**DRAINAGE STUDY**
**FOR**

4240 Morrell Street

PRJ-1128026
August 2025

Prepared By:
LEPPERT ENGINEERING CORPORATION
5190 GOVERNOR DRIVE, SUITE 205
SAN DIEGO, CA 92122
Job No. PB 49.01-06.24

Prepared For:
MDS Architecture
740 13th Street Suite 504
San Diego, California, 92101
MattS@MDSArchitect.com




By: John D. Leppert, RCE 26283
Exp. 3/31/26

8/29/2025
Date

## Table of Contents

Purpose ..... 3
Project Location ..... 3
Project Description ..... 3
Method of Calculation ..... 3
Existing Condition ..... 3
Proposed Condition ..... 4
Conclusions ..... 4

## Exhibits

EXHIBIT "A" – Location Map
EXHIBIT "B" – Existing Condition Drainage Basin Map
EXHIBIT "C" – Existing Condition SSA Calculations
EXHIBIT "D" – Proposed Condition Drainage Basin Map
EXHIBIT "E" – Proposed Condition SSA Calculations

## Appendices

APPENDIX I – Rational Method: City of San Diego Drainage Design Manual
APPENDIX II – Design Runoff: City of San Diego Drainage Design Manual
APPENDIX III – Runoff Coefficients: City of San Diego Drainage Design Manual
APPENDIX IV – Rainfall Intensity-Duration-Frequency Curves: City of San Diego Drainage Design Manual

**Purpose**

The purpose of this drainage study is to estimate the quantity of storm water runoff from the proposed development of 4240 Morrell Street and determine sizing of proposed onsite area drains.

**Project Location**

The project site is located on the SW corner of Morrell Street and Reed Street in Pacific Beach between 4 and 6 blocks from Mission Bay. (see Exhibit A). The project is in the Scripps Hydrologic Area (Sub-area 906.30) of the Penasquitos Hydrologic unit.

**Project Description**

The proposed development includes improvements to an ~0.3-acre site area to remove an existing structure and create proposed residential multi-family units. This project is not subject to Federal Clean Water Act section 401/404, and will not need to obtain additional permitting through the State Regional Water Quality Control Board.

**Method of Calculation**

This study calculates the total runoff from the site using the guidelines set forth in the City of San Diego's Drainage Design Manual, dated January 2017 (see Appendix I – Rational Method: City of San Diego Drainage Design Manual). The specific method used is the Rational Formula for watersheds under 0.5 square miles. A 100-year storm event was used for the analysis. Per the City of San Diego Drainage Design Manual, for tributary areas less than one square mile the storm drain system shall be designed so that the combination of storm drain system capacity and overflow will be able to carry the 100-year frequency storm without damage to or flooding of adjacent existing buildings or potential building sites, and Type D soil shall be used for all areas (see Appendix II– Runoff Coefficients: City of San Diego Drainage Design Manual).

Autodesk Storm and Sanitary Analysis was used for the storm analysis. Autodesk Storm and Sanitary Analysis is a link-node based model that performs hydrology, hydraulic, and water quality analysis of storm water and wastewater drainage systems, including sewage treatment plants and water quality control devices. A link represents a hydraulic element (i.e., a pipe, channel, pump, standpipe, culvert, or weir) that transports flow and constituents. A node can represent the junction of two or more links, a storm drain catch basin inlet, the location of a flow or pollutant input into the system, or a storage element (such as a detention pond, retention pond, settling pond, or lake).

Drainage basin boundaries, flow patterns, and topographic elevations are shown on the drainage basin maps located in the map pockets (see Exhibit B – Existing Condition Drainage Basin Map & Exhibit D – Proposed Condition Basin Map).

**Existing Condition**

The rectangular parcel of land is bordered on all sides by existing single and multi-family residences. The existing condition outfall is sheet flow to the southwest corner of the property to an existing alley which discharges to the easterly roadway gutter system. There is no existing record information identifying any existing storm drain conveyances within the project boundary or immediately adjacent to the site and from our research all flows continue as surface flow to their eventual outfall in Mission Bay.

The site runoff coefficient for the property was determined based upon Table A-1 included as an attachment to this report as Appendix III. A coefficient of 0.55 for single-family was chosen, which coincides with the existing use of the site and is reasonable given the current impervious cover at the property. A total of 1 basin was

identified and analyzed, which is the entire area of the property draining into the alley at the rear of the property.

| Basin | Acres | C | Length (ft) | Upper Elev. (ft) | Lower Elev. (ft) | Slope (%) | Tc (min) | I (in/hr) | $Q_{100}$(cfs) |
|---|---|---|---|---|---|---|---|---|---|
| A | 0.29 | 0.55 | 160 | 34 | 30 | 2.5% | 9.23 | 3.45 | 0.55 |

The total site runoff as shown is 0.55 CFS with a velocity of 1.5 FT/S draining off site into the existing alley along the southerly boundary. This alley drains to the east into Morrell Street's gutter where it continues in a southerly direction eventually reaching Mission Bay.

