Appendix H

Hydrology Study

For

Redwood West
APN 0463-231-11 thru 16 & 34 thru 37
Apple Valley, CA

Prepared by

Merrill-Johnson Companies
22221 US Highway 18
Apple Valley, CA 92307

September16, 2022

HYDROLOGY STUDY

For

REDWOOD WEST
APN 0463-231-11 thru 16 & 34 thru 37
APPLE VALLEY, CA

September 16, 2022

Prepared by:

Merrell-Johnson Companies

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

Job No. 3813.001

9/19/2022

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

Mark D. Rowan
Project Manager

TABLE OF CONTENTS

SECTION 1

DISCUSSION

INTRODUCTION

The purpose of this study was to determine the impact, if any, of the 100-year storm runoff flow tributary to the project site as delineated on the map contained in this study. The project site encompasses approximately 72 acres of property located on the east side of Dale Evans Parkway, between Lafayette Street to the north and Burbank Avenue on the south in the northeastern area of the Town of Apple Valley, San Bernardino County, California. Development of the site will be a proposed distribution warehouse facility.

METHODOLOGY

The method in determining these peak runoff flows was the rational method as specified in the 1986 San Bernardino County Hydrology Manual and the 2010 San Bernardino County Hydrology Manual Addendum for Arid Regions. The existing offsite flow was examined and delineated from U.S.G.S. Map: Apple Valley North, review of the Apple Valley Master Plan of Drainage (MPD) and an examination of the project site.

The tributary watershed areas examined extend westerly and northeasterly from the western property boundary. This tributary area encompasses approximately 130.8 acres. Storm runoff from the north originates from an Apple Valley Master Plan of Drainage facility, N-04. This runoff is intercepted north of the blue line stream entering the property crossing Johnson Road was examined from the existing Walmart Distribution Facility and routed through this facility's on-site drainage improvements. Per the Apple Valley MPD, this drainage channel has a calculated 100-year runoff flow of approximately 2,091 cfs at the northern property boundary crossing on Lafayette Street.

Point rainfalls for the 100-year storm were obtained from the NOAA Atlas 14 per the 2010 Addendum to the County Hydrology Manual. The 100-year 1-hour point rainfall for the site is 1.08". Per the aforementioned addendum, AMC II was used for the project site and the soil types were determined to be Soil Types A and C per the Natural Resources Conservation Service's "Web Soil Survey". Rainfall and maps are included as exhibits in Section 3 of this report.

The offsite tributary area examined in this study is shown in Table A.

Table A

Sub-area	Elevation Difference (ft.)	Length (ft)	Area (Ac)	Avg. Slope (ft/ft)
Node 11 – 15	416	4,412	130.8	0.0943
N-04 – Apple Valley MPD	1,252	37,245	2,034	0.0336

EXISTING CONDITIONS

The site is located along the east side of Dale Evans Parkway between Lafayette Street to the north and Burbank Avenue to the south in the Town of Apple Valley, California. The property is currently vacant, undeveloped land. Dale Evans Parkway and Lafayette Street are paved roads with dirt shoulders. Burbank Avenue is a graded, unimproved road.

Tributary off-site flows come from the west and northwest and are intercepted within the existing improvements of Dale Evans Parkway and Lafayette Street. These flows are conveyed along the northern project frontage to a low point on Lafayette Street. The runoff flows southerly across the property, following its historical flow path to the southern property line where it exits the project site. This flow path follows the drainage course of facility N-04 as outlined in the Apple Valley Master Plan of Drainage.

The results of the offsite flow analysis are summarized in Table B.

Table B

Sub-Area	Q_{100} (cfs)
Node 11 – 15	204
N-04 – Apple Valley MPD	2,091

CONCLUSIONS AND RECOMMENDATIONS

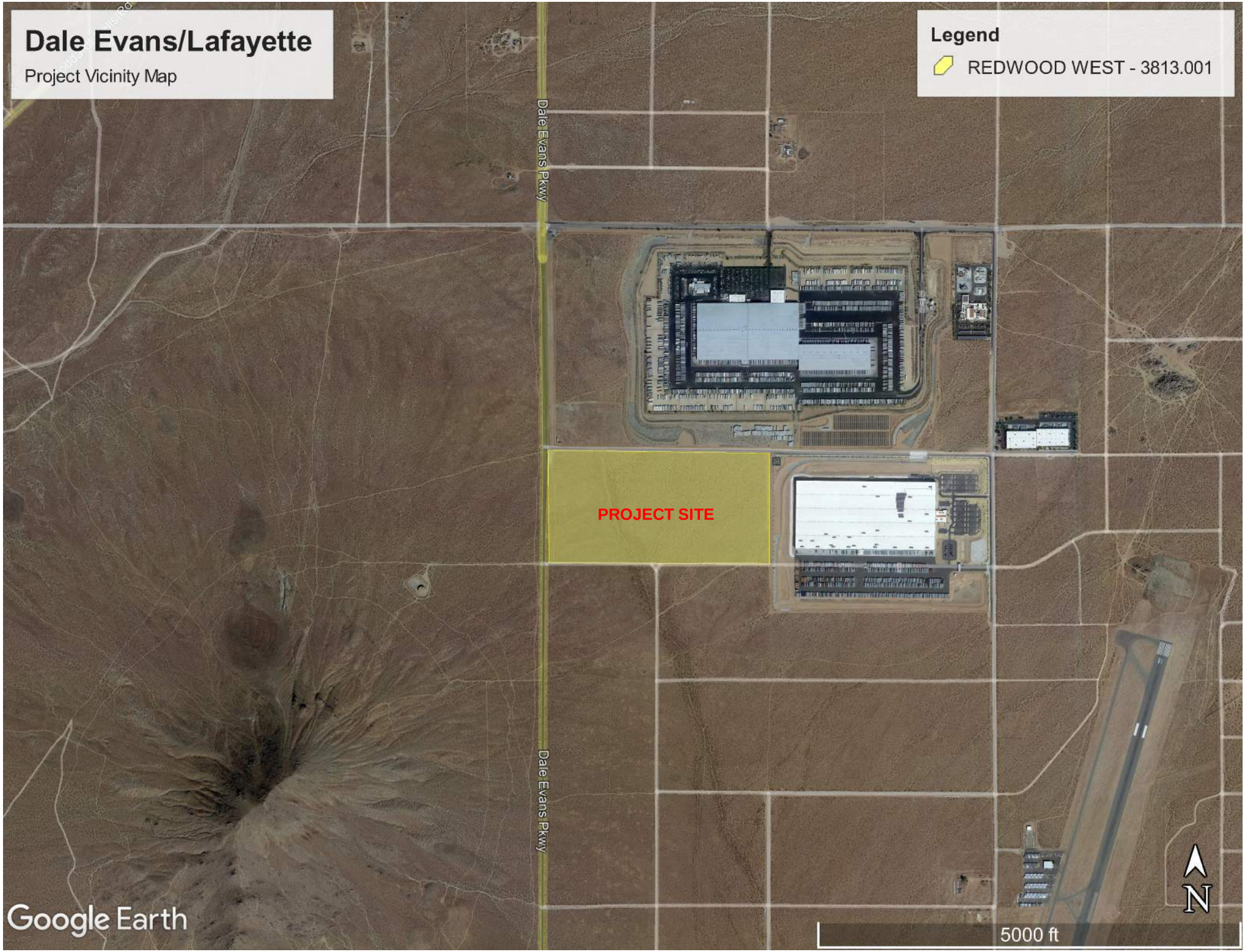
During our field investigation of the site, we observed the existing conditions as stated previously. Future development of the project is being performed in conjunction with engineered improvement plans. Off-site flows will be intercepted at the low point on Lafayette Street and conveyed through the project. Runoff flows will exit the project site

along the southern property boundary. The Apple Valley MPD flow will be conveyed in an improved drainage channel per the San Bernardino County Flood Control District drainage channel design criteria. The increased on-site runoff flow due to development of the site will flow to retention basins along the southern frontage of the project and allowed to infiltrate. Excess runoff from larger storm events will outlet as weir flow across Burbank Avenue following the historical drainage patterns

