NORTHEAST CREEK EXISTING DATA | TECHNICAL MEMORANDUM

TO: Michele Gagnon and Hailey Bondy, Town of Bar Harbor
FROM: Mindee Goodrum, FB Environmental Associates (FBE)
SUBJECT: Northeast Creek Existing Water Quality Data Review
DATE: June 12, 2025
CC: Maggie Mills, Tim Kirsten, & Forrest Bell, FB Environmental Associates (FBE)

Introduction

This memorandum summarizes FBE's review of existing water quality data for the Northeast Creek watershed, highlighting key findings from previous studies and providing summary tables of available surface water and groundwater data. This memorandum is an interim deliverable under the contract between the Town of Bar Harbor and FB Environmental to create an Action Plan for Stewardship of the Northeast Creek watershed. As such, this deliverable is technical in nature and will contribute to the broad recommendations and stewardship practices recommended in the final deliverable for the Action Plan.

This memorandum contains four sections:

1. Executive Summary
2. Identified Data Gaps
3. Historical Data Summary
4. Appendix A: Existing Conditions Summary Tables

EXECUTIVE SUMMARY

Data has been collected in the Northeast Creek watershed by six different state, federal, or institutional organizations as well as one private consulting firm (see Table 1). Available data is most frequently from the U.S. Geological Survey (USGS) but is outdated and clustered around the year 2000 (1999 – 2001) and again in 2008/2009 as part of the N loading studies. Long-term sampling by the Maine Department of Marine Resources (Maine DMR) and Maine Department of Environmental Protection (Maine DEP) is limited to just two sites, but DMR data collection is ongoing and DEP data at the Lake Wood Outlet Stream was ceased in 2023. There is no evidence of existing data collection from any organization except routine fecal coliform sampling by Maine DMR in Thomas Bay to monitor shellfish flat closures. This lack of consistent long-term data and recent data significantly limits the usability of intensive sampling efforts and reinforces the need for a long-term baseline monitoring program.

Table 1. Summary of historical monitoring efforts in the Northeast Creek watershed.

ORGANIZATION	DATA COLLECTION SUMMARY
U.S. Geological Survey (USGS)	The USGS has sampled from the Northeast Creek watershed the most frequently. This has included monthly sampling in the early 2000s and again in 2008/2009 as well as a denitrification rate study conducted in 2008 and 2009. The longest running measurement by the USGS is streamflow collected at the Lake Wood Outlet Stream during odd years from 2006 – 2022. Parameters analyzed by USGS have been extensive and include physical

ORGANIZATION	DATA COLLECTION SUMMARY
	parameters (e.g., streamflow, conductivity) and chemical parameters (nutrients).
Maine Department of Marine Resources (Maine DMR)	Maine DMR collects fecal coliform bacteria samples as part of the shellfish monitoring program several times each year at one station in Thomas Bay.
Maine Department of Environmental Protection (Maine DEP)	Maine DEP has sampled the Lake Wood Outlet Stream on odd years from 2007 – 2023 for macroinvertebrates, dissolved oxygen, water temperature, pH and specific conductance.
Stratex	The private consulting firm, Stratex, conducted sampling of 236 private wells in Bar Harbor annually between 1991 and 2001 for nitrate.
University of Maine	As part of a 2005 Thesis, samples were collected in Northeast Creek and its tributaries monthly from April – October 2002. Surace water and groundwater samples were collected, primarily measuring species of nitrogen and total phosphorus.
College of the Atlantic	College of the Atlantic collected *Escherichia coli* (*E. coli*) samples in May, October and November of 2011 and March, April and May of 2012 in the Northeast Creek Estuary.
Lake Stewards of Maine	Lake Stewards of Maine has sampled from Hamilton Pond, Lake Wood, Fawn Pond, and French Hill Pond with variable frequency. Samples are typically collected for epilimnetic phosphorus, Secchi disk transparency, chlorophyll-a, dissolved oxygen, and temperature.

IDENTIFIED DATA GAPS

The following data gaps limit the Town's ability to fully inform and prioritize water quality action items:

- Baseline water quality sampling in Northeast Creek and its tributaries has lapsed since 2011, with the exception of the sites continually monitored by DMR (Thomas Bay) and DEP (Lake Wood outlet stream).
- No water quality data has been collected for parts of the watershed that have experienced new development since the last sampling in 2011.
- Groundwater nutrient data are limited. According to the Stratex study, only 2% of the Town's wells were tested annually in 1991-2001 (data on the number of wells in Northeast Creek watershed were not available at the time of this report), and USGS groundwater sites sampled in 2004, 2008 and 2009 were located away from developed areas. No groundwater sampling data have been collected in over a decade. The Stratex (2007) report refers to EPA for annual private well water testing recommendations, namely for total coliform bacteria, nitrate, total dissolved solids, pH, and other suspected contaminants. They further recommend testing in vulnerable areas: recharge zones (upper third portion of the watershed), thin soils, soils with low recharge rates, exposed bedrock, and areas within 200 feet of the shoreline. Therefore, two data gaps emerge for groundwater testing:

