Dos Palmas Development

City of Victorville
San Bernardino County, California

PRELIMINARY HYDROLOGY REPORT

APN # 3096-381-01, 3096-381-09

Prepared For:
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Submittal Date:
May 20, 2021

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INTRODUCTION

The project site is located at the southeast corner of Highway 395 and Dos Palmas Road in City of Victorville, County of San Bernardino. The project APNs are 3096-381-01 and 3096-381-09. Total area of the parcels combined is about 22 acres. However, only a small portion of the site will be developed with remaining area staying vacant. The site is split into 5 lots (Lots A thru E) with two lots slated for development currently. Lot “A” includes the construction of a gas station, car wash and Lot “D” is proposed for a hotel. The gas station/carwash site is about 2.39 acres and the hotel site is about 2.23 acres. Please refer to Appendix A for vicinity map.

OBJECTIVE

The objective of this hydrology study is to evaluate drainage patterns in the pre-developed and post-developed conditions. The determined flow rates will be used for the design of the proposed drainage improvements.

As required by the San Bernardino Hydrology Manual, the proposed storm drain improvements will be designed to convey the runoff generated from the 100-year storm while providing one foot of freeboard from all habitable structures. Natural drainage patterns will be preserved to the maximum extent practical.

Pre- and post-developed condition rational method calculations for the 100-year storm events are presented in this report.

HYDROLOGIC METHODOLOGY

Hydrologic calculations were performed using Civil Design Software, Rational Method Hydrology for San Bernardino County.

Rational Method

The hydrologic calculations to determine the peak flow rates for different storm events were performed using the criteria in the San Bernardino County Hydrology Manual. The Rational Method is an empirical computation procedure for developing a peak runoff rate (discharge) for storms of a specific recurrence interval. Rational Method equations are based on the assumption that the peak flow rate is directly proportional to the drainage area, rainfall intensity, and a loss rate coefficient, which describes the effects of land use and soil type. The Rational Method flow rates were computed by generating a hydrologic "link-node" model, which divides the area into drainage subareas.

Soil Type

The soil type within the project area is Type A as shown on the Web Soil Survey Map and Data Results (See Appendix A).

Group A: Low runoff potential. These soils have a high rate of water transmission.
Group B: Soils having a moderate infiltration rates when thoroughly wetted. These soils have a moderate rate of water transmission.

Group C: Soils having slow infiltration rates when thoroughly wetted. These soils have a slow rate of water transmission.

Group D: High runoff potential. These soils have a very slow rate of water transmission.

Loss Rates

Watershed losses consist of infiltration, depression storage, vegetation, and minor amounts of evaporation. Loss rates vary with each land use and soil type. The procedures and criteria used in this study for estimating loss rates follow the guidelines of the *San Bernardino County Hydrology Manual*.

The Antecedent Moisture Condition (AMC) II was used for the 100-year frequency storm.

AMC indicates the soil wetness prior to a particular storm and the runoff potential for the subject storm. An (AMC) is defined as:

AMC I: Lowest runoff potential
AMC II: Moderate runoff potential
AMC III: Highest runoff potential

Precipitation

Intensity-duration data is required for use with the Rational Method. This data is usually presented in the form of curves of rainfall intensity in inches per hour versus storm duration in minutes. Standard intensity-duration curves are automatically populated with the Hydrology Software which are derived from available recording rain gauge records in and near the District.

PRE-DEVELOPMENT CONDITION

The site is currently undeveloped with a gradual descending slope (one to one and half percent) to the northeast. There are no existing storm drain improvements on site or in the adjoining streets. HSG Type A soils are present at the site which are more conducive to infiltration. Rainfall data is taken from NOAA Atlas 14 website. There is some offsite flow that impact to the site from the south. Pre-development hydrological analysis includes the offsite area. The low point of the site at the northeast corner near the Dos Palmas Dr and Proposed Cantina Dr intersection. The drainage area analysis is about 14.78 acres and in the event of a 100-yr storm, the flow rate at the discharge location is 21.08 cfs with time of concentration of 19.74 minutes.

POST-DEVELOPMENT CONDITION

In the post-developed condition, similar drainage patterns will be maintained that of the pre-development condition. Offsite flows to the project are analyzed similar to the pre-developed condition.

As mentioned earlier, the site is divided into five lots (Lots A thru E) and for preliminary hydrology analysis, five drainage subarea boundaries are delineated. Rational method analysis for each area is used to calculate the flowrates at low points of each drainage sub area. Gas Station/Carwash site (Lot A) and the Hotel Site (Lot D) will have underground infiltration basins proposed to capture the storm water. Lots B/C and Lot E will remain undeveloped but are proposed with detention basins to detain the flow so as to not impact the project and its downstream areas. Commercial land use was used for Lot A and D with impervious area of 90%. Offsite area (DA A1) impact from the south is also mitigated by proposing a detention basin south of project boundary. In the overflow situation, offsite runoff will flow along Cantina Drive towards Dos Palmas Road similar to the pre-development drainage pattern. Lot B/C and Lot E will remain undeveloped and runoff from these areas will be stored in graded detention basins in the northeast corner to mitigate the impacts downstream. Runoff generated from the gas station/carwash and hotel site are conveyed in gutters and drain into catch basin inlets located throughout the site. The runoff then conveyed to underground infiltration chamber system for storage and eventual infiltration into the subsoils. These underground basins are adequately designed to capture the storm volumes from the 85th percentile storm as well to comply with the MS4 permit requirements.

The flowrates from pre-developed and post-developed condition for the 100-yr storm are presented below.

Drainage ID	Drainage Area	Pre-Dev 100-Yr 1-Hr Flow Rate (Q)	Time of Concentration (Tc)	Drainage ID	Drainage Area	Post-Dev 100-Yr 1-Hr Flow Rate (Q)	Time of Concentration (Tc)
A1	2.57 ac	4.87 cfs	13.77 min	A1	5.60 ac	8.42 cfs	18.50 min
A2	12.21 ac	21.08 cfs	19.74 min	A2	1.99 ac	3.99 cfs	12.78 min
				A3	2.23 ac	6.84 cfs	8.82 min
				A4	2.39 ac	7.32 cfs	8.85 min
				A5	1.52 ac	3.53 cfs	10.50 min
				A6	1.05 ac	3.11 cfs	9.32 min
TOTAL	14.78 ac	25.95 cfs		TOTAL	14.78 ac	33.21 cfs	

Although the runoff generated in the 100-storm event in the post-developed condition is increased compared to the pre-developed condition, detention basins and underground infiltration basins are proposed onsite will mitigate the impact downstream of the project.

