Hydrology Report

Truck Parking Facility
2175 S Willow Ave Bloomington, CA 92316

APNs: 0258-041-28-0000, 0258-041-29-0000

December 2024

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8/12/2025
Date

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References

Hydrology Manual. County of San Bernardino, August 1986.

100.0 Introduction

Kimley-Horn and Associates has been retained to prepare a Hydrology Report for the proposed truck parking facility project in Rialto, California. The purpose of this report is to demonstrate analysis of the hydrologic and hydraulic conditions associated with the development of the project site. To do so, the following is the scope of this report:

- Discuss potential for hydromodification downstream of the site.
- Discuss the pre-development discharge patterns and points.
- Discuss the post-development discharge patterns and points.
- Determine the pre-development flow rates for the 2-year, 10-year, and 100-year event.
- Determine the pre-development volumes for the 2-year, 10-year, and 100-year event.
- Determine the post-development unmitigated flow rates for the 2-year, 10-year, and 100-year event.
- Determine the post-development volumes for the 2-year, 10-year, and 100-year event.
- Analyze the required post-development onsite mitigation for up to the 100-year event.
- Determine the design of the infiltration/detention basin to ensure that the volume and flow rate requirements are met.

Even though this report discusses stormwater, this report is not a Stormwater Pollution Prevention Plan (SWPPP), a Groundwater Study, a Geotechnical Report, nor a Water Quality Management Plan (WQMP). Each of these reports discuss separate aspects of stormwater. However, portions of the Geotechnical Report are utilized and referenced for the purpose of this report. Similarly, the stormwater mitigation requirements of the WQMP are considered for sizing the BMPs used for this project.

100.1 Project Description

The project site is located 2175 S Willow Ave and is bounded by an existing welding business to the North, an industrial truck parking facility to the East, a truck fuel station to the South, and Willow Avenue to the West. The entire project site measures approximately 4.04 acres and is intended to be developed into a new industrial property.

The existing project site is a developed truck repair facility with existing paved parking areas and existing building. The soils have a hydrologic soil group classification of "A", and the topography along the project site shows that runoff within the site primarily drains towards the southeast of the site where it will enter the public storm drain system.

The proposed site is considered an industrial development and intends to develop approximately 4.04 acres including site paving, site utilities, parking areas, landscaping, and a new driveway. Stormwater runoff will be collected by nearby catch basins and conveyed to a hydrodynamic separator for pre-treatment before entering an *Underground 96" Contech CMP Infiltration System* where it will infiltrate into the soil. Excess runoff will enter a bubbler system to be routed offsite where it will match existing conditions and enter into an existing concrete channel on the adjacent property and ultimately enter the public storm drain system. Refer to the Post-Development Exhibit in Appendix G for more information.

Due to the existing curb and gutter along South Willow Avenue and the existing topography, no offsite run-on is anticipated to enter the project site.

100.2 Methodology

100.2.1 Background

The type of soil and soil conditions are major factors affecting infiltration and storm water runoff as a result. The San Bernardino County Stormwater Facility Mapping Tool has classified soil into general hydrologic soil groups for comparing infiltration and runoff rates. Each group is based on properties that influence runoff, such as water infiltration rate, texture, natural discharge, and moisture condition. The runoff potential is based on the amount of runoff at the end of a long duration storm that occurs after wetting and swelling of the soil not protected by vegetation. Using the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey online tool, the hydrologic soil group classification for the area was determined to be A. Soil type A is defined as soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

In addition, based on the Percolation/Infiltration Testing prepared by Sladden Engineering dated November 2024, the site is suitable for infiltration with a measured average infiltration rate of 16.71 in/hr. Using a factor of safety of 3.5, the design infiltration rate for this project was computed to be 4.78 in/hr. Since the proposed underground infiltration system will have a maximum ponding depth of 8', the BMPs will be able to completely drawdown within 48 hours.

For the hydrologic analysis, the Rational Method and Unit Hydrograph Method was used to solve for the time of concentration, flow rates, and volumes following methodology described in the San Bernardino County Hydrology Manual, and the AES Engineering Software was used to compute the data. Utilizing precipitation data from NOAA Atlas 14 along with the proposed site characteristics, the rational method was used to compute the time of concentrations and peak flow rates generated from the existing and proposed 2-year, 10-year, and 100-year storm events. The time of concentration was then used to solve for the Synthetic Unit Hydrograph of the site which returned the total volume generated for the 24-hour duration of the 2-year, 10-year, and 100-year storm events.

Since the project is a redevelopment that increases the amount of pervious area onsite, the peak flows generated from the proposed project will be lower than existing conditions and peak flow attenuation will not be required. As a result, the proposed basin for this project will be strictly for water quality purposes, and a basin routing analysis is not performed for this project. Since the basin will not be utilized for detention purposes, the basins will not be required to drawdown within 24 hours, and instead will be required to infiltrate within 48 hours.

Antecedent moisture conditions (AMC) I, II, and III were used to calculate the peak flows and volumes for the 2-year, 10-year, and 100-year storm events respectively based on the hydrology manual. In addition, since the project is not located within a location that is HCOC Exempt, hydromodification will be a concern and calculations comparing the pre-development and post-development conditions for a 2-year storm event were performed. Note that for hydromodification analysis the 2-year storm event corresponds to the natural conditions prior to any development. Refer to the WQMP for hydromodification calculations. This hydrology report uses current existing conditions for all pre-development calculations.

100.2.2 Design Methodology

To prevent potential adverse impacts downstream of the site, the project proposes to retain at minimum the difference in stormwater runoff volume for the 100-year storm between post-development and pre-development conditions. In addition, to meet water quality requirements, the project is required to retain both the Design Capture Volume (DCV) and the hydromodification volume onsite. Therefore, the required retention volume for this project is taken to be the greater between the DCV, hydromodification volume, and the difference in runoff between the post-development and pre-development conditions. Refer to the WQMP for more information regarding the water quality retention requirements.

For hydraulic purposes, the storm drain system, and inlets will be designed to be able to accommodate the design storm of a 100-year storm event, and calculations will be performed during Final Engineering.

100.2.3 Calculations Performed

Below is a summary of the calculations that were performed for hydrological and hydraulic analysis. Refer to Appendices H and I for the Rational Method and Unit Hydrograph calculations respectively.

1. Rational Method
    a. 2-year storm event for pre-development and post-development conditions
    b. 10-year storm event for pre-development and post-development conditions
    c. 100-year storm event for pre-development and post-development conditions
        i. Used to determine peak flows and time of concentration.

2. Unit Hydrograph
    a. 2-year storm event for pre-development and post-development conditions
    b. 10-year storm event for pre-development and post-development conditions
    c. 100-year storm event for pre-development and post-development conditions
        i. Used to determine volume differences.

100.3 Drainage Characteristics

The site is in Zone X per the Federal Emergency Management Administration (FEMA) Flood Insurance Rate Maps (FIRM) map numbers 060071C8686J, dated May 08, 2024. For reference, see the FIRMette in Appendix B.

Flood Zone X is defined by FEMA as areas determined to be outside the 0.2% annual chance floodplain.

100.3.1 Pre-development (Existing) Condition

Under the existing conditions, the project site primarily drains towards the eastern side of the lot where it will enter an existing concrete channel on the adjacent property to later enter the public storm drain and ultimately discharge into the Santa Ana River. The existing conditions of the project site is an existing truck repair and parking facility. Under existing conditions, the project site was considered a single drainage area (DA A). See the Pre-Development Hydrology Exhibit in Appendix G for more information.

Table 1 shows a summary of the pre-development (existing) flows and volumes for the project site. See the Pre-Development Hydrology Exhibit in Appendix G for more information, Appendix H for the Rational Method Calculations, and Appendix I for the Unit Hydrograph Calculations.

Table 1: Pre-development (Existing) Flows and Volumes (Refer to Pre-Development Exhibit)

Area Description	Area (acres)	Q_2 (cfs)	V_2 (cf)	Q_{10} (cfs)	V_{10} (cf)	Q_{100} (cfs)	V_{100} (cf)
A	4.04	5.55	36,508	9.01	58,444	14.45	91,319

100.3.2 Post-development Condition

Runoff from the proposed site will be collected by nearby catch basins and conveyed to a hydrodynamic separator for pre-treatment before entering the *Underground 96" Contech Infiltration System* where it will infiltrate into the soil. Excess runoff will be routed to a bubbler system where it will discharge offsite and match existing conditions by entering a concrete channel on the adjacent property and ultimately discharge into the Santa Ana River.

Table 2 shows a summary of the post-development flows. For more information, refer to the Post Development Hydrology Exhibit in Appendix G, the Rational Method Calculations in Appendix H, and the Unit Hydrograph Calculations in Appendix I.

Table 2: Onsite Post-development Flows

Area Description	Area (acres)	Q_2 (cfs)	V_2 (cf)	Q_{10} (cfs)	V_{10} (cf)	Q_{100} (cfs)	V_{100} (cf)
DA 1	4.04	5.40	32,256	8.77	51,274	14.08	81,880

For retention purposes, the project proposes to retain the greater between the DCV, hydromodification volume, and the difference between the post- and pre- development volume for the 100-year storm event. The project proposes to utilize an underground infiltration chamber to retain the required volume. See the below table for a summary of the required retention volume.

Table 3: Retention Requirement

Area Description	DCV (CF)	Hydromodification Volume (CF)	Δ100-Year (CF)	Retention Requirement (CF)	Retention Provided (CF)
A	15,384	23,999	-9,439	23,999	25,093

Since the project is a redevelopment that increases the amount of pervious area onsite, the peak flows generated from the proposed project will be lower than existing conditions and peak flow attenuation will not be required. As a result, the proposed basin for this project will be strictly for water quality purposes, and a basin routing analysis is not performed for this project. Since the basin will not be utilized for detention purposes, the basins will not be required to drawdown within 24 hours, and instead will be required to infiltrate within 48 hours.

100.4 Hydraulic Analysis

The calculated peak flows from the analyses discussed above will be used to size the onsite drainage devices such as the pipes and catch basins. Sizing calculations will be performed and included in the Final Hydrology Report.

100.5 Conclusion

In conclusion, the following was covered in this report:

- The potential for hydromodification downstream of the site was discussed.
- The pre-development discharge patterns and points were analyzed.
- The post-development discharge patterns and points were analyzed.
- The pre-development flow rates for the 2-year, 10-year, and 100-year events were determined.
- The pre-development volumes for the 2-year, 10-year, and 100-year events were determined.
- The post-development unmitigated flows for the 2-year, 10-year, and 100-year events were determined.
- The post-development volumes for the 2-year, 10-year, and 100-year events were determined.
- The required stormwater mitigation was analyzed.
- The infiltration/detention basin was designed to ensure that the volume requirements are met.

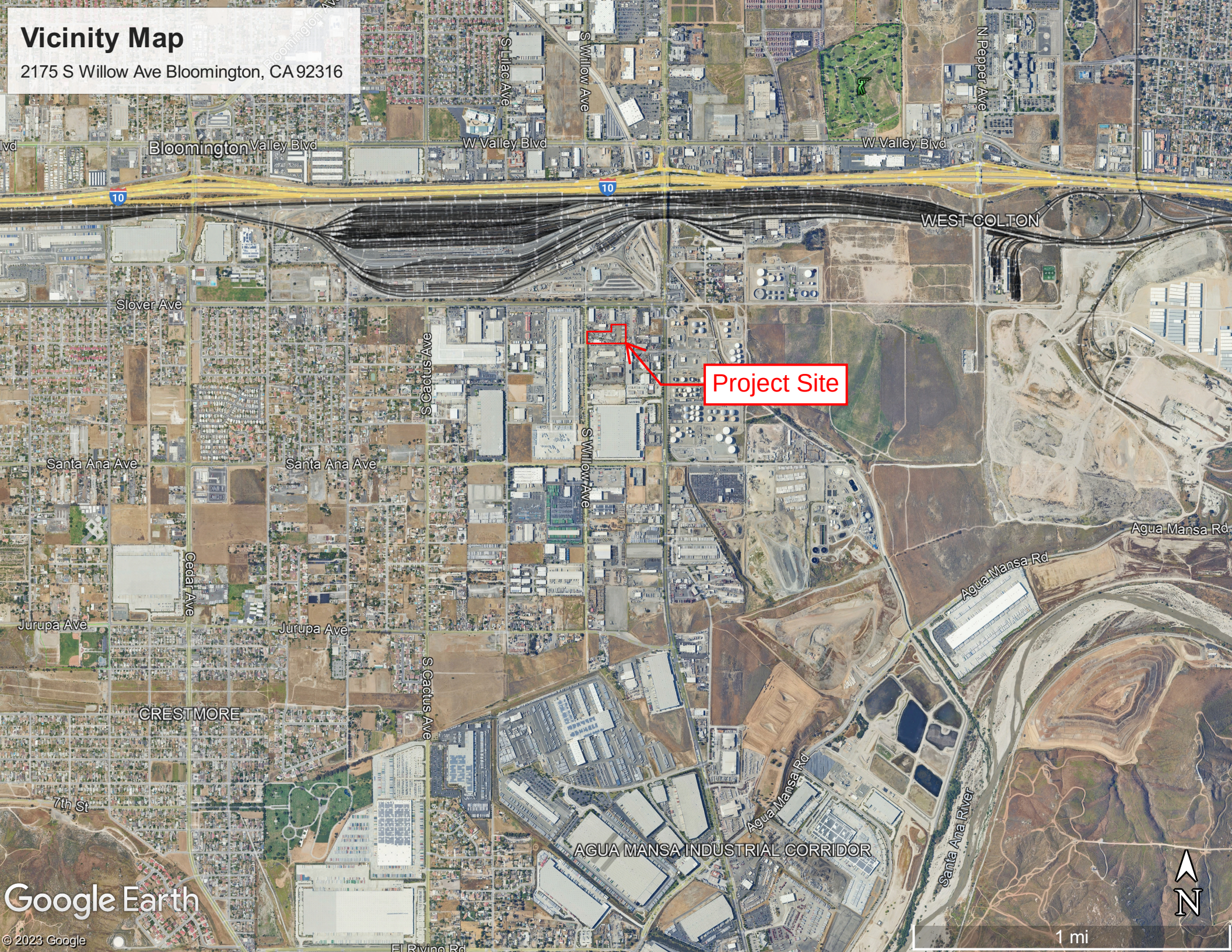
As discussed in the contents of this report, the development is not expected to cause a significant impact to downstream systems for storms up to the 100-year storm.

Appendix A

Vicinity Map

Vicinity Map

2175 S Willow Ave Bloomington, CA 92316



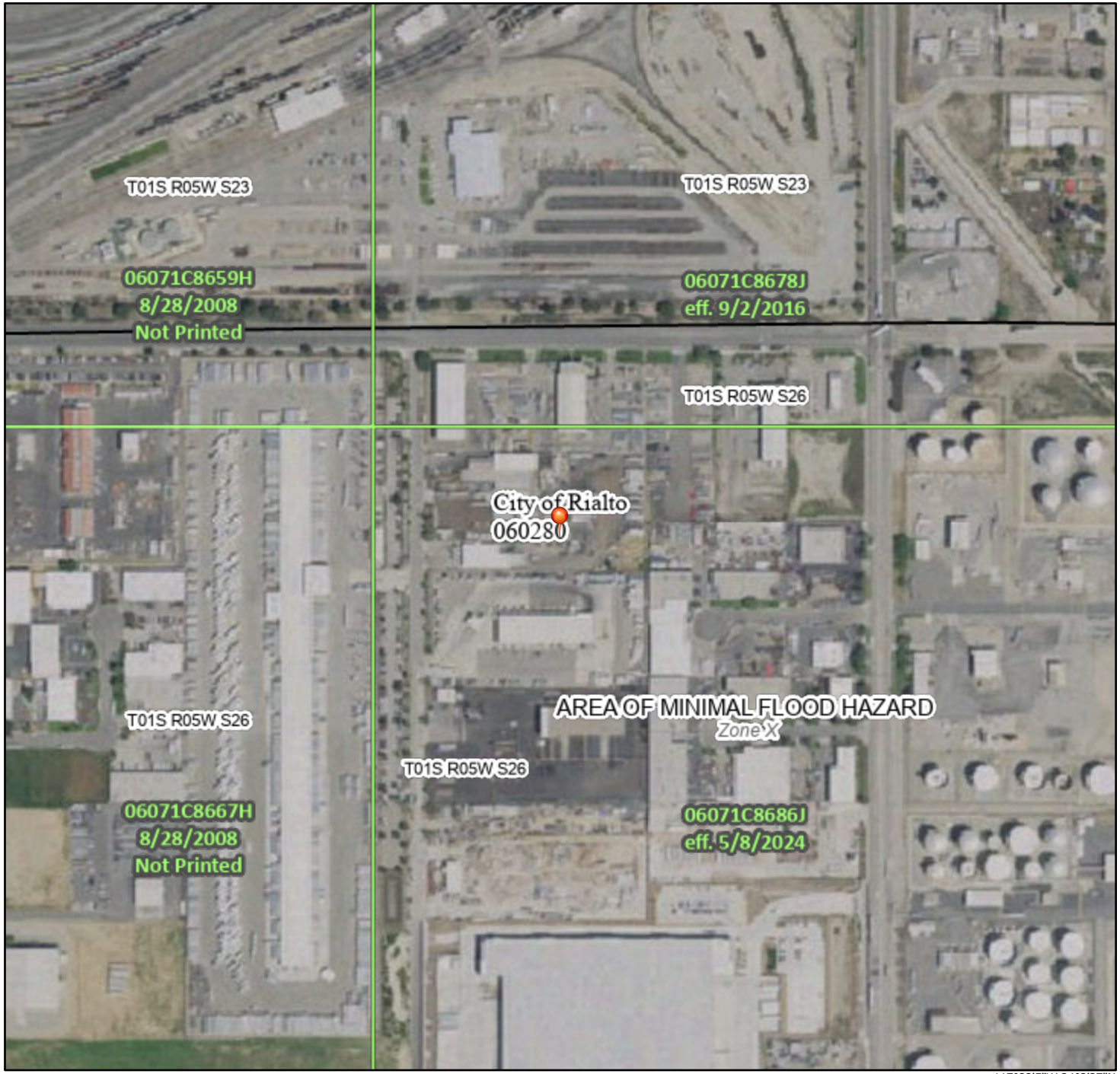
Appendix B

FIRM Map

National Flood Hazard Layer FIRMette

FEMA

117°22'42"W 34°3'57"N



117°22'5"W 34°3'27"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/20/2024 at 8:00 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Appendix C

