GROTON UTILITIES
At Your Service

Avery Brook Homes

Water Quality Concerns of Groton Utilities

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August 22, 2024

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Background and Qualifications

- **Wright-Pierce**
  - 300-person consulting firm
  - In business since 1947
  - Offices in Middletown and Providence
  - Specialty practice in water supply and wastewater disposal
- **Mike Giggey, P.E.**
  - Degrees from Tufts Univ. and Stanford Univ.
  - 50 years of experience
  - Senior Vice President at Wright-Pierce
  - Particular expertise
    - Watershed planning
    - Impact of wastewater disposal on groundwaters and surface waters

Important Documents to Discuss

- **Angus McDonald:**
  - Avery Brook Homes: Septic System Effluent Renovation Analysis, June 20, 2024
- **Wright-Pierce:**
  - Avery Brook Homes: Review of Water Quality Impacts from 18-Lot Re-Subdivision, August 15, 2024
- **CT DEEP:**
  - Guidance for Design of Large-Scale On-Site Wastewater Renovation Systems, 2006
- **Amory Engineers, PC:**
  - Support Letter for Extension of Water to Aljen Heights and Avery Hill Trailer Park, May, 2009
- **CT DPH:**
  - Comments on Quakertown Meadows project, 2015

Overview

- The proposed site is environmentally sensitive
- The developer has not addressed all of the potential contaminants or all of the potential impacts
- The analyses submitted to date are incomplete and understate the impacts
- Further documentation by the developer is unlikely to show that this project on this site is environmentally sound
- The project will have unacceptable impacts on public and private water supplies
- The proposed housing density is 5 times higher than a state task force has judged to be acceptable for this water supply setting.

Broad Project Assessment—What are the "Red Flags"?

NRCS soils mapping

- Severe limitations for on-site wastewater disposal

- **CT DEP recommendations to state housing task force**
  - No more than 1 home per 2 acres in water supply watersheds
- **CT DPH Surface Water Assessment Program**
  - Water supplies are at high risk for contamination if unsewered development occurs with lots smaller than 0.5 acres
- **Massachusetts DEP Title 5**
  - Allowable density is 1 home per 40,000 sf of upland
- **Local health bylaws**
  - Provide on-site wastewater treatment if more than 1 bedroom per 10,000 sf

The Setting

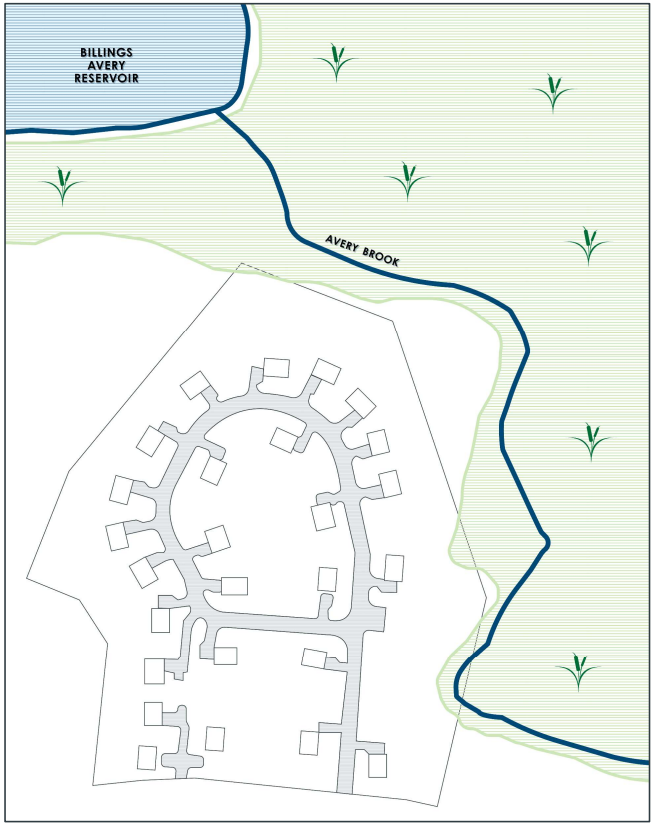
- 6.4 acres site off Stoddards Wharf Road
- Adjacent watercourses and assoc. wetlands
  - Avery Brook
  - Billings Avery Reservoir
- Soils—largely sandy loams
  - Agawam sandy loam
  - Hinckley sandy loams
- Ground surface sloping to east and southeast
- Groundwater flowing generally northwesterly through sandy soils to Billings Avery Reservoir and associated wetlands

Avery Brook Homes

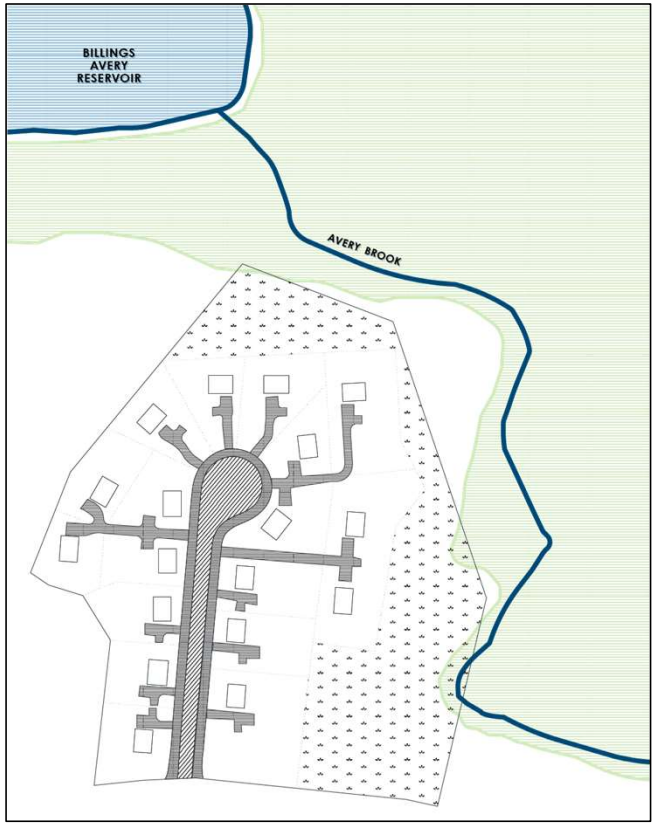
Water Quality Concerns of Groton Utilities

