

# **NPDES Permitting and Sustainability:**

## **Conflicting Goals?**

**Thomas K. Walsh, P.E**  
**Jane E. Madden, P.E., BCEE**

Dr. Paula Rees, U. Mass. Dr. Jim Mangarillo, U. Mass.

***NACWA***  
***July 16, 2008***

- Are stringent NPDES nutrient limits necessary?
- Are they environmentally sustainable?
- Can we manage the permitting process better to achieve mutual goals?



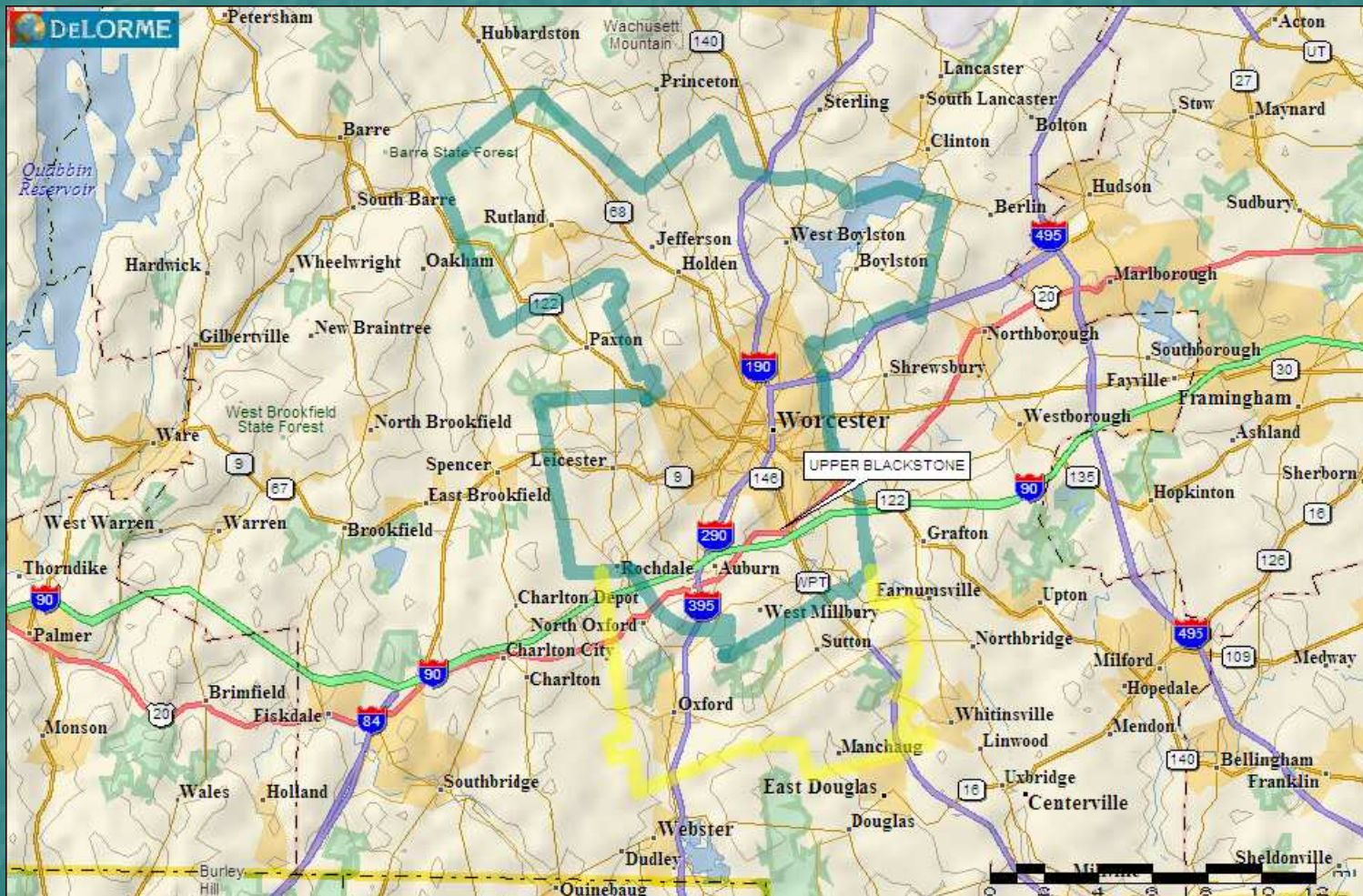
# UBWPAD: Where are we?





# What's an UBWPAD?

Auburn, CVSD, Holden, Millbury, Rutland, West Boylston, Worcester



250,000 People 95,000 Households



# Wastewater Treatment Facility



Secondary Treatment  
56 mgd Average Flow

120 mgd Peak Hourly Flow

# 2001 NPDES Permit

<b>CBOD<sub>5</sub></b>	Nov - April	25
	June - Oct	10
<b>TSS</b>	Nov - April	30
	June - Oct	15
<b>Ammonia</b>	Dec - April	12
	June - Oct	2
<b>Total Phosphorus</b>	Nov - Mar	Report
	April - Oct	0.75
<b>Total Nitrogen</b>		No limit



# UBWPAD Currently Undertaking \$180M Improvement Program

- Meet 2001 permit limits
- 4 Phased Program
  - Maintain Operation
  - Reduce rate shock
- Provide high flow management on-site
  - Avg. Flow = 45 mgd
  - Peak Flow = 160 mgd

