Improving Emergency Coordination on the Sacramento River and the Cosumnes River Systems

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Purpose and Goals

• Develop a system to generate dynamic flood inundation maps in near real-time

• Leverage on high resolution topographic data, hydraulic models, improved hydrologic forecasts, and web-based mapping applications

• Supplement flood intelligence (river stage forecast)

• Improve flood intelligence information exchange through web-based applications
RTIM Tool and Main Steps

• Insert CNRFC forecast data into:

• Run hydraulic model:

• Develop real-time & forecast flood stages and flood inundation maps
Why Hydraulic Routing?

- Additional Stage Forecast Locations
- Effectively evaluate areas affected by backwater
- Hydraulically complex areas
- Tidal effects
- Levee breaches
- Lateral diversions (gates)
- Off-channel storage areas
Sacramento River System Model Layout

- 44 total boundary conditions
- 6 CNRFC forecast releases
  - 3 CNRFC downstream tidal
- 22 Local Watersheds
- 10 Constant flow conditions
- Sacramento Weir 48 Gates

Model 2D Extents
RTIM Tool
Sacramento River Watersheds Uncontrolled vs. Controlled

I. Sacramento River Watershed Total
(Approximately 27,500 sq. mi.)

II. Controlled Watersheds:
- Shasta; (6,980 sq. mi.)
- Oroville; (3,625 sq. mi.)
- NBB; (1,140 sq. mi.)
- CFW; (400 sq. mi.)
- American(2,050 sq. mi.)

II. Uncontrolled Local Watershed
(13,300 sq. mi.)

III. Tidal Influence:
- San Francisco Bay
Testing the Forecasting Tool
February 2017 Results

February 8, 2017 Forecast Model Results
American River at H Street

Date: February 2017
American River at H Street (AME, R01, RS: 6.591)
Model Evaluation: February 9, 2017, 1:00 P.M.
Testing the Forecasting Tool
February 2017 Results

American River at H Street (AME, R01, RS: 6.591)
Model Evaluation: February 10, 2017, 1:00 P.M.

River Stage (Feet, NAVD 88)

Hindcast
Forecast

February 2017

- HEC-RAS Model
- CNRFC Forecast
- CDEC Gage
- Model Evaluation
Sacramento River at I Street (SAC, R08, RS: 59.789)
Model Evaluation: February 10, 2017, 1:00 P.M.

- **Hindcast:** The historical data showing the river stage over time.
- **Forecast:** The predicted river stage using the forecasting tool.

The graph compares the HEC-RAS Model, CNRFC Forecast, and CDEC Gage for the period of February 2017.
Yolo Bypass at Lisbon (YOL, R03, RS: 36.073)
Model Evaluation: February 10, 2017, 1:00 P.M.
Cosumnes River Forecast Model

I. Controlled Watersheds:
• Mokelumne River (2,100 sq. mi.)

II. Uncontrolled Watersheds:
• Cosumnes River (724 sq. mi.)
• Morrison Creek (125 sq. mi.)

III. Tidal Influence
• San Francisco Bay into Sacramento and San Joaquin Rivers
Cosumnes River System Model Layout

- 5 total boundary conditions
  - 1 CNRFC forecast locations (Michigan Bar)
  - 1 CNRFC downstream tidal (Benson Ferry)
- 1 Local Watersheds
  - 2 Constant flow conditions
- No Diversion Gates
- Mokelumne River Reservoir Control
Testing the Cosumnes River Forecast
February 11, 2017

- Map provided 1.5-day lead time
- Local flow gage was lost.
- Flood timing was reasonable
- Computed stage was low by 1’
- Forecast allowed evacuation of small planes and equipment from Franklin Field
Cosumnes River System
Flow Comparison
February 2017 vs. 1997

- Cosumnes River at McConnell near Highway 99
  - 2017 – 46,000 cfs
  - 1997 – 104,000 cfs
Cosumnes River
1997 vs. February 2017
Stage Comparison

- **Cosumnes River at McConnell**
  - 2017 Peak Stage – El. 43.4’
  - 1997 Peak Stage – El. 47.9’

- **Mokelumne at Bensons Ferry**
  - 2017 – El. 20.7’
  - 1997 – El. 21.7’

- **San Joaquin River**
  - Tidal @ Approx. 9.0’
Key Elements for Successful Flood Forecasting

• Accurate Forecast Data
  • Communication between NWS and Reservoir Operators (F-CO)
  • Local flows

• Well represented, robust, and faster running hydraulic model

• High resolution animations, improved user experience with the tool, and disseminate information using web-based GIS mapping platform
Challenges

• Dependent on accurate NWS 6-hour forecasts
• Improving the model stability to run a wide range of flows
• Simplifying the system-wide model to improve run times without compromising the accuracy
• HEC-RAS software limitations (e.g. limited parallel processing abilities)
• Improving the RTIM user experience
Next Steps

• Enhance features in the RTIM tool
• Improve user experience with the RTIM tool
• Coordinate with CNRFC on local flows and RTIM applications
• Improve coordination with locals
• Update the model geometry with the latest data
• Improve model run time
State Officials Open More Flood Gates at Sacramento Weir

Questions