PRELIMINARY HYDROLOGY STUDY

FOR
HESPERIA WEST
SOLAR PV PROJECT

LOCATED AT

The Northeast corner of the intersection of
Fuente Avenue and El Centro Road
in Hesperia, California
APN 0405-372-40
Approximately 20 Acres

42140 Tenth Street West, Lancaster CA 93534  661-940-0043  661-949-9775 Fax:
12-6148

11/29/2012
Introduction

This study was prepared for the potential development of a 20 acre parcel located in unincorporated area of San Bernardino County southwest of the City of Hesperia. The property is rectangular in shape with the approximate dimensions of 660 x 1320 feet. The surrounding streets are Fuente Avenue to the west, Fir Street to the north, Bandicoot Trail to the east, and El Centro Road to the south, all unimproved. The proposed development consists of fixed-tilt, ground mounted photovoltaic solar panel arrays. Concrete equipment pads will be provided for the electrical gear. A reduced copy of the proposed site plan can be seen in Figure 1. Site APN is: 0405-372-40

Site Latitude, Longitude

34.3914°, -117.3617°

Purpose & Scope

The purpose of this study was to provide a preliminary drainage study to comply with submittal requirements of San Bernardino County for CUP purposes.

The study is based on the Hydrology Manual of San Bernardino County and the April 2010 Addendum to the Hydrology Manual. The preliminary study will determine the tributary area for drainage affecting the site and make an estimate for the quantity of water runoff for the 100 year event.

General

The site is currently vacant with amounts of sage brush and native grasses indicative of the Mojave Desert. The site contains two or three trees from the cedar species and a few Joshua trees. The site generally drains to the North East at approximately 2%. A shallow drainage path traverses the site from South to North East. According to FEMA the property lies in Flood Zone "D" on FIRM 06071C6490H. The parcel is not located in a special flood hazard zone. Zone "D" indicates "Flood hazards undetermined, but possible".

Drainage across the site is currently characterized by sheet flow. Storm water leaving the site flows northerly and easterly along unimproved streets to eventually find its way under the California Aqueduct and ultimately the Mojave River. The surficial soils appear to be a silty, fine to coarse, medium brown sand.
Fuente Avenue, on the west side of the site, appears to carry the major portion of upstream storm flows based on observed erosion. A much smaller tributary area of storm water south of El Centro Road appears to slowly sheet flow across El Centro Road near the easement south of the subject site then splits with some water being naturally diverted easterly along El Centro Road and a portion flows northeasterly through the site.

The site is located within the Hesperia Master Plan of Drainage (HMPD). The HMPD shows a planned drainage facility with a north/south alignment in the middle of the parcel. This facility is identified as H-06 and is described as an open trapezoidal earthen channel approximately 7 feet deep, with a 12 foot wide bottom and 3:1 side slopes. The approximate right-of-way width for this facility is 94 feet. There are two existing unimproved offsite drainage easements adjacent to the site. One is located near the midsection of the site south of El Centro Road aligned in a north-south direction and is 84’ wide. The other is located east of Bandicoot Trail approximately half the distance between Fir Street and El Centro Road aligned in a northeast direction and is 125’ wide. It is not known when or if these easements will be utilized in the future by the County for the masterplanned improvements. We have proposed a connecting easement through the site that runs parallel to El Centro Road then turns to the northeast to Bandicoot Trail (see the site plan for the proposed location of easement). Per a telephone discussion with Anthony Pham with San Bernardino County, we agreed upon an onsite easement as shown on the site plans consisting of a 100' wide segment parallel with El Centro Road connecting to the existing easement south of our site, then turning northeast and widening to 125' in order to match the extended alignment of the Northeasterly offsite easement.

This H-06 drainage is planned to empty to a future drainage basin called the "Bandicoot" Basin near the California Aqueduct north of Mesquite Road. These drainage flows that do not percolate into the soil or evaporate will eventually empty into the Mojave River. This site is also subject to a local Storm Water Management Plan (SWMP) covering the Mojave River Watershed.

The site is proposed for development as a photovoltaic solar farm for electrical energy generation. The solar panels will be elevated by column structures supported by the native soil. Using this type of construction minimizes the need for site grading. Elevation of the solar arrays will allow for ease of maintenance as well as relatively unimpeded surface drainage.

The project proposes no habitable structures.
Analysis

The site watershed is approximately 805.4 acres in size and extends for approximately 3.8 miles southwesterly. Drainage approaches the site from the Southwest and appears to cause erosion damage in Fuente Avenue on the west side of the site. This is evidenced by visual assessments at the site.

The watershed boundaries were determined through the use of a topographic map of the area (See Figure 2, Hydrology Map). The soils group was determined by the use of the Natural Resources Conservation Service (NRCS) website referred to in the Addendum to the Hydrology Manual. From this source site soils were determined to be CA671. This corresponds to a Hydrologic Soils Group B soil for the purposes of data input into the computer program for determining estimated runoff amounts. Further search on the website indicates the entire watershed is the same soil designation.

Since the upstream watershed area is sparsely populated, the imperviousness values are extremely low for both the pre and post developed conditions. To look at worst case scenario, only the post developed offsite flows were calculated. Land use designations for the watershed are 774.4 acres of RL (Rural Living) and approximately 31 acres of CN (Neighborhood Commercial). Land use designations were determined from the County of San Bernardino Land Use zoning maps available from the County website. For routing analysis the study assumed a very conservative Manning’s "n" value of 0.025 considering that in the future development roads will be developed. All roads in the upstream watershed appear to be mostly unimproved.

