Preliminary Drainage Study DRNSTY-2025-00043

Proposed Plastics Sorting and Processing Facility
Yermo, San Bernardino County, California
37265 Yermo Rd, Yermo, CA 92398
APNs: 0537-071-15, 0537-071-16, 0537-071-17, 0537-071-19

San Bernardino County Case #PROJ-2024-00168
Tetra Tech Job #117-367023-24003
June 19, 2025, Revised July 31, 2025

PRESENTED TO

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STATE OF CALIFORNIA

County of San Bernardino
Building and Safety

The Plans and Details Have Been

REVIEWED

FOR CODE COMPLIANCE

THE REVIEW OF THESE PLANS SHALL NOT BE CONSTRUCTED TO BE A PERMIT FOR ANY VIOLATION OF ANY CODE OR ORDIANCE OF THIS COUNTY

By Chris Chew

Date 08/06/25

THESE PLANS SHALL BE ON THE JOB FOR ANY REQUESTED INSPECTION

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ac	Acre
ac-ft	Acre-Feet
AMC	Antecedent Moisture Condition
APN	Assessor Parcel Number
BAM	Best Available Map
cfs	Cubic Feet per Second
CN	Curve Number
CUP	Conditional Use Permit
DWR	Department of Water Resources
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling Software
HSG	Hydrologic Soil Group
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
OS	Off-Site
POA	Point of Analysis
SCS	USDA Soil Conservation Service (now the Natural Resources Conservation Service [NRCS])
USDA	United States Department of Agriculture

1.0 INTRODUCTION

The purpose of this study is to present the preliminary drainage study for the Freepoint Eco-Systems Yermo Supply, LLC (Freepoint Eco-Systems) Plastics Sorting and Processing Facility (the “Project”). This preliminary drainage study is based on the preliminary design for the Project, as directed by the County of San Bernardino. A final drainage study will be completed with the final design (which occurs prior to issuance of the grading permit or initiation of land disturbing activity) for the Project.

Typical development of any site will introduce impervious elements to the drainage basin in which the project is located. (Note that “Project area” and “on-site” terms are used interchangeably in this study.) An increase in impervious surfaces within a drainage basin will generally increase peak stormwater runoff rates and runoff volumes compared with existing conditions. This study examines the flow patterns of the off-site (upgradient) drainage basin, the flow patterns of the undeveloped (pre-development) on-site areas, and the flow patterns following incorporation of the proposed stormwater facilities that have been designed to mitigate the effect of increased stormwater runoff resulting from site development.

This study has been prepared to meet the San Bernardino County drainage requirements and generally follow the *San Bernardino County Hydrology Manual* (1986) and *Addendum* (2010), and the *Detention Basin Design Criteria for San Bernardino County* (1987) – collectively referenced herein as the “County Manual”. Calculation methods that differ from the methods discussed in these County documents are discussed as needed.

2.0 PROJECT DESCRIPTION

2.1 LOCATION

The Project is located south of Yermo Road, east of Dusty Trail, and north of the Union Pacific Railroad tracks, in the unincorporated town of Yermo, San Bernardino County, California, and addressed as 37265 Yermo Road. The Project is located in Township 09N, Range 01E, Section 02 of the Yermo U.S. Geological Survey quadrangle (USGS 2021).

The Project sits on a property composed of four (4) existing parcels that are undeveloped desert scrub habitat and are identified as Assessor Parcel Numbers (APNs) 0537-071-15, 16, 17 and 19. As part of the Project, these existing parcels would be reconfigured and a new parcel of approximately 77.57 acres (5.47 acres in existing right-of-way easements and 72.10 acres of developable lot) would be created following purchase of the land by Freepoint Eco-Systems and prior to finalization of a Conditional Use Permit (CUP). West of the Project and within 1,000 feet is the Barstow Marine Corps Logistics Base – Yermo Annex. The property includes half of Dusty Trail, an existing dirt road within a right-of-way easement. The other half of Dusty Trail is owned by the Marine base. To the south of the Project is a Union Pacific railroad switching yard. North of the Project is vacant land. The property adjacent to the Project to the east is predominantly vacant. The southernmost portion of the property (APN 0537-071-19) extends east to the centerline of existing paved Jellico Street, north to the centerline of existing dirt Marine Road, and south to the Union Pacific railroad switching yard. A Vicinity Map is provided in Figure 1 (Appendix A).

2.2 PHYSICAL DESCRIPTION

An aerial image of the Project, including an outline of the Project area boundary, is shown on the Site Location Map provided in Figure 2 (Appendix A). As shown, the Project area is undeveloped with natural grasses, shrubs, and bare soil, with no existing buildings or other structures on site. The Project area consists of undulating topography with a generalized overall slope of less than 1 percent from west to east.

The off-site (upgradient) drainage area that impacts the Project is shown on the Off-site Drainage Plan provided in Figure 3 (Appendix A). The off-site drainage area covers 829 acres.

An outline of the proposed Project improvements is shown on the Project Area Drainage Plan included in Figure 4 (Appendix A). The proposed Project improvements will result in an impermeable area matching the footprint of the buildings and access roads to and around the buildings, with percentages of impermeable areas discussed in Section 3.3 below, under the project area drainage analysis. Portions of the off-site drainage basin include impermeable areas, such as parts of the Marine Corps Logistics Base, as discussed under the off-site drainage analysis in Section 3.2.

The Project is located within the Mojave Watershed which drains to the Mojave River, an intermittent river with its main channel located approximately one mile to the south of the Project. Only a small part of the Mojave Watershed drains through the Project area as discussed below under the off-site drainage analysis. Most of the Mojave Watershed runoff is intercepted by the Yermo Flood Channel (see Appendix B-1 for the FEMA map [FEMA 2008]) which is located approximately 0.5 miles to the north of the Project. Mojave Watershed runoff that is not intercepted by the Yermo Flood Channel flows in an easterly direction between the Yermo Flood Channel and the Union Pacific railroad track embankment. Approximately half of the Mojave Watershed runoff that is not captured by the Yermo Flood Channel flows through the off-site drainage area and affects the Project area. The remaining portion of the Mojave Watershed runoff that is not captured by the Yermo Flood Channel and does not run through the off-site drainage area flows to the north of the Project Area.

The concrete-lined Yermo Flood Channel flows from west to east and was constructed to intercept and convey stormwater runoff originating in the Calico Mountains to the north and east of the Yermo Flood Channel; the outlet of the Yermo Flood Channel discharges toward the Mojave River. Because the Yermo Flood Channel does not affect runoff that passes through the Project area, it is not considered for this preliminary drainage study. Further, the entirety of the Project boundary is located outside of any floodplain boundaries. This is consistent with information presented in the DWR Best Available Map (BAM) (DWR 2025) (see Appendix B-2).

To the south, the Mojave River is separated from the Project area by the topography including the adjacent railroad line. Stormwater runoff from the Project area eventually makes its way to the Mojave River but there is no stream channel for a direct connection between the two; runoff would travel predominantly via overland flow and is not expected to directly affect Mojave River flows, which only occur in response to significant storm events in the larger portion of the watershed that is collected in the Yermo Flood Channel or other upstream areas. The lack of connection between the Project Area and the Mojave River is consistent with the findings of a drainage study that was completed in 2022 for the Yermo Travel Plaza (Drainage Study for Yermo Travel Plaza by LAV//Pinnacle Engineering, Inc., Bakersfield, CA, October 12, 2022), located to the east of the site. No other drainage studies were identified in this area.

According to the Custom Soil Resource Report for San Bernardino County, California, Mojave River Area (NRCS 2025), the soil type that makes up the Project area are Cajon sand (hydrologic soil group [HSG] A), with nearly flat terrain based on site topographic data. The soils that make up the off-site drainage basin include Cajon sand, map units 112 and 113 (HSG A) which covers approximately 83.5% of the drainage basin, Cajon gravelly sand, map unit 115 (HSG A) which covers another 2.5% of the basin, Nebona-cuddeback complex, map unit 151 (HSG D) which covers another 5.5% of the basin, and the Rock outcrop-lithic torriorthents complex, with steep slopes based on site topographic data. Detailed soil survey reports are provided in Appendix B-3.

3.0 METHODOLOGY

3.1 DRAINAGE DESIGN CRITERIA

This study is prepared to meet San Bernardino County drainage requirements and generally follows the County Manual. Calculation methods that differ from the methods in the County Manual, or are more specifically applied, are discussed as needed.

Runoff calculations are summarized below and presented in Appendix C (Appendix C-1 provides calculations prepared in Excel and Appendix C-2 provides HEC-HMS (USACE 2024) input and output). Supporting information will be provided in the final drainage study for the existing off-site, existing on-site, and developed on-site runoff conditions.

Runoff Calculations: Because the off-site drainage basin size of 829 acres is larger than the 640-acre limit for using the Rational Method, the NRCS Curve Number (CN) Method was used in the HEC-HMS Model for stormwater runoff calculations. However, because the on-site drainage basins are much smaller, the Rational Method was applied to calculate peak runoff rates for these basins.

Time of concentration for the off-site basin and individual Project area basins was estimated using physically-based methods to estimate travel times for overland/sheet flow and shallow concentrated flow as these methods were assumed to be reliable for both the off-site and Project area drainage basins (see NRCS National Engineering Handbook [NRCS 2021]).

For storm-event runoff modeling, Antecedent Moisture Condition (AMC) is a factor used to characterize the level of moisture in a soil prior to the start of a significant rainfall event. There are three levels of AMC – AMC I, AMC II, and AMC III – with AMC II representing an average condition. The CN runoff calculations for this preliminary drainage study assume the soils are average in dryness (AMC II) whereas AMC I (which indicates drier than average soils) may be more typical for the high-permeability, very dry and sandy soils in this desert environment. This results in conservative (more protective) calculations which may overestimate the effect of significant rainfall events on the runoff response.

Rainfall Data: Site rainfall depth information was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 6, Version 2, Precipitation-Frequency Atlas of the United States (NOAA 2014) as well as NOAA's Hydrometeorological Design Studies Center's Precipitation Frequency Data Server. Rainfall data are presented in Appendix B-4.

Within the proposed development, the 100-year storm is used as the major storm event when evaluating existing and proposed drainage facilities. The 100-year storm is used because flooding from a storm of this magnitude could cause considerable damage if adequate stormwater controls were not sized for this magnitude of a storm.

Drainage Channel Sizing and Erosion Protection: Drainage channels will be sized in the final drainage study, after the preliminary drainage study is approved. The design will follow the requirements and guidance in the County Manual.

Retention/Infiltration Facility Sizing: For this preliminary drainage study, the retention/infiltration facility is sized based on the methods provided in the County Manual. Further, the estimated size of the retention/infiltration facility is adjusted to account for infiltration in these high-permeability soils. The final drainage study will include a more detailed infiltration analysis.

3.2 OFF-SITE DRAINAGE

3.2.1 Off-Site Drainage Patterns

The Project is located at a lower elevation and is affected by the off-site drainage basin shown in Figure 3 (Appendix A). Runoff within the off-site basin flows from the west to the east-northeast. Runoff within this basin was analyzed using the CN Method within the HEC-HMS Model; the CN Method was utilized due to the 829-acre size of the drainage basin which is larger than the 640-acre limit for the Rational Method as presented in the County Manual and as described previously. Rainfall depths were selected for a 24-hour storm event for each return interval and a USDA – Soil Conservation Service (SCS) Type II Rainfall Distribution was used to calculate peak runoff rates. Time of Concentration was calculated using methods detailed in the NRCS National Engineering Handbook (NRCS 2021). Due to the length of the watershed, sheet flow was not incorporated into the travel calculations and only shallow concentrated flow was used.

Runoff calculations are summarized below and presented in Appendix C. Table 1 provides the peak runoff rates for the off-site drainage basin. Peak runoff rates for the Project area drainage basins are discussed in Section 3.3, below.

Table 1: *Off-Site Drainage Basin Peak Runoff Rates*

Drainage Basin ID	Area (ac)	Composite Runoff Curve Number (CN) [a]	Time of Concentration (hour)	10-Year Peak Rainfall Depth (inch) [b]	100-Year Peak Rainfall Depth (inch) [b]	10-Year Peak Runoff Rate (cfs) [c]	100-Year Peak Runoff Rate (cfs) [c]
OS-1	829	67.2	3.18	1.47	2.40	3.7	44.5

[a] The following runoff CN values were used to calculate an area-weighted composite off-site CN: CN=46 for Open Brush (HSG A), CN=83 for Open Brush (HSG D), CN=90 for Roadways (HSG A), and CN=90 for Industrial (HSG A).
[b] Rainfall depths for the 10- and 100-year events were selected from NOAA (2014) and represent the total depth for a 24-hour duration event.
[c] Peak runoff rates were calculated using an SCS Type II rainfall distribution.

3.2.2 Off-site Drainage Facilities

Off-site drainage will drain into the Project at the western boundary and is expected to be dispersed along this property boundary as shallow concentrated flow. One culvert is envisioned under Dusty Trail, the north-south road along the western property boundary, to allow off-site runoff to pass into drainage basin B, after which the off-site runoff would flow through drainage basin B, with a portion infiltrating before the remaining stormwater reaches the eastern boundary of drainage basin B. Excess off-site stormwater would then be conveyed off site to the east of the Project to infiltrate within a short distance into the existing sandy soils. Any required drainage facilities will be designed as part of the final drainage study. Due to the nearly flat area that dominates the landscape between the steep terrain on the western edge of the off-site drainage basin and the Project area drainage basins, no erosion control beyond vegetation is proposed to manage the off-site drainage at the western perimeter of the Project area. However, velocities will be evaluated during the final drainage study and appropriate erosion protection will be proposed, if needed.

3.3 PROJECT AREA DRAINAGE

3.3.1 Project Area Drainage Basins and Patterns

Four Project area drainage basins were delineated for the Project based on the plans for site improvements including the footprint for the facility and related access roads (see Figure 4 [Appendix A]). In this Project area, there are a total of three “on-site” drainage basins – B, C, and D. Drainage basin A, while part of the current assessor’s parcels, will be excluded from the Project area boundaries after parcel reconfiguration. Therefore, drainage basin A is identified with drainage calculations performed for this preliminary drainage study though this area will be untouched by the proposed development.

The Project area drainage basins will be graded to facilitate drainage from the higher elevations to the lower elevations, which will generally coincide with the highest elevations on the west and the regraded ground surface draining eastward to the eastern property boundaries. However, the actual topographic change through each Project area drainage basin will be minimal. Compacted road base and pavement will be used for the final ground cover where needed to stabilize the site for access by trucks and other vehicles. Runoff calculations for peak runoff rate and retention volume were developed for this preliminary drainage study and are summarized in the following discussion. The calculations are presented in Appendix C.

Two pre-development conditions were evaluated: (1) existing topography and (2) regraded topography (prior to the addition of impervious areas; note that percent pervious values for the evaluated conditions are listed along with other drainage study elements in the summary table [Table 5] of the Conclusion section). One proposed/post-development condition was also evaluated. For each of these conditions, the boundaries of the Project area drainage basins were kept the same to match the parcel boundaries.

The Rational Method was used to calculate the peak runoff rate for the 100-year and 10-year storm events for the pre-development and proposed/post-development conditions, generally following the County Manual guidance with the following exceptions:

- Time of concentration was calculated for each drainage basin using a physically-based approach to delineate topographic-driven drainage paths from highest to lowest elevations, with drainage paths differing for existing and regraded topography but generally going from west to east and around where new facilities would be located; this approach for calculating time of concentration follows the NRCS National Engineering Handbook (NRCS 2021) methods.
- The peak rainfall intensities and depths were selected from NOAA website data which is an updated dataset from what is presented in the County Manual.
- The runoff coefficients (for the Rational Method) were selected from literature values listed in Haan et al. (1994), which presents a collection of hydrology input parameters from various published sources.

The peak runoff rates for the two Project area pre-development conditions are presented in Table 2. Included for the drainage basins are the drainage acreages, results of the time of concentration calculations, and the selected rainfall intensities and runoff coefficients. Note that only one set of results is presented for the two Project area pre-development conditions; this is because the times of concentration for the pre-development existing topography and regraded topography were not substantially different (ranged between 30 and 60 minutes for all pre-development conditions) and 30 minutes was selected for conservatism. Therefore, the storm intensities were the same for all Project drainage basins under pre-development conditions. A runoff coefficient of 0.1 was selected for all pre-development basins, consistent with the coefficient for Unimproved Areas with Flat terrain as listed in the literature referenced above.

Table 2: *Project Area Drainage Basins Pre-Development Peak Runoff Rates*

Basin ID	Area (ac)	Runoff Coefficient	Time of Concentration (minutes) [b]	10-Year Peak Rainfall Intensity (in/hr) [c]	100-Year Peak Rainfall Intensity (in/hr) [c]	10-Year Peak Runoff Rate (cfs)	100-Year Peak Runoff Rate (cfs)
A [a]	7.3	---	---	---	---	---	---
B	29.6	0.1	30 (48.6)	1.11	2.01	3.3	6.0
C	36.1	0.1	30 (58.1)	1.11	2.01	4.0	7.3
D	12.4	0.1	30 (41.2)	1.11	2.01	1.4	2.5

[a] Drainage basin A is within the current assessor's parcels but will be excluded from the Project area boundaries after parcel reconfiguration.
[b] The times of concentration are presented as selected followed by (in parentheses) calculated values (before rounding down to the selected values).
[c] Peak rainfall intensities for the 100- and 10-year events were selected from NOAA (2014).

The peak runoff rates for the Project area proposed/post-development condition are presented in Table 3. Along with the peak runoff rates, this table presents the drainage acreages, results of the time of concentration calculations, and the selected rainfall intensities and runoff coefficients. Note that the runoff coefficients for the proposed/post-development condition were selected from values listed in Haan et al. (1994) and calculated as a composite value for each drainage basin to reflect the mixture of proposed land uses and impervious areas.

Table 3: *Project Area Drainage Basins Proposed/Post-Development Peak Runoff Rates*

Basin ID	Area (ac)	Composite Runoff Coefficient [b]	Time of Concentration (minutes) [c]	10-Year Peak Rainfall Intensity (in/hr) [d]	100-Year Peak Rainfall Intensity (in/hr) [d]	10-Year Peak Runoff Rate (cfs)	100-Year Peak Runoff Rate (cfs)
A [a]	7.3	---	---	---	---	---	---
B	29.6	0.15	30 (48.6)	1.11	2.01	5.0	9.0
C	36.1	0.61	15 (26.4)	1.62	2.93	35.5	64.2
D	12.4	0.17	30 (41.2)	1.11	2.01	2.3	4.1

[a] Drainage basin A is within the current assessor's parcels but will be excluded from the Project area boundaries after parcel reconfiguration.
[b] The following runoff coefficient values were used to calculate an area-weighted composite runoff coefficient for each drainage basin: Coefficient=0.1 for Unimproved Areas on Flat terrain, 0.9 for Pavement and Roofs on Flat terrain.
[c] The times of concentration are presented as selected followed by (in parentheses) calculated values (before rounding down to the selected values).
[d] Peak rainfall intensities for the 100- and 10-year events were selected from NOAA (2014).

3.3.2 Project Area Drainage and Retention/Infiltration Facilities

The required retention/infiltration volume was calculated for each on-site drainage basin, under the pre-development and proposed/post-development conditions, based on the NRCS runoff volume calculation as presented in the County Manual. Results are summarized in Table 4. Based on the current calculations for this preliminary drainage study as summarized below, a total retention volume of 1.65 acre-ft (71,795 cubic ft) will be required for the proposed development in Project area drainage basin C; note that only this basin is assumed to require retention/infiltration and not drainage basins B and D as these basins are only minimally changed due to the proposed development. Drainage basin A will be untouched by the proposed development. At an assumed infiltration rate of 0.86 inch/hour (based on HSG A, AMC II, and CN of 46 in the pervious area, as presented in the County Manual), for drainage basin C, and a goal to infiltrate the retained stormwater within 72 hours, the total depth that would infiltrate is 5.2 ft resulting in a total required retention/infiltration facility area of 0.32 acre. Based on this required minimum acreage compared with the 1.45-acre area currently outlined (in Figure 4), retention/infiltration can occur completely within the proposed retention/infiltration facility located in the northern portion of drainage basin C (see Figure 4 [Appendix A]).

Table 4: *Project Area Drainage Basins Retention Volume Results*

Basin ID	Area (ac)	Composite Runoff Curve Number [b]	10-Year, 24-Hour Peak Rainfall Depth (inch) [c]	100-Year, 24-Hour Peak Rainfall Depth (inch) [c]	10-Year Runoff Volume (cubic ft)	100-Year Runoff Volume (cubic ft)
Pre-Development Conditions						
A [a]	7.3	---	---	---	---	---
B	29.6	46	1.47	2.40	0	24.8
C	36.1	46	1.47	2.40	0	30.2
D	12.4	46	1.47	2.40	0	10.4
Proposed/Post-Development Conditions						
A [a]	7.3	---	---	---	---	---
B	29.6	48.8	1.47	2.40	0	920
C	36.1	73.9	1.47	2.40	17,736	71,795
D	12.4	49.6	1.47	2.40	0	574

[a] Drainage basin A is within the current assessor's parcels but will be excluded from the Project area boundaries after parcel reconfiguration.
[b] The following runoff Curve Number values were used to calculate an area-weighted composite CN for each drainage basin: CN=46 for Open Brush (HSG A) and CN=90 for Commercial/Industrial Areas.
[c] Rainfall depths for the 100- and 10-year events were selected from NOAA (2014).

The design objective for the retention/infiltration facilities is to not exceed the pre-development peak runoff rates and runoff volumes compared with the proposed/post-development conditions. Additionally, drainage facilities including ditches and culverts will be sized for the final drainage study.

The following bullets summarize the planned drainage and retention/infiltration facilities based on the current site layout and plans:

- Drainage basin A, though excluded from this preliminary drainage study as discussed above, includes the northern portion of the Project site but will remain the same under proposed/post-development conditions as for pre-development conditions, as this drainage basin is separate from the others. Runoff from drainage basin A drains towards the east based on the existing topography.
- Drainage basin B lies immediately to the south of drainage basin A and will remain largely undeveloped and with a similar level of perviousness when comparing the pre- and post-development conditions. A paved, sloped road will be constructed on the perimeter of this drainage basin so that runoff from the road surface will drain into this drainage basin. Due to the site's grade and very dry and sandy soils in this

desert environment, only a minimal amount of runoff would be expected to occur within this drainage basin and runoff within basin B would be expected to infiltrate into the existing soils except for allowing off-site stormwater to pass through this drainage basin, as discussed above.

- Drainage basin C occupies the southernmost portion of the Project site and is where the Plastics Sorting and Processing Facility is planned for construction. This drainage basin will involve the most significant change in drainage, as the impervious area will be significantly increased from the pre-development condition. As noted above, the complete Project area drainage basin C runoff volume can be retained and infiltrated within this drainage basin. Further analysis will be conducted as part of the final drainage study.
- Drainage basin D includes the easternmost portion of the Project site and will remain largely undeveloped and with a similar level of perviousness when comparing the pre- and post-development conditions. A paved, sloped road will be constructed on the northern perimeter of this drainage basin so that runoff from the road surface will drain into this drainage basin. Runoff from basin D drains towards the east based on the existing topography. Due to the site's grade and very dry and sandy soils in this desert environment, only a minimal amount of runoff would be expected to occur within this drainage basin and runoff within basin D would be expected to infiltrate into the existing soils.

4.0 CONCLUSION

This study was prepared to meet San Bernardino County drainage requirements and generally follows the *San Bernardino County Hydrology Manual* (1986) and *Addendum* (2010), and the *Detention Basin Design Criteria for San Bernardino County* (1987). Calculation methods that differ from the methods discussed in these County documents are identified and discussed as needed. A summary of information developed and utilized in the drainage study is presented in Table 5.

The proposed stormwater management (including retention/infiltration) facilities are expected to provide stormwater management at a level that will not increase stormwater to other properties in the area as a result of the proposed development, based on the 100-year storm event. Additionally, the peak runoff rates for the proposed development will be managed by runoff facilities as needed to not increase stormwater to other properties in the area – note that specific measures will be designed and presented in the final drainage study. With these factors considered, the drainage design would be sufficient to protect public health, safety, and general welfare while having no adverse impacts on public rights-of-way.

Table 5: *Summary of Drainage Study Elements*

Basin ID	Node Numbers	Upstream/ Downstream Elevations (ft)	Flow Lengths (ft)	Areas (ac)	Land Usages	Primary Soil Types	% Pervious [b]	Composite Runoff Curve Number [c]	10- and 100-Year Peak Rainfall Intensity (in/hr) [d]
Off-Site									
OS-1	1	2674/1946	18894	829	Commercial/Industrial	Cajon sand	66.7	67.2	-
Pre-Development									
A [a]	-	-	-	-	-	-	-	-	-
B	2	1948/1943	1901	29.6	Undeveloped	Cajon sand	100	46	1.11 and 2.01
C	3	1950/1947	2306	36.1	Undeveloped	Cajon sand	100	46	1.11 and 2.01
D	4	1948/1941	1743	12.4	Undeveloped	Cajon sand	100	46	1.11 and 2.01
Proposed/Post-Development									
A [a]	-	-	-	-	-	-	-	-	-
B	2	1948/1943	1901	29.6	Undeveloped	Cajon sand	93.6	48.8	1.11 and 2.01
C	3	1955/1947	2235	36.1	Commercial/Industrial	Cajon sand	36.6	73.9	1.62 and 2.93
D	4	1948/1941	1743	12.4	Undeveloped	Cajon sand	91.9	49.6	1.11 and 2.01

[a] Drainage basin A is within the current assessor's parcels but will be excluded from the Project area boundaries after parcel reconfiguration.

[b] Undeveloped areas are assumed to be 100% pervious whereas commercial/industrial areas are assumed to be 0% pervious.

[c] The following runoff Curve Number values were used to calculate an area-weighted composite CN for each drainage basin: CN=46 for Open Brush (HSG A) and CN=90 for Commercial/Industrial Areas.

[d] Rainfall intensities for the 100- and 10-year events were selected from NOAA (2014).

5.0 REFERENCES

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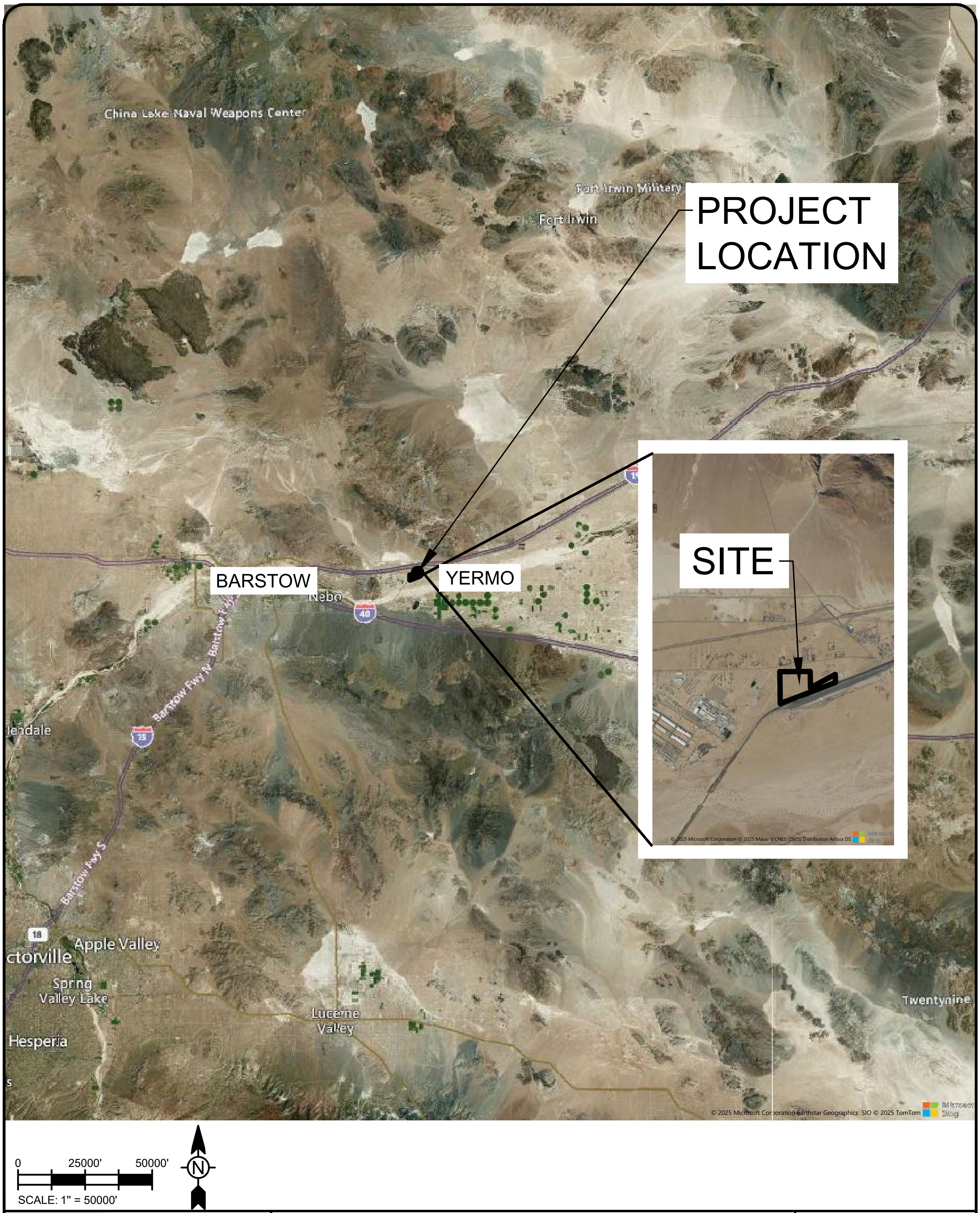
Appendix A - Figures



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Freepoint Eco-Systems Yermo Supply LLC

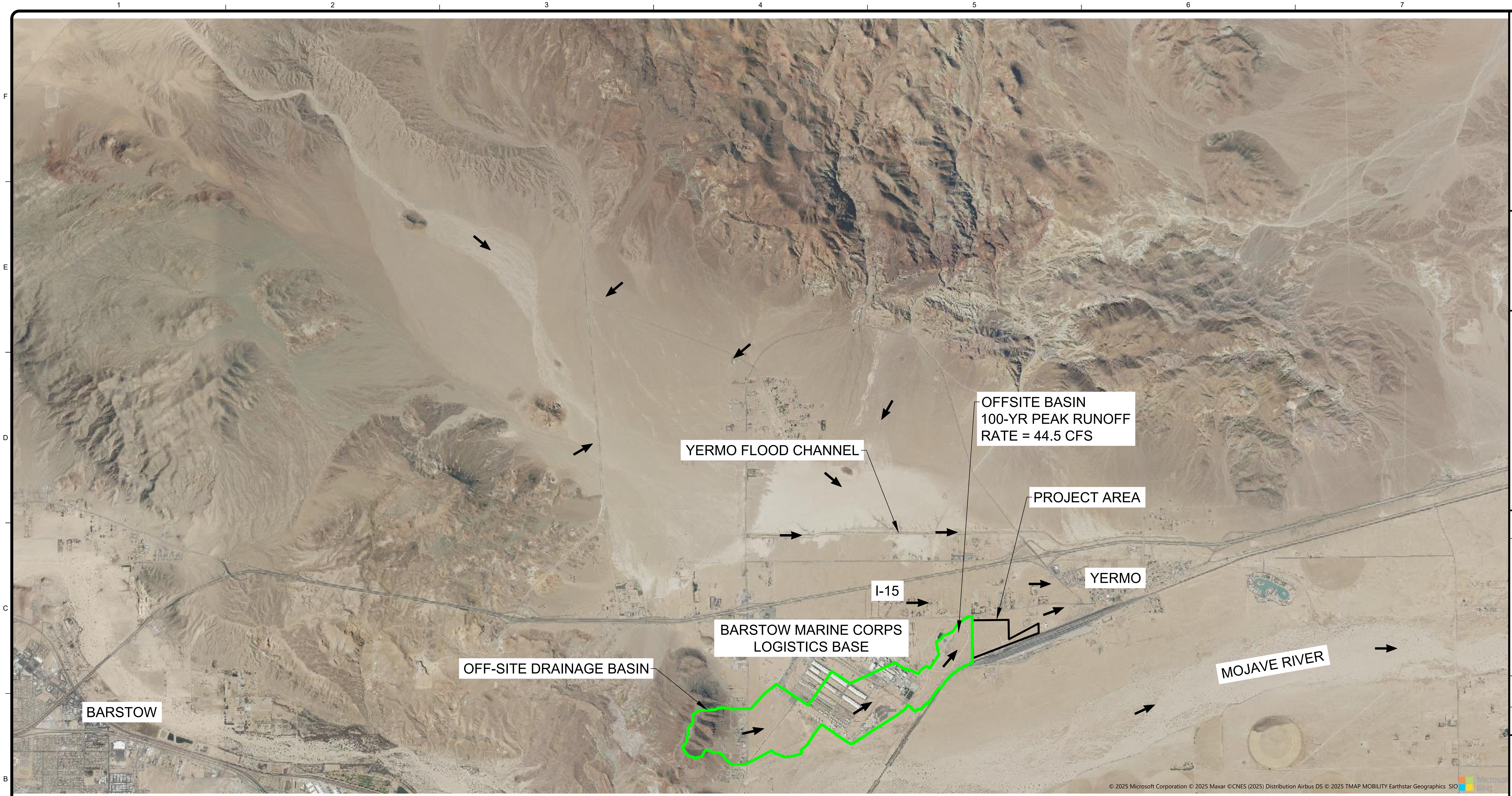
Plastics Sorting and Processing Facility

