Permeable Reactive Barrier (PRB) Demonstration Test at Eldridge Parkway
Nauset Regional School District

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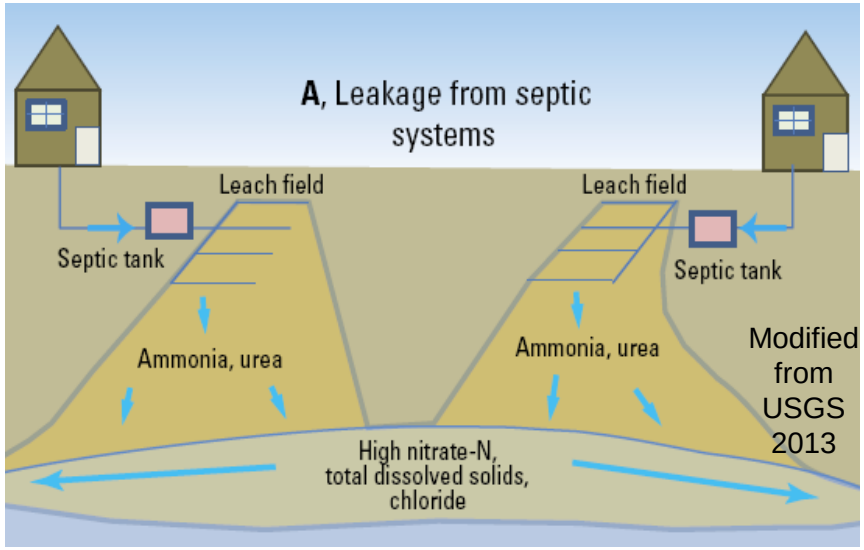
Overview – Nitrogen Problem

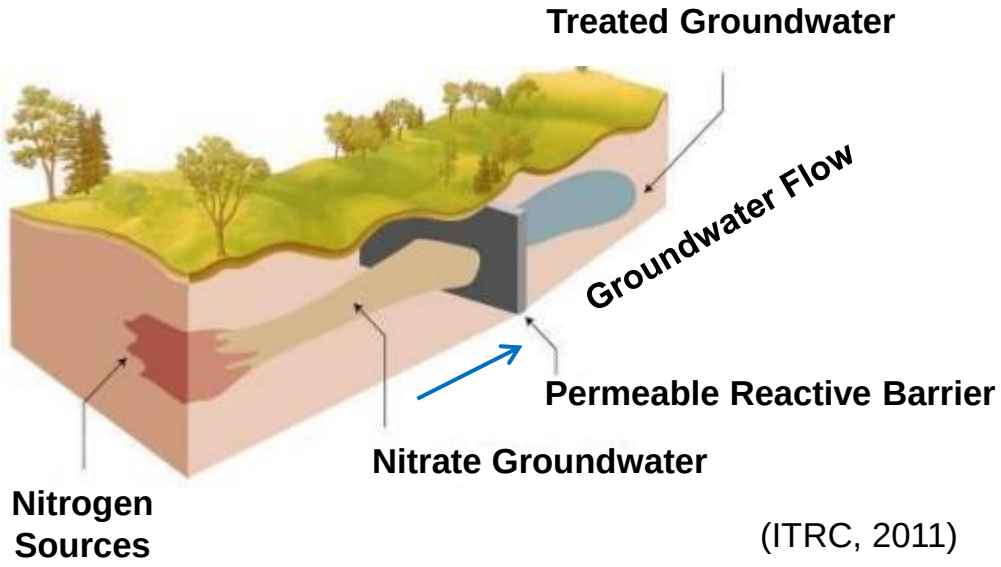
- Septic systems - used for ~85% of wastewater treatment on Cape Cod



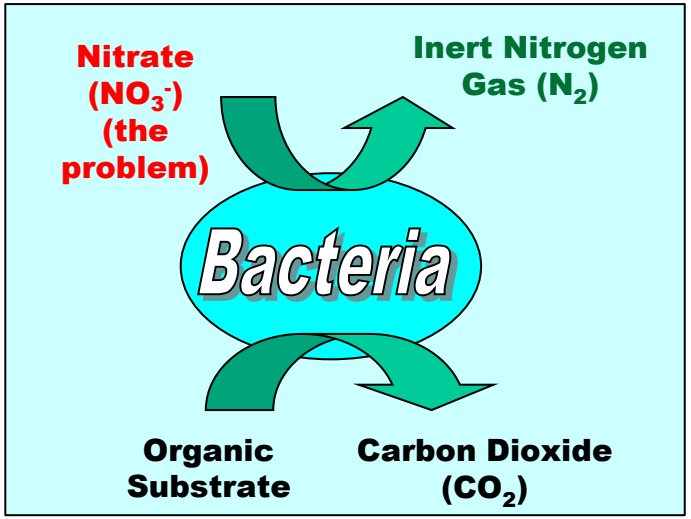
- Naturally-occurring bacterial transform organic nitrogen to nitrate
- Large dilute nitrate plumes in groundwater flow into coastal waters
- Under this project Orleans is the first to implement a “Hybrid” approach under the Cape Cod 208 Water Quality Plan
  - Approved by USEPA and MassDEP
  - Combine traditional wastewater (sewer) and non-traditional treatments
  - Goal is to minimize the proposed area of Town and properties to be sewered

Subsurface PRB

- A PRB consists of a zone of reactive material installed in the path of a plume (e.g. nitrate)



(ITRC, 2011)



- Naturally-occurring bacteria to convert nitrate to inert nitrogen gas (N_2)
- Requires anoxic (low oxygen conditions)