Post-developed 100-yr flow rate for the hotel site (Drainage Area A3) is 6.84 cfs with a time of concentration of 8.82 cfs. The corresponding volume can be calculated as

Volume (100-yr storm) = 1.5 * Q100 * Tc (minutes)

= 1.5*6.84*8.82*60

= 5,430 cu. ft.

StormTech underground infiltration chamber system proposed has a footprint of 59'x57' footprint and has capacity to store this volume. The basin is also capable of storing the 85th percentile storm volume of 4,794 cubic feet. The volume will drawdown into the sub soil strata within the 48-hour time frame.

Similarly, Post-developed 100-yr flow rate for the gas station/carwash site (Drainage Area A4) is 7.32 cfs with a time of concentration of 8.85 cfs. The corresponding volume can be calculated as

Volume (100-yr storm) = 1.5 * Q100 * Tc (minutes)

= 1.5*7.32*8.85*60

= 5,830 cu. ft.

Similar to the hotel site, StormTech underground infiltration chamber system proposed has a footprint of 59’x37’ footprint and has capacity to store this volume. The basin is also capable of storing the 85th percentile storm volume of 5,473 cubic feet. The volume will drawdown into the sub soil strata within the 48-hour time frame.

The design is conservative as the storage basins designed are capable of storing the 100-yr post-development volume not the difference between the post- and pre-development volumes. Minimum 12-inch pipes will be proposed onsite with storm drain inlets to convey the storm flows to be conservative. Please refer to Appendix B and C for pre-development and post-development hydrology exhibits and rational method calculations respectively.

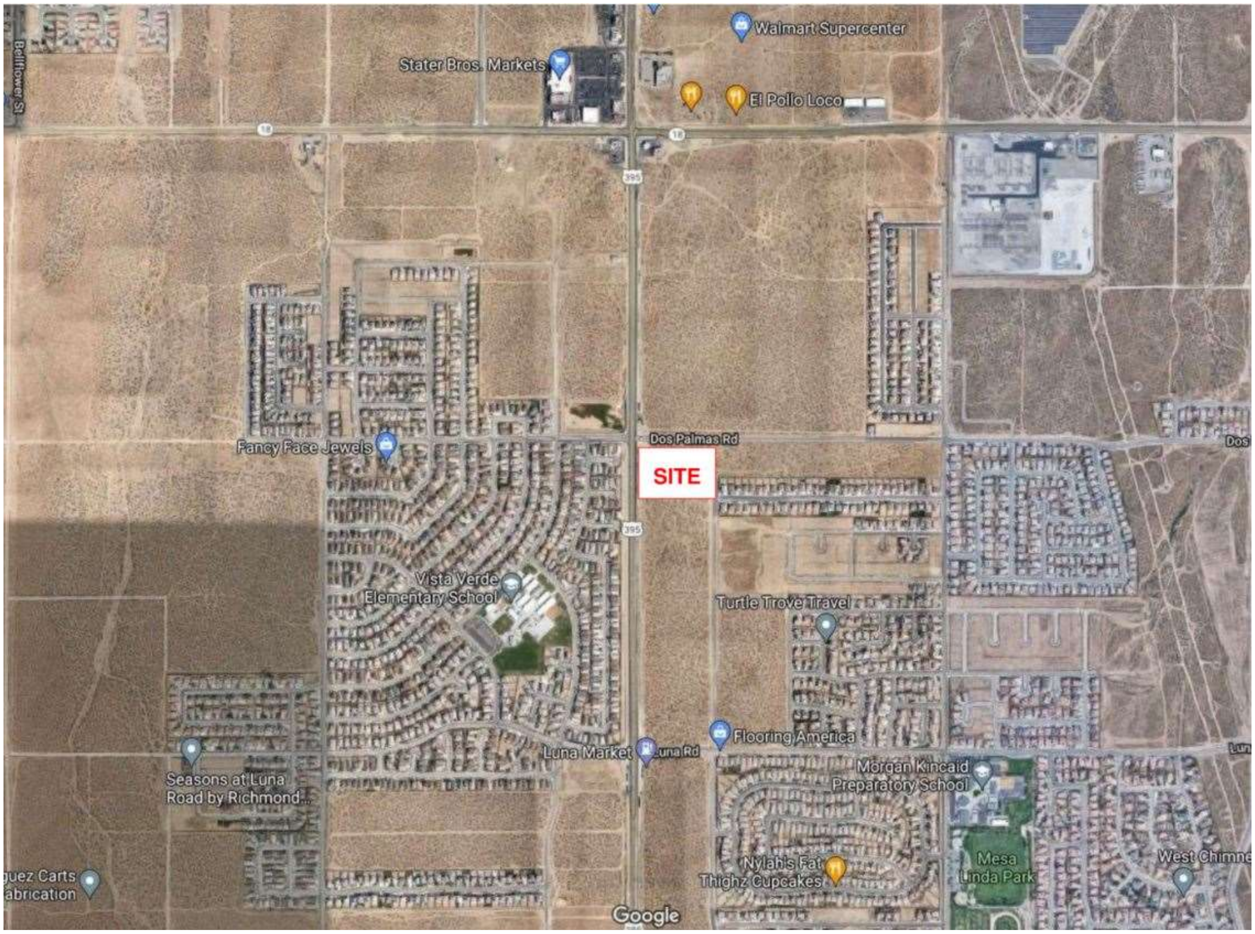
CONCLUSION

All storm drain has been designed in accordance with the San Bernardino County Hydrology Manual. The proposed storm drain improvements have been designed to convey the runoff generated from the 100-year storm while providing one foot of freeboard from all habitable structures. Natural drainage patterns have been preserved to the maximum extent practical. Hydraulic calculations will be presented in the final engineering hydrology and hydraulics report to support the hydrological analysis presented in the report.

