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CalCapture CCS Project

Hydrology and Water Quality Study

Stantec

Prepared for:
Carbon TerraVault Holdings, LLC, a carbon management subsidiary of California Resources Corporation

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October 2025

Project/File:
185806775

Stantec Consulting Services Inc.

Revision Schedule

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date

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Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
BMP	best management practice
CalGEM	California Geologic Energy Management Division
CARB	California Air Resources Board
CCS	Carbon Capture and Sequestration
CCU	Carbon Capture Unit
CEC	California Energy Commission
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO_2	carbon dioxide
CRC	California Resources Corporation
CTV	Carbon TerraVault Holdings, LLC
CTV I	Carbon TerraVault I
CUP	Conditional Use Permit
the CUP	Collectively, CUP No. 13, Map 118; CUP No. 14, Map 118; CUP No. 5, Map 119; CUP No. 3, Map 120; CUP No. 2, Map 138; and CUP No. 6, Map 119
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
EFG+	Econamine FG Plus SM
EHOF	Elk Hills Oilfield
EHPP	Elk Hills Power Plant
EIR	Environmental Impact Report
FEMA	Federal Emergency Management Agency
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GT	gas turbine
HDD	horizontal directional drilling
HRSG	heat recovery steam generator
HSG	Hydrologic Soil Group
Kern County	Kern County Planning and Natural Resources Department
KGA	Kern Groundwater Authority
kV	kilovolt
M	magnitude
MM	mtigation measure
MMTPY	million metric tons per year
MTPD	metric tons per day
MWe	megawatt equivalent
NOAA	National Oceanic and Atmospheric Administration
NOD	Notice of Determination
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
RO	reverse osmosis

Acronym / Abbreviation	Full Name
RWQCB	Regional Water Quality Control Board
SCS	Soil Conservation Service
SGMA	Sustainable Groundwater Management Act of 2014
ST	steam turbine
Stantec	Stantec Consulting Services Inc.
Study Area	The pre-determined portion of the total Project site chosen for hydrologic testing where an increase in impervious area and/or where scour is likely
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
UIC	Underground Injection Control
USDW	underground source of drinking water
U.S. EPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
WKWD	West Kern Water District

1 Introduction

Stantec Consulting Services Inc. (Stantec) prepared a Hydrology Study on behalf of Carbon TerraVault Holdings, LLC (CTV), a carbon management subsidiary of California Resources Corporation (CRC) for the CalCapture Carbon Capture and Sequestration (CCS) Project (Project) located in the Elk Hills Oilfield (EHOF) near Tupman, Kern County, California (Project site). The Regional Location and Project Location are shown in Figures 1 and 2.

1.1 Project Description

The proposed Project would capture carbon dioxide (CO_2) generated as a by-product by CRC's 550-megawatt-equivalent (MWe) Elk Hills Power Plant (EHPP), located in the EHOF near Tupman, Kern County, California. The EHPP was commissioned in 2003 and is powered by two General Electric 7FA gas turbines (GTs), with two heat recovery steam generators (HRSGs) providing steam to a General Electric D11 steam turbine (ST). The Carbon Capture Unit (CCU), not including pipelines or temporary staging and parking areas, would be located immediately south of the EHPP in a 7.64-acre existing disturbed area.

Implementation of the Project will require approval of a Petition for Modification Application from the California Energy Commission (CEC), who has the exclusive authority for licensing thermal power plants of 50 MW or larger, as well as related transmission lines, fuel supply lines, and other facilities.

The CCU would utilize Fluor's Econamine FG Plus^{SM} (EFG+) process to capture and concentrate the CO_2. The EFG+ process is designed to capture 95 percent of the CO_2 from the total flue gas feed to the unit. The EFG+ CCU can be divided into seven primary subsystems or sections: Flue Gas Cooling, CO_2 Absorption, Solvent Regeneration, Solvent Maintenance, Chemical Storage and Supply, CO_2 Compression, and Utility Support Systems. The treated flue gas is vented to the atmosphere directly from the EFG+ CCU plant absorber. The concentrated CO_2 would then be compressed, dehydrated, and stripped of oxygen prior to conveyance to the permitted manifold pad, permitted as part of the approved Carbon TerraVault I (CTV I) project (State Clearinghouse No. 2022030180), which will direct the CO_2 to the U.S. Environmental Protection Agency (U.S. EPA) approved Class VI Underground Injection Control (UIC) wells to be injected into a depleted oil and gas reservoir located on the CRC property and approved as part of the CTV I project. The previously approved CTV I manifold pad, injection wells, depleted oil and gas reservoir and related facilities further discussed in Section 1.2 below are not part of the CalCapture CCS Project analyzed in this report.

A new, approximately 0.5-mile, 8- to 10-inch pipeline, installed primarily below ground utilizing either trenching or horizontal directional drilling (HDD) techniques, would transport the CO_2 from the CCU to the tie-in with the Carbon TerraVault I (CTV I) permitted 35R manifold facility (pad). It is anticipated that the

proposed Project would capture approximately 4,400 metric tons of CO_2 per day (MTPD) (1.6 million metric tons of CO_2 per year [MMTPY]). The proposed Project is estimated to be in operation for up to 26 years.[1]

Water use during operation of the CalCapture CCU would be minimized by the inclusion of a hybrid cooling system (Wet Surface Air Coolers [WSAC], air coolers, secondary glycol cooling, and water cooling). Additionally, the CCU would be equipped with a water treatment system, consisting of a reverse osmosis (RO) Unit that is designed to recover and reuse water from the Cooling Tower blowdown. The recovered water is utilized as make-up to the CO_2 absorption system and the Wash Water WSAC Basin. A wastewater stream (less than 10 gallons per minute) would be collected at the CalCapture CCU and transferred by a new surface pipeline to the EHPP for disposal via an existing UIC Class I injection well.

The proposed Project includes a single connection to the CRC Power System and would include a connection of a new 115-kilovolt (kV) transmission line to a new CRC electrical substation. The proposed Project would require a new transmission tie line to connect the Project switching station to the existing CRC substation. Electrical power would be supplied to the CalCapture Substation with a new dedicated electrical transformer. The new 115-kV transmission tie line is expected to be built using pre-engineered steel poles with anchor bolt foundation designs.

During construction, temporary offices and existing parking areas would be used by construction personnel. Temporary office and parking areas have been designated on previously disturbed areas to the south and northeast of the Project site. Two additional areas are located approximately 5.5 miles southeast of the Project site. There are no permanent new buildings proposed for the Project, and no grading would occur within the temporary office and parking areas. Total temporary staging and parking area would be approximately 30.74 acres.

[1]The life of the project is dependent on the sources permitted for injection into the CTV I approved storage reservoir, the ability of the project year by year to obtain CO_2 and inject at the maximum 2,210,000 million tons per year, and the total estimated storage capacity of up to 48 million tons of CO_2.

Project Area

0 2 4 Miles

(At original document size of 8.5x11)
1:253,440

N

Stantec

Notes
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Data Sources: Stantec 2025.
3. Background: Esri. GEBCO, NOAA, National Geographic, Garin, HERE, Geonames.org Copyright:©2013 National Geographic Society, i-cubed

Project Location
Kern County, CA

Prepared by MMD on 2025-07-03
TR by EH on 2025-07-03
IR by TS on 2025-07-03

Client/Project
185806775
California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Hydrology Study

Figure No.
1

Title
Regional Vicinity

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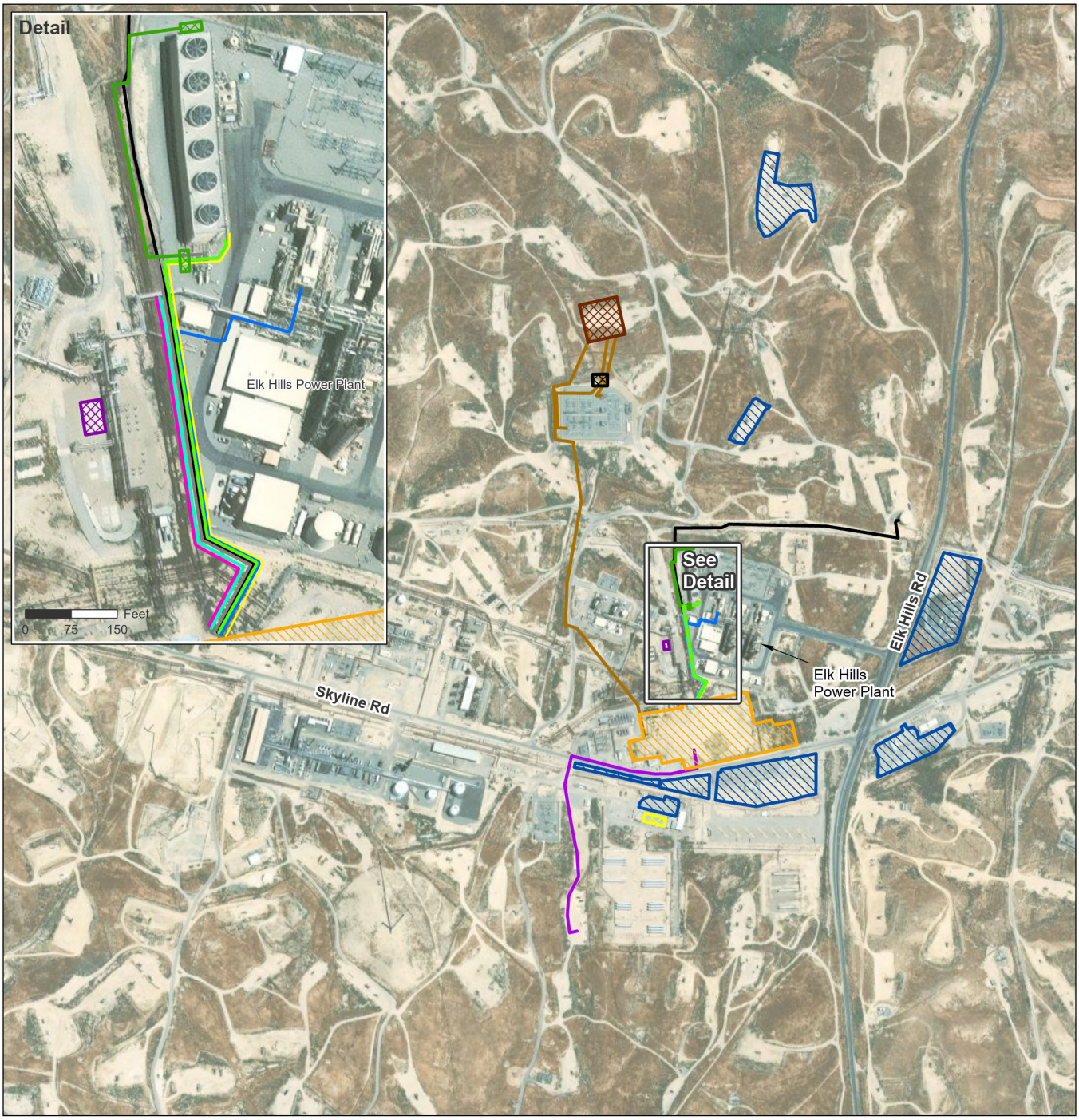

Notes
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Data Sources: Stantec, USGS, 2025.
3. Background: Esri. GEBCO, NOAA, National Geographic, Garin, HERE, Geonames.org Copyright:©2013 National Geographic Society, i-cubed

- Capture Facility
- Temporary Parking, Office, and Staging Areas
- Proposed Sub Location (250 x 250)
- Substation Extension Proposal
- New BPSTG & Transformer
- Warehouse
- Cooling Water Sump
- Electrical Lines
- CO2 Line
- CWR Line
- CWS Line
- Condensate Line
- HP Steam Line
- LP Steam Line
- Raw Water Line
- RO Permeate Stream Pipeline
- CWS Line Alternative

*Entire map extent within Township 30S Range 23E.

0 500 1,000 Feet
(At original document size of 8.5x11)
1:12,000

N

Stantec

Project Location
Kern County, CA

Prepared by MMD on 2025-08-04
TR by CT 2025-08-04
IR by ES on 2025-08-04

Client/Project
185806775
California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Hydrology Study

Figure No.
2a

Title
Site Plan

V:\1858\Active\185806775_CRC_CalCapture\03_data\gis_cad\gis\proHydrology\Hydrology_Figures_20250625.aprx Revised: 2025-08-04 By: mdeseo

Temporary Parking, Office, and Staging Areas

*Entire map extent within Township 31S Range 24E.

0 800 1,600 Feet

(At original document size of 8.5x11)
1:19,200

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Data Sources: Stantec, USGS, 2025.
3. Background: Esri. GEBCO, NOAA, National Geographic, Garin, HERE, Geonames.org Copyright:©2013 National Geographic Society, i-cubed

Project Location
Kern County, CA

Prepared by MMD on 2025-08-04
TR by CT 2025-08-04
IR by ES on 2025-08-04

Client/Project
185806775
California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Hydrology Study

Figure No.
2b

Title
Site Plan

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1.2 CTV I Background Information

On December 31, 2024, the U.S. EPA issued four UIC Class VI well permits to CTV, a carbon management subsidiary of CRC.

The specific U.S. EPA permits issued for the four wells are as follows:

- R9UIC-CA6-FY22 1.1 for well 373-35R
- R9UIC-CA6-FY22 1.2 for well 345C-36R
- R9UIC-CA6-FY22 1.3 for well 353XC-35R
- R9UIC-CA6-FY22 1.4 for well 363C-27R

These four wells would be utilized to inject the CO_2 captured from the proposed Project into the Monterey Formation 26R storage reservoir located approximately 6,000 feet below the ground surface. The CTV I project area is located within the EHOF, which is a suitable area for long-term CO_2 storage and sequestration. The CTV I project was designed to implement sustainable CCS in support of California's initiative to combat climate change by reducing CO_2 levels in the atmosphere.

In addition to the Class VI Permit, CTV obtained a land use permit from the Kern County Planning and Natural Resources Department (Kern County) in 2024. Specifically, the CTV I project was approved by the Kern County Board of Supervisors on October 21, 2024, based on a final Environmental Impact Report (EIR, State Clearinghouse #2022030180) prepared by Kern County and certified by it on the same date. A Notice of Determination was filed with the Kern County Clerk on October 22, 2024. The CTV I project is subject to the terms, conditions and restrictions set forth in the Conditional Use Permits (CUP) issued by Kern County and identified as CUP No. 13, Map 118; CUP No. 14, Map 118; CUP No. 5, Map 119; CUP No. 3, Map 120; CUP No. 2, Map 138; and CUP No. 6, Map 119 (collectively, "the CUP"). Implementation of the CUP authorizes the construction and operation of underground CO_2 facility pipelines to support the CTV I CCS facility and related infrastructure (e.g., injection/monitoring wells, CO_2 manifold piping and metering facilities) within the 9,104-acre project site, located within the EHOF.

Four monitoring wells permitted by the California Geologic Energy Management Division (CalGEM), as part of the CUP issued by Kern County for the CTV I project would be used for CO_2 monitoring. In addition, six CTV I permitted wells would be used to monitor for seismic activity. The seismic monitoring wells will be used to detect seismic events at or above magnitude (M) 1.0 in real time as required by the California Air Resources Board (CARB) CCS Protocol under the Low Carbon Fuel Standard (LCFS) (C.4.3.2.3). Additionally, the California Integrated Seismic Network will be monitored continuously for indication of a 2.7 M or greater earthquake or greater occurring within a 1-mile radius of injection operations from commencement of injection activity to its completion.

Monitoring activities would extend beyond the injection phase of the Project pursuant to Code of Federal Regulation (CFR) Title 40 Section 146.93 until site closure is granted. Monitoring requirements during post-injection are similar to those during injection, with activities such as sampling occurring quarterly and monitoring well integrity testing at frequency per U.S. EPA requirement.

As noted above, the facilities approved as part of the CTV I project, including but not limited to the manifold, pad, injection wells, monitoring wells and related transmission lines, pipelines and other related facilities that have already been approved by applicable agencies with jurisdiction over those facilities, including the U.S. EPA, CalGEM and Kern County, are not included as part of the proposed Project. Accordingly, such facilities are not analyzed in this report.

1.3 Project Location

The Project is located within the EHOF in the southwestern edge of the San Joaquin Valley near Tupman in Kern County, California.

The Project comprises portions of six parcels owned by CRC. The Project is contained within the following sections of EHOF: sections 26, 34, and 35 of Township 30 South Range 23 East and sections 10 and 11 of Township 31 South Range 24 East, Mount Diablo Base and Meridian (MDB&M), Kern County, State of California (Table 1). The proposed Project would be located on approximately 52 acres within the identified parcels.

Table 1 Project Parcel Data

Assessor's Parcel Number	Section/ Township/ Range	Acreage*
158-090-19	Section 35/ Township 30S/ Range 23E	590.61
158-090-16	Section 35/ Township 30S/ Range 23E	14.78
158-090-02	Section 26/ Township 30S/ Range 23E	640
158-090-04	Section 34/ Township 30S/ Range 23E	682.86
298-070-05	Section 11/Township 31S/Range 24E	640
298-070-06	Section 10/Township 31S/Range 24E	640

Notes:
Assessor's parcel acreages from Kern County Web Map (Kern County GIS, 2025).

2 Regulatory Setting

2.1 Federal Plans, Policies, Regulations, and Laws

2.1.1 Clean Water Act

The Federal Clean Water Act (CWA) 33 U.S.C. 1251-1387 presents numerous amendments; notably, the Federal Water Pollution Control Act of 1972 (P.L. 92-217), the Clean Water Act of 1977 (P.L. 95-217), and the Water Quality Act of 1987 (P.L. 100-4). The 1972 amendments to the Clean Water Act established federal jurisdiction over “navigable waters,” defined in the Act as waters of the U.S. (WOTUS) (CWA Section 502(7)).

Section 404. Section 404 of the CWA regulates dredging and the placement of fill within WOTUS, including federally-jurisdictional wetlands. The Section 404 Regulatory Program is managed within the region of the Project site by the Sacramento District of the U.S. Army Corps of Engineers.

Section 402. Section 402 of the CWA required states to set standards to protect, maintain, and restore water quality through the regulation of point source and certain nonpoint source discharges to surface water. Those discharges are regulated by the National Pollutant Discharge Elimination System (NPDES) permit process. For construction-related storm water discharges from the Project site, the Project would be required to comply with the following NPDES permit from California State Water Resource Control Board: General Permit for Storm Water Discharges Associated with Construction and Land Disturbing Activities (Order No. 2022-0057-DWQ).

The State Water Resources Control Board has adopted a general permit for construction activities that disturb one acre or more of land. The general permit applies to discharges of sediment from construction activities associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities. To comply with the general permit, a notice of intent (NOI) must be filed with the State Water Resources Control Board, and a stormwater pollution prevention plan must be implemented at the commencement of grading and remain in effect until construction is completed.

Section 401. Section 401 of the CWA requires that, prior to issuance of any federal permit or license, any activity (including river or stream crossing during road, pipeline, or transmission line construction) which may result in discharges into WOTUS must be certified by the state, as administered by the Regional Water Quality Control Board (RWQCB). This certification ensures that the proposed activity does not violate state and/or federal water quality standards.

Section 303. Section 303(d) of the CWA (33 U.S. Code 1250, et seq., at 1313(d)) requires states to identify “impaired” water bodies as those which do not meet water quality standards. States are required to compile this information in a list and submit the list to the U.S. EPA for review and approval. This list is known as the Section 303(d) list of impaired waters. As part of this listing process, states are required to prioritize waters and watersheds for future development of total maximum daily loads (TMDL) requirements. The SWRCB

and RWQCBs have ongoing efforts to monitor and assess water quality, to prepare the Section 303(d) list, and to develop TMDL requirements.

2.1.2 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect all waters actually or potentially designed for drinking use, whether from aboveground or underground sources, including rivers, lakes, reservoirs, springs, and groundwater wells (EPA 2016). The SDWA authorizes the U.S. EPA to set national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water.

Oil and gas extraction typically produces large amounts of brine, which can contain toxic metals and radioactive substances. These brines can cause damage to the environment and public health if discharged into water or land. Deep underground injection of brines in formations isolated from underground sources of drinking water prevents soil and contamination. Injection became the preferred way to dispose of waste fluids when states began to implement rules preventing disposal of brine to surface water bodies and soils (EPA 2016).

The U.S. EPA has authority under the SDWA to regulate the subsurface injection of fluids below, into, and above an underground source of drinking water (USDW) and has established an UIC program by regulations promulgated under the Act (40 CFR 144-147). A USDW is defined as any aquifer that (1) supplies a public water system or (2) contains enough groundwater to supply a public water system and either currently supplies drinking water for human consumption or contains less than 10,000 mg/L of TDS. An injection well is used to place fluid underground into porous geologic formations that may range from deep sandstone or limestone to a shallow soil layer. Injected fluids may include water, wastewater, brine (saltwater), or water mixed with chemicals (EPA 2016). The U.S. EPA ensures that underground injection wells do not endanger any current and future underground or surface sources of drinking water (EPA 2016). Injection wells are separated into six classes. Class I wells inject hazardous and non-hazardous wastes into deep, isolated rock formations that are separated from the lowest USDW by layers of impermeable clay and rock. Class II wells inject fluids associated with oil and natural gas production operations. Class III wells inject super-heated steam, water, or other fluids into formations to dissolve and extract minerals. Class IV wells inject hazardous or radioactive wastes into underground sources of drinking water and were banned by the U.S. EPA in 1984 (EPA 2016). Class IV wells may only operate as part of a U.S. EPA or state-authorized groundwater cleanup action. Class V injection wells include wastewater disposal wells used by the geothermal industry and shallow septic system and cesspool wells that drain liquid waste into the ground. Class VI wells are used to inject CO2 into deep rock formations for long-term underground storage, also called geologic sequestration or "storage." Geologic storage refers to technologies to reduce CO2 emissions to the atmosphere and mitigate climate change (EPA 2016).

2.1.3 National Pollutant Discharge Elimination System

Part of the CWA provides for the National Pollutant Discharge Elimination System (NPDES), in which discharges into navigable waters, are prohibited except in compliance with specified requirements and authorizations. Under this system, municipal and industrial facilities are required to obtain a NPDES permit that specifies allowable limits based on available wastewater treatment technologies for pollutant levels in their effluent. In California, the U.S. EPA has delegated the implementation of this program to the SWRCB and to the RWQCB. Storm water discharges are regulated somewhat differently.

Storm water runoff from construction areas of one acre or more require either an individual permit or coverage under the statewide General Construction Storm Water Permit. In addition, specific industries, including wastewater treatment plants that have direct storm water discharges to navigable waters are required to obtain either an individual permit issued by the RWQCB, or obtain coverage under the statewide General Industrial Storm Water Permit for storm water discharges.

