Upstream San Joaquin River Dissolved Oxygen TMDL Project

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November 13, 2007

DO Project Collaborators

- San Joaquin Valley Drainage Authority
- San Joaquin River Group Authority
- University of the Pacific
- US Geological Survey
- University of California, Davis
- Berkeley National Laboratory
- Department of Water Resources
- Systech Engineering
- Jones & Stokes

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Outline

- Introduction to DO TMDL Project
  - DO TMDL & study area
- Project objectives
  - Research questions
- Project structure
- Progress toward objectives
- Summary & conclusions

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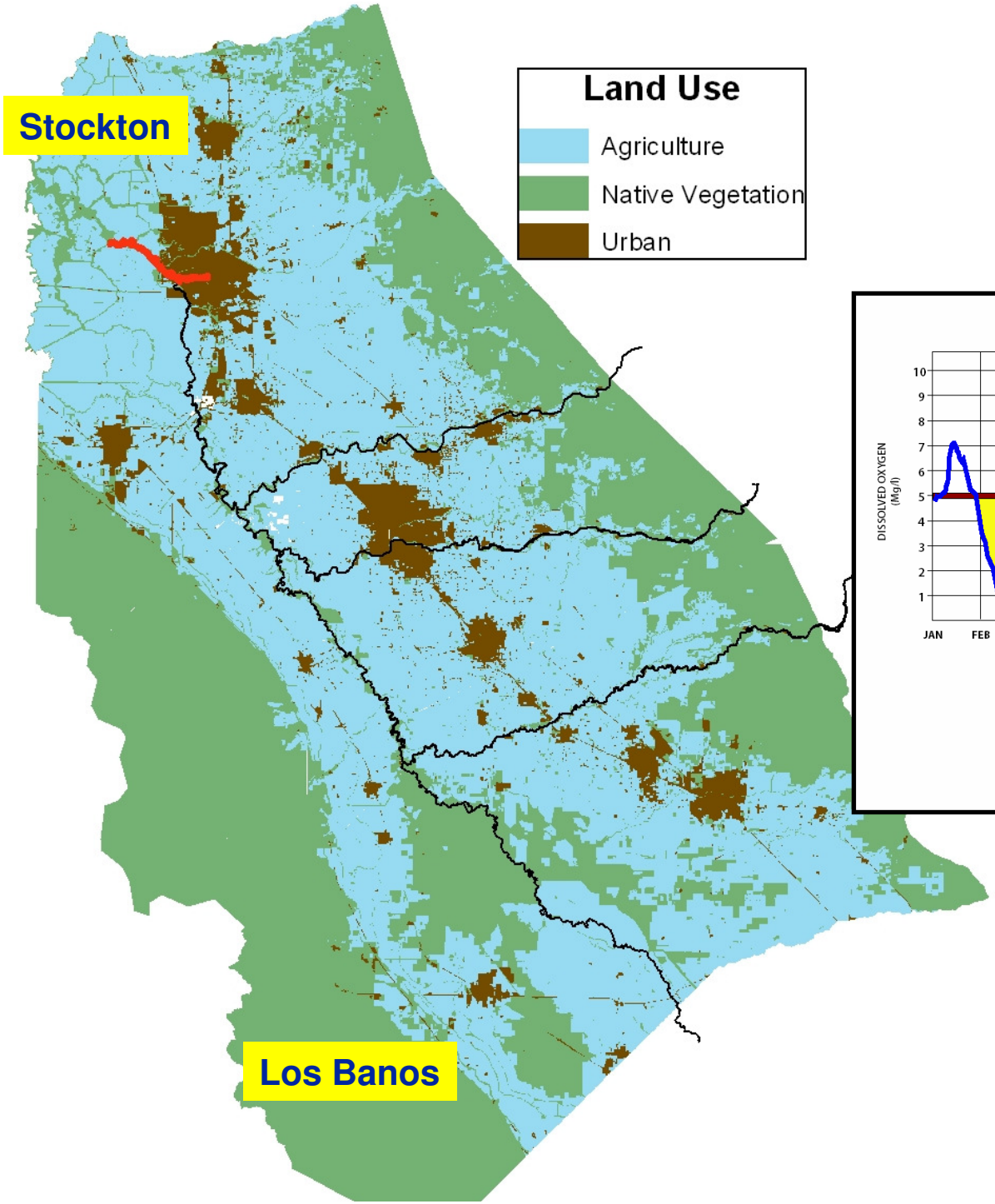

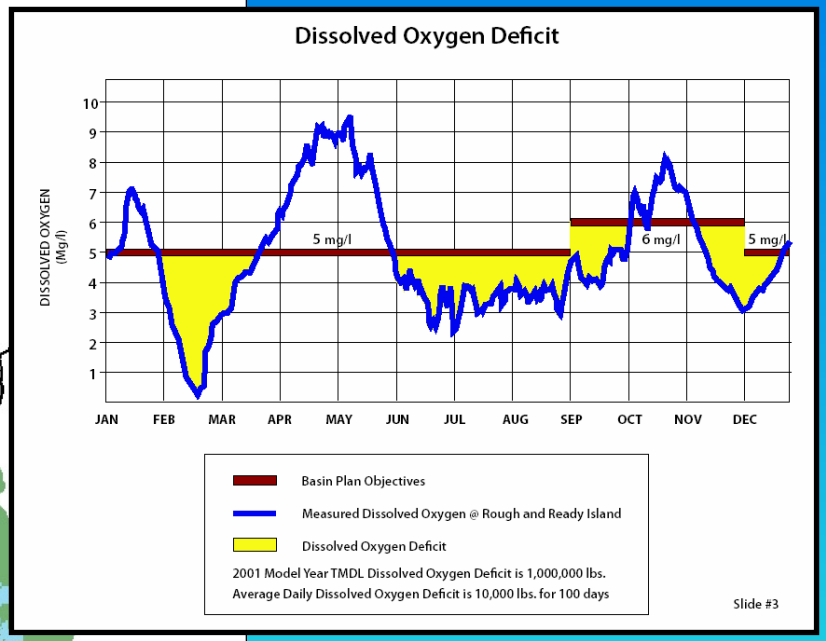

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DO TMDL 2003

- Channel geometry
- Insufficient flow
- Loads of oxygen demanding substances from up-stream of DWSC
  - Suspended algae
  - Municipal discharge
  - Other sources

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Project Objectives

- Objective 1: Establish a comprehensive monitoring program to characterize the loading of algae, other oxygen-demanding materials, and nutrients from individual tributaries and sub-watersheds of the upstream SJR.
- Objective 2: Characterize the transformation and fate of algae and other oxygen-demanding materials between their sources in the watershed and the DWSC.
- Objective 3: Characterize the fate of nutrients and the impact of nutrients on algal growth between their sources in the watershed and the DWSC.

