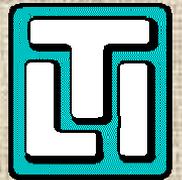


TMDL Water Quality Modeling and Data Interaction

Scott Hinz, Limno-Tech, Inc.



November 2004

Mathematical Models

Analytical abstractions of the real world.

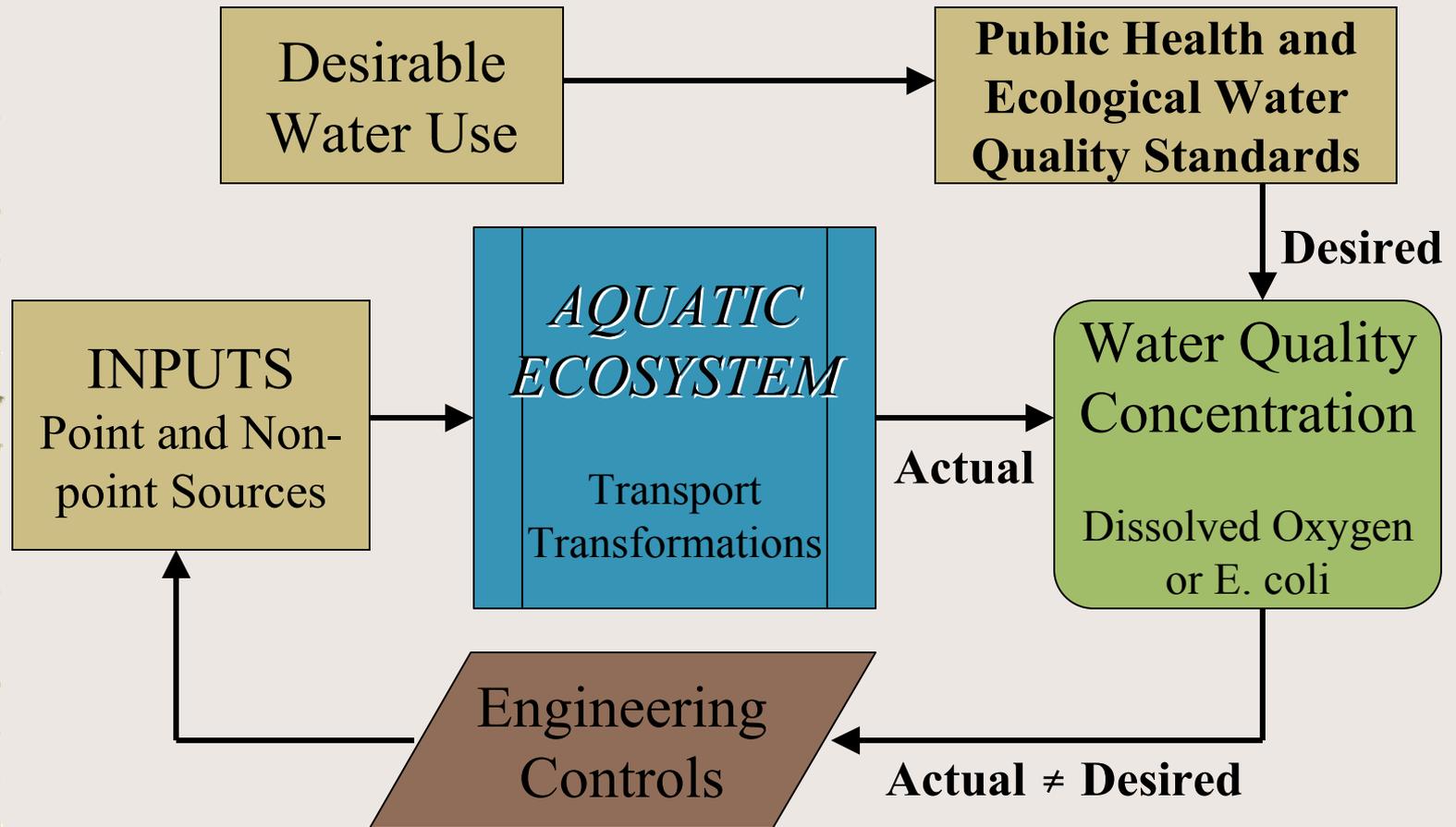
Two Types

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.

