# HYDROLOGY STUDY

**City of Hesperia**

# Fire Station No.305

# PREFABRICATED METAL STORAGE BUILDING

**8331 Caliente Road, Hesperia, CA 92344**

## February 2024

Prepared For:

San Bernardino

385 N. Arrowhead Avenue

San Bernardino, California 92415

Prepared By:



Engineering Resources of Southern California, Inc.

1861 Redlands Blvd. Bldg. 7B

Redlands, CA 92373

(909) 890-1255

# Table of Contents

# INTRODUCTION

## *PURPOSE*

This report was prepared to determine the increased runoff associated with 1-hour 100-year storm events that are tributary to and generated by Parcel Number 3039-351-09 in the City of Hesperia in San Bernardino County for the proposed Fire Station No.305 (FS No.305).

## *SITE DESCRIPTION*

The current Fire Station 305 encompasses 3.5 acres, of which only 2.36 acres are developed. These developed areas include the apparatus building, fire station building, storage building, and parking pavement. Approximately 2.00 acres of the developed area are impervious. It is important to note that this impervious area of the existing fire station, which covers 2.00 acres out of the total 2.36 acres, will not contribute to any flow into the proposed annexation of the new prefabricated garage area. This new garage area spans 0.59 acres, leaving the remaining 0.56 acres undeveloped for a future garage building.

The (Parcel Number 3039-351-09) Fire Station No. 305 (FS No.305) is located at 8331 Caliente Road, Hesperia, California 92344. FS No.305 is located on a commercial land used zone with approximately 0.59 acres. The site is located on the west side of Route 395 approximately 1,940 feet south Joshua Street in the City of Hesperia, California. The site is bounded on the north by vacated parcel 3039-351-08, on the south parcel 3039-351-04 and on the east by Route 395.

## *PRE-DEVELOPMENT*

Historically, onsite runoff sheet flow runs in a northerly direction along an existing drainage easement located on the east boundary of this property (FS No.2305). The existing topography in the watershed area is characterized by moderate natural slopes of approximately 5 percent in a northly direction. The soil site has been classified in the Hydrologic soil group A by the Natural Resources Conservation Service (NRCS); this area is characterized as having high infiltration capacity. The offsite tributary runoff sheet flows along an existing easement that runs parallel to Route 395.

## *POST-DEVELOPMENT*

The current FS305 construction project encompasses 2.36 acres out of the total 3.51 acres of this parcel. The remaining 0.56 acres will be utilized for the future development of a garage building, which is not included in the scope of this reported project and will remain undisturbed. The proposed construction for this project involves the development of a metal storage building, with an estimated floor area of 4,000 square feet. Additionally, a parking area will be included, resulting in a total improvement area of 0.59 acres, with 56% of it being impervious surface.
To manage on-site runoff, the surface will direct the flow towards the proposed bioretention basin situated on the northeast property boundary, as depicted in the Hydrology Map. The Design Capture Volume (DCV) for this project considers the volume of ***962 cubic feet***.

The existing and proposed onsite areas will generate a runoff flow rate for 1-hour 100 year of ***1.30 cfs*** and ***2.74 cfs***, respectively. The proposed runoff flows will be effectively captured by the bioretention basin (See Rational Method Calculation in ***Appendix-A***). The calculations for the 1-hour 100-year Rational method have been conducted to determine the maximum runoff generated by the improvement site. The proposed bioretention basin system has a total effective retention volume of ***987.5 c.f.*** which satisfies the volume requirements for water quality mitigation. ***Table 1-1*** below illustrates the breakdown of the generated runoff and time of concentration, as determined by the rational method calculations for the pre-construction and post-construction conditions.

*Table 1-1*

| Fire Station 305 | | |
|---|---|---|
| **Pre-developed** | **Tc** | **Runoff** |
| 0.59 Acres | 14.18 min. | 1.30 cfs |
| **Post-Developed** | **Tc** | **Runoff** |
| 0.59 Acres | 6.37 min. | 2.74 cfs |

### *Methods*

The Hydrology and Hydraulic Calculations were performed using the Rational Method outlined in the Hydrology Manual, published by the County of San Bernardino, revised in August 1986. Hydrology and Hydraulic calculations are provided in the Appendix of this report.