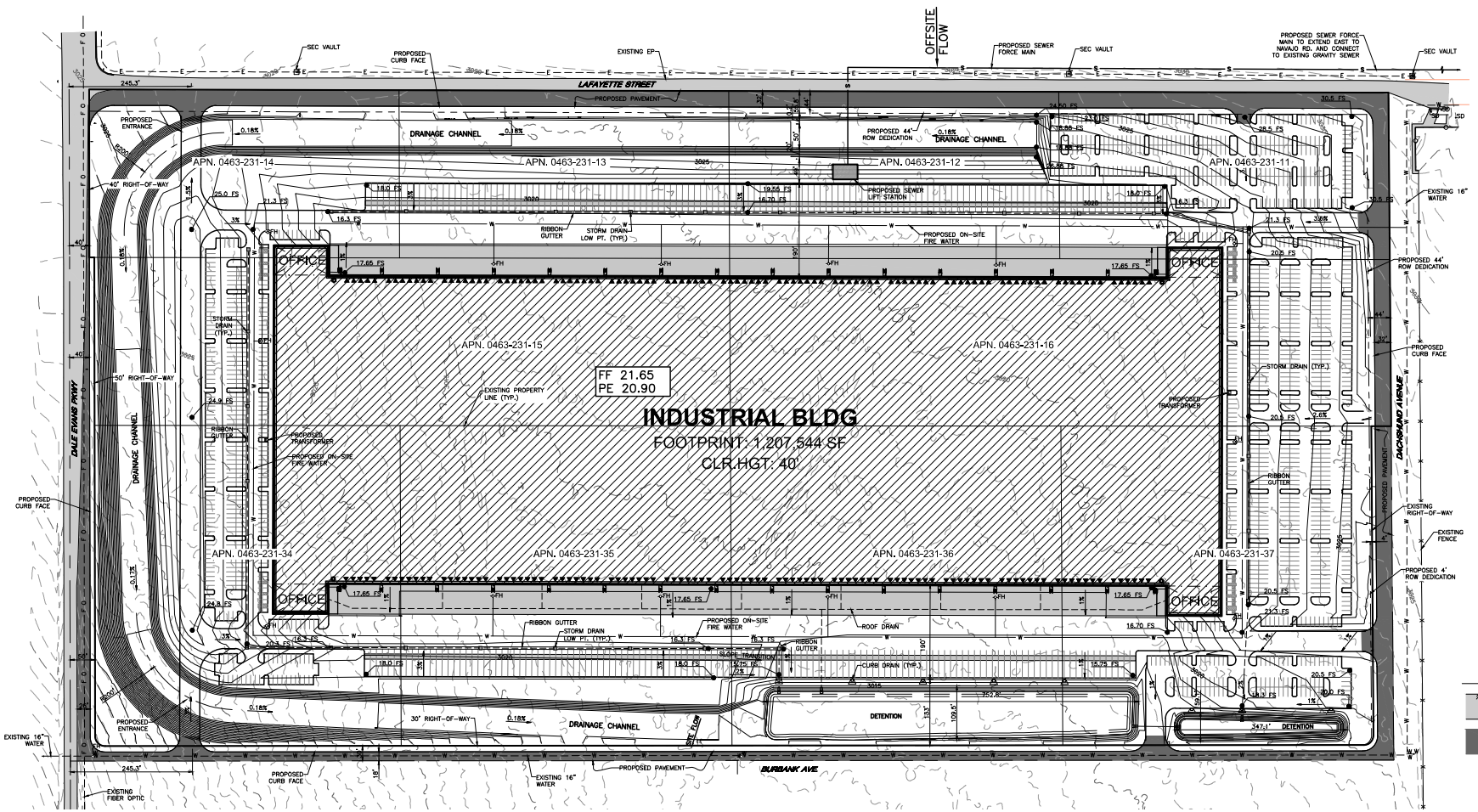
SECTION 2

EXHIBITS

VICINITY MAP


Dale Evans/Lafayette
Project Vicinity Map
Legend
REDWOOD WEST - 3813.001
Dale Evans Pkwy
PROJECT SITE
Dale Evans Pkwy
Google Earth
N
5000 ft

PROPOSED DEVELOPMENT PLAN



NOTE:
BOUNDARY SHOWN ON PLANS IS PRELIMINARY AND MAY NOT BE THE FINAL DETERMINED LOCATION.

Know what's below. Call before you dig.

SURVEY MONUMENTATION:
ALL SURVEY MONUMENTS AND MARKERS SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROTECT IN PLACE UNTIL SURVEYOR HAS TIED OUT LOCATIONS FOR REPLACEMENT PURSUANT TO BUSINESS AND PROFESSIONS CODE SECTION 8700 TO 8805 (LAND SURVEYOR'S ACT).

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

BENCHMARK
DESCRIPTION: CSM BENCHMARK 1-23
LOCATION: 1.0 MILES SOUTH ALONG CENTRAL ROAD FROM THE INTERSECTION OF CENTRAL ROAD AND QUARRY ROAD. 166 FEET EAST OF CENTERLINE CENTRAL ROAD. 53 FEET NORTH OF CENTERLINE JOHNSON ROAD. 16 FEET NORTH OF POWER POLE NO. 63127 CEPCO. 0.60 FEET ABOVE GROUND, 6.00 FEET SOUTH OF A WITNESS POST (11/01/70 ORIGINAL DESCRIPTION)
ELEVATION: 3156.94 DATUM: NAVD88

BASIS OF BEARINGS
CALIFORNIA STATE PLANE COORDINATE SYSTEM ZONE V NAD83

DATE	DELTA	REVISION DESCRIPTION	APPROVAL DATE	APPROVAL BY

Merrell Johnson COMPANIES
22221 HIGHWAY 18
APPLE VALLEY, CALIFORNIA 92307
(760) 240-8000
(760) 240-1400 FAX
16091 KAMANA RD
APPLE VALLEY, CALIFORNIA 92307
(760) 256-2068
(760) 530-6672 FAX

CONCEPTUAL GRADING PLAN

DALE EVANS & LAFAYETTE STREET 78 ACRES

FOR

REDWOOD WEST

DRAWN BY: EKJ/LR
DATE: 07/14/22
JOB NO. 3813.001
SHEET 1 OF 1

SECTION 3

HYDROLOGY CALCULATIONS

RATIONAL CALCULATIONS – Q_{100}

OFF-SITE HYDROLOGY CALCULATIONS

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study Date: 09/16/22

REDWOOD WEST - JOB 3813.001
OFF-SITE TRIBUTARY RUNOFF FLOW
NODE 11 - NODE 15
100-YEAR STORM EVENT - AMC II

MERRELL JOHNSON COMPANIES
22221 HIGHWAY 18
APPLE VALLEY, CA 92307
(760) 240-8000 * FAX (760) 240-1400

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.080 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 11.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.578(In/Hr)
Initial subarea data:
Initial area flow distance = 995.000(Ft.)
Top (of initial area) elevation = 3434.000(Ft.)
Bottom (of initial area) elevation = 3201.000(Ft.)
Difference in elevation = 233.000(Ft.)
Slope = 0.23417 s(%)= 23.42
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.102 min.
Rainfall intensity = 3.519(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.752
Subarea runoff = 12.702(CFS)
Total initial stream area = 4.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.578(In/Hr)

++
Process from Point/Station 12.000 to Point/Station 13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

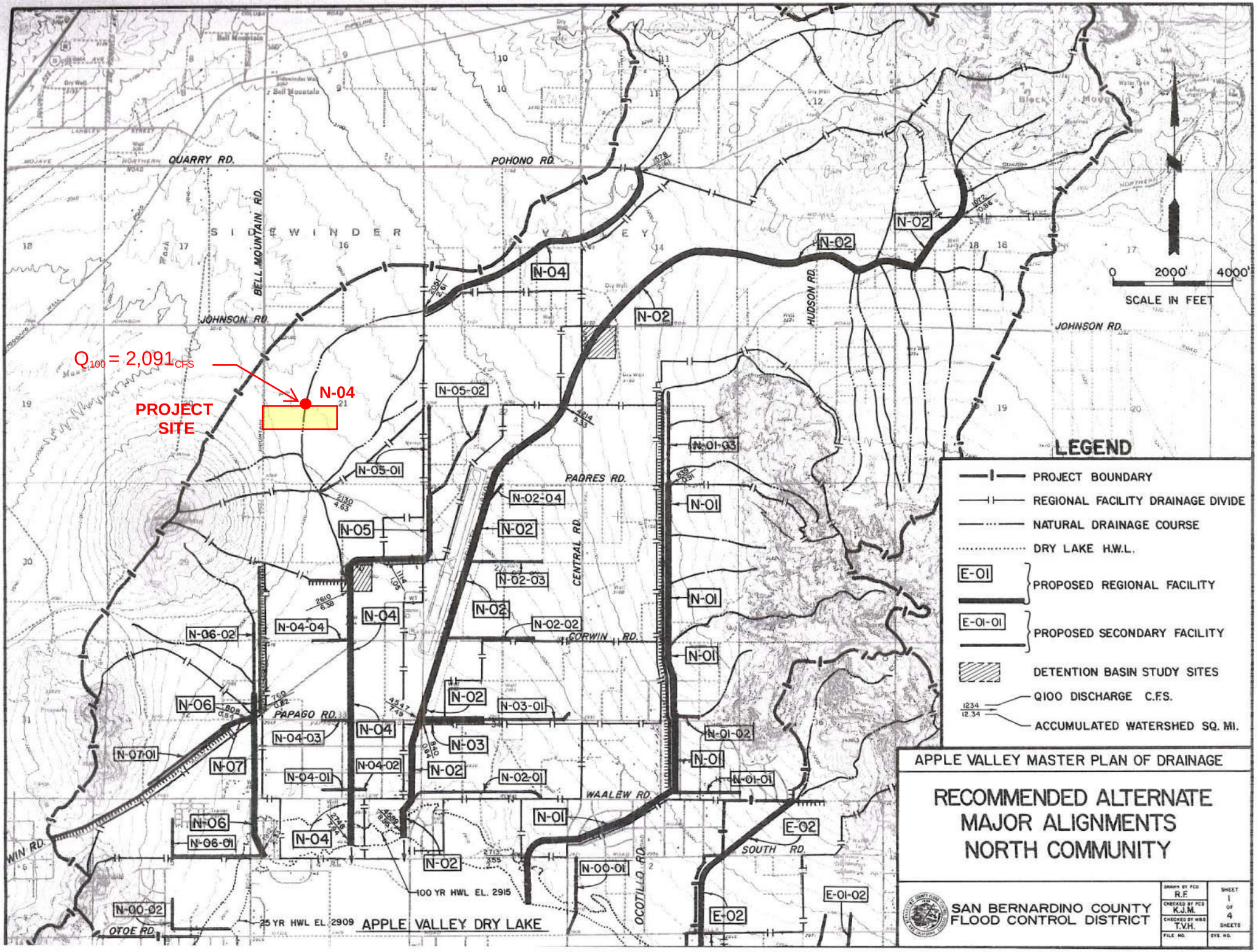
Depth of flow = 0.334(Ft.), Average velocity = 5.691(Ft/s)
******* Irregular Channel Data **********

