**TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS**

---

# Form I—Project Information

1. **Proposal Title:**
TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

2. **Proposal applicants:**
Peter Rabbon, California State Reclamation Board

3. **Corresponding Contact Person:**
Peter Rabbon
California State Reclamation Board
1416 Ninth Street, Room 1601 Sacramento, CA 95814
(916) 653-5434
prabbon@water.ca.gov

4. **Project Keywords:**
- Flood Plain and Bypass Management
- Hydrodynamics
- Modeling

5. **Type of project:**
Planning

6. **Does the project involve land acquisition, either in fee or through a conservation easement?**
No

7. **Topic Area**:
Floodplains and Bypasses as Ecosystem Tools

8. **Type of applicant:**
State Agency

9. **Location - GIS coordinates:**
Latitude: 38.545
Longitude: -121.614
Datum:

**Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.**

The targeted location of this proposal is the 59,000-acre Yolo Bypass, which is located in eastern Yolo and Solano Counties and lies in a general north to south direction extending from Fremont Weir downstream to Egbert Tract. Its leveed northern reach lies west of the Sacramento River and is bisected by Interstates 5 and 80. Its southern reach is bounded to the east by the Sacramento River Deep Water Ship Canal levee.

10. **Location - Ecozone:**
10.1 Cache Creek, 10.2 Putah Creek, 10.3 Solano, 10.4 Willow Slough, and 1.1 North Delta

11. **Location - County:**
Solano, Yolo

12. **Location - City:**
Does your project fall within a city jurisdiction?
No

13. **Location - Tribal Lands:**
Does your project fall on or adjacent to tribal lands?
No

14. **Location - Congressional District:**
3

15. **Location:**
**California State Senate District Number:** 4
**California Assembly District Number:** 8

16. **How many years of funding are you requesting?**
2

17. **Requested Funds:**
a) Are your overhead rates different depending on whether funds are state or federal?
No

If no, list single overhead rate and total requested funds:
Single Overhead Rate: 182% (see comments box)
Total Requested Funds: $500,257

b) Do you have cost share partners already identified?
No

c) Do you have potential cost share partners?
Yes. In a May 10, 2002 letter to CALFED, the Sacramento Area Flood Control Agency (SAFCA) pledged to contribute $50,000 per year for 2 years, provided this project is approved for funding in 2002.

d) Are you specifically seeking non-federal cost share funds through this solicitation?
No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. **Is this proposal for next-phase funding of an ongoing project funded by CALFED?**
No

Have you previously received funding from CALFED for other projects not listed above?
No

19. **Is this proposal for next-phase funding of an ongoing project funded by CVPIA? No**
Have you previously received funding from CVPIA for other projects not listed above?
No

20. **Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA?**
No

**Please list suggested reviewers for your proposal.** (optional)

21. **Comments:**
Question 17a:
-Hourly Overhead Rate = Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary = (1.47 x 1.92 x Salary) – Salary = 182%
-Indirect Costs = Direct Labor Hours x Hourly Overhead Rate
-All benefits accounted for in indirect costs

# Form III—Environmental Compliance Checklist

1. **CEQA or NEPA Compliance**
a) Will this project require compliance with CEQA?
No

b) Will this project require compliance with NEPA?
No

c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.
This proposal will result in no state or federal discretionary action that would be considered a project under CEQA or any action under NEPA.

2. **If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies).** *If not applicable, put "None".*
CEQA Lead Agency:
NEPA Lead Agency (or co-lead:)
NEPA Co-Lead Agency (if applicable):

3. **Please check which type of CEQA/NEPA documentation is anticipated.**
**CEQA**
**-**Categorical Exemption
**-**Negative Declaration or Mitigated Negative Declaration
**-**EIR
**X**none

**NEPA**
**-**Categorical Exclusion
**-**Environmental Assessment/FONSI
**-**EIS
**X**none

If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. **CEQA/NEPA Process**
a) Is the CEQA/NEPA process complete?
Not Applicable

b) If the CEQA/NEPA document has been completed, please list document name(s):

5. **Environmental Permitting and Approvals** (*If a permit is not required, leave both Required?*
*and Obtained? check boxes blank.*)

**LOCAL PERMITS AND APPROVALS**
Conditional use permit
Variance
Subdivision Map Act
Grading Permit
General Plan Amendment
Specific Plan Approval
Rezone
Williamson Act Contract Cancellation
Other
**STATE PERMITS AND APPROVALS**
Scientific Collecting Permit
CESA Compliance: 2081
CESA Compliance: NCCP
1601/03
CWA 401 certification
Coastal Development Permit
Reclamation Board Approval
Notification of DPC or BCDC
Other
**FEDERAL PERMITS AND APPROVALS**
ESA Compliance Section 7 Consultation
ESA Compliance Section 10 Permit
Rivers and Harbors Act
CWA 404
Other
**PERMISSION TO ACCESS PROPERTY**
Permission to access city, county or other local agency land.
Agency Name:
Permission to access state land.
Agency Name:
Permission to access federal land.
Agency Name:
Permission to access private land.
Landowner Name:

6. **Comments.**
No permits are required for this proposed project.

# Form IV—Land Use Checklist

1. **Does the project involve land acquisition, either in fee or through a conservation easement?**
No

2. **Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?**
Yes

3. **Do the actions in the proposal involve physical changes in the land use?**
**No**
If you answered no to #3, explain what type of actions are involved in the proposal (i.e., research only, planning only).
This proposal involves the refinement and update of a hydraulic model.

4. **Comments.**
Question #2: Access across public or private property within the Yolo Bypass may be required for field checks to support the development and refinement of the proposed model.

# Form V—Conflict of Interest Checklist

Please list below the full names and organizations of all individuals in the following categories:

- Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded.
- Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded.
- Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal.

The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

**Applicant(s):**
Peter Rabbon, California State Reclamation Board

**Subcontractor(s):**
Are specific subcontractors identified in this proposal?
No

**Helped with proposal development:**
Are there persons who helped with proposal development?
Yes

If yes, please list the name(s) and organization(s):

**U.S. Corps of Engineers, Sacramento District**
- Johnnie A. Mack
- John Carroll
- Gregory Kukas

**Department of Water Resources, Division of Flood Management**
- Stein Buer
- Steve Yaeger
- Ricardo Pineda
- Steve Gold
- Boone Lek

**California State Reclamation Board**
- Steve Bradley

# Form VI—Budget Summary

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.

**Independent of Fund Source**

# Budget Summary--Cont'd

| Year 1 (Feb 2003 to Feb 2004) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Task No.** | **Task Description** | **Direct Labor Hours** | **Avg. Annual Salary** | **Avg. Annual Benefits** | **Travel** | **Supplies or Expendables** | **Services or Consultants** | **Other Direct Costs** | **Total Direct Costs** | **Indirect Costs** | **Total Cost** |
| 1 | Project Coordination and Management | 196 | 75,716 | 0 | 0 | 0 | 0 | 0 | 7,111 | 12,959 | 20,070 |
| 2 | Topography Acquisition | 40 | 75,716 | 0 | 0 | 0 | 0 | 80,000 | 81,451 | 2,645 | 84,096 |
| 3 | Model Development | 554 | 75,716 | 0 | 0 | 0 | 0 | 0 | 20,099 | 36,629 | 56,728 |
| 4 | Calibration, Reliability Testing, and Sensitivity Analyses | 530 | 75,716 | 0 | 0 | 0 | 0 | 0 | 19,228 | 35,042 | 54,270 |
| 5 | Case Study Application | | | | | | | | | | |
| 6 | Documentation and Production | 206 | 75,716 | 0 | 0 | 0 | 0 | 0 | 7,474 | 13,620 | 21,094 |
| 7 | Quality Control | 108 | 75,716 | 0 | 0 | 0 | 0 | 0 | 3,918 | 7,141 | 11,059 |
| 8 | Revisions and Release | | | | | | | | | | |
| 9 | Technical Workbook Development | | | | | | | | | | |
| 10 | Public Outreach: YBF* | | | 0 | 0 | 0 | 3,500 | 0 | 3,500 | 0 | 3,500 |
| | Total | 1,634 | | 0 | 0 | 0 | 3,500 | 80,000 | 142,782 | 108,035 | **250,817** |

