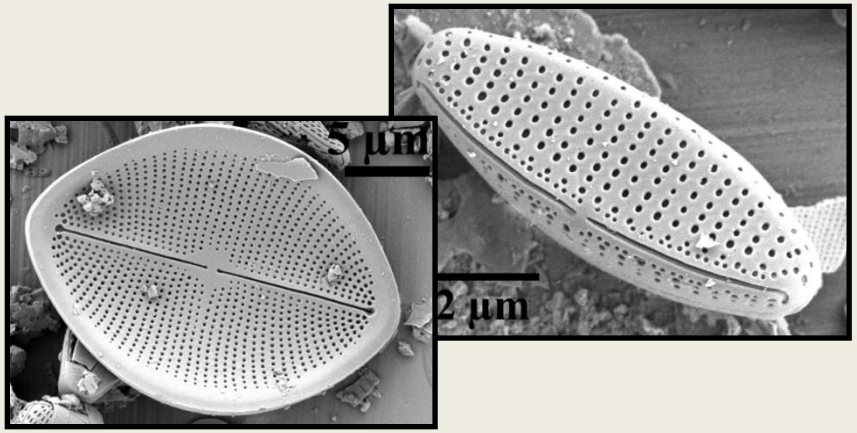
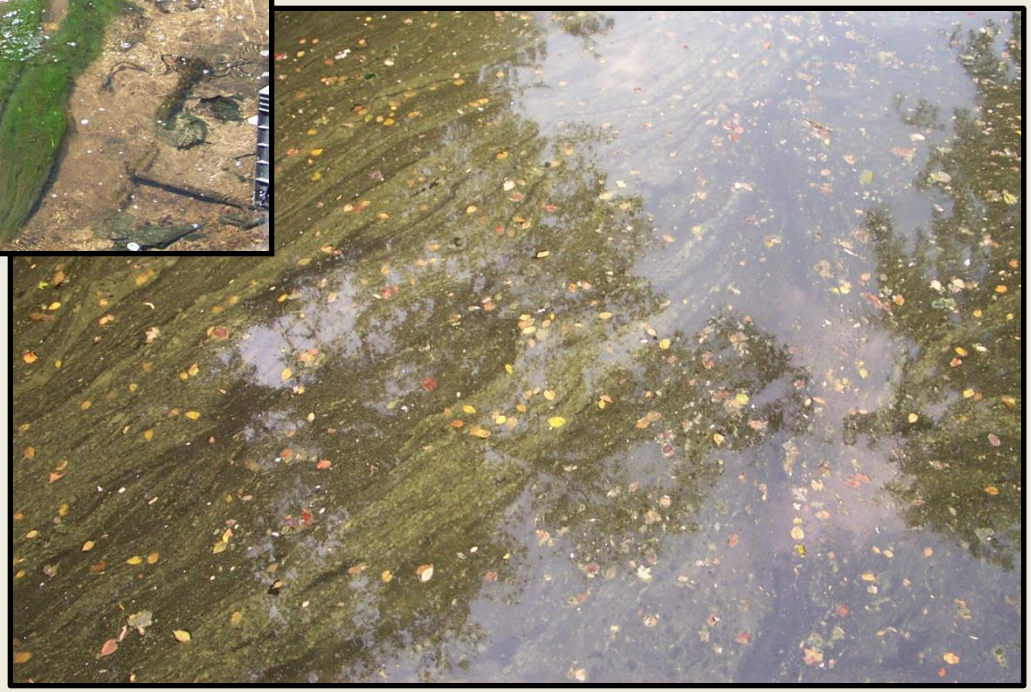
CT DEP Interim Nutrient Management Strategy for Non-Tidal Waste Receiving Streams





CT DEP 2009 Interim Nutrient Management Strategy

- CT DEP Went to Public Notice with Beacon Falls NPDES Permit
- EPA Evaluated and Objected to the Permit Primarily Based on Concerns with Phosphorus Limits

Final Proposed BMP Requirement	BM	Feasibility
High	0.1	ditional Filters and
Medium	0.7 mg/L	nomically Feasible with Or Biological Treatment If
Low	Ca	tment if Future

Addressing EPA Concerns: CT NPDES Phosphorus Limits

EPA Concerns (Re: Beacon Fall CT NPDES Draft Permit Letter June 18, 2010)

- "The Naugatuck River is listed as **impaired for aquatic life**, and municipal point source discharges are listed as one of the causes of impairment."

- "**No analyses of (aquatic life) data** relative to general impairment status or eutrophication impacts was presented."

- "CTDEP must **conduct an appropriate analysis** of the potential that phosphorus in the discharge will cause or contribute to a violation of water quality standard and, if so, must establish a WQBEL…"

EPA Proposed Interim Nutrient Management Strategy

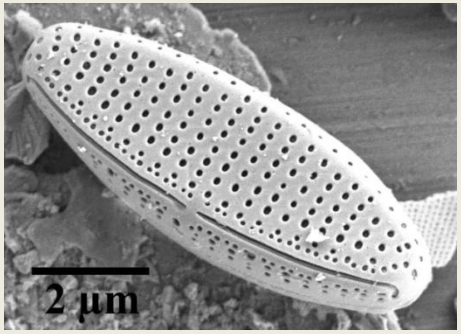
1986 Gold Book Total Phosphorus Recommendations

Habitat	Concentration
Stream at the point where it enters any lake or reservoir	50 µg/L
Within a lake or reservoir	25 µg/L
Stream or other flowing waters not discharging directly to lakes or impoundments	100 µg/L

Addressing EPA Concerns: CT Interim Nutrient Management Strategy for Waste Receiving Streams

CT DEP Response (Re: Beacon Fall CT NPDES Draft Permit Letter June 18, 2010)