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Project Objectives

- Objective 4: Characterize the temporal variability of water quality parameters on a daily and seasonal basis.
- Objective 5: Provide input and calibration data for water quality modeling associated with the low DO problems in the SJR watershed, including modeling on the linkage among nutrients, algae, and low DO.
- Objective 6: Provide stakeholder confidence in the information that will be used to support the DO TMDL allocation and implementation process.

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Research Questions

- What are the sources of algal inoculum in the watershed?
- What are the sources of nutrients in the watershed?
- What is the relative importance of inoculant size and nutrient sources in determining the algal biomass load reaching Channel Point?
- What would be the impact of reducing either inoculum or nutrients or both on algal biomass loads at Channel Point?
- What other sources of BOD (besides algae) are in the San Joaquin River watershed and are these sources important to the SJR BOD load to the DWSC?

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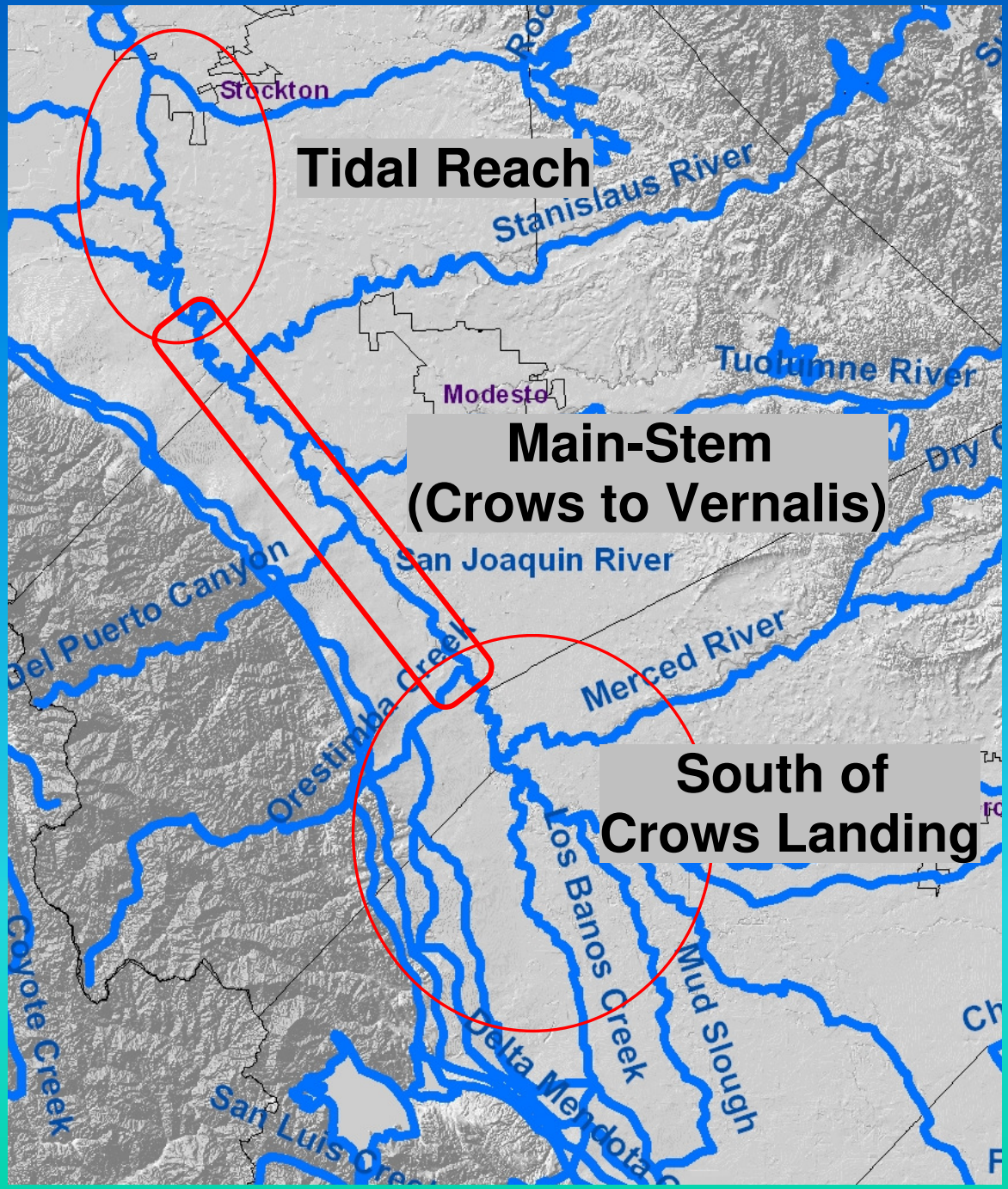

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Project Tasks

- Establish a comprehensive monitoring and data gathering program
  - Task 4, 5, 8, & 10
- Develop comprehensive model for nutrients and algae in the SJR
  - Tasks 6 & 11
- Close data gaps using directed scientific studies
  - Task 4, 7,8, & 9

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Monitoring & Data Gathering

- Task 4 & 8
  - Water quality data collection
  - Flow data collection
  - QA program & data analysis
- Task 5
  - Up-grade existing stations
- Task 10
  - Establish station between Mossdale & DWSC