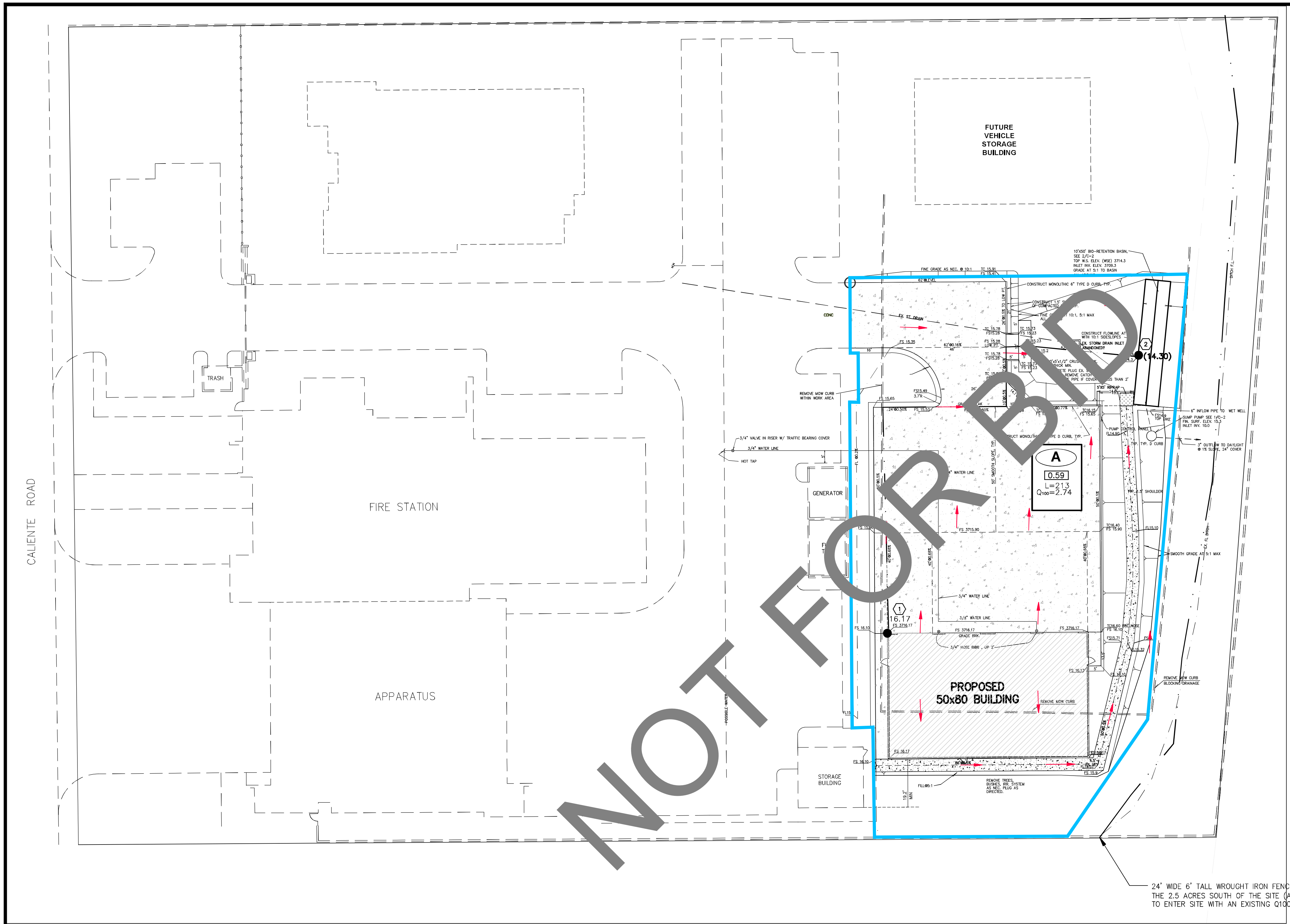
### *Design Criterion*

All facilities proposed in Fire Station No.305 are designed to convey 1-hour and 100-year runoff. The water quality conveyance is provided in accordance with the NPDES requirement implemented per regional water quality control board standards of the Santa Ana watershed. The required water quality treatment volumes were calculated and designed per Mojave River Watershed Water Quality Management Plan Plans (WQMP).

