Appendix F

Drainage Study

DRAINAGE STUDY

FOR

FONTANA SQUARE

CITY OF FONTANA, CALIFORNIA

PREPARED BY:

ACE DESIGN LLC,

1024 IRON FRONT ROAD

FOLSOM, CA 95630

AUGUST 07, 2021

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DRAINAGE STUDY

1. INTRODUCTION:

The Scope of this drainage study is to quantify the Water Quality Control Volume required by the project site and propose the Bio retention basins of the required capacity to treat the storm runoff. The rainfall to be considered for calculation of the Water Quality Control Volume is based on mean 6-hr precipitation. Water Quality volume is calculated based on the City of Fontana, San Bernardino County Stormwater Program. Rainfall, Runoff Coefficient, Drainage Management Area and Water Quality Volume are calculated in the following sections.

2. SITE DESCRIPTION:

The proposed Commercial Development site is located south of Route 210, north of S Highland Avenue, West of Catawba Avenue and east of Citrus Avenue in City of Fontana, California as shown on the Vicinity Map, refer Appendix 1. The total area of the site is 386644 sf (8.876 acres). A Banquet Hall (1 story), Holiday Inn Express Hotel & Suites (104 rooms, 5 story), Staybridge Suites (117 rooms, 5 story), Restaurant (1 story) and an In-n-out Burger Store (1 story) are proposed here.

There is an existing eccentric Cul-d-sac from Route-210 and power lines passing through the project site. The City will relocate the Cul-d-sac and power lines out of the project boundary.

3. AREA BREAKUP:

The proposed site plan consists of total paved area of 250,295 sf (5.746 acres), total landscape area of 74,248 sf (1.70 acres) and building footprint of 62,130 sf (1.43 acres).

4. TOPOGRAPHY:

In present condition, the site is undeveloped and majority of the site drains in south direction and there is an average fall of around 8-10 feet through the width of the site towards South Highland Avenue. South Highland Avenue slopes from east to west. There is an existing public storm drain facility on southeast corner of the site in Citrus Avenue, however there are no public storm drain facilities in South Highland Avenue.

5. RAINFALL:

Rainfall depth is used for calculation of Mean 6-hr precipitation as per NOAA Atlas 14, Volume 6, and Version 2. For LID BMP Design Capture Volume (DCV), the San Bernardino

County Stormwater Program requires use of the P_6 method (MS_4 Permit Section XI.D.6a. ii) – Form 4.2-1.

Mean 6-hr precipitation is calculated as:

$$P_6 = (P_{2yr\text{-}1hr}) * C_1,$$

where C_1 is a function of site climatic region, for valley = 1.4807, mountain = 1.909 and for desert = 1.2371.

Mean 6-hr precipitation (P_6) value comes 0.684 inches.

6. COEFFICIENT OF RUNOFF:

The coefficient of runoff has been calculated by using the following formula, for the calculation of design capture volume.

$$R_c = 0.858(Imp\%)^3 - 0.78(Imp\%)^2 + 0.774(Imp\%) + 0.04$$

where Imp% is the Imperviousness after applying preventive site design practices.

7. DRAINAGE MANAGEMENT AREA:

During earlier discussions held with the City, City informed to route majority of overflow from Retention basins from the site to the existing public storm drainage facility on southeast corner of the site. The grading for the project site and Bio Retention basins are planned in such a way that overflow from Bio Retention basins from two third of the site area is routed to the existing storm drain manhole, located in the South-East corner of the site on Citrus avenue via a network of onsite storm drains.

Proposed Site is divided into six DMAs based on the proposed grades and location of available landscaped/Green area.

DMA 1 – This 29,852 sf area consists of western half of the Banquet Hall building, Parking and landscaped area in West part of the project site. This area is proposed to drain into the landscape area along the Southern West corner. A bio retention area #1 of 1,490 sf flat area without under drains is proposed in the landscaped area to provide the necessary water quality treatment to the storm runoff. The overflow from this bio retention area is proposed to drain to South-West corner of site to S Highland Avenue.

DMA 2 – This 84,552 sf area consists of eastern half of Banquet Hall building, western half of Holiday Inn Express Hotel & Suites building, Parking and landscaped area of the project site. This area is proposed to drain into the landscape area along the S Highland Avenue. A bio retention area #2 of 2,992 sf flat area without under drains is proposed in the landscaped area to provide the necessary water quality treatment to the storm runoff. The overflow from this bio-retention area is proposed to drain to S Highland Avenue.

DMA 3 – This 53,325 sf area consists of eastern half of Holiday Inn Express Hotel & Suites building, Parking and landscaped area of the project site. This area is proposed to drain into the landscape area along the S Highland Avenue. A bio retention area #3 of 2085 sf flat area without under drains is proposed in the landscaped area to provide the necessary

water quality treatment to the storm runoff. The overflow from this bio-retention area is proposed to drain to S Highland Avenue.

DMA 4 – This 124,235 sf area consists of Staybridge Suites building, western portion of Restaurant building, Parking and landscaped area in centre of the project site. This area is proposed to drain into the landscape area along the S Highland Avenue. A bio-retention area #4 of 4,790 sf flat area without under drains is proposed in the landscaped area to provide the necessary water quality treatment to the storm runoff. The overflow from this bio retention area will flow to onsite storm drain network connected to the existing drainage manhole in the Southeast corner of project site in Citrus Avenue.

DMA 5 – This 14,652 sf area consists of northern portion of In-N-Out Burger Store building and landscaped area in North-East corner of the project site. This area is proposed to drain into the landscape area along the corner of Citrus Avenue. A bio retention area #5 of 940 sf flat area without under drains is proposed in the landscaped area to provide the necessary water quality treatment to the storm runoff. The overflow from this bio retention area will flow to onsite storm drain network connected to the existing drainage manhole in the Southeast corner of project site in Citrus Avenue.

DMA 6 – This 71,924 sf area consists of southern portion of In-N-Out Burger Store building, eastern portion of Restaurant building, Parking and landscaped area in eastern corner of the project site. This area is proposed to drain into the landscape area along the intersection of S Highland Avenue and Citrus Avenue. A bio retention area #6 of 3,790 sf flat area without under drains is proposed in the landscaped area to provide the necessary water quality treatment to the storm runoff. The overflow from this bio retention area will flow to onsite storm drain network connected to the existing drainage manhole in the Southeast corner of project site in Citrus Avenue.

The DMA's and proposed grading are shown on WQM & Grading Plan. Refer Appendix-5 and 6 for Grading & Water Quality Management Plan.

DMA	TOTAL AREA	IMPERVIOUS AREA (ROOF + PAVING)	PERVIOUS AREA (LANDSCAPE)
1	29,850	22,620	7,230
2	84,552	68,491	16,061
3	53,325	42,670	10,655
4	124,235	102,904	21,331
5	14,652	7,835	6,817
6	71,924	59,770	12,154

8. DESIGN CAPTURE VOLUME (DCV):

Design Capture Volume (DCV) in cubic feet is determined by following expression mentioned as per City Standards.

DCV = 1/12*(DMA area) * (Runoff coefficient, R_c) * (Mean 6-hr Precipitation, P_6) * C_2,

Where C_2 is a function of drawdown rate (for 48-hr = 1.963)

DMA	TOTAL AREA (IN SF)	IMPERVIOUSNESS RATIO	RUNOFF COEFFICIENT (Rc)	MEAN 6-HR PRECIPITATION (IN INCHES)	DESIGN CAPTURE VOLUME (IN CUBIC FEET)
1	29,850	0.76	0.552	1.01	2,730
2	84,552	0.81	0.611	1.01	8,562
3	53,325	0.80	0.600	1.01	5,297
4	124,235	0.83	0.635	1.01	13,061
5	14,652	0.53	0.363	1.01	881
6	71,924	0.83	0.637	1.01	7,590

9. BIO RETENTION VOLUME:

Bio retention areas in all the six DMAs are proposed to provide the required water quality treatment. The required retention is proposed to be provided by the amended soil having porosity of 15% and by gravel volume provided below the soil having a porosity of 35%. A varying ponding depth of 1.0'-1.25' is provided over the flat area of all the basins. A free board of 0.5' is provided for all the basins. An infiltration rate of underlying soils is 5.75 in/hr and 10.20 in/hr at the depth of 5.0' and 10.0' respectively per infiltration report on dated July 20, 2021. Minimum infiltration value of 5.75 in/hr used for calculations. Infiltration safety factor of 2.2 is calculated from Worksheet H per city standards. Thus, the design percolation rate calculated for the soil is 2.61 in/hr. A typical 3-hr duration of storm is considered for filing the retention basins as per Form 4.3-3 from Water Quality Management Plan Template.

