



HYDROLOGY STUDY

For

**OUHNAR, LLC
APN 0407-052-03
HESPERIA, CA**

November 18, 2022

Prepared by:

Merrell-Johnson Companies

22221 US Highway 18
Apple Valley, CA 92307
(760) 240-8000

Job No. 3853.001


E. Cary Packer, PE
Associate Engineer
R.C.E. 51752 Exp. 06/30/24



11/22/22

Mark D. Rowan
Project Manager

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SECTION 1

DISCUSSION

INTRODUCTION

The purpose of this study was to determine the impact, if any, of the 100-year storm runoff flow tributary to the project site as delineated on the map contained in this study. The project site encompasses approximately 5.3 acres of residential property located on the east side of Third Avenue and north side of Willow Street, in the City of Hesperia, California. Development of the site will be multi-family apartments.

METHODOLOGY

The method in determining these peak runoff flows was the rational method as specified in the 1986 San Bernardino County Hydrology Manual and the 2010 San Bernardino County Hydrology Manual Addendum for Arid Regions. The existing offsite flow was examined and delineated from U.S.G.S. Map: Hesperia and an examination of the project site. Storm runoff from the off-site tributary area is conveyed northerly and easterly past the project site within the existing street improvements. The off-site storm runoff does not enter the site. Development of the site will incorporate engineered street improvements per City of Hesperia requirements that will convey the existing street runoff flows around the property, within their historical flow paths. On-site flows were delineated from topographic mapping of the project and examination of the project site.

Point rainfalls for the 100-year storm were obtained from the NOAA Atlas 14 per the 2010 Addendum to the County Hydrology Manual. The 100-year 1-hour point rainfall for the site is 1.16. Per the aforementioned addendum, AMC II was used for the project site and the soil type was determined to be Soil Type A per the Natural Resources Conservation Service's "Web Soil Survey". Rainfall and maps are included as exhibits in Section 3 of this report.

The on-site tributary area examined in this study is shown in Table A.

Table A

Sub-area	Elevation Difference (ft.)	Length (ft)	Area (Ac)	Avg. Slope (ft/ft)
Node 11 – 12 (Undeveloped)	8.5	715	5.3	0.0119
Node 111 – 112 (Developed)	5.5	810	5.3	0.0068

EXISTING CONDITIONS

The site is located along the east side of Third Avenue and north of Willow Street in the City of Hesperia, California. The property is currently vacant, undeveloped land. Third Avenue and Willow Street are paved roads with dirt shoulders.

Tributary off-site flows come from the west and southwest and are intercepted within the existing improvements of Third Avenue and Willow Street. These flows are conveyed northerly and easterly within the existing street improvements. Development of the project will incorporate engineered street improvements with concrete curbs, gutters, and sidewalks which will maintain the existing drainage flows within the street rights-of-way. On-site runoff flows from the southwest property corner across the site and exits along the easterly property boundary.

The results of the on-site flow analysis are summarized in Table B.

Table B

Sub-Area	Q₁₀₀ (cfs)
Node 11 – 12	10.3
Node 111 – Node 112	15.4

CONCLUSIONS AND RECOMMENDATIONS

During our field investigation of the site, we observed the existing conditions as stated previously. Future development of the project is being performed in conjunction with engineered improvement plans. Off-site flows will continue to be conveyed past the project site within improved streets with concrete curbs and gutters.

Increased on-site runoff flow due to development of the site will be approximately 4,093 cubic feet (CF). City of Hesperia design standards require 13.5 CF of retention for every 100 square feet of impervious area created. This project requires approximately 32,025 CF of retention. On-site runoff will flow to underground retention along the easterly boundary of the property. The underground retention will treat the runoff for pollutants of concern per the project WQMP and allow infiltration of the runoff flows. Excess runoff from larger storm events will leave the site along the eastern project boundary following its historical flow path.

SECTION 2

EXHIBITS

VICINITY MAP

APN 0407-052-03

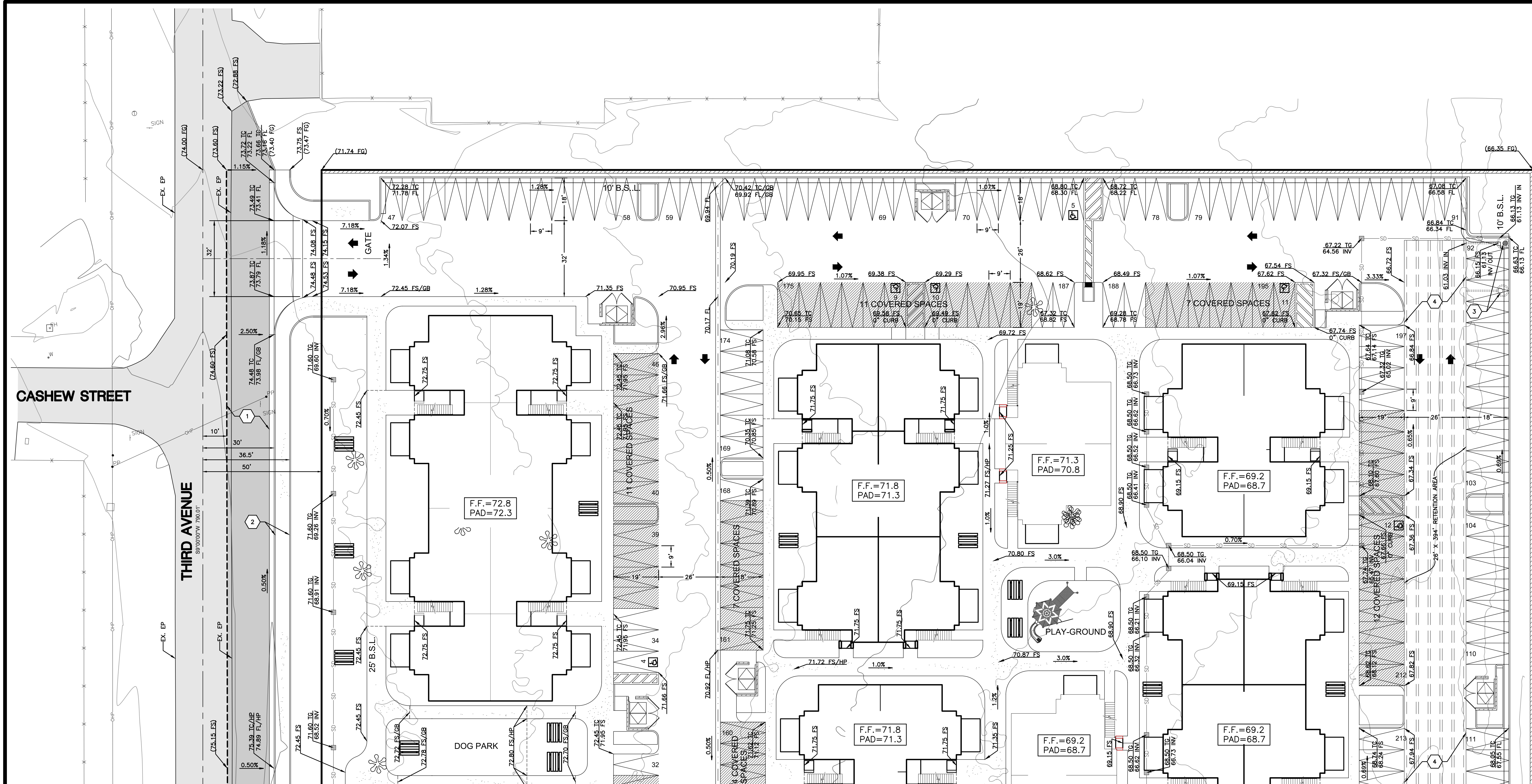
Vicinity Map

Legend

 APN 0407-052-03



PROPOSED DEVELOPMENT PLAN



MATCHLINE SEE SHEET Q2



Know what's below.
Call before you dig.

THE CONTRACTOR IS REQUIRED BY GOVERNMENT CODE 4216 "CALIFORNIA ONE CALL LAW" TO CALL DIG ALERT AT LEAST TWO (2) WORKING DAYS BEFORE DIGGING. CONTRACTOR IS REQUIRED BY SAME CODE TO HAND-EXPOSE TO THE POINT OF NO CONFLICT 24" ON EITHER SIDE OF THE UNDERGROUND FACILITY SO YOU CAN DETERMINE ITS EXACT LOCATION BEFORE USING POWER EQUIPMENT.

REV.	DESCRIPTION	DATE	BY

BENCHMARK

DESIGNED BY: JMF/CP
DRAWN BY: JMF
CHECKED BY: ECP
SUBMITTED BY:



E. CARY PACKER R.C.E. 51752

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**CITY OF HESPERIA
ENGINEERING DEPARTMENT**

RECOMMENDED FOR APPROVAL BY:

APPROVED BY:

DATE

MICHAEL THORNTON

DATE

AUTHORIZED SIGNATURE

R.C.E.: 44226 EXP. DATE 06/30/2023
CITY ENGINEER

**CITY OF HESPERIA
MULTI-FAMILY RESIDENTIAL
A.P.N. 0407-052-03
CONCEPTUAL GRADING PLAN**

FOR:
OUHNAR LLC

C.O. NO.

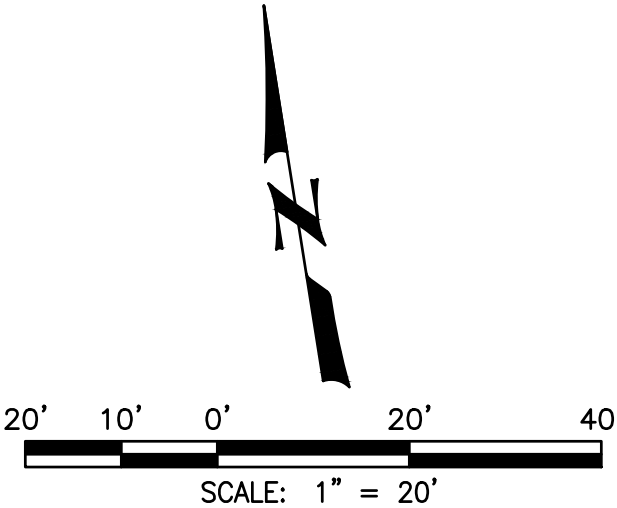
SHEET

1 OF 2

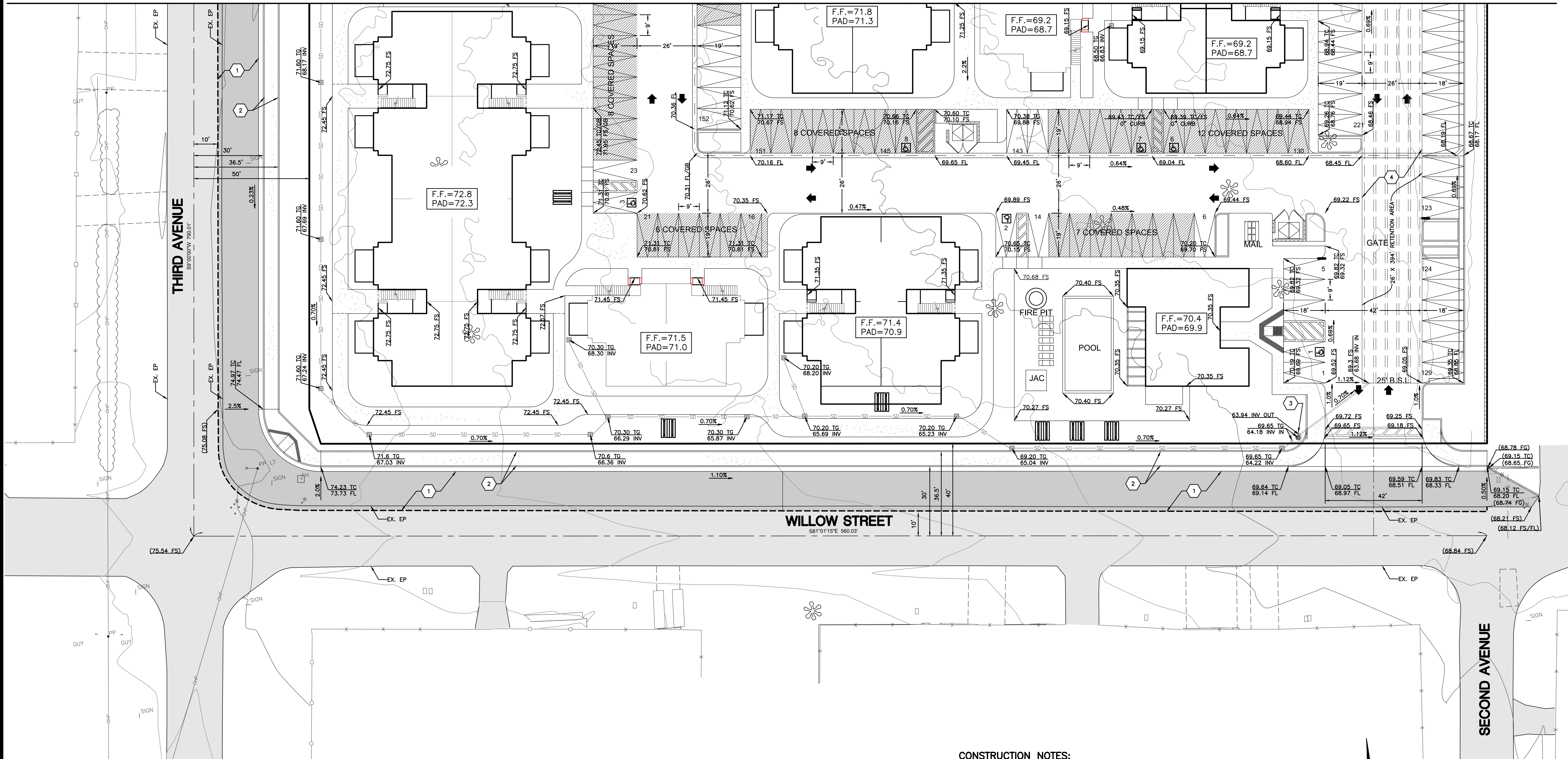
G1

CONSTRUCTION NOTES:

- 1 AC PAVEMENT.
- 2 8" CURB & GUTTER AND SIDEWALK PER CITY OF HESPERIA STD ST-4 TYPE A.
- 3 2 STAGE SEEPAGE PIT PER CITY OF HESPERIA STD SP-1.
- 4 UNDERGROUND RETENTION CHAMBERS TOTAL VOLUME= 32,025 C.F.
PER CALCULATIONS HERE:
REQUIRE VOLUME=13.5 X 237,223 = 32,025 C.F.
100

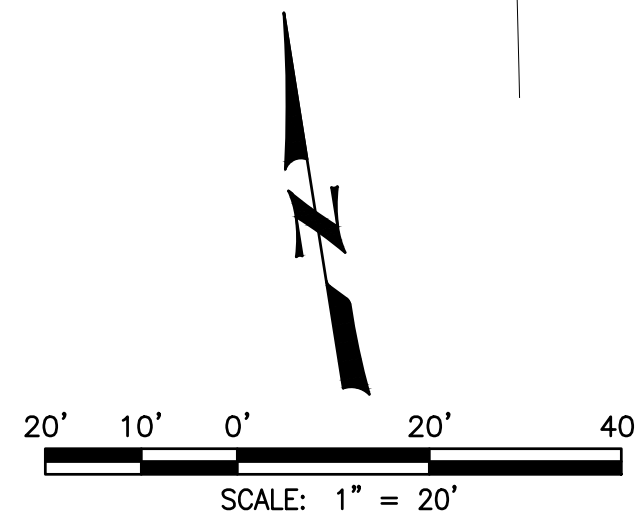


MATCHLINE SEE SHEET G1



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FOR:
OUHNAR LLC

C.O. NO.

SHEET

2 OF 2

G2

SECTION 3

HYDROLOGY CALCULATIONS

RATIONAL CALCULATIONS – Q_{100}

ON-SITE HYDROLOGY CALCULATIONS

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study Date: 11/18/22

OUHNAR LLC - JOB NO. 3853

ON-SITE UNDEVELOPED RUNOFF FLOW

NODE 11 - NODE 12

100-YEAR STORM EVENT - AMC II

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APPLE VALLEY, CA 92307

(760) 240-8000 * FAX (760) 240-1400

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

Rational hydrology study storm event year is 100.0

Computed rainfall intensity:

Storm year = 100.00 1 hour rainfall = 1.160 (In.)

Slope used for rainfall intensity curve b = 0.7000

Soil antecedent moisture condition (AMC) = 2

+++++

Process from Point/Station 11.000 to Point/Station 12.000

**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea

Decimal fraction soil group A = 1.000

Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 0.000

SCS curve number for soil(AMC 2) = 67.00

Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.578(In/Hr)

Initial subarea data:

Initial area flow distance = 715.000(Ft.)

Top (of initial area) elevation = 74.500(Ft.)

Bottom (of initial area) elevation = 66.000(Ft.)

Difference in elevation = 8.500(Ft.)

Slope = 0.01189 s(%)= 1.19

TC = $k(0.525)*[(\text{length}^3)/(\text{elevation change})]^{\wedge 0.2}$

Initial area time of concentration = 17.655 min. T_c

Rainfall intensity = 2.731(In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area (Q=KCIA) is C = 0.709

Subarea runoff = 10.269(CFS) Q_{100}

Total initial stream area = 5.300(Ac.)

Pervious area fraction = 1.000

Initial area Fm value = 0.578(In/Hr)

End of computations, Total Study Area = 5.30 (Ac.)

The following figures may

be used for a unit hydrograph study of the same area.

Note: These figures do not consider reduced effective area

effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number = 67.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study Date: 11/18/22

OUHNAR LLC - JOB NO. 3853
ON-SITE DEVELOPED STORM RUNOFF
NODE 111 - NODE 112
100-YEAR STORM RUNOFF - AMC II

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APPLE VALLEY, CA 92307
(760) 240-8000 * FAX (760) 240-1400

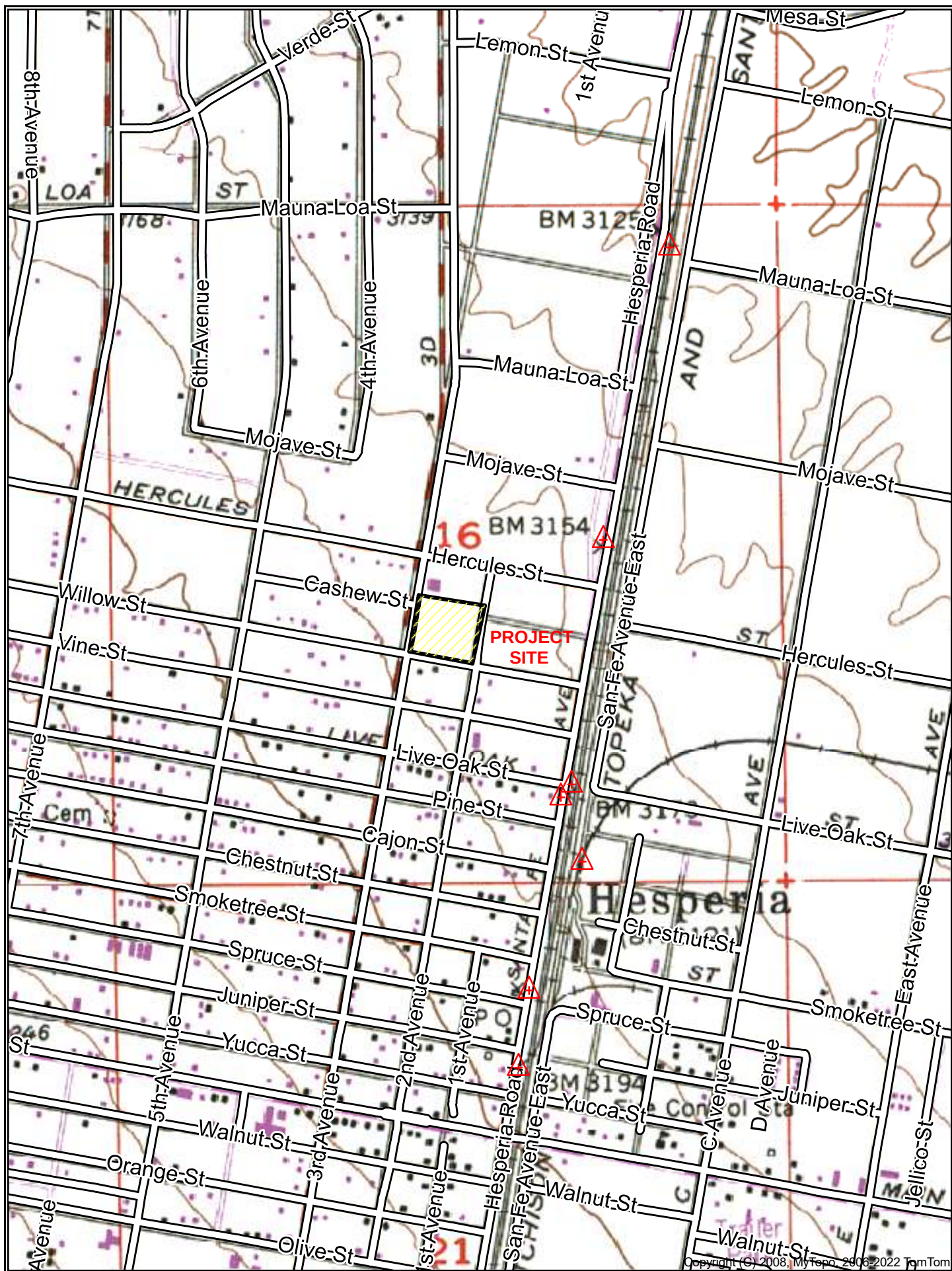
***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.160 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

+++++
Process from Point/Station 111.000 to Point/Station 112.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 810.000(Ft.)
Top (of initial area) elevation = 71.600(Ft.)
Bottom (of initial area) elevation = 66.130(Ft.)
Difference in elevation = 5.470(Ft.)
Slope = 0.00675 s(%)= 0.68
 $TC = k(0.324)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 12.824 min. T_c
Rainfall intensity = 3.416(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.848
Subarea runoff = 15.362(CFS) Q_{100}
Total initial stream area = 5.300(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)
End of computations, Total Study Area = 5.30 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

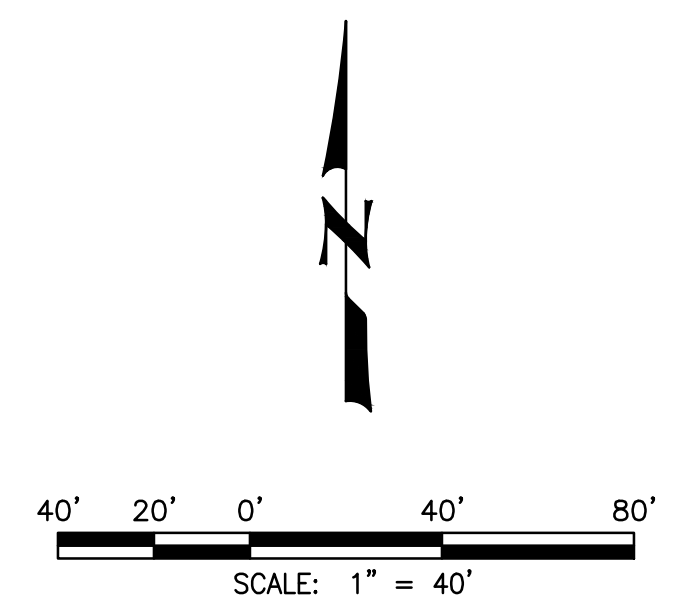
Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number = 32.0



UNDEVELOPED ON-SITE HYDROLOGY MAP

ONSITE UNDEVELOPED DRAINAGE MAP

The map illustrates the drainage path for an undeveloped site. A blue line with arrows shows the flow from point N11 (bottom left) to point N12 (top right). The site is bounded by a thick black line. Topographic contours and trees (marked with asterisks) are shown within the site. Surrounding areas include existing structures, parking lots, and various engineering notes such as 'SIGN', 'PP', 'GUY', and 'OHP'.



THE LOCATIONS AND EXISTENCE OF UNDERGROUND UTILITIES ARE NOT GUARANTEED. THESE DRAWINGS WERE PREPARED BASED ON SURFACE DATA AND AVAILABLE RECORD INFORMATION AND IT IS POSSIBLE THAT ADDITIONAL UNDERGROUND UTILITIES COULD BE PRESENT THAT ARE NOT SHOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFICATION OF THE LOCATION AND DEPTH OF ALL EXISTING UNDERGROUND UTILITIES AND SHALL PERFORM POT-HOLING AS NECESSARY AT ALL LOCATIONS WHERE UNDERGROUND UTILITIES COULD BE PRESENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TAKING ALL PRECAUTIONS NECESSARY TO PROTECT ALL EXISTING UTILITIES AND STRUCTURES FROM DAMAGE DURING THE COURSE OF THE WORK, AND SHALL BE RESPONSIBLE FOR REPAIRING OR REPLACING ANY UTILITIES OR STRUCTURES DAMAGED DURING THE COURSE OF THE WORK.

CENTERLINE OF THIRD AVE AS SHOWN ON PARCEL MAP NO. 16835, BOOK 214 OF PARCEL MAPS AT PAGE 76-77, COUNTY OF SAN BERNARDINO WHICH BEARS N 09°00'00" E.

