



HYDROLOGY STUDY

For

**APN 0602-361-04
JOSHUA TREE, CA
DRNSTY-2022-00034**

ALEX CRAMER

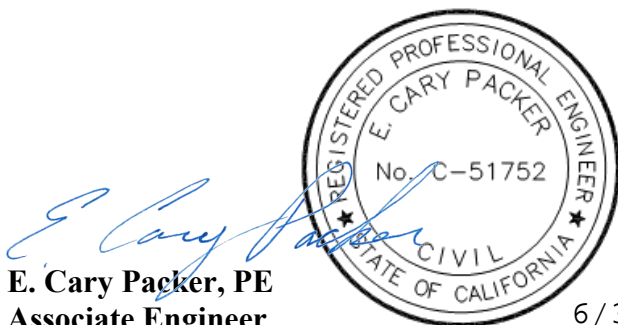
May 30, 2024

Prepared by:

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SECTION 1

DISCUSSION

INTRODUCTION

The project site encompasses approximately 18.9 acres of residential property located on the north side of Alta Loma Road between Hillview Road and Sunset Road in Joshua Tree, an unincorporated area of San Bernardino County. The development of the site will be a residential subdivision per Tentative Tract 20443.

The purpose of this study was twofold, one to determine the impact, if any, of the 100-year storm off-site runoff flow tributary to the project site as delineated on the map contained in this study and the second to determine the rate of runoff flow before and after development of the site and recommended mitigations which are needed to protect the proposed development from these storm events.

The FEMA flood zone designation for this area from FIRM Panel 06071C8880H is Zone D, which indicates an area of undetermined flood hazard. A copy of the FIRMette is included in the appendix of this report.

METHODOLOGY

The method in determining the peak off-site 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: Joshua Tree South and an examination of the project site. The current project is for lot sales and minimal onsite disturbance of the existing condition is expected. Offsite tributary areas to the south and west were examined to determine the tributary storm runoff to the site.

On-site storm runoffs were determined using a unit hydrograph analysis of the undeveloped and developed sites. These runoff flows will be carried through the street rights-of-way and through cross-lot drainage as the lots are sold and developed.

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 1.86”. The 2010 Addendum states that the AMC methodology approach is to be used for calculating the 100-year storm event. Additionally, in the 2010 Addendum, the county issued new mapping indicating where AMC I and AMC II conditions were to be implemented in the arid, desert regions of the county. Using the ADD-1 MAP from the SB County Addendum “AMC Condition Map” the project off-site watershed is in AMC II and part of the on-site is in AMC I. To be conservative we will use AMC II for both off-site and on-site analysis. The AMC condition map from the addendum is included as exhibits in section 3 of this report.

The soils types were determined to be Soil Type C in the watershed per the soil maps in the San Bernardino County Hydrology Manual. Rainfall and soils maps are included as exhibits in Section 3 of this report.

The off-site tributary areas examined in this study are shown in Table A.

Table A (Off-Site)

Sub-area	Elevation Difference (ft.)	Length (ft)	Area (Acres)	Avg. Slope (ft/ft)
Node 11 – Node 16	439	6,613	109.8	0.0664
Node 21 – Node 24	176	3,256	23.5	0.0541

The on-site tributary areas examined in this study are shown in Table B.

Table B (On-Site)

Sub-area	Elevation Difference (ft.)	Length (ft)	Area (Acres)	Avg. Slope (ft/ft)
On-site Undeveloped Unit Hydrograph	69	1,644	21.1	0.0420
On-site Developed Unit Hydrograph	67.5	1,473	18.9	0.0458

EXISTING CONDITIONS

The site is located along the north side of Alta Loma Road and bordered by Hillview Road to the west and Sunset Road to the east. The property is currently a vacant, 18.9-acre parcel. The west tributary area flows northward within the Hillview Road right-of-way and encroaches the project slightly at the northwest property corner. There is existing scour at this location from the offsite flow. This existing, unimproved channel is not a “blue-line” stream on the U.S.G.S. maps and is local to the runoff in this area. From our investigation and the biological study performed for this project, this channel is not within the jurisdiction of US Army Corps of Engineers or California Department of Fish and Wildlife.

The results of the off-site and on-site flow analysis are summarized in Table C.

Table C

Sub-Area	Q₁₀₀ (cfs)
Node 11 – Node 16 Off-site	285.9
Node 21 – Node 24 Off-site	72.3
On-site Undeveloped Condition	84.5
On-site Developed Condition	74.9

CONCLUSIONS AND RECOMMENDATIONS

During our field investigation of the site, we observed the existing conditions as stated previously. Development of the project is being performed in conjunction with engineered improvement plans and planned for future lot sales.

Off-site stormwater tributary to the western property boundary is conveyed north within the right-of-way of Hill View Road, past the project site, following its historical flow path. A drainage easement is recommended at the northwest corner of the proposed tentative tract from the right-of-way to the top of the existing slope of the existing off-site drainage path. The peak Q100 flow rate of this tributary flow is 285.9 cfs.

Off-site stormwater tributary to the southern property boundary will be intercepted within the improvements of Alta Loma Road and conveyed east following the historical flow path. This flow will be intercepted by parkway drains along the north side of Alta Loma Road as it approaches the intersection with Sunset Road. This drainage will be conveyed north within a 20' wide drainage easement along the project's eastern boundary and discharged onto Sunset Road near the northeastern section of the project at the historical flow location. The peak Q100 flow rate of this tributary flow is 72.3 cfs.

Per the Unit Hydrograph analysis, the on-site Q100 stormwater flow rate prior to development is estimated at 84.5 cfs and the post-development Q100 flow rate is estimated at 74.9 cfs. Runoff volume from the undeveloped site is approximately 5.94 Ac.Ft, while runoff volume from the developed site is approximately 5.27 Ac.Ft. Post-development peak runoff flow rates are required to be less than 90% of the pre-development peak runoff flow rate. The post-development peak flow rate is approximately 88.6% of the pre-development peak flow rate while the post-development runoff flow volume is approximately 88.7% of the predevelopment runoff volume, therefore no on-site retention is required.

On-site runoff flows will exit the site through under-sidewalk (parkway) drains along Sunset Road at the northeast corner of the project site. Multiple parkway drain locations will be spaced along the frontage of Lot A to allow runoff to spread evenly as it flows back onto Sunset Road following its historical flow path.

SECTION 2


EXHIBITS

VICINITY MAP

TTM 20443

Axel Cramer - Joshua Tree

Legend

 Axel Cramer

s Highway

62

Park Blvd

Alta Loma Dr

Alta Loma Dr

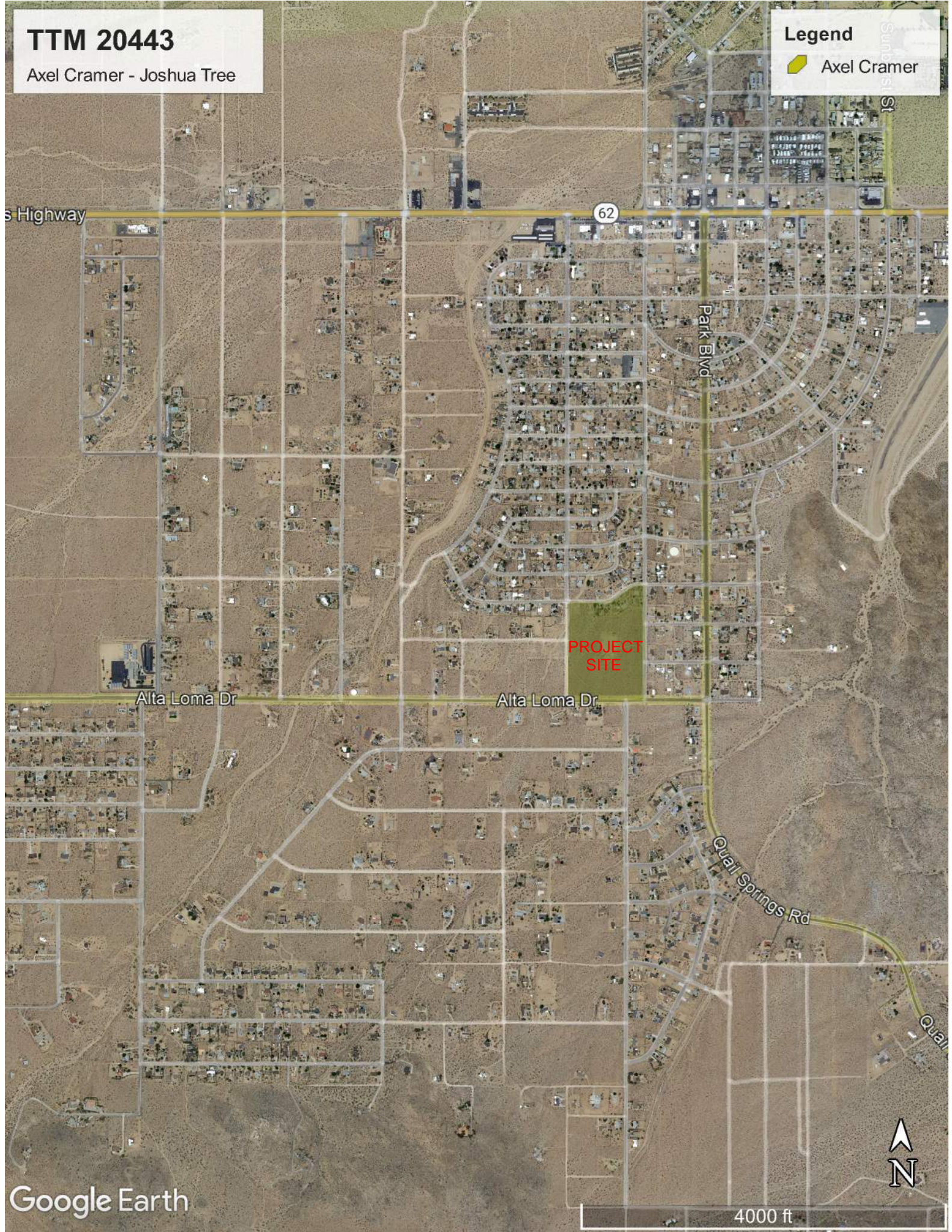
PROJECT SITE

Quail Springs Rd



Google Earth

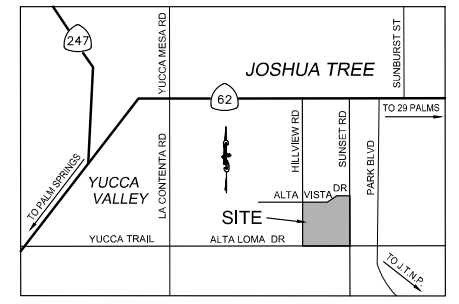
4000 ft



PROPOSED DEVELOPMENT PLAN

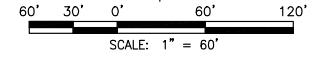
CONCEPTUAL GRADING TENTATIVE TRACT NO. 20443

BEING A SUBDIVISION OF A PORTION OF THE SOUTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 35, T1N, R6E, S.B.M., COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA
MERRELL JOHNSON COMPANIES, OCTOBER 2023



VICINITY MAP
NOT TO SCALE

- LEGEND**
- T.B.R. INDICATES TO BE REMOVED
 - INDICATES JOSHUA TREE
 - INDICATES YUCCA
 - OHP INDICATES OVERHEAD POWER LINE
 - 3010 INDICATES EXISTING CONTOUR
 - BSL INDICATES BUILDING SETBACK LINE
 - INDICATES PROPERTY LINE
 - D.E. INDICATES PROPOSED DRAINAGE EASEMENT
 - INDICATES PROPOSED AC BERM

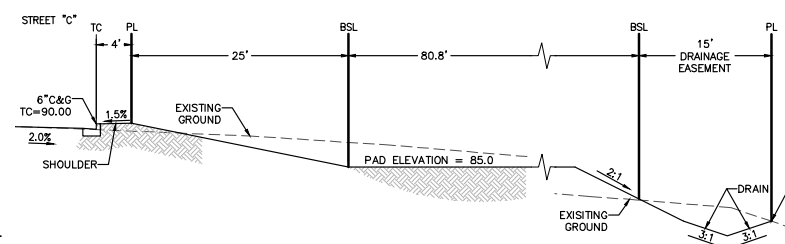


LEGAL DESCRIPTION

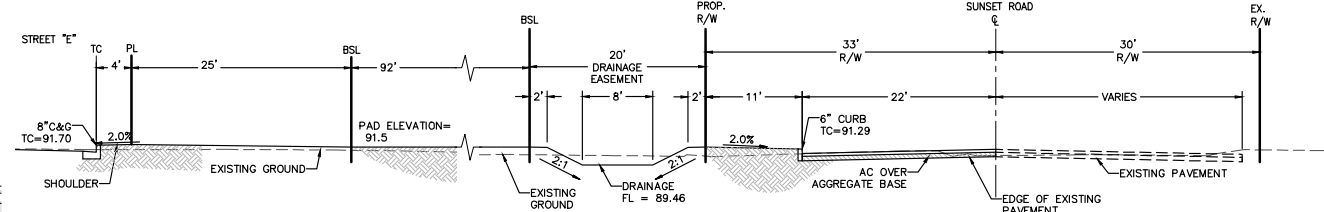
THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE UNINCORPORATED AREA OF SAN BERNARDINO (JOSHUA TREE), IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:
THAT PORTION OF THE SOUTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 35, TOWNSHIP 1 NORTH, RANGE 6 EAST, SAN BERNARDINO BASE AND MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO GOVERNMENT SURVEY, DESCRIBED AS FOLLOWS:
BEGINNING AT THE POINT OF INTERSECTION OF THE CENTER LINE OF SOUTH CHOLLITA ROAD AND THE SOUTHERLY LINE OF TRACT NO. 5163, RECORDED IN BOOK 65 OF MAPS, PAGES 48 TO 50, INCLUSIVE, RECORDS OF SAN COUNTY; THENCE SOUTH ALONG THE SOUTHERLY PROLONGATION OF SAID CENTER LINE, A DISTANCE OF 910 FEET, MORE OR LESS, TO A POINT IN THE SOUTH LINE OF SECTION 35; THENCE EAST ALONG SAID SOUTH LINE, A DISTANCE OF 860 FEET TO THE SOUTHEAST CORNER THEREOF; THENCE NORTH ALONG THE EAST LINE OF SAID SECTION, A DISTANCE OF 1037.99 FEET TO THE SOUTHEAST CORNER OF THE AFORESAID TRACT NO. 5163; THENCE SOUTH 89 DEGREES 58' 00" WEST, 160 FEET TO A POINT; THENCE SOUTH 54 DEGREES 08' 44" WEST, 190.91 FEET TO A POINT; THENCE SOUTH 89 DEGREES 58' 00" WEST, 545.67 FEET TO THE POINT OF BEGINNING.

