NITROGEN LOADING AND LIMITATIONS

YOWA Title 5 Seminar - *Nitrogen and the Effect on Onsite Wastewater Systems*

Mount Ida Campus of UMass Amherst, Newton – June 25, 2024

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DISCUSSION POINTS

- Some Facts About Nitrogen
- Nitrogen in Groundwater
- Nitrogen in Drinking Water
- Where the T5 Limits and Loading Came From
- How to Work with Those Limits
- Other Impacts of Nutrients on Water Resources
- A Few MassDEP Reminders
- Questions
- MassDEP Contacts

SOME FACTS ABOUT NITROGEN

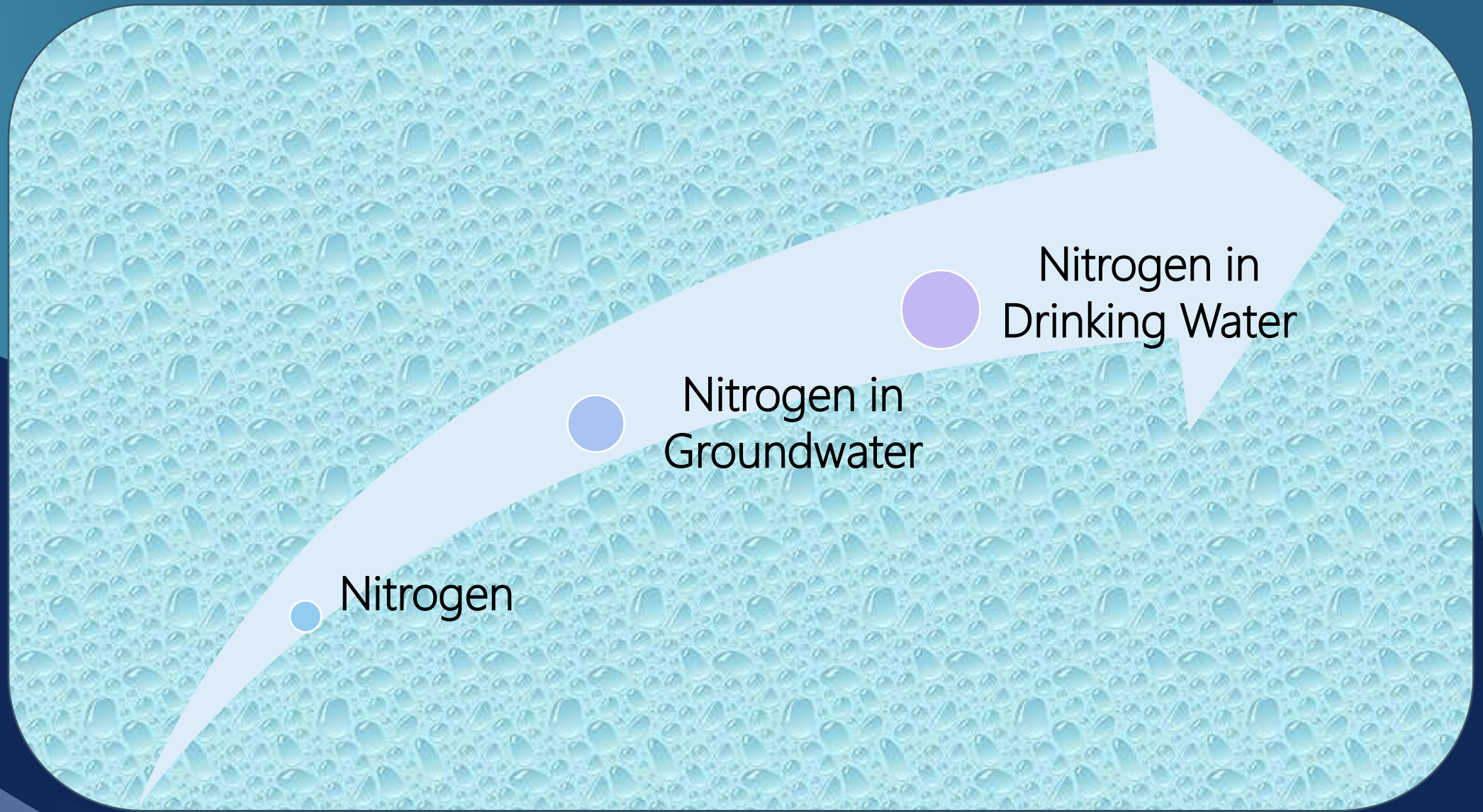
- Most common pure element in the atmosphere but not in the earth's crust.
- Common component of many compounds ranging from fertilizers to explosives.
- Like any chemical, it is present in various forms and has effects, both positive and negative, upon the environment and human health
- Nitrogen in the form of ammonia (ammonium) is a major component of human urine.