Construction Plans

Appendix D

Hydrology Manual and Other Reference Material

Appendix E

NOAA Rainfall Data

NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, USA*
Latitude: 34.0617°, Longitude: -117.3731°
Elevation: 1023 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.30 (1.08-1.57)	1.67 (1.39-2.03)	2.17 (1.80-2.65)	2.59 (2.14-3.18)	3.17 (2.52-4.02)	3.62 (2.82-4.70)	4.08 (3.10-5.44)	4.57 (3.37-6.28)	5.27 (3.72-7.52)	5.81 (3.96-8.62)
10-min	0.924 (0.774-1.12)	1.20 (0.996-1.45)	1.56 (1.29-1.90)	1.86 (1.53-2.28)	2.27 (1.81-2.89)	2.59 (2.02-3.37)	2.93 (2.22-3.90)	3.28 (2.42-4.49)	3.77 (2.66-5.39)	4.16 (2.84-6.17)
15-min	0.748 (0.624-0.904)	0.964 (0.804-1.17)	1.26 (1.04-1.53)	1.50 (1.23-1.84)	1.83 (1.46-2.32)	2.09 (1.63-2.72)	2.36 (1.79-3.14)	2.64 (1.95-3.62)	3.04 (2.15-4.35)	3.36 (2.29-4.98)
30-min	0.558 (0.464-0.676)	0.720 (0.600-0.874)	0.936 (0.778-1.14)	1.12 (0.918-1.37)	1.36 (1.08-1.73)	1.56 (1.21-2.02)	1.76 (1.34-2.34)	1.97 (1.45-2.70)	2.27 (1.60-3.24)	2.50 (1.71-3.71)
60-min	0.403 (0.336-0.489)	0.521 (0.434-0.633)	0.678 (0.563-0.825)	0.808 (0.665-0.992)	0.987 (0.785-1.26)	1.13 (0.878-1.46)	1.27 (0.966-1.70)	1.43 (1.05-1.96)	1.64 (1.16-2.35)	1.81 (1.24-2.69)
2-hr	0.292 (0.244-0.354)	0.375 (0.312-0.455)	0.483 (0.401-0.589)	0.573 (0.471-0.703)	0.695 (0.552-0.883)	0.790 (0.614-1.03)	0.887 (0.673-1.18)	0.989 (0.729-1.36)	1.13 (0.797-1.62)	1.24 (0.845-1.84)
3-hr	0.241 (0.201-0.293)	0.309 (0.257-0.375)	0.397 (0.330-0.483)	0.469 (0.386-0.576)	0.568 (0.451-0.722)	0.644 (0.501-0.837)	0.722 (0.548-0.962)	0.803 (0.592-1.10)	0.915 (0.646-1.31)	1.00 (0.683-1.49)
6-hr	0.170 (0.141-0.206)	0.217 (0.181-0.264)	0.279 (0.232-0.340)	0.330 (0.271-0.405)	0.398 (0.316-0.506)	0.451 (0.351-0.586)	0.504 (0.382-0.672)	0.560 (0.412-0.768)	0.635 (0.448-0.909)	0.695 (0.473-1.03)
12-hr	0.112 (0.093-0.136)	0.144 (0.120-0.175)	0.186 (0.154-0.226)	0.219 (0.180-0.269)	0.265 (0.210-0.337)	0.300 (0.233-0.389)	0.335 (0.254-0.446)	0.371 (0.273-0.509)	0.421 (0.297-0.602)	0.459 (0.313-0.681)
24-hr	0.075 (0.066-0.087)	0.097 (0.086-0.112)	0.126 (0.111-0.146)	0.149 (0.131-0.174)	0.181 (0.153-0.218)	0.205 (0.170-0.252)	0.230 (0.186-0.289)	0.255 (0.201-0.330)	0.288 (0.218-0.389)	0.315 (0.230-0.439)
2-day	0.045 (0.040-0.052)	0.060 (0.053-0.069)	0.079 (0.070-0.091)	0.094 (0.083-0.110)	0.115 (0.098-0.139)	0.132 (0.109-0.162)	0.148 (0.120-0.187)	0.165 (0.130-0.214)	0.188 (0.142-0.254)	0.207 (0.151-0.288)
3-day	0.032 (0.028-0.037)	0.043 (0.038-0.050)	0.058 (0.051-0.067)	0.070 (0.061-0.081)	0.086 (0.073-0.104)	0.099 (0.082-0.122)	0.112 (0.091-0.141)	0.126 (0.099-0.163)	0.144 (0.109-0.195)	0.159 (0.116-0.222)
4-day	0.026 (0.023-0.030)	0.035 (0.031-0.041)	0.047 (0.042-0.055)	0.057 (0.050-0.067)	0.071 (0.060-0.086)	0.082 (0.068-0.101)	0.093 (0.076-0.118)	0.105 (0.083-0.136)	0.121 (0.092-0.164)	0.134 (0.098-0.187)
7-day	0.017 (0.015-0.019)	0.023 (0.020-0.027)	0.031 (0.028-0.036)	0.038 (0.033-0.045)	0.048 (0.040-0.058)	0.055 (0.046-0.068)	0.063 (0.051-0.079)	0.071 (0.056-0.092)	0.082 (0.062-0.111)	0.091 (0.067-0.127)
10-day	0.013 (0.011-0.015)	0.017 (0.015-0.020)	0.024 (0.021-0.028)	0.029 (0.026-0.034)	0.037 (0.031-0.044)	0.043 (0.035-0.053)	0.049 (0.039-0.061)	0.055 (0.043-0.071)	0.064 (0.048-0.086)	0.071 (0.052-0.099)
20-day	0.007 (0.007-0.009)	0.010 (0.009-0.012)	0.015 (0.013-0.017)	0.018 (0.016-0.021)	0.023 (0.019-0.027)	0.026 (0.022-0.033)	0.030 (0.024-0.038)	0.034 (0.027-0.045)	0.040 (0.030-0.054)	0.045 (0.033-0.063)
30-day	0.006 (0.005-0.007)	0.008 (0.007-0.010)	0.011 (0.010-0.013)	0.014 (0.012-0.017)	0.018 (0.015-0.022)	0.021 (0.017-0.026)	0.024 (0.019-0.030)	0.027 (0.022-0.036)	0.032 (0.024-0.044)	0.036 (0.026-0.050)
45-day	0.005 (0.004-0.005)	0.006 (0.006-0.007)	0.009 (0.008-0.010)	0.011 (0.010-0.013)	0.014 (0.012-0.017)	0.016 (0.014-0.020)	0.019 (0.015-0.024)	0.022 (0.017-0.028)	0.025 (0.019-0.034)	0.029 (0.021-0.040)
60-day	0.004 (0.003-0.005)	0.005 (0.005-0.006)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.012 (0.010-0.015)	0.014 (0.012-0.017)	0.016 (0.013-0.021)	0.019 (0.014-0.024)	0.022 (0.016-0.030)	0.025 (0.018-0.034)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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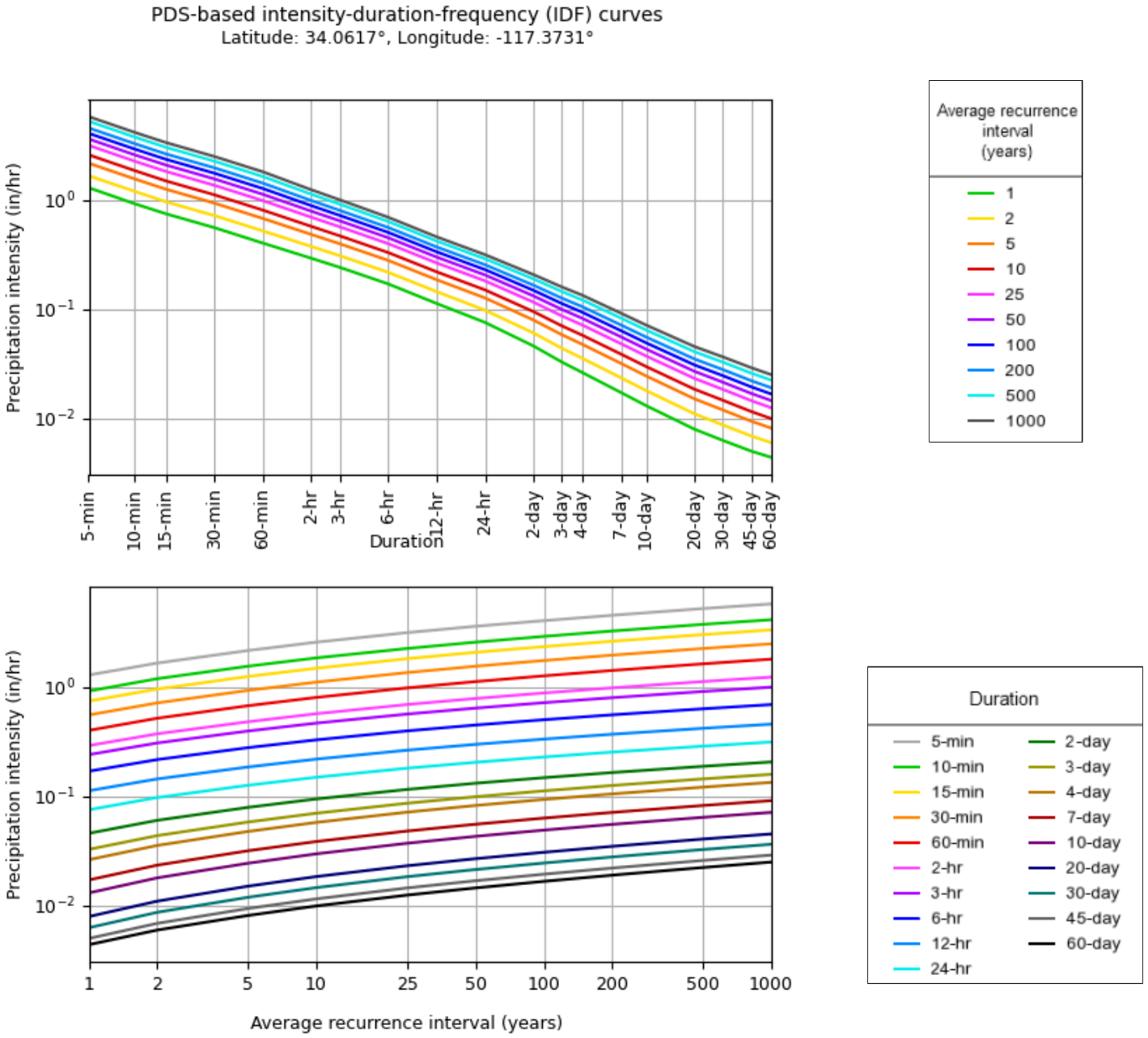
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Wed Nov 13 22:56:48 2024

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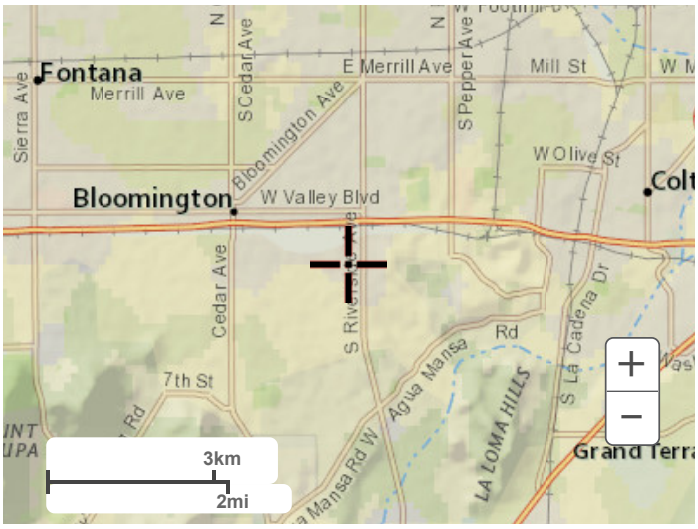
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, USA*
Latitude: 34.0617°, Longitude: -117.3731°
Elevation: 1023 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.108 (0.090-0.131)	0.139 (0.116-0.169)	0.181 (0.150-0.221)	0.216 (0.178-0.265)	0.264 (0.210-0.335)	0.302 (0.235-0.392)	0.340 (0.258-0.453)	0.381 (0.281-0.523)	0.439 (0.310-0.627)	0.484 (0.330-0.718)
10-min	0.154 (0.129-0.187)	0.200 (0.166-0.242)	0.260 (0.215-0.316)	0.310 (0.255-0.380)	0.378 (0.301-0.481)	0.432 (0.336-0.561)	0.488 (0.370-0.650)	0.547 (0.403-0.749)	0.629 (0.444-0.899)	0.694 (0.473-1.03)
15-min	0.187 (0.156-0.226)	0.241 (0.201-0.293)	0.314 (0.261-0.382)	0.374 (0.308-0.460)	0.457 (0.364-0.581)	0.523 (0.407-0.679)	0.590 (0.448-0.786)	0.661 (0.487-0.906)	0.760 (0.537-1.09)	0.840 (0.572-1.24)
30-min	0.279 (0.232-0.338)	0.360 (0.300-0.437)	0.468 (0.389-0.570)	0.558 (0.459-0.685)	0.682 (0.542-0.867)	0.780 (0.606-1.01)	0.880 (0.668-1.17)	0.986 (0.727-1.35)	1.13 (0.800-1.62)	1.25 (0.853-1.86)
60-min	0.403 (0.336-0.489)	0.521 (0.434-0.633)	0.678 (0.563-0.825)	0.808 (0.665-0.992)	0.987 (0.785-1.26)	1.13 (0.878-1.46)	1.27 (0.966-1.70)	1.43 (1.05-1.96)	1.64 (1.16-2.35)	1.81 (1.24-2.69)
2-hr	0.585 (0.488-0.709)	0.750 (0.624-0.911)	0.967 (0.803-1.18)	1.15 (0.943-1.41)	1.39 (1.10-1.77)	1.58 (1.23-2.05)	1.78 (1.35-2.36)	1.98 (1.46-2.71)	2.26 (1.60-3.23)	2.48 (1.69-3.68)
3-hr	0.726 (0.605-0.880)	0.928 (0.772-1.13)	1.19 (0.991-1.45)	1.41 (1.16-1.73)	1.71 (1.36-2.17)	1.94 (1.51-2.51)	2.17 (1.65-2.89)	2.41 (1.78-3.31)	2.75 (1.94-3.93)	3.02 (2.05-4.47)
6-hr	1.02 (0.850-1.24)	1.30 (1.08-1.58)	1.68 (1.39-2.04)	1.98 (1.63-2.43)	2.39 (1.90-3.03)	2.70 (2.10-3.51)	3.02 (2.29-4.03)	3.35 (2.47-4.60)	3.81 (2.69-5.45)	4.16 (2.84-6.17)
12-hr	1.36 (1.13-1.65)	1.74 (1.45-2.12)	2.24 (1.86-2.73)	2.65 (2.18-3.25)	3.20 (2.54-4.06)	3.62 (2.81-4.70)	4.04 (3.06-5.38)	4.48 (3.30-6.14)	5.07 (3.58-7.26)	5.54 (3.77-8.21)
24-hr	1.81 (1.60-2.09)	2.35 (2.08-2.71)	3.04 (2.68-3.52)	3.60 (3.15-4.20)	4.36 (3.69-5.25)	4.93 (4.09-6.07)	5.52 (4.47-6.95)	6.12 (4.82-7.93)	6.94 (5.25-9.35)	7.57 (5.54-10.6)
2-day	2.21 (1.95-2.54)	2.90 (2.57-3.35)	3.81 (3.36-4.41)	4.56 (3.98-5.31)	5.56 (4.71-6.71)	6.34 (5.26-7.80)	7.14 (5.78-8.99)	7.95 (6.27-10.3)	9.07 (6.86-12.2)	9.94 (7.27-13.9)
3-day	2.36 (2.09-2.72)	3.15 (2.79-3.64)	4.20 (3.70-4.86)	5.06 (4.42-5.90)	6.24 (5.28-7.52)	7.16 (5.94-8.80)	8.10 (6.56-10.2)	9.08 (7.16-11.8)	10.4 (7.89-14.1)	11.5 (8.40-16.0)
4-day	2.53 (2.24-2.92)	3.42 (3.02-3.94)	4.59 (4.04-5.31)	5.56 (4.86-6.48)	6.89 (5.84-8.30)	7.94 (6.58-9.76)	9.01 (7.30-11.4)	10.1 (7.99-13.1)	11.7 (8.84-15.8)	12.9 (9.45-18.0)
7-day	2.89 (2.56-3.33)	3.94 (3.49-4.55)	5.34 (4.71-6.18)	6.50 (5.68-7.58)	8.10 (6.86-9.76)	9.35 (7.76-11.5)	10.6 (8.62-13.4)	12.0 (9.46-15.5)	13.9 (10.5-18.7)	15.4 (11.3-21.5)
10-day	3.14 (2.78-3.62)	4.31 (3.81-4.97)	5.86 (5.17-6.79)	7.15 (6.26-8.34)	8.94 (7.57-10.8)	10.3 (8.58-12.7)	11.8 (9.56-14.9)	13.3 (10.5-17.3)	15.5 (11.7-20.8)	17.2 (12.5-23.9)
20-day	3.81 (3.37-4.39)	5.27 (4.66-6.09)	7.23 (6.37-8.36)	8.86 (7.75-10.3)	11.1 (9.42-13.4)	12.9 (10.7-15.9)	14.8 (12.0-18.6)	16.8 (13.2-21.7)	19.5 (14.8-26.4)	21.8 (15.9-30.4)
30-day	4.52 (4.00-5.21)	6.26 (5.53-7.22)	8.59 (7.57-9.94)	10.5 (9.22-12.3)	13.3 (11.2-16.0)	15.4 (12.8-19.0)	17.7 (14.3-22.3)	20.1 (15.9-26.0)	23.5 (17.8-31.7)	26.3 (19.2-36.7)
45-day	5.40 (4.78-6.22)	7.43 (6.57-8.57)	10.2 (8.96-11.8)	12.5 (10.9-14.5)	15.7 (13.3-18.9)	18.2 (15.1-22.4)	21.0 (17.0-26.4)	23.9 (18.8-30.9)	28.0 (21.2-37.8)	31.4 (23.0-43.8)
60-day	6.31 (5.59-7.28)	8.60 (7.61-9.93)	11.7 (10.3-13.5)	14.3 (12.5-16.7)	18.0 (15.2-21.7)	20.9 (17.3-25.7)	24.0 (19.5-30.3)	27.4 (21.6-35.4)	32.2 (24.3-43.4)	36.1 (26.4-50.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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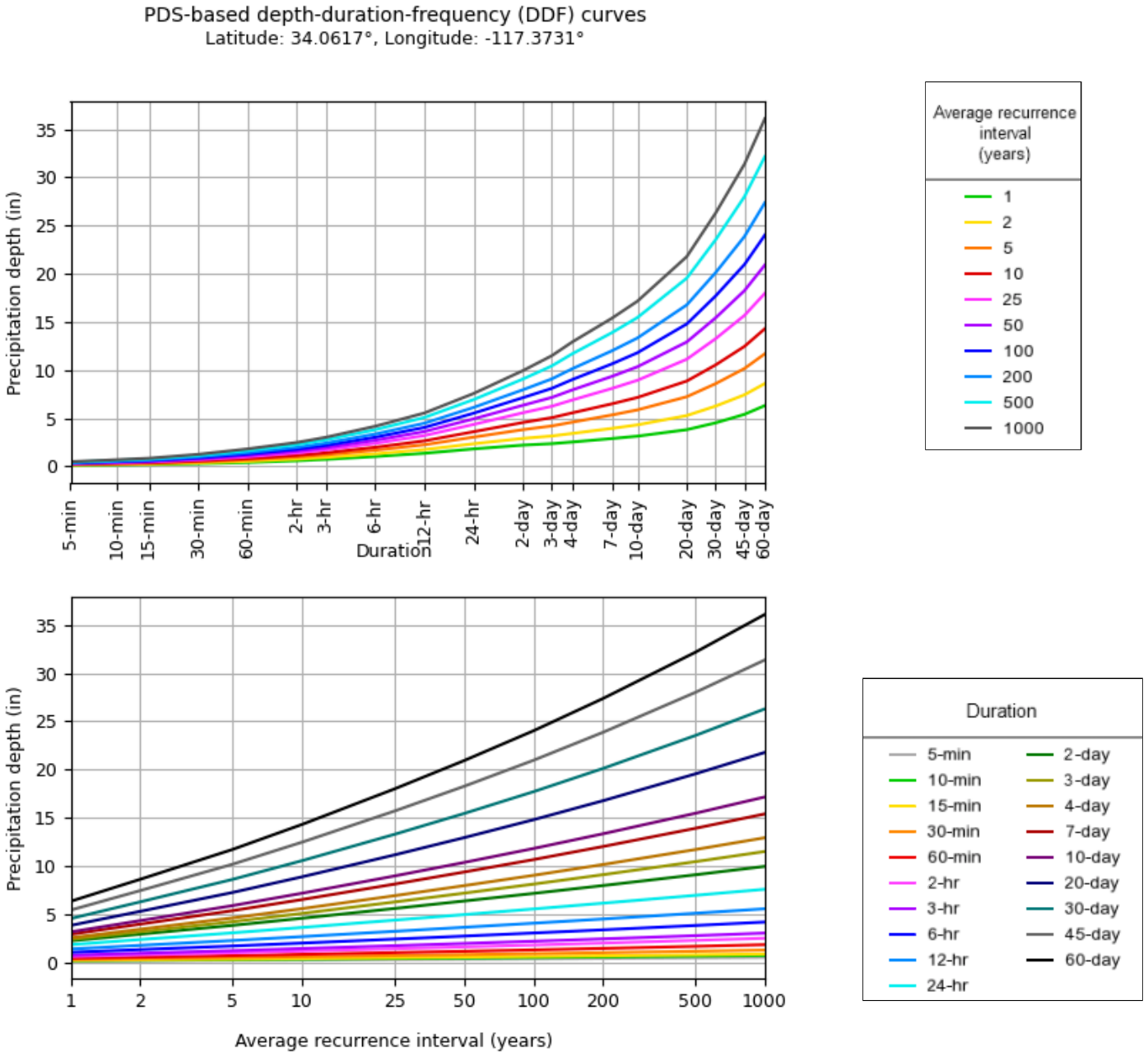
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Wed Nov 13 23:01:13 2024

