Upper San Marcos Creek/Lake San Marcos Nutrient Impairment Diagnostics Public Workshop

December 3, 2014

Outline

- Introductions
- San Diego Regional Water Quality Control Board Update
- Lake Monitoring
- Watershed Monitoring
- Lake and Watershed Modeling Efforts
- Next Steps
- Question and Answer Session

Citizens Development Corporation

Pino Vitti, Citizen's Development Corporation

Nick Buhbe, Great Ecology

PARTICIPATING PUBLIC AGENCY WORK GROUP (PAWG)

Upper San Marcos Creek Watershed

City of San Marcos

County of San Diego

City of Escondido

Vallecitos Water District

Caltrans District 11

San Marcos Unified School District

Diagnostic Effort Oversight Agency

San Diego Regional Water Quality Control Board

Laurie Walsh, PE

WRC Engineer – Storm Water Management Unit

This presentation was not prepared by or submitted on behalf of any one party.

California Regional Water Quality Control Board San Diego Region

Lake San Marcos Public Workshop

December 3, 2014

Laurie Walsh, PE
Water Resource Control Engineer
San Diego Water Board

CALIFORNIA Water Boards

Regulatory Background

- San Diego Water Board receives complaints from residences at Lake San Marcos
- June 2011 – Public Agencies Work Group members sign Participation Agreement
- June 2011 - San Diego Water Board signed Addendum B to Participation Agreement
- September 2011 - Issued Investigative Order to CDC
  - Investigative Work Plan – Completed June 2012
  - Investigation Report – December 1, 2012 - Past Due
- Law Suits Filed

Regulatory Approach

Voluntary Agreement Vs. Total Maximum Daily Load

- Pilot Program
  - Responsible parties participate develop and conduct work within a voluntary process
- Goal
  - Achieve lasting water quality in advance of the schedule contemplated under the formal TMDL process (2019)
  - Develop structural framework for such a voluntary process to be used as an alternative to the otherwise formal TMDL process

Project Timeline

- 2011-2015
  - CDC Finish Investigation Work & Reporting
  - Public Agencies Implement Work Plan
  - Additional Collaborative Work
    - Lake Modeling, Wet Weather and Sediment Sampling
- Future
  - Regional Board Regulatory Measures
    - Water Quality Improvement Plans – Public Agencies
    - Resolutions, Orders – Private Parties

Progress Achieved

- Investigative Order Work Nearly **Completed**
  - Water Quality Monitoring
  - Phytoplankton Sampling
  - Sediment Flux Measurements
  - Bathymetric Survey
  - Vegetation Survey
  - Lake Water Balance
- Three Year Public Agencies Work Plan – Nearing completion (2012 - 2015)
- Additional Future Collaborative Work between CDC and Public Agencies

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California Regional Water Quality Control Board
San Diego Region

Thank you

Lake San Marcos Public Workshop

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CALIFORNIA Water Boards

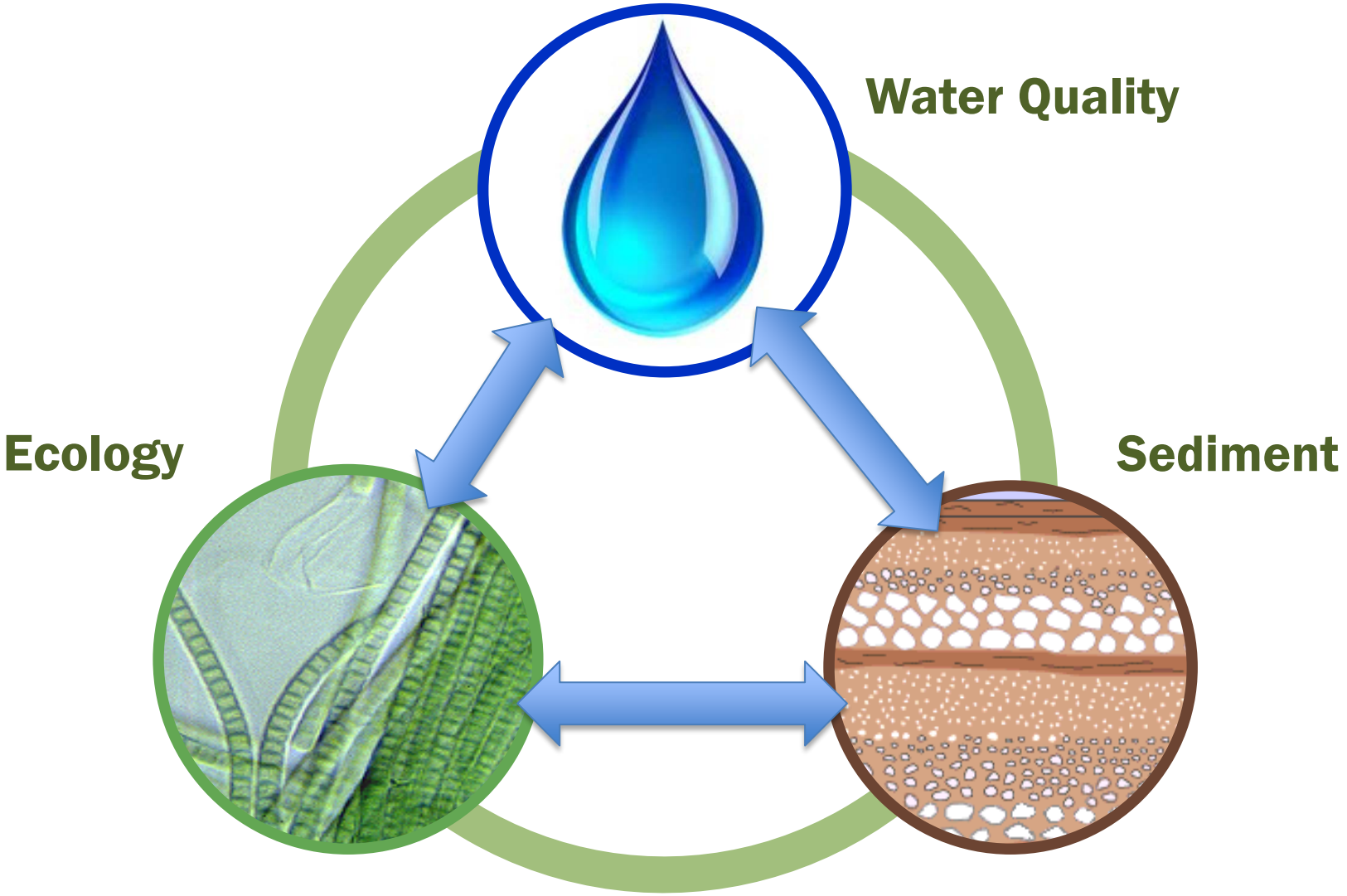
December 3, 2014

In-Lake Monitoring at Lake San Marcos

- Overview of Lake Monitoring Effort
- Biological Resources
- Water Quality
- Sediment Quality
- Looking Ahead

GREATecology
ENVIRONMENT + DESIGN

Nutrient Cycling



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Definitions

- **Eutrophic:** Excessive plant growth due to excess nutrients
- **Phosphorus:**

  Total Phosphorus (TP) – mass measurement

  Orthophosphate (OP, PO_4) – nutrient form; bioavailable
- **Nitrogen:**

  Total Nitrogen (TN) – mass measurement

  Nitrate (NO_3) – nutrient form; bioavailable

  Ammonia (NH_3) – nutrient form; bioavailable;

  complex chemistry, potentially toxic

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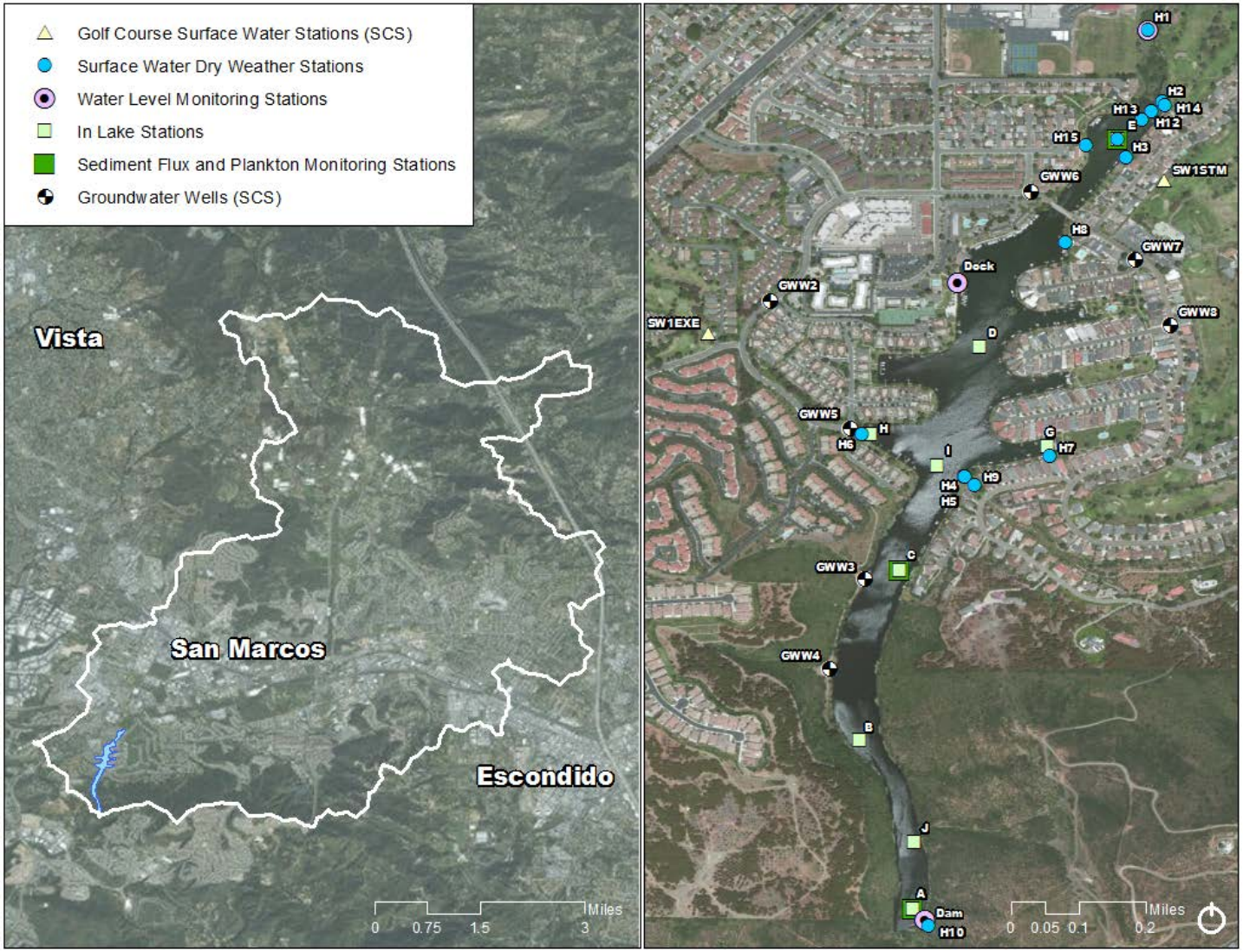
Lake Monitoring Effort: 2012 to 2014