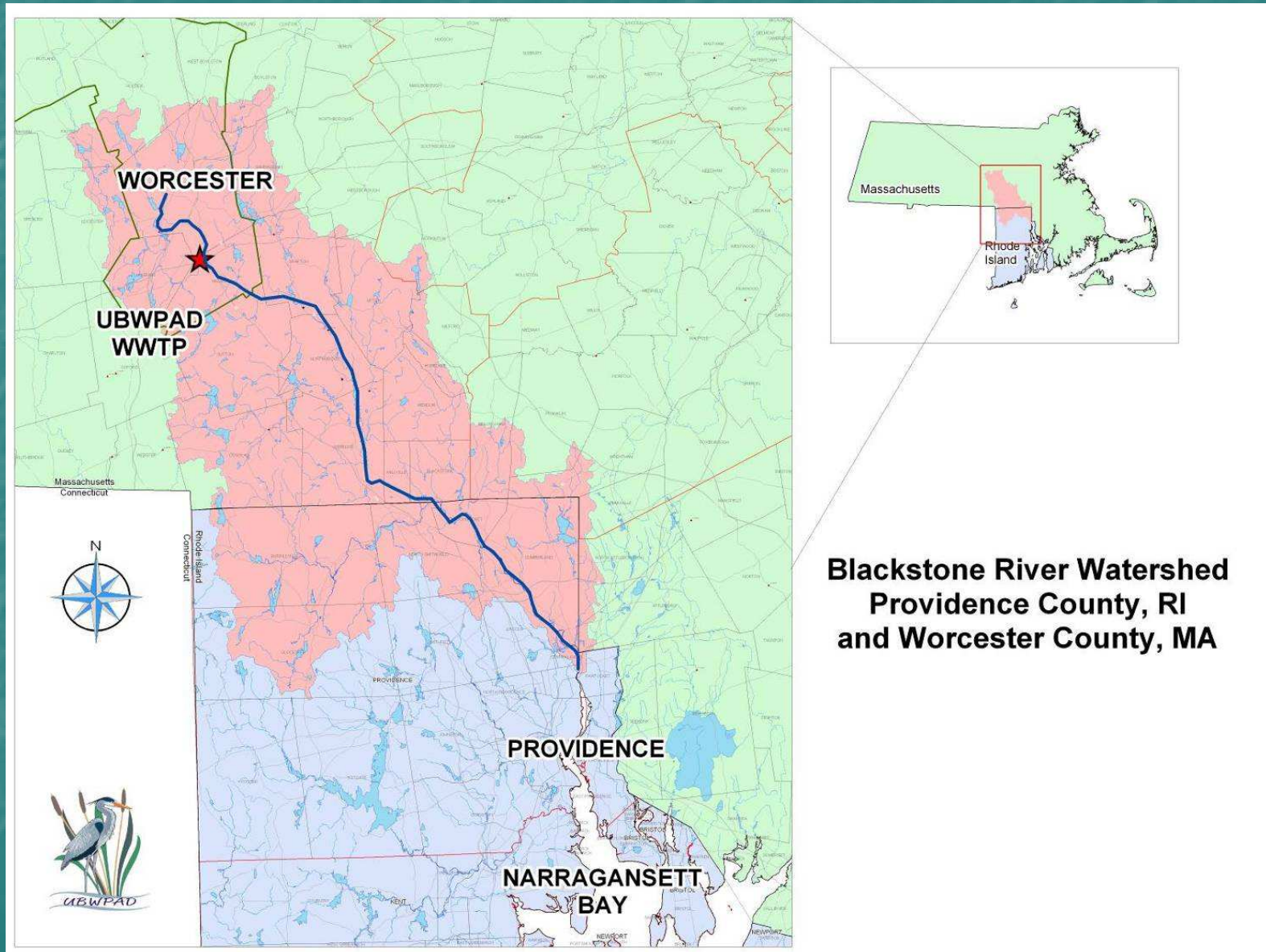


# Will Achieve Compliance with a Sustainable Design

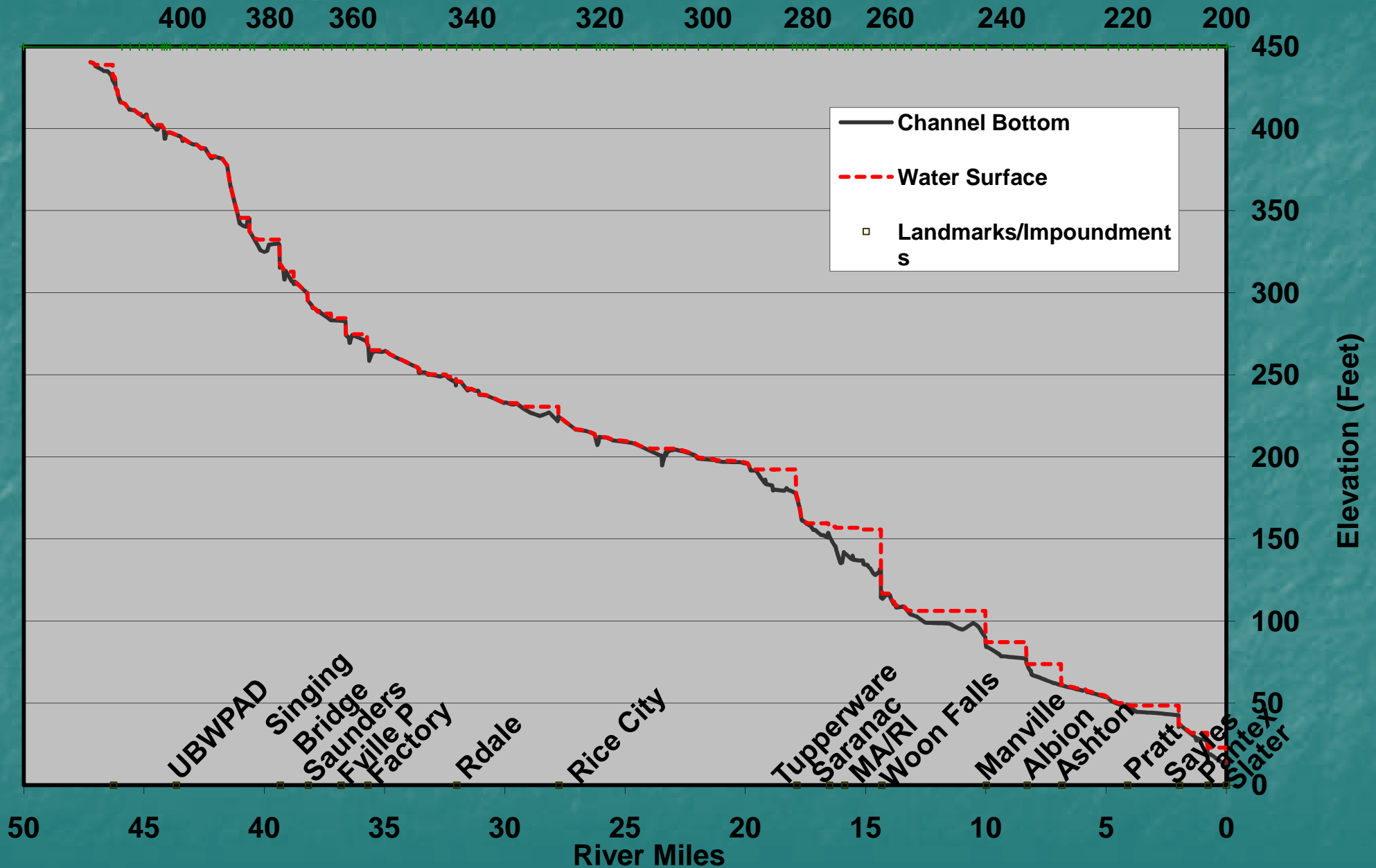
- Upgrade to BNR treatment system
  - Can operate in various modes
- Denitrification incorporated to reduce aeration energy and minimize alkalinity adjustment
  - Can achieve
    - 7 – 10 mg/L Total N
    - 0.6 to 0.7 mg/L Total P
- No Chemical Addition



# Blackstone River Watershed



# River Profile From HEC-RAS Model





# First River to Use Hydropower to Fuel the Industrial Revolution





# Shows Signs of Stress Common to Urban Waterways





# Sediment Reflect Past Industrial Abuses





# Eight Treatment Facilities Discharge to Blackstone River and One CSO Facility





# Ongoing River Modeling Evaluating

- Contaminant Sources
  - Point
  - Non-point
- Fate and transport of contaminants over full hydrologic cycle
- Impoundment management
- Cost-benefit of river restoration decisions

# Despite Progress EPA and MassDEP Issued New Draft NPDES Permit in March 2007

		Permit 2001	2007 Permit
Total Phosphorus	April - Oct	0.75	0.1
	Nov - Mar	Report	1
Total Nitrogen	May - Oct	No Limit	5
	Nov - April	No Limit	Report



# Revised Treatment Processes to Achieve Limits

- Conversion to Modified Bardenpho Process
  - For N removal
  - Requires additional aeration tanks
  - Methanol addition
- High Rate Clarification for TP
  - Multi-point chemical addition with ferric chloride
  - Intermediate pumping
- Full treatment of 160 mgd

