Appendix F-2

Preliminary Hydrology and Hydraulics Study for Amrapur Stoddard Wells, Victorville

Ware Malcomb

July 8, 2022

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PRELIMINARY HYDROLOGY AND HYDRAULICS STUDY

FOR:
Amrapur Stoddard Wells
Victorville, CA 92394

APN: 0472-181-14

Prepared for:
Suraj Victorville, LLC
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Corona, CA 92879
Phone: (714) 893-8808

Project No: IRV21-0068

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Prepared by: ____________________ 07/20/2022
Signature Date

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Prepare Date: March 4th, 2022
Revised: July 8, 2022

Table of Contents

I. Introduction

This Hydrology and Hydraulics Study has been prepared by Ware Malcomb on behalf of the owner/developer of the project site, Suraj Victorville, LLC. The purpose of this Hydrology and Hydraulics Study is to quantify the existing and proposed drainage conditions to support the grading and storm drain design by confirming post-developed runoff does not exceed pre-developed peak flows and justifying there will be no negative impacts to surrounding and downstream properties. The subject site is located at 16716 Stoddard Wells Road, Victorville, CA 92394. The site consists of Parcels 1 through 7 totaling an area of approximately 40.812 acres. The site is bound to the north by Abbey Lane, to the west and the south by neighboring properties, and to the east by Stoddard Wells Road. Refer to the Vicinity Map in Appendix "A".

The project will be disturbing approximately 39.813 acres of currently vacant land. The proposed project includes clearing and grubbing of the existing site to construct a new industrial warehouse building, appurtenant parking and loading areas, private storm drain improvements, and BMPs for stormwater pollutant control and mitigation of increases in runoff. The proposed hydrology will mimic the existing hydrology to the maximum extent practicable, capturing runoff in the proposed condition at the natural outfall location in the existing condition. The project seeks to detain the increase in runoff volume in the proposed condition for the 10-year 24-hour storm event as well as the runoff from the 100-year 1-hour storm event via a subgrade infiltration gallery.

Per the City of Victorville Preliminary Priority Project Checklist, the site is a "Priority Project" that will require a fully executed WQMP during the plan check process, as well as a Maintenance Agreement and Transfer, since the project involves an industrial development with 100,000+ SF of impervious surface. The project shall comply with NPDES General Permit requirements.

II. Site Discussion

i. Site Information and Properties

The site is located in Victorville, CA, with a nearby public storm drain line located on Stoddard Wells Road. An existing storm drain line runs through the property from an existing culvert alongside Stoddard Wells Road. The site is located within the Mojave River watershed in San Bernardino County, with runoff from the site traveling via overland flow into the Mojave River. The site is vacant and barren, with no impervious surfaces in the existing condition. Per the revised San Bernardino County Hydrology Manual (1986), the Hydrologic Soils Group Map for the Southcentral Area of San Bernardino County shows that the project site lies on Hydrologic Soil Group A soils. Additionally, per the USDA Web Soil Survey, the site contains three distinct soil types: Cajon Sand, Cajon-Arizo Complex, and Villa Loamy Sand. All three soil types belong to Hydrologic Soil Group A. The soil map can be found in Appendix "B".

The site is relatively flat, with elevations ranging from over 2740 feet in the northeastern corner of the site to 2687 feet in the southwestern part of the site. Portions of the site feature steeper slopes in areas where erosion has occurred over time, but slopes generally range from 2% to 4%.

Percolation and groundwater tests were performed on site by TGR Geotechnical, Inc. Four percolation tests and ten borings were performed on site. The Geotechnical Investigation Report can be found in Appendix "J".

The project development is a single development and is not part of a larger development.

In the proposed condition, the site will feature an 800,000 SF industrial warehouse building in the center of the site, with loading spaces along its western and eastern sides, and access routes as well as parking spaces surrounding the building. Access drives will be provided from both Abbey Lane to the north and Stoddard Wells Road to the east. The site is approximately 86% impervious surfaces and 14% pervious surfaces.

ii. Design Standards

The revised County of San Bernardino Hydrology Manual (1986) was used as guidance for the design of drainage facilities and to establish criteria for flood protection levels within this project.

iii. Hydrology Software

The CivilCADD/Civil Design (CivilD) Hydrology Software was used for the Rational Hydrology Method & Unit Hydrograph calculations. The Rational Method Analysis was used to calculate the amount of runoff produced in the existing and proposed conditions. The Unit Hydrograph Method Analysis produced a hydrograph for the existing and proposed conditions for both storm events, ultimately providing a total volume of runoff for each.

iv. Hydraulics Software

The Bentley Systems FlowMaster Hydraulic Calculator was used to preliminarily size the proposed storm drain pipes located on-site as well as analyze the proposed inlets' capacities for handling the 10-year storm event flows.

III. Rainfall Data

Rainfall data that was utilized for the on-site runoff hydrology analysis was acquired from the revised San Bernardino County Hydrology Manual (1986). According to the San Bernardino County Hydrology Manual Isohyetal Maps for Desert Areas (shown in Appendix "D"), the six major storm events provided in the manual result in the following intensities, which were utilized to perform Rational Method and Unit Hydrograph hydrologic analyses using the CivilD Hydrologic software:

- 2-year 6-hour storm = 0.80 inches per hour of precipitation
- 2-year 24-hour storm = 1.20 inches per hour of precipitation
- 10-year 1-hour storm = 0.75 inches per hour of precipitation
- 100-year 1-hour storm = 1.20 inches per hour of precipitation
- 100-year 6-hour storm = 2.00 inches per hour of precipitation
- 100-year 24-hour storm = 3.50 inches per hour of precipitation

These rainfall intensities were incorporated into the CivilD Hydrology Software to accurately model the design storm events: the 10-year 24-hour and 100-year 1-hour storm events. Unit Hydrograph Hydrologic Analyses were performed using the CivilD Hydrology Software to determine the peak flow and volume of runoff for the two design storm events. Tables 1 and 2 on the following page illustrate the peak flows and runoff volumes of the 10-year 24-hour and 100-year 1-hour storms in the existing and proposed conditions, respectively. Table 3 demonstrates the increase in runoff volume in the proposed condition for the design storm events, which served as the basis for the sizing of the proposed subgrade infiltration gallery. Refer to Appendixes "G" & "H" for Unit Hydrograph calculation outputs from the CivilD Hydrologic Software.

Table 1: Existing Condition Unit Hydrograph Results

Existing Condition – Peak Flow and Runoff Volume			
Q_{10} (CFS) 24-HR	Q_{100} (CFS) 1-HR	V_{10} (CF) 24-HR	V_{100} (CF) 1-HR
54.38	103.88	119,616	15,382

Table 2: Proposed Condition Unit Hydrograph Results

Proposed Condition – Peak Flow and Runoff Volume			
Q_{10} (CFS) 24-HR	Q_{100} (CFS) 1-HR	V_{10} (CF) 24-HR	V_{100} (CF) 1-HR
88.29	149.70	247,996	18,749

Table 3: Runoff Volume Deficit Summary

ΔV_{10} (CF) 24-HR Deficit	ΔV_{100} (CF) 1-HR Deficit
128,380	3,367

IV. On-Site Runoff

i. Existing Condition Drainage Pattern

The existing project site consists of undeveloped barren land with minimal vegetation. Stormwater from the site sheet flows westerly and eventually discharges in the direction of the Mojave River. The outfall is located on the western edge of the site, where stormwater travels via overland flow. In the existing condition, there are three drainage areas: DMA A, DMA B, and DMA C. DMA A, DMA B, and DMA C encompass the entire site, and they consist of undeveloped barren areas that will be disturbed. The resulting study area is 39.813 acres.

The Existing Hydrology Exhibit can be found in Appendix "E". The values calculated in the Rational Method and Unit Hydrograph Analyses via the CivilD Hydrology Software have been tabulated in the exhibit, including the runoff flows and volumes associated with each drainage subarea.

ii. Proposed Condition Drainage Pattern

The proposed condition features 9 drainage areas: DMA A1 (with initial area), DMA A2, DMA A3, DMA A4, DMA B1 (with initial area), DMA B2, DMA B3, DMA B4, and DMA B5. DMA A1, DMA A2, DMA A3, and DMA A4 include the northern and western regions of the proposed parking lot, as well as the western half of the proposed warehouse building. DMA B1, DMA B2, DMA B3, DMA B4, and DMA B5 include the eastern and southern regions of the proposed parking lot, as well as the landscaped areas along Stoddard Wells Road and the eastern half of the proposed warehouse building. The runoff from DMA A1 through A4 and DMA B1 through B5 will drain into proposed inlets, and eventually be conveyed via a proposed underground storm drain system, which discharges into a proposed subgrade infiltration gallery near the southwestern corner of the site. Overflow from the basin will discharge at the site's outfall to grade, as in the existing condition.

The subgrade infiltration basin is designed to detain the increase in the 10-year 24-hour design storm runoff volume of 128,380 cubic feet as well as provide detention of the increase in the 100-year 1-hour storm event runoff volume of 3,367 cubic feet.

The Proposed Hydrology Exhibit can be found in Appendix "F". The values calculated in the Rational Method and Unit Hydrograph Analyses via the CivilD Hydrology Software have been tabulated in the exhibit, including the runoff flows and volumes associated with each drainage subarea. Additionally, the exhibit features a preliminary storm drain facility design with associated catch basin and pipe invert elevations, sizes and materials.

iii. Rational Method Peak Flows

The Existing and Proposed Hydrology Exhibits provided in this report demonstrate the drainage areas that were prorated to generate conservative flows for the site. Hydrologic computations were performed to determine the 10-year and 100-year storm peak discharges, utilizing the Rational Method of San Bernardino County as a drainage basis. The variables taken into consideration in the computation include rainfall, soil type, and land use (cover type) conditions – characteristics of flow conveyance and time of concentration.

The soil map provided by the USDA Web Soil Survey indicates Hydrologic Soil Group "A" soils throughout the site. HSG A soils typically have high infiltration rates. The model uses this assumption in the determination of the site runoff in the existing and proposed condition.

Per the site-specific percolation testing, a subgrade infiltration is proposed to mitigate the increase in runoff.

See Tables 4 and 5 below for the tabulation of the existing condition and proposed condition drainage areas, their times of concentration, flow rates, and prorated volumes detained in the proposed subgrade infiltration gallery, respectively. There are no impervious surfaces in the existing condition.

Table 4: Existing Condition Rational Method Results

Drainage Area	Area (acres)	Tc_{10} (MIN) 1-HR	Tc_{100} (MIN) 1-HR	Q_{10} (CFS) 1-HR	Q_{100} (CFS) 1-HR
DMA A Initial	0.125	6.318	6.318	0.343	0.620
DMA A	9.727	11.710	9.460	9.960	23.913
DMA A TOTAL (STREAM 1)	9.852	18.028	15.778	10.303	24.533
DMA B Initial	0.165	4.974	4.974	0.551	0.975
DMA B	10.053	9.990	8.160	12.363	28.311
DMA B TOTAL (STREAM 2)	10.218	14.964	13.134	12.913	29.286
DMA C Initial	0.106	5.977	5.977	0.304	0.548
DMA C	19.637	12.360	9.940	19.970	48.280
DMA C TOTAL (STREAM 3)	19.743	18.337	15.917	20.274	48.828
Total after Confluence of Streams	39.813	14.965	13.139	43.606	99.509

Table 5: Proposed Condition Rational Method Results

Drainage Area	Area (acres)	Tc_{10} (MIN) 1-HR	Tc_{100} (MIN) 1-HR	Q_{10} (CFS) 1-HR	Q_{100} (CFS) 1-HR	V_{10} (CF) 24-HR	V_{100} (CF) 1-HR	Impervious Percentage
DMA A1 Initial	0.149	3.688	3.688	0.696	1.123	481	13	68.20%
DMA A1	0.879	2.110	1.870	2.774	4.676	2,834	74	87.31%
DMA A2	1.562	1.802	1.580	3.728	6.437	5,037	133	74.90%
DMA A3	2.750	0.940	0.840	6.444	11.081	8,868	233	93.07%

DMA A4	11.043	1.760	1.570	22.882	39.643	35,609	934	94.96%
DMA A TOTAL (STREAM 1)	16.383	10.300	9.540	36.523	62.960	52,829	1,387	92.08%
DMA B1 Initial	0.049	2.583	2.583	0.295	0.475	158	4	0.00%
DMA B1	4.880	1.330	1.170	21.760	36.213	15,736	413	78.26%
DMA B2	8.257	1.240	1.090	26.420	45.257	26,625	698	88.48%
DMA B3	5.510	0.840	0.730	13.171	23.219	17,767	466	85.82%
DMA B4	1.440	1.640	1.430	0	0	4,643	122	84.56%
DMA B5	3.290	0.400	0.350	2.616	5.784	10,609	278	57.84%
DMA B TOTAL (STREAM 2)	23.426	8.030	7.360	64.262	110.949	75,551	1,981	81.00%
Total	39.813	8.031	7.364	98.370	169.39	128,380	3,367	85.55%

The Rational Method via CivilD Hydrology software derived the following total flow rates for the existing and proposed conditions (see Appendices "G" and "H" for detailed tabulations):

	Area (acres)	Q_{10} (CFS)	Q_{100} (CFS)
Existing Condition	39.813	43.606	99.509
Proposed Condition	39.813	98.370	169.390
	% Change	126%	70.2%

The existing condition calculations model the entire study area discharging at the site's outfall on the western boundary. The proposed subgrade infiltration gallery will be sized to reduce peak flows to be less than or equal to the existing condition peak flows.

iv. Hydraulic Analysis – Design of Storm Drain Facilities

The CivilD Hydrologic Software provided estimated storm drain pipe sizes as part of the Rational Method calculations. The project's inlets and storm drain pipes will be sized to convey the 10-year 24-hour storm event flows. The following table was utilized as a guide for determining on-site storm drain pipe sizes assuming full flow capacities with a roughness coefficient of 0.013 and pipe slope of 0.5%. See Appendix "I" for Hydraulic calculations. StormCAD results will be provided in the final design to support the conveyance of the design storm event flows in the proposed storm drain system.

Pipe Size (inches)	Full Flow Capacity (cfs)
8	0.085
12	2.52
18	7.43
24	16.00
36	47.16
48	101.57

v. Subgrade Infiltration Gallery Design

The proposed subgrade infiltration gallery will provide detention for the increase in the 10-year 24-hour storm event. It was conservatively sized to infiltrate the difference between the pre-and post-development 10-year, 24-hour storm peak runoff volumes, which is 128,380 cubic feet, within 48 hours. The proposed subgrade infiltration gallery unit is an ADS MC-3500 Stormtech Chamber System, and it has a provided volume of 129,361 cubic feet. The ADS MC-3500 Stormtech Chamber System is 85.1 feet wide by 440.24 feet long by 5.5 feet deep, and it is comprised of 12 rows of chambers with 716 individual chamber units. The system contains a stone layer with a porosity of 40%, which also contributes to the storage capacity of the unit along with the chambers. This system encourages detention and infiltration of on-site stormwater runoff while reducing the peak flow of the design storm event. The hydraulic grade line of the system is at an elevation of 2696.70'. Details, calculations and specfiications for the proposed subgrade infiltration gallery can be found in Appendix "K".

As the larger peak runoff volume difference from 10-year, 24-hour storm event will be mitigated, it can be assumed that the smaller 100-year, 1-hour storm event peak runoff volume difference will be mitigated as well. In the final design, a flood routing analysis will be performed to verify that the subgrade infiltration gallery reduces the peak flow of the design storm event in the proposed condition.

V. Off-Site Runoff

There is an existing culvert along the eastern boundary of the property that conveys offsite flow from Stoddard Wells Road into the site as channel flow in the existing condition. The offsite flow discharges at an outfall along the southern property line.

Although the off-site flow rate is unknown and no formal analyses have been performed to determine this value, the runoff from this source has been accounted for in the on-site runoff analysis and hydrologic calculations. The off-site runoff will be piped along the southern property line to prevent comingling of off-site and on-site runoff and to mimic the hydrologic conditions of the pre-developed site.

VI. Stormwater Treatment

The site's stormwater runoff will be treated by the proposed subgrade infiltration gallery, which not only mitigates for peak flow reduction and detention of the 10-year 24-hour storm event runoff volume deficit, but also infiltrates the Design Capture Volume (DCV) for water quality purposes. The calculated DCV value which will be infiltrated is equal to 88,932 cubic feet. The proposed subgrade infiltration basin has an adequate storage capacity equal to 129, 361 cubic feet. A Preliminary Water Quality Management Plan (WQMP) has been prepared to demonstrate the proposed strategy for on-site stormwater treatment. Refer to the Preliminary WQMP for further details and calculations regarding on-site stormwater treatment.

The property owner, Suraj Victorville, LLC, will contract with a third-party maintenance group or be directly responsible for the long-term maintenance of WQMP sstormwater facilities/BMPs for the privately-owner property. The property owner shall be responsible for BMP operation and maintenance until the property is transferred or sold.

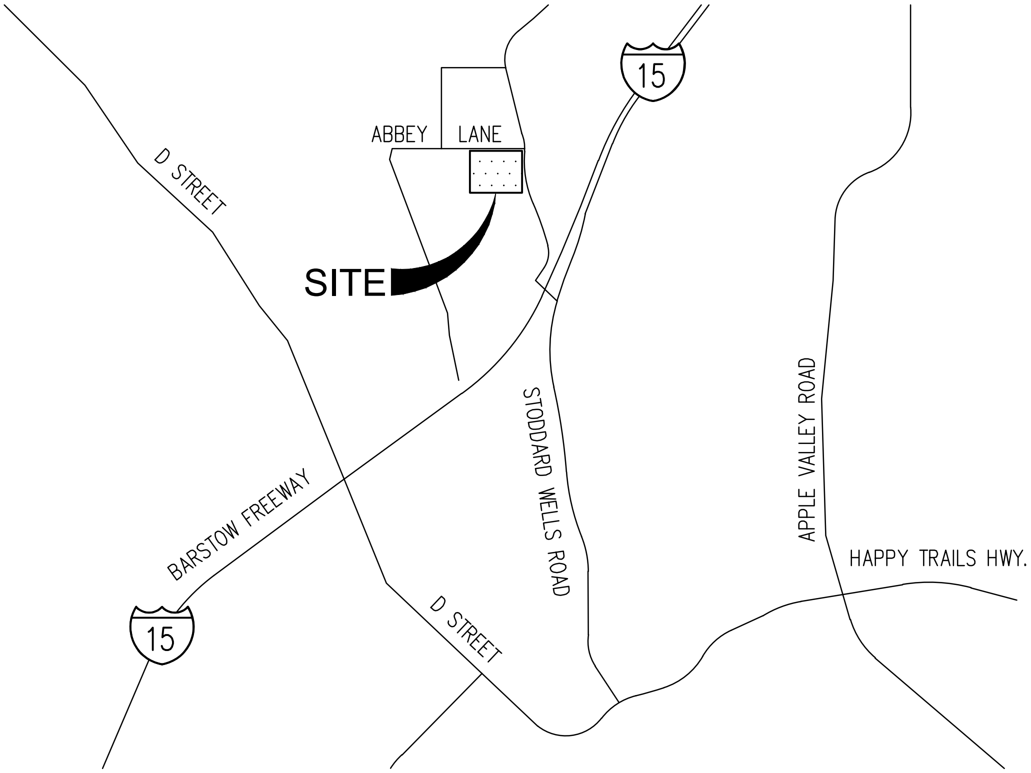
VII. Conclusion

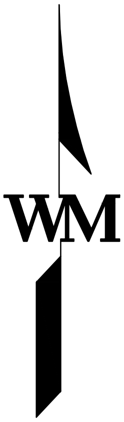
The results of this study show that the proposed condition will detain the increase in the 10-year 24-hour storm event volume, as well as the 100-year 1-hour storm event volume. It will also reduce the 10-year 24-hour and 100-year 1-hour peak flow rates using the proposed subgrade infiltration gallery's detention capacity. Drainage facilities will be sized to convey storm flows for the 10-year 24-hour storm event. The runoff from the 10-year 24-hour and 100-year 1-hour storm events will pond in proposed infiltration basin before eventually discharging via an overflow pipe that connects to the existing outfall at the western boundary. The proposed on-site stormwater network will provide adequate retardation of runoff flow to mitigate any increase in peak flow or discharge in the proposed condition. The final design of the site will incorporate additional flood routing and storm drain facility analyses to further support the overall stormater network design.

VIII. Appendices

Appendix A – Vicinity Map

VICINITY MAP





VICINITY MAP

SCALE: N.T.S.

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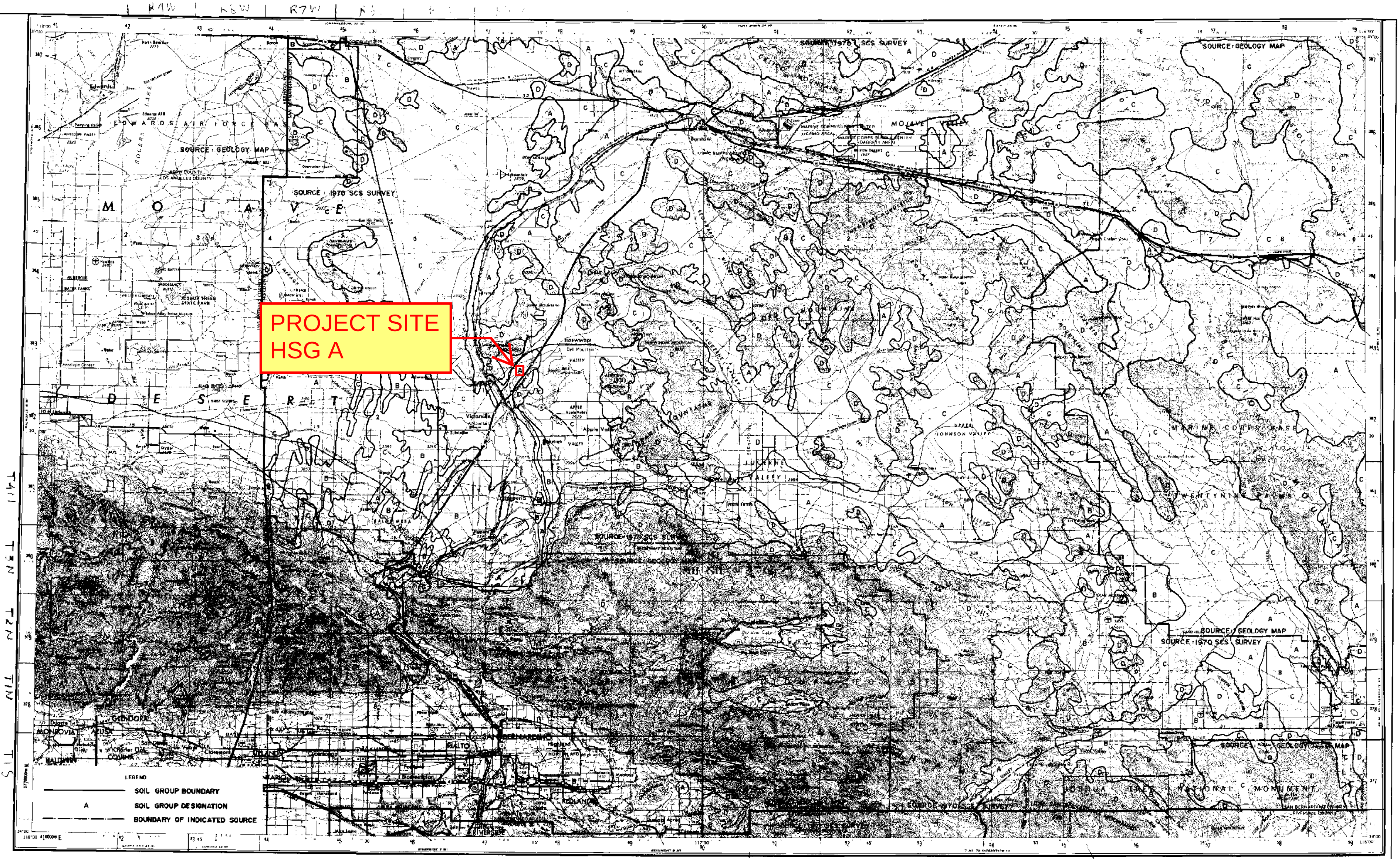
CIVIL ENGINEERING & SURVEYING

PROJECT NAME: AMRAPUR STODDARD WELLS		
JOB NO.: IRV21-0068	DATE : 07/12/2022	
DRAWN: AC	PA/PM: LC	SCALE: N.T.S.

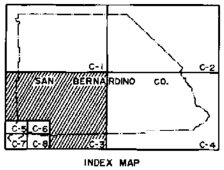
1 OF 1

Appendix B – Soil Map



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

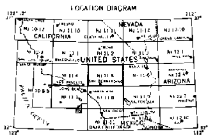


Scale 1:250,000

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

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

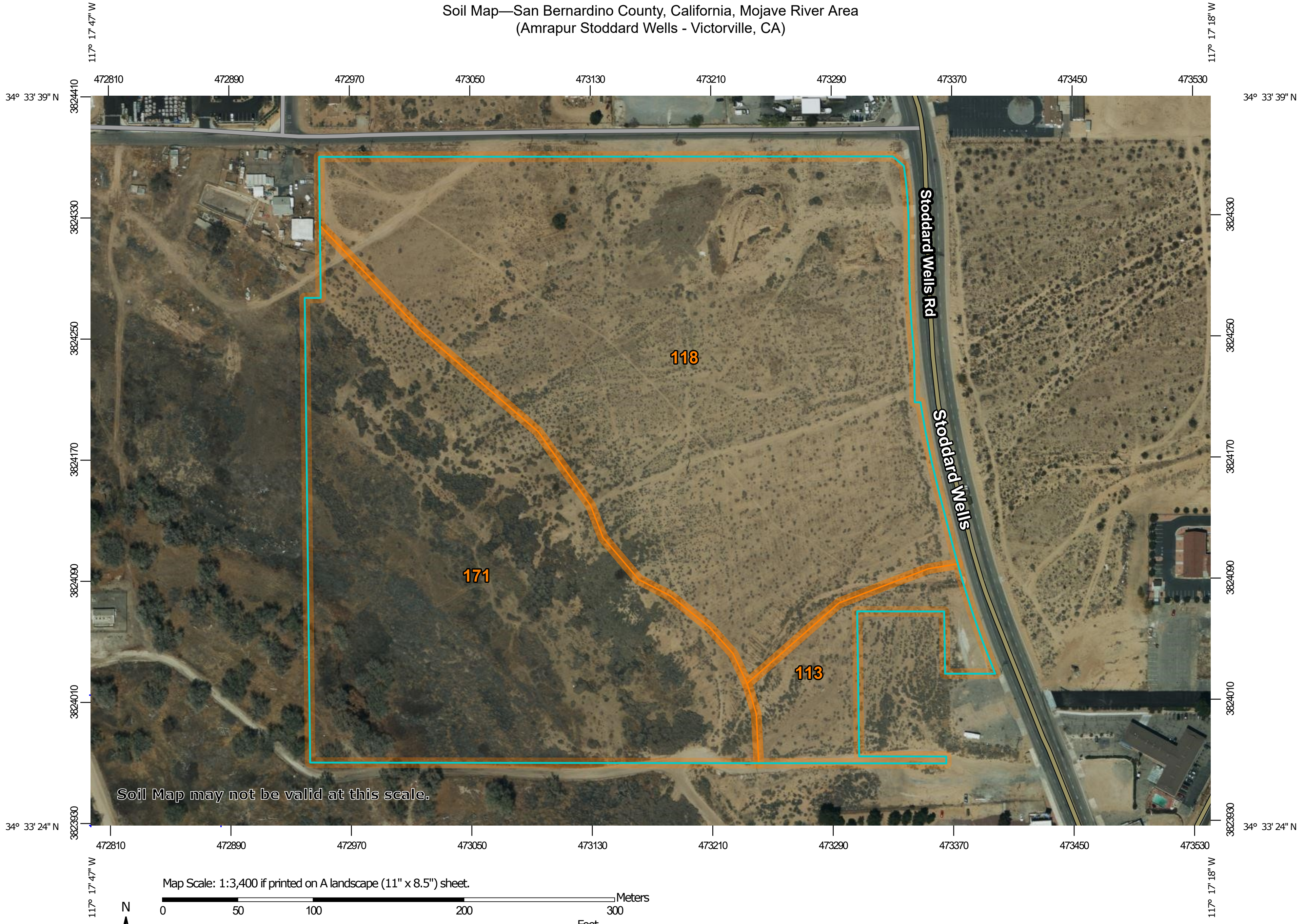
SCALE REDUCED BY 1/2



HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHCENTRAL AREA

FIGURE C-11

Soil Map—San Bernardino County, California, Mojave River Area
(Amrapur Stoddard Wells - Victorville, CA)



Map Scale: 1:3,400 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 13, Sep 13, 2021

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

Date(s) aerial images were photographed: Mar 27, 2021—May 24, 2021

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	2.2	5.5%
118	CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*	22.2	55.8%
171	VILLA LOAMY SAND	15.4	38.7%
Totals for Area of Interest		**39.8**	**100.0%**

San Bernardino County, California, Mojave River Area

113—CAJON SAND, 2 TO 9 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrk
Elevation: 1,800 to 3,500 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 68 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cajon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

A - 0 to 6 inches: sand
C1 - 6 to 25 inches: sand
C2 - 25 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Cajon, gravelly surface
Percent of map unit: 5 percent
Landform: Alluvial fans

Helendale
Percent of map unit: 5 percent
Landform: Alluvial fans
Hydric soil rating: No

Kimberlina
Percent of map unit: 5 percent
Landform: Alluvial fans
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 13, Sep 13, 2021

San Bernardino County, California, Mojave River Area

118—CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*

Map Unit Setting

National map unit symbol: hkrq
Elevation: 2,800 to 3,300 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Cajon, gravelly surface, and similar soils: 55 percent
Arizo and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon, Gravelly Surface

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 6 inches: gravelly sand
H2 - 6 to 60 inches: gravelly sand

Properties and qualities

Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF028CA - COBBLY SANDY
Hydric soil rating: No

Description of Arizo

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 6 inches: gravelly loamy sand
H2 - 6 to 60 inches: extremely gravelly loamy coarse sand

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R030XF025CA - GRAVELLY COARSE LOAMY
Hydric soil rating: No

Minor Components

Helendale

Percent of map unit: 4 percent
Hydric soil rating: No

Bryman

Percent of map unit: 4 percent
Hydric soil rating: No

Joshua

Percent of map unit: 4 percent
Hydric soil rating: No

Cajon, clayey substratum

Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 13, Sep 13, 2021

San Bernardino County, California, Mojave River Area

171—VILLA LOAMY SAND

Map Unit Setting

National map unit symbol: hktf
Elevation: 1,700 to 2,800 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Villa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Villa

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 7 inches: loamy sand
H2 - 7 to 60 inches: stratified sand to fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF034CA - COARSE LOAMY BOTTOM
Hydric soil rating: No

Minor Components

Unnamed soils

Percent of map unit: 10 percent
Hydric soil rating: No

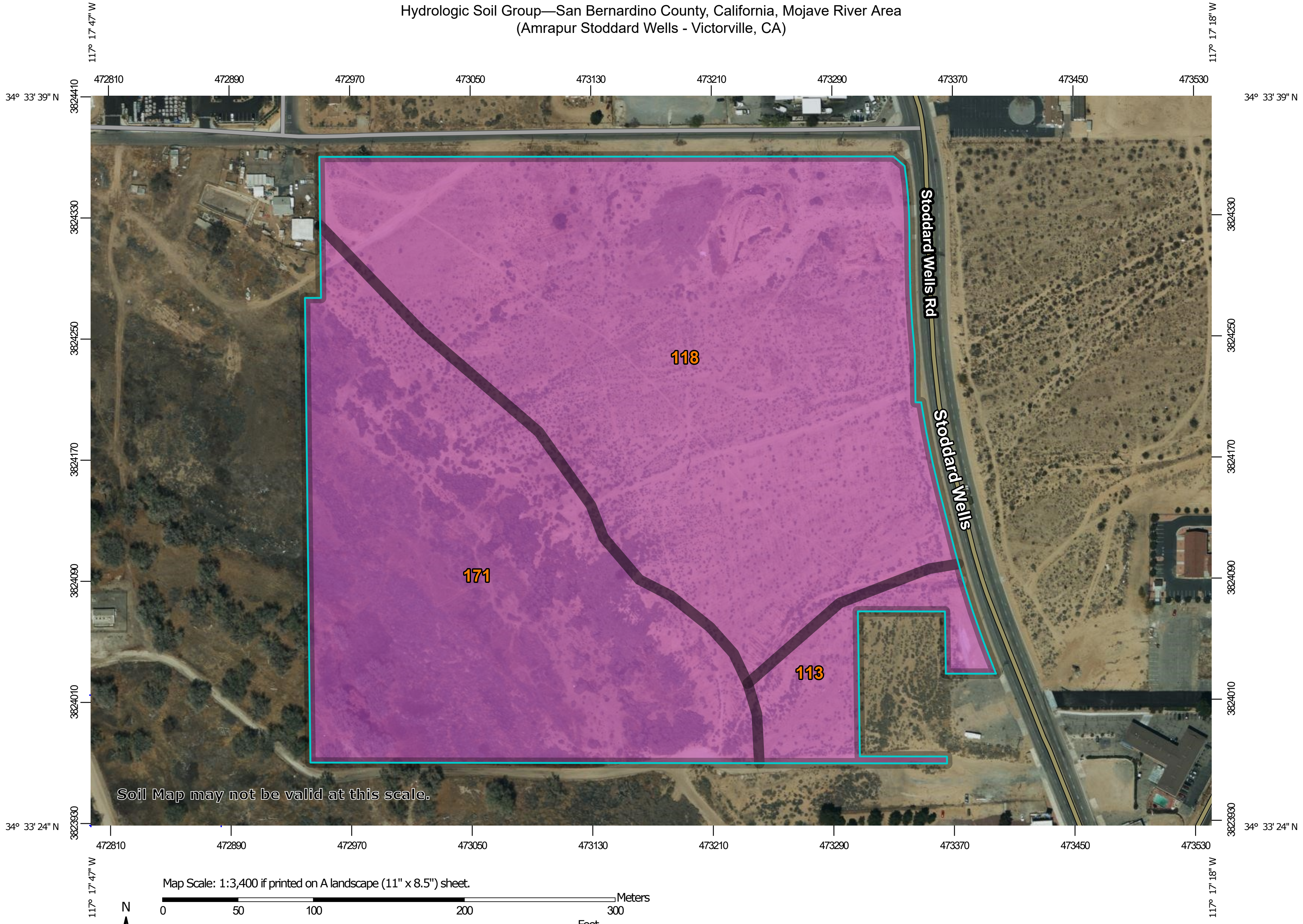
Unnamed

Percent of map unit: 5 percent
Landform: Fan remnants
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 13, Sep 13, 2021

Hydrologic Soil Group—San Bernardino County, California, Mojave River Area
(Amrapur Stoddard Wells - Victorville, CA)



Map Scale: 1:3,400 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

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 13, Sep 13, 2021

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

Date(s) aerial images were photographed: Mar 27, 2021—May 24, 2021

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
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	A	2.2	5.5%
118	CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*	A	22.2	55.8%
171	VILLA LOAMY SAND	A	15.4	38.7%
Totals for Area of Interest			**39.8**	**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.

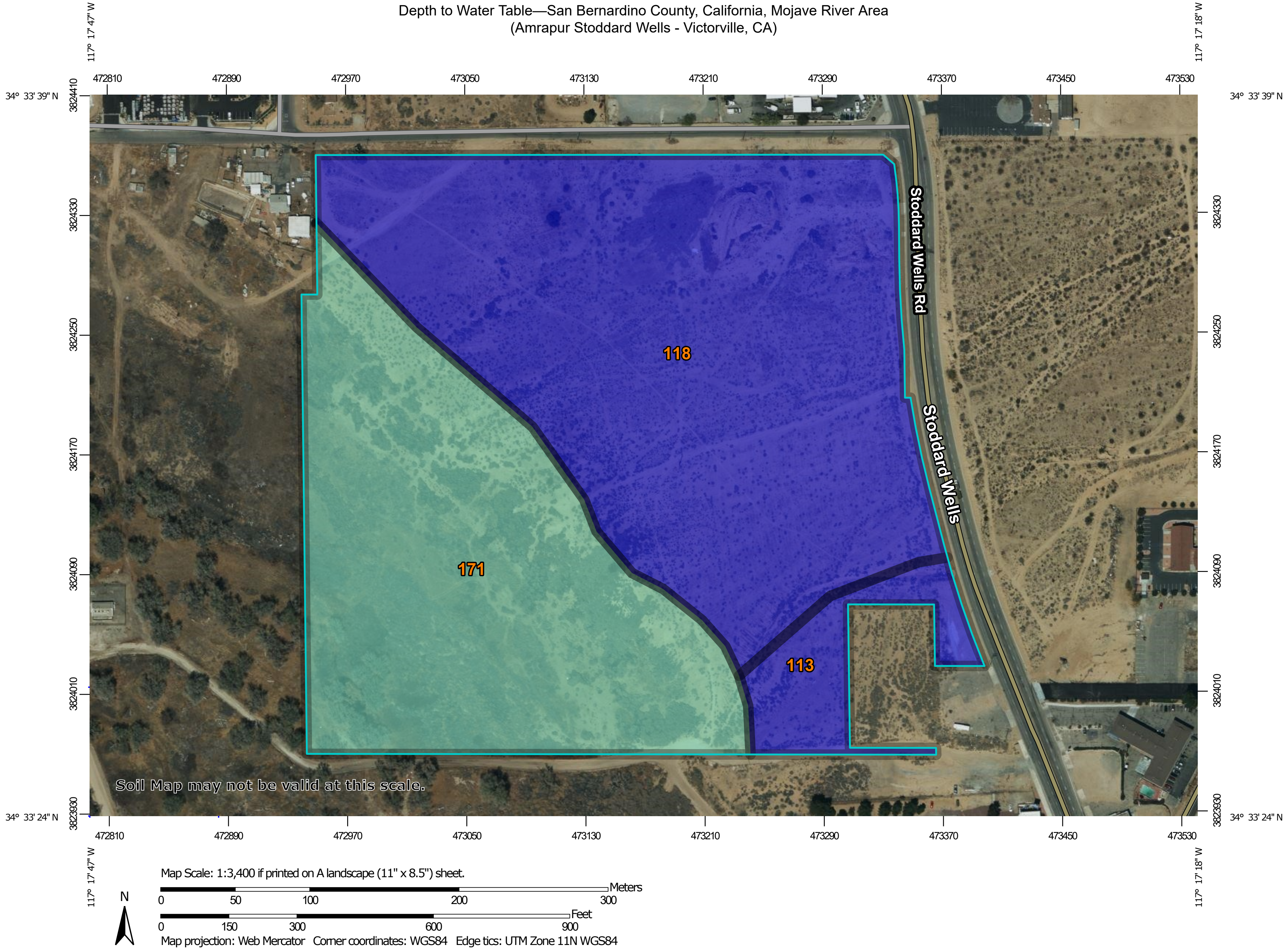
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Depth to Water Table—San Bernardino County, California, Mojave River Area
(Amrapur Stoddard Wells - Victorville, CA)



Depth to Water Table—San Bernardino County, California, Mojave River Area
(Amrapur Stoddard Wells - Victorville, CA)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- 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 13, Sep 13, 2021

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

Date(s) aerial images were photographed: Mar 27, 2021—May 24, 2021

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.

Depth to Water Table

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	>200	2.2	5.5%
118	CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*	>200	22.2	55.8%
171	VILLA LOAMY SAND	137	15.4	38.7%
Totals for Area of Interest			**39.8**	**100.0%**

Description

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

Appendix C – NOAA Atlas 14

NOAA Atlas 14, Volume 6, Version 2 VICTORVILLE
PUMP PT
Station ID: 04-9325
Location name: Victorville, California, USA*
Latitude: 34.535°, Longitude: -117.3058°
Elevation:
Elevation (station metadata): 2858 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	**0.107** (0.088-0.131)	**0.145** (0.119-0.177)	**0.198** (0.163-0.243)	**0.244** (0.199-0.303)	**0.313** (0.247-0.401)	**0.370** (0.286-0.483)	**0.431** (0.325-0.578)	**0.499** (0.366-0.687)	**0.599** (0.421-0.859)	**0.682** (0.464-1.01)
10-min	**0.153** (0.127-0.188)	**0.207** (0.171-0.254)	**0.284** (0.233-0.348)	**0.350** (0.286-0.434)	**0.448** (0.354-0.574)	**0.530** (0.410-0.693)	**0.618** (0.467-0.828)	**0.716** (0.525-0.985)	**0.858** (0.604-1.23)	**0.977** (0.665-1.45)
15-min	**0.185** (0.153-0.227)	**0.251** (0.207-0.307)	**0.343** (0.282-0.421)	**0.424** (0.346-0.525)	**0.542** (0.428-0.694)	**0.641** (0.495-0.838)	**0.748** (0.564-1.00)	**0.866** (0.635-1.19)	**1.04** (0.731-1.49)	**1.18** (0.804-1.76)
30-min	**0.243** (0.201-0.298)	**0.329** (0.271-0.403)	**0.450** (0.370-0.553)	**0.556** (0.453-0.688)	**0.711** (0.561-0.910)	**0.840** (0.650-1.10)	**0.981** (0.740-1.31)	**1.14** (0.833-1.56)	**1.36** (0.958-1.95)	**1.55** (1.06-2.30)
60-min	**0.276** (0.228-0.338)	**0.373** (0.308-0.457)	**0.511** (0.420-0.627)	**0.631** (0.515-0.782)	**0.808** (0.637-1.03)	**0.954** (0.738-1.25)	**1.11** (0.840-1.49)	**1.29** (0.946-1.77)	**1.55** (1.09-2.22)	**1.76** (1.20-2.61)
2-hr	**0.383** (0.316-0.469)	**0.510** (0.421-0.626)	**0.688** (0.566-0.845)	**0.840** (0.685-1.04)	**1.06** (0.837-1.36)	**1.24** (0.958-1.62)	**1.43** (1.08-1.92)	**1.64** (1.20-2.26)	**1.94** (1.36-2.78)	**2.18** (1.48-3.24)
3-hr	**0.451** (0.372-0.551)	**0.599** (0.493-0.733)	**0.802** (0.659-0.985)	**0.975** (0.795-1.21)	**1.22** (0.965-1.57)	**1.42** (1.10-1.86)	**1.63** (1.23-2.19)	**1.86** (1.36-2.56)	**2.18** (1.54-3.13)	**2.44** (1.66-3.62)
6-hr	**0.604** (0.498-0.739)	**0.802** (0.661-0.983)	**1.07** (0.880-1.32)	**1.30** (1.06-1.60)	**1.61** (1.27-2.06)	**1.86** (1.44-2.43)	**2.12** (1.60-2.84)	**2.39** (1.75-3.29)	**2.77** (1.95-3.98)	**3.08** (2.09-4.57)
12-hr	**0.769** (0.635-0.942)	**1.03** (0.851-1.26)	**1.38** (1.13-1.70)	**1.66** (1.36-2.06)	**2.06** (1.62-2.63)	**2.36** (1.82-3.08)	**2.67** (2.01-3.57)	**2.99** (2.19-4.11)	**3.42** (2.41-4.91)	**3.77** (2.56-5.59)
24-hr	**0.981** (0.870-1.13)	**1.33** (1.18-1.54)	**1.79** (1.58-2.07)	**2.16** (1.90-2.52)	**2.67** (2.26-3.21)	**3.05** (2.53-3.75)	**3.43** (2.78-4.33)	**3.83** (3.02-4.96)	**4.36** (3.30-5.89)	**4.77** (3.49-6.67)
2-day	**1.12** (0.990-1.29)	**1.54** (1.37-1.78)	**2.10** (1.86-2.43)	**2.56** (2.24-2.98)	**3.18** (2.69-3.82)	**3.65** (3.03-4.49)	**4.14** (3.35-5.21)	**4.64** (3.66-6.01)	**5.32** (4.02-7.18)	**5.85** (4.27-8.17)
3-day	**1.22** (1.08-1.40)	**1.70** (1.50-1.95)	**2.32** (2.05-2.68)	**2.84** (2.49-3.31)	**3.54** (3.00-4.27)	**4.09** (3.40-5.03)	**4.65** (3.77-5.86)	**5.23** (4.12-6.77)	**6.01** (4.55-8.12)	**6.63** (4.84-9.26)
4-day	**1.30** (1.15-1.49)	**1.81** (1.60-2.08)	**2.48** (2.19-2.86)	**3.03** (2.65-3.52)	**3.77** (3.20-4.54)	**4.35** (3.61-5.35)	**4.94** (4.00-6.22)	**5.54** (4.37-7.18)	**6.37** (4.81-8.60)	**7.01** (5.12-9.79)
7-day	**1.40** (1.25-1.62)	**1.93** (1.71-2.23)	**2.62** (2.31-3.02)	**3.17** (2.78-3.69)	**3.92** (3.32-4.72)	**4.49** (3.72-5.51)	**5.06** (4.10-6.37)	**5.64** (4.45-7.31)	**6.43** (4.86-8.68)	**7.03** (5.14-9.83)
10-day	**1.48** (1.32-1.71)	**2.03** (1.80-2.34)	**2.73** (2.41-3.16)	**3.30** (2.89-3.84)	**4.05** (3.43-4.88)	**4.62** (3.83-5.68)	**5.19** (4.20-6.53)	**5.77** (4.54-7.47)	**6.53** (4.94-8.82)	**7.12** (5.20-9.95)
20-day	**1.70** (1.51-1.95)	**2.34** (2.08-2.70)	**3.18** (2.81-3.67)	**3.85** (3.37-4.48)	**4.75** (4.03-5.72)	**5.44** (4.51-6.68)	**6.13** (4.96-7.72)	**6.83** (5.38-8.84)	**7.76** (5.87-10.5)	**8.48** (6.19-11.8)
30-day	**1.91** (1.69-2.20)	**2.67** (2.36-3.07)	**3.67** (3.24-4.24)	**4.49** (3.94-5.23)	**5.62** (4.76-6.77)	**6.50** (5.39-7.99)	**7.39** (5.99-9.31)	**8.32** (6.55-10.8)	**9.58** (7.24-12.9)	**10.6** (7.72-14.8)
45-day	**2.19** (1.95-2.52)	**3.11** (2.76-3.58)	**4.36** (3.85-5.04)	**5.42** (4.75-6.32)	**6.92** (5.87-8.34)	**8.13** (6.75-9.99)	**9.39** (7.61-11.8)	**10.7** (8.46-13.9)	**12.6** (9.55-17.1)	**14.2** (10.4-19.8)
60-day	**2.37** (2.10-2.73)	**3.39** (3.00-3.91)	**4.83** (4.26-5.58)	**6.08** (5.32-7.08)	**7.90** (6.70-9.51)	**9.41** (7.81-11.6)	**11.0** (8.94-13.9)	**12.8** (10.1-16.6)	**15.4** (11.6-20.8)	**17.5** (12.8-24.5)

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

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

Please refer to NOAA Atlas 14 document for more information.

