Appendix 9
Hydrology and Water Quality Reports

VANTAGEPOINT CHURCH
Project No. PLN15-1174
INITIAL STUDY

PRELIMINARY HYDROLOGY STUDY

VANTAGE POINT CHURCH

Eastvale, California

Prepared For
Vantage Point Church
5171 Edison Avenue, Suite C
Chino, CA 91710
909.465.9700

Prepared By

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Project Manager:
Steven L. Ellis

Date Prepared: March, 2015
Job Number: 3064.01

full circle thinking®

PRELIMINARY HYDROLOGY STUDY

For

VANTAGE POINT CHURCH

Prepared for:

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5171 Edison Avenue, Suite C
Chino, CA 91710
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Date Prepared: March, 2015

FUSCOE ENGINEERING

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APPENDICES

PURPOSE

The purpose of this report is to develop a hydrologic and hydraulic analysis of the proposed conditions, to determine the impact of the 100-year storm event to the proposed project site.

EXISTING SITE DESCRIPTION

The project site is located in the City of Eastvale, in the County of Riverside. It is located in the northeast corner of the intersection of Archibald Avenue and Prado Basin Park Road. The project site is currently undeveloped. Stormwater runoff sheet flows to the southwest and discharges to Prado Basin Park Road.

PROPOSED SITE DESCRIPTION

The proposed project consists of a Church complex featuring classrooms, playground area, parking and landscape areas.

PROPOSED STORM WATER QUALITY

Stormwater runoff from the developed site will be collected by bottomless grate inlets and catch basins or infiltration by the implementation of LID features to minimized offsite discharge. A storm drain system is proposed on-site to direct stormwater to a proposed infiltration basin located to the south of the project. Stormwater runoff from Area 1 is intended to infiltrate thru grass pavers; as an secondary overflow a series of grate inlets are proposed. Area 2 is intetend to sheet flow towards two infiltration trenches on the west portion of the site. Area 3 will discharge offsite as it currently does. Area 4 will sheet flow towards a section of pervious pavement to the south of the proposed parking lot, as a secondary overflow a curb opening catch basin is proposed to then discharge to the infiltration basin.

HYDROLOGIC METHODOLOGY

The hydrology study was performed under the guidelines of the Riverside Hydrology Manual.

The Rational Method was used to calculate peak runoff rates, and the Synthetic Unit Hydrograph was used to calculate runoff volumes as prescribed by the Riverside County Hydrology Manual.

RESULTS AND CONCLUSIONS

On-site analysis was performed to evaluate pre and post construction runoff values for the project area.

Existing Conditions 100 year Storm Total Site Area

Drainage Area (A)	Remarks	Length (ft)	Area (acre)	Soil Type	Q_{100} (cfs)	Q_{10} (cfs)
A1	INITIAL AREA	860	6.40	B	11.66	6.20
A2	IRREGULAR CHANNEL FLOW	574	4.3	B	4.15	1.54
				Total Flow Rate=	**15.81**	**7.74**

Proposed Conditions 100 year Storm Total Site Area

Drainage Area (A)	Remarks	Length (ft)	Area (acre)	Soil Type	Q_{100} (cfs)	Q_{10} (cfs)
A1	INITIAL AREA	826	2.9	B	7.43	4.59
A2	INITIAL AREA	915	3.7	B	9.93	6.15
A3	INITIAL AREA	537	0.40	B	0.92	0.86
A4	INITIAL AREA	173	0.40	B	1.59	0.99
A5	INITIAL AREA	396	3.30	B	11.07	6.87
				Total Flow Rate=	**30.94**	**19.46**

*For complete Table see Appendix 1 "Existing and Proposed Rational Method". See Hydrology Map on Appendix 3 for location of sub-areas.

Unit Hydrograph Summary

The incremental increase runoff volume between the 100yr-24hr and 10yr-24hr event undeveloped condition and the 100yr-24hr and 10yr-24hr event developed condition needs to be retain onsite.

Undeveloped Condition

10year – 24hour	Volume = 0.50 AcFt
100year – 24hour	Volume = 2.72 AcFt

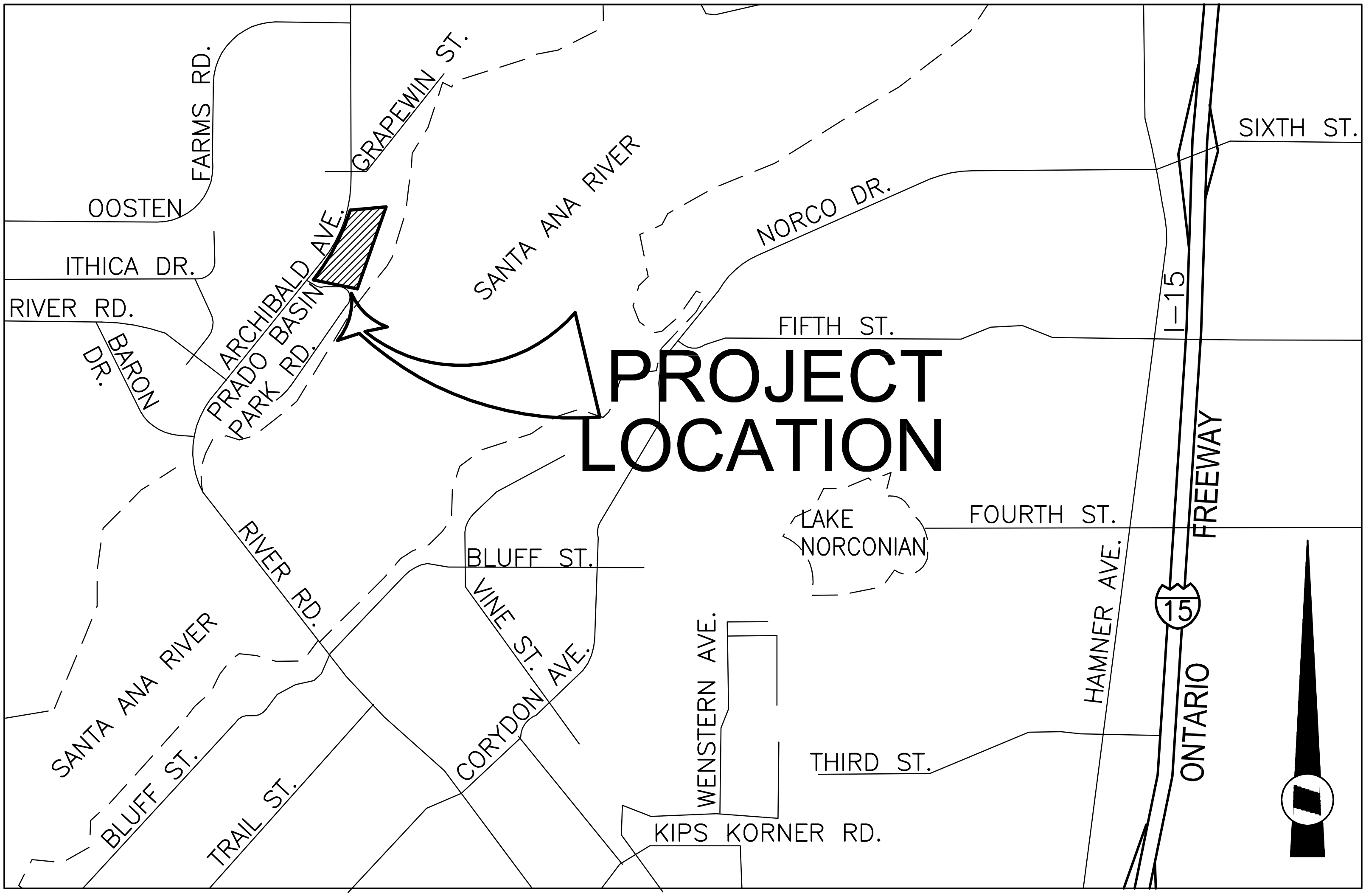
Developed Condition

10year – 24hour	Volume = 2.66 AcFt
100year – 24hour	Volume = 4.66 AcFt

Incremental Increase Runoff Volume

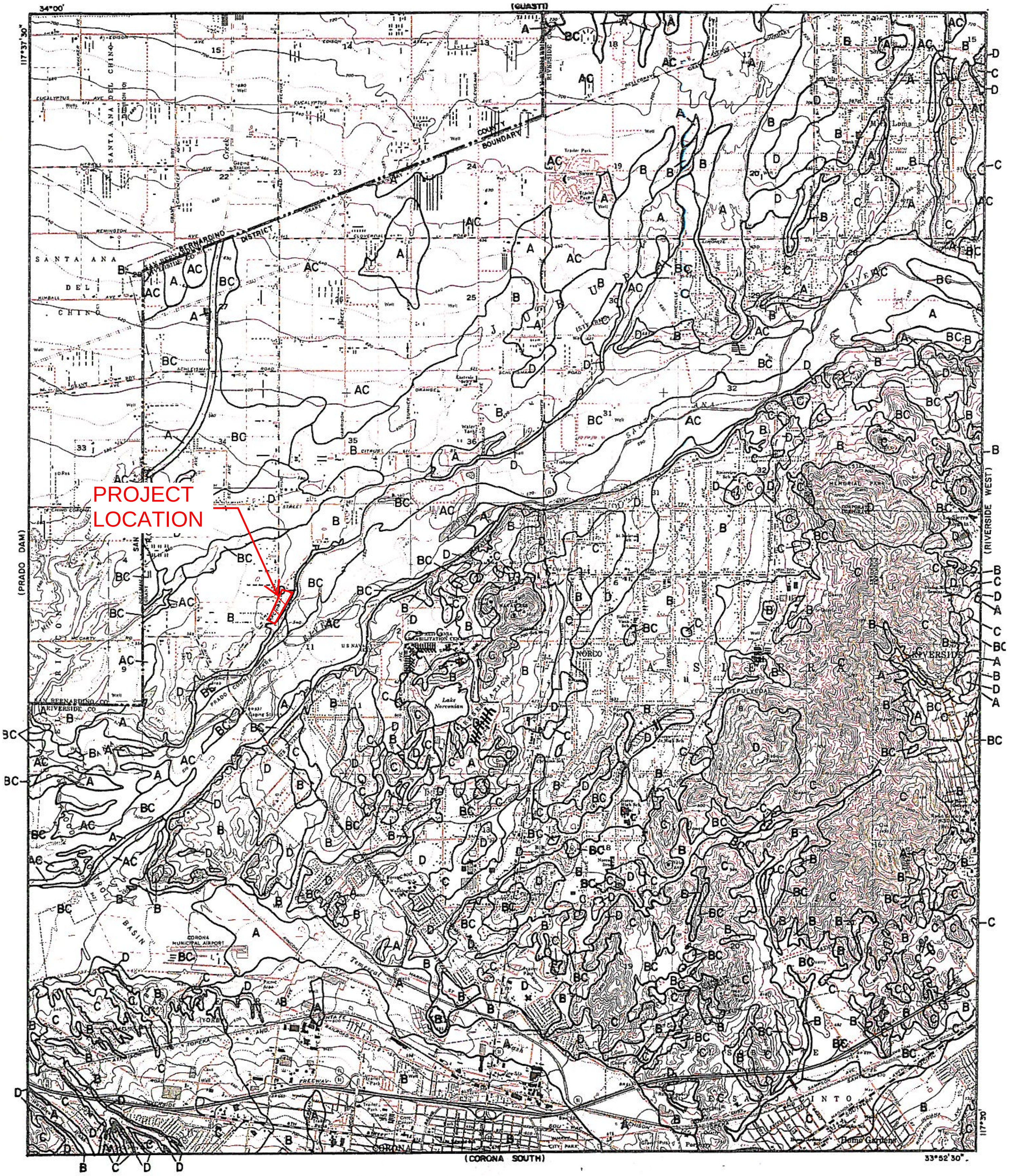
10year – 24hour	2.16 ac-ft
100year – 24hour	1.94 ac-ft

(See Appendix 2)



VICINITY MAP

NOT TO SCALE



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

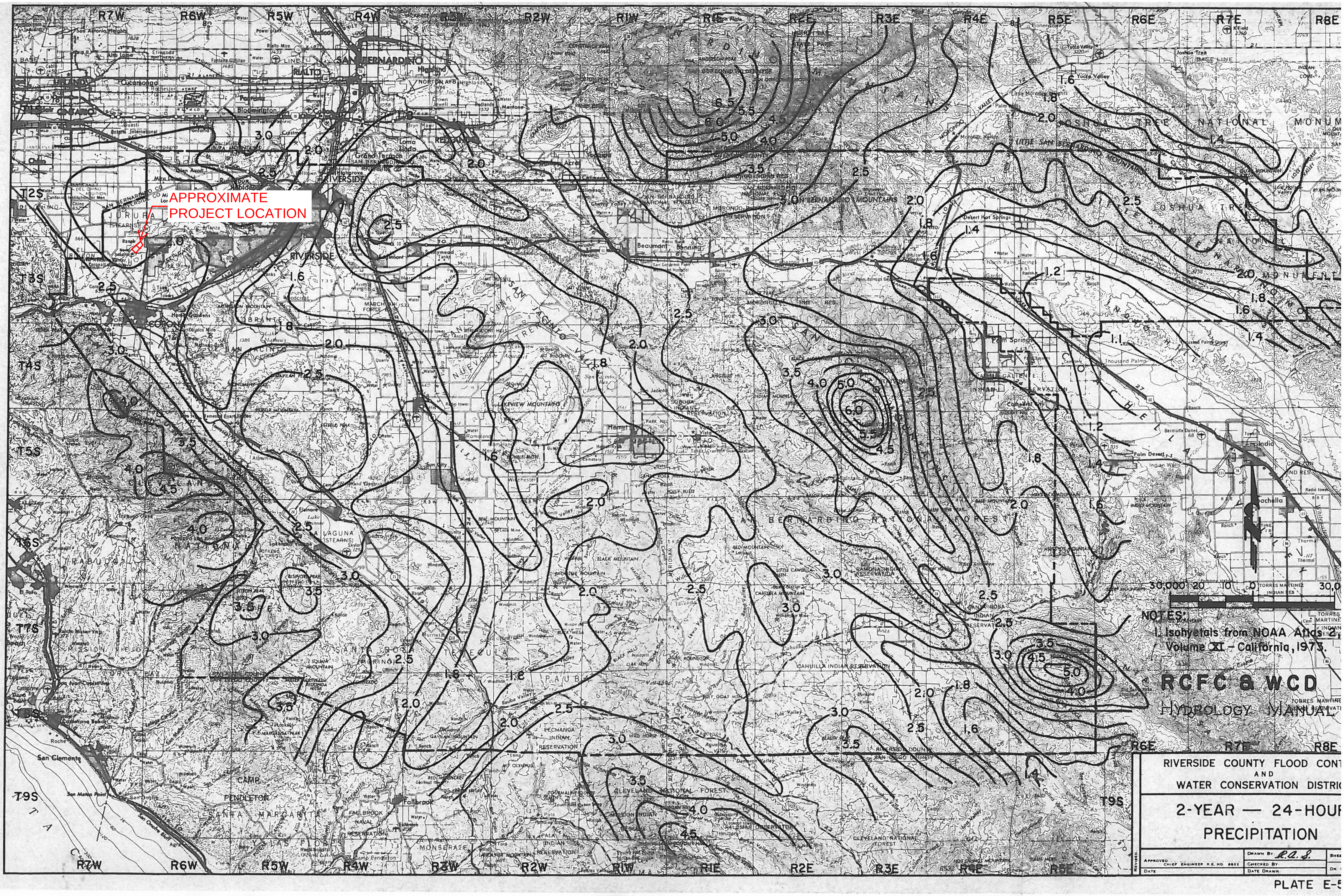
RCFC & WCD

HYDROLOGY MANUAL

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR CORONA-NORTH

PLATE C-1.14


APPROXIMATE
PROJECT LOCATION
NOTES:
1. Isohyetals from NOAA Atlas 2,
Volume XI - California, 1973.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONT
AND
WATER CONSERVATION DISTRIC
2-YEAR — 24-HOUR
PRECIPITATION
PLATE E-5


APPROXIMATE
PROJECT LOCATION
NOTES:
1. Isohyetals from NOAA Atlas
Volume XI - California, 1973.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CON
AND
WATER CONSERVATION DISTR
100-YEAR — 24-HOU
PRECIPITATION
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E
R3E
R4E
R5E
R6E
R7E
R8E
T2S
T3S
T4S
T5S
T6S
T7S
T9S
SAN BERNARDINO
RIALTO
RIVERSIDE
Beaumont
Palm Springs
Hemet
Perris
Fallbrook
San Clemente
JOSHUA TREE NATIONAL MONUM
SAN BERNARDINO NATIONAL FOREST
CLEVELAND NATIONAL FOREST

PLATE E-

APPENDIX 1

RATIONAL METHOD

RATIONAL METHOD NODE TABLE

EXISTING CONDITIONS Q100

AREA	REMARKS	NODE NO.			HIGH	LOW	LENGTH	COVER	AREA	SOIL
					ELEV. (ft)	ELEV. (ft)	(ft)	TYPE	(acre)	TYPE
A1	INITIAL AREA	1.10	→	1.20	600.00	591.00	860	UND	6.40	B
A2	IRREGULAR CHANNLE FLOW	1.20	→	1.30	591.00	583.00	574	UND	4.30	B

Q10 EXISTING CONDITIONS
RATIONAL METHOD

```
                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
        Rational Hydrology Study        Date: 03/13/15  File:306401Q10EX.out
------------------------------------------------------------------------
306401 vantage point church
Q10 EXISTING CONDITIONS HYDROLOGY STUDY
2015-03-12-CG

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

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


Program License Serial Number 6049

------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =   10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [ Mira Loma ] area used.
10 year storm 10 minute intensity =  1.960(In/Hr)
10 year storm 60 minute intensity =  0.760(In/Hr)
100 year storm 10 minute intensity =  3.100(In/Hr)
100 year storm 60 minute intensity =  1.200(In/Hr)

Storm event year =  10.0
Calculated rainfall intensity data:
1 hour intensity =  0.760(In/Hr)
Slope of intensity duration curve = 0.5300




++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.100 to Point/Station        1.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   860.000(Ft.)
Top (of initial area) elevation =   600.000(Ft.)
Bottom (of initial area) elevation =   591.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01047  s(percent)=       1.05
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.685 min.
Rainfall intensity =      1.372(In/Hr) for a    10.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.706
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  78.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      6.202(CFS)
Total initial stream area =        6.400(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.200 to Point/Station        1.300
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      7.015(CFS)
Depth of flow =   0.696(Ft.), Average velocity =   0.289(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
```

```
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2            100.00              0.00
        3            200.00              2.00
Manning's 'N' friction factor =   0.300
-----------------------------------------------------------------
Sub-Channel flow  =      7.015(CFS)
  '     '        flow top width =     69.631(Ft.)
  '     '    velocity=    0.289(Ft/s)
  '     '        area =     24.242(Sq.Ft)
  '     '        Froude number =     0.086

Upstream point elevation =   591.000(Ft.)
Downstream point elevation =   583.000(Ft.)
Flow length =   574.000(Ft.)
Travel time  =   33.06 min.
Time of concentration =   52.75 min.
Depth of flow =   0.696(Ft.)
Average velocity =   0.289(Ft/s)
Total irregular channel flow =     7.015(CFS)
Irregular channel normal depth above invert elev. =   0.696(Ft.)
Average velocity of channel(s) =   0.289(Ft/s)
 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.440
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  61.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      0.814(In/Hr) for a    10.0 year storm
Subarea runoff =      1.538(CFS) for      4.300(Ac.)
Total runoff =      7.740(CFS)  Total area =      10.700(Ac.)
Depth of flow =   0.722(Ft.), Average velocity =   0.297(Ft/s)
End of computations, total study area =          10.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  71.2
```

Q100 EXISTING CONDITIONS
RATIONAL METHOD

```
               Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
        Rational Hydrology Study        Date: 03/12/15  File:306401q100ex.out
------------------------------------------------------------------------
306401 vantage point church
Q100 EXIST
2015-03-12-CG

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

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


Program License Serial Number 6049

------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [ Mira Loma ] area used.
10 year storm 10 minute intensity =  1.960(In/Hr)
10 year storm 60 minute intensity =  0.760(In/Hr)
100 year storm 10 minute intensity =  3.100(In/Hr)
100 year storm 60 minute intensity =  1.200(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.200(In/Hr)
Slope of intensity duration curve = 0.5300




++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   860.000(Ft.)
Top (of initial area) elevation =   600.000(Ft.)
Bottom (of initial area) elevation =   591.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01047  s(percent)=       1.05
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.685 min.
Rainfall intensity =      2.166(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.841
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  89.80
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =     11.662(CFS)
Total initial stream area =        6.400(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.200 to Point/Station       1.300
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =     13.769(CFS)
Depth of flow =   0.897(Ft.), Average velocity =   0.343(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
```

```
Point number      'X' coordinate     'Y' coordinate
        1              0.00             2.00
        2            100.00             0.00
        3            200.00             2.00
Manning's 'N' friction factor =   0.300
-----------------------------------------------------------------
Sub-Channel flow  =     13.769(CFS)
  '     '        flow top width =     89.667(Ft.)
  '     '    velocity=    0.343(Ft/s)
  '     '        area =     40.201(Sq.Ft)
  '     '        Froude number =     0.090

Upstream point elevation =   591.000(Ft.)
Downstream point elevation =   583.000(Ft.)
Flow length =   574.000(Ft.)
Travel time  =   27.93 min.
Time of concentration =   47.62 min.
Depth of flow =   0.897(Ft.)
Average velocity =   0.343(Ft/s)
Total irregular channel flow =    13.769(CFS)
Irregular channel normal depth above invert elev. =   0.897(Ft.)
Average velocity of channel(s) =   0.343(Ft/s)
 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.712
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  78.80
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      1.356(In/Hr) for a   100.0 year storm
Subarea runoff =      4.151(CFS) for      4.300(Ac.)
Total runoff =     15.814(CFS)  Total area =      10.700(Ac.)
Depth of flow =   0.944(Ft.), Average velocity =   0.355(Ft/s)
End of computations, total study area =          10.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  71.2
```

RATIONAL METHOD NODE TABLE

PROPOSED CONDITIONS Q100

AREA	REMARKS	NODE NO.			HIGH ELEV. (ft)	LOW ELEV. (ft)	LENGTH (ft)	COVER TYPE	AREA (acre)	SOIL TYPE
A1	INITIAL AREA	1.10	→	1.20	598.15	591.20	826	COM	2.90	B
A2	INITIAL AREA	2.10	→	2.20	598.73	584.10	915	COM	3.70	B
A3	STREET FLOW	2.20	→	2.30	584.10	582.70	537	COM	0.40	B
A4	INITIAL AREA	4.10	→	4.20	582.90	578.17	173	COM	0.40	B
A5	INITIAL AREA	5.10	→	5.20	592.00	582.50	396	COM	3.30	B

Q10 PROPOSED CONDITIONS
RATIONAL METHOD

```
             Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
        Rational Hydrology Study        Date: 03/13/15  File:306401q10prop.out
------------------------------------------------------------------------
3064.01 VANTAGE POINT CHURCH
qQ10 PROPOSED HYDROLOGY STUDY
2015-03-12 CG

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

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


Program License Serial Number 6049

------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =   10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [ Mira Loma ] area used.
10 year storm 10 minute intensity =  1.960(In/Hr)
10 year storm 60 minute intensity =  0.760(In/Hr)
100 year storm 10 minute intensity =  3.100(In/Hr)
100 year storm 60 minute intensity =  1.200(In/Hr)

Storm event year =  10.0
Calculated rainfall intensity data:
1 hour intensity =  0.760(In/Hr)
Slope of intensity duration curve = 0.5300




++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   826.000(Ft.)
Top (of initial area) elevation =   598.150(Ft.)
Bottom (of initial area) elevation =   591.200(Ft.)
Difference in elevation =     6.950(Ft.)
Slope =    0.00841  s(percent)=       0.84
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.453 min.
Rainfall intensity =      1.828(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      4.598(CFS)
Total initial stream area =        2.900(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       0.000 to Point/Station       2.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   915.000(Ft.)
Top (of initial area) elevation =   598.730(Ft.)
Bottom (of initial area) elevation =   584.100(Ft.)
Difference in elevation =    14.630(Ft.)
Slope =    0.01599  s(percent)=       1.60
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```
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.494 min.
Rainfall intensity =      1.915(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.868
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      6.151(CFS)
Total initial stream area =        3.700(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.200 to Point/Station       2.300
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   584.100(Ft.)
End of street segment elevation =   582.700(Ft.)
Length of street segment  =   537.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   0.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      6.455(CFS)
Depth of flow =   0.501(Ft.), Average velocity =   2.030(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.000(Ft.)
Flow velocity =   2.03(Ft/s)
Travel time =    4.41 min.     TC =   14.90  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      1.590(In/Hr) for a    10.0 year storm
Subarea runoff =      0.550(CFS) for      0.400(Ac.)
Total runoff =      6.701(CFS)  Total area =       4.100(Ac.)
Street flow at end of street =      6.701(CFS)
Half street flow at end of street =      6.701(CFS)
Depth of flow =   0.507(Ft.), Average velocity =   2.060(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.100 to Point/Station       4.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   173.000(Ft.)
Top (of initial area) elevation =   582.900(Ft.)
Bottom (of initial area) elevation =   578.170(Ft.)
Difference in elevation =     4.730(Ft.)
Slope =    0.02734  s(percent)=       2.73
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Warning: TC computed to be less than 5 min.; program is assuming the
time of concentration is 5 minutes.
Initial area time of concentration =    5.000 min.
```

```
Rainfall intensity =      2.836(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.876
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.994(CFS)
Total initial stream area =       0.400(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       5.100 to Point/Station       5.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   396.000(Ft.)
Top (of initial area) elevation =   592.000(Ft.)
Bottom (of initial area) elevation =   582.500(Ft.)
Difference in elevation =     9.500(Ft.)
Slope =    0.02399  s(percent)=       2.40
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.921 min.
Rainfall intensity =      2.387(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.873
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      6.874(CFS)
Total initial stream area =       3.300(Ac.)
Pervious area fraction = 0.100
End of computations, total study area =          10.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  56.0
```

Q100 PROPOSED CONDITIONS
RATIONAL METHOD

```
            Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
        Rational Hydrology Study        Date: 03/12/15  File:306401Q100PROP.out
------------------------------------------------------------------------
3064.01 VANTAGE POINT CHURCH
Q100 PROPOSED
2015-03-12 CG

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 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

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Program License Serial Number 6049

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Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [ Mira Loma ] area used.
10 year storm 10 minute intensity =  1.960(In/Hr)
10 year storm 60 minute intensity =  0.760(In/Hr)
100 year storm 10 minute intensity =  3.100(In/Hr)
100 year storm 60 minute intensity =  1.200(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.200(In/Hr)
Slope of intensity duration curve = 0.5300




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Process from Point/Station       1.100 to Point/Station       1.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   826.000(Ft.)
Top (of initial area) elevation =   598.150(Ft.)
Bottom (of initial area) elevation =   591.200(Ft.)
Difference in elevation =     6.950(Ft.)
Slope =    0.00841  s(percent)=       0.84
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.453 min.
Rainfall intensity =      2.887(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      7.432(CFS)
Total initial stream area =        2.900(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       0.000 to Point/Station       2.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   915.000(Ft.)
Top (of initial area) elevation =   598.730(Ft.)
Bottom (of initial area) elevation =   584.100(Ft.)
Difference in elevation =    14.630(Ft.)
Slope =    0.01599  s(percent)=       1.60
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TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.494 min.
Rainfall intensity =      3.024(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      9.938(CFS)
Total initial stream area =       3.700(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       2.200 to Point/Station       2.300
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   584.100(Ft.)
End of street segment elevation =   582.700(Ft.)
Length of street segment  =   537.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   0.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     10.436(CFS)
Depth of flow =   0.590(Ft.), Average velocity =   2.460(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.000(Ft.)
Flow velocity =   2.46(Ft/s)
Travel time =    3.64 min.     TC =   14.13  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.582(In/Hr) for a   100.0 year storm
Subarea runoff =      0.916(CFS) for      0.400(Ac.)
Total runoff =     10.854(CFS)  Total area =       4.100(Ac.)
Street flow at end of street =     10.854(CFS)
Half street flow at end of street =     10.854(CFS)
Depth of flow =   0.598(Ft.), Average velocity =   2.499(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


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Process from Point/Station       4.100 to Point/Station       4.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   173.000(Ft.)
Top (of initial area) elevation =   582.900(Ft.)
Bottom (of initial area) elevation =   578.170(Ft.)
Difference in elevation =     4.730(Ft.)
Slope =    0.02734  s(percent)=       2.73
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Warning: TC computed to be less than 5 min.; program is assuming the
time of concentration is 5 minutes.
Initial area time of concentration =    5.000 min.
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Rainfall intensity =      4.479(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.892
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.598(CFS)
Total initial stream area =        0.400(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station        5.100 to Point/Station       5.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   396.000(Ft.)
Top (of initial area) elevation =   592.000(Ft.)
Bottom (of initial area) elevation =   582.500(Ft.)
Difference in elevation =     9.500(Ft.)
Slope =    0.02399  s(percent)=       2.40
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.921 min.
Rainfall intensity =      3.770(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     11.077(CFS)
Total initial stream area =        3.300(Ac.)
Pervious area fraction = 0.100
End of computations, total study area =          10.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  56.0
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APPENDIX 2

UNIT HYDROGRAPH

Q10
EXISTING UNIT HYDROGRAPH

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       U n i t   H y d r o g r a p h   A n a l y s i s

       Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
               Study date  03/13/15 File: 306401Q10EXUH2410.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978


Program License Serial Number 6049

---------------------------------------------------------------------
 English (in-lb) Input Units Used
 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



---------------------------------------------------------------------
3064.01 VANTAGE POINT CHURCH
Q10 EXISTING UNIT HYDROGRAPH ANALYSIS
2015-03-12 CG

--------------------------------------------------------------------
Drainage Area =      10.70(Ac.)  =      0.017 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =      10.70(Ac.)  =      0.017 Sq. Mi.
USER Entry of lag time in hours
Lag time =    0.703 Hr.
Lag time =    42.18 Min.
25% of lag time =    10.55 Min.
40% of lag time =    16.87 Min.
Unit time =    30.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
       10.70            2.00                  21.40

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
       10.70            6.00                  64.20

STORM EVENT (YEAR) =   10.00
Area Averaged 2-Year Rainfall =    2.000(In)
Area Averaged 100-Year Rainfall =    6.000(In)

Point rain (area averaged) =    3.646(In)
Areal adjustment factor =  100.00 %
Adjusted average point rain =    3.646(In)

Sub-Area Data:
Area(Ac.)         Runoff Index   Impervious %
    10.700          71.20         0.000
 Total Area Entered =     10.70(Ac.)


RI    RI   Infil. Rate Impervious   Adj. Infil. Rate  Area%     F
AMC2 AMC-2     (In/Hr)    (Dec.%)     (In/Hr)      (Dec.)    (In/Hr)
71.2  71.2      0.348     0.000        0.348       1.000      0.348
                                                   Sum (F) =   0.348
Area averaged mean soil loss (F) (In/Hr) =  0.348
Minimum soil loss rate ((In/Hr)) =  0.174
(for 24 hour storm duration)
Soil low loss rate (decimal) =   0.900
---------------------------------------------------------------------
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U n i t   H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.500	71.124	10.914	1.177
2	1.000	142.248	40.677	4.386
3	1.500	213.371	22.763	2.455
4	2.000	284.495	8.909	0.961
5	2.500	355.619	5.416	0.584
6	3.000	426.743	3.572	0.385
7	3.500	497.866	2.410	0.260
8	4.000	568.990	1.863	0.201
9	4.500	640.114	1.312	0.141
10	5.000	711.238	0.917	0.099
11	5.500	782.361	0.714	0.077
12	6.000	853.485	0.532	0.057
			Sum = 100.000	Sum= 10.784

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.50	0.50	0.036	(0.611)	0.033	0.004
2	1.00	0.70	0.051	(0.597)	0.046	0.005
3	1.50	0.60	0.044	(0.582)	0.039	0.004
4	2.00	0.70	0.051	(0.569)	0.046	0.005
5	2.50	0.80	0.058	(0.555)	0.052	0.006
6	3.00	1.00	0.073	(0.542)	0.066	0.007
7	3.50	1.00	0.073	(0.528)	0.066	0.007
8	4.00	1.10	0.080	(0.515)	0.072	0.008
9	4.50	1.30	0.095	(0.502)	0.085	0.009
10	5.00	1.50	0.109	(0.489)	0.098	0.011
11	5.50	1.30	0.095	(0.477)	0.085	0.009
12	6.00	1.60	0.117	(0.464)	0.105	0.012
13	6.50	1.80	0.131	(0.452)	0.118	0.013
14	7.00	2.00	0.146	(0.440)	0.131	0.015
15	7.50	2.10	0.153	(0.428)	0.138	0.015
16	8.00	2.50	0.182	(0.416)	0.164	0.018
17	8.50	3.00	0.219	(0.405)	0.197	0.022
18	9.00	3.30	0.241	(0.394)	0.217	0.024
19	9.50	3.90	0.284	(0.383)	0.256	0.028
20	10.00	4.30	0.314	(0.372)	0.282	0.031
21	10.50	3.00	0.219	(0.361)	0.197	0.022
22	11.00	4.00	0.292	(0.351)	0.262	0.029
23	11.50	3.80	0.277	(0.340)	0.249	0.028
24	12.00	3.50	0.255	(0.330)	0.230	0.026
25	12.50	5.10	0.372	0.321	(0.335)	0.051
26	13.00	5.70	0.416	0.311	(0.374)	0.105
27	13.50	6.80	0.496	0.302	(0.446)	0.194
28	14.00	4.60	0.335	0.293	(0.302)	0.043
29	14.50	5.30	0.386	0.284	(0.348)	0.103
30	15.00	5.10	0.372	0.275	(0.335)	0.097
31	15.50	4.70	0.343	0.267	(0.308)	0.076
32	16.00	3.80	0.277	(0.259)	0.249	0.028
33	16.50	0.80	0.058	(0.251)	0.052	0.006
34	17.00	0.60	0.044	(0.243)	0.039	0.004
35	17.50	1.00	0.073	(0.236)	0.066	0.007
36	18.00	0.90	0.066	(0.229)	0.059	0.007
37	18.50	0.80	0.058	(0.222)	0.052	0.006
38	19.00	0.50	0.036	(0.216)	0.033	0.004
39	19.50	0.70	0.051	(0.210)	0.046	0.005
40	20.00	0.50	0.036	(0.204)	0.033	0.004
41	20.50	0.60	0.044	(0.199)	0.039	0.004
42	21.00	0.50	0.036	(0.194)	0.033	0.004
43	21.50	0.50	0.036	(0.189)	0.033	0.004
44	22.00	0.50	0.036	(0.185)	0.033	0.004
45	22.50	0.50	0.036	(0.182)	0.033	0.004
46	23.00	0.40	0.029	(0.178)	0.026	0.003
47	23.50	0.40	0.029	(0.176)	0.026	0.003
48	24.00	0.40	0.029	(0.174)	0.026	0.003

