Appendix I. Preliminary Drainage Report

Goodman
&ASSOCIATES

Drainage Report

For

Industrial Parkway Logistics

5770 Industrial Parkway
San Bernardino, CA
APN 0266-041-22 & -40

For

Dedeaux Properties
1430 S. Eastman Ave
Los Angeles, CA 90023
323-981-8293

August 20, 2021

_____
Douglas L. Goodman

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LD_____, THR_____

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Site Description

The proposed project will be a logistics facility along the southeast side of Palm Avenue and the southwest side of Industrial Parkway, with the railroad right-of-way comprising the southwest side of the property, and an existing propane business to the south, in the City of San Bernardino. The project site is approximately 11 acres.

Project Description

The proposed project is a logistics shipping facility on two parcels, one of which is vacant and the other currently operating as a pallet yard and repair business. The existing property improvements consists of an office and warehouse building, miscellaneous industrial buildings and equipment, paving for access and parking, street improvements for the former alignments of Palm Avenue and Industrial Parkway, mature landscaping and chain link fencing. Portions of the property that are currently unpaved will be paved with asphalt for access and parking.

Existing runoff is generally from north to south. Existing drainage crosses and leaves the property as surface sheet flow out to the drainage ditch alongside the rail lines within the railroad right-of-way.

One truck terminal building is proposed with loading docks, access, parking and landscaping. Proposed runoff will maintain existing drainage patterns. For the purposes of stormwater quality, an underground infiltration system is proposed. All runoff will be collected in a series of inlets and piped to a clarifier for pre-treatment and then into the underground system. Once the system fills up, flows will build up and be discharged out into a detention basin proposed in the southerly corner of the site. A spillway will direct flows out to the existing drainage ditch located in the railroad right-of-way. Runoff will not exceed the existing condition.

Hydrologic Criteria and Modeling Approach

The hydrologic conditions of the site were analyzed using the Rational Method and the Small Area Synthetic Unit Hydrograph Method as described in the *San Bernardino County Flood Control District Hydrology Manual (Manual)*, using AES software.

The following hydrologic parameters were used:

Rational Method

AMC III (100-year analysis)
Soil Group: A, D
Curve Number (Proposed Condition): 52 (Residential or Commercial Landscaping, "A" Soil)
91 (Residential or Commercial Landscaping, "D" Soil)

Pct. Impervious Cover (Proposed Condition): 90%
100-year, 1-hour rainfall: 2.07 inches
100-year, 24-hour rainfall: 8.32 inches
Log-Log Slope: 0.60

Proposed Conditions

The proposed condition consists of a few small subareas, all directed to one project outlet, generally mimicking the historic runoff.

Hydrologic Calculations and Results: 100-year

Results of the analysis are summarized in Table 1 below.

Table 1: Hydrology Results

Recurrence Interval	Existing Condition (cfs)	Proposed Condition (cfs)		
		Peak Flow	Infiltration	Basin Routed Discharge
100-year	52.0	55.1	2.3	51.0

Proposed Storm Drains

On-site drainage will be conveyed via surface sheet flow to inlets, and then via pipes to the infiltration system BMP, with overflows draining out via a pipe to the southerly detention basin, and out via a spillway to the existing drainage course to the southwest of the property.

Conclusions

The results above are derived from standard hydraulic models and calculation methods, and are subject to the limitations of those methods.

Limitations

This drainage report is for assessing the drainage facility requirements due to the proposed development as shown on the grading plan. Goodman & Associates shall not be held responsible for any unauthorized application of this report and the contents herein. The opinions expressed in this report have been derived in accordance with current standards of civil engineering practice. No other warranty is expressed or implied.

APPENDICES

Hydrology Data Sources and Results

Hydrology Maps (In Map Pocket)

WQMP Project Report

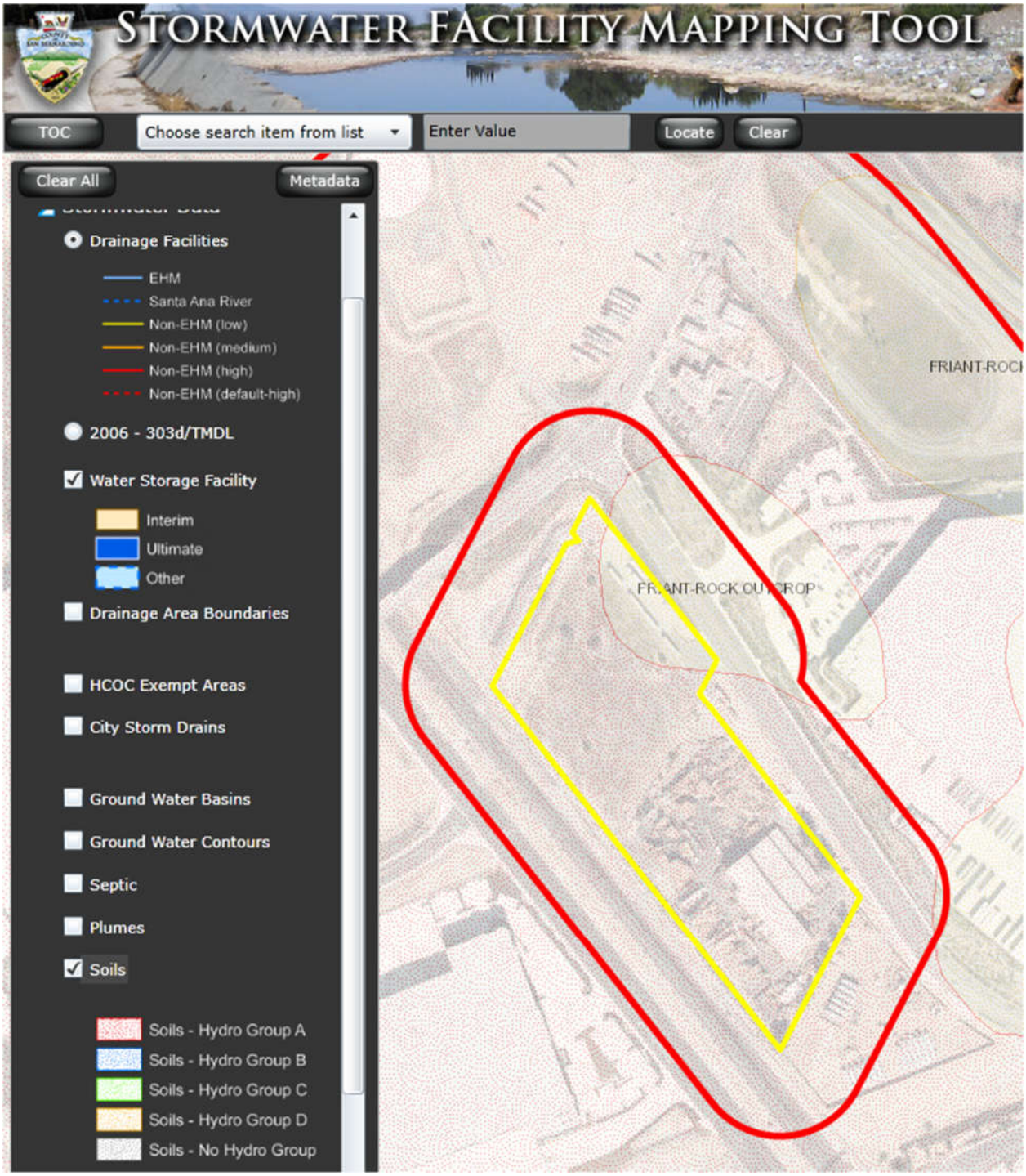
County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Friday, July 23, 2021

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

Project Site Parcel Number(s):	026604140, 026604122
Project Site Acreage:	9.757
HCOC Exempt Area:	No
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	**System Number** - 309 **Facility Name** - Cable Creek Channel **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	High
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	Yes
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	A, D
Environmentally Sensitive Areas within 200':	None
Groundwater Depth (FT):	-185
Parcels with potential septic tanks within 1000':	No
Known Groundwater Contamination Plumes within 1000':	No
Studies and Reports Related to Project Site:	Preliminary Report on Proposed North SBFCP School Site Map Comprehensive Storm Drain Plan SBVMWD High Groundwater / Pressure Zone Area


STORMWATER FACILITY MAPPING TOOL
TOC
Choose search item from list
Enter Value
Locate
Clear
Clear All
Metadata
Drainage Facilities
EHM
Santa Ana River
Non-EHM (low)
Non-EHM (medium)
Non-EHM (high)
Non-EHM (default-high)
2006 - 303d/TMDL
Water Storage Facility
Interim
Ultimate
Other
Drainage Area Boundaries
HCOC Exempt Areas
City Storm Drains
Ground Water Basins
Ground Water Contours
Septic
Plumes
Soils
Soils - Hydro Group A
Soils - Hydro Group B
Soils - Hydro Group C
Soils - Hydro Group D
Soils - No Hydro Group
FRIANT-ROCK OUTCROP

NOAA Atlas 14, Volume 6, Version 2
Location name: San Bernardino, California, USA*
Latitude: 34.1865°, Longitude: -117.362°
Elevation: 1671.8 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	**0.147** (0.122-0.178)	**0.197** (0.164-0.240)	**0.265** (0.220-0.324)	**0.323** (0.265-0.397)	**0.403** (0.320-0.514)	**0.468** (0.364-0.609)	**0.536** (0.406-0.715)	**0.610** (0.449-0.837)	**0.714** (0.504-1.02)	**0.799** (0.544-1.19)
10-min	**0.210** (0.175-0.256)	**0.283** (0.235-0.344)	**0.381** (0.315-0.464)	**0.463** (0.380-0.569)	**0.578** (0.459-0.736)	**0.671** (0.521-0.873)	**0.769** (0.582-1.02)	**0.874** (0.643-1.20)	**1.02** (0.722-1.47)	**1.15** (0.780-1.70)
15-min	**0.254** (0.211-0.309)	**0.342** (0.284-0.416)	**0.460** (0.381-0.561)	**0.559** (0.459-0.688)	**0.699** (0.555-0.890)	**0.812** (0.630-1.06)	**0.930** (0.704-1.24)	**1.06** (0.778-1.45)	**1.24** (0.873-1.77)	**1.39** (0.943-2.06)
30-min	**0.376** (0.312-0.457)	**0.505** (0.419-0.615)	**0.680** (0.563-0.829)	**0.826** (0.678-1.02)	**1.03** (0.820-1.32)	**1.20** (0.931-1.56)	**1.37** (1.04-1.83)	**1.56** (1.15-2.14)	**1.83** (1.29-2.62)	**2.05** (1.39-3.04)
60-min	**0.565** (0.470-0.687)	**0.760** (0.631-0.924)	**1.02** (0.846-1.25)	**1.24** (1.02-1.53)	**1.55** (1.23-1.98)	**1.80** (1.40-2.35)	**2.07** (1.56-2.75)	**2.35** (1.73-3.22)	**2.75** (1.94-3.94)	**3.08** (2.10-4.56)
2-hr	**0.839** (0.698-1.02)	**1.09** (0.906-1.33)	**1.43** (1.18-1.75)	**1.71** (1.41-2.11)	**2.11** (1.67-2.68)	**2.42** (1.88-3.15)	**2.75** (2.08-3.67)	**3.10** (2.28-4.25)	**3.59** (2.53-5.14)	**3.98** (2.71-5.91)
3-hr	**1.05** (0.872-1.27)	**1.35** (1.12-1.64)	**1.75** (1.45-2.13)	**2.08** (1.71-2.56)	**2.54** (2.02-3.23)	**2.90** (2.25-3.78)	**3.28** (2.48-4.38)	**3.68** (2.71-5.05)	**4.24** (2.99-6.06)	**4.68** (3.19-6.94)
6-hr	**1.53** (1.27-1.86)	**1.95** (1.62-2.37)	**2.50** (2.07-3.05)	**2.95** (2.42-3.63)	**3.58** (2.84-4.55)	**4.06** (3.15-5.28)	**4.55** (3.45-6.07)	**5.07** (3.73-6.96)	**5.78** (4.08-8.28)	**6.34** (4.32-9.41)
12-hr	**2.03** (1.69-2.47)	**2.61** (2.17-3.18)	**3.36** (2.78-4.09)	**3.96** (3.25-4.87)	**4.77** (3.78-6.07)	**5.39** (4.18-7.01)	**6.02** (4.56-8.02)	**6.66** (4.90-9.13)	**7.52** (5.30-10.8)	**8.19** (5.57-12.1)
24-hr	**2.73** (2.42-3.14)	**3.56** (3.15-4.11)	**4.62** (4.08-5.35)	**5.48** (4.79-6.39)	**6.61** (5.60-7.97)	**7.47** (6.20-9.18)	**8.32** (6.74-10.5)	**9.19** (7.24-11.9)	**10.3** (7.83-14.0)	**11.2** (8.21-15.7)
2-day	**3.33** (2.95-3.84)	**4.43** (3.92-5.11)	**5.87** (5.18-6.78)	**7.02** (6.15-8.19)	**8.58** (7.27-10.3)	**9.77** (8.10-12.0)	**11.0** (8.88-13.8)	**12.2** (9.61-15.8)	**13.8** (10.5-18.7)	**15.1** (11.1-21.1)
3-day	**3.54** (3.14-4.08)	**4.79** (4.24-5.53)	**6.43** (5.68-7.44)	**7.78** (6.81-9.07)	**9.61** (8.14-11.6)	**11.0** (9.15-13.6)	**12.5** (10.1-15.7)	**14.0** (11.0-18.1)	**16.0** (12.1-21.6)	**17.6** (12.9-24.6)
4-day	**3.73** (3.30-4.30)	**5.11** (4.52-5.89)	**6.92** (6.11-8.01)	**8.42** (7.37-9.82)	**10.5** (8.88-12.6)	**12.1** (10.0-14.9)	**13.7** (11.1-17.3)	**15.5** (12.2-20.0)	**17.8** (13.5-24.0)	**19.7** (14.4-27.5)
7-day	**4.14** (3.67-4.77)	**5.76** (5.10-6.65)	**7.93** (6.99-9.17)	**9.72** (8.50-11.3)	**12.2** (10.3-14.7)	**14.1** (11.7-17.4)	**16.2** (13.1-20.3)	**18.3** (14.4-23.6)	**21.2** (16.0-28.6)	**23.5** (17.2-32.8)
10-day	**4.55** (4.03-5.24)	**6.39** (5.66-7.38)	**8.86** (7.82-10.3)	**10.9** (9.55-12.7)	**13.8** (11.7-16.6)	**16.0** (13.3-19.7)	**18.4** (14.9-23.1)	**20.8** (16.4-27.0)	**24.3** (18.3-32.7)	**27.0** (19.7-37.7)
20-day	**5.66** (5.01-6.52)	**8.05** (7.12-9.29)	**11.3** (9.96-13.1)	**14.0** (12.3-16.3)	**17.8** (15.1-21.5)	**20.9** (17.3-25.7)	**24.1** (19.5-30.4)	**27.5** (21.7-35.6)	**32.3** (24.4-43.5)	**36.1** (26.4-50.4)
30-day	**6.68** (5.92-7.69)	**9.51** (8.41-11.0)	**13.4** (11.8-15.5)	**16.6** (14.5-19.4)	**21.2** (18.0-25.6)	**24.9** (20.7-30.7)	**28.8** (23.4-36.3)	**33.0** (26.0-42.7)	**38.9** (29.4-52.5)	**43.7** (32.0-61.0)
45-day	**8.10** (7.17-9.33)	**11.4** (10.1-13.2)	**16.0** (14.1-18.5)	**19.9** (17.4-23.1)	**25.4** (21.5-30.6)	**29.8** (24.8-36.7)	**34.6** (28.0-43.6)	**39.7** (31.3-51.4)	**46.9** (35.5-63.3)	**52.9** (38.7-73.8)
60-day	**9.54** (8.45-11.0)	**13.3** (11.7-15.3)	**18.4** (16.2-21.3)	**22.8** (19.9-26.6)	**29.1** (24.6-35.0)	**34.2** (28.4-42.1)	**39.6** (32.1-49.9)	**45.5** (35.9-58.9)	**54.0** (40.8-72.8)	**60.9** (44.5-85.0)