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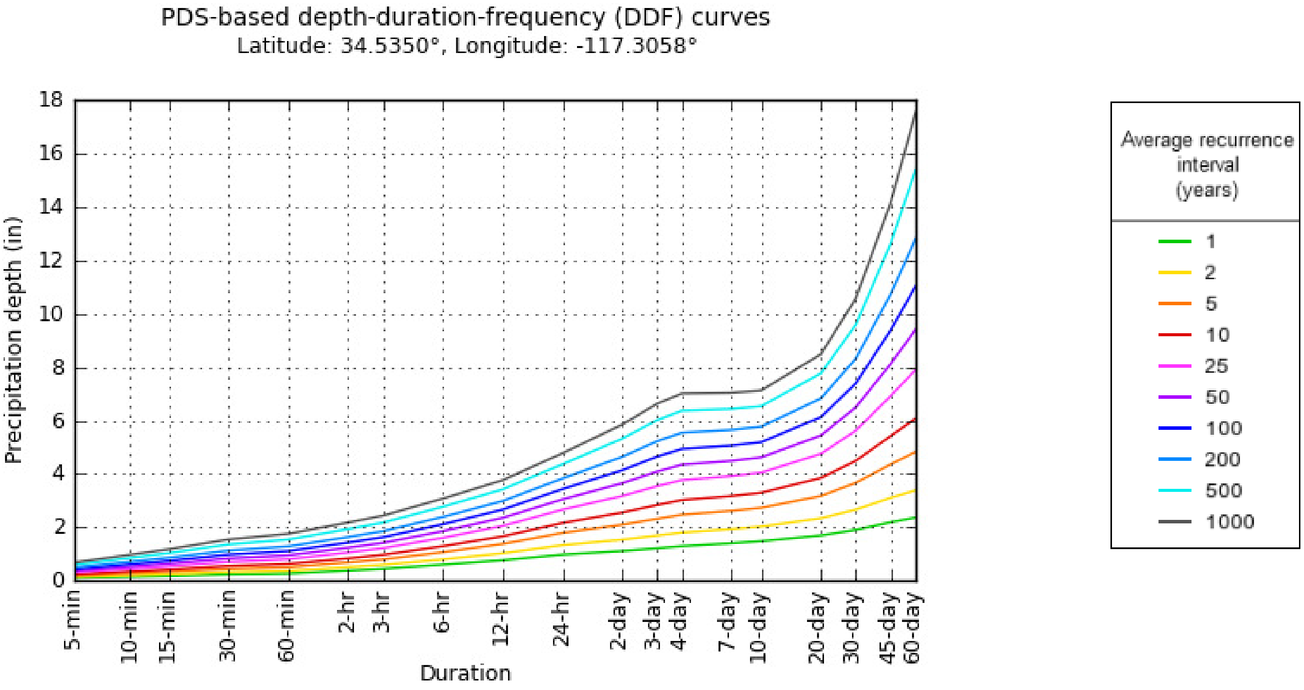
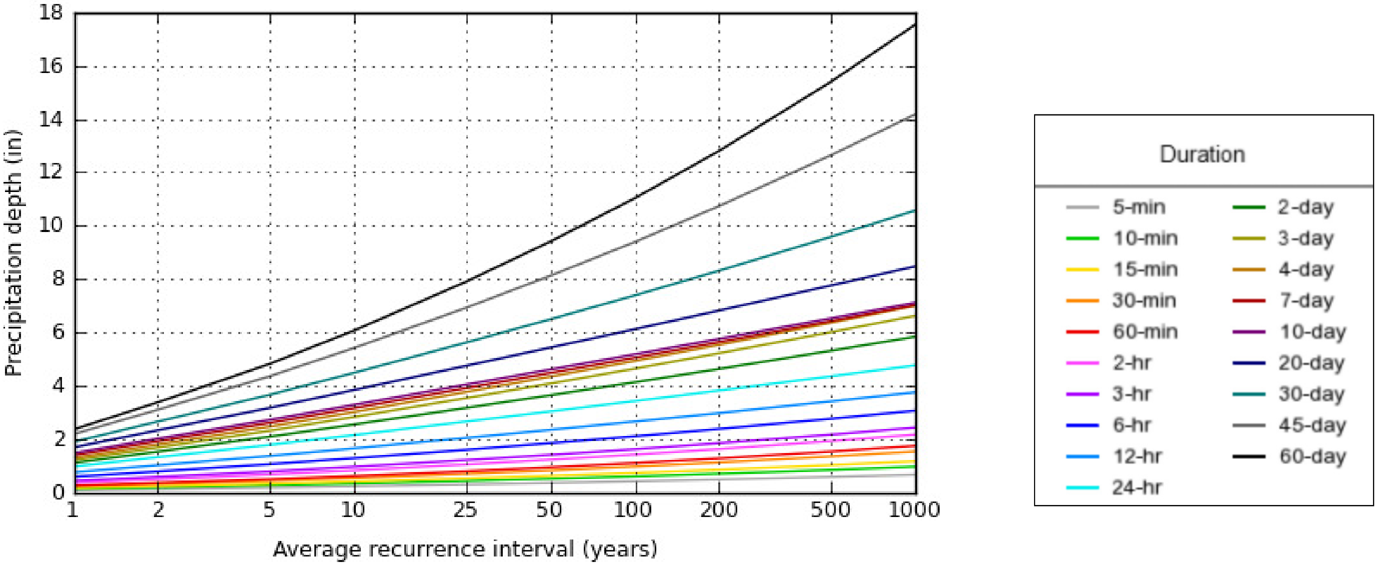
PF graphical





NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Mon Nov 22 19:50:59 2021

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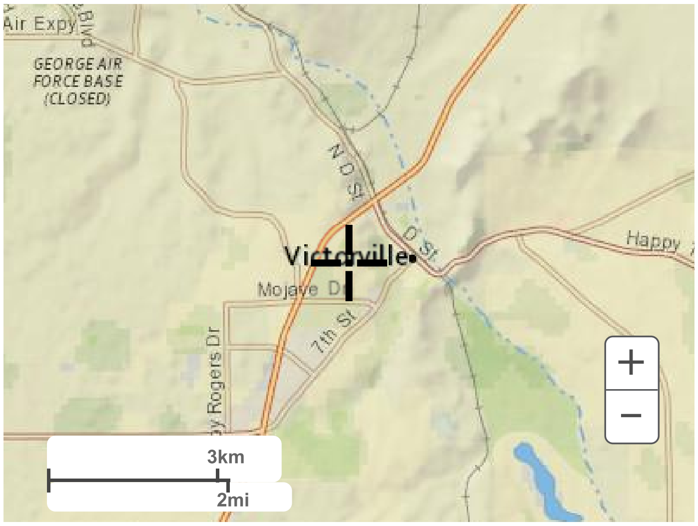
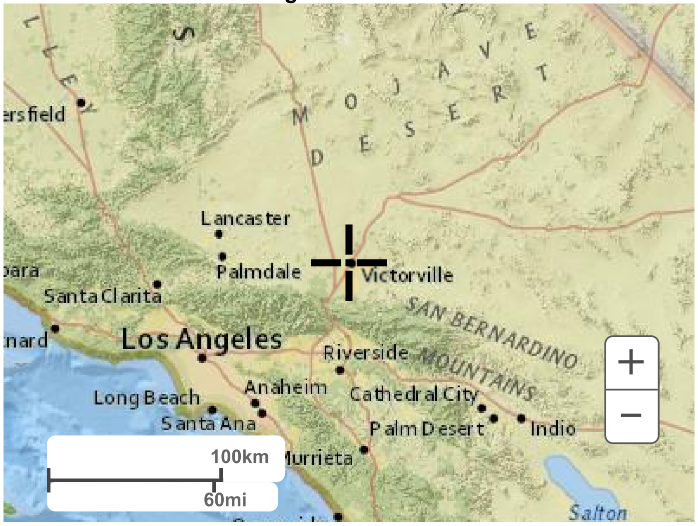
Maps & aerials

Small scale terrain



Large scale terrain



Large scale map

Large scale aerial

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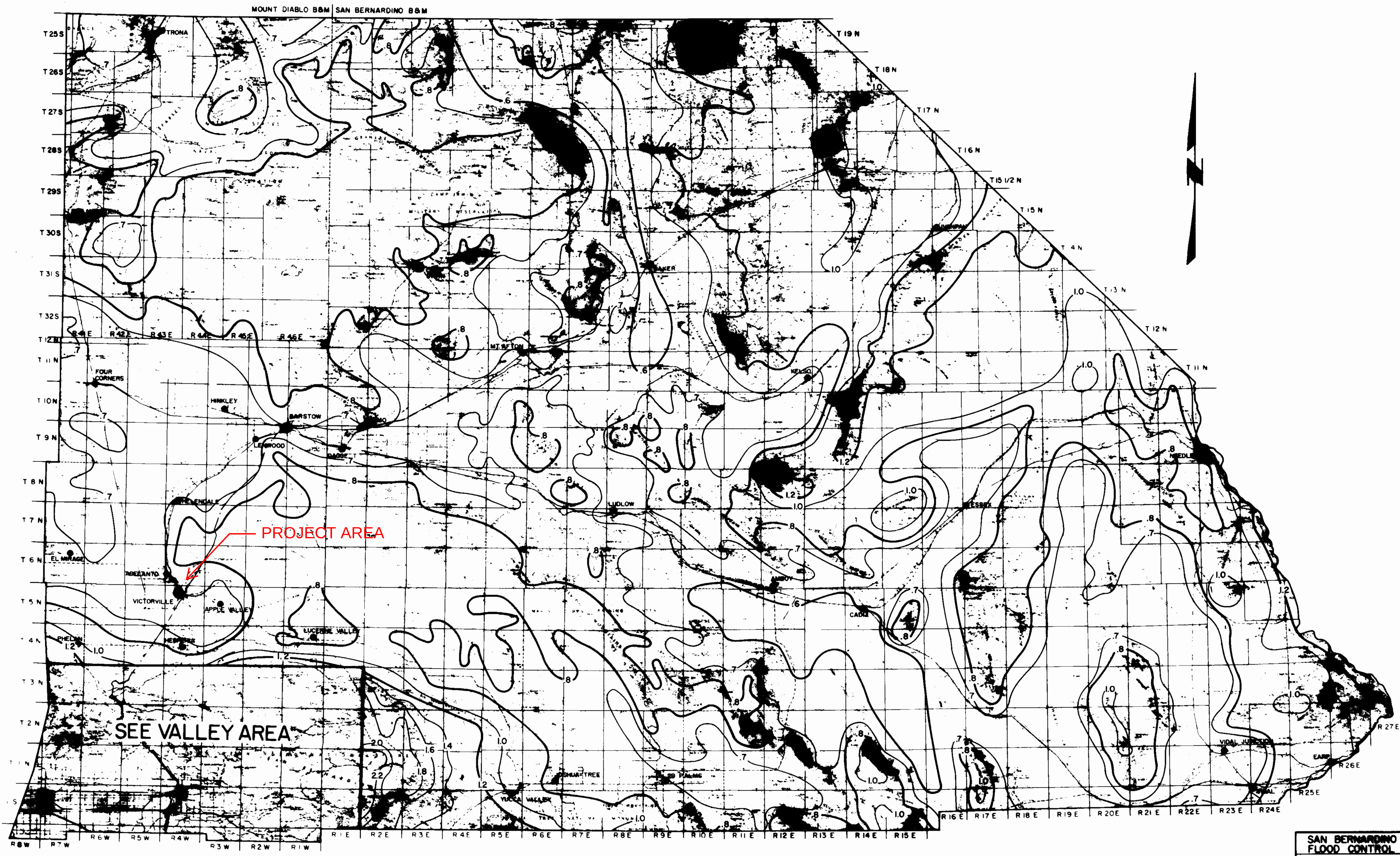
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Appendix D – San Bernardino County Hydrology Manual Isohyetal Maps – Desert Area



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

REDUCED DRAWING

0 1 2 3

3 INCHES ON ORIGINAL

LEGEND:

1.0 ISOLINES PRECIPITATION (INCHES)

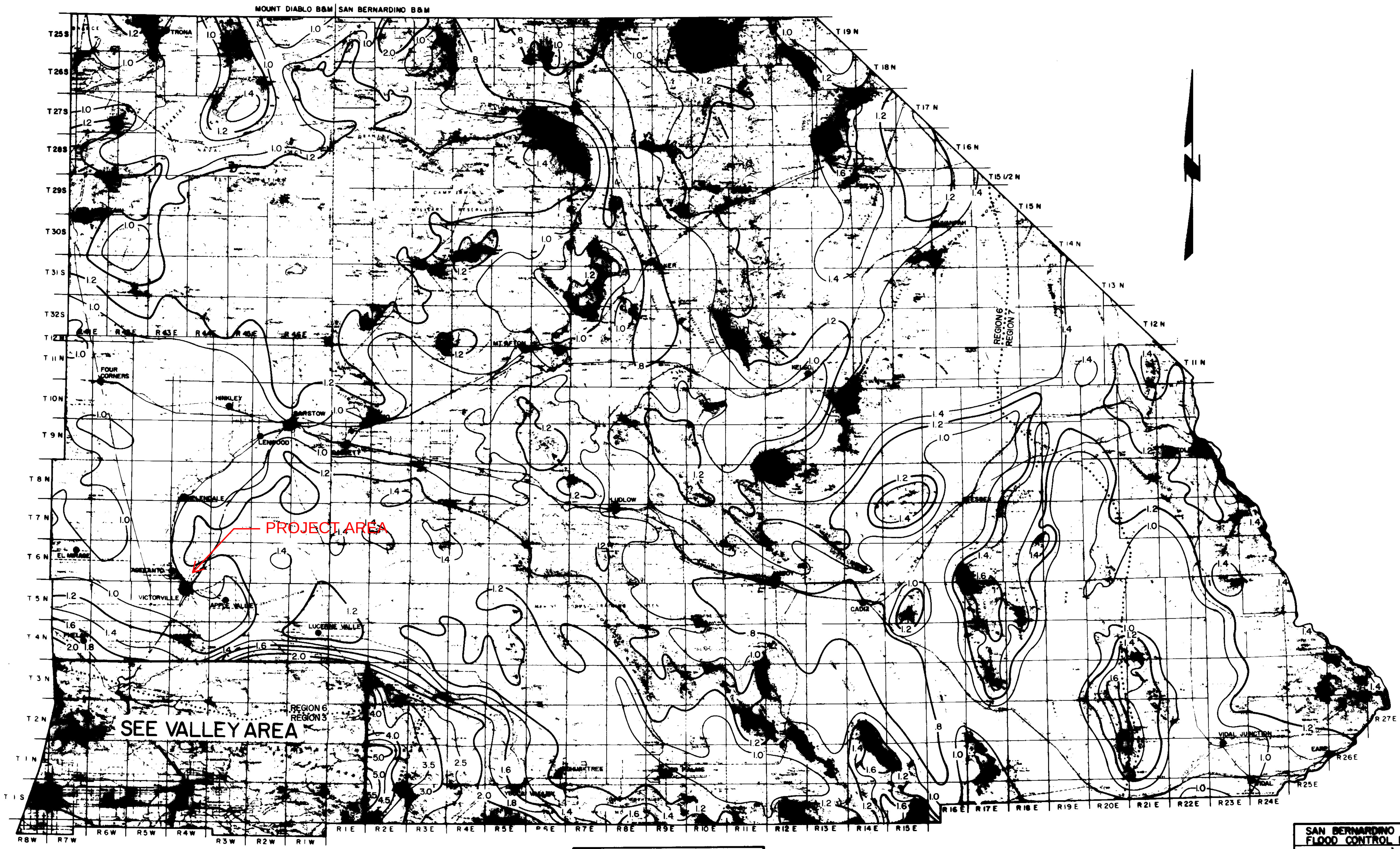
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

DESERT AREA
ISOHYETALS
X_1 - 2 YEAR 6 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY
FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DWG. NO.
1982	1" = 6 MI.	WRD-1	7 of 12

FIGURE B-7



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

REDUCED DRAWING

0 1 2 3

3 INCHES ON ORIGINAL

LEGEND:

1.2 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

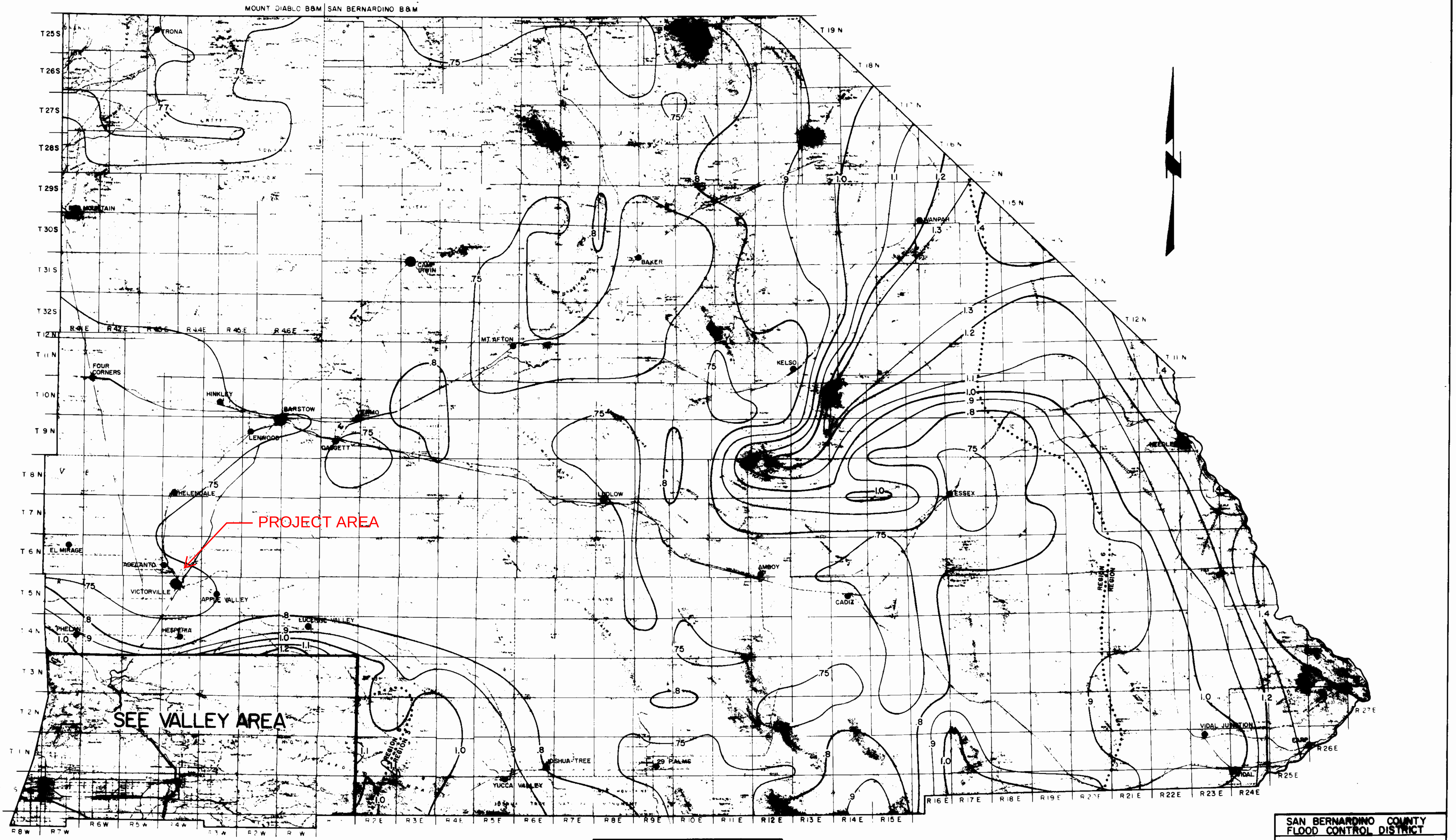
DESERT AREA

ISOHYETALS
X_2 - 2 YEAR 24 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY B. A. [illegible]
FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DWG. NO.
1982	1" = 6 Mi.	WRD-1	8 of 12

FIGURE B-8



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

REDUCED DRAWING

0 1 2 3

3 INCHES ON ORIGINAL

LEGEND:

3.5 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

DESERT AREA

ISOHYETALS

Y_{10} - 10 YEAR 1 HOUR

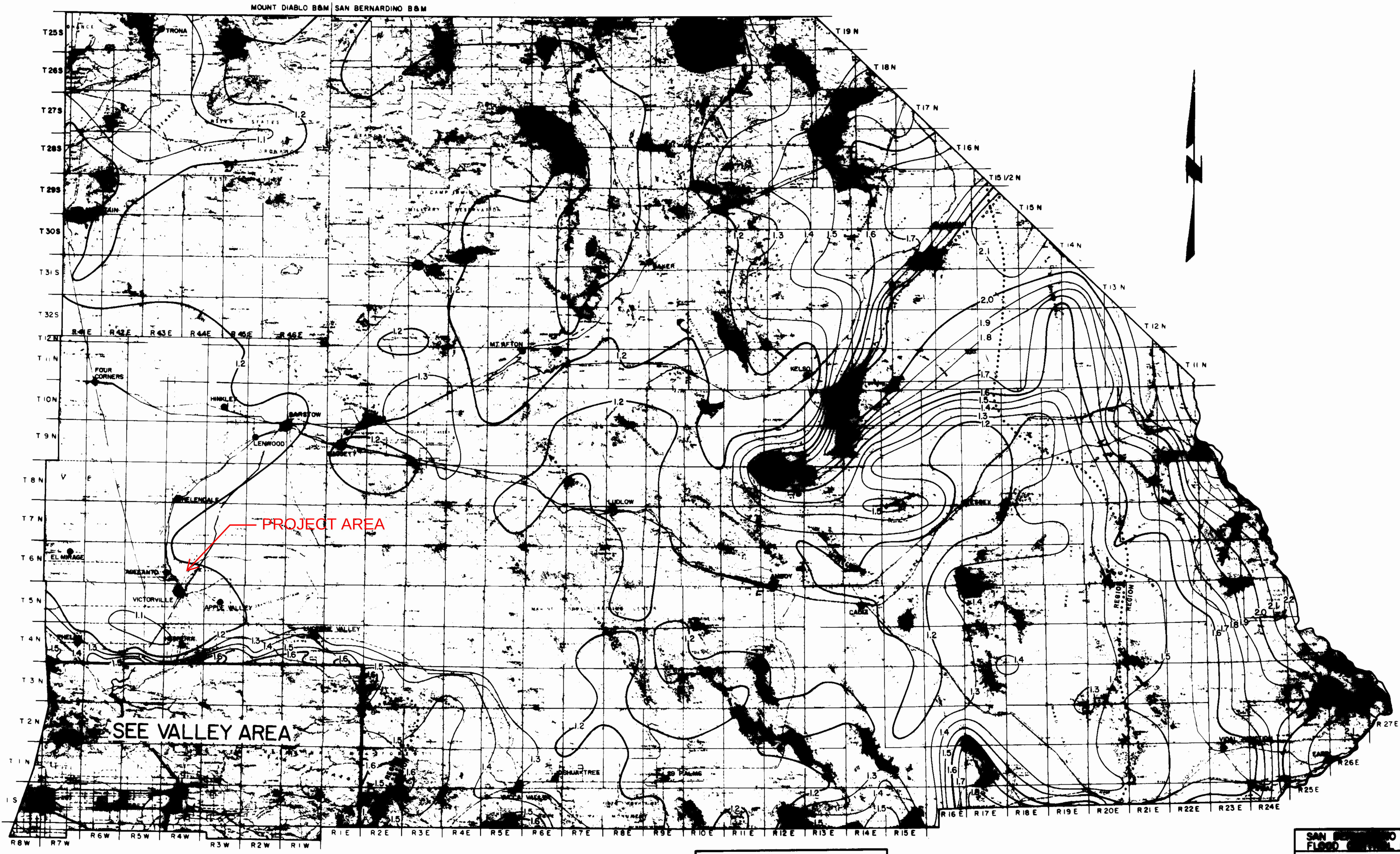
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY

FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1" = 6MI.	WRD-1	9 of 12

FIGURE B-9



REDUCED DRAWING

0 1 2 3

3 INCHES ON ORIGINAL

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

LEGEND:

1.2 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

DESERT AREA

ISOHYETALS

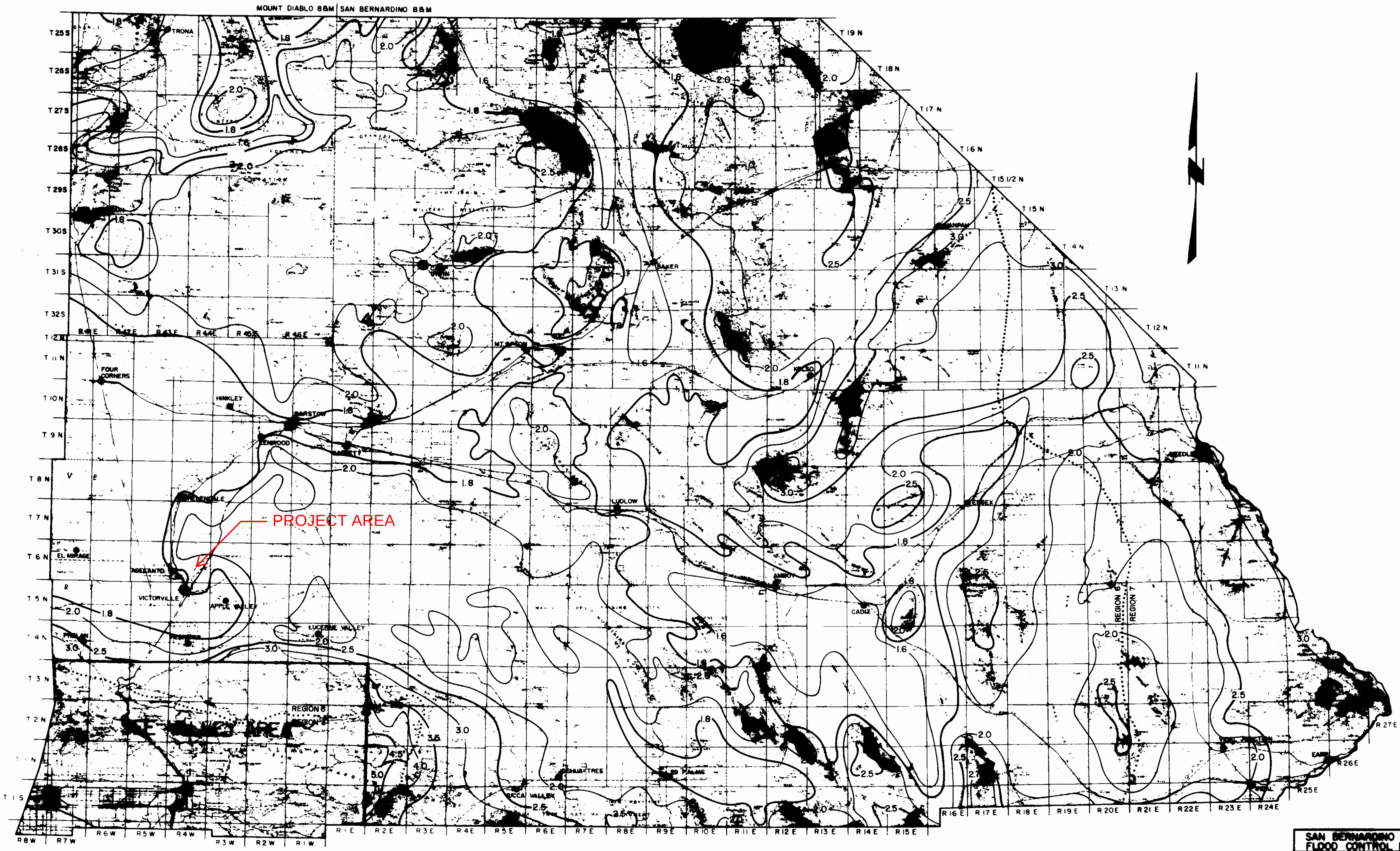
Y_{100}-100 YEAR 1 HOUR

BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY

DATE	SCALE	
1982	1" = [illegible]	[illegible]

FIGURE B-10



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

REDUCED DRAWING

0 1 2 3

3 INCHES ON ORIGINAL

LEGEND:

2.0 ISOLINES PRECIPITATION (INCHES)

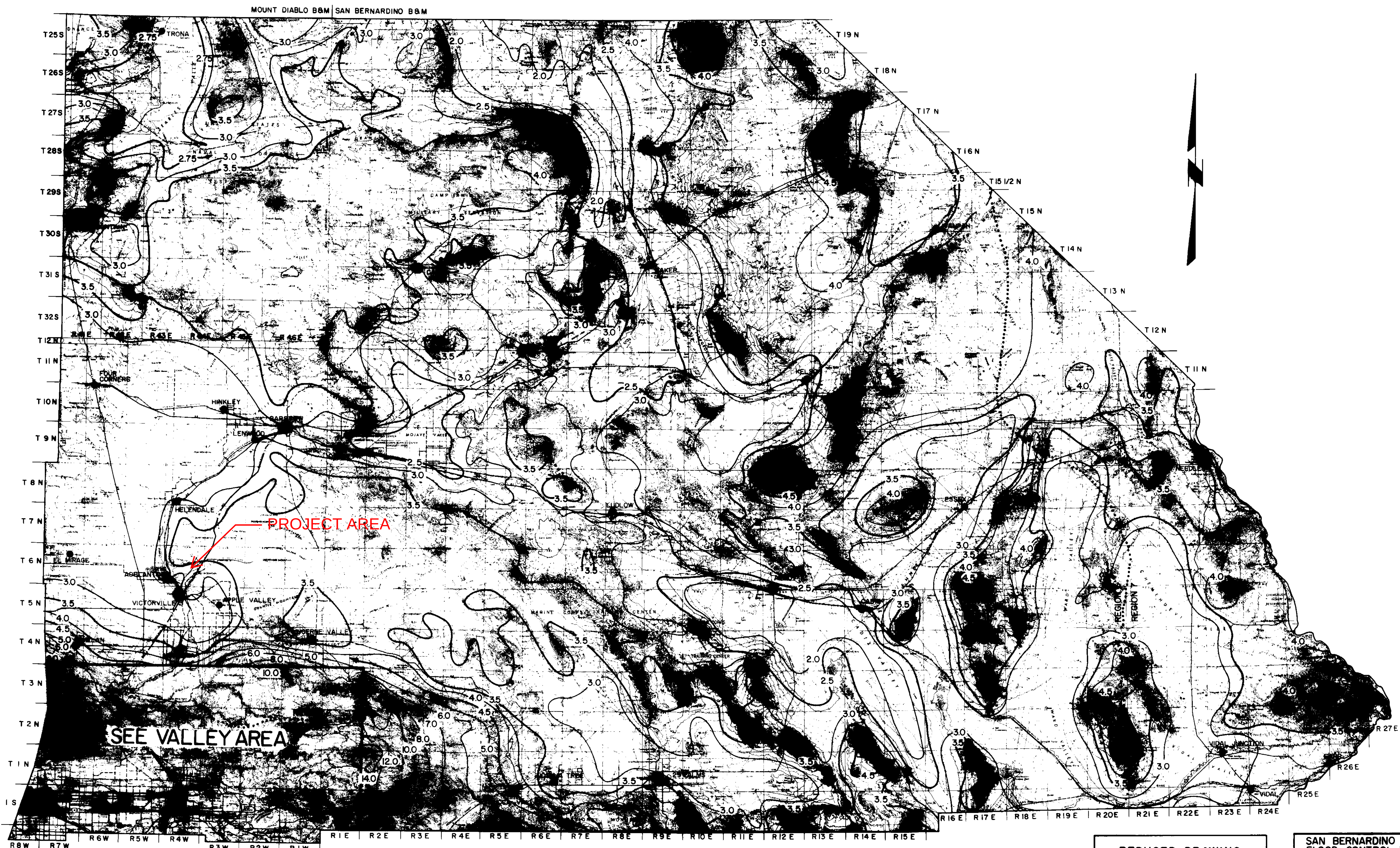
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

DESERT AREA
ISOHYETALS
X_3 -100 YEAR 6 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY B. A. Bergman
FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1" = 6 MI.	WRD-1	11 of 12

FIGURE B-11



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

REDUCED DRAWING

0 1 2 3

3 INCHES ON ORIGINAL

LEGEND:

3.5 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

DESERT AREA

ISOHYETALS

X_4 -100 YEAR 24 HOUR

BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY B. [illegible]

FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1" = 6 Mi.	WRD-1	12 of 12

FIGURE B-12

Appendix E – Existing Condition Hydrology Exhibit

CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

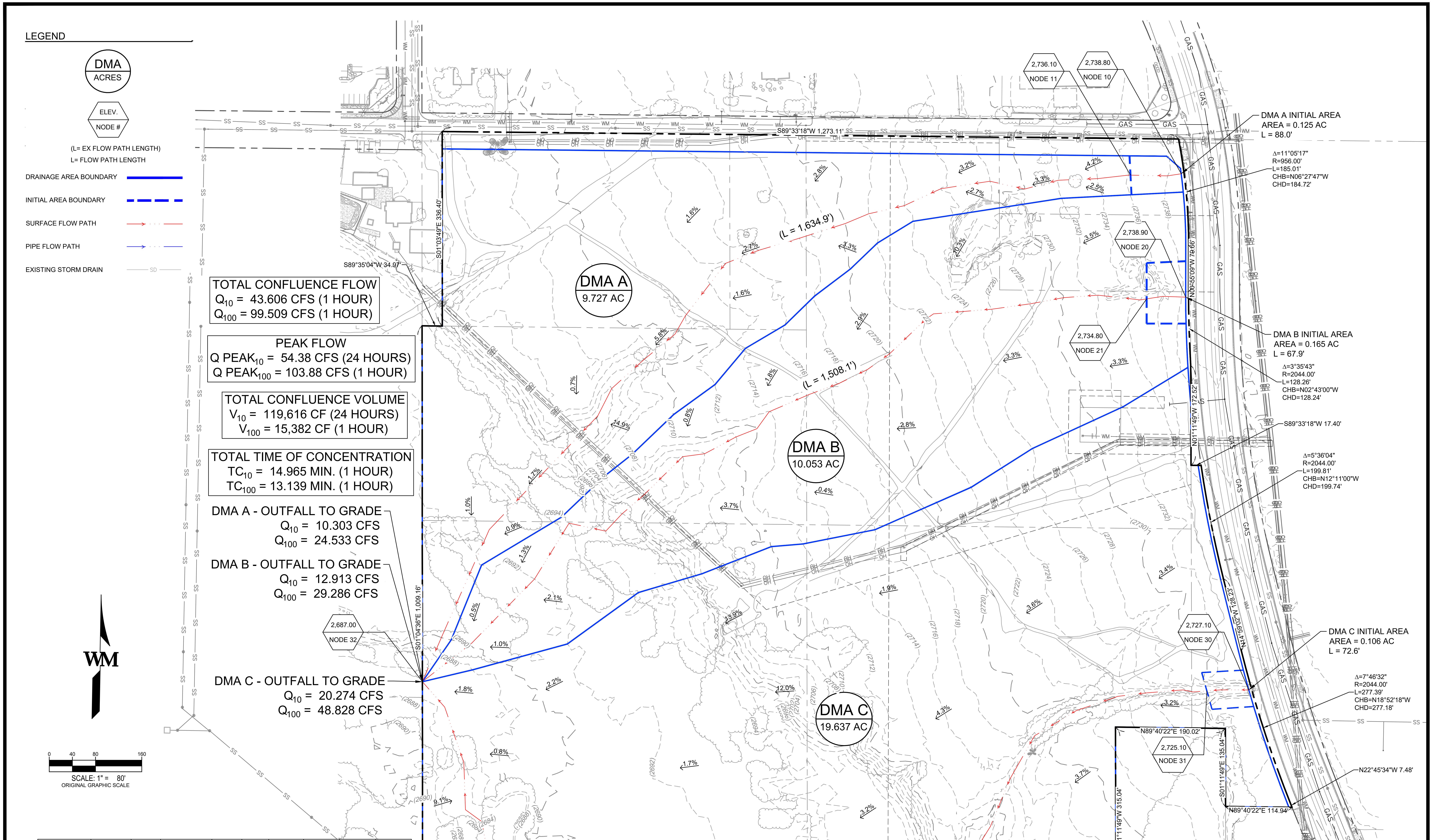
LEGEND

DMA / ACRES

ELEV. / NODE #

(L= EX FLOW PATH LENGTH)
L= FLOW PATH LENGTH

DRAINAGE AREA BOUNDARY
INITIAL AREA BOUNDARY
SURFACE FLOW PATH
PIPE FLOW PATH
EXISTING STORM DRAIN



TOTAL CONFLUENCE FLOW
Q_{10} = 43.606 CFS (1 HOUR)
Q_{100} = 99.509 CFS (1 HOUR)

PEAK FLOW
Q $PEAK_{10}$ = 54.38 CFS (24 HOURS)
Q $PEAK_{100}$ = 103.88 CFS (1 HOUR)

TOTAL CONFLUENCE VOLUME
V_{10} = 119,616 CF (24 HOURS)
V_{100} = 15,382 CF (1 HOUR)

TOTAL TIME OF CONCENTRATION
TC_{10} = 14.965 MIN. (1 HOUR)
TC_{100} = 13.139 MIN. (1 HOUR)

DMA A - OUTFALL TO GRADE
Q_{10} = 10.303 CFS
Q_{100} = 24.533 CFS

DMA B - OUTFALL TO GRADE
Q_{10} = 12.913 CFS
Q_{100} = 29.286 CFS

DMA C - OUTFALL TO GRADE
Q_{10} = 20.274 CFS
Q_{100} = 48.828 CFS

0 40 80 160
SCALE: 1" = 80'
ORIGINAL GRAPHIC SCALE

DMA	AREA (ACRES)	L (FT)	ELEVATION Δ (FT)	Tc_{10} (MIN) 1-HR	Tc_{100} (MIN) 1-HR	Q_{10} (CFS) 1-HR	Q_{100} (CFS) 1-HR	V_{10} (CF) 24-HR	V_{100} (CF) 1-HR
DMA A INITIAL	0.125	88.0	2.7	6.318	6.318	0.343	0.620	375	48
DMA A	9.727	1634.9	49.1	11.710	9.460	9.960	23.913	29,224	3,758
DMA A TOTAL (STREAM 1)	9.852	1722.9	51.8	18.028	15.778	10.303	24.533	29,599	3,806
DMA B INITIAL	0.165	67.9	4.1	4.974	4.974	0.551	0.975	496	64
DMA B	10.053	1508.1	47.8	9.990	8.160	12.363	28.311	30,204	3,884
DMA B TOTAL (STREAM 2)	10.218	1576.0	51.9	14.964	13.134	12.913	29.286	30,700	3,948
DMA C INITIAL	0.106	72.6	2.0	5.977	5.977	0.304	0.548	319	41
DMA C	19.637	1787.7	38.1	12.360	9.940	19.970	48.280	58,998	7,587
DMA C TOTAL (STREAM 3)	19.743	1860.3	40.1	18.337	15.917	20.274	48.828	59,317	7,628
TOTAL AFTER CONFLUENCE OF STREAMS	39.813	-	-	14.965	13.139	43.606	99.509	119,616	15,382

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LUCAS A. CORSBIE
No. 72588
Jul 20, 2022

FOR AND ON BEHALF
OF WARE MALCOMB

VICTORVILLE
16716 STODDARD WELLS ROAD
VICTORVILEE, CA 92307

EXISTING HYDROLOGY
EXHIBIT

NO.	DATE	REMARKS

JOB NO.:	IRV21-0068
PA / PM:	LC
DRAWN BY:	AC
DATE:	07/12/2022
PLOT DATE:	

SHEET
1
Sheet 1 of 1

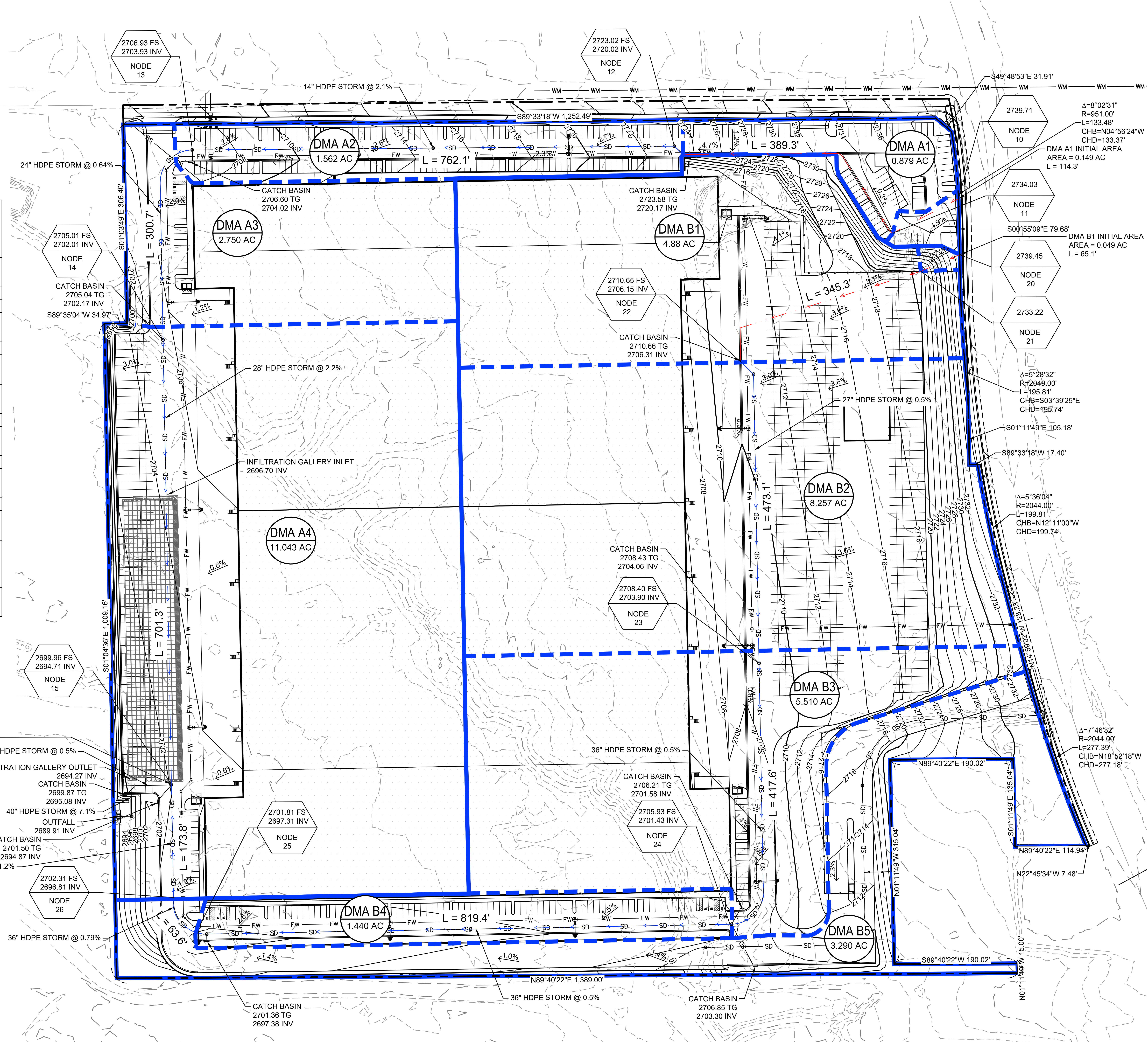
Appendix F – Proposed Condition Hydrology Exhibit

CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

SCALE: 1" = 80'
ORIGINAL GRAPHIC SCALE

DMA	AREA (ACRES)	L (FT)	ELEVATION Δ (FT)	Tc_{10} (MIN) 1-HR	Tc_{100} (MIN) 1-HR	Q_{10} (CFS) 1-HR	Q_{100} (CFS) 1-HR	V_{10} (CF) 24-HR	V_{100} (CF) 1-HR
DMA A1 INITIAL AREA	0.149	114.3	5.68	3.688	3.688	0.696	1.123	481	13
DMA A1	0.879	389.2	11.01	2.110	1.870	2.774	4.676	2,834	74
DMA A2	1.562	762.1	16.09	1.802	1.580	3.728	6.437	5,037	133
DMA A3	2.750	300.7	1.92	0.940	0.840	6.444	11.081	8,868	233
DMA A4	11.043	701.3	7.30	1.760	1.570	22.882	39.643	35,609	934
DMA A TOTAL (STREAM 1)	16.383	2,267.6	45.00	10.300	9.540	36.523	62.960	52,829	1,387
DMA B1 INITIAL AREA	0.049	65.1	6.23	2.583	2.583	0.295	0.475	158	4
DMA B1	4.880	345.3	22.57	1.330	1.170	21.760	36.213	15,736	413
DMA B2	8.257	473.1	2.25	1.240	1.090	26.420	45.257	26,625	698
DMA B3	5.510	417.6	2.47	0.840	0.730	13.171	23.219	17,767	466
DMA B4	1.440	819.4	4.12	1.640	1.430	0	0	4,643	122
DMA B5	3.290	63.6	2.60	0.400	0.350	2.616	5.784	10,609	278
DMA B TOTAL (STREAM 2)	23.426	2,357.9	44.74	8.030	7.360	64.262	110.949	75,551	1,981
TOTAL AFTER CONFLUENCE OF STREAMS	39.813	-	-	8.031	7.364	98.370	169.39	128,380	3,367

NOTE: THESE VALUES DO NOT TAKE INTO ACCOUNT THE EFFECTS OF CONFLUENCING, WHICH IS USED TO DETERMINE THE ULTIMATE DISCHARGE AT THE SITE'S OUTFALL.



LEGEND

SUBAREA
ACRES

ELEV.
NODE #

(L= EX FLOW PATH LENGTH)
L= FLOW PATH LENGTH

DRAINAGE AREA BOUNDARY	▬
INITIAL AREA BOUNDARY	▬ ▬
SURFACE FLOW PATH	→
PIPE FLOW PATH	→
EXISTING STORM DRAIN	SD
PROPOSED STORM DRAIN	▭
PROPOSED STORM JUNCTION STRUCTURE	⊡
PROPOSED STORM INLET	▭
PROPOSED STORM OUTLET	▷
LIGHT	☼

TOTAL CONFLUENCE FLOW
Q_{10} = 98.370 CFS (24 HOURS)
Q_{100} = 169.390 CFS (1 HOUR)

TOTAL CONFLUENCE VOLUME
V_{10} = 247,996 CF (24 HOURS)
V_{100} = 18,749 CF (1 HOUR)

TOTAL TIME OF CONCENTRATION
TC_{10} = 8.031 MIN. (24 HOURS)
TC_{100} = 7.364 MIN. (1 HOUR)

PEAK FLOW
Q $PEAK_{10}$ = 88.290 CFS (24 HOURS)
Q $PEAK_{100}$ = 149.700 CFS (1 HOUR)

TOTAL VOLUME DETAINED IN INFILTRATION GALLERY
V_{10} = 128,380 CF (24 HOURS)
V_{100} = 3,367 CF (1 HOUR)

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CIVIL
Jul 20, 2022

FOR AND ON BEHALF OF WARE MALCOMB

VICTORVILLE
16716 STODDARD WELLS ROAD
VICTORVILLE, CA 92307

PROPOSED HYDROLOGY EXHIBIT

NO.	DATE	REMARKS

JOB NO.:	IRV21-0068
PA / PM:	LC
DRAWN BY:	AC
DATE:	07/12/2022
PLOT DATE:	

SHEET
1
Sheet 1 of 1

Appendix G – Existing Condition Hydrologic Calculations (Rational Method, Unit Hydrograph)

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
        Rational Hydrology Study        Date: 02/17/22
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE EXISTING HYDROLOGY CALCULATIONS
10 YEAR 1 HOUR
RATIONAL METHOD
------------------------------------------------------------------------

Program License Serial Number 6350

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.750 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** 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 =    88.000(Ft.)
Top (of initial area) elevation =  2738.800(Ft.)
Bottom (of initial area) elevation =  2736.100(Ft.)
Difference in elevation =     2.700(Ft.)
Slope =    0.03068  s(%)=       3.07
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.318 min.
Rainfall intensity =      3.625(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.756
Subarea runoff =      0.343(CFS)
Total initial stream area =        0.125(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      11.000 to Point/Station      32.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   2.327(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00             2.00
        2            100.00             0.00
        3            200.00             2.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =      5.369(CFS)
  '     '        flow top width =     21.480(Ft.)
  '     '    velocity=    2.327(Ft/s)
  '     '        area =      2.307(Sq.Ft)
  '     '        Froude number =     1.251

Upstream point elevation =  2736.100(Ft.)
Downstream point elevation =  2687.000(Ft.)
Flow length =  1634.900(Ft.)
Travel time  =   11.71 min.
Time of concentration =   18.03 min.
Depth of flow =   0.215(Ft.)
Average velocity =   2.327(Ft/s)
Total irregular channel flow =     5.369(CFS)
Irregular channel normal depth above invert elev. =   0.215(Ft.)
Average velocity of channel(s) =   2.327(Ft/s)
 Adding area flow to channel
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)
Rainfall intensity =      1.740(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.601
Subarea runoff =      9.960(CFS) for    9.727(Ac.)
Total runoff =     10.303(CFS)
Effective area this stream =        9.85(Ac.)
Total Study Area (Main Stream No. 1) =        9.85(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.274(Ft.), Average velocity =   2.739(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       32.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      9.852(Ac.)
Runoff from this stream =     10.303(CFS)
Time of concentration =   18.03 min.
Rainfall intensity =     1.740(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** 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 =    67.900(Ft.)
Top (of initial area) elevation =  2738.900(Ft.)
Bottom (of initial area) elevation =  2734.800(Ft.)
Difference in elevation =     4.100(Ft.)
Slope =    0.06038  s(%)=       6.04
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    4.974 min.
Rainfall intensity =      4.286(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.779
Subarea runoff =      0.551(CFS)
Total initial stream area =        0.165(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       32.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.232(Ft.), Average velocity =   2.516(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2            100.00              0.00
        3            200.00              2.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =      6.764(CFS)
  '     '        flow top width =     23.189(Ft.)
  '     '    velocity=    2.516(Ft/s)
  '     '        area =      2.689(Sq.Ft)
  '     '        Froude number =     1.302

Upstream point elevation =  2734.800(Ft.)
Downstream point elevation =  2687.000(Ft.)
Flow length =  1508.100(Ft.)
Travel time  =    9.99 min.
Time of concentration =   14.96 min.
Depth of flow =   0.232(Ft.)
Average velocity =   2.516(Ft/s)
Total irregular channel flow =     6.764(CFS)
Irregular channel normal depth above invert elev. =   0.232(Ft.)
Average velocity of channel(s) =   2.516(Ft/s)
 Adding area flow to channel
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)
Rainfall intensity =      1.983(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.637
Subarea runoff =     12.363(CFS) for   10.053(Ac.)
Total runoff =     12.913(CFS)
Effective area this stream =       10.22(Ac.)
Total Study Area (Main Stream No. 2) =       20.07(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.296(Ft.), Average velocity =   2.957(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       32.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     10.218(Ac.)
Runoff from this stream =     12.913(CFS)
Time of concentration =   14.96 min.
```

```
Rainfall intensity =     1.983(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      30.000 to Point/Station      31.000
**** 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 =    72.600(Ft.)
Top (of initial area) elevation =  2727.100(Ft.)
Bottom (of initial area) elevation =  2725.100(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.02755  s(%)=       2.75
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.977 min.
Rainfall intensity =      3.769(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.762
Subarea runoff =      0.304(CFS)
Total initial stream area =        0.106(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      31.000 to Point/Station      32.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.293(Ft.), Average velocity =   2.410(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2            100.00              0.00
        3            200.00              2.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     10.325(CFS)
  '     '        flow top width =     29.274(Ft.)
  '     '    velocity=    2.410(Ft/s)
```

```
  '     '        area =      4.285(Sq.Ft)
  '     '        Froude number =     1.110

Upstream point elevation =  2725.100(Ft.)
Downstream point elevation =  2687.000(Ft.)
Flow length =  1787.700(Ft.)
Travel time  =   12.36 min.
Time of concentration =   18.34 min.
Depth of flow =   0.293(Ft.)
Average velocity =   2.410(Ft/s)
Total irregular channel flow =    10.325(CFS)
Irregular channel normal depth above invert elev. =   0.293(Ft.)
Average velocity of channel(s) =   2.410(Ft/s)
 Adding area flow to channel
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)
Rainfall intensity =      1.719(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.597
Subarea runoff =     19.970(CFS) for   19.637(Ac.)
Total runoff =     20.274(CFS)
Effective area this stream =       19.74(Ac.)
Total Study Area (Main Stream No. 3) =       39.81(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.377(Ft.), Average velocity =   2.853(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       32.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =     19.743(Ac.)
Runoff from this stream =     20.274(CFS)
Time of concentration =   18.34 min.
Rainfall intensity =     1.719(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     10.30     9.852     18.03    0.578      1.740
```

```
2     12.91    10.218     14.96    0.578      1.983
3     20.27    19.743     18.34    0.578      1.719
Qmax(1) =
           1.000 *    1.000 *    10.303) +
           0.827 *    1.000 *    12.913) +
           1.018 *    0.983 *    20.274) + =      41.281
Qmax(2) =
           1.208 *    0.830 *    10.303) +
           1.000 *    1.000 *    12.913) +
           1.231 *    0.816 *    20.274) + =      43.606
Qmax(3) =
           0.982 *    1.000 *    10.303) +
           0.813 *    1.000 *    12.913) +
           1.000 *    1.000 *    20.274) + =      40.884

Total of 3 main streams to confluence:
Flow rates before confluence point:
      11.303      13.913      21.274
Maximum flow rates at confluence using above data:
       41.281       43.606       40.884
Area of streams before confluence:
        9.852       10.218       19.743
Effective area values after confluence:
       39.474       34.504       39.813


Results of confluence:
Total flow rate =     43.606(CFS)
Time of concentration =    14.965 min.
Effective stream area after confluence  =     34.504(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.578(In/Hr)
Study area total =      39.81(Ac.)
End of computations, Total Study Area =           39.81 (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) 1989-2014 Version 9.0
        Rational Hydrology Study        Date: 02/17/22
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE EXISTING HYDROLOGY CALCULATIONS
100 YEAR 1 HOUR
RATIONAL METHOD
------------------------------------------------------------------------