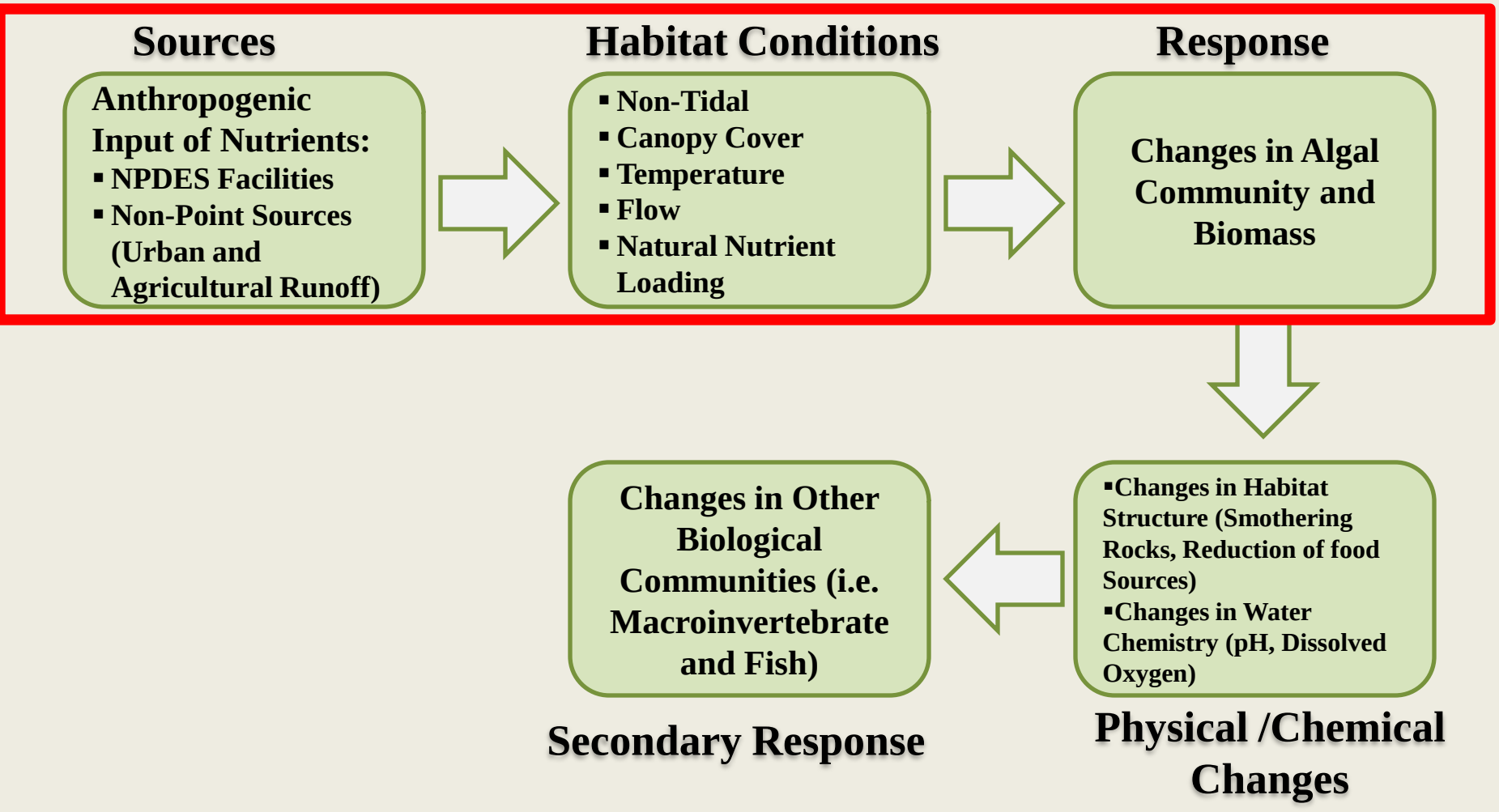
- Using best available science, we shifted the strategy to develop biologically based Phosphorus Limits for NPDES facilities that meet aquatic life designated uses



CT DEP Interim Nutrient Management Strategy

- Focused on changes in stream algal species composition because they respond directly to nutrients and provide a better indicator of enrichment condition in streams than assessment of water chemistry, macroinvertebrates, fish or algal biomass (EPA, 2000).

- Species composition of stream algae communities is also more likely to reflect actual stream conditions because they integrate the effects of stressors over time and space (Stevenson, 2006).



CT DEP Interim Nutrient Management Strategy

Sources

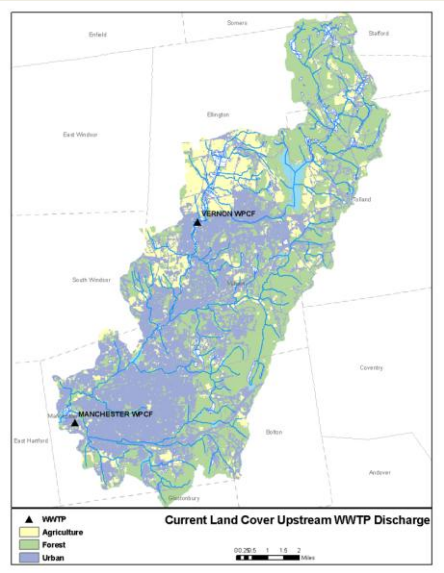
Anthropogenic Input of Nutrients:
- **NPDES Facilities**
- **Non-Point Sources (Urban and Agricultural Runoff)**

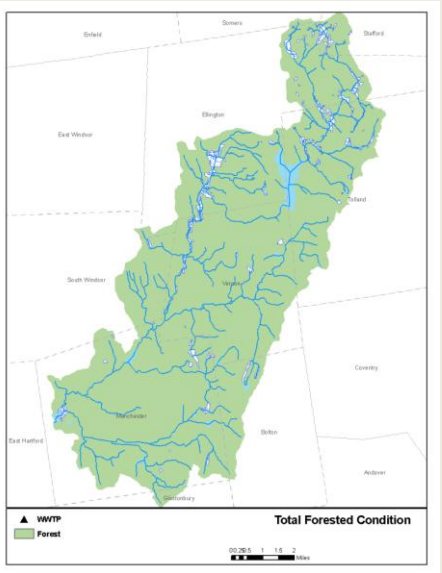
Habitat Conditions
- **Non-Tidal**
- **Canopy Cover**
- **Temperature**
- **Flow**
- **Natural Nutrient Loading**

