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# PRELIMINARY DRAINAGE REPORT

for

## APOLLO WAY

Santa Rosa, CA  
APN 035-490-030, 031



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Report Date: July 7, 2023

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## **1. Project Narrative:**

The 1.52-acre project site is located on Apollo Way in Santa Rosa, south of the intersection with Mercury Way and encompasses two parcels: APN 035-490-030, -031. The project proposed to construct a community kitchen, garden, parking lot and concrete flatwork. There will be a total of 43,195-sf of new impervious surface area when the project is completed, not including 367-sf of new impervious surface in the right-of-way.

The property's slopes and slope directions vary from approximately 0 to 10%, but is generally very flat with an average slope of 1-2%. Runoff sheetflows north east to southwest, to either an existing ditch located offsite; or one of two drainage grates located at the southwesterly corner of parcel APN 035-490-030 and northwestern corner of APN 035-490-031. Existing public storm drain pipes, draining runoff from Apollo Way run through two existing public utility easements on the parcels. Per City File No. 1982-0069, one 42" diameter pipe runs east to west in a 10' P.U.E. in an adjacent parcel; when reaching the western property line of APN 035-490-031, the storm drain pipe turns 90 degrees towards the south, crossing both parcels APN's 035-490-031 and 035-490-030, ultimately exiting the project site at the southwesterly corner of parcel APN 035-490-030. An existing 24" public storm drain pipe enters the parcel APN 035-490-030 at the southeastern property corner and ex. 10' P.U.E., follows the parcels southern parcel line before connecting to the existing 42" storm drain pipe at the southwestern corner of the parcel.

The storm water runoff from the proposed building and asphalt parking lot will sheet flow and flow through a series of drainage swales, inlets, and storm drain pipes, which outlet to 6 different bioretention facilities located onsite. Excess storm water runoff from increased impervious area will be retained and treated in the bioretention facilities before outletting to the existing public storm drain system. Bioretention facilities were sized using the City of Santa Rosa LID Calculator, which should provide more than enough volume retention. See SWLID for calculations. Applicable permits will be filed as necessary, including building and environmental permits.

Drainage analysis is required to:

- Size the proposed pipes and drainage swales to ensure adequate capacity for the 10-year storm;
- Attenuate increased peak flow through volume retention in bioretention facilities.

Refer to the attached hydrology maps, which show the proposed tributary areas and drainage features.



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## 2. Design Parameters

For the purposes of this drainage report we used The Sonoma County Water Agency Flood Management Design Manual (2019) as a guideline for estimating the runoff. The hydrology calculations are shown in Appendix A.

Review of the Sonoma County Water Agency (SCWA) Flood Management Design Manual 2019 provides the following mathematical models and constant values used in the hydrologic analysis:

Description	Value	Source
Runoff Coefficient, C	0.90 0.33	All impervious area (conservative) FMDM Appendix C, residential rural with average slope over 12%
Annual Precipitation, P	33"	FMDM Appendix D
Rainfall Intensity	Varies	NOAA Atlas 14
Min. Time of concentration, Tc	7 min	Commercial
Design Storm	10-Year 100-Year	Inlets and Pipes Bioretention

## 3. Capacity Analysis for Drainage Features

Storm drain systems have been sized to convey the 10-year storm event and retain the 100-year storm event. The Hydraflow Express Extension within AutoCAD Civil 3D was used to perform the capacity calculations. A Manning's n value of 0.012 was used for smooth walled plastic SD pipe while 0.034 was used for earth swales. The geometric parameters used in the calculator match the features detailed on the improvement plans. The worst-case scenario was modelled for each particular component of the proposed drainage system.

See the attached capacity calculations for each worst-case component in Appendix A and the hydrology map for the worst-case tributary areas. See the proposed improvement plans for all inverts, slopes, and bioretention detail. Proposed storm drain pipes vary from 4" (PVC Sch. 40) to 6" (HDPE), with minimum slope of 0.5% proposed. The worst-case pipe, a 6" storm drain pipe with 2% slope was conservatively analyzed using the largest tributary area. The worst-case proposed drainage swale, which will be earth/vegetated, with a minimum slope of 1.5%, was conservatively analyzed using the largest tributary area. Bioretention facilities will have a min. 0.5' ponding depth, with 18" Bio-Treatment Soil (BSM) Mix and 12" Class II Permeable Rock. This analysis demonstrates that the proposed drainage system meets the requirements of the SCWA Flood Control Design Criteria for the 10-year storm event and provides retention for the 100-year storm event.

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#### **4. 100-Year Overland Flow Analysis**

The project site is out of the 100-year flood plain. Any overland flow due to a 100-yr storm event will either maintain current flow paths or will drain towards Apollo Way or the existing storm drain system. The proposed building is situated such that during a storm event all water will be directed away from foundations and will not become inundated during large storms or if drainage inlets were to become clogged.

#### **5. Conclusions**

In conclusion, the proposed project will:

Provide adequate flow capacity for the proposed drainage features during the 10-year and 100-year design storm event;

Provide water quality treatment per the Final SWLID report;

Provide adequate overland flow and mitigation in the case of a 100-year storm.



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# APPENDIX A CALCULATIONS

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Date: 05/01/2023

# POST-CONSTRUCTION HYDRAULICS

Job Name: Ceres Project

Job #: 107-22



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Average Annual Precipitation:	33 "		
Impervious Area C-Value (Cp):	0.90	Vegetated Area C-Value (Cv):	0.33

Pre-Construction											
Tributary ID	Impervious Surface Area (sf)	Pervious Surface Area (sf)	Total Area (sf)	Total Area (ac.)	Composite C-Value	CxA	Tc (min.)	i10	i100	Q10 (CFS)	Q100 (CFS)
1	0	66291	66291	1.52	0.33	0.50	15	1.92	2.82	0.96	1.42

Post-Construction												
Tributary ID	Impervious Surface Area (sf)	Pervious Surface Area (sf)	Total Area (sf)	Total Area (ac.)	Composite C-Value	CxA	Tc (min.)	i10	i100	Q10 (CFS)	Q100 (CFS)	
1A	4233	1637	5870	0.13	0.74	0.10	7	2.940	4.330	0.29	0.43	
1B	4842	10643	15485	0.36	0.51	0.18	7	2.940	4.330	0.53	0.78	
1C	3618	1224	4842	0.11	0.76	0.08	7	2.940	4.330	0.25	0.36	
1D	8832	10412	19244	0.44	0.59	0.26	7	2.940	4.330	0.77	1.13	
1E	8180	2764	10944	0.25	0.76	0.19	7	2.940	4.330	0.56	0.82	
1F	5486	4420	9906	0.23	0.65	0.15	7	2.940	4.330	0.43	0.64	
										Total:	2.83	4.17

Date:05/01/2023

# HYDRAULIC INPUT PARAMETERS

Job Name: Ceres Project

Job #: 107-22



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Mannings "n" Value Table	
Description	n value
Concrete, steel trowled or smooth-form finish	0.013
Concrete pipe, precast or cast-in-place	0.014
Concrete, wood float or broomed finish	0.015
Asphaltic Concrete	0.017
Corrugated metal pipe (non-spiral)	0.024
Grouted rock riprap	0.030
Loose rock riprap	0.035
Grassed Channels	0.035
Plastic Pipe	0.012

Mannings "n" Values are based on Sonoma County Water Agency's Flood Design Criteria.