A non-point source is a diffused source, such as land runoff, precipitation, deposit from the atmosphere, or percolation. Major non-point sources of water pollution are agriculture, mining, oil and gas extraction, pastureland and feedlots, land disposal, and urban runoff. For non-point sources, the Basin Plan outlines the approach that the RWQCB has taken to control non-point source pollution in its Urban Runoff Management scheme. Part of the strategy involves the permitting of storm water discharges from all facilities associated with industrial activities and from all construction activities that result in the disturbance of land totaling one acre or more.

2.1.4 Federal Emergency Management Agency

Under Executive Order 11988, Federal Emergency Management Agency (FEMA) is responsible for the management and mapping of areas subject to flooding during a 100-year flood event (i.e., 1 percent chance of occurring in a given year). FEMA requires that local governments covered by federal flood insurance pass and enforce a floodplain management ordinance that specifies minimum requirements for any construction within the 100-year flood plain, as depicted on FEMA maps.

2.1.5 National Flood Insurance Act

FEMA is responsible for managing the National Flood Insurance Program (NFIP), which makes federally backed flood insurance available for communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. The NFIP, established in 1968 under the National Flood Insurance Act, requires that participating communities adopt certain minimum floodplain management standards, including restrictions on new development in designated floodways, a requirement that new structures in the 100-year flood zone be elevated to or above the 100-year flood level (known as base flood elevation), and a requirement that subdivisions be designed to minimize exposure to flood hazards.

To facilitate identifying areas with flood potential, FEMA has developed Flood Insurance Rate Maps (FIRMs) that can be used for planning purposes, including floodplain management, flood insurance, and

enforcement of mandatory flood insurance purchase requirements. Kern County is a participating jurisdiction in the NFIP and, therefore, all new development must comply with the minimum requirements of the NFIP.

2.2 State Plans, Policies, Regulations, and Laws

2.2.1 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) (Water Code Sections 13000 et seq.), passed in 1969, is the primary statute covering the quality of waters in California and requires protection of water quality by appropriate designing, sizing, and construction of erosion and sediment controls. The Porter-Cologne Act established the SWRCB and divided California into nine regions, each overseen by an RWQCB. SWRCB, located in Sacramento, is the agency with jurisdiction over water quality issues in the State of California. The SWRCB is governed by the Porter-Cologne Water Quality Act (Division 7 of the California Water Code), which establishes the legal framework for water quality control activities by the SWRCB. The intent of the Porter-Cologne Act is to regulate factors that may affect the quality of waters of the State to attain the highest quality which is reasonable, considering a full range of demands and values. Much of the implementation of the SWRCB's responsibilities is delegated to its nine RWQCBs. The Project area is located within the Central Valley Region. The Porter-Cologne Act assigns responsibility for implementing the CWA Sections 401 through 402 and 303(d) to the SWRCB and the nine RWQCBs. The Porter-Cologne Act requires the development and periodic review of water quality control plans (basin plans) that designate beneficial uses of California's major rivers and groundwater basins and establish narrative and numerical water quality objectives for those waters, provide the technical basis for determining waste discharge requirements, identify enforcement actions, and evaluate clean water grant proposals.

2.2.2 Regional Water Quality Control Board, Central Valley Region

The Central Valley RWQCB Basin Plan (Third Edition, May 2018) was referenced to determine existing and potential beneficial uses of groundwater in the Project area, which is located in Detailed Analysis Unit 260. Per SWRCB Resolution No. 88-63, groundwater is designated for municipal and industrial groundwater beneficial uses (RWQCB, 2018). However, as defined in the Aquifer Exemption application and supporting materials, groundwater supply is not sufficient quantity or quality to serve these potential uses (U.S. EPA, 2018). Additionally, this is within the West Kern Water District's (WKWD) Western Watch Area, which is described as predominantly made up of barren land or oil fields (WKWD, 2022). Depth to water in the Spring of 2022 ranged between 122 to 148 feet and shows a gradient to the east-southeast. However, depth to groundwater is estimated at over 500 feet below ground surface in the Project area. A groundwater assessment conducted in 1987 encountered no groundwater to a depth of 420 feet. In addition, a 1,000-foot soil boring was drilled in 1991 at the nearby section 27R facility and no groundwater was encountered (Soils Engineering Inc., 2023).Lastly, any groundwater that is encountered in this area is generally unusable due to high salinity levels.

2.2.3 NPDES Construction General Permit

Construction associated with the Project would disturb more than 1 acre of land surface affecting the quality of stormwater discharges. Therefore, the Project would be subject to the NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Order 2022-0057-DWQ, NPDES No. CAS000002. The Construction General Permit regulates discharges of pollutants in stormwater associated with construction activity to Waters of the United States from construction sites that disturb 1 acre or more of land surface, or that are part of a common plan of development or sale that disturbs more than one acre of land surface. The permit regulates stormwater discharges associated with construction or demolition activities, such as clearing and excavation, construction of buildings, and linear underground projects, including installation of water pipelines and other utility lines. The Construction General Permit requires that construction sites be assigned a Risk Level of 1 (low), 2 (medium), or 3 (high), based both on the sediment transport risk at the site and the receiving waters risk during periods of soil exposure (e.g., grading and site stabilization). The sediment risk level reflects the relative amount of sediment that could potentially be discharged to receiving water bodies and is based on the nature of the construction activities and the location of the site relative to receiving water bodies. The receiving waters risk level reflects the risk to the receiving waters from the sediment discharge. Depending on the risk level, the construction projects could be subject to the following requirements:

- Effluent standards; Good site management “housekeeping”
- Non-stormwater management
- Erosion and sediment controls
- Run-on and runoff controls
- Inspection, maintenance, and repair
- Monitoring and reporting requirements

The Construction General Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) that includes specific best management practices (BMPs) designed to prevent sediment and pollutants from contacting stormwater from moving offsite into receiving waters. The BMPs fall into several categories, including erosion control, sediment control, waste management, and good housekeeping, and are intended to protect surface water quality by preventing the off-site migration of eroded soil and construction-related pollutants from the construction area. Routine inspection of all BMPs is required under the provisions of the Construction General Permit. In addition, the SWPPP is required to contain a visual monitoring program, a chemical monitoring program for non-visible pollutants, and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

The SWPPP must be prepared before construction begins. The SWPPP must contain a site map(s) that delineates the construction work area, existing and proposed buildings, parcel boundaries, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the Project area. The SWPPP must list BMPs and the placement of those BMPs that the applicant would use to protect stormwater runoff. Additionally, the SWPPP must contain a visual monitoring program, a chemical monitoring program for “non-visible” pollutants to be implemented if there is a failure of BMPs, and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment. Examples of typical construction BMPs include scheduling or limiting certain

activities to dry periods, installing sediment barriers, such as silt fence and fiber rolls, and maintaining equipment and vehicles used for construction. Non-stormwater management measures include installing specific discharge controls during certain activities, such as paving operations, vehicle and equipment washing and fueling. The Construction General Permit also sets post-construction standards (i.e., implementation of BMPs to reduce pollutants in stormwater discharges from the site following construction).

In the Project area, the Construction General Permit is implemented and enforced by the CVRWQCB, which administers the stormwater permitting program. Dischargers must electronically submit a notice of intent and permit registration documents to obtain coverage under this Construction General Permit. Dischargers are to notify the CVRWQCB of violations or incidents of noncompliance and submit annual reports identifying deficiencies in the BMPs and explaining how the deficiencies were corrected. The risk assessment and SWPPP must be prepared by a State Qualified SWPPP Developer, and implementation of the SWPPP must be overseen by a State Qualified SWPPP Practitioner. A legally responsible person, who is legally authorized to sign and certify permit registration documents, is responsible for obtaining coverage under the permit.

2.2.4 California State Nondegradation Policy

In 1968, as required under the federal antidegradation policy, SWRCB adopted a nondegradation policy aimed at maintaining a high quality of waters in California. The nondegradation policy states that the disposal of wastes into state waters shall be regulated to achieve the highest water quality consistent with maximum benefit to the people of the state and to promote the peace, health, safety, and welfare of the people of the state. Any discharges associated with the Project would be required to comply with this policy.

2.2.5 Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act of 2014 (SGMA), effective January 1, 2015, authorizes local agencies to manage groundwater in a sustainable manner and allows limited state intervention when necessary to protect groundwater resources. SGMA requires the creation of a Groundwater Sustainability Agency (GSA) that would develop and implement a Groundwater Sustainability Plan (GSP) to manage and use groundwater in a manner that can be maintained during the planning and implementation horizon without undesirable results, defined as follows:

- Chronic lowering of groundwater levels, indicating a significant and unreasonable depletion of supply
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
- Significant and unreasonable land subsidence that substantially interferes with surface land uses
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

The WKWD GSA was created June 28, 2016, when WKWD's Board of Directors adopted Resolution 16.03, electing to become a GSA in the subbasin and included the WKWD service area (WKWD, 2022). The WKWD is a member of the Kern Groundwater Authority (KGA) and has a Management Area Plan within the KGA's GSP for the Project area. The WKWD GSA jurisdictional area is defined by the WKWD service boundary with some addition proximal parcels owned and operated by oil production companies and other private landowners (such as the Project area). The WKWD GSA is located along the western edge of the Subbasin and is comprised of 299 square miles. WKWD GSA formed two management areas, named the North Project and South Project management areas, and three watch areas, named the Lake Watch Area, Little Santa Maria Valley Watch Area, and the Western Watch Area. The Project area is located in the Western Watch Area because "the only known pumping in the area are considered de minimis; in general, yields of water in this area are unsuitable for domestic or industrial use" (WKWD, 2022). Subsequently, no management or monitoring actions have been established in the Western Water Area.

2.3 Regional/Local Plans, Policies, Regulations, and Ordinances

2.3.1 Kern County General Plan

The Kern County General Plan includes elements to protect the groundwater and surface water resources of Kern County through various goals and policies. The following policies would apply to the Project:

Chapter 1: Land Use, Open Space, and Conservation Element

Physical and Environmental Constraints

Policy 6. Regardless of percentage of slope, development on hillsides will be sited in the least obtrusive fashion, thereby minimizing the extent of topographic alteration required and reducing soil erosion while maintaining soil stability.

Policy 11: Protect and maintain watershed integrity within Kern County

> Measure N: Applicants for new discretionary development should consult with the appropriate Resource Conservation District and the California Regional Water Quality Control Board regarding soil disturbances issues.

Resources

Policy 10. To encourage effective groundwater resource management for the long-term economic benefit of the County the following shall be considered:

(a) Promote groundwater recharge activities in various zone districts.

(b) Support for the development of Urban Water Management Plans and promote Department of Water Resources grant funding for all water providers.

(c) Support the development of groundwater management plans.

(d) Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water and groundwater and desalination.

Policy 11: Minimize the alteration of natural drainage areas. Require development plans to include necessary mitigation to stabilize runoff and silt deposition through utilization of grading and flood protection ordinances.

Policy 12. Areas identified by the Natural Resource Conservation Service (formerly Soil Conservation Service) as having high range-site value should be conserved for Extensive Agriculture uses or as Resource Reserve, if located within a county water district.

Implementation Measure C. The County Planning Department will seek review and comment from the County Public Works Department, Engineering and Survey Services Division on the implementation of the National Pollution Discharge Elimination System for all discretionary projects.

Surface Water and Groundwater

Policy 34: Ensure that water quality standards are met for existing users and future development.

Policy 39. Encourage the development of the County's groundwater supply to sustain and ensure water quality and quantity for existing users, planned growth, and maintenance of the natural environment.

Policy 43: Drainage shall conform to the Kern County Development Standards and the Grading Ordinance.

Policy 44: Discretionary projects shall analyze watershed impacts and mitigate for construction related and urban pollutants, as well as alterations of flow patterns and introduction of impervious surfaces as required by CEQA, to prevent the degradation of the watershed to the extent practical.

Chapter 8: Safety Element

Storm Drainage

Goal 1. Ensure the provision of adequate storm drainage facilities to protect planning area residents from flooding resulting from storm water excess.

2.3.2 Kern County Code of Building Regulations

Kern County Grading Ordinance (17.28)

Chapter 17.28 Kern County Grading Ordinance: Requirements of the Kern County Grading Ordinance will be implemented. A grading permit will be obtained prior to commencement of construction activities. Of particular note with respect to hydrology and water quality is Section 17.28.140, Erosion Control, which addresses the following:

Slopes. The faces of cut and fill slopes shall be prepared and maintained to control against erosion. This control may consist of effective planting. The protection for the slopes shall be installed as soon as practicable and prior to calling for final approval. Where cut slopes are not subject to erosion due to the erosion-resistant character of the materials, such protection may be omitted.

Other Devices: Where necessary, check dams, cribbing, riprap, or other devices or methods shall be employed to control erosion and provide safety.

Temporary Devices: Temporary drainage and erosion control shall be provided as needed at the end of each workday during grading operations, such that existing drainage channels would not be blocked. Dust control shall be applied to all graded areas and materials and shall consist of applying water or another approved dust palliative for the alleviation or prevention of dust nuisance. Deposition of rocks, earth materials or debris onto adjacent property, public roads or drainage channels shall not be allowed.

2.3.3 Kern County Development Standards

The Kern County Development Standards apply to all developments within Kern County that are outside of incorporated cities. These standards establish minimum design and construction requirements that will result in improvements that are economical to maintain and will adequately serve the general public. The requirements set forth in these standards are considered minimum design standards and will require the approval of the entity that will maintain the facilities to be constructed prior to approval by Kern County.

2.3.4 Kern County Water Quality Control Plan

Refer to NPDES Construction General Permit (Section 2.2.3). The Kern County Engineering and Survey Services Department requires the completion of an NPDES applicability form for all construction projects disturbing one or more acre within Kern County. This form requires the Project Proponent to provide background information on construction activities. Project Proponents must apply for the permit under one of the following four conditions:

1) All stormwater is retained on site and no stormwater runoff, sediment, or pollutants from on- site construction activity can discharge directly or indirectly off site or to a river, lake, stream, municipal storm drain, or off-site drainage facilities.

2) All stormwater runoff is not retained on site but does not discharge to a Water of the United States (i.e., drains to a terminal drainage facility). Therefore, a SWPPP has been developed and BMPs must be implemented.

3) All stormwater runoff is not retained on site, and the discharge is to a Water of the United States. Therefore, a Notice of Intent must be filed with the State Regional Water Resources Control Board prior to issuance of the building permit. Also, a SWPPP has been developed and BMPs must be implemented.

4) Construction activity is between 1 to 5 acres and an Erosivity Waiver was granted by the SWRCB. BMPs must be implemented.

3 Existing Site Characteristics

The following sections discuss existing site characteristics, hydrologic setting, and water quality conditions of the Project Study Area. For purposes of this report, the Study Area includes the Project site and adjacent drainage areas.

3.1 Regional Setting

3.1.1 Hydrologic Region

The Project is located within the Kern River Flood Canal Subwatershed (HUC ID: 180300121204), which has a total drainage area of 22,270 acres. There are no jurisdictional surface water bodies (creeks, streams, or rivers) within the Project area. However, there are superficial drainages throughout the Project area that drain in the direction of the natural topography to the north.

3.1.2 Climate

Climate in the region is characterized as arid to semi-arid with average annual precipitation of 6 to 7 inches per year. Approximately 95 percent of the precipitation falls between October and April (DWR, 2015). Average precipitation by day within the Bakersfield – Buttonwillow area, located approximately 6 miles north of the Project area, has ranged from zero to 0.37 inches between January 2010 and July 2023. During this same time span and in the same area, average temperature by day ranges from 42.7 degrees Fahrenheit in late December to 85 degrees Fahrenheit in mid-August (NWS and NOAA, 2023).

3.2 Land Cover

The Study Area is located within the developed area of the EHOF that is mostly cleared space for future use with some existing impervious surfacing. The cleared space comprises primarily reclaimed sites with compacted bare soil and native and non-native weedy vegetation. The existing impervious areas consist primarily of roads, parking lots, pipe-racks, oil and gas production facilities, and buildings.

3.3 Soil Characteristics

The Hydrologic Soil Group (HSG) was determined using the Natural Resources Conservation Service (NRCS) Web Soil Survey. The areas tributary to the Study Area consists of HSG A. Soils in HSG A categorization have high infiltration rates even when thoroughly wetted, consisting mostly of excessively well drained soils, and resulting in low runoff potential. The complete Web Soil Survey Report can be found in Appendix A.

3.4 Site Drainage

The Project site is located at the headwaters of the watersheds analyzed. Runoff is mainly overland flow consisting of mostly sheet flow and shallow concentrated flow with some channel flow. Runoff from the Study Area drains north-east for the tributary watersheds located east of Elk Hills Road and south-east for the tributary watersheds east of Elk Hills Road. Drainage courses within the area of the Project site are hydrologically isolated and therefore do not contain Waters of the United States.

4 Hydrology Analysis

A pre- vs post-development hydrology analysis was utilized to determine the impact of the proposed improvements on the stormwater runoff characteristics within the Study Area. More specifically, an accurate hydrology model of the study area quantif how the proposed Project would affect total stormwater runoff volume, time to peak flow, and changes in peak flow compared to pre-development conditions.

4.1 Post-Development Conditions

Post-development drainage would mimic existing conditions except as follows: the addition of a storm drain system is proposed with the capture facility. Runoff would enter the storm drain system via drop inlets and continue east and discharge into a proposed basin. Runoff from the rest of the site would continue discharging offisite like existing conditions and infiltrate into the pervious soil.

The proposed surface improvements would increase the total impervious area within the Study Area watersheds. The increase of impervious areas is a result of the proposed facilities including the capture facility and electrical substation. Table 2 provides a summary of the existing and proposed impervious areas within each watershed.

Table 2 Pre and Post Development Impervious Areas

Watershed	Pre-Development Impervious Area (acres)	Post-Development Impervious Area (acres)
Sub-1	16.30	17.48
Sub-2	22.77	25.28
Sub-3	0.31	1.30

The increase in impervious area to Sub-1 and Sub-2 comes from the proposed capture facility which would add concrete, pavement, and other impervious structures. The increase to the impervious area within Sub-3 comes from the proposed electrical substation which would add concrete and other impervious structures.

Temporary parking, field offices, and stages areas associated with the proposed construction are also part of the proposed improvements. However, as these items are temporary and do not impact the amount of permanent impervious surface area, these areas were not taken into consideration when performing this analysis.

4.2 Methodology

The hydrology model was set up to include the watersheds within the Study Area where an increase in impervious area is proposed. The analysis focused on these watersheds since the increase in impervious surface is likely to increase to peak flow runoff. USGS topography was used to determine the high and low points surrounding the site. The high points were used to delineate the watershed boundaries, and the low

points were used to determine the discharge location of the watersheds. Figure 3 provides a map of the delineated watersheds.

A hydrologic modeling software developed by CivilGEO, GeoHECHMS, was used to evaluate rainfall-runoff relationships for the Study Area. GeoHECHMS integrates geographic information systems containing watershed characteristics with the United States Army Corps of Engineers Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) software. The Soil Conservation Service (SCS) Unit Hydrograph model within GeoHEC-HMS version 4.5 was used for this Project.

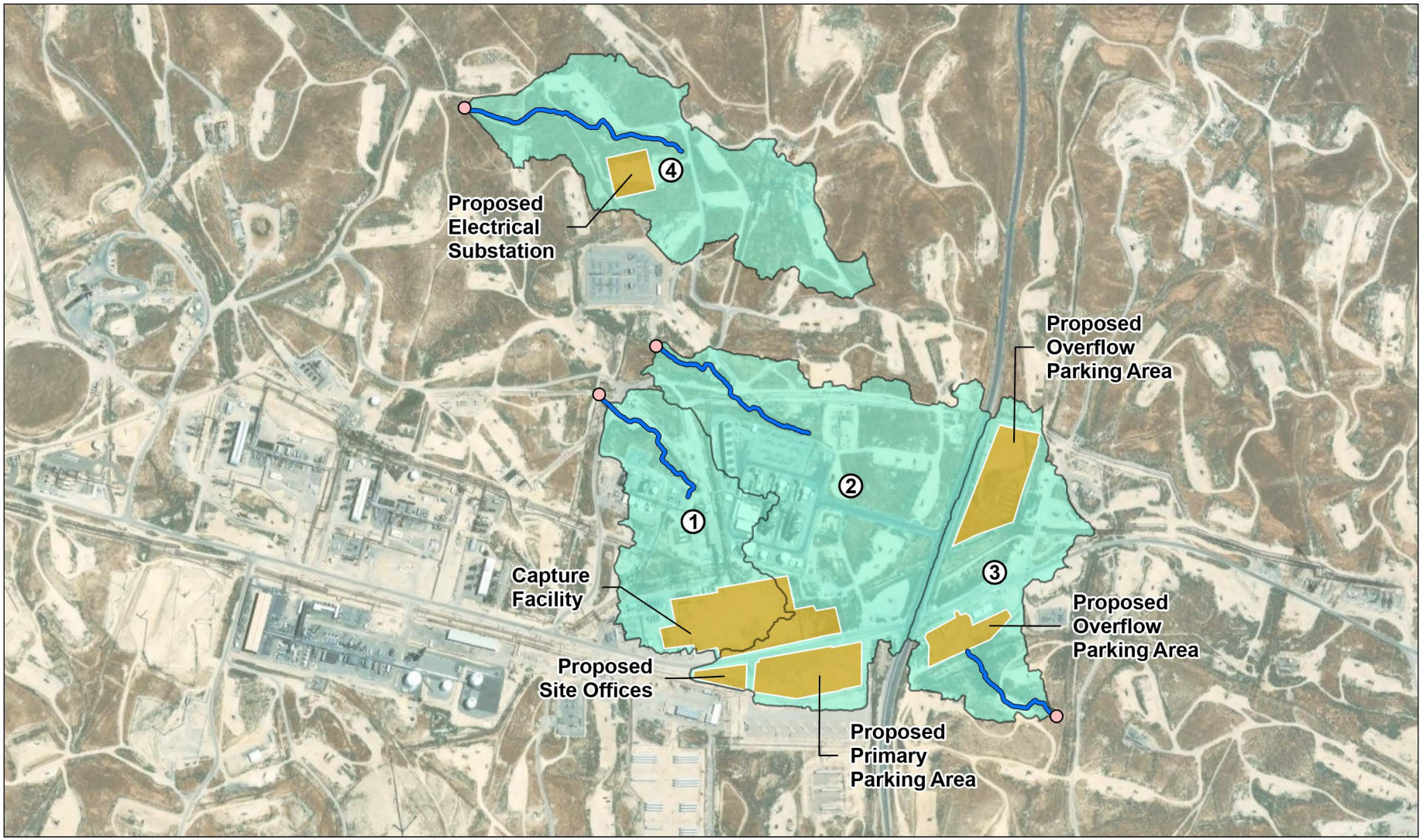
The Kinematic Wave routing method was used for simulating reach routing of the stormwater flows. Reach routing is the delay to the outflow hydrograph from upstream watersheds as they travel through downstream watershed via channel flow. The Kinematic Wave routing method approximates the full unsteady flow equations by ignoring inertial and pressure forces. It is assumed that the energy slope is equal to the bed slope. The Kinematic Wave routing method is one of several accepted reach routing methods used by government agencies including USGS and NOAA.