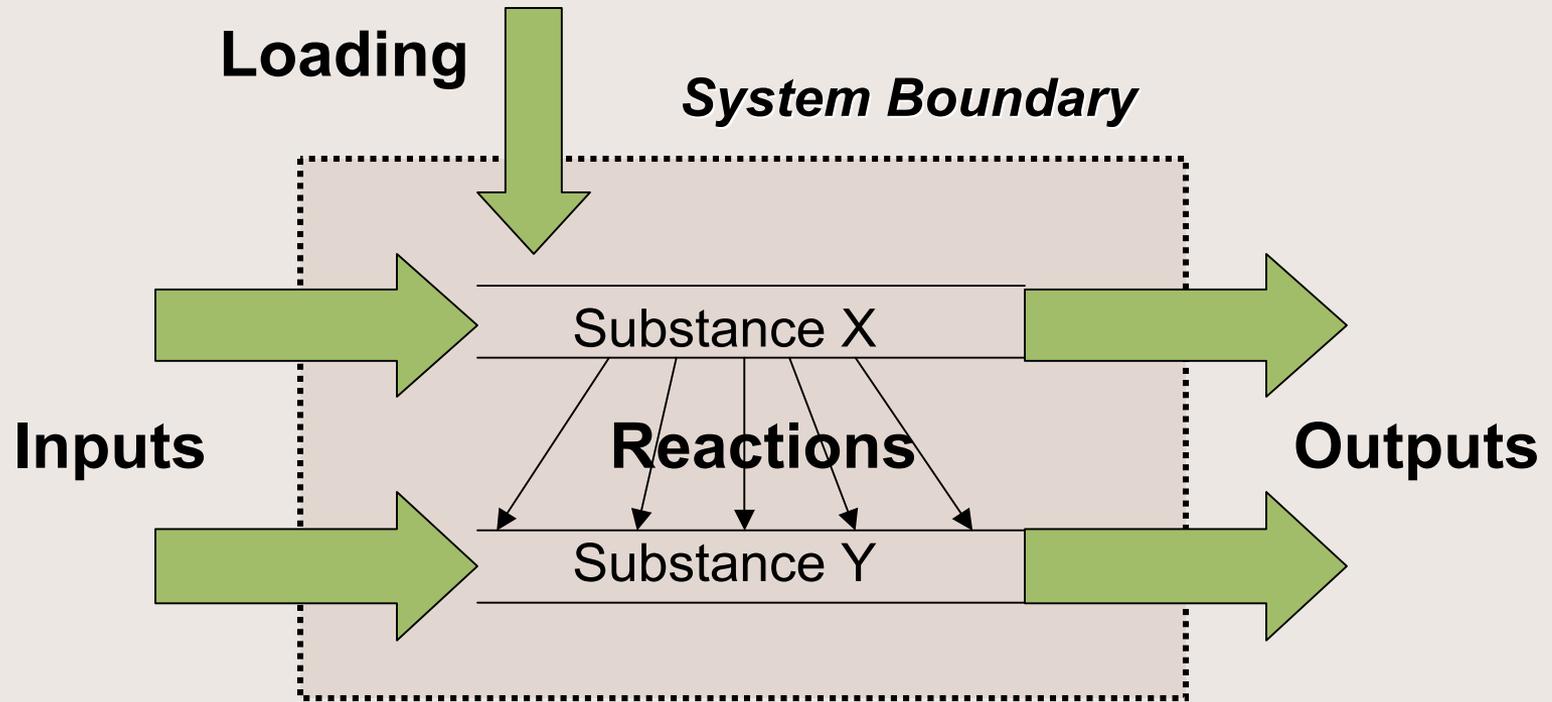
Water Quality Management Flow Diagram



Model Comparison

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

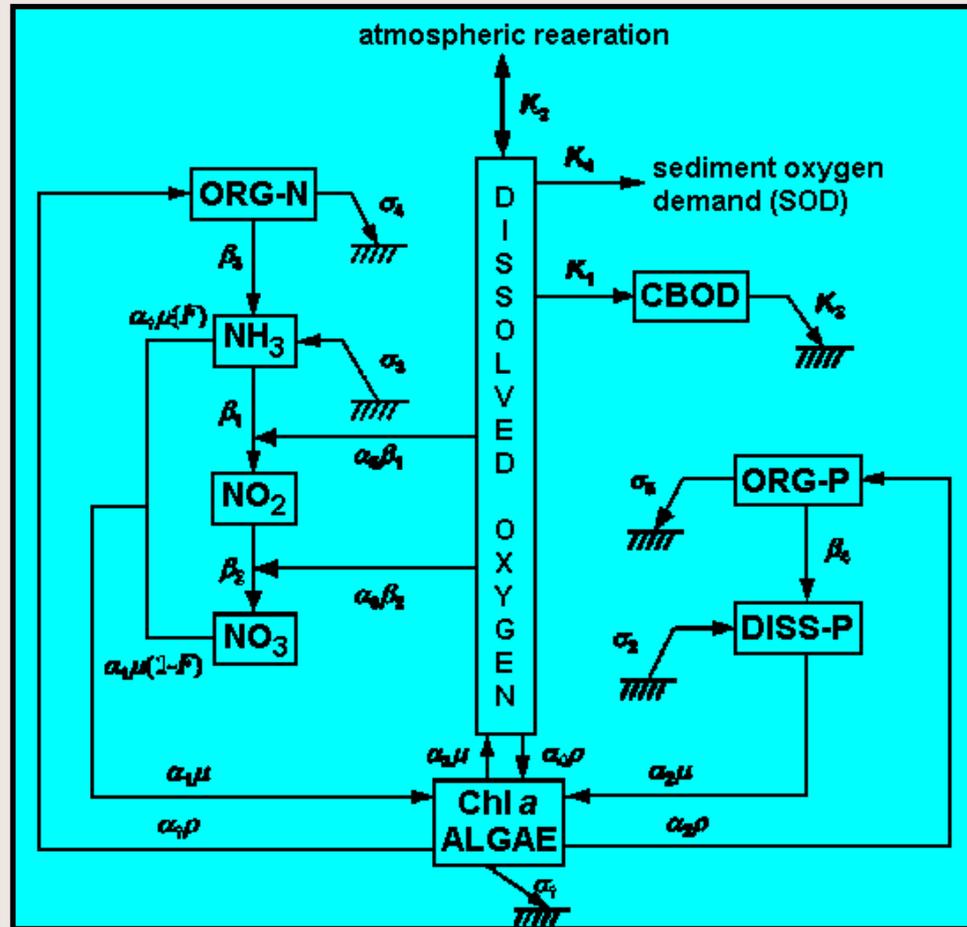
