

PRELIMINARY DRAINAGE STUDY

8561 C AVENUE
HESPERIA, CA 92345
A.P.N. 0410-242-03 & 04

PREPARED FOR:

TAYLOR PROPERTY DEVELOPMENT, LLC
21496 MAIN STREET
10770 I AVENUE
HESPERIA, CA 92345
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PREPARED BY:

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BERNHARD K. MAYER R.C.E. 36866

01/02/24

DATE

PROJECT INTRODUCTION

This project consists of the development of an existing 4.71-acre parcel in the City of Hesperia, County of San Bernardino. The parcel is located north of Lime Street on the east side of C Avenue, having A.P.N.s of 0410-242-03 & 04. The pre-developed land cover is partially developed with single family residences on each lot. The easterly half of the property undeveloped and classified as "Barren (rock land, eroded and graded land)". The proposed demolition to this parcel includes the removal of the existing residences and some fencing. The proposed improvements include 11 apartment buildings with a total of 70 units, a recreation building, 2 garage buildings, parking and drive aisles, 2 trash enclosures, street improvements, a variety of stormwater feature structures including curbs, gutters, Infiltration Basins, and rip rap. The post-developed condition will mimic the same flow pattern as the pre-developed condition. Stormwater will begin to be generated at the westerly property line and will be conveyed to concrete curb & gutters and v-gutters which will convey the runoff easterly to 2 infiltration basins. The Infiltration Basin will treat the runoff and outlet at the east property line like the existing drainage pattern.

Existing impervious area (all being removed) = 5,613 square-feet
Proposed Impervious = 156,775 square-feet.

PROJECT INFORMATION

EXISTING WATERSHED DESCRIPTION

In pre-developed condition the site drains via sheet flow from the west property line to the east property line. There are no existing drainage courses on site.

PROPOSED WATERSHED DESCRIPTION

Stormwater runoff from the southerly portion begins at a high point in the driveway at the west property line and will be conveyed to a series of curb & gutter and v-gutters. These gutters will convey the runoff east to a parkway drain which will convey the runoff into the infiltration basin located at the southeast corner of the lot. Basin overflow will be conveyed to a drainage channel which will outlet the runoff at the existing low point along the east property line.

Stormwater runoff from the northerly portion begins at a high point in the driveway at the west property line and will be conveyed to a series of curb & gutter and v-gutters. These gutters will convey the runoff east to a parkway drain which will convey the runoff into the infiltration basin located at the northeast corner of the lot. Basin overflow will outlet at the existing low point along the east property line.

METHODOLOGY – RATIONAL METHOD

The following scenario was modeled:

Existing Condition: 2-year Storm Event
Pre-Developed Condition: 100-year Storm Event

Developed Condition: 2-year Storm Event
Developed Condition: 100-year Storm Event

Rainfall depth was derived from the San Bernardino County Flood Control & Water Conservation District Hydrology Manual's isohyetal maps and precipitation frequency Atlas, NOAA Atlas 14.

Rational Method computations were performed using Advanced Engineering Software (aes), ver. 23.0, based on the Hydrology Manual. Discharge was calculated by the software, based on user input of rainfall, soil type, acreage, and land use parameters.

Printouts of the rational method calculations, as well as applicable plates from the Manual, are included in this report.

CONCLUSIONS

This drainage study and the calculations presented herein demonstrate the following:

The proposed and existing drainage facilities are adequate to carry the runoff produced by 2-year and 100-year storm events

TOTAL RUNOFF LEAVING THE SITE

Existing Condition:

Q_2	=	3.34 cfs	T_c = 16.02 min.
Q_{100}	=	11.10 cfs	T_c = 16.02 min.

Proposed Condition:

Q_2 (100-110)	=	3.12 cfs	T_c = 11.06 min.
Q_{100} (100-110)	=	6.81 cfs	T_c = 11.06 min.
Q_2 (200-210)	=	4.74 cfs	T_c = 9.65 min.
Q_{100} (200-210)	=	10.26 cfs	T_c = 9.65 min.
TOTAL Q_2	=	7.86 cfs	T_c = 11.06 min.
TOTAL Q_{100}	=	17.07 cfs	T_c = 9.65 min.

Q_2 7.86 – 3.34 = 4.52 cfs Increase

Q_{100} 17.07 – 11.10 = 5.97 cfs Increase

VOLUME MITIGATION

Existing (Q_{100}) = 18,556 ft³

Proposed (Q_{100}) = 26,204 ft³

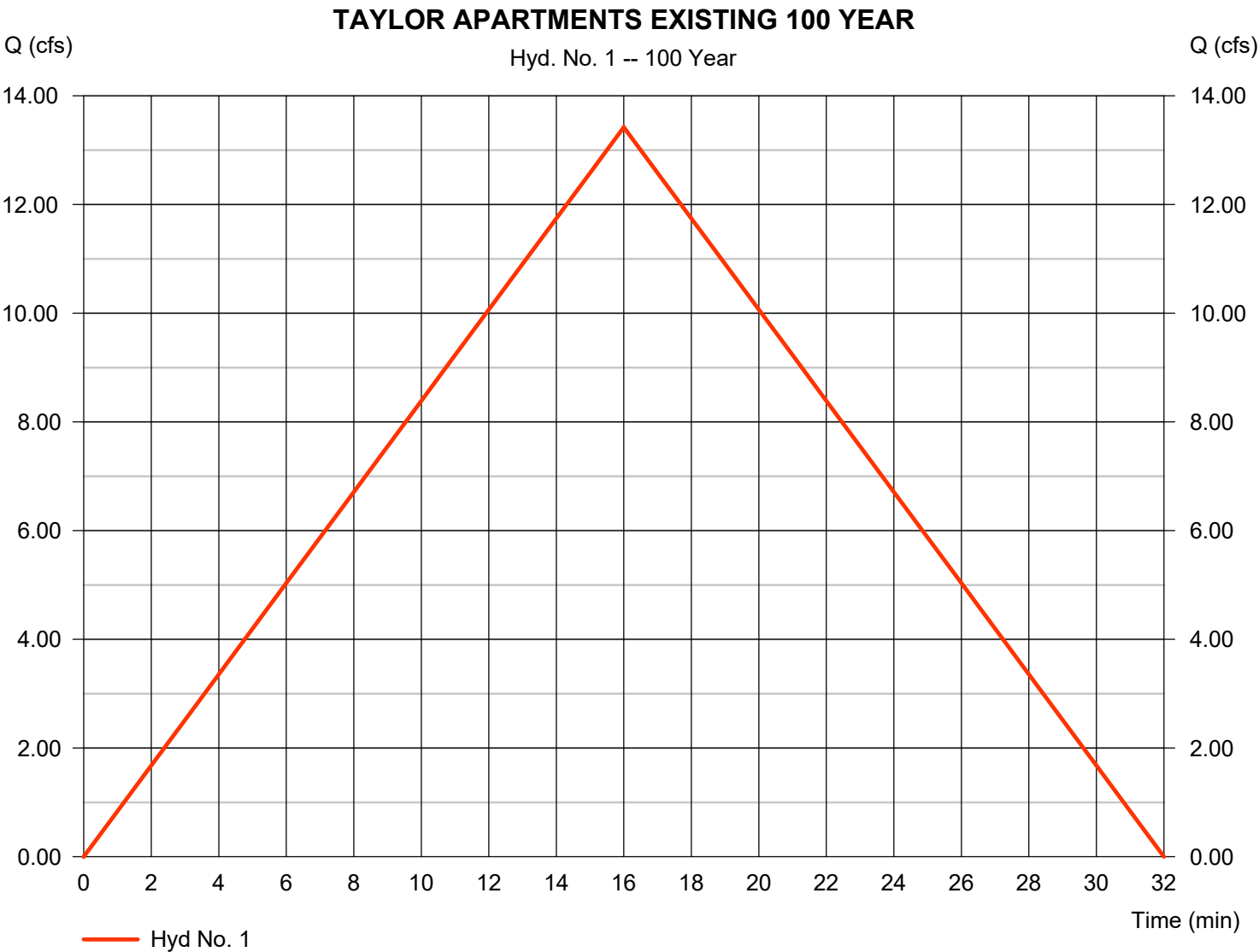
26,204 - 18,556 = 7,648 ft³ < 9,159 ft³ (basin volume)

