Regulation of Nutrients in NJPDES DSW Permits

Presentation for Clean Water Council

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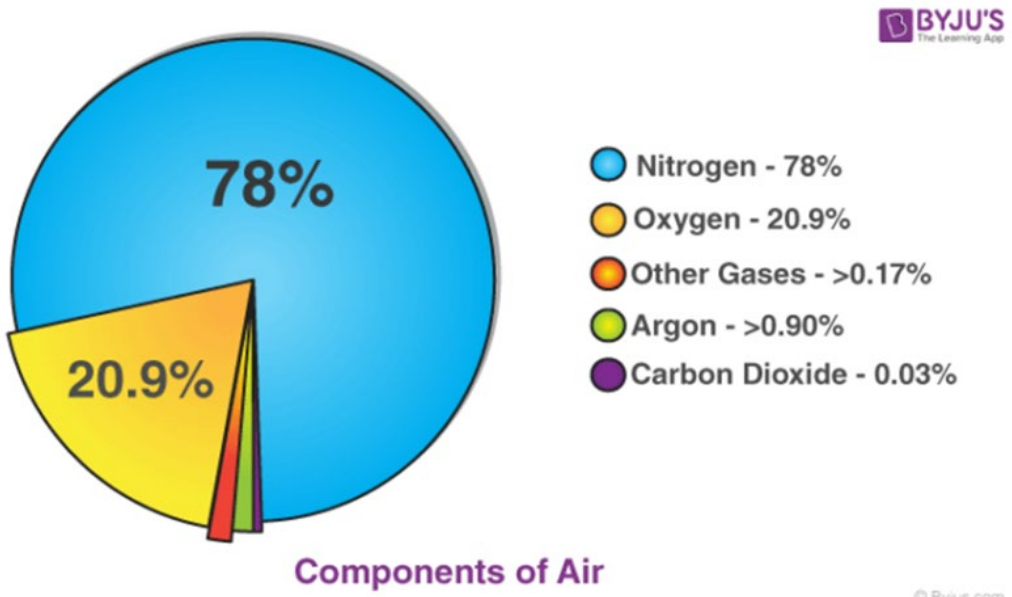
Bureau of Surface Water & Pretreatment Permitting

March 2024

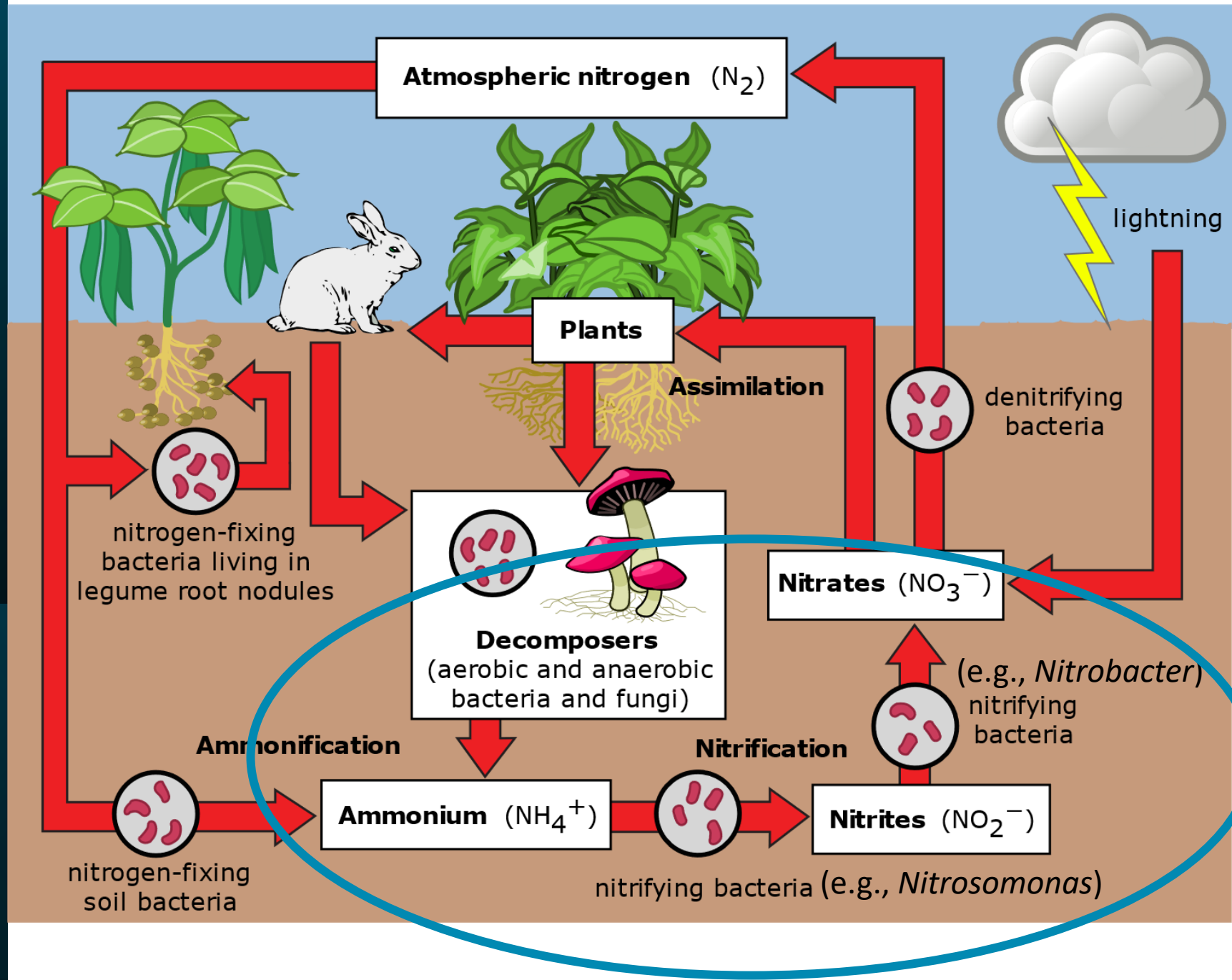
Nutrients: Essential and abundant

- Nitrogen (N) & Phosphorous (P) are essential macronutrients for photosynthesis and cell growth

