DRAINAGE REPORT

Proposed Subdivision
1820 Pickett Road
McKinleyville 95519
County of Humboldt
California
APN: 510-381-021

Report Provided For:
Dane Valadao
3848 E Street
Eureka, CA 95503

Report Provided By:
Trinity Valley Consulting Engineers, Inc.
Post Office Box 1567
Willow Creek, California 95573
(530) 629-3000

Date: February 2021
Revised: December 2023

Project Number: 873.01

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Introduction:
Trinity Valley Consulting Engineers, Inc. (TVCE) was secured by Mr. Dane Valadao to perform a drainage report for the proposed project. The following is an outline of our findings and recommendations.

Project Site Location:
The project site is in a portion of Section 32, of Township 6 North, Range 1 East of Humboldt Meridian, in the town of McKinleyville, in the County of Humboldt, and State of California (see Attachment 1, Location Map). The Assessor Parcel Number (APN) for the property is 509-114-016.

Project Site Conditions:
The existing site is mainly manicured lawn with a single residence, single garage, and storage shed located in the center of the parcel. Paved access is from G Lane to the east. The parcel is bordered by Pickett Road to the north and Gwin Road to the south. Existing stormwater drainage inlets have not been identified in the immediate area.

Relief of the project area slopes to the north. Slopes onsite are nearly flat (less than 1%), and stormwater flows as overland flow and eventually onto Pickett Road (see Attachment 2, Drainage Map). Pickett road drainage consists a roadside swale along the south border and a curb and gutter along the north.

Proposed Project:
The proposed project is to subdivide the existing parcel into approximately twenty (20) lots. The center lot will consist of the existing home and garage. The existing garage may need to be moved in order to accommodate the development. The remaining lots will be developed with single and muti-family residences. New access for this development will consist of a paved two-lane road from Gwin Road to Pickett Road. Grading for each site will consist of construction of access roadways and building pads. Building pads will generally be constructed of standard cut/fill bench construction. All utilities will be trenched underground.

Runoff Calculations:
Calculations were performed for the entire site in order to determine the amount of increase in runoff from the property after the development of the property is complete (see attached calculations, Attachment 3).

For these calculations the following constraints and assumptions were utilized:

<u>Pre-development constraints</u>

Design Storm Event (year):	100
Design Storm Duration (hr):	1
Pervious Surface (Acres):	2.65
Impervious Surface (Acres):	0.09

<u>Post Development constraints</u>

Design Storm Event (year):	100
Design Storm Duration (hr):	1
Pervious Surface (Acres):	1.01
Impervious Surface (Acres):	1.73

Runoff coefficient: The runoff coefficient was determined to be 0.23 pre-development and 0.64 post-development. These numbers were calculated based on the existing conditions, area of roadway surfaces, and assumed area of roof cover at total buildout. Proposed roof areas were calculated by utilizing the preliminary plans for each unit including overhangs and parking areas. Allowance was made for sidewalks and any other hardscapes. The proposed development also incorporates permeable asphalt in the parking stalls.

Calculations showed an increase of 3.38 cubic feet per second (cfs) runoff as a result of the proposed development during a 100-year event. Per this method and the McKinleyville Drainage Plan, the minimum retention volume shall be 4,873 cubic feet (36,452 gallons).

Design Measures:

Primary design measures for treating and handling stormwater include and are not limited to: self-retaining areas, landscaping, tree planting, rain barrels, natural buffers, preservation of existing vegetation, permeable paving and reduction to impervious surfaces. In addition to these basic design measures, there are two other major design measures that a project must consider: bioretention, and subsurface infiltration. Both are explained in greater detail below:

Option 1:
Bioretention uses vegetation and soil, or engineered media, to promote stormwater treatment through filtration and storage. Bioretention utilizes bermed or excavated areas to create a basin to capture runoff. They can be adjacent to impervious areas within parking lot landscaping, along roadsides, and in open spaces to allow stormwater runoff to flow into the retention area either as sheet flow or as an end of pipe system that receives concentrated flows (e.g., from a culvert system or rock lined ditch). Bioretention is used for treating stormwater runoff from project pavement areas (e.g., roadways, parking lots, maintenance facilities, etc.) that contain pollutants of concern. Infiltration (in facilities without a liner), filtration (in facilities with a liner), sedimentation, adsorption to soil particles, biochemical processes, and plant uptake are the primary means for pollutant removal and treatment.

During a storm, runoff enters the Bioretention causing the water level in the basin to rise. During the rainfall, and for some time after it ends, the runoff infiltrates into the soil or engineered media through the invert area which is sized based upon the water treatment volume, the permeability of the soil below the invert, and the time period selected for infiltration. It is preferred that events greater than the design storm event be bypassed around the facility to preserve infiltration capacity and to prevent erosion or scour. Flows greater than the design storm event can be passed through the facility, typically over a spillway through the confining berm or through an overflow riser, when necessary.

Option 2:
Subsurface stormwater infiltration is a stormwater management technique that involves collecting rainwater then allowing it to percolate into the ground rather than runoff into surface waters. Like bioretention, this option can improve water quality by filtering contaminates from stormwater as it passes through the soil.

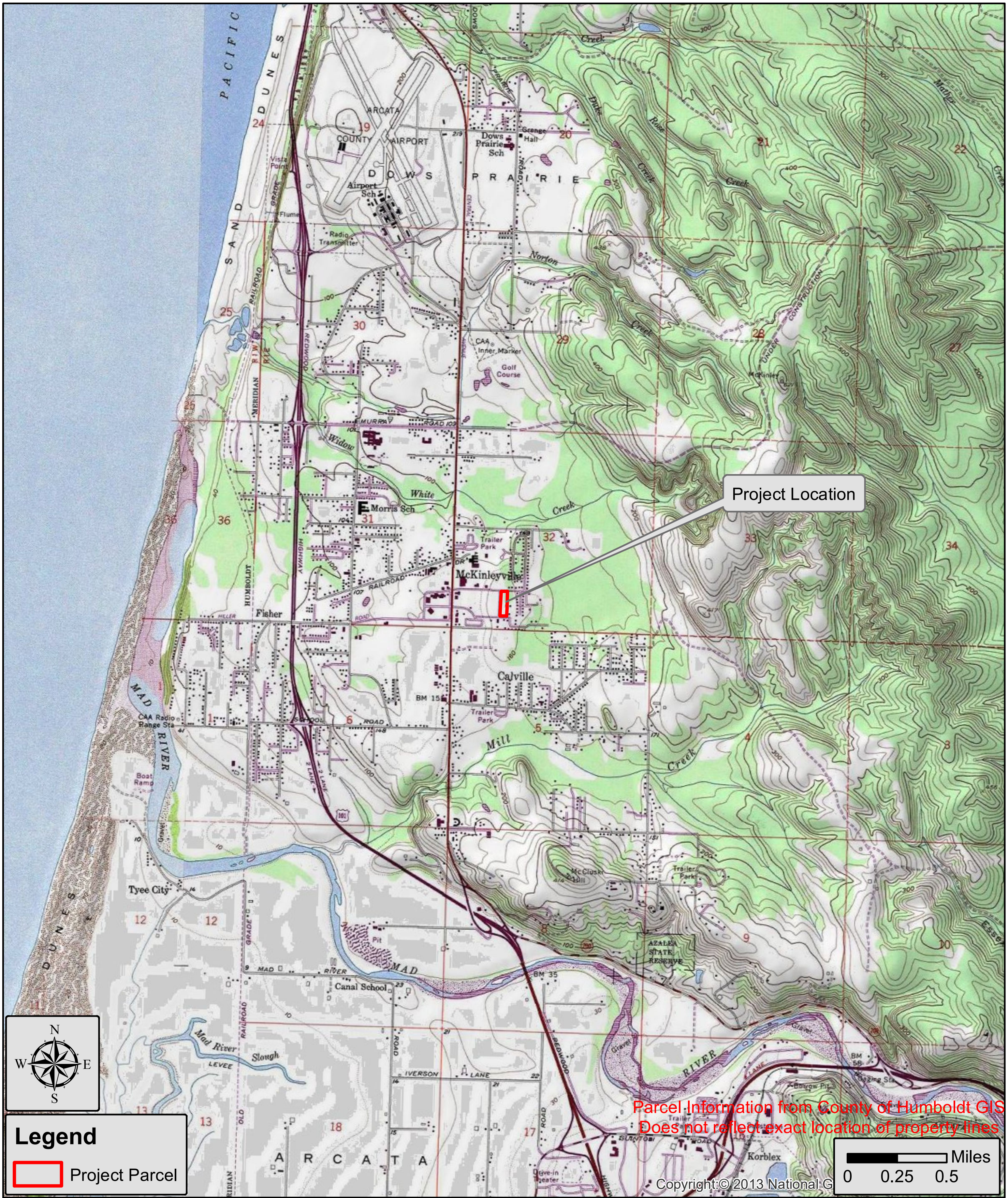
By reducing surface runoff and potential flooding, subsurface infiltration can contribute to the creation of aesthetically pleasing landscapes and recreational spaces. This can enhance the overall quality of life for residents in a development.

