0.45	ft
Froude Number	0.95	
Maximum Discharge	1.76	ft³/s
Discharge Full	1.64	ft³/s
Slope Full	0.00067	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	40.64	%
Downstream Velocity	Infinity	ft/s

Existing Reach 3 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.3386	ft
Critical Depth	0.33	ft
Channel Slope	0.56000	%
Critical Slope	0.00610	ft/ft

Existing Reach 4 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.62000	%
Diameter	10.00	in
Discharge	0.6970	cfs

Results

Normal Depth	0.2841	ft
Flow Area	0.16	ft²
Wetted Perimeter	1.04	ft
Hydraulic Radius	0.1579	ft
Top Width	0.79	ft
Critical Depth	0.37	ft
Percent Full	34.1	%
Critical Slope	0.00624	ft/ft
Velocity	4.25	ft/s
Velocity Head	0.28	ft
Specific Energy	0.56	ft
Froude Number	1.64	
Maximum Discharge	3.00	ft³/s
Discharge Full	2.79	ft³/s
Slope Full	0.00101	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	34.09	%
Downstream Velocity	Infinity	ft/s

Existing Reach 4 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.2841	ft
Critical Depth	0.37	ft
Channel Slope	1.62000	%
Critical Slope	0.00624	ft/ft

Existing Reach 5 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.01000	%
Diameter	10.00	in
Discharge	1.0560	cfs

Results

Normal Depth	0.4065	ft
Flow Area	0.26	ft²
Wetted Perimeter	1.29	ft
Hydraulic Radius	0.2050	ft
Top Width	0.83	ft
Critical Depth	0.46	ft
Percent Full	48.8	%
Critical Slope	0.00683	ft/ft
Velocity	4.00	ft/s
Velocity Head	0.25	ft
Specific Energy	0.65	ft
Froude Number	1.25	
Maximum Discharge	2.37	ft³/s
Discharge Full	2.20	ft³/s
Slope Full	0.00232	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	48.78	%
Downstream Velocity	Infinity	ft/s

Existing Reach 5 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.4065	ft
Critical Depth	0.46	ft
Channel Slope	1.01000	%
Critical Slope	0.00683	ft/ft

Proposed

Table 3 - Existing 8" Sewer Main Hydraulics

Hydraulics of Existing 8" Sewer Main (MH 17-16: STA. 23+70 - STA. 21+75) Reach 1																			
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line Dus	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
435 University Ave	Commercial	18,450	0.42	12.5	5	3.5	19	87	6992	4.00	1	27968	0.027968	0.043	0.043	8	0.82	0.0902	0.1353
3867 4th Ave	Commercial	5,808	0.13	12.5	2	3.5	6	44	3496	4.00	1	13984	0.013984	0.022	0.065	8	0.82	0.1102	0.1653
3845 4th Ave	Commercial	2,026	0.05	12.5	1	3.5	2	44	3496	4.00	1	13984	0.013984	0.022	0.087	8	0.82	0.1269	0.19035
441 University Ave	Commercial	6,062	0.14	12.5	2	3.5	6	87	6992	3.00	1	20976	0.020976	0.033	0.119	8	0.82	0.1484	0.2226
3880 5th Ave	Commercial	11,652	0.27	12.5	3	3.5	12	131	10488	3.00	1	31464	0.031464	0.049	0.168	8	0.82	0.1766	0.2649
3872 5th Ave	Commercial	2,277	0.05	12.5	1	3.5	2	44	3496	3.00	1	10488	0.010488	0.016	0.184	8	0.82	0.1848	0.2772
3862 5th Ave	Commercial	8,103	0.19	12.5	2	3.5	8	44	3496	3.00	1	10488	0.010488	0.016	0.200	8	0.82	0.1932	0.2898
3858 5th Ave	Commercial	5,588	0.13	12.5	2	3.5	6	87	6992	2.75	1	19228	0.019228	0.030	0.230	8	0.82	0.2075	0.31125
3850 5th Ave	Commercial	4,120	0.09	12.5	1	3.5	4	87	6992	2.75	1	19228	0.019228	0.030	0.260	8	0.82	0.2211	0.33165
3838 5th Ave	Commercial	6,657	0.15	12.5	2	3.5	7	44	3496	2.75	1	9614	0.009614	0.015	0.275	8	0.82	0.228	0.342
Cumulative		70,743	1.62		20		71	699	55936	2.75		**177422**	**0.177**	**0.275**	**0.275**			**0.228**	**0.342**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 2.61 ft/s

Proposed

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 16-15: STA. 21+75 - STA. 19+79) Reach 2																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line DUs	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1	Commercial	70,743	1.62	12.5	20	3.5	71	699	55936	2.75	1	177422	0.177	0.275	0.275	8	0.82	0.228	0.342
3833 4th Ave	Commercial	3,322	0.08	12.5	1	3.5	3	44	3496	2.75	1	9614	0.009614	0.015	0.290	10	0.5	0.2443	0.29316
3821 4th Ave	Commercial	5,140	0.12	12.5	1	3.5	5	44	3496	2.75	1	9614	0.009614	0.015	0.305	10	0.5	0.2507	0.30084
420 Robinson Ave	Commercial	6,468	0.15	12.5	2	3.5	6	44	3496	2.75	1	9614	0.009614	0.015	0.320	10	0.5	0.257	0.3084
3828 5th Ave	Commercial	8,744	0.20	12.5	3	3.5	9	87	6992	2.60	1	18179	0.018179	0.028	0.348	10	0.5	0.2687	0.32244
3800 5th Ave	Commercial	12,284	0.28	12.5	4	3.5	12	87	6992	2.50	1	17480	0.01748	0.027	0.375	10	0.5	0.279	0.3348
Cumulative		106,701	2.45		31		107	1005	80408	2.50		**241923**	**0.242**	**0.375**	**0.375**			**0.279**	**0.3348**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 2.34 ft/s

