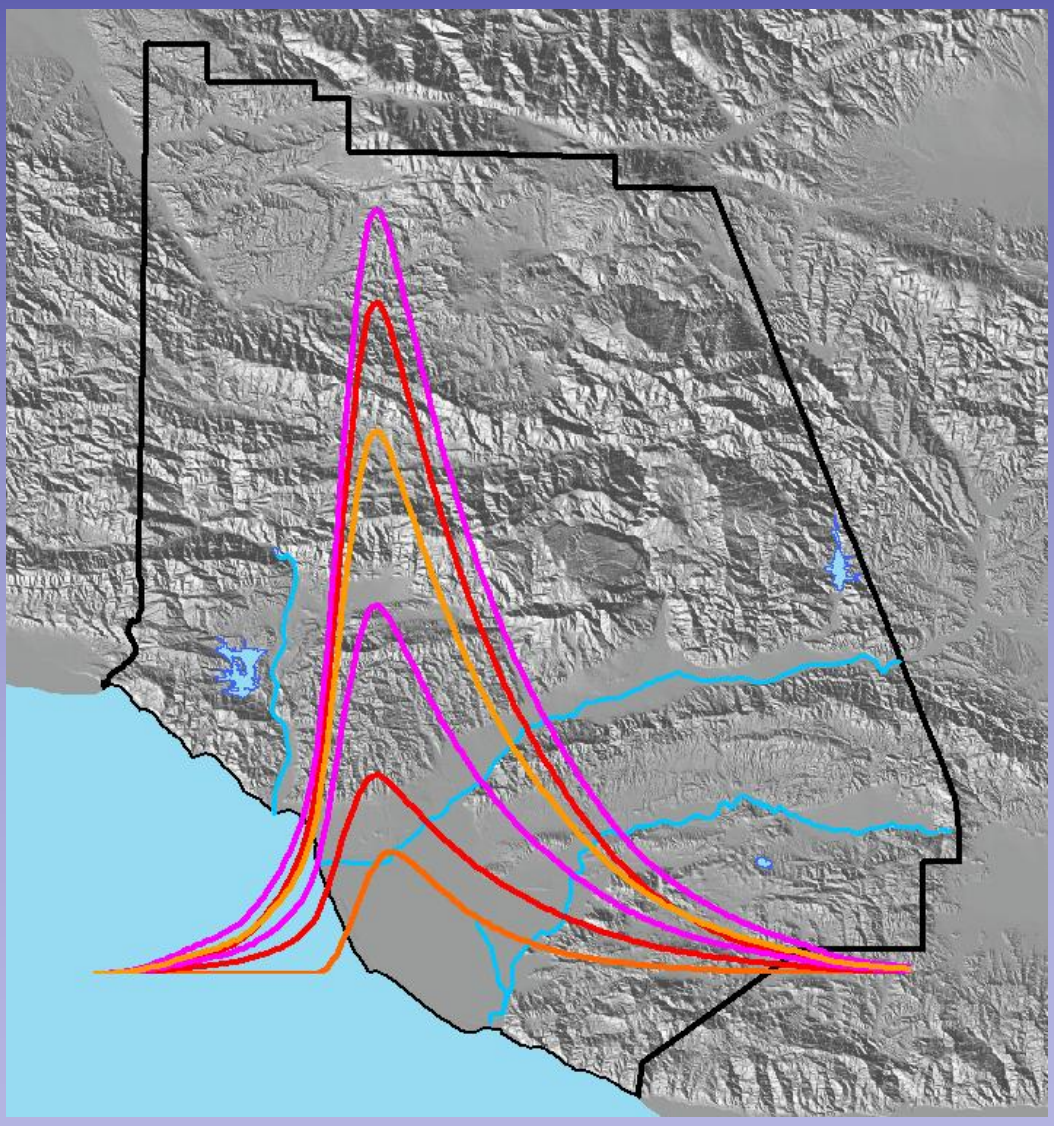
VENTURA RIVER WATERSHED DESIGN STORM MODELING

ADDENDUM III



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Hydrology Section
Watershed Resources and Technology Division
Ventura County Watershed Protection District

