BRG INTELLIGENCE THAT WORKS

Memo

Date: August 6, 2024

To: Carolyn Buckman, Environmental Program Manager,
Delta Conveyance Office, Department of Water Resources

From: Dr. David Sunding

Subject: Response to Dr. Jeff Michael's Critique of the Benefit-Cost Analysis for the Delta Conveyance Project

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Dr. Jeff Michael recently released a critique of the 2024 Benefit-Cost Analysis (BCA) of the Delta Conveyance Project (DCP).[1] Dr. Michael is a longtime critic of the project, and his work has been supported by various Delta farming and environmental interests.

In his latest report, Dr. Michael raises a number of objections to the BCA. As detailed in this memo, Dr. Michael's criticisms reveal some significant misunderstandings about the role of the BCA, the framework of the analysis, the treatment of risk in the BCA, the choice of economic parameters like the discount rate, and other important aspects of the BCA.

The economic analysis we conducted is based on industry standards and follows industry best practices. It is informed by current, applicable and documented data and policies. It carefully avoids speculation and is purposefully conservative in nature. This memo is meant to help decision-makers better understand our approach by correcting Dr. Michael's errors.

1. Benefit Cost Analysis, Alternatives and Decision Making

Claim: Dr. Michael claims that the BCA does not "consider any alternatives" and therefore that a benefit-cost ratio of 2.2 is "not very meaningful."

Response: Contrary to Dr. Michael's claims, DWR assessed numerous alternatives and selected the Bethany Alignment as the preferred project. The BCA evaluates this preferred project because it would be pointless and frankly not very meaningful to conduct an economic analysis of alternatives that fail to meet basic project objectives. Further, the BCA considered the incremental cost of the DCP compared to various water supply alternatives and concluded that investing in the DCP is significantly less expensive than seawater desalination, recycling and stormwater capture.

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[1] Michael, J. (2024). Review of Delta Conveyance Project Benefit-Cost Analysis: Implications for Decision-Makers and Financing. University of the Pacific, Center for Business and Policy Research. https://www.pacificcbpr.org/wp-content/uploads/2024/06/DCP-BCA-review-062424.pdf

Discussion: There are numerous ways in which alternatives have been considered in the DCP planning process, and in the BCA. To begin, DWR selected the Bethany Reservoir Alternative based on the environmental analysis in the Final Environmental Impact Report (EIR), and the BCA assesses the preferred project. This formulation is sensible - after all, it would be pointless to conduct an economic analysis of alternatives that fail to meet basic project objectives.

Within the environmental analysis, DWR considered alternatives from scoping, engagement with interested parties, public outreach activities, and engineering studies. DWR assessed the ability of each alternative to feasibly attain most of the project objectives within Appendix 3A of the Final EIR. DWR considered a wide range of alternatives in this assessment within the EIR and identified the alternatives that best meet the project objectives to be carried forward for additional analysis. The EIR specifically considered alternatives with no new conveyance facilities and determined that they did not meet many (or, in some cases, any) of the evaluation criteria.

The role of economic analysis in the DCP decision-making process is to quantify the benefits and costs of the preferred, and now approved, project. The BCA considers whether the proposed project is economically reasonable (i.e., produces benefits that are at least as large as the costs). Benefits considered in the BCA include water supply, climate change mitigation, resilience following major seismic events and water quality improvements. Costs include capital costs, environmental mitigation, the Community Benefits Program, operations and maintenance costs, and the unintended, external impacts of the project such as those experienced in the Delta during the construction period (e.g., traffic congestion, air quality, noise). The BCA considers the performance of the State Water Project with the DCP in place compared to an alternative scenario that assumes the current infrastructure in the Delta is maintained into the future. The BCA concludes that investing in the DCP produces benefits to ratepayers of $2.20 for every $1 in project cost.

The BCA properly evaluates agency operations with and without the incremental supplies provided by the DCP. For example, the BCA is based on modeling of puts and takes from storage, dry-year option and transfer agreements, and demand management measures like short-term rationing. The BCA uses state of the art, peer-reviewed methods to value the reductions in climate-induced water shortages with implementation of the DCP; these improvements in water supply reliability account for the majority of benefits from the project. The BCA also compares the levelized cost of the DCP with the cost of water supply alternatives including ocean desalination, recycling, stormwater capture and conservation, concluding that the DCP is far less expensive than these alternatives (more detail is provided later in this memo).

