385 N. Arrowhead Ave, First Floor, San Bernardino, CA 92415 | Phone: 909.387-8311 • Fax: 909.387.3223
www.SBCounty.gov

SAN BERNARDINO COUNTY

Land Use Services Department

Plan Review Comments

Project Description:	**APN 0602-361-04 Joshua Tree**	**Application #:**	**DRNSTY-2022-00034**
Site Address/Tract No:	**Tract No. 20443**	**APN:**	**APN 0602-361-04**
Applicant/Contact:	**Merrell-Johnson Companies**	**Application Date:**	
		Expiration Date:	
Applicant Phone:	**(760)240-8000**	**Applicant Email:**	
Plans Reviewer:	**Sarah Seitz (NV5)** **Email:**	**sarah.seitz@NV5.com**	
☐ **1st Review**	**12/8/2022** ☐ **2nd Review:**	**04/12/2023** ☒ **5th Review:**	**11/06/2024**

Your application for a permit, together with plans and specifications, has been examined and you are advised that the issuance of a permit is withheld for the reasons hereinafter set forth. The approval of plans and specifications does not permit the violation of any section of the building code, or other County of San Bernardino ordinances or laws.

Methodology:

No further comments, recommended for preliminary approval.

County of San Bernardino
LAND DEVELOPMENT
PRELIMINARY
APPROVAL
THE APPROVAL OF THIS REPORT SHALL NOT BE CONSTRUED TO BE A PERMIT FOR ANY DEVELOPMENT OR SITE IMPROVEMENT
By: Timothy Cheng (D8256)
Date: 11/12/2024 10:47:20 AM
This report has Preliminary Approval. Prior to Final Approval of the report, all outstanding comments and requirements shall be met.
timothy.cheng@lus.sbcounty.gov
General: (909) 387-8311 Direct: (909) 387-4401

[END of COMMENTS]

I hereby declare that I have exercised responsible charge of the review of this project as defined in Section 6703 of the Business and Professions Code. The comments expressed herein are confined to a review only and do not relieve the Engineer of Work of their responsibilities for project design.

Tamara O'Neal — 11/6/2024
Name — Date:

REGISTERED PROFESSIONAL ENGINEER
TAMARA C. O'NEAL
No. 69107
CIVIL
STATE OF CALIFORNIA

HYDROLOGY STUDY

For

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

ALEX CRAMER

No further comments -
Recommended for Preliminary Approval
Sarah.Seitz
NV5 11/06/2024

Oct 30, 2024

County of San Bernardino
LAND DEVELOPMENT

PRELIMINARY APPROVAL

THE APPROVAL OF THIS REPORT SHALL NOT BE CONSTRUED TO BE A PERMIT FOR ANY DEVELOPMENT OR SITE IMPROVEMENT

By: Timothy Cheng (D8256)
Date: 11/12/2024 10:47:27 AM

This report has Preliminary Approval. Prior to Final Approval of the report, all outstanding comments and requirements shall be met.

timothy.cheng@lus.sbcounty.gov
General: (909) 387-8311 Direct: (909) 387-4096

Prepared by:

Merrell-Johnson Companies

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

Job No. 3753.001

REGISTERED PROFESSIONAL ENGINEER
E. CARY PACKER
No. C-51752
CIVIL
STATE OF CALIFORNIA

E. Cary Packer, PE
Associate Engineer
R.C.E. 51752

10/30/2024

Mark D. Rowan
Project Manager

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SECTION 1

DISCUSSION

INTRODUCTION

The project site encompasses approximately 16.6 acres of residential property within the right of way of the project site, 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 on-site 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 county requires that the post development peak flow be 90% or less of the pre-development peak flow rate for each storm as follows; 2yr, 10yr, 25yr, and 100yr respectively. (i.e. the peak 2 year post-development flow rate is equal to or less than 90% of the peak 2 year pre-development flow rate from the site and etc. for all frequency storm events through 100 year with the following modification: the 10yr storm uses the 5yr rainfall, the 25yr storm uses the 10yr rainfall, and the 100yr storm uses the 25yr rainfall. This criterion is outlined in the County document “Detention Basin Design Criteria For San Bernardino County” Section II sub part A and the interoffice memo dated Sept. 4, 1987 file 1(FC)-53 which modified the criteria.

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 Building homes and lot sales which will require the construction of streets and drainage infrastructure to manage the on-site and off-site storm runoff. 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 the rational method for storms 2yr, 10yr, 25yr, and 100yr to establish the peck run off for each of these storms in the undeveloped condition. The unit hydrograph analysis was used for the 100yr storm for the developed condition in order to calculate the detention volume needed for the detention basin. These runoff flows will be carried through the street rights-of-way and through cross-lot drainage.

Point rainfalls for the 2-year, 10-year, 25-year, and 100-year storms were obtained from the NOAA Atlas 14 per the 2010 Addendum to the County Hydrology Manual. The 1-hour point rainfall for the site is for each of the 4 storm events are as follows: (2-year = 0.477”) (5-year = 0.707”) (10-year = 0.918”) (25-year = 1.25”) (100-year = 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 Node 11 – Node 13	64	1,386	16.6	0.0462
On-site Developed Node 21 – Node 23	64	1,723	16.6	0.0371

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 to the centerline of the streets. The area to the right of way (property line) is 16.6-acre. The west off-site 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 “blueline” 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 flow analysis are summarized in Table C.

Table C

Sub-Area	Q_{100} (cfs)
Node 11 – Node 16 Off-site	285.9
Node 21 – Node 24 Off-site	72.3

The results of the on-site flow analysis are summarized in Table D.

Table D

Storm	Undeveloped Q (cfs)	90% of Undeveloped Q (cfs)	Developed Q (cfs)
2-year	1.1	.99	4.8
10-year	14.9	13.4	31.7
25-year	21.6	19.4	47.4
100-year	31.9	28.7	65.9

CONCLUSIONS AND RECOMMENDATIONS

During our field investigation of the site, we observed the existing conditions as stated previously. Development of the project will be designed after county conditions of approval are received for the Tentative Tract Map. The engineered improvement plans shall include infrastructure to conduct the off-site and on-site flows as determined in this report.

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 post development is estimated at 65.9 cfs and the pre-development Q100 flow rate using the 25yr rainfall is estimated at 31.9 cfs. Post-development peak runoff flow rates are required to be less than 90% of the pre-development peak runoff flow rates for the 2yr, 10yr, 25yr and 100yr storm events. The post-development peak flow rates and the 90% flow rates as discussed here are presented in table D above. Since the post development peak flow rates for each of the evaluated storms are greater than the pre-development peak flow rates, a detention basin or method will need to be designed. The size of the basin or storage means shall be adequate to hold the detention required for the 100yr storm event.

The storage volume shall be greater than 20,233 Cubic Feet. See detention basin volume calculations in section 3 of this report. The outlet structure shall be designed to reduce the flow rate to 90% of the pre-developed flow rates for each of the 2yr, 10yr, 25yr, and 100yr storm events as shown in Table D. The basin design shall follow the applicable requirements of the San Bernardino County "Detention Basin Design Criteria". For concept purposes and to show viable options for the final grading plan we have included a detention basin layout which would hold the 20,233 CF at a depth of about 2.5 feet (see the development plan in section 2 of this report. Another option would be to construct 1,900 feet of 48" diameter storm drain pipe within the tract which would serve both to collect the on-site runoff and to serve as a detention basin holding the 20,233 CF. The outlet of the storm drain system would outlet at the same spot near the Northeast Corner of the site as the detention basin option and would have a restricted outlet to limit the peak flow to the 90% flow rate of the various size storms. The storm drain option would not require the large basin but rather a smaller outflow structure to mitigate the peak flow rate. If the detention basin option is used, the

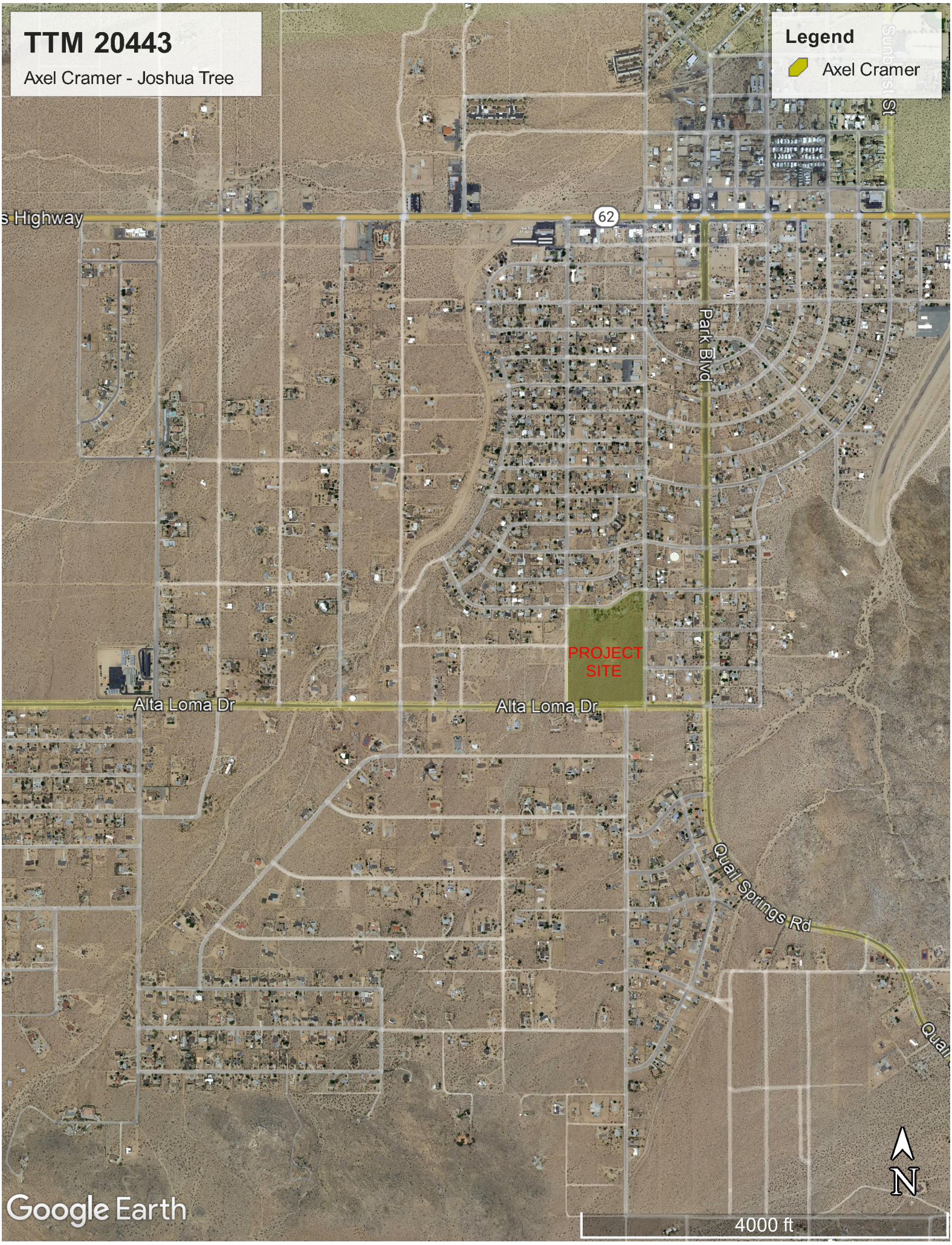
maintenance buildings planned for this location may get moved to another lot on the project.

