ANDREASEN ENGINEERING, INC.

Civil Engineering • Land Surveying • Municipal Engineering

DRAINAGE REPORT

LORD CONTRUCTION INC.
1527 W. RIALTO AVE.
RIALTO, CA. 92376

for

Kelle Lord Lopez
Lord Construction, Inc
Upland, CA. 9186

Prepared by:

Andreasen Engineering, Inc.
195 N. Euclid Avenue, Suite 101
Upland CA. 91768

July 10, 2024
JN 3747

REGISTERED PROFESSIONAL ENGINEER
STEPHEN VENTURA
C 32437
Exp. 12/31/24
CIVIL
STATE OF CALIFORNIA

Stephen Ventura, R.C.E.
Vice-President

7/10/24
Date

DISCUSSION

I. PURPOSE OF STUDY

The purpose of this report is to determine the impact of a 100-year rainfall will have on the proposed development and the carrying capacity of the new storm drain pipes into an existing parkway drain at the southeast corner of the project limits.

The 2-year 1-hour rainfall runoff and volume are calculated based on the San Bernardino County Hydrology Manual; Santa Ana Watershed, Attachment "D" Flow-Volume based BMP Design Calculations. The underground chambers are sized to meet or exceed the flow-volume capacities.

II. LOCATION

The project is located in the City of Rialto, at the southwest corner of W. Rialto Avenue and S. Linden Avenue.

III. PRE-DEVELOPED SITE CONDITIONS

The existing property consists of an asphalt truck parking lot, with the existing ground sloping north to south. There are two existing parkway drains on S. Linden Ave. that are the means to drainage the site.

IV. POST DEVELOPED SITE CONDITIONS

The site will be a light industrial development, two floors, on a 2.13 acres site, with a new parking lot and landscape and irrigation.

The 2-year-1inch rainfall will be treated by a Contech chamber system consisting of two 48" perforated CMP 84 feet long, that will be located on the southside of the project. Storm drain pipes will be routed to the Contech chamber to infiltrate; then the overflow will be taken to the existing parkway drain on the southeast corner of the site.

V. HYDROLOGY DATA

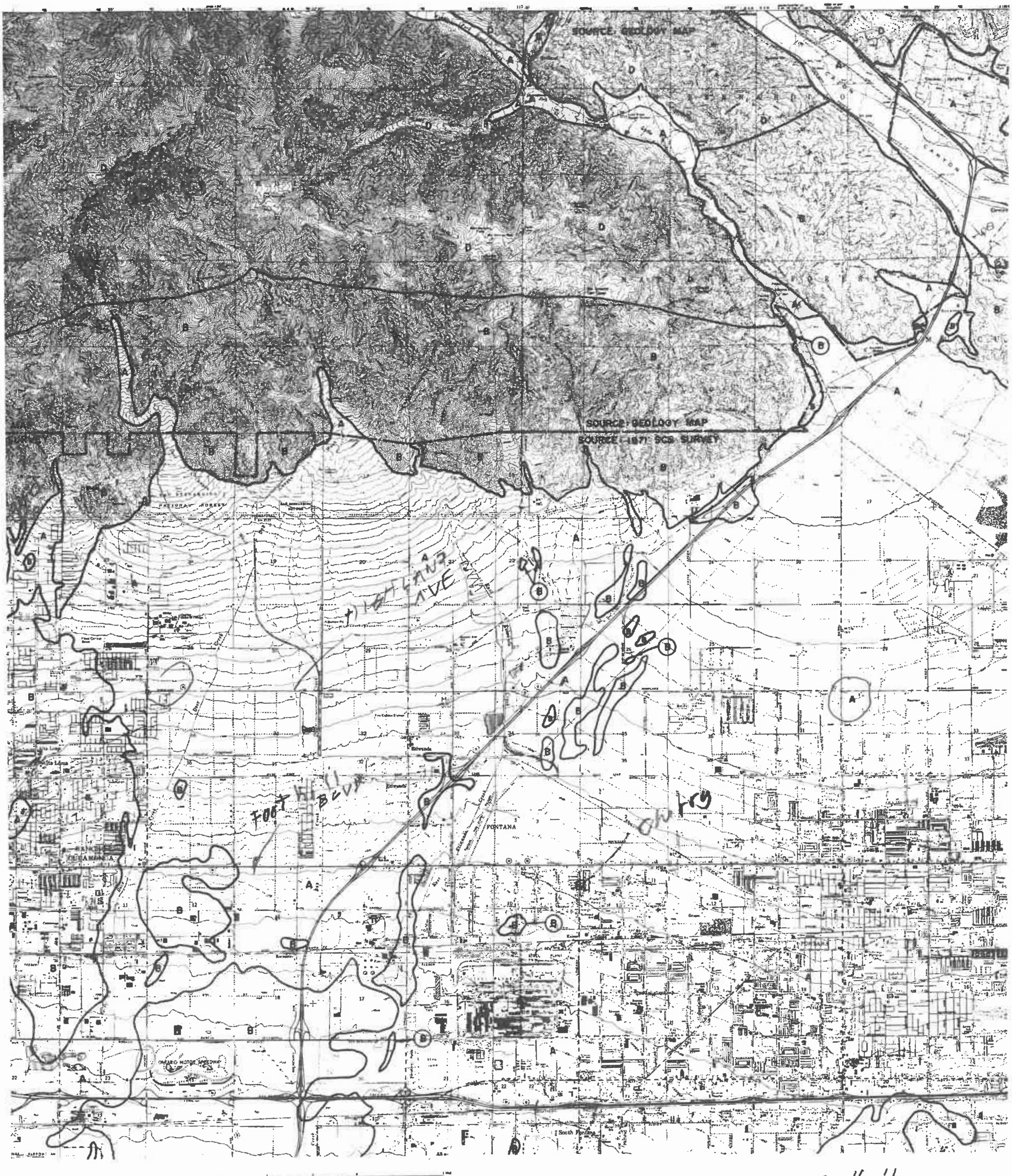
A 100-year rainfall event was used to determine the runoff of the site, along with a Soil Group "A", 1.51-inch 100-year 1hour rainfall, soil antecedent moisture condition of 3, with the support of San Bernardino County Rational, CIVILCADD/CIVILDESIGN software. The results are shown on the Post Development, Hydrology Work Plan.

