Charge for the Peer Review of the Department of Water Resources' March 2016 Report "On Estimating Net Delta Outflow (NDO): Approaches to Estimating NDO in the Sacramento-San Joaquin Delta"

June 24, 2016

Peer Review Purpose

The purpose of this peer review is to evaluate proposed methodological improvements to the estimation of net Delta outflow to inform the State Water Resources Control Board's (State Water Board) decisions regarding the formulation of regulatory parameters to manage net Delta outflow. This technical evaluation will inform the scientific basis for updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan). As part of this peer review, an independent panel of science experts (panel) will be provided the report, "On Estimating Net Delta Outflow (NDO): Approaches to Estimating NDO in the Sacramento-San Joaquin Delta" prepared by the Department of Water Resources at the request of State Water Board staff. The panel will review the report and any supporting information necessary to evaluate its contents in light of the charge questions posed below. The panel will summarize their findings on the charge questions in a written report to the Delta Stewardship Council/Delta Science Program (DSP) and State Water Board.

Background

The State Water Board is currently undertaking a phased process to develop and implement updates to the Bay-Delta Plan and flow objectives for priority tributaries to the Delta to protect beneficial uses in the Bay-Delta watershed. The Bay-Delta Plan identifies beneficial uses of Bay-Delta waters, water quality objectives for the reasonable protection of those beneficial uses, a program of implementation for achieving the water quality objectives and an associated surveillance and monitoring program. Phase 1 of the review of the Bay-Delta Plan is focused on southern Delta water quality and San Joaquin River flows. Phase 2 (Comprehensive Review) is focused on other changes that may be needed to the remainder of the Bay-Delta Plan to protect beneficial uses, including fish and wildlife beneficial uses. The parameters affecting fish and wildlife beneficial uses include: (1) Delta outflows (net Delta outflow), (2) export constraints, (3) Delta Cross Channel Gate closure requirements, (4) Suisun Marsh requirements; (5) Old and Middle River reverse flows; (6) floodplain habitat flows; (7) changes to the monitoring and special studies program, and (8) other potential changes to the program of implementation. Phase 3 involves changes to water rights and other measures to implement changes to the Bay-Delta Plan from Phases 1 and 2. Phase 4 involves developing and implementing flow objectives for priority Delta tributaries outside of the Bay-Delta Plan updates.

Net Delta outflow is strongly influenced by depletions and accretions within the Delta. When the existing Delta outflow objectives were first adopted in the 1995 Bay-Delta Plan, the best available estimates of gross channel depletions in the Sacramento-San Joaquin Delta were those developed for the DAYFLOW program, so these were used in the definition of NDOI (1995 Bay-Delta Plan at page 25). The 1995 Bay-Delta Plan indicated that DWR was in the process of developing new channel depletion estimates that would be used in lieu of DAYFLOW once available (see footnote 2 on page 25 of the 1995 Bay-Delta Plan). State Water Board Decision

1641 (as revised March 15, 2000), which assigned responsibility for implementing the Delta outflow objectives and other Bay-Delta Plan objectives, reiterated this statement (page 190, footnote 2). The 2006 Bay-Delta Plan continues to require that DAYFLOW channel depletion estimates be used if new estimates were not available (2006 Bay-Delta Plan, figure 4, page 20, footnote 2). In the past twenty years, new depletion estimates have not been incorporated into the NDOI calculation nor have other potential needed improvements to the NDOI calculation been made.

The current drought, as well as numerous technical reports and publications, have demonstrated the need to better estimate Delta outflows, including associated depletions and accretions in the Delta, for multiple critical purposes including water supply availability, expected water quality conditions, and protection of beneficial uses. Consequently, in September 2015, the State Water Board staff requested that DWR provide its best available estimates of Delta consumptive uses and channel depletions, the data and methods underlying those estimates, and a recommended method for estimating net Delta outflow in real time on a daily time scale. DWR provided the report on April 7, 2016.

The State Water Board has requested the assistance of the Delta Science Program to obtain a technical peer review of the report provided by DWR in response to this request and to provide further guidance on an appropriate methodology for determining net Delta outflow as a regulatory parameter in the Bay-Delta Plan.

Regulatory Context

The State Water Resources Control Board and the nine Regional Water Quality Control Boards (Water Boards) have broad responsibilities to protect surface and ground water quality and balance competing demands on California water resources through programs that allocate water rights, adjudicate water right disputes, develop statewide and regional water quality control plans and implement and enforce those plans. The State Water Board allocates water rights through an administrative system that is intended to maximize the beneficial uses of water while protecting the public trust, serving the public interest, and preventing the waste and unreasonable use or method of diversion of water. The State Water Board protects water quality by establishing water quality control plans, implementing those plans and enforcing that implementation. Water Quality Control Plans identify existing and potential beneficial uses of waters of the state and establish water quality objectives and implementation measures to reasonably protect the identified beneficial uses along with surveillance and monitoring requirements. While most water quality control planning is done by the Regional Water Quality Control Boards, the State Water Board has authority to adopt statewide Water Quality Control Plans and adopts the Bay-Delta Plan because of the overlapping water quality and water rights issues of statewide significance in the Bay-Delta.

The Bay-Delta Plan includes beneficial uses that fall into three broad categories including: fish and wildlife, agricultural, and municipal and industrial uses. The current Bay-Delta Plan includes water quality objectives to protect the three categories of beneficial uses including: inflows from the Sacramento and San Joaquin Rivers; Delta outflows; water project operations; dissolved oxygen; narrative salmon protection; and various salinity objectives for the protection of fish and wildlife, agriculture, and municipal and industrial uses. The program of implementation identifies actions needed to protect beneficial uses and implement the water quality objectives, including actions the State Water Board will take, actions that the State Water Board will take with other entities, and actions that other entities should take, including non-flow and water quality actions.

