

Back to Basics --

Using Hydrology to Communicate Data as Information

National Water Quality Monitoring Conference
Chattanooga, TN
May 19, 2004

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Discussion Overview

Points to look for ...



Information Needs

- ✓ *Practical approaches*
- ✓ *Partnerships*
- ✓ *Problem-solving framework*



Communicating Data

- ✓ *Hydrology & duration curves*
- ✓ *Watershed processes*
- ✓ *Contributing areas*
- ✓ *Targeted activities*

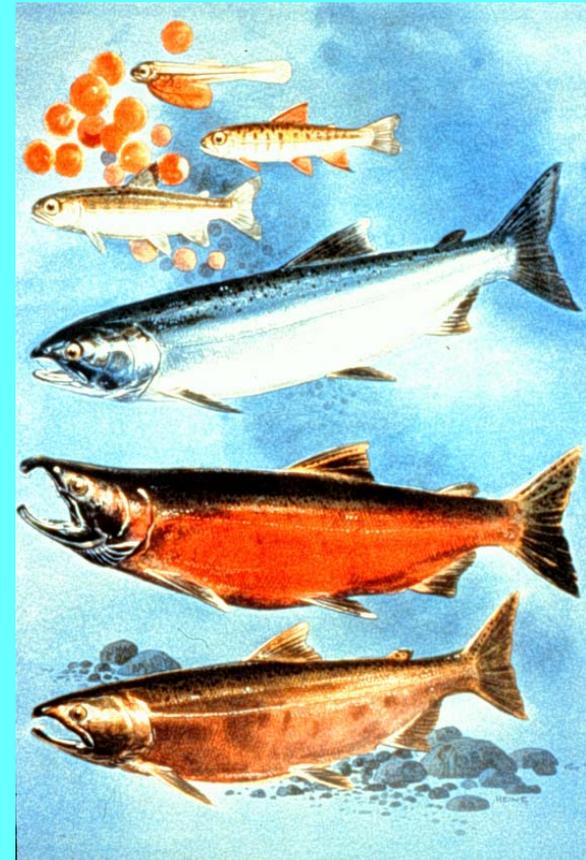


Information Needs

Problem Solving Framework

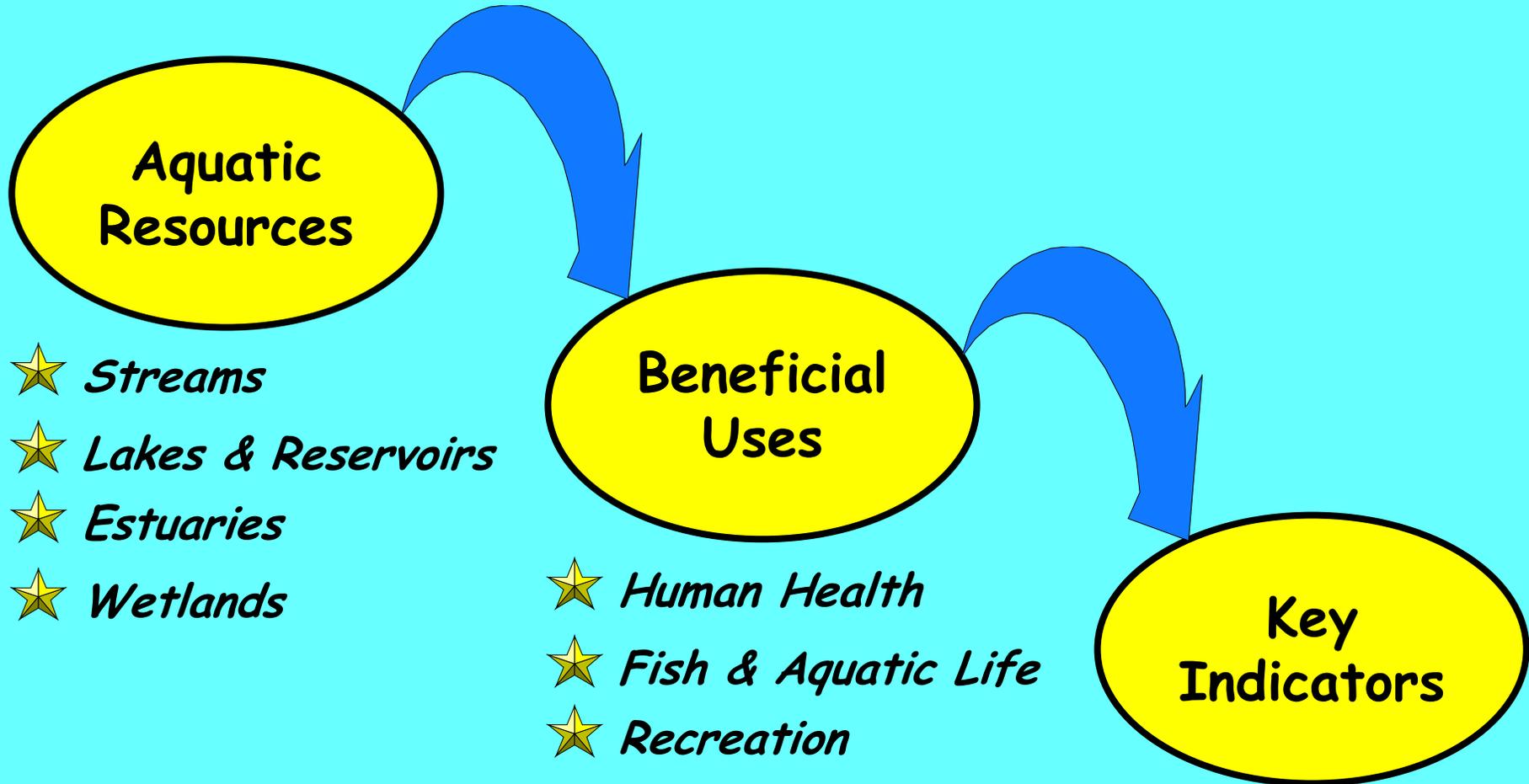
★ Practical approach using key questions ...

- ✓ WHY the concern
- ✓ WHAT reductions are needed
- ✓ WHERE are the sources
- ✓ WHO needs to be involved
- ✓ WHEN will actions occur