VICINITY MAP

PROJ:	117-367023-24003
DATE:	6/2025
DESN:	FLC

Figure
1

Bar Measures 1 inch



LEGEND:

🟩	OFF-SITE DRAINAGE BASIN BOUNDARY
➞	GENERALIZED DRAINAGE DIRECTION

N

0 1250' 2500' 5000'

SCALE: 1" = 2500'

Bar Measures 1 inch, otherwise drawing not to scale

TETRA TECH
www.tetratech.com
351 Coffman Street, Suite 200
Longmont, CO 80501
Phone: +1 (303) 772-5282

MARK	DATE	DESCRIPTION	BY

Freepoint Eco-Systems Yermo Supply LLC

Plastics Sorting and Processing Facility

SITE LOCATION MAP

PROJ:	117-367023-24003
DESN:	FLC
DRWN:	GEH
CHKD:	FLC

2

7/30/2025 11:24:59 AM - C:\USERS\GRACE.HART\ONEDRIVE - TETRA TECH, INC\FREEPOINT YERMO - DOCUMENTS\YERMO\07-CAD\SHEETFILES\GRADING & DRAINAGE\DRAINAGE PLAN_1.DWG - HART, GRACE

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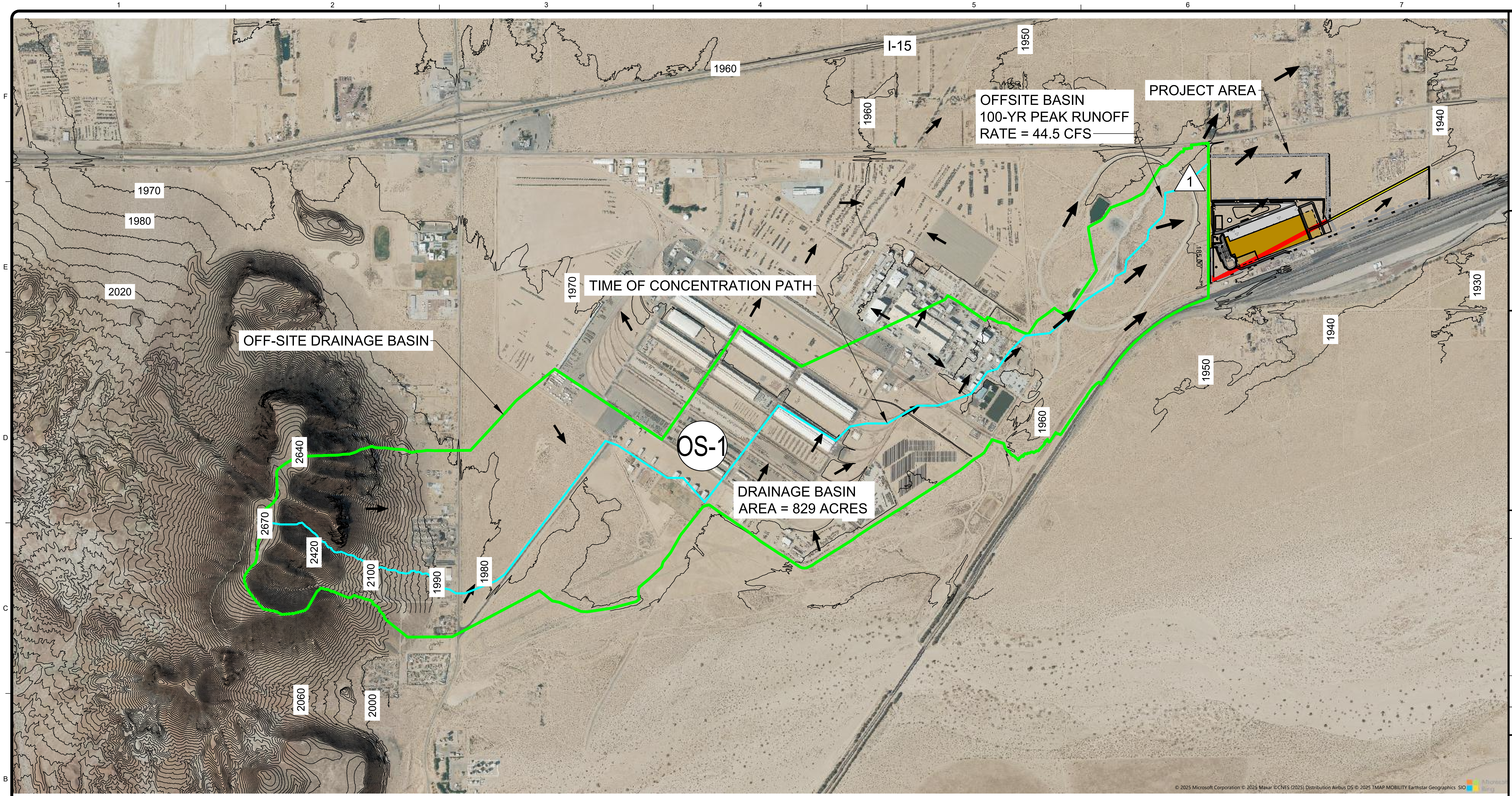

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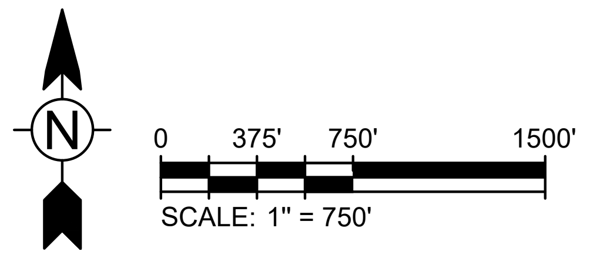
LEGEND:

🟩	OFF-SITE DRAINAGE BASIN BOUNDARY
🟦	TIME OF CONCENTRATION PATH
#	BASIN ID
△ X	POINT OF ANALYSIS
→	GENERALIZED DRAINAGE DIRECTION



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351 Coffman Street, Suite 200
Longmont, CO 80501
Phone: +1 (303) 772-5282

MARK	DATE	DESCRIPTION	BY

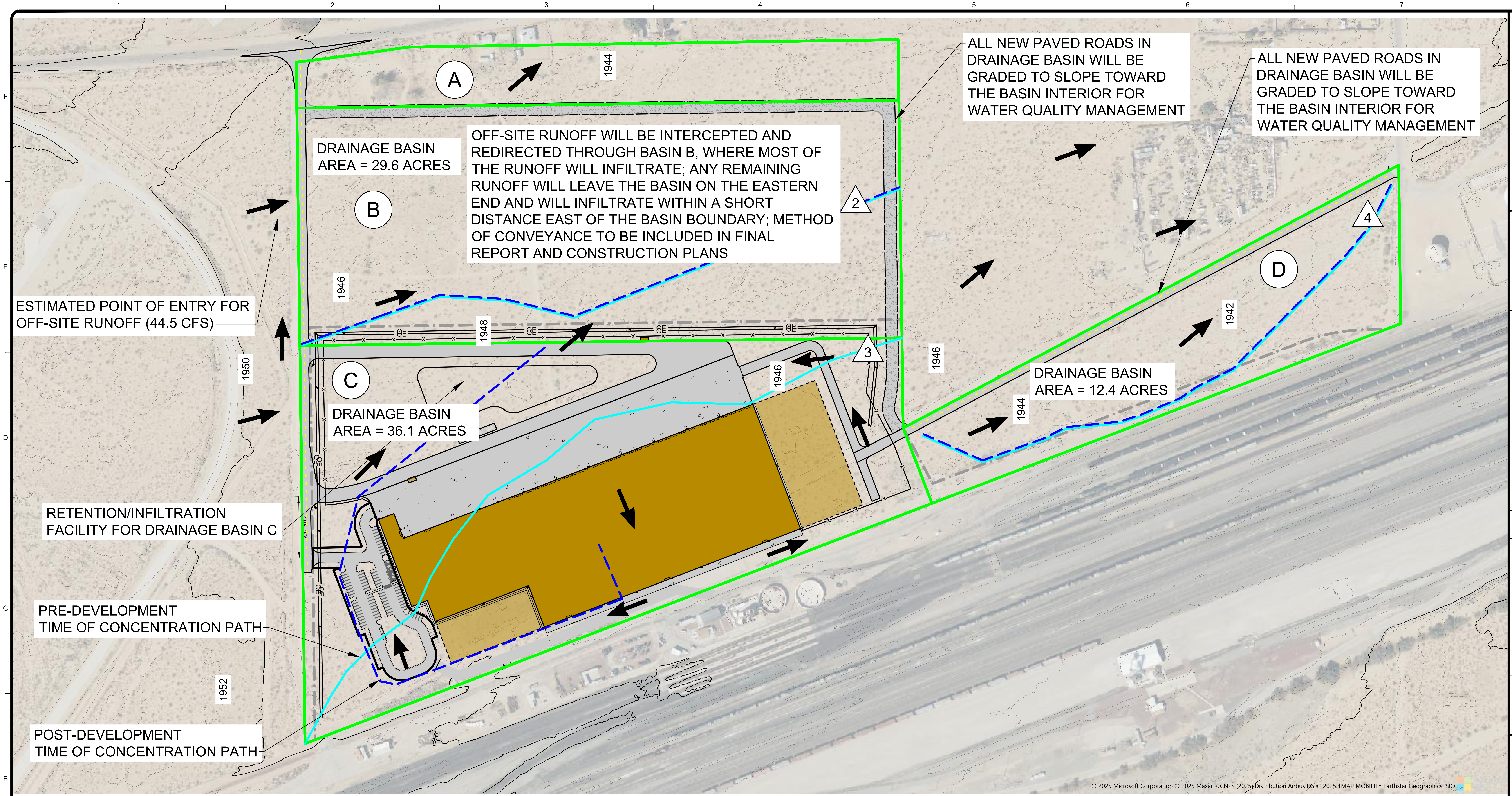
Freepoint Eco-Systems Yermo Supply LLC
Plastics Sorting and Processing Facility

OFF-SITE DRAINAGE PLAN

PROJ: 117-367023-24003
DESN: FLC
DRWN: GEH
CHKD: FLC

3

Bar Measures 1 inch, otherwise drawing not to scale



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LEGEND:

━	BASIN DELINEATION
━	PRE-DEVELOPMENT TIME OF CONCENTRATION PATH
╌	POST-DEVELOPMENT TIME OF CONCENTRATION PATH
#	BASIN ID
△X	POINT OF ANALYSIS
➔	GENERALIZED DRAINAGE DIRECTION

N

0 75' 150' 300'
SCALE: 1" = 150'

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www.tetratech.com
351 Coffman Street, Suite 200
Longmont, CO 80501
Phone: +1 (303) 772-5282

MARK	DATE	DESCRIPTION	BY

Freepoint Eco-Systems Yermo Supply LLC
Plastics Sorting and Processing Facility

PROJECT AREA DRAINAGE PLAN

PROJ:	117-367023-24003
DESN:	FLC
DRWN:	GEH
CHKD:	FLC

4

Bar Measures 1 inch, otherwise drawing not to scale

7/30/2025 11:17:53 AM - C:\USERS\GRACE.HART\ONEDRIVE - TETRA TECH, INC\FREEPOINT YERMO - DOCUMENTS\YERMO\07-CAD\SHEETFILES\GRADING & DRAINAGE\DRAINAGE PLAN_1.DWG - HART, GRACE

Appendix B - Site Data

Appendix B-1 FEMA Map

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11 North. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from digital orthophotography collected by the U.S. Department of Agriculture Farm Service Agency. This imagery was flown in 2005 and was produced with a 1-meter ground sample distance.

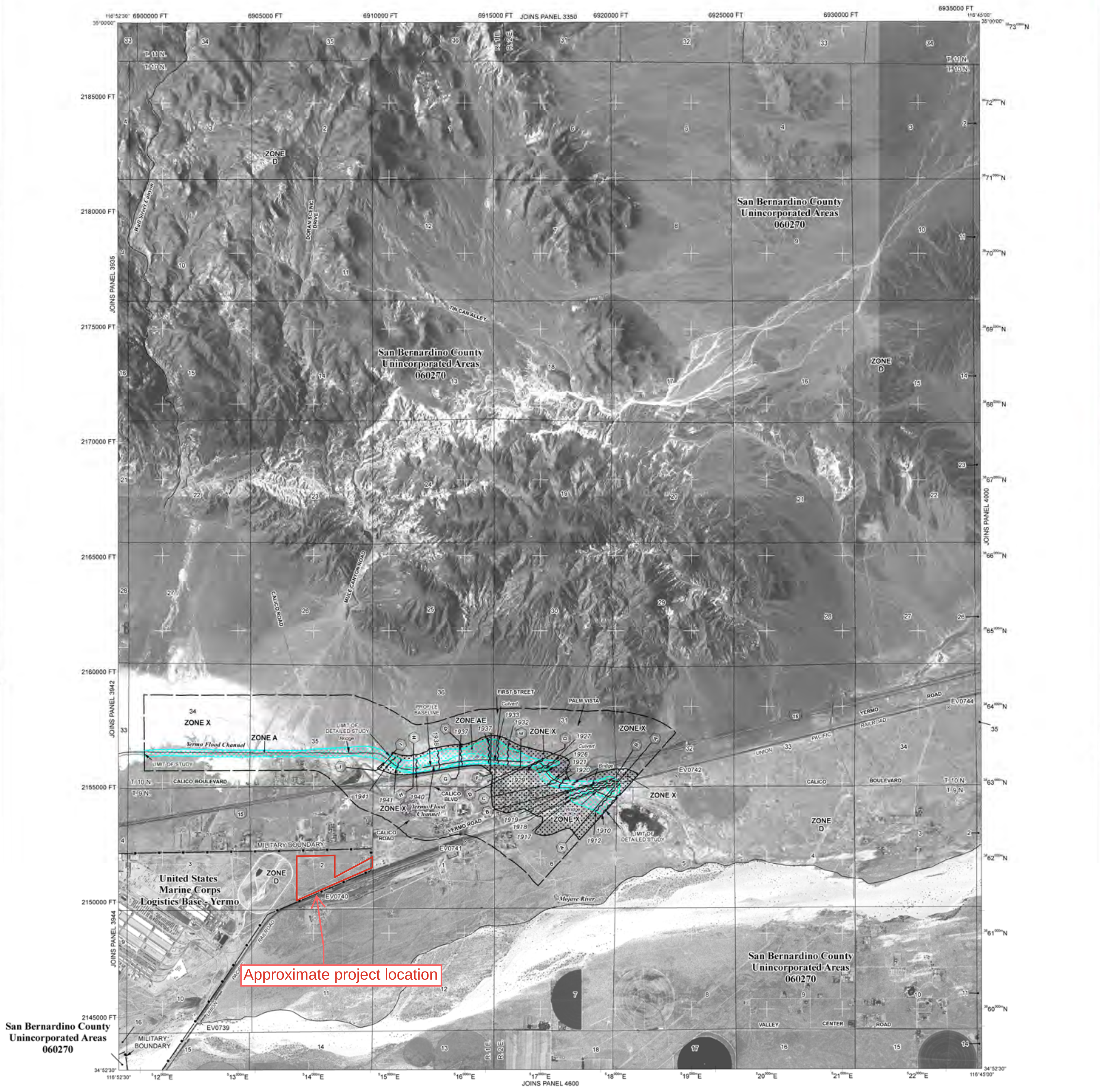
This map may reflect more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to confirm to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

🟦	SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

▨	FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

▒	OTHER FLOOD AREAS
ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
☐	OTHER AREAS
ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.
▧	COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
▨	OTHERWISE PROTECTED AREAS (OPAS)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

———	1% annual chance floodplain boundary
———	0.2% annual chance floodplain boundary
— — —	Floodway boundary
– —— —— –	Zone D boundary
• • • • • • • •	CBRS and OPA boundary
🟦	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

Ⓐ——Ⓐ	Cross section line
㉓- - - -㉓	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{45}76^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 11N
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone V (FIPSZONE 0405), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
●M1.5	River Mile

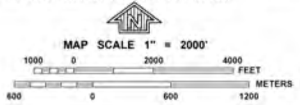
MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
March 18, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
August 28, 2008 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 3975H

FIRM
FLOOD INSURANCE RATE MAP

SAN BERNARDINO COUNTY, CALIFORNIA
AND INCORPORATED AREAS
PANEL 3975 OF 9400
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN BERNARDINO COUNTY	060270	3975	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06071C3975H

MAP REVISED
AUGUST 28, 2008

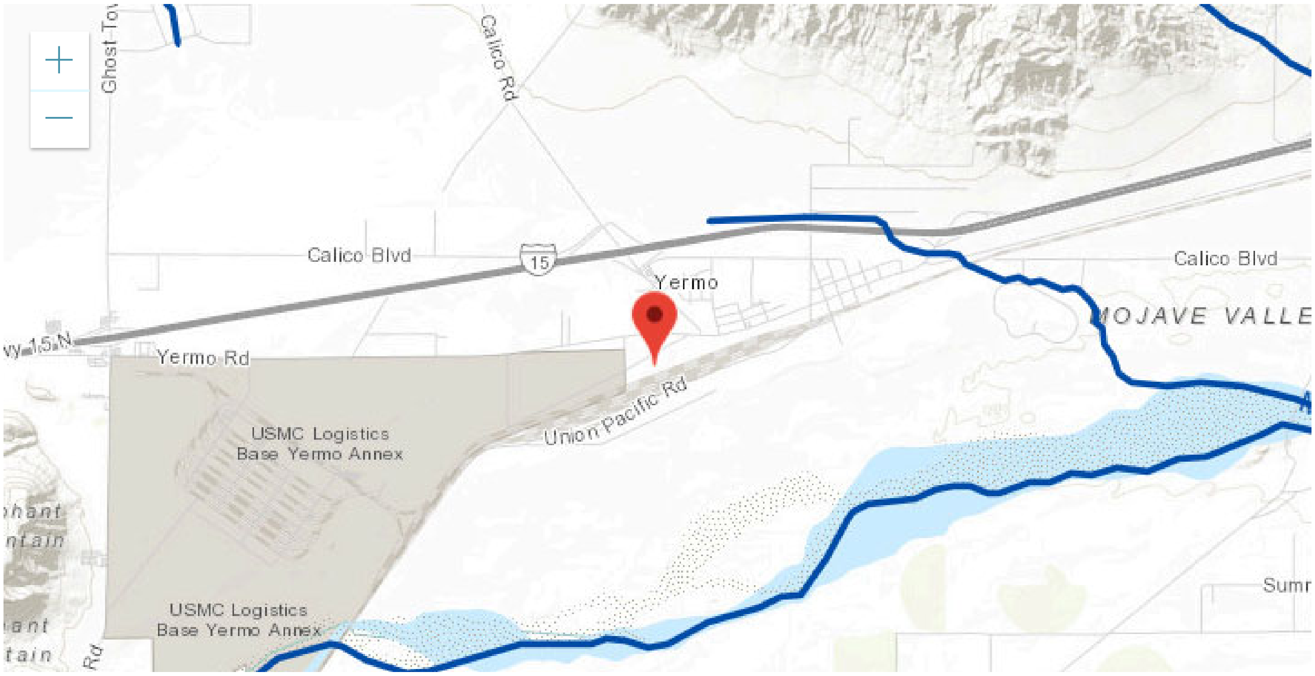
Federal Emergency Management Agency

Appendix B-2 Best Available Map (BAM) from DWR

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

Floodplain Information

Latitude: 34.90147, Longitude: -116.83495



Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA   Powered by Esri

County: San Bernardino (34.90147, -116.83495)

Floodplain Layer	**100-YR**	**200-YR**	**500-YR**
FEMA Effective	N	N/A	N
DWR Awareness	N	N/A	N/A
Regional/Special Studies	N	N/A	N
USACE Comp. Study	N	N	N

Y: The location is within the floodplain
N: The location is not within the floodplain
N/A: Data not available
✓ = Active Layer(s)

Floodplains are displayed using semi transparent colors. When viewing overlapping floodplains, the combination of multiple semi transparent colors will not match the legend colors. For accurate color representation, view floodplains individually.

Appendix B-3 Soil Information

United States
Department of
Agriculture

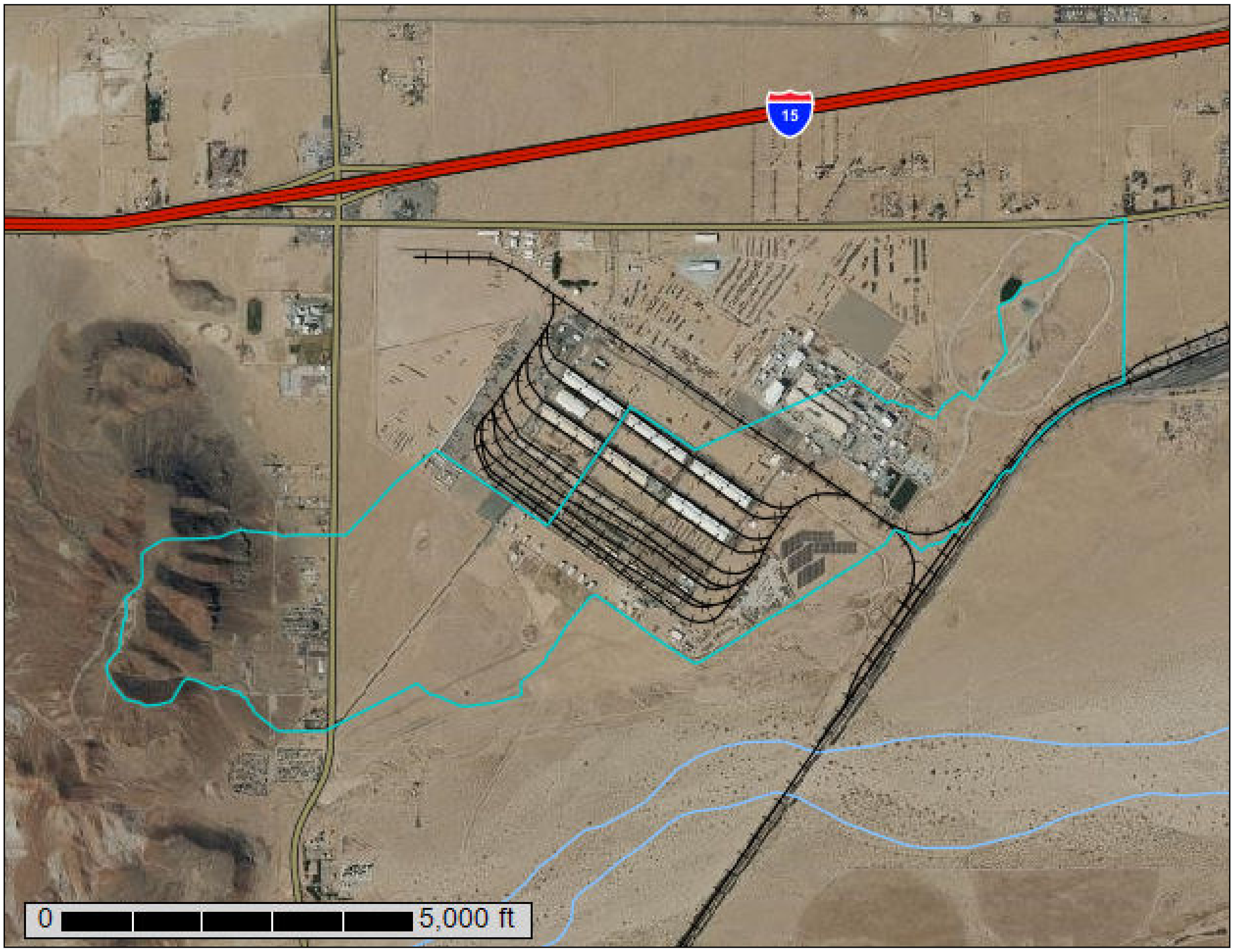
NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for
San Bernardino County, California, Mojave River Area

Off-Site Drainage Basin



June 5, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

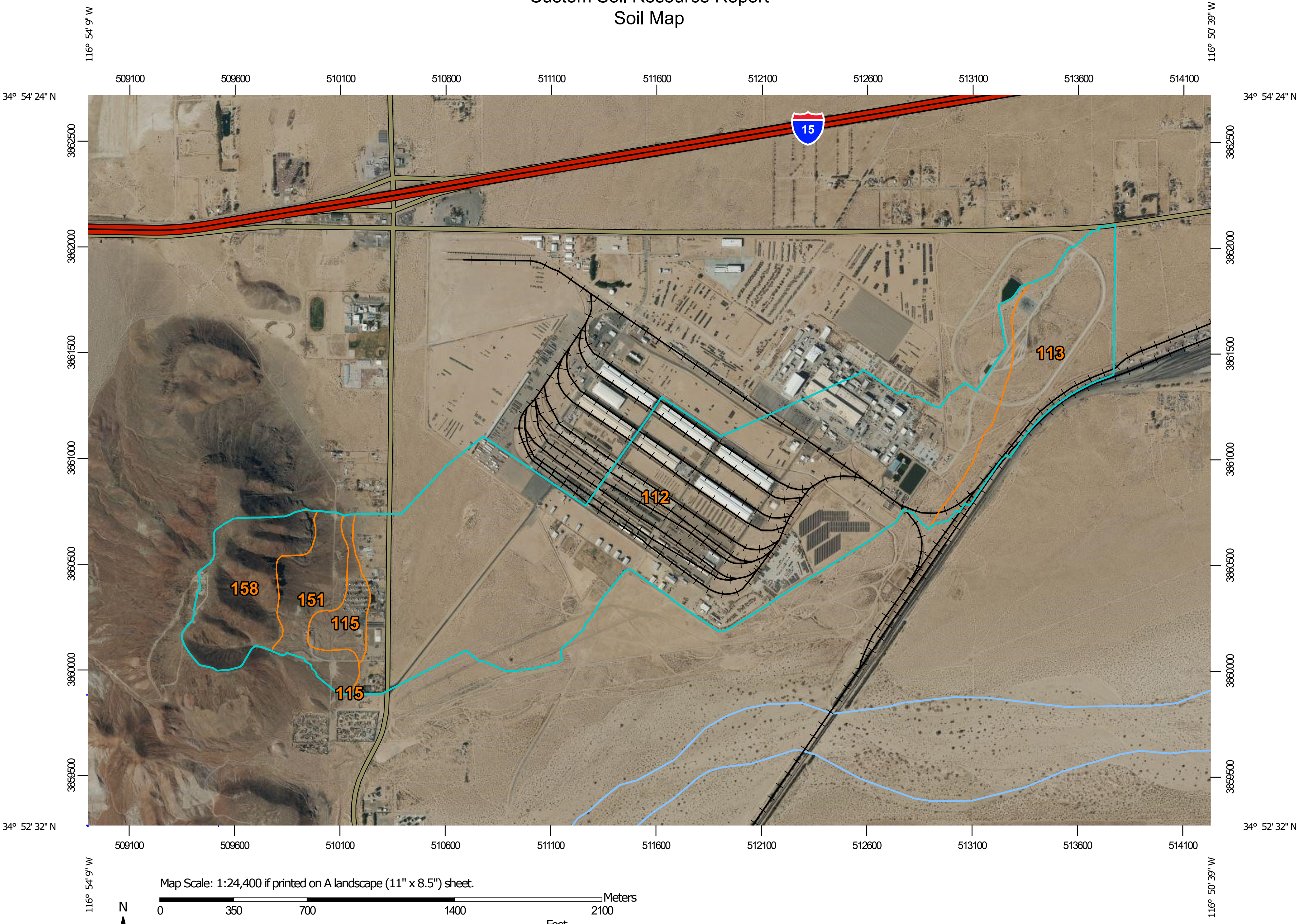
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:24,400 if printed on A landscape (11" x 8.5") sheet.

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

MAP LEGEND

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

Soils
- ▭ Soil Map Unit Polygons
- 〰 Soil Map Unit Lines
- ■ Soil Map Unit Points

Special Point Features
- ⊙ Blowout
- ☒ Borrow Pit
- ✱ Clay Spot
- ◇ Closed Depression
- ✕ Gravel Pit
- ∴ Gravelly Spot
- ● Landfill
- ⋀ Lava Flow
- ⩩ Marsh or swamp
- ⚒ Mine or Quarry
- ◎ Miscellaneous Water
- ○ Perennial Water
- ∨ Rock Outcrop
- ✚ Saline Spot
- ⁙ Sandy Spot
- ⊖ Severely Eroded Spot
- ◇ Sinkhole
- ▷ Slide or Slip
- ø Sodic Spot
- ≡ Spoil Area
- ◍ Stony Spot
- ◍ Very Stony Spot
- ♆ Wet Spot
- △ Other
- ⋯ Special Line Features

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.

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 16, Aug 30, 2024

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	592.9	71.5%
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	99.8	12.0%
115	CAJON GRAVELLY SAND, 2 TO 15 PERCENT SLOPES	20.9	2.5%
151	NEBONA-CUDDEBACK COMPLEX, 2 TO 9 PERCENT SLOPES*	45.7	5.5%
158	ROCK OUTCROP-LITHIC TORRIORTHENTS COMPLEX, 15 TO 50 PERCENT SLOPES*	70.0	8.4%
Totals for Area of Interest		**829.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Bernardino County, California, Mojave River Area

112—CAJON SAND, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrj
Elevation: 1,800 to 3,200 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cajon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 7 inches: sand
H2 - 7 to 25 inches: sand
H3 - 25 to 45 inches: gravelly sand
H4 - 45 to 60 inches: stratified sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Manet

Percent of map unit: 5 percent

Landform: Playas
Hydric soil rating: Yes

Kimberlina
Percent of map unit: 5 percent

Helendale
Percent of map unit: 5 percent

113—CAJON SAND, 2 TO 9 PERCENT SLOPES

Map Unit Setting
National map unit symbol: hkrk
Elevation: 1,800 to 3,500 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 68 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Cajon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon

Setting
Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile
A - 0 to 6 inches: sand
C1 - 6 to 25 inches: sand
C2 - 25 to 60 inches: gravelly sand

Properties and qualities
Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Helendale

Percent of map unit: 5 percent
Landform: Alluvial fans
Hydric soil rating: No

Kimberlina

Percent of map unit: 5 percent
Landform: Alluvial fans
Hydric soil rating: No

Cajon, gravelly surface

Percent of map unit: 5 percent
Landform: Alluvial fans

115—CAJON GRAVELLY SAND, 2 TO 15 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrm
Elevation: 2,300 to 3,500 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Cajon, gravelly surface, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon, Gravelly Surface

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 8 inches: gravelly sand
H2 - 8 to 60 inches: gravelly sand

Properties and qualities

Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF028CA - COBBLY SANDY
Hydric soil rating: No

Minor Components

Arizo

Percent of map unit: 3 percent
Hydric soil rating: No

Cajon

Percent of map unit: 3 percent
Hydric soil rating: No

Kimberlina

Percent of map unit: 3 percent
Hydric soil rating: No

Yermo

Percent of map unit: 3 percent
Hydric soil rating: No

Cajon, cobbly surface

Percent of map unit: 3 percent

151—NEBONA-CUDDEBACK COMPLEX, 2 TO 9 PERCENT SLOPES*

Map Unit Setting

National map unit symbol: hkss
Elevation: 1,800 to 3,400 feet
Mean annual precipitation: 3 to 5 inches
Mean annual air temperature: 63 to 66 degrees F
Frost-free period: 200 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Nebona and similar soils: 60 percent
Cuddeback and similar soils: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nebona

Setting

Landform: Fan remnants
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 2 inches: sandy loam
H2 - 2 to 8 inches: fine sandy loam
H3 - 8 to 12 inches: indurated
H4 - 12 to 65 inches: stratified gravelly sand to loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: 6 to 14 inches to duripan
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 0.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R030XF030CA - DESERT PAVEMENT
Hydric soil rating: No

Description of Cuddeback

Setting

Landform: Inset fans
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 3 inches: sandy loam
H2 - 3 to 6 inches: sandy loam
H3 - 6 to 17 inches: gravelly sandy clay loam
H4 - 17 to 34 inches: gravelly sandy loam

H5 - 34 to 38 inches: indurated

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: 20 to 40 inches to duripan
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R030XG024CA - DESERT PAVEMENT
Hydric soil rating: No

Minor Components

Unnamed soils

Percent of map unit: 19 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent
Landform: Playas
Hydric soil rating: Yes

158—ROCK OUTCROP-LITHIC TORRIORTHENTS COMPLEX, 15 TO 50 PERCENT SLOPES*

Map Unit Setting

National map unit symbol: hkt0
Elevation: 650 to 9,000 feet
Mean annual precipitation: 3 to 5 inches
Mean annual air temperature: 63 to 66 degrees F
Frost-free period: 200 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Rock outcrop: 60 percent
Lithic torriorthents and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Concave

Typical profile

H1 - 0 to 10 inches: unweathered bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Lithic Torriorthents

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Residuum weathered from granite

Typical profile

H1 - 0 to 15 inches: variable
H2 - 15 to 29 inches: bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Excessively drained
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydric soil rating: No

Minor Components

Sparkhule

Percent of map unit: 4 percent
Hydric soil rating: No

Trigger

Percent of map unit: 3 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 3 percent
Hydric soil rating: No

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United States
Department of
Agriculture

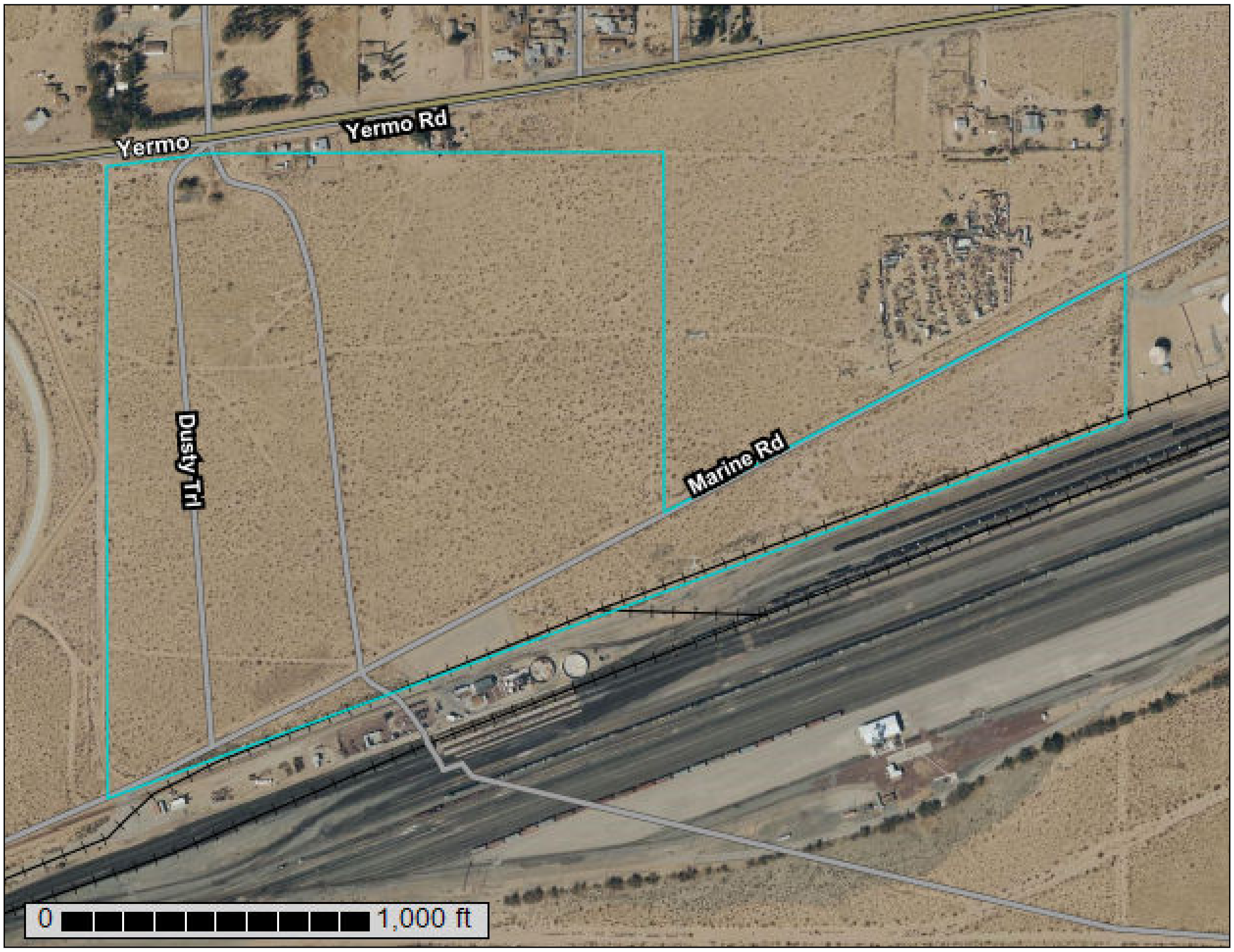
NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for San Bernardino County, California, Mojave River Area

On-Site Drainage Basin



June 5, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:5,540 if printed on A landscape (11" x 8.5") sheet.