HYDROLOGY CALCULATIONS

Google Maps S Linden Ave & W Rialto Ave

Imagery ©2024 Airbus, Maxar Technologies, Map data ©2024 Google

LOCATION MAP



HYDRO. SOILGROUP "A"

ROUP BOUNDARY
ROUP DESIGNATION
RY OF INDICATED SOURCE

SCALE REDUCED BY 1/2

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-A AREA

FIGURE C-13

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005
Version 7.1
Rational Hydrology Study Date: 05/21/24

Program License Serial Number 6247

PRE-DEV. SUBAREA 1A

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.510 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 0.000(Ft.) to Point/Station 375.000(Ft.)
**** 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 = 375.000(Ft.)
Top (of initial area) elevation = 1257.200(Ft.)
Bottom (of initial area) elevation = 1250.930(Ft.)
Difference in elevation = 6.270(Ft.)
Slope = 0.01672 s(%)= 1.67
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.376 min.
Rainfall intensity = 5.311(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff = 1.507(CFS)
Total initial stream area = 0.320(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.079(In/Hr)
End of computations, Total Study Area = 0.32 (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

```
              San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

       CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005
Version 7.1
             Rational Hydrology Study        Date: 05/21/24
      -----------------------------------------------------------------
------


      Program License Serial Number 6247
      ---------------------------PRE-DEV. SUBAREA  1B-----------------
------
       *********   Hydrology Study Control Information **********

      -----------------------------------------------------------------
------
      Rational hydrology study storm event year is   100.0
      Computed rainfall intensity:
      Storm year =   100.00   1 hour rainfall =     1.510 (In.)
      Slope used for rainfall intensity curve b =  0.6000
      Soil antecedent moisture condition (AMC) = 3


      +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station       0.000(Ft.) to Point/Station
446.000(Ft.)
      **** 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 =   446.000(Ft.)
      Top (of initial area) elevation =  1257.610(Ft.)
      Bottom (of initial area) elevation =  1249.290(Ft.)
      Difference in elevation =     8.320(Ft.)
      Slope =    0.01865  s(%)=       1.87
      TC = k(0.304)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =    7.735 min.
      Rainfall intensity =      5.162(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
      Subarea runoff =       8.555(CFS)
      Total initial stream area =        1.870(Ac.)
      Pervious area fraction = 0.100
      Initial area Fm value =    0.079(In/Hr)
      End of computations, Total Study Area =           1.87 (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
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 07/09/24

Program License Serial Number 6247 POST 1A

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

```
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00    1 hour rainfall =     1.510 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3
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```
Process from Point/Station       1.000 to Point/Station    2.000
**** INITIAL AREA EVALUATION ****
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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
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 =   394.000(Ft.)
Top (of initial area) elevation =  1257.620(Ft.)
Bottom (of initial area) elevation =  1252.160(Ft.)
Difference in elevation =     5.460(Ft.)
Slope =    0.01386  s(%)=       1.39
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.811 min.
Rainfall intensity =       5.131(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff =       6.185(CFS)
Total initial stream area =         1.360(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)
End of computations, Total Study Area =           1.36 (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

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005
Version 7.1
Rational Hydrology Study Date: 07/09/24

Program License Serial Number 6247 POST 2A

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.510 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 100.000(Ft.) to Point/Station 522.000(Ft.)
**** 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 = 422.000(Ft.)
Top (of initial area) elevation = 1253.000(Ft.)
Bottom (of initial area) elevation = 1250.000(Ft.)
Difference in elevation = 3.000(Ft.)
Slope = 0.00711 s(%)= 0.71
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.176 min.
Rainfall intensity = 4.659(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff = 3.669(CFS)
Total initial stream area = 0.890(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.079(In/Hr)
End of computations, Total Study Area = 0.89 (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

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth **Units:** English **Time series type:** Partial duration

Select location

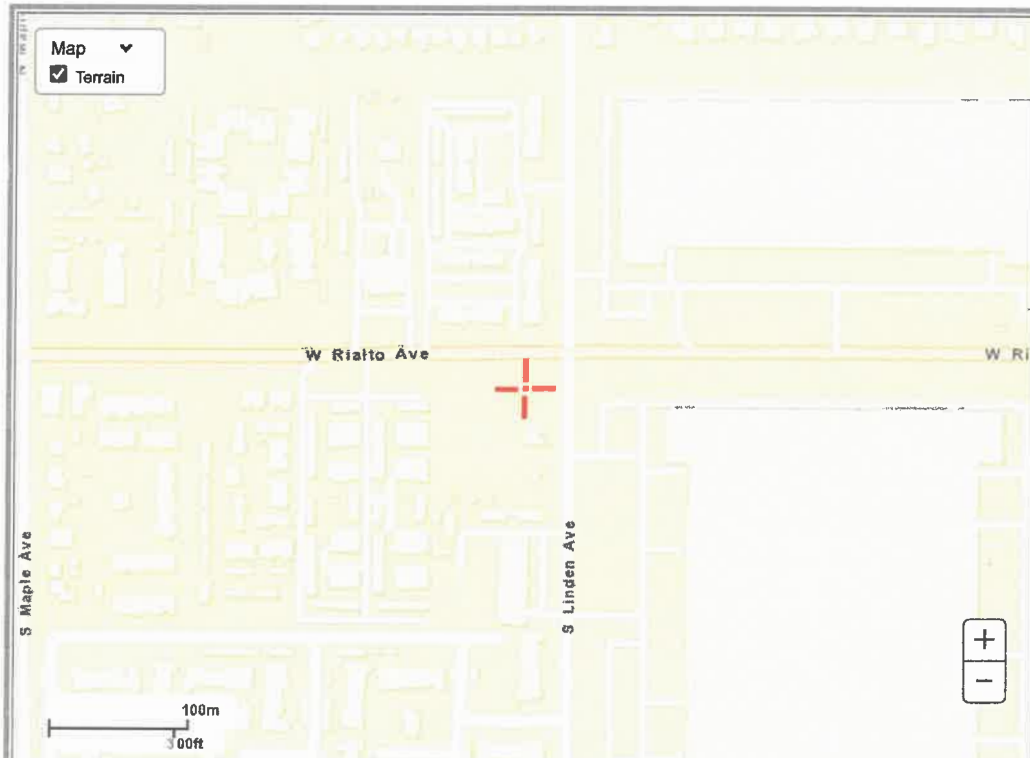
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) By station (list of CA stations): Select station

c) By address W Rialto Ave & N Linden Ave, Fontan:

2) Use map:



a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Fontana, California, USA*
Latitude: 34.0993°
Longitude: -117.4012°
Elevation: 1257 ft **

* Source: ESRI Maps
** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular PF graphical Supplementary information Print page

PDS-based 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	0.122 (0.101-0.148)	0.159 (0.132-0.193)	0.208 (0.172-0.253)	0.248 (0.204-0.305)	0.305 (0.242-0.387)	0.349 (0.271-0.453)	0.395 (0.299-0.526)	0.443 (0.327-0.608)	0.511 (0.361-0.731)	0.565 (0.385-0.838)
10-min	0.174 (0.145-0.212)	0.227 (0.189-0.276)	0.297 (0.247-0.362)	0.356 (0.293-0.437)	0.437 (0.347-0.555)	0.500 (0.389-0.650)	0.566 (0.429-0.754)	0.635 (0.468-0.871)	0.732 (0.517-1.05)	0.810 (0.552-1.20)
15-min	0.211 (0.176-0.256)	0.275 (0.229-0.334)	0.360 (0.298-0.438)	0.430 (0.354-0.529)	0.528 (0.419-0.671)	0.605 (0.470-0.786)	0.684 (0.519-0.912)	0.768 (0.566-1.05)	0.886 (0.625-1.27)	0.980 (0.668-1.45)
30-min	0.315 (0.262-0.382)	0.410 (0.3[illegible])	0.536 (0.445-0.653)	0.641 (0.527-0.788)	0.787 (0.625-1.00)	0.901 (0.701-1.17)	1.02 (0.773-1.36)	1.14 (0.844-1.57)	1.32 (0.932-1.89)	1.46 (0.995-2.17)
60-min	0.465 (0.387-0.564)	0.605 (0.503-0.735)	0.792 (0.657-0.965)	0.947 (0.779-1.16)	1.16 (0.923-1.48)	1.33 (1.04-1.73)	1.51 (1.14-2.01)	1.69 (1.25-2.32)	1.95 (1.38-2.79)	2.16 (1.47-3.20)
2-hr	0.688 (0.573-0.834)	0.888 (0.739-1.08)	1.15 (0.956-1.40)	1.37 (1.13-1.68)	1.67 (1.32-2.12)	1.90 (1.47-2.46)	2.13 (1.62-2.84)	2.38 (1.75-3.26)	2.72 (1.92-3.89)	2.99 (2.04-4.43)
3-hr	0.866 (0.721-1.05)	1.12 (0.927-1.35)	1.44 (1.20-1.76)	1.71 (1.40-2.10)	2.07 (1.64-2.63)	2.35 (1.83-3.05)	2.64 (2.00-3.51)	2.93 (2.16-4.02)	3.34 (2.36-4.78)	3.66 (2.49-5.42)