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Modeling & Data Transfer

- Task 6
  - Create new SJR model that better represents the conditions of the SJR upstream of the DWSC
  - Develop “user-interface” for new SJR model
  - Calibrate the model against the information collected in the monitoring & data gathering programs
- Task 11
  - Data system for transfer between collection, modeling, and SWAMP database

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Directed Scientific Studies

- Task 4
  - Longitudinal studies to establish sub-watershed sources of nutrients and oxygen demand
  - Continuous monitoring to understand diurnal signal and measurement variability
- Task 7
  - Stable isotope studies to differentiate sources of nutrients and carbon

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Directed Scientific Studies

- Task 8
  - Flow-unit (dye) studies to determine gains and losses of nutrients and algae in the critical tidal reach between Mossdale and Channel Point
- Task 9
  - Algal ecology studies examining zooplankton impacts on algal growth
  - Development of rapid techniques for algal assessment

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Completed Tasks

- Task 2 CEQA
- Task 3 QAPP
- Task 5 Upgrading of monitoring stations
- Task 9 Zooplankton studies
  - Results included in Task 4 & 8 reports
- Task 10 New station installation in tidal reach

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Task 4 Objectives

- WQ Grab sampling program
  - Core site list
  - Intermittent site list
- Establish maintenance & QA program for continuous flow & EC monitoring stations
- Deployment of continuous chlorophyll, pH, & DO monitors

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Task Objectives

- Review & compile historical data
- Coordinate collection, compiling, QA review & dissemination of flow and WQ data
- Conduct studies of individual drainages
- Interpretation of results
- Training & outreach
  - CSU Fresno, California Water Institute

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Grab Sampling Program

- Sampled 113 locations SJR & tributaries
  - All locations in Table B-1 of proposal sampled
  - Includes all Dahlgren & USGS sites in previous study
- 1,907 samples collected as of October
- Core station list
  - Sample every two weeks

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Measurements - Grab Sample

- Chlorophyll
  - 4 methods
- BOD_{10}
- CBOD
- NBOD
- TOC/DOC
- Ammonia nitrogen
- Nitrate nitrogen
- Total nitrogen
- o-Phosphate
- Total phosphate
- Total iron
- Total suspended solids
- Volatile suspended solids
- Alkalinity
- pH
- Turbidity (NTU)
- Incident light
- Dissolved oxygen
- Specific conductivity
- Temperature
- Algae cell counts
- Stable isotopes
- Lipids

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Core Sampling Stations

- 4 SJR at Mossdale
- 5 SJR at Vernalis
- 6 SJR at Maze
- 7 SJR at Patterson
- 8 SJR at Crows Landing
- 10 SJR at Lander Avenue
- 12 Stanislaus River
- 14 Tuolumne River
- 16 Merced River
- 18 Mud Slough
- 19 Salt Slough
- 20 Los Banos Creek
- 21 Orestimba Creek
- 25 MID Miller Lake
- 28 TID Westport Drain
- 29 TID Harding Drain
- 30 TID Lat 6 & 7
- 34 Ingram Creek
- 36 Del Puerto Creek
- 44 San Luis Drain End

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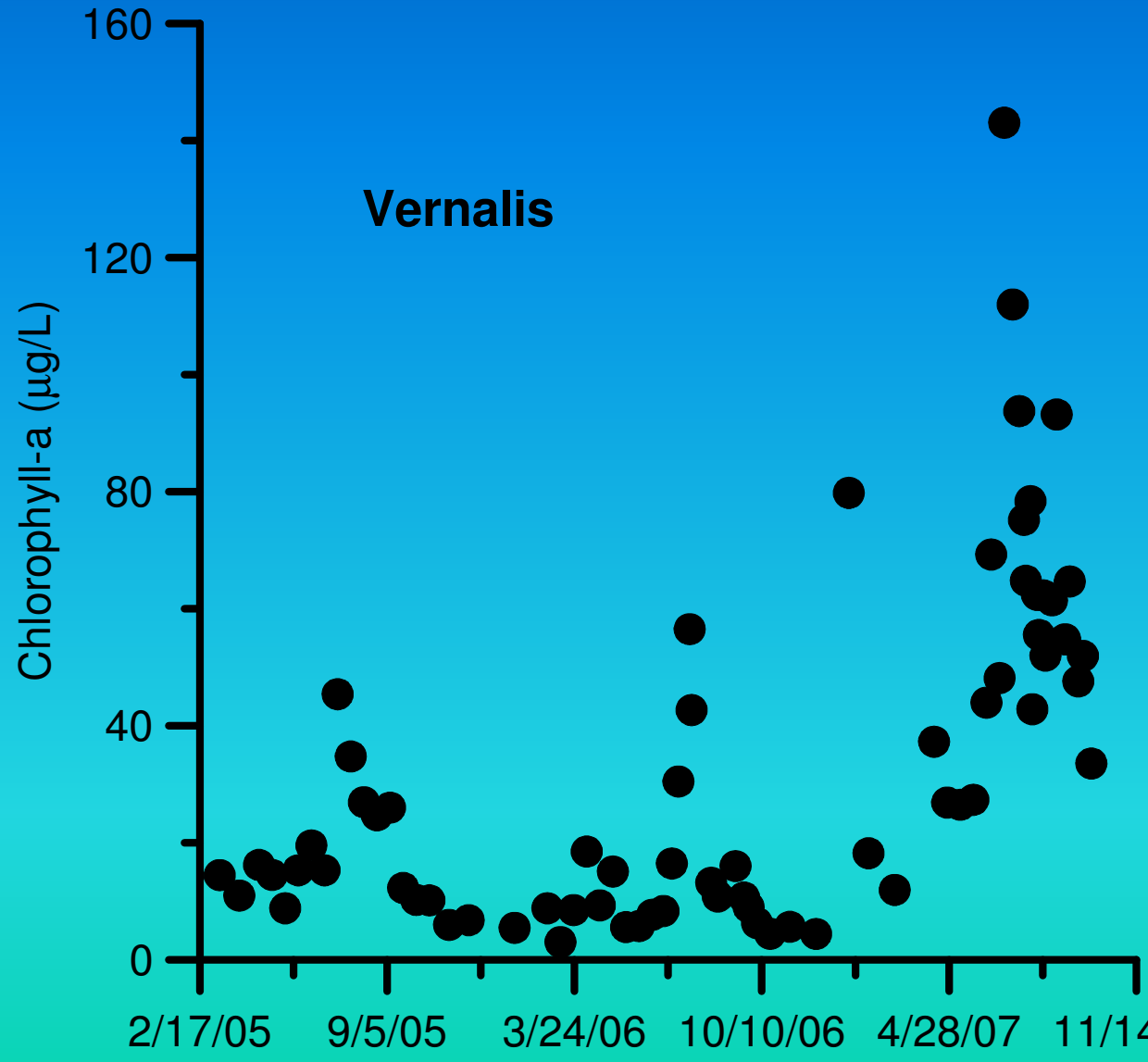
Chlorophyll Concentration



