Hydrology and Hydraulics Report

for

Euclid and Heil

NEC of Euclid Street and Heil Ave

Fountain Valley, 92708

DATE PREPARED: JANUARY 2024 | PRELIMINARY REPORT

REVISED: MAY 2024

JULY 2024

JANUARY 2025

MARCH 2025

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INTRODUCTION

PROJECT DESCRIPTION AND PURPOSE

The proposed project includes the development of the existing 18.64 acres and the widening of Heil creates a net total site area of 18.09 acres. The project site will be developed from agricultural land into a residential community with a variety of living accommodations including small lot single family detached units (SFD), townhomes, and apartments. The project proposes two parks and four points of ingress and egress. JZMK Partners has developed a site plan for the “For-Sale” component of the site and has incorporated Architect Orange’s (AO) design for a multifamily wrap product and an Affordable Housing Podium product. It is understood that the “For-Sale” portion of the proposed site will be developed as a separate project from the multifamily wrap and Affordable Housing Podium.

The purpose of this report is to support the design of the Storm Water Management System for the proposed project. This investigation was conducted to evaluate the hydrologic and hydraulic conditions of the project described above. The purpose is also to determine the impact that the proposed development has on the local drainage system and to show that the post development peak flows, will not increase beyond the level at which the Orange County Drainage Area Master Plan (DAMP) designed the storm sewer lateral along E. Chapman Avenue for.

Figure 1: Project Site Location

PROJECT SITE CONDITIONS

EXISTING SITE (PRE-DEVELOPMENT) CONDITIONS

The site is flat with an elevation of 48-ft at the north-east corner and elevation 45-ft at the south-west corner. Existing site runoff flows from the north to the south toward Heil Avenue. There is an existing ditch along Heil Ave. that conveys the runoff to the west toward an existing catch basin located at the Heil and Euclid intersection (Outfall A). The existing catch basin is connected to a 24—inch storm drain line that discharges in the Mile Square Park channel and ultimately drains into the East Garden Grove Wintersburg Channel. Miles Square Park channel is concrete line and stabilized. A small portion of the site runoff will be directed easterly towards an existing catch basin located in the southeast area of the site on Heil Avenue (Outfall B). There is currently no storm drain within Heil Ave. between Euclid St. and Sugarloaf St. Refer to Existing Hydrology Exhibit in **Appendix D** for the drainage conditions found in the existing condition as well as the drainage areas from the proposed conditions shown for reference only.

PROPOSED SITE (POST-DEVELOPMENT) CONDITIONS

The site will be developed into two separate maintenance entities, one for the 'For-Sale' and the other for the apartment development. Stormwater runoff from each drainage area (DA) will be captured and conveyed to various on-site inlets throughout the site. These flows will be directed to on-site proprietary bioretention BMPs, specified as Modular Wetland Systems (MWS), and underground detention tanks before discharging into the local storm drain system. Refer to the Preliminary Water Quality Management Plan for detailed water quality calculations and documentation. Runoff will discharge from the MWS to the proposed detention tanks, then to the proposed pumps, and ultimately into the existing catch basin located in the southwest corner of the site (Outfall A). Refer to the Proposed Hydrology Exhibit in **Appendix D.** The proposed project will be built conditional to a storm drain extension within Heil Ave. The final plans will include an offsite storm drain improvement as well as an onsite construction document that will connect the onsite storm drain system to the offsite storm drain improvements. In the interim, both the “For Sale” and apartment portions of the project will match the existing outflow offsite into the existing catch basins.

PRECIPITATION

Precipitation values for the hydrologic analysis were determined by using 100 year preset values per the logarithmic equations per Orange County Hydrology Manual Figure B-3. **Appendix A** contains the mean precipitation intensities for non-mountainous areas.

WATERSHED DESCRIPTION

The project is relatively flat slopes and the regional topography slopes to the southwest. The project site is located within the Anaheim Bay/Huntington Harbor watershed.

SOIL TYPES

The type of soil and its conditions are major factors affecting infiltration and resultant storm water runoff. The Natural Resources Conservation Service (NRCS) has classified soils into four general hydrologic groups for comparing infiltration and runoff rates. This Project Site has a hydrologic soil group classification of A. See **Appendix B** for soil type classifications.

LAND USE

The site is located within the City of Fountain Valley Low Density Residential General Plan and is not located within an existing city specific plan. The proposed site currently designated within the R1 – Single-Family Residential (5 units/acre – 0.5 FAR) zone. The Updated Housing Element Policy is anticipated to be approved by the city council in February 2022 with the subject site to be zoned as an R-4 site (pending). No offsite flows run into the site.

GROUNDWATER

Per the geotechnical investigation, the site has historic groundwater levels of 4-ft below ground surface (bgs) and encountered ground water levels of 6-ft (bgs). Because groundwater levels are so high, it is assumed that infiltration will be infeasible.

FEMA MAPPING

The project site is covered by Map Number 06059C0256J of the FEMA Flood Insurance Rate Map (FIRM) for Orange County County, California. The City of Fountain Valley, community number 060219, Is included in this FIRM. None of the project area is within a FEMA-mapped special flood hazard area. The site is classified as Zone X, which is an area of minimal flooding. The effective FEMA map is dated December 3rd, 2009 and is provided in **Appendix C.**

HYDROLOGIC ANALYSIS

METHODOLOGY

The design criteria for the hydrologic calculations for this project have been conducted per requirements as outlined in the Orange County Hydrology Manual (August 1986).

Runoff calculations were performed using the Modified Rational Method as utilized by the HydroWin Advanced Engineering Software, (AES). AES was used to estimate time of concentrations and 100-year peak flow rates generated from the pre-development and post-development conditions. These Rational Method calculations are included in this report as **Appendix E**. Runoff coefficients were established from D.5. of the Hydrology Manual. Point precipitation values drawn from Figure B-3 of the Hydrology Manual.

The site was delineated into 2 drainage management areas (DAs). The DAs were modeled by adding the area to the main line at the main line time of concentration rather than modeling all connections as confluences. This approach is conservative and will generate a slightly higher flow rate.

This site does not fall within a hydromodification zone and therefore the 2-year storm was not analyzed.

The site underground detention was sized with pumps to keep the proposed peak outflow below existing peak flow levels. The underground detention will partially be placed in the groundwater level and will have adequate measures installed to keep the system in place and water type.

RESULTS AND CONCLUSIONS

The Modified Rational Method calculations demonstrate that post-development peak flow is greater than the pre-development peak flow. Therefore, the impacts of the post-development peak flow need to be

mitigated with underground detention. To treat post-development peak flow, modular wetland systems were designed.

Table 1. Rational Method Analysis

Analysis	Storm	Area (AC)	Peak Flow (cfs)	Outfall
Existing	100-yr	2.51	3.86	East - Outfall B
		16.12	19.77	West - Outfall A
	Existing Flow is 3.86 CFS flowing east and 19.77 CFS flowing west			
Proposed	100-yr	18.09	48.20	West - Outfall A
	Proposed Flow from the west apartment portion is 13.35 CFS and from the east single family home portion is 34.86 CFS. The flows will be conveyed to detention tank and reduced through a pump to outflow below existing peak flows at 19.54 CFS.			

