The background of the slide is a solid orange color with a pattern of various leaf shapes in a slightly darker shade of orange. The leaves are scattered across the page, with some larger and more prominent than others. In the center, there is a white rectangular area containing the main text.

Rationale for establishment of Nutrient Standards for the Albemarle-Pamlico Basin

Issue and Background: Currently (2012) North Carolina has not established standards for either nitrogen or phosphorus. Should the State adopt nutrient standards for nitrogen and phosphorus as recommended by EPA?

Problems associated with nutrients

- **Periodic over-production of phytoplankton and resulting depletion of oxygen from bacterial decomposition of massive amounts of organic growth in estuaries of the Albemarle-Pamlico Basin has occurred at least since the 1970s.**
- **Plant nutrients nitrogen and phosphorus have been most often implicated as primary causes for various blooms that have occurred in the Chowan, Tar-Pamlico and Neuse Rivers over the course of several decades (Steele, 1991).**
- **Phosphorus** is generally thought to be the main cause of excessive primary production in freshwater systems and **nitrogen** the main cause of primary production in the brackish to marine estuaries and sounds (Paerl et al., 2004).

**Despite the volume of research that shows nutrients are a major cause of eutrophication, there are still no numeric standards for nutrients in North Carolina
Virginia has P standards set for lakes.**

Poor biological conditions are used to indicate when streams are stressed—when a water body doesn't meet its intended uses, the stream is added to a 303D list and the wheels start turning for restoration.

This approach can work

However, sometimes it doesn't, and without specific in-stream water quality standards, nothing gets done and some watersheds can contribute far more than their share of pollution to a river basin without consequences (rather such watersheds send the consequences downstream!).

Bear Creek-~3X the average yield of N of other streams; 4X the yield of P; 1% DA 6% annual N, P load

Station	Basin	TNTrend?	Total Nitrogen	
			TNLoad (tons)	TNYield (tpsm)
Eno River Hillsborough	Neuse	D	50 (28-72)	.77 (.43-1.1)
Little River Orange Fctory	Neuse	D	69 (38-100)	0.86 (0.48-1.26)
Contentnea Cr Hookerton	Neuse	N	894 (669-1118)	1.22 (0.91-1.52)
Neuse River at Ft. Barnwe	Neuse	N	3942 (3063-4820)	1.01 (0.78-1.23)
Bear Creek Mays Store	Neuse	N	232 (147-317)	3.94 (2.50-5.38)
Trent River near Trenton	Neuse	N	208 (130-286)	1.25 (0.78-1.72)
		Significant at 5%		
		Significant at less than 1%		



