California Water Research

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Comments on the Delta Plan, climate change analysis in BDCP

and the requirements of the Delta Reform Act

While the Delta Stewardship Council is not expected to directly analyze the impacts of climate change and sea level rise on the project proposed by the Bay Delta Conservation Plan, the Delta Reform Act specifically mandates a comprehensive review and analysis of the impacts of "possible changes in total precipitation and runoff patterns" due to climate change on the Proposed Project before incorporation into the Delta Plan:

> b) The BDCP shall not be incorporated into the Delta Plan and the public benefits associated with the BDCP shall not be eligible for state funding, unless the BDCP does all of the following:
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> > …(2) Complies with Division 13 (commencing with Section 21000) of the Public Resources Code, including a comprehensive review and analysis of all of the following:
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> > > .. (C) The potential effects of climate change, possible sea level rise up to 55 inches, and <u>possible changes in total precipitation and runoff patterns</u> on the conveyance alternatives and habitat restoration activities considered in the environmental impact report.

Delta Reform Act section 85320, emphasis added.

The Delta Plan must specifically address these requirements of the Delta Reform Act, and must describe a review process that will ensure that the Bay Delta Conservation Plan takes a sufficiently comprehensive look at how shifts in precipitation and runoff from climate change could affect the planned project and operations, as well as the environment. The Delta Plan must clearly and specifically address how the Delta Stewardship Council will ensure adequate review of the BDCP climate change analysis prior to incorporation of BDCP into the Delta Plan. This is an essential duty of the Delta Stewardship Council as an independent agency and should not be delegated to the Department of Water Resources or any other agency proposing projects in the Delta.

Recent experience with a prolonged, severe drought in the Southwest has shown the importance of preparing for mega-droughts that have occurred historically.[1] A 2010 analysis of modeling of climate change in DWR planning studies noted:

> "there is a lack of analysis of potential drought conditions that are more extreme than have been seen in our relatively short hydrologic record. There is significant evidence to suggest that California has historically been subject to very severe droughts and that climate change could result in droughts being more common, longer, or more severe. However, most current DWR approaches rely on an 82-year historical hydrologic record (1922–2003) on which GCM-generated future climate changed-hydrologic conditions are superposed. This record is likely too short to incorporate the possibility of a low frequency, but extreme, drought."[2]

The Bay Delta Conservation Plan modeling currently relies on mapping onto the 82 year historic record.[3] This loses a great deal of information from global climate models on the structure and persistence of droughts. In DWR's 2009 report, "Using Future Climate Projections to Support Water Resources Decision Making in California,[4]" the authors stated:

> In water resources planning, it is often assumed that future hydrologic variability will be similar to historical variability, which is an assumption of a statistically stationary hydrology. This assumption no longer holds true under climate change where the hydrological variability

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[1] Five Key Lessons (and Challenges) from the Great Texas Drought, University of Texas, September 9, 2012. Available at http://www.utexas.edu/know/2012/09/10/great-texas-drought/. Incorporated by reference.

[2] Climate Change Characterization and Analysis in California Water Resources Planning Studies, Final Report, Abdul Khan and Andrew Schwarz. Department of Water Resources December 2010, p. xvi. Available at http://www.water.ca.gov/climatechange/docs/DWR_CCCStudy_FinalReport_Dec23.pdf Incorporated by reference.

[3] Comparison of CAT and CVP IRP Scenarios, Department of Water Resources. Presentation to Climate Change Technical Advisory Group meeting, May 11, 2012. Available at http://www.water.ca.gov/climatechange/docs/ClimateChangeModelingCAT-BDCP-CVP-IRP_Approaches.pdf. Incorporated by reference.

[4]Using Future Climate Projections to Support Water Resources Decision Making in California, Francis Chung et. al., California Climate Center, Final Report, May 2009. Available at http://www.water.ca.gov/pubs/climate/using_future_climate_projections_to_support_water_resources_decision_making_in_california/usingfutureclimateprojtosuppwater_jun09_web.pdf Incorporated by reference.

> is non-stationary. Recent scientific research indicates that future hydrologic patterns are likely to be significantly different from historical patterns, which is also described as an assumption of a statistically non-stationary hydrology. In an article in *Science*, Milly et al. (2008) stated that "Stationarity is dead" and that "finding a suitable successor is crucial for human adaptation to changing climate."

A growing number of climate change studies have projected an increase in the frequency and severity of droughts in the Sierras and the Central Valley, and particularly under the higher greenhouse gas emissions scenarios. The following section describes some key papers.

Several independent studies have been done using the climate change scenarios in the California Climate Change Scenarios Assessment. A 2012 study by Josh Viers and Sarah Null found a mean increase of dry and critically dry years in the Sacramento Valley Index to 23% of all years in the current period, and to 38% of all years by the latter half of the century, under the A2 scenario.[5] Dry and critically dry years in the San Joaquin Valley Index increased to 53% of all years in the current period, and to 69% of all years by the end of the century.