# COSTS ?

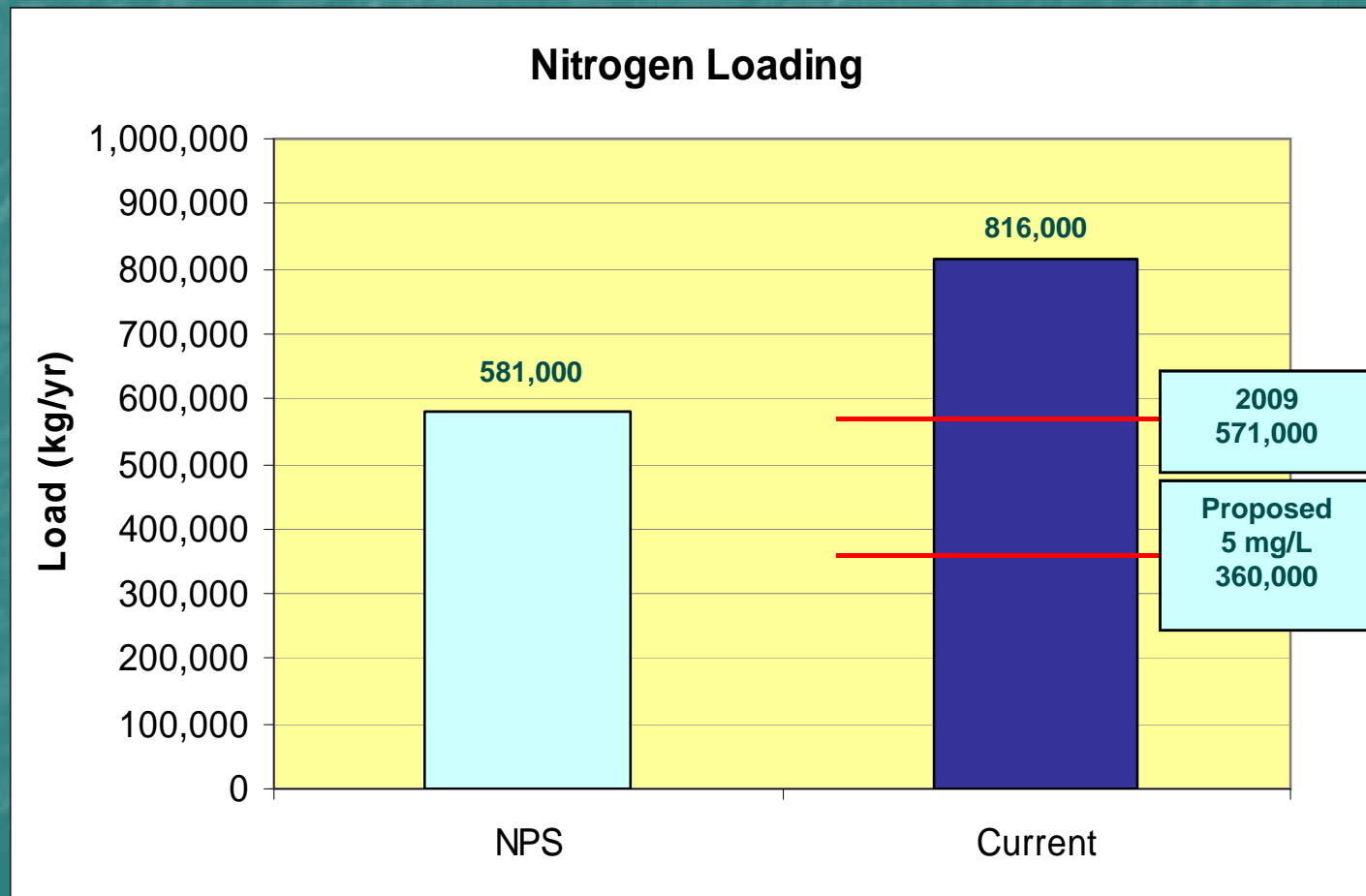
- \$200 million more capital
  - \$10 million/year debt service
- \$5 million/year in operating costs