**Proposed Condition**

The project site is proposed to be graded with building pads to allow the construction multiple units as a for rent product. The existing basin has been split into a total of three proposed basins. The anticipated development will represent a multi-family product, so the runoff coefficient of 0.70 has been utilized.

| Basin | Acres | C | Length (ft) | Upper Elev. (ft) | Lower Elev. (ft) | Slope (%) | Tc (min) | I (in/hr) | $Q_{100}$ (cfs)* |
|---|---|---|---|---|---|---|---|---|---|
| **A** | 0.13 | 0.70 | 90 | 34 | 32 | 2.2 | 5.24 | 4.32 | 0.4 |
| **B** | 0.06 | 0.70 | 60 | 34 | 33 | 1.8% | 4.4 | 4.4 | 0.2 |
| **C** | 0.10 | 0.70 | 90 | 32 | 30 | 2.2% | 5.24 | 4.32 | 0.3 |

*Tabular flows are individual basin hydrologic values, and may vary from the hydraulic calculations slightly due to travel times and recalculated times of confluence prior to outfall

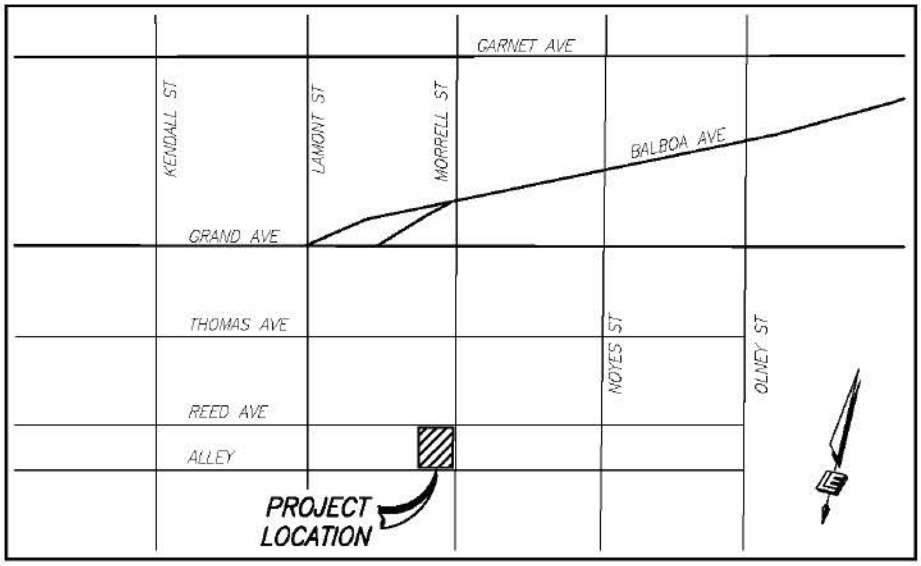
The total site runoff as shown is 0.9 CFS with a velocity of 2.7 FT/S draining off site into the gutter line of Morrell Street via a proposed curb outlet. From this discharge point the runoff continues to flow to Mission Bay via surface flow as it does in the existing condition.

**Conclusions**

The site total runoff is increased 0.35 CFS from the existing to the proposed condition, and the flow velocity is increased 1.2 FT/S. This increase in velocity is reasonably expected as the flow is plumbed to the street vs sheet flowing within the alley way which slows runoff rates due to being spread over a wider area with higher friction present. It is anticipated that this change to the runoff will not cause any negative impact to adjacent or downstream properties, nor will there be any potential for increased erosion either at the site or downstream due to the project since the flows are conveyed in gutter system.