Program License Serial Number 6350

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.200 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** 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
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Initial subarea data:
Initial area flow distance =    88.000(Ft.)
Top (of initial area) elevation =  2738.800(Ft.)
Bottom (of initial area) elevation =  2736.100(Ft.)
Difference in elevation =     2.700(Ft.)
Slope =    0.03068  s(%)=       3.07
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.318 min.
Rainfall intensity =      5.801(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.855
Subarea runoff =      0.620(CFS)
Total initial stream area =        0.125(Ac.)
Pervious area fraction = 1.000
```

```
Initial area Fm value =    0.290(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       32.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.296(Ft.), Average velocity =   2.881(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00             2.00
        2            100.00             0.00
        3            200.00             2.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     12.605(CFS)
  '     '        flow top width =     29.583(Ft.)
  '     '    velocity=    2.881(Ft/s)
  '     '        area =      4.376(Sq.Ft)
  '     '        Froude number =     1.320

Upstream point elevation =  2736.100(Ft.)
Downstream point elevation =  2687.000(Ft.)
Flow length =  1634.900(Ft.)
Travel time  =    9.46 min.
Time of concentration =   15.78 min.
Depth of flow =   0.296(Ft.)
Average velocity =   2.881(Ft/s)
Total irregular channel flow =    12.605(CFS)
Irregular channel normal depth above invert elev. =   0.296(Ft.)
Average velocity of channel(s) =   2.881(Ft/s)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Rainfall intensity =      3.057(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.815
Subarea runoff =     23.913(CFS) for    9.727(Ac.)
Total runoff =     24.533(CFS)
Effective area this stream =        9.85(Ac.)
Total Study Area (Main Stream No. 1) =        9.85(Ac.)
Area averaged Fm value =    0.290(In/Hr)
```

```
Depth of flow =   0.380(Ft.), Average velocity =   3.402(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       32.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      9.852(Ac.)
Runoff from this stream =     24.533(CFS)
Time of concentration =   15.78 min.
Rainfall intensity =     3.057(In/Hr)
Area averaged loss rate (Fm) =    0.2900(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** 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
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Initial subarea data:
Initial area flow distance =    67.900(Ft.)
Top (of initial area) elevation =  2738.900(Ft.)
Bottom (of initial area) elevation =  2734.800(Ft.)
Difference in elevation =     4.100(Ft.)
Slope =    0.06038  s(%)=       6.04
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    4.974 min.
Rainfall intensity =      6.858(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.862
Subarea runoff =      0.975(CFS)
Total initial stream area =         0.165(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.290(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       32.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
```

```
Depth of flow =   0.314(Ft.), Average velocity =   3.079(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00             2.00
        2            100.00             0.00
        3            200.00             2.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     15.167(CFS)
  '     '        flow top width =     31.390(Ft.)
  '     '    velocity=    3.079(Ft/s)
  '     '        area =      4.927(Sq.Ft)
  '     '        Froude number =     1.369

Upstream point elevation =  2734.800(Ft.)
Downstream point elevation =  2687.000(Ft.)
Flow length =  1508.100(Ft.)
Travel time  =    8.16 min.
Time of concentration =   13.14 min.
Depth of flow =   0.314(Ft.)
Average velocity =   3.079(Ft/s)
Total irregular channel flow =    15.167(CFS)
Irregular channel normal depth above invert elev. =   0.314(Ft.)
Average velocity of channel(s) =   3.079(Ft/s)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Rainfall intensity =      3.475(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.825
Subarea runoff =     28.311(CFS) for   10.053(Ac.)
Total runoff =     29.286(CFS)
Effective area this stream =       10.22(Ac.)
Total Study Area (Main Stream No. 2) =       20.07(Ac.)
Area averaged Fm value =    0.290(In/Hr)
Depth of flow =   0.402(Ft.), Average velocity =   3.629(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       32.000
**** CONFLUENCE OF MAIN STREAMS ****

______________________________________________________________________
The following data inside Main Stream is listed:
```

```
In Main Stream number: 2
Stream flow area =     10.218(Ac.)
Runoff from this stream =     29.286(CFS)
Time of concentration =   13.14 min.
Rainfall intensity =     3.475(In/Hr)
Area averaged loss rate (Fm) =    0.2900(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       31.000
**** 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
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Initial subarea data:
Initial area flow distance =    72.600(Ft.)
Top (of initial area) elevation =  2727.100(Ft.)
Bottom (of initial area) elevation =  2725.100(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.02755  s(%)=       2.75
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.977 min.
Rainfall intensity =      6.030(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.857
Subarea runoff =      0.548(CFS)
Total initial stream area =        0.106(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.290(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       31.000 to Point/Station       32.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.406(Ft.), Average velocity =   2.998(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2            100.00              0.00
        3            200.00              2.00
```

```
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     24.724(CFS)
  '     '        flow top width =     40.615(Ft.)
  '     '    velocity=    2.998(Ft/s)
  '     '        area =      8.248(Sq.Ft)
  '     '        Froude number =     1.172

Upstream point elevation =  2725.100(Ft.)
Downstream point elevation =  2687.000(Ft.)
Flow length =  1787.700(Ft.)
Travel time  =    9.94 min.
Time of concentration =   15.92 min.
Depth of flow =   0.406(Ft.)
Average velocity =   2.998(Ft/s)
Total irregular channel flow =    24.724(CFS)
Irregular channel normal depth above invert elev. =   0.406(Ft.)
Average velocity of channel(s) =   2.998(Ft/s)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Rainfall intensity =      3.038(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.814
Subarea runoff =     48.280(CFS) for   19.637(Ac.)
Total runoff =     48.828(CFS)
Effective area this stream =       19.74(Ac.)
Total Study Area (Main Stream No. 3) =       39.81(Ac.)
Area averaged Fm value =    0.290(In/Hr)
Depth of flow =   0.524(Ft.), Average velocity =   3.554(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       32.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =     19.743(Ac.)
Runoff from this stream =     48.828(CFS)
Time of concentration =   15.92 min.
Rainfall intensity =     3.038(In/Hr)
Area averaged loss rate (Fm) =    0.2900(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     24.53     9.852     15.78    0.290      3.057
2     29.29    10.218     13.14    0.290      3.475
3     48.83    19.743     15.92    0.290      3.038
Qmax(1) =
           1.000 *    1.000 *    24.533) +
           0.869 *    1.000 *    29.286) +
           1.007 *    0.991 *    48.828) + =      98.707
Qmax(2) =
           1.151 *    0.833 *    24.533) +
           1.000 *    1.000 *    29.286) +
           1.159 *    0.825 *    48.828) + =      99.509
Qmax(3) =
           0.993 *    1.000 *    24.533) +
           0.863 *    1.000 *    29.286) +
           1.000 *    1.000 *    48.828) + =      98.464

Total of 3 main streams to confluence:
Flow rates before confluence point:
      25.533      30.286      49.828
Maximum flow rates at confluence using above data:
       98.707       99.509       98.464
Area of streams before confluence:
        9.852       10.218       19.743
Effective area values after confluence:
       39.639       34.719       39.813


Results of confluence:
Total flow rate =     99.509(CFS)
Time of concentration =    13.139 min.
Effective stream area after confluence  =     34.719(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.290(In/Hr)
Study area total =      39.81(Ac.)
End of computations, Total Study Area =          39.81 (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
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

                Study date  02/17/22

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE EXISTING HYDROLOGY CALCULATIONS
10 YEAR 24 HOUR
UNIT HYDROGRAPH
------------------------------------------------------------------------

Program License Serial Number 6350

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

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
        Sub-Area       Duration       Isohyetal
        (Ac.)           (hours)         (In)
Rainfall data for year 10
            39.81            1           0.75
--------------------------------------------------------------------
Rainfall data for year 2
            39.81            6           0.80
--------------------------------------------------------------------
Rainfall data for year 2
            39.81           24           1.20
--------------------------------------------------------------------
Rainfall data for year 100
            39.81            1           1.20
```

```
--------------------------------------------------------------------
Rainfall data for year 100
            39.81            6            2.00
--------------------------------------------------------------------
Rainfall data for year 100
            39.81           24            3.50
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 78.0      78.0         39.81      1.000     0.404    1.000    0.404

Area-averaged adjusted loss rate Fm (In/Hr) =  0.404

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
    39.81   1.000         78.0      78.0       2.82     0.265

Area-averaged catchment yield fraction, Y =  0.265
Area-averaged low loss fraction, Yb =  0.735
User entry of time of concentration  =   0.249 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      39.81(Ac.)
Catchment Lag time =   0.200 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 41.7669
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.404(In/Hr)
Average low loss rate fraction (Yb) = 0.735 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.356(In)
Computed peak 30-minute rainfall =  0.609(In)
Specified peak 1-hour rainfall =  0.750(In)
Computed peak 3-hour rainfall =  1.048(In)
Specified peak 6-hour rainfall =  1.294(In)
Specified peak 24-hour rainfall =  2.146(In)


Rainfall depth area reduction factors:
Using a total area of      39.81(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998     Adjusted rainfall =  0.355(In)
30-minute factor = 0.998    Adjusted rainfall =  0.608(In)
1-hour factor = 0.998       Adjusted rainfall =  0.749(In)
3-hour factor = 1.000       Adjusted rainfall =  1.047(In)
```

```
6-hour factor = 1.000       Adjusted rainfall =  1.294(In)
24-hour factor = 1.000      Adjusted rainfall =  2.146(In)
---------------------------------------------------------------------

                        U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
                (K =       481.49 (CFS))

  1                2.946                  14.187
  2               20.730                  85.627
  3               51.600                 148.634
  4               67.313                  75.659
  5               76.184                  42.711
  6               82.034                  28.169
  7               86.305                  20.561
  8               89.477                  15.275
  9               91.817                  11.265
 10               93.721                   9.170
 11               95.202                   7.131
 12               96.388                   5.710
 13               97.298                   4.379
 14               97.934                   3.063
 15               98.373                   2.115
 16               98.869                   2.386
 17               99.363                   2.380
 18               99.693                   1.591
 19              100.000                   1.477
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.3552               0.3552
  2              0.4373               0.0821
  3              0.4939               0.0566
  4              0.5384               0.0445
  5              0.5757               0.0373
  6              0.6081               0.0324
  7              0.6368               0.0288
  8              0.6629               0.0260
  9              0.6867               0.0238
 10              0.7088               0.0221
 11              0.7293               0.0206
 12              0.7486               0.0193
 13              0.7671               0.0185
 14              0.7847               0.0176
 15              0.8015               0.0167
 16              0.8174               0.0160
 17              0.8327               0.0153
 18              0.8474               0.0147
```

19	0.8615	0.0141
20	0.8751	0.0136
21	0.8883	0.0132
22	0.9010	0.0127
23	0.9134	0.0123
24	0.9253	0.0120
25	0.9369	0.0116
26	0.9482	0.0113
27	0.9593	0.0110
28	0.9700	0.0107
29	0.9804	0.0105
30	0.9907	0.0102
31	1.0006	0.0100
32	1.0104	0.0098
33	1.0199	0.0096
34	1.0293	0.0094
35	1.0385	0.0092
36	1.0474	0.0090
37	1.0562	0.0088
38	1.0648	0.0086
39	1.0733	0.0085
40	1.0816	0.0083
41	1.0898	0.0082
42	1.0978	0.0080
43	1.1057	0.0079
44	1.1134	0.0078
45	1.1211	0.0076
46	1.1286	0.0075
47	1.1360	0.0074
48	1.1433	0.0073
49	1.1505	0.0072
50	1.1576	0.0071
51	1.1646	0.0070
52	1.1715	0.0069
53	1.1783	0.0068
54	1.1851	0.0067
55	1.1917	0.0066
56	1.1983	0.0066
57	1.2047	0.0065
58	1.2111	0.0064
59	1.2174	0.0063
60	1.2237	0.0062
61	1.2299	0.0062
62	1.2360	0.0061
63	1.2420	0.0060
64	1.2480	0.0060
65	1.2539	0.0059
66	1.2597	0.0058
67	1.2655	0.0058
68	1.2712	0.0057
69	1.2769	0.0057

70	1.2825	0.0056
71	1.2880	0.0056
72	1.2935	0.0055
73	1.3001	0.0065
74	1.3065	0.0065
75	1.3130	0.0064
76	1.3193	0.0064
77	1.3256	0.0063
78	1.3319	0.0063
79	1.3381	0.0062
80	1.3443	0.0062
81	1.3504	0.0061
82	1.3565	0.0061
83	1.3625	0.0060
84	1.3684	0.0060
85	1.3744	0.0059
86	1.3803	0.0059
87	1.3861	0.0058
88	1.3919	0.0058
89	1.3976	0.0058
90	1.4034	0.0057
91	1.4090	0.0057
92	1.4147	0.0056
93	1.4203	0.0056
94	1.4258	0.0056
95	1.4313	0.0055
96	1.4368	0.0055
97	1.4423	0.0054
98	1.4477	0.0054
99	1.4531	0.0054
100	1.4584	0.0053
101	1.4637	0.0053
102	1.4690	0.0053
103	1.4742	0.0052
104	1.4795	0.0052
105	1.4846	0.0052
106	1.4898	0.0051
107	1.4949	0.0051
108	1.5000	0.0051
109	1.5050	0.0051
110	1.5101	0.0050
111	1.5151	0.0050
112	1.5200	0.0050
113	1.5250	0.0049
114	1.5299	0.0049
115	1.5348	0.0049
116	1.5396	0.0049
117	1.5445	0.0048
118	1.5493	0.0048
119	1.5541	0.0048
120	1.5588	0.0048

121	1.5636	0.0047
122	1.5683	0.0047
123	1.5729	0.0047
124	1.5776	0.0047
125	1.5822	0.0046
126	1.5869	0.0046
127	1.5914	0.0046
128	1.5960	0.0046
129	1.6005	0.0045
130	1.6051	0.0045
131	1.6096	0.0045
132	1.6140	0.0045
133	1.6185	0.0045
134	1.6229	0.0044
135	1.6273	0.0044
136	1.6317	0.0044
137	1.6361	0.0044
138	1.6405	0.0044
139	1.6448	0.0043
140	1.6491	0.0043
141	1.6534	0.0043
142	1.6577	0.0043
143	1.6619	0.0043
144	1.6662	0.0042
145	1.6704	0.0042
146	1.6746	0.0042
147	1.6788	0.0042
148	1.6829	0.0042
149	1.6871	0.0041
150	1.6912	0.0041
151	1.6953	0.0041
152	1.6994	0.0041
153	1.7035	0.0041
154	1.7075	0.0041
155	1.7116	0.0040
156	1.7156	0.0040
157	1.7196	0.0040
158	1.7236	0.0040
159	1.7276	0.0040
160	1.7315	0.0040
161	1.7355	0.0039
162	1.7394	0.0039
163	1.7433	0.0039
164	1.7472	0.0039
165	1.7511	0.0039
166	1.7550	0.0039
167	1.7588	0.0039
168	1.7627	0.0038
169	1.7665	0.0038
170	1.7703	0.0038
171	1.7741	0.0038

172	1.7779	0.0038
173	1.7816	0.0038
174	1.7854	0.0038
175	1.7891	0.0037
176	1.7929	0.0037
177	1.7966	0.0037
178	1.8003	0.0037
179	1.8040	0.0037
180	1.8076	0.0037
181	1.8113	0.0037
182	1.8149	0.0036
183	1.8186	0.0036
184	1.8222	0.0036
185	1.8258	0.0036
186	1.8294	0.0036
187	1.8330	0.0036
188	1.8366	0.0036
189	1.8401	0.0036
190	1.8437	0.0035
191	1.8472	0.0035
192	1.8507	0.0035
193	1.8543	0.0035
194	1.8578	0.0035
195	1.8612	0.0035
196	1.8647	0.0035
197	1.8682	0.0035
198	1.8717	0.0035
199	1.8751	0.0034
200	1.8785	0.0034
201	1.8820	0.0034
202	1.8854	0.0034
203	1.8888	0.0034
204	1.8922	0.0034
205	1.8956	0.0034
206	1.8989	0.0034
207	1.9023	0.0034
208	1.9056	0.0034
209	1.9090	0.0033
210	1.9123	0.0033
211	1.9156	0.0033
212	1.9189	0.0033
213	1.9222	0.0033
214	1.9255	0.0033
215	1.9288	0.0033
216	1.9321	0.0033
217	1.9354	0.0033
218	1.9386	0.0033
219	1.9418	0.0032
220	1.9451	0.0032
221	1.9483	0.0032
222	1.9515	0.0032

223	1.9547	0.0032
224	1.9579	0.0032
225	1.9611	0.0032
226	1.9643	0.0032
227	1.9675	0.0032
228	1.9706	0.0032
229	1.9738	0.0032
230	1.9769	0.0031
231	1.9800	0.0031
232	1.9832	0.0031
233	1.9863	0.0031
234	1.9894	0.0031
235	1.9925	0.0031
236	1.9956	0.0031
237	1.9987	0.0031
238	2.0018	0.0031
239	2.0048	0.0031
240	2.0079	0.0031
241	2.0109	0.0031
242	2.0140	0.0030
243	2.0170	0.0030
244	2.0200	0.0030
245	2.0231	0.0030
246	2.0261	0.0030
247	2.0291	0.0030
248	2.0321	0.0030
249	2.0351	0.0030
250	2.0380	0.0030
251	2.0410	0.0030
252	2.0440	0.0030
253	2.0469	0.0030
254	2.0499	0.0030
255	2.0528	0.0029
256	2.0558	0.0029
257	2.0587	0.0029
258	2.0616	0.0029
259	2.0645	0.0029
260	2.0674	0.0029
261	2.0703	0.0029
262	2.0732	0.0029
263	2.0761	0.0029
264	2.0790	0.0029
265	2.0819	0.0029
266	2.0847	0.0029
267	2.0876	0.0029
268	2.0905	0.0029
269	2.0933	0.0028
270	2.0961	0.0028
271	2.0990	0.0028
272	2.1018	0.0028
273	2.1046	0.0028

```
274              2.1074               0.0028
275              2.1102               0.0028
276              2.1130               0.0028
277              2.1158               0.0028
278              2.1186               0.0028
279              2.1214               0.0028
280              2.1242               0.0028
281              2.1269               0.0028
282              2.1297               0.0028
283              2.1324               0.0028
284              2.1352               0.0027
285              2.1379               0.0027
286              2.1407               0.0027
287              2.1434               0.0027
288              2.1461               0.0027
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0027           0.0020              0.0007
  2              0.0027           0.0020              0.0007
  3              0.0027           0.0020              0.0007
  4              0.0027           0.0020              0.0007
  5              0.0028           0.0020              0.0007
  6              0.0028           0.0020              0.0007
  7              0.0028           0.0020              0.0007
  8              0.0028           0.0020              0.0007
  9              0.0028           0.0021              0.0007
 10              0.0028           0.0021              0.0007
 11              0.0028           0.0021              0.0007
 12              0.0028           0.0021              0.0007
 13              0.0028           0.0021              0.0008
 14              0.0028           0.0021              0.0008
 15              0.0029           0.0021              0.0008
 16              0.0029           0.0021              0.0008
 17              0.0029           0.0021              0.0008
 18              0.0029           0.0021              0.0008
 19              0.0029           0.0021              0.0008
 20              0.0029           0.0021              0.0008
 21              0.0029           0.0021              0.0008
 22              0.0029           0.0022              0.0008
 23              0.0029           0.0022              0.0008
 24              0.0030           0.0022              0.0008
 25              0.0030           0.0022              0.0008
 26              0.0030           0.0022              0.0008
 27              0.0030           0.0022              0.0008
 28              0.0030           0.0022              0.0008
 29              0.0030           0.0022              0.0008
 30              0.0030           0.0022              0.0008
 31              0.0030           0.0022              0.0008
```

32	0.0030	0.0022	0.0008
33	0.0031	0.0022	0.0008
34	0.0031	0.0023	0.0008
35	0.0031	0.0023	0.0008
36	0.0031	0.0023	0.0008
37	0.0031	0.0023	0.0008
38	0.0031	0.0023	0.0008
39	0.0031	0.0023	0.0008
40	0.0031	0.0023	0.0008
41	0.0032	0.0023	0.0008
42	0.0032	0.0023	0.0008
43	0.0032	0.0023	0.0008
44	0.0032	0.0023	0.0008
45	0.0032	0.0024	0.0009
46	0.0032	0.0024	0.0009
47	0.0032	0.0024	0.0009
48	0.0033	0.0024	0.0009
49	0.0033	0.0024	0.0009
50	0.0033	0.0024	0.0009
51	0.0033	0.0024	0.0009
52	0.0033	0.0024	0.0009
53	0.0033	0.0024	0.0009
54	0.0033	0.0025	0.0009
55	0.0034	0.0025	0.0009
56	0.0034	0.0025	0.0009
57	0.0034	0.0025	0.0009
58	0.0034	0.0025	0.0009
59	0.0034	0.0025	0.0009
60	0.0034	0.0025	0.0009
61	0.0035	0.0025	0.0009
62	0.0035	0.0026	0.0009
63	0.0035	0.0026	0.0009
64	0.0035	0.0026	0.0009
65	0.0035	0.0026	0.0009
66	0.0035	0.0026	0.0009
67	0.0036	0.0026	0.0009
68	0.0036	0.0026	0.0009
69	0.0036	0.0026	0.0010
70	0.0036	0.0027	0.0010
71	0.0036	0.0027	0.0010
72	0.0036	0.0027	0.0010
73	0.0037	0.0027	0.0010
74	0.0037	0.0027	0.0010
75	0.0037	0.0027	0.0010
76	0.0037	0.0027	0.0010
77	0.0038	0.0028	0.0010
78	0.0038	0.0028	0.0010
79	0.0038	0.0028	0.0010
80	0.0038	0.0028	0.0010
81	0.0038	0.0028	0.0010
82	0.0039	0.0028	0.0010

83	0.0039	0.0029	0.0010
84	0.0039	0.0029	0.0010
85	0.0039	0.0029	0.0010
86	0.0039	0.0029	0.0010
87	0.0040	0.0029	0.0011
88	0.0040	0.0029	0.0011
89	0.0040	0.0030	0.0011
90	0.0040	0.0030	0.0011
91	0.0041	0.0030	0.0011
92	0.0041	0.0030	0.0011
93	0.0041	0.0030	0.0011
94	0.0041	0.0030	0.0011
95	0.0042	0.0031	0.0011
96	0.0042	0.0031	0.0011
97	0.0042	0.0031	0.0011
98	0.0043	0.0031	0.0011
99	0.0043	0.0032	0.0011
100	0.0043	0.0032	0.0011
101	0.0044	0.0032	0.0012
102	0.0044	0.0032	0.0012
103	0.0044	0.0032	0.0012
104	0.0044	0.0033	0.0012
105	0.0045	0.0033	0.0012
106	0.0045	0.0033	0.0012
107	0.0045	0.0033	0.0012
108	0.0046	0.0034	0.0012
109	0.0046	0.0034	0.0012
110	0.0046	0.0034	0.0012
111	0.0047	0.0034	0.0012
112	0.0047	0.0035	0.0012
113	0.0048	0.0035	0.0013
114	0.0048	0.0035	0.0013
115	0.0048	0.0036	0.0013
116	0.0049	0.0036	0.0013
117	0.0049	0.0036	0.0013
118	0.0049	0.0036	0.0013
119	0.0050	0.0037	0.0013
120	0.0050	0.0037	0.0013
121	0.0051	0.0037	0.0013
122	0.0051	0.0038	0.0014
123	0.0052	0.0038	0.0014
124	0.0052	0.0038	0.0014
125	0.0053	0.0039	0.0014
126	0.0053	0.0039	0.0014
127	0.0054	0.0040	0.0014
128	0.0054	0.0040	0.0014
129	0.0055	0.0040	0.0015
130	0.0055	0.0041	0.0015
131	0.0056	0.0041	0.0015
132	0.0056	0.0041	0.0015
133	0.0057	0.0042	0.0015

134	0.0058	0.0042	0.0015
135	0.0058	0.0043	0.0015
136	0.0059	0.0043	0.0016
137	0.0060	0.0044	0.0016
138	0.0060	0.0044	0.0016
139	0.0061	0.0045	0.0016
140	0.0062	0.0045	0.0016
141	0.0063	0.0046	0.0017
142	0.0063	0.0046	0.0017
143	0.0064	0.0047	0.0017
144	0.0065	0.0048	0.0017
145	0.0055	0.0040	0.0015
146	0.0056	0.0041	0.0015
147	0.0057	0.0042	0.0015
148	0.0057	0.0042	0.0015
149	0.0058	0.0043	0.0015
150	0.0059	0.0043	0.0016
151	0.0060	0.0044	0.0016
152	0.0061	0.0045	0.0016
153	0.0062	0.0046	0.0017
154	0.0063	0.0046	0.0017
155	0.0065	0.0048	0.0017
156	0.0066	0.0048	0.0017
157	0.0067	0.0049	0.0018
158	0.0068	0.0050	0.0018
159	0.0070	0.0051	0.0019
160	0.0071	0.0052	0.0019
161	0.0073	0.0054	0.0019
162	0.0074	0.0054	0.0020
163	0.0076	0.0056	0.0020
164	0.0078	0.0057	0.0021
165	0.0080	0.0059	0.0021
166	0.0082	0.0060	0.0022
167	0.0085	0.0062	0.0022
168	0.0086	0.0063	0.0023
169	0.0090	0.0066	0.0024
170	0.0092	0.0067	0.0024
171	0.0096	0.0070	0.0025
172	0.0098	0.0072	0.0026
173	0.0102	0.0075	0.0027
174	0.0105	0.0077	0.0028
175	0.0110	0.0081	0.0029
176	0.0113	0.0083	0.0030
177	0.0120	0.0088	0.0032
178	0.0123	0.0091	0.0033
179	0.0132	0.0097	0.0035
180	0.0136	0.0100	0.0036
181	0.0147	0.0108	0.0039
182	0.0153	0.0112	0.0041
183	0.0167	0.0123	0.0044
184	0.0176	0.0129	0.0047

185	0.0193	0.0142	0.0051
186	0.0206	0.0151	0.0054
187	0.0238	0.0175	0.0063
188	0.0260	0.0191	0.0069
189	0.0324	0.0238	0.0086
190	0.0373	0.0274	0.0099
191	0.0566	0.0336	0.0229
192	0.0821	0.0336	0.0485
193	0.3552	0.0336	0.3216
194	0.0445	0.0327	0.0118
195	0.0288	0.0212	0.0076
196	0.0221	0.0162	0.0058
197	0.0185	0.0136	0.0049
198	0.0160	0.0117	0.0042
199	0.0141	0.0104	0.0037
200	0.0127	0.0094	0.0034
201	0.0116	0.0085	0.0031
202	0.0107	0.0079	0.0028
203	0.0100	0.0073	0.0026
204	0.0094	0.0069	0.0025
205	0.0088	0.0064	0.0023
206	0.0083	0.0061	0.0022
207	0.0079	0.0058	0.0021
208	0.0075	0.0055	0.0020
209	0.0072	0.0053	0.0019
210	0.0069	0.0051	0.0018
211	0.0066	0.0049	0.0018
212	0.0064	0.0047	0.0017
213	0.0062	0.0045	0.0016
214	0.0060	0.0044	0.0016
215	0.0058	0.0042	0.0015
216	0.0056	0.0041	0.0015
217	0.0065	0.0048	0.0017
218	0.0064	0.0047	0.0017
219	0.0062	0.0046	0.0016
220	0.0061	0.0045	0.0016
221	0.0059	0.0044	0.0016
222	0.0058	0.0043	0.0015
223	0.0057	0.0042	0.0015
224	0.0056	0.0041	0.0015
225	0.0054	0.0040	0.0014
226	0.0053	0.0039	0.0014
227	0.0052	0.0039	0.0014
228	0.0051	0.0038	0.0014
229	0.0051	0.0037	0.0013
230	0.0050	0.0037	0.0013
231	0.0049	0.0036	0.0013
232	0.0048	0.0035	0.0013
233	0.0047	0.0035	0.0013
234	0.0047	0.0034	0.0012
235	0.0046	0.0034	0.0012

236	0.0045	0.0033	0.0012
237	0.0045	0.0033	0.0012
238	0.0044	0.0032	0.0012
239	0.0043	0.0032	0.0011
240	0.0043	0.0031	0.0011
241	0.0042	0.0031	0.0011
242	0.0042	0.0031	0.0011
243	0.0041	0.0030	0.0011
244	0.0041	0.0030	0.0011
245	0.0040	0.0029	0.0011
246	0.0040	0.0029	0.0010
247	0.0039	0.0029	0.0010
248	0.0039	0.0028	0.0010
249	0.0038	0.0028	0.0010
250	0.0038	0.0028	0.0010
251	0.0037	0.0027	0.0010
252	0.0037	0.0027	0.0010
253	0.0037	0.0027	0.0010
254	0.0036	0.0027	0.0010
255	0.0036	0.0026	0.0009
256	0.0035	0.0026	0.0009
257	0.0035	0.0026	0.0009
258	0.0035	0.0026	0.0009
259	0.0034	0.0025	0.0009
260	0.0034	0.0025	0.0009
261	0.0034	0.0025	0.0009
262	0.0034	0.0025	0.0009
263	0.0033	0.0024	0.0009
264	0.0033	0.0024	0.0009
265	0.0033	0.0024	0.0009
266	0.0032	0.0024	0.0009
267	0.0032	0.0024	0.0008
268	0.0032	0.0023	0.0008
269	0.0032	0.0023	0.0008
270	0.0031	0.0023	0.0008
271	0.0031	0.0023	0.0008
272	0.0031	0.0023	0.0008
273	0.0031	0.0022	0.0008
274	0.0030	0.0022	0.0008
275	0.0030	0.0022	0.0008
276	0.0030	0.0022	0.0008
277	0.0030	0.0022	0.0008
278	0.0029	0.0022	0.0008
279	0.0029	0.0021	0.0008
280	0.0029	0.0021	0.0008
281	0.0029	0.0021	0.0008
282	0.0029	0.0021	0.0008
283	0.0028	0.0021	0.0008
284	0.0028	0.0021	0.0007
285	0.0028	0.0021	0.0007
286	0.0028	0.0020	0.0007

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      287              0.0028           0.0020             0.0007
      288              0.0027           0.0020             0.0007
      --------------------------------------------------------------------
      --------------------------------------------------------------------
      Total soil rain loss =      1.32(In)
      Total effective rainfall =      0.83(In)
      Peak flow rate in flood hydrograph =     54.38(CFS)
      ---------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R   S T O R M
                       R u n o f f    H y d r o g r a p h
      --------------------------------------------------------------------
                  Hydrograph in   5   Minute intervals ((CFS))

      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       15.0      30.0      45.0      60.0
-----------------------------------------------------------------------
  0+ 5      0.0001      0.01  Q         |         |         |         |
  0+10      0.0006      0.07  Q         |         |         |         |
  0+15      0.0018      0.18  Q         |         |         |         |
  0+20      0.0034      0.23  Q         |         |         |         |
  0+25      0.0053      0.27  Q         |         |         |         |
  0+30      0.0072      0.29  Q         |         |         |         |
  0+35      0.0093      0.30  Q         |         |         |         |
  0+40      0.0115      0.32  Q         |         |         |         |
  0+45      0.0137      0.32  Q         |         |         |         |
  0+50      0.0160      0.33  Q         |         |         |         |
  0+55      0.0183      0.34  Q         |         |         |         |
  1+ 0      0.0207      0.34  Q         |         |         |         |
  1+ 5      0.0231      0.35  Q         |         |         |         |
  1+10      0.0255      0.35  Q         |         |         |         |
  1+15      0.0280      0.35  Q         |         |         |         |
  1+20      0.0304      0.36  Q         |         |         |         |
  1+25      0.0329      0.36  Q         |         |         |         |
  1+30      0.0354      0.36  Q         |         |         |         |
  1+35      0.0379      0.37  Q         |         |         |         |
  1+40      0.0405      0.37  Q         |         |         |         |
  1+45      0.0430      0.37  Q         |         |         |         |
  1+50      0.0455      0.37  Q         |         |         |         |
  1+55      0.0481      0.37  Q         |         |         |         |
  2+ 0      0.0506      0.37  Q         |         |         |         |
  2+ 5      0.0532      0.37  Q         |         |         |         |
  2+10      0.0558      0.37  Q         |         |         |         |
  2+15      0.0584      0.38  Q         |         |         |         |
  2+20      0.0610      0.38  Q         |         |         |         |
  2+25      0.0636      0.38  Q         |         |         |         |
  2+30      0.0662      0.38  Q         |         |         |         |
  2+35      0.0688      0.38  Q         |         |         |         |
  2+40      0.0715      0.38  QV        |         |         |         |
  2+45      0.0741      0.38  QV        |         |         |         |
  2+50      0.0768      0.39  QV        |         |         |         |
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2+55       0.0795      0.39  QV         |         |         |         |
3+ 0       0.0821      0.39  QV         |         |         |         |
3+ 5       0.0848      0.39  QV         |         |         |         |
3+10       0.0875      0.39  QV         |         |         |         |
3+15       0.0902      0.39  QV         |         |         |         |
3+20       0.0930      0.40  QV         |         |         |         |
3+25       0.0957      0.40  QV         |         |         |         |
3+30       0.0984      0.40  QV         |         |         |         |
3+35       0.1012      0.40  QV         |         |         |         |
3+40       0.1040      0.40  QV         |         |         |         |
3+45       0.1067      0.40  QV         |         |         |         |
3+50       0.1095      0.41  QV         |         |         |         |
3+55       0.1123      0.41  QV         |         |         |         |
4+ 0       0.1152      0.41  QV         |         |         |         |
4+ 5       0.1180      0.41  QV         |         |         |         |
4+10       0.1208      0.41  QV         |         |         |         |
4+15       0.1237      0.41  QV         |         |         |         |
4+20       0.1265      0.42  QV         |         |         |         |
4+25       0.1294      0.42  QV         |         |         |         |
4+30       0.1323      0.42  QV         |         |         |         |
4+35       0.1352      0.42  QV         |         |         |         |
4+40       0.1381      0.42  Q V        |         |         |         |
4+45       0.1411      0.43  Q V        |         |         |         |
4+50       0.1440      0.43  Q V        |         |         |         |
4+55       0.1470      0.43  Q V        |         |         |         |
5+ 0       0.1499      0.43  Q V        |         |         |         |
5+ 5       0.1529      0.43  Q V        |         |         |         |
5+10       0.1559      0.44  Q V        |         |         |         |
5+15       0.1589      0.44  Q V        |         |         |         |
5+20       0.1620      0.44  Q V        |         |         |         |
5+25       0.1650      0.44  Q V        |         |         |         |
5+30       0.1681      0.44  Q V        |         |         |         |
5+35       0.1711      0.45  Q V        |         |         |         |
5+40       0.1742      0.45  Q V        |         |         |         |
5+45       0.1773      0.45  Q V        |         |         |         |
5+50       0.1805      0.45  Q V        |         |         |         |
5+55       0.1836      0.46  Q V        |         |         |         |
6+ 0       0.1867      0.46  Q V        |         |         |         |
6+ 5       0.1899      0.46  Q V        |         |         |         |
6+10       0.1931      0.46  Q V        |         |         |         |
6+15       0.1963      0.46  Q V        |         |         |         |
6+20       0.1995      0.47  Q V        |         |         |         |
6+25       0.2027      0.47  Q V        |         |         |         |
6+30       0.2060      0.47  Q V        |         |         |         |
6+35       0.2093      0.47  Q  V       |         |         |         |
6+40       0.2125      0.48  Q  V       |         |         |         |
6+45       0.2158      0.48  Q  V       |         |         |         |
6+50       0.2192      0.48  Q  V       |         |         |         |
6+55       0.2225      0.49  Q  V       |         |         |         |
7+ 0       0.2259      0.49  Q  V       |         |         |         |
7+ 5       0.2292      0.49  Q  V       |         |         |         |
```

```
 7+10       0.2326      0.49  Q  V       |         |         |         |
 7+15       0.2361      0.50  Q  V       |         |         |         |
 7+20       0.2395      0.50  Q  V       |         |         |         |
 7+25       0.2430      0.50  Q  V       |         |         |         |
 7+30       0.2464      0.51  Q  V       |         |         |         |
 7+35       0.2499      0.51  Q  V       |         |         |         |
 7+40       0.2535      0.51  Q  V       |         |         |         |
 7+45       0.2570      0.51  Q  V       |         |         |         |
 7+50       0.2606      0.52  Q  V       |         |         |         |
 7+55       0.2642      0.52  Q  V       |         |         |         |
 8+ 0       0.2678      0.52  Q  V       |         |         |         |
 8+ 5       0.2714      0.53  Q  V       |         |         |         |
 8+10       0.2751      0.53  Q  V       |         |         |         |
 8+15       0.2787      0.53  Q   V      |         |         |         |
 8+20       0.2824      0.54  Q   V      |         |         |         |
 8+25       0.2862      0.54  Q   V      |         |         |         |
 8+30       0.2899      0.55  Q   V      |         |         |         |
 8+35       0.2937      0.55  Q   V      |         |         |         |
 8+40       0.2975      0.55  Q   V      |         |         |         |
 8+45       0.3013      0.56  Q   V      |         |         |         |
 8+50       0.3052      0.56  Q   V      |         |         |         |
 8+55       0.3091      0.56  Q   V      |         |         |         |
 9+ 0       0.3130      0.57  Q   V      |         |         |         |
 9+ 5       0.3169      0.57  Q   V      |         |         |         |
 9+10       0.3209      0.58  Q   V      |         |         |         |
 9+15       0.3249      0.58  Q   V      |         |         |         |
 9+20       0.3290      0.59  Q   V      |         |         |         |
 9+25       0.3330      0.59  Q   V      |         |         |         |
 9+30       0.3371      0.59  Q   V      |         |         |         |
 9+35       0.3412      0.60  Q   V      |         |         |         |
 9+40       0.3454      0.60  Q    V     |         |         |         |
 9+45       0.3496      0.61  Q    V     |         |         |         |
 9+50       0.3538      0.61  Q    V     |         |         |         |
 9+55       0.3581      0.62  Q    V     |         |         |         |
10+ 0       0.3624      0.62  Q    V     |         |         |         |
10+ 5       0.3667      0.63  Q    V     |         |         |         |
10+10       0.3711      0.63  Q    V     |         |         |         |
10+15       0.3755      0.64  Q    V     |         |         |         |
10+20       0.3799      0.65  Q    V     |         |         |         |
10+25       0.3844      0.65  Q    V     |         |         |         |
10+30       0.3889      0.66  Q    V     |         |         |         |
10+35       0.3935      0.66  Q    V     |         |         |         |
10+40       0.3981      0.67  Q    V     |         |         |         |
10+45       0.4028      0.68  Q    V     |         |         |         |
10+50       0.4074      0.68  Q    V     |         |         |         |
10+55       0.4122      0.69  Q    V     |         |         |         |
11+ 0       0.4170      0.70  Q     V    |         |         |         |
11+ 5       0.4218      0.70  Q     V    |         |         |         |
11+10       0.4267      0.71  Q     V    |         |         |         |
11+15       0.4316      0.72  Q     V    |         |         |         |
11+20       0.4366      0.72  Q     V    |         |         |         |
```

```
11+25       0.4417      0.73  Q     V   |         |         |         |
11+30       0.4468      0.74  Q     V   |         |         |         |
11+35       0.4519      0.75  Q     V   |         |         |         |
11+40       0.4571      0.76  Q     V   |         |         |         |
11+45       0.4624      0.77  Q     V   |         |         |         |
11+50       0.4677      0.77  Q     V   |         |         |         |
11+55       0.4731      0.78  Q     V   |         |         |         |
12+ 0       0.4786      0.79  Q     V   |         |         |         |
12+ 5       0.4841      0.80  Q      V  |         |         |         |
12+10       0.4895      0.78  Q      V  |         |         |         |
12+15       0.4947      0.75  Q      V  |         |         |         |
12+20       0.4998      0.74  Q      V  |         |         |         |
12+25       0.5048      0.74  Q      V  |         |         |         |
12+30       0.5099      0.74  Q      V  |         |         |         |
12+35       0.5151      0.75  Q      V  |         |         |         |
12+40       0.5203      0.75  Q      V  |         |         |         |
12+45       0.5255      0.76  Q      V  |         |         |         |
12+50       0.5308      0.77  Q      V  |         |         |         |
12+55       0.5362      0.78  Q      V  |         |         |         |
13+ 0       0.5417      0.79  Q      V  |         |         |         |
13+ 5       0.5472      0.81  Q      V  |         |         |         |
13+10       0.5529      0.82  Q       V |         |         |         |
13+15       0.5587      0.84  Q       V |         |         |         |
13+20       0.5645      0.85  Q       V |         |         |         |
13+25       0.5705      0.87  Q       V |         |         |         |
13+30       0.5766      0.88  Q       V |         |         |         |
13+35       0.5828      0.90  Q       V |         |         |         |
13+40       0.5891      0.92  Q       V |         |         |         |
13+45       0.5956      0.94  Q       V |         |         |         |
13+50       0.6023      0.96  Q       V |         |         |         |
13+55       0.6091      0.99  Q       V |         |         |         |
14+ 0       0.6160      1.01  Q       V |         |         |         |
14+ 5       0.6232      1.04  Q        V|         |         |         |
14+10       0.6305      1.07  Q        V|         |         |         |
14+15       0.6381      1.10  Q        V|         |         |         |
14+20       0.6459      1.13  Q        V|         |         |         |
14+25       0.6539      1.16  Q        V|         |         |         |
14+30       0.6622      1.20  Q        V|         |         |         |
14+35       0.6707      1.24  Q        V|         |         |         |
14+40       0.6796      1.28  Q        V|         |         |         |
14+45       0.6887      1.33  Q         V         |         |         |
14+50       0.6983      1.38  Q         V         |         |         |
14+55       0.7082      1.44  Q         V         |         |         |
15+ 0       0.7186      1.50  |Q        V         |         |         |
15+ 5       0.7294      1.58  |Q        V         |         |         |
15+10       0.7408      1.65  |Q        V         |         |         |
15+15       0.7528      1.75  |Q        V         |         |         |
15+20       0.7655      1.85  |Q        |V        |         |         |
15+25       0.7791      1.97  |Q        |V        |         |         |
15+30       0.7936      2.10  |Q        |V        |         |         |
15+35       0.8092      2.26  |Q        |V        |         |         |
```

```
15+40       0.8261      2.46  |Q        |V        |         |         |
15+45       0.8450      2.74  |Q        | V       |         |         |
15+50       0.8663      3.10  | Q       | V       |         |         |
15+55       0.8921      3.76  | Q       | V       |         |         |
16+ 0       0.9309      5.63  |  Q      |  V      |         |         |
16+ 5       1.0264     13.86  |        Q|   V     |         |         |
16+10       1.2866     37.78  |         |       V |    Q    |         |
16+15       1.6610     54.38  |         |         |   V     |     Q   |
16+20       1.8687     30.15  |         |         Q      V  |         |
16+25       1.9970     18.63  |         | Q       |       V |         |
16+30       2.0878     13.19  |       Q |         |         V         |
16+35       2.1576     10.14  |     Q   |         |         |V        |
16+40       2.2125      7.96  |    Q    |         |         | V       |
16+45       2.2560      6.32  |   Q     |         |         | V       |
16+50       2.2927      5.33  |  Q      |         |         |  V      |
16+55       2.3231      4.42  | Q       |         |         |  V      |
17+ 0       2.3489      3.74  | Q       |         |         |   V     |
17+ 5       2.3704      3.12  | Q       |         |         |   V     |
17+10       2.3880      2.55  |Q        |         |         |   V     |
17+15       2.4028      2.16  |Q        |         |         |   V     |
17+20       2.4175      2.13  |Q        |         |         |    V    |
17+25       2.4314      2.02  |Q        |         |         |    V    |
17+30       2.4430      1.68  |Q        |         |         |    V    |
17+35       2.4534      1.52  |Q        |         |         |    V    |
17+40       2.4603      1.00  Q         |         |         |    V    |
17+45       2.4668      0.94  Q         |         |         |    V    |
17+50       2.4729      0.90  Q         |         |         |    V    |
17+55       2.4788      0.86  Q         |         |         |    V    |
18+ 0       2.4845      0.82  Q         |         |         |     V   |
18+ 5       2.4900      0.80  Q         |         |         |     V   |
18+10       2.4954      0.79  Q         |         |         |     V   |
18+15       2.5010      0.81  Q         |         |         |     V   |
18+20       2.5066      0.81  Q         |         |         |     V   |
18+25       2.5121      0.80  Q         |         |         |     V   |
18+30       2.5175      0.78  Q         |         |         |     V   |
18+35       2.5228      0.77  Q         |         |         |     V   |
18+40       2.5280      0.76  Q         |         |         |     V   |
18+45       2.5331      0.74  Q         |         |         |     V   |
18+50       2.5381      0.73  Q         |         |         |     V   |
18+55       2.5431      0.71  Q         |         |         |     V   |
19+ 0       2.5479      0.70  Q         |         |         |     V   |
19+ 5       2.5526      0.69  Q         |         |         |      V  |
19+10       2.5573      0.68  Q         |         |         |      V  |
19+15       2.5619      0.66  Q         |         |         |      V  |
19+20       2.5664      0.65  Q         |         |         |      V  |
19+25       2.5708      0.64  Q         |         |         |      V  |
19+30       2.5751      0.63  Q         |         |         |      V  |
19+35       2.5794      0.62  Q         |         |         |      V  |
19+40       2.5836      0.61  Q         |         |         |      V  |
19+45       2.5878      0.60  Q         |         |         |      V  |
19+50       2.5918      0.59  Q         |         |         |      V  |
```

```
   19+55       2.5959      0.58  Q         |         |         |      V  |
   20+ 0       2.5998      0.57  Q         |         |         |      V  |
   20+ 5       2.6037      0.57  Q         |         |         |      V  |
   20+10       2.6076      0.56  Q         |         |         |      V  |
   20+15       2.6113      0.55  Q         |         |         |      V  |
   20+20       2.6151      0.54  Q         |         |         |      V  |
   20+25       2.6188      0.54  Q         |         |         |       V |
   20+30       2.6224      0.53  Q         |         |         |       V |
   20+35       2.6260      0.52  Q         |         |         |       V |
   20+40       2.6296      0.52  Q         |         |         |       V |
   20+45       2.6331      0.51  Q         |         |         |       V |
   20+50       2.6365      0.50  Q         |         |         |       V |
   20+55       2.6400      0.50  Q         |         |         |       V |
   21+ 0       2.6434      0.49  Q         |         |         |       V |
   21+ 5       2.6467      0.49  Q         |         |         |       V |
   21+10       2.6500      0.48  Q         |         |         |       V |
   21+15       2.6533      0.48  Q         |         |         |       V |
   21+20       2.6565      0.47  Q         |         |         |       V |
   21+25       2.6597      0.47  Q         |         |         |       V |
   21+30       2.6629      0.46  Q         |         |         |       V |
   21+35       2.6661      0.46  Q         |         |         |       V |
   21+40       2.6692      0.45  Q         |         |         |       V |
   21+45       2.6722      0.45  Q         |         |         |       V |
   21+50       2.6753      0.44  Q         |         |         |       V |
   21+55       2.6783      0.44  Q         |         |         |       V |
   22+ 0       2.6813      0.43  Q         |         |         |       V |
   22+ 5       2.6843      0.43  Q         |         |         |       V |
   22+10       2.6872      0.43  Q         |         |         |        V|
   22+15       2.6901      0.42  Q         |         |         |        V|
   22+20       2.6930      0.42  Q         |         |         |        V|
   22+25       2.6958      0.41  Q         |         |         |        V|
   22+30       2.6987      0.41  Q         |         |         |        V|
   22+35       2.7015      0.41  Q         |         |         |        V|
   22+40       2.7043      0.40  Q         |         |         |        V|
   22+45       2.7070      0.40  Q         |         |         |        V|
   22+50       2.7098      0.40  Q         |         |         |        V|
   22+55       2.7125      0.39  Q         |         |         |        V|
   23+ 0       2.7152      0.39  Q         |         |         |        V|
   23+ 5       2.7179      0.39  Q         |         |         |        V|
   23+10       2.7205      0.39  Q         |         |         |        V|
   23+15       2.7231      0.38  Q         |         |         |        V|
   23+20       2.7257      0.38  Q         |         |         |        V|
   23+25       2.7283      0.38  Q         |         |         |        V|
   23+30       2.7309      0.37  Q         |         |         |        V|
   23+35       2.7335      0.37  Q         |         |         |        V|
   23+40       2.7360      0.37  Q         |         |         |        V|
   23+45       2.7385      0.37  Q         |         |         |        V|
   23+50       2.7410      0.36  Q         |         |         |        V|
   23+55       2.7435      0.36  Q         |         |         |        V|
   24+ 0       2.7460      0.36  Q         |         |         |        V|
-----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

                Study date  02/17/22

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE EXISTING HYDROLOGY CALCULATIONS
100 YEAR 1 HOUR
UNIT HYDROGRAPH
---------------------------------------------------------------------

Program License Serial Number 6350

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

        Storm Event Year = 100

        Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            39.81            1           0.75
--------------------------------------------------------------------
Rainfall data for year 2
            39.81            6           0.80
--------------------------------------------------------------------
Rainfall data for year 2
            39.81           24           1.20
--------------------------------------------------------------------
Rainfall data for year 100
            39.81            1           1.20
```

```
---------------------------------------------------------------------
Rainfall data for year 100
            39.81            6           2.00
---------------------------------------------------------------------
Rainfall data for year 100
            39.81           24           3.50
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 78.0      92.8         39.81      1.000     0.140    1.000    0.140

Area-averaged adjusted loss rate Fm (In/Hr) =  0.140

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
    39.81   1.000         78.0      92.8       0.78     0.776

Area-averaged catchment yield fraction, Y =  0.776
Area-averaged low loss fraction, Yb =  0.224
User entry of time of concentration  =   0.219 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      39.81(Ac.)
Catchment Lag time =   0.175 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 47.5647
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.140(In/Hr)
Average low loss rate fraction (Yb) = 0.224 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.569(In)
Computed peak 30-minute rainfall =  0.975(In)
Specified peak 1-hour rainfall =  1.200(In)
Computed peak 3-hour rainfall =  1.641(In)
Specified peak 6-hour rainfall =  2.000(In)
Specified peak 24-hour rainfall =  3.500(In)


Rainfall depth area reduction factors:
Using a total area of      39.81(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998     Adjusted rainfall =  0.568(In)
30-minute factor = 0.998    Adjusted rainfall =  0.973(In)
1-hour factor = 0.998       Adjusted rainfall =  1.198(In)
3-hour factor = 1.000       Adjusted rainfall =  1.641(In)
```

```
6-hour factor = 1.000       Adjusted rainfall =  2.000(In)
24-hour factor = 1.000      Adjusted rainfall =  3.500(In)
----------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval           'S' Graph          Unit Hydrograph
Number             Mean values             ((CFS))
----------------------------------------------------------------------
                (K =       481.49 (CFS))

  1                 3.649                  17.568
  2                27.631                 115.472
  3                58.250                 147.428
  4                72.057                  66.480
  5                80.076                  38.608
  6                85.377                  25.525
  7                89.203                  18.419
  8                91.898                  12.976
  9                94.006                  10.153
 10                95.608                   7.712
 11                96.840                   5.931
 12                97.710                   4.188
 13                98.253                   2.615
 14                98.805                   2.662
 15                99.365                   2.695
 16                99.733                   1.770
 17               100.000                   1.286
----------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1                0.5683              0.5683
  2                0.6997              0.1314
  3                0.7902              0.0905
  4                0.8615              0.0712
  5                0.9211              0.0596
  6                0.9729              0.0518
  7                1.0189              0.0460
  8                1.0606              0.0416
  9                1.0987              0.0381
 10                1.1340              0.0353
 11                1.1669              0.0329
 12                1.1978              0.0309
 13                1.2256              0.0278
 14                1.2519              0.0263
 15                1.2769              0.0250
 16                1.3007              0.0238
 17                1.3235              0.0228
 18                1.3453              0.0219
 19                1.3664              0.0210
 20                1.3866              0.0202
```

```
 21              1.4061               0.0195
 22              1.4250               0.0189
 23              1.4433               0.0183
 24              1.4610               0.0177
 25              1.4782               0.0172
 26              1.4949               0.0167
 27              1.5111               0.0163
 28              1.5270               0.0158
 29              1.5424               0.0154
 30              1.5574               0.0151
 31              1.5721               0.0147
 32              1.5865               0.0144
 33              1.6006               0.0141
 34              1.6143               0.0138
 35              1.6278               0.0135
 36              1.6410               0.0132
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0132           0.0030              0.0102
  2              0.0135           0.0030              0.0104
  3              0.0141           0.0032              0.0109
  4              0.0144           0.0032              0.0111
  5              0.0151           0.0034              0.0117
  6              0.0154           0.0035              0.0120
  7              0.0163           0.0036              0.0126
  8              0.0167           0.0037              0.0130
  9              0.0177           0.0040              0.0137
 10              0.0183           0.0041              0.0142
 11              0.0195           0.0044              0.0151
 12              0.0202           0.0045              0.0157
 13              0.0219           0.0049              0.0170
 14              0.0228           0.0051              0.0177
 15              0.0250           0.0056              0.0194
 16              0.0263           0.0059              0.0204
 17              0.0309           0.0069              0.0239
 18              0.0329           0.0074              0.0255
 19              0.0381           0.0086              0.0296
 20              0.0416           0.0093              0.0323
 21              0.0518           0.0116              0.0402
 22              0.0596           0.0117              0.0480
 23              0.0905           0.0117              0.0788
 24              0.1314           0.0117              0.1197
 25              0.5683           0.0117              0.5567
 26              0.0712           0.0117              0.0596
 27              0.0460           0.0103              0.0357
 28              0.0353           0.0079              0.0274
 29              0.0278           0.0062              0.0216
 30              0.0238           0.0053              0.0185
```

```
       31              0.0210           0.0047              0.0163
       32              0.0189           0.0042              0.0146
       33              0.0172           0.0039              0.0133
       34              0.0158           0.0036              0.0123
       35              0.0147           0.0033              0.0114
       36              0.0138           0.0031              0.0107
      --------------------------------------------------------------------
      --------------------------------------------------------------------
      Total soil rain loss =      0.22(In)
      Total effective rainfall =      1.42(In)
      Peak flow rate in flood hydrograph =    103.88(CFS)
      ---------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          3 - H O U R   S T O R M
                     R u n o f f     H y d r o g r a p h
      --------------------------------------------------------------------
                  Hydrograph in   5   Minute intervals ((CFS))

      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       50.0     100.0     150.0     200.0
-----------------------------------------------------------------------
  0+ 5       0.0012      0.18  Q         |         |         |         |
  0+10       0.0106      1.37  Q         |         |         |         |
  0+15       0.0307      2.91  Q         |         |         |         |
  0+20       0.0560      3.68  Q         |         |         |         |
  0+25       0.0848      4.19  Q         |         |         |         |
  0+30       0.1164      4.59  Q         |         |         |         |
  0+35       0.1505      4.94  QV        |         |         |         |
  0+40       0.1867      5.26  |Q        |         |         |         |
  0+45       0.2251      5.57  |Q        |         |         |         |
  0+50       0.2655      5.88  |QV       |         |         |         |
  0+55       0.3082      6.19  |QV       |         |         |         |
  1+ 0       0.3531      6.52  |QV       |         |         |         |
  1+ 5       0.4005      6.87  |Q V      |         |         |         |
  1+10       0.4505      7.27  |Q V      |         |         |         |
  1+15       0.5036      7.71  |Q  V     |         |         |         |
  1+20       0.5602      8.22  |Q  V     |         |         |         |
  1+25       0.6209      8.82  |Q   V    |         |         |         |
  1+30       0.6872      9.62  |Q   V    |         |         |         |
  1+35       0.7602     10.60  | Q   V   |         |         |         |
  1+40       0.8409     11.72  | Q    V  |         |         |         |
  1+45       0.9312     13.11  | Q    V  |         |         |         |
  1+50       1.0348     15.05  |  Q    V |         |         |         |
  1+55       1.1598     18.15  |  Q     V|         |         |         |
  2+ 0       1.3280     24.43  |   Q     |V        |         |         |
  2+ 5       1.6202     42.43  |       Q |  V      |         |         |
  2+10       2.2600     92.90  |         |       QV|         |         |
  2+15       2.9754    103.88  |         |         Q    V    |         |
  2+20       3.3848     59.44  |         |Q        |       V |         |
  2+25       3.6640     40.55  |       Q |         |         |V        |
  2+30       3.8728     30.32  |     Q   |         |         | V       |
```

```
    2+35       4.0377     23.94  |   Q     |         |         |   V     |
    2+40       4.1697     19.16  |  Q      |         |         |    V    |
    2+45       4.2806     16.11  |  Q      |         |         |     V   |
    2+50       4.3741     13.57  | Q       |         |         |      V  |
    2+55       4.4538     11.57  | Q       |         |         |      V  |
    3+ 0       4.5213      9.81  |Q        |         |         |       V |
    3+ 5       4.5776      8.17  |Q        |         |         |       V |
    3+10       4.6221      6.45  |Q        |         |         |        V|
    3+15       4.6532      4.51  Q         |         |         |        V|
    3+20       4.6741      3.04  Q         |         |         |        V|
    3+25       4.6887      2.11  Q         |         |         |        V|
    3+30       4.6959      1.05  Q         |         |         |        V|
    3+35       4.7009      0.73  Q         |         |         |        V|
    3+40       4.7046      0.53  Q         |         |         |        V|
    3+45       4.7072      0.38  Q         |         |         |        V|
    3+50       4.7091      0.27  Q         |         |         |        V|
    3+55       4.7104      0.19  Q         |         |         |        V|
    4+ 0       4.7113      0.13  Q         |         |         |        V|
    4+ 5       4.7120      0.10  Q         |         |         |        V|
    4+10       4.7124      0.06  Q         |         |         |        V|
    4+15       4.7126      0.03  Q         |         |         |        V|
    4+20       4.7127      0.01  Q         |         |         |         V
-----------------------------------------------------------------------
```

