DSM2 Application for the California Aqueduct and Delta-Mendota Canal

Presented to
DSM2 Users Group

July 26, 2005

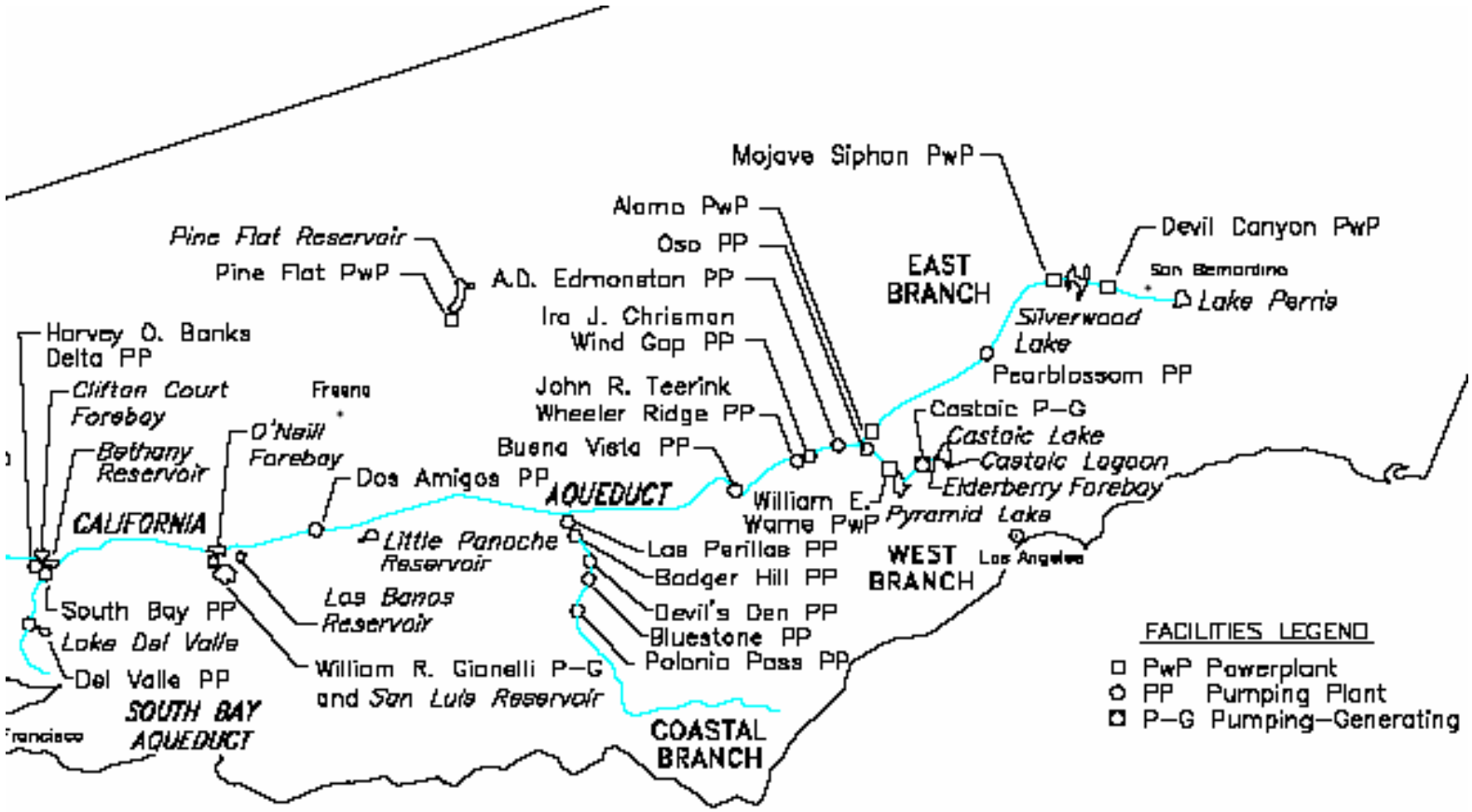
Model Development Goals

- Develop and calibrate a DSM2 hydrodynamic simulation model to predict hydraulics (flow and stage) and salinity transport in the California Aqueduct and Delta-Mendota Canal
- Provide a foundation for development of water quality planning and forecasting simulation capabilities