# EXHIBIT “A” – Location Map

# EXHIBIT "A"

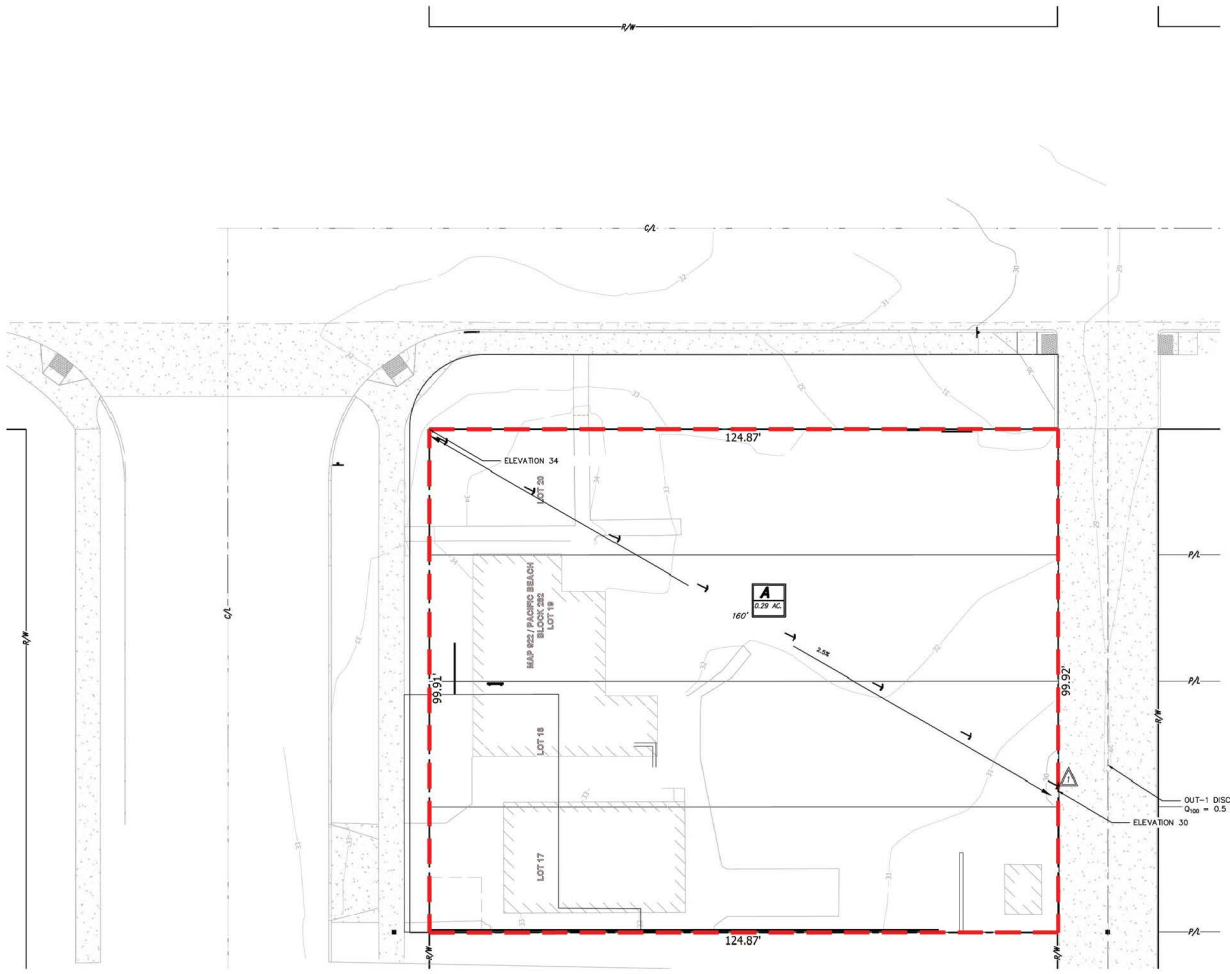



## LOCATION MAP

NO SCALE

# EXHIBIT "B" – Existing Condition Drainage Basin Map

# EX. BASIN MAP




**LEGEND**

| | |
|---|---|
| PROPERTY BOUNDARY | |
| STORM DRAIN | |
| BASIN AREA | Z 0.00 AC. |
| NODE NO. | 1 |
| BASIN LIMITS | |
| CURB INLET | |
| CLEANOUT | |
| GRATE INLET | |
| OVERLAND FLOW | |

| NO. | DATE | BY | DESCRIPTION |
|---|---|---|---|
| 1 | 08/25/25 | MFD | INITIAL SUBMITTAL |

Leppert Engineering CORPORATION
5190 Governor Drive, Suite 205, San Diego, Ca. 92122-2848
Phone: (858) 597-2001 Fax: (858) 597-2009

APPROVED BY ENGINEER OF WORK
REGISTRATION R.C.E. 26283
FILE CODE PB 49.01-06.24
DATE 08/29/2025

PREPARATION AND REVISION LOG

REGISTERED PROFESSIONAL ENGINEER — BRIAN F. LEPPERT — No. 25283 — CIVIL — STATE OF CALIFORNIA

10 0 10 20
1"= 10'

# EXHIBIT "C" – Existing Condition SSA Calculations

## Project Description

| | |
|---|---|
| File Name | SSA Analysis - Ex.SPF |

## Project Options

| | |
|---|---|
| Flow Units | CFS |
| Elevation Type | Elevation |
| Hydrology Method | Rational |
| Time of Concentration (TOC) Method | User-Defined |
| Link Routing Method | Steady Flow |
| Enable Overflow Ponding at Nodes | YES |
| Skip Steady State Analysis Time Periods | YES |

## Analysis Options

| | | |
|---|---|---|
| Start Analysis On | Sep 24, 2019 | 00:00:00 |
| End Analysis On | Oct 24, 2019 | 00:00:00 |
| Start Reporting On | Sep 24, 2019 | 00:00:00 |
| Antecedent Dry Days | 0 | days |
| Runoff (Dry Weather) Time Step | 0 01:00:00 | days hh:mm:ss |
| Runoff (Wet Weather) Time Step | 0 00:05:00 | days hh:mm:ss |
| Reporting Time Step | 0 00:05:00 | days hh:mm:ss |
| Routing Time Step | 30 | seconds |

