Appendix

# Appendix G Hydrology Report

# Appendix

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# Christ's Church of the Valley

## New Auditorium Building

7576 Etiwanda Avenue
Etiwanda, CA

# Hydrology Report

January 2018

**Revised: March 2019**

*Prepared For*
Christ's Church of the Valley (CCV)
7576 Etiwanda Avenue
Etiwanda, CA 91739

*Submitted by*
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**Prepared under the supervision of:**

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|---|---|
| | **3/11/19** |
| Jefferey D. Meiter | Date |
| RCE No. 64696 | |
| Exp: 06/30/20 | |

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SECTIONS

## 1.0 INTRODUCTION

The Christ's Church of the Valley re-development project is located at the northeast corner of Victoria Park Lane and Long Meadow Drive in the City of Rancho Cucamonga. The size of the property is approximately 9.92 acres, consisting of a developed portion located on the easterly half of the property and an undeveloped land located on the westerly half of the property.

The proposed re-development includes the addition of a new auditorium building, new children's wing and additional parking stalls to accommodate the additional buildings on this property. The stormwater for the developed site will be mitigated by using gutters to concentrate the flow and drop inlets to capture and move effluent into the underground storm chambers and 6" above ground infiltration basins. These chambers will be sized to capture and retain a 100-year storm event for the re-developed area. Landscaping will be designed along the property and right-of-way lines to ensure a buffer for the stormwater. These landscaping buffers will be graded to slope away from the property lines to ensure that the stormwater for this property will be captured and treated on-site. There is an overflow outlet pipe connected to an existing storm drain pipe that exits the property in Long Meadow Drive to the public storm drain system.

## 2.0 PURPOSE

The purpose of the study is to quantify the 100-year peak storm flow rates for the existing and proposed site condition. In this study, we will also demonstrate that the proposed on-site drainage basin is adequately sized to contain the additional runoff generated in the post developed condition for the 100-year storm.

The proposed drainage basin was designed to comply with the City of Rancho Cucamonga criteria stating that post-development flows shall not exceed 80% of pre-development flows. The 100-year storm was used for the on-site basin design.

Existing and proposed condition rational method calculations for the 100-year storm events are presented in this report in Section C.

## 3.0 METHODOLOGY

The analysis will be performed in accordance with the San Bernardino County Hydrology Manual. CivilDesign software by Bonadiman was used to perform rational method and hydrograph basin routing computation. The 100-year intensity and Antecedent Moisture Condition (AMC) III was used to simulate the developed hydrology condition.

## 4.0 SITE DESCRIPTION

A preliminary soil examination was conducted using the online resource WebSoilSuvery. This resource shows that the project site location is characterized as having high infiltration rates that can range from 5.95 to 19.98 in/hr. The site contains type A soils (TuB and TvC), which are described as Tujunga Loamy Sand and Tujunga Gravely Loamy Sand, respectively. Saturated hydraulic conductivity (*Ksat*) refers to the ease with which pores in saturated soil transmit water. Site soil type A has high to very high capacity of the most limiting layer to transmit water.

### Existing Drainage Condition

Existing runoff at the site is delineated into two subareas. Subarea A1 is located on the easterly portion of the re-developed area. This portion is mostly hardscape and will flow from the northeast to the southwest. Subarea A1 discharges to a low point at the southwest corner of the property. Subarea A2 is located on the westerly portion of the re-developed area. This undeveloped portion drains from north to south and is collected in an existing storm drain corrugated metal pipe (CMP). The flow from Subarea A1 is also collected in the existing storm drain structure. The collected stormwater is discharged into the city storm drain system in Long Meadow Drive. The existing flow pattern from these subareas are depicted on the existing hydrology map in Section D.

### Proposed Drainage Condition

The re-developed site will be graded to closely mimic the existing drainage patterns. Flow patterns will flow generally from northeast to southwest. The proposed condition will be delineated into two subareas. Subarea A1 will collect the runoff from the easterly majority of the re-developed area. This area will collect runoff from the proposed auditorium, portland cement hardscape (PCC) hardscape, landscaping and asphalt concrete (AC) pavement. This flow will collect in a landscaped island on the east side of the proposed drive approach. Subarea A2 will collect runoff from the westerly majority of the re-developed area. This area will collect runoff from PCC hardscape, landscaping and AC pavement. Runoff from Subarea A2 collect in the previously mentioned landscaping island. Two different curb openings will be used for each Subarea. A drop inlet will be used in the middle of the landscaped island to transport stormwater into proposed underground storage chambers for retention. The proposed flow pattern from these subareas can be seen on the proposed hydrology map in Section D.

## 5.0 RESULTS

The following table summarizes the data and results for the 100-year storm events for the existing and proposed condition. All calculations can be found in Section C of this report.

