

CVPIA Fiscal Year 2008 Annual Work Plan

October 23, 2007

Program Title

Ecological/Water Systems Operations Models, CVPIA Section 3406(g)

Responsible Entities

Staff Name	Agency	Role
Michael Tansey	Reclamation	Lead, MP710
Derek Hilts	FWS	Co-Lead
Lee Mao	Reclamation	Co-Lead, MP740

Program Goals and Objectives for FY 2008

The purpose of the Ecological/Water Operations Models section is to develop readily usable and broadly available models and supporting data to evaluate existing and alternative water management strategies and to improve the scientific understanding of ecosystems in the Sacramento, San Joaquin, and Trinity watersheds. Specific to FY07 program objectives are:

- A. Modeling Master Plan documentation
- B. CalSim III San Joaquin QA/QC review & documentation
- C. RHEM model developments
- D. Riparian vegetation parameter study
- E. HGS/CalSim Linkage – Literature Review & Methodology Development; HGS Temperature Module Planning
- F. Membership and Participation in Professional Organizations

Status of the Program

The Ecological/Water Systems Operations Models, CVPIA Section 3406(g) program is a continuing program that started in 1994.

The program has supported the Ecosystem Modeling Consensus Project, review and update of the Central Valley Ground-Surface water model (CVGSM); development of a graphical user interface (GUI) and database for PROSIM and SANJASM (note: This GUI effort was abandoned because CalSim replaced PROSIM and SANJASM, as well as DWRSIM); development of the 3-D temperature model for Whiskeytown Reservoir, development of CalSim II, and hydrologic inputs for several versions of the California Simulation Model (CalSim).

Since 1998 this program has provided a high level of support for CalSim II development and applications. Reclamation and California Department of Water Resources have made a large

investment in CalSim because it has been essential for Interior to participate in and guide the development of a system-wide model of the operations of the Central Valley Project (CVP) and State Water Project (SWP). CalSim II is now available for public use and has been in many large scale water supply improvement studies. A new version of CalSim (CalSim III) is currently being developed as a joint effort by Reclamation and DWR. The FWS has also participated in the development and application of CalSim through annual interagency agreements. The primary benefit of this work has been the development of an integrated CVP/SWP system model for planning investigations including the most recent Central Valley Project Operations Criteria and Plan (OCAP) and the ongoing CALFED feasibility for storage and conveyance.

In addition to CalSim, the program has supported the development and application of other types of river management and ecological models including water quality, hydrology, groundwater, fish population and riparian habitat models used by the Division of Planning, U.S. Fish and Wildlife Service (USFWS), contractors and public interest organizations for modeling support of operations and planning. These models include:

- Upper Sacramento River Water Quality Model (USRWQM) –for use in planning of reservoir releases for water temperature management in anadromous fish spawning and rearing habitats
- InSalmo and SALMOD – for use in evaluating anadromous fish survival at various life stages and in a variety of aquatic environments.
- Riparian Habitat Establishment Model (RHEM) – for use in evaluating the recruitment and survival of cottonwood and other riparian vegetation
- Land Atmosphere Water Simulator (LAWS) – for use in developing hydrologic budgets and water demands.
- HydroGeoSphere (HGS) – for use in evaluating surface and subsurface hydrologic interactions related to water supply, water quality and ecosystem restoration.
- Ecologically Cogent Operations Suite of Integrated Models (ECOSIM) – for use in analyzing changes to the macroscopic water resources in California’s Central Valley.

This program also supports participation of Reclamation and FWS staff in professional organizations as well as training conducted by Reclamation and the California Department of Water Resources. The Mid-Pacific Region Division of Planning, the U.S. Fish and Wildlife Service, the California Department of Water Resources (DWR), and other stakeholders have been trained in the use of CalSim through funding from this program.

FY 2007 Accomplishments

- A. The Reservoir Systems Analysis Branch (MP-710) staff, Reclamation’s Technical Service Center, the US Fish and Wildlife Service (FWS), and private contractors developed new hydrologic datasets for CalSim III in Sacramento and San Joaquin

Valleys and completed a detailed QA/QC review of the Sacramento Valley water budgets was performed in collaboration with the California Department of Water Resources (DWR) modelers.

