

RECAP ON KEY FINDINGS AND RECOMMENDATIONS

**Meeting to Plan Total Maximum Daily Loads (TMDLs) For
Biostimulatory Substances in Elkhorn Slough**

**Elkhorn Slough Reserve, Watsonville, CA
July 9, 2019**

Prior Efforts

- Summarized basis for 303 (d) listing
 - Summarized available nutrient and eutrophication data in Elkhorn Slough
 - Compared to targets in other estuaries in the US
- Provided preliminary estimate of watershed loading
- Provided preliminary estimate of mixing in estuary waters

(https://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/elkhorn_slough/do/)

Technical Support for Elkhorn Slough Nutrient Total Maximum Daily Load (TMDL) Development

September 28, 2018



Source: Kerstin Wasson

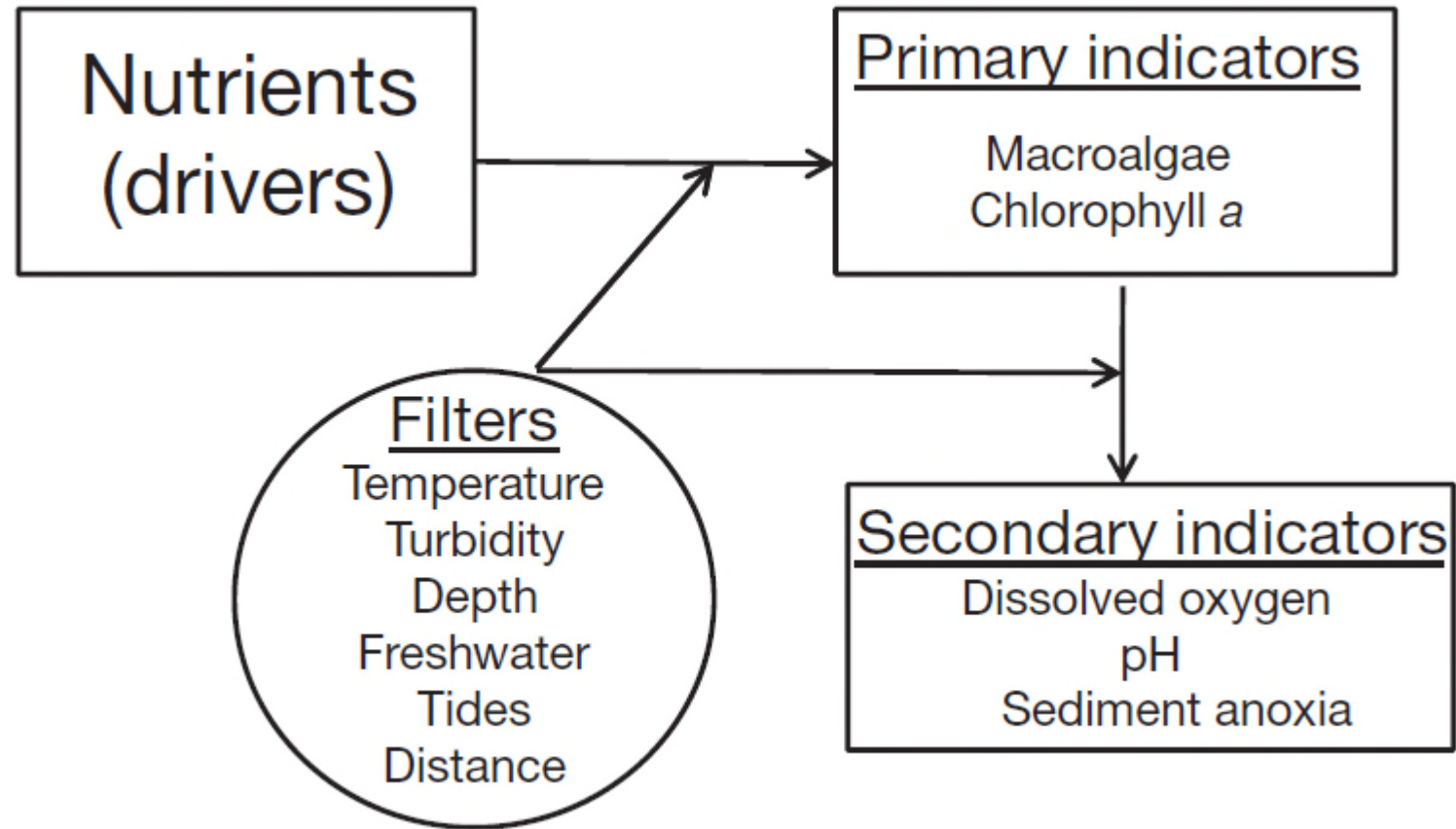
PREPARED FOR

U.S. EPA Region IX
and
California Regional Water Quality Control
Board, Central Coast Region

PREPARED BY

Tetra Tech
Research Triangle Park, NC, Owings Mills,
MD, and Lafayette, CA
Elkhorn Slough Foundation
Watsonville, CA

