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The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Creating a New Nutrient Response Model for Jordan Lake

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This Talk: Q & A with Myself

1. What is a lake nutrient response model?
2. How does a nutrient response model work?
3. Why do we need a new Jordan Lake nutrient response model?
4. What can we do with this new Jordan Lake model?
5. Is this new Jordan Lake model ready now?



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5. Is this new Jordan Lake model ready now?



Q5: Is this new Jordan Lake model ready now?

Ans: NO

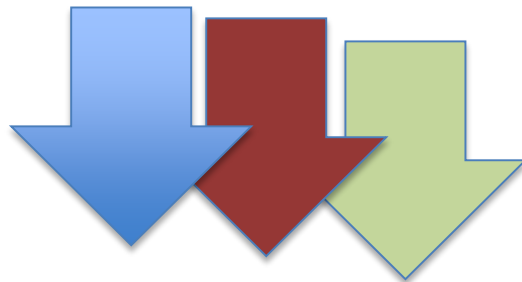
- Project just started in August 2018
- Currently calibrating hydrodynamic model
- Model construction now to summer
- Scenario tests summer into Fall 2019

Come see another presentation in Fall !!

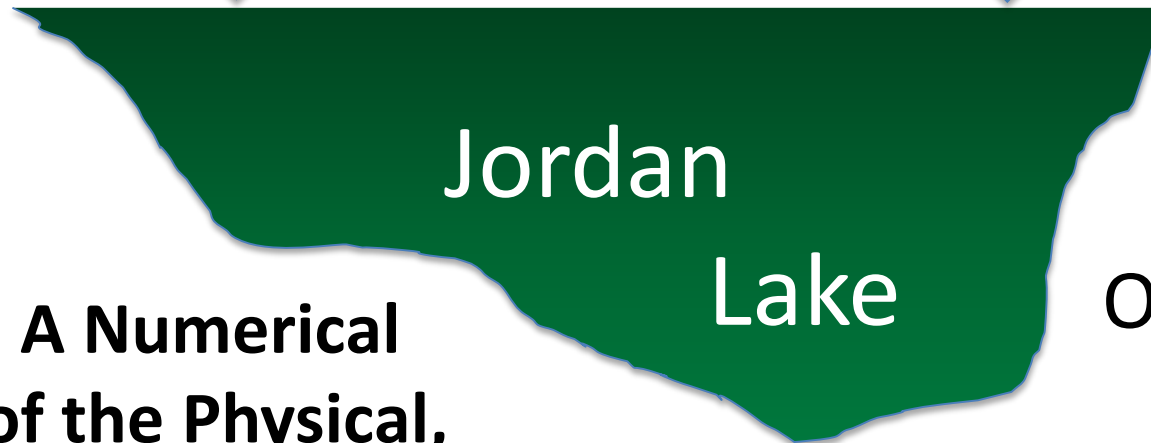
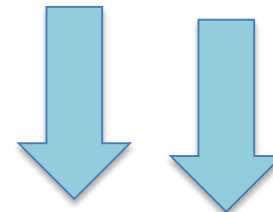


Q1: What is a lake nutrient response model?