HYDRAULIC ANALYSIS

METHODOLOGY

A new on-site storm drain system, designed for the 100 -year storm, will be installed to collect surface runoff at designated storm inlet locations across the site and convey flows downstream. Each inlet has been sized to limit ponding depths to less than the 6-inch curb height.

Hydraulic calculations were performed for the main storm drain pipes utilizing Flowmaster, developed by Bentley. The software utilizes Manning's equation to determine acceptable friction slopes for design. A minimum allowable friction slope of 0.50% was used to keep the hydraulic grades below ground surface.

RESULTS AND CONCLUSIONS

The underground detention was sized to provided storage to keep the peak flow below the existing peak flow conditions. The underground detention will be designed with minimum 6 inches of freeboard. Pipes will be sized according to the table below based on the pipe hydraulic calculations. The flow rate tributary to a pipe size will not exceed the tabulated values listed below:

Table 2. Underground Detention and Pump Table

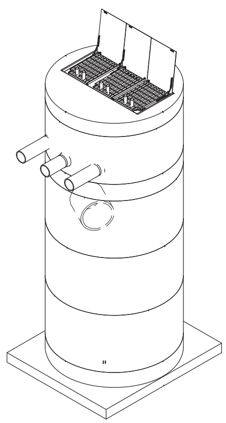
DA	Area (ac)	Volume Provided (CF)	Unmitigated Peak Flow (cfs)	Allowable Flow (cfs)	Mitigated Peak Flow (cfs)
DA 1	14.00	33,600	41.27	15.30	15.22
DA 2	4.09	13,500	13.99	4.47	4.32

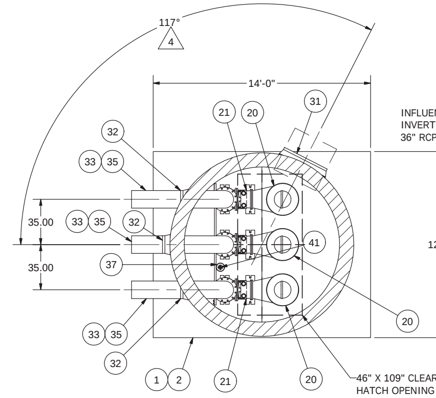
Table 3. Pipe Sizing Table

Pipe Sizing Table			
Pipe Size	Material	Friction Slope	Discharge Capacity
6”	HDPE (n=0.011)	0.50%	0.47 CFS
12”	HDPE (n=0.011)	0.50%	2.98 CFS
18”	HDPE (n=0.011)	0.50%	8.78 CFS
24”	HDPE (n=0.011)	0.50%	18.90 CFS
30”	HDPE (n=0.011)	0.50%	34.27 CFS
36”	HDPE (n=0.011)	0.50%	55.73 CFS

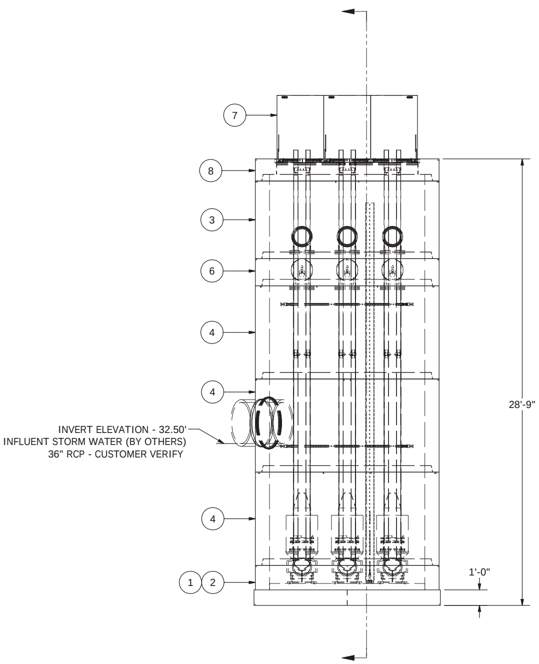
APPENDIX A

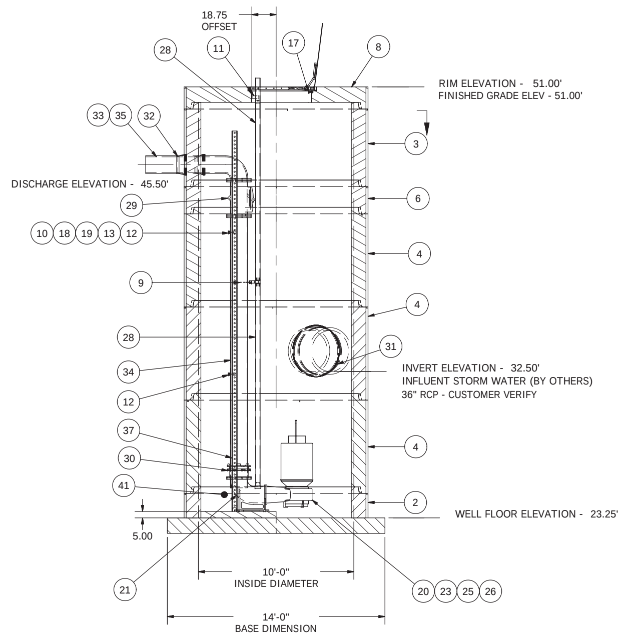
PUMP DETAILS





NOTE: WET WELL TOP SLAB IS PEDESTRIAN RATED





NOTE: ALL DIMENSIONS AND ELEVATIONS SHOWN ARE NOMINAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE ON-SITE CONTRACTOR OR ROMTEC UTILITIES CUSTOMER (NOT ROMTEC UTILITIES) TO VERIFY THE ACCURACY OF ANY CRITICAL DIMENSIONS OR ELEVATIONS PRIOR TO SETTING OR INSTALLING ANY EQUIPMENT.

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REV	DESCRIPTION	DATE	APPROV
7	CHANGED INLET PIPE FROM PVC TO RCP PER CUSTOMER	9/26/11	AD
6	ADDED STILLING WELL FOR LEVEL SENSING	9/9/11	AD
5	REVISED FOR PRODUCTION LAUNCH	9/7/11	AD
4	CHANGED ORIENTATION TO MATCH SITE PLAN	08/23/11	AD
3	REMOVED FLOATS, ADDED PRESSURE TRANSDUCER	08/02/11	AD
2	NEW ELEVATIONS PER CUSTOMER	04/29/11	AM
1	COMPONENT DRAWING	03/16/11	AM

REVISION HISTORY

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DSN -
DRN - AM
CKD -
DATE - 03/16/11

COMPONENT DRAWING

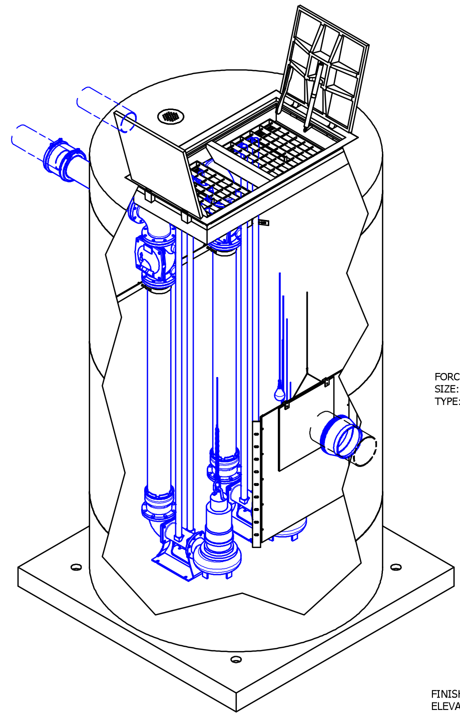
ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
(541) 496-9678
FAX (541) 496-0804