DMA #	AREA OF DMA (IN SF)	BIO - RETENTION #	FLAT AREA (IN SF)	FREE - BOARD DEPTH (IN FEET)	PONDING DEPTH (IN FEET)	DEPTH OF AMENDED SOIL (IN FEET)	POROSITY OF SOIL	GRAVEL DEPTH (IN FEET)	POROSITY OF GRAVEL	VOLUME REQUIRED (IN CUBIC FEET)	VOLUME PROVIDED (IN CUBIC FEET)
1	31,750	1	1,490	0.5	1.0	1.5	0.15	1.0	0.35	2,730	3,320
2	82,640	2	2,992	0.5	1.25	1.5	0.15	2.25	0.35	8,562	8,724
3	53,325	3	2,085	0.5	1.25	1.5	0.15	1.25	0.35	5,297	5,350
4	124,235	4	4,790	0.5	1.25	1.5	0.15	1.75	0.35	13,061	13,129
5	13,895	5	940	0.5	1.0	1.5	0.15	1.0	0.35	881	2,095
6	72,705	6	3,790	0.5	1.0	1.5	0.15	1.0	0.35	7,590	8,446

10.CHECK FOR INFILTRATION OF THE PONDED VOLUME:

Considering a design infiltration rate of 2.61 inch /hour the retained volume will infiltrate into the ground within 48 hours as shown below for all the Bio-retention basins.

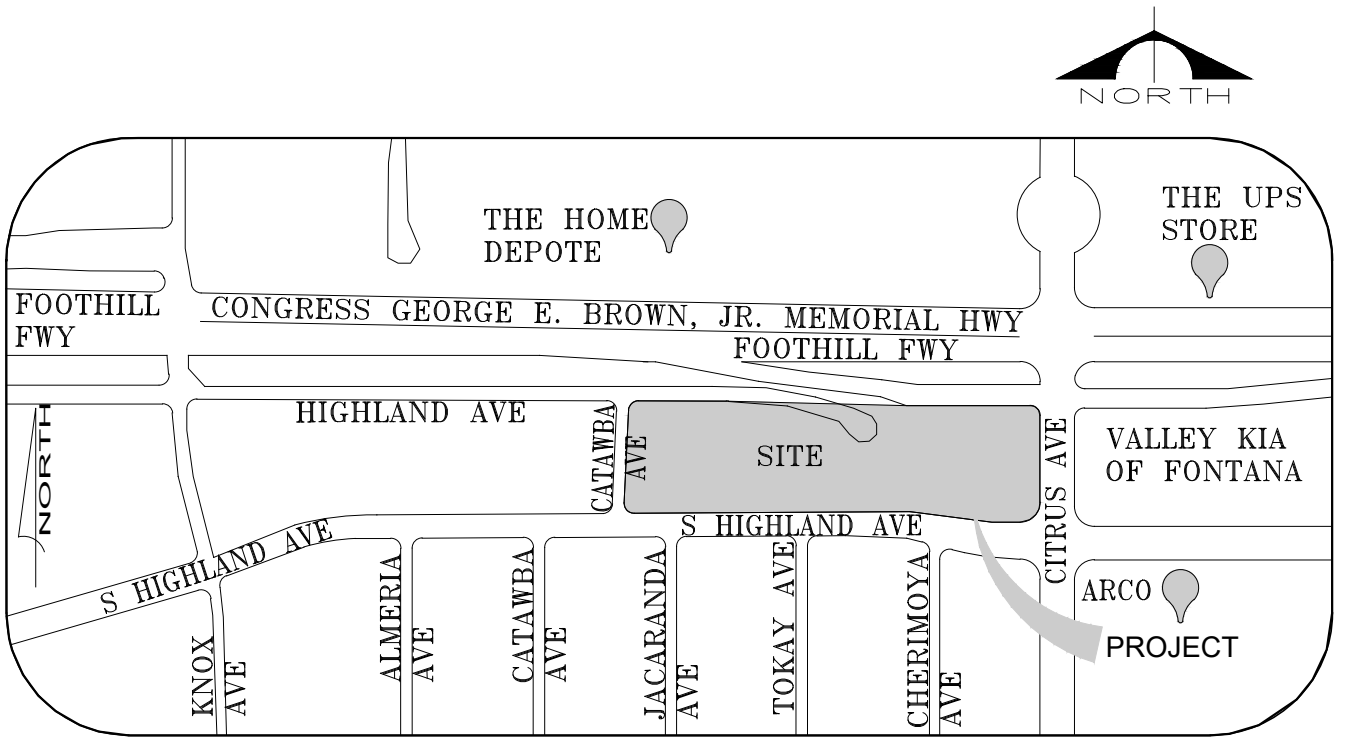
BASIN	PROVIDED VOLUME (IN CF)	FLAT AREA (IN SF)	DESIGN INFILTRATION RATE (IN INCHES/HOUR)	DRAWDOWN TIME (IN HOURS)
1	3,320	1,490	2.61	10
2	8,724	2,992	2.61	13
3	5,350	2,085	2.61	12
4	13,129	4,790	2.61	13
5	2,095	940	2.61	10
6	8,446	3,790	2.61	10

11. DRAINAGE NETWORK:

Overflow from Bio Retention basins 1, 2 and 3 is proposed to be drained through under sidewalk drains to S Highland Avenue and overflow from Bio Retention basins 4, 5 and 6 is proposed to be connected to the onsite storm drainage network. Onsite network is proposed to be connected to existing public storm drainage network on southeast corner of the site in Citrus Avenue. For Storm drain pipeline alignment and invert levels refer Appendix-5 Grading Plan.

APPENDIX - 1
VICINTY MAP

EXHIBIT—B
VICINITY MAP



SCALE: N.T.S.