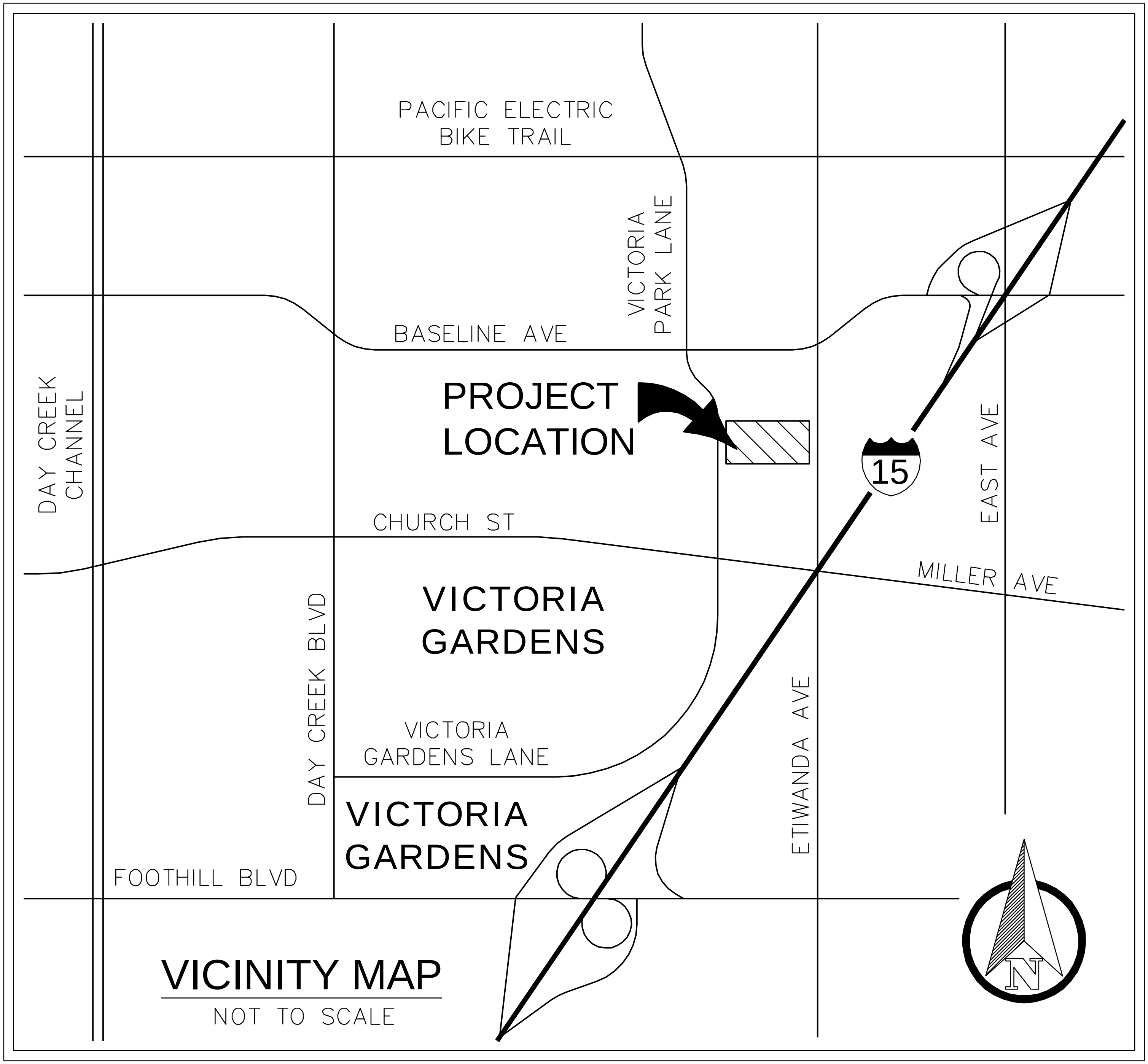
| | 100-YR |
|---|---|
| Pre-Development Site Runoff | 20.193 cfs |
| Post-Development Site Runoff | 20.820 cfs |

The existing 100-year storm pre-development flow for this site is 20.193 cfs. The proposed 100-year storm post-development flow for this site is 20.820 cfs. The proposed site will increase the site discharge by 0.627 cfs. There is one emergency outlet that will be used for excess flows and would prevent stormwater from backing up onto the site. The existing site does not retain any stormwater in the existing condition. Released flows into the city storm drain system will not exceed the 80% flow for a 100-year storm event.

In conclusion, the proposed development will not adversely affect the existing drainage patterns in the area. The proposed on-site storm drain system is designed to reduce the existing runoff by 10%.

# SECTION A
# REFERENCE MATERIALS

VICINITY MAP
POINT PRECIPITATION FREQUENCY ESTIMATES


PACIFIC ELECTRIC
BIKE TRAIL
VICTORIA
PARK LANE
BASELINE AVE
DAY CREEK
CHANNEL
PROJECT
LOCATION
15
EAST AVE
CHURCH ST
MILLER AVE
VICTORIA
GARDENS
DAY CREEK BLVD
VICTORIA
GARDENS LANE
ETIWANDA AVE
VICTORIA
GARDENS
FOOTHILL BLVD
VICINITY MAP
NOT TO SCALE
N