Appendix H – Proposed Condition Hydrologic Calculations (Rational Method, Unit Hydrograph)

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                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
        Rational Hydrology Study        Date: 07/13/22
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE PROPOSED HYDROLOGY CALCULATIONS
10 YEAR 1 HOUR
RATIONAL METHOD
------------------------------------------------------------------------
Program License Serial Number 6350

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.750 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   114.300(Ft.)
Top (of initial area) elevation =  2739.710(Ft.)
Bottom (of initial area) elevation =  2734.030(Ft.)
Difference in elevation =     5.680(Ft.)
Slope =    0.04969  s(%)=       4.97
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.688 min.
Rainfall intensity =      5.284(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =      0.696(CFS)
Total initial stream area =        0.149(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.129(Ft.), Average velocity =   3.068(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2              0.00              0.00
        3             50.00              0.60
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.131(CFS)
  '     '        flow top width =     10.758(Ft.)
  '     '    velocity=    3.069(Ft/s)
  '     '        area =      0.694(Sq.Ft)
  '     '        Froude number =     2.128

Upstream point elevation =  2734.030(Ft.)
Downstream point elevation =  2723.020(Ft.)
Flow length =   389.300(Ft.)
Travel time  =    2.11 min.
Time of concentration =    5.80 min.
Depth of flow =   0.129(Ft.)
Average velocity =   3.068(Ft/s)
Total irregular channel flow =     2.131(CFS)
Irregular channel normal depth above invert elev. =   0.129(Ft.)
Average velocity of channel(s) =   3.068(Ft/s)
 Adding area flow to channel
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      3.848(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.877
Subarea runoff =      2.774(CFS) for    0.879(Ac.)
Total runoff =      3.470(CFS)
Effective area this stream =        1.03(Ac.)
Total Study Area (Main Stream No. 1) =        1.03(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.155(Ft.), Average velocity =   3.466(Ft/s)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =  2720.020(Ft.)
Downstream point/station elevation =  2703.930(Ft.)
Pipe length  =   762.10(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.470(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.470(CFS)
Normal flow depth in pipe =    7.19(In.)
Flow top width inside pipe =   11.76(In.)
Critical Depth =    9.55(In.)
Pipe flow velocity =      7.07(Ft/s)
Travel time through pipe =    1.80 min.
Time of concentration (TC) =     7.60 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =     7.60 min.
Rainfall intensity =      3.185(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.872
Subarea runoff =      3.728(CFS) for    1.562(Ac.)
Total runoff =      7.197(CFS)
Effective area this stream =        2.59(Ac.)
Total Study Area (Main Stream No. 1) =        2.59(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =  2703.930(Ft.)
Downstream point/station elevation =  2702.010(Ft.)
Pipe length  =   300.70(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.197(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.197(CFS)
Normal flow depth in pipe =   12.84(In.)
```

```
Flow top width inside pipe =   16.28(In.)
Critical Depth =   12.47(In.)
Pipe flow velocity =      5.34(Ft/s)
Travel time through pipe =    0.94 min.
Time of concentration (TC) =     8.54 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      14.000 to Point/Station      14.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =     8.54 min.
Rainfall intensity =      2.936(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.870
Subarea runoff =      6.444(CFS) for    2.750(Ac.)
Total runoff =     13.641(CFS)
Effective area this stream =        5.34(Ac.)
Total Study Area (Main Stream No. 1) =        5.34(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      14.000 to Point/Station      15.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2702.010(Ft.)
Downstream point/station elevation =  2694.710(Ft.)
Pipe length  =   701.30(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.641(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    13.641(CFS)
Normal flow depth in pipe =   14.95(In.)
Flow top width inside pipe =   23.26(In.)
Critical Depth =   15.96(In.)
Pipe flow velocity =      6.63(Ft/s)
Travel time through pipe =    1.76 min.
Time of concentration (TC) =    10.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      15.000 to Point/Station      15.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
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```
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    10.30 min.
Rainfall intensity =      2.575(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =     22.882(CFS) for   11.043(Ac.)
Total runoff =     36.523(CFS)
Effective area this stream =       16.38(Ac.)
Total Study Area (Main Stream No. 1) =       16.38(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     16.383(Ac.)
Runoff from this stream =     36.523(CFS)
Time of concentration =   10.30 min.
Rainfall intensity =     2.575(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =    65.100(Ft.)
Top (of initial area) elevation =  2739.450(Ft.)
Bottom (of initial area) elevation =  2733.220(Ft.)
Difference in elevation =     6.230(Ft.)
Slope =    0.09570  s(%)=       9.57
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    2.583 min.
Rainfall intensity =      6.781(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff =      0.295(CFS)
Total initial stream area =        0.049(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.114(Ft.), Average velocity =   4.325(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.25
        2             50.00              0.00
        3            100.00              0.25
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =     11.216(CFS)
  '     '        flow top width =     45.548(Ft.)
  '     '    velocity=    4.325(Ft/s)
  '     '        area =      2.593(Sq.Ft)
  '     '        Froude number =     3.194

Upstream point elevation =  2733.220(Ft.)
Downstream point elevation =  2710.650(Ft.)
Flow length =   345.300(Ft.)
Travel time  =    1.33 min.
Time of concentration =    3.91 min.
Depth of flow =   0.114(Ft.)
Average velocity =   4.325(Ft/s)
Total irregular channel flow =    11.216(CFS)
Irregular channel normal depth above invert elev. =   0.114(Ft.)
Average velocity of channel(s) =   4.325(Ft/s)
 Adding area flow to channel
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      5.069(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.883
```

```
Subarea runoff =     21.760(CFS) for    4.880(Ac.)
Total runoff =     22.055(CFS)
Effective area this stream =       4.93(Ac.)
Total Study Area (Main Stream No. 2) =      21.31(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.147(Ft.), Average velocity =   5.122(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2706.150(Ft.)
Downstream point/station elevation =  2703.900(Ft.)
Pipe length  =   473.10(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.055(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    22.055(CFS)
Normal flow depth in pipe =   19.92(In.)
Flow top width inside pipe =   28.34(In.)
Critical Depth =   19.15(In.)
Pipe flow velocity =      6.37(Ft/s)
Travel time through pipe =    1.24 min.
Time of concentration (TC) =     5.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =     5.15 min.
Rainfall intensity =      4.182(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff =     26.420(CFS) for    8.257(Ac.)
Total runoff =     48.475(CFS)
Effective area this stream =      13.19(Ac.)
Total Study Area (Main Stream No. 2) =      29.57(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
```

```
Upstream point/station elevation =  2703.900(Ft.)
Downstream point/station elevation =  2701.430(Ft.)
Pipe length  =   417.60(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    48.475(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    48.475(CFS)
Normal flow depth in pipe =   27.89(In.)
Flow top width inside pipe =   30.08(In.)
Critical Depth =   27.20(In.)
Pipe flow velocity =      8.26(Ft/s)
Travel time through pipe =    0.84 min.
Time of concentration (TC) =     5.99 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       24.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =     5.99 min.
Rainfall intensity =      3.761(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.877
Subarea runoff =     13.171(CFS) for    5.510(Ac.)
Total runoff =     61.646(CFS)
Effective area this stream =       18.70(Ac.)
Total Study Area (Main Stream No. 2) =       35.08(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       25.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =  2701.430(Ft.)
Downstream point/station elevation =  2697.310(Ft.)
Pipe length  =   819.40(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    61.646(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    61.646(CFS)
Normal flow depth in pipe =   30.14(In.)
Flow top width inside pipe =   37.81(In.)
Critical Depth =   29.53(In.)
Pipe flow velocity =      8.34(Ft/s)
```

```
Travel time through pipe =    1.64 min.
Time of concentration (TC) =     7.63 min.


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     55.796(CFS)
therefore the upstream flow rate of Q =     61.646(CFS) is being used
Time of concentration =     7.63 min.
Rainfall intensity =      3.177(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.872
Subarea runoff =      0.000(CFS) for    1.440(Ac.)
Total runoff =     61.646(CFS)
Effective area this stream =       20.14(Ac.)
Total Study Area (Main Stream No. 2) =       36.52(Ac.)
Area averaged Fm value =    0.098(In/Hr)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =  2697.310(Ft.)
Downstream point/station elevation =  2696.810(Ft.)
Pipe length  =    63.60(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    61.646(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    61.646(CFS)
Normal flow depth in pipe =   27.42(In.)
Flow top width inside pipe =   35.64(In.)
Critical Depth =   30.04(In.)
Pipe flow velocity =      9.89(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =     7.74 min.


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       26.000
**** SUBAREA FLOW ADDITION ****
```

```
COMMERCIAL 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) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =     7.74 min.
Rainfall intensity =      3.146(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.872
Subarea runoff =      2.616(CFS) for    3.290(Ac.)
Total runoff =     64.262(CFS)
Effective area this stream =       23.43(Ac.)
Total Study Area (Main Stream No. 2) =       39.81(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2696.810(Ft.)
Downstream point/station elevation =  2694.720(Ft.)
Pipe length  =   173.80(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    64.262(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    64.262(CFS)
Normal flow depth in pipe =   28.45(In.)
Flow top width inside pipe =   34.65(In.)
Critical Depth =   30.65(In.)
Pipe flow velocity =      9.90(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =     8.03 min.


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Process from Point/Station       15.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     23.426(Ac.)
Runoff from this stream =     64.262(CFS)
Time of concentration =    8.03 min.
Rainfall intensity =     3.065(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC      Fm       Rainfall Intensity
```

```
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     36.52    16.383     10.30    0.098      2.575
2     64.26    23.426      8.03    0.098      3.065
Qmax(1) =
           1.000 *    1.000 *    36.523) +
           0.835 *    1.000 *    64.262) + =      90.167
Qmax(2) =
           1.198 *    0.780 *    36.523) +
           1.000 *    1.000 *    64.262) + =      98.370

Total of 2 main streams to confluence:
Flow rates before confluence point:
      37.523      65.262
Maximum flow rates at confluence using above data:
       90.167       98.370
Area of streams before confluence:
       16.383       23.426
Effective area values after confluence:
       39.809       36.198


Results of confluence:
Total flow rate =     98.370(CFS)
Time of concentration =     8.031 min.
Effective stream area after confluence  =     36.198(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total =      39.81(Ac.)
End of computations, Total Study Area =           39.81 (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) = 0.100
Area averaged SCS curve number =  32.0
```

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                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
        Rational Hydrology Study       Date: 07/13/22
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE PROPOSED HYDROLOGY CALCULATIONS
100 YEAR 1 HOUR
RATIONAL METHOD
------------------------------------------------------------------------
Program License Serial Number 6350

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.200 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   114.300(Ft.)
Top (of initial area) elevation =  2739.710(Ft.)
Bottom (of initial area) elevation =  2734.030(Ft.)
Difference in elevation =     5.680(Ft.)
Slope =    0.04969  s(%)=       4.97
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    3.688 min.
Rainfall intensity =      8.455(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.892
Subarea runoff =      1.123(CFS)
Total initial stream area =        0.149(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.155(Ft.), Average velocity =   3.473(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00               0.50
        2              0.00               0.00
        3             50.00               0.60
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      3.498(CFS)
  '     '        flow top width =     12.955(Ft.)
  '     '    velocity=    3.473(Ft/s)
  '     '        area =      1.007(Sq.Ft)
  '     '        Froude number =     2.195

Upstream point elevation =  2734.030(Ft.)
Downstream point elevation =  2723.020(Ft.)
Flow length =   389.300(Ft.)
Travel time  =    1.87 min.
Time of concentration =    5.56 min.
Depth of flow =   0.155(Ft.)
Average velocity =   3.473(Ft/s)
Total irregular channel flow =     3.498(CFS)
Irregular channel normal depth above invert elev. =   0.155(Ft.)
Average velocity of channel(s) =   3.473(Ft/s)
 Adding area flow to channel
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      6.346(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.889
Subarea runoff =      4.676(CFS) for    0.879(Ac.)
Total runoff =      5.799(CFS)
Effective area this stream =        1.03(Ac.)
Total Study Area (Main Stream No. 1) =        1.03(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.188(Ft.), Average velocity =   3.941(Ft/s)
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Process from Point/Station      12.000 to Point/Station      13.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2720.020(Ft.)
Downstream point/station elevation =  2703.930(Ft.)
Pipe length  =   762.10(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.799(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.799(CFS)
Normal flow depth in pipe =    8.53(In.)
Flow top width inside pipe =   14.86(In.)
Critical Depth =   11.70(In.)
Pipe flow velocity =      8.05(Ft/s)
Travel time through pipe =    1.58 min.
Time of concentration (TC) =     7.13 min.


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Process from Point/Station      13.000 to Point/Station      13.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     7.13 min.
Rainfall intensity =      5.328(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.887
Subarea runoff =      6.437(CFS) for    1.562(Ac.)
Total runoff =     12.236(CFS)
Effective area this stream =        2.59(Ac.)
Total Study Area (Main Stream No. 1) =        2.59(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      13.000 to Point/Station      14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2703.930(Ft.)
Downstream point/station elevation =  2702.010(Ft.)
Pipe length  =   300.70(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.236(CFS)
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Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    12.236(CFS)
Normal flow depth in pipe =   16.59(In.)
Flow top width inside pipe =   17.10(In.)
Critical Depth =   15.64(In.)
Pipe flow velocity =      6.00(Ft/s)
Travel time through pipe =    0.84 min.
Time of concentration (TC) =     7.97 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     7.97 min.
Rainfall intensity =      4.930(In/Hr) for a  100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.886
Subarea runoff =     11.081(CFS) for    2.750(Ac.)
Total runoff =     23.317(CFS)
Effective area this stream =        5.34(Ac.)
Total Study Area (Main Stream No. 1) =        5.34(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2702.010(Ft.)
Downstream point/station elevation =  2694.710(Ft.)
Pipe length  =   701.30(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.317(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    23.317(CFS)
Normal flow depth in pipe =   19.78(In.)
Flow top width inside pipe =   23.90(In.)
Critical Depth =   20.27(In.)
Pipe flow velocity =      7.47(Ft/s)
Travel time through pipe =    1.57 min.
Time of concentration (TC) =     9.54 min.
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      15.000 to Point/Station      15.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     9.54 min.
Rainfall intensity =      4.349(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.884
Subarea runoff =     39.643(CFS) for   11.043(Ac.)
Total runoff =     62.960(CFS)
Effective area this stream =       16.38(Ac.)
Total Study Area (Main Stream No. 1) =       16.38(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      15.000 to Point/Station      15.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     16.383(Ac.)
Runoff from this stream =     62.960(CFS)
Time of concentration =    9.54 min.
Rainfall intensity =     4.349(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      20.000 to Point/Station      21.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
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```
Initial area flow distance =    65.100(Ft.)
Top (of initial area) elevation =  2739.450(Ft.)
Bottom (of initial area) elevation =  2733.220(Ft.)
Difference in elevation =     6.230(Ft.)
Slope =    0.09570  s(%)=       9.57
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.583 min.
Rainfall intensity =     10.849(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.893
Subarea runoff =      0.475(CFS)
Total initial stream area =        0.049(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.138(Ft.), Average velocity =   4.909(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00             0.25
        2             50.00             0.00
        3            100.00             0.25
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =     18.612(CFS)
  '     '        flow top width =     55.075(Ft.)
  '     '    velocity=    4.909(Ft/s)
  '     '        area =      3.792(Sq.Ft)
  '     '        Froude number =     3.297

Upstream point elevation =  2733.220(Ft.)
Downstream point elevation =  2710.650(Ft.)
Flow length =   345.300(Ft.)
Travel time  =    1.17 min.
Time of concentration =    3.76 min.
Depth of flow =   0.138(Ft.)
Average velocity =   4.909(Ft/s)
Total irregular channel flow =    18.612(CFS)
Irregular channel normal depth above invert elev. =   0.138(Ft.)
Average velocity of channel(s) =   4.909(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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```
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      8.349(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.892
Subarea runoff =     36.213(CFS) for    4.880(Ac.)
Total runoff =     36.688(CFS)
Effective area this stream =        4.93(Ac.)
Total Study Area (Main Stream No. 2) =       21.31(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.178(Ft.), Average velocity =   5.817(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2706.150(Ft.)
Downstream point/station elevation =  2703.900(Ft.)
Pipe length  =   473.10(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    36.688(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    36.688(CFS)
Normal flow depth in pipe =   24.30(In.)
Flow top width inside pipe =   33.72(In.)
Critical Depth =   23.65(In.)
Pipe flow velocity =      7.23(Ft/s)
Travel time through pipe =    1.09 min.
Time of concentration (TC) =     4.85 min.


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Process from Point/Station       23.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     4.85 min.
Rainfall intensity =      6.984(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =     45.257(CFS) for    8.257(Ac.)
Total runoff =     81.946(CFS)
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Effective area this stream =       13.19(Ac.)
Total Study Area (Main Stream No. 2) =       29.57(Ac.)
Area averaged Fm value =    0.079(In/Hr)


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Process from Point/Station       23.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2703.900(Ft.)
Downstream point/station elevation =  2701.430(Ft.)
Pipe length  =   417.60(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    81.946(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =    81.946(CFS)
Normal flow depth in pipe =   32.81(In.)
Flow top width inside pipe =   40.00(In.)
Critical Depth =   33.43(In.)
Pipe flow velocity =      9.50(Ft/s)
Travel time through pipe =    0.73 min.
Time of concentration (TC) =     5.58 min.


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Process from Point/Station       24.000 to Point/Station       24.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     5.58 min.
Rainfall intensity =      6.329(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.889
Subarea runoff =     23.219(CFS) for    5.510(Ac.)
Total runoff =    105.165(CFS)
Effective area this stream =       18.70(Ac.)
Total Study Area (Main Stream No. 2) =       35.08(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       25.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2701.430(Ft.)
```

```
Downstream point/station elevation =  2697.310(Ft.)
Pipe length  =   819.40(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   105.165(CFS)
Nearest computed pipe diameter  =     51.00(In.)
Calculated individual pipe flow  =   105.165(CFS)
Normal flow depth in pipe =   37.08(In.)
Flow top width inside pipe =   45.44(In.)
Critical Depth =   36.74(In.)
Pipe flow velocity =      9.52(Ft/s)
Travel time through pipe =    1.43 min.
Time of concentration (TC) =     7.01 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     96.290(CFS)
therefore the upstream flow rate of Q =    105.165(CFS) is being used
Time of concentration =     7.01 min.
Rainfall intensity =      5.392(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.887
Subarea runoff =      0.000(CFS) for    1.440(Ac.)
Total runoff =    105.165(CFS)
Effective area this stream =       20.14(Ac.)
Total Study Area (Main Stream No. 2) =       36.52(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2697.310(Ft.)
Downstream point/station elevation =  2696.810(Ft.)
Pipe length  =    63.60(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   105.165(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =   105.165(CFS)
Normal flow depth in pipe =   36.09(In.)
Flow top width inside pipe =   35.86(In.)
```

```
Critical Depth =   37.58(In.)
Pipe flow velocity =     11.07(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     7.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       26.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     7.11 min.
Rainfall intensity =      5.341(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.887
Subarea runoff =      5.784(CFS) for    3.290(Ac.)
Total runoff =    110.949(CFS)
Effective area this stream =       23.43(Ac.)
Total Study Area (Main Stream No. 2) =       39.81(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2696.810(Ft.)
Downstream point/station elevation =  2694.710(Ft.)
Pipe length  =   173.80(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   110.949(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   110.949(CFS)
Normal flow depth in pipe =   34.83(In.)
Flow top width inside pipe =   42.84(In.)
Critical Depth =   38.21(In.)
Pipe flow velocity =     11.36(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     7.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
```

```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     23.426(Ac.)
Runoff from this stream =    110.949(CFS)
Time of concentration =    7.36 min.
Rainfall intensity =     5.211(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC      Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     62.96    16.383      9.54    0.079      4.349
2    110.95    23.426      7.36    0.079      5.211
Qmax(1) =
           1.000 *    1.000 *    62.960) +
           0.832 *    1.000 *   110.949) + =     155.269
Qmax(2) =
           1.202 *    0.772 *    62.960) +
           1.000 *    1.000 *   110.949) + =     169.390

Total of 2 main streams to confluence:
Flow rates before confluence point:
      63.960     111.949
Maximum flow rates at confluence using above data:
      155.269      169.390
Area of streams before confluence:
       16.383       23.426
Effective area values after confluence:
       39.809       36.078


Results of confluence:
Total flow rate =    169.390(CFS)
Time of concentration =     7.364 min.
Effective stream area after confluence  =     36.078(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.079(In/Hr)
Study area total =      39.81(Ac.)
End of computations, Total Study Area =          39.81 (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) = 0.100
Area averaged SCS curve number =  32.0
```

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

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                Study date  07/13/22

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE PROPOSED HYDROLOGY CALCULATIONS
10 YEAR 24 HOUR
UNIT HYDROGRAPH
------------------------------------------------------------------------

Program License Serial Number 6350

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

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            39.81            1           0.75
--------------------------------------------------------------------
Rainfall data for year 2
            39.81            6           0.80
--------------------------------------------------------------------
Rainfall data for year 2
            39.81           24           1.20
--------------------------------------------------------------------
Rainfall data for year 100
            39.81            1           1.20
```

```
--------------------------------------------------------------------
Rainfall data for year 100
            39.81            6           2.00
--------------------------------------------------------------------
Rainfall data for year 100
            39.81           24           3.50
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 98.0      98.0         34.02      0.855     0.040    0.010    0.000
 32.0      32.0          5.79      0.145     0.978    1.000    0.978

Area-averaged adjusted loss rate Fm (In/Hr) =  0.143

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract          (AMC2)    (AMC2)          Yield Fr
    0.34   0.009          98.0      98.0        0.20     0.894
   33.68   0.846          98.0      98.0        0.20     0.894

    5.79   0.145          32.0      32.0       10.73     0.000

Area-averaged catchment yield fraction, Y =  0.764
Area-averaged low loss fraction, Yb =  0.236
User entry of time of concentration  =   0.134 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      39.81(Ac.)
Catchment Lag time =   0.107 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 77.8234
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.143(In/Hr)
Average low loss rate fraction (Yb) = 0.236 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.356(In)
Computed peak 30-minute rainfall =  0.609(In)
Specified peak 1-hour rainfall =  0.750(In)
Computed peak 3-hour rainfall =  1.048(In)
Specified peak 6-hour rainfall =  1.294(In)
Specified peak 24-hour rainfall =  2.146(In)


Rainfall depth area reduction factors:
Using a total area of      39.81(Ac.) (Ref: fig. E-4)
```

```
5-minute factor = 0.998     Adjusted rainfall =  0.355(In)
30-minute factor = 0.998    Adjusted rainfall =  0.608(In)
1-hour factor = 0.998       Adjusted rainfall =  0.749(In)
3-hour factor = 1.000       Adjusted rainfall =  1.047(In)
6-hour factor = 1.000       Adjusted rainfall =  1.294(In)
24-hour factor = 1.000      Adjusted rainfall =  2.146(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
                (K =       481.49 (CFS))

  1               10.054                 48.407
  2               56.026                221.349
  3               76.994                100.959
  4               86.276                 44.692
  5               91.523                 25.264
  6               94.831                 15.926
  7               96.949                 10.201
  8               98.142                  5.743
  9               99.038                  4.315
 10               99.746                  3.408
 11              100.000                  1.224
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.3552               0.3552
  2              0.4373               0.0821
  3              0.4939               0.0566
  4              0.5384               0.0445
  5              0.5757               0.0373
  6              0.6081               0.0324
  7              0.6368               0.0288
  8              0.6629               0.0260
  9              0.6867               0.0238
 10              0.7088               0.0221
 11              0.7293               0.0206
 12              0.7486               0.0193
 13              0.7671               0.0185
 14              0.7847               0.0176
 15              0.8015               0.0167
 16              0.8174               0.0160
 17              0.8327               0.0153
 18              0.8474               0.0147
 19              0.8615               0.0141
 20              0.8751               0.0136
 21              0.8883               0.0132
 22              0.9010               0.0127
```

23	0.9134	0.0123
24	0.9253	0.0120
25	0.9369	0.0116
26	0.9482	0.0113
27	0.9593	0.0110
28	0.9700	0.0107
29	0.9804	0.0105
30	0.9907	0.0102
31	1.0006	0.0100
32	1.0104	0.0098
33	1.0199	0.0096
34	1.0293	0.0094
35	1.0385	0.0092
36	1.0474	0.0090
37	1.0562	0.0088
38	1.0648	0.0086
39	1.0733	0.0085
40	1.0816	0.0083
41	1.0898	0.0082
42	1.0978	0.0080
43	1.1057	0.0079
44	1.1134	0.0078
45	1.1211	0.0076
46	1.1286	0.0075
47	1.1360	0.0074
48	1.1433	0.0073
49	1.1505	0.0072
50	1.1576	0.0071
51	1.1646	0.0070
52	1.1715	0.0069
53	1.1783	0.0068
54	1.1851	0.0067
55	1.1917	0.0066
56	1.1983	0.0066
57	1.2047	0.0065
58	1.2111	0.0064
59	1.2174	0.0063
60	1.2237	0.0062
61	1.2299	0.0062
62	1.2360	0.0061
63	1.2420	0.0060
64	1.2480	0.0060
65	1.2539	0.0059
66	1.2597	0.0058
67	1.2655	0.0058
68	1.2712	0.0057
69	1.2769	0.0057
70	1.2825	0.0056
71	1.2880	0.0056
72	1.2935	0.0055
73	1.3001	0.0065

74	1.3065	0.0065
75	1.3130	0.0064
76	1.3193	0.0064
77	1.3256	0.0063
78	1.3319	0.0063
79	1.3381	0.0062
80	1.3443	0.0062
81	1.3504	0.0061
82	1.3565	0.0061
83	1.3625	0.0060
84	1.3684	0.0060
85	1.3744	0.0059
86	1.3803	0.0059
87	1.3861	0.0058
88	1.3919	0.0058
89	1.3976	0.0058
90	1.4034	0.0057
91	1.4090	0.0057
92	1.4147	0.0056
93	1.4203	0.0056
94	1.4258	0.0056
95	1.4313	0.0055
96	1.4368	0.0055
97	1.4423	0.0054
98	1.4477	0.0054
99	1.4531	0.0054
100	1.4584	0.0053
101	1.4637	0.0053
102	1.4690	0.0053
103	1.4742	0.0052
104	1.4795	0.0052
105	1.4846	0.0052
106	1.4898	0.0051
107	1.4949	0.0051
108	1.5000	0.0051
109	1.5050	0.0051
110	1.5101	0.0050
111	1.5151	0.0050
112	1.5200	0.0050
113	1.5250	0.0049
114	1.5299	0.0049
115	1.5348	0.0049
116	1.5396	0.0049
117	1.5445	0.0048
118	1.5493	0.0048
119	1.5541	0.0048
120	1.5588	0.0048
121	1.5636	0.0047
122	1.5683	0.0047
123	1.5729	0.0047
124	1.5776	0.0047

125	1.5822	0.0046
126	1.5869	0.0046
127	1.5914	0.0046
128	1.5960	0.0046
129	1.6005	0.0045
130	1.6051	0.0045
131	1.6096	0.0045
132	1.6140	0.0045
133	1.6185	0.0045
134	1.6229	0.0044
135	1.6273	0.0044
136	1.6317	0.0044
137	1.6361	0.0044
138	1.6405	0.0044
139	1.6448	0.0043
140	1.6491	0.0043
141	1.6534	0.0043
142	1.6577	0.0043
143	1.6619	0.0043
144	1.6662	0.0042
145	1.6704	0.0042
146	1.6746	0.0042
147	1.6788	0.0042
148	1.6829	0.0042
149	1.6871	0.0041
150	1.6912	0.0041
151	1.6953	0.0041
152	1.6994	0.0041
153	1.7035	0.0041
154	1.7075	0.0041
155	1.7116	0.0040
156	1.7156	0.0040
157	1.7196	0.0040
158	1.7236	0.0040
159	1.7276	0.0040
160	1.7315	0.0040
161	1.7355	0.0039
162	1.7394	0.0039
163	1.7433	0.0039
164	1.7472	0.0039
165	1.7511	0.0039
166	1.7550	0.0039
167	1.7588	0.0039
168	1.7627	0.0038
169	1.7665	0.0038
170	1.7703	0.0038
171	1.7741	0.0038
172	1.7779	0.0038
173	1.7816	0.0038
174	1.7854	0.0038
175	1.7891	0.0037

176	1.7929	0.0037
177	1.7966	0.0037
178	1.8003	0.0037
179	1.8040	0.0037
180	1.8076	0.0037
181	1.8113	0.0037
182	1.8149	0.0036
183	1.8186	0.0036
184	1.8222	0.0036
185	1.8258	0.0036
186	1.8294	0.0036
187	1.8330	0.0036
188	1.8366	0.0036
189	1.8401	0.0036
190	1.8437	0.0035
191	1.8472	0.0035
192	1.8507	0.0035
193	1.8543	0.0035
194	1.8578	0.0035
195	1.8612	0.0035
196	1.8647	0.0035
197	1.8682	0.0035
198	1.8717	0.0035
199	1.8751	0.0034
200	1.8785	0.0034
201	1.8820	0.0034
202	1.8854	0.0034
203	1.8888	0.0034
204	1.8922	0.0034
205	1.8956	0.0034
206	1.8989	0.0034
207	1.9023	0.0034
208	1.9056	0.0034
209	1.9090	0.0033
210	1.9123	0.0033
211	1.9156	0.0033
212	1.9189	0.0033
213	1.9222	0.0033
214	1.9255	0.0033
215	1.9288	0.0033
216	1.9321	0.0033
217	1.9354	0.0033
218	1.9386	0.0033
219	1.9418	0.0032
220	1.9451	0.0032
221	1.9483	0.0032
222	1.9515	0.0032
223	1.9547	0.0032
224	1.9579	0.0032
225	1.9611	0.0032
226	1.9643	0.0032

227	1.9675	0.0032
228	1.9706	0.0032
229	1.9738	0.0032
230	1.9769	0.0031
231	1.9800	0.0031
232	1.9832	0.0031
233	1.9863	0.0031
234	1.9894	0.0031
235	1.9925	0.0031
236	1.9956	0.0031
237	1.9987	0.0031
238	2.0018	0.0031
239	2.0048	0.0031
240	2.0079	0.0031
241	2.0109	0.0031
242	2.0140	0.0030
243	2.0170	0.0030
244	2.0200	0.0030
245	2.0231	0.0030
246	2.0261	0.0030
247	2.0291	0.0030
248	2.0321	0.0030
249	2.0351	0.0030
250	2.0380	0.0030
251	2.0410	0.0030
252	2.0440	0.0030
253	2.0469	0.0030
254	2.0499	0.0030
255	2.0528	0.0029
256	2.0558	0.0029
257	2.0587	0.0029
258	2.0616	0.0029
259	2.0645	0.0029
260	2.0674	0.0029
261	2.0703	0.0029
262	2.0732	0.0029
263	2.0761	0.0029
264	2.0790	0.0029
265	2.0819	0.0029
266	2.0847	0.0029
267	2.0876	0.0029
268	2.0905	0.0029
269	2.0933	0.0028
270	2.0961	0.0028
271	2.0990	0.0028
272	2.1018	0.0028
273	2.1046	0.0028
274	2.1074	0.0028
275	2.1102	0.0028
276	2.1130	0.0028
277	2.1158	0.0028

```
278              2.1186               0.0028
279              2.1214               0.0028
280              2.1242               0.0028
281              2.1269               0.0028
282              2.1297               0.0028
283              2.1324               0.0028
284              2.1352               0.0027
285              2.1379               0.0027
286              2.1407               0.0027
287              2.1434               0.0027
288              2.1461               0.0027
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0027           0.0006              0.0021
  2              0.0027           0.0006              0.0021
  3              0.0027           0.0006              0.0021
  4              0.0027           0.0006              0.0021
  5              0.0028           0.0007              0.0021
  6              0.0028           0.0007              0.0021
  7              0.0028           0.0007              0.0021
  8              0.0028           0.0007              0.0021
  9              0.0028           0.0007              0.0021
 10              0.0028           0.0007              0.0021
 11              0.0028           0.0007              0.0022
 12              0.0028           0.0007              0.0022
 13              0.0028           0.0007              0.0022
 14              0.0028           0.0007              0.0022
 15              0.0029           0.0007              0.0022
 16              0.0029           0.0007              0.0022
 17              0.0029           0.0007              0.0022
 18              0.0029           0.0007              0.0022
 19              0.0029           0.0007              0.0022
 20              0.0029           0.0007              0.0022
 21              0.0029           0.0007              0.0022
 22              0.0029           0.0007              0.0022
 23              0.0029           0.0007              0.0022
 24              0.0030           0.0007              0.0023
 25              0.0030           0.0007              0.0023
 26              0.0030           0.0007              0.0023
 27              0.0030           0.0007              0.0023
 28              0.0030           0.0007              0.0023
 29              0.0030           0.0007              0.0023
 30              0.0030           0.0007              0.0023
 31              0.0030           0.0007              0.0023
 32              0.0030           0.0007              0.0023
 33              0.0031           0.0007              0.0023
 34              0.0031           0.0007              0.0023
 35              0.0031           0.0007              0.0024
```

36	0.0031	0.0007	0.0024
37	0.0031	0.0007	0.0024
38	0.0031	0.0007	0.0024
39	0.0031	0.0007	0.0024
40	0.0031	0.0007	0.0024
41	0.0032	0.0007	0.0024
42	0.0032	0.0007	0.0024
43	0.0032	0.0008	0.0024
44	0.0032	0.0008	0.0024
45	0.0032	0.0008	0.0025
46	0.0032	0.0008	0.0025
47	0.0032	0.0008	0.0025
48	0.0033	0.0008	0.0025
49	0.0033	0.0008	0.0025
50	0.0033	0.0008	0.0025
51	0.0033	0.0008	0.0025
52	0.0033	0.0008	0.0025
53	0.0033	0.0008	0.0025
54	0.0033	0.0008	0.0026
55	0.0034	0.0008	0.0026
56	0.0034	0.0008	0.0026
57	0.0034	0.0008	0.0026
58	0.0034	0.0008	0.0026
59	0.0034	0.0008	0.0026
60	0.0034	0.0008	0.0026
61	0.0035	0.0008	0.0026
62	0.0035	0.0008	0.0027
63	0.0035	0.0008	0.0027
64	0.0035	0.0008	0.0027
65	0.0035	0.0008	0.0027
66	0.0035	0.0008	0.0027
67	0.0036	0.0008	0.0027
68	0.0036	0.0008	0.0027
69	0.0036	0.0008	0.0027
70	0.0036	0.0009	0.0028
71	0.0036	0.0009	0.0028
72	0.0036	0.0009	0.0028
73	0.0037	0.0009	0.0028
74	0.0037	0.0009	0.0028
75	0.0037	0.0009	0.0028
76	0.0037	0.0009	0.0028
77	0.0038	0.0009	0.0029
78	0.0038	0.0009	0.0029
79	0.0038	0.0009	0.0029
80	0.0038	0.0009	0.0029
81	0.0038	0.0009	0.0029
82	0.0039	0.0009	0.0029
83	0.0039	0.0009	0.0030
84	0.0039	0.0009	0.0030
85	0.0039	0.0009	0.0030
86	0.0039	0.0009	0.0030

87	0.0040	0.0009	0.0030
88	0.0040	0.0009	0.0031
89	0.0040	0.0009	0.0031
90	0.0040	0.0010	0.0031
91	0.0041	0.0010	0.0031
92	0.0041	0.0010	0.0031
93	0.0041	0.0010	0.0032
94	0.0041	0.0010	0.0032
95	0.0042	0.0010	0.0032
96	0.0042	0.0010	0.0032
97	0.0042	0.0010	0.0032
98	0.0043	0.0010	0.0033
99	0.0043	0.0010	0.0033
100	0.0043	0.0010	0.0033
101	0.0044	0.0010	0.0033
102	0.0044	0.0010	0.0033
103	0.0044	0.0010	0.0034
104	0.0044	0.0010	0.0034
105	0.0045	0.0011	0.0034
106	0.0045	0.0011	0.0034
107	0.0045	0.0011	0.0035
108	0.0046	0.0011	0.0035
109	0.0046	0.0011	0.0035
110	0.0046	0.0011	0.0035
111	0.0047	0.0011	0.0036
112	0.0047	0.0011	0.0036
113	0.0048	0.0011	0.0036
114	0.0048	0.0011	0.0037
115	0.0048	0.0011	0.0037
116	0.0049	0.0011	0.0037
117	0.0049	0.0012	0.0038
118	0.0049	0.0012	0.0038
119	0.0050	0.0012	0.0038
120	0.0050	0.0012	0.0038
121	0.0051	0.0012	0.0039
122	0.0051	0.0012	0.0039
123	0.0052	0.0012	0.0040
124	0.0052	0.0012	0.0040
125	0.0053	0.0012	0.0040
126	0.0053	0.0013	0.0041
127	0.0054	0.0013	0.0041
128	0.0054	0.0013	0.0041
129	0.0055	0.0013	0.0042
130	0.0055	0.0013	0.0042
131	0.0056	0.0013	0.0043
132	0.0056	0.0013	0.0043
133	0.0057	0.0013	0.0044
134	0.0058	0.0014	0.0044
135	0.0058	0.0014	0.0045
136	0.0059	0.0014	0.0045
137	0.0060	0.0014	0.0046

138	0.0060	0.0014	0.0046
139	0.0061	0.0014	0.0047
140	0.0062	0.0015	0.0047
141	0.0063	0.0015	0.0048
142	0.0063	0.0015	0.0048
143	0.0064	0.0015	0.0049
144	0.0065	0.0015	0.0049
145	0.0055	0.0013	0.0042
146	0.0056	0.0013	0.0042
147	0.0057	0.0013	0.0043
148	0.0057	0.0013	0.0044
149	0.0058	0.0014	0.0045
150	0.0059	0.0014	0.0045
151	0.0060	0.0014	0.0046
152	0.0061	0.0014	0.0047
153	0.0062	0.0015	0.0048
154	0.0063	0.0015	0.0048
155	0.0065	0.0015	0.0049
156	0.0066	0.0015	0.0050
157	0.0067	0.0016	0.0051
158	0.0068	0.0016	0.0052
159	0.0070	0.0017	0.0053
160	0.0071	0.0017	0.0054
161	0.0073	0.0017	0.0056
162	0.0074	0.0017	0.0057
163	0.0076	0.0018	0.0058
164	0.0078	0.0018	0.0059
165	0.0080	0.0019	0.0061
166	0.0082	0.0019	0.0062
167	0.0085	0.0020	0.0065
168	0.0086	0.0020	0.0066
169	0.0090	0.0021	0.0069
170	0.0092	0.0022	0.0070
171	0.0096	0.0023	0.0073
172	0.0098	0.0023	0.0075
173	0.0102	0.0024	0.0078
174	0.0105	0.0025	0.0080
175	0.0110	0.0026	0.0084
176	0.0113	0.0027	0.0086
177	0.0120	0.0028	0.0091
178	0.0123	0.0029	0.0094
179	0.0132	0.0031	0.0101
180	0.0136	0.0032	0.0104
181	0.0147	0.0035	0.0112
182	0.0153	0.0036	0.0117
183	0.0167	0.0039	0.0128
184	0.0176	0.0041	0.0134
185	0.0193	0.0045	0.0147
186	0.0206	0.0048	0.0157
187	0.0238	0.0056	0.0182
188	0.0260	0.0061	0.0199

189	0.0324	0.0076	0.0247
190	0.0373	0.0088	0.0285
191	0.0566	0.0119	0.0447
192	0.0821	0.0119	0.0702
193	0.3552	0.0119	0.3433
194	0.0445	0.0105	0.0340
195	0.0288	0.0068	0.0220
196	0.0221	0.0052	0.0169
197	0.0185	0.0044	0.0142
198	0.0160	0.0038	0.0122
199	0.0141	0.0033	0.0108
200	0.0127	0.0030	0.0097
201	0.0116	0.0027	0.0089
202	0.0107	0.0025	0.0082
203	0.0100	0.0024	0.0076
204	0.0094	0.0022	0.0071
205	0.0088	0.0021	0.0067
206	0.0083	0.0020	0.0063
207	0.0079	0.0019	0.0060
208	0.0075	0.0018	0.0058
209	0.0072	0.0017	0.0055
210	0.0069	0.0016	0.0053
211	0.0066	0.0016	0.0051
212	0.0064	0.0015	0.0049
213	0.0062	0.0015	0.0047
214	0.0060	0.0014	0.0046
215	0.0058	0.0014	0.0044
216	0.0056	0.0013	0.0043
217	0.0065	0.0015	0.0050
218	0.0064	0.0015	0.0049
219	0.0062	0.0015	0.0047
220	0.0061	0.0014	0.0046
221	0.0059	0.0014	0.0045
222	0.0058	0.0014	0.0044
223	0.0057	0.0013	0.0043
224	0.0056	0.0013	0.0042
225	0.0054	0.0013	0.0042
226	0.0053	0.0013	0.0041
227	0.0052	0.0012	0.0040
228	0.0051	0.0012	0.0039
229	0.0051	0.0012	0.0039
230	0.0050	0.0012	0.0038
231	0.0049	0.0012	0.0037
232	0.0048	0.0011	0.0037
233	0.0047	0.0011	0.0036
234	0.0047	0.0011	0.0036
235	0.0046	0.0011	0.0035
236	0.0045	0.0011	0.0035
237	0.0045	0.0011	0.0034
238	0.0044	0.0010	0.0034
239	0.0043	0.0010	0.0033

```
240              0.0043           0.0010              0.0033
241              0.0042           0.0010              0.0032
242              0.0042           0.0010              0.0032
243              0.0041           0.0010              0.0031
244              0.0041           0.0010              0.0031
245              0.0040           0.0009              0.0031
246              0.0040           0.0009              0.0030
247              0.0039           0.0009              0.0030
248              0.0039           0.0009              0.0030
249              0.0038           0.0009              0.0029
250              0.0038           0.0009              0.0029
251              0.0037           0.0009              0.0029
252              0.0037           0.0009              0.0028
253              0.0037           0.0009              0.0028
254              0.0036           0.0009              0.0028
255              0.0036           0.0008              0.0027
256              0.0035           0.0008              0.0027
257              0.0035           0.0008              0.0027
258              0.0035           0.0008              0.0027
259              0.0034           0.0008              0.0026
260              0.0034           0.0008              0.0026
261              0.0034           0.0008              0.0026
262              0.0034           0.0008              0.0026
263              0.0033           0.0008              0.0025
264              0.0033           0.0008              0.0025
265              0.0033           0.0008              0.0025
266              0.0032           0.0008              0.0025
267              0.0032           0.0008              0.0024
268              0.0032           0.0007              0.0024
269              0.0032           0.0007              0.0024
270              0.0031           0.0007              0.0024
271              0.0031           0.0007              0.0024
272              0.0031           0.0007              0.0024
273              0.0031           0.0007              0.0023
274              0.0030           0.0007              0.0023
275              0.0030           0.0007              0.0023
276              0.0030           0.0007              0.0023
277              0.0030           0.0007              0.0023
278              0.0029           0.0007              0.0022
279              0.0029           0.0007              0.0022
280              0.0029           0.0007              0.0022
281              0.0029           0.0007              0.0022
282              0.0029           0.0007              0.0022
283              0.0028           0.0007              0.0022
284              0.0028           0.0007              0.0021
285              0.0028           0.0007              0.0021
286              0.0028           0.0007              0.0021
287              0.0028           0.0006              0.0021
288              0.0027           0.0006              0.0021
---------------------------------------------------------------------
---------------------------------------------------------------------
```

