NC
Nothing Compares
NORTH CAROLINA

Nutrient Management

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What is Nutrient Management?

- Nitrogen (N) and Phosphorous (P) are nutrients needed by all living organisms
- N & P occur naturally in the environment
- N & P are also a by-product of development
  - Wastewater discharges
  - Fertilizers
  - Stormwater runoff
- Excessive levels of N & P in aquatic environment lead to algae growth
- Water quality standard for algae in NC waters measured by Chlorophyll a levels
  - NC Chlorophyll a standard = 40 ug/l or 40 parts per billion (ppb)
- Exceedance of this Chlorophyll a standard results in “impairment” of water under federal Clean Water Act
- Impaired waters require a Total Maximum Daily Load (TMDL) to correct problem

Total Maximum Daily Load (TMDL)

- TMDL required for all impaired waters not meeting water quality standards
- Management strategy for correcting impairment
- Requires reductions in both "point" and "non-point" sources of pollution
  - Point sources – Wastewater treatment plant discharge
    - Enhanced treatment technology
    - Plant upgrades
  - Nonpoint source controls
    - Stormwater runoff controls for new development
    - Buffers
    - Agricultural use of fertilizers
- TMDL required to address nutrient/chlorophyll a impairment is referred to as a "nutrient management strategy."
- 50,000 approved TMDLs in US
  - 35,000 in place for > 5 years
  - 83% achieve point source reduction targets
  - 20% achieve non-point source reduction targets

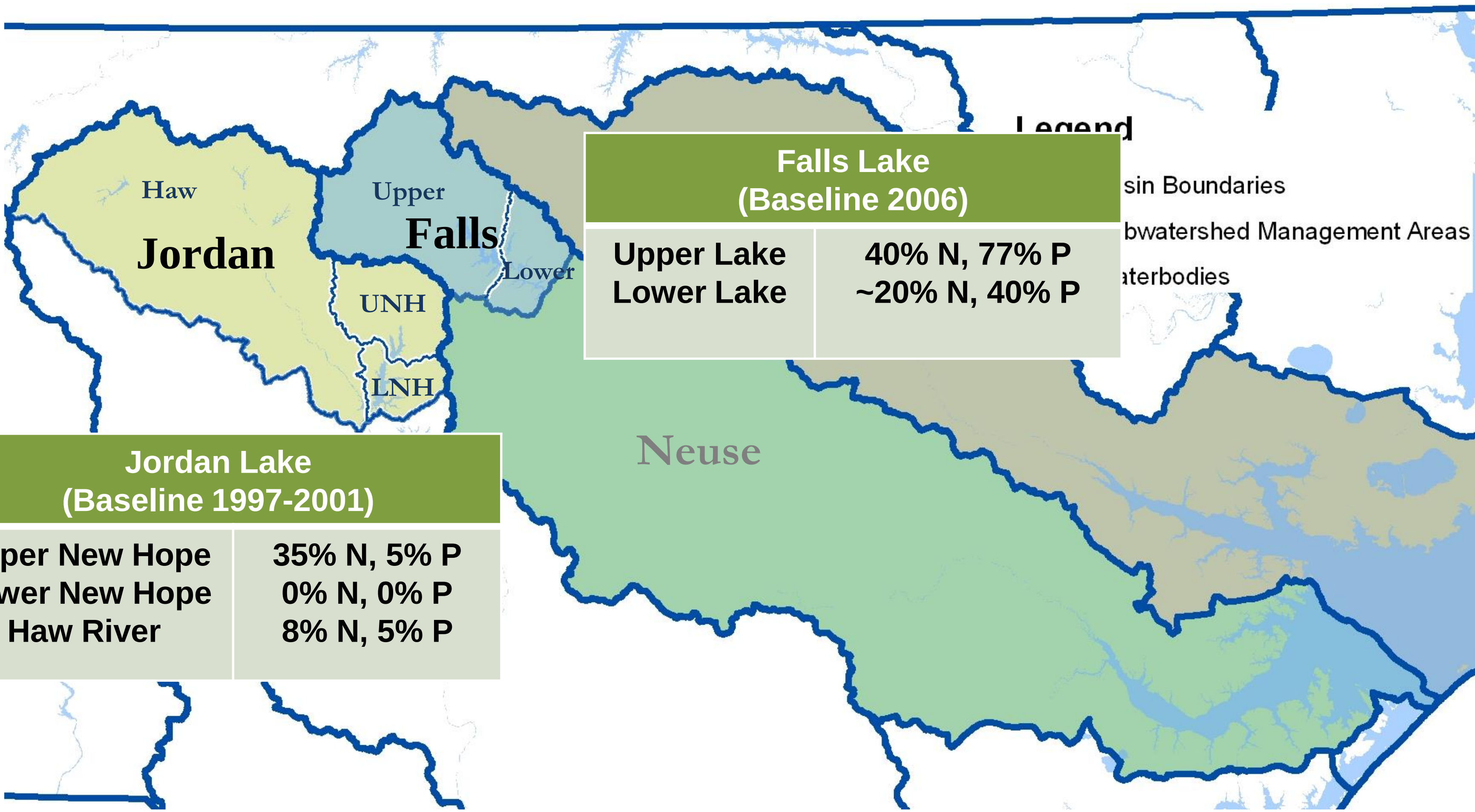
Nutrient Management in Reservoirs – Overview

- NC Waterbodies with Major Nutrient Management Strategies
  - Neuse and Tar-Pamlico Estuaries
  - Falls & Jordan Lakes