**NOAA Atlas 14, Volume 6, Version 2**
**Location name: Rancho Cucamonga, California, USA***
**Latitude: 34.1167°, Longitude: -117.5272°**
**Elevation: 1270.99 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 | **0.119** (0.099-0.145) | **0.157** (0.130-0.190) | **0.206** (0.171-0.251) | **0.246** (0.202-0.302) | **0.300** (0.239-0.382) | **0.342** (0.266-0.445) | **0.385** (0.292-0.513) | **0.429** (0.316-0.589) | **0.490** (0.346-0.701) | **0.537** (0.365-0.796) |
| 10-min | **0.171** (0.142-0.207) | **0.225** (0.187-0.273) | **0.295** (0.245-0.359) | **0.352** (0.290-0.433) | **0.431** (0.342-0.547) | **0.491** (0.382-0.638) | **0.552** (0.419-0.736) | **0.616** (0.453-0.844) | **0.702** (0.495-1.00) | **0.769** (0.524-1.14) |
| 15-min | **0.207** (0.172-0.251) | **0.272** (0.226-0.330) | **0.357** (0.296-0.435) | **0.426** (0.351-0.523) | **0.521** (0.414-0.662) | **0.594** (0.462-0.771) | **0.668** (0.506-0.890) | **0.744** (0.548-1.02) | **0.849** (0.599-1.22) | **0.930** (0.634-1.38) |
| 30-min | **0.298** (0.248-0.361) | **0.392** (0.326-0.476) | **0.515** (0.427-0.627) | **0.615** (0.506-0.755) | **0.751** (0.597-0.955) | **0.856** (0.666-1.11) | **0.963** (0.730-1.28) | **1.07** (0.791-1.47) | **1.22** (0.864-1.75) | **1.34** (0.914-1.99) |
| 60-min | **0.434** (0.361-0.526) | **0.571** (0.475-0.693) | **0.750** (0.622-0.913) | **0.895** (0.736-1.10) | **1.09** (0.869-1.39) | **1.25** (0.969-1.62) | **1.40** (1.06-1.87) | **1.56** (1.15-2.14) | **1.78** (1.26-2.55) | **1.95** (1.33-2.90) |
| 2-hr | **0.670** (0.558-0.813) | **0.877** (0.729-1.07) | **1.14** (0.946-1.39) | **1.35** (1.11-1.66) | **1.63** (1.30-2.07) | **1.84** (1.43-2.39) | **2.05** (1.55-2.73) | **2.26** (1.67-3.10) | **2.55** (1.80-3.65) | **2.77** (1.88-4.10) |
| 3-hr | **0.868** (0.723-1.05) | **1.13** (0.942-1.38) | **1.47** (1.22-1.79) | **1.73** (1.42-2.12) | **2.08** (1.65-2.64) | **2.33** (1.81-3.03) | **2.59** (1.96-3.45) | **2.85** (2.10-3.90) | **3.18** (2.25-4.56) | **3.44** (2.34-5.10) |
| 6-hr | **1.27** (1.06-1.55) | **1.66** (1.38-2.02) | **2.14** (1.78-2.61) | **2.52** (2.07-3.09) | **3.00** (2.38-3.81) | **3.35** (2.61-4.36) | **3.70** (2.81-4.93) | **4.05** (2.98-5.55) | **4.49** (3.17-6.43) | **4.83** (3.29-7.16) |
| 12-hr | **1.73** (1.44-2.10) | **2.27** (1.89-2.75) | **2.92** (2.42-3.56) | **3.43** (2.82-4.21) | **4.08** (3.24-5.18) | **4.54** (3.53-5.90) | **4.99** (3.79-6.65) | **5.44** (4.00-7.45) | **6.00** (4.23-8.59) | **6.41** (4.37-9.51) |
| 24-hr | **2.35** (2.08-2.71) | **3.11** (2.75-3.59) | **4.04** (3.57-4.68) | **4.76** (4.17-5.55) | **5.67** (4.81-6.84) | **6.33** (5.25-7.79) | **6.97** (5.64-8.78) | **7.58** (5.97-9.82) | **8.37** (6.33-11.3) | **8.94** (6.54-12.5) |
| 2-day | **2.87** (2.54-3.31) | **3.89** (3.44-4.49) | **5.17** (4.56-5.99) | **6.19** (5.41-7.21) | **7.51** (6.36-9.04) | **8.48** (7.04-10.4) | **9.45** (7.65-11.9) | **10.4** (8.20-13.5) | **11.7** (8.82-15.7) | **12.6** (9.21-17.6) |
| 3-day | **3.06** (2.71-3.53) | **4.21** (3.72-4.86) | **5.70** (5.03-6.59) | **6.89** (6.03-8.04) | **8.49** (7.19-10.2) | **9.71** (8.06-11.9) | **10.9** (8.85-13.8) | **12.2** (9.59-15.8) | **13.8** (10.5-18.7) | **15.1** (11.1-21.1) |
| 4-day | **3.32** (2.94-3.83) | **4.62** (4.08-5.33) | **6.31** (5.56-7.30) | **7.68** (6.72-8.96) | **9.55** (8.09-11.5) | **11.0** (9.11-13.5) | **12.4** (10.1-15.7) | **13.9** (11.0-18.1) | **16.0** (12.1-21.5) | **17.6** (12.8-24.5) |
| 7-day | **3.84** (3.40-4.42) | **5.37** (4.75-6.20) | **7.41** (6.53-8.57) | **9.07** (7.94-10.6) | **11.4** (9.62-13.7) | **13.1** (10.9-16.2) | **15.0** (12.1-18.9) | **16.9** (13.3-21.8) | **19.4** (14.7-26.2) | **21.5** (15.7-30.0) |
| 10-day | **4.19** (3.71-4.83) | **5.90** (5.21-6.80) | **8.17** (7.20-9.45) | **10.0** (8.79-11.7) | **12.6** (10.7-15.2) | **14.7** (12.2-18.0) | **16.7** (13.6-21.1) | **18.9** (14.9-24.5) | **21.9** (16.6-29.6) | **24.3** (17.8-33.9) |
| 20-day | **4.83** (4.28-5.57) | **6.91** (6.11-7.97) | **9.71** (8.56-11.2) | **12.1** (10.6-14.1) | **15.4** (13.0-18.5) | **18.0** (14.9-22.1) | **20.7** (16.8-26.1) | **23.6** (18.6-30.5) | **27.6** (20.9-37.2) | **30.8** (22.6-43.0) |
| 30-day | **5.72** (5.06-6.59) | **8.20** (7.26-9.47) | **11.6** (10.2-13.4) | **14.5** (12.7-16.9) | **18.5** (15.7-22.3) | **21.8** (18.1-26.8) | **25.2** (20.4-31.8) | **28.9** (22.8-37.4) | **34.1** (25.8-46.0) | **38.3** (28.0-53.4) |
| 45-day | **6.79** (6.01-7.83) | **9.72** (8.59-11.2) | **13.8** (12.1-15.9) | **17.2** (15.0-20.1) | **22.1** (18.7-26.7) | **26.1** (21.7-32.1) | **30.4** (24.6-38.3) | **34.9** (27.5-45.2) | **41.5** (31.4-55.9) | **46.8** (34.2-65.3) |
| 60-day | **7.90** (7.00-9.11) | **11.2** (9.90-12.9) | **15.8** (13.9-18.3) | **19.7** (17.3-23.0) | **25.4** (21.5-30.6) | **30.1** (24.9-37.0) | **35.0** (28.4-44.2) | **40.4** (31.9-52.4) | **48.2** (36.5-65.0) | **54.6** (39.9-76.2) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

