Limitations of Individual Sewage Disposal Systems

Depth to Water Table or Impermeable Layer

- Clear link between vertical separation of Effluent Disposal Area (EDA) and the seasonal high water table or impermeable layer (Humphrey et al., 2015; Humphrey et al., 2011; Pfluger et al., 2009; Meeroff, 2008; Mallin et al., 2004; Van Cuyk et al., 2004) (Figure 1).
- Two to five feet of aerated soil below the bottom of the EDA required for adequate treatment.
- **Though the depth to the water table and impermeable layer is not known at all locations in the Parsons Creek watershed, many of the soil types are characterized by having seasonally shallow water tables (Table 1).**

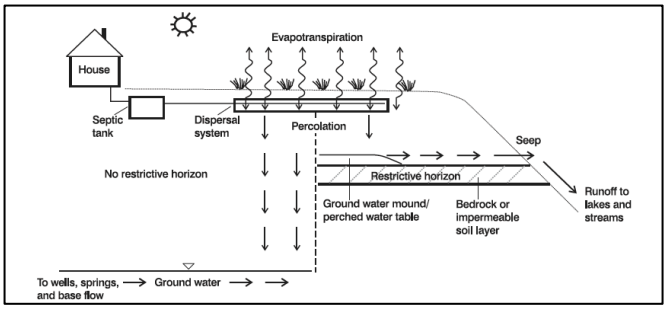


Figure 1 - ISDS in area with and without adequate distance below the Effluent Disposal Area

Soil Percolation Rates

- The soil percolation rate, or rate at which water can be absorbed into the soil, is an indicator of how well a specific type of soil will treat pollutants.
- Soils are considered unsuitable for ISDS if percolation rates are too slow (> 60 minutes/inch) or too fast (< 1 minute/inch) (Harrison et al., 2000; Otis et al., 1980, pg. 214).
- **The Soil Conservation Service (1994) ranks essentially all of the soils in the watershed as "severe" and poorly suitable for onsite wastewater disposal. Treatment is possible for some of these soil types in areas where the depth to bedrock or the SHWT is or can be made sufficiently large (Figure 2, Table 1).**

Proximity to Surface Waters and Wetlands

- Plumes of pollutants below the EDA have been shown to range from 30 to 300 feet depending on soil conditions and distance to water table and/or bedrock (Schneeberger et al., 2015; Scandura and Sobsey, 1997; MPCA, 1999).
- **Of the 843 parcels in the Parsons Creek watershed, 383 parcels are within a 100-foot buffer of a surface water body or wetland. 357 parcels are within 75 feet and 331 parcels are within 50 feet (Figure 3).**

The Number of ISDS in the Watershed

- Too many ISDS in an area may overwhelm the area's carrying capacity for treatment as individual plumes may intermingle and pollute large areas of groundwater.
- A density of more than 0.26 septic tanks per acre has been shown to lead to fecal contamination (Malin, 2004; Yates, 1985).
- **In the Parsons Creek watershed, the density was estimated to be 0.45 ISDS per acre.**