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

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

Please refer to NOAA Atlas 14 document for more information.

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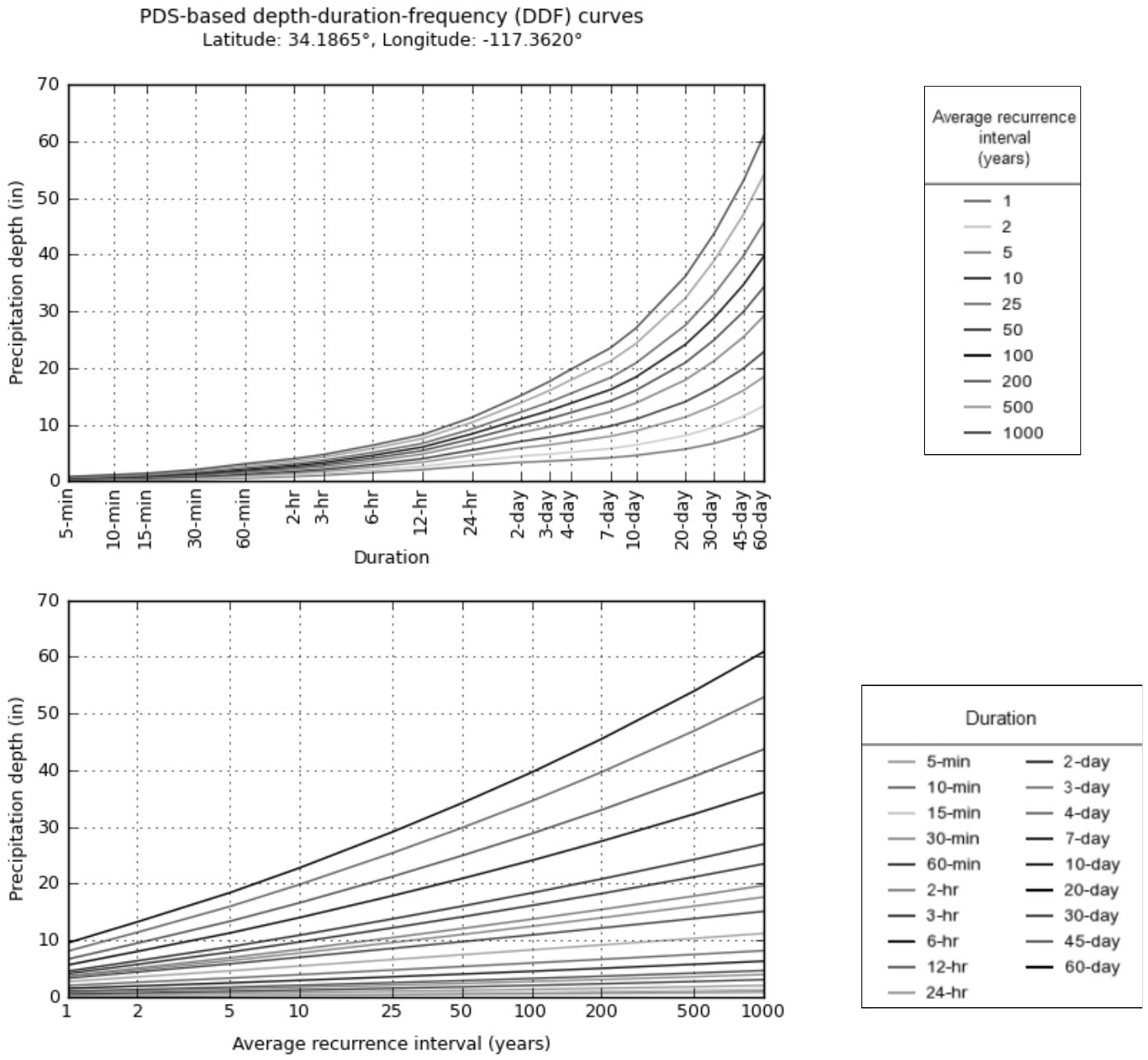
PF graphical



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Created (GMT): Wed Oct 3 16:03:27 2018

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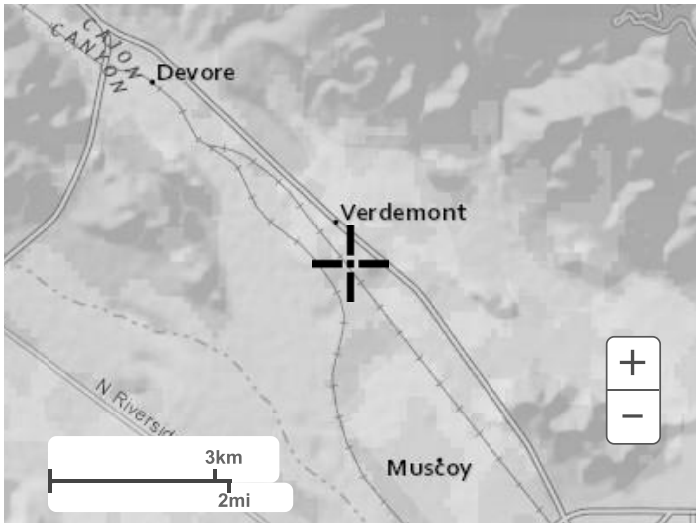
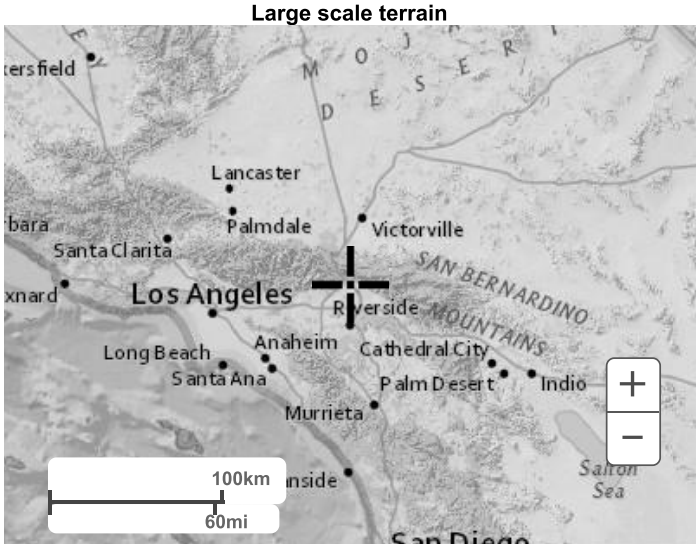
Maps & aerials

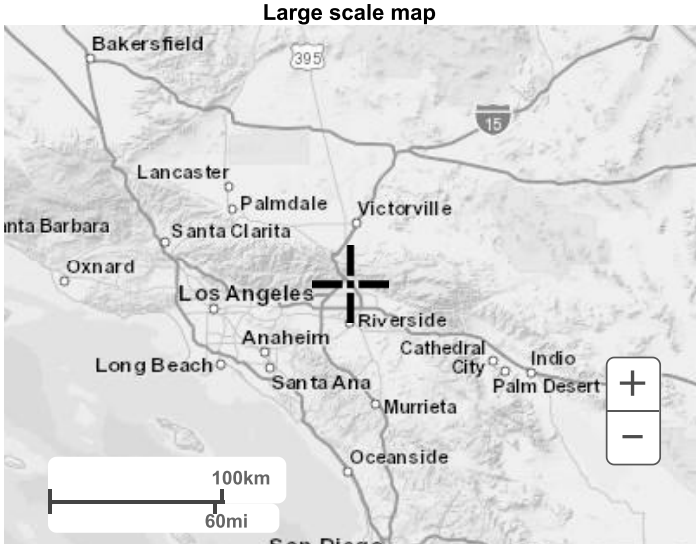
Small scale terrain



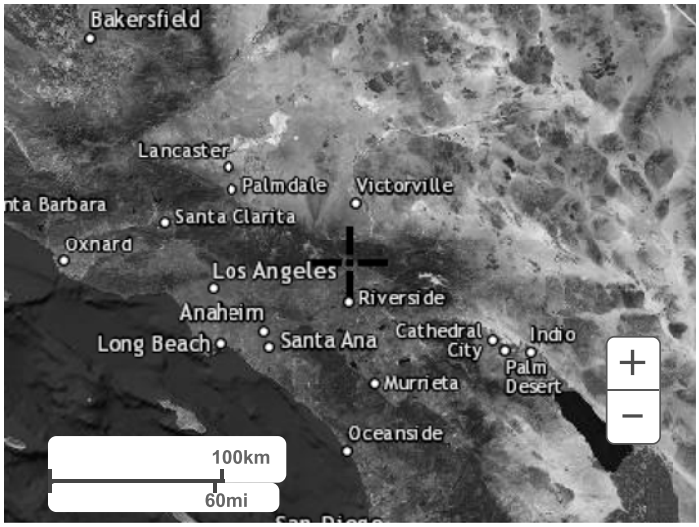
Large scale terrain



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

Disclaimer

RATIONAL METHOD

HYDROLOGY

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**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
        (c) Copyright 1983-2012 Advanced Engineering Software (aes)
            Ver. 19.0  Release Date: 06/01/2012  License ID 1584

                          Analysis prepared by:

                        ENCOMPASS ASSOCIATES, INC.
                            5699 Cousins Place
                        Rancho Cucamonga CA 91737
                   909-684-0093 askeers@encompasscivil.com

 ************************** DESCRIPTION OF STUDY **************************
* 5770 INDUSTRIAL PARKWAY SB                                             *
* EXISTING CONDITION                                                     *
* 100-YEAR                                                               *
 **************************************************************************

  FILE NAME: INDRLE00.DAT
  TIME/DATE OF STUDY: 10:57 08/17/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 2.0700