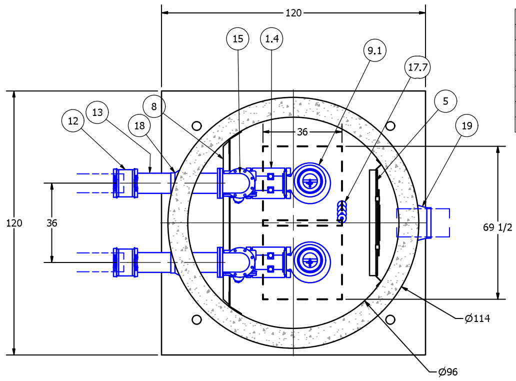
RSC ENGINEERING, INC.
JAI SINGH

EAST CAMPUS STORMWATER
12" - 10' DIA WET WELL

SHEET
1 OF 1

JOB NUMBER
RMTC
0000





FORCE MAIN (BY OTHERS)
SIZE: 8"
TYPE: HDPE DR13.5 IPS (DUAL)

TOP VIEW
SECTION B-B
SCALE 1 / 28

PRIMARY SENSOR ELEVATION TABLE		
DESCRIPTION	ELEVATION	Δ
INFLUENT INVERT	475.35'	
HIGH LEVEL ALARM	476.30'	
LAG PUMP START	475.30'	1.00'
LEAD PUMP START	474.30'	1.00'
PUMP STOP	471.70'	2.60'
WELL FLOOR	468.70'	3.00'

NOTE: TOP SLAB AND HATCH ARE H-20 FULL TRAFFIC RATED

PARTS LIST			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	10-CB000000	BASE SLAB ASSEMBLY
1.1	1	10-CB0812CP	BASE - WW - 8ft DIA x 12in - 10ftx10ft UPLIFT
1.2	2	31-EL0608EB	DISCHARGE ELBOW - 6in x 8in - EBARA
1.3	2	31-HW00AKS6	ANCHOR KIT - 316SS - DISCHARGE ELBOW
1.4	2	31-QD06LLEB	QDC - 6in - LL150
1.5	2	44-AD08RMAL	FLANGE ADAPTER - 8in - ALPHA
2	1	12-CR0836CP	BARREL - 8ft DIA x 3ft H
3	2	12-CR087200	BARREL - 8ft DIA x 6ft H
4	1	14-CT000000	TOP SLAB ASSEMBLY
4.1	1	13-HH3674DG	HATCH - DI - 36in x 74in - SAFETY GRATE
4.2	1	13-VT0000CS	VENT - STEEL - TRAFFIC AREAS
4.3	1	14-CT08FDD0	TOP SLAB - 8ft DIA - H-20 - DUPLEX - FULL TRAFFIC
5	1	15-DP080500	DEFLECTOR PANEL ASSEMBLY - 8ft DIA x 5ft
6	2	17-AC38000B	BOLT KIT - UPPER GUIDE BAR BRACKET
7	2	17-UG02S4EB	BRACKET - UPPER GUIDE BAR - 304SS - EBARA
8	1	18-BR000000	BRACKET ASSEMBLY - 316SS - DISCHARGE SUPPORT
9	1	30-PU000000	PUMP SHIPPING CRATE
9.1	2	30-PU0000EB	PUMP - EBARA 150DLKFU67.5 - 10HP
9.2	2	32-AC0000EB	LIFTING SLING - 18ft CHAIN S5 9/32in
9.3	2	32-CGSS000E	CABLE SUPPORT GRIP - 304SS - 1in-1.24in
9.4	1	32-PLGE0000	GRIP EYE UNIT
10	56.0 ft	40-PP0200S4	PIPE - 304SS SCH40 - 2in DIA
11	2	42-SF0800D0	CHECK VALVE - SWING FLEX - 8in
12	2	44-CP080AD0	COUPLING - 8in - ROMAC ALPHA
13	2	45-FP080420	SPOOL - DI - 8in DIA x 42in - FLGxPE
14	2	45-FP081140	SPOOL - DI - 8in DIA x 114in - FLGxPE
15	2	46-EL0890DI	ELBOW - DI - 8in x 90deg - FLGxFLG
16	6	49-GS080000	GASKET - FLANGE - 8in
17	1	50-AC000000	WELL SHIPPING CRATE
17.1	1	13-KY000000	HATCH KEY
17.2	3	18-AC00CH00	CABLE HANGER ASSEMBLY - 316SS
17.3	4	18-HD080000	LIFTING CLUTCH - 8 TON
17.4	1	51-AC00NSTB	NEVER SIEZE - TUBE
17.5	90 ft	51-JWCS2120	JOINT WRAP - 12in - CONSEAL CS-212
17.6	90 ft	51-SE0101SL	JOINT SEALANT - 1in - CONSEAL CS-202
17.7	4	80-FS20MSNL	FLOAT - 20m - MS1 - NOLTA
18	2	59-KB1208DI	KOR-N-SEAL - 12in CORE x 8in DIPS PIPE
19	1	59-KB1612P0	KOR-N-SEAL - 16in CORE x 12in PVC PIPE

NOTE:
CONDUIT TO CONTROL PANEL (BY OTHERS)
MINIMUM:
(2) FOR POWER
(1) FOR LEVEL SENSING

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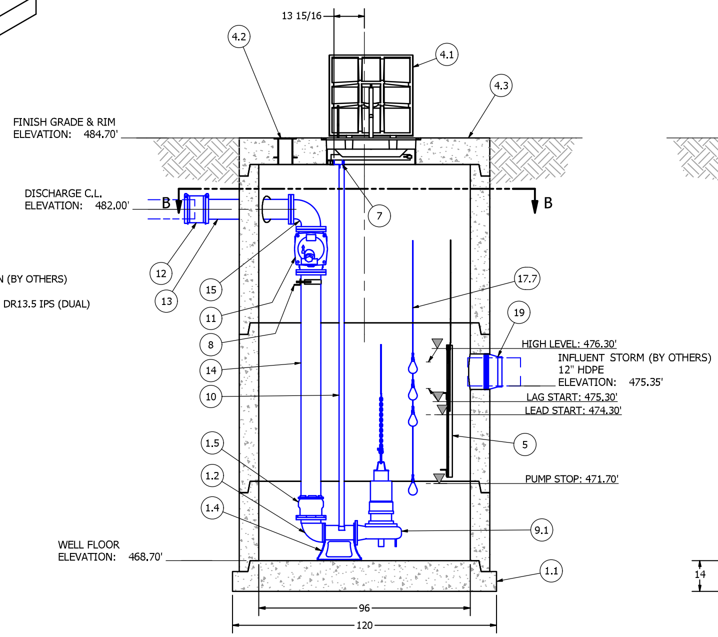
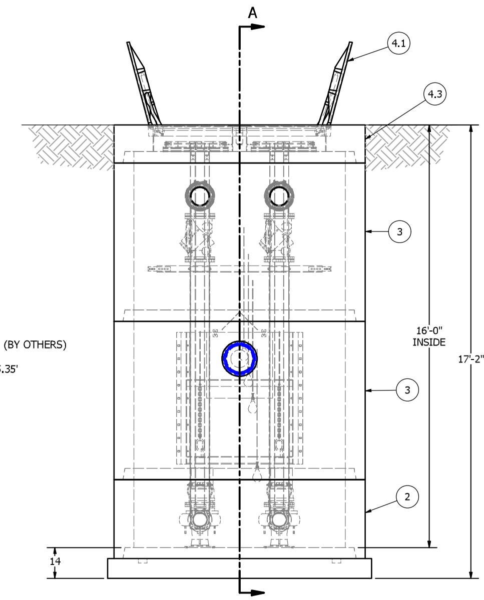
ROMTEC UTILITIES