Information entered for subchannel number 1 :

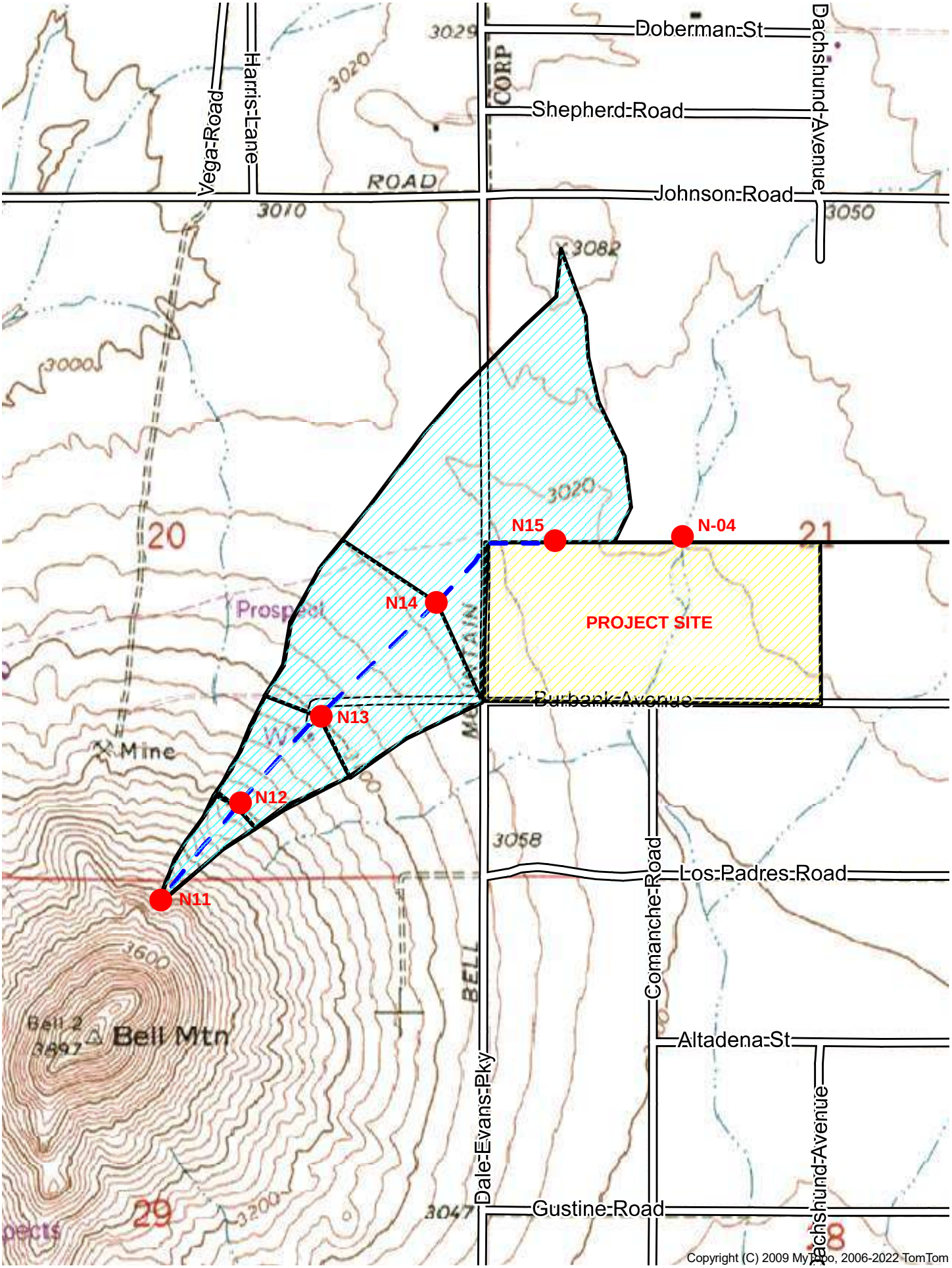
```
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     12.702(CFS)
  '     '    flow top width =      8.345(Ft.)
  '     '    velocity=    5.691(Ft/s)
  '     '    area =      2.232(Sq.Ft)
  '     '    Froude number =     1.939

Upstream point elevation =  3201.000(Ft.)
Downstream point elevation =  3099.000(Ft.)
Flow length =   968.000(Ft.)
Travel time  =    2.83 min.
Time of concentration =   13.94 min.
Depth of flow =   0.334(Ft.)
Average velocity =   5.691(Ft/s)
Total irregular channel flow =    12.702(CFS)
Irregular channel normal depth above invert elev. =   0.334(Ft.)
Average velocity of channel(s) =   5.691(Ft/s)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Time of concentration =    13.94 min.
Rainfall intensity =      3.001(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.727
Subarea runoff =     27.631(CFS) for   13.700(Ac.)
Total runoff =     40.333(CFS)
Effective area this stream =       18.50(Ac.)
Total Study Area (Main Stream No. 1) =       18.50(Ac.)
Area averaged Fm value =    0.578(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Depth of flow =   0.560(Ft.), Average velocity =   5.632(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             15.00              0.00
      4             20.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
```

```
Sub-Channel flow  =     40.333(CFS)
  '     '    flow top width =     15.595(Ft.)
  '     '    velocity=    5.632(Ft/s)
  '     '    area =      7.161(Sq.Ft)
  '     '    Froude number =     1.465

Upstream point elevation =  3099.000(Ft.)
Downstream point elevation =  3034.000(Ft.)
Flow length =  1296.000(Ft.)
Travel time  =    3.83 min.
Time of concentration =   17.77 min.
Depth of flow =   0.560(Ft.)
Average velocity =   5.632(Ft/s)
Total irregular channel flow =    40.333(CFS)
Irregular channel normal depth above invert elev. =   0.560(Ft.)
Average velocity of channel(s) =   5.632(Ft/s)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.800
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.200
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 70.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.520(In/Hr)
Time of concentration =    17.77 min.
Rainfall intensity =      2.531(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.709
Subarea runoff =     65.128(CFS) for   40.300(Ac.)
Total runoff =    105.461(CFS)
Effective area this stream =       58.80(Ac.)
Total Study Area (Main Stream No. 1) =       58.80(Ac.)
Area averaged Fm value =    0.538(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   1.622(Ft.), Average velocity =   4.959(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              2.00
      2            10.00              0.00
      3            15.00              0.00
      4            25.00              2.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =    105.461(CFS)
  '     '    flow top width =     21.222(Ft.)
  '     '    velocity=    4.959(Ft/s)
  '     '    area =     21.268(Sq.Ft)
  '     '    Froude number =     0.873

Upstream point elevation =  3034.000(Ft.)
```

```
Downstream point elevation =  3018.000(Ft.)
Flow length =  1153.000(Ft.)
Travel time  =    3.88 min.
Time of concentration =   21.65 min.
Depth of flow =   1.622(Ft.)
Average velocity =   4.959(Ft/s)
Total irregular channel flow =   105.461(CFS)
Irregular channel normal depth above invert elev. =   1.622(Ft.)
Average velocity of channel(s) =   4.959(Ft/s)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.500
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.300
Decimal fraction soil group D = 0.200
SCS curve number for soil(AMC 2)  = 77.10
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.418(In/Hr)
Time of concentration =    21.65 min. Tc
Rainfall intensity =      2.205(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.707
Subarea runoff =     98.472(CFS) for   72.000(Ac.)
Total runoff =    203.933(CFS) Q100
Effective area this stream =      130.80(Ac.)
Total Study Area (Main Stream No. 1) =      130.80(Ac.)
Area averaged Fm value =    0.472(In/Hr)
End of computations, Total Study Area =          130.80 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  73.7
```