Lastly, subsurface infiltration helps mimic natural hydrological processes by allowing water to gradually percolate into the ground. This preserves the natural flow patterns and reduces the disruption caused by conventional stormwater management practices.

Conclusion:
Based upon the review of the site plan, preliminary drainage plan, and runoff calculations, stormwater flows from the proposed development can be accommodated within the property boundary through the use of self-retaining areas, landscaping, subsurface infiltration and bioretention strategically placed on the property.

Attachment 1:

Location Map



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Trinity Valley Consulting Engineers Inc

Valadao Proposed Subdivision
APN: 510--381-021
1820 Pickett Road
Mckinleyville, CA 95519

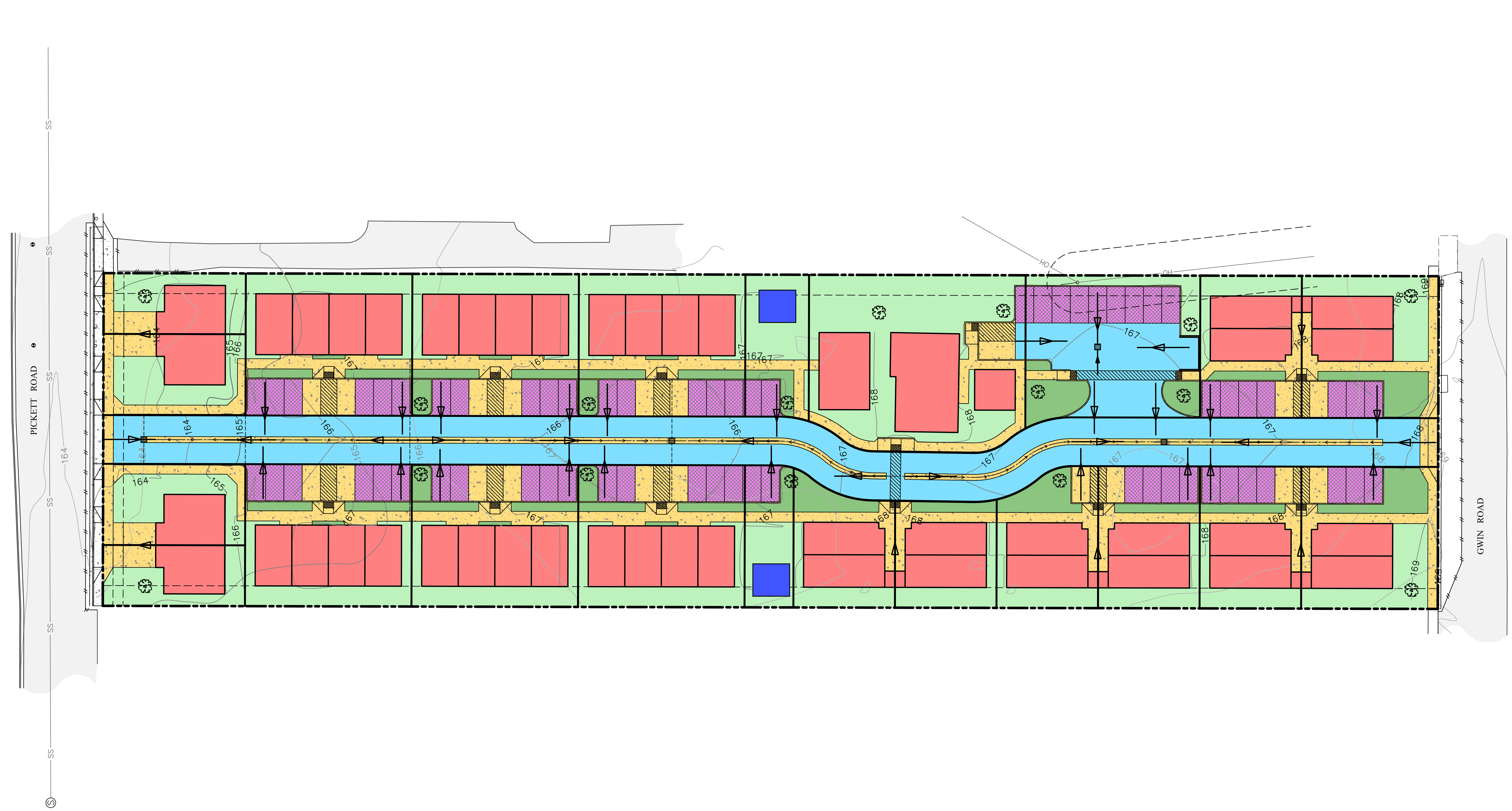
Location Map

Attachment 2:

Drainage Map

PLAN VIEW

SCALE: 1" = 30'



LOW IMPACT DEVELOPMENT NOTES:

1. STREAM SETBACK AND BUFFERS:
   A STREAM SETBACK OR BUFFER IS AN AREA ALONG A SHORELINE, WETLAND, OR STREAM WHERE DEVELOPMENT IS RESTRICTED OR PROHIBITED. THE PRIMARY FUNCTION OF SETBACKS AND BUFFERS IS TO PHYSICALLY PROTECT AND SEPARATE A STREAM, LAKE OR WETLAND FROM FUTURE DISTURBANCE OR ENCROACHMENT. IF PROPERLY DESIGNED, SETBACKS AND BUFFERS CAN PROVIDE STORM WATER MANAGEMENT AND ACT AS A RIGHT–OF–WAY DURING FLOODS, SUSTAINING THE INTEGRITY OF STREAM ECOSYSTEMS AND HABITATS.

2. SOIL QUALITY IMPROVEMENT
   IN AREAS SUBJECT TO GRADING/CLEARING NOT COVERED BY IMPERVIOUS SURFACE, CREATE/AMEND PERVIOUS AREAS WITH A 12" LAYER OF TOPSOIL. SOIL QUALITY IMPROVEMENT OPTIONS INCLUDE THE FOLLOWING:

   OPTION 1: LEAVE NATIVE VEGETATION AND SOIL UNDISTURBED AND PROTECT FROM COMPACTION DURING CONSTRUCTION IDENTIFY AREAS OF THE SITE THAT WILL NOT BE STRIPPED, LOGGED, GRADED, OR DRIVEN ON, AND FENCE OFF THOSE AREAS TO PREVENT IMPACTS DURING CONSTRUCTION. IF NEITHER SOILS NOR VEGETATION ARE DISTURBED, THESE AREAS DO NOT REQUIRE AMENDMENT.