UTILITIES:

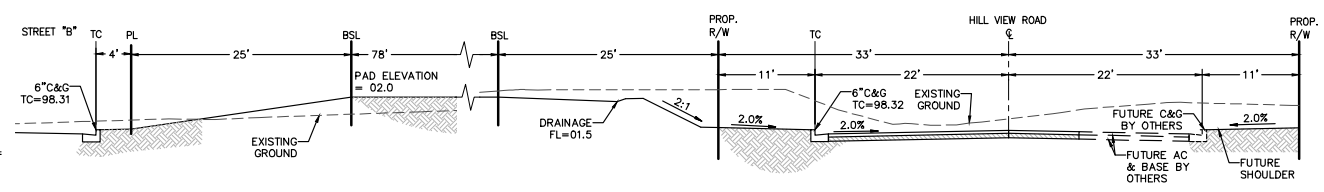
ELECTRIC: SOUTHERN CALIFORNIA EDISON 6999 OLD WOMAN SPRINGS ROAD YUCCA VALLEY, CA 92284 (800) 555-4555	SEWER: SEPTIC 401 MERRITT NORWALK, CONNECTICUT 06851 (877) 236-2894
GAS: SOCAL GAS PO BOX 1628 MONTEREY PARK, CA 91754-8626 (877) 238-0092	TELEPHONE: FRONTIER COMMUNICATIONS 7500 KICKAPOO TRAIL YUCCA VALLEY, CA 92284 (800) 974-2388
WATER: JOSHUA BASIN WATER DISTRICT 61750 CHOLLITA ROAD JOSHUA TREE, CALIFORNIA 92252 (760) 366-8438	CABLE: SPECTRUM 7500 KICKAPOO TRAIL YUCCA VALLEY, CA 92284 (800) 974-2388



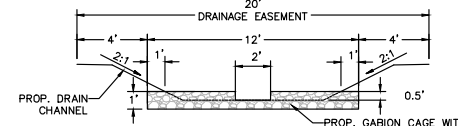
A NORTH CROSS SECTION
(SECTION VIEW) SCALE: 1"=10'



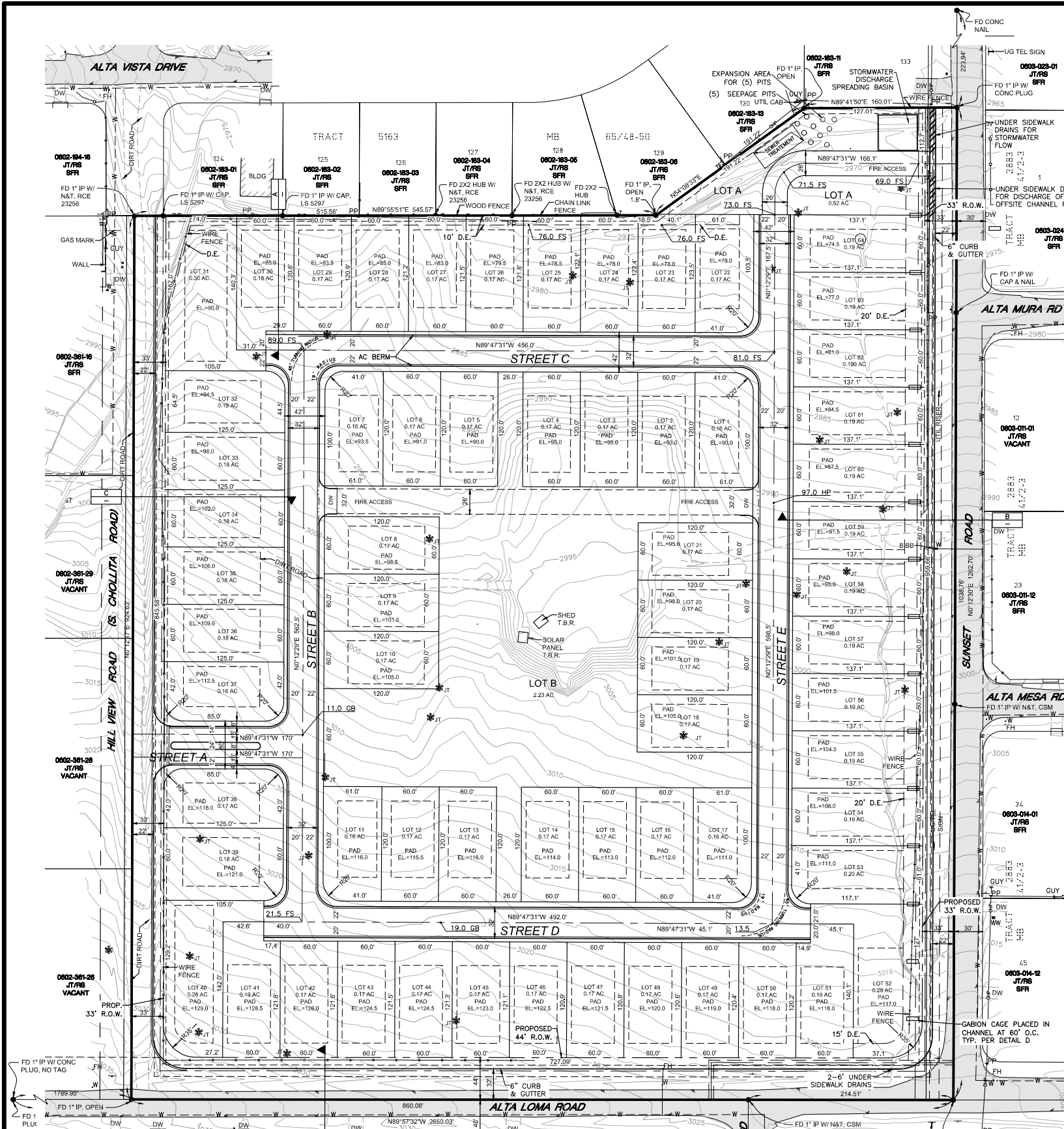
B EAST CROSS SECTION
(SECTION VIEW) SCALE: 1"=10'



C WEST CROSS SECTION
(SECTION VIEW) SCALE: 1"=10'



D GABION CAGE IN CHANNEL
(DETAIL) SCALE: 1"=5'



EASEMENTS:

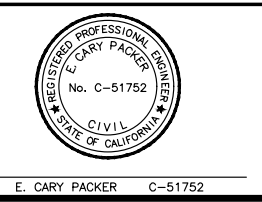
- EASEMENT FOR ROADS, PUBLIC UTILITIES AND INCIDENTAL PURPOSES RECORDED IN BOOK 4824, PAGE 484 OF OFFICIAL RECORDS
- EASEMENT FOR CONDUITS AND INCIDENTAL PURPOSES RECORDED MAY 17, 1983 RECORDED AS INST. NO. 107203 OF OFFICIAL RECORDS
- EASEMENT FOR CONDUITS AND INCIDENTAL PURPOSES RECORDED IN BOOK 6058, PAGE 894 OF OFFICIAL RECORDS
- EASEMENT FOR PUBLIC UTILITIES AND INCIDENTAL PURPOSES GRANTED TO SOUTHERN CALIFORNIA EDISON COMPANY, RECORDED OCTOBER 26, 1992 AS INST. NO. 442525 OF OFFICIAL RECORDS

BASIS OF BEARINGS
USGS BENCHMARK "38 DOR", LOCATED 7.8 MILES EAST ALONG STATE HIGHWAY 63 FROM THE POST OFFICE AT YUCCA VALLEY, THENCE 0.05 MILE NORTH ALONG PARK BOULEVARD TO COMMERCIAL STREET, 32 FT. EAST OF THE CENTER LINE OF ENTRANCE TO THE JOSHUA TREE POST OFFICE, 51 FT. SOUTH OF THE CENTER LINE OF THE STREET, IN TOP OF THE EAST CURB OF THE BOULEVARD.
NAD83 ELEVATION=2730.14 FT

BENCHMARK
USGS BENCHMARK "38 DOR", LOCATED 7.8 MILES EAST ALONG STATE HIGHWAY 63 FROM THE POST OFFICE AT YUCCA VALLEY, THENCE 0.05 MILE NORTH ALONG PARK BOULEVARD TO COMMERCIAL STREET, 32 FT. EAST OF THE CENTER LINE OF ENTRANCE TO THE JOSHUA TREE POST OFFICE, 51 FT. SOUTH OF THE CENTER LINE OF THE STREET, IN TOP OF THE EAST CURB OF THE BOULEVARD.
NAD83 ELEVATION=2730.14 FT

BUILDING SETBACKS

FRONT:	25'
STREET-SIDE:	15'
STREET-INTERIOR:	57'10"
REAR:	15'



**CONCEPTUAL GRADING
TENTATIVE TRACT MAP
APN 0602-361-04
JOSHUA TREE, CA**

FOR:
AXEL CRAMER

APN: 0602-361-04
TENTATIVE TRACT MAP 20443
OWNER/APPLICANT:
AXEL CRAMER
2745 TESLA AVE
LOS ANGELES, CA 90039
PREPARED BY:
MERRELL JOHNSON COMPANIES
22221 HIGHWAY 18
APPLE VALLEY, CALIFORNIA 92307
(760) 240-8000
MAP PREPARATION DATE: 09/29/2021

DRAWN BY:
JMF/NTG
DATE:
5/23/24
JOB NO.
3753.001
SHEET
1 OF 1

SECTION 3

HYDROLOGY CALCULATIONS

RATIONAL CALCULATIONS – Q₁₀₀

OFF-SITE RATIONAL 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: 10/22/21

AXEL CRAMER - TTM 20443
WEST OFFSITE TRIBUTARY AREA
NODE 11 TO NODE 16
100-YEAR STORM EVENT - AMC II

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 = 1.860 (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 ****

RESIDENTIAL(1 acre lot)
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) = 69.00
Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.438(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 3412.000(Ft.)
Bottom (of initial area) elevation = 3331.000(Ft.)
Difference in elevation = 81.000(Ft.)
Slope = 0.08100 s(%)= 8.10
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.288 min.
Rainfall intensity = 5.644(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.830
Subarea runoff = 26.705(CFS)
Total initial stream area = 5.700(Ac.)
Pervious area fraction = 0.800
Initial area Fm value = 0.438(In/Hr)

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

Depth of flow = 0.421(Ft.), Average velocity = 5.235(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 = 0.040

 Sub-Channel flow = 26.705(CFS)
 ' ' flow top width = 14.213(Ft.)
 ' ' velocity= 5.235(Ft/s)
 ' ' area = 5.101(Sq.Ft)
 ' ' Froude number = 1.540

Upstream point elevation = 3331.000(Ft.)
 Downstream point elevation = 3265.000(Ft.)
 Flow length = 841.000(Ft.)
 Travel time = 2.68 min.
 Time of concentration = 14.97 min.
 Depth of flow = 0.421(Ft.)
 Average velocity = 5.235(Ft/s)
 Total irregular channel flow = 26.705(CFS)
 Irregular channel normal depth above invert elev. = 0.421(Ft.)
 Average velocity of channel(s) = 5.235(Ft/s)

+++++
 Process from Point/Station 12.000 to Point/Station 13.000
 **** SUBAREA FLOW ADDITION ****

RESIDENTIAL(1 acre lot)
 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) = 69.00
 Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.438(In/Hr)
 Time of concentration = 14.97 min.
 Rainfall intensity = 4.917(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area,(total area with modified
 rational method)(Q=KCIA) is C = 0.820
 Subarea runoff = 51.485(CFS) for 13.700(Ac.)
 Total runoff = 78.190(CFS)
 Effective area this stream = 19.40(Ac.)
 Total Study Area (Main Stream No. 1) = 19.40(Ac.)
 Area averaged Fm value = 0.438(In/Hr)

+++++
 Process from Point/Station 13.000 to Point/Station 14.000
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

 Depth of flow = 0.552(Ft.), Average velocity = 6.218(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	30.00	0.00
4	40.00	2.00

Manning's 'N' friction factor = 0.040

Sub-Channel flow = 78.190(CFS)
' ' flow top width = 25.524(Ft.)
' ' velocity= 6.218(Ft/s)
' ' area = 12.574(Sq.Ft)
' ' Froude number = 1.561

Upstream point elevation = 3265.000(Ft.)
Downstream point elevation = 3182.000(Ft.)
Flow length = 1146.000(Ft.)
Travel time = 3.07 min.
Time of concentration = 18.04 min.
Depth of flow = 0.552(Ft.)
Average velocity = 6.218(Ft/s)
Total irregular channel flow = 78.190(CFS)
Irregular channel normal depth above invert elev. = 0.552(Ft.)
Average velocity of channel(s) = 6.218(Ft/s)

+++++
Process from Point/Station 13.000 to Point/Station 14.000
**** SUBAREA FLOW ADDITION ****

RESIDENTIAL(1 acre lot)
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) = 69.00
Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.438(In/Hr)
Time of concentration = 18.04 min.
Rainfall intensity = 4.314(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.809
Subarea runoff = 82.623(CFS) for 26.700(Ac.)
Total runoff = 160.813(CFS)
Effective area this stream = 46.10(Ac.)
Total Study Area (Main Stream No. 1) = 46.10(Ac.)
Area averaged Fm value = 0.438(In/Hr)

+++++
Process from Point/Station 14.000 to Point/Station 15.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Depth of flow = 0.885(Ft.), Average velocity = 7.436(Ft/s)
***** Irregular Channel Data *****

Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 3.00
2 15.00 0.00
3 35.00 0.00
4 50.00 3.00
Manning's 'N' friction factor = 0.040

Sub-Channel flow = 160.814(CFS)
' ' flow top width = 28.853(Ft.)
' ' velocity= 7.436(Ft/s)
' ' area = 21.625(Sq.Ft)
' ' Froude number = 1.514

Upstream point elevation = 3182.000(Ft.)