APPENDIX - 2
NOAA ATLAS 14, VOLUME 6, AND VERSION 2

NOAA Atlas 14, Volume 6, Version 2
Location name: Fontana, California, USA*
Latitude: 34.1354°, Longitude: -117.4559°
Elevation: 1506.32 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	**0.131** (0.109-0.159)	**0.173** (0.144-0.210)	**0.228** (0.189-0.278)	**0.273** (0.224-0.335)	**0.334** (0.265-0.425)	**0.382** (0.297-0.496)	**0.430** (0.326-0.574)	**0.481** (0.354-0.660)	**0.551** (0.389-0.789)	**0.606** (0.413-0.899)
10-min	**0.187** (0.156-0.227)	**0.248** (0.206-0.301)	**0.327** (0.271-0.398)	**0.391** (0.321-0.480)	**0.479** (0.380-0.609)	**0.547** (0.425-0.711)	**0.617** (0.468-0.822)	**0.690** (0.508-0.946)	**0.790** (0.557-1.13)	**0.869** (0.592-1.29)
15-min	**0.227** (0.189-0.275)	**0.299** (0.249-0.364)	**0.395** (0.327-0.481)	**0.473** (0.389-0.581)	**0.579** (0.460-0.737)	**0.662** (0.514-0.860)	**0.746** (0.565-0.994)	**0.834** (0.614-1.14)	**0.955** (0.674-1.37)	**1.05** (0.715-1.56)
30-min	**0.341** (0.284-0.413)	**0.450** (0.374-0.547)	**0.594** (0.492-0.723)	**0.711** (0.584-0.873)	**0.871** (0.692-1.11)	**0.995** (0.773-1.29)	**1.12** (0.850-1.50)	**1.25** (0.923-1.72)	**1.44** (1.01-2.06)	**1.58** (1.08-2.34)
60-min	**0.517** (0.431-0.628)	**0.684** (0.568-0.830)	**0.901** (0.747-1.10)	**1.08** (0.887-1.33)	**1.32** (1.05-1.68)	**1.51** (1.17-1.96)	**1.70** (1.29-2.27)	**1.90** (1.40-2.61)	**2.18** (1.54-3.12)	**2.40** (1.63-3.56)
2-hr	**0.794** (0.661-0.963)	**1.04** (0.863-1.26)	**1.35** (1.12-1.65)	**1.61** (1.32-1.98)	**1.95** (1.55-2.48)	**2.21** (1.72-2.88)	**2.48** (1.88-3.30)	**2.75** (2.03-3.77)	**3.12** (2.20-4.47)	**3.41** (2.32-5.05)
3-hr	**1.02** (0.851-1.24)	**1.33** (1.11-1.62)	**1.73** (1.43-2.11)	**2.05** (1.68-2.51)	**2.47** (1.96-3.14)	**2.79** (2.17-3.63)	**3.12** (2.36-4.16)	**3.45** (2.54-4.73)	**3.89** (2.75-5.58)	**4.24** (2.89-6.29)
6-hr	**1.52** (1.26-1.84)	**1.97** (1.64-2.40)	**2.55** (2.11-3.11)	**3.01** (2.47-3.70)	**3.62** (2.87-4.60)	**4.07** (3.16-5.29)	**4.52** (3.43-6.03)	**4.98** (3.67-6.83)	**5.59** (3.95-8.00)	**6.06** (4.13-8.98)
12-hr	**2.07** (1.72-2.51)	**2.71** (2.25-3.29)	**3.50** (2.90-4.27)	**4.13** (3.40-5.08)	**4.95** (3.93-6.29)	**5.56** (4.32-7.22)	**6.15** (4.66-8.20)	**6.75** (4.97-9.26)	**7.54** (5.32-10.8)	**8.13** (5.54-12.1)
24-hr	**2.82** (2.50-3.25)	**3.73** (3.30-4.31)	**4.87** (4.30-5.64)	**5.77** (5.05-6.73)	**6.93** (5.87-8.35)	**7.78** (6.46-9.57)	**8.62** (6.98-10.9)	**9.46** (7.45-12.2)	**10.5** (7.98-14.2)	**11.4** (8.31-15.9)
2-day	**3.46** (3.06-3.98)	**4.67** (4.13-5.39)	**6.22** (5.49-7.20)	**7.46** (6.53-8.70)	**9.11** (7.71-11.0)	**10.3** (8.59-12.7)	**11.6** (9.39-14.6)	**12.9** (10.1-16.6)	**14.5** (11.0-19.6)	**15.8** (11.6-22.1)
3-day	**3.71** (3.28-4.27)	**5.09** (4.50-5.87)	**6.89** (6.08-7.97)	**8.37** (7.32-9.76)	**10.4** (8.79-12.5)	**11.9** (9.90-14.7)	**13.5** (11.0-17.0)	**15.2** (11.9-19.6)	**17.4** (13.2-23.5)	**19.2** (14.0-26.7)
4-day	**3.97** (3.51-4.57)	**5.50** (4.87-6.35)	**7.53** (6.64-8.71)	**9.21** (8.06-10.7)	**11.5** (9.76-13.9)	**13.3** (11.1-16.4)	**15.2** (12.3-19.1)	**17.1** (13.5-22.2)	**19.8** (15.0-26.8)	**22.0** (16.1-30.7)
7-day	**4.54** (4.02-5.23)	**6.37** (5.63-7.35)	**8.80** (7.77-10.2)	**10.8** (9.47-12.6)	**13.6** (11.5-16.4)	**15.8** (13.1-19.5)	**18.1** (14.7-22.9)	**20.6** (16.2-26.6)	**23.9** (18.1-32.3)	**26.6** (19.4-37.1)
10-day	**4.91** (4.35-5.66)	**6.93** (6.13-8.00)	**9.64** (8.50-11.2)	**11.9** (10.4-13.9)	**15.0** (12.7-18.1)	**17.5** (14.6-21.6)	**20.1** (16.3-25.4)	**22.9** (18.0-29.6)	**26.7** (20.2-36.0)	**29.8** (21.8-41.5)
20-day	**5.83** (5.17-6.72)	**8.32** (7.36-9.60)	**11.7** (10.3-13.5)	**14.6** (12.7-17.0)	**18.6** (15.7-22.4)	**21.8** (18.1-26.8)	**25.2** (20.4-31.7)	**28.8** (22.7-37.3)	**34.0** (25.7-45.8)	**38.1** (27.9-53.2)
30-day	**6.81** (6.03-7.85)	**9.73** (8.61-11.2)	**13.7** (12.1-15.9)	**17.1** (15.0-20.0)	**22.0** (18.6-26.5)	**25.9** (21.5-31.9)	**30.1** (24.4-37.9)	**34.6** (27.2-44.8)	**41.0** (31.0-55.3)	**46.2** (33.8-64.5)
45-day	**8.13** (7.20-9.37)	**11.5** (10.2-13.3)	**16.3** (14.3-18.8)	**20.3** (17.8-23.7)	**26.1** (22.1-31.5)	**30.9** (25.6-38.0)	**35.9** (29.1-45.3)	**41.5** (32.7-53.7)	**49.4** (37.4-66.7)	**56.0** (41.0-78.1)
60-day	**9.46** (8.38-10.9)	**13.3** (11.7-15.3)	**18.6** (16.4-21.5)	**23.2** (20.3-27.1)	**29.9** (25.3-36.0)	**35.4** (29.3-43.5)	**41.2** (33.4-52.0)	**47.7** (37.6-61.8)	**57.1** (43.2-77.0)	**64.8** (47.4-90.5)

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

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

Please refer to NOAA Atlas 14 document for more information.

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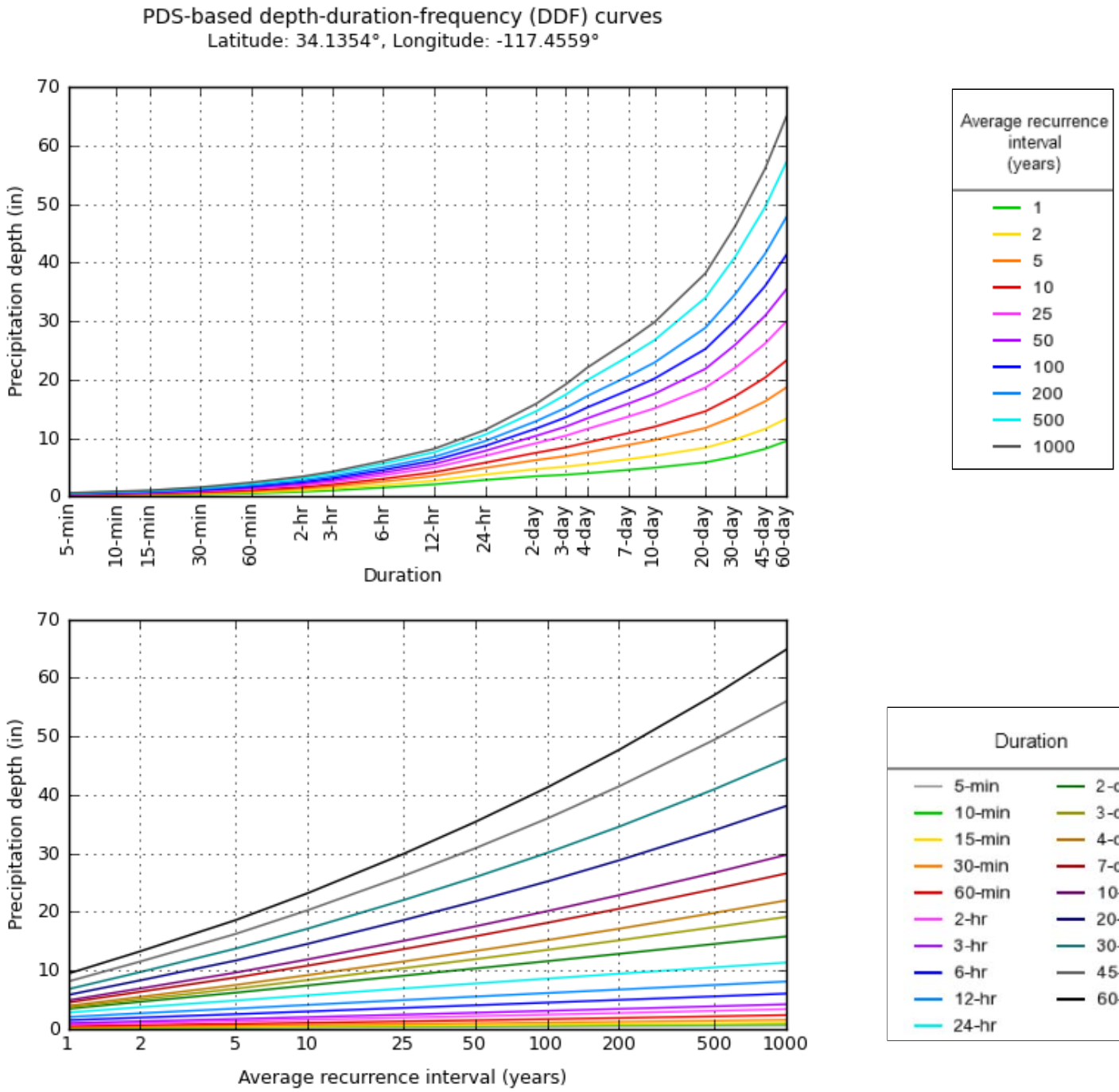
PF graphical