# Comments Submitted on Draft Permit

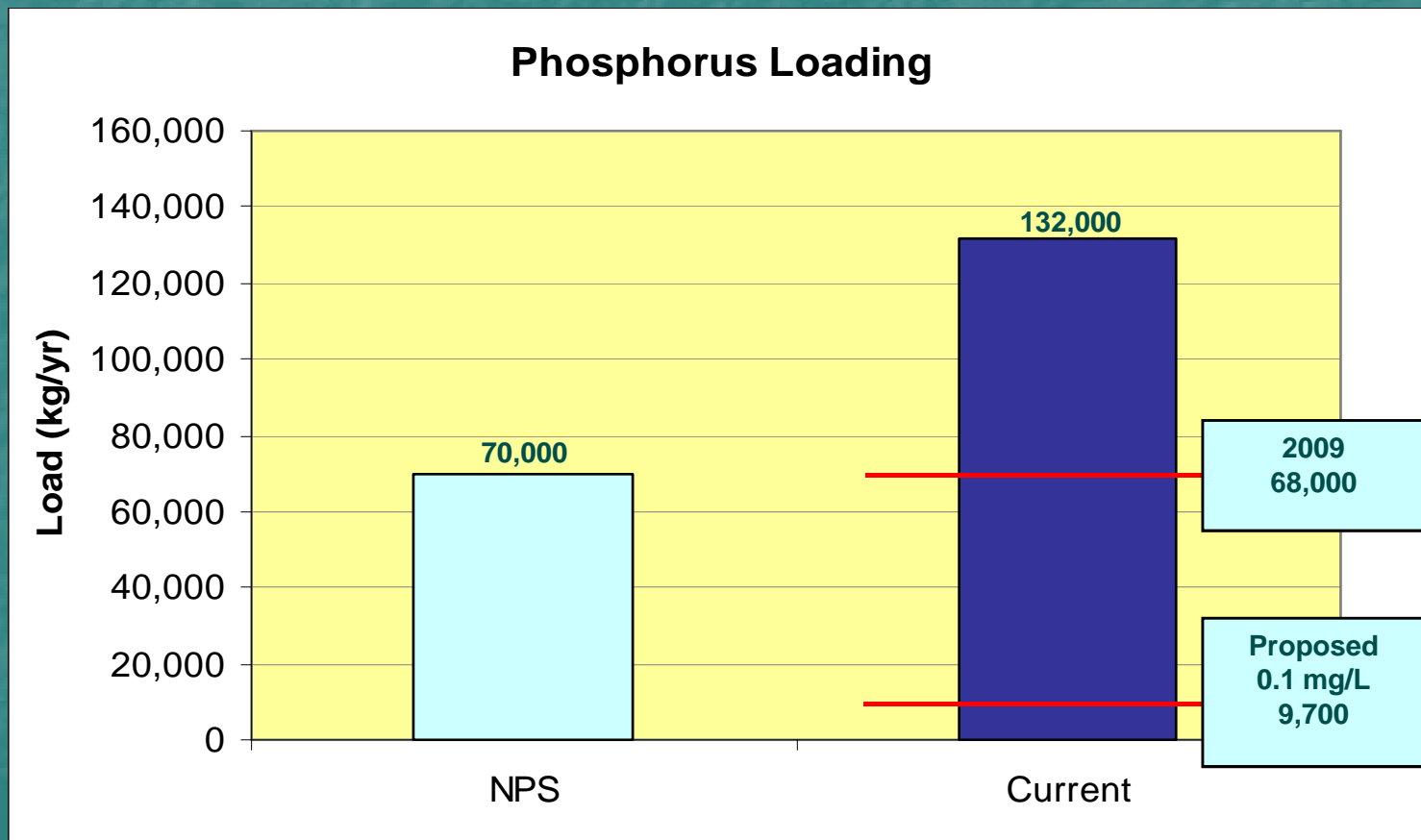
- Little scientific basis for reducing nutrient limits
- Significant economic and environmental impacts to achieve limits