WHY the Concern

Identifying Objectives



WHAT Reductions are Needed

Challenges

- ★ *Wide array of concerns +++
limited time, data, methods, resources*

Silviculture



Urban

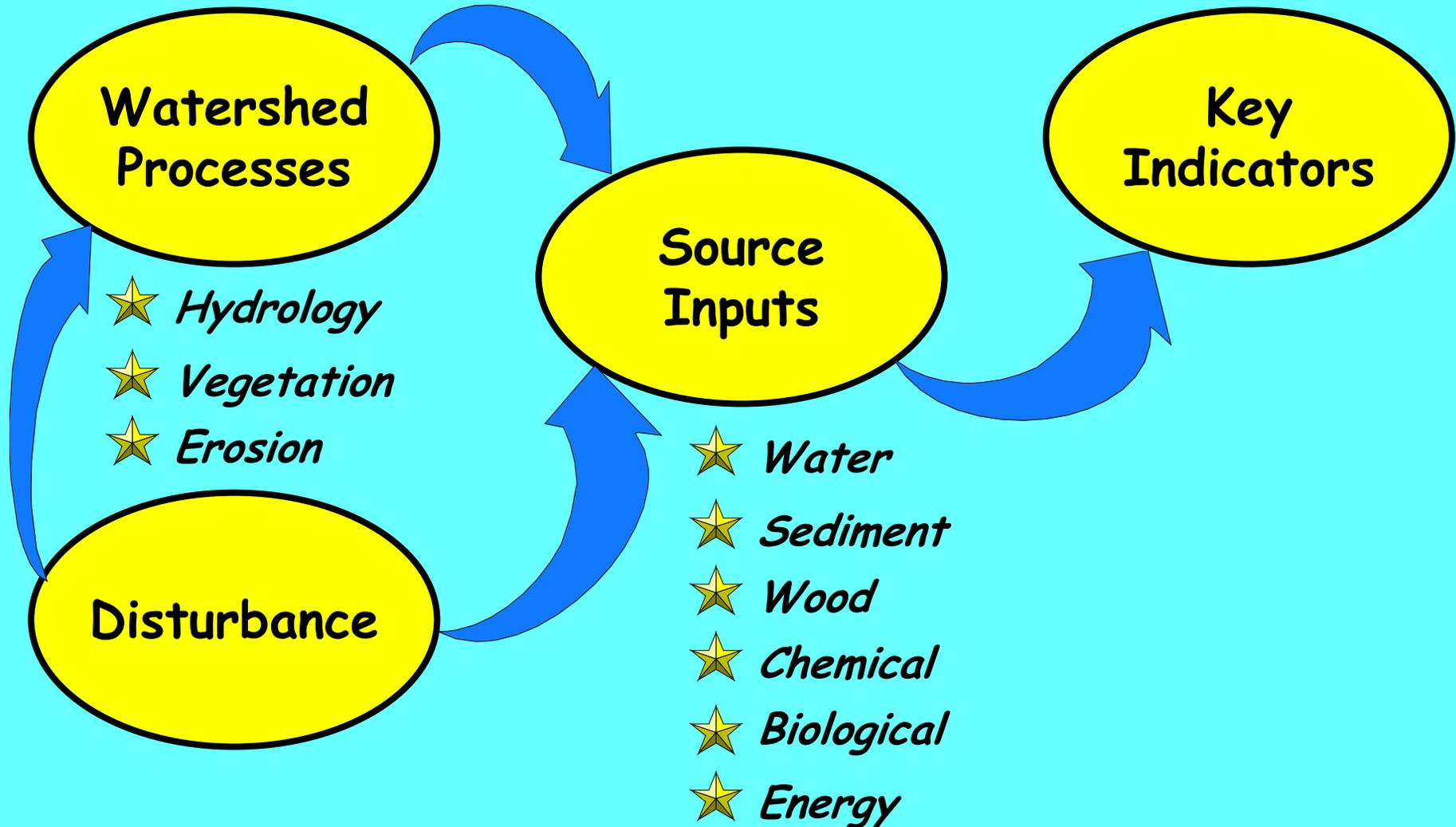


Agriculture



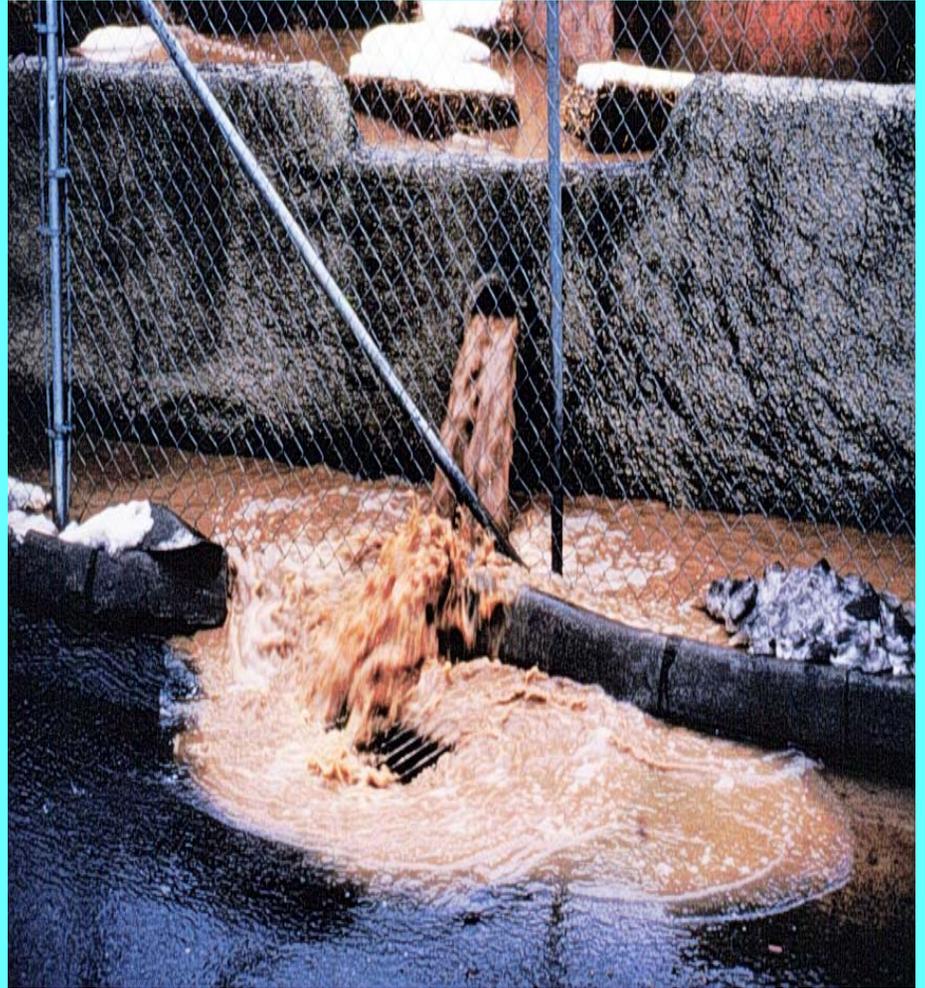
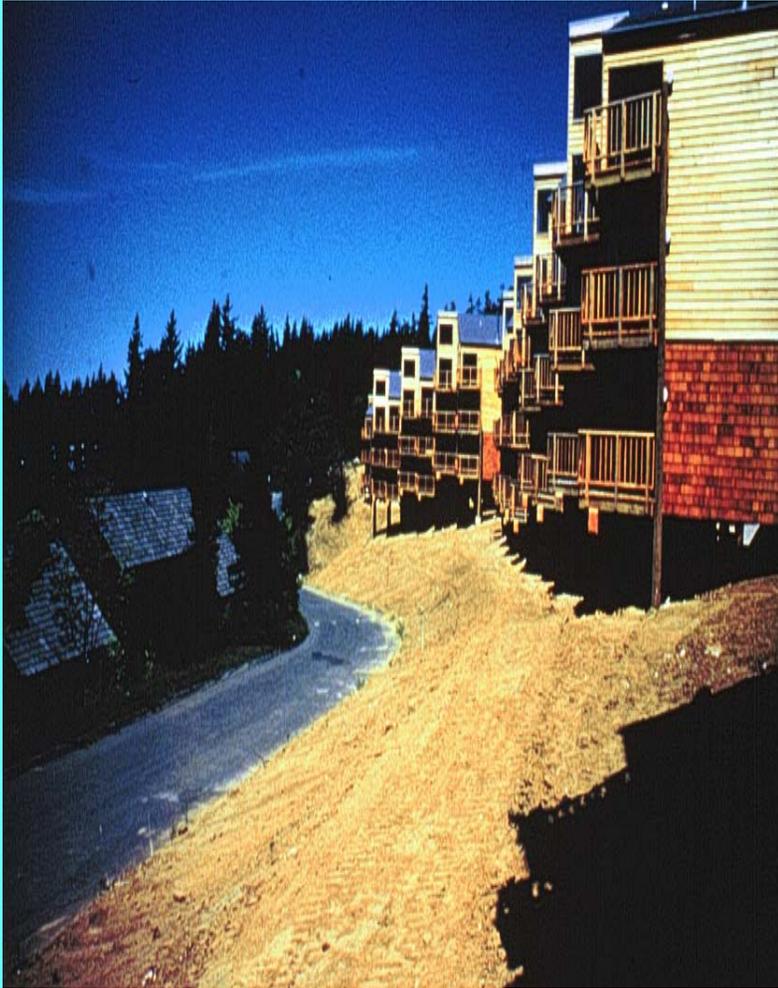
WHERE are the Sources