- B. In cooperation with California DWR, Reclamation staff completed significant improvements for the new CalSim III model including improved methods for evaluating hydrologic inputs based on DWR's Integrated Flow Model (IWFm), groundwater simulation capability based on the new California Central Valley Simulation model (C2VSIM), and a consistent implementation of hydrology and groundwater in both the Sacramento and San Joaquin Valley.
- C. Reclamation staff applied the Upper Sacramento River Water Quality Model (USRWQM) and SALMOD fishery models in support of a CVPIA b(2) operations and other Reclamation planning activities.
- D. Reclamation staff completed the development and demonstration of an initial version of the Riparian Habitat Establishment Model. A work plan for further development of a 2-dimensional version of the model and a Riparian Vegetation Parameter Study was developed and contracts awarded for completion in 2008.
- E. Testing activities related to HGS subtiming/subgridding methodology are currently undergoing. A conceptual model report including both Red Rock Ranch (small scale) and San Joaquin Basin (large scale) has been written by HydroGeoLogic, Inc. and is under review by Reclamation and DWR staff. Furthermore, HydroGeoLogic, Inc. is preparing the input files for the small and large applications. Preparation of input-data files and grid development are being facilitated by means of GIS and visualization tools.

FY 2008 Tasks, Costs, Schedules and Deliverables

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	Funding Source RF	Funding Source WRR
1.1	Program Management						
1.1.1		0.12	(BOR) - Program Lead responsible for coordination of program activities, budget and work with federal and state agencies.	9/30/2008	18,000		
	<u>Subtotal Costs</u>				18,000	0	
1.2	Program Support						
1.2.1		0.30	(FWS) - Co-lead responsible for coordinating program activities within FWS as well as review and development of CALSIM, SALMOD and other modeling tools regarding implementation of CVPIA Section 3406(b) and 3406(g).	9/30/2008	50,000		
1.2.2		0.03	Lee Mao (BOR) - Co-lead responsible for coordinating modeling activities within MP-740		5,000		
	<u>Subtotal Costs</u>				55,000	0	
1.3	Technical Support						
1.3.1		0.23	(BOR) - Modeler responsible for development and implementation of model integration and database management activities (see Tasks 1.13.1 & 1.13.6).	9/30/2008	37,000		
1.3.2		0.23	(BOR) - Modeler responsible for development and applications of water operations and water temperature models. (See Tasks 1.13.1 & 1.13.2)	9/30/2008	37,000		
1.3.3		0.16	(BOR) - responsible for characterizing the hydrogeology of study areas and applying HydroGeoSphere for modeling the integrated surface/subsurface hydrologic and water quality processes of these areas. (see Tasks 1.13.7 & 1.13.8)	9/30/2008	25,000		
1.3.4		0.23	(BOR) - responsible for development and application of HydroGeoSphere for modeling the integrated surface/subsurface hydrologic and water quality processes of study areas. (see Tasks 1.13.7 & 1.13.8)	9/30/2008	37,500		
1.3.5		0.23	(BOR) - responsible for development and application of HydroGeoSphere for modeling the integrated surface/subsurface hydrologic and water quality processes of study areas. (see Tasks 1.13.7 & 1.13.8)	9/30/2008	37,500		
1.3.6		0.23	(BOR) - Modeler responsible for development and applications of water operations, hydraulic and ecosystem models. (See Tasks 1.13.1 & 1.13.2)	9/30/2008	37,000		