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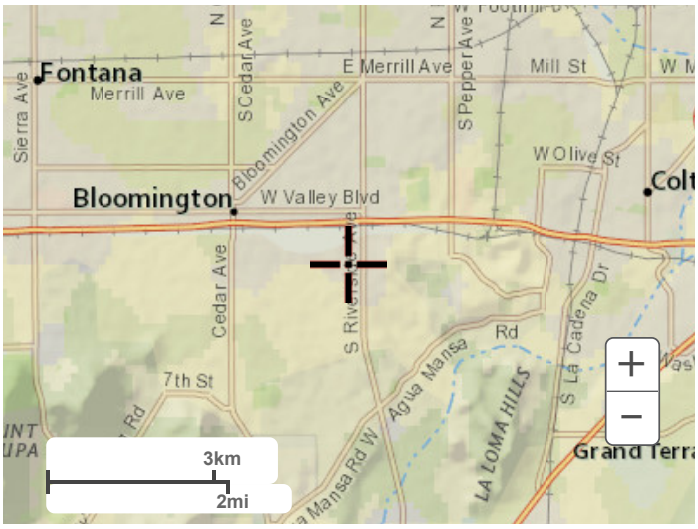
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

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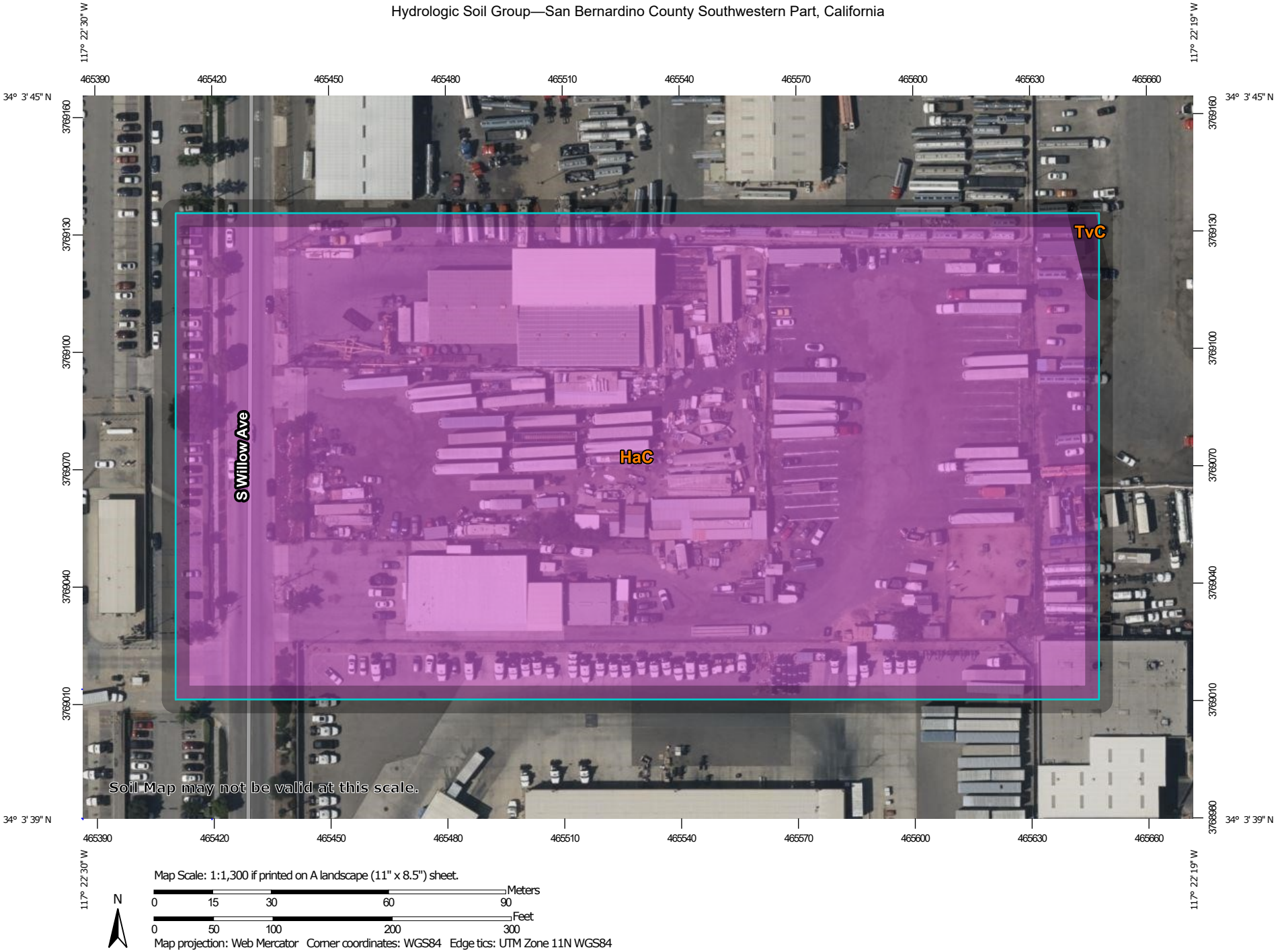
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix F

Soils Reports



Map Scale: 1:1,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 16, Aug 30, 2024

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HaC	Hanford coarse sandy loam, 2 to 9 percent slopes	A	7.3	99.9%
TvC	Tujunga gravelly loamy sand, 0 to 9 percent slopes	A	0.0	0.1%
Totals for Area of Interest			**7.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Sladden Engineering

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6782 Stanton Avenue, Suite C, Buena Park, CA. 90621 (714) 523-0952 Fax (714) 523-1369
450 Egan Avenue, Beaumont, CA. 92223 (951) 845-7743 Fax (951) 845-8863
www.SladdenEngineering.com

November 14, 2024
(Revised November 18, 2024)

Project No. 444-24084
24-11-067

Outour Storage Acquisitions, LLC
800 Brickell Avenue, Suite 904
Miami, Florida 33131

Project: Proposed Truckyard/ IOS Facility
2175 South Willow Avenue
Rialto, California

Subject: Percolation/Infiltration Testing for On-Site Stormwater Management

In accordance with your request, we have performed percolation testing on the subject site to evaluate the infiltration potential of the near surface soil to assist in storm water management system design. It is our understanding that on-site stormwater retention including infiltration is planned for the proposed project.

Percolation testing was performed within two (2) test holes excavated on the site. Testing was performed at a depth of approximately 10 feet below the existing ground surface. The approximate locations of the test holes are presented on the attached Exploration Location Plan (Figure 3). Testing was performed by placing water within the test bores and recording the drop in the water surface with time. Testing was performed in general accordance with the *United States Bureau of Reclamation (BOR) Procedure 7300-89 (1999)*. Test results are summarized in the following table.

PERCOLATION TEST RESULTS

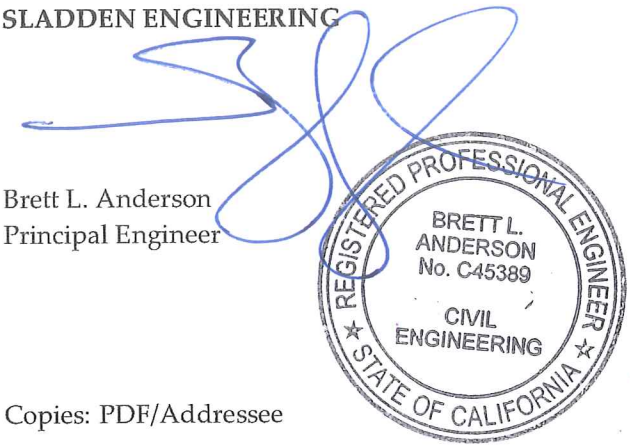
Test No.	Depth (Ft)	USCS	Percolation Rate (in/hr)	Infiltration Rate (in/hr)
BH-7/P-1	10.00	SM	109.50	17.01
BH-3/P-2	10.00	SM	107.25	16.42

The percolation rates determined represent the ultimate field rates that do not include a safety factor. The corresponding infiltration rates were calculated using the Porchet Method. An appropriate safety factor should be incorporated into retention/infiltration system design. Testing indicates a rapid infiltration rate within the test holes which is consistent with the highly permeable native sandy soil encountered below a depth of approximately 5 feet. Infiltration systems should extend through the silty surface soil into the sandy native soil.

Groundwater was not encountered within our exploratory boreholes. Based upon our review of groundwater levels within the vicinity of the site[1], it is our opinion that groundwater should not be a controlling factor in stormwater retention/infiltration system design.

If you have any questions regarding this memo or the testing summarized herein, please contact the undersigned.

Respectfully submitted,
SLADDEN ENGINEERING

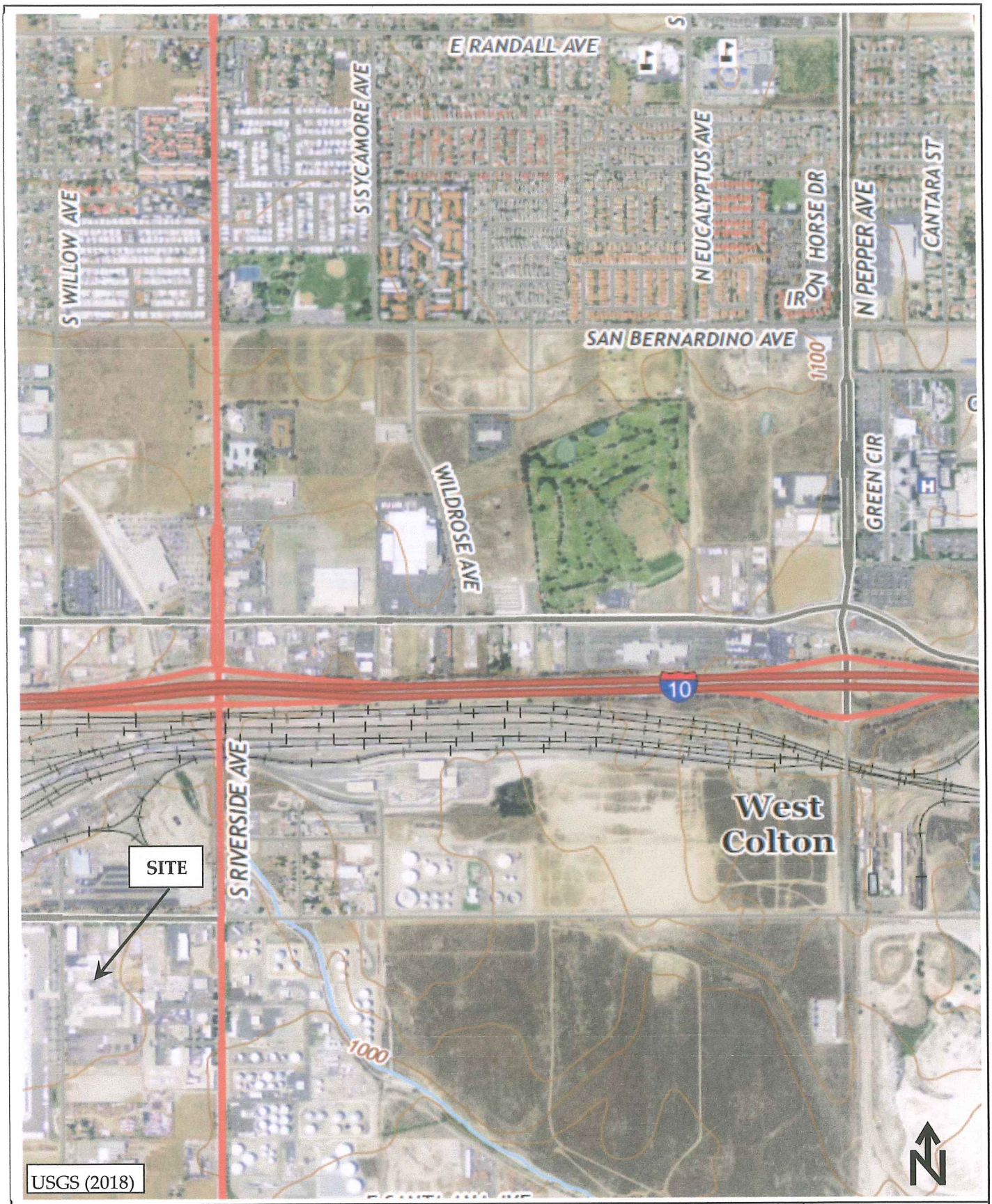


Brett L. Anderson
Principal Engineer

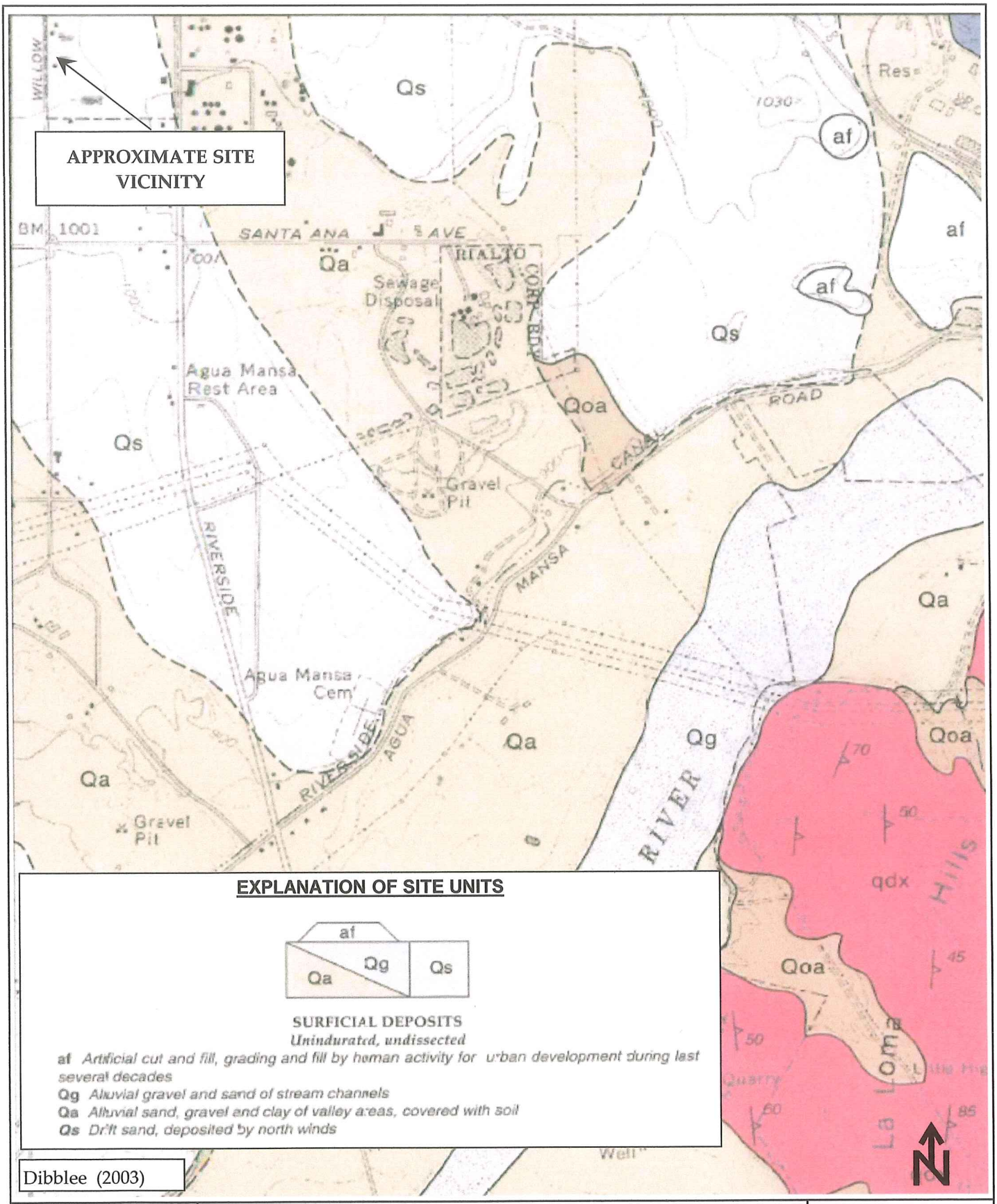
Copies: PDF/Addressee

[1] California Department of Water Resources, 2024, Water Data Library; available at: http://wdl.water.ca.gov/waterdatalibrary/

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
EXPLORATION LOCATION PLAN



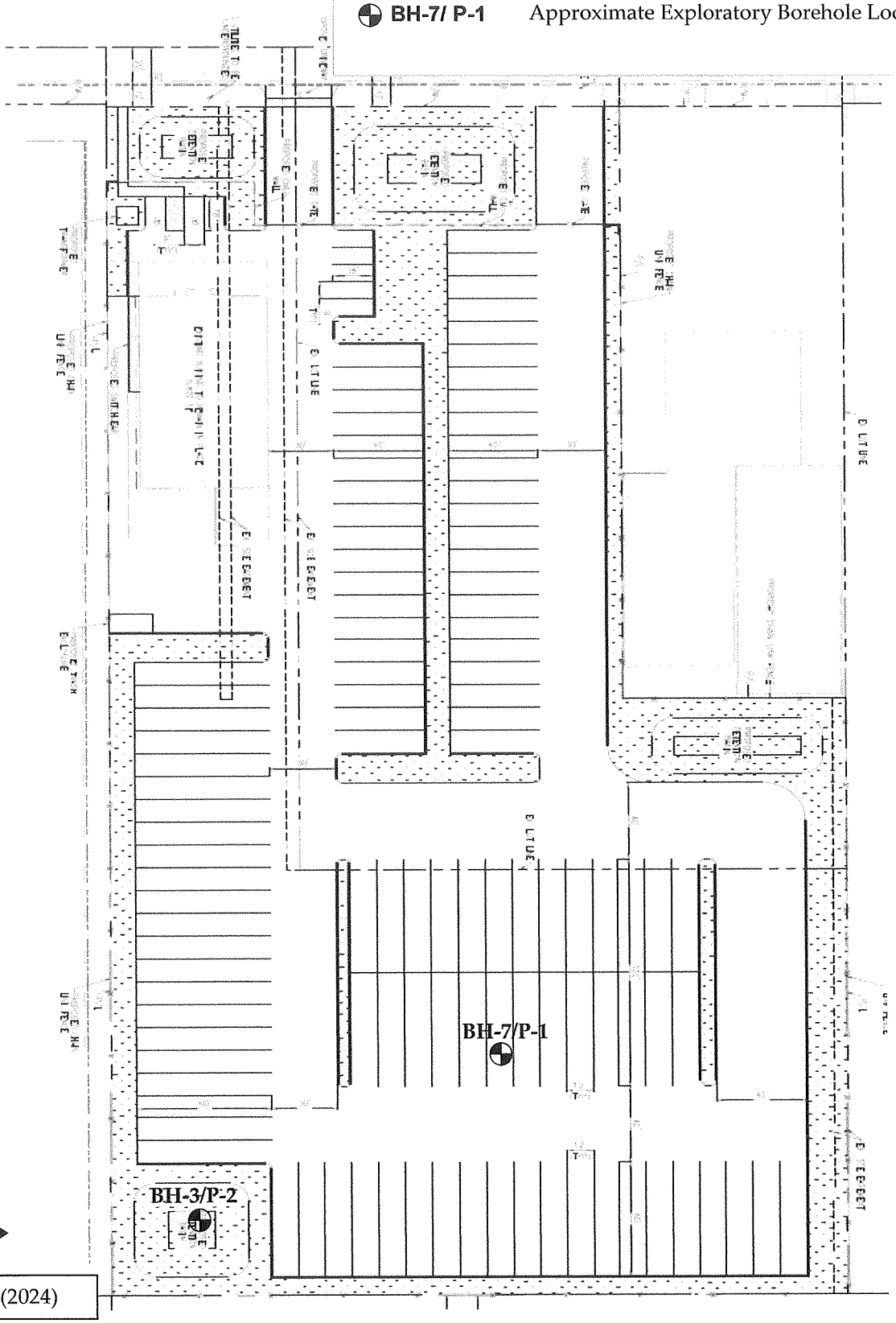
Sladden Engineering	SITE LOCATION MAP		FIGURE 1
	Project Number:	444-24084	
	Report Number:	24-11-067	
	Date:	November 18, 2024	



Sladden Engineering	REGIONAL GEOLOGIC MAP	FIGURE 2
	Project Number: 444-24084	
	Report Number: 24-11-067	
	Date: November 18, 2024	

LEGEND

BH-7/ P-1 Approximate Exploratory Borehole Location/



Kimley Horn (2024)

Sladden Engineering	EXPLORATION LOCATION PLAN		FIGURE 3
	Project Number:	444-24084	
	Report Number:	24-11-067	
	Date:	November 18, 2024	

BORELOGS

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/18/2024
Elevation:	1020 Feet (MSL)	Boring No:	BH-7/P-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Sandy Silt/ Silty Sand (ML/SM); yellowish brown, slightly moist, low plasticity with trace gravel (Fill).
							4		
							6		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with coarse gravel (Qs).
							8		
							10		
							12		Terminated at ~10.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Borehole Cased with Perforated Pipe for Percolation Testing.
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED TRUCK YARD/ IOS FACILITY
2175 SOUTH WILLOW AVENUE, RIALTO

Project No: 444-24084
Report No: 24-11-067

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/13/2024
Elevation:	1020 Feet (MSL)	Boring No:	BH-3/P-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–2		Sandy Silt/ Silty Sand (ML/SM); yellowish brown, slightly moist, low plasticity with trace gravel (Fill).
							2–10		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with coarse gravel (Qs).
							10–50		Terminated at ~10.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Borehole Cased with Perforated Pipe for Percolation Testing.