Q_{100} = 2,091 CFS
PROJECT SITE
N-04
21
QUARRY RD.
POHONO RD.
BELL MOUNTAIN RD.
SIDEWINDER VALLEY
JOHNSON RD.
HUDSON RD.
PADRES RD.
CENTRAL RD.
CORWIN RD.
PAPAGO RD.
WAALEW RD.
SOUTH RD.
OCOTILLO RD.
OTOE RD.
WIN RD.
APPLE VALLEY DRY LAKE
100 YR HWL EL. 2915
25 YR HWL EL. 2909
0 2000' 4000'
SCALE IN FEET
LEGEND
PROJECT BOUNDARY
REGIONAL FACILITY DRAINAGE DIVIDE
NATURAL DRAINAGE COURSE
DRY LAKE H.W.L.
E-01 PROPOSED REGIONAL FACILITY
E-01-01 PROPOSED SECONDARY FACILITY
DETENTION BASIN STUDY SITES
1234 Q100 DISCHARGE C.F.S.
12.34 ACCUMULATED WATERSHED SQ. MI.
APPLE VALLEY MASTER PLAN OF DRAINAGE
RECOMMENDED ALTERNATE MAJOR ALIGNMENTS NORTH COMMUNITY
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
DRAWN BY FCD R.F.
CHECKED BY FCD K.J.M.
CHECKED BY W&S T.V.H.
FILE NO.
SYS. NO.
SHEET 1 OF 4 SHEETS

TRIBUTARY DRAINAGE MAP


Doberman St
Dachshund Avenue
Shepherd Road
Johnson Road
Vega Road
Harris Lane
ROAD
CORP
3029
3020
3010
3050
3082
3000
3020
20
21
N15
N-04
N14
PROJECT SITE
Prospect
Burbank Avenue
N13
Mine
N12
N11
3058
Los Padres Road
Comanche Road
3600
Bell 2
3897
Bell Mtn
BELL
Altadena St
Dale Evans Pky
Dachshund Avenue
3200
3047
Gustine Road
29
28
pects
Copyright (C) 2009 MyTopo, 2006-2022 TomTom

2010 ANTECEDENT MOISTURE CONDITION (AMC) MAP

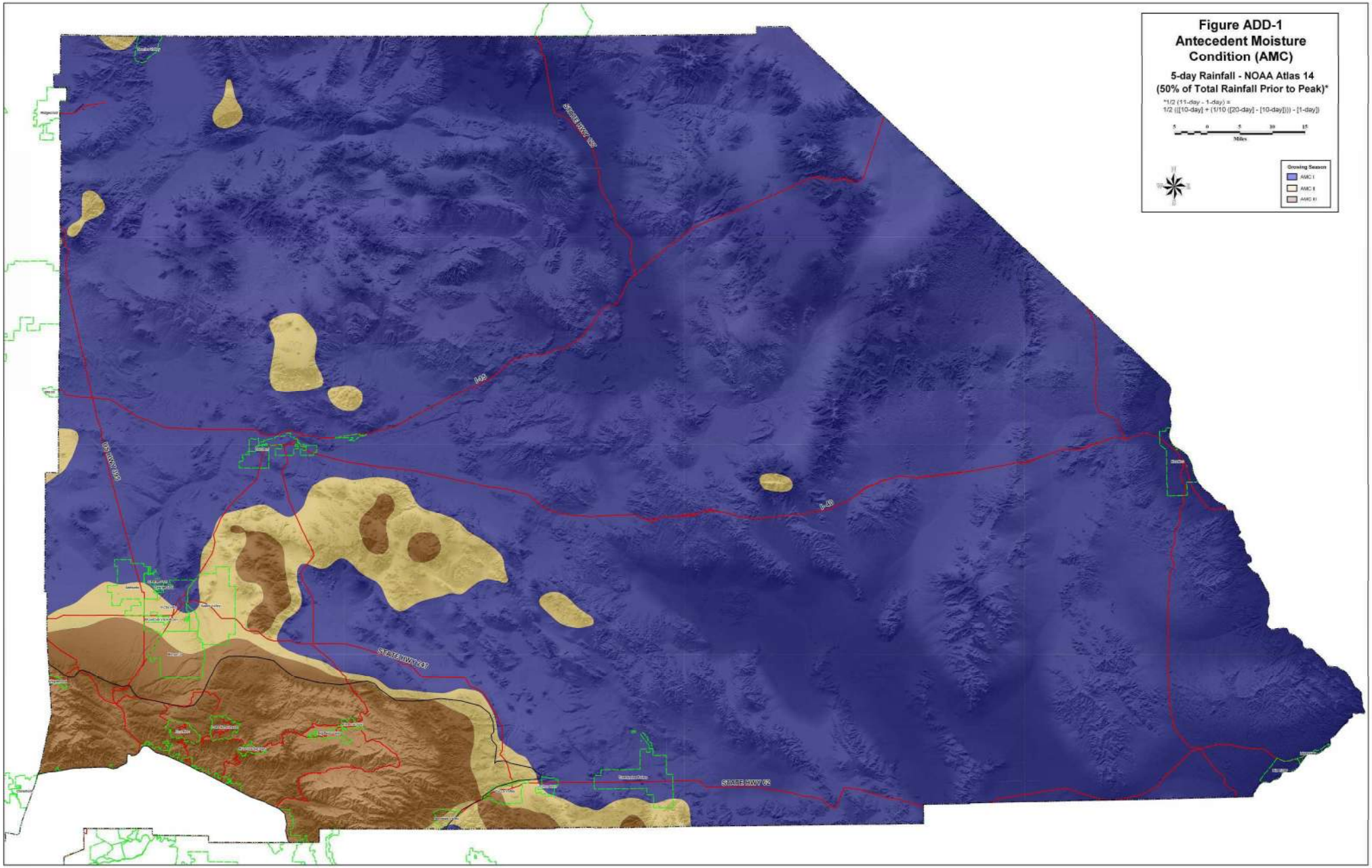
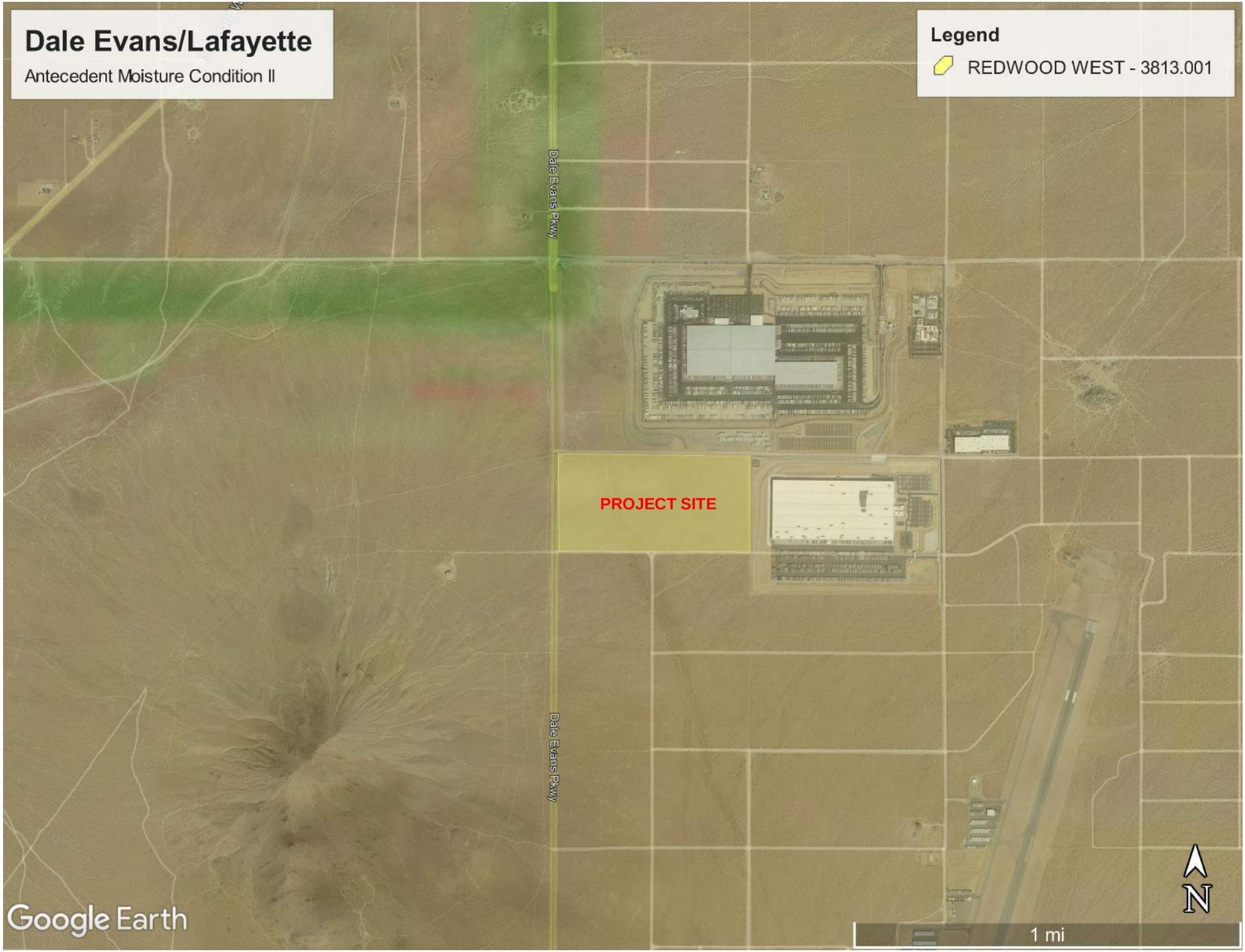