NITROGEN IN GROUNDWATER

- Nitrate is most common form of nitrogen in groundwater.
- Nitrogen in groundwater comes from one of a variety of sources:
  - Fertilizer
  - Manure
  - Decomposition of grasses, crops and leaves
  - Urine
- Median level of nitrate in groundwater is < 2 ppm: Maximum recommended drinking water level is 10 ppm.

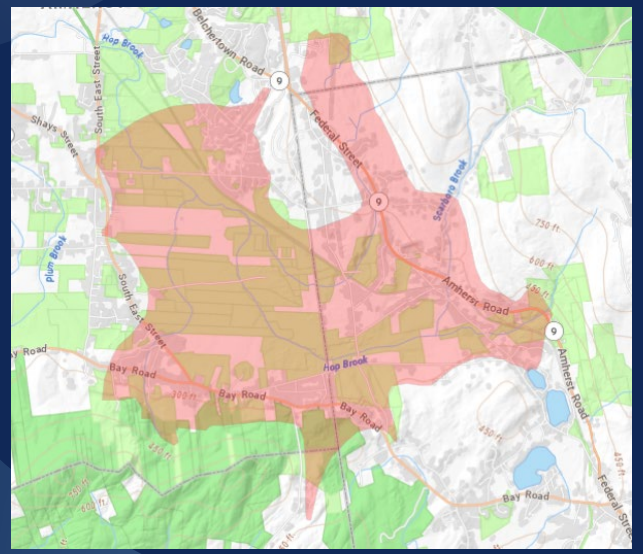
NITROGEN IN DRINKING WATER

- Nitrite in the groundwater binds to hemoglobin in the blood.
- This forms methemoglobin which prevents the blood from carrying oxygen: essentially the nitrate takes the place of the oxygen.
- Methemoglobinemia is a condition of elevated methemoglobin in the blood. Some of the symptoms may include headache, dizziness, shortness of breath, nausea, poor muscle coordination, and cyanosis (blue-colored skin).
- For babies that rely on formula, cyanosis is commonly called *blue baby syndrome*.