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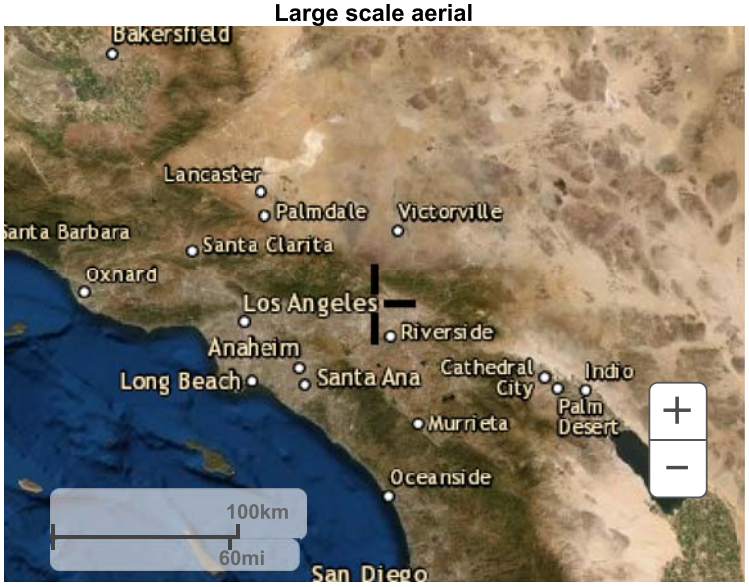
Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

Large scale aerial



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

APPENDIX – 3
WORKSHEET-H

WORKSHEET - H

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	2	0.50
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	2	0.50
		Compaction during construction	0.25	2	0.50
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.2
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					5.75
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT}/K_M$					2.61

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

APPENDIX – 4
SOIL INFILTRATION REPORT

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

July 20, 2021

Project No. 644-21022
21-07-081

Ace Design & Construction
2795 East Bidwell Street, Suite 100-318
Folsom, California 95630

Project: Proposed New Commercial Development
NWC Citrus Avenue & South Highland Avenue
Fontana, California

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

In accordance with your request, we have performed 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 for the project.

Percolation testing was performed on May 24, 2021 within two (2) shallow tests bore excavated on the site. Testing was performed at depths of approximately 10 and 5 feet below existing grade. The approximate locations of the test holes are presented on the attached Borehole Location Photograph (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.	Depth (Ft)	USCS	Percolation Rate (in/hr)	Infiltration Rate (in/hr)
P-1	10.00	SW	78.75	10.20
P-2	5.00	SW	51.00	5.75

The percolation rates determined represent the ultimate field rates that do not include a safety factor. The corresponding infiltration rate was 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.

Groundwater was not encountered to a maximum explored depth of approximately 25 feet below existing grade during our field investigation conducted on May 20, 2021. Based on our review of groundwater levels within the site vicinity, the presence of groundwater should not be a significant consideration in the design or construction of the proposed project.

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

Respectfully submitted,
SLADDEN ENGINEERING

James W. Minor III
Senior Geologist

PROFESSIONAL GEOLOGIST
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No. 9735
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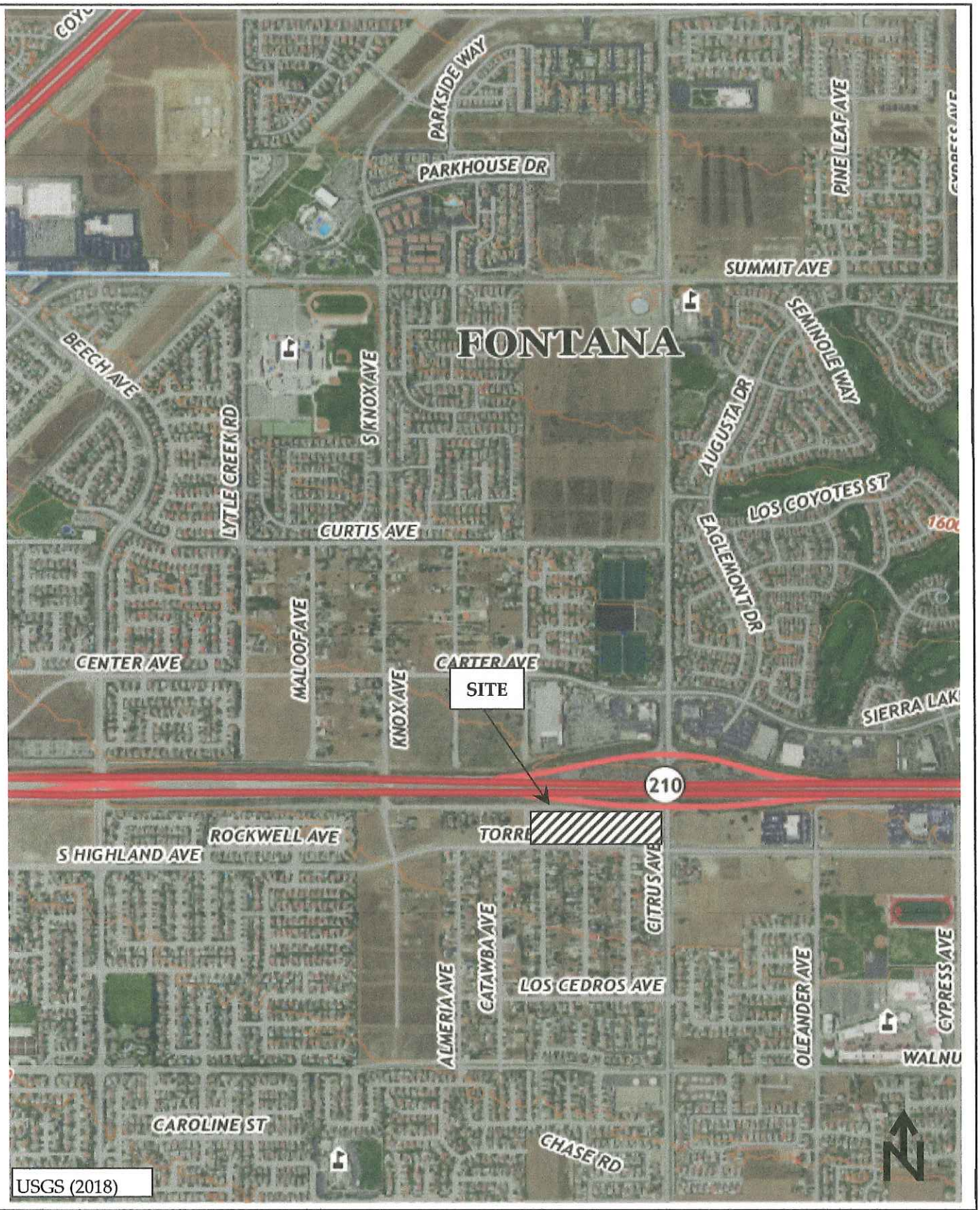
CIVIL ENGINEERING
STATE OF CALIFORNIA