Proposed

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 15-14: STA. 19+79 - STA. 16+50) Reach 3																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line D.U.'s	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1-2	Commercial	106,701	2.45	12.5	31	3.5	107	1005	80408	2.50	1	241923	0.242	0.375	0.375	10	0.5	0.2709	0.3348
419 Robinson Ave	Commercial	2,355	0.05	12.5	1	3.5	2	44	3496	2.50	1	8740	0.00874	0.014	0.389	10	0.56	0.276	0.33144
3795 4th Ave	Commercial	969	0.02	12.5	0	3.5	1	44	3496	2.47	1	8635	0.008635	0.013	0.402	10	0.56	0.281	0.33756
3787 4th Ave	Commercial	3,930	0.09	12.5	1	3.5	4	87	6992	2.45	1	17130	0.01713	0.027	0.428	10	0.56	0.2906	0.34872
3785 4th Ave	Commercial	2,808	0.06	12.5	1	3.5	3	44	3496	2.43	1	8495	0.008495	0.013	0.442	10	0.56	0.29563	0.354756
3775 4th Ave	Residential	8,374	0.19	109	21	1.8	38	38	3017	2.43	1	7332	0.007332	0.011	0.453	10	0.56	0.2966	0.35592
3765 4th Ave	Residential	5,643	0.13	109	14	1.8	25	25	2033	2.43	1	4941	0.004941	0.008	0.461	10	0.56	0.3024	0.36288
3757-3763 4th Ave	Residential	3,792	0.09	109	9	1.8	17	17	1366	2.40	1	3279	0.003279	0.005	0.466	10	0.56	0.3042	0.36504
3796 5th Ave	Commercial	6,204	0.14	12.5	2	3.5	6	44	3496	2.40	1	8390	0.00839	0.013	0.479	10	0.56	0.308	0.37008
3774 5th Ave (proposed project)	*Residential	64,008	1.47	44	65	3.5	155	See Proposed Sewage Gen	18,200	2.36	1	42952	0.042952	0.067	0.545	10	0.56	0.331	0.3972
3774 5th Ave (proposed project)	Commercial	3,947	0.09	12.5	-	3.5	44	See Proposed Sewage Gen	3,496	2.34	1	8181	0.008181	0.013	0.558	10	0.56	0.3353	0.40236
3766 5th Ave	Commercial	3,524	0.08	12.5	1	3.5	4	44	3496	2.34	1	8181	0.008181	0.013	0.571	10	0.56	0.340	0.40752
3754 5th Ave	Hotel	17,421	0.40	12.5	5	3.5	17	131	10488	2.32	1	24332	0.024332	0.038	0.608	10	0.56	0.351	0.42156
Cumulative		229,676	5.27		151		423	1794	143481	2.32	1	**392512**	**0.393**	**0.608**	**0.608**			**0.351**	**0.4216**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 2.78 ft/s

Proposed

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 14-13: STA. 16+50 - STA. 13+19.5) Reach 4																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line DU's	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1-3	Mixed	229,676	5.27	Varies	151	Varies	423	1794	143481	2.32	1	392512	0.393	0.608	0.608	10	0.56	0.351	0.42156
3749-3755 4th Ave	Residential	3,960	0.09	109	10	1.8	18	18	1427	2.32	1	3310	0.00331	0.005	0.614	10	1.62	0.266	0.31896
3745 4th Ave	Commercial	2,344	0.05	12.5	1	3.5	2	44	3496	2.31	1	8076	0.008076	0.013	0.626	10	1.62	0.269	0.32232
3737 4th Ave	Commercial	1,495	0.03	12.5	0	3.5	2	44	3496	2.29	1	8006	0.008006	0.012	0.638	10	1.62	0.271	0.32508
3725 4th Ave	Residential	7,754	0.18	109	19	1.8	35	35	2794	2.29	1	6398	0.006398	0.010	0.648	10	1.62	0.273	0.32772
3717-3719 4th Ave	Residential	6,286	0.14	109	16	1.8	28	28	2265	2.29	1	5187	0.005187	0.008	0.656	10	1.62	0.275	0.33
3703 4th Ave	Commercial	1,416	0.03	12.5	0	3.5	1	44	3496	2.27	1	7936	0.007936	0.012	0.669	10	1.62	0.277	0.3324
412-424 Pennsylvania Ave	Residential	2,031	0.05	109	5	1.8	9	9	732	2.27	1	1661	0.001661	0.003	0.671	10	1.62	0.278	0.33372
426-432 Pennsylvania Ave	Residential	2,970	0.07	109	7	1.8	13	13	1070	2.27	1	2429	0.002429	0.004	0.675	10	1.62	0.279	0.3348
3702-3704 5th Ave	Commercial	2,749	0.06	12.5	1	3.5	3	44	3496	2.27	1	7936	0.007936	0.012	0.687	10	1.62	0.282	0.3384
3720 5th Ave	Commercial	11,142	0.26	12.5	3	3.5	11	44	3496	2.27	1	7936	0.007936	0.012	0.700	10	1.62	0.285	0.34164
3740 5th Ave	Commercial	6,685	0.15	12.5	2	3.5	7	44	3496	2.25	1	7866	0.007866	0.012	0.712	10	1.62	0.287	0.34476
3750 5th Ave	Commercial	4,974	0.11	12.5	1	3.5	5	87	6992	2.24	1	15662	0.015662	0.024	0.736	10	1.62	0.292	0.35076
		283,482	6.51		217		558	2247	179737			**474916**	**0.475**	**0.736**	**0.736**			**0.292**	**0.3508**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 4.31 ft/s