Hydrograph Report

Hyd. No. 1

TAYLOR APARTMENTS EXISTING 100 YEAR

Hydrograph type	= Rational	Peak discharge	= 13.42 cfs
Storm frequency	= 100 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 12,884 cuft
Drainage area	= 4.710 ac	Runoff coeff.	= 0.4
Intensity	= 7.124 in/hr	Tc by User	= 16.00 min
IDF Curve	= SampleFHA.idf	Asc/Rec limb fact	= 1/1

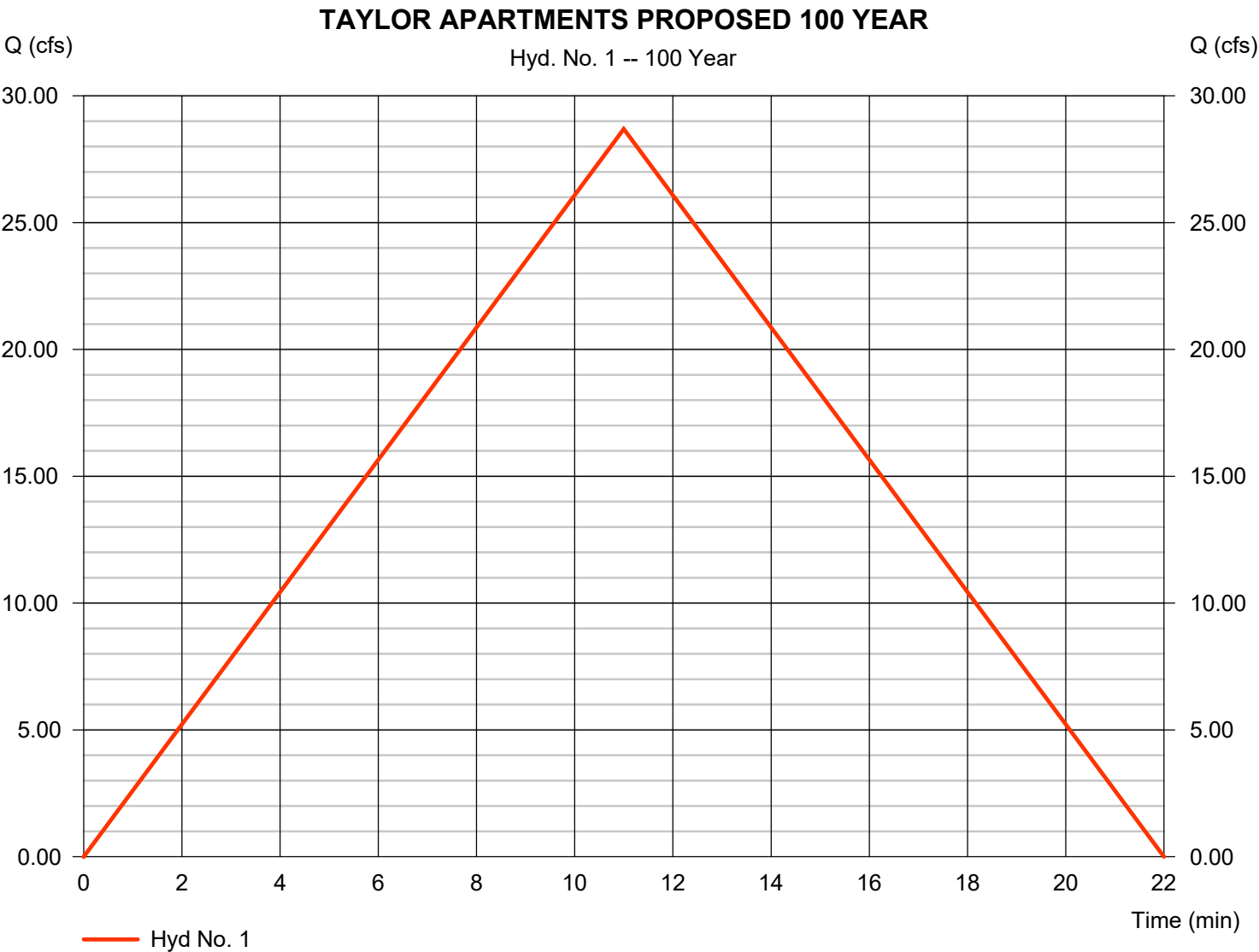


Hydrograph Report

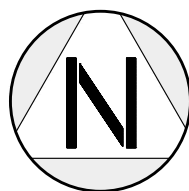
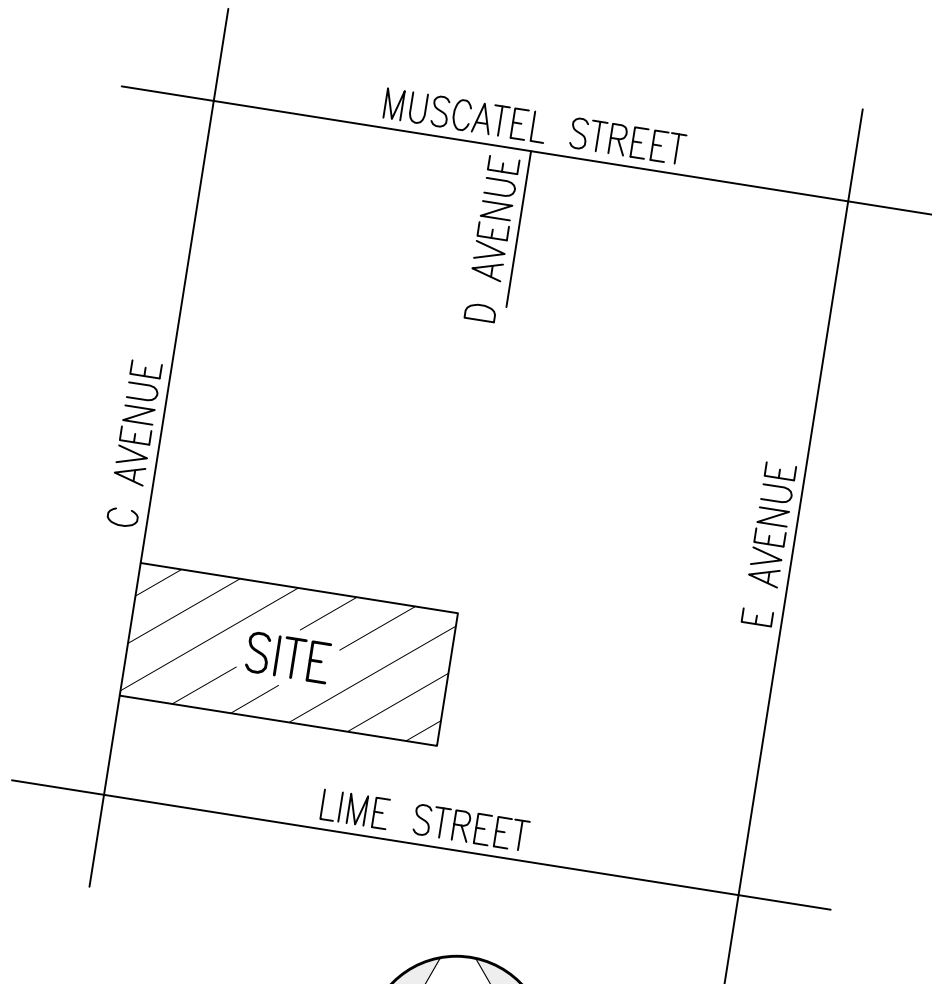
Hyd. No. 1

TAYLOR APARTMENTS PROPOSED 100 YEAR

Hydrograph type	= Rational	Peak discharge	= 28.69 cfs
Storm frequency	= 100 yrs	Time to peak	= 11 min
Time interval	= 1 min	Hyd. volume	= 18,934 cuft
Drainage area	= 4.710 ac	Runoff coeff.	= 0.75
Intensity	= 8.121 in/hr	Tc by User	= 11.00 min
IDF Curve	= SampleFHA.idf	Asc/Rec limb fact	= 1/1



DRAINAGE MAPS



VICINITY MAP

NOT TO SCALE

DRAINAGE MAP – EXISTING

FLOW PROCESS CHART PROPOSED:

FROM NODE	TO NODE	FROM ELEV	TO ELEV	Q (CFS) 2 YR/1 HR	Q (CFS) 100 YR/1 HR
100	110	3265.0	3252.1	3.34	11.10

SCALE: 1"=80'

DRAINAGE LEGEND:

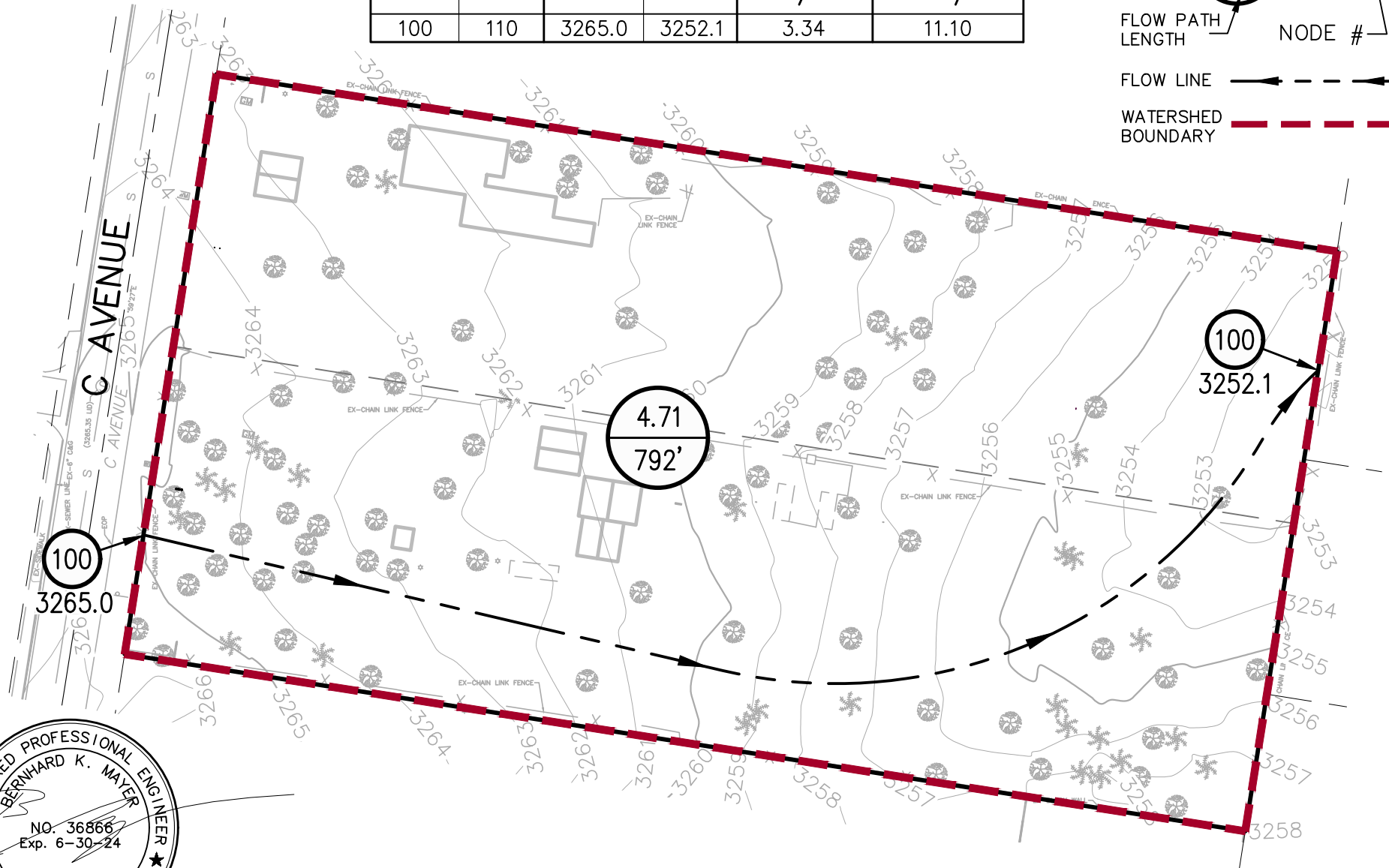
DRAINAGE AREA (AC) NODE ELEV. 3252.1

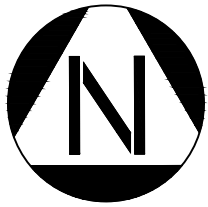
FLOW PATH
LENGTH

NODE #

FLOW LINE

WATERSHED
BOUNDARY





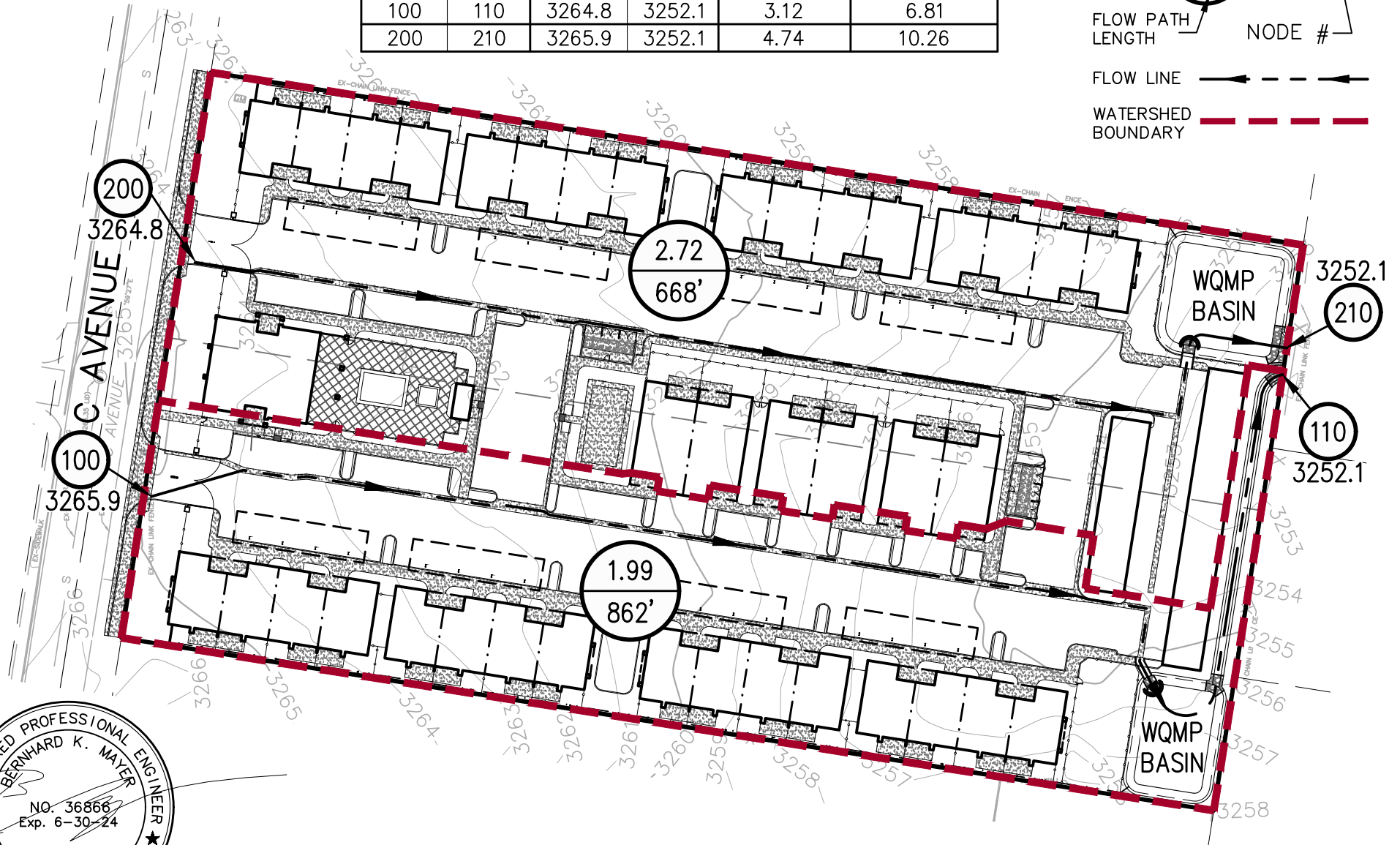
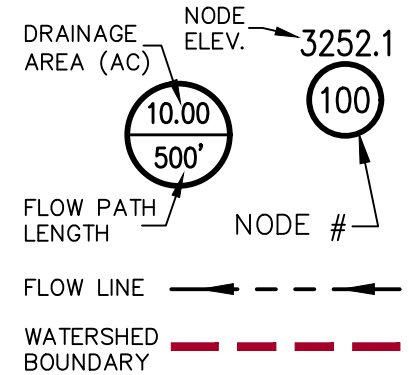
SCALE: 1"=80'