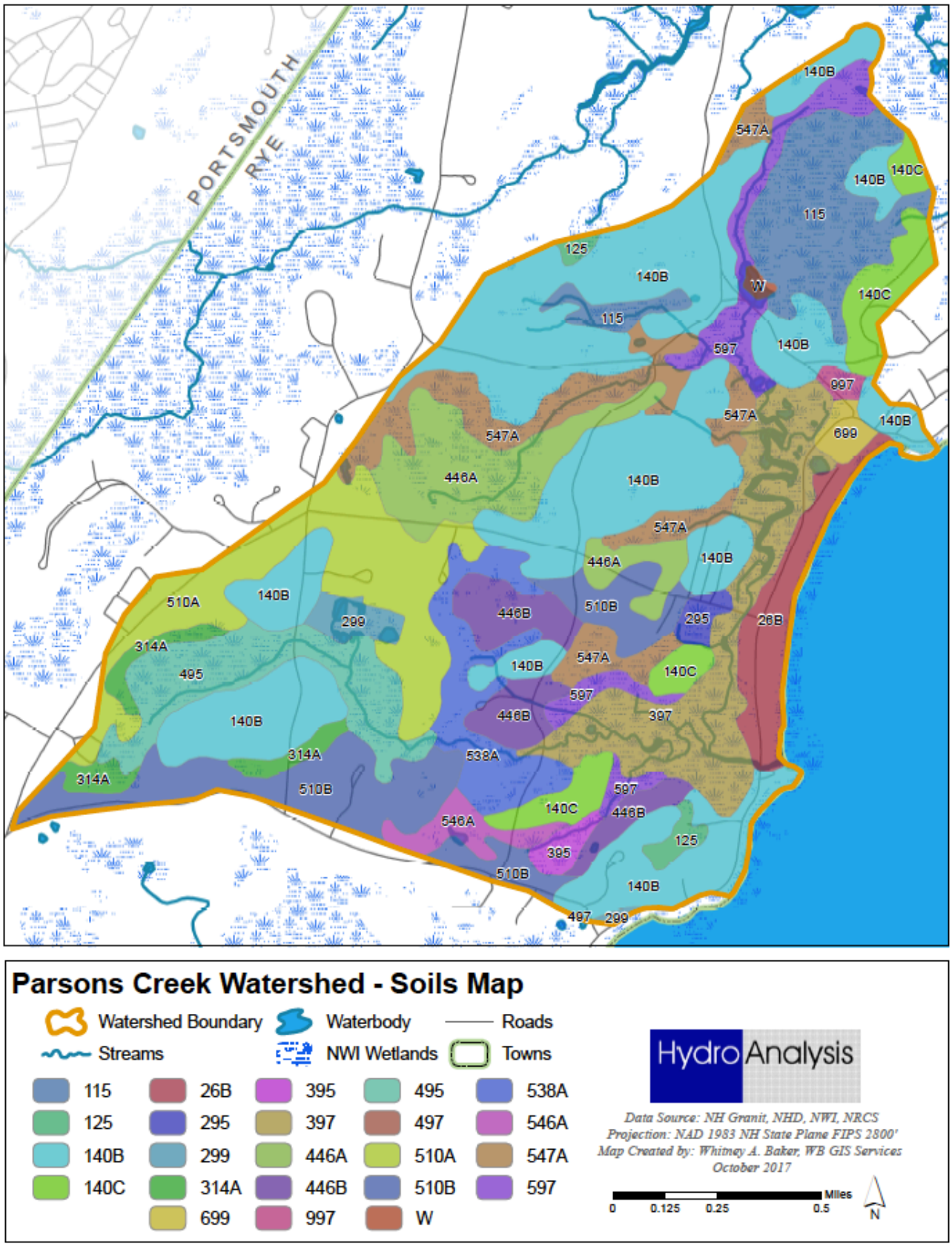


Figure 2 – Soils in the Parsons Creek Watershed, Rye, NH
(See Table 1 for key to soil types)

Table 1 – Soils in the Parsons Creek Watershed, Rye, NH (SCS, 1994)