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 16, Aug 30, 2024

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	85.4	100.0%
Totals for Area of Interest		**85.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Bernardino County, California, Mojave River Area

113—CAJON SAND, 2 TO 9 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrk
Elevation: 1,800 to 3,500 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 68 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cajon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

A - 0 to 6 inches: sand
C1 - 6 to 25 inches: sand
C2 - 25 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Helendale

Percent of map unit: 5 percent

Landform: Alluvial fans
Hydric soil rating: No

Kimberlina

Percent of map unit: 5 percent
Landform: Alluvial fans
Hydric soil rating: No

Cajon, gravelly surface

Percent of map unit: 5 percent
Landform: Alluvial fans

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Appendix B-4 Rainfall Data

Precipitation Depth

NOAA Atlas 14, Volume 6, Version 2
Location name: Yermo, California, USA*
Latitude: 34.8977°, Longitude: -116.8483°
Elevation: 1948 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.080** (0.066-0.099)	**0.124** (0.101-0.153)	**0.184** (0.150-0.228)	**0.234** (0.189-0.292)	**0.305** (0.239-0.393)	**0.362** (0.278-0.476)	**0.422** (0.317-0.568)	**0.486** (0.356-0.672)	**0.577** (0.406-0.829)	**0.651** (0.443-0.966)
10-min	**0.115** (0.094-0.142)	**0.178** (0.145-0.220)	**0.263** (0.215-0.326)	**0.335** (0.271-0.419)	**0.437** (0.343-0.564)	**0.519** (0.399-0.682)	**0.605** (0.455-0.814)	**0.697** (0.510-0.963)	**0.827** (0.582-1.19)	**0.932** (0.634-1.38)
15-min	**0.139** (0.114-0.172)	**0.215** (0.176-0.266)	**0.318** (0.260-0.395)	**0.406** (0.328-0.507)	**0.529** (0.415-0.682)	**0.628** (0.483-0.825)	**0.732** (0.550-0.985)	**0.843** (0.617-1.16)	**1.00** (0.703-1.44)	**1.13** (0.767-1.67)
30-min	**0.191** (0.157-0.236)	**0.295** (0.241-0.365)	**0.437** (0.356-0.542)	**0.557** (0.450-0.695)	**0.726** (0.569-0.936)	**0.862** (0.662-1.13)	**1.00** (0.755-1.35)	**1.16** (0.847-1.60)	**1.37** (0.966-1.97)	**1.55** (1.05-2.30)
60-min	**0.261** (0.213-0.322)	**0.403** (0.329-0.498)	**0.596** (0.486-0.738)	**0.759** (0.614-0.948)	**0.990** (0.776-1.28)	**1.18** (0.903-1.54)	**1.37** (1.03-1.84)	**1.58** (1.15-2.18)	**1.87** (1.32-2.69)	**2.11** (1.44-3.13)
2-hr	**0.348** (0.285-0.430)	**0.494** (0.404-0.611)	**0.694** (0.565-0.859)	**0.861** (0.697-1.08)	**1.10** (0.861-1.42)	**1.29** (0.990-1.69)	**1.49** (1.12-2.00)	**1.70** (1.24-2.35)	**2.00** (1.40-2.87)	**2.23** (1.52-3.32)
3-hr	**0.411** (0.337-0.508)	**0.568** (0.464-0.702)	**0.782** (0.637-0.968)	**0.961** (0.778-1.20)	**1.22** (0.952-1.56)	**1.42** (1.09-1.86)	**1.63** (1.22-2.19)	**1.85** (1.36-2.56)	**2.17** (1.52-3.11)	**2.42** (1.65-3.59)
6-hr	**0.496** (0.406-0.612)	**0.667** (0.545-0.824)	**0.898** (0.732-1.11)	**1.09** (0.883-1.36)	**1.36** (1.07-1.76)	**1.58** (1.22-2.08)	**1.81** (1.36-2.43)	**2.05** (1.50-2.83)	**2.38** (1.67-3.42)	**2.64** (1.80-3.92)
12-hr	**0.555** (0.454-0.685)	**0.746** (0.610-0.922)	**1.00** (0.818-1.24)	**1.22** (0.986-1.52)	**1.52** (1.19-1.96)	**1.75** (1.35-2.30)	**2.00** (1.50-2.69)	**2.26** (1.65-3.12)	**2.61** (1.84-3.75)	**2.89** (1.97-4.29)
24-hr	**0.647** (0.574-0.745)	**0.886** (0.785-1.02)	**1.20** (1.06-1.39)	**1.47** (1.28-1.71)	**1.83** (1.55-2.20)	**2.11** (1.75-2.59)	**2.40** (1.94-3.02)	**2.70** (2.13-3.50)	**3.11** (2.35-4.20)	**3.43** (2.50-4.79)
2-day	**0.781** (0.693-0.898)	**1.07** (0.950-1.24)	**1.46** (1.29-1.69)	**1.78** (1.56-2.07)	**2.22** (1.88-2.67)	**2.56** (2.13-3.15)	**2.92** (2.36-3.67)	**3.28** (2.59-4.25)	**3.78** (2.86-5.11)	**4.18** (3.05-5.83)
3-day	**0.823** (0.730-0.947)	**1.14** (1.01-1.31)	**1.55** (1.37-1.79)	**1.89** (1.66-2.20)	**2.36** (2.00-2.84)	**2.73** (2.26-3.35)	**3.10** (2.51-3.90)	**3.48** (2.74-4.51)	**4.01** (3.03-5.41)	**4.42** (3.23-6.17)
4-day	**0.849** (0.753-0.976)	**1.18** (1.04-1.36)	**1.61** (1.42-1.86)	**1.96** (1.72-2.29)	**2.45** (2.08-2.94)	**2.82** (2.34-3.46)	**3.19** (2.59-4.02)	**3.58** (2.82-4.64)	**4.11** (3.11-5.54)	**4.52** (3.30-6.31)
7-day	**0.904** (0.802-1.04)	**1.26** (1.12-1.45)	**1.73** (1.53-2.00)	**2.10** (1.84-2.45)	**2.61** (2.21-3.14)	**2.98** (2.48-3.66)	**3.36** (2.72-4.23)	**3.74** (2.94-4.84)	**4.24** (3.20-5.72)	**4.61** (3.37-6.44)
10-day	**0.965** (0.856-1.11)	**1.36** (1.20-1.56)	**1.86** (1.65-2.15)	**2.26** (1.99-2.64)	**2.80** (2.37-3.37)	**3.19** (2.65-3.92)	**3.58** (2.90-4.51)	**3.97** (3.13-5.14)	**4.48** (3.39-6.05)	**4.86** (3.55-6.79)
20-day	**1.11** (0.983-1.27)	**1.58** (1.40-1.82)	**2.19** (1.94-2.53)	**2.67** (2.34-3.11)	**3.32** (2.81-3.99)	**3.79** (3.15-4.66)	**4.26** (3.46-5.37)	**4.73** (3.73-6.12)	**5.33** (4.03-7.20)	**5.78** (4.22-8.07)
30-day	**1.23** (1.09-1.41)	**1.76** (1.56-2.03)	**2.46** (2.17-2.84)	**3.02** (2.65-3.52)	**3.78** (3.20-4.54)	**4.34** (3.60-5.33)	**4.90** (3.97-6.17)	**5.46** (4.30-7.06)	**6.18** (4.67-8.34)	**6.71** (4.90-9.37)
45-day	**1.37** (1.22-1.58)	**1.98** (1.75-2.28)	**2.78** (2.46-3.21)	**3.44** (3.01-4.00)	**4.34** (3.68-5.22)	**5.03** (4.18-6.18)	**5.72** (4.63-7.20)	**6.41** (5.05-8.30)	**7.32** (5.54-9.88)	**8.00** (5.84-11.2)
60-day	**1.49** (1.32-1.71)	**2.14** (1.90-2.47)	**3.03** (2.68-3.50)	**3.77** (3.30-4.39)	**4.79** (4.06-5.77)	**5.59** (4.64-6.87)	**6.40** (5.19-8.06)	**7.22** (5.69-9.35)	**8.32** (6.29-11.2)	**9.14** (6.68-12.8)

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

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

Please refer to NOAA Atlas 14 document for more information.

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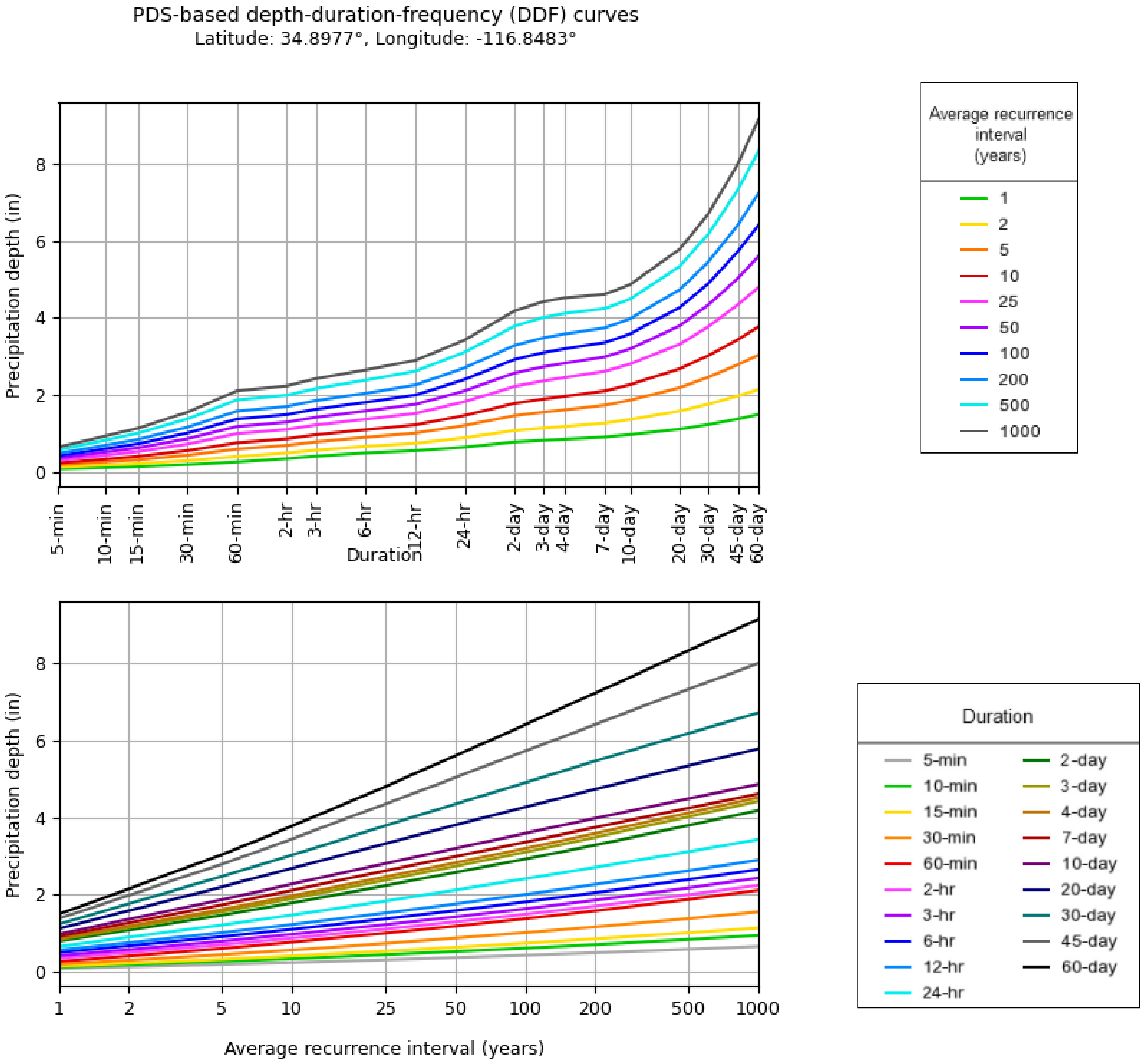
PF graphical



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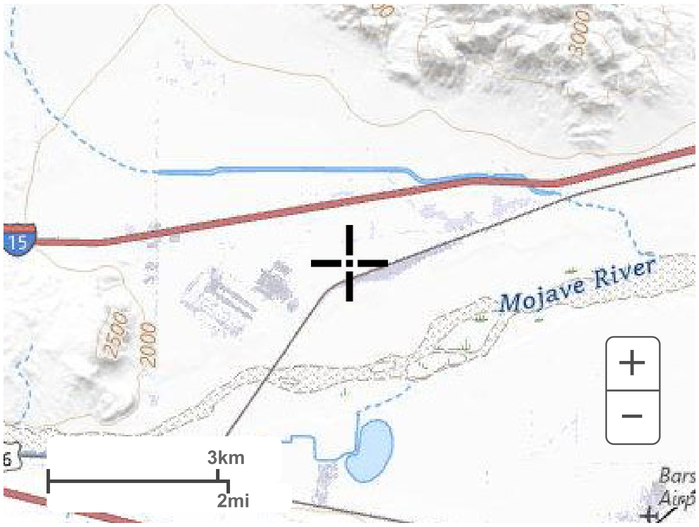
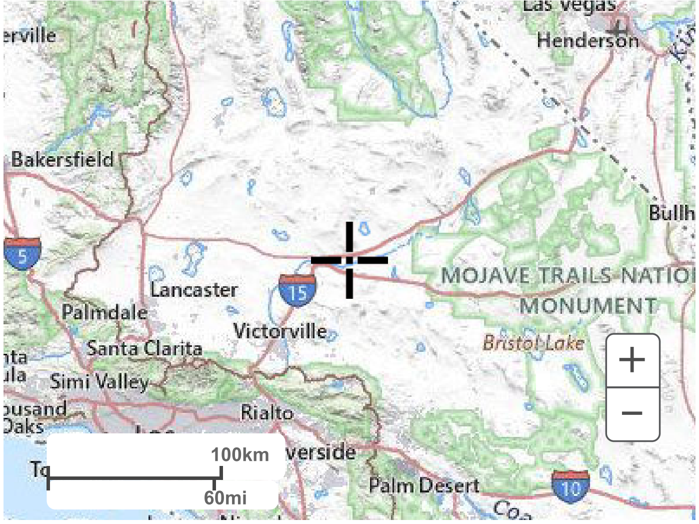
Maps & aerials

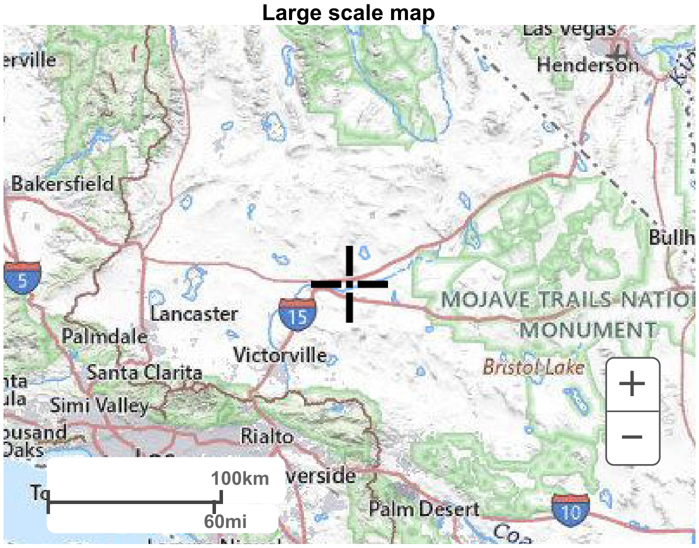
Small scale terrain



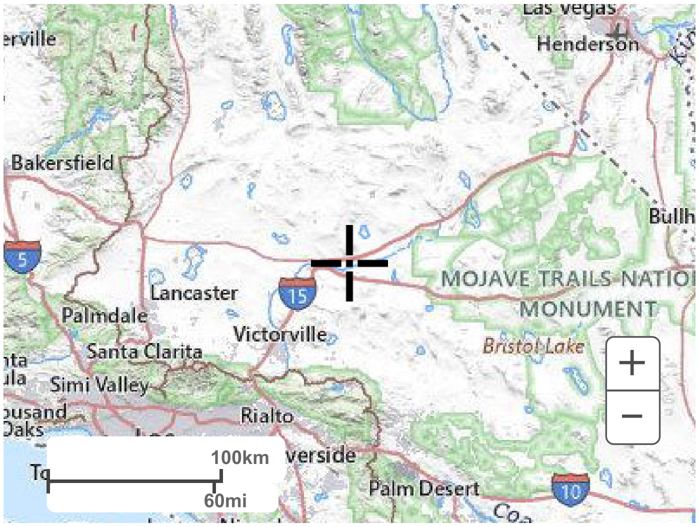
Large scale terrain



Large scale map



Large scale aerial



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

Disclaimer

Precipitation Intensity

NOAA Atlas 14, Volume 6, Version 2
Location name: Yermo, California, USA*
Latitude: 34.8977°, Longitude: -116.8483°
Elevation: 1948 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/hour)[1]

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.960** (0.792-1.19)	**1.49** (1.21-1.84)	**2.21** (1.80-2.74)	**2.81** (2.27-3.50)	**3.66** (2.87-4.72)	**4.34** (3.34-5.71)	**5.06** (3.80-6.82)	**5.83** (4.27-8.06)	**6.92** (4.87-9.95)	**7.81** (5.32-11.6)
10-min	**0.690** (0.564-0.852)	**1.07** (0.870-1.32)	**1.58** (1.29-1.96)	**2.01** (1.63-2.51)	**2.62** (2.06-3.38)	**3.11** (2.39-4.09)	**3.63** (2.73-4.88)	**4.18** (3.06-5.78)	**4.96** (3.49-7.13)	**5.59** (3.80-8.30)
15-min	**0.556** (0.456-0.688)	**0.860** (0.704-1.06)	**1.27** (1.04-1.58)	**1.62** (1.31-2.03)	**2.12** (1.66-2.73)	**2.51** (1.93-3.30)	**2.93** (2.20-3.94)	**3.37** (2.47-4.66)	**4.00** (2.81-5.75)	**4.51** (3.07-6.70)
30-min	**0.382** (0.314-0.472)	**0.590** (0.482-0.730)	**0.874** (0.712-1.08)	**1.11** (0.900-1.39)	**1.45** (1.14-1.87)	**1.72** (1.32-2.27)	**2.01** (1.51-2.70)	**2.31** (1.69-3.20)	**2.75** (1.93-3.95)	**3.10** (2.11-4.60)
60-min	**0.261** (0.213-0.322)	**0.403** (0.329-0.498)	**0.596** (0.486-0.738)	**0.759** (0.614-0.948)	**0.990** (0.776-1.28)	**1.18** (0.903-1.54)	**1.37** (1.03-1.84)	**1.58** (1.15-2.18)	**1.87** (1.32-2.69)	**2.11** (1.44-3.13)
2-hr	**0.174** (0.142-0.215)	**0.247** (0.202-0.305)	**0.347** (0.282-0.429)	**0.430** (0.348-0.538)	**0.549** (0.430-0.708)	**0.644** (0.495-0.846)	**0.743** (0.558-1.00)	**0.849** (0.621-1.17)	**0.997** (0.701-1.43)	**1.12** (0.760-1.66)
3-hr	**0.136** (0.112-0.169)	**0.189** (0.154-0.233)	**0.260** (0.212-0.322)	**0.320** (0.259-0.399)	**0.404** (0.317-0.521)	**0.471** (0.362-0.620)	**0.542** (0.407-0.729)	**0.617** (0.451-0.852)	**0.721** (0.507-1.04)	**0.805** (0.548-1.20)
6-hr	**0.082** (0.067-0.102)	**0.111** (0.091-0.137)	**0.149** (0.122-0.185)	**0.182** (0.147-0.227)	**0.227** (0.178-0.293)	**0.264** (0.203-0.347)	**0.301** (0.226-0.405)	**0.341** (0.249-0.471)	**0.397** (0.279-0.570)	**0.441** (0.300-0.655)
12-hr	**0.046** (0.037-0.056)	**0.061** (0.050-0.076)	**0.083** (0.067-0.103)	**0.101** (0.081-0.126)	**0.125** (0.098-0.162)	**0.145** (0.111-0.191)	**0.165** (0.124-0.223)	**0.187** (0.136-0.258)	**0.216** (0.152-0.311)	**0.239** (0.163-0.356)
24-hr	**0.026** (0.023-0.031)	**0.036** (0.032-0.042)	**0.050** (0.044-0.057)	**0.061** (0.053-0.071)	**0.076** (0.064-0.091)	**0.087** (0.073-0.108)	**0.100** (0.081-0.125)	**0.112** (0.088-0.145)	**0.129** (0.098-0.174)	**0.142** (0.104-0.199)
2-day	**0.016** (0.014-0.018)	**0.022** (0.019-0.025)	**0.030** (0.026-0.035)	**0.037** (0.032-0.043)	**0.046** (0.039-0.055)	**0.053** (0.044-0.065)	**0.060** (0.049-0.076)	**0.068** (0.053-0.088)	**0.078** (0.059-0.106)	**0.087** (0.063-0.121)
3-day	**0.011** (0.010-0.013)	**0.015** (0.013-0.018)	**0.021** (0.019-0.024)	**0.026** (0.023-0.030)	**0.032** (0.027-0.039)	**0.037** (0.031-0.046)	**0.043** (0.034-0.054)	**0.048** (0.038-0.062)	**0.055** (0.042-0.075)	**0.061** (0.044-0.085)
4-day	**0.008** (0.007-0.010)	**0.012** (0.010-0.014)	**0.016** (0.014-0.019)	**0.020** (0.017-0.023)	**0.025** (0.021-0.030)	**0.029** (0.024-0.036)	**0.033** (0.026-0.041)	**0.037** (0.029-0.048)	**0.042** (0.032-0.057)	**0.047** (0.034-0.065)
7-day	**0.005** (0.004-0.006)	**0.007** (0.006-0.008)	**0.010** (0.009-0.011)	**0.012** (0.010-0.014)	**0.015** (0.013-0.018)	**0.017** (0.014-0.021)	**0.019** (0.016-0.025)	**0.022** (0.017-0.028)	**0.025** (0.019-0.034)	**0.027** (0.020-0.038)
10-day	**0.004** (0.003-0.004)	**0.005** (0.005-0.006)	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.011** (0.009-0.014)	**0.013** (0.011-0.016)	**0.014** (0.012-0.018)	**0.016** (0.013-0.021)	**0.018** (0.014-0.025)	**0.020** (0.014-0.028)
20-day	**0.002** (0.002-0.002)	**0.003** (0.002-0.003)	**0.004** (0.004-0.005)	**0.005** (0.004-0.006)	**0.006** (0.005-0.008)	**0.007** (0.006-0.009)	**0.008** (0.007-0.011)	**0.009** (0.007-0.012)	**0.011** (0.008-0.014)	**0.012** (0.008-0.016)
30-day	**0.001** (0.001-0.001)	**0.002** (0.002-0.002)	**0.003** (0.003-0.003)	**0.004** (0.003-0.004)	**0.005** (0.004-0.006)	**0.006** (0.005-0.007)	**0.006** (0.005-0.008)	**0.007** (0.005-0.009)	**0.008** (0.006-0.011)	**0.009** (0.006-0.013)
45-day	**0.001** (0.001-0.001)	**0.001** (0.001-0.002)	**0.002** (0.002-0.002)	**0.003** (0.002-0.003)	**0.004** (0.003-0.004)	**0.004** (0.003-0.005)	**0.005** (0.004-0.006)	**0.005** (0.004-0.007)	**0.006** (0.005-0.009)	**0.007** (0.005-0.010)
60-day	**0.001** (0.000-0.001)	**0.001** (0.001-0.001)	**0.002** (0.001-0.002)	**0.002** (0.002-0.003)	**0.003** (0.002-0.004)	**0.003** (0.003-0.004)	**0.004** (0.003-0.005)	**0.005** (0.003-0.006)	**0.005** (0.004-0.007)	**0.006** (0.004-0.008)

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

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

Please refer to NOAA Atlas 14 document for more information.

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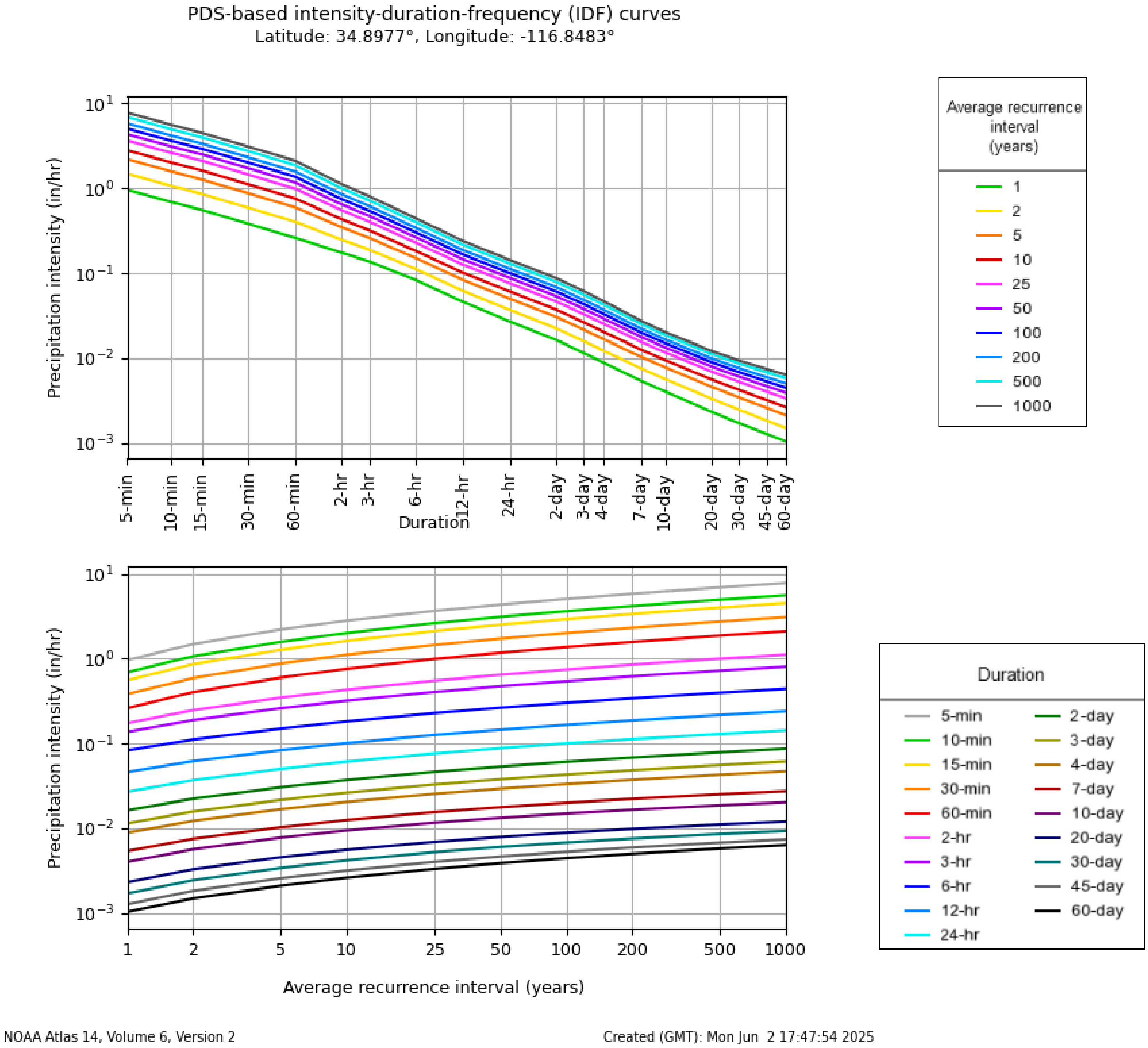
PF graphical



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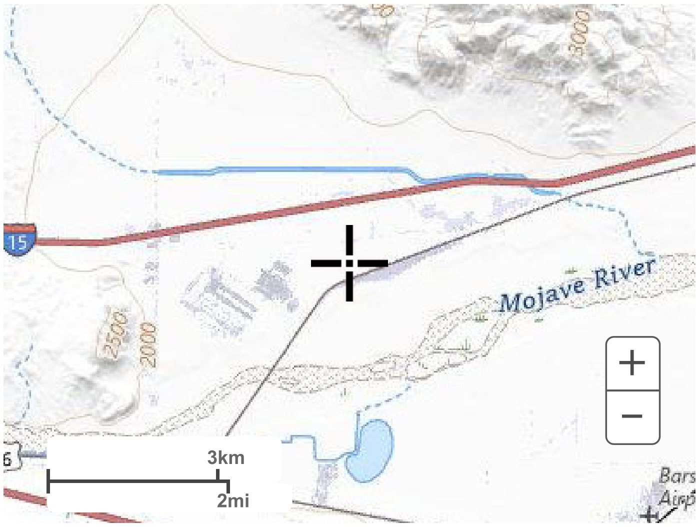
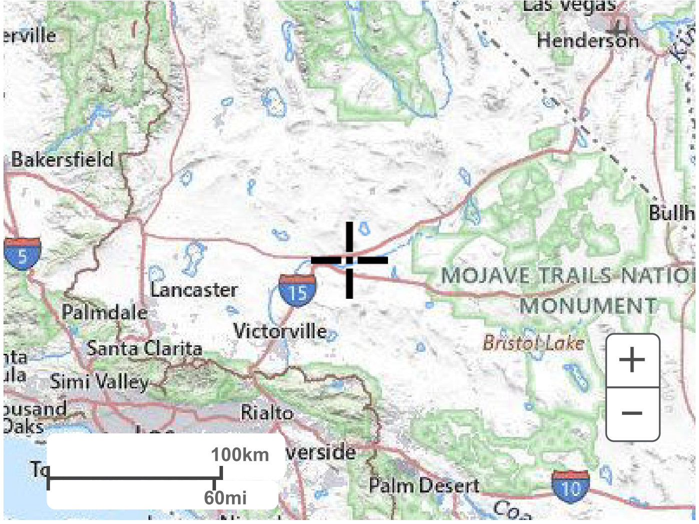
Maps & aerials

Small scale terrain

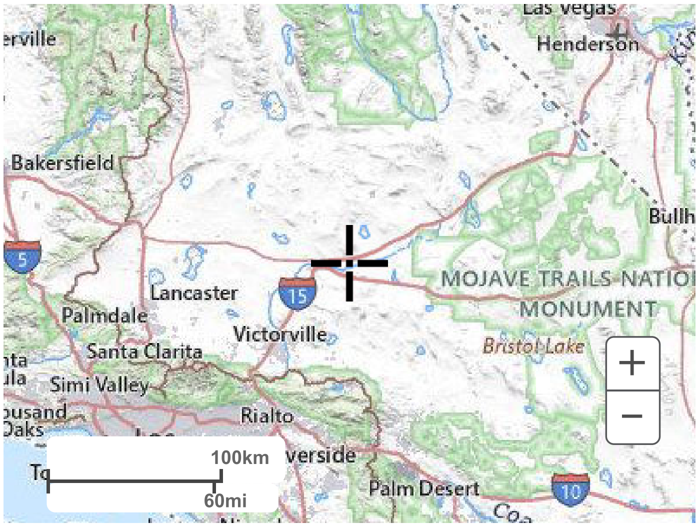


Large scale terrain



Large scale map

Large scale aerial



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

Disclaimer

Appendix C - Calculations

Appendix C-1 Calculations in Excel

Yermo Hydrology Calculations
Completed by: Michael Barzaghi on 6/12/2025
Checked By: Grace Hart 6/17/2025
Reviewed by: Fred Charles 6/24/2025

General Notes:

1. CN Method was used for offsite calculations (HEC - HMS used)
2. Rational Method was used for onsite calculations
3. CN Method was used for offsite and onsite runoff volume
4. AMC 2 was used for all calculations
5. Pre-development uses the same CN
6. Post-development uses composite CN
7. Basin ON-A has been excluded from hydrology results as it is outside the project boundary.