Downstream point elevation = 3100.000(Ft.)
Flow length = 1382.000(Ft.)
Travel time = 3.10 min.
Time of concentration = 21.13 min.
Depth of flow = 0.885(Ft.)
Average velocity = 7.436(Ft/s)
Total irregular channel flow = 160.813(CFS)
Irregular channel normal depth above invert elev. = 0.885(Ft.)
Average velocity of channel(s) = 7.436(Ft/s)

Process from Point/Station 14.000 to Point/Station 15.000
**** SUBAREA FLOW ADDITION ****

RESIDENTIAL(1 acre lot)
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) = 69.00
Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.438(In/Hr)
Time of concentration = 21.13 min.
Rainfall intensity = 3.861(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.798
Subarea runoff = 70.852(CFS) for 29.100(Ac.)
Total runoff = 231.665(CFS)
Effective area this stream = 75.20(Ac.)
Total Study Area (Main Stream No. 1) = 75.20(Ac.)
Area averaged Fm value = 0.438(In/Hr)

Process from Point/Station 15.000 to Point/Station 16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Depth of flow = 0.893(Ft.), Average velocity = 7.531(Ft/s)
***** Irregular Channel Data *****

Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 3.00
2 15.00 0.00
3 45.00 0.00
4 60.00 3.00
Manning's 'N' friction factor = 0.040

Sub-Channel flow = 231.666(CFS)
' ' flow top width = 38.926(Ft.)
' ' velocity= 7.531(Ft/s)
' ' area = 30.760(Sq.Ft)
' ' Froude number = 1.493

Upstream point elevation = 3100.000(Ft.)
Downstream point elevation = 2973.000(Ft.)
Flow length = 2244.000(Ft.)
Travel time = 4.97 min.
Time of concentration = 26.10 min.
Depth of flow = 0.893(Ft.)
Average velocity = 7.531(Ft/s)
Total irregular channel flow = 231.665(CFS)

Irregular channel normal depth above invert elev. = 0.893(Ft.)
Average velocity of channel(s) = 7.531(Ft/s)

+++++
Process from Point/Station 15.000 to Point/Station 16.000
**** SUBAREA FLOW ADDITION ****

RESIDENTIAL(1 acre lot)
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) = 69.00
Pervious ratio(A_p) = 0.8000 Max loss rate(F_m)= 0.438(In/Hr)
Time of concentration = 26.10 min. T_c
Rainfall intensity = 3.331(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)($Q=KCIA$) is $C = 0.782$
Subarea runoff = 54.186(CFS) for 34.600(Ac.)
Total runoff = 285.851(CFS) Q_{100}
Effective area this stream = 109.80(Ac.)
Total Study Area (Main Stream No. 1) = 109.80(Ac.)
Area averaged F_m value = 0.438(In/Hr)
End of computations, Total Study Area = 109.80 (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(A_p) = 0.800
Area averaged SCS curve number = 69.0

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: 12/05/21

AXEL CRAMER - TTM 20443
SOUTH OFFSITE TRIBUTARY AREA
NODE 21 - NODE 24
100-YEAR STORM EVENT - AMC II

MERRELL JOHNSON ENGINEERING, INC.
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***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.860 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

Process from Point/Station 21.000 to Point/Station 22.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(1 acre lot)
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) = 69.00
Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.438(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 3198.000(Ft.)
Bottom (of initial area) elevation = 3136.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.06200 s(%)= 6.20
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.963 min.
Rainfall intensity = 5.437(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.827
Subarea runoff = 11.246(CFS)
Total initial stream area = 2.500(Ac.)
Pervious area fraction = 0.800
Initial area Fm value = 0.438(In/Hr)

Process from Point/Station 22.000 to Point/Station 23.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Depth of flow = 0.284(Ft.), Average velocity = 3.465(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 = 0.040

 Sub-Channel flow = 11.246(CFS)
 ' ' flow top width = 12.842(Ft.)
 ' ' velocity= 3.465(Ft/s)
 ' ' area = 3.246(Sq.Ft)
 ' ' Froude number = 1.215

Upstream point elevation = 3136.000(Ft.)
 Downstream point elevation = 3090.000(Ft.)
 Flow length = 840.000(Ft.)
 Travel time = 4.04 min.
 Time of concentration = 17.00 min.
 Depth of flow = 0.284(Ft.)
 Average velocity = 3.465(Ft/s)
 Total irregular channel flow = 11.246(CFS)
 Irregular channel normal depth above invert elev. = 0.284(Ft.)
 Average velocity of channel(s) = 3.465(Ft/s)

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 Process from Point/Station 22.000 to Point/Station 23.000
 **** SUBAREA FLOW ADDITION ****

RESIDENTIAL(1 acre lot)
 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) = 69.00
 Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.438(In/Hr)
 Time of concentration = 17.00 min.
 Rainfall intensity = 4.496(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area,(total area with modified
 rational method)(Q=KCIA) is C = 0.812
 Subarea runoff = 16.875(CFS) for 5.200(Ac.)
 Total runoff = 28.121(CFS)
 Effective area this stream = 7.70(Ac.)
 Total Study Area (Main Stream No. 1) = 7.70(Ac.)
 Area averaged Fm value = 0.438(In/Hr)

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 Process from Point/Station 23.000 to Point/Station 24.000
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

 Depth of flow = 0.343(Ft.), Average velocity = 3.781(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	30.00	0.00
4	40.00	2.00

Manning's 'N' friction factor = 0.040

Sub-Channel flow = 28.122(CFS)
' ' flow top width = 23.425(Ft.)
' ' velocity= 3.781(Ft/s)
' ' area = 7.437(Sq.Ft)
' ' Froude number = 1.183

Upstream point elevation = 3090.000(Ft.)
Downstream point elevation = 3022.000(Ft.)
Flow length = 1416.000(Ft.)
Travel time = 6.24 min.
Time of concentration = 23.24 min.
Depth of flow = 0.343(Ft.)
Average velocity = 3.781(Ft/s)
Total irregular channel flow = 28.121(CFS)
Irregular channel normal depth above invert elev. = 0.343(Ft.)
Average velocity of channel(s) = 3.781(Ft/s)

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Process from Point/Station 23.000 to Point/Station 24.000
**** SUBAREA FLOW ADDITION ****

RESIDENTIAL(1 acre lot)
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) = 69.00
Pervious ratio(Ap) = 0.8000 Max loss rate(Fm)= 0.438(In/Hr)
Time of concentration = 23.24 min. T_c
Rainfall intensity = 3.612(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.791
Subarea runoff = 44.153(CFS) for 17.600(Ac.)
Total runoff = 72.274(CFS) Q_{100}
Effective area this stream = 25.30(Ac.)
Total Study Area (Main Stream No. 1) = 25.30(Ac.)
Area averaged Fm value = 0.438(In/Hr)
End of computations, Total Study Area = 25.30 (Ac.)

The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.800
Area averaged SCS curve number = 69.0

Tentative Tract Map 20443

Concept Grading
East flow - off site (Q100 = 72.3 cfs) **Parkway Drain**

Calc Depth (h)

h	.48	(ft) depth (5.79")	
Z _L	0	Run/ft Left	
Z _R	0	Run/ft Right	
b	18	(ft) bottom width	Use (3) 6' drains
n	0.015	Manning Coef	
S	0.020	Channel Slope	
V	8.3	(fps) Calculated Velocity	
Q	72.3	(cfs) Calculated Flow Rate	
	32,448	(gpm)	
	18.0	(ft) Water surface width	
A	8.7	(sf) Area	
R _h	0.46	Hydraulic Radius	
Fr	4.46	Froude Number V ² /gz	
Flow type = Supercritical Flow			

Uniform Open-Channel Flow Calculation

Using Manning Equation

$$Q = \frac{1.486}{b n} A R^{2/3} S^{1/2}$$

Where:

- Q = Flow rate in cubic feet per second (cfs)
- b = bottom width of channel in feet (ft)
- n = Manning roughness coefficient
- A = Cross sectional area of channel flow in square feet (ft²)
- R = Hydraulic Radius
- m = side slope run per 1 foot rise in feet (ft)
- z = depth of flow in feet (ft)
- S = Bottom slope of channel

Tentative Tract Map 20443

Concept Grading

East flow - off site (Q100 = 72.3 cfs) **East Channel**

Calc Depth (h)

h	.85	(ft) depth (10.15")
Z _L	3	Run/ft Left
Z _R	3	Run/ft Right
b	8	(ft) bottom width
n	0.028	Manning Coef
S	0.040	Channel Slope
V	8.1	(fps) Calculated Velocity
Q	72.3	(cfs) Calculated Flow Rate
	32,448	(gpm)
		13.1 (ft) Water surface width
A	8.9	(sf) Area
R _h	0.67	Hydraulic Radius
Fr	2.41	Froude Number V ² /gz
Flow type = Supercritical Flow		

Uniform Open-Channel Flow Calculation

Using Manning Equation

$$Q = \frac{1.486}{b n} A R^{2/3} S^{1/2}$$

Where:

- Q = Flow rate in cubic feet per second (cfs)
- b = bottom width of channel in feet (ft)
- n = Manning roughness coefficient
- A = Cross sectional area of channel flow in square feet (ft²)
- R = Hydraulic Radius
- m = side slope run per 1 foot rise in feet (ft)
- z = depth of flow in feet (ft)
- S = Bottom slope of channel

Tentative Tract Map 20443

Concept Grading

Onsite exit flow - NE Corner (Q100 = 74.9 cfs) **(3) Parkway Drains**

Calc Depth (h)

h	.49	(ft) depth (5.92")	
Z _L	0	Run/ft Left	
Z _R	0	Run/ft Right	
b	18	(ft) bottom width	Use (3) 6' drains
n	0.015	Manning Coef	
S	0.020	Channel Slope	
V	8.4	(fps) Calculated Velocity	
Q	74.9	(cfs) Calculated Flow Rate	
	33,615	(gpm)	
	18.0	(ft) Water surface width	
A	8.9	(sf) Area	
R _h	0.47	Hydraulic Radius	
Fr	4.49	Froude Number V ² /gz	
Flow type = Supercritical Flow			

Uniform Open-Channel Flow Calculation

Using Manning Equation

$$Q = \frac{1.486}{b n} A R^{2/3} S^{1/2}$$

Where:

Q = Flow rate in cubic feet per second (cfs)

b = bottom width of channel in feet (ft)

n = Manning roughness coefficient

A = Cross sectional area of channel flow in square feet (ft²)