  - Recent groundwater testing at the USGS well sites in Northeast Creek.
  - Recent private well water quality testing.
- Macroinvertebrate monitoring has been minimal, with sampling limited to a single tributary site high up in the watershed (Lake Wood outlet stream).
  - Additionally, no DEP wetland or algae monitoring sites exist within the watershed.
- Limited bacteria sampling (*E.coli* and fecal coliform) sampling has occurred. Maine DMR has long-term data for fecal coliform only at the mouth of Northeast Creek, and *E. coli* has been sampled only by College of the Atlantic students in 2011 and 2012 samples primarily on the Northeast Creek mainstem.
- Very few lake or pond samples have been collected from the watershed to understand water quality of these waterbodies and their potential inputs to Northeast Creek, with the exception of Lake Wood. Hamilton Pond, Fawn Pond, and French Hill Pond have very few measurements for epilimnetic phosphorus and chlorophyll-a, but the available data indicate elevated nutrient levels.
- No detailed septic system survey has been conducted for the watershed or the Town of Bar Harbor.
- There is a lack of information on past algae blooms, if they have occurred, within Northeast Creek or Thomas Bay. Minimal evidence is available via the DEP Bloom Risk Map suggesting frequent blooms in French Hill Pond.

HISTORICAL DATA SUMMARY

Numerous water quality studies with varying objectives have been conducted in the Northeast Creek watershed (Table 2), each of which is described in the following subsections. These studies were typically to provide investigative sampling of water quality, streamflow, nutrient concentrations, bacteria levels, and denitrification rates of marsh soils to support nitrogen loading model development. A map of sampling sites is provided in Figure 1.

Table 2. Summary of stream data collected in the Northeast Creek watershed. Site numbers reference Figure 1.

Study	Sample Sites	Sampling Period & Frequency	Parameters Measured
USGS (Nielsen, 2002)	Study Goal: To assess water and nitrogen imputs to the Northeat Creek estuary and wetland in response to concerns of rapid development. Site Summary: Four sites at the outlets of the four major tributaries above the wetland complex. • Aunt Betsey's Brook at Gilbert Farm Rd (Site 11) • French Hill Brook at Crooked Rd (Site 12) • Old Mill Brook at Crooked Rd (Site 14) • Stony Brook at Hamilton Pond Outlet (Site 8)	April 1999 – September 2000; Monthly	Streamflow pH Dissolved Oxygen Water Temperature Specific Conductance Nitrate (NO_3) Total Nitrogen (Total N) Ammonia (NH_4) Inorganic N Organic N

USGS (Caldwell & Culbertson, 2007)	Study Goal: To build on the original baseline study. Site Summary: Six sites. • Estuary on Thomas Bay side of Route 3 (Site 2) • Estuary on Fresh Meadow Marsh side of Route 3 (Site 3) • Northeast Creek within Fresh Meadow Marsh (Sites 4, 5, 6, 7)	May – November 2000; May – November 2001; Biweekly Continuous monitoring	Water Temperature Specific Conductance Dissolved Oxygen Dissolved Oxygen (% Saturation) pH Dissolved Calcium, Magnesium, Sodium, Potassium, Chloride, Sulfate, and Silica Nitrate Nitrite plus Nitrate Ammonia Total Phosphorus Orthophosphate Inorganic Carbon Organic Carbon Chlorophyll-*a*
USGS (Huntington et al., 2011; 2012)	Study Goal: To characterize nitrogen removal through microbial denitrification in marsh soils. Site Summary: • Aunt Betsey's Brook at Gilbert Farm Rd (Site 11) • French Hill Brook at Crooked Rd (Site 12) • Old Mill Brook at Old Norway Dr. (Site 15) • Stony Brook at Hamilton Pond Outlet (Site 8)	July 2008 – September 2009; Monthly	Water Temperature Specific Conductance Dissolved Oxygen Ammonium Dissolved Silica Orthophosphate Nitrite + Nitrate Total Nitrogen
	• Six groundwater sites within Fresh Meadow Marsh (Sites 19–24)	May – August 2008, July – August 2009; Monthly	Denitrification Rate (*in situ* and in laboratory)
USGS (Nielsen, 2013)	Study Goal: To evaluate how development and climatic conditions had impacted nutrient inputs to the estuary. Site Summary: Same four sites as the 2002 USGS Nielsen study with the addition of the Stony Brook inlet site. • Aunt Betsey's Brook at Gilbert Farm Rd (Site 11) • French Hill Brook at Crooked Rd (Site 12) • Old Mill Brook at Crooked Rd (Site 14) • Stony Brook at Hamilton Pond outlet (Site 8) • Stony Brook at Hamilton Pond inlet (Site 10)	July 2008 – July 2009 for Old Mill Brook and Stony Brook sites only; Monthly excluding Dec – Apr April 2010 – November 2011 for all sites; Monthly	Streamflow pH Dissolved Oxygen Water Temperature Specific Conductance Filtered and unfiltered samples for: Nitrite plus Nitrate Total Nitrogen Ammonia Organic Nitrogen Total Phosphorus
USGS (Lombard, 2022)	Study Goal: Extend base flow records. • Lake Wood Outlet Stream (Site 16)	Odd years between 2006–2022	Streamflow
Stratex, 2007	Study Goal: To evaluate groundwater resources, assess potential impacts from residential development, and provide strategies. • 236 private wells in Bar Harbor (locations unspecified)	1991–2001; Annual or less frequent	Nitrate