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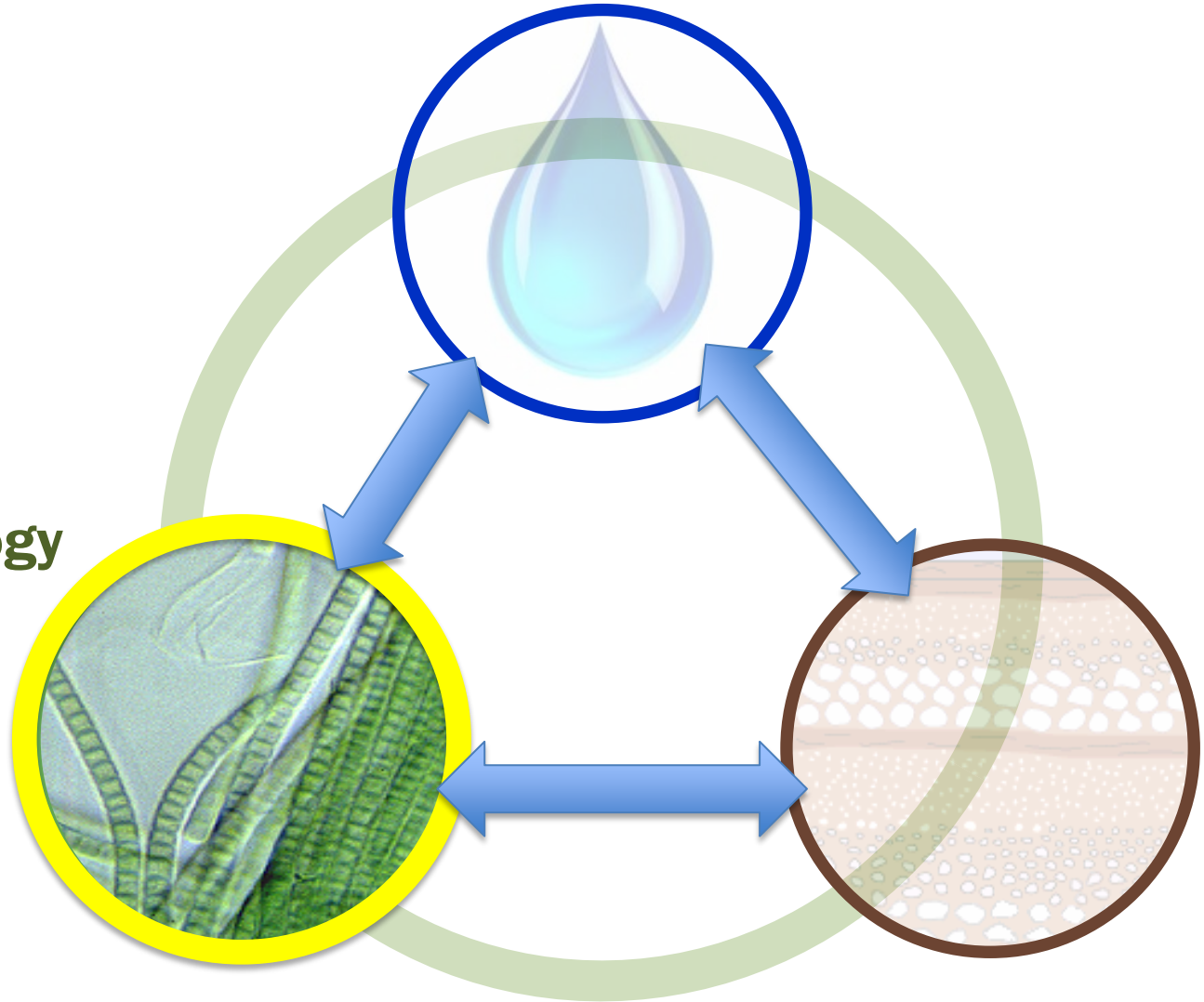
Nutrient Cycling



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Lake Ecology--Fish

TPF

Zooplanktovores

Zooplankton

Nutrients

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Lake Ecology--Fish

1979 Seine Survey
Black Bass
Bluegill(+)
Catfish
Green Sunfish
Bullhead [Catfish]

1991 Gill Net Survey
Black Bass
Bullhead [Catfish]
Threadfin Shad(+)

Fall 2014 Seine Survey
Largemouth Bass
Bluegill
Threadfin Shad(+)
Black Crappie
Mosquitofish

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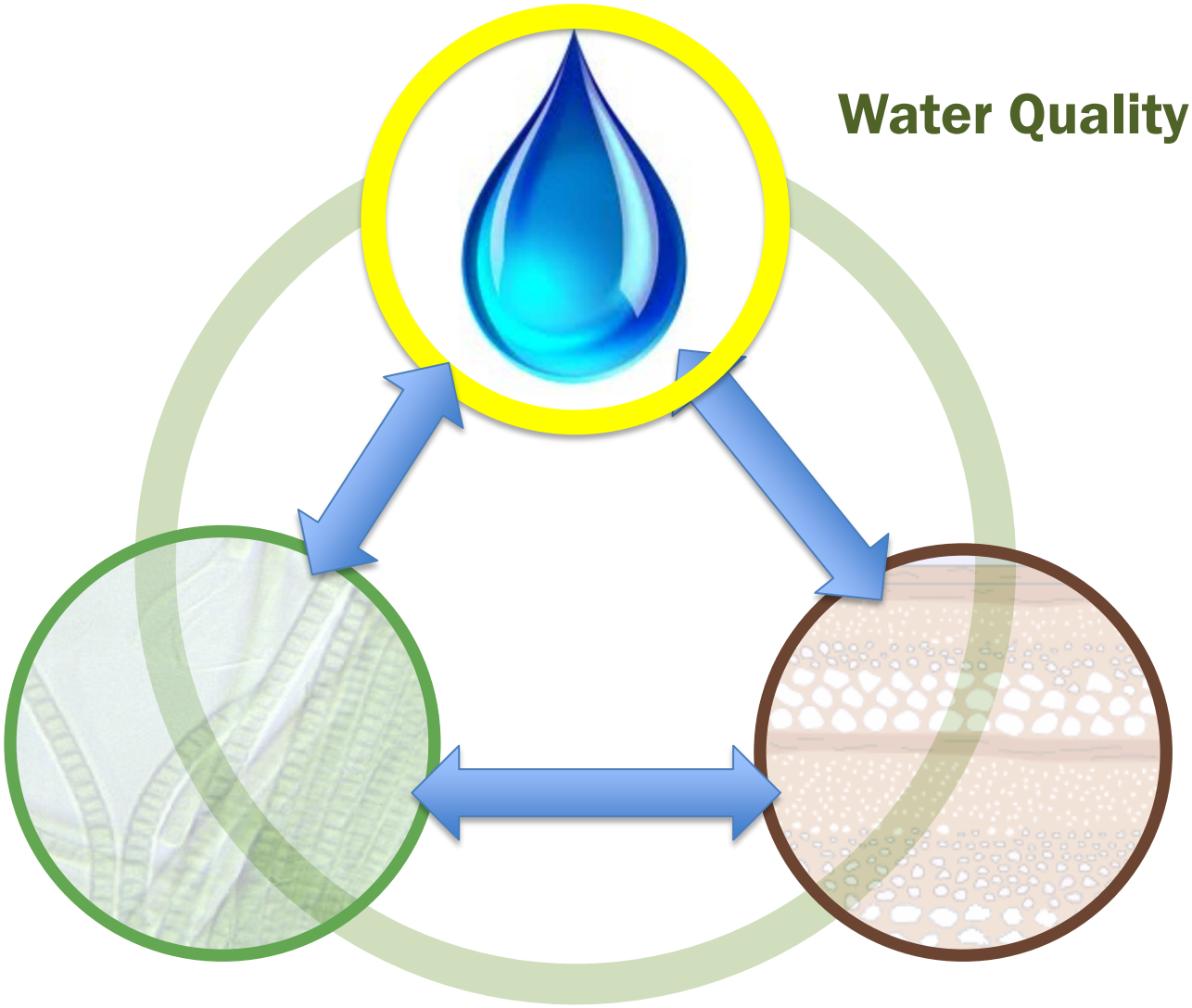
Lake Ecology--Phytoplankton

Date	Green Algae	Diatoms	Cyanobacteria	Other Species
September 2012			●●●	
June 2013	●		●●	
September 2013			●●●	
January 2014	●●●			
May 2014	●	●	●	
August 2014			●●●	

Nutrient Cycling



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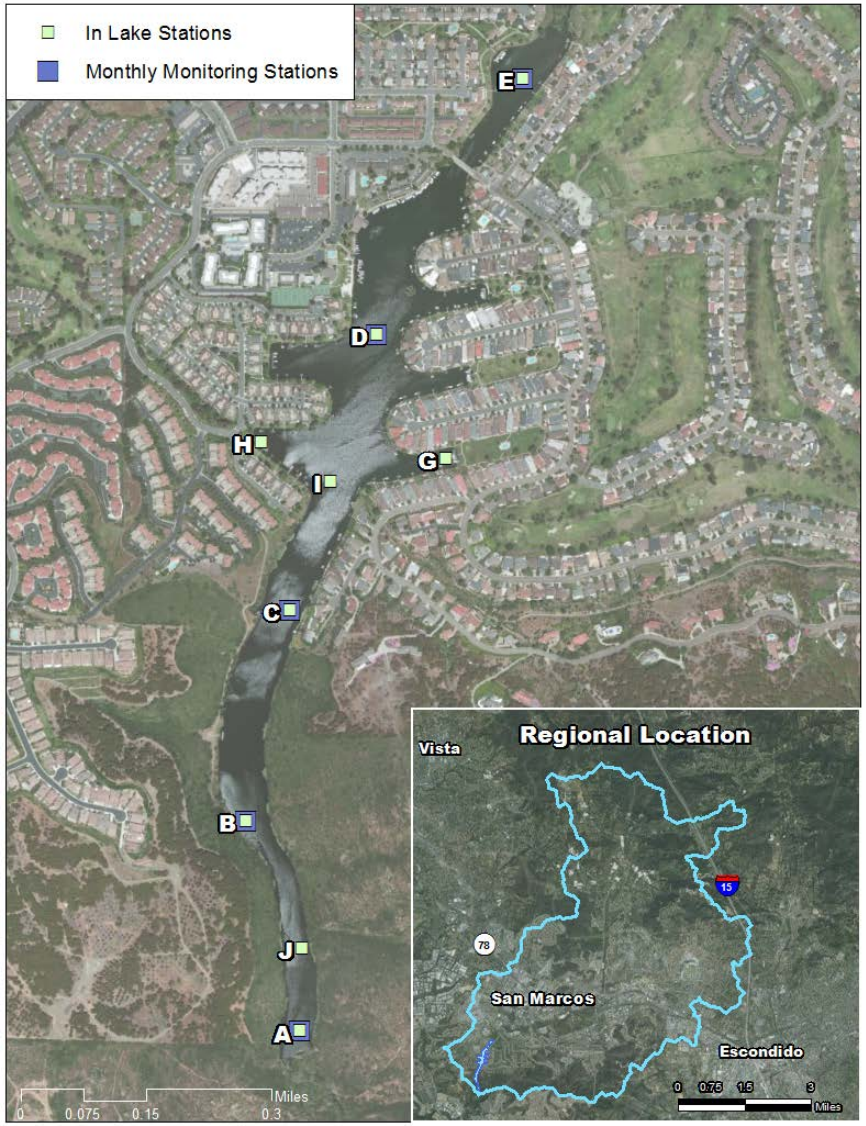
Lake Monitoring Effort: 2012 to 2014



- 21 Water quality monitoring events
- 5 sediment collection events
- 7 Phytoplankton monitoring events

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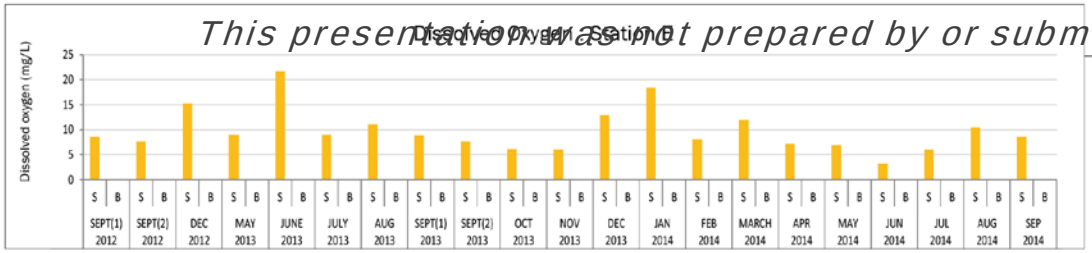