DRAINAGE MAP — PROPOSED

FLOW PROCESS CHART PROPOSED:

FROM NODE	TO NODE	FROM ELEV	TO ELEV	Q (CFS) 2 YR/1 HR	Q (CFS) 100 YR/1 HR
100	110	3264.8	3252.1	3.12	6.81
200	210	3265.9	3252.1	4.74	10.26

DRAINAGE LEGEND:



HYDROLOGY

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 1524

Analysis prepared by:

SITETECH, INC.
8061 CHURCH STREET, P.O. 592
HIGHLAND, CA 92346
PH: (909) 864-3180

***** DESCRIPTION OF STUDY *****
* TAYLOR APARTMENTS - 8561 C AVENUE *
* 2 YEAR - 1 HOUR DESIGN STORM *
* EXISTING CONDITION *

FILE NAME: TAY2E.DAT
TIME/DATE OF STUDY: 10:17 01/02/2024

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT (YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE (INCH) = 6.00
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)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY (INCH/HOUR) = 0.5800

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 110.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 792.00
ELEVATION DATA: UPSTREAM (FEET) = 3265.00 DOWNSTREAM (FEET) = 3252.10

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 16.019

* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.462

SUBAREA T_c AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
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RESIDENTIAL

".4 DWELLING/ACRE"	B	4.71	0.75	0.900	56	16.02
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SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.75

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.900

SUBAREA RUNOFF (CFS) = 3.34

TOTAL AREA (ACRES) = 4.71 PEAK FLOW RATE (CFS) = 3.34

=====

END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 4.7 T_c (MIN.) = 16.02

EFFECTIVE AREA (ACRES) = 4.71 AREA-AVERAGED F_m (INCH/HR) = 0.67

AREA-AVERAGED F_p (INCH/HR) = 0.75 AREA-AVERAGED A_p = 0.900

PEAK FLOW RATE (CFS) = 3.34

=====

END OF RATIONAL METHOD ANALYSIS

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Analysis prepared by:

SITETECH, INC.
8061 CHURCH STREET, P.O. 592
HIGHLAND, CA 92346
PH: (909) 864-3180

***** DESCRIPTION OF STUDY *****
* TAYLOR APARTMENTS - 8561 C AVENUE *
* 100 YEAR - 1 HOUR DESIGN STORM *
* EXISTING CONDITION *

FILE NAME: TAY100E.DAT
TIME/DATE OF STUDY: 10:11 01/02/2024

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USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
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)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1900

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 110.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 792.00
ELEVATION DATA: UPSTREAM (FEET) = 3265.00 DOWNSTREAM (FEET) = 3252.10

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 16.019

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 2.999

SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
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RESIDENTIAL

".4 DWELLING/ACRE"	B	4.71	0.42	0.900	76	16.02
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SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.42

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.900

SUBAREA RUNOFF (CFS) = 11.10

TOTAL AREA (ACRES) = 4.71 PEAK FLOW RATE (CFS) = 11.10

=====

END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 4.7 T_c (MIN.) = 16.02

EFFECTIVE AREA (ACRES) = 4.71 AREA-AVERAGED F_m (INCH/HR) = 0.38

AREA-AVERAGED F_p (INCH/HR) = 0.42 AREA-AVERAGED A_p = 0.900

PEAK FLOW RATE (CFS) = 11.10

=====

END OF RATIONAL METHOD ANALYSIS

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Analysis prepared by:

SITETECH, INC.
8061 CHURCH STREET, P.O. 592
HIGHLAND, CA 92346
PH: (909) 864-3180

***** DESCRIPTION OF STUDY *****
* TAYLOR APARTMENTS - 8561 C AVENUE *
* 2 YEAR - 1 HOUR DESIGN STORM *
* PROPOSED CONDITION *

FILE NAME: TAY2P.DAT
TIME/DATE OF STUDY: 10:15 01/02/2024

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USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
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)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5800

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 110.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

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=====
INITIAL SUBAREA FLOW-LENGTH (FEET) = 862.00
ELEVATION DATA: UPSTREAM (FEET) = 3265.90 DOWNSTREAM (FEET) = 3252.10

Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 11.063
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.894
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.)
APARTMENTS              B      1.99      0.75      0.200      56  11.06
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA RUNOFF (CFS) = 3.12
TOTAL AREA (ACRES) = 1.99 PEAK FLOW RATE (CFS) = 3.12

*****
FLOW PROCESS FROM NODE 200.00 TO NODE 210.00 IS CODE = 21
=====
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH (FEET) = 668.00
ELEVATION DATA: UPSTREAM (FEET) = 3264.80 DOWNSTREAM (FEET) = 3252.10

Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 9.653
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.084
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.)
APARTMENTS              B      2.72      0.75      0.200      56  9.65
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA RUNOFF (CFS) = 4.74
TOTAL AREA (ACRES) = 2.72 PEAK FLOW RATE (CFS) = 4.74
=====
END OF STUDY SUMMARY:
TOTAL AREA (ACRES) = 2.7 TC (MIN.) = 9.65
EFFECTIVE AREA (ACRES) = 2.72 AREA-AVERAGED Fm (INCH/HR) = 0.15
AREA-AVERAGED Fp (INCH/HR) = 0.75 AREA-AVERAGED Ap = 0.200
PEAK FLOW RATE (CFS) = 4.74
=====
END OF RATIONAL METHOD ANALYSIS
=====

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Analysis prepared by:

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8061 CHURCH STREET, P.O. 592
HIGHLAND, CA 92346
PH: (909) 864-3180

***** DESCRIPTION OF STUDY *****
* TAYLOR APARTMENTS - 8561 C AVENUE *
* 100 YEAR - 1 HOUR DESIGN STORM *
* PROPOSED CONDITION *

FILE NAME: TAY100P.DAT
TIME/DATE OF STUDY: 10:06 01/02/2024

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
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)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1900

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 110.00 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 862.00
ELEVATION DATA: UPSTREAM (FEET) = 3265.90 DOWNSTREAM (FEET) = 3252.10

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 11.063

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.886

SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
APARTMENTS	B	1.99	0.42	0.200	76	11.06

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.42

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200

SUBAREA RUNOFF (CFS) = 6.81

TOTAL AREA (ACRES) = 1.99 PEAK FLOW RATE (CFS) = 6.81

FLOW PROCESS FROM NODE 200.00 TO NODE 210.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 668.00
ELEVATION DATA: UPSTREAM (FEET) = 3264.80 DOWNSTREAM (FEET) = 3252.10

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 9.653

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.276

SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
APARTMENTS	B	2.72	0.42	0.200	76	9.65

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.42

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200

SUBAREA RUNOFF (CFS) = 10.26

TOTAL AREA (ACRES) = 2.72 PEAK FLOW RATE (CFS) = 10.26

END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 2.7 T_c (MIN.) = 9.65

EFFECTIVE AREA (ACRES) = 2.72 AREA-AVERAGED F_m (INCH/HR) = 0.08

AREA-AVERAGED F_p (INCH/HR) = 0.42 AREA-AVERAGED A_p = 0.200

PEAK FLOW RATE (CFS) = 10.26

END OF RATIONAL METHOD ANALYSIS

PROPOSED INFILTRATION BASIN VOLUME & DRAWDOWN

SOUTH INFILTRATION BASIN			
Depth of Basin (ft)	1.5	Above Ground Storage (ft ³)	4088
Bottom Footprint (ft ²)	2270	Gravel Storage (ft ³)	0
Area of Side Slope (ft ²)	911	Total System Storage (ft ³)	4088
Volume of Basin (ft ³)	4088.25	Proposed DCV (ft ³)	4003
Infiltration Footprint (ft ²)	3181	% of Total DCV Retention	102%
Gravel Footprint (ft ²)		Measured Infil. Rate (in/hr)	0.76
Gravel Depth (ft)		Factor of Safety	2
Gravel Volume (ft ³)	0	Design Infil. Rate (in/hr)	0.38
Gravel Porosity	40%	BMP Drawdown (hr)	40.6
Results			
Total System Retention (ft ³)	=	4088	
V _{BMP} > V _{DCV} ???	=	YES	
BMP Drawdown < 48 hours ???	=	YES	
	=	INPUT DATA	
	=	CALCULATED DATA	