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Maintenance/QA on Flow Stations

- EERP stations
  - 14 stations
- Support to local agencies

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Continuous Monitoring

- Turbidity
- Chlorophyll
- pH & DO
- EC & ORP

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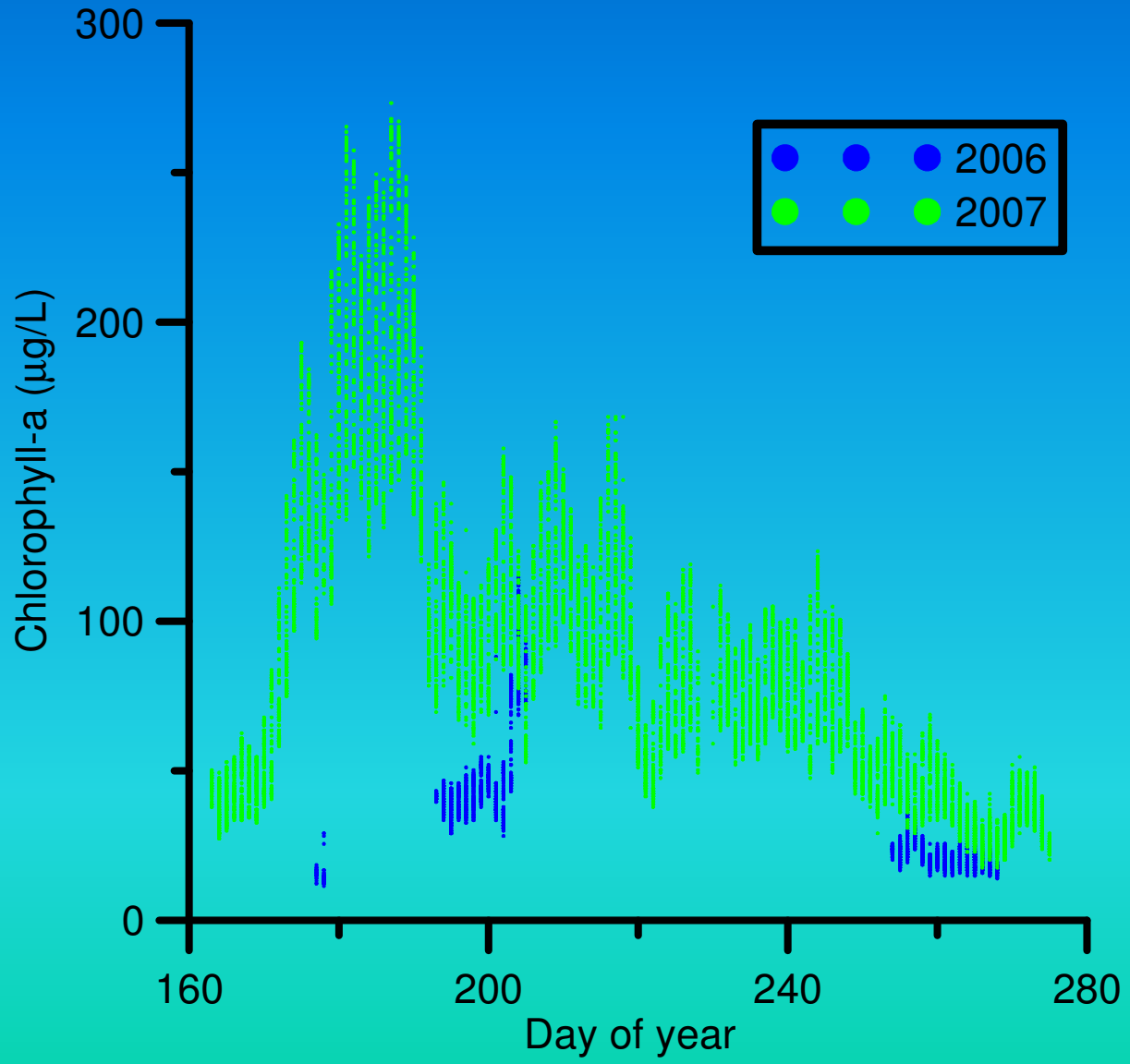
Patterson Chlorophyll



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Collection & Processing of Flow & WQ Data

- Historical data
  - All known pre-2005 data compiled
- Compile & organize flow data
  - Tributaries, diversions, & river stations
  - Data collected from 52 stations
- Publish & distribute data
  - Fall & spring
  - Interagency Ecological Program

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Studies On Individual Drainages

- Examination of WQ changes along drainages
  - San Luis Drain (SLD)
  - Salt Slough
  - Other drainages
- SLD Shutoff study
  - Summer 2007