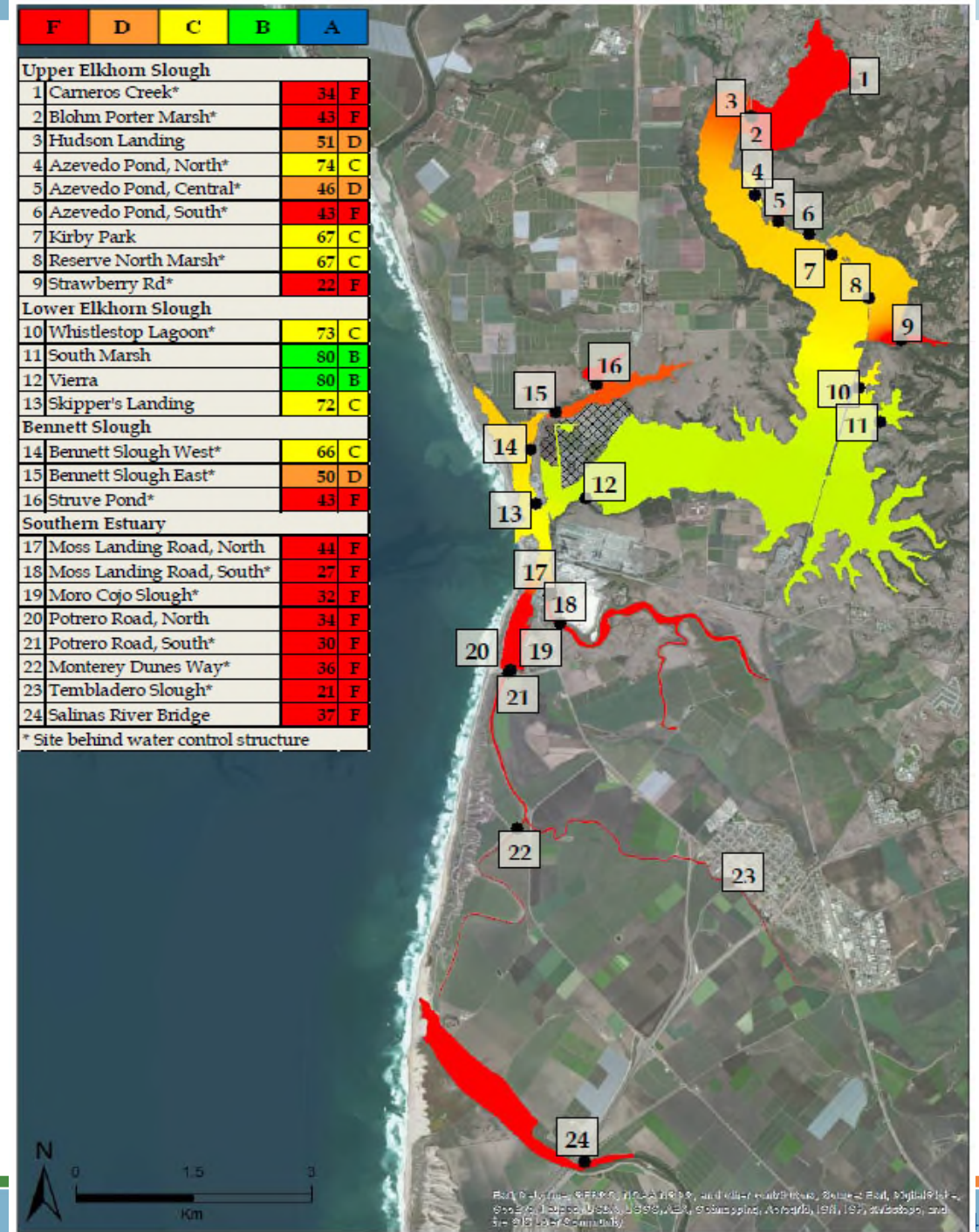
Expression of Eutrophication



Source: Hughes et al. 2011

Water Quality Summary