Proposed

Table 3 - Existing 10" Sewer Main Hydraulics

Hydraulics of Existing 10 " Sewer Main (MH 13-12: STA. 13+19.5 - STA. 9+75) Reach 5																		
Address	Zone	Area (sf)	Area (Acres)	Density Converstion (Table 1-1)	In-Line DU's	Population Factor (People/Unit)	In-Line Population Served	Equivalent Population Served	Avg. Dry Weather Flow (gpd)	Dry Weather Peaking Factor	Wet Weather Peaking Factor	Peak Wet Weather Flow (Design Flow)			Cumulative PWWF	Line Size D (in)	Design Slope (%)	Normal Depth dn (ft)	dn/D
												gpd	mgd	cfs					
Reach 1-4	Mixed	283,482	6.51	Varies	217	Varies	558	2247	179737	2.24	1	474916	0.475	0.736	0.736	10	1.62	0.292	0.35076
3696 5th Ave	Commercial	1771	0.04	12.5	1	3.5	2	44	3496	2.24	1	7831	0.007831	0.012	0.748	10	1.01	0.335	0.402
3690 5th Ave	Commercial	1235	0.03	12.5	0	3.5	1	87	6992	2.22	1	15522	0.015522	0.024	0.772	10	1.01	0.3409	0.40908
3646 5th Ave	Commercial	27,870	0.64	12.5	8	3.5	28	44	3496	2.22	1	7761	0.007761	0.012	0.784	10	1.01	0.3434	0.41208
	Residential	139,350	3.20	109	349	1.8	628	628	50212	2.13	1	106952	0.106952	0.166	0.950	10	1.01	0.3824	0.45888
425 Pennsylvania Ave	Residential	3,644	0.08	109	9	1.8	16	16	1313	2.13	1	2797	0.002797	0.004	0.954	10	1.01	0.3834	0.46008
3687 4th Ave	Residential	84,276	1.93	109	211	1.8	380	380	30367	2.10	1	63771	0.063771	0.099	1.053	10	1.01	0.4058	0.48696
3659 4th Ave	Residential	5,536	0.13	109	14	1.8	25	25	1995	2.10	1	4189	0.004189	0.006	1.060	10	1.01	0.4074	0.48888
3651 4th Ave	Commercial	7,752	0.18	12.5	2	3.5	8	131	10488	2.09	1	21920	0.02192	0.034	1.094	10	1.01	0.415	0.498
		554,916	12.74		811		1645	3601	288096	2.09		**705659**	**0.706**	**1.094**	**1.094**			**0.415**	**0.498**

* Value has been assumed to use factors from Table 1-1 for RM-4-10 based on use.

** Value has been estimated

Segment Velocity = 4.03 ft/s

SEWER STUDY SUMMARY

PROPOSED

SHEET 1 OF 1
DATE: ______
REFER TO PLAN SHEET C400

FOR: ______
BY: ______

WBS NO. ______

Line	From	To	Population Per D.U.'s	In-Line D.U.'s	Population Served		Sewage Per Capita Per Day (gpd)	Average Dry Weather Flow	Dry Weather Peaking Factor (1)	Peak Dry Weather Flow	Wet Weather Peaking Factor (2)	Peak Wet Weather Flow (Design Flow)		Line Diameter (D) (in)	Design Slope (%)	dn (ft)	dn/D	Velocity (ft/s)	Remarks
					In-Line	Cumulative Total						mgd	cfs						
1	MH 17	16	3.5	20	71	699	177,442	55,936	2.75	177,442	1	0.177	0.275	8	0.82	0.228	0.342	2.61	
2	MH 16	15	3.5	31	107	1,005	241,923	80,408	2.50	241,923	1	0.242	0.375	10	0.5	0.279	0.335	2.34	
3	MH 15	14	3.5	151	423	1,794	392,512	143,481	2.32	392,512	1	0.393	0.608	10	0.56	0.351	0.422	2.78	
4	MH 14	13	3.5	271	558	2,247	474,916	179,737	2.24	474,916	1	0.475	0.736	10	1.62	0.292	0.351	4.31	
5	MH 13	12	3.5	811	1,645	3,601	705,659	288,096	2.09	705,659	1	0.706	1.094	10	1.01	0.415	0.498	4.03	

Note 1: Sewer Design Guide, Refer to Subsection 1.3.2.2 for definition of Dry Weather Peaking Factor.
Note 2: Sewer Design Guide, Refer to Subsection 1.3.2.2 for definition of Wet Weather Peaking Factor.

SEWER STUDY SUMMARY
FIGURE 1-2

Proposed Reach 1 8" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.82000	%
Diameter	8.00	in
Discharge	0.2750	cfs

Results

Normal Depth	0.2280	ft
Flow Area	0.11	ft²
Wetted Perimeter	0.83	ft
Hydraulic Radius	0.1267	ft
Top Width	0.63	ft
Critical Depth	0.24	ft
Percent Full	34.2	%
Critical Slope	0.00649	ft/ft
Velocity	2.61	ft/s
Velocity Head	0.11	ft
Specific Energy	0.33	ft
Froude Number	1.13	
Maximum Discharge	1.18	ft³/s
Discharge Full	1.09	ft³/s
Slope Full	0.00052	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	34.20	%
Downstream Velocity	Infinity	ft/s

Proposed Reach 1 8" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.2280	ft
Critical Depth	0.24	ft
Channel Slope	0.82000	%
Critical Slope	0.00649	ft/ft

Proposed Reach 2 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.50000	%
Diameter	10.00	in
Discharge	0.3750	cfs

Results

Normal Depth	0.2790	ft
Flow Area	0.16	ft²
Wetted Perimeter	1.03	ft
Hydraulic Radius	0.1557	ft
Top Width	0.79	ft
Critical Depth	0.27	ft
Percent Full	33.5	%
Critical Slope	0.00597	ft/ft
Velocity	2.34	ft/s
Velocity Head	0.09	ft
Specific Energy	0.36	ft
Froude Number	0.92	
Maximum Discharge	1.67	ft³/s
Discharge Full	1.55	ft³/s
Slope Full	0.00029	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	33.48	%
Downstream Velocity	Infinity	ft/s

Proposed Reach 2 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.2790	ft
Critical Depth	0.27	ft
Channel Slope	0.50000	%
Critical Slope	0.00597	ft/ft

Proposed Reach 3 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.56000	%
Diameter	10.00	in
Discharge	0.6080	cfs

Results

Normal Depth	0.3513	ft
Flow Area	0.22	ft^2
Wetted Perimeter	1.18	ft
Hydraulic Radius	0.1855	ft
Top Width	0.82	ft
Critical Depth	0.34	ft
Percent Full	42.2	%
Critical Slope	0.00614	ft/ft
Velocity	2.78	ft/s
Velocity Head	0.12	ft
Specific Energy	0.47	ft
Froude Number	0.95	
Maximum Discharge	1.76	ft^3/s
Discharge Full	1.64	ft^3/s
Slope Full	0.00077	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	42.15	%
Downstream Velocity	Infinity	ft/s