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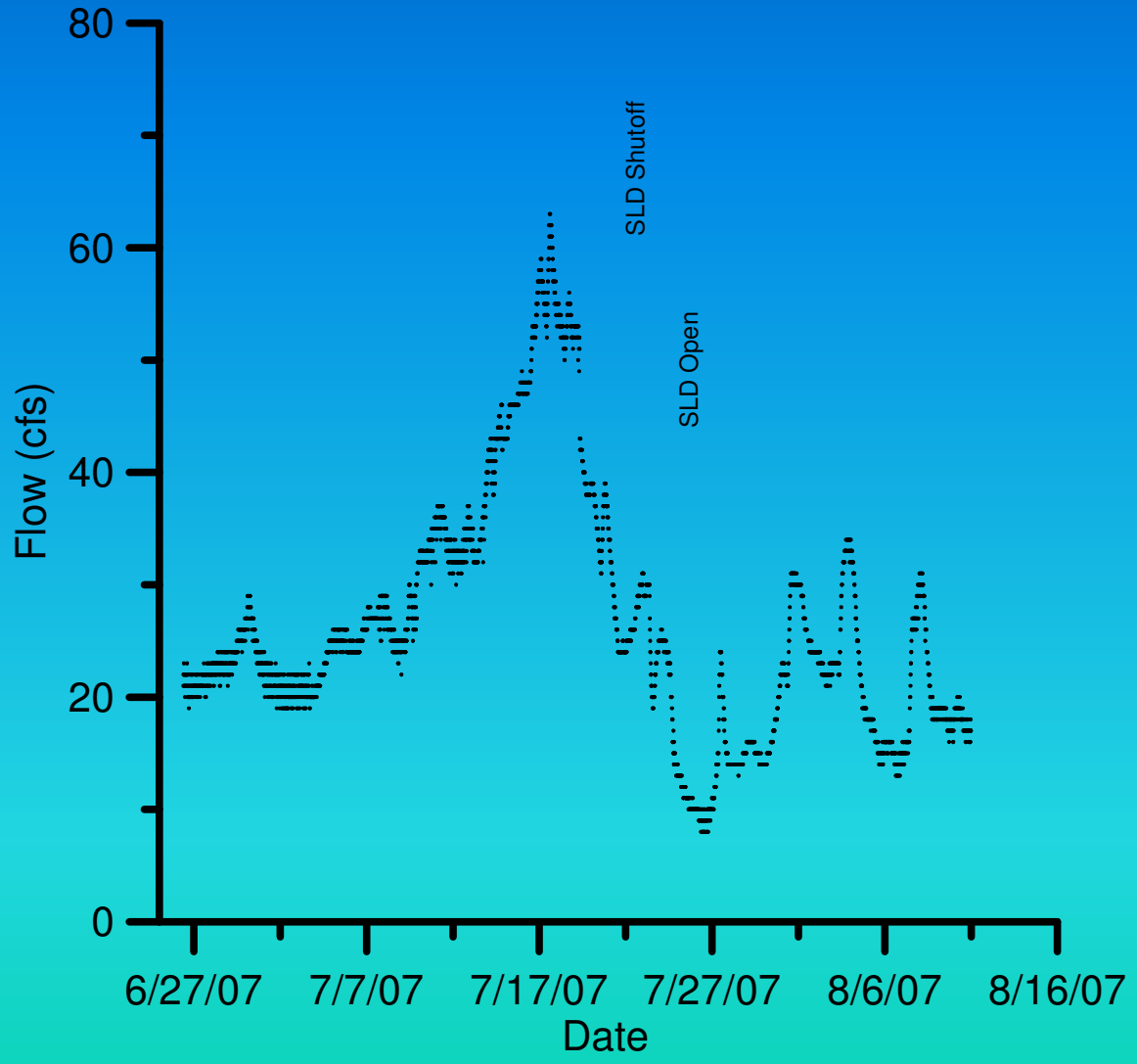
Mud Slough Flow



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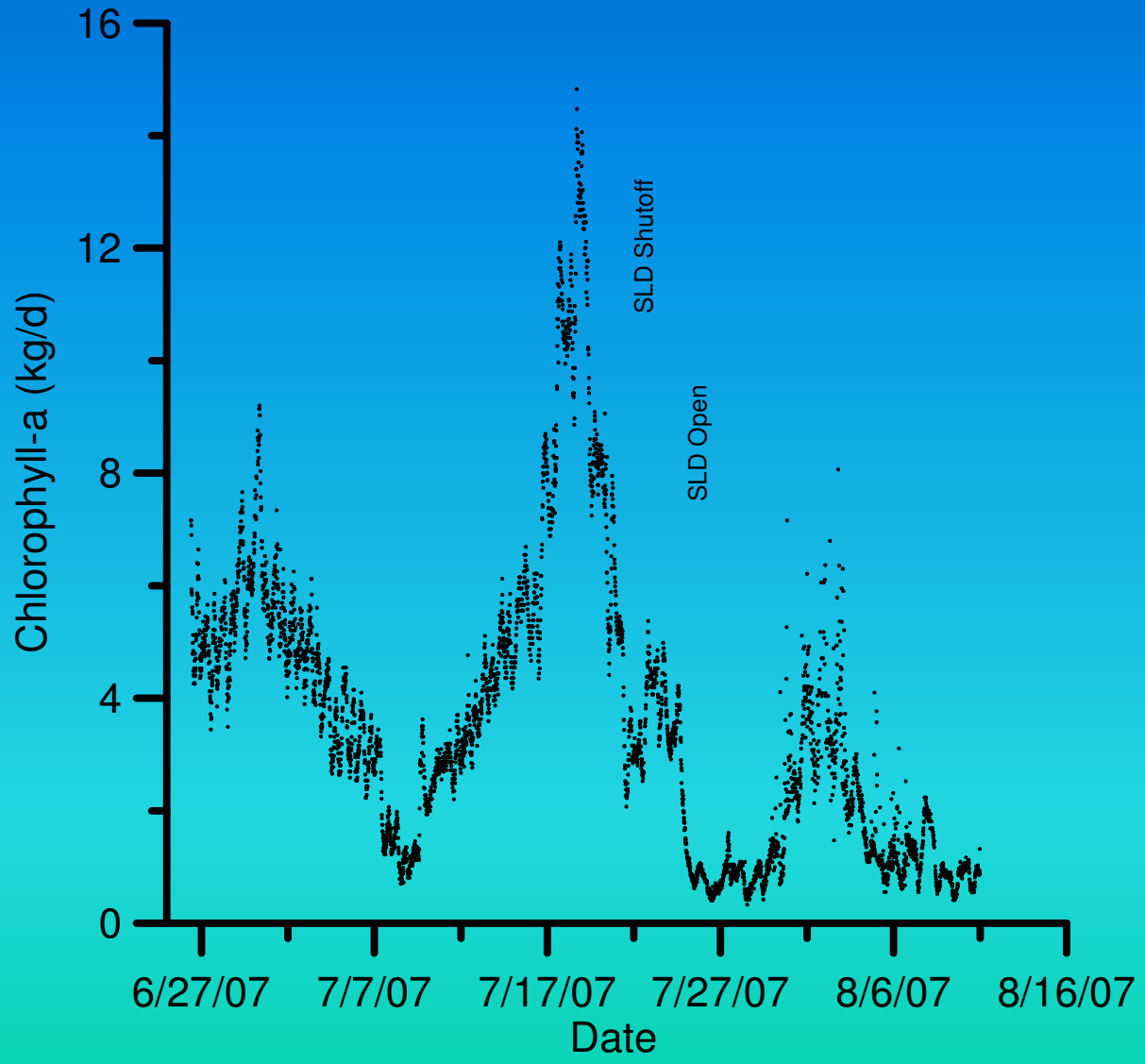
Mud Slough Chl-a Load