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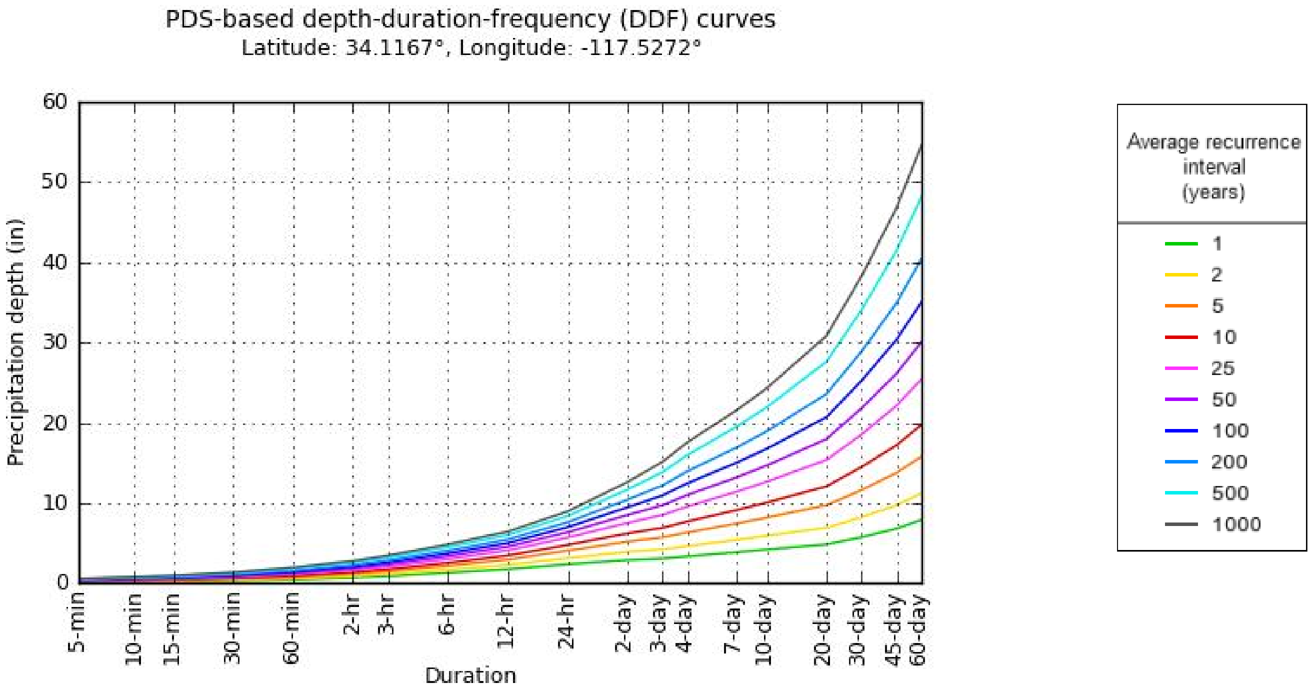
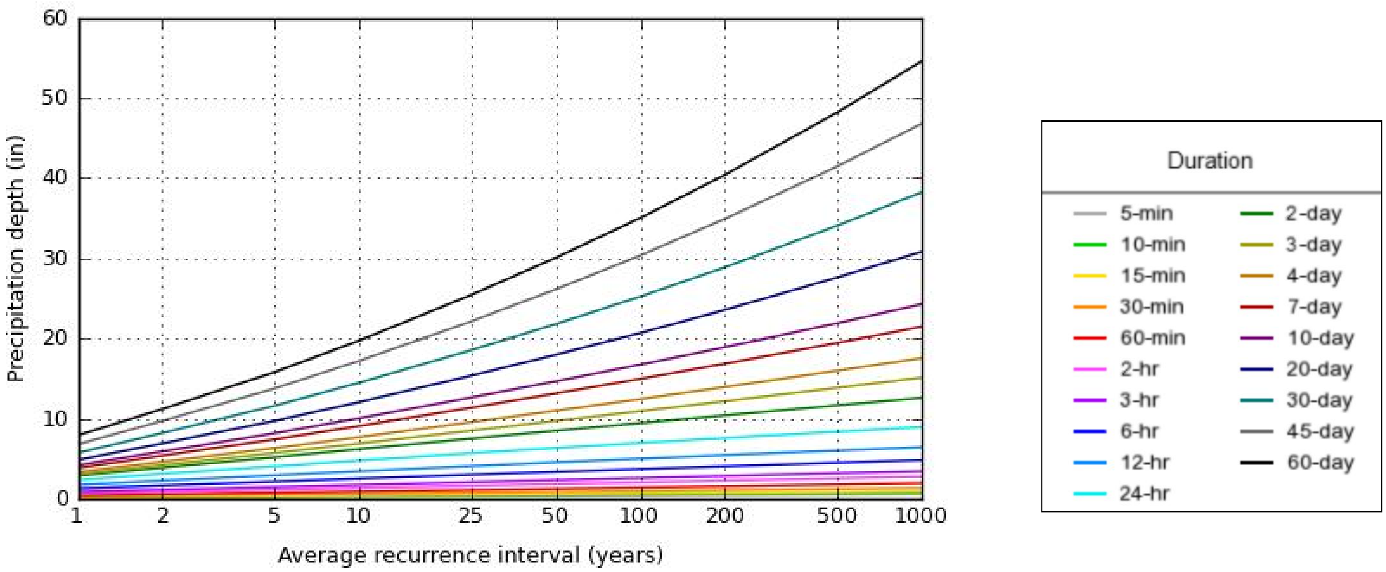
## PF graphical




NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Tue Dec 26 19:06:18 2017

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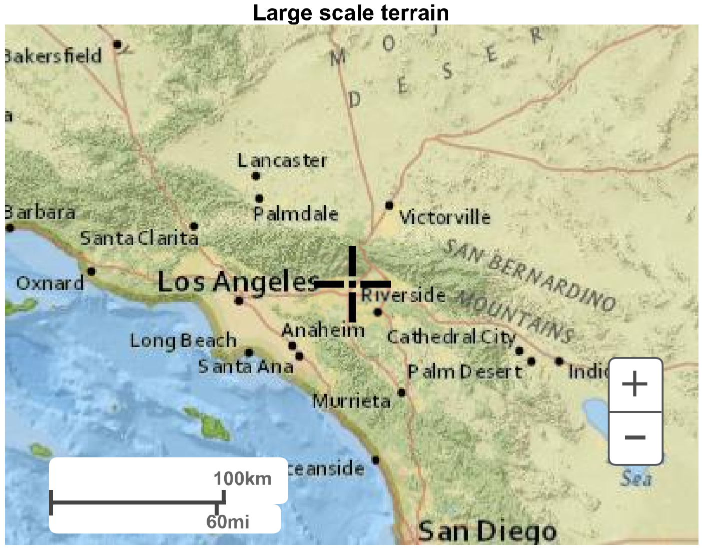
## Maps & aerials