APPENDIX A
VICINITY MAP, SOIL AND RAINFALL DATA

VICINITY MAP

NTS



NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.499°, Longitude: -117.3988°
Elevation: 3170.24 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	**0.079** (0.065-0.096)	**0.113** (0.094-0.139)	**0.159** (0.131-0.195)	**0.196** (0.160-0.243)	**0.247** (0.195-0.316)	**0.287** (0.222-0.375)	**0.328** (0.247-0.439)	**0.370** (0.271-0.509)	**0.427** (0.301-0.613)	**0.472** (0.321-0.700)
10-min	**0.113** (0.093-0.138)	**0.162** (0.134-0.199)	**0.228** (0.187-0.279)	**0.281** (0.230-0.348)	**0.355** (0.280-0.453)	**0.411** (0.318-0.537)	**0.470** (0.355-0.629)	**0.530** (0.389-0.729)	**0.612** (0.431-0.878)	**0.676** (0.460-1.00)
15-min	**0.137** (0.113-0.167)	**0.196** (0.162-0.240)	**0.275** (0.227-0.338)	**0.340** (0.278-0.421)	**0.429** (0.339-0.548)	**0.498** (0.385-0.650)	**0.568** (0.429-0.760)	**0.641** (0.470-0.882)	**0.740** (0.521-1.06)	**0.818** (0.556-1.21)
30-min	**0.202** (0.167-0.247)	**0.291** (0.240-0.356)	**0.408** (0.336-0.500)	**0.504** (0.411-0.623)	**0.635** (0.502-0.812)	**0.737** (0.570-0.963)	**0.842** (0.635-1.13)	**0.949** (0.697-1.31)	**1.10** (0.772-1.57)	**1.21** (0.824-1.80)
60-min	**0.267** (0.221-0.326)	**0.383** (0.317-0.469)	**0.537** (0.442-0.660)	**0.664** (0.542-0.821)	**0.837** (0.661-1.07)	**0.971** (0.751-1.27)	**1.11** (0.837-1.48)	**1.25** (0.919-1.72)	**1.45** (1.02-2.07)	**1.60** (1.09-2.37)
2-hr	**0.374** (0.309-0.457)	**0.508** (0.419-0.621)	**0.690** (0.568-0.847)	**0.844** (0.689-1.05)	**1.06** (0.839-1.36)	**1.24** (0.956-1.61)	**1.42** (1.07-1.90)	**1.61** (1.18-2.22)	**1.88** (1.32-2.69)	**2.09** (1.42-3.11)
3-hr	**0.466** (0.385-0.570)	**0.622** (0.514-0.761)	**0.838** (0.690-1.03)	**1.02** (0.835-1.26)	**1.29** (1.02-1.65)	**1.50** (1.16-1.96)	**1.73** (1.30-2.31)	**1.97** (1.45-2.71)	**2.32** (1.63-3.32)	**2.59** (1.76-3.85)
6-hr	**0.635** (0.525-0.777)	**0.841** (0.694-1.03)	**1.13** (0.930-1.39)	**1.38** (1.13-1.71)	**1.75** (1.38-2.23)	**2.05** (1.58-2.67)	**2.37** (1.79-3.17)	**2.72** (2.00-3.75)	**3.23** (2.28-4.63)	**3.65** (2.48-5.42)
12-hr	**0.791** (0.653-0.966)	**1.09** (0.896-1.33)	**1.50** (1.24-1.84)	**1.86** (1.52-2.30)	**2.39** (1.88-3.05)	**2.82** (2.18-3.68)	**3.28** (2.48-4.39)	**3.79** (2.78-5.21)	**4.52** (3.18-6.49)	**5.13** (3.49-7.61)
24-hr	**1.07** (0.951-1.23)	**1.54** (1.36-1.77)	**2.19** (1.93-2.52)	**2.75** (2.40-3.20)	**3.56** (3.02-4.28)	**4.22** (3.51-5.20)	**4.94** (4.00-6.23)	**5.72** (4.51-7.41)	**6.85** (5.18-9.25)	**7.78** (5.68-10.9)
2-day	**1.16** (1.02-1.33)	**1.65** (1.46-1.90)	**2.35** (2.07-2.71)	**2.95** (2.59-3.44)	**3.83** (3.25-4.62)	**4.56** (3.79-5.61)	**5.35** (4.33-6.74)	**6.21** (4.89-8.05)	**7.47** (5.64-10.1)	**8.51** (6.22-11.9)
3-day	**1.23** (1.09-1.42)	**1.75** (1.55-2.02)	**2.49** (2.19-2.87)	**3.13** (2.74-3.64)	**4.06** (3.44-4.89)	**4.83** (4.01-5.94)	**5.67** (4.59-7.14)	**6.59** (5.19-8.53)	**7.93** (5.99-10.7)	**9.05** (6.61-12.6)
4-day	**1.32** (1.17-1.52)	**1.87** (1.66-2.16)	**2.66** (2.35-3.07)	**3.33** (2.92-3.88)	**4.33** (3.67-5.21)	**5.15** (4.27-6.33)	**6.03** (4.89-7.60)	**7.01** (5.52-9.07)	**8.43** (6.37-11.4)	**9.61** (7.02-13.4)
7-day	**1.43** (1.26-1.64)	**2.00** (1.77-2.31)	**2.82** (2.49-3.26)	**3.53** (3.10-4.12)	**4.57** (3.87-5.50)	**5.41** (4.49-6.65)	**6.32** (5.12-7.96)	**7.31** (5.76-9.46)	**8.74** (6.60-11.8)	**9.91** (7.24-13.9)
10-day	**1.52** (1.35-1.75)	**2.13** (1.88-2.45)	**2.99** (2.64-3.45)	**3.73** (3.27-4.35)	**4.81** (4.08-5.79)	**5.69** (4.72-7.00)	**6.64** (5.37-8.36)	**7.66** (6.03-9.92)	**9.13** (6.90-12.3)	**10.3** (7.55-14.4)
20-day	**1.82** (1.61-2.09)	**2.54** (2.25-2.92)	**3.56** (3.15-4.11)	**4.45** (3.90-5.18)	**5.74** (4.86-6.91)	**6.79** (5.63-8.34)	**7.91** (6.41-9.96)	**9.12** (7.18-11.8)	**10.8** (8.19-14.6)	**12.2** (8.93-17.1)
30-day	**2.11** (1.87-2.43)	**2.93** (2.59-3.37)	**4.10** (3.62-4.74)	**5.12** (4.49-5.97)	**6.61** (5.60-7.96)	**7.83** (6.50-9.62)	**9.12** (7.39-11.5)	**10.5** (8.28-13.6)	**12.5** (9.43-16.8)	**14.1** (10.3-19.7)
45-day	**2.47** (2.19-2.84)	**3.40** (3.01-3.91)	**4.72** (4.17-5.46)	**5.89** (5.16-6.86)	**7.61** (6.45-9.16)	**9.02** (7.49-11.1)	**10.5** (8.52-13.2)	**12.1** (9.55-15.7)	**14.4** (10.9-19.4)	**16.2** (11.9-22.7)
60-day	**2.77** (2.45-3.19)	**3.76** (3.33-4.33)	**5.20** (4.59-6.01)	**6.47** (5.67-7.54)	**8.34** (7.07-10.0)	**9.89** (8.21-12.2)	**11.5** (9.35-14.5)	**13.3** (10.5-17.2)	**15.8** (12.0-21.4)	**17.8** (13.0-24.9)