```
      Total soil rain loss =      0.43(In)
      Total effective rainfall =      1.72(In)
      Peak flow rate in flood hydrograph =     88.29(CFS)
      ---------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R    S T O R M
                     R u n o f f      H y d r o g r a p h
      --------------------------------------------------------------------
                  Hydrograph in   5   Minute intervals ((CFS))

      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       22.5      45.0      67.5      90.0
-----------------------------------------------------------------------
  0+ 5       0.0007      0.10  Q         |         |         |         |
  0+10       0.0046      0.56  Q         |         |         |         |
  0+15       0.0099      0.77  Q         |         |         |         |
  0+20       0.0159      0.87  Q         |         |         |         |
  0+25       0.0222      0.92  Q         |         |         |         |
  0+30       0.0289      0.96  Q         |         |         |         |
  0+35       0.0357      0.99  Q         |         |         |         |
  0+40       0.0425      1.00  Q         |         |         |         |
  0+45       0.0495      1.01  Q         |         |         |         |
  0+50       0.0566      1.02  Q         |         |         |         |
  0+55       0.0637      1.03  Q         |         |         |         |
  1+ 0       0.0708      1.03  Q         |         |         |         |
  1+ 5       0.0779      1.04  Q         |         |         |         |
  1+10       0.0851      1.04  Q         |         |         |         |
  1+15       0.0923      1.04  Q         |         |         |         |
  1+20       0.0995      1.05  Q         |         |         |         |
  1+25       0.1067      1.05  Q         |         |         |         |
  1+30       0.1140      1.06  Q         |         |         |         |
  1+35       0.1213      1.06  Q         |         |         |         |
  1+40       0.1286      1.06  Q         |         |         |         |
  1+45       0.1360      1.07  Q         |         |         |         |
  1+50       0.1434      1.07  QV        |         |         |         |
  1+55       0.1508      1.07  QV        |         |         |         |
  2+ 0       0.1582      1.08  QV        |         |         |         |
  2+ 5       0.1656      1.08  QV        |         |         |         |
  2+10       0.1731      1.09  QV        |         |         |         |
  2+15       0.1806      1.09  QV        |         |         |         |
  2+20       0.1882      1.10  QV        |         |         |         |
  2+25       0.1958      1.10  QV        |         |         |         |
  2+30       0.2034      1.10  QV        |         |         |         |
  2+35       0.2110      1.11  QV        |         |         |         |
  2+40       0.2187      1.11  QV        |         |         |         |
  2+45       0.2263      1.12  QV        |         |         |         |
  2+50       0.2341      1.12  QV        |         |         |         |
  2+55       0.2418      1.13  QV        |         |         |         |
  3+ 0       0.2496      1.13  QV        |         |         |         |
  3+ 5       0.2574      1.13  QV        |         |         |         |
  3+10       0.2653      1.14  QV        |         |         |         |
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3+15       0.2731      1.14  QV        |         |         |         |
3+20       0.2810      1.15  QV        |         |         |         |
3+25       0.2890      1.15  Q V       |         |         |         |
3+30       0.2970      1.16  Q V       |         |         |         |
3+35       0.3050      1.16  Q V       |         |         |         |
3+40       0.3130      1.17  Q V       |         |         |         |
3+45       0.3211      1.17  Q V       |         |         |         |
3+50       0.3292      1.18  Q V       |         |         |         |
3+55       0.3373      1.18  Q V       |         |         |         |
4+ 0       0.3455      1.19  Q V       |         |         |         |
4+ 5       0.3537      1.19  Q V       |         |         |         |
4+10       0.3620      1.20  Q V       |         |         |         |
4+15       0.3703      1.20  Q V       |         |         |         |
4+20       0.3786      1.21  Q V       |         |         |         |
4+25       0.3870      1.21  Q V       |         |         |         |
4+30       0.3954      1.22  Q V       |         |         |         |
4+35       0.4038      1.23  Q V       |         |         |         |
4+40       0.4123      1.23  Q V       |         |         |         |
4+45       0.4208      1.24  Q V       |         |         |         |
4+50       0.4294      1.24  Q  V      |         |         |         |
4+55       0.4379      1.25  Q  V      |         |         |         |
5+ 0       0.4466      1.25  Q  V      |         |         |         |
5+ 5       0.4553      1.26  Q  V      |         |         |         |
5+10       0.4640      1.27  Q  V      |         |         |         |
5+15       0.4727      1.27  Q  V      |         |         |         |
5+20       0.4815      1.28  Q  V      |         |         |         |
5+25       0.4904      1.28  Q  V      |         |         |         |
5+30       0.4993      1.29  Q  V      |         |         |         |
5+35       0.5082      1.30  Q  V      |         |         |         |
5+40       0.5172      1.30  Q  V      |         |         |         |
5+45       0.5262      1.31  Q  V      |         |         |         |
5+50       0.5353      1.32  Q  V      |         |         |         |
5+55       0.5444      1.32  Q  V      |         |         |         |
6+ 0       0.5536      1.33  Q  V      |         |         |         |
6+ 5       0.5628      1.34  Q  V      |         |         |         |
6+10       0.5720      1.34  Q   V     |         |         |         |
6+15       0.5813      1.35  Q   V     |         |         |         |
6+20       0.5907      1.36  Q   V     |         |         |         |
6+25       0.6001      1.37  Q   V     |         |         |         |
6+30       0.6096      1.37  Q   V     |         |         |         |
6+35       0.6191      1.38  Q   V     |         |         |         |
6+40       0.6286      1.39  Q   V     |         |         |         |
6+45       0.6383      1.40  Q   V     |         |         |         |
6+50       0.6479      1.40  Q   V     |         |         |         |
6+55       0.6577      1.41  Q   V     |         |         |         |
7+ 0       0.6674      1.42  Q   V     |         |         |         |
7+ 5       0.6773      1.43  Q   V     |         |         |         |
7+10       0.6872      1.44  Q   V     |         |         |         |
7+15       0.6971      1.44  Q   V     |         |         |         |
7+20       0.7071      1.45  Q   V     |         |         |         |
7+25       0.7172      1.46  Q    V    |         |         |         |
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 7+30       0.7273      1.47  Q    V    |         |         |         |
 7+35       0.7375      1.48  Q    V    |         |         |         |
 7+40       0.7478      1.49  Q    V    |         |         |         |
 7+45       0.7581      1.50  Q    V    |         |         |         |
 7+50       0.7685      1.51  Q    V    |         |         |         |
 7+55       0.7790      1.52  Q    V    |         |         |         |
 8+ 0       0.7895      1.53  Q    V    |         |         |         |
 8+ 5       0.8001      1.54  Q    V    |         |         |         |
 8+10       0.8107      1.55  Q    V    |         |         |         |
 8+15       0.8215      1.56  Q    V    |         |         |         |
 8+20       0.8323      1.57  Q    V    |         |         |         |
 8+25       0.8431      1.58  Q    V    |         |         |         |
 8+30       0.8541      1.59  Q    V    |         |         |         |
 8+35       0.8651      1.60  Q     V   |         |         |         |
 8+40       0.8762      1.61  Q     V   |         |         |         |
 8+45       0.8874      1.62  Q     V   |         |         |         |
 8+50       0.8986      1.64  Q     V   |         |         |         |
 8+55       0.9100      1.65  Q     V   |         |         |         |
 9+ 0       0.9214      1.66  Q     V   |         |         |         |
 9+ 5       0.9329      1.67  Q     V   |         |         |         |
 9+10       0.9445      1.68  Q     V   |         |         |         |
 9+15       0.9562      1.70  Q     V   |         |         |         |
 9+20       0.9680      1.71  Q     V   |         |         |         |
 9+25       0.9798      1.72  Q     V   |         |         |         |
 9+30       0.9918      1.74  Q     V   |         |         |         |
 9+35       1.0038      1.75  Q      V  |         |         |         |
 9+40       1.0160      1.76  Q      V  |         |         |         |
 9+45       1.0282      1.78  Q      V  |         |         |         |
 9+50       1.0406      1.79  Q      V  |         |         |         |
 9+55       1.0530      1.81  Q      V  |         |         |         |
10+ 0       1.0656      1.82  Q      V  |         |         |         |
10+ 5       1.0782      1.84  Q      V  |         |         |         |
10+10       1.0910      1.86  Q      V  |         |         |         |
10+15       1.1039      1.87  Q      V  |         |         |         |
10+20       1.1169      1.89  Q      V  |         |         |         |
10+25       1.1300      1.90  Q      V  |         |         |         |
10+30       1.1433      1.92  Q       V |         |         |         |
10+35       1.1566      1.94  Q       V |         |         |         |
10+40       1.1701      1.96  Q       V |         |         |         |
10+45       1.1837      1.98  Q       V |         |         |         |
10+50       1.1975      2.00  Q       V |         |         |         |
10+55       1.2114      2.02  Q       V |         |         |         |
11+ 0       1.2254      2.04  Q       V |         |         |         |
11+ 5       1.2396      2.06  Q       V |         |         |         |
11+10       1.2539      2.08  Q       V |         |         |         |
11+15       1.2684      2.10  Q       V |         |         |         |
11+20       1.2830      2.13  Q       V |         |         |         |
11+25       1.2978      2.15  Q        V|         |         |         |
11+30       1.3128      2.17  Q        V|         |         |         |
11+35       1.3279      2.20  Q        V|         |         |         |
11+40       1.3432      2.22  Q        V|         |         |         |
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11+45       1.3587      2.25  Q        V|         |         |         |
11+50       1.3744      2.28  |Q       V|         |         |         |
11+55       1.3902      2.30  |Q       V|         |         |         |
12+ 0       1.4063      2.33  |Q       V|         |         |         |
12+ 5       1.4223      2.32  |Q       V|         |         |         |
12+10       1.4372      2.17  Q         V         |         |         |
12+15       1.4518      2.11  Q         V         |         |         |
12+20       1.4663      2.11  Q         V         |         |         |
12+25       1.4808      2.12  Q         V         |         |         |
12+30       1.4956      2.14  Q         V         |         |         |
12+35       1.5104      2.16  Q         V         |         |         |
12+40       1.5255      2.19  Q         V         |         |         |
12+45       1.5408      2.22  Q         V         |         |         |
12+50       1.5564      2.26  |Q        V         |         |         |
12+55       1.5722      2.30  |Q        |V        |         |         |
13+ 0       1.5883      2.34  |Q        |V        |         |         |
13+ 5       1.6047      2.38  |Q        |V        |         |         |
13+10       1.6214      2.43  |Q        |V        |         |         |
13+15       1.6385      2.47  |Q        |V        |         |         |
13+20       1.6559      2.53  |Q        |V        |         |         |
13+25       1.6736      2.57  |Q        |V        |         |         |
13+30       1.6917      2.63  |Q        |V        |         |         |
13+35       1.7102      2.69  |Q        |V        |         |         |
13+40       1.7292      2.75  |Q        | V       |         |         |
13+45       1.7485      2.81  |Q        | V       |         |         |
13+50       1.7684      2.88  |Q        | V       |         |         |
13+55       1.7887      2.95  |Q        | V       |         |         |
14+ 0       1.8096      3.03  |Q        | V       |         |         |
14+ 5       1.8310      3.11  |Q        | V       |         |         |
14+10       1.8531      3.21  |Q        | V       |         |         |
14+15       1.8759      3.30  |Q        |  V      |         |         |
14+20       1.8993      3.41  |Q        |  V      |         |         |
14+25       1.9235      3.51  |Q        |  V      |         |         |
14+30       1.9486      3.64  |Q        |  V      |         |         |
14+35       1.9745      3.76  |Q        |  V      |         |         |
14+40       2.0014      3.91  |Q        |   V     |         |         |
14+45       2.0293      4.05  |Q        |   V     |         |         |
14+50       2.0585      4.23  |Q        |   V     |         |         |
14+55       2.0888      4.41  |Q        |   V     |         |         |
15+ 0       2.1207      4.63  | Q       |   V     |         |         |
15+ 5       2.1541      4.85  | Q       |    V    |         |         |
15+10       2.1895      5.14  | Q       |    V    |         |         |
15+15       2.2269      5.42  | Q       |    V    |         |         |
15+20       2.2669      5.81  | Q       |    V    |         |         |
15+25       2.3095      6.19  | Q       |     V   |         |         |
15+30       2.3554      6.67  | Q       |     V   |         |         |
15+35       2.4052      7.22  |  Q      |     V   |         |         |
15+40       2.4607      8.06  |  Q      |      V  |         |         |
15+45       2.5228      9.02  |   Q     |      V  |         |         |
15+50       2.5959     10.62  |   Q     |       V |         |         |
15+55       2.6848     12.90  |    Q    |       V |         |         |
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16+ 0       2.8117     18.42  |       Q |        V|         |         |
16+ 5       3.0823     39.29  |         |      Q  |V        |         |
16+10       3.6903     88.29  |         |         |    V    |        Q|
16+15       4.0243     48.50  |         |         |Q      V |         |
16+20       4.2140     27.55  |         | Q       |        V|         |
16+25       4.3433     18.77  |       Q |         |         V         |
16+30       4.4393     13.94  |     Q   |         |         |V        |
16+35       4.5132     10.73  |   Q     |         |         |V        |
16+40       4.5704      8.31  |  Q      |         |         | V       |
16+45       4.6189      7.04  |  Q      |         |         | V       |
16+50       4.6607      6.06  | Q       |         |         | V       |
16+55       4.6941      4.85  | Q       |         |         | V       |
17+ 0       4.7222      4.07  |Q        |         |         |  V      |
17+ 5       4.7480      3.75  |Q        |         |         |  V      |
17+10       4.7720      3.49  |Q        |         |         |  V      |
17+15       4.7945      3.27  |Q        |         |         |  V      |
17+20       4.8157      3.08  |Q        |         |         |  V      |
17+25       4.8359      2.92  |Q        |         |         |  V      |
17+30       4.8550      2.78  |Q        |         |         |   V     |
17+35       4.8734      2.66  |Q        |         |         |   V     |
17+40       4.8909      2.55  |Q        |         |         |   V     |
17+45       4.9078      2.45  |Q        |         |         |   V     |
17+50       4.9240      2.36  |Q        |         |         |   V     |
17+55       4.9397      2.28  |Q        |         |         |   V     |
18+ 0       4.9549      2.20  Q         |         |         |   V     |
18+ 5       4.9698      2.17  Q         |         |         |   V     |
18+10       4.9856      2.29  |Q        |         |         |   V     |
18+15       5.0015      2.31  |Q        |         |         |    V    |
18+20       5.0172      2.29  |Q        |         |         |    V    |
18+25       5.0327      2.25  |Q        |         |         |    V    |
18+30       5.0479      2.21  Q         |         |         |    V    |
18+35       5.0629      2.17  Q         |         |         |    V    |
18+40       5.0775      2.13  Q         |         |         |    V    |
18+45       5.0918      2.08  Q         |         |         |    V    |
18+50       5.1059      2.04  Q         |         |         |    V    |
18+55       5.1197      2.00  Q         |         |         |    V    |
19+ 0       5.1333      1.97  Q         |         |         |    V    |
19+ 5       5.1465      1.93  Q         |         |         |     V   |
19+10       5.1596      1.89  Q         |         |         |     V   |
19+15       5.1724      1.86  Q         |         |         |     V   |
19+20       5.1850      1.83  Q         |         |         |     V   |
19+25       5.1974      1.80  Q         |         |         |     V   |
19+30       5.2095      1.77  Q         |         |         |     V   |
19+35       5.2215      1.74  Q         |         |         |     V   |
19+40       5.2333      1.71  Q         |         |         |     V   |
19+45       5.2449      1.69  Q         |         |         |     V   |
19+50       5.2564      1.66  Q         |         |         |     V   |
19+55       5.2677      1.64  Q         |         |         |     V   |
20+ 0       5.2788      1.62  Q         |         |         |      V  |
20+ 5       5.2898      1.59  Q         |         |         |      V  |
20+10       5.3006      1.57  Q         |         |         |      V  |
```

```
   20+15       5.3113      1.55  Q         |         |         |      V  |
   20+20       5.3218      1.53  Q         |         |         |      V  |
   20+25       5.3322      1.51  Q         |         |         |      V  |
   20+30       5.3425      1.49  Q         |         |         |      V  |
   20+35       5.3527      1.47  Q         |         |         |      V  |
   20+40       5.3627      1.46  Q         |         |         |      V  |
   20+45       5.3726      1.44  Q         |         |         |      V  |
   20+50       5.3824      1.42  Q         |         |         |      V  |
   20+55       5.3921      1.41  Q         |         |         |      V  |
   21+ 0       5.4017      1.39  Q         |         |         |      V  |
   21+ 5       5.4111      1.38  Q         |         |         |      V  |
   21+10       5.4205      1.36  Q         |         |         |      V  |
   21+15       5.4298      1.35  Q         |         |         |       V |
   21+20       5.4389      1.33  Q         |         |         |       V |
   21+25       5.4480      1.32  Q         |         |         |       V |
   21+30       5.4570      1.31  Q         |         |         |       V |
   21+35       5.4659      1.29  Q         |         |         |       V |
   21+40       5.4747      1.28  Q         |         |         |       V |
   21+45       5.4835      1.27  Q         |         |         |       V |
   21+50       5.4921      1.26  Q         |         |         |       V |
   21+55       5.5007      1.24  Q         |         |         |       V |
   22+ 0       5.5092      1.23  Q         |         |         |       V |
   22+ 5       5.5176      1.22  Q         |         |         |       V |
   22+10       5.5259      1.21  Q         |         |         |       V |
   22+15       5.5342      1.20  Q         |         |         |       V |
   22+20       5.5424      1.19  Q         |         |         |       V |
   22+25       5.5505      1.18  Q         |         |         |       V |
   22+30       5.5585      1.17  Q         |         |         |       V |
   22+35       5.5665      1.16  Q         |         |         |        V|
   22+40       5.5744      1.15  Q         |         |         |        V|
   22+45       5.5823      1.14  Q         |         |         |        V|
   22+50       5.5901      1.13  Q         |         |         |        V|
   22+55       5.5978      1.12  Q         |         |         |        V|
   23+ 0       5.6055      1.11  Q         |         |         |        V|
   23+ 5       5.6131      1.10  Q         |         |         |        V|
   23+10       5.6206      1.10  Q         |         |         |        V|
   23+15       5.6281      1.09  Q         |         |         |        V|
   23+20       5.6356      1.08  Q         |         |         |        V|
   23+25       5.6429      1.07  Q         |         |         |        V|
   23+30       5.6503      1.06  Q         |         |         |        V|
   23+35       5.6576      1.06  Q         |         |         |        V|
   23+40       5.6648      1.05  Q         |         |         |        V|
   23+45       5.6720      1.04  Q         |         |         |        V|
   23+50       5.6791      1.03  Q         |         |         |        V|
   23+55       5.6861      1.03  Q         |         |         |        V|
   24+ 0       5.6932      1.02  Q         |         |         |        V|
-----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

                Study date  07/18/22

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986
------------------------------------------------------------------------
IRV21-0068 VICTORVILLE PROPOSED HYDROLOGY CALCULATIONS
100 YEAR 1 HOUR
UNIT HYDROGRAPH
---------------------------------------------------------------------

Program License Serial Number 6350

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

        Storm Event Year = 100

        Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            39.81            1           0.75
--------------------------------------------------------------------
Rainfall data for year 2
            39.81            6           0.80
--------------------------------------------------------------------
Rainfall data for year 2
            39.81           24           1.20
--------------------------------------------------------------------
Rainfall data for year 100
            39.81            1           1.20
```

```
---------------------------------------------------------------------
Rainfall data for year 100
            39.81            6            2.00
---------------------------------------------------------------------
Rainfall data for year 100
            39.81           24            3.50
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 98.0      99.6         34.02      0.855     0.008    0.010    0.000
 32.0      52.0          5.79      0.145     0.785    1.000    0.785

Area-averaged adjusted loss rate Fm (In/Hr) =  0.114

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     0.34   0.009         98.0      99.6       0.04     0.986
    33.68   0.846         98.0      98.0       0.20     0.933

     5.79   0.145         32.0      52.0       9.23     0.072

Area-averaged catchment yield fraction, Y =  0.808
Area-averaged low loss fraction, Yb =  0.192
User entry of time of concentration  =   0.123 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      39.81(Ac.)
Catchment Lag time =   0.098 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 84.8954
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.114(In/Hr)
Average low loss rate fraction (Yb) = 0.192 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.569(In)
Computed peak 30-minute rainfall =  0.975(In)
Specified peak 1-hour rainfall =  1.200(In)
Computed peak 3-hour rainfall =  1.641(In)
Specified peak 6-hour rainfall =  2.000(In)
Specified peak 24-hour rainfall =  3.500(In)


Rainfall depth area reduction factors:
Using a total area of      39.81(Ac.) (Ref: fig. E-4)
```

```
5-minute factor = 0.998     Adjusted rainfall =  0.568(In)
30-minute factor = 0.998    Adjusted rainfall =  0.973(In)
1-hour factor = 0.998       Adjusted rainfall =  1.198(In)
3-hour factor = 1.000       Adjusted rainfall =  1.641(In)
6-hour factor = 1.000       Adjusted rainfall =  2.000(In)
24-hour factor = 1.000      Adjusted rainfall =  3.500(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
                (K =       481.49 (CFS))

  1               12.277                  59.112
  2               60.206                 230.773
  3               79.577                  93.270
  4               88.242                  41.721
  5               93.039                  23.097
  6               96.005                  14.280
  7               97.740                   8.355
  8               98.741                   4.817
  9               99.620                   4.234
 10              100.000                   1.828
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.5683               0.5683
  2              0.6997               0.1314
  3              0.7902               0.0905
  4              0.8615               0.0712
  5              0.9211               0.0596
  6              0.9729               0.0518
  7              1.0189               0.0460
  8              1.0606               0.0416
  9              1.0987               0.0381
 10              1.1340               0.0353
 11              1.1669               0.0329
 12              1.1978               0.0309
 13              1.2256               0.0278
 14              1.2519               0.0263
 15              1.2769               0.0250
 16              1.3007               0.0238
 17              1.3235               0.0228
 18              1.3453               0.0219
 19              1.3664               0.0210
 20              1.3866               0.0202
 21              1.4061               0.0195
 22              1.4250               0.0189
 23              1.4433               0.0183
```

```
 24              1.4610               0.0177
 25              1.4782               0.0172
 26              1.4949               0.0167
 27              1.5111               0.0163
 28              1.5270               0.0158
 29              1.5424               0.0154
 30              1.5574               0.0151
 31              1.5721               0.0147
 32              1.5865               0.0144
 33              1.6006               0.0141
 34              1.6143               0.0138
 35              1.6278               0.0135
 36              1.6410               0.0132
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0132           0.0025              0.0107
  2              0.0135           0.0026              0.0109
  3              0.0141           0.0027              0.0114
  4              0.0144           0.0028              0.0116
  5              0.0151           0.0029              0.0122
  6              0.0154           0.0030              0.0125
  7              0.0163           0.0031              0.0131
  8              0.0167           0.0032              0.0135
  9              0.0177           0.0034              0.0143
 10              0.0183           0.0035              0.0148
 11              0.0195           0.0037              0.0158
 12              0.0202           0.0039              0.0164
 13              0.0219           0.0042              0.0177
 14              0.0228           0.0044              0.0184
 15              0.0250           0.0048              0.0202
 16              0.0263           0.0050              0.0213
 17              0.0309           0.0059              0.0249
 18              0.0329           0.0063              0.0266
 19              0.0381           0.0073              0.0308
 20              0.0416           0.0080              0.0337
 21              0.0518           0.0095              0.0423
 22              0.0596           0.0095              0.0501
 23              0.0905           0.0095              0.0810
 24              0.1314           0.0095              0.1218
 25              0.5683           0.0095              0.5588
 26              0.0712           0.0095              0.0617
 27              0.0460           0.0088              0.0372
 28              0.0353           0.0068              0.0285
 29              0.0278           0.0053              0.0225
 30              0.0238           0.0046              0.0193
 31              0.0210           0.0040              0.0170
 32              0.0189           0.0036              0.0153
 33              0.0172           0.0033              0.0139
```

```
       34             0.0158           0.0030              0.0128
       35             0.0147           0.0028              0.0119
       36             0.0138           0.0026              0.0111
      --------------------------------------------------------------------
      --------------------------------------------------------------------
      Total soil rain loss =      0.19(In)
      Total effective rainfall =      1.46(In)
      Peak flow rate in flood hydrograph =    149.70(CFS)
      ---------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          3 - H O U R    S T O R M
                     R u n o f f      H y d r o g r a p h
      --------------------------------------------------------------------
                  Hydrograph in   5   Minute intervals ((CFS))

      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       50.0     100.0     150.0     200.0
-----------------------------------------------------------------------
  0+ 5       0.0043      0.63  Q         |         |         |         |
  0+10       0.0257      3.11  Q         |         |         |         |
  0+15       0.0545      4.18  Q         |         |         |         |
  0+20       0.0873      4.77  Q         |         |         |         |
  0+25       0.1229      5.16  |Q        |         |         |         |
  0+30       0.1608      5.51  |Q        |         |         |         |
  0+35       0.2007      5.78  |Q        |         |         |         |
  0+40       0.2425      6.08  |QV       |         |         |         |
  0+45       0.2862      6.35  |QV       |         |         |         |
  0+50       0.3321      6.66  |QV       |         |         |         |
  0+55       0.3800      6.95  |Q V      |         |         |         |
  1+ 0       0.4304      7.32  |Q V      |         |         |         |
  1+ 5       0.4832      7.67  |Q  V     |         |         |         |
  1+10       0.5393      8.15  |Q  V     |         |         |         |
  1+15       0.5987      8.62  |Q  V     |         |         |         |
  1+20       0.6624      9.25  |Q   V    |         |         |         |
  1+25       0.7310      9.97  |Q    V   |         |         |         |
  1+30       0.8077     11.14  | Q   V   |         |         |         |
  1+35       0.8919     12.22  | Q    V  |         |         |         |
  1+40       0.9866     13.74  | Q     V |         |         |         |
  1+45       1.0933     15.50  |  Q     V|         |         |         |
  1+50       1.2207     18.50  |  Q      V         |         |         |
  1+55       1.3806     23.22  |   Q     |V        |         |         |
  2+ 0       1.6149     34.02  |     Q   |  V      |         |         |
  2+ 5       2.1161     72.78  |         |   Q  V  |         |         |
  2+10       3.1471    149.70  |         |         |     V  Q|         |
  2+15       3.6769     76.93  |         |    Q    |         V         |
  2+20       3.9809     44.14  |       Q |         |         | V       |
  2+25       4.1859     29.76  |    Q    |         |         |   V     |
  2+30       4.3349     21.64  |   Q     |         |         |    V    |
  2+35       4.4463     16.17  |  Q      |         |         |     V   |
  2+40       4.5332     12.62  | Q       |         |         |      V  |
  2+45       4.6079     10.85  | Q       |         |         |       V |
```