6-hr	**1.25** (1.04-1.51)	**1.60** (1.33-1.95)	**2.07** (1.72-2.52)	**2.44** (2.01-3.00)	**2.95** (2.34-3.75)	**3.34** (2.59-4.33)	**3.73** (2.82-4.96)	**4.13** (3.04-5.66)	**4.67** (3.30-6.68)	**5.10** (3.47-7.56)
12-hr	**1.68** (1.40-2.03)	**2.16** (1.80-2.63)	**2.79** (2.31-3.40)	**3.29** (2.71-4.04)	**3.96** (3.14-5.03)	**4.46** (3.47-5.80)	**4.97** (3.77-6.62)	**5.48** (4.04-7.52)	**6.17** (4.36-8.83)	**6.70** (4.56-9.94)
24-hr	**2.26** (2.00-2.61)	**2.95** (2.61-3.41)	**3.83** (3.38-4.43)	**4.52** (3.96-5.28)	**5.44** (4.61-6.56)	**6.14** (5.09-7.55)	**6.83** (5.53-8.60)	**7.52** (5.93-9.74)	**8.45** (6.39-11.4)	**9.16** (6.70-12.8)
2-day	**2.76** (2.45-3.18)	**3.67** (3.25-4.24)	**4.84** (4.27-5.60)	**5.79** (5.07-6.75)	**7.06** (5.98-8.51)	**8.03** (6.66-9.88)	**9.01** (7.30-11.4)	**10.0** (7.89-13.0)	**11.4** (8.60-15.3)	**12.4** (9.08-17.3)
3-day	**2.95** (2.61-3.40)	**3.99** (3.53-4.60)	**5.35** (4.72-6.19)	**6.47** (5.66-7.55)	**8.01** (6.78-9.65)	**9.20** (7.63-11.3)	**10.4** (8.44-13.1)	**11.7** (9.21-15.1)	**13.4** (10.2-18.1)	**14.8** (10.8-20.6)
4-day	**3.16** (2.80-3.64)	**4.31** (3.82-4.98)	**5.85** (5.16-6.76)	**7.12** (6.22-8.30)	**8.87** (7.51-10.7)	**10.2** (8.50-12.6)	**11.7** (9.46-14.7)	**13.2** (10.4-17.0)	**15.2** (11.5-20.5)	**16.9** (12.3-23.5)
7-day	**3.60** (3.19-4.15)	**4.97** (4.40-5.74)	**6.80** (6.00-7.86)	**8.32** (7.28-9.70)	**10.4** (8.83-12.6)	**12.1** (10.0-14.9)	**13.8** (11.2-17.4)	**15.6** (12.3-20.2)	**18.2** (13.7-24.5)	**20.2** (14.8-28.2)
10-day	**3.91** (3.46-4.51)	**5.43** (4.80-6.27)	**7.46** (6.58-8.63)	**9.16** (8.01-10.7)	**11.5** (9.75-13.9)	**13.4** (11.1-16.5)	**15.3** (12.4-19.3)	**17.4** (13.7-22.5)	**20.3** (15.3-27.3)	**22.6** (16.5-31.5)
20-day	**4.72** (4.18-5.44)	**6.62** (5.85-7.63)	**9.17** (8.09-10.6)	**11.3** (9.90-13.2)	**14.3** (12.1-17.3)	**16.8** (13.9-20.6)	**19.3** (15.6-24.3)	**22.0** (17.3-28.5)	**25.8** (19.5-34.8)	**28.9** (21.1-40.3)
30-day	**5.56** (4.92-6.40)	**7.80** (6.90-9.00)	**10.8** (9.56-12.5)	**13.4** (11.7-15.6)	**17.1** (14.4-20.5)	**20.0** (16.6-24.6)	**23.1** (18.7-29.1)	**26.4** (20.8-34.2)	**31.1** (23.6-42.0)	**35.0** (25.6-48.9)
45-day	**6.64** (5.88-7.65)	**9.26** (8.19-10.7)	**12.8** (11.3-14.9)	**15.9** (13.9-18.5)	**20.2** (17.1-24.4)	**23.7** (19.7-29.2)	**27.5** (22.3-34.6)	**31.5** (24.8-40.8)	**37.3** (28.3-50.4)	**42.1** (30.8-58.8)
60-day	**7.75** (6.86-8.93)	**10.7** (9.48-12.4)	**14.8** (13.0-17.1)	**18.3** (16.0-21.3)	**23.2** (19.7-28.0)	**27.3** (22.6-33.6)	**31.6** (25.6-39.8)	**36.3** (28.6-47.1)	**43.2** (32.7-58.2)	**48.8** (35.7-68.1)

[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.

Estimates from the table in CSV format: Precipitation frequency estimates ⌄ Submit