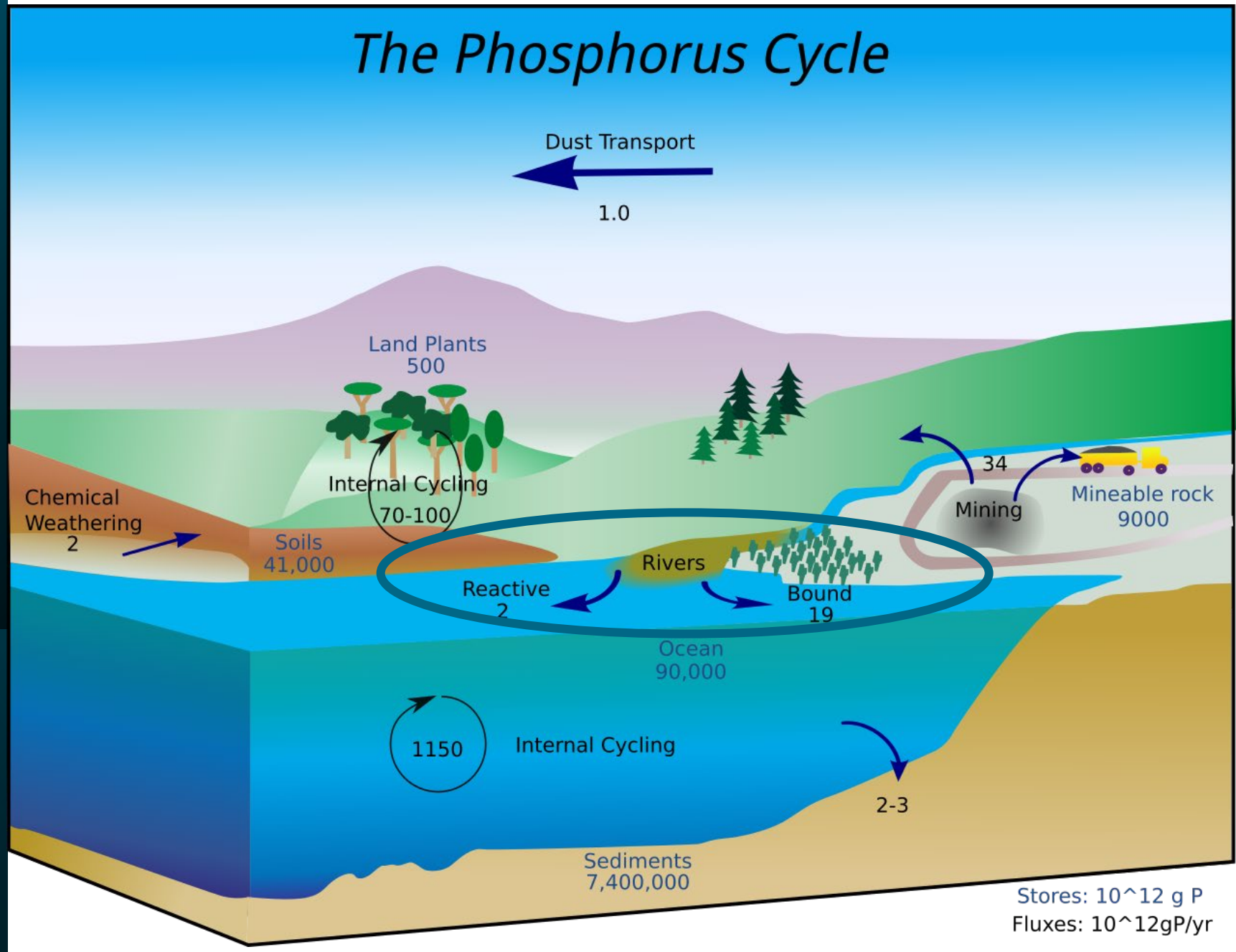


- In theory, N & P are in abundance
  - N_2 gas in atmosphere
  - P from rock phosphates
  - Transformed by living organisms