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Interpretation of Results

- Comparison of drainages
- Statistical analysis
- Ranking & indexing methods
- Longitudinal analysis
  - Source tracking
- Mechanistic & engineering analysis
  - Supplemental to WARMF modeling

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Task 4 Monitoring

- Task 4 has met field objectives
  - Final sampling in December 2007
- Data QA & compiling
- Transfer of data to modeling group
- Transfer of data to IEP
- Interpretation of data
- Final report

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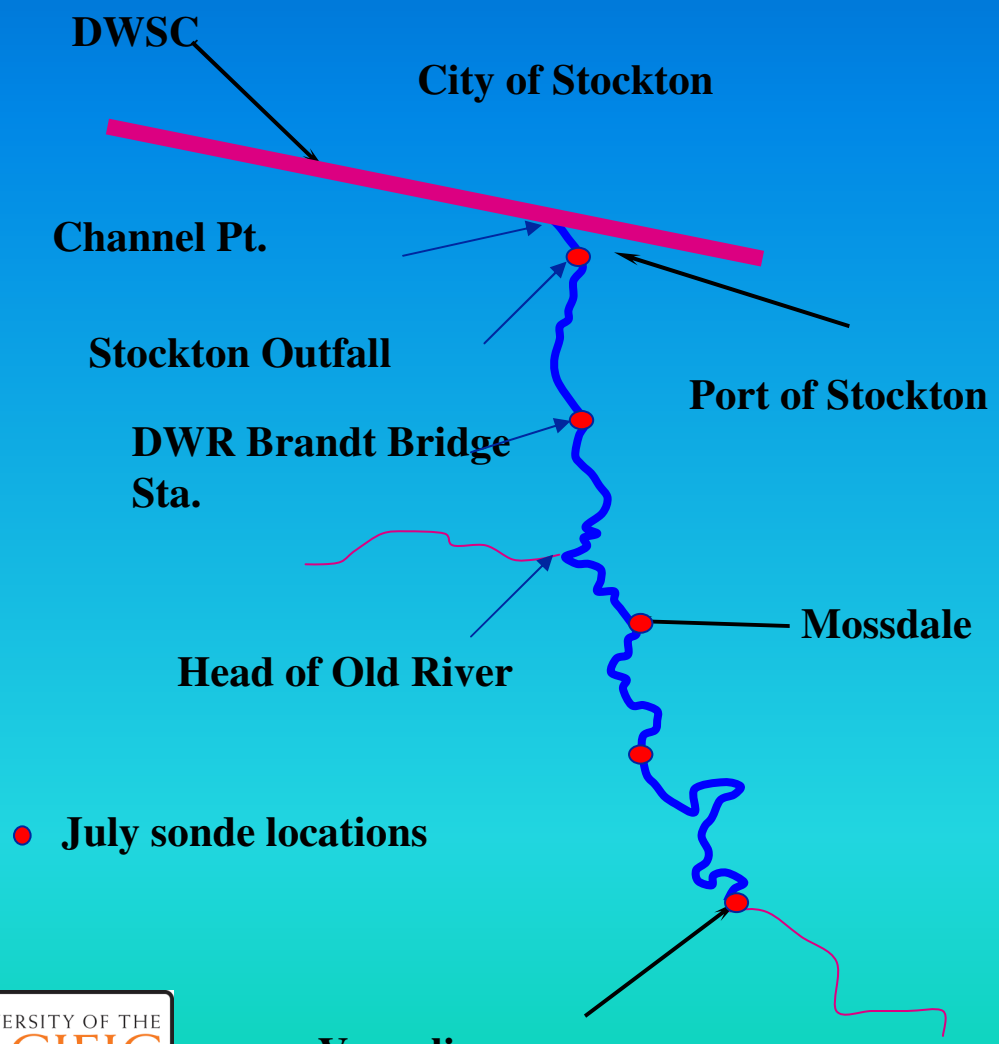
Task 8-9-10 Tidal Studies



- Dye studies
  - Travel time & dispersion
  - Water unit studies
- Zooplankton grazing
- Bivalve grazing
- Phytoplankton fate in tidal zone
- New continuous station

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Task 8-9 Highlights

- Wet & dry years investigated
- Consistent phytoplankton loss between Old river and DWSC
  - Light limitation, settling, zooplankton grazing
- Large data set to characterize predator-prey growth cycle
  - Important for model
  - possible importance to POD issues