Proposed Reach 3 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.3513	ft
Critical Depth	0.34	ft
Channel Slope	0.56000	%
Critical Slope	0.00614	ft/ft

Proposed Reach 4 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.62000	%
Diameter	10.00	in
Discharge	0.7360	cfs

Results

Normal Depth	0.2923	ft
Flow Area	0.17	ft²
Wetted Perimeter	1.06	ft
Hydraulic Radius	0.1615	ft
Top Width	0.80	ft
Critical Depth	0.38	ft
Percent Full	35.1	%
Critical Slope	0.00629	ft/ft
Velocity	4.31	ft/s
Velocity Head	0.29	ft
Specific Energy	0.58	ft
Froude Number	1.64	
Maximum Discharge	3.00	ft³/s
Discharge Full	2.79	ft³/s
Slope Full	0.00113	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	35.08	%
Downstream Velocity	Infinity	ft/s

Proposed Reach 4 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.2923	ft
Critical Depth	0.38	ft
Channel Slope	1.62000	%
Critical Slope	0.00629	ft/ft

Proposed Reach 5 10" PVC Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.01000	%
Diameter	10.00	in
Discharge	1.0940	cfs

Results

Normal Depth	0.4150	ft
Flow Area	0.27	ft²
Wetted Perimeter	1.31	ft
Hydraulic Radius	0.2078	ft
Top Width	0.83	ft
Critical Depth	0.47	ft
Percent Full	49.8	%
Critical Slope	0.00691	ft/ft
Velocity	4.03	ft/s
Velocity Head	0.25	ft
Specific Energy	0.67	ft
Froude Number	1.25	
Maximum Discharge	2.37	ft³/s
Discharge Full	2.20	ft³/s
Slope Full	0.00249	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.0000	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0000	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	49.80	%
Downstream Velocity	Infinity	ft/s

Proposed Reach 5 10" PVC Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.4150	ft
Critical Depth	0.47	ft
Channel Slope	1.01000	%
Critical Slope	0.00691	ft/ft

APPENDIX C
Reference Tables and Calculations

319 Main Street
El Segundo, California 90245
t: 213/239 9700
info@labibse.com
www.labibse.com

The final approved sewer study shall also be submitted electronically in PDF format.

For new development, the planning study must be approved prior to approval of the tentative map. The study shall include all items listed in the minimum intake standards for sewer studies and subsequent reviews shall include an explanation for each review comment.

1.3.1.1 **Capacity**

For new development and/or redevelopment, the planning study shall address the capacity of all sewer collection and trunk sewer systems that will be impacted downstream of the new development and/or redevelopment and shall demonstrate that sewer capacity is available in those systems to accommodate the new development and/or redevelopment (refer to Section 1.7). Authorization and approval to impact any downstream sewer system must be obtained from the reviewing Senior Civil Engineer. If such downstream sewer system has already been identified as critical or sub-critical in a monitoring report, the Senior Civil Engineer may require additional field monitoring to determine if adequate capacity is available.

For an existing development and/or redevelopment, the planning study shall address the existing capacity within the existing sewer collection system, and identify all existing facilities whose capacity will be exceeded by projected sewage flows.

Where available capacity will be exceeded, the planning study shall propose upsizing of sewer facilities in accordance with Subsection 1.3.3.

Where applicable, the DESIGN ENGINEER shall incorporate into the community's existing master sewer plan, including zoning changes and other specific plans, the proposed sewer system amendments resulting from the drainage basin evaluation.

1.3.1.2 **Drainage Basin**

The planning study shall address the sewage generating potential of the entire drainage basin where the development is located. It shall also include current topographic maps of the entire drainage basin and any and all adjacent new developments for which a planning study has not yet been submitted and/or approved. The maps shall demonstrate that no adjacent development, including potential and existing pumped lands outside of the drainage basin and any lands outside of the incorporated boundaries of the City of San Diego with potential to be served but where no current master sewerage plan exists, will be precluded from obtaining sewer service. The planning study shall also show all proposed sewer system alignments (superimposed on planned street alignments) and all potential points of entry of sewage from surrounding lands.

1.3.1.3 **Depth of Mains**

The planning study shall clearly identify all existing and/or proposed facilities which will exceed standard depths for sewer mains as defined in Subsection 2.2.1.5. In cases where proposed sewers will exceed 15 feet in depth, a request for design deviation (ATTACHMENT 2) must be submitted to the Water and Sewer Development Review Senior Civil Engineer with the Sewer Planning Study. A design deviation will only be approved in exceptional cases and when adequate justification is provided. Mains more than 20 feet deep shall also require approval from the Wastewater Collection Division Senior Civil Engineer.

1.3.1.4 **Existing Studies**

The City of San Diego maintains an extensive library of sewer planning studies which were prepared for lands throughout the City. These studies are available for review at the Water and Sewer Development Section, Public Utilities Department. All studies are catalogued by subdivision or trunk sewer name. Logs of sewer flow study analyses for recently monitored trunk sewers and a map of sewers which meet the Regional Water Quality Control Board (RWQCB) criteria for being critical or sub-critical may also be viewed. In addition, information regarding proposed CIP projects within the vicinity of a given project may be requested. In many cases, an addendum or reference to one of the existing planning studies may be acceptable in lieu of an independent study. Concurrent with the preparation of planning studies for sewers proposed to connect to existing canyon sewer mains, a study of flow redirection per Council Policy 400-13 and a cost-benefit analysis per Council Policy 400-14 shall be prepared (Refer to ATTACHMENT 1). An existing analysis of redirection of flows and a cost-benefit analysis, as required by Council Policies 400-13 and 400-14 respectively, may be available for reference for various existing canyon sewers.

1.3.2 **Flow Estimation**

1.3.2.1 **Land Use**

Present or future allowable land use, whichever results in higher equivalent population, shall be used to generate potential sewage flows.

1.3.2.2 **Flow Determination**

Flow definitions and calculation procedures are listed below. All calculations shall be tabulated for each sewer main section (manhole to manhole) in the format shown on Figure 1-2.