Nitrogen Cycle



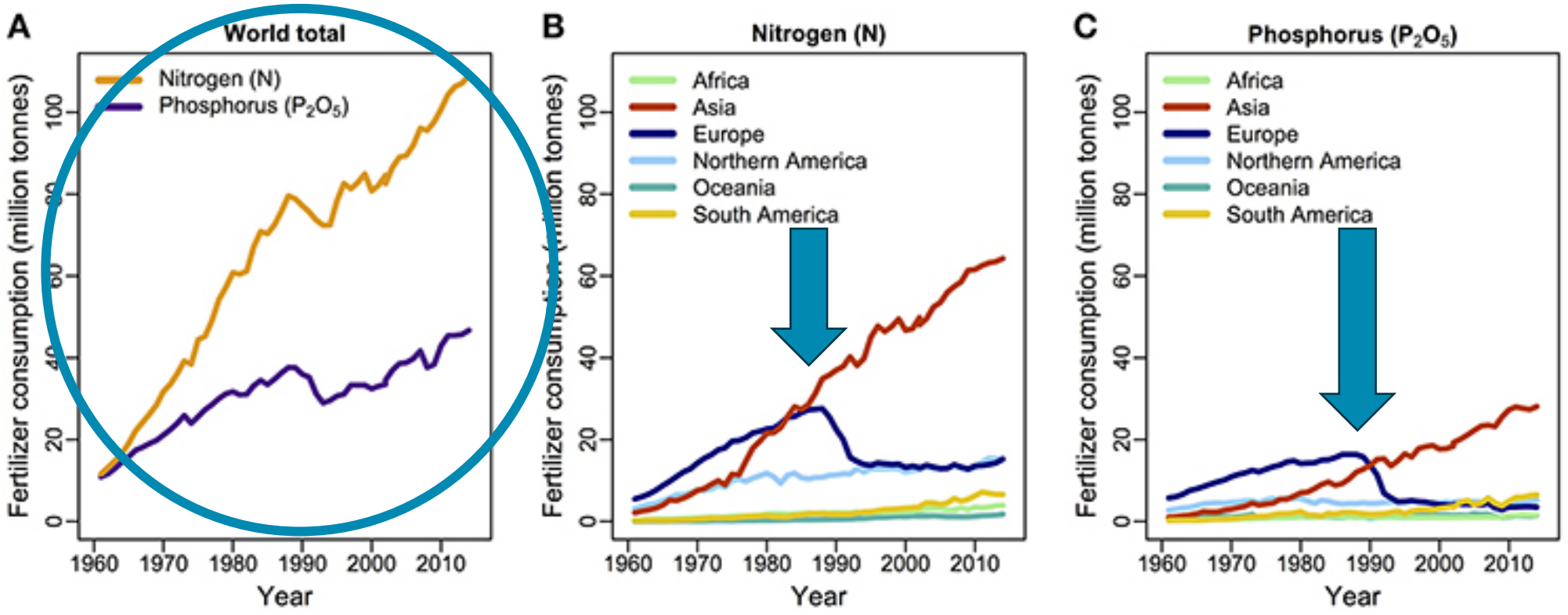
Phosphorous Cycle



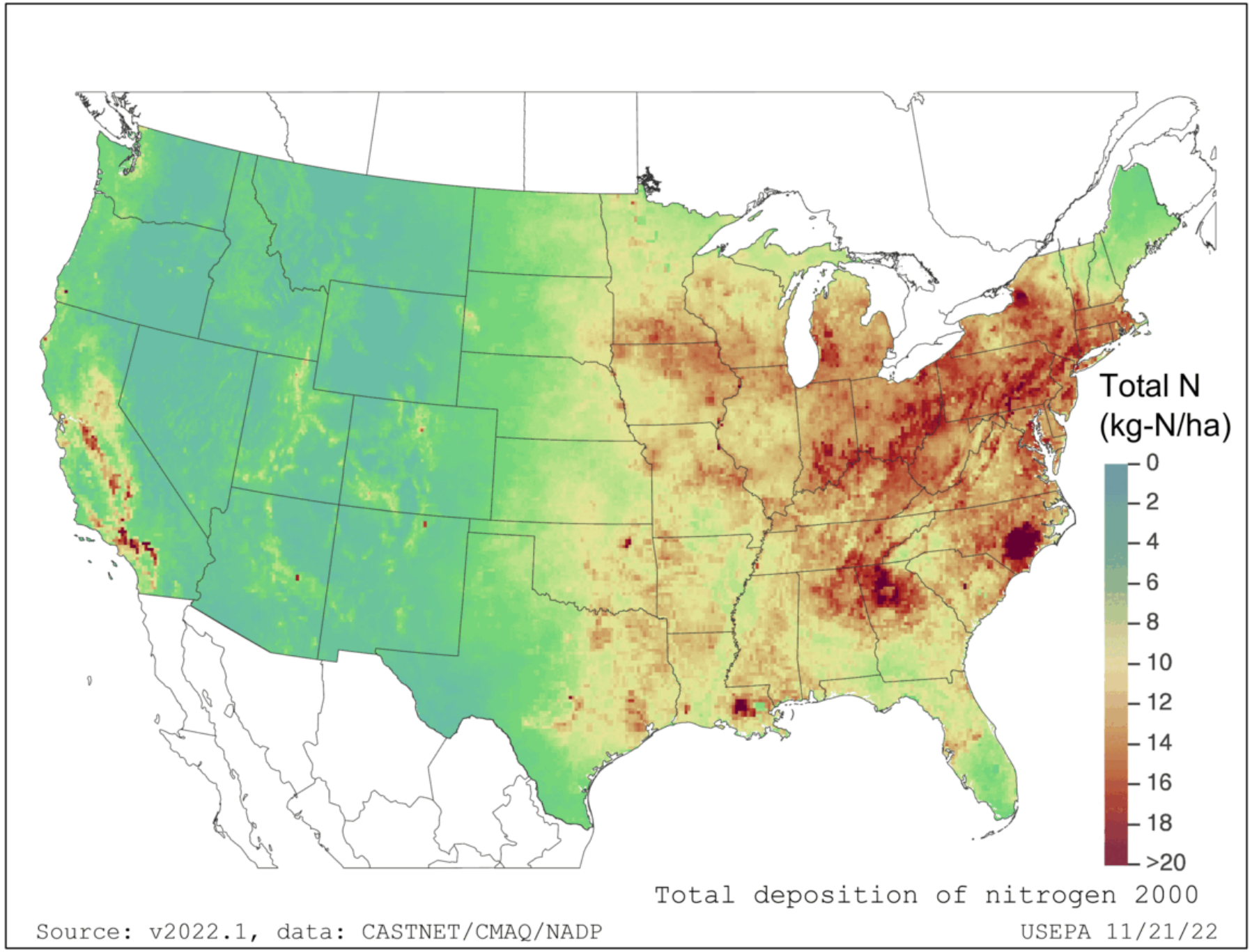
Harris 2022

Nutrients: Anthropogenic alterations

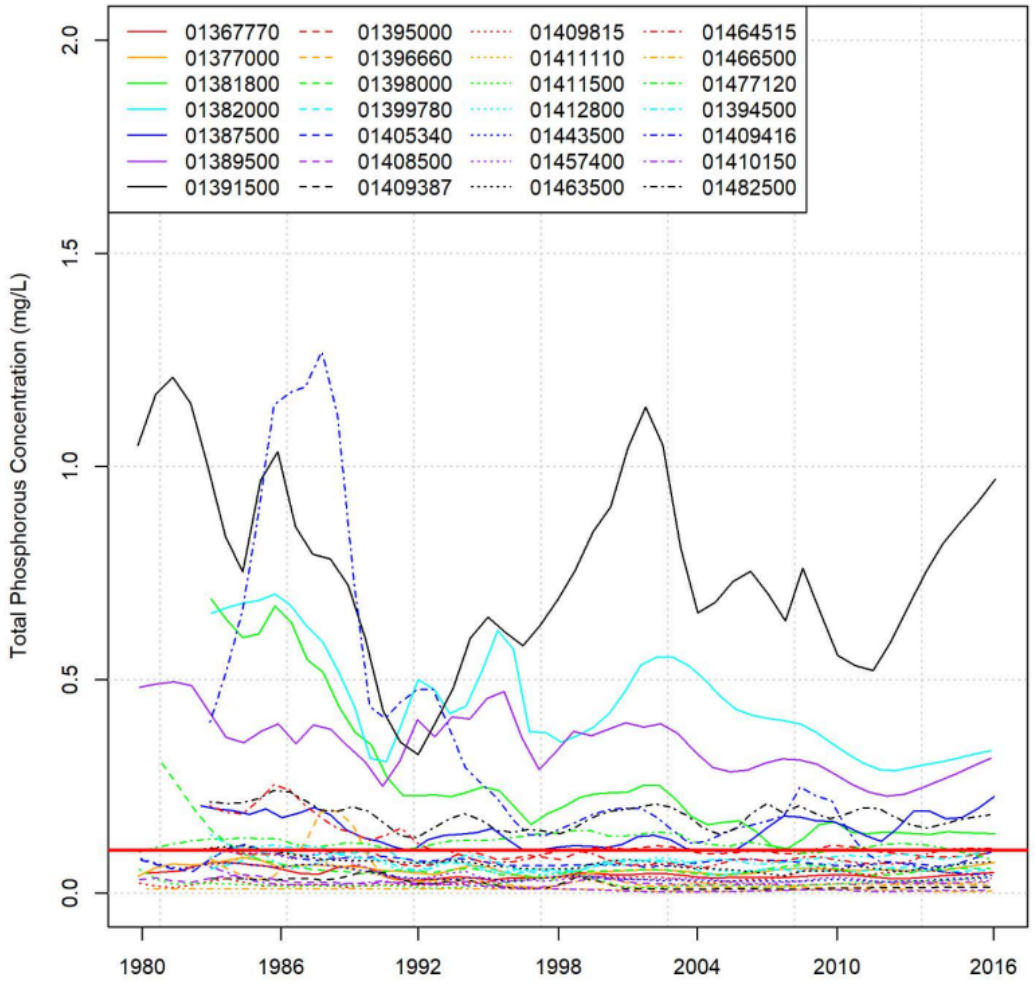
- Anthropogenic processes have altered availability of N & P – Examples:
  - Haber-Bosch process (for N) and fertilizers revolutionized food production
  - Fossil fuel combustion (associated NOx) enhances N deposition