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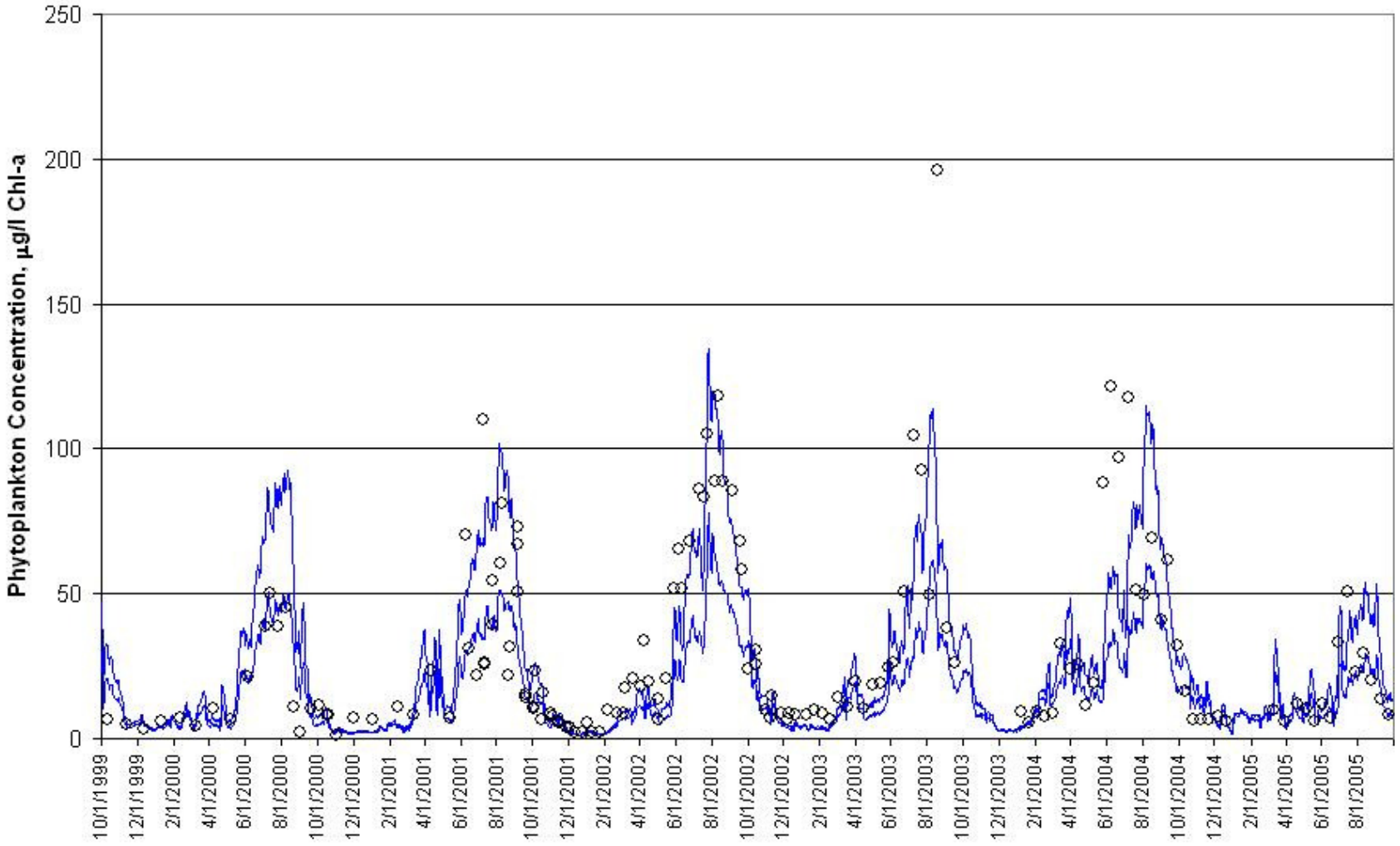
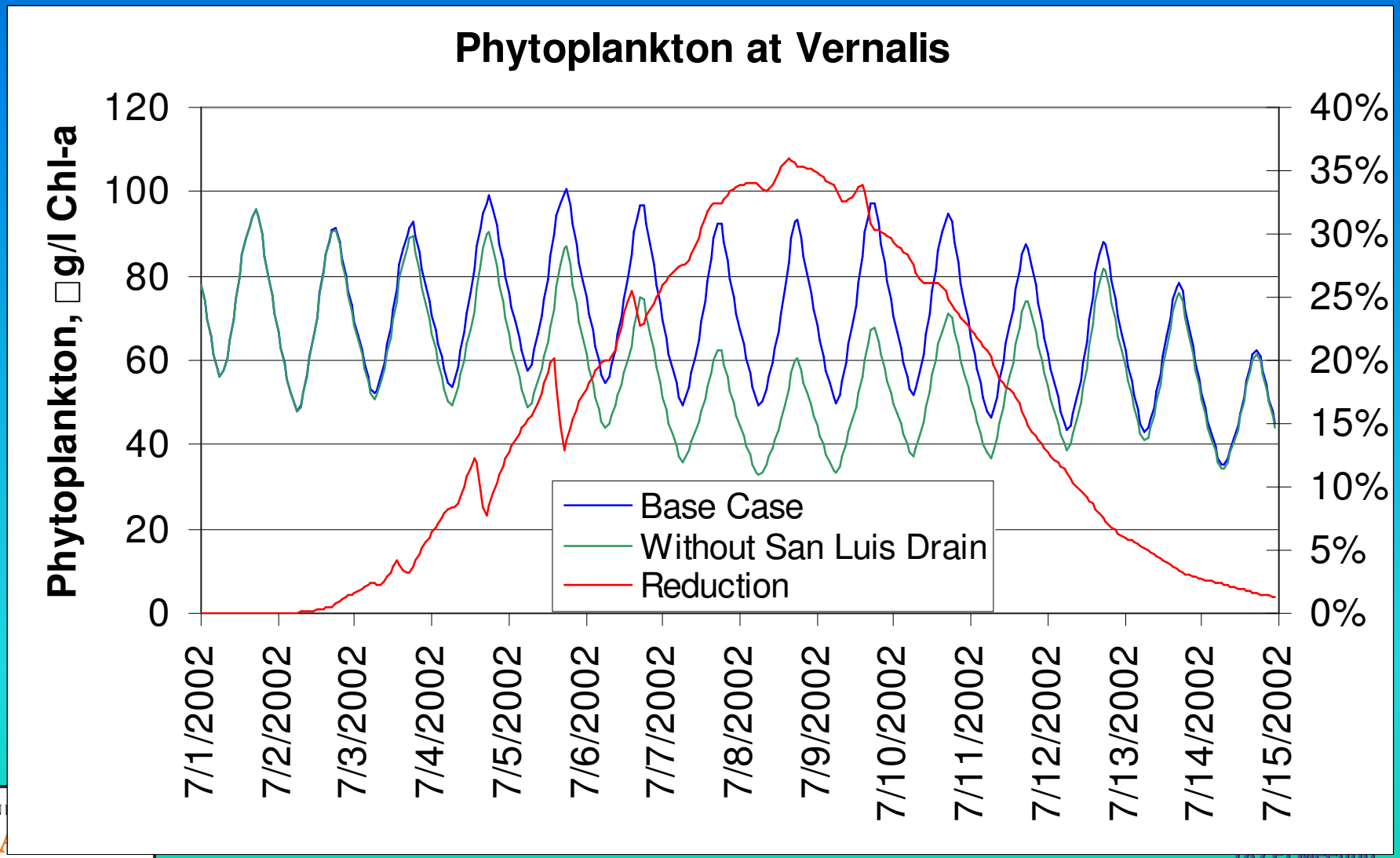
Task 6 WARMF Model