## Number of Elements

| | Qty |
|---|---|
| Rain Gages | 0 |
| Subbasins | 1 |
| Nodes | 2 |
| *Junctions* | 1 |
| *Outfalls* | 1 |
| *Flow Diversions* | 0 |
| *Inlets* | 0 |
| *Storage Nodes* | 0 |
| Links | 1 |
| *Channels* | 1 |
| *Pipes* | 0 |
| *Pumps* | 0 |
| *Orifices* | 0 |
| *Weirs* | 0 |
| *Outlets* | 0 |
| Pollutants | 0 |
| Land Uses | 0 |

## Rainfall Details

| | |
|---|---|
| Return Period | 100 year(s) |

## Subbasin Summary

| Subbasin ID | Area (ac) | Weighted Runoff Coefficient | Total Rainfall (in) | Total Runoff (in) | Total Runoff Volume (ac-in) | Peak Runoff (cfs) | Time of Concentration (days hh:mm:ss) |
|---|---|---|---|---|---|---|---|
| A | 0.29 | 0.5500 | 0.53 | 0.29 | 0.08 | 0.55 | 0 00:09:13 |

## Node Summary

| Element ID | Element Type | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Surcharge Elevation (ft) | Ponded Area (ft²) | Peak Inflow (cfs) | Max HGL Elevation Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Time of Peak Flooding Occurrence (days hh:mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| Jun-01 | Junction | 29.20 | 29.70 | 0.00 | 0.00 | 0.55 | 29.24 | 0.00 | 0.46 | 0 00:00 |
| Out-01 | Outfall | 29.00 | | | | 0.55 | 29.04 | | | |

## Link Summary

| Element ID | Element Type | From (Inlet) Node | To (Outlet) Node | Length | Inlet Invert Elevation | Outlet Invert Elevation | Average Slope | Diameter or Height | Manning's Roughness | Peak Flow | Design Flow Capacity | Peak Flow/ Design Flow Ratio | Peak Flow Velocity | Peak Flo Dept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ft) | (ft) | (ft) | (%) | (in) | | (cfs) | (cfs) | | (ft/sec) | (f |
| Ex-Alley | Channel | Jun-01 | Out-01 | 10.00 | 29.20 | 29.00 | 2.00 | 6.00 | 0.015 | 0.55 | 43.83 | 0.01 | 1.52 | 0.0 |

## Junction Input

| Element ID | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Ground/Rim (Max) Offset (ft) | Surcharge Elevation (ft) | Surcharge Depth (ft) | Ponded Area ($ft^2$) |
|---|---|---|---|---|---|---|
| Jun-01 | 29.20 | 29.70 | 0.50 | 0.00 | -29.70 | 0.00 |

## Junction Results

| SN | Element ID | Peak Inflow (cfs) | Peak Lateral Inflow (cfs) | Max HGL Elevation Attained (ft) | Max HGL Depth Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Average HGL Elevation Attained (ft) | Average HGL Depth Attained (ft) | Time of Max HGL Occurrence (days hh:mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jun-01 | 0.55 | 0.55 | 29.24 | 0.04 | 0.00 | 0.46 | 29.20 | 0.00 | 0 00:09 |