```
    2+50       4.6669      8.56  |Q         |         |         |       V |
    2+55       4.7141      6.85  |Q         |         |         |        V|
-----------------------------------------------------------------------
```

Appendix I – Hydraulic Analysis Calculations

Worksheet for 8" Circular Pipe - 0.5% Slope

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	8.0 in
Diameter	8.0 in
Discharge	0.85 cfs

Results

Discharge	0.85 cfs
Normal Depth	8.0 in
Flow Area	0.3 ft²
Wetted Perimeter	2.1 ft
Hydraulic Radius	2.0 in
Top Width	0.00 ft
Critical Depth	5.3 in
Percent Full	100.0 %
Critical Slope	0.008 ft/ft
Velocity	2.45 ft/s
Velocity Head	0.09 ft
Specific Energy	0.76 ft
Froude Number	(N/A)
Maximum Discharge	0.92 cfs
Discharge Full	0.85 cfs
Slope Full	0.005 ft/ft
Flow Type	Undefined

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	8.0 in
Critical Depth	5.3 in
Channel Slope	0.005 ft/ft
Critical Slope	0.008 ft/ft

Worksheet for 12" Circular Pipe - 0.5% Slope

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	12.0 in
Diameter	12.0 in
Discharge	2.52 cfs

Results

Discharge	2.52 cfs
Normal Depth	12.0 in
Flow Area	0.8 ft²
Wetted Perimeter	3.1 ft
Hydraulic Radius	3.0 in
Top Width	0.00 ft
Critical Depth	8.2 in
Percent Full	100.0 %
Critical Slope	0.008 ft/ft
Velocity	3.21 ft/s
Velocity Head	0.16 ft
Specific Energy	1.16 ft
Froude Number	(N/A)
Maximum Discharge	2.71 cfs
Discharge Full	2.52 cfs
Slope Full	0.005 ft/ft
Flow Type	Undefined

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	12.0 in
Critical Depth	8.2 in
Channel Slope	0.005 ft/ft
Critical Slope	0.008 ft/ft

Worksheet for 18" Circular Pipe - 0.5% Slope

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	18.0 in
Diameter	18.0 in
Discharge	7.43 cfs

Results

Discharge	7.43 cfs
Normal Depth	18.0 in
Flow Area	1.8 ft²
Wetted Perimeter	4.7 ft
Hydraulic Radius	4.5 in
Top Width	0.00 ft
Critical Depth	12.7 in
Percent Full	100.0 %
Critical Slope	0.007 ft/ft
Velocity	4.20 ft/s
Velocity Head	0.27 ft
Specific Energy	1.77 ft
Froude Number	(N/A)
Maximum Discharge	7.99 cfs
Discharge Full	7.43 cfs
Slope Full	0.005 ft/ft
Flow Type	Undefined

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	18.0 in
Critical Depth	12.7 in
Channel Slope	0.005 ft/ft
Critical Slope	0.007 ft/ft

Worksheet for 24" Circular Pipe - 0.5% Slope

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	24.0 in
Diameter	24.0 in
Discharge	16.00 cfs

Results

Discharge	16.00 cfs
Normal Depth	24.0 in
Flow Area	3.1 ft²
Wetted Perimeter	6.3 ft
Hydraulic Radius	6.0 in
Top Width	0.00 ft
Critical Depth	17.3 in
Percent Full	100.0 %
Critical Slope	0.007 ft/ft
Velocity	5.09 ft/s
Velocity Head	0.40 ft
Specific Energy	2.40 ft
Froude Number	(N/A)
Maximum Discharge	17.21 cfs
Discharge Full	16.00 cfs
Slope Full	0.005 ft/ft
Flow Type	Undefined

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	24.0 in
Critical Depth	17.3 in
Channel Slope	0.005 ft/ft
Critical Slope	0.007 ft/ft

Worksheet for 36" Circular Pipe - 0.5% Slope

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	36.0 in
Diameter	36.0 in
Discharge	47.16 cfs

Results

Discharge	47.16 cfs
Normal Depth	36.0 in
Flow Area	7.1 ft²
Wetted Perimeter	9.4 ft
Hydraulic Radius	9.0 in
Top Width	0.00 ft
Critical Depth	26.8 in
Percent Full	100.0 %
Critical Slope	0.006 ft/ft
Velocity	6.67 ft/s
Velocity Head	0.69 ft
Specific Energy	3.69 ft
Froude Number	(N/A)
Maximum Discharge	50.73 cfs
Discharge Full	47.16 cfs
Slope Full	0.005 ft/ft
Flow Type	Undefined

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	36.0 in
Critical Depth	26.8 in
Channel Slope	0.005 ft/ft
Critical Slope	0.006 ft/ft

Worksheet for 48" Circular Pipe - 0.5% Slope

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	48.0 in
Diameter	48.0 in
Discharge	101.57 cfs

Results

Discharge	101.57 cfs
Normal Depth	48.0 in
Flow Area	12.6 ft²
Wetted Perimeter	12.6 ft
Hydraulic Radius	12.0 in
Top Width	0.00 ft
Critical Depth	36.6 in
Percent Full	100.0 %
Critical Slope	0.006 ft/ft
Velocity	8.08 ft/s
Velocity Head	1.02 ft
Specific Energy	5.02 ft
Froude Number	(N/A)
Maximum Discharge	109.25 cfs
Discharge Full	101.57 cfs
Slope Full	0.005 ft/ft
Flow Type	Undefined

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	48.0 in
Critical Depth	36.6 in
Channel Slope	0.005 ft/ft
Critical Slope	0.006 ft/ft

Appendix J – Percolation Test Report

TGR

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Environmental
Hydrogeology
Material Testing
Construction Inspection

November 29, 2021 Project No. 21-7253

Robert A. Martinez AIA, CASp, CASI
MOA Architects, Inc.
14467 Park Avenue,
Victorville, CA 92392

Subject: Percolation Testing Report for Storm Water Infiltration, Proposed Industrial Building, 17198-17000 Abbey Lane, Victorville, California 92394

Robert,

In accordance with your request and authorization, TGR Geotechnical, Inc. (TGR) has completed percolation testing at the subject site for the design of the proposed storm water infiltration. Presented below are the details of our investigation.

Scope of Work

The scope of work for this percolation testing was limited to the following:

- Site reconnaissance, mark boring locations and call Dig-Alert.
- Drilling, sampling and logging four (4) hollow stem auger borings to an approximate depth of 5 feet below existing grade to perform percolation testing.
- Drilling, sampling and logging six (6) hollow stem auger boring to approximate depths ranging from 16.5 to 51.5 feet below existing grade to evaluate the presence or absence of groundwater. All borings were backfilled with soil cuttings and excess soil was disposed on-site.
- Preparation of this report summarizing the field and lab work and presenting infiltration rates along with a discussion of historic and seasonal high groundwater levels.

Field Investigation

Field exploration was performed on November 16 and 17, 2021 by members from our firm who logged the borings and obtained representative samples, which were subsequently transported to the laboratory for further review and testing. The approximate locations of the borings are indicated on the enclosed Boring Location Map (Figure 1).

The subsurface conditions were explored by drilling, sampling, and logging four (4) borings with a truck mounted hollow stem drill rig to approximate depths of 5 feet to perform percolation testing and six (6) hollow stem auger borings to depths ranging from 16.5 to 51.5 feet below existing grade to verify the presence or absence of groundwater. Subsequent to drilling, all borings were backfilled with cuttings. The boring logs are presented on Plates 1 through 12.

The drill rig was equipped with a sampling apparatus to allow for recovery of driven modified California Ring Sampler (CRS), 3-inch outside diameter, and 2.42-inch inside diameter and SPT samples. Driven samples and bulk samples of the earth materials encountered at selected intervals were recovered from the borings.

The samples were driven using an automatic 140-pound hammer falling freely from a height of 30-inches. The blow counts for CRS were converted to equivalent SPT blow counts. Soil descriptions were entered on the logs in general accordance with the Unified Soil Classification System (USCS). The locations and depths of the soil samples recovered are indicated on the logs in Plates 1 through 12.

Earth Units

The site soils generally consist of sand and silty sand with varying amounts of gravel interbedded to the maximum depth explored, 51.5 feet below existing grade. A more detailed description of the soils encountered is presented in the boring logs on Plates 1 through 12.

Groundwater

Groundwater was encountered during our subsurface exploration to a depth of 40 feet below existing grade in Boring B-3. Groundwater was no encountered in any other exploratory boring. Based on our review of available historical groundwater information (CDMG) regional historic high groundwater has not been mapped at the subject site.

Per USGS groundwater well data for the nation, the historic high groundwater for the northern portion of the subject site is approximately 11.9 feet below existing grade and 2688.1 feet above NGVD 1929, and for the historic high groundwater for the southern portion (area of the proposed infiltration basins) of the subject site groundwater is approximately 48.25 feet below existing grade and 2671.75 feet above NGVD 1929, dating back to 1957.

Seasonal and long-term fluctuations in the groundwater may occur as a result of variations in subsurface conditions, rainfall, run-off conditions and other factors. Therefore, variations from our observations may occur.

Static groundwater is not anticipated to impact the proposed stormwater infiltration for the southern half of the subject site based upon review of USGS groundwater well data and absence of groundwater in the six exploratory borings in the southern portion of the subject site.

Laboratory Testing

Wash Sieve Test: Typical materials were washed over No. 200 sieve (ASTM Test Method D1140). The test results are presented below:

Sample Location	% Passing No. 200 Sieve
P-1 @ 0-5 feet	17.5%
P-2 @ 0-5 feet	14.5%
P-3 @ 0-5 feet	14.3%
P-4 @ 0-5 feet	15.2%

Percolation Testing

Percolation testing was performed at the subject site utilizing the Porchet Method. Presented below is the infiltration rate from the percolation tests performed at the subject site. These do not include any factor of safety.

P-1 at 0-5 feet	22.18 inches per hour
P-2 at 0-5 feet	7.05 inches per hour
P-3 at 0-5 feet	3.46 inches per hour
P-4 at 0-5 feet	5.98 inches per hour

The infiltration test rates were generally determined utilizing the County of San Bernardino Technical Guidance Document (2011). Details of calculations are presented in Table 1. Based on the percolation test results, the subject site is generally considered suitable for storm water infiltration from a geotechnical standpoint.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

TGR GEOTECHNICAL, INC.

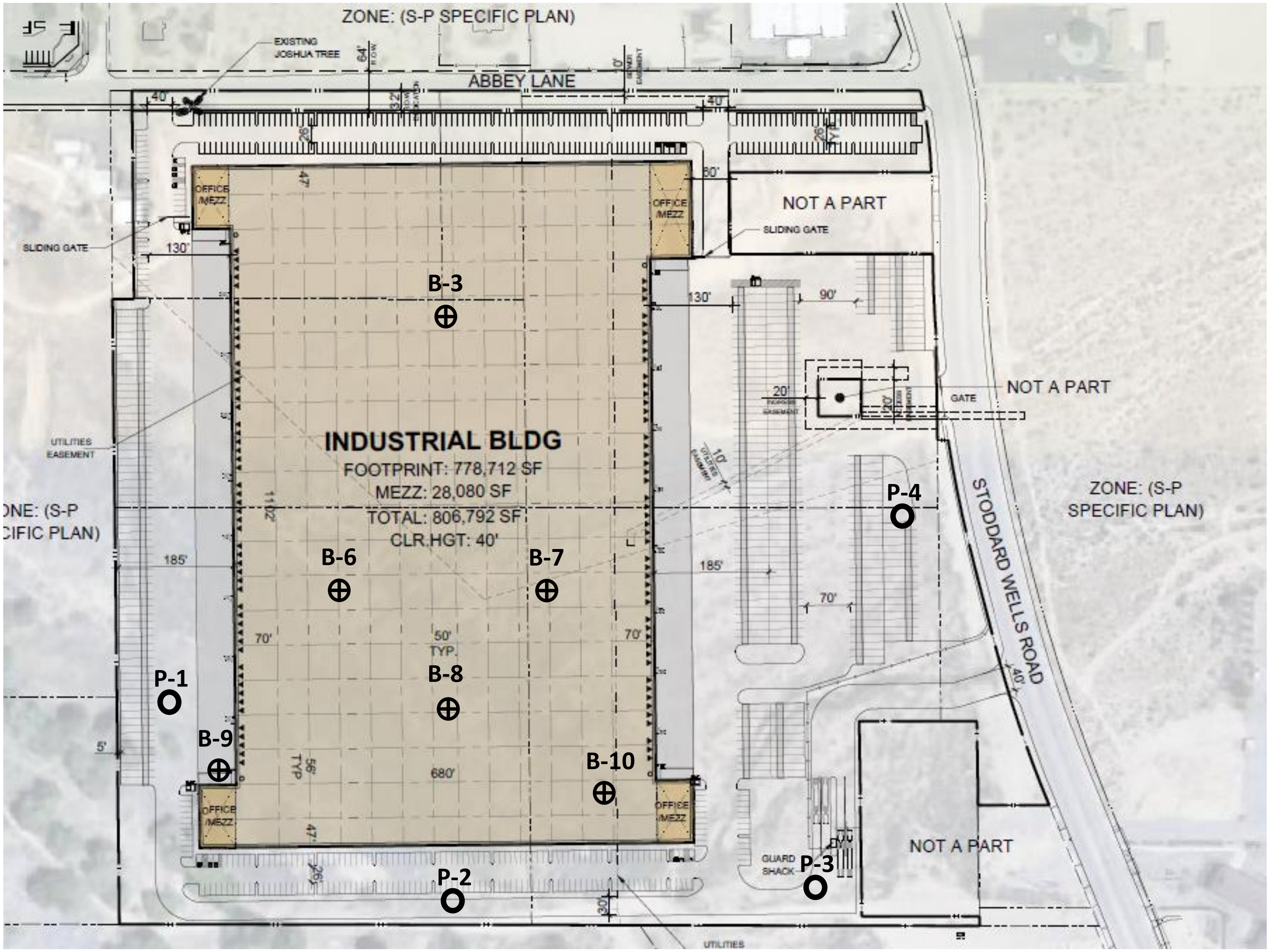
Robert Aguilar

Robert Aguilar
Staff Engineer

REGISTERED PROFESSIONAL ENGINEER
SANJAY GOVIL
No. GE2382
EXP. 6/30/2022
GEOTECHNICAL
STATE OF CALIFORNIA

Sanjay Govil, PhD, PE, GE 2382
Principal Geotechnical Engineer

Attachments:	Figure 1 – Boring Location Map Figure 2 – Site Location Map
	Plates 1 through 12 – Boring Logs
	Table 1 – Percolation Test Worksheet
Distribution:	(1) Addressee



NORTH

B-10 ⊕ APPROXIMATE LOCATION OF EXPLORATORY BORING

P-4 ○ APPROXIMATE LOCATION OF PERCOLATION BORING

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BORING LOCATION MAP
SW CORNER OF ABBEY LANE AND STODDARD WELLS ROAD
VICTORVILLE, CALIFORNIA

PROJECT NO. 21-7253

FIGURE 1

SITE LOCATION MAP
SW CORNER OF ABBEY LANE AND STODDARD WELLS ROAD
VICTORVILLE, CALIFORNIA

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Hydrogeology
Material Testing
Construction Inspection

PROJECT NO. 21-7253

FIGURE 2

LOG OF EXPLORATORY BORING B-3

Sheet **1** of **2**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/17/21 - 11/17/21**
Ground Elev: **2722**
Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
			Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	0							Surface is sand and dry vegetation. Silty SAND to Sandy SILT- tan to white, dry, medium dense, fine grained, trace coarse.			
2720											
	5			⧗	9		SM	Silty SAND- tan, dry, medium dense, fine grained.	3	116	Consol
2715											
	10			⧗	18		SP	SAND- light orange brown, dry, medium dense, fine to coarse grained.	1	114	Consol
2710											
	15			⧗	31		SP	SAND- light brown, dry, dense, very fine to fine grained.	2	115	-200= 19.8%
2705											
	20			☒	19		SP	...Same as above.	2		-200= 12.8%
2700											
	25			☒	26		MLS	Sandy SILT- light pale brown, slightly moist, very stiff, very fine to fine grained.	5		-200= 60.3%
2695											

PLATE 1

LOG OF EXPLORATORY BORING B-3

Sheet **2** of **2**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/17/21 - 11/17/21**
Ground Elev: **2722**

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
				☒	81		SPG	Gravelly SAND- orange brown, dry, very dense, fine to coarse sand, fine to coarse gravel.	1		-200= 5.4%
2690											
	35			☒	56		SM	Silty SAND- orange brown, moist, very dense, fine to coarse sand, some fine to coarse gravel.	9		
2685											
	40			☒	29		SP	▼ SAND- dark grey brown, wet, medium dense, fine to coarse grained.	16		-200= 9.6%
2680											
	45			☒	27		SP	...Same as above, reddish brown.	19		-200= 15.2%
2675											
	50			☒	83		SP	...Same as above, grey brown, some gravel, very dense.	14		-200= 12.8%
2670								Total Depth: 51.5 feet. Groundwater encountered at 40 feet during drilling. No caving observed. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
	55										
2665											

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 2

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-6

Sheet **1** of **1**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/16/21 - 11/16/21**
Ground Elev: **2704**
Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

			FIELD RESULTS						LAB RESULTS		
Elevation (ft)	Depth (ft)	Graphic Log	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	Moisture Content (%)	Dry Density, (pcf)	Other Tests
		▨						Surface is sand and dry vegetation. Silty SAND to Sandy SILT- tan, dry, medium dense, very fine to coarse grained.			
2700		▨									
	5	▨		⧗	20		SP	Silty SAND- light orange brown, dry, medium dense, fine to coarse grained, some gravel.	1	124	
2695		▨									
	10	▨		⧗	>50		SP	...Same as above, very dense.	2	123	
2690		▨									
	15	▨		⧗	31		SP	...Same as above, dense.	2	125	
								Total Depth: 16.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2685											
	20										
2680											
	25										
2675											

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 3

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-7

Sheet **1** of **1**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/16/21 - 11/16/21**
Ground Elev: **2723**
Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	Moisture Content (%)	Dry Density, (pcf)	Other Tests
	0						Surface is sand and dry vegetation. Silty SAND- tan, slightly moist, medium dense, fine to coarse grained.			
2720										
	5		⧗	12		SM	...Same as above, light reddish brown.	2	116	
2715										
	10		⧗	21		SP	SAND- orange brown, moist, medium dense, fine to coarse grained.	3	117	
2710										
	15		⧗	33		SM	Silty SAND to Sandy SILT- white, slightly moist, dense, fine to medium grained, cemented.	3	125	
2705										
	20		☒	43		SM	...Same as above, tan, dry.	4		
2700										
	25		☒	23		SM	...Same as above, medium dense.	3		
							Total Depth: 26.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2695										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 4

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-8

Sheet 1 of 2

Project Number:	**21-7253**	Logged By:	**RA**
Project Name:	**17198-17000 Abbey Lane, Victorville**	Project Engineer:	**SG**
Date Drilled:	**11/16/21 - 11/16/21**	Drill Type:	**CME 75 Hollow Stem**
Ground Elev:	**2715**	Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
			▬				SM	Surface is sand and dry vegetation. Silty SAND- tan, dry, medium dense, fine to coarse grained.			Corrosion
2710	5			⧗	29		SP	SAND- light orange brown, dry, medium dense, fine to coarse grained.	1	112	Consol -200= 12.8%
2705	10			⧗	31		SP	...Same as above, dense.	2	121	
2700	15			⧗	55		SP	...Same as above, very dense, fine to medium grained.	2	128	
2695	20			☒	25		SP	...Same as above, medium dense.	2		-200= 11.4%%
2690	25			☒	32		SM	Silty SAND- tan, dry, dense, very fine to fine grained.	3		-200= 26.6%

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 5

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-8

Sheet **2** of **2**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/16/21 - 11/16/21**
Ground Elev: **2715**

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
				☒	18		SM	Silty <u>SAND</u>- tan, dry, dense, very fine to fine grained. *(continued)* ...Same as above, medium dense.	2		
2680	35			☒	36		SPG	Gravelly <u>SAND</u>- light orange brown, dry, dense, fine to coarse sand, fine to medium gravel.	1		-200= 4.4%
2675	40			☒	>50		SPG	...Same as above, very dense.	1		
								Total Depth: 41.5 feet due to refusal. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2670	45										
2665	50										
2660	55										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 6

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-9

Sheet **1** of **1**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/16/21 - 11/16/21**
Ground Elev: **2393**

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS: Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS: Moisture Content (%)	Dry Density, (pcf)	Other Tests
								Surface is sand and dry vegetation. Sandy SILT- white, dry, firm to soft, fine to coarse grained sand.			
2390											
	5			⧗	20		SM	Silty SAND- light orange brown, medium dense, fine to coarse grained, trace gravel.	2	119	
2385											
	10			⧗	28		SM	...Same as above, slightly moist to moist.	3	125	
2380											
	15			⧗	47		SP	SAND- light orange brown, slightly moist, dense, fine to coarse grained.	2	122	
2375											
	20			☒	19		SM	Silty SAND- light brown, medium dense, dry, fine to medium grained.	3		
2370											
	25			☒	15		SM	...Same as above, reddish brown, moist.	3		
								Total Depth: 26.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2365											

PLATE 7

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-10

Sheet **1** of **1**

Project Number:	**21-7253**	Logged By:	**RA**
Project Name:	**17198-17000 Abbey Lane, Victorville**	Project Engineer:	**SG**
Date Drilled:	**11/16/21 - 11/16/21**	Drill Type:	**CME 75 Hollow Stem**
Ground Elev:	**2720**	Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
			Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	0	▨						Surface is sand and dry vegetation. Silty SAND- tan, dry, medium dense, fine to coarse grained.			
2715	5	▨		⧗	21		SM	Silty SAND- light orange brown, dry, medium dense, fine to coarse grained, some gravel.	1	105	Consol
2710	10	▨		⧗	39		SM	...Same as above, dense.	2	128	
2705	15	▨		⧗	26		SM	...Same as above, no gravel.	2	121	
	16.5							Total Depth: 16.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2700	20										
2695	25										

PLATE 8

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-1

Sheet **1** of **1**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/16/21 - 11/16/21**
Ground Elev: **2693**
Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
			Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	0							Surface is sand and vegetation.			
2690			▬				SP	SAND- light brown, slightly moist to dry, loose, very fine to fine grained, some silt.	3		-200= 17.5%
	5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2685											
	10										
2680											

PLATE 9

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-2

Sheet **1** of **1**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/16/21 - 11/16/21**
Ground Elev: **2713**

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
			Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
								Surface is sand and dry vegetation.			
							SP	SAND- tan, dry, medium dense, fine to medium grained, some silt.	1		-200= 14.5%
2710											
	5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2705											
	10										
2700											

PLATE 10

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-3

Sheet **1** of **1**

Project Number:	**21-7253**	Logged By:	**RA**
Project Name:	**17198-17000 Abbey Lane, Victorville**	Project Engineer:	**SG**
Date Drilled:	**11/16/21 - 11/16/21**	Drill Type:	**CME 75 Hollow Stem**
Ground Elev:	**2717**	Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS: Bulk Sample	FIELD RESULTS: Drive Sample	FIELD RESULTS: SPT blows/ft (or equivalent N)	FIELD RESULTS: Pocket Pen (tsf)	FIELD RESULTS: USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS: Moisture Content (%)	LAB RESULTS: Dry Density, (pcf)	LAB RESULTS: Other Tests
2717	0							Surface is sand and dry vegetation.			
	0-5		▬				SP	SAND- tan, dry, medium dense, fine to medium grained, some silt.	2		-200= 14.3%
2715											
	5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2710											
	10										
2705											

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 11

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-4

Sheet **1** of **1**

Project Number: **21-7253**
Project Name: **17198-17000 Abbey Lane, Victorville**
Date Drilled: **11/16/21 - 11/16/21**
Ground Elev: **2741**

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD

Elevation (ft)	Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
			Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	0							Surface is sand and dry vegetation.			
			▬				SP	SAND- tan, dry, medium dense, fine to medium grained, some silt.	1		-200= 15.2%
2740											
	5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing. Boring backfilled with soil cuttings upon completion. Ground elevation approximated with Google Earth.			
2735											
	10										
2730											

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 12

TGR GEOTECHNICAL, INC.

Percolation Test Worksheet

Test Hole	Total Depth (in)	Initial Depth (in)	Final Depth (in)	∆Water Level (in)	Initial Time (min)	Final Time (min)	∆ Time (min)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate (in/hr)
P-1	60	8.4	32.4	24	0.0	2.0	2.0	51.6	27.6	39.60	26.28
	60	8.4	31.8	23.4	0.0	2.0	2.0	51.6	28.2	39.90	25.43
	60	8.4	31.8	23.4	0.0	2.0	2.0	51.6	28.2	39.90	25.43
	60	8.4	32.4	24	0.0	2.0	2.0	51.6	27.6	39.60	26.28
	60	8.4	30.6	22.2	0.0	2.0	2.0	51.6	29.4	40.50	23.79
	60	8.4	29.4	21	0.0	2.0	2.0	51.6	30.6	41.10	22.18
	60	8.4	30	21.6	0.0	2.0	2.0	51.6	30	40.80	22.98
	60	8.4	30	21.6	0.0	2.0	2.0	51.6	30	40.80	22.98
	60	8.4	30	21.6	0.0	2.0	2.0	51.6	30	40.80	22.98
P-2	60	21	48.6	27.6	0.0	10.0	10.0	39	11.4	25.20	9.30
	60	21	47.4	26.4	0.0	10.0	10.0	39	12.6	25.80	8.70
	60	21	45.5	24.5	0.0	10.0	10.0	39	14.5	26.75	7.81
	60	21	45.6	24.6	0.0	10.0	10.0	39	14.4	26.70	7.85
	60	21	43.8	22.8	0.0	10.0	10.0	39	16.2	27.60	7.05
	60	21	45.6	24.6	0.0	10.0	10.0	39	14.4	26.70	7.85
P-3	60	15	33	18	0.0	10.0	10.0	45	27	36.00	4.32
	60	15	31.2	16.2	0.0	10.0	10.0	45	28.8	36.90	3.80
	60	15	33	18	0.0	10.0	10.0	45	27	36.00	4.32
	60	15	30.1	15.1	0.0	10.0	10.0	45	29.9	37.45	3.49
	60	15	30.4	15.4	0.0	10.0	10.0	45	29.6	37.30	3.57
	60	15	30	15	0.0	10.0	10.0	45	30	37.50	3.46
P-4	60	18.6	43.3	24.7	0.0	10.0	10.0	41.4	16.7	29.05	7.28
	60	18.6	41.4	22.8	0.0	10.0	10.0	41.4	18.6	30.00	6.51
	60	18.6	41.4	22.8	0.0	10.0	10.0	41.4	18.6	30.00	6.51
	60	18.6	41.5	22.9	0.0	10.0	10.0	41.4	18.5	29.95	6.55
	60	18.6	41.4	22.8	0.0	10.0	10.0	41.4	18.6	30.00	6.51
	60	18.6	40	21.4	0.0	10.0	10.0	41.4	20	30.70	5.98
	60	18.6	41.4	22.8	0.0	10.0	10.0	41.4	18.6	30.00	6.51

$$I_t = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

ΔH = Change in height

Δt = Time interval

r = Radius

I_t Infiltration Rate

H_{ave} Average Head Height over the time interval

Appendix K – Subgrade Infiltration Gallery Details, Calculations and Specifications

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS™
Advanced Drainage Systems, Inc.

ADS SiteAssist™
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

AMRAPUR STODDARD WELLS

VICTORVILLE, CA

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. 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 450 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.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

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.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

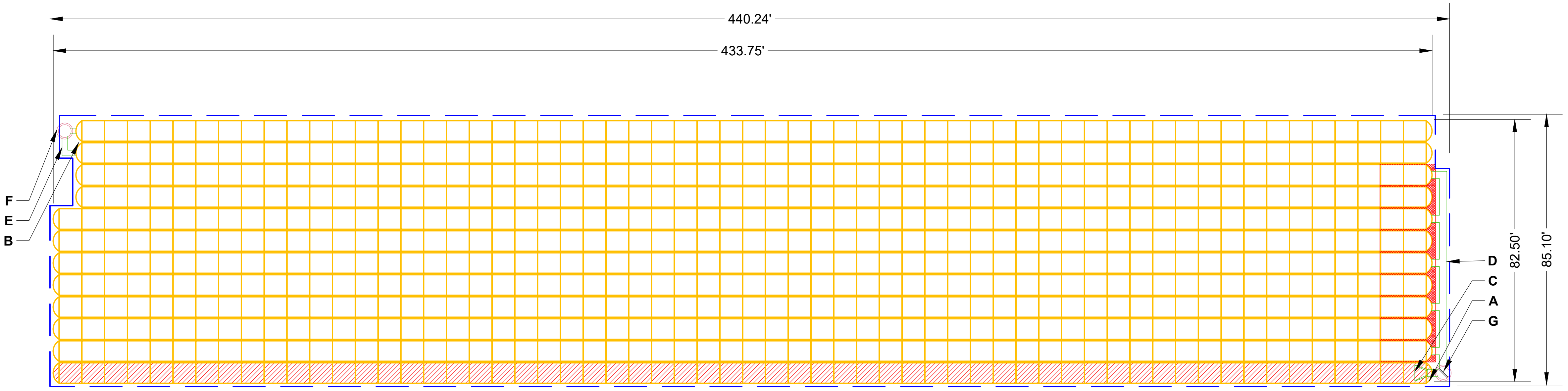
716	STORMTECH MC-3500 CHAMBERS
24	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
129381	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
37242	SYSTEM AREA (SF)
1058.9	SYSTEM PERIMETER (ft)

PROPOSED ELEVATIONS

MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	2699.50
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	2693.50
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	2693.00
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	2693.00
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	2693.00
TOP OF STONE:	2692.50
TOP OF MC-3500 CHAMBER:	2691.50
24" x 24" BOTTOM MANIFOLD INVERT:	2687.92
24" ISOLATOR ROW PLUS INVERT:	2687.92
18" x 18" BOTTOM MANIFOLD INVERT:	2687.90
18" BOTTOM CONNECTION INVERT:	2687.90
BOTTOM OF MC-3500 CHAMBER:	2687.75
BOTTOM OF STONE:	2687.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC350024RAMP		
MANIFOLD	D	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.06"	
MANIFOLD	E	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		8.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		35.8 CFS IN



▨	ISOLATOR ROW PLUS (SEE DETAIL)
▩	PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS
— —	BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

AMRAPUR STODDARD WELLS
VICTORVILLE, CA

DATE:
DRAWN: AC
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

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Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

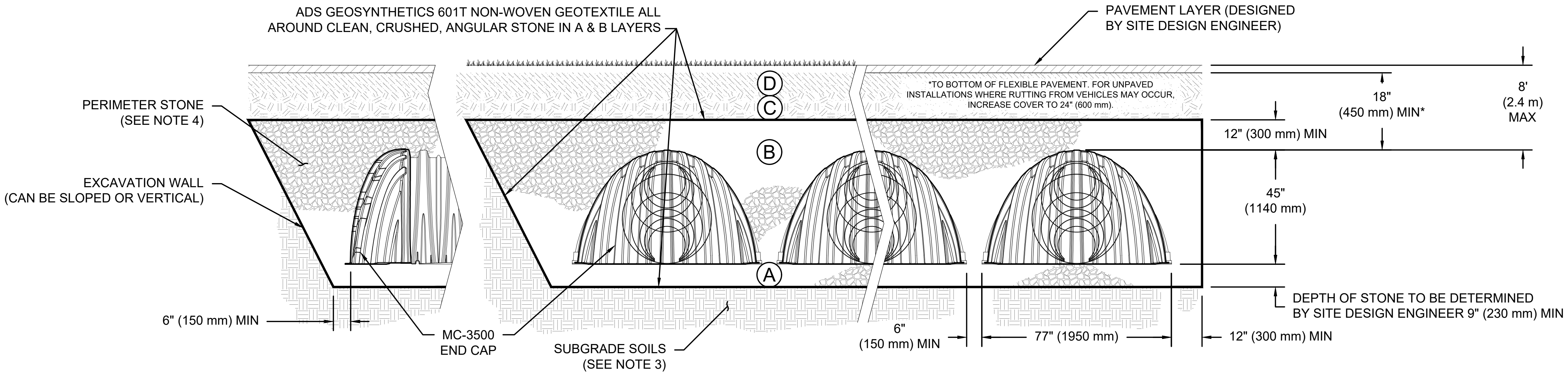
0 40' 80'

SHEET
2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 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.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 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 450 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.

AMRAPUR STODDARD WELLS
VICTORVILLE, CA

DATE:
DRAWN: AC
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

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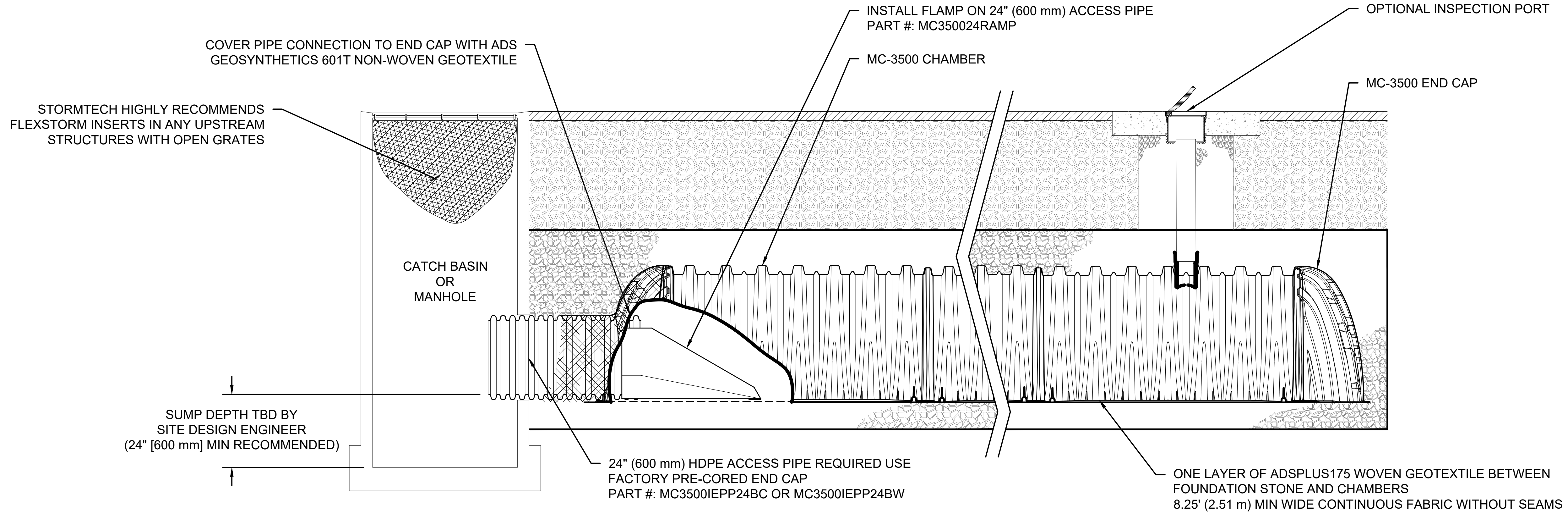

MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

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.

AMRAPUR STODDARD WELLS
VICTORVILLE, CA

DATE:
DRAWN: AC
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

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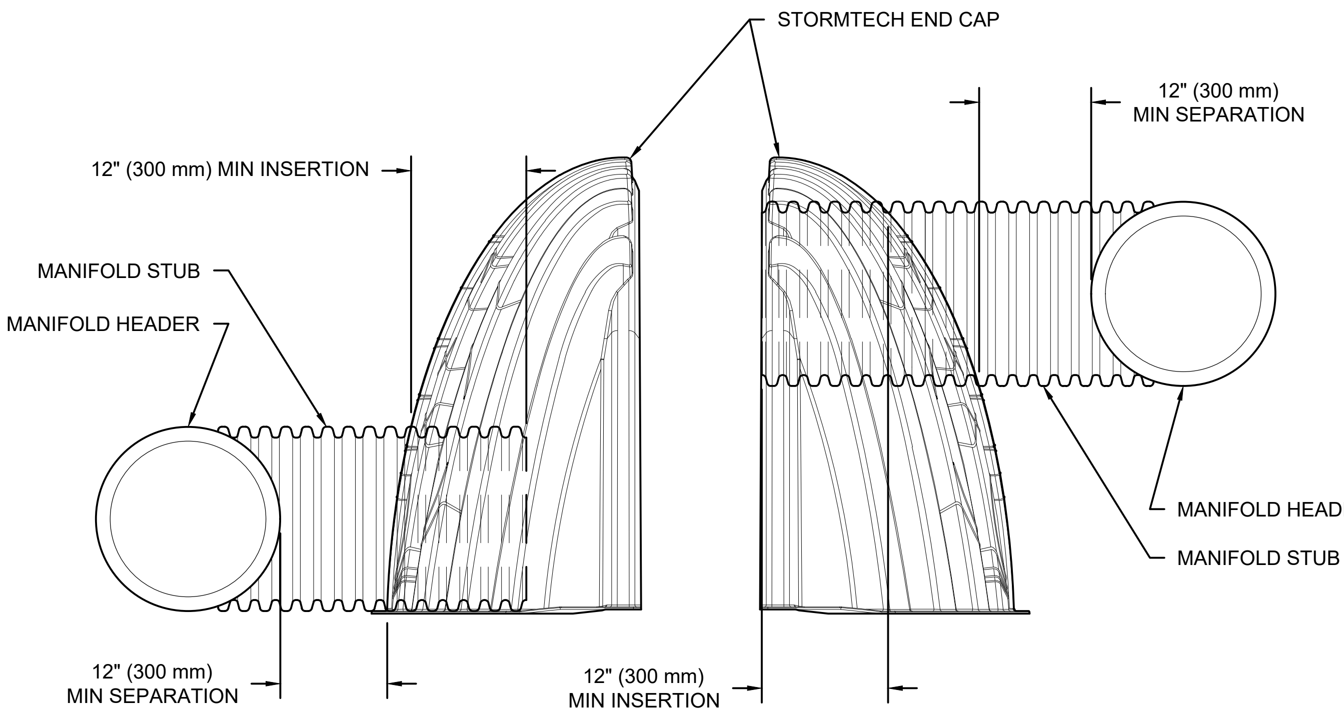
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE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

MC-SERIES END CAP INSERTION DETAIL

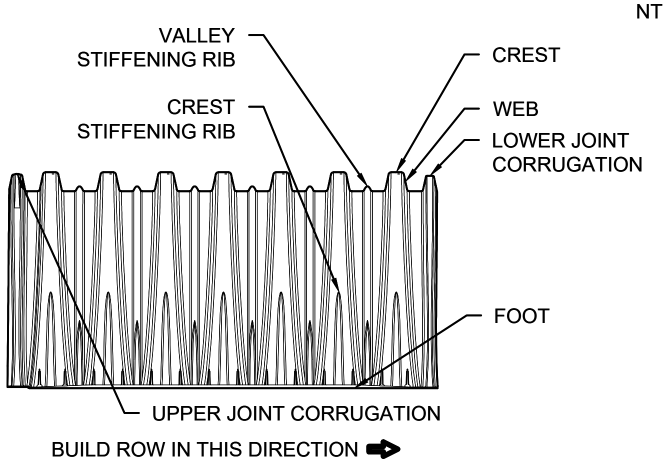
NTS

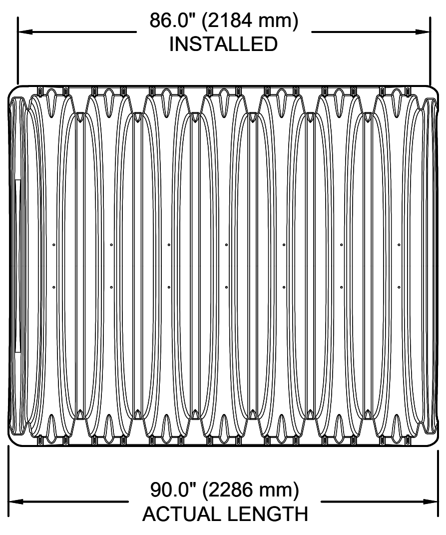


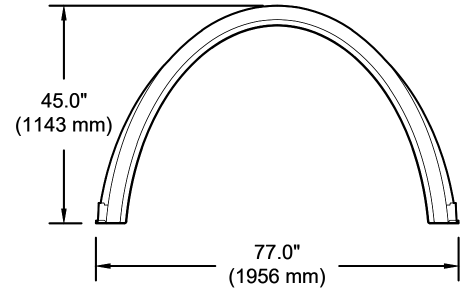
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL
FOR A PROPER FIT IN END CAP OPENING.

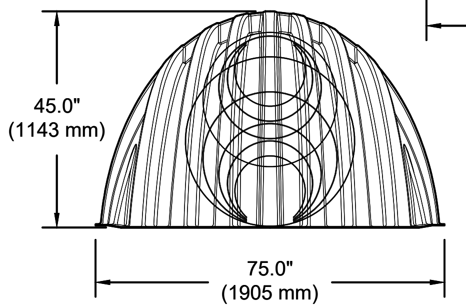
MC-3500 TECHNICAL SPECIFICATION

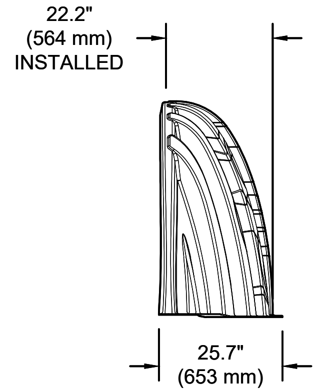
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

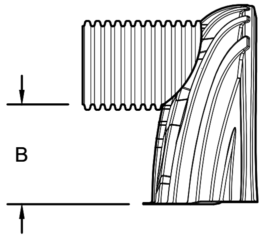
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

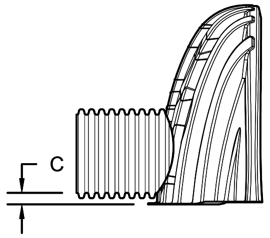
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL





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AMRAPUR STODDARD WELLS
VICTORVILLE, CA

DATE:
DRAWN: AC
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

ADS

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

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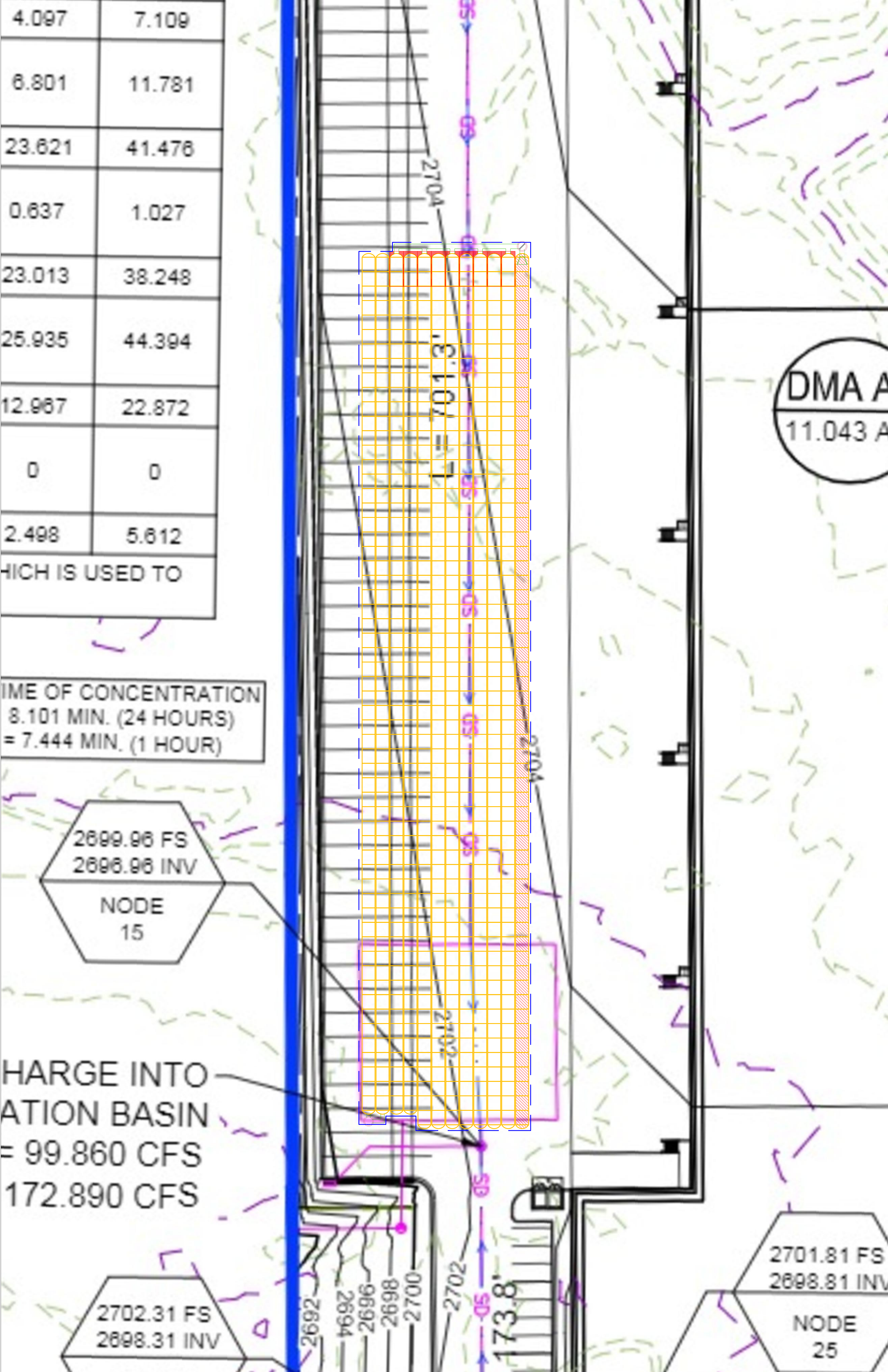
Chamber System
888-892-2694 | WWW.STORMTECH.COM



4.097	7.109
6.801	11.781
23.621	41.476
0.637	1.027
23.013	38.248
25.935	44.394
12.967	22.872
0	0
2.498	5.612

HICH IS USED TO

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	Amrapur Stoddard Wells
Engineer:	Anthony Castelo
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	128507 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(88 ft. x 445 ft.)

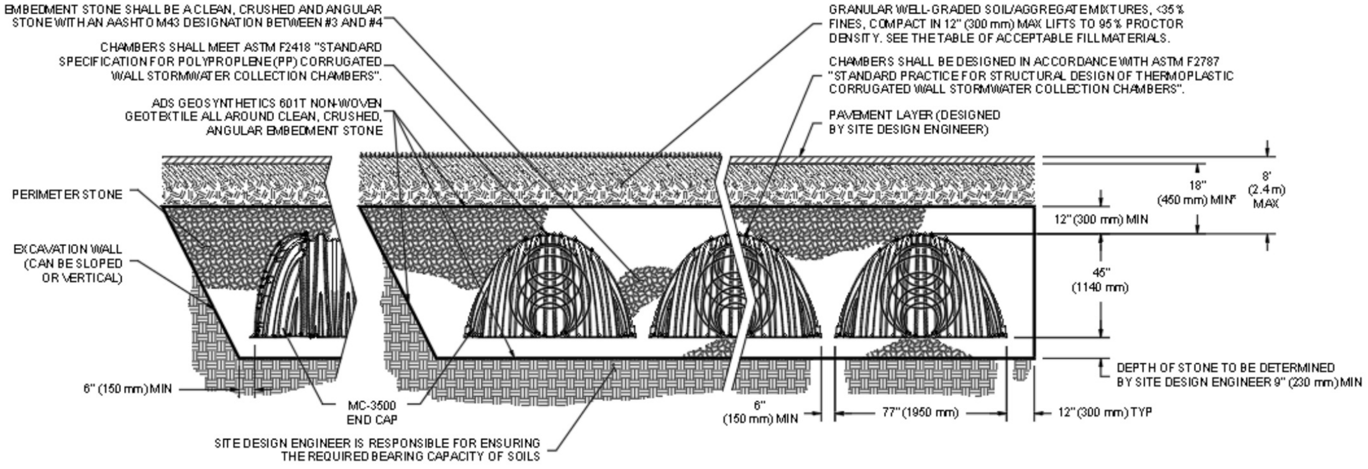
Results

System Volume and Bed Size

Installed Storage Volume:	129360.11 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	716
Number Of End Caps Required:	24
Chamber Rows:	12
Maximum Length:	440.24 ft.
Maximum Width:	85.10 ft.
Approx. Bed Size Required:	37242.05 square ft.

System Components

Amount Of Stone Required:	4658.71 cubic yards
Volume Of Excavation (Not Including Fill):	7586.34 cubic yards
Total Non-woven Geotextile Required:	10707.77 square yards
Woven Geotextile Required (excluding Isolator Row):	150.57 square yards
Woven Geotextile Required (Isolator Row):	506.04 square yards
Total Woven Geotextile Required:	656.61 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24"

STORMTECH MC-3500 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.

STORMTECH MC-3500 CHAMBER

(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
90” x 77” x 45”
2,286 mm x 1,956 mm x 1,143 mm

Chamber Storage
109.9 ft^3 (3.11 m^3)

Min. Installed Storage*
175.0 ft^3 (4.96 m^3)

Weight
134 lbs (60.8 kg)

Shipping
15 chambers/pallet
7 end caps/pallet
7 pallets/truck

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below chambers, 6” (150 mm) of stone between chambers/end caps and 40% stone porosity.

STORMTECH MC-3500 END CAP

(not to scale)

Nominal End Cap Specifications

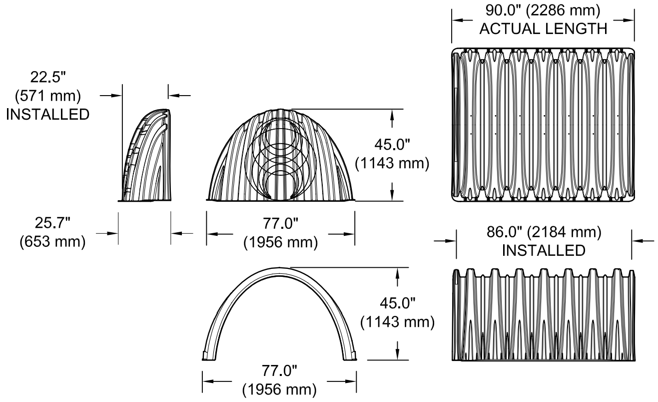
Size (L x W x H)
26.5” x 71” x 45.1”
673 mm x 1,803 mm x 1,145 mm

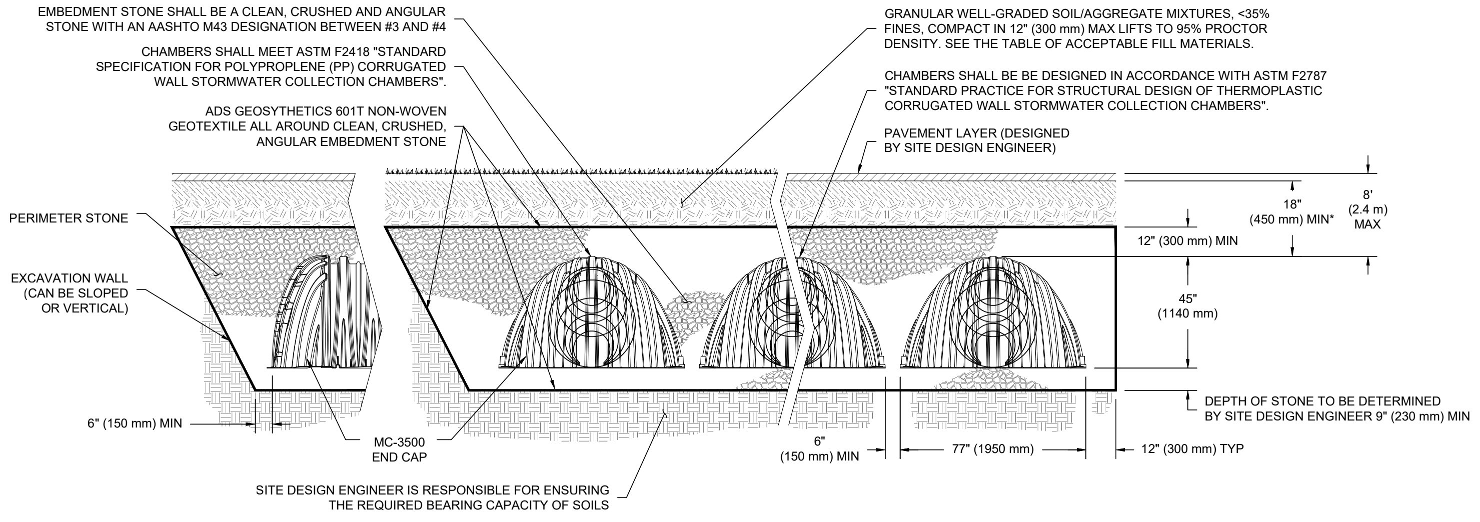
End Cap Storage
14.9 ft^3 (0.42 m^3)

Min. Installed Storage*
45.1ft ^{3} (1.28 m^3)

Weight
49 lbs (22.2 kg)

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 6” (150 mm) of stone perimeter, 6” (150 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 24" (600 mm).

MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT^3 (M^3)

	Bare Chamber Storage ft^3 (m^3)	Chamber and Stone Foundation Depth in. (mm)			
		9” (230 mm)	12” (300 mm)	15” (375 mm)	18” (450 mm)
MC-3500 Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
MC-3500 End Cap	14.9 (.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6” (150 mm) row spacing, 40% stone porosity, 12” (300 mm) stone above and includes the bare chamber/end cap volume.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds^3)	Stone Foundation Depth			
	9”	12”	15”	18”
MC-3500 Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
MC-3500 End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC KILOGRAMS (m^3)	230 mm	300 mm	375 mm	450 mm
MC-3500 Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
MC-3500 End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12” (300 mm) of stone above and 6” (150 mm) row spacing and 6” (150 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD^3 (M^3)

	Stone Foundation Depth			
	9” (230 mm)	12” (300 mm)	15” (375mm)	18” (450 mm)
MC-3500 Chamber	11.9 (9.1)	12.4 (9.5)	12.8(9.8)	13.3 (10.2)
MC-3500 End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6” (150 mm) of separation between chamber rows 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 StormTech Design Tool

For more information on the StormTech MC-3500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

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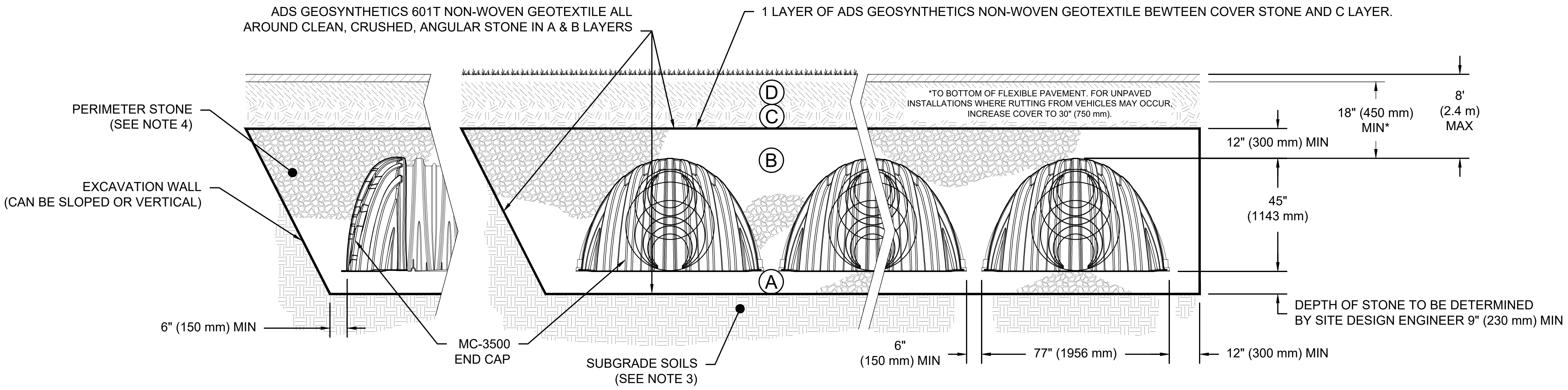
ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

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 8.0' (2.4 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 45x76 DESIGNATION SS.
2. MC-3500 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.

MC-3500
STANDARD CROSS SECTION

DATE: 05-10-19
DRAWN: KR
PROJECT #:
CHECKED: KR

DATE	DRWN	CHKD	DESCRIPTION

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT 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.

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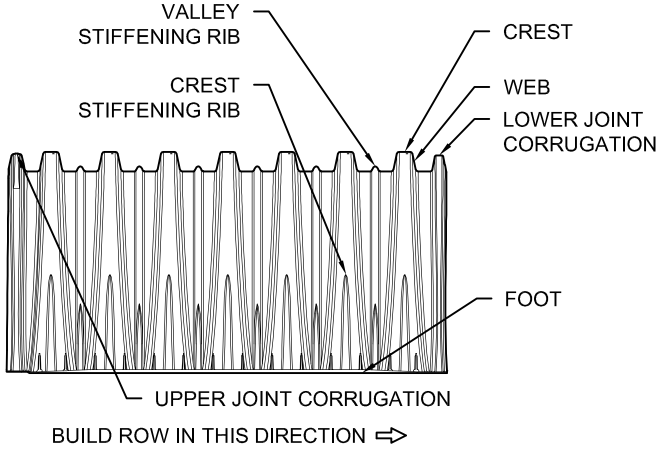
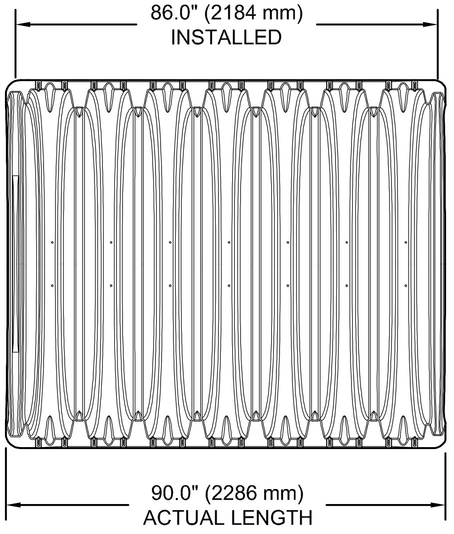
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026

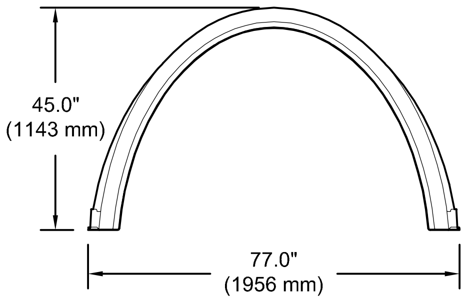
SHEET
1 OF 1

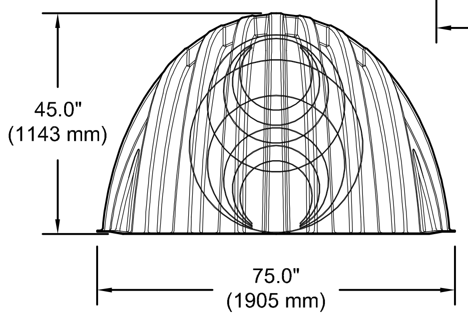
MC-3500 TECHNICAL SPECIFICATION

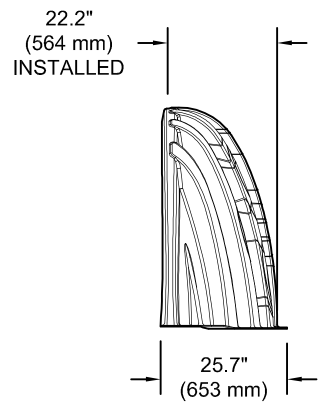
NTS











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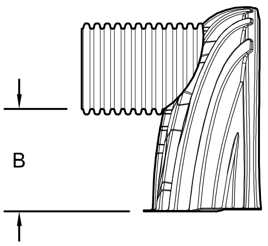

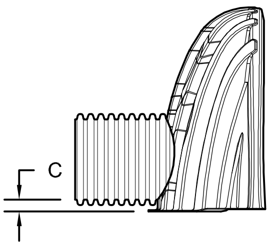

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STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

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MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
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MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
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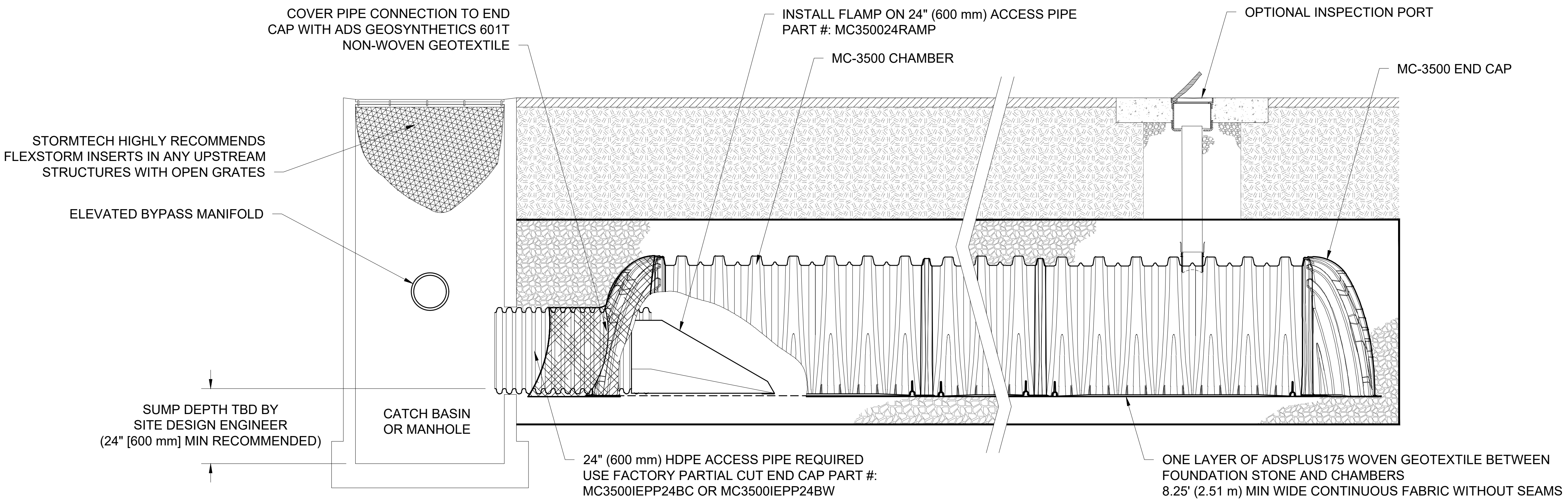


MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

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

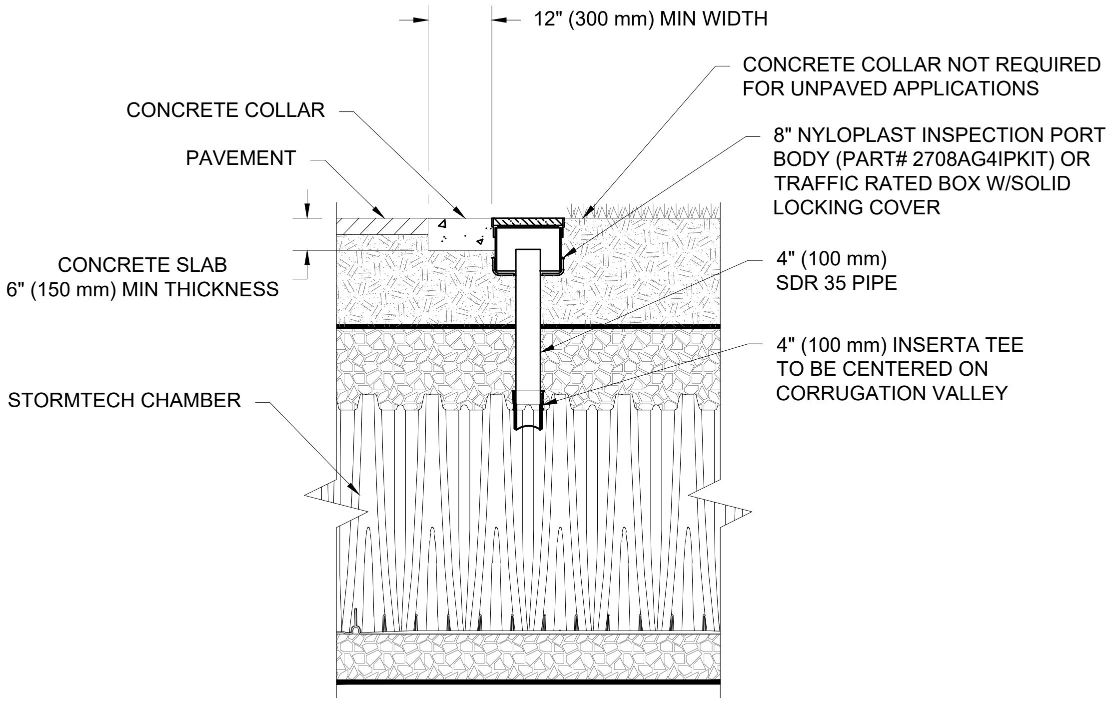
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

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.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4" PVC INSPECTION PORT DETAIL