AECOM PRB Team Activities

- Evaluated numerous sites in Orleans for placement of PRB
- Collected groundwater and soil samples
- Recommend PRB Demonstration Test sites
  - Eldredge Park
  - Town Landfill
- Preliminary Engineering Work Plan for PRBs
  - Conceptual design
- Final Technical Memos available on Town website

  http://www.town.orleans.ma.us/water-quality-advisory-panel/pages/aecom-contract-and-deliverables

PRB Amendment – Emulsified Vegetable Oil (EVO)

- Food-grade substrate made with soybean oil
  - Consistency similar to soy milk
- Slowly releases dissolved organic carbon and provides a long term carbon source for denitrifying bacteria
- Relatively immobile once injected into groundwater
  - AECOM experience at 10s of sites
  - Never travels more than 100 feet (mostly less than 20 feet)
- Laboratory studies with Cape Cod sand used to develop an EVO mixture that does not migrate
  - Less than 3 feet in a column study

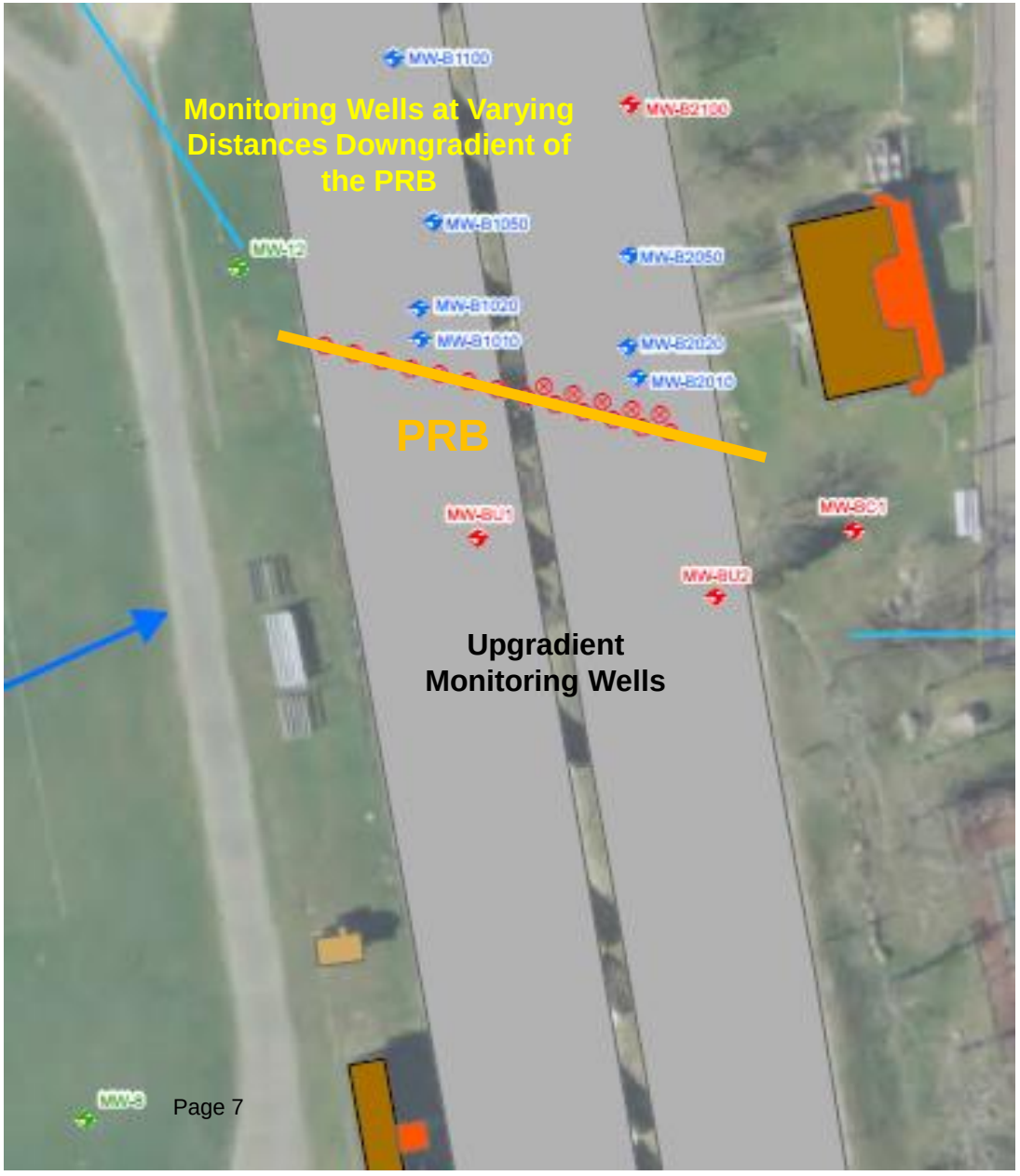
PRB Application Method – Injection

- Widely accepted groundwater treatment method and equipment readily available.
- Small equipment footprint
  - Small drill rig
  - All pumps and mixing tanks contained to box truck/trailer
  - All points temporary
- Injection can be performed under roadways/parking lots
  - Hose ramps can be used to keep street open to traffic
  - Limited impact to traffic and abutters

Site at end of an injection day

Eldredge Park PRB Demonstration Test

- Approximately 110 feet long
- Injection points spaced 10 feet apart
- Upgradient and downgradient monitoring wells



PRB Demonstration Test Activities

- Install groundwater monitoring wells
  - 2-3 days (proposed start 9/26/16)
  - 2-3 days (mid-October)
- Collect groundwater samples (baseline)
  - 2-3 days (early October)
  - 2-3 days (late October)
- Inject vegetable oil
  - 4-5 days (late October/early November)
- Collect groundwater samples
  - Quarterly for 2-3 years
  - 2-3 days each
- Collaborate with science classes

Thank You

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