Map Unit Symbol	Map Unit Name	Square Miles	Percent of Watershed	Depth (feet) to SHWT[1]	Rating for EDA[2]
140B	Chatfield-Hollis-Canton complex, 0 to 8 percent slopes, rocky	0.67	29.3%	> 6	Severe (depth to rock)
510A	Hoosic gravelly fine sandy loam, 0 to 3 percent slopes	0.18	8.0%	> 6	Severe (poor filter)
397	Ipswich mucky peat, 0 to 2 percent slopes, very frequently flooded	0.18	7.9%	-1 to 0	Severe (flooding, ponding)
510B	Hoosic gravelly fine sandy loam, 3 to 8 percent slopes	0.17	7.6%	> 6	Severe (poor filter)
115	Scarboro muck, coastal lowland, 0 to 3 percent slopes	0.14	6.4%	-1 to 1	Severe (ponding, poor filter)
547A	Walpole very fine sandy loam, 0 to 3 percent slopes, very stony	0.14	6.1%	0 to 1	Severe (wetness, poor filter)
446A	Scituate-Newfields complex, 0 to 3 percent slopes	0.13	5.7%	1.5 to 4	Severe (wetness)
495	Natchaug mucky peat, 0 to 2 percent slopes	0.11	4.9%	-1 to 0.5	Severe (ponding, percs slowly)
140C	Chatfield-Hollis-Canton complex, 8 to 15 percent slopes, rocky	0.09	3.8%	> 6	Severe (depth to rock)
446B	Scituate-Newfields complex, 3 to 8 percent slopes	0.08	3.6%	1.5 to 4	Severe (wetness, percs slowly)
538A	Squamscott fine sandy loam, 0 to 5 percent slopes	0.08	3.6%	0 to 1	Severe (wetness, percs slowly)
597	Westbrook mucky peat, 0 to 2 percent slopes, very frequently flooded	0.08	3.5%	-1 to 0	Severe (flooding, ponding)
26B	Windsor loamy sand, 3 to 8 percent slopes	0.07	3.0%	> 6	Severe (poor filter)
314A	Pipestone sand, 0 to 5 percent slopes	0.04	1.7%	0.5 to 1.5	Severe (wetness, poor filter)
546A	Walpole very fine sandy loam, 0 to 5 percent slopes	0.03	1.2%	0 to 1	Severe (wetness, poor filter)
299	Udorthents, smoothed	0.02	0.9%	–	–
125	Scarboro muck, very stony	0.02	0.7%	-1 to 1	Severe (ponding, poor filter)
395	Swansea mucky peat, 0 to 2 percent slopes	0.01	0.6%	-1 to 0.5	Severe (ponding, poor filter)
699	Urban land	0.01	0.6%	–	–
295	Freetown mucky peat, 0 to 2 percent slopes	0.01	0.5%	-1 to 0.5	Severe (subsides, ponding)
997	Ipswich mucky peat, low salt	0.01	0.3%	-1 to 0	Severe (ponding, flooding)
W	Water	0.00	0.2%	–	–
497	Pawcatuck mucky peat, 0 to 2 percent slopes, very frequently flooded	0.00	0.0%	-1 to 0	Severe (flooding, ponding)
	Total	**2.28**	**100%**		

[1] Based on SCS (1994, Table 16). Negative values indicate water above the land surface.

[2] Based on SCS (1994, Table 11). Entries indicate "restrictive soil features" given by SCS as well overall rating of restriction.

