MAJOR MODELLING ISSUES FOR

THE WATERFIX BIOLOGICAL ASSESSMENT

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Independent reviews have shown major problems with the computer models for the Biological Assessment. One of the fundamental issues is that the underlying hydrologic models have not been fully validated or calibrated, and contain unrealistic assumptions that result in major modelling issues.

In 2014, an outside firm, MBK Engineers, was commissioned by nine major water agencies[1] to review the models for the Bay Delta Conservation Plan Draft EIR/EIS. This was the key conclusion:

> Assumptions, errors, and outdated tools used in the BDCP Model results in impractical or unrealistic CVP and SWP operations. Therefore, the BDCP Model provides very limited useful information to illustrate the effects of the BDCP.[2]

In another review in 2014, independent biologist Dave Vogel noted,

> Much of the BDCP fish modeling efforts relied on CalSim II model outputs but a recent independent review of the BDCP Model revealed numerous significant flaws (MBK 2014) that were, unfortunately, carried through to the BDCP fish models. The BDCP's inaccurate depiction of changes in water storage in upstream reservoirs, reservoir releases, and water exports in the north and south Delta would undoubtedly significantly alter analyses of the BDCP effects on salmonids and other fish species. The BDCP Model errors result in an adverse cascading affect on the reliability of the BDCP fish models and, therefore, the BDCP effects on salmonids were obviously mischaracterized by an unknown, but probably very severe, degree. Given the limitations and errors of the BDCP fish models described in these comments, the fish models' reliance on faulty BDCP Model outputs at the outset further adds to the undependably modeled and unknown BDCP effects. [3]

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[1] Contra Costa Water District, East Bay Municipal Utility District, Friant Water Authority, Northern California Water Association, North Delta Water Agency, San Joaquin River Exchange Contractors Water Authority, San Joaquin Tributaries Authority, and Tehama Colusa Canal Authority.

[2] MBK Engineers, Report on Review of the Bay Delta Conservation Program Modeling, June 20, 2014. p. 2

[3] Dave Vogel, Comments on the Public Draft Bay-Delta Conservation Plan (BDCP) and Draft BDCP Environmental Impact Report/Environmental Impact Statement, p. 2. Available at http://www.norcalwater.org/wp-content/uploads/BDCP_Comments-Vogel.pdf

Past Peer Reviews

It is difficult to understand why a major computer model, used for so many major water planning decisions, would have such significant issues. But a careful look at the first Peer Review in 2003 by Close et al[4] shows that there were major gaps in the initial calibration and validation of the model. The peer reviewers noted with respect to the first historical validation in 2003,

> Because the SWP south of delta demands were set to historical deliveries in many years, comparison with the historical deliveries in the validation report is of limited validity.[5]

This meant that the CALSIM II delivery logic and reservoir operations were not fully validated when the model first came out. Three years later, the problems persisted. In a 2006 Peer Review, the reviewers declined to endorse the use of the CALSIM II software for any purpose, stating,

> The panel does not in any way certify or endorse the model presented. On the other hand, we do not disapprove of or discourage its use by knowledgeable users.
>
> Users must take responsibility for model selection and application, and they must accept the responsibility for decisions that they make with information produced by the model. Relying on an external body to provide a blanket endorsement covering all possible applications is a dangerous practice. It tempts users to avoid accountability for their work. It tempts decisionmakers to place responsibility on general model reviews which are remote from a particular application. Further, it opens the door to intentional and unintentional abuse, negligence or complacency by model users and developers, or their managers who may shift responsibility to tools or some external general review panel for decisions made or actions recommended based on their use of a model.[6]

In reviewing the model assumptions and sensitivity and error analyses, the reviewers stated

> Documentation for the entire CalSim software and model should be improved to a level that sufficiently justifies assumptions and assesses the effects of major uncertainties on model results. Major elements of the system (e.g., groundwater) that are not well modeled by CalSim II, should be discussed in the documentation. A modest additional effort can address these concerns. Currently no general guidance is available to indicate whether differences of 1 taf, 50 taf, 100 taf, or 500 taf are significant enough to rise above the level of error and noise inherent in the model [...]
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> At a minimum, error analyses should be conducted, combining a sensitivity analysis of critical model results to some of the largest and least well supported model assumptions

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[4] A. Close, W.M. Haneman, J.W. Labadie, D.P. Loucks (Chair), J.R. Lund, D.C. McKinney, and J.R. Stedinger, A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California. Submitted to the California Bay Delta Authority Science Program Association of Bay Governments Oakland, California, December 4, 2003.