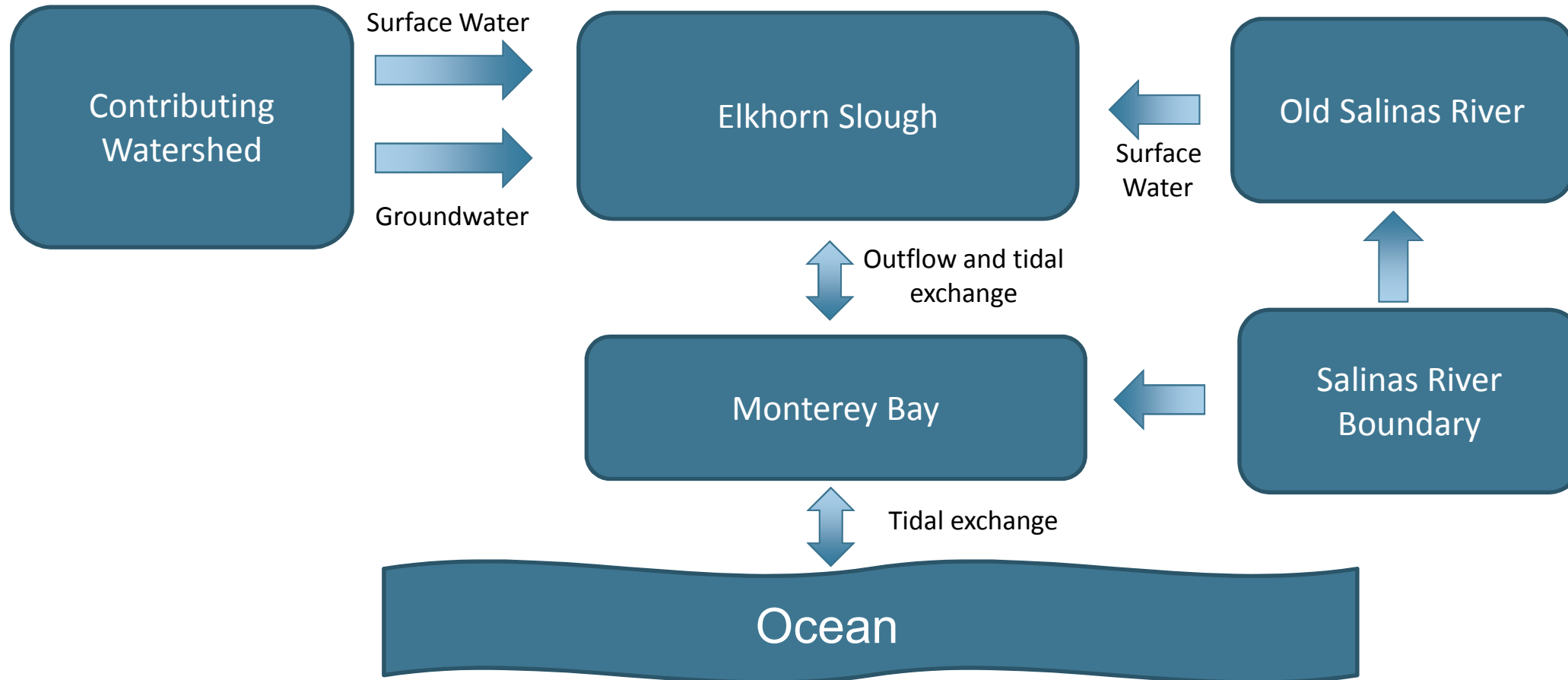
- Grades based on *Report Card of Water Quality for the Elkhorn Slough Estuary* (ESF, 2014)