[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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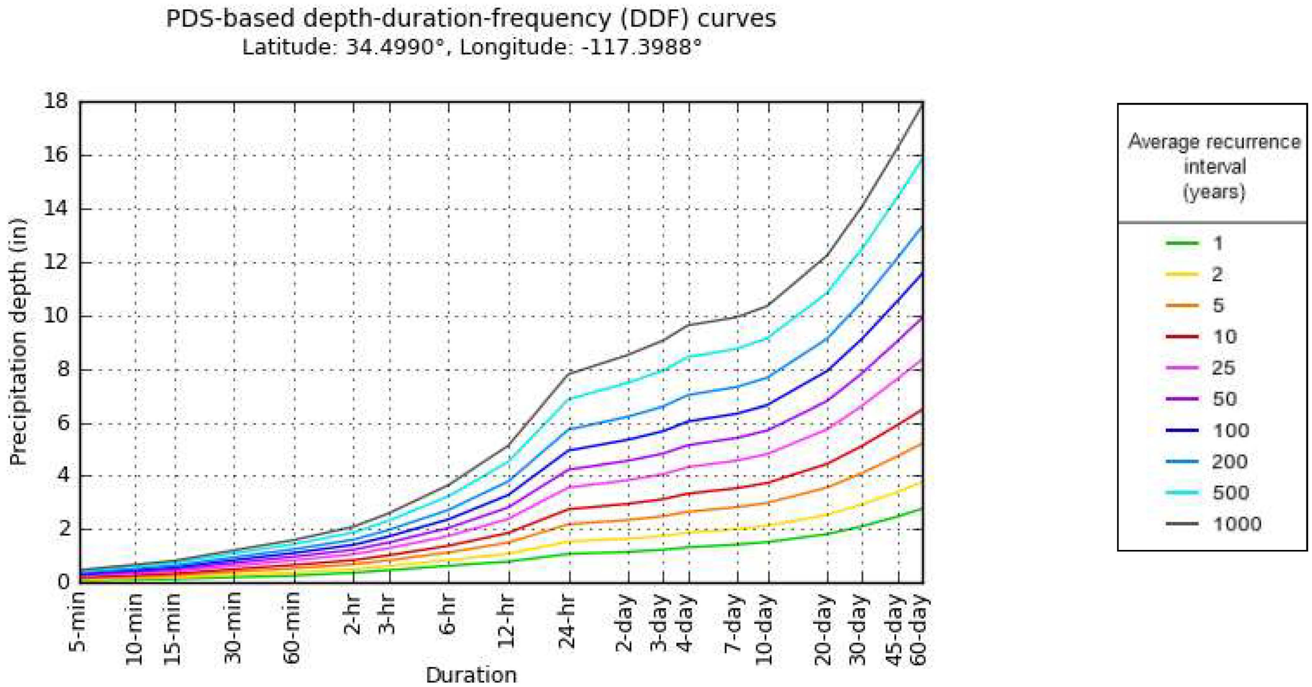
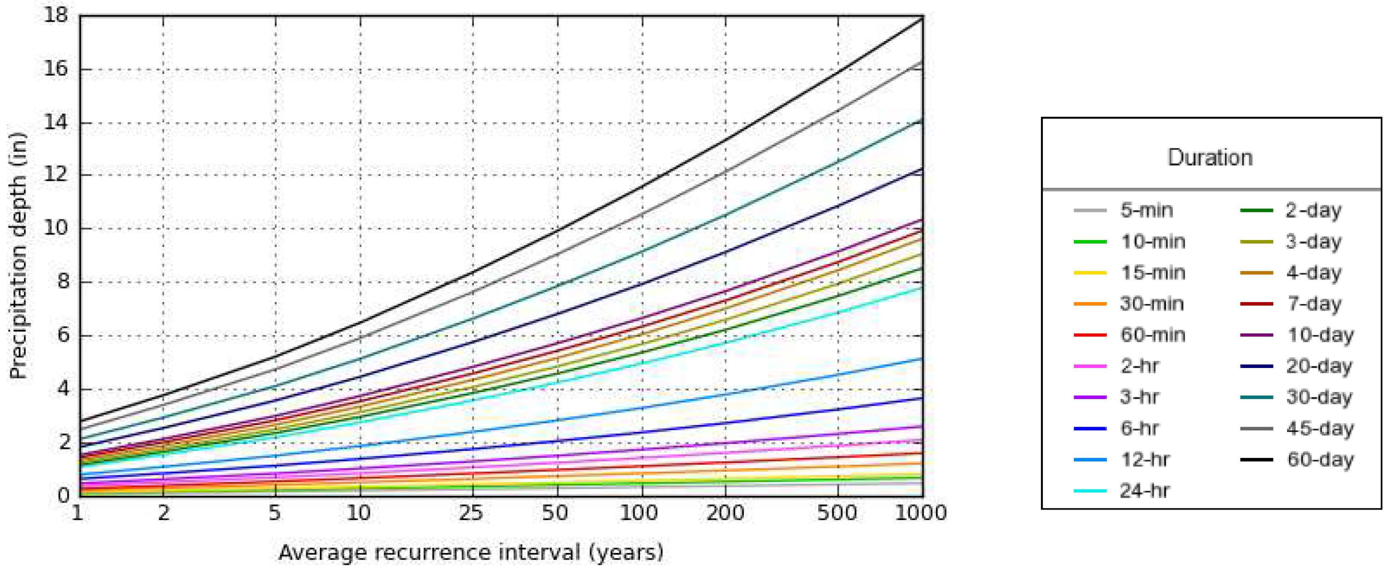
PF graphical





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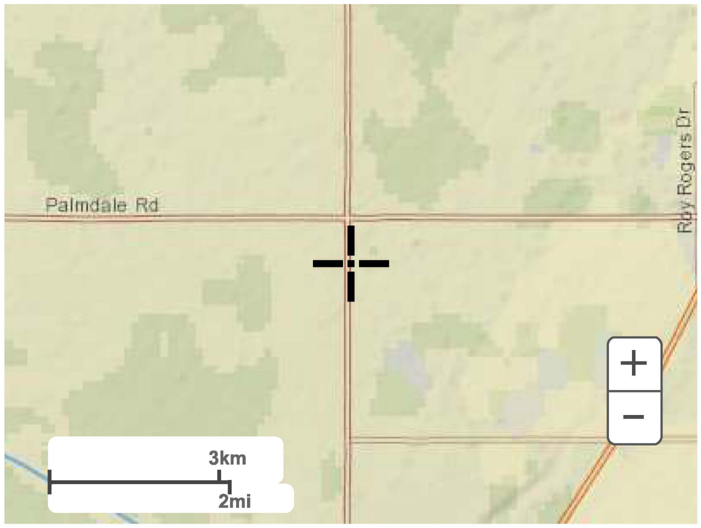
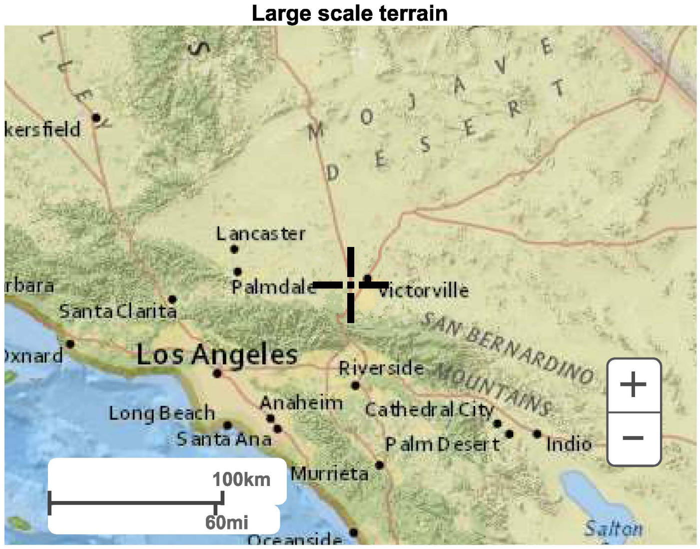
Maps & aerials