Ventura County

Watershed Protection District

Hydrology Section

Project 11033

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EXECUTIVE SUMMARY

This report documents the work done by the Ventura County Watershed Protection District (District) using the calibrated Ventura River HSPF Model (Tetra Tech 2009 Draft). The model was previously used to provide the design storm peaks for hydraulic modeling and floodplain mapping of the river and its tributaries for the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS). The report prepared by the District (February, 2010) served as the basis for the hydrology evaluation performed by FEMA's contractor for the study. The approach involved identifying a storm that caused saturated conditions in the model and then applying 100-yr design storm balanced hyetographs for each rain gage used in the HSPF Model. Flood Frequency Analysis (FFA) results of stream data from gaged tributaries were used to calibrate the model in the modeling. Ungaged tributary HSPF results were verified by comparing the HSPF results to previous modeling study results.

Report Addendum I described work done to update the HSPF model based on site-specific studies done since February, 2010. The addendum (VCWPD 2010a) contained information about adjustments to the model due to a redelineation of the Canada De San Joaquin (CSJ) watershed based on consultant feedback and field visits to the watershed. Addendum II described the work to produce and evaluate the hydrographs from the CSJ and East Ojai portion of the HSPF model for use in two-dimensional flow models (FLO-2D). The major East Ojai watersheds of interest included the McNell, Thacher, and Senior-Gridley watersheds.

The current Addendum describes the work done to add four tributaries in the vicinity of Matilija Dam and two tributaries near Canada Larga to the model. In addition, subarea 371incorporating the lower portion of San Antonio Creek below Lion Canyon was split into two subareas to provide more refinement of the model in this area.

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1. INTRODUCTION

This report provides design peak flows for six additional tributaries in the Ventura River Watershed. The work done previously to provide design peak flows for the tributaries and mainstem reaches included in FEMA's Flood Insurance Study (FIS) was documented in the District's February 2010 report. In that report, the calibrated Ventura River HSPF Model (Tetra Tech 2009) was used as the basis for generating the tributary design storm peaks for use in hydraulic modeling of the river and its tributaries in this study. The design storm flows for the Ventura River mainstem were provided by the USBR as a result of their work on the Matilija project. (USBR, 2004). The tributaries in the study included most of the major creeks downstream of the Matilija Dam.

Since that report was published, other projects evaluating the hydrology in the watershed have been finished and have provided better information related to the hydrology of various watersheds. Addendum I (August, 2010a) contained information about adjustments to the model due to a refinement of the Canada De San Joaquin (CSJ) watershed. Addendum II (May, 2011) provides a summary of the work done to generate hydrographs from the HSPF model for use in studies of the CSJ area and the East Ojai floodplain mapping study for FEMA. The main tributaries in the East Ojai study watershed include the Senior-Gridley Creeks, McNell Creek, and Thacher Creek.

In April, 2012, the calibration of the continuous model was re-evaluated to see if the matches to hydrograph peaks from major historic storms could be improved (VCWPD, 2012). The revised parameter sets obtained from the calibration update were then used in the design storm model. The design storm model was then refined to provide design storm peaks for several tributaries that had been the subject of data requests in past years. This current report describes the revisions to the design storm model and the tributaries results.

2. NEW TRIBUTARIES

Figure 1 shows the Ventura River watershed. Figure 2 shows the four new tributaries included in the model in the vicinity of the Matilija Dam. New subareas 917 and 918 were created from the original subarea 912, and 915 and 916 were created from the original subarea 913. The tributaries are Wills Canyon (915), Rice Canyon (916), Kennedy Canyon (917), and an unnamed tributary to the north of Cozy Dell Canyon (918). Figure 3 shows the refinement of the original lower San Antonio Creek watershed (371) into two subareas (371 and 372). Figure 4 shows the two new tributaries (Canada de las Encinas, 868 and Canada Rodriguez, 865) added to the model in the original mainstem subarea 875.