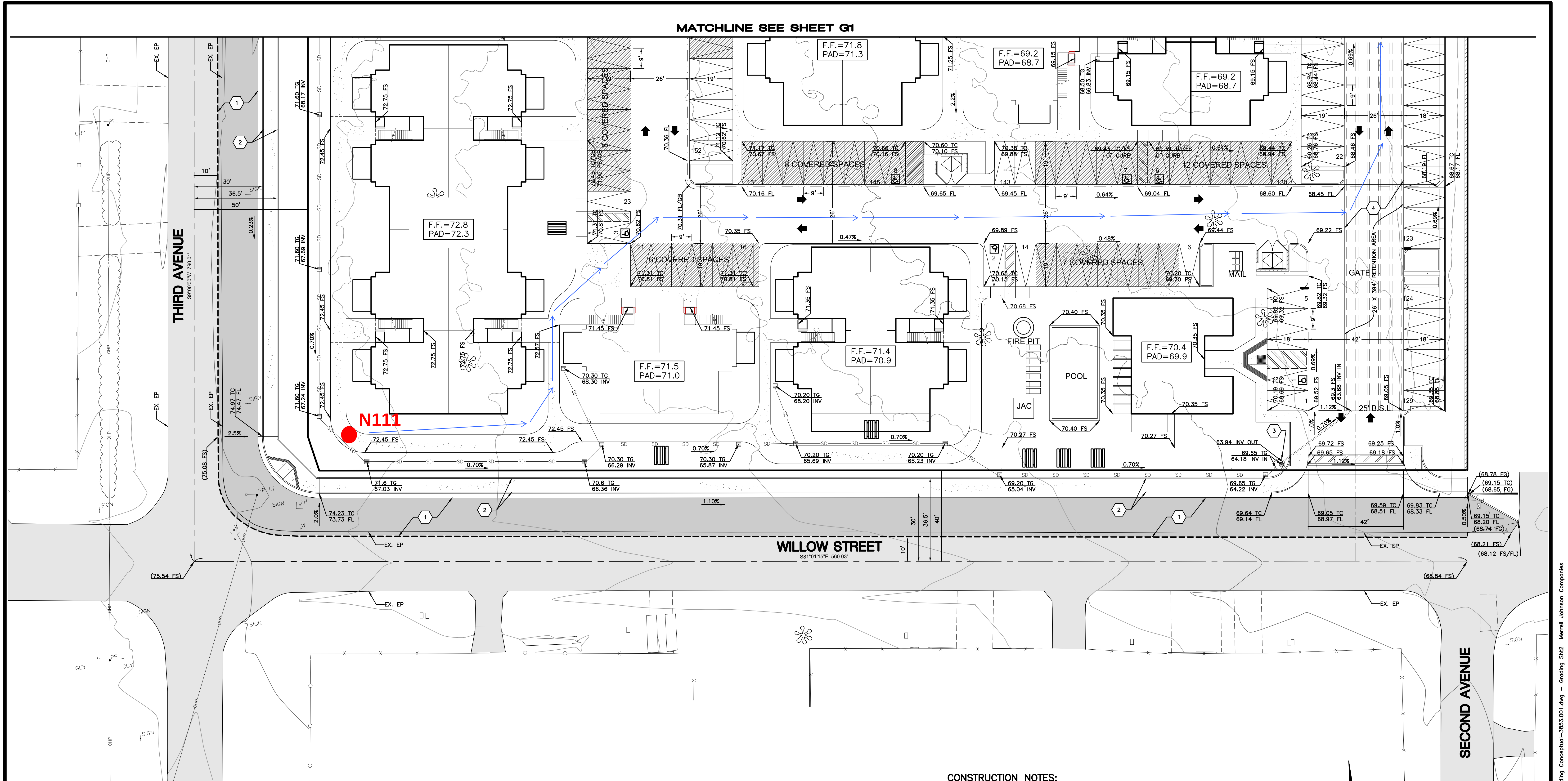
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1 OF 1

DEVELOPED ON-SITE HYDROLOGY MAP

The site plan illustrates a residential development with several key features and annotations:

- Streets:** CASHW STREET (top) and THIRD AVENUE (left) are shown with existing (EX) and proposed (PRO) centerlines and elevations.
- Buildings:** Multiple building footprints are shown with finished floor (F.F.) and proposed grade (PAD) elevations. For example, one building has F.F. = 71.8 and PAD = 71.3.
- Parking and Covered Spaces:** Various parking areas and covered spaces are indicated, with some labeled as "11 COVERED SPACES" or "7 COVERED SPACES".
- Playground:** A "PLAY-GROUND" is located in the lower right quadrant of the site.
- DOG PARK:** A "DOG PARK" is situated in the lower left quadrant.
- Stormwater Management:** The plan includes numerous elevation points, slopes, and labels for stormwater management features, such as "ON-SITE DEVELOPED STORM RUNOFF" and "20' X 30' RETENTION AREA".
- Other Features:** A "GATE" is located near the top center, and a "25' B.S.L." (Base of Subgrade Line) is marked near the bottom center.
- Red Dot:** A red dot labeled "N112" is located near the top right corner of the site.

G1

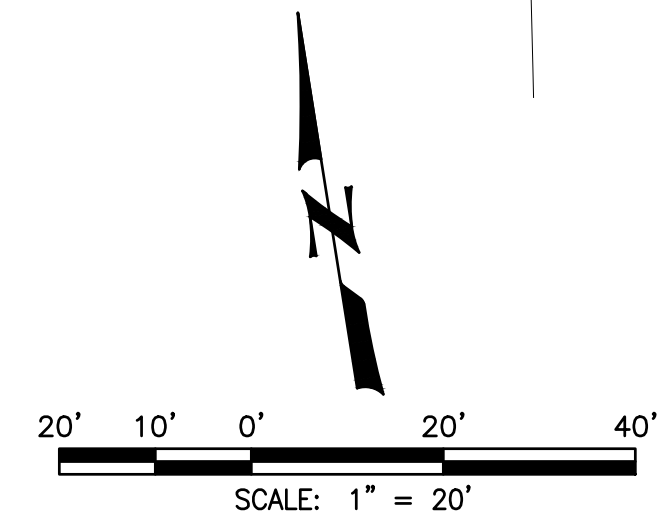


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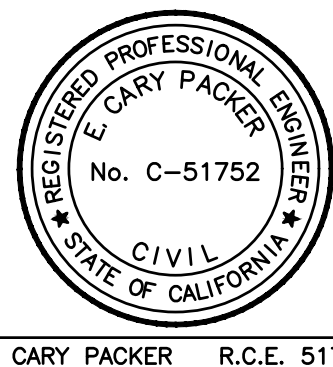
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- 4 UNDERGROUND RETENTION CHAMBERS TOTAL VOLUME= 32,025 C.F.
PER CALCULATIONS HERE:
REQUIRE VOLUME=13.5 X 237.223 = 32,025 C.F.



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DESIGNED BY: JMF/CP
DRAWN BY: JMF
CHECKED BY: ECP
SUBMITTED BY:



E. CARY PACKER R.C.E. 51752

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CITY OF HESPERIA ENGINEERING DEPARTMENT

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MICHAEL THORNTON

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AUTHORIZED SIGNATURE

R.C.E.: 44226 EXP. DATE: 06/30/2023
CITY ENGINEER

CITY OF HESPERIA
MULTI-FAMILY RESIDENTIAL
A.P.N. 0407-052-03
CONCEPTUAL GRADING PLAN

FOR:
OUHNAR LLC

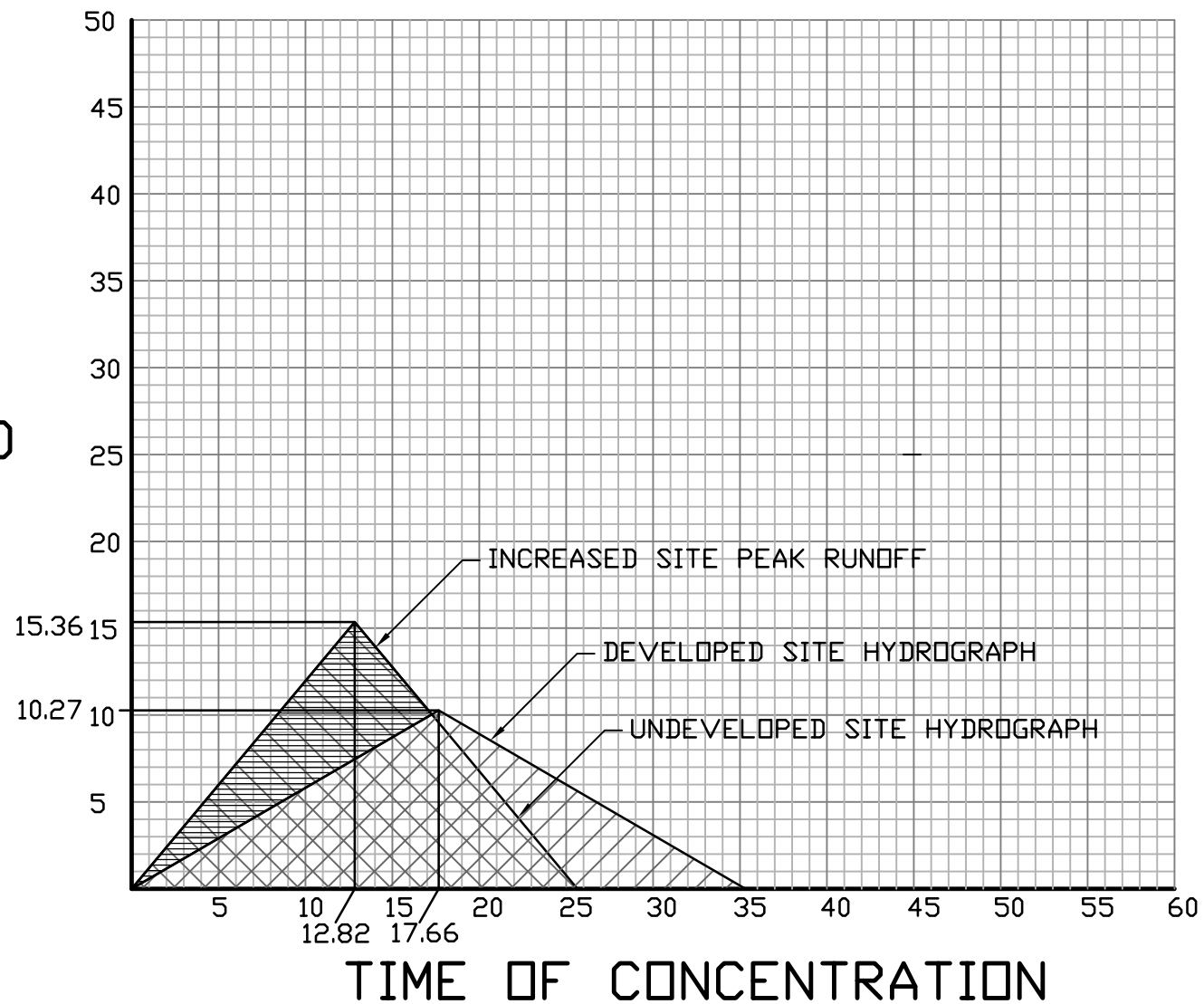
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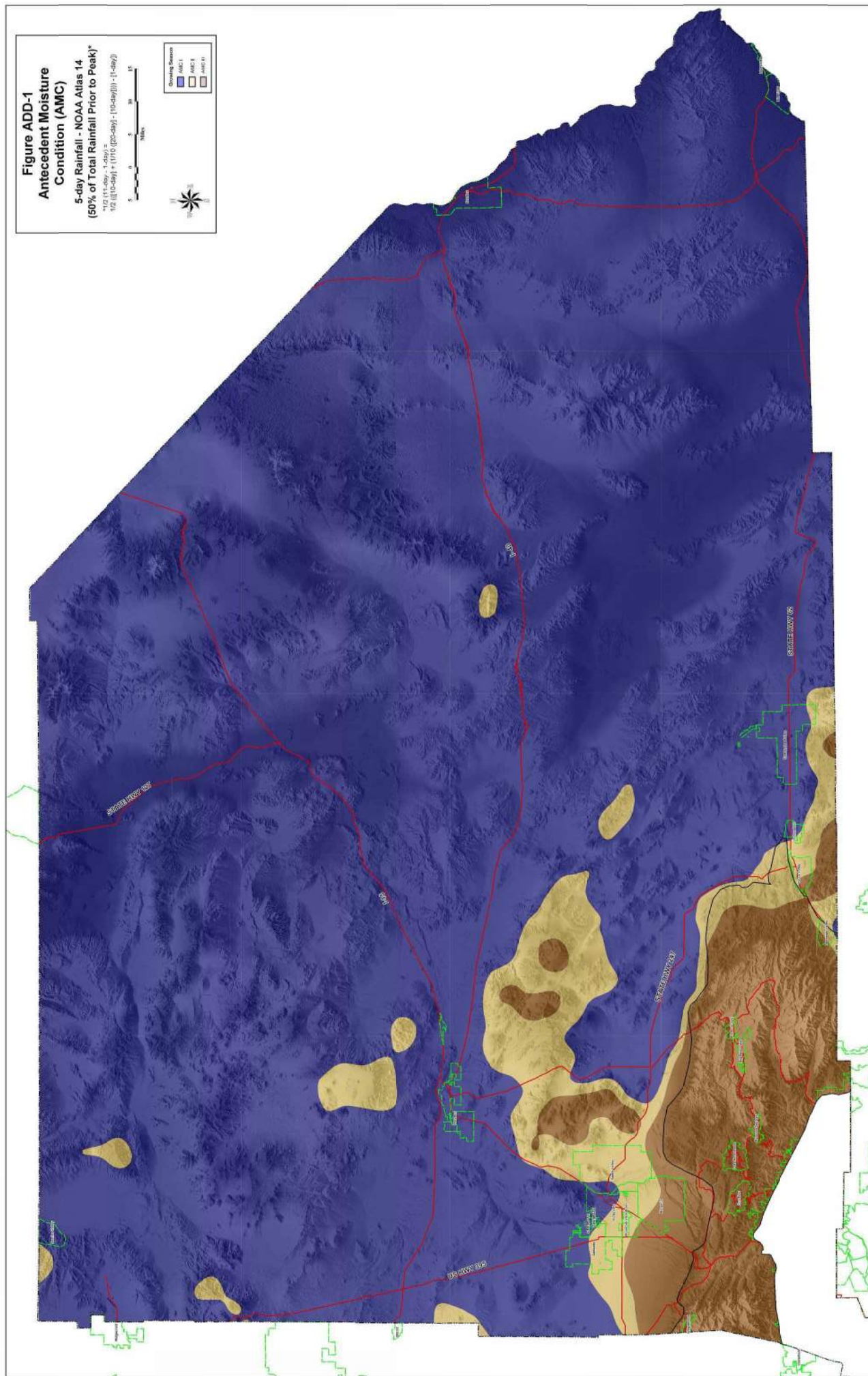
Q 100



SITE RUNOFF PARAMETERS	
UNDEVELOPED SITE RUNOFF	= 10,882 CF
DEVELOPED SITE RUNOFF	= 11,815 CF
INCREASED STORM PEAK RUNOFF	= 4,093 CF

2010 ANTECEDENT MOISTURE CONDITION (AMC) MAP

Figure ADD-1
Antecedent Moisture
Condition (AMC)
 5-day Rainfall - NOAA Atlas 14
 (50% of Total Rainfall Prior to Peak)*
 $1/2 [(10\text{-day}) + (1/10 [(20\text{-day}) - (10\text{-day})]) - (1\text{-day})]$



APN 0407-052-03

Antecedent Moisture Condition II

Legend

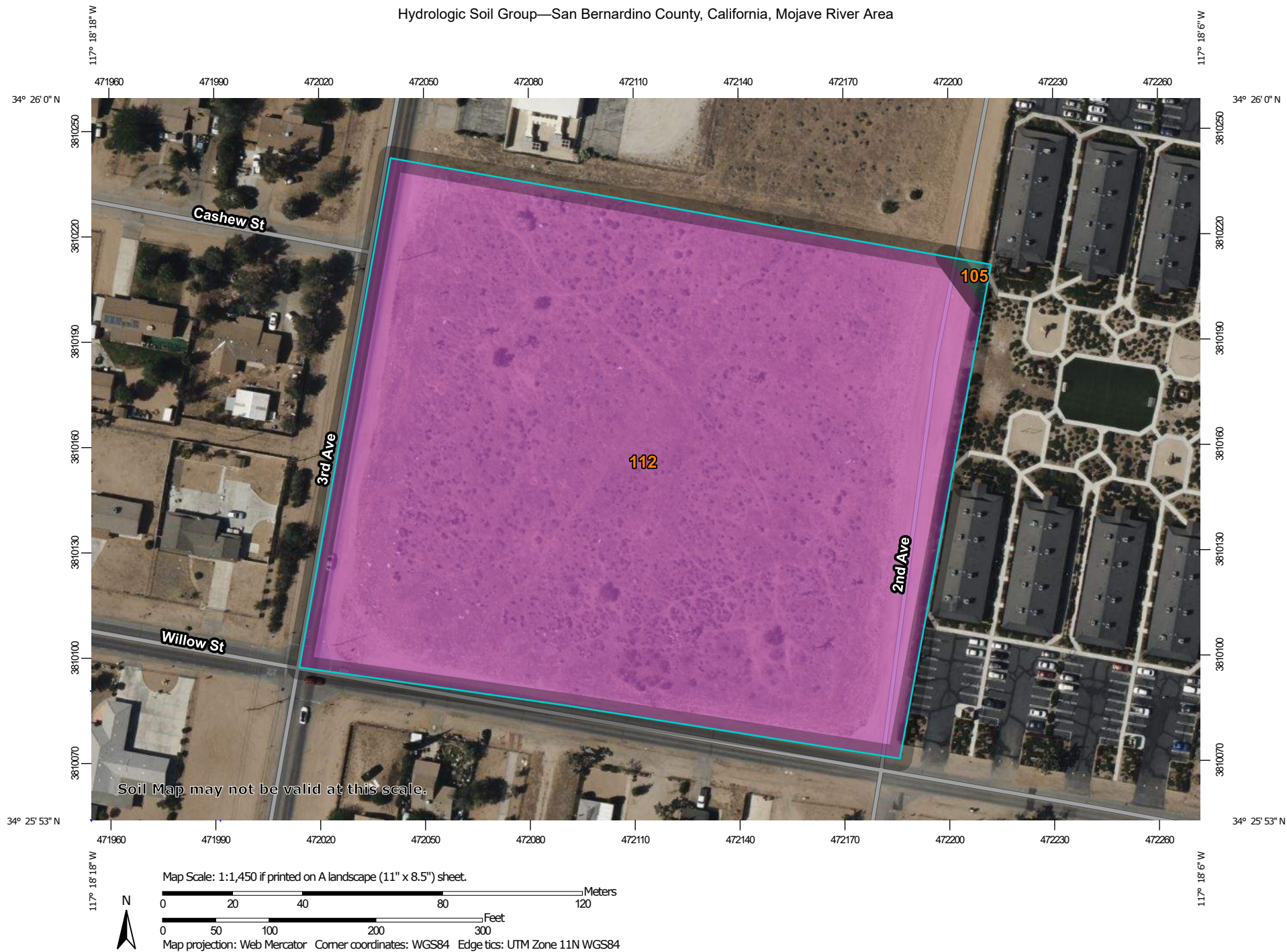
 APN 0407-052-03



EXHIBITS

SOILS MAP

Hydrologic Soil Group—San Bernardino County, California, Mojave River Area



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

Water Features

-  Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

-  Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area

Survey Area Data: Version 14, Sep 1, 2022

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
105	BRYMAN LOAMY FINE SAND, 0 TO 2 PERCENT SLOPES	C	0.0	0.3%
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	A	6.2	99.7%
Totals for Area of Interest			6.3	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA ATLAS 14 POINT RAINFALLS



NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4326°, Longitude: -117.3034°
Elevation: 3175.11 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.086 (0.071-0.106)	0.121 (0.100-0.147)	0.167 (0.137-0.205)	0.206 (0.168-0.254)	0.260 (0.205-0.332)	0.303 (0.235-0.396)	0.348 (0.263-0.466)	0.396 (0.291-0.545)	0.463 (0.326-0.664)	0.516 (0.351-0.766)
10-min	0.124 (0.102-0.151)	0.173 (0.143-0.211)	0.239 (0.197-0.293)	0.295 (0.241-0.364)	0.373 (0.294-0.476)	0.435 (0.336-0.567)	0.499 (0.377-0.668)	0.568 (0.417-0.781)	0.664 (0.468-0.952)	0.740 (0.504-1.10)
15-min	0.150 (0.124-0.183)	0.209 (0.173-0.256)	0.289 (0.238-0.355)	0.356 (0.291-0.440)	0.451 (0.356-0.576)	0.526 (0.407-0.686)	0.604 (0.456-0.808)	0.687 (0.504-0.945)	0.803 (0.565-1.15)	0.895 (0.609-1.33)
30-min	0.216 (0.178-0.264)	0.301 (0.249-0.368)	0.417 (0.343-0.511)	0.513 (0.419-0.634)	0.649 (0.513-0.830)	0.757 (0.586-0.988)	0.870 (0.657-1.16)	0.989 (0.726-1.36)	1.16 (0.814-1.66)	1.29 (0.877-1.91)
60-min	0.286 (0.237-0.350)	0.400 (0.330-0.489)	0.553 (0.455-0.678)	0.681 (0.556-0.842)	0.861 (0.681-1.10)	1.00 (0.777-1.31)	1.16 (0.872-1.54)	1.31 (0.964-1.81)	1.53 (1.08-2.20)	1.71 (1.16-2.54)
2-hr	0.408 (0.337-0.498)	0.547 (0.452-0.669)	0.737 (0.607-0.903)	0.897 (0.733-1.11)	1.12 (0.888-1.44)	1.31 (1.01-1.71)	1.50 (1.13-2.00)	1.70 (1.25-2.34)	1.98 (1.40-2.84)	2.21 (1.50-3.28)
3-hr	0.504 (0.417-0.616)	0.668 (0.552-0.817)	0.891 (0.734-1.09)	1.08 (0.883-1.34)	1.35 (1.07-1.73)	1.57 (1.21-2.04)	1.79 (1.35-2.40)	2.04 (1.49-2.80)	2.37 (1.67-3.41)	2.65 (1.80-3.93)
6-hr	0.699 (0.578-0.853)	0.917 (0.757-1.12)	1.22 (1.00-1.49)	1.47 (1.20-1.82)	1.83 (1.45-2.34)	2.12 (1.64-2.77)	2.43 (1.84-3.25)	2.76 (2.03-3.79)	3.22 (2.27-4.62)	3.60 (2.45-5.34)
12-hr	0.900 (0.744-1.10)	1.21 (0.996-1.48)	1.62 (1.34-1.99)	1.98 (1.61-2.44)	2.47 (1.96-3.16)	2.87 (2.22-3.75)	3.29 (2.49-4.40)	3.74 (2.75-5.14)	4.37 (3.08-6.26)	4.88 (3.32-7.24)
24-hr	1.21 (1.07-1.39)	1.66 (1.47-1.92)	2.28 (2.01-2.64)	2.80 (2.45-3.26)	3.53 (2.99-4.25)	4.11 (3.41-5.05)	4.72 (3.82-5.95)	5.37 (4.23-6.95)	6.28 (4.75-8.48)	7.02 (5.13-9.80)
2-day	1.38 (1.22-1.59)	1.92 (1.70-2.21)	2.65 (2.34-3.07)	3.28 (2.87-3.82)	4.16 (3.52-5.00)	4.86 (4.04-5.98)	5.61 (4.54-7.06)	6.40 (5.04-8.29)	7.53 (5.69-10.2)	8.44 (6.17-11.8)
3-day	1.48 (1.31-1.71)	2.07 (1.83-2.39)	2.88 (2.54-3.33)	3.57 (3.12-4.16)	4.54 (3.85-5.47)	5.32 (4.42-6.54)	6.15 (4.98-7.75)	7.04 (5.55-9.12)	8.31 (6.29-11.2)	9.35 (6.83-13.1)
4-day	1.59 (1.41-1.83)	2.22 (1.97-2.56)	3.10 (2.73-3.58)	3.84 (3.36-4.47)	4.89 (4.14-5.88)	5.73 (4.76-7.05)	6.63 (5.37-8.35)	7.60 (5.99-9.84)	8.98 (6.79-12.1)	10.1 (7.38-14.1)
7-day	1.75 (1.55-2.01)	2.44 (2.16-2.81)	3.39 (2.99-3.92)	4.19 (3.67-4.89)	5.34 (4.52-6.43)	6.26 (5.19-7.69)	7.23 (5.86-9.10)	8.27 (6.52-10.7)	9.75 (7.37-13.2)	11.0 (8.00-15.3)
10-day	1.86 (1.65-2.15)	2.59 (2.30-2.99)	3.60 (3.18-4.16)	4.45 (3.90-5.19)	5.66 (4.80-6.82)	6.64 (5.51-8.16)	7.66 (6.21-9.65)	8.76 (6.91-11.4)	10.3 (7.81-13.9)	11.6 (8.47-16.2)
20-day	2.21 (1.96-2.54)	3.08 (2.73-3.55)	4.29 (3.79-4.96)	5.32 (4.66-6.19)	6.78 (5.75-8.17)	7.97 (6.61-9.79)	9.21 (7.46-11.6)	10.6 (8.31-13.7)	12.4 (9.41-16.8)	14.0 (10.2-19.5)
30-day	2.56 (2.27-2.95)	3.57 (3.16-4.11)	4.97 (4.39-5.74)	6.17 (5.40-7.19)	7.89 (6.69-9.50)	9.28 (7.70-11.4)	10.8 (8.71-13.5)	12.3 (9.71-16.0)	14.6 (11.0-19.7)	16.4 (12.0-22.9)
45-day	3.02 (2.68-3.48)	4.19 (3.71-4.83)	5.83 (5.15-6.74)	7.24 (6.34-8.44)	9.28 (7.87-11.2)	10.9 (9.09-13.5)	12.7 (10.3-16.0)	14.6 (11.5-18.9)	17.3 (13.1-23.4)	19.5 (14.2-27.2)
60-day	3.40 (3.01-3.91)	4.67 (4.13-5.38)	6.46 (5.70-7.46)	8.01 (7.01-9.33)	10.3 (8.69-12.4)	12.1 (10.0-14.9)	14.1 (11.4-17.7)	16.2 (12.8-21.0)	19.3 (14.6-26.0)	21.8 (15.9-30.4)