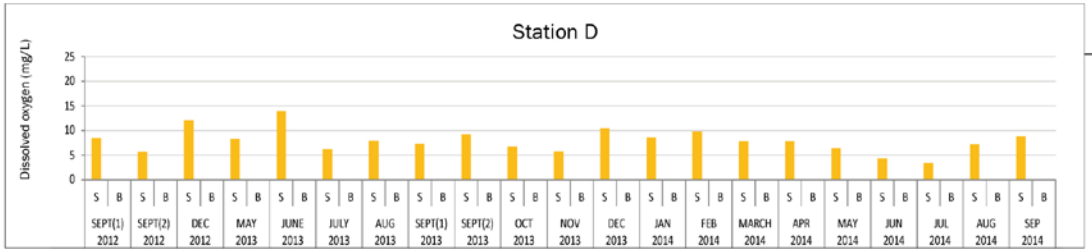

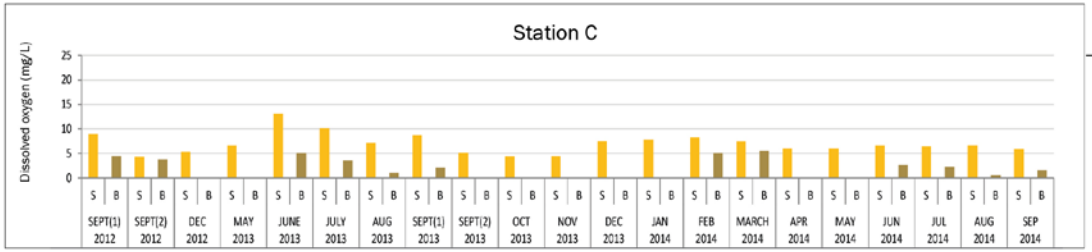

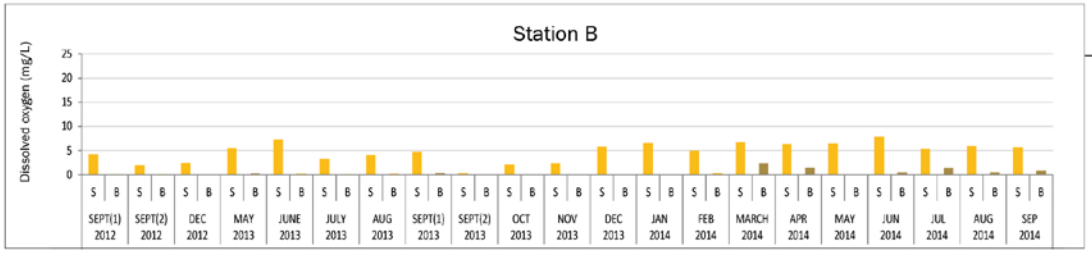

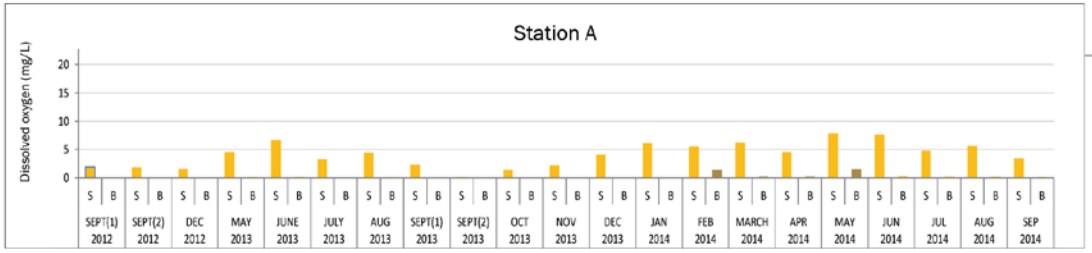

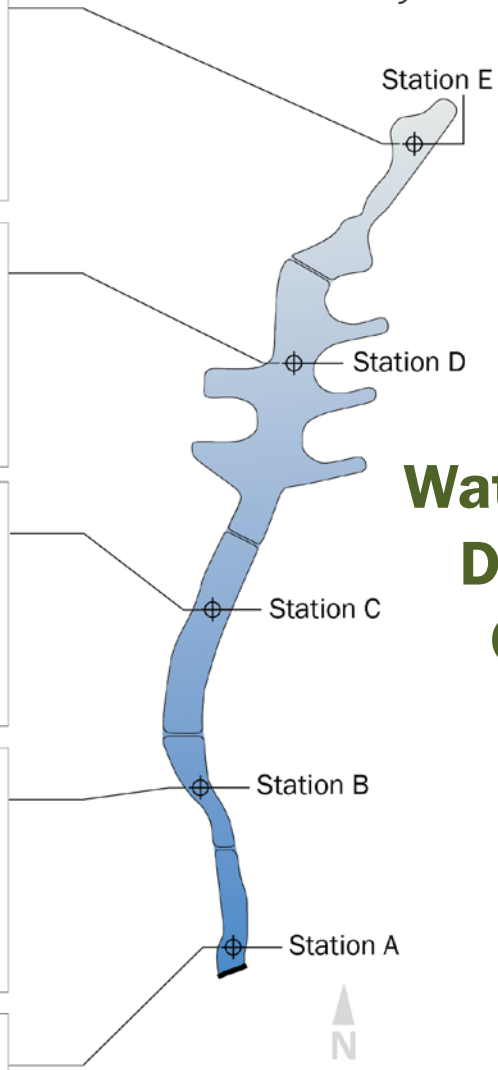

Water Quality Dissolved Oxygen

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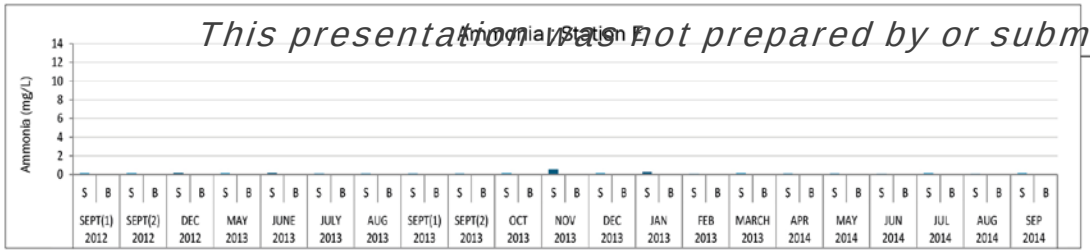

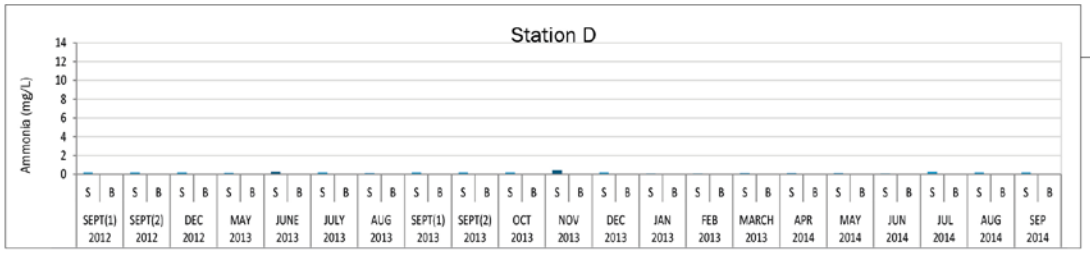

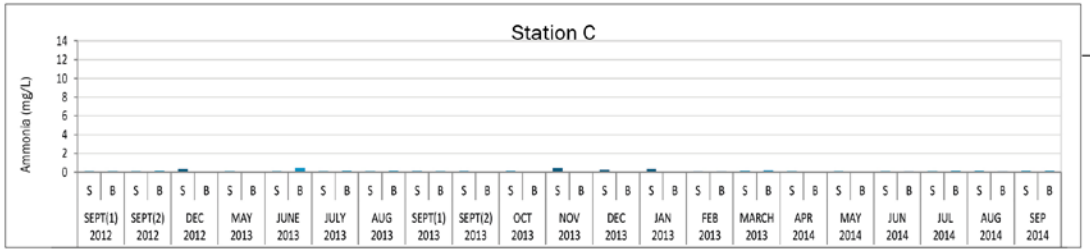

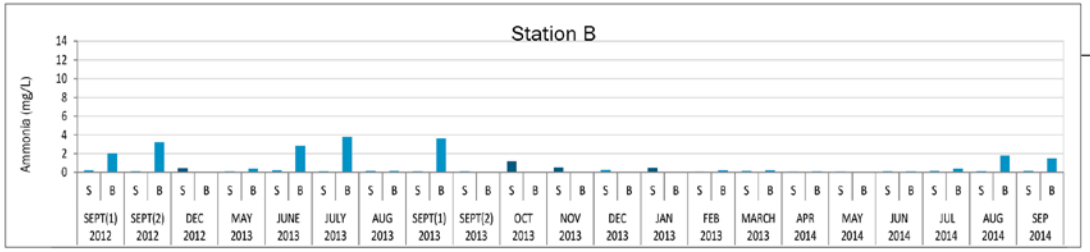

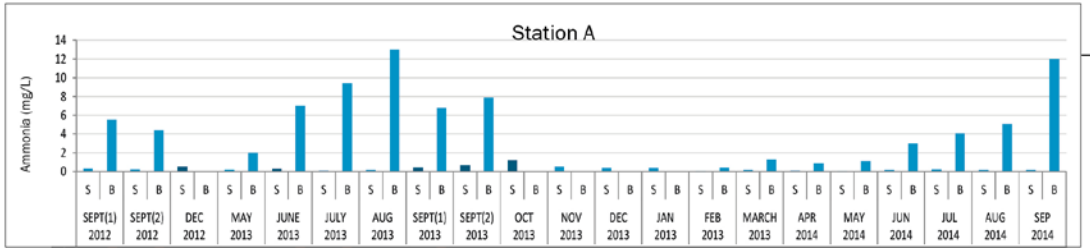

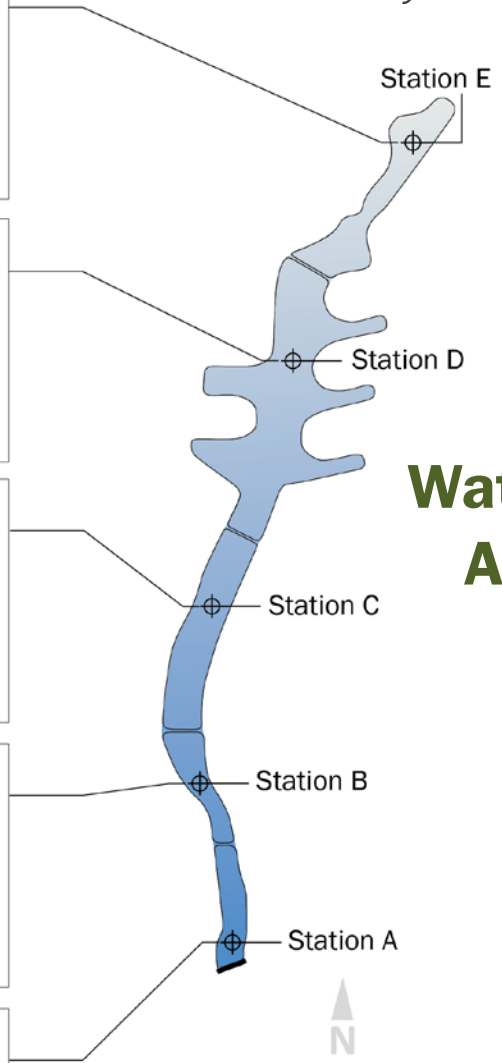

Water Quality
Ammonia

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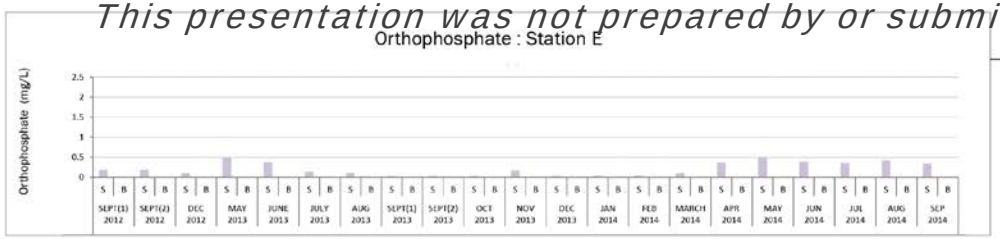