Water, Nutrients, Organic Matter

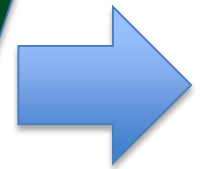


Heat & Light



Jordan

Lake



Outputs

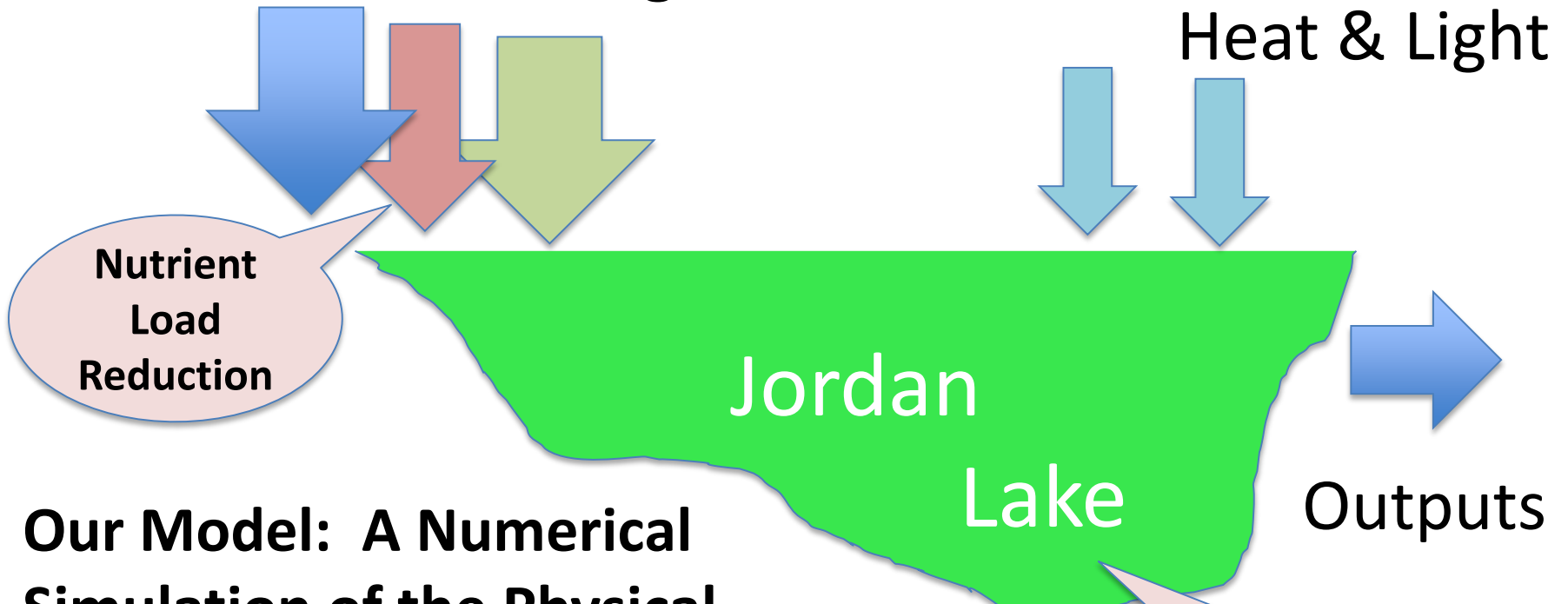
Our Model: A Numerical Simulation of the Physical, Chemical, Biological Processes in Our Lake



Q1: What is a lake nutrient response model?

Water, Nutrients, Organic Matter

Heat & Light



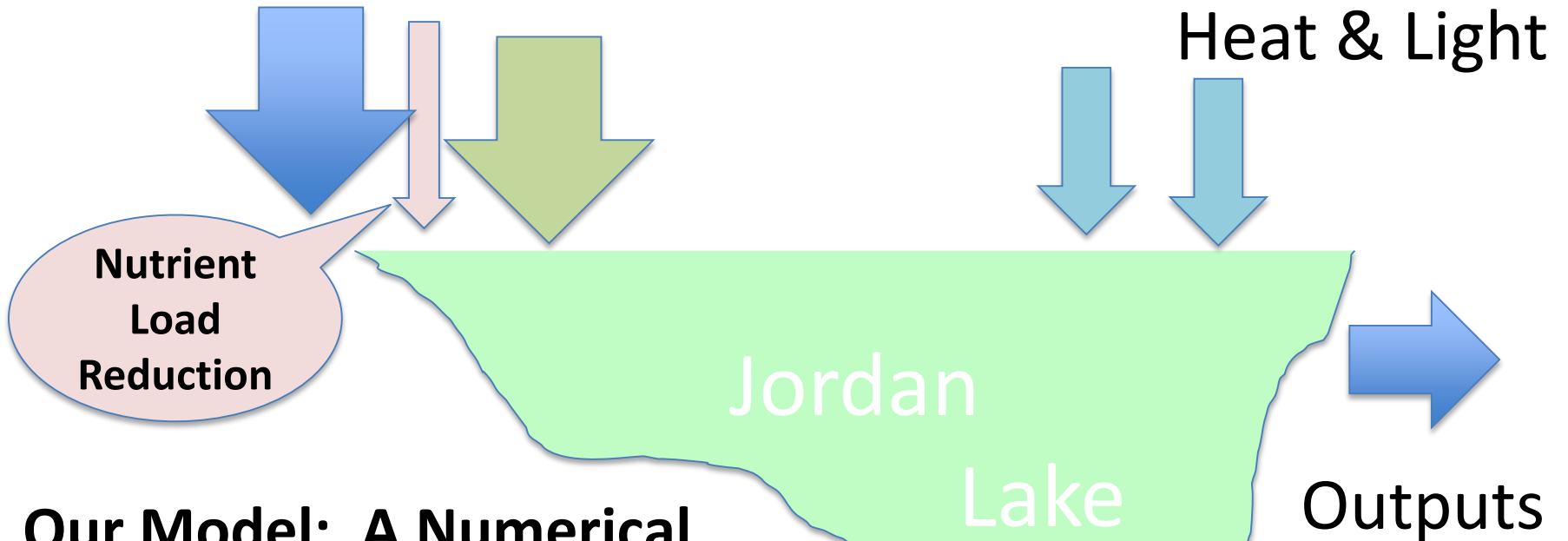
Our Model: A Numerical Simulation of the Physical, Chemical, Biological Processes in Our Lake