Response

Changes in Algal Community and Biomass

$$\text{Enrichment Factor (EF)} = \frac{\text{Total NPDES Load (lbs/day) + Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}$$





Enrichment Factor (EF)

Example:

Current Load (lbs/day)	205.3
Forested Load (lbs/day)	4.80
Enrichment Factor	42.79

CT DEP Interim Nutrient Management Strategy

Sources

Anthropogenic Input of Nutrients:
- **NPDES Facilities**
- **Non-Point Sources (Urban and Agricultural Runoff)**

Habitat Conditions
- **Non-Tidal**
- **Canopy Cover**
- **Temperature**
- **Flow**
- **Natural Nutrient Loading**

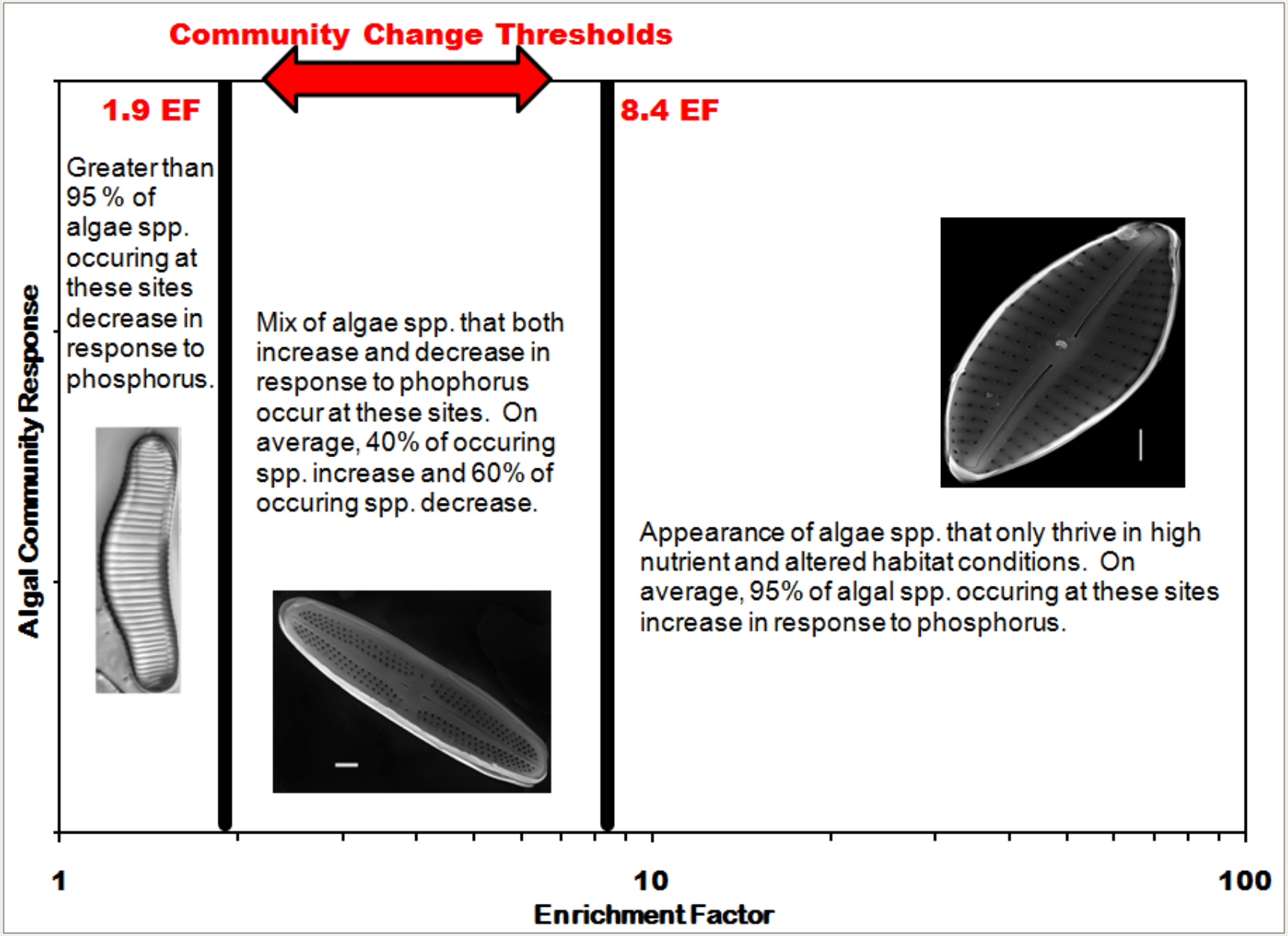
Response

Changes in Algal Community and Biomass

- Stream Algae Species Data Collected From 2002 – 2004
- 78 Sites
- EF Range from 1.2 - 76
- Readily Available GIS Data and Statistical Tools
- Identify Initial Statewide EF goal to Issue Permits and Protect the Environment. Conducting Additional Studies to Better Incorporate Varying Habitat Conditions and Refine Stream Goals.