### *Conclusion*

This report intends to determine the runoff for a 1-hour 100-year storm event. The onsite generated runoff will be sheet flow over the surface and discharged to the proposed bioretention as depicted in the hydrology map. The incremental peak flow due to the new improvement of the FS305 will be controlled by the proposed bioretention basin.

# *APPENDIX A-ONSITE RATIONAL METHOD CALCULATIONS FOR 1 Hour 100-Year Storm Event*




## LEGEND

| | |
|---|---|
| (1) | NODE NUMBER |
| | WATERSHED BOUNDARY |
| — · · — | WATERCOURSE |
| (100) | ELEVATION |
| 0.50 | AREA (ACRES) |
| $Q_{100}$=100 | 100 YEAR MAX. FLOW IN CFS. |
| ← | DIRECTION OF THE FLOW. |
| A | DRAINAGE AREA |
| L=100 | LENGTH OF FLOWPATH IN FT. |

24' WIDE 6' TALL WROUGHT IRON FENCE TO ALLOW FOR SURFACE STORM WATER RUNOFF FROM THE 2.5 ACRES SOUTH OF THE SITE (AND NORTH OF THE1.5 ACRES OFFSITE RETENSION BASIN) TO ENTER SITE WITH AN EXISTING Q100=6.2 CFS. NOT A PART OF THIS HYDROLOGY ANALYSIS.

0 20 40 Feet

REGISTERED PROFESSIONAL ENGINEER JOHN M. BRUDIN No. 41836 CIVIL STATE OF CALIFORNIA

DESIGN BUILD CONTRACTOR:

ERSC INC.
Engineering Resources of Southern California

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PREPARED BY: ENGINEERING RESOURCES
JOHN M. BRUDIN

03/31/2024
DATE:

**CITY OF HESPERIA**
**SAN BERNARDINO COUNTY**

***HYDROLOGY MAP***
***FIRE STATION 305***
***PREFABRICATED METAL STORAGE BUILDING***
***PROPOSED CONDITION***

SHEET No. 1 OF 1 SHEETS

FOR: | W.O. | FILE NO. —

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 02/12/24

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FIRE STATION 305
EXISTING CONDITION EAST VACATED LOTE AT FS 305

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Program License Serial Number 6158

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

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Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.370 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 50.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.810(In/Hr)
Initial subarea data:
Initial area flow distance = 187.000(Ft.)
Top (of initial area) elevation = 16.000(Ft.)
Bottom (of initial area) elevation = 14.000(Ft.)
Difference in elevation = 2.000(Ft.)
Slope = 0.01070 s(%)= 1.07
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.181 min.
Rainfall intensity = 3.255(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.676
Subarea runoff = 1.299(CFS)
Total initial stream area = 0.590(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.810(In/Hr)

End of computations, Total Study Area = 0.59 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 50.0


## LEGEND

| | |
| --- | --- |
| 1 | NODE NUMBER |
| | WATERSHED BOUNDARY |
| | WATERCOURSE |
| (100) | ELEVATION |
| 0.50 | AREA (ACRES) |
| $Q_{100}$=100 | 100 YEAR MAX. FLOW IN CFS. |
| | DIRECTION OF THE FLOW. |
| A | DRAINAGE AREA |
| L=100 | LENGTH OF FLOWPATH IN FT. |

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JOHN M. BRUDIN

03/31/2024
DATE:

# CITY OF HESPERIA
# SAN BERNARDINO COUNTY

***HYDROLOGY MAP***
***FIRE STATION 305***
***PREFABRICATED METAL STORAGE BUILDING***
***EXISTING CONDITION***

SHEET No. 1

OF 1 SHEETS

FOR:

W.O.