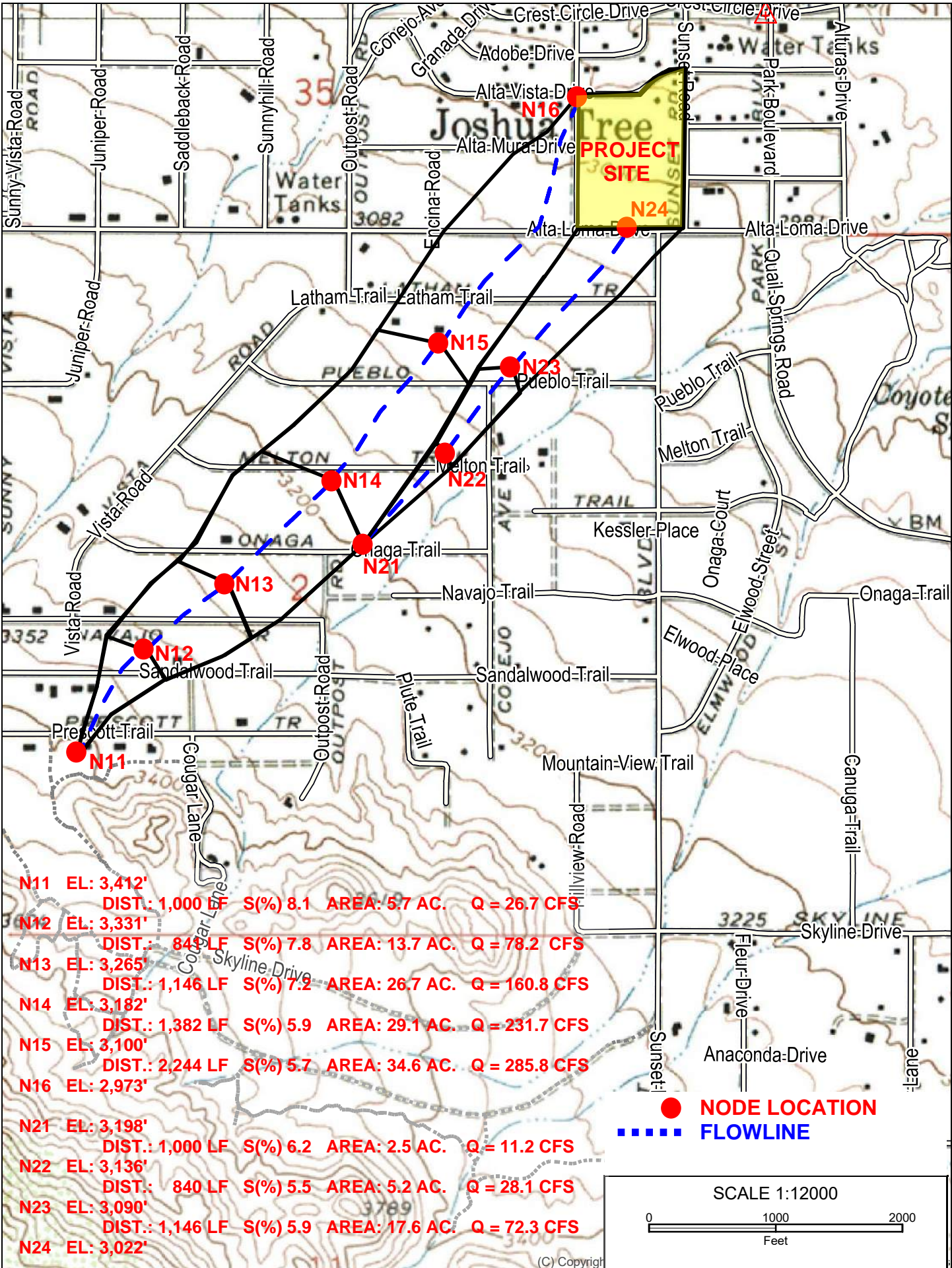
R = Hydraulic Radius

m = side slope run per 1 foot rise in feet (ft)

z = depth of flow in feet (ft)

S = Bottom slope of channel

TRIBUTARY DRAINAGE MAP



AXEL CRAMER - TTM 20443

APN 0602-361-04

JOSHUA TREE, CA

Q100 = 285.9 CFS - NATURAL DRAINAGE COURSE FLOW

NW DRAINAGE EASEMENT FLOW CALCULATIONS

Channel

d	0.95
m (left side)	3
m (right side)	3
b	26
A	27.4075
Rn	0.85626154
n	0.03
S	0.055
V	10.4748994
Q	287.090804
desired Q	285.9
delta	1.19080449

D = 4.0

D

Channel depth

d = 0.95

d

Flow depth

V = 10.5 F/S

v

Velocity (feet per second)

m = 3 (left)

m

Side slope (run) as in rise over run w/ rise =1

m = 3 (right)

m

if side is vertical enter a zero for m

b = 26 FT

b

Base width

A = 27.4

A

Cross sectional area

n = 0.030

n

manning coef.

s = 0.055

S

Channel Slope (MIN)

Supporting Data

A

27.41 (sf) Area

Rh

0.86 Hydraulic Radius

Fr

3.60 Froude Number V^2/gz

Flow type = SuperCritical Flow

ON-SITE UNIT HYDROGRAPH CALCUATIONS

U n i t H y d r o g r a p h A n a l y s i s

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Study date 11/06/23

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 5006

AXEL CRAMER - TTM 20443

ON-SITE UNDEVELOPED STORM RUNOFF

100-YEAR STORM RUNOFF - AMC II

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
21.30	1	0.92

Rainfall data for year 2
21.30 6 0.95

Rainfall data for year 2
21.30 24 1.49

Rainfall data for year 100

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                21.30                1                1.86
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Rainfall data for year 100
                21.30                6                2.94
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Rainfall data for year 100
                21.30                24               4.81
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***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	21.30	1.000	0.548	0.600	0.329

Area-averaged adjusted loss rate Fm (In/Hr) = 0.329

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
12.78	0.600	69.0	69.0	4.49	0.378
8.52	0.400	98.0	98.0	0.20	0.951

Area-averaged catchment yield fraction, Y = 0.607

Area-averaged low loss fraction, Yb = 0.393

User entry of time of concentration = 0.247 (hours)

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Watershed area = 21.30(Ac.)

Catchment Lag time = 0.197 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 42.2240

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.329(In/Hr)

Average low loss rate fraction (Yb) = 0.393 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.883(In)

Computed peak 30-minute rainfall = 1.511(In)

Specified peak 1-hour rainfall = 1.860(In)

Computed peak 3-hour rainfall = 2.463(In)

Specified peak 6-hour rainfall = 2.940(In)

Specified peak 24-hour rainfall = 4.810(In)

Rainfall depth area reduction factors:

Using a total area of 21.30(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.882(In)

30-minute factor = 0.999 Adjusted rainfall = 1.509(In)
 1-hour factor = 0.999 Adjusted rainfall = 1.858(In)
 3-hour factor = 1.000 Adjusted rainfall = 2.462(In)
 6-hour factor = 1.000 Adjusted rainfall = 2.940(In)
 24-hour factor = 1.000 Adjusted rainfall = 4.810(In)

 Unit Hydrograph

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 Interval 'S' Graph Unit Hydrograph
 Number Mean values ((CFS))

 (K = 257.60 (CFS))

1	2.999	7.726
2	21.266	47.054
3	52.198	79.681
4	67.728	40.004
5	76.525	22.663
6	82.325	14.939
7	86.568	10.930
8	89.688	8.039
9	92.012	5.986
10	93.891	4.840
11	95.354	3.769
12	96.521	3.005
13	97.400	2.266
14	98.000	1.545
15	98.449	1.156
16	98.954	1.300
17	99.439	1.250
18	99.743	0.784
19	100.000	0.661

 Total soil rain loss = 1.46(In)
 Total effective rainfall = 3.35(In)
 Peak flow rate in flood hydrograph = 84.51(CFS)

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 24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	22.5	45.0	67.5	90.0
0+ 5	0.0002	0.03	Q				

0+10	0.0016	0.20	Q
0+15	0.0049	0.49	Q
0+20	0.0092	0.63	Q
0+25	0.0142	0.72	Q
0+30	0.0195	0.77	Q
0+35	0.0251	0.81	Q
0+40	0.0309	0.85	Q
0+45	0.0369	0.87	Q
0+50	0.0430	0.89	Q
0+55	0.0493	0.91	Q
1+ 0	0.0556	0.92	Q
1+ 5	0.0620	0.93	Q
1+10	0.0685	0.94	Q
1+15	0.0751	0.95	Q
1+20	0.0816	0.96	Q
1+25	0.0883	0.96	Q
1+30	0.0950	0.97	Q
1+35	0.1017	0.98	Q
1+40	0.1085	0.98	Q
1+45	0.1152	0.98	Q
1+50	0.1220	0.99	Q
1+55	0.1289	0.99	Q
2+ 0	0.1357	1.00	Q
2+ 5	0.1426	1.00	Q
2+10	0.1495	1.00	QV
2+15	0.1564	1.01	QV
2+20	0.1634	1.01	QV
2+25	0.1704	1.01	QV
2+30	0.1774	1.02	QV
2+35	0.1844	1.02	QV
2+40	0.1915	1.03	QV
2+45	0.1986	1.03	QV
2+50	0.2057	1.03	QV
2+55	0.2129	1.04	QV
3+ 0	0.2200	1.04	QV
3+ 5	0.2273	1.05	QV
3+10	0.2345	1.05	QV
3+15	0.2418	1.06	QV
3+20	0.2491	1.06	QV
3+25	0.2564	1.06	QV
3+30	0.2637	1.07	QV
3+35	0.2711	1.07	QV
3+40	0.2786	1.08	QV
3+45	0.2860	1.08	QV
3+50	0.2935	1.09	QV
3+55	0.3010	1.09	Q V
4+ 0	0.3086	1.10	Q V
4+ 5	0.3161	1.10	Q V
4+10	0.3238	1.11	Q V
4+15	0.3314	1.11	Q V

4+20	0.3391	1.12	Q	V
4+25	0.3468	1.12	Q	V
4+30	0.3546	1.13	Q	V
4+35	0.3624	1.13	Q	V
4+40	0.3702	1.14	Q	V
4+45	0.3780	1.14	Q	V
4+50	0.3859	1.15	Q	V
4+55	0.3939	1.15	Q	V
5+ 0	0.4019	1.16	Q	V
5+ 5	0.4099	1.16	Q	V
5+10	0.4179	1.17	Q	V
5+15	0.4260	1.17	Q	V
5+20	0.4341	1.18	Q	V
5+25	0.4423	1.19	Q	V
5+30	0.4505	1.19	Q	V
5+35	0.4587	1.20	Q	V
5+40	0.4670	1.20	Q	V
5+45	0.4754	1.21	Q	V
5+50	0.4837	1.22	Q	V
5+55	0.4922	1.22	Q	V
6+ 0	0.5006	1.23	Q	V
6+ 5	0.5091	1.23	Q	V
6+10	0.5177	1.24	Q	V
6+15	0.5263	1.25	Q	V
6+20	0.5349	1.25	Q	V
6+25	0.5436	1.26	Q	V
6+30	0.5523	1.27	Q	V
6+35	0.5611	1.28	Q	V
6+40	0.5699	1.28	Q	V
6+45	0.5788	1.29	Q	V
6+50	0.5878	1.30	Q	V
6+55	0.5967	1.30	Q	V
7+ 0	0.6058	1.31	Q	V
7+ 5	0.6149	1.32	Q	V
7+10	0.6240	1.33	Q	V
7+15	0.6332	1.33	Q	V
7+20	0.6424	1.34	Q	V
7+25	0.6517	1.35	Q	V
7+30	0.6611	1.36	Q	V
7+35	0.6705	1.37	Q	V
7+40	0.6800	1.38	Q	V
7+45	0.6895	1.38	Q	V
7+50	0.6991	1.39	Q	V
7+55	0.7088	1.40	Q	V
8+ 0	0.7185	1.41	Q	V
8+ 5	0.7283	1.42	Q	V
8+10	0.7381	1.43	Q	V
8+15	0.7480	1.44	Q	V
8+20	0.7580	1.45	Q	V
8+25	0.7681	1.46	Q	V

8+30	0.7782	1.47	Q	V				
8+35	0.7883	1.48	Q	V				
8+40	0.7986	1.49	Q	V				
8+45	0.8089	1.50	Q	V				
8+50	0.8193	1.51	Q	V				
8+55	0.8298	1.52	Q	V				
9+ 0	0.8403	1.53	Q	V				
9+ 5	0.8510	1.54	Q	V				
9+10	0.8617	1.55	Q	V				
9+15	0.8725	1.57	Q	V				
9+20	0.8833	1.58	Q	V				
9+25	0.8943	1.59	Q	V				
9+30	0.9053	1.60	Q	V				
9+35	0.9165	1.62	Q	V				
9+40	0.9277	1.63	Q	V				
9+45	0.9390	1.64	Q	V				
9+50	0.9504	1.66	Q	V				
9+55	0.9619	1.67	Q	V				
10+ 0	0.9735	1.68	Q	V				
10+ 5	0.9852	1.70	Q	V				
10+10	0.9970	1.71	Q	V				
10+15	1.0089	1.73	Q	V				
10+20	1.0209	1.74	Q	V				
10+25	1.0330	1.76	Q	V				
10+30	1.0452	1.77	Q	V				
10+35	1.0576	1.79	Q	V				
10+40	1.0700	1.81	Q	V				
10+45	1.0826	1.83	Q	V				
10+50	1.0953	1.84	Q	V				
10+55	1.1081	1.86	Q	V				
11+ 0	1.1210	1.88	Q	V				
11+ 5	1.1341	1.90	Q	V				
11+10	1.1473	1.92	Q	V				
11+15	1.1607	1.94	Q	V				
11+20	1.1742	1.96	Q	V				
11+25	1.1879	1.98	Q	V				
11+30	1.2016	2.00	Q	V				
11+35	1.2156	2.03	Q	V				
11+40	1.2297	2.05	Q	V				
11+45	1.2440	2.07	Q	V				
11+50	1.2584	2.10	Q	V				
11+55	1.2731	2.12	Q	V				
12+ 0	1.2879	2.15	Q	V				
12+ 5	1.3027	2.16	Q	V				
12+10	1.3170	2.07	Q	V				
12+15	1.3300	1.90	Q	V				
12+20	1.3426	1.83	Q	V				
12+25	1.3550	1.80	Q	V				
12+30	1.3673	1.79	Q	V				
12+35	1.3797	1.79	Q	V				