# Budget Summary--Cont'd

| Year 2 (Feb 2004 to Feb 2005) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Task No.** | **Task Description** | **Direct Labor Hours** | **Avg. Annual Salary** | **Avg. Annual Benefits** | **Travel** | **Supplies or Expendables** | **Services or Consultants** | **Other Direct Costs** | **Total Direct Costs** | **Indirect Costs** | **Total Cost** |
| 1 | Project Coordination and Management | 108 | 78,617 | 0 | 0 | 0 | 0 | 0 | 4,068 | 7,414 | 11,483 |
| 2 | Topography Acquisition | | | | | | | | | | |
| 3 | Model Development | | | | | | | | | | |
| 4 | Calibration, Reliability Testing, and Sensitivity Analyses | 510 | 78,617 | 0 | 0 | 0 | 0 | 0 | 19,212 | 35,011 | 54,223 |
| 5 | Case Study Application | | | | | | | | | | |
| 5a | Planning | 52 | 78,617 | 0 | 0 | 0 | 0 | 0 | 1,959 | 3,570 | 5,529 |
| 5b | Design | 260 | 78,617 | 0 | 0 | 0 | 0 | 0 | 9,794 | 17,849 | 27,643 |
| 5c | Impact Assessment/ Documentation | 106 | 78,617 | 0 | 0 | 0 | 0 | 0 | 3,993 | 7,277 | 11,270 |
| 5d | Quality Control | 56 | 78,617 | 0 | 0 | 0 | 0 | 0 | 2,110 | 3,844 | 5,954 |
| 6 | Documentation and Production | 402 | 78,617 | 0 | 0 | 0 | 5,000 | 0 | 20,143 | 27,597 | 47,741 |
| 7 | Quality Control | 240 | 78,617 | 0 | 0 | 0 | 5,000 | 0 | 14,041 | 16,476 | 30,517 |
| 8 | Revisions and Release | 250 | 78,617 | 0 | 0 | 0 | 0 | 0 | 9,418 | 17,162 | 26,580 |
| 9 | Technical Workbook Development | | | 0 | 0 | 0 | 25,000 | 0 | 25,000 | 0 | 25,000 |
| 10 | Public Outreach: YBF* | | | 0 | 0 | 0 | 3,500 | 0 | 3,500 | 0 | 3,500 |
| | Total | 1,984 | | 0 | 0 | 0 | 38,500 | 0 | 113,237 | 136,201 | **249,440** |

# Budget Summary--Cont'd

**GRAND TOTAL = 500,257**

**COMMENTS:**

| **Notes:** | |
|---|---|
| Salary: | Expected 2003 GS12-10 Salary For Year 1<br>Expected 2004 GS12-10 Salary For Year 2 |
| Benefits: | All benefits accounted for in indirect costs |
| Indirect Costs: | Indirect Costs = Direct Labor Hours x Overhead Rate |
| Overhead Rate: | Corps Engineering Division Overhead Multiplier * Indirect Cost Multiplier * Salary - Salary |
| *The Yolo Basin Foundation to provide meeting facilities for public outreach of the model. | |

# Form VII—Budget Justification

**Direct Labor Hours.** Provide estimated hours proposed for each individual.
Corps staff (GS-12-10): 3178 Hours
DWR staff (Avg. Range D): 440 Hours

**Salary.** Provide estimated rate of compensation proposed for each individual.
Corps staff annual salary: Year 1=$75,716, Year 2=$78,617
Used same annual salary for DWR staff, since salaries of DWR and Corps staff are comparable.

**Benefits.** Provide the overall benefit rate applicable to each category of employee proposed in the project.
Benefits are accounted for in indirect costs.

**Travel.** Provide purpose and estimate costs for all non-local travel.
None

**Supplies & Expendables.** Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.
None

**Services or Consultants.** Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

- Task 6 (Documentation and Production) = $5,000
- Task 7 (Quality Control) = $5,000
- Task 9 (Technical Workbook Development) = $25,000
- Task 10 (Public Outreach) = $7,000.

**Equipment.** Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.
None

**Project Management.** Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentations, response to project specific questions and necessary costs directly associated with specific project oversight.
Total cost of Project Management and Coordination is $31,553.

**Other Direct Costs.** Provide any other direct costs not already covered.
Acquisition of new topographic data = $80,000

**Indirect Costs.** Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs.

- Indirect Costs = Direct Labor Hours x Hourly Overhead Rate
- Corps Hourly Overhead Rate = Engineering Division Overhead Multiplier x Indirect Cost Multiplier x Salary = (1.47 x 1.92 x Salary) – Salary = $66.12/hr (Year 1), $68.65/hr (Year 2)
- Used same overhead rate for DWR staff, since total costs per hour of DWR and Corps staff are comparable.

# Form II—Executive Summary

Project Title: Two-Dimensional Detailed Hydraulic Model For Determining Flood Conveyance Impacts of Ecosystem Restoration Projects in the Yolo Bypass

Amount Requested: $500,257.

Geographic Location: The targeted location of this proposal is the 59,000-acre Yolo Bypass (Bypass) located in CALFED ERP Sacramento and Delta Regions and in Ecozones 10 (Yolo Basin) and 1.1 (North Delta).

Project Type: This proposal involves updating and refining an existing two-dimensional (2-D) hydraulic model of the Bypass.

Project Objective: The objective of this proposed CALFED project effort is the topographic update and improvement of the existing Yolo Bypass RMA-2 2-D hydraulic model. The new Yolo Bypass 2-D would provide the California State Reclamation Board (the Board) and restoration proponents with a useful tool to effectively evaluate the hydraulic impacts to flood capacity of the Bypass. As the regulating agency, the Board requires applicants to provide a hydraulic analysis of any proposed restoration or any land-use modification project, which demonstrates that the proposal does not adversely impact the flood conveyance capacity. Currently, the cost of developing a model capable of accurately demonstrating neutral or beneficial impact is generally a considerable burden and potentially cost prohibitive to individual restoration proponents.

Approach: The finalization of the proposed model will include: 1) acquisition of more accurate and best available geometry data, 2) calibration, reliability testing, and sensitivity analyses, 3) application of case studies, and 4) documentation with the User's Manual and technical workbook. The Board will coordinate with the U.S Army Corps of Engineers and the Department of Water Resources in this project.

Expected Outcome: In addition to the proposed model, a User's Manual and technical workbook will also be developed to provide guidelines for usage of the model. The finalized model, its User's Manual and the technical workbook would be provided on a CD-R, and would include documentation of case studies.

Relationship to CALFED ERP and/or CVPIA Goals: This proposal addresses ERP priorities for the Sacramento and Delta Regions, specifically for the Yolo Basin and North Delta Ecological Management Zones, of which the Yolo Bypass is part. Indeed, while striving to achieve ERP goals and priorities for the Bypass, its flood conveyance capacities and adjacent flood control components of the SRFCP *must* be maintained. The availability of the proposed model would facilitate responsible ecosystem restoration project development and management leading to advancements towards ERP goals envisioned by CALFED for the Bypass.