## Worst-Case Drainage Feature Calculations

Drainage Feature ID	Worst Case Scenario	n-value	Slope	Tribs Contributing to Flow	Q10 (cfs)	Q100 (cfs)
6" SD Pipe	10-yr storm event - Largest Flow Smallest Slope	0.012	2.0%	1D	0.77	1.13
6" Deep Swale	10-yr storm event - Largest Flow Smallest Slope	0.034	1.5%	1D	0.77	1.13

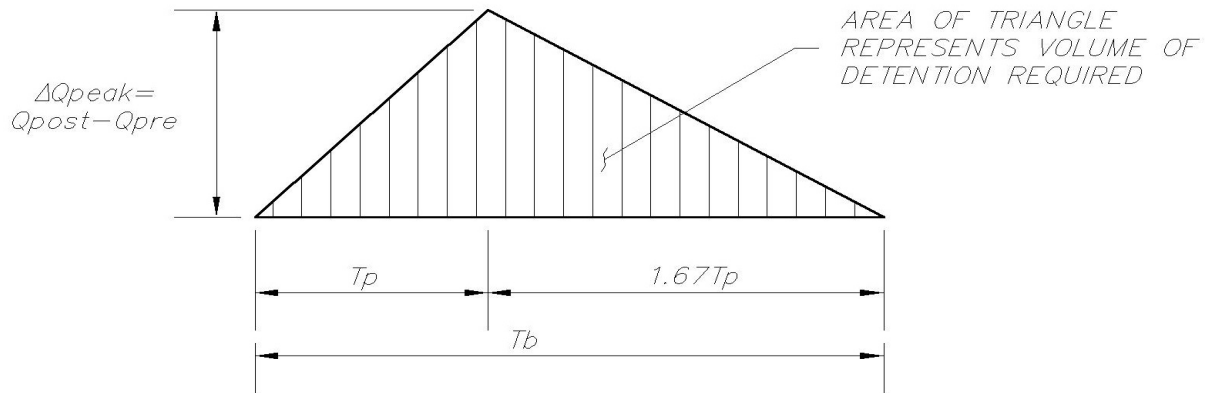


**Volume Retention Calculations for 100 yr Storm**  
**Ceres Project**  
**Santa Rosa, CA**  
**6/29/2023**

Qpre=	1.420 cfs
Qpost=	4.170 cfs
$\Delta Q$ =	2.750 cfs

Triangular Hydrograph Method\*:

\*The triangular hydrograph is an approximation of the NRCS dimensionless unit hydrograph. According to Debo and Rees (1995) this method produces results that are sufficiently accurate for most stormwater management facility designs. In this model, the base of the hydrograph is 2.67 times the time of concentration (Tp).



$T_c = T_p =$	7.00 minutes
$T_p =$	420.0 seconds
$T_b = 2.67 * T_p =$	1121.4 seconds
<b><math>V = 0.5 * \Delta Q * T_b =</math></b>	<b>1541.9 cubic ft.</b>

<b>Required Volume Retention:</b>	1541.9	cf
<b>Volume Retention Provided:</b> (See SWLID for LID Calculator)	2207	cf

## BMP Specifications

BMP ID	BMP Type	Area (sf)	Soil Depth (ft)	Planter Soil Porosity (cf)	Soil Volume Retention (cf)	Rock Depth (ft)	Drain Rock Porosity	Rock Volume Retention (cf)	Min. Ponding Depth (ft)	Ponding Volume (cf)	Total Volume (cf)
BMP-1	P1-02	144.0	1.5	0.3	64.80	1.0	0.4	57.6	0.5	72	194.40
*BMP-2	P1-02	153.0	1.5	0.3	68.85	1.0	0.4	61.2	0.5	76.5	206.55
BMP-3	P1-02	288.0	1.5	0.3	129.60	1.0	0.4	115.2	0.5	144	388.80
BMP-4	P1-02	223.0	1.5	0.3	100.35	1.0	0.4	89.2	0.5	111.5	301.05
BMP-5	P1-02	522.0	1.5	0.3	234.90	1.0	0.4	208.8	0.5	261	704.70
BMP-6	P1-02	297.0	1.5	0.3	133.65	1.0	0.4	118.8	0.5	148.5	400.95
BMP-7	P1-02	4.0	1.5	0.3	1.80	1.0	0.4	1.6	0.5	2	5.40
BMP-8	P1-02	4.0	1.5	0.3	1.80	1.0	0.4	1.6	0.5	2	5.40

\*Note: BMP-2 Volume storage offset by BMP-3, BMP-5, and BMP-6

Total BMP Area:	1635.0
-----------------	--------

Required Volume Retention:	1796	(from LID calculator)
Total Bioretention Volume Retention:	2207	

# Channel Report

## Worst-Case 6-in SD Pipe (10-year Storm)

### Circular

Diameter (ft) = 0.50

Invert Elev (ft) = 1.00

Slope (%) = 2.00

N-Value = 0.012

### Calculations

Compute by: Known Q

Known Q (cfs) = 0.77

### Highlighted

Depth (ft) = 0.37

Q (cfs) = 0.770

Area (sqft) = 0.16

Velocity (ft/s) = 4.93

Wetted Perim (ft) = 1.04

Crit Depth, Yc (ft) = 0.44

Top Width (ft) = 0.44

EGL (ft) = 0.75

Elev (ft)