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE      0.10 TO NODE      0.20 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
```

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   583.00
 ELEVATION DATA: UPSTREAM(FEET) =   1690.00  DOWNSTREAM(FEET) =   1672.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.784
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  7.049
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL POOR COVER
 "BARREN"                   A        0.40      0.18     1.000    93   13.44
 COMMERCIAL                 A        0.10      0.74     0.100    52    7.78
 NATURAL POOR COVER
 "BARREN"                   D        0.80      0.05     1.000    98   13.44
 COMMERCIAL                 D        0.30      0.21     0.100    91    7.78
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.10
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.775
 SUBAREA RUNOFF(CFS) =     10.04
 TOTAL AREA(ACRES) =      1.60   PEAK FLOW RATE(CFS) =     10.04

****************************************************************************
 FLOW PROCESS FROM NODE      0.20 TO NODE      0.30 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1672.00  DOWNSTREAM(FEET) =   1658.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   853.00   CHANNEL SLOPE =  0.0164
 CHANNEL FLOW THRU SUBAREA(CFS) =      10.04
 FLOW VELOCITY(FEET/SEC) =   3.21 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   4.44   Tc(MIN.) =   12.22
 LONGEST FLOWPATH FROM NODE      0.10 TO NODE      0.30 =    1436.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      0.30 TO NODE      0.30 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   12.22
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.378
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL POOR COVER
 "BARREN"                   A        4.90      0.18     1.000    93
 COMMERCIAL                 A        4.40      0.74     0.100    52
 NATURAL POOR COVER
 "BARREN"                   D        0.10      0.05     1.000    98
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.22
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.579
 SUBAREA AREA(ACRES) =    9.40      SUBAREA RUNOFF(CFS) =   44.41
 EFFECTIVE AREA(ACRES) =     11.00   AREA-AVERAGED Fm(INCH/HR) =  0.12
 AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.61
 TOTAL AREA(ACRES) =       11.0       PEAK FLOW RATE(CFS) =      52.04
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       11.0  TC(MIN.) =     12.22
 EFFECTIVE AREA(ACRES) =     11.00  AREA-AVERAGED Fm(INCH/HR)=  0.12
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap = 0.607
  PEAK FLOW RATE(CFS)   =      52.04
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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                          Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* 5770 INDUSTRIAL PARKWAY LOGISTICS                                     *
* DEVELOPED RUNOFF                                                      *
* 100-YEAR                                                              *
 *************************************************************************

  FILE NAME: X:\FTP\AES\INDRLD00.DAT
  TIME/DATE OF STUDY: 13:26 08/19/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 2.0700

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
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  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   994.00
  ELEVATION DATA: UPSTREAM(FEET) =   1690.00  DOWNSTREAM(FEET) =   1668.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.300
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.959
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        2.80      0.74     0.100    52   10.30
  COMMERCIAL                 D        1.10      0.21     0.100    91   10.30
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.59
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     20.71
  TOTAL AREA(ACRES) =      3.90   PEAK FLOW RATE(CFS) =     20.71

********************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  61
--------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) = 1668.00  DOWNSTREAM ELEVATION(FEET) = 1665.00
  STREET LENGTH(FEET) =    97.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 26.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.97
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.50
    HALFSTREET FLOOD WIDTH(FEET) =   18.94
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.73
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.88
  STREET FLOW TRAVEL TIME(MIN.) =   0.28   Tc(MIN.) =   10.58
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.863
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        0.10      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.52
  EFFECTIVE AREA(ACRES) =      4.00    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.60  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.0        PEAK FLOW RATE(CFS) =      20.89

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  18.84
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 FLOW VELOCITY(FEET/SEC.) =  5.74   DEPTH*VELOCITY(FT*FT/SEC.) =   2.88
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1091.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   10.58
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.863
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 A        0.30      0.74     0.100    52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    0.30      SUBAREA RUNOFF(CFS) =    1.56
 EFFECTIVE AREA(ACRES) =      4.30   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.61  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        4.3       PEAK FLOW RATE(CFS) =      22.46

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1661.00  DOWNSTREAM(FEET) =  1659.00
 FLOW LENGTH(FEET) =   360.00   MANNING'S N =  0.010
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.11
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      22.46
 PIPE TRAVEL TIME(MIN.) =   0.74    Tc(MIN.) =   11.32
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    1451.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   11.32
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.630
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 A        0.70      0.74     0.100    52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    3.50
 EFFECTIVE AREA(ACRES) =      5.00   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.62  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        5.0       PEAK FLOW RATE(CFS) =      25.05

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
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==============================================================================
  MAINLINE Tc(MIN.) =   11.32
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.630
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        6.00      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    6.00      SUBAREA RUNOFF(CFS) =   30.00
  EFFECTIVE AREA(ACRES) =     11.00   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.69  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       11.0       PEAK FLOW RATE(CFS) =      55.06
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       11.0  TC(MIN.) =     11.32
  EFFECTIVE AREA(ACRES) =     11.00  AREA-AVERAGED Fm(INCH/HR)=  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.69  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      55.06
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
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SYNTHETIC UNIT HYDROGRAPH

CALCULATIONS

AND

DETENTION BASIN

FLOOD ROUTING

ANALYSIS

Encompass Associates, Inc.
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5770 Industrial Pkwy
San Bernardino

156-241.034
8/17/21

AMC Type III (I,II or III)

Maximum Loss Rate **Developed** Set # 1

Cover	Area	%	Soil type	Area	%	CN-II	CN-III	Ap	%	S	Fp (F.C-6)	Fm	Fm (wt)
Com A	9.9	0.90	A	9.9	0.90	32	52	0.1	0.09	9.23	0.74	0.07	0.06
Com D	1.1	0.10	D	1.1	0.10	75	91	0.1	0.01	0.99	0.218	0.02	0.00
(AutoCalc: Impervious)				(9.9)	(0.9)		98	0	0.90	0.2			
	11.0			11								Fm=	0.07

Low Loss Fraction

Return Period	**2**	2.73 in		**10**	5.03 in		**25**	6.34 in		**100**	8.32 in	
Cover	Ia	Y	Y (wt)	Ia	Y	Y (wt)	Ia	Y	Y (wt)	Ia	Y	Y (wt)
Com A	1.85	0.03	0.00	1.85	0.16	0.01	1.85	0.23	0.02	1.85	0.32	0.03
Com D	0.2	0.67	0.01	0.2	0.8	0.01	0.2	0.83	0.01	0.2	0.87	0.01
(AutoCalc: Impervious)	0.04	0.92	0.83	0.04	0.95	0.86	0.04	0.96	0.86	0.04	0.97	0.87
		Y=	0.84		Y=	0.88		Y=	0.89		Y=	0.91
Low Loss Fraction,Y-bar =			0.16			0.12			0.11			0.09
Est Vol (ac-ft)=			2			4			5			7

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1	Design Storm		yr	2	10	25	100
2	Catchment Lag time		hrs	0.15	0.00	0.00	0.15
			Tc (min)	11.62	0	0	11.32
3	Catchment Area	acres 11					
4	Base flow	cfs/sq mi 0					
5	S-graph	n/a					
6	Maximum loss rate, Fm	in/hr 0.07					
7	Low loss fraction, Y-bar			0.16	0.12	0.11	0.09
8	Watershed area-averaged 5-minute point rainfall		inches	0.28	0.46	0.58	0.77
	Watershed area-averaged 30-minute point rainfall		inches	0.58	0.94	1.19	1.57
	Watershed area-averaged 1-hour point rainfall		inches	0.76	1.24	1.57	2.07
	Watershed area-averaged 3-hour point rainfall		inches	1.05	2.03	2.56	3.35
	Watershed area-averaged 6-hour point rainfall		inches	1.53	2.77	3.48	4.55
	Watershed area-averaged 24-hour point rainfall		inches	2.73	5.03	6.34	8.32
9	24-hour storm unit interval (use TC for Small UH)		minutes	5			

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Job 5770 Industrial Pkwy **156-241.034**
Sheet No. _____ of _____
Calculated by: ATS Date 8/17/21
Checked by: _____ Date _____
Scale nts

5770 Industrial Pkwy
San Bernardino

Table 1: Basin Geometries

Depth	Elevation	Area*	Dvol*	Total V	
ft	ft	sq ft	cf	cf	ac-ft
Basin 1					
0	0	*9,749.0*	*0.0*	0	0.000
1	1	*9,749.0*		5015	0.115
2	2	*9,749.0*		13228	0.304
3	3	*9,749.0*		21080	0.484
4	4	*9,749.0*		28346	0.651
5	5	*9,749.0*		34654	0.796
6	6	*9,749.0*		39083	0.897
6.75	6.75	*9,749.0*		42008	0.964
7	7	*11,749.0*		**42008**	0.964
9	9	*11,749.0*		**46008**	1.056
	**area and DVol values from Manufacturer's Calculation Sheet*				

See Calculation for Volume of Ponded Water (add to Total V)

4000 cf Surface Ponding

Project: **5770 Industrial - San Bernardino**

Chamber Model -	MC-4500	
Units -	**Imperial**	Click Here for Metric
Number of Chambers -	241	
Number of End Caps -	12	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	100.00	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	9	in
Area of system -	9749	sf Min. Area - 9218 sf min. area

☑ Include Perimeter Stone in Calculations

StormTech MC-4500 Cumulative Storage Volumes

Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Single End Cap (cubic feet)	Incremental Chambers (cubic feet)	Incremental End Cap (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch, EC and Stone (cubic feet)	Cumulative System (cubic feet)	Elevation (feet)
81	0.00	0.00	0.00	0.00	324.97	324.97	42007.87	106.75
80	0.00	0.00	0.00	0.00	324.97	324.97	41682.91	106.67
79	0.00	0.00	0.00	0.00	324.97	324.97	41357.94	106.58
78	0.00	0.00	0.00	0.00	324.97	324.97	41032.97	106.50
77	0.00	0.00	0.00	0.00	324.97	324.97	40708.01	106.42
76	0.00	0.00	0.00	0.00	324.97	324.97	40383.04	106.33
75	0.00	0.00	0.00	0.00	324.97	324.97	40058.07	106.25
74	0.00	0.00	0.00	0.00	324.97	324.97	39733.11	106.17
73	0.00	0.00	0.00	0.00	324.97	324.97	39408.14	106.08
72	0.00	0.00	0.00	0.00	324.97	324.97	39083.17	106.00
71	0.00	0.00	0.00	0.00	324.97	324.97	38758.21	105.92
70	0.00	0.00	0.00	0.00	324.97	324.97	38433.24	105.83
69	0.04	0.01	9.87	0.16	320.96	330.98	38108.27	105.75
68	0.12	0.03	27.98	0.41	313.61	342.00	37777.29	105.67
67	0.16	0.05	39.70	0.62	308.84	349.16	37435.29	105.58
66	0.21	0.07	50.30	0.79	304.53	355.62	37086.13	105.50
65	0.27	0.08	64.67	1.00	298.70	364.37	36730.51	105.42
64	0.45	0.11	109.12	1.26	280.81	391.20	36366.14	105.33
63	0.67	0.13	160.33	1.59	260.20	422.12	35974.94	105.25
62	0.80	0.16	192.56	1.93	247.17	441.66	35552.83	105.17
61	0.91	0.19	218.86	2.26	236.52	457.64	35111.16	105.08
60	1.00	0.22	241.70	2.62	227.24	471.56	34653.52	105.00
59	1.09	0.25	262.05	2.96	218.96	483.97	34181.96	104.92
58	1.16	0.28	280.40	3.30	211.49	495.19	33697.99	104.83
57	1.23	0.30	297.40	3.62	204.56	505.58	33202.80	104.75
56	1.30	0.33	313.22	3.93	198.11	515.26	32697.22	104.67
55	1.36	0.35	328.01	4.25	192.06	524.32	32181.96	104.58
54	1.42	0.38	341.91	4.60	186.36	532.88	31657.64	104.50
53	1.47	0.41	355.07	4.91	180.97	540.96	31124.77	104.42
52	1.53	0.44	367.56	5.29	175.83	548.68	30583.81	104.33
51	1.57	0.47	379.45	5.63	170.94	556.01	30035.13	104.25
50	1.62	0.50	390.75	5.94	166.29	562.99	29479.12	104.17
49	1.67	0.52	401.56	6.25	161.84	569.65	28916.13	104.08
48	1.71	0.54	411.90	6.53	157.60	576.02	28346.48	104.00
47	1.75	0.57	421.77	6.80	153.54	582.11	27770.46	103.92
46	1.79	0.59	431.22	7.06	149.65	587.94	27188.35	103.83
45	1.83	0.61	440.35	7.32	145.90	593.57	26600.41	103.75
44	1.86	0.63	449.09	7.59	142.30	598.97	26006.84	103.67
43	1.90	0.64	457.50	7.72	138.88	604.09	25407.87	103.58
42	1.93	0.68	465.57	8.13	135.49	609.19	24803.77	103.50
41	1.96	0.70	473.34	8.40	132.27	614.01	24194.59	103.42
40	2.00	0.72	480.82	8.67	129.17	618.66	23580.58	103.33
39	2.03	0.74	488.03	8.92	126.19	623.14	22961.91	103.25
38	2.05	0.76	494.96	9.17	123.31	627.45	22338.78	103.17
37	2.08	0.79	501.64	9.43	120.54	631.61	21711.33	103.08
36	2.11	0.80	508.05	9.63	117.90	635.57	21079.72	103.00
35	2.13	0.82	514.26	9.84	115.33	639.42	20444.15	102.92
34	2.16	0.84	520.24	10.06	112.85	643.15	19804.72	102.83
33	2.18	0.85	525.99	10.22	110.48	646.69	19161.57	102.75
32	2.21	0.86	531.53	10.31	108.23	650.07	18514.88	102.67
31	2.23	0.89	536.86	10.67	105.95	653.49	17864.81	102.58
30	2.25	0.90	541.98	10.85	103.84	656.66	17211.32	102.50
29	2.27	0.92	546.91	11.01	101.80	659.72	16554.65	102.42
28	2.29	0.92	551.65	11.04	99.89	662.58	15894.94	102.33
27	2.31	0.94	556.19	11.32	97.96	665.47	15232.36	102.25
26	2.33	0.96	560.55	11.48	96.15	668.18	14566.88	102.17
25	2.34	0.97	564.73	11.62	94.42	670.78	13898.70	102.08
24	2.36	0.98	568.74	11.78	92.76	673.28	13227.92	102.00
23	2.38	0.97	572.57	11.65	91.28	675.50	12554.64	101.92
22	2.39	1.00	576.23	12.04	89.66	677.93	11879.14	101.83
21	2.41	1.01	579.72	12.13	88.23	680.08	11201.22	101.75
20	2.42	1.02	583.04	12.24	86.85	682.14	10521.14	101.67
19	2.43	1.03	586.20	12.36	85.54	684.11	9839.00	101.58
18	2.44	1.04	589.21	12.46	84.30	685.97	9154.90	101.50
17	2.46	1.05	592.05	12.56	83.12	687.73	8468.93	101.42
16	2.47	1.05	594.74	12.65	82.01	689.40	7781.20	101.33

Detention Basin Outlet Hydraulics

156-241.034
5770 Industrial Pkwy
8/17/2021

Outlet Structure		
C	3	weir
C	0.62	(orifice)
L (eff)	28	ft
H (eff)	10	ft
Bottom EL	7.00	ft

Infiltration		
rate	20	in/hr
FS	2	
Net rate	10	in/hr
SA	9749	sf
I	2.26	cfs

	Outlet Structure			Summary				
Elevation	Head	Orifice	Weir	Elevation	Infiltration	Outlet Outflow	Total Outflow	Volume
ft	ft	cfs	cfs	ft	cfs	cfs		ac-ft
0	0	0.00	0.00	0	2.26	0.00	2.26	0.00
1	0.00	0.00	0.00	1	2.26	0.00	2.26	0.12
2	0	0.00	0.00	2	2.26	0.00	2.26	0.30
3	0	0.00	0.00	3	2.26	0.00	2.26	0.48
4	0	0.00	0.00	4	2.26	0.00	2.26	0.65
5	0	0.00	0.00	5	2.26	0.00	2.26	0.80
6	0	0.00	0.00	6	2.26	0.00	2.26	0.90
6.75	0	0.00	0.00	6.75	2.26	0.00	2.26	0.96
7	0	0.00	0.00	7	2.26	0.00	2.26	0.96
9	2	278.63	237.59	9	2.26	237.59	239.84	1.06

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==========================================================================
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                           Analysis prepared by:

                         ENCOMPASS ASSOCIATES, INC.
                             5699 Cousins Place
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                      909-684-0093 askeers@encompasscivil.com

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:
  5770 Industrial Parkway - San Bernardino
  Developed Condition Basin Routing
  100-year
--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   11.00
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.065
    LOW LOSS FRACTION = 0.090
    TIME OF CONCENTRATION(MIN.) = 11.32
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.77
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.57
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  2.07
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  3.35
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  4.55
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  8.32

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     6.32
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.31

**************************************************************************
  TIME     VOLUME       Q    0.       15.0      30.0      45.0      60.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.15      0.0106      1.36  Q         .         .         .         .
  0.34      0.0319      1.37  Q         .         .         .         .
  0.53      0.0533      1.38  Q         .         .         .         .
  0.72      0.0749      1.39  Q         .         .         .         .
  0.91      0.0966      1.40  Q         .         .         .         .
  1.10      0.1185      1.41  Q         .         .         .         .
  1.28      0.1405      1.42  Q         .         .         .         .
  1.47      0.1627      1.43  Q         .         .         .         .
  1.66      0.1851      1.44  Q         .         .         .         .
  1.85      0.2076      1.45  Q         .         .         .         .
```