**Small scale terrain**


Large scale terrain




Large scale map


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

Disclaimer

# SECTION B

## SOILS 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 San Bernardino County Southwestern Part, California


December 27, 2017

# 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.

# Soil Map


117° 31' 41" W
117° 31' 33" W
451290
451310
451330
451350
451370
451390
451410
451430
451450
451470
34° 7' 2" N
34° 6' 58" N
3775280
3775260
3775240
3775220
3775200
3775180
3775160
TuB
TvC
TuB
Long Meadow Dr
Soil Map may not be valid at this scale.
Map Scale: 1:896 if printed on A landscape (11" x 8.5") sheet.
Meters
0
10
20
40
60
Feet
0
40
80
160
240
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

**Special Point Features**

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 9, Sep 11, 2017

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

Date(s) aerial images were photographed: Jan 5, 2015—Jan 18, 2015

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 |
|---|---|---|---|
| TuB | Tujunga loamy sand, 0 to 5 percent slopes | 1.6 | 39.2% |
| TvC | Tujunga gravelly loamy sand, 0 to 9 percent slopes | 2.4 | 60.8% |
| **Totals for Area of Interest** | | **4.0** | **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 Southwestern Part, California

## TuB—Tujunga loamy sand, 0 to 5 percent slopes

### Map Unit Setting

*National map unit symbol:* 2sx6y
*Elevation:* 650 to 3,110 feet
*Mean annual precipitation:* 10 to 25 inches
*Mean annual air temperature:* 62 to 65 degrees F
*Frost-free period:* 325 to 365 days
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

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

### Description of Tujunga, Loamy Sand

#### Setting

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

#### Typical profile

*A - 0 to 6 inches:* loamy sand
*C1 - 6 to 18 inches:* loamy sand
*C2 - 18 to 60 inches:* loamy sand

#### Properties and qualities

*Slope:* 0 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Somewhat excessively drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* Rare
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 4.2 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* A
*Hydric soil rating:* No

### Minor Components

#### Tujunga, gravelly loamy sand

*Percent of map unit:* 10 percent
*Landform:* Alluvial fans
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear

*Across-slope shape:* Linear
*Hydric soil rating:* No

**Hanford, sandy loam**

*Percent of map unit:* 5 percent
*Landform:* Alluvial fans
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Hydric soil rating:* No

## TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes

**Map Unit Setting**

*National map unit symbol:* hcl2
*Elevation:* 10 to 1,500 feet
*Mean annual precipitation:* 10 to 25 inches
*Mean annual air temperature:* 59 to 64 degrees F
*Frost-free period:* 250 to 350 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

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

**Description of Tujunga**

**Setting**

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

**Typical profile**

*H1 - 0 to 36 inches:* gravelly loamy sand
*H2 - 36 to 60 inches:* gravelly sand

**Properties and qualities**

*Slope:* 0 to 9 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Somewhat excessively drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* Rare
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 3.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 4s
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* A
*Hydric soil rating:* No

## Minor Components

### Unnamed

*Percent of map unit:* 5 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

### Soboba, gravelly loamy sand

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

### Delhi, fine sand

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

# Soil Information for All Uses

## Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

## Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

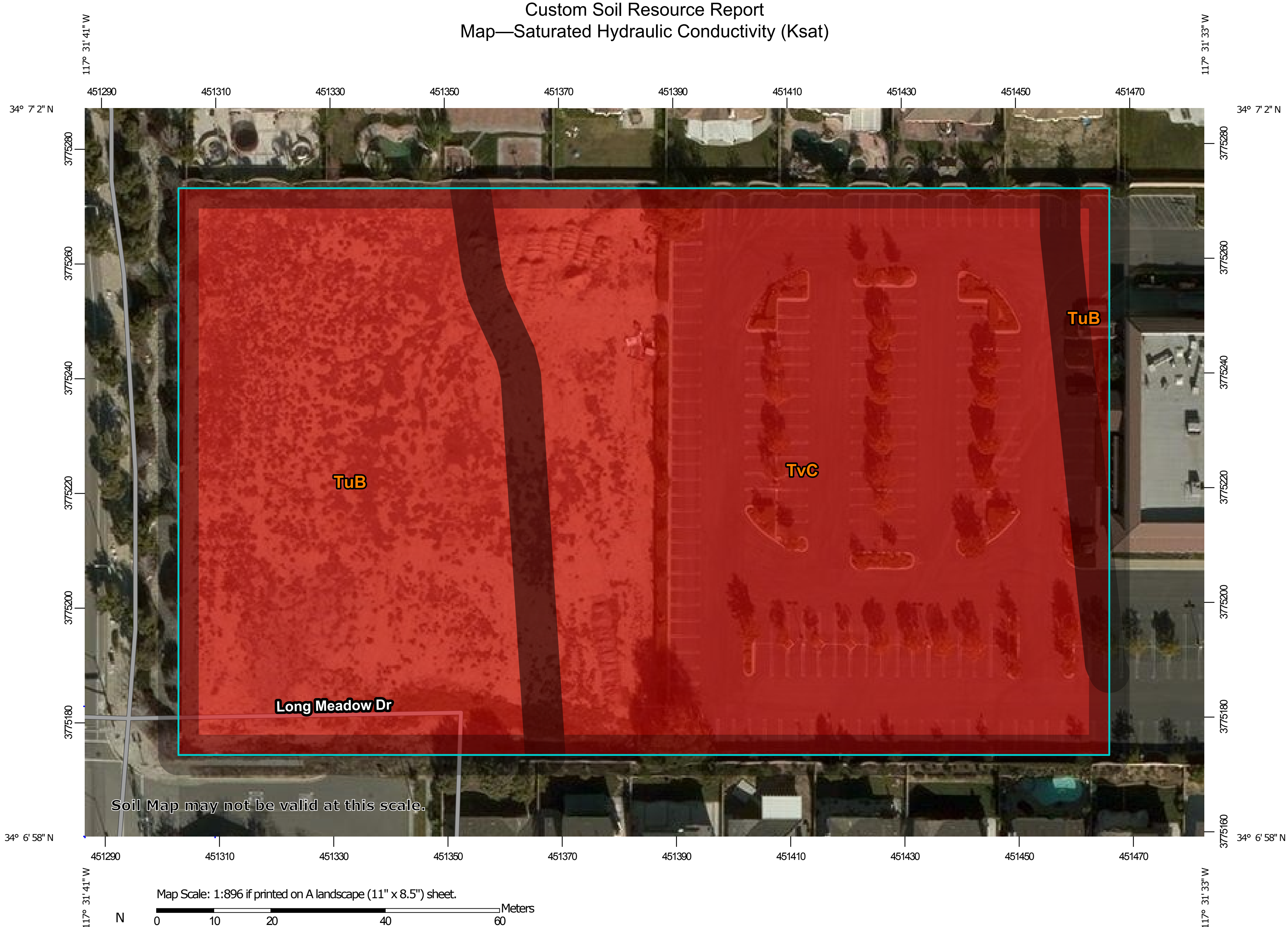
### Saturated Hydraulic Conductivity (Ksat)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