- Strategies Require Reductions from Point & Nonpoint Sources
  - Wastewater Treatment Plants
  - Agriculture
  - New Development Stormwater
  - Existing Development Stormwater (Falls & Jordan only)
  - Riparian Buffer Protection & Mitigation

- Tracking Progress
  - Annual reporting & accounting tools track implementation
  - Sampling to track water quality improvement

Nutrient Reduction Goals in Falls & Jordan Lake



Falls Lake (Baseline 2006)	
Upper Lake Lower Lake	40% N, 77% P ~20% N, 40% P

Jordan Lake (Baseline 1997-2001)	
Upper New Hope Lower New Hope Haw River	35% N, 5% P 0% N, 0% P 8% N, 5% P

(Year) = baseline period on which goals are based

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Falls & Jordan - Overview

	Jordan Lake Reservoir – North Carolina	Falls Lake Reservoir – North Carolina
Waterbody Size	14,000 acres	12,000 acres
Watershed Size	1,079,040 acres	492,800 acres
Impairment	Chlorophyll-a - UNH 2002 303(d) LNH, Haw 2006 303(d)	Chlorophyll-a – 2008 303(d)
Management Actions Implemented	Point Source P Reductions Agriculture Reductions	Point Source N & P Reductions New Development Stromwater Controls NCDOT New & Existing Stormwater Controls Agriculture Reductions Buffers Protection (Existing Neuse Rule)
Management Actions Pending	Point Source N Reductions New Development Controls Buffer Protection Existing Development Stormwater	Existing Development Stormwater
WQ Status	Remains impaired for Chl-a	Lower lake meeting Chl-a Standard in 2014

Falls Strategy 2010 Cost Projections

Source	Stage I Projected Costs* (2011-2020)**	Stage II Projected Costs* (2021-2036)**
Wastewater	$315 million	$478 million
Existing Development	$225 million	$551 million
Agriculture	$5.4 – $6.6 million	$4.5 - $6.1 million
New Development Stormwater	$56 - $109 million	$124 - $238 million

**Conservative cost projections from 2010 Fiscal Note*
*** Currently working w/ UNRBA to revise end of Stage I & start of Stage II implementation dates*

- Actual Wastewater costs to date lower than projections
  - Hillsborough: $19 million WW plant upgrade
  - Durham $13 million WW plant upgrade
- SGWASA has achieved Stage I reductions without upgrades
  - $30 million upgrade planned for further reductions
- Not all discharger upgrade costs related to Falls requirements