2. Differences Between the DCP and WaterFix

Claim: Comparing the WaterFix and DCP economic analyses, Dr. Michael claims that we "added favorable assumptions to increase the project's estimated benefits as the real-world economics of the project have become more unfavorable."

Response: The DCP is not WaterFix. It is a very different project at a different point in time, set within the context of currently applicable policies, operational criteria and technical data. It is reasonable and desirable to evaluate the DCP using updated, correct and applicable assumptions. In many ways, the DCP is a more conservative analysis.

Discussion: The modeling choices made when conducting both WaterFix and DCP BCAs were informed by DWR policy, the criteria by which each project would be operated, water values in the SWP service area and technical analyses of issues like post-earthquake water deliveries of the SWP.

One important difference between the DCP and WaterFix economic analyses is the definition of the baseline scenario assuming current infrastructure. The WaterFix economic analysis assumed a "declining baseline" where tighter environmental regulations would reduce Delta exports over time without additional conveyance infrastructure. By contrast, the DCP BCA uses the EIR no project alternative to model future deliveries under the current infrastructure focusing on the impacts of climate change and sea level rise on State Water Project deliveries. We note that the effect of using the EIR no project baseline as opposed to the "declining baseline" of the 2016 analysis is to reduce incremental deliveries through the DCP, meaning a reduction in benefits. Dr. Michael has previously endorsed the use of the EIR no project alternative in the benefit cost analysis of the DCP, so we assume he would agree with our choice of a baseline.

The most important remaining differences between the WaterFix economic analysis and the DCP BCA result from increases in the value of water in the eight years since the WaterFix analysis was completed. In particular, retail water rates in the MWD service area are roughly 70% higher than in 2016 when the WaterFix economic analysis was released. The benefits of avoided water shortages are correspondingly higher as well. Thus, while the DCP is smaller capacity than the WaterFix and produces smaller incremental supply benefits, the value of these incremental supplies is higher than evaluated in 2016.

It should also be noted that several important differences between the DCP and WaterFix analyses *reduce* the benefits of the project, which reduces the benefit-cost ratio. For example, the seismic risk reduction benefits in the DCP analysis are based on a 1-in-500-year earthquake as opposed to a 1-in-100-year event. Because the resulting benefits are weighted by the much-lower probability of occurrence, the seismic risk reduction benefits were lower in the DCP analysis vs. WaterFix. The DCP analysis also assumes a smaller improvement in water quality than the WaterFix analysis; this is due to the smaller reliance on north of Delta pumping in the DCP.

3. Assumed Project Lifespan

Claim: Dr. Michael claims that a 100-year lifespan assumption is "unusually optimistic" and that it is "amplified by an unusually low discount rate, especially for a project with a high-risk profile."

Response: An assumption of a 100-year design life for the DCP, particularly for the project's major concrete structures such as the tunnels and shafts, is based on, and entirely consistent with, industry standards for critical underground infrastructure. To assume a shorter design life would be contrary to industry standards.

Discussion: Assumptions regarding capital replacement costs are similarly based on industry standards and guidelines. Major structures such as the tunnel and shafts have a longer expected life than the 100 years assumed in the BCA. Therefore, the refurbishment and replacement estimates focused on major mechanical, electrical, instrumentation and control equipment. Equipment refurbishment costs are based on a percentage of full replacement of the equipment reflective of the estimated maintenance activities. Replacement costs are based on unit costs outlined in the cost estimate. Equipment refurbishment and replacement frequency is based on commonly accepted industry standards for the life of the specific equipment.

4. Discount Rate

Claim: Dr. Michael criticizes our use of the real discount rates specified in OMB Circular A-94 to calculate present values. He argues instead for the 2.75% rate specified in 2023 guidance from the Bureau of Reclamation. He further argues that Circular A-94 actually specifies a rate of 3.1% if benefits are not certainty-equivalent valuations.

Response: The discount rates used in the BCA are consistent with recent guidance issued by the White House Office of Management and Budget (OMB) and reflect real rates of return on inflation-adjusted treasuries, a market-based approach that has been advocated by economists for more than two decades.

Discussion: Not only is the discount rate consistent with OMB guidance and economic theory, so too is the use of declining discount rates to reflect future uncertainty and income growth. This approach has been advocated by economists as well as numerous environmental interests to evaluate the economics of climate mitigation and adaptation projects like the DCP.