SHEET INDEX

Calculation Sheet Name	Notes
Hydrology Results	Results from various methods, separated into exisiting vs. post development
Offsite Composite CN	Evaluates Composite CN for offsite conditions under AMC 2
Offsite CN Method Runoff	Evaluates offsite existing peak discharge
Onsite PostDev CN & C	Evaluates composite CN and C for onsite post developed conditions
Onsite Rational Method - PreDev	Evaluates onsite pre-development peak discharge
Onsite Rational Method - PostDev	Evaluates onsite post-development peak discharge
Vol Onsite CN - PreDev	Evaluates onsite pre-development storage volume using CN method (AMC 2 conditions)
Vol Onsite CN - PostDev	Evaluates onsite post-development volume using CN method
Point Precipitation Frequency Estimates	Precipitation/intensity data from NOAA
References	

HYDROLOGY RESULTS

Yermo Drainage - Existing Basin Hydrology

		Peak Flow Rate by Basin (cfs)					
Method	**Event**	**Offsite**	**EX ON-A**	**EX ON-B**	**EX ON-C**	**EX ON-D**	**Notes**
HEC-HMS SCS Type II	100-yr, 24-hr	44.5	--	--	--	--	
HEC-HMS SCS Type II	10-yr, 24-hr	3.7	--	--	--	--	
Rational Method - Onsite (C=0.1)	100-yr, 30-min	--	--	6.0	7.3	2.5	
Rational Method - Onsite (C=0.1)	10-yr, 30-min	--	--	3.3	4.0	1.4	

		Runoff Volume by Basin (cubic feet)					
Method	**Event**	**Offsite**	**EX ON-A**	**EX ON-B**	**EX ON-C**	**EX ON-D**	**Notes**
TR-55 Excel calcs	100-yr, 24-hr	--	--	24.8	30.2	10.4	
TR-55 Excel calcs	10-yr, 24-hr	--	--	0.00	0.00	0.00	

Yermo Drainage - Post-Development Basin Hydrology

		Peak Flow Rate by Basin (cfs)					
Method	**Event**	**Offsite**	**ON-A**	**ON-B**	**ON-C**	**ON-D**	**Notes**
Rational Method - Onsite	100-yr, 30-min	--	--	9.0	64.2	4.1	Undevelped area C=0.1, intensity = 15 min for ON-C
Rational Method - Onsite	10-yr, 30-min	--	--	5.0	35.5	2.3	Undevelped area C=0.1, intensity = 15 min for ON-C

		Runoff Volume by Basin (cubic feet)					
Method	**Event**	**Offsite**	**ON-A**	**ON-B**	**ON-C**	**ON-D**	**Notes**
TR-55 Excel Calcs	100-yr, 24-hr	--	--	919.6	71795.0	574.0	
TR-55 Excel Calcs	10-yr, 24-hr	--	--	0.0	17735.7	0.0	

OFFSITE COMPOSITE CN

Areas

Assume Fair soil condition

Total offsite drainage area	36118958	SF

Hilly area (green, west side)

Area	6394524	SF
	146.8	AC
	0.229	SQ. MI.
Soil Hyd. Group	D	from Web Soil Survey report
Curve Number	83	Reference: San Bernardino County

Roads (orange, from CAD but not visible in image)

Area	869567	SF
	20.0	AC
	0.031	SQ. MI.
Soil Hyd. Group	A	from Web Soil Survey report
Curve Number	90	Reference: San Bernardino County

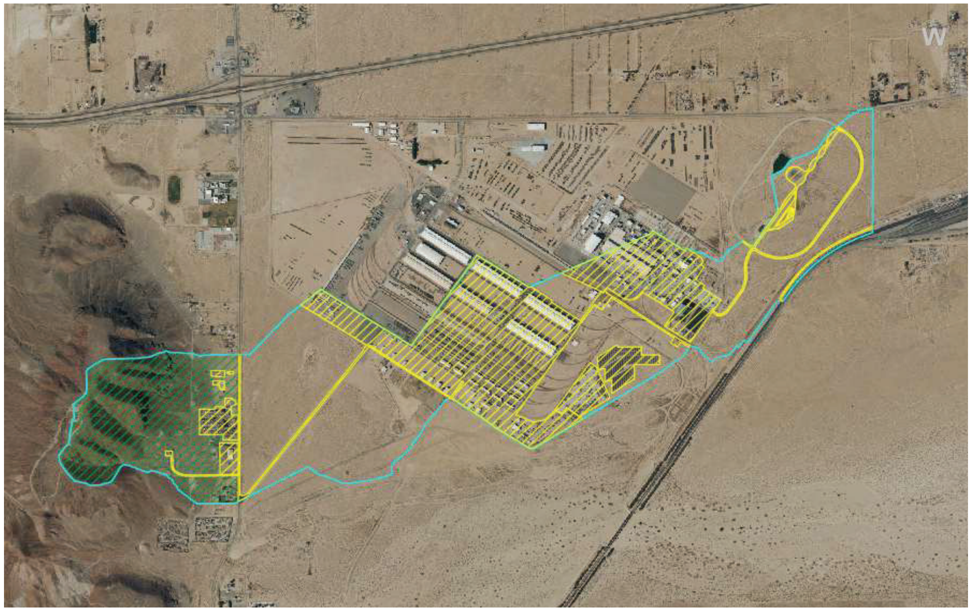
Industrial (yellow)

Area	11143916	SF
	255.8	AC
	0.400	SQ. MI.
Soil Hyd. Group	A	from Web Soil Survey report
Curve Number	90	Reference: San Bernardino County

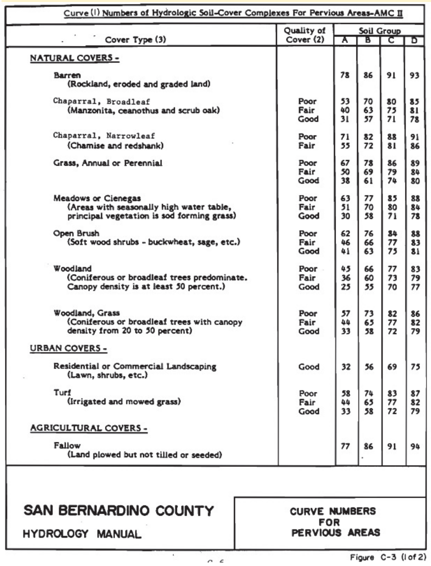
Desert (all other areas)

Area	17710951	SF
	406.6	AC
	0.635	SQ. MI.
Soil Hyd. Group	A	from Web Soil Survey report
Curve Number	46	Reference: San Bernardino County

Composite CN	**67.2**
% Pervious	66.74



Source: San Bernardino County Hydrology Manual



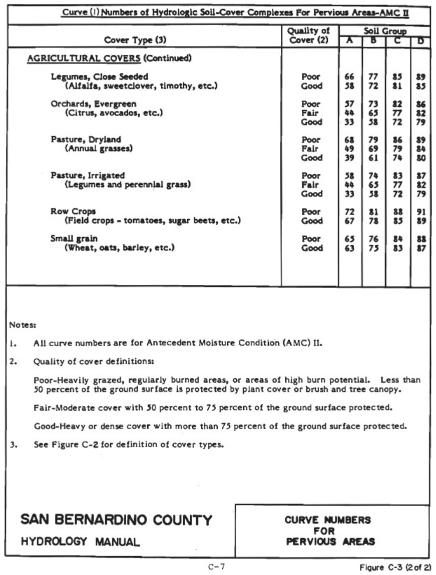
Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

Figure C-3 (1 of 2)



Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

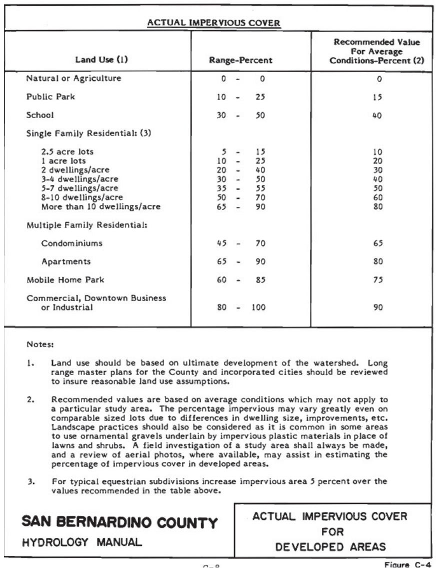
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

C-7

Figure C-3 (2 of 2)



ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER
FOR
DEVELOPED AREAS

Figure C-4

OFFSITE CN METHOD RUNOFF

Offsite Drainage Area

CAD area	36118958	SF
	829.2	AC
	1.30	SQ. MI.

use soil group C for hilly area on west side of watershed
use B for low lying areas

Curve Number Method - HEC HMS

Composite CN	67.2		
Storage, S	4.88		
Initial Abstraction, IA	0.98		Input for HEC HMS; Reference Eqn 2-2
100-yr, 24-hr Rainfall Depth, P	2.40	IN	Input for HEC HMS; Reference PF_Depth

Travel Times

Assume all shallow concentrated flow

Section 1 - hill area on west side of drainage

U/S Elev.	2674	FT
D/S Elev.	1984	FT
Flowpath Length	3437	FT
Slope	0.20	FT/FT

From Fig. 15-4
Use Alluvial Fan Western Mountain

Velocity	4.4	FT/S
Section 1 Travel Time	781.1	SEC
	13.0	MIN

Section 2 - remaining area apart from hill area

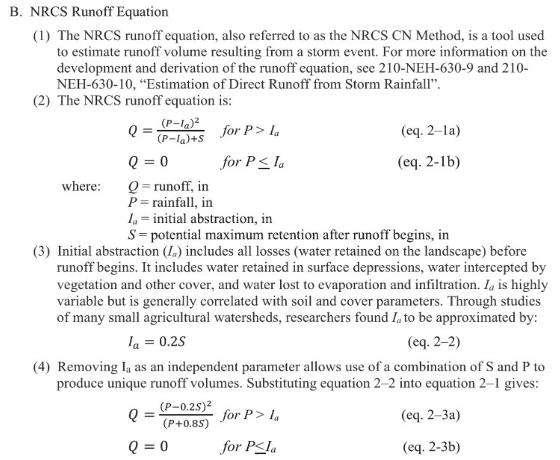
U/S Elev.	1984	FT
D/S Elev.	1946	FT
Flowpath Length	15457	FT
Slope	0.0024584	FT/FT

From Fig. 15-4
Use Pavement and Small Gullies

Velocity	1.45	FT/S
Section 2 Travel Time	10660.0	SEC
	177.7	MIN

Total Travel Time (TOC)	190.7	MIN	
	3.18	HR	
Lag Time	114.4	MIN	Input for HEC HMS; Reference: Eqn 15-3
	1.91	HR	

Source: NRCS National Engineering Handbook



B. NRCS Runoff Equation

(1) The NRCS runoff equation, also referred to as the NRCS CN Method, is a tool used to estimate runoff volume resulting from a storm event. For more information on the development and derivation of the runoff equation, see 210-NEH-630-9 and 210-NEH-630-10, "Estimation of Direct Runoff from Storm Rainfall".

(2) The NRCS runoff equation is:

$$Q = \frac{(P-I_a)^2}{(P-I_a)+S} \quad for\ P > I_a \qquad \text{(eq. 2–1a)}$$

$$Q = 0 \quad for\ P \leq I_a \qquad \text{(eq. 2-1b)}$$

where:
Q = runoff, in
P = rainfall, in
I_a = initial abstraction, in
S = potential maximum retention after runoff begins, in

(3) Initial abstraction (I_a) includes all losses (water retained on the landscape) before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation and other cover, and water lost to evaporation and infiltration. I_a is highly variable but is generally correlated with soil and cover parameters. Through studies of many small agricultural watersheds, researchers found I_a to be approximated by:

$$I_a = 0.2S \qquad \text{(eq. 2–2)}$$

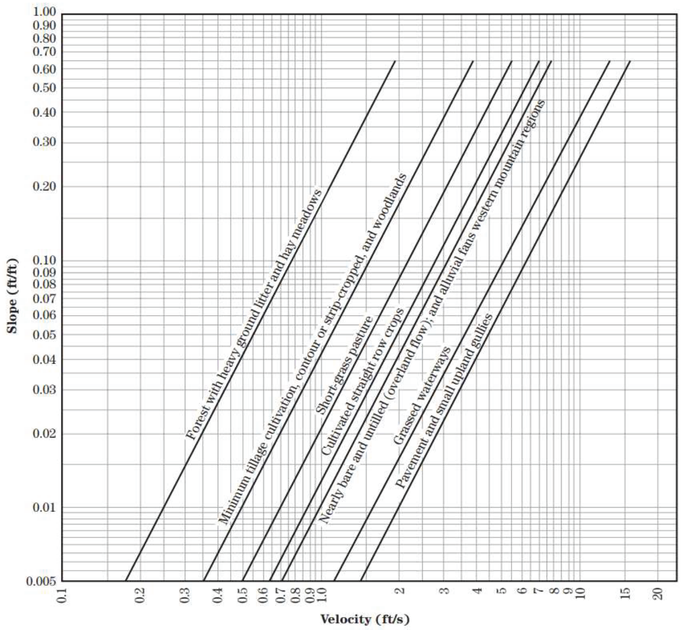
(4) Removing I_a as an independent parameter allows use of a combination of S and P to produce unique runoff volumes. Substituting equation 2–2 into equation 2–1 gives:

$$Q = \frac{(P-0.2S)^2}{(P+0.8S)} \quad for\ P > I_a \qquad \text{(eq. 2–3a)}$$

$$Q = 0 \quad for\ P \leq I_a \qquad \text{(eq. 2-3b)}$$

Source: NRCS National Engineering Handbook

Figure 15–4 Velocity versus slope for shallow concentrated flow

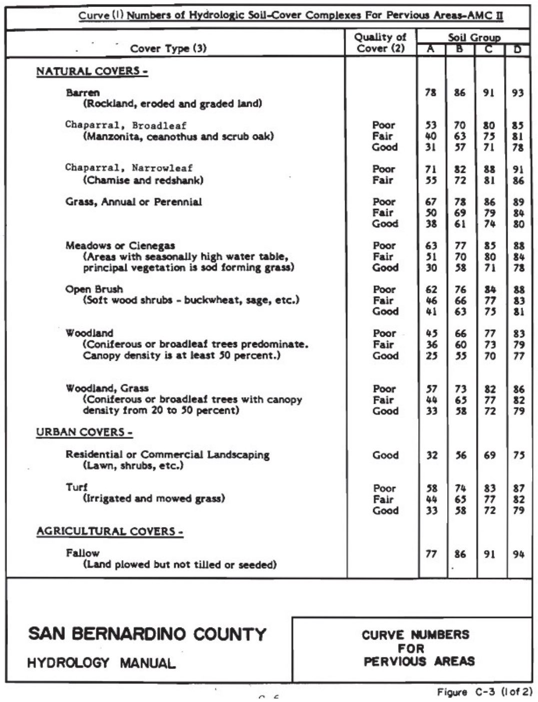


ONSITE POSTDEV CN & C

					Commercial Area			Remaining Undeveloped Area			Runoff Parameters		
Basin	Node #	Area (SF)	Area (AC)	Area (SQ MI)	Area (sf)	Runoff Coefficient C	Curve Number CN	Undeveloped Area (sf)	Undeveloped C	Curve Number CN	Composite C	Composite CN	% Pervious
ON-A	-	319095	7.33	0.011	4261	-	-	314834	-	-	-	-	-
ON-B	2	1291130	29.64	0.046	82854	0.9	90	1208276	0.1	46	0.15	48.8	93.58
ON-C	3	1571657	36.08	0.056	995879	0.9	90	575778	0.1	46	0.61	73.9	36.64
ON-D	4	539539	12.39	0.019	43987	0.9	90	495552	0.1	46	0.17	49.6	91.85
						for runoff rate	for volume		for runoff rate	for volume	for runoff rate	for volume	
2-yr, 24 hr rainfall	0.886	in				Rational Method	CN Method		Rational Method	CN Method	Rational Method	CN Method	

Assumes fair soil condition CN, assume Soil Group A, desert shrub cover	46.0
Commercial Area CN - Commercial	90

Source: San Bernardino County Hydrology Manual



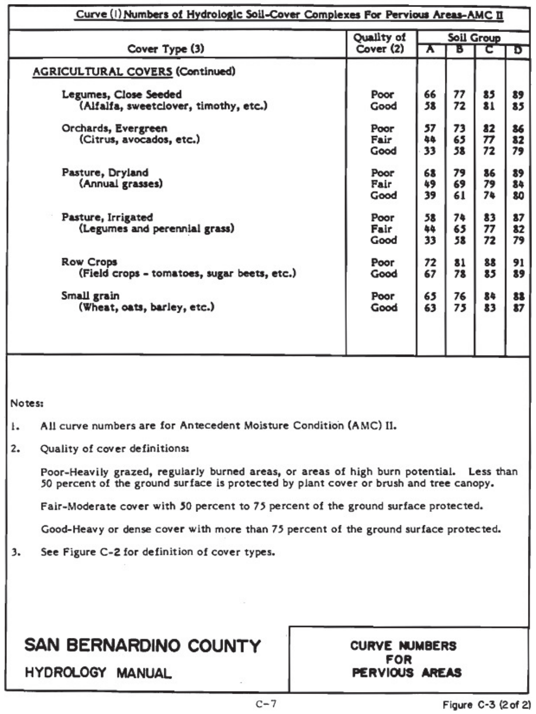
Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

Figure C-3 (1 of 2)



Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

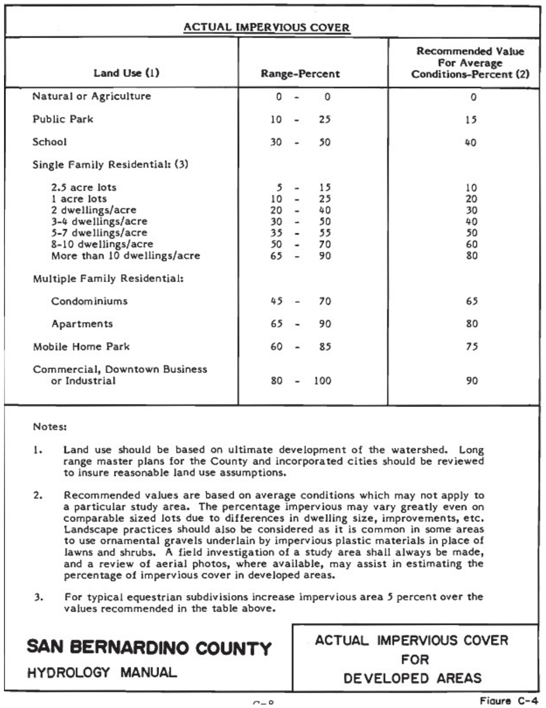
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

C-7

Figure C-3 (2 of 2)



ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER
FOR
DEVELOPED AREAS

Figure C-4

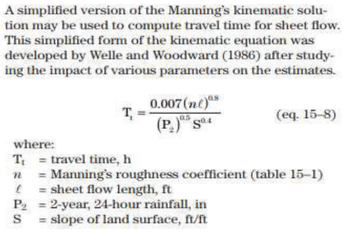
ONSITE RATIONAL METHOD - PREDEV

Rational Method

				Sheet Flow						*Shallow Concentrated Flow*						*Time of Concentration*			*C = 0.10 for Undeveloped*				
Basin	**Area (SF)**	**Area (AC)**	**Area (SQ MI)**	**U/S Elev**	**D/S Elev**	**Flow Length (ft)**	**Slope (ft/ft)**	**Manning's n**	**Travel Time (hr)**	**U/S Elev**	**D/S Elev**	**Flow Length (ft)**	**Slope (ft/ft)**	**Velocity (ft/s)**	**Travel Time (hr)**	**Total Travel Time (TOC, hr)**	**Total Travel Time (TOC, min)**	**Intensity Duration Used (min)**	**C**	**10-yr Intensity (in/hr)**	**10-yr Peak Flow (cfs)**	**100-yr Intensity (in/hr)**	**100-yr Peak Flow (cfs)**
ON-A	319095	7.33	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ON-B	1291130	29.64	0.046	1948	1947	260	0.004	0.011	0.159	1947	1943	1641	0.002	0.7	0.651	0.81	48.6	30	0.1	1.11	3.3	2.01	5.96
ON-C	1571657	36.08	0.056	1949.5	1949	157	0.003	0.011	0.115	1949	1947	2149	0.000931	0.7	0.853	0.97	58.1	30	0.1	1.11	4.0	2.01	7.25
ON-D	539539	12.39	0.019	1948	1945	195	0.015	0.011	0.073	1945	1941	1548	0.002584	0.7	0.614	0.69	41.2	30	0.1	1.11	1.4	2.01	2.49

2-yr, 24 hr rainfall 0.886 in

Source: NRCS National Engineering Handbook



A simplified version of the Manning's kinematic solution may be used to compute travel time for sheet flow. This simplified form of the kinematic equation was developed by Welle and Woodward (1986) after studying the impact of various parameters on the estimates.

$$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5} S^{0.4}} \qquad \text{(eq. 15–8)}$$

where:

T_t = travel time, h
n = Manning's roughness coefficient (table 15–1)
ℓ = sheet flow length, ft
P_2 = 2-year, 24-hour rainfall, in
S = slope of land surface, ft/ft

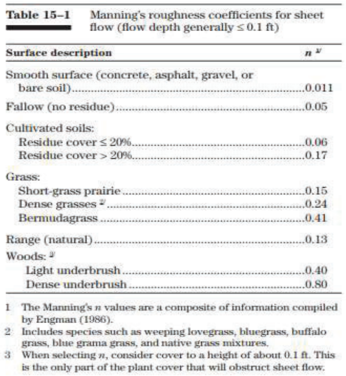


Table 15–1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	***n*** [1]
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

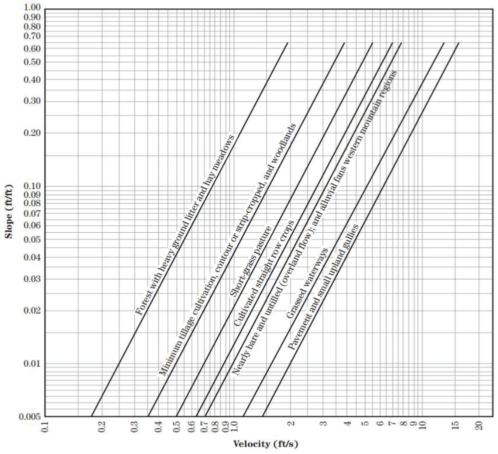
1 The Manning's *n* values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting *n*, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Shallow concentrated flow

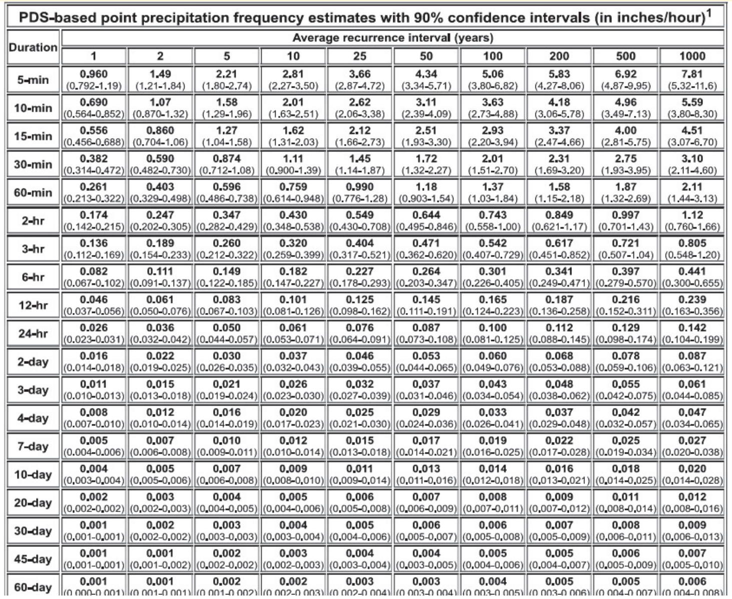
Velocity = Nearly bare and untilled; and alluvial fans

Source: NRCS National Engineering Handbook

Figure 15–4 Velocity versus slope for shallow concentrated flow



Source: NOAA



PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	**Average recurrence interval (years)**									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.960** (0.792-1.19)	**1.49** (1.21-1.84)	**2.21** (1.80-2.74)	**2.81** (2.27-3.50)	**3.66** (2.87-4.72)	**4.34** (3.34-5.71)	**5.06** (3.80-6.82)	**5.83** (4.27-8.06)	**6.92** (4.87-9.95)	**7.81** (5.32-11.6)
10-min	**0.690** (0.564-0.852)	**1.07** (0.870-1.32)	**1.58** (1.29-1.96)	**2.01** (1.63-2.51)	**2.62** (2.06-3.38)	**3.11** (2.39-4.09)	**3.63** (2.73-4.88)	**4.18** (3.06-5.78)	**4.96** (3.49-7.13)	**5.59** (3.80-8.30)
15-min	**0.556** (0.456-0.688)	**0.860** (0.704-1.06)	**1.27** (1.04-1.58)	**1.62** (1.31-2.03)	**2.12** (1.66-2.73)	**2.51** (1.93-3.30)	**2.93** (2.20-3.94)	**3.37** (2.47-4.66)	**4.00** (2.81-5.75)	**4.51** (3.07-6.70)
30-min	**0.382** (0.314-0.472)	**0.590** (0.482-0.730)	**0.874** (0.712-1.08)	**1.11** (0.900-1.39)	**1.45** (1.14-1.87)	**1.72** (1.32-2.27)	**2.01** (1.51-2.70)	**2.31** (1.69-3.20)	**2.75** (1.93-3.95)	**3.10** (2.11-4.60)
60-min	**0.261** (0.213-0.322)	**0.403** (0.329-0.498)	**0.596** (0.486-0.738)	**0.759** (0.614-0.948)	**0.990** (0.776-1.28)	**1.18** (0.903-1.54)	**1.37** (1.03-1.84)	**1.58** (1.15-2.18)	**1.87** (1.32-2.69)	**2.11** (1.44-3.13)
2-hr	**0.174** (0.142-0.215)	**0.247** (0.202-0.305)	**0.347** (0.282-0.429)	**0.430** (0.348-0.538)	**0.549** (0.430-0.708)	**0.644** (0.495-0.846)	**0.743** (0.558-1.00)	**0.849** (0.621-1.17)	**0.997** (0.701-1.43)	**1.12** (0.760-1.66)
3-hr	**0.136** (0.112-0.169)	**0.189** (0.154-0.233)	**0.260** (0.212-0.322)	**0.320** (0.259-0.399)	**0.404** (0.317-0.521)	**0.471** (0.362-0.620)	**0.542** (0.407-0.729)	**0.617** (0.451-0.852)	**0.721** (0.507-1.04)	**0.805** (0.548-1.20)
6-hr	**0.082** (0.067-0.102)	**0.111** (0.091-0.137)	**0.149** (0.122-0.185)	**0.182** (0.147-0.227)	**0.227** (0.178-0.293)	**0.264** (0.203-0.347)	**0.301** (0.226-0.405)	**0.341** (0.249-0.471)	**0.397** (0.279-0.570)	**0.441** (0.300-0.655)
12-hr	**0.046** (0.037-0.056)	**0.061** (0.050-0.076)	**0.083** (0.067-0.103)	**0.101** (0.081-0.126)	**0.125** (0.098-0.162)	**0.145** (0.111-0.191)	**0.165** (0.124-0.223)	**0.187** (0.136-0.258)	**0.216** (0.152-0.311)	**0.239** (0.163-0.356)
24-hr	**0.026** (0.023-0.031)	**0.036** (0.032-0.042)	**0.050** (0.044-0.057)	**0.061** (0.053-0.071)	**0.076** (0.064-0.091)	**0.087** (0.073-0.108)	**0.100** (0.081-0.125)	**0.112** (0.088-0.145)	**0.129** (0.098-0.174)	**0.142** (0.104-0.199)
2-day	**0.016** (0.014-0.018)	**0.022** (0.019-0.025)	**0.030** (0.026-0.035)	**0.037** (0.032-0.043)	**0.046** (0.039-0.055)	**0.053** (0.044-0.065)	**0.060** (0.049-0.076)	**0.068** (0.053-0.088)	**0.078** (0.059-0.106)	**0.087** (0.063-0.121)
3-day	**0.011** (0.010-0.013)	**0.015** (0.013-0.018)	**0.021** (0.019-0.024)	**0.026** (0.023-0.030)	**0.032** (0.027-0.039)	**0.037** (0.031-0.046)	**0.043** (0.034-0.054)	**0.048** (0.038-0.062)	**0.055** (0.042-0.075)	**0.061** (0.044-0.085)
4-day	**0.008** (0.007-0.010)	**0.012** (0.010-0.014)	**0.016** (0.014-0.019)	**0.020** (0.017-0.023)	**0.025** (0.021-0.030)	**0.029** (0.024-0.036)	**0.033** (0.026-0.041)	**0.037** (0.029-0.048)	**0.042** (0.032-0.057)	**0.047** (0.034-0.065)
7-day	**0.005** (0.004-0.006)	**0.007** (0.006-0.008)	**0.010** (0.009-0.011)	**0.012** (0.010-0.014)	**0.015** (0.013-0.018)	**0.017** (0.014-0.021)	**0.019** (0.016-0.025)	**0.022** (0.017-0.028)	**0.025** (0.019-0.034)	**0.027** (0.020-0.038)
10-day	**0.004** (0.003-0.004)	**0.005** (0.005-0.006)	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.011** (0.009-0.014)	**0.013** (0.011-0.016)	**0.014** (0.012-0.018)	**0.016** (0.013-0.021)	**0.018** (0.014-0.025)	**0.020** (0.014-0.028)
20-day	**0.002** (0.002-0.002)	**0.003** (0.002-0.003)	**0.004** (0.004-0.005)	**0.005** (0.004-0.006)	**0.006** (0.005-0.008)	**0.007** (0.006-0.009)	**0.008** (0.007-0.011)	**0.009** (0.007-0.012)	**0.011** (0.008-0.014)	**0.012** (0.008-0.016)
30-day	**0.001** (0.001-0.001)	**0.002** (0.002-0.002)	**0.003** (0.003-0.003)	**0.004** (0.003-0.004)	**0.005** (0.004-0.006)	**0.006** (0.005-0.007)	**0.006** (0.005-0.008)	**0.007** (0.005-0.009)	**0.008** (0.006-0.011)	**0.009** (0.006-0.013)
45-day	**0.001** (0.001-0.001)	**0.001** (0.001-0.002)	**0.002** (0.002-0.002)	**0.003** (0.002-0.003)	**0.004** (0.003-0.004)	**0.004** (0.003-0.005)	**0.005** (0.004-0.006)	**0.005** (0.004-0.007)	**0.006** (0.005-0.009)	**0.007** (0.005-0.010)
60-day	**0.001** (0.000-0.001)	**0.001** (0.001-0.001)	**0.002** (0.001-0.002)	**0.002** (0.002-0.003)	**0.003** (0.002-0.004)	**0.003** (0.003-0.004)	**0.004** (0.003-0.005)	**0.005** (0.003-0.006)	**0.005** (0.004-0.007)	**0.006** (0.004-0.008)