On-site runoff flows will exit the site through under-sidewalk (parkway) drains along Sunset Road at the northeast corner of the project site. Two or three 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

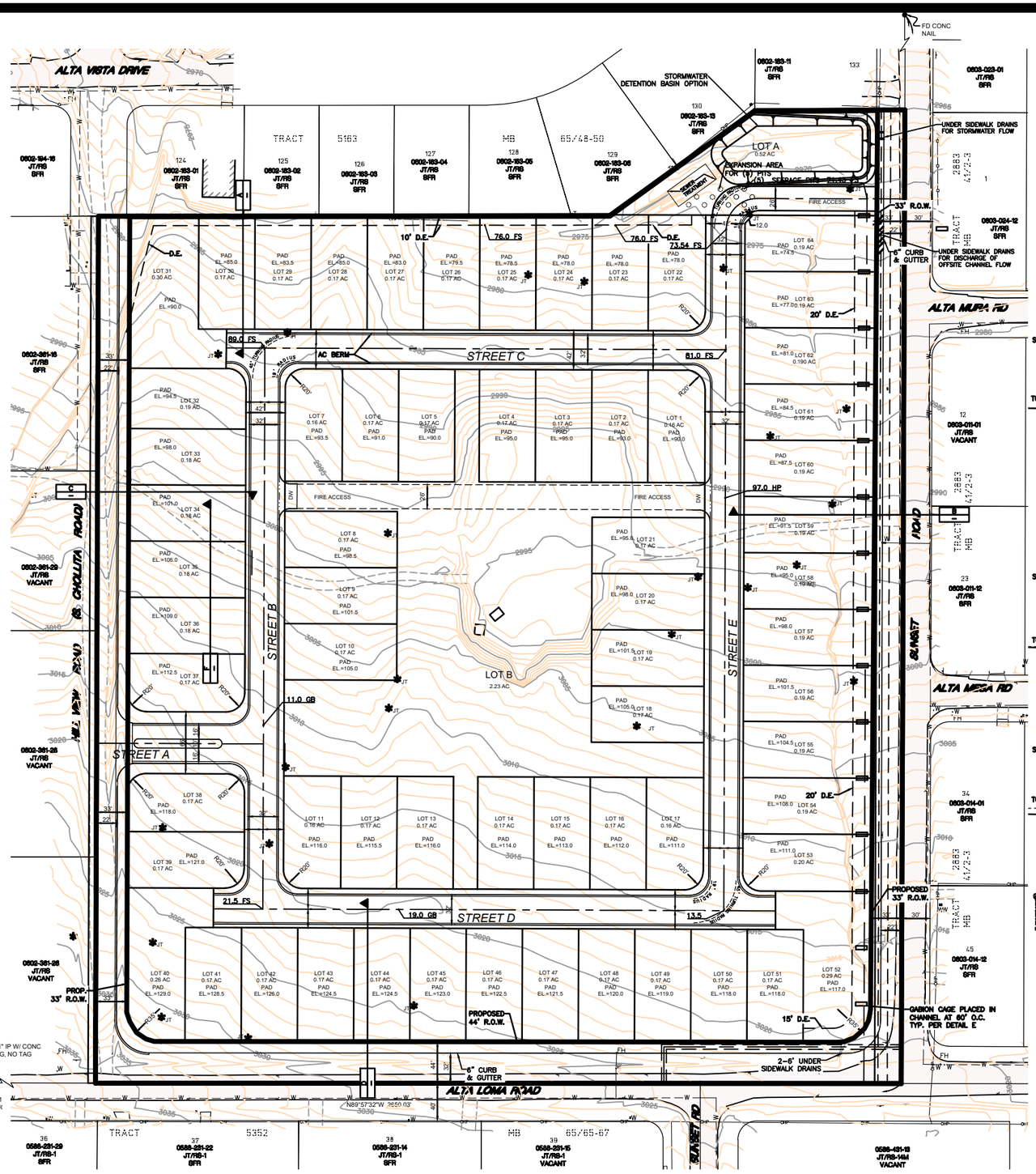
VICINITY MAP


TTM 20443
Axel Cramer - Joshua Tree
Legend
Axel Cramer
s Highway
62
Park Blvd
PROJECT SITE
Alta Loma Dr
Alta Loma Dr
Quail Springs Rd
N
Google Earth
4000 ft

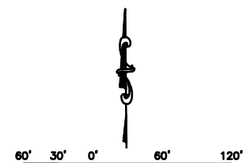
CONCEPTUAL GRADING
TENTATIVE TRACT NO. 20443

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

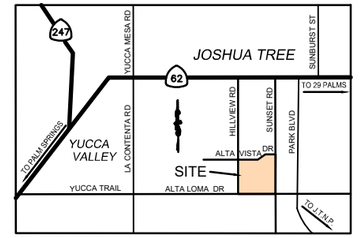
MERRELL JOHNSON COMPANIES, OCTOBER 2023



LEGEND



T.B.R.	INDICATES TO BE REMOVED
JT	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
FL	INDICATES FLOWLINE
PE	INDICATES PAD ELEVATION



VICINITY MAP

NOT TO SCALE

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 SAID 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 56' 00" WEST, 160 FEET TO A POINT; THENCE SOUTH 54 DEGREES 08' 44" WEST, 190.91 FEET TO A POINT; THENCE SOUTH 89 DEGREES 56' 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) 655-4555

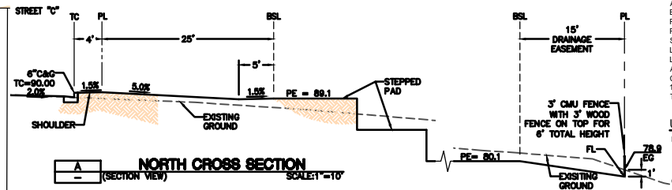
GAS: SOCAL GAS
PO BOX 1626
MONTEREY PARK, CA 91754-8626
(877) 238-0092

WATER: JOSHUA BASIN WATER DISTRICT
61750 CHOLLITA ROAD
JOSHUA TREE, CALIFORNIA 92252
(760) 366-8438

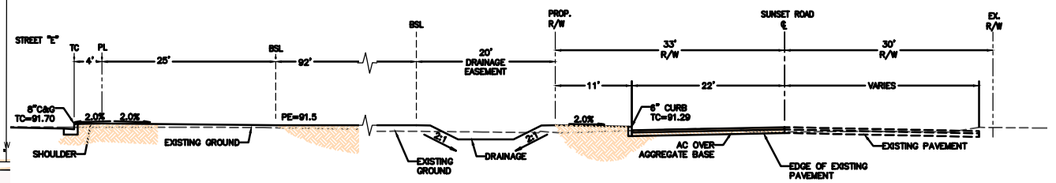
SEWER: SEPTIC

TELEPHONE: FRONTIER COMMUNICATIONS
401 MERRITT 7
NORWALK, CONNECTICUT 06851
(877) 236-2894

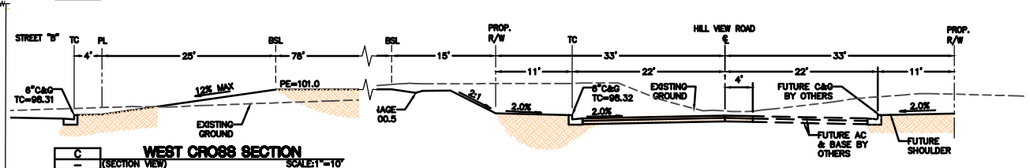
CABLE: SPECTRUM
7500 KICKAPOO TRAIL
YUCCA VALLEY, CA 92284
(800) 874-2389



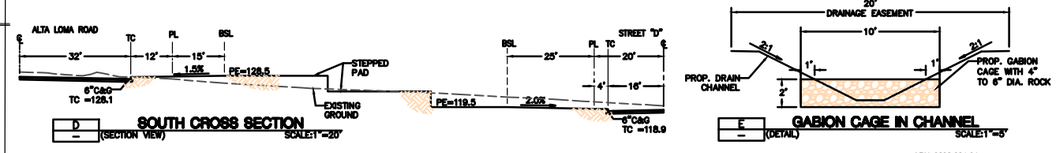
A (SECTION VIEW) **NORTH CROSS SECTION** SCALE:1"=10'



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

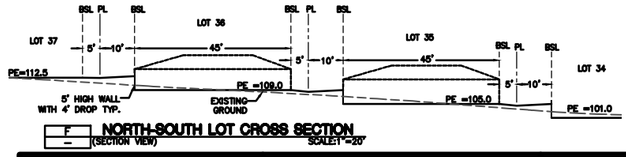


C (SECTION VIEW) **WEST CROSS SECTION** SCALE:1"=10'

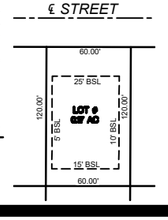


D (SECTION VIEW) **SOUTH CROSS SECTION** SCALE:1"=20'

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



F (SECTION VIEW) **NORTH-SOUTH LOT CROSS SECTION** SCALE:1"=20'



APN: 0602-361-04

TENATIVE 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

EASEMENTS:

3. EASEMENT FOR ROADS, PUBLIC UTILITIES AND INCIDENTAL PURPOSES RECORDED IN BOOK 4824, PAGE 464 OF OFFICIAL RECORDS
4. EASEMENT FOR CONDUITS AND INCIDENTAL PURPOSES RECORDED IN BOOK 6058, PAGE 894 OF OFFICIAL RECORDS
5. EASEMENT FOR CONDUITS AND INCIDENTAL PURPOSES RECORDED MAY 17, 1983 RECORDED AS INST. NO. 107203 OF OFFICIAL RECORDS
6. 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

TAKEN FROM THE EAST LINE OF THE SE 1/4 OF SECTION 35, T1N, R6E PER TRACT 5163, MB 65/48-50 BEING: N0°12'30"E

BENCHMARK

USGS BENCHMARK "38 DOR", LOCATED 7.9 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 PARK BOULEVARD, 16 FT. NORTH OF THE EXTENDED CENTER LINE OF FRONT 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.
NAVD88 ELEV=2730.14 FT.

BUILDING SETBACKS

FRONT:	25'
STREET-SIDE:	15'
STREET-INTERIOR:	5'/10'
REAR:	15'

MERRELL JOHNSON

MERRELL JOHNSON ENGINEERING, INC.
22221 HIGHWAY 18, APPLE VALLEY, CA 92307
760.240.8000 | MERRELLJOHNSON.COM

CONCEPTUAL GRADING TENTATIVE TRACT MAP
APN 0602-361-04
JOSHUA TREE, CA
FOR
AXEL CRAMER

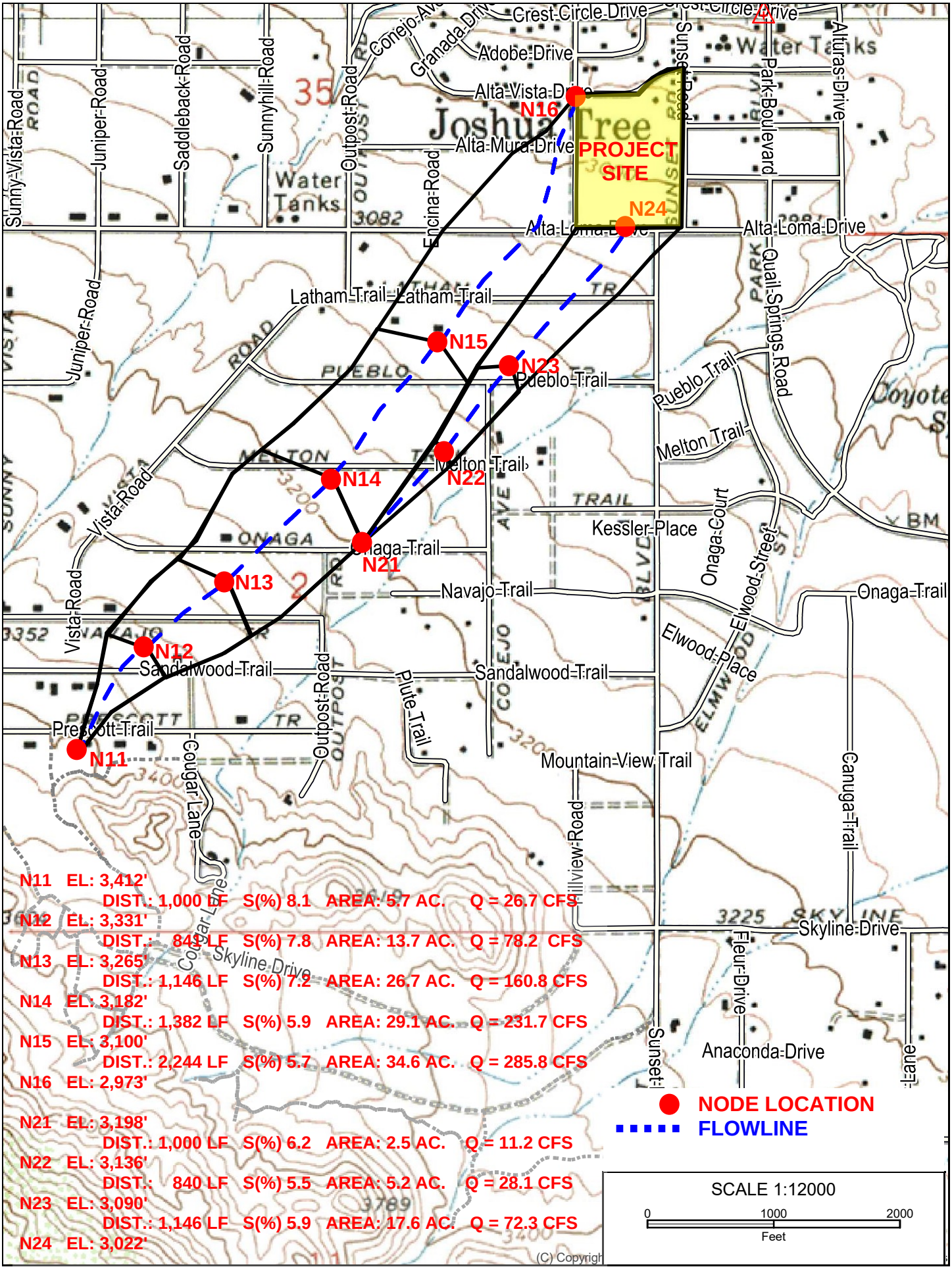
DRAWN BY:	JMF/NTG
DATE:	07/09/24
JOB NO.	3753.001
SHEET	1 OF 1

opcdsr 2:59pm 16 October 2024 P:\3753.001 Cramer\Maps\Tentative Tract\GP for Hydrology Study.dwg — Conceptual Grading Merrell Johnson Companies