Dr. Michael points to a 2.75% interest rate recommended by the Bureau of Reclamation and the Department of the Interior, arguing that this rate should have been used in our analysis. However, Dr. Michael apparently does not realize that Reclamation's recommended 2.75% interest rate is a *nominal* rate based on 4% Treasury yields, without maximum quarterly adjustments. Using Reclamation's recommended nominal interest rate would result in an even lower real discount rate than the one used in our analysis.

Dr. Michael also cites Circular A-94 to argue for a higher real discount rate, stating: "[d]iscounted benefits or costs should be determined using a real discount rate of 2.0 percent if the benefits or costs reflect certainty-equivalent valuations and 3.1 percent if they do not (unless a project-specific risk premium is calculated)." Roughly speaking, one way to account for risk in benefit-cost analysis is to calculate average benefits by year and then discount back to present value using a relatively high discount rate to account for risk and avoid overvaluing benefits. This is the rationale behind OMB's identified 3.1% discount rate. The theoretically preferred approach, however, is to model risk explicitly (i.e., calculate benefits under a range of future dry and wet conditions) and then discount each possible future using a risk-free rate and calculate the average across future outcomes. This is the approach taken in the DCP BCA. Our analysis addresses risk explicitly by calculating the monetary benefits of the DCP for each of the 94 hydrologic scenarios considered in the CalSim model. This calculation produces 94 present values each calculated using different future hydrologies. Average benefits across these simulations then provide a certainty-equivalent benefit estimate, making our choice of a 2.0 percent rate entirely appropriate and consistent with OMB guidance. Additionally, a 30% contingency is added to account for cost uncertainty, equivalent to a risk premium on construction cost that can be interpreted as a certainty equivalent.

5. Urban Water Values

Claim: "Water transfers are a direct approach for agencies to augment their supplies and are comparable to DCP water supplies at the source."

Response: Dr. Michael appears to be advocating for the use of water transfer prices as a measure of the value of additional Delta exports to urban agencies. If so, he is seriously misguided as the California water market is highly constrained and far from a perfectly competitive market.

Discussion: Metropolitan and other California urban water agencies have tried with only limited success to purchase additional water from willing sellers in agriculture, particularly in dry years. If Dr. Michael's assumptions were accurate, urban agencies would have experienced no or only very modest shortages in the past as they would simply have purchased water from farmers during drought conditions. One need only look at the recent record to understand this is an overly simplistic and erroneous assumption.

The BCA follows best practice and uses a more meaningful measure of the value of water to urban customers, namely the value of avoided water shortages. Recall that without the DCP in place, as climate change and sea level rise take hold over the coming decades, SWP deliveries are projected to decline by 22% by 2070 relative to current conditions. As a result of this loss of water supply, Metropolitan can expect shortages of greater than 20% in one year out of five; it can expect shortages of greater than 10% in roughly four years out of ten. These shortages are economically costly, and reducing the frequency and magnitude of shortages is economically beneficial to urban water customers in Southern California. Similar results hold in other parts of the SWP service territory.

6. Urban Water Demand Forecasts

Claim: The urban water demand forecasts for Metropolitan are inflated, resulting in unrealistically large estimated shortages in Southern California.

Response: MWD's demand projections are reasonable and based on demographic growth projections made with the assistance of the Center for the Continuing Study of the California Economy (CCSCE), which were based on national growth studies conducted by the US. Census Bureau. Furthermore, the BCA assumes the same demand in 2045 as in 2145, which is very conservative, to purposefully avoid unrealistically large shortages.

Discussion: The BCA uses operational models for the urban state water contractors to estimate future shortages under the DCP and current infrastructure. These shortages are in turn calculated based on future urban water demands, together with assumptions about alternative supplies in the future.

The water demand projections for Southern California used in the BCA are appropriate. Metropolitan uses an econometric framework known as MWD-EDM to forecast future retail water demands using projected population growth and conservation savings for each of the four IRP Needs Assessment scenarios (based on CCSCE assistance referenced above). MWD-EDM also included drivers of change such as smaller lot sizes of future homes, future water conservation behaviors, and changes in water use norms and rebound.

Scenario D does entail the highest level of supply development to meet demands reliably over the four basic planning scenarios considered by Metropolitan. However, MWD has determined that this is a realistic scenario that must be planned for, given the long lead time needed to implement water supply alternatives and conservation programs and the uncertainties around population growth, changes in employment and economic activity, and the impacts of climate change.