The following parameters and data sources were used for model setup:

- Topography: Digital Elevation Model developed from the United States Geological Survey (USGS) contour data.
- Land Cover: Land Cover data was obtained from the National land Cover Database.
- Soil Type(s): Soil type coverage was obtained from the Soil Survey Geographic Database.
- Effective Precipitation: Rainfall depths for various design storm events were obtained from National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 6 (see Appendix B)
    - Rainfall Losses: SCS "Curve Number" Loss method
    - Storm Type: Type I 24-hour
    - Storm Duration: 24 hours
    - Rainfall Depth (10-year, 24-hour storm): 2.03 inches
    - Rainfall Depth (100-year, 24-hour storm): 3.55 inches
- Time of Concentration: The time of concentration was determined using the SCS TR-55 method (see Appendix C). This is the time required for runoff to travel from the hydraulically most distant point in the watershed to the outlet.

The 10-year and 100-year storm events were selected for this analysis as these are the recommended design events found within the Kern County *Division 4: Standards for Drainage* manual. The Type 1 storm type distribution was used as the site is located within the Type 1 region of the SCS rainfall distribution.

This analysis was applied to watersheds Sub-1, Sub-2, and Sub-3 as shown in Figure 3.



Watershed Boundary
Watershed Area
New Impervious Area

1 Watershed ID
Reaches
Discharge Point

N

0 450 900 Feet
(At original document size of 8.5x11)
1:10,800

Notes
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Data Sources: Stantec, 2025.
3. Background: Maxar

Stantec

Project Location
Kern County, CA

Prepared by MMD on 2025-07-03
TR by EH on 2025-07-03
IR by TS on 2025-07-03

Client/Project
185806775
California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Hydrology Study

Figure No.
3

Title
Watershed Map

V:\18558\Active\185806775_CRC_CalCapture\03_data\gis_cad\gis\proj\Hydrology\Hydrology_Figures_20250625.aprx Revised: 2025-07-03 By: mdeseo

5 Scour Analysis

The possibility of scour occurring where the proposed CO_2 pipeline or other proposed utility lines crossed existing drainageways was considered. Drainage crossings within the EHOF were determined using the USGS contour topography and aerial imagery of the Study Area.

It is unlikely that significant scour would occur along any of the proposed utility locations given the post-development conditions. Runoff for most of the site outside of the watersheds identified above travels via sheet flow which is not scour inducive given the spread of the flow. It anticipated that construction of the pipeline and other utilities would not impact this as these features would be placed primarily underground and should not impact surface level drainage.

The capture facility does concentrate onsite flows which could lead to scour, but flows enter a storm drain system via drop inlets that would convey the concentrated flow to an onsite basin where energy dissipation structures (riprap apron or similar) would be used to mitigate scour.

6 Results

6.1 Peak Flow Runoff

Table 3 summarizes the pre-development versus post-development peak runoffs for the 10-year, 24-hour and 100-year, 24-hour storms in cubic feet per second (cfs). The table only includes the watersheds where the proposed improvements would possibly increase the total impervious area of the Study Area. The detailed peak flow analysis can be found in Appendix C.

Table 3 Pre and Post Development Peak Runoff Flows

Watershed	Pre 10-year Peak Runoff (cfs)	Post 10-year Peak Runoff (cfs)	Pre 100-year Peak Runoff (cfs)	Post 100-year Peak Runoff (cfs)
Sub-1	14.92	15.96	30.10	31.85
Sub-2	13.07	14.50	24.76	27.29
Sub-3	0.22	0.93	0.38	1.62

Source: GeoHECHMS CRC CalCapture Hydrology Analysis Report, 2025

Table 3 shows that the proposed improvements within the Study Area increase the peak flow runoff from the site. Although the final site plan for the new capture facility has not been developed at this time, the proposed location is known. To be conservative with post-development peak flow runoff, it was assumed that all improvements within the boundary of the proposed location would be impervious. The results in Table 3 were obtained using a model which implemented this assumption.

This, however, may not be the case once the site plan is developed. If the actual amount of new impervious area created within these watersheds is determined to affect on-site drainage characteristics, peak flow management features would need to be used to help reduce the post-development peak flow runoff.

7 Impact Analysis

This section discusses potential hydrology impacts associated with the Project and recommends mitigation measures (MMs) where necessary.

7.1 Thresholds of Significance

In accordance with the CEQA Guidelines Appendix G Environmental Checklist,[2] the following questions are to be analyzed and evaluated to determine whether a project would have a significant impact on hydrology and water quality. Would the proposed project:

a) Would the Project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface of groundwater quality?
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the Project may impede sustainable groundwater management of the basin?
c) Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

   i) result in a substantial erosion or siltation on- or off-site;

   ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;

   iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or

   iv) impede or redirect flood flows?

d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

[2]Appendix G Environmental Checklist Form, Guidelines for the Implementation of the California Environmental Quality Act, 2023

7.2 CEQA Impact Analysis

7.2.1 HYD-1 Impact Analysis

Impact HYD-1 Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface of groundwater quality?

Construction

Less than significant with mitigation. Construction of the Project would require excavation, grading, and recontouring of soil at the Project area. During these activities, soils could become exposed to high winds or heavy precipitation causing a substantial increase in sedimentation in storm water run-off. In addition, construction activities would require the use of hazardous materials including but not limited to petroleum products (e.g., gasoline, diesel, and motor oil) and automotive fluids (e.g., antifreeze and hydraulic fluids). Dewatering is not anticipated for this Project.The mobilization of sediment or inadvertent spills or leaks of such pollutants could affect the quality of runoff water from the construction sites. However, because the Project would disturb more than 1 acre, construction would be subject to the NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activity (Construction General Permit). As part of this process, the CRC would be required to comply with the NPDES Construction General Permit. Compliance with this permit would require the preparation and implementation of a SWPPP that would identify pollutant sources that may affect the quality of storm water discharge and implement BMPs, such as erosion control and pollution prevention measures, to be used during construction. The Project SWPPP would include BMPs to minimize the impacts of construction activities to water quality. With implementation of the BMP requirements required by the state Construction General Permit, the potential for pollutants and sediment to affect the water quality of runoff from construction sites would be minimized to less- than-significant levels with the implementation of MMs HYDRO-1 through HYDRO-3.

Operations

Less than significant impact. The proposed Project or variant would comply with all applicable water quality regulations for disposal of wastewater. The limited footprint of the Capture Facility would not modify surface water quality because of the minimal increase in impervious area and peak runoff (less than 3 cfs for each watershed) from the existing conditions. In compliance with U.S. EPA Spill Prevention, Control, and Countermeasures (SPCC) Plan requirements, chemical storage tanks would be provided with secondary containment with 110% capacity for the largest tank. Additionally, the proposed implementation of a lined retention basin onsite would capture the excess runoff and assist with water quality treatment. Finally, CRC has submitted a Notice of Non-Applicability (NONA) report to the CVRWQCB that documents the EHOF's hydrological isolation from surface waters of the United States (Insight Environmental 2015).Therefore, the operation of the Project would not violate water quality standards, waste discharge requirements, or degrade surface or water quality in the area. The proposed Project would have less than significant impacts to hydrology and water quality with the implementation of MMs HYDRO-1 through HYDRO-3.

7.2.2 HYD-2 Impact Analysis

Impact HYD-2	**Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the Project may impede sustainable groundwater management of the basin?**

Construction

Less than significant impact with mitigation. The Project would require water for dust suppression, fire protection, and pipeline hydrotesting. The water would be trucked from existing water hydrants within the EHOF and stored on-site, using water from CRC's existing contracted water amounts with WKWD. Therefore, impacts related to construction would be less than significant with implementation of MMs HYDRO-1 through HYDRO-3.

Operations

Less than significant impact with mitigation. The Project would include the addition of new impervious surfaces within the Project area due to the implementation of concrete foundations, resurfacing (concrete) of existing dirt roads, development of new access roads, implementation of the proposed CO_2 compression and pumping facility, which includes the Control Room and Parking Area, and aboveground pipelines. The proposed facilities would not have the scale or massing to interfere with groundwater recharge. Additionally, the Project site lies in an area with low annual precipitation amounts and high evapotranspiration rates, which limit rainfall infiltration for groundwater recharge. Storm water falling on the proposed CCU facility would be directed to a lined storm water basin and the water would be pumped out and injected into the deep subsurface via existing injection wells. Additionally, water utilized during operation of the proposed CCS project would be sourced from the WKWD under existing water contracts. Therefore, implementation of impervious surfaces and facilities would not impede groundwater management of the Subbasin.

Project operation would utilize water supplied by WKWD under existing contracts. The western anticline in the Elk Hills is believed to divert the movement of groundwater south through the Buena Vista Valley toward Buena Vista Lake. WKWD describes the Project area as "predominantly made up of barren land or oil fields. The only known pumping in the area are considered *de minimis*; in general, yields of water in this area are unsuitable for domestic or industrial use" (WKWD, 2022). For the same reasons there is no groundwater use, the Project area is also not suitable for groundwater recharge.

Implementation of the Project would utilize water currently allocated to CRC within its existing water contracts with WKWD. Therefore, it would not decrease groundwater supplies or impede sustainable management of the Subbasin. Impacts would be less than significant.

7.2.3 HYD-3 Impact Analysis

Impact HYD-3	**Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would: i) result in a substantial erosion or siltation on- or off-site; ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite; iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or iv) impede or redirect flood flows?**

Construction

Less than significant impact. Construction of the Project would require excavation, grading, and recontouring of soils in the Project area. During these activities, soils could become exposed to high winds or heavy precipitation causing erosion. As discussed above in Impact 1, the Project would disturb more than 1 acre. Therefore, the Project would be required to comply with the NPDES Construction General Permit, which would require the preparation and implementation of a SWPPP. The SWPPP would include BMPs requiring erosion control and pollution prevention measures to be used during construction. The Project SWPPP would include BMPs to minimize the impacts of construction to a less than significant level. Erosion control BMPs have been proven effective at minimizing erosion during construction and associated earthwork activities. Additionally, CRC would be required to provide regular reporting to the CVRWQCB to verify compliance with the SWPPP. The CVRWQCB would provide regulatory oversight to ensure compliance with the NPDES Construction General Permit. With implementation of the SWPPP, the Project would minimize the potential for erosion or siltation to occur during construction, and the impact would be less than significant.

Operations

Less than significant impact. The proposed Project components would add a minimal amount of impervious area to the overall Project site. The increase in impervious area would primarily be located at the 7.25-acre Capture Facility; however, impervious surfaces at this facility would be limited to equipment and vessel foundations, secondary containment basins, roads, and building footprints, and the majority of the Capture Facility surfaces would be surfaced in gravel. The Project would not modify existing drainage patterns. While the Project proposes the addition of a storm drain system within the Capture Facility, this storm drain system would follow existing drainage patterns and discharge to a sump located east of the site. The sump would be regarded as a basin to capture the runoff from the site, which reflects current drainage patterns at the site. Based on the limited increase in impervious area combined with low annual precipitation and high evapotranspiration rates, scour is expected to be minimal.

The modeled peak flow rates show the Project would not excessively create or contribute runoff water or provide substantial additional sources of polluted runoff. However, the proposed improvements may affect the peak flow runoff from the Capture Facility. To provide added hydrologic control at the Project site, the

Project proposes the use of a storm water basin to the east of the capture facility that would provide peak flow mitigation for this area.

No jurisdictional aquatic resources are present that would be directly impacted from the Project.

Given the minimal addition of impervious area combined with the implementation of the proposed basin to capture runoff, the Project would not increase any flooding potential within the EHOF or downstream.

7.2.4 HYD-4 Impact Analysis

Impact HYD-4	**In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?**

No impact. The Project is not located within flood hazard, tsunami, or seiche zones. The flood hazard information was obtained from the FEMA Flood Insurance Rate Map for Kern County, California, and Incorporated areas, panel 2225 of 4125 (FEMA, 2008). Therefore, the Project would not create impacts during the construction and operation phases.

7.2.5 HYD-5 Impact Analysis

Impact HYD-5	**Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?**

Less than significant impact. Operation of the Project would not conflict with or obstruct implementation of the CWA or Basin Plan because there is no significant surface drainage, no surface water beneficial uses associated with the Project area, and the Aquifer Exemption process determined the groundwater cannot serve as a current or future source of drinking water. In addition, the Project would comply with all applicable regulatory requirements related to water quality and sustainable groundwater management. Therefore, operation of the Project would not conflict with or obstruct implementation of a water quality control or groundwater management plan. This impact would be less than significant.

8 Cumulative Impacts

Due to the proposed Project's location within an existing oil and gas field, the impacts of the Project together with the impacts of past, present, and reasonably foreseeable future oil and gas development, including wells and abandonment activity to implement CCS projects, constitute cumulative impacts. Mitigation measures presented below in Section 9 would reduce Project-specific impacts to less than significant levels. Additionally, the CTV I project, currently under construction, would also comply with SWPPP requirements to address potential hydrologic and water quality impacts. Mitigation measures imposed on the CTV I project by Kern County will reduce potential hydrologic and water impacts from that Project to less than significant levels. Finally, Kern County has prepared an EIR evaluating the potential impacts (including contributions to cumulative impacts) of oil and gas development in connection with previously proposed amendments to the Kern County Zoning Ordinance: Final Environmental Impact Report - Revisions to the Kern County Zoning Ordinance - 2015(C) Focused on Oil and Gas Local Permitting, certified on November 9, 2015, supplemented by a Supplemental EIR certified on December 11, 2018; an SREIR certified on March 8, 2021; and an Addendum adopted on August 23, 2022. The Oil and Gas EIR is referenced herein as a source of information regarding cumulative impacts from oil and gas development (Kern County 2024). The proposed Project would not cumulatively impact water resources within the Tulare Lake Hydrologic Basin..

8.1 Water Quality

The proposed Project's potential impacts on water quality from erosion and sedimentation are expected to be localized and temporary during construction. During Project operation, runoff from rainwater would drain naturally and most water would infiltrate the ground surface. While some rainfall from the margins of the site could flow off-site via sheet flow, effects would be minimal and the potential for substantial erosion that could occur under concentrated runoff condition is considered low. Nonetheless, where potential for channel erosions exists and for consistency with the over-arching CTV I project requirements, mitigation measure (MM) HYDRO-1 through MM HYDRO-3 would be implemented to prevent long-term impacts on drainage patterns and water quality. In addition, all cumulative projects would be subject to regulatory measures that would require projects to prepare and implement a SWPPP in accordance with County requirements. All projects that would not retain all runoff on-site would be required to prepare a SWPPP, which would include BMPs designed to prevent the mixture of sediment and other pollutants with stormwater and degrading water quality.

8.2 Groundwater

The Project's potential impacts to groundwater is low considering the minimal increase to the sites overall impervious area and that all improvements are within an existing oil and gas field with significant existing development. Refer to the Water Supply Assessment report for a discussion of groundwater supplies identified for use during operation of the proposed Project and cumulative groundwater impacts (Stantec, 2025).

8.3 Erosion, Drainage, and Flooding

In summary, nearby cumulative projects would be subject to the same water conservation, stormwater management, and wastewater discharge ordinances and regulations applicable to the proposed project or variant. As with the proposed project or variant, compliance with these ordinances and regulations would reduce the effects of nearby cumulative projects to less- than-significant levels. For these reasons, the proposed project or variant would not combine with cumulative projects in the project vicinity to create a significant cumulative impact related to hydrology and water quality, and no mitigation measures are necessary. Cumulative impacts would be less than significant.

9 Mitigation Measures

The following MMs are proposed for the Project to reduce impacts to hydrology and water quality to less than significant.

MM HYDRO-1: Prior to construction, the Owner/operator shall provide a comprehensive Worker Environmental Awareness Program to the CEC with its first project-related permit application in each calendar year. The program shall include all training requirements identified in Owner/operator Best Management Practices and mitigation measures and include training for all field personnel (including Owner/operator employees, agents and contractors). The Worker Environmental Awareness Program shall include protocols and training for responding to and handling of hazardous materials and hazardous waste management in accordance with federal, state, and local regulations, emergency preparedness, release reporting, and response requirements.

MM HYDRO-2: The Owner/operator shall comply with all applicable federal, state, regional, and local agency water quality protection laws and regulations, including (where applicable) obtaining coverage under the stormwater construction general permit and industrial general permit (or Notice of Non-Applicability) issued by the State Water Resources Control Board.

MM HYDRO-3: The Project shall comply with the following:

1. In areas subject to National Pollutant Discharge Elimination System stormwater permitting requirements, project Owner/operators shall file a Notice of Intent to the State Water Resources Control Board to comply with the statewide General Permit for Discharges of Stormwater Associated with Construction Activities (Construction General Permit State Water Resources Quality Control Board Order No 2022-0057-DWQ) (as such permit may be amended, revised or superseded) prior to undertaking all ground-disturbing activities greater than one acre and shall prepare and implement a Stormwater Pollution Prevention Plan for construction activities on the Project site in accordance with the Construction General Permit. For facilities requiring coverage under the Construction General Permit, the site specific Stormwater Pollution Prevention Plan shall include measures to achieve the following objectives: (1) all pollutants and their sources, including sources of sediment associated with construction activity are controlled; (2) all non-stormwater discharges are identified and either eliminated, controlled and treated, (3) site Best Management Practices are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity and (4) stabilization Best Management Practices to reduce or eliminate pollutants after construction are completed. The Stormwater Pollution Prevention Plan shall be prepared by a qualified preparer and shall include the minimum Best Management Practices required for the identified risk level. The Stormwater Pollution Prevention Plan shall include a construction site monitoring program that identified requirements for dry weather visual observations of pollutants at all discharge locations and, as applicable, depending on the project risk level, sampling of site effluent and receiving waters. A qualified Stormwater Pollution Prevention Plan practitioner shall be responsible for

implementing and all monitoring for the Best Management Practices as well as all inspection, maintenance and repair activities at the project site. If applicable, each project shall also implement and fully comply with the Industrial Storm Water Permit (Order No 2014-0057-DWQ) and Kern County Municipal Stormwater Permit (Order No 5-01-130). All plans under these requirements shall be submitted to Kern County Public Works for review and approval.

a. Any change to this State Water Regional Control Board determination will require full compliance with National Pollutant Discharge Elimination System requirements.

2. Any operator not subject to National Pollutant Discharge Elimination System stormwater permitting requirements shall implement Best Management Practices during construction and operation. All selected practices shall be shown on a drainage implementation plan and self-certified as complete by a licensed professional qualified in drainage and flood control issues. The plan shall be submitted to CEC. The following Best Management Practices shall be implemented and shown on the drainage implementation plan:

    a. Utilizing established facilities design and construction standards as applicable (e.g., American Society for the Testing and Materials (ASTM) American Petroleum Institute (API).

    b. Implementing good housekeeping and maintenance practices:

        1. Preventing trash, waste materials and equipment from construction storm water.

        2. Maintaining wellheads, compressors, tanks and pipelines in good condition without leaks or spills.

        3. Designing and maintaining graded pads to not actively erode and discharge sediment

        4. Maintaining vehicles in good working order

        5. Providing secondary containment for all aboveground storage tanks and maintaining such containment features in good operating condition

    c. Implementing spill prevention and response measures:

        1. Utilizing preventative operating practices such as tank level monitoring, safe chemical handling and conducting regular inspections.

        2. Developing and maintaining a spill response plan

        3. Conducting spill response training for employees and have a process to ensure contractors have the necessary training

        4. Maintaining spill response equipment on site.

    d. Implementing material storage and management practices:

1. Preventing unauthorized access
2. Utilizing “run-on” and “run-off” control berms and swales
3. Stabilizing exposed slopes through vegetation and other standard slope stability methods.

3. The project shall comply with all applicable state, federal and local stormwater management laws. Prior to construction or grading, the owner/operator shall submit a drainage and flood study plan to the CEC for review and approval.

   The Owner/operator shall prepare a drainage plan that complies with requirements to address runoff and the potential for impeding or redirecting 100-year flood flows. The drainage plan shall be prepared in accordance with the Kern County Grading Ordinance, Kern County Green Code, Development Standards and approved by the CEC. The drainage plan shall specify best management practices to prevent all construction pollutants from contacting stormwater, with the intent of keeping sedimentation or any other pollutants from moving offsite and into receiving waters. The requirements of the drainage plan shall be incorporated into design specifications. Recommended best management practices for the construction phase must be shown on a drainage plan, and shall include the following:

   a. Erosion Control -

      1. Scheduling of construction activities to avoid rain events.
      2. Implementing runoff erosion control methods consistent with the drainage plan when vegetation has been removed.

   b. Sediment Control -

      1. Secure stockpiling of soil.
      2. Installation of a stabilized construction entrance/exit and stabilization of disturbed areas.

   c. Non-stormwater Control -

      1. Fueling and maintenance of equipment and vehicles shall be managed so as to prevent contamination of runoff from the site.
      2. Concrete handling techniques shall be consistent with the drainage plan.

   d. Waste and Material Management -

      1. Managing construction materials, consistent with the drainage plan and designating construction staging areas in or around the Project site.

2. Stockpiling and disposing of demolition debris, concrete, and soil in compliance with regulatory requirements and consistent with the drainage plan.

3. Prompt removal and disposal of litter.

4. Disposal of demolition debris, concrete and soil in compliance with regulatory requirements for solid waste.

5. Provide and maintain secondary containment to prevent or eliminate pollutants from moving offsite and into receiving waters.

i. Post-Construction Stabilization -

1. Ensuring the stabilization of all disturbed soils per revegetation or application of a soil binder.

4. If construction activities will alter federal jurisdictional waters, project Owner/operator s shall comply with the federal Clean Water Act Section 404 and Section 401 permitting and certification requirements. If construction activities will alter state waters, project Owner/operator s shall comply with California Department of Fish and Wildlife Streambed Alteration requirements.

10 Conclusion

This study provides a hydrology study and scour assessment of the proposed Project. The hydrologic analysis has revealed the proposed improvements may increase the peak flow runoff exiting the Study Area for a worst case scenario. The Project proposes the implementation of a basin that would capture runoff from the site and mitigate the peak flow runoff.

