

HYDROLOGY STUDY
FOR
BUNKER HILL 3-STORY BUILDING
BUNKER HILL STREET SAN DIEGO, CA 92109

PROJECT NO. _____

PREPARED FOR

NAME: BUNKER HILL LOFTS LLC

CONTACT: EVAN GERBER

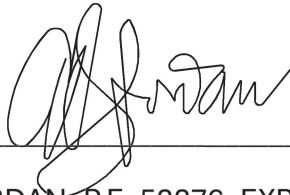
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PREPARED BY

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DATE PREPARED

July 31, 2023

DATE REVISED

July 7, 2026

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I. INTRODUCTION

This Study is prepared as a supplemental study for the construction of a 3-story apartment building located on two lots along Bunker Hill Street, San Diego, CA 92109. The APN numbers of these lots/properties are 424-321-03 & 424-321-04.

The existing site is currently vacant and primarily consists of AC pavement with a couple existing light poles. The Drainage tributary area is approximately 0.14 acres.

- **PURPOSE**

The purpose of this drainage study is to provide engineering evaluation and drainage analysis of the disturbed area affected by this development. Storm frequency for the 10 and 100 year events were analyzed in conformance with the San Diego County Hydrology manual utilizing Civil Design Hydrology software for San Diego County.

- **SITE/PROJECT LOCATION**

Project site is located at approximately the middle of the block located at the south east of the intersection of Bunker Hill street and Mission Bay Drive, San Diego, CA 92109. (See Vicinity Map)

- **SOIL TYPE**

Based on the NRCS Soil Survey, the soil type is classified under type “D”. (See NCRS Soil Survey). Soil material is stratified sand to sandy loam.

- **Runoff Summary**

A. EXISTING DEVELOPED CONDITION

The existing site is presently used as a parking lot. It is completely paved with asphalt concrete. The perimeter surrounding Bunker Hill Street is fully developed with sidewalks and existing curbs and gutters. No run-ons are anticipated to enter the project site. Based on existing site topography, drainage runoff flows from the east towards the west side of the property.

Discharge Point	Area (Acres)	Discharge, Q10 (cfs)	Discharge, Q100 (cfs)
NODE 11	0.14 AC	0.45 CFS	0.64 CFS

B. POST DEVELOPED CONDITION

An 3-story apartment building will be constructed at the subject property. Surface runoff is subdivided into three drainage areas with most of the area outflowing towards bunker hill street & the remainder outflowing towards the alley. The post developed condition is very similar to the existing condition with the post developed Q100 & Q10 increasing by only 0.01CFS. Downstream adjacent properties will not be affected by this development.

Discharge Point	Area (Acres)	Discharge, Q10 (cfs)	Discharge, Q100 (cfs)
NODE 17	0.1086	0.35	0.49
NODE 26	0.0216	0.07	0.10
NODE 27	0.0129	0.04	0.06
TOTAL	0.1431	0.46	0.65

- **METHODOLOGY**

Unless otherwise noted, the primary technical references that will be used in this study will be the San Diego County Hydrology Manual of June 2003.

Back-up calculation sheets will be based on the Rational Method, briefly described as follows:

The drainage area tributary to this project is less than 1.0 square mile (640 acres). Therefore, the methodology of computing its hydrologic elements will be the Rational Method (RM), briefly described as follows:

$$Q = C I A$$

Where:

Q = peak discharge, in cubic feet per second (cfs)

C = runoff coefficient, proportion of the rainfall that runs off the surface (no units)

I = average rainfall intensity in inches per hour for storm durations of 6 and 24 hours appropriate for developing peak flood discharges for the 100-year storm event.

A = drainage area contributing to the design location, in acres

• RUNOFF COEFFICIENT

The runoff coefficient “C” has to be modified in the “Post Development” conditions due to the land use and imperviousness of the improvements, as shown in the following equation:

$$C_M = 0.90 \times (\% \text{ Impervious}) + C_P \times (1 - \% \text{ Imp})$$

Where:

C_M = Modified coefficient of runoff

C_P = Coefficient of Runoff for Pervious soil

% Imp = imperviousness factor, dimensionless
ratio

The coefficients of runoff will be derived from Table 3-1, Runoff Coefficients for Urban Areas, San Diego County Hydrology Manual.

TIME OF CONCENTRATION

The Time of Concentration (T_c) is the time required for runoff to flow from the most remote and highest part of the drainage area to the point of discharge.

For the purposes of this study, the duration time (T_c), for the pre and post development condition will be the time for overland flow to reach the point of discharge at the outskirts of the property. Overland flow will be calculated assuming peak flow is achieved based on land use, average slope, and flow length.

Using table 3.2 we can approximate the Time of Concentration (T_c). If T_c is less than 5.0 minutes, use 5.0 minutes for T_i in accordance with the San Diego County Hydrology Manual to evaluate rainfall intensity (I). (See calculation sheets at end for T_c Calculations)

● RAINFALL INTENSITY

The rainfall precipitations, P_6 and P_{24} (6-hr and 24-hr peak flow durations, respectively) are determined by the location of the project in isopluvial maps with contour lines representing rainfall gauge readings at various storm frequencies.

The isopluvial lines connect points of equal rainfall precipitation in inches. These were recorded by precipitation gauges distributed all over the county of San Diego. Recorded data are based on either 6-hour or 24-hour time duration readings for various frequencies.

As recorded on isopluvial maps the rates of precipitation for 10-year & 100-year storm events at 6-hr/24-hr time durations, the corresponding rainfall precipitation rates for this drainage area are as follows:

10 year - P_6 = 1.50 inches

10 year - P_{24} = 2.55 inches

100 year - P_6 = 2.10 inches

100 year - P_{24} = 3.50 inches

Precipitation rates in inches are converted to rainfall intensities in inches per hour for use in the rational method (RM) formula as discussed earlier in this report.

The equation for converting rainfall precipitation (inches) into rainfall intensity (inches per hour) is:

$$I = 7.44 \times P_6 \times D^{-0.645}$$

Where,

I = Intensity (in/hr)

P_6 = 6-hour precipitation (in)

D = Time duration (min), also referred to as T_C

- **U.S. Clean Water Act**

The U.S. Clean Water Act has jurisdiction over waters of the United States, which includes but is not limited to traditional navigable waters, interstate waters, wetlands adjacent to traditionally navigable waters, as well as interstate waters directly abutting relatively permanent waters.

CWA Section 401 establishes the requirements for clean water quality standards within its jurisdiction, which consists of 4 basic elements, namely:

- 1) Designated uses of the water body;
- 2) Water quality criteria;
- 3) Antidegradation policies to maintain/protect existing uses; and
- 4) General Policies addressing implementation issues.

CWA Section 404 sets the requirements for clean water quality standards within its jurisdiction, mainly:

- 1) Protection of critical course sediment yield areas; and

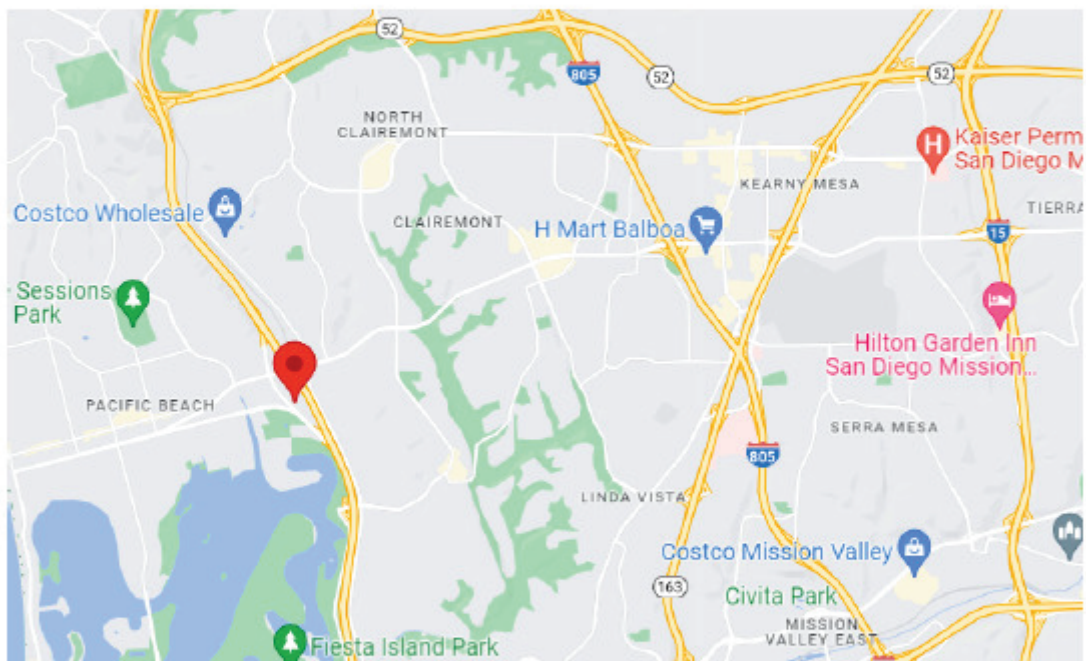
- 2) Flow control for post project runoff from the project site.

CWA Section 404 also sets permit regulations to cover the discharge of dredged or fill material into the waters of the United States.

This project proposes the construction of a 3-story apartment building and is located a couple blocks from the nearest body of water. As such this project proposes no dredging or filling of material into waters of the United States and will not discharge any runoff into waters of the United States. This project therefore is not covered by the provisions of the Clean Water Act Sections 401 & 404.