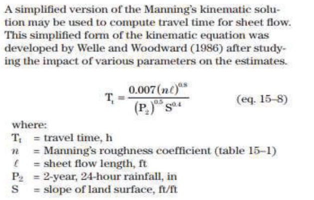
ONSITE RATIONAL METHOD - POST DEV

Rational Method

				Sheet Flow						*Shallow Concentrated Flow*						*Time of Concentration*				*Post-Development Composite C*				
Basin	**Area (SF)**	**Area (AC)**	**Area (SQ MI)**	**U/S Elev**	**D/S Elev**	**Flow Length (ft)**	**Slope (ft/ft)**	**Manning's n**	**Travel Time (hr)**	**U/S Elev**	**D/S Elev**	**Flow Length (ft)**	**Slope (ft/ft)**	**Velocity (ft/s)**	**Travel Time (hr)**	**Total Travel Time (TOC, hr)**	**Total Travel Time (TOC, min)**	**Lag Time (min)**	**Intensity Duration Used (min)**	**C**	**10-yr Intensity (in/hr)**	**10-yr Peak Flow (cfs)**	**100-yr Intensity (in/hr)**	**100-yr Peak Flow (cfs)**
ON-A	319095	7.33	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ON-B	1291130	29.64	0.046	1948	1947	260	0.004	0.011	0.159	1947	1943	1641	0.002	0.7	0.651	0.81	48.6	29.2	30	0.15	1.11	5.0	2.01	9.0
ON-C	1571657	36.08	0.056	1955	1948	172	0.041	0.011	0.045	1948	1947	2063	0.000485	1.45	0.395	0.44	26.4	15.8	15	0.61	1.62	35.5	2.93	64.2
ON-D	539539	12.39	0.019	1948	1945	195	0.015	0.011	0.073	1945	1941	1548	0.002584	0.7	0.614	0.69	41.2	24.7	30	0.17	1.11	2.3	2.01	4.1

2-yr, 24 hr rainfall	0.886	in

Source: NRCS National Engineering Handbook



A simplified version of the Manning's kinematic solution may be used to compute travel time for sheet flow. This simplified form of the kinematic equation was developed by Welle and Woodward (1986) after studying the impact of various parameters on the estimates.

$$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5} S^{0.4}} \qquad \text{(eq. 15–8)}$$

where:

T_t = travel time, h
n = Manning's roughness coefficient (table 15–1)
ℓ = sheet flow length, ft
P_2 = 2-year, 24-hour rainfall, in
S = slope of land surface, ft/ft

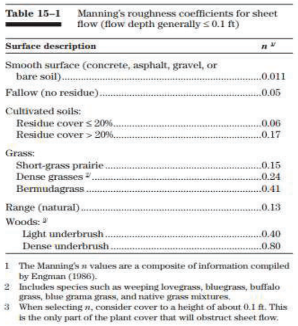


Table 15–1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

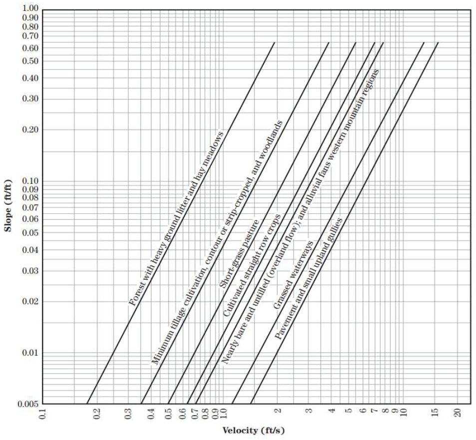
Surface description	***n*** [1]
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

1 The Manning's *n* values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting *n*, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

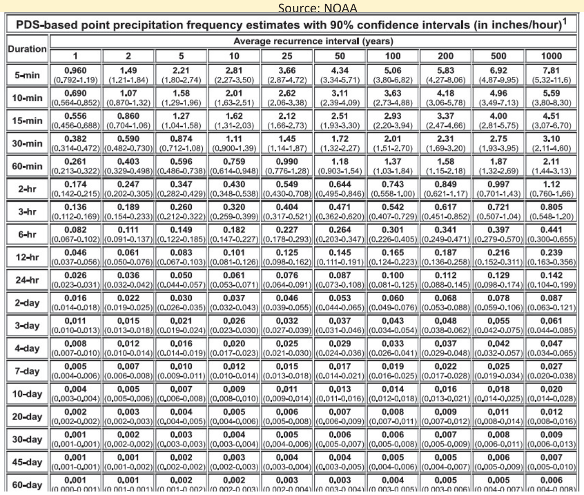
Shallow concentrated flow
Velocity ON-A, ON-B, ON-D = Nearly bare and untilled; and alluvial fans
Velocity ON-C = Pavement and small upland gullies

Source: NRCS National Engineering Handbook

Figure 15–4 Velocity versus slope for shallow concentrated flow



Source: NOAA



PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.960 (0.792-1.19)	1.49 (1.21-1.84)	2.21 (1.80-2.74)	2.81 (2.27-3.50)	3.66 (2.87-4.72)	4.34 (3.34-5.71)	5.06 (3.80-6.82)	5.83 (4.27-8.06)	6.92 (4.87-9.95)	7.81 (5.32-11.6)
10-min	0.690 (0.564-0.852)	1.07 (0.870-1.32)	1.58 (1.29-1.96)	2.01 (1.63-2.51)	2.62 (2.06-3.38)	3.11 (2.39-4.09)	3.63 (2.73-4.88)	4.18 (3.06-5.78)	4.96 (3.49-7.13)	5.59 (3.80-8.30)
15-min	0.556 (0.456-0.688)	0.860 (0.704-1.06)	1.27 (1.04-1.58)	1.62 (1.31-2.03)	2.12 (1.66-2.73)	2.51 (1.93-3.30)	2.93 (2.20-3.94)	3.37 (2.47-4.66)	4.00 (2.81-5.75)	4.51 (3.07-6.70)
30-min	0.382 (0.314-0.472)	0.590 (0.482-0.730)	0.874 (0.712-1.08)	1.11 (0.900-1.39)	1.45 (1.14-1.87)	1.72 (1.32-2.27)	2.01 (1.51-2.70)	2.31 (1.69-3.20)	2.75 (1.93-3.95)	3.10 (2.11-4.60)
60-min	0.261 (0.213-0.322)	0.403 (0.329-0.498)	0.596 (0.486-0.738)	0.759 (0.614-0.948)	0.990 (0.776-1.28)	1.18 (0.903-1.54)	1.37 (1.03-1.84)	1.58 (1.15-2.18)	1.87 (1.32-2.69)	2.11 (1.44-3.13)
2-hr	0.174 (0.142-0.215)	0.247 (0.202-0.305)	0.347 (0.282-0.429)	0.430 (0.348-0.538)	0.549 (0.430-0.708)	0.644 (0.495-0.846)	0.743 (0.558-1.00)	0.849 (0.621-1.17)	0.997 (0.701-1.43)	1.12 (0.760-1.66)
3-hr	0.136 (0.112-0.169)	0.189 (0.154-0.233)	0.260 (0.212-0.322)	0.320 (0.259-0.399)	0.404 (0.317-0.521)	0.471 (0.362-0.620)	0.542 (0.407-0.729)	0.617 (0.451-0.852)	0.721 (0.507-1.04)	0.805 (0.548-1.20)
6-hr	0.082 (0.067-0.102)	0.111 (0.091-0.137)	0.149 (0.122-0.185)	0.182 (0.147-0.227)	0.227 (0.178-0.293)	0.264 (0.203-0.347)	0.301 (0.226-0.405)	0.341 (0.249-0.471)	0.397 (0.279-0.570)	0.441 (0.300-0.655)
12-hr	0.046 (0.037-0.056)	0.061 (0.050-0.076)	0.083 (0.067-0.103)	0.101 (0.081-0.126)	0.125 (0.098-0.162)	0.145 (0.111-0.191)	0.165 (0.124-0.223)	0.187 (0.136-0.258)	0.216 (0.152-0.311)	0.239 (0.163-0.356)
24-hr	0.026 (0.023-0.031)	0.036 (0.032-0.042)	0.050 (0.044-0.057)	0.061 (0.053-0.071)	0.076 (0.064-0.091)	0.087 (0.073-0.108)	0.100 (0.081-0.125)	0.112 (0.088-0.145)	0.129 (0.098-0.174)	0.142 (0.104-0.199)
2-day	0.016 (0.014-0.018)	0.022 (0.019-0.025)	0.030 (0.026-0.035)	0.037 (0.032-0.043)	0.046 (0.039-0.055)	0.053 (0.044-0.065)	0.060 (0.049-0.076)	0.068 (0.053-0.088)	0.078 (0.059-0.106)	0.087 (0.063-0.121)
3-day	0.011 (0.010-0.013)	0.015 (0.013-0.018)	0.021 (0.019-0.024)	0.026 (0.023-0.030)	0.032 (0.027-0.039)	0.037 (0.031-0.046)	0.043 (0.034-0.054)	0.048 (0.038-0.062)	0.055 (0.042-0.075)	0.061 (0.044-0.085)
4-day	0.008 (0.007-0.010)	0.012 (0.010-0.014)	0.016 (0.014-0.019)	0.020 (0.017-0.023)	0.025 (0.021-0.030)	0.029 (0.024-0.036)	0.033 (0.026-0.041)	0.037 (0.029-0.048)	0.042 (0.032-0.057)	0.047 (0.034-0.065)
7-day	0.005 (0.004-0.006)	0.007 (0.006-0.008)	0.010 (0.009-0.011)	0.012 (0.010-0.014)	0.015 (0.013-0.018)	0.017 (0.014-0.021)	0.019 (0.016-0.025)	0.022 (0.017-0.028)	0.025 (0.019-0.034)	0.027 (0.020-0.038)
10-day	0.004 (0.003-0.004)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.011 (0.009-0.014)	0.013 (0.011-0.016)	0.014 (0.012-0.018)	0.016 (0.013-0.021)	0.018 (0.014-0.025)	0.020 (0.014-0.028)
20-day	0.002 (0.002-0.002)	0.003 (0.002-0.003)	0.004 (0.004-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.008)	0.007 (0.006-0.009)	0.008 (0.007-0.011)	0.009 (0.007-0.012)	0.011 (0.008-0.014)	0.012 (0.008-0.016)
30-day	0.001 (0.001-0.001)	0.002 (0.002-0.002)	0.003 (0.003-0.003)	0.004 (0.003-0.004)	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.006 (0.005-0.008)	0.007 (0.005-0.009)	0.008 (0.006-0.011)	0.009 (0.006-0.013)
45-day	0.001 (0.001-0.001)	0.001 (0.001-0.002)	0.002 (0.002-0.002)	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.004 (0.003-0.005)	0.005 (0.004-0.006)	0.005 (0.004-0.007)	0.006 (0.005-0.009)	0.007 (0.005-0.010)
60-day	0.001 (0.000-0.001)	0.001 (0.001-0.001)	0.002 (0.001-0.002)	0.002 (0.002-0.003)	0.003 (0.002-0.004)	0.003 (0.003-0.004)	0.004 (0.003-0.005)	0.005 (0.003-0.006)	0.005 (0.004-0.007)	0.006 (0.004-0.008)

VOL ONSITE CN - PREDEV

				100-yr Runoff Vol.		10-yr Runoff Vol.	
Basin	**Area (SF)**	**Area (AC)**	**Area (SQ MI)**	**Runoff vol. (ac-ft)**	**Runoff vol. (CF)**	**Runoff vol. (ac-ft)**	**Runoff vol. (CF)**
ON-A	319095	7.33	0.011	-	-	-	-
ON-B	1291130	29.64	0.046	0.00057	24.8	0.00000	0.0
ON-C	1571657	36.08	0.056	0.00069	30.2	0.00000	0.0
ON-D	539539	12.39	0.019	0.00024	10.4	0.00000	0.0

Total Drainage Area

CAD area 3402326 SF ON-B, ON-C, ON-D
78.1 AC
0.12 SQ. MI.

use soil group C for hilly area on west side of watershed
use B for low lying areas
Use HEC-HMS

Curve Number Method (100-yr, each basin)

CN, assume Soil Group A,
desert shrub cover 46.0
Storage, S 11.74
Initial Abstraction, IA 2.35

100-yr, 24-hr Rainfall Depth, P 2.40 IN

Runoff, Q 0.00023 IN
Runoff Vol. 0.0015 AC-FT for ON-B, ON-C, ON-D basins combined

Runoff, Q 0.00023 IN

Curve Number Method (10-yr, each basin)

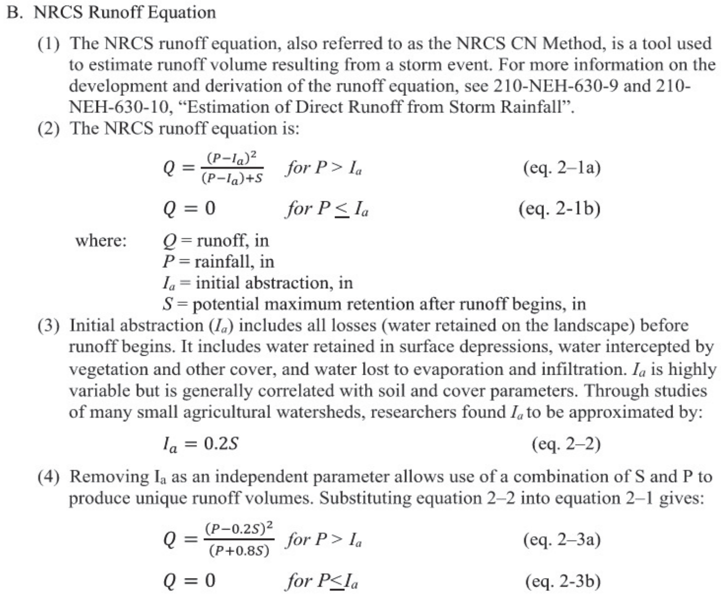
CN, assume Soil Group A,
desert shrub cover 46.0
Storage, S 11.74
Initial Abstraction, IA 2.35

10-yr, 24-hr Rainfall Depth, P 1.47 IN

Runoff, Q 0.00000 IN
Runoff Vol. 0.0000 AC-FT for ON-B, ON-C, ON-D basins combined

Runoff, Q 0.07095 IN

Source: NRCS National Engineering Handbook



B. NRCS Runoff Equation

(1) The NRCS runoff equation, also referred to as the NRCS CN Method, is a tool used to estimate runoff volume resulting from a storm event. For more information on the development and derivation of the runoff equation, see 210-NEH-630-9 and 210-NEH-630-10, "Estimation of Direct Runoff from Storm Rainfall".

(2) The NRCS runoff equation is:

$$Q = \frac{(P-I_a)^2}{(P-I_a)+S} \quad for\ P > I_a \qquad \text{(eq. 2–1a)}$$

$$Q = 0 \quad for\ P \leq I_a \qquad \text{(eq. 2-1b)}$$

where:
Q = runoff, in
P = rainfall, in
I_a = initial abstraction, in
S = potential maximum retention after runoff begins, in

(3) Initial abstraction (I_a) includes all losses (water retained on the landscape) before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation and other cover, and water lost to evaporation and infiltration. I_a is highly variable but is generally correlated with soil and cover parameters. Through studies of many small agricultural watersheds, researchers found I_a to be approximated by:

$$I_a = 0.2S \qquad \text{(eq. 2–2)}$$

(4) Removing I_a as an independent parameter allows use of a combination of S and P to produce unique runoff volumes. Substituting equation 2–2 into equation 2–1 gives:

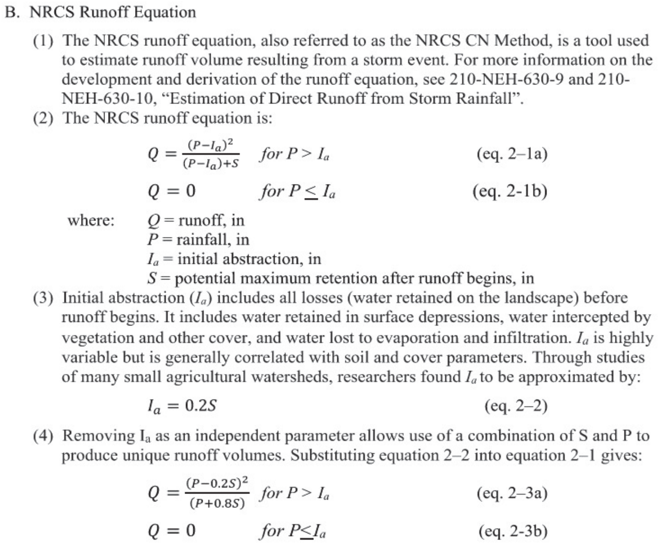
$$Q = \frac{(P-0.2S)^2}{(P+0.8S)} \quad for\ P > I_a \qquad \text{(eq. 2–3a)}$$

$$Q = 0 \quad for\ P \leq I_a \qquad \text{(eq. 2-3b)}$$

VOL ONSITE CN - POSTDEV

				Lag Time			*Rainfall*		*Post-Development CN Method (AMC 2)*			*10-year Runoff (AMC 2)*			*100-year Runoff (AMC 2)*		
Basin	**Area (SF)**	**Area (AC)**	**Area (SQ MI)**	**Total Travel Time (TOC, hr)**	**Total Travel Time (TOC, min)**	**Lag Time (min)**	**10-yr, 24-hr**	**100-yr, 24-hr**	**Post-Dev CN (AMC 2)**	**Storage, S**	**Initial Abstraction, IA**	**Runoff, Q (in)**	**Runoff vol. (cf)**	**Runoff vol. (ac-ft)**	**Runoff, Q (in)**	**Runoff vol. (cf)**	**Runoff vol. (ac-ft)**
ON-A	319095	7.33	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ON-B	1291130	29.64	0.046	0.81	48.63	29.2	1.47	2.40	48.8	10.5	2.10	0.000	0.0	0.0	0.009	919.6	0.0
ON-C	1571657	36.08	0.056	0.44	26.39	15.8	1.47	2.40	73.9	3.5	0.71	0.135	17735.7	0.4	0.548	71795.0	1.6
ON-D	539539	12.39	0.019	0.69	41.22	24.7	1.47	2.40	49.6	10.2	2.03	0.000	0.0	0.0	0.013	574.0	0.0

Source: NRCS National Engineering Handbook



B. NRCS Runoff Equation

(1) The NRCS runoff equation, also referred to as the NRCS CN Method, is a tool used to estimate runoff volume resulting from a storm event. For more information on the development and derivation of the runoff equation, see 210-NEH-630-9 and 210-NEH-630-10, “Estimation of Direct Runoff from Storm Rainfall”.

(2) The NRCS runoff equation is:

$$Q = \frac{(P-I_a)^2}{(P-I_a)+S} \quad \text{for } P > I_a \qquad \text{(eq. 2–1a)}$$

$$Q = 0 \quad \text{for } P \leq I_a \qquad \text{(eq. 2-1b)}$$

where:
Q = runoff, in
P = rainfall, in
I_a = initial abstraction, in
S = potential maximum retention after runoff begins, in

(3) Initial abstraction (I_a) includes all losses (water retained on the landscape) before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation and other cover, and water lost to evaporation and infiltration. I_a is highly variable but is generally correlated with soil and cover parameters. Through studies of many small agricultural watersheds, researchers found I_a to be approximated by:

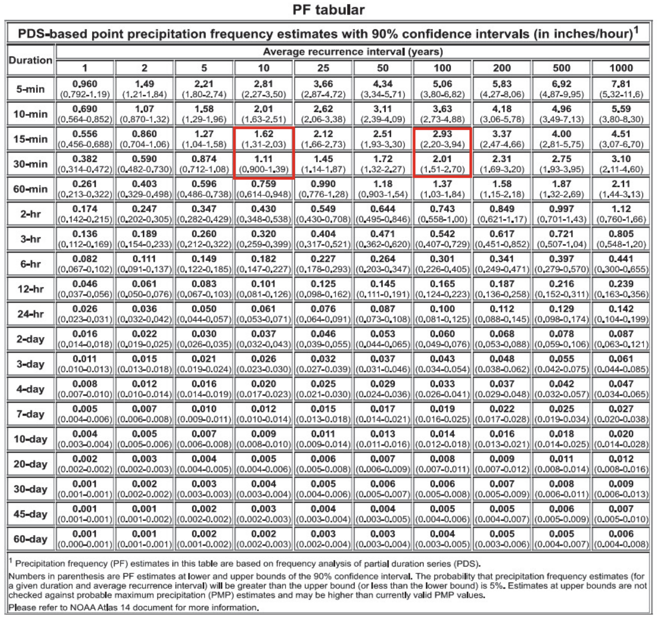
$$I_a = 0.2S \qquad \text{(eq. 2–2)}$$

(4) Removing I_a as an independent parameter allows use of a combination of S and P to produce unique runoff volumes. Substituting equation 2–2 into equation 2–1 gives:

$$Q = \frac{(P-0.2S)^2}{(P+0.8S)} \quad \text{for } P > I_a \qquad \text{(eq. 2–3a)}$$

$$Q = 0 \quad \text{for } P \leq I_a \qquad \text{(eq. 2-3b)}$$

POINT PRECIPIATION FREQUENCY ESTIMATES (INCHES)
NOAA Atlas 14 Volume 6 Version 2
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Location na California USA
Station Name: -
Latitude: 34.8977 Degree
Longitude: -116.8483 Degree
Elevation (USGS): 1948 ft
Date/time (GMT): Mon Jun 2 17:27:55 2025



PF tabular

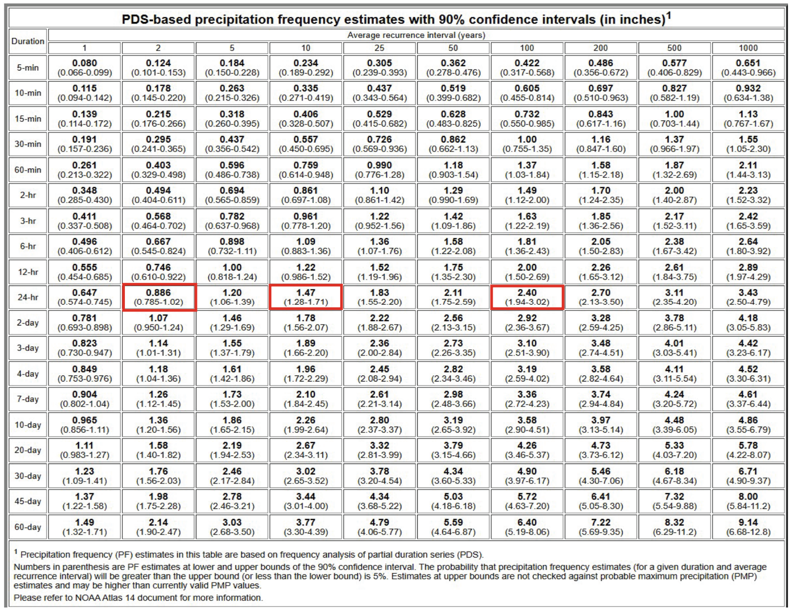
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.960 (0.792-1.19)	1.49 (1.21-1.84)	2.21 (1.80-2.74)	2.81 (2.27-3.50)	3.66 (2.87-4.72)	4.34 (3.34-5.71)	5.06 (3.80-6.82)	5.83 (4.27-8.06)	6.92 (4.87-9.95)	7.81 (5.32-11.6)
10-min	0.690 (0.564-0.852)	1.07 (0.870-1.32)	1.58 (1.29-1.96)	2.01 (1.63-2.51)	2.62 (2.06-3.38)	3.11 (2.39-4.09)	3.63 (2.73-4.88)	4.18 (3.06-5.78)	4.96 (3.49-7.13)	5.59 (3.80-8.30)
15-min	0.556 (0.456-0.688)	0.860 (0.704-1.06)	1.27 (1.04-1.58)	1.62 (1.31-2.03)	2.12 (1.66-2.73)	2.51 (1.93-3.30)	2.93 (2.20-3.94)	3.37 (2.47-4.66)	4.00 (2.81-5.75)	4.51 (3.07-6.70)
30-min	0.382 (0.314-0.472)	0.590 (0.482-0.730)	0.874 (0.712-1.08)	1.11 (0.900-1.39)	1.45 (1.14-1.87)	1.72 (1.32-2.27)	2.01 (1.51-2.70)	2.31 (1.69-3.20)	2.75 (1.93-3.95)	3.10 (2.11-4.60)
60-min	0.261 (0.213-0.322)	0.403 (0.329-0.498)	0.596 (0.486-0.738)	0.759 (0.614-0.948)	0.990 (0.776-1.28)	1.18 (0.903-1.54)	1.37 (1.03-1.84)	1.58 (1.15-2.18)	1.87 (1.32-2.69)	2.11 (1.44-3.13)
2-hr	0.174 (0.142-0.215)	0.247 (0.202-0.305)	0.347 (0.282-0.429)	0.430 (0.348-0.538)	0.549 (0.430-0.708)	0.644 (0.495-0.846)	0.743 (0.558-1.00)	0.849 (0.621-1.17)	0.997 (0.701-1.43)	1.12 (0.760-1.66)
3-hr	0.136 (0.112-0.169)	0.189 (0.154-0.233)	0.260 (0.212-0.322)	0.320 (0.259-0.399)	0.404 (0.317-0.521)	0.471 (0.362-0.620)	0.542 (0.407-0.729)	0.617 (0.451-0.852)	0.721 (0.507-1.04)	0.805 (0.548-1.20)
6-hr	0.082 (0.067-0.102)	0.111 (0.091-0.137)	0.149 (0.122-0.185)	0.182 (0.147-0.227)	0.227 (0.178-0.293)	0.264 (0.203-0.347)	0.301 (0.226-0.405)	0.341 (0.249-0.471)	0.397 (0.279-0.570)	0.441 (0.300-0.655)
12-hr	0.046 (0.037-0.056)	0.061 (0.050-0.076)	0.083 (0.067-0.103)	0.101 (0.081-0.126)	0.125 (0.098-0.162)	0.145 (0.111-0.191)	0.165 (0.124-0.223)	0.187 (0.136-0.258)	0.216 (0.152-0.311)	0.239 (0.163-0.356)
24-hr	0.026 (0.023-0.031)	0.036 (0.032-0.042)	0.050 (0.044-0.057)	0.061 (0.053-0.071)	0.076 (0.064-0.091)	0.087 (0.073-0.108)	0.100 (0.081-0.125)	0.112 (0.088-0.145)	0.129 (0.098-0.174)	0.142 (0.104-0.199)
2-day	0.016 (0.014-0.018)	0.022 (0.019-0.025)	0.030 (0.026-0.035)	0.037 (0.032-0.043)	0.046 (0.039-0.055)	0.053 (0.044-0.065)	0.060 (0.049-0.076)	0.068 (0.053-0.088)	0.078 (0.059-0.106)	0.087 (0.063-0.121)
3-day	0.011 (0.010-0.013)	0.015 (0.013-0.018)	0.021 (0.019-0.024)	0.026 (0.023-0.030)	0.032 (0.027-0.039)	0.037 (0.031-0.046)	0.043 (0.034-0.054)	0.048 (0.038-0.062)	0.055 (0.042-0.075)	0.061 (0.044-0.085)
4-day	0.008 (0.007-0.010)	0.012 (0.010-0.014)	0.016 (0.014-0.019)	0.020 (0.017-0.023)	0.025 (0.021-0.030)	0.029 (0.024-0.036)	0.033 (0.026-0.041)	0.037 (0.029-0.048)	0.042 (0.032-0.057)	0.047 (0.034-0.065)
7-day	0.005 (0.004-0.006)	0.007 (0.006-0.008)	0.010 (0.009-0.011)	0.012 (0.010-0.014)	0.015 (0.013-0.018)	0.017 (0.014-0.021)	0.019 (0.016-0.025)	0.022 (0.017-0.028)	0.025 (0.019-0.034)	0.027 (0.020-0.038)
10-day	0.004 (0.003-0.004)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.011 (0.009-0.014)	0.013 (0.011-0.016)	0.014 (0.012-0.018)	0.016 (0.013-0.021)	0.018 (0.014-0.025)	0.020 (0.014-0.028)
20-day	0.002 (0.002-0.002)	0.003 (0.002-0.003)	0.004 (0.004-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.008)	0.007 (0.006-0.009)	0.008 (0.007-0.011)	0.009 (0.007-0.012)	0.011 (0.008-0.014)	0.012 (0.008-0.016)
30-day	0.001 (0.001-0.001)	0.002 (0.002-0.002)	0.003 (0.003-0.003)	0.004 (0.003-0.004)	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.006 (0.005-0.008)	0.007 (0.005-0.009)	0.008 (0.006-0.011)	0.009 (0.006-0.013)
45-day	0.001 (0.001-0.001)	0.001 (0.001-0.002)	0.002 (0.002-0.002)	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.004 (0.003-0.005)	0.005 (0.004-0.006)	0.005 (0.004-0.007)	0.006 (0.005-0.009)	0.007 (0.005-0.010)
60-day	0.001 (0.000-0.001)	0.001 (0.001-0.001)	0.002 (0.001-0.002)	0.002 (0.002-0.003)	0.003 (0.002-0.004)	0.003 (0.003-0.004)	0.004 (0.003-0.005)	0.005 (0.003-0.006)	0.005 (0.004-0.007)	0.006 (0.004-0.008)

[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.



PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.080 (0.066-0.099)	0.124 (0.101-0.153)	0.184 (0.150-0.228)	0.234 (0.189-0.292)	0.305 (0.239-0.393)	0.362 (0.278-0.476)	0.422 (0.317-0.568)	0.486 (0.356-0.672)	0.577 (0.406-0.829)	0.651 (0.443-0.966)
10-min	0.115 (0.094-0.142)	0.178 (0.145-0.220)	0.263 (0.215-0.326)	0.335 (0.271-0.419)	0.437 (0.343-0.564)	0.519 (0.399-0.682)	0.605 (0.455-0.814)	0.697 (0.510-0.963)	0.827 (0.582-1.19)	0.932 (0.634-1.38)
15-min	0.139 (0.114-0.172)	0.215 (0.176-0.266)	0.318 (0.260-0.395)	0.406 (0.328-0.507)	0.529 (0.415-0.682)	0.628 (0.483-0.825)	0.732 (0.550-0.985)	0.843 (0.617-1.16)	1.00 (0.703-1.44)	1.13 (0.767-1.67)
30-min	0.191 (0.157-0.236)	0.295 (0.241-0.365)	0.437 (0.356-0.542)	0.557 (0.450-0.695)	0.726 (0.569-0.936)	0.862 (0.662-1.13)	1.00 (0.755-1.35)	1.16 (0.847-1.60)	1.37 (0.966-1.97)	1.55 (1.05-2.30)
60-min	0.261 (0.213-0.322)	0.403 (0.329-0.498)	0.596 (0.486-0.738)	0.759 (0.614-0.948)	0.990 (0.776-1.28)	1.18 (0.903-1.54)	1.37 (1.03-1.84)	1.58 (1.15-2.18)	1.87 (1.32-2.69)	2.11 (1.44-3.13)
2-hr	0.348 (0.285-0.430)	0.494 (0.404-0.611)	0.694 (0.565-0.859)	0.861 (0.697-1.08)	1.10 (0.861-1.42)	1.29 (0.990-1.69)	1.49 (1.12-2.00)	1.70 (1.24-2.35)	2.00 (1.40-2.87)	2.23 (1.52-3.32)
3-hr	0.411 (0.337-0.508)	0.568 (0.464-0.702)	0.782 (0.637-0.968)	0.961 (0.778-1.20)	1.22 (0.952-1.56)	1.42 (1.09-1.86)	1.63 (1.22-2.19)	1.85 (1.36-2.56)	2.17 (1.52-3.11)	2.42 (1.65-3.59)
6-hr	0.496 (0.406-0.612)	0.667 (0.545-0.824)	0.898 (0.732-1.11)	1.09 (0.883-1.36)	1.36 (1.07-1.76)	1.58 (1.22-2.08)	1.81 (1.36-2.43)	2.05 (1.50-2.83)	2.38 (1.67-3.42)	2.64 (1.80-3.92)
12-hr	0.555 (0.454-0.685)	0.746 (0.610-0.922)	1.00 (0.818-1.24)	1.22 (0.986-1.52)	1.52 (1.19-1.96)	1.75 (1.35-2.30)	2.00 (1.50-2.69)	2.26 (1.65-3.12)	2.61 (1.84-3.75)	2.89 (1.97-4.29)
24-hr	0.647 (0.574-0.745)	0.886 (0.785-1.02)	1.20 (1.06-1.39)	1.47 (1.28-1.71)	1.83 (1.55-2.20)	2.11 (1.75-2.59)	2.40 (1.94-3.02)	2.70 (2.13-3.50)	3.11 (2.35-4.20)	3.43 (2.50-4.79)
2-day	0.781 (0.693-0.898)	1.07 (0.950-1.24)	1.46 (1.29-1.69)	1.78 (1.56-2.07)	2.22 (1.88-2.67)	2.56 (2.13-3.15)	2.92 (2.36-3.67)	3.28 (2.59-4.25)	3.78 (2.86-5.11)	4.18 (3.05-5.83)
3-day	0.823 (0.730-0.947)	1.14 (1.01-1.31)	1.55 (1.37-1.79)	1.89 (1.66-2.20)	2.36 (2.00-2.84)	2.73 (2.26-3.35)	3.10 (2.51-3.90)	3.48 (2.74-4.51)	4.01 (3.03-5.41)	4.42 (3.23-6.17)
4-day	0.849 (0.753-0.976)	1.18 (1.04-1.36)	1.61 (1.42-1.86)	1.96 (1.72-2.29)	2.45 (2.08-2.94)	2.82 (2.34-3.46)	3.19 (2.59-4.02)	3.58 (2.82-4.64)	4.11 (3.11-5.54)	4.52 (3.30-6.31)
7-day	0.904 (0.802-1.04)	1.26 (1.12-1.45)	1.73 (1.53-2.00)	2.10 (1.84-2.45)	2.61 (2.21-3.14)	2.98 (2.48-3.66)	3.36 (2.72-4.23)	3.74 (2.94-4.84)	4.24 (3.20-5.72)	4.61 (3.37-6.44)
10-day	0.965 (0.856-1.11)	1.36 (1.20-1.56)	1.86 (1.65-2.15)	2.26 (1.99-2.64)	2.80 (2.37-3.37)	3.19 (2.65-3.92)	3.58 (2.90-4.51)	3.97 (3.13-5.14)	4.48 (3.39-6.05)	4.86 (3.55-6.79)
20-day	1.11 (0.983-1.27)	1.58 (1.40-1.82)	2.19 (1.94-2.53)	2.67 (2.34-3.11)	3.32 (2.81-3.99)	3.79 (3.15-4.66)	4.26 (3.46-5.37)	4.73 (3.73-6.12)	5.33 (4.03-7.20)	5.78 (4.22-8.07)
30-day	1.23 (1.09-1.41)	1.76 (1.56-2.03)	2.46 (2.17-2.84)	3.02 (2.65-3.52)	3.78 (3.20-4.54)	4.34 (3.60-5.33)	4.90 (3.97-6.17)	5.46 (4.30-7.06)	6.18 (4.67-8.34)	6.71 (4.90-9.37)
45-day	1.37 (1.22-1.58)	1.98 (1.75-2.28)	2.78 (2.46-3.21)	3.44 (3.01-4.00)	4.34 (3.68-5.22)	5.03 (4.18-6.18)	5.72 (4.63-7.20)	6.41 (5.05-8.30)	7.32 (5.54-9.88)	8.00 (5.84-11.2)
60-day	1.49 (1.32-1.71)	2.14 (1.90-2.47)	3.03 (2.68-3.50)	3.77 (3.30-4.39)	4.79 (4.06-5.77)	5.59 (4.64-6.87)	6.40 (5.19-8.06)	7.22 (5.69-9.35)	8.32 (6.29-11.2)	9.14 (6.68-12.8)

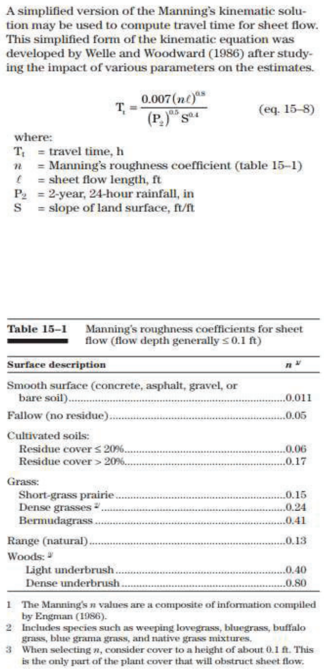
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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.