HYDRAULIC CALCULATIONS

Andreasen Engineering, Inc.
195 N. Euclid Ave., Suite 101
Upland, California 91786
(909)623-1595

```
          |<--------(   4.00')---------->|
          |                              |
* * * * * *                              * * * * *
        * *                              * *
        * *^^^Water Surface (   0.50')^^^* *
        * *                              * *
        * *                              * *
        * *                              * *
        * * * * * * * * * * * * * * * * * *
        * * * * * * * * * * * * * * * * * *
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PARKWAY DRAIN CAPACITY
DOWN STREAM SIDE

Rectangular Open Channel

Flowrate	20.519	CFS → CALC> Q_{1A+2A} = 9.86 CFS OK
Velocity	10.260	fps
Depth of Flow	* 0.500	feet
Critical Depth	0.935	feet
Total Depth	0.500	feet
Base Width	* 4.000	feet
Slope of Channel	* 3.170	%
X-Sectional Area	2.000	sq. ft.
Wetted Perimeter	5.000	feet
AR^(2/3)	1.086	
Mannings 'n'	* 0.014	

* GIVEN

CONTECH SYSTEM

ANDREASEN ENGINEERING, INC.
195 N. Euclid Ave., Suite 101
Upland, California 91786
(909) 623-1595

JOB
SHEET NO. OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Lord Construction, Rialto, CA

Infiltration Rate 12.17in/hr. (Soils Southwest, Inc.) with safety factor of to 5.

12.17 in/hr. X (1/5) X (1 ft/12in) X 72Hrs (drawdown)=14.60 ft (infiltration test taken at 15')

Contech Area

$V_{2yr\text{-}1hr}$ =8505 cu.ft.- Target Volume (from San Bernardino Storm Water Santa Ana Watershed Calc.)

Contech Gravel Rectangular Footprint (shown on DYODS): 11'x84'

11 x 84' x 0.40(rock voids) X 14.60'=5396 cu.ft.

Storage in Contech = 3130 cu.ft.

Total Volume=8526 cu.ft. >8505 cu.ft. Ok

Use 2 roll of barrel of 48" CMP @ 11' x 84' Gravel Rectangular Footprint.

Andreasen Engineering, Inc.
Stephen Ventura
Vice-President

DYODS™
Design Your Own Detention System

CONTECH® Construction Products Inc.

CONTECH® CMP DETENTION SYSTEMS

For design assistance, drawings, and pricing send completed worksheet to:
dyods@contech-cpi.com

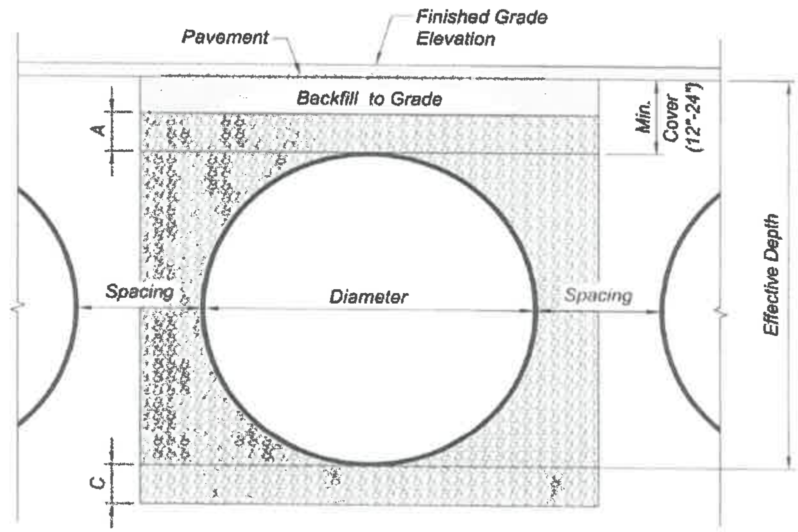
Project Summary

Date:	7/9/2024
Project Name:	Lord Construction
City / County:	City of Rialto
State:	CA
Designed By:	Stephen
Company:	Andreasen Engineering, Inc.
Telephone:	909-523-1592

Enter Information in Blue Cells

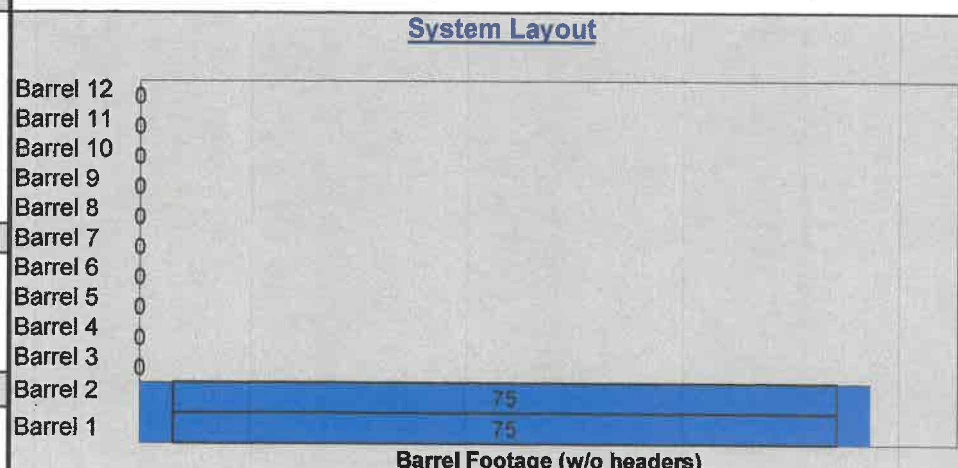
Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	3,100	
Limiting Width (ft):	15.00	
Invert Depth Below Asphalt (ft):	13.00	
Solid or Perforated Pipe:	Perforated	
Shape Or Diameter (in):	48	12.57 ft^2 Pipe Area
Number Of Headers:	2	
Spacing between Barrels (ft):	2.00	
Stone Width Around Perimeter of System (ft):	0.5	
Depth A: Porous Stone Above Pipe (in):	6	
Depth C: Porous Stone Below Pipe (in):	6	
Stone Porosity (0 to 40%):	40	



System Sizing

Pipe Storage:	2,136	cf	
Porous Stone Storage:	993	cf	
Total Storage Provided:	3,130	cf	101.0% Of Required Storage
Number of Barrels:	2	barrels	
Length per Barrel:	75.0	ft	
Length Per Header:	10.0	ft	
Rectangular Footprint (W x L):	11. ft x 84. ft		



CONTECH Materials

Total CMP Footage:	170	ft
Approximate Total Pieces:	10	pcs
Approximate Coupling Bands:	10	bands
Approximate Truckloads:	2	trucks

Construction Quantities**

Total Excavation:	445	cy
Porous Stone Backfill For Storage:	92	cy stone
Backfill to Grade Excluding Stone:	274	cy fill

***Construction quantities are approximate and should be verified upon final design*

ANDREASEN ENGINEERING, INC.
195 N. Euclid Ave., Suite 101
Upland, California 91786
(909) 623-1595

JOB
SHEET NO. OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

San Bernardino Storm Water Program
Santa Ana Watershed

Lord Construction, City of Rialto, CA.
San Bernadino Storm Program

1) Composite i=[(1.74)(1)+(0.39)(0.02)]/2.13=0.82
Impervious Area:1.74 ac.
Pervious Area: 0.39ac.
Total Area: 2.13ac.
2) 2year-1hr Rainfall: 0.605" (Ref. NOAA Atlas 14)
A. Flow- Based BMP Design

1) **CBMP**=0.858i^3-0.78i^2 + 0.774i + 0.04
0.858(0.82)^3-0.78(0.82)^2+0.774(0.82) +0.04=0.62
2) Region BMP Drainage Area: **Valley, I=0.2787**, Table D-1
3) Determine IBMP: 0.605"x 0.2787=0.17, Factor of Safety 2, IBMP 0.085
4)Calculate Q=CBMP x IBMP x A
Entire Area: Q=0.62x0.085x2.13=0.11 cfs,

B. Volume - Based BMP Design
3)Regional Drainage Area: Valley
4) 6-Hour Mean Storm Fall, P6
P6=1.4807, 2yr-1hr. 0.605": 1.4807 x 0.605" =0.90"
5) Determine the Appropriate Drawdown Time
a= 1.963 for 48 hours
6) Maximum Detention Volume, P0
PO=a x CBMP x P6= 1.963 x 0.62 x 0.90=1.1"
7) Target Volume, VO
VO= (PO X A)/12=(1.1X2.13)/12=0.195ac-ft or 8505c.f.

Andreasen Engineering, Inc.
Stephen Ventura, RCE
Vice-President

ANDREASEN ENGINEERING, INC.
195 N. Euclid Ave., Suite 101
Upland, California 91786
(909) 623-1595

JOB

SHEET NO. OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

W.Rialto Ave. & Linden Ave.
JN 3747 Lord.

Total Area: 92664 Sq.Ft. or 2.13 ac

Composite imprevious percentage

Landscape Area		Impervious Percentage
Sq.Ft.	Ac.	
17062	0.39	2

Bldg., A.C Pavement		Impervious Percentage
75602	1.74	100

(17602*0.02)+(1*75602)/92664=0.82

Attachment D
Flow- and Volume-Based BMP Design Calculations
Revised May 1, 2012

INSTRUCTIONS FOR ESTIMATING VOLUME- AND FLOW-BASED BMP DESIGN RUNOFF QUANTITIES[4]

1) Identify the "BMP Drainage Area" that drains to the proposed BMP element. This includes all areas that will drain to the proposed BMP element, including pervious areas, impervious areas, and off-site areas, whether or not they are directly or indirectly connected to the BMP element. Calculate the BMP Drainage Area (A) in acres.