"Bottom-up" Focus



WHERE are the Sources

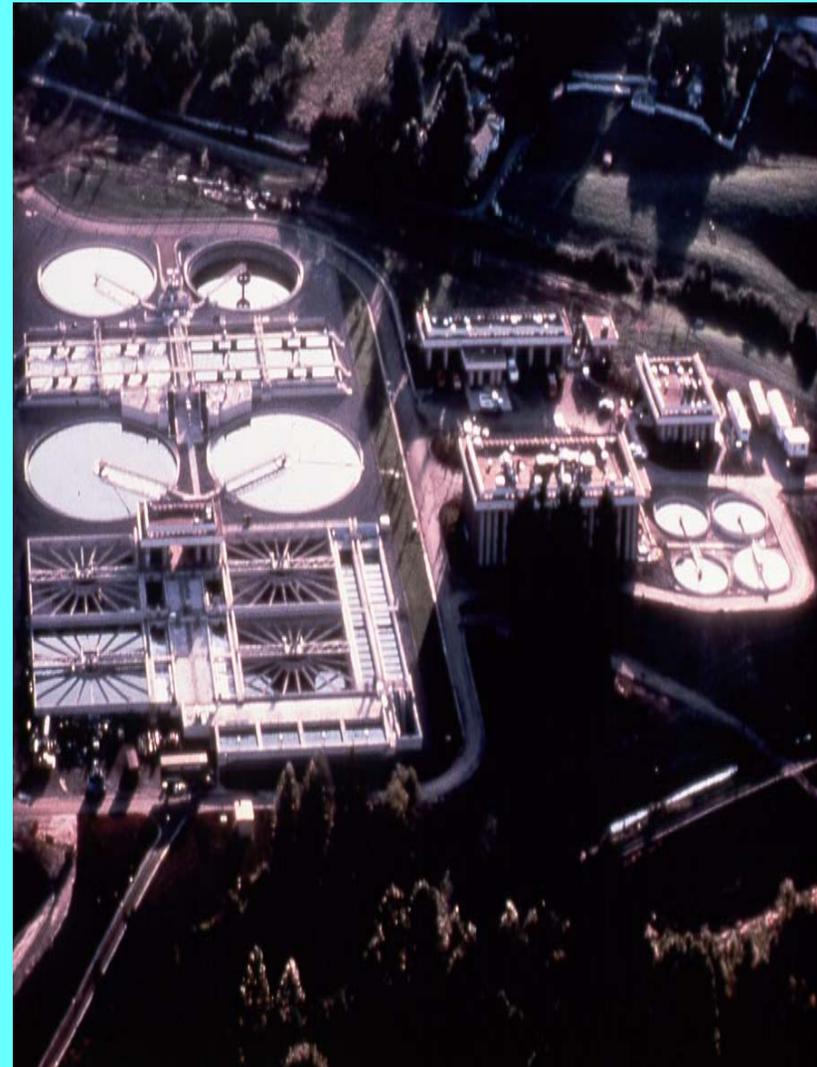
Hazard / Delivery



WHO Needs to be Involved

Partnerships

★ Treatment



WHO Needs to be Involved

Partnerships

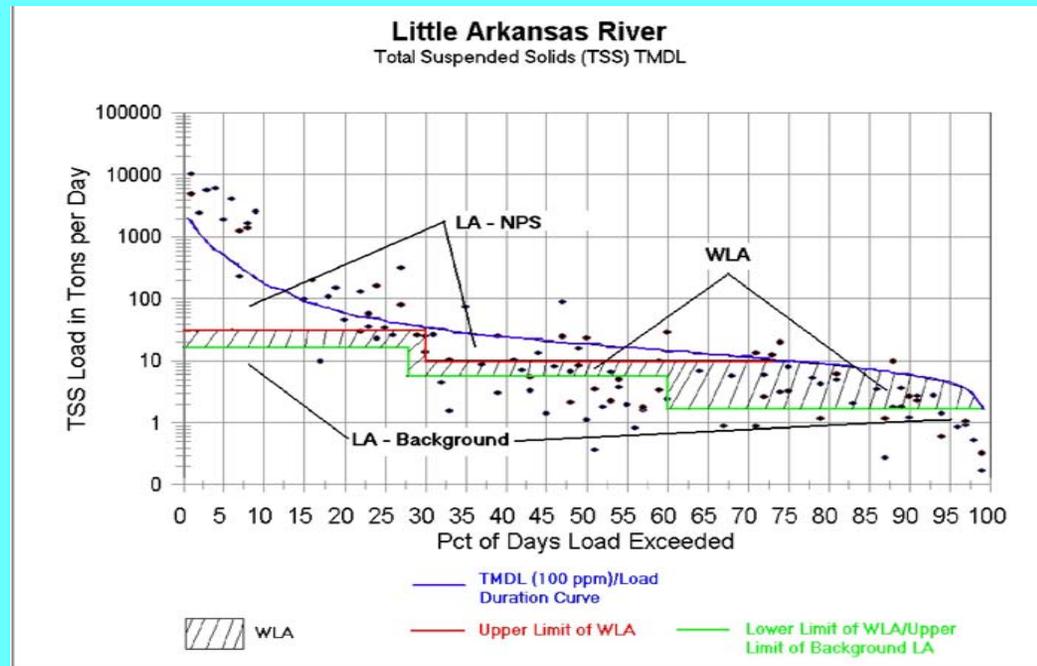
★ Restoration /
Protection



Hydrology-Based Framework

Duration Curves

★ Pioneered by Kansas

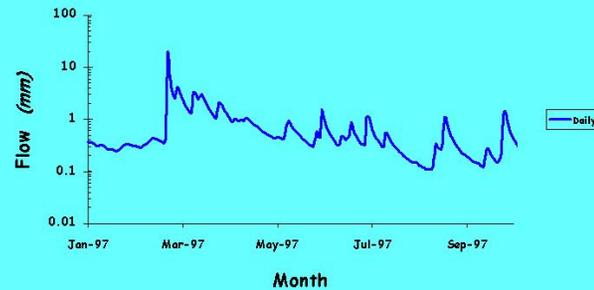


Hydrology-Based Framework

Some Basic Concepts

✓ *Daily Average Flows*

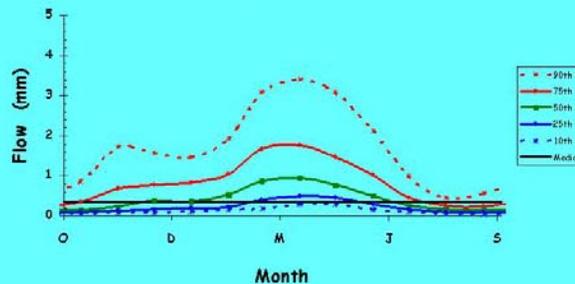
Elk River near Tiff City, MO
Daily Flow Patterns
USGS Gage: 07189000



USGS Flow Data

✓ *Seasonal Patterns*

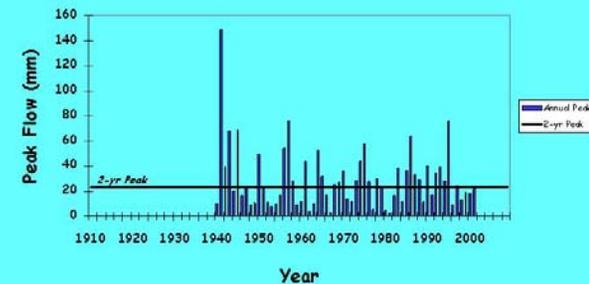
Elk River near Tiff City, MO
Seasonal Variation --- Flow
USGS Gage: 07189000



USGS Flow Data

✓ *Annual Variation*

Elk River near Tiff City, MO
Peak Flow History
USGS Gage: 07189000



USGS Flow Data

✓ *Frequency Distributions*

Flow Duration Curves

Nuts & Bolts

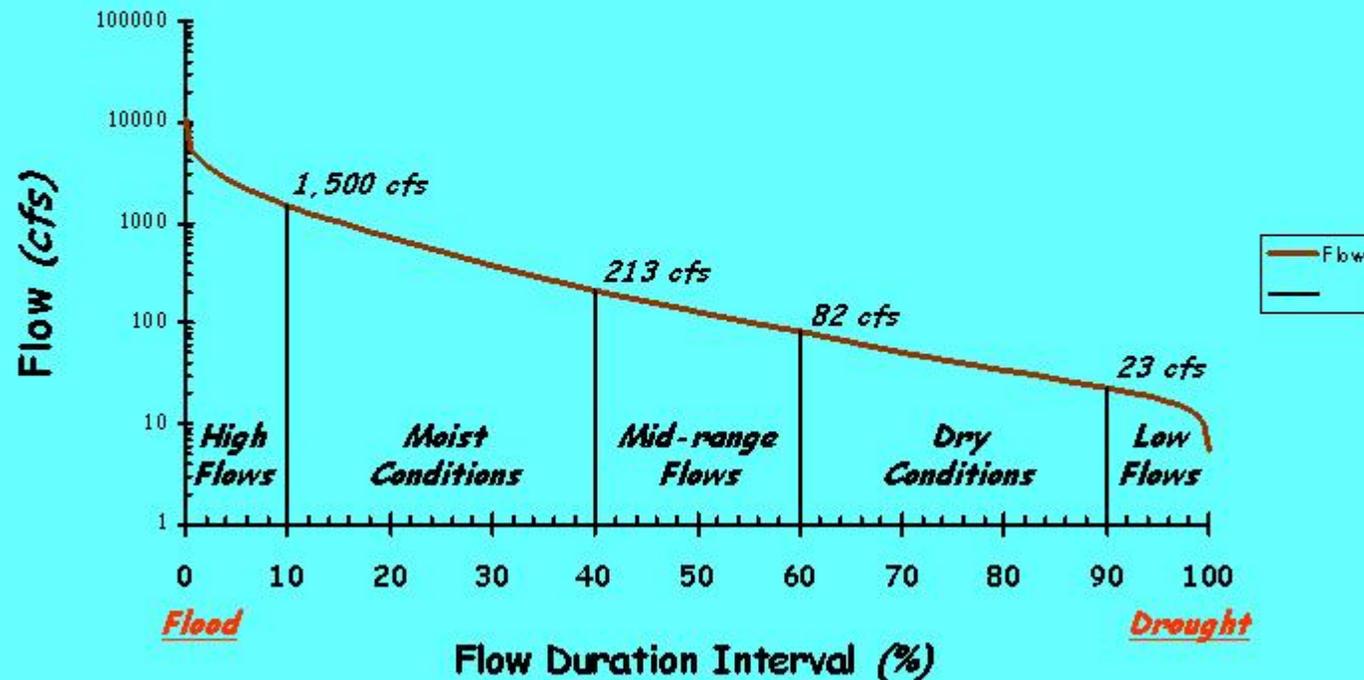
★ Based on Cumulative Frequency Distribution

- ✓ *Historic hydrologic record -- daily average flows
[e.g. download from USGS NWIS-Web]*
- ✓ *Developed with statistical software or spreadsheet
[e.g. =PERCENTILE(a1:a3650,0.5) in Excel]*
- ✓ *Can also look at other key recurrence intervals
[e.g. median flow, 2-year peak, 7Q10]*

Flow Duration Curves

Basic Form

St. Marys River at Decatur, IN
Flow Duration Curve
USGS Gage: 04181500



Water Quality Duration Curves

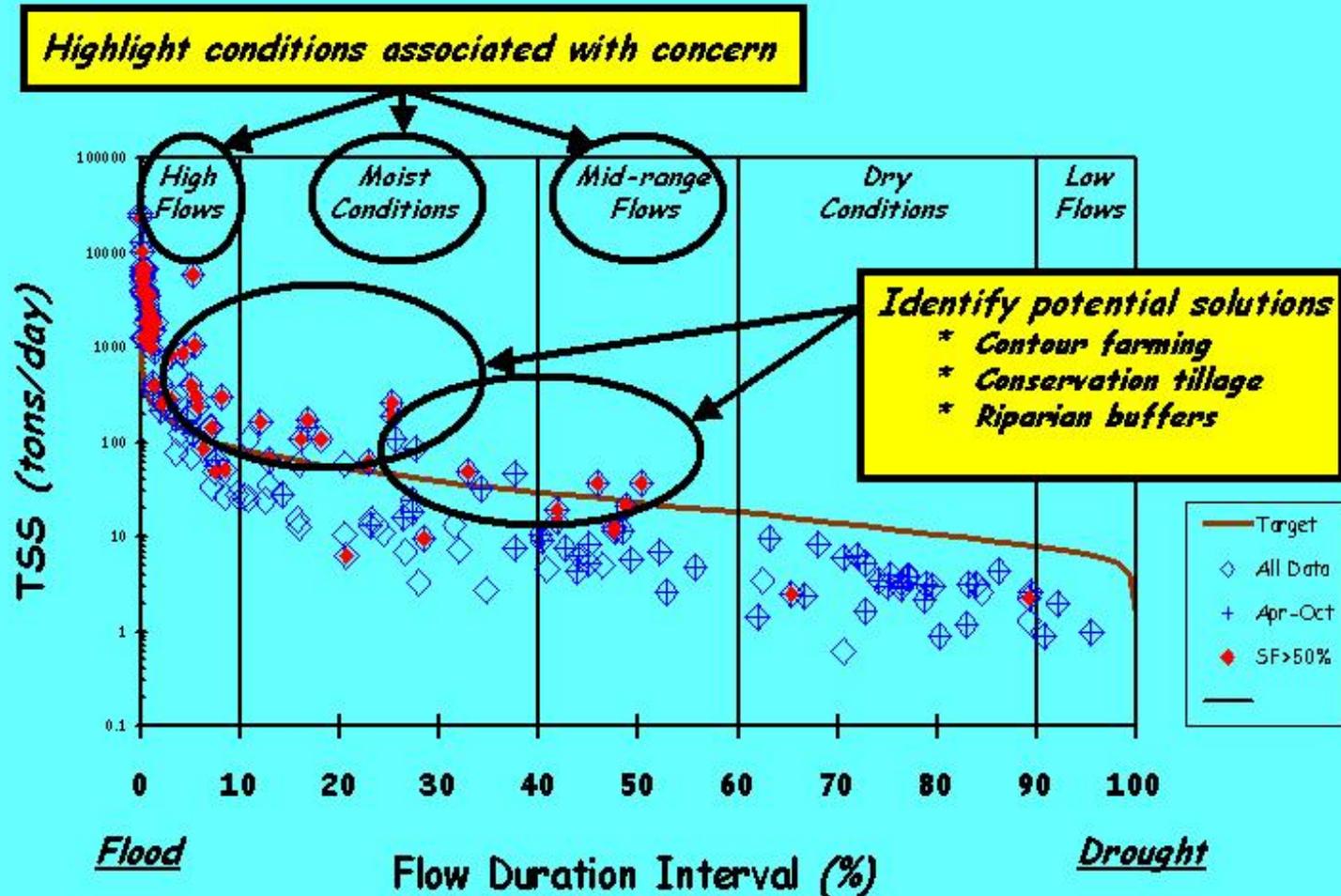
Concept

★ Again, use Cumulative Frequency Distribution

- ✓ *Y-axis becomes water quality parameter value
[e.g. load or concentration]*
- ✓ *X-axis position matches flow recurrence interval*
- ✓ *Curve determined by target concentration and
flow associated with recurrence interval*