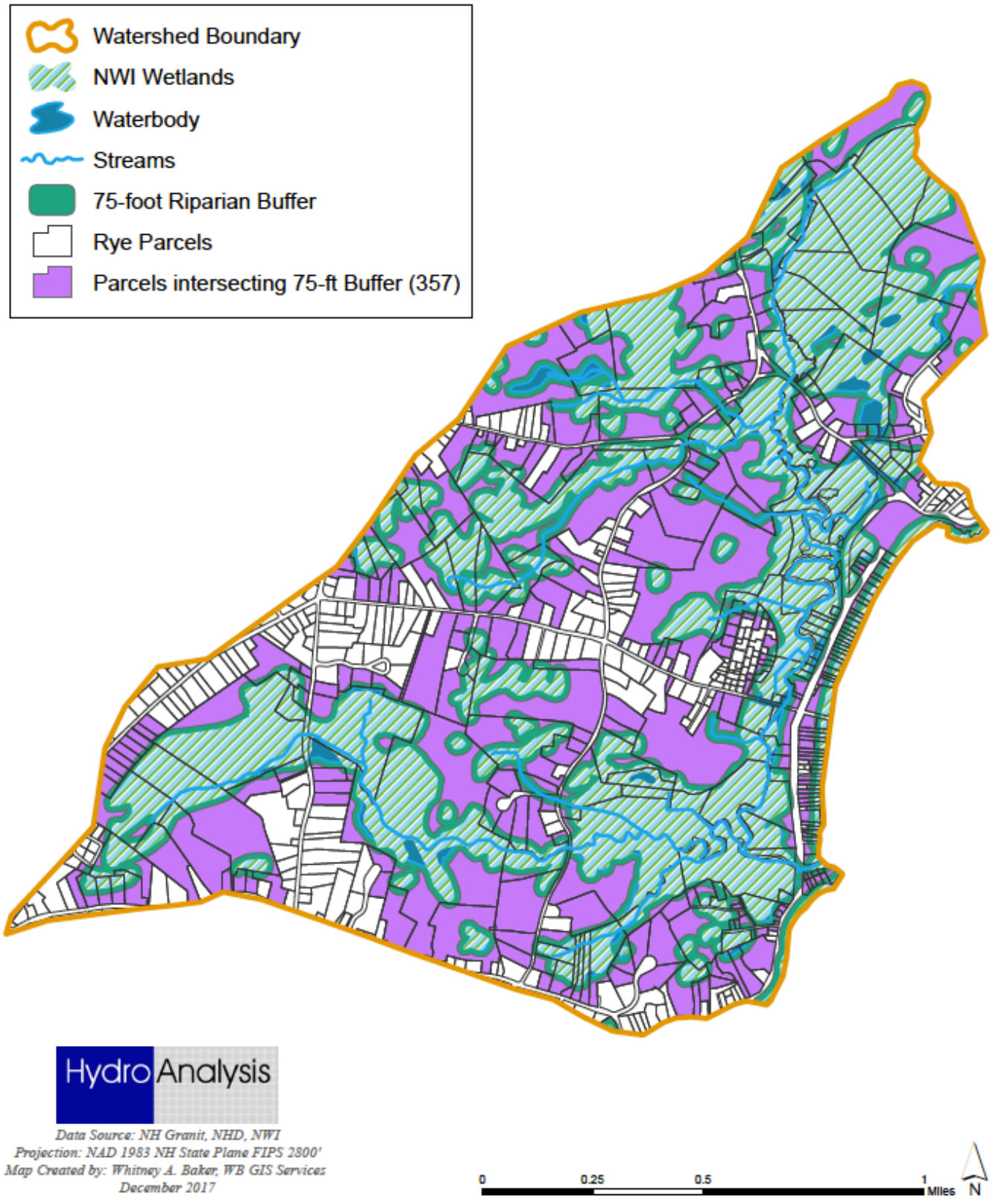


Figure 3 – Parcels in the Parsons Creek Watershed that lie within 75-feet of surface water or wetlands

Applicable ISDS Regulations

The construction and operation of ISDS are primarily governed by a comprehensive set of state regulations. Local municipalities are free to enforce local by-laws with stricter, but never more lenient, requirements. A summary of these regulations is provided in Table 2.

- ISDS are regulated by the State of New Hampshire under Chapter Env-Wq 1000 Subdivision; Individual Sewage Disposal Systems in the New Hampshire Code of Administrative Rules and promulgated under the authority of Statute Title 50, Water Management and Protection, Chapter 485A, Water Pollution and Waste Disposal.
- ISDS are regulated by the Town of Rye under the Section 7.9 of the Building Code most recently revised in March 2017.

Table 2 – Summary of Applicable State and Town ISDS Regulations

Category	State Regulations	Town Building Code
Setbacks from Surface Water/Wetlands	75 feet from surface waters; 50-75 feet from wetlands	100 feet of protected wetland; 75 feet of other surface waters
Effluent Disposal Area Seasonal High Water Table	2-4 feet	2-4 feet
Effluent Disposal Area Permeable Soil	2 feet	6 feet
Effluent Disposal Area Bedrock	4 feet	6 feet

Treatment Recommendations

Establishing performance standards or criteria for the treatment of bacteria by a system under different conditions will ensure that the correct type of ISDS is installed in the proper setting. EPA (2002) provides a management scheme that considers the setting and depth to the water table to recommend a set of treatment standards (Table 3).