# Proposal

## California State Reclamation Board

## TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

# TWO-DIMENSIONAL DETAILED HYDRAULIC MODEL FOR DETERMINING FLOOD CONVEYANCE IMPACTS OF ECOSYSTEM RESTORATION PROJECTS IN THE YOLO BYPASS

## A. Project Description: Project Goals and Scope of Work

### 1. Background

The Yolo Bypass (Bypass) is a critical component of the Sacramento River Flood Control Project (SRFCP). It is a leveed floodplain covering an area of approximately 59,000 acres located in eastern Yolo and Solano Counties (Figure 1). It lies in a general north to south orientation and spans approximately 43 miles from Fremont Weir downstream to Egbert Tract. Its purpose is to convey and contain floodwaters from virtually the entire Sacramento River drainage basin between its levees, providing flood protection to the nearby Cities of Sacramento, West Sacramento, Davis, and Woodland. The SRFCP was designed to divert 343,000 cubic feet per second (cfs) from the Sacramento River into the Bypass via the Fremont Weir and to divert another 112,000 cfs from the American River into the Bypass via the Sacramento Weir. The Bypass also accepts floodwater contributions from Cache Creek, Willow Slough Bypass, Putah Creek, and Knight's Landing Ridge Cut. The Bypass design discharge is 480,000 cfs downstream of the Interstate 80 crossing and 490,000 cfs downstream of the Putah Creek tributary.

The Bypass also represents a tremendous opportunity for the restoration of substantial amounts of aquatic and riparian terrestrial habitats within California's Central Valley and Sacramento River Delta. Efforts are currently underway to convert the land use of at least 25,000 acres in the Bypass from agricultural crop production to wildlife habitat restoration and creation. The Bypass itself links a large, diverse, and active community of proponents interested in maximizing the value of this unique regional ecological and public safety resource. This community includes representatives from multiple local, state, and federal government entities as well as many private non-profit groups, local residents, and landowners. Habitat creation, restoration, and management are primary mission areas of many of these groups, virtually assuring continued interest in future land-use conversion activities in the Bypass.

The California State Reclamation Board (the Board) owns the important responsibility of ensuring that the flood conveyance capacity of the Bypass and other designated floodways is maintained. As part of the SRFCP implementation, the Board purchased flowage easements on lands in the Bypass. Consequently, the Board regulates floodway land use activities by requiring a project proponent to enter into an agreement with the Board or by administering an encroachment permit program. Under this program, project or land-use change proponents are required to apply for a permit for any activity that could potentially encroach on the floodway's conveyance, regardless of the purpose of the proposed activity. A permit signifying Board approval must be issued prior to the initiation of any construction activity in the Bypass associated with any project. For restoration projects of any significance, a hydraulic impact assessment demonstrating neutral or beneficial hydraulic impact is required for a Board permit to be

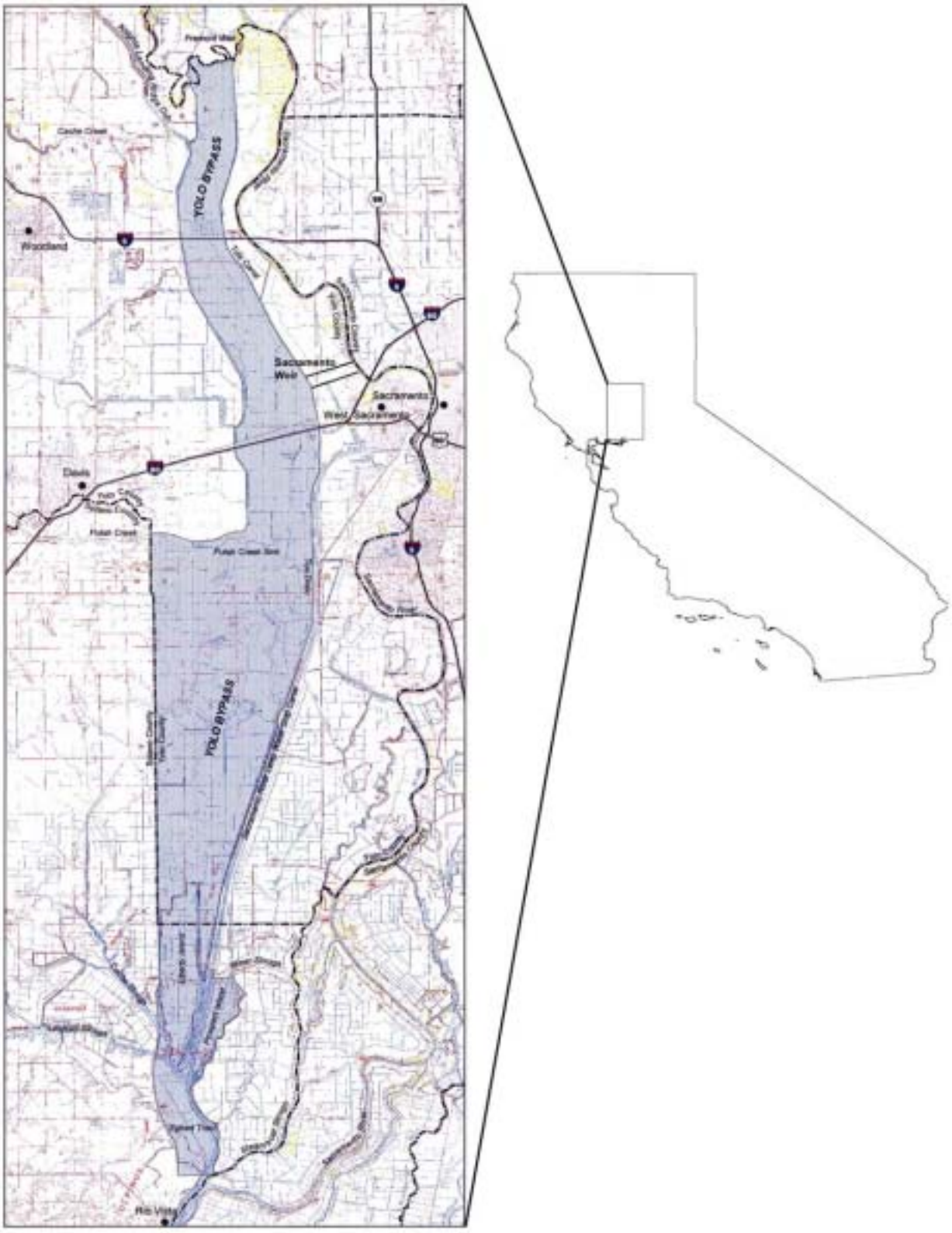



**Figure 1.** The Yolo Bypass (Source, Yolo Bypass Management Strategy)

issued. This impact assessment generally requires a comparison of pre- and post-project (steady-state) hydraulic modeling results.

Bypass restoration proponents recognize the need for hydraulic impact assessments. However, the cost of developing a model capable of accurately demonstrating neutral or beneficial impact is generally a considerable burden and potentially cost prohibitive to individual restoration proponents. The availability of an accurate and reliable baseline condition hydraulic model of the Bypass would significantly reduce the costs of performing an impact assessment and greatly assist decision-makers in administering responsible habitat restoration, creation, and management in the Bypass.

The primary goal of this proposed CALFED project effort is the update and improvement of an existing two-dimensional (2-D) hydraulic model of the Bypass. The new model would be capable of supporting meaningful, reliable, precise and accurate assessments of the hydraulic impacts of proposed land-use changes in the Bypass. The availability of this tool would greatly facilitate responsible habitat restoration, creation, and management within the Bypass. Additional products of the proposed effort include a User's Manual for the model and a workbook to guide Board permit applicants. Additional objectives and planned outcomes of the effort include the development of modeling and impact assessment standards; planning, design, and impact assessment support of an actual restoration project; and the development of useful information to assist in future Bypass restoration planning and design efforts.

## 2. Problem

The technical requirements associated with accurately portraying water surface (stage) impacts on the order of < 0.1' are relatively rigorous. The lack of availability of an accurate, precise, reliable, and suitably sophisticated baseline hydraulic model is a substantial impediment to restoration activities in the Bypass.