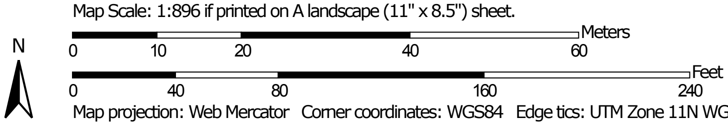
For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

# Map—Saturated Hydraulic Conductivity (Ksat)




Map Scale: 1:896 if printed on A landscape (11" x 8.5") sheet.




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

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

= 92.0000

Not rated or not available

**Soil Rating Lines**

= 92.0000

Not rated or not available

**Soil Rating Points**

= 92.0000

Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

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

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

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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 Southwestern Part, California
Survey Area Data: Version 9, Sep 11, 2017

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

Date(s) aerial images were photographed: Jan 5, 2015—Jan 18, 2015

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. |

## Table—Saturated Hydraulic Conductivity (Ksat)

| Map unit symbol | Map unit name | Rating (micrometers per second) | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| TuB | Tujunga loamy sand, 0 to 5 percent slopes | 92.0000 | 1.6 | 39.2% |
| TvC | Tujunga gravelly loamy sand, 0 to 9 percent slopes | 92.0000 | 2.4 | 60.8% |
| **Totals for Area of Interest** | | | **4.0** | **100.0%** |

## Rating Options—Saturated Hydraulic Conductivity (Ksat)

*Units of Measure:* micrometers per second

*Aggregation Method:* Dominant Component

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Fastest

*Interpret Nulls as Zero:* No

*Layer Options (Horizon Aggregation Method):* All Layers (Weighted Average)

# Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

## Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

### Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Depth* to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

*Sand* as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

*Silt* as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

*Clay* as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

*Moist bulk density* is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

*Saturated hydraulic conductivity (Ksat)* refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

*Available water capacity* refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

*Linear extensibility* refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

*Erosion factors* are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor Kw* indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

*Erosion factor Kf* indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

*Erosion factor T* is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

*Wind erodibility index* is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

| Physical Soil Properties–San Bernardino County Southwestern Part, California | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map symbol and soil name** | **Depth** | **Sand** | **Silt** | **Clay** | **Moist bulk density** | **Saturated hydraulic conductivity** | **Available water capacity** | **Linear extensibility** | **Organic matter** | **Erosion factors** | | | **Wind erodibility group** | **Wind erodibility index** |
| | | | | | | | | | | **Kw** | **Kf** | **T** | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| TuB—Tujunga loamy sand, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Tujunga, loamy sand | 0-6 | -81- | -17- | 0- 3- 5 | 1.45-1.53-1.60 | 42.00-92.00-141.00 | 0.07-0.08-0.09 | 0.0- 1.5- 2.9 | 0.5- 0.8-1.0 | .15 | .15 | 5 | 2 | 134 |
| | 6-18 | -81- | -17- | 0- 3- 5 | 1.45-1.53-1.60 | 42.00-92.00-141.00 | 0.06-0.07-0.09 | 0.0- 1.5- 2.9 | 0.0- 0.3-0.5 | .15 | .15 | | | |
| | 18-60 | -81- | -17- | 0- 3- 5 | 1.45-1.53-1.60 | 42.00-92.00-141.00 | 0.06-0.07-0.09 | 0.0- 1.5- 2.9 | 0.0- 0.3-0.5 | .15 | .15 | | | |
| Tujunga, gravelly loamy sand | 0-36 | -81- | -17- | 0- 3- 5 | 1.45-1.53-1.60 | 42.00-92.00-141.00 | 0.05-0.06-0.07 | 0.0- 1.5- 2.9 | 0.5- 0.8-1.0 | .10 | .15 | 5 | 2 | 134 |
| | 36-60 | -96- | - 2- | 0- 3- 5 | 1.45-1.53-1.60 | 42.00-92.00-141.00 | 0.04-0.05-0.07 | 0.0- 1.5- 2.9 | 0.0- 0.3-0.5 | .02 | .02 | | | |
| Hanford, sandy loam | 0-12 | -68- | -20- | 7-13- 18 | 1.35-1.43-1.50 | 14.00-28.00-42.00 | 0.12-0.13-0.14 | 0.0- 1.5- 2.9 | 0.5- 0.8-1.0 | .24 | .24 | 5 | 3 | 86 |
| | 12-60 | -71- | -17- | 7-13- 18 | 1.35-1.43-1.50 | 14.00-28.00-42.00 | 0.15-0.16-0.17 | 0.0- 1.5- 2.9 | 0.5- 0.8-1.0 | .24 | .24 | | | |