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	Funding Source RF	Funding Source WRR
1.3.7		0.23	(BOR) - Modeler responsible for development and application of riparian vegetation growth and habitat suitability models. (see Task 1.13.4)	9/30/2008	37,000		
1.3.7		0.23	(BOR) - Modeler responsible for development and applications of water operations, water temperature and fish survival models. (See Task 1.13.2 & 1.13.3)	9/30/2008	37,000		
1.3.8		0.23	New Hire (BOR) - Modeler responsible for development and application of GIS based hydrologic and ecosystem modeling and data integration framework. (See Task 1.13.1 & 1.13.4)	9/30/2008	37,000		
<u>Subtotal Costs</u>					322,000	0	0
1.7	Outreach and Public Involvement						
1.7.1			Membership and participation in California Water and Environmental Water Modeling Forum and other professional organizations, attend workshops and conferences, prepare publications and provide support for model application to stakeholders.	9/30/2008	20,000		
<u>Subtotal Costs</u>					20,000	0	0
1.13	Modeling						
1.13.1			Water Operations Models - CalSim II & III - simulations performed to evaluate alternative operations of CVP/SWP and effects on 3406 (b2) supplies. CalSim models linked to water temperature, fish survival and riparian habitat models. DWR is a major cost-sharing partner and typically exceeds CVPIA funding by a factor 5 or on an annual basis. CalSim models and hydrologic data inputs are routinely updated to better represent changes in the CVP/SWP operations. CalSim model has been widely distributed and is used by Federal, State, and stakeholder organizations for planning studies. (CVPIA law: model type #1)		Work performed by BOR Technical Staff (See Task 1.3 for staffing)		
1.13.2			Water Quality Models - Upper Sacramento River Water Quality Model (USRWQM) - simulations performed to evaluate the effects of alternative operations of CVP/SWP on the cold water pool in Shasta, Keswick, Lewiston and Whiskeytown reservoirs and effects on water temperature in the Sacramento River at mandated compliance points. USRWQM cost-sharing comes from Reclamation's Central Valley Operations Office and from CALFED storage project feasibility studies of Shasta and NODOS. USRWQM is fully functional and improvements are beginning to better represent the Colusa Basin and Sacramento weirs. USRWQM results are currently being used by Reclamation and other federal and state agencies for planning and operations assessment on the Sacramento River. A SJR temperature model has been developed for the reach of Friant Dam to the confluence with the Merced River.		Work performed by BOR Technical Staff (See Task 1.3 for staffing)		

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	Funding Source RF	Funding Source WRR
			(CVPIA Law: model type #2)				
1.13.3			Ecosystem Models - SALMOD - simulations performed to evaluate the effects of alternative operations of CVP/SWP on anadromous fish survival. SALMOD can be linked directly to USRWQM for flow and water temperature inputs. SALMOD is a fully functional model that is regularly used for planning studies such as the CALFED storage investigations. (CVPIA Law: model type #4)		Work performed by BOR Technical Staff (See Task 1.3 for staffing)		
1.13.4			Ecosystem Models - Riparian Habitat Establishment Model (RHEM) - simulations performed to evaluate the effects of alternative operations of CVP/SWP on the establishment and survival riparian vegetation for restoring anadromus fisheries. RHEM can be linked indirectly to CalSim by a suite of intermediary models developed by Reclamation to assess the effects of alternative CVP/SWP operations on sediment transport, channel migration and river hydraulics. RHEM is fully functional but requires physical and biological inputs that restrict its application to specific point bar locations. Results from RHEM can be used by Reclamation's SRH-1D, SIAM, SRH-M models to provide larger space and time scale evaluations of riparian vegetation survival. A riparian vegetation study is being performed to obtain new data for use in RHEM. Cost-sharing for RHEM development has come from Shasta and NODOS storage project feasibility investigations. RHEM is currently being used for assessments of riparian habitat establishment on the Sacramento River. (CVPIA Law: model type #4)		Work performed by BOR Technical Staff (See Task 1.3 for staffing)		
1.13.5			Unfunded Need - CVPIA Integrated Modeling and Database Framework (CIMDF) - a capability to link the diverse types of models (CVP/SWP operations, hydrologic, hydraulic, sediment transport, groundwater, fish and riparian habitat, etc) is essential to performing the complex water and ecosystem management and analysis activities required by the 3406(g) legislation. To accomplish these objectives, CIMDF will allow modelers to couple various types of models together so that results from a particular model can be used as inputs to another type model and equally important to insure that all the models use consistent sets of data inputs. The development of CIMDF will promote modeling efficiency because no single model can be constructed that could perform all the needed types of modeling analyses. Furthermore, CIMDF will help to promote quality control and quality assurance (QA/QC) of model results because standard database management and maintenance procedures can be enforced throughout the modeling process. Essential elements of the CIMDF include geospatial referencing of database elements as well as the ability to import and export time series data. By adopting the ArcHydro database template as a starting point and developing CIMDF as a loosely coupled ArcView (a commercially available geographic information system) application,		250,000		