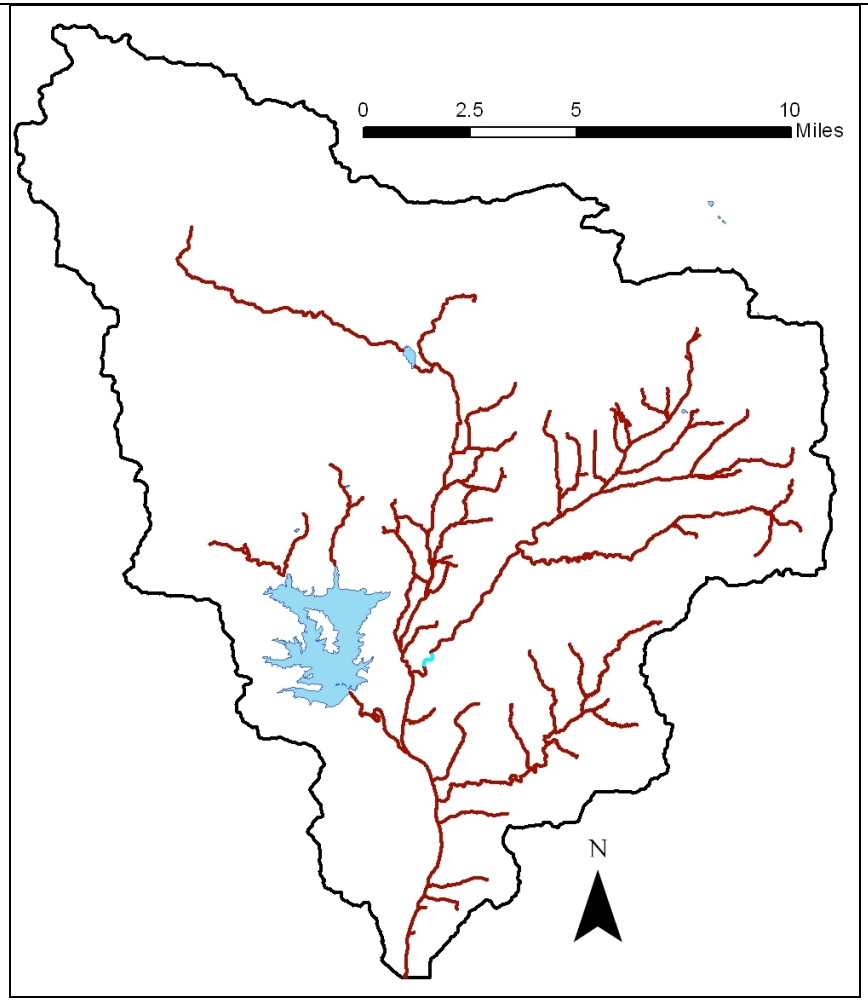

Figure 1 – Ventura River Watershed

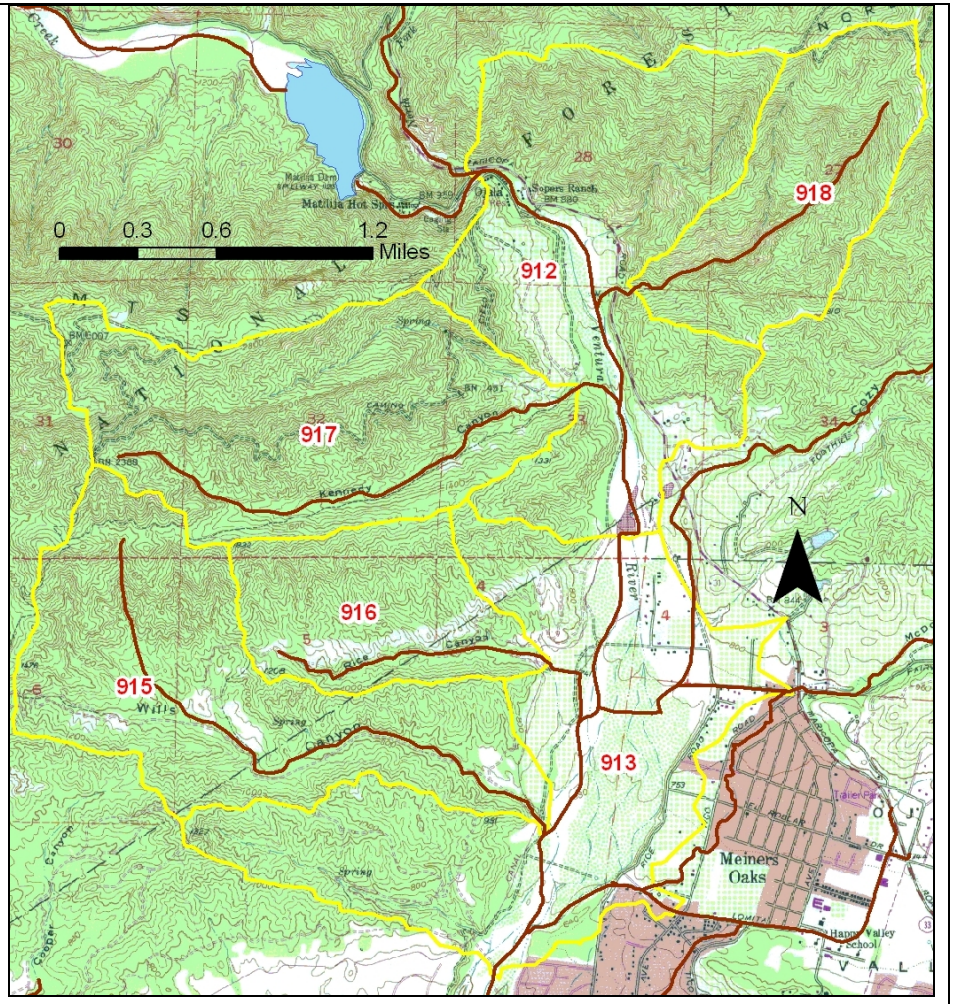

Figure 2 – New Tributaries Near Matilija Dam

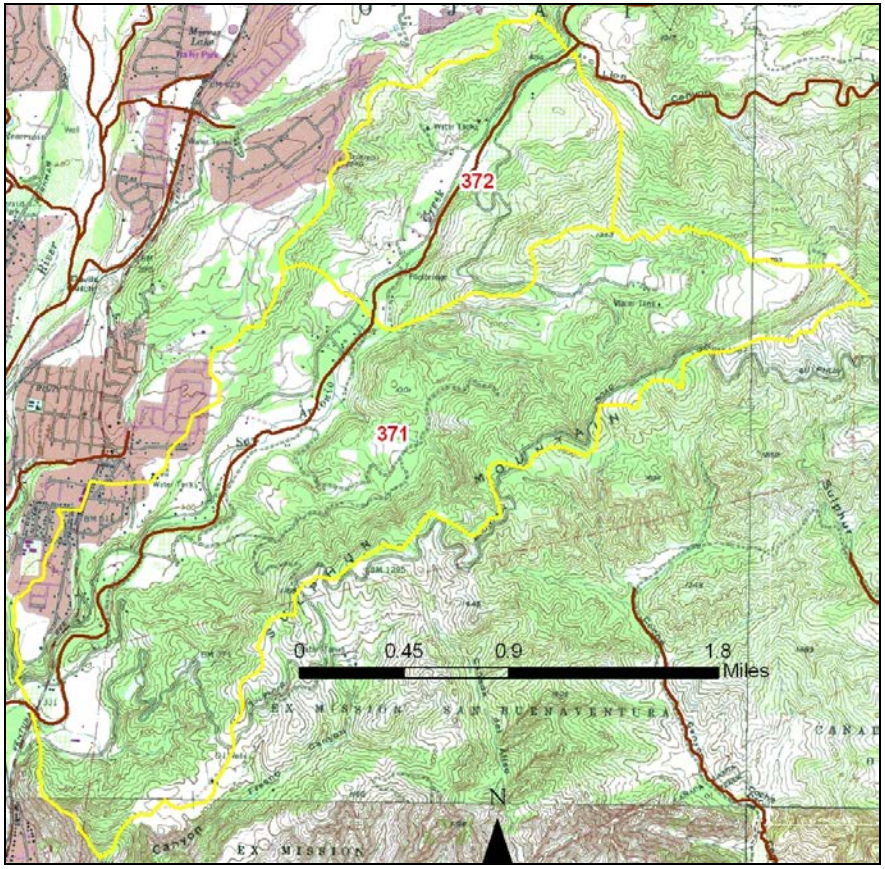

Figure 3 – Revised San Antonio Creek Subareas

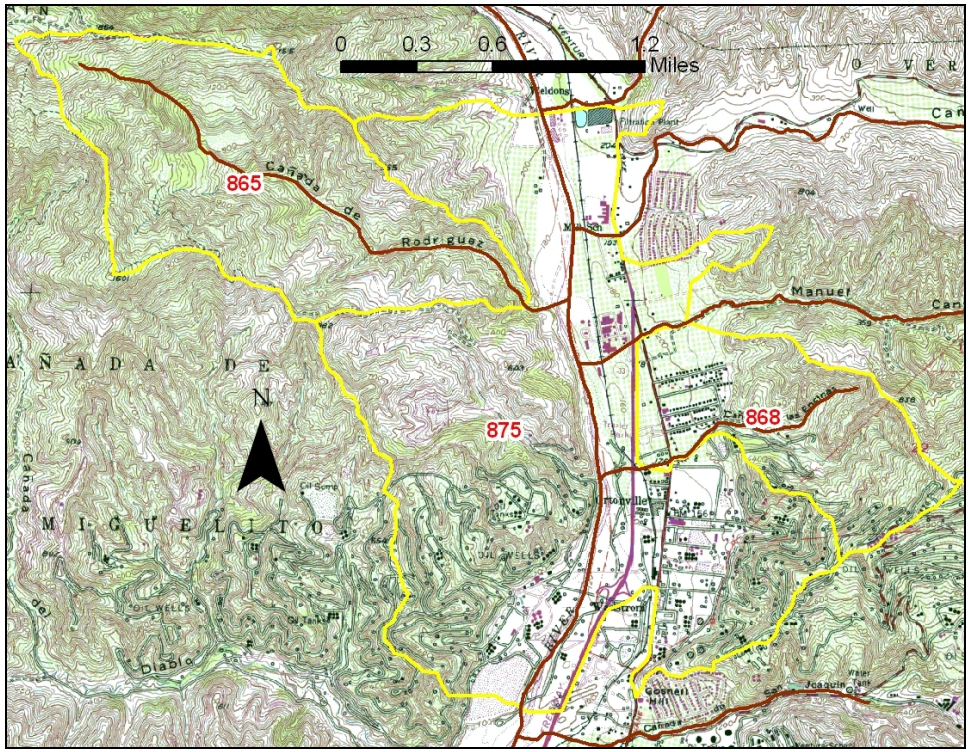

Figure 4 – Revised Lower Ventura River Subareas

2.1 Revised Land Use

The land use files used to generate the HSPF input data in the original Tetra Tech (2009) model were used in this study. The revised subarea boundaries were applied to the spatial information in the Tetra Tech geodatabase and summary tables of the land uses were generated. The land uses and their associated areas were then entered into the design storm files.

2.2 Revised FTables

The new and revised subareas each had an FTable assigned to them containing the stage-storage-discharge information used for flow routing in the HSPF model. For revised subareas such as San Antonio Creek 371 and 372, the surface areas and volumes were assigned to each reach according to the respective reach length ratios based on the original reach length for 371. After the revision, the reach length for subarea 372 was about 35% of the total.

The reach lengths for the new subareas were generated based on the reach lengths measured in GIS and the slopes calculated from the elevations shown on topo maps of the watersheds. Normal depth calculations using the Bentley FlowMaster program were used to develop rating tables that could be used to create FTables in the HSPF input file.

As the slopes were relatively steep in the undeveloped tributary watersheds (865, 868, 915-8), the flow was supercritical with an assumed n value of 0.035. Previous experience in creating FTables for use in the HSPF program has shown that natural channels will attempt to form energy dissipaters because supercritical channel conditions are not stable for long periods of time. Therefore, in those other studies and in this one, the depth of flow for a given flow level is assumed to be at critical depth and surface areas and flow volumes are calculated using this assumption.