Table 3 – Recommended Vertical Separation of the ISDS from the Water Table (adapted from US EPA, 2002)

Vertical Separation of Bottom of EDA from SHWT (feet)	Treatment Performance Standard for Fecal Coliform Bacteria (CFU/100mL)
>4	10 million
3 to 4	50,000
1 to 3	10,000
<1	200

Methods to Address Failing ISDS

Increase the Vertical Separation

- Install Mounded Effluent Disposal Area (EDA) to increase the separation.

Increase Bacteria Treatment

- Install Alternative ISDS such as Aerobic Treatment Units, Recirculating Sand Filters, Constructed Wetlands, Trickling Filters, and Membrane Bioreactors to improve the quality of effluent discharged to the EDA.

Recommended Changes to the Building Code for the Parsons Creek Watershed

Effluent Disposal Systems for Homes in the Parsons Creek Watershed Overlay District

All requirements of the current Building Code Section 7.9: Effluent apply. If a property fails any of the conditions listed in the current building code, an alternative ISDS must be installed. Failing conditions include:

- All lands within 100 feet of protected wetlands (as indicated in Section 301.7 of the Zoning Ordinance), or 75 feet of other wetlands and surface water bodies.
- Soils with a percolation rate greater than 60 minutes per inch.

Additional requirements are necessary for properties in the following areas:

- Vertical separation of the effluent disposal area (EDA)
    - Soils with a seasonal high water table (SHWT) of less than **four feet** from the bottom of the existing or proposed EDA. The SHWT must be determined under high tide conditions.
    - Soils with an impermeable layer (bedrock or ledge) less than **four feet** from the bottom of the existing or proposed EDA.
    - Soils with a percolation rate less than 1 minute per inch.
    - If a property meets the conditions noted above, the installation of an alternative ISDS must be installed.

- Alternative ISDS Requirements
    - The type of alternative ISDS will depend on the depth of the vertical separation from the bottom of the EDA and the SHWT (during high tide) and the impermeable layer (bedrock or ledge).
    - The type of ISDS must meet the treatment requirements as indicated in Table 4.
        - The technologies listed in Table 4 are examples of those that potentially meet the recommended treatment standards.

- Note the vertical separation ranges in Table 4 differ slightly from those listed in Table 2. Vertical separation distances were modified in Table 3 to conform better with the treatment levels achieved by the various technologies.

- All designs and specifications for alternative systems must be submitted to the Building Inspector.

- Conditions must be verified by the Building Inspector before installation of any ISDS, upon signs of ISDS failure, and upon transfer of property.