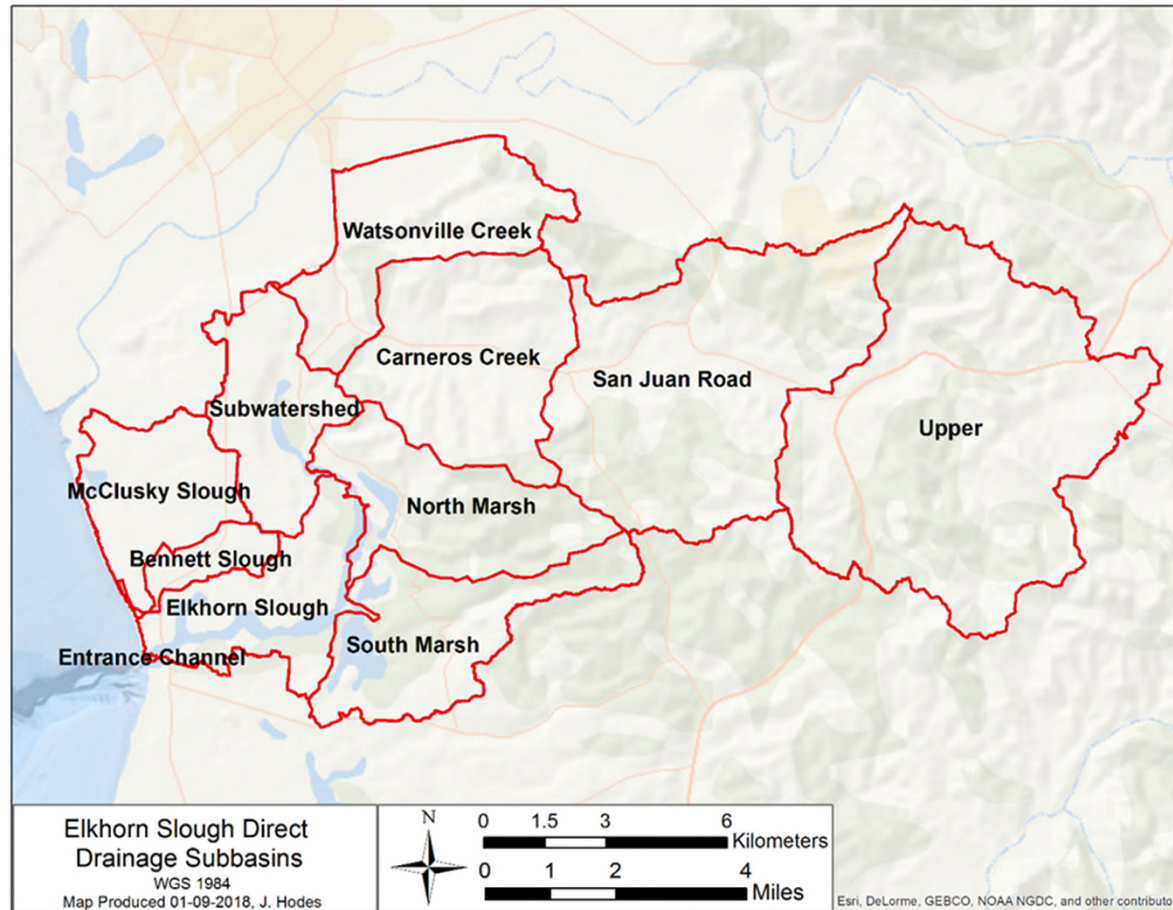
Nutrient Targets Reported in the Literature