Completion Notes:

PROPOSED TRUCK YARD/ IOS FACILITY
2175 SOUTH WILLOW AVENUE, RIALTO

Project No: 444-24084
Report No: 24-11-067

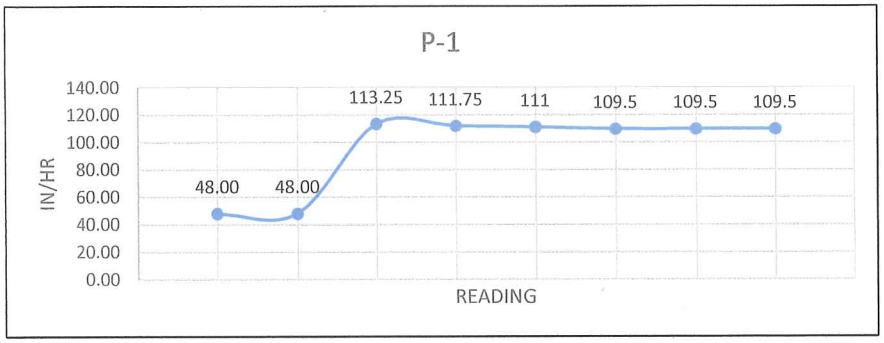
STORMWATER TESTING DATA SHEETS

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	2175 South Willow Ave., Rialto	Depth (ft):	10.00
Job No. :	444-24084	USCS Soil Class:	SM
Date:	4/18/2024	Sandy Soil:	J.M.
Test Hole #:	P-1	Tested By:	J.M.

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
A	25.00	10.00	20	0	20	48.00
B	25.00	10.00	20	0	20	48.00

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
1	10.00	10.00	20	1 1/8	18 7/8	113.25
2	10.00	10.00	20	1 3/8	18 5/8	111.75
3	10.00	10.00	20	1 4/8	18 4/8	111
4	10.00	10.00	20	1 6/8	18 2/8	109.5
5	10.00	10.00	20	1 6/8	18 2/8	109.5
6	10.00	10.00	20	1 6/8	18 2/8	109.5



PERCOLATION RATE CONVERSION (PORCHET METHOD)

$$I_{t=} \quad \frac{\Delta H\ 60\ R}{\Delta t(r+2H_{avg})}$$

Δt =	10.00
D_f =	118.25
r =	4.00
D_0 =	100
D_t =	120.00
H_0 =	20
H_f =	1.75
ΔH =	18.25
H_{avg} =	10.88

Δt (minutes)
D_f (Final Depth to water)
r (hole radius in inches)
D_0 (Initial Depth to water)
D_t (Total Depth of test hole)
H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

H_{avg} (average head height over the time interval)

$$H_{avg} = (H_0 + H_f)/2$$

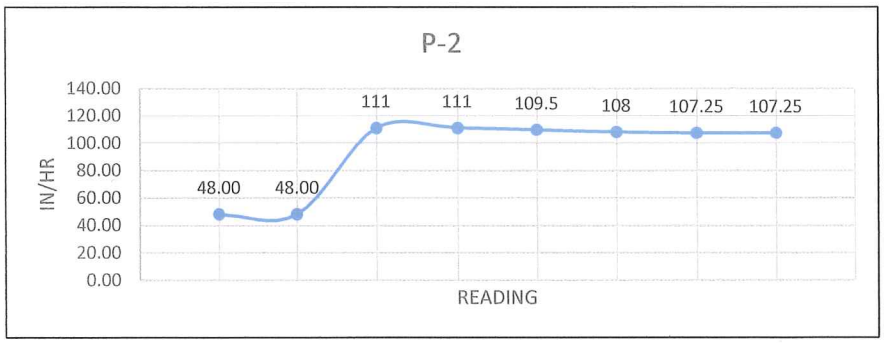
Field Rate:	109.5 in/hr
Infiltration Rate:	17.01 in/hr

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	2175 South Willow Ave., Rialto	Depth (ft):	10.00
Job No. :	444-24084	USCS Soil Class:	SM
Date:	4/18/2024	Sandy Soil:	J.M.
Test Hole #:	P-2	Tested By:	J.M.

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
A	25.00	10.00	20	0	20	48.00
B	25.00	10.00	20	0	20	48.00

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
1	10.00	10.00	20	1 4/8	18 4/8	111
2	10.00	10.00	20	1 4/8	18 4/8	111
3	10.00	10.00	20	1 6/8	18 2/8	109.5
4	10.00	10.00	20	2	18	108
5	10.00	10.00	20	2 1/8	17 7/8	107.25
6	10.00	10.00	20	2 1/8	17 7/8	107.25



PERCOLATION RATE CONVERSION (PORCHET METHOD)

$$I_{t=} \quad \frac{\Delta H\ 60\ R}{\Delta t(r+2H_{avg})}$$

Δt =	10.00
D_f =	117.88
r =	4.00
D_0 =	100
D_t =	120.00
H_0 =	20
H_f =	2.125
ΔH =	17.88
H_{avg} =	11.06

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

H_{avg} (average head height over the time interval)

$$H_{avg} = (H_0 + H_f)/2$$

Field Rate: 107.25 in/hr

Infiltration Rate: 16.42 in/hr

Appendix G

Hydrology Exhibits

CITY OF RIALTO

PRE-DEVELOPMENT HYDROLOGY EXHIBIT

FOR

2175 S WILLOW AVE.

HYDROLOGY INFORMATION

SITE AREA:	4.04 ACRES	
SOIL TYPE:	A	(NRCS WEB SOIL SURVEY)
IMPERVIOUS:	100%	(PER CALCULATIONS)
ISOHYETALS:	0.521 INCH	(2-YEAR, 1-HR STORM EVENT)
	1.27 INCH	(100-YEAR, 1-HR STORM EVENT)
CURVE NUMBER	67	(SOIL GROUP A)
FREQUENCY:	2-YEAR	(FOR STORMWATER QUALITY)
	100-YEAR	(FOR STORM DRAIN DESIGN)
METHOD:	SAN BERNARDINO COUNTY HYDROLOGY MANUAL	

LEGEND:

- DRAINAGE AREA BOUNDARY
- FLOW PATH
- PROPOSED FLOW DIRECTION ARROW
- X / X.XX — DRAINAGE AREA DESIGNATION / AREA (AC)
- STREAM #
- NODE

HYDROLOGY SUMMARY					
DRAINAGE AREA NO.	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO	Q_{100} (CFS)	V_{100} (CF)
A	175,959	4.04	1.00	14.45	91,319

PREPARED BY:

Kimley»Horn

1100 W TOWN AND COUNTRY ROAD,SUITE 700,
ORANGE, CA 92868
PHONE: 714-939-1030 FAX: 714-938-9488
WWW.KIMLEY-HORN.COM

2175 S WILLOW AVE

PRE-DEVELOPMENT HYDROLOGY EXHIBIT

OUTOUR

CITY OF RIALTO

DATE: DEC 2024

SHEET 1 OF 1

CITY OF RIALTO
POST-DEVELOPMENT HYDROLOGY EXHIBIT
FOR
2175 S WILLOW AVE.

HYDROLOGY INFORMATION

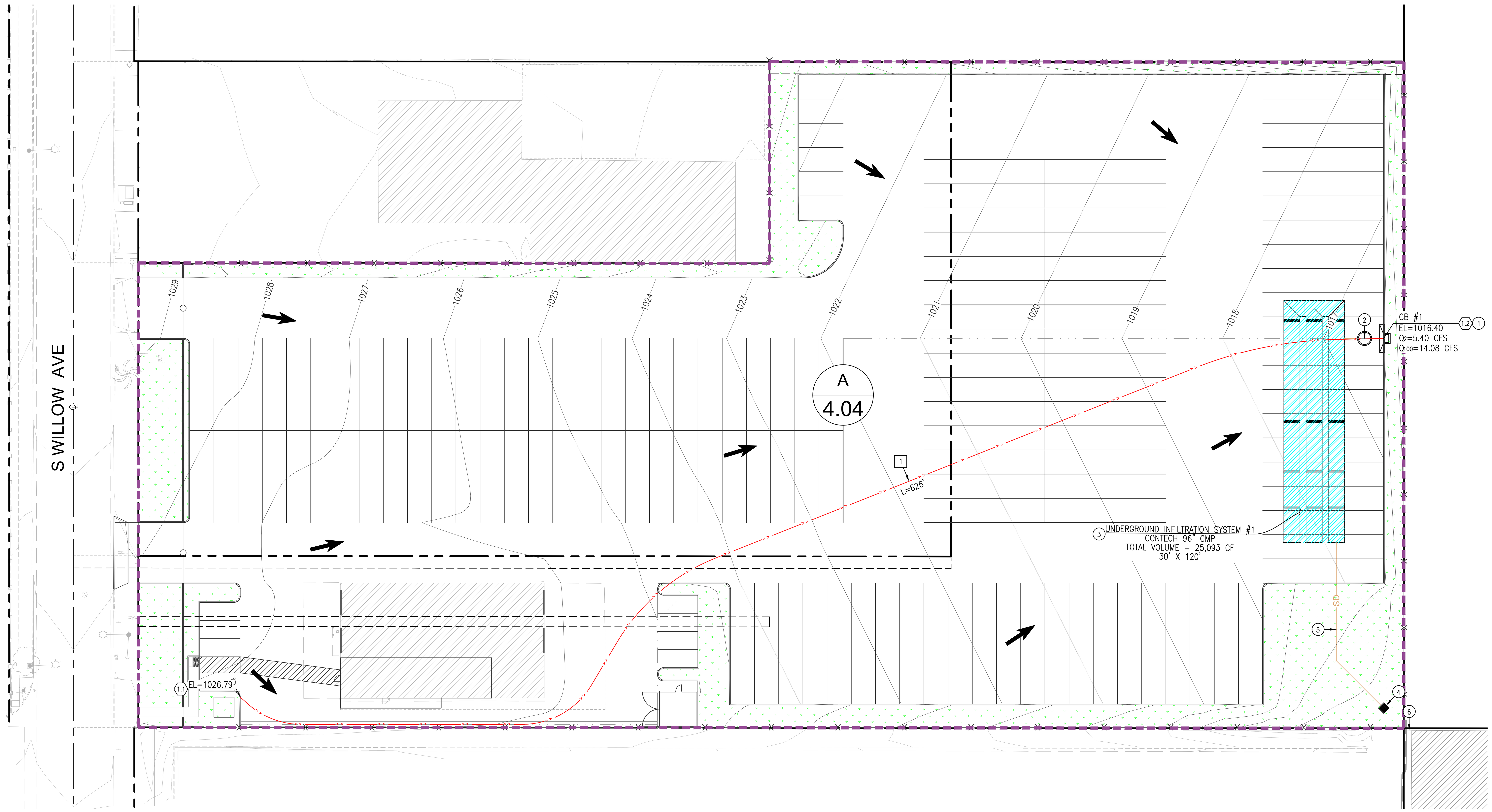
SITE AREA:	4.04 ACRES	
SOIL TYPE:	A	(NRCS WEB SOIL SURVEY)
IMPERVIOUS:	87%	(PER CALCULATIONS)
ISOHYETALS:	0.521 INCH	(2-YEAR, 1-HR STORM EVENT)
	1.27 INCH	(100-YEAR, 1-HR STORM EVENT)
CURVE NUMBER	32	(SOIL GROUP A)
FREQUENCY:	2-YEAR	(FOR STORMWATER QUALITY)
	100-YEAR	(FOR STORM DRAIN DESIGN)
METHOD:	SAN BERNARDINO COUNTY HYDROLOGY MANUAL	

LEGEND:

- DRAINAGE AREA BOUNDARY
- FLOW PATH
- SD — PROPOSED STORM DRAIN PIPE
- PROPOSED FLOW DIRECTION ARROW
- X / X.XX — DRAINAGE AREA DESIGNATION / AREA (AC)
- 1.1 — STREAM #
- 1 — NODE

DRAINAGE NOTES:

1. PROPOSED CATCH BASIN WITH FILTER INSERT
2. PROPOSED BMP – HYDRODYNAMIC SEPARATOR
3. PROPOSED BMP – UNDERGROUND INFILTRATION BASIN
4. PROPOSED BUBBLER SYSTEM
5. PROPOSED STORM DRAIN PIPE PRIVATE MAINTAINED
6. EXISTING CONCRETE CHANNEL



HYDROLOGY SUMMARY

DRAINAGE AREA NO.	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO	Q_{100} (CFS)	V_{100} (CF)	RETENTION REQUIRED (CF)	RETENTION PROVIDED (CF)
A	175,959	4.04	0.87	14.08	81,880	23,999	25,093

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

SCALE: 1" = 30'
WHEN PRINTED AT FULL
SIZE 24"X36"

PREPARED BY:
Kimley»Horn

1100 W TOWN AND COUNTRY ROAD,SUITE 700,
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2175 S WILLOW AVE
POST-DEVELOPMENT HYDROLOGY EXHIBIT
OUTOUR
CITY OF RIALTO

DATE: DEC 2024
SHEET
1
OF 1

Appendix H

Rational Method Analysis

Appendix H.I

Rational Method Analysis
Pre-Development Conditions
2-Year Storm

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

                          Analysis prepared by:




 ************************ DESCRIPTION OF STUDY *************************
* 2175 S WILLOW                                                        *
* RATIONAL METHOD                                                      *
* PRE-DEVELOPMENT CONDITIONS, 2-YEAR, DA A                             *
 **********************************************************************

  FILE NAME: RAT2PR.DAT
  TIME/DATE OF STUDY: 13:33 11/15/2024
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5210

  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

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

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

******************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.10 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   655.11
  ELEVATION DATA: UPSTREAM(FEET) =   1029.41  DOWNSTREAM(FEET) =   1014.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.693
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.660
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      1.33     0.100    17    8.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  1.33
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      5.55
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =      5.55
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      8.69
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.13
  AREA-AVERAGED Fp(INCH/HR) =  1.33  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       5.55
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix H.II

Rational Method Analysis
Pre-Development Conditions
10-Year Storm

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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                          Analysis prepared by:




 ************************ DESCRIPTION OF STUDY ************************
* 2175 S WILLOW                                                      *
* RATIONAL METHOD                                                    *
* PRE-DEVELOPMENT CONDITIONS, 10-YEAR, DA A                          *
 **********************************************************************

  FILE NAME: RAT100PR.DAT
  TIME/DATE OF STUDY: 12:23 11/15/2024
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.8080

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

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

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

**************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.10 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   655.11
  ELEVATION DATA: UPSTREAM(FEET) =   1029.41  DOWNSTREAM(FEET) =   1014.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.693
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.575
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      0.98     0.100    32    8.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      9.01
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =      9.01
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      8.69
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       9.01
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix H.III

Rational Method Analysis
Pre-Development Conditions
100-Year Storm

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

                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* 2175 S WILLOW                                                        *
* RATIONAL METHOD                                                      *
* PRE-DEVELOPMENT CONDITIONS, 100-YEAR, DA A                           *
 ************************************************************************

  FILE NAME: RAT100PR.DAT
  TIME/DATE OF STUDY: 11:31 11/15/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2700

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

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

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

************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.10 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   655.11
  ELEVATION DATA: UPSTREAM(FEET) =   1029.41  DOWNSTREAM(FEET) =   1014.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.693
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.048
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      0.74     0.100    52    8.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     14.45
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =     14.45
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      8.69
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      14.45
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix H.IV

Rational Method Analysis
Post-Development Conditions
2-Year Storm

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

                          Analysis prepared by:




 ************************ DESCRIPTION OF STUDY ************************
* 2175 S WILLOW                                                      *
* RATIONAL METHOD                                                    *
* POST DEVELOPMENT CONDITIONS, 2-YEAR, DA A                          *
 **********************************************************************

  FILE NAME: RAT2PO.DAT
  TIME/DATE OF STUDY: 17:41 12/03/2024
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5210

  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

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

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

**************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.20 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   626.20
  ELEVATION DATA: UPSTREAM(FEET) =   1026.79  DOWNSTREAM(FEET) =   1016.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.069
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.619
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      1.33     0.100    17    9.07
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  1.33
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      5.40
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =      5.40
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      9.07
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.13
  AREA-AVERAGED Fp(INCH/HR) =  1.33  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       5.40
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix H.V

Rational Method Analysis
Post-Development Conditions
10-Year Storm

```
************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* 2175 S WILLOW                                                        *
* RATIONAL METHOD                                                      *
* POST DEVELOPMENT CONDITIONS, 10-YEAR, DA A                           *
 ************************************************************************

  FILE NAME: RAT10PO.DAT
  TIME/DATE OF STUDY: 17:35 12/03/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.8080

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

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

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

************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.20 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   626.20
  ELEVATION DATA: UPSTREAM(FEET) =   1026.79  DOWNSTREAM(FEET) =   1016.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.069
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.510
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      0.98     0.100    32    9.07
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      8.77
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =      8.77
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      9.07
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       8.77
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix H.VI

Rational Method Analysis
Post-Development Conditions
100-Year Storm

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

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* 2175 S WILLOW                                                        *
* RATIONAL METHOD                                                      *
* POST DEVELOPMENT CONDITIONS, 100-YEAR, DA A                          *
 ************************************************************************

  FILE NAME: RAT100PO.DAT
  TIME/DATE OF STUDY: 17:30 12/03/2024
==============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2700

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

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

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

******************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.20 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   626.20
  ELEVATION DATA: UPSTREAM(FEET) =   1026.79  DOWNSTREAM(FEET) =   1016.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.069
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.946
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.04      0.74     0.100    52    9.07
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     14.08
  TOTAL AREA(ACRES) =      4.04   PEAK FLOW RATE(CFS) =     14.08
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.0  TC(MIN.) =      9.07
  EFFECTIVE AREA(ACRES) =      4.04  AREA-AVERAGED Fm(INCH/HR)=  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      14.08
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

↟

Appendix I

Synthetic Unit Hydrograph Method Analysis

Appendix I.I

Synthetic Unit Hydrograph Method Analysis
Pre-Development Conditions
2-Year Storm

```
******************************************************************************
                     SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
         (C) Copyright 1989-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                              Analysis prepared by:




******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  2175 S WILLOW
  UNIT HYDROGRAPH
  PRE-DEVELOPMENT CONDITIONS, 2-YEAR, DA A
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.07
    TOTAL CATCHMENT AREA(ACRES) =    4.04
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.000
    LOW LOSS FRACTION = 0.097
    TIME OF CONCENTRATION(MIN.) =  8.69
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.14
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.36
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.52
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.93
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.30
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.35

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.84
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    -0.05

******************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.07      0.0000      0.00  Q         .         .         .         .
  0.21      0.0011      0.18  Q         .         .         .         .
  0.36      0.0033      0.18  Q         .         .         .         .
  0.50      0.0054      0.18  Q         .         .         .         .
  0.65      0.0076      0.18  Q         .         .         .         .
  0.79      0.0098      0.18  Q         .         .         .         .
  0.94      0.0121      0.19  Q         .         .         .         .
  1.08      0.0143      0.19  Q         .         .         .         .
  1.23      0.0165      0.19  Q         .         .         .         .
  1.37      0.0188      0.19  Q         .         .         .         .
  1.52      0.0211      0.19  Q         .         .         .         .
  1.66      0.0233      0.19  Q         .         .         .         .
  1.81      0.0256      0.19  Q         .         .         .         .
  1.95      0.0279      0.19  Q         .         .         .         .
  2.10      0.0303      0.19  Q         .         .         .         .
  2.24      0.0326      0.20  Q         .         .         .         .
  2.39      0.0349      0.20  Q         .         .         .         .
  2.53      0.0373      0.20  Q         .         .         .         .
  2.68      0.0397      0.20  Q         .         .         .         .
  2.82      0.0421      0.20  Q         .         .         .         .
  2.97      0.0445      0.20  Q         .         .         .         .
```

3.11	0.0469	0.20	Q	.	.	.	.
3.25	0.0493	0.20	Q	.	.	.	.
3.40	0.0518	0.21	Q	.	.	.	.
3.54	0.0543	0.21	Q	.	.	.	.
3.69	0.0567	0.21	Q	.	.	.	.
3.83	0.0592	0.21	Q	.	.	.	.
3.98	0.0618	0.21	Q	.	.	.	.
4.12	0.0643	0.21	Q	.	.	.	.
4.27	0.0669	0.21	Q	.	.	.	.
4.41	0.0694	0.22	Q	.	.	.	.
4.56	0.0720	0.22	Q	.	.	.	.
4.70	0.0746	0.22	Q	.	.	.	.
4.85	0.0773	0.22	Q	.	.	.	.
4.99	0.0799	0.22	Q	.	.	.	.
5.14	0.0826	0.22	Q	.	.	.	.
5.28	0.0853	0.23	Q	.	.	.	.
5.43	0.0880	0.23	Q	.	.	.	.
5.57	0.0907	0.23	Q	.	.	.	.
5.72	0.0934	0.23	Q	.	.	.	.
5.86	0.0962	0.23	Q	.	.	.	.
6.01	0.0990	0.23	Q	.	.	.	.
6.15	0.1018	0.24	Q	.	.	.	.
6.30	0.1047	0.24	Q	.	.	.	.
6.44	0.1075	0.24	Q	.	.	.	.
6.59	0.1104	0.24	Q	.	.	.	.
6.73	0.1134	0.24	Q	.	.	.	.
6.88	0.1163	0.25	Q	.	.	.	.
7.02	0.1193	0.25	Q	.	.	.	.
7.17	0.1223	0.25	.Q	.	.	.	.
7.31	0.1253	0.25	.Q	.	.	.	.
7.45	0.1283	0.26	.Q	.	.	.	.
7.60	0.1314	0.26	.Q	.	.	.	.
7.74	0.1345	0.26	.Q	.	.	.	.
7.89	0.1377	0.26	.Q	.	.	.	.
8.03	0.1408	0.27	.Q	.	.	.	.
8.18	0.1441	0.27	.Q	.	.	.	.
8.32	0.1473	0.27	.Q	.	.	.	.
8.47	0.1506	0.27	.Q	.	.	.	.
8.61	0.1539	0.28	.Q	.	.	.	.
8.76	0.1572	0.28	.Q	.	.	.	.
8.90	0.1606	0.29	.Q	.	.	.	.
9.05	0.1640	0.29	.Q	.	.	.	.
9.19	0.1675	0.29	.Q	.	.	.	.
9.34	0.1710	0.29	.Q	.	.	.	.
9.48	0.1746	0.30	.Q	.	.	.	.
9.63	0.1782	0.30	.Q	.	.	.	.
9.77	0.1818	0.31	.Q	.	.	.	.
9.92	0.1855	0.31	.Q	.	.	.	.
10.06	0.1892	0.32	.Q	.	.	.	.
10.21	0.1930	0.32	.Q	.	.	.	.
10.35	0.1969	0.32	.Q	.	.	.	.
10.50	0.2008	0.33	.Q	.	.	.	.
10.64	0.2047	0.33	.Q	.	.	.	.
10.79	0.2087	0.34	.Q	.	.	.	.
10.93	0.2128	0.34	.Q	.	.	.	.
11.08	0.2170	0.35	.Q	.	.	.	.
11.22	0.2212	0.36	.Q	.	.	.	.
11.37	0.2255	0.36	.Q	.	.	.	.
11.51	0.2298	0.37	.Q	.	.	.	.
11.65	0.2343	0.37	.Q	.	.	.	.
11.80	0.2388	0.38	.Q	.	.	.	.
11.94	0.2434	0.39	.Q	.	.	.	.
12.09	0.2483	0.42	.Q	.	.	.	.
12.23	0.2536	0.46	.Q	.	.	.	.
12.38	0.2591	0.47	.Q	.	.	.	.
12.52	0.2648	0.48	.Q	.	.	.	.
12.67	0.2706	0.49	.Q	.	.	.	.
12.81	0.2766	0.50	.Q	.	.	.	.
12.96	0.2826	0.51	. Q	.	.	.	.

```
13.10     0.2888     0.52  . Q       .         .         .         .
13.25     0.2952     0.54  . Q       .         .         .         .
13.39     0.3017     0.55  . Q       .         .         .         .
13.54     0.3084     0.57  . Q       .         .         .         .
13.68     0.3154     0.58  . Q       .         .         .         .
13.83     0.3225     0.61  . Q       .         .         .         .
13.97     0.3298     0.62  . Q       .         .         .         .
14.12     0.3377     0.69  . Q       .         .         .         .
14.26     0.3461     0.72  . Q       .         .         .         .
14.41     0.3550     0.76  .  Q      .         .         .         .
14.55     0.3642     0.78  .  Q      .         .         .         .
14.70     0.3739     0.83  .  Q      .         .         .         .
14.84     0.3840     0.86  .  Q      .         .         .         .
14.99     0.3947     0.93  .  Q      .         .         .         .
15.13     0.4060     0.97  .  Q      .         .         .         .
15.28     0.4182     1.07  .   Q     .         .         .         .
15.42     0.4314     1.14  .   Q     .         .         .         .
15.57     0.4462     1.33  .    Q    .         .         .         .
15.71     0.4629     1.47  .    Q    .         .         .         .
15.86     0.4832     1.93  .      Q  .         .         .         .
16.00     0.5095     2.47  .        Q.         .         .         .
16.14     0.5575     5.55  .         .         . Q       .         .
16.29     0.6006     1.65  .     Q   .         .         .         .
16.43     0.6178     1.23  .   Q     .         .         .         .
16.58     0.6313     1.01  .   Q     .         .         .         .
16.72     0.6427     0.89  .  Q      .         .         .         .
16.87     0.6528     0.80  .  Q      .         .         .         .
17.01     0.6621     0.74  . Q       .         .         .         .
17.16     0.6703     0.64  . Q       .         .         .         .
17.30     0.6777     0.60  . Q       .         .         .         .
17.45     0.6846     0.56  . Q       .         .         .         .
17.59     0.6911     0.53  . Q       .         .         .         .
17.74     0.6973     0.51  . Q       .         .         .         .
17.88     0.7033     0.48  .Q        .         .         .         .
18.03     0.7090     0.47  .Q        .         .         .         .
18.17     0.7141     0.39  .Q        .         .         .         .
18.32     0.7187     0.38  .Q        .         .         .         .
18.46     0.7232     0.36  .Q        .         .         .         .
18.61     0.7274     0.35  .Q        .         .         .         .
18.75     0.7316     0.34  .Q        .         .         .         .
18.90     0.7356     0.33  .Q        .         .         .         .
19.04     0.7395     0.32  .Q        .         .         .         .
19.19     0.7433     0.31  .Q        .         .         .         .
19.33     0.7470     0.30  .Q        .         .         .         .
19.48     0.7506     0.30  .Q        .         .         .         .
19.62     0.7541     0.29  .Q        .         .         .         .
19.77     0.7575     0.28  .Q        .         .         .         .
19.91     0.7609     0.28  .Q        .         .         .         .
20.06     0.7642     0.27  .Q        .         .         .         .
20.20     0.7674     0.27  .Q        .         .         .         .
20.34     0.7705     0.26  .Q        .         .         .         .
20.49     0.7736     0.25  .Q        .         .         .         .
20.63     0.7766     0.25  .Q        .         .         .         .
20.78     0.7796     0.25  Q         .         .         .         .
20.92     0.7825     0.24  Q         .         .         .         .
21.07     0.7854     0.24  Q         .         .         .         .
21.21     0.7882     0.23  Q         .         .         .         .
21.36     0.7910     0.23  Q         .         .         .         .
21.50     0.7937     0.23  Q         .         .         .         .
21.65     0.7964     0.22  Q         .         .         .         .
21.79     0.7990     0.22  Q         .         .         .         .
21.94     0.8016     0.22  Q         .         .         .         .
22.08     0.8042     0.21  Q         .         .         .         .
22.23     0.8067     0.21  Q         .         .         .         .
22.37     0.8092     0.21  Q         .         .         .         .
22.52     0.8117     0.20  Q         .         .         .         .
22.66     0.8141     0.20  Q         .         .         .         .
22.81     0.8166     0.20  Q         .         .         .         .
22.95     0.8189     0.20  Q         .         .         .         .
```

23.10	0.8213	0.20	Q	.	.	.	.
23.24	0.8236	0.19	Q	.	.	.	.
23.39	0.8259	0.19	Q	.	.	.	.
23.53	0.8282	0.19	Q	.	.	.	.
23.68	0.8304	0.19	Q	.	.	.	.
23.82	0.8326	0.18	Q	.	.	.	.
23.97	0.8348	0.18	Q	.	.	.	.
24.11	0.8370	0.18	Q	.	.	.	.
24.26	0.8381	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.5
10%	243.3
20%	69.5
30%	26.1
40%	17.4
50%	8.7
60%	8.7
70%	8.7
80%	8.7
90%	8.7

Appendix I.II

Synthetic Unit Hydrograph Method Analysis
Pre-Development Conditions
10-Year Storm

```
******************************************************************************
                     SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                              Analysis prepared by:




******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  2175 S WILLOW
  UNIT HYDROGRPAH
  PRE-DEVELOPMENT CONDITIONS, 10-YEAR, DA A
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.12
    TOTAL CATCHMENT AREA(ACRES) =    4.04
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.000
    LOW LOSS FRACTION = 0.065
    TIME OF CONCENTRATION(MIN.) =  8.69
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.22
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.56
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.81
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.41
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.98
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.60

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.34
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    -0.13

******************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.07      0.0000      0.00  Q         .         .         .         .
  0.21      0.0018      0.29  .Q        .         .         .         .
  0.36      0.0053      0.29  .Q        .         .         .         .
  0.50      0.0088      0.30  .Q        .         .         .         .
  0.65      0.0123      0.30  .Q        .         .         .         .
  0.79      0.0159      0.30  .Q        .         .         .         .
  0.94      0.0195      0.30  .Q        .         .         .         .
  1.08      0.0231      0.30  .Q        .         .         .         .
  1.23      0.0267      0.30  .Q        .         .         .         .
  1.37      0.0304      0.31  .Q        .         .         .         .
  1.52      0.0340      0.31  .Q        .         .         .         .
  1.66      0.0377      0.31  .Q        .         .         .         .
  1.81      0.0414      0.31  .Q        .         .         .         .
  1.95      0.0451      0.31  .Q        .         .         .         .
  2.10      0.0489      0.31  .Q        .         .         .         .
  2.24      0.0527      0.32  .Q        .         .         .         .
  2.39      0.0565      0.32  .Q        .         .         .         .
  2.53      0.0603      0.32  .Q        .         .         .         .
  2.68      0.0641      0.32  .Q        .         .         .         .
  2.82      0.0680      0.32  .Q        .         .         .         .
  2.97      0.0719      0.33  .Q        .         .         .         .
```

3.11	0.0758	0.33	.Q	.	.	.	.
3.25	0.0797	0.33	.Q	.	.	.	.
3.40	0.0837	0.33	.Q	.	.	.	.
3.54	0.0877	0.33	.Q	.	.	.	.
3.69	0.0917	0.34	.Q	.	.	.	.
3.83	0.0957	0.34	.Q	.	.	.	.
3.98	0.0998	0.34	.Q	.	.	.	.
4.12	0.1039	0.34	.Q	.	.	.	.
4.27	0.1080	0.35	.Q	.	.	.	.
4.41	0.1122	0.35	.Q	.	.	.	.
4.56	0.1163	0.35	.Q	.	.	.	.
4.70	0.1206	0.35	.Q	.	.	.	.
4.85	0.1248	0.36	.Q	.	.	.	.
4.99	0.1291	0.36	.Q	.	.	.	.
5.14	0.1334	0.36	.Q	.	.	.	.
5.28	0.1377	0.36	.Q	.	.	.	.
5.43	0.1421	0.37	.Q	.	.	.	.
5.57	0.1465	0.37	.Q	.	.	.	.
5.72	0.1509	0.37	.Q	.	.	.	.
5.86	0.1554	0.37	.Q	.	.	.	.
6.01	0.1599	0.38	.Q	.	.	.	.
6.15	0.1645	0.38	.Q	.	.	.	.
6.30	0.1691	0.39	.Q	.	.	.	.
6.44	0.1737	0.39	.Q	.	.	.	.
6.59	0.1783	0.39	.Q	.	.	.	.
6.73	0.1830	0.39	.Q	.	.	.	.
6.88	0.1878	0.40	.Q	.	.	.	.
7.02	0.1926	0.40	.Q	.	.	.	.
7.17	0.1974	0.41	.Q	.	.	.	.
7.31	0.2023	0.41	.Q	.	.	.	.
7.45	0.2072	0.41	.Q	.	.	.	.
7.60	0.2122	0.42	.Q	.	.	.	.
7.74	0.2172	0.42	.Q	.	.	.	.
7.89	0.2223	0.42	.Q	.	.	.	.
8.03	0.2274	0.43	.Q	.	.	.	.
8.18	0.2326	0.43	.Q	.	.	.	.
8.32	0.2378	0.44	.Q	.	.	.	.
8.47	0.2431	0.44	.Q	.	.	.	.
8.61	0.2484	0.45	.Q	.	.	.	.
8.76	0.2538	0.45	.Q	.	.	.	.
8.90	0.2592	0.46	.Q	.	.	.	.
9.05	0.2648	0.46	.Q	.	.	.	.
9.19	0.2703	0.47	.Q	.	.	.	.
9.34	0.2760	0.47	.Q	.	.	.	.
9.48	0.2817	0.48	.Q	.	.	.	.
9.63	0.2875	0.49	.Q	.	.	.	.
9.77	0.2934	0.49	.Q	.	.	.	.
9.92	0.2993	0.50	.Q	.	.	.	.
10.06	0.3053	0.51	. Q	.	.	.	.
10.21	0.3114	0.51	. Q	.	.	.	.
10.35	0.3176	0.52	. Q	.	.	.	.
10.50	0.3239	0.53	. Q	.	.	.	.
10.64	0.3303	0.54	. Q	.	.	.	.
10.79	0.3367	0.54	. Q	.	.	.	.
10.93	0.3433	0.55	. Q	.	.	.	.
11.08	0.3500	0.56	. Q	.	.	.	.
11.22	0.3568	0.57	. Q	.	.	.	.
11.37	0.3637	0.58	. Q	.	.	.	.
11.51	0.3707	0.59	. Q	.	.	.	.
11.65	0.3778	0.60	. Q	.	.	.	.
11.80	0.3851	0.62	. Q	.	.	.	.
11.94	0.3925	0.62	. Q	.	.	.	.
12.09	0.4003	0.68	. Q	.	.	.	.
12.23	0.4088	0.74	. Q	.	.	.	.
12.38	0.4177	0.76	. Q	.	.	.	.
12.52	0.4268	0.77	. Q	.	.	.	.
12.67	0.4361	0.79	. Q	.	.	.	.
12.81	0.4456	0.80	. Q	.	.	.	.
12.96	0.4554	0.82	. Q	.	.	.	.

```
13.10     0.4653     0.84  .  Q     .        .        .        .
13.25     0.4755     0.87  .  Q     .        .        .        .
13.39     0.4860     0.88  .  Q     .        .        .        .
13.54     0.4967     0.91  .  Q     .        .        .        .
13.68     0.5078     0.93  .  Q     .        .        .        .
13.83     0.5192     0.97  .  Q     .        .        .        .
13.97     0.5310     0.99  .  Q     .        .        .        .
14.12     0.5433     1.07  .   Q    .        .        .        .
14.26     0.5563     1.11  .   Q    .        .        .        .
14.41     0.5699     1.17  .   Q    .        .        .        .
14.55     0.5841     1.20  .   Q    .        .        .        .
14.70     0.5989     1.28  .    Q   .        .        .        .
14.84     0.6145     1.33  .    Q   .        .        .        .
14.99     0.6311     1.44  .    Q   .        .        .        .
15.13     0.6486     1.50  .     Q  .        .        .        .
15.28     0.6676     1.67  .     Q  .        .        .        .
15.42     0.6882     1.77  .      Q .        .        .        .
15.57     0.7117     2.16  .       Q.        .        .        .
15.71     0.7389     2.38  .        .Q       .        .        .
15.86     0.7718     3.11  .         .   Q    .        .        .
16.00     0.8143     4.00  .         .      Q .        .        .
16.14     0.8921     9.01  .         .        .        .     Q  .
16.29     0.9620     2.67  .        Q         .        .        .
16.43     0.9899     1.99  .      Q  .        .        .        .
16.58     1.0112     1.58  .     Q   .        .        .        .
16.72     1.0289     1.38  .    Q    .        .        .        .
16.87     1.0446     1.24  .   Q     .        .        .        .
17.01     1.0588     1.14  .   Q     .        .        .        .
17.16     1.0717     1.02  .   Q     .        .        .        .
17.30     1.0834     0.95  .  Q      .        .        .        .
17.45     1.0945     0.90  .  Q      .        .        .        .
17.59     1.1050     0.85  .  Q      .        .        .        .
17.74     1.1149     0.81  .  Q      .        .        .        .
17.88     1.1244     0.78  .  Q      .        .        .        .
18.03     1.1336     0.75  . Q       .        .        .        .
18.17     1.1418     0.63  . Q       .        .        .        .
18.32     1.1492     0.61  . Q       .        .        .        .
18.46     1.1564     0.59  . Q       .        .        .        .
18.61     1.1633     0.57  . Q       .        .        .        .
18.75     1.1700     0.55  . Q       .        .        .        .
18.90     1.1764     0.53  . Q       .        .        .        .
19.04     1.1827     0.52  . Q       .        .        .        .
19.19     1.1888     0.50  . Q       .        .        .        .
19.33     1.1948     0.49  .Q        .        .        .        .
19.48     1.2005     0.48  .Q        .        .        .        .
19.62     1.2062     0.47  .Q        .        .        .        .
19.77     1.2117     0.46  .Q        .        .        .        .
19.91     1.2171     0.45  .Q        .        .        .        .
20.06     1.2224     0.44  .Q        .        .        .        .
20.20     1.2276     0.43  .Q        .        .        .        .
20.34     1.2326     0.42  .Q        .        .        .        .
20.49     1.2376     0.41  .Q        .        .        .        .
20.63     1.2425     0.40  .Q        .        .        .        .
20.78     1.2473     0.40  .Q        .        .        .        .
20.92     1.2520     0.39  .Q        .        .        .        .
21.07     1.2566     0.38  .Q        .        .        .        .
21.21     1.2611     0.38  .Q        .        .        .        .
21.36     1.2656     0.37  .Q        .        .        .        .
21.50     1.2700     0.37  .Q        .        .        .        .
21.65     1.2744     0.36  .Q        .        .        .        .
21.79     1.2786     0.35  .Q        .        .        .        .
21.94     1.2828     0.35  .Q        .        .        .        .
22.08     1.2870     0.34  .Q        .        .        .        .
22.23     1.2911     0.34  .Q        .        .        .        .
22.37     1.2951     0.34  .Q        .        .        .        .
22.52     1.2991     0.33  .Q        .        .        .        .
22.66     1.3031     0.33  .Q        .        .        .        .
22.81     1.3069     0.32  .Q        .        .        .        .
22.95     1.3108     0.32  .Q        .        .        .        .
```

23.10	1.3146	0.32	.Q	.	.	.	.
23.24	1.3183	0.31	.Q	.	.	.	.
23.39	1.3220	0.31	.Q	.	.	.	.
23.53	1.3257	0.30	.Q	.	.	.	.
23.68	1.3293	0.30	.Q	.	.	.	.
23.82	1.3329	0.30	.Q	.	.	.	.
23.97	1.3365	0.29	.Q	.	.	.	.
24.11	1.3400	0.29	.Q	.	.	.	.
24.26	1.3417	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.5
10%	234.6
20%	60.8
30%	26.1
40%	17.4
50%	8.7
60%	8.7
70%	8.7
80%	8.7
90%	8.7

Appendix I.III

Synthetic Unit Hydrograph Method Analysis
Pre-Development Conditions
100-Year Storm