Water Quality Duration Curves

Basic Form



Duration Curves

Basics

- ★ Method offers a number of advantages
 - ✓ *Moves away from single point estimate*
 - ✓ *Easier to explain - fairly simple graphic display*
 - ✓ *Context for looking at monitoring / modeling data*
 - ✓ *Targeting focus - framework to evaluate options*
 - ✓ *Being evaluated as a tool in more & more States*

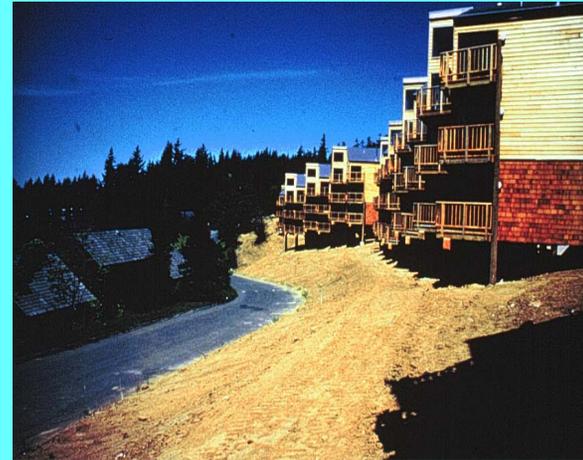
Duration Curves

Advantages

✓ Context to interpret monitoring data
(*modeling data as well*)

✓ Help guide implementation

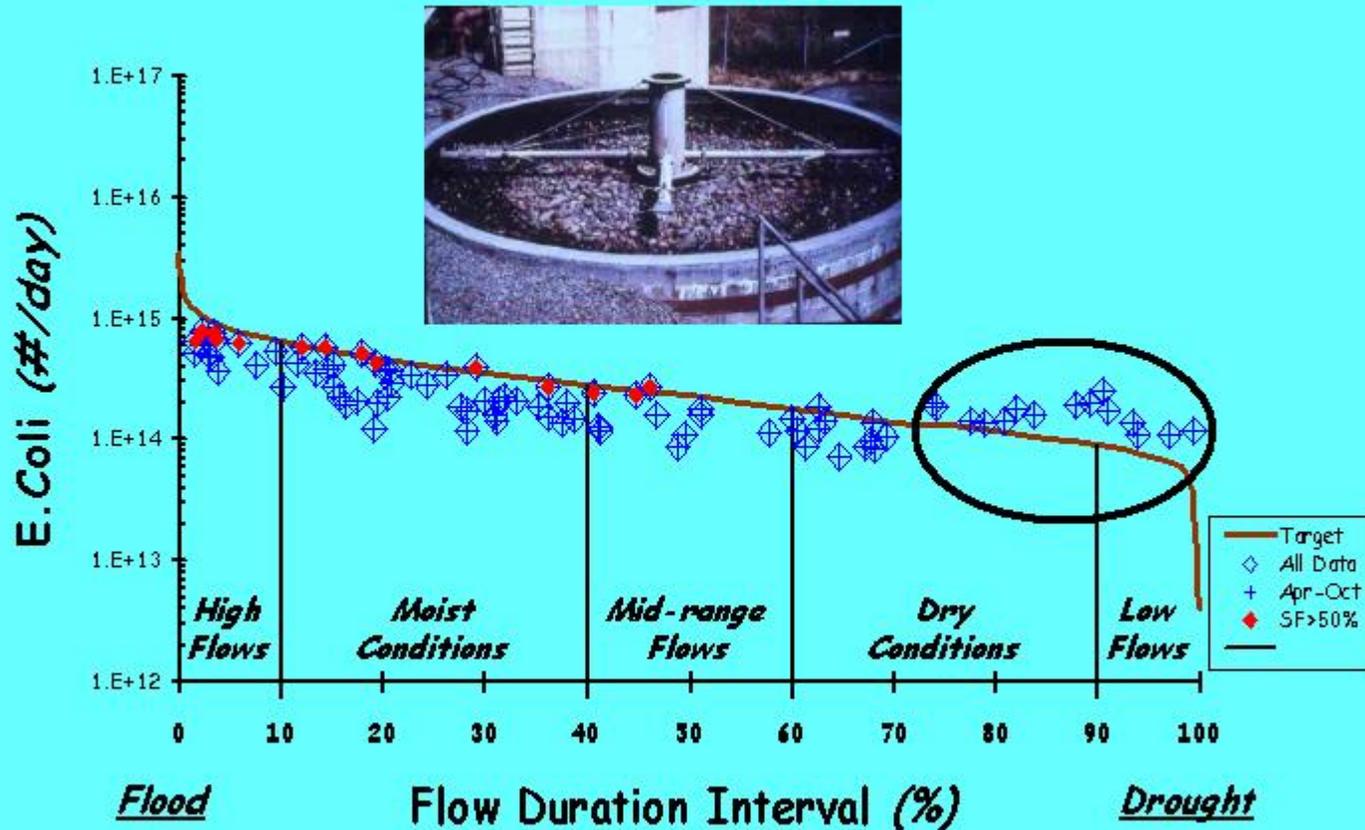
- Targeted Participants
- Targeted Programs
- Targeted Activities
- Targeted Areas