Equivalent Population: The equivalent population shall be calculated from zoning information (Ref. Section 1.6). For major new facilities such as high rise apartment buildings, flow rates (assuming one lateral) shall be checked based on the most current, adopted edition of the Uniform Plumbing Code. The most conservative flow rate shall govern.

Daily Per Capita Sewer Flow: The sewer flow for the equivalent population shall be 80 gallons per capita per day (gpcd).

Average Dry Weather Flow (ADWF): Equivalent populations shall be used to calculate the average dry weather flow. The average dry weather flow for each sewer main reach (manhole to manhole) shall be determined by multiplying the total accumulated equivalent population contributing to that reach by 80 gallons per capita per day:

Average Dry Weather Flow = (80 gpcpd) x (Equivalent Population)

Peaking Factor for Dry Weather Flow (PFDWF): The peaking factor is the ratio of peak dry weather flow to average dry weather flow. It is dependent upon the equivalent population within a tributary area. The tributary area is the area upstream of, and including, the current reach for the total flow in each reach of pipe. Figure 1-1, consisting of the table prepared by Holmes and Narver in 1960, shall be used to determine peaking factors for each tributary area. In no instance shall the dry weather flow peaking factor be less than 1.5.

Peak Dry Weather Flow (PDWF): The peak dry weather flow for each sewer main reach shall be determined by multiplying the average dry weather flow by the appropriate peaking factor (Note that peak dry weather flows are not algebraically cumulative as routed through the sewer system, i.e. the peak dry weather flow at any point shall be based on the equivalent population in the basin to that point (Ref. Figure 1-2).

Peak Dry Weather Flow = (Average Dry Weather Flow) x (Dry Weather Flow Peaking Factor)

Peaking Factor for Wet Weather Flow (PFWWF): The peaking factor for wet weather flow is the ratio of peak wet weather flow to peak dry weather flow. It is basin-specific and shall be based on essential information available at the time of the planning study. Information such as historical rainfall/sewage flow data, land use, soil data, pipe/manhole age, materials and conditions, groundwater elevations (post development), inflow and infiltration (I/I) studies, size, slope and densities of the drainage basin, etc., should be utilized in the wet weather analysis to estimate the peaking factor for wet weather. Upward adjustments shall be made in areas with expected high inflow and infiltration (i.e. high ground water or in areas with lush landscaping schemes). Flow meters are installed throughout the City's sewer system. Flow data collected from these meters are available upon request. The objective of this analysis is to quantify the magnitude of peak wet weather flow with a 10-year return period on a statistical basis.

The Senior Civil Engineer overseeing the preparation of the planning study shall coordinate with the City Sewer Modeling Group for approval of the peaking factors to be used for design.

<u>Peak Wet Weather Flow (PWWF)</u>: The peak wet weather flow (or design flow) for a gravity sewer main reach shall be determined by multiplying the peak dry weather flow (ref. Figure 1-2) by the appropriate wet weather peaking factor. The peak wet weather flow is the design flow for a gravity sewer main. It is determined at any point in the system based on the associated upstream average dry weather flow in the basis to that point times the peaking factor for wet weather.

Peak Wet Weather Flow = (Peak Dry Weather Flow) x (Wet Weather Peaking Factor)

1.3.3 Pipe Sizing Criteria

1.3.3.1 Hydraulic Requirements

Manning's formula for open-channel flows shall be used to calculate flows in gravity sewer mains. Manning's coefficient of roughness "n" shall be assumed to be 0.013 for all types of sewer pipe. Sewer grades shall be designed for velocities of 3 to 5 feet per second (fps) where possible. This is extremely important in areas where peak flow will not be achieved for many years. The minimum allowable velocity is 2 fps at calculated peak dry weather flow, excluding infiltration. Sewer mains that do not sustain 2 fps at peak flows shall be designed to have a minimum slope of 1 percent. Additional slope may be required by the Senior Civil Engineer where fill of varied depth is placed below the pipe in order to provide adequate slope after expected settlement occurs. The maximum allowable velocity shall be 10 fps and shall be avoided by adjusting slopes, by increasing the pipe diameter, or by utilizing a vertical curve transition to lower velocities per subsections 2.2.4 and 2.2.9.4. If the Senior Civil Engineer approves a velocity greater than 10 fps, the pipe shall be upgraded to SDR 18 PVC (standard dimension ratio polyvinyl chloride), concrete-encased VC (vitrified clay), or PVC sheet-lined reinforced concrete pipe.

1.3.3.2 Slope

Slope shall be calculated as the difference in elevation at each end of the pipe divided by the horizontal length of the pipe, and shall be a constant value between manholes.

1.3.3.3 Ratio of Depth of Flow to Pipe Diameter (d_n/D)

New sewer mains 15 inches and smaller in diameter shall be sized to carry the projected peak wet weather flow at a depth not greater than half of the inside diameter of the pipe (d_n/D not to exceed 0.5). New sewer mains 18 inches and larger shall be sized to carry the projected peak wet weather flow at a depth of flow not greater than 3/4 of the inside diameter of the pipe (d_n/D not to exceed 0.75).

1.3.3.4 Minimum Pipe Sizes

The size of a sewer pipe is defined as the inside diameter of the pipe. Sewer mains shall be a minimum of 8 inches in diameter in residential areas, and a minimum of 10 inches in commercial, industrial, and high-rise building areas.

1.3.4 Sewer Study Exhibit Criteria

The DESIGN ENGINEER's sewer study exhibits shall be used to evaluate hydraulics and to establish minimum street and easement widths. Therefore, these documents need to reflect depths and separation of mains from other utilities and improvements. Refer to the Minimum Intake Standards for Sewer Studies in Subsection 1.8.

1.3.5 Private On-Site Wastewater Treatment and Reuse

Refer to Attachment 6 for permitting guidelines of private on-site wastewater treatment and reuse in the City of San Diego.