The Setting—Re-Subdivision of 4 Existing Parcels

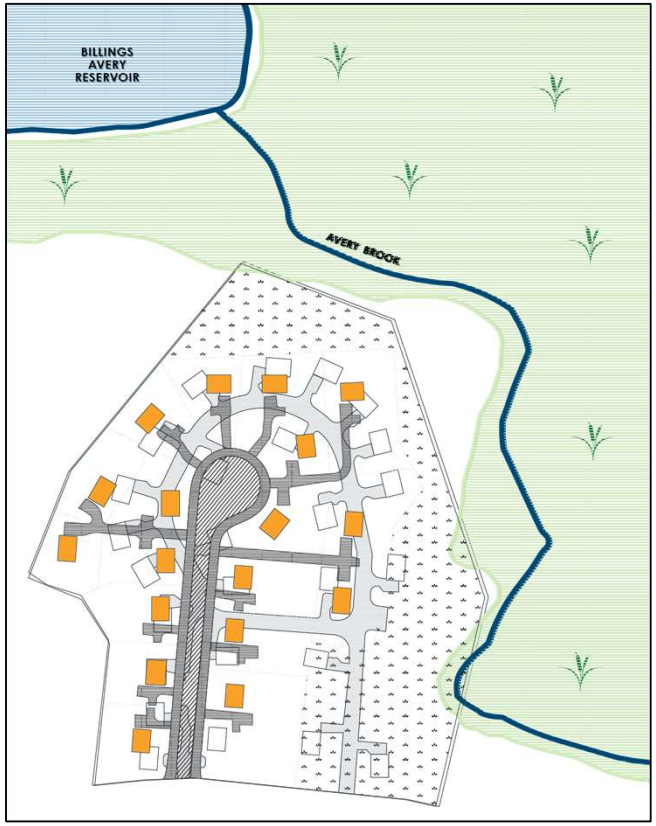
2022 project | 28 homes | 9.21 AC



2024 project | 18 homes | 6.38 AC



Comparison



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Sensitive Receptors

- The watercourse named Avery Brook
- The watercourse called Billings Avery Reservoir---an open pond that is part of the Groton water supply system
- The wetlands surrounding the brook and the reservoir
- 18 proposed private drinking water wells
- 2 or more existing private wells on neighboring lots

Contaminants of Concern

- Nitrogen compounds, including nitrates
- Phosphorus compounds
- Pathogens
  - Bacteria
  - Viruses
- Suspended solids
- Petroleum products
- Other organic compounds (including PFAS)
- Heavy metals
- Sodium

Hydrologic Cycle

- Surface waters
- Wetlands
- Groundwater

- Interactions
  - Groundwater recharge of streams
  - Stream recharge of groundwater
  - Wetlands that dampen stream flow and interact with water quality

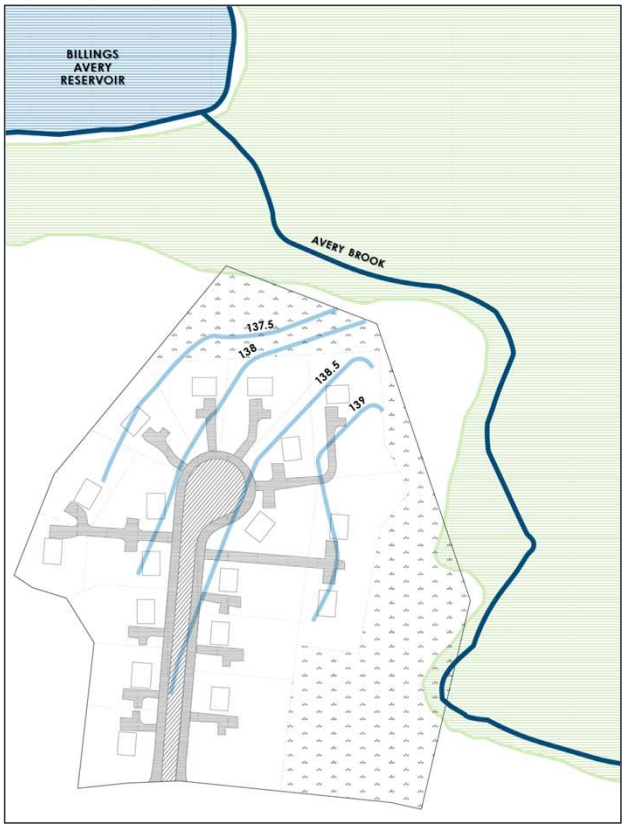
The interactions are critical to environmental protection