ATTACHMENTS

II VICINITY MAP / RAINFALL ISOPLUVIALS/ SOIL DATA



VICINITY MAP

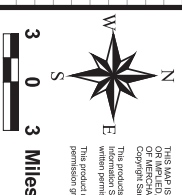
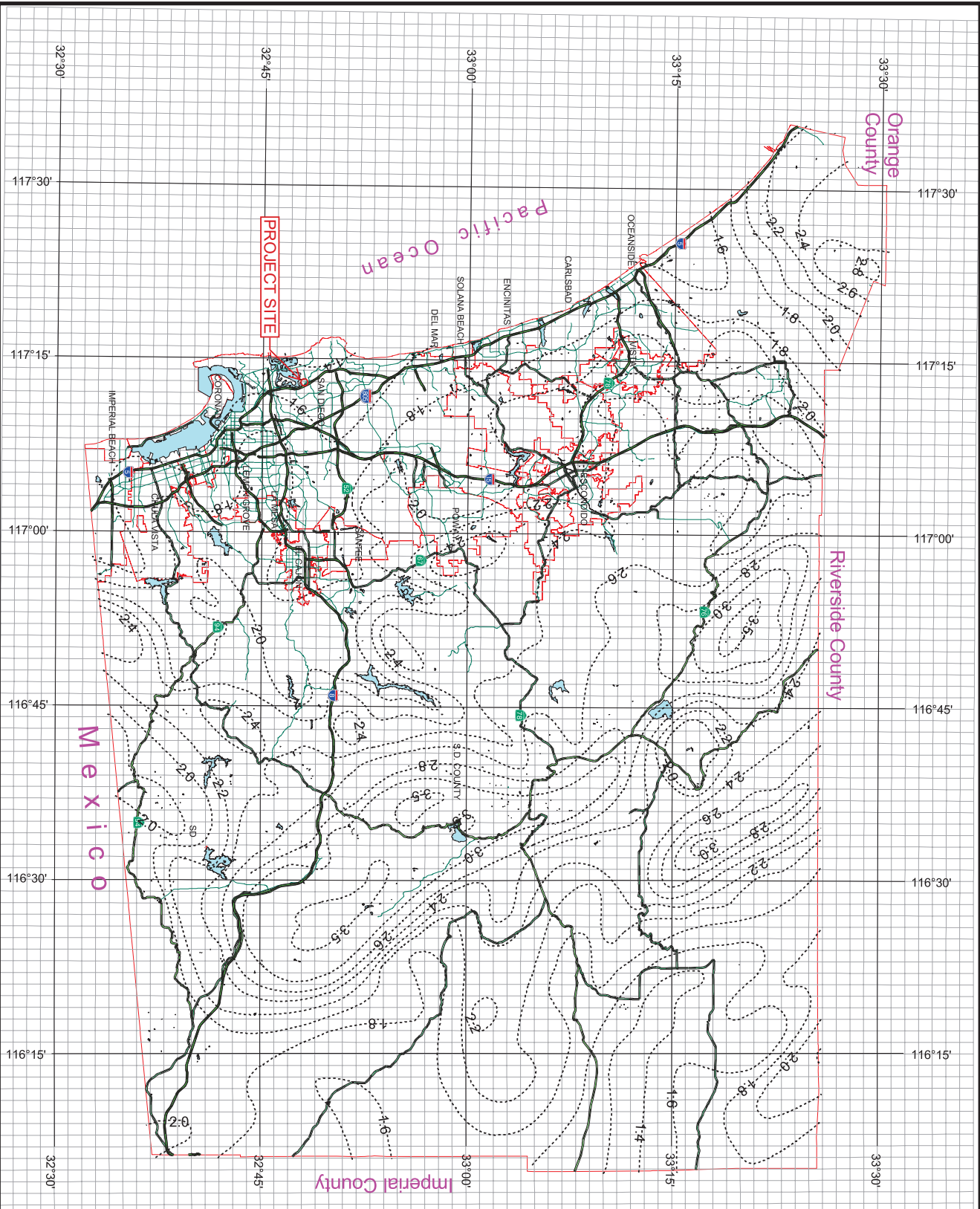
County of San Diego Hydrology Manual



Rainfall Isopleths

10 Year Rainfall Event - 6 Hours

..... Isopleth (inches)



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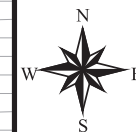
County of San Diego Hydrology Manual



Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours

----- Isopluvial (inches)

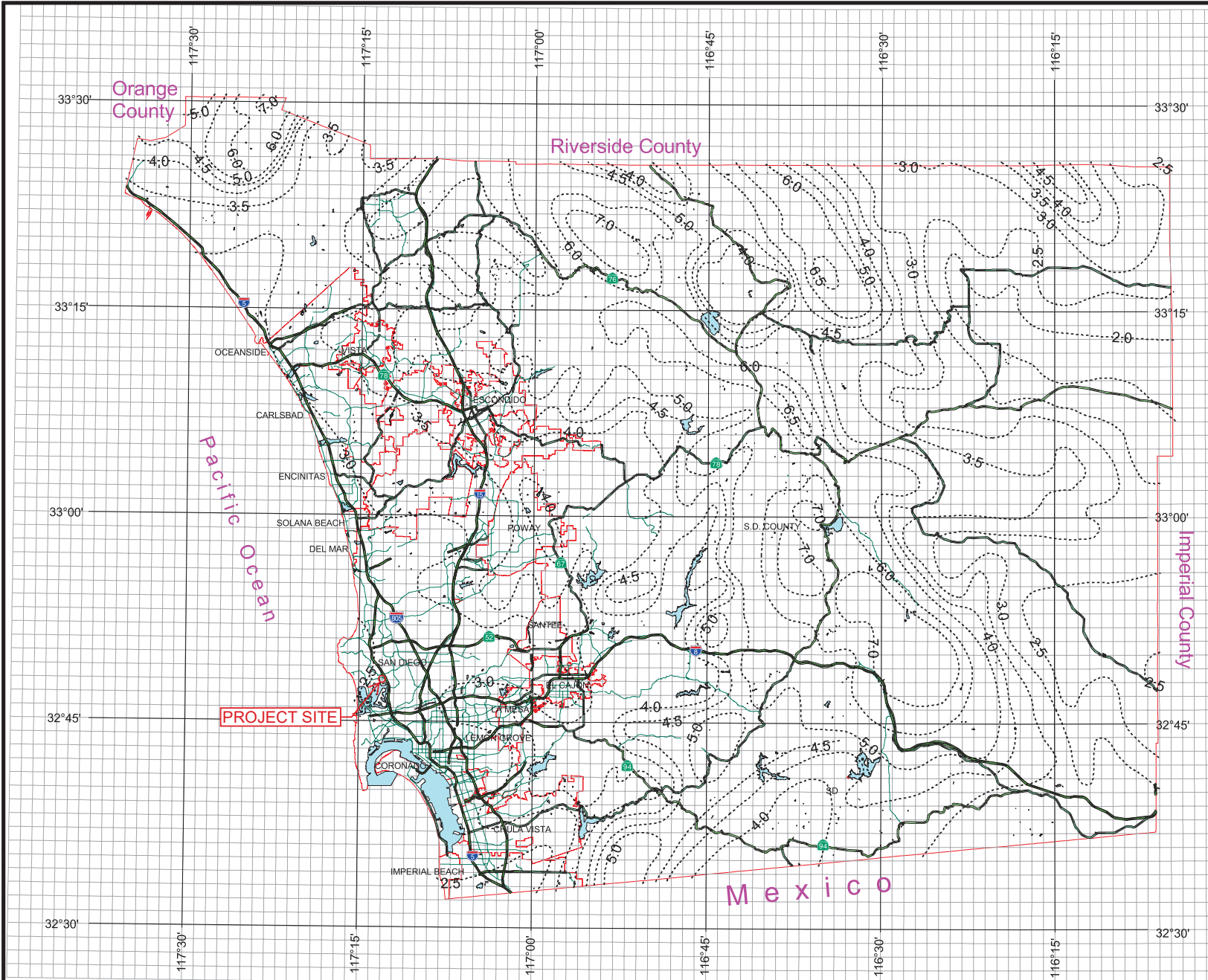


3 0 3 Miles

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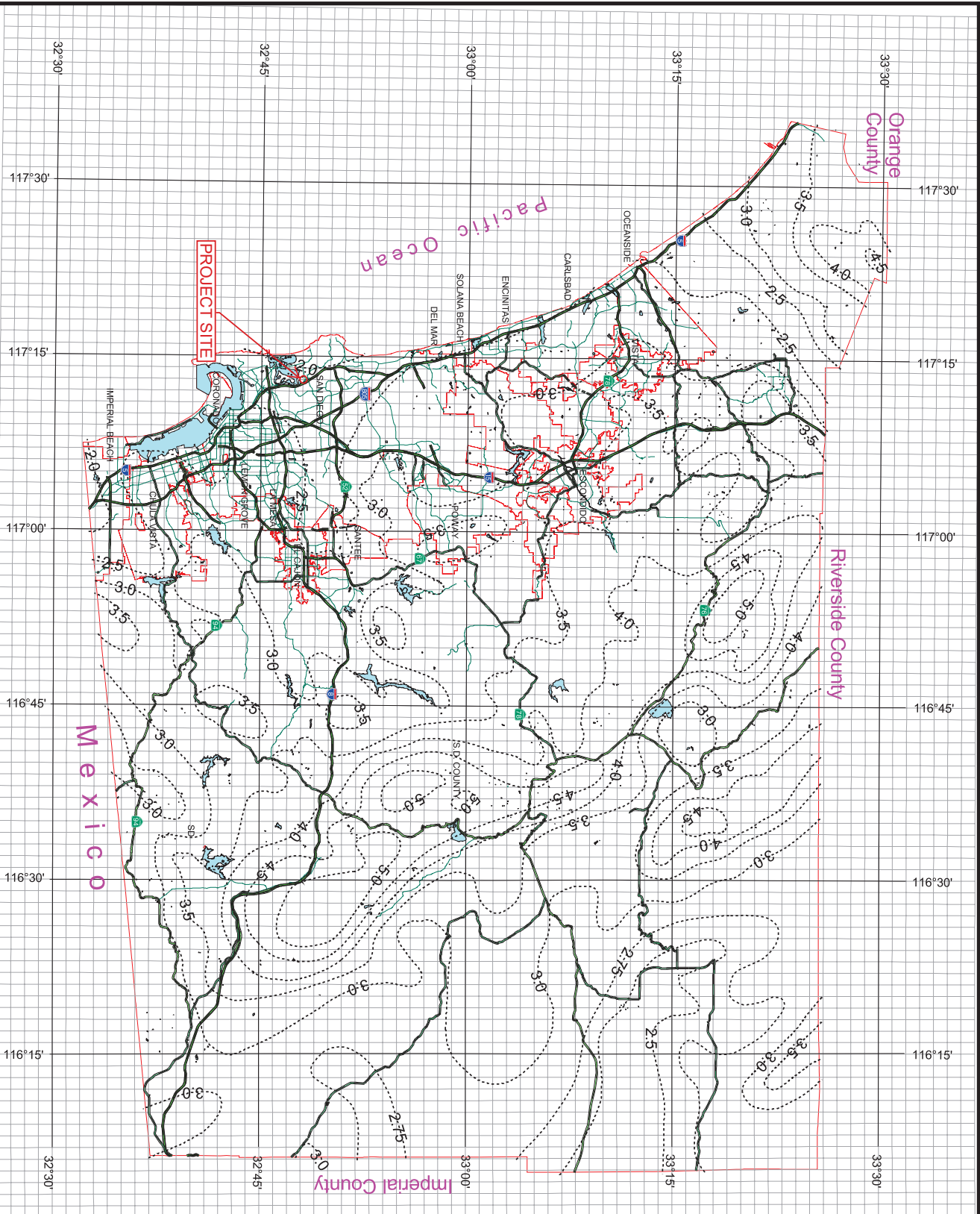
County of San Diego Hydrology Manual