12+40	1.3921	1.80	Q	V					
12+45	1.4046	1.82	Q	V					
12+50	1.4172	1.84	Q	V					
12+55	1.4301	1.86	Q	V					
13+ 0	1.4430	1.89	Q	V					
13+ 5	1.4562	1.92	Q	V					
13+10	1.4697	1.95	Q	V					
13+15	1.4834	1.99	Q	V					
13+20	1.4973	2.02	Q	V					
13+25	1.5115	2.06	Q	V					
13+30	1.5260	2.11	Q	V					
13+35	1.5408	2.15	Q	V					
13+40	1.5560	2.20	Q	V					
13+45	1.5715	2.26	Q	V					
13+50	1.5874	2.31	Q	V					
13+55	1.6038	2.37	Q	V					
14+ 0	1.6205	2.43	Q	V					
14+ 5	1.6377	2.50	Q	V					
14+10	1.6555	2.57	Q	V					
14+15	1.6737	2.65	Q	V					
14+20	1.6926	2.74	Q	V					
14+25	1.7120	2.83	Q	V					
14+30	1.7322	2.92	Q	V					
14+35	1.7530	3.03	Q	V					
14+40	1.7746	3.14	Q	V					
14+45	1.7971	3.27	Q	V					
14+50	1.8205	3.40	Q	V					
14+55	1.8450	3.55	Q	V					
15+ 0	1.8706	3.72	Q	V					
15+ 5	1.8975	3.91	Q	V					
15+10	1.9259	4.12	Q	V					
15+15	1.9559	4.36	Q	V					
15+20	1.9878	4.64	Q	V					
15+25	2.0223	5.00	Q	V					
15+30	2.0607	5.58	Q	V					
15+35	2.1048	6.41	Q	V					
15+40	2.1544	7.19	Q	V					
15+45	2.2105	8.15	Q	V					
15+50	2.2762	9.54	Q	V					
15+55	2.3586	11.97	Q	V					
16+ 0	2.4721	16.48	Q	V					
16+ 5	2.6753	29.50	Q	V					
16+10	3.1093	63.03	Q	V					
16+15	3.6914	84.51	Q ₁₀₀	V					Q
16+20	4.0408	50.74	Q	V					
16+25	4.2699	33.27	Q	V					
16+30	4.4370	24.27	Q	V					
16+35	4.5666	18.82	Q	V					
16+40	4.6695	14.94	Q	V					
16+45	4.7530	12.13	Q	V					

16+50	4.8237	10.27	Q	V
16+55	4.8833	8.65	Q	V
17+ 0	4.9342	7.39	Q	V
17+ 5	4.9773	6.26	Q	V
17+10	5.0135	5.26	Q	V
17+15	5.0454	4.64	Q	V
17+20	5.0760	4.44	Q	V
17+25	5.1043	4.10	Q	V
17+30	5.1282	3.48	Q	V
17+35	5.1496	3.11	Q	V
17+40	5.1662	2.41	Q	V
17+45	5.1817	2.25	Q	V
17+50	5.1964	2.13	Q	V
17+55	5.2104	2.03	Q	V
18+ 0	5.2238	1.95	Q	V
18+ 5	5.2368	1.89	Q	V
18+10	5.2501	1.93	Q	V
18+15	5.2643	2.06	Q	V
18+20	5.2788	2.10	Q	V
18+25	5.2932	2.09	Q	V
18+30	5.3075	2.08	Q	V
18+35	5.3216	2.05	Q	V
18+40	5.3355	2.02	Q	V
18+45	5.3492	1.99	Q	V
18+50	5.3626	1.95	Q	V
18+55	5.3759	1.92	Q	V
19+ 0	5.3889	1.89	Q	V
19+ 5	5.4016	1.85	Q	V
19+10	5.4142	1.82	Q	V
19+15	5.4265	1.79	Q	V
19+20	5.4386	1.76	Q	V
19+25	5.4505	1.73	Q	V
19+30	5.4622	1.70	Q	V
19+35	5.4738	1.68	Q	V
19+40	5.4851	1.65	Q	V
19+45	5.4963	1.62	Q	V
19+50	5.5073	1.60	Q	V
19+55	5.5181	1.57	Q	V
20+ 0	5.5288	1.55	Q	V
20+ 5	5.5393	1.52	Q	V
20+10	5.5496	1.50	Q	V
20+15	5.5598	1.48	Q	V
20+20	5.5699	1.46	Q	V
20+25	5.5798	1.44	Q	V
20+30	5.5896	1.42	Q	V
20+35	5.5993	1.40	Q	V
20+40	5.6088	1.39	Q	V
20+45	5.6183	1.37	Q	V
20+50	5.6276	1.35	Q	V
20+55	5.6368	1.34	Q	V

21+ 0	5.6459	1.32	Q	V
21+ 5	5.6549	1.31	Q	V
21+10	5.6638	1.29	Q	V
21+15	5.6726	1.28	Q	V
21+20	5.6813	1.26	Q	V
21+25	5.6899	1.25	Q	V
21+30	5.6984	1.24	Q	V
21+35	5.7068	1.22	Q	V
21+40	5.7152	1.21	Q	V
21+45	5.7234	1.20	Q	V
21+50	5.7316	1.19	Q	V
21+55	5.7397	1.18	Q	V
22+ 0	5.7477	1.16	Q	V
22+ 5	5.7557	1.15	Q	V
22+10	5.7635	1.14	Q	V
22+15	5.7713	1.13	Q	V
22+20	5.7791	1.12	Q	V
22+25	5.7867	1.11	Q	V
22+30	5.7943	1.10	Q	V
22+35	5.8018	1.09	Q	V
22+40	5.8093	1.08	Q	V
22+45	5.8167	1.07	Q	V
22+50	5.8240	1.06	Q	V
22+55	5.8313	1.06	Q	V
23+ 0	5.8385	1.05	Q	V
23+ 5	5.8457	1.04	Q	V
23+10	5.8528	1.03	Q	V
23+15	5.8598	1.02	Q	V
23+20	5.8668	1.01	Q	V
23+25	5.8737	1.01	Q	V
23+30	5.8806	1.00	Q	V
23+35	5.8875	0.99	Q	V
23+40	5.8942	0.98	Q	V
23+45	5.9010	0.98	Q	V
23+50	5.9077	0.97	Q	V
23+55	5.9143	0.96	Q	V
24+ 0	5.9209	0.96	Q	V
24+ 5	5.9272	0.92	Q	V
24+10	5.9324	0.75	Q	V
24+15	5.9355	0.45	Q	V
24+20	5.9376	0.31	Q	V
24+25	5.9392	0.22	Q	V
24+30	5.9403	0.17	Q	V
24+35	5.9412	0.13	Q	V
24+40	5.9419	0.10	Q	V
24+45	5.9424	0.08	Q	V
24+50	5.9428	0.06	Q	V
24+55	5.9431	0.04	Q	V
25+ 0	5.9433	0.03	Q	V
25+ 5	5.9435	0.02	Q	V

25+10	5.9436	0.02	Q				V
25+15	5.9437	0.01	Q				V
25+20	5.9438	0.01	Q				V
25+25	5.9438	0.01	Q				V
25+30	5.9439	0.00	Q				V

