SALTON SEA
HYDROLOGIC FOCUSED TECHNICAL GROUP
MEETING NOTES

March 26, 2008
9:00 – 4:00
UC Riverside
Palm Desert, CA

Welcome and Introductions

Jerry Boles (DWR) welcomed the attendees and led introductions of those present.

Tetra Tech Presentation

Mike Walker (Reclamation) and Dr. Chris Holdren (Reclamation) introduced the efforts of Tetra Tech. Tetra Tech was hired to implement a pilot nutrient removal project and to develop a 3-D water quality model of the Salton Sea. Field studies conducted by UC Riverside were also included to support water quality data needs. In addition to these efforts, Tetra Tech has performed other work within the watershed, including environmental planning, evaluation of the performance of New River wetlands, and development of a wetlands master plan.

Sujoy Roy and John Hamrick, both from Tetra Tech, presented a summary of their past efforts and the Reclamation contract efforts.

One of the past efforts undertaken in the watershed has been the evaluation of wetlands performance, including development of a stream/wetland model to simulate water quality benefits of a network of wetlands the New and Alamo rivers. The model was calibrated to flow, nitrogen, phosphorus, suspended sediments, coliform bacteria, and selenium. The model was constructed using 35 river reaches, which are based on the IID drainsheds. Flow and nutrient loading calculations and assumptions inherent to this modeling effort, as well as the modeled results, are shown in the PowerPoint attachment.

The nutrient removal project involved pilot testing of ozone treatment to remove sulfide. Initial plans to utilize Salton Sea water withdrawn from deep within the anoxic zone were shelved, due to the costs and complexities associated with such an intake pipeline. Instead, sample water was spiked with various concentrations of sulfide. Over an approximate one-month pilot testing period, ozone requirements to treat sulfide were determined, as shown on slide 15, and a dose-response relationship was estimated. Based on the pilot testing results, conceptual sizing and a cost estimate for development of a full-scale treatment system were developed.

The next phase of the nutrient removal project involved water quality modeling. Based on several evaluation criteria, the model EFDC was selected. EFDC is an open-source

code model with wide-spread application throughout the US. Key model capabilities were summarized as follows:

- Three-Dimensional hydrodynamics with coupled salinity and temperature transport
- Mellor-Yamada and GLS turbulence closures
- Directly coupled water quality-eutrophication model with predictive sediment flux (diagenesis)
- Directly coupled sediment and toxic contaminated transport and fate model
- Integrated near-field mixing zone model
- Preprocessing software for grid generation and input file creation
- Post-processing software for analysis, graphic and visualization

Model parameters included: hydrodynamics, salinity, nutrients (especially phosphorus and ammonia), sulfate/sulfide, dissolved oxygen, and chlorophyll a. Detailed information regarding the model's representation of hydrodynamic, sediment transport, toxics fate and transport, water quality and eutrophication, and sediment diagenesis is included in the PowerPoint. Also included is a list of the state variables that are modeled.

Input data to the modeling effort included:

- Temperature and Current Profiles During 1997
  - 5 Temperature Sites
  - 3 Current Meter Sites
  - Data provided by Dr. Chris Cook
- Water Quality Monitoring Data During 1999
  - USBR data provided by Dr. Chris Holdren
  - Temperature, Nutrients and Organics
  - Additional water quality data
- River Inflow records
- Atmospheric conditions
  - CIMIS stations provide wind, radiation, rainfall, relative humidity
  - Additions data from private facilities

The model grid was developed based on bathymetry included within the Redlands Salton Sea Digital Atlas. Based on the bathymetry, two types of grids were developed at two levels of resolution. A Rotated Cartesian Grid (horizontal) was developed at 2600 cell (600m x 600m) resolution for sensitivity analysis, and a 650 cell grid was developed for long-term simulation. Two types of vertical grids were evaluated: a 16-layer sigma grid and a 25 layer GVC (z-behaving, free surface following) grid, with the GVC grid providing superior results.