Rainfall Isopleths

100 Year Rainfall Event - 6 Hours

..... Isopleth (inches)



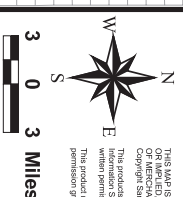
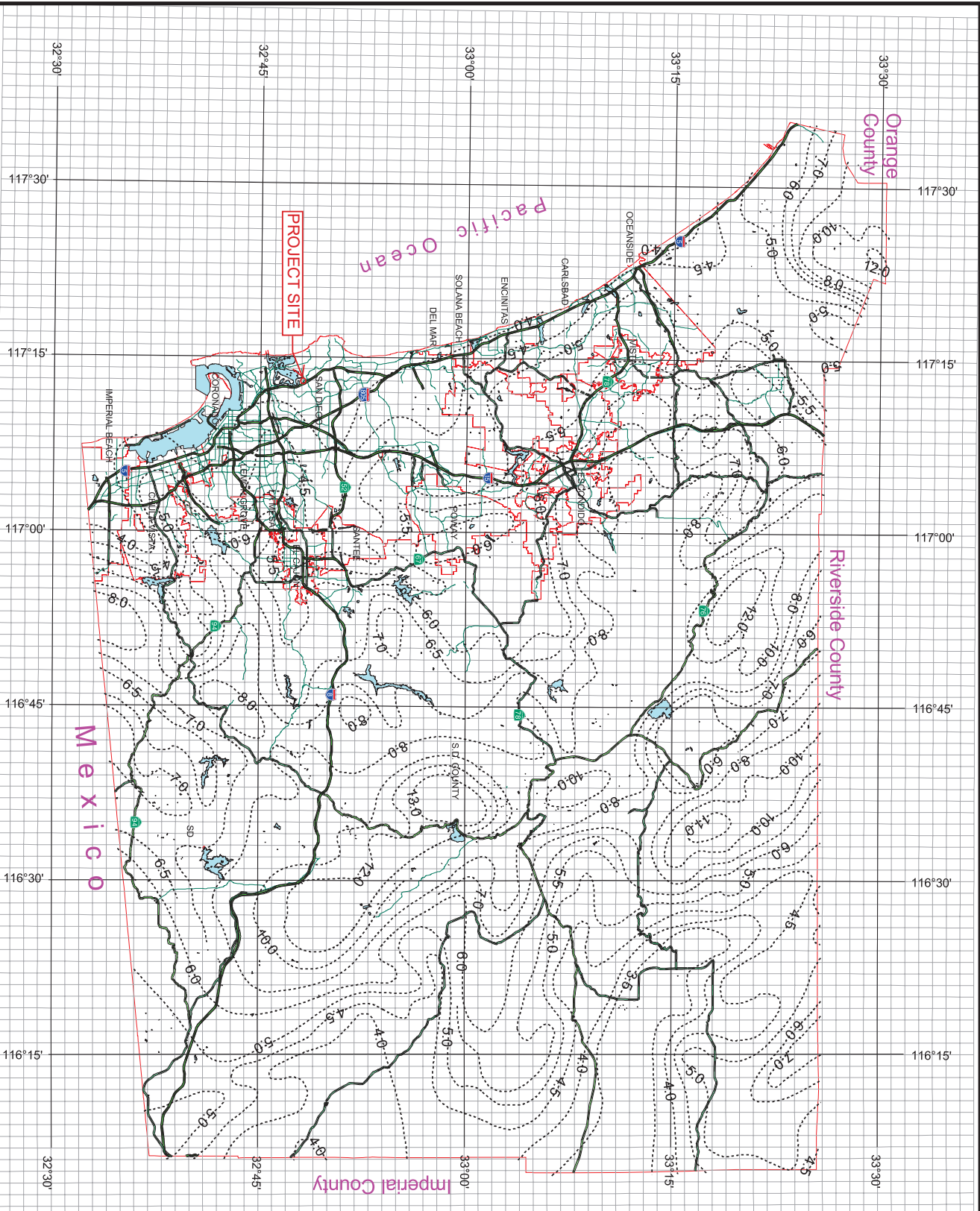
County of San Diego Hydrology Manual



Rainfall Isoplethals

100 Year Rainfall Event - 24 Hours

..... Isopleth (inches)



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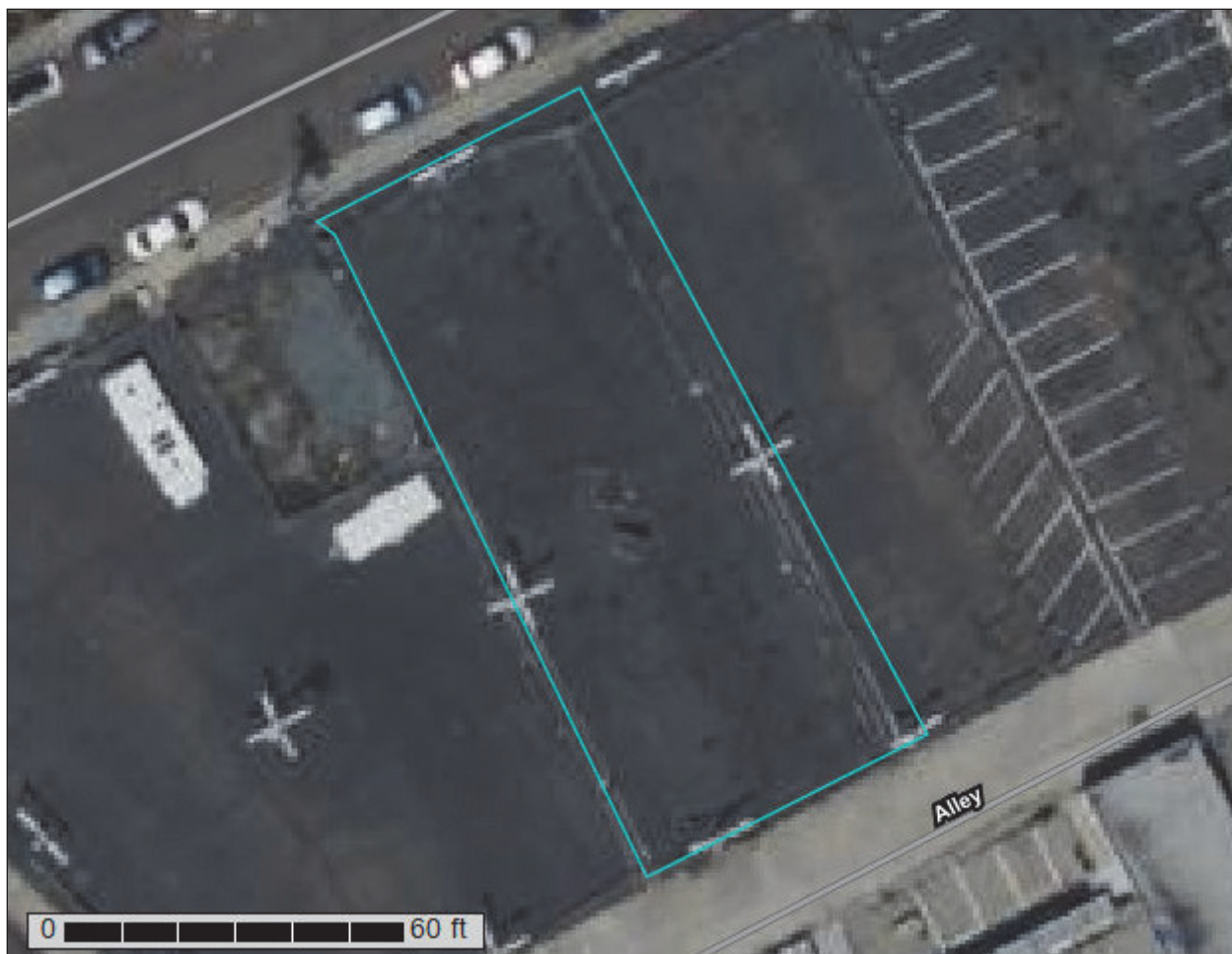
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for San Diego County Area, California



August 1, 2023

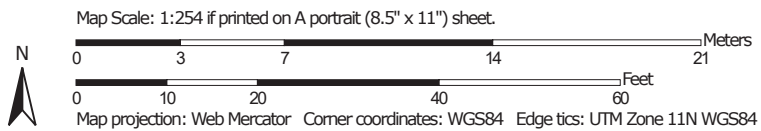
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.