Further, demands in the IRP Needs Assessment are only projected to 2045, which is the same year the DCP is expected to begin operating. Thus, while the BCA is predicated on the relatively high demand growth in Scenario D, it also assumes *no water demand growth at all*, and no deterioration in other sources of water, over the ensuing 100-year operating life. In effect, the BCA assumes the same demand in 2045 as in 2145, which is very conservative, and does not result in unrealistically large shortages.

Finally, the BCA is predicated on 2070 climate and sea level conditions, which is only 25 years into the 100-year operating life of the DCP. Given that most analysts project climate and sea level conditions to worsen after 2070, this assumption is conservative, not unrealistically inflated.

7. Cost of Alternative Water Supplies

Claim: The DCP is more expensive than available water supply alternatives.

Response: The DCP is more durable and less expensive than available alternatives such as desalination, recycling and stormwater capture, even when accounting for energy costs and lifespan. Moreover, not all alternatives are available to all water agencies and are not scalable to the magnitude of the State Water Project.

Discussion: It is instructive to compare the unit cost of the incremental water supplies resulting from operation of the DCP to the cost of common water supply alternatives employed in California, namely desalination, recycling, storm water capture and water conservation. Making such a comparison shows that the implicit cost of the DCP is far lower than the cost of most available water supply alternatives. Thus, even setting aside the ability of the DCP to withstand large earthquakes and deliver higher quality water supplies, the project is still more economical than large-scale investment in water supply alternatives.

Using a standard formula accounting for the time value of incremental water supplies, the levelized unit cost of the DCP is $1,325 per acre-foot. This figure is calculated using the same assumed project life, discount rate and incremental yields as used to calculate water supply benefits, ensuring a consistent estimate. For comparison, the urban water supply benefits of the DCP alone are worth $2,560 per acre-foot.

Dr. Michael points out that the unit cost and water supply benefit is measured at the Delta. For any given water agency, customers must also pay the *marginal* cost of conveyance and treatment (not the average cost cited by Dr. Michael). Unit power costs of conveyance and treatment range from $100 - $300 per acre-foot across the SWP service area, depending on the location of the agency. Adding these costs to the DCP unit cost cited above does not change the conclusion that the DCP is more durable and less expensive than available alternatives such as desalination, recycling and stormwater capture.

8. Seismic Risk Reduction Benefits

Claim: The estimated seismic risk reduction benefits are small and overstated due to a calculation error.

Response: The 2024 BCA employs a different and more conservative seismic scenario compared to the previous analysis of the California WaterFix, considering a 500-year event (e.g. less frequent benefit) rather than the previously assessed 100-year event. This is a purposeful change in assumptions and incorporates the best available and most recent science.

Discussion: Dr. Michael's estimation of approximately $10,000 per acre-foot of water supply benefits during a prolonged seismic outage derives from our reliability models, which project future demand and shortage conditions during such an outage. This estimate is robust and reflects the high value of water during an emergency situation such as that following a major earthquake near the Delta that can cut off SWP deliveries for a period of months.

Dr. Michael's report compares the 2016 WaterFix analysis to the 2024 BCA and infers that the differences imply that there is some unspecified error in the BCA. The 2016 and 2024 analyses consider completely different outage and water quality assumptions; the 2024 BCA uses information from the 2018 *Delta Flood Emergency Management Plan* which was not available when the 2016 analysis was completed. Further, as detailed above, urban and agricultural water values in California have increased significantly over the past 8 years and the 2024 BCA incorporates this more recent information.

9. Agricultural Water Values

Claim: "Instead of using the well-established approach of valuing agricultural water value with SWAP, the 2024 BCA made a bizarre choice to average the SWAP value with an unrelated non-agricultural water price index traded on the NASDAQ."

Response: The BCA approach to measuring the value of water to agriculture is the exact method recommended by the California Water Commission (CWC).