UMaine Thesis (Caron, 2005)	Study Goal: To characterize the role of shallow groundwater in transporting nutrients to downstream waterbodies. Site Summary: 3 surface water sites and a network of groundwater wells in the Aunt Betsey's Brook subwatershed. • Eight groundwater wells in Fresh Meadow Marsh near Site 19 • Aunt Betsey's Brook at Gilbert Farm Rd (Site 11) • French Hill Brook at Crooked Rd (Site 12)	April – October 2002; Monthly	**Surface Water:** Total Nitrogen Nitrite plus Nitrate Ammonia Total Phosphorus Conductivity Nitrogen Flux **Groundwater Wells:** Total Nitrogen Nitrite plus Nitrate Ammonia
College of the Atlantic, 2011–2012	Study Goal: Student-led studies to test *E. coli* contamination in Thomas Bay. Site Summary: Nine sites within Fresh Meadow Marsh, one in Thomas Bay • Six sites within the estuary near Sites 3, 4, 5 and 19 • Old Mill Brook at Crooked Rd (Site 14) • Northeast Creek Estuary at Thomas Bay (Site 1) • One site along Route 3 (exact location not specified)	May 2011	*E. coli*
Maine DMR	Study Goal: Routine fecal coliform monitoring for the National Shellfish Sanitation Program. • Station EI034.20 in Thomas Bay	Frequency varies, but several times a year	Fecal Coliform Bacteria Water Temperature Salinity
Maine DEP	Study Goal: Maine DEP Biomonitoring Program statutory class monitoring. • Lake Wood Outlet Stream (Site 16)	2007–2023; odd years	Macroinvertebrates Dissolved Oxygen Water Temperature pH Conductivity
Lake Stewards of Maine	Study Goal: Long-term monitoring of lake health in four ponds. • Hamilton Pond • Lake Wood • Fawn Pond • French Hill Pond	Varies	Variable, but often includes Epilimnetic Phosphorus, Secchi disk transparency, chlorophyll-a, and dissolved oxygen-temperature profiles