FILE NO. –

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 02/12/24

------------------------------------------------------------------------

FIRE STATION 305
PROPOSED CONDITION,NEW GARAGE BUILDING
4,000 SQ. FT.GARAGE BUILDING

------------------------------------------------------------------------

Program License Serial Number 6158

------------------------------------------------------------------------

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

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Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.370 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2



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Process from Point/Station 1.000(Ft.) to Point/Station 2.000(Ft.)
**** INITIAL AREA EVALUATION ****

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COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 196.000(Ft.)
Top (of initial area) elevation = 16.170(Ft.)
Bottom (of initial area) elevation = 14.300(Ft.)
Difference in elevation = 1.870(Ft.)
Slope = 0.00954 s(%)= 0.95
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.366 min.
Rainfall intensity = 5.264(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff = 2.743(CFS)
Total initial stream area = 0.590(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)
End of computations, Total Study Area = 0.59 (Ac.)

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

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 32.0

# APPENDIX C-HYDROLOGIC SOIL GROUP MAP BY NRCS

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

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




September 20, 2023

# 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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# Contents

# How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

# Soil Map

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

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: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 14, Sep 1, 2022

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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

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

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 134 | HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES | 1.2 | 100.0% |
| **Totals for Area of Interest** | | **1.2** | **100.0%** |

# Map Unit Descriptions



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

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

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

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

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

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

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

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

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

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

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

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

# San Bernardino County, California, Mojave River Area

## 134—HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES

**Map Unit Setting**

*National map unit symbol:* hks7
*Elevation:* 200 to 4,000 feet
*Mean annual precipitation:* 6 to 9 inches
*Mean annual air temperature:* 57 to 61 degrees F
*Frost-free period:* 150 to 250 days
*Farmland classification:* Prime farmland if irrigated

**Map Unit Composition**

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

**Description of Hesperia**

**Setting**

*Landform:* Fan aprons
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from granite sources

**Typical profile**

*H1 - 0 to 6 inches:* loamy fine sand
*H2 - 6 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 2 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*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:* 10 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 5.9 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 2e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* A
*Ecological site:* R030XE006CA - COARSE LOAMY
*Hydric soil rating:* No