Analyte Name	Literature Targets for other Estuaries
Ammonia (NH3) as N, Un-ionized	0.025 mg/L
Chlorophyll a	8-15 ug/L
Floating Algae	30-50%
Macroalgal Cover	<30-<50%
Nitrogen, Total	0.65-1.0 mg/L
Oxygen, Dissolved	4.8-7 mg/L
Phosphorus as P	0.10-0.20 mg/L

Conceptual Representation of Water Flows



Elkhorn Slough Subbasins



Nutrient Load Estimation

- STEPL model: Spreadsheet Tool for the Estimation of Pollutant Load (Tetra Tech, 2017) is a simplified spreadsheet model of pollutant loading.
- HAWQs model: uncalibrated watershed model contained in the EPA Hydrologic and Water Quality System (HAWQS; <https://epahawqs.tamu.edu>). HAWQS is a web-based interactive water quantity and quality modeling system that employs as its core modeling engine the Soil and Water Assessment Tool (SWAT).

The screenshot displays the HAWQS web application interface. The top navigation bar includes the HAWQS logo, the title 'Hydrologic and Water Quality System - A National Watershed and Water Quality Assessment Tool', and a 'Log off' button. The left sidebar contains a 'Projects' dropdown menu with options: 'Elkhorn', 'Create a new project', 'Account settings', 'Help', and 'Log off'. The main content area features a 'Welcome!' message and a 'Projects' table.

Name	Last Modified	Res.	Start HUC	End HUC	# Subs	Area
Elkhorn	1/15/2018 8:13 AM	HUC 12	Head	180600150301	4	475.12 km ²

Below the table, there are instructions: 'Archive a project you are no longer using, but may want to come back to at a later date - more about arch' and 'have 0 archived projects.' and 'Permanently delete project.'

At the bottom of the main content area, it states: 'This project was jointly sponsored by the U.S. EPA Office of Water, the USDA Agricultural Research Service, and' followed by logos for EPA, Texas A&M AgriLife, Texas A&M University, and USDA.