Section

2.00

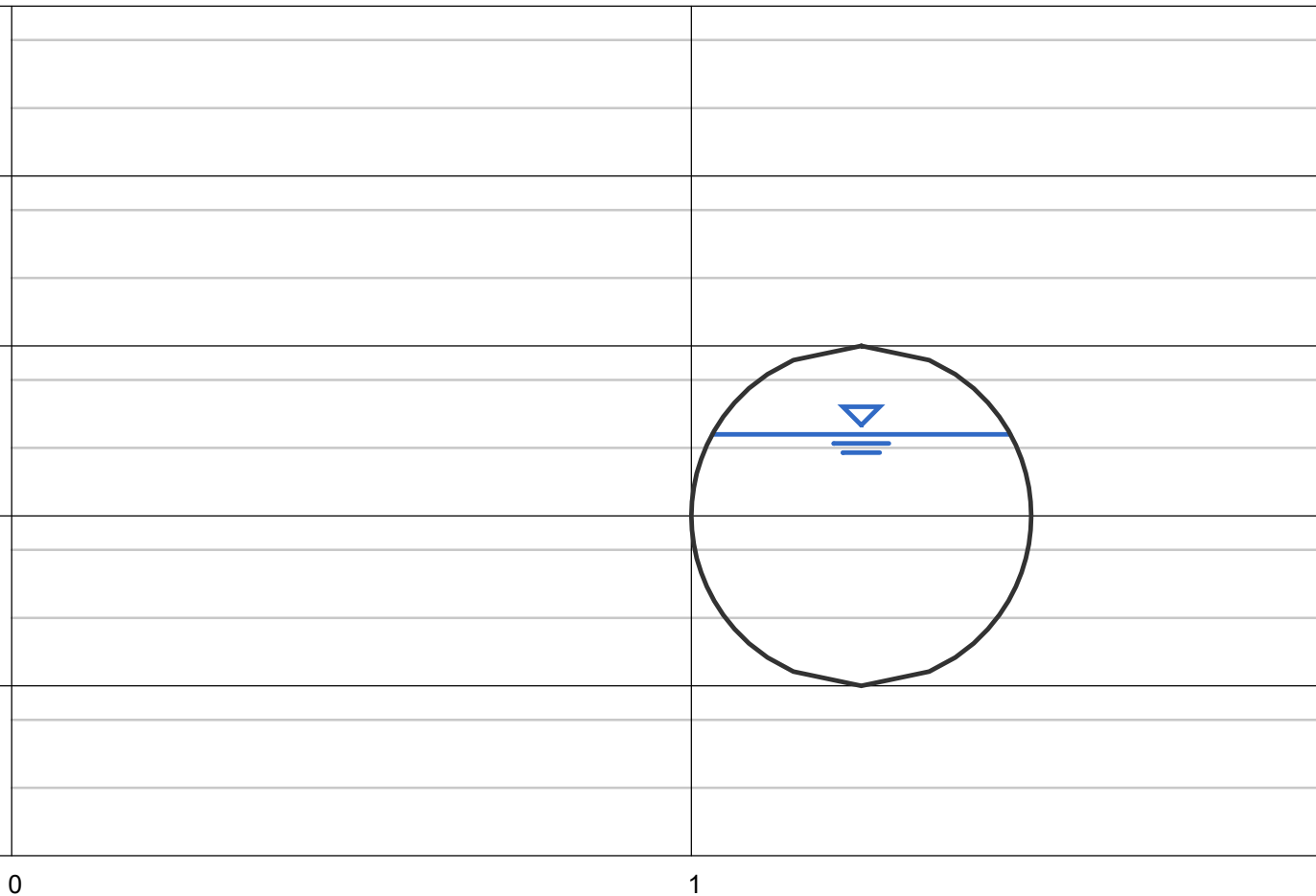
1.75

1.50

1.25

1.00

0.75



Reach (ft)