San Diego County Area, California

HuC—Huerhuero-Urban land complex, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbcs
Elevation: 1,100 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Huerhuero and similar soils: 50 percent
Urban land: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huerhuero

Setting

Landform: Marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 12 inches: loam
H2 - 12 to 55 inches: clay
H3 - 55 to 72 inches: stratified sand to sandy loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XG909CA - Terrace
Hydric soil rating: No

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Custom Soil Resource Report

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydric soil rating: No

Minor Components

Las flores

Percent of map unit: 10 percent

Hydric soil rating: No

Oliventain

Percent of map unit: 5 percent

Hydric soil rating: No

III HYDROLOGY STUDY (10 YEAR & 100 YEAR STORM)

- 10 YEAR PRE-DEVELOPED CONDITION

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2014 Version 9.0

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 08/01/23

BUNKER HILL APARTMENT
10 YEAR PRE-DEVELOPED CONDITION
FN: 10PRE

***** Hydrology Study Control Information *****

Program License Serial Number 6420

Rational hydrology study storm event year is 10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.500
24 hour precipitation(inches) = 2.550
P6/P24 = 58.8%
San Diego hydrology manual 'C' values used

+++++
++
Process from Point/Station 10.000 to Point/Station
11.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Initial subarea total flow distance = 134.000(Ft.)
 Highest elevation = 19.860(Ft.)
 Lowest elevation = 17.290(Ft.)
 Elevation difference = 2.570(Ft.) Slope = 1.918 %
 Top of Initial Area Slope adjusted by User to 1.727 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 75.00 (Ft)
 for the top area slope value of 1.73 %, in a development type of
 General Commercial
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 3.64 minutes

$$TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$$

$$TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (1.727^{(1/3)})] = 3.64$$
 Calculated TC of 3.638 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.454(CFS)
 Total initial stream area = 0.140(Ac.)
 End of computations, total study area = 0.140 (Ac.)

- **100 YEAR PRE-DEVELOPED CONDITION**

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2014 Version 9.0

Rational method hydrology program based on
 San Diego County Flood Control Division 2003 hydrology manual
 Rational Hydrology Study Date: 08/01/23

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BUNKER HILL APRTMENT
100 YEAR PRE DEVELOPED CONDITION
FN: 100PRE
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***** Hydrology Study Control Information *****
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Program License Serial Number 6420
-----
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```
-----
Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.100
24 hour precipitation(inches) = 3.500
P6/P24 = 60.0%
San Diego hydrology manual 'C' values used
-----
```

```
+++++
++
Process from Point/Station 10.000 to Point/Station
11.000
**** INITIAL AREA EVALUATION ****
-----
```

```
-----
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type ]
(General Commercial )
Impervious value, Ai = 0.850
-----
```

Sub-Area C Value = 0.820
 Initial subarea total flow distance = 134.000(Ft.)
 Highest elevation = 19.860(Ft.)
 Lowest elevation = 17.290(Ft.)
 Elevation difference = 2.570(Ft.) Slope = 1.918 %
 Top of Initial Area Slope adjusted by User to 1.727 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 75.00 (Ft)
 for the top area slope value of 1.73 %, in a development type of
 General Commercial
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 3.64 minutes

$$TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$$

$$TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (1.727^{(1/3)})] = 3.64$$
 Calculated TC of 3.638 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.635(CFS)
 Total initial stream area = 0.140(Ac.)
 End of computations, total study area = 0.140 (Ac.)

HYDROLOGY STUDY 10 YEAR STORM – POST DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/26

***** Hydrology Study Control Information *****

Program License Serial Number 6750

Rational hydrology study storm event year is 10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.500
24 hour precipitation(inches) = 2.550
P6/P24 = 58.8%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 13.000 to Point/Station 8.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 35.840(Ft.)
Highest elevation = 30.720(Ft.)
Lowest elevation = 30.000(Ft.)
Elevation difference = 0.720(Ft.) Slope = 2.009 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.46 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$

$TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (2.000^{(1/3)})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.081(CFS)
 Total initial stream area = 0.025(Ac.)

++++++
 Process from Point/Station 8.000 to Point/Station 14.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.330(Ft.)
 Downstream point/station elevation = 18.180(Ft.)
 Pipe length = 35.59(Ft.) Slope = 0.0042 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.081(CFS)
 Given pipe size = 6.00(In.)
 Calculated individual pipe flow = 0.081(CFS)
 Normal flow depth in pipe = 1.93(In.)
 Flow top width inside pipe = 5.60(In.)
 Critical Depth = 1.68(In.)
 Pipe flow velocity = 1.49(Ft/s)
 Travel time through pipe = 0.40 min.
 Time of concentration (TC) = 3.86 min.

++++++
 Process from Point/Station 18.000 to Point/Station 14.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.861 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.86 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.025
 Subarea runoff = 0.019(CFS) for 0.006(Ac.)
 Total runoff = 0.100(CFS) Total area = 0.031(Ac.)

```

+++++
Process from Point/Station      14.000 to Point/Station      15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

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```

Upstream point/station elevation = 18.180(Ft.)
Downstream point/station elevation = 17.960(Ft.)
Pipe length = 44.61(Ft.) Slope = 0.0049 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 0.100(CFS)
Given pipe size = 6.00(In.)
Calculated individual pipe flow = 0.100(CFS)
Normal flow depth in pipe = 2.07(In.)
Flow top width inside pipe = 5.70(In.)
Critical Depth = 1.87(In.)
Pipe flow velocity = 1.68(Ft/s)
Travel time through pipe = 0.44 min.
Time of concentration (TC) = 4.30 min.

```

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+++++
Process from Point/Station      19.000 to Point/Station      15.000
**** SUBAREA FLOW ADDITION ****

```

```

Calculated TC of 4.304 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type ]
(General Commercial )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration = 4.30 min.
Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820 CA = 0.031
Subarea runoff = 0.023(CFS) for 0.007(Ac.)
Total runoff = 0.123(CFS) Total area = 0.038(Ac.)

```

```

+++++
Process from Point/Station      15.000 to Point/Station      16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

```

```

Upstream point/station elevation = 17.960(Ft.)
Downstream point/station elevation = 17.830(Ft.)
Pipe length = 26.21(Ft.) Slope = 0.0050 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 0.123(CFS)
Given pipe size = 6.00(In.)

```

Calculated individual pipe flow = 0.123(CFS)
 Normal flow depth in pipe = 2.30(In.)
 Flow top width inside pipe = 5.84(In.)
 Critical Depth = 2.09(In.)
 Pipe flow velocity = 1.78(Ft/s)
 Travel time through pipe = 0.25 min.
 Time of concentration (TC) = 4.55 min.

++++++
 Process from Point/Station 15.000 to Point/Station 16.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 1
 Stream flow area = 0.038(Ac.)
 Runoff from this stream = 0.123(CFS)
 Time of concentration = 4.55 min.
 Rainfall intensity = 3.952(In/Hr)
 Program is now starting with Main Stream No. 2

++++++
 Process from Point/Station 13.000 to Point/Station 5.000
 **** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Initial subarea total flow distance = 31.660(Ft.)
 Highest elevation = 30.630(Ft.)
 Lowest elevation = 30.000(Ft.)
 Elevation difference = 0.630(Ft.) Slope = 1.990 %
 Top of Initial Area Slope adjusted by User to 2.000 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 75.00 (Ft)
 for the top area slope value of 2.00 %, in a development type of
 General Commercial
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 3.46 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{1.5} / (\% \text{ slope}^{1/3})]$
 $TC = [1.8 * (1.1 - 0.8200) * (75.000^{1.5}) / (2.000^{1/3})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm

Effective runoff coefficient used for area (Q=KCIA) is $C = 0.820$
 Subarea runoff = $0.052(\text{CFS})$
 Total initial stream area = $0.016(\text{Ac.})$

+++++
 Process from Point/Station 5.000 to Point/Station 20.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = $18.300(\text{Ft.})$
 Downstream point/station elevation = $18.230(\text{Ft.})$
 Pipe length = $4.50(\text{Ft.})$ Slope = 0.0156 Manning's $N = 0.013$
 No. of pipes = 1 Required pipe flow = $0.052(\text{CFS})$
 Given pipe size = $4.00(\text{In.})$
 Calculated individual pipe flow = $0.052(\text{CFS})$
 Normal flow depth in pipe = $1.27(\text{In.})$
 Flow top width inside pipe = $3.72(\text{In.})$
 Critical Depth = $1.50(\text{In.})$
 Pipe flow velocity = $2.18(\text{Ft/s})$
 Travel time through pipe = 0.03 min.
 Time of concentration (TC) = 3.50 min.

+++++
 Process from Point/Station 24.000 to Point/Station 20.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.499 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = $3.952(\text{In/Hr})$ for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, $A_i = 0.850$
 Sub-Area C Value = 0.820
 Time of concentration = 3.50 min.
 Rainfall intensity = $3.952(\text{In/Hr})$ for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is $C = 0.820$ $CA = 0.015$
 Subarea runoff = $0.006(\text{CFS})$ for $0.002(\text{Ac.})$
 Total runoff = $0.058(\text{CFS})$ Total area = $0.018(\text{Ac.})$

+++++
 Process from Point/Station 20.000 to Point/Station 21.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.230(Ft.)
 Downstream point/station elevation = 18.140(Ft.)
 Pipe length = 18.17(Ft.) Slope = 0.0050 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.058(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.058(CFS)
 Normal flow depth in pipe = 1.41(In.)
 Flow top width inside pipe = 6.10(In.)
 Critical Depth = 1.31(In.)
 Pipe flow velocity = 1.39(Ft/s)
 Travel time through pipe = 0.22 min.
 Time of concentration (TC) = 3.72 min.