Since the watershed drainage slope was fairly uniform, only one type of soil was encountered, and only two land use designations were found, the tributary areas were broken down by the 100 acre limit of the hydrology method. The land use condition of 31 acres of Neighborhood Commercial property was proportionalized in the data input. In the analysis a 0.4 dwelling/acre approximation (90% Perviousness) was used for the RL area. Ten percent perviousness was used for the CN area. Calculations for the weighted average pervious percent are provided in the appendix. The resulting subarea map can be seen in Figure 2. The node numbers were organized into 100 series values to aid in the separation of areas. This figure also contains the values for area, elevation, travel length, and node numbers.

The values obtained for each subarea were then used in the flood routing analysis. The analysis was computed by the rational method using software prepared by AES (Advanced Engineering Software) Ver. 16.0. The one hour rainfall depth for the 100-year, 60 minute, event was determined from the point frequency estimates within NOAA Atlas 14 to be 1.32 inches (see Figure 4). The analysis was performed using Antecedent Moisture Condition (AMC) III. This value was obtained by determining the
site location on the map provided on the county website inside the 2010 Addendum to the Hydrology Manual. The detailed calculations and results can be sound in the detailed calculations in the appendix. The results show the 100 year event flows are estimated to be 506.39 CFS at node 112.

The storm flows will sheet across the property towards the northeast and continue as it does currently. Since minimum grading is proposed for the site and no changes in the imperviousness are expected no mitigation measures other than providing drainage easements for future drainage improvements are proposed.

**Conclusions and Recommendations**

The nature of the construction of this proposed solar farm project will have no appreciable effects to the current runoff rates, drainage patterns, or quantity of runoff. At this time only drainage easements are proposed through the site to connect the two existing adjacent offsite easements. Due to sheet flow drainage conditions across the site we recommend that the photo voltaic modules be placed at least 2 feet above existing ground.
APPENDIX

Attachment - Attachment A  Land Use Zoning District Map
Attachment - Detailed Calculations Watershed 100-116 (10 pages)
Attachment - Summary Watershed 100-112 (2 pages)
Attachment - Web Soil Survey, webpage printout (NRCS) (2 pages)
Attachment - Point Precipitation Frequency Estimates (4 pages) (NOAA Atlas 14)
Attachment - Hesperia Master Plan of Drainage Plan Profile Line H-06 (3 pages)
Attachment - Calculation for weighted average land use pervious percent between nodes 109 and 110
Attachment - Figure ADD-1 AMC areas (2 pages)
Attachment - Bandicoot - Node 112 Chanel Sizing
Attachment - Photos (3 pages)
Detailed Calculations Watershed 100-112

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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION
(c) Copyright 1983-2009 Advanced Engineering Software (aes)
Ver. 16.0 Release Date: 04/01/2009 License ID 1276

Analysis prepared by:
Arrow Engineering
42138 10th Street West
Lancaster CA, 93534
(661) 949-2525

FILE NAME: 6148HYD3.DAT
TIME/DATE OF STUDY: 14:36 11/30/2012

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL*--
USER SPECIFIED STORM EVENT (YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE (INCH) = 24.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
SLOPE OF INTENSITY DURATION CURVE (LOG(I; IN/HR) vs. LOG(Tc; MIN)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY (INCH/HOUR) = 1.3200

*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*

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<th>HALF-CROWN TO STREET-CROSSFALL</th>
<th>SIDEWAY</th>
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GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 1.00 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
FLOW PROCESS FROM NODE    100.00 TO NODE  101.00 IS CODE = 21

RATIONAL METHOD INITIAL SUBAREA ANALYSIS

USE TIME-OF-CONCENTRATION NOMOGRAM FOR INITIAL SUBAREA

Page 1
INITIAL SUBAREA FLOW-LENGTH(Feet) = 1000.00

ELEVATION DATA: UPSTREAM(Feet) = 4037.00  DOWNSTREAM(Feet) = 4007.00

\[ Tc = K \times \left( \frac{L^3}{Elevation \ Change} \right)^{0.20} \]

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.395

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 15.56

*NOTE: INITIAL SUBAREA NOMOGRAPh WITH SUBAREA PARAMETERS, AND L = 3950.0 FT WITH ELEVATION DROP = 57.0 FT, IS 60.8 CFS, WHICH EXCEEDS THE TOP-OF-Curb STREET CAPACITY AT NODE 102.00.

LONGEST FLOWPATH FROM NODE 100.00 TO NODE 102.00 IS CODE = 62

FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 62

**FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 62**

**GRAPHIC STREET HYDRAULICS**

*NOTE: INITIAL SUBAREA NOMOGRAPh WITH SUBAREA PARAMETERS, AND L = 3950.0 FT WITH ELEVATION DROP = 57.0 FT, IS 60.8 CFS, WHICH EXCEEDS THE TOP-OF-Curb STREET CAPACITY AT NODE 102.00.