Guignard et al. 2017


Total N
(kg-N/ha)
0
2
4
6
8
10
12
14
16
18
>20
Total deposition of nitrogen 2000
Source: v2022.1, data: CASTNET/CMAQ/NADP
USEPA 11/21/22

Water Quality Trends in Nutrients in NJ



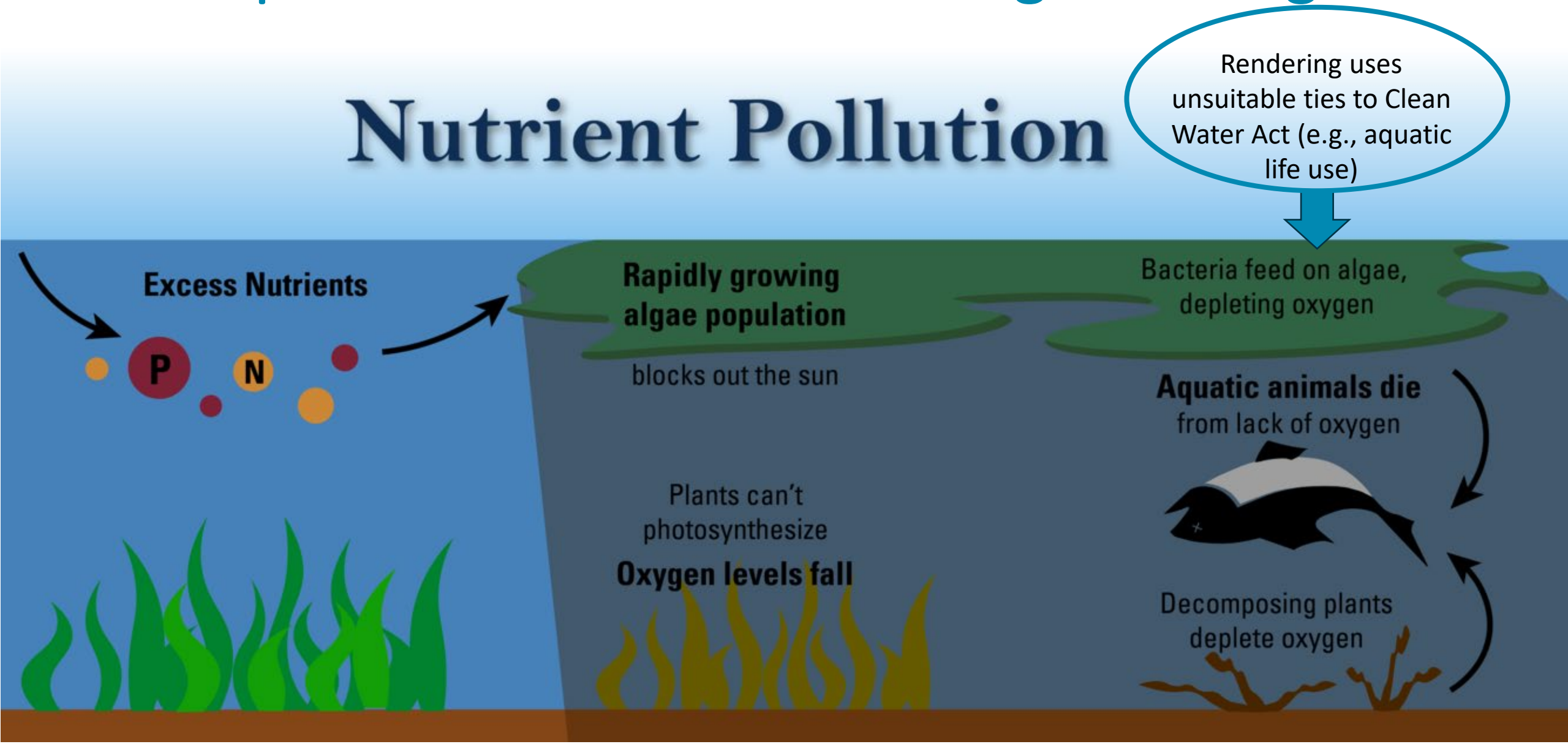
Lester et al., 2020

USGS and NJDEP reports on water quality trends over recent ~40-year periods found **TN and TP declined or stayed the same** at the far majority of stream sites.