++++++
 Process from Point/Station 12.000 to Point/Station 4.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.717 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.72 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.023
 Subarea runoff = 0.032(CFS) for 0.010(Ac.)
 Total runoff = 0.091(CFS) Total area = 0.028(Ac.)

++++++
 Process from Point/Station 4.000 to Point/Station 21.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.200(Ft.)
 Downstream point/station elevation = 18.140(Ft.)
 Pipe length = 4.50(Ft.) Slope = 0.0133 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.091(CFS)
 Given pipe size = 4.00(In.)
 Calculated individual pipe flow = 0.091(CFS)
 Normal flow depth in pipe = 1.79(In.)
 Flow top width inside pipe = 3.98(In.)
 Critical Depth = 2.02(In.)

Pipe flow velocity = 2.39(Ft/s)
 Travel time through pipe = 0.03 min.
 Time of concentration (TC) = 3.75 min.

+++++
 Process from Point/Station 21.000 to Point/Station 22.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.140(Ft.)
 Downstream point/station elevation = 18.070(Ft.)
 Pipe length = 15.14(Ft.) Slope = 0.0046 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.091(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.091(CFS)
 Normal flow depth in pipe = 1.79(In.)
 Flow top width inside pipe = 6.66(In.)
 Critical Depth = 1.64(In.)
 Pipe flow velocity = 1.54(Ft/s)
 Travel time through pipe = 0.16 min.
 Time of concentration (TC) = 3.91 min.

+++++
 Process from Point/Station 11.000 to Point/Station 3.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.911 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.91 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.031
 Subarea runoff = 0.032(CFS) for 0.010(Ac.)
 Total runoff = 0.123(CFS) Total area = 0.038(Ac.)

+++++
 Process from Point/Station 3.000 to Point/Station 22.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.140(Ft.)
 Downstream point/station elevation = 18.070(Ft.)
 Pipe length = 4.50(Ft.) Slope = 0.0156 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.123(CFS)
 Given pipe size = 4.00(In.)
 Calculated individual pipe flow = 0.123(CFS)
 Normal flow depth in pipe = 2.04(In.)
 Flow top width inside pipe = 4.00(In.)
 Critical Depth = 2.36(In.)
 Pipe flow velocity = 2.74(Ft/s)
 Travel time through pipe = 0.03 min.
 Time of concentration (TC) = 3.94 min.

++++++
 Process from Point/Station 22.000 to Point/Station 23.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.070(Ft.)
 Downstream point/station elevation = 17.980(Ft.)
 Pipe length = 16.95(Ft.) Slope = 0.0053 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.123(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.123(CFS)
 Normal flow depth in pipe = 2.02(In.)
 Flow top width inside pipe = 6.95(In.)
 Critical Depth = 1.92(In.)
 Pipe flow velocity = 1.78(Ft/s)
 Travel time through pipe = 0.16 min.
 Time of concentration (TC) = 4.10 min.

++++++
 Process from Point/Station 10.000 to Point/Station 2.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 4.098 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 4.10 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area

(Q=KCIA) is C = 0.820 CA = 0.040
 Subarea runoff = 0.036(CFS) for 0.011(Ac.)
 Total runoff = 0.159(CFS) Total area = 0.049(Ac.)

+++++
 Process from Point/Station 2.000 to Point/Station 23.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.050(Ft.)
 Downstream point/station elevation = 17.980(Ft.)
 Pipe length = 4.50(Ft.) Slope = 0.0156 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.159(CFS)
 Given pipe size = 4.00(In.)
 Calculated individual pipe flow = 0.159(CFS)
 Normal flow depth in pipe = 2.40(In.)
 Flow top width inside pipe = 3.92(In.)
 Critical Depth = 2.70(In.)
 Pipe flow velocity = 2.92(Ft/s)
 Travel time through pipe = 0.03 min.
 Time of concentration (TC) = 4.12 min.

+++++
 Process from Point/Station 23.000 to Point/Station 25.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 17.980(Ft.)
 Downstream point/station elevation = 17.860(Ft.)
 Pipe length = 24.34(Ft.) Slope = 0.0049 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.159(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.159(CFS)
 Normal flow depth in pipe = 2.35(In.)
 Flow top width inside pipe = 7.29(In.)
 Critical Depth = 2.19(In.)
 Pipe flow velocity = 1.86(Ft/s)
 Travel time through pipe = 0.22 min.
 Time of concentration (TC) = 4.34 min.

+++++
 Process from Point/Station 10.000 to Point/Station 1.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 4.341 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 4.34 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.047
 Subarea runoff = 0.026(CFS) for 0.008(Ac.)
 Total runoff = 0.185(CFS) Total area = 0.057(Ac.)

++++++
 Process from Point/Station 1.000 to Point/Station 25.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 4.341 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 4.34 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.057
 Subarea runoff = 0.042(CFS) for 0.013(Ac.)
 Total runoff = 0.227(CFS) Total area = 0.070(Ac.)

++++++
 Process from Point/Station 25.000 to Point/Station 16.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 17.860(Ft.)
 Downstream point/station elevation = 17.830(Ft.)
 Pipe length = 5.85(Ft.) Slope = 0.0051 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.227(CFS)
 Given pipe size = 6.00(In.)
 Calculated individual pipe flow = 0.227(CFS)
 Normal flow depth in pipe = 3.23(In.)
 Flow top width inside pipe = 5.98(In.)
 Critical Depth = 2.87(In.)

Pipe flow velocity = 2.11(Ft/s)
 Travel time through pipe = 0.05 min.
 Time of concentration (TC) = 4.39 min.

+++++
 Process from Point/Station 25.000 to Point/Station 16.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 0.070(Ac.)
 Runoff from this stream = 0.227(CFS)
 Time of concentration = 4.39 min.
 Rainfall intensity = 3.952(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	0.123	4.55	3.952
2	0.227	4.39	3.952

Qmax(1) =

1.000 *	1.000 *	0.123)	+	
1.000 *	1.000 *	0.227)	+	0.350

Qmax(2) =

1.000 *	0.964 *	0.123)	+	
1.000 *	1.000 *	0.227)	+	0.346

Total of 2 main streams to confluence:

Flow rates before confluence point:

0.123 0.227

Maximum flow rates at confluence using above data:

0.350 0.346

Area of streams before confluence:

0.038 0.070

Results of confluence:

Total flow rate = 0.350(CFS)

Time of concentration = 4.550 min.

Effective stream area after confluence = 0.108(Ac.)

+++++
 Process from Point/Station 16.000 to Point/Station 17.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 17.830(Ft.)

Downstream point/station elevation = 17.680(Ft.)
 Pipe length = 15.04(Ft.) Slope = 0.0100 Manning's N = 0.013
 No. of pipes = 3 Required pipe flow = 0.350(CFS)
 Given pipe size = 3.00(In.)
 NOTE: Normal flow is pressure flow in user selected pipe size.
 The approximate hydraulic grade line above the pipe invert is
 0.244(Ft.) at the headworks or inlet of the pipe(s)
 Pipe friction loss = 0.262(Ft.)
 Minor friction loss = 0.132(Ft.) K-factor = 1.50
 Pipe flow velocity = 2.38(Ft/s)
 Travel time through pipe = 0.11 min.
 Time of concentration (TC) = 4.66 min.
 End of computations, total study area = 0.108 (Ac.)

HYDROLOGY STUDY 10 YEAR STORM – POST DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/26

***** Hydrology Study Control Information *****

Program License Serial Number 6750

Rational hydrology study storm event year is 10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.500
24 hour precipitation(inches) = 2.550
P6/P24 = 58.8%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 13.000 to Point/Station 6.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 30.660(Ft.)
Highest elevation = 30.610(Ft.)
Lowest elevation = 30.000(Ft.)
Elevation difference = 0.610(Ft.) Slope = 1.990 %
Top of Initial Area Slope adjusted by User to 2.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.46 minutes

$TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (2.000^{(1/3)})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.045(CFS)
 Total initial stream area = 0.014(Ac.)

++++++
 Process from Point/Station 6.000 to Point/Station 26.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.46 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.017
 Subarea runoff = 0.023(CFS) for 0.007(Ac.)
 Total runoff = 0.068(CFS) Total area = 0.021(Ac.)

HYDROLOGY STUDY 10 YEAR STORM – POST DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/26

***** Hydrology Study Control Information *****

Program License Serial Number 6750

Rational hydrology study storm event year is 10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.500
24 hour precipitation(inches) = 2.550
P6/P24 = 58.8%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 13.000 to Point/Station 9.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 27.510(Ft.)
Highest elevation = 30.550(Ft.)
Lowest elevation = 30.000(Ft.)
Elevation difference = 0.550(Ft.) Slope = 1.999 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.46 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$

$TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (2.000^{(1/3)})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.019(CFS)
 Total initial stream area = 0.006(Ac.)

++++++
 Process from Point/Station 9.000 to Point/Station 26.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 3.952(In/Hr) for a 10.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.46 min.
 Rainfall intensity = 3.952(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.011
 Subarea runoff = 0.026(CFS) for 0.008(Ac.)
 Total runoff = 0.045(CFS) Total area = 0.014(Ac.)

HYDROLOGY STUDY 100 YEAR STORM – POST DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/26

***** Hydrology Study Control Information *****

Program License Serial Number 6750

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.100
24 hour precipitation(inches) = 3.500
P6/P24 = 60.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 13.000 to Point/Station 8.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 35.840(Ft.)
Highest elevation = 30.720(Ft.)
Lowest elevation = 30.000(Ft.)
Elevation difference = 0.720(Ft.) Slope = 2.009 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.46 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$

$TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (2.000^{(1/3)})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.113(CFS)
 Total initial stream area = 0.025(Ac.)