   OPTION 2: AMEND EXISTING SITE TOPSOIL OR SUBSOIL
   SCARIFY OR TILL SUBGRADE TO 8 INCH DEPTH (OR TO DEPTH NEEDED TO ACHIEVE A TOTAL DEPTH OF 12 INCHES OF UN–COMPACTED SOIL AFTER CALCULATED AMOUNT OF AMENDMENT IS ADDED). ENTIRE SURFACE SHOULD BE DISTURBED BY SCARIFICATION. AMEND SOIL TO MEET DESIRED ORGANIC CONTENT.

   OPTION 3: STOCKPILE EXISTING TOPSOIL DURING GRADING. REPLACE TOPSOIL BEFORE PLANTING. STOCKPILE AND COVER SOIL WITH WEED BARRIER MATERIAL THAT SHEDS MOISTURE YET ALLOWS AIR TRANSMISSION. REPLACE STOCKPILED TOPSOIL PRIOR TO PLANTING AND ENSURE THAT REPLACED SOIL PLUS ADDITIONAL COMPOST AS NEEDED WILL AMOUNT TO AT LEAST 12 INCHES OF DEPTH.

3. TREE PLANTING AND PRESERVATION
   TREES INTERCEPT RAIN WATER ON THEIR LEAVES AND BRANCHES, ALLOWING WATER TO EVAPORATE OR RUN DOWN THE BRANCHES AND TRUNK WHERE IT READILY INFILTRATES INTO THE SOIL. TREE ROOTS ALSO INCREASE INFILTRATION OF THE SOIL.

4. ROOFTOP AND IMPERVIOUS AREA DISCONNECTION
   DISCONNECTION OF ROOFTOP AND IMPERVIOUS AREAS FROM THE STORM DRAIN SYSTEM HELPS REDUCE RUNOFF AND PROVIDE POLLUTANT REMOVAL AS THE RE–DIRECTED WATER TRAVELS OVER AND THROUGH VEGETATION AND SOIL INSTEAD OF BEING DIRECTLY PIPED AND DISCHARGED INTO THE STORM DRAIN. ROOF RUNOFF IS DIRECTED TO SPREAD OVER A PERVIOUS AREAS SUCH AS A STREAM SETBACK AND BUFFERS, AREAS OF SOIL QUALITY IMPROVEMENT, OR OTHER APPROPRIATE INFILTRATION AREAS.

5. POROUS PAVEMENT
   THIS OPTION CAN BE EASY TO INSTALL AND MAINTAIN, COST EFFECTIVE, AND CAN ADD AESTHETIC VALUE TO YOUR PROJECT. PERMEABLE PAVEMENTS MAY INCLUDE PERVIOUS CONCRETE, PERVIOUS ASPHALT, POROUS PAVERS, CRUSHED AGGREGATE, OPEN PAVERS WITH GRASS OR PLANTINGS, OPEN PAVERS WITH GRAVEL, OR SOLID PAVERS.

6. GREEN ROOFS
   A GREEN ROOF IS A MULTI–LAYERED, VEGETATED ROOFTOP SYSTEM DESIGN FOR FILTERING, ABSORBING, AND RETAINING STORM WATER. A GREEN ROOF CAPTURES STORM WATER WITHIN THE PORE SPACE OF THE GROWTH MEDIUM AND THEN RELEASES THE WATER SLOWLY VIA EVAPORATION, TRANSPIRATION, AND DISCHARGE TO THE ROOF DRAINS.

7. VEGETATED SWALES
   A VEGETATED SWALE IS A BROAD, SHALLOW CHANNEL WITH DENSE VEGETATION COVERING THE BOTTOM AND SIDE SLOPES. VEGETATION IN THE CHANNEL PROVIDES FILTRATION AND SOLIDS REMOVAL AND REDUCES FLOW VELOCITIES AS STORM WATER IS CONVEYED THROUGH THE SYSTEM. DEPENDING ON SOIL TYPE, SOME INFILTRATION MAY ALSO OCCUR, DECREASING RUNOFF VOLUME AND PROVIDING ADDITIONAL FILTRATION.

8. RAIN BARRELS AND CISTERNS
   RAIN BARRELS AND CISTERNS ARE A SYSTEM THAT COLLECTS AND STORES STORM WATER RUNOFF FROM A ROOF OR OTHER IMPERVIOUS SURFACE. THESE TYPICALLY HAVE OVERFLOW MECHANISMS OR PLUGS THAT DRAIN TO A VEGETATED AREA OR TO THE STORM DRAIN SYSTEM WHEN THE BARREL IS FULL.

DOWNSPOUTS:

1. DIRECT DOWNSPOUT RAINWATER AWAY FROM BUILDING TO PREVENT SATURATION OF FOUNDATION.
2. PROVIDE SPLASH BLOCKS OR OTHER MEANS TO PREVENT SOIL EROSION.
3. DOWNSPOUT RAINWATER SHALL NOT DISCHARGE ONTO A SIDEWALK. CONTRACTOR TO PROVIDE UNDER–WALK DRAINS IN THESE AREAS.

ON–SITE LID LEGEND

	IMPERVIOUS ASPHALT	16,733 SF
	IMPERVIOUS CONCRETE	19,139 SF
	IMPERVIOUS ROOF SURFACING	29,484 SF
	PERMEABLE ASPHALT	10,236 SF
	PERVIOUS LANDSCAPING	25,163 SF
	SELF RETAINING AREA	6,985 SF
✳	ROOF DRAIN	
	TREE	17 EA
	BIORETENTION	
	IMPERVIOUS SURFACE TOTALS:	65,356 SF
	PERVIOUS SURFACE TOTALS:	42,384 SF

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REGISTERED PROFESSIONAL ENGINEER JOSHUA T. McKNIGHT C60687 EXP. 12–31–2024 CIVIL STATE OF CALIFORNIA
PRELIMINARY NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	12/12/23	REVISED LOT LID VALUES PER AGENCY REVIEW	NRG	EEK	EEK	JTM

VALADAO, ET AL
1820 PICKETT ROAD
McKINLEYVILLE, CA 95519
APN 510–381–021

LID PLAN

HUMBOLDT, CALIFORNIA

DATE OF ISSUE: FEB 2023
SCALE: 1" = 30'
PROJECT NO: 873.01
DRAWING NO: L1.0

Attachment 3:

Stormwater Runoff Calculations

Project:	Proposed Subdivision	**Project No:**	873
Date:	12/18/2023	**APN:**	510-381-021
Client:	Dane Valadao	**By:**	E. Keyes
Address:	1820 Pickett Road	**Check By:**	J. McKnight
	McKinleyville, CA	**Sheet:**	1 of 3

HYDRAULIC CALCULATIONS - PRE-DEVELOPMENT

Summary

Drainage Area #1

Q_{100}	5.25 cfs	Post Development	See Page 3
Q_2	1.87 cfs	Pre development	See Page 2
Difference	3.38 cfs	increase	

Conversions
60 sec/min
60 min/hour
24 hours/day
7.48 gal/cf

Total	**4873 cf**	**Minimum Detention Volume**
Total	**36452 gallons**	**for 24 Hour Storm Event**

Project:	Proposed Subdivision	**Project No:**	873
Date:	12/18/2023	**APN:**	510-381-021
Client:	Dane Valadao	**By:**	E. Keyes
Address:	1820 Pickett Road	**Check By:**	J. McKnight
	McKinleyville, CA	**Sheet:**	2 of 3