LONGEST FLOWPATH FROM NODE 100.00 TO NODE 102.00 IS CODE = 62
FLOW PROCESS FROM NODE 102.00 TO NODE 103.00 IS CODE = 62

>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>(STREET TABLE SECTION # 2 USED)<<<<<
============================================================================
UPSTREAM ELEVATION (FEET) = 3950.00 DOWNSTREAM ELEVATION (FEET) = 3874.00
STREET LENGTH (FEET) = 2661.00 CURB HEIGHT (INCHES) = 8.0
STREET HALF WIDTH (FEET) = 40.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 30.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0250
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 127.34
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.86
HALFSTREET FLOOD WIDTH (FEET) = 44.56
AVERAGE FLOW VELOCITY (FEET/SEC.) = 4.77
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 4.09
STREET FLOW TRAVEL TIME (MIN.) = 9.30 Tc (MIN.) = 33.69

* 100 YEAR RAINFOLL INTENSITY (INCH/HR) = 1.977
SUBAREA LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL *.4 DWELLING/ACRE* B 94.36 0.42 0.900 76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA (ACRES) = 94.36
SUBAREA RUNOFF (CFS) = 135.58

EFFECTIVE AREA (ACRES) = 125.65 AREA-AVERAGED Fm (INCH/HR) = 0.38
AREA-AVERAGED Fp (INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.90
TOTAL AREA (ACRES) = 125.7 PEAK FLOW RATE (CFS) = 180.54

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.95 HALFSTREET FLOOD WIDTH (FEET) = 53.47
FLOW VELOCITY (FEET/SEC.) = 5.10 PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 4.83
*NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS, AND L = 2661.0 FT WITH ELEVATION DROP = 76.0 FT, IS 185.4 CFS, WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 103.00
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 103.00 = 5615.00 FEET.

FLOW PROCESS FROM NODE 103.00 TO NODE 104.00 IS CODE = 62

>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>(STREET TABLE SECTION # 2 USED)<<<<<
============================================================================
UPSTREAM ELEVATION (FEET) = 3874.00 DOWNSTREAM ELEVATION (FEET) = 3837.00
STREET LENGTH (FEET) = 1798.00 CURB HEIGHT (INCHES) = 8.0
STREET HALF WIDTH (FEET) = 40.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 30.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

Page 3
6148 HYD3

Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0250
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS)** = 239.96
***STREET FLOWING FULL***
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 1.06
HALFSTREET FLOOD WIDTH (FEET) = 59.68
AVERAGE FLOW VELOCITY (FEET/SEC.) = 4.97
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 5.27
STREET FLOW TRAVEL TIME (MIN.) = 6.03  Tc (MIN.) = 39.72
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 1.762

SUBAREA LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE /  SC S SOIL AREA Fp Ap  SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
*.4 DWELLING/ACRE * B 95.47 0.42 0.900 76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA (ACRES) = 95.47
SUBAREA RUNOFF (CFS) = 118.68
EFFECTIVE AREA (ACRES) = 221.12
AREA-AVERAGED Fp (INCH/HR) = 0.42
AREA-AVERAGED Ap = 0.90
TOTAL AREA (ACRES) = 221.1
PEAK FLOW RATE (CFS) = 274.88

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 1.10
HALFSTREET FLOOD WIDTH (FEET) = 61.63
FLOW VELOCITY (FEET/SEC.) = 5.19
DEPTH*VELOCITY (FT*FT/SEC.) = 5.70
*NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
AND L = 1798.0 FT WITH ELEVATION DROP = 37.0 FT, IS 202.1 CFS,
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 104.00
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 104.00 = 7413.00 FEET.

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FLOW PROCESS FROM NODE 104.00 TO NODE 105.00 IS CODE = 62

============================================================================
UPSTREAM ELEVATION (FEET) = 3837.00
DOWNSTREAM ELEVATION (FEET) = 3804.00
STREET LENGTH (FEET) = 1709.00
CURB HEIGHT (INCHES) = 8.0
STREET HALFWIDTH (FEET) = 40.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 30.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0250
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS)** = 330.40
***STREET FLOWING FULL***
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 1.17
HALFSTREET FLOOD WIDTH (FEET) = 65.05
AVERAGE FLOW VELOCITY (FEET/SEC.) = 5.36
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 6.26
STREET FLOW TRAVEL TIME (MIN.) = 5.32  Tc (MIN.) = 45.03
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 1.614

SUBAREA LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE /  SCS SOIL AREA Fp Ap  SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
Page 4
RESIDENTIAL

*.4 DWELLING/ACRE* B 100.00 0.42 0.900 76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA(ACRES) = 100.00 SUBAREA RUNOFF(CFS) = 110.96
EFFECTIVE AREA(ACRES) = 321.12 AREA-AVERAGED Fm(INCH/HR) = 0.38
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 321.1 PEAK FLOW RATE(CFS) = 356.32

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FeET) = 1.19 HALFSTREET FLOOD WIDTH(FeET) = 66.27
FLOW VELOCITY(FEET/SEC.) = 5.49 DEPTH*VELOCITY(FT*FT/SEC.) = 6.55
*NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
AND L = 1709.0 FT WITH ELEVATION-DROP = 33.0 FT, IS 213.0 CFS,
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 105.00
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 105.00 = 9122.00 FEET.

