

**Review Report on**  
**DRAFT Agricultural Economic Effects**  
**of Lower San Joaquin River Flow Alternatives**

prepared for the  
**State of California Water Resources Control Board**

by

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of Lower San Joaquin River Flow Alternatives**

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This review report responds to specific points raised by the State Water Resources Control Board in Attachment 2 of the March 22, 2012 “Request for External Peer Review of Agricultural Economics Modeling for the Phase 1 Update to the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (2006 Bay-Delta Plan)” authored by Patricia Fernandez. My review comments are presented in shaded boxes following the text of each point.

**Economic Conclusions or Assumptions Regarding the Analysis Approach in the Draft Agricultural Economics Report**

**1. Use of the Statewide Agricultural Production (SWAP) model was based on sound economic knowledge, methods, and practices.**

State Water Board staff reviewed models for estimating agricultural production and revenues associated with the surface water diversions potentially needed under the LSJR flow alternatives and baseline conditions. Staff found that the SWAP model was an appropriate model for estimating the effect of the LSJR flow alternatives and baseline conditions. For the purposes of this analysis, the SWAP model was calibrated to the Department of Water Resources (DWR) estimates of land use and applied water data for water year 2005, because this water year represented the most recent normal water year in terms of both water availability and crop prices. This data is presented in Table X-7 of the report. Annual surface water diversion changes estimated in the section of the report titled “Surface Water Diversion Estimates” were input to the SWAP model to estimate the associated agricultural production and revenues. For each water year, SWAP uses a Positive Mathematical Programming (PMP) methodology to calculate the crop acreage mix that would maximize revenue from the annual available surface water diversions. The output from the SWAP model was used as input to the IMPLAN model. State Water Board staff believes the use of the SWAP model with the described assumptions and approach was based on sound economic knowledge, methods, and practices.

I agree that the SWAP model is appropriate to the needs of this study. SWAP is a state-of-the-art nonlinear economic optimization model of agricultural production. The underlying PMP methodology has the advantages of calibration to actual conditions of prices and input use, and of allowing marginal costs of production to vary in a plausible manner.

Concerning the noted assumptions, I have no particular basis to question the selection of 2005 as an appropriate year on which to base the calibration for the region of interest, although somewhat greater generality might be achieved by conducting the analysis for several alternative calibrations. Solving the model for a range of water availability conditions provides insight into the key question of economic tradeoffs between uses of water in local agricultural versus maintaining river flows.

I do have one concern about the way that water availability is handled in the SWAP analyses. As indicated in section X.3.2, for modeling purposes, water availability is specified on an annual basis. However, Tables X-3 and X-4 show that allowable withdrawals and storage amounts are restricted on a monthly basis. The use of annual versus monthly restrictions could affect optimal crop selection. An annual restriction allows the possibility of choosing crops that all need water during the same part of the growing season, thereby exceeding the monthly water restrictions although not exceeding the annual limit. I have no way of determining whether the results presented in this draft would violate any monthly withdrawal restrictions. Even if they do, the consequences for the results of the study are likely to be very small.

## **2. Use of version 3 of the Impact Analysis for Planning (IMPLAN) model was based on sound economic knowledge, methods, and practices.**

Version 3.0 of the IMPLAN model was used to predict the indirect, and induced economic effects associated with the changes to agricultural direct revenue estimated by the SWAP model. Output from the SWAP model, appropriate region-specific multipliers, and other assumptions, were input to IMPLAN to estimate the indirect and induced economic activity on the agricultural industry in the LSJR, and related effects on other connected sectors of the economy. State Water Board staff believes the use of the IMPLAN model with the described assumptions and approach was based on sound economic knowledge, methods, and practices.

I agree that the IMPLAN model is appropriate for use in forecasting regional economic impacts of agricultural water use scenarios. The IMPLAN modeling system has a long history of use for resource-based regional economic impact analysis. I believe SWAP output is appropriately injected into IMPLAN to forecast the effects of water-driven changes in agricultural sector revenues on economic activity in the region, holding prices and technical production relationships steady as captured in the 2005 calibration of SWAP and the 2009 IMPLAN social accounting matrix.

I do have a concern about the manner in which IMPLAN results are characterized in the report. Table X-9 reports the average annual results (over 82 years of water flow records) for Total Sector Output, Direct Output, and Indirect and Induced Output (the first is the sum of the latter two). Table X-10 provides analogous results for employment. Each table also reports a percentage change equal to the change in the sectoral outcome divided by the Baseline Total Sector outcome. My concern focuses on the percentage calculation. I believe it may be misinterpreted as a relative change in overall economic activity in the region rather than a relative change only in the activity associated with agriculture. Accordingly, I encourage the addition of computations of the changes in sectoral outcomes as percentages of the overall regional output and employment. These calculations would indicate the relative impact on overall economic activity in the region, not just agriculturally-based activity.