PROFILE VIEW
SECTION A-A
SCALE 1 / 28



FRONT VIEW
SCALE 1 / 28

FOR PRODUCTION

8' DIAMETER WET WELL
8" DISCHARGE PIPING
DUPLEX EBARA PUMPS

COLOR LEGEND

- MAJOR CONCRETE COMPONENTS WITH PRE-INSTALLED COMPONENTS.
- COMPONENTS PRE-ASSEMBLED TO THE EXTENT POSSIBLE AND WILL NEED TO BE FIELD INSTALLED.

NOTE: PRE-ASSEMBLY IS DONE AT ROMTEC UTILITIES' DISCRETION AND MAY CHANGE AT THE TIME OF PRODUCTION.

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REVISION HISTORY			
REV	DATE	DESCRIPTION	BY
2	11/19/2020	UPDATED BASE THICKNESS PER PRECASTER	AD
1	10-20-20	PRODUCTION LAUNCH	AD

VERIFY SCALE
0 — 1"

DSN: KB
DRN: KB
CKD: AD
DATE: 10-2-20

ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
PHONE: (541) 496-9878
WWW.ROMTECUTILITIES.COM

ROCKEFELLER AIRWAY
SAN DIEGO, CA

WET WELL ASSEMBLY
COMPONENT DRAWING

MECHANICAL SHEET
1 OF 2

APPENDIX B

SOIL TYPE

117° 56' 14" W

117° 55' 56" W

33° 43' 32" N

33° 43' 24" N

Map Scale: 1:1,250 if printed on B landscape (17" x 11") sheet.

N

0 15 30 60 90 Meters

0 50 100 200 300 Feet

Map projection: Web Mercator Corner coordinates: WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 9, Sep 23, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 3, 2015—Jan 17, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Orange County and Part of Riverside County, California (CA678)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
164	Metz loamy sand, moderately fine substratum	B	18.3	100.0%
Totals for Area of Interest			**18.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

APPENDIX C

FIRM

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the National Agriculture Imagery Program, dated 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

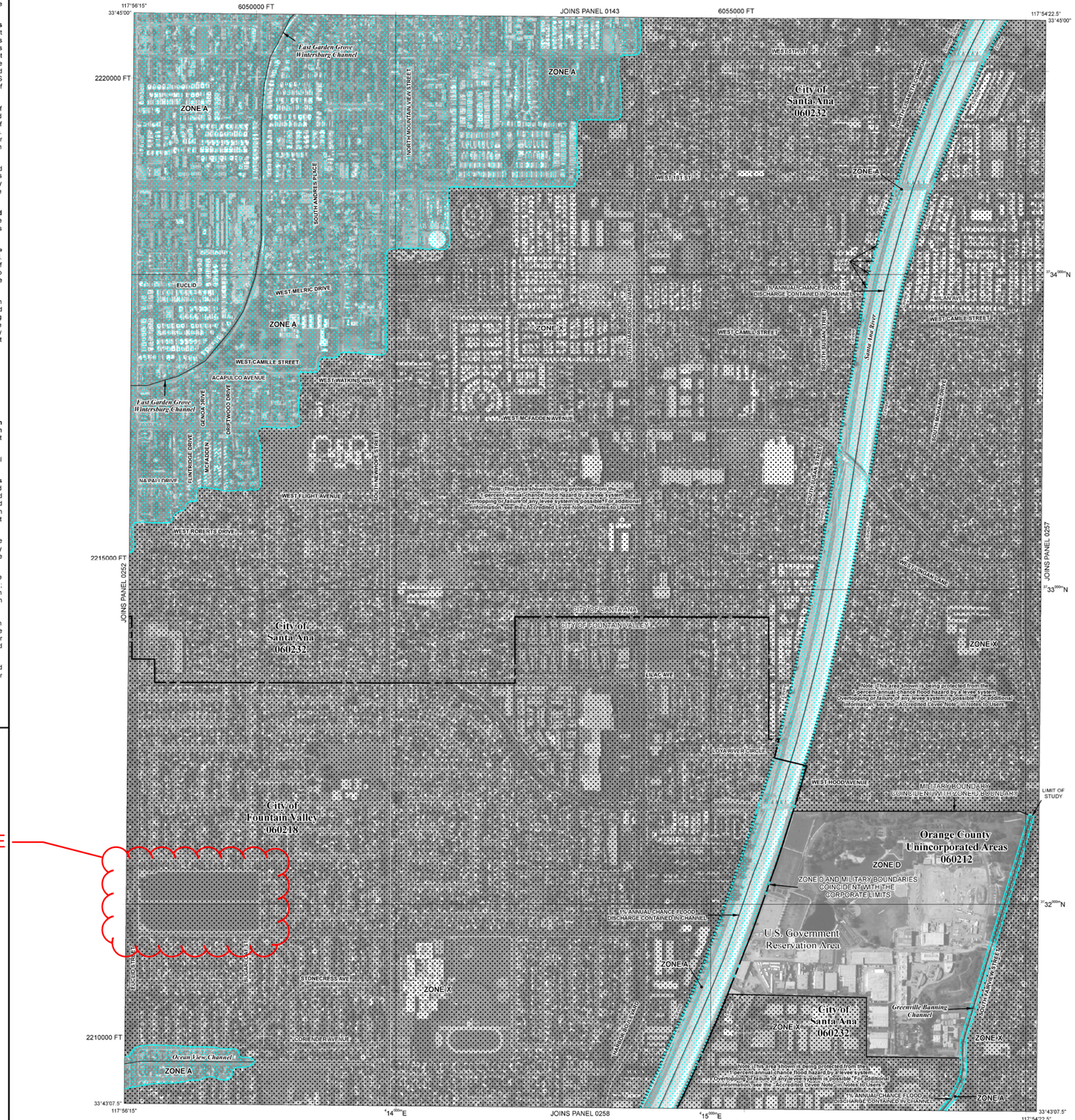
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROJECT SITE



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 1000-meter Universal Transverse Mercator grid values, zone 11N
- 600000 FT — 5000-foot grid ticks: California State Plane coordinate system, zone VI (FIPSZONE 0406), Lambert Conformal Conic projection
- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 15, 1989

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
February 5, 1992 - November 3, 1993 - January 3, 1997 - February 18, 2004 - December 3, 2009 : for description of revisions, see Notice to Users page in the Flood Insurance Study report.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0256J