SECTION 3

HYDROLOGY CALCULATIONS

OFF-SITE TRIBUTARY DRAINAGE MAP


PROJECT SITE
N16
N24
N15
N23
N14
N22
N13
N21
N12
N11
Joshua Tree
Water Tanks
Crest Circle Drive
Adobe Drive
Alta Vista Drive
Alta Mura Drive
Alta Loma Drive
Latham Trail
Pueblo Trail
Melton Trail
Onaga Trail
Navajo Trail
Sandalwood Trail
Prescott Trail
Mountain View Trail
Skyline Drive
Anaconda Drive
Sunny Vista Road
Juniper Road
Saddleback Road
Sunnyhill Road
Outpost Road
Encina Road
Granada Drive
Conejo Ave
Sunset Road
Park Boulevard
Alturas Drive
Quail Springs Road
Vista Road
Onaga Court
Kessler Place
Elwood Street
Elwood Place
Pluto Trail
Millview Road
Canuga Trail
Fleur Drive
Cougar Lane
N11 EL: 3,412'
DIST.: 1,000 LF S(%) 8.1 AREA: 5.7 AC. Q = 26.7 CFS
N12 EL: 3,331'
DIST.: 849 LF S(%) 7.8 AREA: 13.7 AC. Q = 78.2 CFS
N13 EL: 3,265'
DIST.: 1,146 LF S(%) 7.2 AREA: 26.7 AC. Q = 160.8 CFS
N14 EL: 3,182'
DIST.: 1,382 LF S(%) 5.9 AREA: 29.1 AC. Q = 231.7 CFS
N15 EL: 3,100'
DIST.: 2,244 LF S(%) 5.7 AREA: 34.6 AC. Q = 285.8 CFS
N16 EL: 2,973'
N21 EL: 3,198'
DIST.: 1,000 LF S(%) 6.2 AREA: 2.5 AC. Q = 11.2 CFS
N22 EL: 3,136'
DIST.: 840 LF S(%) 5.5 AREA: 5.2 AC. Q = 28.1 CFS
N23 EL: 3,090'
DIST.: 1,146 LF S(%) 5.9 AREA: 17.6 AC. Q = 72.3 CFS
N24 EL: 3,022'
NODE LOCATION
FLOWLINE
SCALE 1:12000
0 1000 2000
Feet

OFF-SITE HYDROLOGY 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: 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.
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 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)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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.
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)
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
```

T_C

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: 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(Ap) = 0.8000     Max loss rate(Fm)=     0.438(In/Hr)
Time of concentration =    26.10 min.
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)
Effective area this stream =      109.80(Ac.)
Total Study Area (Main Stream No. 1) =      109.80(Ac.)
Area averaged Fm 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(Ap) = 0.800
Area averaged SCS curve number =  69.0
```

T_c

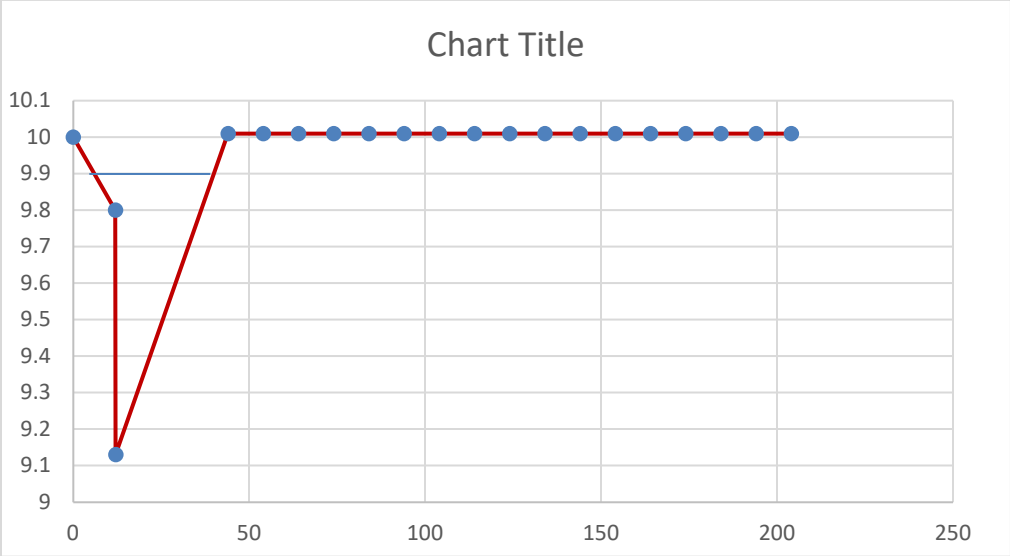
Q_{100}

Merrell Johnson COMPANIES

Date: 10/03/24
MJC Job No: 3753.001
Client: Axel Cramer

Q100 street flow in Alta Loma Road = 72.3 cfs

Flow in north curb and gutter and within street.



Channel X-Section

Node	X axis	Y axis
1	0	10
2	12	9.8
3	12.1	9.13
4	44	10.01
5	54	10.01
6	64	10.01
7	74	10.01
8	84	10.01
9	94	10.01
10	104	10.01

WS Elev	9.90
S	0.020
n	0.015
Area	11.02
Rh	0.32
V (fps)	6.56
Q (cfs)	72.30
WS width	33.82
WS depth	0.77

Merrell Johnson COMPANIES

Date: 05/30/24
MJC Job No: 3753.001
Client: Axel Cramer

Q100 = 72.3 cfs - Flow on Alta Loma Road

(3) 6' Parkway drain flow calculations from street to on-site channel. 24.1 cfs per parkway drain

Calc Depth (h)

h	**.50**		(ft) depth (6.03")
Z_L		0	Run/ft Left
Z_R		0	Run/ft Right
b		6	(ft) bottom width
n		0.015	Manning Coef
S		0.020	Channel Slope
V		8.0	(fps) Calculated Velocity
Q		24.1	(cfs) Calculated Flow Rate
		10,816	(gpm)
		6.0	(ft) Water surface width
A		3.0	(sf) Area
R_h		0.43	Hydraulic Radius
Fr		3.94	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 (ft^2)
R = Hydraulic Radius
m = side slope run per 1 foot rise in feet (ft)
z = depth of flow in feet (ft)

Merrell Johnson COMPANIES

Date: 05/30/24
MJC Job No: 3753.001
Client: Axel Cramer

Q100 = 72.3 cfs - Flow in east channel

Utilizing small dams at lot to slow flow down 60' o.c.

Calc Depth (h)

h	**1.14**		(ft) depth (13.64")
Z_L		2	Run/ft Left
Z_R		2	Run/ft Right
b		6	(ft) bottom width
n		0.030	Manning Coef
S		0.030	Channel Slope
V		7.7	(fps) Calculated Velocity
Q		72.3	(cfs) Calculated Flow Rate
		32,448	(gpm)
		10.5	(ft) Water surface width
A		9.4	(sf) Area
R_h		0.85	Hydraulic Radius
Fr		1.62	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 (ft^2)
R = Hydraulic Radius
m = side slope run per 1 foot rise in feet (ft)
z = depth of flow in feet (ft)

Merrell Johnson COMPANIES

Date: 05/02/22
MJC Job No: 3753.001
Client: Cramer

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 (ft^2)
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

ON-SITE CALCULATIONS

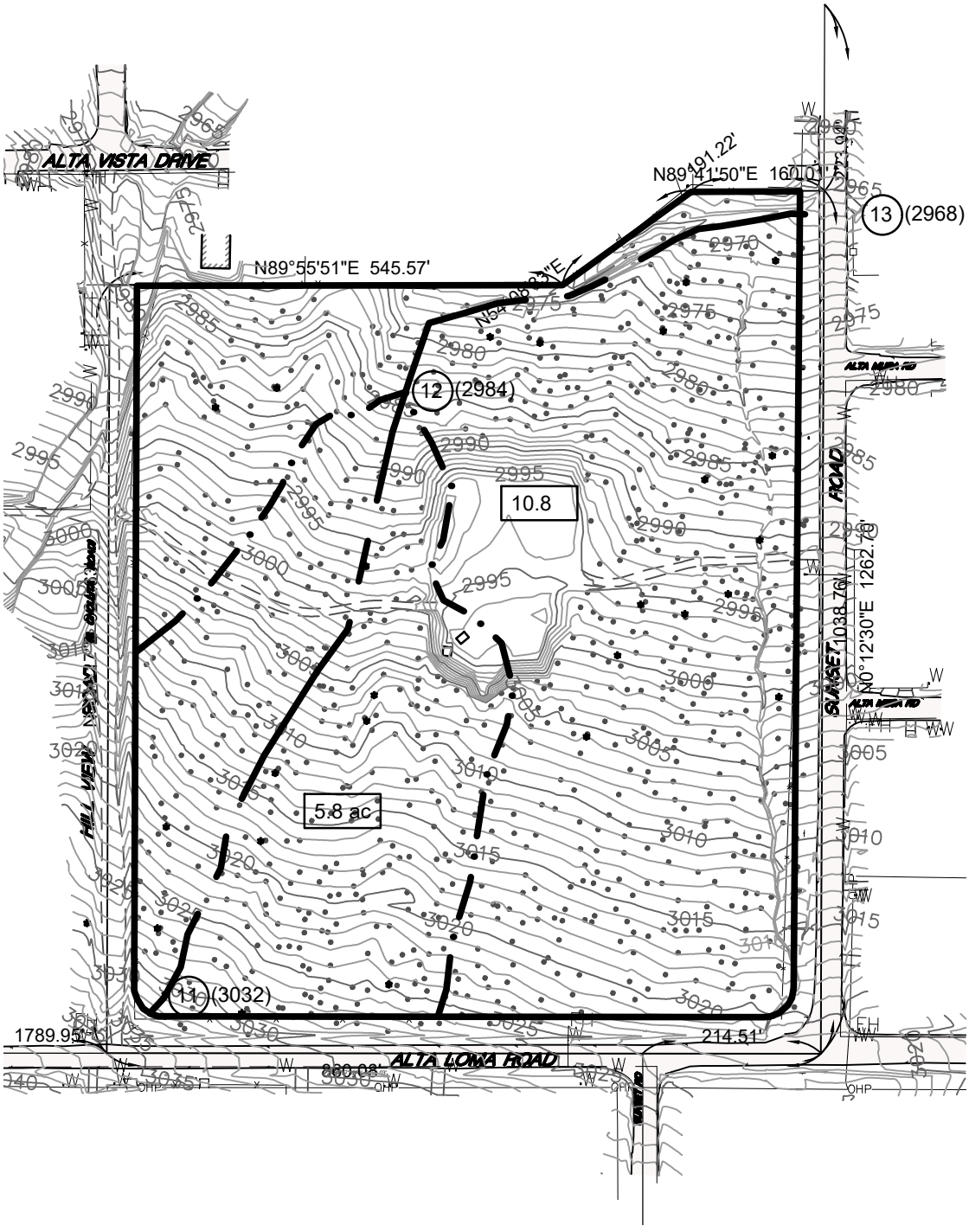
On-Site

Undeveloped

Drainage System

LEGEND

- Watercourse
- Watershed Boundary
- Sub-area Boundary
- (11) Node Number 11
- (3032) Elevation 3032
- 7.0 ac — 7.0 acres