HYDRAULIC CALCULATIONS - PRE-DEVELOPMENT

Determination of Runoff Coefficients, C

Area Number	Total Area (acres)	$Area_{ground}$	$Area_{impervious}$	C_{ground}	$C_{impervious}$	$C_{adjusted}$
1	2.74	2.65	0.09	0.2	0.98	0.23

100-Year Runoff Flow Rates

Area Number	L	H	S	T_c	C	i_{100}	Q_2
1	0.131	6	0.01	0.167	0.23	2.9	1.87

A = area of runoff in acres
C = Runoff Coefficient per McKinleyville Drainage report
L = Overland Travel Distance in miles
S = Slope in ft/ft
T_c = Time of Concentration in Minutes (California Culvert Method)

T_c = $((11.9L^3)/H)^{0.385}$
(0.167 hours minimum)

i_{100} = rainfall intensity for a 100-year storm event (in/hour)
Q = Water flow rate in cubic feet per second

Q_2 = $1.04*Ci_{100}A$ Reational Method with 1.04 adjustment factor

HYDRAULIC CALCULATIONS - POST-DEVELOPMENT

Determination of Runoff Coefficients, C

Area Number	Total Area (acres)	$Area_{ground}$	$Area_{impervious}$	C_{ground}	$C_{impervious}$	$C_{adjusted}$
1	2.74	1.01	1.73	0.2	0.89	0.64

100-Year Runoff Flow Rates

Area Number	L	H	S	T_c	C	i_{100}	Q
1	0.131	6	0.01	0.167	0.64	2.9	5.25
					Flow Difference (cfs) :		**3.38**

A = area of runoff in acres
C = Runoff Coefficient per McKinleyville Drainage Report
L = Overland Travel Distance in miles
S = Slope in ft/ft
T_c = Time of Concentration in Minutes (California Culvert Method)

T_c = $((11.9L^3)/H)^{0.385}$
(0.167 hours minimum)

i_{100} = rainfall intensity for a 100-year storm event (in/hour)
Q = Water flow rate in cubic feet per second

Q_{100} = $1.04*Ci_{100}A$ Reational Method with 1.04 adjustment factor

Attachment 4:

IDF Intensity Chart

NOAA Atlas 14, Volume 6, Version 2
Location name: Mckinleyville, California, USA*
Latitude: 40.9435°, Longitude: -124.0958°
Elevation: 168.1 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	**0.135** (0.118-0.155)	**0.169** (0.148-0.195)	**0.216** (0.189-0.251)	**0.258** (0.223-0.301)	**0.318** (0.265-0.387)	**0.369** (0.299-0.459)	**0.423** (0.334-0.541)	**0.483** (0.369-0.638)	**0.570** (0.415-0.790)	**0.643** (0.451-0.927)
10-min	**0.193** (0.169-0.223)	**0.242** (0.212-0.279)	**0.310** (0.270-0.359)	**0.370** (0.319-0.432)	**0.456** (0.379-0.555)	**0.528** (0.429-0.658)	**0.606** (0.478-0.776)	**0.692** (0.528-0.914)	**0.817** (0.595-1.13)	**0.922** (0.646-1.33)
15-min	**0.234** (0.205-0.269)	**0.292** (0.256-0.337)	**0.375** (0.327-0.434)	**0.447** (0.386-0.522)	**0.552** (0.459-0.671)	**0.639** (0.518-0.795)	**0.733** (0.578-0.939)	**0.836** (0.639-1.11)	**0.988** (0.720-1.37)	**1.11** (0.781-1.61)
30-min	**0.313** (0.274-0.361)	**0.392** (0.343-0.452)	**0.503** (0.438-0.582)	**0.599** (0.518-0.700)	**0.740** (0.615-0.899)	**0.856** (0.695-1.07)	**0.983** (0.775-1.26)	**1.12** (0.857-1.48)	**1.32** (0.965-1.84)	**1.49** (1.05-2.15)
60-min	**0.439** (0.385-0.506)	**0.550** (0.481-0.634)	**0.705** (0.615-0.816)	**0.840** (0.726-0.982)	**1.04** (0.862-1.26)	**1.20** (0.974-1.50)	**1.38** (1.09-1.76)	**1.57** (1.20-2.08)	**1.86** (1.35-2.57)	**2.10** (1.47-3.02)
2-hr	**0.677** (0.593-0.780)	**0.831** (0.727-0.959)	**1.05** (0.913-1.21)	**1.23** (1.07-1.44)	**1.50** (1.25-1.83)	**1.73** (1.40-2.15)	**1.97** (1.55-2.52)	**2.23** (1.70-2.94)	**2.61** (1.90-3.61)	**2.92** (2.04-4.20)
3-hr	**0.877** (0.768-1.01)	**1.07** (0.934-1.23)	**1.33** (1.16-1.54)	**1.56** (1.35-1.83)	**1.89** (1.57-2.30)	**2.16** (1.75-2.69)	**2.45** (1.93-3.14)	**2.76** (2.11-3.65)	**3.21** (2.34-4.45)	**3.58** (2.51-5.16)
6-hr	**1.35** (1.18-1.56)	**1.63** (1.43-1.88)	**2.01** (1.76-2.33)	**2.34** (2.02-2.73)	**2.80** (2.33-3.41)	**3.18** (2.58-3.95)	**3.57** (2.82-4.57)	**4.00** (3.05-5.28)	**4.60** (3.35-6.38)	**5.09** (3.57-7.34)
12-hr	**2.01** (1.76-2.32)	**2.43** (2.13-2.80)	**2.99** (2.61-3.46)	**3.46** (2.99-4.05)	**4.12** (3.42-5.01)	**4.64** (3.77-5.78)	**5.18** (4.09-6.64)	**5.76** (4.40-7.61)	**6.56** (4.78-9.10)	**7.21** (5.05-10.4)
24-hr	**2.92** (2.61-3.33)	**3.55** (3.17-4.05)	**4.38** (3.91-5.01)	**5.07** (4.48-5.84)	**6.00** (5.16-7.13)	**6.74** (5.68-8.16)	**7.49** (6.17-9.27)	**8.28** (6.65-10.5)	**9.36** (7.24-12.3)	**10.2** (7.66-13.9)
2-day	**3.94** (3.52-4.49)	**4.81** (4.30-5.49)	**5.95** (5.30-6.81)	**6.87** (6.08-7.92)	**8.12** (6.97-9.64)	**9.07** (7.65-11.0)	**10.0** (8.28-12.4)	**11.0** (8.88-14.0)	**12.4** (9.60-16.4)	**13.5** (10.1-18.3)
3-day	**4.62** (4.13-5.26)	**5.67** (5.06-6.47)	**7.01** (6.25-8.03)	**8.10** (7.17-9.34)	**9.57** (8.22-11.4)	**10.7** (9.00-12.9)	**11.8** (9.73-14.6)	**13.0** (10.4-16.4)	**14.5** (11.2-19.1)	**15.7** (11.8-21.4)
4-day	**5.19** (4.65-5.92)	**6.39** (5.71-7.30)	**7.92** (7.06-9.06)	**9.15** (8.10-10.5)	**10.8** (9.27-12.8)	**12.0** (10.1-14.6)	**13.3** (11.0-16.4)	**14.6** (11.7-18.5)	**16.3** (12.6-21.4)	**17.6** (13.2-23.9)
7-day	**6.57** (5.88-7.49)	**8.13** (7.26-9.28)	**10.1** (9.00-11.6)	**11.7** (10.3-13.4)	**13.7** (11.8-16.3)	**15.3** (12.9-18.5)	**16.8** (13.9-20.8)	**18.4** (14.8-23.3)	**20.5** (15.8-27.0)	**22.0** (16.5-30.0)
10-day	**7.63** (6.83-8.70)	**9.47** (8.46-10.8)	**11.8** (10.5-13.5)	**13.6** (12.0-15.7)	**16.0** (13.7-19.0)	**17.7** (14.9-21.5)	**19.5** (16.1-24.1)	**21.2** (17.1-27.0)	**23.5** (18.2-31.0)	**25.3** (19.0-34.4)
20-day	**10.4** (9.32-11.9)	**12.9** (11.6-14.8)	**16.0** (14.3-18.3)	**18.4** (16.3-21.2)	**21.5** (18.5-25.6)	**23.7** (20.0-28.8)	**25.9** (21.4-32.1)	**28.1** (22.6-35.7)	**30.9** (23.9-40.7)	**32.9** (24.7-44.8)
30-day	**13.0** (11.6-14.8)	**16.1** (14.4-18.3)	**19.8** (17.7-22.7)	**22.7** (20.1-26.2)	**26.4** (22.7-31.3)	**29.0** (24.4-35.1)	**31.5** (26.0-39.0)	**34.0** (27.3-43.2)	**37.2** (28.8-49.0)	**39.5** (29.6-53.8)
45-day	**16.7** (15.0-19.1)	**20.6** (18.5-23.6)	**25.3** (22.6-29.0)	**28.9** (25.6-33.3)	**33.3** (28.6-39.6)	**36.5** (30.7-44.1)	**39.4** (32.5-48.8)	**42.3** (34.0-53.7)	**46.0** (35.6-60.6)	**48.6** (36.5-66.2)
60-day	**19.9** (17.8-22.7)	**24.4** (21.8-27.9)	**29.8** (26.6-34.1)	**33.8** (29.9-39.0)	**38.8** (33.3-46.1)	**42.3** (35.6-51.2)	**45.6** (37.6-56.4)	**48.7** (39.1-61.8)	**52.7** (40.7-69.4)	**55.5** (41.6-75.5)