```
            (Loss Rate Not Used)
    Sum =     100.0                                           Sum =     1.1
       Flood volume = Effective rainfall      0.56(In)
        times area      10.7(Ac.)/[(In)/(Ft.)] =       0.5(Ac.Ft)
       Total soil loss =      3.08(In)
       Total soil loss =     2.749(Ac.Ft)
       Total rainfall =      3.65(In)
       Flood volume =      21843.8 Cubic Feet
       Total soil loss =      119753.3 Cubic Feet
       --------------------------------------------------------------------
        Peak flow rate of this hydrograph =      1.256(CFS)
       --------------------------------------------------------------------
       ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           24 - H O U R    S T O R M
                      R u n o f f     H y d r o g r a p h
       --------------------------------------------------------------------
                  Hydrograph in  30   Minute intervals ((CFS))

       --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5       10.0
-----------------------------------------------------------------------
  0+30       0.0002      0.00  Q         |         |         |         |
  1+ 0       0.0011      0.02  Q         |         |         |         |
  1+30       0.0026      0.04  Q         |         |         |         |
  2+ 0       0.0043      0.04  Q         |         |         |         |
  2+30       0.0062      0.05  Q         |         |         |         |
  3+ 0       0.0085      0.06  Q         |         |         |         |
  3+30       0.0112      0.07  Q         |         |         |         |
  4+ 0       0.0142      0.07  QV        |         |         |         |
  4+30       0.0175      0.08  QV        |         |         |         |
  5+ 0       0.0212      0.09  QV        |         |         |         |
  5+30       0.0254      0.10  Q V       |         |         |         |
  6+ 0       0.0297      0.10  Q V       |         |         |         |
  6+30       0.0344      0.11  Q V       |         |         |         |
  7+ 0       0.0397      0.13  Q  V      |         |         |         |
  7+30       0.0456      0.14  Q  V      |         |         |         |
  8+ 0       0.0520      0.16  Q   V     |         |         |         |
  8+30       0.0593      0.18  Q   V     |         |         |         |
  9+ 0       0.0678      0.21  Q    V    |         |         |         |
  9+30       0.0775      0.23  Q     V   |         |         |         |
 10+ 0       0.0886      0.27  |Q     V  |         |         |         |
 10+30       0.1005      0.29  |Q      V |         |         |         |
 11+ 0       0.1116      0.27  |Q      V |         |         |         |
 11+30       0.1234      0.29  |Q       V|         |         |         |
 12+ 0       0.1354      0.29  |Q        V         |         |         |
 12+30       0.1483      0.31  |Q         V        |         |         |
 13+ 0       0.1683      0.48  |Q        |  V      |         |         |
 13+30       0.2049      0.89  |  Q      |     V   |         |         |
 14+ 0       0.2568      1.26  |    Q    |         V         |         |
 14+30       0.2960      0.95  |  Q      |         |  V      |         |
 15+ 0       0.3356      0.96  |  Q      |         |     V   |         |
 15+30       0.3765      0.99  |  Q      |         |         V         |
 16+ 0       0.4116      0.85  |  Q      |         |         | V       |
 16+30       0.4351      0.57  | Q       |         |         |   V     |
 17+ 0       0.4492      0.34  |Q        |         |         |    V    |
 17+30       0.4586      0.23  Q         |         |         |     V   |
 18+ 0       0.4662      0.18  Q         |         |         |      V  |
 18+30       0.4725      0.15  Q         |         |         |      V  |
 19+ 0       0.4773      0.12  Q         |         |         |       V |
 19+30       0.4809      0.09  Q         |         |         |       V |
 20+ 0       0.4840      0.07  Q         |         |         |       V |
 20+30       0.4865      0.06  Q         |         |         |       V |
 21+ 0       0.4887      0.05  Q         |         |         |       V |
 21+30       0.4906      0.05  Q         |         |         |        V|
 22+ 0       0.4923      0.04  Q         |         |         |        V|
 22+30       0.4940      0.04  Q         |         |         |        V|
 23+ 0       0.4956      0.04  Q         |         |         |        V|
 23+30       0.4971      0.04  Q         |         |         |        V|
 24+ 0       0.4985      0.03  Q         |         |         |        V|
 24+30       0.4998      0.03  Q         |         |         |        V|
 25+ 0       0.5004      0.02  Q         |         |         |        V|
 25+30       0.5008      0.01  Q         |         |         |        V|
 26+ 0       0.5010      0.01  Q         |         |         |        V|
 26+30       0.5012      0.00  Q         |         |         |        V|
 27+ 0       0.5013      0.00  Q         |         |         |        V|
 27+30       0.5014      0.00  Q         |         |         |        V|
 28+ 0       0.5014      0.00  Q         |         |         |        V|
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   28+30        0.5014       0.00  Q          |         |         |        V|
   29+ 0        0.5015       0.00  Q          |         |         |        V|
   29+30        0.5015       0.00  Q          |         |         |         V
-----------------------------------------------------------------------
```

Q100
EXISTING UNIT HYDROGRAPH

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 03/12/15 File: 306401Q100EXUH24100.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Program License Serial Number 6049

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

3064.01 VANTAGE POINT CHURCH
Q100 EXISTING UNIT HYDROGRAPH ANALISYS
2015-03-12 CG

Drainage Area = 10.70(Ac.) = 0.017 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 10.70(Ac.) = 0.017 Sq. Mi.
USER Entry of lag time in hours
Lag time = 0.634 Hr.
Lag time = 38.04 Min.
25% of lag time = 9.51 Min.
40% of lag time = 15.22 Min.
Unit time = 30.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
10.70	2.00	21.40

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
10.70	6.00	64.20

STORM EVENT (YEAR) = 100.00
Area Averaged 2-Year Rainfall = 2.000(In)
Area Averaged 100-Year Rainfall = 6.000(In)

Point rain (area averaged) = 6.000(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 6.000(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
10.700	71.20	0.000

Total Area Entered = 10.70(Ac.)

RI AMC2	RI AMC-3	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
71.2	85.7	0.179	0.000	0.179	1.000	0.179
					Sum (F) =	0.179

Area averaged mean soil loss (F) (In/Hr) = 0.179
Minimum soil loss rate ((In/Hr)) = 0.089
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.900

Unit Hydrograph
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.500	78.864	12.985	1.400
2	1.000	157.729	44.019	4.747
3	1.500	236.593	20.268	2.186
4	2.000	315.457	8.321	0.897
5	2.500	394.322	5.002	0.539
6	3.000	473.186	3.177	0.343
7	3.500	552.050	2.270	0.245
8	4.000	630.915	1.581	0.171
9	4.500	709.779	1.072	0.116
10	5.000	788.644	0.798	0.086
11	5.500	867.508	0.508	0.055
			Sum = 100.000	Sum= 10.784

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Loss rate(In./Hr) Low	Effective (In/Hr)
1	0.50	0.50	0.060	(0.314)	0.054	0.006
2	1.00	0.70	0.084	(0.307)	0.076	0.008
3	1.50	0.60	0.072	(0.299)	0.065	0.007
4	2.00	0.70	0.084	(0.292)	0.076	0.008
5	2.50	0.80	0.096	(0.285)	0.086	0.010
6	3.00	1.00	0.120	(0.278)	0.108	0.012
7	3.50	1.00	0.120	(0.271)	0.108	0.012
8	4.00	1.10	0.132	(0.265)	0.119	0.013
9	4.50	1.30	0.156	(0.258)	0.140	0.016
10	5.00	1.50	0.180	(0.251)	0.162	0.018
11	5.50	1.30	0.156	(0.245)	0.140	0.016
12	6.00	1.60	0.192	(0.239)	0.173	0.019
13	6.50	1.80	0.216	(0.232)	0.194	0.022
14	7.00	2.00	0.240	(0.226)	0.216	0.024
15	7.50	2.10	0.252	0.220	(0.227)	0.032
16	8.00	2.50	0.300	0.214	(0.270)	0.086
17	8.50	3.00	0.360	0.208	(0.324)	0.152
18	9.00	3.30	0.396	0.202	(0.356)	0.194
19	9.50	3.90	0.468	0.197	(0.421)	0.271
20	10.00	4.30	0.516	0.191	(0.464)	0.325
21	10.50	3.00	0.360	0.186	(0.324)	0.174
22	11.00	4.00	0.480	0.180	(0.432)	0.300
23	11.50	3.80	0.456	0.175	(0.410)	0.281
24	12.00	3.50	0.420	0.170	(0.378)	0.250
25	12.50	5.10	0.612	0.165	(0.551)	0.447
26	13.00	5.70	0.684	0.160	(0.616)	0.524
27	13.50	6.80	0.816	0.155	(0.734)	0.661
28	14.00	4.60	0.552	0.150	(0.497)	0.402
29	14.50	5.30	0.636	0.146	(0.572)	0.490
30	15.00	5.10	0.612	0.141	(0.551)	0.471
31	15.50	4.70	0.564	0.137	(0.508)	0.427
32	16.00	3.80	0.456	0.133	(0.410)	0.323
33	16.50	0.80	0.096	(0.129)	0.086	0.010
34	17.00	0.60	0.072	(0.125)	0.065	0.007
35	17.50	1.00	0.120	(0.121)	0.108	0.012
36	18.00	0.90	0.108	(0.118)	0.097	0.011
37	18.50	0.80	0.096	(0.114)	0.086	0.010
38	19.00	0.50	0.060	(0.111)	0.054	0.006
39	19.50	0.70	0.084	(0.108)	0.076	0.008
40	20.00	0.50	0.060	(0.105)	0.054	0.006
41	20.50	0.60	0.072	(0.102)	0.065	0.007
42	21.00	0.50	0.060	(0.100)	0.054	0.006
43	21.50	0.50	0.060	(0.097)	0.054	0.006
44	22.00	0.50	0.060	(0.095)	0.054	0.006
45	22.50	0.50	0.060	(0.093)	0.054	0.006
46	23.00	0.40	0.048	(0.092)	0.043	0.005
47	23.50	0.40	0.048	(0.090)	0.043	0.005
48	24.00	0.40	0.048	(0.090)	0.043	0.005

(Loss Rate Not Used)

```
Sum =     100.0                                      Sum =     6.1
   Flood volume = Effective rainfall      3.06(In)
    times area      10.7(Ac.)/[(In)/(Ft.)] =      2.7(Ac.Ft)
   Total soil loss =      2.94(In)
   Total soil loss =     2.624(Ac.Ft)
   Total rainfall =      6.00(In)
   Flood volume =      118755.1 Cubic Feet
   Total soil loss =      114286.0 Cubic Feet
   --------------------------------------------------------------------
    Peak flow rate of this hydrograph =      5.655(CFS)
   --------------------------------------------------------------------
   ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                     24 - H O U R    S T O R M
                R u n o f f      H y d r o g r a p h
   --------------------------------------------------------------------
               Hydrograph in  30   Minute intervals ((CFS))

   --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0         2.5       5.0       7.5      10.0
----------------------------------------------------------------------
  0+30       0.0003       0.01  Q         |         |         |         |
  1+ 0       0.0020       0.04  Q         |         |         |         |
  1+30       0.0046       0.06  Q         |         |         |         |
  2+ 0       0.0075       0.07  Q         |         |         |         |
  2+30       0.0108       0.08  Q         |         |         |         |
  3+ 0       0.0147       0.09  Q         |         |         |         |
  3+30       0.0192       0.11  Q         |         |         |         |
  4+ 0       0.0242       0.12  Q         |         |         |         |
  4+30       0.0297       0.13  Q         |         |         |         |
  5+ 0       0.0361       0.15  Q         |         |         |         |
  5+30       0.0431       0.17  Q         |         |         |         |
  6+ 0       0.0502       0.17  Q         |         |         |         |
  6+30       0.0581       0.19  Q         |         |         |         |
  7+ 0       0.0670       0.22  Q         |         |         |         |
  7+30       0.0772       0.25  QV        |         |         |         |
  8+ 0       0.0925       0.37  |Q        |         |         |         |
  8+30       0.1231       0.74  |VQ       |         |         |         |
  9+ 0       0.1744       1.24  | V Q     |         |         |         |
  9+30       0.2466       1.75  |  V  Q   |         |         |         |
 10+ 0       0.3447       2.37  |    V   Q|         |         |         |
 10+30       0.4556       2.68  |     V   Q         |         |         |
 11+ 0       0.5544       2.39  |       VQ|         |         |         |
 11+30       0.6685       2.76  |        V|Q        |         |         |
 12+ 0       0.7864       2.85  |         |Q        |         |         |
 12+30       0.9116       3.03  |         | QV      |         |         |
 13+ 0       1.0787       4.04  |         |    VQ   |         |         |
 13+30       1.2864       5.03  |         |       V Q         |         |
 14+ 0       1.5201       5.65  |         |         | Q       |         |
 14+30       1.7275       5.02  |         |         Q    V    |         |
 15+ 0       1.9370       5.07  |         |         Q       V |         |
 15+30       2.1445       5.02  |         |         Q         |V        |
 16+ 0       2.3373       4.67  |         |       Q |         |   V     |
 16+30       2.4880       3.65  |         |   Q     |         |     V   |
 17+ 0       2.5661       1.89  |      Q  |         |         |      V  |
 17+30       2.6111       1.09  |   Q     |         |         |       V |
 18+ 0       2.6420       0.75  | Q       |         |         |       V |
 18+30       2.6637       0.53  | Q       |         |         |        V|
 19+ 0       2.6788       0.37  |Q        |         |         |        V|
 19+30       2.6893       0.25  |Q        |         |         |        V|
 20+ 0       2.6969       0.18  Q         |         |         |        V|
 20+30       2.7022       0.13  Q         |         |         |        V|
 21+ 0       2.7060       0.09  Q         |         |         |        V|
 21+30       2.7090       0.07  Q         |         |         |        V|
 22+ 0       2.7118       0.07  Q         |         |         |        V|
 22+30       2.7146       0.07  Q         |         |         |        V|
 23+ 0       2.7173       0.06  Q         |         |         |        V|
 23+30       2.7197       0.06  Q         |         |         |        V|
 24+ 0       2.7219       0.06  Q         |         |         |        V|
 24+30       2.7239       0.05  Q         |         |         |        V|
 25+ 0       2.7249       0.02  Q         |         |         |        V|
 25+30       2.7254       0.01  Q         |         |         |        V|
 26+ 0       2.7257       0.01  Q         |         |         |        V|
 26+30       2.7259       0.01  Q         |         |         |        V|
 27+ 0       2.7261       0.00  Q         |         |         |        V|
 27+30       2.7262       0.00  Q         |         |         |        V|
 28+ 0       2.7262       0.00  Q         |         |         |        V|
 28+30       2.7262       0.00  Q         |         |         |        V|
```

```
   29+ 0       2.7262      0.00  Q         |         |         |        V|
-----------------------------------------------------------------------
```

Q10
PROPOSED UNIT HYDROGRAPH

```
        U n i t   H y d r o g r a p h   A n a l y s i s

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
                Study date  03/13/15 File: 306401q10propuh2410.out

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

Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978


Program License Serial Number 6049

---------------------------------------------------------------------
 English (in-lb) Input Units Used
 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



---------------------------------------------------------------------
3064.01 VANTAGE POINT CHURCH
Q10 PROPOSED UNIT HYDROGRAPH
2015-03-12-CG

--------------------------------------------------------------------
Drainage Area =      10.70(Ac.)  =      0.017 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =      10.70(Ac.)  =      0.017 Sq. Mi.
USER Entry of lag time in hours
Lag time =    0.198 Hr.
Lag time =    11.88 Min.
25% of lag time =     2.97 Min.
40% of lag time =     4.75 Min.
Unit time =    30.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
       10.70            2.00                  21.40

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
       10.70            6.00                  64.20

STORM EVENT (YEAR) =   10.00
Area Averaged 2-Year Rainfall =    2.000(In)
Area Averaged 100-Year Rainfall =    6.000(In)

Point rain (area averaged) =    3.646(In)
Areal adjustment factor =  100.00 %
Adjusted average point rain =    3.646(In)

Sub-Area Data:
Area(Ac.)         Runoff Index   Impervious %
    10.700           56.00        0.900
 Total Area Entered =     10.70(Ac.)


RI    RI   Infil. Rate Impervious   Adj. Infil. Rate  Area%     F
AMC2 AMC-2     (In/Hr)    (Dec.%)     (In/Hr)      (Dec.)    (In/Hr)
56.0  56.0      0.511     0.900       0.097       1.000      0.097
                                                  Sum (F) =   0.097
Area averaged mean soil loss (F) (In/Hr) =  0.097
Minimum soil loss rate ((In/Hr)) =  0.049
(for 24 hour storm duration)
Soil low loss rate (decimal) =   0.180
---------------------------------------------------------------------
```

U n i t   H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.500	252.525	51.223	5.524
2	1.000	505.051	39.898	4.302
3	1.500	757.576	6.938	0.748
4	2.000	1010.101	1.941	0.209
			Sum = 100.000	Sum= 10.784

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.50	0.50	0.036	(0.170)	0.007	0.030
2	1.00	0.70	0.051	(0.166)	0.009	0.042
3	1.50	0.60	0.044	(0.163)	0.008	0.036
4	2.00	0.70	0.051	(0.159)	0.009	0.042
5	2.50	0.80	0.058	(0.155)	0.010	0.048
6	3.00	1.00	0.073	(0.151)	0.013	0.060
7	3.50	1.00	0.073	(0.147)	0.013	0.060
8	4.00	1.10	0.080	(0.144)	0.014	0.066
9	4.50	1.30	0.095	(0.140)	0.017	0.078
10	5.00	1.50	0.109	(0.137)	0.020	0.090
11	5.50	1.30	0.095	(0.133)	0.017	0.078
12	6.00	1.60	0.117	(0.130)	0.021	0.096
13	6.50	1.80	0.131	(0.126)	0.024	0.108
14	7.00	2.00	0.146	(0.123)	0.026	0.120
15	7.50	2.10	0.153	(0.119)	0.028	0.126
16	8.00	2.50	0.182	(0.116)	0.033	0.149
17	8.50	3.00	0.219	(0.113)	0.039	0.179
18	9.00	3.30	0.241	(0.110)	0.043	0.197
19	9.50	3.90	0.284	(0.107)	0.051	0.233
20	10.00	4.30	0.314	(0.104)	0.056	0.257
21	10.50	3.00	0.219	(0.101)	0.039	0.179
22	11.00	4.00	0.292	(0.098)	0.052	0.239
23	11.50	3.80	0.277	(0.095)	0.050	0.227
24	12.00	3.50	0.255	(0.092)	0.046	0.209
25	12.50	5.10	0.372	(0.089)	0.067	0.305
26	13.00	5.70	0.416	(0.087)	0.075	0.341
27	13.50	6.80	0.496	0.084	(0.089)	0.412
28	14.00	4.60	0.335	(0.082)	0.060	0.275
29	14.50	5.30	0.386	(0.079)	0.070	0.317
30	15.00	5.10	0.372	(0.077)	0.067	0.305
31	15.50	4.70	0.343	(0.074)	0.062	0.281
32	16.00	3.80	0.277	(0.072)	0.050	0.227
33	16.50	0.80	0.058	(0.070)	0.010	0.048
34	17.00	0.60	0.044	(0.068)	0.008	0.036
35	17.50	1.00	0.073	(0.066)	0.013	0.060
36	18.00	0.90	0.066	(0.064)	0.012	0.054
37	18.50	0.80	0.058	(0.062)	0.010	0.048
38	19.00	0.50	0.036	(0.060)	0.007	0.030
39	19.50	0.70	0.051	(0.059)	0.009	0.042
40	20.00	0.50	0.036	(0.057)	0.007	0.030
41	20.50	0.60	0.044	(0.055)	0.008	0.036
42	21.00	0.50	0.036	(0.054)	0.007	0.030
43	21.50	0.50	0.036	(0.053)	0.007	0.030
44	22.00	0.50	0.036	(0.052)	0.007	0.030
45	22.50	0.50	0.036	(0.051)	0.007	0.030
46	23.00	0.40	0.029	(0.050)	0.005	0.024
47	23.50	0.40	0.029	(0.049)	0.005	0.024
48	24.00	0.40	0.029	(0.049)	0.005	0.024

(Loss Rate Not Used)

Sum = 100.0 Sum = 6.0

Flood volume = Effective rainfall 2.99(In)
times area 10.7(Ac.)/[(In)/(Ft.)] = 2.7(Ac.Ft)
Total soil loss = 0.65(In)
Total soil loss = 0.583(Ac.Ft)
Total rainfall = 3.65(In)
Flood volume = 116207.7 Cubic Feet

```
       Total soil loss =      25389.4 Cubic Feet
       --------------------------------------------------------------------
        Peak flow rate of this hydrograph =     4.014(CFS)
       --------------------------------------------------------------------
       ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           24 - H O U R    S T O R M
                      R u n o f f      H y d r o g r a p h
       --------------------------------------------------------------------
                  Hydrograph in  30   Minute intervals ((CFS))

       --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0         2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+30       0.0068      0.17  Q         |         |         |         |
  1+ 0       0.0217      0.36  VQ        |         |         |         |
  1+30       0.0383      0.40  VQ        |         |         |         |
  2+ 0       0.0558      0.42  VQ        |         |         |         |
  2+30       0.0756      0.48   Q        |         |         |         |
  3+ 0       0.0994      0.58  |VQ       |         |         |         |
  3+30       0.1255      0.63  |VQ       |         |         |         |
  4+ 0       0.1534      0.68  | Q       |         |         |         |
  4+30       0.1852      0.77  | VQ      |         |         |         |
  5+ 0       0.2221      0.89  |  Q      |         |         |         |
  5+30       0.2588      0.89  |  Q      |         |         |         |
  6+ 0       0.2979      0.95  |  QV     |         |         |         |
  6+30       0.3426      1.08  |   QV    |         |         |         |
  7+ 0       0.3927      1.21  |   QV    |         |         |         |
  7+30       0.4468      1.31  |    QV   |         |         |         |
  8+ 0       0.5079      1.48  |    Q V  |         |         |         |
  8+30       0.5804      1.75  |      QV |         |         |         |
  9+ 0       0.6631      2.00  |       QV|         |         |         |
  9+30       0.7582      2.30  |        Q V        |         |         |
 10+ 0       0.8661      2.61  |         Q V       |         |         |
 10+30       0.9617      2.31  |        Q|   V     |         |         |
 11+ 0       1.0582      2.34  |        Q|    V    |         |         |
 11+30       1.1604      2.47  |        Q|      V  |         |         |
 12+ 0       1.2575      2.35  |        Q|       V |         |         |
 12+30       1.3735      2.81  |         |Q        V         |         |
 13+ 0       1.5140      3.40  |         |  Q        V        |         |
 13+30       1.6798      4.01  |         |     Q   |    V    |         |
 14+ 0       1.8290      3.61  |         |   Q     |      V  |         |
 14+30       1.9660      3.31  |         |  Q      |        V|         |
 15+ 0       2.1041      3.34  |         |  Q      |          V        |
 15+30       2.2347      3.16  |         | Q       |         |  V      |
 16+ 0       2.3487      2.76  |         |Q        |         |    V    |
 16+30       2.4114      1.52  |     Q   |         |         |     V   |
 17+ 0       2.4375      0.63  | Q       |         |         |     V   |
 17+30       2.4610      0.57  | Q       |         |         |     V   |
 18+ 0       2.4855      0.59  | Q       |         |         |      V  |
 18+30       2.5081      0.55  | Q       |         |         |      V  |
 19+ 0       2.5256      0.42  |Q        |         |         |      V  |
 19+30       2.5424      0.41  |Q        |         |         |       V |
 20+ 0       2.5581      0.38  |Q        |         |         |       V |
 20+30       2.5731      0.36  |Q        |         |         |       V |
 21+ 0       2.5876      0.35  |Q        |         |         |       V |
 21+30       2.6011      0.33  |Q        |         |         |        V|
 22+ 0       2.6145      0.32  |Q        |         |         |        V|
 22+30       2.6278      0.32  |Q        |         |         |        V|
 23+ 0       2.6398      0.29  |Q        |         |         |        V|
 23+30       2.6507      0.26  |Q        |         |         |        V|
 24+ 0       2.6614      0.26  |Q        |         |         |        V|
 24+30       2.6666      0.13  Q         |         |         |        V|
 25+ 0       2.6676      0.02  Q         |         |         |        V|
 25+30       2.6678      0.01  Q         |         |         |         V
----------------------------------------------------------------------
```

Q100
PROPOSED UNIT HYDROGRAPH

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 03/12/15 File: 306401Q100PROPUH24100.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Program License Serial Number 6049

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

3064.01 VANTAGE POINT CHURCH
Q100 PROPOSED UNIT HYROGRAPH ANALYSIS
2015-03-12-CG

Drainage Area = 10.70(Ac.) = 0.017 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 10.70(Ac.) = 0.017 Sq. Mi.
USER Entry of lag time in hours
Lag time = 0.146 Hr.
Lag time = 8.76 Min.
25% of lag time = 2.19 Min.
40% of lag time = 3.50 Min.
Unit time = 30.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
10.70	2.00	21.40

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
10.70	6.00	64.20

STORM EVENT (YEAR) = 100.00
Area Averaged 2-Year Rainfall = 2.000(In)
Area Averaged 100-Year Rainfall = 6.000(In)

Point rain (area averaged) = 6.000(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 6.000(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
10.700	56.00	0.900

Total Area Entered = 10.70(Ac.)

RI AMC2	RI AMC-3	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
56.0	74.8	0.305	0.900	0.058	1.000	0.058
					Sum (F) =	0.058

Area averaged mean soil loss (F) (In/Hr) = 0.058
Minimum soil loss rate ((In/Hr)) = 0.029
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.500	342.466	60.660	6.541
2	1.000	684.932	34.903	3.764
3	1.500	1027.397	4.437	0.478
			Sum = 100.000	Sum= 10.784

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Loss rate(In./Hr) Low	Effective (In/Hr)
1	0.50	0.50	0.060	(0.102)	0.011	0.049
2	1.00	0.70	0.084	(0.099)	0.015	0.069
3	1.50	0.60	0.072	(0.097)	0.013	0.059
4	2.00	0.70	0.084	(0.095)	0.015	0.069
5	2.50	0.80	0.096	(0.093)	0.017	0.079
6	3.00	1.00	0.120	(0.090)	0.022	0.098
7	3.50	1.00	0.120	(0.088)	0.022	0.098
8	4.00	1.10	0.132	(0.086)	0.024	0.108
9	4.50	1.30	0.156	(0.084)	0.028	0.128
10	5.00	1.50	0.180	(0.082)	0.032	0.148
11	5.50	1.30	0.156	(0.080)	0.028	0.128
12	6.00	1.60	0.192	(0.077)	0.035	0.157
13	6.50	1.80	0.216	(0.075)	0.039	0.177
14	7.00	2.00	0.240	(0.073)	0.043	0.197
15	7.50	2.10	0.252	(0.071)	0.045	0.207
16	8.00	2.50	0.300	(0.069)	0.054	0.246
17	8.50	3.00	0.360	(0.068)	0.065	0.295
18	9.00	3.30	0.396	0.066	(0.071)	0.330
19	9.50	3.90	0.468	0.064	(0.084)	0.404
20	10.00	4.30	0.516	0.062	(0.093)	0.454
21	10.50	3.00	0.360	0.060	(0.065)	0.300
22	11.00	4.00	0.480	0.058	(0.086)	0.421
23	11.50	3.80	0.456	0.057	(0.082)	0.399
24	12.00	3.50	0.420	0.055	(0.076)	0.365
25	12.50	5.10	0.612	0.053	(0.110)	0.559
26	13.00	5.70	0.684	0.052	(0.123)	0.632
27	13.50	6.80	0.816	0.050	(0.147)	0.766
28	14.00	4.60	0.552	0.049	(0.099)	0.503
29	14.50	5.30	0.636	0.047	(0.114)	0.589
30	15.00	5.10	0.612	0.046	(0.110)	0.566
31	15.50	4.70	0.564	0.045	(0.102)	0.519
32	16.00	3.80	0.456	0.043	(0.082)	0.413
33	16.50	0.80	0.096	(0.042)	0.017	0.079
34	17.00	0.60	0.072	(0.041)	0.013	0.059
35	17.50	1.00	0.120	(0.039)	0.022	0.098
36	18.00	0.90	0.108	(0.038)	0.019	0.089
37	18.50	0.80	0.096	(0.037)	0.017	0.079
38	19.00	0.50	0.060	(0.036)	0.011	0.049
39	19.50	0.70	0.084	(0.035)	0.015	0.069
40	20.00	0.50	0.060	(0.034)	0.011	0.049
41	20.50	0.60	0.072	(0.033)	0.013	0.059
42	21.00	0.50	0.060	(0.032)	0.011	0.049
43	21.50	0.50	0.060	(0.032)	0.011	0.049
44	22.00	0.50	0.060	(0.031)	0.011	0.049
45	22.50	0.50	0.060	(0.030)	0.011	0.049
46	23.00	0.40	0.048	(0.030)	0.009	0.039
47	23.50	0.40	0.048	(0.029)	0.009	0.039
48	24.00	0.40	0.048	(0.029)	0.009	0.039

(Loss Rate Not Used)

Sum = 100.0 Sum = 10.5

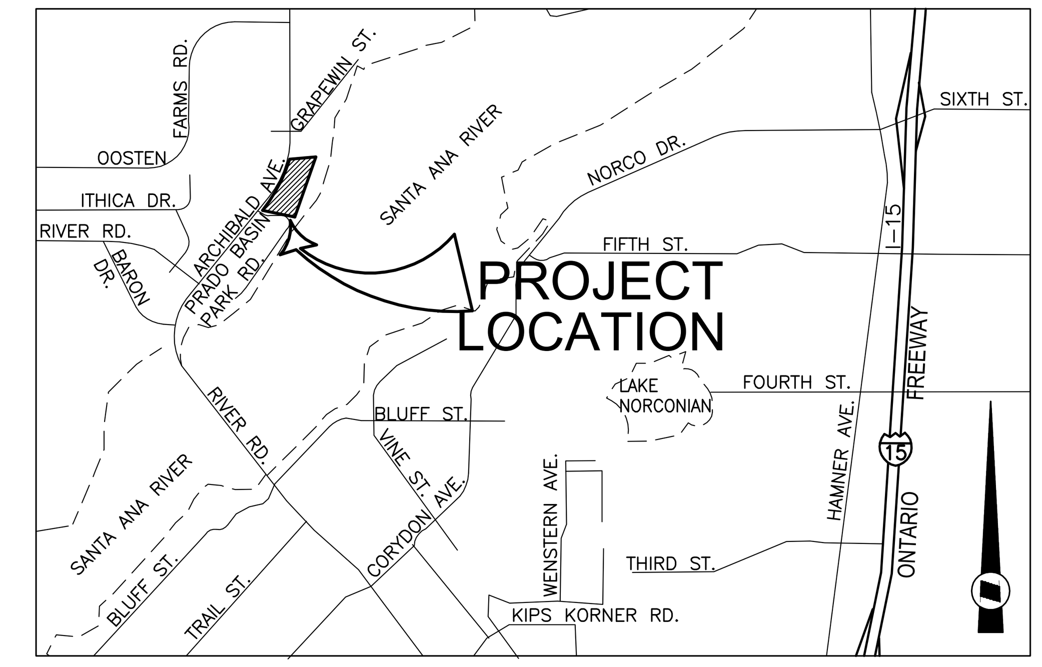
Flood volume = Effective rainfall 5.24(In)
times area 10.7(Ac.)/[(In)/(Ft.)] = 4.7(Ac.Ft)
Total soil loss = 0.76(In)
Total soil loss = 0.679(Ac.Ft)
Total rainfall = 6.00(In)
Flood volume = 203473.5 Cubic Feet
Total soil loss = 29567.6 Cubic Feet

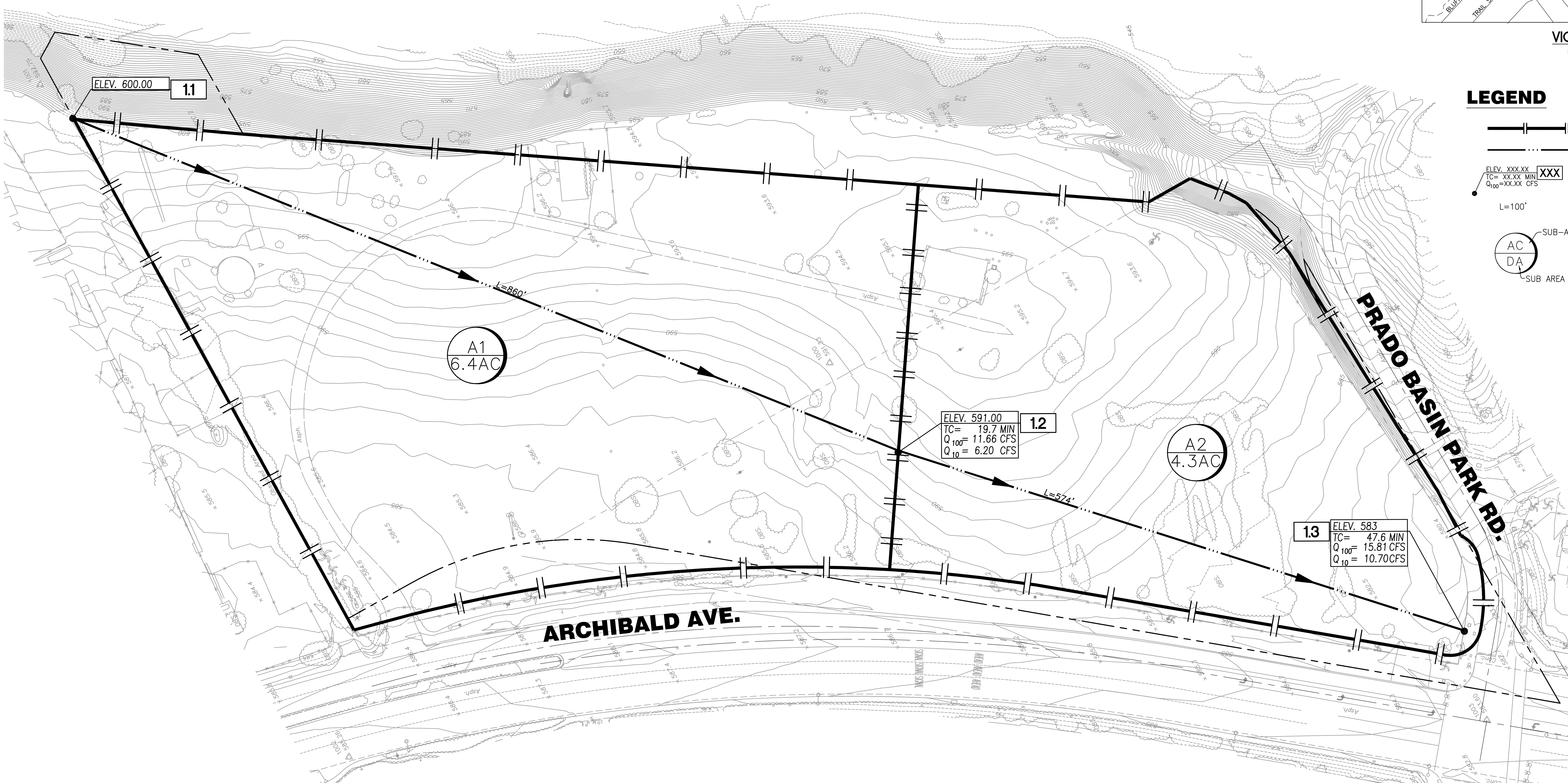
```
     ----------------------------------------------------------------------
      Peak flow rate of this hydrograph =      7.659(CFS)
     ----------------------------------------------------------------------
     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                       24 - H O U R     S T O R M
                  R u n o f f      H y d r o g r a p h
     ----------------------------------------------------------------------
                 Hydrograph in  30   Minute intervals ((CFS))