Standard hydraulic modeling practice requires that all physical and hydraulic boundary conditions be represented in the hydraulic model. Additionally, the input hydraulic (flow and stage) boundary locations must also be located a sufficient distance from the area of interest so as not to influence and also fully capture simulation results. These requirements generally dictate that an area much greater than the specific area of interest be included in the hydraulic model. In the case of the Bypass, laterally confining levees (or high ground) would have to be captured in the model. Given the strong backwater character of the Bypass, both the downstream stage and upstream inflow boundaries would likely need to be a considerable distance away from the area of interest to avoid influencing and fully capture hydraulic impact results, respectively.

These minimum hydraulic model development requirements, and additional efforts generally required to calibrate and validate a hydraulic model, represent a substantial burden on restoration proponents. Indeed, costs to perform this work might often exceed the entire planning and design budgets of proposed restoration projects, depending on the scale of the project.

Existing hydraulic models of the Bypass are available for use by restoration proponents, but the models are severely limited by their usability and/or the accuracy of their results.

A UNET 1-D hydraulic model of the entire SRFCP, including the Bypass, was developed as part of the Board and U.S. Army Corps of Engineers' (Corps) Sacramento and San Joaquin River Basins Comprehensive Study (Comp Study). The Comp Study UNET model coverage of the Bypass consists of cross-sections spaced at 1000' intervals, with additional cross-sections at the locations of the various bridge crossings. The Comp Study UNET model was calibrated and validated using data from the 1986 and 1997 flood events and has been used extensively and successfully to analyze the entire SRFCP system.

The Comp Study UNET model is significantly less adept at accurately portraying localized water surface conditions. The model is primarily limited by its 1-D character. UNET produces a single, average water surface elevation result per cross-section and is therefore unable to explicitly address laterally varying water surfaces. This limitation is particularly relevant to cases where a restoration project might only have a localized impact on water surface elevations. UNET would necessarily average the impact across the width of the Bypass, providing no clear indication of the amount or location of the actual maximum impact. This limitation is critical in cases where a localized or maximum impact might occur either directly adjacent to or sufficiently distant from a confining project levee. In each case, the decision to approve or disapprove a Board permit application would likely be affected.

In general, because 1-D models implicitly simplify flow behavior, they require more judgment in both their application and results interpretation compared to 2-D models.

An existing 2- D hydraulic model is available, but the resolution of its topographic base and stability problems severely limit its utility.

In 1995, the U.S. Army Corps of Engineers (Corps) successfully developed and utilized an RMA-2 2-D hydraulic model to determine the hydraulic impacts of the proposed Yolo Basin (Vic Fazio) Wetlands Project. A plan to create a comprehensive Yolo Bypass Model (the 660k model) by expanding coverage of the Vic Fazio project model to cover the entire Yolo Bypass was enacted shortly thereafter. The 660k model relied on the best available topography for its geometric basis, which often consisted of USGS 1"=2,400' quad sheet contour maps. As a result, the model geometry's resolution and accuracy is limited over a significant portion of its area. Additionally, unanticipated calibration and stability problems prevented full model calibration and reliability testing. As a result, the 660k model is significantly limited in terms of its accuracy and reliability.

More detailed discussion on the 660k model calibration and stability issues, and on the plan to overcome those problems is provided in the Approach (Task 4) and Feasibility sections.

## 3. Objective

The objective of this proposed CALFED project effort is the topographic update and improvement of the existing Yolo Bypass RMA-2 2-D hydraulic model. The new Yolo Bypass 2-D model (the model) would provide the Board and restoration proponents with a useful tool to effectively evaluate the hydraulic impacts to flood conveyance capacity of the Yolo Bypass. The model's geometry would be updated and refined based on newly available and acquired topography. The model would be calibrated, validated

and tested extensively to ensure a product with improved accuracy, end-user operability and reliability. Sensitivity analysis application of the model would be performed to develop standard model input parameters. A case study application of the model in support of an actual restoration project would be performed and documented. A User's Manual prescribing model standards and usage, and documenting the case study application, would be developed. Additionally, a technical workbook guiding Board permit applicants on whether the 2-D model or more simplified models or analysis is adequate to assess the impacts of their proposed project would be developed.

## 4. Justification

The model allows a more precise definition of the flood conveyance impact by land use and Bypass configuration modification proposals within the Yolo Bypass than other available hydraulic models. Along with other future projects, the proposed model would support the CALFED ERP funded Yolo Bypass Management Strategy (Management Strategy), which was finalized in August 2001 by the Yolo Basin Foundation (YBF). This project would provide an essential tool for future restoration project proposals within the Bypass, as part of CALFED or other programs. The model can also be used in the design analysis of alternative measures to mitigate for the impact caused by the proposed project.

**RMA-2 Model:** RMA-2 is a two-dimensional depth averaged finite element hydrodynamic numerical model. It computes water surface elevations and horizontal velocity components for subcritical, free-surface flow in two-dimensional flow fields. RMA-2 solves the depth-integrated equations of fluid mass and momentum conservation in two horizontal directions.

RMA-2 explicitly addresses laterally varying roughness conditions and computes laterally varying water surfaces. This provides needed resolution of computed water surfaces that allows accurate determinations of water surface impacts.

RMA-2 was initially developed for the Corps in 1973, and has been revised and improved many times since its inception. RMA-2 is frequently applied by water resource engineering professionals nationwide to the analysis of two-dimensional surface water flow conditions. RMA-2 is maintained and supported by the Corps at its Engineer Research and Development Center (ERDC), formerly the Waterways Experiment Station (WES), in Vicksburg, Mississippi.

RMA-2 is supported by the pre- and post-processing program SMS (Surface-water Modeling System). SMS is a user friendly, graphically based platform for developing input files and viewing solution files for RMA-2 and other surface water modeling programs. SMS supports raster image backgrounds and allows users to import digital drafting drawings, facilitating both model development and interpretation of results. SMS is a product of the Environmental Modeling Research Laboratory of Brigham Young University in cooperation with ERDC.

## 5. Approach

The model would consist of a single finite element mesh geometric representation of the Bypass and short segments of its tributaries, design discharge inflow data for the tributaries, design stage data for the model's downstream boundaries, and baseline

condition discharge and stage data for each of approximately 15 internal boundaries spread along the length of the Bypass. Model users would first "trim" the geometry to an appropriate size by deleting portions of the total mesh upstream and downstream of internal boundary locations capturing, and sufficiently distant from, the area of interest. Then, baseline conditions would be established by running the trimmed model using standard input parameters and the baseline stage and discharge data provided. In some cases, the baseline model geometry and/or roughness coefficients in the area of interest would need to be refined prior to establishing baseline conditions in order to more accurately reflect existing hydraulic conditions therein. Proposed conditions would be represented in the model by modifications to its geometry and roughness coefficients, and the associated hydraulic conditions would be established by applying the same standard input parameters and boundary conditions to the modified model. Comparison of the baseline and proposed condition model results would serve as the basis of the impact assessment. Generally, multiple iterations would be required until the proposed conditions produce neutral or beneficial hydraulic impact. Indeed, the model would essentially be used in both the planning and design of restoration projects in the Bypass in order to avoid negative hydraulic impacts.

The project work plan presented below is based on the proposed typical model usage described above. Ultimately, all efforts to improve end-user model operability would be included to the extent feasible.

**Task 1: Coordination (Budget = $31,553).** The primary objective of the coordination phase is to achieve consensus on appropriate and feasible model capabilities and usage by engaging the affected community. Factors to be considered and discussed include likely restoration activity scenarios, Board permit requirements, end-user needs and operability, and inherent model limitations. YBF would assist extensively in pulling together involved and affected parties and it is expected that the Yolo Basin Working Group (YBWG) meetings it administers would be the forum for much of the coordination activities and discussion.