2) Outline the Drainage Area on the NOAA Atlas 14 Precipitation Depths (2-year 1hour Rainfall) map (Figure D-1).

3) Determine the area-averaged 2-year 1-hour rainfall value for the Drainage Area outlined above.

A. Flow-Based BMP Design

1) Calculate the composite runoff coefficient, CBMP, as defined in part B.2, below.

2) Determine which Region the BMP Drainage Area is located in (Valley, Mountain or Desert).

3) Determine BMP design rainfall intensity, IBMP, by multiplying the area-averaged 2-year 1-hour value from the NOAA Atlas 14 map by the appropriate regression coefficient from Table D-1 ("I"), and then multiplying by the safety factor specified in the criteria—usually a factor of 2.

---

[4] Rainfall analysis to develop regression coefficients in Table D-1 and modifications to the NOAA Atlas 14 map were conducted by:

Hromadka II, T.V., Professor Emeritus, Department of Mathematics, California State University, Fullerton, and Adjunct Professor, Department of Mathematical Sciences, United States Military Academy, West Point, NY

Laton, W.R , Assistant Professor, Department of Geological Sciences, California State University, Fullerton

Picciuto J.A.., Assistant Professor, Department of Mathematical Sciences, United States Military Academy, West Point, NY

With assistance from:

Rene Perez, M.S. Candidate, Department of Geological Sciences, California State University, Fullerton, and

Jim Friel, Ph.D. Professor Emeritus, Department of Mathematics, California State University, Fullerton

Reported as follows:

1. Hromadka II, T.V., Laton, W.R., and Picciuto J.A., 2005. Estimating Runoff Quantities for Flow and Volume-based BMP Design. Final Report to the San Bernardino County Flood Control District.

2. Laton, W.R., Hromadka II, T.V., and Picciuto J.A., 2005. Estimating Runoff Quantities for Flow and Volume-based BMP Design (submitted). Journal of the American Water Resources Association.

4) Calculate the target BMP flow rate, Q, by using the following formula (see Table D-2 below for limitations on the use of this formula):

$$Q = CBMP \cdot IBMP \cdot A$$

where: Q = flow in ft^3/s

IBMP = BMP design rainfall intensity, in inches/hour

A = Drainage Area in acres

CBMP = composite runoff coefficient

Table D-1: Regression Coefficients for Intensity (I) and 6-hour mean storm rainfall (P6).

Quantity	Valley 85% upper confidence limit	Mountain 85% upper confidence limit	Desert 85% upper confidence limit
I	0.2787	0.3614	0.3250
P6	1.4807	1.9090	1.2371

Table D-2: Use of the flow-based formula for BMP Design (CASQA 2003).

	Composite Runoff Coefficient, "C"			
BMP Drainage Area (Acres)	**0.00 to 0.25**	**0.26 to 0.50**	**0.51 to 0.75**	**0.76 to 1.00**
0 to 25	**Caution**	**Yes**	**Yes**	**Yes**
26 to 50	**High Caution**	**Caution**	**Yes**	**Yes**
51 to 75	**Not Recommended**	**High Caution**	**Caution**	**Yes**
76 to 100	**Not Recommended**	**High Caution**	**Caution**	**Yes**

If the flow-based BMP formula use case, as determined by Table D-2, shows "Caution," "High Caution," or "Not Recommended," considering the project's characteristics, then he project proponent must calculate the BMP design flow using the unit hydrograph method, as specified in the most current version of the San Bernardino County Hydrology Manual, using the design storm pattern with rainfall return frequency such that the peak one hour rainfall depth equals the 85th-percentile 1-hour rainfall multiplied by two.

B. Volume-Based BMP Design

1) Calculate the "Watershed Imperviousness Ratio", i, which is equal to the percent of impervious area in the BMP Drainage Area divided by 100.

2) Calculate the composite runoff coefficient CBMP for the Drainage Area above using the following equation:

$$\mathbf{CBMP = 0.858i^3 - 0.78i^2 + 0.774i + 0.04}$$

where: **CBMP** = composite runoff coefficient; and,

i = watershed imperviousness ratio.

3) Determine which Region the Drainage Area is located in (Valley, Mountain or Desert).

4) Determine the area-averaged "6-hour Mean Storm Rainfall", P6, for the Drainage Area. This is calculated by multiplying the area averaged 2-year 1-hour value by the appropriate regression coefficient from Table 1. (D-1)

5) Determine the appropriate drawdown time. Use the regression constant a = 1.582 for 24 hours and a = 1.963 for 48 hours. *Note: Regression constants are provided for both 24 hour and 48 hour drawdown times; however, 48 hour drawdown times should be used in most areas of California. Drawdown times in excess of 48 hours should be used with caution as vector breeding can be a problem after water has stood in excess of 72 hours. (Use of the 24 hour drawdown time should be limited to drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.)*

6) Calculate the "Maximized Detention Volume", P0, using the following equation:

$$\mathbf{P0 = a \cdot CBMP \cdot P6}$$

where: **P0** = Maximized Detention Volume, in inches

a = 1.582 for 24 hour and a = 1.963 for 48 hour drawdown,

CBMP = composite runoff coefficient; and,

P6 = 6-hour Mean Storm Rainfall, in inches

7) Calculate the "Target Capture Volume", V0, using the following equation:

$$\mathbf{V0 = (P0 \cdot A) / 12}$$

where: **V0** = Target Capture Volume, in acre-feet

P0 = Maximized Detention Volume, in inches; and,

A = BMP Drainage Area, in acres

GEOTECHNICAL REPORT

SOILS SOUTHWEST, INC.
SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS
897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

Report of Soil Infiltration Tests
Planned WQMP-BMP Storm Water Infiltration Disposal System

Planned Office/Warehouse
1527 Rialto Avenue w/o Linden Avenue, Rialto
APN: 0246-201-51

Project No. 24021-BMP

May 30, 2024

Prepared for:

Lord Constructors, Inc.
c/o Mr. Gregg Lord
1920 West Eleventh Street
Upland, CA 91786

soilssouthwest@aol.com
Established 1984

SOILS SOUTHWEST, INC.

SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

May 30, 2024 Project No. 24021-BMP

Lord Constructors, Inc.
1920 West Eleventh Street
Upland, CA 91786

Attention: Mr. Gregg Lord

Subject: Report of Soil Infiltration Tests
Planned WQMP-BMP Storm water Infiltration Disposal System
Planned Office/Warehouse
1527 Rialto Avenue w/o Linden Avenue, Rialto
APN: 0246-201-51

Reference: 1. Site Plan by Bonadiman & Associates
2. Riverside County Low Impact Development BMP Design Handbook &
San Bernardino County Technical Guidance Document for Water Quality Management Plans Handbook

Gentlemen:

Presented herewith are the results of soils infiltration testing for the proposed WQMP-BMP stormwater Infiltration Basin design planned for the proposed site improvements to the existing Horsepower Ranch maintenance and equipment yard facility.

In general, the WQMP-BMP evaluations consisted of two (2) soil infiltration test borings, P-1 and P-2 within the general test locations as described in the development plan supplied (advanced to approximately 15 feet below the existing grade surface, respectively. The deeper boring evaluation was advanced to about 25 feet below grade to identify presence or absence of shallow-depth groundwater and shallow-depth impermeable layer, if any. Subsequent soils infiltration testing is performed using the standardized "falling-head" test methods, with the observed soil percolation rate being converted to infiltration rates using Porchet Method as per the guidelines of the Table 1, Infiltration Basin Option 2 method as described in the Appendix A of the Riverside County-Low Impact Development (LID) BMP design Handbook and as per the Appendix VII, Section VII.3.8.2: Infiltration Rate Evaluation Protocols as described in the San Bernardino County Technical Guidance Document for Water Quality Management Plans Handbook. Approximate test locations are shown on the attached Plate 1.

The soils encountered consist, in general, of upper 5 feet of consists of dry fine to coarse sands with some silts overlying gravel sand mixtures with fine to coarse sands, rocks and cobbles to the proposed infiltration design system bottom of 15 feet below existing grade surface. For the exploratory deep boring (B-1), the soils primarily consist of upper 5 feet of medium to coarse gravely sands overlying variegating layers of gravels and gravel sand mixtures with rocks and cobbles to the maximum depth of 25 feet explored. Test exploration logs are described in the Log of Borings P-1, P-2, and B-1, attached. No shallow-depth groundwater or layers considered impermeable to water was encountered.

Based on the testing completed, it is our opinion that the observed infiltration rates are 12.17 in/hr and 12.71 inch/hr. for the test locations P-1 and P-2 respectively as described in Table II, Section 3.0 of this report.

For design an appropriate safety factor to the observed rate should be considered as selected by the project design engineer.

We offer no other warranty express or implied.

Respectfully submitted,
Soils Southwest, Inc.

Moloy Gupta, RCE 31708

REGISTERED PROFESSIONAL ENGINEER
MALAY K. GUPTA
No 31708
Exp. 12-31-24
CIVIL
STATE OF CALIFORNIA

John Flippin, Project Supervisor

1.0 EXCAVATED TEST EXPLORATIONS

BMP soil percolation testing is performed at about 15 feet below grade for the test locations P-1 and P-2 respectively. An additional test boring (B-1) advanced to approximately 25 feet below grade surface is included primarily to identify presence or absence of groundwater and shallow depth bedrock, if any. The test explorations described are made using an 8-inch diameter hollow-stem auger drill rig for the test locations as shown on accompanying Plate 1. Water used during infiltration percolation testing is supplied by using a portable water jugs.

2.0 METHODOLOGY AND TEST PROCEDURES:

Following test boring completion, each of the test holes were fitted with perforated pvc pipes, underlain by 2-inch crushed rock at the bottoms to minimize potentials for scouring and caving. As per the handbook, for testing and to establish test intervals, each test hole was initially filled with 24-inch of water supplied as described.

During initial testing, since 6-inch or more water seeped away in 25 minutes or less, subsequent percolation testing was performed at 10-minute time intervals for minimum one (1) hour, or until the soil percolation rates became relatively consistent for test borings. Actual testing included water placement at about 13 feet below the existing grade surface (inlet depth) or 24 inches above proposed infiltration chamber bottoms.

The final 10-minute recorded percolation test data were converted to an Infiltration Rate (I_t) in inches per hour using the "Porchet Method" equation as described in the Reference 2, Riverside County Low Impact Development BMP Design Handbook and San Bernardino County Technical Guidance Document for Water Quality Management Plans Handbook. The logs of soil percolation rates, along with the log for the deep test exploration and necessary calculations, are attached.