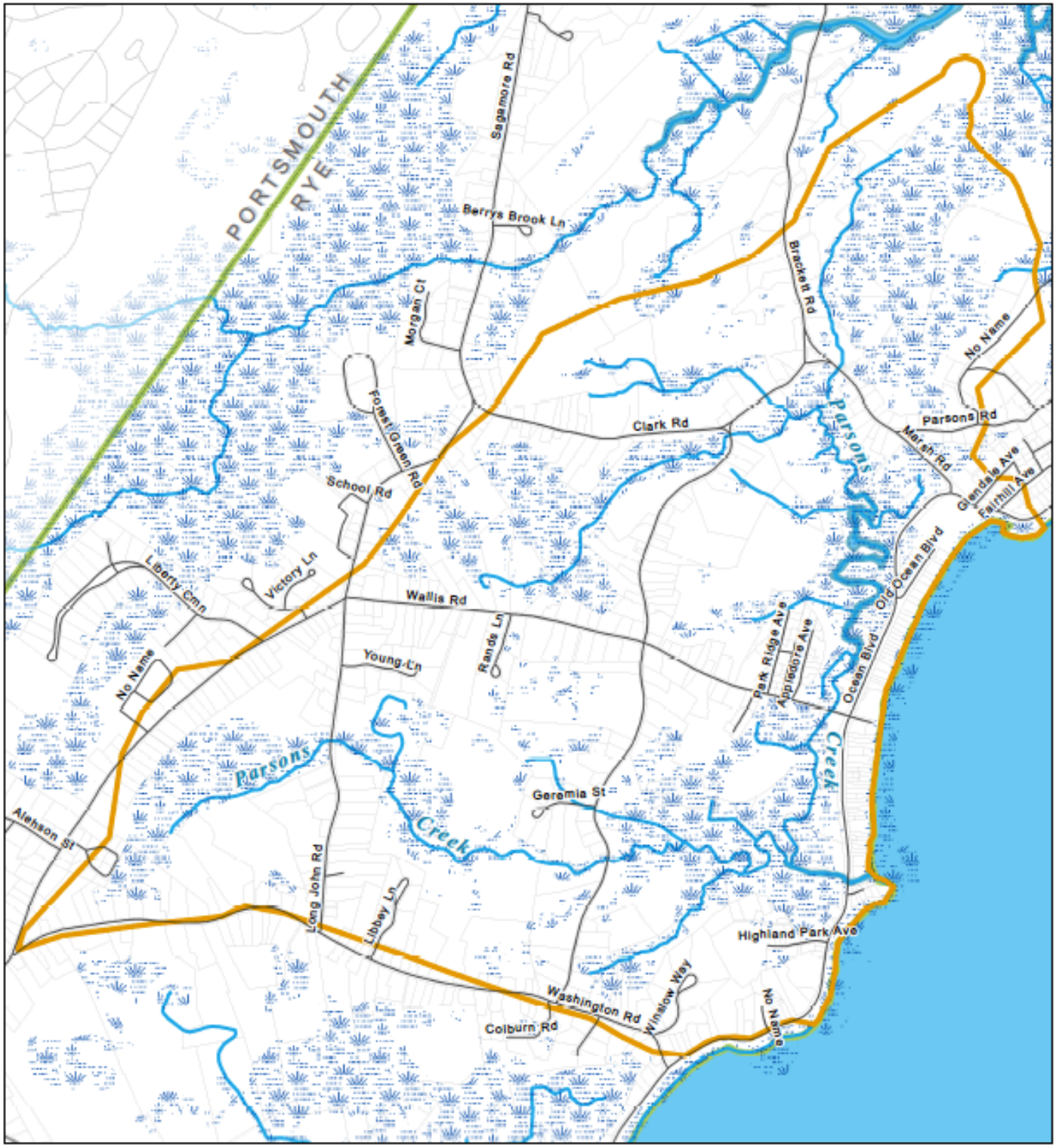
- Maintenance of alternative ISDS must adhere to the manufacturers' recommendations. These recommendations must be submitted to the Building Inspector with the ISDS design. Verification of maintenance must be submitted to the Building Inspector annually.

Table 4 – Recommended Performance Requirements and Examples of ISDS Alternatives

Vertical Separation of EDA from SHWT and Impermeable Layer (feet)	Treatment Performance Standard for Fecal Coliform Bacteria (CFU/100mL)	Examples of ISDS meeting Treatment Standards
4	10 million	Conventional ISDS
3 to 4	50,000	Mounded System (to raise separation to >4 feet)
2 to 3	10,000 – 20,000	Mounded System (to raise separation to >4 feet) Aerobic Treatment Unit Recirculating Sand Filter Constructed Wetland Trickling Filter
1-2	200	Membrane Bioreactor Alternative ISDS with Disinfection
< 1	--	ISDS are prohibited

Other Recommended Actions for the Town of Rye

1. Develop a groundwater-monitoring program to determine the range in depth to the SHWT and groundwater quality.
2. Form a Water Pollution Control Agency at the town level.
3. Build upon the existing Septic System Database.
4. Develop a comprehensive Onsite Wastewater Management Program with partners from the town, state, and Department of Public Health to ensure all ISDS in the watershed are working.



Parsons Creek Watershed - Rye, NH

Watershed Boundary
Waterbody
Parcels
NWI Wetlands
Streams
Town Boundary
Roads

0 0.25 0.5 1 Miles

N

HydroAnalysis

Data Source: NH Granit, NHD, NWI
Projection: NAD 1983 NH State Plane FIPS 2800'
Map Created by: Whitney A. Baker, WB GIS Services
October 2017