It was concluded per review of aerial imagery and USGS topography that scour would be unlikely to impact the proposed gas pipeline and other proposed utility lines within the Study Area due to lack of significant drainage crossings within the Study Area.

11 References

DWR, 2015. California's Groundwater Update 2013. Available online at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin- 118/Files/Statewide-Reports/GWU2013_Ch9_TulareLake_Final.pdf, accessed July 2023.

Federal Emergency Management Agency (FEMA). 2008. Flood Risk Insurance Rate Map for Kern County, California and Incorporated Areas, Panel 2225 of 4125. Accessed Online at: https://msc.fema.gov/portal/home

Insight Environmental Consultants. 2015. Industrial Storm Water No Discharge Non-Applicability (NONA) Technical Report. Prepared for California Resources Corporation. June 17.

Kern County Planning and Natural Resources Department. *2021. Oil and Gas Ordinance Supplemental Recirculated Environmental Impact Report* (2020/2021). Accessed November 2023. https://kernplanning.com/SREIR2020-oil-gas-zoning-revisions/

Kern County Planning and Natural Resources Department. 2024. Recirculated Draft Environmental Impact Report, Volume I. June.

National Oceanic and Atmospheric Administration (NOAA). 2025. Atlas 14, Volume 6, Version 2 Point Precipitation Frequency Estimates. Accessed online at: https://hdsc.nws.noaa.gov/pfds/

Natural Resources Conservation Service (NRCS). 2025. Custom Soils Resource Report. Accessed online at: https://websoilsurvey.nrcs.usda.gov/app/

National Weather Service and National Oceanic and Atmospheric Administration (NWS and NOAA), 2023. NOWData - NOAA Online Weather Data. Available online at: https://www.weather.gov/wrh/Climate?wfo=hnx, accessed July 2023.

Regional Water Quality Control Board, Central Valley Region (RWQCB), 2018. Water Quality Control Plan for the Tulare Lake Basin Third Edition. Available online at: https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/tularelakebp_20 1805.pdf, accessed July 2023.

Soils Engineering Inc. 2023. *Preliminary Soil and Geologic Evaluation Terra Vault 1 Carbon Capture Project Elk Hills, Kern County, California.*

https://www.hec.usace.army.mil/publications/TrainingDocuments/TD-10.pdfUnited States Environmental Protection Agency (EPA), 2018. *Aquifer Exemption Request for the Elk Hills Oil Field, Phase 1 Area, Kern County, California*. March 29, 2018.

West Kern Water District (WKWD), 2022. Management Area Groundwater Sustainability Plan. Available online at: https://kerngwa.com/wp-content/uploads/2022/07/wkwd-chapter- gsp_fy-2022_clean_2022-07-13_compiled.pdf, accessed Jul 2023.

Appendices

Appendix A Web Soil Survey Report

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 Kern County, California, Northwestern Part

March 12, 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.

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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.

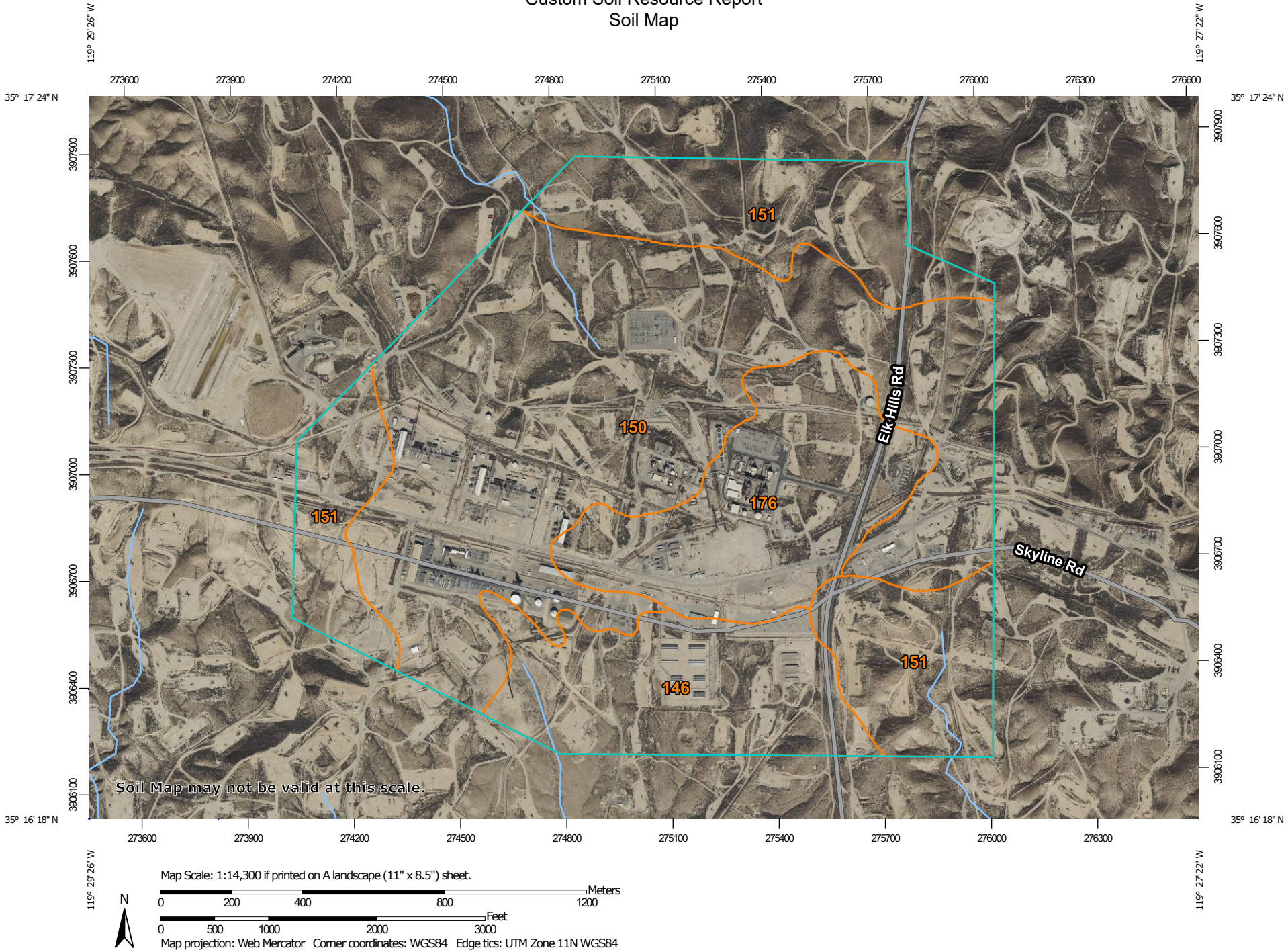
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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.

Custom Soil Resource Report
Soil Map



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: Kern County, California, Northwestern Part
Survey Area Data: Version 17, Sep 3, 2024

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

Date(s) aerial images were photographed: Mar 12, 2022—Mar 22, 2022

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
146	Elkhills sandy loam, 9 to 50 percent slopes, eroded	90.4	13.1%
150	Elkhills-Torriorthents stratified complex, 9 to 15 perc ent slopes	326.7	47.4%
151	Elkhills-Torriorthents stratified, eroded complex, 15 t o 50 percent slopes	166.7	24.2%
176	Kimberlina sandy loam, 5 to 9 percent slopes	105.9	15.3%
Totals for Area of Interest		**689.7**	**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.

Kern County, California, Northwestern Part

146—Elkhills sandy loam, 9 to 50 percent slopes, eroded

Map Unit Setting

National map unit symbol: hkhs
Elevation: 400 to 1,600 feet
Mean annual precipitation: 6 to 8 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 240 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Elkhills

Setting

Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

A - 0 to 29 inches: gravelly sandy loam
C1 - 29 to 49 inches: gravelly sandy loam
C2 - 49 to 65 inches: stratified gravelly sand to silt loam

Properties and qualities

Slope: 9 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 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: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R017XG043CA - Loamy 6-8" P.Z.
Hydric soil rating: No

Minor Components

Torriorthents, stratified
Percent of map unit: 5 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Very sandy soils
Percent of map unit: 5 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Unnamed, finer textured underlying material
Percent of map unit: 5 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

150—Elkhills-Torriorthents stratified complex, 9 to 15 perc ent slopes

Map Unit Setting
National map unit symbol: hkhx
Elevation: 400 to 3,500 feet
Mean annual precipitation: 6 to 8 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 240 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition
Elkhills and similar soils: 50 percent
Torriorthents and similar soils: 25 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elkhills

Setting
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

A - 0 to 29 inches: gravelly sandy loam
C1 - 29 to 49 inches: gravelly sandy loam
C2 - 49 to 65 inches: stratified gravelly sand to silt loam

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 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: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R017XG043CA - Loamy 6-8" P.Z.
Hydric soil rating: No

Description of Torriorthents

Setting

Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

AC - 0 to 60 inches: variable

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
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
Hydrologic Soil Group: A
Ecological site: R017XY906CA - Non-Alkali San Joaquin Valley Desert
Hydric soil rating: No

Minor Components

Unnamed, gentler slopes
Percent of map unit: 7 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Bitterwater
Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Very sandy soils
Percent of map unit: 7 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Unnamed, cemented layers in subsoil
Percent of map unit: 4 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

151—Elkhills-Torriorthents stratified, eroded complex, 15 t o 50 percent slopes

Map Unit Setting
National map unit symbol: hkhy
Elevation: 400 to 3,500 feet

Mean annual precipitation: 6 to 8 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 240 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Elkhills and similar soils: 50 percent
Torriorthents and similar soils: 25 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elkhills

Setting

Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

A - 0 to 29 inches: gravelly sandy loam
C1 - 29 to 49 inches: gravelly sandy loam
C2 - 49 to 65 inches: stratified gravelly sand to silt loam

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 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: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R017XG043CA - Loamy 6-8" P.Z.
Hydric soil rating: No

Description of Torriorthents

Setting

Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

AC - 0 to 60 inches: variable

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
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
Hydrologic Soil Group: A
Ecological site: R017XY906CA - Non-Alkali San Joaquin Valley Desert
Hydric soil rating: No

Minor Components

Unnamed, gentler slopes

Percent of map unit: 7 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Unnamed, soils with hardpan

Percent of map unit: 7 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Very sandy soils

Percent of map unit: 7 percent
Landform: Erosion remnants on terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Bitterwater

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave

Across-slope shape: Convex
Hydric soil rating: No

176—Kimberlina sandy loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: hkjr
Elevation: 120 to 1,000 feet
Mean annual precipitation: 4 to 8 inches
Mean annual air temperature: 63 to 64 degrees F
Frost-free period: 190 to 300 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Kimberlina

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

A - 0 to 9 inches: sandy loam
C - 9 to 45 inches: fine sandy loam
2C - 45 to 71 inches: stratified silt loam to sandy clay loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
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: 10 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A

Ecological site: R017XY906CA - Non-Alkali San Joaquin Valley Desert
Hydric soil rating: No

Minor Components

Elkhills

Percent of map unit: 4 percent
Landform: Erosion remnants
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Panoche

Percent of map unit: 4 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Kettleman

Percent of map unit: 4 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Milham

Percent of map unit: 3 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix B NOAA Atlas 14 Rainfall Data

NOAA Atlas 14, Volume 6, Version 2
Location name: Mc Kittrick, California, USA*
Latitude: 35.2823°, Longitude: -119.4731°
Elevation: 1309 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	0.064 (0.056-0.074)	0.083 (0.073-0.095)	0.111 (0.097-0.128)	0.137 (0.119-0.159)	0.177 (0.149-0.213)	0.212 (0.174-0.260)	0.252 (0.202-0.317)	0.298 (0.233-0.385)	0.370 (0.277-0.499)	0.434 (0.314-0.605)
10-min	0.092 (0.081-0.105)	0.119 (0.104-0.137)	0.159 (0.139-0.184)	0.196 (0.170-0.228)	0.253 (0.213-0.305)	0.304 (0.250-0.373)	0.361 (0.290-0.454)	0.427 (0.334-0.552)	0.530 (0.397-0.715)	0.622 (0.450-0.867)
15-min	0.111 (0.097-0.127)	0.144 (0.126-0.165)	0.192 (0.168-0.222)	0.237 (0.206-0.276)	0.306 (0.257-0.368)	0.367 (0.302-0.451)	0.436 (0.351-0.549)	0.517 (0.404-0.668)	0.641 (0.481-0.864)	0.752 (0.545-1.05)
30-min	0.154 (0.136-0.177)	0.200 (0.175-0.230)	0.268 (0.234-0.309)	0.330 (0.287-0.384)	0.427 (0.358-0.513)	0.511 (0.421-0.628)	0.608 (0.488-0.764)	0.719 (0.562-0.930)	0.893 (0.669-1.20)	1.05 (0.759-1.46)
60-min	0.218 (0.192-0.251)	0.283 (0.248-0.325)	0.379 (0.331-0.437)	0.467 (0.405-0.543)	0.603 (0.507-0.725)	0.723 (0.595-0.887)	0.859 (0.690-1.08)	1.02 (0.794-1.32)	1.26 (0.946-1.70)	1.48 (1.07-2.06)
2-hr	0.328 (0.288-0.377)	0.414 (0.363-0.476)	0.541 (0.473-0.624)	0.656 (0.570-0.763)	0.834 (0.700-1.00)	0.988 (0.813-1.21)	1.16 (0.934-1.46)	1.36 (1.06-1.76)	1.67 (1.25-2.25)	1.95 (1.41-2.71)
3-hr	0.402 (0.354-0.462)	0.507 (0.445-0.584)	0.661 (0.578-0.762)	0.799 (0.694-0.930)	1.01 (0.850-1.22)	1.19 (0.983-1.47)	1.40 (1.12-1.76)	1.64 (1.28-2.12)	2.00 (1.50-2.69)	2.31 (1.67-3.22)
6-hr	0.541 (0.475-0.622)	0.692 (0.607-0.796)	0.909 (0.795-1.05)	1.10 (0.957-1.28)	1.39 (1.17-1.67)	1.64 (1.35-2.01)	1.91 (1.54-2.40)	2.22 (1.73-2.87)	2.68 (2.01-3.62)	3.09 (2.24-4.31)
12-hr	0.669 (0.588-0.768)	0.899 (0.789-1.04)	1.22 (1.07-1.41)	1.50 (1.30-1.74)	1.91 (1.60-2.29)	2.24 (1.84-2.75)	2.60 (2.09-3.28)	3.00 (2.35-3.89)	3.59 (2.69-4.84)	4.09 (2.96-5.70)
24-hr	0.815 (0.724-0.936)	1.16 (1.03-1.33)	1.63 (1.44-1.88)	2.03 (1.78-2.36)	2.60 (2.22-3.11)	3.06 (2.57-3.72)	3.55 (2.92-4.42)	4.08 (3.27-5.20)	4.85 (3.75-6.41)	5.49 (4.11-7.47)
2-day	0.950 (0.844-1.09)	1.36 (1.21-1.57)	1.93 (1.71-2.22)	2.41 (2.12-2.80)	3.11 (2.65-3.71)	3.67 (3.08-4.47)	4.28 (3.51-5.31)	4.93 (3.95-6.28)	5.88 (4.54-7.76)	6.66 (4.99-9.06)
3-day	1.03 (0.918-1.19)	1.48 (1.31-1.70)	2.10 (1.85-2.42)	2.62 (2.31-3.05)	3.39 (2.90-4.05)	4.02 (3.37-4.89)	4.69 (3.85-5.83)	5.42 (4.34-6.91)	6.49 (5.01-8.56)	7.37 (5.52-10.0)
4-day	1.11 (0.987-1.28)	1.59 (1.41-1.83)	2.25 (1.99-2.60)	2.82 (2.48-3.28)	3.65 (3.12-4.36)	4.33 (3.63-5.27)	5.06 (4.16-6.29)	5.86 (4.70-7.46)	7.02 (5.42-9.27)	7.99 (5.99-10.9)
7-day	1.27 (1.12-1.46)	1.82 (1.62-2.10)	2.59 (2.29-2.99)	3.24 (2.85-3.77)	4.19 (3.58-5.00)	4.96 (4.16-6.04)	5.79 (4.75-7.19)	6.69 (5.36-8.52)	8.01 (6.19-10.6)	9.11 (6.83-12.4)
10-day	1.36 (1.20-1.56)	1.96 (1.74-2.25)	2.77 (2.45-3.20)	3.47 (3.05-4.03)	4.46 (3.81-5.34)	5.28 (4.43-6.43)	6.16 (5.06-7.65)	7.12 (5.70-9.06)	8.51 (6.58-11.2)	9.68 (7.26-13.2)
20-day	1.67 (1.48-1.92)	2.37 (2.10-2.73)	3.32 (2.94-3.83)	4.13 (3.63-4.79)	5.28 (4.51-6.32)	6.23 (5.23-7.58)	7.25 (5.95-9.01)	8.37 (6.70-10.7)	10.0 (7.73-13.2)	11.4 (8.54-15.5)
30-day	2.00 (1.77-2.29)	2.78 (2.47-3.20)	3.86 (3.41-4.45)	4.77 (4.19-5.54)	6.08 (5.19-7.26)	7.14 (5.99-8.69)	8.30 (6.81-10.3)	9.56 (7.66-12.2)	11.4 (8.82-15.1)	13.0 (9.73-17.7)
45-day	2.44 (2.17-2.80)	3.32 (2.95-3.82)	4.52 (4.00-5.22)	5.54 (4.87-6.44)	7.01 (5.98-8.37)	8.20 (6.88-9.98)	9.49 (7.80-11.8)	10.9 (8.74-13.9)	13.0 (10.0-17.2)	14.7 (11.1-20.1)
60-day	2.87 (2.54-3.29)	3.81 (3.38-4.39)	5.10 (4.52-5.89)	6.21 (5.46-7.21)	7.79 (6.66-9.31)	9.09 (7.62-11.1)	10.5 (8.61-13.0)	12.0 (9.64-15.3)	14.3 (11.0-18.9)	16.2 (12.1-22.1)

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

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

Please refer to NOAA Atlas 14 document for more information.

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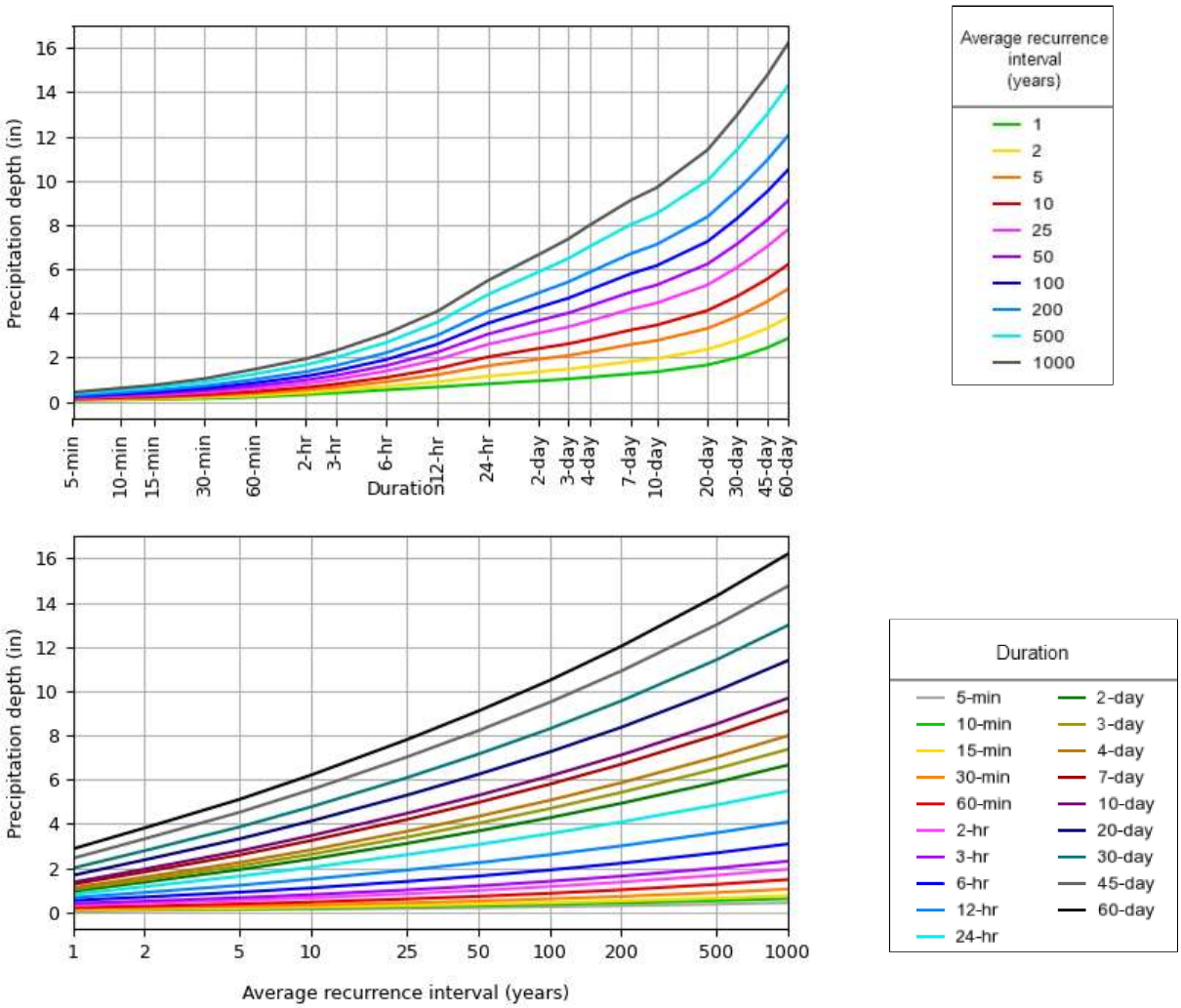
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 35.2823°, Longitude: -119.4731°



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Wed Mar 12 18:35:17 2025

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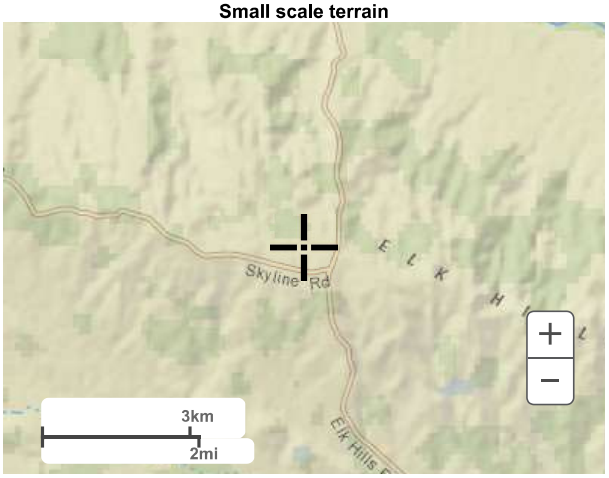
Maps & aerials