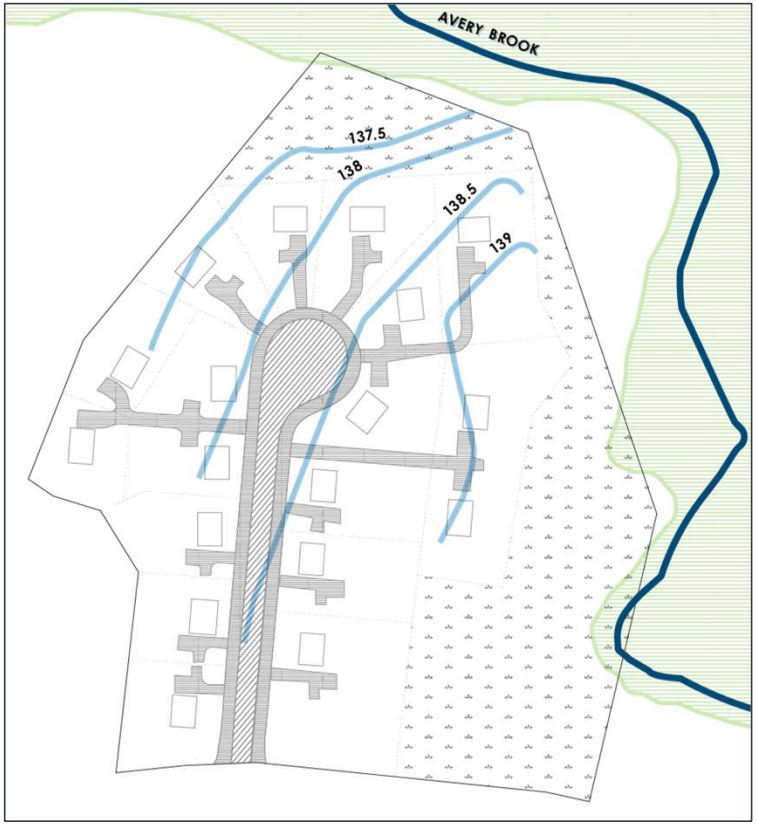
Groundwater Elevations and Flow Directions

- **Data needed to determine the degree of impacts on watercourses, wetlands and groundwater**
  - **How deep is the water table?**
  - **What is the direction of groundwater flow?**
  - **How fast does groundwater travel?**
  - **How long will contaminants be retained in the groundwater before reaching wetlands and watercourses?**
  - **How long will contaminants be retained in the groundwater before reaching abutters' properties?**

- **Developer has not fully characterized the interactions between the groundwater and Avery Brook on and near this site**

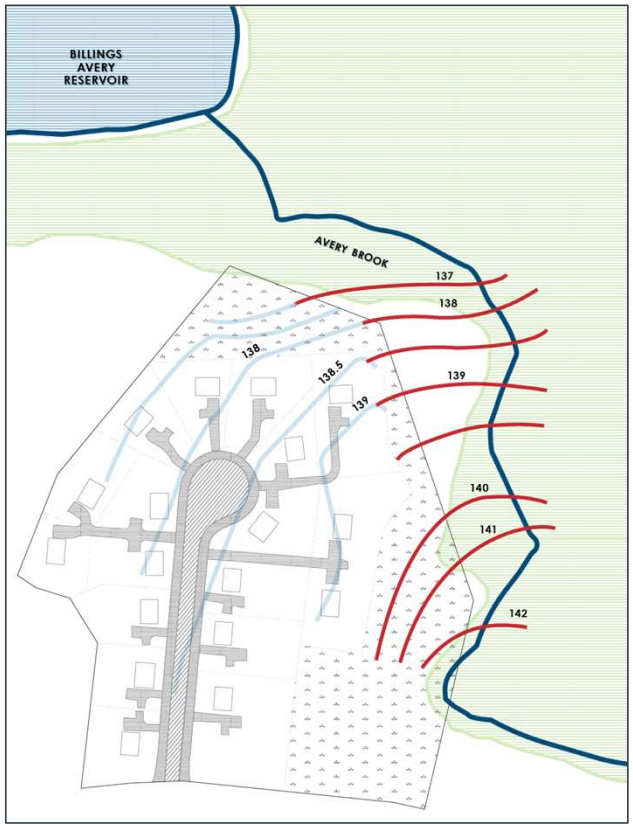
Groundwater Contours Reported by Angus McDonald

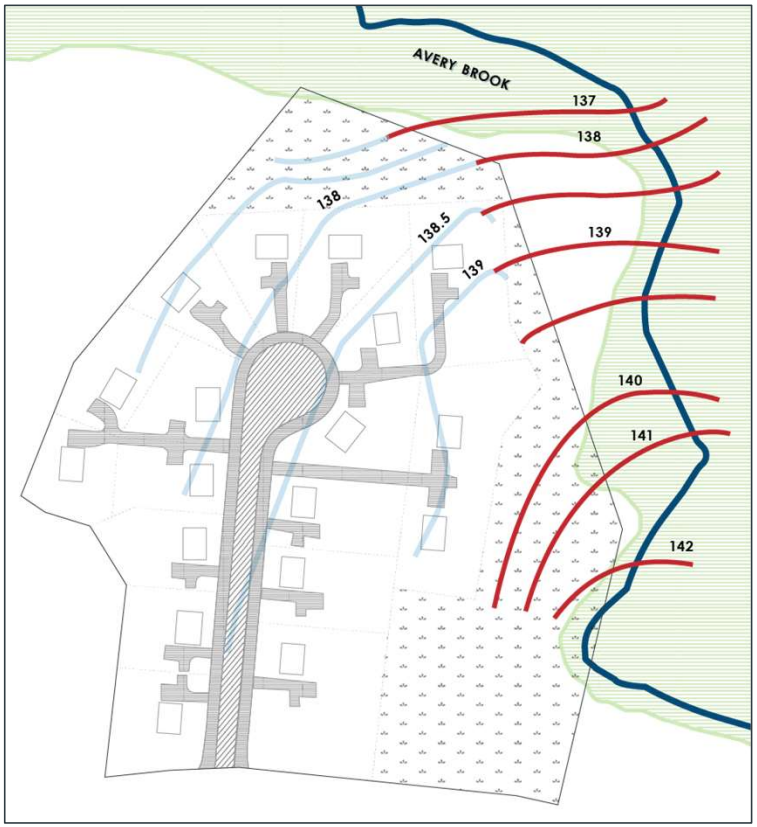




- Water table data limited to central portion of site
- Apparent northwesterly flow of groundwater