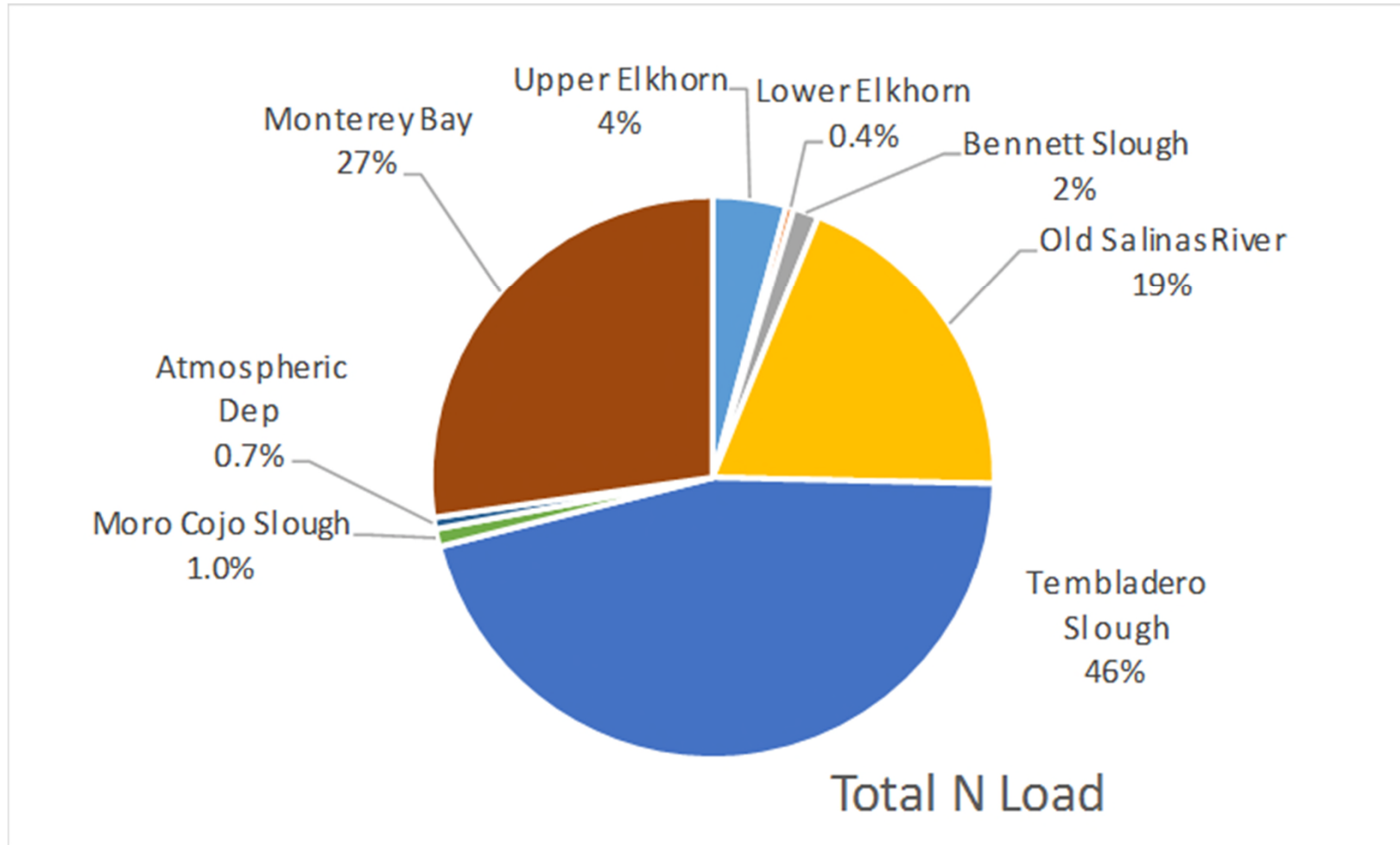
On the right side, there is a map titled 'HUC 12 Watershed - Head to 180600150301'. The map shows the watershed boundary in green, with subbasins outlined in blue. A tooltip 'Hover over a subbasin' is visible. The map includes labels for 'Watsonville', 'Hollister', 'Monterey', 'CA 1', 'CA 68', and 'Salinas Municipal Airport'. The current position is shown as 36.979, -121.752. The date 2/25/2018 is displayed at the bottom right of the map.

Preliminary Nutrient Loads from Old Salinas River, Tembladero Slough, and Moro Cojo Slough: Estimates Using Flows and Concentrations

	Flow (AF/yr)	Total N (mg/L)	Total P (mg/L)	Total N Load (lb/yr)	Total P Load (lb/yr)
Old Salinas River	5,129	35.04	0.53	488,479	7,403
Tembladero Slough	15,376	27.80	0.58	1,161,733	24,396
Moro Cojo Slough	4,495	2.13	0.59	25,962	7,258
Total	25,000			1,676,175	39,057