1.4 SEPARATION OF MAINS

1.4.1 Horizontal Separation

1.4.1.1 Wet Utilities

The separation of water, sewer, reclaimed water mains, and storm drains shall comply with the *State of California Department of Health Services Criteria for the Separation of Water Mains and Sanitary Sewers*. At least 10 feet of horizontal separation shall be maintained between the nearest outer surfaces of sewer lines and potable water mains. More stringent separation requirements may be necessary if unusual conditions, such as high groundwater levels or large diameter mains, exist (Ref. State of California "Blue Book"). If a horizontal separation of 10 feet or other requirement is not possible, a deviation from standards may be permitted by the City provided the structural integrity of both the pipe and the pipe joints is upgraded in accordance with the *State of California Department of Health Services Criteria for the Separation of Water Mains and Sanitary Sewers - Special Provisions*, and provided it has been reviewed and written approval has been obtained from the California Department of Health Services, Drinking Water Field Operations Branch. This deviation is not applicable for subdivisions, or where sewers are placed in new streets. Lateral connections to sewer mains typically do not meet the upgraded joint requirements for reduced separation. All installations of sewer mains which fail to comply with the basic separation standards must be reviewed and approved by the State of California Department of Health Services. For separation from curbs, see Subsection 2.2.5.2. For separation from structures, see Subsections 2.2.5.8 and 2.2.5.9.

1.4.1.2 Separation for Dry Utility Pipes and Cable Conduits

Other utility pipes, conduits, and cable lines shall be governed by their respective franchise agreement with the City of San Diego. A minimum 10-foot horizontal separation is desirable between sewer mains and any other utility infrastructure. Separations of less than 10 feet must be approved by the Senior Civil Engineer of Water and Sewer Development Section, Public Utilities Department. Additional separation may be required for sewer mains which exceed 10 feet in depth. The DESIGN ENGINEER shall consider the relative depth of adjacent utilities and the stability of the soils where the sewer shall be constructed when designing the separation from other utilities. Refer to San Diego Regional Standard Drawing (SDRSD) M-22 and City of San Diego Drawing SDM-111 for standard locations of utilities in streets.

1.4.2 Vertical Separation

1.4.2.1 Shallow Mains, General

Shallow mains require a special design. Review and written approval is required from the California Department of Health Services, Drinking Water Field Operations Branch for deviations from vertical separation requirements for water and sewer utilities. For mains less than 4 feet deep, special design shall be required for live and dead loads and vertical cyclical deflections which shall include an evaluation to demonstrate zero deflection in the pavement.

1.4.2.2 Parallel Mains

Potable water, reclaimed water, and sewer mains shall be located at various depths below the ground surface, in order of descending water quality. Potable water pipelines shall be located above both reclaimed water pipes and sewer mains, and reclaimed water mains shall be located above sewer mains. A minimum vertical separation of one foot shall be provided between the top and bottom surfaces of the pipes in the same street or easement.

1.4.2.3 Crossing Mains

A minimum vertical separation of 12 inches shall be provided between the top and bottom surfaces of crossing utility conduits and shall comply with the *State of California Department of Health Services Criteria for the Separation of Water Mains and Sanitary Sewers*. Separation measurements shall be taken from the outer most surface of any pipeline protection (i.e. concrete encasement or steel sleeve) which may be installed. Where the vertical separation is less than 12 inches, a request for design deviation (ATTACHMENT 2), with justification, shall be submitted for review. If approved, for pipes 12 inches or less in diameter, a 12-inch sand cushion, or alternatively a minimum 6-inch sand cushion with 1 inch neoprene pad shall be used. Separations of less than 7 inches will not be allowed by the City. For skewed main crossings, see Subsection 2.2.6. Mains crossing large facilities shall evaluate deflection across the span, changes in hydraulics due to change of slope, shear forces, and special joint designs to account for pipe movement.

1.5 PUMP STATION PLANNING CRITERIA

If at all possible, the construction of a sewer pump station is to be avoided. However, in cases where constraints such as topography and environmentally sensitive habitat dictate, a pump station may be necessary (Ref. Council Policies 400-13 and 400-14 – ATTACHMENT 1). The DESIGN ENGINEER shall analyze the planning area for the sewer system to minimize the number of units to be pumped and to design the shortest possible force main. In cases where only a small tributary area is to be served by a pump station, the City will accept the facility as public only if it can be shown that the capitalized cost of facility replacement and maintenance will not exceed 50 percent of the standard sewer fees for the area to be served. Otherwise, the pump station must be privately owned, maintained and operated. In cases where a pump station will be a public facility, specific criteria for the design, construction, and operational testing of sewer pump stations are given in Chapter 7.

1.5.1 Pump Station Design Capacity

The Pump Station Design Capacity shall be calculated as follows:

<u>Pump Station Design Capacity (PSDC)</u>: Pump stations shall be designed to pump the calculated peak wet weather flow from the upstream tributary area.

<u>Pump Station Reserve Capacity Factor (PSRCF)</u>: This is a safety factor that takes into account that service pumps will generally not be operating at their

full intended design capacity due to mechanical wear and the subsequent loss of efficiency, and increases in force main friction loss due to the deposition of solids and grit. The reserve capacity factor shall be 1.0 if two (2) hours emergency storage (Ref. Subsection 7.2.6.7) or six hours emergency storage (Ref. Subsection 7.2.7) are provided. Where this storage is not provided in design, then a reserve capacity factor greater than 1.0 shall be used and an appropriate factor shall be evaluated for approval, on a case-by-case basis, by the Wastewater Collections Division Senior Civil Engineer.