NJDEP produces Nutrient Criteria Enhancement Plans (2009, 2013, 2018, draft 2023)

EPA, ACWA, and States documenting Nutrient Reduction Strategies

Eutrophication: "Too much of a good thing"



USGS VA & WV Water Science Center, March 2023

How we regulate nutrients
N.J.A.C 7:9B-1.14(d)4i
All classifications

<u>Nutrients</u> - Narrative criteria

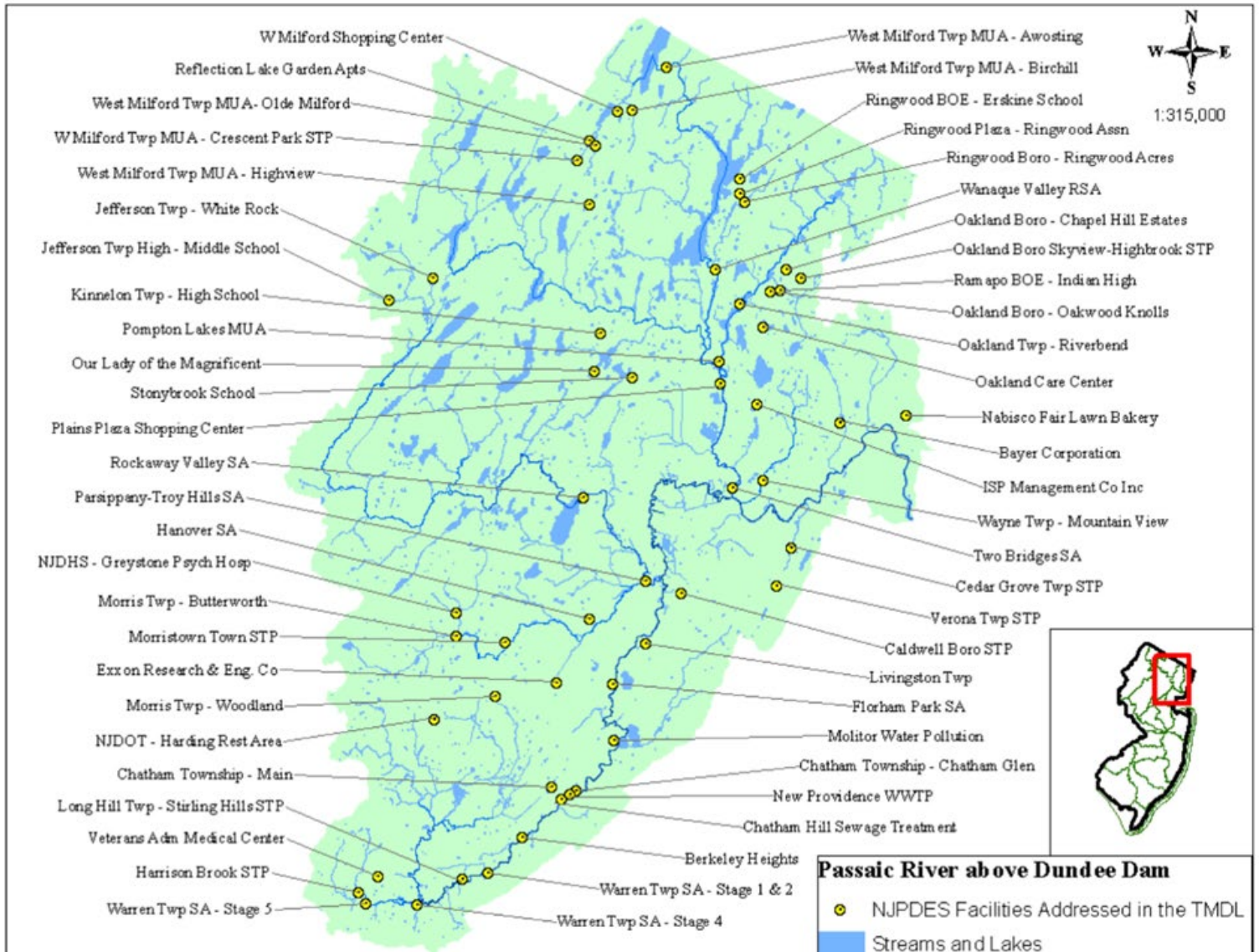
Except as due to natural conditions, **nutrients shall not be allowed in concentrations that render the waters unsuitable for the existing or designated uses** due to objectionable algal densities, nuisance aquatic vegetation, diurnal fluctuations in dissolved oxygen or pH indicative of excessive photosynthetic activity, detrimental changes to the composition of aquatic ecosystems, or other **indicators of use impairment caused by nutrients**.

In addition, there are specific numeric criteria for nutrients or forms.