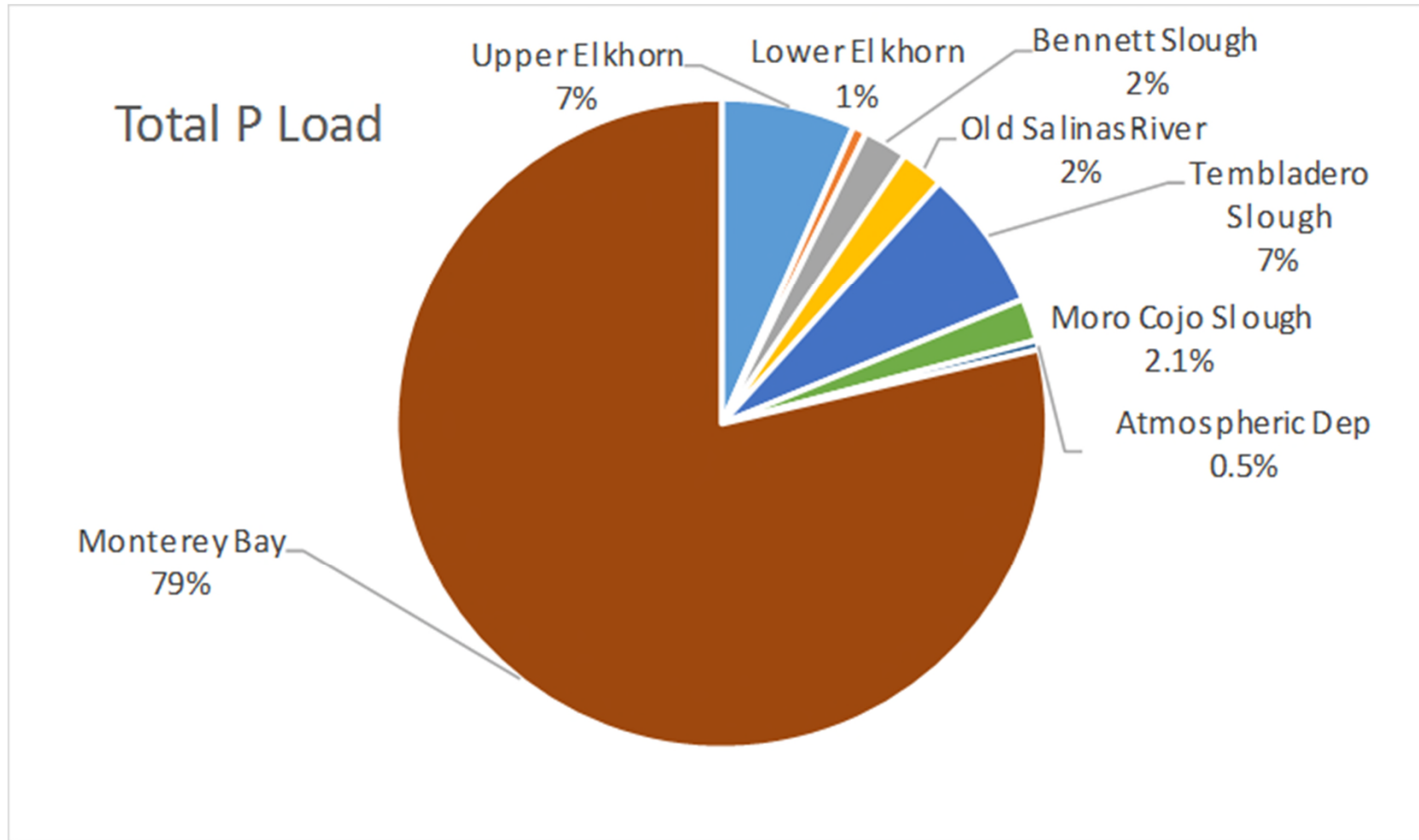
These load estimates need to be updated with a more sophisticated watershed model

Nitrogen Load Summary Across Entire Slough*



*Contributions will vary by location

Phosphorus Load Summary Across Entire Slough*



*Contributions will vary by location

Recommended Next Steps in Tetra Tech (2018)

Develop watershed loading model

- Develop SWAT model of direct drainages to Elkhorn Slough

Develop receiving water model of Elkhorn Slough

- Select, update, and calibrate an estuarine hydrodynamic or tidal mixing model

Address, to the extent possible, data gaps

- Assemble additional information on contributions from Old Salinas River
- Additional information on groundwater loading and internal nutrient loading from sediments