```
******************************************************************************
                     SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
         (C) Copyright 1989-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                              Analysis prepared by:




******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  2175 S WILLOW
  UNIT HYDROGRAPH
  PRE-DEVELOPMENT CONDITIONS, 100-YEAR, DA A
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.14
    TOTAL CATCHMENT AREA(ACRES) =    4.04
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.000
    LOW LOSS FRACTION = 0.043
    TIME OF CONCENTRATION(MIN.) =  8.69
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.34
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.88
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.27
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.17
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.02
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.52

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.09
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    -0.24

******************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.07      0.0000      0.00  Q         .         .         .         .
  0.21      0.0028      0.46  Q         .         .         .         .
  0.36      0.0083      0.46  Q         .         .         .         .
  0.50      0.0138      0.47  Q         .         .         .         .
  0.65      0.0194      0.47  Q         .         .         .         .
  0.79      0.0250      0.47  Q         .         .         .         .
  0.94      0.0307      0.47  Q         .         .         .         .
  1.08      0.0364      0.48  Q         .         .         .         .
  1.23      0.0421      0.48  Q         .         .         .         .
  1.37      0.0478      0.48  Q         .         .         .         .
  1.52      0.0536      0.48  Q         .         .         .         .
  1.66      0.0594      0.49  Q         .         .         .         .
  1.81      0.0652      0.49  Q         .         .         .         .
  1.95      0.0711      0.49  Q         .         .         .         .
  2.10      0.0770      0.49  Q         .         .         .         .
  2.24      0.0829      0.50  Q         .         .         .         .
  2.39      0.0889      0.50  .Q        .         .         .         .
  2.53      0.0949      0.50  .Q        .         .         .         .
  2.68      0.1010      0.51  .Q        .         .         .         .
  2.82      0.1070      0.51  .Q        .         .         .         .
  2.97      0.1132      0.51  .Q        .         .         .         .
```

3.11	0.1193	0.52	.Q	.	.	.	.
3.25	0.1255	0.52	.Q	.	.	.	.
3.40	0.1318	0.52	.Q	.	.	.	.
3.54	0.1380	0.53	.Q	.	.	.	.
3.69	0.1444	0.53	.Q	.	.	.	.
3.83	0.1507	0.53	.Q	.	.	.	.
3.98	0.1571	0.54	.Q	.	.	.	.
4.12	0.1636	0.54	.Q	.	.	.	.
4.27	0.1700	0.54	.Q	.	.	.	.
4.41	0.1766	0.55	.Q	.	.	.	.
4.56	0.1832	0.55	.Q	.	.	.	.
4.70	0.1898	0.55	.Q	.	.	.	.
4.85	0.1965	0.56	.Q	.	.	.	.
4.99	0.2032	0.56	.Q	.	.	.	.
5.14	0.2100	0.57	.Q	.	.	.	.
5.28	0.2168	0.57	.Q	.	.	.	.
5.43	0.2237	0.58	.Q	.	.	.	.
5.57	0.2306	0.58	.Q	.	.	.	.
5.72	0.2376	0.59	.Q	.	.	.	.
5.86	0.2446	0.59	.Q	.	.	.	.
6.01	0.2517	0.60	.Q	.	.	.	.
6.15	0.2588	0.60	.Q	.	.	.	.
6.30	0.2661	0.61	.Q	.	.	.	.
6.44	0.2733	0.61	.Q	.	.	.	.
6.59	0.2807	0.62	.Q	.	.	.	.
6.73	0.2880	0.62	.Q	.	.	.	.
6.88	0.2955	0.63	.Q	.	.	.	.
7.02	0.3030	0.63	.Q	.	.	.	.
7.17	0.3106	0.64	.Q	.	.	.	.
7.31	0.3183	0.64	.Q	.	.	.	.
7.45	0.3260	0.65	.Q	.	.	.	.
7.60	0.3338	0.65	.Q	.	.	.	.
7.74	0.3417	0.66	.Q	.	.	.	.
7.89	0.3497	0.67	.Q	.	.	.	.
8.03	0.3577	0.68	.Q	.	.	.	.
8.18	0.3658	0.68	.Q	.	.	.	.
8.32	0.3741	0.69	.Q	.	.	.	.
8.47	0.3823	0.70	.Q	.	.	.	.
8.61	0.3907	0.71	.Q	.	.	.	.
8.76	0.3992	0.71	.Q	.	.	.	.
8.90	0.4078	0.72	.Q	.	.	.	.
9.05	0.4164	0.73	.Q	.	.	.	.
9.19	0.4252	0.74	.Q	.	.	.	.
9.34	0.4341	0.74	.Q	.	.	.	.
9.48	0.4431	0.76	.Q	.	.	.	.
9.63	0.4521	0.76	.Q	.	.	.	.
9.77	0.4614	0.78	.Q	.	.	.	.
9.92	0.4707	0.78	.Q	.	.	.	.
10.06	0.4801	0.80	.Q	.	.	.	.
10.21	0.4897	0.80	.Q	.	.	.	.
10.35	0.4994	0.82	.Q	.	.	.	.
10.50	0.5093	0.83	.Q	.	.	.	.
10.64	0.5193	0.84	.Q	.	.	.	.
10.79	0.5294	0.85	.Q	.	.	.	.
10.93	0.5397	0.87	.Q	.	.	.	.
11.08	0.5502	0.88	.Q	.	.	.	.
11.22	0.5608	0.90	.Q	.	.	.	.
11.37	0.5716	0.91	.Q	.	.	.	.
11.51	0.5826	0.93	.Q	.	.	.	.
11.65	0.5938	0.94	.Q	.	.	.	.
11.80	0.6052	0.97	.Q	.	.	.	.
11.94	0.6169	0.98	.Q	.	.	.	.
12.09	0.6290	1.05	. Q	.	.	.	.
12.23	0.6419	1.11	. Q	.	.	.	.
12.38	0.6554	1.14	. Q	.	.	.	.
12.52	0.6692	1.16	. Q	.	.	.	.
12.67	0.6833	1.19	. Q	.	.	.	.
12.81	0.6977	1.21	. Q	.	.	.	.
12.96	0.7124	1.25	. Q	.	.	.	.

13.10	0.7275	1.27	. Q	.	.	.	.
13.25	0.7430	1.32	. Q	.	.	.	.
13.39	0.7589	1.34	. Q	.	.	.	.
13.54	0.7752	1.39	. Q	.	.	.	.
13.68	0.7921	1.42	. Q	.	.	.	.
13.83	0.8094	1.48	. Q	.	.	.	.
13.97	0.8274	1.52	. Q	.	.	.	.
14.12	0.8461	1.62	. Q	.	.	.	.
14.26	0.8658	1.67	. Q	.	.	.	.
14.41	0.8863	1.76	. Q	.	.	.	.
14.55	0.9078	1.82	. Q	.	.	.	.
14.70	0.9303	1.94	. Q	.	.	.	.
14.84	0.9540	2.02	. Q	.	.	.	.
14.99	0.9792	2.19	. Q	.	.	.	.
15.13	1.0060	2.29	. Q	.	.	.	.
15.28	1.0350	2.56	. Q	.	.	.	.
15.42	1.0666	2.73	. Q	.	.	.	.
15.57	1.1035	3.44	. Q	.	.	.	.
15.71	1.1467	3.78	. Q	.	.	.	.
15.86	1.1993	5.01	. Q	.	.	.	.
16.00	1.2677	6.42	. Q	.	.	.	.
16.14	1.3926	14.44	.	.	.	Q	.
16.29	1.5045	4.26	. Q	.	.	.	.
16.43	1.5489	3.15	. Q	.	.	.	.
16.58	1.5822	2.41	. Q	.	.	.	.
16.72	1.6092	2.10	. Q	.	.	.	.
16.87	1.6330	1.88	. Q	.	.	.	.
17.01	1.6545	1.72	. Q	.	.	.	.
17.16	1.6741	1.55	. Q	.	.	.	.
17.30	1.6920	1.45	. Q	.	.	.	.
17.45	1.7089	1.36	. Q	.	.	.	.
17.59	1.7248	1.29	. Q	.	.	.	.
17.74	1.7399	1.23	. Q	.	.	.	.
17.88	1.7543	1.18	. Q	.	.	.	.
18.03	1.7681	1.13	. Q	.	.	.	.
18.17	1.7808	0.99	.Q	.	.	.	.
18.32	1.7924	0.95	.Q	.	.	.	.
18.46	1.8036	0.92	.Q	.	.	.	.
18.61	1.8144	0.89	.Q	.	.	.	.
18.75	1.8249	0.86	.Q	.	.	.	.
18.90	1.8351	0.83	.Q	.	.	.	.
19.04	1.8449	0.81	.Q	.	.	.	.
19.19	1.8545	0.79	.Q	.	.	.	.
19.33	1.8638	0.77	.Q	.	.	.	.
19.48	1.8729	0.75	.Q	.	.	.	.
19.62	1.8818	0.73	.Q	.	.	.	.
19.77	1.8905	0.72	.Q	.	.	.	.
19.91	1.8989	0.70	.Q	.	.	.	.
20.06	1.9072	0.69	.Q	.	.	.	.
20.20	1.9153	0.67	.Q	.	.	.	.
20.34	1.9233	0.66	.Q	.	.	.	.
20.49	1.9311	0.65	.Q	.	.	.	.
20.63	1.9388	0.63	.Q	.	.	.	.
20.78	1.9463	0.62	.Q	.	.	.	.
20.92	1.9537	0.61	.Q	.	.	.	.
21.07	1.9610	0.60	.Q	.	.	.	.
21.21	1.9681	0.59	.Q	.	.	.	.
21.36	1.9752	0.58	.Q	.	.	.	.
21.50	1.9821	0.57	.Q	.	.	.	.
21.65	1.9889	0.57	.Q	.	.	.	.
21.79	1.9956	0.56	.Q	.	.	.	.
21.94	2.0023	0.55	.Q	.	.	.	.
22.08	2.0088	0.54	.Q	.	.	.	.
22.23	2.0152	0.53	.Q	.	.	.	.
22.37	2.0216	0.53	.Q	.	.	.	.
22.52	2.0279	0.52	.Q	.	.	.	.
22.66	2.0341	0.51	.Q	.	.	.	.
22.81	2.0402	0.51	.Q	.	.	.	.
22.95	2.0462	0.50	.Q	.	.	.	.

23.10	2.0522	0.50	Q	.	.	.	.
23.24	2.0581	0.49	Q	.	.	.	.
23.39	2.0640	0.48	Q	.	.	.	.
23.53	2.0697	0.48	Q	.	.	.	.
23.68	2.0754	0.47	Q	.	.	.	.
23.82	2.0811	0.47	Q	.	.	.	.
23.97	2.0867	0.46	Q	.	.	.	.
24.11	2.0922	0.46	Q	.	.	.	.
24.26	2.0949	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.5
10%	217.2
20%	60.8
30%	26.1
40%	17.4
50%	8.7
60%	8.7
70%	8.7
80%	8.7
90%	8.7

Appendix I.IV

Synthetic Unit Hydrograph Method Analysis
Post-Development Conditions
2-Year Storm

```
******************************************************************************
                     SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                              Analysis prepared by:




******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  2175 S WILLOW
  UNIT HYDROGRAPH
  POST DEVELOPMENT CONDITIONS
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.18
    TOTAL CATCHMENT AREA(ACRES) =    4.04
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.130
    LOW LOSS FRACTION = 0.211
    TIME OF CONCENTRATION(MIN.) =  9.07
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.14
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.36
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.52
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.93
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.30
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.35

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.74
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.05

******************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.13      0.0008      0.16  Q         .         .         .         .
  0.28      0.0028      0.16  Q         .         .         .         .
  0.43      0.0048      0.16  Q         .         .         .         .
  0.58      0.0068      0.16  Q         .         .         .         .
  0.73      0.0088      0.16  Q         .         .         .         .
  0.88      0.0108      0.16  Q         .         .         .         .
  1.03      0.0128      0.16  Q         .         .         .         .
  1.19      0.0149      0.16  Q         .         .         .         .
  1.34      0.0169      0.17  Q         .         .         .         .
  1.49      0.0190      0.17  Q         .         .         .         .
  1.64      0.0211      0.17  Q         .         .         .         .
  1.79      0.0232      0.17  Q         .         .         .         .
  1.94      0.0253      0.17  Q         .         .         .         .
  2.09      0.0274      0.17  Q         .         .         .         .
  2.24      0.0295      0.17  Q         .         .         .         .
  2.40      0.0317      0.17  Q         .         .         .         .
  2.55      0.0338      0.17  Q         .         .         .         .
  2.70      0.0360      0.17  Q         .         .         .         .
  2.85      0.0382      0.18  Q         .         .         .         .
  3.00      0.0404      0.18  Q         .         .         .         .
  3.15      0.0426      0.18  Q         .         .         .         .
```

3.30	0.0448	0.18	Q	.	.	.	.
3.45	0.0471	0.18	Q	.	.	.	.
3.60	0.0493	0.18	Q	.	.	.	.
3.76	0.0516	0.18	Q	.	.	.	.
3.91	0.0539	0.18	Q	.	.	.	.
4.06	0.0562	0.19	Q	.	.	.	.
4.21	0.0585	0.19	Q	.	.	.	.
4.36	0.0609	0.19	Q	.	.	.	.
4.51	0.0632	0.19	Q	.	.	.	.
4.66	0.0656	0.19	Q	.	.	.	.
4.81	0.0680	0.19	Q	.	.	.	.
4.96	0.0704	0.19	Q	.	.	.	.
5.12	0.0728	0.20	Q	.	.	.	.
5.27	0.0753	0.20	Q	.	.	.	.
5.42	0.0777	0.20	Q	.	.	.	.
5.57	0.0802	0.20	Q	.	.	.	.
5.72	0.0827	0.20	Q	.	.	.	.
5.87	0.0853	0.20	Q	.	.	.	.
6.02	0.0878	0.20	Q	.	.	.	.
6.17	0.0904	0.21	Q	.	.	.	.
6.33	0.0930	0.21	Q	.	.	.	.
6.48	0.0956	0.21	Q	.	.	.	.
6.63	0.0982	0.21	Q	.	.	.	.
6.78	0.1009	0.21	Q	.	.	.	.
6.93	0.1036	0.22	Q	.	.	.	.
7.08	0.1063	0.22	Q	.	.	.	.
7.23	0.1091	0.22	Q	.	.	.	.
7.38	0.1118	0.22	Q	.	.	.	.
7.53	0.1146	0.22	Q	.	.	.	.
7.69	0.1175	0.23	Q	.	.	.	.
7.84	0.1203	0.23	Q	.	.	.	.
7.99	0.1232	0.23	Q	.	.	.	.
8.14	0.1261	0.23	Q	.	.	.	.
8.29	0.1291	0.24	Q	.	.	.	.
8.44	0.1320	0.24	Q	.	.	.	.
8.59	0.1351	0.24	Q	.	.	.	.
8.74	0.1381	0.25	Q	.	.	.	.
8.90	0.1412	0.25	Q	.	.	.	.
9.05	0.1443	0.25	.Q	.	.	.	.
9.20	0.1475	0.26	.Q	.	.	.	.
9.35	0.1507	0.26	.Q	.	.	.	.
9.50	0.1539	0.26	.Q	.	.	.	.
9.65	0.1572	0.26	.Q	.	.	.	.
9.80	0.1605	0.27	.Q	.	.	.	.
9.95	0.1639	0.27	.Q	.	.	.	.
10.10	0.1673	0.28	.Q	.	.	.	.
10.26	0.1708	0.28	.Q	.	.	.	.
10.41	0.1743	0.28	.Q	.	.	.	.
10.56	0.1779	0.29	.Q	.	.	.	.
10.71	0.1815	0.29	.Q	.	.	.	.
10.86	0.1852	0.30	.Q	.	.	.	.
11.01	0.1890	0.30	.Q	.	.	.	.
11.16	0.1928	0.31	.Q	.	.	.	.
11.31	0.1967	0.31	.Q	.	.	.	.
11.47	0.2007	0.32	.Q	.	.	.	.
11.62	0.2047	0.33	.Q	.	.	.	.
11.77	0.2088	0.33	.Q	.	.	.	.
11.92	0.2130	0.34	.Q	.	.	.	.
12.07	0.2173	0.34	.Q	.	.	.	.
12.22	0.2219	0.40	.Q	.	.	.	.
12.37	0.2270	0.41	.Q	.	.	.	.
12.52	0.2322	0.42	.Q	.	.	.	.
12.67	0.2375	0.43	.Q	.	.	.	.
12.83	0.2429	0.44	.Q	.	.	.	.
12.98	0.2484	0.45	.Q	.	.	.	.
13.13	0.2541	0.46	.Q	.	.	.	.
13.28	0.2600	0.47	.Q	.	.	.	.
13.43	0.2659	0.49	.Q	.	.	.	.
13.58	0.2721	0.50	.Q	.	.	.	.