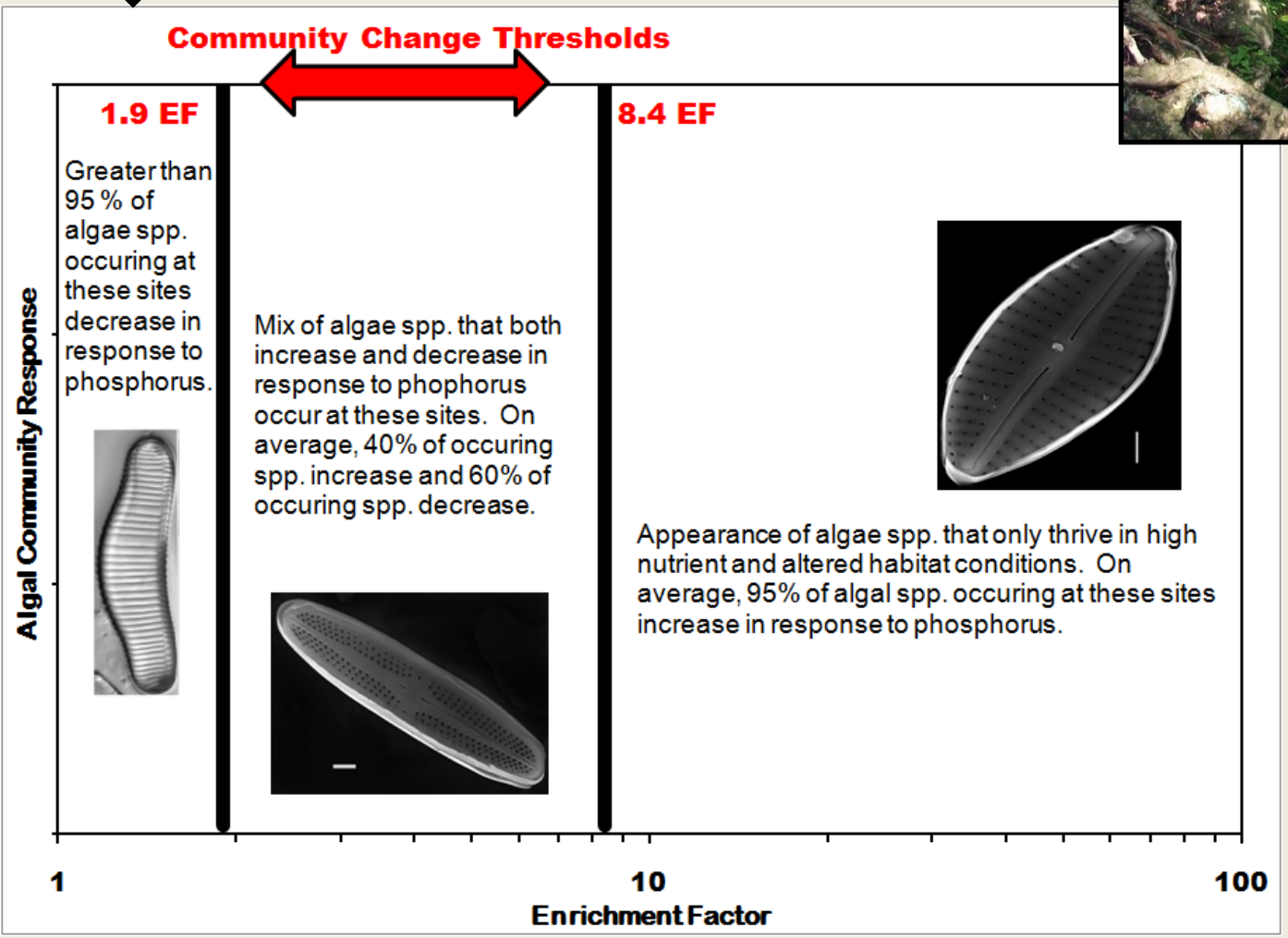
CT DEP Interim Nutrient Management Strategy

Conducted a statistical analysis that looked at algal species changes in response to the Enrichment Factor (EF)



CT DEP Interim Nutrient Management Strategy

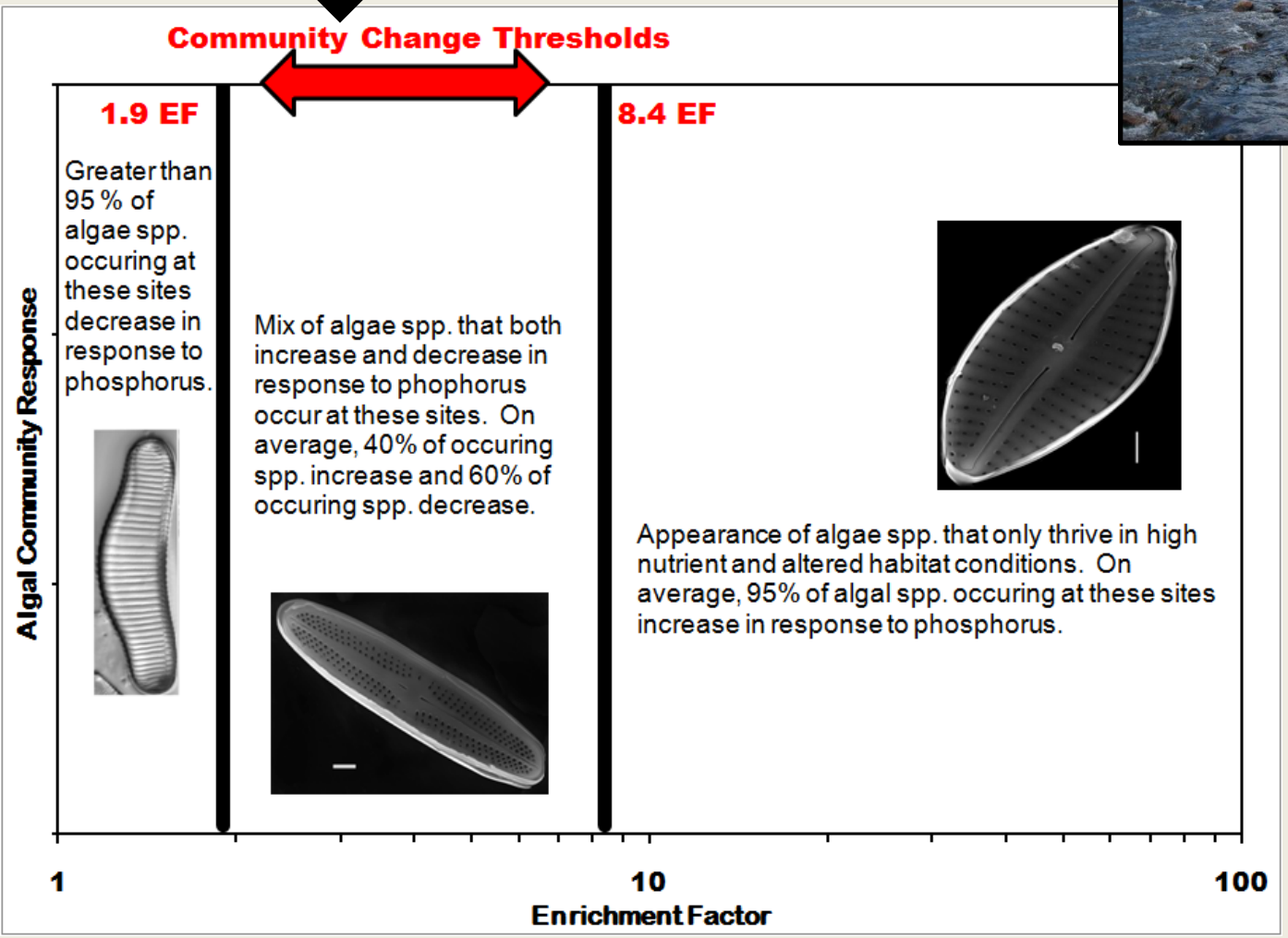
Beach Brook in Granby (EF = 1.89)