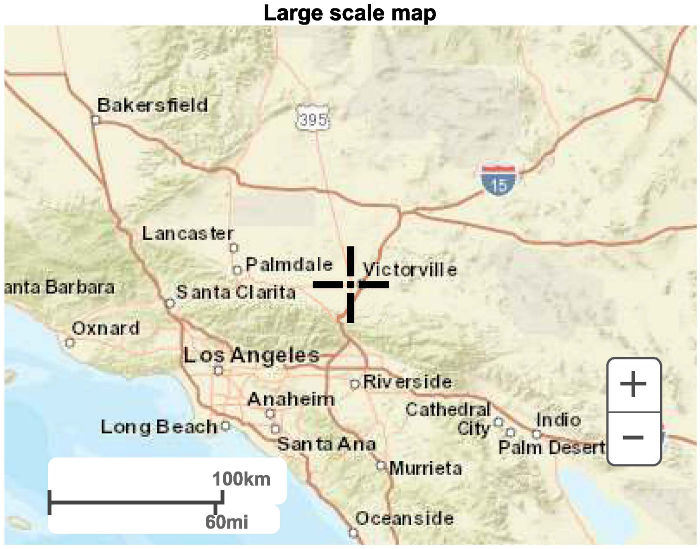
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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United States Department of Agriculture

NRCS

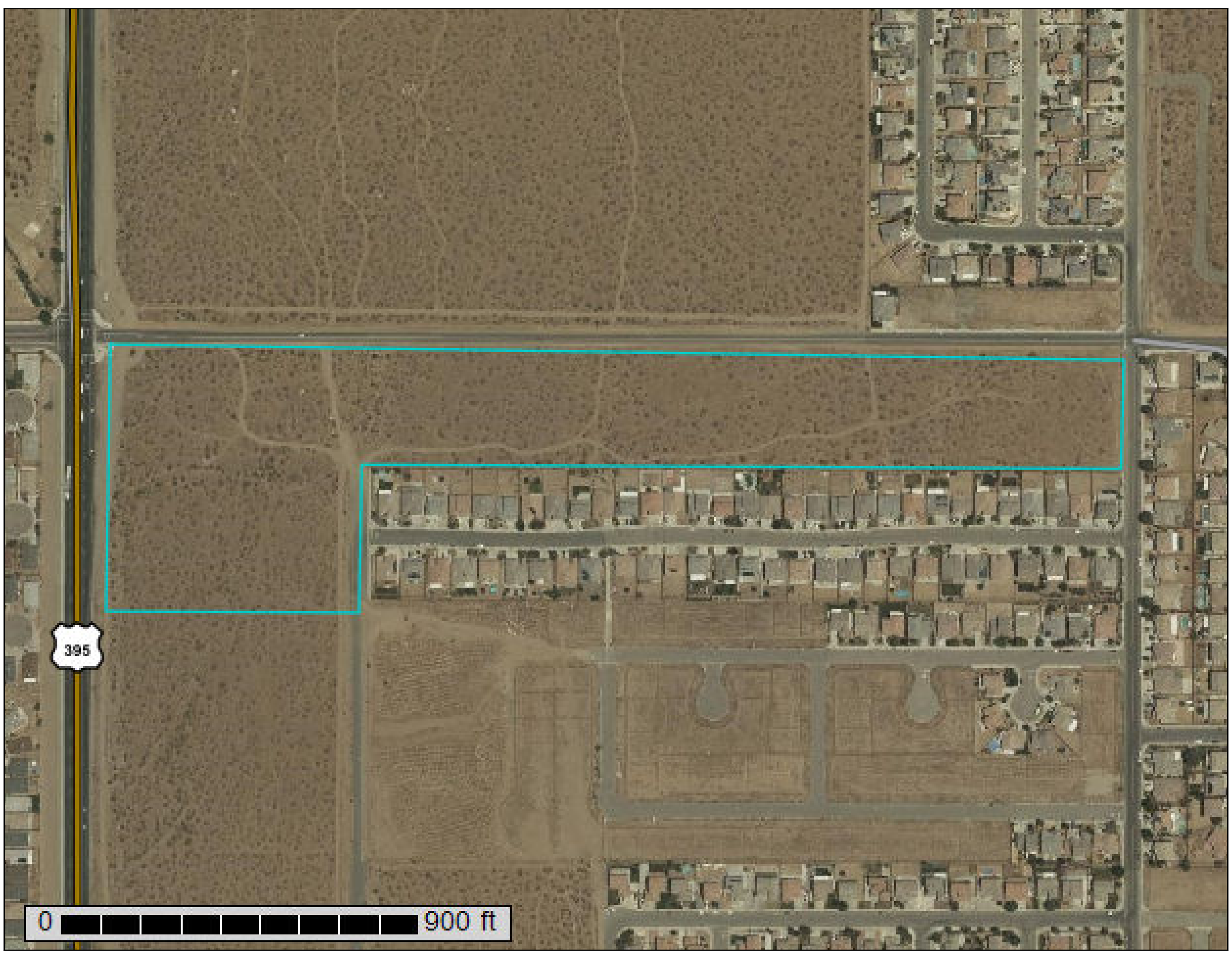
Natural Resources Conservation Service

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

Dos Palmas Site



May 16, 2021

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.