REFERENCES

Source: NRCS National Engineering Handbook



A simplified version of the Manning's kinematic solution may be used to compute travel time for sheet flow. This simplified form of the kinematic equation was developed by Welle and Woodward (1986) after studying the impact of various parameters on the estimates.

$$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5} S^{0.4}} \qquad \text{(eq. 15–8)}$$

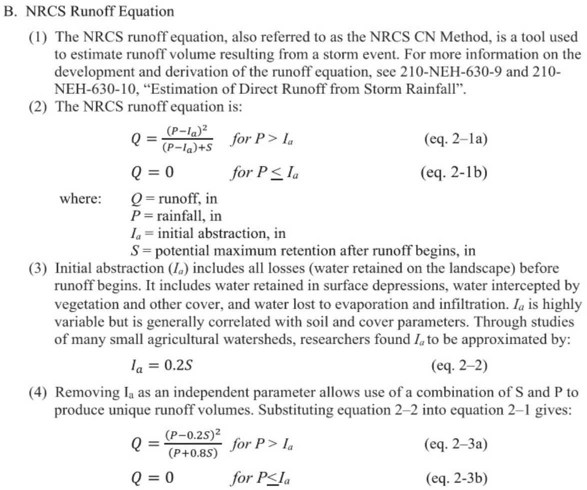
where:
T_t = travel time, h
n = Manning's roughness coefficient (table 15–1)
ℓ = sheet flow length, ft
P_2 = 2-year, 24-hour rainfall, in
S = slope of land surface, ft/ft

Table 15–1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	*n* [1]
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

1 The Manning's *n* values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting *n*, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Source: NRCS National Engineering Handbook



B. NRCS Runoff Equation

(1) The NRCS runoff equation, also referred to as the NRCS CN Method, is a tool used to estimate runoff volume resulting from a storm event. For more information on the development and derivation of the runoff equation, see 210-NEH-630-9 and 210-NEH-630-10, "Estimation of Direct Runoff from Storm Rainfall".

(2) The NRCS runoff equation is:

$$Q = \frac{(P-I_a)^2}{(P-I_a)+S} \quad for\ P > I_a \qquad \text{(eq. 2–1a)}$$

$$Q = 0 \qquad for\ P \leq I_a \qquad \text{(eq. 2-1b)}$$

where: Q = runoff, in
P = rainfall, in
I_a = initial abstraction, in
S = potential maximum retention after runoff begins, in

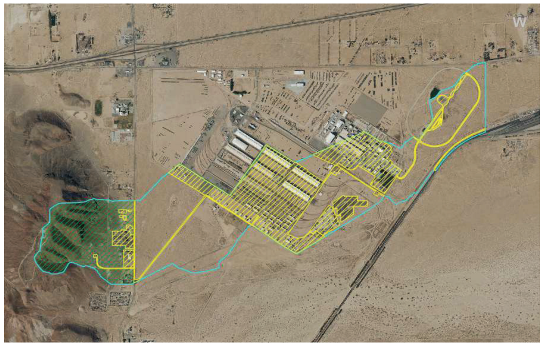
(3) Initial abstraction (I_a) includes all losses (water retained on the landscape) before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation and other cover, and water lost to evaporation and infiltration. I_a is highly variable but is generally correlated with soil and cover parameters. Through studies of many small agricultural watersheds, researchers found I_a to be approximated by:

$$I_a = 0.2S \qquad \text{(eq. 2–2)}$$

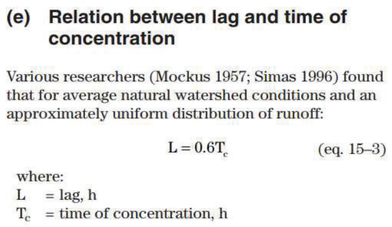
(4) Removing I_a as an independent parameter allows use of a combination of S and P to produce unique runoff volumes. Substituting equation 2–2 into equation 2–1 gives:

$$Q = \frac{(P-0.2S)^2}{(P+0.8S)} \quad for\ P > I_a \qquad \text{(eq. 2–3a)}$$

$$Q = 0 \qquad for\ P \leq I_a \qquad \text{(eq. 2-3b)}$$



Source: NRCS National Engineering Handbook



(e) Relation between lag and time of concentration

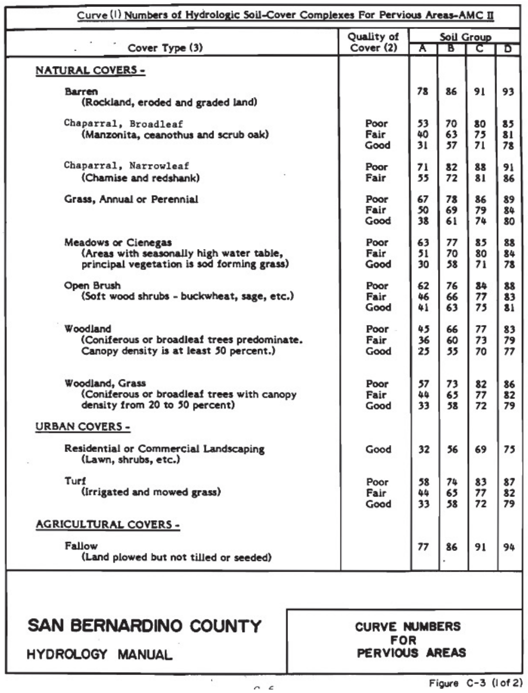
Various researchers (Mockus 1957; Simas 1996) found that for average natural watershed conditions and an approximately uniform distribution of runoff:

$$L = 0.6T_c \qquad \text{(eq. 15–3)}$$

where:
L = lag, h
T_c = time of concentration, h

REFERENCES

Source: San Bernardino County Hydrology Manual



Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

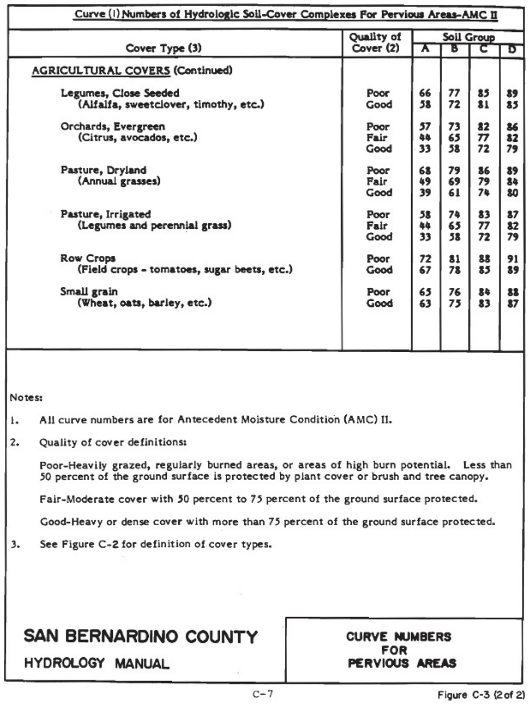
Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

Figure C-3 (1 of 2)



Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

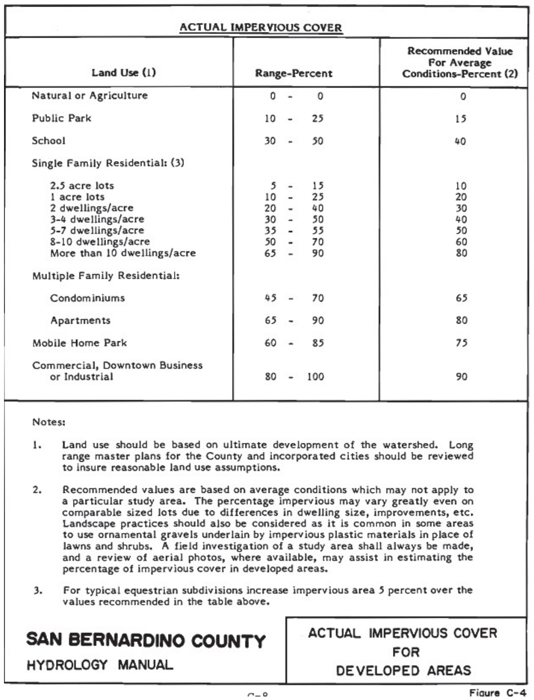
SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

C-7

Figure C-3 (2 of 2)



ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

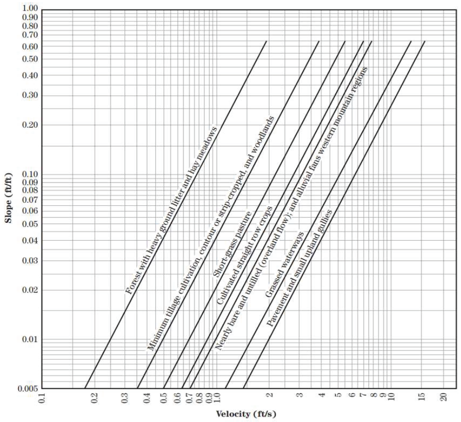
ACTUAL IMPERVIOUS COVER
FOR
DEVELOPED AREAS

Figure C-4

REFERENCES

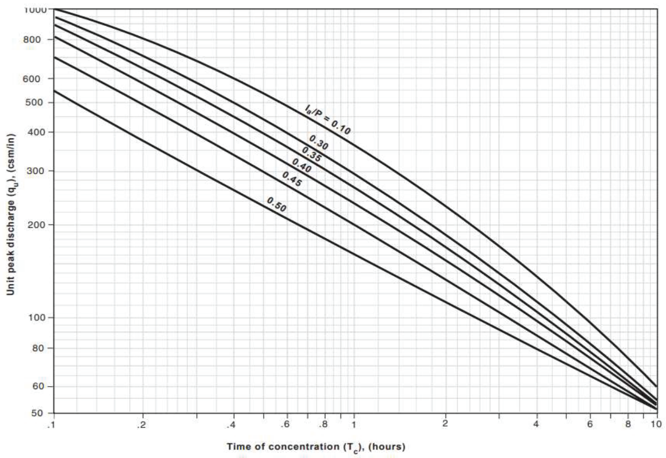
Source: NRCS National Engineering Handbook

Figure 15–4 Velocity versus slope for shallow concentrated flow

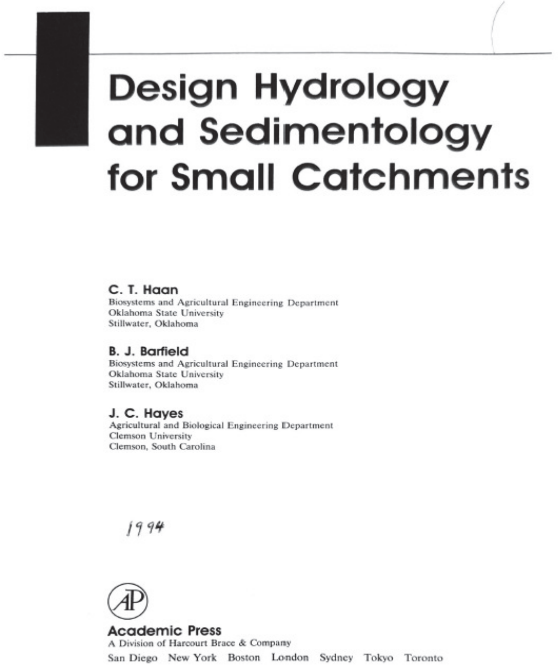


Source: NRCS National Engineering Handbook

Exhibit 4-II Unit peal discharge (q_u) for NRCS (SCS) type II rainfall distribution



Source: Design Hydrology and Sedimentology for Small Catchments, Haan, Barfield, Hayes



Design Hydrology and Sedimentology for Small Catchments

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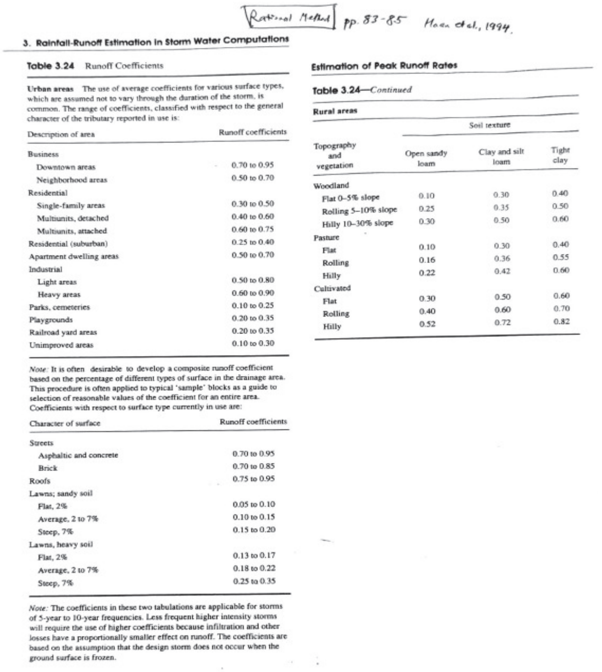
San Diego New York Boston London Sydney Tokyo Toronto



Rational Method pp. 83-85 Haan et al., 1994.

3. Rainfall-Runoff Estimation in Storm Water Computations

Table 3.24 Runoff Coefficients

Urban areas The use of average coefficients for various surface types, which are assumed not to vary through the duration of the storm, is common. The range of coefficients, classified with respect to the general character of the tributary reported in use is:

Description of area	Runoff coefficients
Business	
Downtown areas	0.70 to 0.95
Neighborhood areas	0.50 to 0.70
Residential	
Single-family areas	0.30 to 0.50
Multiunits, detached	0.40 to 0.60
Multiunits, attached	0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment dwelling areas	0.50 to 0.70
Industrial	
Light areas	0.50 to 0.80
Heavy areas	0.60 to 0.90
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad yard areas	0.20 to 0.35
Unimproved areas	0.10 to 0.30

Note: It is often desirable to develop a composite runoff coefficient based on the percentage of different types of surface in the drainage area. This procedure is often applied to typical 'sample' blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are:

Character of surface	Runoff coefficients
Streets	
Asphaltic and concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns; sandy soil	
Flat, 2%	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns, heavy soil	
Flat, 2%	0.13 to 0.17
Average, 2 to 7%	0.18 to 0.22
Steep, 7%	0.25 to 0.35

Note: The coefficients in these two tabulations are applicable for storms of 5-year to 10-year frequencies. Less frequent higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients are based on the assumption that the design storm does not occur when the ground surface is frozen.

Estimation of Peak Runoff Rates

Table 3.24—*Continued*

Rural areas

	Soil texture		
Topography and vegetation	Open sandy loam	Clay and silt loam	Tight clay
Woodland			
Flat 0–5% slope	0.10	0.30	0.40
Rolling 5–10% slope	0.25	0.35	0.50
Hilly 10–30% slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60
Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.82

Appendix C-2 HEC-HMS

Offsite and onsite basins are labeled in HEC HMS as Ex offsite basin and EX ON-1 through ON-4, respectively. In the report text, offsite and onsite basins are titled as OS-1 and ON-A through ON-D, respectively.

Project: Yermo

Simulation Run: Ex_Cond_24hr_10yr_SCS_Type2

Simulation Start: 31 July 2024, 24:00

Simulation End: 3 August 2024, 24:00

HMS Version: 4.13

Executed: 12 June 2025, 16:58

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Ex offsite basin	1.3
EX ON - 1	0.01
EX ON - 2	0.05
EX ON - 3	0.06
EX ON - 4	0.02

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Ex offsite basin	0	67.2	0.98
EX ON - 1	0	46	2.35
EX ON - 2	0	46	2.35
EX ON - 3	0	46	2.35
EX ON - 4	0	46	2.35

Transform: Scs

Element Name	Lag	Unitgraph Type
Ex offsite basin	114.1	Standard
EX ON - 1	18.9	Standard
EX ON - 2	18.7	Standard
EX ON - 3	19.1	Standard
EX ON - 4	24.7	Standard

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)

Ex offsite basin	1.3	3.69	01Aug2024, 16:35	0.04
EX ON - 1	0.01	0	31Jul2024, 24:00	0
EX ON - 2	0.05	0	31Jul2024, 24:00	0
EX ON - 3	0.06	0	31Jul2024, 24:00	0
EX ON - 4	0.02	0	31Jul2024, 24:00	0

Subbasin: Ex offsite basin

Area (MI2) : 1.3

Loss Rate: Scs

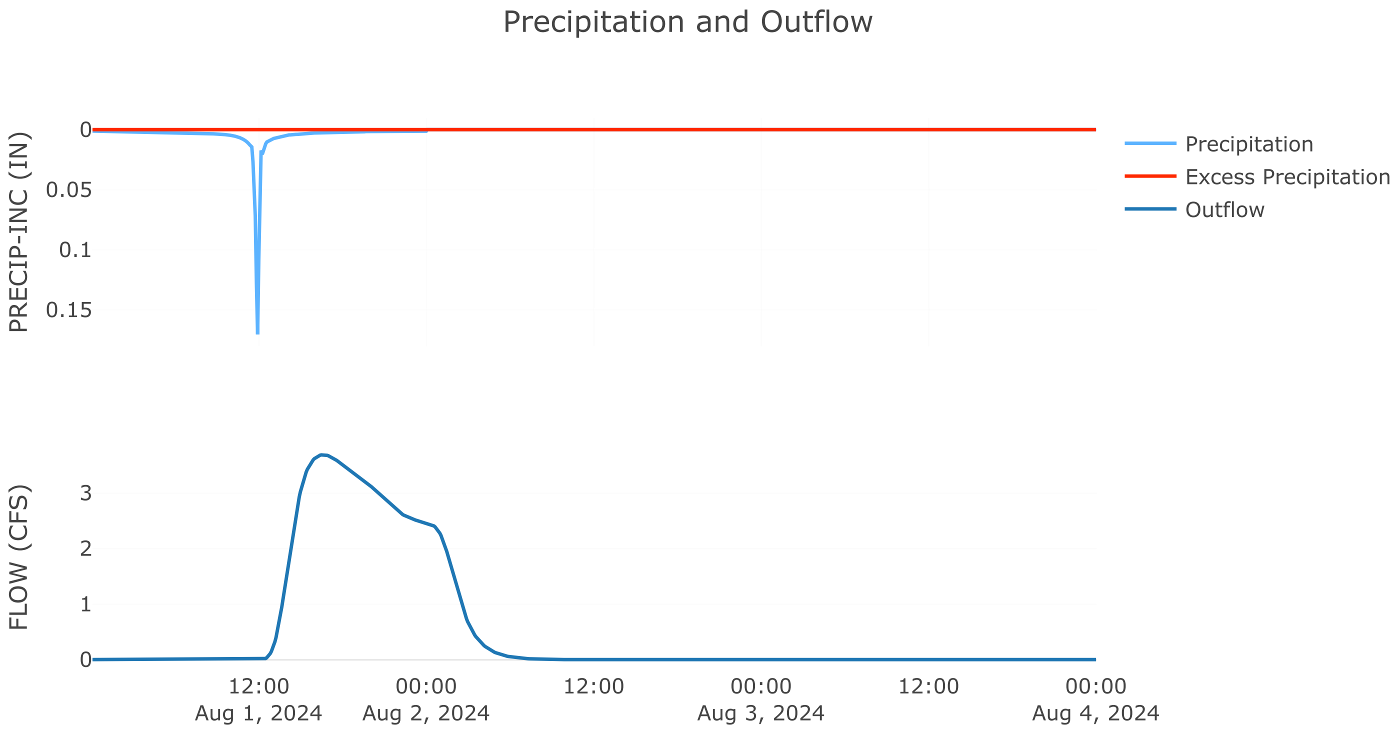
Percent Impervious Area	0
Curve Number	67.2
Initial Abstraction	0.98

Transform: Scs

Lag	114.1
Unitgraph Type	Standard

Results: Ex offsite basin

Peak Discharge (CFS)	3.69
Time of Peak Discharge	01Aug2024, 16:35
Volume (IN)	0.04
Precipitation Volume (AC - FT)	101.92
Loss Volume (AC - FT)	98.82
Excess Volume (AC - FT)	3.1
Direct Runoff Volume (AC - FT)	3.1
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
FLOW (CFS)
3
2
1
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024
Precipitation
Excess Precipitation
Outflow

Subbasin: EX ON-1

Area (MI2) : 0.01

Loss Rate: Scs

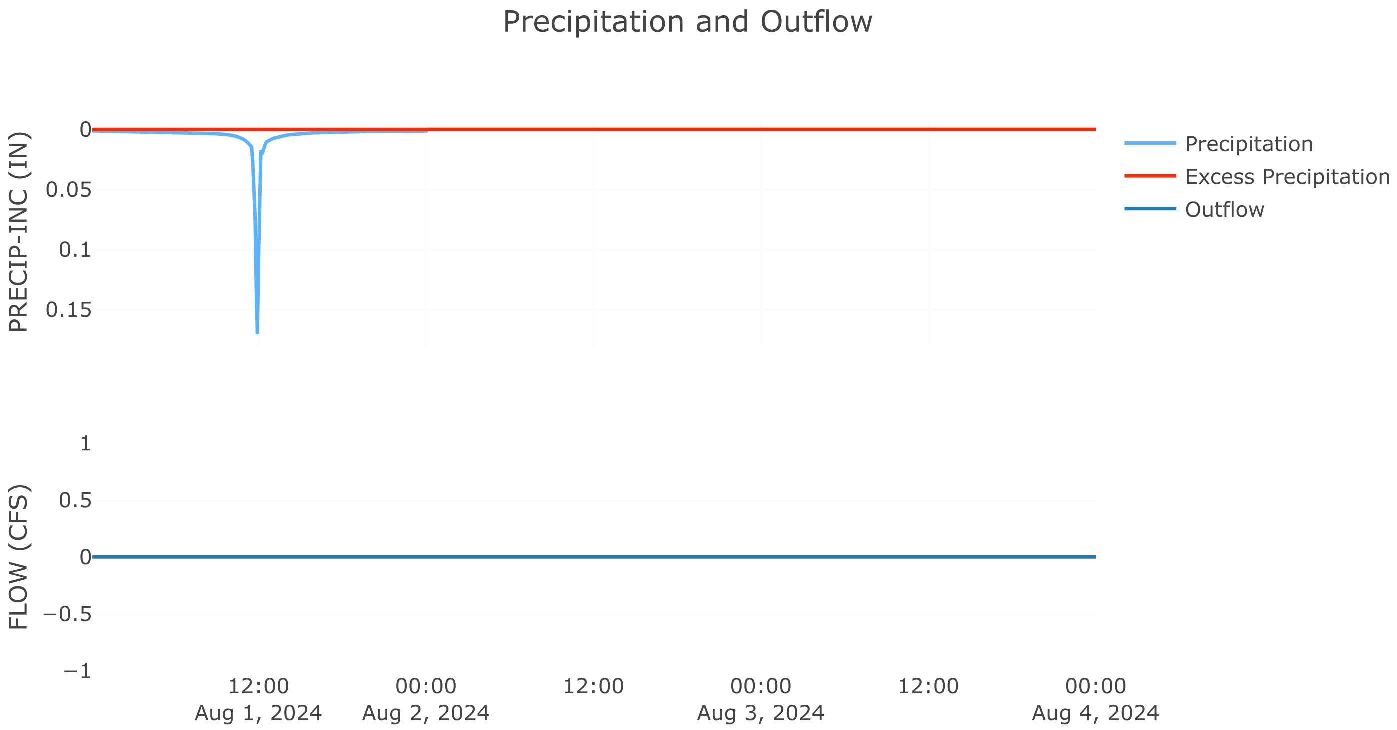
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	18.9
Unitgraph Type	Standard

Results: EX ON-1

Peak Discharge (CFS)	0
Time of Peak Discharge	31Jul2024, 24:00
Volume (IN)	0
Precipitation Volume (AC - FT)	0.86
Loss Volume (AC - FT)	0.86
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
1
0.5
0
−0.5
−1
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-2

Area (MI2) : 0.05

Loss Rate: Scs

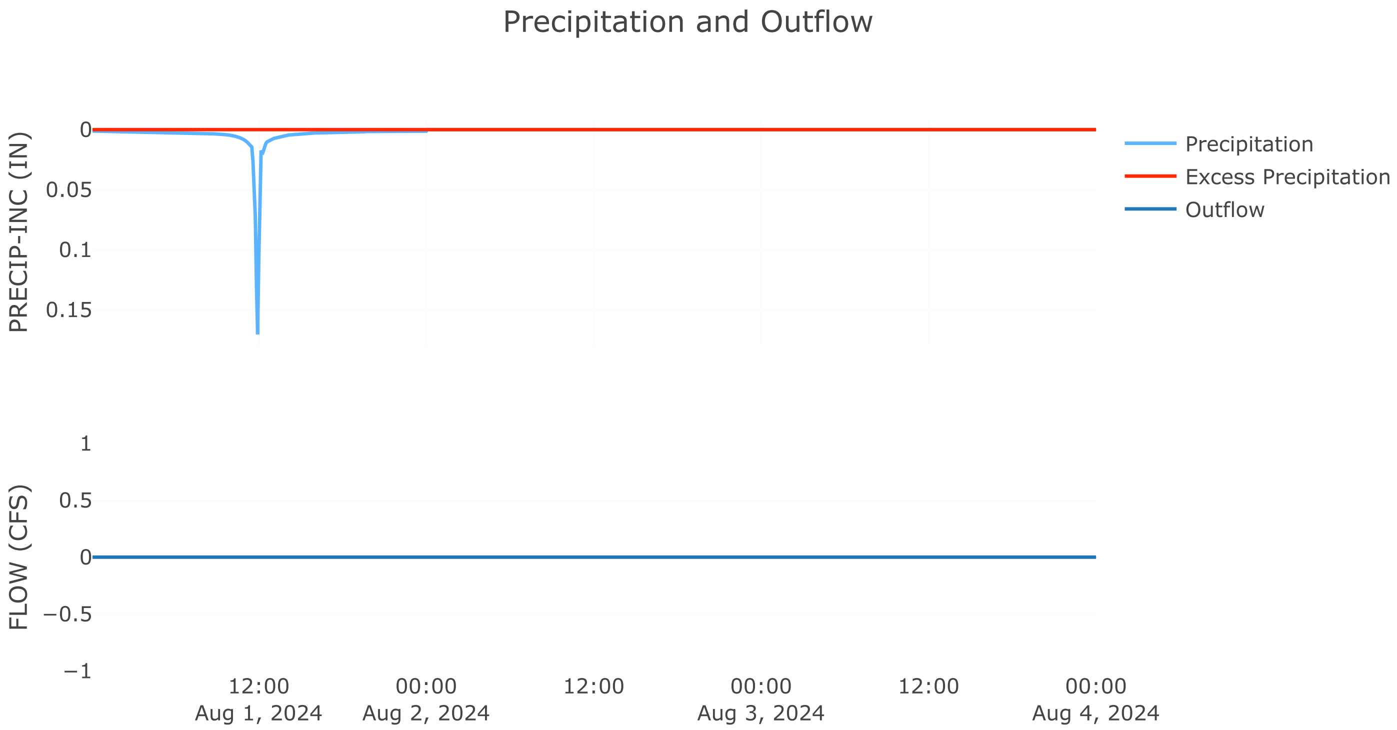
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	18.7
Unitgraph Type	Standard

Results: EX ON-2

Peak Discharge (CFS)	0
Time of Peak Discharge	31Jul2024, 24:00
Volume (IN)	0
Precipitation Volume (AC - FT)	3.61
Loss Volume (AC - FT)	3.61
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0



Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
1
0.5
0
−0.5
−1
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-3

Area (MI2) : 0.06

Loss Rate: Scs

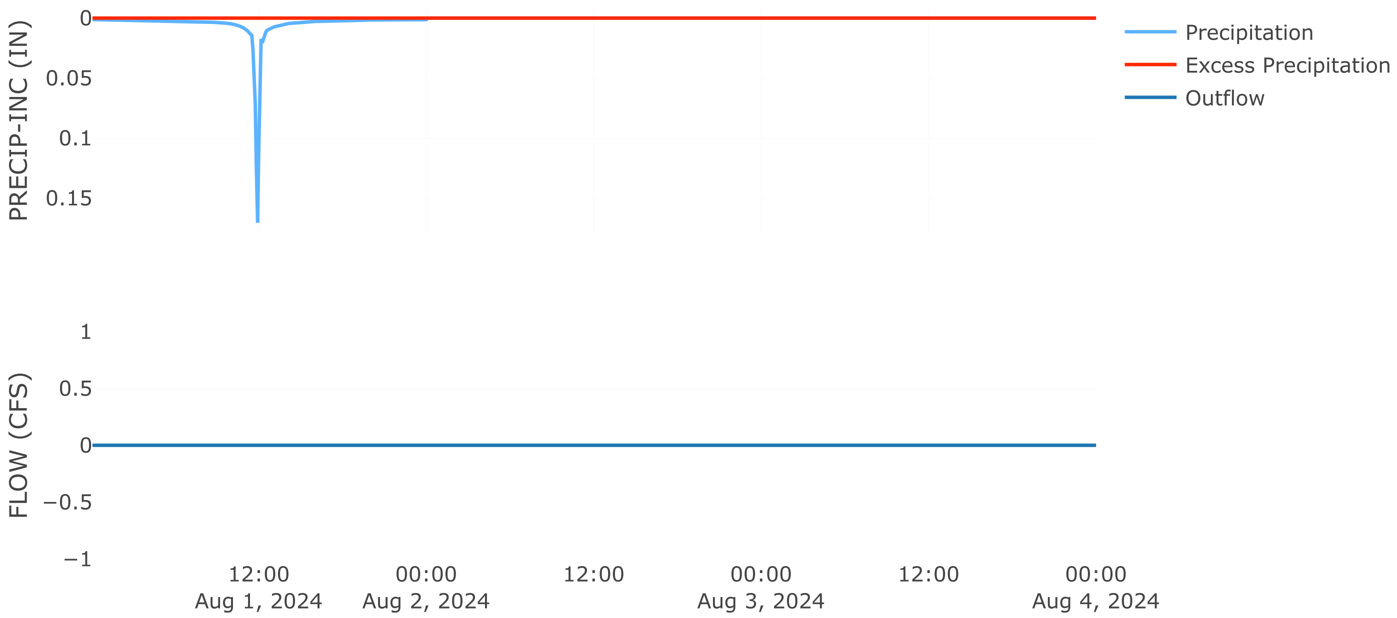
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	19.1
Unitgraph Type	Standard