- Small Drainage Basin (**1.2 mi^2**)
- Minimal Disturbance
- Dense Canopy (Tree Cover)

CT DEP Interim Nutrient Management Strategy

Farmington River in Canton (EF = 3.8)

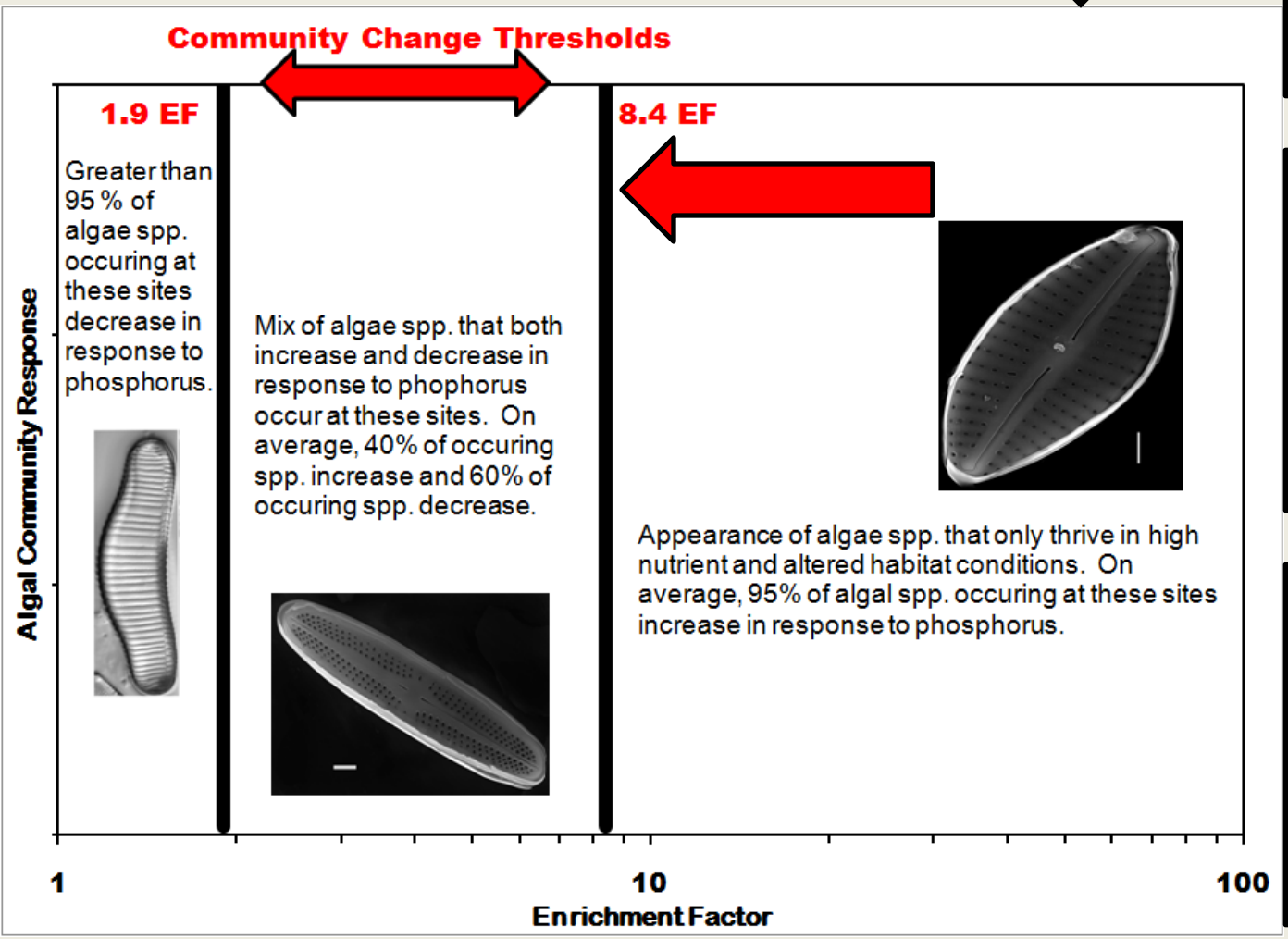


- Large Drainage Basin (**354 mi^2**)
- Moderate Disturbance
- Open Canopy (Tree Cover)