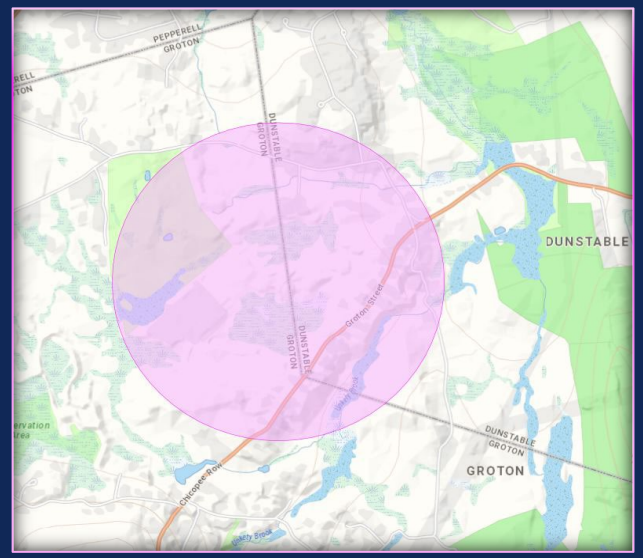

Nitrogen in Drinking Water
Nitrogen in Groundwater
Nitrogen

PROTECTION OF WATER SUPPLIES

Zone II



Interim Wellhead Protection Area



Private Well/Septic System Area

SOLUTION: MAINTAIN < 10 mg/l*

- Limit average wastewater loading across property for new construction and use MFC for upgrades;
- Based on some hydrogeologic analysis, this equates to 440 gpd/acre where an acre is a building acre;
- Building acre = 40,000 sf vs 43,460 sf and makes for easier calculations

* 10 mg/l is the drinking water standard

NITROGEN-REDUCING I/A TECHNOLOGIES MAY HELP

- Must be MassDEP-approved under
  - Piloting Use Approval
  - Provisional Use Approval
  - General Use Approval
- Must meet all requirements of the appropriate approval
  - Facility type limitation (residential, multi-residential, non-residential)
  - Design flow limitation, operations, etc.
- Resulting loading may increase, depending on technology, flow, etc. to:
  - 550 gpd/acre
  - 660 gpd/acre

And then there is the whole issue of credit land...

Which Brian will explore in far more detail.

HOW TO WORK WITH THOSE LIMITATIONS

LOADING RATE CALCULATION

$$LR = \frac{Q_F}{A_T}$$

Where:

LR = Loading Rate (gpd/acre)

Q_F = Design flow of the facility (gpd)

A_T = Area of the facility land and any credit land (acre)*

EXPANDED LOADING RATE CALCULATION

$$LR = \frac{40,000 \cdot Q_F}{A_F + A_C}$$

Where:

LR = Loading Rate (gpd/acre)

Q_F = Design flow of the facility (gpd)

A_F = Area of the facility land in square feet

A_C = Area of any credit land in square feet

OTHER IMPACTS OF NUTRIENTS ON WATER RESOURCES

aka things I know from the other part of my job!

NITROGEN IMPACTS

- Other than nitrogen affecting groundwater as a source of drinking water, marine waters are what it primarily impacted:
- Excess nitrogen can cause:
  - Excessive growth of aquatic plants and algae
  - Which use up dissolved oxygen as they decompose
  - And block light to deeper water
  - Fish kills may result
- Nitrogen impacts are being felt in
  - Gulf of Maine
  - Long Island Sound

PHOSPHORUS IMPACTS

- Freshwater is primarily impacted
- Impacts can include:
  - Excessive algae growth
  - Reduced water clarity
  - Unpleasant odor and taste
  - Low dissolved oxygen
  - Changes in fish populations or fish kills
  - Toxins from bluegreen algae

A FEW MassDEP REMINDERS

Or how I am likely to get people talking today……

ALTERNATIVE TECHNOLOGIES

- For alternative SASs with treatment, depth to gw and/or depth of naturally occurring pervious material and/or SAS reductions may be selected but may not be combined with any reductions from "wet" resource permitted under LUA or variance (such as wetlands, surface water, private well, etc.). If required, you may have to look at a different type of I/A technology, such as an STU for remedial use. For more information, please contact Hersh Thakor - harshraj.thakor@mass.gov.

- BOHs cannot grant variances to the terms and conditions of I/A approvals. Variances may only be granted to Title 5.

MISCELLANEOUS

- BOHs cannot grant variances to Zone A setback distances to surface water supplies and tributaries thereto (see 310 CMR 15.411(5). MassDEP and in some cases DCR have the authority.
- BOHs cannot approve systems with less than 2 feet of naturally occurring pervious material. The only option is a tight tank. For difficult sites, please contact your regional MassDEP office for assistance.
- ADUs – If the ADU is to be connected to the main house septic system, that septic system must comply with new construction standards and meet standards for multi-dwelling units. BTW – *dwelling* is defined in 310 CMR 15.002.

MassDEP REGIONAL TITLE 5 CONTACTS

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THANK YOU

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