2.04	0.2302	1.46	Q	.	.	.	.
2.23	0.2531	1.47	Q	.	.	.	.
2.42	0.2761	1.48	Q	.	.	.	.
2.60	0.2993	1.50	Q	.	.	.	.
2.79	0.3227	1.50	.Q	.	.	.	.
2.98	0.3463	1.52	.Q	.	.	.	.
3.17	0.3701	1.53	.Q	.	.	.	.
3.36	0.3940	1.55	.Q	.	.	.	.
3.55	0.4182	1.55	.Q	.	.	.	.
3.74	0.4426	1.57	.Q	.	.	.	.
3.93	0.4671	1.58	.Q	.	.	.	.
4.11	0.4919	1.60	.Q	.	.	.	.
4.30	0.5169	1.61	.Q	.	.	.	.
4.49	0.5422	1.63	.Q	.	.	.	.
4.68	0.5677	1.64	.Q	.	.	.	.
4.87	0.5934	1.66	.Q	.	.	.	.
5.06	0.6193	1.67	.Q	.	.	.	.
5.25	0.6455	1.69	.Q	.	.	.	.
5.43	0.6720	1.70	.Q	.	.	.	.
5.62	0.6987	1.73	.Q	.	.	.	.
5.81	0.7257	1.74	.Q	.	.	.	.
6.00	0.7530	1.76	.Q	.	.	.	.
6.19	0.7805	1.77	.Q	.	.	.	.
6.38	0.8084	1.80	.Q	.	.	.	.
6.57	0.8366	1.81	.Q	.	.	.	.
6.76	0.8650	1.84	.Q	.	.	.	.
6.94	0.8939	1.85	.Q	.	.	.	.
7.13	0.9230	1.88	.Q	.	.	.	.
7.32	0.9525	1.90	.Q	.	.	.	.
7.51	0.9823	1.93	.Q	.	.	.	.
7.70	1.0125	1.95	.Q	.	.	.	.
7.89	1.0431	1.98	.Q	.	.	.	.
8.08	1.0741	2.00	.Q	.	.	.	.
8.26	1.1055	2.03	.Q	.	.	.	.
8.45	1.1374	2.05	.Q	.	.	.	.
8.64	1.1696	2.09	.Q	.	.	.	.
8.83	1.2024	2.11	.Q	.	.	.	.
9.02	1.2356	2.15	.Q	.	.	.	.
9.21	1.2693	2.17	.Q	.	.	.	.
9.40	1.3035	2.22	.Q	.	.	.	.
9.59	1.3383	2.24	.Q	.	.	.	.
9.77	1.3737	2.29	.Q	.	.	.	.
9.96	1.4096	2.32	.Q	.	.	.	.
10.15	1.4462	2.37	.Q	.	.	.	.
10.34	1.4834	2.40	.Q	.	.	.	.
10.53	1.5213	2.46	.Q	.	.	.	.
10.72	1.5599	2.49	.Q	.	.	.	.
10.91	1.5993	2.56	.Q	.	.	.	.
11.09	1.6396	2.60	.Q	.	.	.	.
11.28	1.6806	2.67	.Q	.	.	.	.
11.47	1.7226	2.71	.Q	.	.	.	.
11.66	1.7655	2.80	.Q	.	.	.	.
11.85	1.8095	2.84	.Q	.	.	.	.
12.04	1.8546	2.94	.Q	.	.	.	.
12.23	1.9010	3.02	. Q	.	.	.	.
12.42	1.9489	3.13	. Q	.	.	.	.
12.60	1.9983	3.20	. Q	.	.	.	.
12.79	2.0491	3.33	. Q	.	.	.	.

12.98	2.1016	3.40	. Q . . . .
13.17	2.1559	3.56	. Q . . . .
13.36	2.2121	3.65	. Q . . . .
13.55	2.2705	3.84	. Q . . . .
13.74	2.3312	3.95	. Q . . . .
13.92	2.3948	4.20	. Q . . . .
14.11	2.4614	4.34	. Q . . . .
14.30	2.5316	4.67	. Q . . . .
14.49	2.6059	4.86	. Q . . . .
14.68	2.6852	5.31	. Q . . . .
14.87	2.7702	5.59	. Q . . . .
15.06	2.8629	6.30	. Q . . . .
15.25	2.9648	6.78	. Q . . . .
15.43	3.0796	7.95	. Q . . . .
15.62	3.2072	8.42	. Q . . . .
15.81	3.3688	12.31	. Q . . . .
16.00	3.5985	17.17	. .Q . . . .
16.19	4.1619	55.10	. . . . Q .
16.38	4.6687	9.91	. Q . . . .
16.57	4.8036	7.40	. Q . . . .
16.75	4.9074	5.92	. Q . . . .
16.94	4.9931	5.07	. Q . . . .
17.13	5.0677	4.50	. Q . . . .
17.32	5.1345	4.07	. Q . . . .
17.51	5.1954	3.74	. Q . . . .
17.70	5.2517	3.48	. Q . . . .
17.89	5.3042	3.26	. Q . . . .
18.08	5.3536	3.08	. Q . . . .
18.26	5.4001	2.89	.Q . . . .
18.45	5.4441	2.75	.Q . . . .
18.64	5.4861	2.63	.Q . . . .
18.83	5.5263	2.53	.Q . . . .
19.02	5.5650	2.43	.Q . . . .
19.21	5.6022	2.34	.Q . . . .
19.40	5.6382	2.27	.Q . . . .
19.58	5.6730	2.20	.Q . . . .
19.77	5.7067	2.13	.Q . . . .
19.96	5.7394	2.07	.Q . . . .
20.15	5.7713	2.01	.Q . . . .
20.34	5.8023	1.96	.Q . . . .
20.53	5.8325	1.91	.Q . . . .
20.72	5.8620	1.87	.Q . . . .
20.91	5.8908	1.83	.Q . . . .
21.09	5.9189	1.79	.Q . . . .
21.28	5.9465	1.75	.Q . . . .
21.47	5.9735	1.71	.Q . . . .
21.66	6.0000	1.68	.Q . . . .
21.85	6.0259	1.65	.Q . . . .
22.04	6.0514	1.62	.Q . . . .
22.23	6.0764	1.59	.Q . . . .
22.41	6.1010	1.56	.Q . . . .
22.60	6.1252	1.54	.Q . . . .
22.79	6.1489	1.51	.Q . . . .
22.98	6.1723	1.49	Q . . . .
23.17	6.1954	1.47	Q . . . .
23.36	6.2180	1.44	Q . . . .
23.55	6.2404	1.42	Q . . . .
23.74	6.2624	1.40	Q . . . .

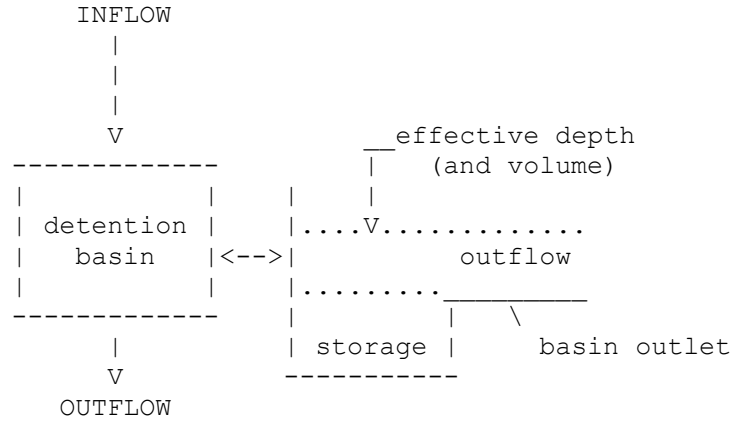
```
 23.92      6.2841      1.38  Q         .         .         .         .
 24.11      6.3056      1.36  Q         .         .         .         .
 24.30      6.3162      0.00  Q         .         .         .         .
 ----------------------------------------------------------------------------
----------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                Duration
        Peak Flow Rate                     (minutes)
    ======================                 =========
               0%                           1449.0
              10%                            124.5
              20%                             34.0
              30%                             22.6
              40%                             11.3
              50%                             11.3
              60%                             11.3
              70%                             11.3
              80%                             11.3
              90%                             11.3

  Problem Descriptions:
   5770 Industrial Parkway - San Bernardino
   Developed Condition Basin Routing
   100-year


============================================================================
     FLOW-THROUGH DETENTION BASIN MODEL

     SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
     CONSTANT HYDROGRAPH TIME UNIT(MINUTES) =   11.320
     DEAD STORAGE(AF) =       0.00
     SPECIFIED DEAD STORAGE(AF) FILLED =       0.00
     ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN =    0.00
```




```
     DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
     TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES =  10
```

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	**BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)
0.000	0.000	0.000**	1.000	0.120	2.260*
2.000	0.300	2.260**	3.000	0.480	2.260*
4.000	0.650	2.260**	5.000	0.800	2.260*
6.000	0.900	2.260**	6.750	0.960	2.260*
7.000	0.960	2.260**	9.000	1.060	239.840*

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	1.00	0.10238	0.13762
3	2.00	0.28238	0.31762
4	3.00	0.46238	0.49762
5	4.00	0.63238	0.66762
6	5.00	0.78238	0.81762
7	6.00	0.88238	0.91762
8	6.75	0.94238	0.97762
9	7.00	0.94238	0.97762
10	9.00	-0.80983	2.92983

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.152	0.000	1.36	0.15	0.17	0.019
0.341	0.000	1.37	0.27	0.48	0.032
0.529	0.000	1.38	0.36	0.71	0.043
0.718	0.000	1.39	0.42	0.88	0.051
0.907	0.000	1.40	0.47	1.01	0.057
1.095	0.000	1.41	0.51	1.11	0.061
1.284	0.000	1.42	0.54	1.19	0.065
1.473	0.000	1.43	0.56	1.25	0.068
1.661	0.000	1.44	0.58	1.30	0.070
1.850	0.000	1.45	0.60	1.33	0.072
2.039	0.000	1.46	0.61	1.36	0.073
2.227	0.000	1.47	0.62	1.39	0.074
2.416	0.000	1.48	0.63	1.41	0.076
2.605	0.000	1.50	0.64	1.43	0.077
2.793	0.000	1.50	0.64	1.45	0.077
2.982	0.000	1.52	0.65	1.47	0.078
3.171	0.000	1.53	0.66	1.48	0.079
3.359	0.000	1.55	0.66	1.49	0.080
3.548	0.000	1.55	0.67	1.51	0.080
3.737	0.000	1.57	0.68	1.52	0.081
3.925	0.000	1.58	0.68	1.54	0.082
4.114	0.000	1.60	0.69	1.55	0.083
4.303	0.000	1.61	0.69	1.56	0.083
4.491	0.000	1.63	0.70	1.58	0.084
4.680	0.000	1.64	0.71	1.59	0.085
4.869	0.000	1.66	0.71	1.61	0.086
5.057	0.000	1.67	0.72	1.62	0.086

