HYDROLOGY STUDY

For

LCM DEVELOPMENT, LLC.
841 EAST WASHINGTON AVENUE
SANTA ANA, CA 92701

RAIL LOOP LOADING FACILITY
HINKLEY, CA

December 16, 2024

Prepared by:

Merrell-Johnson Companies

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

Job No. 3104.006

E. Cary Packer, PE
Associate Engineer
R.C.E. 51752 Exp. 06/30/26

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 from the watershed tributary to the proposed expanded project site as delineated on the map contained in this study. This study also examines measures to intercept the runoff flows and to convey them through the project site to their historical flow locations. The development of the site is 120 car rail loop and rock ballast loading operation.

PROJECT LOCATION

The project site is located southeast of Harper Dry Lake approximately four miles northwest of Hinkley and 13 miles west of Barstow, California in the unincorporated area of Hinkley in northwesterly San Bernardino County. The project site is the Lynx Cat Mountain Quarry, Mine I.D. # 91-36-0049. It encompasses APN's 0496-011-07 located in Section 1, Township 10 North, Range 4 West (T10N, R4W). The project site is highlighted on the attached vicinity map.

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. Maps: Twelve Gage Lake and Hinkley and an examination of the project site.

Point rainfalls for the 100-year storms were obtained from the NOAA Atlas 14 per the 2010 Addendum to the County Hydrology Manual. The original hydrology analysis of the project, performed in 2009 incorporated a point rainfall of 1.2" and AMC II. Per the aforementioned 2010 addendum, the off-site unit hydrograph analysis was performed using a 100-year 1-hour point rainfall of 1.11" and AMC II. The soil type was determined to be Soil Type C in the off-site tributaries per the county hydrology manual. Rainfall and soils maps are included as exhibits in Section 3 of this report.

The parameters of the off-site tributary sub-areas examined in this study are shown in Table A and are outlined on the attached U.S.G.S. map.

Table A

Sub-area	Elevation Difference (ft.)	Length (ft)	Area (Acres)	Avg. Slope (ft/ft)
Node 31 – Node 34	27	3,882	109.4	0.0069
Node 41 – Node 43	23	1,063	12.9	0.0216

EXISTING CONDITIONS

The project site is located south of Harper Dry Lake in an unincorporated area of San Bernardino County. The tributary watershed area south of the project site is bounded on the south by the BNSF railroad main line. The raised rail bed serves to divert storm runoff flows to the east and west towards existing drainage culverts beneath the railroad. The proposed site is located north of the railroad and between two existing drainage culverts. Runoff flows from areas south of the BNSF railroad are diverted to the east and west of the project site. These two flowlines are mapped as blueline streams on the U.S.G.S maps and flow around and past the project site. Both blueline streams and the tributary watershed between the railroad and the project site are shown on the attached map exhibit. Runoff flows from this tributary area enter the site along the southern property line as sheet flows across the project site. Existing vegetation on the site consists of desert brush and vegetation in sandy surface soils.

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

Table B

Sub-Area	Q_{100} (cfs)
Node 31 – Node 34	83.2
Node 41 – Node 43	27.3

CONCLUSIONS AND RECOMMENDATIONS

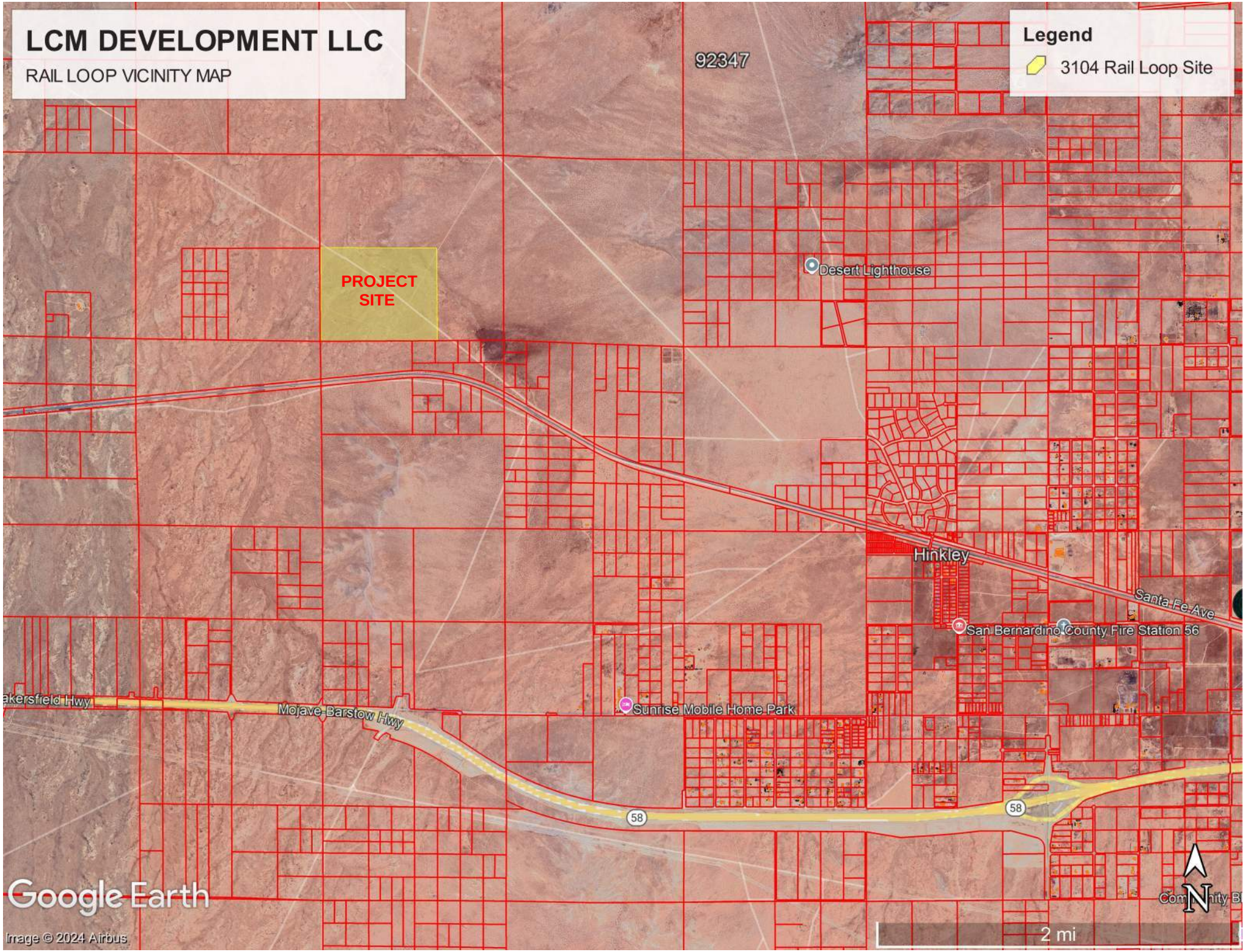
During our field investigation of the site, we observed the existing conditions as stated previously. The calculated 100-year storm runoff flows enter the site along the southern and southwestern boundaries of the project as indicated on the attached exhibits.

The existing drainage flows are captured as they enter the project site along the southern and southwestern project boundaries. Storm runoff crossing the southern project boundary will be directed towards a proposed drainage culvert beneath the loop railbed. This flow will be retained within the rail loop and infiltrated into the ground. The runoff will infiltrate within the area of the crushed ballast and will not flow across the loading areas or equipment storage areas. The blue line streams which flow beneath the BNSF railroad improvements do not enter the project site and will not be disturbed by this project.