Groundwater Contours—reasonable extrapolation by Wright-Pierce





- Contours bend to the east as groundwater interfaces with Avery Brook
- Expect more groundwater flow to the north
- Much of recharge from 94 Stoddards Wharf Road flows to the north

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Travel Times

- Groundwater flow from the site to the reservoir
  - A few months
- Groundwater flow from the site to Avery Brook
  - A few weeks
- Surface water flow in Avery Brook to Reservoir
  - A few hours

Pathogen Inactivation, specifically viruses

- CT DEEP requirements for wastewater disposal
  - 21-day inactivation period for most cases
  - 56-day inactivation period for nearby public and private drinking water supplies
  - Provide inactivation period on-site or obtain easement for off-site encroachment
- Developer's assessment (Angus McDonald report)
  - Based on 21 days, not 56 days
  - Shows encroachment on land of Groton Utilities
  - Ignores travel time to Avery Brook

CT DEEP statement on viral inactivation

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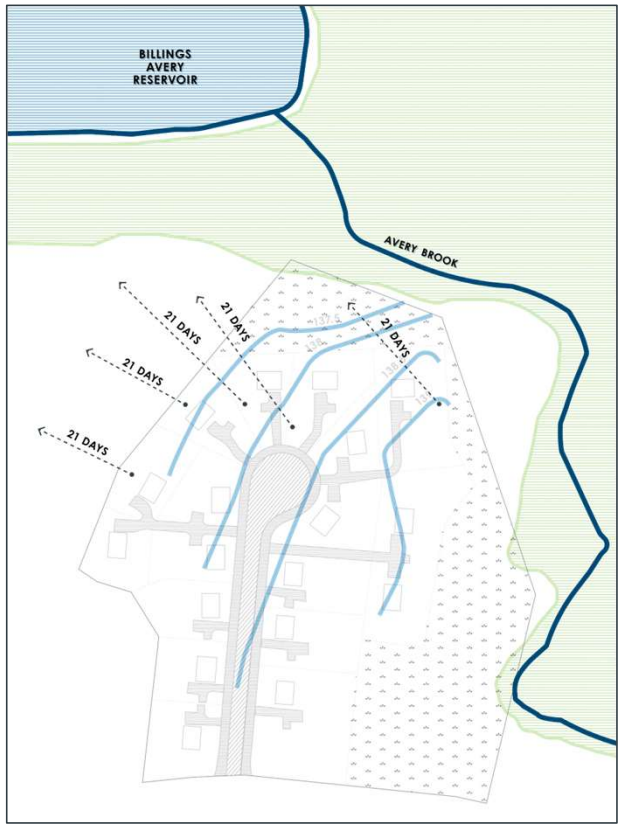
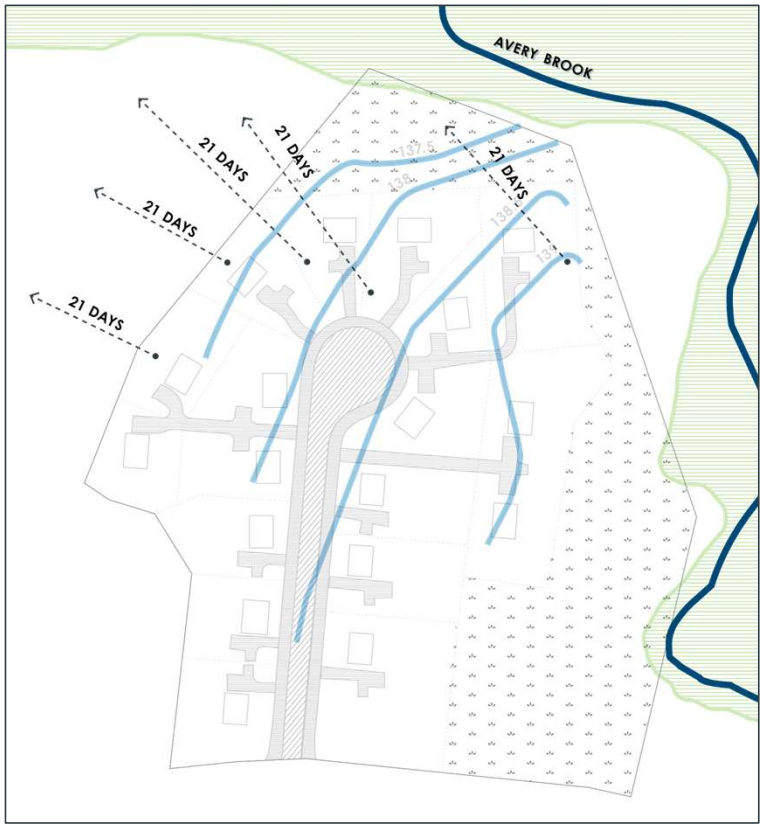
"Based on an inactivation rate of 0.036 log-10 per day, a travel time of 56 days is indicated between a SWAS and existing and potential sensitive receptors such as:

a. ***The outer limits of a cone of depression of a public (community) drinking water supply well,***
b. ***A surface water body used, or intended to be used, as a source of public (community) drinking water supply,***
c. ***A private drinking water supply well serving an individual residence.***
d. ***An impoundment used for aquaculture.***

The minimum required travel time to all other points of concern should be not less than 21 days, and a greater travel time is preferable."