Quantify Water Quality Change

Q1: What is a lake nutrient response model?

Water, Nutrients, Organic Matter

Heat & Light



Our Model: A Numerical Simulation of the Physical, Chemical, Biological Processes in Our Lake

Q2: How does a nutrient response model work?

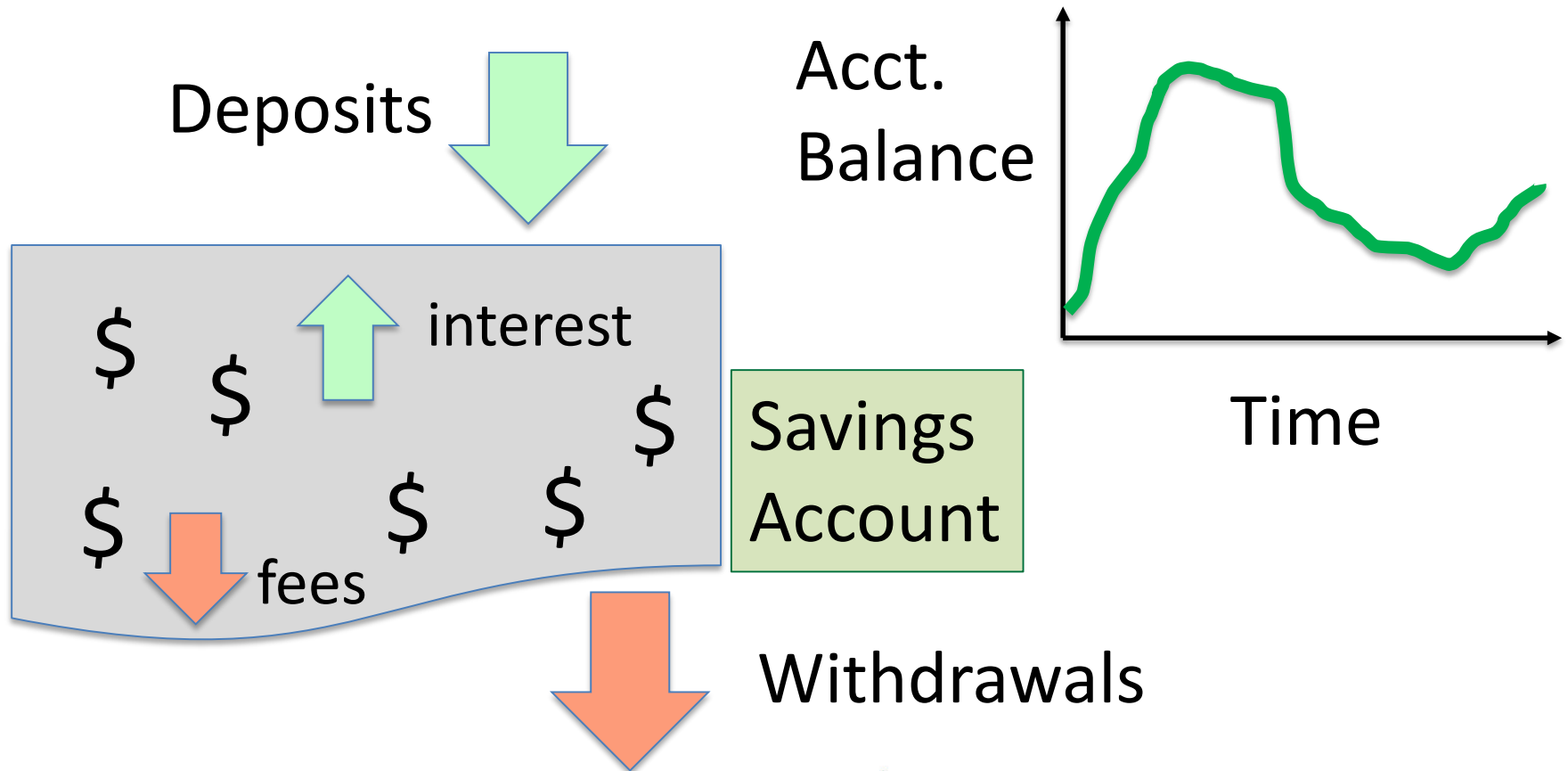
Simulation Model Based on
Material Balances:

e.g. water, heat, momentum,
mass of water quality
constituents



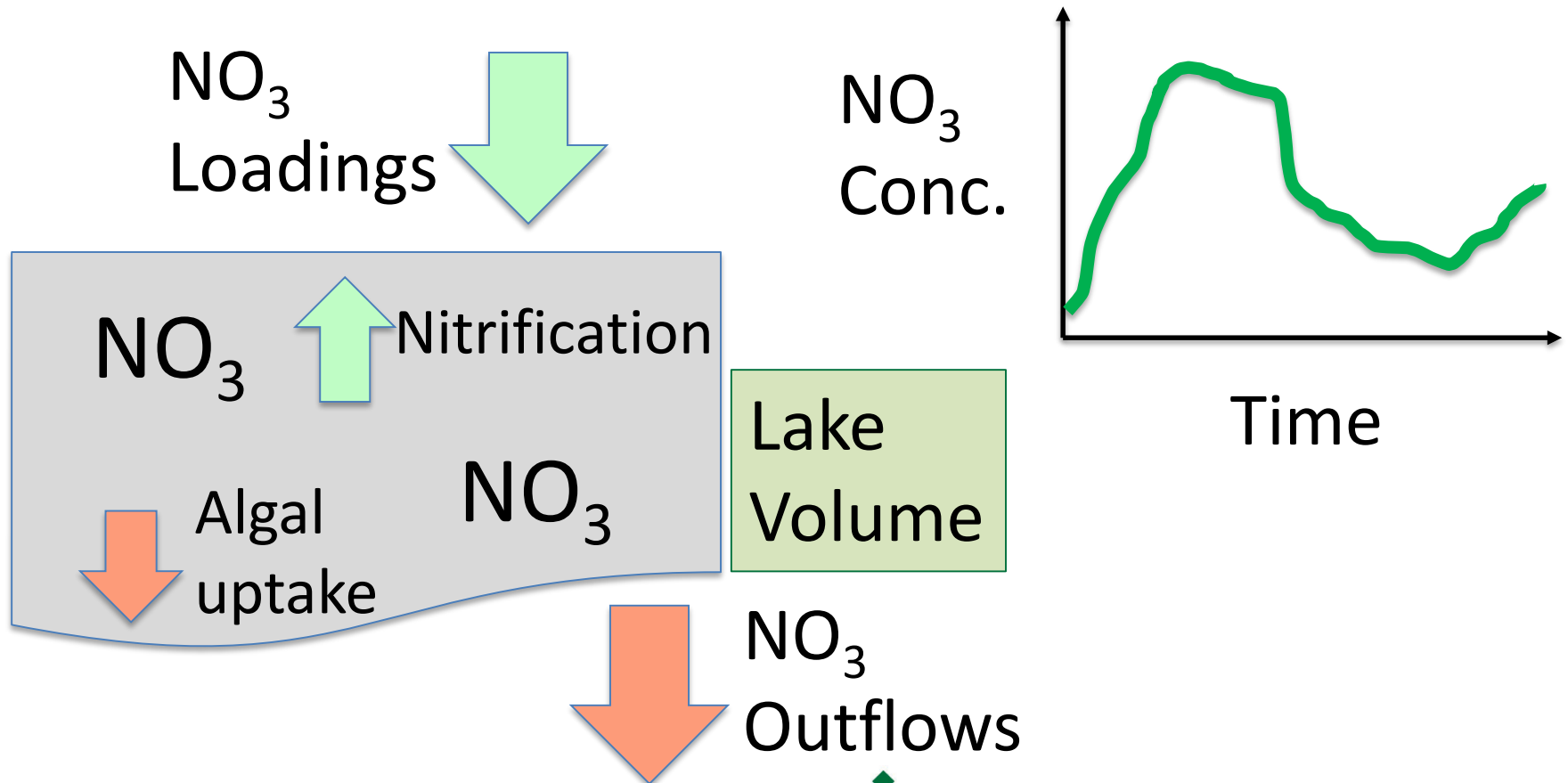
Q2.1: What are Material Balances?