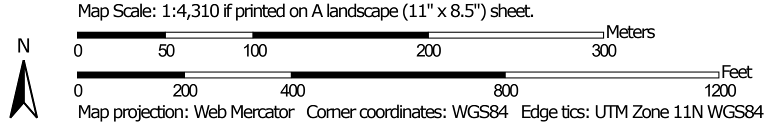
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in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

Map Scale: 1:4,310 if printed on A landscape (11" x 8.5") sheet.



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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 12, May 27, 2020

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

Date(s) aerial images were photographed: Jun 26, 2019—Jul 8, 2019

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

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
106	BRYMAN LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	0.4	1.9%
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	21.3	95.3%
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	0.2	0.9%
131	HELENDALE LOAMY SAND, 0 TO 2 PERCENT SLOPES	0.4	1.8%
Totals for Area of Interest		**22.4**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

San Bernardino County, California, Mojave River Area

106—BRYMAN LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrb
Elevation: 3,000 to 3,400 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Bryman and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bryman

Setting

Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 9 inches: loamy fine sand
H2 - 9 to 43 inches: sandy clay loam
H3 - 43 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): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Bryman, gravelly surface

Percent of map unit: 5 percent

Helendale

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

Mohave variant

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

Cajon, loamy surface

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

112—CAJON SAND, 0 TO 2 PERCENT SLOPES

Map Unit Setting

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

Map Unit Composition

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

Description of Cajon

Setting

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

Typical profile

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water capacity: Low (about 4.1 inches)

Interpretive groups

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

Minor Components

Helendale

Percent of map unit: 5 percent

Manet

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

Kimberlina

Percent of map unit: 5 percent

113—CAJON SAND, 2 TO 9 PERCENT SLOPES

Map Unit Setting

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

Map Unit Composition

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

Description of Cajon

Setting

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

Typical profile

A - 0 to 6 inches: sand
C1 - 6 to 25 inches: sand

C2 - 25 to 60 inches: gravelly sand, stratified gravelly sand to sand
C2 - 25 to 60 inches:

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water capacity: Low (about 4.7 inches)

Interpretive groups

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

Minor Components

Helendale

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

Cajon, gravelly surface

Percent of map unit: 5 percent
Landform: Alluvial fans

Kimberlina

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

131—HELENDALE LOAMY SAND, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hks4
Elevation: 2,500 to 3,800 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Helendale and similar soils: 85 percent

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

Description of Helendale

Setting

Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 4 inches: loamy sand
H2 - 4 to 30 inches: sandy loam
H3 - 30 to 66 inches: sandy loam
H4 - 66 to 70 inches: loamy sand

Properties and qualities

Slope: 0 to 2 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: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Kimberlina

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

Bryman

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

Cajon

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 B
PRE-DEVELOPMENT CONDITION HYDROLOGY
EXHIBIT AND RATIONAL METHOD CALCULATIONS

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               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: 05/17/21
------------------------------------------------------------------------
DOS PALMAS DEVELOPMENT
PRE-DEVELOPED CONDITION
10-YR DESIGN STORM
RATIONAL METHOD ANALYSIS BY PK MAY 2021
------------------------------------------------------------------------


Program License Serial Number 6388

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.664 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   463.000(Ft.)
Top (of initial area) elevation =  3182.000(Ft.)
Bottom (of initial area) elevation =  3174.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.01728  s(%)=       1.73
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.769 min.
Rainfall intensity =      1.606(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.576
Subarea runoff =      2.377(CFS)
Total initial stream area =        2.570(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.075(Ft.), Average velocity =   1.591(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             40.00              0.00
       3             80.00              0.00
       4            120.00              0.50
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      5.497(CFS)
  '     '       flow top width =     52.012(Ft.)
  '     '    velocity=    1.591(Ft/s)
  '     '       area =      3.454(Sq.Ft)
  '     '       Froude number =     1.088

Upstream point elevation =  3174.000(Ft.)
Downstream point elevation =  3161.000(Ft.)
```

```
Flow length =   762.000(Ft.)
Travel time  =    7.98 min.
Time of concentration =   21.75 min.
Depth of flow =   0.075(Ft.)
Average velocity =   1.591(Ft/s)
Total irregular channel flow =     5.496(CFS)
Irregular channel normal depth above invert elev. =   0.075(Ft.)
Average velocity of channel(s) =   1.591(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Rainfall intensity =      1.221(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.474
Subarea runoff =      6.167(CFS) for   12.210(Ac.)
Total runoff =      8.544(CFS)
Effective area this stream =       14.78(Ac.)
Total Study Area (Main Stream No. 1) =       14.78(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.097(Ft.), Average velocity =   1.850(Ft/s)
End of computations, Total Study Area =           14.78 (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 =  67.0
```

```
               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: 05/17/21
------------------------------------------------------------------------
DOS PALMAS DEVELOPMENT
PRE-DEVELOPED CONDITION
100-YR DESIGN STORM
RATIONAL METHOD ANALYSIS BY PK MAY 2021
------------------------------------------------------------------------


Program License Serial Number 6388

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.110 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2