Significant topics of continuous coordination and discussion would include methods to fund and implement model distribution, model maintenance and support, and future model improvements and updates. Additional topics of discussion would include design or baseline inflow boundary conditions to be used, Board permit application review procedure and Quality Control (QC) and Quality Assurance (QA) requirements. A QC/QA Plan would be developed during this phase.

Coordination with YBWG and the California Department of Fish and Game (DFG) would also be maintained regarding the planned expansion of the Vic Fazio Yolo Wildlife Area (Yolo Wildlife Area), a proposed model case study application candidate.

An additional activity that would occur during this phase is the establishment of funding distribution and control mechanisms and oversight.

**Task 2: Acquisition of Topography (Budget = $84,096).** Existing digital topographic data would be used as a basis for most of the model geometry. Topography data recently acquired in support of the Comp Study would serve as the basis for updating model geometry. The Comp Study data has a contour interval of 2 feet (=1 foot vertical accuracy), far surpassing the accuracy of much of the previously used data. It is

planned that additional topography would be acquired in select locations where existing topography is of limited accuracy (i.e. USGS Quadrangle sheet source) or of insufficient precision (i.e. at height-restricted levees and other relevant features). The primary location where additional data is required is in the vicinity of the Yolo Wildlife Area, just south of the Interstate 80 causeway. In this location, existing topography data does not account for project-related modifications.

**Task 3: Model Development (Budget = $56,728).** Model geometry would be updated based on the best available source data, including that acquired directly for this effort. SMS and Computer Aided Design and Drafting (CADD) technology would be used extensively to update and refine the model geometry. Optimal geometry development methodology would be determined and documented in the User's Manual. Standard geometry element size and configuration parameters would be identified and utilized.

**Task 4: Calibration, Reliability Testing and Sensitivity Analyses (Budget = $108,493).** This phase features a sizable modeling effort to maximize both the accuracy of computed baseline conditions and the functional reliability of the model, and to establish standard modeling parameters.

Model calibration would be pursued through unsteady flow simulations of the 1986 flood event and would rely on measured data as well as synthetic data from the Comp Study UNET model simulations. Calibration would be performed in a sub-mesh fashion rather than on the entire mesh. The model would also be verified using the 1997 flood event data. The 1986 and 1997 flood event data are anticipated to be adequate for calibration and verification of the model; however, the resolution of baseline surface roughness definitions (i.e. 'n' values) would be limited to a somewhat large (i.e. regional) scale. This level of baseline roughness condition resolution would still be appropriate for impact assessment purposes.

Extensive model troubleshooting and refinement efforts are anticipated during unsteady calibration and verification simulation. As a contingency plan, roughness coefficients determined for the Comp Study UNET model may be utilized if previously encountered calibration and stability problems are experienced. This method of assigning baseline roughness coefficients is less rigorous, but would still be satisfactory for impact assessment purposes.

Multiple simulations of design discharge conditions using various mesh sizes and internal boundaries would be performed to ensure functional reliability for the end-user.

Sensitivity analyses would be performed to determine standard model usage parameters including boundary condition locations, roughness coefficients and momentum exchange coefficients. Additional effort would be devoted to determining standard roughness coefficients to be used for emergent aquatic and riparian vegetation species and communities.

**Task 5: Case Study Application (Budget = $50,396).** A case study application of the model is proposed in support of planning, design, and permit application efforts of an actual or fictitious restoration project. Documentation of the case study would be included in the User's Manual. The objective of the case study is the illustration of typical model application activities and hydraulic impact assessment steps,

documentation, and level of detail required to support a Board permit application. The case study would provide a useful example for restoration project proponents.

Restoration activities associated with the planned expansion of the Yolo Wildlife Area being managed by DFG currently represent the top case study candidate. All case study cost estimates included with this proposal were developed assuming that the Causeway Ranch property component of the Wildlife Area expansion would be the basis of the case study as described below. However, it should be noted that if Causeway Ranch restoration planning and design progress isn't compatible with timely case study completion, then the case study content may depart from actual Causeway Ranch restoration efforts in order to complete the case study and meet the schedule included in this proposal. Additionally, the intent is to develop a case study that would lead to a successful permit application. If actual restoration designs are inconsistent with this objective, then the case study designs would differ in order to achieve neutral or beneficial hydraulic impact.

The Causeway Ranch covers about 3,000 acres in the Bypass (Figure 2). Proposed restoration activities planned for this area include active and passive establishment of aquatic and riparian vegetation and the establishment and management of permanent and seasonal wetlands habitat. Proposed management activities consist of vegetation control and periodic reconfiguration of wetland habitat cells and water supply ditches. Vegetation control would be achieved by a combination of approaches including hydro period manipulation, burning, and disking. Periodic reconfiguration would entail earth-moving activities to form wetland ponds and confining berms and water supply and drainage ditches.

Case study activities would include coordination with and limited assistance to restoration planning and design efforts, model simulations of baseline (existing) and alternative plan conditions, and development of the hydraulic impact assessment documentation required to support a Board permit application.

Planning assistance would be based on the results of preliminary modeling efforts performed for the purposes of model calibration and optimization as described previously, and on limited model simulations of various site configuration parameters (e.g. berm heights, wetland cell alignments, vegetative roughness increase, etc.).

Design assistance would consist of modeling simulation of design discharges under baseline and alternative plan conditions. It is assumed for this proposal that initially two (2) model simulation iterations would be performed for each of three (3) alternative plan conditions and that each alternative plan would include a significant amount of area requiring modification to the baseline mesh (geometry) configuration as well as roughness conditions. It is also assumed that an additional three (3) model simulations would be performed on a selected final restoration plan. It is further assumed that selection of roughness coefficients associated with alternative vegetation conditions based on standard handbook methods would be acceptable.

A hydraulic impact assessment based on comparison of baseline and final restoration plan simulations results would be performed. The impact assessment and other pertinent case study efforts performed would be documented to support the Board permit application process.