# Channel Report

## Worst-Case Swale (10-year Storm)

### Triangular

Side Slopes (z:1) = 2.00, 2.00

Total Depth (ft) = 0.50

Invert Elev (ft) = 1.00

Slope (%) = 1.50

N-Value = 0.034

### Calculations

Compute by: Known Q

Known Q (cfs) = 0.77

### Highlighted

Depth (ft) = 0.46

Q (cfs) = 0.770

Area (sqft) = 0.42

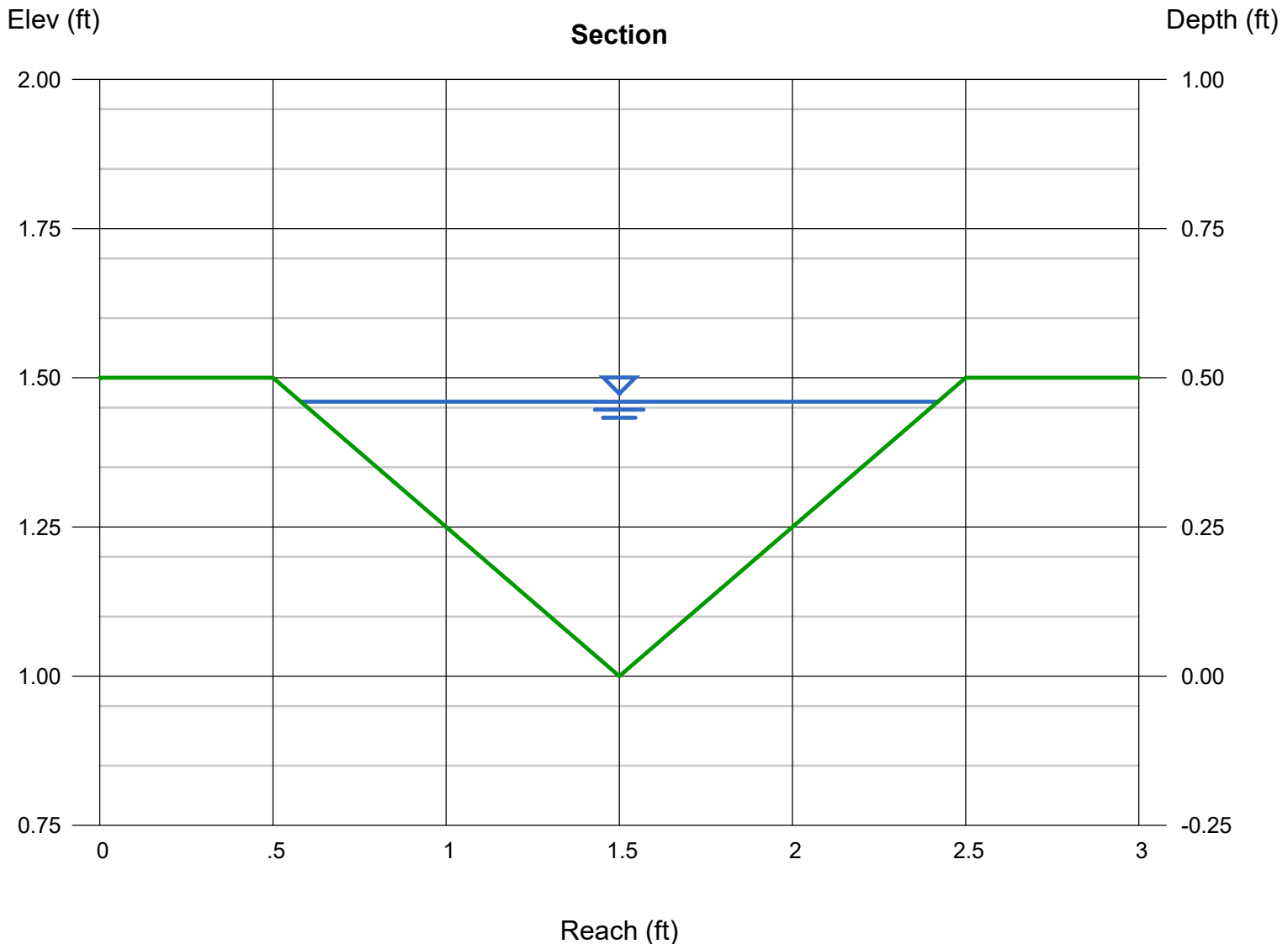
Velocity (ft/s) = 1.82

Wetted Perim (ft) = 2.06

Crit Depth,  $Y_c$  (ft) = 0.40

Top Width (ft) = 1.84

EGL (ft) = 0.51





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# APPENDIX B

## REFERENCE MATERIAL

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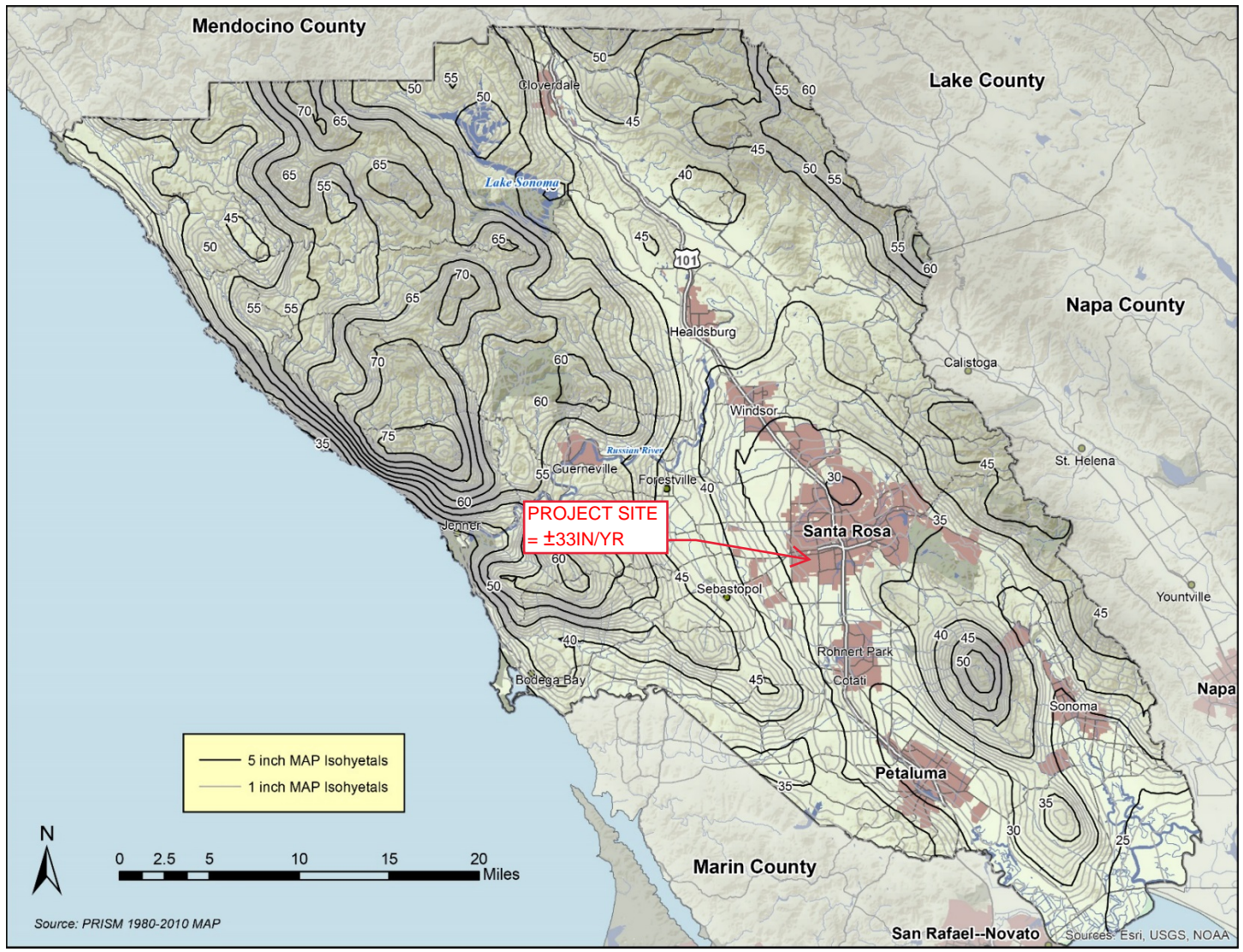


Figure D.2-1. Mean Annual Precipitation



**NOAA Atlas 14, Volume 6, Version 2**  
**Location name: Santa Rosa, California, USA\***  
**Latitude: 38.4217°, Longitude: -122.7494°**  
**Elevation: m/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](#)

**Interpolation:  
2.94 at 7-min.**

**Interpolation:  
4.33 at 7-min.**

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)<sup>1</sup></b>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.96 (1.74-2.22)	2.35 (2.09-2.68)	2.88 (2.56-3.29)	3.32 (2.92-3.83)	3.92 (3.31-4.70)	4.39 (3.61-5.40)	4.88 (3.90-6.18)	5.40 (4.18-7.06)	6.11 (4.50-8.36)	6.66 (4.72-9.50)
10-min	1.40 (1.25-1.59)	1.69 (1.50-1.92)	2.06 (1.83-2.36)	2.38 (2.09-2.74)	2.81 (2.37-3.37)	3.15 (2.59-3.87)	3.50 (2.80-4.43)	3.87 (2.99-5.05)	4.37 (3.22-6.00)	4.77 (3.38-6.81)
15-min	1.13 (1.00-1.28)	1.36 (1.21-1.55)	1.66 (1.48-1.90)	1.92 (1.68-2.21)	2.27 (1.91-2.72)	2.54 (2.09-3.12)	2.82 (2.26-3.57)	3.12 (2.41-4.08)	3.53 (2.60-4.84)	3.85 (2.72-5.49)
30-min	0.784 (0.696-0.890)	0.942 (0.836-1.07)	1.15 (1.02-1.32)	1.33 (1.17-1.53)	1.57 (1.32-1.88)	1.76 (1.45-2.16)	1.96 (1.56-2.47)	2.16 (1.67-2.82)	2.44 (1.80-3.35)	2.66 (1.89-3.80)
60-min	0.540 (0.481-0.614)	0.650 (0.578-0.739)	0.796 (0.705-0.908)	0.917 (0.804-1.06)	1.08 (0.913-1.30)	1.21 (0.999-1.49)	1.35 (1.08-1.71)	1.49 (1.15-1.95)	1.69 (1.24-2.31)	1.84 (1.30-2.62)
2-hr	0.404 (0.359-0.458)	0.484 (0.430-0.550)	0.587 (0.520-0.670)	0.670 (0.587-0.772)	0.780 (0.657-0.934)	0.862 (0.709-1.06)	0.944 (0.754-1.19)	1.03 (0.794-1.34)	1.14 (0.838-1.56)	1.22 (0.864-1.74)
3-hr	0.339 (0.301-0.385)	0.406 (0.361-0.462)	0.491 (0.435-0.560)	0.558 (0.489-0.642)	0.645 (0.544-0.773)	0.710 (0.584-0.872)	0.774 (0.618-0.979)	0.838 (0.648-1.10)	0.921 (0.679-1.26)	0.983 (0.696-1.40)
6-hr	0.254 (0.226-0.288)	0.304 (0.270-0.346)	0.366 (0.324-0.418)	0.415 (0.364-0.478)	0.477 (0.402-0.571)	0.522 (0.429-0.641)	0.566 (0.452-0.716)	0.609 (0.471-0.796)	0.665 (0.490-0.911)	0.705 (0.499-1.01)
12-hr	0.177 (0.157-0.201)	0.213 (0.189-0.243)	0.258 (0.228-0.294)	0.292 (0.256-0.337)	0.336 (0.284-0.403)	0.368 (0.303-0.452)	0.399 (0.319-0.504)	0.429 (0.332-0.560)	0.467 (0.344-0.640)	0.495 (0.350-0.706)
24-hr	0.120 (0.108-0.136)	0.146 (0.132-0.166)	0.179 (0.160-0.204)	0.203 (0.181-0.233)	0.235 (0.203-0.277)	0.258 (0.218-0.310)	0.279 (0.232-0.343)	0.300 (0.243-0.379)	0.327 (0.255-0.428)	0.347 (0.262-0.468)
2-day	0.079 (0.071-0.090)	0.098 (0.088-0.112)	0.122 (0.109-0.138)	0.139 (0.124-0.160)	0.161 (0.139-0.191)	0.177 (0.150-0.213)	0.193 (0.160-0.237)	0.207 (0.168-0.261)	0.226 (0.176-0.295)	0.239 (0.181-0.323)
3-day	0.060 (0.054-0.068)	0.076 (0.068-0.086)	0.095 (0.085-0.108)	0.109 (0.097-0.125)	0.127 (0.109-0.150)	0.139 (0.118-0.168)	0.152 (0.126-0.186)	0.163 (0.132-0.206)	0.178 (0.139-0.232)	0.188 (0.142-0.254)
4-day	0.050 (0.045-0.057)	0.063 (0.057-0.072)	0.080 (0.071-0.091)	0.092 (0.082-0.105)	0.107 (0.092-0.126)	0.118 (0.100-0.142)	0.128 (0.106-0.157)	0.138 (0.112-0.174)	0.150 (0.117-0.196)	0.159 (0.120-0.214)
7-day	0.036 (0.032-0.040)	0.045 (0.041-0.051)	0.057 (0.051-0.065)	0.065 (0.058-0.075)	0.076 (0.066-0.090)	0.084 (0.071-0.101)	0.091 (0.076-0.112)	0.098 (0.079-0.124)	0.107 (0.083-0.139)	0.113 (0.085-0.152)
10-day	0.028 (0.026-0.032)	0.036 (0.032-0.041)	0.045 (0.041-0.052)	0.052 (0.047-0.060)	0.061 (0.053-0.072)	0.067 (0.057-0.081)	0.073 (0.060-0.089)	0.078 (0.063-0.098)	0.085 (0.066-0.111)	0.089 (0.068-0.121)
20-day	0.019 (0.017-0.021)	0.024 (0.022-0.027)	0.030 (0.027-0.034)	0.035 (0.031-0.040)	0.040 (0.035-0.047)	0.044 (0.037-0.053)	0.048 (0.039-0.058)	0.051 (0.041-0.064)	0.055 (0.043-0.072)	0.058 (0.044-0.078)
30-day	0.015 (0.014-0.017)	0.019 (0.017-0.022)	0.024 (0.022-0.028)	0.028 (0.025-0.032)	0.032 (0.028-0.038)	0.035 (0.030-0.042)	0.038 (0.031-0.047)	0.040 (0.033-0.051)	0.043 (0.034-0.057)	0.046 (0.034-0.061)
45-day	0.012 (0.011-0.014)	0.016 (0.014-0.018)	0.020 (0.018-0.022)	0.022 (0.020-0.026)	0.026 (0.022-0.031)	0.028 (0.024-0.034)	0.030 (0.025-0.037)	0.032 (0.026-0.041)	0.035 (0.027-0.045)	0.036 (0.027-0.049)
60-day	0.011 (0.010-0.012)	0.014 (0.013-0.016)	0.017 (0.016-0.020)	0.020 (0.018-0.023)	0.023 (0.020-0.027)	0.025 (0.021-0.030)	0.026 (0.022-0.032)	0.028 (0.023-0.035)	0.030 (0.023-0.039)	0.031 (0.024-0.042)