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

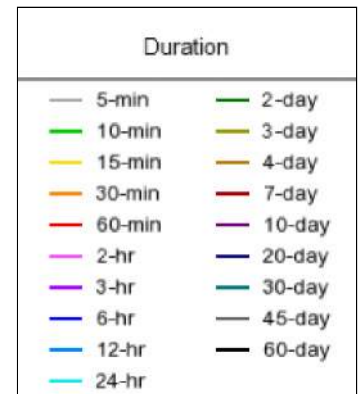
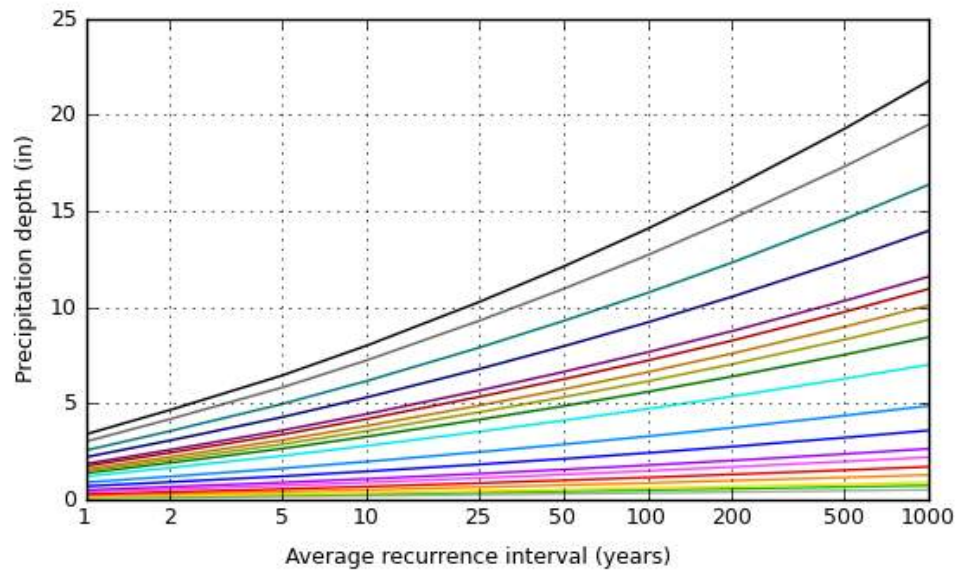
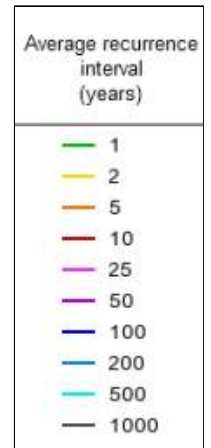
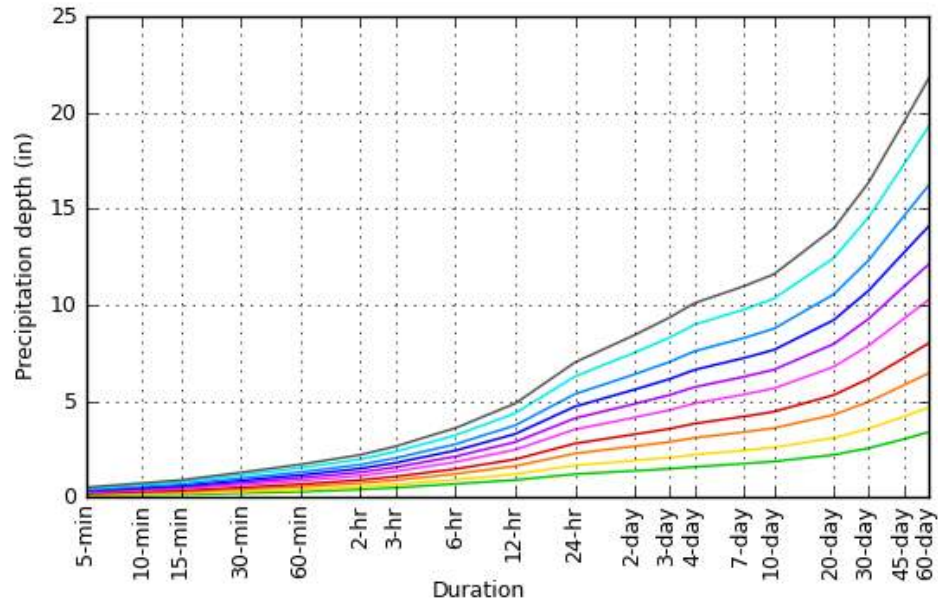
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

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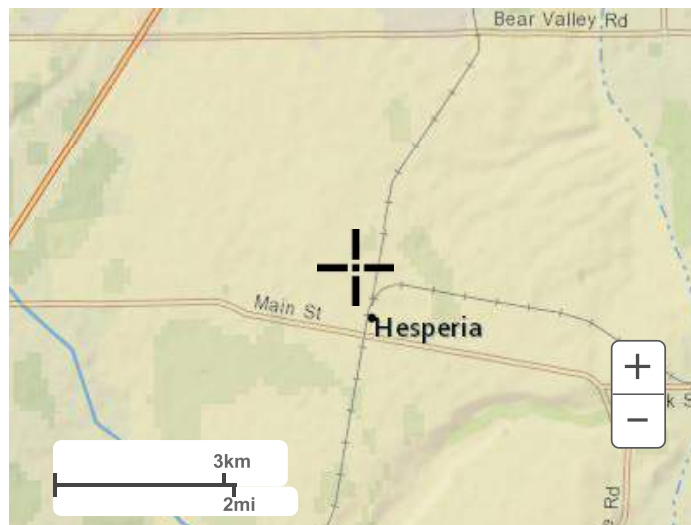
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.4326°, Longitude: -117.3034°



Maps & aerials

Small scale terrain



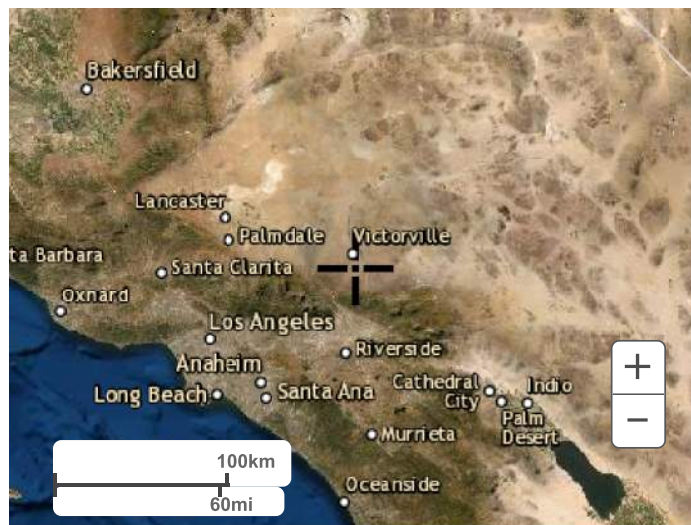
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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MOJAVE RIVER WATERSHED

Preliminary Water Quality Management Plan

For:

Ouhnar LLC Multi-Family Residential Development

STRM__ - ____

Tract

APN: APN#: 0407-052-03

Prepared for:

Ouhar, LLC

Narbik Babakhanian Landowner

Owner's Phone:

narbikb@yahoo.com

270 Kempton Road

Glendale, CA 91202

Prepared by:

Merrell Johnson Companies

22221 U.S. Highway 18

Apple Valley, CA 92307

760-240-8000

Submittal Date: 11/18/2022 (PRELIMINARY)

Revision No. and Date: Insert Initial Submittal Date

Revision No. and Date: Insert Initial Submittal Date

Revision No. and Date: Insert Initial Submittal Date

Revision No. and Date: Insert Initial Submittal Date

Revision No. and Date: Insert Initial Submittal Date

Final Approval Date: Insert Initial Submittal Date

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for:

Ouhar, LLC

by **Merrell Johnson Companies.**

The WQMP is intended to comply with the requirements of the Insert Jurisdiction and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP.

A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	STRM __-____	Grading Permit Number(s):	GRADING PERMIT # (pending)
Tract/Parcel Map Number(s):	Tract	Building Permit Number(s):	BUILDING PERMIT # (pending)
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN#: 0407-052-03
Owner's Signature			
Owner Name:	Ouhnar, LLC		
Title	Land Owner		
Company	Ouhar, LLC		
Address	270 Kempton Road		
	Glendale, CA 91202		
Email	narbikb@yahoo.com		
Telephone #	Owner's Phone:		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	STRM__-____	Grading Permit Number(s):	GRADING PERMIT # (pending)
Tract/Parcel Map Number(s):	Tract	Building Permit Number(s):	BUILDING PERMIT # (pending)
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN#: 0407-052-03

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer:	E. Cary Packer R.C.E	PE Stamp Below
Title	Associate Engineer	
Company	Merrell Johnson Companies	
Address	22221 US Highway 18, Apple Valley, CA 92307	
Email	Cary.Packer@MerrellJohnson.com	
Telephone #	760-240-8000	
Signature		
Date		

MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

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MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

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Section I - Introduction

This WQMP template has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB). This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: <http://cms.sbcounty.gov/dpw/Land/NPDES.aspx> to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)														
Form 1-1 Project Information														
Project Name		Ouhnar LLC Multi-Family Residential Development												
Project Owner Contact Name:		Narbik Babakhanian												
Mailing Address:	270 Kempton Road Glendale, CA 91202	Email Address: narbikb@yahoo.com	Telephone:	Owner's Phone:										
Permit/Application Numbers(s):		STRM__ - ____	Tract/Parcel Map Number(s):	Tract										
Additional Information/Comments:		The purpose of this PRELIMINARY WQMP is to submit for review low impact development design methods for stormwater in accordance to City Hesperia standards. Not all data/reports and supporting documents (e.g., Geotechnical Studies, Infiltration Reports, Operations & Maintenance Plan/Agreements , Landscape Plans, etc.,) have been conducted at this time and are indicated as "(Pending)". These in addition to any conditions from the City of Hesperia will be provided after initial review.												
Description of Project:		<u>Existing conditions include:</u> Undeveloped site (corner of Willow St & 3rd Ave. Total area (sq. ft.): 229,426 Road improvements to Willow & 3rd. Total area (sq. ft.): 34,346 Total project disturbance (sq.ft.): 263,772 This WQMP has included road and right of way areas to the project totals although the road and right of ways will remain the City of Hesperia after project completion. <u>Proposed Conditions include:</u> Project includes 92 new two story apartment units with common areas (outdoor playground, community center with pool, fire pit, dog park), and some covered parking. There will be uncovered parking, front and back landscaping to each building. There will be gated entrances on Willow Street and another of 3rd Avenue. The right of way will include new sidewalks, landscape and curb and gutters. Willow Street and 3rd Avenue improvements will match existing grade and widened. Proposed finished surfaces are as follows: <table border="0"> <tr> <td>New Roofs</td> <td>59,830 Sq. Ft.</td> </tr> <tr> <td>New Concrete & Asphalt Paving</td> <td>145,806 Sq. Ft.</td> </tr> <tr> <td>New curbed Landscape (Self-treating)</td> <td>54,243 Sq. Ft.</td> </tr> <tr> <td>New Pool Area (Self Treating)</td> <td>3,893 Sq. Ft.</td> </tr> <tr> <td>Total DA1 Project Area =</td> <td>263,772 Sq. Ft.</td> </tr> </table>			New Roofs	59,830 Sq. Ft.	New Concrete & Asphalt Paving	145,806 Sq. Ft.	New curbed Landscape (Self-treating)	54,243 Sq. Ft.	New Pool Area (Self Treating)	3,893 Sq. Ft.	Total DA1 Project Area =	263,772 Sq. Ft.
New Roofs	59,830 Sq. Ft.													
New Concrete & Asphalt Paving	145,806 Sq. Ft.													
New curbed Landscape (Self-treating)	54,243 Sq. Ft.													
New Pool Area (Self Treating)	3,893 Sq. Ft.													
Total DA1 Project Area =	263,772 Sq. Ft.													
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.		No formal conditions have been issued at this time. The City of Hesperia requires their 2 Stage Seepage Pit (SP-1, Dry Well) for infiltration methods. This project has included SP-1 in addition to an underground chamber (horizontal layout) system sized for the needed volume. See Form 4.3-8 Comformance Summary for details of the treatment train proposed.												

Section 2 Project Description

2.1 Project Information

The WQMP shall provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

Form 2.1-1 Description of Proposed Project			
1 Regulated Development Project Category (Select all that apply):			
☒ #1 New development involving the creation of 5,000 ft ² or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	☒ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface
☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.			
2 Project Area (ft ²): 263,772	3 Number of Dwelling Units: 92	4 SIC Code: 6513 Operators of Apartment Buildings	
5 Is Project going to be phased? ☐ Yes ☐ No			
<i>If yes, ensure that the WQMP evaluates phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>			

Notes:

Item #2 includes the WQMP drainage areas as described in Forms 3-1 and 4.2-1A, and is delineated in the WQMP Exhibit provided.

Item #5 is unknown at this time. This submittal addresses a conceptual design.

2.2 **Property Ownership/Management**

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

Ouhnar, LLC
270 Kempton Road
Glendale, CA 91202
Owner's Phone:
Narbik Babakhanian
narbikb@yahoo.com

is the Land Owner and Developer of the project, and will over see the construction.

The Owner will continue site and facility management after construction is completed and occupancy is approved.

As dwelling (apartments) are leased, the Owner will continue site responsibilities of the onsite BMPs.

The Owner may assign, hire or employ an onsite manager/management to assist in maintenance and upkeep of the day to day operations. They shall inform the Owner of necessary or additional maintenance actions.

The Owner will provide its tenants and occupants with information of the site's treatment system and will any restrictions pertaining to the BMPs onsite.

Although tasks may be assigned and interests shared, the sole financial and legal responsibility (care and maintenance of the BMPs will be the Owner's until the land is sold or transfers to another.

Right of way and street improvements made by the Owner are per the City of Hesperia requirements. After completion they will remain the City's to maintain and care for.

2.3 Potencial Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
	E	N	
Pathogens (Bacterial / Virus)	☒	☐	Expected to be minimal: Due to uncovered parking; bacterial indicators of pavement runoff
Nutrients - Phosphorous	☒	☐	Expected to be minimal: Due to drought tolerant landscape, and drip irrigation within a curbed planter will decrease runoff from planter areas. Applications only as needed.
Nutrients - Nitrogen	☒	☐	Expected to be minimal: Due to drought tolerant landscape, and drip irrigation within a curbed planter will decrease runoff from planter areas. Applications only as needed and by trained personnel.
Noxious Aquatic Plants	☒	☐	Expected to be minimal: Due to drought tolerant landscape. Additionally, there are no water bodies near site where algae/organic matter is harmed due to site's runoff. Applications only as needed and by trained personnel.
Sediment	☒	☐	Expected: Surrounding development may minimize although strong winds occasionally create wind-blown transfer.
Metals	☒	☐	Expected to be minimal: Due to uncovered parking.
Oil and Grease	☒	☐	Expected to be minimal: Due to uncovered parking; pavement runoff.
Trash/Debris	☒	☐	Expected: Due to shared trash enclosures and strong winds occasionally create wind-blown transfer.
Pesticides / Herbicides	☒	☐	Expected to be minimal: Due to landscaping and general care of the facility. Applications only as needed and by trained personnel.
Organic Compounds	☒	☐	See Pesticides/Herbicides. No other Organic Compounds expected on site as part of operations.
Other:	☐	☐	
Other:	☐	☐	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.

Form 3-1 Site Location and Hydrologic Features			
Site coordinates take GPS measurement at approximate center of site	Latitude: 34.432571	Longitude: -117.30352	Thomas Bros Map page 4476
1 San Bernardino County climatic region: ☒ Desert			
2 Does the site have more than one drainage area (DA): ☐ Yes ☒ No <i>If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached</i>			
<pre> graph LR DMA_A["DMA A Rooftop"] --> Chamber["Pre-Treatment PRIMARY SETTLING CHAMBER"] DMA_B["DMA B Concrete and Asphalt /Paving"] --> Chamber DMA_D["DMA D Landscaped / Self-Treating"] --> Chamber Chamber --> Secondary["Secondary Treatment ADS MC-7200 with Isolator Row & Infiltration"] Secondary --> Third["Third Treatment SECONDARY INFILTRATION DEEP DRY WELL SP-1"] DMA_E["DMA E Pool Area Self contained"] Third -- "100 yr storm will outlet to Historical sheet flow" --> Outlet[" "] </pre>			
DA 1	Right of way and road improvements will not change from historical direction, and these areas have been added to the project's size. The entire site will drain to treatment train. SP-1 will be interrupted by MC-7200 system.		
<u>Surface Types:</u>	<u>Descriptions</u>		
DMA A: Impervious	<u>New Roofs</u> Covered parking is included in DMA B, because roofs comingle with drive lanes sheet flow.		
DMA B: Impervious	<u>New Concrete & Asphalt Paving</u> Includes walkways, sidewalks, driveways, parking and drive lanes. Also street and right of way sidewalks.		
DMA D: Pervious - Self treating	<u>New curbed Landscape (Self-treating)</u> Areas are surrounded by concrete curbs, sidewalks and/or against walls		
DMA E: Self contained	<u>New Pool Area (Self Treating)</u> Area drains into it self.		

Form 3-2: Existing Hydrologic Characteristics for Drainage Management Areas					
	DA 1	DA 2	DA 3	DA 4	Totals
For Drainage Management Area 1's sub-watershed DMA, provide the following information:	DA1: Entire development				
1 DMA drainage area (ft ²)	263,772				
2 Existing site impervious area (ft ²)	0				
3 Antecedent moisture condition <i>For desert areas, use</i> http://www.sbcounty.gov/dpw/floodcontrol/pdf/2_0100412_map.pdf	II				
4 Hydrologic soil group <i>Refer to County Hydrology Manual Addendum for Arid Regions –</i> http://www.sbcounty.gov/dpw/floodcontrol/pdf/2_0100412_addendum.pdf	A				
5 Longest flowpath length (ft)	520				
6 Longest flowpath slope (ft/ft)	0.02				
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Barren				
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Poor				

Notes: Information for Item 3 provided as Appendix A, AMC Maps

Information for Item 4 provided as Appendix B, Web Soil Survey

Form 3-3 Watershed Description for Drainage Area		
Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River (Mojave Forks Reservoir outlet to Upper Narrows)	
Applicable TMDLs http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	<u>Fluoride</u>	
303(d) listed impairments http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	<u>Fluoride</u>: Natural Sources	
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP	Desert Tortoise - Category 3 Mojave Ground Squirrel	
Hydromodification Assessment	☒	Yes Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal
	☐	No

Notes: Information above provided as Appendix C, Quality Reports & Maps

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design Measures

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control BMPs and Site Design BMP Measures are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

The identified list of source control BMPs correspond to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Owner shall manage property including, but not limited to: occupants, tenants, and grounds maintenance. Tenant managers, and site operators shall be informed of this document and the Operation and Maintenance Plan with instructions of the underground infiltration system. See SC-41 in the Operation & Maintenance Plan.
N2	Activity Restrictions	☐	☒	Activities are minimized to facility operations only.
N3	Landscape Management BMPs	☒	☐	Landscape management includes weed maintenance, irrigation controls, proper use of fertilizers/pesticides, etc. Owner shall adhere to N1 for grounds maintenance contracted services. No cuttings, sediment or other landscaping debris shall enter the storm drainage system. See SD-12 and SC-41 in the Operation & Maintenance Plan.
N4	BMP Maintenance	☒	☐	Underground system education as part of Grounds/Maintenance Personnel Training, and record keeping of inspections, replacements of filters per manufacture's specifications. BMP inspection, maintenance and repairs shall be provided and funded by the owner.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	There are no outdoor hazardous waste materials and storage designed at this site/facility. Medical, and biohazard waste shall be properly managed through a licensed disposal and transportation company. See N-11.
N6	Local Water Quality Ordinances	☒	☐	City of Hesperia, State, and Federal Regulations include, but not limited to: conservation, protection, discharge prohibitions, those addressed in this document.
N7	Spill Contingency Plan	☐	☒	There is no Spill Contingency Plan required for this site
N8	Underground Storage Tank Compliance	☐	☒	No Underground Storage Tanks enforced by the County Environmental Health on behave of the State are located on this site.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Each tenant shall adhere to local, state, and federal regulations under the Medical Waste Management Act as applicable at time of occupancy.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☐	☒	Storage, use and handling of any flammable and nonflammable compressed gases, such as those that are used in medical facilities shall address local, state and federal regulations at time of occupancy. This is not a site-wide requirement.
N11	Litter/Debris Control Program	☒	☐	Facility shall adhere to local waste control regulations at time of occupancy. Operation and Maintenance Program shall address Goodhousekeeping practices.
N12	Employee Training	☒	☐	Education program (see N1) as it would apply to future employees/contracts within the site.
N13	Housekeeping of Loading Docks	☐	☒	There are no industrial/commercial loading docks on this site.
N14	Catch Basin Inspection Program	☒	☐	Owner shall ensure grounds maintenance, will include inspection schedule and recorded documentation. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. Drainage facilities include inlets, pipes, and infiltration system in its entirety. Records should be kept to document the annual maintenance.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Part of Grounds / Maintenance Personnel Training. Parking lots and grounds shall be swept prior to the storm season, in late summer or early fall, prior to the start of the rainy season or equivalent and as required by the governing jurisdiction.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a Public Agency Project

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N17	Comply with all other applicable NPDES permits	☒	☐	This project is subject to the Construction General Permit and will require a WDID# prior to disturbances. The City of Hesperia shall enforce Water Discharge and/or Waste Discharge requirements and standards applicable, including but not limited to requesting an Erosion Control Plan during construction and code enforcements thereafter. Dry wells are considered Class V injection well, which is defined as a conduit for non-hazardous fluids that is deeper than it is wide. Dry wells may be authorized to operate as long as they are registered with the US EPA, and only inject uncontaminated stormwater. The City of Hesperia's 2 Stage Seepage Pit (SP-1) is provided in Appendix H. The land owner shall register after completion.
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Form 4.1-2 Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	Glued plate or painted near inlet. (TEXT PENDING PRELIMINARY REVIEW OF CITY STANDARDS)
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor storage areas on this site.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas have been placed with significant distance from treatment system to detect visual pollutants. Enclosures are secure from weather and containers provided shall be covered (lid). Area shall be cleaned and maintained regularly. Trash enclosure will have permanent roofing. Trash container storage and placement shall be placed with significant distance from runoff potential and designed according to County standards. See Appendix F.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Refer to landscape plan and irrigation designs.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Part of Grounds / Maintenance Personnel Training, including, where applicable of any overflow piping.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Landscaped areas adjacent to building have been designed to acquire roof runoff. Runoff controls shall be implement. See SD-10 and SD-11 in the Operation and Maintenance Plan.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered docks.

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S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Part of Personnel Training.	
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No commercial or industrial vehicle washing on this site as part of facility operations. Residential developments are under the City's code enforcements.	
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing on this project.	

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No outdoor designated area. Not part of day-to-day operations. In event needed, protocols to protect treatment systems will be in place.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling on this site. In fueling is needed, protocols to protect/contain/clean/and dispose will be in place.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping on this site.
S14	Wash water control for food preparation areas	☐	☒	No food preparations on this site.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car washing on this site.

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

Describe site design and drainage plan including:

- . A narrative of site design practices utilized or rationale for not using practices
- . A narrative of how site plan incorporates preventive site design practices
- . A narrative of site design practices utilized or rationale for not using practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Site Design Practices Checklist		
Site Design Practices		
<i>If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets</i>		
	Yes	No
Minimize impervious areas:	☒	☐
Explanation: The units are built up (two-story) and clustered to minimize pavement. Buildings are separated with landscaped areas.		
Maximize natural infiltration capacity; Including improvement and maintenance of soil:	☒	☐
Explanation: Based on preliminary soil survey, the existing soils have optimal infiltration capacity, therefore landscaping will be provided on native soils and will improve evapotranspiration. However, impervious surface flows will require pre-treatment prior to infiltration.		
Preserve existing drainage patterns and time of concentration:	☒	☐
Explanation: Pattern same as historical flow. Time of concentration provided at retention and treatment system.		
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain :	☐	☒
Explanation: Roof drain down spouts and building roof driplines are directed to landscaped areas first. Landscaping will include tree wells, however limited space area surrounding buildings will drain away.		
Use of Porous Pavement.:	☐	☒
Explanation: Porous pavement was not included in this site design because of the maintenance needed due to surrounding areas still undeveloped and high winds that carry sediment.		
Protect existing vegetation and sensitive areas:	☐	☒
Explanation: Project will address protection requirements per the conditions at time of final design.		
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. :	☒	☐
Explanation: There will be drought tolerant landscaping per City's requirements.		

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	Yes	No
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Explanation: Landscaping will not be compacted, or will be retilled at time of new plant and amended soils addition.	☐	☒
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Explanation: No impervious swales.	☐	☒
Stake off areas that will be used for landscaping to minimize compaction during construction Explanation: The Erosion Control Plans shall show landscaped areas to be retilled prior to landscape installation, and the BMP system protected.	☒	☐
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Explanation: Not feasible to site conditions	☐	☒
Stream Setbacks. Includes a specified distance from an adjacent stream: : Explanation: No streams adjacent to project.	☐	☒

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping

<http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795>

Recommended High-Desert Plants -

<http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553>

Mojave Water Agency:

Desert Ranch: <http://www.mojavewater.org/files/desertranchgardenprototype.pdf>

Summertree: <http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf>

Thornless Garden: <http://www.mojavewater.org/files/thornlessgardenprototype.pdf>

Mediterranean Garden: <http://www.mojavewater.org/files/mediterraneangardenprototype.pdf>

Lush and Efficient Garden: <http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf>

Alliance for Water Awareness and Conservation (AWAC) outdoor tips –

<http://hdawac.org/save-outdoors.html>

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evapotranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi²), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for hydromodification performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft ²): 263,772	2 Imperviousness after applying preventative site design practices (Imp%): 205,636 77.96%	3 Runoff Coefficient (Rc): 0.576 $Rc = 0.858(Imp\%)^3 - 0.78(Imp\%)^2 + 0.774(Imp\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P2yr-1hr (in): http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		0.400
5 Compute P6, Mean 6-hr Precipitation (inches): <i>P6 = Item 4 * C1, where C1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)</i>		0.495
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs ☒ 48-hrs
7 Compute design capture volume, DCV (ft ³): <i>DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C2], where C2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)</i> <i>Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		12,303

Form 4.2-2 Summary of Hydromodification Assessment (DA1)			
Is the change in post- and pre- condition flows captured on-site? :		☒	Yes
If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below (Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)		☐	No
If "No," then proceed to Section 4.3 BMP Selection and Sizing			
Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 21,797 <i>Form 4.2-3 Item 12</i>	2 15.00 <i>Form 4.2-4 Item 13</i>	3 3.60 <i>Form 4.2-5 Item 10</i>
Post-development	4 27,861 <i>Form 4.2-3 Item 13</i>	5 9.50 <i>Form 4.2-4 Item 14</i>	6 7.53 <i>Form 4.2-5 Item 14</i>
Difference	7 6,064 <i>Item 4 – Item 1</i>	8 5.50 <i>Item 2 – Item 5</i>	9 3.93 <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	10 28% <i>Item 7 / Item 1 %</i>	11 37% <i>Item 8 / Item 2 %</i>	12 109% <i>Item 9 / Item 3 %</i>

Notes:

Information for Item 4 provided as Insert D, NOAA Atlas.