[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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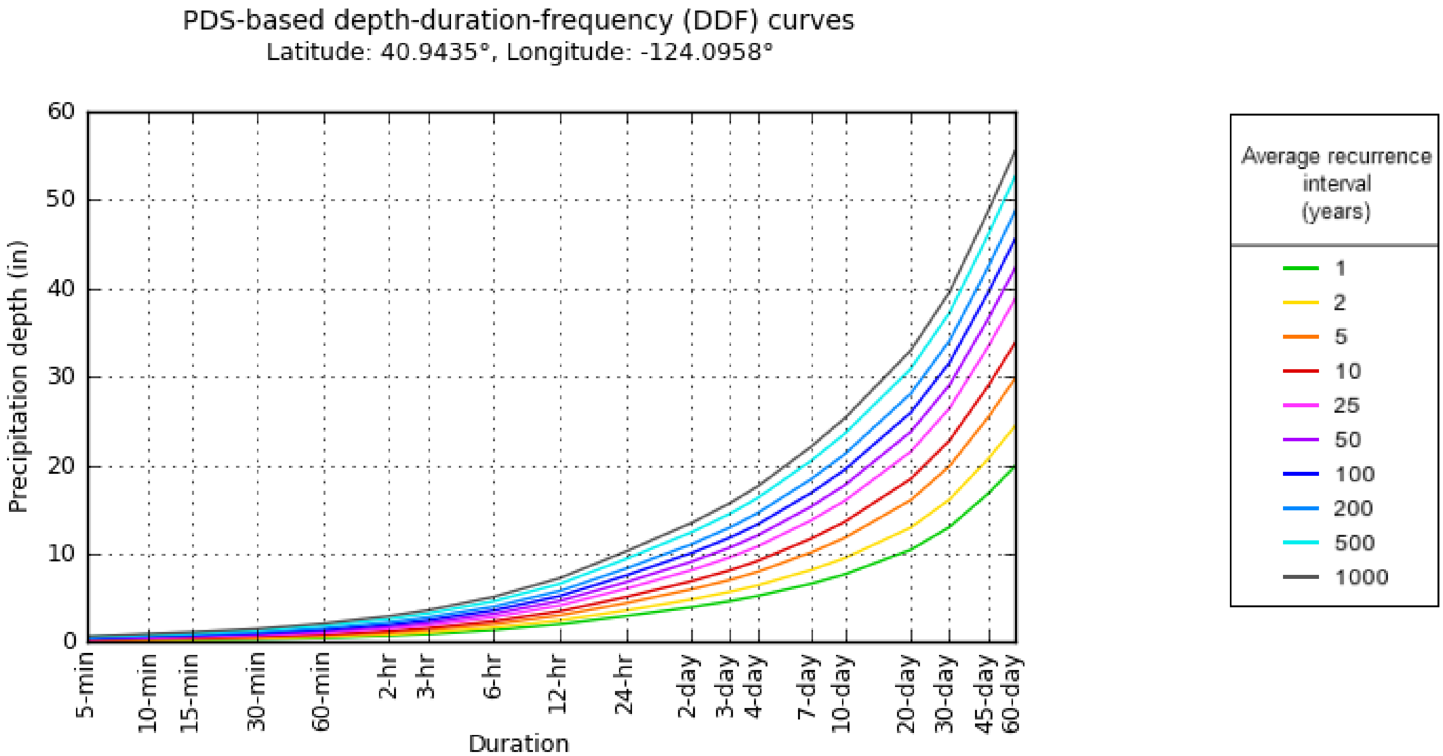
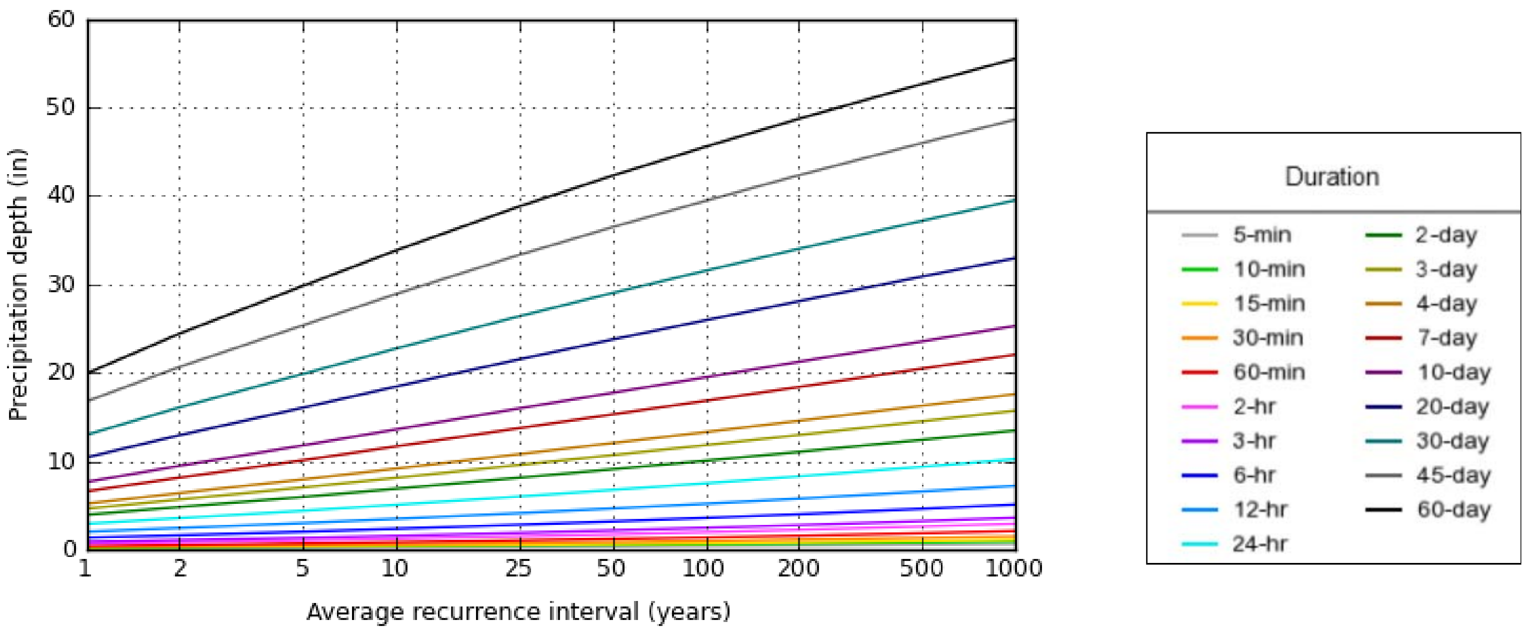
PF graphical





