1 Introduction

Over the last ten years, the Delta Modeling Section has been developing and enhancing the Delta Simulation Model 2 (DSM2) and its support tools. The following are brief summaries of work that was conducted during the past year. The names of contributing authors are in parentheses.

Chapter 2 – REALM

Even though the Section continues to enhance DSM2 in response to numerous hydrodynamic and water quality needs in the Delta, a growing number of these requests are beyond DSM2's ability to address. To continue to provide technical support to the Department for issues related to the Delta, the first phase of this project assessed the possibility of using existing tools to meet the current and future technical questions the Section would likely face. After surveying these existing decision-support tools, it was concluded that, like DSM2, many of these existing tools had their own limitations. REALM is the working title of a new multi-agency decision-support system for modeling in the Delta. This chapter introduces the early development of REALM. *(Eli Ateljevich and Ralph Finch)*

Chapter 3 – Extending DSM2-QUAL Calibration of Dissolved Oxygen

The Section has been reporting progress in dissolved oxygen (DO) and temperature modeling in its annual reports since 1994. The last DSM2-QUAL DO and temperature calibration was conducted near Stockton on the San Joaquin River in 2000. Since that time, new DO, temperature, and nutrient data in the South Delta have become available. Originally a part of a project to study the effects of increasing flow in the San Joaquin River, the calibration and validation of QUAL for DO have been spatially extended to include the South Delta. Furthermore, two years of additional data along the San Joaquin River was also used to extend the existing validation through the present. This chapter focuses on the results of the extension of the previous QUAL DO and temperature calibrations and validations. *(Hari Rajbhandari)*

Chapter 4 – Morrow Island Distribution System Calibration

The current DSM2 grid includes an extensive portion of the Suisun Marsh, which is near the model's current downstream ocean boundary at Martinez. In fall 2002, the Morrow Island Distribution System (MIDS) intake gate was replaced with a new structure. The Department's Suisun Marsh Planning Section was responsible for overseeing this extensive project, as well as monitoring the new intake's impact on both the surrounding channels and within DSM2. In February 2003, the Suisun Marsh Planning Section conducted two field studies near the MIDS intake, and later recalibrated the MIDS intake gate coefficients in DSM2 to account for the changes in flow associated with the new structure. This chapter covers the Suisun Marsh Planning Section's work related to MIDS. (*Kate Le*)

Chapter 5 – Use of CALVIN in DSM2 Planning Studies

Previous annual reports have focused on the connections between DSM2 and CALSIM; however, DSM2 planning studies can be conducted using any water resources model that can provide the required flow and operations information. The University of California Davis's CALVIN (CALifornia Value Integrated Network)—an economic optimization model that varies water resources by month-- was recently used in a series of climate change and sea level rise studies to provide input into DSM2. DSM2 then was used to provide feedback to CALVIN on how well the system operations suggested in the CALVIN operations meet Delta water quality standards. This chapter focuses on the integration of CALVIN output into DSM2 and the role DSM2 plays in providing feedback to CALVIN for improving its representation of the Delta. (*Jamie Anderson*)

Chapter 6 – New Behaviors and Control Switches in DSM2-PTM

This chapter introduces a new stage-triggering behavior and a seepage control switch that were added to DSM2-PTM. Sometimes aquatic organisms in the Delta behave differently when the tide is flooding or ebbing. The new stage-triggering behavior allows this type of behavior to be specified using the Particle Tracking Model (PTM) behavior graphical user interface described in the 2000 annual report. In the past, PTM did not treat seepage flows differently from other agricultural diversions or channel junctions. While the assumption that the particle fate associated with seepage flows may be appropriate for contaminate flows, it was necessary to change PTM so some particles (such as aquatic organisms) would not be removed from the Delta by seepage flows. (*Aaron Miller*)

Chapter 7 – Implementation of a New DOC Growth Algorithm in DSM2-QUAL

Last year's annual progress report described the implementation of a dissolved organic carbon (DOC) growth algorithm in DSM2-QUAL. This algorithm was utilized to characterize the growth of DOC on flooded Delta islands in support of DWR's Integrated Storage Investigations' In-Delta Storage (ISI-IDS) project. Feedback on the ISI-IDS project from CALFED and others recommended improving the field experiments from which this algorithm was based, thus ISI conducted new experiments to develop a better routine for QUAL. Chapter 7 summarizes the new DOC growth algorithm used by QUAL to represent DOC growth on a flooded island. An example comparing the behavior of this new algorithm to the behavior of the old algorithm is shown. (*Michael Mierzwa and Ganesh Pandey*)

Chapter 8 – DSM2-HYDRO Binary Output File Reader

The binary output file generated by DSM2-HYDRO links HYDRO to DSM2-QUAL and DSM2-PTM. This file is also used to provide additional information on flow and stage data after a HYDRO simulation has been completed. This chapter introduces a new easy-to-use tool that facilitates access to the flow and stage information at any location in the DSM2 grid. This binary output file reader is used by the Section to provide quality assurance / quality control (QA/QC) in its modeling studies. (*Aaron Miller*)

Chapter 9 – Developing EC for Inflows for the San Joaquin River Extension to DSM2 for Planning Studies

The Delta Modeling Section developed a method to assign Electrical Conductivity (EC) to inflows in the San Joaquin River during the recent expansion of DSM2 from Vernalis to Bear Creek. This methodology assumes CALSIM-generated flows are available and can account for the recirculation of Delta-Mendota Canal water through the San Joaquin River. (*Jim Wilde*)