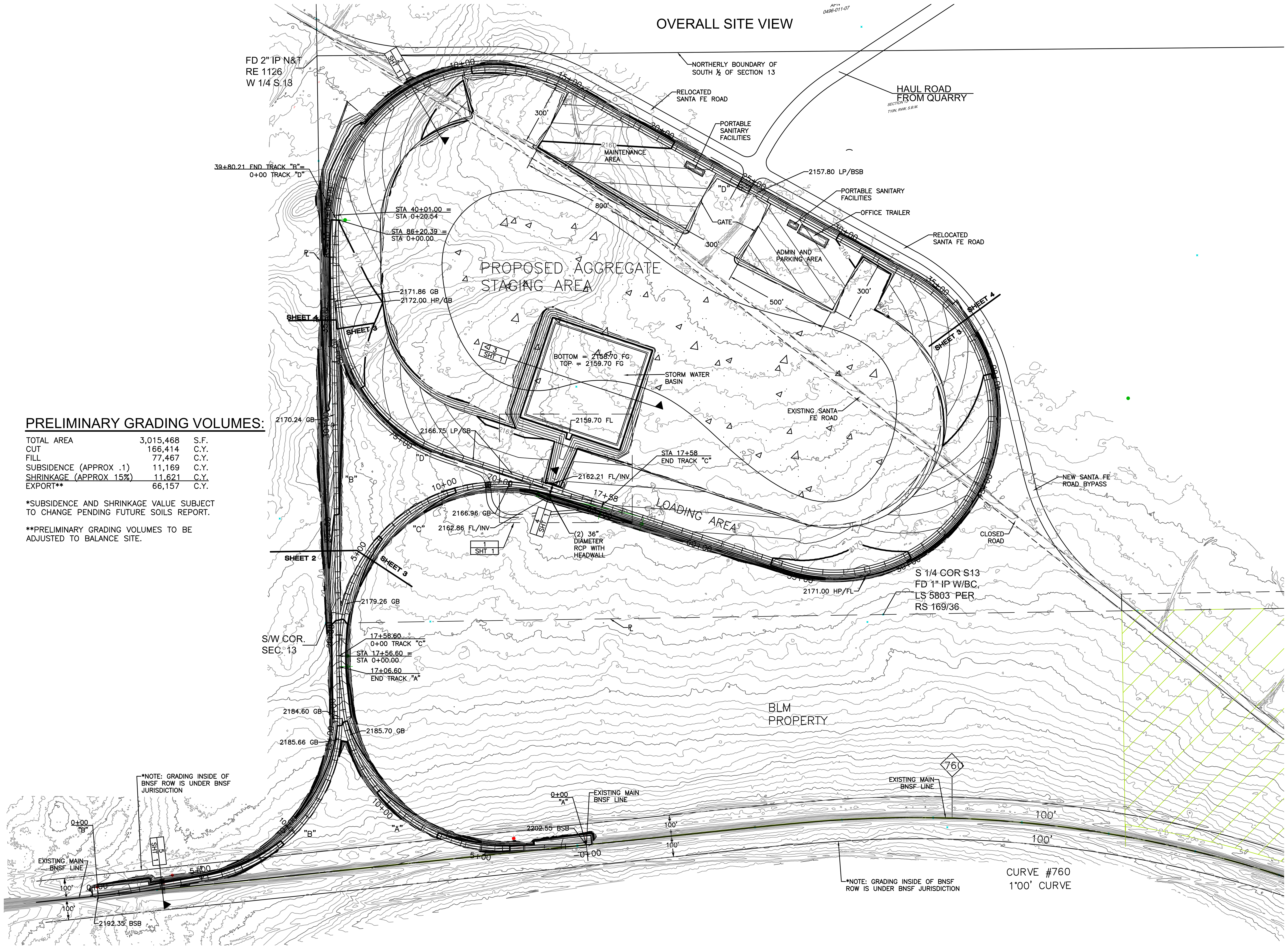
SECTION 2

EXHIBITS

VICINITY MAP


LCM DEVELOPMENT LLC
RAIL LOOP VICINITY MAP
Legend
3104 Rail Loop Site
92347
PROJECT SITE
Desert Lighthouse
Hinkley
Santa Fe Ave
San Bernardino County Fire Station 56
Sunrise Mobile Home Park
Mojave-Barstow Hwy
58
58
Google Earth
Image © 2024 Airbus
2 mi
N

PROPOSED DEVELOPMENT PLAN

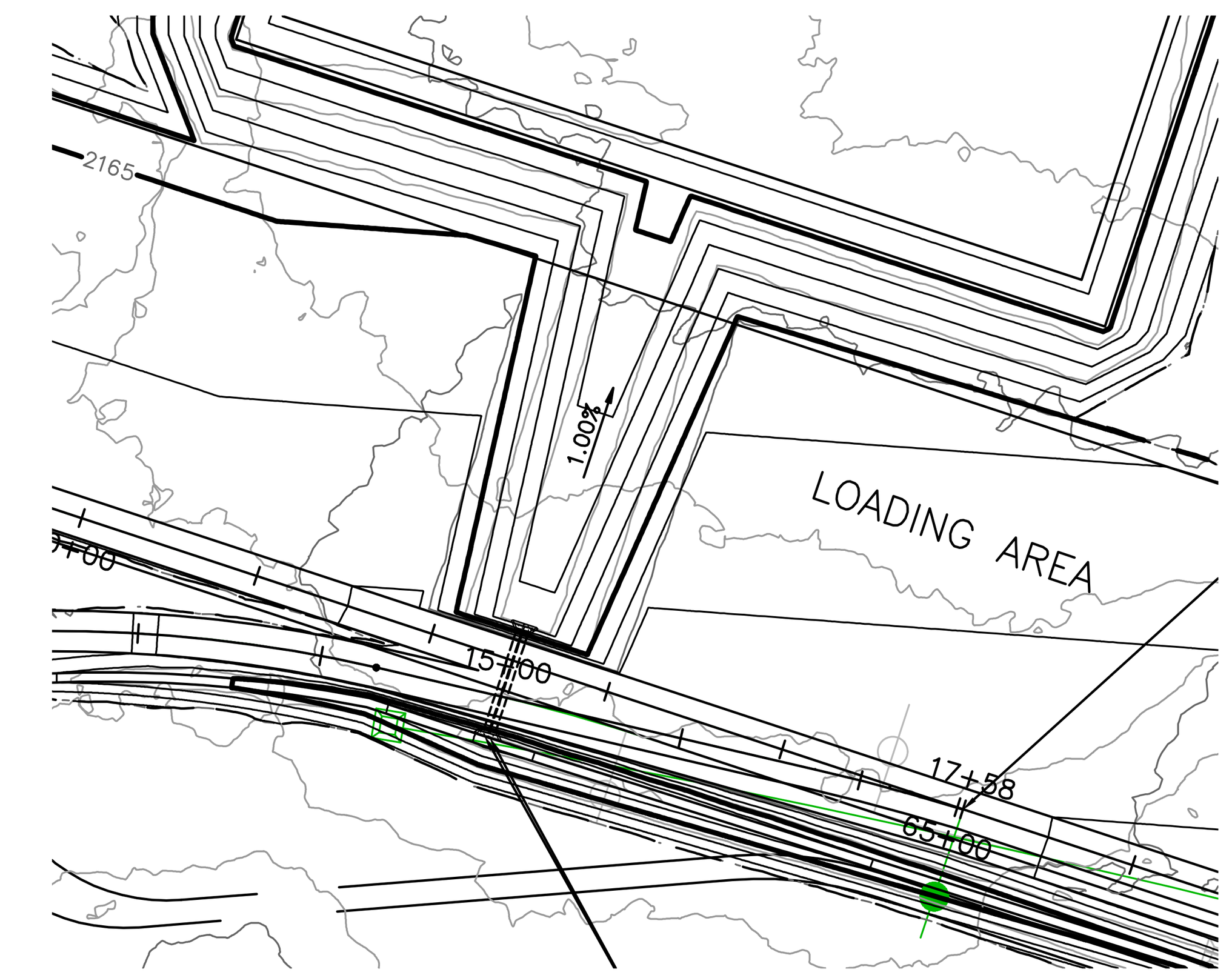


PRELIMINARY GRADING VOLUMES:

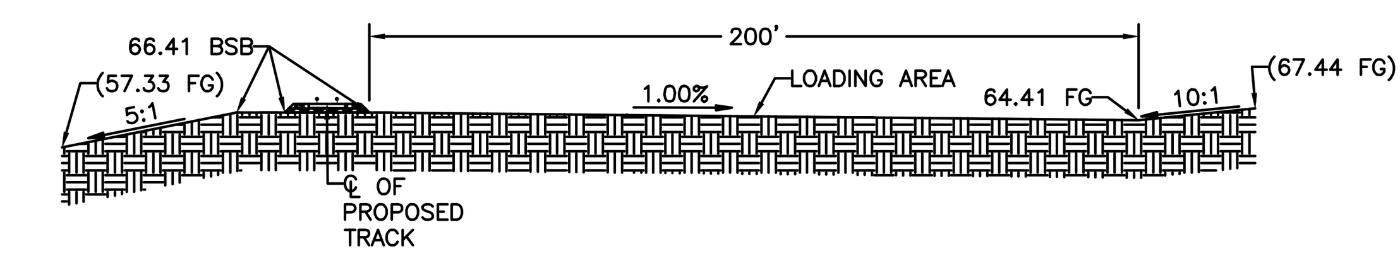
TOTAL AREA	3,015,468	S.F.
CUT	166,414	C.Y.
FILL	77,467	C.Y.
SUBSIDENCE (APPROX .1)	11,169	C.Y.
SHRINKAGE (APPROX 15%)	11,621	C.Y.
EXPORT**	66,157	C.Y.

*SUBSIDENCE AND SHRINKAGE VALUE SUBJECT TO CHANGE PENDING FUTURE SOILS REPORT.

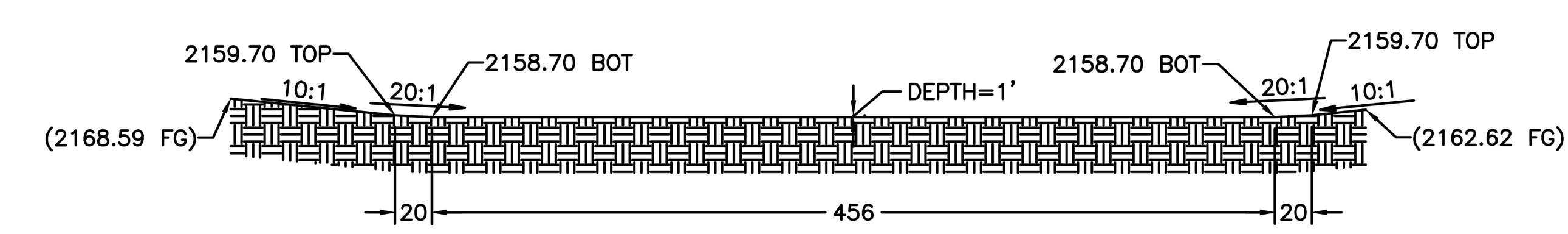
**PRELIMINARY GRADING VOLUMES TO BE ADJUSTED TO BALANCE SITE.



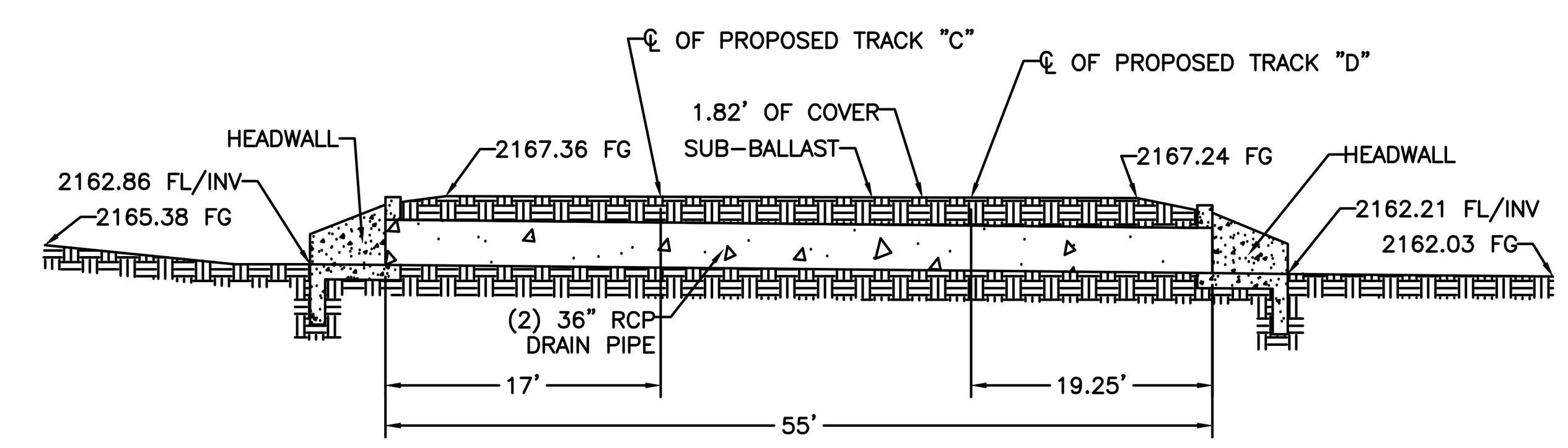
1 SHT 1 DRAINAGE BLOW-UP



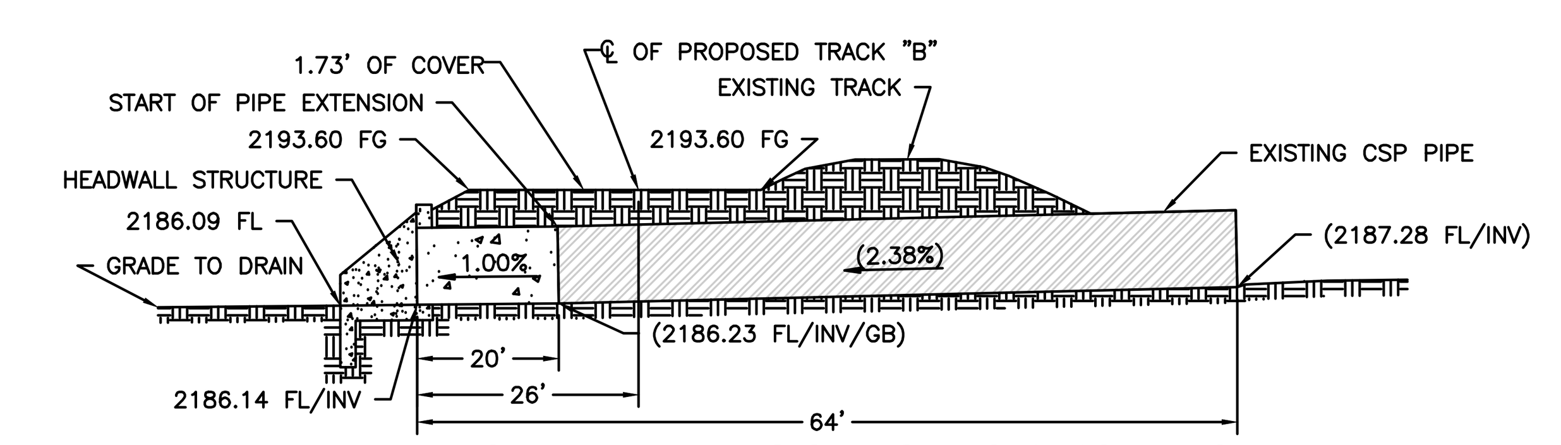
2 SHT 1 TRACK "B" AND LOADING AREA SECTION