Virus Inactivation—distances reported by Angus McDonald





- Based on northwesterly flow
- Based on 21-day inactivation period
- Demonstrated impact on abutters

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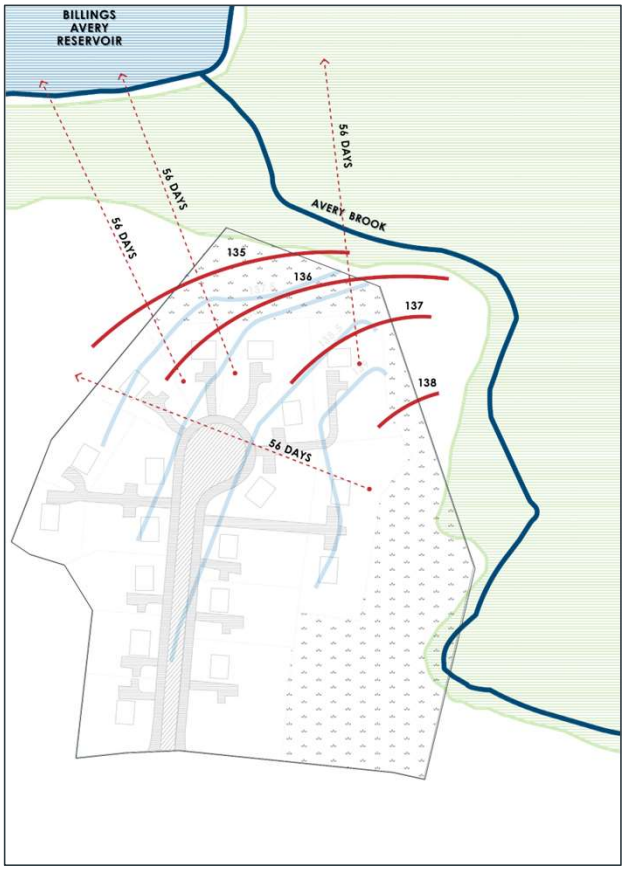
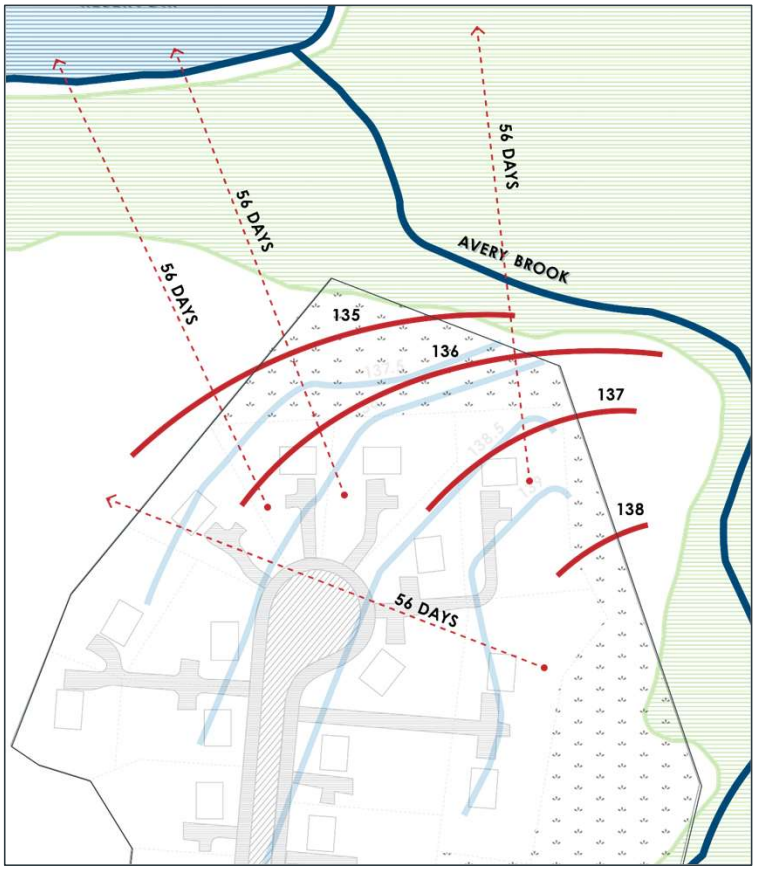
Virus Inactivation—reasonable extrapolation





- Consider likely flow to the north
- Consider 56-day inactivation period
- Expect impacts on
  - Avery Brook
  - Billings Avery Reservoir
  - Many on-site potable wells
  - Abutters' wells

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Nitrate Contamination

- Drinking water standard = 10 mg/l
- Planning guideline = 5 mg/l
- High nitrates are always associated with measurable amounts of other contaminants
- Average recharge nitrogen concentration
  - Add up all nitrogen sources—pounds per year
  - Add up all recharge sources—million gallons per year
  - Compute composite concentration— mg/l---an average across the site
    - Compare with 5 mg/l planning guideline
  - Show that all points along property line are less than 10 mg/l