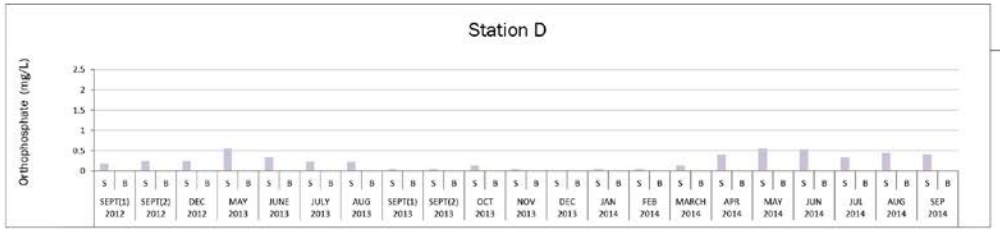

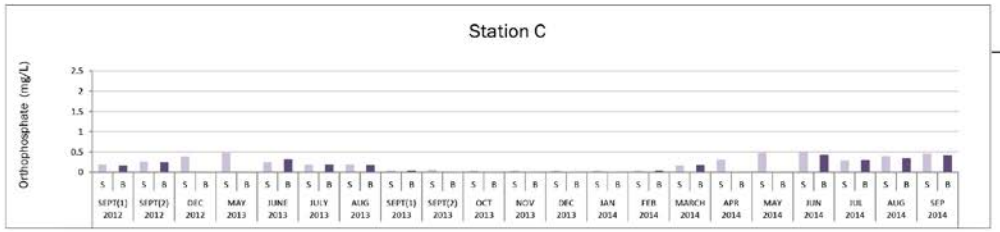

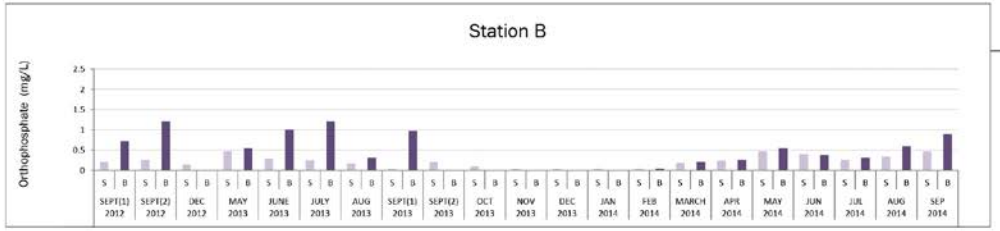

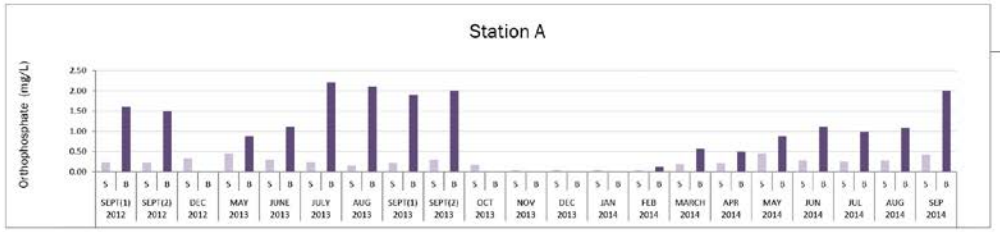

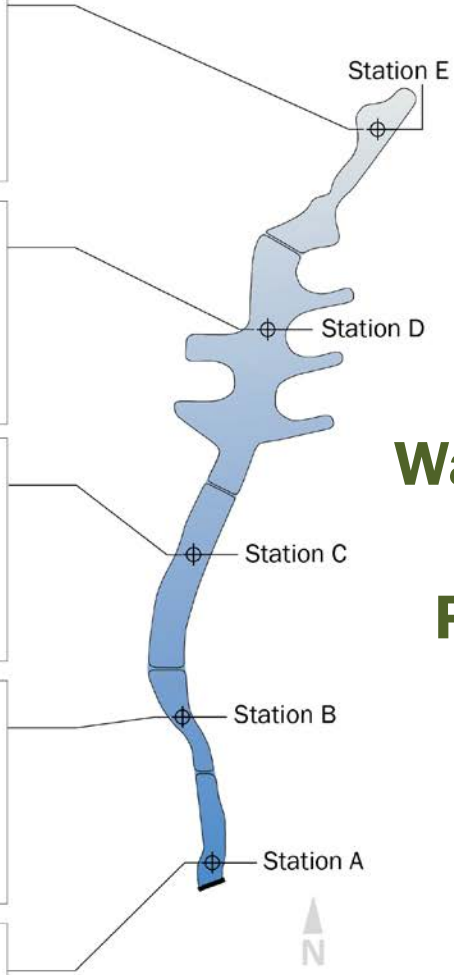

Water Quality Ortho-Phosphate

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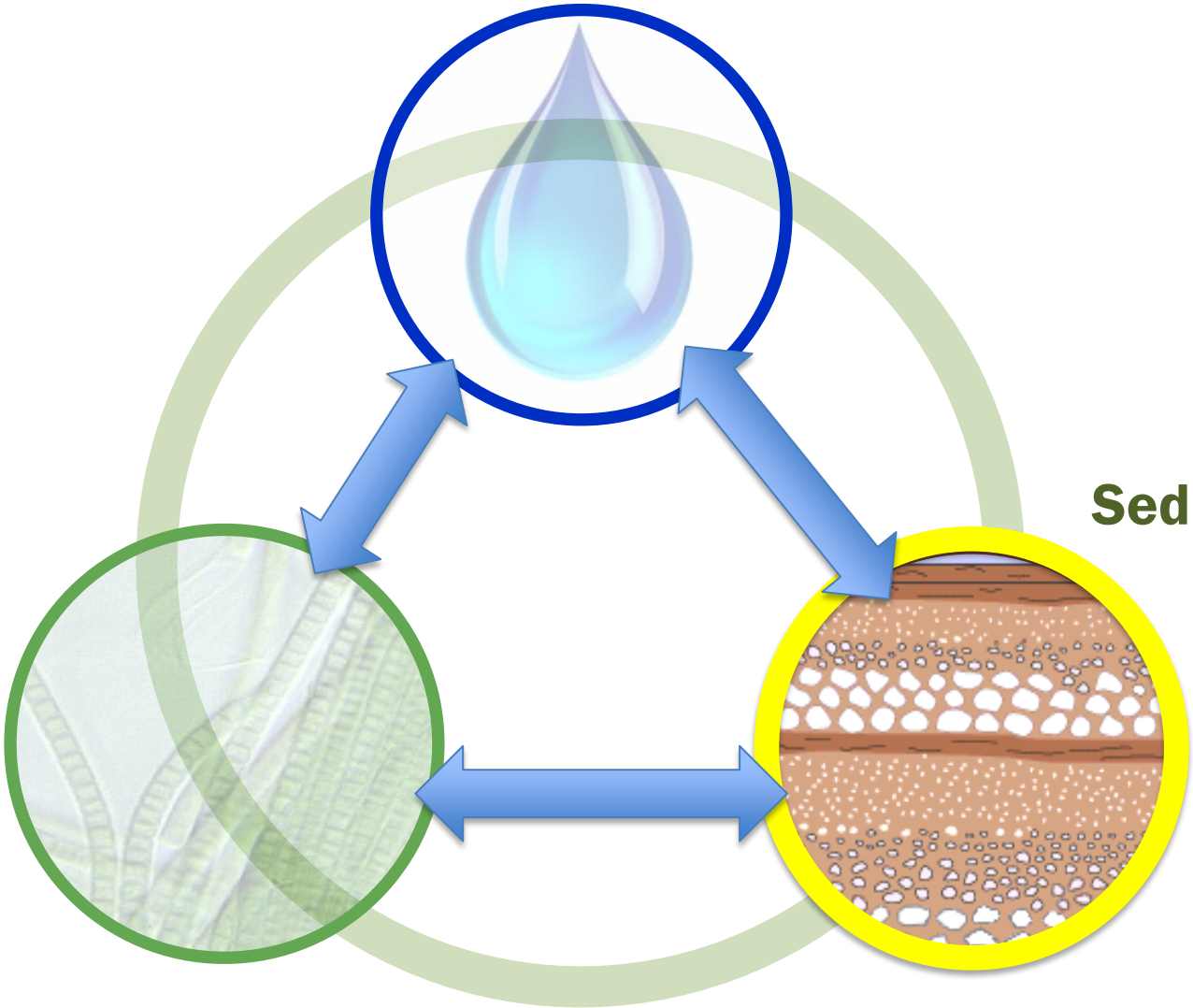
Nutrient Cycling



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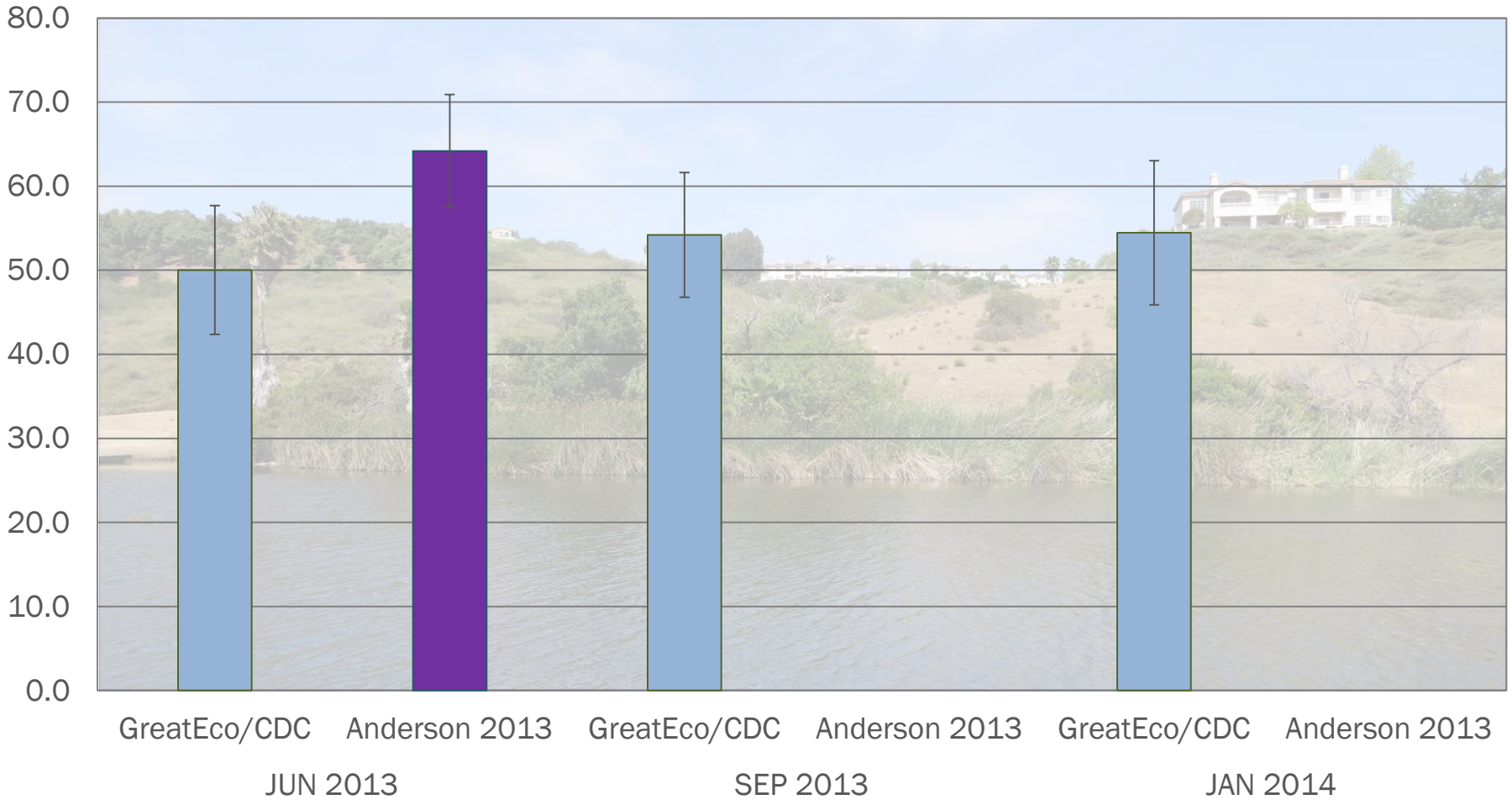
Sediment Quality

Sediment Flux: Ammonia



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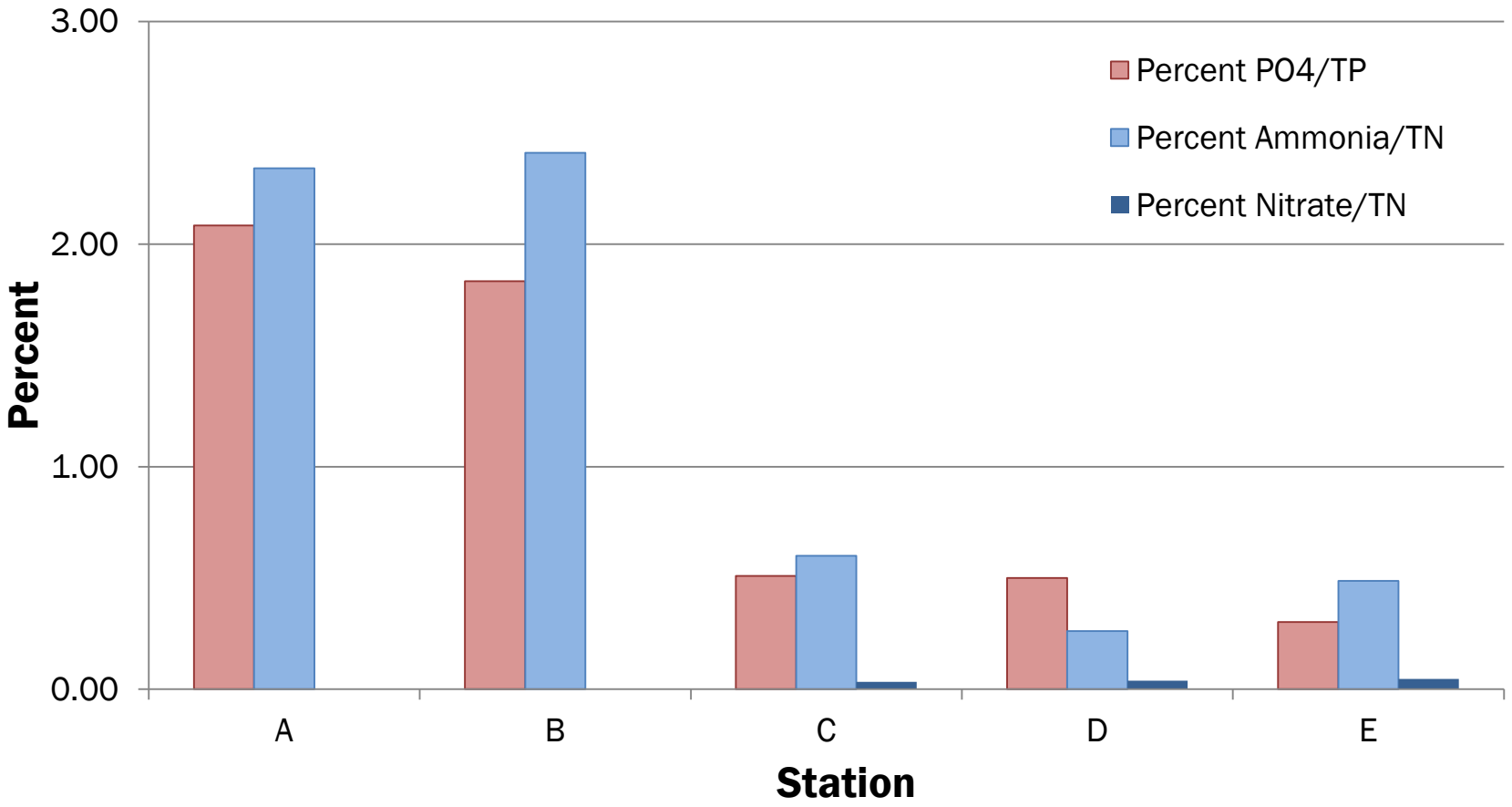
Sediment Nutrient Data