3 SHT 1 BASIN CROSS SECTIONS



4 SHT 1 CORRUGATED PIPE DRAINAGE SECTION : STA 15+00.00 TRACK "C"



5 SHT 1 RCP PIPE EXTENSION : STA 3+07.83 TRACK "B"

PROPOSED DEVELOPMENT PLAN

811 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: USGS BENCHMARK Q 1137 (PID EV0282)

LOCATION: 13.6 MI WEST FROM BARSTOW.
13.6 MILES WEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE STATION AT BARSTOW, AT THE WEST END OF A LONG CURVE, 55 FEET SOUTH AND ACROSS THE TRACK FROM MILEPOST 760, 43.6 FEET SOUTH OF THE SOUTH RAIL, 4 FEET WEST OF A TELEPHONE POLE, 1.6 FEET SOUTH OF A WITNESS POST, ABOUT LEVEL WITH THE TRACK, AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.3 FOOT ABOVE THE GROUND.

ELEVATION: 2203.15 (NAVD88)

BASIS OF BEARINGS

STATIC GPS OBSERVATION – CALIFORNIA STATE PLANE COORDINATES ZONE V
BASE POINT – N: 2180292.58 E: 6787357.92

DATE	DELTA	REVISION DESCRIPTION	APPROVAL DATE	APPROVAL BY

MERRELL JOHNSON

MERRELL JOHNSON ENGINEERING, INC.
22221 U.S. HIGHWAY 18, APPLE VALLEY, CA 92307
760 240 8000 | MERRELLJOHNSON.COM

RAIL LOOP PRELIMINARY GRADING AND CROSS SECTIONS

FOR:
LCM DEVELOPMENT LLC
841 EAST WASHINGTON AVENUE
SANTA ANA, CA 92701

DRAWN BY: HR
DATE: 07/15/24
JOB NO. 3104.006
SHEET 1 OF 34

SECTION 3

HYDROLOGY CALCULATIONS

OFF-SITE HYDROLOGY CALCULATIONS

RATIONAL CALCULATIONS – Q_{100}

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: 04/05/24

LYNX CAT MINE - RAIL LOOP - MATCON
OFF-SITE TRIBUTARY RUNOFF FLOWS
NODE 31 - NODE 32
100-YEAR STORM EVENT - AMC I

MERRELL JOHNSON ENGINEERING
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 = 1.110 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 1

++
Process from Point/Station 31.000 to Point/Station 32.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.507(In/Hr)
Initial subarea data:
Initial area flow distance = 915.000(Ft.)
Top (of initial area) elevation = 2200.000(Ft.)
Bottom (of initial area) elevation = 2181.000(Ft.)
Difference in elevation = 19.000(Ft.)
Slope = 0.02077 s(%)= 2.08
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 17.429 min.
Rainfall intensity = 2.637(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.727
Subarea runoff = 16.868(CFS)
Total initial stream area = 8.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.507(In/Hr)

++
Process from Point/Station 32.000 to Point/Station 33.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Depth of flow = 0.739(Ft.), Average velocity = 1.667(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            20.00              0.00
      4            30.00              2.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     16.868(CFS)
  '     '    flow top width =     17.390(Ft.)
  '     '    velocity=    1.667(Ft/s)
  '     '    area =     10.121(Sq.Ft)
  '     '    Froude number =     0.385

Upstream point elevation =  2181.000(Ft.)
Downstream point elevation =  2176.000(Ft.)
Flow length =  1559.000(Ft.)
Travel time  =   15.59 min.
Time of concentration =   33.02 min.
Depth of flow =   0.739(Ft.)
Average velocity =   1.667(Ft/s)
Total irregular channel flow =    16.868(CFS)
Irregular channel normal depth above invert elev. =   0.739(Ft.)
Average velocity of channel(s) =   1.667(Ft/s)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       33.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
Time of concentration =    33.02 min.
Rainfall intensity =      1.686(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.629
Subarea runoff =     28.218(CFS) for   33.700(Ac.)
Total runoff =     45.086(CFS)
Effective area this stream =       42.50(Ac.)
Total Study Area (Main Stream No. 1) =       42.50(Ac.)
Area averaged Fm value =    0.507(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       33.000 to Point/Station       34.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Depth of flow =   1.385(Ft.), Average velocity =   1.923(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            20.00              0.00
      4            30.00              2.00
```

```
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     45.086(CFS)
  '     '    flow top width =     23.853(Ft.)
  '     '    velocity=    1.923(Ft/s)
  '     '    area =     23.448(Sq.Ft)
  '     '    Froude number =     0.342