## Channel Input

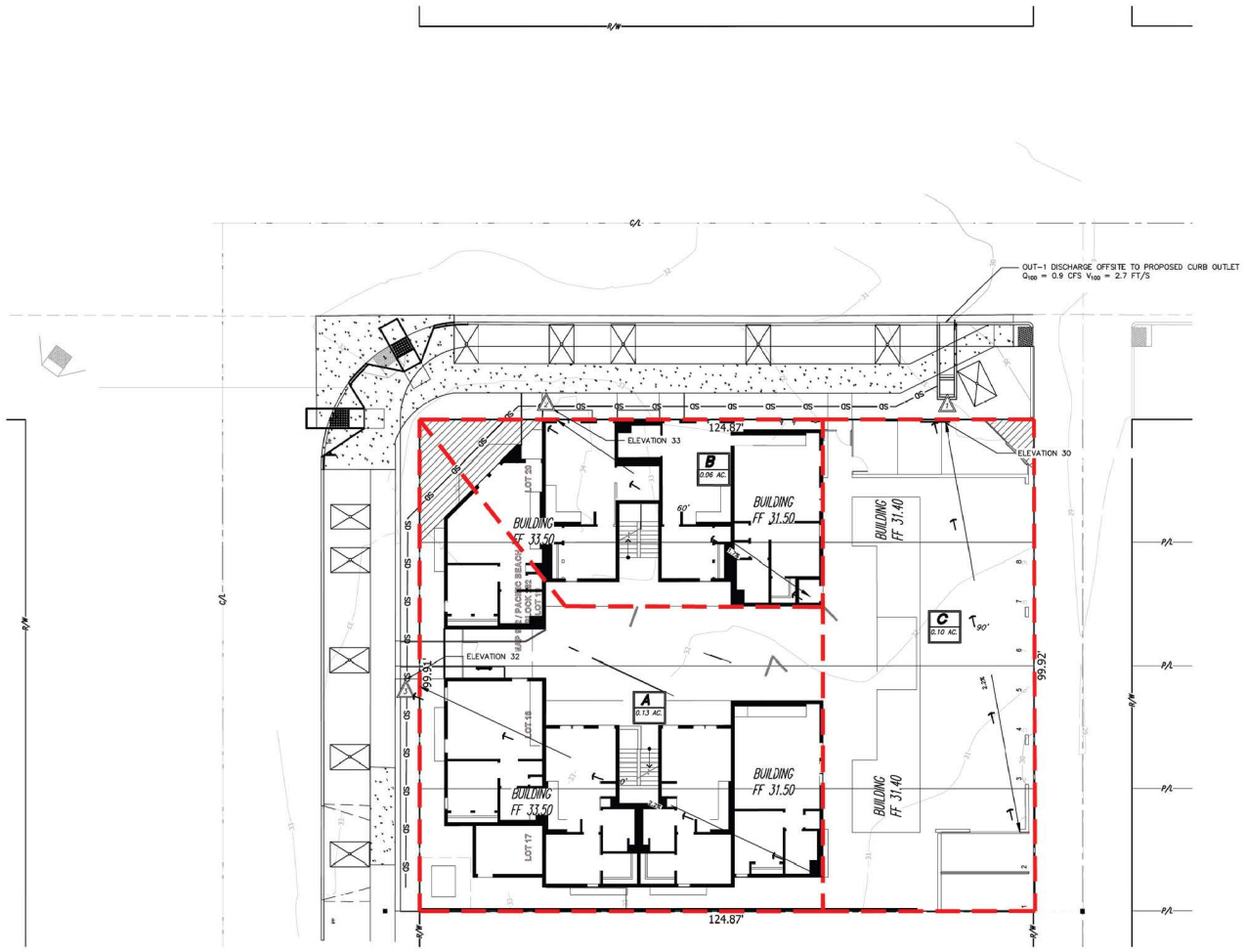
| Element ID | Length (ft) | Inlet Invert Elevation (ft) | Inlet Invert Offset (ft) | Outlet Invert Elevation (ft) | Outlet Invert Offset (ft) | Total Drop (ft) | Average Slope (%) | Shape | Height (ft) | Width (ft) | Manning's Roughness | Entrance Losses |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ex-Alley | 10.00 | 29.20 | 0.00 | 29.00 | 0.00 | 0.20 | 2.0000 | Trapezoidal | 0.5 | 11.0 | 0.0150 | 0.5000 |

## Channel Results

| Element ID | Peak Flow | Time of Peak Flow Occurrence | Design Flow Capacity | Peak Flow/ Design Flow Ratio | Peak Flow Velocity | Travel Time | Peak Flow Depth | Peak Flow Depth/ Total Depth Ratio | Total Time Surcharged | Fl Nu |
|---|---|---|---|---|---|---|---|---|---|---|
| | (cfs) | (days hh:mm) | (cfs) | | (ft/sec) | (min) | (ft) | | (min) | |
| Ex-Alley | 0.55 | 0 00:09 | 43.83 | 0.01 | 1.52 | 0.11 | 0.04 | 0.07 | 0.00 | |

# EXHIBIT "D" – Proposed Condition Drainage Basin Map

# PRO. BASIN MAP




**LEGEND**

| | |
|---|---|
| PROPERTY BOUNDARY | |
| STORM DRAIN | |
| BASIN AREA | Z 0.00 AC. |
| NODE NO. | 1 |
| BASIN LIMITS | |
| CURB INLET | |
| CLEANOUT | |
| GRATE INLET | |
| OVERLAND FLOW | |

| NO. | DATE | BY | DESCRIPTION |
|---|---|---|---|
| 3 | 05/14/25 | MFD | FIRST RESUBMITTA. |
| 2 | 01/25/25 | MFD | AGENCY REVISIONS |
| 1 | 11/25/24 | MFD | INITIAL SUBMITTAL |


Leppert Engineering CORPORATION
5190 Governor Drive, Suite 205, San Diego, Ca. 92122-2648
Phone: (858) 597-2001 Fax: (858) 597-2009


APPROVED BY ENGINEER OF WORK
REGISTRATION R.C.E. 26283
FILE CODE PB 49.01-06.24
DATE 5/12/2025

PREPARATION AND REVISION LOG

REGISTERED PROFESSIONAL ENGINEER — No. 25283 — CIVIL — STATE OF CALIFORNIA

10 0 10 20
1"= 10'

# EXHIBIT "E" – Proposed Condition SSA Calculations

## Project Description

| | |
|---|---|
| File Name | SSA Analysis - Pro.SPF |

## Project Options

| | |
|---|---|
| Flow Units | CFS |
| Elevation Type | Elevation |
| Hydrology Method | Rational |
| Time of Concentration (TOC) Method | User-Defined |
| Link Routing Method | Steady Flow |
| Enable Overflow Ponding at Nodes | YES |
| Skip Steady State Analysis Time Periods | YES |