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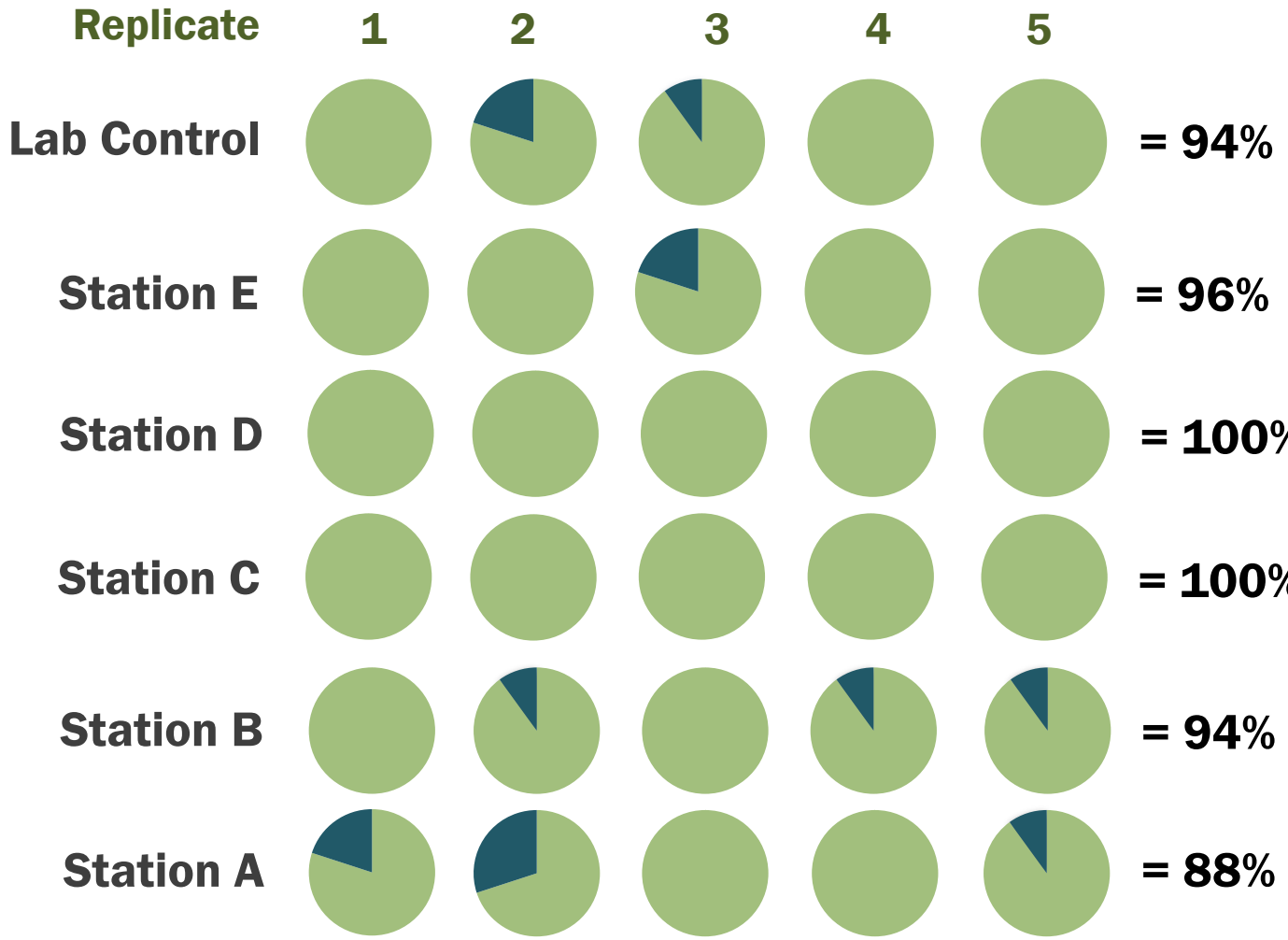
Sediment Quality--Sediment Toxicity

Survival of *Hyallela*



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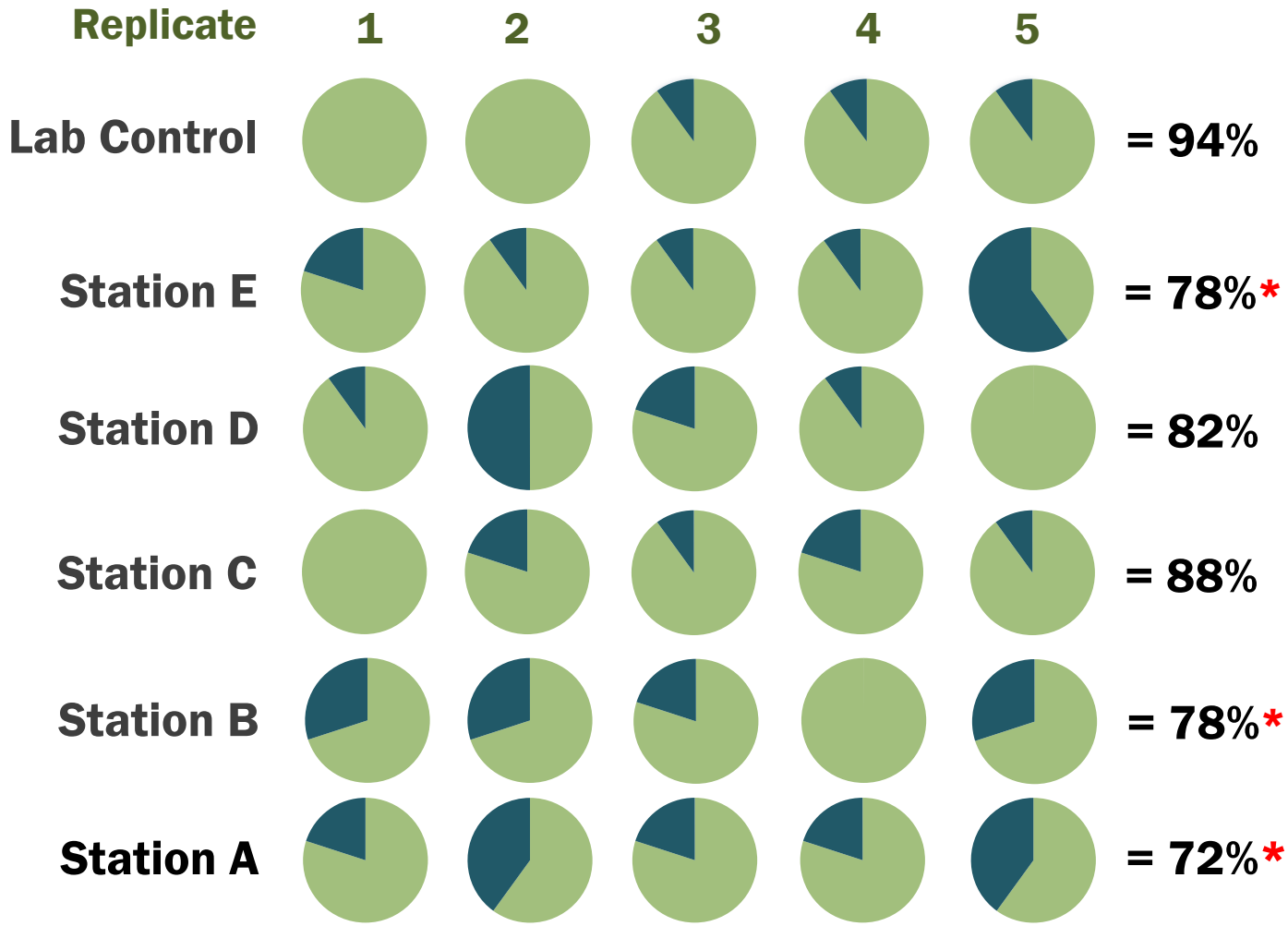
Sediment Quality

Sediment Toxicity: Survival of *Chironomus*



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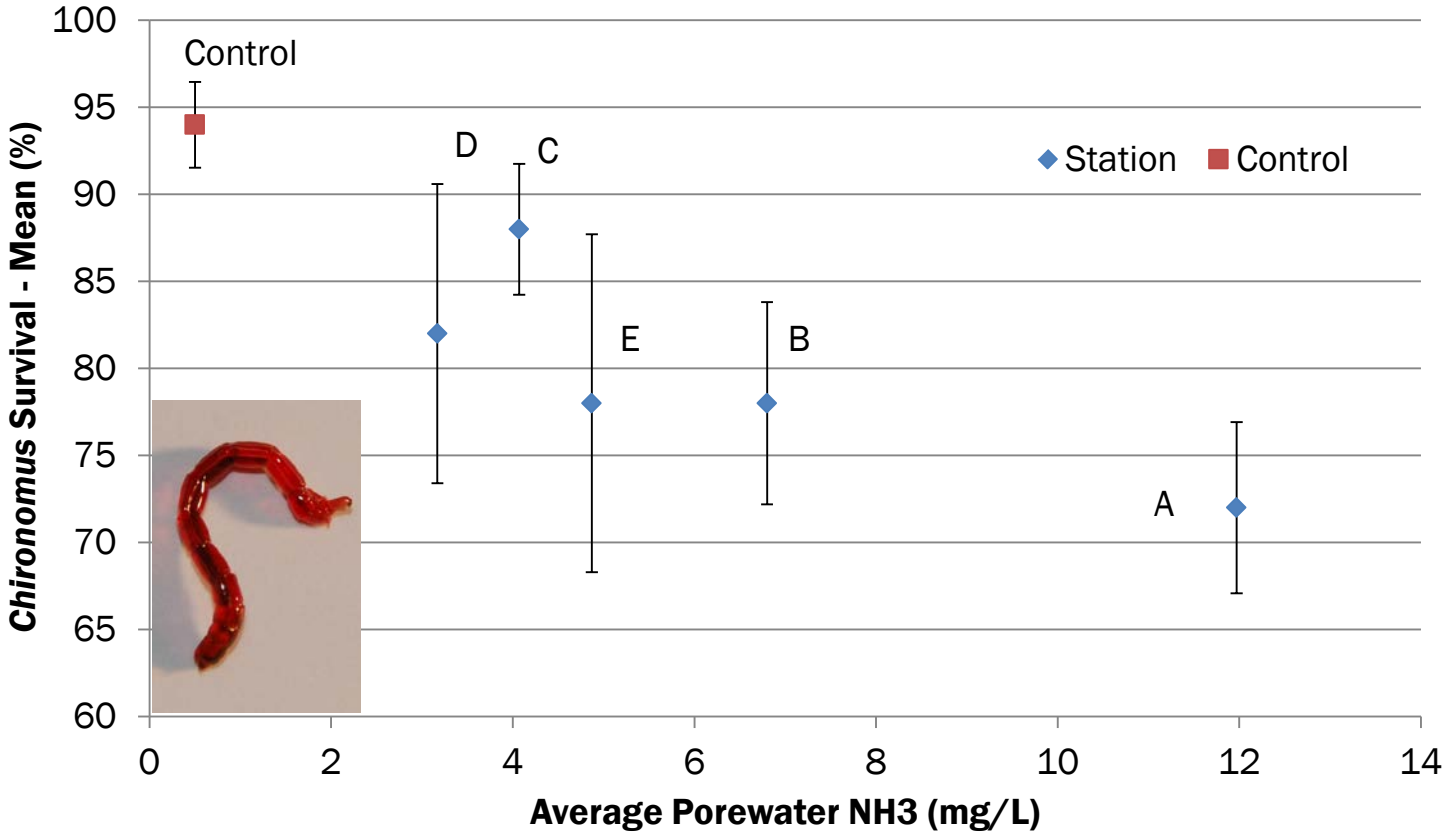
Sediment Quality--Sediment Toxicity

Toxicity and Ammonia



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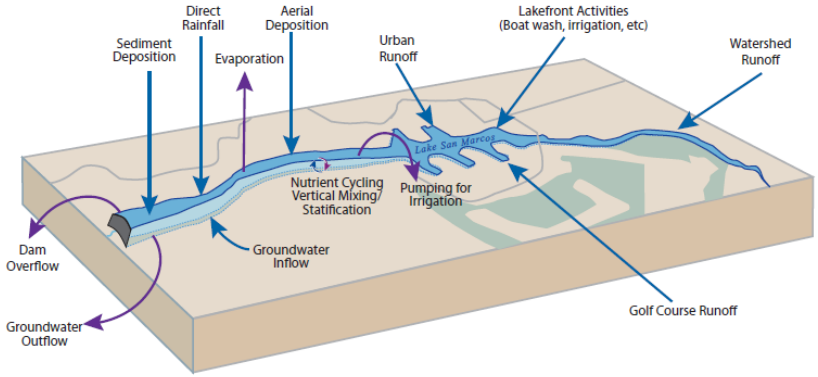
Looking Ahead