5.246	0.000	1.69	0.73	1.64	0.087
5.435	0.000	1.70	0.73	1.65	0.088
5.623	0.000	1.73	0.74	1.67	0.089
5.812	0.000	1.74	0.75	1.68	0.090
6.001	0.000	1.76	0.76	1.70	0.091
6.189	0.000	1.77	0.76	1.72	0.092
6.378	0.000	1.80	0.77	1.74	0.093
6.567	0.000	1.81	0.78	1.75	0.094
6.755	0.000	1.84	0.79	1.77	0.095
6.944	0.000	1.85	0.80	1.79	0.096
7.133	0.000	1.88	0.81	1.81	0.097
7.321	0.000	1.90	0.81	1.83	0.098
7.510	0.000	1.93	0.82	1.85	0.099
7.699	0.000	1.95	0.83	1.87	0.100
7.887	0.000	1.98	0.84	1.90	0.101
8.076	0.000	2.00	0.85	1.92	0.103
8.265	0.000	2.03	0.87	1.94	0.104
8.453	0.000	2.05	0.88	1.97	0.105
8.642	0.000	2.09	0.89	1.99	0.107
8.831	0.000	2.11	0.90	2.02	0.108
9.019	0.000	2.15	0.91	2.05	0.110
9.208	0.000	2.17	0.93	2.08	0.111
9.397	0.000	2.22	0.94	2.11	0.113
9.585	0.000	2.24	0.95	2.14	0.114
9.774	0.000	2.29	0.97	2.17	0.116
9.963	0.000	2.32	0.98	2.21	0.118
10.151	0.000	2.37	1.00	2.24	0.120
10.340	0.000	2.40	1.01	2.26	0.122
10.529	0.000	2.46	1.03	2.26	0.125
10.717	0.000	2.49	1.05	2.26	0.129
10.906	0.000	2.56	1.08	2.26	0.134
11.095	0.000	2.60	1.11	2.26	0.139
11.283	0.000	2.67	1.14	2.26	0.145
11.472	0.000	2.71	1.18	2.26	0.152
11.661	0.000	2.80	1.23	2.26	0.161
11.849	0.000	2.84	1.28	2.26	0.170
12.038	0.000	2.94	1.34	2.26	0.181
12.227	0.000	3.02	1.40	2.26	0.192
12.415	0.000	3.13	1.48	2.26	0.206
12.604	0.000	3.20	1.56	2.26	0.220
12.793	0.000	3.33	1.65	2.26	0.237
12.981	0.000	3.40	1.75	2.26	0.255
13.170	0.000	3.56	1.86	2.26	0.275
13.359	0.000	3.65	1.98	2.26	0.297
13.547	0.000	3.84	2.12	2.26	0.322
13.736	0.000	3.95	2.27	2.26	0.348
13.925	0.000	4.20	2.43	2.26	0.378
14.113	0.000	4.34	2.61	2.26	0.411
14.302	0.000	4.67	2.82	2.26	0.448
14.491	0.000	4.86	3.05	2.26	0.489
14.679	0.000	5.31	3.33	2.26	0.536
14.868	0.000	5.59	3.64	2.26	0.588
15.057	0.000	6.30	4.01	2.26	0.651
15.245	0.000	6.78	4.48	2.26	0.722
15.434	0.000	7.95	5.10	2.26	0.810
15.623	0.000	8.42	6.08	2.26	0.906
15.811	0.000	12.31	7.11	8.52	0.965
16.000	0.000	17.17	7.14	17.04	0.967

16.189	0.000	55.10	7.72	53.27	0.996
16.377	0.000	9.91	2.85	44.74	0.453
16.566	0.000	7.40	3.31	2.26	0.533
16.755	0.000	5.92	3.65	2.26	0.590
16.943	0.000	5.07	3.90	2.26	0.634
17.132	0.000	4.50	4.12	2.26	0.668
17.321	0.000	4.07	4.31	2.26	0.697
17.509	0.000	3.74	4.46	2.26	0.720
17.698	0.000	3.48	4.59	2.26	0.739
17.887	0.000	3.26	4.70	2.26	0.754
18.075	0.000	3.08	4.78	2.26	0.767
18.264	0.000	2.89	4.85	2.26	0.777
18.453	0.000	2.75	4.90	2.26	0.785
18.641	0.000	2.63	4.94	2.26	0.790
18.830	0.000	2.53	4.96	2.26	0.795
19.019	0.000	2.43	4.98	2.26	0.797
19.207	0.000	2.34	4.99	2.26	0.798
19.396	0.000	2.27	4.99	2.26	0.799
19.585	0.000	2.20	4.98	2.26	0.798
19.773	0.000	2.13	4.97	2.26	0.796
19.962	0.000	2.07	4.95	2.26	0.793
20.151	0.000	2.01	4.93	2.26	0.789
20.339	0.000	1.96	4.89	2.26	0.784
20.528	0.000	1.91	4.86	2.26	0.779
20.717	0.000	1.87	4.82	2.26	0.773
20.905	0.000	1.83	4.77	2.26	0.766
21.094	0.000	1.79	4.72	2.26	0.758
21.283	0.000	1.75	4.67	2.26	0.751
21.471	0.000	1.71	4.61	2.26	0.742
21.660	0.000	1.68	4.55	2.26	0.733
21.849	0.000	1.65	4.49	2.26	0.723
22.037	0.000	1.62	4.42	2.26	0.713
22.226	0.000	1.59	4.35	2.26	0.703
22.415	0.000	1.56	4.28	2.26	0.692
22.603	0.000	1.54	4.21	2.26	0.681
22.792	0.000	1.51	4.13	2.26	0.669
22.981	0.000	1.49	4.05	2.26	0.657
23.169	0.000	1.47	3.97	2.26	0.645
23.358	0.000	1.44	3.89	2.26	0.632
23.547	0.000	1.42	3.82	2.26	0.619
23.735	0.000	1.40	3.74	2.26	0.606
23.924	0.000	1.38	3.66	2.26	0.592
24.113	0.000	1.36	3.58	2.26	0.578
24.301	0.000	0.00	3.37	2.26	0.543
24.490	0.000	0.00	3.16	2.26	0.508
24.679	0.000	0.00	2.96	2.26	0.472
24.867	0.000	0.00	2.76	2.26	0.437
25.056	0.000	0.00	2.57	2.26	0.402
25.245	0.000	0.00	2.37	2.26	0.367
25.433	0.000	0.00	2.17	2.26	0.331
25.622	0.000	0.00	1.98	2.26	0.296
25.811	0.000	0.00	1.78	2.26	0.261
25.999	0.000	0.00	1.59	2.26	0.226
26.188	0.000	0.00	1.39	2.26	0.190
26.377	0.000	0.00	1.20	2.26	0.155
26.565	0.000	0.00	1.00	2.26	0.120
26.754	0.000	0.00	0.74	1.97	0.089
26.943	0.000	0.00	0.55	1.46	0.066

27.131	0.000	0.00	0.41	1.09	0.049
27.320	0.000	0.00	0.31	0.81	0.037
27.509	0.000	0.00	0.23	0.60	0.027
27.697	0.000	0.00	0.17	0.45	0.020
27.886	0.000	0.00	0.13	0.33	0.015
28.075	0.000	0.00	0.09	0.25	0.011
28.263	0.000	0.00	0.07	0.18	0.008
28.452	0.000	0.00	0.05	0.14	0.006
28.641	0.000	0.00	0.04	0.10	0.005
28.829	0.000	0.00	0.03	0.08	0.003
29.018	0.000	0.00	0.02	0.06	0.003
29.207	0.000	0.00	0.02	0.04	0.002
29.395	0.000	0.00	0.01	0.03	0.001
29.584	0.000	0.00	0.01	0.02	0.001

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

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MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
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 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.
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-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 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 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 9" (230 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 SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. 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-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 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.

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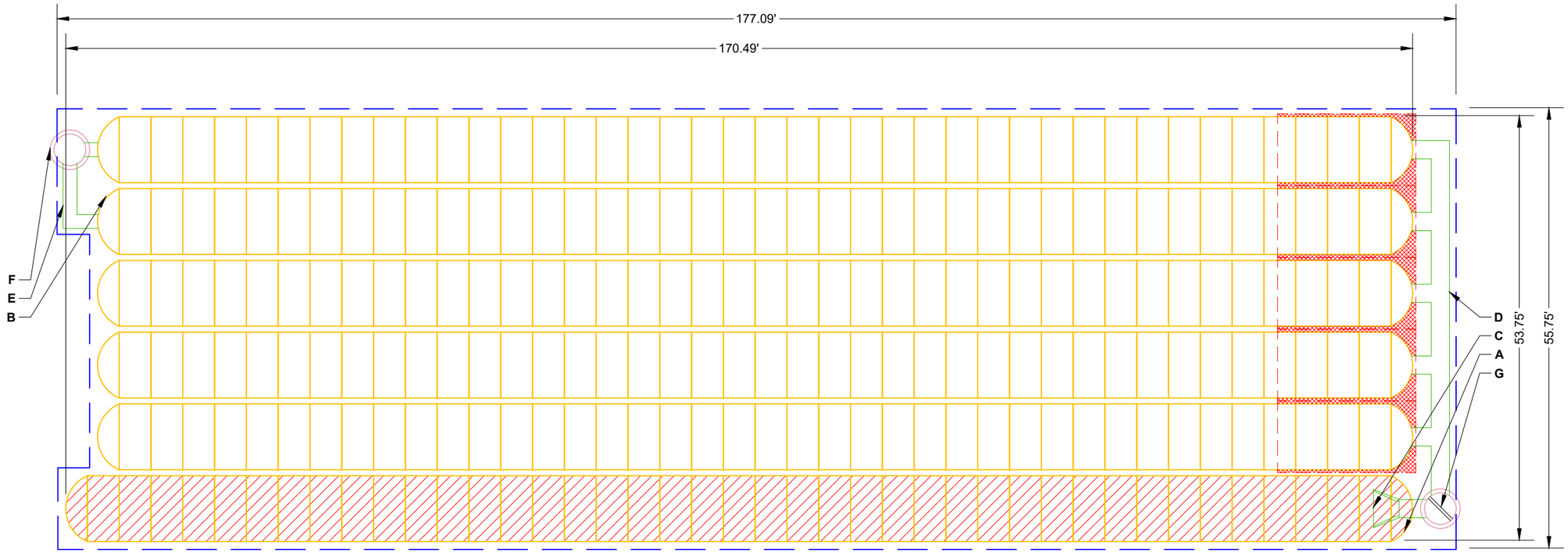
PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS	
241	STORMTECH MC-4500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
12	STORMTECH MC-4500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
42009	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-4500 CHAMBER:	5.75
		24" x 24" BOTTOM MANIFOLD INVERT:	0.94
		24" ISOLATOR ROW PLUS INVERT:	0.94
9749	SYSTEM AREA (SF)	18" x 18" BOTTOM MANIFOLD INVERT:	0.91
473.7	SYSTEM PERIMETER (ft)	18" BOTTOM CONNECTION INVERT:	0.91
		BOTTOM OF MC-4500 CHAMBER:	0.75
		BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
PREFABRICATED END CAP	B	18" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP18B / TYP OF ALL 18" BOTTOM CONNECTIONS	1.97"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC450024RAMP		
MANIFOLD	D	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.26"	
MANIFOLD	E	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.97"	
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)		41.5 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.

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ADS

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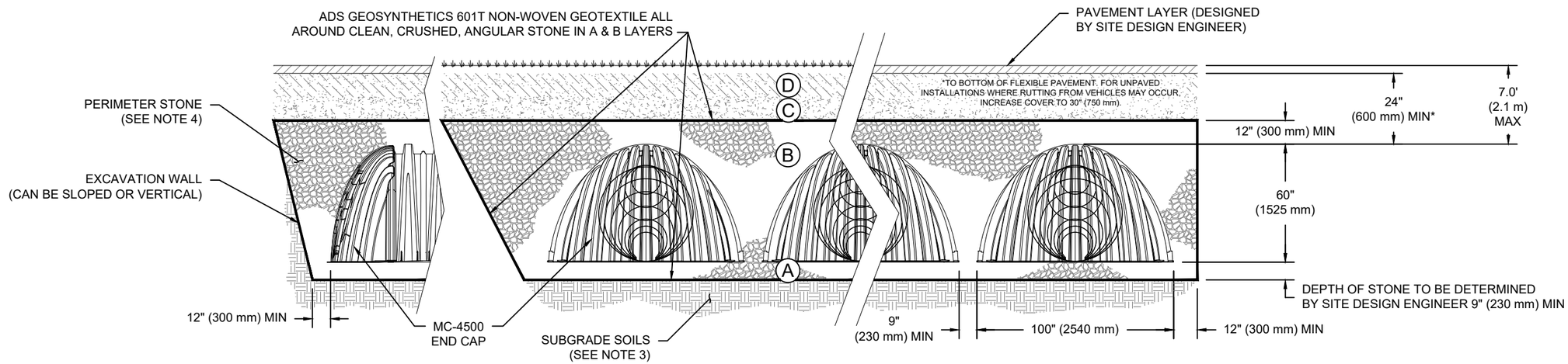
ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

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 F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-4500 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.

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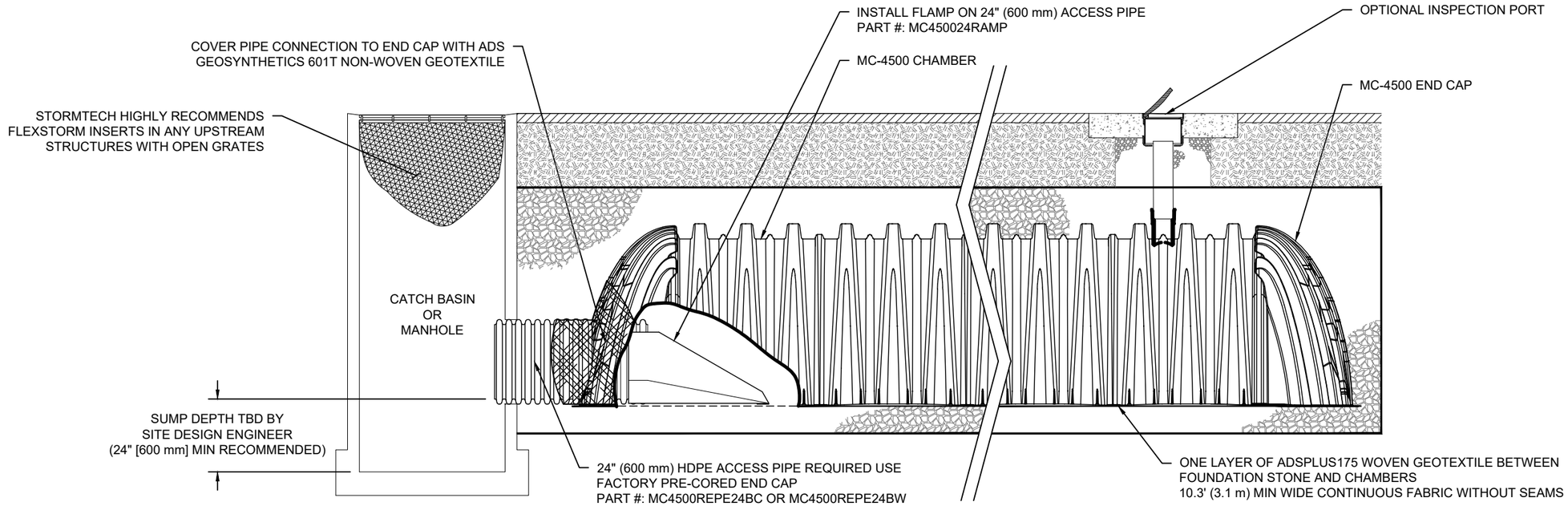

MC-4500 ISOLATOR ROW PLUS DETAIL
NTS

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.