3.0 INFILTRATION TEST RESULTS

Based on the testing completed at the test locations and to the test depth described, it is our opinion that the observed soil *infiltration* rates are 12.17 in/hr and 12.71 inch/hr. for the test locations P-1 and P-2 respectively. Calculations to convert the standardized "falling head" percolation rates to "infiltration" rates were in accordance with the Section 2.3 of the referenced County Handbooks are described in the following Table I and II. *It is suggested that in design, use of an appropriate safety factor should be used to the observed rates as selected by the design engineer.*

3.1. Conversion Summary and Calculations

TABLE I

Based on the testing completed, the following describes the observed field percolation rates for WQMP-BMP converted to soils design infiltration rate as per the referenced design handbooks. Actual field test data are attached.

Infiltration Rate for BMP Design

Test Date & Test No. (5-28-2024)	Relative Site Location	Test Depth (ft.) Below Grade	Observed Soil Percolation Rates (inch/hour.)	Design Infiltration Rates following Conversion of Soil Percolation Rates using Porchet Method (with no Factor of Safety)
P-1	SW	15	17.5	12.17
P-2	NE	15	18.0	12.71

TABLE II

Conversion Table (Porchet Method)

Test No.	Depth Test (inches)	Time Interval	Initial Depth (inch)	Final Depth (inch)	Initial Water Height (inch)	Final Water Height (inch)	Change in Height/ Time	Average Head Height/Time
	D_T	ΔT (Min)	D_O (in)	D_f (in)	$H_o=D_t-D_o$	$H_f=D_t-D_f$	$\Delta H= H_f-H_O$	$H_{avg} = (H_o+H_f)/2$
P-1	180	10	156	173.5	24.0	6.5	17.5	15.25
P-2	180	10	156	174.0	24.0	6.0	18.0	15.0

Test No.	Observed Infiltration Rate (It)=ΔH60r/Δt(r+2Havg)		
	A	B	C (Factor of Safety not included)
	ΔH60r	Δt(r+2Havg)	A/B=in/hr
P-1	4200	345	12.17
P-2	4320	340	12.71

In design, use of an appropriate safety factor should be considered to account for long-term saturation, inconsistencies in subsoil conditions, along with the potential for silting of percolating soils.

The infiltration rates described are based on the in-situ testing completed at the locations as suggested by the project civil engineer. In the event the test locations and the test depths described vary considerably supplemental soils infiltration testing may be warranted.

It should be noted that over prolong use and lack of maintenance the detention/infiltration basins or deep chambers constructed based on the suggested design rate may experience much lower infiltration rates due to the accumulation of silts, fines, soils, and others. Regular maintenance of the chambers in the form of removal of debris, oil and fines are strongly recommended. A maintenance record of such is suggested for future use, if any.

Suggested Requirements for Standard Stormwater BMP Installation

The invert of stormwater infiltration should be set at least 10 feet above the groundwater elevation and should not be placed on steep slopes to create conditions for slopes instability.

When adequately installed, it is our opinion that the Stormwater infiltration systems installed should not increase the potentials for static or seismic settlement of structures.

Stormwater infiltration installed should not place an increased surcharge on structures or foundations on or its adjacent. The pore water pressure should not increase the soils retained by retaining structures.

The invert of stormwater infiltration should be set back at least 15 feet and outside a 1:1 plan drawn up from the bottom of adjacent foundations.

Stormwater infiltration should not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill.

Stormwater infiltration systems should not be allowed within 100 feet of any potable groundwater production well.

Once installed, regular maintenance of the detention systems is recommended.

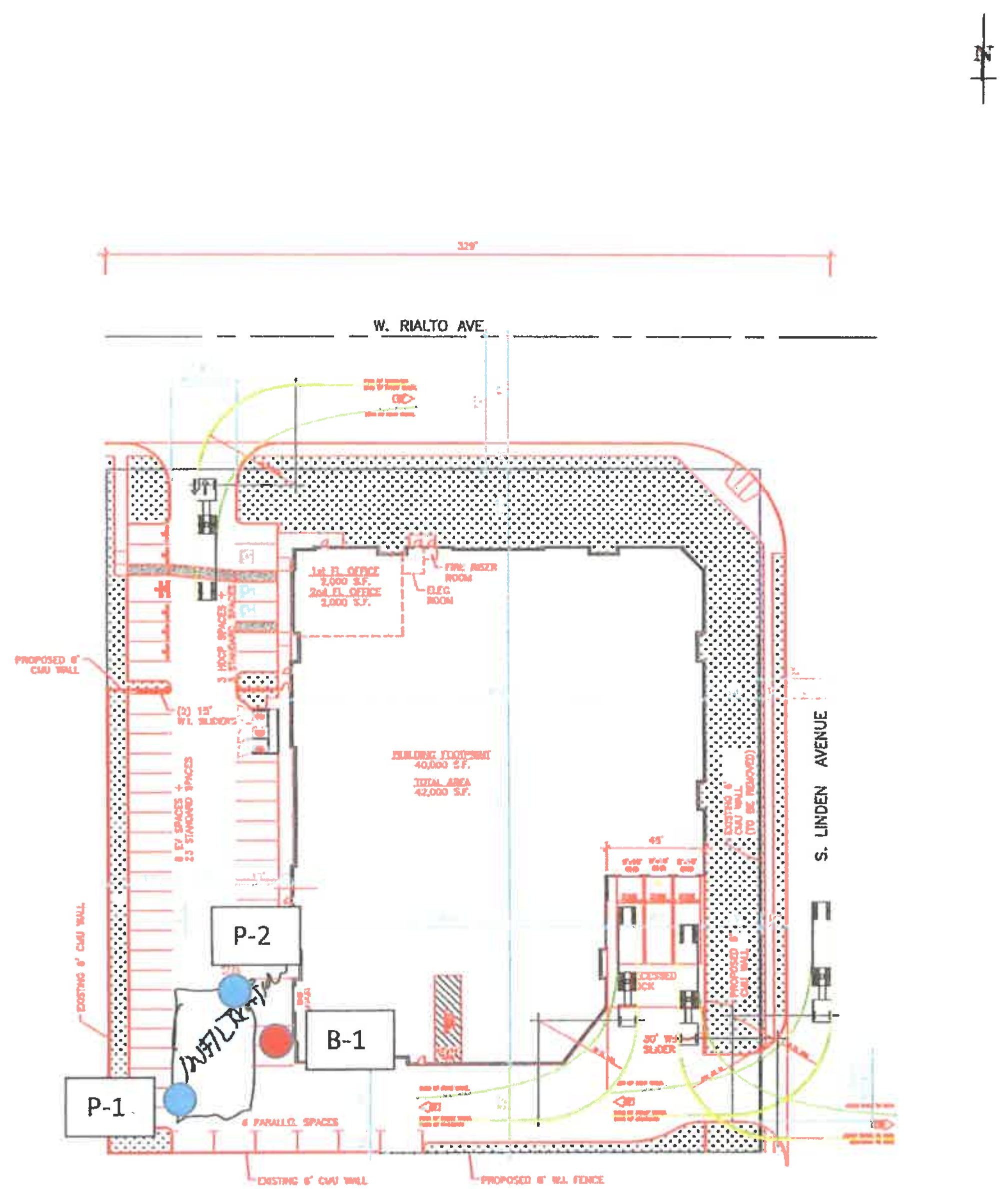
Stormwater infiltration shall not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill.

Stormwater infiltration is not allowed within 100 feet of any potable groundwater production well.

Once installed, regular maintenance of the installed systems should be considered.

PLOT PLAN AND TEST LOCATIONS
Planned Office/Warehous
1527 Rialto Avenue, Rialto, California
APN: 0246-201-51

(Schematic, not to scale)



Legend: P-1 Approximate Location of BMP Testing
B-1 Approximate Location of Deep Boring

Plate 1

LOG OF TEST BORINGS

PERCOLATION TEST DATA

And

LABORATORY ANALYSES

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-1

Project: Lord Constructors		**Job No.:**	24021-BMP
Logged By: John F.	**Boring Diam.:** 8" HSA	**Date:**	May 28,2024

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			disturbed soils and gravels with scattered weeds and debris
								SAND - brown, gravely, medium to coarse, rock fragments, rocks, damp
					GP-SP		5	GRAVELS and SAND mixture, medium coarse sands with rock fragments, rocks, occasional cobbles
							10	
					GP		15	GRAVELS with little to no sands
					GP-SP		20	GRAVEL and SAND mixture-fine to coarse with traces of silt, fine to coarse, rock fragments, rocks, cobbles
	Bulk/Grab				GP		25	GRAVELS with little to no sand material
								- End of exploratory test boring @ 25 ft. - no bedrock - no groundwater
							30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: n/a

Site Location

Planned Office/Warehouse