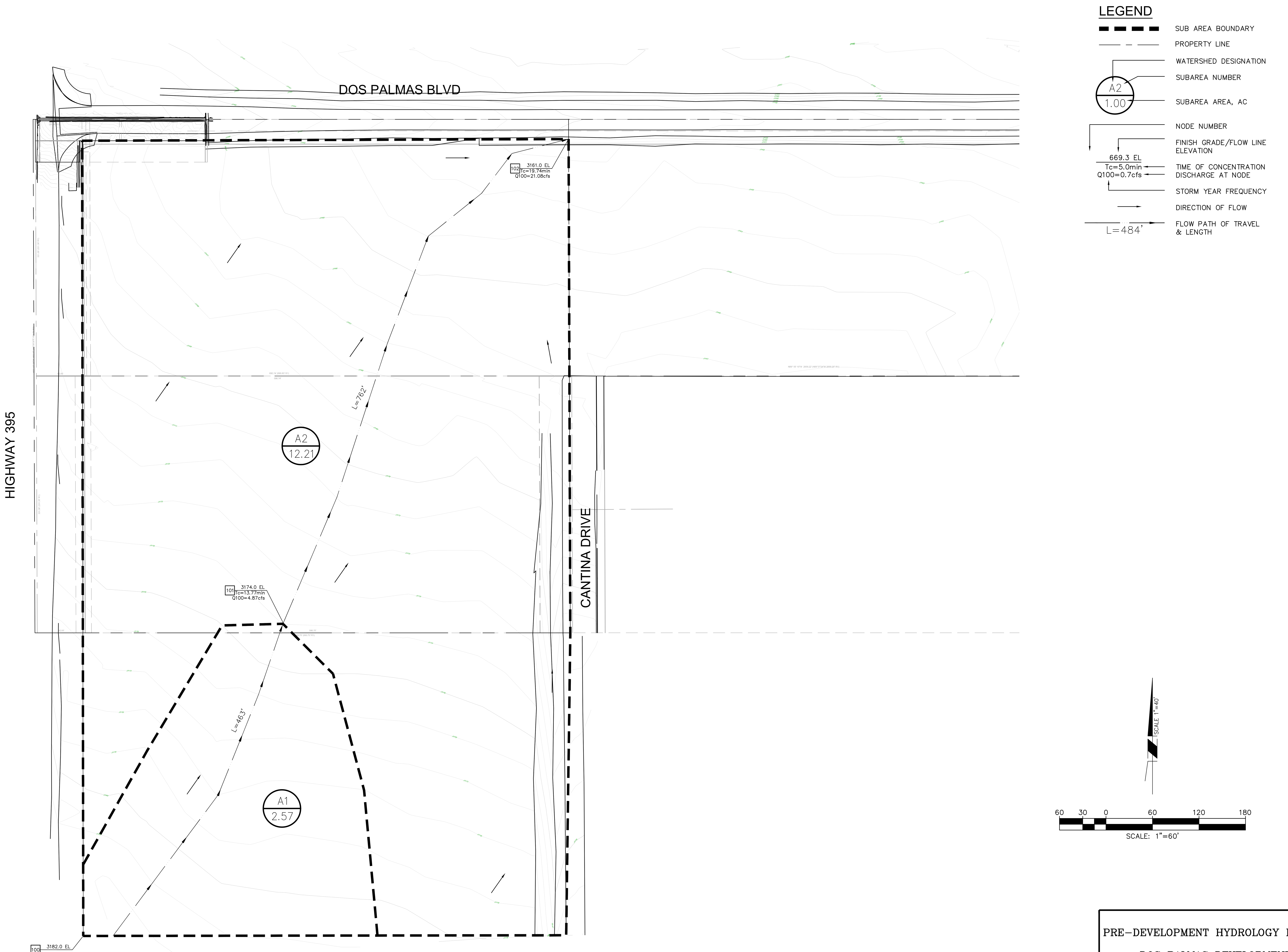

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   463.000(Ft.)
Top (of initial area) elevation =  3182.000(Ft.)
Bottom (of initial area) elevation =  3174.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.01728  s(%)=       1.73
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.769 min.
Rainfall intensity =      2.685(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.706
Subarea runoff =      4.872(CFS)
Total initial stream area =        2.570(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.123(Ft.), Average velocity =   2.127(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             40.00              0.00
       3             80.00              0.00
       4            120.00              0.50
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =     13.012(CFS)
  '     '       flow top width =     59.649(Ft.)
  '     '    velocity=    2.127(Ft/s)
  '     '       area =      6.119(Sq.Ft)
  '     '       Froude number =     1.170

Upstream point elevation =  3174.000(Ft.)
Downstream point elevation =  3161.000(Ft.)
```