Refer to following Comparative Calculation sheets for the Retention Volume required by the City of Hesperia

COMPARATIVE WQMP CALCULATIONS

Form 4.2-1 DA1

Ouhnar LLC Multi-Family Residential Development

<u>DRAINAGE AREA</u>		<u>Entire Site</u>	
1 <u>BMP Drainage Area</u>	SqFt	<u>263,772</u>	Total Drainage Area to BMP
<u>Impervious Site Area</u>	SqFt	<u>205,636</u>	On-site Impervious Area
2 Percent Impervious	%	77.96%	
Watershed Impervious Ratio	i	0.7796	Percent Impervious / 100
3 Composite Runoff Coefficient CBMP = $0.858i3 - 0.78i2 + 0.774i + 0.04$	CBMP, or C	0.576	
4 <u>2-Year 1-Hour Rainfall</u>	(in)	<u>0.400</u>	Point Rainfall from Figure D1
<u>BMP Drainage Area Region</u>	V M D	<u>D</u>	V - Valley M - Mountain D - Desert
Regression Coefficient	Rc, I, C1	1.2371	Value from Table D-1
5 6-hour Mean Storm Rainfall	P6	0.495	2-year 1-hour Rainfall * Regression Coefficient
6 <u>Drawdown Time</u>	24 48	<u>48</u>	24 Hour Drawdown Time 48 Hour Drawdown Time
Drawdown Regression Constant (a)	(a)	1.963	Value from B.5 (pg D-4)
7 Design Capture Volume (ft3)	DCV, Vo	12,302.56	DCV=SqFt*CBMP*P6*/12*(a)
85th percentile Volume (ROUNDED UP)	DCV	12,303	Ft3
8 City of Hesperia Retention Requirement = <u>Impervious area/100*13.5</u>	RET	27,761	Ft3

Form 4.2-3 HCOC Assessment for Runoff Volume (ALL)							
Weighted Curve Number Determination: for Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA H
1a Land Cover Type	Barren	N/A	N/A	N/A	N/A	N/A	N/A
2a Hydrologic Soil Group (HSG)	A	N/A	N/A	N/A	N/A	N/A	N/A
3a DMA Area ft ² <i>Sum of areas of DMA should equal area of DA</i>	263,772						
4a Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>	78						
Weighted Curve Number Determination: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	<u>Totals</u>
1b Land Cover Type	Rooftop	Concrete & Paving	0.00	Curbed Landscape	Pool self treating	0	
2b Hydrologic Soil Group (HSG)	N/A	N/A	N/A	A	N/A	N/A	
3b DMA Area ft ² <i>sum of areas of DMA should equal area of DA</i>	59,830	145,806	0	54,243	3,893	0	263,772
4b Curve Number (CN) <i>use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>	98	98	0	32	0	0	0
5 Pre-Developed area-weighted CN: 78	7 Pre-developed soil storage capacity, S (in): $S=(1000/\text{item } 5) - 10$ 2.82				9 Initial abstraction, Ia(in): $Ia=0.2*\text{Item } 7$ 0.56		
6 Post Developed area weighted CN: 83	8 Post developed soil storage capacity, S (in): $S=(1000/\text{Item } 6) - 10$ 2.05				10 Initial abstraction, Ia (in): $Ia = 0.2*\text{Item } 8$ 0.41		
11 Precipitation for 10 yr, 24 hr storm (in): Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html							2.80
12 Pre-developed Volume (ft ³): $V_{pre}=(1/12)*(\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 9)^2 / ((\text{Item } 11 - \text{Item } 9 + \text{Item } 7))$						21,796.81	
13 Post developed Volume (ft ³): $V_{pre}=(1/12) * (\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 10)^2 / ((\text{Item } 11 - \text{Item } 10 + \text{Item } 8))$						27,861.39	
14 Volume Reduction needed to meet hydromodification requirement, (ft ³): $V_{hydro} = (\text{Item } 13 * 0.95) - \text{Item } 12$						4,671.5	

Notes:

Item #6 weighted CN calculation is

$$=(DMA\ A\ 3b*4b)+(DMA\ B\ 3b*4b)+(DMA\ C\ 3b*4b)+(DMA\ D\ 3b*4b)+(DMA\ E\ 3b*4b)+(DMA\ F\ 3b*4b) / (\text{sum of DMA } 3b)$$

as provided in the technical guide. In this case, Item 6 is relatively close to Item 5 CN value because, the CN value for landscaped Urban Covers for Hydrologic Soil Group "A" is 32 and factored for 24% of the pervious surfaces.

Values were obtained by Figure C-3, page C-6 of the SB Hydrology Manual.

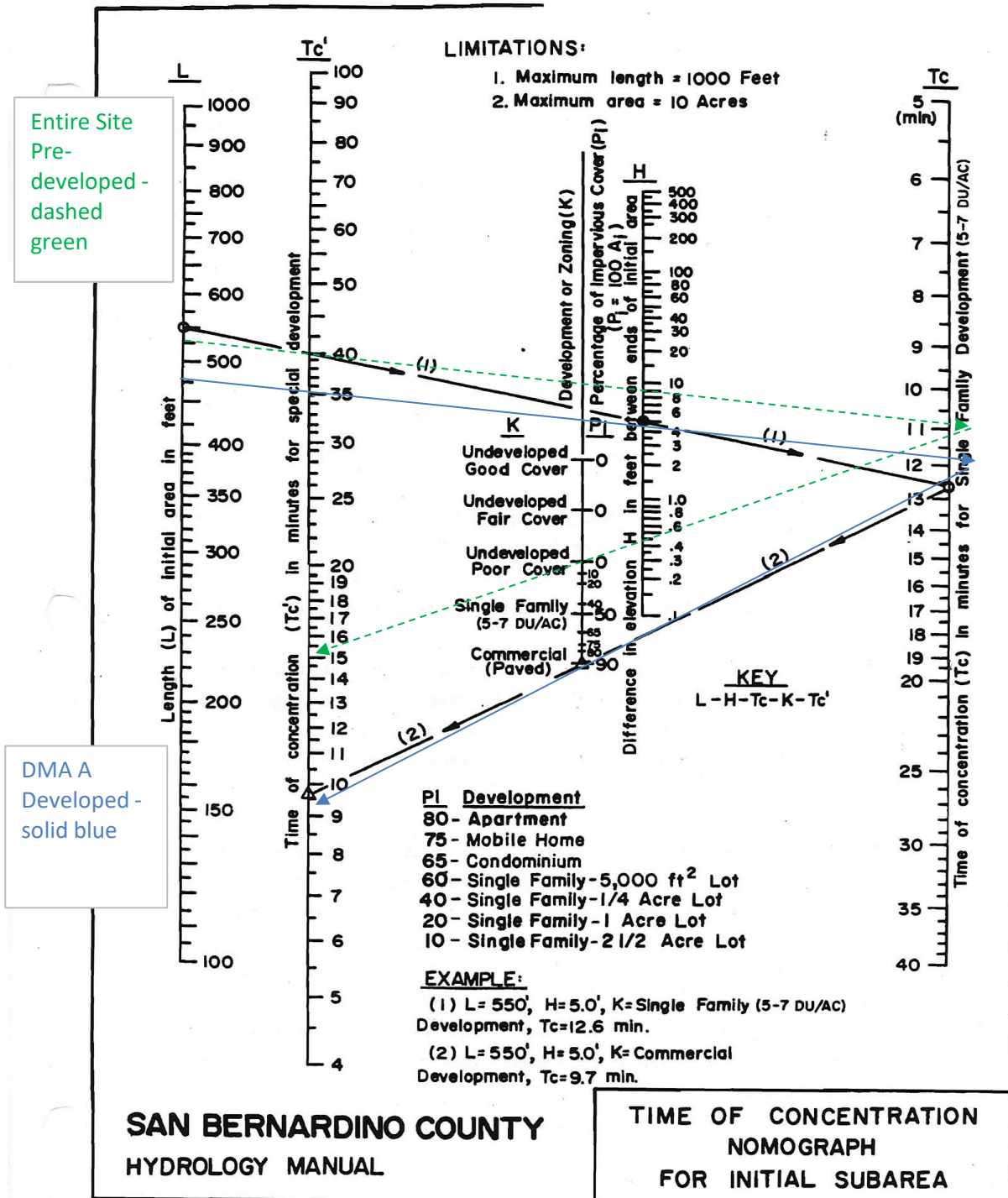
Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA

(For projects using the Hydrology Manual complete the form below)

Variables	Pre-developed DA1			Post-developed DA1		
	Entire Site	DMA X	DMA X	Entire Site	DMA X	DMA X
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>	520			475	0	0
2 Change in elevation (ft)	8			4	0	0
3 Slope (ft/ft), <i>So = Item 2 / Item 1</i>	0.015	0.000	0.000	0.008	#DIV/0!	0.000
4 Land cover	Barren			Pl-Apartments	0	
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>	15.0	0.0	0.0	9.5	0.0	0.0
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>	0	0	0	0	0	0
7 Cross-sectional area of channel (ft ²)	0	0	N/A	0	0	0
8 Wetted perimeter of channel (ft)	0	0	N/A	0	0	0
9 Manning's roughness of channel (n)	0	0	N/A	0	0	0
10 Channel flow velocity (ft/sec) <i>$V_{fps} = (1.49 / \text{Item } 9) * (\text{Item } 7 / \text{Item } 8)^{0.67} * (\text{Item } 3)^{0.5}$</i>	0	0	N/A	0.00	0	0
11 Travel time to outlet (min) <i>$T_t = \text{Item } 6 / (\text{Item } 10 * 60)$</i>	0	0	0	0	0	0
12 Total time of concentration (min) <i>$T_c = \text{Item } 5 + \text{Item } 11$</i>	15.00	0.00	0.00	9.5	0.00	0.00
13 Pre-developed time of concentration (min):	<i>Minimum of Item 12 pre-developed DMA</i>					15.00
14 Post-developed time of concentration (min):	<i>Minimum of Item 12 post-developed DMA</i>					9.50
15 Additional time of concentration needed to meet HCOC requirement (min):	<i>$T_{C-HCOC} = (\text{Item } 13 * 0.95) - \text{Item } 14$</i>					4.8

Notes: Refer to Nomograph Figure D-1, following sheet.



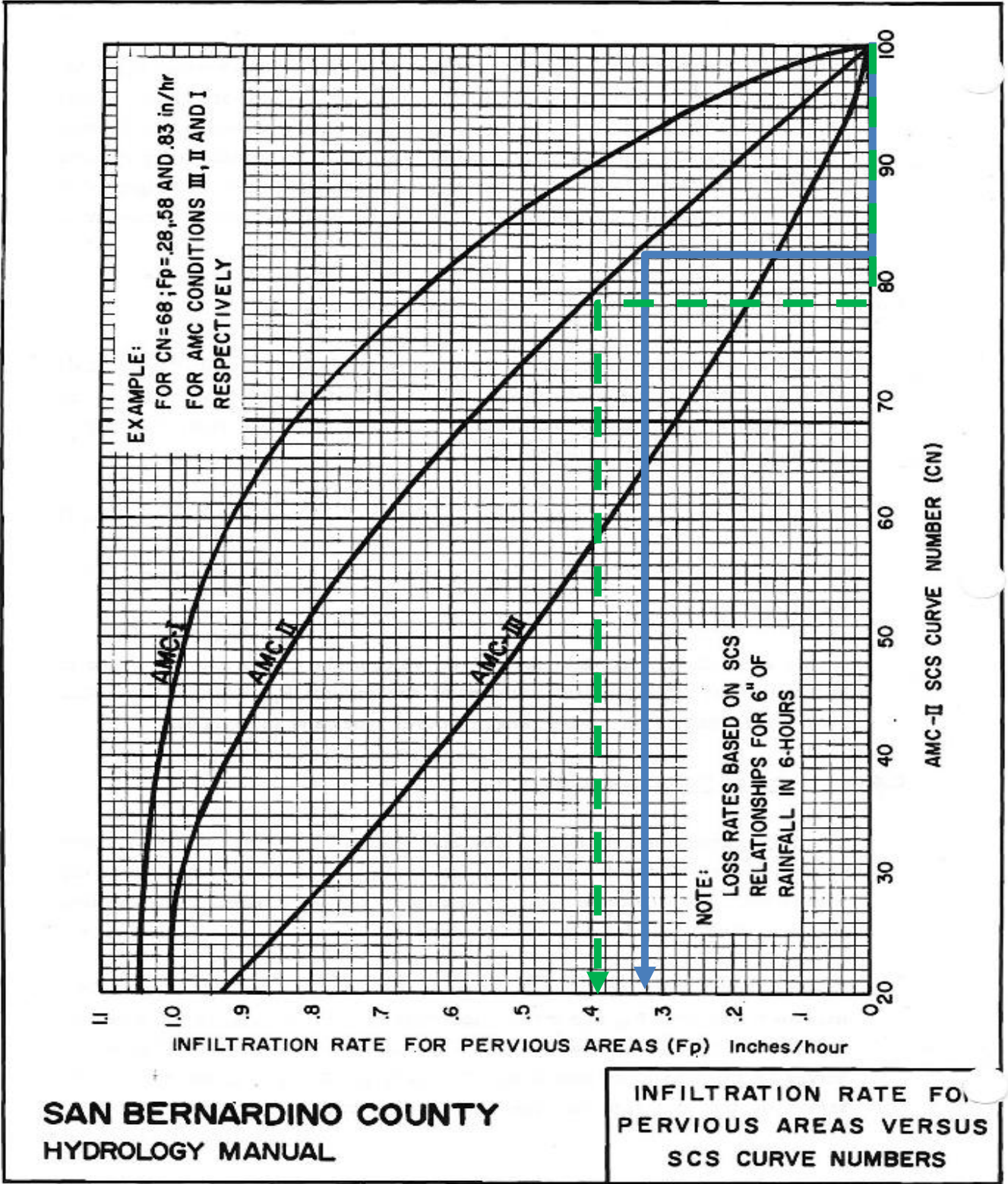
Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet (Use additional forms if more than 3 DMA)			Post-developed DA to Project Outlet (Use additional forms if more than 3 DMA)		
	Entire Site	-	-	Entire Site	-	-
1 Rainfall Intensity for storm duration equal to time of concentration $I_{peak} = 10^{(LOG \text{ Form 4.2-1 Item 4} - 0.7 \text{ LOG Form 4.2-4 Item 5} / 60)}$	1.06	0.00	0.00	1.45	0.00	0.00
2 Drainage Area of each DMA (Acres) <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>	6.06	0.00	0.00	6.06	0.00	0.00
3 Ratio of pervious area to total area <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>	1.00	0.00	0.00	0.22	0.00	0.00
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>	0.40	0	0	0.34	0.00	0.00
5 Maximum loss rate (in/hr) $F_m = \text{Item 3} * \text{Item 4}$ <i>Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>	0.40	0.00	0.00	0.07	0.00	0.00
6 Peak Flow from DMA (cfs) $Q_p = \text{Item 2} * 0.9 * (\text{Item 1} - \text{Item 5})$	3.60	0.00	0.00	7.53	0.00	0.00
7 Time of concentration adjustment factor for other DMA to site discharge point <i>Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)</i>	DMA A	n/a	0	0	n/a	0
	DMA B	0.00	n/a	0	0	n/a
	DMA C	0	0	0	0	0.00
8 Pre-developed Q_p at T_c for DMA A: $Q_p = \text{Item 6}_{DMAA} + [\text{Item 6}_{DMAB} * (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAB}) / (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAB}) * \text{Item 7}_{DMAA/2}] + [\text{Item 6}_{DMAC} * (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAC}) / (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAC}) * \text{Item 7}_{DMAA/3}]$						3.60
9 Pre-developed Q_p at T_c for DMA B: $Q_p = \text{Item 6}_{DMAB} + [\text{Item 6}_{DMAA} * (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAA}) / (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAA}) * \text{Item 7}_{DMAB/1}] + [\text{Item 6}_{DMAC} * (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAC}) / (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAC}) * \text{Item 7}_{DMAB/3}]$						0.00
10 Pre-developed Q_p at T_c for DMA C: $Q_p = \text{Item 6}_{DMAC} + [\text{Item 6}_{DMAA} * (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAA}) / (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAA}) * \text{Item 7}_{DMAC/1}] + [\text{Item 6}_{DMAB} * (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAB}) / (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAB}) * \text{Item 7}_{DMAC/2}]$						0.00
10 Peak runoff from pre-developed condition confluence analysis (cfs): <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						3.60
11 Post-developed Q_p at T_c for DMA A: <i>Same as Item 8 for post-developed values</i>						7.53
12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>						0.00
13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>						0.00
14 Peak runoff from post-developed condition confluence analysis (cfs): <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						7.53
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): $Q_{p-hydro} = (\text{Item 14} * 0.95) - \text{Item 10}$						3.55

Notes:

Refer to following sheet Figure C-6 from the SB Hydrology Manual.



C-15

Figure C-6

Pre-Development=Green dashed line. CN taken from Form 4.2-3 Item 4a. And Item 5.
Post-Development=Blue solid line. CN is the weighted value from Form 4.2-3, Item #6.
AMC per Form 3-2 Item 3 and Appendix A maps.

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretenention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design Measures (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is “Yes,” provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable Site Design BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

- 1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;
- 2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and
- 3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)		
Feasibility Criterion – Complete evaluation for each DA on the Project Site	<u>Yes</u>	<u>No</u>
1 Would infiltration BMP pose significant risk for groundwater related concerns? <i>Refer to Section 5.3.2.1 of the TGD for WQMP</i> If Yes, Provide basis: (attach)	☐	☒
2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): ☐ The location is less than 50 feet away from slopes steeper than 15 percent ☐ The location is less than eight feet from building foundations or an alternative setback. ☐ A study certified by a geotechnical professional or an available watershed study determines that If Yes, Provide basis: (attach)	☐	☒
3 Would infiltration of runoff on a Project site violate downstream water rights? If Yes, Provide basis: (attach)	☐	☒
4 Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? If Yes, Provide basis: (attach)	☐	☒
5 Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? If Yes, Provide basis: (attach)	☐	☒
6 Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? <i>See Section 3.5 of the TGD for WQMP and WAP</i> If Yes, Provide basis: (attach)	☐	☒
7 Any answer from Item 1 through Item 3 is “Yes”: <i>If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.</i>	☐	☒
8 Any answer from Item 4 through Item 6 is “Yes”: <i>If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.</i>	☐	☒
9 All answers to Item 1 through Item 6 are “No”: <i>Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.</i>		

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive

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with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP ☐ Yes <i>If yes, complete Items 2-5;</i> ☒ No <i>If no, proceed to Item 6</i>	DA	DA	DA
	BMP Type	BMP Type	BMP Type
2 Total impervious area draining to pervious area (ft ²)	0	0	0
3 Ratio of pervious area receiving runoff to impervious area	0.00	0.00	
4 Retention volume achieved from impervious area dispersion (ft ³) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff	0	0	0
5 Sum of retention volume achieved from impervious area dispersion (ft ³): <i>Vretention = Sum of Item 4 for all BMPs</i>			0
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): ☐ Yes <i>if yes, complete Items 7- 13 for aggregate of all on-lot infiltration BMP in each DA;</i> ☒ No <i>If no, proceed to Item 14</i>	DA	DA	DA
	BMP Type	BMP Type	BMP Type
7 Ponding surface area (ft ²)	0	0	
8 Ponding depth (ft)	0	0	
9 Surface area of amended soil/gravel (ft ²)	0	0	
10 Average depth of amended soil/gravel (ft)	0	0	
11 Average porosity of amended soil/gravel	0	0	
12 Retention volume achieved from on-lot infiltration (ft ³) <i>Vretention = (Item 7 * Item 8) + (Item 9 * Item 10 * Item 11)</i>	0	0	
13 Runoff volume retention from on-lot infiltration (ft ³): <i>Vretention = Sum of Item 12 for all BMPs</i>			0
14 Implementation of Street Trees: ☐ Yes <i>If yes, complete Items 22-25.</i> ☒ No <i>If no, proceed to Item 26</i>	DA	DA	DA 5
	BMP Type	BMP Type	BMP Type
15 Number of Street Trees	0	0	0
16 Average canopy cover over impervious area (ft ²)	0	0	0
17 Runoff volume retention from street trees (ft ³) <i>Vretention = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches</i>	0	0	0
18 Runoff volume retention from street tree BMPs (ft ³): <i>Vretention = Sum of Item 24 for all BMPs</i>			0
19 Total Retention Volume from Site Design Hydrologic Source Control BMPs: <i>Sum of Items 5, 13, 20, 25 and 29</i>			0

Notes:

Roof ridges and directions of roof fall are unknown at this time. Spaces surrounding buildings will be landscaped and tree wells may provide some retention but is not included as BMP. Doing so would create many mini-detentions that would be hard to maintain and manage over time. The project is providing site design measures by landscaping within curbs and sidewalks which improves soil quality and promotes infiltration. However, the design is to drain away from the buildings. Impervious sheet flow will be pre-treated prior to infiltration by a system that can be sized accordingly to accept the intake.

4.3.3 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix C of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

- 1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.
- 2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).
- 3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.
- 4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC BMP (ft3):						
Form 4.2-1 Item 7		12,303				
City of Hesperia Retention Requirement		27,761				
- Form 4.3-2 Item 19 =		0				
Vunmet or Remaining Volume needed.		27,761				
BMP Type Use columns to the right to compute runoff volume retention from proposed infiltration BMP - Use additional forms for more BMPs		Entire Site MC-7200	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type
2 Infiltration rate of underlying soils (in/hr)		0	N/A	N/A	N/A	N/A
3 Infiltration safety factor		2.0	2.0	2.0	2.0	0.0
4 Design percolation rate (in/hr) <i>P_{design} = Item 2 / Item 3</i>		0	0	0	0	0
5 Ponded water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>		48	48	48	48	48
6 Maximum ponding depth (ft) <i>6 ft maximum per City code</i>		0	-	-	-	-
7 Ponding Depth (ft) <i>dBMP = Minimum of (1/12*Item 4*Item 5) or Item 6</i>		0	0	0	0	0
8 Infiltrating surface area, <i>SA_{BMP} (ft²)</i>		0	0	0	0	0
9 Amended soil depth, dmedia (ft) <i>Only included in certain BMP types</i>		0	0	0	0	0
10 Amended soil porosity		0	0	0	0	0
11 Gravel depth, dmedia (ft) <i>Only included in certain BMP types</i>		0	0	0	0	0
12 Gravel porosity		0	0	0	0	0
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>		3	3	3	3	3
14 Above Ground Retention Volume (ft3) <i>V_{retention} = Item 8 * [Item 7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]</i>		0	0	0	0	0
15 Underground Retention Volume (ft3) <i>Volume determined using manufacturer's specifications and calculations</i>		32,692				
16 Total Retention Volume from LID Infiltration BMPs: <i>(Sum of Items 14 and 15 for all infiltration BMP included in plan)</i>		32,692	0	0	0	0
17 Fraction of DCV achieved with infiltration BMP: <i>% Retention% = Item 16 / Form 4.2-1 Item 7</i>		118%				
18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs?						☒ Yes ☐ No

Note:

Item #15 only includes the volume provided by the MC-7200 Underground Retention and Infiltration System. Specification attached in Appendix H. Hesperia's SP-1 Dry Wells are not included and would provide additional storage.

4.3.4 Biotreatment BMPs

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);

Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);

Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)			
1 Remaining LID DCV not met by site design, or infiltration, BMP for potential biotreatment (ft3):	0	List pollutants of concern <i>Copy from Form 2.3-1.</i>	See 2.3-1
2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i>	Volume-based biotreatment <i>Use Forms 4.3-5 and 4.3-6 to compute treated volume</i>		Flow-based biotreatment <i>Use Form 4.3-7 to compute treated volume</i>
		Bioretention with underdrain	Vegetated swale
		Planter box with underdrain	Vegetated filter strip
		Constructed wetlands	Proprietary biotreatment
		Wet extended detention	
		Dry extended detention	
3 Volume biotreated in volume based biotreatment BMP (ft3): <i>Form 4.3- 5 Item 15 + Form 4.3-6 Item 13</i>	0		
4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft3): <i>Item 1 – Item 3</i>	0		
5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: <i>% Item 4 / Item 1</i>	100%		
6 Flow-based biotreatment BMP capacity provided (cfs): <i>Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</i>	0.00		
7 Metrics for MEP determination:			
Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <i>If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</i>			

Form 4.3-5 Volume Based Biotreatment (DA 1) Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DA 1	DA 2	DA 3
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>	0		
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>	5.0		
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>	2.0		
4 Amended soil design percolation rate (in/hr) <i>$P_{design} = \text{Item 2} / \text{Item 3}$</i>	2.5		
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>	48		
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0		
7 Ponding Depth (ft) <i>$d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$</i>	0		
8 Amended soil surface area (ft ²)	0		
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0		
10 Amended soil porosity, <i>n</i>	0		
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0		
12 Gravel porosity, <i>n</i>	0		
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	3		
14 Biotreated Volume (ft ³) <i>$V_{biotreated} = \text{Item 8} * [(\text{Item 7} / 2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$</i>	0		
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: <i>Sum of Item 14 for all volume-based BMPs included in this form</i>	0	0	0

Notes:

This Form not used.