(MC SERIES CHAMBER)

NTS

MC-3500
ISOLATOR ROW PLUS DETAILS

DATE: 08/26/20
DRAWN: ALI
PROJECT #: ----
CHECKED: ALI

DATE	DRWN	CHKD	DESCRIPTION

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SHEET
1 OF 1

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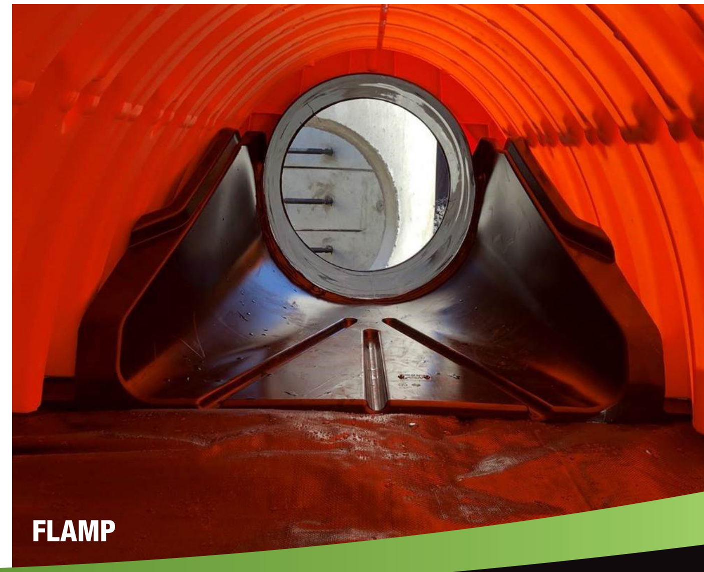
Isolator® Row PLUS O&M Manual



THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS®

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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-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row PLUS and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row PLUS protecting the storage areas of the adjacent stone and chambers 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 perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 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 not only provides access to the Isolator Row PLUS but 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 either 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 StormTech chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

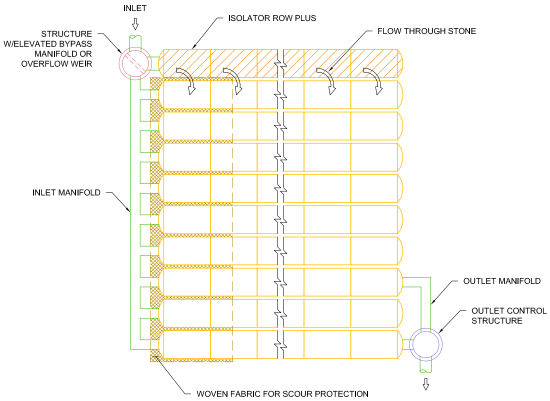
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus that is attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by enhancing outflow of solid debris that would otherwise collect at an end of the chamber. 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 design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row PLUS is recommended by StormTech as an effective means 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.

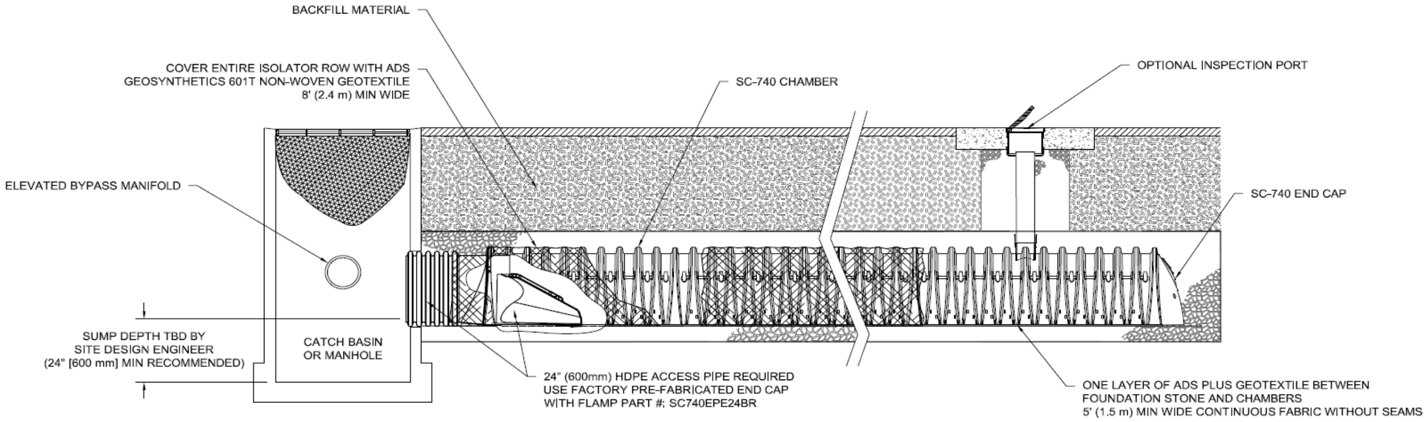
MAINTENANCE

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. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row PLUS up to 50 chambers long. **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-4500 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. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row PLUS using the JetVac process.

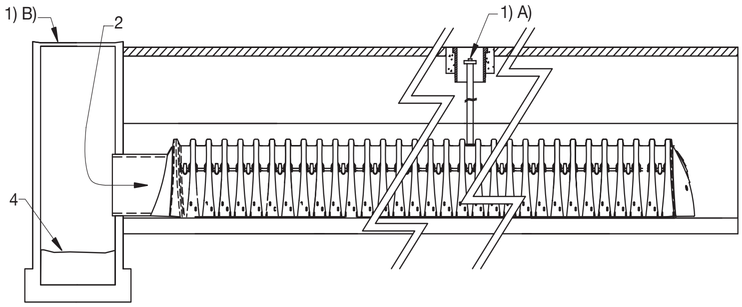
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

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		Sediment 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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MC-3500/MC-4500

StormTech Construction Guide

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-3500 chamber pallets are 77” x 90” (2.0 m x 2.3 m) and weigh about 2010 lbs. (912 kg) and MC-4500 pallets are 100” x 52” (2.5 m x 1.3 m) and weigh about 840 lbs. (381 kg). Unloading chambers requires 72” (1.8 m) (min.) forks and/or tie downs (straps, chains, etc).

IMPORTANT NOTES:

A. This installation guide provides the minimum requirements for proper installation of chambers. Nonadherence 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.

B. 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.

C. 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

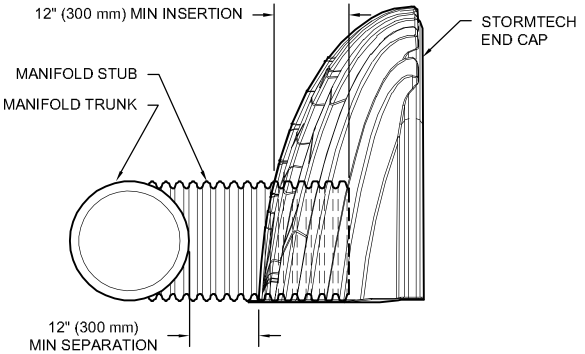
Install manifolds and lay out ADS PLUS fabric at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® PLUS Row(s).

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.

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 6" (150 mm) spacing between MC-3500 rows and 9" (230 mm) spacing between MC-4500 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.

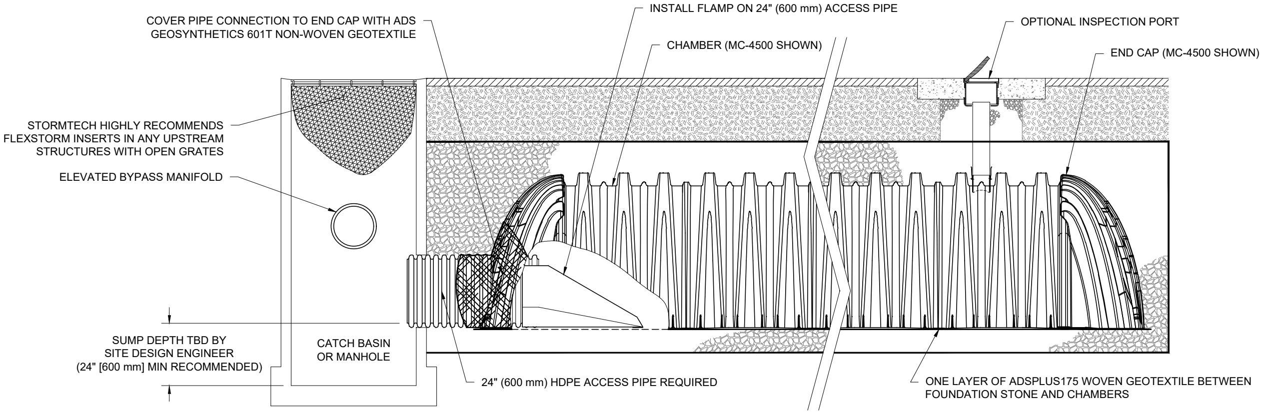
Manifold Insertion



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

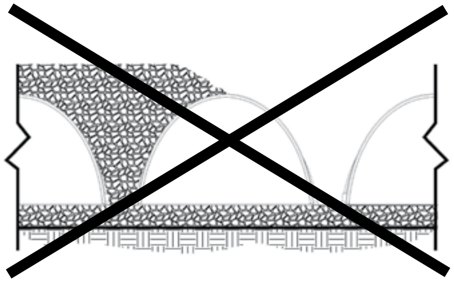


Initial Anchoring of Chambers – Embedment Stone

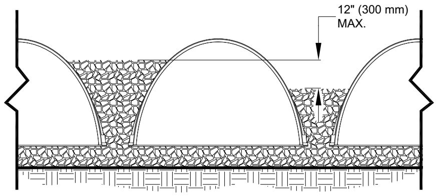
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

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.

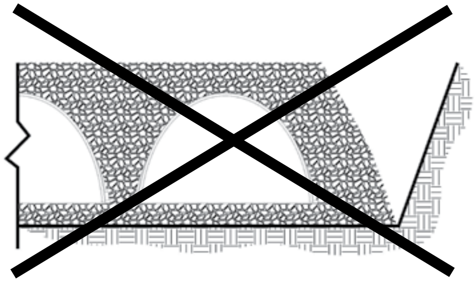
Backfill of Chambers – Embedment Stone



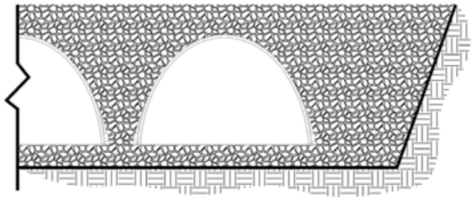
UNEVEN BACKFILL



EVEN BACKFILL



PERIMETER NOT BACKFILLED



PERIMETER FULLY BACKFILLED

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.

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

Backfill of Chambers – Embedment Stone and Cover Stone

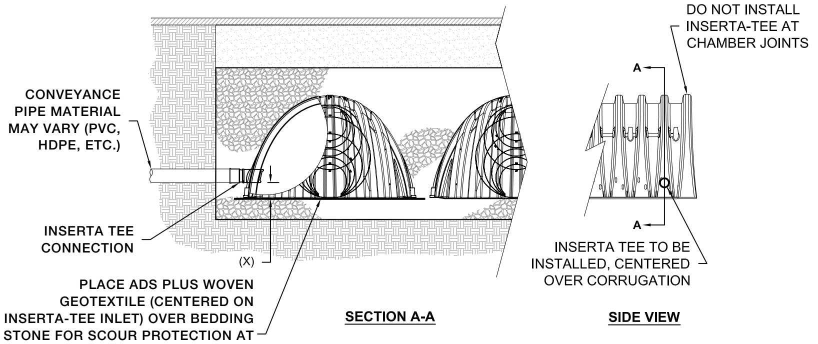
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers and a minimum 12” (300 mm) of cover stone is in place. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. The recommended backfill methods are 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-3500	12" (250 mm)	6" (150 mm)
MC-4500	12" (250 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

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

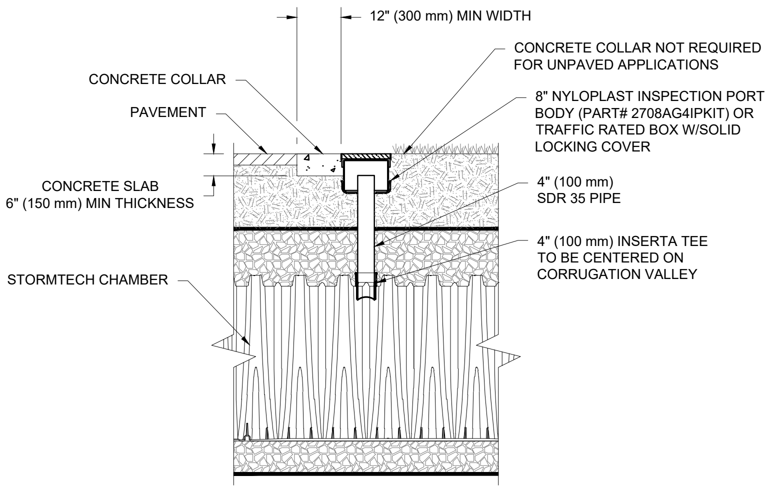
Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
Ⓓ **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.
Ⓒ **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.
Ⓑ **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, 357, 4	No compaction required.
Ⓐ **Foundation Stone:** Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4	Place and compact in 9" (230 mm) max lifts using two full coverages with a vibratory compactor.[2,3]

PLEASE NOTE:

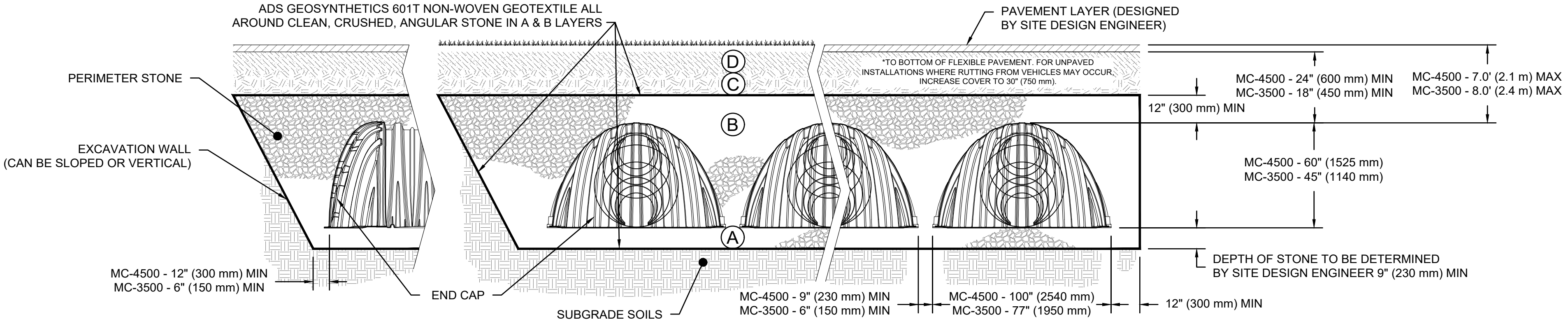
1. ***The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".***
2. ***StormTech compaction requirements are met for 'A' location materials when placed 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 1- Inspection Port Detail



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

Figure 2 - Fill Material Locations



NOTES:

1. *36” (900 mm) of stabilized cover materials over the chambers is required for full dump truck travel and dumping.*
2. *During paving operations, dump truck axle loads on 24” (600mm) for MC-4500s or 18” (450mm) for MC-3500s of cover 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 24” (600 mm) for MC-4500s or 18” (450mm) for MC-3500s of cover 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 (<8,000lbs/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.*

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Table 2 - Maximum Allowable Construction Vehicle Loads[6]

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]	Max Drum Weight or Dynamic Force lbs [kN]
Ⓓ **Final Fill Material**	36” [900] Compacted	32,000 [142]	16,000 [71]	12” [305] 18” [457] 24” [610] 30” [762] 36” [914]	3420 [164] 2350 [113] 1850 [89] 1510 [72] 1310 [63]	38,000 [169]
Ⓒ **Initial Fill Material**	24” [600] Compacted	32,000 [142]	16,000 [71]	12” [305] 18” [457] 24” [610] 30” [762] 36” [914]	2480 [119] 1770 [85] 1430 [68] 1210 [58] 1070 [51]	20,000 [89]
	24” [600] Loose/Dumped	24,000 [107]	12,000 [53]	12” [305] 18” [457] 24” [610] 30” [762] 36” [914]	2245 [107] 1625 [78] 1325 [63] 1135 [54] 1010 [48]	16,000 [71]
	18” [450]	24,000 [107]	12,000 [53]	12” [305] 18” [457] 24” [610] 30” [762]	2010 [96] 1480 [71] 1220 [58] 1060 [51]	5,000 [22] (static loads only)[5]
Ⓑ **Embedment Stone**	12” [300]	NOT ALLOWED	NOT ALLOWED	12” [305] 18” [457] 24” [610] 30” [762]	1100 [53] 715 [34] 660 [32] 580 [28]	NOT ALLOWED
	6” [150]	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	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 NEGLECT; 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.**

StormTech®
Detention • Retention • Water Quality

An ADS company

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www.stormtech.com

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 GEOSYNTHETICS 315W WOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 315W woven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 315W is manufactured using high tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS Geosynthetics 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS Geosynthetics 315W conforms to the physical property values listed below:

Filter Fabric Properties

PROPERTY	TEST METHOD	ENGLISH M.A.R.V. (Minimum Average Roll Value)	METRIC M.A.R.V. (Minimum Average Roll Value)
Tensile Strength (Grab)	ASTM D-4632	315 lbs	1400 N
Elongation	ASTM D-4632	15%	15%
CBR Puncture	ASTM D-6241	900 lbs	4005 N
Puncture	ASTM D-4833	150 lbs	667 N
Mullen Burst	ASTM D-3786	600 psi	4134 kPa
Trapezoidal Tear	ASTM D-4533	120 lbs	533 N
UV Resistance (at 500 hrs)	ASTM D-4355	70%	70%
Apparent Opening Size (AOS)*	ASTM D-4751	40 US Std. Sieve	0.425 mm
Permittivity	ASTM D-4491	.05 sec^{-1}	.05 sec^{-1}
Water Flow Rate	ASTM D-4491	4 gpm/ft^{2}	163 l/min/m^{2}
Roll Sizes		12.5’ x 360’ 15.0’ x 300’ 17.5’ x 258’	3.81 m x 109.8 m 4.57 m x 91.5 m 5.33 m x 78.6 m

*Maximum average roll value.

StormTech®

MC-3500 & MC-4500 Design Manual

StormTech® Chamber Systems for Stormwater Management

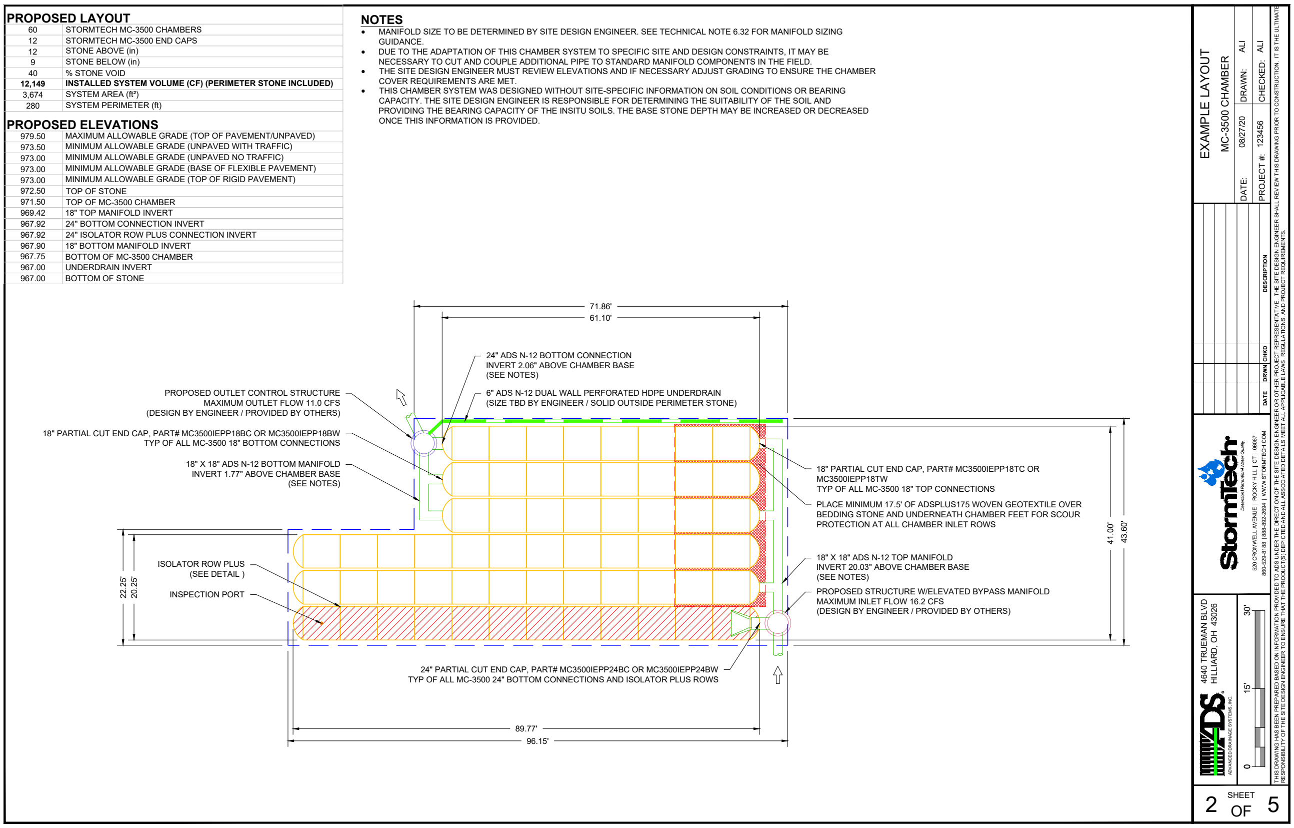
THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS®

ADS®

Table of Contents

***For SC-160LP, SC-310, SC-740 & DC-780 designs, please refer to the SC-160LP/SC-310/SC-740/DC-780 Design Manual.**

StormTech Engineering Services assists design professionals in specifying StormTech stormwater systems. This assistance includes the layout of chambers to meet the engineer's volume requirements and the connections to and from the chambers. They can also assist converting and cost engineering projects currently specified with ponds, pipe, concrete vaults and other manufactured stormwater detention/retention products. Please note that it is the responsibility of the site design engineer to ensure that the chamber bed layout meets all design requirements and is in compliance with applicable laws and regulations governing a project.



PROPOSED LAYOUT

60	STORMTECH MC-3500 CHAMBERS
12	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	% STONE VOID
12,149	**INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED)**
3,674	SYSTEM AREA (ft²)
280	SYSTEM PERIMETER (ft)

PROPOSED ELEVATIONS

979.50	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED)
973.50	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC)
973.00	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC)
973.00	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT)
973.00	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT)
972.50	TOP OF STONE
971.50	TOP OF MC-3500 CHAMBER
969.42	18" TOP MANIFOLD INVERT
967.92	24" BOTTOM CONNECTION INVERT
967.92	24" ISOLATOR ROW PLUS CONNECTION INVERT
967.90	18" BOTTOM MANIFOLD INVERT
967.75	BOTTOM OF MC-3500 CHAMBER
967.00	UNDERDRAIN INVERT
967.00	BOTTOM OF STONE

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.

This manual is exclusively intended to assist engineers in the design of subsurface stormwater systems using StormTech chambers.

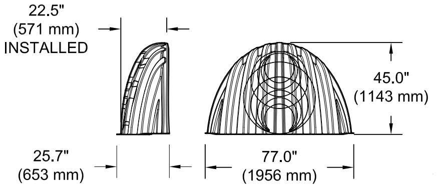
StormTech MC-3500 Chamber

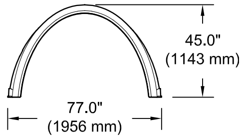
Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land 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.

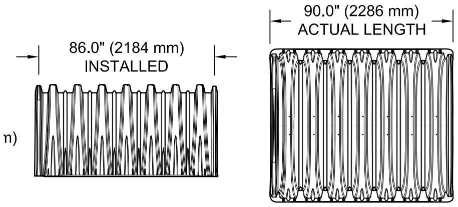
Stormtech MC-3500 Chamber (not to scale) **Nominal Chamber Specifications**	**Stormtech MC-3500 END CAP** (not to scale) **Nominal End Cap Specifications**
Size (L x W x H) 90" x 77" x 45" 2,286 mm x 1,956 mm x 1,143 mm	**Size (L x W x H)** 26.5" x 71" x 45.1" 673 mm x 1,803 mm x 1,145 mm
Chamber Storage 109.9 ft^3 (3.11 m^3)	**End Cap Storage** 14.9 ft^3 (0.42 m^3)
Min. Installed Storage* 175.0 ft^3 (4.96 m^3)	**Min. Installed Storage*** 45.1ft^3 (1.28 m^3)
Weight 134 lbs (60.8 kg)	**Weight** 49 lbs (22.2 kg)
Shipping 15 chambers/pallet 7 end caps/pallet 7 pallets/truck	

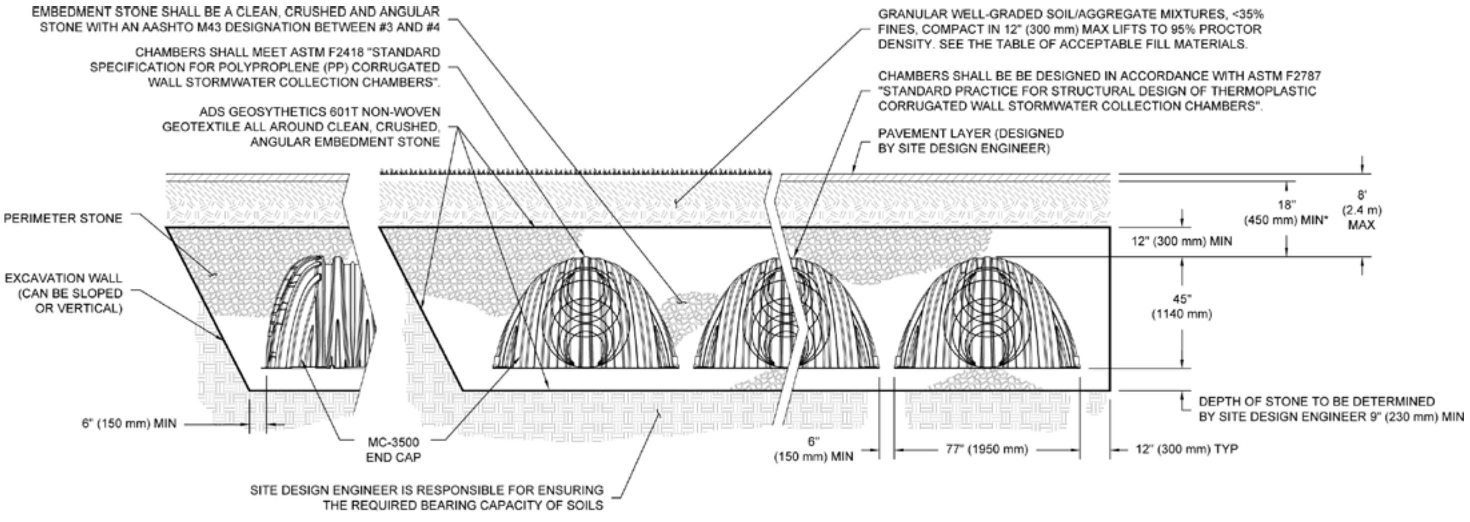
*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 6" (150 mm) of stone perimeter, 6" (150 mm) of stone between chambers/end caps and 40% stone porosity.

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 6" (150 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 24" (600 mm).

StormTech MC-3500 Chamber

Storage Volume Per Chamber/End Cap ft^3 (m^3)

	Bare Unit Storage ft^3 (m^3)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-3500 Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
MC-3500 End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

Amount of Stone Per Chamber

ENGLISH tons (yd^3)	Stone Foundation Depth			
	9"	12"	15"	18"
Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC kg (m^3)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

Volume of Excavation Per Chamber/End Cap yd^3 (m^3)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
Chamber	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

StormTech MC-4500 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.

Stormtech MC-4500 Chamber
(not to scale)
Nominal Chamber Specifications

Size (L x W x H)
52” x 100” x 60”
1321 mm x 2540 mm x 1524 mm

Chamber Storage
106.5 ft^3 (3.01 m^3)

Min. Installed Storage*
162.6 ft^3 (4.60 m^3)

Weight
Nominal 125 lbs (56.7 kg)

Shipping
7 chambers/pallet
5 end caps/pallet
11 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.

Stormtech MC-4500 end cap
(not to scale)
Nominal End Cap Specifications

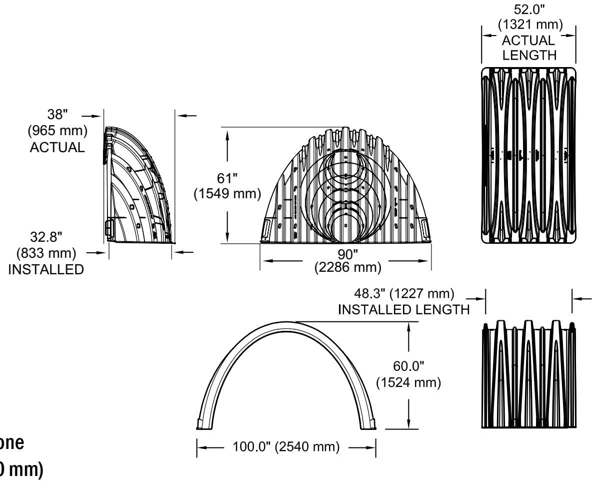
Size (L x W x H)
38” x 90” x 61”
965 mm x 2286 mm x 1549 mm

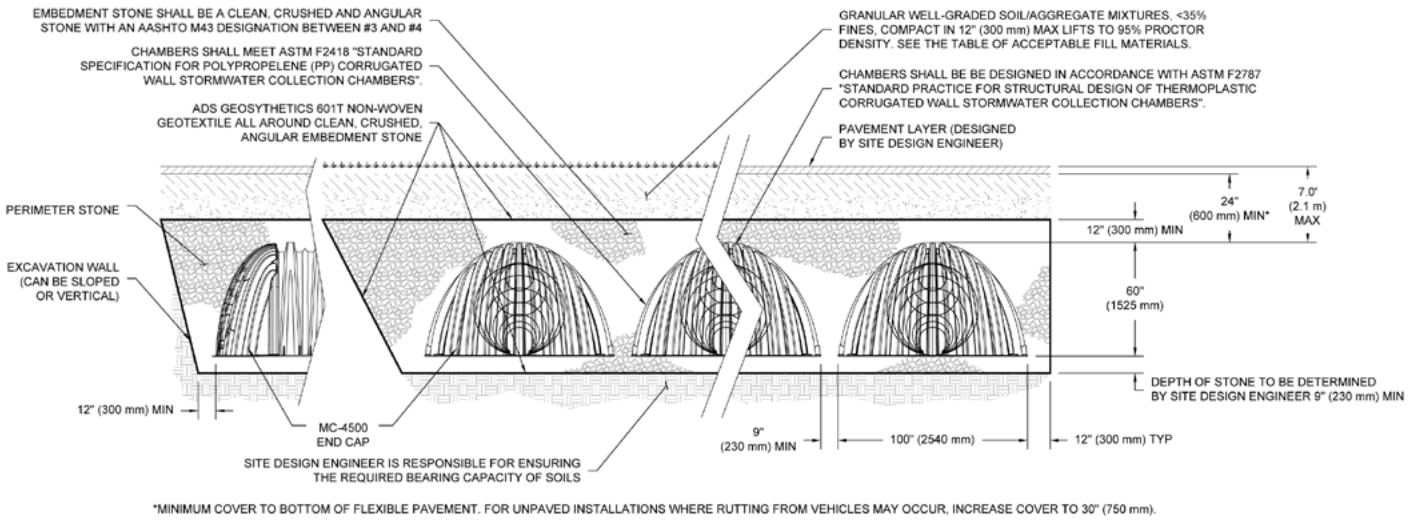
End Cap Storage
39.5 ft^3 (1.12 m^3)

Min. Installed Storage*
115.3 ft^3 (3.26 m^3)

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-4500 Chamber

Storage Volume Per Chamber/End Cap ft^3 (m^3)

	Bare Unit Storage ft^3 (m^3)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-4500 Chamber	106.5 (3.02)	162.6 (4.60)	166.3 (4.71)	169.9 (4.71)	173.6 (4.91)
MC-4500 End Cap	39.5 (1.12)	115.3 (3.26)	111.9 (3.17)	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 (yd^3)	Stone Foundation Depth			
	9"	12"	15"	18"
Chamber	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
End Cap	9.8 (7.0)	10.2 (7.3)	10.6 (7.6)	11.1 (7.9)
METRIC kg (m^3)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	6713 (4.0)	7076 (4.2)	7529 (4.5)	7983 (4.7)
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.

Volume of Excavation Per Chamber/End Cap yd^3 (m^3)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
Chamber	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
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.

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

1.0 Product Information

1.1 PRODUCT DESIGN

StormTech's commitment to thorough product testing programs, materials evaluation and adherence to national standards has resulted in two more superior products. Like other StormTech chambers, the MC-3500 and MC-4500 are designed to meet the full scope of design requirements of the American Society of Testing Materials (ASTM) International specification F2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers" and produced to the requirements of the ASTM F 2418 "Standard Specification for Polypropylene (PP) Corrugated Stormwater Collection Chambers".

The StormTech MC-3500 and MC-4500 chambers provide the full AASHTO safety factors for live loads and permanent earth loads. The ASTM F 2787 standard provides specific guidance on how to design thermoplastic chambers in accordance with AASHTO Section 12.12. of the AASHTO LRFD Bridge Design Specifications. ASTM F 2787 requires that the safety factors included in the AASHTO guidance are achieved as a prerequisite to meeting ASTM F 2418. The three standards provide both the assurance of product quality and safe structural design.

The design of larger chambers in the same tradition of our other chambers required the collaboration of experts in soil-structure interaction, plastics and manufacturing. Years of extensive research, including laboratory testing and field verification, were required to produce chambers that are ready to meet both the rigors of installation and the longevity expected by engineers and owners.

This Design Manual provides the details and specifications necessary for consulting engineers to design stormwater management systems using the MC-3500 and MC-4500 chambers. It provides specifications for storage capacities, layout dimensions as well as requirements for design to ensure a long service life. The basic design concepts for foundation and backfill materials, subgrade bearing capacities and row spacing remain equally as pertinent for the MC-3500 and MC-4500 as the SC-740, SC-310 and DC-780 chamber systems. However, since many design values and dimensional requirements are different for these larger chambers than the SC-740, SC-310 and DC-780 chambers, design manuals and installation instructions are not interchangeable.

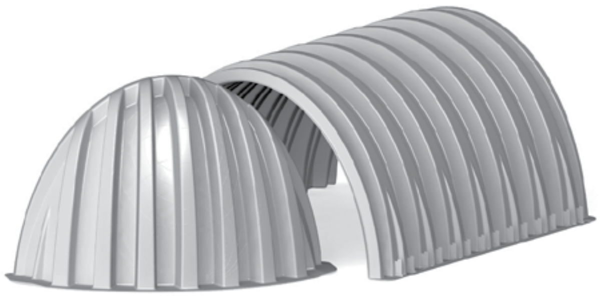
This manual includes only those details, dimensions, cover limits, etc for the MC-3500 and MC-4500 and is intended to be a stand-alone design guide for the MC-3500 and MC-4500 chambers. A Construction Guide specifically for these two chamber models has also been published.

1.2 TECHNICAL SUPPORT

The StormTech Technical Services Department is available to assist the engineer with the layout of MC-3500 and MC-4500 chamber systems and answer questions regarding all the StormTech chamber models. Call the Technical Services Department, email us at info@stormtech.com or contact your local StormTech representative.

1.3 MC-3500 AND MC-4500 CHAMBERS

All StormTech chambers are designed to the full scope of AASHTO requirements without repeating end walls or other structural reinforcing. StormTech's continuously curved, elliptical arch and the surrounding angular backfill are the key components of the structural system. With the addition of patent pending integral stiffening ribs **(Figure 5)**, the MC-3500 and MC-4500 are assured to provide a long, safe service life. Like other StormTech chambers, the MC-3500 and MC-4500 are produced from high quality, impact modified resins which are tested for short-term and long-term mechanical properties.



With all StormTech chambers, one chamber type is used for the start, middle and end of rows. Rows are formed by overlapping the upper joint corrugation of the next chamber over the lower joint corrugation of the previous chamber **(Figure 6)**.

1.4 CHAMBER JOINTS

All StormTech chambers are designed with an optimized joining system. The height and width of the end corrugations have been designed to provide the required structural safety factors while providing an unobstructed flow path down each row.

To assist the contractor, StormTech chambers are molded with simple assembly instructions and arrows that indicate the direction in which to build rows. The corrugation valley immediately adjacent to the lower joint corrugation is marked "Overlap Here - Lower Joint." The corrugation valley immediately adjacent to the upper joint corrugation is marked "Build This Direction - Upper Joint."

Two people can safely and efficiently carry and place chambers without cumbersome connectors, special tools or heavy equipment. Each row of chambers must begin and end with a joint corrugation. Since joint corrugations are of a different size than the corrugations along the body of the chamber, chambers cannot be field cut and installed. Only whole MC-3500 and MC-4500 chambers can be used. For system layout assistance contact StormTech.

1.5 MC-3500 AND MC-4500 END CAPS

The MC-3500 and MC-4500 end caps are easy to install. These end caps are designed with a corrugation joint that fits over the top of either end of the chamber. The end cap joint is simply set over the top of either of the upper or lower chamber joint corrugations **(Figure 7)**.

The MC-3500 end cap has pipe cutting guides for 12"–24" (300 mm–600 mm) top inverts **(Figure 9)**.

The MC-4500 end cap has pipe cutting guides for 12"–42" (300 mm–1050 mm) bottom inverts and 12"–24" (300 mm–600 mm) top inverts **(Figure 8)**.

Standard and custom pre-cored end caps are available. MC-3500 pre-cored end caps, 18" in diameter and larger include a welded crown plate.

FIGURE 5—Chamber and End Cap Components

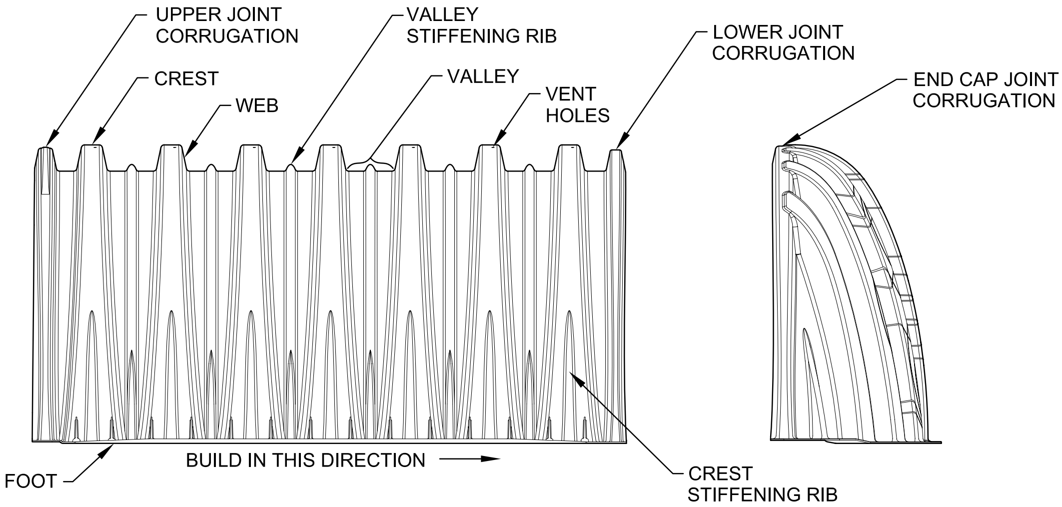


FIGURE 6—Chamber Joint Overlap

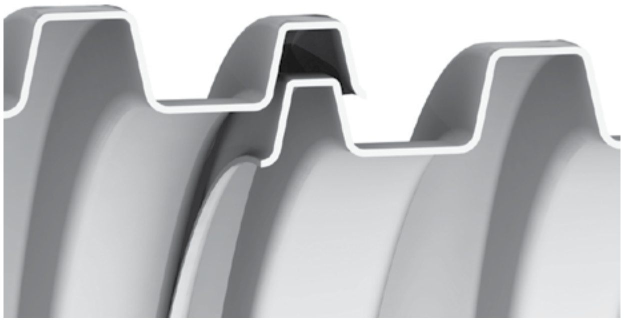
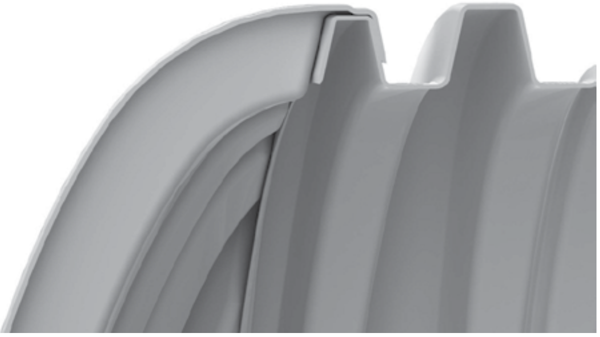


FIGURE 7—End Cap Joint Overlap



1.0 Product Information

FIGURE 8—MC-4500 End Cap Inverts

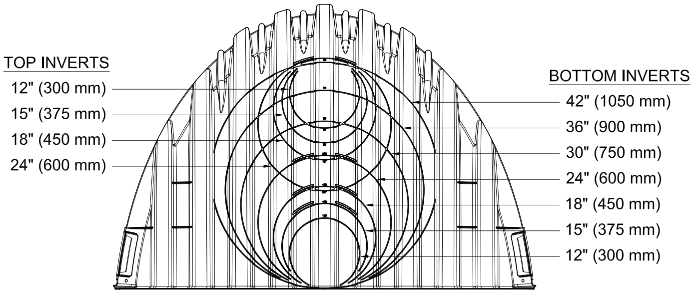
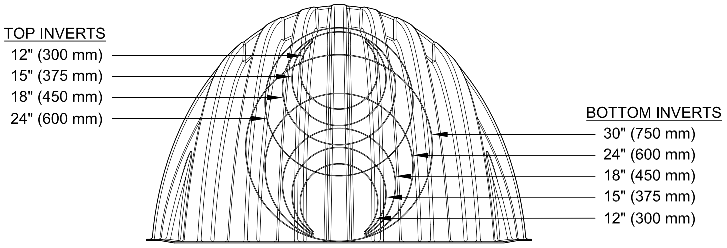


FIGURE 9—MC-3500 End Cap Inverts

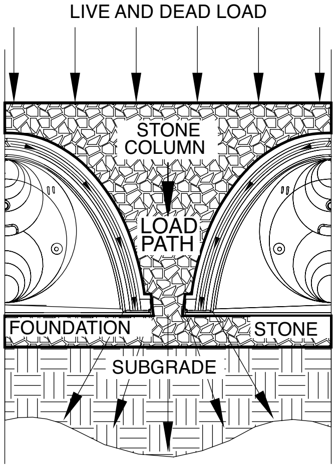


2.0 Foundations for Chambers

2.1 FOUNDATION REQUIREMENTS

StormTech chamber systems can be installed in various soil types. The subgrade bearing capacity and the cover height over the chambers determine the required depth of clean, crushed, angular foundation stone below the chambers. Foundation stone, also called bedding, is the stone between the subgrade soils and the feet of the chamber. Flexible structures are designed to transfer a significant portion of both live and dead loads through the surrounding soils. Chamber systems accomplish this by creating load paths through the columns of embedment stone between and around the rows of chambers. This creates load concentrations at the base of the columns between the rows. The foundation stone spreads out the concentrated loads to distributed loads that can be supported by the subgrade soils.

Since increasing the cover height (top of chamber to finished grade) causes increasing soil load, a greater depth of foundation stone is necessary to distribute the load to the subgrade soils. **Table 1** and **2** specify the minimum required foundation depths for varying cover heights and allowable subgrade bearing capacities. These tables are based on StormTech service loads. The minimum required foundation depth is 9" (230 mm) for both chambers. For additional guidance on foundation stone design please see our Technical Note 6.22 - StormTech Subgrade Performance



2.2 WEAKER SOILS

StormTech has not provided guidance for subgrade bearing capacities less than 2000 pounds per square foot [(2.0 ksf) (96 kPa)]. These soils are often highly variable, may contain organic materials and could be more sensitive to moisture. A geotechnical engineer must be consulted if soils with bearing capacities less than 2000 psf (96 kPa) are present.

2.0 Foundations for Chambers

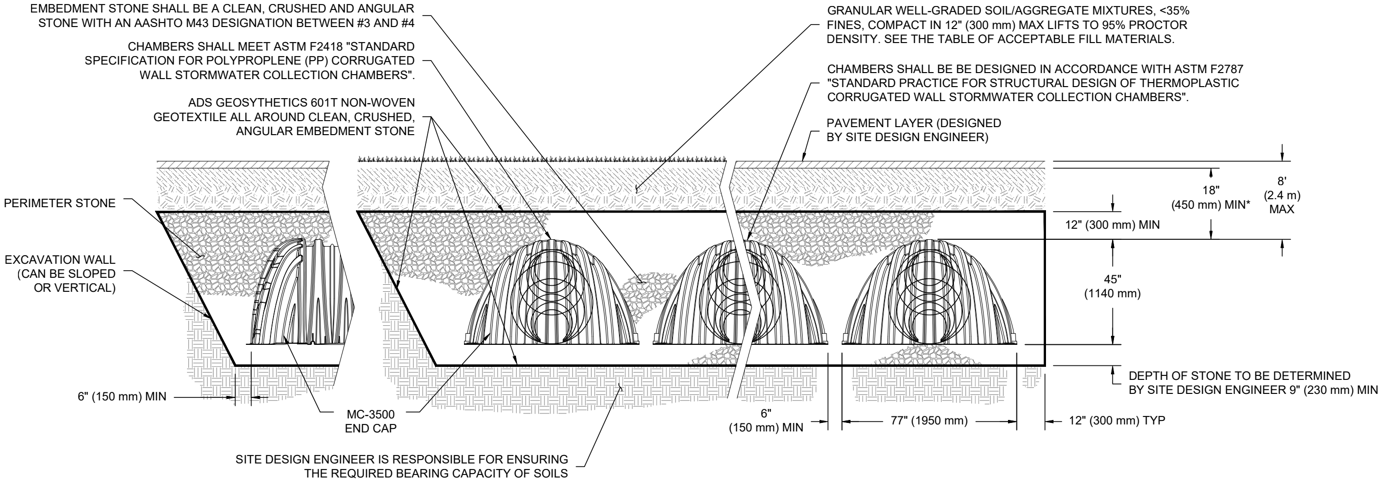
TABLE 1—MC-3500 Minimum Required Foundation Depth in inches (millimeters)

Assumes 6” (150 mm) row spacing.

Cover Hgt. ft. (m)	Minimum Bearing Resistance for Service Loads ksf (kPa)																								
	4.4 (211)	4.3 (206)	4.2 (201)	4.1 (196)	4.0 (192)	3.9 (187)	3.8 (182)	3.7 (177)	3.6 (172)	3.5 (168)	3.4 (163)	3.3 (158)	3.2 (153)	3.1 (148)	3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
1.5 (0.46)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)
2.0 (0.61)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)
2.5 (0.76)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)
3.0 (0.91)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)
3.5 (1.07)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)
4.0 (1.22)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)
4.5 (1.37)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)
5.0 (1.52)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	30 (750)
5.5 (1.68)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)
6.0 (1.83)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)
6.5 (1.98)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)
7.0 (2.13)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)	30 (750)
7.5 (2.30)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)	30 (750)
8.0 (2.44)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)	30 (750)	30 (750)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

FIGURE 10A—MC-3500 Structural Cross Section Detail (Not to Scale)



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

Special applications will be considered on a project by project basis. Please contact our applications department should you have a unique application for our team to evaluate.

2.0 Foundations for Chambers

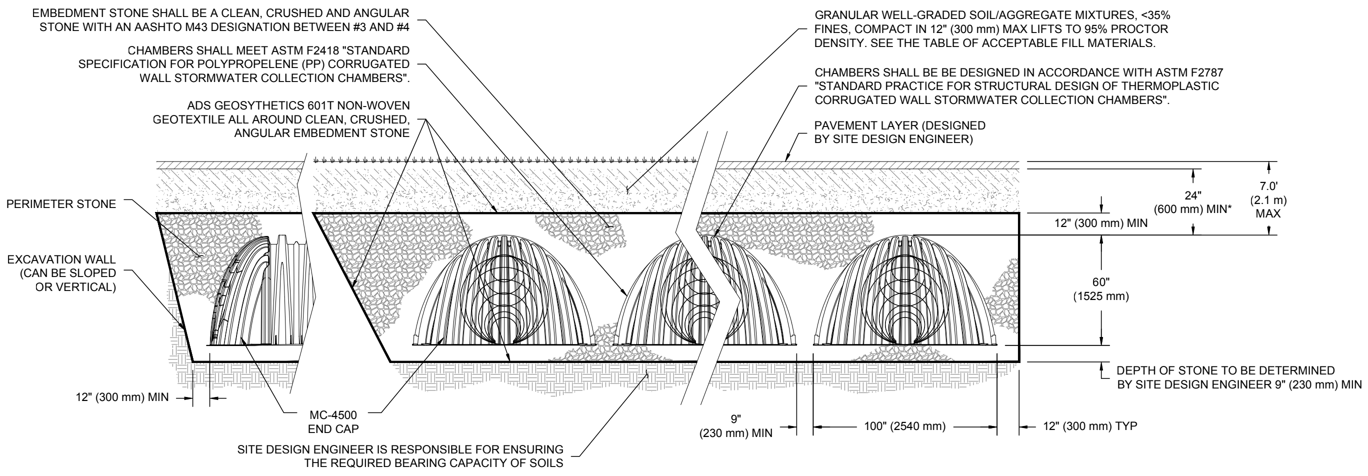
TABLE 2—MC-4500 Minimum Required Foundation Depth in inches (millimeters)

Assumes 9” (230 mm) row spacing.

Cover Hgt. ft. (m)	Minimum Bearing Resistance for Service Loads ksf (kPa)																								
	4.4 (211)	4.3 (206)	4.2 (201)	4.1 (196)	4.0 (192)	3.9 (187)	3.8 (182)	3.7 (177)	3.6 (172)	3.5 (168)	3.4 (163)	3.3 (158)	3.2 (153)	3.1 (148)	3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
2.0 (0.61)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)	21 (525)
2.5 (0.76)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)
3.0 (0.91)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)
3.5 (1.07)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	30 (750)
4.0 (1.22)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)
4.5 (1.37)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	33 (825)
5.0 (1.52)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	33 (825)	36 (900)
5.5 (1.68)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	33 (825)	36 (900)	36 (900)
6.0 (1.83)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	33 (825)	33 (825)	36 (900)	36 (900)	36 (900)
6.5 (1.98)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	33 (825)	33 (825)	36 (900)	36 (900)	36 (900)	36 (900)
7.0 (2.13)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	33 (825)	36 (900)	36 (900)	36 (900)	36 (900)	36 (900)	36 (900)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

FIGURE 10B—MC-4500 Structural Cross Section Detail (Not to Scale)



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

Special applications will be considered on a project by project basis. Please contact our applications department should you have a unique application for our team to evaluate.

3.0 Required Materials/Row Separation

3.1 Foundation and Embedment Stone

The stone surrounding the chambers consists of the foundation stone below the chambers and embedment stone surrounding the chambers. The foundation stone and embedment stone are important components of the structural system and also provide open void space for stormwater storage. **Table 3** provides the stone specifications that achieve both structural requirements and a porosity of 40% for stormwater storage. **Figure 11** specifies the extents of each backfill stone location.

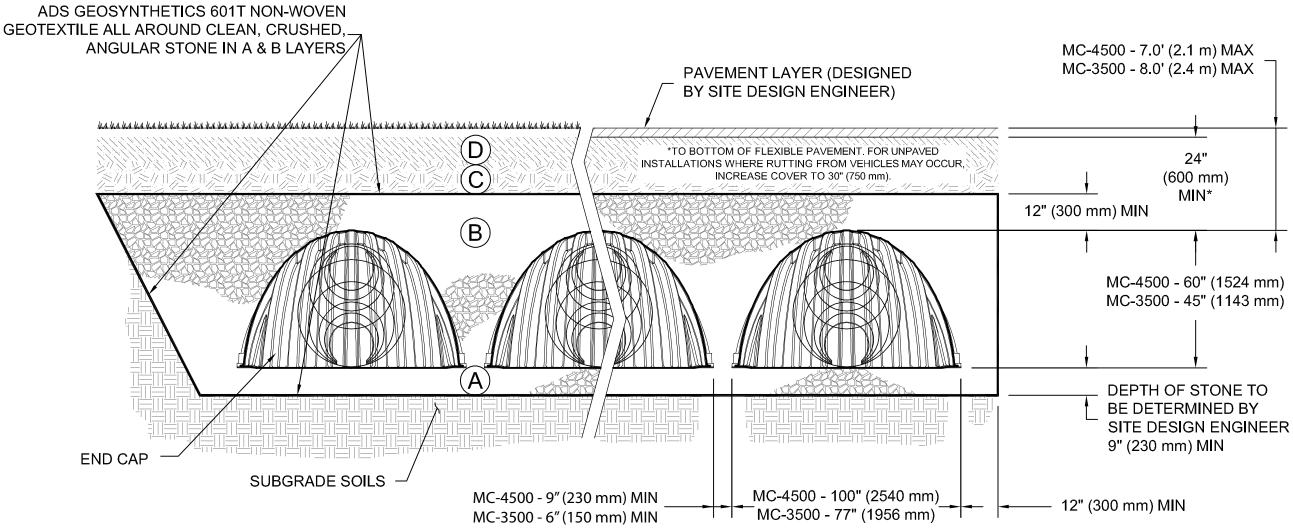
TABLE 3—Acceptable Fill Materials

MATERIAL LOCATION		DESCRIPTION	AASHTO DESIGNATION	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 COMPACTOINS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDTIONAL 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 FORM THE FOUDATION 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.

FIGURE 11—Fill Material Locations



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 materials of layer 'C' or 'D' at the design engineer's discretion.

3.0 Required Materials/Row Separation

3.2 FILL ABOVE CHAMBERS

Refer to **Table 3** and **Figure 11** for acceptable fill material above the clean, crushed, angular stone. StormTech requires a minimum of 24" (600 mm) from the top of the chamber to the bottom of flexible pavement. For non-paved installations where rutting from vehicles may occur StormTech requires a minimum of 30" (750 mm) from top of chamber to finished grade.

3.3 GEOTEXTILE SEPARATION

A non-woven geotextile meeting AASHTO M288 Class 2 separation requirements must be installed to completely envelope the system and prevent soil intrusion into the crushed, angular stone. Overlap adjacent geotextile rolls per AASHTO M288 separation guidelines. Contact StormTech for a list of acceptable geotextiles.

3.4 PARALLEL ROW SEPARATION/ PERPENDICULAR BED SEPARATION

Parallel Row Separation

The minimum installed spacing between parallel rows after backfilling is 9" (230 mm) for the MC-4500 chambers and 6" (150mm) for the MC-3500 (measurement taken between the outside edges of the feet). Spacers may be used for layout convenience. Row spacing wider than the minimum spacing above may be specified.

Perpendicular Bed Separation

When beds are laid perpendicular to each other, a minimum installed spacing of 36" (900 mm) between beds is required.

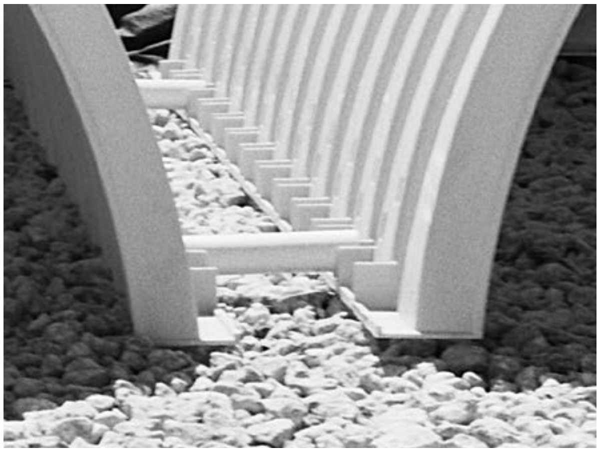
3.5 Special Structural Designs

StormTech engineers may provide special structural designs to enable deeper cover depths or increase the capacity to carry higher live loads. Special designs may utilize the additional strength that can be achieved by compaction of embedment stone or by increasing the spacing between rows.

Increasing the spacing between chamber rows may also facilitate the application of StormTech chambers with either less foundation stone or with weaker subgrade soils. This may be a good option where vertical restrictions on site prevent the use of a deeper foundation.

Contact ADS Engineering Services for more information on special structural designs.

System Cross Section



Minimum Row Spacing

4.1 GENERAL

StormTech subsurface chamber systems offer the flexibility for a variety of inlet and outlet configurations. Contact the StormTech Technical Services Department or your local StormTech representative for assistance configuring inlet and outlet connections.

The open graded stone around and under the chambers provides a significant conveyance capacity ranging from approximately 0.8 cfs (23 l/s) to 13 cfs (368 l/s) per MC-3500 chamber and 0.54 cfs (15 l/s) to 8.5 cfs (240 l/s) for the MC-4500 chamber. The actual conveyance capacity is dependent upon stone size, depth of foundation stone and head of water. Although the high conveyance capacity of the open graded stone is an important component of the flow network, StormTech recommends that a system of inlet and outlet manifolds be designed to distribute and convey the peak flow through the chamber system.

It is the responsibility of the design engineer to provide the design flow rates and storage volumes for the stormwater system and to ensure that the final design meets all conveyance and storage requirements. However, StormTech will work with the design engineer to assist with manifold and chamber layouts that meet the design objectives.

4.2 THE ISOLATOR® ROW PLUS

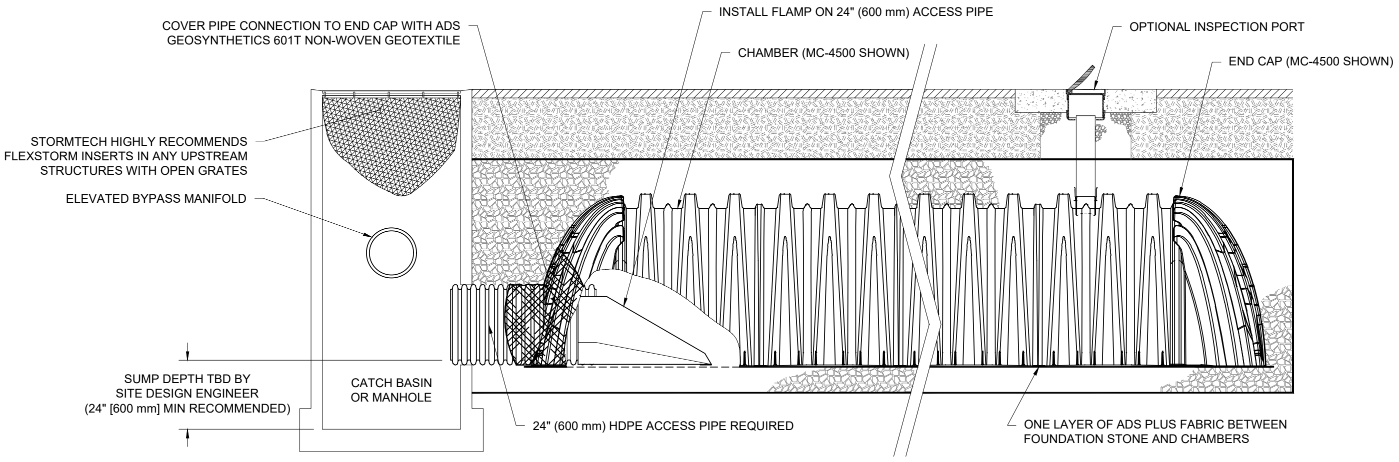
The Isolator Row PLUS is a patented system that inexpensively captures total suspended solids (TSS) and debris and provides easy access for inspection and maintenance. In a typical configuration, a single layer of ADS PLUS fabric is placed between the chambers and the stone foundations. This fabric traps and filters sediments as well as protects the stone base during cleaning and maintenance. Each installed MC-3500 chamber and MC-3500 end cap provides 42.9 ft2 (4.0 m2) and 7.5 ft2 (0.7 m2) of bottom filter area respectively. Each installed MC-4500 chamber and MC-4500 end cap provides 30.1 ft^2 (2.80 m^2) and 12.8 ft^2 (1.19 m^2) of bottom filter area respectively.

The Isolator Row PLUS can be configured for maintenance objectives or, in some regulatory jurisdictions, for water quality objectives. For water quality applications, the Isolator Row PLUS can be sized based on water quality volume or flow rate.

All Isolator Plus Rows require: 1) a manhole for maintenance access, 2) a means of diversion of flows to the Isolator Row PLUS 3) a high flow bypass and 4) FLAMP (Flared End Ramp). 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.. Flow diversion can be accomplished by either a weir in the upstream access manhole or simply by feeding the Isolator Row PLUS at a lower elevation than the high flow bypass. Contact StormTech for assistance sizing Isolator Plus Rows.

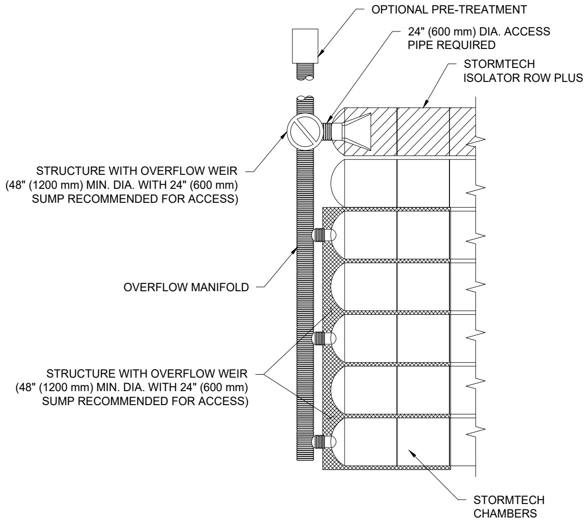
When additional stormwater treatment is required, StormTech systems can be configured using a treatment train approach where other stormwater BMPs are located in series.

FIGURE 12—StormTech Isolator Row PLUS Detail



4.0 Hydraulics

FIGURE 13—Typical Inlet Configuration With Isolator Row PLUS and Scour Protection



4.3 INLET MANIFOLDS

The primary function of the inlet manifold is to convey and distribute flows to a sufficient number of rows in the chamber bed such that there is ample conveyance capacity to pass the peak flows without creating an unacceptable backwater condition in upstream piping or scour the foundation stone under the chambers.

Manifolds are connected to the end caps either at the top or bottom of the end cap. Standard distances from the base of chamber to the invert of inlet and outlet manifolds connecting to StormTech end caps can be found in table 6. High inlet flow rates from either connection location produce a shear scour potential of the foundation stone. Inlet flows from top inlets also produce impingement scour potential. Scour potential is reduced when standing water is present over the foundation stone. However, for safe design across the wide range of applications, StormTech assumes minimal standing water at the time the design flow occurs.