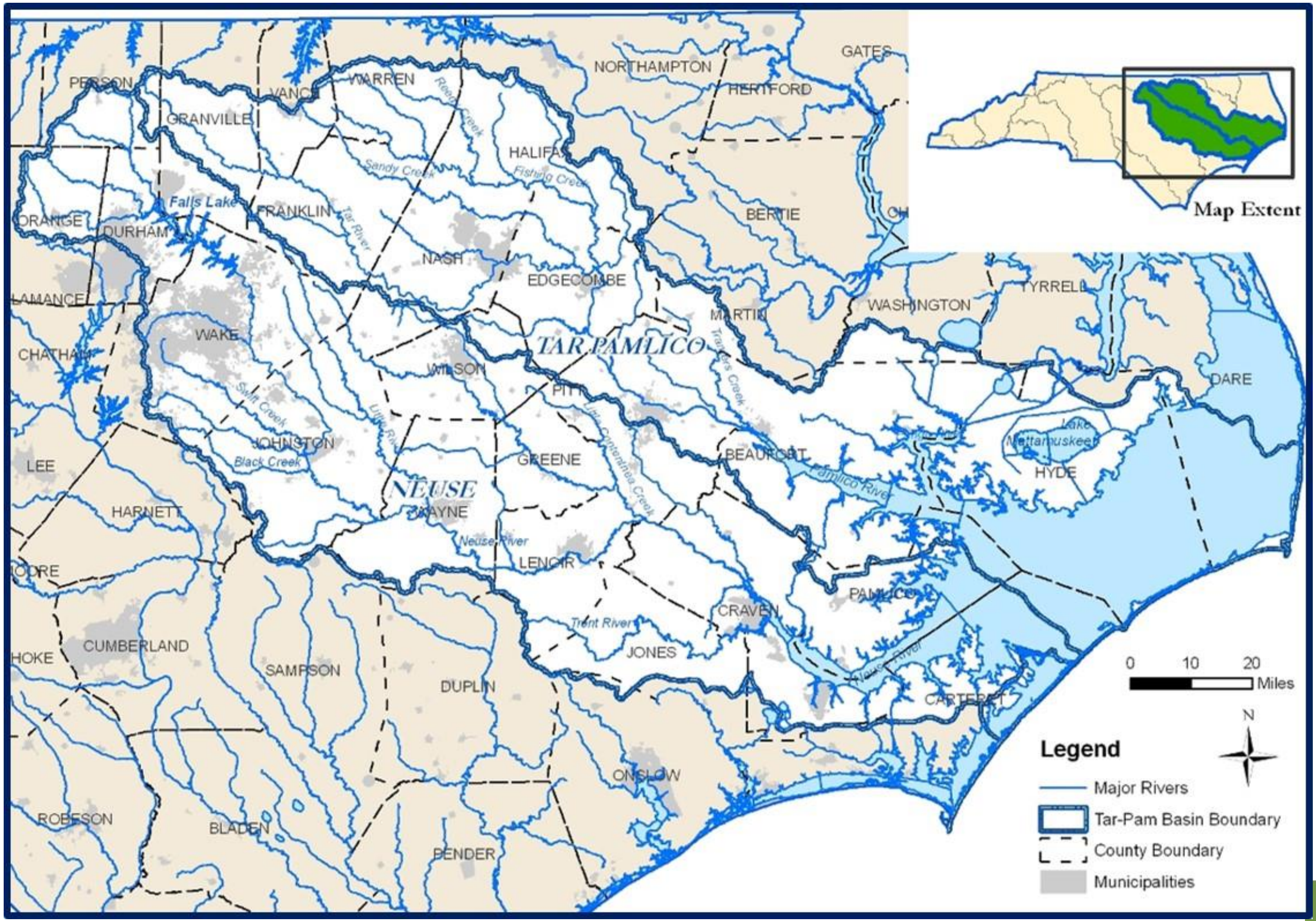
Jordan Strategy 2007 Cost Projections

Source	Projected Costs (Total Cost)*
Wastewater	$209 million
Existing Development	$528 million
Buffer Protection	$4.2 million per year
Buffer Mitigation	$2.5 million
Agriculture	$2.5 million
New Development Stormwater	$480,000 per year

**Conservative cost projections from 2007 Fiscal Note*

- Actual Wastewater costs to date lower than projections
  - Total wastewater expenditure ~ $38.6 million
- Not all discharger upgrade costs related to Jordan requirements
- No other costs incurred due to delayed implementation

Neuse & Tar-Pamlico River Basins



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Neuse & Tar-Pamlico Strategies Overview

- Chl-a Impairment in both estuaries
- Nutrient management strategies for each basin
  - Address Point Sources & Nonpoint Sources: Stormwater, Ag, Buffers
- Reduction Goals
  - Neuse: 30% reduction (compared to 1991-95 baseline)
  - Tar-Pam: 30% reduction N, no increase in P (1991 baseline)
- Effective Dates
  - Neuse (1998) – Achieve reduction goals within 5 yrs
  - Tar-Pamlico (2001) – Achieve reduction goals within 6-9 yrs

Implementation Dates – Neuse & Tar-Pamlico

	Neuse	Tar-Pam
Nutrient Strategy Requirements	**Implementation Dates**	**Implementation Dates**
Rules Adopted (Effective Date)	1998	2001
Point Source	1997	1990*
Buffers	1998	2001
New Development Stormwater	2001	2005 / 2006
Agriculture	2001	2001
Nutrient Management Training	2000 / 2001	2005 / 2006

*No WW rule in Tar-Pam. Reductions achieved under signed “Agreement” between Association of Point Sources & DWR.

Neuse Cost Projections

Neuse Projected Costs

Source	Neuse Projected Costs (Total Cost)*
Wastewater	$87.5 million
Buffer Protection	$2.75 million
Agriculture	$31 million
Nutrient Management	$910K
New Development Stormwater	$18.2million

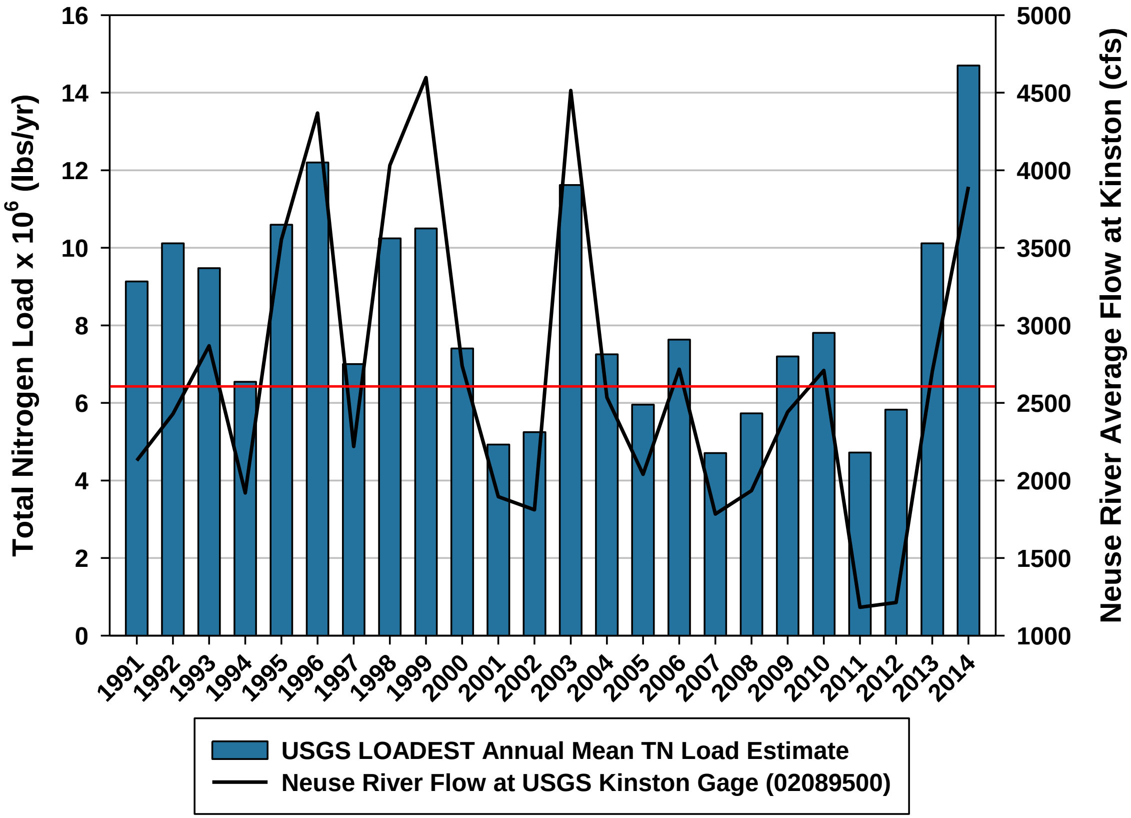
**Conservative cost projections from 1997 Neuse Fiscal Note*