Duration Curves

Watershed Condition -- Hydrologic

Pipe Creek below Elfton
Sample Load Duration Curve

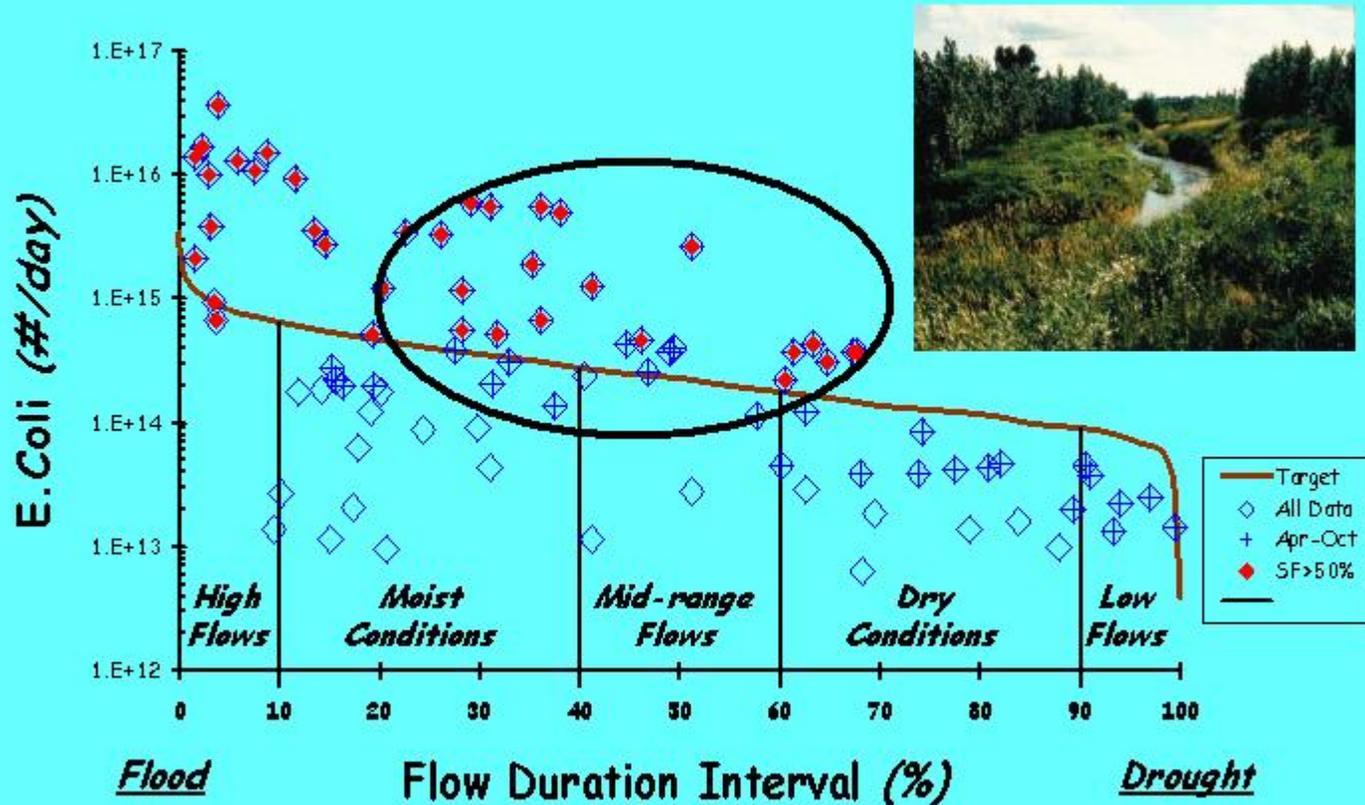


TARGETED Participants: *Point Sources*

Duration Curves

Contributing Areas

Willow Creek near Turkey Gap
Sample Load Duration Curve

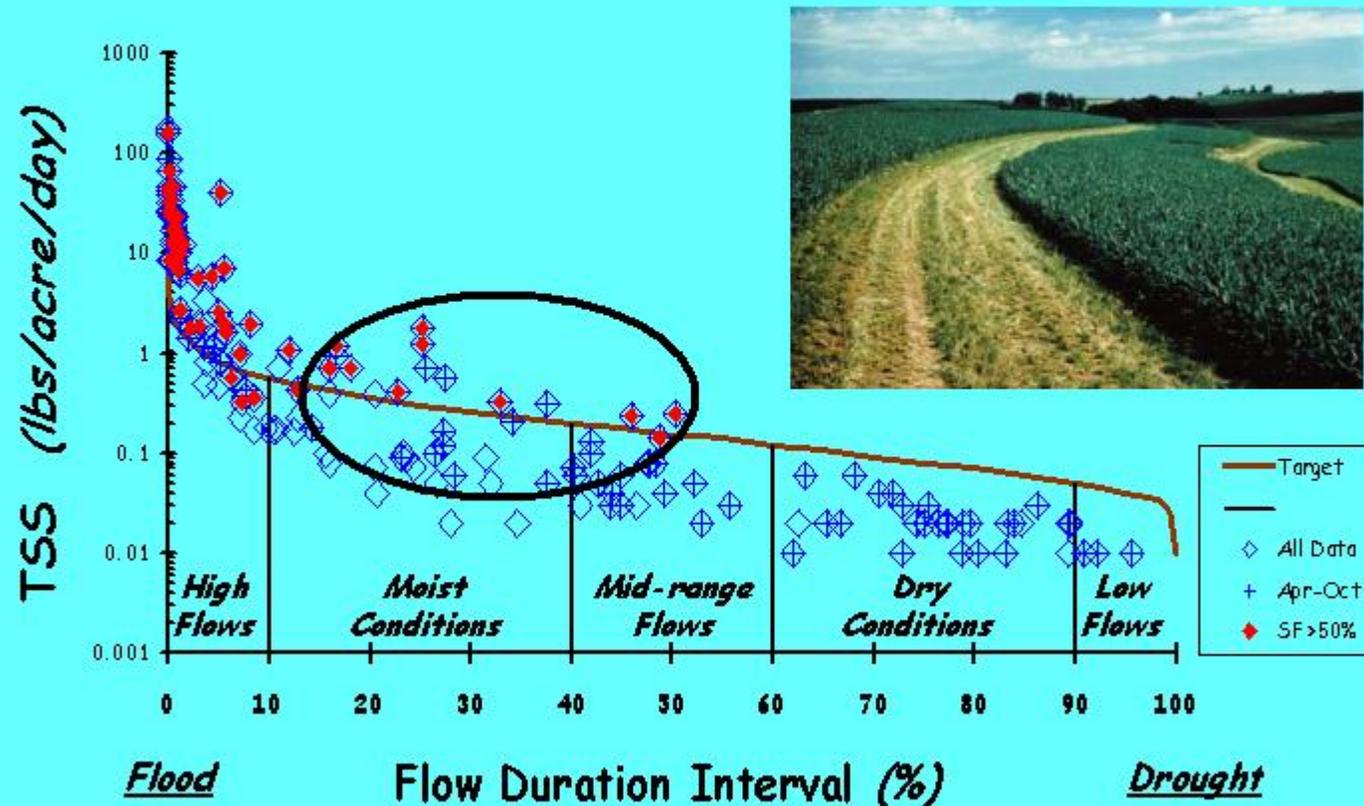


TARGETED Programs: *Riparian Buffers (e.g. CRP, CREP)*

Duration Curves

Contributing Areas

Chicken Run above Mt. Pleasant
Sample Yield Duration Curve

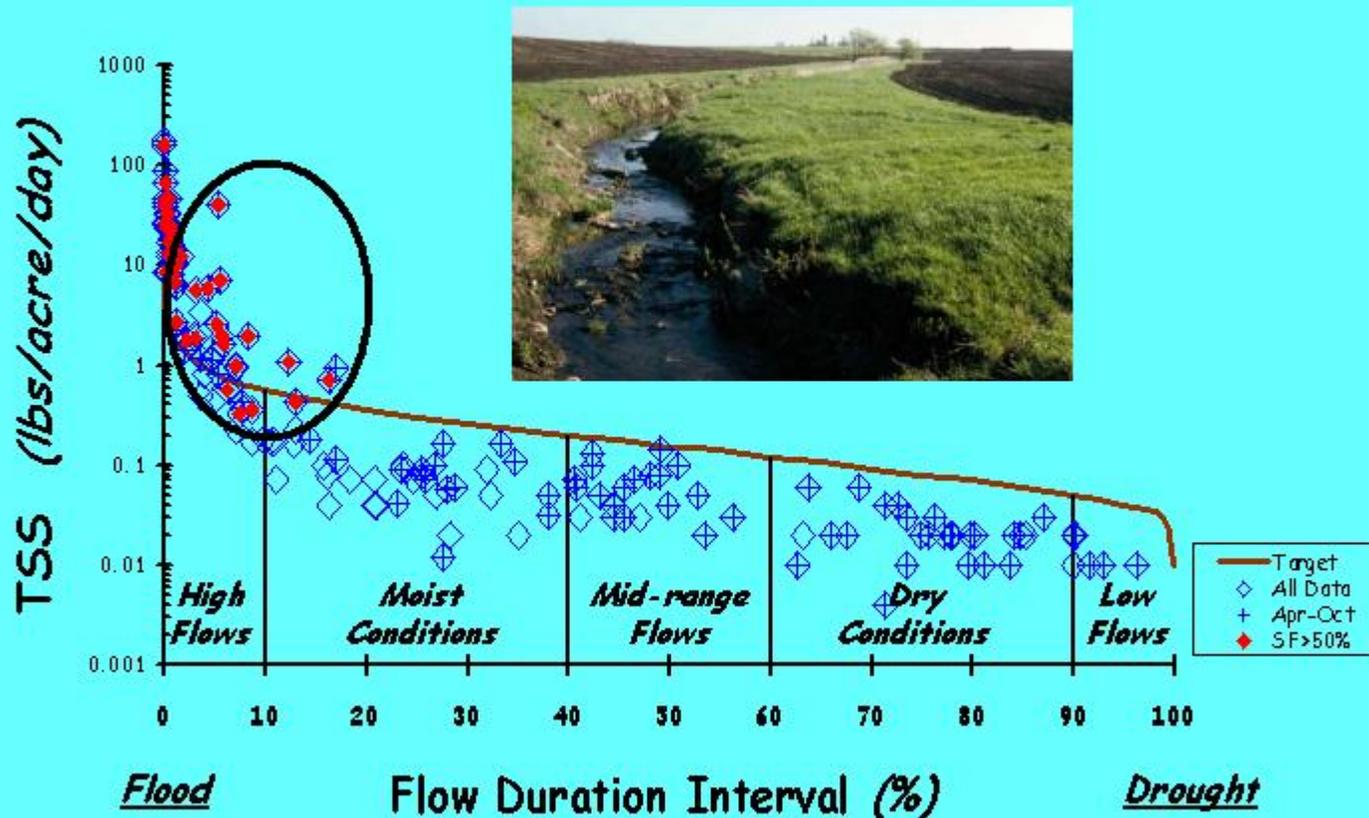


TARGETED Activities: *Contour Strips, Conservation Tillage*

Duration Curves

Delivery Mechanisms

Rock Creek near Moose Junction
Sample Yield Duration Curve



TARGETED Areas: *Streambank Erosion, Bank Stability*

Hydrology-Based Framework

Duration Curves

★ Support watershed planning through ...

✓ *Enhanced description of water quality concerns*

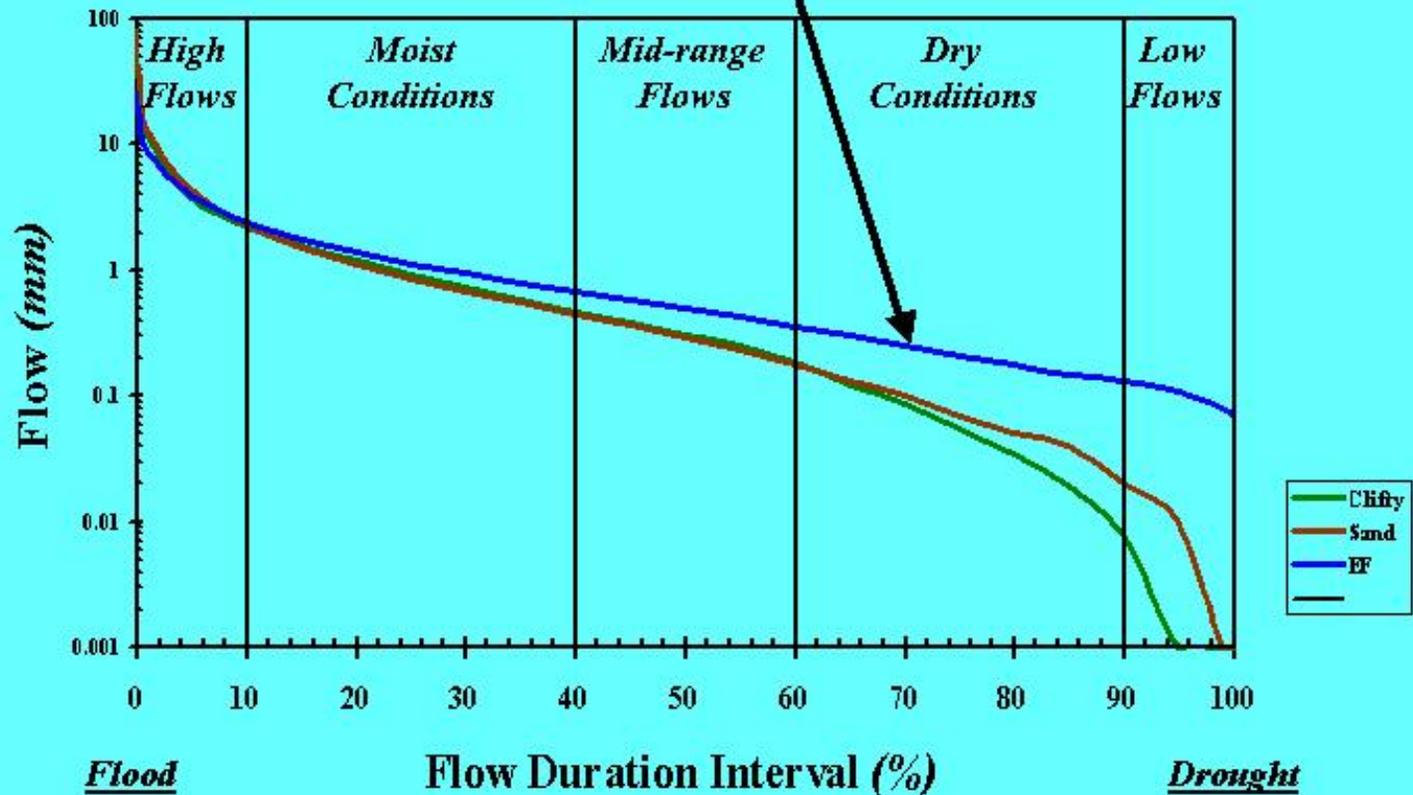
✓ *Improve basic understanding of key processes*