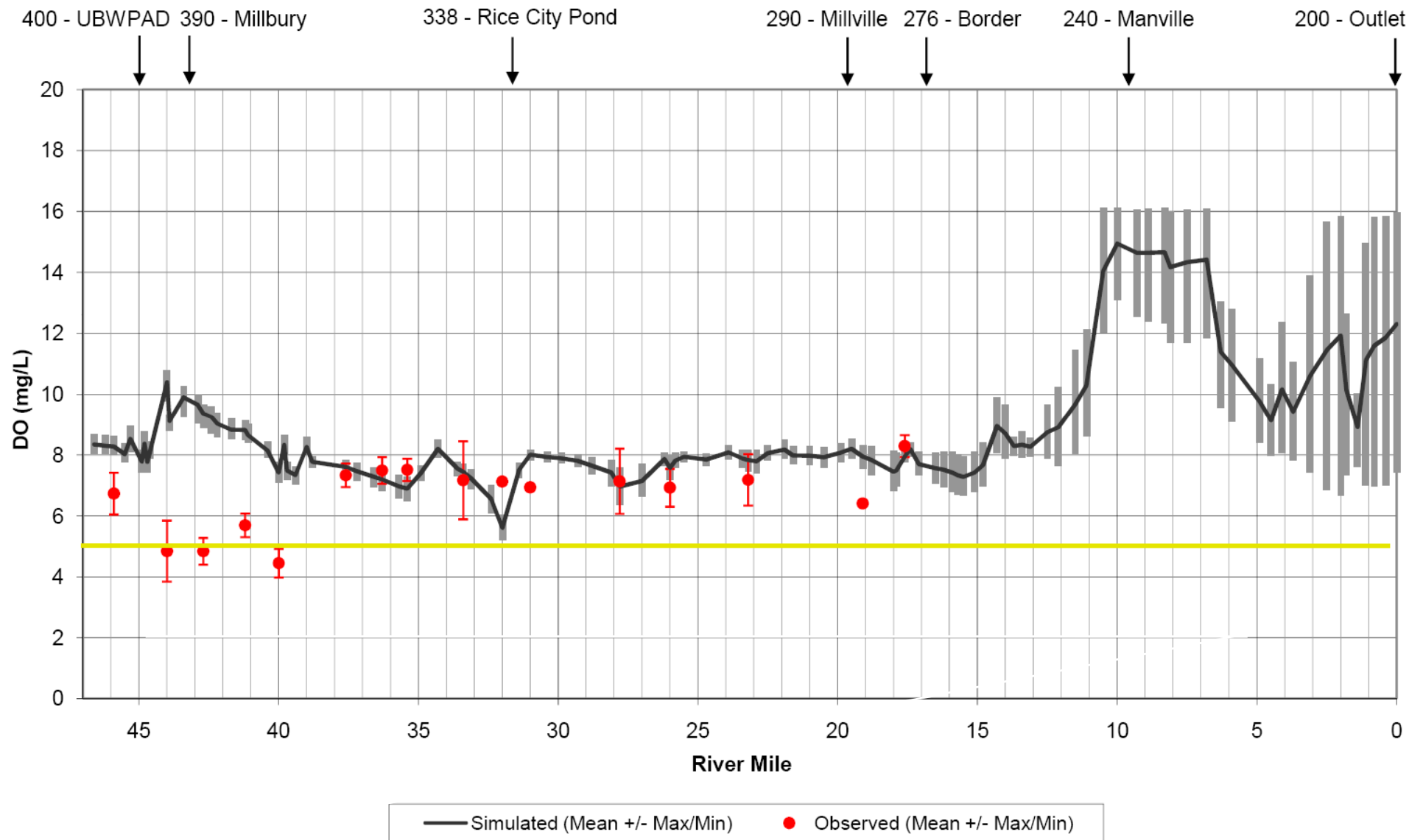
# Nitrogen Loading to Blackstone River





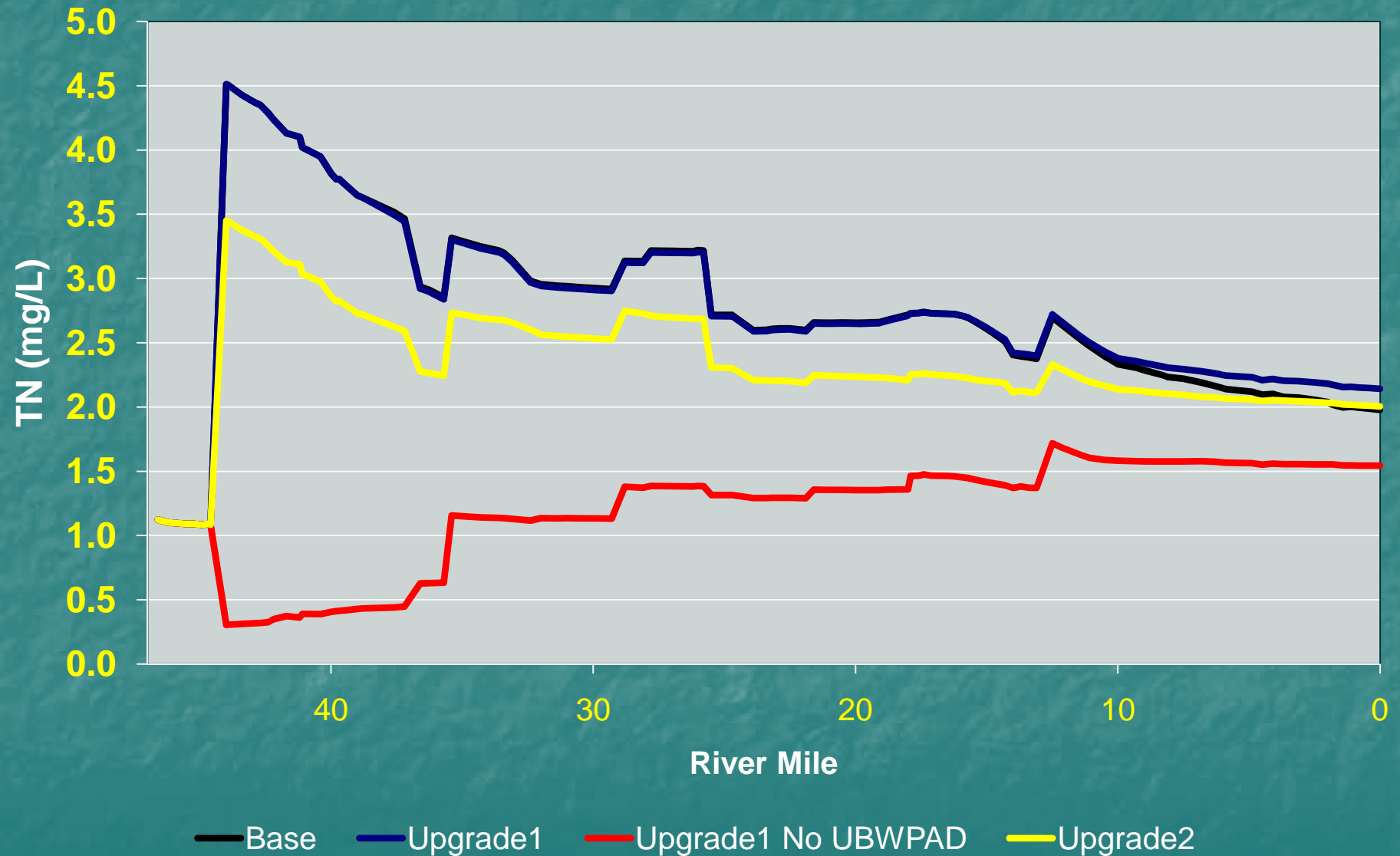
# Phosphorus Loading to Blackstone River