```
Flow length =   762.000(Ft.)
Travel time  =    5.97 min.
Time of concentration =   19.74 min.
Depth of flow =   0.123(Ft.)
Average velocity =   2.127(Ft/s)
Total irregular channel flow =    13.012(CFS)
Irregular channel normal depth above invert elev. =   0.123(Ft.)
Average velocity of channel(s) =   2.127(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Rainfall intensity =      2.163(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.659
Subarea runoff =     16.204(CFS) for   12.210(Ac.)
Total runoff =     21.075(CFS)
Effective area this stream =       14.78(Ac.)
Total Study Area (Main Stream No. 1) =       14.78(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.161(Ft.), Average velocity =   2.481(Ft/s)
End of computations, Total Study Area =           14.78 (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 =  67.0
```



PRE-DEVELOPMENT HYDROLOGY EXHIBIT

DOS PALMAS DEVELOPMENT

CITY OF VICTORVILLE

APPENDIX C
PRE-DEVELOPMENT CONDITION HYDROLOGY EXHIBIT AND RATIONAL METHOD CALCULATIONS

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               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: 05/18/21
------------------------------------------------------------------------
DOS PALMAS DEVELOPMENT
POST-DEVELOPED CONDITION
10-YR DESIGN STORM
RATIONAL METHOD ANALYSIS BY PK MAY 2021
------------------------------------------------------------------------


Program License Serial Number 6388

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.664 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   788.000(Ft.)
Top (of initial area) elevation =  3182.000(Ft.)
Bottom (of initial area) elevation =  3173.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01142  s(%)=       1.14
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.502 min.
Rainfall intensity =      1.345(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.513
Subarea runoff =      3.864(CFS)
Total initial stream area =        5.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   391.000(Ft.)
Top (of initial area) elevation =  3176.000(Ft.)
Bottom (of initial area) elevation =  3169.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01790  s(%)=       1.79
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.777 min.
Rainfall intensity =      1.680(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.590
Subarea runoff =      1.972(CFS)
Total initial stream area =        1.990(Ac.)
Pervious area fraction = 1.000
```
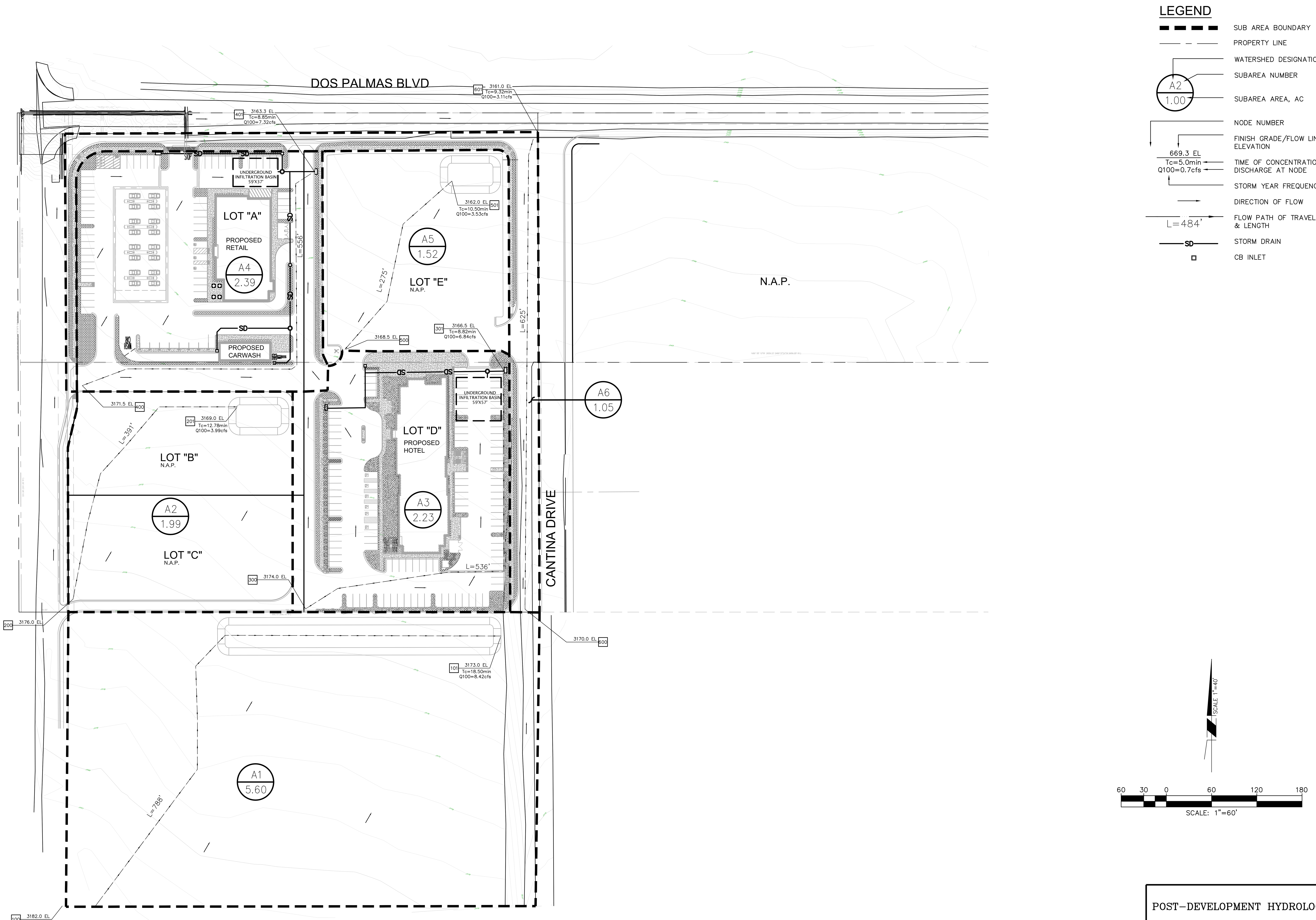

```
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** 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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   536.000(Ft.)
Top (of initial area) elevation =  3174.000(Ft.)
Bottom (of initial area) elevation =  3166.500(Ft.)
Difference in elevation =     7.500(Ft.)
Slope =    0.01399  s(%)=       1.40
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.818 min.
Rainfall intensity =      2.098(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.858
Subarea runoff =      4.015(CFS)
Total initial stream area =        2.230(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      400.000 to Point/Station      401.000
**** 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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   556.000(Ft.)
Top (of initial area) elevation =  3171.500(Ft.)
Bottom (of initial area) elevation =  3163.300(Ft.)
Difference in elevation =     8.200(Ft.)
Slope =    0.01475  s(%)=       1.47
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.854 min.
Rainfall intensity =      2.093(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.858
Subarea runoff =      4.292(CFS)
Total initial stream area =        2.390(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      501.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   275.000(Ft.)
Top (of initial area) elevation =  3168.500(Ft.)
Bottom (of initial area) elevation =  3162.000(Ft.)
Difference in elevation =     6.500(Ft.)
Slope =    0.02364  s(%)=       2.36
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.500 min.
Rainfall intensity =      1.890(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.625
Subarea runoff =      1.794(CFS)
```

```
Total initial stream area =        1.520(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      600.000 to Point/Station      601.000
**** 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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   625.000(Ft.)
Top (of initial area) elevation =  3170.000(Ft.)
Bottom (of initial area) elevation =  3161.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01440  s(%)=       1.44
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.323 min.
Rainfall intensity =      2.029(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.857
Subarea runoff =      1.825(CFS)
Total initial stream area =        1.050(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
End of computations, Total Study Area =           14.78 (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) = 0.655
Area averaged SCS curve number =  53.6
```

```
              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: 05/18/21
------------------------------------------------------------------------
DOS PALMAS DEVELOPMENT
POST-DEVELOPED CONDITION
100-YR DESIGN STORM
RATIONAL METHOD ANALYSIS BY PK MAY 2021
------------------------------------------------------------------------


Program License Serial Number 6388

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.110 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   788.000(Ft.)
Top (of initial area) elevation =  3182.000(Ft.)
Bottom (of initial area) elevation =  3173.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01142  s(%)=       1.14
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.502 min.
Rainfall intensity =      2.248(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.669
Subarea runoff =      8.417(CFS)
Total initial stream area =        5.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   391.000(Ft.)
Top (of initial area) elevation =  3176.000(Ft.)
Bottom (of initial area) elevation =  3169.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01790  s(%)=       1.79
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.777 min.
Rainfall intensity =      2.808(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.715
Subarea runoff =      3.993(CFS)
Total initial stream area =        1.990(Ac.)
Pervious area fraction = 1.000
```

```
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** 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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   536.000(Ft.)
Top (of initial area) elevation =  3174.000(Ft.)
Bottom (of initial area) elevation =  3166.500(Ft.)
Difference in elevation =     7.500(Ft.)
Slope =    0.01399  s(%)=       1.40
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.818 min.
Rainfall intensity =      3.507(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =      6.843(CFS)
Total initial stream area =        2.230(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      400.000 to Point/Station      401.000
**** 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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   556.000(Ft.)
Top (of initial area) elevation =  3171.500(Ft.)
Bottom (of initial area) elevation =  3163.300(Ft.)
Difference in elevation =     8.200(Ft.)
Slope =    0.01475  s(%)=       1.47
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.854 min.
Rainfall intensity =      3.499(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =      7.316(CFS)
Total initial stream area =        2.390(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      501.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor 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)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   275.000(Ft.)
Top (of initial area) elevation =  3168.500(Ft.)
Bottom (of initial area) elevation =  3162.000(Ft.)
Difference in elevation =     6.500(Ft.)
Slope =    0.02364  s(%)=       2.36
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.500 min.
Rainfall intensity =      3.159(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.735
Subarea runoff =      3.530(CFS)
```

```
Total initial stream area =        1.520(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      600.000 to Point/Station      601.000
**** 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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   625.000(Ft.)
Top (of initial area) elevation =  3170.000(Ft.)
Bottom (of initial area) elevation =  3161.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01440  s(%)=       1.44
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.323 min.
Rainfall intensity =      3.392(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff =      3.113(CFS)
Total initial stream area =        1.050(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
End of computations, Total Study Area =           14.78 (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) = 0.655
Area averaged SCS curve number =  53.6
```



POST-DEVELOPMENT HYDROLOGY EXHIBIT

DOS PALMAS DEVELOPMENT

CITY OF VICTORVILLE