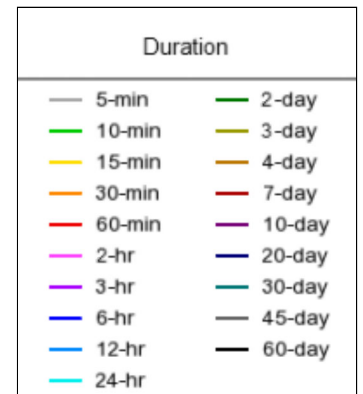
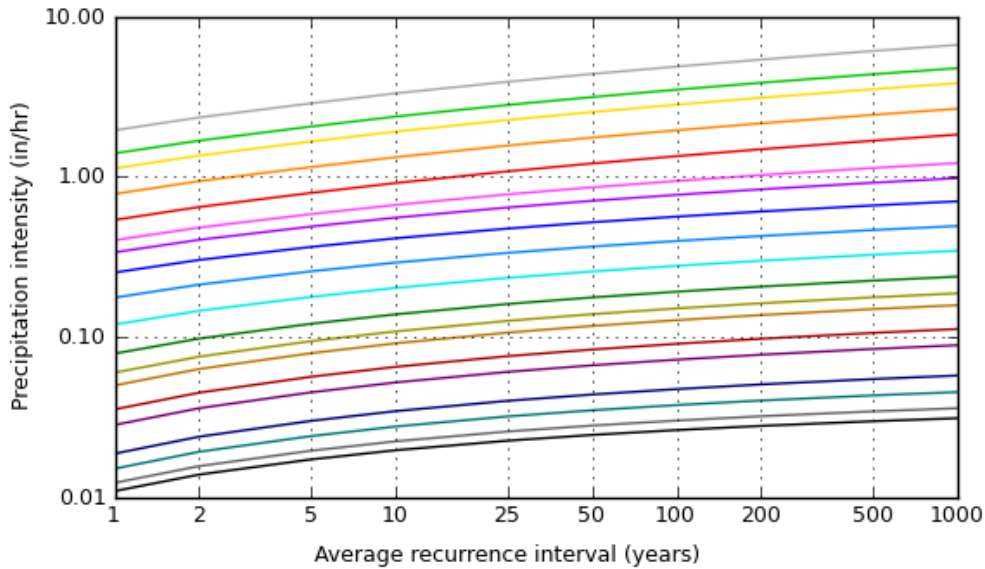
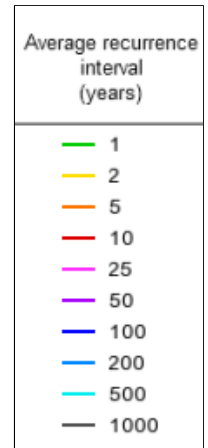
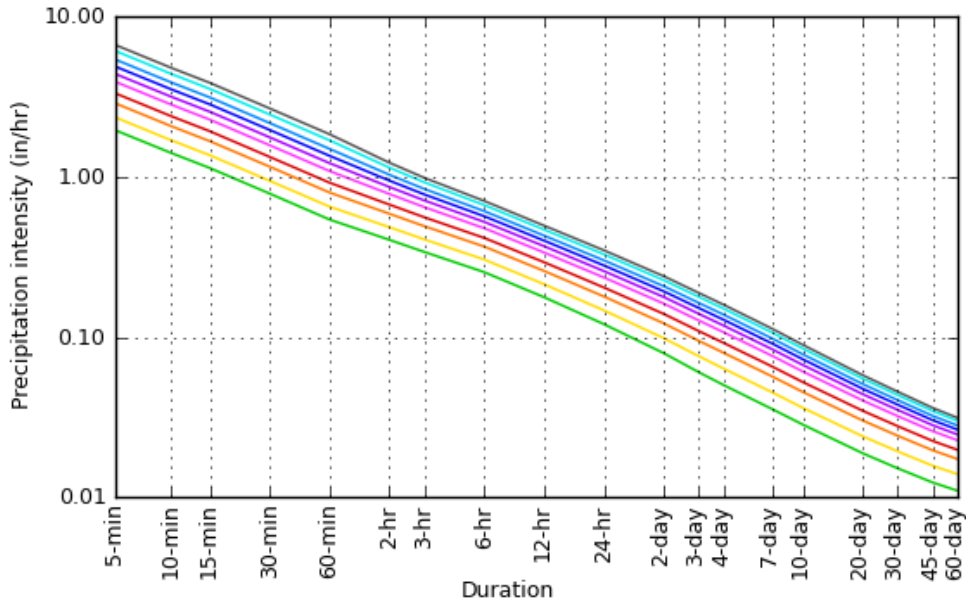
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration 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 intensity-duration-frequency (IDF) curves