[5] Ibid, p. 68

[6] David Ford, Les Grober, Thomas Harmon , Jay R. Lund (Chair), Daene McKinney, Review Panel Report, San Joaquin River Valley CalSim II Model Review, Jan 12, 2006, p. 8 Available at http://science.calwater.ca.gov/pdf/calsim/calsim_II_final_report_011206.pdf.

with an assessment of the likely range of error in these major model parameters and assumptions.[7]

The Bureau of Reclamation and the Department of Water Resources wrote a formal response to the 2006 Peer Review. [8] With respect to quality control, the response stated,

> 5.12 Testing, Quality Control, and Quality Assurance
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> The Review Panel highlighted three areas of model testing in the SJR Peer Review Report (p. 10):
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> 1. Relevant historical comparisons
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> 2. Uncertainty and Sensitivity analyses
>
> 3. Local expert involvement
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> 5.12.1 Response to Review Panel Concerns
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> • Reclamation continues to develop procedures and has prepared documentation supporting the suggested model tests for quality control and quality assurance. The revised Draft CalSim-II San Joaquin River Documentation (available February 2007) will contain a section specifically dedicated to the comparisons of the new model, old model and historical records.
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> • Testing of the CalSim-II San Joaquin River model for sensitivity and uncertainty is complete and can be found in Appendix B.
>
> • Both Reclamation and DWR encourage continued collaboration with local experts to evaluate model assumptions.[9]

However, the adoption by Reclamation of these quality control and quality assurance procedures and documentation appeared to be short lived, and focused mostly on the San Joaquin River module. For the BDCP and WaterFix CALSIM II model versions, comparisons of the new model, old model, and historical records have not been disclosed.

Local experts expressed some very strong concerns about the BDCP and WaterFix model assumptions, most notably in the Bourez report.

> "...the BDCP Model results that include climate change indicate that during droughts, water in reservoirs is reduced to the minimum capacity possible. Reservoirs have not been operated like this in the past during extreme droughts and the current drought also provides evidence that

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[7] Ford et al, p. 8

[8] U.S. Bureau of Reclamation & California Department of Water Resources, CalSim-II San Joaquin River Peer Review Response, January 2007. Available at http://www.usbr.gov/mp/mp700/modeling/calsim/calsim_rpt.pdf.

[9] Ibid., p. 14-15.

> adaptation measures are called for long in advanced to avoid draining the reservoirs. In this aspect, the BDCP Model simply does not reflect a real future condition.[10]

The report goes on to state,

> With the predicted changes in precipitation and temperature implemented in the BDCP Model, there is simply not enough water available to meet all regulatory objectives and water user demands. Yet the BDCP Model continues its normal routine and thus fails to meet its objectives. In this aspect, the BDCP Model simply does not simulate reality. For instance, if the ELT and LLT conditions actually occur, the CVP and SWP would likely adapt to protect water supplies and the environment.

One of the critical issues not addressed by the modelling is the high level of exports by the State Water Project, given the lack of adequate upstream supplies, 483,000 af/year of increased North of Delta demands, and future sea level rise.

When the State Water Project was planned between 1951 and 1960, it was understood that Oroville dam and flows in the Delta would only provide about half of the contracted amounts for the State Water Project.[11] Planners hoped that additional facilities would eventually augment flows on the Sacramento River to provide full allocations. They looked to North Coast rivers to provide augmentation of Sacramento flows.[12] The Department of Water Resources proposed a dam on the Eel River, which was supposed to augment the flow of the Sacramento River by 900,000 acre feet a year, but it was never built, due to environmental concerns.

In 1981, the Department of Water Resources estimated that the dependable annual yield of the State Water Project was 2.3 million acre feet per year, and projected to go down to 1.6 to 1.8 million acre feet per year by 2000, "as a result of increased use in areas of origin, maturity of contractual obligations of the Central Valley Project, and other prior rights."[13] The average deliveries for the State Water Project between 1990 and 2000 were in line with the 1981 projections -- about 1.86 million acre feet per year. In 1987, the Department of Water Resources estimated that the state needed to acquire 250,000 to 500,000 af/year of CVP water to firm up State Water Project supplies, as well as develop the Kern Water Bank to store wet year flows and provide another 140,000 af/year towards meeting Table A allocations.[14]

WaterFix modelling assumptions

The WaterFix modelling assumes that the minimum average demand by the State Water Project will be 3 million acre feet a year. This is almost twice the 1981 estimates by engineers of the dependable yield of the project at 1.6 to 1.8 million acre feet a year. Further analyses need to be done to distinguish the effects of allocation assumptions.

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[10] Ibid., p. 4.
[11] Governmental History Documentation Project, Goodwin Knight / Edmund Brown, Sr., Era: California Water Issues, 1950-1966, William E. Warne, Administration of the Department of Water Resources 1961-66, p. 104 Available at http://archive.org/details/califwatertapere00chalrich
[12] Department of Water Resources, Water Progress in California, 1965.
[13] California Department of Water Resources, State Water Project – Status of Water Conservation and Water Supply Augmentation Plans, November 1981.
[14] California Department of Water Resources, Bulletin 160-87, California Water: Looking to the Future, p.48