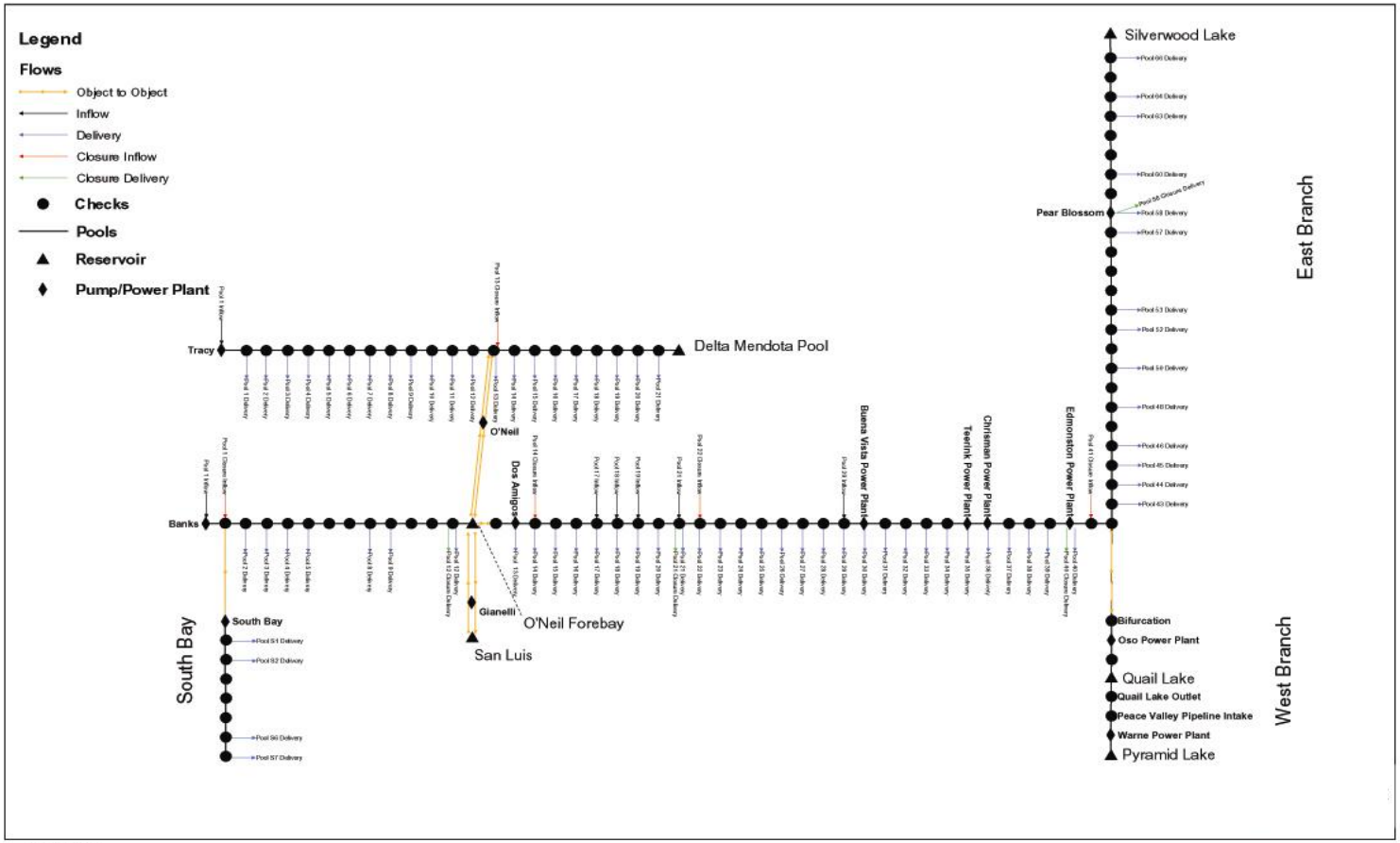
Physical System

- **The model includes**
  - California Aqueduct, South Bay Aqueduct
  - East Branch to Silverwood Lake, West Branch to Pyramid Lake,
  - San Luis Reservoir and O’Neill Forebay, and
  - Delta-Mendota Canal from Tracy Pumping Plant to the Mendota Pool
  - 580 miles in total

Model Area
SWP South of Banks PP



Model Schematic



System Operations

- **California Aqueduct**
  - Four field divisions
  - 66 check structures
  - 270 diversion structures
  - Constant pool elevation
- **Delta-Mendota Canal**
  - 200 turnouts
  - Constant pool elevation