**Minor Components**

**Cajon**

*Percent of map unit:* 5 percent
*Hydric soil rating:* No

**Wrightwood**

*Percent of map unit:* 5 percent
*Hydric soil rating:* No

**Bull trail**

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

**Unnamed soils**

*Percent of map unit:* 2 percent
*Hydric soil rating:* No

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# APPENDIX D-NOAA ATLAS 14, PRECIPITATION TABLE

**NOAA Atlas 14, Volume 6, Version 2**
**Location name: Hesperia, California, USA***
**Latitude: 34.4016°, Longitude: -117.403°**
**Elevation: 3720 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 | 0.092 (0.076-0.112) | 0.129 (0.107-0.158) | 0.179 (0.147-0.219) | 0.220 (0.180-0.271) | 0.276 (0.218-0.352) | 0.320 (0.248-0.418) | 0.366 (0.276-0.489) | 0.413 (0.304-0.568) | 0.479 (0.338-0.687) | 0.531 (0.361-0.788) |
| 10-min | 0.132 (0.109-0.161) | 0.185 (0.153-0.226) | 0.256 (0.211-0.314) | 0.315 (0.257-0.389) | 0.396 (0.313-0.505) | 0.459 (0.355-0.599) | 0.524 (0.396-0.[illegible]01) | 0.592 (0.4[illegible]5-0.815) | 0.687 (0.484-0.985) | 0.761 (0.518-1.13) |
| 15-min | 0.159 (0.132-0.195) | 0.224 (0.185-0.274) | 0.310 (0.256-0.379) | 0.381 (0.311-0.470) | 0.478 (0.378-0.611) | 0.555 (0.430-0.724) | [illegible].634 (0.47[illegible].847) | 0[illegible]716 (0.[illegible]26-0.985) | 0.830 (0.585-1.19) | 0.921 (0.627-1.37) |
| 30-min | 0.240 (0.199-0.293) | 0.337 (0.279-0.412) | 0.466 (0.385-0.571) | 0.573 (0.469-0.708) | 0.720 (0.570-0.920) | 0.835 (0.647-1.[illegible]) | 0.954 (0[illegible]1.28) | 1.08 (0.792-1.48) | 1.25 (0.881-1.79) | 1.39 (0.943-2.06) |
| 60-min | 0.345 (0.285-0.420) | 0.484 (0.400-0.591) | 0.670 (0.552-0.820) | 0.823 (0.673-1.02) | 1.03 (0.818-1.32) | 1.20 (0.929-1.56) | 1.[illegible] ([illegible]-1.83) | 1.55 (1.14-2.13) | 1.80 (1.26-2.57) | 1.99 (1.35-2.95) |
| 2-hr | 0.512 (0.424-0.625) | 0.693 (0.573-0.847) | 0.936 (0.772-1.15) | 1.14 (0.932-1.41) | 1.42 (1.12-1.82) | 1[illegible]5 (1.[illegible]-2.15) | 1.88 (1.42-2.51) | 2.13 (1.56-2.92) | 2.47 (1.74-3.54) | 2.75 (1.87-4.08) |
| 3-hr | 0.646 (0.535-0.789) | 0.863 (0.714-1.05) | 1.16 (0.953-1.42) | 1.40 (1.15-1.73) | 1.74 (1.3[illegible]-2.23) | 2.02 (1.[illegible]6-2.63) | 2.31 (1.74-3.08) | 2.61 (1.92-3.59) | 3.04 (2.14-4.36) | 3.39 (2.30-5.03) |
| 6-hr | 0.932 (0.772-1.14) | 1.23 (1.02-1.51) | 1.64 (1.36-2.01) | 1.99 (1.62-2.45) | [illegible].47 (1.[illegible]-3.16) | 2.86 (2.22-3.74) | 3.28 (2.48-4.38) | 3.72 (2.73-5.11) | 4.34 (3.06-6.22) | 4.85 (3.30-7.20) |