NORTH INFILTRATION BASIN			
Depth of Basin (ft)	1.5	Above Ground Storage (ft ³)	6074
Bottom Footprint (ft ²)	3503	Gravel Storage (ft ³)	0
Area of Side Slope (ft ²)	1092	Total System Storage (ft ³)	6074
Volume of Basin (ft ³)	6073.50	Proposed DCV (ft ³)	5,700
Infiltration Footprint (ft ²)	4595	% of Total DCV Retention	107%
Gravel Footprint (ft ²)		Measured Infil. Rate (in/hr)	0.76
Gravel Depth (ft)		Factor of Safety	2
Gravel Volume (ft ³)	0	Design Infil. Rate (in/hr)	0.38
Gravel Porosity	40%	BMP Drawdown (hr)	41.7
Results			
Total System Retention (ft ³)	=	6074	
V _{BMP} > V _{DCV} ???	=	YES	
BMP Drawdown < 48 hours ???	=	YES	
	=	INPUT DATA	
	=	CALCULATED DATA	

* Infiltration Basin Volume = (Bottom Footprint x Depth) + (Area of Side Slope x Depth)/2

* Total Gravel Storage = (Gravel Volume) x Gravel Porosity

* Total System Storage = Above Ground Storage + Gravel Storage

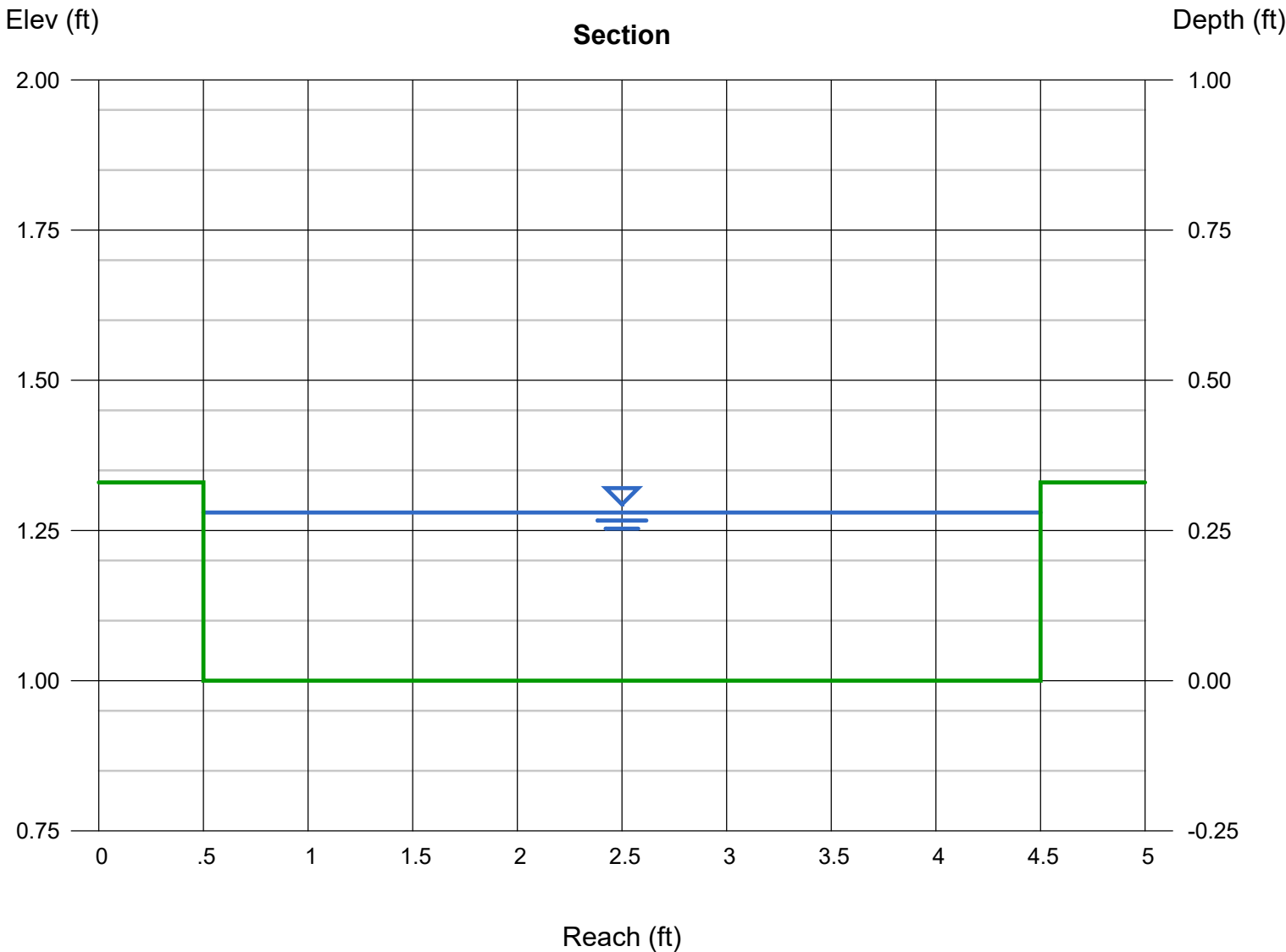
* BMP Drawdown = [(Total Storage / Infiltration Footprint) x 12 in/ft] / Design Infil. Rate

HYDRAULIC CALCULATIONS

Channel Report

SOUTH BASIN INLET - 36IN PARKWAY DRAIN

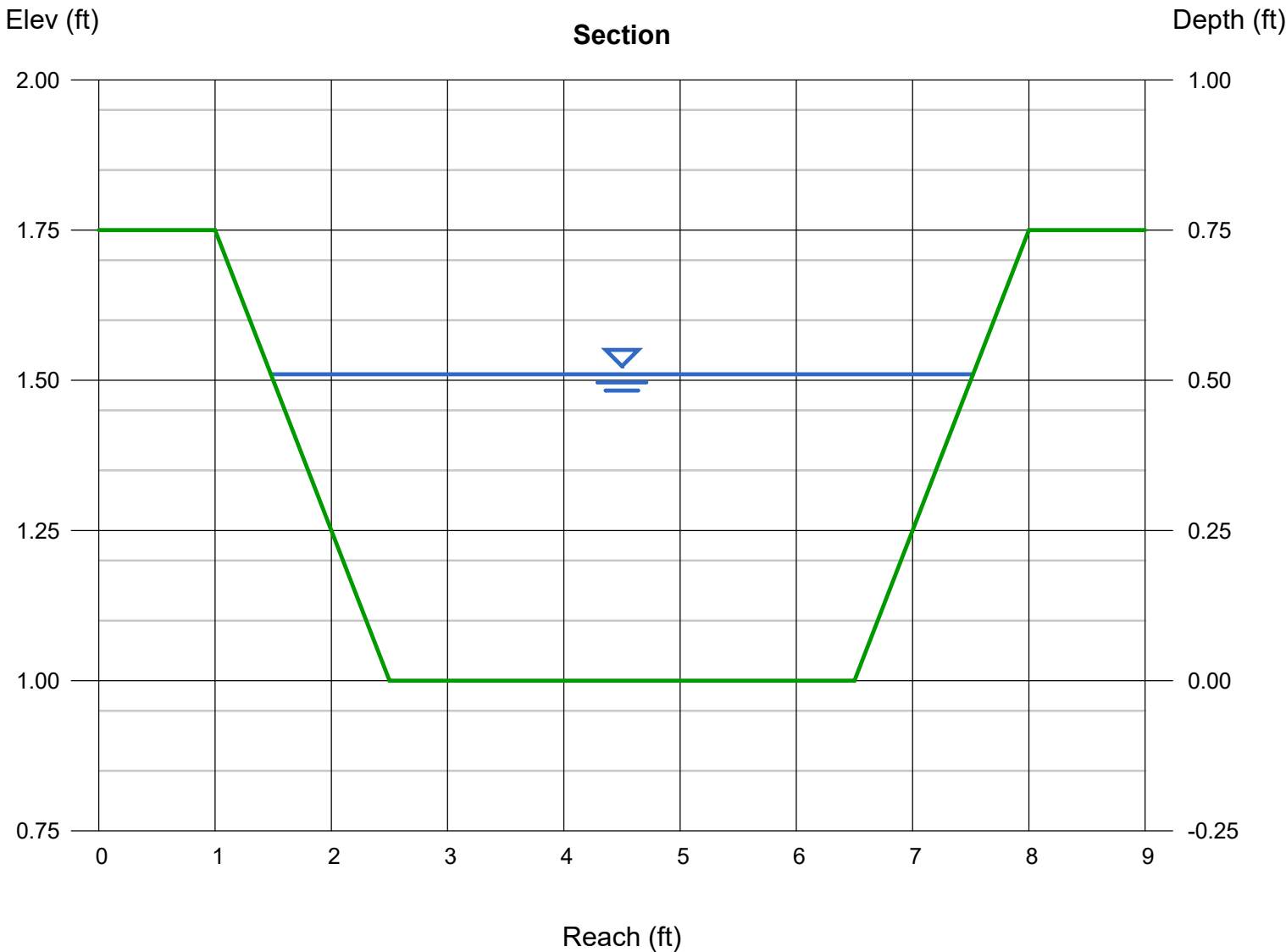
Rectangular		Highlighted	
Bottom Width (ft)	= 4.00	Depth (ft)	= 0.28
Total Depth (ft)	= 0.33	Q (cfs)	= 6.810
		Area (sqft)	= 1.12
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 6.08
Slope (%)	= 2.00	Wetted Perim (ft)	= 4.56
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.33
		Top Width (ft)	= 4.00
		EGL (ft)	= 0.85
Calculations			
Compute by:	Known Q		
Known Q (cfs)	= 6.81		