Model results were presented. These included simulation of temperature, current, and water quality (ammonia, dissolved oxygen, phosphate, and total phosphorus) at depths. Meeting attendees noted that the model predicted higher than observed DO concentrations during the May/June timeframe, indicating that model's ability to represent the prolonged stratification events observed at the Salton Sea might be limited by the available data or the model assumptions. Dr. Hamrick expressed his

opinion that the model was overall sufficient in representing conditions, based on the available data.

Finally, the model was utilized to simulate water quality conditions under the Salton Sea Authority's preferred alternative. A conceptual model was developed, based on the Salton Sea Authority's preferred alternative. This conceptual model included treatment of inflows (nutrient and TSS removal), a south lake discharging to a north lake, a north lake discharging hypolimnetic waters to treatment, treatment (odor and TSS) discharging to the north lake, and a discharge to a salt sink. Comparisons were made between the baseline condition (existing condition of the Salton Sea, as modeled), and three alternative scenarios. Comparisons were made in terms of modeled "volume days less than 1 mg/L," which is a representation of the percent of the modeled lake that is anoxic. Conclusions regarding the modeled alternatives were presented and discussed.

The final report is due to be completed soon. The report will be submitted to Reclamation and will then be publically available. Those individuals wishing to comment on the results presented may submit their comments to Dr. Holdren.

Lawrence Livermore National Labs Groundwater
Mike Walker introduced Andy Tompson (Lawrence Livermore National Labs).

LLNL was funded to undertake a comprehensive evaluation of potential groundwater availability within the vicinity of the Salton Sea. Paleohydrology was presented, including a description of the deep basin (20,000 feet depth), the period of inundation of the basin by the Colorado River, and geothermal resources. Groundwater resources today could potentially be as high as 4.5 to 6.5 BAF in the basin as a whole, yet most of this resource is confined to the deeper system where quality is poor, producibility is low, and natural recharge is not significant. Potential areas of new production may exist in the West Mesa areas of the Imperial Valley, and with conceptual aquifer storage recovery (ASR) operations.

The project objectives included:
- integrated database development,
- isotopic characterization, and
- development of a groundwater model for the Imperial Valley.

The following key activities and evaluations were completed:

- An extensive amount of groundwater information was collected, including over 300 reports, well data for over 6,000 wells, and 1,700 surface water sampling collection sites.
- Using depth and production data from select wells, aquifer characteristics were calculated for four formations. These formations represent the aquifer volume on the U.S. side of the International Boundary.
- Aquifer recharge was estimated using regional precipitation data.

- A detailed evaluation of the East Mesa area was undertaken. Aggregate losses from the unlined All-American Canal have been estimated at approximately 4.9 MAF from 1948 through 1988, with the accrued storage increase (now steady) estimated at 0.7 to 1.5 MAF. The evaluation included an isotopic characterization of East Mesa groundwater that provides a means to assess nature of “60 year aquifer storage experiment,” determination of the extent of recent recharge from unlined canals, delineation of losing reaches, determination of residence time and flow paths of groundwater in ‘mounded’ areas, and assessment of water quality changes along recharge pathways.
- Development of a groundwater model, using MODFLOW, allows further evaluation of potential ASR opportunities. Potential production within the Coachella Valley and Imperial Valley was characterized.

LLNL is in the process of validating and calibrating the MODFLOW model. The full presentation is attached for reference.

Approaches to Hydrologic Monitoring and Assessment Plan (MAP)
Brief presentations of the approaches to development of the Hydrologic MAP were made. The slides are attached. This information builds on the problem statement, objectives, and key questions developed at previous Hydrologic FTG meetings. A draft matrix, attached, was distributed showing a wish list of monitoring sites, parameters, and frequencies. Attendees were asked to review the matrix and provide comments to Jerry for incorporation into the draft MAP.