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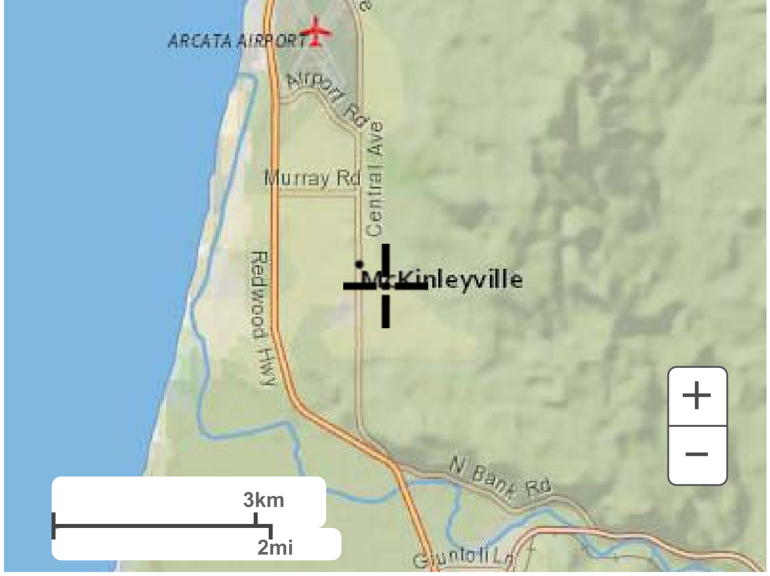
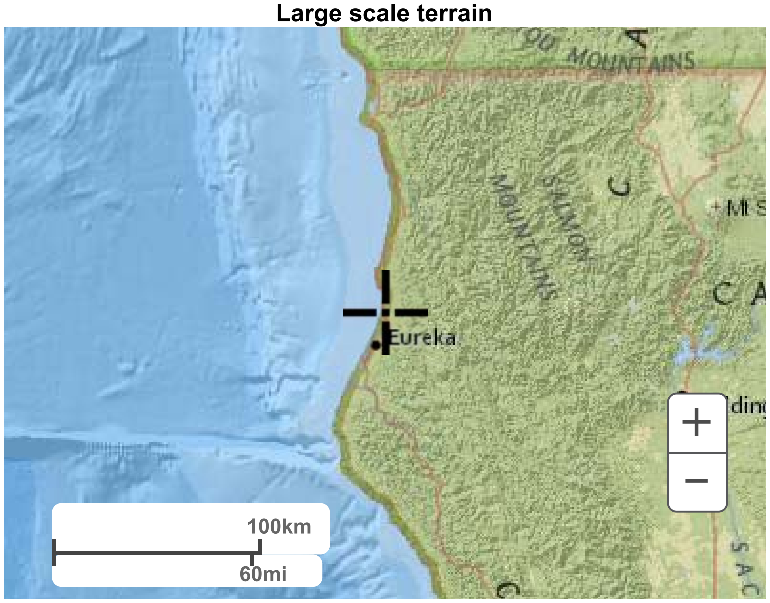
Maps & aerials

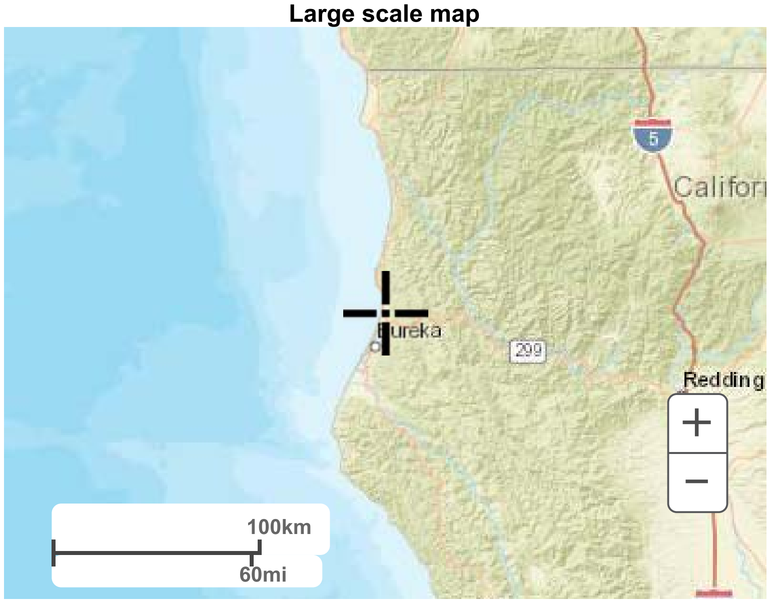
Small scale terrain



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

Attachment 5:

Runoff Coefficients

Table 819.2B

Run off Coefficients for Developed Areas[(1)]

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, cemeteries:	0.10 - 0.25
Playgrounds:	0.20 - 0.40
Railroad yard areas:	0.20 - 0.40
Unimproved areas:	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2-7%	0.10 - 0.15
Sandy soil, steep, 7%	0.15 - 0.20
Heavy soil, flat, 2%	0.13 - 0.17
Heavy soil, average, 2-7%	0.18 - 0.22
Heavy soil, steep, 7%	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs:	0.75 - 0.95

NOTES:

(1) From HDS No. 2.

Attachment 6:

Bioretention

Project:	Proposed Subdivision	**Project No:**	873
Date:	12/18/2023	**APN:**	510-381-021
Client:	Dane Valadao	**By:**	E. Keyes
Address:	1820 Pickett Road	**Check By:**	J. McKnight
	McKinleyville, CA	**Sheet:**	1 of 3

BIORETENTION

Equations:

A_f = WQV(df/[k(hf+df)tf])

A_{br} = LxW

WQV = Q_t-Q_g

Definitions:

A_f = Minimum surface area of the bioretention ponding area

WQV = Water quality volume

d_f = Media layer depth

k = Coefficient of permeability for bioretention soil media (infiltration rate)

h_f = Average water depth above the soil media layer (ponding depth)

t_f = Design drain time for WQV

Q_t = Total volumne

Q_g = Volume of Gravel

L = Length of Bioretention

W = Width of Bioretention

D = Depth of Bioretention

A_{br} = Design area of bioretention facility

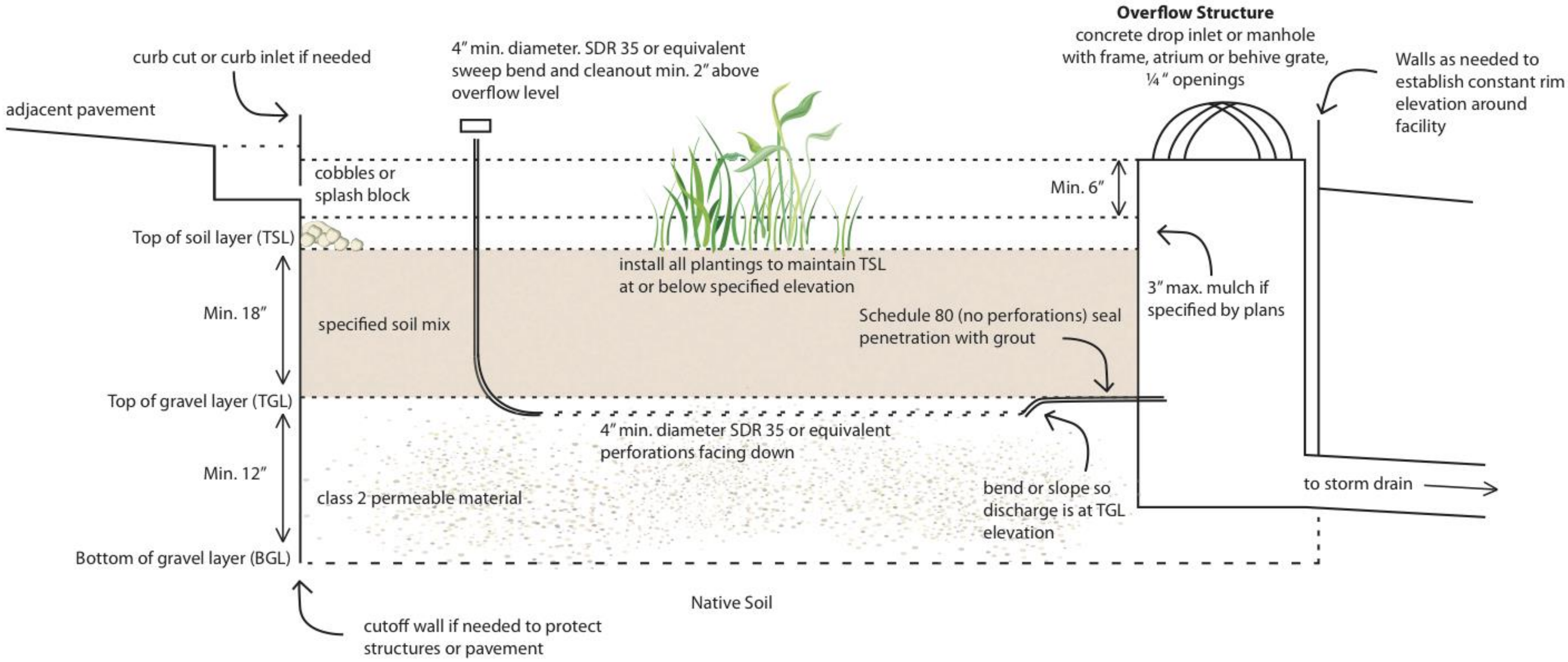
Calculations:

Q_t	=	4873	ft^3
L		20	ft
W		20	ft
D		1	ft
A_{br}		**400**	**ft^2**
V_s		20	%
Q_g	=	80	ft3
WQV	=	4793	ft^3
d_f	=	2	ft
k	=	10	ft/day
h_f	=	0.5	ft
t_f	=	1	days
A_f	**=**	**383.4**	**ft^2**

Use a 400 square foot bioretention facility to mitigate excess stormwater

Bioretention Facility

not to scale



Allowed variations for special site conditions:

- Facilities located within 10 feet of structures or other potential geotechnical hazards may incorporate an impervious cutoff wall

- Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner between the native soil and the BGL and locate the underdrain discharge at the BGL (flow-through planter configuration)

- Facilities located in areas of high groundwater, highly infiltrative soils, or where connection of the underdrain to a surface drain or subsurface storm drain are infeasible may omit the underdrain

Notes:

- No liner, no filter fabric, no landscape cloth.

- Maintain BGL, TGL, TSL throughout facility area at elevations to be specified in plan.

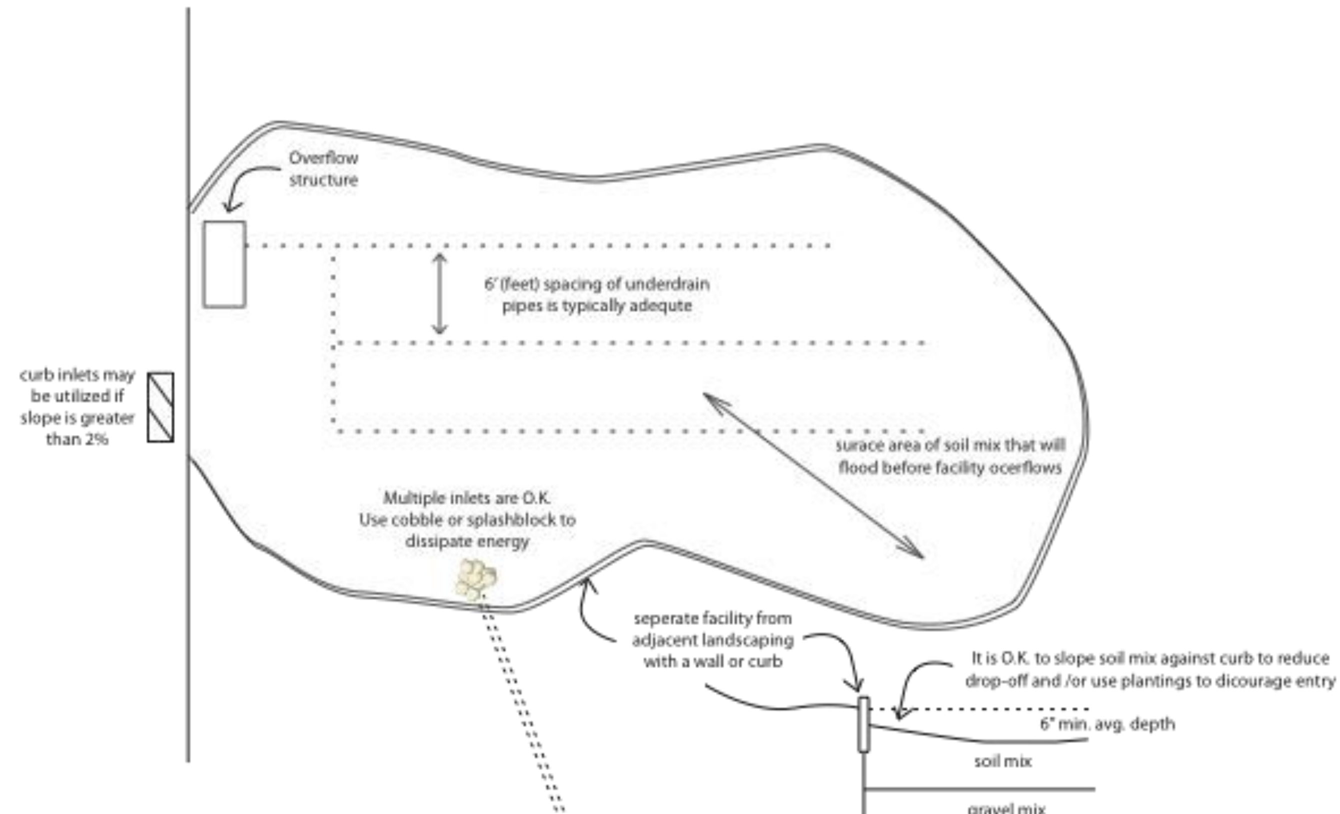
- Class 7 permeable layer may extend below and underneath drop inlet.