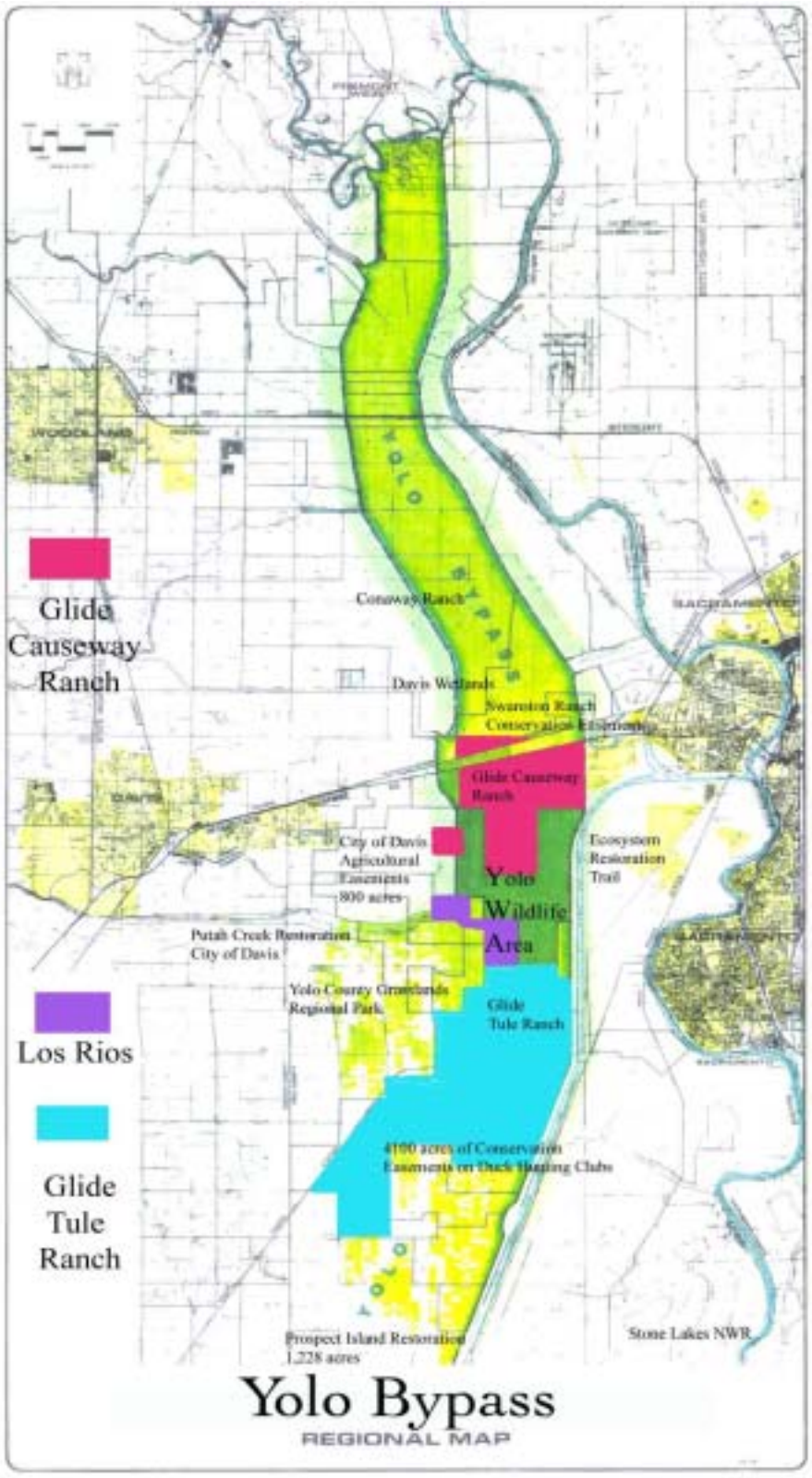



**Figure 2.** Recent Additions to the Vic Fazio Yolo Wildlife Area. (Source, Department of Fish and Game)

Quality Control would be performed on all case study application efforts performed and documents developed.

**Task 6: Documentation and Production (Budget = $68,834).** Documentation would include a Corps Office Report describing the overall model development effort and the User's Manual. A CD-R would be produced containing the User's Manual, the model, and associated supplementary items. Items to be provided with the model and manual include but are not limited to:

- Boundary condition files and index.
- Topographic base of the model.
- Digital aerial photographic images of the Bypass.

**Task 7: Quality Control (Budget = $41,576).** Quality Control (QC) and Quality Assurance (QA) activities would include seamless, peer, and final Independent Technical Review (ITR) performed by Corps personnel and/or contractors. Extensive review by DWR, the Board, and YBWG would also be performed. QC/QA procedures would be discussed and determined during the coordination phase, and a QC/QA Plan would be developed.

**Task 8: Revisions and Release (Budget = $26,580).** This phase features the revision of the model and manual and release of the CD-ROM.

**Task 9: Technical Workbook (Budget = $25,000).** A technical workbook would be developed to provide a protocol for usage of the proposed model. This workbook would provide a guideline specifying when it is applicable to use the proposed model and when an alternative or more simplified model would be sufficient. Additionally, the workbook would outline the Board permit process and data requirements for the model. Once determined, other essential guidelines would also be added to the workbook.

## 6. Feasibility

Proposed project efforts utilize available technology and would be performed by experienced personnel. Lessons learned from the previous Bypass 2-D model efforts have influenced the proposed model usage, work plan, and contingencies contained herein.

Specifically, a number of the objectives of the original model effort extended significantly beyond the performance of impact assessments and were incompatible with the stability limitations of the RMA-2 program. This proposal and plan recognizes the inherent limitations and has been developed accordingly. For instance, an original objective was that the 2-D model could be applied to flow simulations of the entire Bypass. This plan recognizes only a need for steady state, impact analysis of portions of the Bypass. The original effort sought to expand the model's coverage to include portions of the Sacramento and lower American Rivers before the Bypass geometry itself was calibrated and ensured reliable. This proposal emphasizes developing a reliable and usable product above all else. Planned activities such as extensive reliability testing and case study application will ensure that the new 2-D model will maximize end-user operability.

Additionally, the original effort didn't foresee the need to perform unsteady flow simulations in order to calibrate the model. After steady flow calibration attempts failed to produce satisfactory results, unsteady flow simulations were attempted but they failed for stability reasons. The stability problems stemmed from including considerably large portions of the total mesh geometry in the simulations. The current plan features calibration of the total model on a piece-by-piece basis and includes an acceptable contingency plan.

Lastly, substantially faster run-times afforded by contemporary computer processor capabilities assure that the efficiency of model troubleshooting and refinement efforts would be greatly improved from that of the previous effort. Individual simulations are estimated to take about a tenth (1/10) of the time that the previous simulations took.

## 7. Data Handling and Storage

As indicated previously, the finalized model, its User's Manual, and the technical workbook would be provided on a CD-R, and would include documentation of case studies.

## 8. Expected Product/Outcomes

Quarterly programmatic and financial reports and annual reports detailing with work progress and updates will be provided to CALFED.

The expected product is a baseline Yolo Bypass RMA-2 2-D hydraulic model. A User's Manual and a technical workbook providing guidelines for usage of the model and hydraulic impact assessment standards would accompany the model. The proposed case study application of the model would support the planning, design, and impact assessment efforts of an actual restoration activity. Appropriate documentation of the topographic data acquisition, model development, case study application, and quality control would also be produced.

The model's utility would generally be limited to steady state, flood-level flow simulations, and its usage would likely require a moderately experienced modeler. The model is intended to be a comparative, impact assessment tool and is not intended as a stand-alone tool for designing top of levee profiles. Users of the model would be limited to analyzing discrete, yet significant, portions of the Bypass with each model run, and would not likely be able to analyze the entire Bypass with a single model run. Other available models, namely the Comp Study UNET model, would be better able to analyze Bypass and SRFCP system-wide responses to proposed large-scale projects.

Existing hydraulic models will benefit from the development of the model. The 2-D model's results could be used to improve most 1-D model's representation of 2-D flow areas, particularly at weirs and junctions.