Nitrate Contamination

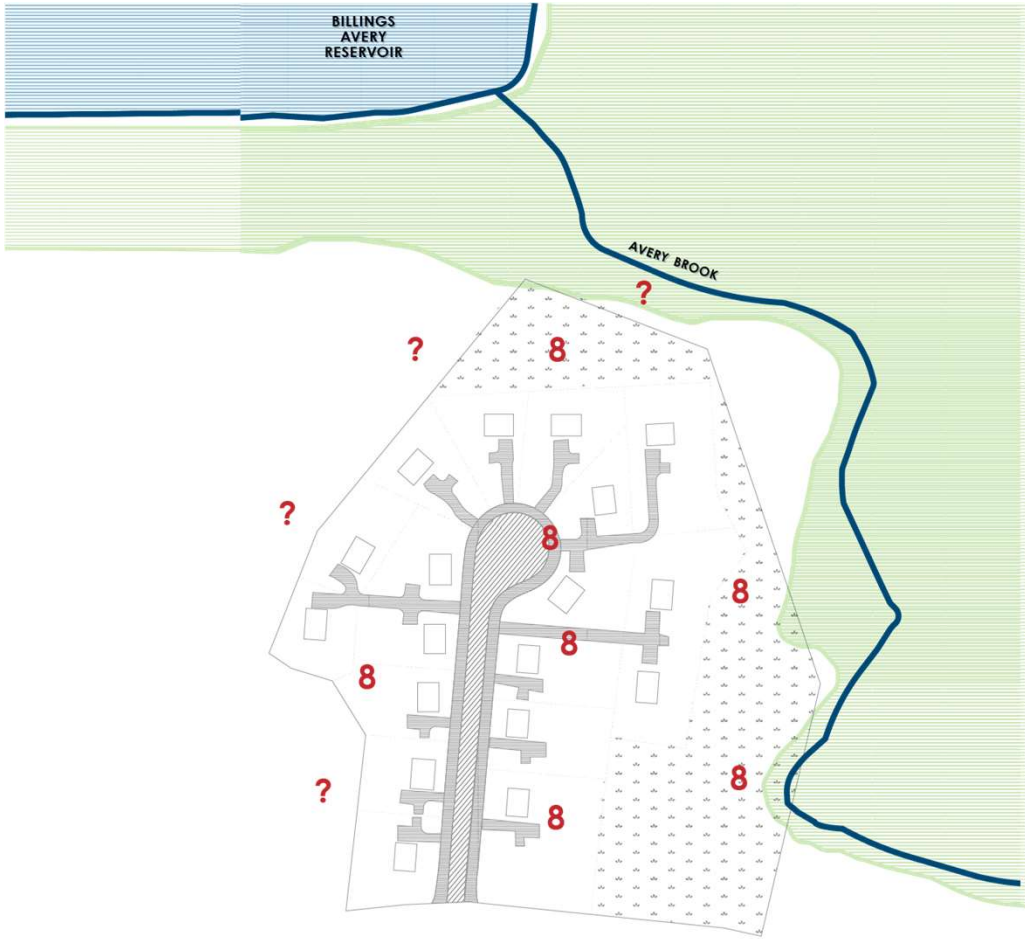
- Wright-Pierce estimate of avg. recharge concentration
- N load from wastewater effluent 500 lb/yr
- N load from fertilizer 50 lb/yr
- N load from stormwater infiltration 10 lb/yr
- Total 560 lb/yr
- Recharge volume 6.1 Mgal/yr
- Average recharge concentration 11 mg/l
- At points along property line > 14 mg/l
- Drinking water standard 10 mg/l

Nitrate Contamination

- Angus McDonald estimate of avg. recharge concentration

N load from wastewater effluent	500 lb/yr	450 lb/yr
N load from fertilizer	50 lb/yr	0
N load from stormwater infiltration	10 lb/yr	0
Total	560 lb/yr	450 lb/yr
Estimate of recharge volume	6.1 Mgal/yr	6.7 Mgal/yr
Average recharge concentration	11 mg/l	8 mg/l
At points along property line	> 14 mg/l	not reported
Drinking water standard	10 mg/l	10 mg/l

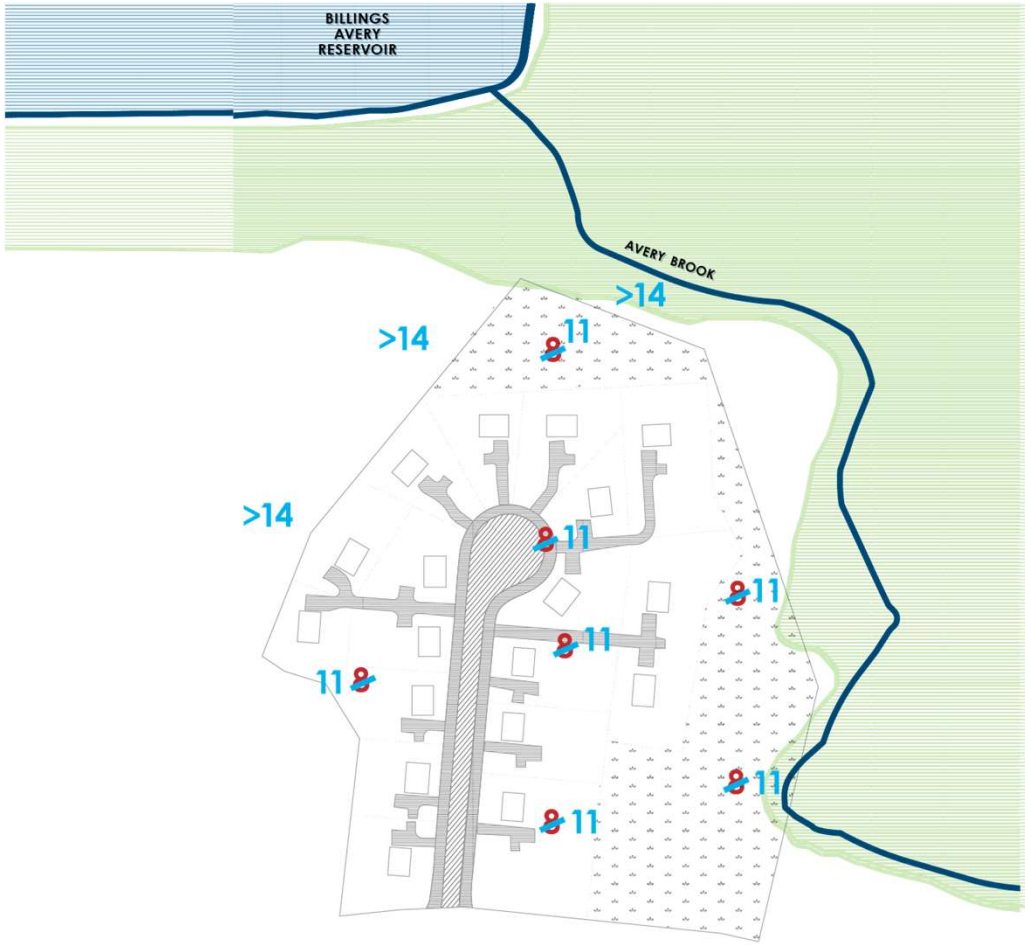
Groundwater Nitrate Map



Reported by Developer

- Based on Angus McDonald calculations
- Site average recharge concentration---8 mg/l
- Concentrations at property lines not estimated