WARMF Model Accuracy

River Station	EC Prediction (Absolute Error)	Phytoplankton Prediction (Absolute Error)
Stevinson	5%	8%
Crows Landing	17%	47%
Patterson	13%	42%
Maze Road	14%	45%
Vernalis	15%	44%
Mossdale	15%	46%

WARMF Model Test



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Task 6 Highlights

- User friendly interface
- Model calibrated
- Peer reviewed by stakeholder group
  - Model modified in response to stakeholder comments
- Current model version posted on Systech FTP site
- SLD shutoff analysis on-going

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DO TMDL Project

- Objectives met
- Tasks completed
  - Adaptive management sucessful
- Final Task reports will be completed by April
- Synthesis report finished by July

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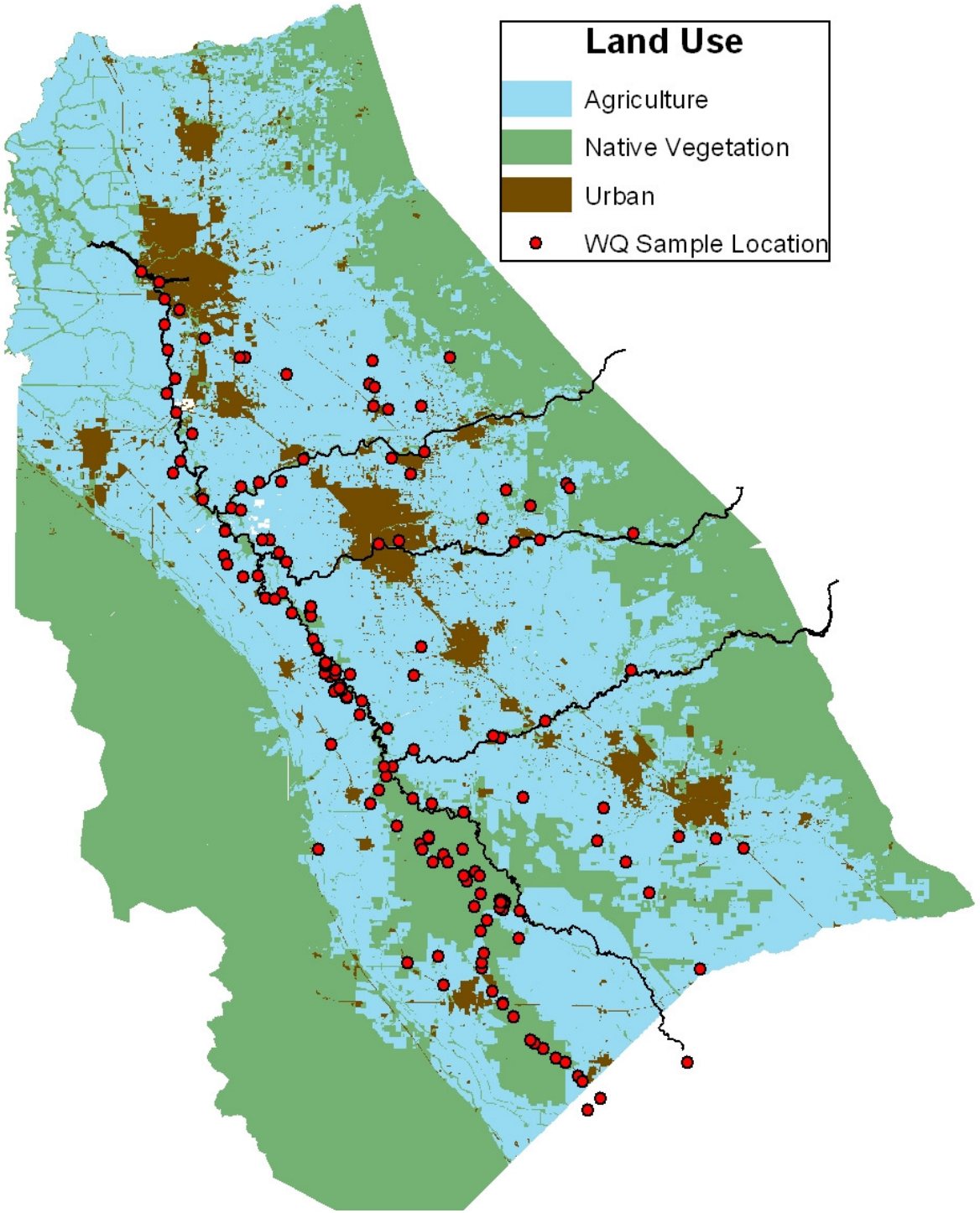

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