MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

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To: MWQI RTDF Steering Committee

From: Paul Hutton

Subject: Seasonal Water Quality Forecast Proof of Concept

Computer model simulations were successfully conducted to demonstrate a seasonal water quality forecast proof of concept in the Delta, O'Neill Forebay and the California Aqueduct. The proof of concept was designed and executed under the direction of the Municipal Water Quality Investigations Real Time Data and Forecasting (RTDF) Steering Committee. This report summarizes proof of concept motivation, methods, findings and recommendations. A summary report on Delta model simulations by Bob Suits and Jim Wilde (Department of Water Resources) is attached. Similarly, a summary report on O'Neill Forebay and the California Aqueduct model simulations by Tony Liudzius (Metropolitan Water District) is also attached.

Motivation

The purpose of the proof of concept effort was to (1) demonstrate the concept of seasonal water quality forecasting through the use of existing modeling tools and (2) identify strengths and weaknesses of available forecasting assumptions and tools. This effort was described in the June 2003 RTDF work plan that was approved by the Steering Committee on June 10, 2003.

Methods

The proof of concept methodology is summarized in tabular form below. The forecast period, calendar year 1998, was selected because historical Delta hydrology and operations data were readily available for the Delta simulations. The year was very wet and therefore was less than ideal for a proof of concept. Delta water quality simulations were conducted for electrical conductivity only; total dissolved solids (TDS) and bromide concentrations were estimated at Banks and Tracy Pumping Plants through regression analysis. Refer to the attachments for details on proof of concept methodology.

Period	January 1998 – December 1998
Scenarios	Historical Hydrology and Operations DWR January 50% Exceedance Forecast DWR March 50% Exceedance Forecast DWR May 50% Exceedance Forecast
Water Quality Constituents	Electrical Conductivity Total Dissolved Solids (TDS) Bromide
Reporting Locations	Banks & Tracy Pumping Plants O'Neill Outlet California Aqueduct Checks 41 & 66
Tools Delta O'Neill Forebay California Aqueduct	 DWR Delta Simulation Model (DSM2) MWD O'Neill/San Luis Blending Model MWD California Aqueduct Model

Findings

- DWR has a well-established procedure for developing short-term (1-4 weeks) forecasts of Delta hydrology, operations and water quality (electrical conductivity). With a modest investment in tool development, this procedure can be adapted to a longer-term seasonal forecast. However, a similar procedure is not currently available for the South Bay and California Aqueducts. A more extensive investment in tool and data development will be necessary to forecast water quality in the aqueducts.
- The inability to forecast hydrology, operations and water quality along the San Joaquin River at and above Vernalis is a limitation of DWR's current forecasting procedure. Under current conditions, this limitation is expected to have little impact on the integrity of seasonal salinity forecasts beyond May, particularly under drier hydrologies. However, this limitation is more critical in the development of short-term dissolved organic carbon (DOC) forecasts, particularly under high flow conditions when the San Joaquin River "fingerprint" dominates the southern Delta. This limitation may also become more critical if Delta Mendota Canal re-circulation and upstream source reduction are implemented as part of a CALFED implementation package, as currently being discussed elsewhere.
- Water quality forecasts are highly dependent on the integrity of hydrology and operations forecasts, including (but not limited to) tidal conditions, river inflows, Delta consumptive use, gate and barrier operations, and pumping and delivery schedules. The hydrologic uncertainty associated with early year water allocation forecasts suggests that water quality forecasts prior to May are more prone to hydrology related error. The proof of concept results suggest that a reasonable fall water quality forecast could be produced with a May hydrology forecast. Subsequent updates of the forecast are expected to provide additional resolution.
- Volumetric and constituent "fingerprints" provide useful qualitative assessments of forecasted water quality conditions. Fingerprints indicate when water quality conditions are dominated by seawater intrusion during low outflow conditions or by San Joaquin River inputs during high outflow conditions.

Recommendations

- The RTDF Steering Committee should continue to support data and tool development for short-term (1-4 weeks) and seasonal salinity forecasts. High priority should be placed on development of aqueduct water quality forecasts. Based upon preferences expressed in recent utility surveys, initial emphasis should be given to short-term salinity forecasts over seasonal salinity forecasts. The following data and tool development milestones have been identified:
    - Refine short-term forecasts to include fingerprinting information.
    - Develop a data retrieval system necessary to forecast aqueduct operations.
    - Enhance DSM2 to forecast TDS, bromide and DOC concentrations. DOC forecasts should be limited to short-term forecasts, given the degree of uncertainty associated with predicting peak rainfall-runoff events and the relatively low value of summer/fall DOC forecasts.
    - Enhance DSM2 to forecast flow and water quality in the Delta Mendota Canal, South Bay and California Aqueducts, and O'Neill Forebay.
    - Refine short-term and seasonal water quality forecasts to consider hydrology, operations along the San Joaquin River upstream of Vernalis.
- Seasonal water quality forecasts produced in May or later are subject to less hydrologic uncertainty; however, ealier forecasts may still provide utility to water users. The exact timing and number of seasonal forecasts is yet to be determined. At a minimum, seasonal water quality forecasts should be produced in May and be updated monthly through September, for a total of five seasonal forecasts per year. Short-term forecasts should be conducted continuously throughout the year. Forecast data should be made available to utilities as part of RTDF's upcoming email distribution.