     ----------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+30       0.0133      0.32  VQ        |         |         |         |
  1+ 0       0.0396      0.64  V Q       |         |         |         |
  1+30       0.0672      0.67  V Q       |         |         |         |
  2+ 0       0.0964      0.71  V Q       |         |         |         |
  2+30       0.1296      0.80   V Q      |         |         |         |
  3+ 0       0.1698      0.97  |V Q      |         |         |         |
  3+30       0.2133      1.05  |V  Q     |         |         |         |
  4+ 0       0.2598      1.13  | V Q     |         |         |         |
  4+30       0.3132      1.29  | V  Q    |         |         |         |
  5+ 0       0.3752      1.50  |  V Q    |         |         |         |
  5+30       0.4353      1.45  |  V Q    |         |         |         |
  6+ 0       0.5007      1.58  |   V Q   |         |         |         |
  6+30       0.5756      1.81  |   V  Q  |         |         |         |
  7+ 0       0.6595      2.03  |    V  Q |         |         |         |
  7+30       0.7495      2.18  |     V Q |         |         |         |
  8+ 0       0.8521      2.48  |      V Q|         |         |         |
  8+30       0.9743      2.96  |       V |Q        |         |         |
  9+ 0       1.1144      3.39  |        V|  Q      |         |         |
  9+30       1.2810      4.03  |         V     Q   |         |         |
 10+ 0       1.4732      4.65  |         | V     Q |         |         |
 10+30       1.6329      3.86  |         |  V Q    |         |         |
 11+ 0       1.8025      4.10  |         |    VQ   |         |         |
 11+30       1.9820      4.34  |         |     VQ  |         |         |
 12+ 0       2.1511      4.09  |         |     Q V |         |         |
 12+30       2.3668      5.22  |         |         Q         |         |
 13+ 0       2.6319      6.41  |         |           V  Q    |         |
 13+30       2.9484      7.66  |         |         |    V    Q         |
 14+ 0       3.2161      6.48  |         |         |    Q V  |         |
 14+30       3.4687      6.11  |         |         |   Q    V|         |
 15+ 0       3.7234      6.16  |         |         |   Q      V        |
 15+30       3.9636      5.81  |         |         |  Q      |  V      |
 16+ 0       4.1673      4.93  |         |        Q|         |    V    |
 16+30       4.2631      2.32  |        Q|         |         |     V   |
 17+ 0       4.2995      0.88  |  Q      |         |         |     V   |
 17+30       4.3368      0.90  |  Q      |         |         |      V  |
 18+ 0       4.3773      0.98  |  Q      |         |         |      V  |
 18+30       4.4143      0.90  |  Q      |         |         |      V  |
 19+ 0       4.4416      0.66  | Q       |         |         |       V |
 19+30       4.4694      0.67  | Q       |         |         |       V |
 20+ 0       4.4944      0.60  | Q       |         |         |       V |
 20+30       4.5194      0.60  | Q       |         |         |       V |
 21+ 0       4.5429      0.57  | Q       |         |         |       V |
 21+30       4.5650      0.54  | Q       |         |         |        V|
 22+ 0       4.5869      0.53  | Q       |         |         |        V|
 22+30       4.6089      0.53  | Q       |         |         |        V|
 23+ 0       4.6281      0.47  |Q        |         |         |        V|
 23+30       4.6459      0.43  |Q        |         |         |        V|
 24+ 0       4.6634      0.42  |Q        |         |         |        V|
 24+30       4.6703      0.17  Q         |         |         |        V|
 25+ 0       4.6711      0.02  Q         |         |         |         V
----------------------------------------------------------------------
```

APPENDIX 3

HYDROLOGY MAPS

Q 10 & Q100
EXISTING HYDROLOGY MAP





LEGEND

Symbol	Description
—‖—‖—‖—	AREA BOUNDARY
—··—··—	PROPOSED FLOWLINE
ELEV. XXX.XX / TC= XX.XX MIN / Q_{100}=XX.XX CFS [XXX]	SURFACE FLOW NODE
L=100'	SURFACE FLOW LENGTH
AC / DA (SUB-AREA (ACRES); SUB AREA)	AREA NODE

GRAPHIC SCALE

50 0 25 50 100 150

(IN FEET)
1 inch = 50 ft.

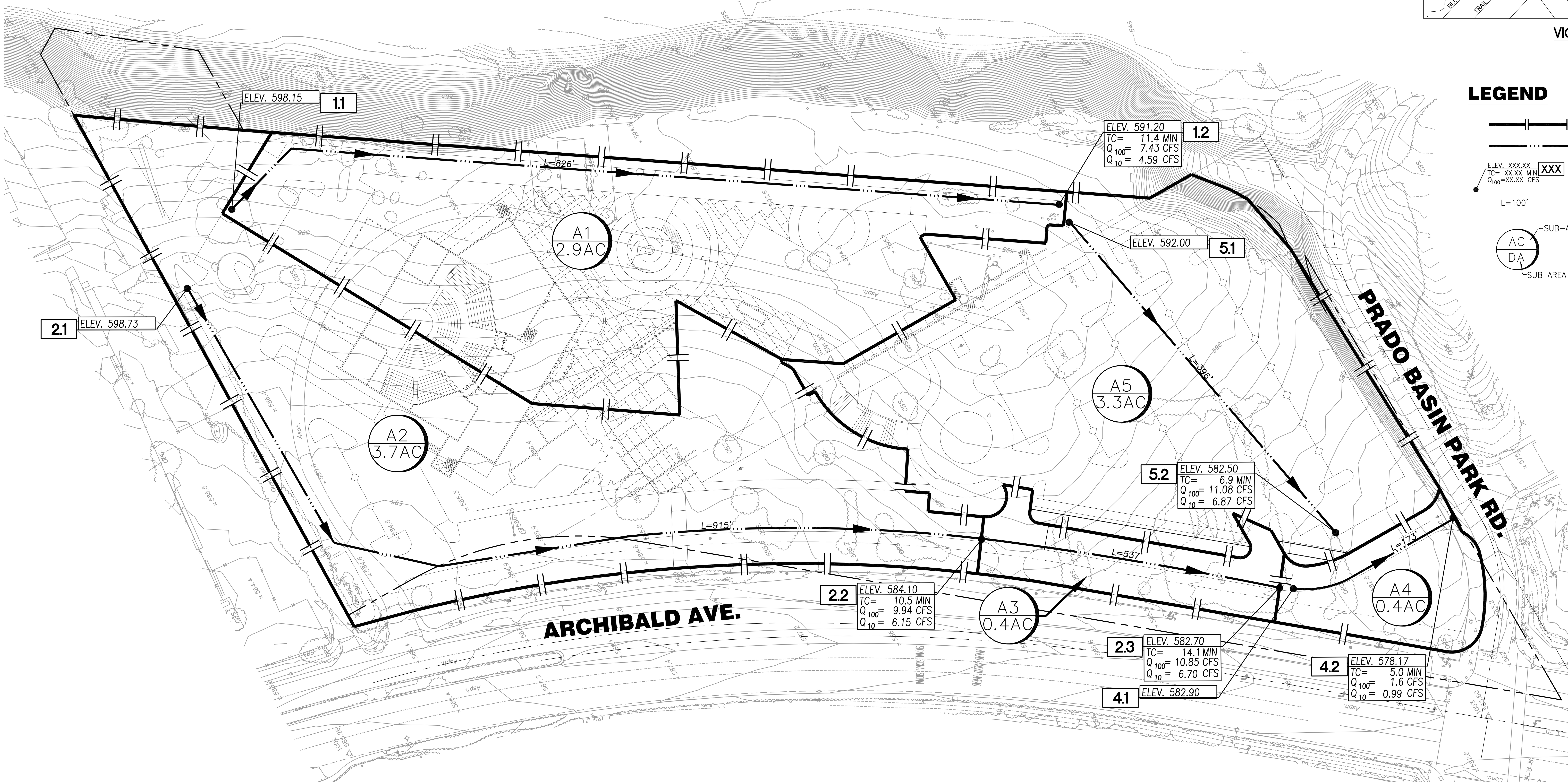
PREPARED BY:

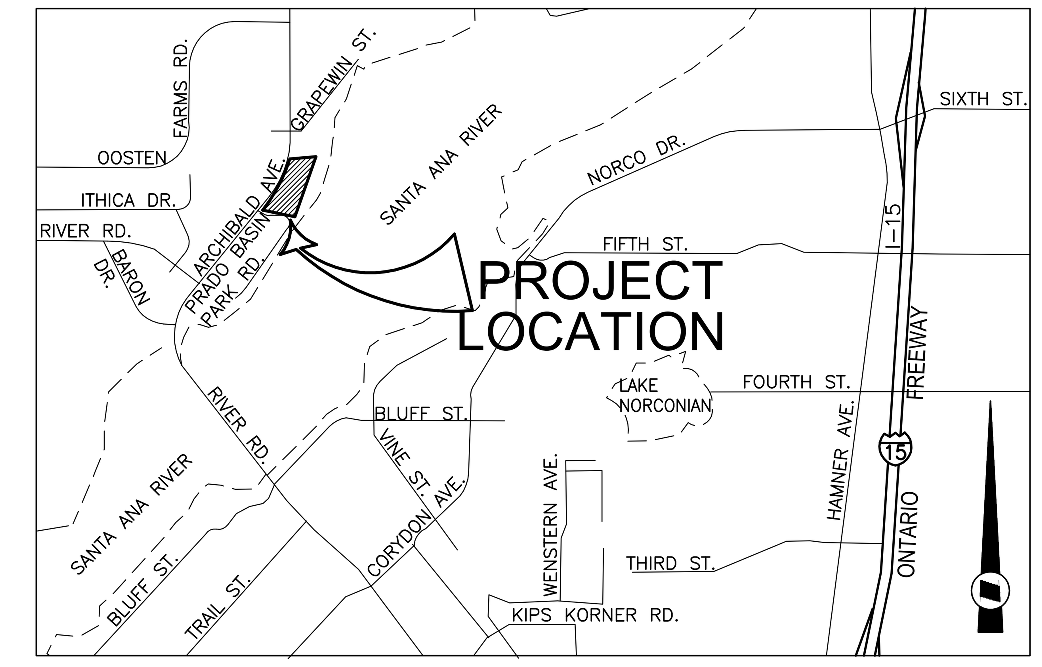
March, 2015

FUSCOE ENGINEERING
full circle thinking

EXISTING 10 & 100 YR
HYDROLOGY MAP
VANTAGE POINT CHURCH
EASTVALE, CA

Q10 & Q100
PROPOSED HYDROLOGY MAP





VICINITY MAP

NOT TO SCALE

LEGEND

	AREA BOUNDARY
	PROPOSED FLOWLINE
ELEV. XXX.XX TC= XX.XX MIN Q_{100}=XX.XX CFS XXX	SURFACE FLOW NODE
L=100'	SURFACE FLOW LENGTH
AC / DA — SUB-AREA (ACRES), SUB AREA	AREA NODE

GRAPHIC SCALE

50 0 25 50 100 150

(IN FEET)
1 inch = 50 ft.

PREPARED BY:

March, 2015

FUSCOE ENGINEERING
full circle thinking

PROPOSED 10 & 100 YR HYDROLOGY MAP
VANTAGE POINT CHURCH
EASTVALE, CA

FUSCOE
ENGINEERING

PRELIMINARY WATER QUALITY MANAGEMENT PLAN

VANTAGE POINT CHURCH

Eastvale, California

Prepared For
Vantage Point Church
5171 Edison Avenue
Chino, California 91710
909.465.9700

Prepared By

Fuscoe Engineering, Inc.
2850 Inland Empire Blvd. Building B
Ontario, California, 91764
909.581.0676
www.fuscoe.com

Project Manager:
Steven L. Ellis

Date Prepared: March, 2015
Job Number: 3064.001

full circle thinking®

PRELIMINARY WATER QUALITY MANAGEMENT PLAN
(P-WQMP)

VANTAGE POINT CHURCH

APN: 130080008 -13008005

Located at Northeast corner of the Intersection of
Archibald Avenue & Prado Park Road
in the
City of Eastvale
County of Riverside, California

Prepared for:

VANTAGE POINT CHURCH
5171 Edison Avenue, Suite C
Chino, CA 91710
909.465.9700

Prepared by:

FUSCOE ENGINEERING, INC.
2850 Inland Empire Blvd., Suite B
Ontario, CA 91764
909.581.0676

Date Prepared: March 11, 2015

OWNER'S CERTIFICATION

WATER QUALITY MANAGEMENT PLAN (WQMP)
City of Eastvale
APN 130080008 -13008005

This project-specific Water Quality Management Plan (WQMP) has been prepared for Vantage Point Church by Fuscoe Engineering, Inc., for the project known as Vantage Point Church at the Northeast corner of Archibald Avenue and Prado Park Basin Road in the City of Eastvale, California. This WQMP is intended to comply with the requirements of the City of Eastvale, for APN 130080008-13008005.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity.

The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under the City of Eastvale Water Quality Ordinance (Municipal Code Section Water Code 10562).

If the undersigned transfers its interest in the subject property/project, its successor in interest the undersigned shall notify the successor in interest of its responsibility to implement this WQMP.

"I certify under penalty of law that the provision of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

____________________________ ____________________________
Signature Title

____________________________ ____________________________
Name Company

____
Address

____________________________ ____________________________
Phone Date

PREPARER'S CERTIFICATION

WATER QUALITY MANAGEMENT PLAN (WQMP)
City of Eastvale
APN 130080008 -13008005

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0033 and any subsequent amendments thereto."

______________________________	______________________________
Preparer's Signature	Date
Steve L. Ellis	Principal
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

TABLE OF CONTENTS

INTRODUCTION

This Water Quality Management Plan (WQMP) has been prepared to provide specifications for the post-construction management of storm water runoff from the proposed project at Vantage Point Church in the City of Eastvale, California. Improperly managed runoff can be a significant source of water pollution causing impacts to aquatic habitat, wildlife, and water-dependent beneficial uses.

This WQMP covers the post-construction operations on Vantage Point Church in the City of Eastvale, California. It has been developed as required under the Santa Ana Regional Water Quality Control Board Municipal NPDES Storm Water Permit for the County of Riverside and the Incorporated Cities of Riverside County, and in accordance with good engineering practices. This WQMP describes this facility and its operations, identifies potential sources of storm water pollution at the facility, and describes appropriate Best Management Practices (BMPs) or pollution control measures to be implemented to reduce the discharge of pollutants in storm water runoff (see Appendix 1 for the Project's Vicinity Map).

A PROJECT AND SITE INFORMATION

PROJECT INFORMATION	
Type of Project:	Commercial
Planning Area:	N/A
Community Name:	N/A
Development Name:	N/A
PROJECT LOCATION	
Latitude & Longitude (DMS): 33° 56′ 1.05″ -117° 35′ 37.09″	
Project Watershed and Sub-Watershed: Santa Ana/Chino Split	
APN(s): 130080008-130080005	
Map Book and Page No.: Not Available	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Commercial
Proposed or Potential SIC Code(s)	1542
Area of Impervious Project Footprint (SF)	334,976 SF
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	No
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	0 SF
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☐ Y ☒ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	A/D
What is the Water Quality Design Storm Depth for the project?	2 year 24hr.

A.1 MAPS AND SITE PLANS`

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

A.2 IDENTIFY RECEIVING WATERS

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

RECEIVING WATERS	EPA APPROVED 303(D) LIST IMPAIRMENTS	DESIGNATED BENEFICIAL USES	PROXIMITY TO RARE BENEFICIAL USE
Santa Ana River Reach 3	*Copper, Lead, Pathogens*	*AGR, GWR, RARE, REC1, REC2, WARM, WILD*	*520-ft*
Prado Dam	*Nutrient, Pathogens, Ph*	*RARE, REC1, REC2, WARM, WILD*	*3.20 miles*

A.3 ADDITIONAL PERMITS/APPROVALS REQUIRED FOR THE PROJECT:

Table A.2 Other Applicable Permits

AGENCY	PERMIT REQUIRED (YES/NO)
State Department of Fish and Game, 1602 Streambed Alteration Agreement	No
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Certification	No
US Army Corps of Engineers, CWA Section 404 Permit	No
US Fish and Wildlife, Endangered Species Act Section 7 Biological Option	No
Statewide Construction General Permit Coverage	Yes
Statewide Industrial General Permit Coverage	No
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	No
Other (please list in the space below as required)	No

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

B OPTIMIZE SITE UTILIZATION (LID PRINCIPLES)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, constraints might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. Opportunities might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

B.1 SITE OPTIMIZATION

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

- Did you identify and preserve existing drainage patterns? If so, how? If not, why?
  Yes, existing drainage patters were identify and preserved. Currently the site is sheet flowing to the south west boundary discharging to Prado Basin Park Road. The proposed drainage will continue the existing drainage patters by discharging to a proposed infiltration basin on the southwest corner of the site which when full will discharge to Prado Basin Park Road.

- Did you identify and protect existing vegetation? If so, how? If not, why?
  No, the project site is cover with grass only. There are no trees or other vegetation to conserve.

- Did you identify and preserve natural infiltration capacity? If so, how? If not, why?
  Yes, the project site is proposing a series of infiltration trenches, a small infiltration basin, permeable pavement and drivable grass to promote infiltration to the soil and groundwater recharge.

- Did you identify and minimize impervious area? If so, how? If not, why?
  Yes, open space areas, planters, and landscape areas are proposed for the project site

- Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?
  Yes, stormwater runoff from the project will be directed to infiltration trenches, pervious pavement and drivable grass.

C DELINEATE DRAINAGE MANAGEMENT AREAS (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA NAME OR ID	SURFACE TYPE(S)[1]	AREA (SQ. FT.)	DMA TYPE
DA1	Mixed Surface Types	130,680	Type D
DA2	Mixed Surface Types	161,172	Type D
DA3	Mixed Surface Types	143,748	Type D
DA4	Mixed Surface Types	17,424	Type D
DA5	Mixed Surface Types	17,424	Type D

[1]Reference Table 2-1 in the WQMP Guidance Document to populate this column

Table C.2 Type 'D', Areas Draining to BMPs

DMA NAME OR ID	BMP NAME OR ID
DA1	Drivable grass
DA2	Infiltration Trench
DA3	Pervious Concrete
DA4	Bioretention /Infiltration Trench
DA5	Infiltration Basin

Note: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

D IMPLEMENT LID BMPs

D.1 INFILTRATION APPLICABILITY

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☐ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site. If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in this report. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in this report.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?		
If Yes, list affected DMAs: TBD		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration? TBD		
Describe here:		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 HARVEST AND USE ASSESSMENT

Please check what applies:

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☒The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If neither of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.
Total Area of Irrigated Landscape: N/A
Type of Landscaping (Conservation Design or Active Turf): N/A

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.
Total Area of Impervious Surfaces: N/A

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).
Enter your EIATIA factor: N/A

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.
Minimum required irrigated area: N/A

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
N/A	N/A

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shut downs or other lapses in occupancy:
Projected Number of Daily Toilet Users: TBD
Project Type: TBD

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.
Total Area of Impervious Surfaces: TBD

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-1 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).
Enter your TUTIA factor: TBD

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.
Minimum number of toilet users: TBD

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	Projected number of toilet users (Step 1)
TBD	*TBD*

Other Non-Potable Use Feasibility

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.
N/A

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.
Average Daily Demand: N/A

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.
Total Area of Impervious Surfaces: N/A

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-3 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.
Enter the factor from Table 2-3: N/A

Step 4: Multiply the unit value obtained from Step 4 by the total of impervious areas from Step 3 to develop the minimum number of gallons per day of non-potable use that would be required.
Minimum required use: N/A

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required non-potable use (Step 4)	Projected average daily use (Step 1)
N/A	N/A

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment, unless a site-specific analysis has been completed that demonstrates technical infeasibility as noted in D.3 below.

D.3 BIORETENTION AND BIOTREATMENT ASSESSMENT

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☐ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 FEASIBILITY ASSESSMENT SUMMARIES

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.1 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DA1	☒	☐	☐	☐	☐
DA2	☒	☐	☐	☐	☐
DA3	☒	☐	☐	☐	☐
DA4	☒	☐	☐	☐	☐
DA5	☒	☐	☐	☐	☐
	☐	☐	☐	☐	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in this report, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

D.5 LID BMP SIZING

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First, calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second, design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 2. You may add additional rows to the table below as needed.

Table D.2 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Drivable grass*		
	[A]		[B]	[C]	[A] x [C]			
DA1	*130,680*	*Mixed Surface*	*0.7*	*0.49*	*64,542*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
						0.85	4,571.7	TBD

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Bioretention/Infiltration Trench*		
	[A]		[B]	[C]	[A] x [C]			
DA2	*161,172*	*Mixed Surface*	*0.8*	*0.60*	*95,589*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
						0.85	6,842	TBD

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Infiltration Basin*		
	[A]		[B]	[C]	[A] x [C]			
DA3	*143,748*	*Mixed Surface*	*0.9*	*0.73*	*104,977*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DA4	*17,424*	*Mixed Surface*	*0.4*	*0.28*	*4,873*			
	A_T = 161,172				Σ= 109,850			
						0.85	7,780	TBD

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Infiltration Basin*		
	[A]		[B]	[C]	[A] x [C]			
DA5	*17,424*	*Mixed Surface*	*0.4*	*0.28*	*4,873*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
						0.85	345	TBD

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 2

E ALTERNATIVE COMPLIANCE (LID WAIVER PROGRAM)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

X LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in this report. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

E.1 IDENTIFY POLLUTANTS OF CONCERN

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE									
	Priority Development Project Categories and/or Project Features (Check those that apply)	**BACTERIAL INDICATOR**	**METALS**	**NUTRIENTS**	**PESTICIDES**	**TOXIC ORGANIC COMPUOUND**	**SEDIMENTS**	**TRASH DEBRIS**	**OIL & GREASE**
☐	Detached Residential Development	P	N	P	P	N	P	P	P
☐	Attached Residential Development	P	N	P	P	N	P	P	P(2)
☒	Commercial/ Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐	Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☐	Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐	Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☒	Parking Lots (>5,000 ft^2)	P(6)	P	P(1)	P(1)	P(4)	P(1)	P	P
☐	Retail Gasoline Outlets	N	P	N	N	P	N	P	P

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected
(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected
(3) A potential Pollutant is land use involving animal waste
(4) Specifically petroleum hydrocarbons
(5) Specifically solvents
(6) Bacterial indicators are routinely detected in pavement runoff

Notes:
P = Potential
N = Not Expected

E.2 STORMWATER CREDITS

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage2
N/A	N/A
Total Credit Percentage[1]	N/A

[1]Cannot Exceed 50%
[2]Obtain corresponding data from Table 3-8 in the WQMP Guidance Document

E.3 SIZING CRITERIA

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor	*Drivable grass*			
	[A]		[B]	[C]	[A] x [C]				
N/A	N/A	N/A	N/A	N/A	N/A	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
						N/A		N/A	[I] N/A

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 2

E.4 TREATMENT CONTROL BMP SELECTION