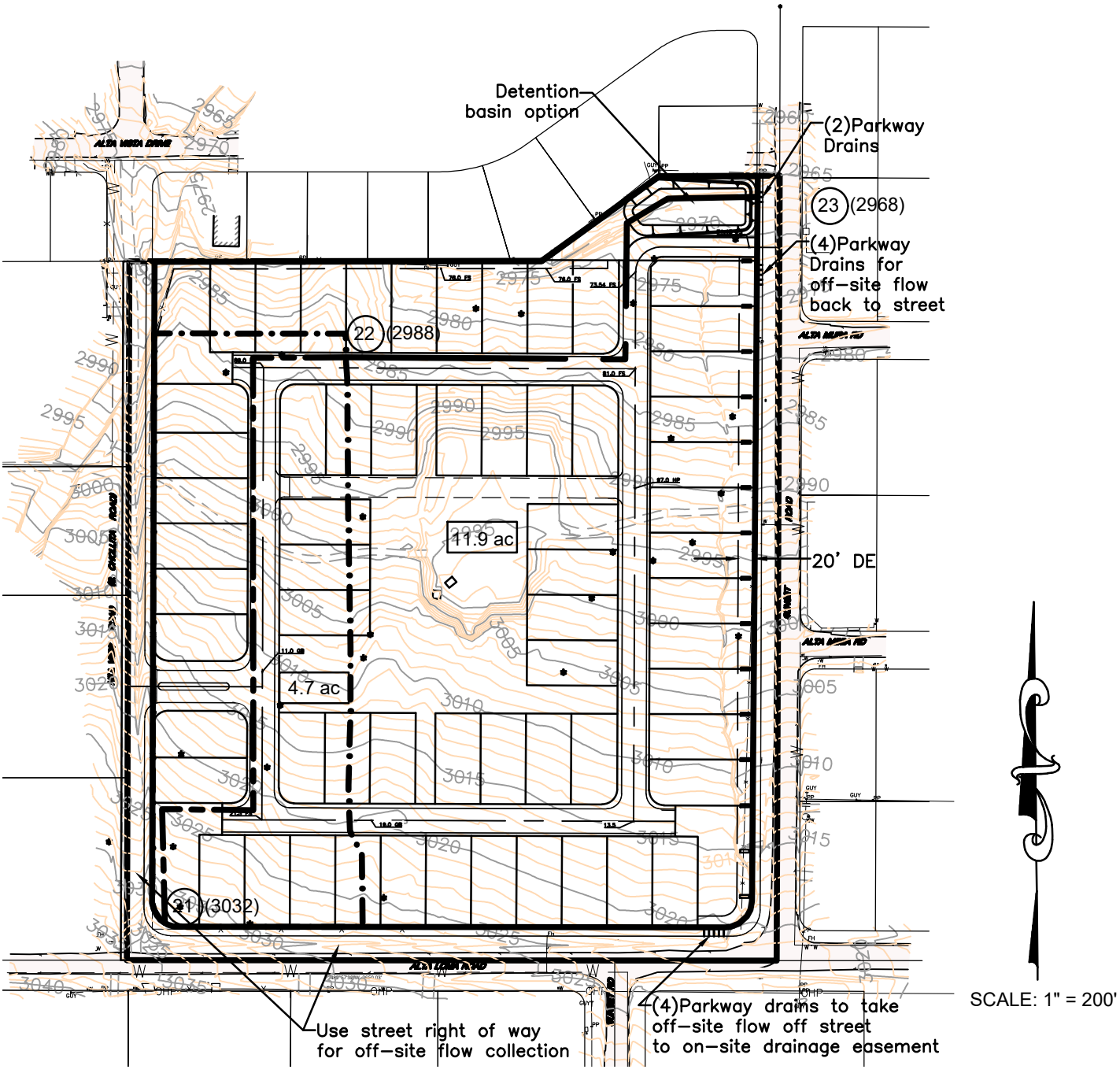


SCALE: 1" = 200'

On-Site Developed Drainage System

LEGEND

- Watercourse
- Watershed Boundary
- Sub-area Boundary
- (11) Node Number 11
- (3032) Elevation 3032
- [7.0 ac] 7.0 acres



San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/01/24

Axel Crammer - 3753.001
Undeveloped On-site 2 year storm flow
Node 11 to 13

Merrell Johnson Engineering
22221 Hwy 18, Apple Valley, CA
760 240-8000

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

Rational hydrology study storm event year is 2.0
10 Year storm 1 hour rainfall = 0.918(In.)
100 Year storm 1 hour rainfall = 1.860(In.)
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.260 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

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

UNDEVELOPED (average 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) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 820.000(Ft.)
Top (of initial area) elevation = 3032.000(Ft.)
Bottom (of initial area) elevation = 2984.000(Ft.)
Difference in elevation = 48.000(Ft.)
Slope = 0.05854 s(%)= 5.85
TC = k(0.706)*[(length^3)/(elevation change)]^0.2

```
Initial area time of concentration =   18.232 min.
Rainfall intensity =      0.598(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.318
Subarea runoff =      1.100(CFS)
Total initial stream area =        5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.387(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.054(Ft.), Average velocity =   0.998(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              0.00
        4             60.00              2.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =      1.101(CFS)
  '     '        flow top width =     21.074(Ft.)
  '     '    velocity=    0.998(Ft/s)
  '     '        area =      1.102(Sq.Ft)
  '     '        Froude number =     0.769

Upstream point elevation =  2984.000(Ft.)
Downstream point elevation =  2968.000(Ft.)
Flow length =   566.000(Ft.)
Travel time  =    9.45 min.
Time of concentration =   27.68 min.
Depth of flow =   0.054(Ft.)
Average velocity =   0.998(Ft/s)
Total irregular channel flow =     1.100(CFS)
Irregular channel normal depth above invert elev. =   0.054(Ft.)
Average velocity of channel(s) =   0.998(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (average 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) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q = 0.887(CFS)
therefore the upstream flow rate of Q = 1.100(CFS) is being used
Time of concentration = 27.68 min.
Rainfall intensity = 0.446(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.120
Subarea runoff = 0.000(CFS) for 10.800(Ac.)
Total runoff = 1.100(CFS)
Effective area this stream = 16.60(Ac.)
Total Study Area (Main Stream No. 1) = 16.60(Ac.)
Area averaged Fm value = 0.387(In/Hr)
End of computations, Total Study Area = 16.60 (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 = 79.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/16/24

Axel Cramer 3753.001
Undeveloped On-Site 10 year Storm
Node 11 to 13
Using 5yr rainfall for 10yr and 25yr rainfall for 100yr

Program License Serial Number 6663

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.707 (In.) 5yr Rainfall
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

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

UNDEVELOPED (average 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) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 820.000(Ft.)
Top (of initial area) elevation = 3032.000(Ft.)
Bottom (of initial area) elevation = 2984.000(Ft.)
Difference in elevation = 48.000(Ft.)
Slope = 0.05854 s(%)= 5.85
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 18.232 min.
Rainfall intensity = 1.628(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.686
Subarea runoff = 6.477(CFS)

```
Total initial stream area =        5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.387(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.154(Ft.), Average velocity =   1.956(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              0.00
        4             60.00              2.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =      6.477(CFS)
  '     '        flow top width =     23.075(Ft.)
  '     '    velocity=    1.956(Ft/s)
  '     '        area =      3.312(Sq.Ft)
  '     '        Froude number =     0.910

Upstream point elevation =  2984.000(Ft.)
Downstream point elevation =  2968.000(Ft.)
Flow length =   566.000(Ft.)
Travel time  =    4.82 min.
Time of concentration =   23.06 min.
Depth of flow =   0.154(Ft.)
Average velocity =   1.956(Ft/s)
Total irregular channel flow =     6.477(CFS)
Irregular channel normal depth above invert elev. =   0.154(Ft.)
Average velocity of channel(s) =   1.956(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (average 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)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    23.06 min.
```

Rainfall intensity = 1.381(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.648
Subarea runoff = 8.377(CFS) for 10.800(Ac.)
Total runoff = 14.854(CFS)
Effective area this stream = 16.60(Ac.)
Total Study Area (Main Stream No. 1) = 16.60(Ac.)
Area averaged Fm value = 0.387(In/Hr)
End of computations, Total Study Area = 16.60 (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 = 79.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/16/24

Axel Cramer 3753.001
Undeveloped On-Site 25 year
Node 11 to 13
Use 10yr Rainfall for 25yr and 25yr rainfall for 100yr

Program License Serial Number 6663

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

Rational hydrology study storm event year is 25.0
10 Year storm 1 hour rainfall = 0.707(In.) 5yr Rainfall
100 Year storm 1 hour rainfall = 1.250(In.) 25yr Rainfall
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.923 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

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

UNDEVELOPED (average 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) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 820.000(Ft.)
Top (of initial area) elevation = 3032.000(Ft.)
Bottom (of initial area) elevation = 2984.000(Ft.)
Difference in elevation = 48.000(Ft.)
Slope = 0.05854 s(%)= 5.85
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 18.232 min.
Rainfall intensity = 2.125(In/Hr) for a 25.0 year storm

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.736
Subarea runoff =      9.074(CFS)
Total initial stream area =        5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.387(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.187(Ft.), Average velocity =   2.212(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              0.00
        4             60.00              2.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =      9.074(CFS)
  '     '        flow top width =     23.750(Ft.)
  '     '    velocity=    2.212(Ft/s)
  '     '        area =      4.101(Sq.Ft)
  '     '        Froude number =     0.938

Upstream point elevation =  2984.000(Ft.)
Downstream point elevation =  2968.000(Ft.)
Flow length =   566.000(Ft.)
Travel time  =    4.26 min.
Time of concentration =   22.50 min.
Depth of flow =   0.187(Ft.)
Average velocity =   2.212(Ft/s)
Total irregular channel flow =     9.074(CFS)
Irregular channel normal depth above invert elev. =   0.187(Ft.)
Average velocity of channel(s) =   2.212(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (average 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)  = 79.00
```

Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Time of concentration = 22.50 min.
Rainfall intensity = 1.834(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.710
Subarea runoff = 12.553(CFS) for 10.800(Ac.)
Total runoff = 21.627(CFS)
Effective area this stream = 16.60(Ac.)
Total Study Area (Main Stream No. 1) = 16.60(Ac.)
Area averaged Fm value = 0.387(In/Hr)
End of computations, Total Study Area = 16.60 (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 = 79.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/16/24

Axel Cramer 3753.001
Undeveloped On-Site 100 year Storm
Node 11 to 13
Using 5yr for 10yr and 25yr for 100yr rainfall

Program License Serial Number 6663

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

Rational hydrology study storm event year is 100.0
10 Year storm 1 hour rainfall = 0.707(In.) 5yr Rainfall
100 Year storm 1 hour rainfall = 1.250(In.) 25yr Rainfall
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

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

UNDEVELOPED (average 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) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 820.000(Ft.)
Top (of initial area) elevation = 3032.000(Ft.)
Bottom (of initial area) elevation = 2984.000(Ft.)
Difference in elevation = 48.000(Ft.)
Slope = 0.05854 s(%)= 5.85
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 18.232 min.
Rainfall intensity = 2.878(In/Hr) for a 100.0 year storm

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.779
Subarea runoff =     13.002(CFS)
Total initial stream area =        5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.387(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.231(Ft.), Average velocity =   2.518(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              0.00
        4             60.00              2.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =     13.002(CFS)
  '     '        flow top width =     24.628(Ft.)
  '     '    velocity=    2.518(Ft/s)
  '     '        area =      5.164(Sq.Ft)
  '     '        Froude number =     0.969

Upstream point elevation =  2984.000(Ft.)
Downstream point elevation =  2968.000(Ft.)
Flow length =   566.000(Ft.)
Travel time  =    3.75 min.
Time of concentration =   21.98 min.
Depth of flow =   0.231(Ft.)
Average velocity =   2.518(Ft/s)
Total irregular channel flow =    13.002(CFS)
Irregular channel normal depth above invert elev. =   0.231(Ft.)
Average velocity of channel(s) =   2.518(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (average 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)  = 79.00
```

Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Time of concentration = 21.98 min.
Rainfall intensity = 2.525(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.762
Subarea runoff = 18.939(CFS) for 10.800(Ac.)
Total runoff = 31.941(CFS)
Effective area this stream = 16.60(Ac.)
Total Study Area (Main Stream No. 1) = 16.60(Ac.)
Area averaged Fm value = 0.387(In/Hr)
End of computations, Total Study Area = 16.60 (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 = 79.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/01/24

Axel Cramer 3753.001
Developed On-Site 2 year storm
Node 21 to 23

Program License Serial Number 6663

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

Rational hydrology study storm event year is 2.0
10 Year storm 1 hour rainfall = 0.918(In.)
100 Year storm 1 hour rainfall = 1.860(In.)
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.260 (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(3 - 4 dwl/acre)
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) = 0.6000 Max loss rate(Fm)= 0.329(In/Hr)
Initial subarea data:
Initial area flow distance = 993.000(Ft.)
Top (of initial area) elevation = 3032.000(Ft.)
Bottom (of initial area) elevation = 2988.000(Ft.)
Difference in elevation = 44.000(Ft.)
Slope = 0.04431 s(%)= 4.43
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.144 min.