FIRM

FLOOD INSURANCE RATE MAP

ORANGE COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 256 OF 539

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FOUNTAIN VALLEY, CITY OF	060218	0256	J
ORANGE COUNTY	060212	0256	J
SANTA ANA, CITY OF	060232	0256	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06059C0256J

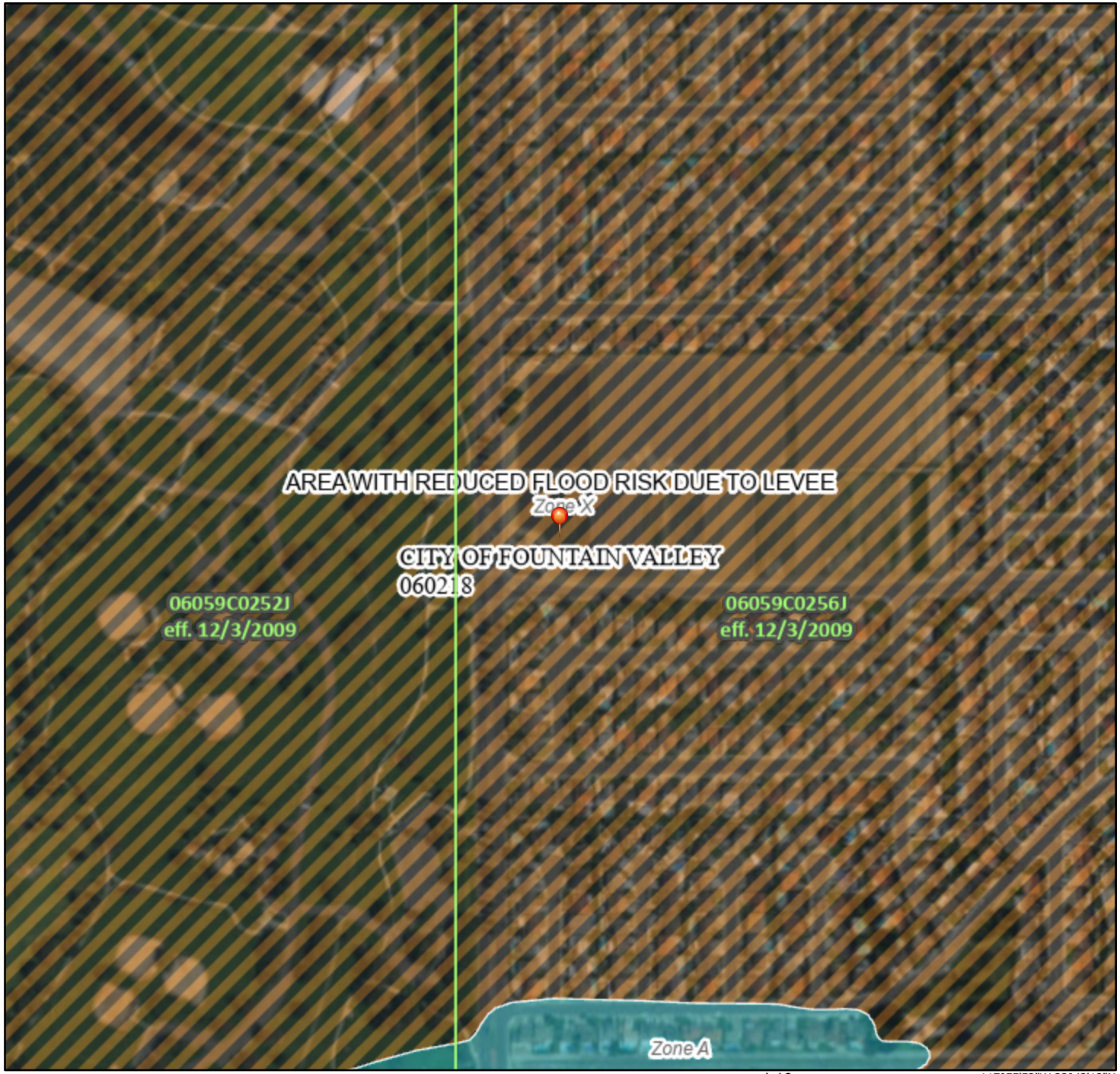
MAP REVISED
DECEMBER 3, 2009

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

117°56'30"W 33°43'42"N



117°55'53"W 33°43'12"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

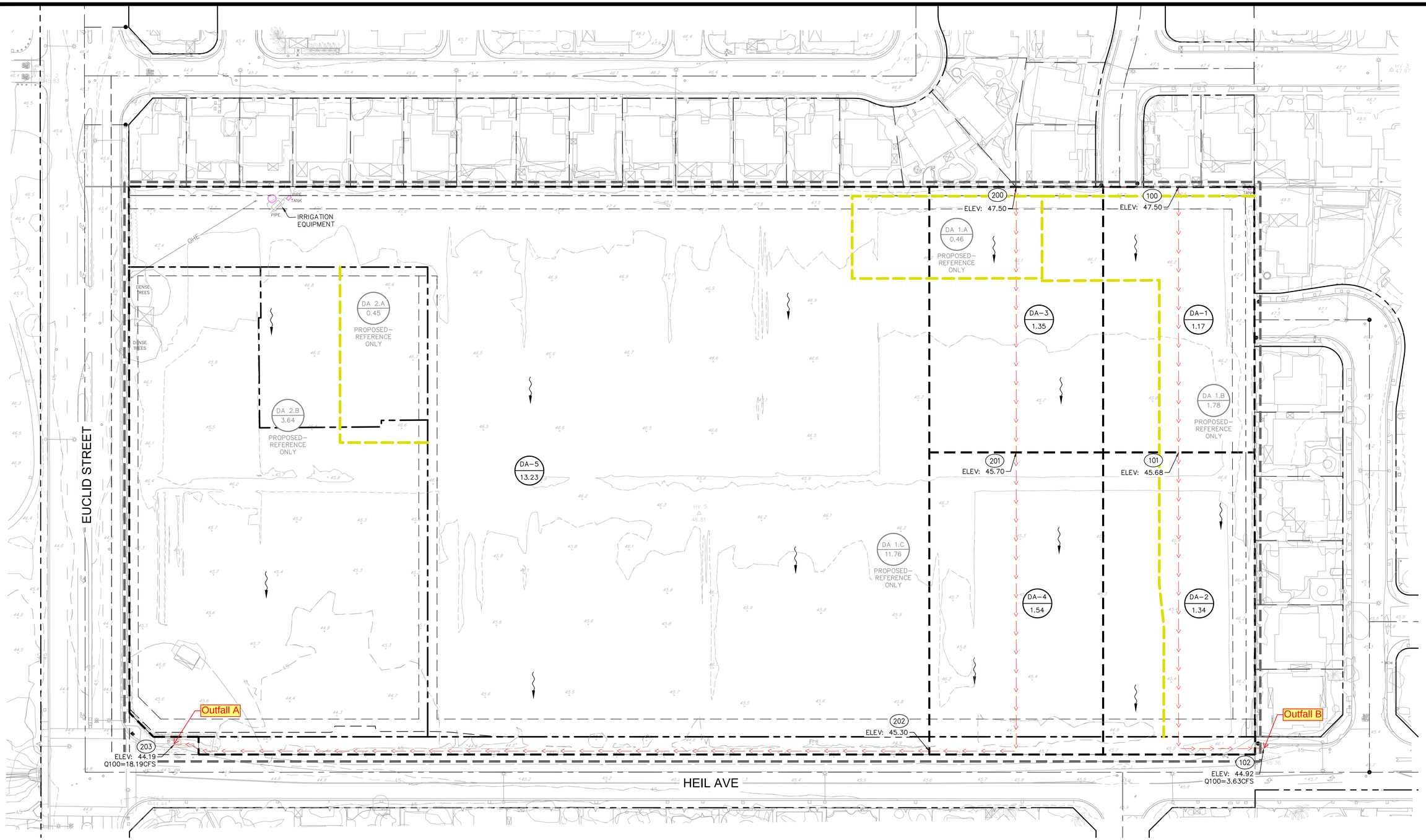
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/11/2023 at 5:35 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX D