The Bay-Delta Plan like other Water Quality Control Plans is not self-implementing and requires additional actions to be implemented. The primary mechanism for implementing the Bay-Delta Plan in the past has been through the State Water Board's water rights authorities. The water quality control planning process and water rights implementation processes are separate processes governed by separate statutory and regulatory requirements. The water quality control planning process is a quasi-legislative planning process, whereas the water rights process is a more formal evidentiary quasi-judicial process.

Pursuant to state and federal law, the State Water Board is required to regularly review the Bay-Delta Plan to determine what, if any, changes should be made to the Bay-Delta Plan to protect beneficial uses. The State Water Board conducted a review of the current 2006 Bay-Delta Plan in 2009. As a result of several species declines in the Bay-Delta that may be associated with Bay-Delta Plan requirements the State Water Board determined that Delta outflows and other requirements for the protection of fish and wildlife beneficial uses should be considered for potential amendment to ensure the protection of fish and wildlife beneficial uses. The State Water Board started the process of updating the Bay-Delta Plan with Phase 1 in 2009 and Phase 2 in 2012. The update process is being conducted in compliance with applicable statutory and regulatory requirements, including the California Environmental Quality Act (CEQA). The Water Quality Control Planning process is a Certified Regulatory Process pursuant to CEQA. Accordingly, the State Water Board is exempt from preparing an Environmental Impact Report (EIR) for its review. Instead, the State Water Board is preparing a SED that is functionally equivalent to a programmatic EIR. In addition to the evaluation of environmental impacts, the SED will also evaluate economic effects and other public interest considerations at a programmatic level. All of this information will be used along with public comments from the public to inform the State Water Board's decisions regarding changes to the Bay-Delta Plan. Prior to implementation through water rights and other measures, additional project specific environmental documentation will be prepared as necessary and other statutory and regulatory requirements will be met.

Charge to the Panel

The Panel is charged with reviewing and assessing the provided written materials in order to identify the best available science regarding net Delta outflow to inform the State Water Board's decisions on Bay-Delta Plan requirements related to Delta outflow. The Panel will evaluate and synthesize the best available scientific information and prepare a report that addresses the following questions:

1. How well does the 2016 report provided by DWR, "On Estimating Net Delta Outflow (NDO): Approaches to estimating NDO in the Sacramento-San Joaquin Delta" (the DWR report) respond to the State Water Board's request? That is, are the methods for estimating consumptive use and channel depletions and the underlying data and methods the best available?

2. Does the DWR report provide a firm technical basis for its key conclusions and recommendations? Specifically, the following conclusions and recommendations from pages 1-2 of the DWR report:

    a. A water balance approach similar to the Net Delta Outflow Index (NDOI) remains the most suitable tool to define net Delta outflow for regulatory purposes, but should be updated to incorporate improvements to consumptive use estimates and correct a few known water accounting errors.

b. The Delta Island Consumptive Use model (DICU) is the most mature consumptive use estimate, and should be used to calculate NDOI until an improved daily model, such as DETAW, is sufficiently validated and officially released.

c. Direct measurement of net Delta outflow using the United States Geological Survey (USGS) acoustic Doppler current profiler (ADCP) stations at Rio Vista, Jersey Point, Dutch Slough, and Threemile Slough is inaccurate, and should not be used.

d. More studies are needed.

3. Do the two additional net Delta outflow estimation methods described in the report, the Multiple Control Volume Method (pp. 31-32) and salinity inversion method (p. 37), hold promise for future use as outflow estimation tools?

4. What are the panel's recommendations for improvements to the report? Based on the panel's knowledge of flow management in the Bay-Delta or other estuarine systems, what additional information, methods, or research are needed to improve net Delta outflow estimates?

Materials

Document for Review

DWR. 2016. On Estimating Net Delta Outflow (NDO): Approaches to estimating NDO in the Sacramento-San Joaquin Delta. http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/ndo_report_march2016.pdf

Additional Background Materials

California Department of Water Resources. (1995). *Estimation of Delta Island Diversions and Return Flows.* DWR.

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California Department of Water Resources. (2015). *Current Full Dayflow Documentation*. Retrieved November 2, 2015, from Dayflow: An Estimate of Daily Average Delta Outflow: http://www.water.ca.gov/dayflow/documentation/dayflowDoc.cfm#Introduction

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Davids Engineering, Inc. (2012). *Remote Sensing: Consumptive Use Analysis*. Retrieved November 2, 2015, from Davids Engineering, Inc.:

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Denton, R. a. (1993). *Antecedent Flow-Salinity Relations: Application to Delta Planning Models.* *http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/ccwd/spprt_docs/ccwd_denton_sullivan_1993.pdf*

Kadir, T. (2006). *Estimates for Consumptive Water Demands in the Delta using DETAW.* DWR. http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/delta/reports/annrpt/2006/2006Ch7.pdf

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Liang, L., & Suits, B. (2015). *Annual Report, Chapter 3. Estimating the Impact of Groundwater on Delta Channel Depletions.* DWR. http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/AR2015/Method_2015_Ch3.pdf

Russ T. Brown and Anne Huber, I. I. (2015, February 17). *Relationships between Measured X2 and Equivalent Outflow (cfs) and Salinity (EC) during Low-Flow Conditions*. *DSM2 User Group Meeting*. http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/DSM2UsersGroup/ICF_2014%20salinity%20intrusion_Feb%202015%20DSM2%20User%20Group.pdf