✓ *Focus on solution development*

Expanded Characterization

Recognizing Key Watershed Processes

Larger watershed with sustained baseflow

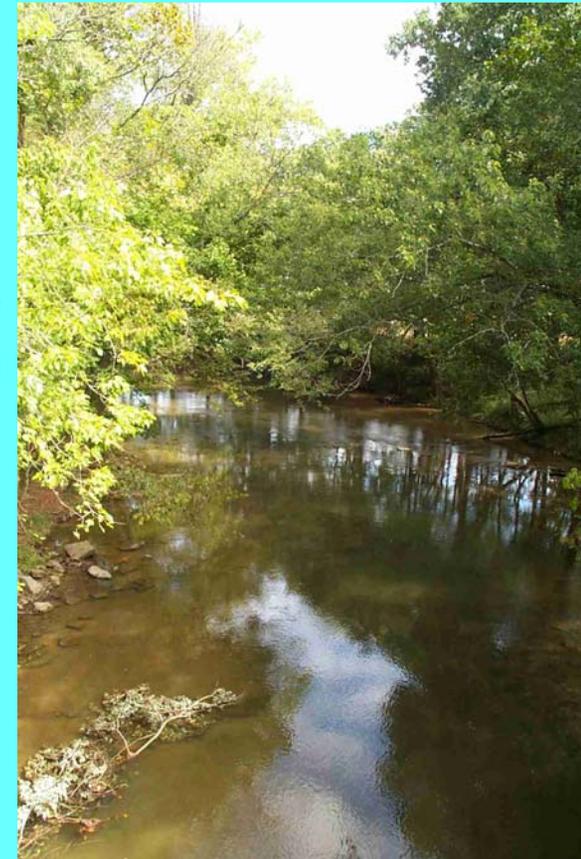
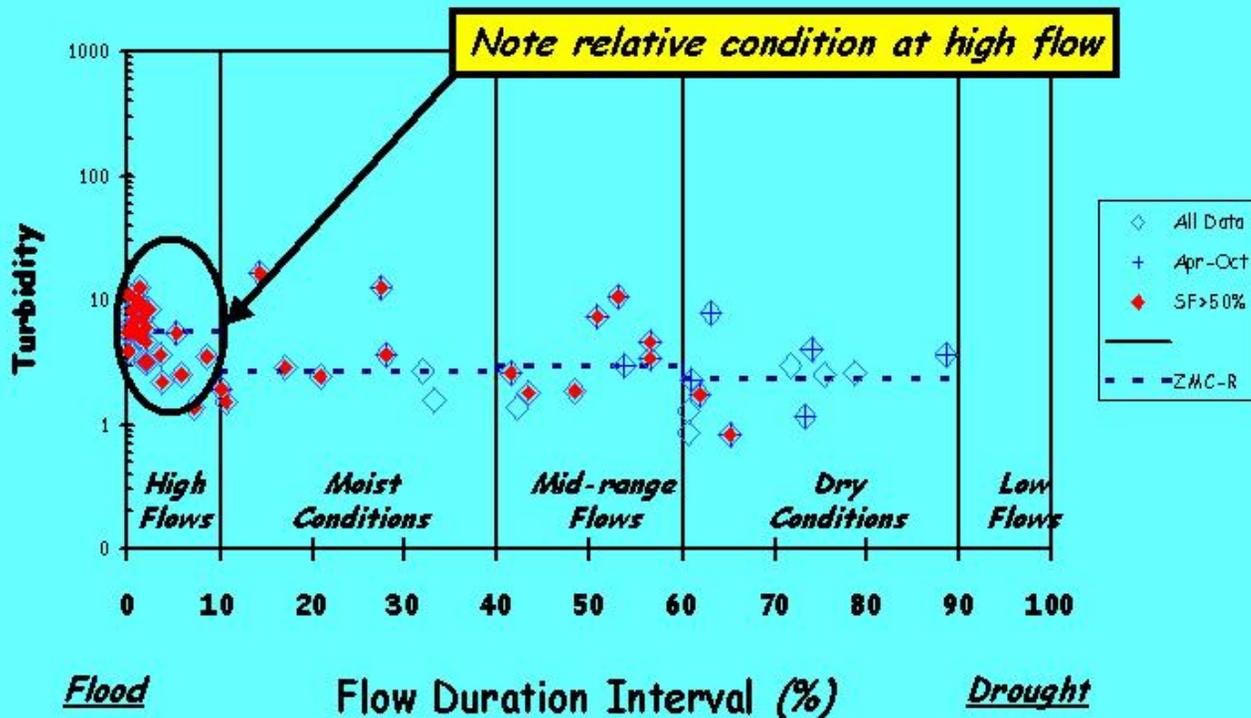


Hydrology-Based Framework

Use with Volunteer Monitoring Data

★ Reference watershed

Reference Site
Water Quality Duration Curve

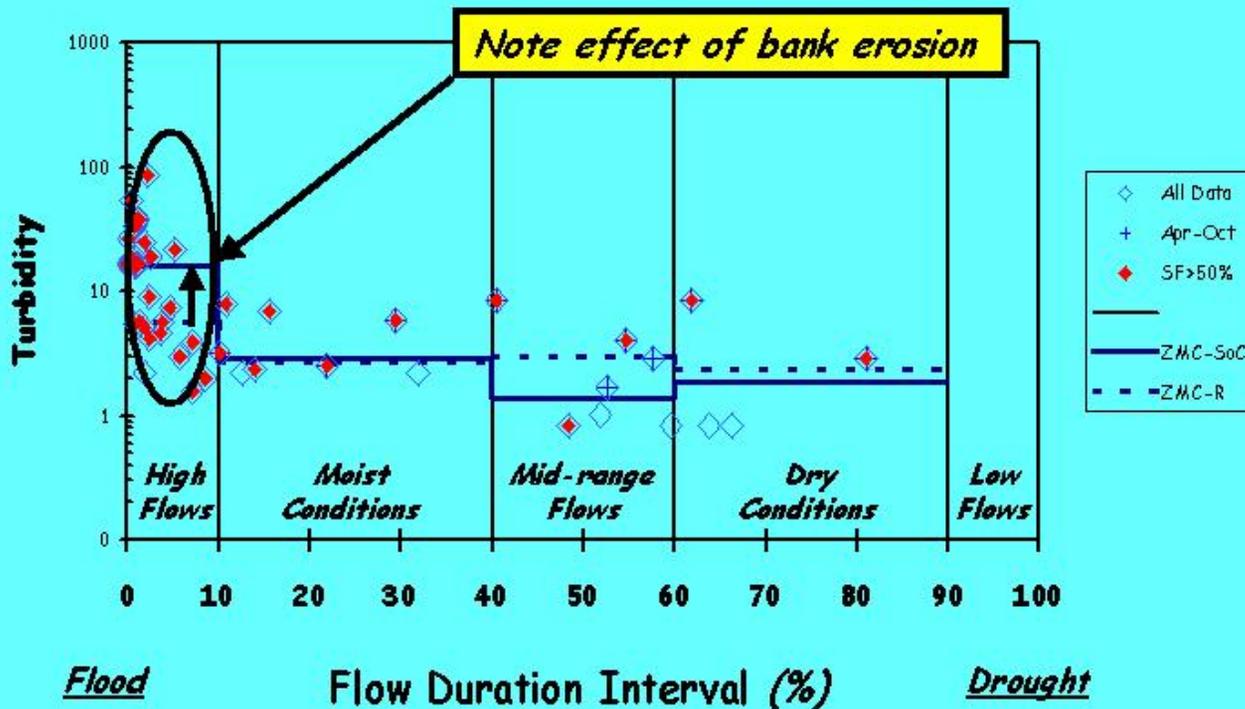


Hydrology-Based Framework

Use with Volunteer Monitoring Data

★ Provides feedback opportunities ...