Mass Balance Model (Mechanistic)



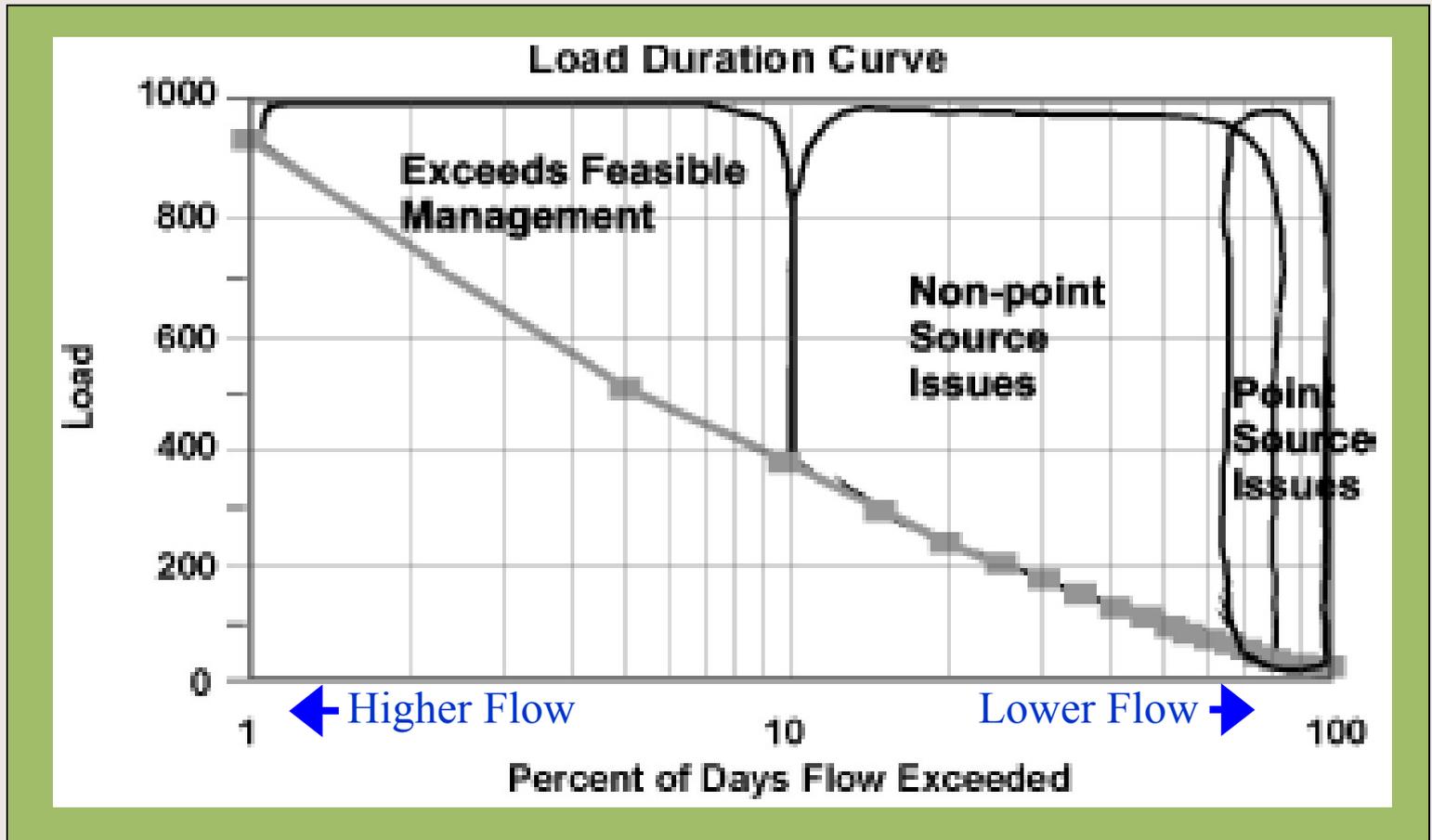
$$[\text{Accumulation}] = [\text{Loading}] \pm [\text{Transport}] \pm [\text{Transformations}]$$