HYDROLOGY MAPS



LEGEND

- CENTER LINE
- PROPERTY LINE
- EASEMENT LINE
- APPROXIMATE LIMITS OF DISTURBANCE
- LIMITS OF DRAINAGE AREA
- LONGEST FLOW PATH
- EXISTING FLOW DIRECTION
- PROPOSED LIMITS OF DRAINAGE AREA (SHOWN FOR REFERENCE ONLY)

FOUNTAIN VALLEY (EUCLID & HEIL)
EXISTING CONDITIONS HYDROLOGY EXHIBIT

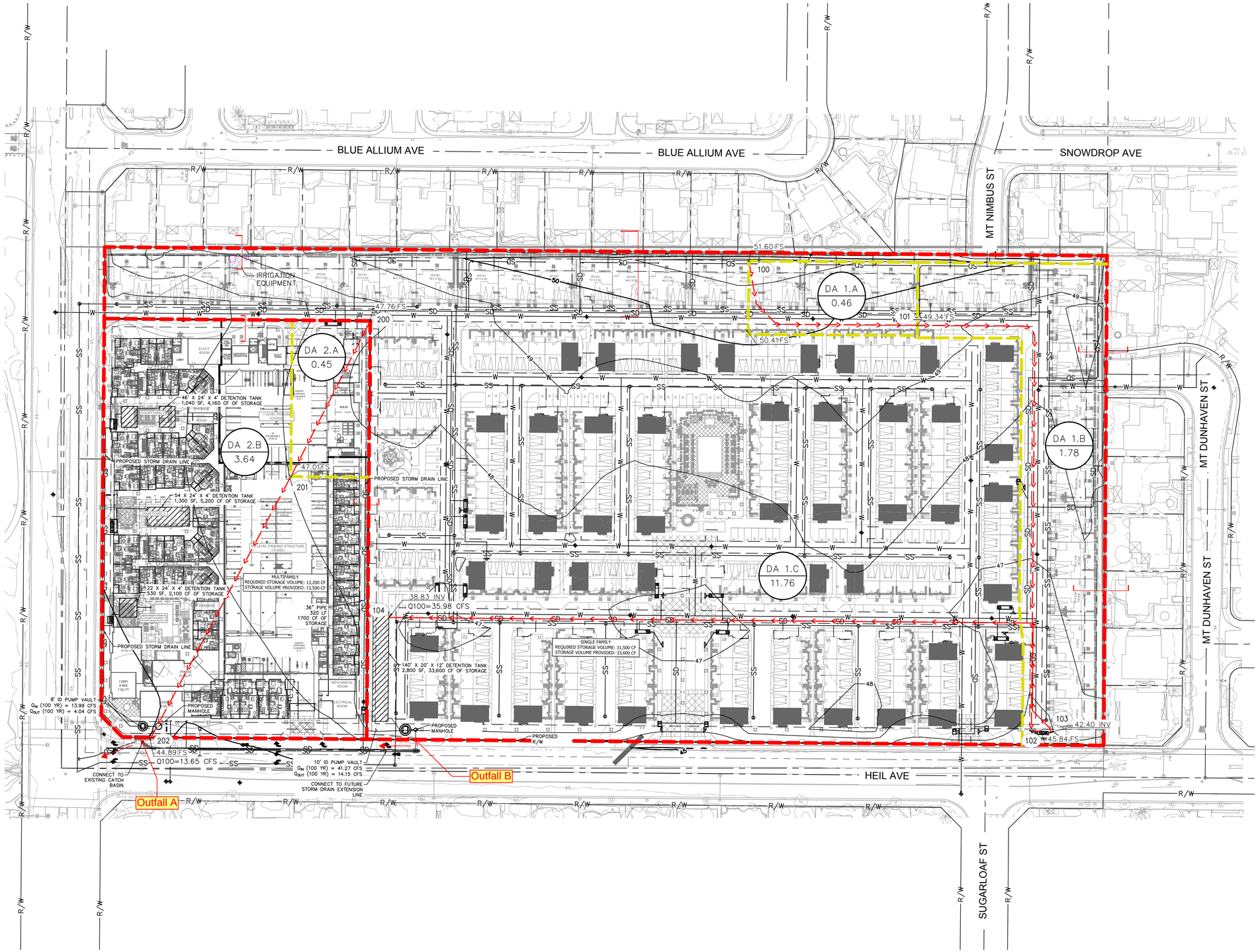
NORTH

GRAPHIC SCALE IN FEET
0 25 50 100

SCALE
1" = 20'
WHEN PRINTED AT FULL SIZE (24"X36")

Kimley»Horn

1100 W TOWN AND COUNTRY ROAD, SUITE 700, ORANGE, CA 92868
PHONE: 714–939–1030 FAX: 714–938–9488



LEGEND

- PROPOSED PROPERTY LINE
- EXISTING PROPERTY LINE
- CENTER LINE
- PROPOSED LOT LINE
- EXISTING LOT LINE
- EASEMENT OR SETBACK LINE
- LIMIT OF GRADING
- DEEPENED FOOTING (DF) OR STEM WALL (SW)
- GB — GRADE BREAK LINE
- R — RIDGE LINE
- FLOW LINE
- FW — PROPOSED STORM DRAIN PIPE
- SD — WATER LINE (SEE UTILITY SHEETS)
- W — SEWER LINE (SEE UTILITY SHEETS)
- SS — POINT OF CONNECTION (TO EXISTING)
- PIPE END CAP
- STORM DRAIN AND SANITARY SEWER MANHOLE
- CATCH BASIN INLET
- CURB DRAIN INLET
- 2:1 SLOPE (MAX)
- TOP / TOE — PROPOSED SPOT GRADE
- XX.XX TC / XX.XX FS — EXISTING SPOT GRADE
- (XX.XX TC) / (XX.XX FS) — PROPOSED FLOW (DIRECTION AND SLOPE)
- 2.00%
- DETENTION TANK

NORTH

GRAPHIC SCALE IN FEET
0 30 60 120
1" = 60'

Drawing name: K:\ORA_LDEV\094794004 – Euclid and Heil\CADD\Exhibits\Hydrology Exhibits\Proposed Hydrology Exhibit – Prelim.dwg GRADING AND DRAINAGE OVERALL Mar 31, 2025 7:30am by: Francisco.Carranco