Operational and Water Quality Data

- **DWR OCO Operations Reports**
  - Pumping Plants
  - Inflows
  - Deliveries
- **Reclamation Central Valley Operations**
  - Monthly Operations Reports
- **Water Quality**
  - CDEC daily electrical conductivity (EC)
  - OCO Monthly Operations Data Reports

Model Boundary Conditions

- Flow at Tracy and Banks
- San Luis Reservoir Operations
- DMC and O'Neill Forebay Operations
- Diversions to South Bay Aqueduct and West Branch (pumping plant data)
- Contractor Diversions Database

Modeling Assumptions

- **Treatment of Check Structures**
  - use weir approximation to control water elevation
- **Pipes, siphons, and tunnels treated as open channels**
- **Use of Object to Object programming**
  - DSM2 allows instantaneous transfer of water from location to another:
    - *Flow into South Bay Aqueduct*
    - *O'Neill Pumping and Generating Flows*
    - *Gianelli Pumping and Generating Flows*
    - *Flow south out of O'Neill Forebay into California Aqueduct*
    - *DMC Wasteways*

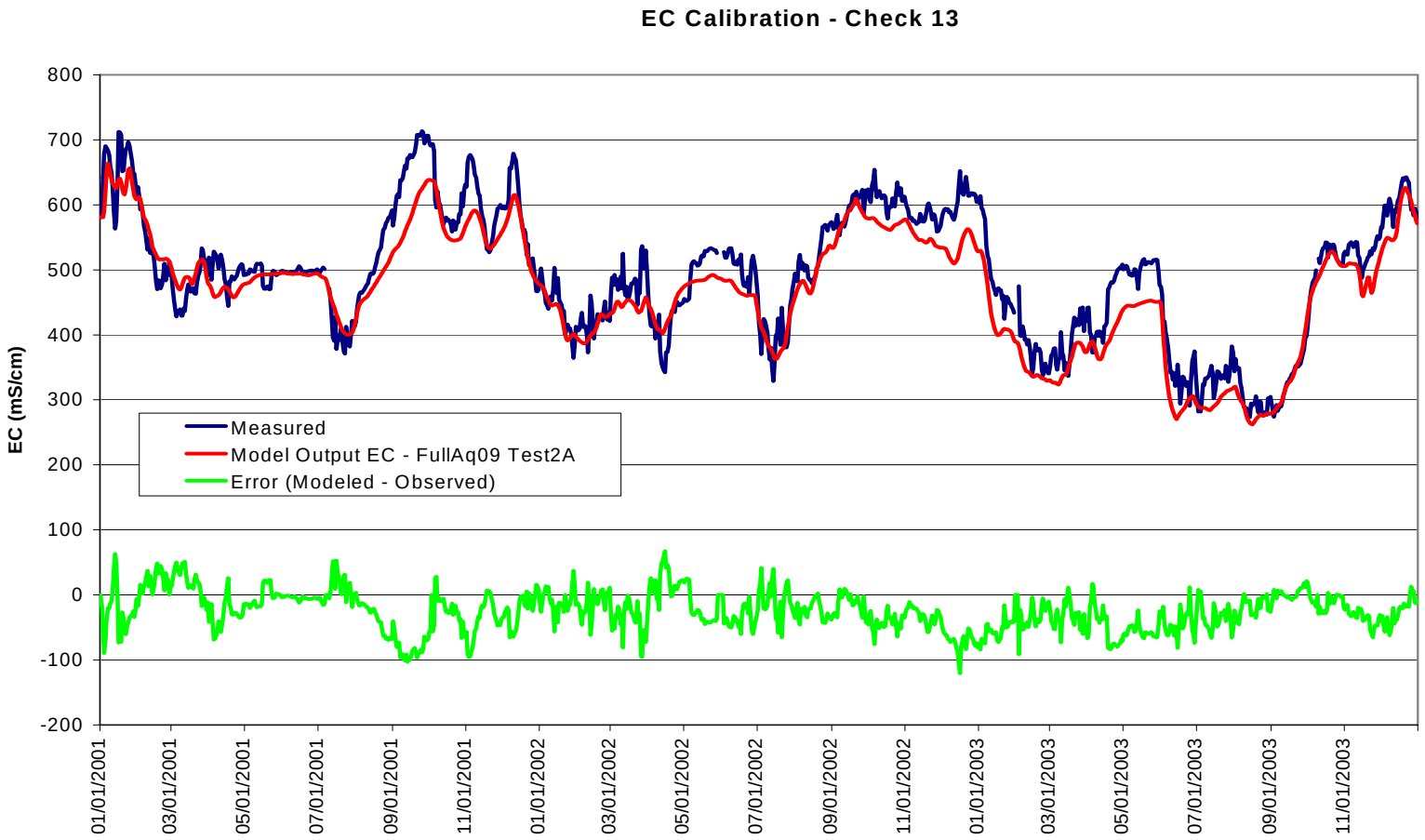
Modeling Assumptions

- Reservoirs
- San Luis Reservoir and O’Neill Forebay
- Canal Cross Section Geometry
- Water Balance and Required Closure Terms (flow and salinity)