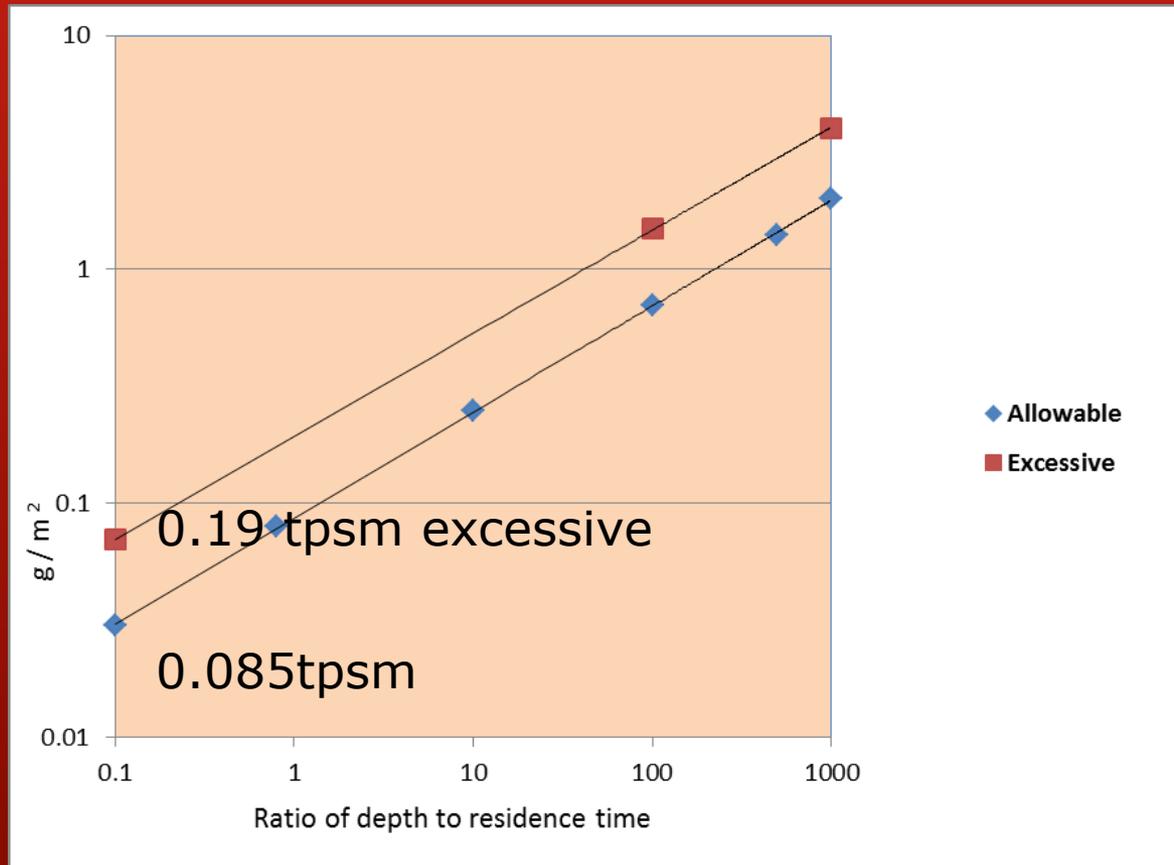
N

Station	TPTrend?	Total Phosphorus	
		TPLoad (tons)	TPYield (tpsm)
Eno River Hillsborough	N	6.4(2.5-10.3)	0.10(0.04-0.19)
Little River Orange Fctory	N	8.18(4.34-12.02)	0.10(0.05-0.15)
Contentnea Cr Hookerton	D	110(66.7-154.36)	0.15(0.09-0.21)
Neuse River at Ft. Barnwell	N	430 (323-537)	0.11(0.08-0.14)
Bear Creek Mays Store	N	24.21(1.11-47.33)	0.41(0.02-0.80)
Trent River near Trenton	N	21.9 (12.0-31.8)	0.13 (0.07-0.19)
		Significant at 5%	
		Significant at less than 1%	



P

Relationship between Total P loading and ratio of depth to residence time in a fresh water body (from Vollenweider (1975))



Concentration standards

- **Phosphorus concentrations that are likely to cause excessive algal growths have been known for at least 40 years-R.A. Vollenweider's work from 1968 and later 1975 is best known because it includes depth and residence time variables that are important**
- **Mackenthum (1973) suggested no stream should exceed 0.1 mg/L and 0.05 mg/L where a stream enters a lake (simplifyfying Vollenweider's approach)**

EPA Proposed Standards

Lakes and Reservoirs

Parameter	Table 1. EPA Proposed Standards for Lakes and Reservoirs (maximum concentration, mg/L)		
	EcoRegion 9 (Piedmont)	Ecoregion 11 (Central and Eastern Forests)	Ecoregion 14 (Coastal Plain)
Total Nitrogen	0.36	0.46	0.32
Total Phosphorus	0.02	0.008	0.008

Rivers and Streams

Parameter	Table 2. EPA Proposed Standards for Streams and Rivers (maximum concentration, mg/L)		
	EcoRegion 9 (Piedmont)	Ecoregion 11 (Central and Eastern Forests)	Ecoregion 14 (Coastal Plain)
Total Nitrogen	0.7	0.31	0.71
Total Phosphorus	0.04	0.01	0.03

Standards Proposed for Albemarle-Pamlico

- ***Dual control of N and P will be necessary to limit chronic algal blooms in freshwater grading to saline portions of major river basins (Paerl et al., 2004; Paerl, 2009; Conley et al, 2009).***
- ***It is proposed, for phosphorus, that 0.1 mg/L and for nitrogen 0.7 mg/L be adopted for streams, 0.05 mg/L total P and 0.35 mg/L total N for lakes and estuaries be adopted***
- ***Using previous work of Vollenweider (1975), the loading rate for rivers entering lakes (estuaries) total P would not exceed 0.085 tpsm. However, a slightly higher rate of 0.1 tpsm P would probably be effective in limiting chronic algal blooms in the A-P, with 0.7 tpsm the target for N.***

Summary Points

- Principles controlling eutrophication in freshwater systems have been known for decades-concentrations of nitrogen and phosphorus in flowing and quiescent waters that are associated with nuisance algal blooms are generally known and are useful for establishing acceptable water quality conditions in a watershed. **Adopting such standards establishes water quality conditions that are suitable for most of waters uses in the freshwater portions of the Basin and may help in controlling chronic nuisance algal blooms in the estuaries and sounds.**
- **Establishing uniform nutrient standards prevents occurrences of streams draining watersheds that overload nutrient sensitive receiving waters.** These standards ensure that all watershed communities are equally responsible for ensuring that they are maintaining generally acceptable stream and ground water quality for the streams intended public uses and they are not over polluting and using the stream as a low cost dumping ground for fertilizers and manures.

Summary Contd.

- **•For watersheds that clearly have nutrient issues, extensive buffers or other BMPs may be in order to bring streams such as Bear Creek into compliance with newly adopted standards.** If a stream exceeds the standard, the States would have a legal reason to take action and watersheds out of compliance would be forced to cooperate. Otherwise such streams will continue to be an excessive source of nutrients to the nutrient sensitive Neuse River for years to come.
- **•The monitoring system necessary for using standards as a management tool is already in place in North Carolina (DENRs DWQ Ambient Monitoring System and USGS streamflow monitoring) and should not add to costs required for monitoring, although some stations may need to be restored to the AMS.** New standards simply allow a “trigger” for focusing actions to restore water quality and reduce nutrient loading for streams that do not exhibit biological degradation.
- **•Although there are no standards for the receiving estuaries, reduced nutrient input from freshwater streams may help reduce the supply of bed-derived “legacy” nutrients and reduce the water column concentrations at low to moderate flows in the estuary and sounds.**