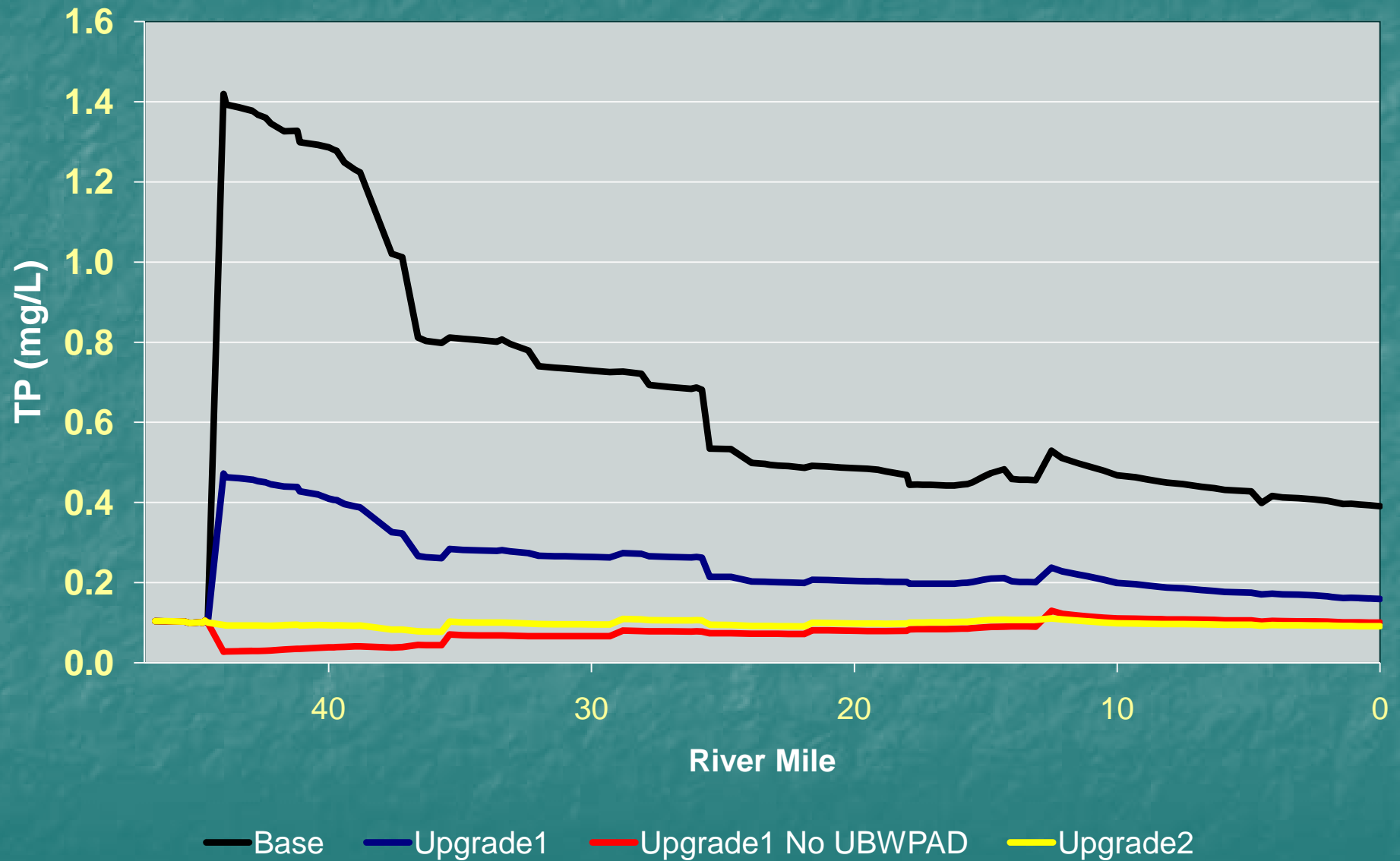




# Blackstone River Model - Scenario Simulations - **TN**

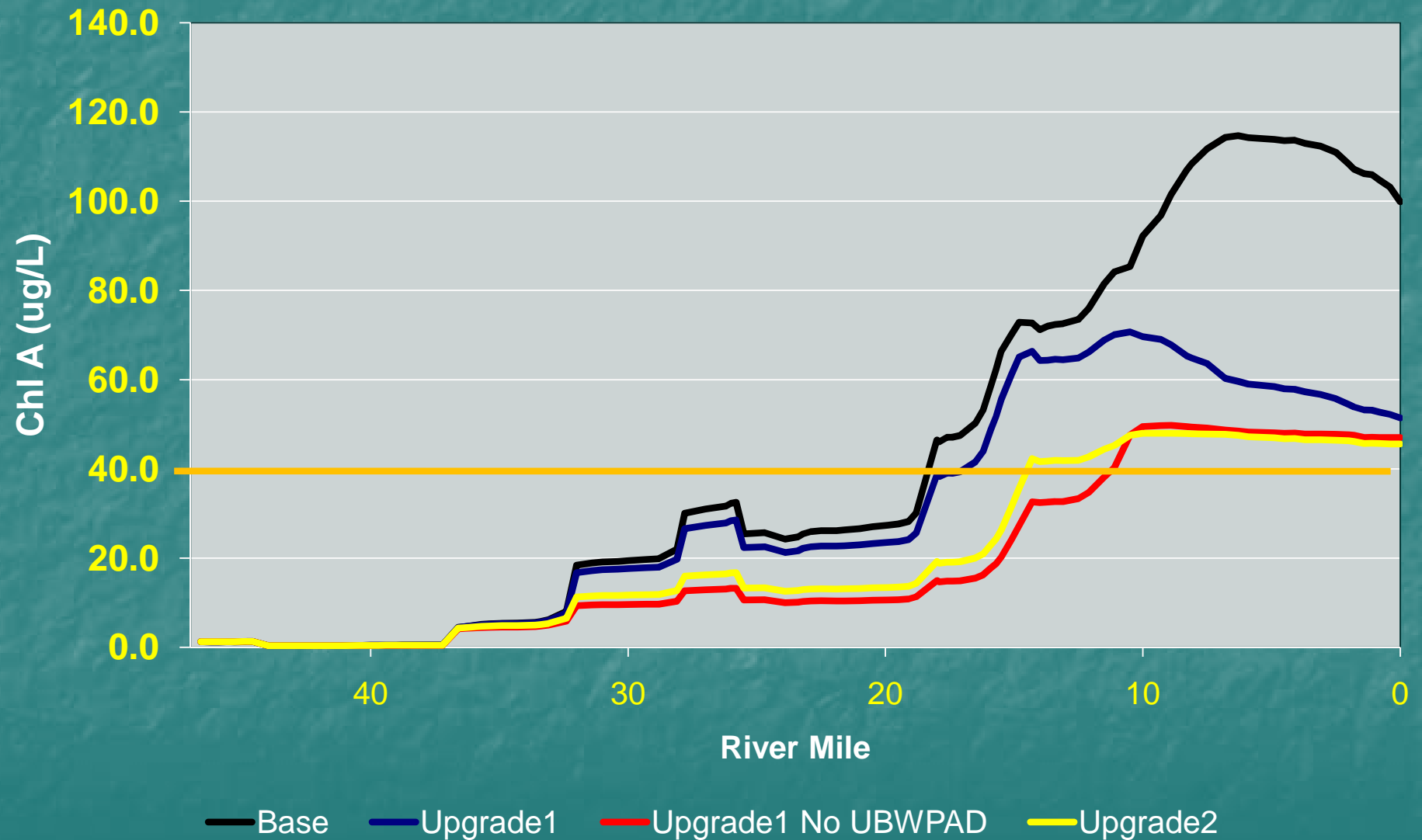


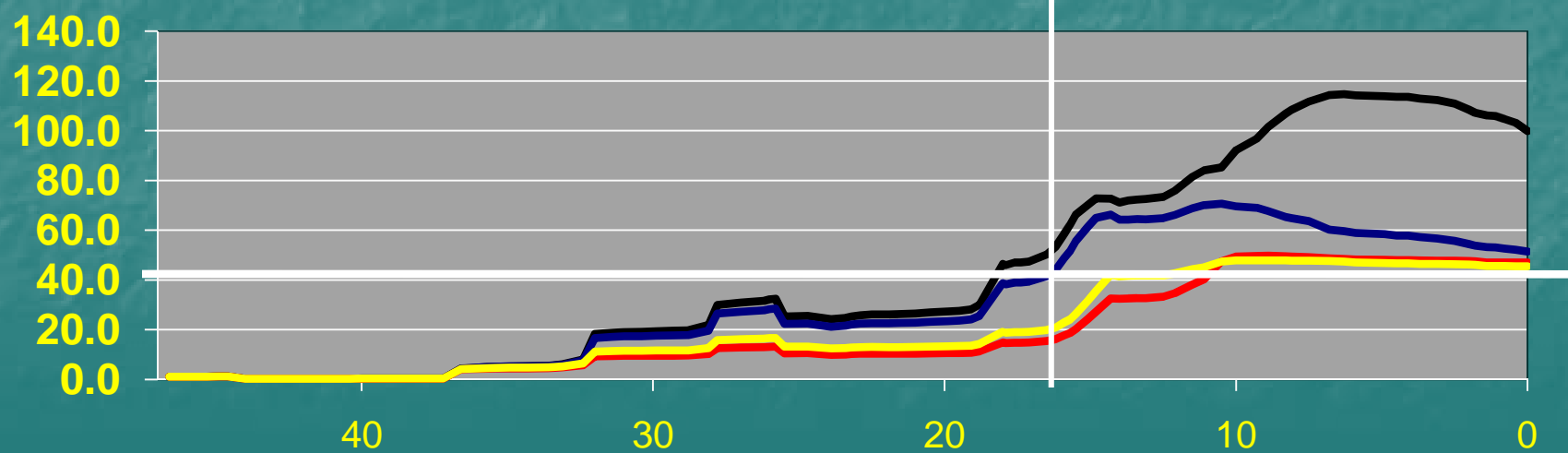
# Blackstone River Model - Scenario Simulations - **TP**





# Blackstone River HSPF Model - Scenario Simulations - Chl a







# Detrimental Environmental Impacts to Achieve Extreme Permit Limits

- Power use
- Chemical consumption
- Sludge production
- Air emissions

# 20% Increase in Power Consumption

- Additional 3,000,000 kWh annually
- Intermediate pumping
- High rate clarification
- Additional aeration
- 4,650,000 pounds of CO<sub>2</sub> annually

# Five Additional 8,000 gallon Tanker Trucks per Day



- 150,000 gallons of methanol annually
- 1.8 MG ferric seasonally
- GHG emissions associated with chemical delivery



# 14% Increase in NOx Emissions from Multiple Hearth Furnaces

- Decrease in sludge % solids
- Increase in inerts
- Lower sludge BTU value
- Increase in natural gas to maintain burn



# 50% Increase in Sludge Production and Four-fold Increase in Ash Production

- 5-6 more trucks per week
- Capacity of landfill consumed more readily
- Increase in dust



# RESOURCES !

- 3,000,000 kWh of power annually,
  - enough to power 600 homes;
  - enough to generate 4,650,000 pounds of CO<sub>2</sub>
- 1,825,000 gallons of ferric chloride
- 8,162,000 gallons of Sodium Hydroxide
- 150,000 gallons of methanol
- 20,600,000 cubic feet of natural gas
  - enough to heat 500 homes
  - enough to increase NO<sub>x</sub> emissions by 14%



# Regulators need to Balance Cost-Benefit of NPDES Permit Limits

- Consider indirect impacts of achieving nutrient limits
- Understand site specific receiving water conditions
- Look for alternative solutions to achieve water quality standards
  - Investigate impoundment management
  - Consider removal of some dams

# Practitioners Must Push for Sustainable Solutions

- Optimize biological nutrient removal
  - Without chemical addition
- Minimize non-point source contributions
- Educate public and legislators regarding:
  - Limited benefits and high costs to achieve more stringent limits
  - Environmental impacts of stringent limits
  - Questionable sustainability of stringent limits