QUAL-TX

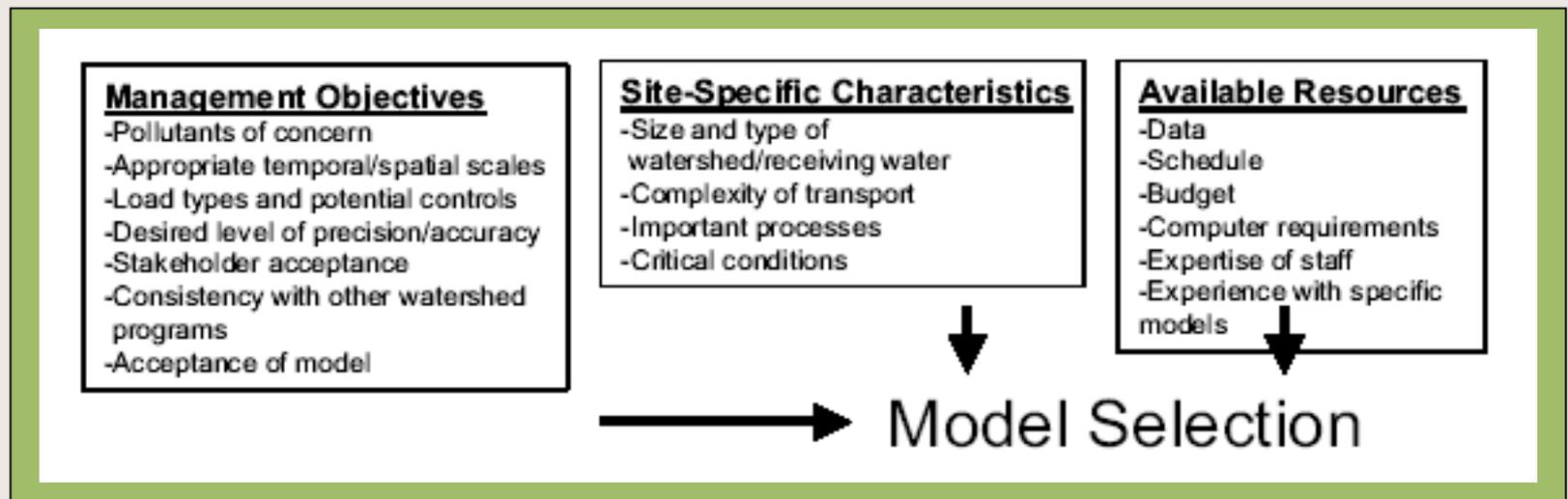
Dissolved Oxygen Kinetics



TMDL Curve (Empirical)



Considerations in Model Selection



Water Environment Research Foundation, 2002

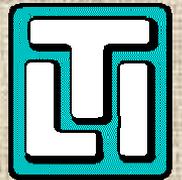
QUESTIONS?