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	Funding Source RF	Funding Source WRR
			the costs and time frame for deployment of CIMDF can be minimized.				
1.13.6			Unfunded Need - Climate Change Impact Analysis (CCIA) - an analysis of the impacts of climate change on anadromous fishery populations in one or more selected tributary streams in the Central Valley watershed will be performed by modeling the combined effects of stream flow (water depth and velocity), geomorphology (channel meander and point bar formation), sediment transport (bedload and suspended), water temperature (surface water and groundwater) and riparian vegetation (recruitment and survival). The results from these model simulations will be compared to existing anadromous fish habitat suitability functions to evaluate the range of potential effects of changes in the amounts and timing of temperature and precipitation (obtained from a variety of downscaled global climate models (GCM) on fish populations in the selected tributaries.		150,000		
1.13.7			HydroGeoSphere (HGS) - Linkage with CALSIM: links to other models -->benefits CALSIM project by combining realistic physically based hydrology of HGS with realistic operations modeling of CALSIM to render CALSIM more suitable for studying ecological impacts; cost-share --> with PTMS program; data collection? --> no; methodology --> HGS and CALSIM experts will work together to create a dynamic linkage between the two models; phase of project --> algorithm development and code modification (see Task 1.3 for BOR technical staff) (CVPIA Law: #3)		54,000		
1.13.8			HydroGeoSphere (HGS) - Temperature Module: partners --> HydroGeoLogic Inc and University of Waterloo; cost-share --> with University of Waterloo; data collection? --> no; methodology --> HGS developers will add temperature modeling capabilities to the surface water domain (temperature is already in subsurface); both subsurface and surface temperature modules will be tested via application in the San Joaquin River Basin; phase of project --> algorithm development, code modification & verification, and application to San Joaquin Basin. (see Task 1.3 for BOR technical staff) (CVPIA Law: #3)		81,000		
	<u>Subtotal Costs</u>				135,000	0	0
	Total Costs				550,000	0	0
	BOR cost				500,000		
	FWS cost				50,000		
	Lee Mao				240,000		
	Mike Tansey				310,000		

CVPIA Budget Breakdown

Task	Agency	FTE	Direct Salary and Benefits Costs	Contract Costs	Misc. Costs	Admin Costs	Total Costs
1.1 Program Management	FWS						
	BOR	0.12	\$15,000			\$3,000	\$18,000
1.2 Program Support	FWS	0.3	\$45,000			\$5,000	\$50,000
	BOR	0.03	\$4,000			\$1,000	\$5,000
1.3 Technical Support	FWS						
	BOR	0.23	\$290,000			\$32,000	\$322,000
1.7 Outreach and Public Involvement	FWS						
	BOR						\$20,000
1.13 Modeling	FWS						
	BOR			\$135,000			
FWS Total Costs							\$50,000
BOR Total Costs							\$500,000
Total							\$550,000

CVPIA 5 Year Budget

(\$ thousands)

Funding Source	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
W&RR						
RF	798	822	847	871	898	4236
State						
Other (identify)						
Total	798	822	847	871	898	4,236

The primary focus of the 3406 (g) in the next 5 five year period will be to develop additional modeling capabilities to assist managers and other decision makers with the task of improving habitats for the restoration of Central Valley fish and wildlife populations while continuing to support the core mission of Reclamation. Achieving this goal will require the collection of new data sets, better information management and analysis methods and improved integration of physical and biologic modeling tools.