Modeling and Feasibility Studies

- **Objective:** Address lake eutrophication and improve water quality
- **Near-Term Goal:** Identify remedial actions
- **Next Steps:**

  Assess ammonia toxicity
  Complete modeling of lake and watershed
  Address data gaps



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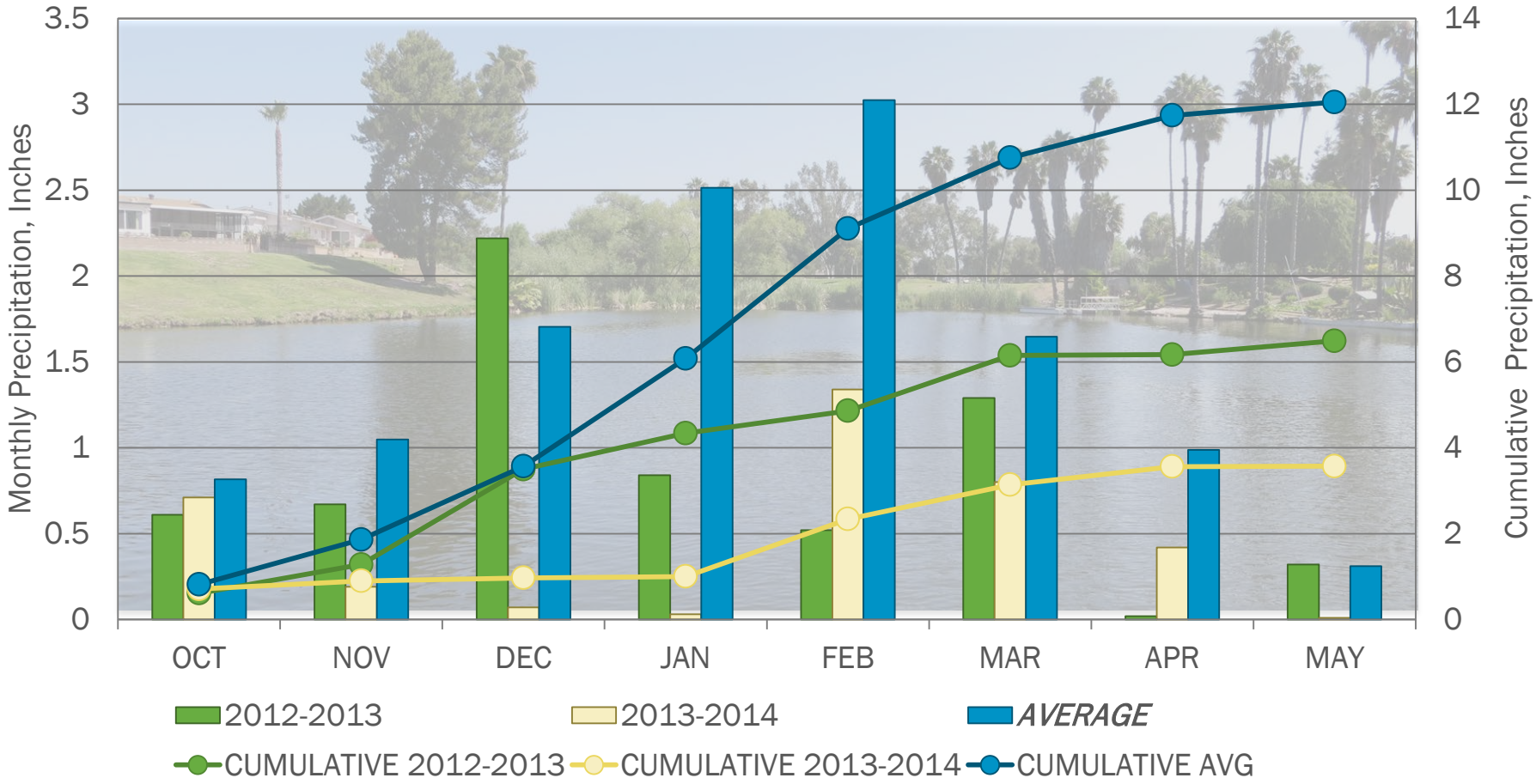
Looking Ahead

Monthly and Cumulative Precipitation Totals



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SCS ENGINEERS







Lake San Marcos Water Quality Investigation

12/3/14

Presented by:
Daniel E. Johnson, SCS Engineers
In Collaboration with:
Sean Porter, Brown and Caldwell
And
George Liddle, SCS Engineers

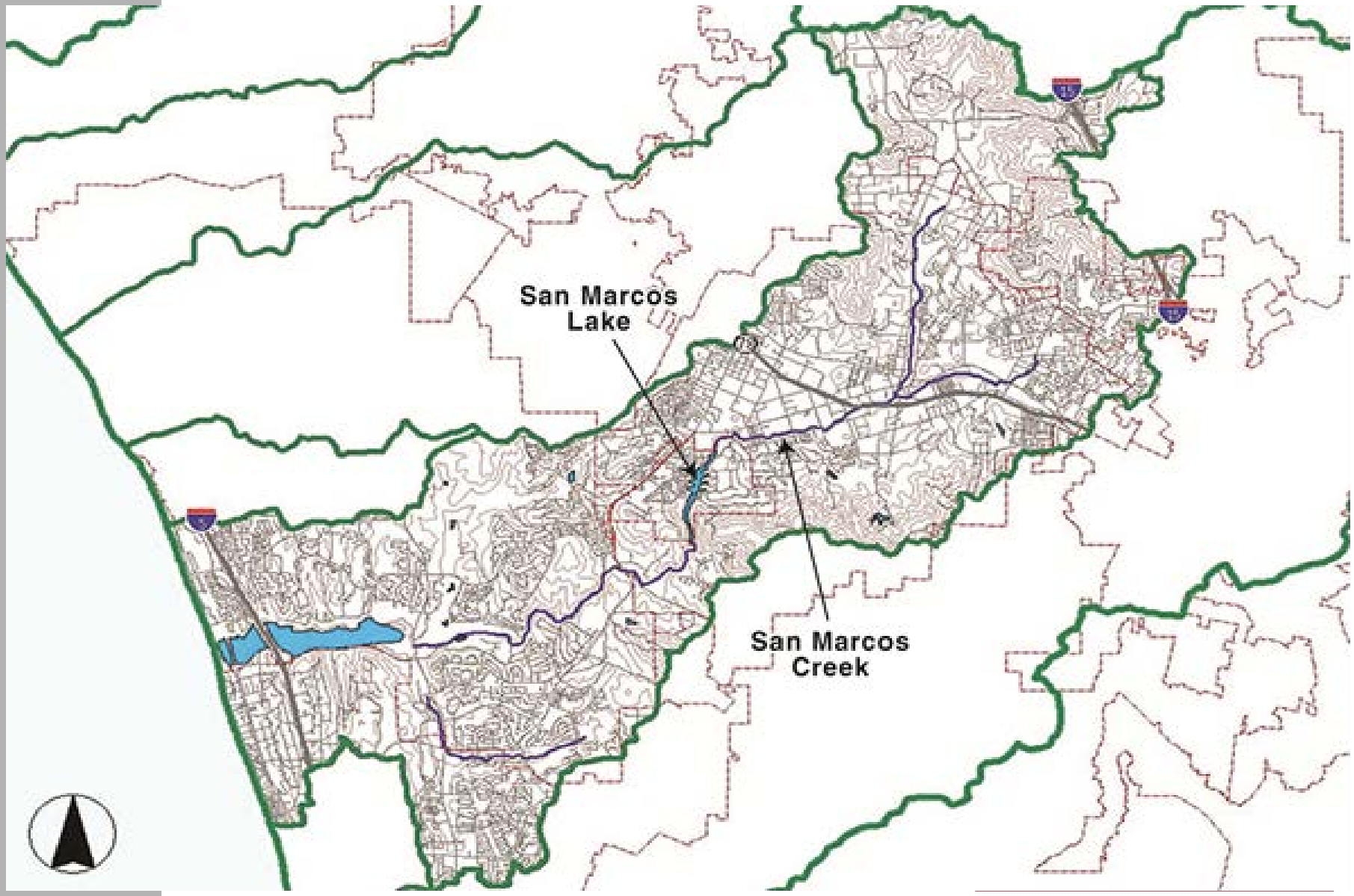
Investigation and Diagnostics

- Focused Efforts on Data Collection or "Diagnostics" in Cooperation/Coordination with Great Ecology and Agency Technical Working Group
- Working to Refine Site Conceptual Model – Nutrient Sources as Result of:
  - Surface Water Flows - Dry and Wet Weather Flows
  - Groundwater – Proximate and Upstream
  - "Watershed"/upstream and proximate sources
  - Focus is to better understand sources of nutrient "mass" and "loading" to Lake

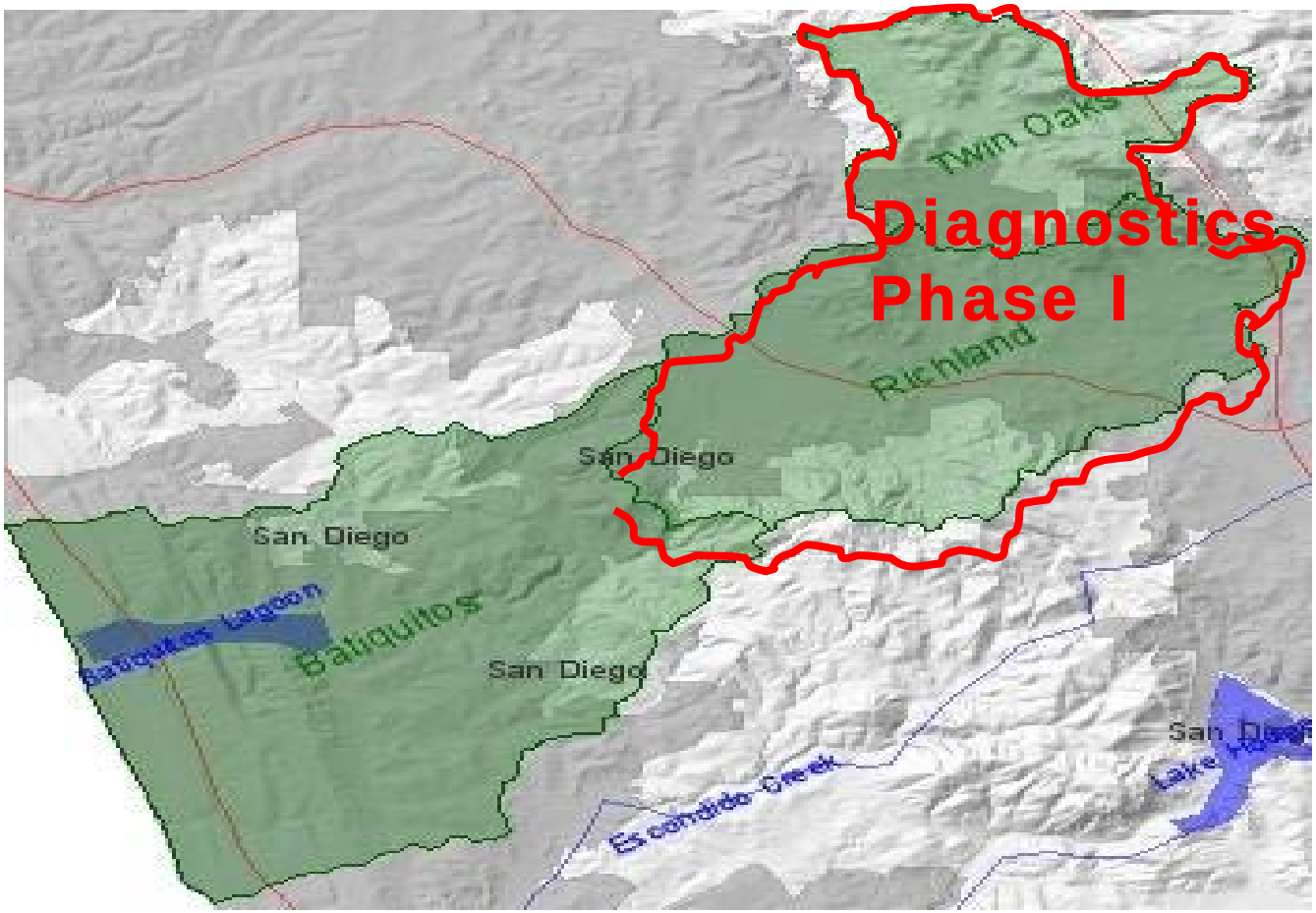
Investigation (cont.)

- Imperative to Develop Good Understanding of Sources and Mechanisms of Impacts to Design Effective Remediation or Cleanup
- Different Sources/Mechanisms of Transport Demand Different Approaches (e.g., Lake cleanup without addressing underlying sources not effective)
- Caveat: Good Data Collection May Not Address Historical Sources/Loading and Variation Over Time – Management practices have changed!

