1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study/Letter of Map Revision for Cosumnes River is to update and revise the existing Zone A of the Flood Insurance Rate Maps for Sacramento County Unincorporated Areas Panel Number 275D and 400D dated July 1998.

Community Name - Sacramento County (Community Number 060262)
State - California

1.2 Authority and Acknowledgements

The hydraulic analysis for this study is prepared by Civil Engineering Solutions, Inc., the Study Contractor for the Sacramento County. The study was completed in November 2008.

1.3 Coordination

In July of 2008, an initial Consultation and Coordination Meeting was held with representative of the Sacramento County Department of Water Resources and the Study Contractor. The stream to be studied and limits of the study were identified at the meeting. Available mapping and other data identified at a subsequent meeting between the Sacramento County Department of Water Resources and the Study Contractor.

During the conduct of the study, meetings, telephones and e-mail discussions have been held between the Study Contractor and representative of the Sacramento County Department of Water Resources.

The Sacramento County Department of Water Resources has provided the funding for this study and all relevant data such as hydrologic data, field survey and topographic mapping.
2.0 AREA STUDIED

2.1 The stream studied by detailed methods in this study is the Cosumnes River located within the easterly portion of the Sacramento County and flows from northeast to southwest. See attached vicinity map.

The downstream study limit begins at Dillard Road and ends approximately one (1) mile upstream of Michigan Barr Road. The total study reach is approximately 9.8 miles.

This reach of the Cosumnes River is studied by Approximate Method and shown as Zone A on the effective Flood Insurance Rate Map for Sacramento County Panel Number 275D and 400D dated July 1998 (reference 1).

2.2 Community Description

The community description is presented in the Flood Insurance Study for the unincorporated areas of Sacramento County.

2.3 Principal flood problems

There are documented significant flood problems along the Cosumnes River in the study area.

2.4 Flood protection Measures

The Cosumnes River within the study reach is in natural conditions and no major channelization or other flood protection measures exists along the study reach. There is water diversion dam constructed across the Cosumnes River channel approximately --- feet upstream of State Highway 16 Bridge. The dam is a concrete structure about 10 feet high and 3 feet wide and diverts irrigation water during low flow periods. There are four (4) bridges crossing Cosumnes River along the study reach.
3.0 ENGINEERING ANALYSES

3.1 Hydrologic Analyses

The 10-, 50-, 100- and 500-year peak discharges used in this study were determined by U. S. geological Survey (reference 2). The U. S. geological Survey has operated a stream flow gauging station (No.11335000) on Cosumnes River from 19907 to 2007. The gauging station is located on the downstream side of the Michigan Barr Road Bridge. The peak discharges are summarized on Table 1.

<table>
<thead>
<tr>
<th>Flooding Source &amp; Location</th>
<th>Drainage Area (Sq. Mi)</th>
<th>10-Year (cfs)</th>
<th>50-Year (cfs)</th>
<th>100-Year (cfs)</th>
<th>500-Year (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosumnes River at Michigan Barr</td>
<td>536</td>
<td>34,200</td>
<td>66,800</td>
<td>82,900</td>
<td>125,000</td>
</tr>
</tbody>
</table>

3.2 HYDRAULIC ANALYSES

Water surface elevations were computed utilizing the U. S. Army Corp of Engineers (COE) HEC-RAS computer program (reference 3). The following parameters were used:

- The geometry of the Cosumnes River channel and overbank floodplain areas were primarily derived from topographic mapping based on the Sacramento County latest LIDR data. The areas within the channel banks were field surveyed to verify the accuracy of the topographic mapping and to get a better definition of the channel invert elevations.

- As a part of the reconnaissance effort, a field inventory and measurement process was completed to determine the location, size and characteristics of all existing bridges and other hydraulic structures.

- The Manning’s roughness coefficient ‘n’ values were established based on field observations and the USGS publication (reference 4). The channel roughness varies between 0.022 and 0.022 for earthen natural channel and overbank roughness values ranges from 0.03 to 0.069. The Manning’s ‘n’ values were calibrated to the USGS Rating Curve published flow and stage values. The following graph shows that an exact calibration was not obtained, but a best fit was.
- Contraction and expansion coefficients for open channel sections of 0.1 and 0.3 were used in accordance with the COE guidelines. Contraction coefficients of 0.3 and expansion coefficients of 0.5 were used at bridges.

- The downstream starting water surface elevations for 10-year through 500-year are based on known water surface elevations as determined by U.S. geological Survey (reference 2) at the Dillard Road Bridge (upstream side), which was the upper limit of their study reach. The U. S. geological Survey has performed a detailed hydraulic analysis of Cosumnes River using WSPRO computer model to determine water surface elevations for 5-year through 500-year and 100-year floodplain limits under several conditions. The U. S. geological Survey study started at State Highway 99 (at the downstream) and ended at Dillard Road. This study begins at Dillard Road and continues upstream to the Sacramento County limit line. The U. S. geological Survey study is included in the appendix of this report.

- Supercritical flow conditions can occur in some channel reaches. In accordance with FEMA’s guidelines, subcritical analyses were conducted to determined base flood elevations for Cosumnes River.
- Calibration of the model is the process used to insure that the model predicts actual system behavior as closely as possible. The HEC-RAS model for Cosumnes River was calibrated with stream gauge data (water surface elevations) for different storm events at Michigan Barr Bridge. Parameters in the HEC-RAS model such as Manning’s roughness coefficient ‘n’ values are then adjusted until the model output (water surface elevations) matched closely the historical gauge data for a specific storm event.

- Surveys and Datums: The Sacramento County Base LiDAR obtained for the limits of this Study, and other County areas, was obtained in 1997. We considered this LiDAR to be recent and accurate enough to establish base topography for this study. We verified the LiDAR data, by obtaining spot shots near the channel bank full locations of the stream. Supplemental surveys were also performed to obtain THALWEG elevations at the cross section locations. All Data included in these studies was prepared using the National Geodetic Vertical Datum of 1929 (NGVD 29), and the 1983 North American Datum (NAD83) for horizontal measurements.

4.0 FLOODPLAIN MANAGEMENT APPLICATION

The floodplain and floodway boundaries as determined by the hydrologic and hydraulic analyses have been delineated on Sacramento County one inch equal 300 foot horizontal scale topographic mapping with 1 foot contour interval.

4.1 Flood Boundaries

In accordance with the FEMA guideline, floodplain boundaries have been defined based on base flood elevations as determined by subcritical flow analyses. In channel reaches where supercritical flow conditions could occur, the base flood elevations are based on critical depth. In this study two analyses were performed, one With Levees and the other Without Levees. Two base flood elevations are shown on the work maps representing the With Levees and Without Levees conditions.

4.2 Floodway

The floodway presented in this study is initially computed on the basis of equal conveyance reduction from each side of the floodplains. Where flows are contained within the channel, the floodway boundaries coincidence with the 100-year floodplain limits. The results of these computations were tabulated at selected cross sections and presented here as Table 2.
An annotated copy of the effected FEMA FIRM is attached in appendix.

BIBLIOGRAPHY AND REFERENCES

Federal Emergency Management Agency, Flood Insurance Study, Sacramento Count, California (unincorporated Areas), Washington, DC.


WATER SURFACE PROFILES
FLOODPLAIN and FLOODWAY
BOUNDARY MAPS

(WORK MAPS)
HEC-RAS FILES DISKETTE