**3. The LSJR flow alternatives have the potential to affect the amount of allowable surface water diversions from within the LSJR watershed. The economic analysis assumes that construction or installation of alternative water supplies would not be implemented in response to changes in estimated allowable surface water deliveries. Staff believes this is a conservative assumption.**

For the purposes of this analysis it was assumed that irrigation water from alternative water supplies, such as groundwater pumping or Central Valley Project water deliveries, would not be increased to make up for any decrease in surface water diversions. This is a conservative assumption that would result in higher economic impacts than an analysis that assumes implementation of alternative water supplies.

I concur that this is a “conservative” assumption in the sense that it is likely to produce model result greater in magnitude than would be realized if it was assumed that alternative water supplies were available at reasonable cost.

#### **4. Reasonableness of other assumptions.**

Other assumptions beyond those identified above were utilized in the analysis. For example, a time series of 82 annual estimates of differences in crop acreages and revenue was used to estimate effects on crop acreages and agricultural revenue. It was also assumed that surface water diversion reductions can be applied equally across the Central Valley Production Model regions analyzed. Another key assumption in the IMPLAN analysis was that trading patterns between industries were fixed. State Water Board staff believes these assumptions and others, as described in the report, are conservatively valid and are consistent with those used in similar types of economic analyses.

I concur that holding trading patterns fixed is “conservative” in the sense noted for point 3 above. This is a standard practice in economic impact analyses. I agree that the use of a time series of 82 years of actual water flow data to produce a distribution of “optimal” crop acreages and revenue outcomes, holding price and production relationships steady as in the 2005 calibration of SWAP, is a reasonable approach to reflect historical variation in water availability and resulting agricultural economic outcomes.

#### **5. The level of effort used in analyzing the potential economic effects to agriculture covers a reasonable range of economic factors and considerations.**

As a certified regulatory program, the State Water Board is required to take economic considerations into account, but is not required to perform a cost/benefit analysis. Therefore, State Water Board staff believes the level of detail in the report’s analysis appropriately considers a reasonable range of economic factors and economic considerations as they relate to the impacts of the proposed project on agriculture, is consistent with the requirements of a certified regulatory program, and provides adequate input to the State Water Board’s decision-making process.

ranged from an increase of 0.3 percent to a decrease of 4.1 percent. Table X-10 of the report displays the estimated change in regional employment that would be associated with the proposed flow alternatives, which ranged between an increase of 0.3 percent to a reduction of 4.1 percent from baseline conditions. State Water Board staff believes these results are valid estimates of the effects of the proposed flow alternatives on the regional economy of the LSJR watershed.

The overall agricultural economic effects are derived from sound analytical methods under plausible assumptions. Intuitively, they seem reasonable. However, I caution against the interpretation that they represent effects on the “regional economy.” As noted in my comments for point 2 above, as reported, the results represent relative changes only in the portion of the regional economy attributable to agriculture. I encourage the addition of calculations that would express the relative effects on the overall regional economy. These additions should not be difficult to make.

## 7. Other Issues

Additionally, reviewers are not limited to addressing only the specific issues presented above, and are asked to contemplate the following “Big Picture” questions: In reading the Draft Agricultural Economics Report, are there any additional agriculture related economic issues that should be a part of the report’s analysis that are not described above? Effects of the LSJR flow alternatives on other non-agriculture related sectors of the economy will be addressed elsewhere in the SED. Taken as a whole, is the report’s analysis based upon sound economic knowledge, methods, and practices?

I believe the analyses presented in the report are based on sound economic knowledge, methods, and practices. I believe the regional agricultural sector, including production agriculture and the input, processing, and marketing channels in which it is embedded, is well represented in scope at appropriate levels of detail.

In my comments elsewhere, I have raised points that might strengthen the analysis or more accurately portray the findings. However, I do not believe these points are of fundamental importance or consequence for the general findings of this study.

Reviewers should note that some conclusions or proposed actions, for instance selection of flow alternatives for the amended Bay-Delta Plan, may rely significantly on professional judgment in instances where economic data and our understanding of the underlying processes are not as extensive as may be ideal. Nonetheless, the evaluation of the economic data and use of professional judgment are appropriate in the context of current economic knowledge regarding such actions. In these situations, the proposed course of action is favored over no action. The preceding guidance will ensure that reviewers have an opportunity to comment on all aspects of the agriculture-related economic effects of the proposed State Water Board action.

At the same time, reviewers also should recognize that the State Water Board has a legal obligation to consider and respond to all feedback on the proposed rules. Because of this obligation, reviewers are encouraged to focus feedback on economic issues that are relevant to the central regulatory elements being proposed.