San Marcos HA



Upper San Marcos Watershed



SCS ENGINEERS

Task Summary

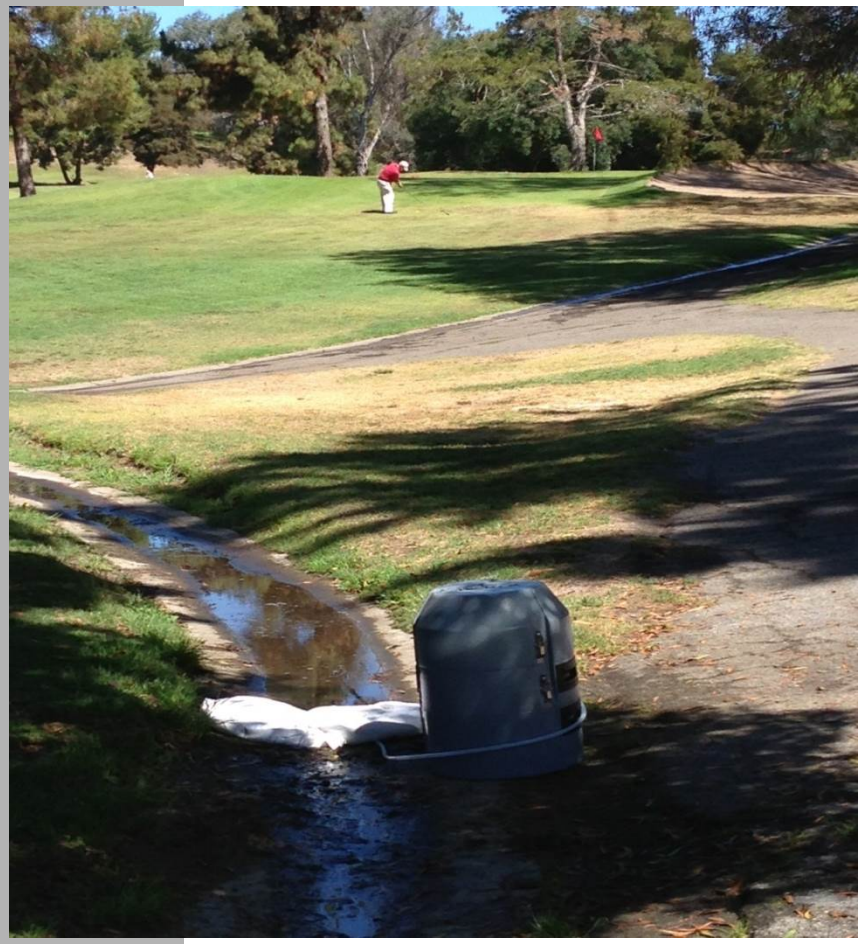
- Always Start with a Plan!
- "Workplan" and "QAPP" to Define Objectives and Data Quality to Support Modeling Efforts
- Surface Flows and Drainage Survey – "Inputs" to Lake
- Dry Weather Monitoring/Sampling
  - Question: Are dry weather flows contributing significant nutrient mass ?
  - Trickle or inconsistent flows during "dry" season
  - Nutrients detected but at concentrations less than water quality goals

Surface Flow Estimates/ Sampling

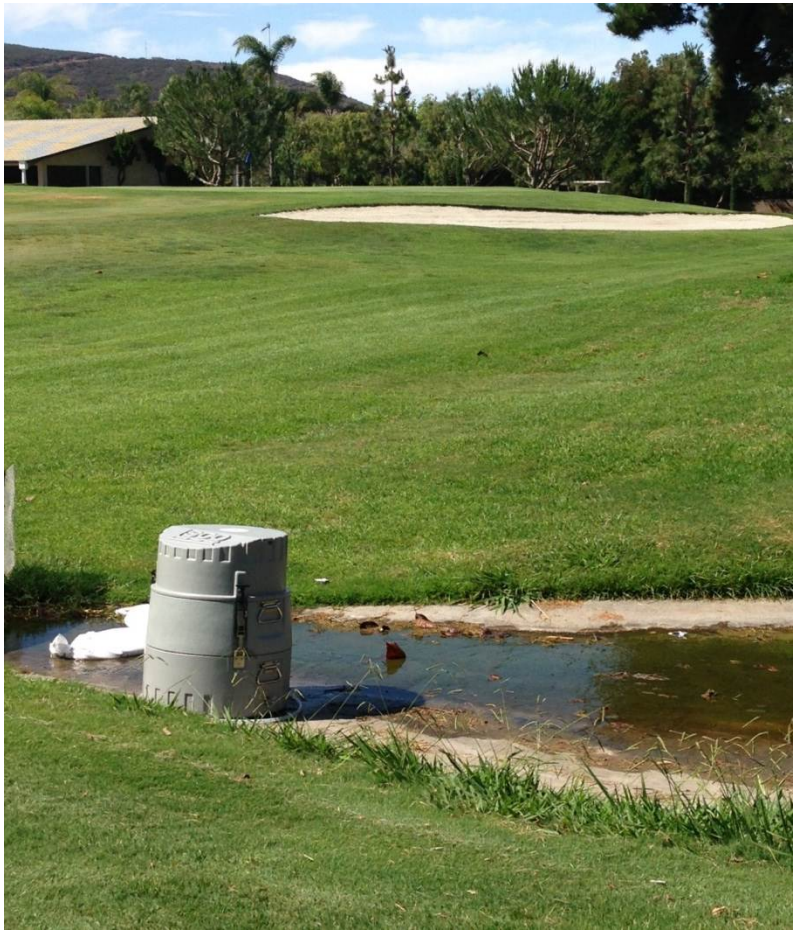
- Work Completed:
  - Area reconnaissance, GPS conveyance structures
  - Review County/City drainage data
  - Sampled St. Mark and Executive dry weather surface water runoff
  - GIS mapping
  - Includes Land Use, Flow Paths, and Discharge Points

St. Mark GC Dry Weather Flows

Dry Weather Flows/Sampling



Executive GC Dry Weather Runoff Collection



St. Mark GC Dry Weather Runoff Collection

Groundwater

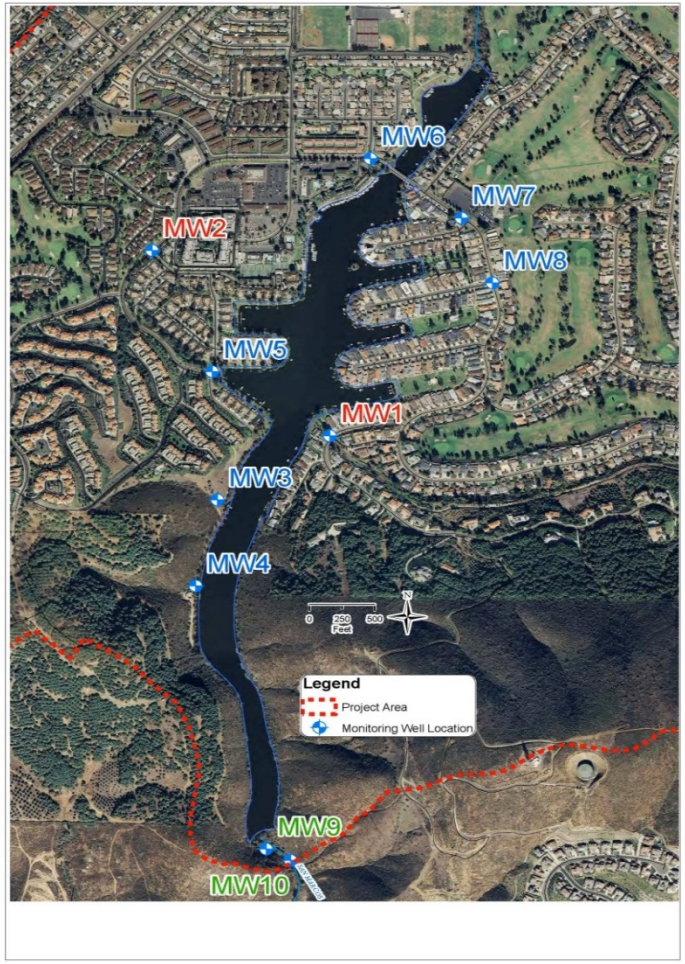
- Questions: What is the Relationship of Groundwater to the Lake and If Groundwater Replenishes Lake or San Marcos Creek is this a Source of Nutrients and Impairment?
  - Groundwater Supply Well is a Known Source of Supply to Lake but Exact Volume Not Known
  - Groundwater Investigation around Lake to Understand Possible Natural “Discharge” to Lake (i.e., due to natural flows)
  - Investigation of Groundwater Quality – Source of Nutrients?
  - Similar Investigations Upstream in Watershed

Groundwater Supply/Quality

- Work Completed:
  - Site Recon
  - Sampled St. Mark Well
  - Splits Collected
  - Mapping
  - Water Quality is Generally Good with Low or No Detectable Nutrients

Groundwater Investigation

- Designed, Drilled and Installed Wells



GW Chemistry Results

Sample	MW6
Sampling Date	7/16/2013
Total Hardness	1000
Total Dissolved Solids	2,180
Total Kjeldahl Nitrogen	1.3
o-Phosphate	<0.10
Total Phosphorous	<0.10
Dissolved Phosphorous	<0.10
Ammonia	<0.10
Nitrate-Nitrite	<0.10

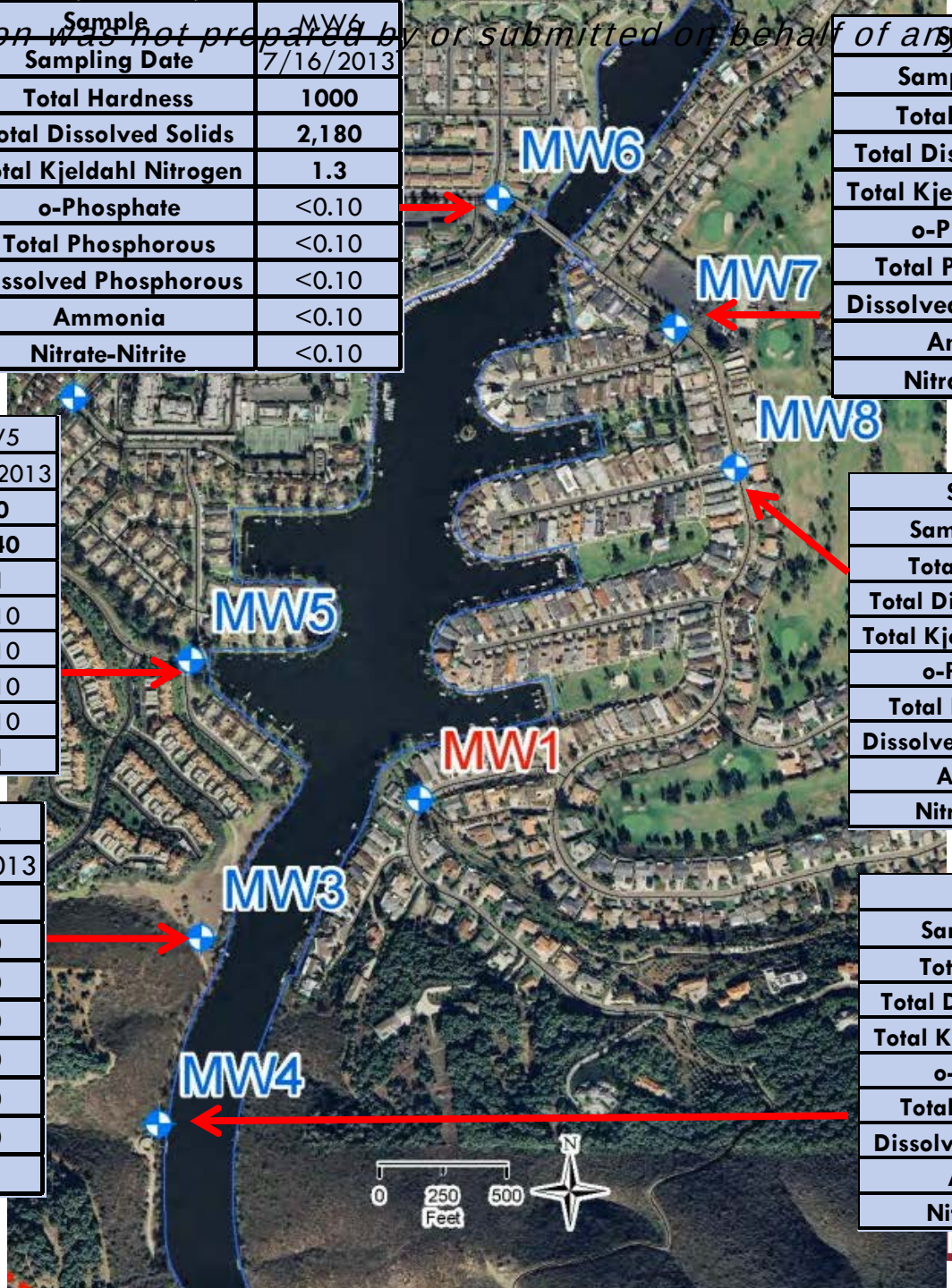
Sample	MW7
Sampling Date	7/16/2013
Total Hardness	1300
Total Dissolved Solids	2,920
Total Kjeldahl Nitrogen	0.7
o-Phosphate	<0.10
Total Phosphorous	<0.10
Dissolved Phosphorous	<0.10
Ammonia	<0.10
Nitrate-Nitrite	1.6