Tar-Pam Projected Costs

Source	Tar-Pam Projected Costs* (Annual Cost)
Buffer Protection	$4.5 million
Agriculture	$4.7 million
Nutrient Management	$235K
New Development Stormwater	$2.1 million

**Conservative yearly cost projections from 1999 Tar-Pam Fiscal Note*

Estimated Mass Nitrogen Load Delivered to Fort Barnwell



Red Line = 30% reduction of mean of baseline TN load estimate

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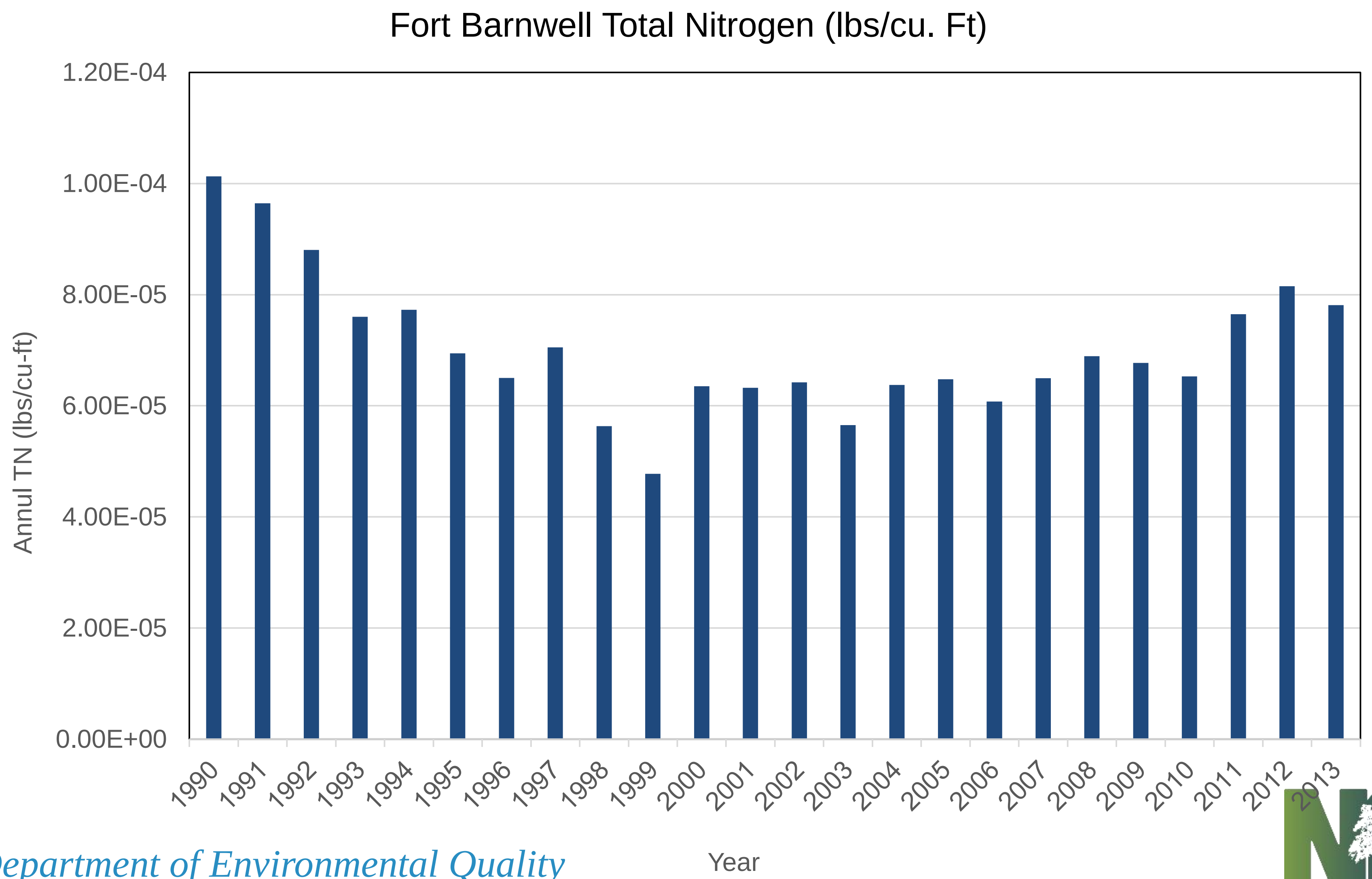
Neuse Nitrogen: Load / Flow (lbs per cubic feet)