CT DEP Interim Nutrient Management Strategy

Naugatuck River in Beacon Falls
(EF = 50)

Quinnipiac River in Meriden
(EF = 52)



DEP Interim Strategy for Issuing NPDES Permits Until Full Nutrient Strategy Criteria is Developed

- Maintain an in-stream enrichment factor of 8.4 throughout the drainage basin

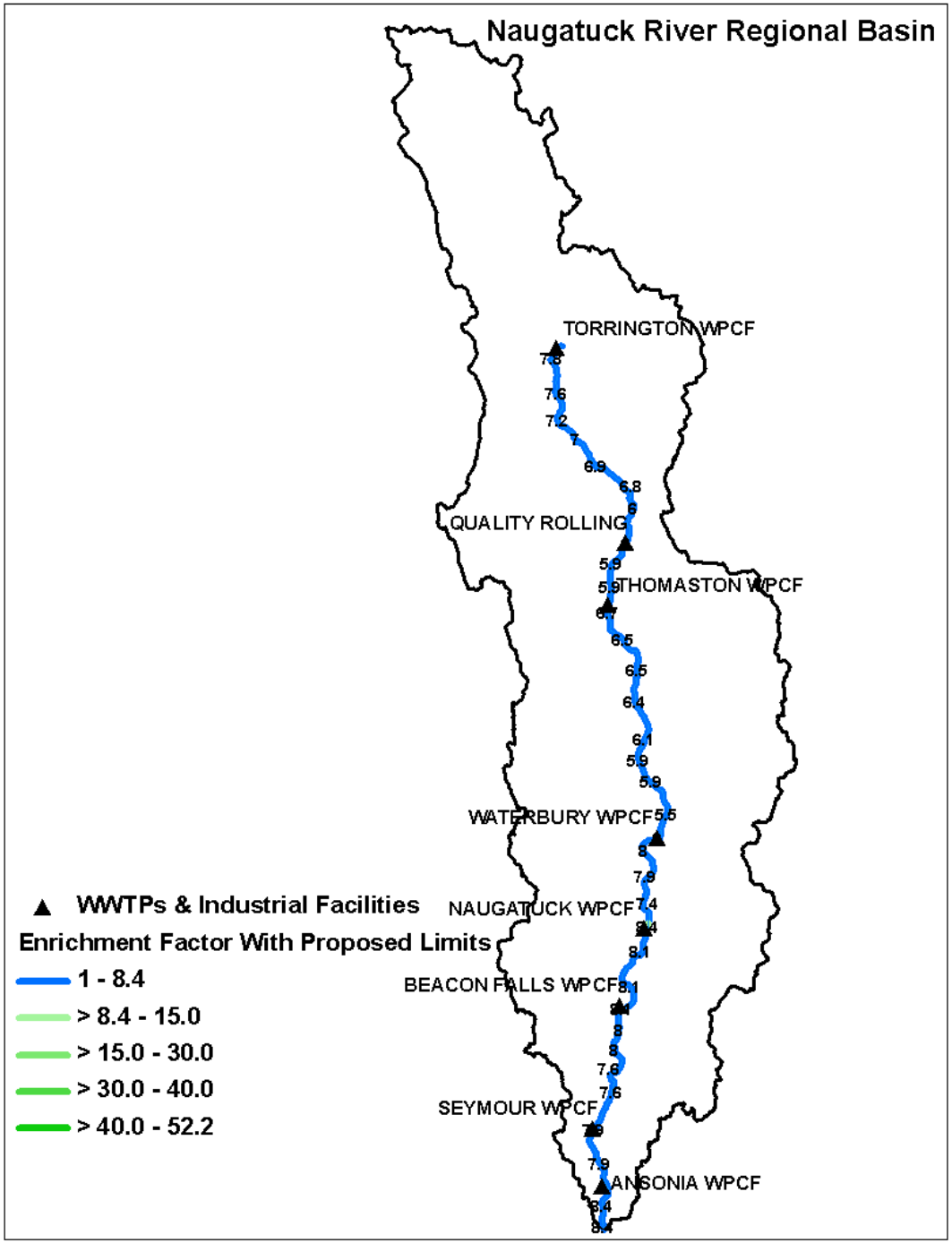
Margin of Safety

- Conservatively Assumed No Reductions in Current Land Cover / Use Loadings
- Assumed No Attenuation
- NPDES Facilites Load Based on Current Flow Rate (Increases in Flow Rate Would Require NPDES Facilities to Lower Effluent Concentrations of Nutrients in Order to Meet Mass-based Nutrient Loading Limit)

East Branch Naugatuck River in Torrington. July 2010.

Implementation Example: Naugatuck River Basin

- Watershed-Based Analysis Using GIS To Assess Current Phosphorus Loads
- Calculated the Current Enrichment Factor at Multiple Locations along Waste Receiving Streams
- Conducted a Loading-Based Analysis to Determine Reductions in Phosphorus Needed at Each Facility to Meet the Goal of 8.4 or Less

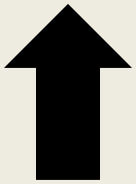


Implementation Example: Naugatuck River Basin

$$\text{Enrichment Factor (EF)} = \frac{\text{Total NPDES Load (lbs/day) + Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}$$

Current

NPDES	Flow (MGD)	Concentration (mg/L)	NPDES Load (lbs/day)	Forested Load (lbs/day)	Enrichment Factor At Discharge
TORRINGTON WPCF	5.18	**1.68**	64.73	3.63	**21.0**
QUALITY ROLLING & DEBURRING	0.09	**0.7**	0.53	6.72	**13.1**
THOMASTON WPCF	0.88	**3.29**	22.68	7.29	**15.5**
WATERBURY WPCF	20.52	**3.19**	539.92	13.87	**49.0**
NAUGATUCK WPCF	4.92	**4.3**	159.97	16.26	**52.2**
BEACON FALLS WPCF	0.32	**3.19**	7.91	17.66	**48.7**
SEYMOUR WPCF	1.29	**3.98**	41.09	20.05	**45.4**
ANSONIA WPCF	2.04	**2.89**	43.32	20.65	**46.2**