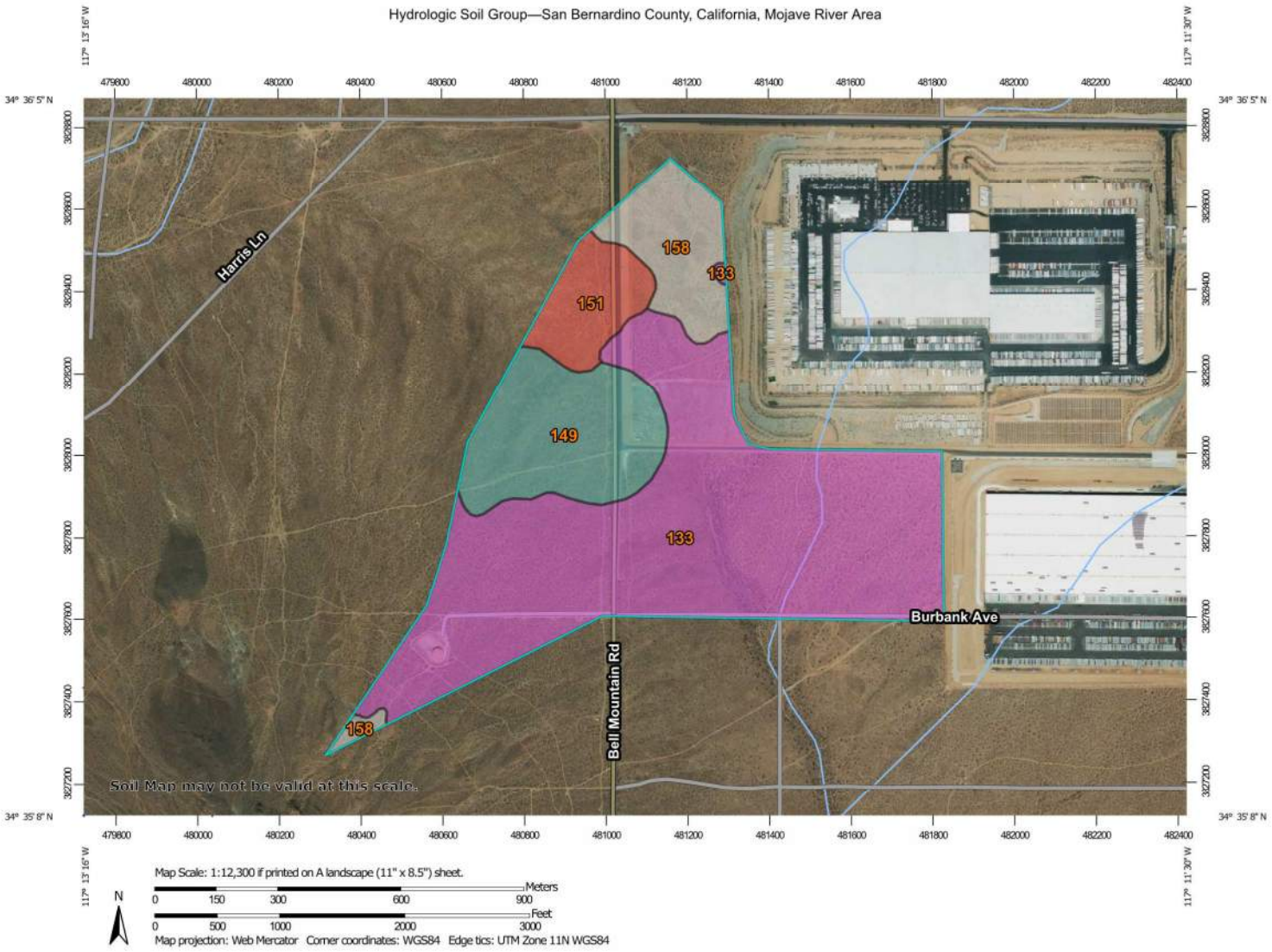
Figure ADD-1
Antecedent Moisture
Condition (AMC)
5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*
*1/2 (11-day - 1-day) =
1/2 ([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day]
5 0 5 10 15
Miles
Growing Season
AMC I
AMC II
AMC III
STATE HWY 237
STATE HWY 52
I-40


Dale Evans/Lafayette
Antecedent Moisture Condition II
Legend
REDWOOD WEST - 3813.001
Dale Evans Pkwy
PROJECT SITE
Dale Evans Pkwy
Google Earth
N
1 mi

EXHIBITS

SOILS MAP

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



Map Scale: 1:12,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

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

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
133	HELENDALE-BRYMAN LOAMY SANDS, 2 TO 5 PERCENT SLOPES*	A	144.0	66.1%
149	MIRAGE-JOSHUA COMPLEX, 2 TO 5 PERCENT SLOPES*	C	36.6	16.8%
151	NEBONA-CUDDEBACK COMPLEX, 2 TO 9 PERCENT SLOPES*	D	15.5	7.1%
158	ROCK OUTCROP-LITHIC TORRIORTHENTS COMPLEX, 15 TO 50 PERCENT SLOPES*		21.8	10.0%
Totals for Area of Interest			**217.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA ATLAS 14 POINT RAINFALLS