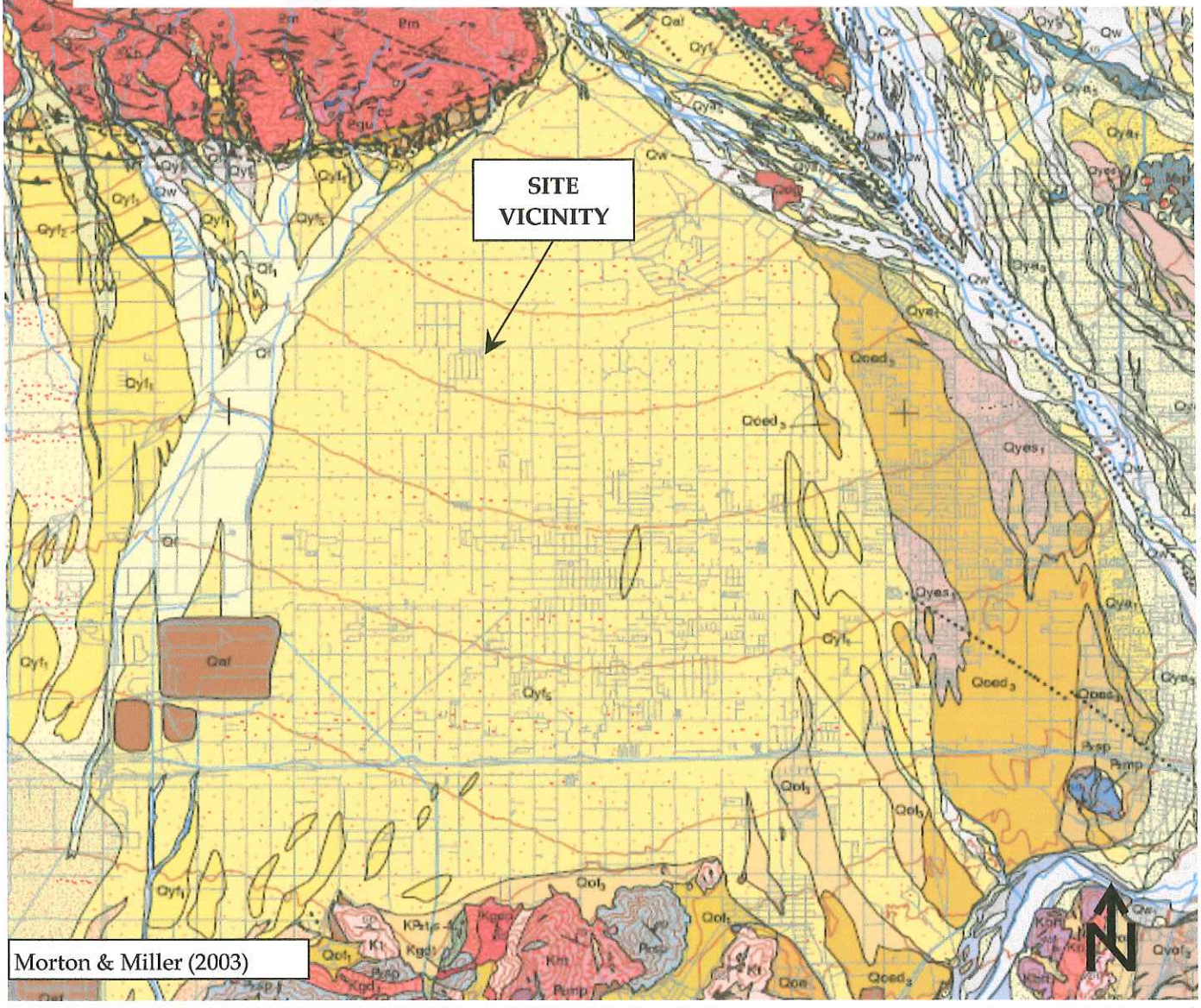
Copies: 4/Addressee

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
BOREHOLE LOCATION PHOTOGRAPH
SITE PLAN



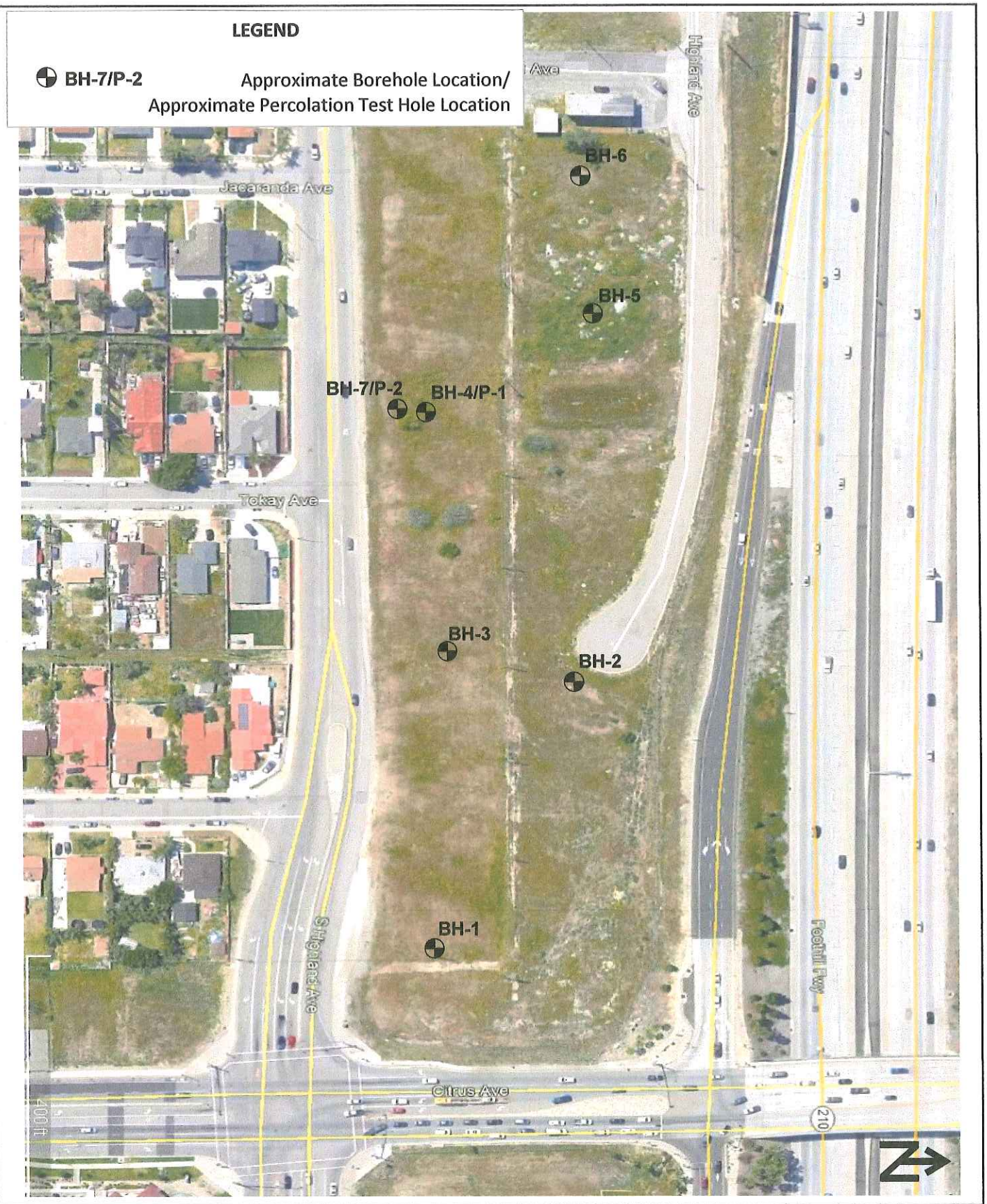
	SITE LOCATION MAP		FIGURE
Sladden Engineering	Project Number:	644-21022	1
	Report Number:	21-07-081	
	Date:	July 20, 2021	

Qyf_5 **Young alluvial-fan deposits, Unit 5 (late Holocene)**—Unconsolidated to slightly consolidated coarse-grained sand to bouldery alluvial fan deposits having slightly dissected to essentially undissected surfaces. Stage S_7 soils in Devore area. Notably finer grained in some parts of quadrangle, especially in distal parts of fans. Braided stream pattern on surfaces of fans that is related to deposition is relatively unmodified. On south side of San Gabriel Mountains, includes large, well formed fan emanating from Lytle Creek drainage; largely boulder alluvium in headward parts of fan, grading southward into dominantly sand and gravel. West of Phelan, includes Sheep Creek fan which has distinct gray-green color, and strongly contrasts with nearly all other alluvial material in quadrangle. Sheep Creek fan is composed essentially of material derived from Pelona Schist, and mainly deposited by debris flows. Parts of unit subsequently redistributed by conventional stream flow, especially in distal areas. Fans of Qyf_5 sequence are younger than Qyf_4 fans based mainly on relative position in terrace riser sequence and on superposition and overlap relations of adjacent fans