Channel Report

SOUTH BASIN OUTLET - 4FT WIDE GRADED DRAINAGE CHANNEL

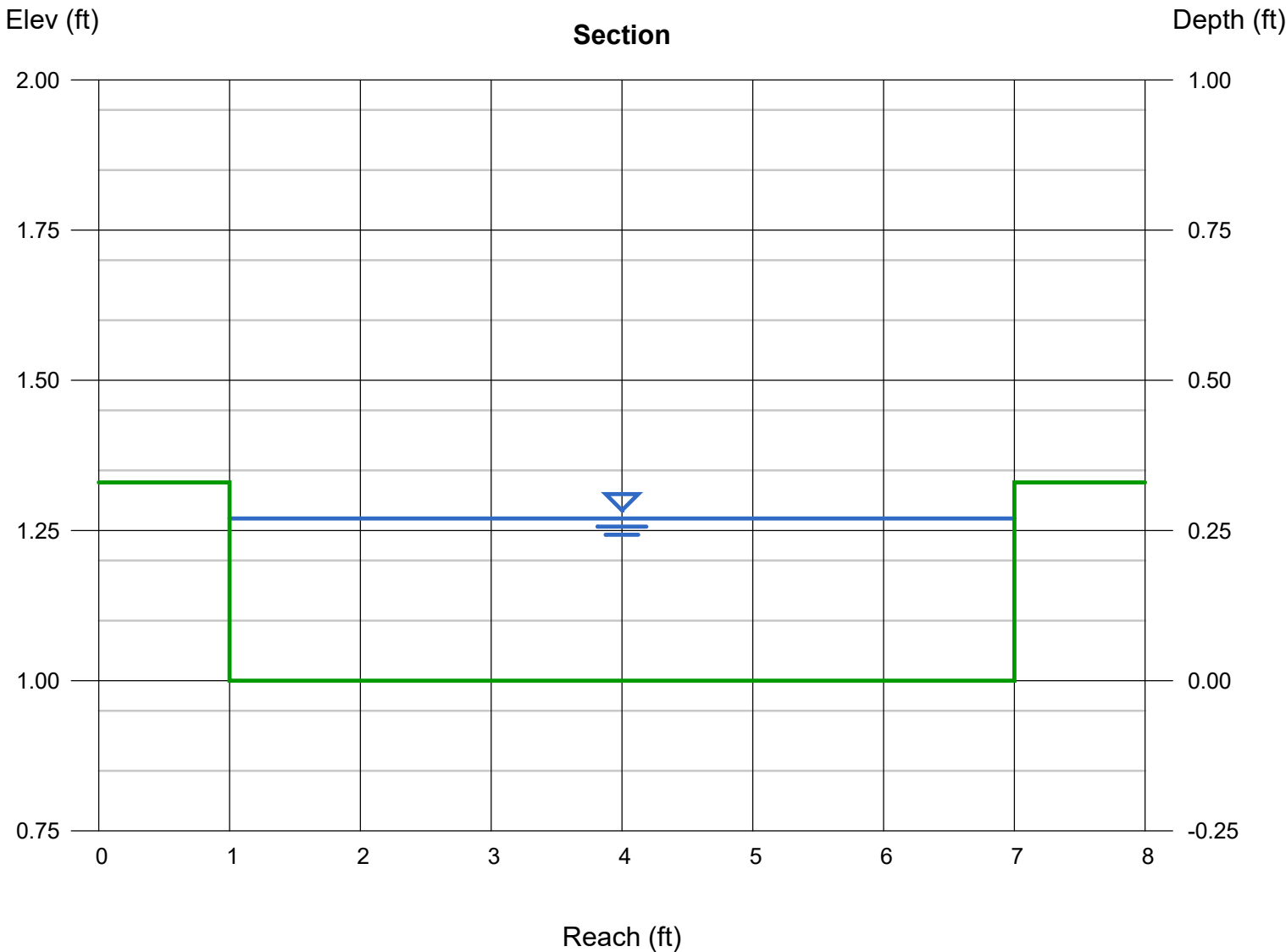
Trapezoidal		Highlighted	
Bottom Width (ft)	= 4.00	Depth (ft)	= 0.51
Side Slopes (z:1)	= 2.00, 2.00	Q (cfs)	= 6.810
Total Depth (ft)	= 0.75	Area (sqft)	= 2.56
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.66
Slope (%)	= 1.00	Wetted Perim (ft)	= 6.28
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.42
Calculations		Top Width (ft)	= 6.04
Compute by:	Known Q	EGL (ft)	= 0.62
Known Q (cfs)	= 6.81		



Channel Report

NORTH BASIN INLET - 72IN PARKWAY DRAIN

Rectangular		Highlighted	
Bottom Width (ft)	= 6.00	Depth (ft)	= 0.27
Total Depth (ft)	= 0.33	Q (cfs)	= 10.26
		Area (sqft)	= 1.62
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 6.33
Slope (%)	= 2.00	Wetted Perim (ft)	= 6.54
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.33
		Top Width (ft)	= 6.00
		EGL (ft)	= 0.89
Calculations			
Compute by:	Known Q		
Known Q (cfs)	= 10.26		



REFERENCE MAPS



NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4068°, Longitude: -117.2986°
Elevation: 3255 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 & aerals](#)