NOAA Atlas 14, Volume 6, Version 2
Location name: Apple Valley, California, USA*
Latitude: 34.5975°, Longitude: -117.2034°
Elevation: 3044.35 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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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	0.083 (0.068-0.101)	0.116 (0.096-0.143)	0.163 (0.134-0.201)	0.204 (0.166-0.253)	0.263 (0.207-0.337)	0.311 (0.240-0.407)	0.362 (0.273-0.486)	0.418 (0.307-0.577)	0.500 (0.352-0.717)	0.567 (0.386-0.841)
10-min	0.118 (0.098-0.145)	0.167 (0.137-0.205)	0.234 (0.192-0.288)	0.292 (0.238-0.363)	0.376 (0.297-0.482)	0.445 (0.344-0.583)	0.519 (0.391-0.696)	0.600 (0.440-0.826)	0.716 (0.504-1.03)	0.812 (0.553-1.21)
15-min	0.143 (0.118-0.176)	0.202 (0.166-0.248)	0.283 (0.232-0.348)	0.353 (0.288-0.438)	0.455 (0.359-0.583)	0.539 (0.416-0.705)	0.628 (0.473-0.842)	0.725 (0.532-0.999)	0.866 (0.610-1.24)	0.982 (0.668-1.46)
30-min	0.196 (0.161-0.240)	0.275 (0.227-0.338)	0.387 (0.317-0.476)	0.483 (0.393-0.599)	0.622 (0.490-0.797)	0.736 (0.568-0.963)	0.858 (0.647-1.15)	0.991 (0.727-1.37)	1.18 (0.833-1.70)	1.34 (0.913-1.99)
60-min	0.245 (0.202-0.301)	0.345 (0.284-0.424)	0.485 (0.398-0.597)	0.605 (0.493-0.751)	0.779 (0.614-0.999)	0.922 (0.712-1.21)	1.08 (0.811-1.44)	1.24 (0.911-1.71)	1.48 (1.04-2.13)	1.68 (1.15-2.50)
2-hr	0.348 (0.287-0.427)	0.472 (0.388-0.579)	0.642 (0.527-0.790)	0.788 (0.641-0.977)	0.997 (0.785-1.28)	1.17 (0.900-1.53)	1.35 (1.01-1.81)	1.54 (1.13-2.12)	1.82 (1.28-2.61)	2.04 (1.39-3.03)
3-hr	0.423 (0.348-0.519)	0.565 (0.465-0.694)	0.760 (0.624-0.936)	0.927 (0.754-1.15)	1.16 (0.917-1.49)	1.36 (1.05-1.77)	1.56 (1.17-2.09)	1.77 (1.30-2.44)	2.08 (1.46-2.99)	2.33 (1.59-3.46)
6-hr	0.576 (0.475-0.707)	0.762 (0.627-0.935)	1.01 (0.832-1.25)	1.23 (0.998-1.52)	1.53 (1.20-1.96)	1.77 (1.36-2.31)	2.02 (1.52-2.70)	2.28 (1.67-3.14)	2.66 (1.87-3.81)	2.96 (2.01-4.39)
12-hr	0.742 (0.611-0.910)	0.984 (0.810-1.21)	1.31 (1.08-1.61)	1.58 (1.29-1.96)	1.96 (1.55-2.52)	2.26 (1.75-2.96)	2.57 (1.94-3.45)	2.90 (2.13-3.99)	3.35 (2.36-4.81)	3.71 (2.53-5.51)
24-hr	0.976 (0.865-1.12)	1.31 (1.16-1.51)	1.76 (1.55-2.03)	2.12 (1.86-2.47)	2.63 (2.23-3.17)	3.03 (2.51-3.72)	3.44 (2.78-4.33)	3.86 (3.04-5.00)	4.45 (3.37-6.01)	4.92 (3.59-6.87)
2-day	1.16 (1.02-1.33)	1.58 (1.40-1.82)	2.14 (1.89-2.47)	2.60 (2.28-3.02)	3.23 (2.73-3.88)	3.71 (3.08-4.57)	4.22 (3.42-5.31)	4.74 (3.73-6.13)	5.45 (4.12-7.36)	6.01 (4.39-8.39)
3-day	1.26 (1.12-1.45)	1.73 (1.54-2.00)	2.36 (2.09-2.73)	2.88 (2.52-3.35)	3.58 (3.04-4.32)	4.13 (3.43-5.08)	4.69 (3.80-5.91)	5.27 (4.15-6.83)	6.06 (4.58-8.19)	6.69 (4.88-9.34)
4-day	1.33 (1.18-1.53)	1.84 (1.63-2.12)	2.52 (2.23-2.91)	3.07 (2.69-3.58)	3.83 (3.24-4.61)	4.41 (3.66-5.42)	5.01 (4.06-6.30)	5.62 (4.43-7.28)	6.47 (4.89-8.73)	7.13 (5.21-9.96)
7-day	1.45 (1.29-1.67)	1.99 (1.77-2.30)	2.71 (2.40-3.13)	3.30 (2.89-3.85)	4.11 (3.49-4.95)	4.74 (3.94-5.83)	5.39 (4.36-6.78)	6.06 (4.77-7.84)	6.97 (5.27-9.41)	7.69 (5.62-10.7)
10-day	1.54 (1.36-1.77)	2.10 (1.86-2.42)	2.85 (2.52-3.29)	3.47 (3.04-4.04)	4.32 (3.66-5.20)	4.99 (4.14-6.13)	5.67 (4.60-7.14)	6.38 (5.03-8.27)	7.37 (5.57-9.94)	8.14 (5.94-11.4)
20-day	1.76 (1.56-2.02)	2.41 (2.14-2.78)	3.29 (2.91-3.80)	4.02 (3.52-4.68)	5.04 (4.27-6.06)	5.84 (4.84-7.17)	6.66 (5.40-8.39)	7.53 (5.93-9.75)	8.73 (6.60-11.8)	9.68 (7.07-13.5)
30-day	1.99 (1.76-2.29)	2.73 (2.42-3.15)	3.75 (3.31-4.33)	4.60 (4.03-5.35)	5.79 (4.91-6.97)	6.73 (5.59-8.28)	7.71 (6.25-9.71)	8.75 (6.89-11.3)	10.2 (7.70-13.7)	11.3 (8.27-15.8)
45-day	2.34 (2.08-2.69)	3.23 (2.86-3.72)	4.45 (3.93-5.14)	5.48 (4.80-6.38)	6.94 (5.89-8.36)	8.12 (6.74-9.97)	9.34 (7.57-11.8)	10.6 (8.39-13.8)	12.5 (9.43-16.8)	13.9 (10.2-19.5)
60-day	2.56 (2.27-2.95)	3.53 (3.12-4.06)	4.86 (4.29-5.61)	6.00 (5.26-6.99)	7.63 (6.47-9.19)	8.96 (7.43-11.0)	10.4 (8.39-13.0)	11.8 (9.33-15.3)	14.0 (10.6-18.8)	15.7 (11.4-21.9)

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

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

Please refer to NOAA Atlas 14 document for more information.

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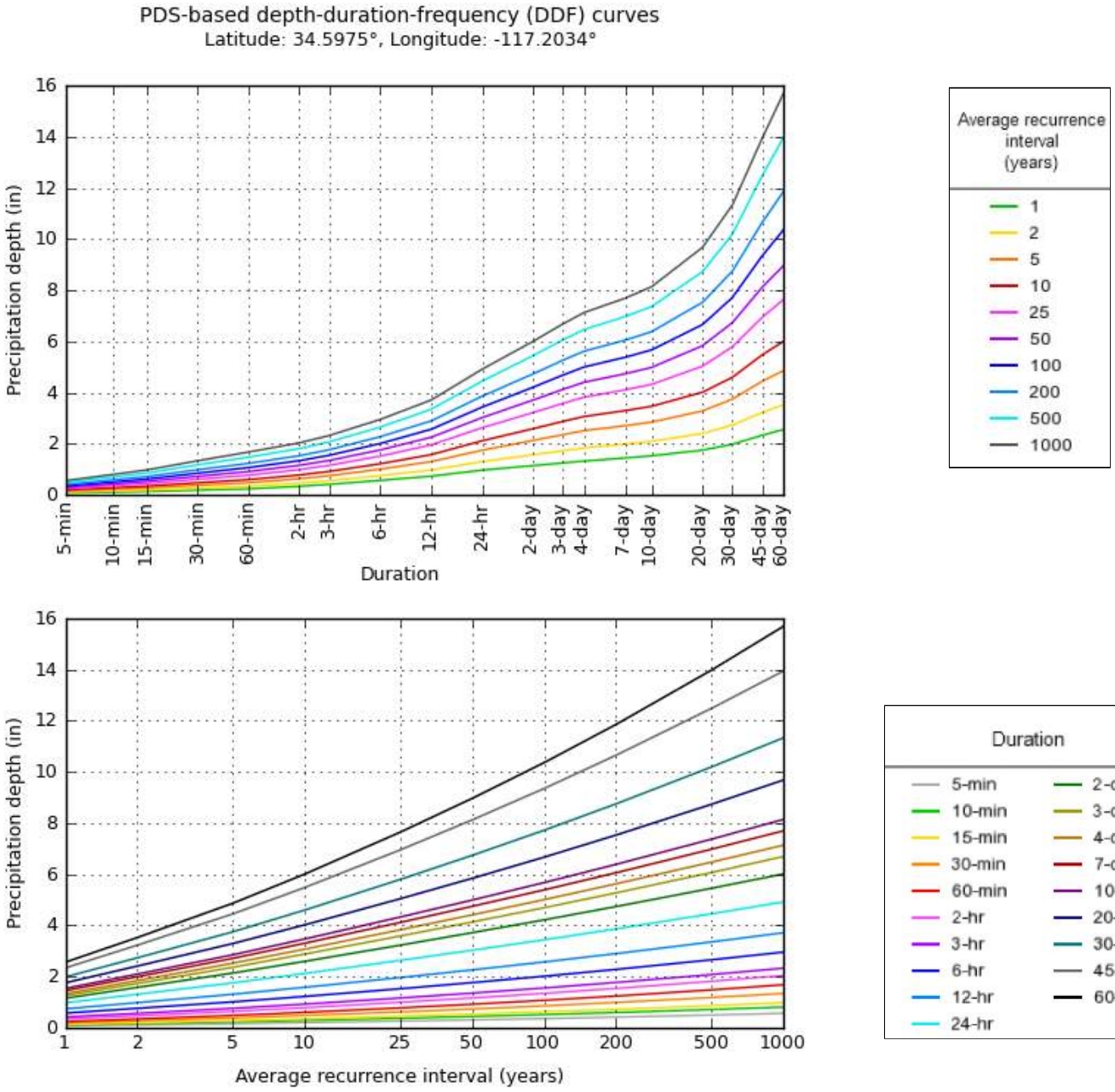
PF graphical