Current Average Seasonal (April through October) Flow, Concentration and Load Based on Submitted NAR Data (Typically 2001 – 2007)

Implementation Example: Naugatuck River Basin

$$\text{Enrichment Factor (EF)} = \frac{\text{Total NPDES Load (lbs/day) + Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}$$

Proposed Seasonal (April through October) Management Limits

NPDES	Flow (MGD)	Concentration (mg/L)	NPDES Load (lbs/day)	Forested Load (lbs/day)	Enrichment Factor At Discharge
TORRINGTON WPCF	5.18	**0.4**	17.29	3.63	**7.9**
QUALITY ROLLING & DEBURRING	0.09	**0.7 (Cap)**	0.53	6.72	**6.0**
THOMASTON WPCF	0.88	**1**	7.35	7.29	**6.9**
WATERBURY WPCF	20.52	**0.2**	34.26	13.87	**8.0**
NAUGATUCK WPCF	4.92	**0.4**	16.43	16.26	**8.4**
BEACON FALLS WPCF	0.32	**1**	2.67	17.66	**8.1**
SEYMOUR WPCF	1.29	**0.7**	7.54	20.05	**7.9**
ANSONIA WPCF	2.04	**0.7**	11.92	20.65	**8.4**

Current Average Seasonal (April through October) Flow Based on Submitted NAR Data (Typically 2001 – 2007)

Concentration Rounded to the Nearest Tenth

Load = Current Flow * Proposed Concentration

In some cases the EF is below 8.4 to ensure that the goal is met downstream

Implementation Example: Quinnipiac River Basin

$$\text{Enrichment Factor (EF)} = \frac{\text{Total NPDES Load (lbs/day) + Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}$$

Current

NPDES	Flow (MGD)	Concentration (mg/L)	NPDES Load (lbs/day)	Forested Load (lbs/day)	Enrichment Factor At Discharge
SOUTHINGTON WPCF	4.51	**2.74**	100	3.72	**30.81**
CHESHIRE WPCF	2.43	**4.61**	88.2	3.75	**44.94**
MERIDEN WPCF	10.44	**1.47**	121.64	4.22	**52.74**
WALLINGFORD WATER & SEWER	5.36	**3.46**	145.16	4.28	**66.24**
CYTEC INDUSTRIES INC.	1.79	**1.31**	19.44	4.53	**67.6**

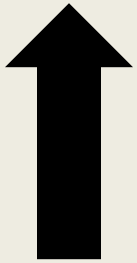
Current Average Seasonal (April through October) Flow, Concentration and Load Based on Submitted NAR Data (Typically 2001 – 2007)

Implementation Example: Quinnipiac River Basin

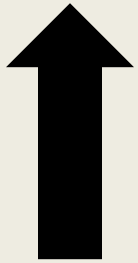
$$\text{Enrichment Factor (EF)} = \frac{\text{Total NPDES Load (lbs/day) + Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}$$

Proposed Seasonal (April through October) Management Limits

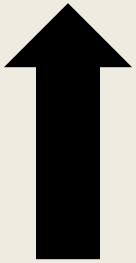
NPDES	Flow (MGD)	Concentration (mg/L)	NPDES Load (lbs/day)	Forested Load (lbs/day)	Enrichment Factor At Discharge
SOUTHINGTON WPCF	4.51	**0.2**	7.53	3.72	**6.0**
CHESHIRE WPCF	2.43	**0.2**	4.06	3.75	**6.6**
MERIDEN WPCF	10.44	**0.1**	8.71	4.22	**7.3**
WALLINGFORD WATER & SEWER	5.36	**0.2**	8.95	4.28	**8.3**
CYTEC INDUSTRIES INC.	1.79	**0.1**	1.49	4.53	**8.4**



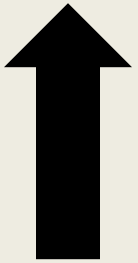
Current Average Seasonal (April through October) Flow Based on Submitted NAR Data (Typically 2001 – 2007)



Concentration Rounded to the Nearest Tenth



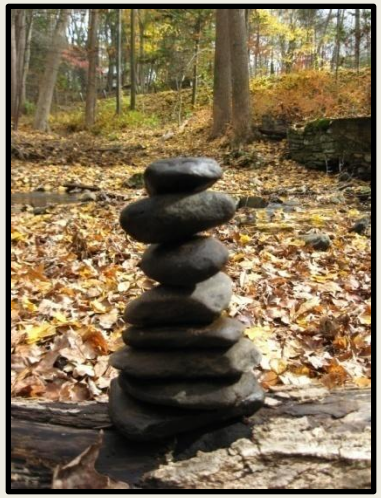
Load = Current Flow * Proposed Concentration