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	0.089 (0.073-0.108)	0.123 (0.101-0.150)	0.169 (0.139-0.207)	0.207 (0.169-0.256)	0.261 (0.206-0.334)	0.304 (0.235-0.396)	0.348 (0.263-0.466)	0.395 (0.290-0.543)	0.460 (0.324-0.659)	0.511 (0.348-0.759)
10-min	0.127 (0.105-0.155)	0.176 (0.145-0.215)	0.242 (0.199-0.297)	0.297 (0.243-0.367)	0.374 (0.296-0.478)	0.435 (0.337-0.568)	0.499 (0.377-0.667)	0.566 (0.416-0.779)	0.659 (0.465-0.945)	0.733 (0.499-1.09)
15-min	0.154 (0.127-0.188)	0.213 (0.176-0.260)	0.293 (0.241-0.359)	0.359 (0.293-0.444)	0.452 (0.358-0.578)	0.526 (0.408-0.687)	0.604 (0.456-0.807)	0.685 (0.503-0.942)	0.797 (0.562-1.14)	0.886 (0.603-1.32)
30-min	0.223 (0.185-0.273)	0.309 (0.255-0.378)	0.425 (0.350-0.521)	0.522 (0.427-0.645)	0.658 (0.520-0.840)	0.765 (0.592-0.999)	0.877 (0.663-1.17)	0.995 (0.731-1.37)	1.16 (0.817-1.66)	1.29 (0.877-1.91)
60-min	0.303 (0.251-0.370)	0.419 (0.347-0.513)	0.577 (0.475-0.707)	0.708 (0.579-0.875)	0.892 (0.705-1.14)	1.04 (0.803-1.35)	1.19 (0.899-1.59)	1.35 (0.992-1.86)	1.57 (1.11-2.25)	1.75 (1.19-2.59)
2-hr	0.435 (0.360-0.531)	0.580 (0.480-0.709)	0.779 (0.642-0.954)	0.945 (0.773-1.17)	1.18 (0.934-1.51)	1.37 (1.06-1.79)	1.57 (1.18-2.09)	1.77 (1.30-2.44)	2.06 (1.45-2.96)	2.29 (1.56-3.40)
3-hr	0.540 (0.446-0.659)	0.711 (0.588-0.870)	0.946 (0.779-1.16)	1.14 (0.935-1.41)	1.42 (1.13-1.82)	1.65 (1.28-2.15)	1.88 (1.42-2.52)	2.13 (1.57-2.94)	2.48 (1.75-3.56)	2.76 (1.88-4.10)
6-hr	0.753 (0.623-0.919)	0.984 (0.813-1.20)	1.30 (1.07-1.59)	1.57 (1.28-1.94)	1.95 (1.54-2.49)	2.25 (1.74-2.94)	2.57 (1.94-3.44)	2.92 (2.14-4.01)	3.40 (2.39-4.87)	3.78 (2.58-5.62)
12-hr	0.975 (0.807-1.19)	1.30 (1.08-1.59)	1.75 (1.44-2.14)	2.12 (1.74-2.62)	2.65 (2.10-3.39)	3.08 (2.38-4.01)	3.52 (2.66-4.70)	3.99 (2.93-5.48)	4.64 (3.27-6.66)	5.17 (3.52-7.68)
24-hr	1.30 (1.16-1.50)	1.80 (1.59-2.07)	2.46 (2.17-2.84)	3.01 (2.64-3.51)	3.79 (3.21-4.57)	4.41 (3.66-5.42)	5.06 (4.10-6.37)	5.74 (4.53-7.44)	6.71 (5.07-9.05)	7.48 (5.46-10.4)
2-day	1.51 (1.34-1.74)	2.10 (1.86-2.42)	2.90 (2.56-3.35)	3.58 (3.14-4.17)	4.54 (3.85-5.47)	5.31 (4.41-6.53)	6.12 (4.96-7.71)	6.99 (5.51-9.05)	8.22 (6.21-11.1)	9.21 (6.73-12.9)
3-day	1.62 (1.44-1.86)	2.26 (2.00-2.61)	3.15 (2.78-3.64)	3.91 (3.42-4.55)	4.98 (4.22-6.00)	5.84 (4.85-7.18)	6.76 (5.47-8.51)	7.74 (6.10-10.0)	9.14 (6.91-12.3)	10.3 (7.52-14.4)
4-day	1.74 (1.54-2.00)	2.43 (2.15-2.80)	3.40 (3.00-3.93)	4.22 (3.70-4.92)	5.38 (4.56-6.48)	6.33 (5.25-7.78)	7.33 (5.93-9.23)	8.40 (6.62-10.9)	9.94 (7.52-13.4)	11.2 (8.18-15.6)
7-day	1.93 (1.71-2.22)	2.70 (2.39-3.11)	3.76 (3.32-4.35)	4.67 (4.09-5.44)	5.97 (5.06-7.19)	7.01 (5.82-8.62)	8.12 (6.58-10.2)	9.30 (7.33-12.0)	11.0 (8.32-14.8)	12.4 (9.04-17.3)
10-day	2.06 (1.82-2.37)	2.88 (2.55-3.32)	4.02 (3.54-4.64)	4.98 (4.36-5.81)	6.37 (5.40-7.67)	7.48 (6.21-9.20)	8.66 (7.02-10.9)	9.93 (7.82-12.9)	11.7 (8.88-15.8)	13.2 (9.65-18.4)
20-day	2.44 (2.16-2.81)	3.43 (3.04-3.96)	4.82 (4.25-5.57)	6.00 (5.25-6.99)	7.70 (6.52-9.27)	9.07 (7.53-11.2)	10.5 (8.52-13.3)	12.1 (9.52-15.6)	14.3 (10.8-19.3)	16.1 (11.8-22.5)
30-day	2.84 (2.52-3.27)	3.99 (3.54-4.60)	5.61 (4.95-6.48)	6.99 (6.12-8.15)	8.99 (7.62-10.8)	10.6 (8.81-13.0)	12.3 (9.99-15.5)	14.2 (11.2-18.4)	16.8 (12.7-22.7)	18.9 (13.8-26.4)
45-day	3.36 (2.98-3.87)	4.70 (4.16-5.42)	6.59 (5.82-7.61)	8.22 (7.20-9.57)	10.6 (8.96-12.7)	12.5 (10.4-15.4)	14.6 (11.8-18.3)	16.8 (13.2-21.7)	19.9 (15.1-26.9)	22.5 (16.4-31.4)
60-day	3.81 (3.38-4.38)	5.27 (4.66-6.07)	7.33 (6.47-8.47)	9.12 (7.99-10.6)	11.7 (9.93-14.1)	13.9 (11.5-17.0)	16.1 (13.1-20.3)	18.6 (14.7-24.1)	22.1 (16.7-29.9)	25.0 (18.3-35.0)

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.

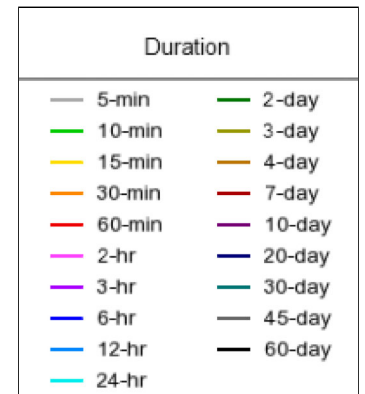
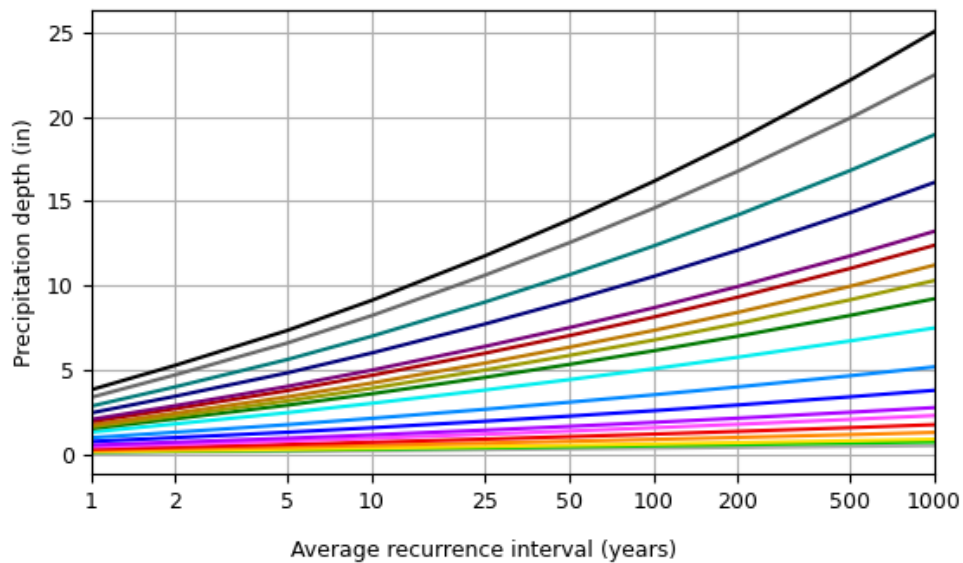
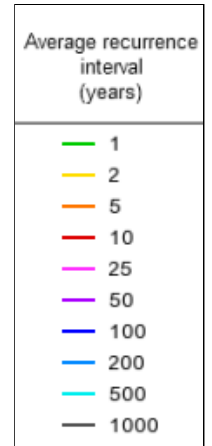
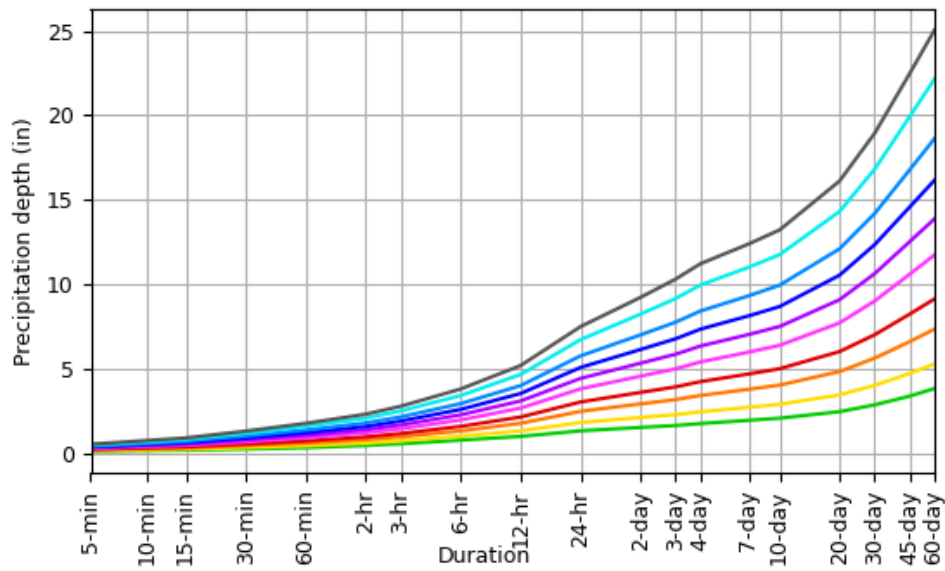
Please refer to NOAA Atlas 14 document for more information.