To minimize scour potential, StormTech recommends the installation of woven scour protection fabric at each inlet row. This enables a protected transition zone from the concentrated flow coming out of the inlet pipe to a uniform flow across the entire width of the chamber for both top and bottom connections.

Allowable flow rates for design are dependent upon: the elevation of inlet pipe, foundation stone size and scour protection. With an appropriate scour protection geotextile installed from the end cap to at least 14.5 ft (4.42 m) in front of the inlet pipe for the MC-3500 and for the MC-4500, for both top and bottom feeds, the flow rates listed in **Table 4** can be used for all StormTech specified foundation stone gradations.

***See StormTech's Tech Note 6.32 for manifold sizing guidance.**

Table 4—Allowable Inlet Flows*

Inlet Pipe Diameter Inches (mm)	Allowable Maximum Flow Rate cfs (l/s)
12 (300)	2.48 (70)
15 (375)	3.5 (99)
18 (450)	5.5 (156)
24 (600)	8.5 (241) [MC-3500]
24 (600)	9.5 (269) [MC-4500]

*Assumes appropriate length of scour fabric per section 4.3

Table 5—Maximum Outlet Flow Rate Capacities From StormTech Oulet Manifolds

PIPE DIA.	FLOW (CFS)	FLOW (L/S)
6" (150 mm)	0.4	11.3
8" (200 mm)	0.7	19.8
10" (250 mm)	1.0	28.3
12" (300 mm)	2.0	56.6
15" (375 mm)	2.7	76.5
18" (450 mm)	4.0	113.3
24" (600 mm)	7.0	198.2
30" (750 mm)	11.0	311.5
36" (900 mm)	16.0	453.1
42" (1050 mm)	22.0	623.0
48" (1200 mm)	28.0	792.9

Table 6—Standard Distances From Base of Chamber to Invert of Inlet and Outlet Manifolds on StormTech End Caps

MC-3500 ENDCAPS

PIPE DIA.		INV. (IN)	INV. (MM)
TOP	6" (150 mm)	33.21	841
	8" (200 mm)	31.16	789
	10" (250 mm)	29.04	738
	12" (300 mm)	26.36	671
	15" (375 mm)	23.39	594
	18" (450 mm)	20.03	509
	24" (600 mm)	14.48	369
BOTTOM	12" (750 mm)	1.35	34
	15" (900 mm)	1.5	40
	18" (1050 mm)	1.77	46
	24" (1200 mm)	2.06	52

MC-4500 ENDCAPS

PIPE DIA.		INV. (IN)	INV. (MM)
TOP	12" (300 mm)	35.69	907
	15" (375 mm)	32.72	831
	18" (450 mm)	29.36	746
	24" (600 mm)	23.05	585
BOTTOM	12" (750 mm)	1.55	34
	15" (900 mm)	1.7	43
	18" (1050 mm)	1.97	50
	24" (1200 mm)	2.26	57

4.4 OUTLET MANIFOLDS

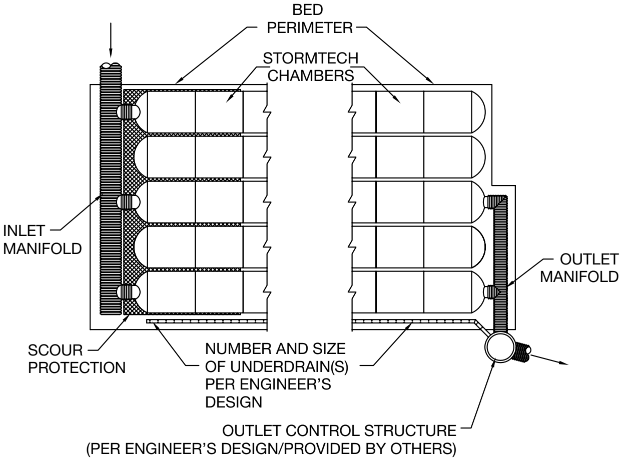
The primary function of the outlet manifold is to convey peak flows from the chamber system to the outlet control structure. Outlet manifolds are often sized for attenuated flows. They may be smaller in diameter and have fewer row connections than inlet manifolds. In some applications however, the intent of the outlet piping is to convey an unattenuated bypass flow rate and manifolds may be sized similar to inlet manifolds.

Since chambers are generally flowing at or near full at the time of the peak outlet flow rate, scour is generally not governing and outlet manifold sizing is based on pipe flow equations. In most cases, StormTech recommends that outlet manifolds connect the same rows that are connected to an inlet manifold. This provides a continuous flow path through open conduits to pass the peak flow without dependence on passing peak flows through stone.

The primary function of the underdrains is to draw down water stored in the stone below the invert of the manifold. Underdrains are generally not sized for conveyance of the peak flow.

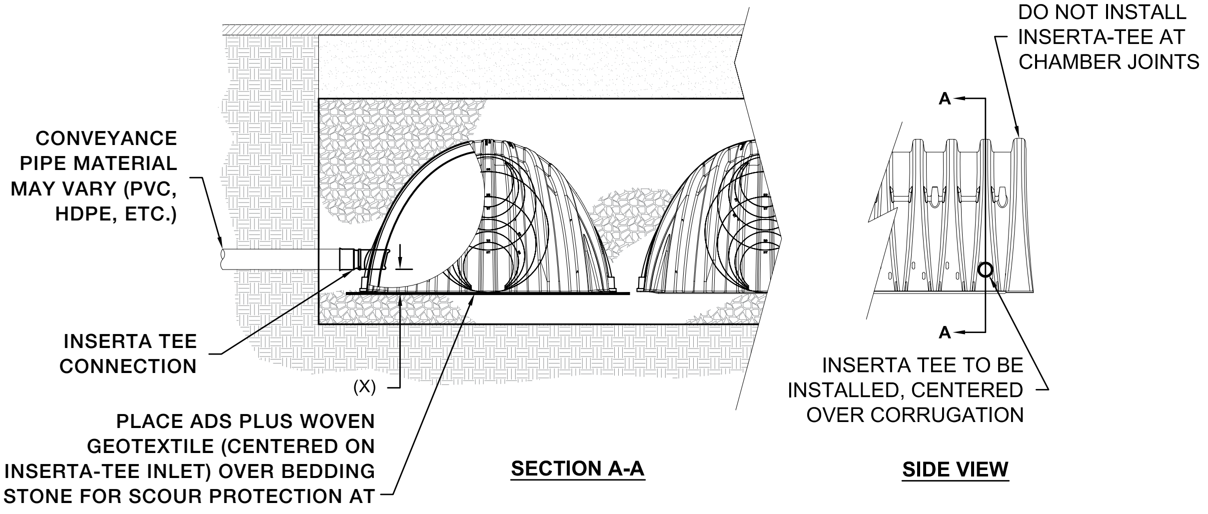
The maximum outlet flow rate capacities from StormTech outlet manifolds can be found in **Table 5.**

FIGURE 14—Typical Inlet, Outlet and Underdrain Configuration



4.5 INSERTA TEE INLET CONNECTIONS

FIGURE 15—Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-3500	12" (250 mm)	6" (150 mm)
MC-4500	12" (250 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

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

5.0 Cumulative Storage Volumes

Tables 7 and **8** provide cumulative storage volumes for the MC-3500 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

TABLE 7 – MC-3500 Incremental Storage Volume Per Chamber

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 6" (150 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
66 (1676)	↑ 0.00	175.02 (4.956)
65 (1651)	0.00	173.36 (4.909)
64 (1626)	0.00	171.71 (4.862)
63 (1600)	Stone 0.00	170.06 (4.816)
62 (1575)	Cover 0.00	168.41 (4.7.69)
61 (1549)	0.00	166.76 (4.722)
60 (1524)	0.00	165.10 (4.675)
59 (1499)	0.00	163.45 (4.628)
58 (1473)	0.00	161.80 (4.582)
57 (1448)	0.00	160.15 (4.535)
56 (1422)	0.00	158.49 (4.488)
55 (1397)	↓ 0.00	156.84 (4.441)
54 (1372)	109.95 (3.113)	155.19 (4.394)
53 (1346)	109.89 (3.112)	153.50 (4.347)
52 (1321)	109.69 (3.106)	151.73 (4.297)
51 (1295)	109.40 (3.098)	149.91 (4.245)
50 (1270)	109.00 (3.086)	148.01 (4.191)
49 (1245)	108.31 (3.067)	145.95 (4.133)
48 (1219)	107.28 (3.038)	143.68 (4.068)
47 (1194)	106.03 (3.003)	141.28 (4.000)
46 (1168)	104.61 (2.962)	138.77 (3.930)
45 (1143)	103.04 (2.918)	136.17 (3.856)
44 (1118)	101.33 (2.869)	133.50 (3.780)
43 (1092)	99.50 (2.818)	130.75 (3.702)
42 (1067)	97.56 (2.763)	127.93 (3.623)
41 (1041)	95.52 (2.705)	125.06 (3.541)
40 (1016)	93.39 (2.644)	122.12 (3.458)
39 (991)	91.16 (2.581)	119.14 (3.374)
38 (965)	88.86 (2.516)	116.10 (3.288)
37 (948)	86.47 (2.449)	113.02 (3.200)
36 (914)	84.01 (2.379)	109.89 (3.112)
35 (889)	81.49 (2.307)	106.72 (3.022)
34 (864)	78.89 (2.234)	103.51 (2.931)
33 (838)	76.24 (2.159)	100.27 (2.839)
32 (813)	73.52 (2.082)	96.98 (2.746)
31 (787)	70.75 (2.003)	93.67 (2.652)
30 (762)	67.92 (1.923)	90.32 (2.558)
29 (737)	65.05 (1.842)	86.94 (2.462)
28 (711)	62.12 (1.759)	83.54 (2.366)
27 (686)	59.15 (1.675)	80.10 (2.268)
26 (680)	56.14 (1.590)	76.64 (2.170)
25 (635)	53.09 (1.503)	73.16 (2.072)
24 (610)	49.99 (1.416)	69.65 (1.972)
23 (584)	46.86 (1.327)	66.12 (1.872)
22 (559)	43.70 (1.237)	62.57 (1.772)
21 (533)	40.50 (1.147)	59.00 (1.671)
20 (508)	37.27 (1.055)	55.41 (1.569)
19 (483)	34.01 (0.963)	51.80 (1.467)
18 (457)	30.72 (0.870)	48.17 (1.364)
17 (432)	27.40 (0.776)	44.53 (1.261)
16 (406)	24.05 (0.681)	40.87 (1.157)
15 (381)	20.69 (0.586)	37.20 (1.053)
14 (356)	17.29 (0.490)	33.51 (0.949)
13 (330)	13.88 (0.393)	29.81 (0.844)
12 (305)	10.44 (0.296)	26.09 (0.739)
11 (279)	6.98 (0.198)	22.37 (0.633)
10 (254)	3.51 (0.099)	18.63 (0.527)
9 (229)	↑ 0.00	14.87 (0.421)
8 (203)	0.00	13.22 (0.374)
7 (178)	0.00	11.57 (0.328)
6 (152)	Stone 0.00	9.91 (0.281)
5 (127)	Foundation 0.00	8.26 (0.234)
4 (102)	0.00	6.61 (0.187)
3 (76)	0.00	4.96 (0.140)
2 (51)	0.00	3.30 (0.094)
1 (25)	↓ 0.00	1.65 (0.047)

NOTE: Add 1.65 ft^3 (0.047 m^3) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volume

TABLE 8 – MC-3500 Incremental Storage Volume Per End Cap

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above end caps, and 6" (150 mm) of spacing between end caps and 6" (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
66 (1676)	0.00	45.10 (1.277)
65 (1651)	0.00	44.55 (1.262)
64 (1626)	0.00	44.00 (1.246)
63 (1600)	Stone 0.00	43.46 (1.231)
62 (1575)	Cover 0.00	42.91 (1.2.15)
61 (1549)	0.00	42.36 (1.200)
60 (1524)	0.00	41.81 (1.184)
59 (1499)	0.00	41.27 (1.169)
58 (1473)	0.00	40.72 (1.153)
57 (1448)	0.00	40.17 (1.138)
56 (1422)	0.00	39.62 (1.122)
55 (1397)	0.00	39.08 (1.107)
54 (1372)	15.64 (0.443)	38.53 (1.091)
53 (1346)	15.64 (0.443)	37.98 (1.076)
52 (1321)	15.63 (0.443)	37.42 (1.060)
51 (1295)	15.62 (0.442)	36.85 (1.043)
50 (1270)	15.60 (0.442)	36.27 (1.027)
49 (1245)	15.56 (0.441)	35.68 (1.010)
48 (1219)	15.51 (0.439)	35.08 (0.993)
47 (1194)	15.44 (0.437)	34.47 (0.976)
46 (1168)	15.35 (0.435)	33.85 (0.959)
45 (1143)	15.25 (0.432)	33.22 (0.941)
44 (1118)	15.13 (0.428)	32.57 (0.922)
43 (1092)	14.99 (0.424)	31.91 (0.904)
42 (1067)	14.83 (0.420)	31.25 (0.885)
41 (1041)	14.65 (0.415)	30.57 (0.866)
40 (1016)	14.45 (0.409)	29.88 (0.846)
39 (991)	14.24 (0.403)	29.18 (0.826)
38 (965)	14.00 (0.396)	28.48 (0.806)
37 (948)	13.74 (0.389)	27.76 (0.786)
36 (914)	13.47 (0.381)	27.04 (0.766)
35 (889)	13.18 (0.373)	26.30 (0.745)
34 (864)	12.86 (0.364)	25.56 (0.724)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
33 (838)	12.53 (0.355)	24.82 (0.703)
32 (813)	12.18 (0.345)	24.06 (0.681)
31 (787)	11.81 (0.335)	23.30 (0.660)
30 (762)	11.42 (0.323)	22.53 (0.638)
29 (737)	11.01 (0.312)	21.75 (0.616)
28 (711)	10.58 (0.300)	20.96 (0.594)
27 (686)	10.13 (0.287)	20.17 (0.571)
26 (680)	9.67 (0.274)	19.37 (0.549)
25 (635)	9.19 (0.260)	18.57 (0.526)
24 (610)	8.70 (0.246)	17.76 (0.503)
23 (584)	8.19 (0.232)	16.94 (0.480)
22 (559)	7.67 (0.217)	16.12 (0.456)
21 (533)	7.13 (0.202)	15.29 (0.433)
20 (508)	6.59 (0.187)	14.45 (0.409)
19 (483)	6.03 (0.171)	13.61 (0.385)
18 (457)	5.46 (0.155)	12.76 (0.361)
17 (432)	4.88 (0.138)	11.91 (0.337)
16 (406)	4.30 (0.122)	11.06 (0.313)
15 (381)	3.70 (0.105)	10.20 (0.289)
14 (356)	3.10 (0.088)	9.33 (0.264)
13 (330)	2.49 (0.071)	8.46 (0.240)
12 (305)	1.88 (0.053)	7.59 (0.215)
11 (279)	1.26 (0.036)	6.71 (0.190)
10 (254)	0.63 (0.018)	5.83 (0.165)
9 (229)	0.00	4.93 (0.139)
8 (203)	0.00	4.38 (0.124)
7 (178)	0.00	3.83 (0.108)
6 (152)	Stone 0.00	3.28 (0.093)
5 (127)	Foundation 0.00	2.74 (0.077)
4 (102)	0.00	2.19 (0.062)
3 (76)	0.00	1.64 (0.046)
2 (51)	0.00	1.09 (0.031)
1 (25)	0.00	0.55 (0.015)

NOTE: Add 0.56 ft^3 (0.016 m^3) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volumes

Tables 9 and **10** provide cumulative storage volumes for the MC-4500 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

TABLE 9 – MC-4500 Incremental Storage Volume Per Chamber

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 9" (230 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
81 (2057)	0.00	162.62 (4.065)
80 (2032)	0.00	161.40 (4.570)
79 (2007)	0.00	160.18 (4.536)
78 (1981)	Stone 0.00	158.98 (4.501)
77 (1956)	Cover 0.00	157.74 (4.467)
76 (1930)	0.00	156.62 (4.432)
75 (1905)	0.00	155.30 (4.398)
74 (1880)	0.00	154.09 (4.363)
73 (1854)	0.00	152.87 (4.329)
72 (1829)	0.00	151.65 (4.294)
71 (1803)	0.00	150.43 (4.294)
70 (1778)	0.00	149.21 (4.225)
69 (1753)	106.51 (3.016)	147.99 (4.191)
68 (1727)	106.47 (3.015)	146.75 (4.156)
67 (1702)	106.35 (3.012)	145.46 (4.119)
66 (1676)	106.18 (3.007)	144.14 (4.082)
65 (1651)	105.98 (3.001)	142.80 (4.044)
64 (1626)	105.71 (2.993)	141.42 (4.005)
63 (1600)	105.25 (2.981)	139.93 (3.962)
62 (1575)	104.59 (2.962)	138.31 (3.917)
61 (1549)	103.79 (2.939)	136.61 (3.869)
60 (1524)	102.88 (2.913)	134.85 (3.819)
59 (1499)	101.88 (2.885)	133.03 (3.767)
58 (1473)	100.79 (2.854)	131.16 (3.714)
57 (1448)	99.63 (2.821)	129.24 (3.660)
56 (1422)	98.39 (2.786)	127.28 (3.604)
55 (1397)	97.10 (2.749)	125.28 (3.548)
54 (1372)	95.73 (2.711)	123.25 (3.490)
53 (1346)	94.32 (2.671)	121.18 (3.490)
52 (1321)	92.84 (2.629)	119.08 (3.372)
51 (1295)	91.32 (2.586)	116.94 (3.311)
50 (1270)	89.74 (2.541)	114.78 (3.250)
49 (1245)	88.12 (2.495)	112.59 (3.188)
48 (1219)	86.45 (2.448)	110.37 (3.125)
47 (1194)	84.75 (2.400)	108.13 (3.062)
46 (1168)	83.00 (2.350)	105.86 (2.998)
45 (1143)	81.21 (2.300)	103.56 (2.933)
44 (1118)	79.38 (2.248)	101.25 (2.867)
43 (1092)	77.52 (2.195)	98.91 (2.801)
42 (1067)	75.62 (2.141)	96.55 (2.734)
41 (1041)	73.69 (2.087)	94.18 (2.667)
40 (1016)	71.72 (2.031)	91.78 (2.599)
39 (991)	69.73 (1.974)	89.36 (2.531)
38 (965)	67.70 (1.917)	86.93 (2.462)
37 (948)	65.65 (1.859)	84.48 (2.392)
36 (914)	63.57 (1.800)	82.01 (2.322)
35 (889)	61.46 (1.740)	79.53 (2.252)
34 (864)	59.32 (1.680)	77.03 (2.181)
33 (838)	57.17 (1.619)	74.52 (2.110)
32 (813)	54.98 (1.557)	71.99 (2.038)
31 (787)	52.78 (1.495)	69.45 (1.966)
30 (762)	50.55 (1.431)	66.89 (1.894)
29 (737)	48.30 (1.368)	64.32 (1.821)
28 (711)	46.03 (1.303)	61.74 (1.748)
27 (686)	43.74 (1.239)	59.19 (1.675)
26 (680)	41.43 (1.173)	56.55 (1.601)
25 (610)	39.11 (1.107)	53.93 (1.527)
24 (609)	36.77 (1.041)	51.31 (1.453)
23 (584)	34.41 (0.974)	48.67 (1.378)
22 (559)	32.03 (0.907)	46.03 (1.303)
21 (533)	29.64 (0.839)	43.38 (1.228)
20 (508)	27.23 (0.771)	40.71 (1.153)
19 (483)	24.81 (0.703)	38.04 (1.077)
18 (457)	22.38 (0.634)	35.37 (1.001)
17 (432)	19.94 (0.565)	32.68 (0.925)
16 (406)	17.48 (0.495)	29.99 (0.849)
15 (381)	15.01 (0.425)	27.29 (0.773)
14 (356)	12.53 (0.355)	24.58 (0.696)
13 (330)	10.05 (0.284)	21.87 (0.619)
12 (305)	7.55 (0.214)	19.15 (0.542)
11 (279)	5.04 (0.143)	16.43 (0.465)
10 (254)	2.53 (0.072)	13.70 (0.388)
9 (229)	0.00	10.97 (0.311)
8 (203)	0.00	9.75 (0.276)
7 (178)	0.00	8.53 (0.242)
6 (152)	Stone 0.00	7.31 (0.207)
5 (127)	Foundation 0.00	6.09 (0.173)
4 (102)	0.00	4.87 (0.138)
3 (76)	0.00	3.66 (0.104)
2 (51)	0.00	2.44 (0.069)
1 (25)	0.00	1.22 (0.035)

NOTE: Add 1.22 ft^3 (0.035 m^3) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volumes

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TABLE 10 – MC-4500 Incremental Storage Volume Per End Cap

Assumes 40% stone porosity. Calculations are based upon a 9” (230 mm) stone base under the chambers, 12” (300 mm) of stone above end caps, and 9” (230 mm) of spacing between end caps and 6” (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
81 (2057)	↑ 0.00	115.28 (3.264)
80 (2032)	0.00	114.15 (3.232)
79 (2007)	0.00	113.02 (3.200)
78 (1981)	Stone 0.00	111.89 (3.168)
77 (1956)	Cover 0.00	110.76 (3.136)
76 (1930)	0.00	109.63 (3.104)
75 (1905)	0.00	108.50 (3.072)
74 (1880)	0.00	107.37 (3.040)
73 (1854)	0.00	106.24 (3.008)
72 (1829)	0.00	105.11 (2.976)
71 (1803)	0.00	103.98 (2.944)
70 (1778)	↓ 0.00	102.85 (2.912)
69 (1753)	39.54 (1.120)	101.72 (2.880)
68 (1727)	39.53 (1.119)	100.58 (2.848)
67 (1702)	39.50 (1.118)	99.43 (2.816)
66 (1676)	39.45 (1.117)	98.27 (2.783)
65 (1651)	39.38 (1.115)	97.10 (2.750)
64 (1626)	39.30 (1.113)	95.92 (2.716)
63 (1600)	39.19 (1.110)	94.73 (2.682)
62 (1575)	39.06 (1.106)	93.52 (2.648)
61 (1549)	38.90 (1.101)	92.29 (2.613)
60 (1524)	38.71 (1.096)	91.04 (2.578)
59 (1499)	38.49 (1.090)	89.78 (2.542)
58 (1473)	38.24 (1.083)	88.50 (2.506)
57 (1448)	37.97 (1.075)	87.21 (2.469)
56 (1422)	37.67 (1.067)	85.90 (2.432)
55 (1397)	37.34 (1.057)	84.57 (2.395)
54 (1372)	36.98 (1.047)	83.23 (2.357)
53 (1346)	36.60 (1.036)	81.87 (2.318)
52 (1321)	36.19 (1.025)	80.49 (2.279)
51 (1295)	35.75 (1.012)	79.10 (2.240)
50 (1270)	35.28 (0.999)	77.69 (2.200)
49 (1245)	34.79 (0.985)	76.26 (2.159)
48 (1219)	34.27 (0.970)	74.82 (2.119)
47 (1194)	33.72 (0.955)	73.36 (2.077)
46 (1168)	33.15 (0.939)	71.89 (2.036)
45 (1143)	32.57 (0.922)	70.40 (1.994)
44 (1118)	31.96 (0.905)	68.91 (1.951)
43 (1092)	31.32 (0.887)	67.40 (1.909)

NOTE: Add 1.08 ft³ (0.031 m³) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	30.68 (0.869)	65.88 (1.866)
41 (1041)	30.00 (0.850)	64.35 (1.822)
40 (1016)	29.30 (0.830)	62.80 (1.778)
39 (991)	28.58 (0.809)	61.23 (1.734)
38 (965)	27.84 (0.788)	59.65 (1.689)
37 (948)	27.07 (0.767)	58.07 (1.644)
36 (914)	26.29 (0.744)	56.46 (1.599)
35 (889)	25.48 (0.722)	54.85 (1.553)
34 (864)	24.66 (0.698)	53.23 (1.507)
33 (838)	23.83 (0.675)	51.60 (1.461)
32 (813)	22.98 (0.651)	49.96 (1.415)
31 (787)	22.12 (0.626)	48.31 (1.368)
30 (762)	21.23 (0.601)	46.65 (1.321)
29 (737)	20.32 (0.575)	44.97 (1.273)
28 (711)	19.40 (0.549)	43.29 (1.226)
27 (686)	18.48 (0.523)	41.61 (1.178)
26 (680)	17.54 (0.497)	39.91 (1.130)
25 (610)	16.59 (0.470)	38.21 (1.082)
24 (609)	15.62 (0.442)	36.50 (1.033)
23 (584)	14.64 (0.414)	34.78 (0.985)
22 (559)	13.66 (0.387)	33.07 (0.936)
21 (533)	12.66 (0.359)	31.33 (0.887)
20 (508)	11.65 (0.330)	29.60 (0.838)
19 (483)	10.63 (0.301)	27.85 (0.3789)
18 (457)	9.60 (0.272)	26.11 (0.739)
17 (432)	8.56 (0.242)	24.35 (0.690)
16 (406)	7.51 (0.213)	22.59 (0.640)
15 (381)	6.46 (0.183)	20.83 (0.590)
14 (356)	5.41 (0.153)	19.07 (0.540)
13 (330)	4.35 (0.123)	17.31 (0.490)
12 (305)	3.28 (0.093)	15.53 (0.440)
11 (279)	2.19 (0.062)	13.75 (0.389)
10 (254)	1.11 (0.031)	11.97 (0.339)
9 (229)	↑ 0.00	10.17 (0.288)
8 (203)	0.00	9.04 (0.256)
7 (178)	0.00	7.91 (0.224)
6 (152)	Stone 0.00	6.78 (0.192)
5 (127)	Foundation 0.00	5.65 (0.160)
4 (102)	0.00	4.52 (0.128)
3 (76)	0.00	3.39 (0.096)
2 (51)	0.00	2.26 (0.064)
1 (25)	↓ 0.00	1.13 (0.032)

6.0 MC-3500 Chamber System Sizing

The following steps provide the calculations necessary for preliminary sizing of an MC-3500 chamber system. For custom bed configurations to fit specific sites, contact the StormTech Technical Services Department or your local StormTech representative.

1) Determine the amount of storage volume (VS) required. It is the design engineer's sole responsibility to determine the storage volume required.

TABLE 11—Storage Volume Per Chamber/End Cap ft^3 (m^3)

	Bare Unit Storage ft^3 (m^3)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-3500 Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
MC-3500 End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

NOTE: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 6" (150 mm) stone perimeter.

2) Determine the number of chambers (C) required. To calculate the number of chambers required for adequate storage, divide the storage volume (Vs) by the storage volume of the chamber (from **Table 11**), as follows: **C = Vs / Storage Volume per Chamber**

3) Determine the number of end caps required. The number of end caps (EC) required depends on the number of rows required by the project. Once the number of chamber rows is determined, multiply the number of chamber rows by 2 to determine the number of end caps required. **EC = No. of Chamber Rows x 2**

NOTE: Additional end caps may be required for systems having inlet locations within the chamber bed.

4) Determine additional storage provided by end caps. End Caps will provide additional storage to the project. Multiply the number of end caps (EC) by the storage volume per end cap (ECS) to determine the additional storage (As) provided by the end caps. **As = EC x ECs**

5) Adjust number of chambers (C) to account for additional end cap storage (As). The original number of chambers (C) can now be reduced due to the additional storage in the end caps. Divide the additional storage (As) by the storage volume per chamber to determine the number of chambers that can be removed. **Number of chambers to remove = As/ volume per chamber**

NOTE: Additional storage exists in the stone perimeter as well as in the inlet and outlet manifold systems. Contact StormTech's Technical Services Department for assistance with determining the number of chambers and end caps required for your project.

6) Determine the required bed size (S). The size of the bed will depend on the number of chambers and end caps required:

MC-3500 area per chamber = 49.6 ft^2 (4.6 m^2)
MC-3500 area per end cap = 16.4 ft^2 (1.5 m^2)

S = (C x area per chamber) + (EC x area per end cap)

NOTE: It is necessary to add 12" (300 mm) of stone perimeter parallel to the chamber rows and 6" (150 mm) of stone perimeter from the base of all end caps. The additional area due to perimeter stone is not included in the area numbers above.

7) Determine the amount of stone (Vst) required. To calculate the total amount of clean, crushed, angular stone required, multiply the number of chambers (C) and the number of end caps (EC) by the selected weight of stone from **Table 12.**

NOTE: Clean, crushed, angular stone is also required around the perimeter of the system.

TABLE 12—Amount of Stone Per Chamber/End Cap

ENGLISH tons (yd^3)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC kg (m^3)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-3500	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

NOTE: Assumes 12" (300 mm) of stone above, and 6" (150 mm) row spacing, and 6" (150 mm) of perimeter stone in front of end caps.

8) Determine the volume of excavation (Ex) required. Each additional foot of cover will add a volume of excavation of 1.9 yd^3 (1.5 m^3) per MC-3500 chamber and 0.6 yd^3 (0.5 m^3) per MC-3500 end cap.

TABLE 13—Volume of Excavation Per Chamber/End Cap yd^3 (m^3)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
MC-3500	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

NOTE: Assumes 6" (150 mm) separation between chamber rows, 6" (150 mm) of perimeter in front of end caps, and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.

9) Determine the area of geotextile (F) required. The bottom, top and sides of the bed must be covered with a non-woven geotextile (filter fabric) that meets AASHTO M288 Class 2 requirements. The area of the sidewalls must be calculated and a 24" (600 mm) overlap must be included for all seams. Geotextiles typically come in 15 foot (4.57 m) wide rolls.

6.0 MC-4500 Chamber System Sizing

The following steps provide the calculations necessary for preliminary sizing of an MC-4500 chamber system. For custom bed configurations to fit specific sites, contact the StormTech Technical Services Department or your local StormTech representative.

1) Determine the amount of storage volume (VS) required. It is the design engineer's sole responsibility to determine the storage volume required.

TABLE 14—Storage Volume Per Chamber/End Cap ft^3 (m^3)

	Bare Unit Storage ft^3 (m^3)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-4500 Chamber	106.5 (3.01)	162.6 (4.60)	166.3 (4.71)	169.9 (4.81)	173.6 (4.91)
MC-4500 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.

2) Determine the number of chambers (C) required. To calculate the number of chambers required for adequate storage, divide the storage volume (Vs) by the storage volume of the chamber (from **Table 14**), as follows: **C = Vs / Storage Volume per Chamber**

3) Determine the number of end caps required. The number of end caps (EC) required depends on the number of rows required by the project. Once the number of chamber rows is determined, multiply the number of chamber rows by 2 to determine the number of end caps required. **EC = No. of Chamber Rows x 2**

NOTE: Additional end caps may be required for systems having inlet locations within the chamber bed.

4) Determine additional storage provided by end caps. End Caps will provide additional storage to the project. Multiply the number of end caps (EC) by the storage volume per end cap (ECS) to determine the additional storage (As) provided by the end caps. **As = EC x ECs**

5) Adjust number of chambers (C) to account for additional end cap storage (As). The original number of chambers (C) can now be reduced due to the additional storage in the end caps. Divide the additional storage (As) by the storage volume per chamber to determine the number of chambers that can be removed. **Number of chambers to remove = As/ volume per chamber**

NOTE: Additional storage exists in the stone perimeter as well as in the inlet and outlet manifold systems. Contact StormTech's Technical Services Department for assistance with determining the number of chambers and end caps required for your project.

6) Determine the required bed size (S). The size of the bed will depend on the number of chambers and end caps required:

MC-4500 area per chamber = 36.6 ft^2 (3.4 m^2)
MC-4500 area per end cap = 23.9 ft^2 (2.2 m^2)

S = (C x area per chamber) + (EC x area per end cap)

NOTE: It is necessary to add 12" (300 mm) of stone perimeter parallel to the chamber rows and 6" (150 mm) of stone perimeter from the base of all end caps. The additional area due to perimeter stone is not included in the area numbers above.

7) Determine the amount of stone (Vst) required. To calculate the total amount of clean, crushed, angular stone required, multiply the number of chambers (C) and the number of end caps (EC) by the selected weight of stone from **Table 15.**

NOTE: Clean, crushed, angular stone is also required around the perimeter of the system.

TABLE 15—Amount of Stone Per Chamber

ENGLISH tons (yd^3)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-4500	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
End Cap	9.8 (7.0)	10.2 (7.3)	10.6 (7.6)	11.1 (7.9)
METRIC kg (m^3)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-4500	6681 (4.0)	7117 (4.2)	7552 (4.5)	7987 (4.7)
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.

8) Determine the volume of excavation (Ex) required. Each additional foot of cover will add a volume of excavation of 1.4 yd^3 (1.0 m^3) per MC-4500 chamber and 1.4 yd^3 (0.8 m^3) per MC-4500 end cap.

TABLE 16—Volume of Excavation Per Chamber/End Cap yd^3 (m^3)

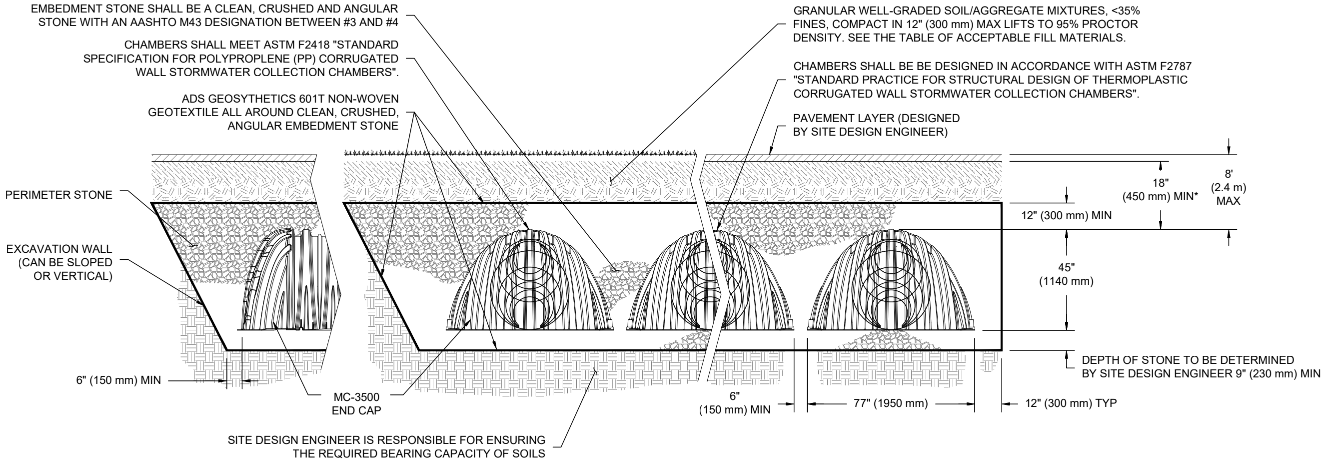
	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
MC-4500	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
End Cap	9.7 (7.4)	10.0 (7.6)	10.3 (7.9)	10.6 (8.1)

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

9) Determine the area of geotextile (F) required. The bottom, top and sides of the bed must be covered with a non-woven geotextile (filter fabric) that meets AASHTO M288 Class 2 requirements. The area of the sidewalls must be calculated and a 24" (600 mm) overlap must be included for all seams. Geotextiles typically come in 15 foot (4.57 m) wide rolls.

7.0 Structural Cross Sections and Specifications

FIGURE 16—MC-3500 Structural Cross Section Detail (Not to Scale)



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

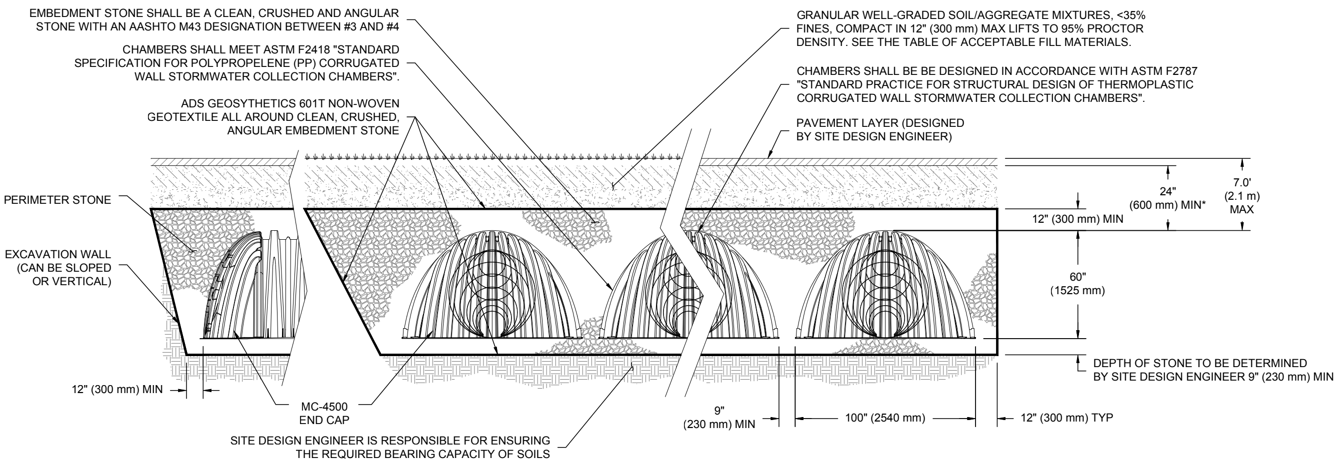
MC-3500 STORMWATER CHAMBER SPECIFICATIONS

1. Chambers shall be StormTech MC-3500 or approved equal.
2. Chambers shall be made from virgin, impact-modified polypropylene copolymers.
3. Chamber rows shall provide continuous, unobstructed internal space with no internal panels that would impede flow.
4. The structural design of the chambers, the structural backfill and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO Design Truck with consideration for impact and multiple vehicle presences.
5. Chambers shall meet the requirements of ASTM F 2418, “Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers.”
6. Chambers shall conform to the requirements of ASTM F 2787, “Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers.”
7. Only chambers that are approved by the engineer will be allowed. The contractor shall submit (3 sets) of the following to the engineer for approval before delivering chambers to the project site:
    - A structural evaluation by a registered structural engineer that demonstrates that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.
    - Structural cross section detail on which the structural cross section is based.
8. The installation of chambers shall be in accordance with the manufacturer’s latest Construction Guide.

Detail drawings available in Cad Rev. 2000 format at www.stormtech.com

7.0 Structural Cross Sections and Specifications

FIGURE 16—MC-4500 Structural Cross Section Detail (Not to Scale)



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

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

MC-4500 STORMWATER CHAMBER SPECIFICATIONS

1. Chambers shall be StormTech MC-4500 or approved equal.
2. Chambers shall be made from virgin, impact-modified polypropylene copolymers.
3. Chamber rows shall provide continuous, unobstructed internal space with no internal panels that would impede flow.
4. The structural design of the chambers, the structural backfill and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO Design Truck with consideration for impact and multiple vehicle presences.
5. Chambers shall meet the requirements of ASTM F 2418, "Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers."
6. Chambers shall conform to the requirements of ASTM F 2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers."
7. Only chambers that are approved by the engineer will be allowed. The contractor shall submit (3 sets) of the following to the engineer for approval before delivering chambers to the project site:
    - A structural evaluation by a registered structural engineer that demonstrates that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.
    - Structural cross section detail on which the structural cross section is based.
8. The installation of chambers shall be in accordance with the manufacturer's latest Construction Guide.

Detail drawings available in Cad Rev. 2000 format at www.stormtech.com

8.0 General Notes

1. StormTech requires installing contractors to use and understand the latest **StormTech MC-3500 and MC-4500 Construction Guide** prior to beginning system installation.

2. StormTech offers installation consultations to installing contractors. Contact our Technical Service Department or local StormTech representative at least 30 days prior to system installation to arrange a pre-installation consultation. Our representatives can then answer questions or address comments on the StormTech chamber system and inform the installing contractor of the minimum installation requirements before beginning the system's construction. Call 860-529-8188 to speak to a Technical Service Representative or visit www.stormtech.com to receive a copy of our Construction Guide.

3. StormTech requirements for systems with pavement design (asphalt, concrete pavers, etc.): Minimum cover is 18" (450mm) for the MC-3500 and 24"(600mm) for the MC-4500 not including pavement; MC-3500 maximum cover is 8.0' (1.98 m) and MC-4500 maximum cover is 7.0' (2.43 m) both including pavement. For designs with cover depths deeper than these maximums, please contact Stormtech. For installations that do not include pavement, where rutting from vehicles may occur, minimum required cover is increased to 30" (762 mm).

4. The contractor must report any discrepancies with the bearing capacity of the subgrade materials to the design engineer.

5. AASHTO M288 Class 2 non-woven geotextile (ADS601 or equal) (filter fabric) must be used as indicated in the project plans.

6. Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of StormTech MC-3500 / MC-4500 Construction Guide.

7. Backfilling over the chambers must follow requirements as indicated in the most current version of StormTech MC-3500 / MC-4500 Construction Guide.

8. The contractor must refer to StormTech MC-3500 / MC-4500 Construction Guide for a Table of Acceptable Vehicle Loads at various depths of cover. This information is also available at the StormTech website: www.stormtech.com. The contractor is responsible for preventing vehicles that exceed StormTech requirements from traveling across or parking over the stormwater system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.

9. The contractor must apply erosion and sediment control measures to protect the stormwater system during all phases of site construction per local codes and design engineer's specifications.

10. STORMTECH PRODUCT WARRANTY IS LIMITED. Contact StormTech for warranty information.

9.0 Inspection and Maintenance

9.1 ISOLATOR ROW PLUS PLUS INSPECTION

Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row PLUS. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a confined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3” (76 mm), cleanout is required.

A StormTech Isolator Row PLUS should initially be inspected immediately after completion of the site’s construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site’s owner. Once in normal service, a StormTech Isolator Row PLUS should be inspected bi-annually until an understanding of the sites characteristics is developed. The site’s maintenance manager can then revise the inspection schedule based on experience or local requirements.

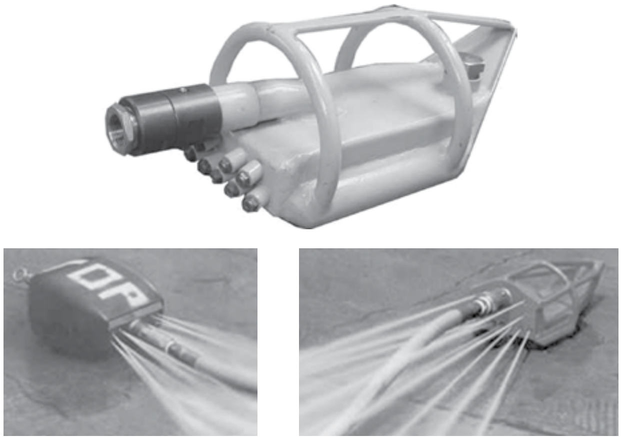
9.2 ISOLATOR ROW PLUS MAINTENANCE

JetVac maintenance is recommended if sediment has been collected to an average depth of 3” (76 mm) inside the Isolator Row PLUS. More frequent maintenance may be required to maintain minimum flow rates through the Isolator Row PLUS. 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, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combi- nation vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” (1143 mm) are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. The JetVac process shall only be performed on StormTech Rows that have ADS PLUS fabric over the foundation stone.

A FLAMP (flared end ramp) is attached to the inlet pipe on the inside of the chamber end cap to provide a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by distributing sediment and debris that would otherwise collect at the inlet. It also serves to improve the fluid and solid flow back into the inlet pipe during maintenance and cleaning, and to guide cleaning and inspection equipment back into the inlet pipe when complete.

FLAMP (Flared End Ramp)

A typical JetVac truck (This is not a StormTech product.)



Examples of culvert cleaning nozzles appropriate for Isolator Row PLUS maintenance. (These are not StormTech products).

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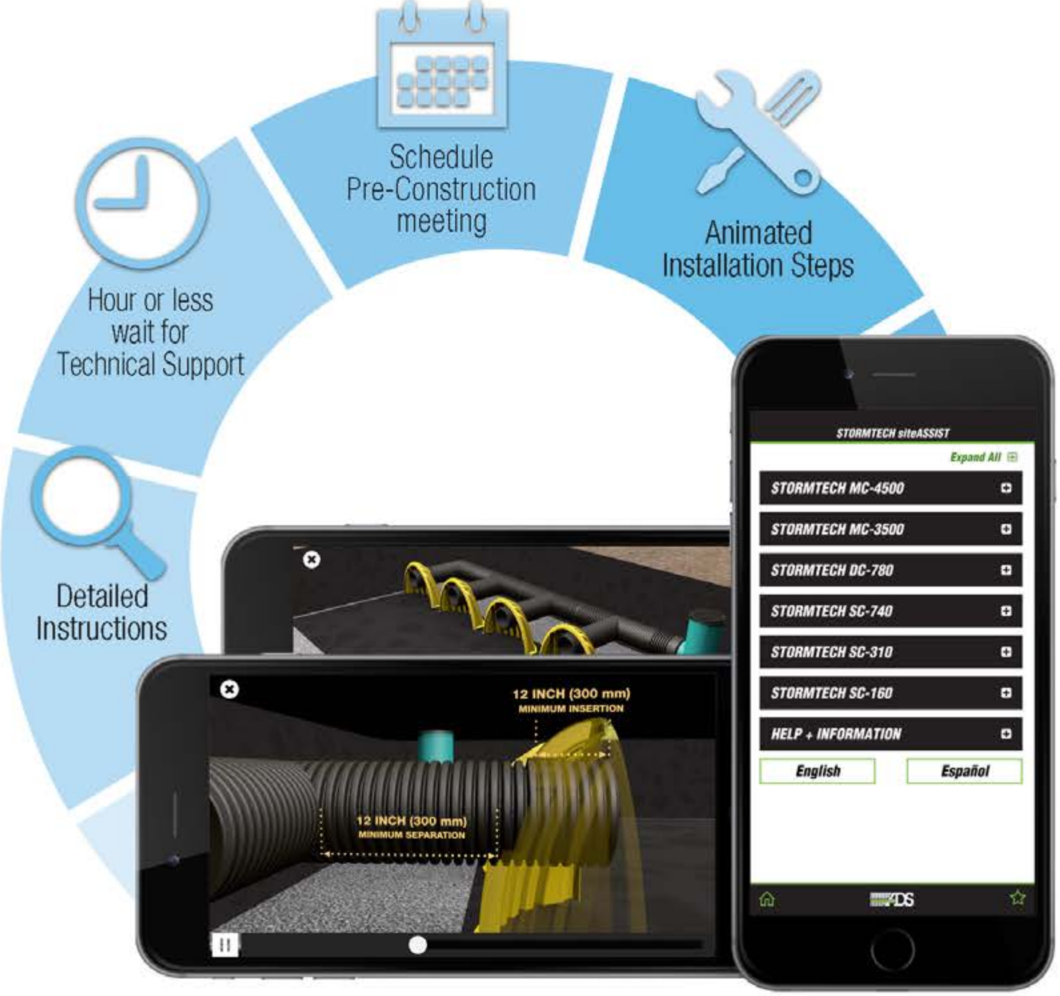

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