Upstream point elevation =  2176.000(Ft.)
Downstream point elevation =  2173.000(Ft.)
Flow length =  1408.000(Ft.)
Travel time  =   12.20 min.
Time of concentration =   45.22 min.
Depth of flow =   1.385(Ft.)
Average velocity =   1.923(Ft/s)
Total irregular channel flow =    45.086(CFS)
Irregular channel normal depth above invert elev. =   1.385(Ft.)
Average velocity of channel(s) =   1.923(Ft/s)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       33.000 to Point/Station       34.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
Time of concentration =    45.22 min.
Rainfall intensity =      1.353(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.562
Subarea runoff =     38.162(CFS) for   66.900(Ac.)
Total runoff =     83.248(CFS)
Effective area this stream =      109.40(Ac.)
Total Study Area (Main Stream No. 1) =      109.40(Ac.)
Area averaged Fm value =    0.507(In/Hr)
End of computations, Total Study Area =          109.40 (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 =  86.0
```

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: 04/05/24

LYNX CAT MINE - RAIL LOOP - MATCON
OFF-SITE TRIBUTARY RUNOFF FLOW
NODE 41 - NODE 43
100-YEAR STORM EVENT - AMC I

MERRELL JOHNSON ENGINEERING
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 = 1.110 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 1

++
Process from Point/Station 41.000 to Point/Station 42.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.507(In/Hr)
Initial subarea data:
Initial area flow distance = 360.000(Ft.)
Top (of initial area) elevation = 2200.000(Ft.)
Bottom (of initial area) elevation = 2191.000(Ft.)
Difference in elevation = 9.000(Ft.)
Slope = 0.02500 s(%)= 2.50
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.564 min.
Rainfall intensity = 3.515(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.770
Subarea runoff = 9.743(CFS)
Total initial stream area = 3.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.507(In/Hr)

++
Process from Point/Station 42.000 to Point/Station 43.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Depth of flow = 0.455(Ft.), Average velocity = 2.940(Ft/s)
******* Irregular Channel Data **********

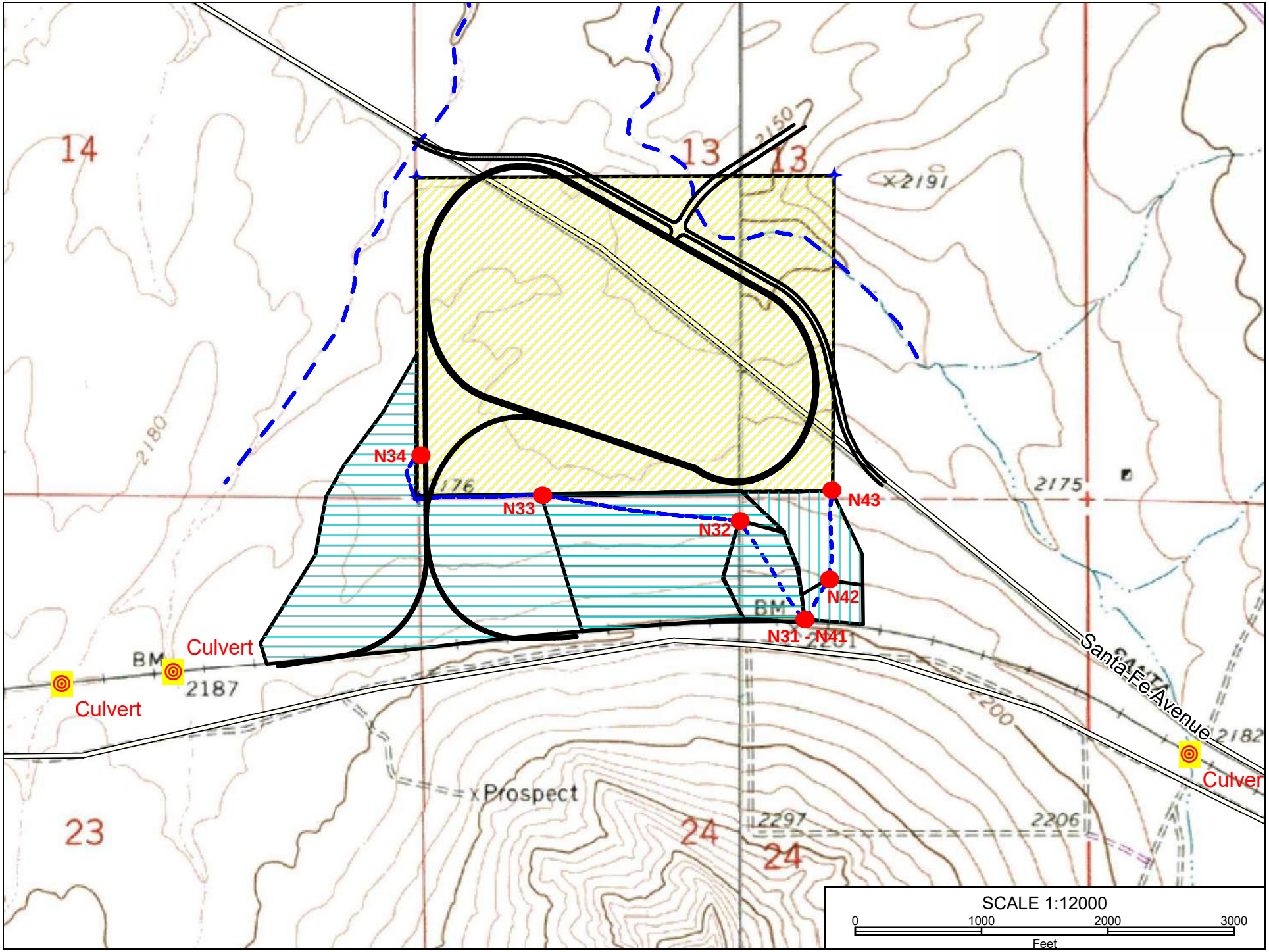
```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =      9.743(CFS)
  '     '    flow top width =      9.554(Ft.)
  '     '    velocity=    2.940(Ft/s)
  '     '    area =      3.314(Sq.Ft)
  '     '    Froude number =     0.880