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type <i>Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.</i>	DA DMA BMP TYPE		DA DMA BMP TYPE	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes</i>				
2 Bottom width (ft)	0	0	0	0
3 Bottom length (ft)	0	0	0	0
4 Bottom area (ft ²) <i>A_{bottom} = Item 2 * Item 3</i>	0	0	0	0
5 Side slope (ft/ft)	0.0	0	0	0
6 Depth of storage (ft)	0	0	0	0
7 Water surface area (ft ²) <i>A_{surface} = (Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))</i>	0.00	0.00	0.00	0.00
8 Storage volume (ft ³) <i>For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i> <i>V = Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^{0.5}]</i>	0.0	0	0.0	0.0
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>	48		48	
10 Outflow rate (cfs) <i>Q_{BMP} = (Item 8_{forebay} + Item 8_{basin}) / (Item 9 * 3600)</i>	0.00		0.00	
11 Duration of design storm event (hrs) <i>All default shown in Table 5-6 of the TGD for detention types</i>	3		3	
12 Biotreated Volume (ft ³) <i>V_{biotreated} = (Item 8_{forebay} + Item 8_{basin}) + (Item 10 * Item 11 * 3600)</i>	0		0	
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : <i>(Sum of Item 12 for all BMP included in plan)</i>				0

Notes:

This Form not used.

Form 4.3-7 Flow Based Biotreatment (DA 1)			
Drainage Areas	DA	DA	DA
Biotreatment BMP Type : <i>Vegetated swale, vegetated filter strip, or other comparable proprietary BMP</i>	DMA	DMA	DMA
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5</i>			
2 Flow depth for water quality treatment (ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0		
3 Bed slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	1		
4 Manning's roughness coefficient	0		
5 Bottom width (ft) <i>$b_w = (\text{Form 4.3-4 Item 6} * \text{Item 4}) / (1.49 * \text{Item 2}^{1.67} * \text{Item 3}^{0.5})$</i>	-		
6 Side Slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0		
7 Cross sectional area (ft ²) <i>$A = (\text{Item 5} * \text{Item 2}) + (\text{Item 6} * \text{Item 2}^{0.5})$</i>	-		
8 Water quality flow velocity (ft/sec) <i>$V = \text{Form 4.3-4 Item 6} / \text{Item 7}$</i>	-		
9 Hydraulic residence time (min) <i>Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0		0
10 Length of flow based BMP (ft) <i>$L = \text{Item 8} * \text{Item 9} * 60$</i>	-		
11 Water surface area at water quality flow depth (ft ²) <i>$SA_{top} = (\text{Item 5} + (2 * \text{Item 2} * \text{Item 6})) * \text{Item 10}$</i>	-		
Notes: This Form not used.			

4.3.5 Conformance Summary

Complete Form 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)		
1 Total LID DCV for the Project DA (ft ³):	Copy Item 7 in Form 4.2-1	
2 On-site retention with site design BMP (ft ³):	Copy Item 19 in Form 4.3-2	
3 On-site retention with LID infiltration BMP (ft ³):	Copy Item 16 in Form 4.3-3	
4 On-site biotreatment with volume based biotreatment BMP (ft ³):	Copy Item 3 in Form 4.3-4	
5 Flow capacity provided by flow based biotreatment BMP (cfs):	Copy Item 6 in Form 4.3-4	
6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":		
	Yes	No
a. Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i>	☒	☐
b. Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: <i>If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3-5 Item 6 and Items 2, 3 and 4 are maximized</i>	☐	☒
c. On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>	☐	☒
7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:		
a. Combination of Site Design, retention and infiltration, and biotreatment BMPs provide less than full LID DCV capture: <i>Checked "Yes" if Form 4.3-4 Item 7 is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2,3,4, and 5 is less than 1. If so, apply water quality credits and calculate volume for alternative compliance,</i> $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$	N/A	
b. Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ55 February 5, 2013 measures of equivalent effectiveness are demonstrated:		
1) Equal or greater amount of runoff infiltrated or evapotranspired;	N/A	
2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;	N/A	
3) Equal or greater protection against shock loadings and spills;	N/A	
4) Equal or greater accessibility and ease of inspection and maintenance	N/A	

Notes:

Design summary to meet compliances is described in the following page.

Form 4.3-8 Conformance Summary Continued...

Site design measures were implemented as part of the design. Buildings are clusters and separated by new landscaped areas that will improve the existing barren conditions and promote evapotranspiration and infiltration with the landscaped islands that are surrounded by curbs, sidewalks, and/or walls. However, these areas are not large enough to adequately provide all the retention and infiltration needed. Therefore, not counted as a BMP, a post construction underground system is provided.

Final studies shall confirm the preliminary WQMP and conceptual design indicated that an underground infiltration system is feasible because the depth of ground water table and distance to nearest wells. In addition, the City of Hesperia provides and requires the use of a 2-stage seepage pit for infiltration.

Addition storage was required for the volume needed. A modified treatment train is proposed to place an ADS MC-7200 system between SP-1's primary settling chamber and secondary infiltration well. The treatment train is as follows:

1. Sheet flows from the ribbon gutters enter via storm drain inlets the Primary settling chamber. Large particles (Pollutants of Concern generated by common areas of residential facilities) are captured within it's sump. Absorbent pillows are required in the primary chamber for oils and greases. During heavy rains where velocities maybe higher, an overflow will non settling flows to:
2. MC-7200 system's Isolator Row. The Isolator Row in itself is designed to provide a treatment train by capturing the first-flush (sediment and particulates within), further enhancing pollutant capture. Stubs connect the rest of the chambers and surrounding gravel provides vertical infiltration. This system is sized larger than the retention volume required by the City of Hesperia. In a larger event, an outlet will carry flows to:
3. Enter the Secondary chamber of the Dry Well (final component) where infiltration will occur at a deeper depth.

The system is located under the drive lane where the primary settling chambers and the Isolator Rows will have service accesses in parking stalls and accessible for vacuuming.

4.3.6 Hydromodification Control BMP Conformance Summary

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-9 Hydromodification Control BMPs (DA 1)											
1 Volume reduction needed for HCOC performance criteria (ft ³): <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i>	4,671	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft ³): <i>Sum of Form 4.3-8 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</i>	32,692								
3 Remaining volume for HCOC volume capture (ft ³): <i>Item 1 – Item 2</i>	(28,021)	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft ³):	0								
5 Is Form 4.2-2 Item 11 less than or equal to 5%: <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i>			<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> </tr> </thead> <tbody> <tr> <td>☐</td> <td>☒</td> </tr> <tr> <td>☒</td> <td>☐</td> </tr> <tr> <td>☒</td> <td>☐</td> </tr> </tbody> </table>	Yes	No	☐	☒	☒	☐	☒	☐
Yes	No										
☐	☒										
☒	☐										
☒	☐										
Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP											
Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities											
6 Form 4.2-2 Item 12 less than or equal to 5%: <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i>			<table border="1"> <thead> <tr> <th>Yes</th> <th>No</th> </tr> </thead> <tbody> <tr> <td>☐</td> <td>☒</td> </tr> <tr> <td>☒</td> <td>☐</td> </tr> </tbody> </table>	Yes	No	☐	☒	☒	☐		
Yes	No										
☐	☒										
☒	☐										
Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs											

Hydromodification requirements have been met, and exceed as shown in Item #3.

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance.

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

- 1) Equal or greater amount of runoff infiltrated or evapotranspired;
- 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;
- 3) Equal or greater protection against shock loadings and spills;
- 4) Equal or greater accessibility and ease of inspection and maintenance

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

Form 5-1 BMP Inspection and Maintenance (use addition forms as necessary)			
BMP	Responsible Party(s)	Inspection / Maintenance Activities Required	Minimum Frequency of Activities
Site Good Housekeeping	Tenants	Daily, as activities occur. Each tenant shall be responsible for their own lot frontage. Owner shall address requirements in future lease/rental agreements.	Visual/Action (as needed)
Education of Property Owners, Onsite Manager(s), and Site Care Takers of Grounds and Stormwater BMPs	Owner	Grounds / Maintenance Personnel Training by Owner of the underground system and assign regular visual inspections. Site General Good-Housekeeping and Ground Maintenance, including, but not limited to: Landscape Maintenance and cuttings not entering the system by gutter flow and wind (or blower), Inspect Landscaping vegetation remains healthy, and weed-free, Ensure Effective Irrigation Controls and timers are set per City's requirements, Replace vegetation and broken sprinklers, Litter and debris removal, including perimeters and road-sides, Regular inspections of the Catch Basin Inlets and replace the Filters as needed Keeping records of Inspections & Maintenance as described in Manufacturer's Manuals.	Monthly (as needed)
Litter/Debris Control Program	Owner	Owner shall ensure City of Hesperia Standards and contract regular services with lidded containers.	Weekly
Education of Property Tenants and Occupants on Stormwater BMPs	Owner & Assigned Onsite Manager	As part of the Tenants Lease, the Owner shall list any restrictions that may harm, hinder and damage the underground treatment system.	As needed
Vacuum and Street Sweep of private streets	Owner & Assigned Onsite Manager	Schedule and provide regular street sweeping to remove sediment, oil/grease, spills, stains and other pollutants that could enter the catch basin and overload the filters and enter the underground system where removal and cleaning would cause extra costs.	Annually
Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	Owner & Assigned Onsite Manager	Signage shall be inspected and replaced as needed. Repaint (if painted) to provide awareness of the structure and its function.	Annually
Pre-treatment Filters	Owner & Assigned Onsite Manager	Owner shall ensure the Site Manager or assigned regularly inspect the filters within the inlets. Grates are to be opened and filters removed. Follow the manufacturer's Owner Manual for cleaning and replacing. Each inspection and cleaning shall be documented.	After rain events Refer to manufacturer's specifications

MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

Underground BMP Structure	Owner & Assigned Onsite Manager	Refer to Manufacturer's Operations and Maintenance Manual. Owner shall schedule professional services to enter site and inspect and or remove captured pollutants in the system. Owner shall enform the Site Manager of the schedule to allow entrance and provide equipment truck access to necessary inlets and ports. OWNER SHALL KEEP ALL RECORDS.	Monthly and after rain events

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- . Project location
- . Site boundary
- . Land uses and land covers, as applicable
- . Suitability/feasibility constraints
- . Structural Source Control BMP locations
- . Site Design Hydrologic Source Control BMP locations
- . LID BMP details
- . Drainage delineations and flow information
- . Drainage connection

6.2. Electronic data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3. Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4. Other Support Documentation

- . BMP Education Materials
- . Activity Restriction - C,C&R's & Lease Agreements

6.1 Site Plan and Drainage Plan

Attached to the end of the document or provided separately with Grading Plans.
See Appendix A for additional Site Maps

6.3. Post Construction

(pending conceptual design approval)

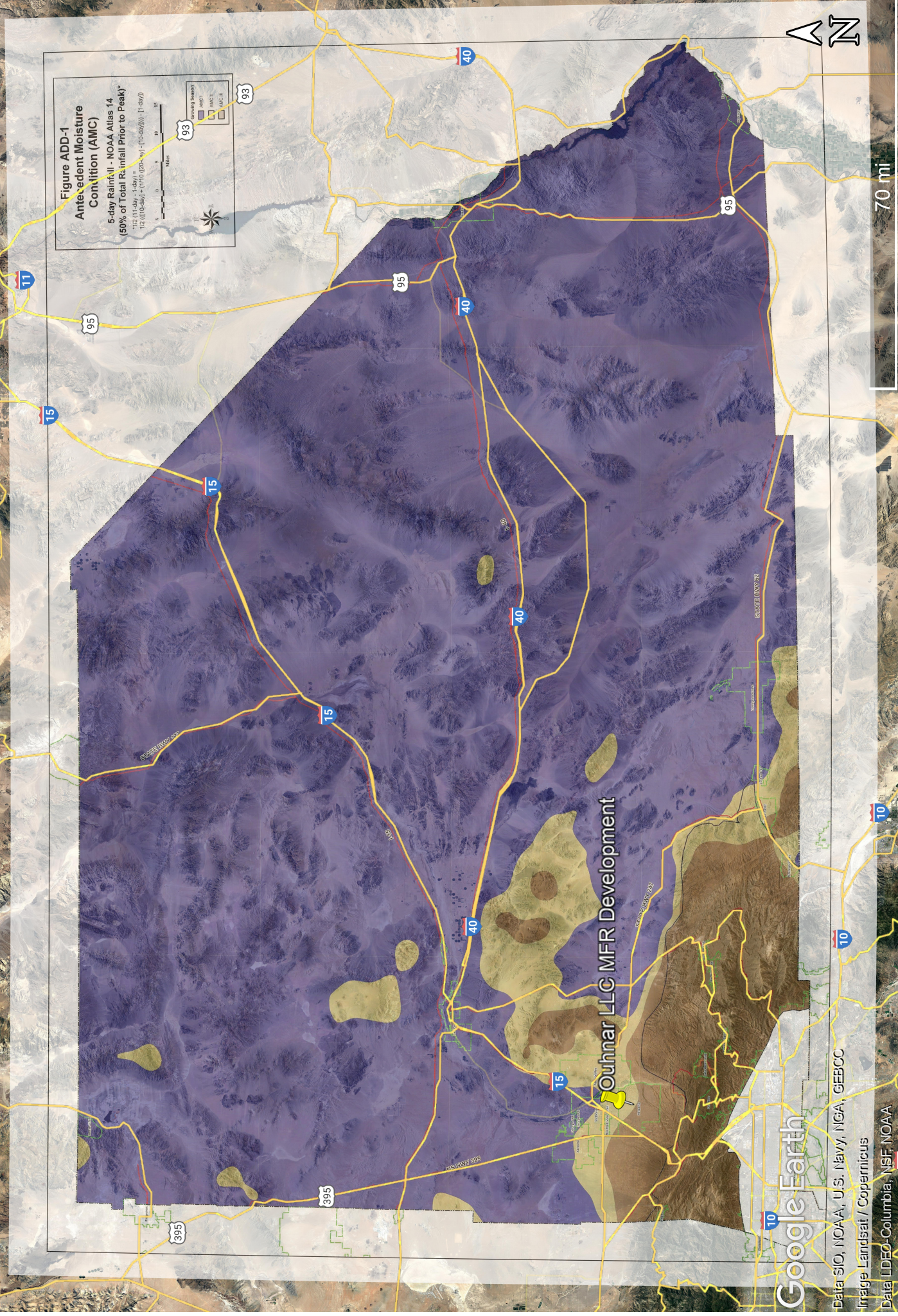
An Operations and Maintenance Plan (O&M) and the Covenant and Agreement will be provided during design completion.

6.4 Plan Checking Supporting Documentation

Appendix A. Antecedent Moisture Condition (AMC) Maps

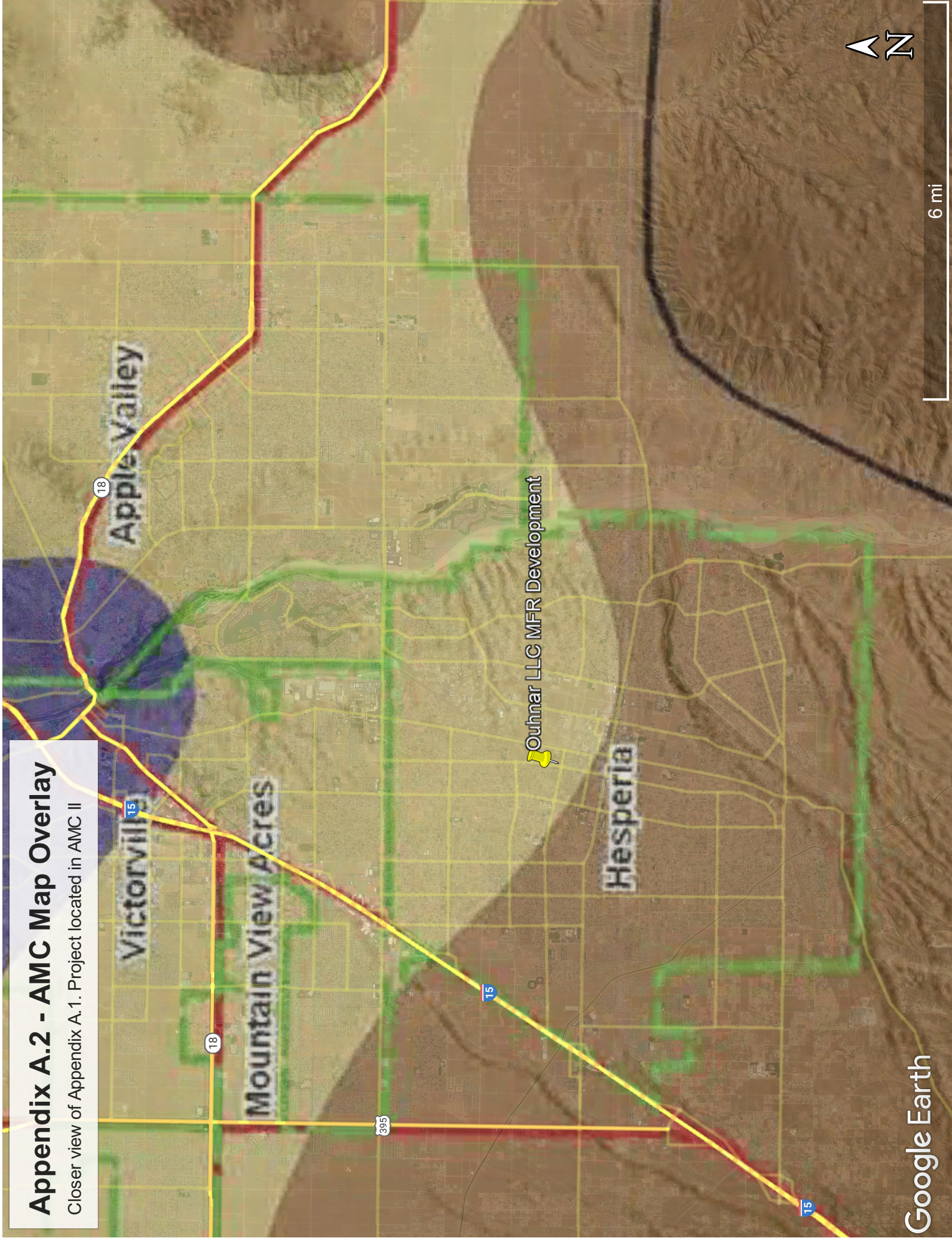
- Appendix A.1: AMC Map overlay of Google Earth. Project location indicated with yellow pin
- Appendix A.2: Zoomed view of Appendix A.1
- Appendix A.3: San Bern Stormwater Geodatabase Info sheet

Project located in AMC II



Appendix A.2 - AMC Map Overlay

Closer view of Appendix A.1. Project located in AMC II





WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

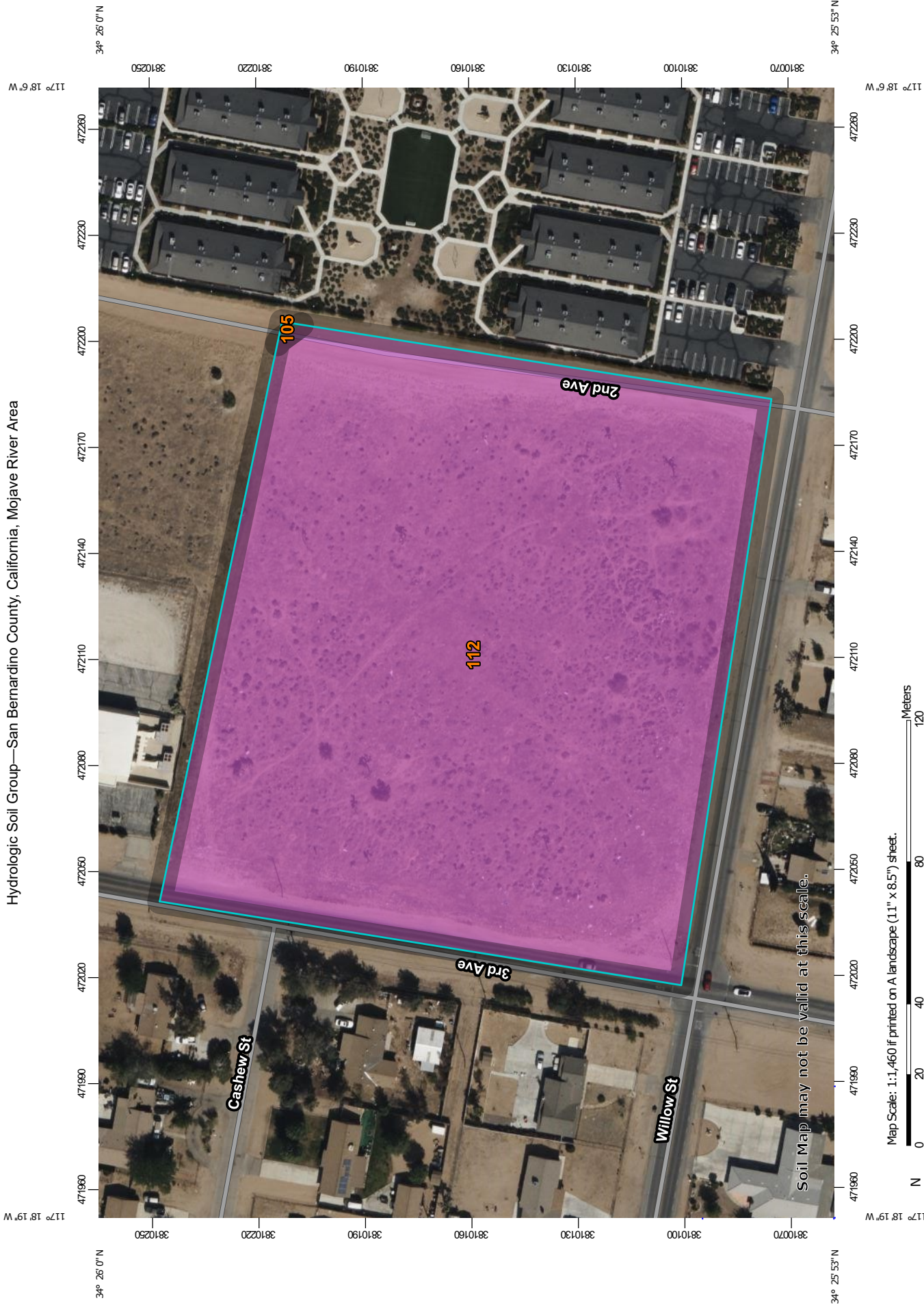
Wednesday, November 16, 2022

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino 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):	040706116, 040708221, 040708202, 040708204, 040708203, 040708214, 040705203, 040708213, 040708222
Project Site Acreage:	7.987
HCOC Exempt Area:	No
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	System Number - See Note Facility Name - See Note Owner - See Note
Closest channel segment's susceptibility to Hydromodification:	See Note
Highest downstream hydromodification susceptibility:	See Note
Is this drainage segment subject to TMDLs?	See Note
Are there downstream drainage segments subject to TMDLs?	See Note
Is this drainage segment a 303d listed stream?	See Note
Are there 303d listed streams downstream?	See Note
Are there unlined downstream waterbodies?	See Note
Project Site Onsite Soil Group(s):	A, B
Environmentally Sensitive Areas within 200':	DESERT TORTOISE HABITAT CAT 3
Groundwater Depth (FT):	No data available
Parcels with potential septic tanks within 1000':	Yes
Known Groundwater Contamination Plumes within 1000':	No
Studies and Reports Related to Project Site:	

Note: No drainage facilities located within 2 miles of site.

Appendix B: Hydrologic Soil Group Data



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

C

C/D

D

Not rated or not available

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area

Survey Area Data: Version 14, Sep 1, 2022

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
105	BRYMAN LOAMY FINE SAND, 0 TO 2 PERCENT SLOPES	C	0.0	0.1%
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	A	6.0	99.9%
Totals for Area of Interest			6.0	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C: State Water Resources Control Board 303(d) Map in relation to site

Appendix C.1: Google Map of site to Mojave River 3.5 miles



[Home](#) » [Water Issues](#) » [Programs](#) » [Tmdl](#)

Impaired Water Bodies

Listing a water body as impaired in California is governed by the [Water Quality Control Policy for developing California's Clean Water Act Section 303\(d\) Listing Policy](#). The State and Regional Water Boards assess water quality data for California's waters every two years to determine if they contain pollutants at levels that exceed protective water quality criteria and standards. This biennial assessment is required under Section 303(d) of the [Federal Clean Water Act](#).

» [Fact Sheet](#) - "2010 Integrated Report on Water Quality with Web-Based Interactive Map," April 2010

Please allow time for the information below to appear. Tabs will be available to navigate to various topics.

ATTENTION: The information on this page is not updated and is retained for archival purposes only. Please visit our current [Surface Water Quality Assessment page](#) for the most up-to-date information. Thank you.

2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report) — Statewide

[2010 Integrated Report](#)
[Map](#)
[303\(d\) List](#)
[References](#)
[Data Download](#)
[Draft Reports](#)
[Contact Us](#)

2010 INTEGRATED REPORT — 303(D) LISTED WATERS

Zoom to county:

All

Zoom to Regional Board:

All

☐ Show county

☐ Show Regional Board

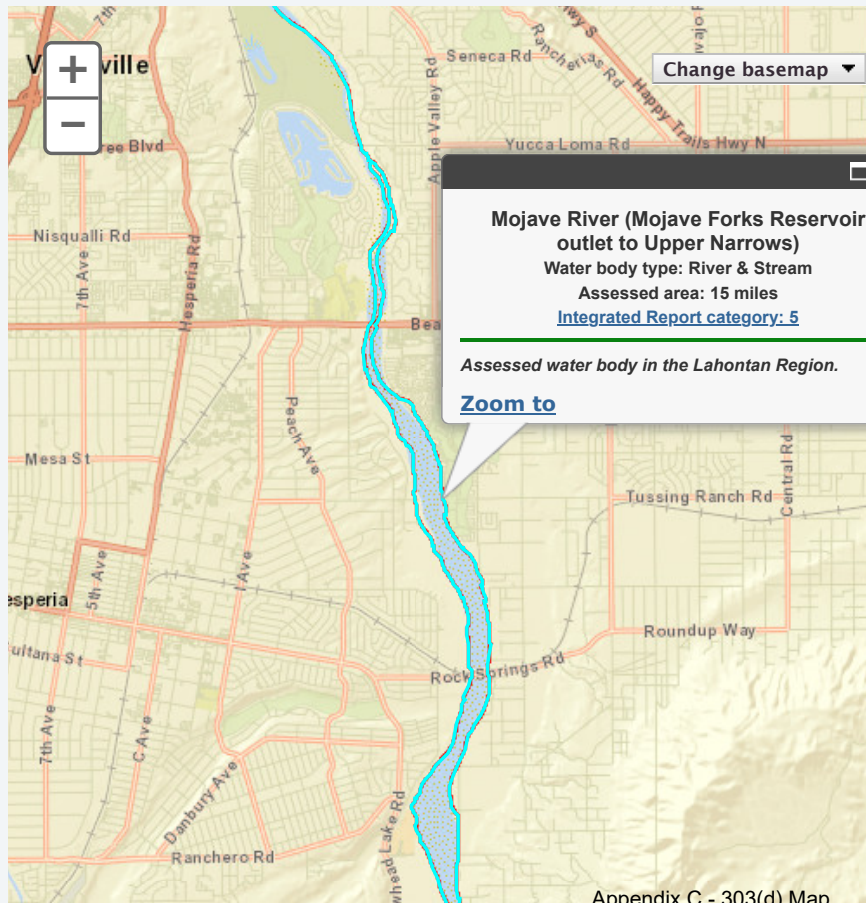
[Map Help](#)

Zoom to water body: (Filter: All)

All

Filter list by:

Reset list



Mojave River (Mojave Forks Reservoir outlet to Upper Narrows)
 Pollutant listings

[Close](#)

Pollutants	Listing Decision
	Report Link
	Potential Sources
	Schedule
	Comments

Appendix C - 303(d) Map



This [Webinar](#) walks the user through the Integrated Report and its geospatial information s

- **Geographical Information Systems (GIS) Files**

Update 12/23/11: The information presented on this map reflects the final USEPA-approved 2010 303(d) list. If you have any questions regarding the Integrated Report data and information, please email [Lori Webber](#) or call 916-341-5736. For any GIS-related questions, please email [Nirmal Sandhar](#) or call (916)341-5571.