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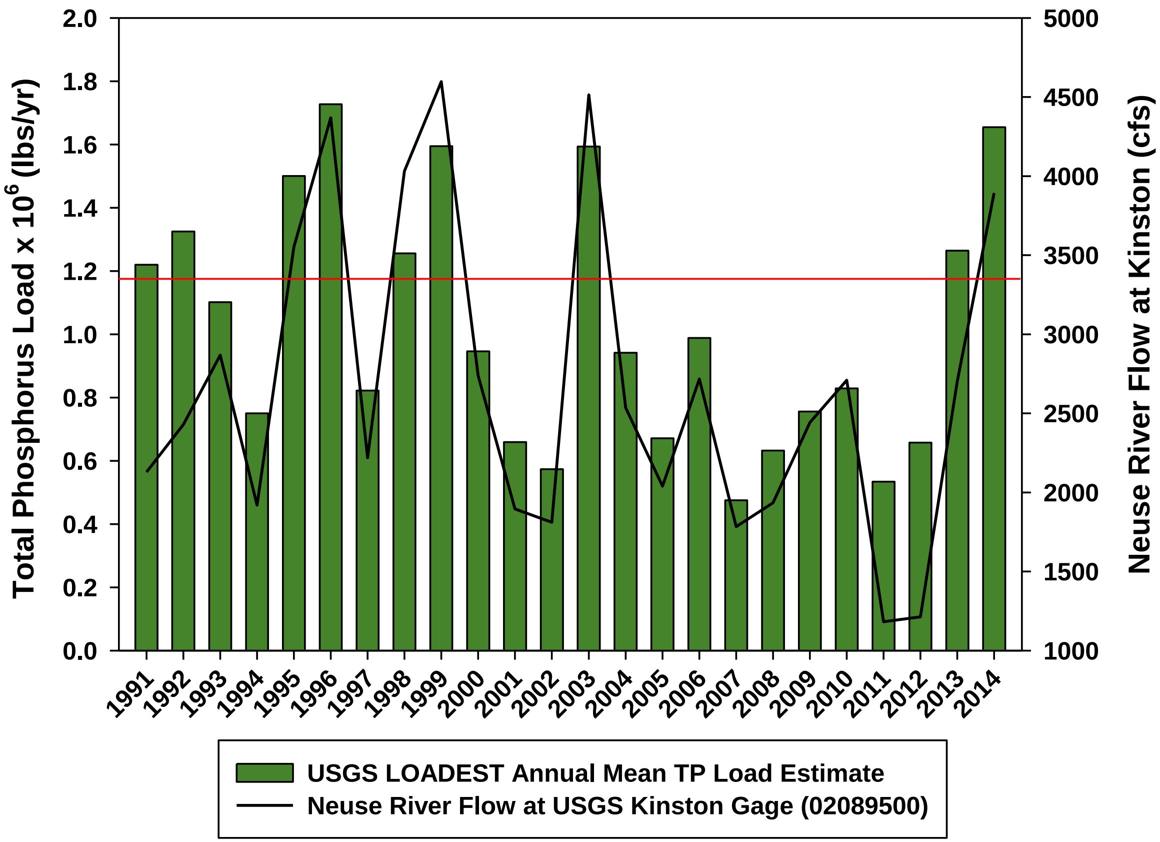
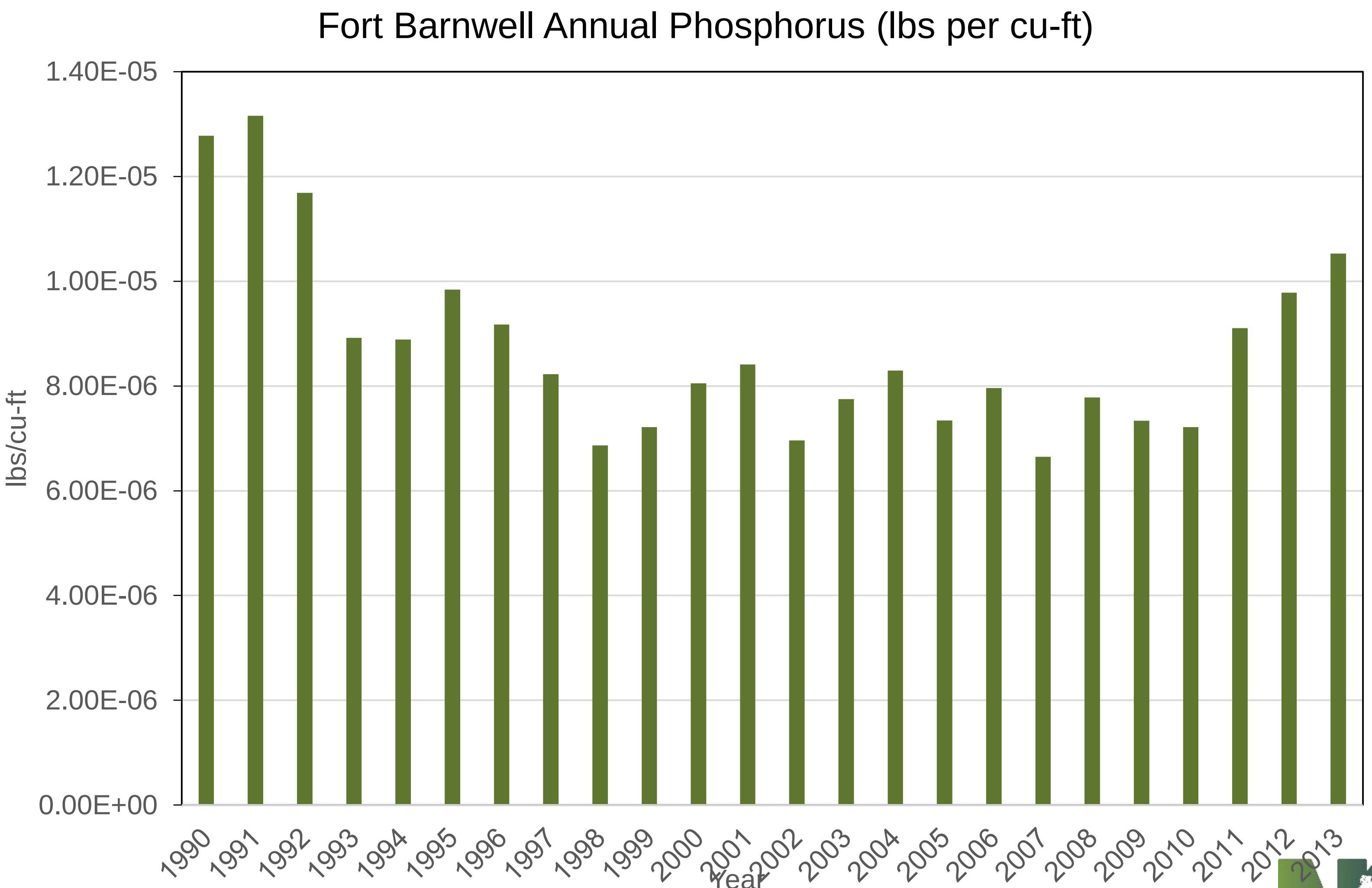
Estimated Mass Phosphorus Load Delivered to Fort Barnwell