Pump Station Design Capacity = (Peak Wet Weather Flow) x (Pump Station Reserve Capacity Factor)

1.5.2 Private Pump Stations

Private pump stations (privately-owned and operated) serving more than one lot shall not be located in the public right-of-way. The capacity for private pump stations shall be determined in the same manner as for public pump stations. Station wet well detention times shall not exceed 4 hours. A planning study for the pump station outlining capacity of the pumps, equivalent dwelling units (EDU) served, capacity of the wet well, detention times, length and size of the force main, and provision of any odor control equipment shall be submitted for review to Water and Sewer Development Review, Public Utilities Department. Private pump stations shall require separate structural, mechanical, and electrical permits from the City of San Diego, Development Services Department, Building Review Division. However, private pump station plans are not reviewed for compliance with City of San Diego Sewer Design Guide Chapter 7 criteria. As such, it shall be the responsibility of the DESIGN ENGINEER to ensure that all private pump stations are adequately sized, have sufficient redundant measures (dual force mains, back-up power supply, auto dialer alarm system to a licensed plumber with 24-hour response, etc.), and comply with all applicable local, state, and federal regulations. In the design of such facilities, the DESIGN ENGINEER shall utilize sound engineering judgment to provide for an adequate design for any potential failure during the service life of the pump station. If a developer elects to construct a private sewer system including a sewer pump station, then a letter of agreement must be executed over all lots served in the subdivision if the pump station will serve two or more lots. A copy of this agreement is available at the City Plan Check Counter and the City Website http://www.sandiego.gov/mwwd/business/sewer. Also required is a recorded copy of the CC&R's for the home or business owners association, outlining the responsibility and maintenance requirements for the shared private improvements.

1.6 ZONE - DENSITY CONVERSIONS

Table 1-1 shall be used in planning studies to determine the equivalent population for a given land use. These tabulated figures represent a general case analysis. When more accurate or detailed information, such as fixture unit counts, is available, Table 1-1 shall not be used. For more information on the requirements of the zones shown in Table 1-1, refer to Chapter 13 of the City of San Diego Municipal Code.

1.7 REQUIRED CAPACITY IN EXISTING SEWER SYSTEMS DOWNSTREAM OF NEW FACILITIES

1.7.1 Required Capacity Downstream of New Gravity Sewers

For a new development, the projected peak wet weather flow from the proposed system (ref. Subsection 1.3.2.2) will be added to the field measured maximum flow in the downstream sewer to determine if the projected d_n/D is in compliance with the depth criterion described in Subsection 1.3.3.3. If this criterion is not met, a comprehensive sewer study of the area shall be prepared.

The downstream system shall be studied to the point in the system where the projected peak wet weather flow from the proposed new development is less than 10% of the total flow. All sewers to this point are required to carry the total flow per the depth criterion described in the above paragraph. The existing system to be studied shall not be less than two pipe reaches (i.e. manhole to manhole) from the point of discharge of the new development into the existing system.

1.7.2 Required Capacity Downstream of New Pump Stations

In developed lands, the discharge of the pump station design capacity from the proposed new development will be added to the field measured maximum flow in the existing downstream sewer to determine if the projected d_n/D will comply with the depth criteria described in Subsection 1.3.3.3. If these criteria are not met, a comprehensive sewer study of the area shall be prepared.

The sewer system downstream of the pump station shall be designed for cyclical pumping operation (i.e. on-off pumping). Use the design discharge capacity of the pump station for the tributary area. As a rule of thumb, the cyclical effect in single family residential may be considered negligible when the pump station’s discharge is less than 10% of the total flow. For other density types consult with the Senior Engineer. All sewers to this point are required to carry the total flow per the depth criterion described in the above paragraph. The proposed new system shall discharge at a point not less than two pipe reaches (i.e. manhole to manhole) away the existing system.

1.7.3 Odor Control

The DESIGN ENGINEER shall design the wastewater system so that objectionable odors are not discharged into the atmosphere or through plumbing vents. Odors are caused by organic biologic activity and the location of the problematic area in the system is not always predictable.

The DESIGN ENGINEER shall account for the possibility of odors developing as the subdivisions build out including setting right of way aside that has good access for the locations of odor control equipment. The developer will modify the system up to one year after final occupancy of the drainage basin.

Some of the properties that impact odor may include the following:

- sewage detention times
- force main discharge points
- submerged flow at siphons
- locations with turbulent flow
- flat slopes
- type of discharge content including industrial waste discharge
- temperature and weather conditions

Odor control may include chemical injection such as calcium nitrate or other approved chemicals, or installation of an activated carbon system, or both.

1.8 MINIMUM INTAKE STANDARDS FOR SEWER STUDIES

At a minimum, include the following items on the exhibit and within the body of all wastewater planning studies for new sewer development projects:

a. Internal order numbers, tentative map numbers, and any discretionary permit numbers [i.e. Conditional Use Permit (CUP), Planned Residential Development (PRD), or Planned Industrial Development (PID)].

b. Project name.

c. Vicinity map.

d. Scale of sufficient size to accommodate the details required by this list. Minimum Scale will be 1 inch = 100 feet.

e. Reference drawing numbers for existing sewer mains.

f. Limits of the project area.

g. Streets with names or distinguishing labels and dimensions.

h. All existing and proposed utilities with adequate separation, whether in streets, side yards, or canyon slopes. Cross sections shall show dry and wet utilities.

i. Existing and proposed sewer mains labeled as public or private.

j. Deviation requests for all sewer mains which exceed standard depths.

k. All existing and proposed “sewer access” easements. Indicate whether these will be permanent, to be abandoned after construction, or will be dedicated.

l. Paved width of all easements and connections to streets and manholes.

m. Typical bench section for limits of easement width and paving.

n. Topography of the entire drainage basin and the proposed development.

o. Elevations for existing and proposed grades throughout the project area. A reference copy of the proposed grading plans may be provided instead, if applicable.

p. Manhole numbers and reach or pipe segment numbers for ease of comparison with the flow data in the Sewer Study Summary (Figure 1-2). Label all points of connection where project flows discharge to existing facilities and, where applicable, to the terminus of the study area. For off-site sewer mains, show information for a minimum of two reaches upstream and downstream in accordance with Subsection 1.7.1. Also identify all existing sewer mains in the Remarks column of Figure 1-2 - Sewer Study Summary.

q. Pipes labeled with size, type, flow direction, and slope.

r. Manholes, within the limits of the project area, shown with rim elevation and invert elevation. Note that sewer depth information is more critical where the mains are not at standard depths (refer to section 2.2.1.5), where they are located in easements, where off-site flows join the project area, or where grading is proposed over existing facilities.

s. Number of Dwelling Units per Pipe Reach. Equivalent dwelling units per each reach shall be identified from the most upstream manhole to the downstream end of the project boundary.

t. Land use areas labeled as single family residential, multi-family residential, commercial, industrial, schools, parks, open space, multiple habitat preservation area (MHPA), multiple species conservation program area (MSCP), stream beds or 100-year flood area.

u. Location of all proposed pump stations. Label all pump stations as public or private. For public pump stations, show access roads and lots as dedicated in fee title to the City of San Diego. All pipe systems upstream of private pump stations shall be clearly labeled "private".

v. Location of any sewer facilities proposed in canyons and environmentally sensitive lands. Show any required sewer access roads in order to implement the Sewer Maintenance Plan to be developed as part of the planning study (refer to Council Policy 400-13 - ATTACHMENT 1).

w. List any documents or studies that are incorporated by reference into the report. Do not include copies of the reports in the sewer study if they are part of the Public Utilities Department's Library.

x. Master plan of the project area, when requested.

y. As-built plans of existing facilities where any point of connection is planned.

z. Flow metering data, when requested.