Analogous to Bank Account



Q2.1: What are Material Balances?

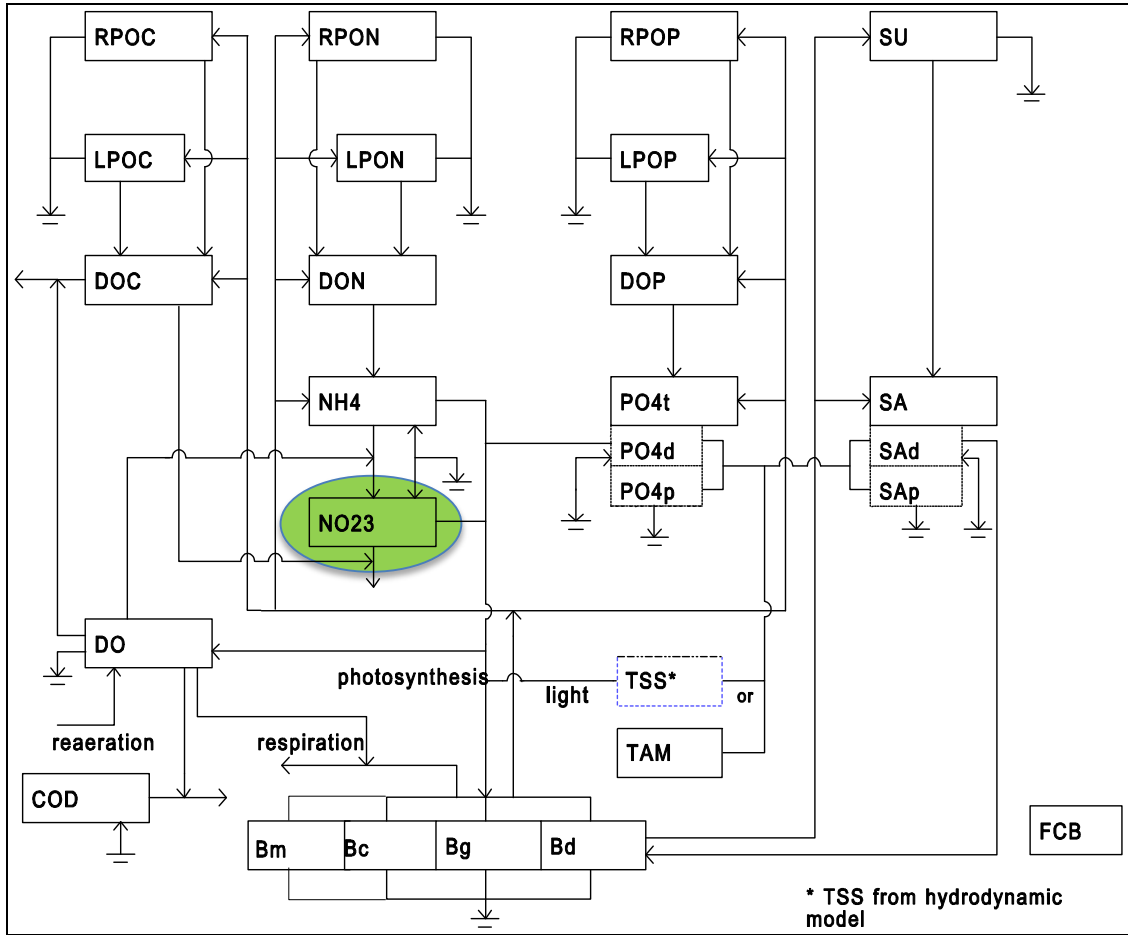
NO₃ Material Balance



Material Balances in EFDC, water column

Water Quality