(Updated 10/10/17)

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The California Water Boards include the [State Water Resources Control Board](#) and nine [Regional Boards](#)

The State Water Board is one of six environmental entities operating under

the authority of the California Environmental Protection Agency
[Cal/EPA](#) | [ARB](#) | [CalRecycle](#) | [DPR](#) | [DTSC](#) | [OEHHA](#) | [SWRCB](#)

Appendix C - 303(d) Map

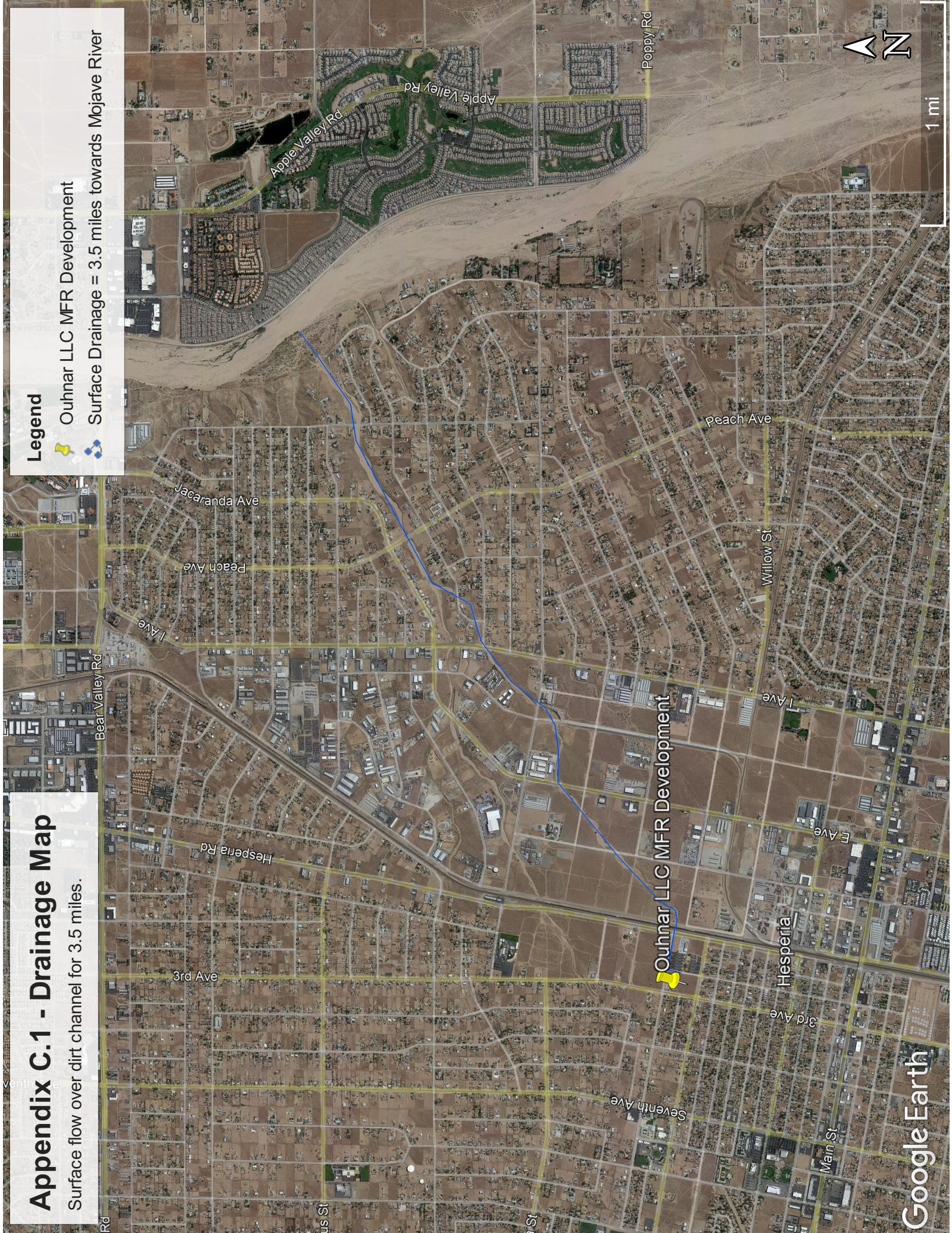
Appendix C.1 - Drainage Map

Surface flow over dirt channel for 3.5 miles.

Legend

 Ouhnar LLC MFR Development

 Surface Drainage = 3.5 miles towards Mojave River



Appendix D: NOAA Precipitation Frequency Estimates Sheet

Highlighted are relevant to this document.



NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4326°, Longitude: -117.3035°
Elevation: 3175.37 ft**

* source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.086 (0.071-0.106)	0.121 (0.100-0.147)	0.167 (0.137-0.205)	0.206 (0.168-0.254)	0.260 (0.205-0.332)	0.303 (0.235-0.396)	0.348 (0.263-0.466)	0.396 (0.291-0.545)	0.463 (0.326-0.664)	0.516 (0.351-0.766)
10-min	0.124 (0.102-0.151)	0.173 (0.143-0.211)	0.239 (0.197-0.293)	0.295 (0.241-0.364)	0.373 (0.294-0.476)	0.435 (0.336-0.567)	0.499 (0.377-0.668)	0.568 (0.417-0.781)	0.664 (0.468-0.952)	0.740 (0.504-1.10)
15-min	0.150 (0.124-0.183)	0.209 (0.173-0.256)	0.289 (0.238-0.355)	0.356 (0.291-0.440)	0.451 (0.356-0.576)	0.526 (0.407-0.686)	0.604 (0.456-0.808)	0.687 (0.504-0.945)	0.803 (0.565-1.15)	0.895 (0.609-1.33)
30-min	0.216 (0.178-0.264)	0.301 (0.249-0.368)	0.417 (0.343-0.511)	0.513 (0.419-0.634)	0.649 (0.513-0.830)	0.757 (0.586-0.988)	0.870 (0.657-1.16)	0.989 (0.726-1.36)	1.16 (0.814-1.66)	1.29 (0.877-1.91)
60-min	0.286 (0.237-0.350)	0.400 (0.330-0.489)	0.553 (0.455-0.678)	0.681 (0.556-0.842)	0.861 (0.681-1.10)	1.00 (0.777-1.31)	1.16 (0.872-1.54)	1.31 (0.964-1.81)	1.53 (1.08-2.20)	1.71 (1.16-2.54)
2-hr	0.408 (0.337-0.498)	0.547 (0.452-0.669)	0.737 (0.607-0.903)	0.897 (0.733-1.11)	1.12 (0.888-1.44)	1.31 (1.01-1.71)	1.50 (1.13-2.00)	1.70 (1.25-2.34)	1.98 (1.40-2.84)	2.21 (1.50-3.28)
3-hr	0.504 (0.417-0.616)	0.668 (0.552-0.817)	0.891 (0.734-1.09)	1.08 (0.883-1.34)	1.35 (1.07-1.73)	1.57 (1.21-2.04)	1.79 (1.35-2.40)	2.04 (1.49-2.80)	2.37 (1.67-3.41)	2.65 (1.80-3.93)
6-hr	0.699 (0.578-0.853)	0.917 (0.757-1.12)	1.22 (1.00-1.49)	1.47 (1.20-1.82)	1.83 (1.45-2.34)	2.12 (1.64-2.77)	2.43 (1.84-3.25)	2.76 (2.03-3.79)	3.22 (2.27-4.62)	3.60 (2.45-5.34)
12-hr	0.900 (0.744-1.10)	1.21 (0.996-1.48)	1.62 (1.34-1.99)	1.98 (1.61-2.44)	2.47 (1.96-3.16)	2.87 (2.22-3.75)	3.29 (2.49-4.40)	3.74 (2.75-5.14)	4.37 (3.08-6.26)	4.88 (3.32-7.24)
24-hr	1.21 (1.07-1.39)	1.66 (1.47-1.92)	2.28 (2.01-2.64)	2.80 (2.45-3.26)	3.53 (2.99-4.25)	4.11 (3.41-5.05)	4.72 (3.82-5.95)	5.37 (4.23-6.95)	6.28 (4.75-8.48)	7.02 (5.13-9.80)
2-day	1.38 (1.22-1.59)	1.92 (1.70-2.21)	2.65 (2.34-3.07)	3.28 (2.87-3.82)	4.16 (3.52-5.00)	4.86 (4.04-5.98)	5.61 (4.54-7.06)	6.40 (5.04-8.29)	7.53 (5.69-10.2)	8.44 (6.17-11.8)
3-day	1.48 (1.31-1.71)	2.07 (1.83-2.39)	2.88 (2.54-3.33)	3.57 (3.12-4.16)	4.54 (3.85-5.47)	5.32 (4.42-6.54)	6.15 (4.98-7.75)	7.04 (5.55-9.12)	8.31 (6.29-11.2)	9.35 (6.83-13.1)
4-day	1.59 (1.41-1.83)	2.22 (1.97-2.56)	3.10 (2.73-3.58)	3.84 (3.36-4.47)	4.89 (4.14-5.88)	5.73 (4.76-7.05)	6.63 (5.37-8.35)	7.60 (5.99-9.84)	8.98 (6.79-12.1)	10.1 (7.38-14.1)
7-day	1.75 (1.55-2.01)	2.44 (2.16-2.81)	3.39 (2.99-3.92)	4.19 (3.67-4.89)	5.34 (4.52-6.43)	6.26 (5.19-7.69)	7.23 (5.86-9.10)	8.27 (6.52-10.7)	9.75 (7.37-13.2)	11.0 (8.00-15.3)
10-day	1.86 (1.65-2.15)	2.59 (2.30-2.99)	3.60 (3.18-4.16)	4.45 (3.90-5.19)	5.66 (4.80-6.82)	6.64 (5.51-8.16)	7.66 (6.21-9.65)	8.76 (6.91-11.4)	10.3 (7.81-13.9)	11.6 (8.47-16.2)
20-day	2.21 (1.96-2.54)	3.08 (2.73-3.55)	4.29 (3.79-4.96)	5.32 (4.66-6.19)	6.78 (5.75-8.17)	7.97 (6.61-9.79)	9.21 (7.46-11.6)	10.6 (8.31-13.7)	12.4 (9.41-16.8)	14.0 (10.2-19.5)
30-day	2.56 (2.27-2.95)	3.57 (3.16-4.11)	4.97 (4.39-5.74)	6.17 (5.40-7.19)	7.89 (6.69-9.50)	9.28 (7.70-11.4)	10.8 (8.71-13.5)	12.3 (9.71-16.0)	14.6 (11.0-19.7)	16.4 (12.0-22.9)
45-day	3.02 (2.68-3.48)	4.19 (3.71-4.83)	5.83 (5.15-6.74)	7.24 (6.34-8.44)	9.28 (7.87-11.2)	10.9 (9.09-13.5)	12.7 (10.3-16.0)	14.6 (11.5-18.9)	17.3 (13.1-23.4)	19.5 (14.2-27.2)
60-day	3.40 (3.01-3.91)	4.67 (4.13-5.38)	6.46 (5.70-7.46)	8.01 (7.01-9.33)	10.3 (8.69-12.4)	12.1 (10.0-14.9)	14.1 (11.4-17.7)	16.2 (12.8-21.0)	19.3 (14.6-26.0)	21.8 (15.9-30.4)

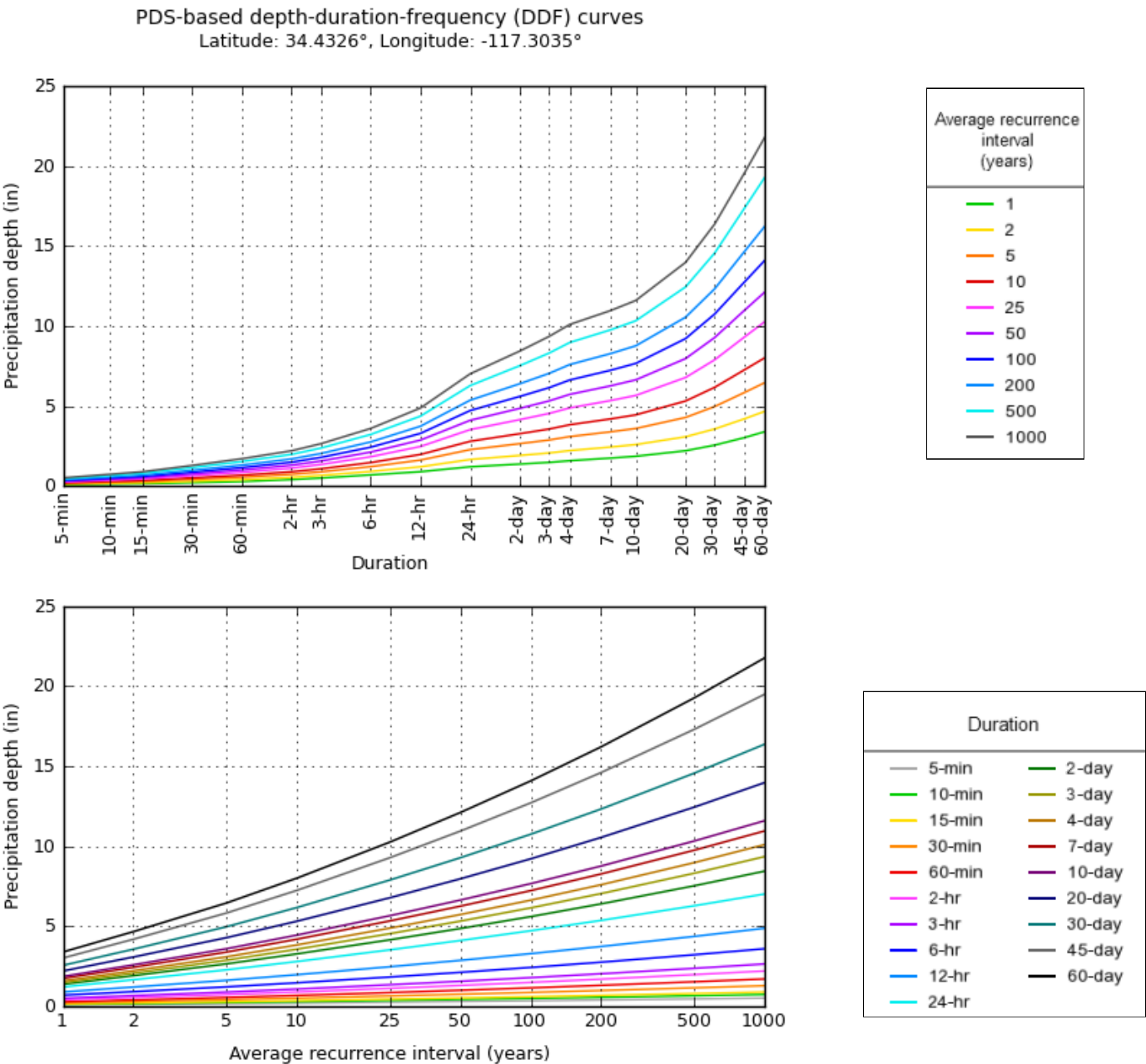
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



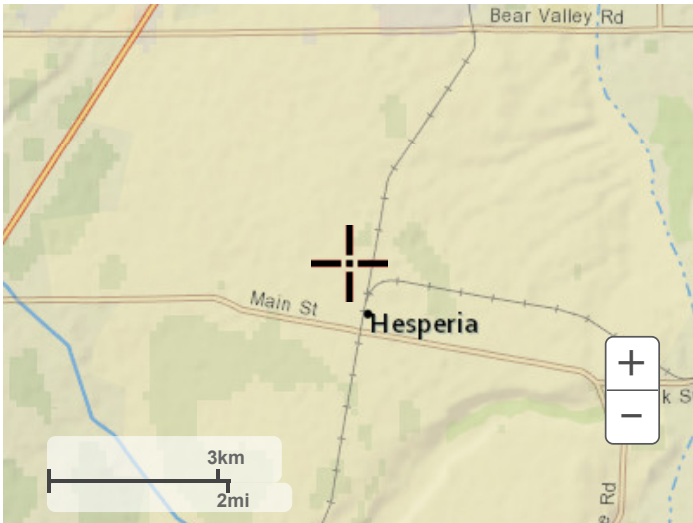
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Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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Appendix E: Pre-Project Site Photos



On corner of Willow St. & 3rd Ave. looking east at Willow St (the southern pl).



On Willow St. & 2nd looking north at 2nd (the east pl).



On 3rd looking north at west pl.



On the northwest corner of the property, looking east at the north pl.

Appendix F: Soils/Geotechnical Report/Study (pending)

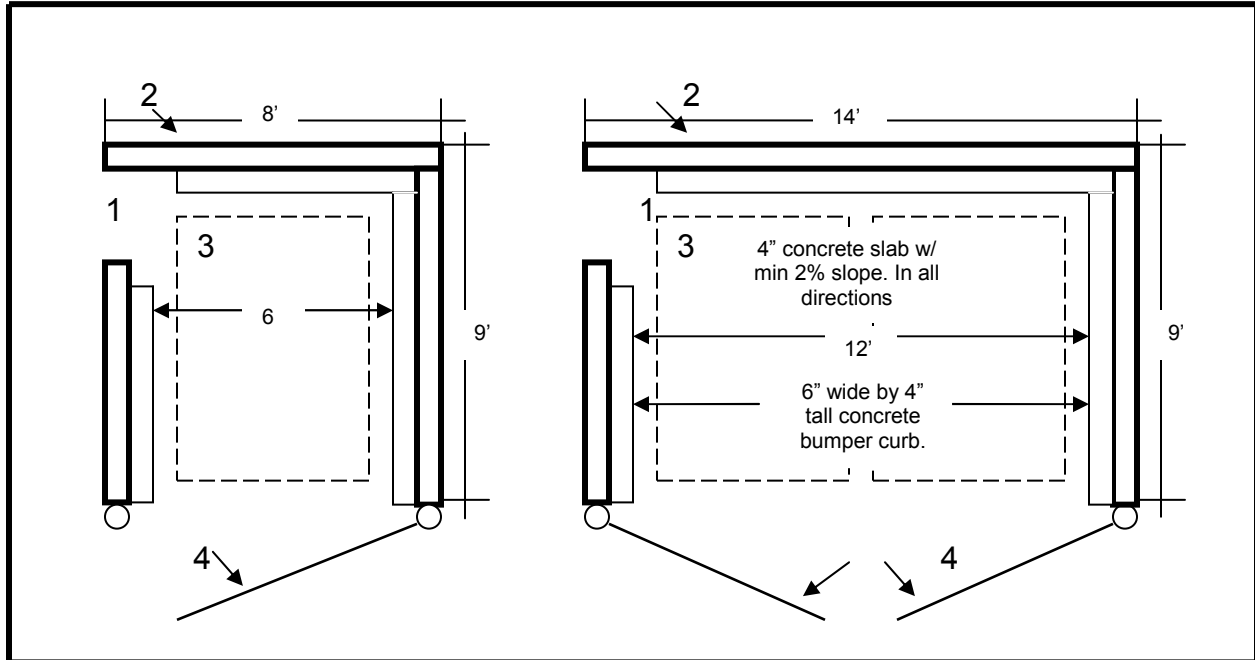
Appendix G: Infiltration Test/Study (pending)

Appendix H: Local Standards relevant to Post Construction BMPs/Site Design



City of Hesperia
BUILDING AND SAFETY DIVISION
9700 Seventh Ave., Hesperia CA., 92345
760-947-1300

Trash Enclosure Detail Minimum Standard



GENERAL NOTES: Location to be indicated on planning department approved site plan.

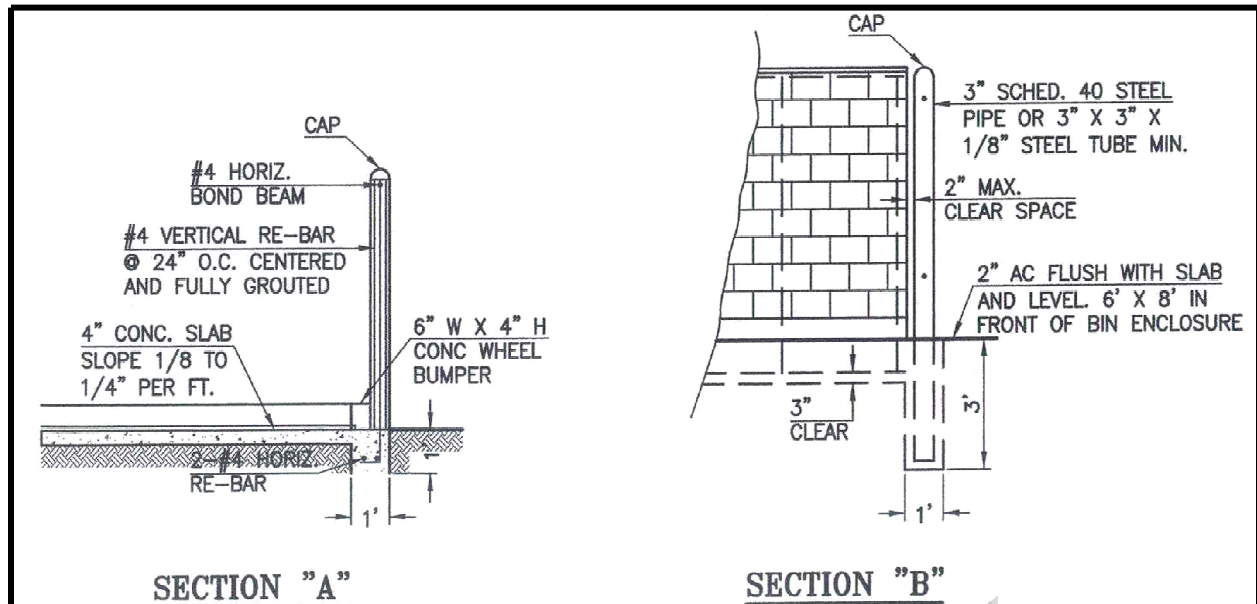
CONSTRUCTION NOTES:

1. Minimum 36" wide with 32" clear opening (gate optional).
2. Masonry walls shall be constructed of a 6" minimum precision block with a split face block on the viewable side and decorative cap. (Earth tone in color & a contrasting decorative cap).
3. Trash bins
4. Mesh or solid metal gates



City of Hesperia
BUILDING AND SAFETY DIVISION
 9700 Seventh Ave., Hesperia CA., 92345
 760-947-1300

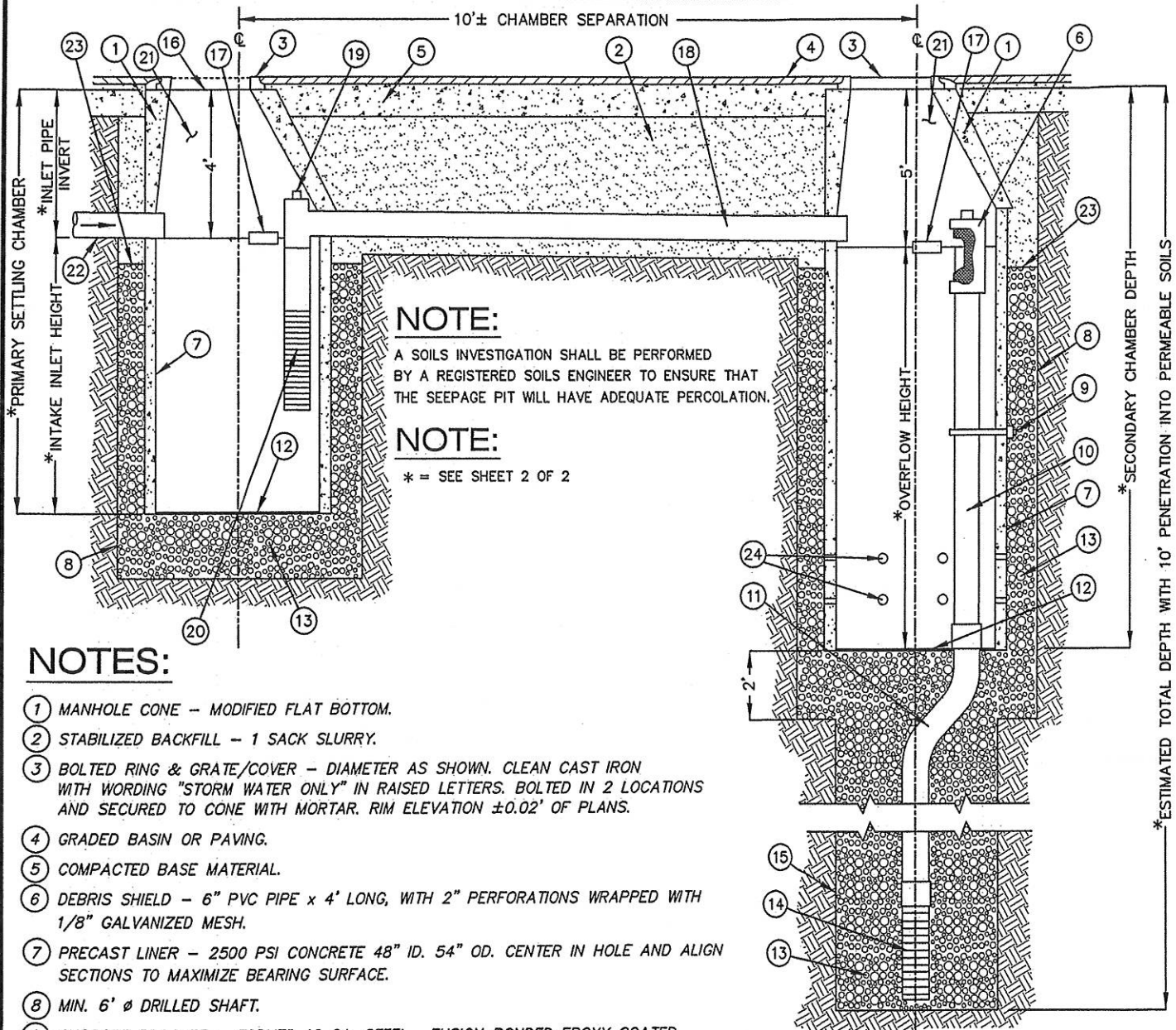
Trash Enclosure Detail Minimum Standard



NOTES:

1. Lap all re-bar splices 24 inches, minimum.
2. All cells contacting reinforcing steel are to be solidly grouted.
3. Cells required to be grouted are to be in vertical alignment and free from obstruction. Extreme care should be taken when using slump blocking to allow for a clear unobstructed cell.
4. Grout to be puddle, rodded or vibrated and consolidated.
5. Footing to be dug 12" minimum into undisturbed soil.
6. Request inspection for footing and obtain approval prior to pouring.
7. Request inspection for wall steel and obtain approval prior to grouting.
8. Request a final inspection and obtain final approval.