Red Line = Baseline TP load estimate

Neuse Phosphorus: Load / Flow (lbs per cubic feet)



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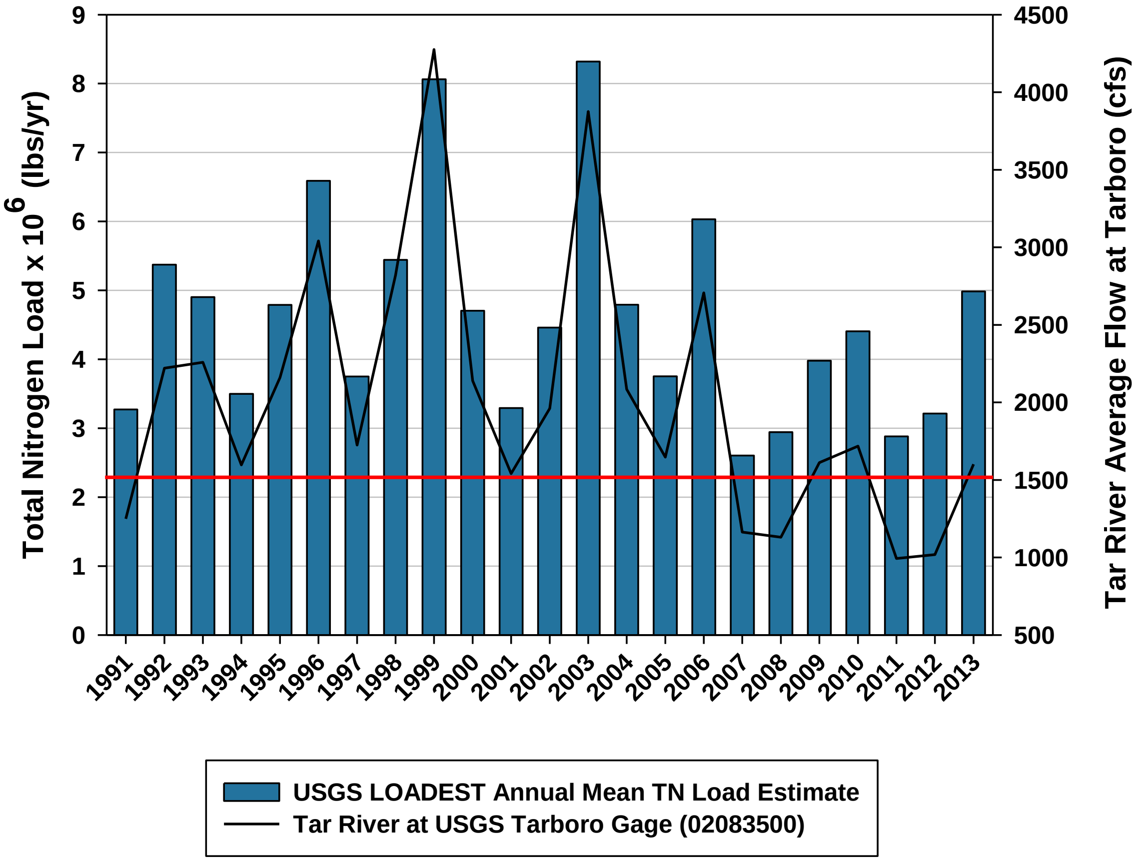
Tar-Pam Estuary Nitrogen Load Estimate