The US Geological Survey released a paper in February 2012 with a very detailed simulation using the A2 GHG scenario with the Global Fluid Dynamics Lab (GFDL) climate model.[6] The modeling projected a decrease of 16-17% in Sacramento River flows from 2020-2030 and 2040-2050, and a 34% reduction by 2080-2090. While the GFDL model is one of the drier climate change models, it should also be noted that the model projections in the Southwest were consistent with the recent megadrought.[7]

The U.S. Bureau of Reclamation did a much larger study for the 2011 Westwide Climate Risk Assessment, used an ensemble of 112 Global Climate Model / scenario combinations.[8] The ensemble median projected drying in Southern California and the Central Sierras by mid-century, as well as drying across the Southwest. By the 2070s, the ensemble median projected drying throughout California.[9] The ensemble median projections are in agreement with regional trends in precipitation in the state.[10],[11]

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[5] Water and Energy Sector Vulnerability to Climate Warming in the Sierra Nevada: Water Year Classification in Non-Stationary Climates, Sarah Null and Josh Viers, California Climate Change Center, July 31, 2012, p. 15. Available at http://www.energy.ca.gov/2012publications/CEC-500-2012-015/CEC-500-2012-015.pdf. Incorporated by reference.

[6] R.T. Hanson et. al., "A method for physically based model analysis of conjunctive use in response to potential climate changes," Feb 4, 2012. Available at http://ca.water.usgs.gov/projects/cvhm/Hanson_etal_2012_WRR.pdf. Incorporated by reference.

[7] Model Projections of an Imminent Transition to a More Arid Climate in Southwestern North America, Richard Seager, Mingfang Ting, Isaac Held, et. al., Science, Vol 316 no. 5828 p. 1181-1184, May 25, 2007. Available at http://www.sciencemag.org/content/316/5828/1181.short. Incorporated by reference.

[8] West-Wide Climate Risk Assessments: Bias-Corrected and Spatially Downscaled Surface Water Projections, U.S. Department of the Interior Bureau of Reclamation Technical Memorandum No. 86-68210-2011-01, March 2011. Available at http://www.usbr.gov/WaterSMART/docs/west-wide-climate-risk-assessments.pdf. Incorporated by reference.

[9] Ibid.

Such major shifts in precipitation and runoff could have huge impacts on yields of proposed storage and conveyance projects, as well as huge environmental impacts. It is essential that information on projected flows and diversions under drier climate change scenarios be made available so that the risk to both water supply and aquatic species in the Delta can be evaluated by the public trust agencies, NMFS, USFWS, and DFG, as well as the Department of Interior, and water agencies in both areas of origin and export areas. The possible environmental impacts under these scenarios should also be available to stakeholders, including fishermen, Indian tribes, and NGOs.

Unfortunately, the Bay Delta Conservation Plan currently provides little analysis of the potential impacts of such major shifts in climate from the historic frequency of wet and dry years. The modeling also uses a non-peer reviewed technique to aggregate predictions from lower and higher GHG emissions scenarios, and wetter and drier climate change models into a single "Central Tendency" projection.[12] This projection masks the risks to both water supply and the environment under the drier climate change model/scenario combinations.[13]

These analyses are core to ensuring that BDCP meets the goals of"a more reliable water supply" and to "protecting and enhancing the Delta ecosystem," which is a core agency responsibility under the Delta Reform Act. To adequately discharge its public trust duties, the Delta Stewardship Council must ensure that the deficiencies described above are remedied, prior to incorporation of the Bay Delta Conservation Plan into the Delta Plan. The Delta Stewardship Council should also ensure that adequate analysis of potential drought impacts of climate change is done for all projects incorporated into the Delta Plan, not just BDCP. Addressing the risk of an increase in the frequency and severity of droughts in the Sacramento and San Joaquin River watersheds.is essential to meeting the co-equal goals of "providing for a more reliable water supply for California" and "protecting and enhancing the Delta ecosystem."

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[10] Killam, D., A. Bui, S. LaDochy, P. Ramirez, W. Patzert and J. Willis. 2011. Precipitation trends in California: Northern and central regions wetter, southern regions drier. Unpublished. Cited in Temperature and precipitation trends in California: Global warming and Pacific Ocean influences, LaDochy and Ramirez et. al.

[11] Regional precipitation data with linear trends also available from Western Regional Climate Center, California Climate Tracker. Available at http://www.wrcc.dri.edu/monitor/cal-mon/frames_version.html. Incorporated by reference.

[12] Jamie Anderson, presentation on Climate Change Approaches, Department of Water Resources, March 2012. Available at http://www.water.ca.gov/climatechange/docs/CCTAG_climate_change_approaches%20final_3-28-12_Jamie%20Anderson_with%20extra%20slides.pdf. Incorporated by reference.

[13] Incorporating Drought Risk From Climate Change Into California Water Planning, comments on Department of Water Resources Draft Climate Change Adaptation Strategy, California Water Research, August 2012. Incorporated by reference.

Sincerely,

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