DRAINAGE SYSTEM DETAIL AND SPECIFICATION



NOTE:

A SOILS INVESTIGATION SHALL BE PERFORMED BY A REGISTERED SOILS ENGINEER TO ENSURE THAT THE SEEPAGE PIT WILL HAVE ADEQUATE PERCOLATION.

NOTE:

* = SEE SHEET 2 OF 2

NOTES:

- ① MANHOLE CONE - MODIFIED FLAT BOTTOM.
- ② STABILIZED BACKFILL - 1 SACK SLURRY.
- ③ BOLTED RING & GRATE/COVER - DIAMETER AS SHOWN. CLEAN CAST IRON WITH WORDING "STORM WATER ONLY" IN RAISED LETTERS. BOLTED IN 2 LOCATIONS AND SECURED TO CONE WITH MORTAR. RIM ELEVATION $\pm 0.02'$ OF PLANS.
- ④ GRADED BASIN OR PAVING.
- ⑤ COMPACTED BASE MATERIAL.
- ⑥ DEBRIS SHIELD - 6" PVC PIPE x 4' LONG, WITH 2" PERFORATIONS WRAPPED WITH 1/8" GALVANIZED MESH.
- ⑦ PRECAST LINER - 2500 PSI CONCRETE 48" ID. 54" OD. CENTER IN HOLE AND ALIGN SECTIONS TO MAXIMIZE BEARING SURFACE.
- ⑧ MIN. 6' ϕ DRILLED SHAFT.
- ⑨ SUPPORT BRACKET - FORMED 12 GA. STEEL. FUSION BONDED EPOXY COATED.
- ⑩ OVERFLOW PIPE - 6" SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
- ⑪ DRAINAGE PIPE - ADS HIGHWAY GRADE WITH TRI-A COUPLER (OR APPROVED EQUAL). SUSPEND PIPE DURING BACKFILL OPERATIONS TO PREVENT BUCKLING OR BREAKAGE. DIAMETER AS NOTED (MINIMUM PIPE SIZE TO BE 8" DIAMETER).
- ⑫ BASE SEAL - GEOTEXTILE, POLY LINER OR CONCRETE SLURRY.
- ⑬ ROCK - CLEAN AND WASHED, SIZED BETWEEN 3/4" AND 1-1/2" TO BEST COMPLEMENT SOIL CONDITIONS.
- ⑭ DRAINAGE SCREEN - 6" CORRUGATED PERFORATED POLYETHYLENE (ADS OR APPROVED EQUAL).
- ⑮ MIN. 4' ϕ SHAFT - DRILLED TO MAINTAIN PERMEABILITY OF DRAINAGE SOILS.
- ⑯ FABRIC SEAL - U.V. RESISTANT GEOTEXTILE - TO BE REMOVED BY CUSTOMER AT PROJECT COMPLETION.
- ⑰ ABSORBENT - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY.
- ⑱ CONNECTOR PIPE - 6" ϕ SCH 40 PVC.
- ⑲ ANTI-SIPHON VENT WITH FLOW REGULATOR.
- ⑳ INTAKE SCREEN - 6-INCH CORRUGATED PERFORATED POLYETHYLENE (ADS OR APPROVED EQUAL).
- ㉑ FREEBOARD DEPTH VARIES WITH INLET PIPE ELEVATION. INCREASE PRIMARY/SECONDARY SETTLING CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE CONNECTOR PIPE OVERFLOW.
- ㉒ OPTIONAL INLET PIPE.
- ㉓ MOISTURE MEMBRANE - 6 MIL. PLASTIC. PLACE SECURELY AGAINST ECCENTRIC CONE AND HOLE SIDEWALL. USED IN LIEU OF SLURRY IN LANDSCAPE AREAS.
- ㉔ EIGHT - (8) PERFORATIONS PER FOOT, 2 ROW MIN.

DRAWN BY: M.W.M.

APPROVED BY:

DATE: 8/20/13

CITY OF HESPERIA

2 STAGE
SEEPAGE PITS



REV. DATE

M.M. 5/18/18

STD. DRW'G. NO.

SP-1
SHEET 1 OF 2

PRIMARY SETTLING CHAMBER DEPTH

THE OVERALL DEPTH OF THE PRIMARY SETTLING CHAMBER IS DETERMINED BY THE AMOUNT OF SURFACE AREA BEING DRAINED. USE A STANDARD DEPTH OF 15 FEET FOR THE INITIAL ACRE OF CONTRIBUTORY DRAINAGE AREA, PLUS 2 FEET FOR EACH ADDITIONAL ACRE, UP TO 2 ACRES OF PAVED SURFACE. OTHER CONDITIONS THAT WOULD REQUIRE INCREASE CHAMBER DEPTHS ARE PROPERTY USAGE, MAINTENANCE SCHEDULING, AND SEVERE OR UNUSUAL CONDITIONS. CONNECTING PIPE DEPTH MAY DICTATE DEEPER CHAMBERS SO AS TO MAINTAIN THE EFFECTIVENESS OF THE SETTLING PROCESS. MAXIMUM CHAMBER DEPTH IS 25 FEET.

ESTIMATED TOTAL DEPTH

THE ESTIMATED TOTAL DEPTH IS THE APPROXIMATE TOTAL SYSTEM DEPTH REQUIRED TO ACHIEVE 10 CONTINUOUS FEET OF PENETRATION INTO PERMEABLE SOILS, BASED UPON KNOWN SOILS INFORMATION.

SETTLING CHAMBER DEPTH

SYSTEMS OVER 30 FEET OVERALL DEPTH AND UP TO 0.25 CFS DESIGN RATE, THE STANDARD SETTLING CHAMBER DEPTH IS 18 FEET. MAXIMUM CHAMBER DEPTH IS 25 FEET.

OVERFLOW HEIGHT / SECONDARY SETTLING CHAMBER

THE OVERFLOW HEIGHT AND SECONDARY SETTLING CHAMBER DEPTH DETERMINE THE EFFECTIVENESS OF THE SETTLING PROCESS. THE HIGHER THE OVERFLOW PIPE, THE DEEPER THE CHAMBER, THE GREATER THE SETTLING CAPACITY. AN OVERFLOW HEIGHT OF 13 FEET IS USED WITH THE STANDARD SETTLING CHAMBER DEPTH OF 18 FEET.

DRAINAGE PIPE

THIS DIMENSION ALSO APPLIES TO THE DEBRIS SHIELDS, THE DRAINAGE SCREEN, AND FITTINGS. THE SIZE IS BASED UPON SYSTEM DESIGN RATES, MULTIPLE PRIMARY SETTLING CHAMBERS, SOIL CONDITIONS, AND NEED FOR ADEQUATE VENTING. CHOICES ARE 8" (MIN.) OR 12" DIAMETER.

INLET PIPE INVERT

PIPES UP TO 12" IN DIAMETER FROM CATCH BASINS, UNDERGROUND STORAGE, ETC. MAY BE CONNECTED INTO THE PRIMARY SETTLING CHAMBER. LARGER PIPE DIAMETERS DICTATE THE USE OF MANHOLE MATERIAL FOR THE PRIMARY SETTLING CHAMBER WITH 48" GRATES ON THE CONE. INVERTS DEEPER THAN 5 FEET WILL REQUIRE ADDITIONAL DEPTH IN BOTH SYSTEM SETTLING CHAMBERS TO MAINTAIN RESPECTIVE EFFECTIVE SETTLING CAPACITIES.

INTAKE INLET HEIGHT

THE INTAKE INLET HEIGHT DETERMINES THE EFFECTIVENESS OF THE SETTLING PROCESS IN THE PRIMARY SETTLING CHAMBER. A MINIMUM INLET HEIGHT OF 11 FEET IS USED WITH THE STANDARD PRIMARY SETTLING CHAMBER DEPTH OF 15 FEET. GREATER INLET HEIGHTS WOULD REQUIRED WITH INCREASED SYSTEM DEMANDS AS NOTED IN PRIMARY SETTLING CHAMBER DEPTH. FREEBOARD DEPTH VARIES WITH INLET PIPE ELEVATION. INCREASE PRIMARY/ SECONDARY SETTLING CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE CONNECTOR PIPE OVERFLOW.

DRAWN BY: M.W.M.

APPROVED BY:

DATE: 8/20/13

CITY OF HESPERIA

2 STAGE
SEEPAGE PITS



REV. DATE

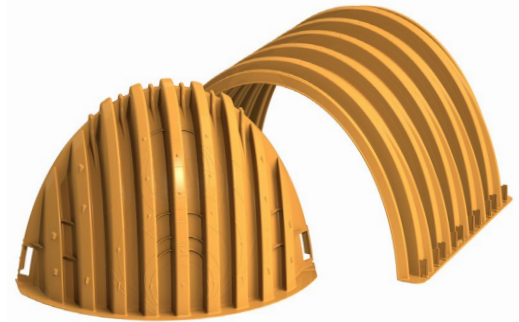
M.M. 5/18/18

STD. DRW'G. NO.

SP-1
SHEET 2 OF 2

StormTech MC-7200 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



Nominal Chamber Specifications (not to scale)

Size (L x W x H)
83" x 100" x 60"
2108 mm x 2540 mm x 1524 mm

Chamber Storage
175.9 ft³ (4.98 m³)

Min. Installed Storage*
267.3 ft³ (7.57 m³)

Weight
202 lbs (91.6 kg)

Shipping
7 chambers/pallet
5 end caps/pallet
6 pallets/truck

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.

Nominal End Cap Specifications (not to scale)

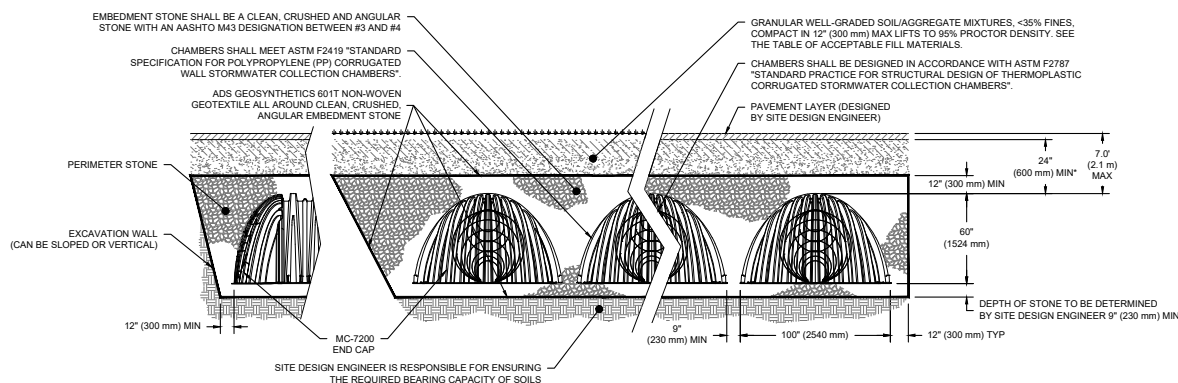
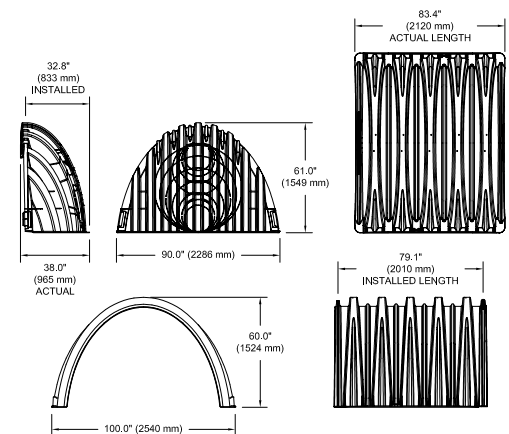
Size (L x W x H)
38" x 90" x 61"
965 mm x 2286 mm x 1549 mm

End Cap Storage
39.5 ft³ (1.12 m³)

Min. Installed Storage*
115.3 ft³ (3.26 m³)

Weight
Nominal 90.0 lbs (40.8 kg)

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 12" (300 mm) of stone perimeter, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

StormTech MC-7200 Specifications

Storage Volume Per Chamber

	Bare Chamber Storage ft ³ (m ³)	Chamber and Stone Foundation Depth in. (mm)			
		9 in (230 mm)	12 in (300 mm)	15 in (375 mm)	18 in (450 mm)
Chamber	175.9 (4.98)	267.3 (7.57)	273.3 (7.74)	279.3 (7.91)	285.3 (8.08)
End Cap	39.5 (1.12)	115.3 (3.26)	118.6 (3.36)	121.9 (3.45)	125.2 (3.54)

Note: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter in front of end cap.

Amount of Stone Per Chamber

English Tons (yds ³)	Stone Foundation Depth			
	9 in	12 in	15 in	18 in
Chamber	12.1 (8.5)	12.9 (9.0)	13.6 (9.6)	14.3 (10.1)
End Cap	9.8 (7.0)	10.2 (7.3)	10.6 (7.6)	11.1 (7.9)
Metric Kilograms (m ³)	230 mm	300 mm	375 mm	450 mm
Chamber	10977 (6.5)	11703 (6.9)	12338 (7.3)	12973 (7.7)
End Cap	8890 (5.3)	9253 (5.5)	9616 (5.8)	10069 (6.0)

Note: Assumes 12" (300 mm) of stone above and 9" (230 mm) row spacing and 12" (300 mm) of perimeter stone in front of end caps. 1 yd³ = 1.42 english tons.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth			
	9 in (230 mm)	12 in (300 mm)	15 in (375mm)	18 in (450 mm)
Chamber	17.2 (13.2)	17.7 (13.5)	18.3 (14.0)	18.8 (14.4)
End Cap	9.7 (7.4)	10.0 (7.6)	10.3 (7.9)	10.6 (8.1)

Note: Assumes 9" (230 mm) of separation between chamber rows, 12" (300 mm) of perimeter in front of the end caps, and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

Working on a project?

Visit us at www.stormtech.com and utilize the Design Tool



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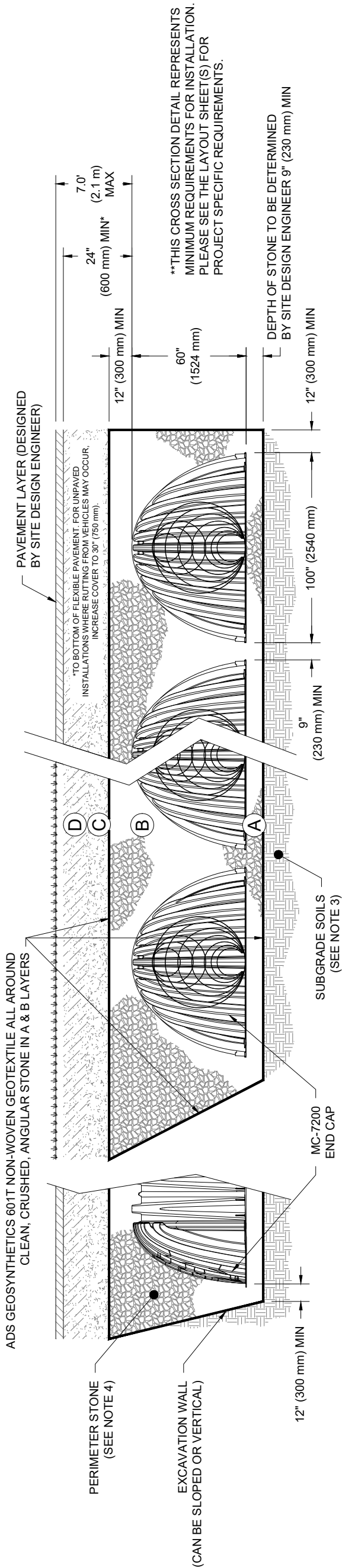
800-821-6710

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	FINAL FILL: FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	INITIAL FILL: FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145 ¹ A-1, A-2.4, A-3 OR AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	EMBEDMENT STONE: FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43 ¹ 3, 4	NO COMPACTION REQUIRED.
A	FOUNDATION STONE: FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43 ¹ 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. ^{2,3}

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



*** FOR COVER DEPTHS GREATER THAN 7.0' (2.1 m) PLEASE CONTACT STORMTECH**

NOTES:

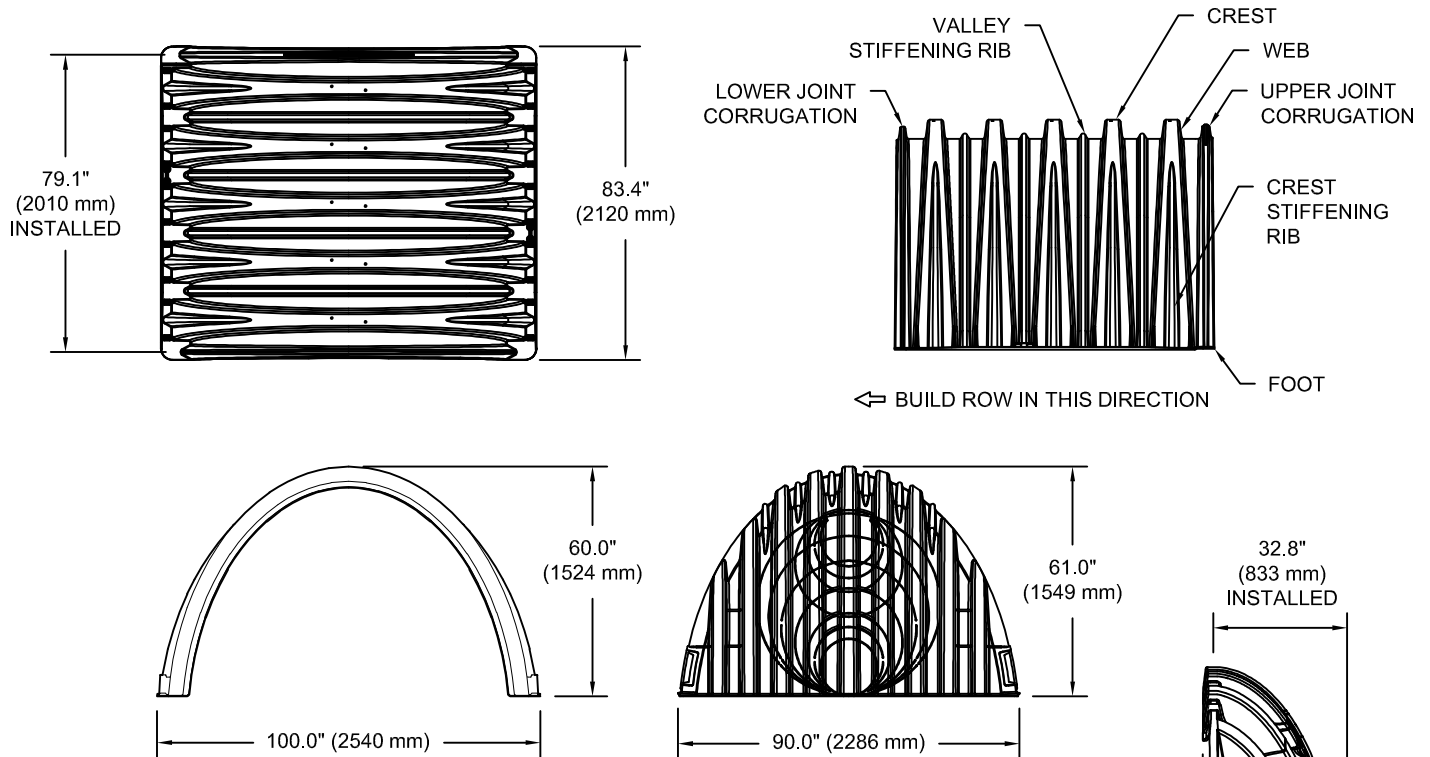
1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x10
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
 - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
 - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
 - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION; a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73 ° F / 23 ° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

 4640 TRUEMAN BLVD HILLIARD, OH 43026		StormTech® Chamber System 888-892-2694 WWW.STORMTECH.COM		<table><tr><th>DATE</th><th>DRWN</th><th>CHKD</th><th>DESCRIPTION</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table>		DATE	DRWN	CHKD	DESCRIPTION																					<table><tr><td>PROJECT #:</td><td>CHECKED: KLJ</td></tr><tr><td>DATE: 6/11/21</td><td>DRAWN: KLJ</td></tr></table>	PROJECT #:	CHECKED: KLJ	DATE: 6/11/21	DRAWN: KLJ	MC-7200 STANDARD CROSS SECTION
DATE	DRWN	CHKD	DESCRIPTION																																
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DATE: 6/11/21	DRAWN: KLJ																																		

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROFESSIONAL REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

MC-7200 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m ³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m ³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

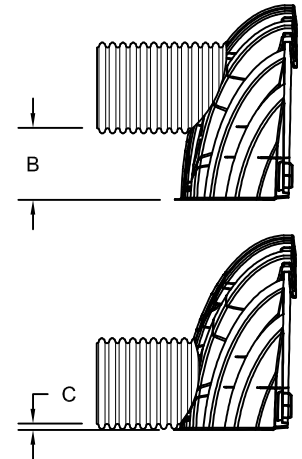
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m ³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m ³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

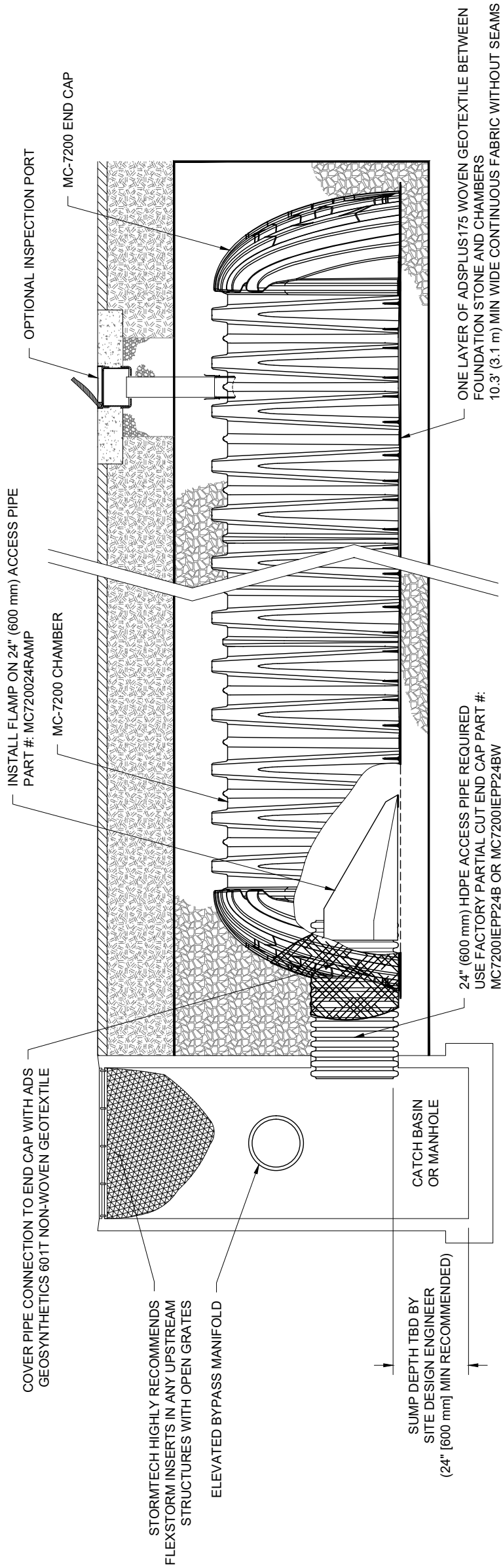
PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC7200IEPP06B		---	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC7200IEPP08B		---	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC7200IEPP10B		---	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC7200IEPP12B		---	1.55" (39 mm)
MC7200IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC7200IEPP15B		---	1.70" (43 mm)
MC7200IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC7200IEPP18TW		---	1.97" (50 mm)
MC7200IEPP18B			
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC7200IEPP24TW		---	2.26" (57 mm)
MC7200IEPP24B			
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-7200 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

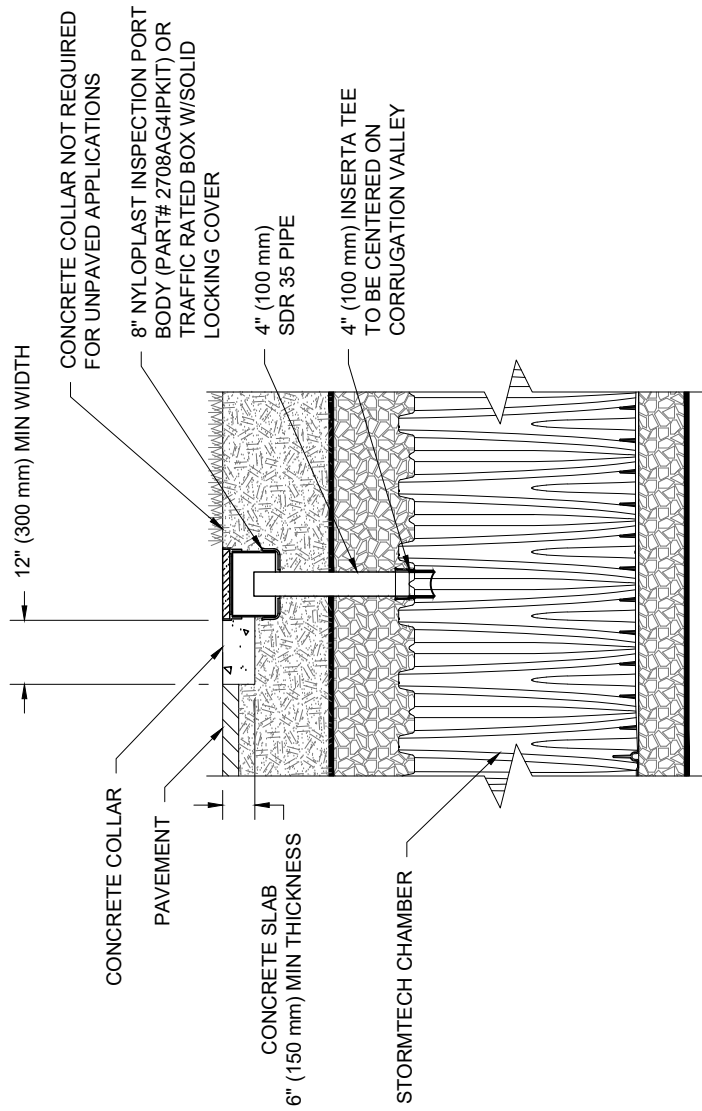


INSPECTION & MAINTENANCE

- STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
 - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
 - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
 - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
 - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
 - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
 - B. ALL ISOLATOR PLUS ROWS
 - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
 - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
 - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
 - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
 - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45° (1.1 m) OR MORE IS PREFERRED
 - B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
 - C. VACUUM STRUCTURE SUMP AS REQUIRED
- STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.
- STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



**4" PVC INSPECTION PORT DETAIL
(MC SERIES CHAMBER)**

Isolator[®] Row Plus

O&M Manual



The Isolator[®] Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

The Isolator Row FLAMP[™] (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

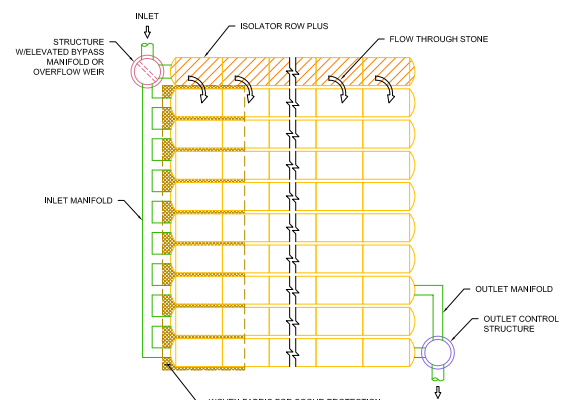
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.



Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.



StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

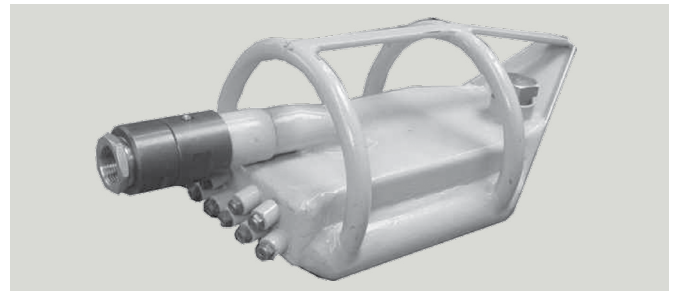
If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided

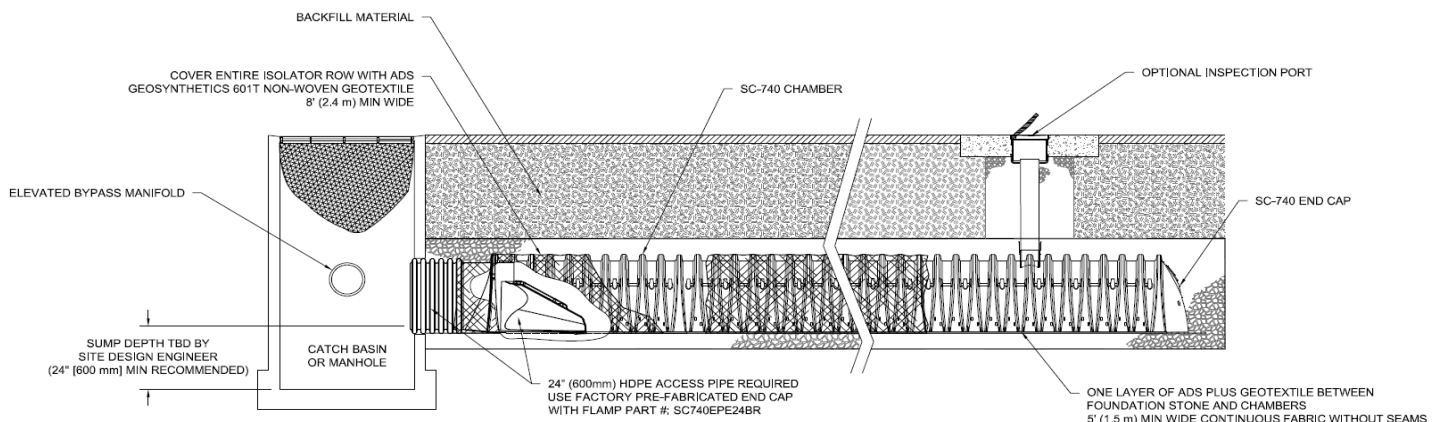
via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Row Plus
 - i. Remove cover from manhole at upstream end of Isolator Row Plus
 - ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
 - 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 - 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
 - 2.If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

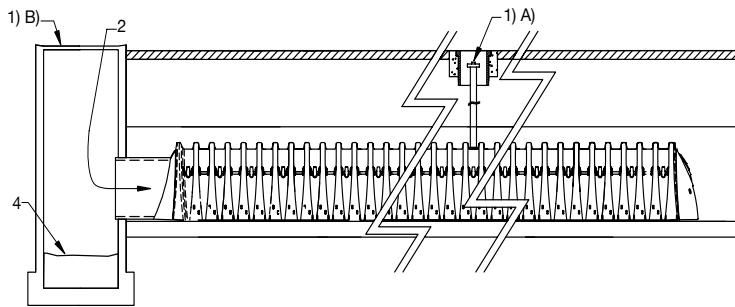
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sedi- ment Depth (1)-(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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800-821-6710

StormTech® Installation Guide

MC-7200 Chamber



StormTech
Installation Video

Required Materials and Equipment List

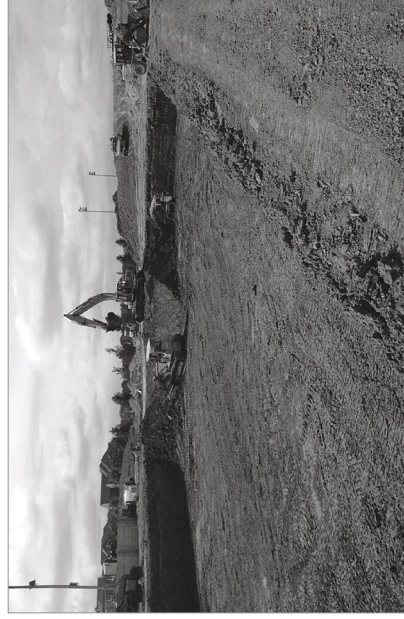
- Acceptable fill materials per Table 1
- ADS PLUS and non-woven geotextile fabrics
- StormTech solid end caps, pre-cored and pre-fabricated end caps
- StormTech chambers, manifolds and fittings

Note: MC-7200 chamber pallets are 100" x 84" (2.5 m x 2.1 m) and weigh about 1435 lbs. (651 kg). Unloading chambers requires 72" (1.8 m) (min.) forks and/or tie downs (straps, chains, etc).

Important Notes:

- This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.
- Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.
- Care should be taken in the handling of chambers and end caps. End caps must be stored standing upright. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation



Excavate bed and prepare subgrade per engineer's plans. Plans and specifications should include Best Management Practices (BMPs) to deter contamination of open pits during construction.



Place non-woven geotextile over prepared soils and up excavation walls.



Place clean, crushed, angular stone foundation 9" (230 mm) min. Install underdrains if required. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly



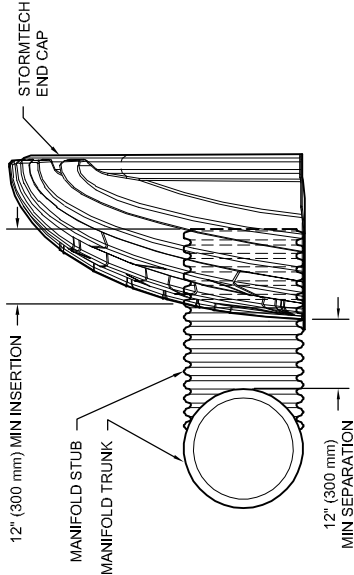
Install manifolds and lay out ADS Plus fabric at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® Plus Row(s). Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

The MC-7200 contains built in ropes at the feet on both sides of the chambers to be used to lift and place the chambers using an excavator. No more than two chambers should be lifted at a time using the ropes. A 14' x 3/8" (10 mm) chain is recommended along with a 5/8" (16 mm) Jaw and Eye Swivel. Using this method, chambers can be placed directly on an existing row. Using too long of a chain may cause the chambers to be less stable during picking.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled "Lower Joint – Overlap Here" and "Build this direction – Upper Joint" Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 9" (230 mm) spacing between MC-7200 rows.

Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. When used on an Isolator Row Plus, a 24" FLAMP (flared end ramp) is attached to the inside of the inlet pipe with a provided threaded rod and bolt. The FLAMP then lays on top of the ADS Plus fabric.

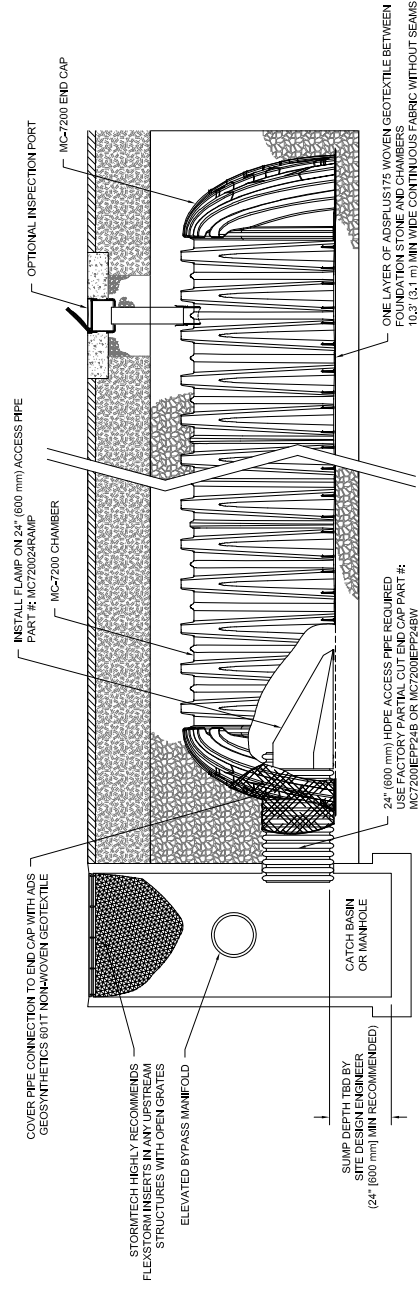
Manifold Insertion



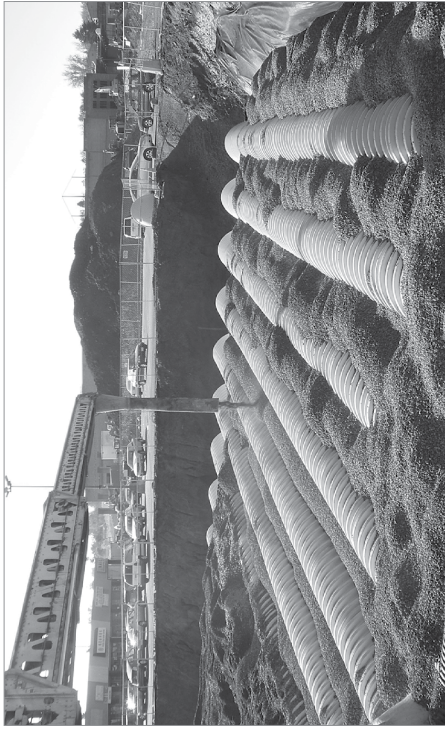
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

Insert inlet and outlet manifolds a minimum 12" (300 mm) into chamber end caps. Manifold header should be a minimum 12" (300 mm) from base of end cap.

StormTech Isolator Row Plus Detail



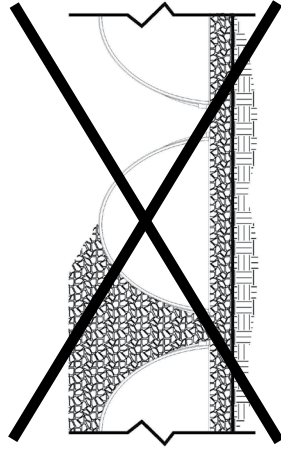
Initial Anchoring of Chambers – Embedment Stone



Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

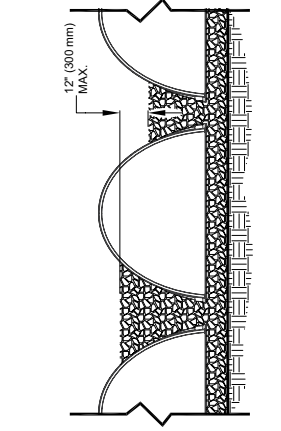
No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

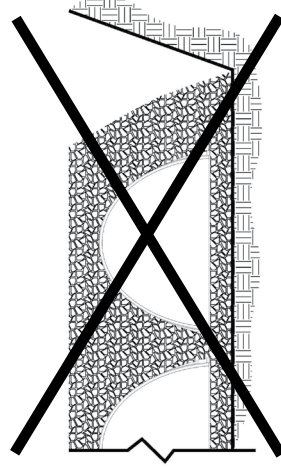


Uneven Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12" (300 mm) between adjacent chamber rows or between chamber rows and perimeter.

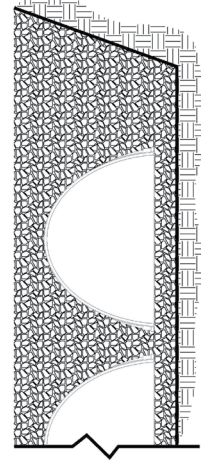


Even Backfill



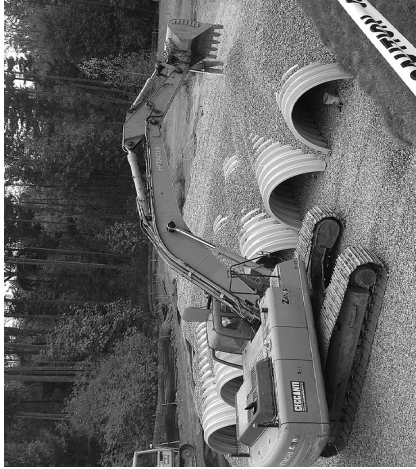
Perimeter Not Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.



Perimeter Fully Backfilled

Backfill of Chambers – Embedment Stone and Cover Stone



Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers and a minimum 12" (300 mm) of cover stone is in place. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. The recommended backfill methods are with a stone conveyor outside of the bed or build as you go with an excavator inside the bed reaching along the rows. Backfilling while assembling chambers rows as shown in the picture will help to ensure that equipment reach is not exceeded.

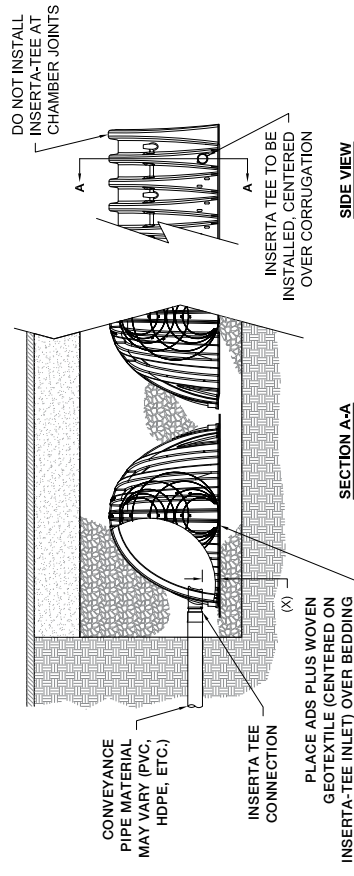
Only after chambers have been backfilled to top of chamber and with a minimum 12" (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends the contractor inspect chamber rows before placing final backfill. Any chambers damaged by construction equipment shall be removed and replaced.

Final Backfill of Chambers – Fill Material



Install non-woven geotextile over stone. Geotextile must overlap 24" (600 mm) where edges meet. Compact at 24" (600 mm) of fill. Roller travel parallel with rows.

Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-7200	12" (250 mm)	8" (200 mm)

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation ¹	Compaction/Density Requirement
(D) Final Fill: Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) Initial Fill: Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 24" (600 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M145 A-1, A-2-4, A-3 or AASHTO M431 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 24" (600 mm) of material over the chambers is reached. Compact additional layers in 12" (300 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials.
(B) Embedment Stone: Fill the surrounding chambers from the foundation stone ('A' layer) to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43 ¹ 3, 4	No compaction required.
(A) Foundation Stone: Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43 ¹ 3, 4	Place and compact in 9" (230 mm) max lifts using two full coverages with a vibratory compactor. ^{2, 3}

Please Note:

1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 9" (230 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 2 - Fill Material Locations

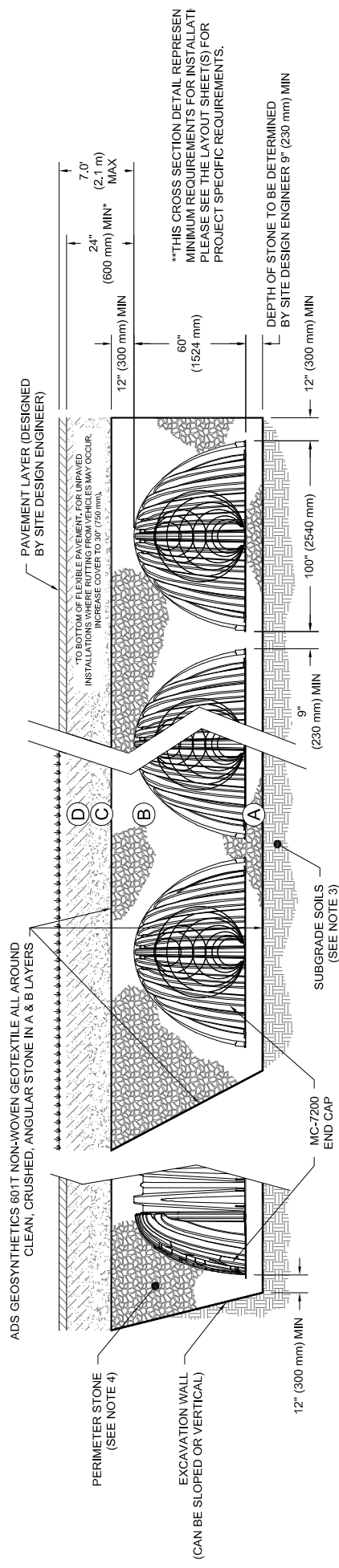
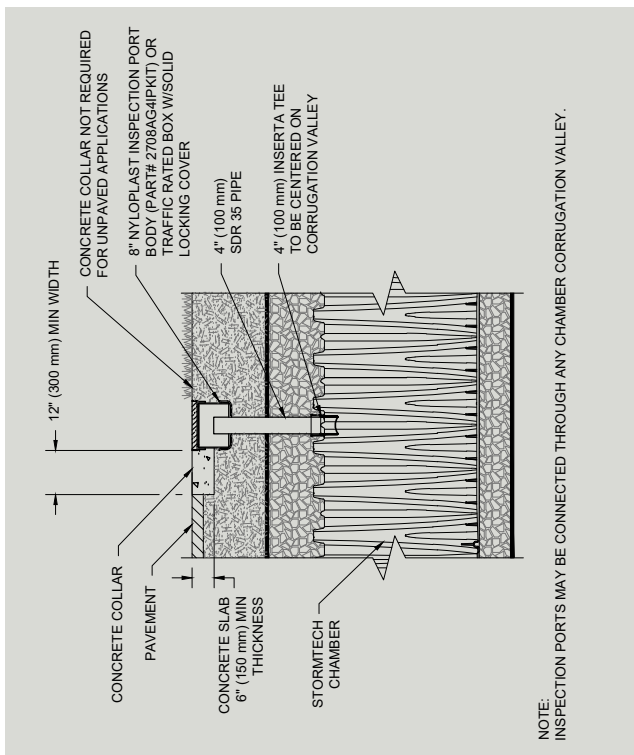


Figure 1- Inspection Port Detail



Notes:

1. 36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18" (450 mm) of cover for MC-7200s may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450 mm) of cover for MC-7200s exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (<8,000 lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. StormTech does not require compaction of initial fill at 18" (450 mm) of cover. However, requirements by others for 6" (150 mm) lifts may necessitate the use of small compactors at 18" (450 mm) of cover.
6. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
7. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Call StormTech at **888.892.2694** for technical and product information or visit www.stormtech.com

Table 2 - Maximum Allowable Construction Vehicle Loads⁶

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads ⁶		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	
Ⓐ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305)	4050 (194)	38,000 (169)
				18" (457)	2760 (132)	
				24" (610)	2130 (102)	
				30" (762)	1770 (84)	
				36" (914)	1530 (73)	
Ⓑ Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305)	2750 (131)	20,000 (89)
				18" (457)	1920 (92)	
				24" (610)	1520 (73)	
				30" (762)	1310 (63)	
				36" (914)	1180 (56)	
Ⓒ Embedment Stone	24" (600) Loose/Dumped	24,000 (107)	12,000 (53)	12" (305)	2430 (116)	16,000 (71)
				18" (457)	1730 (82)	
				24" (610)	1390 (66)	
				30" (762)	1210 (58)	
				36" (914)	1100 (52)	
Ⓓ Final Fill Material	18" (450)	24,000 (107)	12,000 (53)	12" (305)	2140 (102)	5,000 (22) (static loads only) ⁵
				18" (457)	1530 (73)	
				24" (610)	1260 (60)	
				30" (762)	1120 (53)	
				36" (914)	1030 (49)	
Ⓔ Embedment Stone	12" (300)	Not Allowed	Not Allowed	12" (305)	1100 (53)	Not Allowed
				18" (457)	710 (34)	
				24" (610)	660 (32)	
				30" (762)	580 (28)	
				Not Allowed	Not Allowed	

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
See Table 2 for Maximum Construction Loads				
Ⓐ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows. ⁴	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓑ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 24" (600 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 12" (300 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 24" (600 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓒ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 12" (300 mm) cover stone is in place.	No rollers allowed.
Ⓓ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

17.0 Standard Limited Warranty



STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

- (A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."
- (B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.
- (C) **THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**
- (D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. **UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.**
- (E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.
- (F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.
- (G) **THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLIGENCE; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.**



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ADS GEOSYNTHETICS 0601T NONWOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 6.0 oz (0601T) nonwoven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 6.0 oz (0601T) is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. ADS Geosynthetics 6.0 oz (0601T) resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. ADS Geosynthetics 6.0 oz (0601T) conforms to the physical property values listed below:

Filter Fabric Properties

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight (Typical)	ASTM D 5261	oz/yd ² (g/m ²)	6.0 (203)
Grab Tensile	ASTM D 4632	lbs (kN)	160 (0.711)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	60 (0.267)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	410 (1.82)
Permittivity*	ASTM D 4491	sec ⁻¹	1.5
Water Flow*	ASTM D 4491	gpm/ft ² (l/min/m ²)	110 (4480)
AOS*	ASTM D 4751	US Sieve (mm)	70 (0.212)
UV Resistance	ASTM D 4355	%/hrs	70/500

PACKAGING	
Roll Dimensions (W x L) – ft	12.5 x 360 / 15 x 300
Square Yards Per Roll	500
Estimated Roll Weight – lbs	195

* At the time of manufacturing. Handling may change these properties.



ADS PLUS 125/175 WOVEN GEOTEXTILE

For use with StormTech® Isolator® Row Plus

Scope

This specification describes ADS Plus 125/175 Woven Geotextile.

ADS Plus 125/175 woven geotextile fabrics are woven polypropylene materials offering optimum performance when used in stabilization applications. Produce from first quality raw materials, they provide the perfect balance of strength and separation in styles capable of functioning exceptionally well in a wide range of performance requirements.

Unless indicated below, all list properties are Minimum Average Roll Values:

Filter Fabric Properties

PROPERTY	TEST METHOD	ENGLISH M.A.R.V. (MARV ²)	METRIC M.A.R.V. (MARV ²)
Weight	ASTM D5261	8.0 oz/yd ²	271.25 g/m ²
Grab Tensile Strength	ASTM D4632	325 lbs.	1.45 kN
Grab Elongation	ASTM D4632	15%	15%
Trapezoidal Tear Strength	ASTM D4533	200 lbs	0.89 kN
CBR Puncture Resistance	ASTM D6241	1,124 lbs.	5.0 kN

NOTES:

1. The property values listed above are subject to change without notice.
2. Minimum Average Roll Values (MARV) is calculated as the average minus two standard deviations. Statistically, it yields approximately 97.5% degree of confidence that any samples taken from quality assurance testing will meet or exceed the values described above.

END OF REPORT