Nutrient TMDLs in Raritan and Passaic

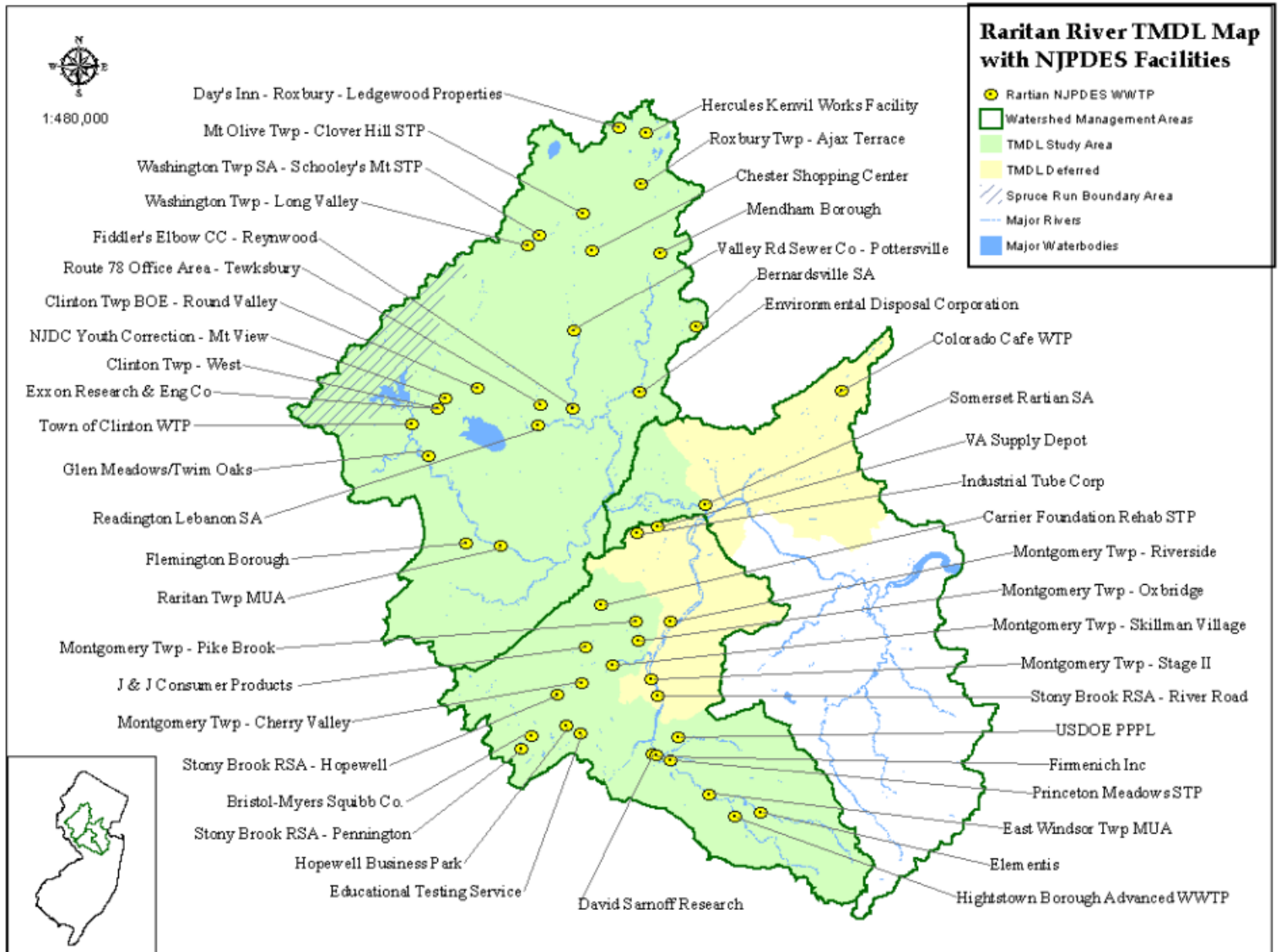
Passaic River TMDL – Non-tidal, Phosphorous

Figure 4. NJPDES Point Source Discharges of Phosphorus in the Passaic River above Dundee Dam



Raritan River TMDL – Non-tidal, TP, DO, pH, TSS

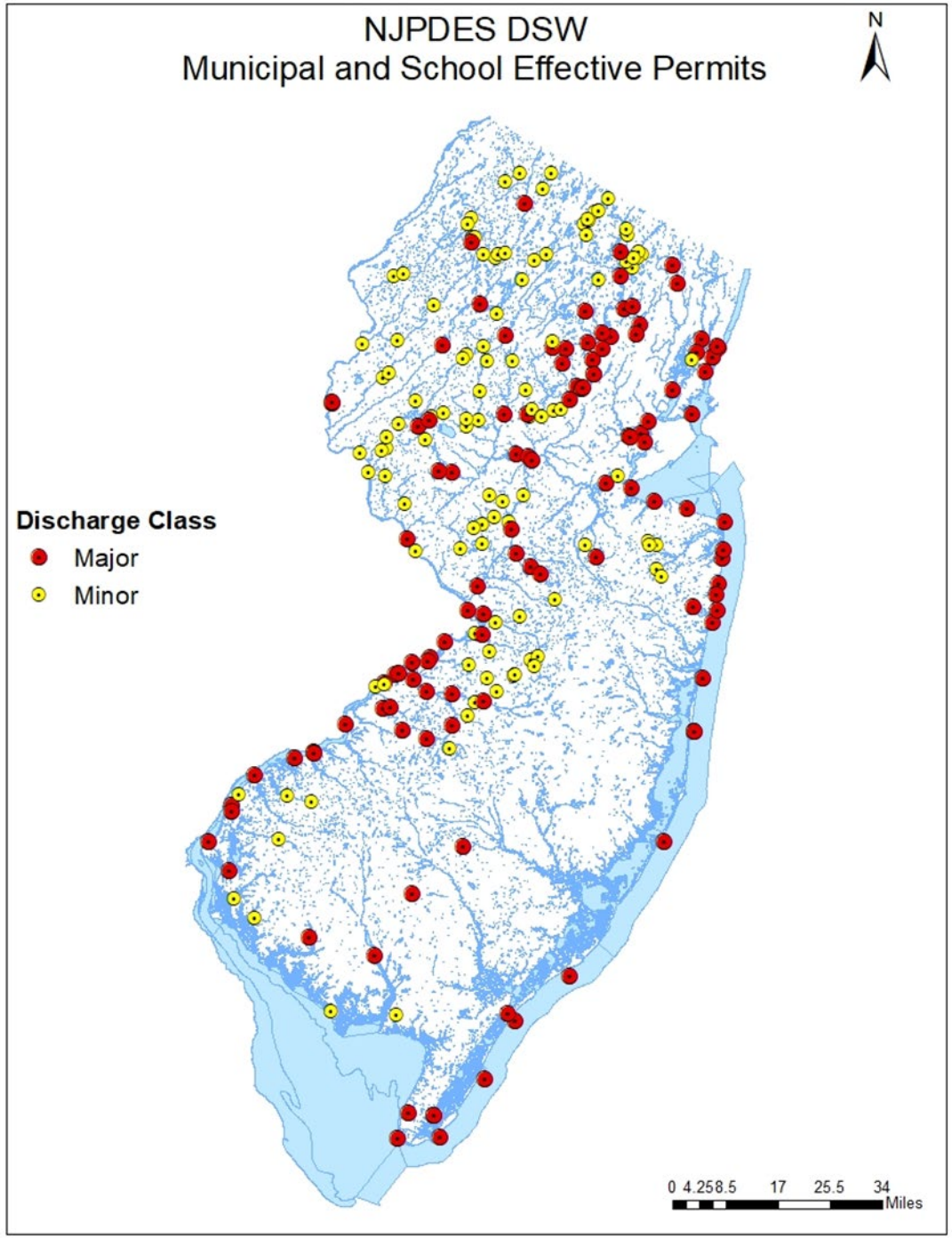
Figure 8. NJPDES Permitted Discharges within TMDL Study Area



