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Comments on climate change modelling in the California Water Fix RDEIR/SDEIS

The California Water Fix RDEIR/SDEIS does not use the best available science in modelling of climate change, and there are some significant omissions in the analysis.

The RDEIR/SDEIS asserts that the new conveyance project will mitigate risks to water supply from climate change, but without defining the expected lifetime of the project. In the case of a $17 billion water supply project, the expected design lifetime is at least 50-100 years. The simple fact is that the project could easily fail to meet the objective of mitigating sea level rise within 50 years, and in the near term, of increasing water supply reliability.

The limitations to the proposed projected should have been more clearly analyzed and disclosed in the RDEIR/SDEIS.

Climate Change Impacts

> In the 2009 Delta Reform Act, the legislature mandated that the Bay Delta Conservation Plan
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> "… shall not be considered for incorporation into the Delta Plan, unless it does all of the following... including a comprehensive review and analysis of...
>
> ….(C) The potential effects of climate change, possible sea level rise up to 55 inches, and possible changes in total precipitation and runoff patterns on the conveyance alternatives and habitat restoration activities considered in the environmental impact report.

The analysis in the RDEIR fails to meet the plain meaning of the statute with respect to the conveyance alternatives, in that it fails to provide a comprehensive review and analysis of potential effects of sea level rise up to 55 inches (1.4 meters) on the proposed conveyance. Instead, it uses values of 15 cm (6 inches) in the "Early Long Term" and 45 cm (18 inches) in the "Late Long Term" as input to all of the modelling. This input value was selected by DWR in previous modelling as the "most likely" values for these periods.

The RDEIR/SDEIS does significant disservice to water agencies in not evaluating or discussing the finite lifetime of the proposed conveyance project as a solution to sea level rise. In particular, there may be significant risks to urban water agencies in relying on the project as water supply for new housing and industrial infrastructure. The RDEIR should have included

modelling so that water agencies could evaluate and compare the $17 billion project with alternatives which are not as vulnerable to continuing effects of sea level rise. Agricultural users that would be planting salt-sensitive permanent crops such as almonds, based on the projected water supply would also be affected.

Changes to runoff

The modelling for the RDEIR/DEIS uses the Q5, or Central Tendency runoff projections for inputs to all hydrological modelling. The Central Tendency scenario considers the ensemble of all 112 Global Climate Models / Greenhouse Gas Emissions Scenarios as equally likely, and computes the Central Tendency estimate after pruning.

The problem is that the recent research shows that the Global climate Change Models (GCMs) with lower sensitivity, that is, reduced temperature increases for a given increase in C02 emissions, are increasingly unlikely. A recent study by Sherwood, Bony, and Dufresne [1] found that

> … The mixing inferred from observations appears to be sufficiently strong to imply a climate sensitivity of more than 3 degrees for a doubling of carbon dioxide. This is significantly higher than the currently accepted lower bound of 1.5 degrees, thereby constraining model projections towards relatively severe future warming.

Similar results were found in a 2012 study by Fausilio and Treberth, which compared current observations of May through August relative humidity with model projections.[2]

This means that a significant number of the GCMs in the 112 model ensemble used by DWR in formulating the Q5 runoff projections have likely been shown to be incorrect by recent research.

The problem with the Q5 Central Tendency projection was exacerbated further by the pruning that was done on the ensemble of Global Climate Models prior to computing the Central Tendency. The pruning throws out the 25% driest models, which projected the greatest decrease in precipitation, and the 75% warmest models, which projected the greatest increase in evapotranspiration.

The graph on the next page, from the BDCP Draft EIR Appendix 5A-2, shows the extent of the model pruning for runoff in the Feather River Basin, and how the pruning eliminates models which predict drying greater than about 5%. Unfortunately, the models which predict drying greater than 5% in the current period were likely the same models which predicted the recent severe droughts in the Southwest and California. (Q1-Q4 will be explained on the next page.)

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1 S.C. Sherwood, S. Bony, and J. Dufresne, "Spread in model climate sensitivity traced to atmospheric convective mixing", Nature, vol. 505, pp. 37-42, 2014. http://dx.doi.org/10.1038/nature12829.

2 J.T. Fasullo, and K.E. Trenberth, "A Less Cloudy Future: The Role of Subtropical Subsidence in Climate Sensitivity", Science, vol. 338, pp. 792-794, 2012. http://dx.doi.org/10.1126/science.1227465.