++++++
 Process from Point/Station 8.000 to Point/Station 14.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.330(Ft.)
 Downstream point/station elevation = 18.180(Ft.)
 Pipe length = 35.59(Ft.) Slope = 0.0042 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.113(CFS)
 Given pipe size = 4.00(In.)
 Calculated individual pipe flow = 0.113(CFS)
 Normal flow depth in pipe = 3.00(In.)
 Flow top width inside pipe = 3.46(In.)
 Critical Depth = 2.26(In.)
 Pipe flow velocity = 1.60(Ft/s)
 Travel time through pipe = 0.37 min.
 Time of concentration (TC) = 3.83 min.

++++++
 Process from Point/Station 18.000 to Point/Station 14.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.834 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.83 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.025
 Subarea runoff = 0.027(CFS) for 0.006(Ac.)
 Total runoff = 0.141(CFS) Total area = 0.031(Ac.)

```

+++++
Process from Point/Station      14.000 to Point/Station      15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

```

```

Upstream point/station elevation = 18.180(Ft.)
Downstream point/station elevation = 17.960(Ft.)
Pipe length = 44.61(Ft.) Slope = 0.0049 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 0.141(CFS)
Given pipe size = 6.00(In.)
Calculated individual pipe flow = 0.141(CFS)
Normal flow depth in pipe = 2.48(In.)
Flow top width inside pipe = 5.91(In.)
Critical Depth = 2.24(In.)
Pipe flow velocity = 1.84(Ft/s)
Travel time through pipe = 0.40 min.
Time of concentration (TC) = 4.24 min.

```

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+++++
Process from Point/Station      19.000 to Point/Station      15.000
**** SUBAREA FLOW ADDITION ****

```

```

Calculated TC of 4.238 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type ]
(General Commercial )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration = 4.24 min.
Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820 CA = 0.031
Subarea runoff = 0.032(CFS) for 0.007(Ac.)
Total runoff = 0.172(CFS) Total area = 0.038(Ac.)

```

```

+++++
Process from Point/Station      15.000 to Point/Station      16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

```