TABLE 1-1
CITY OF SAN DIEGO SEWER DESIGN GUIDE
DENSITY CONVERSIONS

Zone	Maximum Density (DU/Net Ac)	Population per DU	Equivalent Population (Pop/Net Ac)
AR-1-1, RE-1-1	0.1	3.5	0.4
RE-1-2	0.2	3.5	0.7
AR-1-2, RE-1-3	1	3.5	3.5
RS-1-1, RS-1-8	1	3.5	3.5
RS-1-2, RS-1-9	2	3.5	7.0
RS-1-3, RS-1-10	3	3.5	10.5
RS-1-4, RS-1-11	4	3.5	14.0
RS-1-5, RS-1-12	5	3.5	17.5
RS-1-6, RS-1-13	7	3.5	24.5
RS-1-7, RS-1-14	9	3.5	31.5
RX-1-1	11	3.4	37.4
RT-1-1	12	3.3	39.6
RX-1-2, RT-1-2, RU-1-1	14	3.2	44.8
RT-1-3, RM-1-2	17	3.1	52.7
RT-1-4	20	3.0	60.0
RM-1-3	22	3.0	66.0
RM-2-4	25	3.0	75.0
RM-2-5	29	3.0	87.0
RM-2-6	35	2.8	98.0
RM-3-7, RM-5-12	43	2.6	111.8
RM-3-8	54	2.4	129.6
RM-3-9	73	2.2	160.6
RM-4-10	109	1.8	196.2
RM-4-11	218	1.5	327.0

TABLE 1-1
CITY OF SAN DIEGO SEWER DESIGN GUIDE
DENSITY CONVERSIONS (Continued)

Zone	**Maximum Density (DU / Net Ac)**	**Population Per DU**	**Equivalent Population (Pop/Net Ac)**
Schools/Public	8.9	3.5	31.2
Offices	10.9	3.5	38.2*
Commercial/Hotels	12.5	3.5	43.7*
Industrial	17.9	3.5	62.5*
Hospital	42.9	3.5	150.0*

Figures with asterisk (*) represent equivalent population per floor of the building.

Definitions:
DU = Dwelling Units
Ac = Acreage
Pop = Population

Net Acreage is the developable lot area excluding areas that are dedicated as public streets in acres. Gross Area is the entire area in acres of the drainage basin, including lots, streets, etc.

For undeveloped areas, assume Net Acreage = 0.8 x Gross Area in Acres

For developed areas, calculate actual Net Acreage.

Tabulated figures are for general case. The tabulated figures shall not be used if more accurate figures are available.

Population is based on actual equivalent dwelling units (EDU) or the maximum estimate obtained from zoning.

Conversion of Fixture Units to Equivalent Dwelling Units (EDU): The Water Meter Data Card, maintained by the Development Services Department, contains a table of plumbing fixtures that should be used for determining the equivalent dwelling units (EDU's) for the purpose of estimating the rate of wastewater generation in residential, commercial, or industrial areas. Currently, the basis for conversion is: 20 fixtures = 1 EDU and 1 EDU = 280 gallons of wastewater per day.

In high rise building areas, flow rates shall be based on the most current, adopted edition of the applicable Plumbing Code, assuming one lateral per area. The most conservative flow rate shall govern.

PUBLIC UTILITIES DEPARTMENT

PEAKING FACTOR FOR SEWER FLOWS
(Dry Weather)

Ratio of Peak to Average Flow*
Versus Tributary Population

Population	Ratio of Peak to Average Flow	Population	Ratio of Peak to Average Flow
200	4.00	4,800	2.01
500	3.00	5,000	2.00
800	2.75	5,200	1.99
900	2.60	5,500	1.97
1,000	2.50	6,000	1.95
1,100	2.47	6,200	1.94
1,200	2.45	6,400	1.93
1,300	2.43	6,900	1.91
1,400	2.40	7,300	1.90
1,500	2.38	7,500	1.89
1,600	2.36	8,100	1.87
1,700	2.34	8,400	1.86
1,750	2.33	9,100	1.84
1,800	2.32	9,600	1.83
1,850	2.31	10,000	1.82
1,900	2.30	11,500	1.80
2,000	2.29	13,000	1.78
2,150	2.27	14,500	1.76
2,225	2.25	15,000	1.75
2,300	2.24	16,000	1.74
2,375	2.23	16,700	1.73
2,425	2.22	17,400	1.72
2,500	2.21	18,000	1.71
2,600	2.20	18,900	1.70
2,625	2.19	19,800	1.69
2,675	2.18	21,500	1.68
2,775	2.17	22,600	1.67
2,850	2.16	25,000	1.65
3,000	2.14	26,500	1.64
3,100	2.13	28,000	1.63
3,200	2.12	32,000	1.61
3,500	2.10	36,000	1.59
3,600	2.09	38,000	1.58
3,700	2.08	42,000	1.57
3,800	2.07	49,000	1.55
3,900	2.06	54,000	1.54
4,000	2.05	60,000	1.53
4,200	2.04	70,000	1.52
4,400	2.03	90,000	1.51
4,600	2.02	100,000+	1.50

***Based on formula:** **Peak Factor = 6.2945 x $(pop)^{-0.1342}$**
(Holmes & Narver, 1960)

FIGURE 1-1