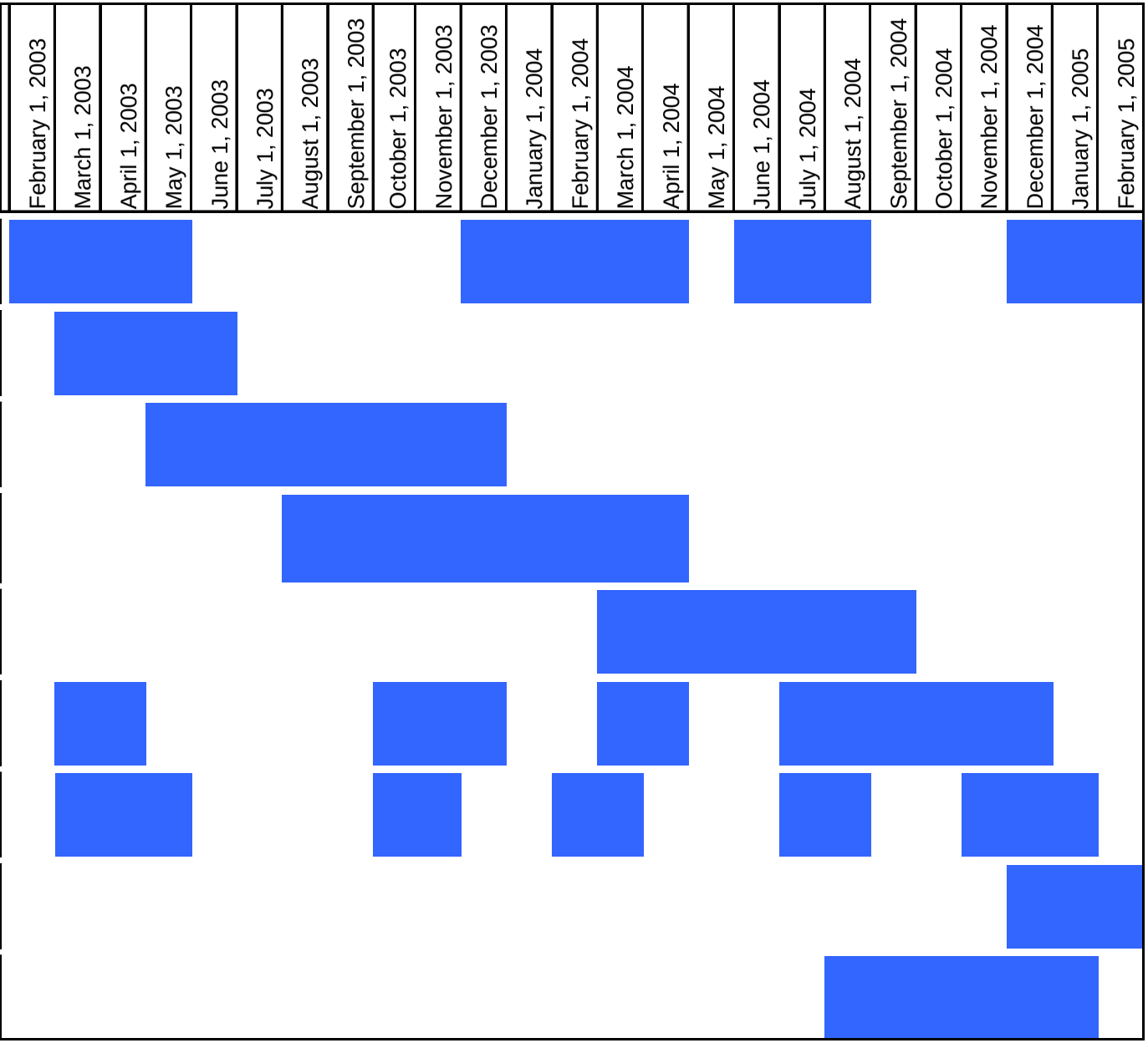
Restoration planning and design efforts stand to benefit from the lessons learned during the model's development and each subsequent model application.

## 9. Work Schedule

As shown in Table 1, the proposed project is expected to take 2 years to complete. If this proposal were accepted and funding were provided to start the effort by February 2003, the approximate date indicated in discussions with CALFED staff, the proposed

**Table 1.** Proposed Work Schedule

| Task ID | Task Name |
|---|---|
| 1 | Project Coordination and Management |
| 2 | Topography Acquisition |
| 3 | Model Development |
| 4 | Model Calibration, Reliability Testing, and Sensitivity Analyses |
| 5 | Case Study Application |
| 6 | Documentation and Production |
| 7 | Quality Control |
| 8 | Revisions and Release |
| 9 | Technical Workbook Development |



project would be completed by February 2005.

## B. Applicability to CALFED ERP and Science Program Goals and Implementation Plan and CVPIA Priorities

### 1. ERP, Science Program and CVPIA Priorities

This proposal addresses ERP priorities for the Sacramento and Delta Regions, specifically for the Yolo Basin and North Delta Ecological Management Zones, of which the Yolo Bypass is part. This project addresses the hydraulic modeling needs identified by YBF in its Yolo Bypass Management Strategy, Phase II, which received partial funding from CALFED ERP in 2001(CALFED Proposal 2001-D203). By supporting Phase II of the Management Strategy, this project will help advance several ERP goals. The following recaps those goals identified by YBF:

- **Goal 1**: Achieve recovery of at-risk native species dependent on the Delta and the Bypass.
- **Goal 2**: Rehabilitate natural processes in the Bay-Delta system to support natural aquatic and associated terrestrial biotic communities.
- **Goal 3**: Maintain and enhance populations of selected species for sustainable commercial and recreational harvest consistent with Goals 1 and 2.
- **Goal 4**: Protect and restore functional habitat types for public values such as recreation, scientific research, and aesthetics.

Indeed, while striving to achieve these ERP goals and priorities, the flood conveyance capacities of the Bypass and its adjacent flood control components of the SRFCP *must* be maintained. The availability of the proposed model would facilitate responsible ecosystem restoration project development and management leading to advancements towards ERP goals envisioned by CALFED for the Bypass.

### 2. Relationship to Other Ecosystem Restoration Projects

As previously indicated, the availability of the proposed model would greatly assist decision-makers in administering responsible ecosystem restoration, creation, and management in the Bypass. Along with other future projects, the following projects would benefit from this proposed model:

- Yolo Basin Management Strategy, Phase II. The hydraulic modeling portion of this 2001 CALFED ERP proposal was not funded. This current proposal would support the hydraulic modeling need of Phase II of the Management Strategy.
- Vic Fazio Yolo Wildlife Area. DFG is in the process of developing a Management Plan for expanding its Yolo Wildlife Area from 4,000 acres to 16,000 acres. This proposed model would support DFG's hydraulic impact assessment needs in its preparation of the Management Plan for the expanded Yolo Wildlife Area
- Proposed North Delta National Wildlife Refuge. The proposed model would be available for use by the U.S. Fish and Wildlife Service to assess the hydraulic impact of its land use modification alternatives in the Bypass.

### 3. Next Phase Funding

This is not a request for next phase CALFED or CVPIA funding.

### 4. Previous Recipients of CALFED Program or CVPIA funding

To date, the Board has not received any CALFED or CVPIA grants related to this proposed effort. The Board, though, recently submitted another proposal for Consideration of Directed Actions funding. That proposal is the #261D entitled "Hamilton City Ecosystem Restoration and Flood Damage Reduction: Chico Landing Sub-Reach".

### 5. System-Wide Ecosystem Benefits

The successful implementation of a habitat restoration or other land use modification project in the Bypass requires a demonstration to the Board, which requires concurrence from the Corps, of a neutral or beneficial hydraulic impact by the project on the flood conveyance capacity. The availability of the proposed model would help facilitate successful and responsible habitat restoration, creation, and management within the Bypass. These successful land use modification projects would then lead to ERP goals being achieved, thus leading to the improvement and restoration of the ecosystem within the Bypass and further benefiting adjacent and connecting ecosystems.

## C. Qualifications

The Board will coordinate with the Corps and DWR in this project. This project team will be composed of staff from the Corps, DWR, and the Board. The team has in-depth knowledge and experience with hydraulic modeling and analysis. In addition to the staff identified below, supervisors in all of the organizations involved have pledged their support to the project and are committed to providing the leadership and resources required to make the effort successful.

### Summary of Qualification for Key Participants

**Gregory Kukas.** Greg is a senior hydraulic engineer with the Corps with over 8 years of experience in hydraulic modeling development and analysis. Greg has performed numerous one- and two-dimensional hydraulic modeling simulations, including RMA-2 modeling of the Napa River flood control and restoration project that is currently under construction. Additionally, Greg has worked on previous Yolo Bypass RMA-2 modeling efforts and has benefited from many of the lessons learned therein. His previous experience also includes hydraulic (flood conveyance) impact assessments of proposed riparian restoration projects and hydraulic analyses and designs in support of stream corridor and wetlands restoration projects. Greg also has extensive experience in developing and managing contracts for hydrologic, geomorphologic, and hydraulic analyses performed by consultants. Greg has represented the Corps at meetings of the Yolo Bypass Hydraulic Modeling Technical Advisory Committee and also in meetings with the U.S. Fish and Wildlife Service on their planned North Delta National Wildlife Refuge. Greg received his Bachelor of Science degree in Civil Engineering from Cal Poly in San Luis Obispo, California, in 1994, and received his P.E. certification in 1999.