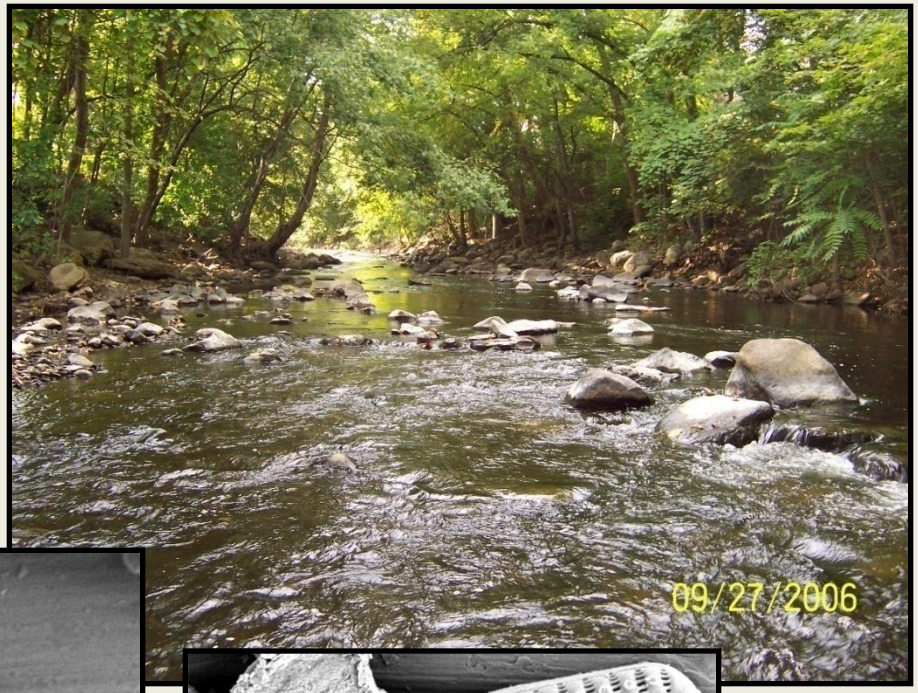
In some cases the EF is below 8.4 to ensure that the goal is met downstream

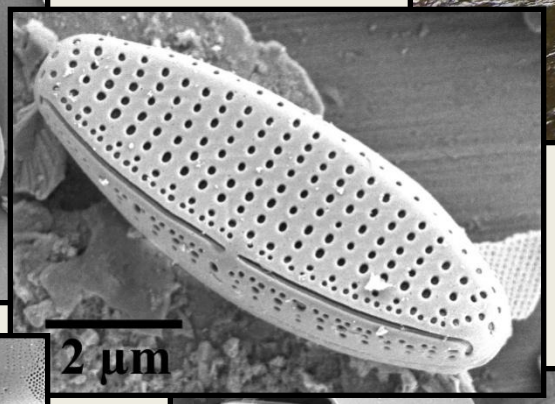
Next Steps: Adaptive Management

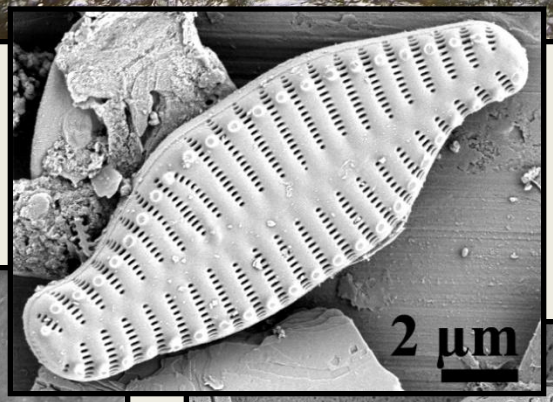
- **Expand Approach to Include Non-Waste Receiving Streams.**
- **Collecting Additional Stream Algae (Diatom) Species Data to Test and Improve Statistical Models.**
- **Continue Ongoing Monitoring and Research that Incorporates the Responsiveness of the Aquatic Systems to these Initial Steps to Manage Phosphorus from NPDES Permitted Sources as well as Growing Emphasis on Land-Based Management Practices Required Under Connecticut's WQS.**
- **Improve GIS Model to Better Incorporate Spatial and Temporal Habitat Conditions That Effect Changes in Stream Algae.**
- **May Refine the EF Target Goal to Better Reflect Watershed-Specific Conditions if Sufficient Information is Available in the Future.**

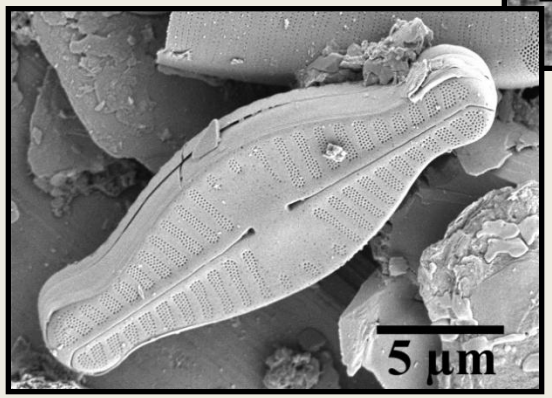


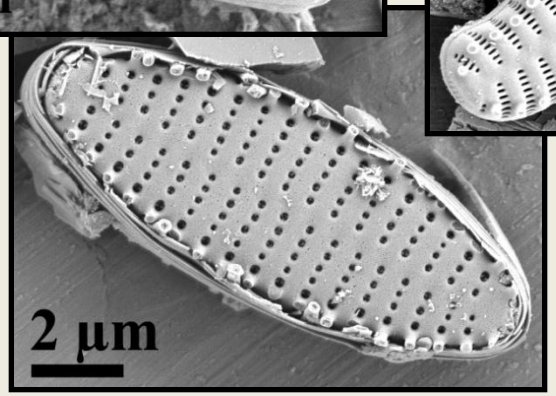
Questions?

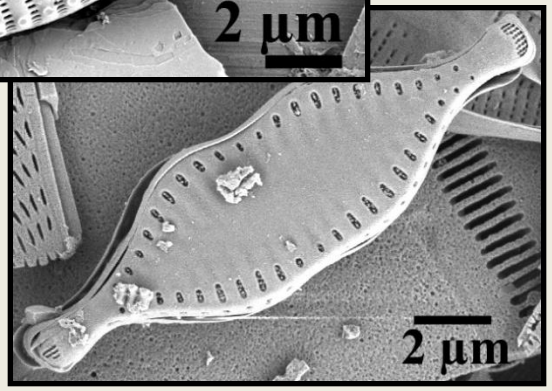












Diatom Images From Norwalk River At South Wilton CT: ANSP Algae Image Database from the Phycology Section, Patrick Center for Environmental Research, The Academy of Natural Sciences at http://diatom.acnatsci.org/AlgaeImage/