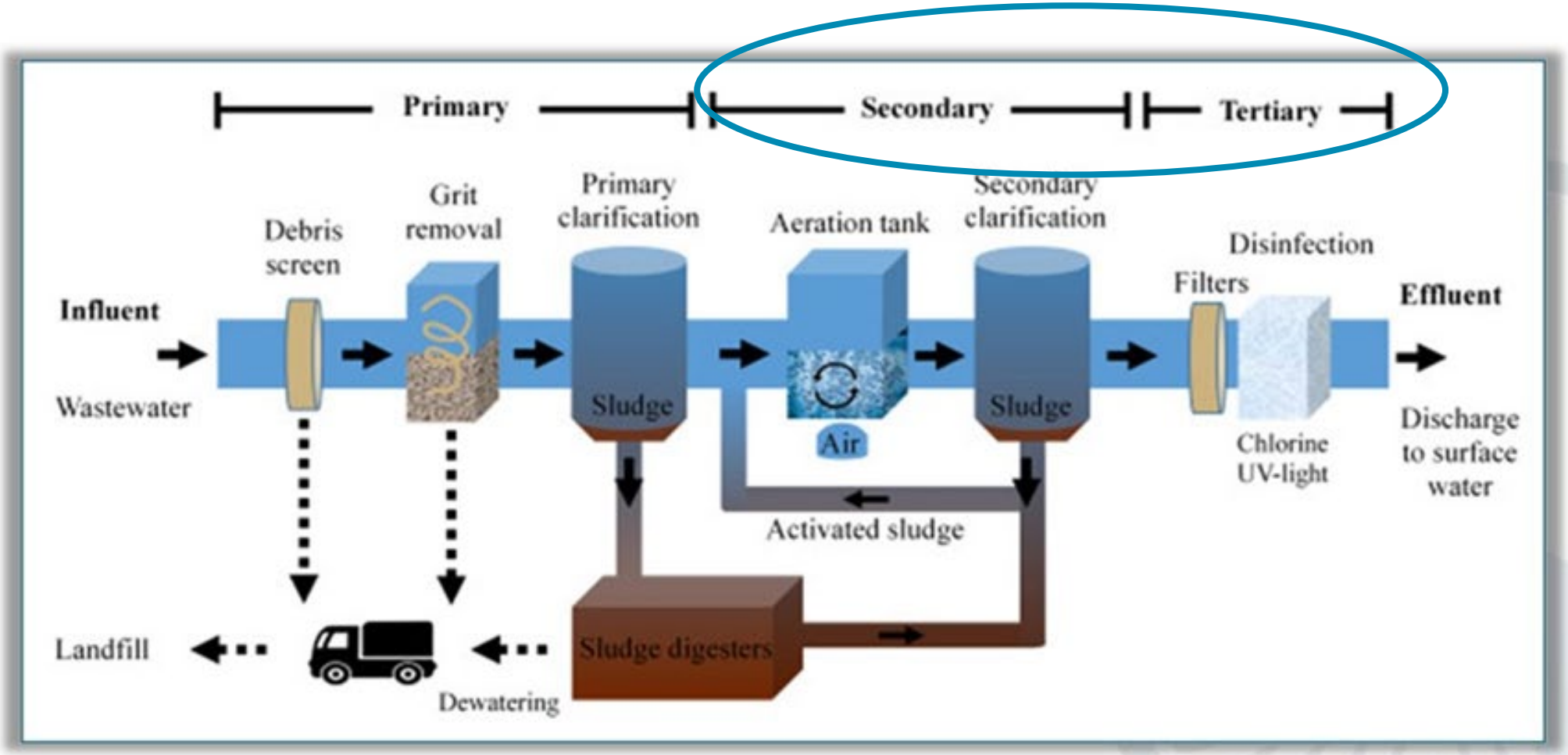
NJPDES Municipal Discharges and Nutrient Transformation in WWTFs

NJPDES DSW Permits

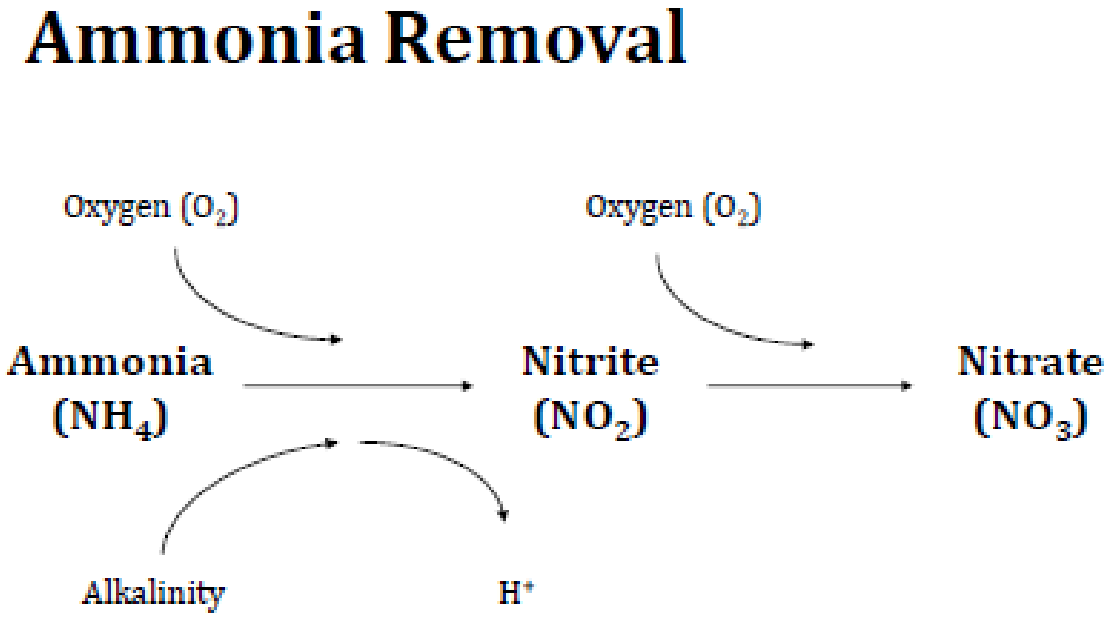
- General Permits and Individual Permits
- Major ≥ 1.0 MGD vs Minor < 1.0 MGD
- Category A – Individual Municipal = 94 majors + 86 minors
- Category ASC – Schools = 23
- For ocean dischargers, nutrient impacts are generally less of a concern