```
13.73     0.2785     0.52  . Q       .         .         .         .
13.88     0.2850     0.53  . Q       .         .         .         .
14.03     0.2919     0.56  . Q       .         .         .         .
14.19     0.2991     0.61  . Q       .         .         .         .
14.34     0.3070     0.65  . Q       .         .         .         .
14.49     0.3153     0.67  . Q       .         .         .         .
14.64     0.3239     0.71  . Q       .         .         .         .
14.79     0.3329     0.74  . Q       .         .         .         .
14.94     0.3425     0.79  .  Q      .         .         .         .
15.09     0.3526     0.83  .  Q      .         .         .         .
15.24     0.3635     0.92  .  Q      .         .         .         .
15.40     0.3753     0.97  .  Q      .         .         .         .
15.55     0.3885     1.14  .   Q     .         .         .         .
15.70     0.4035     1.26  .    Q    .         .         .         .
15.85     0.4217     1.65  .     Q   .         .         .         .
16.00     0.4452     2.12  .       Q .         .         .         .
16.15     0.4922     5.41  .         .         .Q        .         .
16.30     0.5348     1.41  .    Q    .         .         .         .
16.45     0.5502     1.05  .   Q     .         .         .         .
16.60     0.5621     0.87  .  Q      .         .         .         .
16.76     0.5723     0.76  .  Q      .         .         .         .
16.91     0.5814     0.69  . Q       .         .         .         .
17.06     0.5897     0.63  . Q       .         .         .         .
17.21     0.5970     0.54  . Q       .         .         .         .
17.36     0.6036     0.51  . Q       .         .         .         .
17.51     0.6098     0.48  .Q        .         .         .         .
17.66     0.6156     0.45  .Q        .         .         .         .
17.81     0.6212     0.43  .Q        .         .         .         .
17.97     0.6265     0.41  .Q        .         .         .         .
18.12     0.6314     0.38  .Q        .         .         .         .
18.27     0.6359     0.34  .Q        .         .         .         .
18.42     0.6400     0.32  .Q        .         .         .         .
18.57     0.6440     0.31  .Q        .         .         .         .
18.72     0.6478     0.30  .Q        .         .         .         .
18.87     0.6515     0.29  .Q        .         .         .         .
19.02     0.6551     0.28  .Q        .         .         .         .
19.17     0.6586     0.27  .Q        .         .         .         .
19.33     0.6619     0.27  .Q        .         .         .         .
19.48     0.6652     0.26  .Q        .         .         .         .
19.63     0.6684     0.25  .Q        .         .         .         .
19.78     0.6716     0.25  Q         .         .         .         .
19.93     0.6746     0.24  Q         .         .         .         .
20.08     0.6776     0.24  Q         .         .         .         .
20.23     0.6805     0.23  Q         .         .         .         .
20.38     0.6834     0.23  Q         .         .         .         .
20.53     0.6862     0.22  Q         .         .         .         .
20.69     0.6889     0.22  Q         .         .         .         .
20.84     0.6916     0.21  Q         .         .         .         .
20.99     0.6942     0.21  Q         .         .         .         .
21.14     0.6968     0.21  Q         .         .         .         .
21.29     0.6994     0.20  Q         .         .         .         .
21.44     0.7019     0.20  Q         .         .         .         .
21.59     0.7044     0.20  Q         .         .         .         .
21.74     0.7068     0.19  Q         .         .         .         .
21.90     0.7092     0.19  Q         .         .         .         .
22.05     0.7115     0.19  Q         .         .         .         .
22.20     0.7139     0.18  Q         .         .         .         .
22.35     0.7162     0.18  Q         .         .         .         .
22.50     0.7184     0.18  Q         .         .         .         .
22.65     0.7206     0.18  Q         .         .         .         .
22.80     0.7228     0.17  Q         .         .         .         .
22.95     0.7250     0.17  Q         .         .         .         .
23.10     0.7272     0.17  Q         .         .         .         .
23.26     0.7293     0.17  Q         .         .         .         .
23.41     0.7314     0.17  Q         .         .         .         .
23.56     0.7334     0.16  Q         .         .         .         .
23.71     0.7355     0.16  Q         .         .         .         .
23.86     0.7375     0.16  Q         .         .         .         .
24.01     0.7395     0.16  Q         .         .         .         .
```

```
  24.16      0.7405      0.00  Q         .         .         .         .
 ------------------------------------------------------------------------------
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                Duration
        Peak Flow Rate                     (minutes)
    ======================                 =========
               0%                           1442.1
              10%                            199.5
              20%                             54.4
              30%                             27.2
              40%                              9.1
              50%                              9.1
              60%                              9.1
              70%                              9.1
              80%                              9.1
              90%                              9.1
```

Appendix I.V

Synthetic Unit Hydrograph Method Analysis
Post-Development Conditions
10-Year Storm

```
******************************************************************************
                     SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                           Analysis prepared by:




******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  2175 S WILLOW
  UNIT HYDROGRAPH
  POST DEVELOPMENT CONDITIONS, 10-YEAR, DA A
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.18
    TOTAL CATCHMENT AREA(ACRES) =    4.04
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.123
    LOW LOSS FRACTION = 0.183
    TIME OF CONCENTRATION(MIN.) =  9.07
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.22
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.56
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.81
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.41
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.98
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.60

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.18
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.03

******************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.13      0.0013      0.25  .Q        .         .         .         .
  0.28      0.0045      0.25  .Q        .         .         .         .
  0.43      0.0077      0.26  .Q        .         .         .         .
  0.58      0.0109      0.26  .Q        .         .         .         .
  0.73      0.0141      0.26  .Q        .         .         .         .
  0.88      0.0173      0.26  .Q        .         .         .         .
  1.03      0.0206      0.26  .Q        .         .         .         .
  1.19      0.0238      0.26  .Q        .         .         .         .
  1.34      0.0271      0.26  .Q        .         .         .         .
  1.49      0.0304      0.27  .Q        .         .         .         .
  1.64      0.0337      0.27  .Q        .         .         .         .
  1.79      0.0371      0.27  .Q        .         .         .         .
  1.94      0.0405      0.27  .Q        .         .         .         .
  2.09      0.0438      0.27  .Q        .         .         .         .
  2.24      0.0472      0.27  .Q        .         .         .         .
  2.40      0.0507      0.27  .Q        .         .         .         .
  2.55      0.0541      0.28  .Q        .         .         .         .
  2.70      0.0576      0.28  .Q        .         .         .         .
  2.85      0.0611      0.28  .Q        .         .         .         .
  3.00      0.0646      0.28  .Q        .         .         .         .
  3.15      0.0681      0.28  .Q        .         .         .         .
```

3.30	0.0717	0.29	.Q	.	.	.	.
3.45	0.0753	0.29	.Q	.	.	.	.
3.60	0.0789	0.29	.Q	.	.	.	.
3.76	0.0825	0.29	.Q	.	.	.	.
3.91	0.0862	0.29	.Q	.	.	.	.
4.06	0.0899	0.30	.Q	.	.	.	.
4.21	0.0936	0.30	.Q	.	.	.	.
4.36	0.0973	0.30	.Q	.	.	.	.
4.51	0.1011	0.30	.Q	.	.	.	.
4.66	0.1049	0.31	.Q	.	.	.	.
4.81	0.1087	0.31	.Q	.	.	.	.
4.96	0.1126	0.31	.Q	.	.	.	.
5.12	0.1165	0.31	.Q	.	.	.	.
5.27	0.1204	0.31	.Q	.	.	.	.
5.42	0.1243	0.32	.Q	.	.	.	.
5.57	0.1283	0.32	.Q	.	.	.	.
5.72	0.1323	0.32	.Q	.	.	.	.
5.87	0.1364	0.33	.Q	.	.	.	.
6.02	0.1404	0.33	.Q	.	.	.	.
6.17	0.1445	0.33	.Q	.	.	.	.
6.33	0.1487	0.33	.Q	.	.	.	.
6.48	0.1529	0.34	.Q	.	.	.	.
6.63	0.1571	0.34	.Q	.	.	.	.
6.78	0.1613	0.34	.Q	.	.	.	.
6.93	0.1656	0.35	.Q	.	.	.	.
7.08	0.1700	0.35	.Q	.	.	.	.
7.23	0.1744	0.35	.Q	.	.	.	.
7.38	0.1788	0.36	.Q	.	.	.	.
7.53	0.1833	0.36	.Q	.	.	.	.
7.69	0.1878	0.36	.Q	.	.	.	.
7.84	0.1923	0.37	.Q	.	.	.	.
7.99	0.1969	0.37	.Q	.	.	.	.
8.14	0.2016	0.37	.Q	.	.	.	.
8.29	0.2063	0.38	.Q	.	.	.	.
8.44	0.2111	0.38	.Q	.	.	.	.
8.59	0.2159	0.39	.Q	.	.	.	.
8.74	0.2207	0.39	.Q	.	.	.	.
8.90	0.2256	0.40	.Q	.	.	.	.
9.05	0.2306	0.40	.Q	.	.	.	.
9.20	0.2357	0.41	.Q	.	.	.	.
9.35	0.2408	0.41	.Q	.	.	.	.
9.50	0.2459	0.42	.Q	.	.	.	.
9.65	0.2512	0.42	.Q	.	.	.	.
9.80	0.2565	0.43	.Q	.	.	.	.
9.95	0.2619	0.43	.Q	.	.	.	.
10.10	0.2673	0.44	.Q	.	.	.	.
10.26	0.2729	0.45	.Q	.	.	.	.
10.41	0.2785	0.45	.Q	.	.	.	.
10.56	0.2842	0.46	.Q	.	.	.	.
10.71	0.2900	0.47	.Q	.	.	.	.
10.86	0.2959	0.47	.Q	.	.	.	.
11.01	0.3018	0.48	.Q	.	.	.	.
11.16	0.3079	0.49	.Q	.	.	.	.
11.31	0.3141	0.50	. Q	.	.	.	.
11.47	0.3204	0.51	. Q	.	.	.	.
11.62	0.3268	0.52	. Q	.	.	.	.
11.77	0.3334	0.53	. Q	.	.	.	.
11.92	0.3400	0.54	. Q	.	.	.	.
12.07	0.3468	0.55	. Q	.	.	.	.
12.22	0.3543	0.64	. Q	.	.	.	.
12.37	0.3623	0.65	. Q	.	.	.	.
12.52	0.3705	0.67	. Q	.	.	.	.
12.67	0.3789	0.68	. Q	.	.	.	.
12.83	0.3875	0.70	. Q	.	.	.	.
12.98	0.3963	0.71	. Q	.	.	.	.
13.13	0.4053	0.73	. Q	.	.	.	.
13.28	0.4146	0.75	. Q	.	.	.	.
13.43	0.4241	0.77	. Q	.	.	.	.
13.58	0.4339	0.79	. Q	.	.	.	.

13.73	0.4439	0.82	. Q . . . .
13.88	0.4543	0.84	. Q . . . .
14.03	0.4651	0.88	. Q . . . .
14.19	0.4765	0.93	. Q . . . .
14.34	0.4885	0.99	. Q . . . .
14.49	0.5010	1.02	. Q . . . .
14.64	0.5141	1.08	. Q . . . .
14.79	0.5279	1.12	. Q . . . .
14.94	0.5425	1.22	. Q . . . .
15.09	0.5581	1.27	. Q . . . .
15.24	0.5748	1.41	. Q . . . .
15.40	0.5930	1.50	. Q . . . .
15.55	0.6139	1.84	. Q . . . .
15.70	0.6380	2.02	. Q . . . .
15.85	0.6671	2.65	. Q . . . .
16.00	0.7059	3.56	. . Q . . .
16.15	0.7829	8.76	. . . . Q .
16.30	0.8517	2.26	. Q. . . . .
16.45	0.8763	1.66	. Q . . . .
16.60	0.8950	1.34	. Q . . . .
16.76	0.9107	1.17	. Q . . . .
16.91	0.9245	1.05	. Q . . . .
17.06	0.9371	0.96	. Q . . . .
17.21	0.9485	0.86	. Q . . . .
17.36	0.9589	0.81	. Q . . . .
17.51	0.9687	0.76	. Q . . . .
17.66	0.9779	0.72	. Q . . . .
17.81	0.9867	0.69	. Q . . . .
17.97	0.9951	0.66	. Q . . . .
18.12	1.0030	0.61	. Q . . . .
18.27	1.0102	0.53	. Q . . . .
18.42	1.0167	0.51	. Q . . . .
18.57	1.0230	0.50	.Q . . . .
18.72	1.0291	0.48	.Q . . . .
18.87	1.0350	0.46	.Q . . . .
19.02	1.0407	0.45	.Q . . . .
19.17	1.0462	0.44	.Q . . . .
19.33	1.0516	0.42	.Q . . . .
19.48	1.0569	0.41	.Q . . . .
19.63	1.0620	0.40	.Q . . . .
19.78	1.0669	0.39	.Q . . . .
19.93	1.0718	0.39	.Q . . . .
20.08	1.0766	0.38	.Q . . . .
20.23	1.0812	0.37	.Q . . . .
20.38	1.0858	0.36	.Q . . . .
20.53	1.0902	0.35	.Q . . . .
20.69	1.0946	0.35	.Q . . . .
20.84	1.0989	0.34	.Q . . . .
20.99	1.1031	0.33	.Q . . . .
21.14	1.1073	0.33	.Q . . . .
21.29	1.1114	0.32	.Q . . . .
21.44	1.1154	0.32	.Q . . . .
21.59	1.1193	0.31	.Q . . . .
21.74	1.1232	0.31	.Q . . . .
21.90	1.1270	0.30	.Q . . . .
22.05	1.1308	0.30	.Q . . . .
22.20	1.1345	0.30	.Q . . . .
22.35	1.1382	0.29	.Q . . . .
22.50	1.1418	0.29	.Q . . . .
22.65	1.1454	0.28	.Q . . . .
22.80	1.1489	0.28	.Q . . . .
22.95	1.1523	0.28	.Q . . . .
23.10	1.1558	0.27	.Q . . . .
23.26	1.1592	0.27	.Q . . . .
23.41	1.1625	0.27	.Q . . . .
23.56	1.1658	0.26	.Q . . . .
23.71	1.1691	0.26	.Q . . . .
23.86	1.1723	0.26	.Q . . . .
24.01	1.1755	0.25	.Q . . . .

```
  24.16      1.1771      0.00  Q         .         .         .         .
 ------------------------------------------------------------------------------
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated               Duration
        Peak Flow Rate                    (minutes)
    ======================                =========
               0%                          1442.1
              10%                           190.5
              20%                            54.4
              30%                            27.2
              40%                            18.1
              50%                             9.1
              60%                             9.1
              70%                             9.1
              80%                             9.1
              90%                             9.1
```

Appendix I.VI

Synthetic Unit Hydrograph Method Analysis
Post-Development Conditions
100-Year Storm

```
******************************************************************************
                     SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
         (C) Copyright 1989-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1499

                              Analysis prepared by:




******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  2175 S WILLOW
  UNIT HYDROGRAPH
  POST DEVELOPMENT CONDITIONS, 100-YEAR, DA A
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.16
    TOTAL CATCHMENT AREA(ACRES) =    4.04
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.093
    LOW LOSS FRACTION = 0.140
    TIME OF CONCENTRATION(MIN.) =  9.07
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.34
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.88
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.27
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.17
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.02
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.52

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.88
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    -0.02