```
Rainfall intensity =      0.794(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.527
Subarea runoff =      1.969(CFS)
Total initial stream area =        4.700(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =  2988.000(Ft.)
End of street segment elevation =  2968.000(Ft.)
Length of street segment  =   730.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  14.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   4.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.463(CFS)
Depth of flow =   0.225(Ft.), Average velocity =   3.028(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.978(Ft.)
Flow velocity =   3.03(Ft/s)
Travel time =    4.02 min.     TC =   16.16  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
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) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      0.650(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.445
Subarea runoff =      2.833(CFS) for   11.900(Ac.)
Total runoff =      4.802(CFS)
Effective area this stream =       16.60(Ac.)
Total Study Area (Main Stream No. 1) =       16.60(Ac.)
Area averaged Fm value =    0.329(In/Hr)
```

Street flow at end of street = 4.802(CFS)
Half street flow at end of street = 2.401(CFS)
Depth of flow = 0.247(Ft.), Average velocity = 3.257(Ft/s)
Flow width (from curb towards crown)= 8.075(Ft.)
End of computations, Total Study Area = 16.60 (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) = 0.600
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/01/24

Axel Cramer 3753.001
Developed On-Site 10 Year Storm
Node 21 to 23

Merrell Johnson Engineering
22221 Hwy 18, Apple Valley, CA
760 240-8000

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.918 (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(3 - 4 dwl/acre)
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) = 0.6000 Max loss rate(Fm)= 0.329(In/Hr)
Initial subarea data:
Initial area flow distance = 993.000(Ft.)
Top (of initial area) elevation = 3032.000(Ft.)
Bottom (of initial area) elevation = 2988.000(Ft.)
Difference in elevation = 44.000(Ft.)
Slope = 0.04431 s(%)= 4.43
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.144 min.
Rainfall intensity = 2.809(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.795
Subarea runoff = 10.490(CFS)

```
Total initial stream area =        4.700(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =  2988.000(Ft.)
End of street segment elevation =  2968.000(Ft.)
Length of street segment  =   730.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  14.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   4.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     21.175(CFS)
Depth of flow =   0.382(Ft.), Average velocity =   4.632(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.834(Ft.)
Flow velocity =   4.63(Ft/s)
Travel time =    2.63 min.     TC =   14.77  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
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) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      2.449(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.779
Subarea runoff =     21.185(CFS) for   11.900(Ac.)
Total runoff =     31.674(CFS)
Effective area this stream =       16.60(Ac.)
Total Study Area (Main Stream No. 1) =       16.60(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =     31.674(CFS)
Half street flow at end of street =     15.837(CFS)
Depth of flow =   0.427(Ft.), Average velocity =   5.278(Ft/s)
```

Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown)= 16.000(Ft.)
End of computations, Total Study Area = 16.60 (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) = 0.600
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2019 Version 9.1
Rational Hydrology Study Date: 10/01/24

Axel Cramer 3753.001
Developed On-Site 25 Year Storm
Node 21 to 23

Merrell Johnson Engineering
22221 Hwy 18, Apple Valley, CA
760 240-8000

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

Rational hydrology study storm event year is 25.0
10 Year storm 1 hour rainfall = 0.918(In.)
100 Year storm 1 hour rainfall = 1.860(In.)
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.293 (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(3 - 4 dwl/acre)
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) = 0.6000 Max loss rate(Fm)= 0.329(In/Hr)
Initial subarea data:
Initial area flow distance = 993.000(Ft.)
Top (of initial area) elevation = 3032.000(Ft.)
Bottom (of initial area) elevation = 2988.000(Ft.)
Difference in elevation = 44.000(Ft.)
Slope = 0.04431 s(%)= 4.43
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.144 min.

```
Rainfall intensity =      3.955(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.825
Subarea runoff =     15.341(CFS)
Total initial stream area =        4.700(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =  2988.000(Ft.)
End of street segment elevation =  2968.000(Ft.)
Length of street segment  =   730.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  14.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   4.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     31.431(CFS)
Depth of flow =   0.426(Ft.), Average velocity =   5.262(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.000(Ft.)
Flow velocity =   5.26(Ft/s)
Travel time =    2.31 min.     TC =   14.46  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
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) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      3.501(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.815
Subarea runoff =     32.054(CFS) for   11.900(Ac.)
Total runoff =     47.395(CFS)
Effective area this stream =       16.60(Ac.)
Total Study Area (Main Stream No. 1) =       16.60(Ac.)
```

Area averaged Fm value = 0.329(In/Hr)
Street flow at end of street = 47.395(CFS)
Half street flow at end of street = 23.698(CFS)
Depth of flow = 0.479(Ft.), Average velocity = 6.193(Ft/s)
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown)= 16.000(Ft.)
End of computations, Total Study Area = 16.60 (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) = 0.600
Area averaged SCS curve number = 69.0

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 10/02/24

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

Merrell Johnson Engineering
22221 Hwy 18, Apple Valley, CA
760 240-8000

Axel Cramer 3753.001
Developed On-Site 100 Year Storm
Node 21 to 23
Unit Hydograph

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		
16.60	1	0.92
Rainfall data for year 2		
16.60	6	0.95
Rainfall data for year 2		
16.60	24	1.49

```
------------------------------------------------------------------------
Rainfall data for year 100
           16.60           1           1.86
------------------------------------------------------------------------
Rainfall data for year 100
           16.60           6           2.94
------------------------------------------------------------------------
Rainfall data for year 100
           16.60          24           4.81
------------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 69.0      69.0         16.60      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       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     9.96   0.600         69.0      69.0       4.49     0.378
     6.64   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  =   0.235 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      16.60(Ac.)
Catchment Lag time =   0.188 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 44.3262
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      16.60(Ac.) (Ref: fig. E-4)
```

```
5-minute factor = 0.999     Adjusted rainfall =  0.882(In)
30-minute factor = 0.999    Adjusted rainfall =  1.510(In)
1-hour factor = 0.999       Adjusted rainfall =  1.859(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)
--------------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
--------------------------------------------------------------------------
                (K =       200.76 (CFS))

  1                3.248                   6.520
  2               23.770                  41.199
  3               54.755                  62.204
  4               69.544                  29.691
  5               78.011                  16.998
  6               83.592                  11.204
  7               87.711                   8.269
  8               90.605                   5.810
  9               92.859                   4.525
 10               94.617                   3.529
 11               95.997                   2.770
 12               97.062                   2.137
 13               97.811                   1.505
 14               98.294                   0.968
 15               98.813                   1.042
 16               99.339                   1.057
 17               99.696                   0.717
 18              100.000                   0.610
--------------------------------------------------------------------------
--------------------------------------------------------------------------
--------------------------------------------------------------------------
Total soil rain loss =      1.46(In)
Total effective rainfall =      3.35(In)
Peak flow rate in flood hydrograph =     65.93(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       17.5      35.0      52.5      70.0
--------------------------------------------------------------------------
```

0+ 5	0.0002	0.02	Q				
0+10	0.0013	0.17	Q				
0+15	0.0041	0.40	Q				
0+20	0.0076	0.51	Q				
0+25	0.0115	0.57	Q				
0+30	0.0157	0.61	Q				
0+35	0.0201	0.64	Q				
0+40	0.0247	0.67	Q				
0+45	0.0294	0.68	Q				
0+50	0.0342	0.70	Q				
0+55	0.0391	0.71	Q				
1+ 0	0.0441	0.72	Q				
1+ 5	0.0491	0.73	Q				
1+10	0.0542	0.74	Q				
1+15	0.0593	0.74	Q				
1+20	0.0645	0.75	Q				
1+25	0.0697	0.75	Q				
1+30	0.0749	0.76	Q				
1+35	0.0801	0.76	Q				
1+40	0.0854	0.76	Q				
1+45	0.0907	0.77	Q				
1+50	0.0960	0.77	Q				
1+55	0.1013	0.77	Q				
2+ 0	0.1067	0.78	Q				
2+ 5	0.1120	0.78	Q				
2+10	0.1174	0.78	QV				
2+15	0.1228	0.78	QV				
2+20	0.1282	0.79	QV				
2+25	0.1337	0.79	QV				
2+30	0.1391	0.79	QV				
2+35	0.1446	0.80	QV				
2+40	0.1501	0.80	QV				
2+45	0.1557	0.80	QV				
2+50	0.1612	0.81	QV				
2+55	0.1668	0.81	QV				
3+ 0	0.1724	0.81	QV				
3+ 5	0.1780	0.82	QV				
3+10	0.1837	0.82	QV				
3+15	0.1893	0.82	QV				
3+20	0.1950	0.83	QV				
3+25	0.2008	0.83	QV				
3+30	0.2065	0.83	QV				
3+35	0.2123	0.84	QV				
3+40	0.2180	0.84	QV				
3+45	0.2239	0.84	QV				
3+50	0.2297	0.85	QV				
3+55	0.2356	0.85	Q V				
4+ 0	0.2414	0.85	Q V				
4+ 5	0.2474	0.86	Q V				
4+10	0.2533	0.86	Q V				

4+15	0.2593	0.87	Q V	|	|	|	|
4+20	0.2653	0.87	Q V	|	|	|	|
4+25	0.2713	0.87	Q V	|	|	|	|
4+30	0.2773	0.88	Q V	|	|	|	|
4+35	0.2834	0.88	Q V	|	|	|	|
4+40	0.2895	0.89	Q V	|	|	|	|
4+45	0.2956	0.89	Q V	|	|	|	|
4+50	0.3018	0.89	Q V	|	|	|	|
4+55	0.3080	0.90	Q V	|	|	|	|
5+ 0	0.3142	0.90	Q V	|	|	|	|
5+ 5	0.3204	0.91	Q V	|	|	|	|
5+10	0.3267	0.91	Q V	|	|	|	|
5+15	0.3330	0.92	Q V	|	|	|	|
5+20	0.3394	0.92	Q V	|	|	|	|
5+25	0.3457	0.92	Q V	|	|	|	|
5+30	0.3521	0.93	Q V	|	|	|	|
5+35	0.3586	0.93	Q V	|	|	|	|
5+40	0.3650	0.94	Q V	|	|	|	|
5+45	0.3715	0.94	Q V	|	|	|	|
5+50	0.3781	0.95	Q V	|	|	|	|
5+55	0.3846	0.95	Q V	|	|	|	|
6+ 0	0.3912	0.96	Q V	|	|	|	|
6+ 5	0.3979	0.96	Q V	|	|	|	|
6+10	0.4045	0.97	Q V	|	|	|	|
6+15	0.4112	0.97	Q V	|	|	|	|
6+20	0.4180	0.98	Q V	|	|	|	|
6+25	0.4248	0.98	Q V	|	|	|	|
6+30	0.4316	0.99	Q V	|	|	|	|
6+35	0.4384	0.99	Q V	|	|	|	|
6+40	0.4453	1.00	Q V	|	|	|	|
6+45	0.4522	1.01	Q V	|	|	|	|
6+50	0.4592	1.01	Q V	|	|	|	|
6+55	0.4662	1.02	Q V	|	|	|	|
7+ 0	0.4733	1.02	Q V	|	|	|	|
7+ 5	0.4804	1.03	Q V	|	|	|	|
7+10	0.4875	1.04	Q V	|	|	|	|
7+15	0.4947	1.04	Q V	|	|	|	|
7+20	0.5019	1.05	Q V	|	|	|	|
7+25	0.5091	1.05	Q V	|	|	|	|
7+30	0.5164	1.06	Q V	|	|	|	|
7+35	0.5238	1.07	Q V	|	|	|	|
7+40	0.5312	1.07	Q V	|	|	|	|
7+45	0.5386	1.08	Q V	|	|	|	|
7+50	0.5461	1.09	Q V	|	|	|	|
7+55	0.5536	1.09	Q V	|	|	|	|
8+ 0	0.5612	1.10	Q V	|	|	|	|
8+ 5	0.5688	1.11	Q V	|	|	|	|
8+10	0.5765	1.12	Q V	|	|	|	|
8+15	0.5842	1.12	Q V	|	|	|	|
8+20	0.5920	1.13	Q V	|	|	|	|

8+25	0.5999	1.14	Q	V				
8+30	0.6077	1.15	Q	V				
8+35	0.6157	1.15	Q	V				
8+40	0.6237	1.16	Q	V				
8+45	0.6317	1.17	Q	V				
8+50	0.6399	1.18	Q	V				
8+55	0.6480	1.19	Q	V				
9+ 0	0.6563	1.20	Q	V				
9+ 5	0.6646	1.20	Q	V				
9+10	0.6729	1.21	Q	V				
9+15	0.6813	1.22	Q	V				
9+20	0.6898	1.23	Q	V				
9+25	0.6984	1.24	Q	V				
9+30	0.7070	1.25	Q	V				
9+35	0.7157	1.26	Q	V				
9+40	0.7244	1.27	Q	V				
9+45	0.7332	1.28	Q	V				
9+50	0.7421	1.29	Q	V				
9+55	0.7511	1.30	Q	V				
10+ 0	0.7602	1.31	Q	V				
10+ 5	0.7693	1.33	Q	V				
10+10	0.7785	1.34	Q	V				
10+15	0.7878	1.35	Q	V				
10+20	0.7971	1.36	Q	V				
10+25	0.8066	1.37	Q	V				
10+30	0.8161	1.39	Q	V				
10+35	0.8258	1.40	Q	V				
10+40	0.8355	1.41	Q	V				
10+45	0.8453	1.43	Q	V				
10+50	0.8552	1.44	Q	V				
10+55	0.8652	1.45	Q	V				
11+ 0	0.8753	1.47	Q	V				
11+ 5	0.8855	1.48	Q	V				
11+10	0.8959	1.50	Q	V				
11+15	0.9063	1.51	Q	V				
11+20	0.9168	1.53	Q	V				
11+25	0.9275	1.55	Q	V				
11+30	0.9382	1.56	Q	V				
11+35	0.9491	1.58	Q	V				
11+40	0.9602	1.60	Q	V				
11+45	0.9713	1.62	Q	V				
11+50	0.9826	1.64	Q	V				
11+55	0.9940	1.66	Q	V				
12+ 0	1.0056	1.68	Q	V				
12+ 5	1.0171	1.68	Q	V				
12+10	1.0282	1.60	Q	V				
12+15	1.0383	1.47	Q	V				
12+20	1.0481	1.42	Q	V				
12+25	1.0577	1.40	Q	V				
12+30	1.0673	1.39	Q	V				