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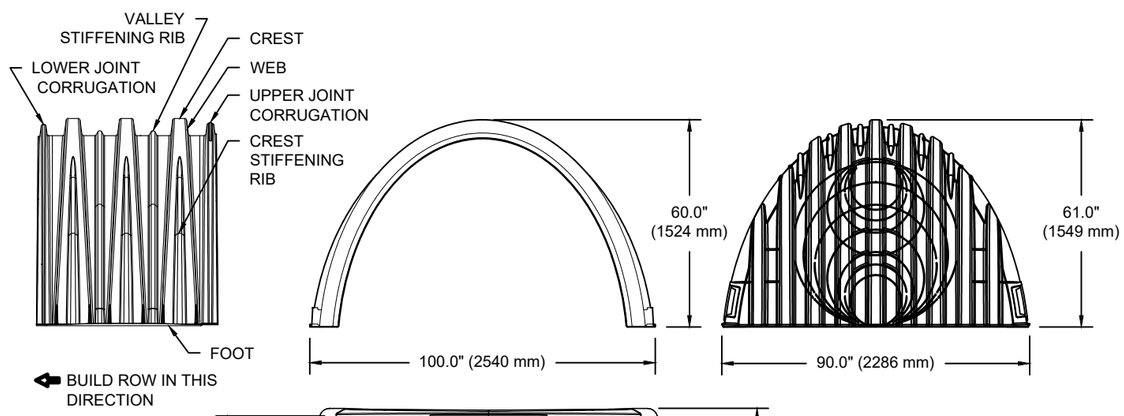
MC-4500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT (NOMINAL)	125.0 lbs.	(56.7 kg)

NOMINAL END CAP SPECIFICATIONS

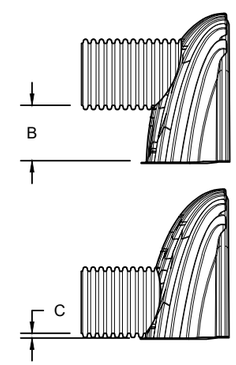
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

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

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

PART #	STUB	B	C
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC4500IEPP06B		---	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC4500IEPP08B		---	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC4500IEPP10B		---	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC4500IEPP12B		---	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC4500IEPP15B		---	1.70" (43 mm)
MC4500IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC4500IEPP18TW			
MC4500IEPP18B		---	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC4500IEPP24TW			
MC4500IEPP24B		---	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

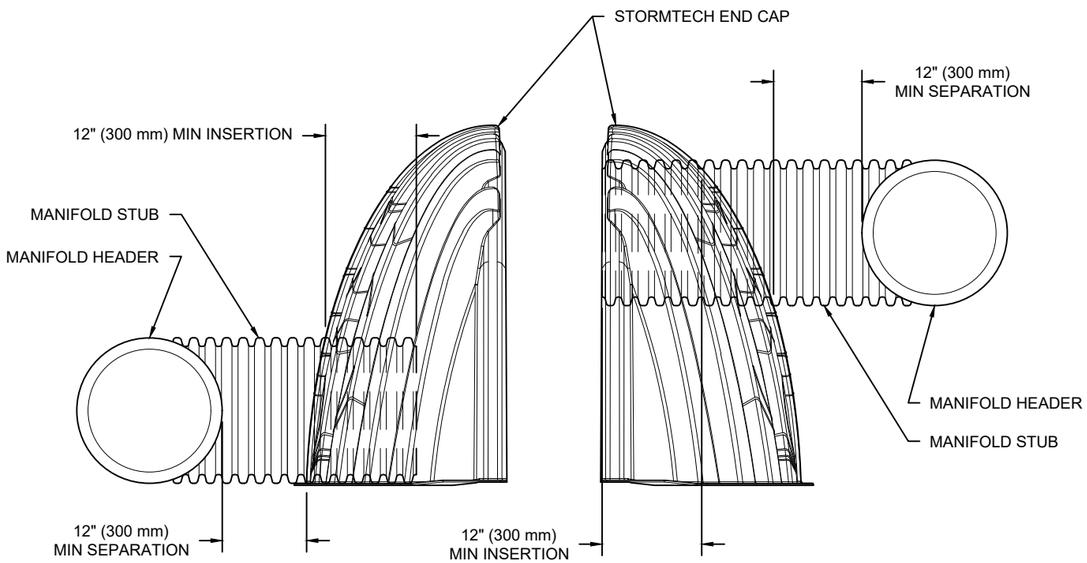
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



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

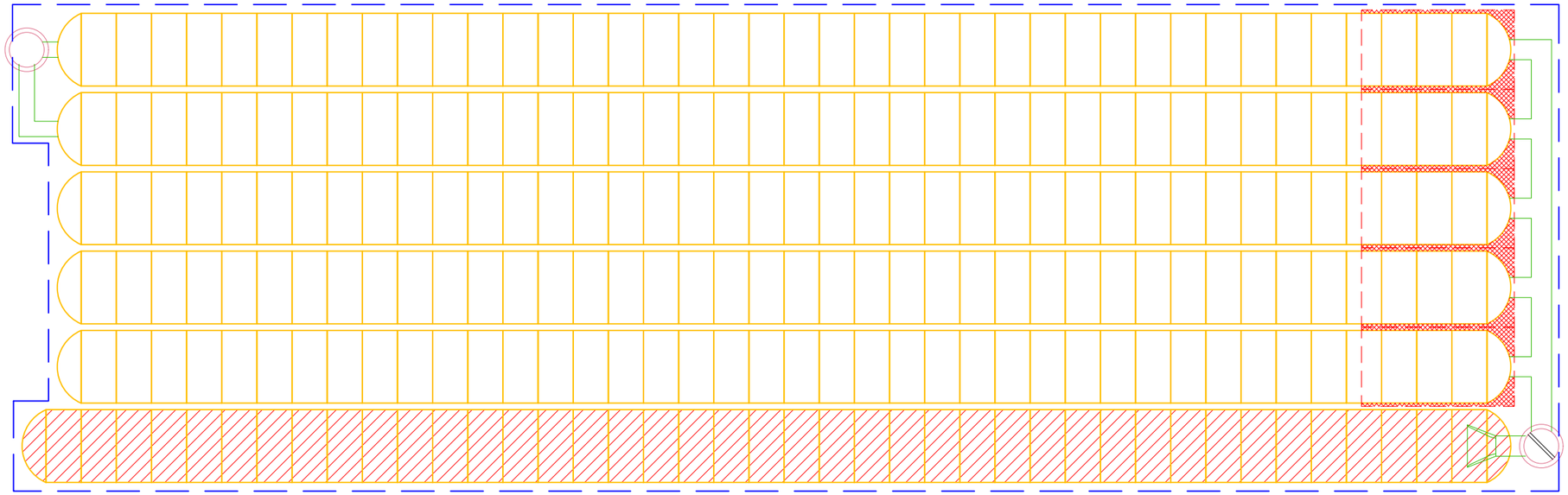
INDUSTRIAL
SAN BERNARDINO, CA
DATE:
DRAWN: AS
PROJECT #:
CHECKED: N/A

REV	DRW	CHK	DESCRIPTION

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

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

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.



User Inputs

Chamber Model:	MC-4500
Outlet Control Structure:	Yes
Project Name:	Industrial
Engineer:	Aaron Skeers
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	41000 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(500 ft. x 200 ft.)

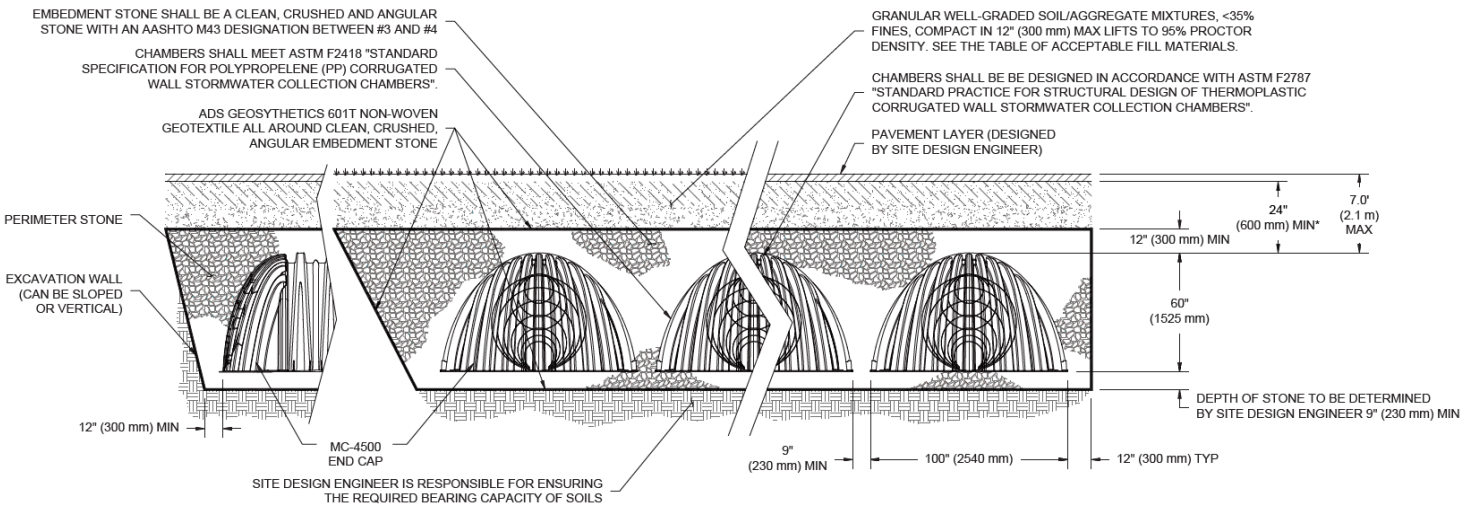
Results

System Volume and Bed Size

Installed Storage Volume:	42007.64 cubic ft.
Storage Volume Per Chamber:	106.50 cubic ft.
Number Of Chambers Required:	241
Number Of End Caps Required:	12
Chamber Rows:	6
Maximum Length:	177.09 ft.
Maximum Width:	55.75 ft.
Approx. Bed Size Required:	9749.39 square ft.

System Components

Amount Of Stone Required:	1469.18 cubic yards
Volume Of Excavation (Not Including Fill):	2437.35 cubic yards
Total Non-woven Geotextile Required:	3026.19 square yards
Woven Geotextile Required (excluding Isolator Row):	106.17 square yards
Woven Geotextile Required (Isolator Row):	397.81 square yards
Total Woven Geotextile Required:	503.98 square yards



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

Sladden Engineering

45090 Golf Center Parkway, Suite F, Indio, CA. 92201 (760) 863-0713 Fax (760) 863-0847
6782 Stanton Avenue, Suite C, Buena Park, CA. 90621 (714) 523-0952 Fax (714) 523-1369
450 Egan Avenue, Beaumont, CA. 92223 (951) 845-7743 Fax (951) 845-8863
www.sladdenengineering.com

June 2, 2021

Project No. 644-21023
21-06-061

Dedeaux Properties
100 Wilshire Boulevard, Suite 250
Santa Monica, California 90401

Project: Proposed Logistics Facility
5770 Industrial Parkway
San Bernardino, California

Subject: Percolation/Infiltration Testing for On-Site Storm Water Management

In accordance with your request, we have performed infiltration/percolation testing on the subject site to evaluate the infiltration potential of the near surface soil to assist in storm water management system design. It is our understanding that on-site storm water retention including infiltration is proposed to serve the project.

Percolation testing was performed on April 16, 2021 within two (2) shallow test bores excavated on the site. Testing was performed at depths of approximately 5 and 10 feet below existing grade for P-1 & P-2, respectively. The approximate locations of the tests are presented on the attached Exploration Location Plan (Figure 3). Testing was performed by placing water within the test bores and recording the drop in the water surface with time. Testing was performed in general accordance with the *United States Bureau of Reclamation (BOR) Procedure 7300-89 (1999)*. Test results are summarized in the following table.

PERCOLATION TEST RESULTS

Test No.	USCS	Depth (Ft)	Percolation Rate (in/hr)	*Infiltration Rate (in/hr)
P-1	SW	5.0	120.00	20.00
P-2	SW	10.0	120.00	20.00

*Porchet Method

The percolation rates determined represent ultimate field rates that do not include a safety factor. The corresponding infiltration rates were calculated using the Porchet Method. An appropriate safety factor should be applied to account for long-term saturation, subsoil inconsistencies and the potential for silting of the percolating soil. The safety factor should be determined with consideration to other factors in the storm water retention system design (specifically storm water volume estimates) and the safety factors associated with these design components.

If you have any questions regarding this memo, please contact the undersigned.