U n i t H y d r o g r a p h A n a l y s i s

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Study date 11/06/23

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 5006

AXEL CRAMER - TTM 20443
ON-SITE DEVELOPED STORM RUNOFF

100-YEAR STORM RUNOFF - AMC II

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
18.90	1	0.92

Rainfall data for year 2
18.90 6 0.95

Rainfall data for year 2
18.90 24 1.49

Rainfall data for year 100

```

          18.90          1          1.86
-----
Rainfall data for year 100
          18.90          6          2.94
-----
Rainfall data for year 100
          18.90         24          4.81
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***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	18.90	1.000	0.548	0.600	0.329

Area-averaged adjusted loss rate Fm (In/Hr) = 0.329

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
11.34	0.600	69.0	69.0	4.49	0.378
7.56	0.400	98.0	98.0	0.20	0.951

Area-averaged catchment yield fraction, Y = 0.607

Area-averaged low loss fraction, Yb = 0.393

User entry of time of concentration = 0.249 (hours)

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Watershed area = 18.90(Ac.)

Catchment Lag time = 0.199 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 41.7837

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.329(In/Hr)

Average low loss rate fraction (Yb) = 0.393 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.883(In)

Computed peak 30-minute rainfall = 1.511(In)

Specified peak 1-hour rainfall = 1.860(In)

Computed peak 3-hour rainfall = 2.463(In)

Specified peak 6-hour rainfall = 2.940(In)

Specified peak 24-hour rainfall = 4.810(In)

Rainfall depth area reduction factors:

Using a total area of 18.90(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.882(In)

30-minute factor = 0.999 Adjusted rainfall = 1.509(In)
 1-hour factor = 0.999 Adjusted rainfall = 1.858(In)
 3-hour factor = 1.000 Adjusted rainfall = 2.463(In)
 6-hour factor = 1.000 Adjusted rainfall = 2.940(In)
 24-hour factor = 1.000 Adjusted rainfall = 4.810(In)

Unit Hydrograph

+-----+
 Interval 'S' Graph Unit Hydrograph
 Number Mean values ((CFS))

(K = 228.57 (CFS))

1	2.948	6.739
2	20.750	40.689
3	51.622	70.566
4	67.329	35.901
5	76.197	20.270
6	82.045	13.368
7	86.314	9.758
8	89.485	7.247
9	91.824	5.346
10	93.727	4.351
11	95.208	3.384
12	96.393	2.709
13	97.301	2.076
14	97.936	1.451
15	98.376	1.004
16	98.872	1.134
17	99.366	1.129
18	99.695	0.753
19	100.000	0.697

 Total soil rain loss = 1.46(In)
 Total effective rainfall = 3.35(In)
 Peak flow rate in flood hydrograph = 74.90(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	20.0	40.0	60.0	80.0
0+ 5	0.0002	0.02	Q				

0+10	0.0013	0.17	Q
0+15	0.0043	0.43	Q
0+20	0.0081	0.56	Q
0+25	0.0125	0.63	Q
0+30	0.0172	0.68	Q
0+35	0.0221	0.72	Q
0+40	0.0273	0.75	Q
0+45	0.0326	0.77	Q
0+50	0.0380	0.79	Q
0+55	0.0435	0.80	Q
1+ 0	0.0492	0.82	Q
1+ 5	0.0549	0.83	Q
1+10	0.0606	0.83	Q
1+15	0.0664	0.84	Q
1+20	0.0722	0.85	Q
1+25	0.0781	0.86	Q
1+30	0.0841	0.86	Q
1+35	0.0900	0.87	Q
1+40	0.0960	0.87	Q
1+45	0.1020	0.87	Q
1+50	0.1081	0.88	Q
1+55	0.1141	0.88	Q
2+ 0	0.1202	0.88	Q
2+ 5	0.1263	0.89	Q
2+10	0.1324	0.89	QV
2+15	0.1386	0.89	QV
2+20	0.1448	0.90	QV
2+25	0.1510	0.90	QV
2+30	0.1572	0.90	QV
2+35	0.1634	0.91	QV
2+40	0.1697	0.91	QV
2+45	0.1760	0.91	QV
2+50	0.1823	0.92	QV
2+55	0.1886	0.92	QV
3+ 0	0.1950	0.92	QV
3+ 5	0.2014	0.93	QV
3+10	0.2078	0.93	QV
3+15	0.2143	0.94	QV
3+20	0.2208	0.94	QV
3+25	0.2273	0.94	QV
3+30	0.2338	0.95	QV
3+35	0.2403	0.95	QV
3+40	0.2469	0.96	QV
3+45	0.2535	0.96	QV
3+50	0.2602	0.96	QV
3+55	0.2669	0.97	Q V
4+ 0	0.2736	0.97	Q V
4+ 5	0.2803	0.98	Q V
4+10	0.2870	0.98	Q V
4+15	0.2938	0.99	Q V

4+20	0.3006	0.99	Q	V
4+25	0.3075	0.99	Q	V
4+30	0.3144	1.00	Q	V
4+35	0.3213	1.00	Q	V
4+40	0.3282	1.01	Q	V
4+45	0.3352	1.01	Q	V
4+50	0.3422	1.02	Q	V
4+55	0.3492	1.02	Q	V
5+ 0	0.3563	1.03	Q	V
5+ 5	0.3634	1.03	Q	V
5+10	0.3706	1.04	Q	V
5+15	0.3777	1.04	Q	V
5+20	0.3849	1.05	Q	V
5+25	0.3922	1.05	Q	V
5+30	0.3995	1.06	Q	V
5+35	0.4068	1.06	Q	V
5+40	0.4141	1.07	Q	V
5+45	0.4215	1.07	Q	V
5+50	0.4290	1.08	Q	V
5+55	0.4364	1.08	Q	V
6+ 0	0.4439	1.09	Q	V
6+ 5	0.4515	1.10	Q	V
6+10	0.4591	1.10	Q	V
6+15	0.4667	1.11	Q	V
6+20	0.4744	1.11	Q	V
6+25	0.4821	1.12	Q	V
6+30	0.4898	1.13	Q	V
6+35	0.4976	1.13	Q	V
6+40	0.5054	1.14	Q	V
6+45	0.5133	1.14	Q	V
6+50	0.5212	1.15	Q	V
6+55	0.5292	1.16	Q	V
7+ 0	0.5372	1.16	Q	V
7+ 5	0.5453	1.17	Q	V
7+10	0.5534	1.18	Q	V
7+15	0.5616	1.18	Q	V
7+20	0.5698	1.19	Q	V
7+25	0.5780	1.20	Q	V
7+30	0.5863	1.21	Q	V
7+35	0.5947	1.21	Q	V
7+40	0.6031	1.22	Q	V
7+45	0.6115	1.23	Q	V
7+50	0.6200	1.24	Q	V
7+55	0.6286	1.24	Q	V
8+ 0	0.6372	1.25	Q	V
8+ 5	0.6459	1.26	Q	V
8+10	0.6546	1.27	Q	V
8+15	0.6634	1.28	Q	V
8+20	0.6723	1.28	Q	V
8+25	0.6812	1.29	Q	V

8+30	0.6902	1.30	Q	V				
8+35	0.6992	1.31	Q	V				
8+40	0.7083	1.32	Q	V				
8+45	0.7174	1.33	Q	V				
8+50	0.7267	1.34	Q	V				
8+55	0.7360	1.35	Q	V				
9+ 0	0.7453	1.36	Q	V				
9+ 5	0.7547	1.37	Q	V				
9+10	0.7642	1.38	Q	V				
9+15	0.7738	1.39	Q	V				
9+20	0.7835	1.40	Q	V				
9+25	0.7932	1.41	Q	V				
9+30	0.8030	1.42	Q	V				
9+35	0.8128	1.43	Q	V				
9+40	0.8228	1.44	Q	V				
9+45	0.8328	1.46	Q	V				
9+50	0.8429	1.47	Q	V				
9+55	0.8531	1.48	Q	V				
10+ 0	0.8634	1.49	Q	V				
10+ 5	0.8738	1.51	Q	V				
10+10	0.8843	1.52	Q	V				
10+15	0.8948	1.53	Q	V				
10+20	0.9055	1.55	Q	V				
10+25	0.9162	1.56	Q	V				
10+30	0.9270	1.57	Q	V				
10+35	0.9380	1.59	Q	V				
10+40	0.9490	1.60	Q	V				
10+45	0.9602	1.62	Q	V				
10+50	0.9715	1.64	Q	V				
10+55	0.9828	1.65	Q	V				
11+ 0	0.9943	1.67	Q	V				
11+ 5	1.0059	1.69	Q	V				
11+10	1.0176	1.70	Q	V				
11+15	1.0295	1.72	Q	V				
11+20	1.0415	1.74	Q	V				
11+25	1.0536	1.76	Q	V				