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 2. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.4 Treatment Control BMP Selection

TREATMENT CONTROL BMP SELECTION MATRIX									
	SEDIMENT/ TURBIDITY	NUTRIENTS	ORGANIC COMPOUNDS	TRASH & DEBRIS	OXYGEN DEMANDING SUBSTANCES	BACTERIA & VIRUSES	OIL AND GREASE	PESTICIDES	METALS
Vegetated Swale/ Vegetated Filter Strips[1]	H/M	L	U	L	L	U	H/M	U	H/M
Detention Basins[2]	M	M	U	M	M	U	M	U	M
Infiltration/ Permeable pavement[3]	H/M	H/M	U	U	H/M	H/M	U	U	H
Wet Ponds/ Wetlands[4]	H/M	H/M	U	U	H/M	U	U	U	H
Sand Filter/ Filtration[5]	H/M	L/M	H/M	H/M	H/M	H/M	H/M	U	H
Water Quality Inlets	L	L	L	M	L	L	M	L	L
Hydrodynamic Separators[6]	H/M*	L	L	H/M	L	L	L/M	L	L
Manufactured/ Proprietary Control Devices	U	U	U	U	U	U	U	U	U

Notes:
L: Low removal efficiency
M: Medium removal efficiency
H: High removal efficiency
U: Unknown removal efficiency
* L for turbidity

1 Includes grass swales, grass strips, vegetated swales, and bioretention
2 Includes extended/dry detention basins with 36-48-hour drawdown time
3 Includes infiltration basins, infiltration trenches, and permeable pavements
4 Includes permanent pool wet ponds and constructed wetlands
5 Includes sand filters and media filters
6 Also known as hydrodynamic devices, baffle boxes, swirl concentrators, or cyclone separators

Source: Excerpted, with minor revision, from the Riverside County Water Quality Management Plan for Urban Runoff, Santa Ana River Region and Santa Margarita River Region. September 17, 2004.

F HYDROMODIFICATION

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Impacts to the hydrologic regime resulting from the Project may include increased runoff volume and velocity; reduced infiltration; increased flow frequency, duration, and peaks; faster time to reach peak flow; and water quality degradation. Under certain circumstances, changes could also result in the reduction in the amount of available sediment for transport; storm flows could fill this sediment-carrying capacity by eroding the downstream channel. These changes have the potential to permanently impact downstream channels and habitat integrity. A change to the hydrologic regime of a Project's site would be considered a hydrologic condition of concern if the change would have a significant impact on downstream erosion compared to the pre-development condition or have significant impacts on stream habitat, alone or as part of a cumulative impact from development in the watershed.

Due to the alteration of perviousness of the property as a result of the proposed project, this project may generate a hydrologic condition of concern during its interim phase of development. This project-specific WQMP must, therefore, address the issue of HCOC unless one of the following conditions are met:

- **HCOC EXEMPTION 1:** Runoff from the Project is discharged directly to a publicly-owned, operated and maintained MS4; the discharge is in full compliance with Co-Permittee requirements for connections and discharges to the MS4 (including both quality and quantity requirements); the discharge would not significantly impact stream habitat in proximate Receiving Waters; and the discharge is authorized by the Co-Permittee.

  Does the project qualify for this HCOC Exemption? ☐ Y ☒ N
  If Yes, HCOC criteria do not apply.

- **HCOC EXEMPTION 2:** HCOC EXEMPTION 2: The volume and time of concentration1 of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

  - Riverside County Hydrology Manual
  - Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
  - Other methods acceptable to the Co-Permittee

  Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

  If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 3.

Table 0.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	Post-condition	% Difference
Time of Concentration	N/A	N/A	N/A
Volume (Cubic Feet)	N/A	N/A	N/A

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

- **HCOC EXEMPTION 3:** HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.

  Does the project qualify for this HCOC Exemption? ☒ Y ☐ N
  If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier: Prado Dam.

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

G BEST MANAGEMENT PRACTICES

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 4, review the following procedure to specify Source Control BMPs for your site:

1. **Identify Pollutant Sources:** Review Column 1 in the **Pollutant Sources/Source Control Checklist**. Check off the potential sources of Pollutants that apply to your site.

2. **Note Locations on Project-Specific WQMP Exhibit:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. **Prepare a Table and Narrative:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding **permanent, Structural Source Control BMPs** (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. Add additional narrative in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. **Identify Operational Source Control BMPs:** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table 0.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	• Maintain and periodically repaint or replace inlet markings. • Provide stormwater pollution prevention information to new site owners, lessees, or operators. • See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality

		Handbooks at www.cabmphandbooks.com • Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
Landscape/Outdoor Pesticide Use	• Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. • Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. • Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. • Consider using pest-resistant plants, especially adjacent to hardscape. • To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	• Maintain landscaping using minimum or no pesticides. • See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at http://rcflood.org/stormwater/ • Provide IPM information to new owners, lessees and operators.
Sidewalks, and parking lots		Sweep, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into

		the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.
Efficient Irrigation	• The Owner will be responsible for the installation and maintenance of all common landscape areas utilizing similar planting materials with similar water requirements to reduce excess irrigation runoff. • The developer will be responsible for implementing all efficient irrigation systems for common area landscaping including but not limited to provisions for water sensors and programmable irrigation cycles. • The irrigation systems shall be in conformance with water use efficiency guidelines.	In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, day or nighttime temperatures based on system specifications and local climate patterns.

H CONSTRUCTION PLAN CHECKLIST

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table 0.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
Drivable Grass	Drivable Grass is a permeable, flexible and plantable concrete pavement system. It facilitates the growth of a continuous root system below the product in the bedding course, promoting healthy turf while minimizing moisture evaporation. Drivable grass is proposed to the west of the site.	Appendix 1: WQMP Exhibit
Infiltration Trench	Infiltration trench is a shallow excavated areas that are filled with rock material to create subsurface reservoir layer. The trench is sized to store the design capture volume V_{BMP} in the void space between the rocks. Infiltration trenches are proposed to the west of the site.	Appendix 1: WQMP Exhibit
Permeable Pavement	Permeable pavement can be either pervious asphalt and concrete surfaces, or permeable modular block. These reduce the volume and peak of stormwater runoff as well as mitigate pollutants from stormwater runoff, provided that the underlying soils can accept infiltration.	Appendix 1: WQMP Exhibit
Infiltration Basin	Earthen basin designed to capture the designed capture volume V_{BMP}. The stormwater infiltrates through the bottom of the basin into the underlying soil over a 72 hour drawdown period. An infiltration basin is proposed to the south portion of the site.	Appendix 1: WQMP Exhibit

Note that the updated table — or Construction Plan WQMP Checklist — is only a reference tool to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

I OPERATION, MAINTENANCE AND FUNDING

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 5 of this Project-Specific WQMP:

A means to finance and implement facility maintenance in perpetuity, including replacement cost.

1. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.

2. An outline of general maintenance requirements for the Stormwater BMPs you have selected.

3. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.

4. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: N/A (PRELIM WQMP)

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☐ Y ☒ N

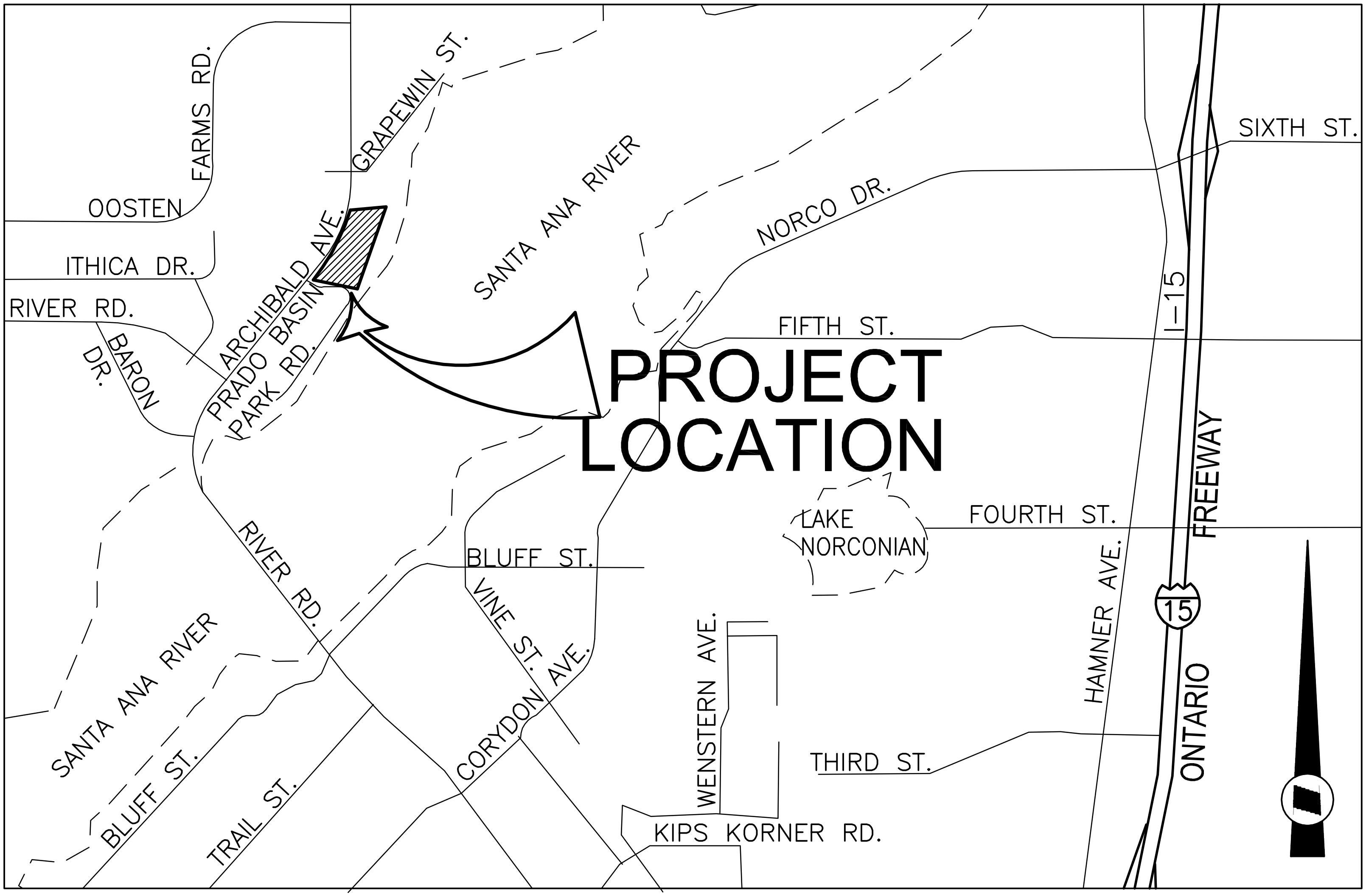
Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 5. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 5.

APPENDICES

Appendix 1	*Maps and Site Plans*
Appendix 2	*BMP Design Details*
Appendix 3	*Hydromodification*
Appendix 4	*Source Control*
Appendix 5	*Operation and Maintenance*
Appendix 6	*Educational Materials*

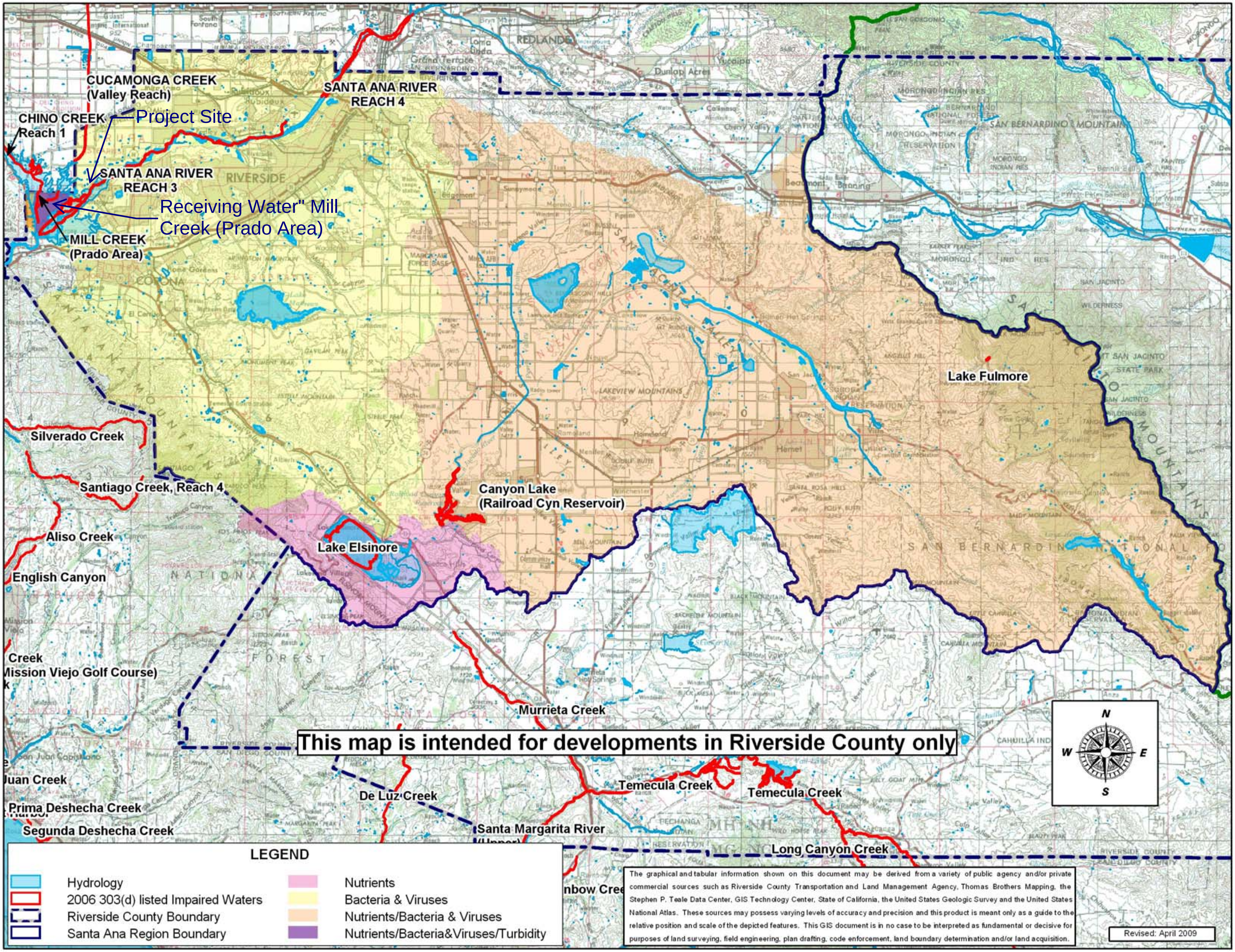
Appendix 1: Maps and Site Plans

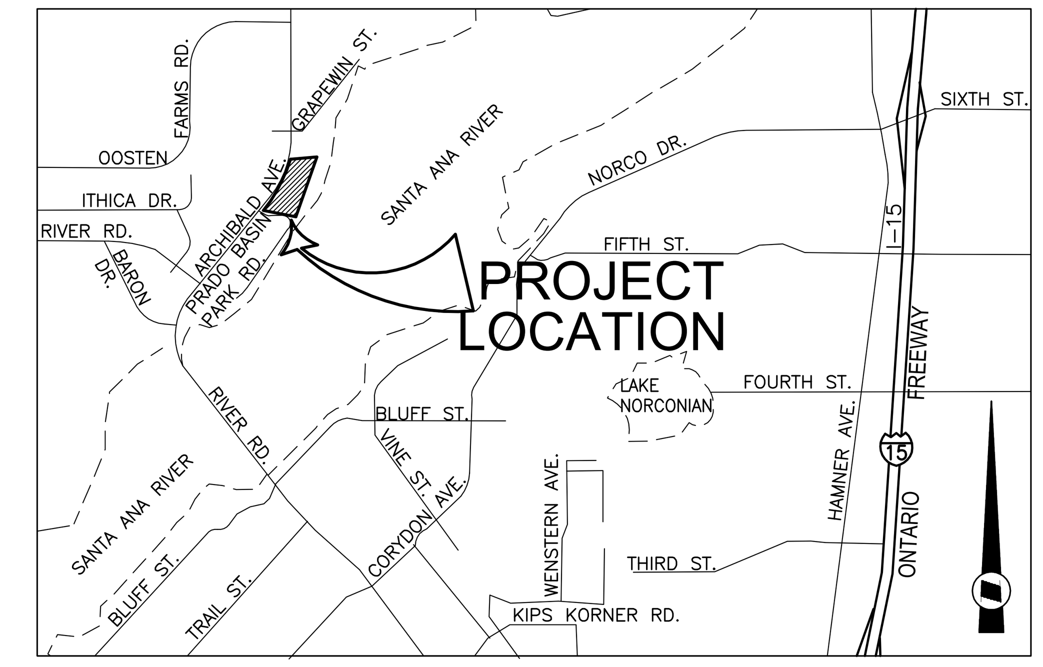
Location Map, WQMP Site Plan and Receiving Waters Map



VICINITY MAP

NOT TO SCALE

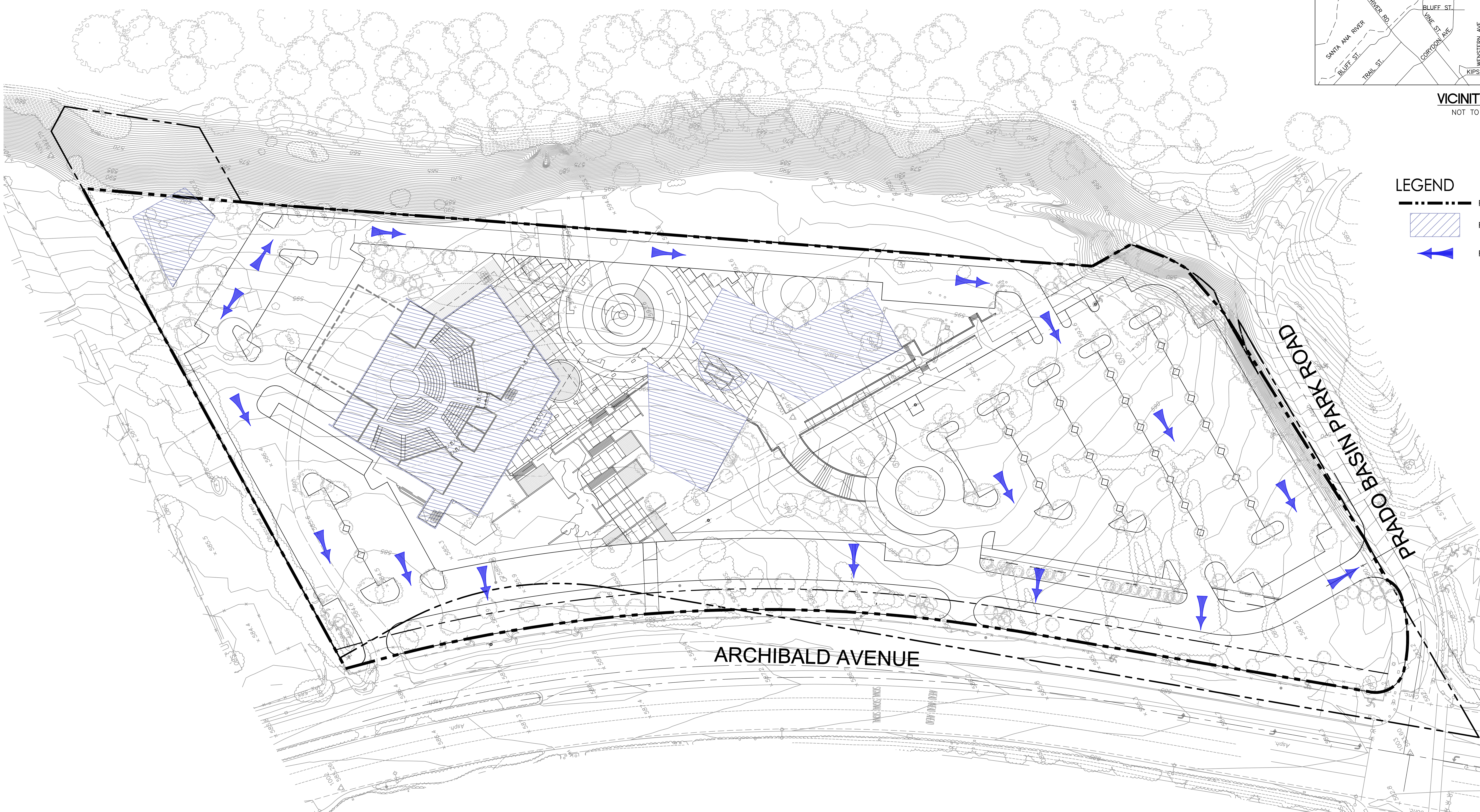

CUCAMONGA CREEK
(Valley Reach)
SANTA ANA RIVER
REACH 4
CHINO CREEK
Reach 1
Project Site
SANTA ANA RIVER
REACH 3
Receiving Water" Mill
Creek (Prado Area)
MILL CREEK
(Prado Area)
Lake Fulmore
Silverado Creek
Santiago Creek, Reach 4
Canyon Lake
(Railroad Cyn Reservoir)
Aliso Creek
Lake Elsinore
English Canyon
Creek
Mission Viejo Golf Course)
Murrieta Creek
This map is intended for developments in Riverside County only
N
W
E
S
Juan Creek
De Luz Creek
Temecula Creek
Temecula Creek
Prima Deshecha Creek
Segunda Deshecha Creek
Santa Margarita River
(Upper)
Long Canyon Creek
LEGEND
Hydrology
2006 303(d) listed Impaired Waters
Riverside County Boundary
Santa Ana Region Boundary
Nutrients
Bacteria & Viruses
Nutrients/Bacteria & Viruses
Nutrients/Bacteria&Viruses/Turbidity
The graphical and tabular information shown on this document may be derived from a variety of public agency and/or private commercial sources such as Riverside County Transportation and Land Management Agency, Thomas Brothers Mapping, the Stephen P. Teale Data Center, GIS Technology Center, State of California, the United States Geologic Survey and the United States National Atlas. These sources may possess varying levels of accuracy and precision and this product is meant only as a guide to the relative position and scale of the depicted features. This GIS document is in no case to be interpreted as fundamental or decisive for purposes of land surveying, field engineering, plan drafting, code enforcement, land boundary determination and/or land acquisition.
Revised: April 2009



VICINITY MAP
NOT TO SCALE

LEGEND

- PROJECT BOUNDARY
- PROPOSED BUILDING
- FLOW DIRECTION



FUSCOE ENGINEERING
full circle thinking

Scale: 1"=50'
Exhibit Date:03/19/15

SITE PLAN
VANTAGE POINT CHURCH
EASTVALE, CA

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FUSCOE ENGINEERING
full circle thinking

Scale: 1"=50'
Exhibit Date:03/19/15

DRAINAGE AREA MAP
VANTAGE POINT CHURCH
EASTVALE, CA

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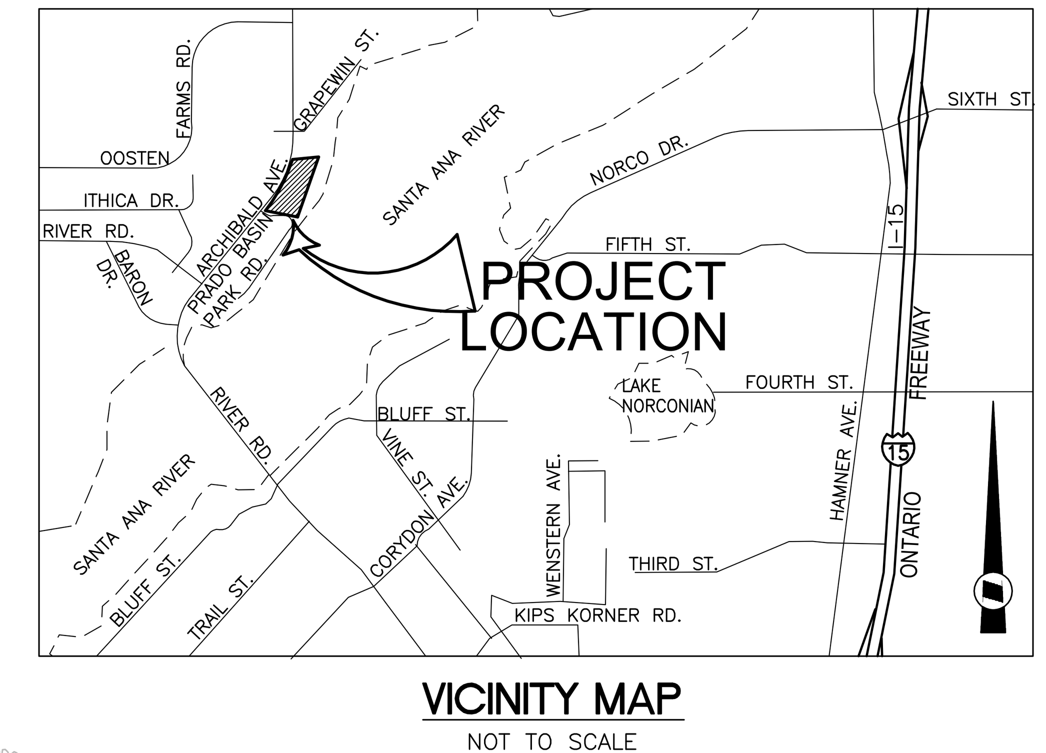
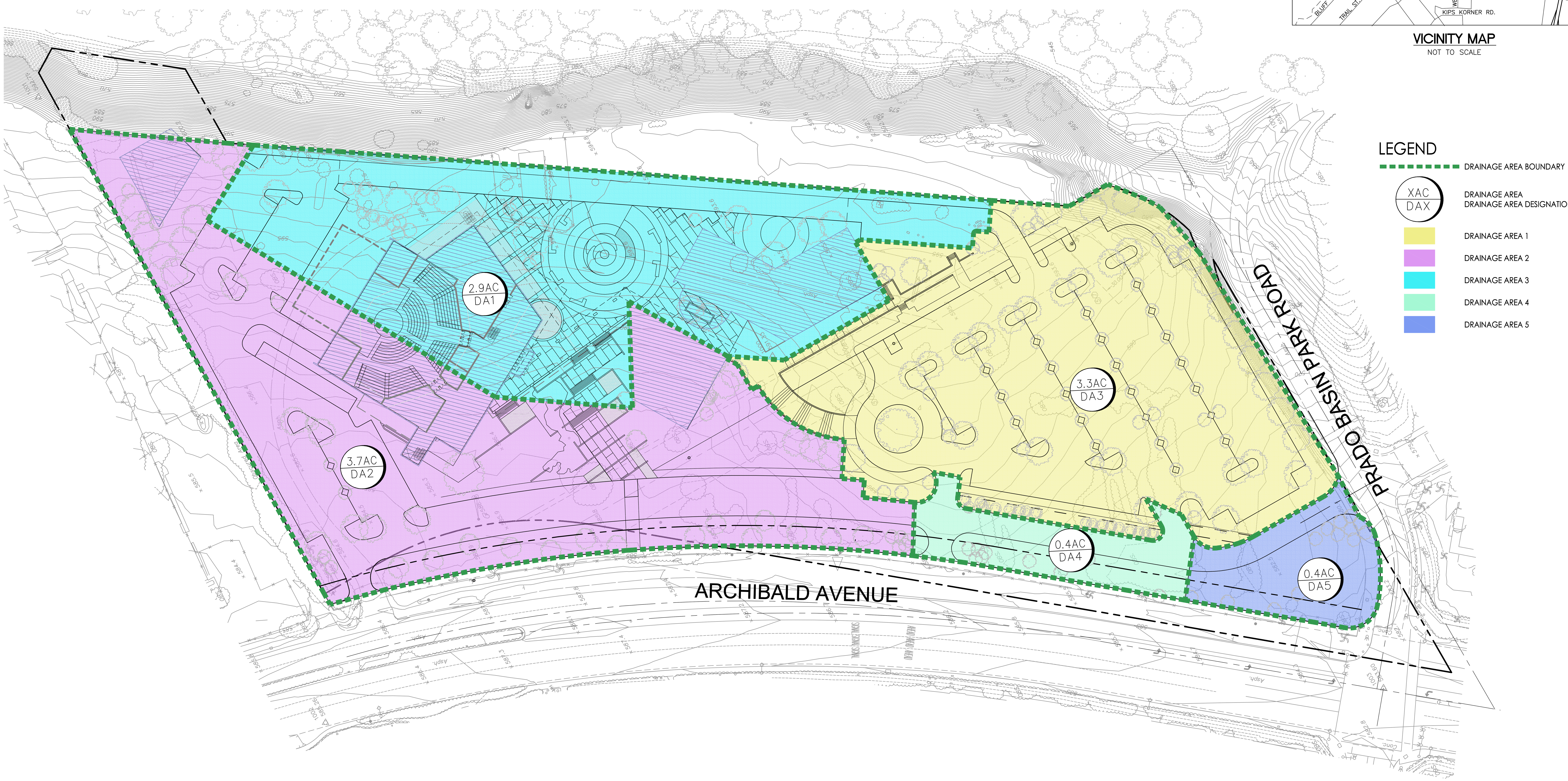




FUSCOE ENGINEERING
full circle thinking

Scale: 1"=50'
Exhibit Date:03/19/15

SITE PLAN
VANTAGE POINT CHURCH
EASTVALE, CA

Appendix 2: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: Fuscoe Engineering Inc — Date: 3/5/2015
Designed by: Carolina Gonzalez — Case No:
Company Project Number/Name: Vintage Point Church

BMP Identification

BMP NAME / ID: LID Site Volume DA1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.85 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DA1	*130680*	*Mixed Surface Types*	*0.7*	*0.49*	*64542.1*			
	130680	***Total***			**64542.1**	**0.85**	***4571.7***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: Fuscoe Engineering Inc — Date: 3/5/2015

Designed by: Carolina Gonzalez — Case No:

Company Project Number/Name: Vintage Point Church

BMP Identification

BMP NAME / ID: LID Site Volume DA2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.85 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DA2	*161172*	*Mixed Surface Types*	*0.8*	*0.60*	*96589.7*			
	161172	***Total***			96589.7	0.85	*6841.8*	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: Fuscoe Engineering Inc — Date: 3/5/2015

Designed by: Carolina Gonzalez — Case No:

Company Project Number/Name: Vintage Point Church

BMP Identification

BMP NAME / ID: LID Site Volume DA3

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.85 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DA3	*143748*	*Mixed Surface Types*	*0.9*	*0.73*	*104976.6*			
	143748	***Total***			**104976.6**	**0.85**	**7435.8**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: Fuscoe Engineering Inc — Date: 3/5/2015
Designed by: Carolina Gonzalez — Case No:
Company Project Number/Name: Vintage Point Church

BMP Identification

BMP NAME / ID: LID Site Volume DA4

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.85 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DA4	*17424*	*Mixed Surface Types*	*0.4*	*0.28*	*4873.7*			
	17424	***Total***			**4873.7**	**0.85**	**345.2**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: Fuscoe Engineering Inc
Date: 3/5/2015
Designed by: Carolina Gonzalez
Case No:
Company Project Number/Name: Vintage Point Church

BMP Identification

BMP NAME / ID: LID Site Volume DA5

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.85 inches

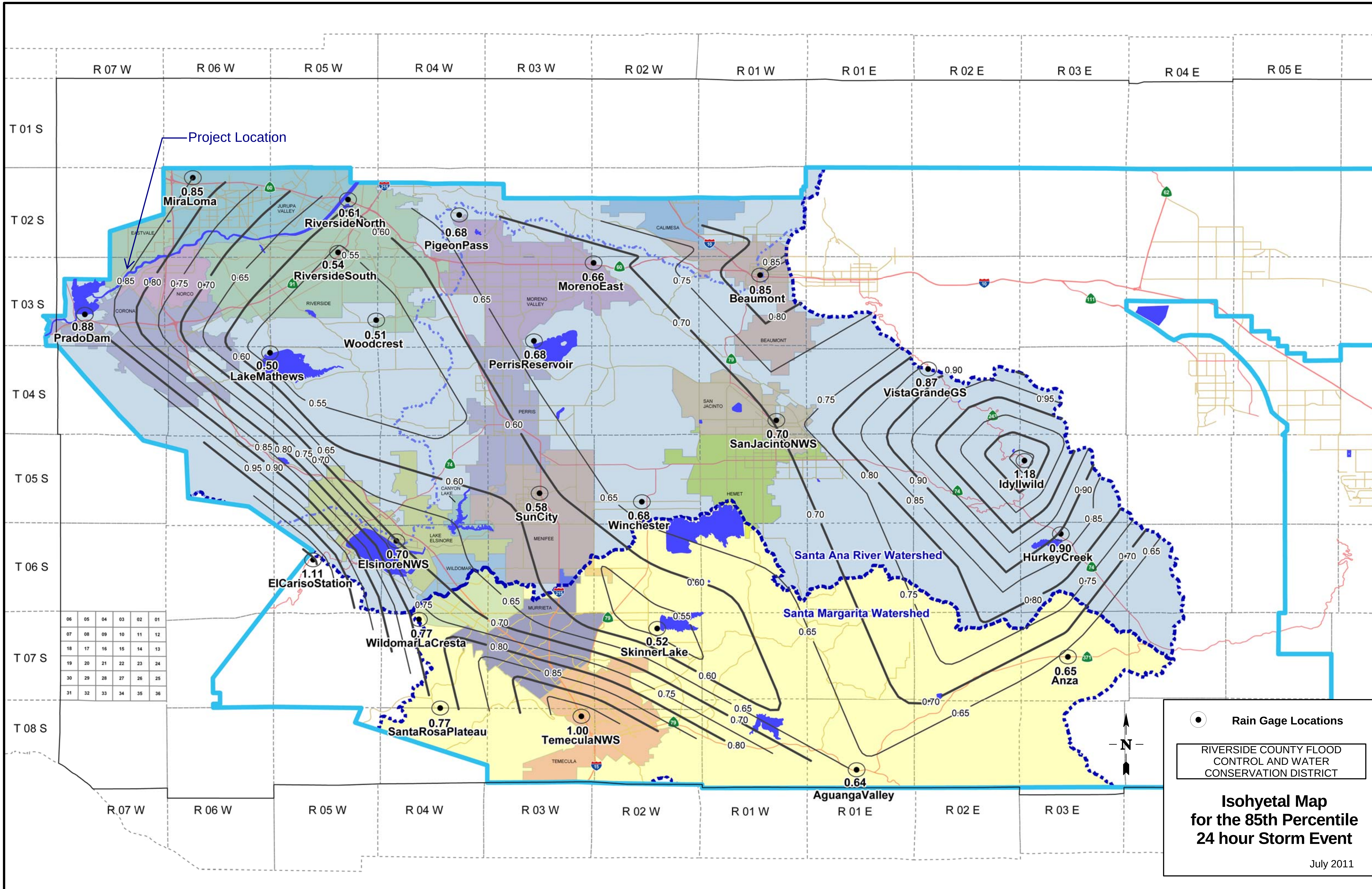
Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DA5	*17424*	*Mixed Surface Types*	*0.4*	*0.28*	*4873.7*			
	17424	***Total***			**4873.7**	**0.85**	***345.2***	

Proposed Volume must be greater than the Design Capture Volume

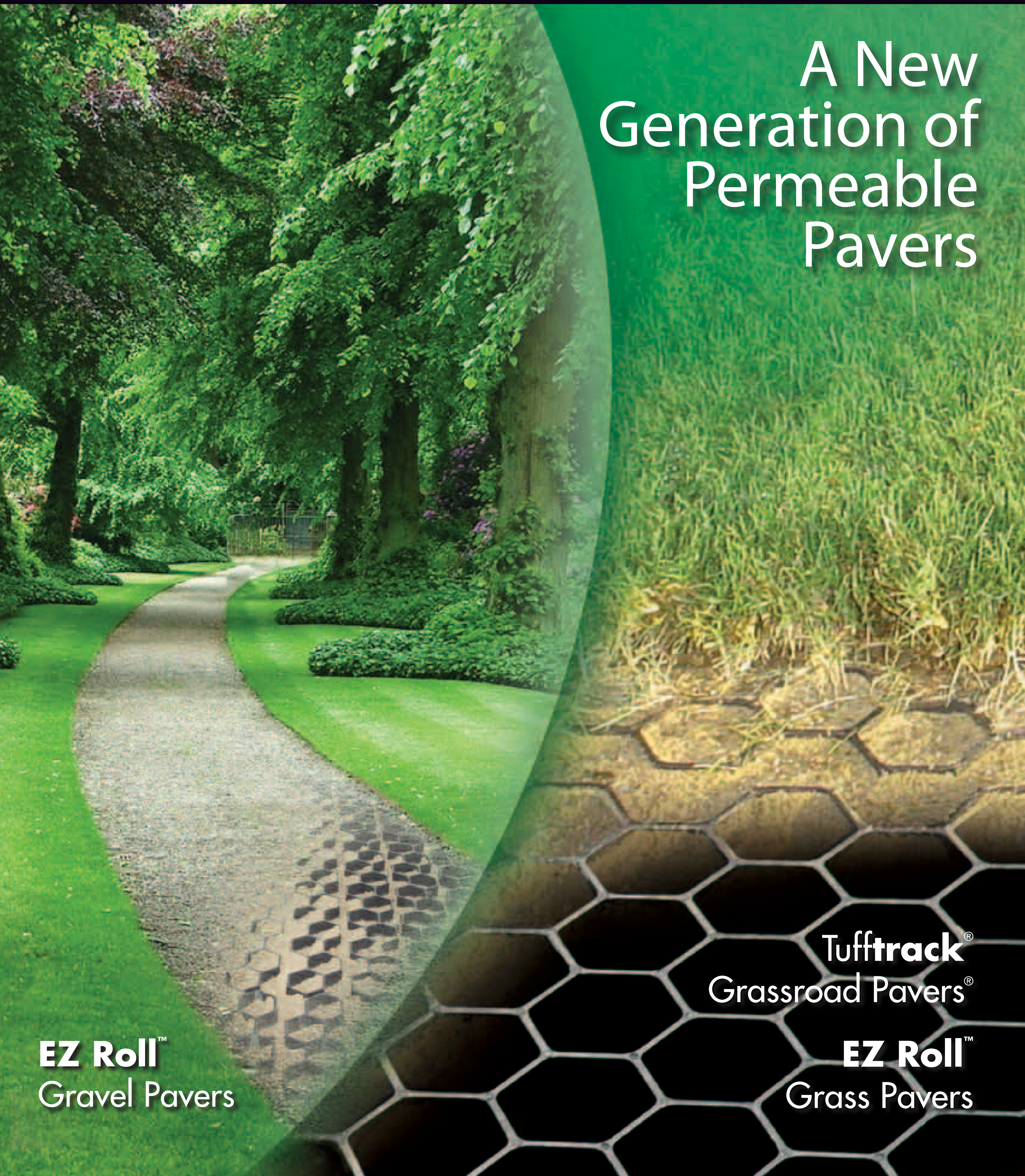
Notes:


Project Location
R 07 W
R 06 W
R 05 W
R 04 W
R 03 W
R 02 W
R 01 W
R 01 E
R 02 E
R 03 E
R 04 E
R 05 E
T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S
0.85 MiraLoma
0.61 RiversideNorth
0.68 PigeonPass
0.54 RiversideSouth
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.68 PerrisReservoir
0.50 LakeMathews
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.90 HurkeyCreek
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley
Santa Ana River Watershed
Santa Margarita Watershed
Rain Gage Locations
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011
N

NDS™

WE PUT WATER IN ITS PLACE

A New Generation of Permeable Pavers

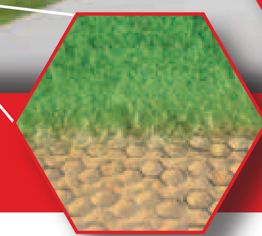


EZ Roll™
Gravel Pavers

Tuff**track**®
Grassroad Pavers®

EZ Roll™
Grass Pavers

NDS **Permeable Paver** Systems



NDS Permeable Paver Systems are designed to provide design professionals with an alternative paving solution to concrete, asphalt or similar surfaces. The final area looks identical to regular turf or a gravel road, but can support anything from heavy vehicles, such as a firetruck, to daily vehicle parking.

Reduced Stormwater Runoff

The large open surface and bottom areas allow stormwater to percolate directly into the ground to significantly reduce runoff. Reduction of stormwater runoff minimizes the size requirements for water detention/retention ponds and can eliminate the need for large drainage systems.

High Load Bearing Capacity

NDS Permeable Pavers are designed with a series of hexagonal cells connected together to form a flexible grid system that can withstand significant structural loads. The grid system provides a stable and continuous load-bearing surface throughout large areas.

Sustainable Products to Achieve **LEED® Credits**

Credit categories:

- Construction Activity: Pollution Prevention
- Stormwater Design: Quantity Control
- Stormwater Design: Quality Control
- Heat Island Effect: Non-Roof
- Recycled Material Content

Recommended Uses:

- Parking Lots
- Pedestrian Trails
- Horse Trails
- Bicycle Paths
- Garden Paths
- Greenhouse Aisles
- Sidewalks
- Wilderness Paths
- Fire Lanes
- Maintenance Access Roads

"These permeable pavers allow me to design a self-draining solid ground surface that is strong enough to support heavy traffic. More important, I can design a drivable road without compromising the aesthetics of the landscape with concrete or asphalt."

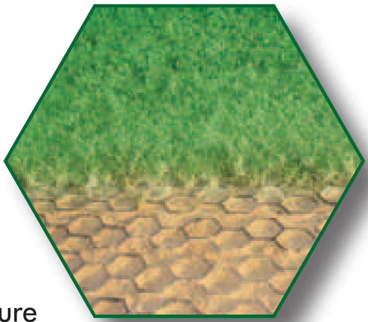
Advantages to **NDS Permeable Paver** Systems

	EZ-Roll™ Grass & Gravel Pavers	**Concrete**	**Asphalt**	**Porous Hardscape**
Permeability	**PERMEABLE** More than 40% void space in proper base course to absorb significant amount of rainfall before becoming saturated and creating runoff.	**NOT PERMEABLE** 0% void space; it is completely impervious, it does not absorb rainfall. Expensive drainage system required.	**NOT PERMEABLE** 0% void space; it is completely impervious, it does not absorb rainfall. Expensive drainage system required.	**PERMEABLE** Void space in base course allows rainfall to be absorbed before creating runoff.
Strength	**H20 LOAD RATING** Gravel Paver cells support up to 66,000 psf (empty). Grass Paver cells support up to 57,888 psf (empty). As strong as concrete or asphalt when properly installed.	**H20 LOAD RATING** As strong as a properly installed EZ-Roll™ Gravel Paver system.	**H20 LOAD RATING** As strong as a properly installed EZ-Roll™ Gravel Paver system.	**H-20 LOAD RATING** As strong as a properly installed EZ-Roll™ Gravel Paver system.
Maintenance Cost	**LOW** Requires gravel to be lightly graded once per year. Can save over 50% of maintenance costs over a 20 year life span.	**MODERATE** Requires resurfacing every 15 years, and periodic repainting and filling of cracks.	**HIGH** Requires sealcoating every 3 years, resurfacing every 15 years, and periodic repainting.	**HIGH** Highly susceptible to clogging. Requires an expensive high pressure cleaning process.
Aesthetics	**NATURAL** Naturally blends in with the landscape.	**NOT NATURAL** Does NOT blend in with the landscape.	**NOT NATURAL** Does NOT blend in with the landscape.	**NOT NATURAL** Does NOT blend in with the landscape.
Heat Island Effect	**LOW HEAT** Maintains low temperatures on surface and surrounding areas.	**HIGH HEAT** Increased temperature on surface and surrounding areas.	**HIGH HEAT** Increased temperature on surface and surrounding areas.	**HIGH HEAT** Increased temperature on surface and surrounding areas.
Durability	Over 20 years	Over 20 years	Over 20 years	Less than 20 years

NDS **Grass Pavers**

NDS grass pavers allow light to heavy vehicular traffic to drive over turf areas. They prevent soil compaction and promote healthy root growth. The pavers are used to stabilize the soil and allow turf to grow in areas that would traditionally have impervious hardscaping installed. NDS grass pavers are the ultimate product for promoting healthy turf in traffic areas as an alternative to aesthetically unpleasant concrete or asphalt pavements.