- Elevation or underdrain discharge is at top of gravel layer.

- See Section 6.3 for instructions on facility sizing and additional specifications

Bioretention Facility - Overview

not to scale



Note:

Show all elevations of curb, pavement, inlet, top of soil layer (TSL), top of gravel layer (TGL), and bottom of gravel layer (BGL) at all inlets and outlets and at key points along edge of facility.

Soil/Compost and Gravel Specifications for Bioretention Facility

Compost shall be a well-decomposed, stable, weed-free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids, and shall meet the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

Compost Quality Analysis:

Before delivery of the soil, the supplier shall submit a copy of the lab analysis performed by a laboratory that is enrolled in the USCC's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify that the compost parameters are within the limits specified below.

Parameter	**Range**	**Reported as (units)**
Organic Matter Content	35-75	%, dry weight basis
Carbon to Nitrogen Ratio	15:1 to 25:1	ratio
Maturity (Seed Emergence and Seedling Vigor)	>80	average % of control
Stability (CO_2 Evolution Rate)	<8	mg CO_2-C/g unit OM/day
Soluble Salts (Salinity)	<6.0	mmhos/cm
pH	6.5 - 8.0 May vary with plant species	units
Heavy Metals Content	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.13, tables 1 and 3.
Pathogens		
Fecal coliform	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Salmonella	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Nutrient Content (provide analysis, including):		
Total Nitrogen (N)	≥0.9	%
Boron (Total B)	<80	ppm
Calcium (Ca)	For information only	%
Sodium (Na)	For information only	%
Magnesium (Mg)	For information only	%
Sulfur (S)	For information only	%

Soil/Compost and Gravel Specifications for Bioretention Facility

Gravel Layer

The gravel layer used in the bioretention facility must consist of *Class 2 Permeable Material* as specified in the State of California's Business, Transportation and Housing Agency, Department of Transportation; Standard Specifications 2010, manual (http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2010_StdSpecs/2010_StdSpec s.pdf).

The specific section, Subsurface Drains, Sec. 68, of the manual is used because it offers specific specifications for subsurface drains. In addition to the standardized permeable layer, a membrane layer of pea gravel or other intermediate-sized material is recommended at the top of the gravel layer to prevent fines from the soil/compost layer from moving downward into the gravel layer.

68-2.02F (1) General
Permeable material for use in backfilling trenches under, around, and over underdrains must consist of hard, durable, clean sand, gravel, or crushed stone and must be free from organic material, clay balls, or other deleterious substances.

Permeable material must have a durability index of not less than 40.

68-2.02F (3) Class 2 Permeable Material
The percentage composition by weight of Class 2 permeable material in place must comply with the grading requirements shown in the following table:

Class 2 Permeable Material* Grading Requirements

Sieve sizes	Percentage passing
1"	100
3/4"	90–100
3/8"	40–100
No. 4	25–40
No. 8	18–33
No. 30	5–15
No. 50	0–7
No. 200	0–3

*Class 2 permeable material must have a sand equivalent value of not less than 75.

Bioretention Facility Construction Checklist

Layout (to be confirmed prior to beginning excavation permit approval stage)	
☐	Square footage of the facility meets or exceeds minimum shown in Stormwater Control Plan
☐	Site grading and grade breaks are consistent with the boundaries of the tributary Drainage Management Area(s) (DMAs) shown in the Stormwater Control Plan
☐	Inlet elevation of the facility is low enough to receive drainage from the entire tributary DMA
☐	Locations and elevations of overland flow or piping, including roof leaders, from impervious areas to the facility have been laid out and any conflicts resolved
☐	Rim elevation of the facility is laid out to be level all the way around, or elevations are consistent with a detailed cross-section showing location and height of interior dams
☐	Locations for vaults, utility boxes, and light standards have been identified so that they will not conflict with the facility
☐	Facility is protected as needed from construction-phase runoff and sediment

Excavation (to be confirmed prior to backfilling or pipe installation)	
☐	Excavation conducted with materials and techniques to minimize compaction of soils within the facility area
☐	Excavation is to accurate area and depth
☐	Slopes or side walls protect from sloughing of native soils into the facility
☐	Moisture barrier, if specified, has been added to protect adjacent pavement or structures.
☐	Native soils at bottom of excavation are ripped or loosened to promote infiltration

Overflow or Surface Connection to Storm Drainage (to be confirmed prior to backfilling with any materials)	
☐	Grating excludes mulch and litter (beehive or atrium-style grates recommended)
☐	Overflow is connected to storm drain via appropriately sized
☐	No knockouts or side inlets are in overflow riser
☐	Overflow is at specified elevation
☐	Overflow location selected to minimize surface flow velocity (near, but offset from, inlet recommended)
☐	Grating excludes mulch and litter (beehive or atrium-style grates recommended)
☐	Overflow is connected to storm drain via appropriately sized

Bioretention Facility Construction Checklist

Underground connection to storm drain/outlet orifice	
☐	Perforated pipe underdrain (PVC SDR 35 or approved equivalent) is installed with holes facing down
☐	Perforated pipe is connected to storm drain at specified elevation (typ. bottom of soil elevation)
☐	Cleanouts are in accessible locations and connected via sweep

Drain Rock/Subdrain (to be confirmed prior to installation of soil mix)	
☐	Rock is installed as specified, 12" min. depth. Class 2 permeable, Caltrans specification 68- 2.02F(3) recommended
☐	Rock is smoothed to a consistent top elevation. Depth and top elevation are as shown in plans
☐	Slopes or side walls protect from sloughing of native soils into the facility
☐	No filter fabric is placed between the subdrain and soil mix layers

Soil Mix	
☐	Soil mix is as specified.
☐	Mix installed in lifts not exceeding 12"
☐	Mix is not compacted during installation but may be thoroughly wetted to encourage consolidation
☐	Mix is smoothed to a consistent top elevation. Depth of mix (18" min.) and top elevation are as shown in plans, accounting for depth of mulch to follow and required reservoir depth

Irrigation	
☐	Irrigation system is installed so it can be controlled separately from other landscaped areas
☐	Smart irrigation controllers and drip emitters are recommended and may be required by local code or ordinance.
☐	Spray heads, if any, are positioned to avoid direct spray into outlet structures

Bioretention Facility Construction Checklist

Planting	
☐	Plants are installed consistent with approved planting plan, consistent with site water allowance
☐	Any trees and large shrubs are staked securely
☐	No fertilizer is added; compost tea may be used
☐	No native soil or clayey material are imported into the facility with plantings
☐	1"-2" mulch may be applied following planting; mulch selected to avoid floating
☐	Final elevation of soil mix maintained following planting
☐	Curb openings are free of obstructions

Final Engineering Inspection	
☐	Drainage Management Area(s) are free of construction sediment and landscaped areas are stabilized
☐	Inlets are installed to provide smooth entry of runoff from adjoining pavement, have sufficient reveal (drop from the adjoining pavement to the top of the mulch or soil mix, and are not blocked
☐	Inflows from roof leaders and pipes are connected and operable
☐	Temporary flow diversions are removed
☐	Rock or other energy dissipation at piped or surface inlets is adequate
☐	Overflow outlets are configured to allow the facility to flood and fill to near rim before overflow
☐	Plantings are healthy and becoming established
☐	Irrigation is operable
☐	Facility drains rapidly; no surface ponding is evident
☐	Any accumulated construction debris, trash, or sediment is removed from facility
☐	Permanent signage is installed and is visible to site users and maintenance personnel