11+30	1.0658	1.78	Q	V				
11+35	1.0782	1.80	Q	V				
11+40	1.0907	1.82	Q	V				
11+45	1.1034	1.84	Q	V				
11+50	1.1162	1.86	Q	V				
11+55	1.1291	1.88	Q	V				
12+ 0	1.1423	1.91	Q	V				
12+ 5	1.1555	1.91	Q	V				
12+10	1.1681	1.84	Q	V				
12+15	1.1797	1.69	Q	V				
12+20	1.1909	1.62	Q	V				
12+25	1.2019	1.60	Q	V				
12+30	1.2129	1.59	Q	V				
12+35	1.2238	1.59	Q	V				

12+40	1.2348	1.60	Q	V					
12+45	1.2459	1.61	Q	V					
12+50	1.2571	1.63	Q	V					
12+55	1.2685	1.65	Q	V					
13+ 0	1.2800	1.67	Q	V					
13+ 5	1.2917	1.70	Q	V					
13+10	1.3036	1.73	Q	V					
13+15	1.3158	1.76	Q	V					
13+20	1.3281	1.79	Q	V					
13+25	1.3407	1.83	Q	V					
13+30	1.3536	1.87	Q	V					
13+35	1.3667	1.91	Q	V					
13+40	1.3802	1.95	Q	V					
13+45	1.3940	2.00	Q	V					
13+50	1.4081	2.05	Q	V					
13+55	1.4225	2.10	Q	V					
14+ 0	1.4374	2.16	Q	V					
14+ 5	1.4527	2.22	Q	V					
14+10	1.4684	2.28	Q	V					
14+15	1.4846	2.35	Q	V					
14+20	1.5013	2.42	Q	V					
14+25	1.5185	2.50	Q	V					
14+30	1.5363	2.59	Q	V					
14+35	1.5548	2.68	Q	V					
14+40	1.5740	2.78	Q	V					
14+45	1.5939	2.89	Q	V					
14+50	1.6146	3.01	Q	V					
14+55	1.6363	3.15	Q	V					
15+ 0	1.6590	3.29	Q	V					
15+ 5	1.6828	3.46	Q	V					
15+10	1.7079	3.65	Q	V					
15+15	1.7345	3.86	Q	V					
15+20	1.7628	4.11	Q	V					
15+25	1.7933	4.43	Q	V					
15+30	1.8273	4.94	Q	V					
15+35	1.8663	5.67	Q	V					
15+40	1.9101	6.36	Q	V					
15+45	1.9598	7.21	Q	V					
15+50	2.0178	8.43	Q	V					
15+55	2.0906	10.57	Q	V					
16+ 0	2.1906	14.52	Q	V					
16+ 5	2.3692	25.93	Q	V					
16+10	2.7484	55.07	Q	V					
16+15	3.2643	74.90	Q ₁₀₀	V					Q
16+20	3.5768	45.37	Q	V					
16+25	3.7813	29.69	Q	V					
16+30	3.9305	21.67	Q	V					
16+35	4.0461	16.79	Q	V					
16+40	4.1383	13.38	Q	V					
16+45	4.2129	10.83	Q	V					

16+50	4.2761	9.18	Q	V
16+55	4.3294	7.74	Q	V
17+ 0	4.3750	6.62	Q	V
17+ 5	4.4138	5.63	Q	V
17+10	4.4465	4.75	Q	V
17+15	4.4748	4.11	Q	V
17+20	4.5020	3.94	Q	V
17+25	4.5273	3.68	Q	V
17+30	4.5491	3.16	Q	V
17+35	4.5687	2.86	Q	V
17+40	4.5836	2.15	Q	V
17+45	4.5974	2.01	Q	V
17+50	4.6105	1.90	Q	V
17+55	4.6229	1.81	Q	V
18+ 0	4.6348	1.73	Q	V
18+ 5	4.6464	1.68	Q	V
18+10	4.6582	1.72	Q	V
18+15	4.6708	1.83	Q	V
18+20	4.6836	1.86	Q	V
18+25	4.6965	1.86	Q	V
18+30	4.7091	1.84	Q	V
18+35	4.7217	1.82	Q	V
18+40	4.7340	1.79	Q	V
18+45	4.7461	1.76	Q	V
18+50	4.7581	1.73	Q	V
18+55	4.7698	1.70	Q	V
19+ 0	4.7813	1.67	Q	V
19+ 5	4.7927	1.65	Q	V
19+10	4.8038	1.62	Q	V
19+15	4.8148	1.59	Q	V
19+20	4.8255	1.56	Q	V
19+25	4.8361	1.54	Q	V
19+30	4.8465	1.51	Q	V
19+35	4.8568	1.49	Q	V
19+40	4.8668	1.46	Q	V
19+45	4.8767	1.44	Q	V
19+50	4.8865	1.42	Q	V
19+55	4.8961	1.39	Q	V
20+ 0	4.9056	1.37	Q	V
20+ 5	4.9149	1.35	Q	V
20+10	4.9241	1.33	Q	V
20+15	4.9331	1.32	Q	V
20+20	4.9421	1.30	Q	V
20+25	4.9509	1.28	Q	V
20+30	4.9596	1.26	Q	V
20+35	4.9682	1.25	Q	V
20+40	4.9767	1.23	Q	V
20+45	4.9850	1.22	Q	V
20+50	4.9933	1.20	Q	V
20+55	5.0015	1.19	Q	V

21+ 0	5.0096	1.17	Q	V
21+ 5	5.0175	1.16	Q	V
21+10	5.0254	1.15	Q	V
21+15	5.0332	1.13	Q	V
21+20	5.0410	1.12	Q	V
21+25	5.0486	1.11	Q	V
21+30	5.0562	1.10	Q	V
21+35	5.0637	1.09	Q	V
21+40	5.0711	1.08	Q	V
21+45	5.0784	1.06	Q	V
21+50	5.0856	1.05	Q	V
21+55	5.0928	1.04	Q	V
22+ 0	5.1000	1.03	Q	V
22+ 5	5.1070	1.02	Q	V
22+10	5.1140	1.01	Q	V
22+15	5.1209	1.00	Q	V
22+20	5.1278	1.00	Q	V
22+25	5.1346	0.99	Q	V
22+30	5.1413	0.98	Q	V
22+35	5.1480	0.97	Q	V
22+40	5.1546	0.96	Q	V
22+45	5.1612	0.95	Q	V
22+50	5.1677	0.95	Q	V
22+55	5.1741	0.94	Q	V
23+ 0	5.1805	0.93	Q	V
23+ 5	5.1869	0.92	Q	V
23+10	5.1932	0.92	Q	V
23+15	5.1994	0.91	Q	V
23+20	5.2056	0.90	Q	V
23+25	5.2118	0.89	Q	V
23+30	5.2179	0.89	Q	V
23+35	5.2240	0.88	Q	V
23+40	5.2300	0.87	Q	V
23+45	5.2360	0.87	Q	V
23+50	5.2419	0.86	Q	V
23+55	5.2478	0.86	Q	V
24+ 0	5.2536	0.85	Q	V
24+ 5	5.2593	0.82	Q	V
24+10	5.2639	0.67	Q	V
24+15	5.2667	0.41	Q	V
24+20	5.2686	0.28	Q	V
24+25	5.2700	0.20	Q	V
24+30	5.2710	0.15	Q	V
24+35	5.2718	0.12	Q	V
24+40	5.2724	0.09	Q	V
24+45	5.2729	0.07	Q	V
24+50	5.2733	0.05	Q	V
24+55	5.2736	0.04	Q	V
25+ 0	5.2738	0.03	Q	V
25+ 5	5.2739	0.02	Q	V

25+10	5.2740	0.02	Q				V
25+15	5.2741	0.01	Q				V
25+20	5.2742	0.01	Q				V
25+25	5.2742	0.01	Q				V
25+30	5.2743	0.00	Q				V

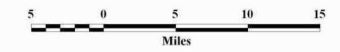
2010 ANTECEDENT MOISTURE CONDITION (AMC) MAP

**Figure ADD-1
Antecedent Moisture
Condition (AMC)**

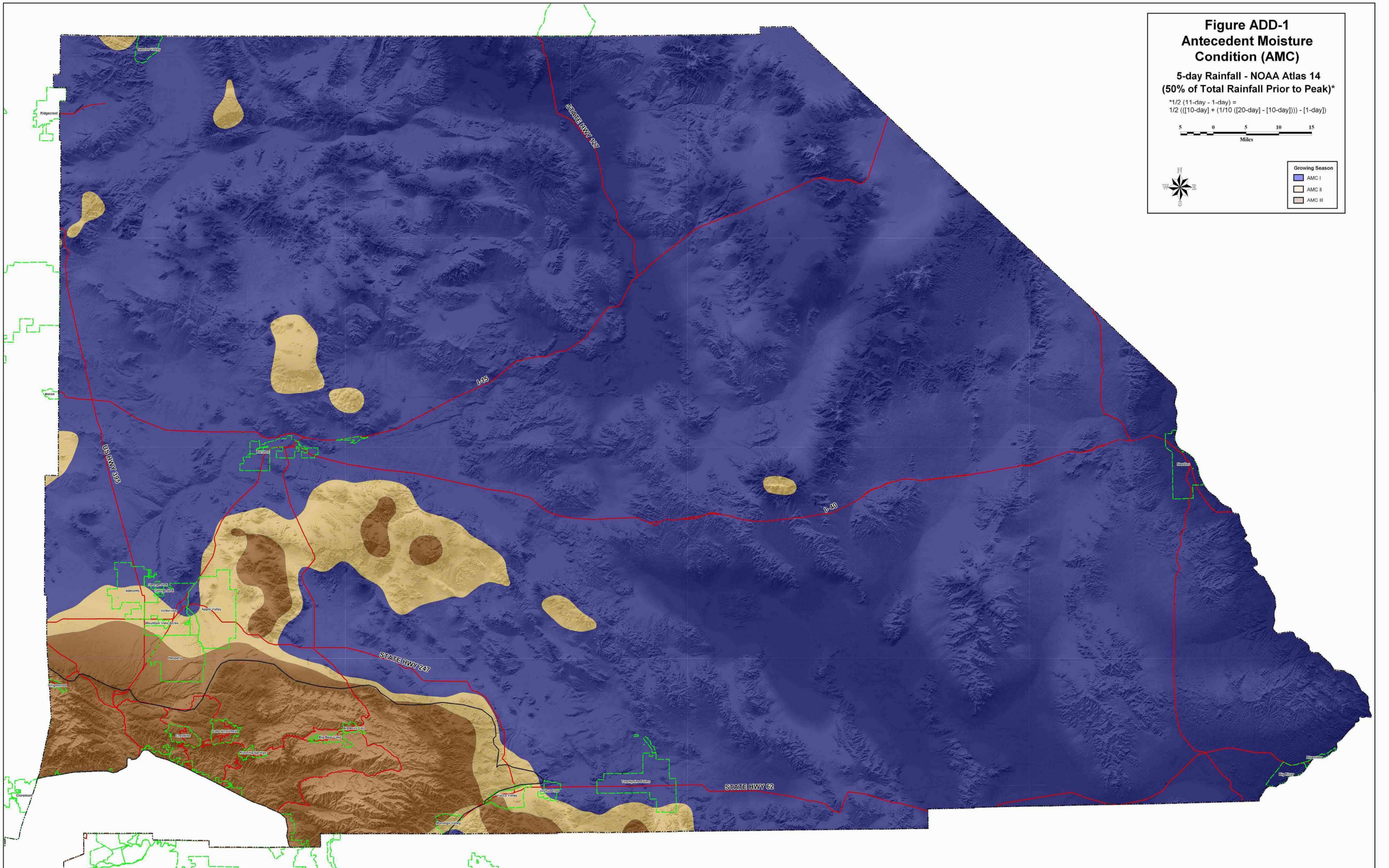
**5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)***

$$*1/2 ((11\text{-day} - 1\text{-day}) =$$

$$1/2 (((10\text{-day}) + (1/10 ((20\text{-day}) - [10\text{-day}]))) - [1\text{-day}]))$$



Growing Season	
Blue	AMC I
Light Yellow	AMC II
Dark Yellow	AMC III



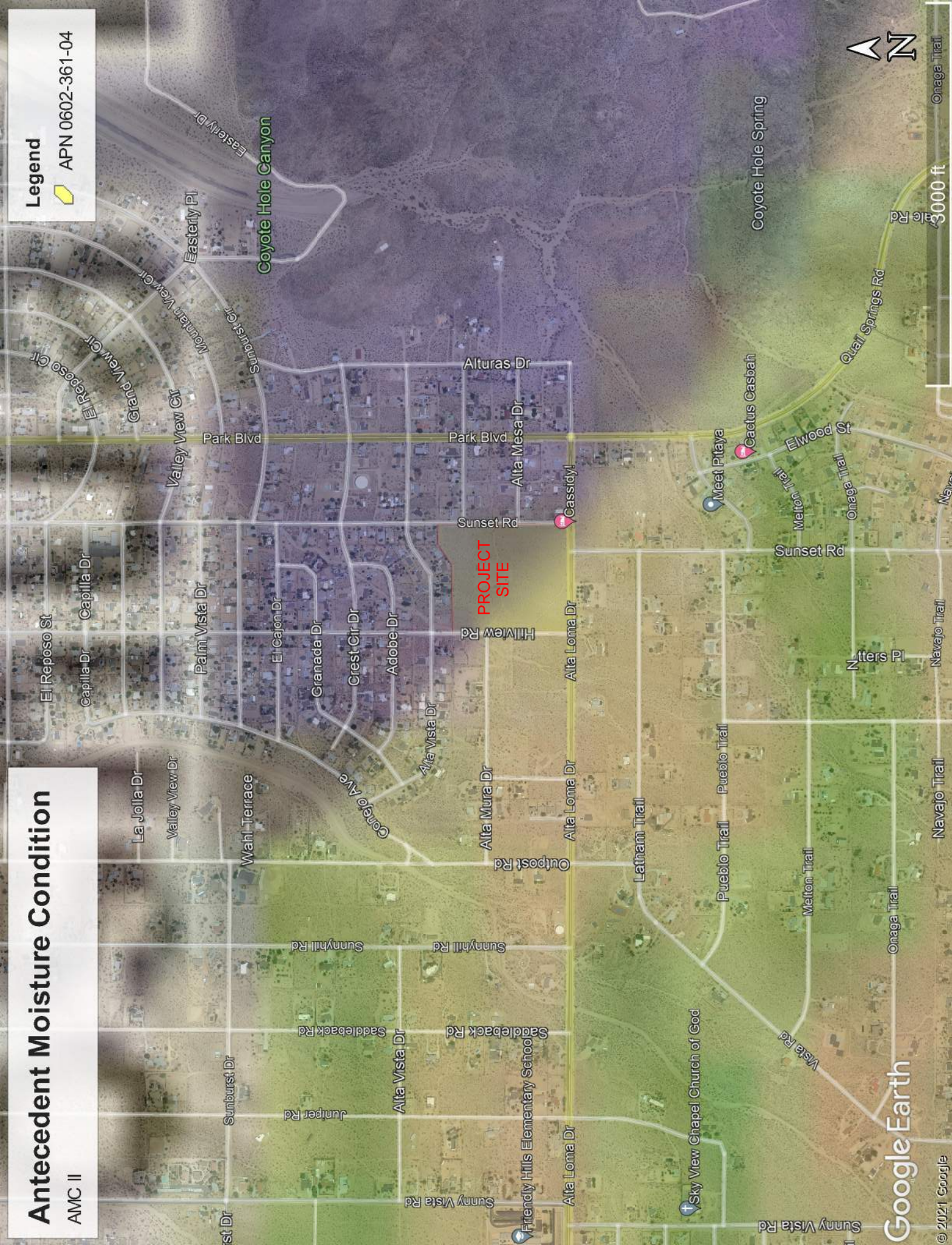
Antecedent Moisture Condition

AMC II

Legend



APN 0602-361-04



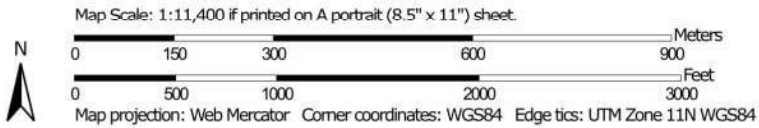
EXHIBITS

SOILS MAP















Map Unit Name—Mojave Desert Area, West Central Part, California



Soil Map may not be valid at this scale.



MAP LEGEND

- Area of Interest (AOI)**
 -  Area of Interest (AOI)
- Soils**
 - Soil Rating Polygons**
 -  No Digital Data Available
 -  Not rated or not available
 - Soil Rating Lines**
 -  No Digital Data Available
 -  Not rated or not available
 - Soil Rating Points**
 -  No Digital Data Available
 -  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: Mojave Desert Area, West Central Part, California
Survey Area Data: Version 14, 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: Jun 26, 2019—Jul 8, 2019

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.

Map Unit Name

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
NOTCOM	No Digital Data Available	No Digital Data Available	167.9	100.0%
Totals for Area of Interest			167.9	100.0%

Description