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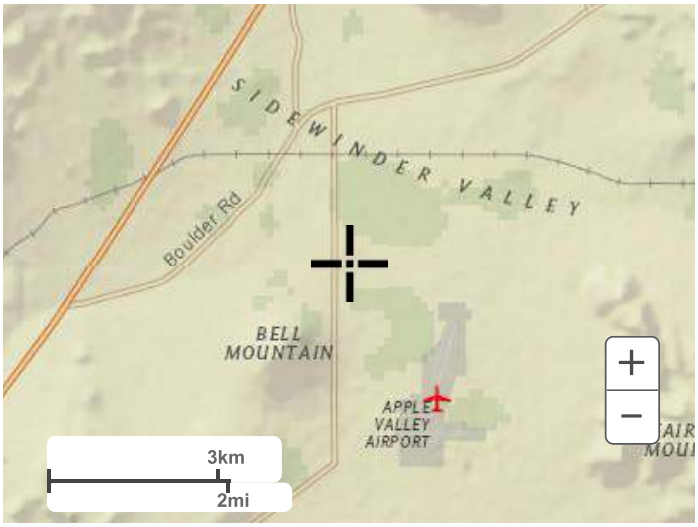
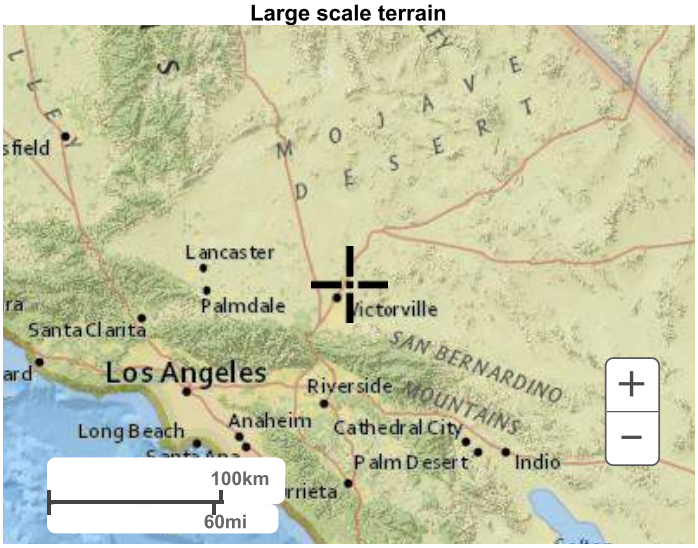
Maps & aerials

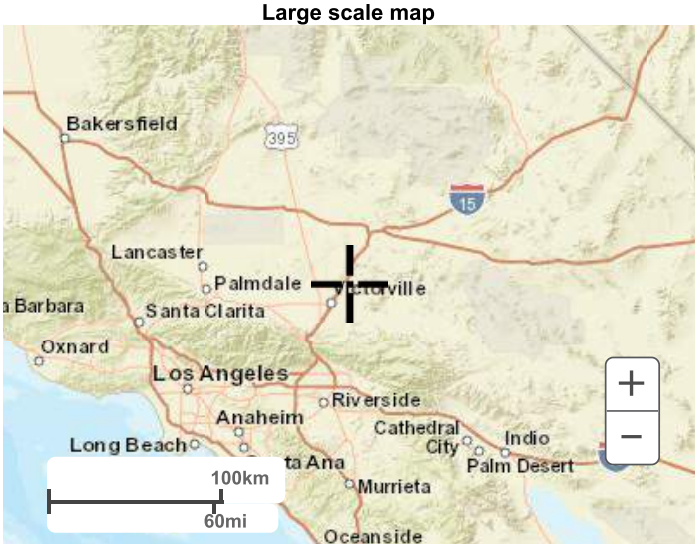
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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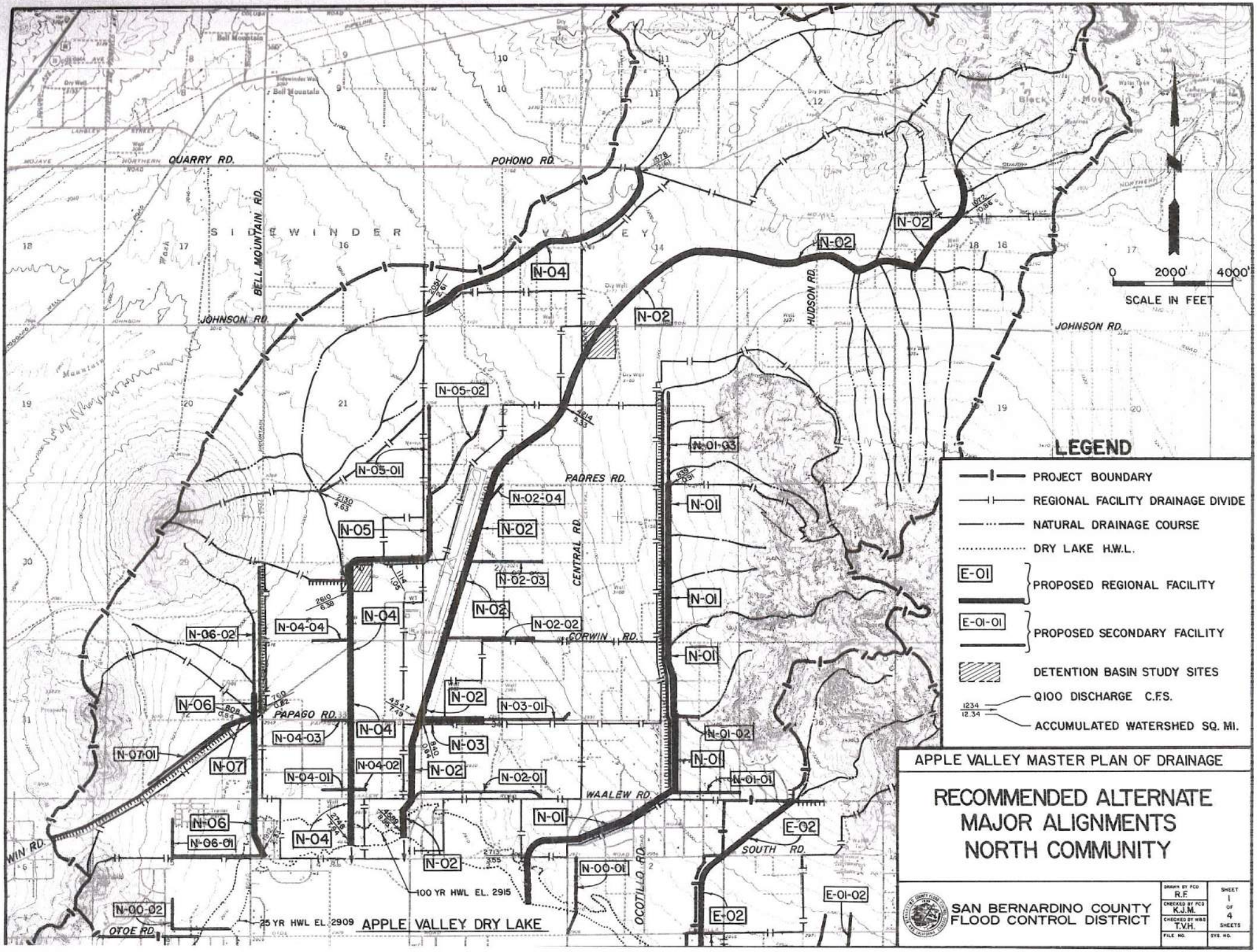
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