Results: EX ON-3

Peak Discharge (CFS)	0
Time of Peak Discharge	31Jul2024, 24:00
Volume (IN)	0
Precipitation Volume (AC - FT)	4.39
Loss Volume (AC - FT)	4.39
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0



Precipitation and Outflow

Subbasin: EX ON-4

Area (MI2) : 0.02

Loss Rate: Scs

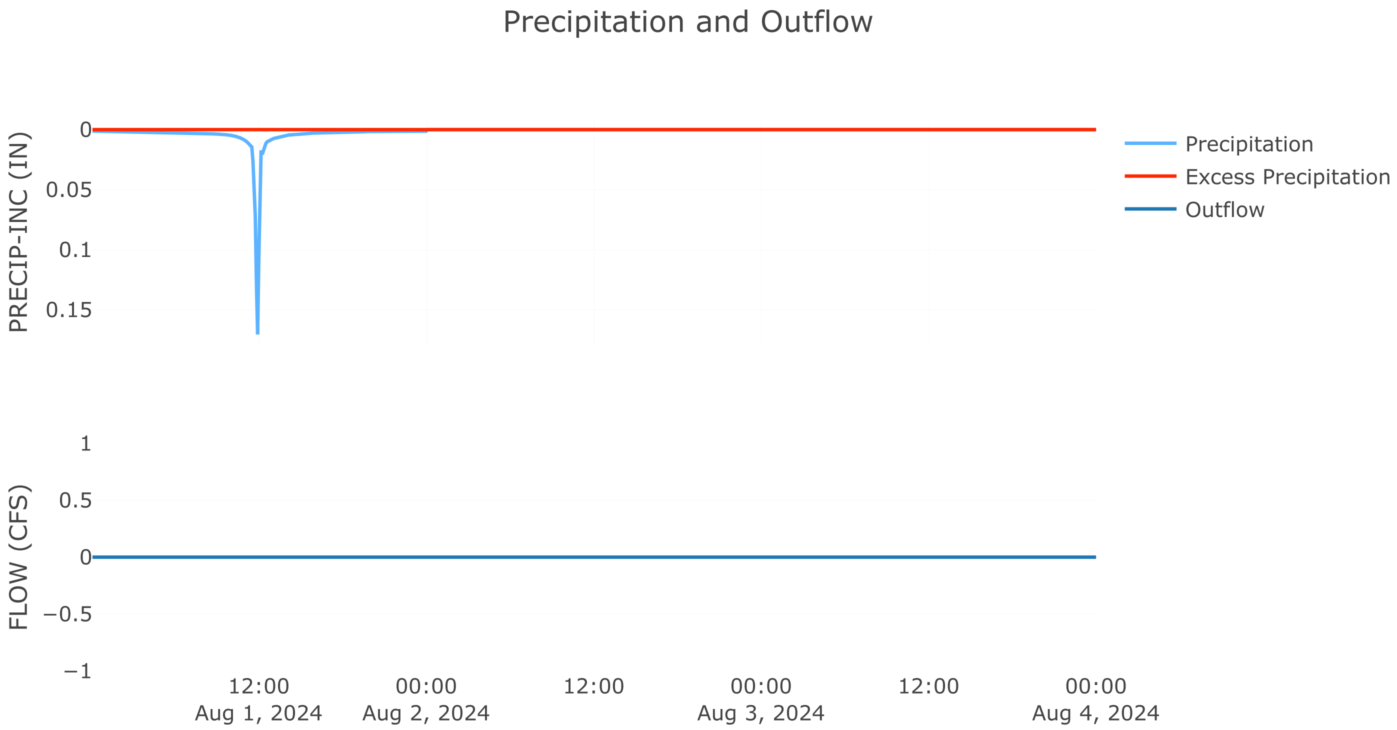
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	24.7
Unitgraph Type	Standard

Results: EX ON-4

Peak Discharge (CFS)	0
Time of Peak Discharge	31Jul2024, 24:00
Volume (IN)	0
Precipitation Volume (AC - FT)	1.49
Loss Volume (AC - FT)	1.49
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
1
0.5
0
−0.5
−1
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Project: Yermo
Simulation Run: Ex_Cond_24hr_100yr_SCS_Type2
Simulation Start: 31 July 2024, 24:00
Simulation End: 3 August 2024, 24:00

HMS Version: 4.13
Executed: 12 June 2025, 17:02

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Ex offsite basin	1.3
EX ON - 1	0.01
EX ON - 2	0.05
EX ON - 3	0.06
EX ON - 4	0.02

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Ex offsite basin	0	67.2	0.98
EX ON - 1	0	46	2.35
EX ON - 2	0	46	2.35
EX ON - 3	0	46	2.35
EX ON - 4	0	46	2.35

Transform: Scs

Element Name	Lag	Unitgraph Type
Ex offsite basin	114.1	Standard
EX ON - 1	18.9	Standard
EX ON - 2	18.7	Standard
EX ON - 3	19.1	Standard
EX ON - 4	24.7	Standard

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)

Ex offsite basin	1.3	44.49	01Aug2024, 14:25	0.32
EX ON - 1	0.01	0	02Aug2024, 00:05	0
EX ON - 2	0.05	0.01	02Aug2024, 00:05	0
EX ON - 3	0.06	0.01	02Aug2024, 00:05	0
EX ON - 4	0.02	0	02Aug2024, 00:10	0

Subbasin: Ex offsite basin

Area (MI2) : 1.3

Loss Rate: Scs

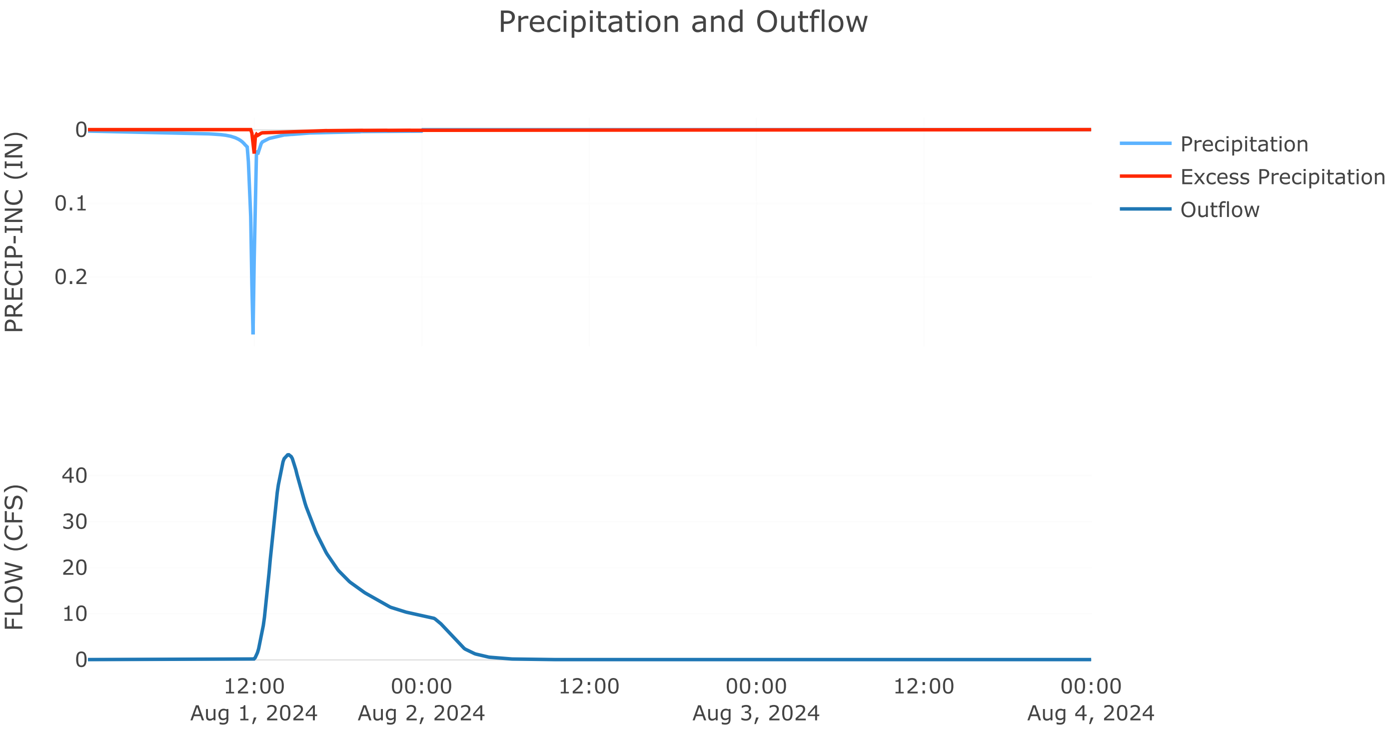
Percent Impervious Area	0
Curve Number	67.2
Initial Abstraction	0.98

Transform: Scs

Lag	114.1
Unitgraph Type	Standard

Results: Ex offsite basin

Peak Discharge (CFS)	44.49
Time of Peak Discharge	01Aug2024, 14:25
Volume (IN)	0.32
Precipitation Volume (AC - FT)	166.4
Loss Volume (AC - FT)	144.21
Excess Volume (AC - FT)	22.19
Direct Runoff Volume (AC - FT)	22.19
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
40
30
20
10
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-1

Area (MI2) : 0.01

Loss Rate: Scs

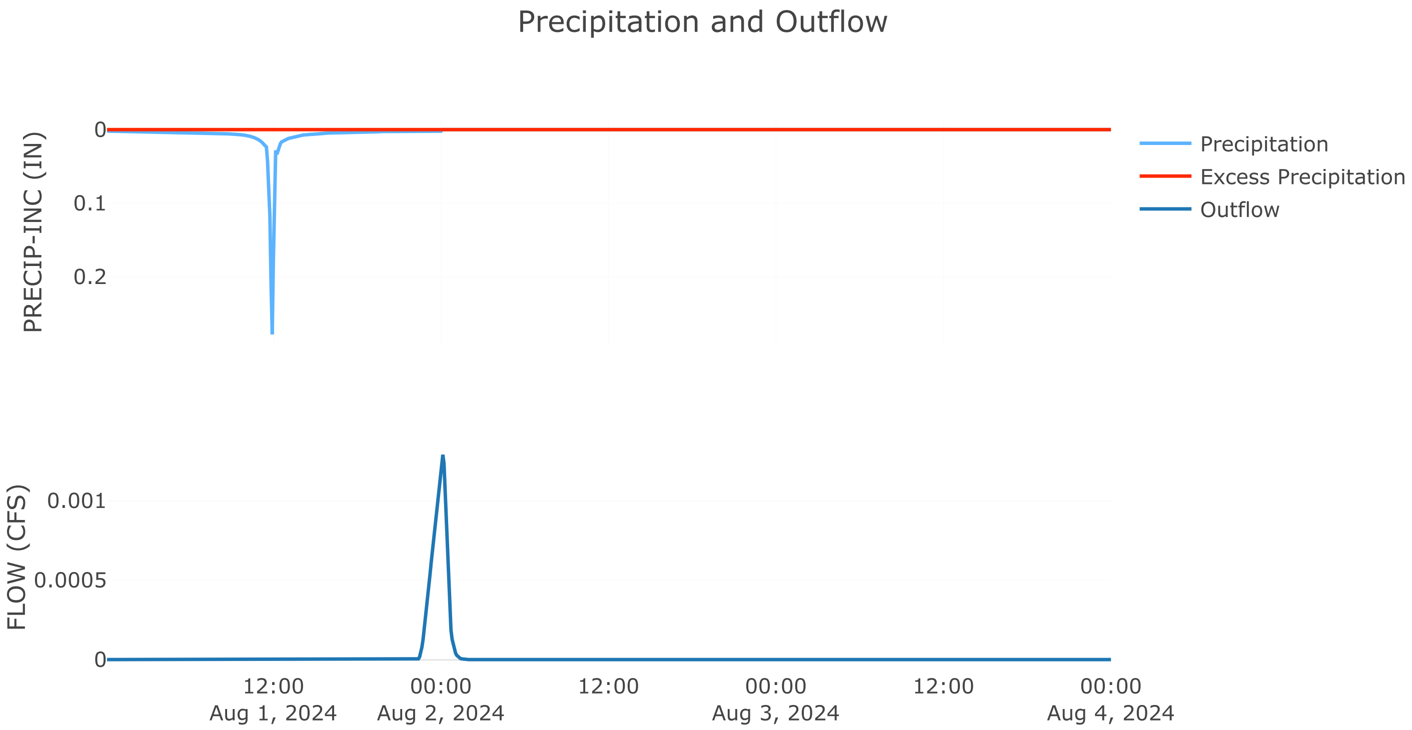
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	18.9
Unitgraph Type	Standard

Results: EX ON-1

Peak Discharge (CFS)	0
Time of Peak Discharge	02Aug2024, 00:05
Volume (IN)	0
Precipitation Volume (AC - FT)	1.41
Loss Volume (AC - FT)	1.41
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
FLOW (CFS)
0.001
0.0005
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024
Precipitation
Excess Precipitation
Outflow

Subbasin: EX ON-2

Area (MI2) : 0.05

Loss Rate: Scs

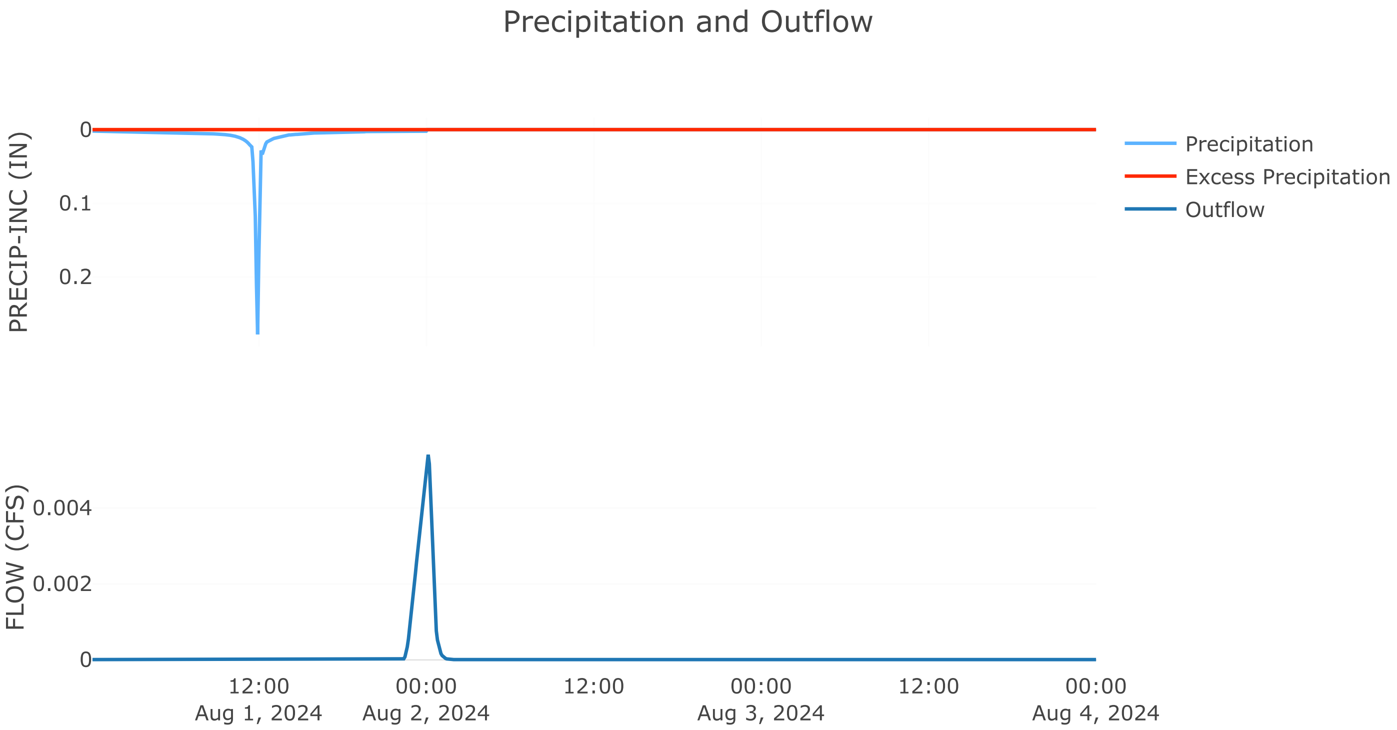
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	18.7
Unitgraph Type	Standard

Results: EX ON-2

Peak Discharge (CFS)	0.01
Time of Peak Discharge	02Aug2024, 00:05
Volume (IN)	0
Precipitation Volume (AC - FT)	5.89
Loss Volume (AC - FT)	5.89
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
0.004
0.002
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-3

Area (MI2) : 0.06

Loss Rate: Scs

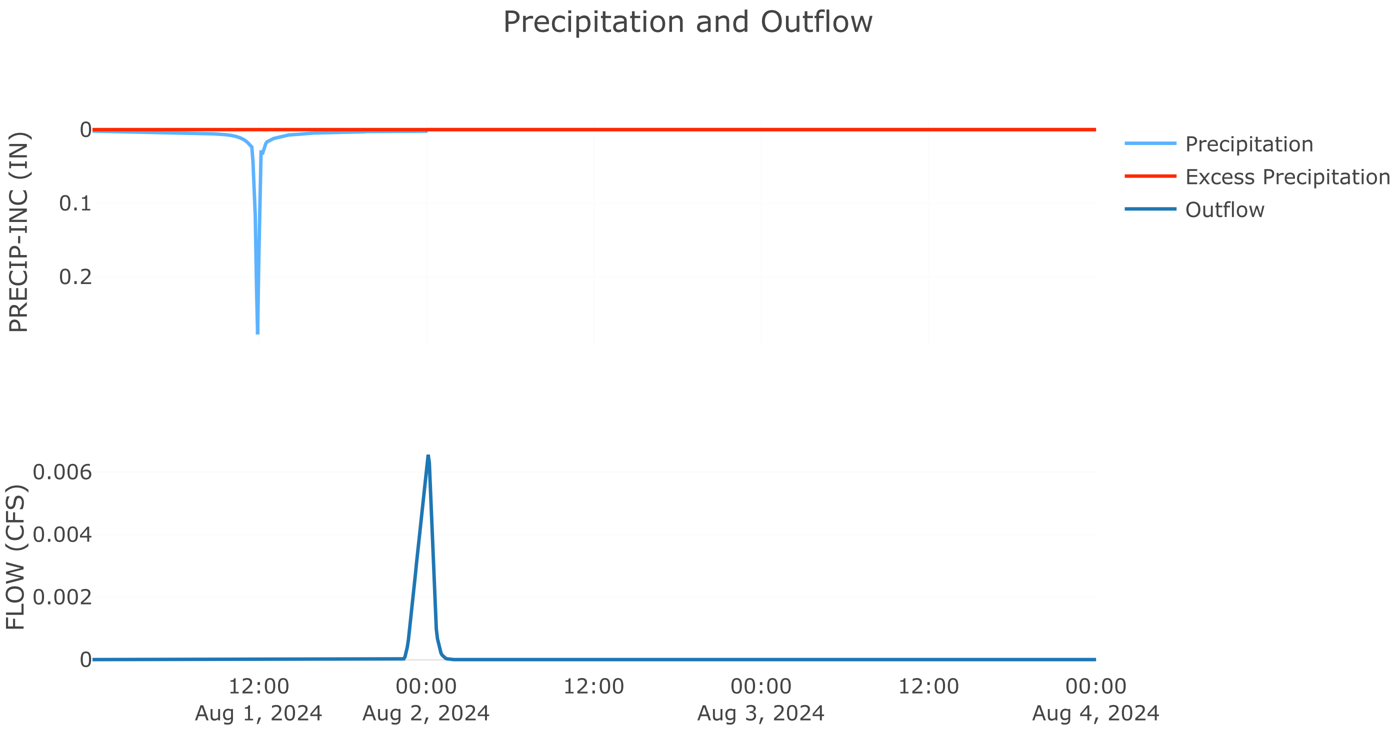
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	19.1
Unitgraph Type	Standard

Results: EX ON-3

Peak Discharge (CFS)	0.01
Time of Peak Discharge	02Aug2024, 00:05
Volume (IN)	0
Precipitation Volume (AC - FT)	7.17
Loss Volume (AC - FT)	7.17
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0



Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
0.006
0.004
0.002
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-4

Area (MI2) : 0.02

Loss Rate: Scs

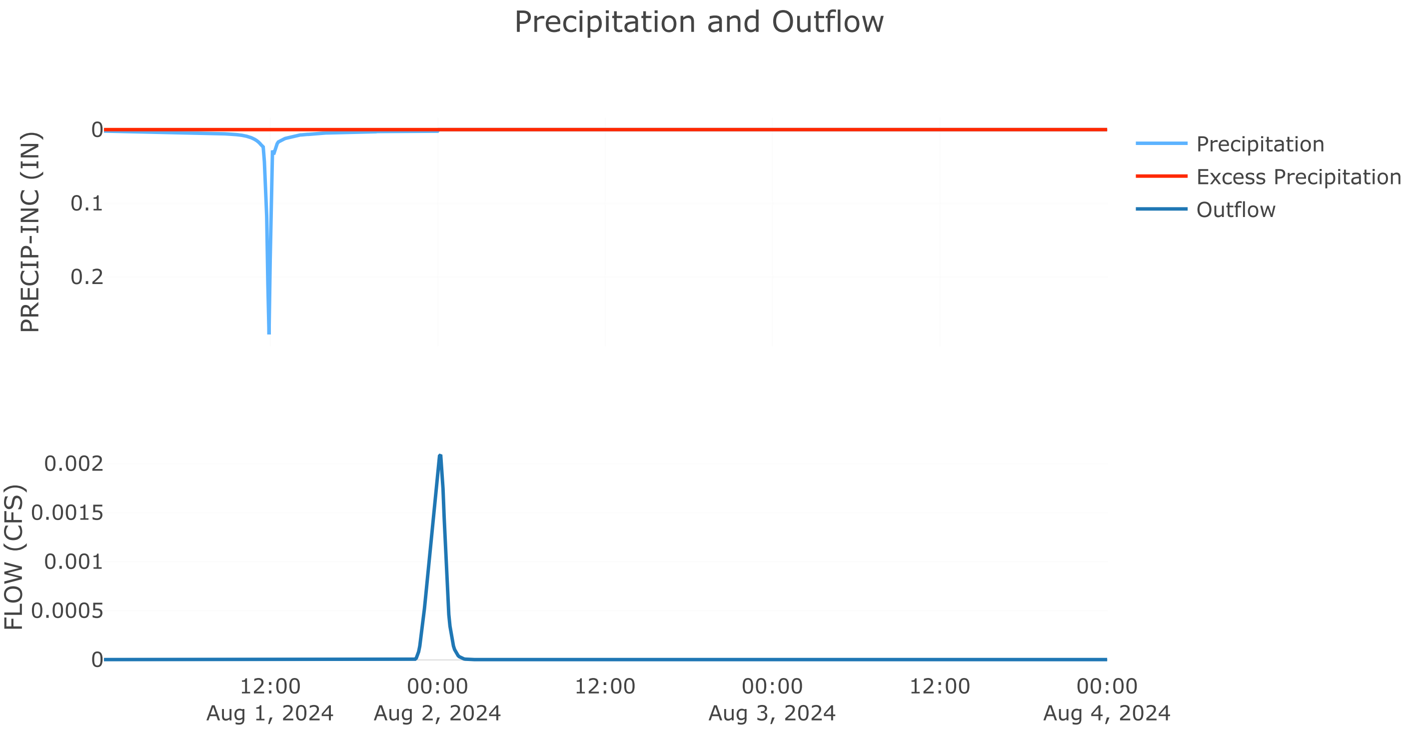
Percent Impervious Area	0
Curve Number	46
Initial Abstraction	2.35

Transform: Scs

Lag	24.7
Unitgraph Type	Standard

Results: EX ON-4

Peak Discharge (CFS)	0
Time of Peak Discharge	02Aug2024, 00:10
Volume (IN)	0
Precipitation Volume (AC - FT)	2.43
Loss Volume (AC - FT)	2.43
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
0.002
0.0015
0.001
0.0005
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Project: Yermo
Simulation Run: Post-Dev_24hr10yr_SCS_Typ2
Simulation Start: 31 July 2024, 24:00
Simulation End: 3 August 2024, 24:00

HMS Version: 4.13
Executed: 12 June 2025, 16:49

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Ex offsite basin	1.3
EX ON - 1	0.01
EX ON - 2	0.05
EX ON - 3	0.06
EX ON - 4	0.02

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Ex offsite basin	0	67.2	0.98
EX ON - 1	0	46.6	2.29
EX ON - 2	0	48.8	2.1
EX ON - 3	0	73.9	0.71
EX ON - 4	0	49.6	2.03

Transform: Scs

Element Name	Lag	Unitgraph Type
Ex offsite basin	114.1	Standard
EX ON - 1	25.7	Standard
EX ON - 2	29.2	Standard
EX ON - 3	15.8	Standard
EX ON - 4	24.7	Standard

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)

Ex offsite basin	1.3	3.69	01Aug2024, 16:35	0.04
EX ON - 1	0.01	0	31Jul2024, 24:00	0
EX ON - 2	0.05	0	31Jul2024, 24:00	0
EX ON - 3	0.06	2	01Aug2024, 12:15	0.13
EX ON - 4	0.02	0	31Jul2024, 24:00	0

Subbasin: Ex offsite basin

Area (MI2) : 1.3

Loss Rate: Scs

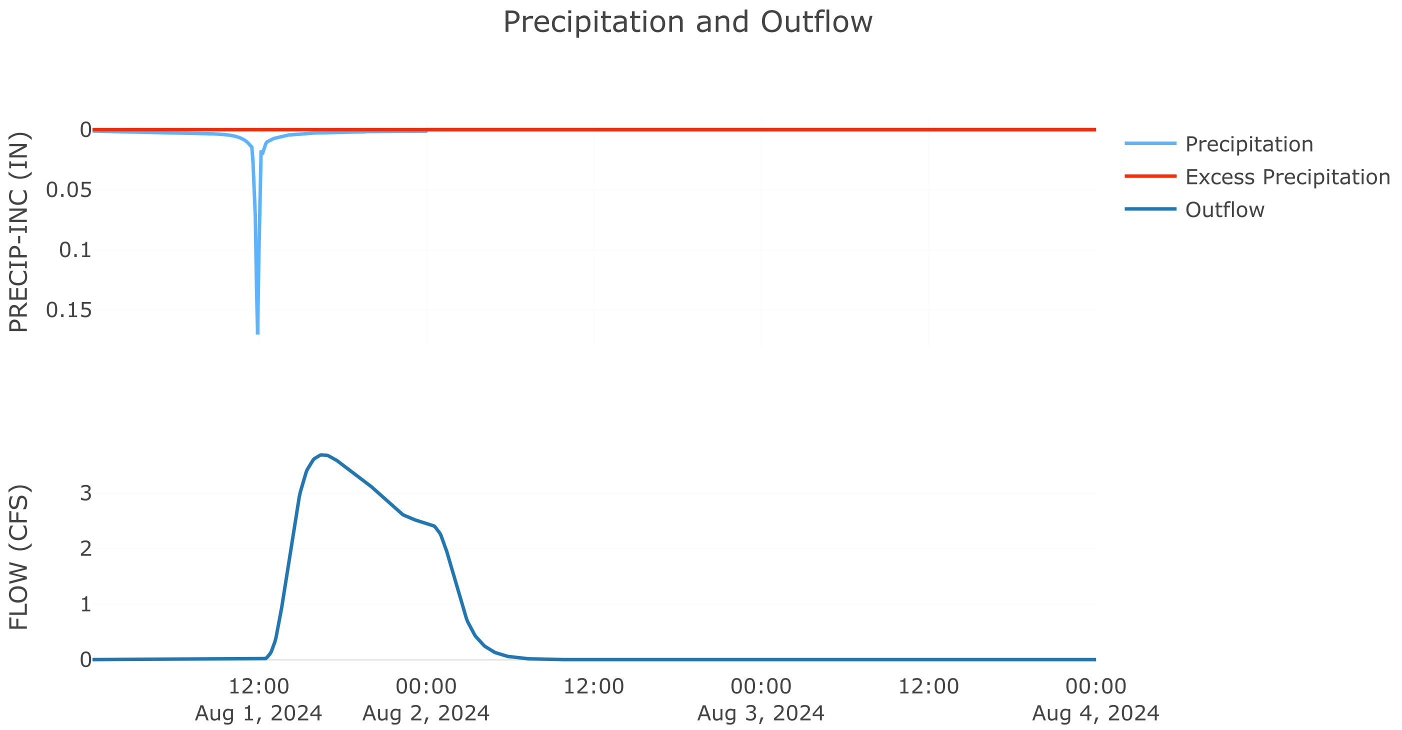
Percent Impervious Area	0
Curve Number	67.2
Initial Abstraction	0.98

Transform: Scs

Lag	114.1
Unitgraph Type	Standard

Results: Ex offsite basin

Peak Discharge (CFS)	3.69
Time of Peak Discharge	01Aug2024, 16:35
Volume (IN)	0.04
Precipitation Volume (AC - FT)	101.92
Loss Volume (AC - FT)	98.82
Excess Volume (AC - FT)	3.1
Direct Runoff Volume (AC - FT)	3.1
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
3
2
1
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-1

Area (MI2) : 0.01

Loss Rate: Scs

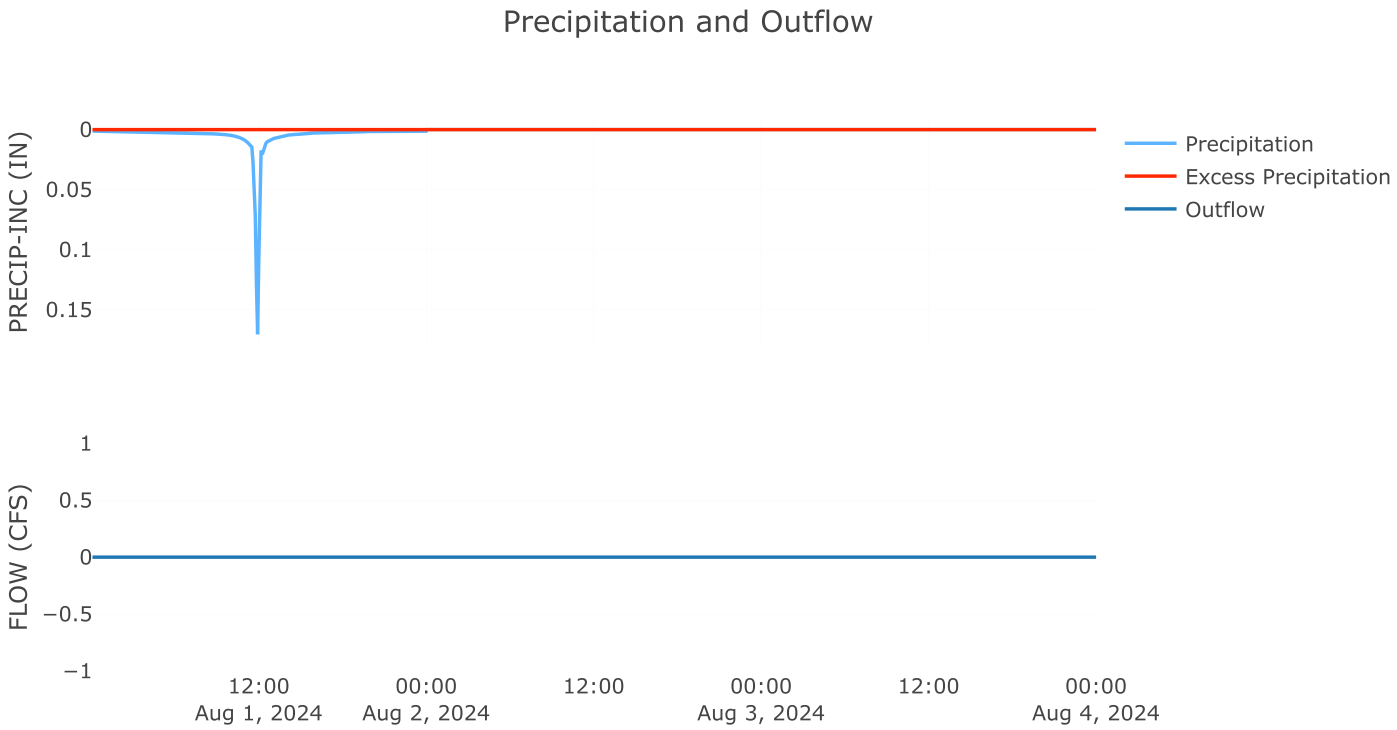
Percent Impervious Area	0
Curve Number	46.6
Initial Abstraction	2.29