Respectfully submitted,
SLADDEN ENGINEERING

James W. Minor III
Senior Geologist

PROFESSIONAL GEOLOGIST
JAMES W. MINOR III
No. 9735
STATE OF CALIFORNIA

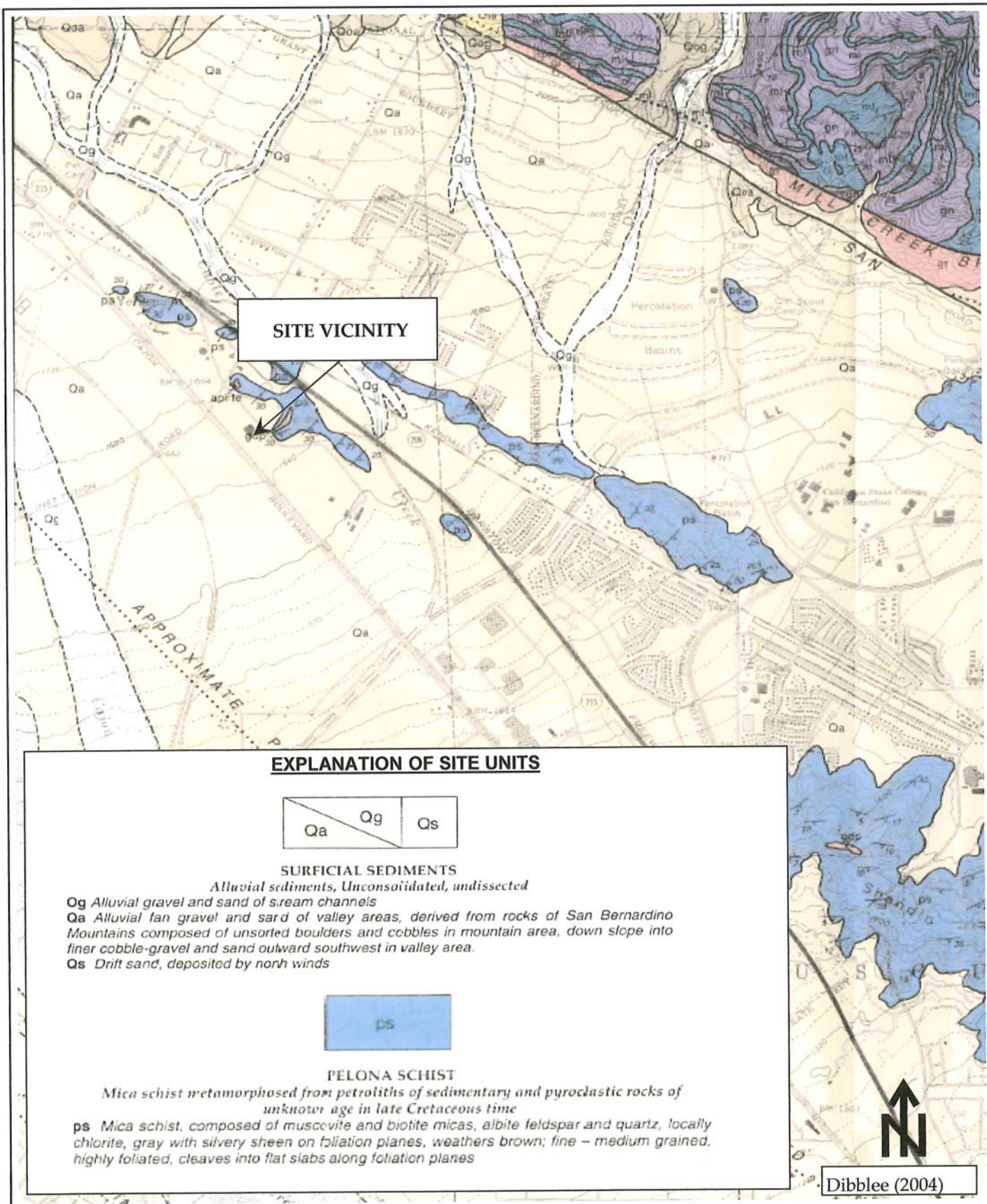
Brett L. Anderson
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
BRETT L. ANDERSON
No. C45389
CIVIL ENGINEERING
STATE OF CALIFORNIA

Copies: 4/Addressee

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
EXPLORATION LOCATION PLAN

Sladden Engineering	SITE LOCATION MAP		FIGURE 1
	Project Number:	644-21023	
	Report Number:	21-06-061	
	Date:	June 2, 2021	



EXPLANATION OF SITE UNITS

Qa | Qg | Qs

SURFICIAL SEDIMENTS

Alluvial sediments, Unconsolidated, undissected

Og *Alluvial gravel and sand of stream channels*

Qa *Alluvial fan gravel and sand of valley areas, derived from rocks of San Bernardino Mountains composed of unsorted boulders and cobbles in mountain area, down slope into finer cobble-gravel and sand outward southwest in valley area.*

Qs *Drift sand, deposited by north winds*

ps

PELONA SCHIST

Mica schist metamorphosed from petroliths of sedimentary and pyroclastic rocks of unknown age in late Cretaceous time

ps *Mica schist, composed of muscovite and biotite micas, albite feldspar and quartz, locally chlorite, gray with silvery sheen on foliation planes, weathers brown; fine – medium grained, highly foliated, cleaves into flat slabs along foliation planes*

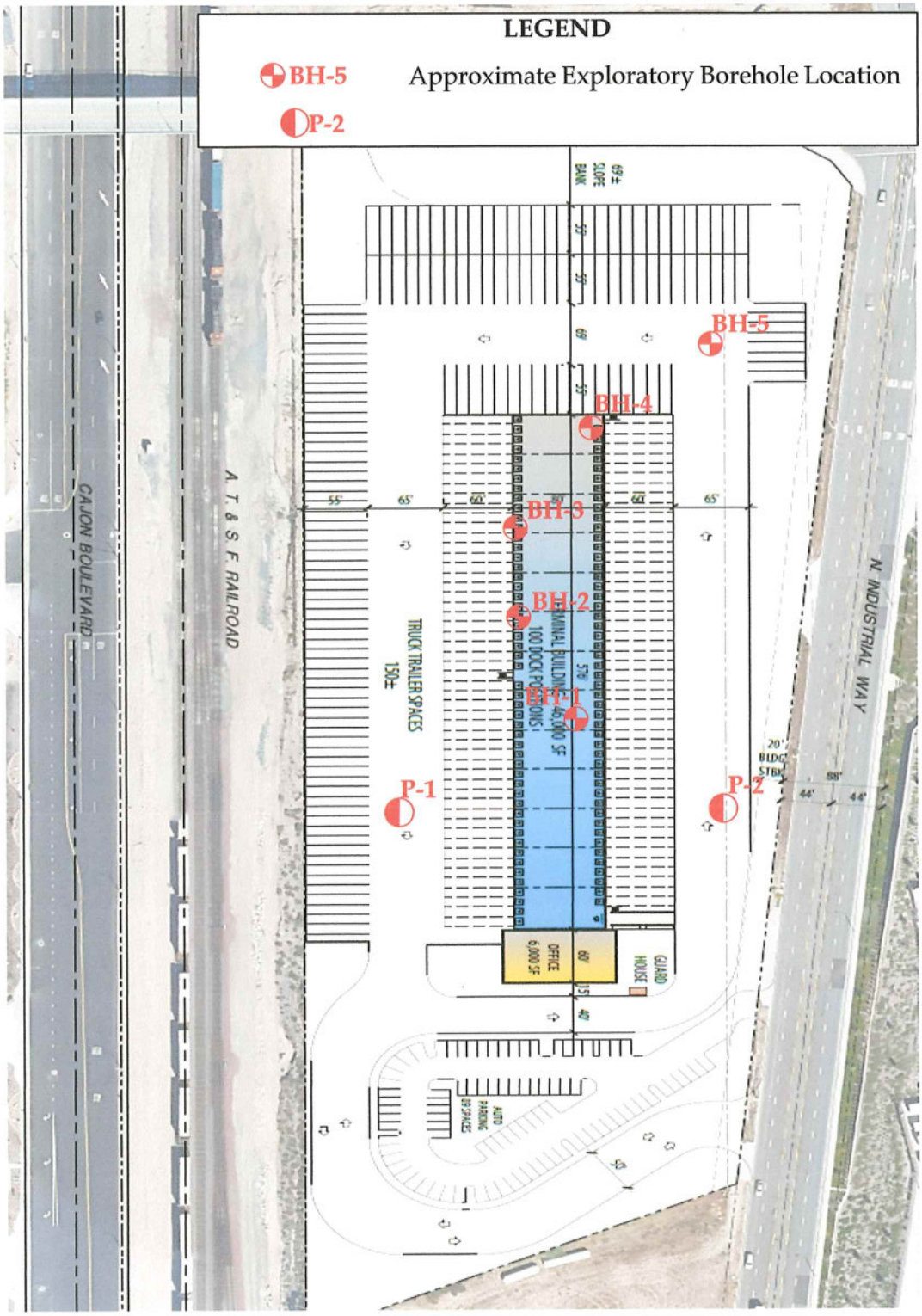
Sladden Engineering

REGIONAL GEOLOGIC MAP

Project Number:	644-21023
Report Number:	21-06-061
Date:	June 2, 2021

FIGURE

2



5770 N. INDUSTRIAL WAY LOGISTICS FACILITY - CITY OF SAN BERNARDINO, CA

DEDEAUX PROPERTIES

CONCEPTUAL SITE PLAN SCHEME B.2 GAA ARCHITECTS

Sladden Engineering	EXPLORATION LOCATION PLAN
Project Number:	644-21023
Report Number:	21-06-061
Date:	June 2, 2021
FIGURE	3

BORE LOGS

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	4/14/2021
Elevation:	1670 Ft (MSL)	Boring No:	BH-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
	5/8/14	1	0	2.4	1.5	124.0	2		Gravelly Sand (SW); yellowish brown, dry, medium dense, fine- to coarse-grained (Fill).
	6/10/11			6.6	3.5	113.0	6		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	7/50-6"			4.5	3.4		10		Gravelly Sand (SW); yellowish brown, dry to slightly moist, very dense, fine- to coarse-grained (Qa).
	50-4"						16		No Recovery.
	10/11/11			0.0	2.7		20		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	20/24/28			5.3	3.0	127.1	26		Gravelly Sand (SP); yellowish brown, dry to slightly moist, dense, fine- to coarse-grained (Qa).
	33/28/26			9.3	3.6		30		Gravelly Sand (SP); yellowish brown, dry to slightly moist, very dense, fine- to coarse-grained (Qa).
	26/34/42			5.1	2.1	125.1	36		Gravelly Sand (SP); yellowish brown, dry to slightly moist, very dense, fine- to coarse-grained (Qa).
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:
Practical Auger Refusal at ~ 38.0 feet bgs.
No Bedrock Encountered.
No Groundwater or Seepage Encountered.

PROPOSED LOGISTICS FACILITY
5770 INDUSTRIAL PARKWAY, SAN BERNARDINO

Project No: 644-21023
Report No: 20-06-061

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	4/14/2021
Elevation:	1670 Ft (MSL)	Boring No:	BH-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Gravelly Sand (SW); yellowish brown, dry, fine- to coarse-grained (Fill).
	11/11/10			8.6	2.7		6		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	15/17/18			3.4	3.1	117.2	10		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	9/12/13			3.6	2.5		16		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
							18		Terminated at ~ 16.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED LOGISTICS FACILITY
5770 INDUSTRIAL PARKWAY, SAN BERNARDINO

Project No: 644-21023
Report No: 20-06-061

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	4/14/2021
Elevation:	1670 Ft (MSL)	Boring No:	BH-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Gravelly Sand (SW); yellowish brown, dry, fine- to coarse-grained (Fill).
	10/14/14			3.0	2.0	120.9	6		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	9/11/11			5.3	3.9		10		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	10/14/15			9.5	4.8	128.9	16		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
									Terminated at ~ 16.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED LOGISTICS FACILITY
5770 INDUSTRIAL PARKWAY, SAN BERNARDINO

Project No: 644-21023
Report No: 20-06-061

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	4/14/2021
Elevation:	1670 Ft (MSL)	Boring No:	BH-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Gravelly Sand (SW); yellowish brown, dry, fine- to coarse-grained (Fill).
	6/9/11			4.3	2.8		6		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	10/16/20			3.4	2.4	123.3	10		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	11/15/15			4.9	2.9		16		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	14/31/37			4.3	2.1	133.0	20		Gravelly Sand (SW); yellowish brown, dry to slightly moist, dense, fine- to coarse-grained (Qa).
							22		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED LOGISTICS FACILITY
5770 INDUSTRIAL PARKWAY, SAN BERNARDINO

Project No: 644-21023
Report No: 20-06-061

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	4/14/2021
Elevation:	1670 Ft (MSL)	Boring No:	BH-5

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Gravelly Sand (SW); yellowish brown, dry, fine- to coarse-grained (Fill).
	8/11/16			2.9	1.9	115.5	6		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	5/9/13			3.6	3.1		10		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	13/14/18			4.7	2.0	120.0	16		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
	9/11/13			4.4	3.1		20		Gravelly Sand (SW); yellowish brown, dry to slightly moist, medium dense, fine- to coarse-grained (Qa).
							22		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED LOGISTICS FACILITY
5770 INDUSTRIAL PARKWAY, SAN BERNARDINO

Project No: 644-21023
Report No: 20-06-061

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	4/14/2021
Elevation:	1670 Ft (MSL)	Boring No:	P-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Gravelly Sand (SW); yellowish brown, dry, fine- to coarse-grained (Fill).
							4		Gravelly Sand (SW); yellowish brown, dry to slightly moist, fine- to coarse-grained (Qa).
							6		Terminated at ~ 5.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Borehole Cased with Perforated Pipe for Percolation Testing.
							8		
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED LOGISTICS FACILITY
5770 INDUSTRIAL PARKWAY, SAN BERNARDINO

Project No: 644-21023
Report No: 20-06-061

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	4/14/2021
Elevation:	1670 Ft (MSL)	Boring No:	P-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Gravelly Sand (SW); yellowish brown, dry, fine- to coarse-grained (Fill).
							4		
							6		Gravelly Sand (SW); yellowish brown, dry to slightly moist, fine- to coarse-grained (Qa).
							8		
							10		
							12		Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Borehole Cased with Perforated Pipe for Percolation Testing.
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED LOGISTICS FACILITY
5770 INDUSTRIAL PARKWAY, SAN BERNARDINO

Project No: 644-21023
Report No: 20-06-061

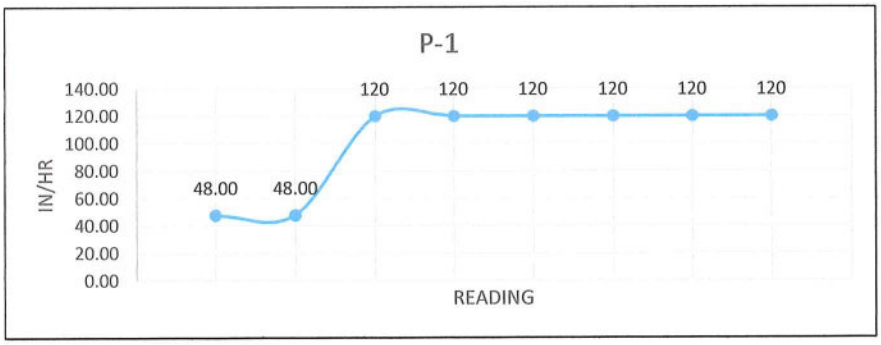
STORMWATER PERCOLATION DATA SHEETS

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	5770 Industrial Parkway, San Bernardino	Depth (ft):	5.00
Job No. :	644-21023	USCS Soil Class:	SW
Date:	4/16/2021	Sandy Soil:	Kusal
Test Hole #:	P-1	Tested By:	R.F.