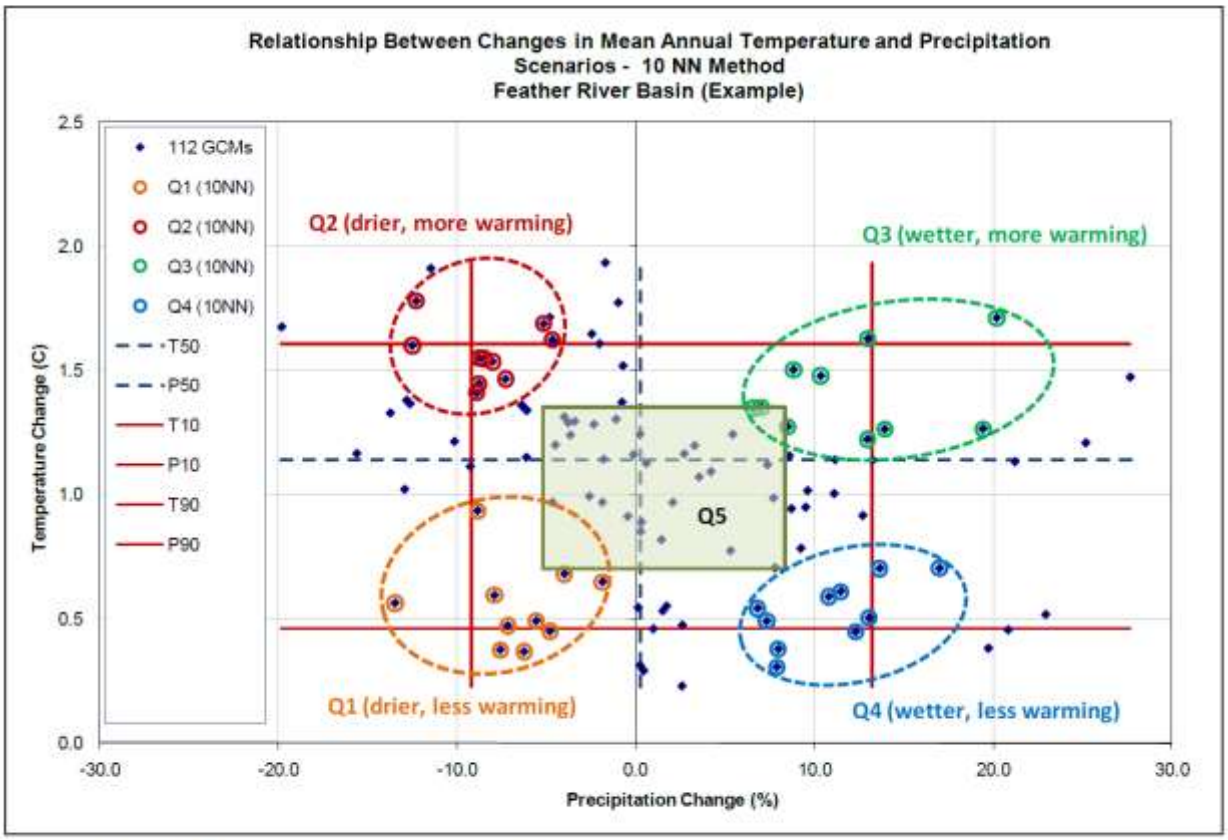

Figure 5.A.2.2-1. Example of Downscaled Climate Projections and Sub-Ensembles Used for Deriving Climate Scenarios (Q1–Q5), Feather River Basin at 2025[1]

The Q1-Q4 projections were used in prior modelling for BDCP. As I indicated in previous comments, these projections should have been used in the RDEIR/SDEIS to estimate the worst case decrease in runoff and the absolute risk to water supply.

In prior BDCP modelling, the set of 112 GCM/GHG scenario projections were broken four different quartiles, based on the mean projected change in temperature and mean projected change in precipitation for the ensemble.

- Drier, less warming [Q1, orange]
- Drier, more warming [Q2, red]
- Wetter, more warming [Q3, green]
- Wetter, less warming [Q4, dark blue]

Each quartile was used to produce an ensemble model, after pruning off the 10% driest and 10% wettest models. These models projected potentially much greater changes in runoff.

The Q1-Q4 estimates from the prior BDCP modelling showed significant reductions in runoff, even by 2025, worse in the San Joaquin Valley and the Trinity basin. The warmest, driest quartile (Q2) has the greatest reduction in both precipitation and evapotranspiration, and thus the greatest reduction in runoff. The Q1 and Q2 models showed reductions in average runoff

to the major reservoirs on the Sacramento River – Shasta, Oroville and Folsom, of over 10% by 2025, and almost 20% to Trinity. As recent experience has shown, because of senior water rights on the Sacramento and Feather Rivers, even a 10%-20% reduction in flow in the Sacramento watershed can result in much greater reductions in exports, with a huge impact on water supply.

The RDEIR / SDEIS asserts that the proposed conveyance project increases water supply reliability, but without doing any analysis of the potential for a major and absolute decrease in water yield over current conditions. This information is essential for water agencies in planning and in evaluation of the proposed project. It could and should have been provided using model runs with inputs from Q2.