Transform: Scs

Lag	25.7
Unitgraph Type	Standard

Results: EX ON-1

Peak Discharge (CFS)	0
Time of Peak Discharge	31Jul2024, 24:00
Volume (IN)	0
Precipitation Volume (AC - FT)	0.86
Loss Volume (AC - FT)	0.86
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
1
0.5
0
−0.5
−1
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-2

Area (MI2) : 0.05

Loss Rate: Scs

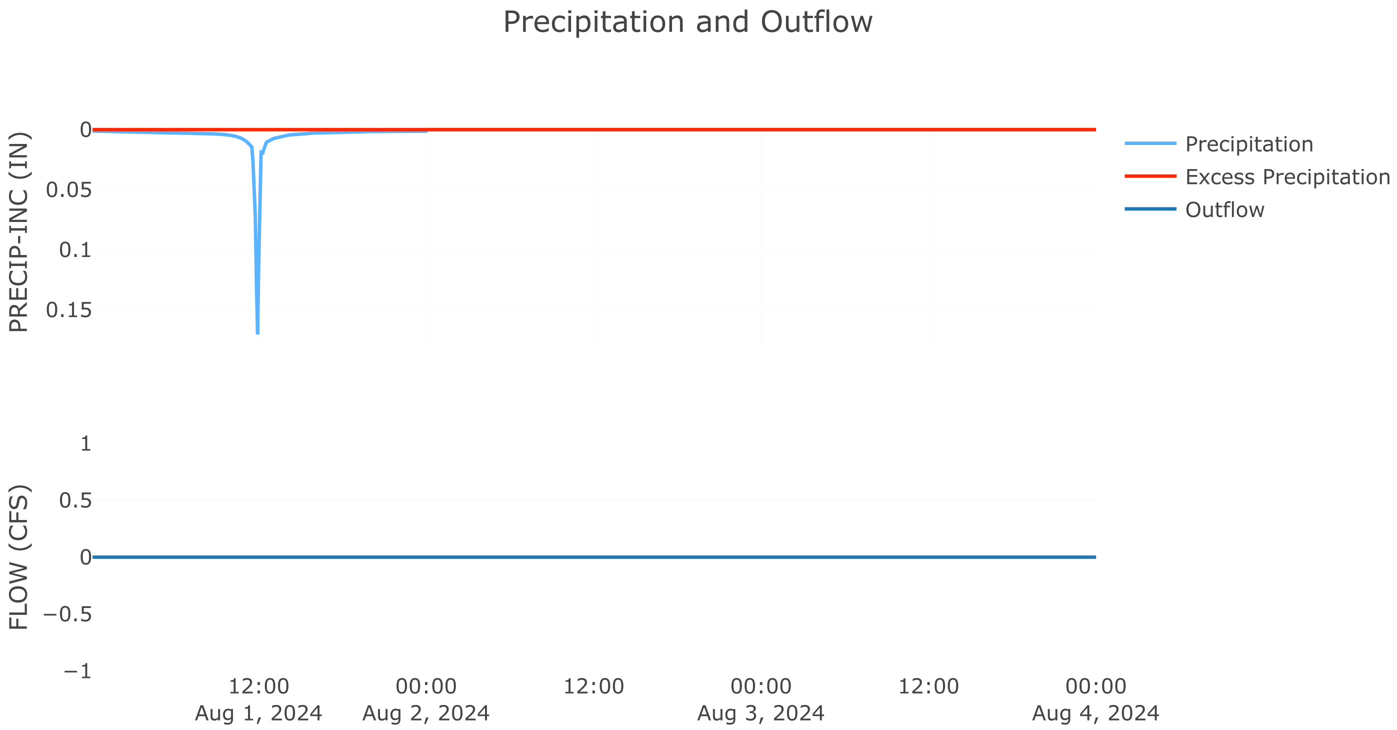
Percent Impervious Area	0
Curve Number	48.8
Initial Abstraction	2.1

Transform: Scs

Lag	29.2
Unitgraph Type	Standard

Results: EX ON-2

Peak Discharge (CFS)	0
Time of Peak Discharge	31Jul2024, 24:00
Volume (IN)	0
Precipitation Volume (AC - FT)	3.61
Loss Volume (AC - FT)	3.61
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
FLOW (CFS)
1
0.5
0
−0.5
−1
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024
Precipitation
Excess Precipitation
Outflow

Subbasin: EX ON-3

Area (MI2) : 0.06

Loss Rate: Scs

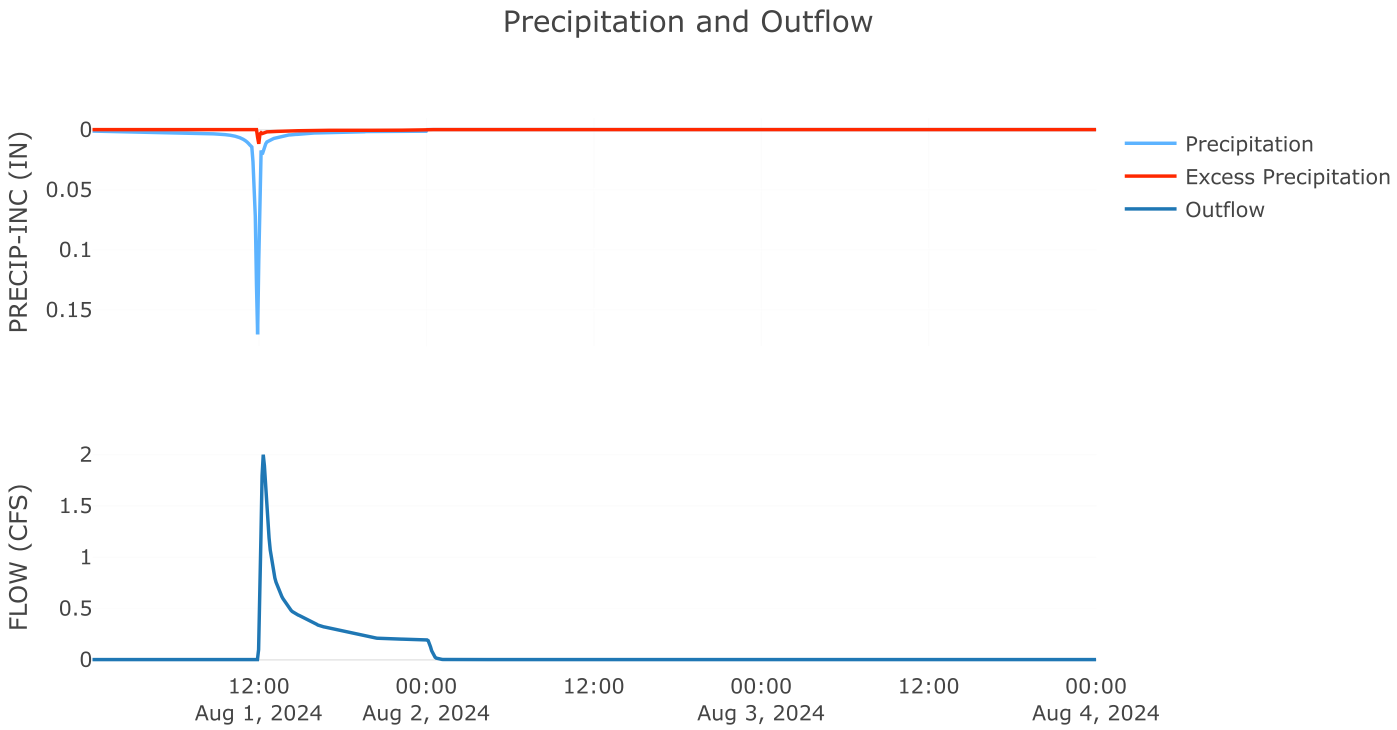
Percent Impervious Area	0
Curve Number	73.9
Initial Abstraction	0.71

Transform: Scs

Lag	15.8
Unitgraph Type	Standard

Results: EX ON-3

Peak Discharge (CFS)	2
Time of Peak Discharge	01Aug2024, 12:15
Volume (IN)	0.13
Precipitation Volume (AC - FT)	4.39
Loss Volume (AC - FT)	3.99
Excess Volume (AC - FT)	0.4
Direct Runoff Volume (AC - FT)	0.4
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
2
1.5
1
0.5
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-4

Area (MI2) : 0.02

Loss Rate: Scs

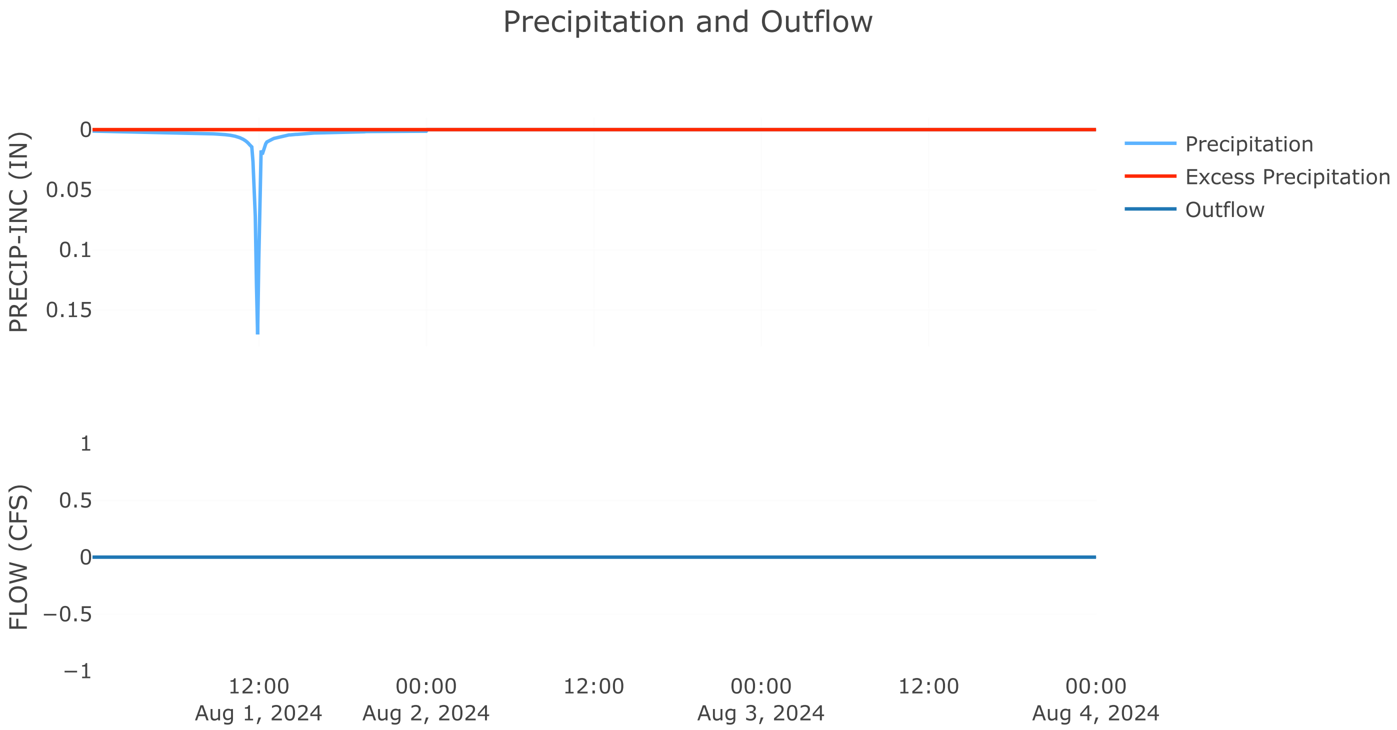
Percent Impervious Area	0
Curve Number	49.6
Initial Abstraction	2.03

Transform: Scs

Lag	24.7
Unitgraph Type	Standard

Results: EX ON-4

Peak Discharge (CFS)	0
Time of Peak Discharge	31Jul2024, 24:00
Volume (IN)	0
Precipitation Volume (AC - FT)	1.49
Loss Volume (AC - FT)	1.49
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.05
0.1
0.15
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
1
0.5
0
−0.5
−1
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Project: Yermo
Simulation Run: Post-Dev_24hr100yr_SCS_Typ2
Simulation Start: 31 July 2024, 24:00
Simulation End: 3 August 2024, 24:00

HMS Version: 4.13
Executed: 12 June 2025, 16:51

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Ex offsite basin	1.3
EX ON - 1	0.01
EX ON - 2	0.05
EX ON - 3	0.06
EX ON - 4	0.02

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Ex offsite basin	0	67.2	0.98
EX ON - 1	0	46.6	2.29
EX ON - 2	0	48.8	2.1
EX ON - 3	0	73.9	0.71
EX ON - 4	0	49.6	2.03

Transform: Scs

Element Name	Lag	Unitgraph Type
Ex offsite basin	114.1	Standard
EX ON - 1	25.7	Standard
EX ON - 2	29.2	Standard
EX ON - 3	15.8	Standard
EX ON - 4	24.7	Standard

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)

Ex offsite basin	1.3	44.49	01Aug2024, 14:25	0.32
EX ON - 1	0.01	0	02Aug2024, 00:05	0
EX ON - 2	0.05	0.04	01Aug2024, 24:00	0.01
EX ON - 3	0.06	15.06	01Aug2024, 12:10	0.55
EX ON - 4	0.02	0.02	01Aug2024, 24:00	0.01

Subbasin: Ex offsite basin

Area (MI2) : 1.3

Loss Rate: Scs

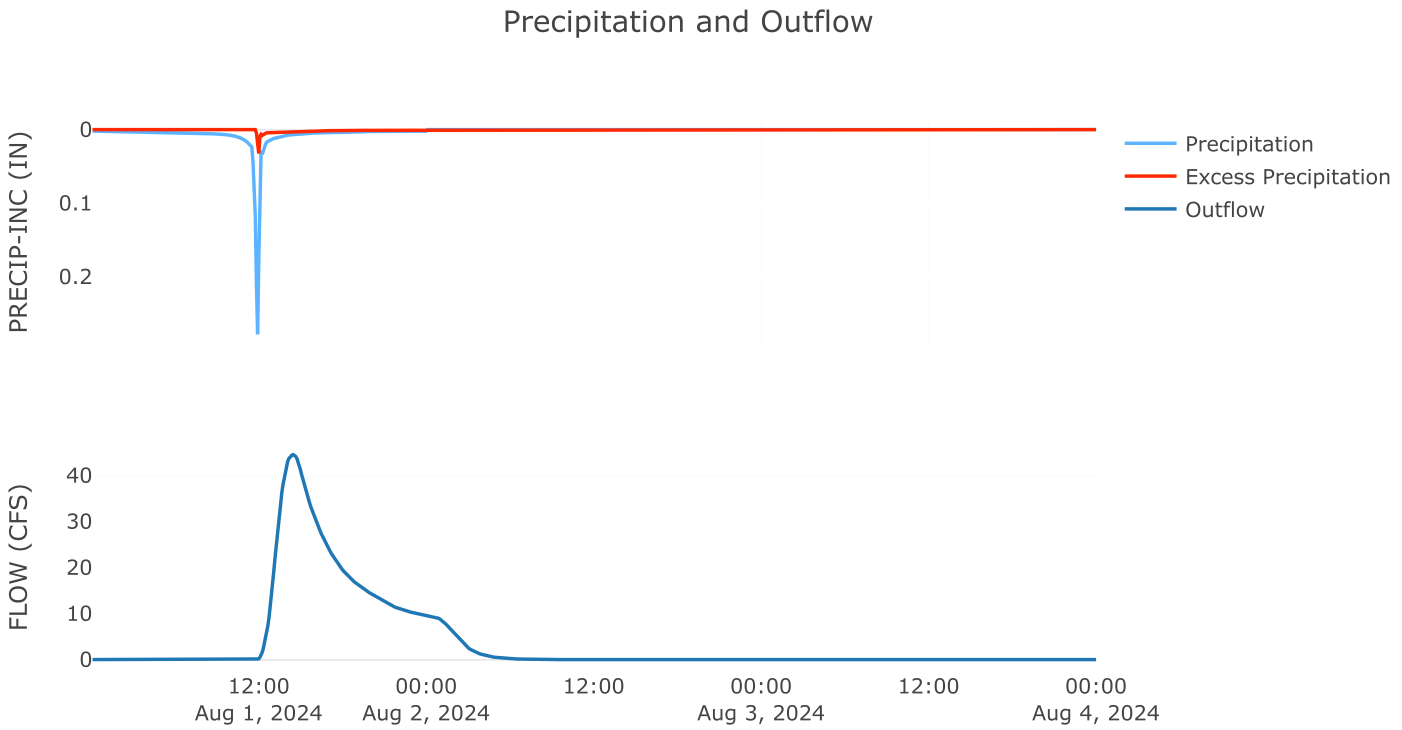
Percent Impervious Area	0
Curve Number	67.2
Initial Abstraction	0.98

Transform: Scs

Lag	114.1
Unitgraph Type	Standard

Results: Ex offsite basin

Peak Discharge (CFS)	44.49
Time of Peak Discharge	01Aug2024, 14:25
Volume (IN)	0.32
Precipitation Volume (AC - FT)	166.4
Loss Volume (AC - FT)	144.21
Excess Volume (AC - FT)	22.19
Direct Runoff Volume (AC - FT)	22.19
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
FLOW (CFS)
40
30
20
10
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024
Precipitation
Excess Precipitation
Outflow

Subbasin: EX ON-1

Area (MI2) : 0.01

Loss Rate: Scs

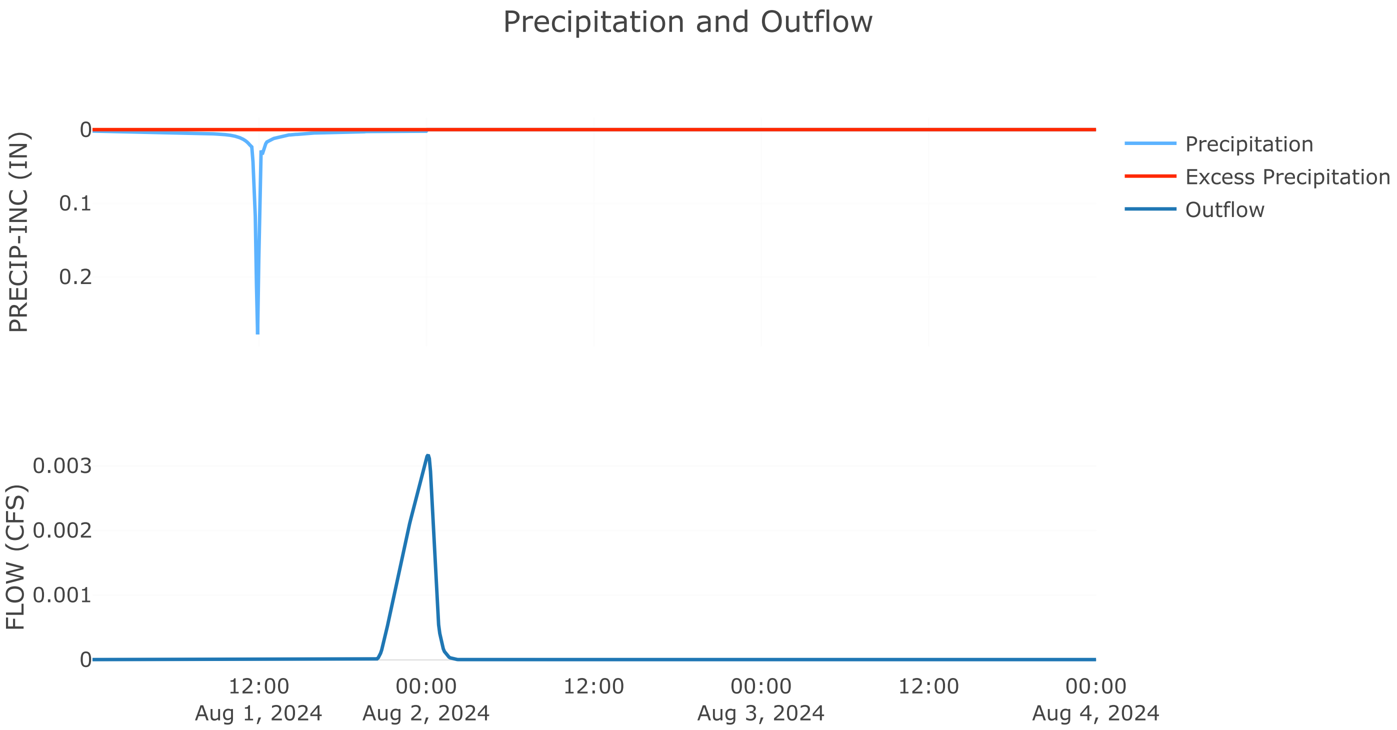
Percent Impervious Area	0
Curve Number	46.6
Initial Abstraction	2.29

Transform: Scs

Lag	25.7
Unitgraph Type	Standard

Results: EX ON-1

Peak Discharge (CFS)	0
Time of Peak Discharge	02Aug2024, 00:05
Volume (IN)	0
Precipitation Volume (AC - FT)	1.41
Loss Volume (AC - FT)	1.41
Excess Volume (AC - FT)	0
Direct Runoff Volume (AC - FT)	0
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
FLOW (CFS)
0.003
0.002
0.001
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024
Precipitation
Excess Precipitation
Outflow

Subbasin: EX ON-2

Area (MI2) : 0.05

Loss Rate: Scs

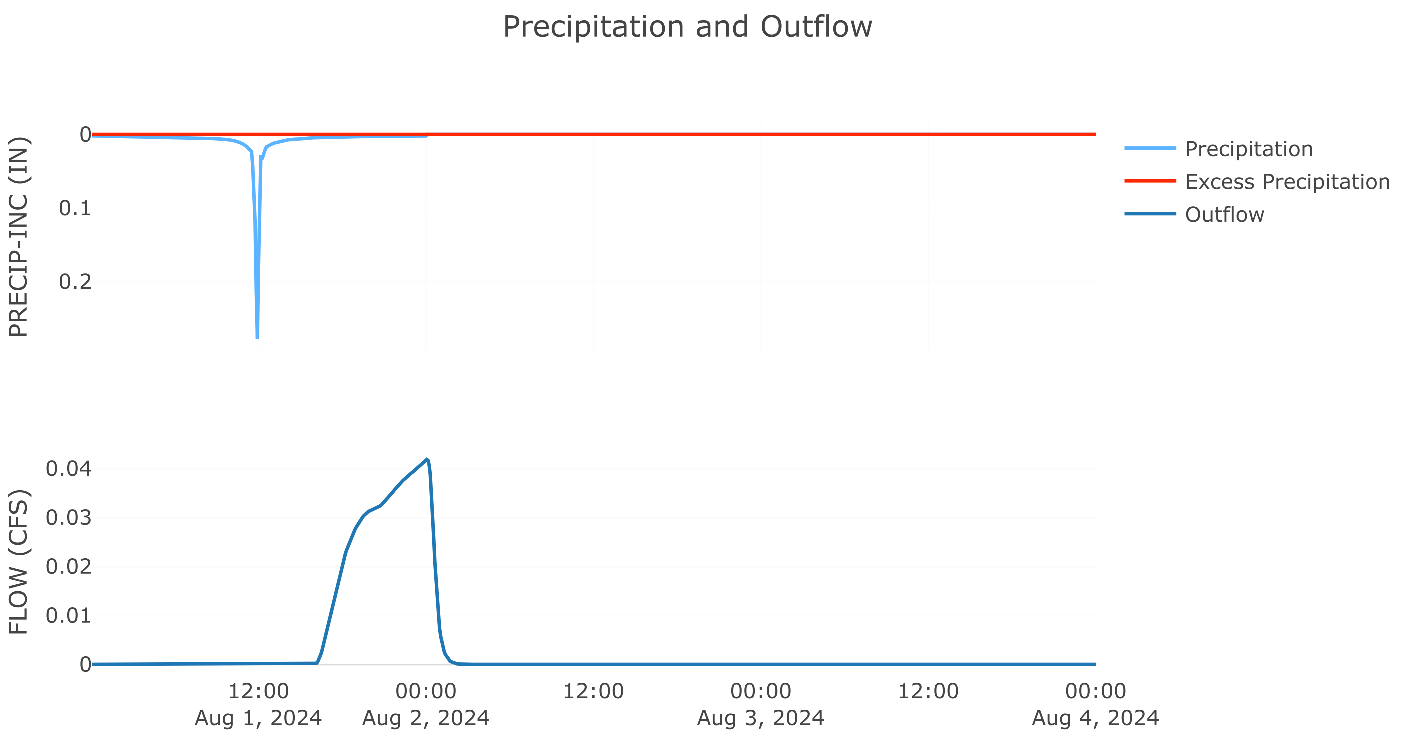
Percent Impervious Area	0
Curve Number	48.8
Initial Abstraction	2.1

Transform: Scs

Lag	29.2
Unitgraph Type	Standard

Results: EX ON-2

Peak Discharge (CFS)	0.04
Time of Peak Discharge	01Aug2024, 24:00
Volume (IN)	0.01
Precipitation Volume (AC - FT)	5.89
Loss Volume (AC - FT)	5.87
Excess Volume (AC - FT)	0.02
Direct Runoff Volume (AC - FT)	0.02
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
0.04
0.03
0.02
0.01
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024

Subbasin: EX ON-3

Area (MI2) : 0.06

Loss Rate: Scs

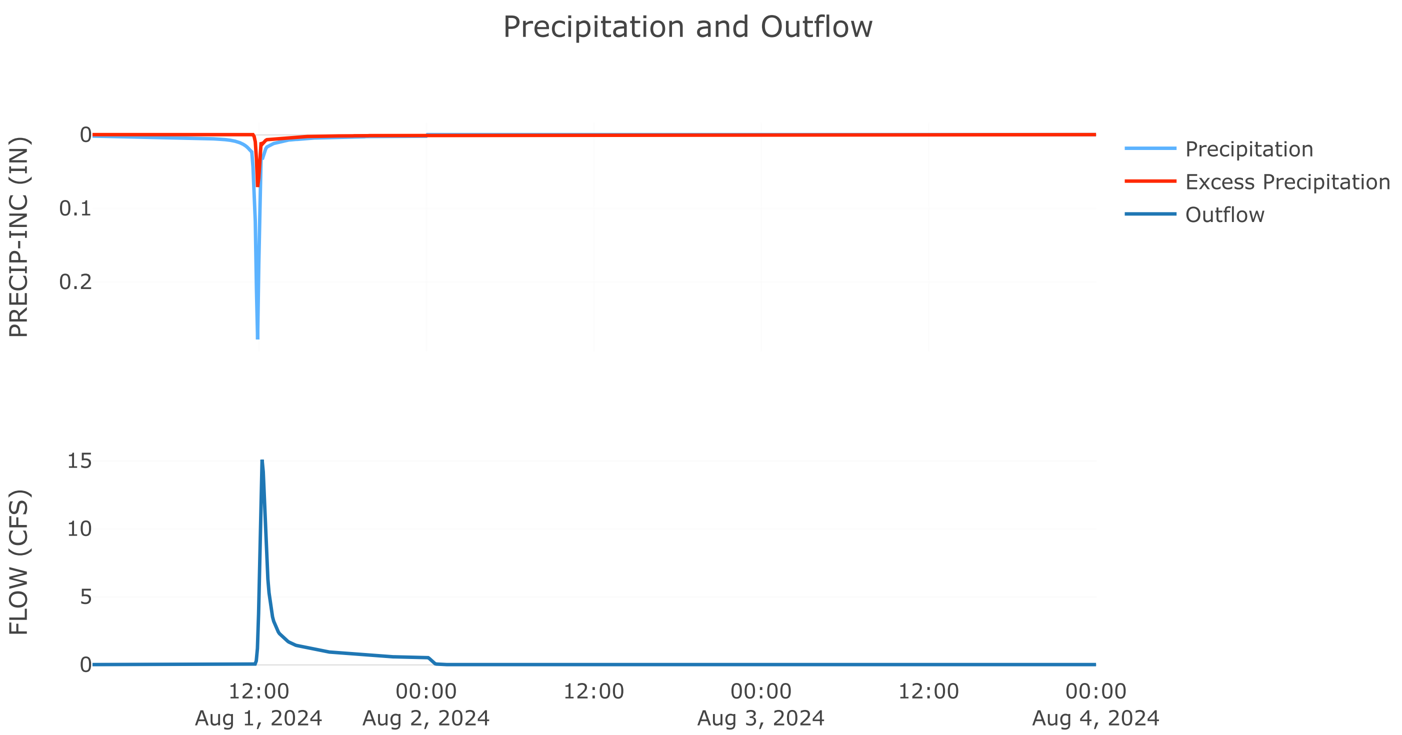
Percent Impervious Area	0
Curve Number	73.9
Initial Abstraction	0.71

Transform: Scs

Lag	15.8
Unitgraph Type	Standard

Results: EX ON-3

Peak Discharge (CFS)	15.06
Time of Peak Discharge	01Aug2024, 12:10
Volume (IN)	0.55
Precipitation Volume (AC - FT)	7.17
Loss Volume (AC - FT)	5.53
Excess Volume (AC - FT)	1.63
Direct Runoff Volume (AC - FT)	1.63
Baseflow Volume (AC - FT)	0


Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
FLOW (CFS)
15
10
5
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024
Precipitation
Excess Precipitation
Outflow

Subbasin: EX ON-4

Area (MI2) : 0.02

Loss Rate: Sccs

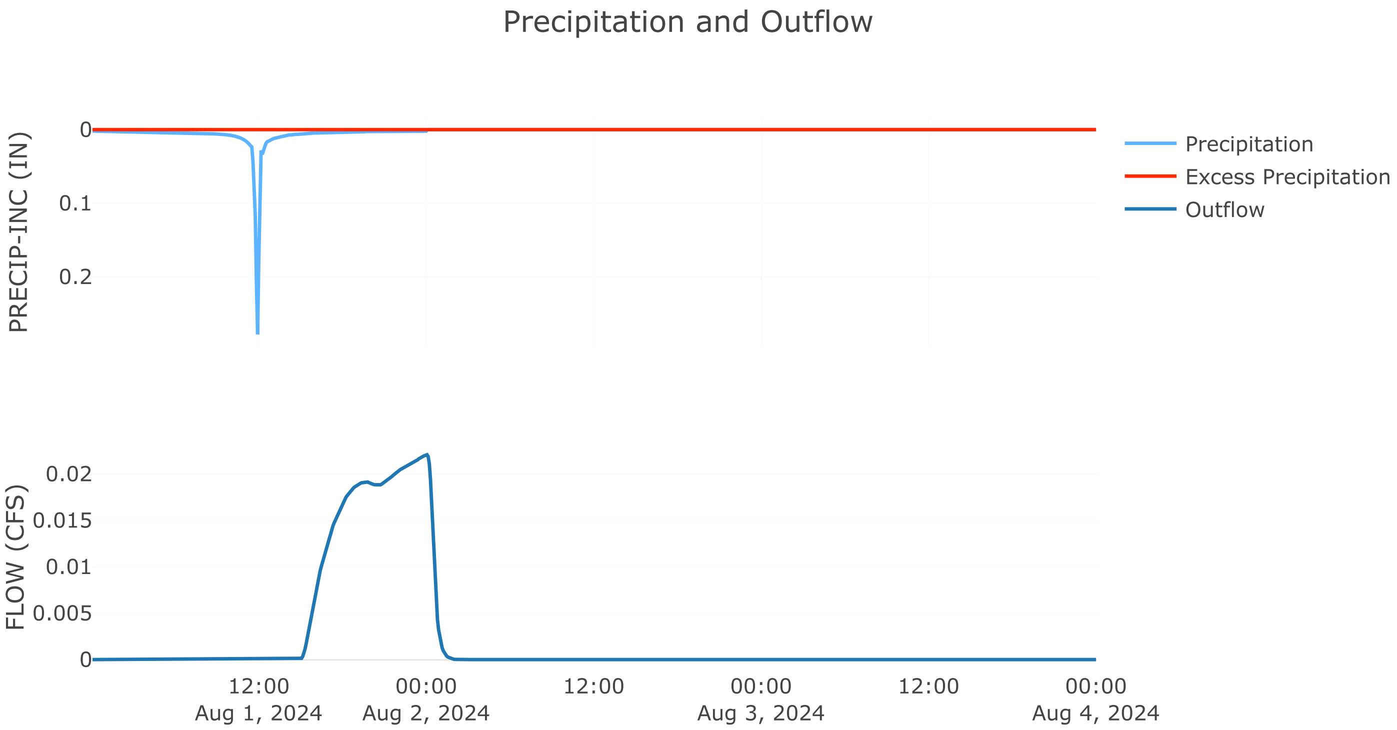
Percent Impervious Area	0
Curve Number	49.6
Initial Abstraction	2.03

Transform: Scs

Lag	24.7
Unitgraph Type	Standard

Results: EX ON-4

Peak Discharge (CFS)	0.02
Time of Peak Discharge	01Aug2024, 24:00
Volume (IN)	0.01
Precipitation Volume (AC - FT)	2.43
Loss Volume (AC - FT)	2.42
Excess Volume (AC - FT)	0.01
Direct Runoff Volume (AC - FT)	0.01
Baseflow Volume (AC - FT)	0



Precipitation and Outflow
PRECIP-INC (IN)
0
0.1
0.2
Precipitation
Excess Precipitation
Outflow
FLOW (CFS)
0.02
0.015
0.01
0.005
0
12:00
Aug 1, 2024
00:00
Aug 2, 2024
12:00
00:00
Aug 3, 2024
12:00
00:00
Aug 4, 2024