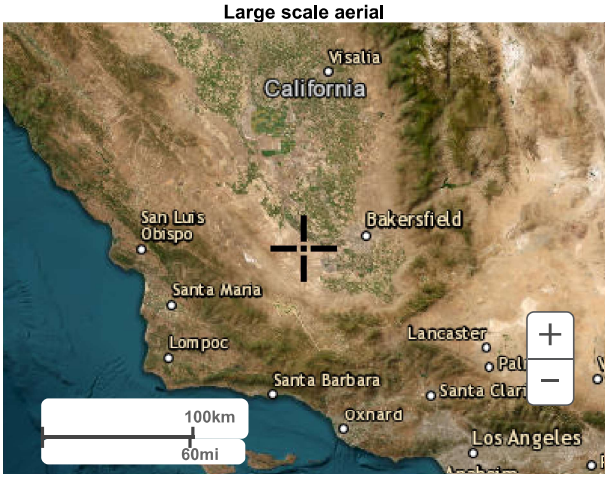
Small scale terrain



Large scale terrain

Large scale map

Large scale aerial



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

Disclaimer

Appendix C GeoHECHMS Report

CRC CalCapture Hydrology Study

Prepared for:

Carbon TerraVault Holdings, LLC,
a carbon management subsidiary of
California Resources Corporation

March 12, 2025

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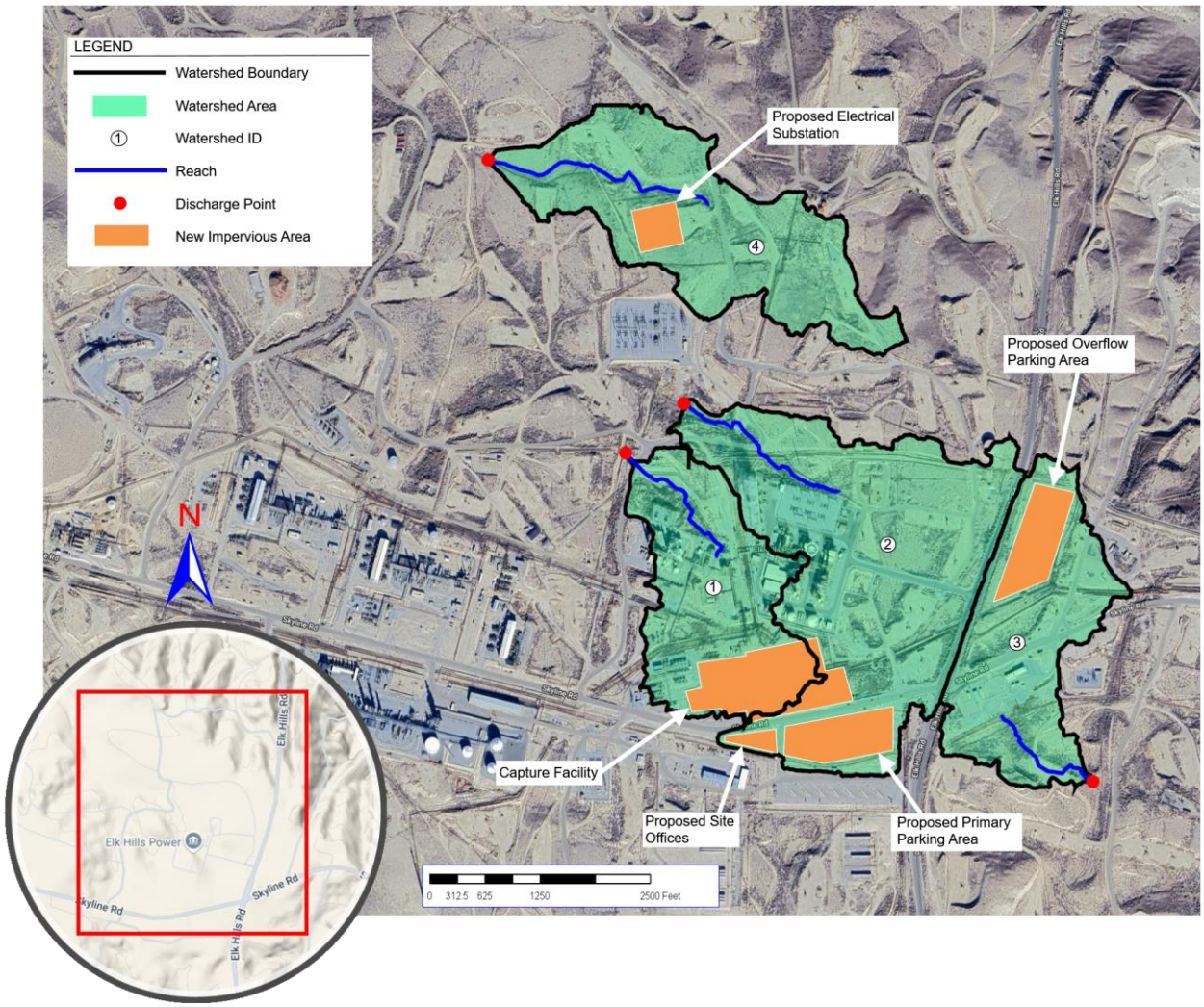
Routing Reaches..40

Project Description

The project is located at **4026 Skyline Rd, Tupman, CA 93276.** The site is 146.451 acres in size.



Purpose

The purpose of this hydrology study is to determine the peak runoff rates for pre-development and post-development conditions.

Methodology Used

The HEC-HMS version 4.5 computer software was used in this hydrology study. The **SCS Curve Number** infiltration (loss) method and **SCS Unit Hydrograph** runoff (transform) method was used for determining the stormwater runoff**.** The **Kinematic Wave** routing method was used for routing the stormwater**.**

The following scenarios were analyzed in this hydrology study:

Existing 10yr, 24-hrs

This scenario contains:

- 4 delineated subbasin areas and corresponding lag time flow paths.
- 4 routing reaches.
- 4 connecting junctions.

Existing 100-yr,24-hrs

This scenario contains:

- 4 delineated subbasin areas and corresponding lag time flow paths.
- 4 routing reaches.
- 4 connecting junctions.

Proposed 10-yr,24-hrs

This scenario contains:

- 4 delineated subbasin areas and corresponding lag time flow paths.
- 4 routing reaches.
- 4 connecting junctions.

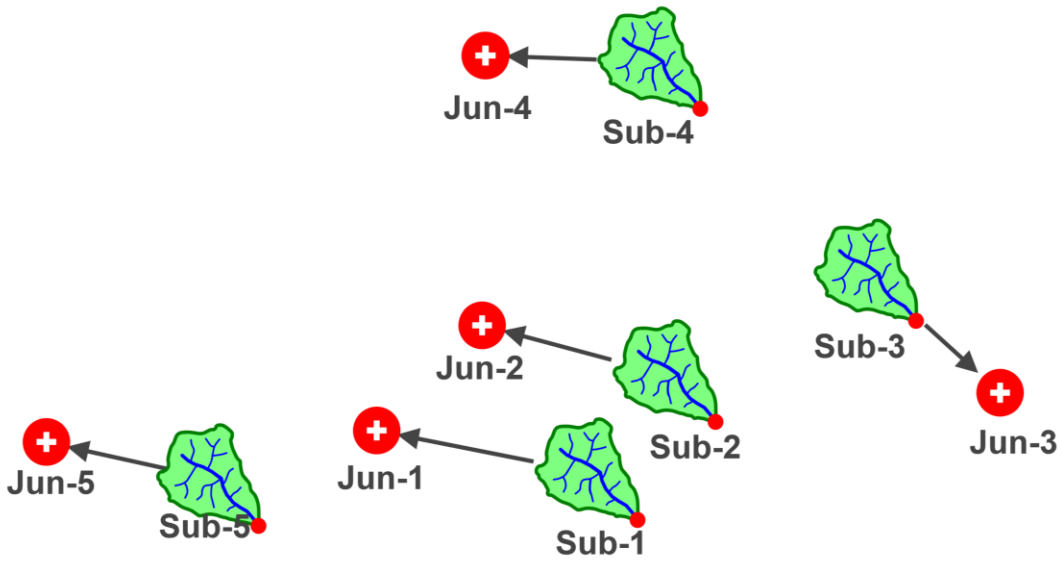
Proposed 100-yr,24-hr

This scenario contains:

- 4 delineated subbasin areas and corresponding lag time flow paths.
- 4 routing reaches.
- 4 connecting junctions.

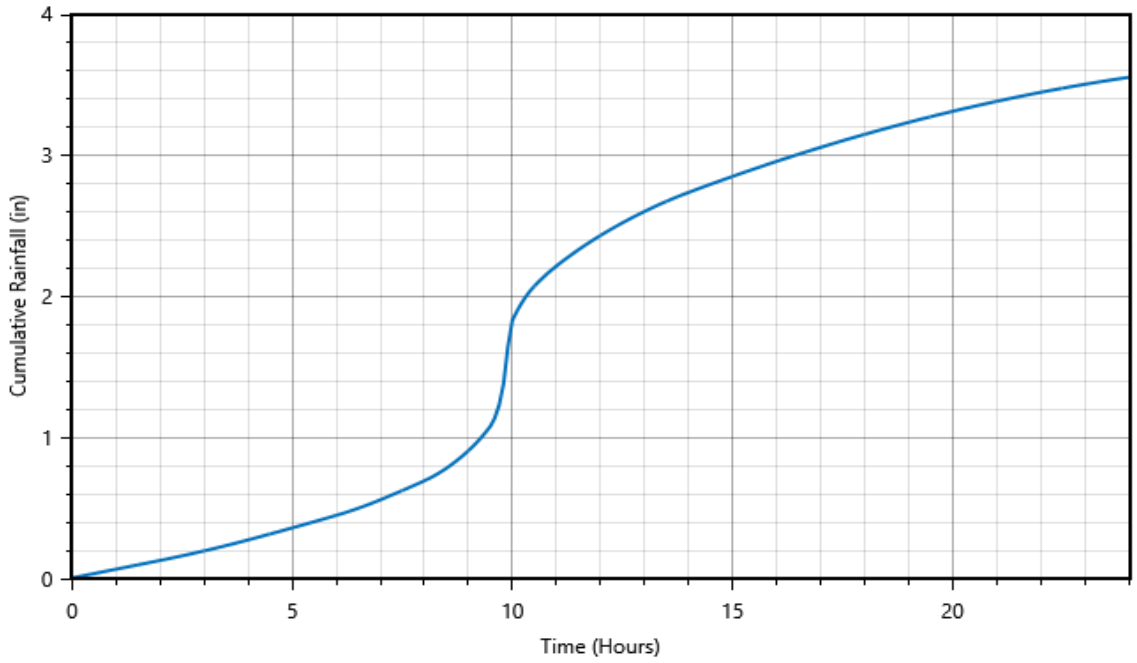
Existing 10yr, 24-hrs

Watershed Routing Diagram



Design Storm

Precipitation type: SCS Storm
SCS storm distribution: Type I
Rainfall depth: 3.55 in



Watershed Summary

Subbasin ID	Drainage Area (acres)	Initial Abstraction (in)	Curve Number	Impervious Surface (%)	Lag Time (minutes)	Peak Discharge (cfs)
Sub-1	26.940	0.70	75	60.5	18.08	30.10
Sub-2	56.927	1.35	60	40.0	39.33	24.76
Sub-3	27.576	1.21	63	37.2	34.82	12.70
Sub-4	35.008	4.18	33	0.9	25.58	0.38

Subbasins

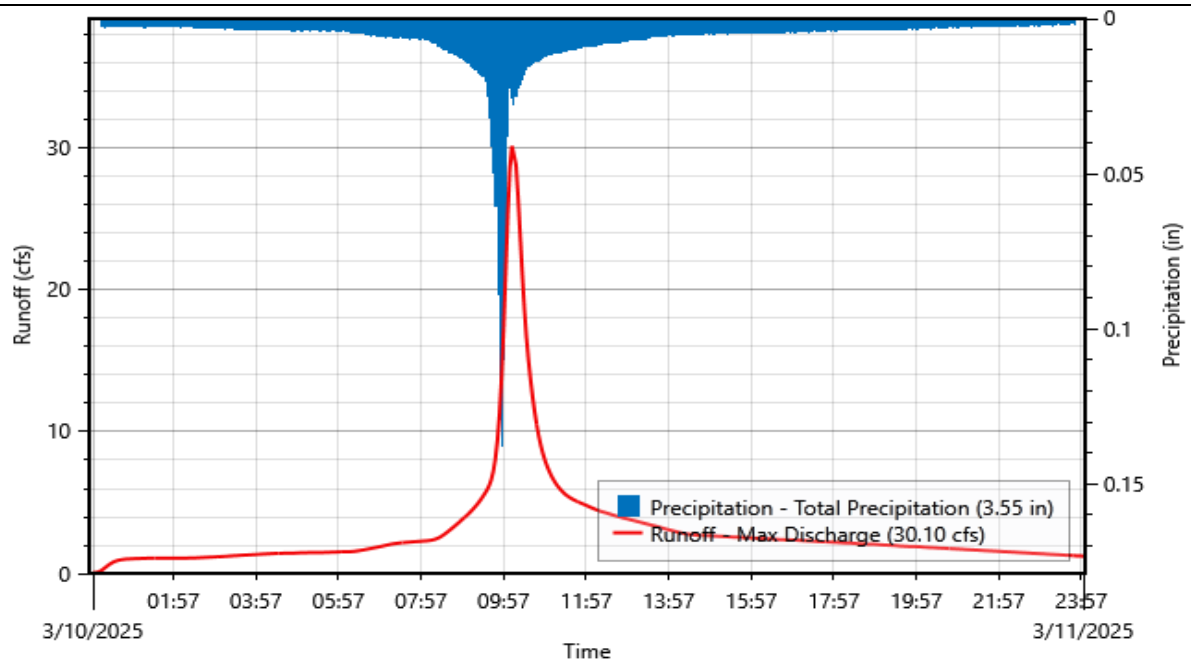
Subbasin ID:	**Sub-1**			
Scenario:	**Existing 10yr, 24-hrs**		**Depth**	**Volume**
Peak discharge:	30.10 cfs	**Time of peak:**	10 Mar 2025, 10:09	
Drainage area:	26.940 acres	**Total rainfall:**	3.55 in	7.97093 ac-ft
Initial abstraction:	0.70 in	**Losses:**	0.90 in	2.01216 ac-ft
Curve Number:	75	**Precip excess:**	2.65 in	5.95878 ac-ft
Impervious surface:	60.5%	**Direct runoff:**	2.64 in	5.92 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	18.08 minutes	**Total runoff:**	2.64 in	5.92 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
6.361	23.61	77.00	Developed, Medium Density
4.650	17.26	61.00	Developed, Low Density
4.399	16.33	49.00	Developed, Open Space
0.269	1.00	30.00	Undeveloped, Grassland
11.260	41.80	89.00	Developed, High Density
26.940	**100.00**	**75**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
1.81	100.00	0.02615	21.8465	Sheet Flow
5.26	503.38	0.00979	3.2670	Shallow Concentrated Flow
5.02	400.54	0.03611	6.2751	Shallow Concentrated Flow
15.37	512.50	0.00309	1.8343	Shallow Concentrated Flow
2.66	890.10	0.02832	5.5567	Channel Flow
30.12	**2,406.52**	**Total**	**Lag Time = 18.08 minutes**	



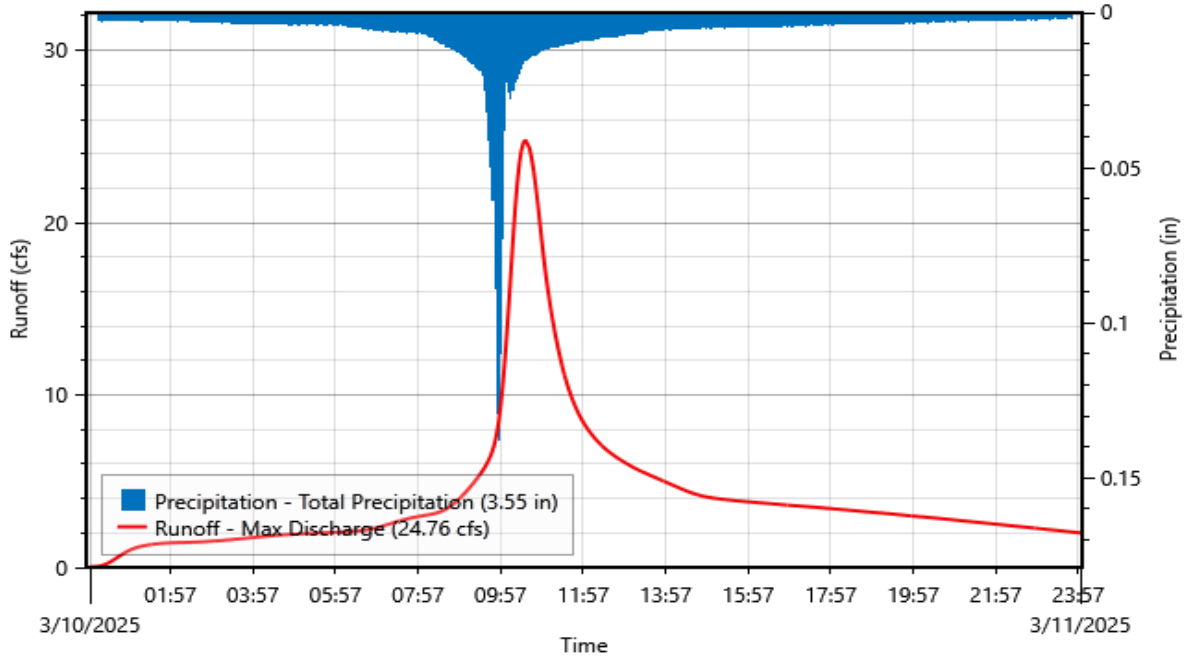
Subbasin ID:	Sub-2			
Scenario:	**Existing 10yr, 24-hrs**		**Depth**	**Volume**
Peak discharge:	24.76 cfs	**Time of peak:**	10 Mar 2025, 10:33	
Drainage area:	56.927 acres	**Total rainfall:**	3.55 in	16.83173 ac-ft
Initial abstraction:	1.35 in	**Losses:**	1.81 in	8.56633 ac-ft
Curve Number:	60	**Precip excess:**	1.74 in	8.26540 ac-ft
Impervious surface:	40.0%	**Direct runoff:**	1.72 in	8.13 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	39.33 minutes	**Total runoff:**	1.72 in	8.13 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
8.193	14.39	77.00	Developed, Medium Density
11.295	19.84	61.00	Developed, Low Density
12.040	21.15	89.00	Developed, High Density
9.565	16.80	49.00	Developed, Open Space
1.455	2.56	77.00	Undeveloped, Barren Land
14.379	25.26	30.00	Undeveloped, Grassland
56.927	**100.00**	**60**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
2.23	100.00	0.01556	16.8499	Sheet Flow
3.49	539.58	0.02558	5.2817	Shallow Concentrated Flow
55.85	2,122.01	0.00401	2.0903	Shallow Concentrated Flow
3.97	1,204.27	0.02333	5.0436	Channel Flow
65.54	**3,965.86**	**Total**	**Lag Time = 39.33 minutes**	



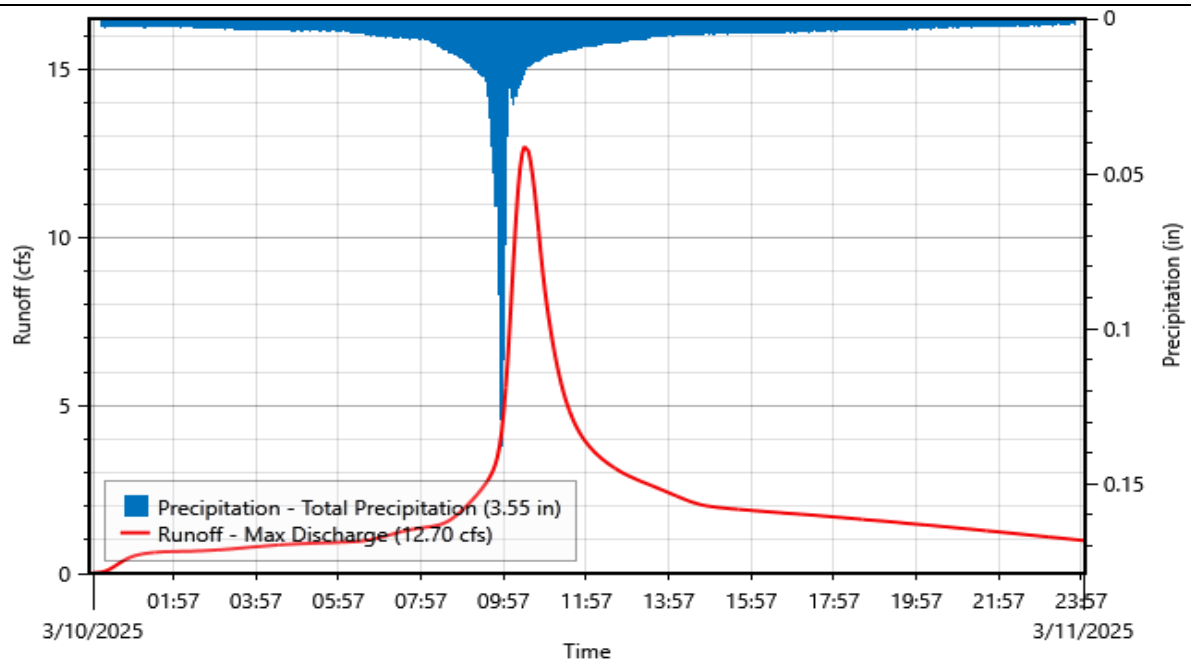
Subbasin ID:	Sub-3			
Scenario:	**Existing 10yr, 24-hrs**		**Depth**	**Volume**
Peak discharge:	12.70 cfs	**Time of peak:**	10 Mar 2025, 10:30	
Drainage area:	27.576 acres	**Total rainfall:**	3.55 in	8.16027 ac-ft
Initial abstraction:	1.21 in	**Losses:**	1.82 in	4.18656 ac-ft
Curve Number:	63	**Precip excess:**	1.73 in	3.97370 ac-ft
Impervious surface:	37.2%	**Direct runoff:**	1.70 in	3.92 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	34.82 minutes	**Total runoff:**	1.70 in	3.92 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
5.596	20.29	77.00	Developed, Medium Density
4.970	18.02	89.00	Developed, High Density
6.178	22.40	49.00	Developed, Open Space
3.789	13.74	30.00	Undeveloped, Grassland
7.043	25.54	61.00	Developed, Low Density
27.576	**100.00**	**63**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
20.46	100.00	0.08024	1.0523	Sheet Flow
11.44	727.28	0.01122	3.4981	Shallow Concentrated Flow
17.72	744.10	0.01000	3.3016	Shallow Concentrated Flow
6.65	533.66	0.00687	2.7380	Shallow Concentrated Flow
1.75	796.88	0.05266	7.5777	Channel Flow
58.02	**2,901.92**	**Total**	**Lag Time = 34.82 minutes**	