```

Upstream point/station elevation = 17.960(Ft.)
Downstream point/station elevation = 17.830(Ft.)
Pipe length = 26.21(Ft.) Slope = 0.0050 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 0.172(CFS)
Given pipe size = 6.00(In.)

```

Calculated individual pipe flow = 0.172(CFS)
 Normal flow depth in pipe = 2.77(In.)
 Flow top width inside pipe = 5.98(In.)
 Critical Depth = 2.48(In.)
 Pipe flow velocity = 1.94(Ft/s)
 Travel time through pipe = 0.22 min.
 Time of concentration (TC) = 4.46 min.

++++++
 Process from Point/Station 15.000 to Point/Station 16.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 1
 Stream flow area = 0.038(Ac.)
 Runoff from this stream = 0.172(CFS)
 Time of concentration = 4.46 min.
 Rainfall intensity = 5.533(In/Hr)
 Program is now starting with Main Stream No. 2

++++++
 Process from Point/Station 13.000 to Point/Station 5.000
 **** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Initial subarea total flow distance = 31.660(Ft.)
 Highest elevation = 30.630(Ft.)
 Lowest elevation = 30.000(Ft.)
 Elevation difference = 0.630(Ft.) Slope = 1.990 %
 Top of Initial Area Slope adjusted by User to 2.000 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 75.00 (Ft)
 for the top area slope value of 2.00 %, in a development type of
 General Commercial
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 3.46 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.49} / (Slope^{1/3})]$
 $TC = [1.8 * (1.1 - 0.8200) * (75.000^{1.49}) / (2.000^{1/3})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area (Q=KCIA) is $C = 0.820$
 Subarea runoff = $0.073(\text{CFS})$
 Total initial stream area = $0.016(\text{Ac.})$

+++++
 Process from Point/Station 5.000 to Point/Station 20.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = $18.300(\text{Ft.})$
 Downstream point/station elevation = $18.230(\text{Ft.})$
 Pipe length = $4.50(\text{Ft.})$ Slope = 0.0156 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = $0.073(\text{CFS})$
 Given pipe size = $4.00(\text{In.})$
 Calculated individual pipe flow = $0.073(\text{CFS})$
 Normal flow depth in pipe = $1.53(\text{In.})$
 Flow top width inside pipe = $3.89(\text{In.})$
 Critical Depth = $1.79(\text{In.})$
 Pipe flow velocity = $2.40(\text{Ft/s})$
 Travel time through pipe = 0.03 min.
 Time of concentration (TC) = 3.50 min.

+++++
 Process from Point/Station 24.000 to Point/Station 20.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.496 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = $5.533(\text{In/Hr})$ for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, $A_i = 0.850$
 Sub-Area C Value = 0.820
 Time of concentration = 3.50 min.
 Rainfall intensity = $5.533(\text{In/Hr})$ for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is $C = 0.820$ CA = 0.015
 Subarea runoff = $0.009(\text{CFS})$ for $0.002(\text{Ac.})$
 Total runoff = $0.082(\text{CFS})$ Total area = $0.018(\text{Ac.})$

+++++
 Process from Point/Station 20.000 to Point/Station 21.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.230(Ft.)
 Downstream point/station elevation = 18.140(Ft.)
 Pipe length = 18.17(Ft.) Slope = 0.0050 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.082(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.082(CFS)
 Normal flow depth in pipe = 1.67(In.)
 Flow top width inside pipe = 6.50(In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 1.54(Ft/s)
 Travel time through pipe = 0.20 min.
 Time of concentration (TC) = 3.69 min.

++++++
 Process from Point/Station 12.000 to Point/Station 4.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.693 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.69 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.023
 Subarea runoff = 0.045(CFS) for 0.010(Ac.)
 Total runoff = 0.127(CFS) Total area = 0.028(Ac.)

++++++
 Process from Point/Station 4.000 to Point/Station 21.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.200(Ft.)
 Downstream point/station elevation = 18.140(Ft.)
 Pipe length = 4.50(Ft.) Slope = 0.0133 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.127(CFS)
 Given pipe size = 4.00(In.)
 Calculated individual pipe flow = 0.127(CFS)
 Normal flow depth in pipe = 2.18(In.)
 Flow top width inside pipe = 3.98(In.)
 Critical Depth = 2.40(In.)

Pipe flow velocity = 2.61(Ft/s)
 Travel time through pipe = 0.03 min.
 Time of concentration (TC) = 3.72 min.

+++++
 Process from Point/Station 21.000 to Point/Station 22.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.140(Ft.)
 Downstream point/station elevation = 18.070(Ft.)
 Pipe length = 15.14(Ft.) Slope = 0.0046 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.127(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.127(CFS)
 Normal flow depth in pipe = 2.13(In.)
 Flow top width inside pipe = 7.07(In.)
 Critical Depth = 1.95(In.)
 Pipe flow velocity = 1.71(Ft/s)
 Travel time through pipe = 0.15 min.
 Time of concentration (TC) = 3.87 min.

+++++
 Process from Point/Station 11.000 to Point/Station 3.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.869 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.87 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.031
 Subarea runoff = 0.045(CFS) for 0.010(Ac.)
 Total runoff = 0.172(CFS) Total area = 0.038(Ac.)

+++++
 Process from Point/Station 3.000 to Point/Station 22.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.140(Ft.)
 Downstream point/station elevation = 18.070(Ft.)
 Pipe length = 4.50(Ft.) Slope = 0.0156 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.172(CFS)
 Given pipe size = 4.00(In.)
 Calculated individual pipe flow = 0.172(CFS)
 Normal flow depth in pipe = 2.54(In.)
 Flow top width inside pipe = 3.85(In.)
 Critical Depth = 2.81(In.)
 Pipe flow velocity = 2.97(Ft/s)
 Travel time through pipe = 0.03 min.
 Time of concentration (TC) = 3.89 min.

++++++
 Process from Point/Station 22.000 to Point/Station 23.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.070(Ft.)
 Downstream point/station elevation = 17.980(Ft.)
 Pipe length = 16.95(Ft.) Slope = 0.0053 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.172(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.172(CFS)
 Normal flow depth in pipe = 2.40(In.)
 Flow top width inside pipe = 7.33(In.)
 Critical Depth = 2.28(In.)
 Pipe flow velocity = 1.96(Ft/s)
 Travel time through pipe = 0.14 min.
 Time of concentration (TC) = 4.04 min.

++++++
 Process from Point/Station 10.000 to Point/Station 2.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 4.039 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 4.04 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area

(Q=KCIA) is C = 0.820 CA = 0.040
 Subarea runoff = 0.050(CFS) for 0.011(Ac.)
 Total runoff = 0.222(CFS) Total area = 0.049(Ac.)

+++++
 Process from Point/Station 2.000 to Point/Station 23.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 18.050(Ft.)
 Downstream point/station elevation = 17.980(Ft.)
 Pipe length = 4.50(Ft.) Slope = 0.0156 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.222(CFS)
 Given pipe size = 4.00(In.)
 Calculated individual pipe flow = 0.222(CFS)
 Normal flow depth in pipe = 3.06(In.)
 Flow top width inside pipe = 3.39(In.)
 Critical Depth = 3.18(In.)
 Pipe flow velocity = 3.09(Ft/s)
 Travel time through pipe = 0.02 min.
 Time of concentration (TC) = 4.06 min.

+++++
 Process from Point/Station 23.000 to Point/Station 25.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 17.980(Ft.)
 Downstream point/station elevation = 17.860(Ft.)
 Pipe length = 24.34(Ft.) Slope = 0.0049 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.222(CFS)
 Given pipe size = 8.00(In.)
 Calculated individual pipe flow = 0.222(CFS)
 Normal flow depth in pipe = 2.79(In.)
 Flow top width inside pipe = 7.63(In.)
 Critical Depth = 2.60(In.)
 Pipe flow velocity = 2.05(Ft/s)
 Travel time through pipe = 0.20 min.
 Time of concentration (TC) = 4.26 min.

+++++
 Process from Point/Station 10.000 to Point/Station 1.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 4.261 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 4.26 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.047
 Subarea runoff = 0.036(CFS) for 0.008(Ac.)
 Total runoff = 0.259(CFS) Total area = 0.057(Ac.)

++++++
 Process from Point/Station 1.000 to Point/Station 25.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 4.261 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 4.26 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.057
 Subarea runoff = 0.059(CFS) for 0.013(Ac.)
 Total runoff = 0.318(CFS) Total area = 0.070(Ac.)

++++++
 Process from Point/Station 25.000 to Point/Station 16.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 17.860(Ft.)
 Downstream point/station elevation = 17.830(Ft.)
 Pipe length = 5.85(Ft.) Slope = 0.0051 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 0.318(CFS)