Groundwater Nitrate Map



Better Estimate

- Based on Wright-Pierce calculations
- Site average recharge concentration—11 mg/l
- Property line calculations well above 10 mg/l

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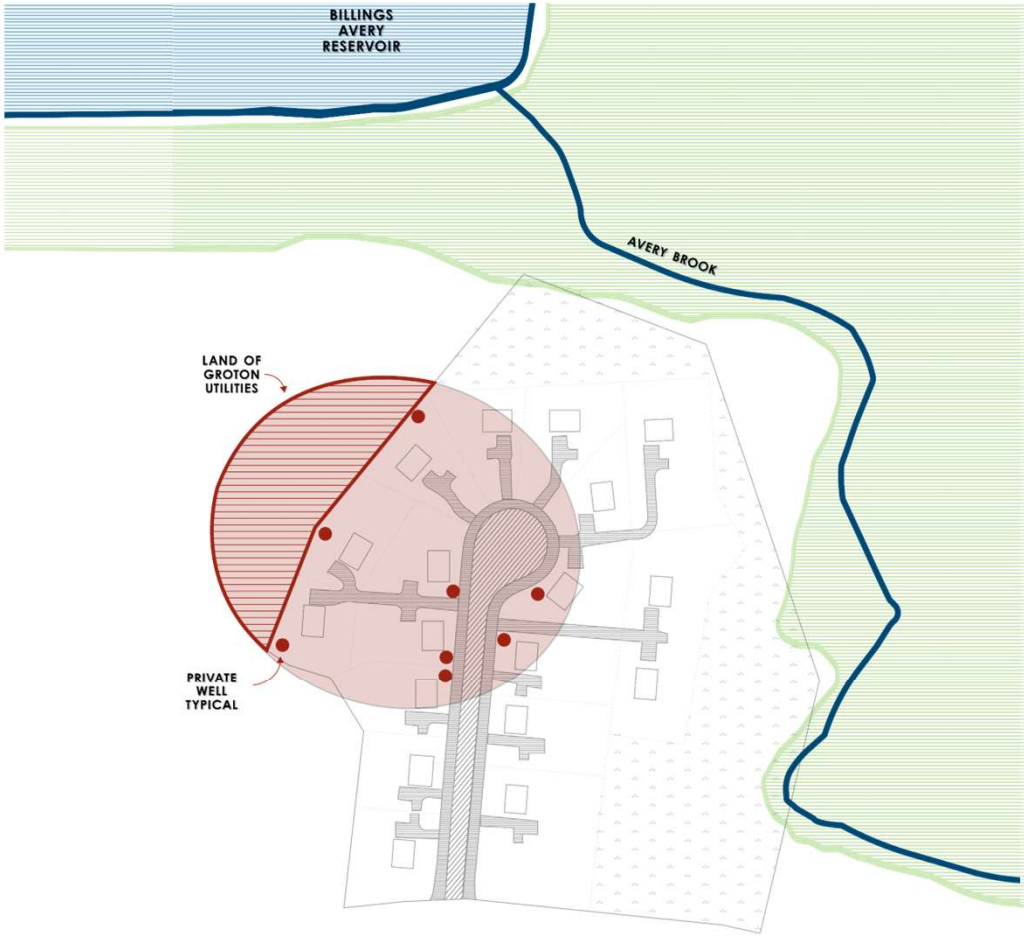
Nitrate Contamination

	Adjusted Input Variable	Nitrate Load, lb/yr	Recharge Volume, Mil.Gal/yr	Avg. Recharge Nitrogen Conc., mg/l
Base Case, Angus McDonald	None	450	6.7	8.2
Base Case	Add fertilizer load	510	6.7	9.1
Base Case	Increase occupancy to 4.0 persons per home	630	6.9	10.8
	Increase occupancy to 4.5 persons per home	700	7.1	11.8
Base Case	50% reduction in recharge from 94 Stoddards Wharf Rd.	700	6.4	13.2

Groundwater Nitrate Map



Possible Nitrate Plume

- Where on site will nitrate exceed 10 mg/l?
- That plume is likely to extend off-site onto GU land
- Developer proposes many private wells in that area!