```
12+35       1.0769      1.39  Q        V|         |         |         |
12+40       1.0866      1.40  Q        V|         |         |         |
12+45       1.0963      1.42  Q        V|         |         |         |
12+50       1.1062      1.43  Q        V|         |         |         |
12+55       1.1162      1.45  Q        V|         |         |         |
13+ 0       1.1263      1.47  Q        V|         |         |         |
13+ 5       1.1366      1.50  Q        V|         |         |         |
13+10       1.1471      1.52  Q        V|         |         |         |
13+15       1.1578      1.55  Q        V|         |         |         |
13+20       1.1686      1.58  Q         V         |         |         |
13+25       1.1797      1.61  Q         V         |         |         |
13+30       1.1911      1.65  Q         V         |         |         |
13+35       1.2027      1.68  Q         V         |         |         |
13+40       1.2145      1.72  Q         V         |         |         |
13+45       1.2267      1.76  |Q        V         |         |         |
13+50       1.2391      1.81  |Q        V         |         |         |
13+55       1.2519      1.85  |Q        V         |         |         |
14+ 0       1.2650      1.90  |Q        V         |         |         |
14+ 5       1.2785      1.96  |Q        |V        |         |         |
14+10       1.2923      2.01  |Q        |V        |         |         |
14+15       1.3066      2.08  |Q        |V        |         |         |
14+20       1.3214      2.14  |Q        |V        |         |         |
14+25       1.3366      2.21  |Q        |V        |         |         |
14+30       1.3524      2.29  |Q        |V        |         |         |
14+35       1.3687      2.37  |Q        |V        |         |         |
14+40       1.3856      2.46  |Q        |V        |         |         |
14+45       1.4032      2.56  |Q        | V       |         |         |
14+50       1.4216      2.66  |Q        | V       |         |         |
14+55       1.4407      2.78  |Q        | V       |         |         |
15+ 0       1.4608      2.91  |Q        | V       |         |         |
15+ 5       1.4819      3.06  |Q        | V       |         |         |
15+10       1.5042      3.23  |Q        | V       |         |         |
15+15       1.5277      3.42  |Q        |  V      |         |         |
15+20       1.5528      3.64  | Q       |  V      |         |         |
15+25       1.5799      3.93  | Q       |  V      |         |         |
15+30       1.6103      4.41  | Q       |  V      |         |         |
15+35       1.6452      5.06  | Q       |   V     |         |         |
15+40       1.6843      5.68  |  Q      |   V     |         |         |
15+45       1.7287      6.44  |  Q      |   V     |         |         |
15+50       1.7809      7.59  |   Q     |    V    |         |         |
15+55       1.8466      9.54  |    Q    |    V    |         |         |
16+ 0       1.9381     13.28  |      Q  |     V   |         |         |
16+ 5       2.1036     24.03  |         |  Q    V |         |         |
16+10       2.4670     52.76  |         |         |V        Q         |
16+15       2.9210     65.93  |         |         |    V    |       Q |
16+20       3.1845     38.25  |         |         |Q     V  |         |
16+25       3.3582     25.22  |         |   Q     |       V |         |
16+30       3.4848     18.38  |         Q         |         V         |
16+35       3.5832     14.28  |       Q |         |         V         |
16+40       3.6599     11.14  |     Q   |         |         |V        |
```

16+45	3.7233	9.20	| Q |	|	|	V |
16+50	3.7762	7.68	| Q |	|	|	V |
16+55	3.8208	6.48	| Q |	|	|	V |
17+ 0	3.8585	5.47	| Q |	|	|	V |
17+ 5	3.8899	4.57	| Q |	|	|	V |
17+10	3.9165	3.86	| Q |	|	|	V |
17+15	3.9416	3.64	| Q |	|	|	V |
17+20	3.9651	3.40	|Q |	|	|	V |
17+25	3.9851	2.91	|Q |	|	|	V |
17+30	4.0029	2.59	|Q |	|	|	V |
17+35	4.0165	1.96	|Q |	|	|	V |
17+40	4.0290	1.82	|Q |	|	|	V |
17+45	4.0409	1.72	Q |	|	|	V |
17+50	4.0522	1.64	Q |	|	|	V |
17+55	4.0630	1.57	Q |	|	|	V |
18+ 0	4.0733	1.50	Q |	|	|	V |
18+ 5	4.0833	1.46	Q |	|	|	V |
18+10	4.0937	1.51	Q |	|	|	V |
18+15	4.1048	1.61	Q |	|	|	V |
18+20	4.1161	1.63	Q |	|	|	V |
18+25	4.1273	1.63	Q |	|	|	V |
18+30	4.1384	1.62	Q |	|	|	V |
18+35	4.1494	1.59	Q |	|	|	V |
18+40	4.1602	1.57	Q |	|	|	V |
18+45	4.1709	1.54	Q |	|	|	V |
18+50	4.1813	1.52	Q |	|	|	V |
18+55	4.1916	1.49	Q |	|	|	V |
19+ 0	4.2017	1.47	Q |	|	|	V |
19+ 5	4.2116	1.44	Q |	|	|	V |
19+10	4.2214	1.42	Q |	|	|	V |
19+15	4.2310	1.39	Q |	|	|	V |
19+20	4.2404	1.37	Q |	|	|	V |
19+25	4.2496	1.35	Q |	|	|	V |
19+30	4.2588	1.32	Q |	|	|	V |
19+35	4.2677	1.30	Q |	|	|	V |
19+40	4.2765	1.28	Q |	|	|	V |
19+45	4.2852	1.26	Q |	|	|	V |
19+50	4.2938	1.24	Q |	|	|	V |
19+55	4.3022	1.22	Q |	|	|	V |
20+ 0	4.3104	1.20	Q |	|	|	V |
20+ 5	4.3186	1.19	Q |	|	|	V |
20+10	4.3266	1.17	Q |	|	|	V |
20+15	4.3346	1.15	Q |	|	|	V |
20+20	4.3424	1.14	Q |	|	|	V |
20+25	4.3501	1.12	Q |	|	|	V |
20+30	4.3577	1.11	Q |	|	|	V |
20+35	4.3653	1.09	Q |	|	|	V |
20+40	4.3727	1.08	Q |	|	|	V |
20+45	4.3800	1.07	Q |	|	|	V |
20+50	4.3873	1.05	Q |	|	|	V |

20+55	4.3944	1.04	Q	|	|	|	V |
21+ 0	4.4015	1.03	Q	|	|	|	V |
21+ 5	4.4085	1.02	Q	|	|	|	V |
21+10	4.4154	1.00	Q	|	|	|	V |
21+15	4.4223	0.99	Q	|	|	|	V |
21+20	4.4290	0.98	Q	|	|	|	V |
21+25	4.4357	0.97	Q	|	|	|	V |
21+30	4.4424	0.96	Q	|	|	|	V |
21+35	4.4489	0.95	Q	|	|	|	V |
21+40	4.4554	0.94	Q	|	|	|	V |
21+45	4.4618	0.93	Q	|	|	|	V |
21+50	4.4682	0.92	Q	|	|	|	V |
21+55	4.4745	0.91	Q	|	|	|	V |
22+ 0	4.4807	0.91	Q	|	|	|	V |
22+ 5	4.4869	0.90	Q	|	|	|	V |
22+10	4.4930	0.89	Q	|	|	|	V |
22+15	4.4991	0.88	Q	|	|	|	V |
22+20	4.5051	0.87	Q	|	|	|	V |
22+25	4.5111	0.87	Q	|	|	|	V |
22+30	4.5170	0.86	Q	|	|	|	V|
22+35	4.5228	0.85	Q	|	|	|	V|
22+40	4.5286	0.84	Q	|	|	|	V|
22+45	4.5344	0.84	Q	|	|	|	V|
22+50	4.5401	0.83	Q	|	|	|	V|
22+55	4.5458	0.82	Q	|	|	|	V|
23+ 0	4.5514	0.82	Q	|	|	|	V|
23+ 5	4.5569	0.81	Q	|	|	|	V|
23+10	4.5625	0.80	Q	|	|	|	V|
23+15	4.5679	0.80	Q	|	|	|	V|
23+20	4.5734	0.79	Q	|	|	|	V|
23+25	4.5788	0.78	Q	|	|	|	V|
23+30	4.5841	0.78	Q	|	|	|	V|
23+35	4.5895	0.77	Q	|	|	|	V|
23+40	4.5947	0.77	Q	|	|	|	V|
23+45	4.6000	0.76	Q	|	|	|	V|
23+50	4.6052	0.76	Q	|	|	|	V|
23+55	4.6103	0.75	Q	|	|	|	V|
24+ 0	4.6155	0.74	Q	|	|	|	V|
24+ 5	4.6204	0.72	Q	|	|	|	V|
24+10	4.6243	0.56	Q	|	|	|	V|
24+15	4.6266	0.34	Q	|	|	|	V|
24+20	4.6281	0.23	Q	|	|	|	V|
24+25	4.6293	0.16	Q	|	|	|	V|
24+30	4.6301	0.12	Q	|	|	|	V|
24+35	4.6307	0.09	Q	|	|	|	V|
24+40	4.6312	0.07	Q	|	|	|	V|
24+45	4.6316	0.05	Q	|	|	|	V|
24+50	4.6319	0.04	Q	|	|	|	V|
24+55	4.6321	0.03	Q	|	|	|	V|
25+ 0	4.6322	0.02	Q	|	|	|	V|