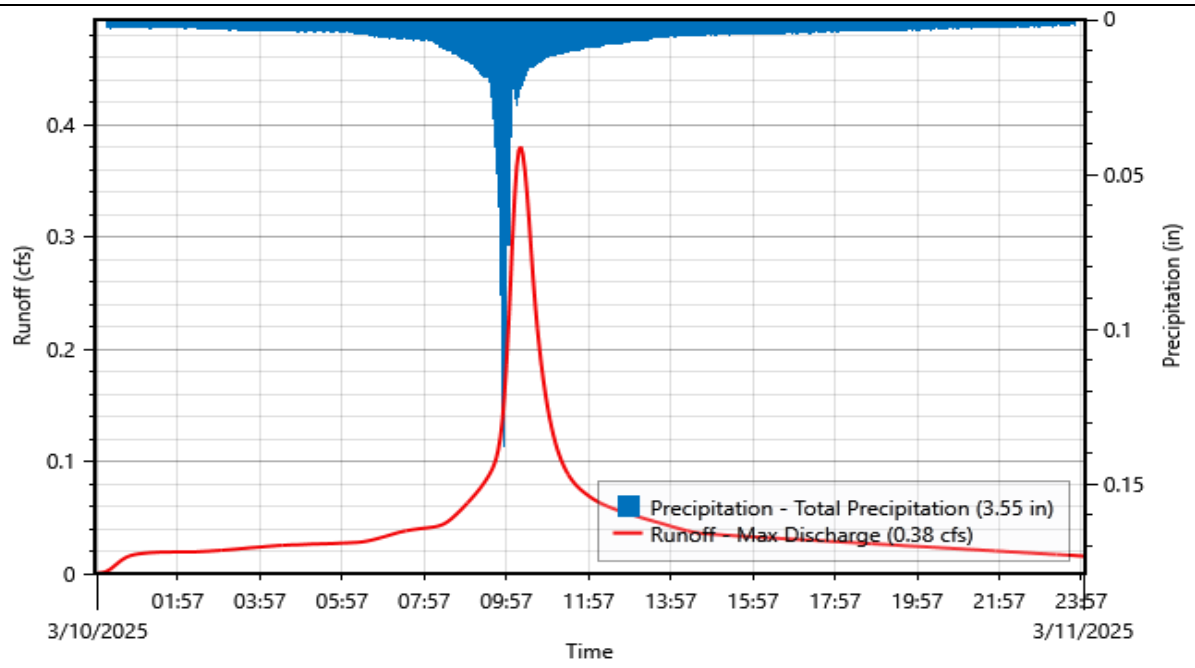
Subbasin ID:	Sub-4			
Scenario:	**Existing 10yr, 24-hrs**		**Depth**	**Volume**
Peak discharge:	0.38 cfs	**Time of peak:**	10 Mar 2025, 10:18	
Drainage area:	35.008 acres	**Total rainfall:**	3.55 in	10.35653 ac-ft
Initial abstraction:	4.18 in	**Losses:**	3.52 in	10.26850 ac-ft
Curve Number:	33	**Precip excess:**	0.03 in	0.08803 ac-ft
Impervious surface:	0.9%	**Direct runoff:**	0.03 in	0.09 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	25.58 minutes	**Total runoff:**	0.03 in	0.09 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
1.129	3.23	30.00	Undeveloped, Shrub/Scrub
0.336	0.96	61.00	Developed, Low Density
3.759	10.74	49.00	Developed, Open Space
29.783	85.08	30.00	Undeveloped, Grassland
35.008	**100.00**	**33**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
17.95	100.00	0.08524	1.2396	Sheet Flow
7.07	440.55	0.02201	4.8995	Shallow Concentrated Flow
7.25	455.65	0.01096	3.4567	Shallow Concentrated Flow
5.97	428.72	0.02928	5.6507	Shallow Concentrated Flow
4.38	1,400.46	0.02592	5.3168	Channel Flow
42.62	**2,825.38**	**Total**	**Lag Time = 25.58 minutes**	



Nodes

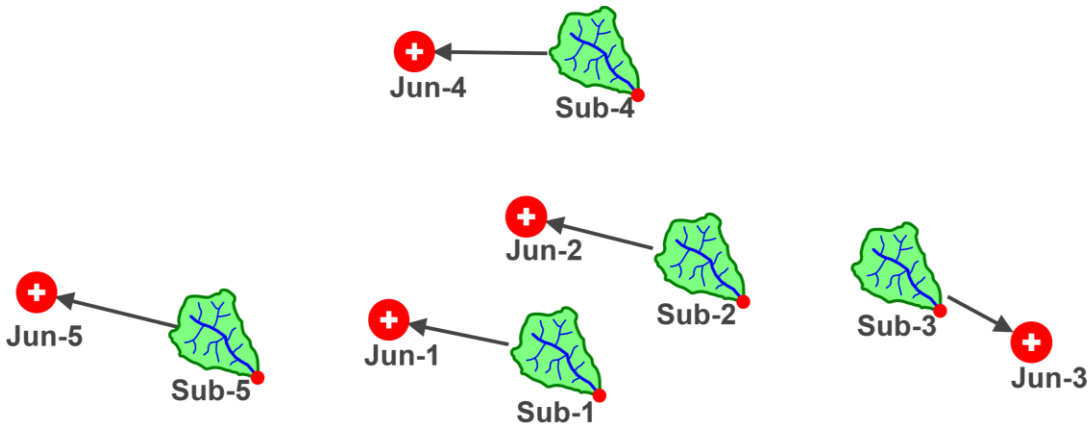
Element ID	Element Type	Peak Inflow (cfs)	Peak Outflow (cfs)	Peak Diverted Flow (cfs)
Jun-1	Junction	30.10	30.10	
Jun-2	Junction	24.76	24.76	
Jun-3	Junction	12.70	12.70	
Jun-4	Junction	0.38	0.38	

Routing Reaches

Reach ID	Peak Inflow (cfs)	Peak Outflow (cfs)	Attenuated Flow (cfs)
Reach-1	0.00	0.00	0.00
Reach-2	0.00	0.00	0.00
Reach-3	0.00	0.00	0.00
Reach-4	0.00	0.00	0.00

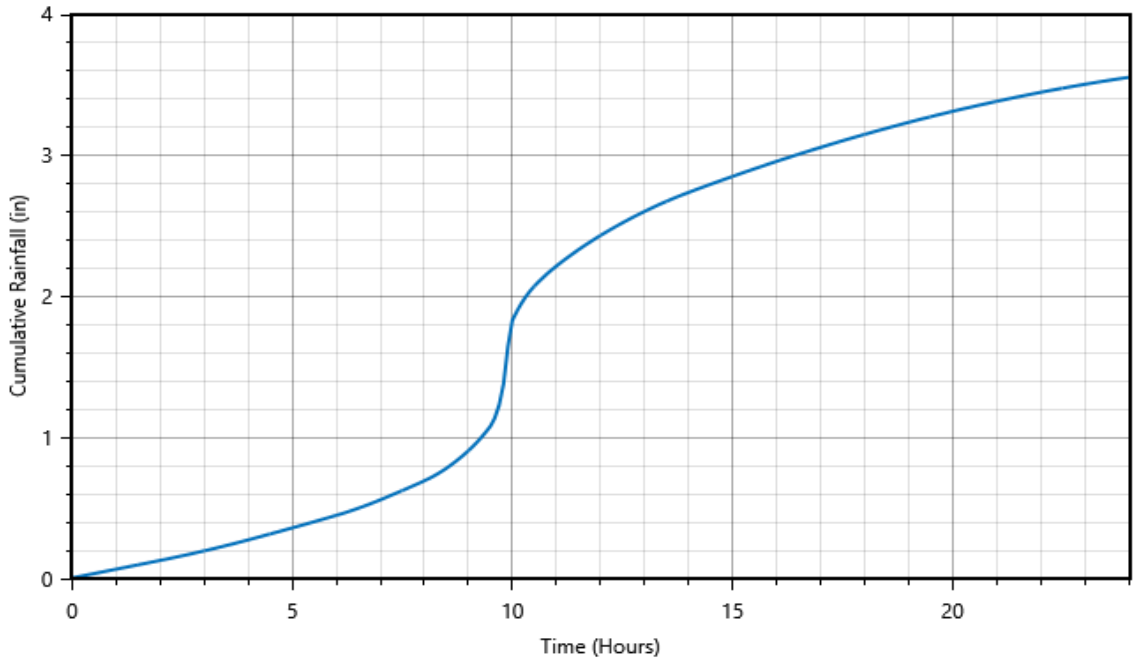
Existing 100-yr,24-hrs

Watershed Routing Diagram



Design Storm

Precipitation type: SCS Storm
SCS storm distribution: Type I
Rainfall depth: 3.55 in



Watershed Summary

Subbasin ID	Drainage Area (acres)	Initial Abstraction (in)	Curve Number	Impervious Surface (%)	Lag Time (minutes)	Peak Discharge (cfs)
Sub-1	26.940	0.70	75	60.5	18.08	30.10
Sub-2	56.927	1.35	60	40.0	39.33	24.76
Sub-3	27.576	1.21	63	37.2	34.82	12.70
Sub-4	35.008	4.18	33	0.9	25.58	0.38

Subbasins

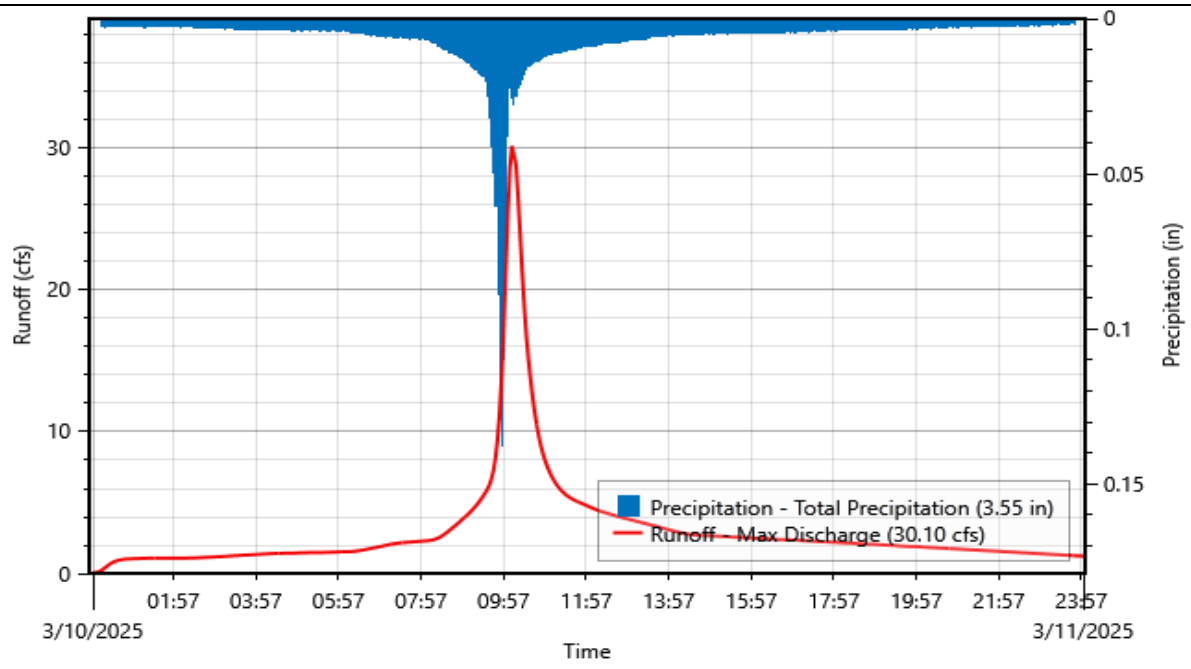
Subbasin ID:	**Sub-1**			
Scenario:	**Existing 100-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	30.10 cfs	**Time of peak:**	10 Mar 2025, 10:09	
Drainage area:	26.940 acres	**Total rainfall:**	3.55 in	7.97093 ac-ft
Initial abstraction:	0.70 in	**Losses:**	0.90 in	2.01216 ac-ft
Curve Number:	75	**Precip excess:**	2.65 in	5.95878 ac-ft
Impervious surface:	60.5%	**Direct runoff:**	2.64 in	5.92 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	18.08 minutes	**Total runoff:**	2.64 in	5.92 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
6.361	23.61	77.00	Developed, Medium Density
4.650	17.26	61.00	Developed, Low Density
4.399	16.33	49.00	Developed, Open Space
0.269	1.00	30.00	Undeveloped, Grassland
11.260	41.80	89.00	Developed, High Density
26.940	**100.00**	**75**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
1.81	100.00	0.02615	21.8465	Sheet Flow
5.26	503.38	0.00979	3.2670	Shallow Concentrated Flow
5.02	400.54	0.03611	6.2751	Shallow Concentrated Flow
15.37	512.50	0.00309	1.8343	Shallow Concentrated Flow
2.66	890.10	0.02832	5.5567	Channel Flow
30.12	**2,406.52**	**Total**	**Lag Time = 18.08 minutes**	



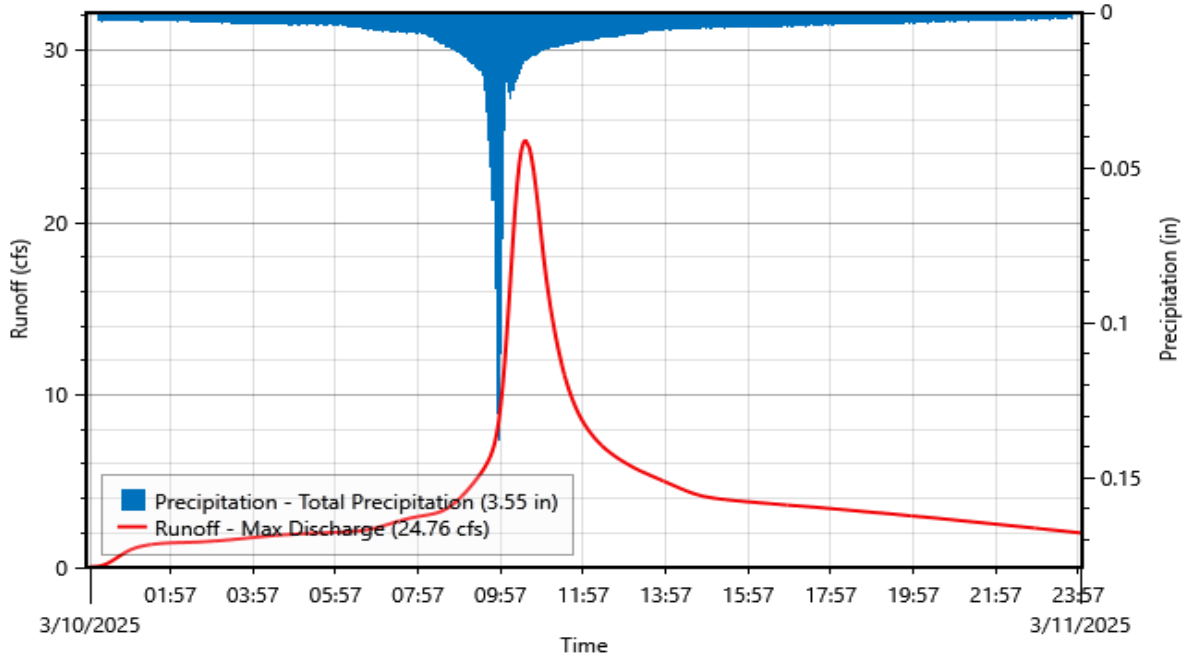
Subbasin ID:	Sub-2			
Scenario:	**Existing 100-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	24.76 cfs	**Time of peak:**	10 Mar 2025, 10:33	
Drainage area:	56.927 acres	**Total rainfall:**	3.55 in	16.83173 ac-ft
Initial abstraction:	1.35 in	**Losses:**	1.81 in	8.56633 ac-ft
Curve Number:	60	**Precip excess:**	1.74 in	8.26540 ac-ft
Impervious surface:	40.0%	**Direct runoff:**	1.72 in	8.13 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	39.33 minutes	**Total runoff:**	1.72 in	8.13 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
8.193	14.39	77.00	Developed, Medium Density
11.295	19.84	61.00	Developed, Low Density
12.040	21.15	89.00	Developed, High Density
9.565	16.80	49.00	Developed, Open Space
1.455	2.56	77.00	Undeveloped, Barren Land
14.379	25.26	30.00	Undeveloped, Grassland
56.927	**100.00**	**60**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
2.23	100.00	0.01556	16.8499	Sheet Flow
3.49	539.58	0.02558	5.2817	Shallow Concentrated Flow
55.85	2,122.01	0.00401	2.0903	Shallow Concentrated Flow
3.97	1,204.27	0.02333	5.0436	Channel Flow
65.54	**3,965.86**	**Total**	**Lag Time = 39.33 minutes**	



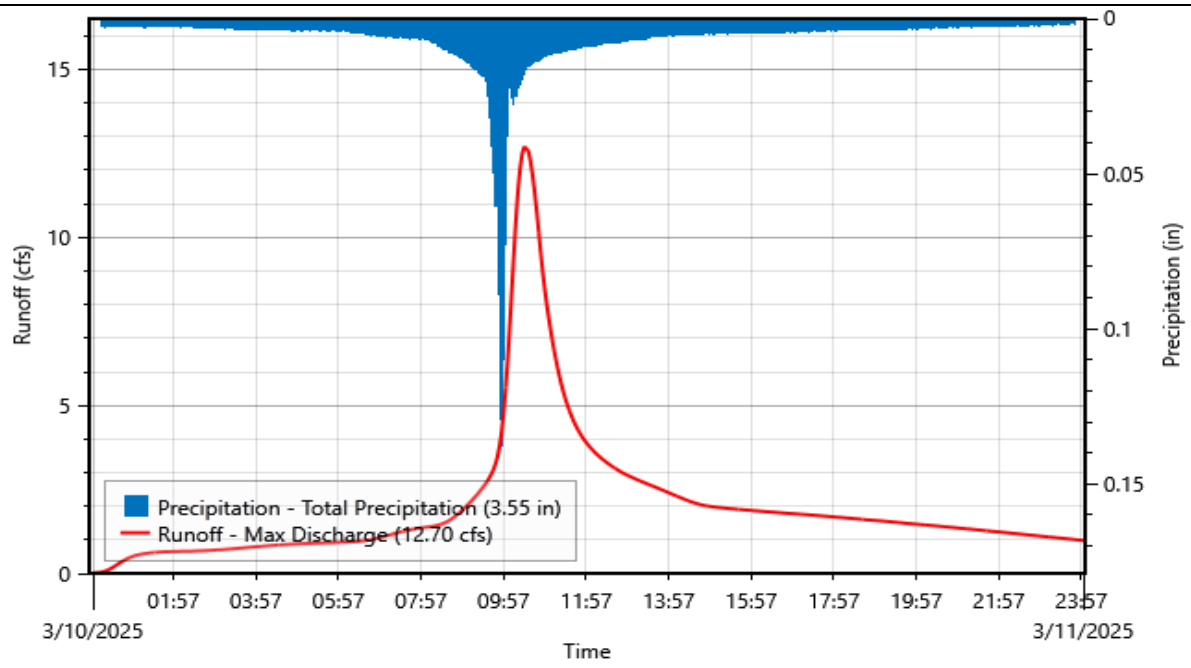
Subbasin ID:	Sub-3			
Scenario:	**Existing 100-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	12.70 cfs	**Time of peak:**	10 Mar 2025, 10:30	
Drainage area:	27.576 acres	**Total rainfall:**	3.55 in	8.16027 ac-ft
Initial abstraction:	1.21 in	**Losses:**	1.82 in	4.18656 ac-ft
Curve Number:	63	**Precip excess:**	1.73 in	3.97370 ac-ft
Impervious surface:	37.2%	**Direct runoff:**	1.70 in	3.92 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	34.82 minutes	**Total runoff:**	1.70 in	3.92 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
5.596	20.29	77.00	Developed, Medium Density
4.970	18.02	89.00	Developed, High Density
6.178	22.40	49.00	Developed, Open Space
3.789	13.74	30.00	Undeveloped, Grassland
7.043	25.54	61.00	Developed, Low Density
27.576	**100.00**	**63**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
20.46	100.00	0.08024	1.0523	Sheet Flow
11.44	727.28	0.01122	3.4981	Shallow Concentrated Flow
17.72	744.10	0.01000	3.3016	Shallow Concentrated Flow
6.65	533.66	0.00687	2.7380	Shallow Concentrated Flow
1.75	796.88	0.05266	7.5777	Channel Flow
58.02	**2,901.92**	**Total**	**Lag Time = 34.82 minutes**	