Latitude: 38.4217°, Longitude: -122.7494°

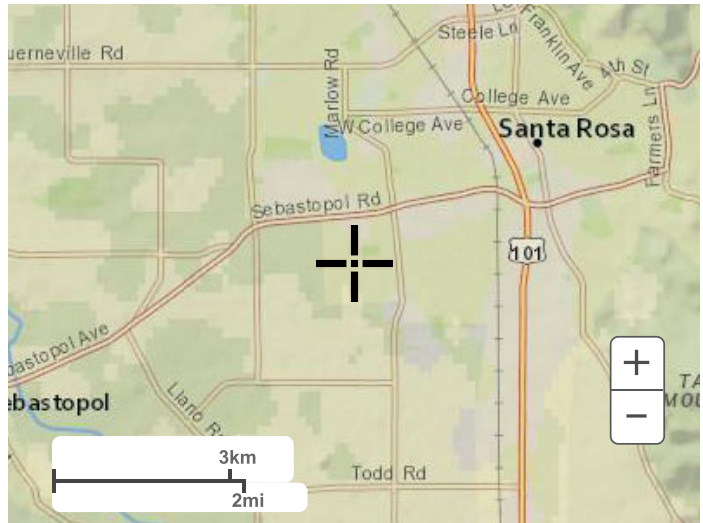


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**Maps & aerials**

**Small scale terrain**





Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

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[National Oceanic and Atmospheric Administration](#)  
[National Weather Service](#)  
[National Water Center](#)  
1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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Surveying  
Entitlements  
Concept Design  
Feasibility Studies

# APPENDIC C

## HYDROLGY MAP

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**LEGEND**

- RECORD BOUNDARY LINE
- RECORD ADJOINING BOUNDARY LINE
- EXISTING EASEMENT LINE
- BOUNDARY CENTER LINE
- SURFACE GRADE BREAK
- VEGETATED SWALE, SIZE TO BE DETERMINED
- EXISTING FLOWLINE
- PROPOSED FENCE
- PROPOSED STRIPING
- NEW IMPERVIOUS AREA
- BMP AREA - PROPOSED BIORETENTION CELLS
- TRIBUTARY AREA
- EXISTING CONTOURS
- EXISTING STORM DRAIN PIPE
- PROPOSED CORRUGATED HDPE STORM DRAIN PIPE
- FLOW DIRECTION
- EX. FIRE HYDRANT
- EX. WATER VALVE
- EX. IRRIGATION VALVE
- EX. WATER METER
- EX. ELECTRIC PULL BOX
- EX. SEWER MANHOLE
- EX. SEWER CLEAN OUT
- EX. STREET LIGHT
- TRIBUTARY ID
- AREA SF
- AREA AC

**ABBREVIATIONS**

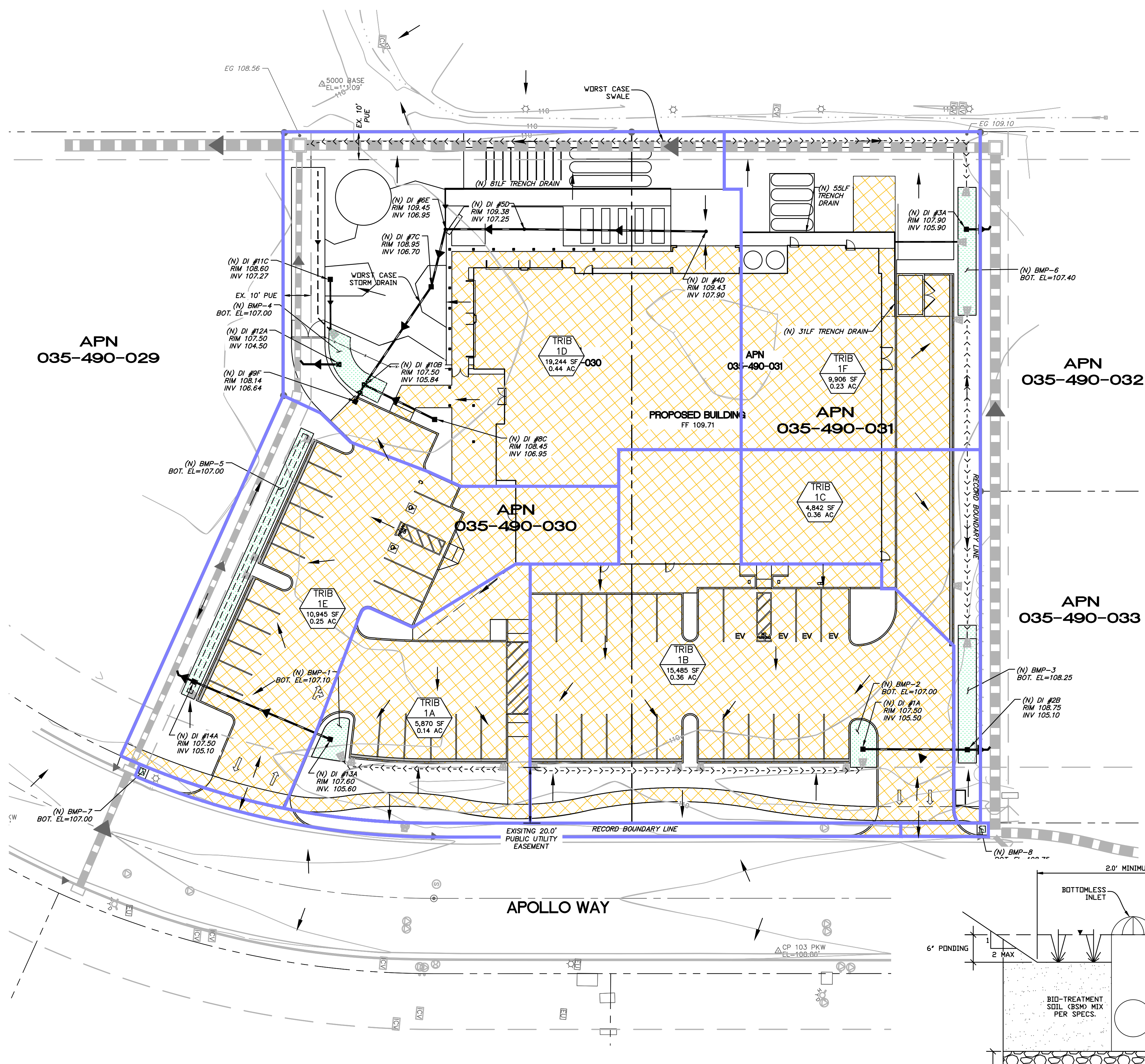
- BMP** BEST MANAGEMENT PRACTICE
- BTM** BOTTOM
- CB** CATCH BASIN
- CO** CLEANOUT
- DI** DROP INLET
- DWY** DRIVEWAY
- EL, E.L.E.** ELEVATION
- EG** EXISTING GRADE
- EX, EX.** EXISTING
- FF** FINISH FLOOR ELEVATION
- FL** FLOWLINE
- FS** FINISH SURFACE ELEVATION
- FG** FINISH GRADE ELEVATION
- HDPE** HIGH DENSITY POLYETHYLENE
- HP** HIGH POINT
- INV** INVERT
- LF** LINEAR FEET
- MCE** MUNSELLE CIVIL ENGINEERING
- NEW** NEW
- (N)** PROPOSED
- (P)** PUBLIC UTILITY EASEMENT
- PUE** PROPERTY LINE
- PL** PROPERTY LINE
- PVC** POLYVINYL CHLORIDE
- RIM** DROP INLET RIM ELEVATION
- R.O.W., ROW** RIGHT OF WAY
- SD** STORM DRAIN
- TD** TRENCH DRAIN
- TYP.** TYPICAL