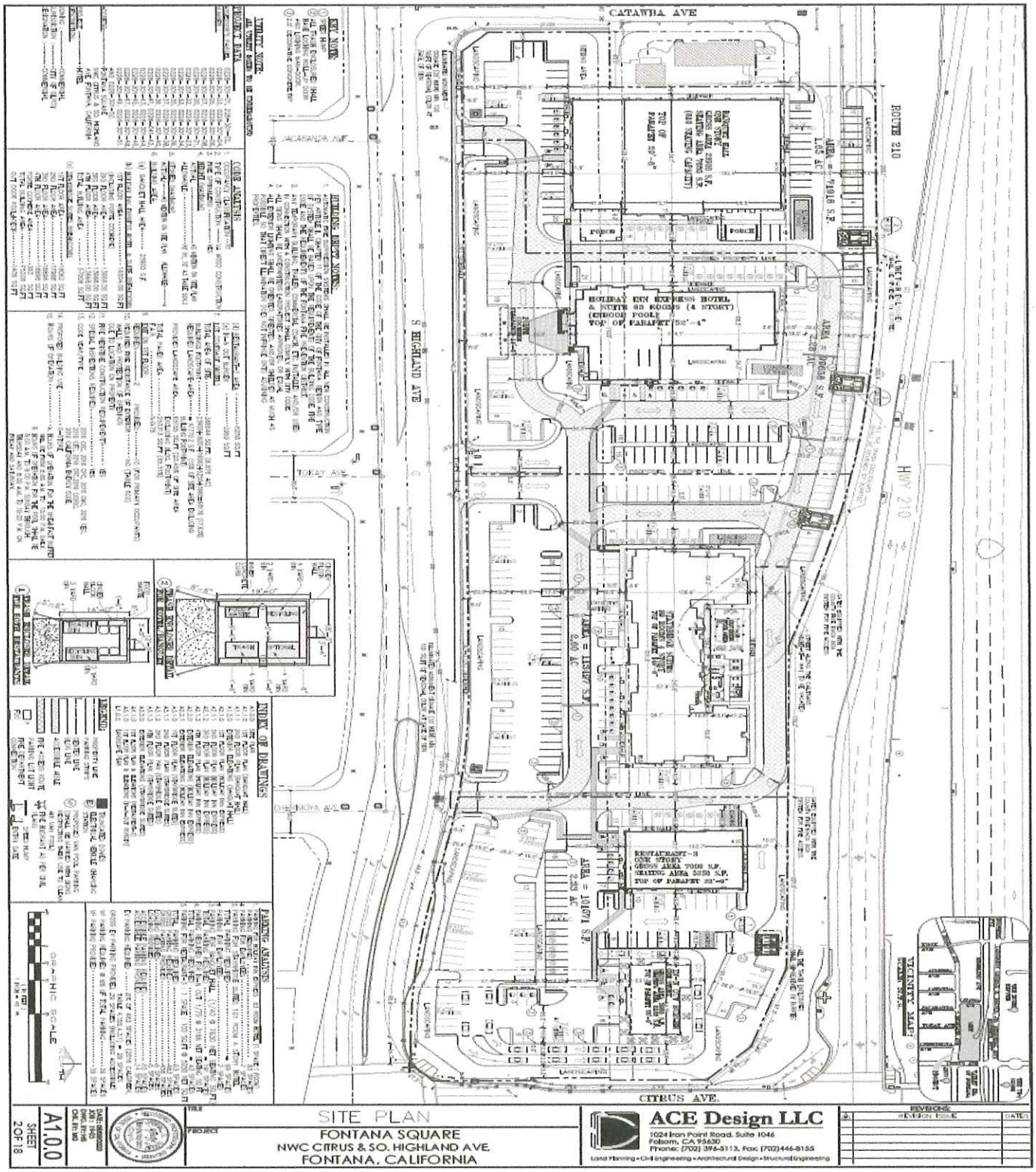


Morton & Miller (2003)

Sladden Engineering	REGIONAL GEOLOGIC MAP	FIGURE 2
	Project Number: 644-21022	
	Report Number: 21-07-081	
	Date: July 20, 2021	



	BOREHOLE LOCATION PHOTOGRAPH		FIGURE
Sladden Engineering	Project Number:	644-21022	3
	Report Number:	21-07-081	
	Date:	July 20, 2021	



Sladden Engineering	SITE PLAN	FIGURE 4
	Project Number:	644-21022
	Report Number:	21-07-081
	Date:	July 20, 2021

BORELOGS

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	5/20/2021
Elevation:	1500 Ft (MSL)	Boring No:	BH-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
		1	0				2		Gravelly Sand (SW/SM); grayish brown, dry to slightly moist, fine-to-coarse grained (Fill/Disturbed).
	19/3//50-5"			6.4	0.7		6		Gravelly Sand (SW); grayish brown, dry, very dense, fine-to-coarse grained with cobbles (Qyf).
	22/50-5"			12.9	3.1		10		Gravelly Sand (SW/SM); grayish brown, dry to slightly moist, very dense, fine-to-coarse grained with cobbles (Qyf).
							12		Practical Auger Refusal at ~ 11.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED COMMERCIAL DEVELOPMENT
NWC CITRUS AVE. & SOUTH HIGHLAND AVE., FONTANA

Project No: 644-21022
Report No: 21-07-081

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	5/20/2021
Elevation:	1500 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/SM); grayish brown, dry to slightly moist, fine-to-coarse grained (Fill/Disturbed).
	11/14/28			5.2	2.3	123.5	4		Gravelly Sand (SW); grayish brown, dry to slightly moist, medium dense, fine-to-coarse grained with cobbles (Qyf).
	35/36/36			6.9	1.3	146.4	6		Gravelly Sand (SW); grayish brown, dry, dense, fine-to-coarse grained with cobbles (Qyf).
							8		
	50-5"						10		No Recovery.
							12		
							14		
	50-4"						16		No Recovery.
							18		
							20		
	46/50-3"			11.5	2.7		22		Gravelly Sand (SW); grayish brown, dry to slightly moist, very dense, fine-to-coarse grained with cobbles (Qyf).
							24		
							26		Practical Auger Refusal at ~ 25.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED COMMERCIAL DEVELOPMENT
NWC CITRUS AVE. & SOUTH HIGHLAND AVE., FONTANA

Project No: 644-21022
Report No: 21-07-081

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	5/20/2021
Elevation:	1500 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/SM); grayish brown, dry to slightly moist, fine-to-coarse grained (Fill/Disturbed).
	8/20/29			6.1	1.4		6		Gravelly Sand (SW); grayish brown, dry, dense, fine-to-coarse grained with cobbles (Qyf).
							14		Practical Auger Refusal at ~ 7.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED COMMERCIAL DEVELOPMENT
NWC CITRUS AVE. & SOUTH HIGHLAND AVE., FONTANA

Project No: 644-21022
Report No: 21-07-081

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	5/20/2021
Elevation:	1500 Ft (MSL)	Boring No:	BH-4/P-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Gravelly Sand (SW/SM); grayish brown, dry to slightly moist, fine-to-coarse grained (Fill/Disturbed).
							2		
							4		
	23/19/18			4.9	1.3		6		Gravelly Sand (SW); grayish brown, dry, medium dense, fine-to-coarse grained with cobbles (Qyf).
							8		
	9/40/50-4"			9.8	1.3		10		Gravelly Sand (SW); grayish brown, dry, very dense, fine-to-coarse grained with cobbles (Qyf).
							12		Practical Auger Refusal at ~ 10.5 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 COMMERCIAL DEVELOPMENT
NWC CITRUS AVE. & SOUTH HIGHLAND AVE., FONTANA

Project No: 644-21022
Report No: 21-07-081

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	5/20/2021
Elevation:	1500 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/SM); grayish brown, dry to slightly moist, fine-to-coarse grained (Fill/Disturbed).
	16/19/27			9.5	1.7		4 6 8		Gravelly Sand (SW); grayish brown, dry, dense, fine-to-coarse grained with cobbles (Qyf).
							10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50		Practical Auger Refusal at ~ 8.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED COMMERCIAL DEVELOPMENT
NWC CITRUS AVE. & SOUTH HIGHLAND AVE., FONTANA

Project No: 644-21022
Report No: 21-07-081

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	5/20/2021
Elevation:	1500 Ft (MSL)	Boring No:	BH-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0		Gravelly Sand (SW/SM); grayish brown, dry to slightly moist, fine-to-coarse grained (Fill/Disturbed).
							2		
							4		
	7/18/21			7.5	1.6		6		Gravelly Sand (SW); grayish brown, dry, dense, fine-to-coarse grained with cobbles (Qyf).
							8		
	24/50-5"			6.1	2.4	131.2	10		Gravelly Sand (SW/SM); grayish brown, dry to slightly moist, very dense, fine-to-coarse grained with cobbles (Qyf).
							12		
							14		
	16/10/10			7.2	2.1		16		Gravelly Sand (SW/SM); grayish brown, dry to slightly moist, medium dense, fine-to-coarse grained with cobbles (Qyf).
							18		Practical Auger Refusal at ~ 18.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED COMMERCIAL DEVELOPMENT
NWC CITRUS AVE. & SOUTH HIGHLAND AVE., FONTANA

Project No: 644-21022
Report No: 21-07-081

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	5/20/2021
	Elevation:	1500 Ft (MSL)	Boring No:	BH-7/P-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Gravelly Sand (SW/SM); grayish brown, dry to slightly moist, fine-to-coarse grained (Fill/Disturbed).
							4		Gravelly Sand (SW); grayish brown, dry, fine-to-coarse grained with cobbles (Qyf).
							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 COMMERCIAL DEVELOPMENT
NWC CITRUS AVE. & SOUTH HIGHLAND AVE., FONTANA