1527 Rialto Avenue
Rialto, California

Plate #

Bulk/Grab sample

KEY TO SYMBOLS

Symbol Description

Strata symbols

Poorly graded sand with silt

Silty sand

Poorly graded gravel and sand

Poorly graded sand

Poorly graded gravel

Soil Samplers

Bulk/Grab sample

Notes:

1. Exploratory borings were drilled on May 28,2024 using a 4-inch diameter continuous flight power auger.

2. No free water was encountered at the time of drilling or when re-checked the following day.

3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

Conversion Table (Porchet Method)
Lord Constructors
1527 Rialto Avenue, Rialto
Project No. 24021-BMP

Test No. no.	Test Hole Depth (inches) D_T	Time Interval Δ_T	Initial Depth (inches) D_O (in)	Final Depth (inches) D_f (in)	Initial Water Height (inches) $H_O = D_T - D_O$	Final Water Height (inches) $H_f = D_T - D_f$	Change Height/Time $\Delta H/\Delta D = H_O - H_f$	Average Head Height/Time $H_{avg} = (H_O + H_f)/2$
P-1	180	10	156	173.5	24	6.5	17.5	15.25
P-2	180	10	156	174	24	6	18	15

	Observed Infiltration Rate (It) = ΔH60r/Δt (r+2Havg)		
	A	B	C
	ΔH60r	$\Delta t\ (r+2H_{avg})$	A/B= inch/hr
P-1	4200	345	**12.17**
P-2	4320	340	**12.71**

Legend

Δ H/ΔD = Observed Field Rate

H_O = inches of water filled from bottom

D_O = initial height of water (inches) from bottom

D_f = final heigh of water (inches) from bottom

Columns A-B-C : Porchet Conversion Calculations

Column C: Observed Rate following Porchet Conversion

D_t = depth of test hole bottom (inches)

Percolation Test Data Sheet

Project: Lord Constructors 1527 Rialto Ave. Rialto			Project No. 24021-BMP	
Test Hole No:	P-1		Tested By: RM	Date: 5/28/24
Depth of Test Hole, D_T	180	15 ft	USCS Soil Classification	South West
Test Hole Dimensions (inches)			Length	Width
Diameter (if round)=	8.0 in.	Sides (if rectangular)=		

Sandy Soil Criteria Test *

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Greater Than or Equal to 6.0 inches??? (Y/N)
1	12:15	12:40	25	156	180	24	Y
2	12:42	1:07	25	156	180	24	Y

* If two consective measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fiill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25."

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	ΔT/ΔD Percolation Rate (min./in.)
1	1:08	1:18	10	156	176.75	20.75	0.49
2	1:19	1:29	10	156	176	20.0	0.5
3	1:31	1:41	10	156	175.5	19.5	0.51
4	1:43	1:53	10	156	175.25	19.25	0.52
5	1:55	2:05	10	156	174.5	18.5	0.54
6	2:07	2:17	10	156	174.5	18.5	0.54
7	2:19	2:29	10	156	173.75	17.75	0.56
8	2:31	2:41	10	156	173.5	17.5	0.57
9	2:44	2:54	10	156	173.5	17.5	0.57
10	2:56	3:06	10	156	173.5	17.5	0.57
11							
12							
13							
14							
15							
16							
17							
18							

Comments

Percolation Test Data Sheet

Project: Lord Constructors 1527 Rialto Ave. Rialto			Project No. 24021-BMP		
Test Hole No:	P-2		Tested By: RM		Date: 5/28/24
Depth of Test Hole, D_T	180	15 ft	USCS Soil Classification		
Test Hole Dimensions (inches)				Length	Width
Diameter (if round)=	8.0 in.	Sides (if rectangular)=			

Sandy Soil Criteria Test *

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Greater Than or Equal to 6.0 inches??? (Y/N)
1	12:17	12:42	25	156	180	24	Y
2	12:44	1:09	25	156	180	24	Y

* If two consective measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fiill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25."

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	ΔT/ΔD Percolation Rate (min./in.)
1	1:10	1:20	10	156	179.50	23.5	0.42
2	1:22	1:32	10	156	178.75	22.75	0.44
3	1:33	1:43	10	156	177.75	21.75	0.46
4	1:46	1:56	10	156	177.75	21.75	0.47
5	1:57	2:07	10	156	176.5	20.5	0.49
6	2:09	2:19	10	156	176.5	20.5	0.49
7	2:21	2:31	10	156	175.75	19.75	0.51
8	2:34	2:44	10	156	175.0	19.0	0.53
9	2:47	2:57	10	156	174.5	18.5	0.54
10	3:01	3:11	10	156	174.0	18.0	0.56
11	3:12	3:22	10	156	174.0	18.0	0.56
12	3:23	3:33	10	156	174.0	18.0	0.56
13							
14							
15							
16							
17							
18							

Comments

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)			
1 Remaining LID DCV not met by site design BMP (ft³): *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	12.17	12.71	
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, SA_{BMP} (ft²) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity			
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Above Ground Retention Volume (ft³) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Underground Retention Volume (ft³) *Volume determined using manufacturer's specifications and calculations*			
16 Total Retention Volume from LID Infiltration BMPs: *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: % *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☐ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

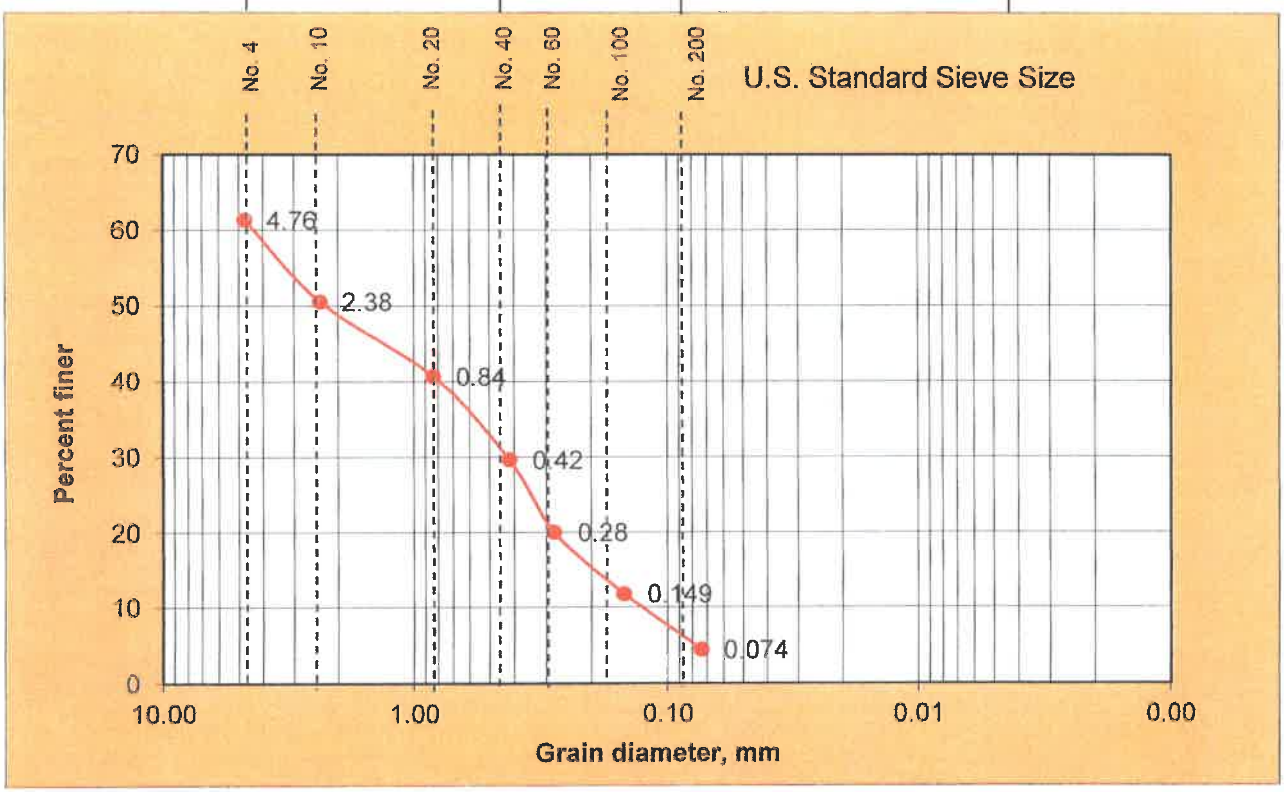
GRAIN SIZE DISTRIBUTION ASTM D422

Project: Lord Constructors **Job #** 24021-BMP
Location: 1527 Rialto Avenue, Rialto **Boring No:** P-1 @ 15' **Sample No:** 1
Description of Soil: GP-SP
Date of Sample: 5/28/2024
Tested By: JG **Date of Testing:** 5/29/2024

Sieve No.	Sieve Openings in mm	Percent Finer
4	4.76	61.42
10	2.38	50.60
20	0.84	40.70
40	0.42	29.70
60	0.28	20.06
100	0.149	11.82
200	0.074	4.40

Grain Size	% Retained
Gravel	39
Med. to Crs	29
Fines	26
Silts	6

Gravel	Sand		Silt	Clay
	Coarse to Medium	Fine		



Visual Soil Description : GRAVEL SAND mixture with more gravels (rocks and cobbles) with fine to very coarse sands

Soil Classification: GP-SP

System: USC

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