**DRAINAGE SCHEDULE**

- #A** OLDCASTLE PRECAST CONCRETE 12"x12" DROP INLET WITH ATRIUM GRATE AND FLOW GARD CB OUTLET TRASH SCREEN INSERT, OR EQUIVALENT OTHER
  - #B** 12"x12" BUBBLE-UP DRAIN WITH NDS 12" SQUARE GREEN ATRIUM GRATES, OR EQUIVALENT OTHER
  - #C** PIPE RISER WITH NDS 6" GREEN ATRIUM GRATE, OR EQUIVALENT OTHER
  - #D** PIPE RISER WITH 6" DECORATIVE GRATE, DESIGN BY OTHERS
  - #E** STORM DRAIN CLEANOUT WITH 6" DECORATIVE LID, DESIGN BY OTHERS
  - #F** OLDCASTLE PRECAST CONCRETE 12"x12" DROP INLET WITH TRAFFIC-RATED GRATE (H2O LOADING)
- TRENCH DRAIN TO BE NDS MICRO CHANNEL OR ACO BRICKSLOT K100 (OR APPROVED EQUAL), DESIGN TO BE BY OTHERS

**PERMEABILITY CALCULATIONS**

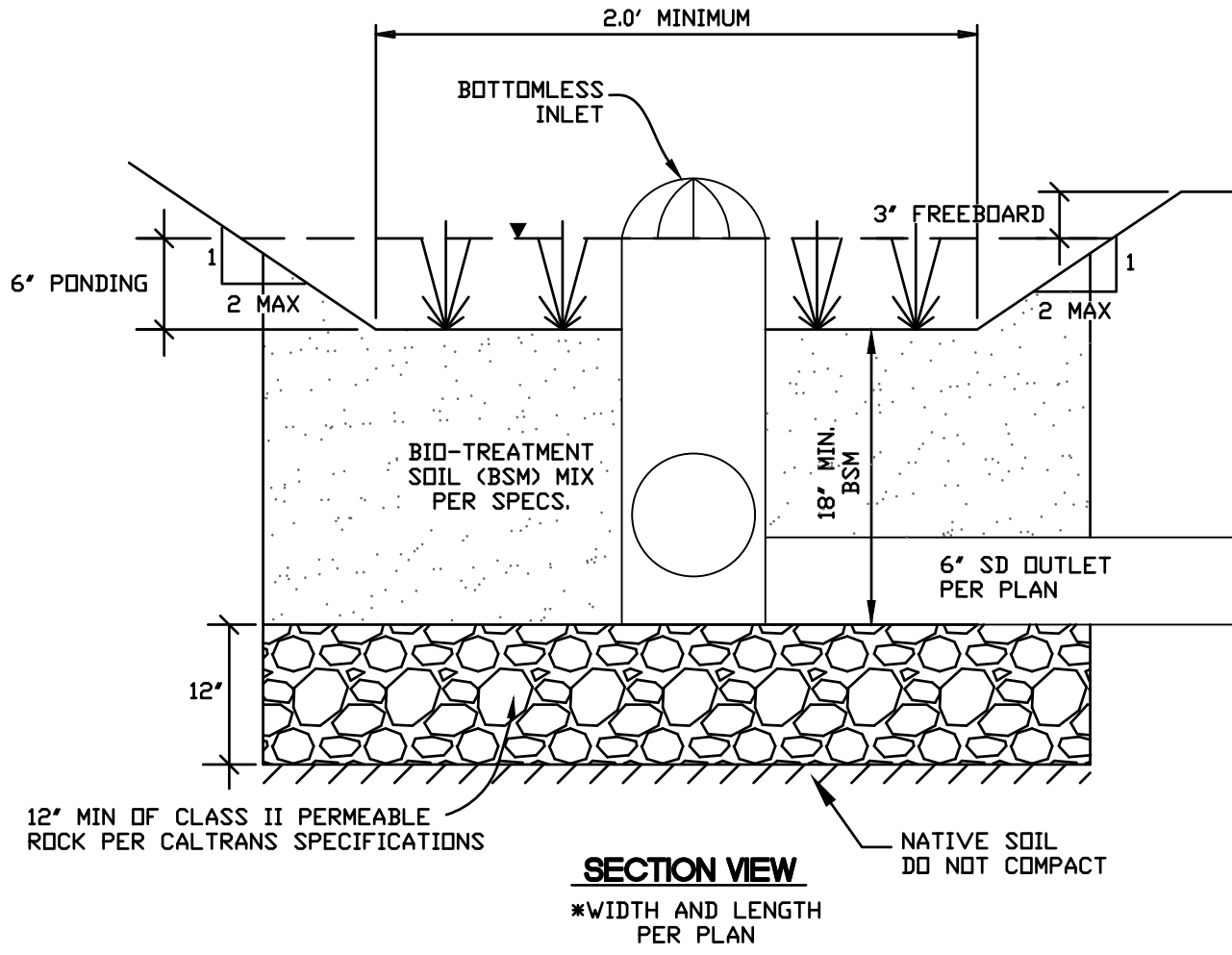
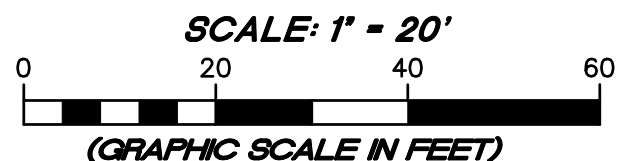
PRE-AND POST-CONSTRUCTION PERVIOUS/IMPERVIOUS AREAS (WITHIN TRIB LIMITS)			
	IMPERVIOUS AREA (SF)	% OF TRIB	PERVIOUS AREA (SF)
NOTE: TOTAL PARCEL AREA=66,291 SF=1.52 AC			
PRE-CONSTRUCTION	0 SF	0.0%	66,274 SF
POST CONSTRUCTION	43,195 SF	65.2%	23,096 SF
POST CONSTRUCTION INCREASED IMPERVIOUS AREA (INCLUDING 367 SF WITHIN R.O.W.)	43,562 SF		



**SOIL TYPES:**  
 ZcA - ZAMORA SILTY CLAY LOAM  
 CIA - CLEAR LAKE CLAY

**NOTE:**  
 IMPERVIOUS AREA SHOWN AND CORRESPONDING CV VALUES ACCOUNT FOR THE FULL BUILDOUT OF THE PROJECT.

**PROPOSED CONDITIONS**



REVISION	DESCRIPTION	BY	DATE

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**DANIEL JOHN HUGHES**  
 REGISTERED PROFESSIONAL ENGINEER - CIVIL  
 No. 60225  
 STATE OF CALIFORNIA