1991 - 2013

Estimated Mass Nitrogen Load Delivered to Grimesland



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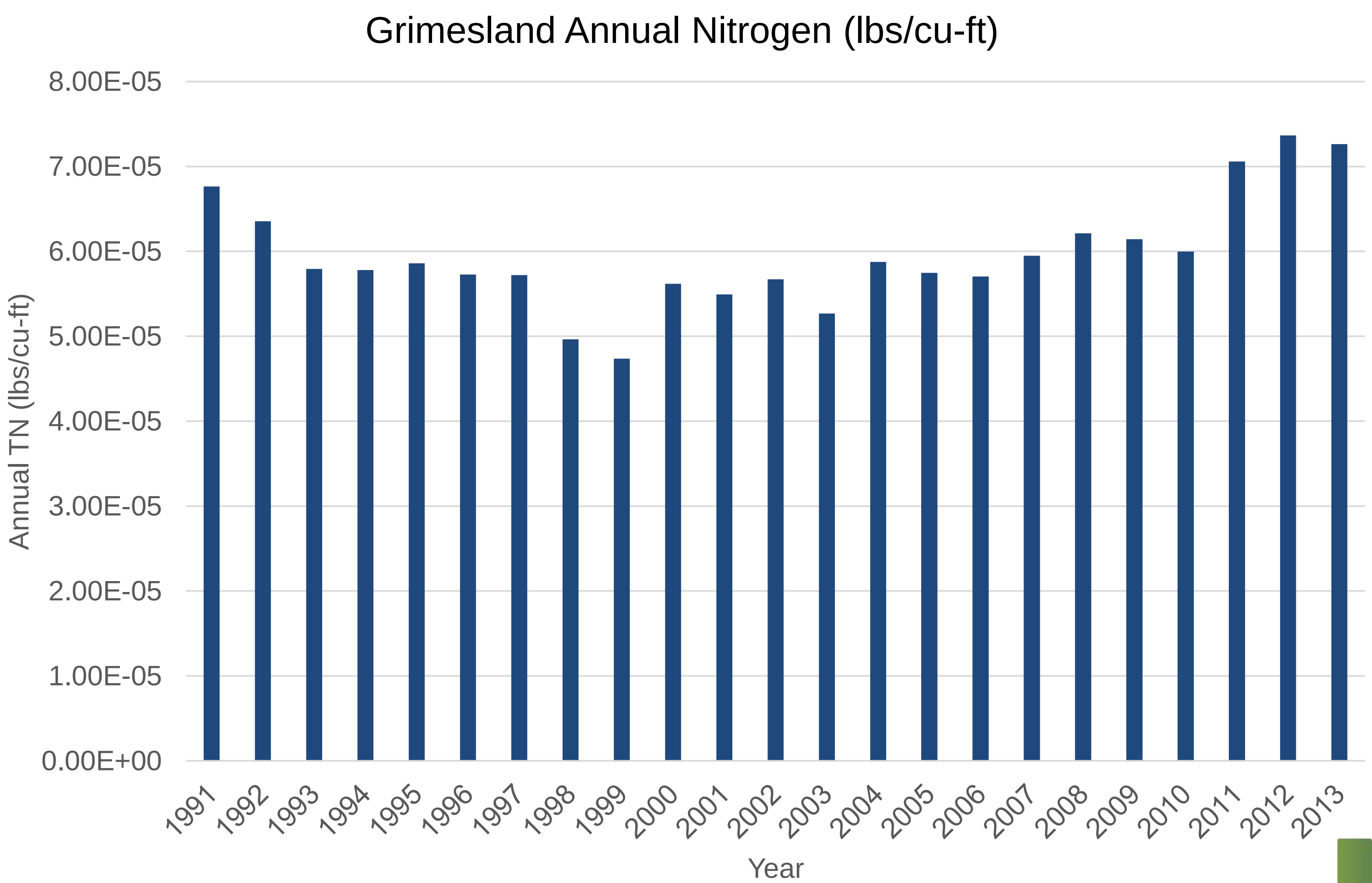
Tar-Pam Nitrogen: Load / Flow (lbs per cubic feet)



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Tar-Pam Estuary Phosphorus Load Estimate

1991 - 2013

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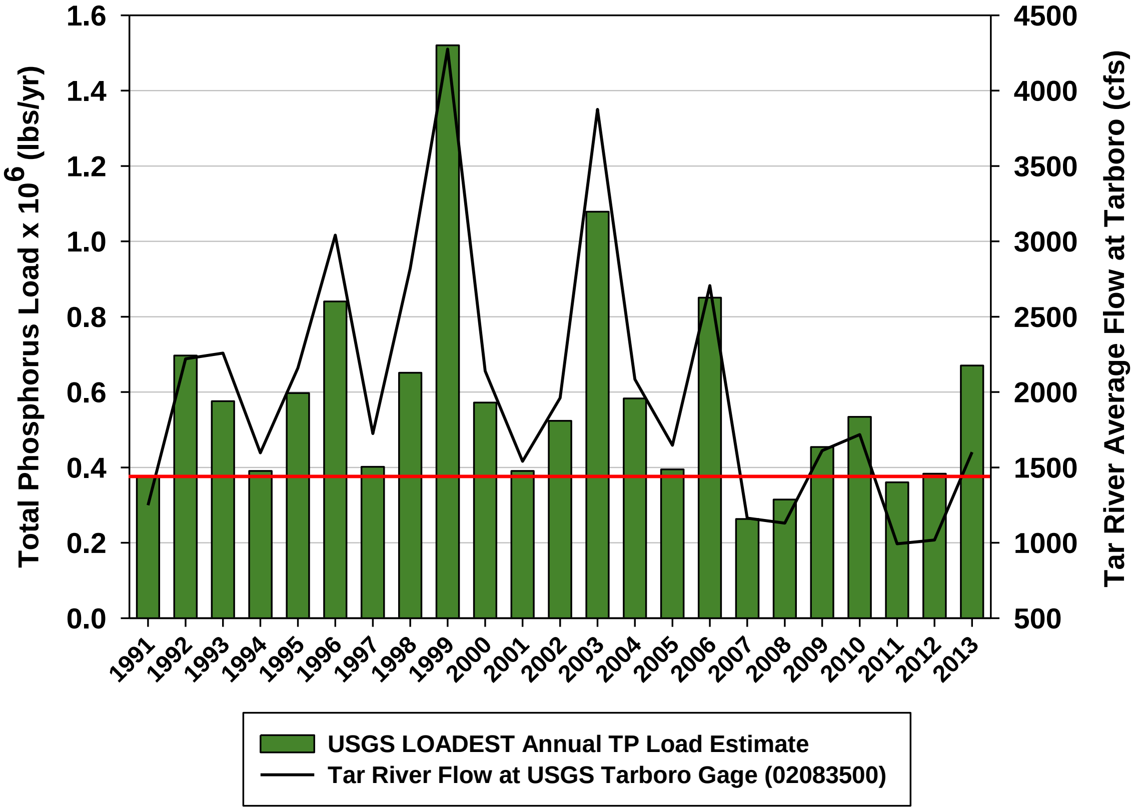