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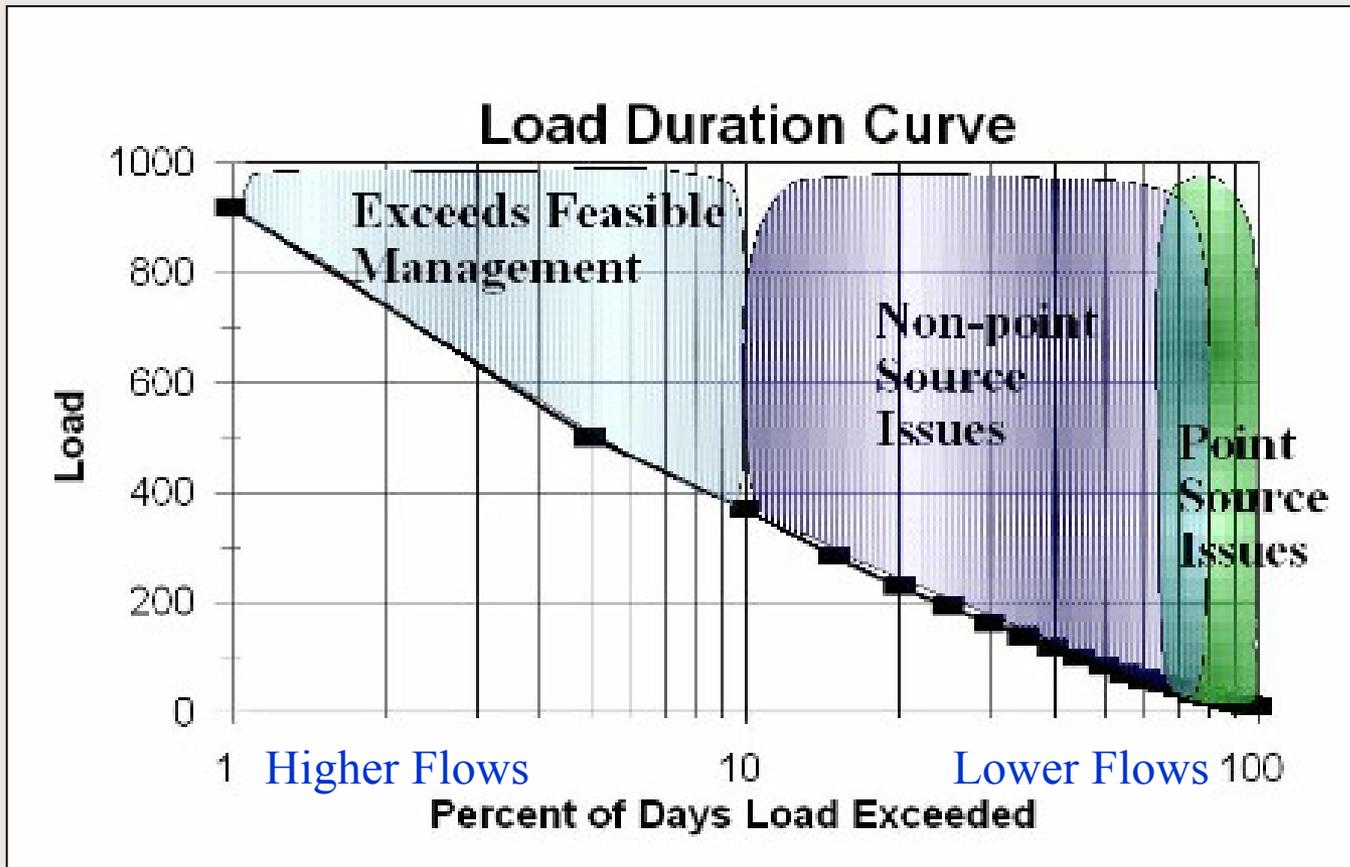
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TMDL Curve (Empirical)



Kansas Dept. of Health and Environment

Steps in Water Quality Modeling

1. Determine objectives (*problem definition*) and establish criteria for meeting the objectives.
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* a mechanistic model to monitoring data or develop empirical (data-based) relationships to assess existing conditions.
5. *Confirm* a mechanistic model against additional data.
6. *Apply* the modeling approach to address defined problem (calculate the TMDL).