Hydrodynamic



Water

Heat

X momentum

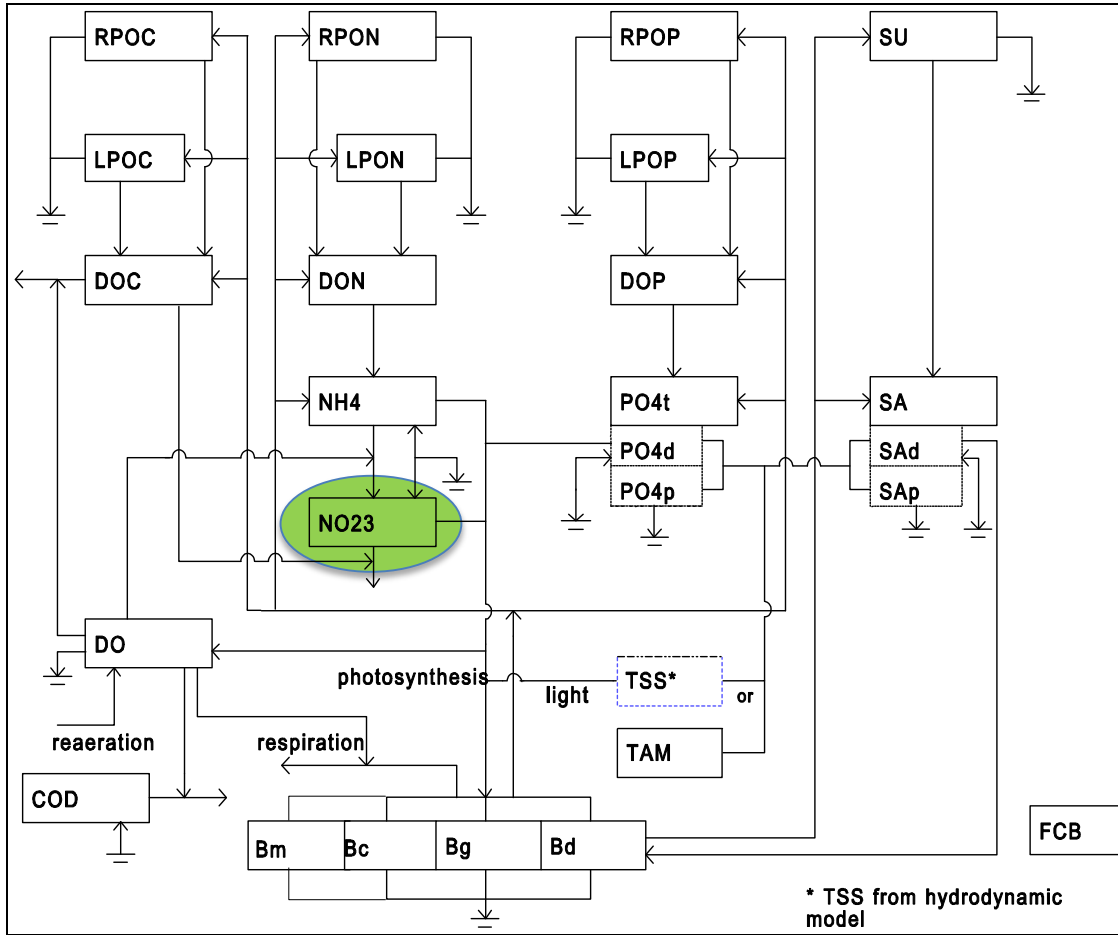
Y momentum

Z momentum

Figure 2.1 Schematic diagram of EFDC Water Quality Model Structure.