*-------------------------------------------------------------------------*
**FLO W PROCESS FROM NODE 105.00 TO NODE 106.00 IS CODE = 62**
*-------------------------------------------------------------------------*

UPSTREAM ELEVATION(FeET) = 3804.00 DOWNSTREAM ELEVATION(FeET) = 3775.00
STREET LENGTH(FeET) = 1584.00 CURB HEIGHT(INCHES) = 8.0
STREET HALFWDTH(FeET) = 40.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FeET) = 30.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0250
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 400.78**
***STREET FLOWING FULL***
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FeET) = 1.24
HALFSTREET FLOOD WIDTH(FeET) = 68.83
AVERAGE FLOW VELOCITY(FeET/SEC.) = 5.58
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 6.94
STREET FLOW TRAVEL TIME(MI.N.) = 4.73 Tc(MI.N.) = 49.76
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.505
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL *.4 DWELLING/ACRE* B 87.87 0.42 0.900 76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA(ACRES) = 87.87 SUBAREA RUNOFF(CFS) = 88.89
EFFECTIVE AREA(ACRES) = 408.99 AREA-AVERAGED Fm(INCH/HR) = 0.38
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 409.0 PEAK FLOW RATE(CFS) = 413.72

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FeET) = 1.26 HALFSTREET FLOOD WIDTH(FeET) = 69.44
FLOW VELOCITY(FeET/SEC.) = 5.63 DEPTH*VELOCITY(FT*FT/SEC.) = 7.07
*NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
AND L = 1584.0 FT WITH ELEVATION-DROP = 29.0 FT, IS 190.2 CFS,
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 106.00
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 106.00 = 10706.00 FEET.

FLOW PROCESS FROM NODE 106.00 TO NODE 107.00 IS CODE = 62

COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA
(STREET TABLE SECTION # 2 USED)

UPSTREAM ELEVATION(FEET) = 3775.00 DOWNSTREAM ELEVATION(FeET) = 3744.00
STREET LENGTH(FeET) = 1667.00 CURB HEIGHT(INCHES) = 8.0
STREET HALFWIDTH(FeET) = 40.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FeET) = 30.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0250
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 454.71
***STREET FLOWING FULL***
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FeET) = 1.29
HALFSTREET FLOOD WIDTH(FeET) = 71.03
AVERAGE FLOW VELOCITY(FeET/SEC.) = 5.83
PRODUCT OF DEPTH&VELOCI TY(FT*FT/SEC.) = 7.51
STREET FLOW TRAVEL TIME(MN.) = 4.76 Tc(MN.) = 54.53
* 100 YEAR RA INFALL INTENSI TY(INCH/HR) = 1.411
SUBAREA LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE/ SOIL SC S CN
LAND USE (ACRES) (INCH/HR) (DECI M A L)
RESIDENTIAL
" .4 DWELLING/ACRE" B 88.36 0.42 0.900 76

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA(ACRES) = 88.36 SUBAREA RUNOFF(CFS) = 81.97
EFFECTIVE AREA(ACRES) = 497.35 AREA-AVERAGED Fm(INCH/HR) = 0.38
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 497.35 PEAK FLOW RATE(CFS) = 461.36

END OF SUBAREA STREET FLOW HYDRAULICS:
DE PT(FeET) = 1.29 HALFSTREET FLOOD WIDTH(FeET) = 71.33
FLOW VELO CI TY(FeET/SEC.) = 5.83 DEPTH&VELO CI TY(FT*FT/SEC.) = 7.57
*NOTE: INITIAL SUBAREA NOMO GRAPH WITH SUBAREA PARAMETERS,
AND L = 1667.0 FT WITH ELEVATION DROP = 31.0 FT, IS 188.5 CFS,
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 107.00
LONGEST FLOWPATH FROM NODE 107.00 TO NODE 107.00 = 12373.00 FEET.

FLOW PROCESS FROM NODE 107.00 TO NODE 108.00 IS CODE = 62

COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA
(STREET TABLE SECTION # 2 USED)

UPSTREAM ELEVATION(FeET) = 3744.00 DOWNSTREAM ELEVATION(FeET) = 3706.00
STREET LENGTH(FeET) = 1988.00 CURB HEIGHT(INCHES) = 8.0
STREET HALFWIDTH(FeET) = 40.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FeET) = 30.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

Page 6
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 492.90**

**STREET FLOWING FULL***

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

- STREET FLOW DEPTH (FEET) = 1.31
- HALFSTREET FLOOD WIDTH (FEET) = 72.37
- AVERAGE FLOW VELOCITY (FEET/SEC.) = 6.03
- PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 7.92

STREET FLOW TRAVEL TIME (MIN.) = 5.50, Tc (MIN.) = 60.03

**100 YEAR RAINFALL INTENSITY (INCH/HR) = 1.320**

SUBAREA LOSS RATE DATA (AMC III):

- RESIDENTIAL
  - "4 DWELLING/ACRE":
    - SCS SOIL GROUP: B
    - AREA (ACRES) = 74.63
    - Fp (INCH/HR) = 0.42
    - Ap (DECIMAL) = 0.900
    - CN = 76

- SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.42
- SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
- EFFECTIVE AREA (ACRES) = 571.98
- AREA-AVERAGED Fm (INCH/HR) = 0.38
- AREA-AVERAGED Fp (INCH/HR) = 0.42
- AREA-AVERAGED Ap = 0.90
- TOTAL AREA (ACRES) = 572.0
- PEAK FLOW RATE (CFS) = 483.33