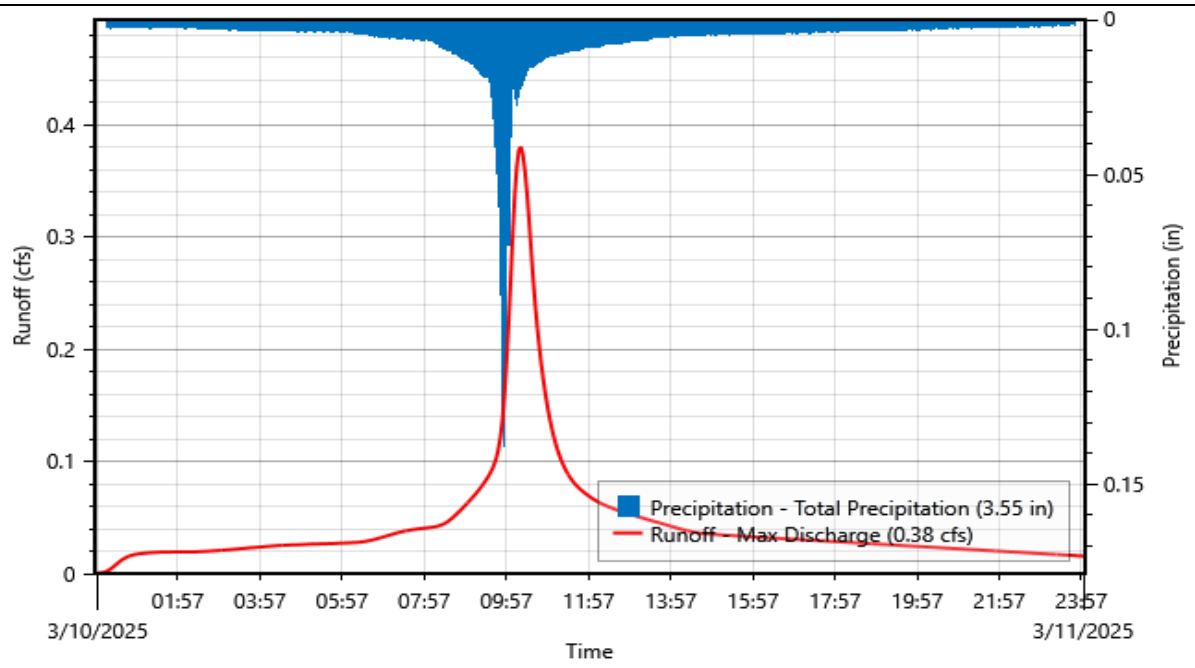
Subbasin ID:	**Sub-4**			
Scenario:	**Existing 100-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	0.38 cfs	**Time of peak:**	10 Mar 2025, 10:18	
Drainage area:	35.008 acres	**Total rainfall:**	3.55 in	10.35653 ac-ft
Initial abstraction:	4.18 in	**Losses:**	3.52 in	10.26850 ac-ft
Curve Number:	33	**Precip excess:**	0.03 in	0.08803 ac-ft
Impervious surface:	0.9%	**Direct runoff:**	0.03 in	0.09 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	25.58 minutes	**Total runoff:**	0.03 in	0.09 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
1.129	3.23	30.00	Undeveloped, Shrub/Scrub
0.336	0.96	61.00	Developed, Low Density
3.759	10.74	49.00	Developed, Open Space
29.783	85.08	30.00	Undeveloped, Grassland
35.008	**100.00**	**33**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
17.95	100.00	0.08524	1.2396	Sheet Flow
7.07	440.55	0.02201	4.8995	Shallow Concentrated Flow
7.25	455.65	0.01096	3.4567	Shallow Concentrated Flow
5.97	428.72	0.02928	5.6507	Shallow Concentrated Flow
4.38	1,400.46	0.02592	5.3168	Channel Flow
42.62	**2,825.38**	**Total**	**Lag Time = 25.58 minutes**	



Nodes

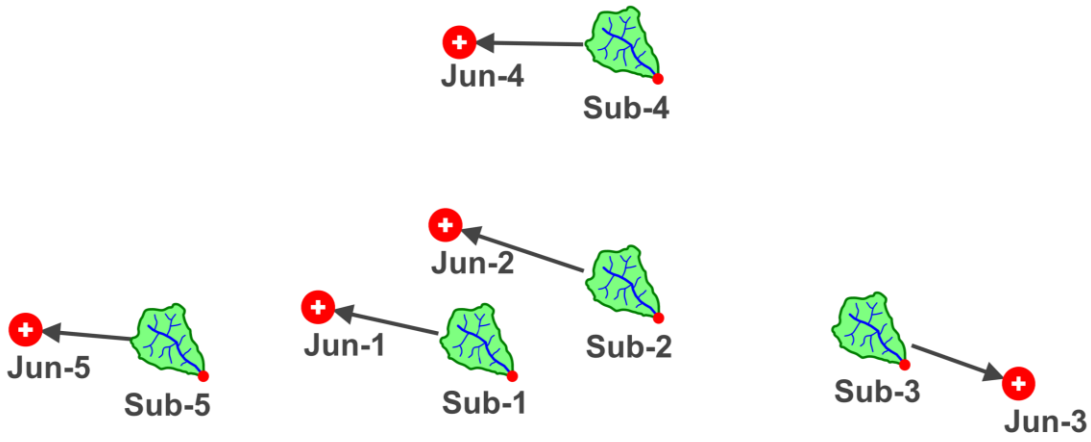
Element ID	Element Type	Peak Inflow (cfs)	Peak Outflow (cfs)	Peak Diverted Flow (cfs)
Jun-1	Junction	30.10	30.10	
Jun-2	Junction	24.76	24.76	
Jun-3	Junction	12.70	12.70	
Jun-4	Junction	0.38	0.38	

Routing Reaches

Reach ID	Peak Inflow (cfs)	Peak Outflow (cfs)	Attenuated Flow (cfs)
Reach-1	0.00	0.00	0.00
Reach-2	0.00	0.00	0.00
Reach-3	0.00	0.00	0.00
Reach-4	0.00	0.00	0.00

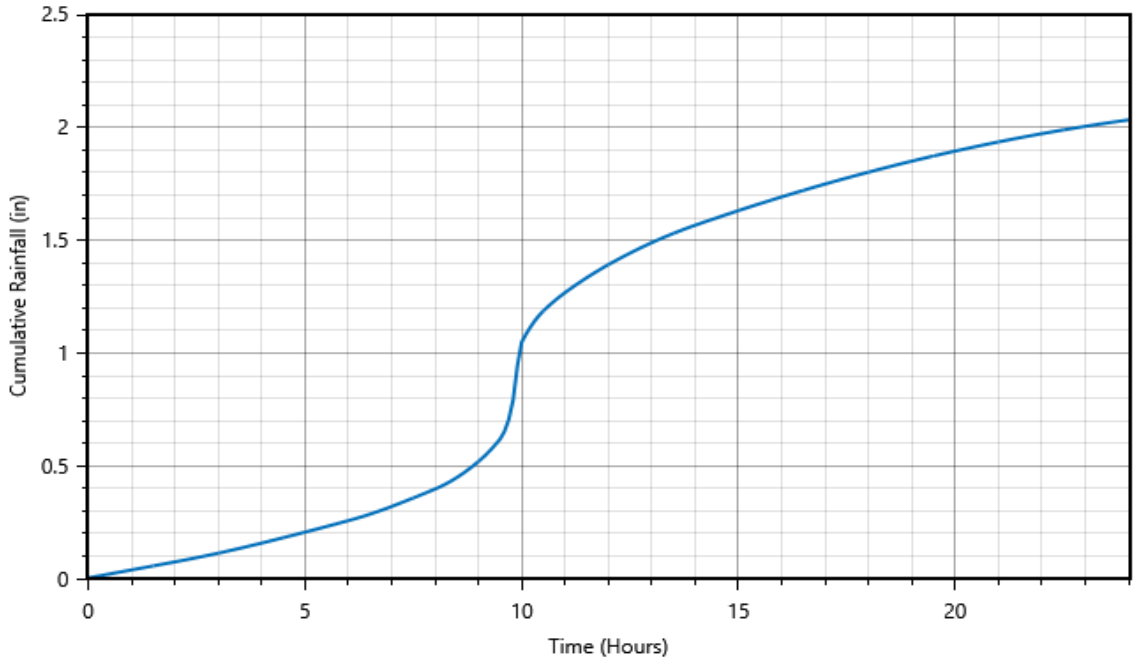
Proposed 10-yr,24-hrs

Watershed Routing Diagram



Design Storm

Precipitation type: SCS Storm
SCS storm distribution: Type I
Rainfall depth: 2.03 in



Watershed Summary

Subbasin ID	Drainage Area (acres)	Initial Abstraction (in)	Curve Number	Impervious Surface (%)	Lag Time (minutes)	Peak Discharge (cfs)
Sub-1	26.940	0.70	77		0.00	15.96
Sub-2	56.927	1.35	63		0.00	14.50
Sub-3	27.576	1.21	68		0.00	7.48
Sub-4	35.008	4.18	35		0.00	0.93

Subbasins

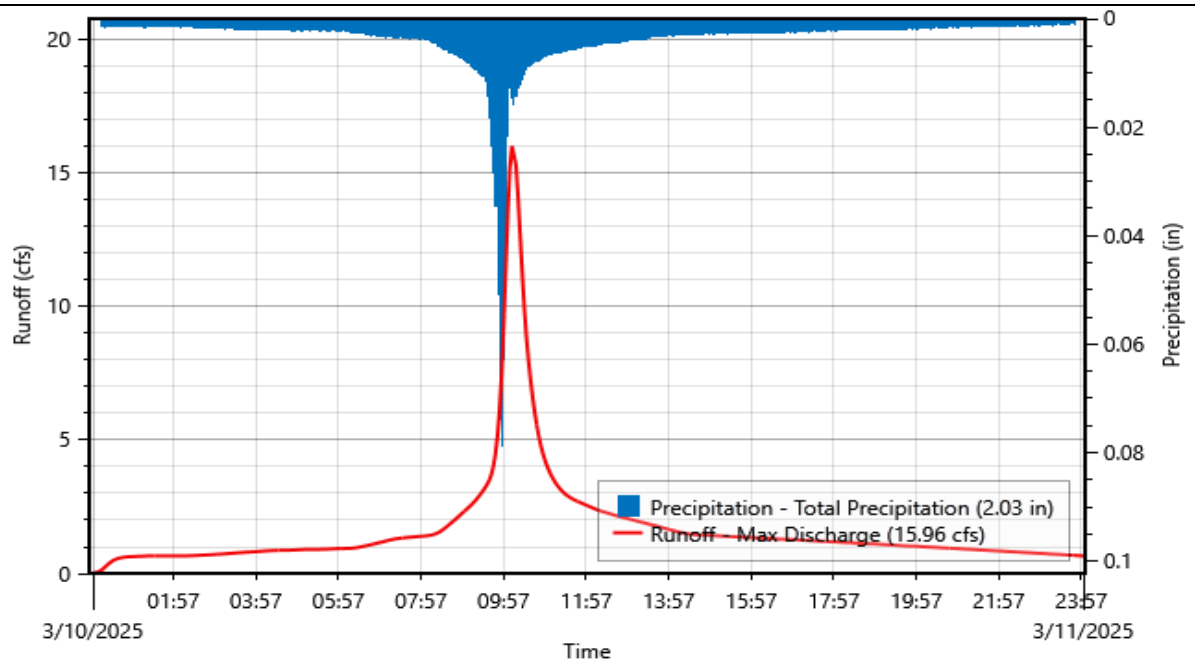
Subbasin ID:	**Sub-1**			
Scenario:	**Proposed 10-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	15.96 cfs	**Time of peak:**	10 Mar 2025, 10:09	
Drainage area:	26.940 acres	**Total rainfall:**	2.03 in	4.55803 ac-ft
Initial abstraction:	0.70 in	**Losses:**	0.57 in	1.27841 ac-ft
Curve Number:	77	**Precip excess:**	1.46 in	3.27962 ac-ft
Impervious surface:	%	**Direct runoff:**	1.45 in	3.26 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	1.45 in	3.26 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
5.236	19.44	77.00	Developed, Medium Density
4.243	15.75	61.00	Developed, Low Density
4.399	16.33	49.00	Developed, Open Space
5.496	20.40	98.00	Paved parking lots, roofs, driveways
0.269	1.00	30.00	Undeveloped, Grassland
7.296	27.08	89.00	Developed, High Density
26.940	**100.00**	**77**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
1.81	100.00	0.02615	21.8465	Sheet Flow
5.26	503.38	0.00979	3.2670	Shallow Concentrated Flow
5.02	400.54	0.03611	6.2751	Shallow Concentrated Flow
15.37	512.50	0.00309	1.8343	Shallow Concentrated Flow
2.66	890.10	0.02832	5.5567	Channel Flow
30.12	**2,406.52**	**Total**	**Lag Time = 18.08 minutes**	



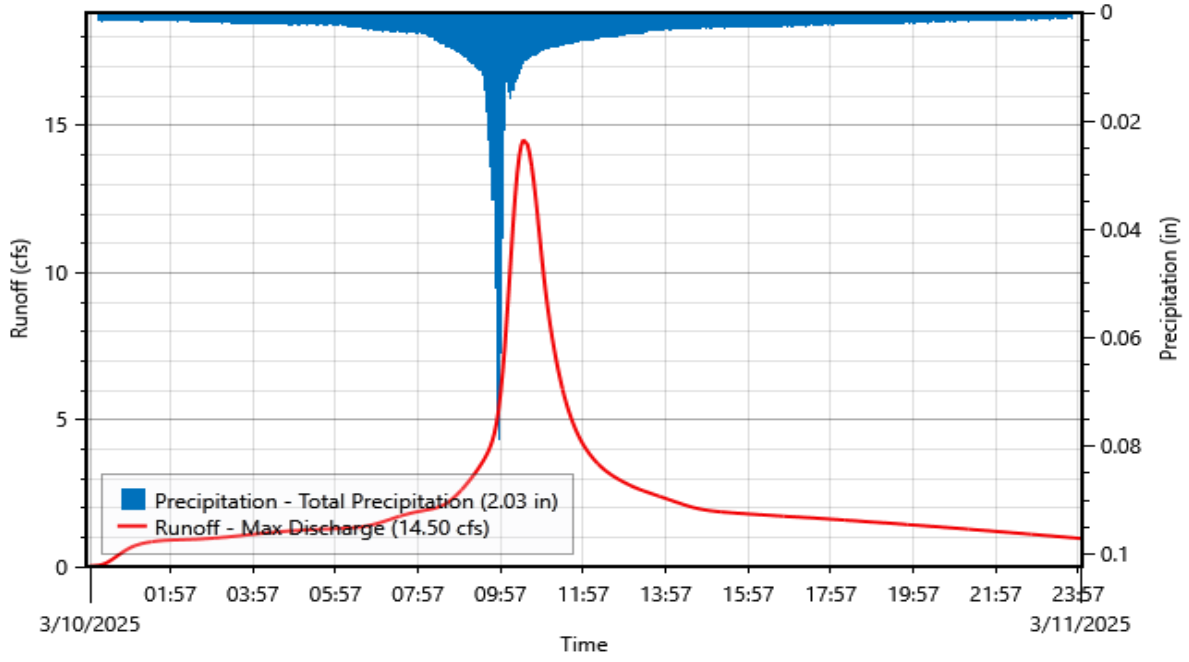
Subbasin ID:	Sub-2			
Scenario:	**Proposed 10-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	14.50 cfs	**Time of peak:**	10 Mar 2025, 10:33	
Drainage area:	56.927 acres	**Total rainfall:**	2.03 in	9.62491 ac-ft
Initial abstraction:	1.35 in	**Losses:**	1.09 in	5.18004 ac-ft
Curve Number:	63	**Precip excess:**	0.94 in	4.44486 ac-ft
Impervious surface:	%	**Direct runoff:**	0.92 in	4.38 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	0.92 in	4.38 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
6.993	12.28	77.00	Developed, Medium Density
9.173	16.11	61.00	Developed, Low Density
9.379	16.48	89.00	Developed, High Density
9.565	16.80	49.00	Developed, Open Space
1.243	2.18	77.00	Undeveloped, Barren Land
6.194	10.88	98.00	Paved parking lots, roofs, driveways
14.379	25.26	30.00	Undeveloped, Grassland
56.927	**100.00**	**63**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
2.23	100.00	0.01556	16.8499	Sheet Flow
3.49	539.58	0.02558	5.2817	Shallow Concentrated Flow
55.85	2,122.01	0.00401	2.0903	Shallow Concentrated Flow
3.97	1,204.27	0.02333	5.0436	Channel Flow
65.54	**3,965.86**	**Total**	**Lag Time = 39.33 minutes**	



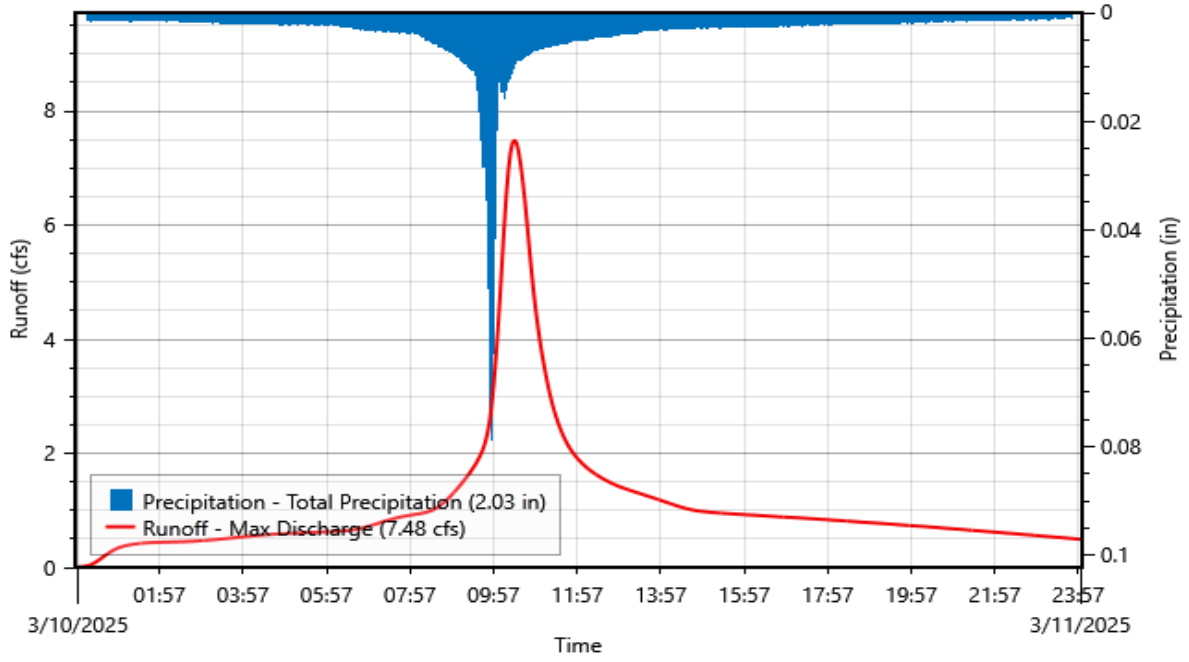
Subbasin ID:	Sub-3			
Scenario:	**Proposed 10-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	7.48 cfs	**Time of peak:**	10 Mar 2025, 10:27	
Drainage area:	27.576 acres	**Total rainfall:**	2.03 in	4.66629 ac-ft
Initial abstraction:	1.21 in	**Losses:**	1.07 in	2.46067 ac-ft
Curve Number:	68	**Precip excess:**	0.96 in	2.20562 ac-ft
Impervious surface:	%	**Direct runoff:**	0.95 in	2.18 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	0.95 in	2.18 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
5.087	18.45	77.00	Developed, Medium Density
4.032	14.62	89.00	Developed, High Density
4.527	16.42	49.00	Developed, Open Space
3.911	14.18	98.00	Paved parking lots, roofs, driveways
3.314	12.02	30.00	Undeveloped, Grassland
6.705	24.32	61.00	Developed, Low Density
27.576	**100.00**	**68**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
20.46	100.00	0.08024	1.0523	Sheet Flow
11.44	727.28	0.01122	3.4981	Shallow Concentrated Flow
17.72	744.10	0.01000	3.3016	Shallow Concentrated Flow
6.65	533.66	0.00687	2.7380	Shallow Concentrated Flow
1.75	796.88	0.05266	7.5777	Channel Flow
58.02	**2,901.92**	**Total**	**Lag Time = 34.82 minutes**	



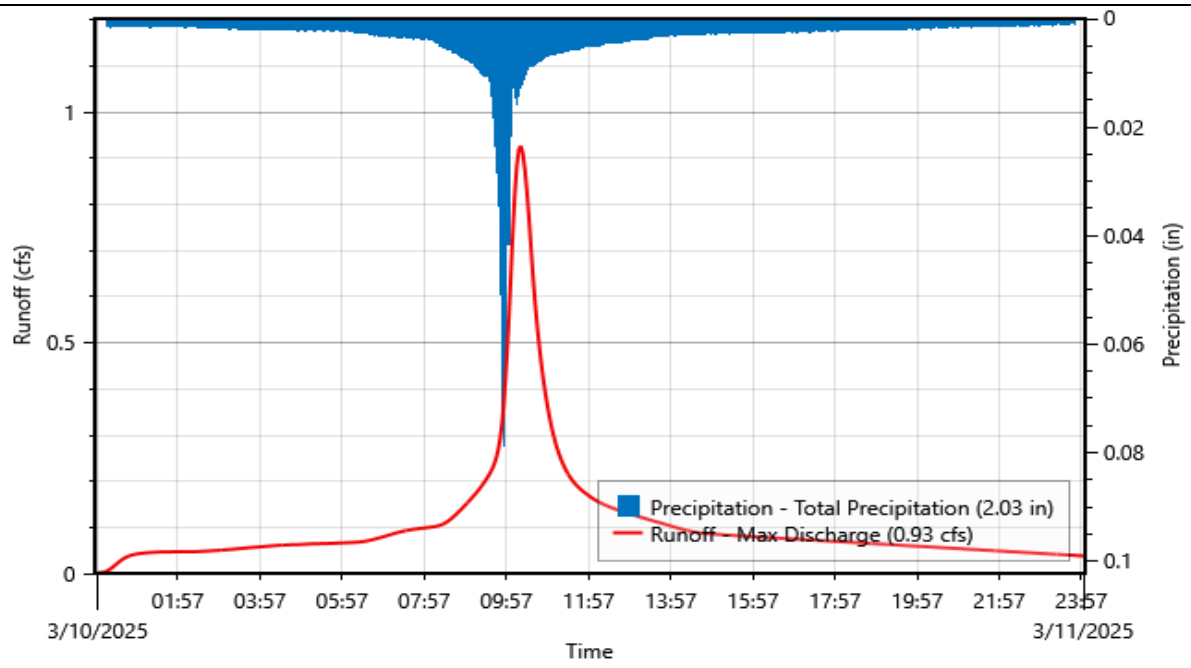
Subbasin ID:	Sub-4			
Scenario:	**Proposed 10-yr,24-hrs**		**Depth**	**Volume**
Peak discharge:	0.93 cfs	**Time of peak:**	10 Mar 2025, 10:18	
Drainage area:	35.008 acres	**Total rainfall:**	2.03 in	5.92219 ac-ft
Initial abstraction:	4.18 in	**Losses:**	1.96 in	5.70780 ac-ft
Curve Number:	35	**Precip excess:**	0.07 in	0.21438 ac-ft
Impervious surface:	%	**Direct runoff:**	0.07 in	0.21 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	0.07 in	0.21 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
1.129	3.23	30.00	Undeveloped, Shrub/Scrub
0.042	0.12	61.00	Developed, Low Density
3.393	9.69	49.00	Developed, Open Space
1.536	4.39	98.00	Paved parking lots, roofs, driveways
28.908	82.58	30.00	Undeveloped, Grassland
35.008	**100.00**	**35**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
17.95	100.00	0.08524	1.2396	Sheet Flow
7.07	440.55	0.02201	4.8995	Shallow Concentrated Flow
7.25	455.65	0.01096	3.4567	Shallow Concentrated Flow
5.97	428.72	0.02928	5.6507	Shallow Concentrated Flow
4.38	1,400.46	0.02592	5.3168	Channel Flow
42.62	**2,825.38**	**Total**	**Lag Time = 25.58 minutes**	