Discussion: The BCA measures the value of water to agriculture by combining the results of the Statewide Agricultural Production Model (SWAP) with water market prices as reported by the NASDAQ Veles Water Index. Contrary to Dr. Michael's claim, combining the results of a programming model like SWAP with observed water market prices is not "bizarre;" rather, it is the method recommended by the California Water Commission (CWC) for valuing agricultural water supplies. The CWC also concluded that using SWAP model results alone is likely to result in overly conservative estimates of the value of agricultural water supplies. For example, in the 2017 *North of Delta Offstream Storage Investigation Draft Feasibility Report* released by the Bureau of Reclamation, the authors conclude as follows:

> The *Draft Technical Reference*, published by the WSIP of the CWC (CWC 2016), compared the results of SWAP modeling to transfer analysis. The CWC concluded that combining the two approaches would improve a project's values for future conditions and the safe-yield limits imposed by the Sustainable Groundwater Management Act. This suggests that the NED benefits estimates using the SWAP model are likely conservative. WSIP recommends instead using a methodology that combines the results of SWAP modeling with transfer price data to develop unit values for estimating agricultural supply benefits.

The agricultural water value of $474 per acre-foot used in the BCA is consistent with farm water values used in other analyses of California water projects. For example, the Sites Reservoir feasibility study cited above found farm water values of between roughly $300 and $400 per acre-foot. Applying growth rates for irrigated land prices to these figures yields an estimate of between $422 and $563 per acre-foot, a range that includes the value of agricultural water used in the BCA, indicating that the analysis in the BCA is well supported.

10. Environmental Costs

Claim: "The environmental review documents for the DCP disclose scores of important environmental impacts during both construction and operation, but the 2024 BCA ignores most of these impacts."

Response: The BCA in fact does address the cost of environmental impacts in two important ways. Firstly, the BCA accounts for the cost of mitigation for significant impacts identified in the project's Environmental Impact Report. Secondly, the BCA includes economic analysis of numerous local impacts of the DCP, even though the EIR shows them to be "less than significant."

Discussion: Quantified impacts are included for increased traffic congestion during the construction period, noise impacts, air quality impacts and lost farmland. It also includes an economic analysis of impacts to Delta agriculture resulting from operation of the DCP; these modest impacts occur as a result of moderate changes in salinity in the Delta. The total economic cost of these local impacts is $167 million, a number that is roughly 1/200th of the value of the statewide benefits of the DCP.

Dr. Michael also claims that the BCA should have included an economic assessment of the impacts to species resulting from construction and operation of the DCP. The EIR provides a detailed assessment of potential impacts to native species, including State and Federally listed salmonids and smelt. The DCP incorporates design and operational elements to avoid and minimize potential effects to fish and the aquatic environment. The effects analysis relies on substantial evidence and best available science to assess potential effects to the aquatic environment and is particularly focused on mechanisms known or hypothesized to be of concern for listed species, such as interactions with fish screens, modifications and impacts to habitat, and indirect effects to migration and survival.

The assessment concludes that the incremental effect of DCP is unlikely to be significant on a population level scale, but through an abundance of caution for listed species, provides for mitigation tailored to address those mechanistic effects identified as particular concerns. For example, the tidal restoration proposed to mitigate impacts to salmon is based on the scale and location necessary to offset flow reductions downstream of the proposed North Delta Diversions by redirecting tidal energy and flow away from the lower Sacramento River. This mitigation is specifically designed to bring flows – which influence routing and survival of juvenile salmon in the lower Sacramento River – back to levels consistent with the no-project condition. Other benefits of this restoration, such as increased quantity and quality of rearing habitat, are above and beyond the direct flow benefits. Additionally, DWR will continue to work with the State and Federal fish and wildlife agencies to further refine avoidance and minimization measures, as well as the type and extent of restoration, to insure DCP does not jeopardize the continued existence of listed species and is fully mitigated. Because the potential impacts are mitigated, the DCP does not have remaining impacts that need to be incorporated into the BCA.

11. Remaining Agricultural Users

Claim: The benefit-cost ratio of the DCP for agriculture is 0.39, making it likely that agricultural users will drop out.

Response: Dr. Michael makes assumptions about cost allocation that are unfounded and go well beyond the BCA.

Discussion: The BCA calculates *aggregate* benefits and costs. Because we conclude that the total benefits far outweigh total costs, it is reasonable to conclude that project participants can structure an agreement to divide incremental supplies and costs in a way that leaves all participants better off than if the project were not undertaken. We agree that the benefits of the DCP are in general lower for agricultural water users, on both an absolute and a per-acre foot basis. However, the BCA makes no assumptions about cost allocation among project participants and Dr. Michael's assumptions about cost allocation are premature at best. Further, many agricultural water users are concerned with the forecasted cost of SWP supplies and how these would change after the DCP is financed. Here again, however, it is premature to speculate about how the DCP will impact SWP rates.