| 12-hr | 1.24 (1.02-1.51) | 1.67 (1.38-2.04) | 2.25 (1.86-2.76) | 2.74 (2.25-3.3[illegible]) | 3.44 (2.72-4.39) | 4.00 (3.09-5.21) | 4.58 (3.46-6.12) | 5.21 (3.82-7.16) | 6.09 (4.29-8.74) | 6.82 (4.64-10.1) |
| 24-hr | 1.67 (1.48-1.92) | 2.32 (2.05-2.67) | 3.19 (2.82-3.69) | 3.93 (3.44-4.58) | 4.96 ([illegible].21-5.98) | 5.79 (4.81-7.12) | 6.66 (5.40-8.40) | 7.59 (5.98-9.83) | 8.91 (6.73-12.0) | 9.98 (7.29-13.9) |
| 2-day | 1.96 (1.74-2.26) | 2.74 (2.43-3.16) | 3.81 (3.36-4.40) | [illegible].71 (4.1[illegible]5.49) | 6.01 (5.09-7.24) | 7.06 (5.86-8.68) | 8.17 (6.62-10.3) | 9.37 (7.38-12.1) | 11.1 (8.39-15.0) | 12.5 (9.14-17.5) |
| 3-day | 2.10 (1.87-2.42) | 2.95 (2.61-3.40) | [illegible].11 (3.[illegible]3-4.75) | 5.11 ([illegible]4.48-5.96) | 6.55 (5.55-7.89) | 7.73 (6.41-9.50) | 8.99 (7.28-11.3) | 10.4 (8.16-13.4) | 12.3 (9.32-16.6) | 14.0 (10.2-19.5) |
| 4-day | 2.27 (2.01-2.61) | 3.18 (2.82-3.67) | 4.[illegible]5 ([illegible]93-5.[illegible]) | 5.54 (4.85-6.45) | 7.12 (6.03-8.57) | 8.41 (6.98-10.3) | 9.80 (7.94-12.3) | 11.3 (8.91-14.6) | 13.5 (10.2-18.2) | 15.3 (11.2-21.4) |
| 7-day | 2.55 (2.26-2.93) | 3.5[illegible] (3.16-4.1[illegible]) | [illegible]8 (4.40-5.76) | 6.20 (5.43-7.23) | 7.97 (6.75-9.60) | 9.41 (7.81-11.6) | 11.0 (8.88-13.8) | 12.7 (9.97-16.4) | 15.1 (11.4-20.4) | 17.1 (12.5-23.9) |
| 10-day | 2.72 (2.41-3.13) | 3.81 (3.37-4.39) | 5.31 (4.69-6.14) | 6.61 (5.79-7.70) | 8.48 (7.19-10.2) | 10.0 (8.32-12.3) | 11.7 (9.45-14.7) | 13.5 (10.6-17.4) | 16.1 (12.2-21.7) | 18.2 (13.3-25.5) |
| 20-day | 3.24 (2.87-3.73) | 4.54 (4.02-5.24) | 6.34 (5.60-7.33) | 7.90 (6.92-9.20) | 10.1 (8.59-12.2) | 12.0 (9.95-14.7) | 14.0 (11.3-17.6) | 16.1 (12.7-20.9) | 19.3 (14.6-26.1) | 21.9 (16.0-30.6) |
| 30-day | 3.82 (3.39-4.40) | 5.33 (4.72-6.15) | 7.43 (6.56-8.58) | 9.24 (8.09-10.8) | 11.9 (10.0-14.3) | 14.0 (11.6-17.2) | 16.3 (13.2-20.6) | 18.9 (14.9-24.5) | 22.6 (17.1-30.5) | 25.8 (18.8-36.0) |
| 45-day | 4.56 (4.04-5.25) | 6.30 (5.57-7.26) | 8.70 (7.68-10.1) | 10.8 (9.44-12.6) | 13.8 (11.7-16.6) | 16.3 (13.5-20.0) | 19.0 (15.4-23.9) | 22.0 (17.3-28.5) | 26.4 (19.9-35.6) | 30.1 (22.0-42.0) |
| 60-day | 5.23 (4.64-6.02) | 7.10 (6.28-8.18) | 9.70 (8.56-11.2) | 11.9 (10.5-13.9) | 15.2 (12.9-18.3) | 17.9 (14.9-22.1) | 20.9 (16.9-26.3) | 24.2 (19.0-31.3) | 29.0 (21.9-39.2) | 33.1 (24.2-46.3) |