## Analysis Options

| | | |
|---|---|---|
| Start Analysis On | Sep 24, 2019 | 00:00:00 |
| End Analysis On | Oct 24, 2019 | 00:00:00 |
| Start Reporting On | Sep 24, 2019 | 00:00:00 |
| Antecedent Dry Days | 0 | days |
| Runoff (Dry Weather) Time Step | 0 01:00:00 | days hh:mm:ss |
| Runoff (Wet Weather) Time Step | 0 00:05:00 | days hh:mm:ss |
| Reporting Time Step | 0 00:05:00 | days hh:mm:ss |
| Routing Time Step | 30 | seconds |

## Number of Elements

| | Qty |
|---|---|
| Rain Gages | 0 |
| Subbasins | 3 |
| Nodes | 4 |
| *Junctions* | 3 |
| *Outfalls* | 1 |
| *Flow Diversions* | 0 |
| *Inlets* | 0 |
| *Storage Nodes* | 0 |
| Links | 3 |
| *Channels* | 1 |
| *Pipes* | 2 |
| *Pumps* | 0 |
| *Orifices* | 0 |
| *Weirs* | 0 |
| *Outlets* | 0 |
| Pollutants | 0 |
| Land Uses | 0 |

## Rainfall Details

| | |
|---|---|
| Return Period | 100 year(s) |

## Subbasin Summary

| Subbasin ID | Area (ac) | Weighted Runoff Coefficient | Total Rainfall (in) | Total Runoff (in) | Total Runoff Volume (ac-in) | Peak Runoff (cfs) | Time of Concentration (days hh:mm:ss) |
|---|---|---|---|---|---|---|---|
| A | 0.13 | 0.7000 | 0.37 | 0.26 | 0.03 | 0.39 | 0 00:05:14 |
| B | 0.06 | 0.7000 | 0.37 | 0.26 | 0.02 | 0.19 | 0 00:05:00 |
| C | 0.10 | 0.7000 | 0.37 | 0.26 | 0.03 | 0.30 | 0 00:05:14 |

## Node Summary

| Element ID | Element Type | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Surcharge Elevation (ft) | Ponded Area (ft²) | Peak Inflow (cfs) | Max HGL Elevation Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Time of Peak Flooding Occurrence (days hh:mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| Jun-01 | Junction | 30.15 | 31.00 | 0.00 | 0.00 | 0.87 | 30.46 | 0.00 | 0.54 | 0 00:00 |
| Jun-02 | Junction | 31.85 | 33.00 | 0.00 | 0.00 | 0.57 | 32.16 | 0.00 | 0.84 | 0 00:00 |
| Jun-03 | Junction | 32.45 | 33.50 | 0.00 | 0.00 | 0.39 | 32.76 | 0.00 | 0.74 | 0 00:00 |
| Out-01 | Outfall | 30.00 | | | | 0.87 | 30.11 | | | |

## Link Summary

| Element ID | Element Type | From (Inlet) Node | To (Outlet) Node | Length | Inlet Invert Elevation | Outlet Invert Elevation | Average Slope | Diameter or Height | Manning's Roughness | Peak Flow | Design Flow Capacity | Peak Flow/ Design Flow Ratio | Peak Flow Velocity | Peak D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (ft) | (ft) | (ft) | (%) | (in) | | (cfs) | (cfs) | | (ft/sec) | |
| SD-01 | Pipe | Jun-03 | Jun-02 | 60.00 | 32.45 | 31.85 | 1.00 | 6.00 | 0.013 | 0.39 | 0.56 | 0.70 | 3.09 | |
| SD-02 | Pipe | Jun-02 | Jun-01 | 85.00 | 31.85 | 30.15 | 2.00 | 6.00 | 0.013 | 0.57 | 0.79 | 0.72 | 4.40 | |
| Curb-Outlet | Channel | Jun-01 | Out-01 | 10.00 | 30.15 | 30.00 | 1.50 | 3.00 | 0.015 | 0.87 | 3.26 | 0.27 | 2.65 | |

## Junction Input

| Element ID | Invert Elevation (ft) | Ground/Rim (Max) Elevation (ft) | Ground/Rim (Max) Offset (ft) | Surcharge Elevation (ft) | Surcharge Depth (ft) | Ponded Area ($ft^2$) |
|---|---|---|---|---|---|---|
| Jun-01 | 30.15 | 31.00 | 0.85 | 0.00 | -31.00 | 0.00 |
| Jun-02 | 31.85 | 33.00 | 1.15 | 0.00 | -33.00 | 0.00 |
| Jun-03 | 32.45 | 33.50 | 1.05 | 0.00 | -33.50 | 0.00 |

## Junction Results

| SN | Element ID | Peak Inflow (cfs) | Peak Lateral Inflow (cfs) | Max HGL Elevation Attained (ft) | Max HGL Depth Attained (ft) | Max Surcharge Depth Attained (ft) | Min Freeboard Attained (ft) | Average HGL Elevation Attained (ft) | Average HGL Depth Attained (ft) | Time of Max HGL Occurrence (days hh:mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jun-01 | 0.87 | 0.30 | 30.46 | 0.31 | 0.00 | 0.54 | 30.15 | 0.00 | 0 00:05 |
| 2 | Jun-02 | 0.57 | 0.18 | 32.16 | 0.31 | 0.00 | 0.84 | 31.85 | 0.00 | 0 00:05 |
| 3 | Jun-03 | 0.39 | 0.39 | 32.76 | 0.31 | 0.00 | 0.74 | 32.45 | 0.00 | 0 00:05 |