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
A	25.00	5.00	20	0	20	48.00
B	25.00	5.00	20	0	20	48.00

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
1	10.00	5.00	20	0	20	120
2	10.00	5.00	20	0	20	120
3	10.00	5.00	20	0	20	120
4	10.00	5.00	20	0	20	120
5	10.00	5.00	20	0	20	120
6	10.00	5.00	20	0	20	120



PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt =	10.00
D_f =	60.00
r =	4.00
D_0 =	40
D_t =	60.00
H_0 =	20
H_f =	0
ΔH =	20.00
H_{avg} =	10.00

Δt (minutes)
D_f (Final Depth to water)
r (hole radius in inches)
D_0 (Initial Depth to water)
D_t (Total Depth of test hole)
H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

H_{avg} (average head height over the time interval)

$$H_{avg} = (H_0 + H_f)/2$$

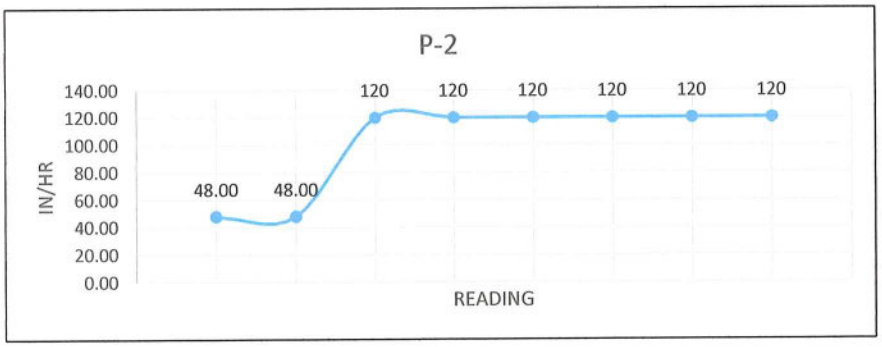
Field Rate: 120 in/hr
Infiltration Rate: 20.00 in/hr

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	5770 Industrial Parkway, San Bernardino	Depth (ft):	10.00
Job No. :	644-21023	USCS Soil Class:	SW
Date:	4/16/2021	Sandy Soil:	Kusal
Test Hole #:	P-2	Tested By:	R.F.

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
A	25.00	10.00	20	0	20	48.00
B	25.00	10.00	20	0	20	48.00

READING	TIME (min)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	IN/HR
1	10.00	10.00	20	0	20	120
2	10.00	10.00	20	0	20	120
3	10.00	10.00	20	0	20	120
4	10.00	10.00	20	0	20	120
5	10.00	10.00	20	0	20	120
6	10.00	10.00	20	0	20	120



PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt =	10.00
D_f =	120.00
r =	4.00
D_0 =	100
D_t =	120.00
H_0 =	20
H_f =	0
ΔH =	20.00
H_{avg} =	10.00

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

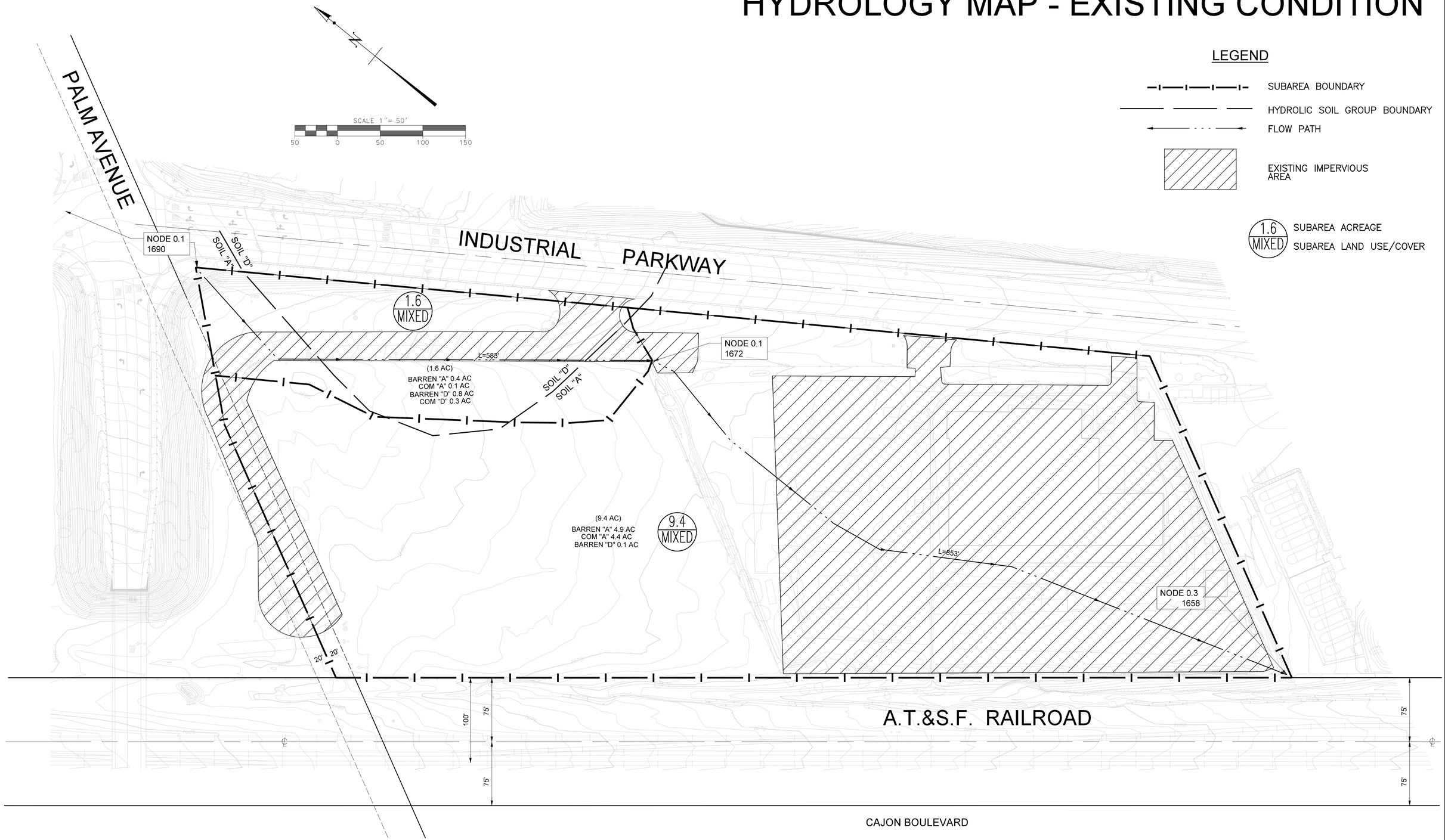
H_{avg} (average head height over the time interval)

$$H_{avg} = (H_0 + H_f)/2$$

Field Rate: 120 in/hr

Infiltration Rate: 20.00 in/hr

HYDROLOGY MAP - EXISTING CONDITION



BENCHMARK: CITY OF S.B. HI - 1

A 3" STANDARD BRASS DISK STAMPED "T-1445-1989", SET VERTICALLY IN THE NORTHERLY FACE OF THE NORTHEAST COLUMN OF THE PALM AVENUE OVERPASS OF I-215, 4.9 FEET ABOVE THE GROUND.

ELEVATION = 1705.55 (NAVD 88)

REGISTERED PROFESSIONAL ENGINEER
DOUGLAS L. GOODMAN
No. 28500
CIVIL
Date 3-31-22
STATE OF CALIFORNIA

Goodman & ASSOCIATES
2079 SKY VIEW DRIVE
COLTON, CA 92324
(909) 824-2775

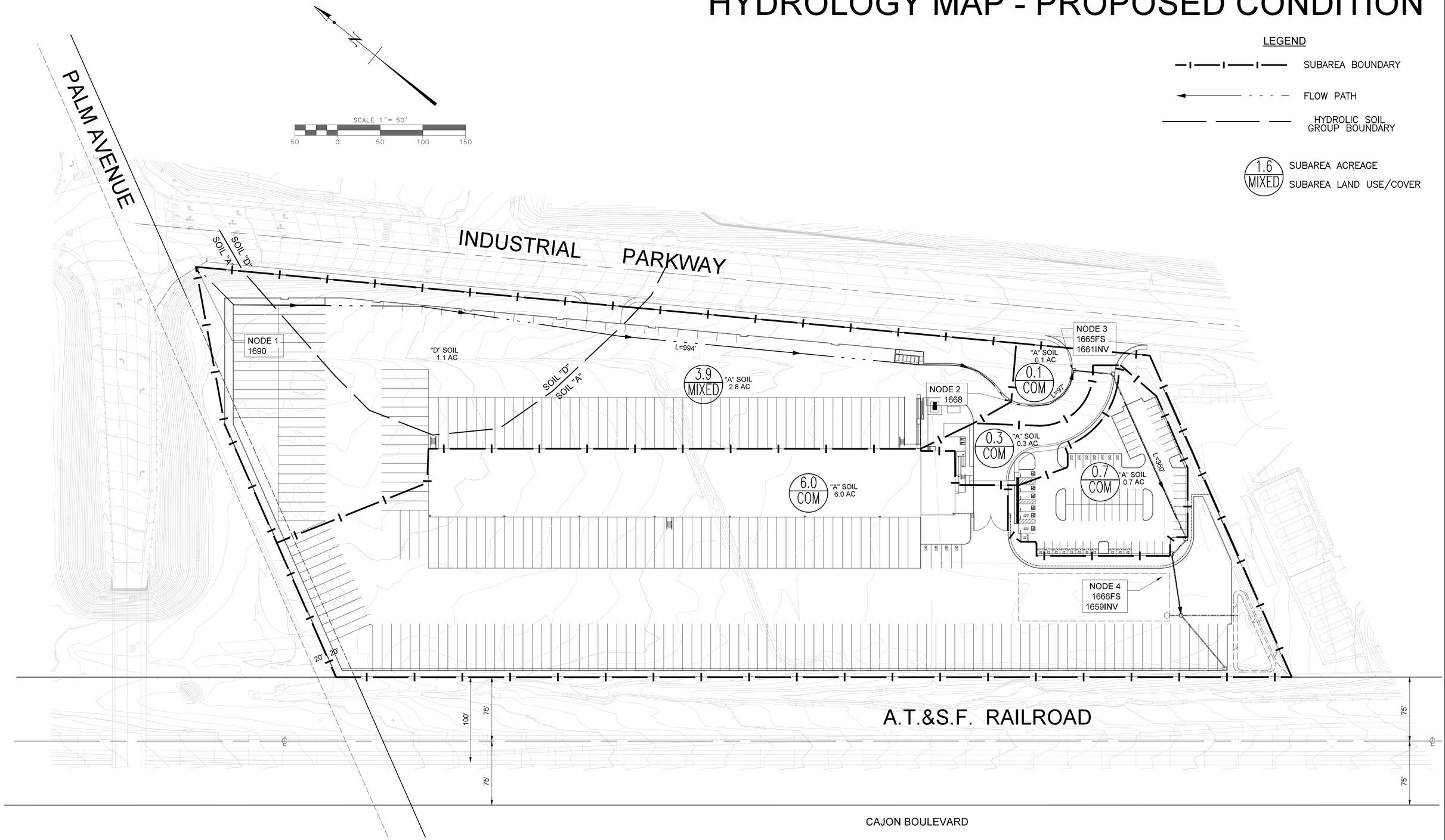
AUGUST 20, 2021
DATE

DOUGLAS L. GOODMAN
RCE 28500, 3-31-2022

IN THE CITY OF SAN BERNARDINO
HYDROLOGY MAP - EXISTING CONDITION
PREPARED FOR DEDEAUX PROPERTIES
5770 N. INDUSTRIAL PARKWAY
LOGISTICS FACILITY
APN 0266-041-22 AND 40

SCALE: AS SHOWN
DATE: AUGUST 20, 2021
G&A JOB NO.: 1/1

HYDROLOGY MAP - PROPOSED CONDITION



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HYDROLOGY MAP - PROPOSED CONDITION

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5770 N. INDUSTRIAL PARKWAY
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