Upstream point elevation =  2191.000(Ft.)
Downstream point elevation =  2177.000(Ft.)
Flow length =   703.000(Ft.)
Travel time  =    3.99 min.
Time of concentration =   15.55 min.
Depth of flow =   0.455(Ft.)
Average velocity =   2.940(Ft/s)
Total irregular channel flow =     9.743(CFS)
Irregular channel normal depth above invert elev. =   0.455(Ft.)
Average velocity of channel(s) =   2.940(Ft/s)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       43.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Adjusted SCS curve number for AMC 1 = 71.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.507(In/Hr)
Time of concentration =    15.55 min.
Rainfall intensity =      2.856(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.740
Subarea runoff =     17.529(CFS) for    9.300(Ac.)
Total runoff =     27.272(CFS)
Effective area this stream =       12.90(Ac.)
Total Study Area (Main Stream No. 1) =       12.90(Ac.)
Area averaged Fm value =    0.507(In/Hr)
End of computations, Total Study Area =           12.90 (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 =  86.0
```

TRIBUTARY DRAINAGE MAP


14
13
13
2150
2191
2180
N34
176
N33
N32
N43
2175
N42
BM
N31 - N41
Culvert
BM
2187
Culvert
Santa Fe Avenue
2182
Culver
Prospect
23
24
2297
2206
24
SCALE 1:12000
0
1000
2000
3000
Feet

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)*

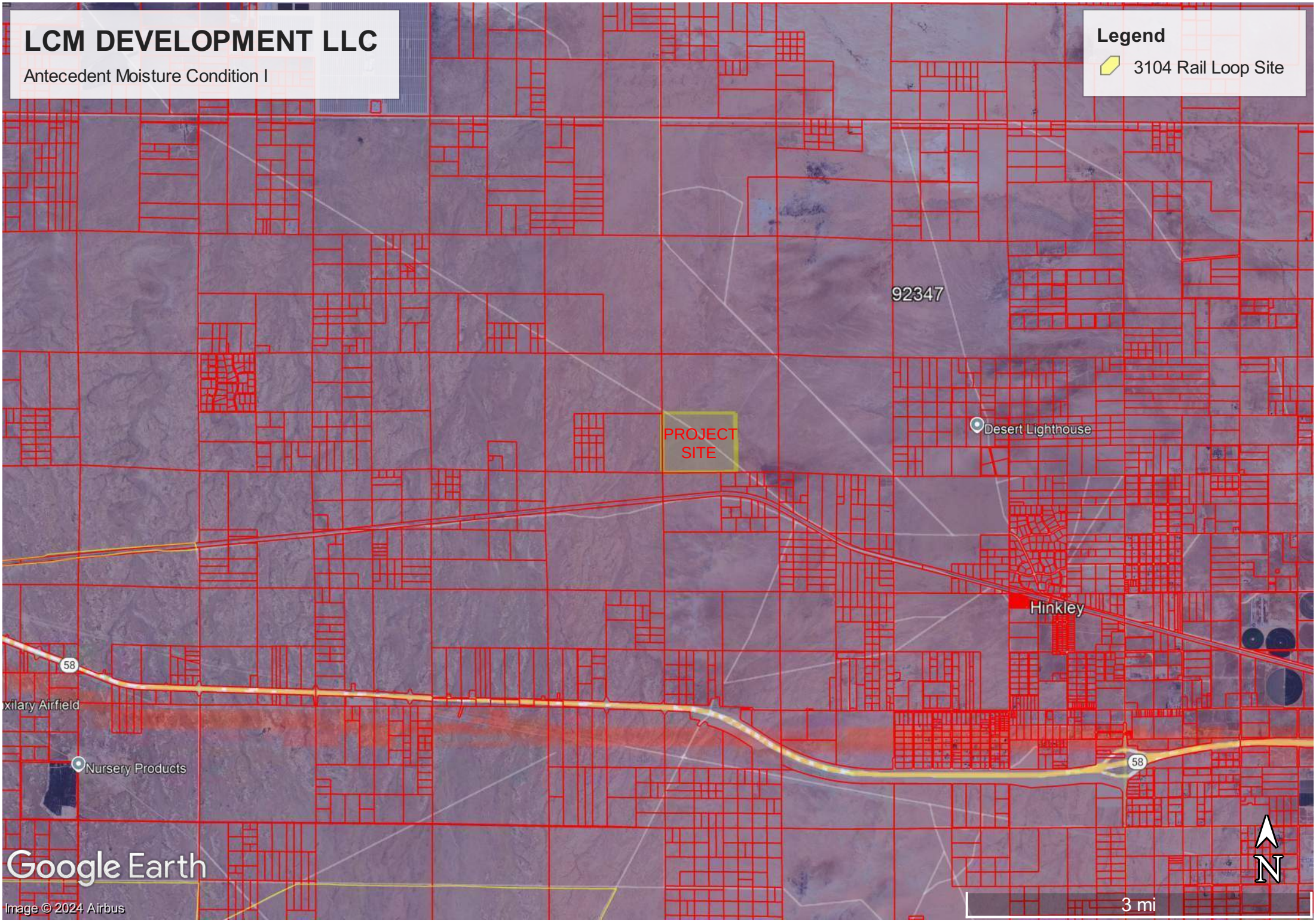
*1/2 (11-day - 1-day) =
1/2 (([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day])

5 0 5 10 15
Miles

N
W E
S

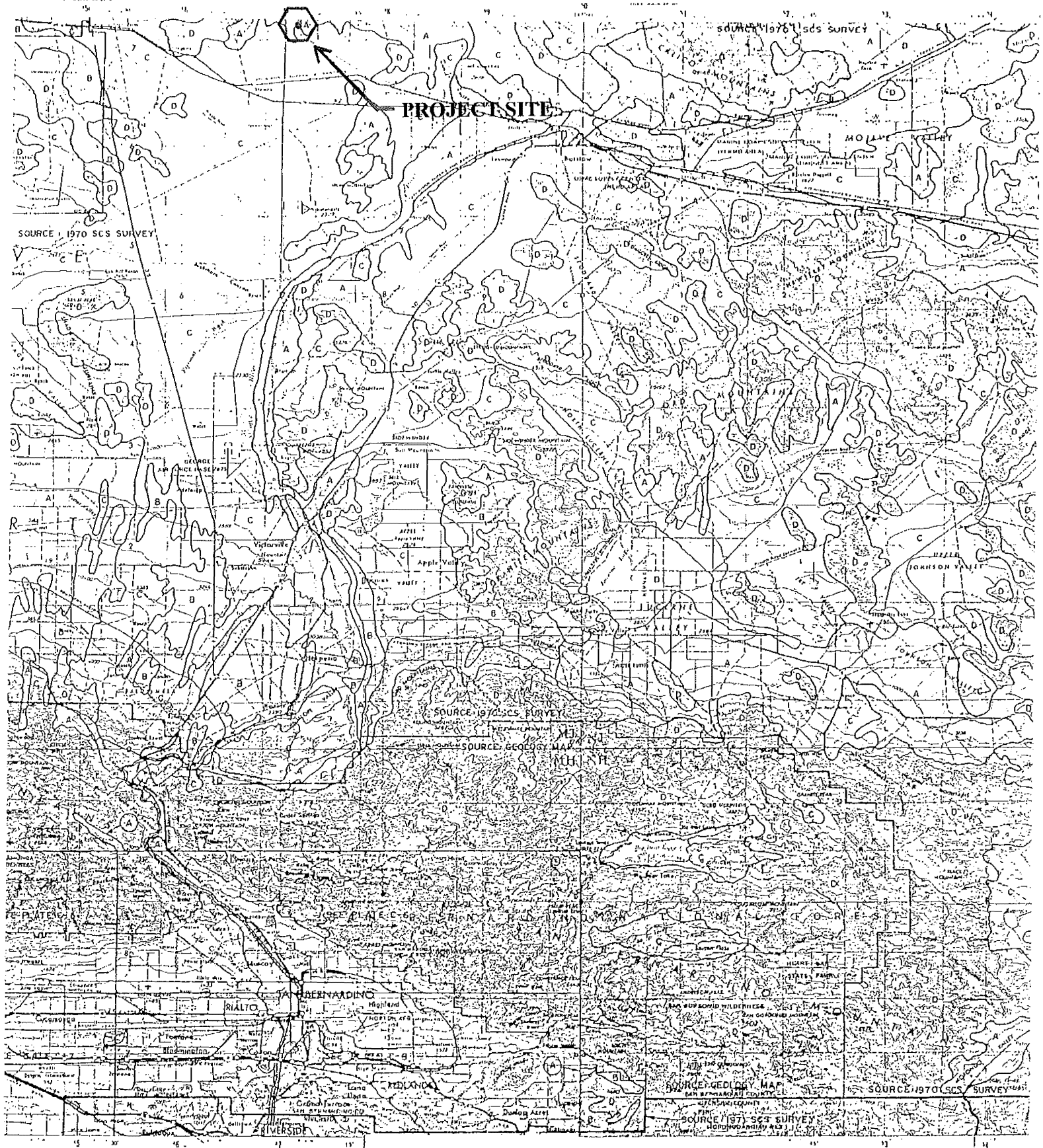
Growing Season
- AMC I
- AMC II
- AMC III

Death Valley
Ridgecrest
STATE HWY 127
Boron
I-15
US HWY 395
Barstow
Needles
I-40
Adelanto
George AFB
George Field
Victorville
Apple Valley
Mountain View Acres
Hesperia
STATE HWY 247
Wrightwood
Crestline
Lake Arrowhead
Big Bear City
Big Bear Lake
Running Springs
Yucaipa
Yucaipa Pass
STATE HWY 62
Yucca Valley
Morongo Valley
Joshua Tree
Twentynine Palms
Claremont
Blythe
Big River


LCM DEVELOPMENT LLC
Antecedent Moisture Condition I
Legend
3104 Rail Loop Site
92347
PROJECT SITE
Desert Lighthouse
Hinkley
58
xilary Airfield
Nursery Products
58
Google Earth
Image © 2024 Airbus
N
3 mi

EXHIBITS

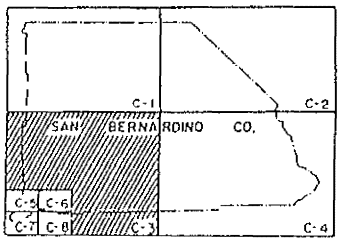
SOILS MAP



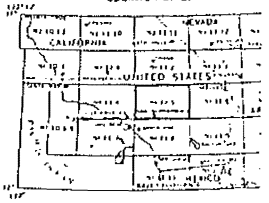
SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP FOR SOUTHCENTRAL AREA



INDEX MAP



NOAA ATLAS 14 POINT RAINFALLS

NOAA Atlas 14, Volume 6, Version 2
Location name: Hinkley, California, USA*
Latitude: 34.9455°, Longitude: -117.2462°
Elevation: 2233 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	0.080 (0.065-0.098)	0.113 (0.092-0.139)	0.158 (0.129-0.195)	0.196 (0.159-0.245)	0.251 (0.197-0.324)	0.296 (0.227-0.389)	0.343 (0.257-0.461)	0.393 (0.288-0.544)	0.466 (0.327-0.669)	0.524 (0.356-0.779)
10-min	0.114 (0.094-0.141)	0.161 (0.132-0.199)	0.226 (0.185-0.280)	0.282 (0.228-0.351)	0.360 (0.283-0.464)	0.424 (0.326-0.557)	0.491 (0.369-0.661)	0.564 (0.412-0.779)	0.667 (0.469-0.959)	0.752 (0.511-1.12)
15-min	0.138 (0.113-0.170)	0.195 (0.160-0.241)	0.274 (0.223-0.339)	0.340 (0.276-0.425)	0.436 (0.342-0.561)	0.513 (0.394-0.674)	0.594 (0.446-0.799)	0.682 (0.499-0.942)	0.807 (0.567-1.16)	0.909 (0.618-1.35)
30-min	0.191 (0.157-0.236)	0.270 (0.221-0.334)	0.379 (0.309-0.469)	0.472 (0.382-0.589)	0.604 (0.473-0.778)	0.710 (0.546-0.933)	0.823 (0.618-1.11)	0.945 (0.691-1.30)	1.12 (0.785-1.61)	1.26 (0.856-1.87)
60-min	0.258 (0.211-0.318)	0.364 (0.298-0.450)	0.510 (0.416-0.632)	0.635 (0.514-0.792)	0.813 (0.637-1.05)	0.956 (0.735-1.26)	1.11 (0.832-1.49)	1.27 (0.930-1.76)	1.50 (1.06-2.16)	1.70 (1.15-2.52)
2-hr	0.351 (0.287-0.433)	0.478 (0.391-0.590)	0.652 (0.532-0.808)	0.800 (0.648-0.999)	1.01 (0.793-1.30)	1.18 (0.907-1.55)	1.36 (1.02-1.83)	1.55 (1.13-2.14)	1.82 (1.28-2.62)	2.04 (1.39-3.03)
3-hr	0.412 (0.338-0.509)	0.556 (0.455-0.687)	0.752 (0.614-0.931)	0.919 (0.743-1.15)	1.16 (0.905-1.49)	1.34 (1.03-1.77)	1.54 (1.16-2.08)	1.76 (1.28-2.43)	2.06 (1.44-2.96)	2.30 (1.56-3.42)
6-hr	0.521 (0.427-0.643)	0.699 (0.571-0.863)	0.940 (0.767-1.16)	1.14 (0.926-1.43)	1.43 (1.12-1.84)	1.66 (1.28-2.18)	1.90 (1.43-2.56)	2.16 (1.58-2.98)	2.51 (1.77-3.61)	2.80 (1.90-4.16)
12-hr	0.616 (0.504-0.760)	0.837 (0.685-1.03)	1.14 (0.927-1.41)	1.39 (1.12-1.73)	1.74 (1.36-2.24)	2.01 (1.55-2.65)	2.30 (1.73-3.10)	2.61 (1.91-3.60)	3.03 (2.13-4.36)	3.37 (2.29-5.00)
24-hr	0.772 (0.685-0.888)	1.07 (0.949-1.23)	1.47 (1.30-1.70)	1.80 (1.58-2.10)	2.26 (1.92-2.72)	2.62 (2.17-3.22)	2.99 (2.42-3.76)	3.38 (2.66-4.37)	3.91 (2.95-5.28)	4.33 (3.16-6.06)