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

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

Please refer to NOAA Atlas 14 document for more information.

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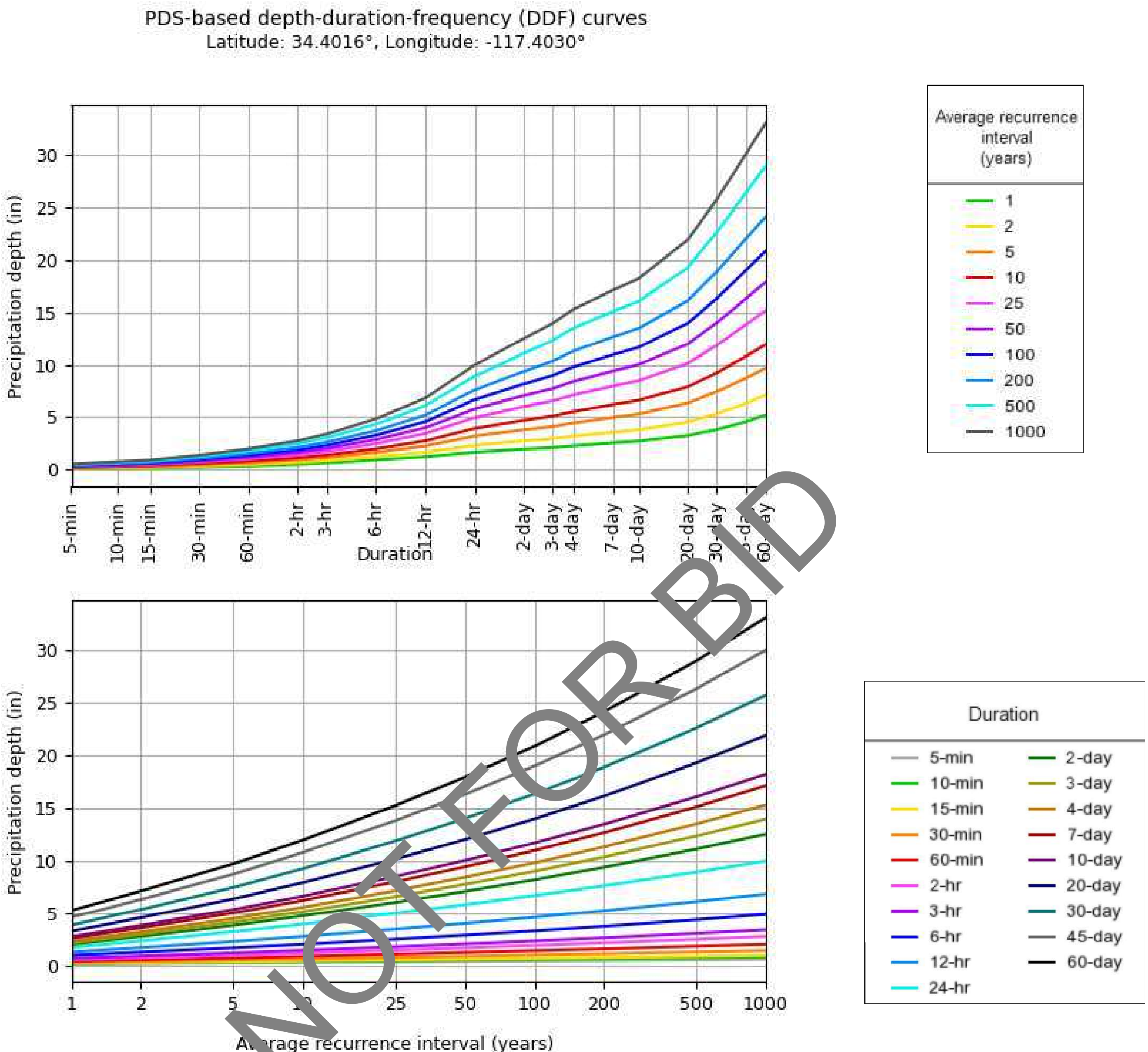
## PF graphical



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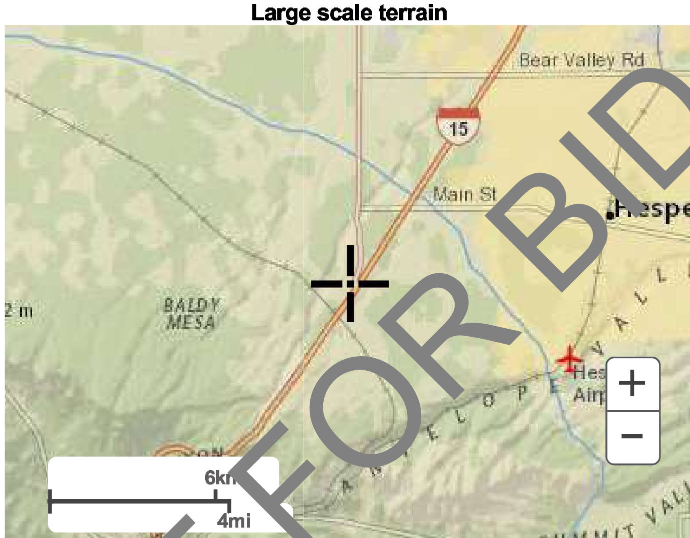
## Maps & aerials

**Small scale terrain**


Large scale terrain




Large scale map


Large scale aerial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# *APPENDIX F-PRECISE GRADING PLAN*