DIGALERT
DIAL BEFORE YOU DIG — TWO WORKING DAYS BEFORE YOU DIG
TOLL FREE 1-800-422-4133
A PUBLIC SERVICE BY UNDERGROUND SERVICE ALERT

ISSUE	DATE	DESCRIPTION

DRAWN BY: FC
CHECKED BY: TG
RECOMMENDED: JM

LICENSED PROFESSIONAL
JASON MARECHAL
CA LICENSE NUMBER 63164
EXP. DATE: 6/30/2026

Kimley»Horn
1100 W TOWN AND COUNTRY ROAD, SUITE 700
ORANGE, CA 92868
(714) 939-1030

PREPARED UNDER THE DIRECT SUPERVISION OF:
JASON MARECHAL, P.E. NO. 63164 DATE: EXP. 06/30/2026

CITY OF FOUNTAIN VALLEY
DEPARTMENT OF ENGINEERING
APPROVED BY:
FOUNTAIN VALLEY CITY ENGINEER — DATE
REVIEWED AND RECOMMENDED BY: — DATE

SHOPOFF REALTY INVESTMENTS
Transforming Opportunity into Value
16300 EUCLID STREET, FOUNTAIN VALLEY, CA 92708

CITY OF FOUNTAIN VALLEY

PROPOSED HYDROLOGY EXHIBIT

SHEET 1 OF SHEETS 1
CITY PROJECT NO.