 Given pipe size = 6.00(In.)
 Calculated individual pipe flow = 0.318(CFS)
 Normal flow depth in pipe = 4.03(In.)
 Flow top width inside pipe = 5.63(In.)
 Critical Depth = 3.43(In.)

Pipe flow velocity = 2.27(Ft/s)
 Travel time through pipe = 0.04 min.
 Time of concentration (TC) = 4.30 min.

+++++
 Process from Point/Station 25.000 to Point/Station 16.000
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 0.070(Ac.)
 Runoff from this stream = 0.318(CFS)
 Time of concentration = 4.30 min.
 Rainfall intensity = 5.533(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	0.172	4.46	5.533
2	0.318	4.30	5.533

Qmax(1) =
 1.000 * 1.000 * 0.172) +
 1.000 * 1.000 * 0.318) + = 0.490

Qmax(2) =
 1.000 * 0.964 * 0.172) +
 1.000 * 1.000 * 0.318) + = 0.484

Total of 2 main streams to confluence:

Flow rates before confluence point:

0.172 0.318

Maximum flow rates at confluence using above data:

0.490 0.484

Area of streams before confluence:

0.038 0.070

Results of confluence:

Total flow rate = 0.490(CFS)

Time of concentration = 4.463 min.

Effective stream area after confluence = 0.108(Ac.)

+++++
 Process from Point/Station 16.000 to Point/Station 17.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 17.830(Ft.)

Downstream point/station elevation = 17.680(Ft.)
 Pipe length = 15.04(Ft.) Slope = 0.0100 Manning's N = 0.013
 No. of pipes = 3 Required pipe flow = 0.490(CFS)
 Given pipe size = 3.00(In.)
 NOTE: Normal flow is pressure flow in user selected pipe size.
 The approximate hydraulic grade line above the pipe invert is
 0.622(Ft.) at the headworks or inlet of the pipe(s)
 Pipe friction loss = 0.514(Ft.)
 Minor friction loss = 0.258(Ft.) K-factor = 1.50
 Pipe flow velocity = 3.33(Ft/s)
 Travel time through pipe = 0.08 min.
 Time of concentration (TC) = 4.54 min.
 End of computations, total study area = 0.108 (Ac.)

HYDROLOGY STUDY 100 YEAR STORM – POST DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/26

***** Hydrology Study Control Information *****

Program License Serial Number 6750

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.100
24 hour precipitation(inches) = 3.500
P6/P24 = 60.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 13.000 to Point/Station 6.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 30.660(Ft.)
Highest elevation = 30.610(Ft.)
Lowest elevation = 30.000(Ft.)
Elevation difference = 0.610(Ft.) Slope = 1.990 %
Top of Initial Area Slope adjusted by User to 2.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.46 minutes

$TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (2.000^{(1/3)})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.064(CFS)
 Total initial stream area = 0.014(Ac.)

++++++
 Process from Point/Station 6.000 to Point/Station 26.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.46 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.017
 Subarea runoff = 0.032(CFS) for 0.007(Ac.)
 Total runoff = 0.095(CFS) Total area = 0.021(Ac.)
 End of computations, total study area = 0.021 (Ac.)

HYDROLOGY STUDY 100 YEAR STORM – POST DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/26

***** Hydrology Study Control Information *****

Program License Serial Number 6750

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.100
24 hour precipitation(inches) = 3.500
P6/P24 = 60.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 13.000 to Point/Station 9.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 27.510(Ft.)
Highest elevation = 30.550(Ft.)
Lowest elevation = 30.000(Ft.)
Elevation difference = 0.550(Ft.) Slope = 1.999 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.46 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$

$TC = [1.8 * (1.1 - 0.8200) * (75.000^{.5}) / (2.000^{(1/3)})] = 3.46$
 Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.027(CFS)
 Total initial stream area = 0.006(Ac.)

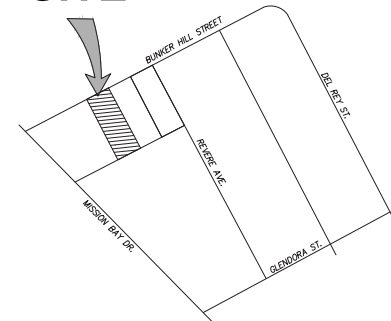
++++++
 Process from Point/Station 9.000 to Point/Station 26.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.464 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 5.533(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Time of concentration = 3.46 min.
 Rainfall intensity = 5.533(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.820 CA = 0.011
 Subarea runoff = 0.036(CFS) for 0.008(Ac.)
 Total runoff = 0.064(CFS) Total area = 0.014(Ac.)
 End of computations, total study area = 0.014 (Ac.)

HYDROLOGY MAP PRE-DEVELOPED CONDITION

BUNKER HILL STREET,
SAN DIEGO, CA 92109

SITE

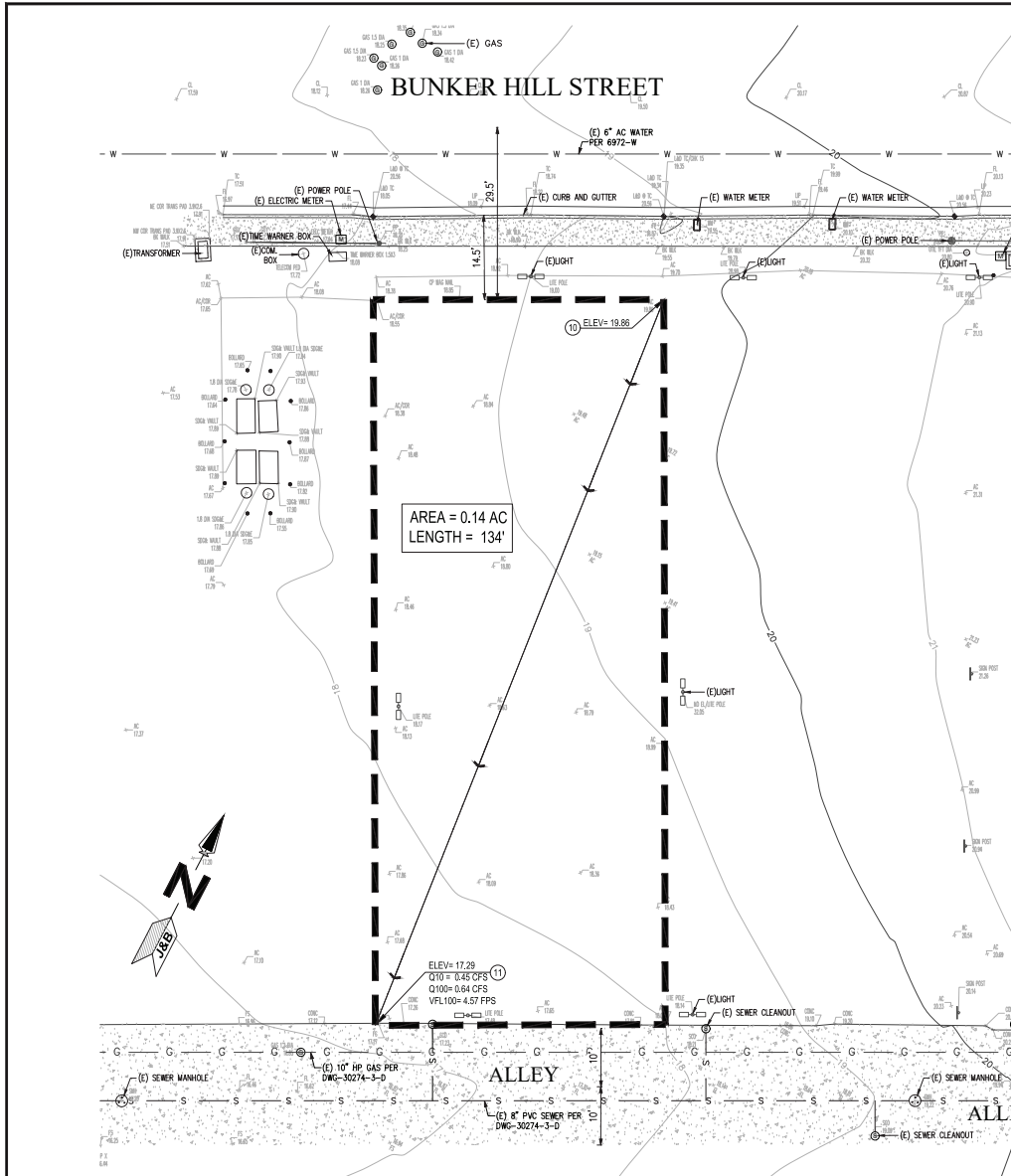


VICINITY MAP
NO SCALE

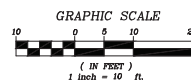
LEGEND OR KEY TO SYMBOLS

---	PROPERTY LINE
---	PROPOSED ELEV.
---	EXISTING ELEV.
← ← ←	DRAINAGE FLOW
---	DRAINAGE BOUNDARY
AREA A LENGTH	DRAINAGE AREA DRAINAGE LENGTH
10	NODE NUMBER

NODE NO.	AREA (AC)	Q10 (CFS)	Tc (MINS)	Q100 (CFS)	Tc (MINS)
11	0.14	0.45 CFS	5.0 MINS	0.64 CFS	5.0 MINS



PLANS PREPARED BY:
J&B PLANNING • ENGINEERING • SURVEYING
13670 DANIELSON ST., SUITE G POWAY, CA 92064
PH: 619.513.1744 FAX: 619.513.1744
email: jbsurvey@jbsglobal.net



Designed By: _____ Drawn By: _____ Checked By: _____
Plans Prepared Under Supervision Of: _____ Date: _____
RCE No. _____

HYDROLOGY EXHIBIT FOR:

**APN'S 424-321-03-00 & 424-321-04-00
BUNKER HILL STREET, SAN DIEGO, CA.**

CIVIL ENGINEER

J&B ENGINEERS, SURVEYORS
13670 DANIELSON ST., SUITE G
POWAY, CA 92064

[Signature]
EDGARDO C. FORDAN

10/28/25

RCE 52276

EXP: 12/31/24



SHEET 2 OF 2

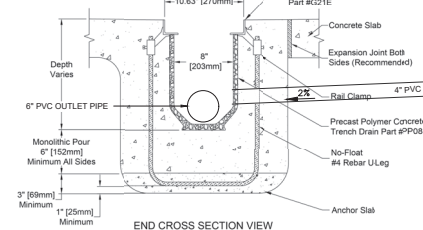
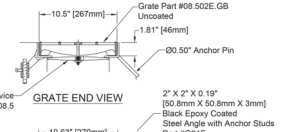
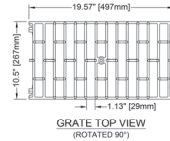
DATE: 07/31/2023

CONSTRUCTION NOTES:

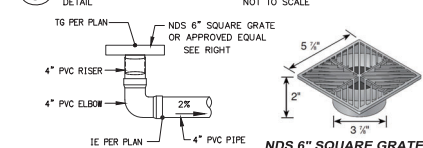
- REMOVE EXISTING ASPHALT PAVEMENT.
- REMOVE EXISTING ASPHALT PAVEMENT & REPLACED WITH 4" CONCRETE WALKWAY.
- CONSTRUCT NON-CONTIGUOUS SIDEWALK TO CITY STANDARD. PER SEPARATE PERMIT
- REMOVE EXISTING LIGHT POLE.
- CONSTRUCT 12" X 12" CATCH BASIN PER DETAIL 1
- CONSTRUCT 4" PVC STORM DRAIN PIPE.
- CONSTRUCT 18" X 18" CATCH BASIN.
- CONSTRUCT 2" WATER SERVICE PER SEPARATE PERMIT.
- CONSTRUCT 4" FIRE SERVICE PER SEPARATE PERMIT.
- CONSTRUCT 6" SEWER LATERAL PER SEPARATE PERMIT
- CONSTRUCT 4" WILKINS 475DA BACKFLOW PREVENTER PER SDW-105 (PET COCK TO BE LOCATED AWAY FROM BUILDING WALL).
- CONSTRUCT 2" WILKINS 975XL2 BACKFLOW PREVENTER PER SDW-155.
- CONSTRUCT 2-3" DIAMETER PIPES SIDEWALK UNDERDRAIN PIPE PER D-27. PER SEPARATE PERMIT.
- REMOVE EXISTING SIDEWALK & REPLACED WITH LANDSCAPING. PER SEPARATE PERMIT.
- EXISTING DRIVEWAY TO BE CLOSED AND REPLACE BY FULL HEIGHT CURB & GUTTER TO CITY STANDARD. PER SEPARATE PERMIT.
- REMOVE & REPLACED EXISTING CURB & GUTTER TO CITY STANDARD. PER SEPARATE PERMIT
- CONSTRUCT 6" SQUARE GRATE AREA DRAIN PER DETAIL 2.
- CONSTRUCT 8" POLYDRAIN PRE-SLOPED TRENCH DRAIN SYSTEM S=0.5% SEE DETAIL 3.
- CONSTRUCT 6" PVC STORM DRAIN PIPE.
- CONSTRUCT 6"-8" CURB PER SDG-150.
- PROPOSED 5' WIDE NON-CONTIGUOUS SIDEWALK PER SEPARATE PERMIT.

NOTES:

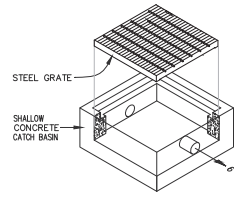
- PRIOR TO THE ISSUANCE OF ANY CONSTRUCTION PERMIT, THE OWNER/PERMITTEE SHALL INCORPORATE ANY CONSTRUCTION BEST MANAGEMENT PRACTICES NECESSARY TO COMPLY WITH CHAPTER 14, ARTICLE 2, DIVISION 1 (GRADING REGULATIONS) OF THE SAN DIEGO MUNICIPAL CODE, INTO THE CONSTRUCTION PLANS OR SPECIFICATIONS.
- THE PROPOSED PROJECT WILL COMPLY WITH ALL THE REQUIREMENTS OF THE CURRENT CITY OF SAN DIEGO STORM WATER STANDARDS MANUAL BEFORE A GRADING OR BUILDING PERMIT IS ISSUED. IT IS THE RESPONSIBILITY OF THE OWNER/DESIGNER/APPLICANT TO ENSURE THAT THE CURRENT STORM WATER PERMANENT BMP DESIGN STANDARDS ARE INCORPORATED INTO THE PROJECT.
- PRIOR TO THE ISSUANCE OF ANY CONSTRUCTION PERMIT THE OWNER/PERMITTEE SHALL SUBMIT A WATER POLLUTION CONTROL PLAN (WPCP). THE WPCP SHALL BE PREPARED IN ACCORDANCE WITH THE GUIDELINES IN PART 2 CONSTRUCTION BMP STANDARDS CHAPTER 4 OF THE CITY'S STORM WATER STANDARDS.



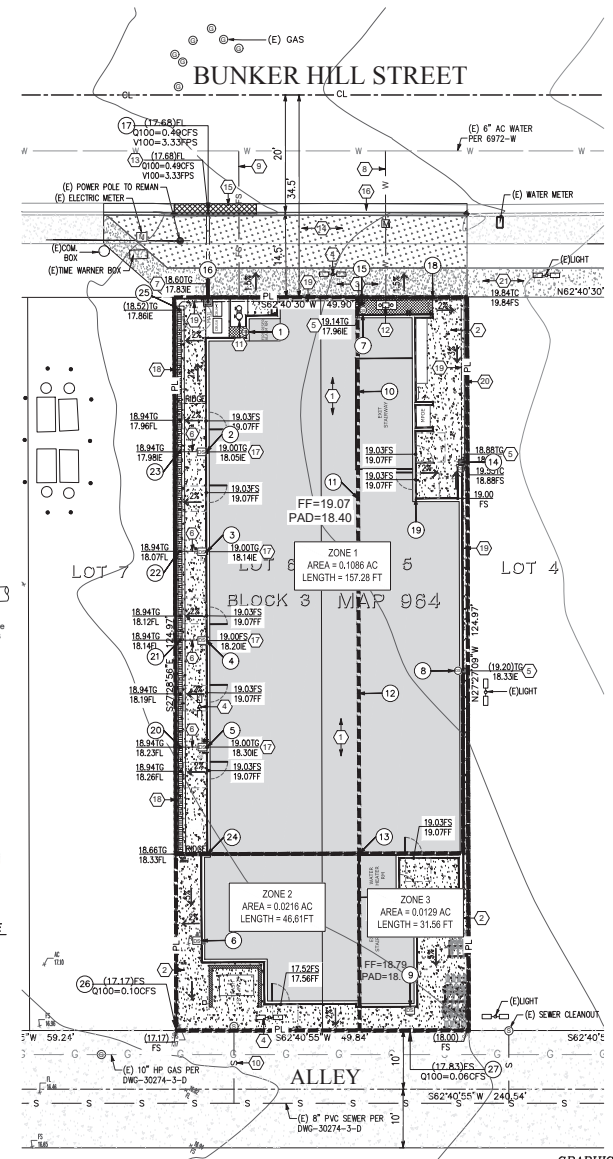
PDX 08 - 8" [203mm] ID Precast Trench Drain with E-Coated Frame & Uncoated Ductile Iron Grate (HD High Intake)



6" AREA DRAIN

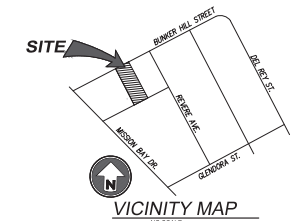


12"X12" CONC. CATCH BASIN



HYDROLOGY MAP POST-DEVELOPED CONDITION

LOTS 5 & 6, BLOCK 8 MAP 964
BUNKER HILL STREET, SAN DIEGO, CA 92109



LEGEND OR KEY TO SYMBOLS

- PROPERTY LINE
- PROPOSED ELEV.
- EXISTING ELEV.
- DRAINAGE FLOW
- DRAINAGE BOUNDARY

ZONE X
AREA =
LENGTH =

4 NODE NUMBER

NODE NO.	AREA (AC)	Q10 (CFS)	VEL (FPS)	Tc (MINS)	Q100 (CFS)	VEL (FPS)	Tc (MINS)
17	0.1086	0.35	2.38	4.66	0.49	3.33	4.54
26	0.0216	0.07	N/A	3.46	0.10	N/A	3.46
27	0.0129	0.04	N/A	3.46	0.06	N/A	3.46
SUM	0.1431	0.46	N/A	N/A	0.65	N/A	X.XX

CIVIL ENGINEER

J&B ENGINEERS, SURVEYORS
13670 DANIELSON ST., SUITE G
POWAY, CA 92064

EDGARDO C. FORDAN
RCE 52276

7/07/26

EXP: 12/31/26

HYDROLOGY EXHIBIT BUNKER HILL APARTMENTS