**Daniel J. Hughes**  
 DANIEL JOHN HUGHES DATE  
 PCE 60225

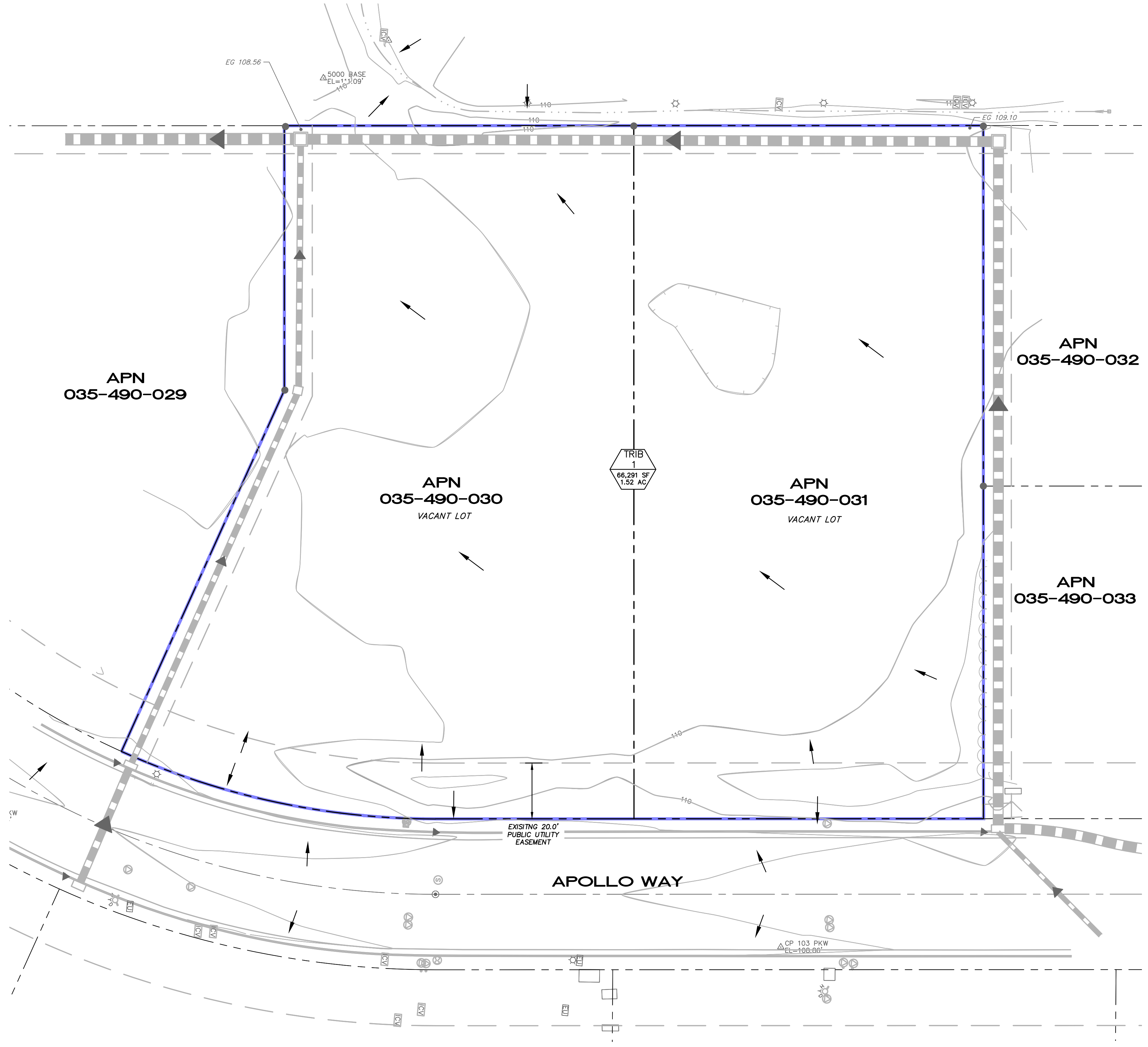
**APOLLO WAY  
 PROPOSED CONDITIONS**  
 APN 035-490-030 - 031  
 APOLLO WAY  
 SANTA ROSA, CA

JUNE 29, 2023  
 JOB NO. 107-22  
 SHEET NO.

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**LEGEND**

- RECORD BOUNDARY LINE
- RECORD ADJOINING BOUNDARY LINE
- EXISTING EASEMENT LINE
- BOUNDARY CENTER LINE
- EXISTING FLOWLINE
- TRIBUTARY AREA
- EXISTING CONTOURS
- EXISTING STORM DRAIN PIPE
- FLOW DIRECTION
- EX. FIRE HYDRANT
- EX. WATER VALVE
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- EX. SEWER MANHOLE
- EX. SEWER CLEAN OUT
- EX. STREET LIGHT
- TRIBUTARY ID
- AREA SF
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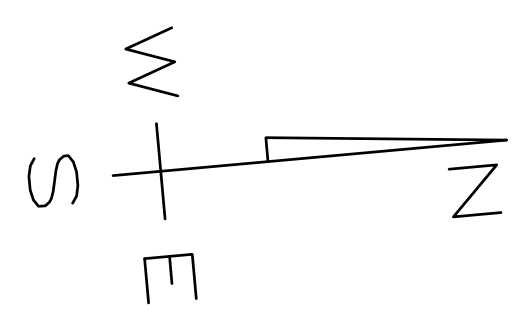
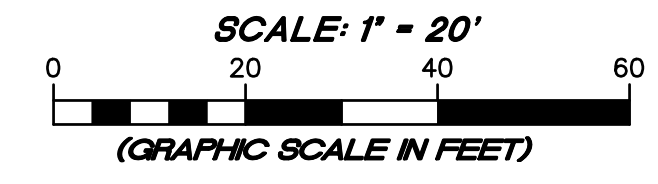
**PERMEABILITY CALCULATIONS**

PRE- AND POST-CONSTRUCTION PERVIOUS/IMPERVIOUS AREAS (WITHIN TRIBUTARY LIMITS)				
	IMPERVIOUS AREA (SF)	% OF TRIBUTARY	PERVIOUS AREA (SF)	% OF TRIBUTARY
NOTE: TOTAL PARCEL AREA-66,291 SF-1.52 AC				
PRE-CONSTRUCTION	0 SF	0.0%	66,274 SF	100.0%
POST CONSTRUCTION	43,195 SF	65.2%	23,096 SF	34.8%
POST CONSTRUCTION INCREASED IMPERVIOUS AREA (INCLUDING 367 SF WITHIN R.O.W.)	43,562 SF			

**SOIL TYPES:**  
 ZcA - ZAMORA SILTY CLAY LOAM  
 CIA - CLEAR LAKE CLAY

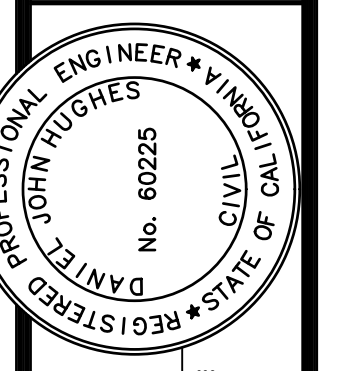
**NOTE:**  
 IMPERVIOUS AREA SHOWN AND CORRESPONDING CV VALUES ACCOUNT FOR THE FULL BUILDOUT OF THE PROJECT.

**EXISTING CONDITIONS**



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*Daniel Hughes*  
 DANIEL JOHN HUGHES DATE  
 PCE 60225

**APOLLO WAY**  
**EXISTING CONDITIONS**  
 APN 035-490-030 -031  
 APOLLO WAY  
 SANTA ROSA, CA

JUNE 29, 2023  
 JOB NO.  
 107-22

SHEET NO.  
**2**  
 OF 2 SHEETS