A soil map unit is a collection of soil areas or nonsoil areas (miscellaneous areas) delineated in a soil survey. Each map unit is given a name that uniquely identifies the unit in a particular soil survey area.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower



Scale 1:250,000
 0 5 10 15 20 25 30 Statute Miles
 0 5 10 15 20 25 30 Kilometers
 0 5 10 15 20 25 30 Nautical Miles

CONTOUR INTERVAL 200 FEET
 SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
 TRANSVERSE MERCATOR PROJECTION
 RED LINES INDICATE THE 1000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 11
 THE DECLINATION FROM TRUE NORTH VARIES FROM 1°04' 18"00" WEST TO 1°00' 00" EAST AT THE CENTER OF THE SHEET 1988
 DERIVED FROM U.S.G.S. "SAN BERNARDINO" TOPOGRAPHIC MAP

REDUCED BY 1/2



**HYDROLOGIC SOILS GROUP MAP
 FOR
 SOUTHCENTRAL AREA**

NOAA ATLAS 14 POINT RAINFALLS



* 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	0.089 (0.073-0.108)	0.131 (0.108-0.160)	0.194 (0.160-0.237)	0.252 (0.206-0.311)	0.341 (0.270-0.436)	0.420 (0.326-0.548)	0.511 (0.386-0.682)	0.615 (0.453-0.845)	0.778 (0.550-1.11)	1.03 (0.701-1.52)
10-min	0.127 (0.105-0.155)	0.187 (0.155-0.229)	0.278 (0.229-0.340)	0.361 (0.295-0.445)	0.489 (0.387-0.625)	0.603 (0.467-0.785)	0.732 (0.554-0.977)	0.882 (0.649-1.21)	1.12 (0.788-1.60)	1.47 (1.00-2.18)
15-min	0.154 (0.127-0.187)	0.227 (0.187-0.277)	0.336 (0.277-0.411)	0.436 (0.357-0.538)	0.592 (0.468-0.755)	0.729 (0.565-0.950)	0.885 (0.670-1.18)	1.07 (0.785-1.46)	1.35 (0.953-1.93)	1.78 (1.21-2.63)
30-min	0.233 (0.193-0.284)	0.343 (0.284-0.419)	0.509 (0.419-0.623)	0.660 (0.540-0.815)	0.896 (0.709-1.14)	1.10 (0.856-1.44)	1.34 (1.01-1.79)	1.62 (1.19-2.22)	2.04 (1.44-2.92)	2.70 (1.84-3.99)
60-min	0.323 (0.268-0.394)	0.477 (0.395-0.583)	0.707 (0.583-0.865)	0.918 (0.751-1.13)	1.25 (0.986-1.59)	1.53 (1.19-2.00)	1.86 (1.41-2.49)	2.25 (1.65-3.08)	2.84 (2.01-4.06)	3.75 (2.56-5.54)
2-hr	0.444 (0.368-0.542)	0.629 (0.520-0.768)	0.897 (0.740-1.10)	1.14 (0.931-1.41)	1.50 (1.19-1.92)	1.81 (1.40-2.36)	2.15 (1.63-2.88)	2.54 (1.87-3.49)	3.13 (2.21-4.48)	3.78 (2.58-5.60)
3-hr	0.527 (0.436-0.643)	0.735 (0.608-0.898)	1.03 (0.854-1.27)	1.30 (1.06-1.61)	1.70 (1.34-2.17)	2.03 (1.58-2.65)	2.40 (1.82-3.20)	2.81 (2.07-3.86)	3.42 (2.42-4.89)	3.95 (2.69-5.84)
6-hr	0.687 (0.569-0.838)	0.949 (0.785-1.16)	1.32 (1.09-1.62)	1.64 (1.34-2.03)	2.12 (1.68-2.70)	2.51 (1.95-3.27)	2.94 (2.22-3.92)	3.41 (2.51-4.68)	4.10 (2.89-5.86)	4.67 (3.19-6.92)
12-hr	0.847 (0.702-1.03)	1.18 (0.976-1.44)	1.65 (1.36-2.02)	2.06 (1.68-2.54)	2.65 (2.10-3.38)	3.14 (2.43-4.09)	3.67 (2.78-4.90)	4.25 (3.13-5.84)	5.11 (3.61-7.30)	5.82 (3.97-8.61)
24-hr	1.05 (0.930-1.21)	1.49 (1.31-1.71)	2.10 (1.86-2.43)	2.64 (2.31-3.08)	3.43 (2.91-4.13)	4.09 (3.40-5.03)	4.81 (3.90-6.05)	5.60 (4.42-7.24)	6.76 (5.13-9.11)	7.74 (5.67-10.8)
2-day	1.17 (1.04-1.35)	1.69 (1.50-1.95)	2.42 (2.14-2.80)	3.07 (2.69-3.58)	4.03 (3.41-4.85)	4.83 (4.01-5.93)	5.70 (4.62-7.17)	6.67 (5.26-8.63)	8.11 (6.14-10.9)	9.32 (6.83-13.0)
3-day	1.26 (1.11-1.45)	1.83 (1.62-2.11)	2.65 (2.34-3.06)	3.37 (2.95-3.93)	4.45 (3.77-5.35)	5.35 (4.44-6.57)	6.34 (5.14-7.98)	7.45 (5.88-9.63)	9.08 (6.88-12.2)	10.5 (7.67-14.6)
4-day	1.31 (1.16-1.51)	1.92 (1.70-2.22)	2.80 (2.47-3.24)	3.58 (3.13-4.17)	4.73 (4.01-5.70)	5.71 (4.74-7.02)	6.78 (5.50-8.53)	7.97 (6.29-10.3)	9.74 (7.38-13.1)	11.3 (8.24-15.7)
7-day	1.45 (1.28-1.67)	2.15 (1.90-2.48)	3.16 (2.79-3.65)	4.06 (3.55-4.73)	5.39 (4.57-6.49)	6.52 (5.41-8.01)	7.76 (6.29-9.76)	9.14 (7.21-11.8)	11.2 (8.48-15.1)	12.9 (9.49-18.0)
10-day	1.54 (1.36-1.77)	2.31 (2.04-2.66)	3.40 (3.00-3.93)	4.37 (3.83-5.09)	5.81 (4.93-7.00)	7.03 (5.84-8.64)	8.37 (6.79-10.5)	9.87 (7.79-12.8)	12.1 (9.16-16.3)	14.0 (10.2-19.5)
20-day	1.77 (1.57-2.04)	2.65 (2.34-3.05)	3.90 (3.44-4.50)	4.99 (4.37-5.82)	6.62 (5.61-7.97)	7.99 (6.64-9.82)	9.49 (7.70-11.9)	11.2 (8.81-14.4)	13.6 (10.3-18.4)	15.8 (11.5-21.9)
30-day	1.99 (1.77-2.30)	2.98 (2.64-3.44)	4.37 (3.86-5.05)	5.59 (4.89-6.52)	7.39 (6.26-8.89)	8.89 (7.38-10.9)	10.5 (8.54-13.3)	12.4 (9.76-16.0)	15.1 (11.4-20.3)	17.4 (12.7-24.2)
45-day	2.32 (2.06-2.67)	3.44 (3.04-3.96)	4.99 (4.41-5.77)	6.35 (5.56-7.40)	8.33 (7.06-10.0)	9.98 (8.29-12.3)	11.8 (9.55-14.8)	13.8 (10.9-17.8)	16.7 (12.7-22.5)	19.2 (14.1-26.8)
60-day	2.64 (2.34-3.04)	3.88 (3.43-4.47)	5.59 (4.93-6.46)	7.07 (6.19-8.24)	9.22 (7.82-11.1)	11.0 (9.14-13.5)	12.9 (10.5-16.3)	15.1 (11.9-19.5)	18.3 (13.8-24.6)	20.9 (15.3-29.2)

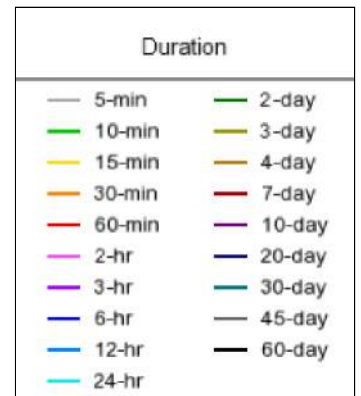
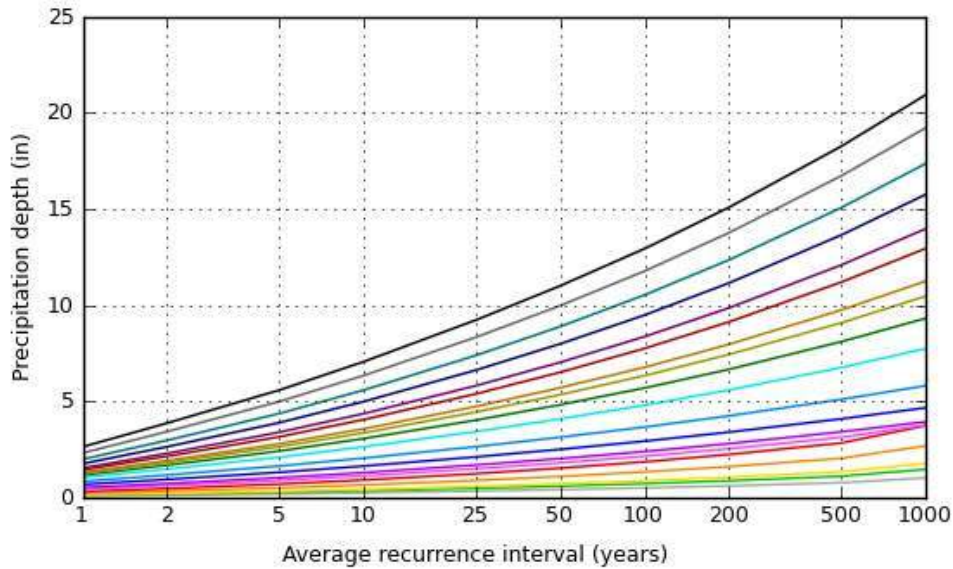
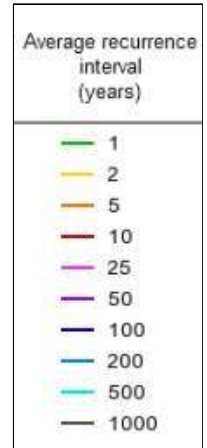
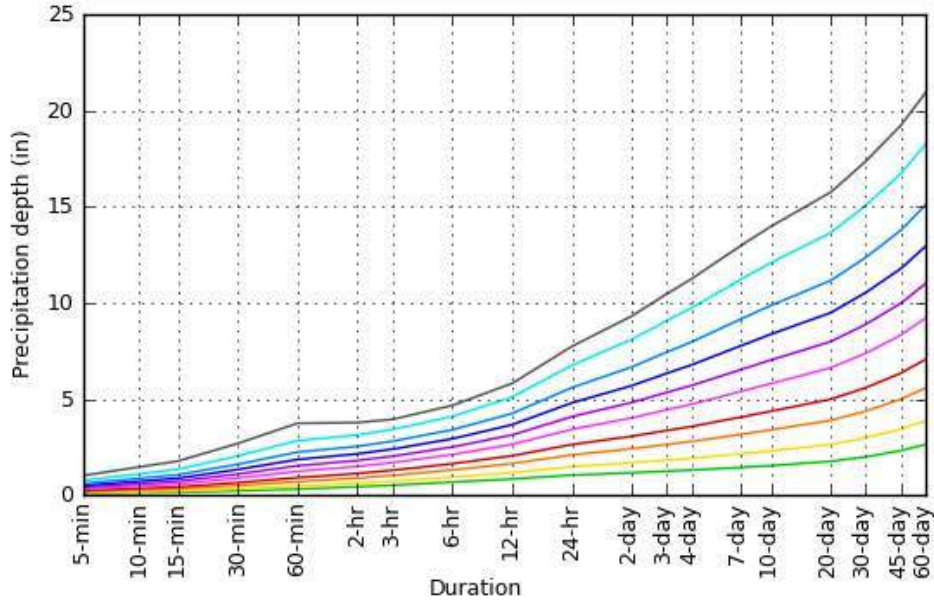
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and 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.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves

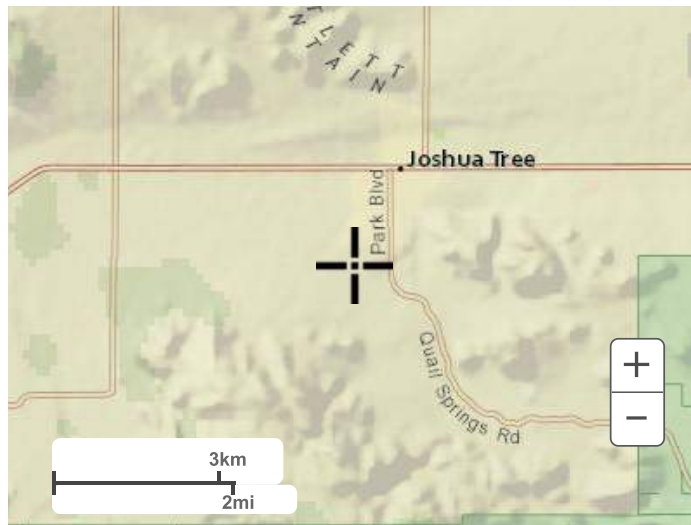
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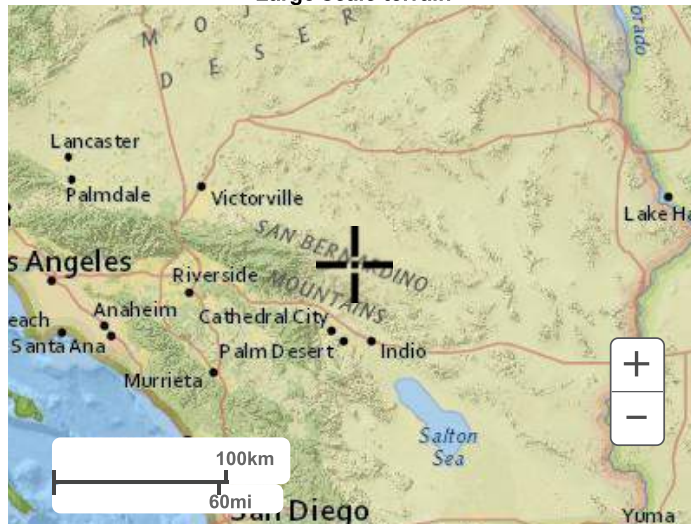
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Maps & aerials

Small scale terrain



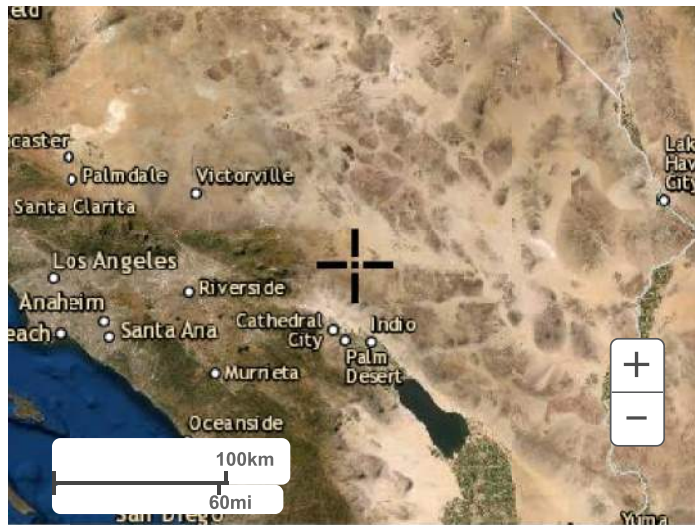
Large scale terrain



Large scale map



Large scale aerial



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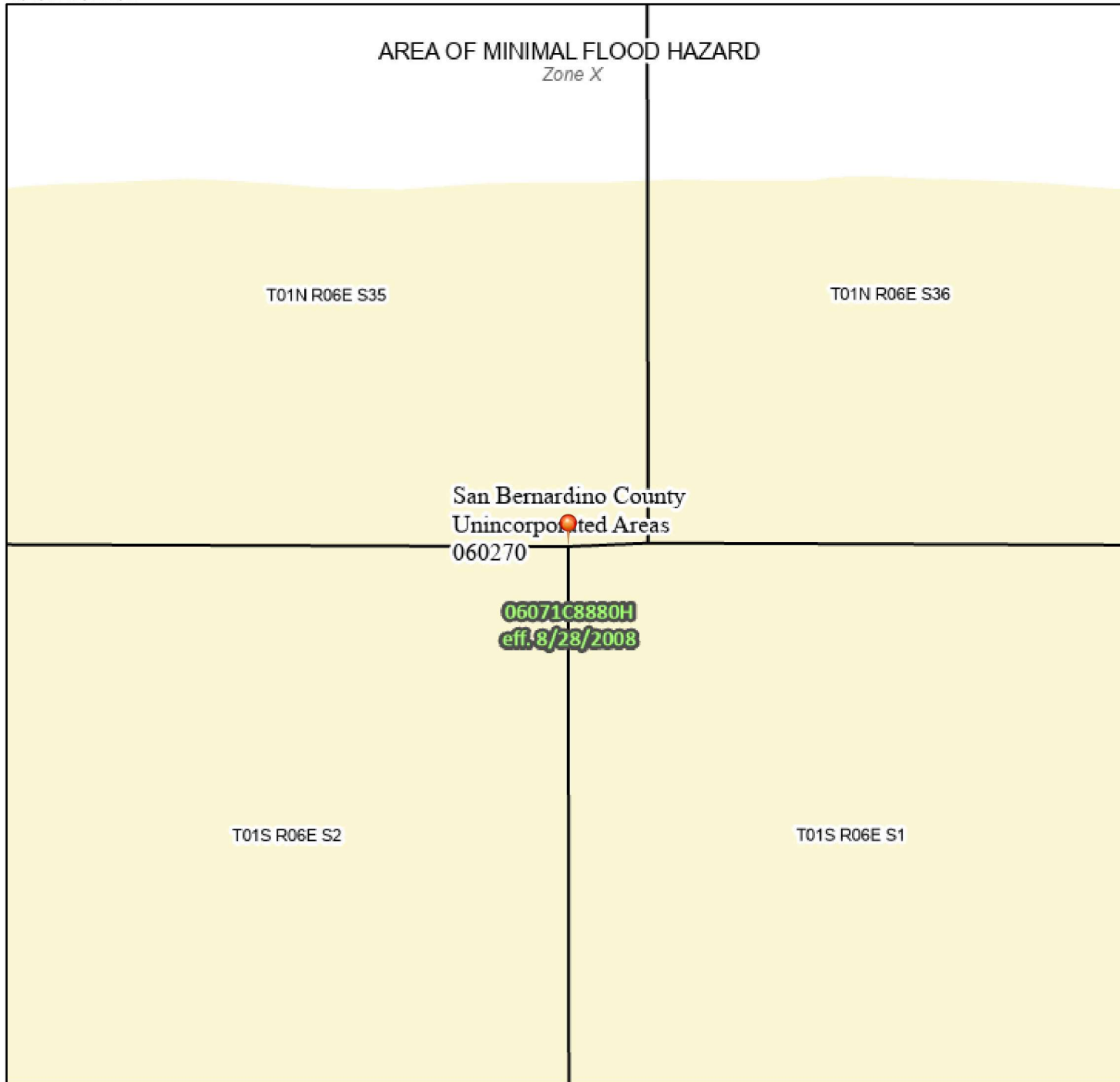
[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

National Flood Hazard Layer FIRMMette



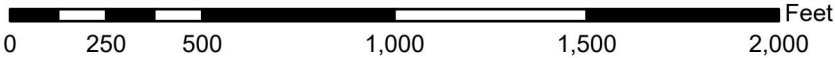
116°19'24"W 34°7'28"N



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard <i>Zone D</i>
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped
		The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.



1:6,000

116°18'46"W 34°6'59"N

Basemap Imagery Source: USGS National Map 2023

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/29/2024 at 9:48 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.