Tuff**track**® Grassroad Pavers®



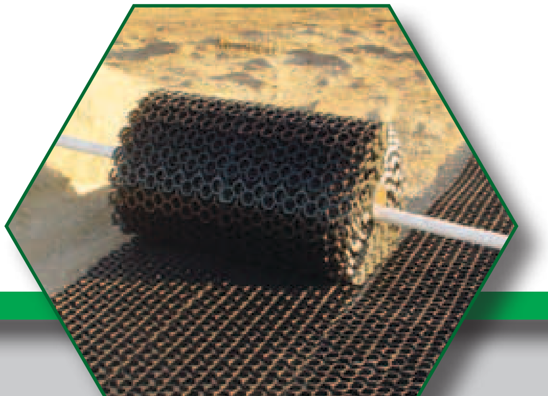
Manufactured in 24" square panels that are rigid for maximum strength. Tongue-and-groove latching system provides quick and secure connections between panels without the need of special tools.

Compressive strength (empty): **98,770 psf**

EZ Roll® Grass Pavers

Manufactured in pre-assembled rolls for easy installation. Lateral snap-lock system allows rolls to be connected without any special tools to provide continuous stability and load-bearing capacity.

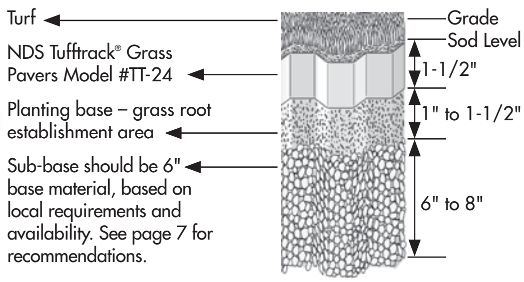
Compressive strength (empty): **57,888 psf**



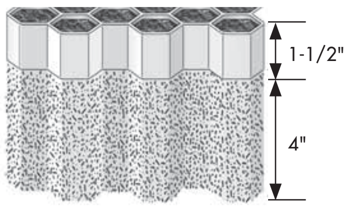
NDS **Grassroad Pavers**
Technical Data

Tuff**track**® Grass Pavers

Heavy Load and
Firelane Access



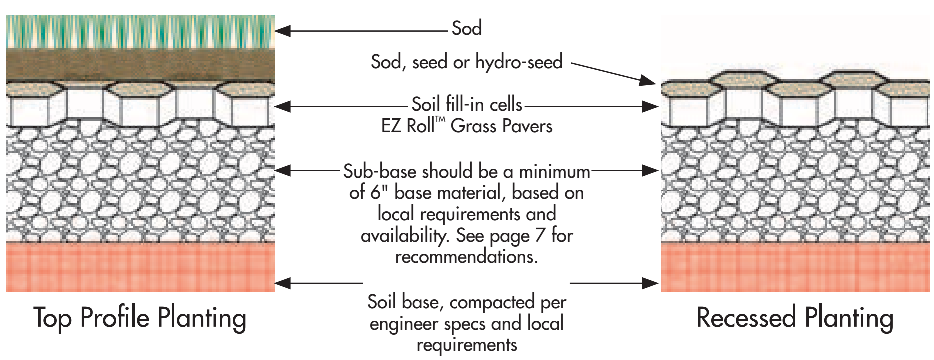
Light to Moderate Weight –
Utility, Golf, RV, Service Access



Height	Panel Dimensions	Area Covered Per Panel	Compressive Strength (empty)	Plastic Material	Recycled Content
1-1/2"	24" x 24"	4 Sq. Feet	98,770 psf	HIPP with UV inhibitors	100%

EZ Roll® Grass Pavers

Planting Profile and Soil Levels



Height	Panel Dimensions	Roll Size	Compressive Strength (empty)	Plastic Material	Recycled Content
1"	24" x 24"	600 Sq. Feet	57,888 psf	HDPE with UV inhibitors	100%

NDS **Grass Pavers** - Design

Design Considerations:

- High-traffic areas should have a slope less than 8%
- Light-traffic, bicycle and pedestrian areas can have a slope of up to 10%
- Percolation rates of underlying soils should be at least 0.64 cm of water per hour
- Water table should be at least 3 feet below base course
- Bedrock should not be closer than 2 feet below base course
- Surrounding hardscape areas should be slightly higher than grass paver surface

Always consult with a soil engineer for site-specific base requirements. This information is dependent on soil type, conditions of the soil and water table.

Depth of Base Course

To calculate the depth and composition of material for the base course, consider:

- Load-bearing capacity of subsoil
- Plasticity or impact of moisture
- Frost-heave potential
- Volume of traffic

Typical Base Course Depths are:

- Golf carts and pedestrian traffic – 0 to 4 inches
- Cars and light vehicles – 0 to 6 inches
- Buses, trucks and fire engines – 6 to 12 inches

"These grass pavers allow grass to grow in areas where it would not normally be possible to have grass. My customers are impressed when I build them a road that is fully covered with healthy grass and looks no different than a normal lawn, but yet they can drive and park their cars on it."

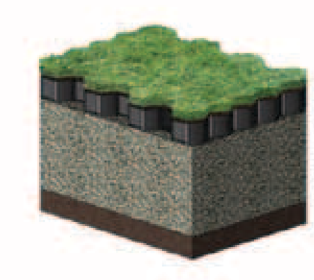
Typical Base Course Materials

Permeable Base

AASHTO #57 permeable subbase material defined as:

Sieve Size		Percent Passing	
mm	in.	#57	Typical
37.5	1-1/2	100	100
25	1	95-100	97
19	3/4		75
12.5	1/2	25-60	45
9.5	3/8		25
4.75	#4	0-10	5
2.36	#8	0-5	2

Other permeable gradations include AASHTO #5, 6, 7, or sandy gravel material.



Crushed Stone

A "Crusher Run" base material. 20-40% sand may be mixed with the base material to ensure a porous base. Alternative products may be used based on availability, such as sandy gravel.

Ensure that the surface of the base course is smooth and compacted. Avoid the use of 100% crushed limestone. Lime absorbs moisture and is capable of solidifying. Other materials may be used.

NDS **Gravel Pavers**

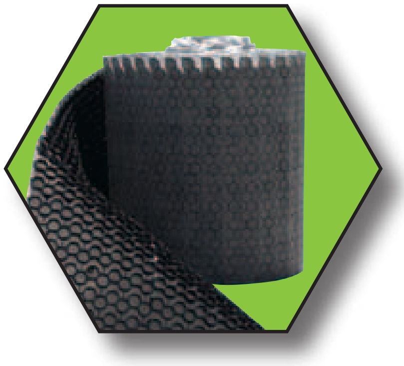
NDS gravel pavers are the ultimate product to reduce the amount of stormwater runoff and recharge the groundwater. The water is allowed to naturally drain into the underlying soils. NDS gravel pavers provide a solid ground surface that is strong enough to support light to heavy vehicular traffic. By transferring the weight of the vehicle to the base layer underneath the gravel, the pavers prevent rutting and maintain the rustic look of a gravel road.

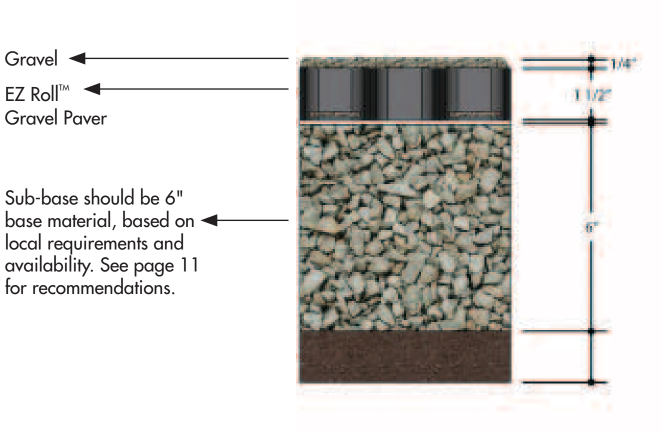
EZ Roll™ Gravel Pavers

Manufactured in pre-assembled rolls that can be rolled out over the base material onsite, allowing for easy installation and labor savings. A single continuous piece of geotextile fabric prevents gravel from migrating down into the base. 40 stakes are provided with every 600 sq. ft. roll.

Compressive strength (empty): **66,000 psf**

EZ Roll™ Gravel Pavers





Height	Panel Dimensions	Panel Weight	Compressive Strength (empty)	Compressive Strength (empty)
1"	24" x 24"	2.31 pounds	66,000 psf	463 psi

Wall Thickness	Plastic Material	Recycled Content	Recyclability	Geotextile Fabric	GP4X150 Roll Size	Compressive Strength	Cell Width
.100"	HDPE with UV inhibitors	100%	100% Recyclable	Spun, non-woven polypropylene	4' x 150' 600 sq. ft.	Exceeds H20 loading	2-1/4"

Tan Black
Brick Red Gray

Color Options:

EZ Roll™ Gravel Pavers are available in four colors, allowing for design flexibility when choosing gravel colors and applications. 1/2" minus clean stone, decomposed granite, and pea gravel are just some of the possibilities that work well with EZ Roll™ Gravel Pavers.

ADA Compliant

EZ Roll™ Gravel Pavers have been tested to ensure they meet ADA requirements.

NDS **Gravel Pavers -** Design

The proper design and installation of EZ Roll™ Gravel Pavers results in a self-draining system that saves money on additional drainage and retention systems.

Design Considerations:

- High-traffic areas should have a slope less than 8%
- Light-traffic, bicycle and pedestrian areas can have a slope of up to 10%
- Percolation rates of underlying soils should be between 0.64 cm of water per hour
- Water table should be approximately 3 feet below base course
- Bedrock should not be closer than 2 feet below base course
- Surrounding hardscape areas should be slightly higher than gravel paver surface
- Gravel paver installation should be at least 10 feet away from building structure
- Keep adjacent areas free of sediment and erosion

Depth of Base Course

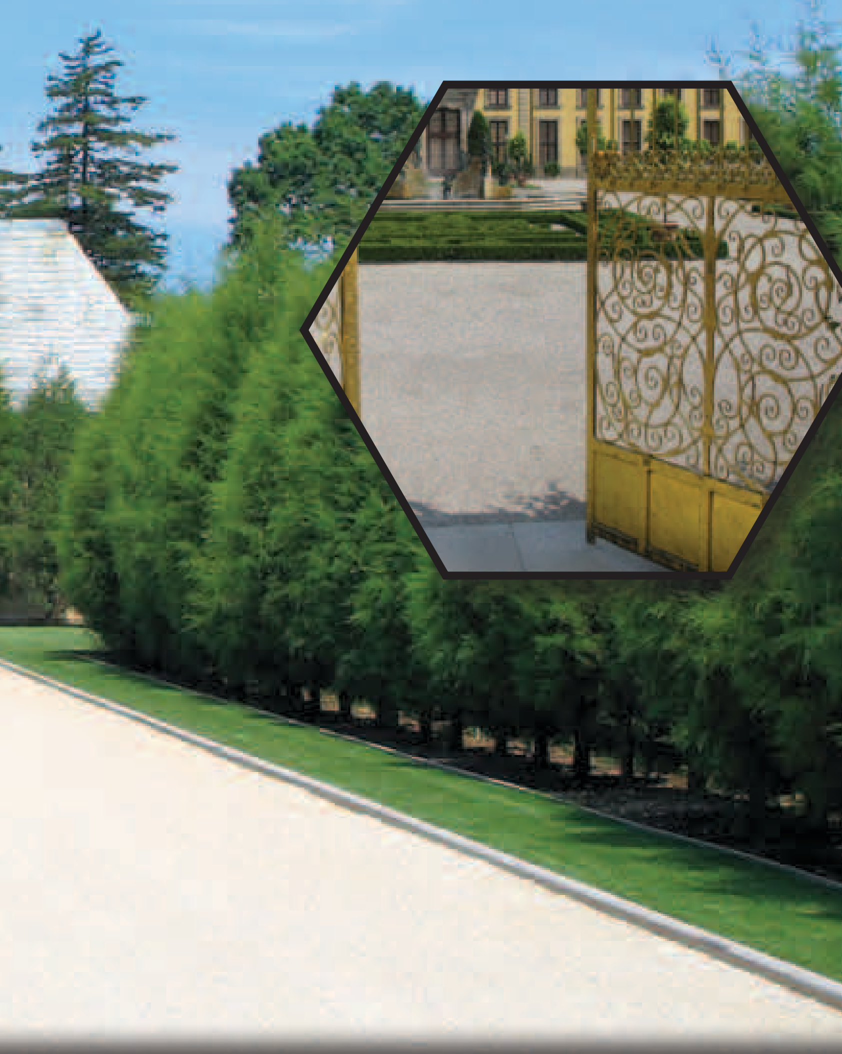
To calculate the depth and composition of material for the base course, consider:

- Load-bearing capacity of subsoil
- Plasticity or impact of moisture
- Frost-heave potential
- Traffic load

Typical base course depths are:

- Golf carts and pedestrian traffic – 0 to 4 inches
- Cars and light vehicles – 0 to 6 inches
- Buses, trucks and fire engines – 6 to 12 inches

Always consult with a soil engineer for site-specific base requirements. Compact base course with a vibrating plate type compactor or a heavy motorized roller. Test porosity of base course with a water hose to see if water drains properly through base course.



"The problem with gravel roads is that they rut and the gravel shifts all over the place so you have to constantly add more gravel. These gravel pavers prevent rutting and the plastic cells keep the gravel from shifting or compacting under the weight of a vehicle. My gravel roads are now very easy to maintain and keep their rustic look for years. It is a perfect add-on to a custom home looking to be different."

Typical Base Course Materials

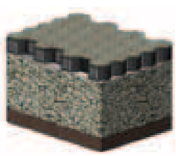
A mixture of stone and sand or a sandy gravel material allows for a free-draining structural base for use in light to heavy load applications.

A clean stone base contains most void space for storage of stormwater and minimizes or eliminates runoff. A clean stone base may be used for light to moderate load applications only.

Recommended fill material:

Use up to 3/8" angular stone or up to 1/2" round stone.

Round stone is more susceptible to movement and migration. Other materials may be used.

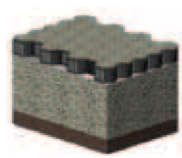


Permeable Base

AASHTO #57 permeable subbase material defined as:

Sieve Size		Percent Passing	
mm	in.	#57	Typical
37.5	1-1/2	100	100
25	1	95-100	97
19	3/4		75
12.5	1/2	25-60	45
9.5	3/8		25
4.75	#4	0-10	5
2.36	#8	0-5	2

Other permeable Gradations include AASHTO #5, 6, 7, or sandy gravel material.



Crushed Stone

A "Crusher Run" base material. 20-40% sand may be mixed with the base material to ensure a porous base. Alternative products may be used based on availability, such as sandy gravel.

Ensure that the surface of the base course is smooth and compacted. Avoid the use of 100% crushed limestone. Lime absorbs moisture and is capable of solidifying. Other materials may be used.

Delineation

Delineation may be required and an important part of the design. Many items can be used to identify parking stalls, fire lanes or paths.

Some examples include:

- Concrete curbs or blocks
- Railroad ties
- Lights
- Benches
- Trees
- Shrubs

NDS **Permeable Paver** Systems

Tuff**track**® Grassroad Pavers®

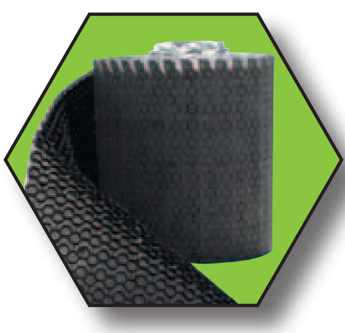
Manufactured in 24" square panels that are rigid for maximum strength. Tongue-and-groove latching system provides quick and secure connections between panels without the need of special tools. Manufactured in the U.S.A. from 100% recycled plastic.

Compressive strength (empty): **98,770 psf**

EZ Roll™ Grass Pavers

Manufactured in pre-assembled rolls for easy installation. Lateral snap-lock system allows rolls to be connected without any special tools to provide continuous stability and load-bearing capacity. Manufactured in the U.S.A. from 100% recycled plastic.

Compressive strength (empty): **57,888 psf**



EZ Roll™ Gravel Pavers

Manufactured in pre-assembled rolls for easy installation, with stakes provided for anchoring. A single continuous piece of geotextile fabric provides sufficient strength for the paver to be installed on clean stone base material. Manufactured in the U.S.A. from 100% recycled plastic.
ADA compliant.

Compressive strength (empty): **66,000 psf**

GrasGravlPavrBro_122010.indd

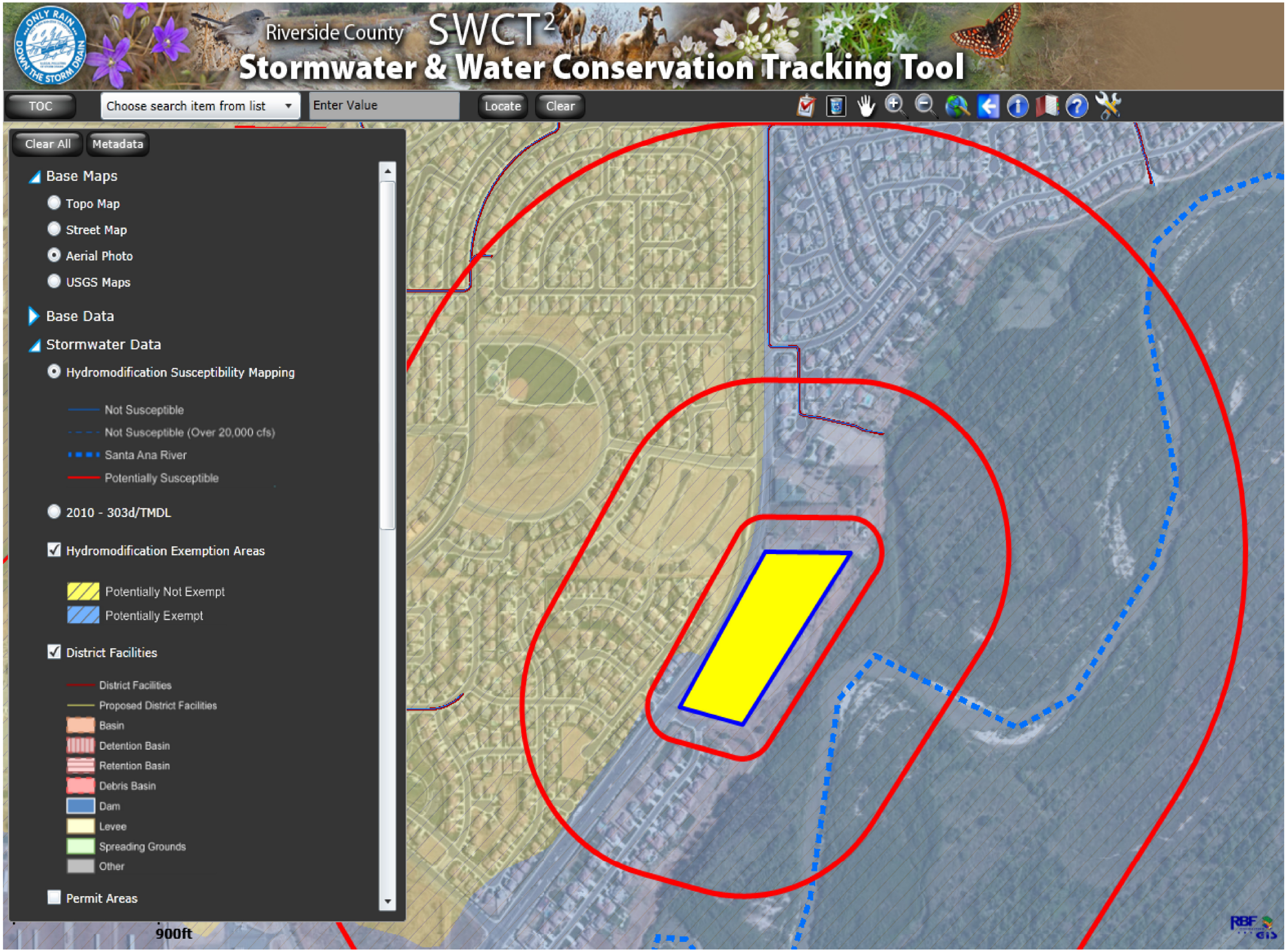
12.2010

NDS Customer Service
851 N. Harvard Ave., Lindsay, CA 93247
Phone: 800.726.1994 • 559.562.9888
Fax: 800.726.1998 • 559.562.4488
www.NDSPRO.com

NDS™
WE PUT WATER IN ITS PLACE

Appendix 3: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern


Riverside County SWCT2
Stormwater & Water Conservation Tracking Tool
TOC
Choose search item from list
Enter Value
Locate
Clear
Clear All
Metadata
Base Maps
Topo Map
Street Map
Aerial Photo
USGS Maps
Base Data
Stormwater Data
Hydromodification Susceptibility Mapping
Not Susceptible
Not Susceptible (Over 20,000 cfs)
Santa Ana River
Potentially Susceptible
2010 - 303d/TMDL
Hydromodification Exemption Areas
Potentially Not Exempt
Potentially Exempt
District Facilities
District Facilities
Proposed District Facilities
Basin
Detention Basin
Retention Basin
Debris Basin
Dam
Levee
Spreading Grounds
Other
Permit Areas
900ft

Riverside County SWCT²
Stormwater & Water Conservation Tracking Tool

WQMP Project Report

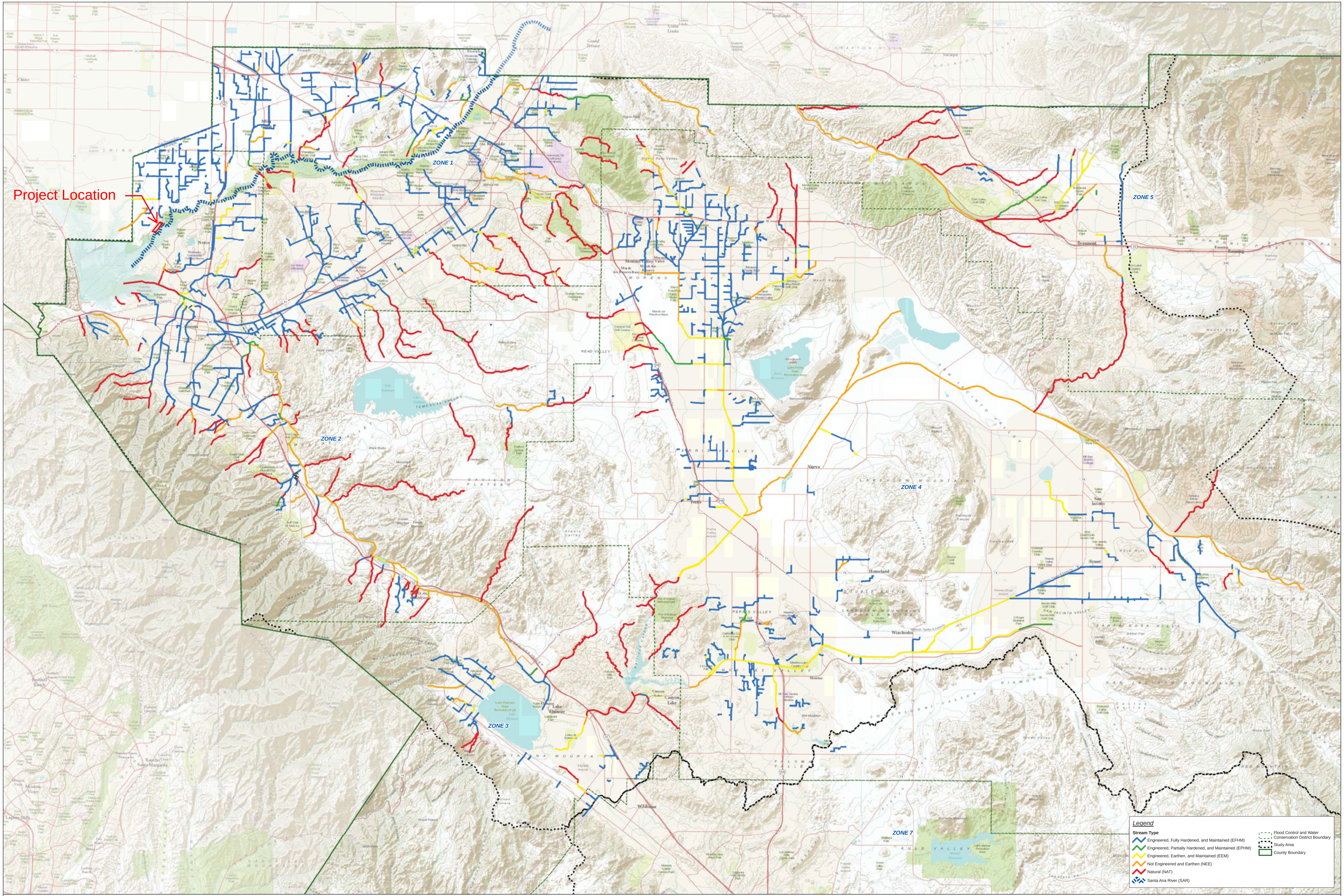
County of Riverside Stormwater Program

Santa Ana River Watershed Geodatabase

Friday, March 06, 2015

Note: The information provided in this report and on the Stormwater Geodatabase for the County of Riverside Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

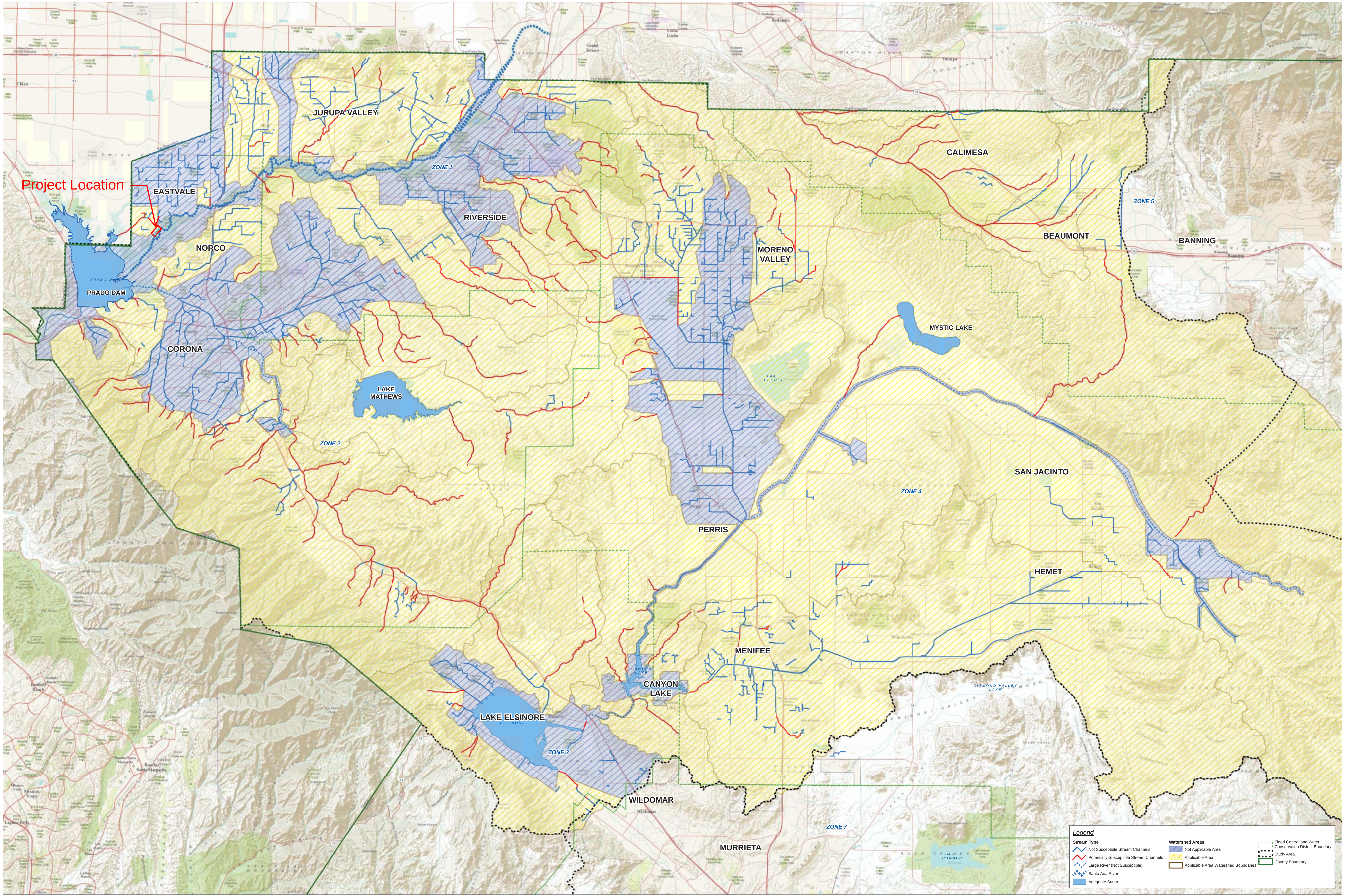
Project Site Parcel Number(s):	130080008, 130080004, 130080005
Latitude/Longitude:	33.9345, -117.5931
Thomas Brothers Page:	713
Project Site Acreage:	11.07
Watershed(s):	SANTA ANA
This Project Site Resides in the following Hydrologic Unit (s) (HUC):	**HUC Name** - HUC Number **Lower Cucamonga Creek** - 180702030705 **East Etiwanda Creek-Santa Ana River** - 180702030804
The HUCs Contribute stormwater to the following 303d listed water bodies and TMDLs which may include drainage from your proposed Project Site:	**WBID Name** - WBID Number **Cucamonga Creek Reach 1 (Valley Reach)** - CAR8012100019990211101136 **Santa Ana River, Reach 3** - CAR8012100019990211140353
These 303d listed Water bodies and TMDLs have the following Pollutants of Concern (POC):	**Bacterial Indicators** - Coliform Bacteria, Pathogens **Metals/Metalloids** - Cadmium, Copper, Lead, Zinc
Is the Site subject to Hydromodification:	Yes
Limitations on Infiltration: *Project discharges to Prado Dam which is an appropriate sump.*	**Project Site Onsite Soils Group(s)** - A, B, C, D **Known Groundwater Contamination Plumes within 1000'** - No **Adjacent Water Supply Wells(s)** - No information available please contact your local water agency for more information. Your local contact agency is JURUPA C.S.D.. Your local wholesaler contact agency is METROPOLITAN WATER DISTRICT.
Environmentally Sensitive Areas within 200'(Fish and Wildlife Habitat/Species):	LEAST BELL'S VIREO,Santa Ana Sucker
Environmentally Sensitive Areas within 200'(CVMSHCP):	None
Environmentally Sensitive Areas within 200'(WRMSHCP):	Burrowing Owl Survey Required Area,Narrow Endemic Plants Survey Req. - Area 7
Groundwater elevation from Mean Sea Level:	
85th Percentile Design Storm Depth (in):	0.853
Groundwater Basin:	Prado Basin
MSHCP/CVMSHCP Criteria Cell(s):	No Data
Retention Ordinance Information:	No Data
Studies and Reports Related to Project Site:	IBI Scores - Southern Cal TemescalValleyBasins bulletin118_4-sc water_fact_3_7.11 8039-SAR-Hydromodification final UWMP 051011 JCSD Master Water Plan 2005 Comprehensive Bacteria Reduction Plan 34th Annual Report Chino Basin Watermaster 2012 Annual Report of Santa Ana River



Existing Stream Channel Delineation Map

Hydromodification Susceptibility Documentation Report and Mapping
Riverside County Flood Control and Water Conservation District

Map 1



HCOC Applicability Map

Hydromodification Susceptibility Documentation Report and Mapping
Riverside County Flood Control and Water Conservation District

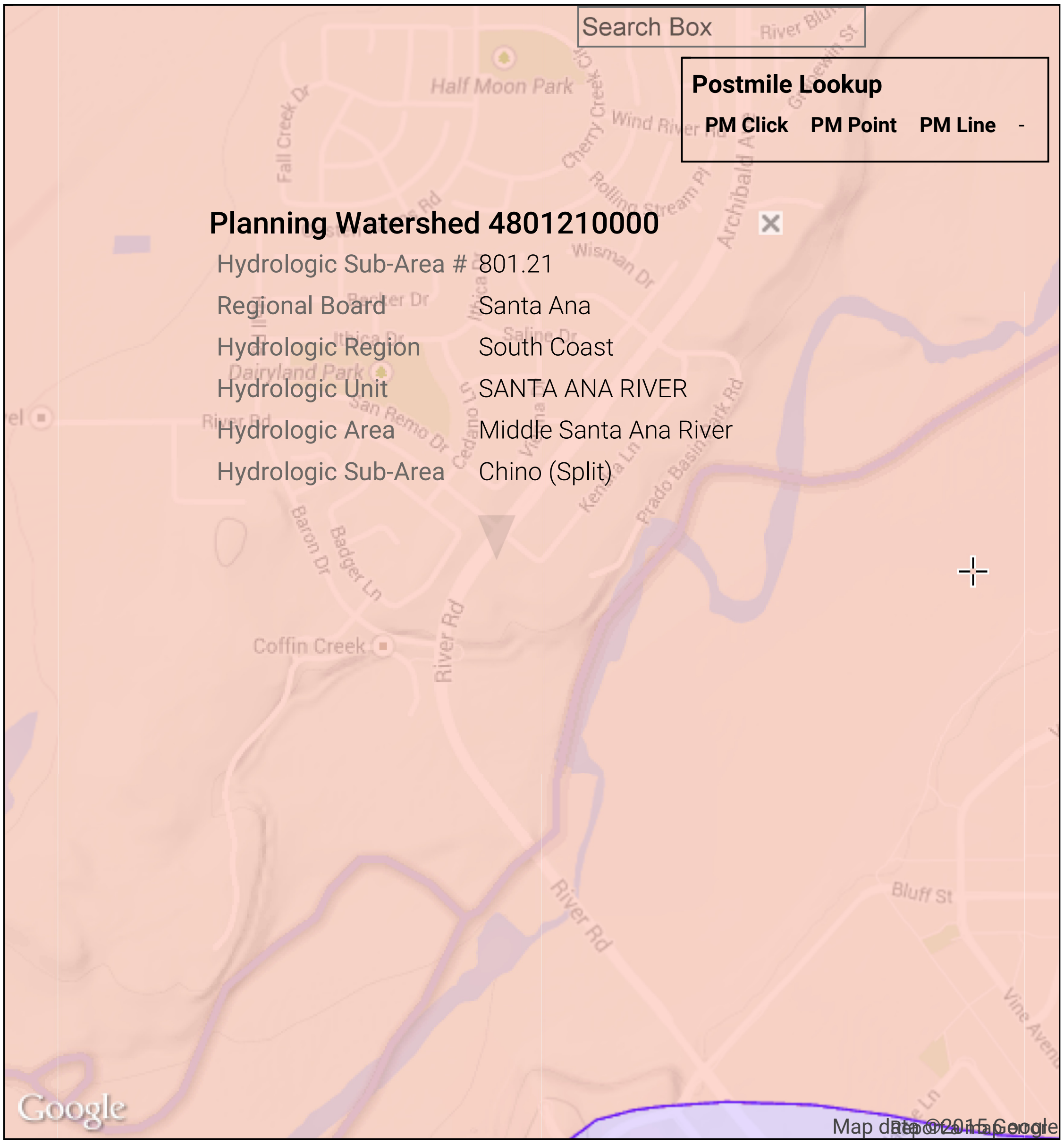
Map 2

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans > DEA > Stormwater > **Water Quality Planning Tool**

Layers

- [x] 303(d) List and TMDL (Legend)
- [ ] Areas of Special Biological Significance
- [ ] Caltrans Districts
- [ ] Caltrans Facilities (Legend)
- [ ] Caltrans T 1 Monitoring Sites
- [x] Calwater Watershed
- [ ] Coastal Zone
- [ ] Counties
- ( ) Geologic Map (Legend)
- [ ] High Risk Receiving



Information
Hover over a layer name for a description. Additional information, tables, coordinates, and links are below the map.
Help

Watershed Information

CALWATER WATERSHED

Hydrologic Unit	SANTA ANA RIVER	**Hydrologic Area**	Middle Santa Ana River	**Hydrologic Sub-Area #**	801.21
Hydrologic Sub-Area Name	Chino (Split)	**Planning Watershed**	4801210000	**HSA Area (acres)**	190515
Latitude, Longitude	33.9289, -117.5878				

WATERSHED BOUNDARY DATASET

Watershed	Middle Santa Ana River	Subwatershed	East Etiwanda Creek-Santa Ana River	Hydrologic Unit Code	180702030804
Average Annual Precipitation (inches)	17.31				

TMDLs & 303(d) Listed Water Bodies (2010 List)

Key: Water body on 303(d) list Water body with a TMDL

Name	Pollutant	Size	Status
Chino Creek Reach 1A (Santa Ana River R5 confl to just downstream of confl with Mill Creek)	Nutrients	0.79 Miles	TMDL required
Chino Creek Reach 1A (Santa Ana River R5 confl to just downstream of confl with Mill Creek)	Pathogens	0.79 Miles	Being addressed with USEPA approved TMDL
Chino Creek Reach 1B (Mill Creek confl to start of concrete lined channel)	Chemical oxygen demand (COD)	7 Miles	TMDL required
Chino Creek Reach 1B (Mill Creek confl to start of concrete lined channel)	Nutrients	7 Miles	TMDL required
Chino Creek Reach 1B (Mill Creek confl to start of concrete lined channel)	Pathogens	7 Miles	Being addressed with USEPA approved TMDL
Chino Creek Reach 2 (Beginning of concrete channel to confl w San Antonio Creek)	Coliform Bacteria	2.51 Miles	Being addressed with USEPA approved TMDL
Chino Creek Reach 2 (Beginning of concrete channel to confl w San Antonio Creek)	pH	2.51 Miles	TMDL required
Cucamonga Creek Reach 1 (Valley Reach)	Cadmium	9.57 Miles	TMDL required
Cucamonga Creek Reach 1 (Valley Reach)	Coliform Bacteria	9.57 Miles	Being addressed with USEPA approved TMDL
Cucamonga Creek Reach 1 (Valley Reach)	Copper	9.57 Miles	TMDL required
Cucamonga Creek Reach 1 (Valley Reach)	Lead	9.57 Miles	TMDL required
Cucamonga Creek Reach 1 (Valley Reach)	Zinc	9.57 Miles	TMDL required
Mill Creek (Prado Area)	Nutrients	1.58 Miles	TMDL required
Mill Creek (Prado Area)	Pathogens	1.58 Miles	Being addressed with USEPA approved TMDL
Mill Creek (Prado Area)	Total Suspended Solids (TSS)	1.58 Miles	TMDL required
Prado Park Lake	Nutrients	89.54 Acres	TMDL required
Prado Park Lake	Pathogens	89.54 Acres	Being addressed with USEPA approved TMDL
San Antonio Creek	pH	23.29 Miles	TMDL required
Santa Ana River, Reach 2	Indicator Bacteria	20.08 Miles	TMDL required
Santa Ana River, Reach 3	Copper	25.5 Miles	TMDL required
Santa Ana River, Reach 3	Lead	25.5 Miles	TMDL required

Santa Ana River, Reach 3	Pathogens	25.5 Miles	Being addressed with USEPA approved TMDL
Temescal Creek, Reach 1	pH	2.28 Miles	TMDL required

Water Quality Objectives

The following waterbodies are in or near HSA 801.21. Click on the waterbody to get information on water quality objectives and beneficial uses

Waterbody Name	Beneficial Uses	Sediment-Sensitive Waterbody
Aliso Creek	GWR, MUN, RARE, REC1, REC2, WARM, WILD	False
All other minor San Gabriel Mountain streams tributary to San Gabriel Valley	ALL	False
Angalls Stream - Tributaries to Angalls Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Angalls Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Anza Park Drain	MUN, REC1, REC2, SPWN, WARM, WILD	False
Bull Stream - Tributaries to Bull Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Bull Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Cajon Canyon Streams - Tributaries to Cajon Canyon Streams	COLD, GWR, MUN, REC1, REC2, WILD	False
Cajon Canyon Streams - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Carbon Canyon Creek	GWR, MUN, RARE, REC1, REC2, WARM, WILD	False
Cascade Canyon Streams - Tributaries to Casacade Canyon Streams	COLD, GWR, MUN, REC1, REC2, WILD	False
Cascade Canyon Streams - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Cedar Stream - Tributaries to Casacade Cedar Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Cedar Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Cherry Creeks - Tributaries to Cherry Creeks	COLD, GWR, MUN, REC1, REC2, WILD	False
Cherry Creeks - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Chino Creek Reach 1 - Santa Ana River confluence to beginning of concrete-lined channel south of Los Serranos Rd.	ALL	False
Chino Creek Reach 1 - Santa Ana River confluenceto beginning of concrete-lined channel south of Los Serranos Rd.	RARE, REC1, REC2, WARM, WILD	False
Chino Creek Reach 2 - Beginning of concrete lined channel south of Los Serranos Rd. to confluence with San Antonio Creek	REC1, REC2, WARM, WILD	False

Chino Creek Reach 2 - Santa Ana River confluence to beginning of concrete-lined channel south of Los Serranos Rd.	ALL	False
Cold Water Canyon Creek - Valley Reaches of Cold Water Canyon Creek - San Gabriel Mountain Streams (Mountain Reaches)	GWR, MUN, REC1, REC2, WARM, WILD	False
Coldwater Canyon Creek - San Gabriel Mountain Streams (Mountain Reaches)	AGR, COLD, GWR, IND, MUN, POW, PROC, RARE, REC1, REC2, WILD	False