Nitrate Contamination

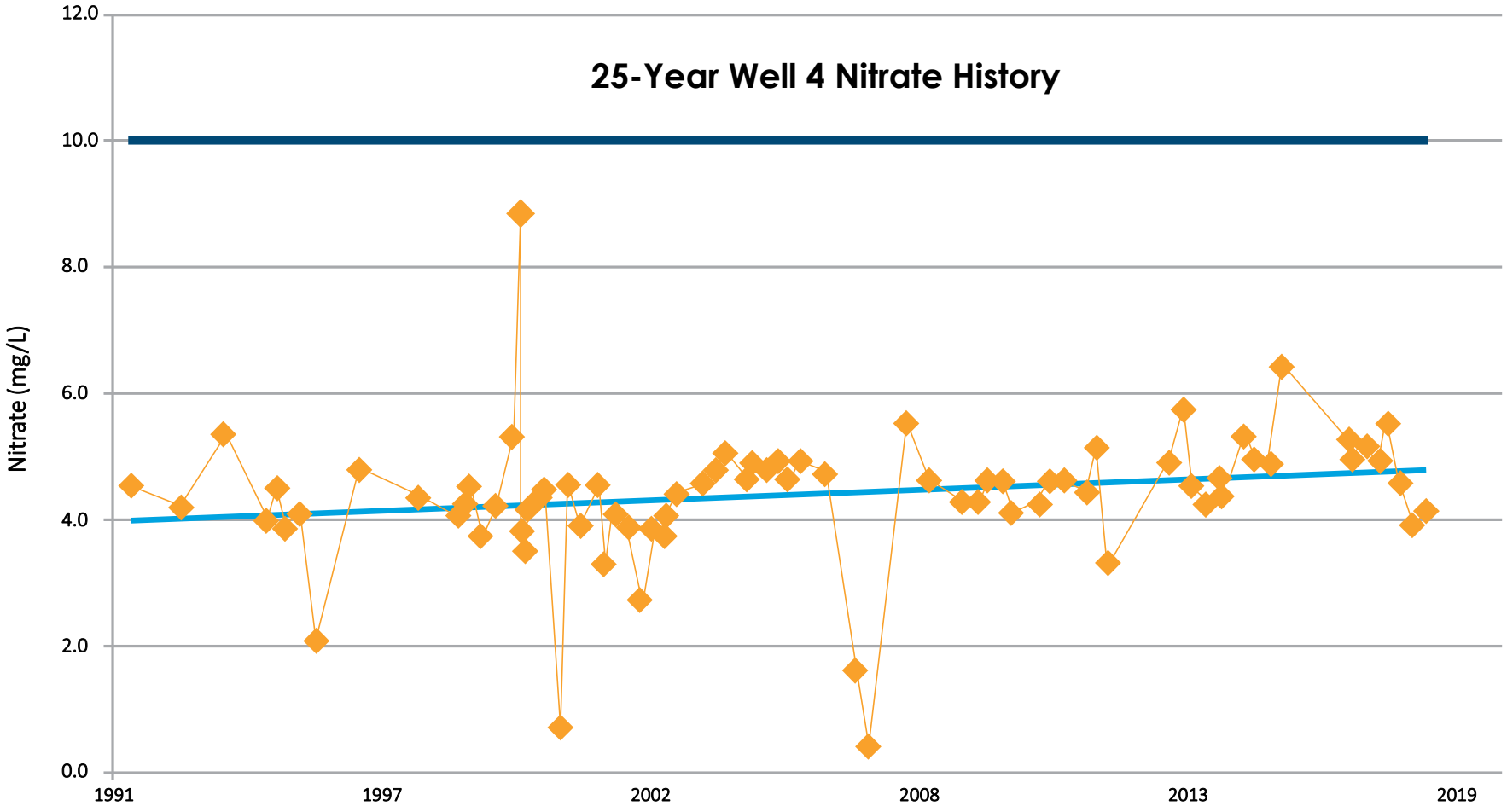
Remember that these calculations look only at the average recharge concentration across the site.

If the average concentration is near or over 10 mg/l, there will be places where the actual concentration will be well over 10 mg/l

An industry-standard planning threshold is 5 mg/l as an average concentration, recognizing the variability across the site and the impacts of year-to-year variability in recharge amounts.

It is widely required that any nitrate concentrations be no more than 10 mg/l at the property line; that is, that dilution and natural attenuation occur on the property of developer. It is clear from the Angus McDonald report, that the nitrate contamination will extend onto the adjacent properties.

Yarmouth (Mass) Well 4--Nitrate Graph



Nitrate Contamination--Summary

- Many locations within the site where concentrations > 10 mg/l
- Many locations along property line >10 mg/l
- 700 lb/yr headed toward reservoir
- Little attenuation expected in downgradient groundwater
- Project does not comply with DEEP edict to attenuate nitrogen on-site
- No assessment provided of impact on public drinking water supply
- No assessment of impacts on neighboring wells
- Use of on-site wastewater disposal precludes on-site water supply at this development density

Other contaminants

- Petroleum products—not addressed by developer
- Other organics (including PFAS)—not addressed by developer
- Sodium—not addressed by developer

General Guidelines and Specific Analyses

- The proposed housing density is significantly higher than planning guidelines issues in several states
  - Average recharge N conc. less than 5 mg/l
  - No more than one bedroom per 10,000 sf of upland
  - No more than 1 dwelling unit per 2 acres of upland
- Those guidelines are based on analyses of specific contaminants and how they are attenuated in the environment
- Wright-Pierce has applied the fundamental scientific basis for those guidelines to this project
- This site can support only a small fraction of the proposed number of homes
- As proposed, this project does not comply with requirements for renovation of nitrates and viruses.

Amory Engineers Support of Aljen Heights Water Extension

See letter dated May 29, 2009

Lot sizes of 10,000 to 15,000 sf

On-site septic systems and private wells

Existing water quality problems

- High nitrates at 21 wells (5 to 15 mg/l)
- Numerous sanitary violations

Estimated cost of providing public water supply--$4.85 million (2009)

Was groundwater nitrate contamination considered when developer first proposed this project?

Wright-Pierce Conversations with CT DPH staff

1. Wright-Pierce asked DPH for information on similar high-density developments with both private wells and on-site wastewater disposal

2. DPH staff provided the 2015 comment letter it issued on the Quakertown Meadows project in Ledyard, addressing these topics:

- **Difficulties of providing necessary setbacks for septic systems and private wells on small lots.**
- **Water quality in private drinking water wells that may be impacted by septic systems**
- **Possibility of water treatment systems and the need for proper disposal of chemicals used to regenerate those systems.**
- **Adequacy of soils and bedrock to produce sufficient quantities of water.**

3. DPH staff has drafted a letter with concerns about Avery Brook Homes, but it was not completed in time for this hearing.

Overall Assessment

- The proposed site is environmentally sensitive
- The developer has not addressed all of the potential contaminants or all of the potential impacts
- The analyses submitted to date understate the impacts of nitrogen and viruses
- The analyses submitted to date are incomplete with respect to petroleum products, other organics (PFAS) and sodium
- Further documentation by the developer is unlikely to show that this site is project is environmentally sound
- The project will have unacceptable impacts on watercourses and their associated wetlands.
- The proposed housing density is significantly higher that CT DEEP has judged to be acceptable for this water supply setting
- This site can support only a small fraction of the proposed number of homes.

THANK YOU