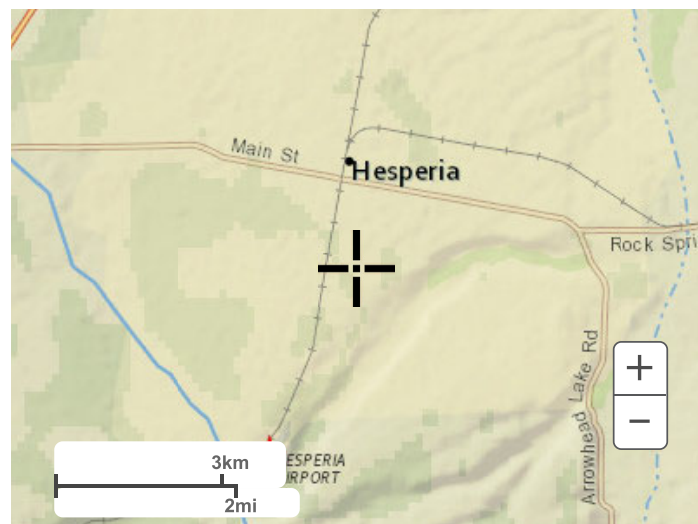
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PF graphical

PDS-based depth-duration-frequency (DDF) curves

Latitude: 34.4068°, Longitude: -117.2986°

[Back to Top](#)**Maps & aerals****Small scale terrain**



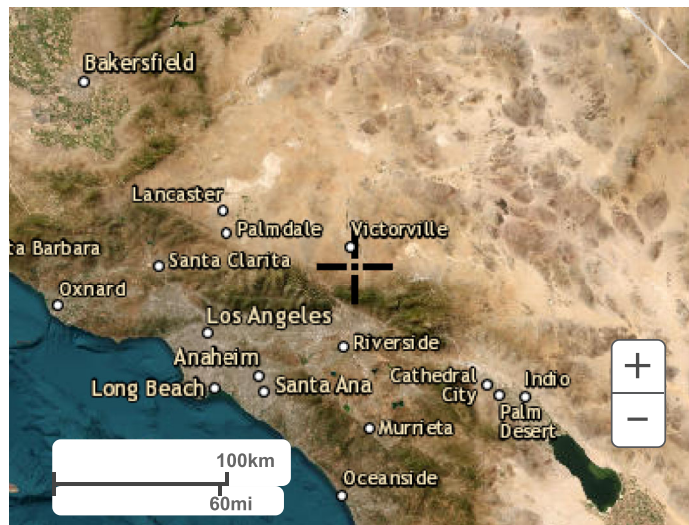
Large scale terrain



Large scale map

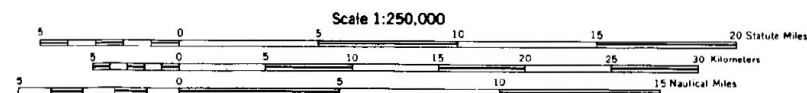
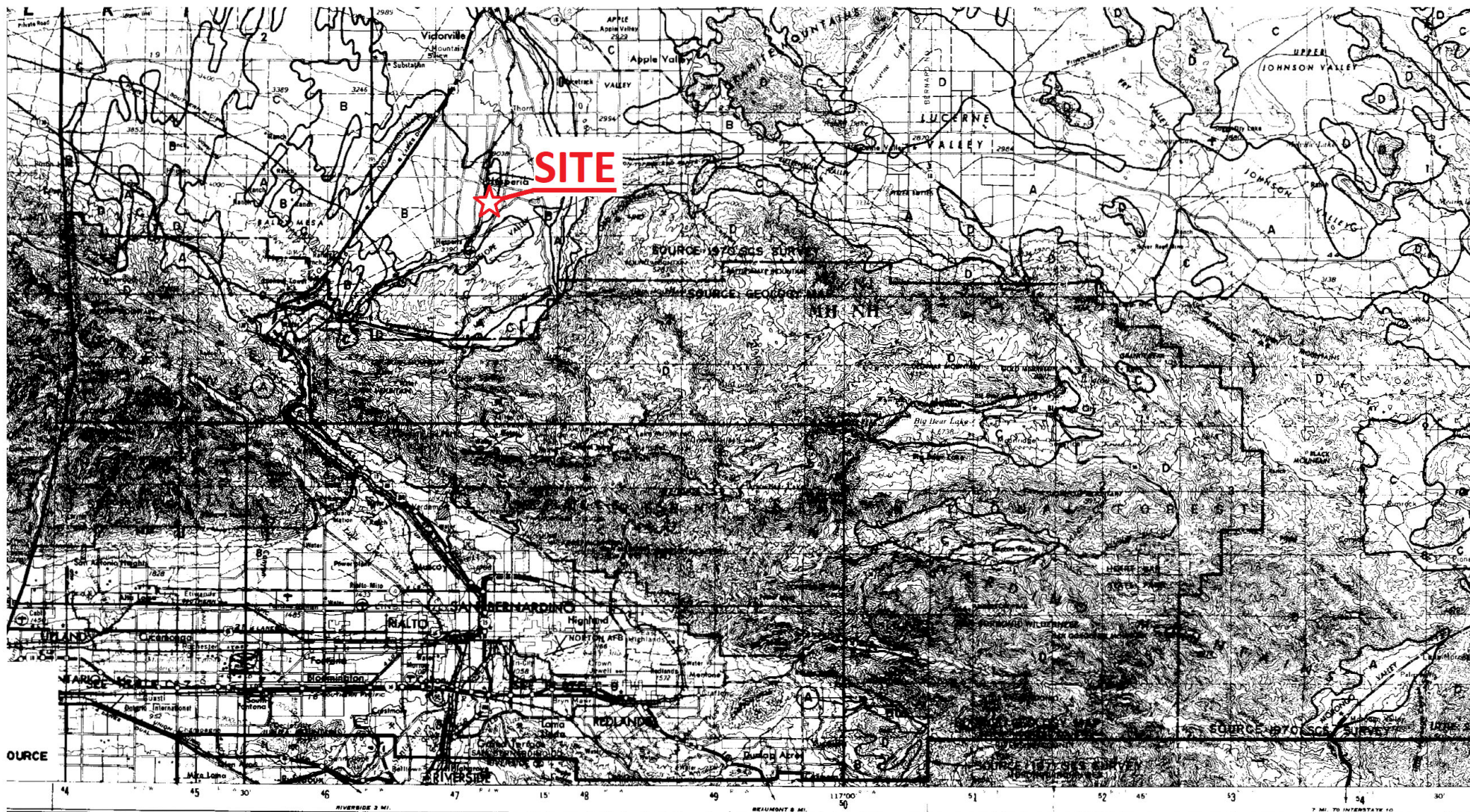


Large scale aerial



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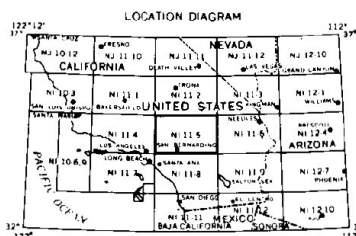
[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
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[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov
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CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION
BLACK NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 11
1965 MAGNETIC DECLINATION FROM TRUE NORTH VARIES FROM 15M° (200 MILES) EASTERLY FOR THE CENTER OF THE WEST EDGE TO 18° (210 MILES) EASTERLY FOR THE CENTER OF THE EAST EDGE

BASE MAP REPRODUCED FROM U.S.G.S. "SAN BERNARDINO" TOPOGRAPHIC MAP

SCALE REDUCED BY 1/2



HYDROLOGIC SOILS GROUP MAP FOR SOUTHCENTRAL AREA