Red Line = Baseline TP load estimate

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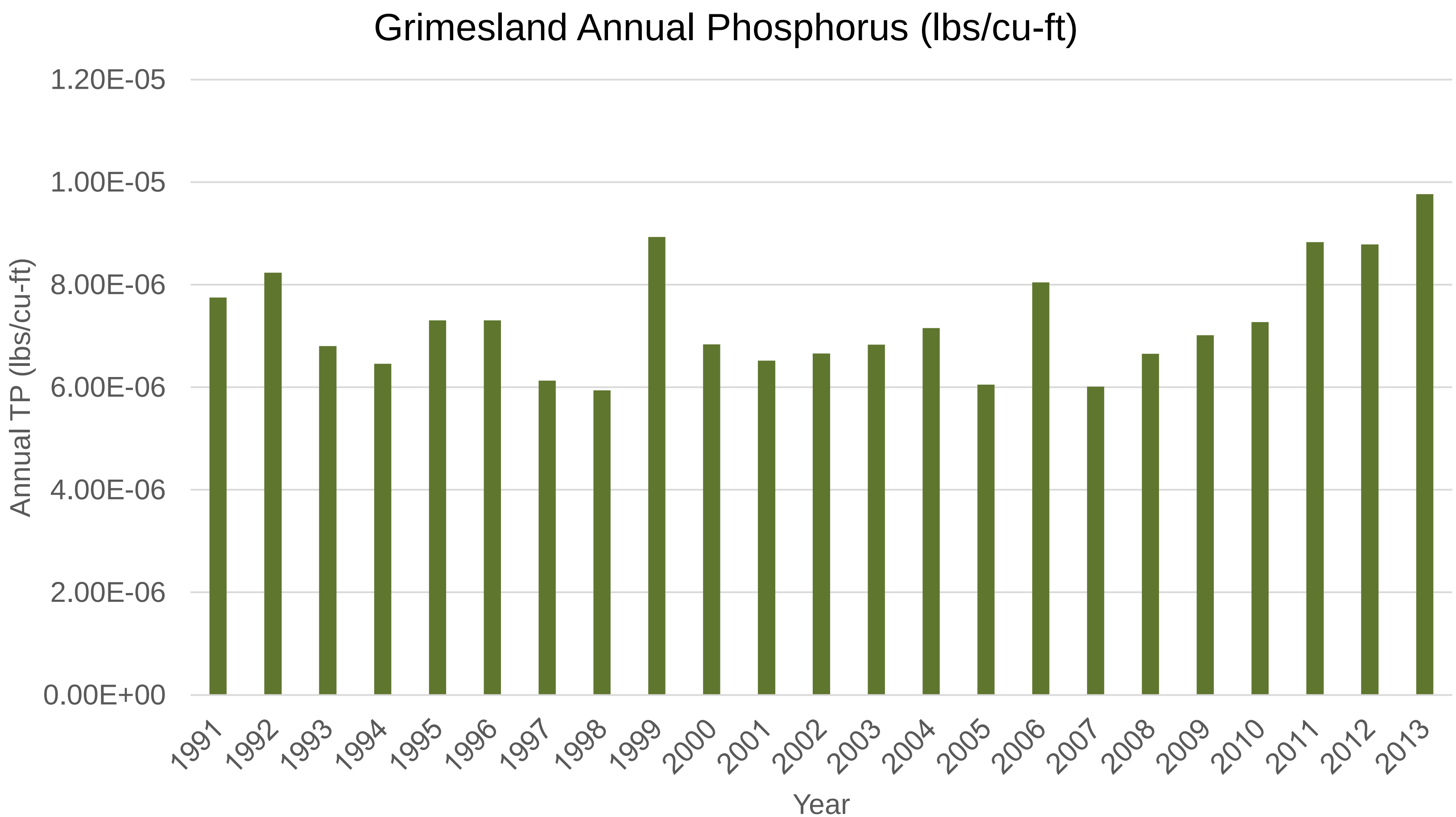
Tar-Pam Phosphorus: Load / Flow (lbs per cubic feet)



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Questions Moving Forward

- Do measures/technology/scientific understanding exist to resolve nutrient management issues in large reservoirs and estuaries?
- How to effectively deal with non-point sources?
- Is there a better way?
- Utilization of additional measures?
- Examples of success that NC can replicate?