Coyote Creek (within Santa Ana Regional boundary) - San Gabriel River Drainage	MUN, REC1, REC2, WARM, WILD	False
Cucamonga Creek	ALL	False
Cucamonga Creek Reach 1 - Confluence with Mill Creek to 23rd St. in Upland	GWR, REC1, REC2, WILD	False
Cucamonga Creek Reach 2 - (Mountain Reach) 23rd St. in Upland to headwaters	COLD, GWR, IND, MUN, POW, PROC, REC1, REC2, SPWN, WILD	False
Day Creek	ALL	False
Day Creek - San Gabriel Mountain Streams (Mountain Reaches)	COLD, GWR, MUN, PROC, REC1, REC2, WILD	False
Day Creek - Valley Reaches of Day Creek - San Gabriel Mountain Streams (Mountain Reaches)	GWR, MUN, REC1, REC2, WARM, WILD	False
Deer Stream - Tributaries to Deer Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Deer Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Demens Stream - Tributaries to Demens Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Demens Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Duncan Canyon Streams - Tributaries to Duncan Canyon Streams	COLD, GWR, MUN, REC1, REC2, WILD	False
Duncan Canyon Streams - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
East Etiwanda Creek	ALL	False
East Etiwanda Creek - San Gabriel Mountain Streams (Mountain Reaches)	COLD, GWR, MUN, PROC, RARE, REC1, REC2, WILD	False
East Etiwanda Creek - Valley Reaches of East Etiwanda Creek - San Gabriel Mountain Streams (Mountain Reaches)	GWR, MUN, REC1, REC2, WARM, WILD	False
Evans, Lake	ALL	False
Falling Rock Stream - Tributaries to Falling Rock Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Falling Rock Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Fan Stream - Tributaries to Fan Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Fan Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Henderson Canyon Streams - Tributaries to Henderson Canyon Streams	COLD, GWR, MUN, REC1, REC2, WILD	False
		False

Henderson Canyon Streams - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	
Icehouse Canyon Streams - Tributaries to Icehouse Canyon Streams	COLD, GWR, MUN, REC1, REC2, WILD	False
Icehouse Canyon Streams - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Kerkhoff Stream - Tributaries to Kerkhoff Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Kerkhoff Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Lake Evans - Upper Santa Ana River Basin	COLD, REC1, REC2, WARM, WILD	False
Lake Norconian - Upper Santa Ana River Basin	REC1, REC2, WARM, WILD	False
Lytle Creek - Valley Reaches of Lytle Creek (South,Middle, and North Forks) - San Gabriel Mountain Streams (Mountain Reaches)	GWR, MUN, REC1, REC2, WARM, WILD	False
Lytle creek (South, Middle and North Forks) and Coldwater Canyon Creek	ALL	False
Lytle Creek (South,Middle and North Forks) - San Gabriel Mountain Streams (Mountain Reaches)	AGR, COLD, GWR, IND, MUN, POW, PROC, RARE, REC1, REC2, WILD	False
Mill Creek (Prado Area)	RARE, REC1, REC2, WARM, WILD	False
Mockingbird Reservoir	ALL	False
Mockingbird Reservoir - Upper Santa Ana River Basin	MUN, REC1, REC2, WARM, WILD	False
Norconian, Lake	ALL	False
Offshore Zone - Water between Nearshore Zone and Limit of State Waters	COMM, IND, MAR, MUN, NAV, RARE, REC1, REC2, SPWN, WILD	False
Prado Flood Control Basin Wetland (Inland)	RARE, REC1, REC2, WARM, WILD	False
San Antonio Canyon Creek	AGR, COLD, GWR, MUN, POW, PROC, REC1, REC2, SPWN, WARM, WILD	False
San Antonio Creek	ALL	False
San Antonio Creek - Valley Reaches of Cold Water San Antonio Creek - San Gabriel Mountain Streams (Mountain Reaches)	GWR, MUN, REC1, REC2, WARM, WILD	False
San Antonio Creek - San Gabriel Mountain Streams (Mountain Reaches)	AGR, COLD, GWR, IND, MUN, POW, PROC, REC1, REC2, WILD	False
San Antonio Dam and Reservoir	GWR, MUN, REC1, REC2, WARM, WILD	False
San Sevaine Stream - Tributaries to San Sevaine Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
San Sevaine Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Santa Ana River, Reach 3-Prado Dam to Mission Blvd. In Riverside	AGR, GWR, RARE, REC1, REC2, WARM, WILD	False
Santa Ana River, Reach 4-Mission Blvd. In Riverside to San Jacinto Fault in San Bernardino	GWR, REC1, REC2, WARM, WILD	False
Stoddard Canyon Streams - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Sunnyslope Cahnnel	MUN, REC1, REC2, SPWN, WARM, WILD	False

Telegraph Canyon Streams - Tributaries to Telegraph Canyon Streams	COLD, GWR, MUN, REC1, REC2, WILD	False
Telegraph Canyon Streams - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False
Temescal Creek Reach 1A - Santa Ana River confluence to Lincoln Ave.	AGR, GWR, IND, RARE, REC1, REC2, SPWN, WARM, WILD	False
Temescal Creek Reach 1B Lincoln Ave. to Riverside Canal	REC1, REC2, WILD	False
Tequesquite Arroyo (Sycamore Creek)	GWR, REC1, REC2, SPWN, WARM, WILD	False
Thorpe Stream - Tributaries to Thorpe Stream	COLD, GWR, MUN, REC1, REC2, WILD	False
Thorpe Stream - Tributary to Mill Creek (Prado Area)	COLD, GWR, MUN, REC1, REC2, WILD	False

Caltrans Facilities

MAINTENANCE STATIONS

Name	Address
Ontario	1165 E Philadelphia Street

FREEWAYS AND HIGHWAYS

Route	Length (miles)
10	18.5
15	16.6
30	14.4
60	17.4
66	18.2
71	10.9
83	14
142	3.6
210	5.6

PARK & RIDE LOTS

Name	District	County	Route	Post Mile
VAN BUREN	8	RIV	60	R1.7
RANCHO CUCAMONGA	8	SBD	15	6.691
MONTCLAIR TRANSCENTER	8	SBD	10	0.7
CHINO	8	SBD	71	R1.091
COUNTRY VILLAGE	8	RIV	60	R3.05
MIRA LOMA	8	RIV	15	48.266

REST AREAS

Name	District	County	Route	Post Mile

Additional Information

Help for the Water Quality Planning Tool

TMDL information from the SWRCB

Construction General Permit information from the SWRCB

Groundwater Depth information from the California Department of Water Resouces

R Factor erosivity calculations

Appendix 4: Source Control

Pollutant Sources/Source Control Checklist

Appendix 8

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the 2014 SMR WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 31 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ A. **On-site storm drain inlets**	☒ **Locations of inlets.**	☒ **Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.**	☒ **Maintain and periodically repaint or replace inlet markings.** ☒ **Provide stormwater pollution prevention information to new site owners, lessees, or operators.** ☒ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** ☒ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
☐ B. **Interior floor drains and elevator shaft sump pumps**		☐ **State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**
☐ C. **Interior parking garages**		☐ **State that parking garage floor drains will be plumbed to the sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ D1. **Need for future indoor & structural pest control**		❑ **Note building design features that discourage entry of pests.**	❑ **Provide Integrated Pest Management information to owners, lessees, and operators.**
☒ D2. **Landscape/ Outdoor Pesticide Use**	❑ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ☒ **Show self-retaining landscape areas, if any.** ❑ **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**State that final landscape plans will accomplish all of the following.** ☒ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ☒ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ☒ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ☒ **Consider using pest-resistant plants, especially adjacent to hardscape. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	☒ **Maintain landscaping using minimum or no pesticides.** ❑ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening"** at http://www.rcflood.org/stormwater/Downloads/LandscapeGardenBrochure.pdf ❑ **Provide IPM information to new owners, lessees and operators.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ E. **Pools, spas, ponds, decorative fountains, and other water features.**	❑ **Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)**	**If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.**	❑ **See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at** http://www.rcflood.org/stormwater/Downloads/poolsandspas.pdf
❑ F. **Food service**	❑ **For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment.** ❑ **On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.**	❑ **Describe the location and features of the designated cleaning area.** ❑ **Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.**	❑ **See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at** http://www.rcflood.org/stormwater/downloads/FoodServ.pdf **Provide this brochure to new site owners, lessees, and operators.**
❑ G. **Refuse areas**	❑ **Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.** ❑ **If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.** ❑ **Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.**	❑ **State how site refuse will be handled and provide supporting detail to what is shown on plans.** ❑ **State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.**	❑ **State how the following will be implemented:** **Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at** www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ H. **Industrial processes.**	❑ **Show process area.**	❑ **If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."**	❑ **See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://www.rcflood.org/stormwater/Downloads/IndustrialCommercialFacilities.pdf
❑ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	❑ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ❑ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ❑ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	❑ **Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank** **www.cchealth.org/groups/hazmat/**	❑ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ J. **Vehicle and Equipment Cleaning**	❑ **Show on drawings as appropriate:** **(1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses.** **(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use).** **(3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer.** **(4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.**	❑ **If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.**	**Describe operational measures to implement the following (if applicable):** ❑ **Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at** http://www.rcflood.org/stormwater/downloads/OutdoorCleaningActivities.pdf ❑ **Car dealerships and similar may rinse cars with water only.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ K. **Vehicle/Equipment Repair and Maintenance**	❑ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ❑ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ❑ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	❑ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ❑ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ❑ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:** ❑ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ❑ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ❑ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.** **Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at** http://rcflood.org/stormwater/ **Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at** http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ L. **Fuel Dispensing Areas**	❑ **Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ❑ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		❑ **The property owner shall dry sweep the fueling area routinely.** ❑ **See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

[6] **The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ M. **Loading Docks**	❑ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.** ❑ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ❑ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		❑ **Move loaded and unloaded items indoors as soon as possible.** ❑ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ N. **Fire Sprinkler Test Water**		❑ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	❑ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
O. **Miscellaneous Drain or Wash Water or Other Sources** ❑ **Boiler drain lines** ❑ **Condensate drain lines** ❑ **Rooftop equipment** ❑ **Drainage sumps** ❑ **Roofing, gutters, and trim.** ❑ **Other sources**		❑ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ❑ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ❑ **Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ❑ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ❑ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.** ❑ **Include controls for other sources as specified by local reviewer.**	

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ P. **Plazas, sidewalks, and parking lots.**			☒ **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 5: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Appendix 6: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End

3.1 INFILTRATION BASIN

Type of BMP	LID - Infiltration
Treatment Mechanisms	Infiltration, Evapotranspiration (when vegetated), Evaporation, and Sedimentation
Maximum Treatment Area	50 acres
Other Names	Bioinfiltration Basin

Description

An Infiltration Basin is a flat earthen basin designed to capture the design capture volume, V_{BMP}. The stormwater infiltrates through the bottom of the basin into the underlying soil over a 72 hour drawdown period. Flows exceeding V_{BMP} must discharge to a downstream conveyance system. Trash and sediment accumulate within the forebay as stormwater passes into the basin. Infiltration basins are highly effective in removing all targeted pollutants from stormwater runoff.

Figure 1 – Infiltration Basin

See Appendix A, and Appendix C, Section 1 of *Basin Guidelines*, for additional requirements.

Siting Considerations

The use of infiltration basins may be restricted by concerns over ground water contamination, soil permeability, and clogging at the site. See the applicable WQMP for any specific feasibility considerations for using infiltration BMPs. Where this BMP is being used, the soil beneath the basin must be thoroughly evaluated in a geotechnical report since the underlying soils are critical to the basin's long term performance. To protect the basin from erosion, the sides and bottom of the basin must be vegetated, preferably with native or low water use plant species.

In addition, these basins may not be appropriate for the following site conditions:

- Industrial sites or locations where spills of toxic materials may occur
- Sites with very low soil infiltration rates
- Sites with high groundwater tables or excessively high soil infiltration rates, where pollutants can affect ground water quality
- Sites with unstabilized soil or construction activity upstream
- On steeply sloping terrain
- Infiltration basins located in a fill condition should refer to Appendix A of this Handbook for details on special requirements/restrictions

Setbacks

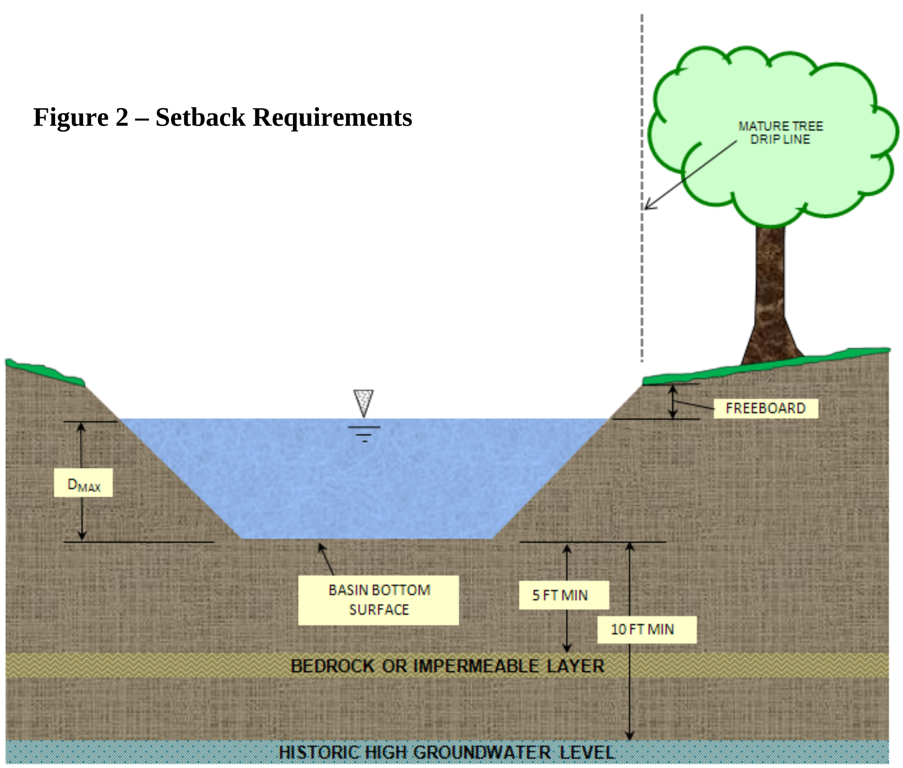
Always consult your geotechnical engineer for site specific recommendations regarding setbacks for infiltration trenches. Recommended setbacks are needed to protect buildings, existing trees, walls, onsite or nearby wells, streams, and tanks. Setbacks should be considered early in the design process since they can affect where infiltration facilities may be placed and how deep they are allowed to be. For instance, depth setbacks can dictate fairly shallow facilities that will have a larger footprint and, in some cases, may make an infiltration basin infeasible. In that instance, another BMP must be selected.

Infiltration basins typically must be set back:

- 10 feet from the historic high groundwater (measured vertically from the bottom of the basin, as shown in Figure 2)
- 5 feet from bedrock or impermeable surface layer (measured vertically from the bottom of the basin, as shown in Figure 2)
- From all existing mature tree drip lines as indicated in Figure 2 (to protect their root structure)
- 100 feet horizontally from wells, tanks or springs

Setbacks to walls and foundations must be included as part of the Geotechnical Report. All other setbacks shall be in accordance with applicable standards of the District's *Basin Guidelines* (Appendix C).

Figure 2 – Setback Requirements



Forebay

A concrete forebay shall be provided to reduce sediment clogging and to reduce erosion. The forebay shall have a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall / berm. Full height notch-type weir(s), offset from the line of flow from the basin inlet to prevent short circuiting, shall be used to outlet the forebay. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

Overflow

Flows exceeding V_{BMP} must discharge to an acceptable downstream conveyance system. Where an adequate outlet is present, an overflow structure may be used. Where an embankment is present, an emergency spillway may be used instead. Overflows must be placed just above the design water surface for V_{BMP} and be near the outlet of the system. The overflow structure shall be similar to the District's Standard Drawing CB 110. Additional details may be found in the District's *Basin Guidelines* (Appendix C).

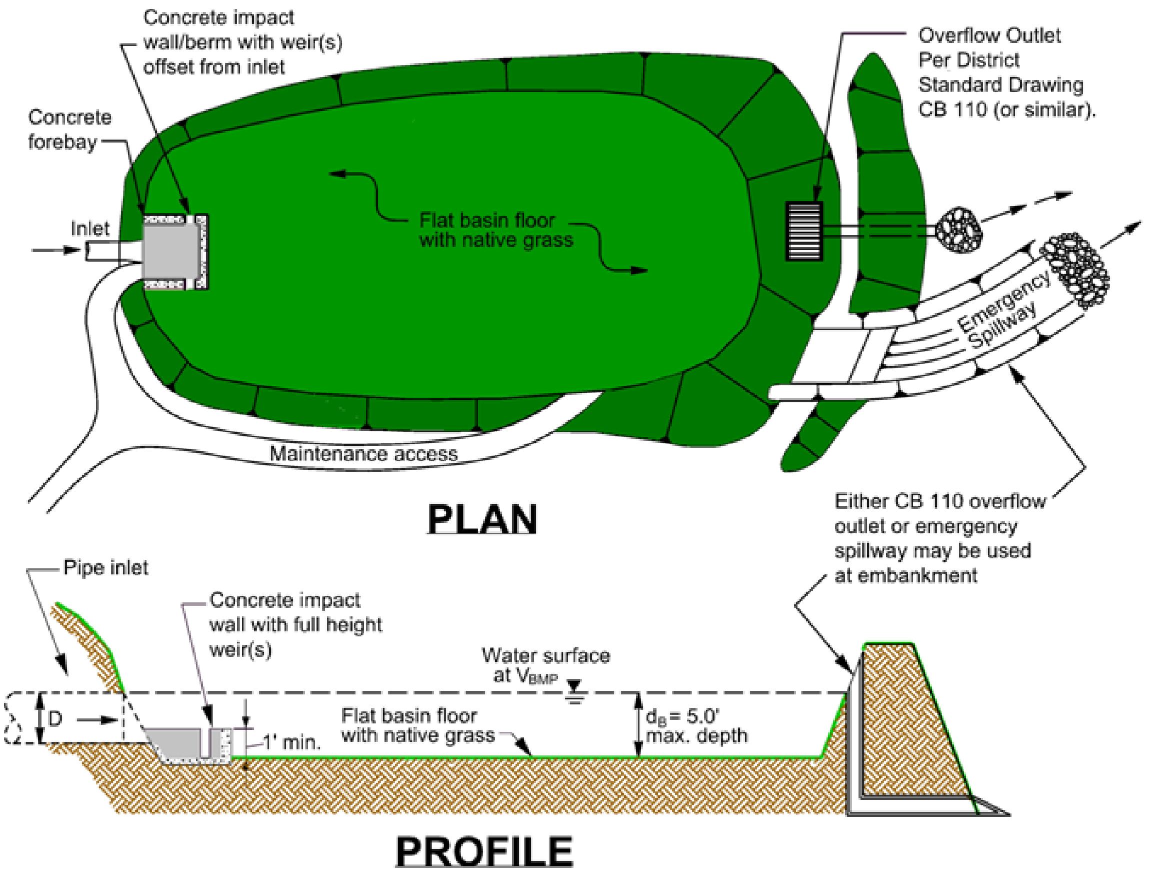


Figure 3 – Infiltration Basin

Landscaping Requirements

Basin vegetation provides erosion protection, improves sediment removal and assists in allowing infiltration to occur. The basin surface and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with County of Riverside Ordinance 859 and the District's *Basin Guidelines* (Appendix C), or other guidelines issued by the Engineering Authority.

Maintenance

Normal maintenance of an infiltration basin includes the maintenance of landscaping, debris and trash removal from the surface of the basin, and tending to problems associated with standing water (vectors, odors, etc.). Significant ponding, especially more than 72 hours after an event, may indicate that the basin surface is no longer providing sufficient infiltration and requires aeration. See the District's *Basin Guidelines* (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.).

Table 1 - Inspection and Maintenance

Schedule	Inspection and Maintenance Activity
Ongoing including just before annual storm seasons and following rainfall events.	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strenuously avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used, o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rain season. • Remove debris and litter from the entire basin to minimize clogging and improve aesthetics. • Check for obvious problems and repair as needed. Address odor, insects, and overgrowth issues associated with stagnant or standing water in the basin bottom. There should be no long-term ponding water. • Check for erosion and sediment laden areas in the basin. Repair as needed. Clean forebay if needed. • Revegetate side slopes where needed.