Material Balances in EFDC, water column

Water Quality



Hydrodynamic

Water

Heat

X momentum

Y momentum

Z momentum

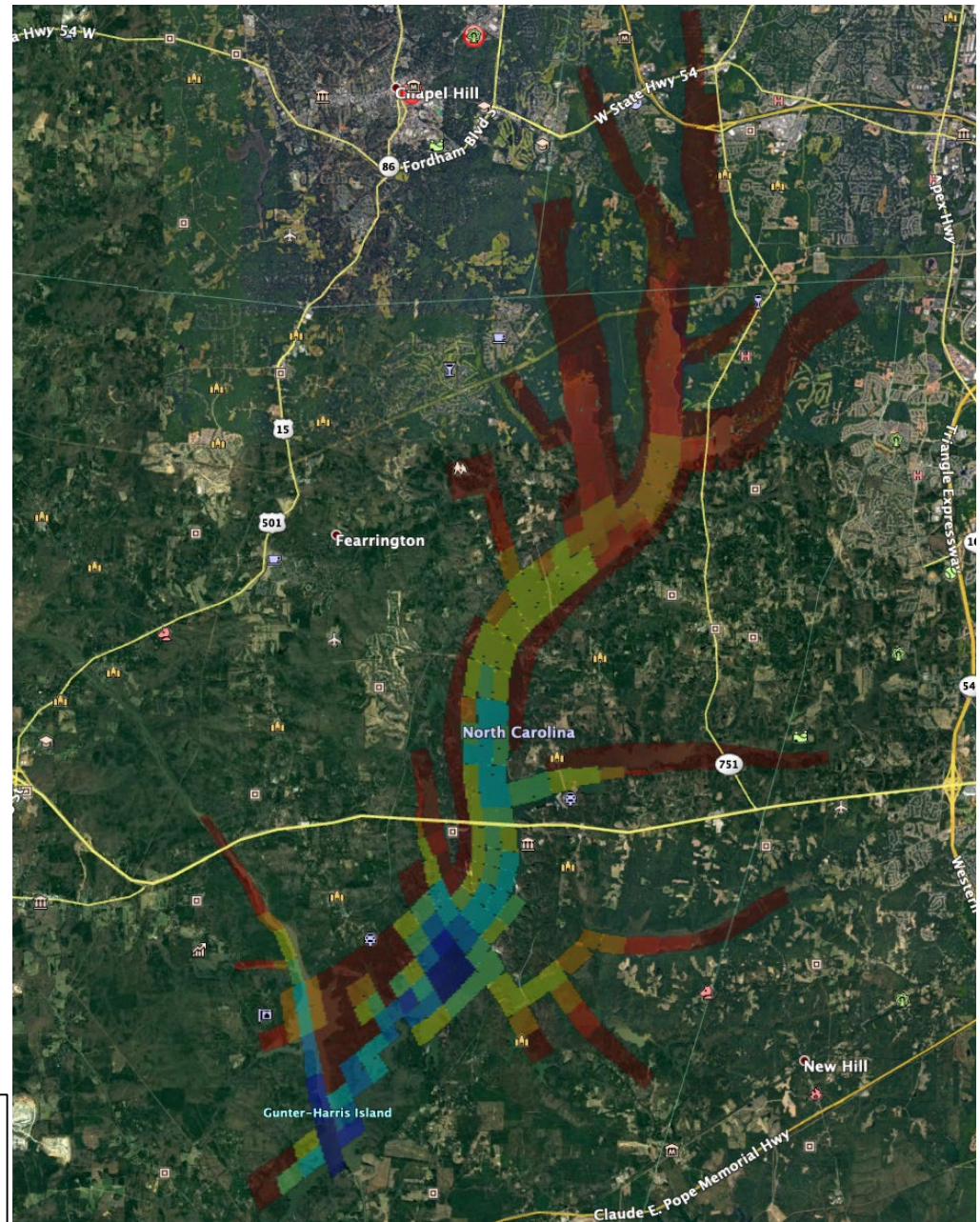
Figure 2.1 Schematic diagram of EFDC Water Quality Model Structure.

Sediment model too!

Multiple Material Balances in Thousands of Water Volumes

- Lake surface divided into hundreds of cells
- Each cell has 4 – 12 vertical layers