Calibration/Verification

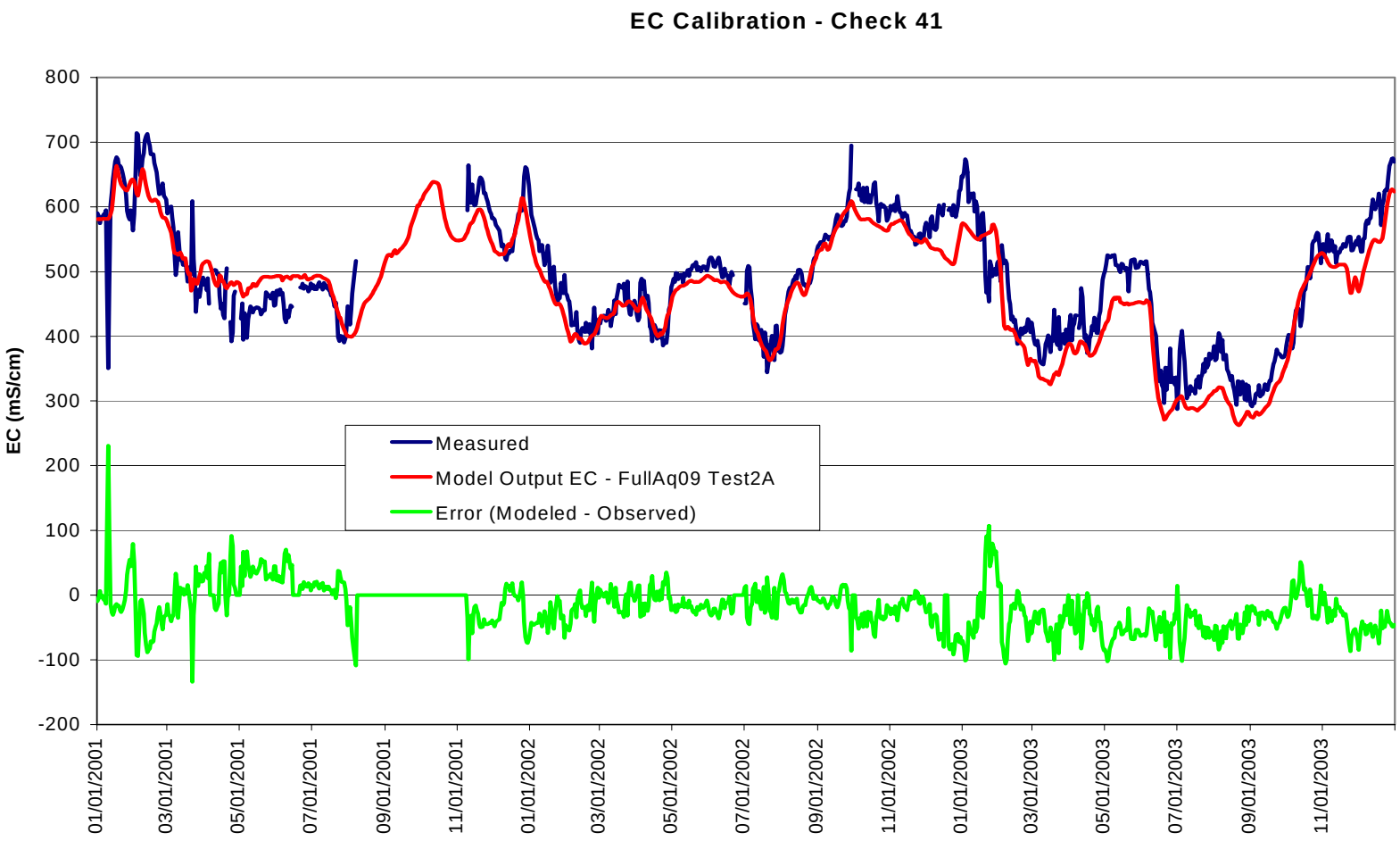
- **Calibration/Verification Period**
  - Jan1, 2001 to December 31,2003
- **Flow**
  - Closure terms
- **Stage**
  - Compare to specified operating range
- **Electrical Conductivity**
  - Measured Data along California Aqueduct at Checks 12, 13, 18, 21,29, 41, and 66
  - Measured Data in the DMC at the O'Neill Intake and Checks 20 and 21upstream of Mendota Pool