Annually. If possible, schedule these inspections within 72 hours after a significant rainfall.	• Inspection of hydraulic and structural facilities. Examine the inlet for blockage, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Check basin depth for sediment build up and reduced total capacity. Scrape bottom as needed and remove sediment. Restore to original cross-section and infiltration rate. Replant basin vegetation. • Verify the basin bottom is allowing acceptable infiltration. Use a disc or other method to aerate basin bottom only if there is actual significant loss of infiltrative capacity, rather than on a routine basis[1]. • No water should be present 72 hours after an event. No long term standing water should be present at all. No algae formation should be visible. Correct problem as needed.
1. CA Stormwater BMP Handbook for New Development and Significant Redevelopment	

Table 2 - Design and Sizing Criteria for Infiltration Basins

Design Parameter	Infiltration Basin
Design Volume	V_{BMP}
Forebay Volume	0.5% V_{BMP}
Drawdown time (maximum)	72 hours
Maximum tributary area	50 acres [2]
Minimum infiltration rate	Must be sufficient to drain the basin within the required Drawdown time over the life of the BMP. The WQMP may include specific requirements for minimum tested infiltration rates.
Maximum Depth	5 feet
Spillway erosion control	Energy dissipators to reduce velocities[1]
Basin Slope	0%
Freeboard (minimum)	1 foot [1]
Historic High Groundwater Setback (max)	10 feet
Bedrock/impermeable layer setback (max)	5 feet
Tree setbacks	Mature tree drip line must not overhang the basin
Set back from wells, tanks or springs	100 feet
Set back from foundations	As recommended in Geotechnical Report

1. Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures
2. CA Stormwater BMP Handbook for New Development and Significant Redevelopment

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the District's Basin Guidelines (Appendix C). In addition, information herein may be superseded by other guidelines issued by the co-permittee.

INFILTRATION BASIN SIZING PROCEDURE

1. Find the Design Volume, V_{BMP}.
   a) Enter the Tributary Area, A_T.
   b) Enter the Design Volume, V_{BMP}, determined from Section 2.1 of this Handbook.
2. Determine the Maximum Depth.
   a) Enter the infiltration rate. The infiltration rate shall be established as described in Appendix A: "Infiltration Testing".
   b) Enter the design Factor of Safety from Table 1 in Appendix A: "Infiltration Testing".
   c) The spreadsheet will determine D_1, the maximum allowable depth of the basin based on the infiltration rate along with the maximum drawdown time (72 hours) and the Factor of Safety.

$$D_1 = [(t) \times (I)] / 12s$$

Where I = site infiltration rate (in/hr)
s = safety factor
t = drawdown time (maximum 72 hours)

d) Enter the depth of freeboard.

e) Enter the depth to the historic high groundwater level measured from the top of the basin.

f) Enter the depth to the top of bedrock or other impermeable layer measured from the finished grade.

g) The spreadsheet will determine D_2, the total basin depth (including freeboard, if used) of the basin, based on restrictions to the depth by groundwater and an impermeable layer.

$$D_2 = \text{Depth to groundwater} - (10 + \text{freeboard}) \text{ (ft)};$$

or

$$D_2 = \text{Depth to impermeable layer} - (5 + \text{freeboard}) \text{ (ft)}$$

Whichever is least.

h) The spreadsheet will determine the maximum allowable effective depth of basin, D_{MAX}, based on the smallest value between D_1 and D_2. D_{MAX} is the maximum depth of water only and does not include freeboard. D_{MAX} shall not exceed 5 feet.

3. Basin Geometry

a) Enter the basin side slopes, z (no steeper than 4:1).

b) Enter the proposed basin depth, d_B excluding freeboard.

c) The spreadsheet will determine the minimum required surface area of the basin:

$$A_s = V_{BMP} / d_B$$

Where A_s = minimum area required (ft^2)
V_{BMP} = volume of the infiltration basin (ft^3)
d_B= proposed depth not to exceed maximum allowable depth, D_{MAX} (ft)

d) Enter the proposed bottom surface area. This area shall not be less than the minimum required surface area.

4. Forebay

A concrete forebay with a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall shall be provided. Full-height rectangular weir(s) shall be used to outlet the forebay. The weir(s) must be offset from the line of flow from the basin inlet. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

a) The spreadsheet will determine the minimum required forebay volume based on 0.5% V_{BMP}.

b) Enter the proposed depth of the forebay berm/splashwall (1foot minimum).

c) The spreadsheet will determine the minimum required forebay surface area.

d) Enter the width of rectangular weir to be used (minimum 1.5 inches). Weir width should be established based on a 5 minute drawdown time.

3.2 INFILTRATION TRENCH

Type of BMP	LID - Infiltration
Treatment Mechanisms	Infiltration, Evapotranspiration (when vegetated), Evaporation
Maximum Drainage Area	10-acres
Other Names	None

Description

Infiltration trenches are shallow excavated areas that are filled with rock material to create a subsurface reservoir layer. The trench is sized to store the design capture volume, V_{BMP}, in the void space between the rocks. Over a period of 72 hours, the stormwater infiltrates through the bottom of the trench into the surrounding soil. Infiltration basins are highly effective in removing all targeted pollutants from stormwater runoff.

Figure 1 shows the components of an infiltration trench. The section shows the reservoir layer and observation well, which is used to monitor water depth. An overflow pipe that is used to bypass flows once the trench fills with stormwater is also shown.

Site Considerations

Location

The use of infiltration trenches may be restricted by concerns over groundwater contamination, soil permeability, and clogging at the site. See the applicable WQMP for any specific feasibility considerations for using infiltration BMPs. Where this BMP is being used, the soil beneath the basin must be thoroughly evaluated in a geotechnical report since the underlying soils are critical to the basin's long term performance. These basins may not be appropriate for the following site conditions:

- Industrial sites or locations where spills of toxic materials may occur.
- Sites with very low soil infiltration rates.
- Sites with high groundwater tables or excessively high soil infiltration rates, where pollutants can affect groundwater quality.
- Sites with unstabilized soil or construction activity upstream.
- On steeply sloping terrain.
- Infiltration trenches located in a fill condition should refer to Appendix A of this Handbook for details on special requirements/restrictions.

This BMP has a flat surface area, so it may be challenging to incorporate into steeply sloping terrain.

Setbacks

Always consult your geotechnical engineer for site specific recommendations regarding setbacks for infiltration trenches. Recommended setbacks are needed to protect buildings, walls, onsite or nearby wells, streams, and tanks. Setbacks should be considered early in the design process as they affect where infiltration facilities may be placed and how deep they are allowed to be. For instance, depth setbacks can dictate fairly shallow facilities that will have a larger footprint and, in some cases, may make an infiltration trench infeasible. In that instance, another BMP must be selected.

In addition to setbacks recommended by the geotechnical engineer, infiltration trenches must be set back:

- 10 feet from the historic high groundwater mark (measured vertically from the bottom of the trench, as shown in Figure 1)
- 5 feet from bedrock or impermeable surface layer (measured vertically from the bottom of the trench, as shown in Figure 1)
- From all mature tree drip lines as indicated in Figure 1
- 100 feet horizontally from wells, tanks or springs

Setbacks to walls and foundations must be included as part of the Geotechnical Report.

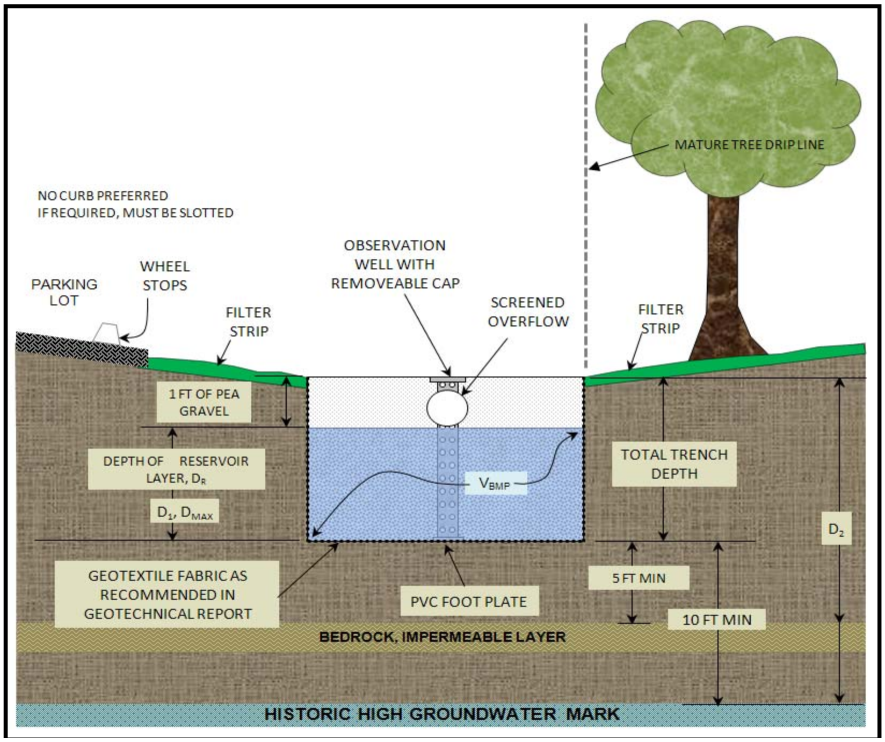


Figure 1 Section View of an Infiltration Trench

Sediment Control

Infiltration BMPs have the risk of becoming plugged over time. To prevent this, sediment must be removed before stormwater enters the trench. Both sheet and concentrated flow types have requirements that should be considered in the design of an infiltration trench.

When sheet type flows approach the trench along its length (as illustrated in Figure 2), a vegetated filter strip should be placed between the trench and the upstream drainage area. The filter strip must be a minimum of 5 feet wide and planted with grasses (preferably native) or covered with mulch.

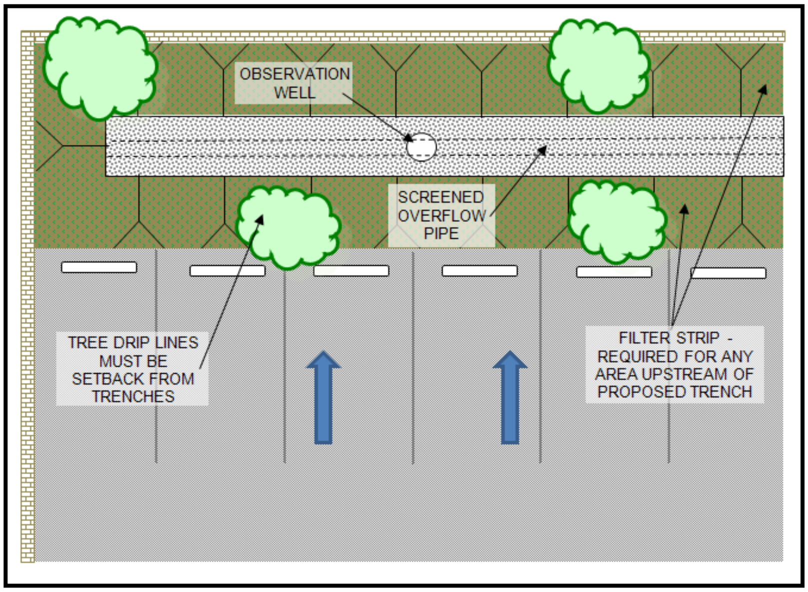


Figure 2 Plan View, Sheet Type Flows

Concentrated flows require a different approach. A 2004 Caltrans BMP Retrofit Report found that flow spreaders recommended in many water quality manuals are ineffective in distributing concentrated flows. As such, concentrated flows should either be directed toward a traditional vegetated swale (as shown on the right side of Figure 3) or to catch basin filters that can remove litter and sediment. Catch basins must discharge runoff as surface flow above the trench; they cannot outlet directly into the reservoir layer of the infiltration trench. If catch basins are used, the short and long term costs of the catch basin filters should be considered.

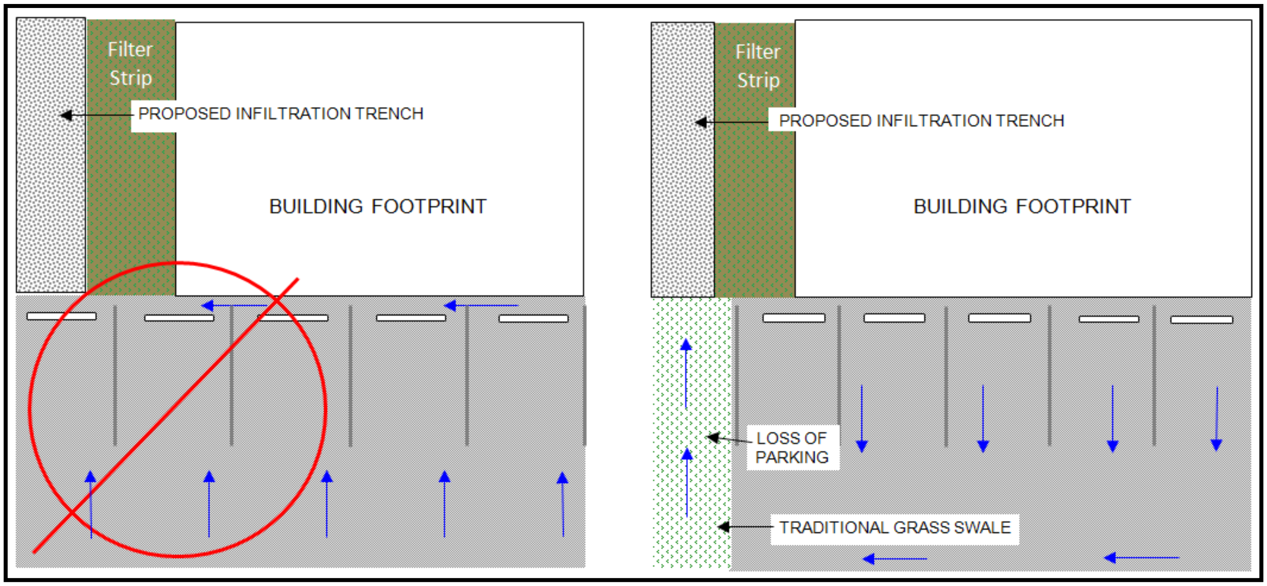


Figure 3 Plan View, Concentrated Flows

Additional Considerations

Class V Status

In certain circumstances, for example, if an infiltration trench is "deeper than its widest surface dimension," or includes an assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground, it would probably be considered by the EPA to be a Class V injection well. Class V injection wells are subject to regulations and reporting requirements via the Underground Injection Control (UIC) Program. To ensure that infiltration trenches are not considered Class V wells, the design procedure in this manual requires that the trench not be deeper than it is wide.

Geotechnical Report

A geotechnical report must be included for all infiltration trenches. Appendix A of this Handbook entitled "Infiltration Testing Guidelines", details which types of infiltration tests are acceptable and how many tests or boring logs must be performed. A Geotechnical Report must be submitted in support of all infiltration trenches. Setbacks to walls and foundations must be included in the Geotechnical Report.

Observation Wells

One or more observation wells should be provided. The observation well consists of a vertical section of perforated pipe, 4 to 6 inches in diameter, installed flush with top of trench on a foot plate and have a locking, removable cap.

Overflow

An overflow route is needed to bypass storm flows larger than the V_{BMP} or in the event of clogging. Overflow systems must connect to an acceptable discharge point such as a downstream conveyance system.

Maintenance Access

Normal maintenance of an infiltration trench includes maintenance of the filter strip as well as debris and trash removal from the surface of the trench and filter strip. More substantial maintenance requiring vehicle access may be required every 5 to 10 years. Vehicular access along the length of the swale should be provided to all infiltration trenches. It is preferred that trenches be placed longitudinally along a street or adjacent to a parking lot area. These conditions have high visibility which makes it more likely that the trench will be maintained on a regular basis.

Inspection and Maintenance

Schedule	Inspection and Maintenance Activity
Every two weeks, or as often as necessary to maintain a pleasant appearance	- Maintain adjacent landscaped areas. Remove clippings from landscape maintenance activities. - Remove trash & debris
3 days after Major Storm Events	- Check for surface ponding. If ponding is only above the trench, remove, wash and replace pea gravel. May be needed every 5-10 years. - Check observation well for ponding. If the trench becomes plugged, remove rock materials. Provide a fresh infiltration surface by excavating an additional 2-4 inches of soil. Replace the rock materials.

Design and Sizing Criteria

Design Parameter	Design Criteria
Design Volume	V_{BMP}
Design Drawdown time	72 hrs
Maximum Tributary Drainage Area	10 acres
Maximum Trench Depth	8.0 ft
Width to Depth Ratio	Width must be greater than depth
Reservoir Rock Material	AASHTO #3 or 57 material or a clean, washed aggregate 1 to 3-in diameter equivalent
Filter Strip Width	Minimum of 5 feet in the direction of flow for all areas draining to trench
Filter Strip Slope	Max slope = 1%
Filter Strip Materials	Mulch or grasses (non-mowed variety preferred)
Historic High Groundwater Mark	10 ft or more below bottom of trench
Bedrock/Impermeable Layer Setback	5 ft or more below bottom of trench
Tree Setbacks	Mature tree drip line must not overhang the trench
Trench Lining Material	As recommended in Geotechnical Report

Infiltration Trench Design Procedure

1. Enter the area tributary to the trench, maximum drainage area is 10 acres.

2. Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3. Enter the site infiltration rate, found in the geotechnical report.

4. Enter the factor of safety from Table 1 of Appendix A, Infiltration Testing.

5. Determine the maximum reservoir layer depth, $D_{MAX.}$ The value is obtained by taking the smaller of two depth equations but may never exceed 8 feet. The first depth, D_1 is related to the infiltration rate of the soil. The second depth, $D_{2,}$ is related to required setbacks to groundwater, bedrock/impermeable layer. These parameters are shown in Figure 1.

   Calculate D_1.

$$D_1 = \frac{I\left({}^{in}/_{hr}\right) \times 72\ (hrs)}{12\left({}^{in}/_{ft}\right) \times {}^{n}/_{100} \times FS}$$

   Where:
   I = site infiltration rate (in/hr), found in the geotechnical report
   FS = factor of safety, refer to Appendix A - Infiltration Testing
   n = porosity of the trench material, 40%

   Calculate D_2. Enter the depth to the seasonal high groundwater and bedrock/impermeable layer measured from the finished grade. The spreadsheet checks the minimum setbacks shown in Figure 1 and selects the smallest value. The equations are listed below for those doing hand calculations.

   Minimum Setbacks (includes 1 foot for pea gravel):
   = Depth to historic high groundwater mark - 11 feet
   = Depth to impermeable layer - 6 feet

   D_2 is the smaller of the two values.

   D_{MAX} is the smaller value of D_1 and $D_{2,}$ and must be less than or equal to 8 feet.

6. Enter the proposed reservoir layer depth, D_R. The value must be no greater than D_{MAX}.

7. Find the required surface area of the trench, A_S. Once D_R is entered, the spreadsheet will calculate the corresponding depth of water and the minimum surface area of the trench.

$$Design\ d_W = D_R \times \left({}^{n}/_{100}\right) \qquad A_S = \frac{V_{BMP}}{Design\ d_W}$$

Where:

A_S = minimum area required (ft^2)
V_{BMP} = BMP storage volume (ft^3)
Design d_W = Depth of water in reservoir layer (ft)

8. Enter the proposed design surface area; it must be greater than the minimum surface area.

9. Calculate the minimum trench width. This is to ensure that EPA's Class V Injection well status is not triggered. The total trench depth (shown in Figure 1) includes the upper foot where the overflow pipe is located. The minimum surface dimension is D_R + 1 foot.

Additional Items

The following items detailed in the preceding sections should also be addressed in the design.

- Sediment Control
- Geotechnical Report
- Observation well(s)
- Overflow

Reference Material

California Stormwater Quality Association. California Stormwater BMP Handbook New Development and Redevelopment. 2003.

County of Los Angeles Department of Public Works. Stormwater BMP Best Management Practice Design and Maintenance Manual for Publicly Maintained Storm Drain Systems. Los Angeles, CA, 2009.

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3.3 Permeable Pavement

Type of BMP	LID - Infiltration
Treatment Mechanisms	Infiltration, Evaporation
Maximum Drainage Area	10 acres
Other Names	porous pavement, pervious concrete, pervious asphalt, pervious gravel pavement, cobblestone block, modular block, modular pavement

Description

Permeable pavements can be either pervious asphalt and concrete surfaces, or permeable modular block. Unlike traditional pavements that are impermeable, permeable pavements reduce the volume and peak of stormwater runoff as well as mitigate pollutants from stormwater runoff, provided that the underlying soils can accept infiltration. Permeable pavement surfaces work best when they are designed to be flat or with gentle slopes. This factsheet discusses criteria that apply to infiltration designs.

The permeable surface is placed on top of a reservoir layer that holds the water quality stormwater volume, $V_{BMP.}$ The water infiltrates from the reservoir layer into the native subsoil. Tests must be performed according to the Infiltration Testing Section in Appendix A to be able to use this design procedure.

In some circumstances, permeable pavement may be implemented on a project as a source control feature. Where implemented as a source control feature (sometimes referred to as a 'self-retaining' area), the pavement is not considered a 'BMP' that would be required to be designed and sized per this manual. Where permeable pavement receives runoff from adjacent tributary areas, the permeable pavement *may* be considered a BMP that must be sized according to this manual. Consult the Engineering Authority and the WQMP for any applicable requirements for designing and sizing permeable pavement installations.

Siting Considerations

The WQMP applicable to the project location should be consulted, as it may include criteria for determining the applicability of this and other Infiltration-based BMPs to the project.

Permeable pavements can be used in the same manner as concrete or asphalt in low traffic parking lots, playgrounds, walkways, bike trails, and sports courts. Most types of permeable pavement can be designed to meet Americans with Disabilities Act (ADA) requirements. Permeable pavements **should not** be used in the following conditions:

- ⃠ Downstream of erodible areas
- ⃠ Downstream of areas with a high likelihood of pollutant spills
- ⃠ Industrial or high vehicular traffic areas (25,000 or greater average daily traffic)
- ⃠ Areas where geotechnical concerns, such as soils with low infiltration rates, would preclude the use of this BMP.

Sites with Impermeable Fire Lanes

Oftentimes, Fire Departments do not allow alternative pavement types including permeable pavement. They require traditional impermeable surfaces for fire lanes. In this situation, it is acceptable to use an impermeable surface for the fire lane drive aisles and permeable pavement for the remainder of the parking lot.

Where impermeable fire lanes are used in the design, the impermeable surface must slope towards the permeable pavement, and the base layers shall remain continuous underneath the two pavement types, as shown in Figure 1. This continuous reservoir layer helps to maintain infiltration throughout the pervious pavement site, and can still be considered as part of the total required storage area.

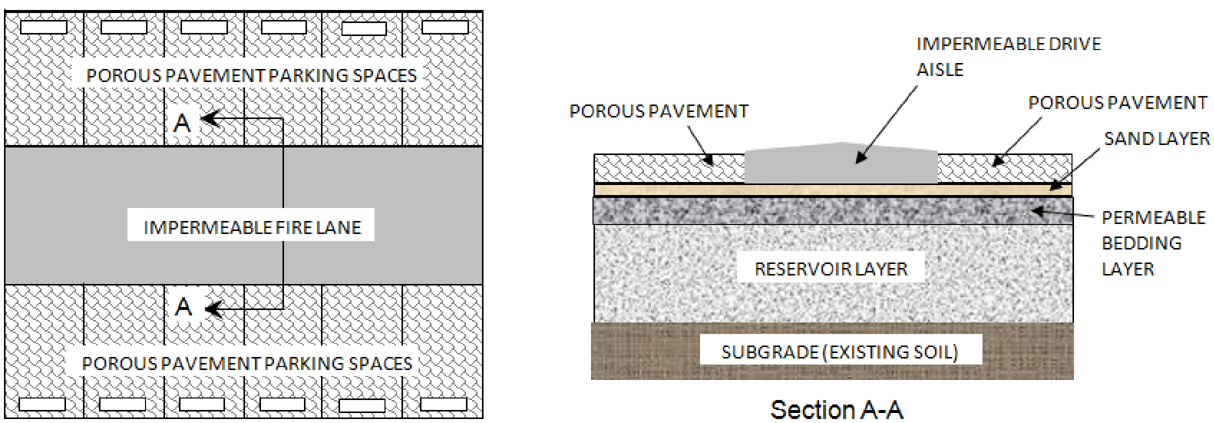