2.3 Reach Assignments

HSPF has the underlying assumption embedded in it that any tributary inflow added to a mainstem reach is assumed to be added at the upstream end of the mainstem reach and is thus subject to routing for the entire length of the mainstem reach. For most of the new tributaries added to the model, this assumption was concluded to be valid. However, for new subarea 915 created out of original subarea 913, the confluence is sufficiently near the downstream end of 913 that the reach was connected to the upstream end of the next downstream mainstem reach, 825. Therefore, peak flows for reach 913 in the revised model are slightly smaller than peak flows from the original model.

2.4 Design Storm Peaks

Table 1 shows a summary of the design storm peaks extracted from the revised model. Also included are modeling results from historical studies where available.

Table 1. 100-Yr Design Storm Peak Flow Summary Table

Reach	Stream Name	Area ac	HSPF Peak Flow cfs	Peak/Area Ratio cfs/ac	Previous Study Q100 cfs	Source
RCH 865	Canada de Rodriguez	779	1,400	1.80	NA	NA
RCH 868	Canada de las Encinas	402	762	1.90	684	VCWPD, 2005 (1)
RCH 915	Wills Canyon	839	1,630	1.94	NA	NA
RCH 916	Rice Canyon	372	820	2.20	NA	NA
RCH 917	Kennedy Canyon	828	1,510	1.82	NA	NA
RCH 918	N. of Cozy Dell	462	915	1.98	NA	NA
RCH 372	San Antonio Blw Lion Cyn	30,694	38,900	1.27	NA	NA
RCH 371	San Antonio at Vta River (Gage 605)	32,928	38,000	1.15	38,200	VCWPD, 2010
RCH 912	Ventura River below Matilija (Gage 602)	49,547	33,900	0.68	27,100 34,500	USBR '02 FEMA '97
RCH 913	Ventura River at Cozy Dell	50,988	32,300	0.63	NA	NA
RCH 875	Ventura River nr Encinas	136,876	78,000	0.57	78,900 77,000	USBR '02 FEMA '97

Notes: (1) Estimated for School Fire analysis based on 2.9 cfs/ac in burned area from Prince Barranca Hydrology Study in 2005.

The tributaries added to the model have not been studied previously by the District and so validation information is not available. The peak/area ratio values range from 1.80 to 2.20 cfs/ac for the undeveloped subareas. The largest ratio of 2.2 cfs/ac is obtained from the smallest subarea added to the model, Rice Canyon.

One estimate exists for Canada de las Encinas based on the Q100 ratio obtained from the Prince Barranca hydrology study in 2005 to evaluate the watershed response to the School Fire Incident. The mainstem flow peaks are available from the USBR or FEMA reports. The San Antonio Q100 was developed through a flow frequency analysis of the stream gage data and was used to calibrate the model at that location.

2.5 Discussion and Results

The results presented in Table 1 show that the model with updated parameters from the continuous model calibration update gives reasonable design storm peak flow ratios compared to previous data providing by VCWPD (2010). The results at other comparions points in the watershed were either that same or slightly higher by 1-2%. The differences were not considered large enough relative to the uncertainties related to rainfall intensities and stream channel routing parameter to issue an update of the February 2010 results. Therefore, those results are still considered to represent the official hydrology for the watershed except where they were updated by Addenda I or II.

2.6 File Summary

K:\WRT\hydrology\Watersheds\Ventura\WPP-Prop50\HSPF\DesignStorm\Design Storm Model\Updated6-09\2012Update
Contains updated HSPF input and output files and spreadsheets used to provide updated FTable, initial conditions, and model results.

K:\WRT\hydrology\Watersheds\Ventura\WPP-Prop50\HSPF\GIS
Contains GIS files and .jpg maps used for yield analyses and in this report.

K:\WRT\hydrology\Watersheds\Ventura\WPP-Prop50\HSPF\DesignStorm\FinalRept2-2010\ReptAddenda
This report.

4. REFERENCES

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