EC at Check 13
(Downstream of O'Neill Forebay)

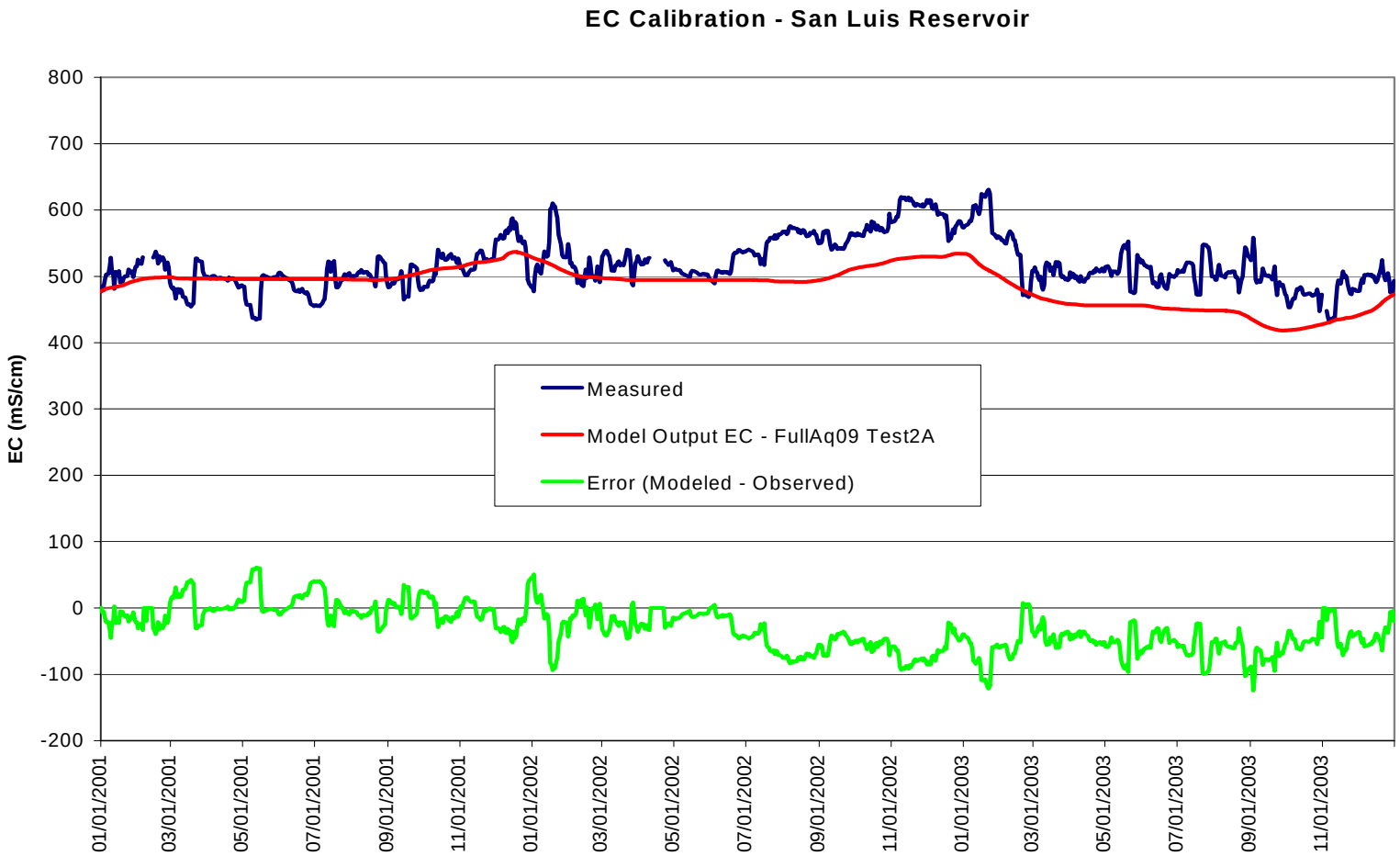


EC at Check 41

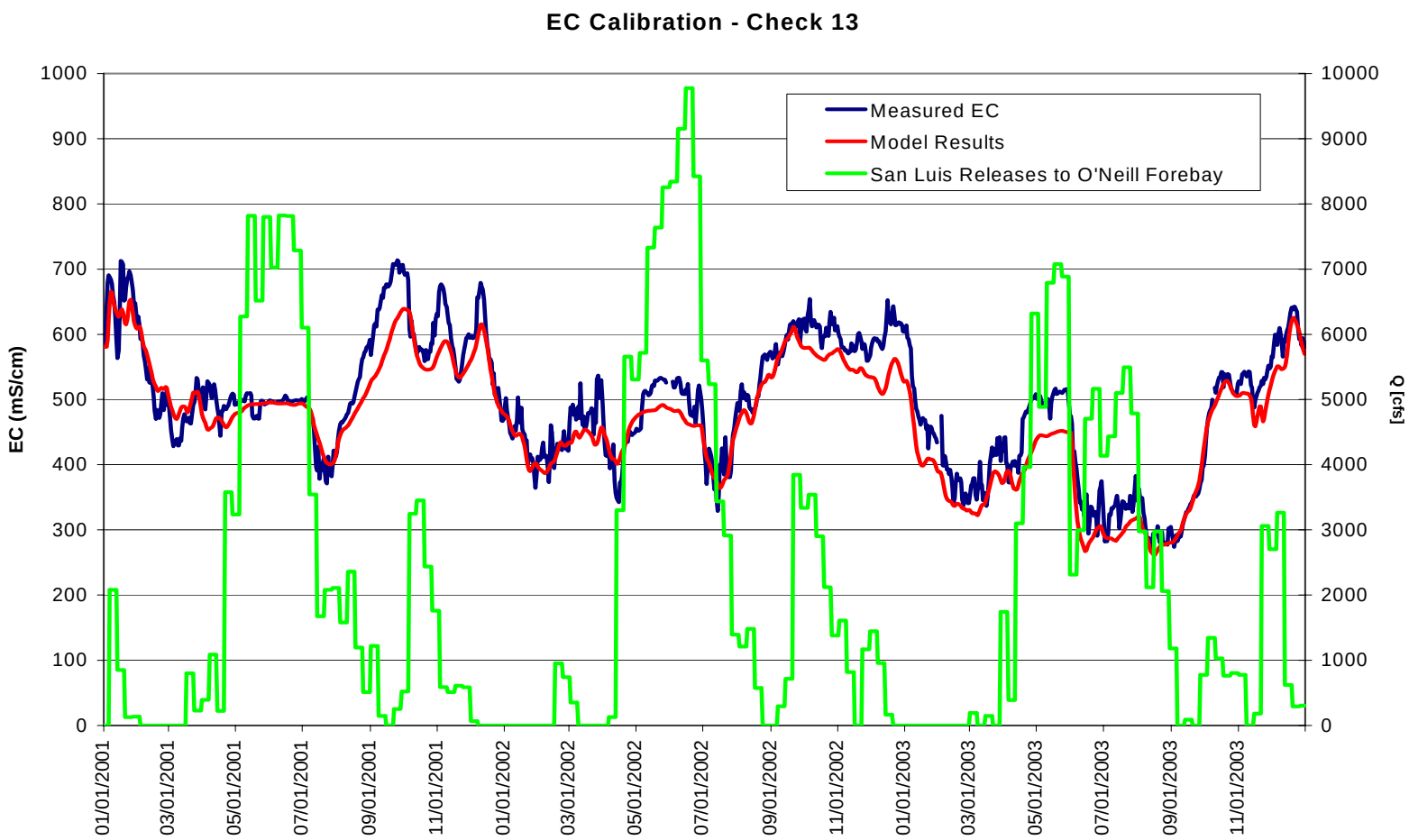
(Downstream of Edmonston Pumping Plant)



EC in San Luis Reservoir



EC Calibration Downstream of O'Neill with Major Flows



Model Sensitivity Analysis

- Check structure gate operations
- Manning’s friction coefficients

Limitations/Next Steps in Model Refinement

- San Luis Reservoir (completely mixed)
- Monthly diversion data
- Stormwater inflows and associated EC
- Treatment of mass balance error terms
- Gate operations flexibility - update to new DWR DSM2 Database version

Potential Future Applications

- Develop forecasting mode - specify projected conditions
- Develop planning mode - CALSIM2 Model interface
- Combine DSM2 Aqueduct model with Delta and San Joaquin River models to allow recirculation, San Joaquin River salinity management, and fingerprinting studies