```
   25+ 5       4.6323      0.02  Q         |         |         |        V|
   25+10       4.6324      0.01  Q         |         |         |        V|
   25+15       4.6325      0.01  Q         |         |         |        V|
   25+20       4.6325      0.00  Q         |         |         |        V|
   25+25       4.6325      0.00  Q         |         |         |         V
-------------------------------------------------------------------------
```

Merrell Johnson COMPANIES

Date: 10/16/24
MJC Job No: 3753.001
Client: Axel Cramer

Detention Volume

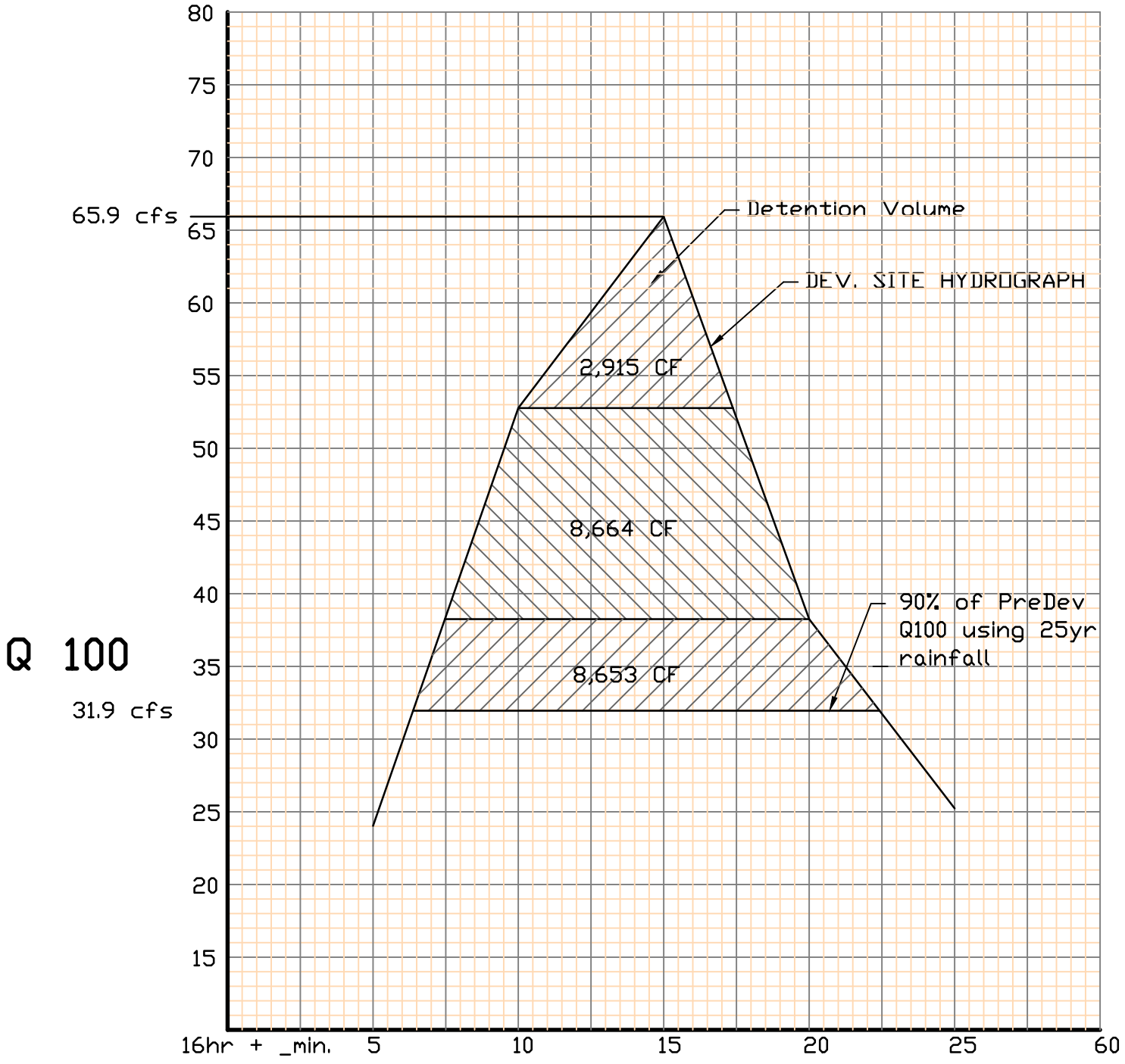
Undeveloped Peak Flow 31.94 cfs **100yr using 25 year rainfall**
Required max flow X 0.90 = 28.75 cfs

Developed Peak Flow

Time Hr	Time Min	Time hrs	Peak Q (cfs)		
16	5	16.083	24.03		
16	10	16.167	52.76		
16	15	16.250	65.93	**Peak**	**100 year storm using 100yr rainfall**
16	20	16.333	38.25		
16	25	16.417	25.22		

28.7 (cfs)	hits at	16.10 hrs	and	16.394 hrs	Volume		
Total time above		28.75 cfs	=	17.83 min			
Volume between		52.76 cfs	and	65.93 cfs	**2,915**	**CF**	
Volume between		38.25 cfs	and	52.76 cfs	**8,664**	CF	
Volume between		28.75 cfs	and	38.25 cfs	**8,653**	CF	
				Total Detention Volume	**20,233**	**CF**	

Axel Cramer 3753.001



Detention Volume

SITE RUNOFF PARAMETERS
UNDEVELOPED Q100 x 0.90 = 31.94 cfs
DEVELOPED Q100 = 65.9 cfs
Detention Volume needed = 20,233 CF

EXHIBITS

Figure ADD-1
Antecedent Moisture Condition (AMC)

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

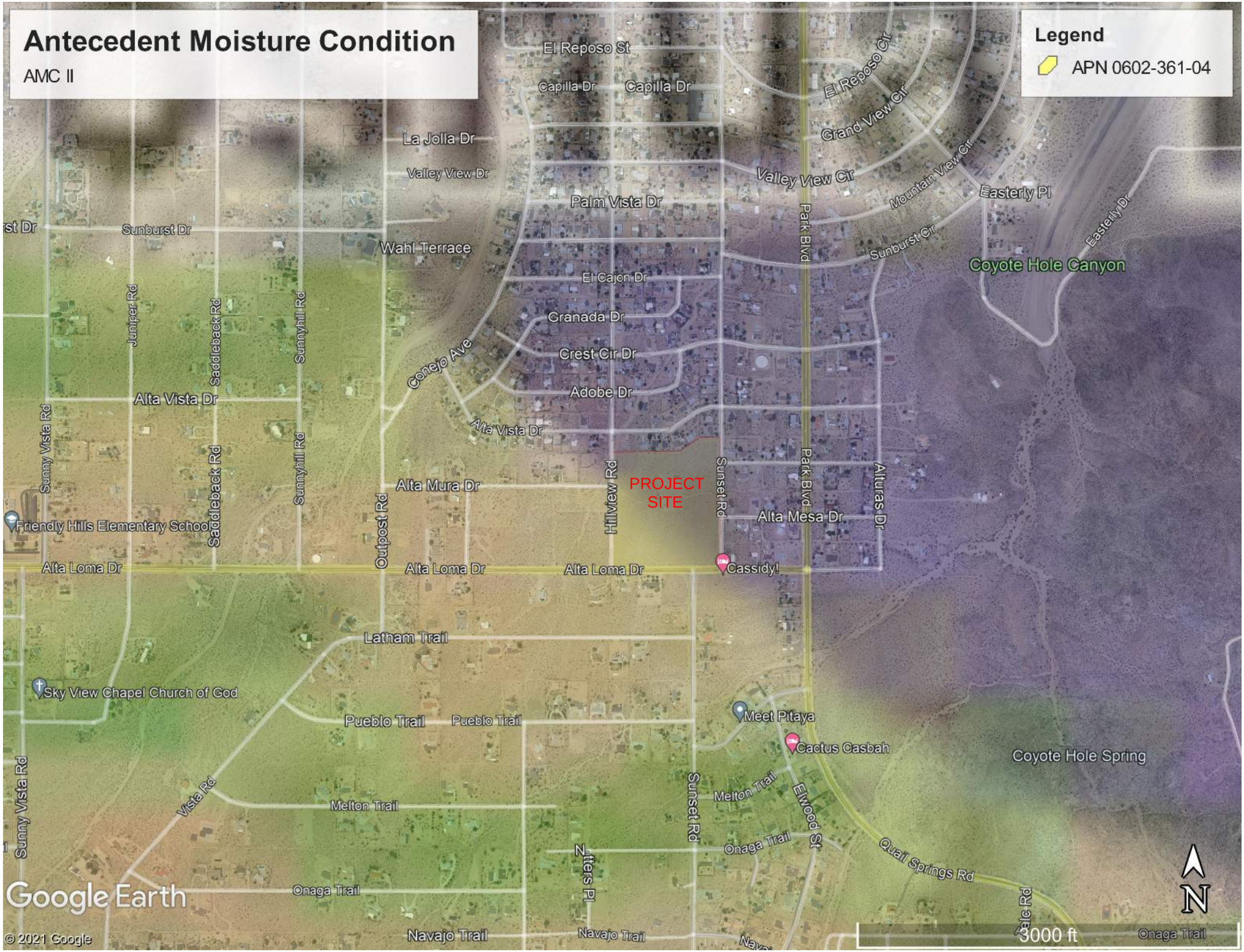
*1/2 (11-day - 1-day) =
1/2 (([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day])

5 0 5 10 15
Miles

N
W E
S

Growing Season
- AMC I
- AMC II
- AMC III

STATE HWY 127
I-15
US HWY 395
I-40
STATE HWY 247
STATE HWY 62
Ridgecrest
Barstow
Adelanto
Victorville
Apple Valley
Hesperia
Yucca Valley
Twentynine Palms
Joshua Tree
Morongo Valley
Yucaipa
Redlands
Highland
Big Bear Lake
Running Springs
Crestline
Lake Arrowhead
Wrightwood
Claremont
Needles
Parker Dam


Antecedent Moisture Condition
AMC II
Legend
APN 0602-361-04
El Reposo St
Capilla Dr
Capilla Dr
El Reposo Cir
Grand View Cir
La Jolla Dr
Valley View Dr
Valley View Cir
Mountain View Cir
Easterly Pl
Palm Vista Dr
Park Blvd
Sunburst Dr
Sunburst Dr
Sunburst Cir