END OF SUBAREA STREET FLOW HYDRAULICS:

- DEPTH (FEET) = 1.31
- HALFSTREET FLOOD WIDTH (FEET) = 72.00
- FLOW VELOCITY (FEET/SEC.) = 5.99
- DEPTH & VELOCITY (FT*FT/SEC.) = 7.82

*NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS, AND L = 1988.0 FT WITH ELEVATION DROP = 38.0 FT IS 151.0 CFS, WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 108.00

LONGEST FLOWPATH FROM NODE 100.00 TO NODE 108.00 = 14361.00 FEET.
### SUBAREA LOSS RATE DATA (AMC III):

**DEVELOPMENT TYPE / SCS SOIL AREA Fp Ap SCS LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN**

<table>
<thead>
<tr>
<th>LAND USE</th>
<th>SCS SOIL</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>CN</th>
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<tbody>
<tr>
<td>RESIDENTIAL</td>
<td>*&quot; .4 DWELLING/ACRE&quot;</td>
<td>B 64.71</td>
<td>0.42</td>
<td>0.900</td>
<td>76</td>
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</table>

**SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42**

**SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900**

**SUBAREA AREA (ACRES) = 64.71**

**SUBAREA RUNOFF (CFS) = 49.79**

**EFFECTIVE AREA (ACRES) = 636.69**

**AREA - AVERAGED Fp(INCH/HR) = 0.42 AREA - AVERAGED Ap = 0.90**

**TOTAL AREA (ACRES) = 636.7**

**PEAK FLOW RATE (CFS) = 489.91**

---

### END OF SUBAREA STREET FLOW HYDRAULICS:

- **DEPTH (FEET) = 1.35**
- **HALFSTREET FLOOD WIDTH (FEET) = 74.39**

**FLOW VELOCITY (FEET/SEC.) = 5.59**

**DEPTH * VELOCITY (FT*FT/SEC.) = 7.56**

**NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS, AND L = 2000.0 FT WITH ELEVATION DROP = 31.0 FT, IS 126.3 CFS, WHICH EXCEEDS THE TOP-OFCURB STREET CAPACITY AT NODE 109.00**

**LONGEST FLOWPATH FROM NODE 100.00 TO NODE 109.00 = 16361.00 FEET.**

---

**FLOW PROCESS FROM NODE 109.00 TO NODE 110.00 IS CODE = 62**

** computational error...**

**UPSTREAM ELEVATION (FEET) = 3675.00 DOWNSTREAM ELEVATION (FEET) = 3627.00**

**STREET LENGTH (FEET) = 2974.00 CURB HEIGHT (INCHES) = 8.0**

**STREET HALFWIDTH (FEET) = 40.00**

**DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 30.00**

**INSIDE STREET CROSSFALL (DECIMAL) = 0.020**

**OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020**

**SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2**

**STREET PARKWAY CROSSFALL (DECIMAL) = 0.020**

**Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0250**

**Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250**

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 524.26**

**STREET FLOWING FULL**

**STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:**

**STREET FLOW DEPTH (FEET) = 1.37**

**HALFSTREET FLOOD WIDTH (FEET) = 75.36**

**AVERAGE FLOW VELOCITY (FEET/SEC.) = 5.78**

**PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 7.95**

**STREET FLOW TRAVEL TIME (MIN.) = 8.57**

**Tc (MIN.) = 74.50**

**100 YEAR RAINFALL INTENSITY (INCH/HR) = 1.134**

**SUBAREA LOSS RATE DATA (AMC III):**

**DEVELOPMENT TYPE / SCS SOIL AREA Fp Ap SCS LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN**

<table>
<thead>
<tr>
<th>LAND USE</th>
<th>SCS SOIL</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>CN</th>
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<tbody>
<tr>
<td>RESIDENTIAL</td>
<td>*&quot;3-4 DWELLINGS/ACRE&quot;</td>
<td>B 86.70</td>
<td>0.42</td>
<td>0.600</td>
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</table>

**SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42**

**SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600**

**SUBAREA AREA (ACRES) = 86.70**

**SUBAREA RUNOFF (CFS) = 68.71**

**EFFECTIVE AREA (ACRES) = 723.39**

**AREA - AVERAGED Fp(INCH/HR) = 0.42 AREA - AVERAGED Ap = 0.86**

**TOTAL AREA (ACRES) = 723.4**

**PEAK FLOW RATE (CFS) = 500.58**

---

**END OF SUBAREA STREET FLOW HYDRAULICS:**

- **DEPTH (FEET) = 1.35**
- **HALFSTREET FLOOD WIDTH (FEET) = 74.39**

**FLOW VELOCITY (FEET/SEC.) = 5.71**

**DEPTH * VELOCITY (FT*FT/SEC.) = 7.73**
NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS, 
AND L = 2974.0 FT WITH ELEVATION DROP = 48.0 FT, IS 181.4 CFS, 
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 110.00 
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 110.00 = 19335.00 FEET.