| Physical Soil Properties–San Bernardino County Southwestern Part, California | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map symbol and soil name | Depth | Sand | Silt | Clay | Moist bulk density | Saturated hydraulic conductivity | Available water capacity | Linear extensibility | Organic matter | Erosion factors | | | Wind erodibility group | Wind erodibility index |
| | | | | | | | | | | Kw | Kf | T | | |
| | *In* | *Pct* | *Pct* | *Pct* | *g/cc* | *micro m/sec* | *In/In* | *Pct* | *Pct* | | | | | |
| TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes | | | | | | | | | | | | | | |
| Tujunga | 0-36 | -81- | -17- | 0- 3- 5 | 1.45-1.53-1.60 | 42.00-92.00-141.00 | 0.05-0.06-0.07 | 0.0- 1.5- 2.9 | 0.5- 0.8-1.0 | .10 | .15 | 5 | 2 | 134 |
| | 36-60 | -96- | - 2- | 0- 3- 5 | 1.45-1.53-1.60 | 42.00-92.00-141.00 | 0.06-0.07-0.07 | 0.0- 1.5- 2.9 | 0.0- 0.3-0.5 | .02 | .02 | | | |
| Delhi, fine sand | — | — | — | — | — | — | — | — | — | | | | | |
| Soboba, gravelly loamy sand | — | — | — | — | — | — | — | — | — | | | | | |
| Unnamed | — | — | — | — | — | — | — | — | — | | | | | |

## Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

*Hydrologic soil group* is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

*Group A.* Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

*Group B.* Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

*Group C.* Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

*Group D.* Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

*Depth* to the upper and lower boundaries of each layer is indicated.

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

*Classification* of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

*Percentage of rock fragments* larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

*Percentage (of soil particles) passing designated sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

*Liquid limit* and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

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.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

| Engineering Properties–San Bernardino County Southwestern Part, California | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Map unit symbol and soil name** | **Pct. of map unit** | **Hydrologic group** | **Depth** | **USDA texture** | **Classification** | | **Pct Fragments** | | **Percentage passing sieve number—** | | | | **Liquid limit** | **Plasticity index** |
| | | | | | **Unified** | **AASHTO** | **>10 inches** | **3-10 inches** | **4** | **10** | **40** | **200** | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| TuB—Tujunga loamy sand, 0 to 5 percent slopes | | | | | | | | | | | | | | |
| Tujunga, loamy sand | 85 | A | 0-6 | Loamy sand | SM | A-2-4 | 0- 0- 0 | 0- 3- 4 | 100-100-100 | 61-91-100 | 46-71-81 | 16-26-31 | 0-0 -20 | NP-0 -2 |
| | | | 6-18 | Loamy sand, coarse sand, loamy coarse sand | SM | A-2-4 | 0- 0- 0 | 0- 3- 4 | 91-95-100 | 69-84-100 | 52-65-81 | 18-24-31 | 0-0 -0 | NP |
| | | | 18-60 | Loamy sand, coarse sand, loamy coarse sand | SM | A-2-4 | 0- 0- 0 | 0- 3- 4 | 91-95-100 | 69-84-100 | 52-65-81 | 18-24-31 | 0-0 -0 | NP |
| Tujunga, gravelly loamy sand | 10 | A | 0-36 | Gravelly loamy sand | SM | A-2-4, A-2, A-1 | 0- 0- 0 | 0- 2- 4 | 75-79-82 | 55-68-82 | 42-53-66 | 14-19-25 | 0-0 -0 | NP |
| | | | 36-60 | Fine gravelly sand, fine gravelly loamy sand | SP-SM | A-3 | 0- 0- 0 | 0- 3- 4 | 100-100-100 | 61-79-100 | 45-61-79 | 3- 6- 11 | 0-0 -0 | NP |
| Hanford, sandy loam | 5 | A | 0-12 | Sandy loam | SM | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 89-95-100 | 63-72-82 | 29-36-44 | 0-0 -0 | NP |
| | | | 12-60 | Fine sandy loam, sandy loam, coarse sandy loam | SM | A-4 | 0- 0- 0 | 0- 0- 0 | 100-100-100 | 89-95-100 | 78-88-98 | 30-37-44 | 0-0 -0 | NP |

| Engineering Properties–San Bernardino County Southwestern Part, California | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map unit symbol and soil name | Pct. of map unit | Hydrologic group | Depth | USDA texture | Classification | | Pct Fragments | | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
| | | | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | | | *In* | | | | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* | *L-R-H* |
| TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes | | | | | | | | | | | | | | |
| Tujunga | 85 | A | 0-36 | Gravelly loamy sand | SM, SP-SM | A-1, A-2 | 0- 0- 0 | 0- 3- 5 | 70-75-80 | 55-65-75 | 40-50-60 | 10-15-20 | 0-0 -0 | NP |
| | | | 36-60 | Gravelly sand, gravelly loamy sand | SP-SM | A-1 | 0- 0- 0 | 0- 3- 5 | 100-100-100 | 55-78-100 | 25-38-50 | 5- 8- 10 | 0-0 -0 | NP |

# Water Features

This folder contains tabular reports that present soil hydrology information. The reports (tables) include all selected map units and components for each map unit. Water Features include ponding frequency, flooding frequency, and depth to water table.

## Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

*Surface runoff* refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

### Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

| Hydrologic Soil Group and Surface Runoff–San Bernardino County Southwestern Part, California | | | |
|---|---|---|---|
| **Map symbol and soil name** | **Pct. of map unit** | **Surface Runoff** | **Hydrologic Soil Group** |
| | | | |
| TuB—Tujunga loamy sand, 0 to 5 percent slopes | | | |
| Tujunga, loamy sand | 85 | Very low | A |
| Tujunga, gravelly loamy sand | 10 | Very low | A |
| Hanford, sandy loam | 5 | Very low | A |
| TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes | | | |
| Tujunga | 85 | Very low | A |
| Delhi, fine sand | 5 | — | — |
| Soboba, gravelly loamy sand | 5 | — | — |
| Unnamed | 5 | — | — |

# 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

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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

# SECTION C

## RATIONAL METHOD – Q100

PRE-DEVELOPED CONDITION
POST-DEVELOPED CONDITION

```
              San Bernardino County Rational Hydrology Program

                   (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
        Rational Hydrology Study        Date: 06/04/18
------------------------------------------------------------------------
VALUED ENGINEERING, INC
CCV EXPANSION
PRE-DEVELOPED
100-YEAR STORM
------------------------------------------------------------------------


Program License Serial Number 6335

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.895(In.)
  100 Year storm 1 hour rainfall  =      1.400(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.400 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       1.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   655.000(Ft.)
Top (of initial area) elevation =  1272.500(Ft.)
Bottom (of initial area) elevation =  1263.500(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01374  s(%)=      1.37
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.589 min.
Rainfall intensity =      4.207(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =     13.179(CFS)
Total initial stream area =       3.547(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.200
**** SUBAREA FLOW ADDITION ****
```

```
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
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Time of concentration =     9.59 min.
Rainfall intensity =      4.207(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.847
Subarea runoff =      7.014(CFS) for    2.121(Ac.)
Total runoff =     20.193(CFS)
Effective area this stream =        5.67(Ac.)
Total Study Area (Main Stream No. 1) =        5.67(Ac.)
Area averaged Fm value =    0.248(In/Hr)
End of computations, Total Study Area =            5.67 (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) = 0.437
Area averaged SCS curve number =  38.7
```

621701PR

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

```
 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
        Rational Hydrology Study        Date: 06/04/18
------------------------------------------------------------------------
VALUED ENGINEERING, INC
CCV EXPANSION
POST-DEVELOPED
100-YEAR STORM
------------------------------------------------------------------------


Program License Serial Number 6335

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.895(In.)
  100 Year storm 1 hour rainfall  =      1.400(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.400 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       1.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   688.000(Ft.)
Top (of initial area) elevation =  1270.000(Ft.)
Bottom (of initial area) elevation =  1260.500(Ft.)
Difference in elevation =     9.500(Ft.)
Slope =    0.01381  s(%)=      1.38
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.770 min.
Rainfall intensity =      4.160(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =     11.740(CFS)
Total initial stream area =       3.196(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       2.100
**** SUBAREA FLOW ADDITION ****
```

```
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     9.77 min.
Rainfall intensity =      4.160(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.883
Subarea runoff =      9.080(CFS) for    2.472(Ac.)
Total runoff =     20.820(CFS)
Effective area this stream =        5.67(Ac.)
Total Study Area (Main Stream No. 1) =        5.67(Ac.)
Area averaged Fm value =    0.079(In/Hr)
End of computations, Total Study Area =            5.67 (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
```

# SECTION D

## HYDROLOGY MAP


LEGEND

- BASIN BOUNDARY
- 978.61 (8) DENOTES NODE No. and FG ELEVATION
- FL FLOW LENGTH
- A BASIN AREA
- FLOW PATTERN

| EXISTING HYDROLOGY | | |
|---|---|---|
| SUBAREA | ACRE | $Q_{100}$ |
| A1 | 3.547 | 13.179 |
| A2 | 2.121 | 7.014 |
| TOTAL | 5.668 | 20.193 |

SCALE 1"=40'

0 20' 40' 80'

GRAPHIC SCALE

Underground Service Alert

Call: TOLL FREE

811

TWO WORKING DAYS BEFORE YOU DIG

| REVISION BLOCK | | | |
|---|---|---|---|
| MARK | DESCRIPTION | APPR | DATE |

DESIGNED BY DAVID HWAN

DRAWN BY BILL WALLANDER

CHECKED BY JEFF MEITER

DATE AUGUST 2016

PLANS PREPARED UNDER SUPERVISION OF:

VALUED ENGINEERING, INC

CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
180 N. BENSON AVE, STE A, UPLAND, CA 91786
PHONE: (909) 982-4601

PRELIMINARY PRE-DEVELOPED HYDROLOGY MAP

CHRIST'S CHURCH OF THE VALLEY

7576 ETIWANDA AVENUE

City of Rancho Cucamonga, California

SHEET 1 of 1

CONTRACT

ACCOUNT

DRAWING No.

File: P:\JOBS\621701\ADMIN\REPORTS\HYDRO\HYDRO-PRE.dwg Jun 04, 2018 - 5:29pm WALTON


LEGEND

| | |
|---|---|
| (heavy line) | BASIN BOUNDARY |
| 978.61 (8) | DENOTES NODE No. and FG ELEVATION |
| FL | FLOW LENGTH |
| A | BASIN AREA |
| → · · · → · · · | FLOW PATTERN |

## PROPOSED HYDROLOGY

| SUBAREA | ACRE | $Q_{100}$ |
|---|---|---|
| A1 | 3.196 | 11.740 |
| A2 | 2.472 | 9.080 |
| TOTAL | 5.668 | 20.820 |

SCALE 1"=40'

0 20' 40' 80'

GRAPHIC SCALE

Underground Service Alert

Call: TOLL FREE

811

TWO WORKING DAYS BEFORE YOU DIG

REVISION BLOCK

| MARK | DESCRIPTION | APPR | DATE |
|---|---|---|---|
| | | | |

DESIGNED BY DAVID HWAN

DRAWN BY BILL WALLANDER

CHECKED BY JEFF MEITER

DATE AUGUST 2016

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PHONE: (909) 982-4601

PRELIMINARY POST-DEVELOPED HYDROLOGY MAP

CHRIST'S CHURCH OF THE VALLEY

7576 ETIWANDA AVENUE

City of Rancho Cucamonga, California

SHEET 1 of 1

CONTRACT

ACCOUNT

DRAWING No.

File: P:\JOBS\621701\ADMIN\REPORTS\PHYDRO\HYDRO-POST.dwg Jun 04, 2018 - 5:28pm WALTON