Easterly Dr
Wahl Terrace
Coyote Hole Canyon
El Cajon Dr
Granada Dr
Crest Cir Dr
Adobe Dr
Alta Vista Dr
Alta Vista Dr
Conejo Ave
Juniper Rd
Saddleback Rd
Sunnyhill Rd
Sunny Vista Rd
Saddleback Rd
Sunnyhill Rd
Alta Mura Dr
PROJECT SITE
Hillview Rd
Sunset Rd
Park Blvd
Alturas Dr
Alta Mesa Dr
Outpost Rd
Friendly Hills Elementary School
Alta Loma Dr
Alta Loma Dr
Alta Loma Dr
Cassidy!
Latham Trail
Sky View Chapel Church of God
Pueblo Trail
Pueblo Trail
Meet Pitaya
Cactus Casbah
Coyote Hole Spring
Sunny Vista Rd
Vista Rd
Melton Trail
Melton Trail
Sunset Rd
Ewood St
Onaga Trail
Quail Springs Rd
Nutters Pl
Onaga Trail
Navajo Trail
Navajo Trail
Google Earth
© 2021 Google
3000 ft
N

SOILS MAP

Scale 1:250,000

CONTOUR INTERVAL 200 FEET
SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

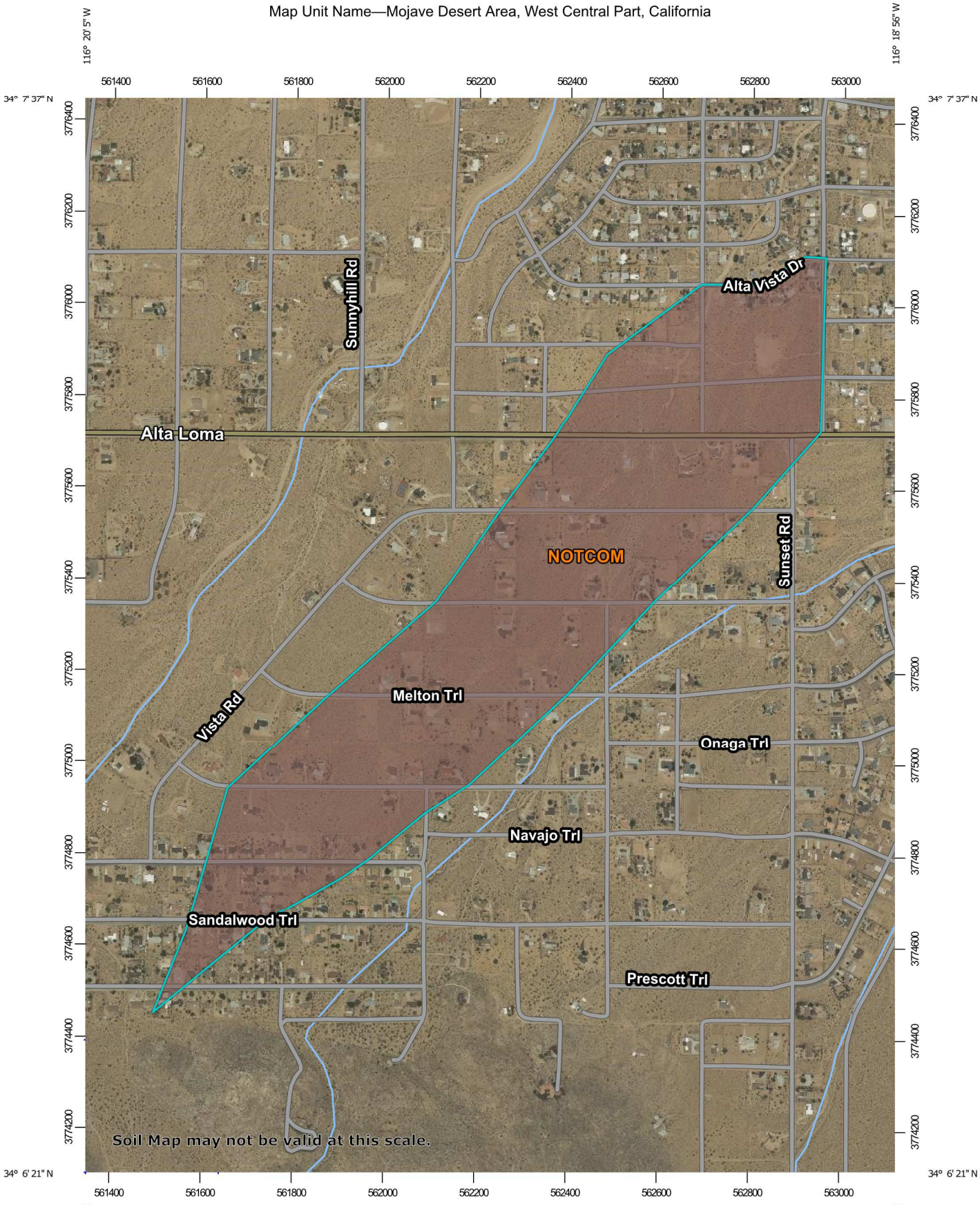
UCED FROM U.S.G.S. "SAN BERNARDINO" TOPOGRAPHIC MAP

REDUCED BY 1/2

LOCATION DIAGRAM

HYDROLOGIC SOILS GROUP MAP FOR SOUTHCENTRAL AREA

FIGURE C-11



Map Scale: 1:11,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

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

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

NOAA ATLAS 14 POINT RAINFALLS

NOAA Atlas 14, Volume 6, Version 2
Location name: Joshua Tree, California, USA*
Latitude: 34.1189°, Longitude: -116.3219°
Elevation: 3071.35 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	0.089 (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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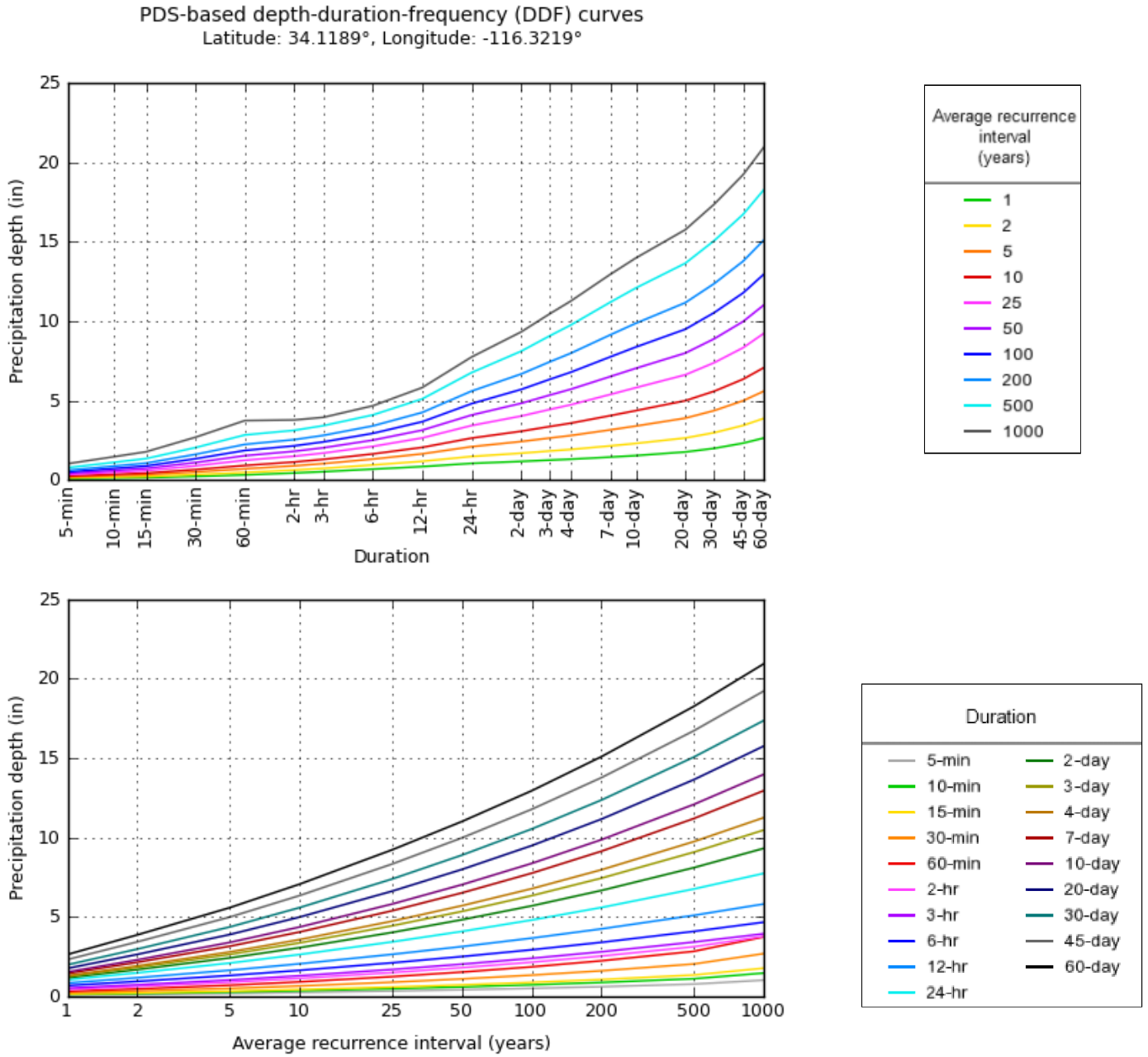
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Oct 22 17:08:26 2021

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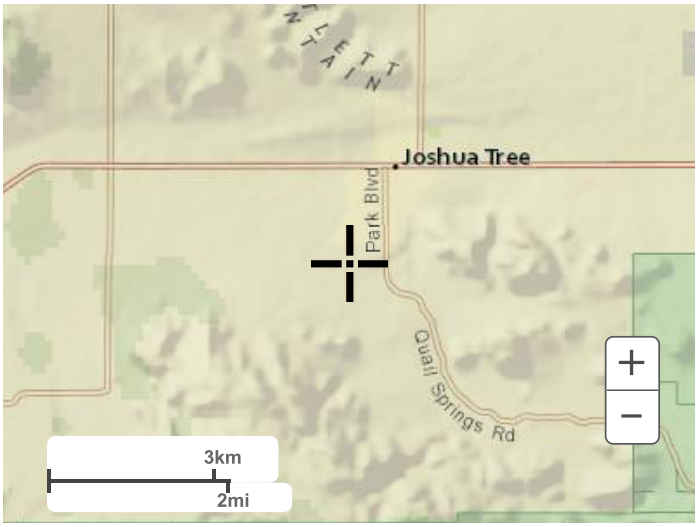
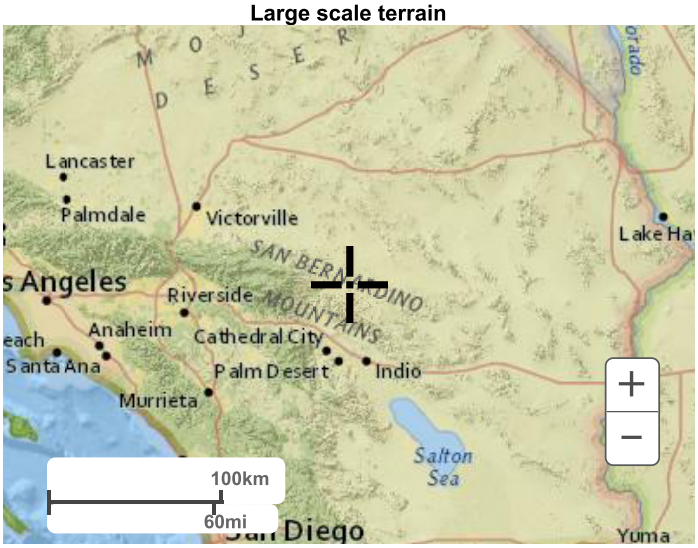
Maps & aerials

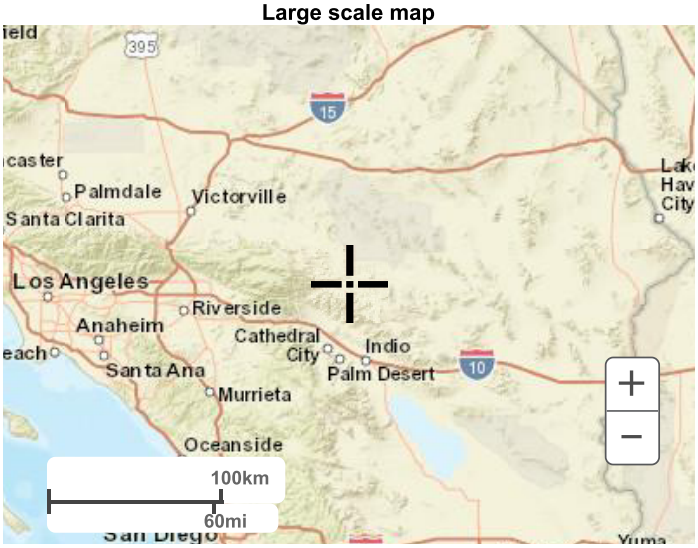
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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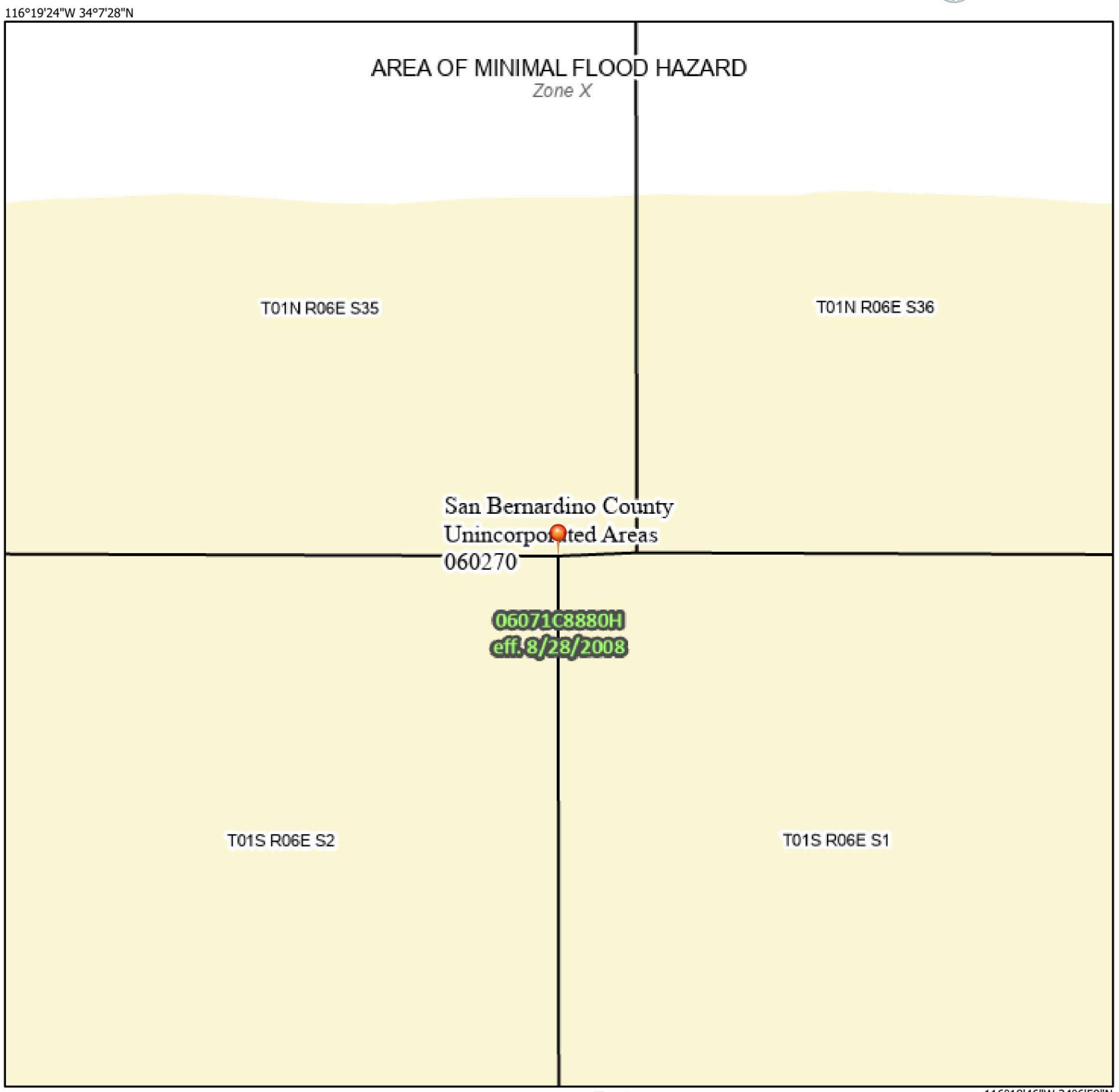
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

National Flood Hazard Layer FIRMette

FEMA



Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- 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 *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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.