Project No: 644-21022
Report No: 21-07-081

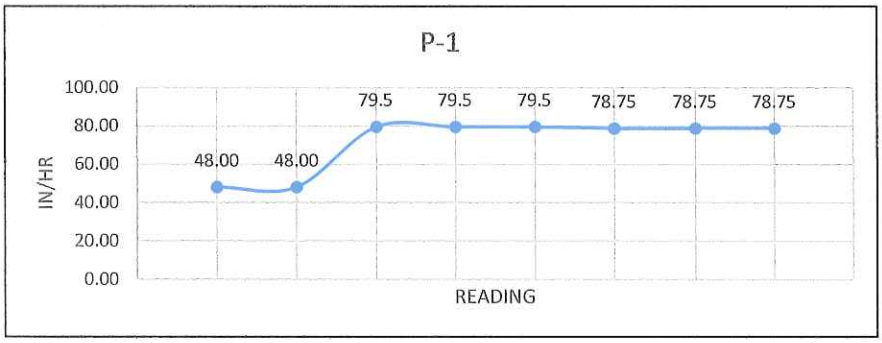
RIVERSIDE COUNTY STORMWATER TESTING DATA SHEETS

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	NWC Citrus Ave & Highland Ave, Fontana	Depth (ft):	10.00
Job No. :	644-21022	USCS Soil Class:	SW
Date:	5/24/2021	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	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	6 6/8	13 2/8	79.5
2	10.00	10.00	20	6 6/8	13 2/8	79.5
3	10.00	10.00	20	6 6/8	13 2/8	79.5
4	10.00	10.00	20	6 7/8	13 1/8	78.75
5	10.00	10.00	20	6 7/8	13 1/8	78.75
6	10.00	10.00	20	6 7/8	13 1/8	78.75



PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt =	10.00
D_f =	113.13
r =	4.00
D_0 =	100
D_t =	120.00
H_0 =	20
H_f =	6.875
ΔH =	13.13
H_{avg} =	13.44

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)

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

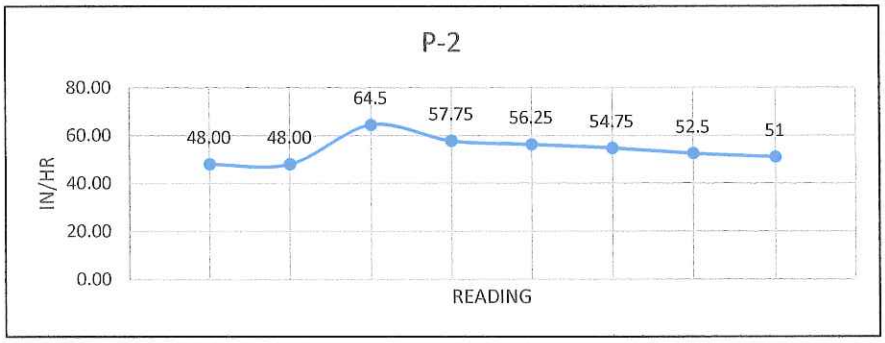
Field Rate:	78.75 in/hr
Infiltration Rate:	10.20 in/hr

STORMWATER PERCOLATION SHEET (LESS THAN 10 FT)

Project:	NWC Citrus Ave & Highland Ave, Fontana	Depth (ft):	5.00
Job No. :	644-21022	USCS Soil Class:	SW
Date:	5/24/2021	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	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	9 2/8	10 6/8	64.5
2	10.00	5.00	20	10 3/8	9 5/8	57.75
3	10.00	5.00	20	10 5/8	9 3/8	56.25
4	10.00	5.00	20	10 7/8	9 1/8	54.75
5	10.00	5.00	20	11 2/8	8 6/8	52.5
6	10.00	5.00	20	11 4/8	8 4/8	51



PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt =	10.00
D_f =	48.50
r =	4.00
D_0 =	40
D_t =	60.00
H_0 =	20
H_f =	11.5
ΔH =	8.50
H_{avg} =	15.75

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)

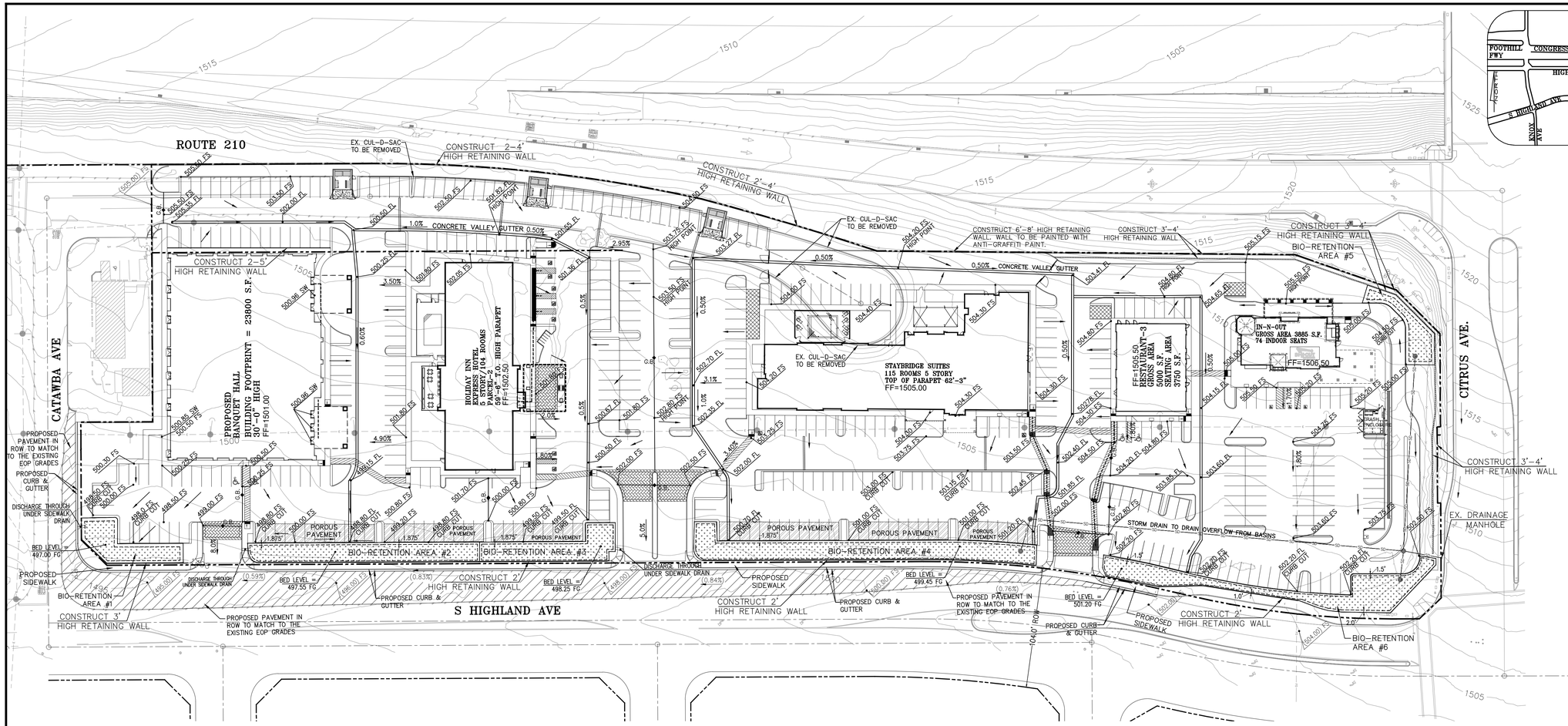
$$\Delta H = H_0 - H_f$$

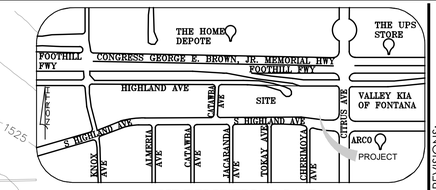
H_{avg} (average head height over the time interval)

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

Field Rate:	51 in/hr
Infiltration Rate:	5.75 in/hr

APPENDIX – 5
GRADING PLAN





VICINITY MAP:
SCALE: N.T.S.

NORTH

LEGEND:

SD	EXISTING STORM DRAIN MANHOLE
468	EXISTING CONTOUR
SD	STORM DRAIN PIPE
	PROPERTY LINE
	HANDICAP ACCESSIBLE ROUTE
	LOADING/UNLOADING AREA
	BIO RETENTION AREA
	POROUS PAVEMENT
	GRADE BREAK
	PROPOSED RETAINING WALL
12.35 FF	FINISHED FLOOR ELEVATION
12.35 CL	CENTER LINE ELEVATION
12.35 TC	TOP OF CURB ELEVATION
12.35 FL	FLOW LINE ELEVATION
12.35 FS	FINISHED SURFACE ELEVATION
12.35 FG	FINISHED GRADE ELEVATION
12.35 HP	HIGH POINT ELEVATION
12.35 EP	EDGE OF PAVEMENT ELEVATION
12.35 AC	TOP OF ASPHALT CONC.
TRW	TOP OF RETAINING WALL
TF	TOP OF FLOOR
TOW	TOP OF WALL(TOE WALL)
CG & SW	CURB GUTTER AND SIDEWALK
(12.35) FS	EX. FINISHED SURFACE ELEVATION
(0.5%)	EX. SLOPE

GRAPHIC SCALE

−50 −25 0 50 100

1" = 50'

REVISIONS:

NO.	REVISION ISSUE	DATED

ACE Design LLC
1024 IRON POINT ROAD
FOLSOM, CA 95630
Phone: (702) 396-5113, Fax: (702)446-8155
Land Planning • Civil Engineering • Architectural Design • Structural Engineering

TITLE: CONCEPTUAL GRADING PLAN

PROJECT: FONTANA SQUARE
NWC CITRUS & S. HIGHLAND AVE.
FONTANA, CALIFORNIA

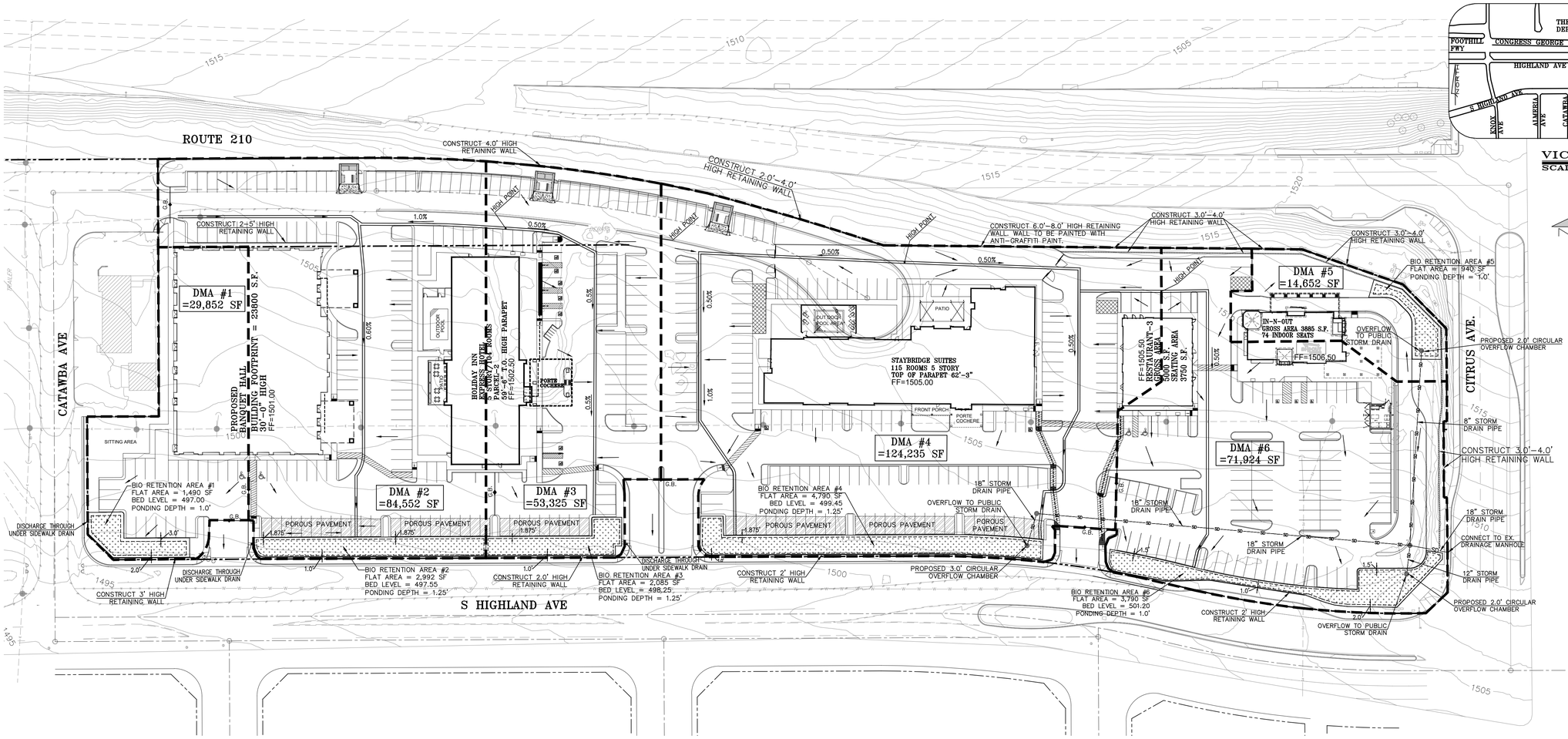
REGISTERED PROFESSIONAL ENGINEER
JASSAL S. SIDHU
56924
EXP.06/30/2023
CIVIL
STATE OF CALIFORNIA

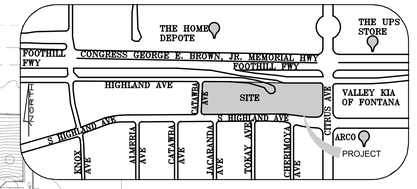
DATE: 08/12/2021
JOB : 19-03
DWG. BY: LS
CHK. BY: DS

C2

SHEET 2 OF 04

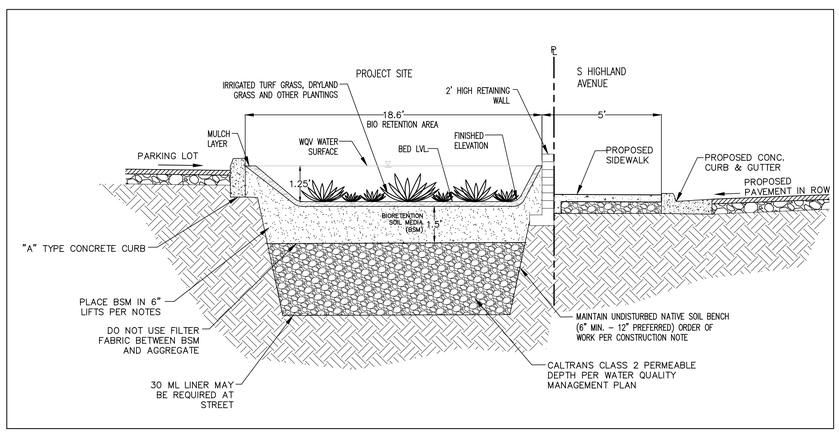
APPENDIX – 6
WATER QUALITY MANAGEMENT PLAN





VICINITY MAP:
SCALE: N.T.S.

NORTH



TYPICAL DETAIL OF BIO-RETENTION AREA

BMP SUMMARY TABLE:

DMA #	AREA OF DMA (IN SF)	AREA OF DMA (IN ACRE)	BIO-RETENTION #	FLAT AREA OF BASIN (IN SF)	PONDING DEPTH (IN FEET)	DEPTH OF AMENDED SOIL (IN FEET)	POROSITY OF SOIL	GRAVEL DEPTH (IN FEET)	POROSITY OF GRAVEL	VOLUME REQUIRED (IN CUBIC FEET)	VOLUME PROVIDED (IN CUBIC FEET)	REMARKS
1	29,850	0.69	1	1,490	1.0	1.5	0.15	1.00	0.35	2,730	3,320	
2	84,552	1.94	2	2,992	1.25	1.5	0.15	2.25	0.35	8,562	8,724	3,250 SF POROUS PAVEMENT AREA CONSIDER AS A LANDSCAPING AREA
3	53,325	1.22	3	2,085	1.25	1.5	0.15	1.25	0.35	5,297	5,350	1,295 SF POROUS PAVEMENT AREA CONSIDER AS A LANDSCAPING AREA
4	124,235	2.85	4	4,790	1.25	1.5	0.15	1.75	0.35	13,061	13,129	4,465 SF POROUS PAVEMENT AREA CONSIDER AS A LANDSCAPING AREA
5	14,652	0.34	5	940	1.0	1.5	0.15	1.00	0.35	881	2,095	
6	71,924	1.65	6	3,790	1.0	1.5	0.15	1.00	0.35	7,590	8,446	
TOTAL	**378,538**	**8.69**		**16,087**						**38,120**	**41,064**	

LEGEND:

- OVERFLOW DEVICE
- SD — STORM DRAIN PIPE
- PROPERTY LINE
- HANDICAP ACCESSIBLE ROUTE
- BIO RETENTION AREA
- POROUS PAVEMENT
- GRADE BREAK
- DMA BOUNDARY
- DMA — DRAINAGE MANAGEMENT AREA
- PROPOSED RETAINING WALL
- 1505 — EXISTING CONTOURS

GRAPHIC SCALE

-50 -25 0 50 100

1" = 50'

REVISIONS:		
NO.	REVISION ISSUE	DATED
1		
2		
3		
4		

ACE Design LLC
1024 IRON POINT ROAD
FOLSOM, CA 95630
Phone: (702) 396-5113, Fax: (702)446-8155
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TITLE: WATER QUALITY MANAGEMENT PLAN

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STATE OF CALIFORNIA

DATE: 08/12/2021
JOB : 19-03
DWG. BY: LS
CHK. BY: DS

C4

SHEET 4 OF 04