Figure 1: Impermeable Fire Lanes

Also, while a seal coat treatment may be used on the impermeable fire land, traditional seal coat treatments **shall not** be used on permeable pavement.

Setbacks

Always consult your geotechnical engineer for site specific recommendations regarding setbacks for permeable pavement. Recommended setbacks are needed to protect buildings, walls, onsite wells, streams and tanks.

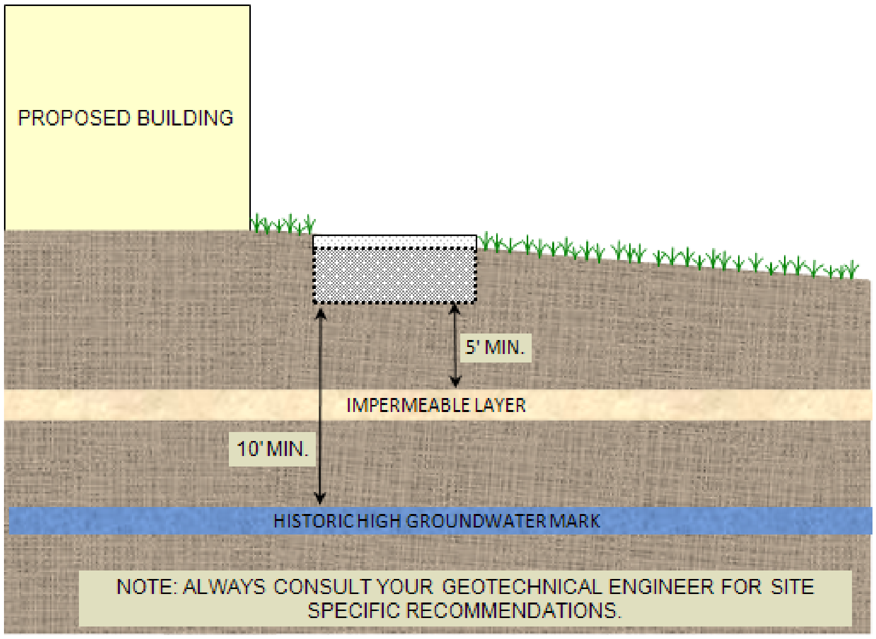

Figure 2: Permeable Pavement Setback Requirements

A minimum vertical separation of 10 feet is required from the bottom of the reservoir layer to the historic high groundwater mark, see Figure 2. A minimum vertical separation of 5 feet is required from the bottom of the reservoir layer to any impermeable layer in the soil. If the historic high groundwater mark is less than 10 feet below the reservoir layer section, or less than 5 feet from an impermeable layer, the infiltration design is not feasible.

Design and Sizing Criteria

To ensure that the pavement structural section is not compromised, a 24-hour drawdown time is utilized for this BMP instead of the longer drawdown time used for most volume based BMPs.

Reservoir Layer Considerations

Even with proper maintenance, sediment will begin to clog the soil below the permeable pavement. Since the soil cannot be scarified or replaced, this will result in slower infiltration rates over the life of the permeable pavement. Therefore, the reservoir layer is limited to a maximum of 12 inches in depth to ensure that over the life of the BMP, the reservoir layer will drain in an adequate time.

***Note**: All permeable pavement BMP installations (not including Permeable Pavement as a source control BMP i.e. a self-retaining area) must be tested by the geotechnical engineer to ensure that the soils drain at a minimum allowable rate to ensure drainage.. See the Infiltration Testing Section of this manual for specific details for the required testing and applied factors of safety.*

Sloping Permeable Pavement

Ideally permeable pavement would be level, however most sites will have a mild slope. If the tributary drainage area is too steep, the water may be flowing too fast when it approaches the permeable pavement, which may cause water to pass over the pavement instead of percolating and entering the reservoir layer. If the maximum slopes shown in Table 1 are complied with, it should address these concerns.

Table 1: Design Parameters for Permeable Pavement

Design Parameter	Permeable Pavement
Maximum slope of permeable pavement	3%
Maximum contributing area slope	5%

Regardless of the slope of the pavement surface design, the bottom of the reservoir layers **shall be flat and level** as shown in Figure 3. The design shown ensures that the water quality volume will be contained in the reservoir layer. A terraced design utilizing non-permeable check dams may be a useful option when the depth of gravel becomes too great as shown in Figure 3.

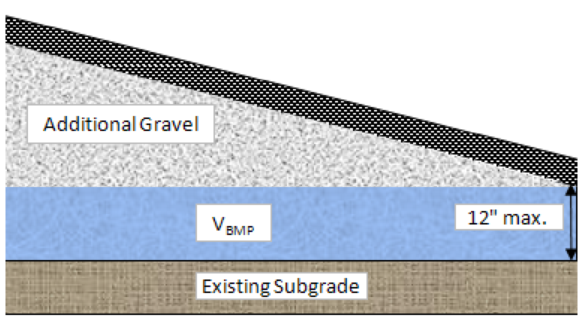

Figure 3: Sloped Cross Sections for Permeable Pavement

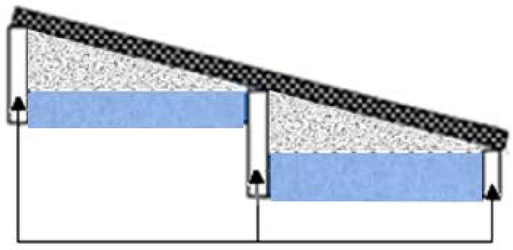

Figure 4: Permeable Pavement with Non-permeable Check Dams

In Figure 4, the bottom of the gravel reservoir layer is incorrectly sloped parallel to the pavement surface. Water would only be allowed to pond up to the lowest point of the BMP. Additional flows would simply discharge from the pavement. Since only a portion of the gravel layer can store water, this design would result in insufficient capacity. This is not acceptable.

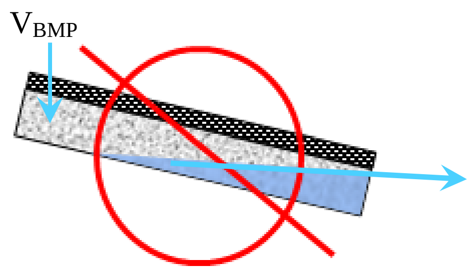

Figure 5: Incorrect Sloping of Permeable Pavement

To assure that the subgrade will empty within the 24 hour drawdown time, it is important that the maximum depth of 12 inches for the reservoir layer discussed in the design procedure is not exceeded. The value should be measured from the lowest elevation of the slope (Figure 4).

Minimum Surface Area

The minimum surface area required, A_S, is calculated by dividing the water quality volume, V_{BMP}, by the depth of water stored in the reservoir layer. The depth of water is found by multiplying the void ratio of the reservoir aggregate by the depth of the layer, b_{TH}. The void ratio of the reservoir aggregate is typically 40%; the maximum reservoir layer depth is 12".

Sediment Control

A pretreatment BMP should be used for sediment control. This pretreatment BMP will reduce the amount of sediment that enters the system and reduce clogging. The pretreatment BMP will also help to spread runoff flows, which allows the system to infiltrate more evenly. The pretreatment BMP must discharge to the surface of the pavement and not the subgrade. Grass swales may also be used as part of a treatment train with permeable pavements.

Liners and Filter Fabric

Always consult your geotechnical engineer for site specific recommendations regarding liners and filter fabrics. Filter fabric may be used around the edges of the permeable pavement; this will help keep fine sediments from entering the system. Unless recommended for the site, impermeable liners are not to be used below the subdrain gravel layer.

Overflow

An overflow route is needed in the permeable pavement design to bypass storm flows larger than the V_{BMP} or in the event of clogging. Overflow systems must connect to an acceptable discharge point such as a downstream conveyance system.

Roof Runoff

Permeable pavement can be used to treat roof runoff. However, the runoff cannot be discharged beneath the surface of the pavement directly into the subgrade, as shown in Figure 6. Instead the pipe should empty on the surface of the permeable pavement as shown in Figure 7. A filter on the drainpipe should be used to help reduce the amount of sediment that enters the permeable pavement.

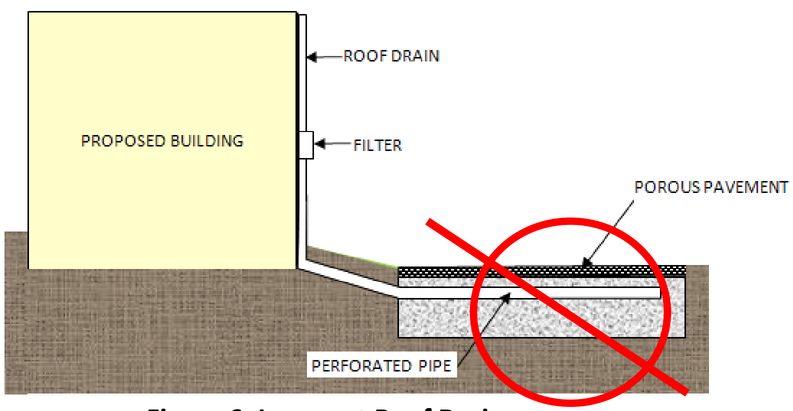

Figure 6: Incorrect Roof Drainage

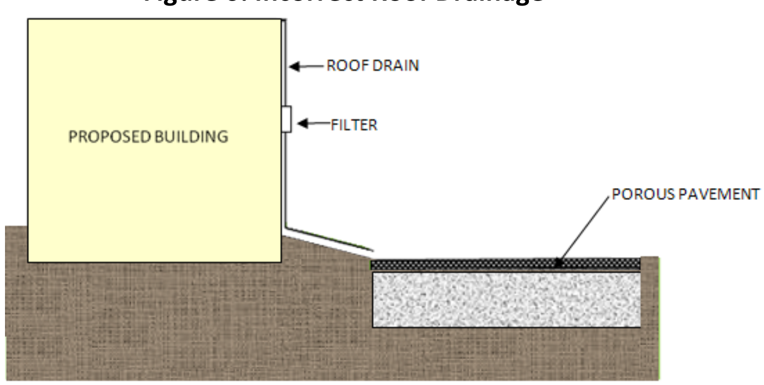

Figure 7: Correct Roof Runoff Drainage

Infiltration

Refer to the Infiltration Testing Section (Appendix A) in this manual for recommendations on testing for this BMP.

Pavement Section

The cross section necessary for infiltration design of permeable pavement includes:

- The thickness of the layers of permeable pavement, sand and bedding layers depends on whether it is permeable modular block or pervious pavement. A licensed geotechnical or civil engineer is required to determine the thickness of these upper layers appropriate for the pavement type and expected traffic loads.
- A 12" maximum reservoir layer consisting of AASHTO #57 gravel vibrated in place or equivalent with a minimum of 40% void ratio.

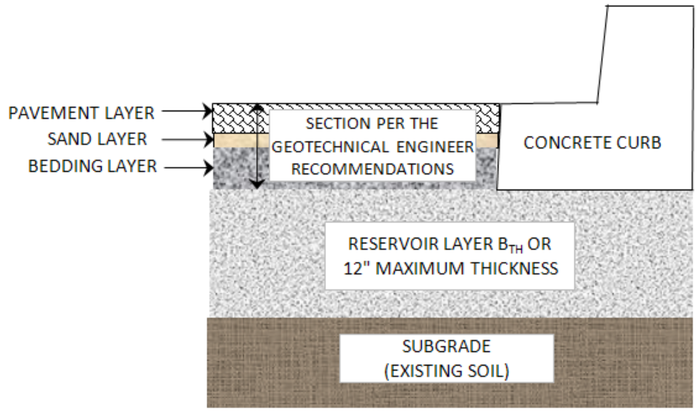

Figure 8: Infiltration Cross Section

Inspection and Maintenance Schedule –Modular Block

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris
Utility Trenching and other pavement repairs	• Remove and reset modular blocks, structural section and reservoir layer as needed. Replace damaged blocks in-kind. • Do not pave repaired areas with impermeable surfaces.
After storm events	• Inspect areas for ponding
2-3 times per year	• Sweep to reduce the chance of clogging
As needed	• Sand between pavers may need to be replaced if infiltration capacity is lost

Inspection and Maintenance Schedule –Pervious Concrete/Asphalt

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris
Utility Trenching other pavement repairs	• Replace structural section and reservoir layer in kind. • Re-pave using pervious concrete/asphalt. Do not pave repaired areas with impermeable surfaces.
After storm events	• Inspect areas for ponding
2-3 times per year	• Vacuum the permeable pavement to reduce the chance of clogging
As needed	• Remove and replace damaged or destroyed permeable pavement

Design Procedure Permeable Pavement

1. Enter the Tributary Area, A_T.

2. Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3. Enter the reservoir layer depth, b_{TH} for the proposed permeable pavement. The reservoir layer maximum depth is 12 inches.

4. Calculate the Minimum Surface Area, A_S, required.

$$A_S(\text{ft}) = \frac{V_{BMP}\ (\text{ft}^3)}{(0.4\ \times\ b_{TH}\ (\text{in}))/12(\text{in/ft})}$$

   Where, the porosity of the gravel in the reservoir layer is assumed to be 40%.

5. Enter the proposed surface area and ensure that this is equal to or greater than the minimum surface area required.

6. Enter the dimensions, per the geotechnical engineer's recommendations, for the pavement cross section. The cross section includes a pavement layer, usually a sand layer and a permeable bedding layer. Then add this to the maximum thickness of the reservoir layer to find the total thickness of the BMP.

7. Enter the slope of the top of the permeable pavement. The maximum slope is 3%.

8. Enter whether sediment control was provided.

9. Enter whether the geotechnical approach is attached.

10. Describe the surfaces surrounding the permeable pavement. It is preferred that a vegetation buffer is used around the permeable pavement.
11. Check to ensure that vertical setbacks are met. There should be a minimum of 10 feet between the bottom of the BMP and the top of the high groundwater table, and a minimum of 5 feet between the reservoir layer the top of the impermeable layer.

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Sacramento Stormwater Quality Partnership and the City of Roseville. Stormwater Quality Design Manual for the Sacramento and South Placer Regions. County of Sacramento, 2007.

Taylor, Chuck. "Advanced Pavement Technology." Riverside, 2008.

Tennis, Paul D., Michael L. Leming and David J. Akers. Pervious Concrete Pavements. Silver Spring: Portland Cement Association and National Ready Mixed Concrete Association, 2004.

Urban Drainage and Flood Control District. Urban Storm Drainage Criteria Manual Volume 3 - Best Management Practices. Vol. 3. Denver, 2008. 3 vols.

Urbonas, Ben R. Stormwater Sand Filter Sizing and Design: A Unit Operations Approach. Denver: Urban Drainage and Flood Control District, 2002.

For Information:

LOCAL SEWERING AGENCIES IN RIVERSIDE COUNTY:

City of Beaumont	(909) 769-8520
Belair Homeowners Association	(909) 277-1414
City of Banning	(909) 922-3130
City of Blythe	(760) 922-6161
City of Coachella	(760) 391-5008
Coachella Valley Water District	(760) 398-2651
City of Corona	(909) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(909) 928-3777
Elsinore Valley MWD	(909) 674-3146
Farm Mutual Water Company	(909) 244-4198
Idyllwild Water District	(909) 659-2143
Jurupa Community Services Dist.	(909) 685-7434
Lake Hemet MWD	(909) 658-3241
Lee Lake Water District	(909) 277-1414
March Air Force Base	(909) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8242
Rancho Caballero	(909) 780-9272
Rancho California Water Dist.	(909) 676-4101
Ripley, CSA #62	(760) 922-4909
Rubidoux Community Services Dist.	(909) 684-7580
City of Riverside	(909) 782-5341
Silent Valley Club, Inc	(909) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(909) 780-4170

SPILL RESPONSE AGENCY:

HAZ-MAT:	(909) 358-5055
HAZARDOUS WASTE DISPOSAL:	(909) 358-5055
TO REPORT ILLEGAL DUMPING OR A CLOGGED STORM DRAIN:	1-800-506-2555

StormWater CleanWater PROTECTION PROGRAM

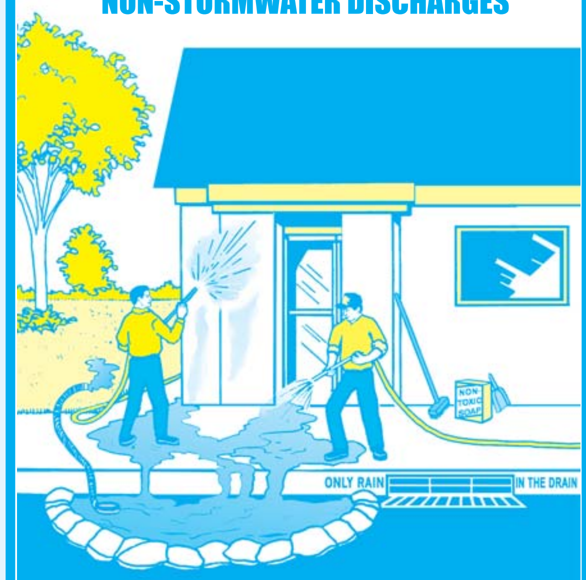
Riverside County gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES

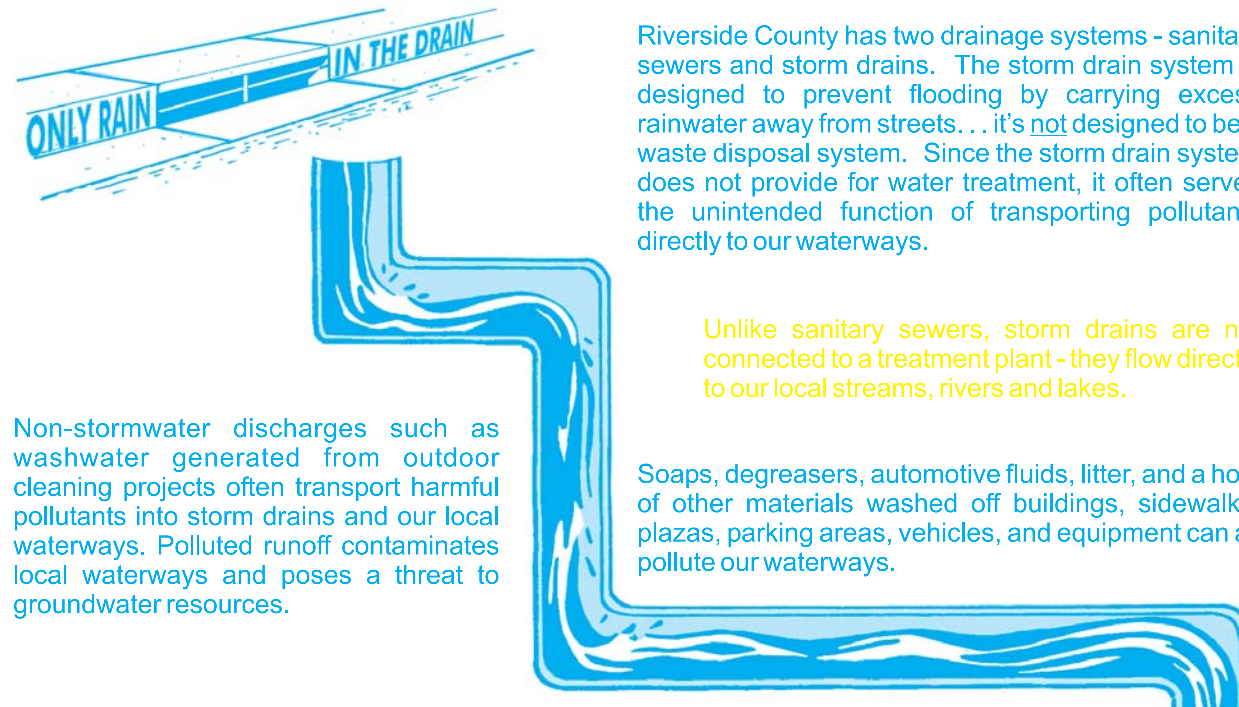
NON-STORMWATER DISCHARGES



GUIDELINES for disposal of washwater from:

- **Sidewalk, plaza or parking lot cleaning**
- **Vehicle washing or detailing**
- **Building exterior cleaning**
- **Waterproofing**
- **Equipment cleaning or degreasing**

Do you know . . . where the water should go?



Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to prevent flooding by carrying excess rainwater away from streets. . . it's not designed to be a waste disposal system. Since the storm drain system does not provide for water treatment, it often serves the unintended function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

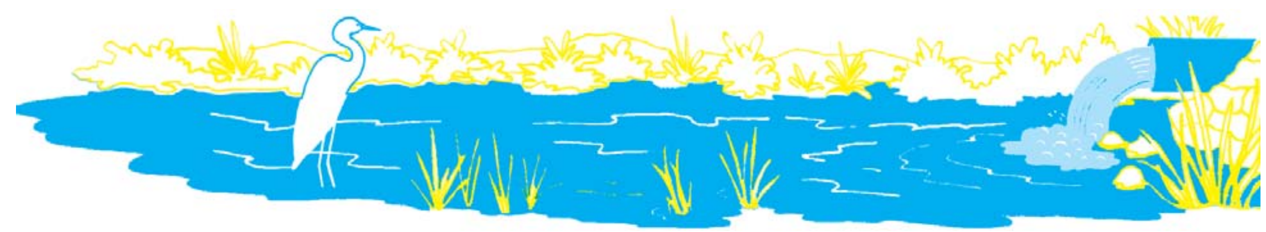
Non-stormwater discharges such as washwater generated from outdoor cleaning projects often transport harmful pollutants into storm drains and our local waterways. Polluted runoff contaminates local waterways and poses a threat to groundwater resources.

Soaps, degreasers, automotive fluids, litter, and a host of other materials washed off buildings, sidewalks, plazas, parking areas, vehicles, and equipment can all pollute our waterways.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Since preventing pollution is much easier, and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses of pollution prevention activities such as those described in this pamphlet.

The Cities and County of Riverside have adopted ordinances for stormwater management and discharge control. In accordance with state and federal law, these local stormwater ordinances **prohibit** the discharge of wastes into the storm drain system or local surface waters. This includes non-stormwater discharges containing oil, grease, detergents, degreasers, trash, or other waste materials.



PLEASE NOTE: The discharge of pollutants into the street, gutters, storm drain system, or waterways - without a Regional Water Quality Control Board permit or waiver - is ***strictly prohibited*** by local ordinances and state and federal law.

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Washwater Disposal

DO . . . Dispose of **small amounts** of **washwater from cleaning building exteriors, sidewalks, or plazas** onto landscaped or unpaved surfaces provided you have the owner's permission and the discharge will not cause flooding or nuisance problems, or flow into a storm drain.

DO NOT . . . Discharge **large amounts** of these types of washwater onto landscaped areas or soil where water may run to a street or storm drain. Wastewater from exterior cleaning may be pumped to a sewer line with specific permission from the local sewering agency.

DO . . . Check with your local sewering agency's policies and requirements concerning waste water disposal. **Water from many outdoor cleaning activities** may be acceptable for disposal to the sewer system. See the list on the back of this flyer for phone numbers of the sewering agencies in your area.

DO NOT . . . Pour **hazardous wastes** or toxic materials into the storm drain or sewer system . . . properly dispose of it instead. When in doubt, contact the local sewering agency! The agency will tell you what types of liquid wastes can be accepted.

DO . . . Understand that **water (without soap) used to remove dust from clean vehicles** may be discharged to a street or storm drain. **Washwater from sidewalk, plaza, and building surface cleaning** may go into a street or storm drain if ALL of the following conditions are met:

1) The surface being washed is free of residual oil stains, debris and similar pollutants by using dry cleanup methods (sweeping, and cleaning any oil or chemical spills with rags or other absorbent materials before using water).
2) Washing is done with water only - no soap or other cleaning materials.
3) You have not used the water to remove paint from surfaces during cleaning.

DO NOT . . . Dispose of water containing **soap or any other type of cleaning agent** into a storm drain or water body. This is a direct violation of state and/or local regulations. Because **wastewater from cleaning parking areas or roadways** normally contains metallic brake pad dust, oil and other automotive fluids, it should never be discharged to a street, gutter, or storm drain.

DO . . . Understand that **mobile auto detailers** should divert washwater to landscaped or dirt areas. Note: Be aware that soapy washwater may adversely affect landscaping; consult with the property owner. Residual washwater may remain on paved surfaces to evaporate; sweep up any remaining residue. If there is sufficient water volume to reach the storm drain, collect the runoff and obtain permission to pump it into the sanitary sewer. Follow local sewering agency's requirements for disposal.

DO NOT . . . Dispose of left over cleaning agents into the gutter, storm drain or sanitary sewer.

Regarding Cleaning Agents:

If you must use soap, use biodegradable/phosphate free cleaners. Avoid use of petroleum based cleaning products. Although the use of nontoxic cleaning products is strongly encouraged, ***do*** understand that these products can still degrade water quality and, therefore, the discharge of these products into the street, gutters, storm drain system, or waterways is prohibited by local ordinances and the State Water Code.

Note: When cleaning surfaces with a high pressure washer or steam cleaning methods, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning, as compared to the use of a low pressure hose, can remove additional materials that can contaminate local waterways.

OTHER TIPS TO HELP PROTECT OUR WATER . . .

SCREENING WASH WATER

A thorough dry cleanup before washing (without soap) surfaces such as building exteriors and decks without loose paint, sidewalks, or plaza areas, *should be sufficient to protect storm drains.* **However,** if any debris (solids) could enter storm drains or remain in the gutter or street after cleaning, washwater should first pass through a "20 mesh" or finer screen to catch the solid material, which should then be disposed of in the trash.

DRAIN INLET PROTECTION/ CONTAINING & COLLECTING WASH WATER

- Sand bags can be used to create a barrier around storm drain inlets.
- Plugs or rubber mats can be used to temporarily seal storm drain openings.
- You can also use vacuum booms, containment pads, or temporary berms to keep wash water away from the street, gutter, or storm drain.

EQUIPMENT AND SUPPLIES

Special materials such as absorbents, storm drain plugs and seals, small sump pumps, and vacuum booms are available from many vendors. For more information check catalogs such as New Pig (800-468-4647), Lab Safety Supply (800-356-0783), C&H (800-558-9966), and W.W. Grainger (800-994-9174); or call the Cleaning Equipment Trade Association (800-441-0111) or the Power Washers of North America (800-393-PWNA).

After the Storm

A Citizen's Guide to Understanding Stormwater

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

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What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.

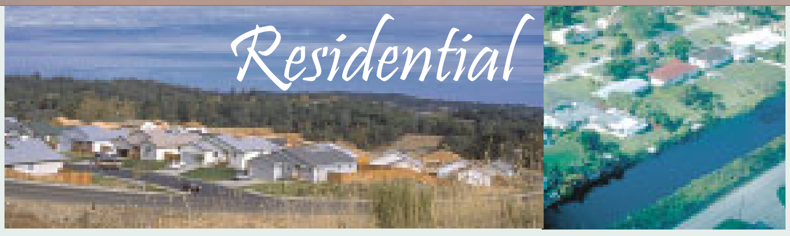
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.

- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential



Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

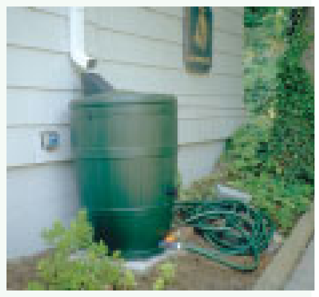
Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.



Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

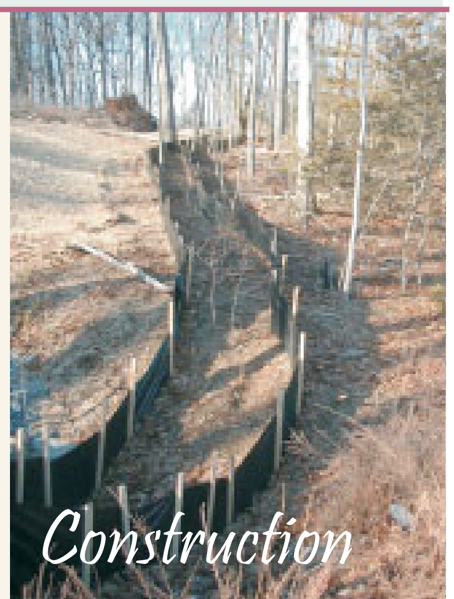
Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction

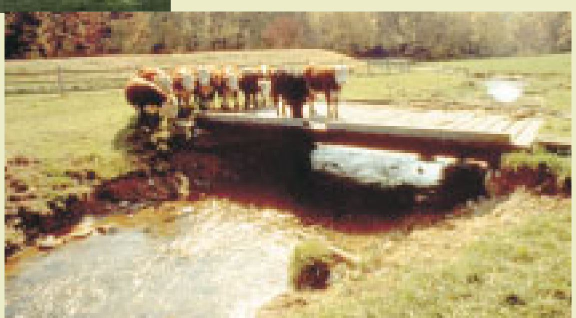


Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

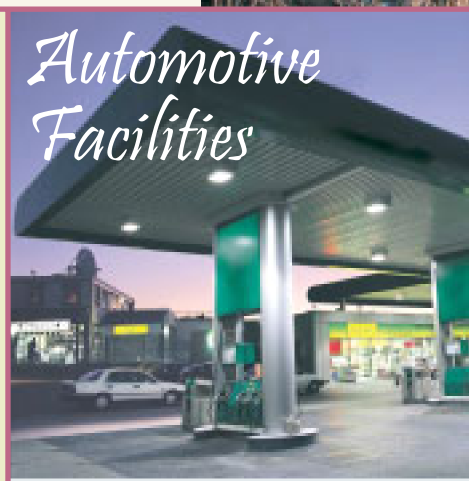
Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.



- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.