APPENDIX E

RATIONAL METHOD CALCULATIONS

```
******************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2016 Advanced Engineering Software (aes)
              Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                           Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* FOUNTAIN VALLEY ENTITLEMENT                                           *
* 100 YEAR EXISTING CONDITIONS                                          *
*                                                                       *
 *************************************************************************

  FILE NAME: FV1X100.DAT
  TIME/DATE OF STUDY: 17:38 02/03/2025
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =     47.50  DOWNSTREAM(FEET) =     45.68

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   25.414
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.437
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  AGRICULTURAL GOOD COVER
  "ROW CROPS,STRAIGHT ROW"   B        1.17      0.30     1.000    93   25.41
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.25
  TOTAL AREA(ACRES) =      1.17   PEAK FLOW RATE(CFS) =      2.25

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     45.68  DOWNSTREAM(FEET) =     44.92
  CHANNEL LENGTH THRU SUBAREA(FEET) =   430.00   CHANNEL SLOPE =  0.0018
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  30.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.010
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL GOOD COVER
  "ROW CROPS,STRAIGHT ROW"   B        1.34      0.30     1.000    93
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.28
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.71
  AVERAGE FLOW DEPTH(FEET) =   0.39   TRAVEL TIME(MIN.) =  10.16
  Tc(MIN.) =   35.57
  SUBAREA AREA(ACRES) =     1.34       SUBAREA RUNOFF(CFS) =    2.06
  EFFECTIVE AREA(ACRES) =      2.51     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        2.5         PEAK FLOW RATE(CFS) =       3.86

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.42   FLOW VELOCITY(FEET/SEC.) =   0.74
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     730.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =     47.50  DOWNSTREAM(FEET) =     45.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   25.470
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.434
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  AGRICULTURAL GOOD COVER
  "ROW CROPS,STRAIGHT ROW"   B        1.35      0.30     1.000    93   25.47
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.59
  TOTAL AREA(ACRES) =      1.35   PEAK FLOW RATE(CFS) =      2.59

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     45.70  DOWNSTREAM(FEET) =     45.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   435.00   CHANNEL SLOPE =  0.0009
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  30.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   5.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.928
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL GOOD COVER
  "ROW CROPS,STRAIGHT ROW"   B        1.54      0.30     1.000    93
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.73
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.57
  AVERAGE FLOW DEPTH(FEET) =   0.47   TRAVEL TIME(MIN.) =  12.79
  Tc(MIN.) =   38.26
  SUBAREA AREA(ACRES) =     1.54       SUBAREA RUNOFF(CFS) =    2.26
  EFFECTIVE AREA(ACRES) =      2.89     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        2.9         PEAK FLOW RATE(CFS) =       4.23
```

```
  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.49   FLOW VELOCITY(FEET/SEC.) =   0.59
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     735.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   45.30  DOWNSTREAM ELEVATION(FEET) =   44.19
  STREET LENGTH(FEET) =   850.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.38
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.57
    HALFSTREET FLOOD WIDTH(FEET) =   23.01
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.26
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.72
  STREET FLOW TRAVEL TIME(MIN.) =  11.26   Tc(MIN.) =   49.52
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.663
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  AGRICULTURAL GOOD COVER
  "ROW CROPS,STRAIGHT ROW"   B       13.23      0.30     1.000    93
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =   13.23      SUBAREA RUNOFF(CFS) =   16.23
  EFFECTIVE AREA(ACRES) =     16.12    AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =       16.1        PEAK FLOW RATE(CFS) =      19.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.66   HALFSTREET FLOOD WIDTH(FEET) =  27.62
  FLOW VELOCITY(FEET/SEC.) =  1.41   DEPTH*VELOCITY(FT*FT/SEC.) =   0.93
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1585.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       16.1  TC(MIN.) =     49.52
```

```
  EFFECTIVE AREA(ACRES) =     16.12  AREA-AVERAGED Fm(INCH/HR)=  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      19.77
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
******************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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              Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                            Analysis prepared by:




 ************************** DESCRIPTION OF STUDY **************************
* FOUNTAIN VALLEY ENTITLEMENT                                             *
* 100 YEAR CONDITION ANALYSIS                                             *
*                                                                         *
 ***************************************************************************

  FILE NAME: FVP100.DAT
  TIME/DATE OF STUDY: 17:33 02/03/2025
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   270.00
  ELEVATION DATA: UPSTREAM(FEET) =     51.60  DOWNSTREAM(FEET) =     49.34

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.917
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.755
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  APARTMENTS                 B        0.46      0.30     0.200    76    7.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.93
  TOTAL AREA(ACRES) =      0.46   PEAK FLOW RATE(CFS) =      1.93

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     49.34  DOWNSTREAM(FEET) =     45.84
  CHANNEL LENGTH THRU SUBAREA(FEET) =   670.00   CHANNEL SLOPE =  0.0052
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.206
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  APARTMENTS                 B        1.78      0.30     0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.49
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.43
  AVERAGE FLOW DEPTH(FEET) =   0.18   TRAVEL TIME(MIN.) =   7.83
  Tc(MIN.) =   15.75
  SUBAREA AREA(ACRES) =     1.78       SUBAREA RUNOFF(CFS) =    5.04
  EFFECTIVE AREA(ACRES) =      2.24     AREA-AVERAGED Fm(INCH/HR) =   0.06
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.20
  TOTAL AREA(ACRES) =        2.2         PEAK FLOW RATE(CFS) =       6.33

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOW VELOCITY(FEET/SEC.) =   1.55
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     940.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    42.40  DOWNSTREAM(FEET) =    38.83
 FLOW LENGTH(FEET) =   970.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.19
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       6.33
 PIPE TRAVEL TIME(MIN.) =   3.86    Tc(MIN.) =   19.61
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    1910.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   19.61
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.828
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 APARTMENTS                 B       11.76      0.30     0.200    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =   11.76      SUBAREA RUNOFF(CFS) =   29.29
 EFFECTIVE AREA(ACRES) =     14.00   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =       14.0       PEAK FLOW RATE(CFS) =      34.86

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   215.00
 ELEVATION DATA: UPSTREAM(FEET) =     47.76  DOWNSTREAM(FEET) =     47.01

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.610
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.532
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 APARTMENTS                 B        0.45      0.30     0.200    76    8.61
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
```

```
  SUBAREA RUNOFF(CFS) =      1.81
  TOTAL AREA(ACRES) =      0.45   PEAK FLOW RATE(CFS) =      1.81

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     47.01  DOWNSTREAM(FEET) =     44.89
  CHANNEL LENGTH THRU SUBAREA(FEET) =   377.00   CHANNEL SLOPE =  0.0056
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.684
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  APARTMENTS                 B        3.64      0.30     0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.77
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.68
  AVERAGE FLOW DEPTH(FEET) =   0.22   TRAVEL TIME(MIN.) =   3.75
  Tc(MIN.) =   12.36
  SUBAREA AREA(ACRES) =     3.64       SUBAREA RUNOFF(CFS) =   11.87
  EFFECTIVE AREA(ACRES) =      4.09     AREA-AVERAGED Fm(INCH/HR) =   0.06
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.20
  TOTAL AREA(ACRES) =        4.1         PEAK FLOW RATE(CFS) =      13.34

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.26   FLOW VELOCITY(FEET/SEC.) =   1.93
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     592.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.1  TC(MIN.) =     12.36
  EFFECTIVE AREA(ACRES) =      4.09  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =      13.34
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX F

FLOWMASTER CALCULATIONS

6" Pipe

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.011
Channel Slope	0.500 %
Normal Depth	6.0 in
Diameter	6.0 in
Discharge	0.47 cfs

Results	
Discharge	0.47 cfs
Normal Depth	6.0 in
Flow Area	0.2 ft²
Wetted Perimeter	1.6 ft
Hydraulic Radius	1.5 in
Top Width	0.00 ft
Critical Depth	4.2 in
Percent Full	100.0 %
Critical Slope	0.717 %
Velocity	2.39 ft/s
Velocity Head	0.09 ft
Specific Energy	0.59 ft
Froude Number	(N/A)
Maximum Discharge	0.50 cfs
Discharge Full	0.47 cfs
Slope Full	0.500 %
Flow Type	Critical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.0 in
Critical Depth	4.2 in
Channel Slope	0.500 %
Critical Slope	0.717 %

12" Pipe

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.011
Channel Slope	0.500 %
Normal Depth	12.0 in
Diameter	12.0 in
Discharge	2.98 cfs

Results	
Discharge	2.98 cfs
Normal Depth	12.0 in
Flow Area	0.8 ft²
Wetted Perimeter	3.1 ft
Hydraulic Radius	3.0 in
Top Width	0.00 ft
Critical Depth	8.9 in
Percent Full	100.0 %
Critical Slope	0.621 %
Velocity	3.79 ft/s
Velocity Head	0.22 ft
Specific Energy	1.22 ft
Froude Number	(N/A)
Maximum Discharge	3.20 cfs
Discharge Full	2.98 cfs
Slope Full	0.500 %
Flow Type	Critical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	12.0 in
Critical Depth	8.9 in
Channel Slope	0.500 %
Critical Slope	0.621 %

18" Pipe

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.011
Channel Slope	0.500 %
Normal Depth	18.0 in
Diameter	18.0 in
Discharge	8.78 cfs

Results	
Discharge	8.78 cfs
Normal Depth	18.0 in
Flow Area	1.8 ft²
Wetted Perimeter	4.7 ft
Hydraulic Radius	4.5 in
Top Width	0.00 ft
Critical Depth	13.8 in
Percent Full	100.0 %
Critical Slope	0.575 %
Velocity	4.97 ft/s
Velocity Head	0.38 ft
Specific Energy	1.88 ft
Froude Number	(N/A)
Maximum Discharge	9.44 cfs
Discharge Full	8.78 cfs
Slope Full	0.500 %
Flow Type	Critical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	18.0 in
Critical Depth	13.8 in
Channel Slope	0.500 %
Critical Slope	0.575 %

24" Pipe

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.011
Channel Slope	0.500 %
Normal Depth	24.0 in
Diameter	24.0 in
Discharge	18.90 cfs

Results	
Discharge	18.90 cfs
Normal Depth	24.0 in
Flow Area	3.1 ft²
Wetted Perimeter	6.3 ft
Hydraulic Radius	6.0 in
Top Width	0.00 ft
Critical Depth	18.8 in
Percent Full	100.0 %
Critical Slope	0.548 %
Velocity	6.02 ft/s
Velocity Head	0.56 ft
Specific Energy	2.56 ft
Froude Number	(N/A)
Maximum Discharge	20.34 cfs
Discharge Full	18.90 cfs
Slope Full	0.500 %
Flow Type	Critical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	24.0 in
Critical Depth	18.8 in
Channel Slope	0.500 %
Critical Slope	0.548 %

30" Pipe

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.011
Channel Slope	0.500 %
Normal Depth	36.0 in
Diameter	36.0 in
Discharge	55.73 cfs

Results	
Discharge	55.73 cfs
Normal Depth	36.0 in
Flow Area	7.1 ft²
Wetted Perimeter	9.4 ft
Hydraulic Radius	9.0 in
Top Width	0.00 ft
Critical Depth	29.1 in
Percent Full	100.0 %
Critical Slope	0.514 %
Velocity	7.88 ft/s
Velocity Head	0.97 ft
Specific Energy	3.97 ft
Froude Number	(N/A)
Maximum Discharge	59.95 cfs
Discharge Full	55.73 cfs
Slope Full	0.500 %
Flow Type	Critical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	36.0 in
Critical Depth	29.1 in
Channel Slope	0.500 %
Critical Slope	0.514 %

36" Pipe

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.011
Channel Slope	0.500 %
Normal Depth	30.0 in
Diameter	30.0 in
Discharge	34.27 cfs

Results	
Discharge	34.27 cfs
Normal Depth	30.0 in
Flow Area	4.9 ft²
Wetted Perimeter	7.9 ft
Hydraulic Radius	7.5 in
Top Width	0.00 ft
Critical Depth	23.9 in
Percent Full	100.0 %
Critical Slope	0.528 %
Velocity	6.98 ft/s
Velocity Head	0.76 ft
Specific Energy	3.26 ft
Froude Number	(N/A)
Maximum Discharge	36.87 cfs
Discharge Full	34.27 cfs
Slope Full	0.500 %
Flow Type	Critical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	30.0 in
Critical Depth	23.9 in
Channel Slope	0.500 %
Critical Slope	0.528 %

Worksheet for Catch Basin at 6 in Curb Capacity

Project Description	
Solve For	Discharge

Input Data	
Headwater Elevation	0.50 ft
Crest Elevation	0.00 ft
Weir Coefficient	3.33 ft^(1/2)/s
Crest Length	7.0 ft

Results	
Discharge	8.24 cfs
Headwater Height Above Crest	0.50 ft
Flow Area	3.5 ft²
Velocity	2.35 ft/s
Wetted Perimeter	8.0 ft
Top Width	7.00 ft