FLOW PROCESS FROM NODE 110.00 TO NODE 111.00 IS CODE = 62

>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<
STREET TABLE SECTION # 2 USED)<<<

UPSTREAM ELEVATION (FEET) = 3627.00 DOWNSTREAM ELEVATION (FEET) = 3604.00
STREET LENGTH (FEET) = 1264.00 CURB HEIGHT (INCHES) = 8.0
STREET HALF WIDTH (FEET) = 40.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 30.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Street Flow Section (curb-to-curb) = 0.0250
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 513.94**
**STREET FLOWING FULL**
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 1.34
HALFSTREET FLOOD WIDTH (FEET) = 73.71
AVERAGE FLOW VELOCITY (FEET/SEC.) = 6.00
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 8.04
STREET FLOW TRAVEL TIME (MIN.) = 3.51 Tc (MIN.) = 78.02
100 YEAR RAINFALL INTENSITY (INCH/HR) = 1.098
SUBAREA LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE / SCS SOIL GROUP / AREA (ACRES) / Fp(INCH/HR) / Ap (DECIMAL) / SCS CN
RESIDENTIAL
".4 DWELLING/ACRE" B 41.38 0.42 0.900 76
SUBAREA AVERAGE Pervious LOSS RATE, Fp (INCH/HR) = 0.42
SUBAREA AVERAGE Pervious AREA FRACTION, Ap = 0.900
SUBAREA AREA (ACRES) = 41.38 SUBAREA RUNOFF (CFS) = 26.73
EFFECTIVE AREA (ACRES) = 764.77 AREA-AVERAGED Fm (INCH/HR) = 0.37
AREA-AVERAGED Fp (INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.87
TOTAL AREA (ACRES) = 764.8 PEAK FLOW RATE (CFS) = 503.86

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 1.33 HALFSTREET FLOOD WIDTH (FEET) = 73.29
FLOW VELOCITY (FEET/SEC.) = 5.96 DEPTH*VELOCITY (FT*FT/SEC.) = 7.95
NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
AND L = 1264.0 FT WITH ELEVATION DROP = 23.0 FT, IS 96.2 CFS,
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 111.00
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 111.00 = 20599.00 FEET.

FLOW PROCESS FROM NODE 111.00 TO NODE 112.00 IS CODE = 62

>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<
STREET TABLE SECTION # 2 USED)<<<

UPSTREAM ELEVATION (FEET) = 3604.00 DOWNSTREAM ELEVATION (FEET) = 3573.00
STREET LENGTH (FEET) = 1348.00 CURB HEIGHT (INCHES) = 8.0
STREET HALF WIDTH (FEET) = 40.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 30.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0250
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0250

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 516.38
***STREET FLOWING FULL***

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 1.30
HALFSTREET FLOOD WIDTH (FEET) = 71.46
AVERAGE FLOW VELOCITY (FEET/SEC.) = 6.52
PRODUCT OF DEPTH & VELOCITY (FT*FT/SEC.) = 8.45
STREET FLOW TRAVEL TIME (MIN.) = 3.44 Tc (MIN.) = 81.46

*100 YEAR RAINFALL INTENSITY (INCH/HR) = 1.066

SUBAREA LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE / SCS SOIL / AREA / Fp / Ap / SCS
LAND USE / GROUP / (ACRES) / (INCH/HR) / (DECIMAL) / CN
RESIDENTIAL
".4 DWELLING/ACRE" / B / 40.64 / 0.42 / 0.900 / 76

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA (ACRES) = 40.64 SUBAREA RUNOFF (CFS) = 25.05
EFFECTIVE AREA (ACRES) = 805.41 AREA-AVERAGED Fm (INCH/HR) = 0.37
AREA-AVERAGED Fp (INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.87
TOTAL AREA (ACRES) = 805.4 PEAK FLOW RATE (CFS) = 506.39

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 1.29 HALFSTREET FLOOD WIDTH (FEET) = 71.09
FLOW VELOCITY (FEET/SEC.) = 6.48 DEPTH*VELOCITY (FT*FT/SEC.) = 8.35

*NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
AND L = 1348.0 FT WITH ELEVATION DROP = 31.0 FT, IS 96.1 CFS,
WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE 112.00
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 112.00 = 21947.00 FEET.

END OF SUBAREA STREET FLOW HYDRAULICS:
END OF STUDY SUMMARY:
TOTAL AREA (ACRES) = 805.4 TC (MIN.) = 81.46
EFFECTIVE AREA (ACRES) = 805.41 AREA-AVERAGED Fm (INCH/HR) = 0.37
AREA-AVERAGED Fp (INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.868
PEAK FLOW RATE (CFS) = 506.39

END OF RATIONAL METHOD ANALYSIS
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<th>POINT NUMBER</th>
<th>SUBAREA</th>
<th>AREA (ACRES)</th>
<th>SOIL TYPE</th>
<th>TC MIN.</th>
<th>I (in/hr)</th>
<th>Fm (Avg)</th>
<th>Fm (cfs)</th>
<th>Q-SUM (cfs)</th>
<th>PATH (ft)</th>
<th>SLOPE</th>
<th>V (ft/ft)</th>
<th>FPS</th>
<th>HYDRAULICS AND NOTES</th>
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Page 1
**DESCRIPTION OF STUDY:**
ARROW ENGINEERING SERVICES
HESPERIA WEST (PV SOLAR PROJECT) 20 ACRES APN 0405-372-40
HYDROLOGY FLOWS FOR NODES 100-112