Sample	MW5
Sampling Date	7/16/2013
Total Hardness	440
Total Dissolved Solids	1,140
Total Kjeldahl Nitrogen	1.1
o-Phosphate	<0.10
Total Phosphorous	<0.10
Dissolved Phosphorous	<0.10
Ammonia	<0.10
Nitrate-Nitrite	2.1

Sample	MW8
Sampling Date	7/16/2013
Total Hardness	410
Total Dissolved Solids	1,380
Total Kjeldahl Nitrogen	0.7
o-Phosphate	0.14
Total Phosphorous	0.2
Dissolved Phosphorous	0.18
Ammonia	<0.10
Nitrate-Nitrite	0.12

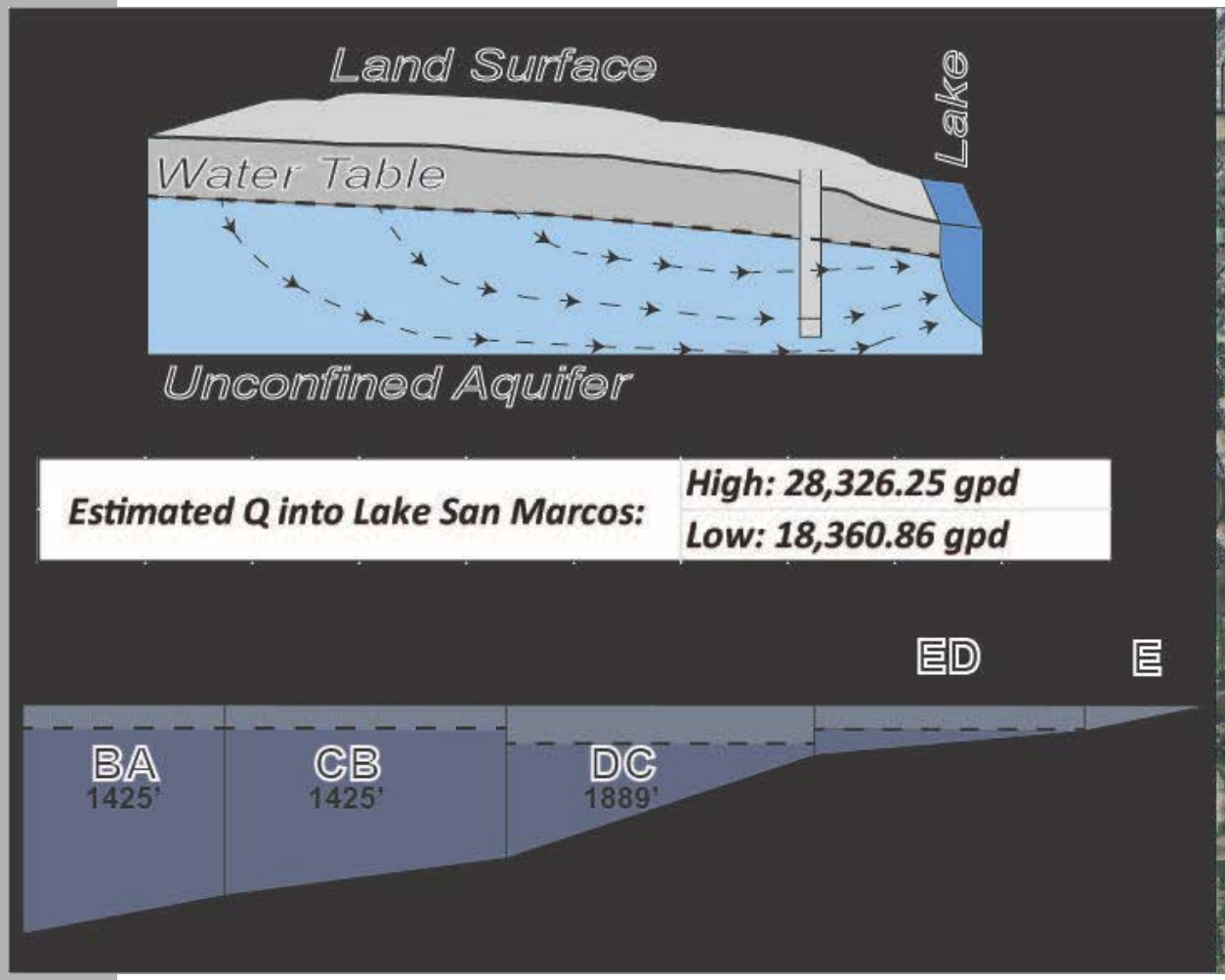
Sample	MW3
Sampling Date	7/25/2013
Total Hardness	620
Total Dissolved Solids	1,340
Total Kjeldahl Nitrogen	<0.10
o-Phosphate	<0.10
Total Phosphorous	<0.10
Dissolved Phosphorous	<0.10
Ammonia	<0.10
Nitrate-Nitrite	1.8

Sample	MW4
Sampling Date	7/25/2013
Total Hardness	160
Total Dissolved Solids	400
Total Kjeldahl Nitrogen	<0.10
o-Phosphate	<0.10
Total Phosphorous	0.19
Dissolved Phosphorous	<0.10
Ammonia	<0.10
Nitrate-Nitrite	2

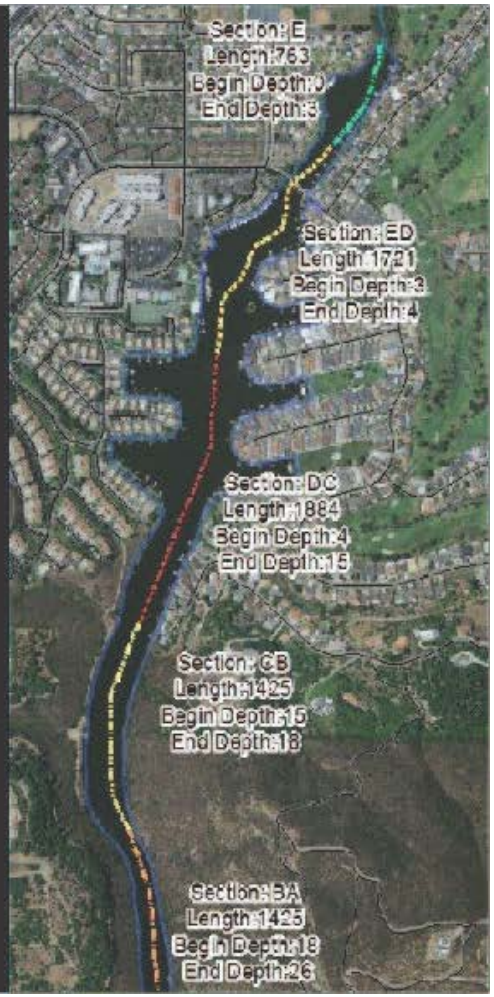


NGINEERS

Estimated Groundwater Discharge (Gallons Per Day)



Estimated Q into Lake San Marcos:	***High: 28,326.25 gpd***
	Low: 18,360.86 gpd

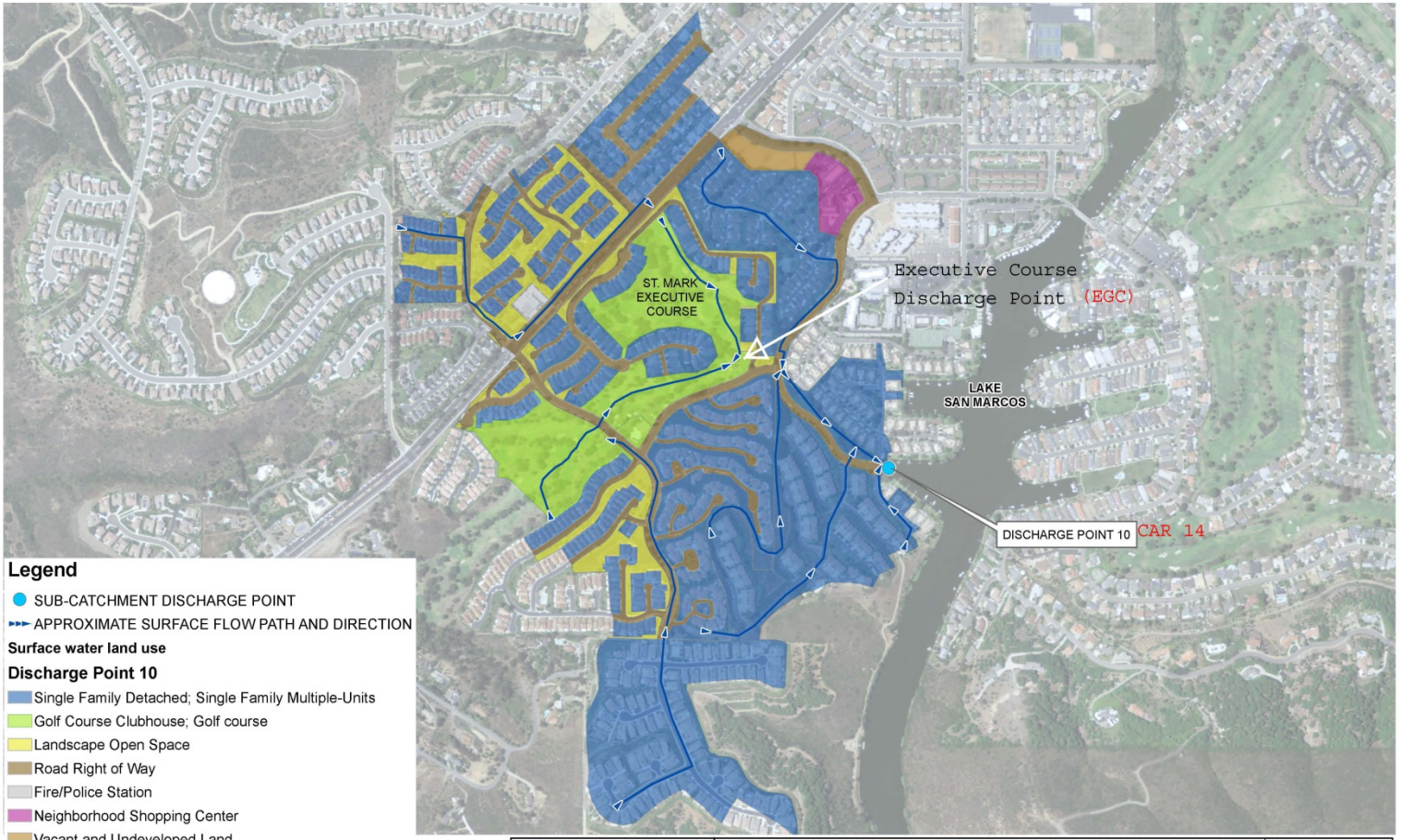


San Marcos Shallow Creek Wells Project

Wet Weather Sampling

- As We Speak! (Started Yesterday)
- Collect and Analyze Samples from Seven Locations Around and Upstream from Lake
- Assess Stream Flows/Volume of Water
- “Composite” Sample Designed to be Representative of Entire Storm
- Initial Event February/March 2014 – Indicated Nutrients in All Samples

Example Sampling Station Design and Drainage Area



Wet Weather

- Evaluate Data to Assess “Loads” or Mass (weight) of Nutrients into Lake
- Preliminary Results from Initial Round Suggest Nutrient Loads from All Wet Weather Locations – Largest Load Upstream at Via Vera Cruz
- Evaluate Nutrient Data and Report Out Event 1 and 2

Looking Forward…

- Possible Upstream Sources? (Former Dairies/Ranches)
- Wet Weather: Looking to Collect Additional Upstream (San Marcos Creek)
- Sediments or “soil” in Streams as Source?
- Groundwater: Assess Upstream Sources and Possible Groundwater Contribution
- Thank you!

Limnotech Modeling Efforts

- The Lake San Marcos Technical Team (LSM Tech Team) developed a Request for Proposal (RFP) for a Lake Modeling effort last year.
- Limnotech was awarded this project and has completed the first draft of the Lake Model and presented the draft to the LSM Tech Team.
- The Watershed Model was prepared by Tetra Tech via an EPA Grant for the RWQCB.
- The Watershed model that was developed to predict runoff from storm events and nutrient loading to the Creek and the Lake, is missing rain event data due to the drought.
- To make the model more useful, Limnotech has been tasked with adding the two rain events from earlier this year, and to add any additional rain events from the current rainy season.
- The completion of the Lake Model is on hold until the Watershed model is complete as its' output goes directly into the Lake Model.

Next Steps

- The LSM Tech Team will soon prepare an RFP for an RI/FS for the Lake and Creek areas.
- Once the Remedial Investigation is completed, The Lake Model will be used with this information to determine the feasibility of a variety of remediation efforts to clean up the Lake.
- Different options will be presented to the RWQCB and will likely be pilot tested before full scale implementation.

Question & Answer Session