Introduction to Wastewater Treatment



WWTP Treatment: Ammonia to Nitrate



Nitrification:
Ammonia (NH_4) is converted to Nitrate (NO_3)

Oxygen Rich Habitat

MLSS* of 2500+ mg/L (High Sludge Age / MCRT / low F:M)
ORP* of +150 mV (High DO)
Time* (high HRT ... 24 hr, 12 hr, 6 hr)
Low BOD

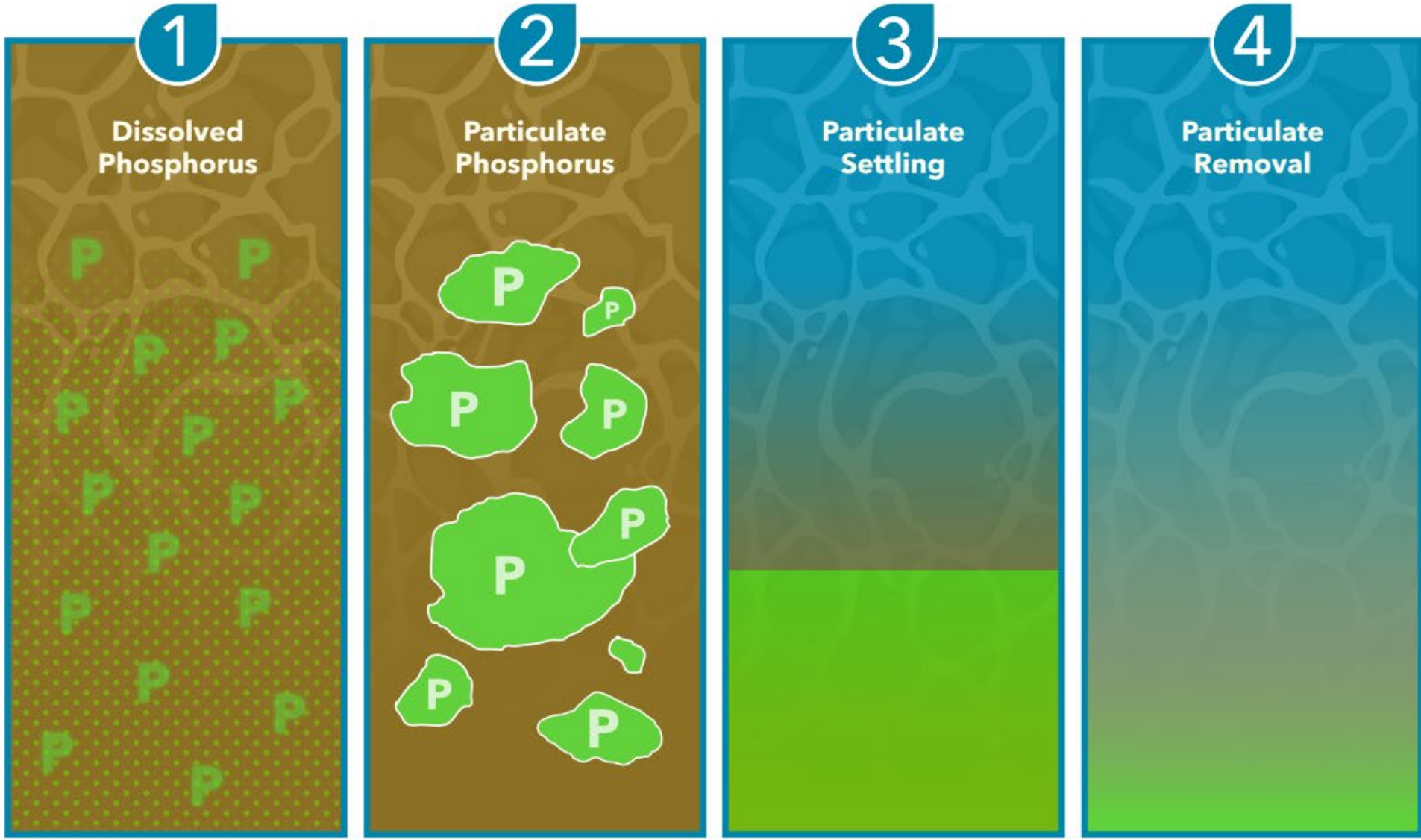
Consumes Oxygen
Adds acid - Consumes 7 mg/L alkalinity per mg/L of $NH_4 \rightarrow NO_3$

*Approximate, each facility is different.

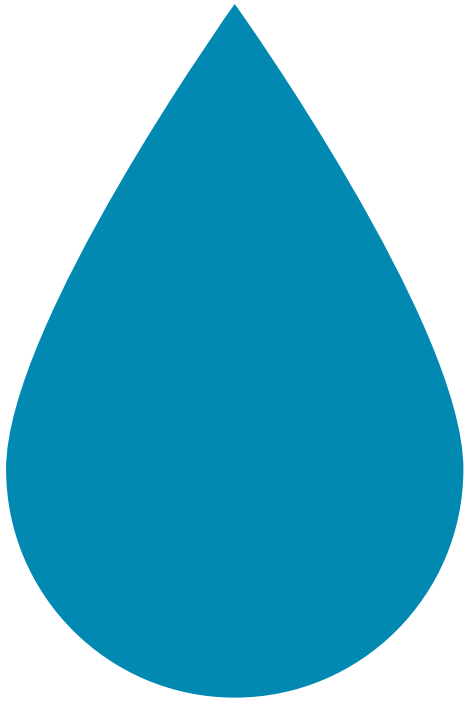
Stages of Phosphorus Removal

Phosphorus removal (both chemical and biological) can be broken down into four general steps:

1. Influent wastewater is high in dissolved phosphorus.
2. Dissolved phosphorus is converted into particulate phosphorus either chemically or biologically.
3. These particulate solids are settled in a clarifier or filtered.
4. Particulate solids are removed from process, reducing the total phosphorus concentration in the water.



YSI



Thank you

Questions?