TOWN OF APPLE VALLEY

MASTER PLAN OF DRAINAGE MAP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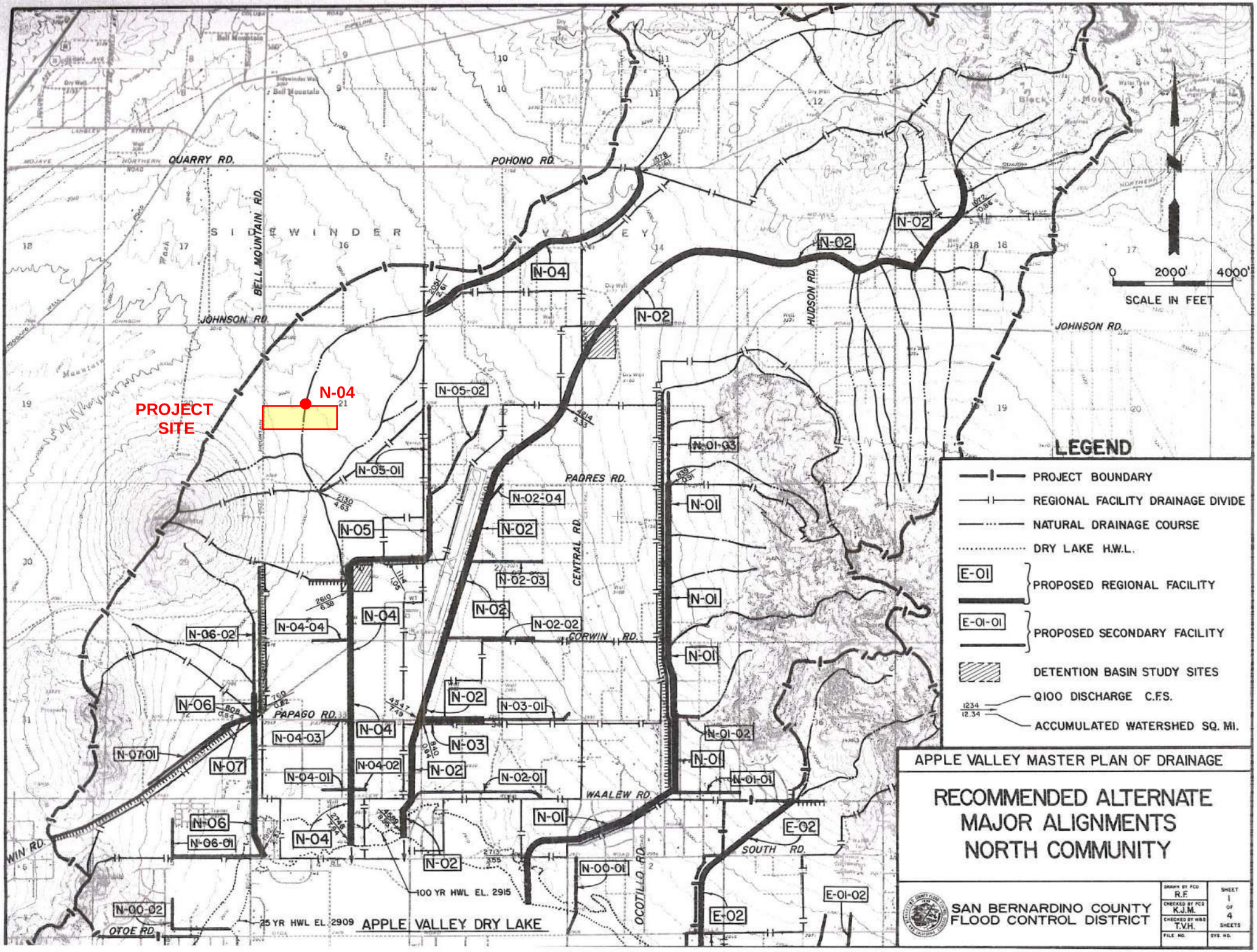
CORWIN RD.
PAPAGO RD.
WAALEW RD.
SOUTH RD.
OCOTILLO RD.
OTOE RD.
WIN RD.
SIDEWINDER VALLEY
APPLE VALLEY DRY LAKE
100 YR HWL EL. 2915
25 YR HWL EL. 2909
0 2000' 4000'
SCALE IN FEET
LEGEND
PROJECT BOUNDARY
REGIONAL FACILITY DRAINAGE DIVIDE
NATURAL DRAINAGE COURSE
DRY LAKE H.W.L.
E-01 PROPOSED REGIONAL FACILITY
E-01-01 PROPOSED SECONDARY FACILITY
DETENTION BASIN STUDY SITES
Q100 DISCHARGE C.F.S.
ACCUMULATED WATERSHED SQ. MI.
APPLE VALLEY MASTER PLAN OF DRAINAGE
RECOMMENDED ALTERNATE MAJOR ALIGNMENTS NORTH COMMUNITY
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
DRAWN BY FCD R.F.
CHECKED BY FCD K.J.M.
CHECKED BY W&S T.V.H.
FILE NO.
SYS. NO.
SHEET 1 OF 4 SHEETS


PROJECT SITE
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CORWIN RD.
PAPAGO RD.
WAALEW RD.
SOUTH RD.
OCOTILLO RD.
OTOE RD.
WIN RD.
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SCALE IN FEET
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SHEET 1 OF 4 SHEETS

ON-SITE CHANNEL FLOW PARAMETERS

Calc Depth (h)

h	**5.98**		(ft) depth (71.70")
Z_L		2.5	Run/ft Left
Z_R		2.5	Run/ft Right
b		50	(ft) bottom width
n		0.030	Manning Coef
S		0.002	Channel Slope
V		5.9	(fps) Calculated Velocity
Q		2,295	(cfs) Calculated Flow Rate
		1,029,996	(gpm)
		79.9	(ft) Water surface width
A		388.0	(sf) Area
R_h		4.72	Hydraulic Radius
Fr		0.18	Froude Number V^2/gz
		Flow type =	Subcritical Flow

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

DRAINAGE CHANNEL DESIGN CRITERIA

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
DESIGN CRITERIA

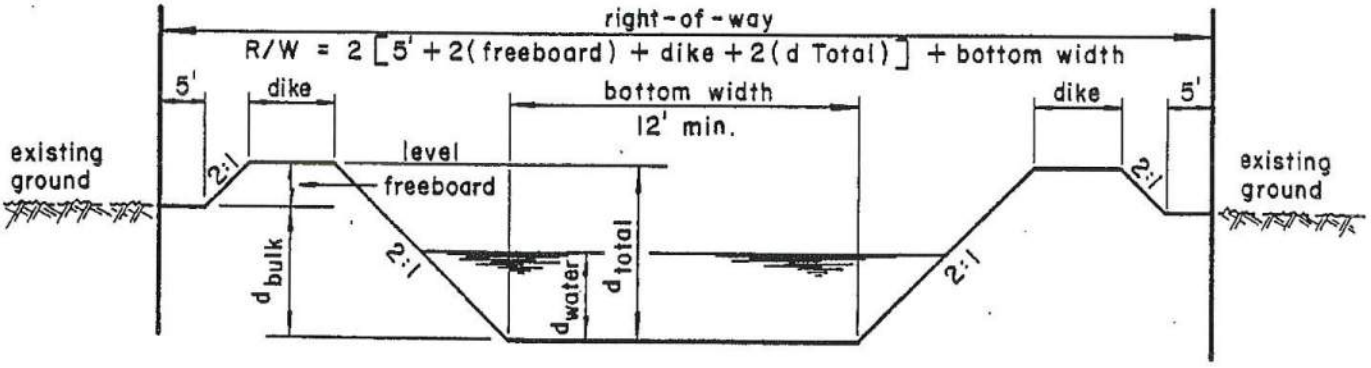
1) Hydrology calculations shall adhere to the San Bernardino County Hydrology Manual.

2) Structural calculations shall adhere to the Los Angeles County Flood Control District Structural Design Manual and to the State of California Department of Transportation Bridge Planning and Design Manuals and the Standard Plans.

3) Basin structural design shall adhere to the Los Angeles County Flood Control District Design Manual for Debris Dams and Basins.

4) Hydraulic design shall adhere to the Los Angeles County Flood Control District Hydraulic Design Manual and to the State of California Department of Transportation Highway Design Manual. Lined drainage facilities shall be designed with a bulking factor of 50% increase in water depth when there are no facilities to remove debris.
Closed conduit systems shall be designed with a surface backup system to handle a Q_{100} frequency storm, a bulking factor of 50% increase in Q_{100} and a debris basin system to remove debris. Culverts under roadways, except when connected to lined open channels, shall be designed in accordance with Caltrans Highway Design Manual.

5) Earth channel design shall adhere to the following:
   a) Bulk depth
      i) For graded earth channels, use $d_{bulk} = 1.5 d_{water}$
      ii) For natural drainage courses, compute d_{bulk} based upon $Q_{bulk} = 2\ Q_{100}$
   b) For total depth use $*d_{total} = d_{bulk}$ + freeboard
      * When "V" < 6 f.p.s. - use d_{water} + 2' freeboard
        8 f.p.s. > "V" ≥ 6 f.p.s. use d_{bulk} + 2' freeboard "V" = velocity
        "V" ≥ 8 f.p.s. use d_{bulk} + 3' freeboard
   c) Dike width
      When bottom width = 12' to 40' use dike width + 15'
      bottom width = 40' or more use dike width = 18'



EARTH CHANNEL SECTION

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT		
REVISIONS	DWN. BY	DATE
	FILE NO.	
	S.P. 100	