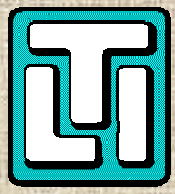
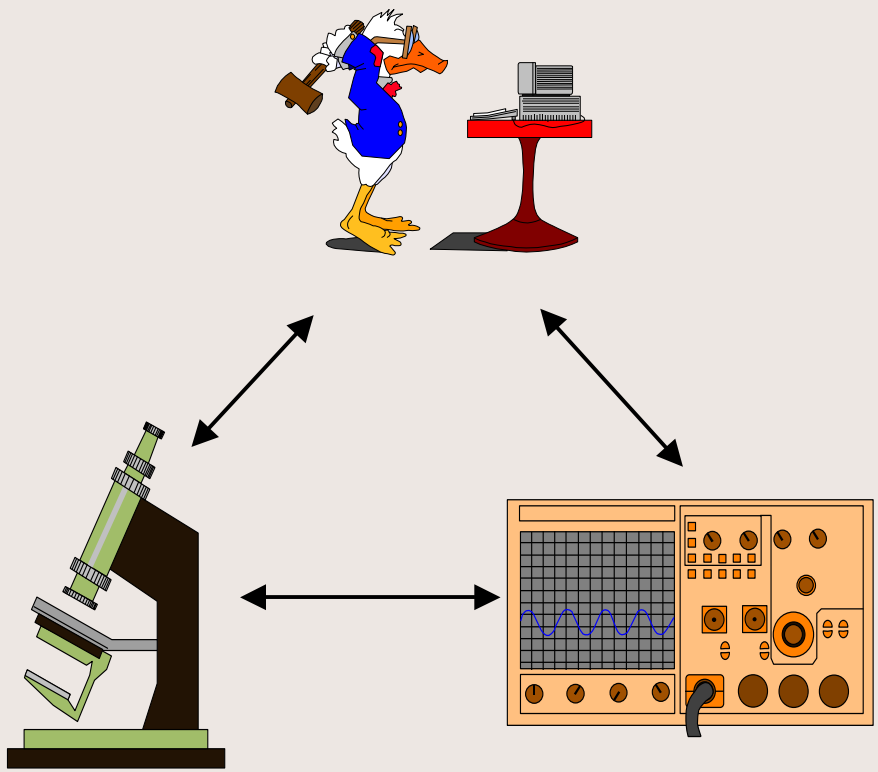
TMDL Water Quality Modeling and Data Interaction

Scott Hinz, Limno-Tech, Inc.



Modeling/Monitoring/Research Symbiosis

- Models provide insight and make projections
- Monitoring provides input and credibility for Models
- Research provides Understanding and parameterization for Model Development



Mathematical Models

Analytical abstractions of the real world.

Two Types

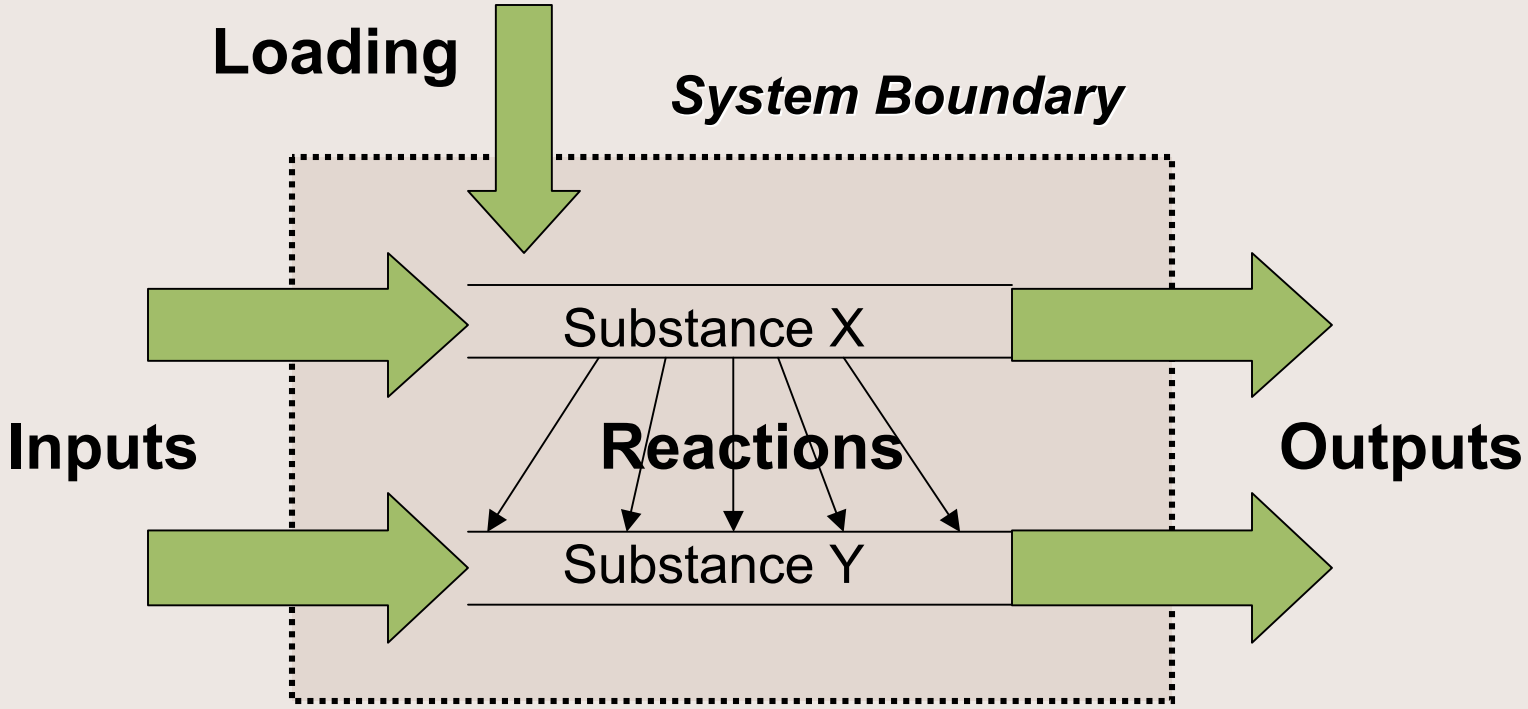
- **Mechanistic – simplified estimation based upon theoretical physical principals**
- **Empirical – statistical summary of observational water quality data**