Greg's role in the effort would be to assist in both the management and performance of the Corps coordination and product development activities. Greg would be responsible for additional work plan refinements and the development of the QC/QA Plan.

**Scott Tincher.** Scott is a senior hydraulic engineer with the Corps with over 7 years experience with the Corps, Tetra Tech, Inc., and Ayres Associates in hydraulic model development and analysis. Scott has performed numerous one- and two-dimensional analyses in support of planning studies and project designs. His experience includes RMA-2 analysis of the Feather and Yuba river confluence, use of FLO-2D on the Yuba River and on many other watercourses, and UNET one-dimensional unsteady state analysis of the San Joaquin and Sacramento River systems. Scott is also involved in the final stages of establishing design water surface elevations for levee improvements on the Yuba and Feather Rivers using both steady and unsteady HEC-RAS modeling techniques. In addition, Scott has experience managing contracts for hydraulic analysis activities from both the government and A/E perspectives. Scott received a Bachelor of Science degree in Aeronautical Engineering from Cal Poly in San Luis Obispo, California, in 1982, and a Masters of Science degree in Civil Engineering from California State University Sacramento in 1995. He received his P.E. certificate in 1999.

Scott Tincher's role in the proposed effort would consist primarily of the technical product development, including construction of the model geometry, calibration and verification simulations, reliability testing, sensitivity analyses, and case study application of the model as well as associated documentation.

**Scott Stonestreet.** Scott is a senior hydraulic engineer with over 16 years experience with the Corps, including both the Los Angeles and Sacramento Districts. Scott has been involved in development and analysis in hydraulic and sedimentation models. Scott has performed numerous one- and two-dimensional analyses in support of planning studies and project designs. His experience includes HIVEL-2D analyses of high-velocity flow at several bridges in the Los Angeles County Drainage Area and use of FLO-2D for floodplain delineation in the Sacramento River basin. Additionally, Scott has conducted two-dimensional analyses using the FESWMS model. Scott has been the Corps' lead hydraulic engineer for the basin-wide hydraulic modeling efforts in support of the Sacramento and San Joaquin River Basins Comprehensive Study. In that study, Scott was responsible for model development of the San Joaquin River basin-wide UNET model. In addition, Scott has been involved with research activities at the Corps' Waterways Experiment Station as well as within the Los Angeles District and has written numerous papers documenting these research activities. Scott is a member of the Corps' Committee on Channel Stabilization consulting on water resource projects throughout the United States. Scott received a Bachelor of Science degree in Civil Engineering from Cal Poly in Pomona, California, in 1985, and a Masters of Science degree in Civil Engineering from California State University, Long Beach, in 1990. He received his P.E. certificate in 1989.

Scott Stonestreet's role in the proposed effort would consist primarily of the technical product development, including topographic data acquisition, construction of the model geometry, calibration and verification simulations, reliability testing, sensitivity analyses, case study application of the model as well as associated documentation.

**Mike Deering.** Mike serves as the senior hydraulic engineering team leader at the Seattle District Corps of Engineers performing hydraulic, hydrologic, flood plain management, and environmental restoration engineering investigations for all phases of water resource project planning and design. Mike has over 25 years of experience (15 in the Sacramento District) in water resources planning and development including flood control, habitat restoration, and fish passage related projects. Mike spent time at the Hydrologic Engineering Center assisting in the advancement of the risk-based methodology for flood damage reduction. Mike received a BS and MS in Civil Engineering, University of California at Davis, 1977 and 1986, and a PE certification in Civil Engineering - State of California in August 1982.

Mike's role in the proposed effort would consist of quality control activities including informal seamless review, formal milestone review, and final technical review of the Corps' technical products and documentation.

**Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL).** ERDC, formerly the Waterways Experiment Station (WES), is the Corps' primary civil engineering and environmental quality research and development facility. The CHL is internationally renowned for its world-class personnel, unmatched facilities, and cutting edge products. The CHL administers the development and distribution of the RMA-2 program. The CHL also provides technical support to Corps users of both RMA-2 and SMS.

The CHL will provide technical support to the team members performing the model development, calibration, verification, and optimization tasks on an as-needed basis.

**Steve Bradley**. As Chief Engineer to the Board, Steve is responsible for ensuring the safety and reliability of flood control systems, including the Yolo Bypass, regulated by the Board. Steve oversees the analyses and evaluations of Board permit applications. Steve has more than 20 years of varied experience in water resources engineering and flood control in California. His experience includes 10 years as a senior water resources engineer and project manager with Boyle Engineering Corporation, 9 years as a hydraulic engineer with the U.S. Bureau of Reclamation, and 1 year as a design engineer with the U.S. Fish and Wildlife Service. Steve received his Bachelor of Science degree in Civil Engineering from the University of Colorado in 1978 and is a registered P.E. in California.

Steve's role will include representing the Board in all discussions of permit requirements, impact assessment standards, and other Board requirements during the development of this project.

**Boone Lek**. Boone is a Water Resources Engineer with DWR's Division of Flood Management. His role will include representing DWR in maintaining coordination between the Board and the Corps throughout this project effort, and the development of the Technical Workbook.

## D. Cost

**Budget.** The total cost to complete this project is $500,257.

**Cost-Sharing.** In a May 10, 2002 letter to CALFED, the Sacramento Area Flood Control Agency (SAFCA) pledged to contribute $50,000 per year for 2 years, provided this project is approved for funding in 2002.

## E. Local Involvement

This proposed CALFED project has a strong local interest and support from many local groups involved or associated with the Yolo Bypass. Letters of support have been submitted to CALFED from the following people or organizations:

- Yolo Basin Foundation (YBF)
- Yolo Bypass Working Group (YBWG)
- State Assemblywoman Helen Thomson
- State Senator Michael Machado
- Sacramento Area Flood Control Agency (SAFCA)
- California Central Valley Flood Control Agency

This project has been an agenda item at YBWG meetings involving Bypass and other stakeholders. YBWG meetings have provided a forum for acquiring productive inputs and feedbacks for this proposed project.

Coordination with local organizations such as YBF, YBWG, SAFCA, Yolo Bypass Hydraulic Modeling Technical Advisory Committee, Sacramento River Floodway Corridor Planning Forum, and other interest groups is anticipated in order to optimize feedback and support for this project. Funding requested for this proposal includes money for YBF to conduct public outreach (Task 10 in Detailed Budget), through YBWG or other forums, regarding application and promotion of the proposed model.

## F. Compliance with Standard Terms and Conditions

*This proposal requests that funding be paid up front preferably on an annual basis*. Federal law has an anti-deficiency clause stipulating that funds be secured in an account prior to work performed by the Corps. Otherwise, participants will comply with the rest of the standard State and Federal contract terms as described in Attachment D and E of the Ecosystem Restoration Program 2002 Proposal Solicitation Package.

## G. Literature Cited

Daniel H. Hoggan, Ph.D, P.E. 1995. Yolo Bypass Floodplain Management Model Draft Users Manual.

U.S. Army Corps of Engineers, Sacramento District. 1993. Yolo Bypass Plan of Action for Flood Plain Management Planning Model, U.S. Army Corps of Engineers, August 1993.

Yolo Basin Foundation. 2001. CALFED Proposal #2001-D203.

Yolo Basin Foundation, Yolo Bypass Working Group, and Jones & Stokes. 2001. Final Report—A Framework for the Future: Yolo Bypass Management Strategy.