2-day	0.902 (0.801-1.04)	1.26 (1.12-1.45)	1.74 (1.54-2.01)	2.13 (1.87-2.48)	2.67 (2.26-3.21)	3.09 (2.56-3.79)	3.51 (2.85-4.43)	3.96 (3.12-5.13)	4.56 (3.45-6.16)	5.04 (3.68-7.04)
3-day	0.972 (0.863-1.12)	1.37 (1.21-1.57)	1.88 (1.67-2.18)	2.31 (2.02-2.69)	2.89 (2.45-3.47)	3.33 (2.76-4.09)	3.78 (3.07-4.77)	4.25 (3.35-5.51)	4.89 (3.70-6.61)	5.39 (3.94-7.54)
4-day	1.02 (0.906-1.17)	1.44 (1.27-1.65)	1.98 (1.75-2.29)	2.43 (2.13-2.82)	3.03 (2.57-3.64)	3.49 (2.90-4.29)	3.96 (3.21-4.98)	4.44 (3.50-5.75)	5.09 (3.85-6.88)	5.60 (4.09-7.83)
7-day	1.10 (0.981-1.27)	1.55 (1.37-1.78)	2.13 (1.88-2.46)	2.60 (2.28-3.02)	3.22 (2.73-3.88)	3.70 (3.07-4.55)	4.18 (3.39-5.27)	4.68 (3.68-6.06)	5.34 (4.03-7.21)	5.84 (4.26-8.17)
10-day	1.16 (1.03-1.34)	1.63 (1.45-1.88)	2.24 (1.98-2.58)	2.73 (2.39-3.17)	3.38 (2.87-4.07)	3.88 (3.22-4.76)	4.38 (3.54-5.51)	4.88 (3.84-6.32)	5.56 (4.20-7.51)	6.08 (4.43-8.49)
20-day	1.34 (1.19-1.54)	1.90 (1.68-2.18)	2.62 (2.32-3.02)	3.20 (2.81-3.72)	3.98 (3.38-4.79)	4.58 (3.80-5.62)	5.17 (4.19-6.52)	5.78 (4.55-7.49)	6.58 (4.98-8.89)	7.20 (5.25-10.1)
30-day	1.51 (1.34-1.74)	2.15 (1.91-2.48)	2.99 (2.64-3.45)	3.67 (3.22-4.27)	4.59 (3.90-5.53)	5.30 (4.40-6.51)	6.00 (4.86-7.56)	6.73 (5.30-8.71)	7.69 (5.81-10.4)	8.42 (6.15-11.8)
45-day	1.74 (1.54-2.00)	2.49 (2.20-2.86)	3.48 (3.08-4.02)	4.30 (3.77-5.00)	5.41 (4.59-6.51)	6.27 (5.21-7.71)	7.14 (5.79-9.00)	8.04 (6.33-10.4)	9.24 (6.98-12.5)	10.2 (7.42-14.2)
60-day	1.91 (1.69-2.19)	2.74 (2.43-3.16)	3.85 (3.41-4.45)	4.77 (4.18-5.55)	6.04 (5.12-7.27)	7.02 (5.83-8.63)	8.04 (6.51-10.1)	9.08 (7.15-11.8)	10.5 (7.93-14.2)	11.6 (8.46-16.2)

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

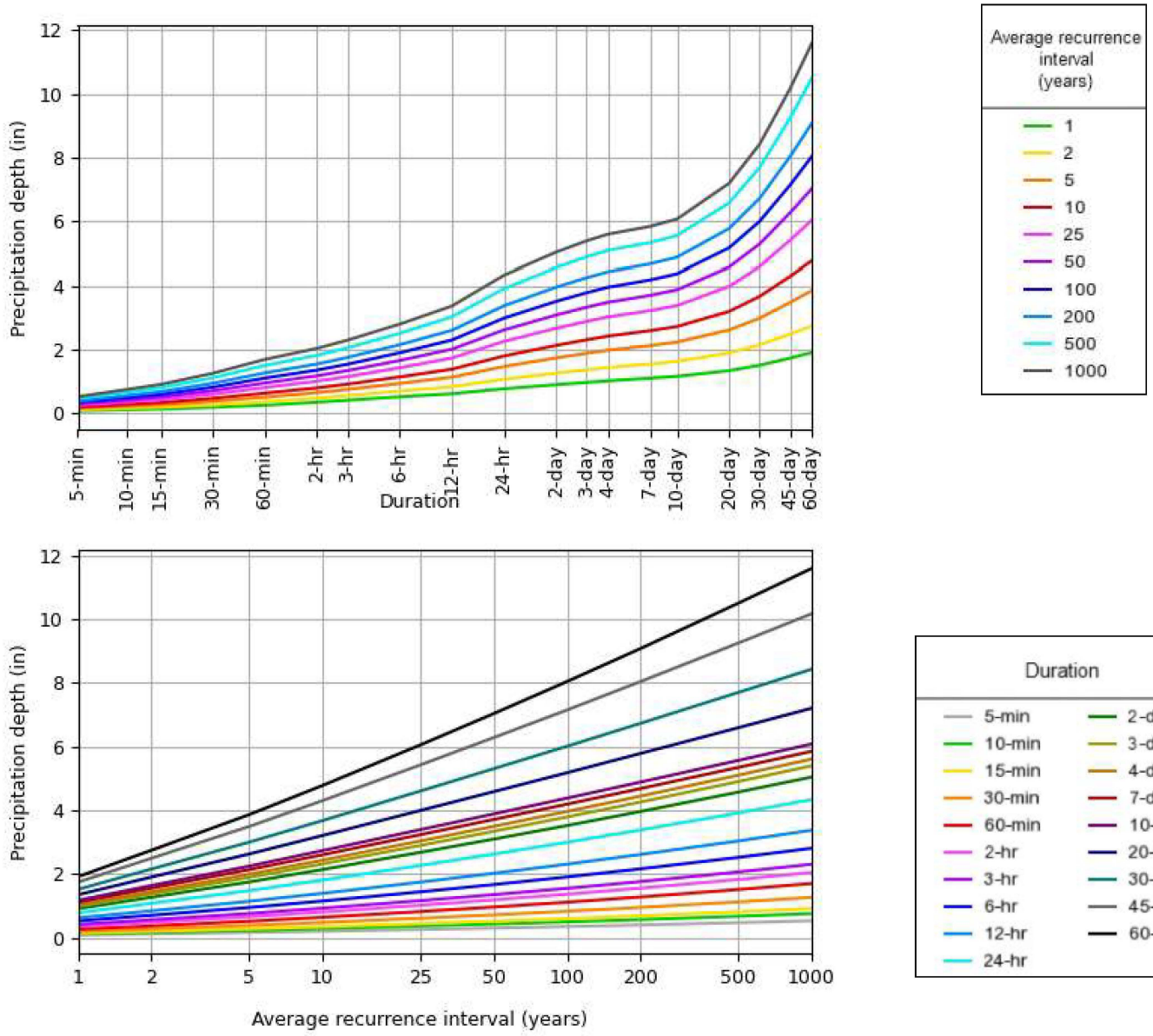
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper 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.

Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.9455°, Longitude: -117.2462°



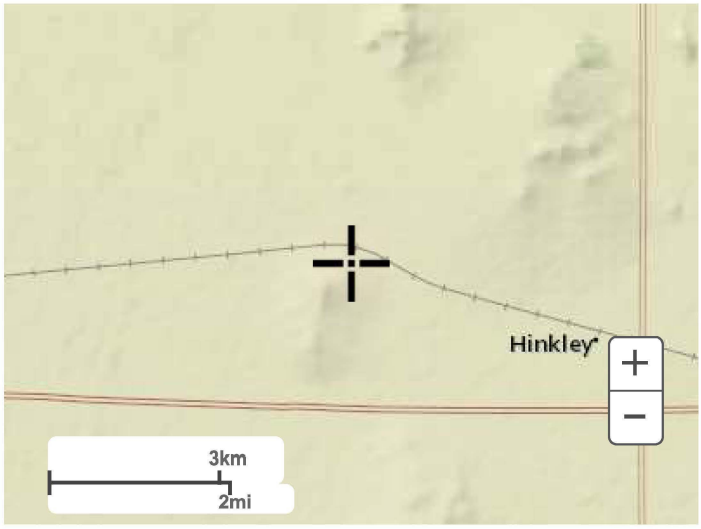
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Jan 25 19:48:17 2024

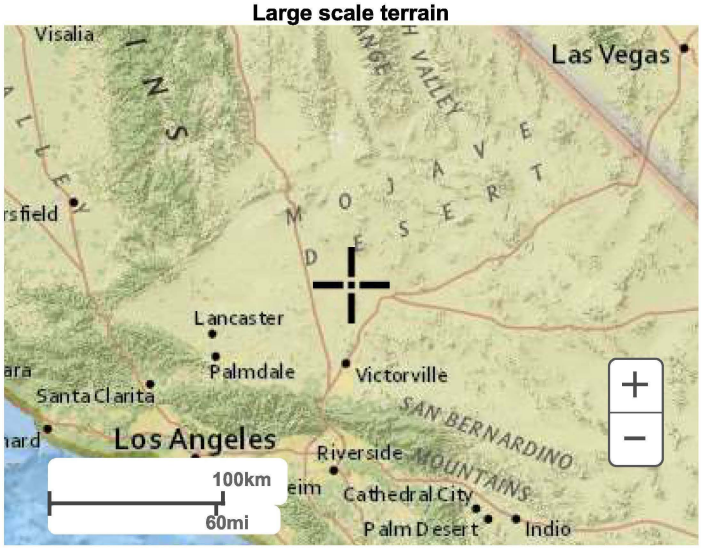
Back to Top

Maps & aerials

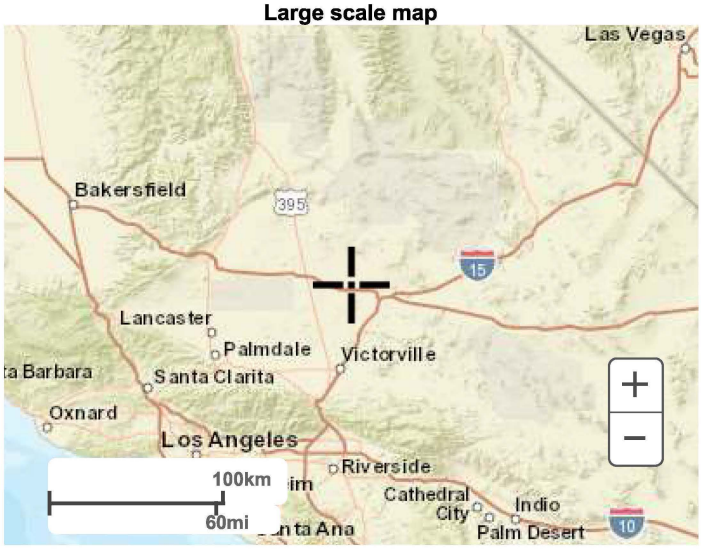
Small scale terrain



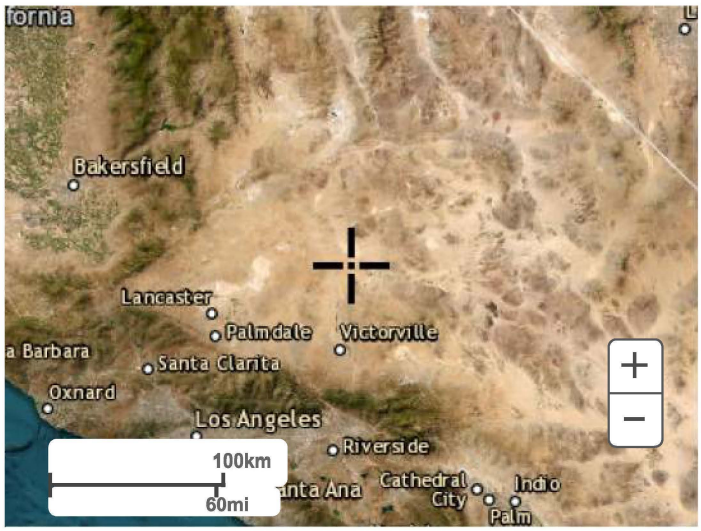
Large scale terrain



Large scale map



Large scale aerial



Back to Top

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