Can only approximate the complexity of the water bodies, watersheds, pollutants, and pollutant sources under study.

Model Comparison

	Empirical Approach	Mechanistic Approach
Pollutant Sources	Few	Many
Data Requirements	Low	High
Time	Short	Longer
Cost	Low	Higher

Mass Balance Model Concept

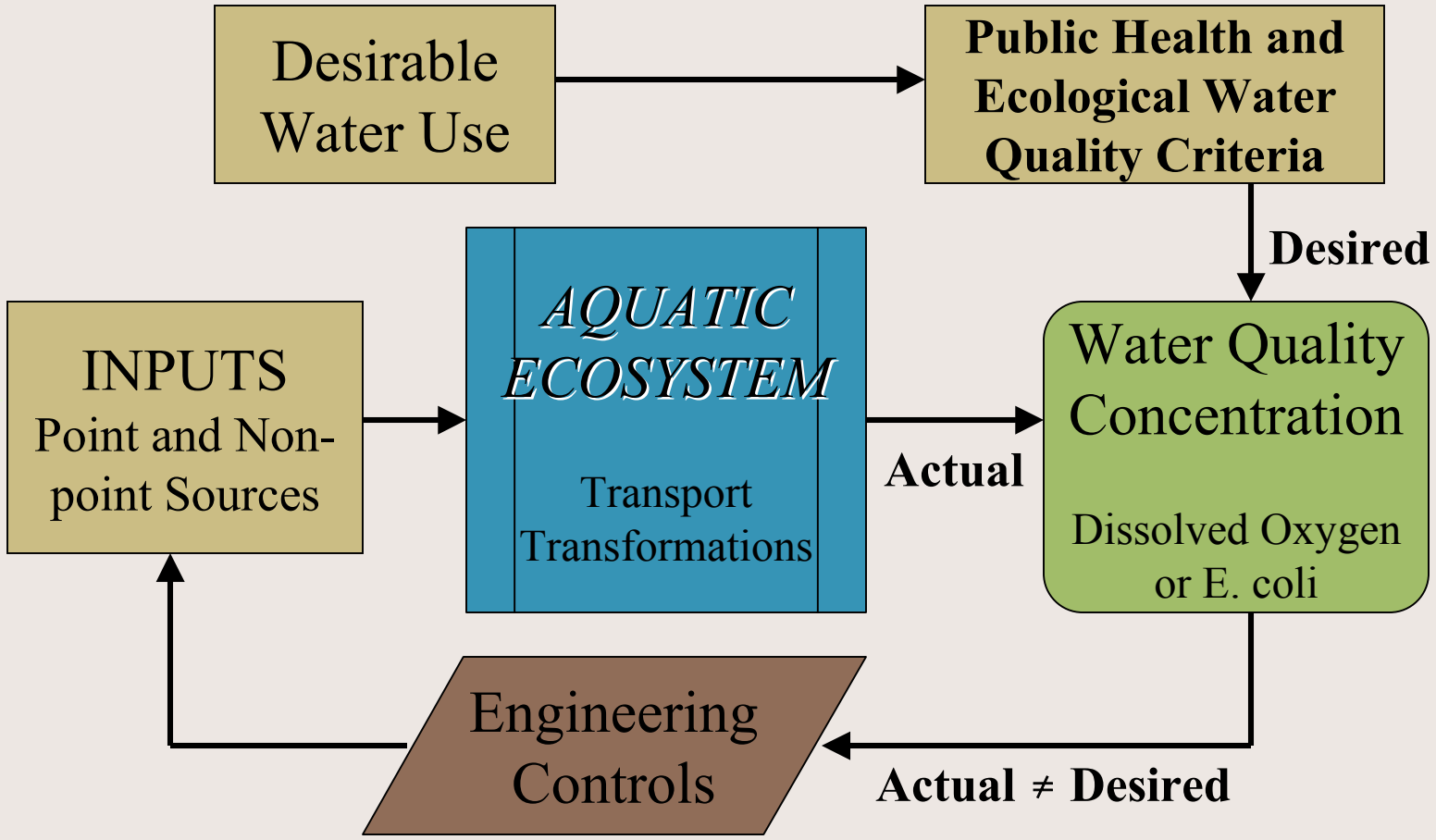


[Accumulation] = [Loading] ± [Transport] ± [Transformations]

Steps in Water Quality Modeling

1. Determine objectives (*problem definition*) and establish criteria for meeting the objectives. In this case, the problem is defined by *dissolved oxygen and pathogen* levels not in compliance with water quality criteria.
2. Develop a *conceptual model* of the system of interest and of the attributes of the system relevant to the problem definition.
3. Formulate the *mathematical model* from the conceptual model.
4. *Calibrate* the model.
5. *Confirm* the model.
6. *Apply* the model to address defined problem.