--- [SAN BERNARDINO COUNTY] ---

**FILE NAME:** 6148HYD3.DAT
**TIME/DATA OF STUDY:** 14:56 11/30/2012
**CALCULATED BY:**
**CHECKED BY:**

--- [AMC III LOSSES] ---
**100-YEAR STORM RATIONAL METHOD STUDY**
**ADVANCED ENGINEERING SOFTWARE**

--- PAGE NUMBER 2 OF ---

<table>
<thead>
<tr>
<th>CONCENTRATION POINT NUMBER</th>
<th>AREA (ACRES)</th>
<th>SUBAREA SUM</th>
<th>SOIL DEP. TYPE</th>
<th>TT MIN.</th>
<th>Tc TIME</th>
<th>I (in/hr)</th>
<th>Fm (Avg)</th>
<th>Q-SUM (cfs)</th>
<th>PATH (ft)</th>
<th>SLOPE</th>
<th>V</th>
<th>HYDRAULICS AND NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.0 ft-Street Flow To Pt.#110.00</td>
<td>86.7</td>
<td>723.39</td>
<td>B</td>
<td>4D/AC</td>
<td>8.6</td>
<td>74.6</td>
<td>1.13</td>
<td>0.25</td>
<td>0.365</td>
<td>500.6</td>
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<tr>
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<td>41.4</td>
<td>764.77</td>
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<td>2.5AC</td>
<td>3.5</td>
<td>78.0</td>
<td>1.10</td>
<td>0.38</td>
<td>0.366</td>
<td>503.9</td>
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<tr>
<td>112.00</td>
<td>40.6</td>
<td>805</td>
<td>B</td>
<td>2.5AC</td>
<td>3.4</td>
<td>81.5</td>
<td>1.07</td>
<td>0.38</td>
<td>0.367</td>
<td>506.4</td>
<td>---</td>
<td>---</td>
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<tr>
<td>112.00</td>
<td>805</td>
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<td></td>
<td>81.5</td>
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<td></td>
<td></td>
<td>506</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

**EFFECTIVE AREA = 805.41 Acres**
**TOTAL AREA = 805.41 Acres**
**PEAK FLOW RATE = 506.39 cfs**
**TIME OF CONCENTRATION (MIN.) = 81.46**

**MEAN VALUES:**
Fp = 0.423 (in/hr); Ap = 0.868; Fm = 0.367 (in/hr)
Soil Chemical Properties

- Calcium Carbonate (CaCO₃)
- Cation-Exchange Capacity (CEC-7)
- Effective Cation-Exchange Capacity (ECEC)
- Electrical Conductivity (EC)
- Gypsum
- pH (1 to 1 Water)
- Sodium Adsorption Ratio (SAR)

Soil Erosion Factors

- K Factor, Rock Free
- K Factor, Whole Soil
- T Factor
- Wind Erodibility Group
- Wind Erodibility Index

Soil Physical Properties

- Available Water Capacity
- Available Water Supply, 0 to 100 cm
- Available Water Supply, 0 to 150 cm
- Available Water Supply, 0 to 25 cm
- Available Water Supply, 0 to 50 cm
- Bulk Density, 15 Bar
- Bulk Density, One-Tenth Bar
- Bulk Density, One-Third Bar
- Linear Extensibility
- Liquid Limit
- Organic Matter
- Percent Clay
- Percent Sand
- Percent Silt

Summary by Map Unit - San Bernardino County, California, Mojave River Area (CA671)

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>134</td>
<td>HESPERIA LOAMY FINE</td>
<td>B</td>
<td>20.2</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>SAND, 2 TO 5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Totals for Area of Interest

- 20.2 acres (100.0%)

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.

- 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. Only the soils that in their natural condition are in group D are assigned to dual classes.

<table>
<thead>
<tr>
<th>Rating Options — Hydrologic Soil Group</th>
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<tbody>
<tr>
<td><strong>Aggregation Method:</strong> Dominant Condition</td>
</tr>
<tr>
<td><strong>Component Percent Cutoff:</strong> None Specified</td>
</tr>
<tr>
<td><strong>Tie-break Rule:</strong> Higher</td>
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</tbody>
</table>

**Soil Qualities and Features**

- AASHTO Group Classification (Surface)
- Depth to a Selected Soil Restrictive Layer
- Depth to Any Soil Restrictive Layer
- Drainage Class
- Frost Action
- Frost-Free Days
- Hydrologic Soil Group

**View Options**

- Map
- Table
- Description of Rating
- Rating Options
- Detailed Description

**Advanced Options**

- Aggregation Method: Dominant Condition
- Component Percent Cutoff
- Tie-break Rule: Lower, Higher

**Water Features**

- Depth to Water Table
- Flooding Frequency Class
- Ponding Frequency Class
### PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹

<table>
<thead>
<tr>
<th>Duration</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>500</th>
<th>1000</th>
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</thead>
<tbody>
<tr>
<td>5-min</td>
<td>0.092</td>
<td>0.128</td>
<td>0.176</td>
<td>0.216</td>
<td>0.271</td>
<td>0.314</td>
<td>0.358</td>
<td>0.405</td>
<td>0.469</td>
<td>0.520</td>
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<tr>
<td>10-min</td>
<td>0.132</td>
<td>0.183</td>
<td>0.252</td>
<td>0.309</td>
<td>0.388</td>
<td>0.450</td>
<td>0.514</td>
<td>0.580</td>
<td>0.673</td>
<td>0.745</td>
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<tr>
<td>15-min</td>
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<td>0.222</td>
<td>0.217</td>
<td>0.265</td>
<td>0.317</td>
<td>0.370</td>
<td>0.422</td>
<td>0.486</td>
<td>0.573</td>
<td>0.615-1.34</td>
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<td>30-min</td>
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<td>0.331</td>
<td>0.456</td>
<td>0.588</td>
<td>0.701</td>
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<td>1.21</td>
<td>1.35</td>
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<tr>
<td>60-min</td>
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<td>0.470</td>
<td>0.646</td>
<td>0.792</td>
<td>0.989</td>
<td>1.10</td>
<td>1.29</td>
<td>1.49</td>
<td>1.72</td>
<td>1.91</td>
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<tr>
<td>2-h</td>
<td>0.498</td>
<td>0.667</td>
<td>0.895</td>
<td>1.08</td>
<td>1.35</td>
<td>1.55</td>
<td>1.78</td>
<td>2.01</td>
<td>2.32</td>
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<td>1.65</td>
<td>1.90</td>
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<td>2.45</td>
<td>2.84</td>
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<tr>
<td>6-h</td>
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<tr>
<td>12-h</td>
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<td>2.12</td>
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<td>8.73</td>
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<td>15.0</td>
<td>17.0</td>
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<tr>
<td>20-day</td>
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<td>5.98</td>
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<td>13.2</td>
<td>15.0</td>
<td>18.1</td>
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<tr>
<td>30-day</td>
<td>3.59</td>
<td>5.02</td>
<td>7.00</td>
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<td>13.2</td>
<td>15.4</td>
<td>18.1</td>
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<td>24.1</td>
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<td>45-day</td>
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<td>27.5</td>
<td>31.3</td>
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<tr>
<td>60-day</td>
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<td>19.0</td>
<td>23.0</td>
<td>27.5</td>
<td>31.3</td>
<td>33.0</td>
</tr>
</tbody>
</table>

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

Numbers in parentheses 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.

Source: National Weather Service, Silver Spring, Maryland

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Coordinates: 34.3914, -117.3617

Average recurrence interval (years)
- 1
- 2
- 5
- 10
- 25
- 50
- 100
- 200
- 500
- 1000

Duration
- 5-min
- 10-min
- 15-min
- 30-min
- 60-min
- 2-hr
- 3-hr
- 6-hr
- 12-hr
- 24-hr
- 4-day
- 7-day
- 10-day
- 30-day
- 60-day
- 60-dy

NOAA/NWS/OHD/HDSC
Created (GMT): Thu Nov 29 16:41:58 2012
Back to Top
Maps & aerials
Small scale terrain

Calculation for Weighted Average

Land use pervious percentage between nodes 109 and 110

<table>
<thead>
<tr>
<th>Total Acres = 86.70</th>
<th>% pervious</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres RL = 55.70 AC</td>
<td>90</td>
<td>= 5013</td>
</tr>
<tr>
<td>Acres CN = 31 AC</td>
<td>10</td>
<td>= 310</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5323</td>
</tr>
</tbody>
</table>

\[
\frac{5323}{86.70AC} = 61.4 \text{ pervious}
\]

therefore use 60% 

Ref: 12-6148
Hesperia West
Solar Project
Bandicoot - Node 112: 507 cfs

Channel Calculator

Given Input Data:
- Shape: Trapezoidal
- Solving for: Depth of Flow
- Flowrate: 570.0000 cfs
- Slope: 0.0230 ft/ft
- Manning's n: 0.0350
- Height: 5.0000 ft
- Bottom width: 12.0000 ft
- Left slope: 0.3300 ft/ft (V/H)
- Right slope: 0.3300 ft/ft (V/H)

Computed Results:
- Depth: 2.7986 ft
- Velocity: 9.9449 fps
- Full Flowrate: 1855.1394 cfs
- Flow area: 57.3160 ft²
- Flow perimeter: 29.8607 ft
- Hydraulic radius: 1.9194 ft
- Top width: 28.9610 ft
- Area: 135.7576 ft²
- Perimeter: 43.9104 ft
- Percent full: 55.9713%

REF: HESPERIA WEST SOLAR PROJECT
APN 0405-372-40
S.B. COUNTY

DEPTH
2.2' FREE BOARD

CHANNEL
13'
ACCESS RD

42'
ACCESS RD

13'
55' WIDTH NEEDED

100' WIDTH PROVIDED

Page 1
Looking northerly down Fuente Avenue. Standing near the northwest corner of the property. This erosion illustrates a fairly large volume has flowed in this location recently.

Looking southerly down Fuente Avenue. Standing near the southwest corner of the property. This erosion illustrates a fairly large volume is flowing from the south and the west at this location.
Looking northerly down Fuente Avenue along the westerly project boundary. Standing near the southwest corner of the property.

Looking westerly down El Centro. Standing near the southwest corner of the property. Some water is entering Fuente from the west.
Looking southerly down the 84’ drainage easement from approximately the midpoint of the southern property line on El Centro Road. This erosion illustrates a fairly low volume has flowed in this location recently.

Looking northerly down Bandicoot along the easterly project boundary. Standing near the southeast corner of the property.