Site of Concern
Water Quality Duration Curve



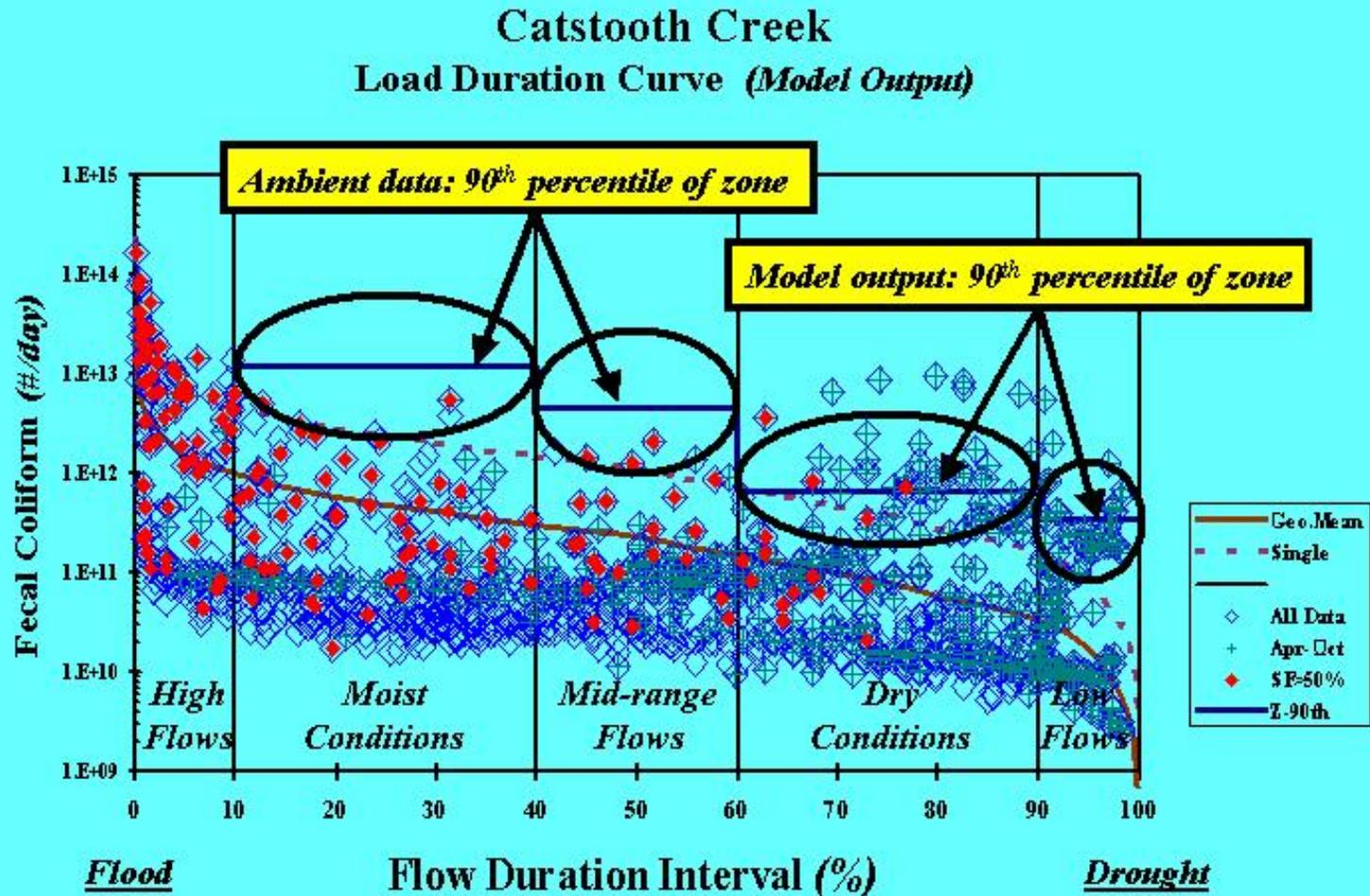
Hydrology-Based Framework

Use with Other Analytical Methods



Hydrology-Based Framework

Analysis of Model Output



Hydrology-Based Framework

Use with Other Analytical Methods

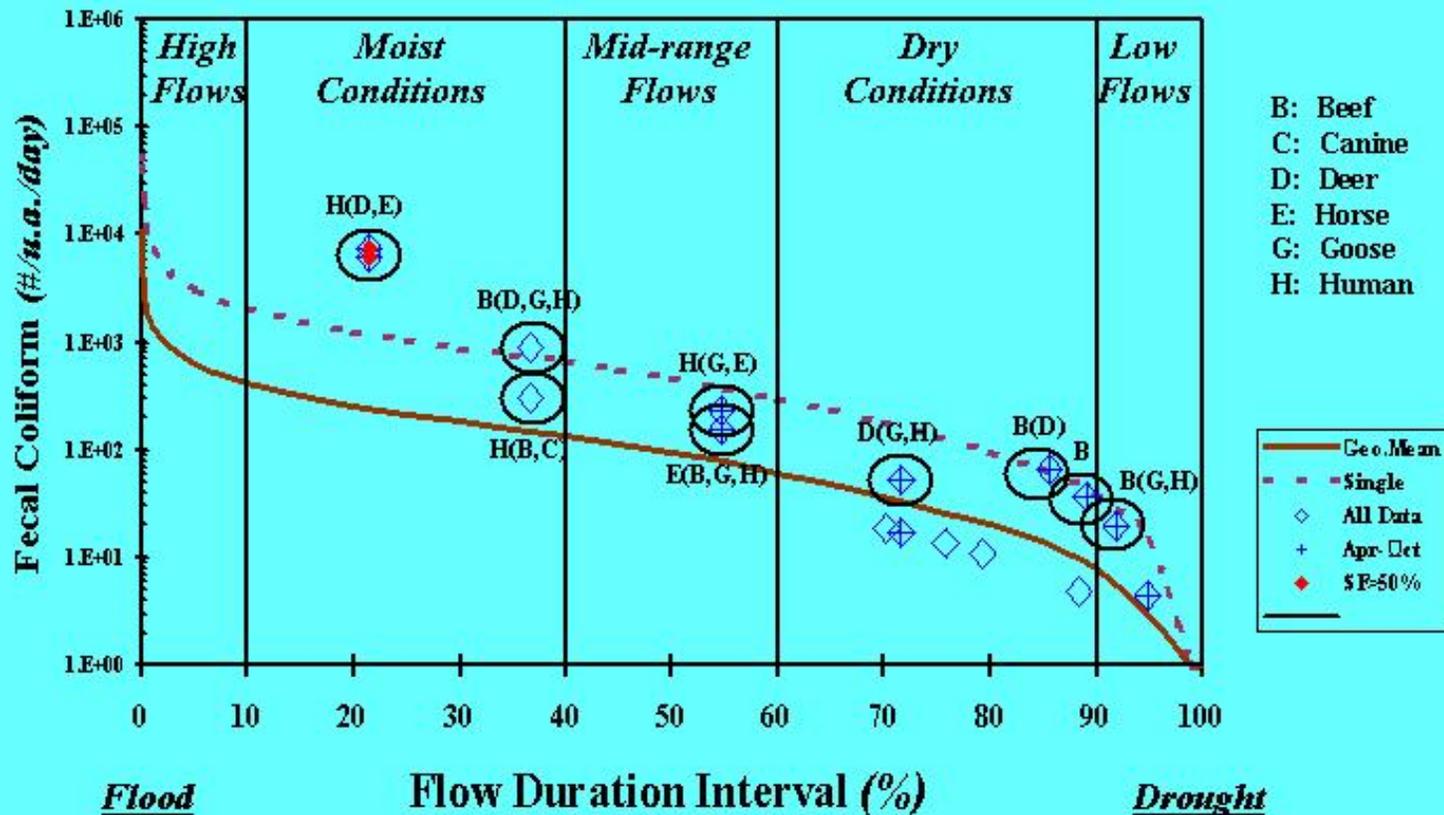


Hydrology-Based Framework

Analysis of Bacteria Source Tracking Data

Spots Run

Modified LDC (Ambient WQ Monitoring Data with BST)



Hydrology-Based Framework

Developing Solutions



Hydrology-Based Framework

Developing Solutions

★ Focus: *Source Areas & Delivery Mechanisms*

<u>EXAMPLE</u>		Duration Curve Zone				
	<u>Source Area</u>	<u>High</u>	<u>Moist</u>	<u>Mid-Range</u>	<u>Dry</u>	<u>Low</u>
	Point source				M	H
	Septic systems			M	H	
	Riparian areas		H	H	M	
	Stormwater: Impervious		H	H	H	
	CSO's	H	H	M		
	Stormwater: Upland	H	H	M		
		<i>Potential for source area contribution under given hydrologic condition</i>				

Connecting the Pieces

Agricultural Fields



Targeted Activities

- ✓ *Residue Management*
- ✓ *Crop Rotation & Cover*
- ✓ *Critical Area Planting*
- ✓ *Contour Farming*



Calculation

- ✓ *Contributing Area*
- ✓ *Delivery Ratio*



Connecting the Pieces

Developing Solutions

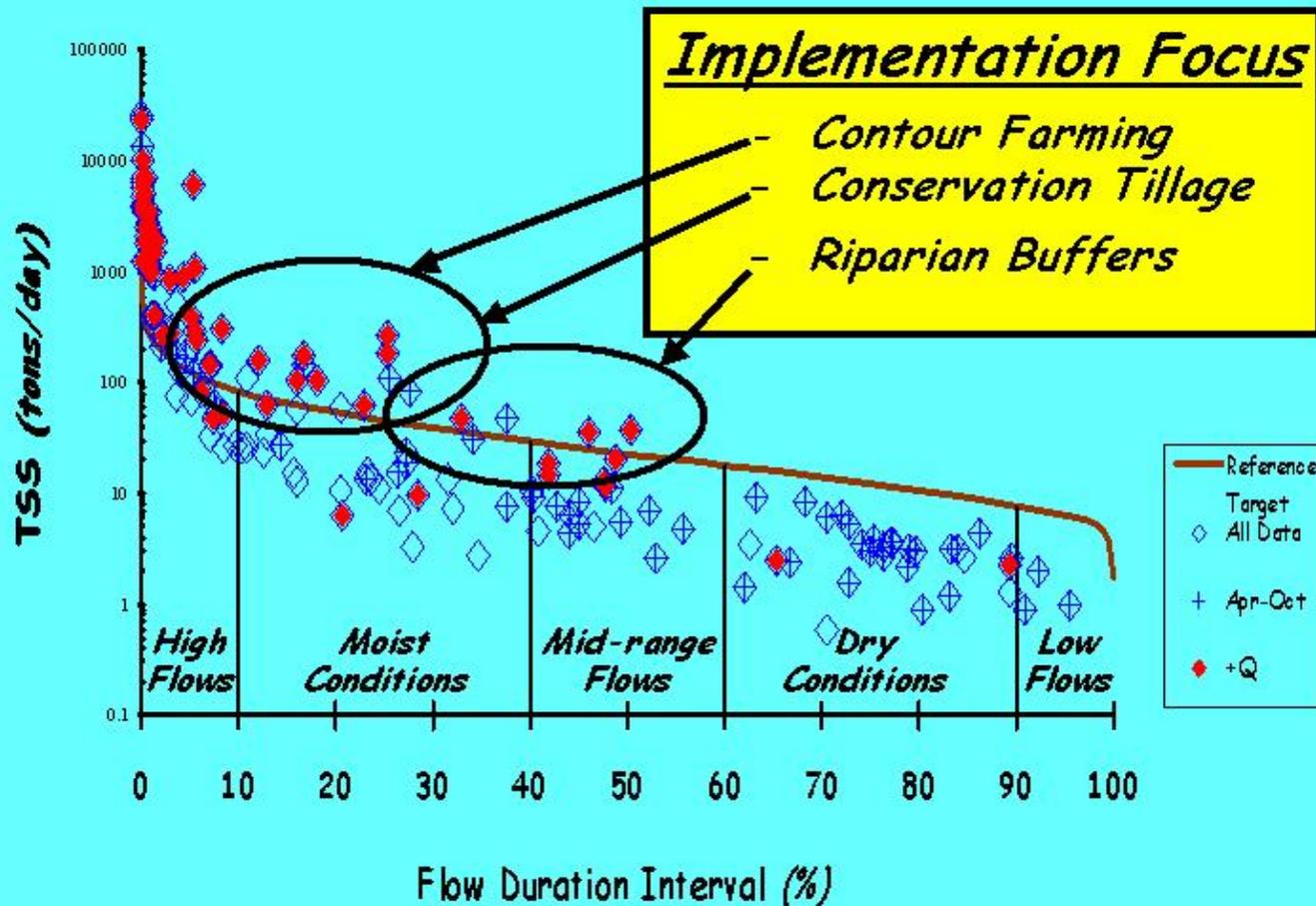
★ Focus: *Potential Management Practices*

<u>EXAMPLE</u>		Duration Curve Zone				
		<u>High</u>	<u>Moist</u>	<u>Mid-Range</u>	<u>Dry</u>	<u>Low</u>
	<u>Source Area</u>					
	Point source controls	L	L	M	H	H
	Septic system inspection	L	M	H	H	M
	CSO repair / abatement	H	H	H		
	SSO repair / abatement			M	H	H
	Riparian buffers		H	H	H	
	Pasture management	H	H	M		
	Pet waste education & ordinances		M	H	H	
	Hobby farm livestock education & ordinances		H	H	M	
		<i>Potential for effective load reductions under given hydrologic condition</i>				

Connecting the Pieces

Developing Solutions

★ Example: Agricultural erosion control ...