******************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.13      0.0021      0.41  Q         .         .         .         .
  0.28      0.0072      0.41  Q         .         .         .         .
  0.43      0.0123      0.41  Q         .         .         .         .
  0.58      0.0174      0.41  Q         .         .         .         .
  0.73      0.0226      0.41  Q         .         .         .         .
  0.88      0.0278      0.42  Q         .         .         .         .
  1.03      0.0330      0.42  Q         .         .         .         .
  1.19      0.0382      0.42  Q         .         .         .         .
  1.34      0.0435      0.42  Q         .         .         .         .
  1.49      0.0488      0.43  Q         .         .         .         .
  1.64      0.0541      0.43  Q         .         .         .         .
  1.79      0.0595      0.43  Q         .         .         .         .
  1.94      0.0649      0.43  Q         .         .         .         .
  2.09      0.0703      0.44  Q         .         .         .         .
  2.24      0.0758      0.44  Q         .         .         .         .
  2.40      0.0813      0.44  Q         .         .         .         .
  2.55      0.0868      0.44  Q         .         .         .         .
  2.70      0.0924      0.45  Q         .         .         .         .
  2.85      0.0980      0.45  Q         .         .         .         .
  3.00      0.1037      0.45  Q         .         .         .         .
  3.15      0.1093      0.46  Q         .         .         .         .
```

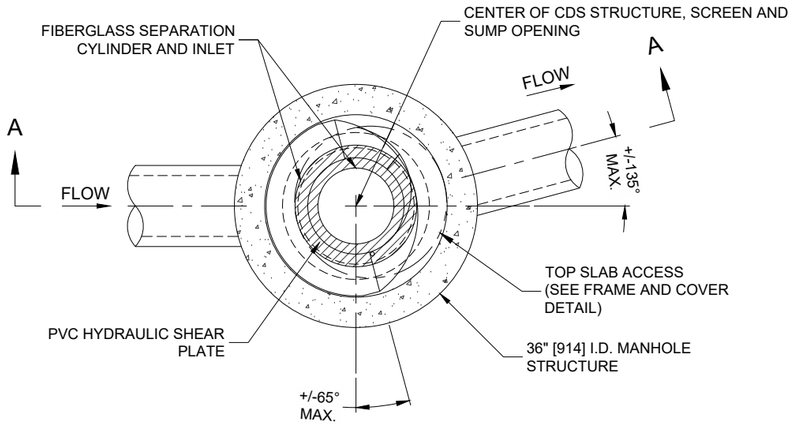
3.30	0.1150	0.46	Q	.	.	.	.
3.45	0.1208	0.46	Q	.	.	.	.
3.60	0.1266	0.46	Q	.	.	.	.
3.76	0.1324	0.47	Q	.	.	.	.
3.91	0.1383	0.47	Q	.	.	.	.
4.06	0.1442	0.48	Q	.	.	.	.
4.21	0.1501	0.48	Q	.	.	.	.
4.36	0.1561	0.48	Q	.	.	.	.
4.51	0.1622	0.48	Q	.	.	.	.
4.66	0.1683	0.49	Q	.	.	.	.
4.81	0.1744	0.49	Q	.	.	.	.
4.96	0.1806	0.50	Q	.	.	.	.
5.12	0.1868	0.50	Q	.	.	.	.
5.27	0.1931	0.50	.Q	.	.	.	.
5.42	0.1994	0.51	.Q	.	.	.	.
5.57	0.2058	0.51	.Q	.	.	.	.
5.72	0.2122	0.52	.Q	.	.	.	.
5.87	0.2187	0.52	.Q	.	.	.	.
6.02	0.2252	0.52	.Q	.	.	.	.
6.17	0.2318	0.53	.Q	.	.	.	.
6.33	0.2384	0.53	.Q	.	.	.	.
6.48	0.2451	0.54	.Q	.	.	.	.
6.63	0.2519	0.54	.Q	.	.	.	.
6.78	0.2587	0.55	.Q	.	.	.	.
6.93	0.2656	0.55	.Q	.	.	.	.
7.08	0.2726	0.56	.Q	.	.	.	.
7.23	0.2796	0.56	.Q	.	.	.	.
7.38	0.2867	0.57	.Q	.	.	.	.
7.53	0.2938	0.57	.Q	.	.	.	.
7.69	0.3010	0.58	.Q	.	.	.	.
7.84	0.3083	0.59	.Q	.	.	.	.
7.99	0.3157	0.59	.Q	.	.	.	.
8.14	0.3232	0.60	.Q	.	.	.	.
8.29	0.3307	0.61	.Q	.	.	.	.
8.44	0.3383	0.61	.Q	.	.	.	.
8.59	0.3460	0.62	.Q	.	.	.	.
8.74	0.3538	0.63	.Q	.	.	.	.
8.90	0.3617	0.64	.Q	.	.	.	.
9.05	0.3696	0.64	.Q	.	.	.	.
9.20	0.3777	0.65	.Q	.	.	.	.
9.35	0.3859	0.66	.Q	.	.	.	.
9.50	0.3941	0.67	.Q	.	.	.	.
9.65	0.4025	0.67	.Q	.	.	.	.
9.80	0.4110	0.69	.Q	.	.	.	.
9.95	0.4196	0.69	.Q	.	.	.	.
10.10	0.4283	0.70	.Q	.	.	.	.
10.26	0.4372	0.71	.Q	.	.	.	.
10.41	0.4462	0.73	.Q	.	.	.	.
10.56	0.4553	0.73	.Q	.	.	.	.
10.71	0.4645	0.75	.Q	.	.	.	.
10.86	0.4739	0.76	.Q	.	.	.	.
11.01	0.4835	0.77	.Q	.	.	.	.
11.16	0.4932	0.78	.Q	.	.	.	.
11.31	0.5031	0.80	.Q	.	.	.	.
11.47	0.5132	0.81	.Q	.	.	.	.
11.62	0.5234	0.83	.Q	.	.	.	.
11.77	0.5339	0.84	.Q	.	.	.	.
11.92	0.5445	0.86	.Q	.	.	.	.
12.07	0.5554	0.88	.Q	.	.	.	.
12.22	0.5670	0.99	.Q	.	.	.	.
12.37	0.5794	1.00	. Q	.	.	.	.
12.52	0.5921	1.03	. Q	.	.	.	.
12.67	0.6051	1.05	. Q	.	.	.	.
12.83	0.6183	1.08	. Q	.	.	.	.
12.98	0.6319	1.10	. Q	.	.	.	.
13.13	0.6459	1.13	. Q	.	.	.	.
13.28	0.6602	1.16	. Q	.	.	.	.
13.43	0.6749	1.20	. Q	.	.	.	.
13.58	0.6900	1.22	. Q	.	.	.	.

13.73	0.7056	1.28	. Q	.	.	.	.
13.88	0.7218	1.31	. Q	.	.	.	.
14.03	0.7385	1.37	. Q	.	.	.	.
14.19	0.7561	1.44	. Q	.	.	.	.
14.34	0.7745	1.52	. Q	.	.	.	.
14.49	0.7939	1.57	. Q	.	.	.	.
14.64	0.8141	1.68	. Q	.	.	.	.
14.79	0.8355	1.74	. Q	.	.	.	.
14.94	0.8581	1.89	. Q	.	.	.	.
15.09	0.8823	1.98	. Q	.	.	.	.
15.24	0.9084	2.20	. Q	.	.	.	.
15.40	0.9369	2.35	. Q	.	.	.	.
15.55	0.9704	3.02	. Q	.	.	.	.
15.70	1.0102	3.36	. Q	.	.	.	.
15.85	1.0599	4.60	. Q.	.	.	.	.
16.00	1.1262	6.02	. Q	.	.	.	.
16.15	1.2518	14.08	.	.	.	Q .	.
16.30	1.3638	3.84	. Q	.	.	.	.
16.45	1.4044	2.66	. Q	.	.	.	.
16.60	1.4340	2.08	. Q	.	.	.	.
16.76	1.4583	1.81	. Q	.	.	.	.
16.91	1.4798	1.62	. Q	.	.	.	.
17.06	1.4991	1.48	. Q	.	.	.	.
17.21	1.5167	1.34	. Q	.	.	.	.
17.36	1.5329	1.25	. Q	.	.	.	.
17.51	1.5481	1.18	. Q	.	.	.	.
17.66	1.5624	1.11	. Q	.	.	.	.
17.81	1.5760	1.06	. Q	.	.	.	.
17.97	1.5889	1.01	. Q	.	.	.	.
18.12	1.6012	0.95	.Q	.	.	.	.
18.27	1.6124	0.85	.Q	.	.	.	.
18.42	1.6229	0.82	.Q	.	.	.	.
18.57	1.6330	0.79	.Q	.	.	.	.
18.72	1.6427	0.76	.Q	.	.	.	.
18.87	1.6521	0.74	.Q	.	.	.	.
19.02	1.6612	0.72	.Q	.	.	.	.
19.17	1.6701	0.70	.Q	.	.	.	.
19.33	1.6787	0.68	.Q	.	.	.	.
19.48	1.6870	0.66	.Q	.	.	.	.
19.63	1.6952	0.65	.Q	.	.	.	.
19.78	1.7032	0.63	.Q	.	.	.	.
19.93	1.7110	0.62	.Q	.	.	.	.
20.08	1.7186	0.60	.Q	.	.	.	.
20.23	1.7260	0.59	.Q	.	.	.	.
20.38	1.7333	0.58	.Q	.	.	.	.
20.53	1.7405	0.57	.Q	.	.	.	.
20.69	1.7475	0.56	.Q	.	.	.	.
20.84	1.7544	0.55	.Q	.	.	.	.
20.99	1.7612	0.54	.Q	.	.	.	.
21.14	1.7678	0.53	.Q	.	.	.	.
21.29	1.7743	0.52	.Q	.	.	.	.
21.44	1.7808	0.51	.Q	.	.	.	.
21.59	1.7871	0.50	.Q	.	.	.	.
21.74	1.7933	0.49	Q	.	.	.	.
21.90	1.7994	0.49	Q	.	.	.	.
22.05	1.8055	0.48	Q	.	.	.	.
22.20	1.8114	0.47	Q	.	.	.	.
22.35	1.8173	0.47	Q	.	.	.	.
22.50	1.8231	0.46	Q	.	.	.	.
22.65	1.8288	0.45	Q	.	.	.	.
22.80	1.8344	0.45	Q	.	.	.	.
22.95	1.8400	0.44	Q	.	.	.	.
23.10	1.8455	0.44	Q	.	.	.	.
23.26	1.8509	0.43	Q	.	.	.	.
23.41	1.8563	0.43	Q	.	.	.	.
23.56	1.8616	0.42	Q	.	.	.	.
23.71	1.8669	0.42	Q	.	.	.	.
23.86	1.8720	0.41	Q	.	.	.	.
24.01	1.8772	0.41	Q	.	.	.	.

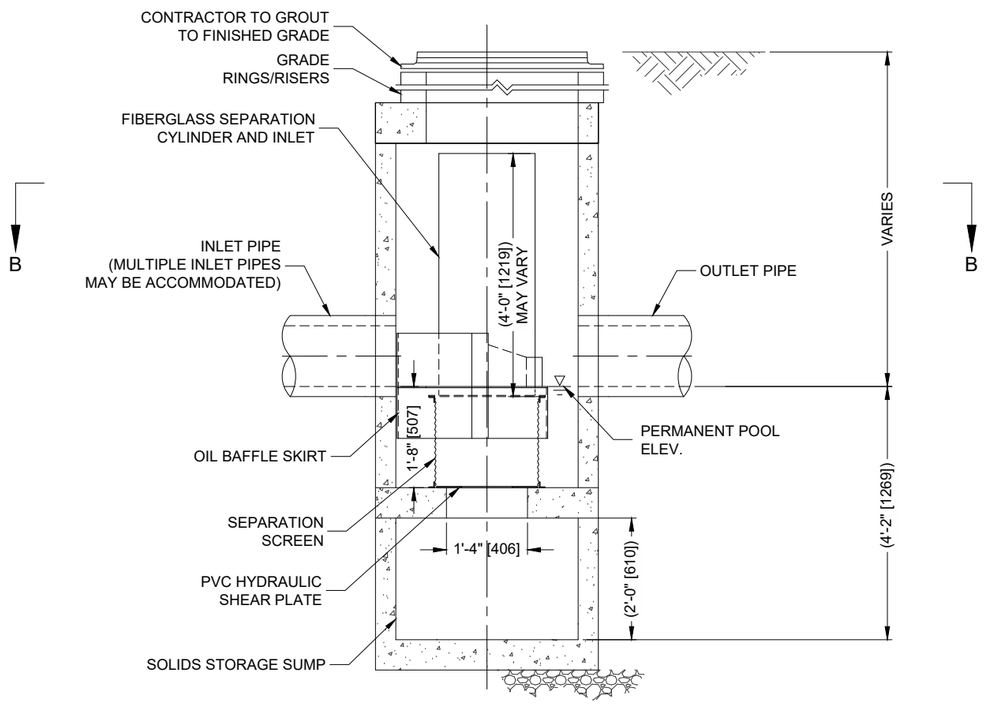
```
  24.16      1.8797      0.00  Q         .         .         .         .
 ------------------------------------------------------------------------------
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                Duration
        Peak Flow Rate                     (minutes)
    ======================                 =========
               0%                           1442.1
              10%                            181.4
              20%                             54.4
              30%                             27.2
              40%                             18.1
              50%                              9.1
              60%                              9.1
              70%                              9.1
              80%                              9.1
              90%                              9.1
```

Appendix J

BMP Analysis



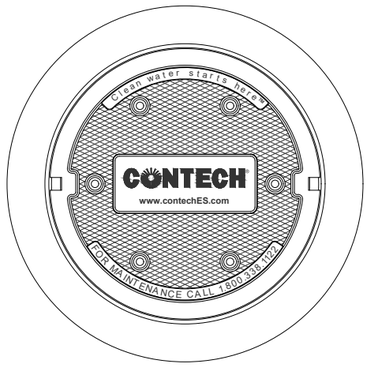
PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.

CDS1515-3-C DESIGN NOTES

THE STANDARD CDS1515-3-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS OR L/s)			*
PEAK FLOW RATE (CFS OR L/s)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
SCREEN APERTURE (2400 OR 4700)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO..
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS1515-3-C
ONLINE CDS
STANDARD DETAIL

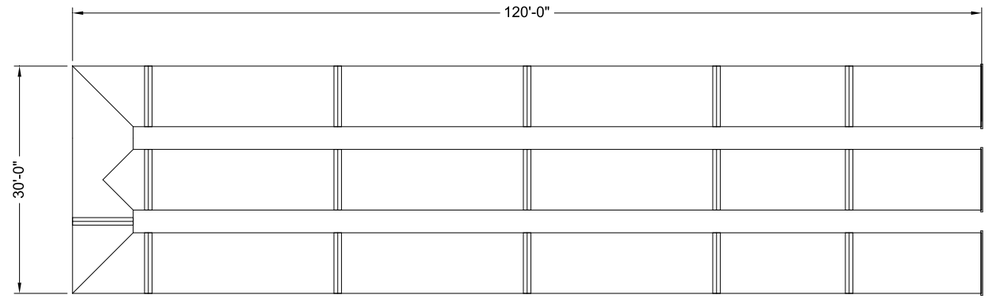
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 366 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 25,000 CF
- PIPE STORAGE VOLUME = 18,397 CF
- BACKFILL STORAGE VOLUME = 6,696 CF
- TOTAL STORAGE PROVIDED = 25,093 CF

PIPE DETAILS
- DIAMETER = 96"
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = SOLID
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 6"



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 20'

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO63472 2175 S Willow
Basin #1
West Covina, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
45078	63472	11/22/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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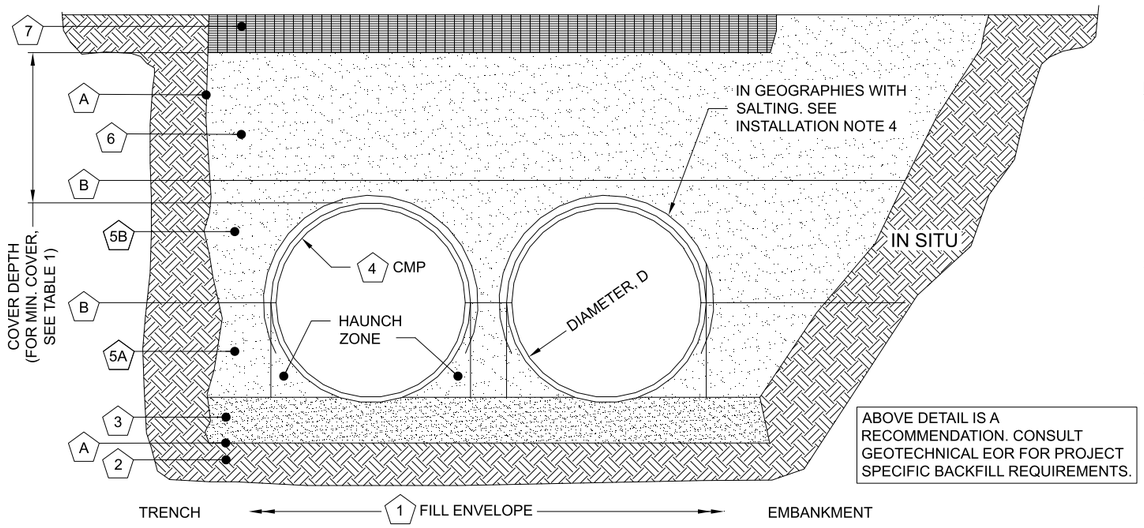
TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT
- ULTRAFLO ALSO AVAILABLE FOR SIZES 18" - 120" WITH 3/4"x 3/4"x 7 1/2" CORRUGATION



MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. BACKFILL USING CONTROLLED LOW-STRENGTH MATERIAL (CLSM, "FLASH FILL" OR "FLOWABLE FILL") MAY BE USED WHEN THE SPACING BETWEEN THE PIPES WILL NOT ALLOW FOR PLACEMENT AND ADEQUATE COMPACTION OF THE BACKFILL. CONTACT CONTECH FOR FURTHER EVALUATION.
4. IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED OVER THE UPPER HALF OF THE PIPE. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

TABLE 2: SOLID STANDARD

CMP DETENTION AND CMP DRAINAGE STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** OR PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** (APPROVED REGIONAL EQUIVALENTS INCLUDE CA-7)	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE FOUNDATION SOILS CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5A	CRITICAL BACKFILL	**AASHTO M 145: A-1, A-2, A-3** *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A THREE LIFT (24") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WELL GRADED GRANULAR MATERIAL WHICH MAY CONTAIN SMALL AMOUNTS OF SILT OR CLAY AND MAXIMUM PARTICLE SIZE OF 3" (PER AASHTO 26.3.8.1 AND 12.4-1.3).	
5B	BACKFILL	**AASHTO M 145: A-1, A-2, A-3**		
6	COVER MATERIAL	UP TO MIN. COVER - SEE 5A AND 5B ABOVE ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROAD BASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	OPTIONAL GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:
- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5A INCLUDE CA-7, CODOT #67, MIDOT 2G, 34G, OR 21AA STONE OR GRAVEL; #8; #57; MIDOT 6A, 2G, 3G, 34G.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
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CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO63472 2175 S Willow
Basin #1
West Covina, CA
DETENTION SYSTEM

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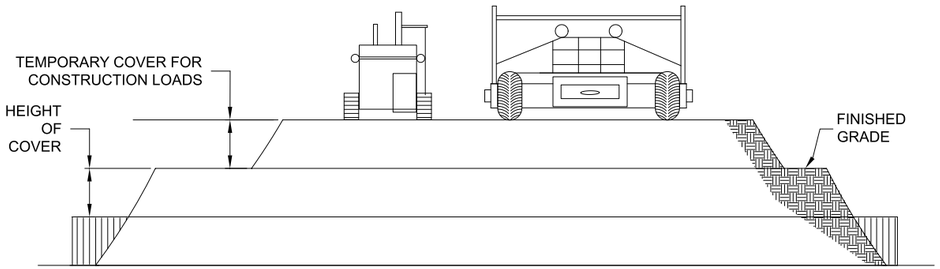


CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

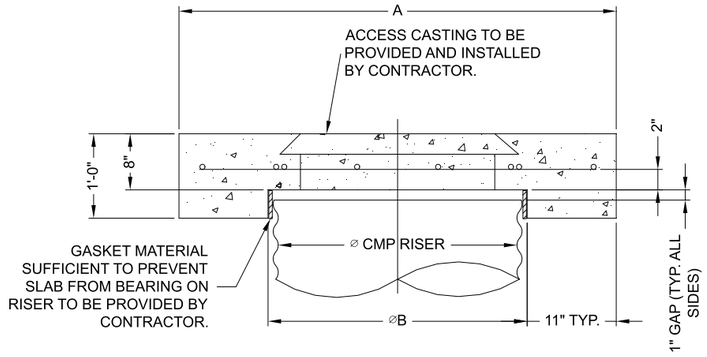
APPLICABLE POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

APPLICABLE
HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.
REQUIREMENTS
INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

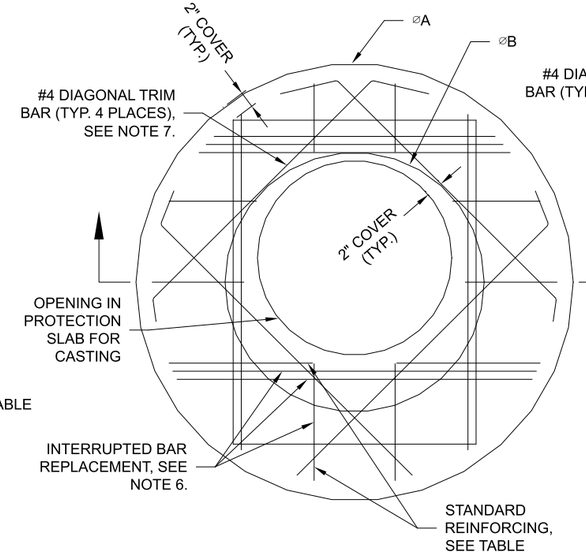
NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



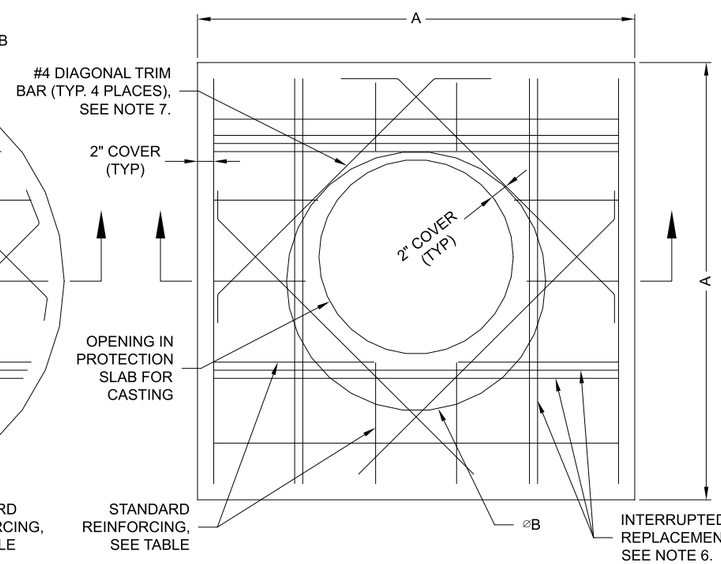
SECTION VIEW

REINFORCING TABLE				
⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

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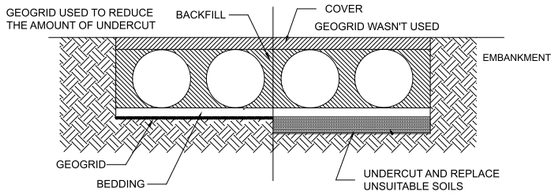
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

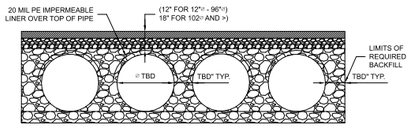
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

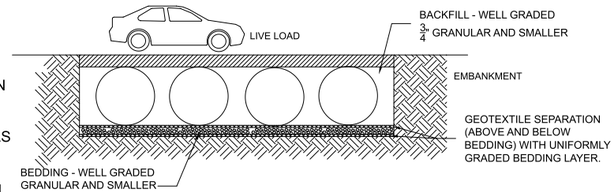
THE RESISTIVITY OF A PROJECT SITE MAY CHANGE OVER TIME DUE TO THE USE OF VARIOUS SALTING, DE-ICING, AND AGRICULTURAL AGENTS APPLIED ON OR NEAR THE AREA. TO MITIGATE THE POTENTIAL IMPACT OF THESE AGENTS, AN HDPE MEMBRANE LINER WILL BE INSTALLED ON THE CROWN OF EACH PIPE, CREATING AN IMPERMEABLE BARRIER. THIS MEASURE IS DESIGNED TO PROTECT THE SYSTEM FROM ENVIRONMENTAL CHANGES THAT COULD LEAD TO PREMATURE CORROSION AND REDUCE THE OVERALL SERVICE LIFE.



IN-SITU TRENCH WALL

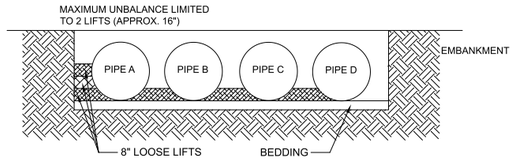
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



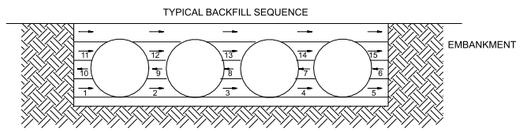
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

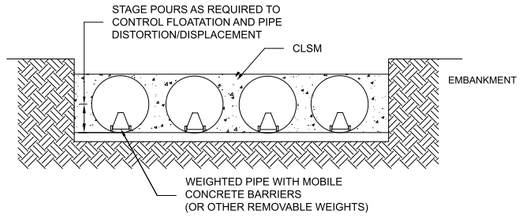


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

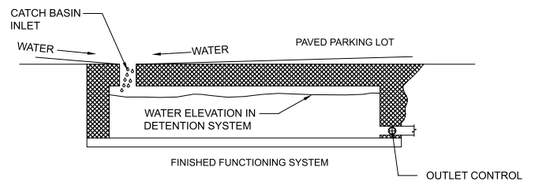


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

DATE	REVISION DESCRIPTION	BY

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CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO63472 2175 S Willow
Basin #1
West Covina, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
45078	63472	11/22/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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Appendix K

Hydraulic Analysis