Nodes

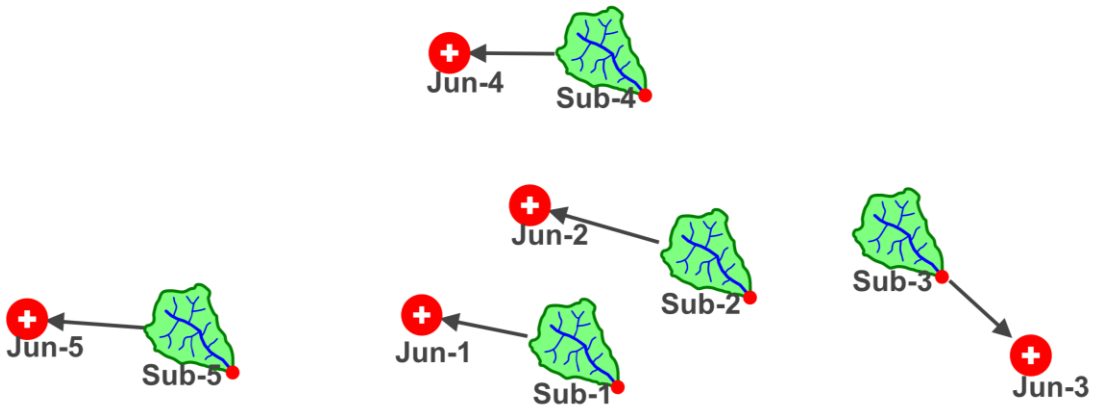
Element ID	Element Type	Peak Inflow (cfs)	Peak Outflow (cfs)	Peak Diverted Flow (cfs)
Jun-1	Junction	15.96	15.96	
Jun-2	Junction	14.50	14.50	
Jun-3	Junction	7.48	7.48	
Jun-4	Junction	0.93	0.93	

Routing Reaches

Reach ID	Peak Inflow (cfs)	Peak Outflow (cfs)	Attenuated Flow (cfs)
Reach-1	0.00	0.00	0.00
Reach-2	0.00	0.00	0.00
Reach-3	0.00	0.00	0.00
Reach-4	0.00	0.00	0.00

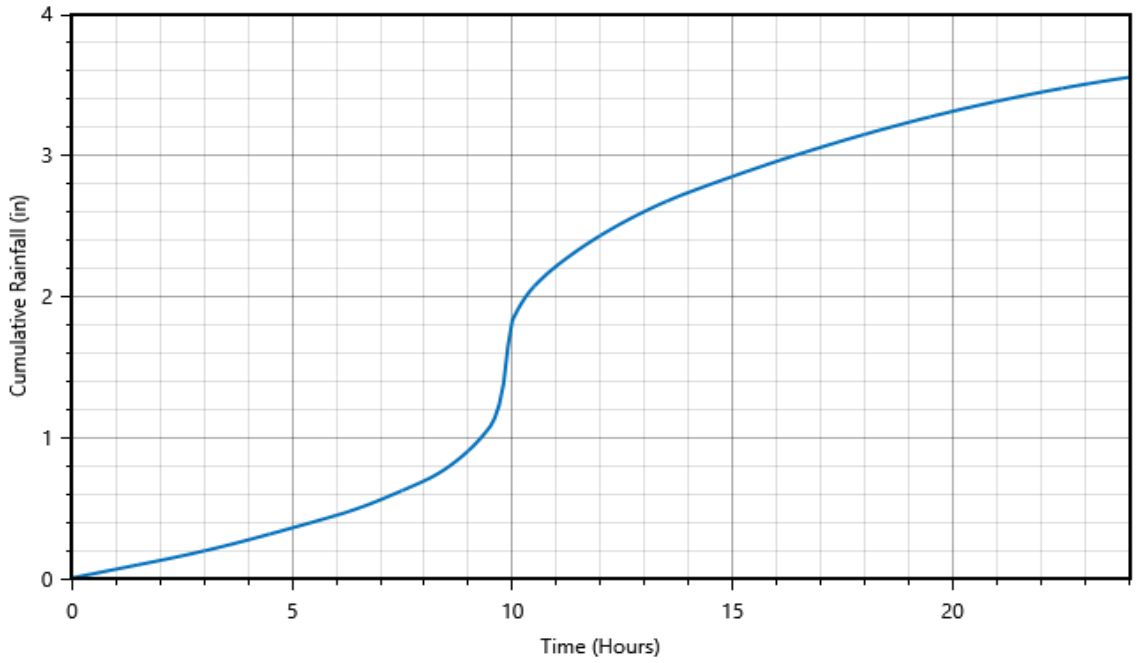
Proposed 100-yr,24-hr

Watershed Routing Diagram



Design Storm

Precipitation type: SCS Storm
SCS storm distribution: Type I
Rainfall depth: 3.55 in



Watershed Summary

Subbasin ID	Drainage Area (acres)	Initial Abstraction (in)	Curve Number	Impervious Surface (%)	Lag Time (minutes)	Peak Discharge (cfs)
Sub-1	26.940	0.70	77		0.00	31.85
Sub-2	56.927	1.35	63		0.00	27.29
Sub-3	27.576	1.21	68		0.00	14.88
Sub-4	35.008	4.18	35		0.00	1.62

Subbasins

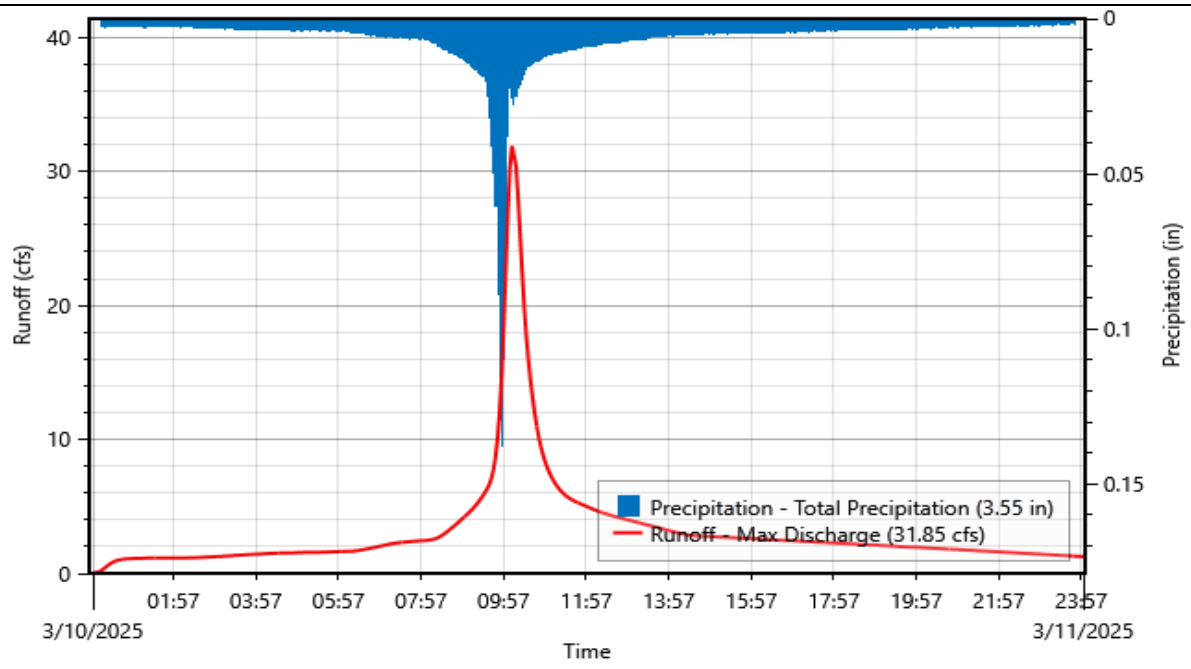
Subbasin ID:	**Sub-1**			
Scenario:	**Proposed 100-yr,24-hr**		**Depth**	**Volume**
Peak discharge:	31.85 cfs	**Time of peak:**	10 Mar 2025, 10:09	
Drainage area:	26.940 acres	**Total rainfall:**	3.55 in	7.97093 ac-ft
Initial abstraction:	0.70 in	**Losses:**	0.76 in	1.70350 ac-ft
Curve Number:	77	**Precip excess:**	2.79 in	6.26743 ac-ft
Impervious surface:	%	**Direct runoff:**	2.77 in	6.23 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	2.77 in	6.23 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
5.236	19.44	77.00	Developed, Medium Density
4.243	15.75	61.00	Developed, Low Density
4.399	16.33	49.00	Developed, Open Space
5.496	20.40	98.00	Paved parking lots, roofs, driveways
0.269	1.00	30.00	Undeveloped, Grassland
7.296	27.08	89.00	Developed, High Density
26.940	**100.00**	**77**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
1.81	100.00	0.02615	21.8465	Sheet Flow
5.26	503.38	0.00979	3.2670	Shallow Concentrated Flow
5.02	400.54	0.03611	6.2751	Shallow Concentrated Flow
15.37	512.50	0.00309	1.8343	Shallow Concentrated Flow
2.66	890.10	0.02832	5.5567	Channel Flow
30.12	**2,406.52**	**Total**	**Lag Time = 18.08 minutes**	



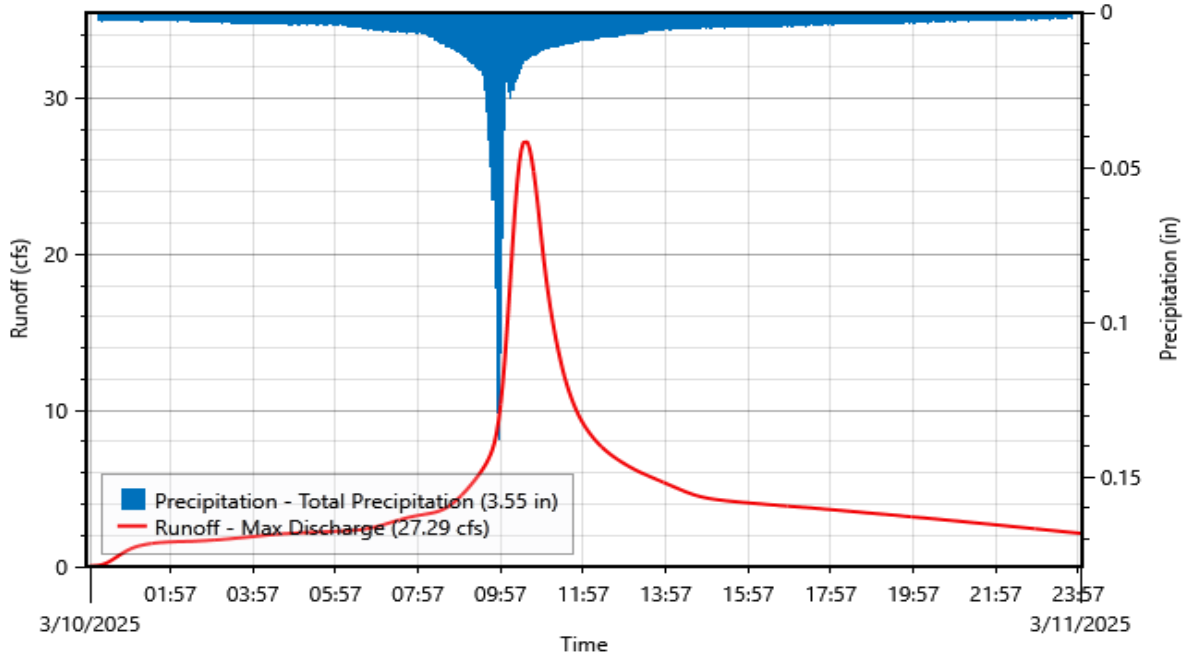
Subbasin ID:	Sub-2			
Scenario:	**Proposed 100-yr,24-hr**		**Depth**	**Volume**
Peak discharge:	27.29 cfs	**Time of peak:**	10 Mar 2025, 10:33	
Drainage area:	56.927 acres	**Total rainfall:**	3.55 in	16.83173 ac-ft
Initial abstraction:	1.35 in	**Losses:**	1.65 in	7.83395 ac-ft
Curve Number:	63	**Precip excess:**	1.90 in	8.99779 ac-ft
Impervious surface:	%	**Direct runoff:**	1.87 in	8.86 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	1.87 in	8.86 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
6.993	12.28	77.00	Developed, Medium Density
9.173	16.11	61.00	Developed, Low Density
9.379	16.48	89.00	Developed, High Density
9.565	16.80	49.00	Developed, Open Space
1.243	2.18	77.00	Undeveloped, Barren Land
6.194	10.88	98.00	Paved parking lots, roofs, driveways
14.379	25.26	30.00	Undeveloped, Grassland
56.927	**100.00**	**63**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
2.23	100.00	0.01556	16.8499	Sheet Flow
3.49	539.58	0.02558	5.2817	Shallow Concentrated Flow
55.85	2,122.01	0.00401	2.0903	Shallow Concentrated Flow
3.97	1,204.27	0.02333	5.0436	Channel Flow
65.54	**3,965.86**	**Total**	**Lag Time = 39.33 minutes**	



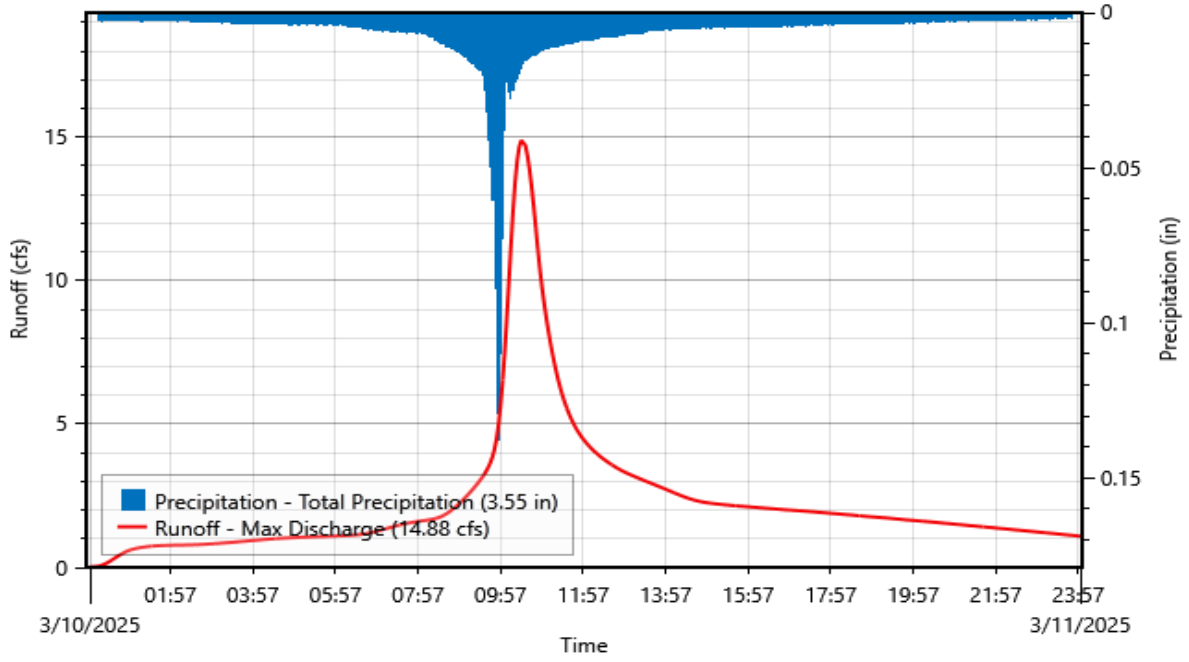
Subbasin ID:	Sub-3			
Scenario:	**Proposed 100-yr,24-hr**		**Depth**	**Volume**
Peak discharge:	14.88 cfs	**Time of peak:**	10 Mar 2025, 10:30	
Drainage area:	27.576 acres	**Total rainfall:**	3.55 in	8.16027 ac-ft
Initial abstraction:	1.21 in	**Losses:**	1.56 in	3.58414 ac-ft
Curve Number:	68	**Precip excess:**	1.99 in	4.57612 ac-ft
Impervious surface:	%	**Direct runoff:**	1.96 in	4.51 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	1.96 in	4.51 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
5.087	18.45	77.00	Developed, Medium Density
4.032	14.62	89.00	Developed, High Density
4.527	16.42	49.00	Developed, Open Space
3.911	14.18	98.00	Paved parking lots, roofs, driveways
3.314	12.02	30.00	Undeveloped, Grassland
6.705	24.32	61.00	Developed, Low Density
27.576	**100.00**	**68**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
20.46	100.00	0.08024	1.0523	Sheet Flow
11.44	727.28	0.01122	3.4981	Shallow Concentrated Flow
17.72	744.10	0.01000	3.3016	Shallow Concentrated Flow
6.65	533.66	0.00687	2.7380	Shallow Concentrated Flow
1.75	796.88	0.05266	7.5777	Channel Flow
58.02	**2,901.92**	**Total**	**Lag Time = 34.82 minutes**	



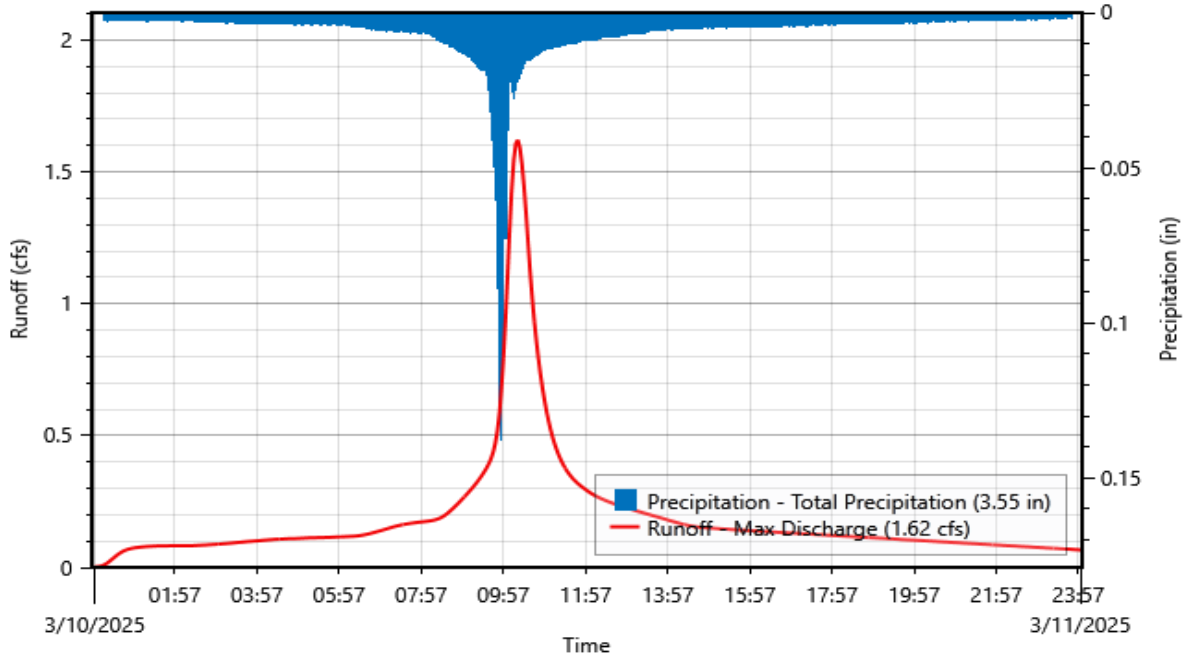
Subbasin ID:	Sub-4			
Scenario:	**Proposed 100-yr,24-hr**		**Depth**	**Volume**
Peak discharge:	1.62 cfs	**Time of peak:**	10 Mar 2025, 10:18	
Drainage area:	35.008 acres	**Total rainfall:**	3.55 in	10.35653 ac-ft
Initial abstraction:	4.18 in	**Losses:**	3.42 in	9.98163 ac-ft
Curve Number:	35	**Precip excess:**	0.13 in	0.37491 ac-ft
Impervious surface:	%	**Direct runoff:**	0.13 in	0.37 ac-ft
Peaking factor:	484	**Baseflow:**	0.00 in	0.00 ac-ft
Lag time:	0.00 minutes	**Total runoff:**	0.13 in	0.37 ac-ft

Weighted Curve Number Calculations

Area (acres)	Area (%)	CN	Description
1.129	3.23	30.00	Undeveloped, Shrub/Scrub
0.042	0.12	61.00	Developed, Low Density
3.393	9.69	49.00	Developed, Open Space
1.536	4.39	98.00	Paved parking lots, roofs, driveways
28.908	82.58	30.00	Undeveloped, Grassland
35.008	**100.00**	**35**	**Weighted Average**

Time of Concentration (TOC) / Lag time Calculations

TOC (min)	Length (ft)	Slope (ft/ft)	Velocity (ft/s)	Description
17.95	100.00	0.08524	1.2396	Sheet Flow
7.07	440.55	0.02201	4.8995	Shallow Concentrated Flow
7.25	455.65	0.01096	3.4567	Shallow Concentrated Flow
5.97	428.72	0.02928	5.6507	Shallow Concentrated Flow
4.38	1,400.46	0.02592	5.3168	Channel Flow
42.62	**2,825.38**	**Total**	**Lag Time = 25.58 minutes**	



Nodes

Element ID	Element Type	Peak Inflow (cfs)	Peak Outflow (cfs)	Peak Diverted Flow (cfs)
Jun-1	Junction	31.85	31.85	
Jun-2	Junction	27.29	27.29	
Jun-3	Junction	14.88	14.88	
Jun-4	Junction	1.62	1.62	

Routing Reaches

Reach ID	Peak Inflow (cfs)	Peak Outflow (cfs)	Attenuated Flow (cfs)
Reach-1	0.00	0.00	0.00
Reach-2	0.00	0.00	0.00
Reach-3	0.00	0.00	0.00
Reach-4	0.00	0.00	0.00

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

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