Connecting the Pieces

Combined Sewer Overflows



Connecting the Pieces

Combined Sewer Overflows

★ Targeted Activities

- ✓ *Separation*
- ✓ *Storage Basins*
- ✓ *Tunnels*
- ✓ *Treatment Basins*

★ Calculation

- ✓ *SWMM Modeling*



Connecting the Pieces

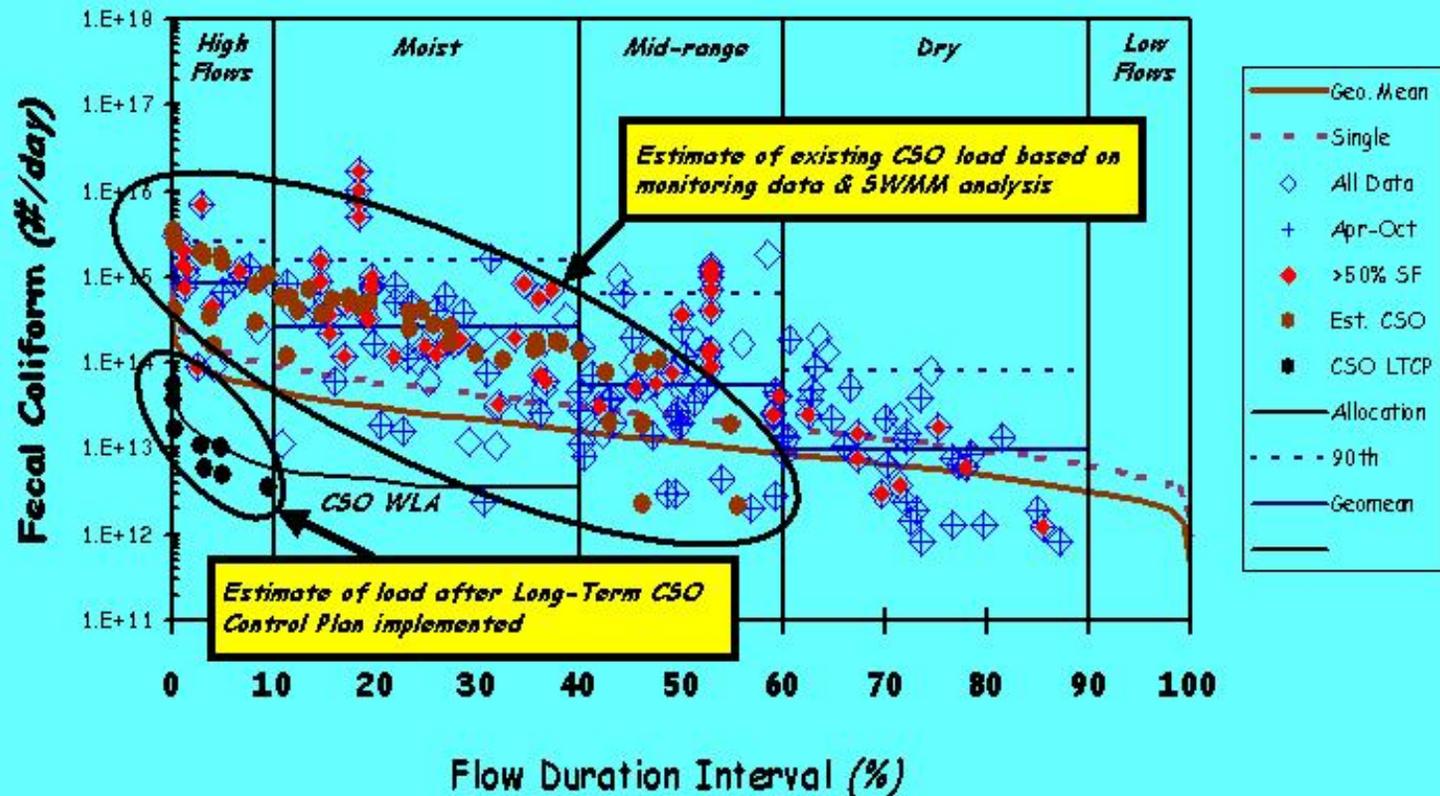
"The Challenge"



Hydrology-Based Framework

Connecting the Pieces

Crooked River at Freedom Bend Load Duration Curve (1974 - 1995 Monitoring Data)



Hydrology-Based Framework

Developing Solutions

★ Components plus Opportunities

<u>TMDL SUMMARY</u>		Loads expressed as (cfu/day)				
		<u>High</u>	<u>Moist</u>	<u>Mid-Range</u>	<u>Dry</u>	<u>Low</u>
Reduction		92%	90%	79%	41%	0%
TMDL		1.39E+14	5.09E+13	2.37E+13	1.15E+13	5.09E+12
Load Allocations		9.32E+12	2.73E+12	2.26E+13	1.05E+13	4.22E+12
Wasteload Allocations		4.68E+11	4.68E+11	4.68E+11	4.68E+11	4.68E+11
CSO		1.25E+14	4.58E+13	0.00E+00	0.00E+00	0.00E+00
Margin of Safety		4.11E+12	1.89E+12	6.20E+11	4.99E+11	4.06E+11
Implementation		Long Term CSO Plan			Municipal NPDES	
Opportunities				Riparian Protection		
				Pet Waste Ordinance		
				Stormwater Mgt.		

Problem Solving Framework

Adaptive Management

- ✓ Plan development using *"best available data"*
- ✓ Phased implementation with measurable milestones
- ✓ Iterative approach - evaluate results & enhance plan, as appropriate
- ✓ Focus - cumulative reductions in loading



Problem Solving Framework

Public Involvement

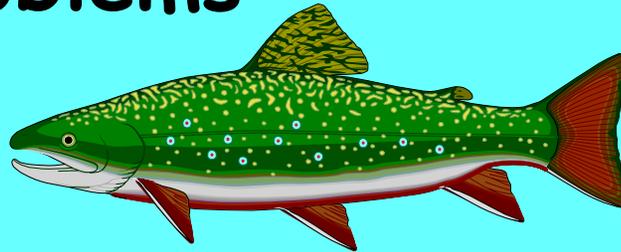
- ✓ Fundamental to successful watershed plan development & implementation
- ✓ Challenge of explaining technical concepts & information in *"plain English"*
- ✓ Enormous effort, time, & resources to achieve meaningful participation
- ✓ Genuine commitment to listen, consider, & utilize citizen input



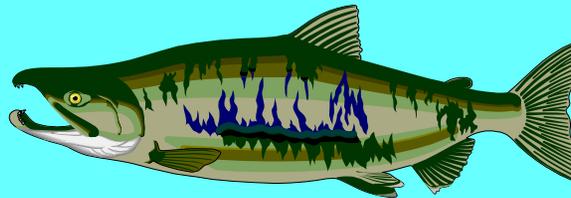
Hydrology-Based Framework

Making It Work !!!

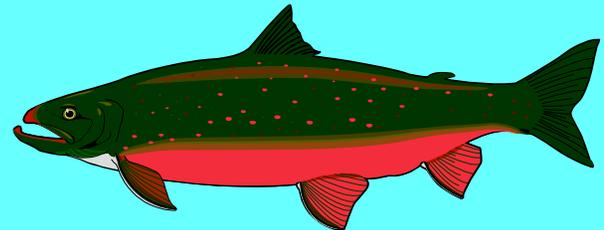
 Target Problems



 Geographic Focus



 Environmental Results



Hydrology-Based Framework

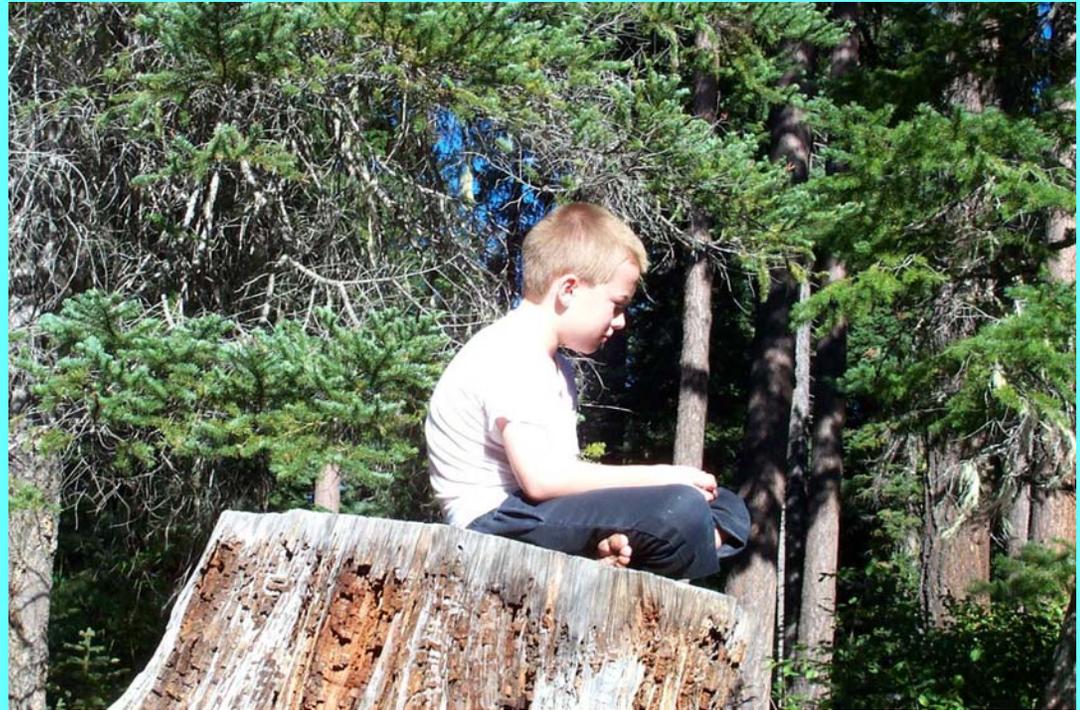
Thanx for Your Time

★ Discussion ...

✓ Examples

✓ Opportunities

✓ Issues



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