## Channel Input

| Element ID | Length (ft) | Inlet Invert Elevation (ft) | Inlet Invert Offset (ft) | Outlet Invert Elevation (ft) | Outlet Invert Offset (ft) | Total Drop (ft) | Average Slope (%) | Shape | Height (ft) | Width (ft) | Manning's Roughness | Entra Los |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Curb-Outlet | 10.00 | 30.15 | 0.00 | 30.00 | 0.00 | 0.15 | 1.5000 | Rectangular | 0.3 | 3.0 | 0.0150 | 0.2 |

## Channel Results

| Element ID | Peak Flow | Time of Peak Flow Occurrence | Design Flow Capacity | Peak Flow/ Design Flow Ratio | Peak Flow Velocity | Travel Time | Peak Flow Depth | Peak Flow Depth/ Total Depth Ratio | Total Time Surcharged |
|---|---|---|---|---|---|---|---|---|---|
| | (cfs) | (days hh:mm) | (cfs) | | (ft/sec) | (min) | (ft) | | (min) |
| Curb-Outlet | 0.87 | 0 00:05 | 3.26 | 0.27 | 2.65 | 0.06 | 0.11 | 0.44 | 0.00 |

## Pipe Input

| Element ID | Length (ft) | Inlet Invert Elevation (ft) | Inlet Invert Offset (ft) | Outlet Invert Elevation (ft) | Outlet Invert Offset (ft) | Total Drop (ft) | Average Slope (%) | Pipe Shape | Pipe Diameter or Height (in) | Manning's Roughness | Entrance Losses | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SD-01 | 60.00 | 32.45 | 0.00 | 31.85 | 0.00 | 0.60 | 1.0000 | CIRCULAR | 6 | 0.0130 | 0.5000 | |
| SD-02 | 85.00 | 31.85 | 0.00 | 30.15 | 0.00 | 1.70 | 2.0000 | CIRCULAR | 6 | 0.0130 | 0.5000 | |

# APPENDIX I – Rational Method: City of San Diego Drainage Design Manual

Appendix A

# Rational Method and Modified Rational Method

## A.1. Rational Method (RM)

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and drainage structures. The RM is recommended for analyzing the runoff response from drainage areas for watersheds less than 0.5 square miles. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 0.5 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section A.2); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Appendix B).

### A.1.1. Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration ($T_c$), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed in Equation A-1.

**Equation A-1. RM Formula Expression**

$$Q = C\ I\ A$$

where:

| | | |
|---|---|---|
| Q | = | peak discharge, in cubic feet per second (cfs) |
| C | = | runoff coefficient expressed as that percentage of rainfall which becomes surface runoff (no units); Refer to Appendix A.1.2 |
| I | = | average rainfall intensity for a storm duration equal to the time of concetrnatation ($T_c$) of the contributing draiange area, in inches per hour; Refer to Appendix A.1.3 and Appendix A.1.4 |
| A | = | drainage area contributing to the design location, in acres |

# APPENDIX II – Design Runoff: City of San Diego Drainage Design Manual

2. For all drainage channels and storm water conveyance systems, which will convey drainage from a tributary area equal to or greater than one (1) square mile, the runoff criteria, shall be based upon a 100-year frequency storm.
3. For tributary areas under one (1) square mile:
    a. The storm water conveyance system shall be designed so that the combination of storm drain system capacity and overflow (streets and gutter) will be able to carry the 100-year frequency storm without damage to or flooding of adjacent existing buildings or potential building sites.
    b. The runoff criteria for the underground storm drain system shall be based upon a 50-year frequency storm.

## 2.3. Soil Type

For storm drain, culverts, channels, and all associated structures, Type D soil shall be used for all areas.

## 2.4. Other Requirements

1. Design runoff for drainage and flood control facilities within the City shall be based upon full development of the watershed area in accordance with the land uses shown on the City of San Diego, Progress Guide and General Plan.
2. When determining criteria for floodplain management and flood proofing, design runoff within the City shall be based upon existing conditions in accordance with the City Floodplain Management Requirements and FEMA Regulations.
3. Under City requirements, the minimum elevation of the finished, first floor elevation of any building is 2 feet above the 100-year frequency flood elevation.

## 2.5. Water Quality Considerations

Requirements for hydrologic studies specific to the design of pollution prevention controls and hydromodification management controls are detailed in the Storm Water Standards. Where the Storm Water Standards specify modifications to the guidelines stated herein on discharge flow methods, design storm frequency, or soil type, the modifications shall supersede these but only for the purposes stated in the Storm Water Standards. Where the Storm Water Standards does not specify a modification, the guidance found here in Chapter 2 shall apply.