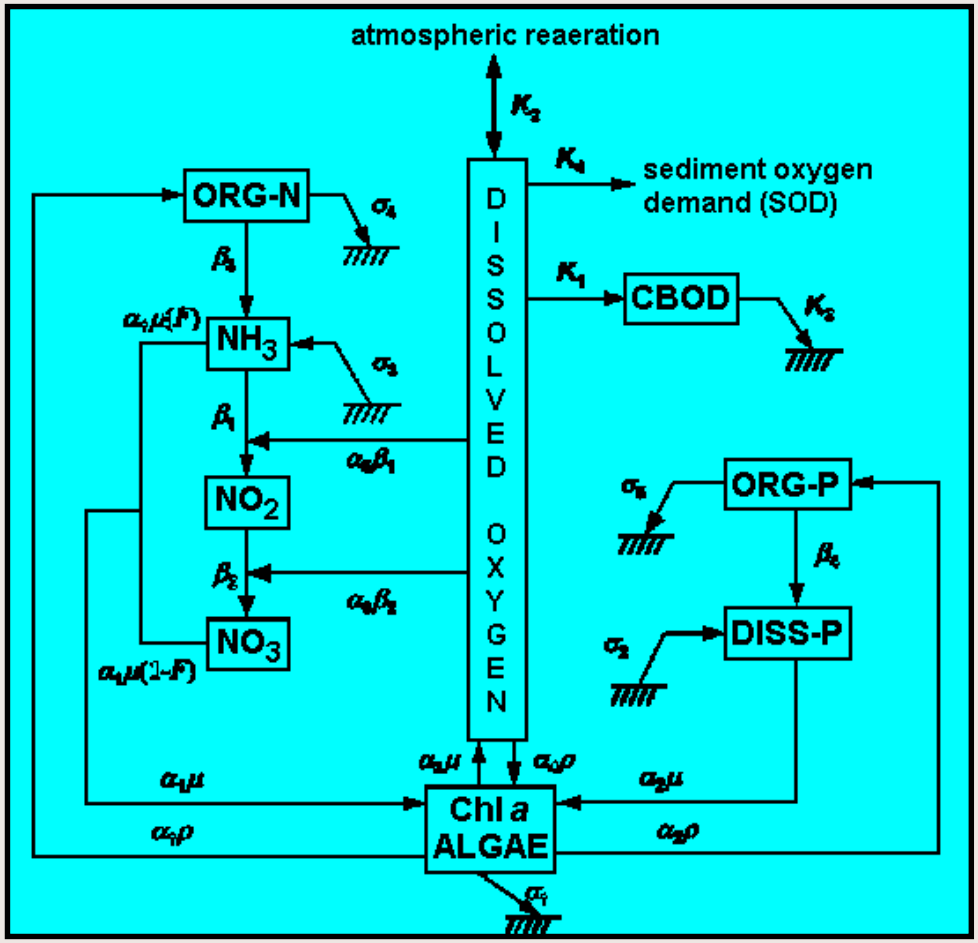
Water Quality Management Flow Diagram



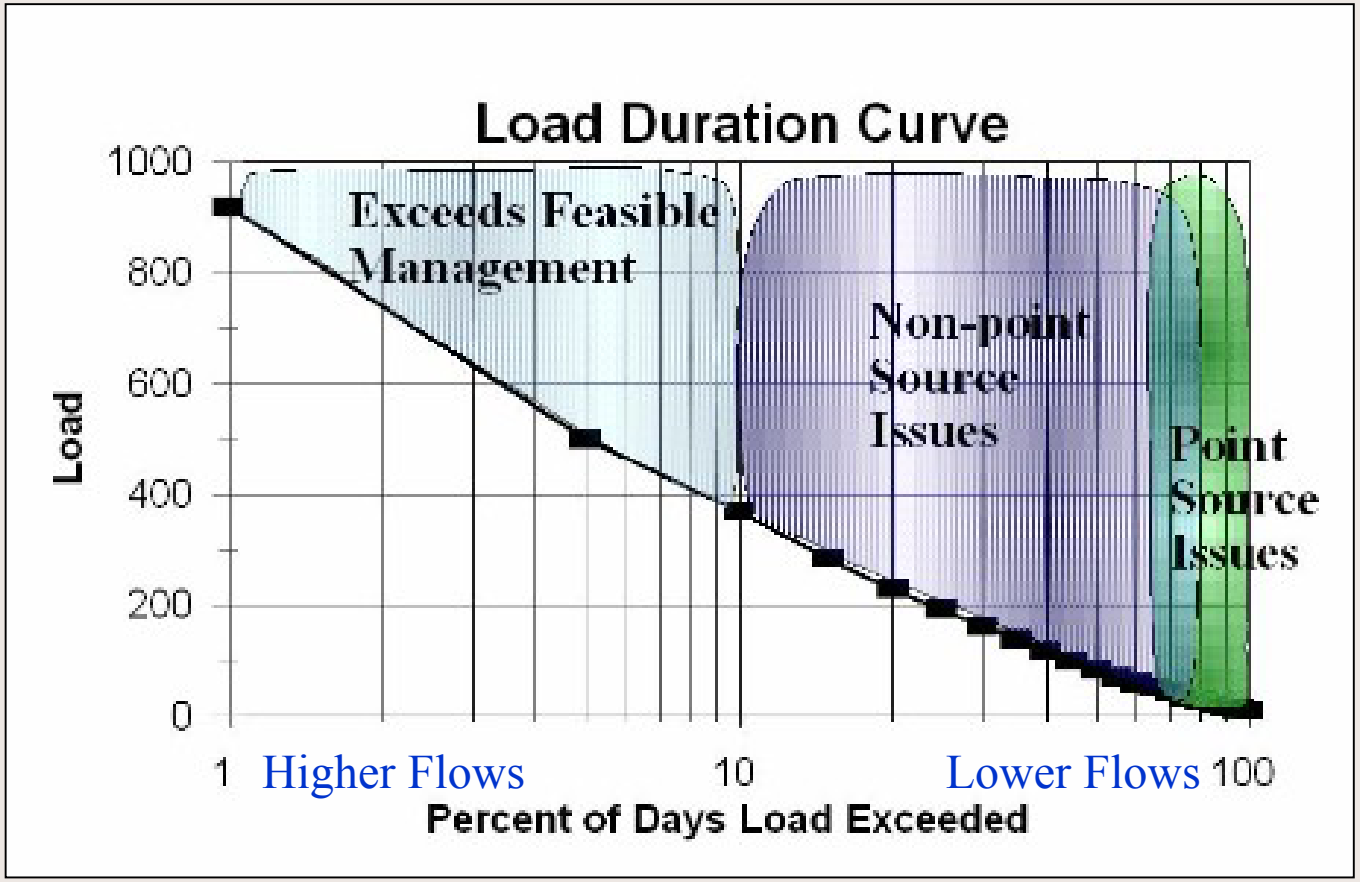
Considerations in Model Selection

1. Problem definition – does it address the questions? Is there an appropriate cause-effect relationship?
2. Assumptions – are model assumptions violated?
3. Complexity vs. reliability – is the model complexity appropriate for the problem definition?
4. Model uncertainty – is uncertainty within tolerance of problem definition?
5. Model sensitivity – is output sensitive to management perturbations?
6. Cost – will budget permit necessary data acquisition and model implementation?
7. Ease of use – can the model be implemented and output generated by available modeling expertise?
8. Track record – has model been used successfully for other similar management applications?

QUAL-TX
Dissolved Oxygen Kinetics



TMDL Curve (Data-based)



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QUESTIONS?

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