Jordan Lk. Grid, cells colored by bottom elevation



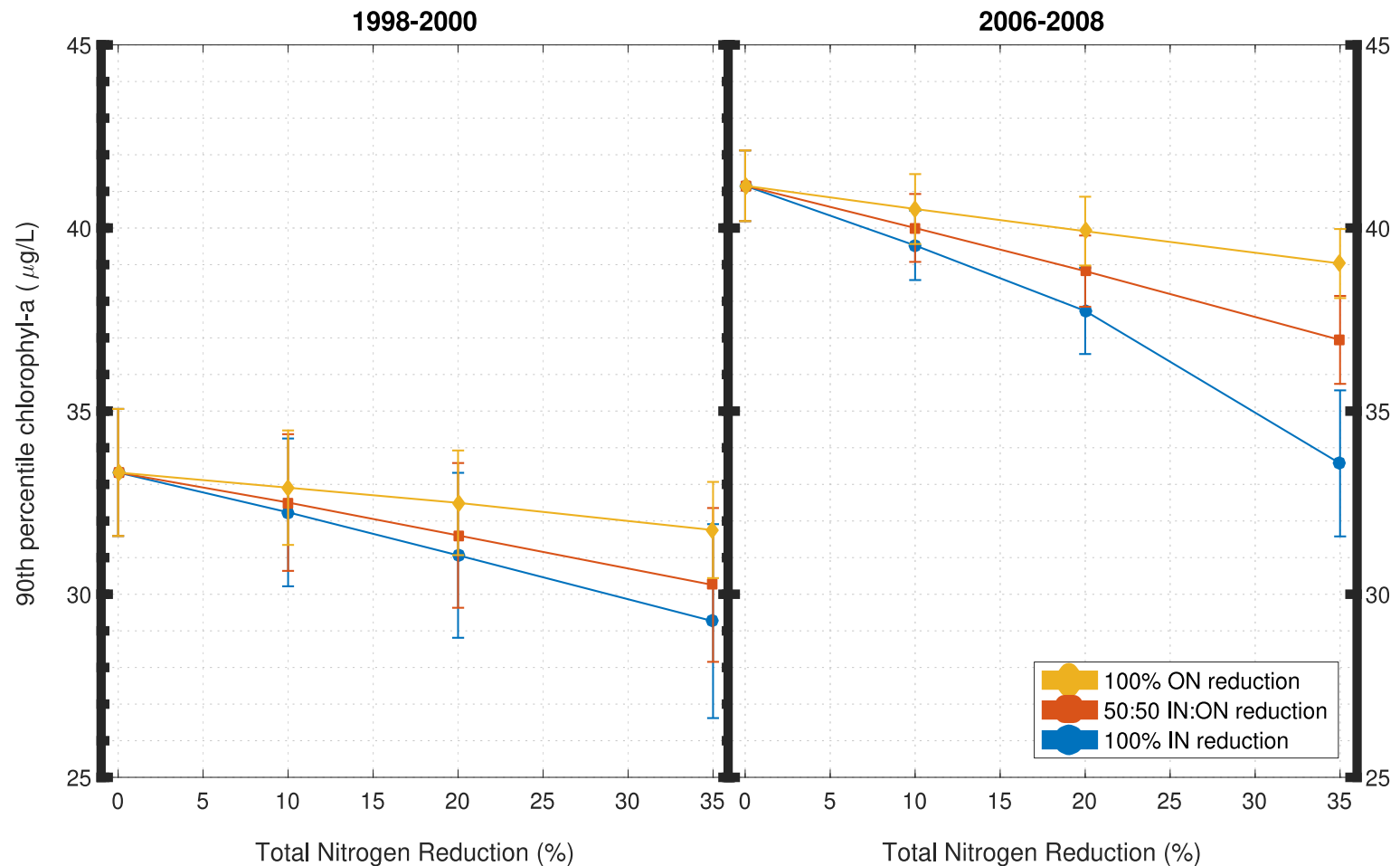
Q3: Why do we need a new Jordan Lake nutrient response model?

- Previous model based on conditions from 1992-2000, lots of development in watershed since then
- Modeling capabilities have advanced greatly in the past 15 years (e.g. interactive sediment submodel now available)
- New model can be informed by the latest research taking place in Jordan Lake



Q4: What can we do with this new Jordan Lake model? Effect of Reducing Nutrient (N & P) Load

Neuse Estuary Example

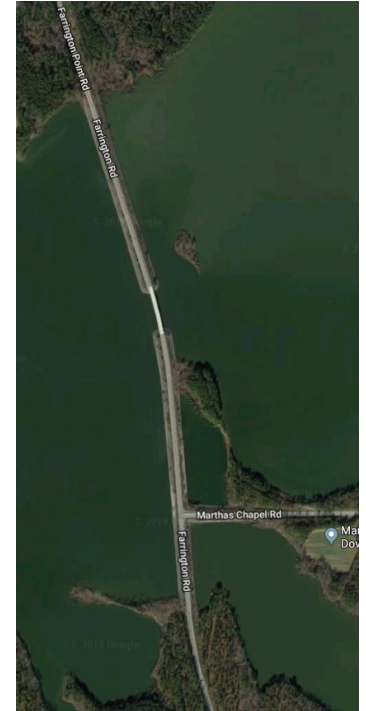


Q4: What can we do with this new Jordan Lake model?

Effect of Removing One or Both Causeways

Jordan Lake

Zooming In



A Model Scenario: Causeway Removal

Causeway removal might improve lake flushing thereby improving water quality – to be tested with Lake Response Model

Hwy 64
Causeway



A Model Scenario: Causeway Removal



Farrington Road Causeway

Causeway removal might improve lake flushing thereby improving water quality – to be tested with Lake Response Model

Q & A Summary

- Developing a new lake response model with new capabilities
- Similar approach to models used in other NC water bodies
- Will be informed by latest research and conditions in Jordan Lake
- Results of scenario testing with the model will be available in Fall 2019



Thanks for your attention!



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