# APPENDIX III – Runoff Coefficients: City of San Diego Drainage Design Manual

**Table A-1. Runoff Coefficients for Rational Method**

| Land Use | Runoff Coefficient (C) |
|---|---|
| | Soil Type [1] |
| **Residential:** | |
| Single Family | 0.55 |
| Multi-Units | 0.70 |
| Mobile Homes | 0.65 |
| Rural (lots greater than ½ acre) | 0.45 |
| **Commercial** [2] | |
| 80% Impervious | 0.85 |
| **Industrial** [2] | |
| 90% Impervious | 0.95 |

**Note:**
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%
Tabulated imperviousness = 80%
Revised C = (50/80) x 0.85 = 0.53

The values in Table A–1 are typical for urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the City.

## A.1.3. Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the $T_c$ for a selected storm frequency. Once a particular storm frequency has been selected for design and a $T_c$ calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

# APPENDIX IV – Rainfall Intensity-Duration-Frequency Curves: City of San Diego Drainage Design Manual

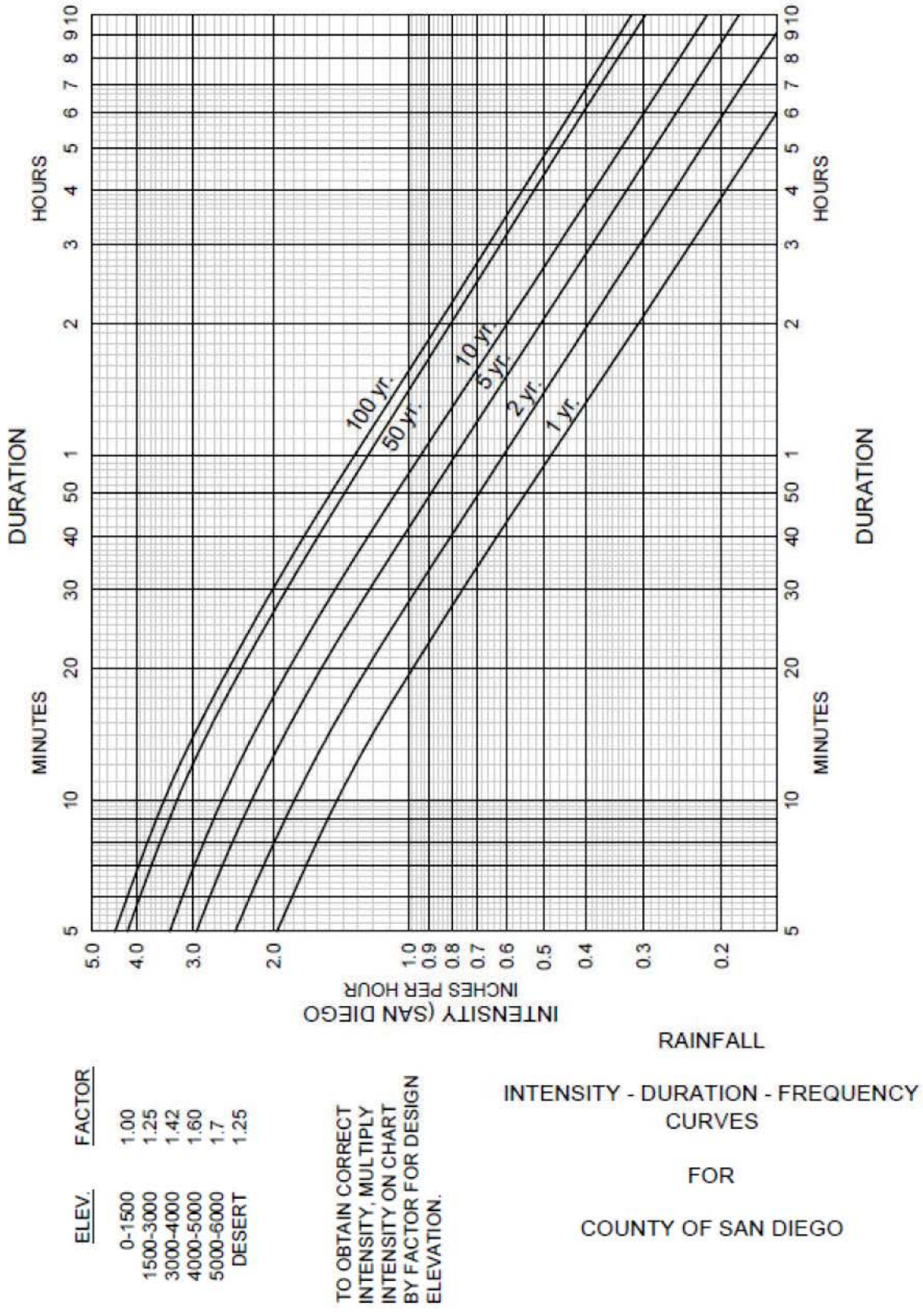



**Figure A-1. Intensity-Duration-Frequency Design Chart**