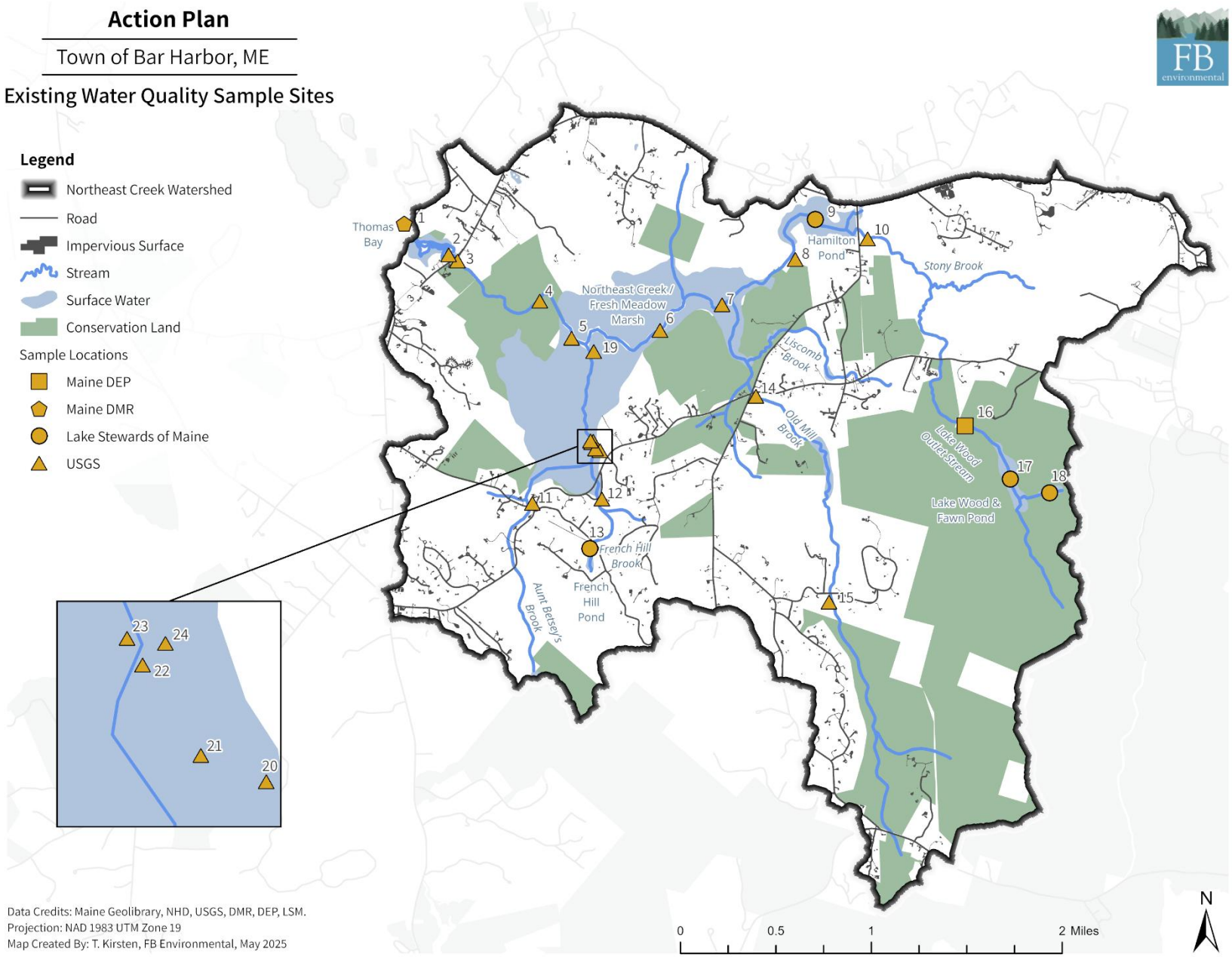

Figure 1. A map of sampling sites for the Northeast Creek watershed. Refer to Table 2 for site names.

USGS WATER BUDGET AND NITROGEN LOADING STUDY (NIELSEN, 2002)

In response to concerns over the potential impacts of rapid residential development and nutrient enrichment on estuarine ecosystems, the U.S. Geological Survey (USGS), in cooperation with the National Park Service, conducted a comprehensive study from 1999 to 2000 to assess water and nitrogen inputs to the Northeast Creek estuary and its adjacent wetlands. This research aimed to quantify baseline nutrient loads, characterize hydrologic inputs, and evaluate the ecological condition of the estuary.

The study involved monthly monitoring of streamflow and nitrogen concentrations at Aunt Betsey's Brook, French Hill Brook, Old Mill Brook, and Stony Brook at the Hamilton Pond outlet over an 18-month period. Old Mill Brook was continuously gauged, and its data were used—along with the MOVE.1 record-extension technique and nearby stream gauges—to estimate daily surface water inflows to the wetland. For ungauged basins, streamflow was estimated using unit-area yields derived from the gauged tributaries. Precipitation and atmospheric nitrogen deposition data were obtained from monitoring stations within the park, while evapotranspiration was estimated using a regionalized model.

Geologic investigations indicated that groundwater contributions to the wetland were likely negligible. Due to the tidal nature of Northeast Creek's outlet, direct measurement of surface-water outflow from the wetland was not possible. Instead, a residual term in the water budget—interpreted to represent surface outflows, storage changes, and calculation error—was used to account for this component.

Nitrogen loading was assessed for the Northeast Creek stream specifically, as this area was considered more vulnerable to ecological impacts from development than the surrounding wetlands. Daily nitrogen loads were calculated by combining streamflow data with monthly measurements of nitrate and total nitrogen concentrations. Average unit-area yields were used to estimate nitrogen contributions from ungauged areas.

Findings indicated that nitrogen inputs to Northeast Creek were relatively low compared to those in more urbanized or degraded estuarine systems in the northeastern United States. Nitrate as N concentrations in surface water ranged from below detection (<0.01 mg/L) to 0.20 mg/L, while total nitrogen ranged from 0.19 to 0.98 mg/L. The current total nitrogen thresholds of estuarine waters in Maine are 0.45 mg/L for the protection of aquatic life using dissolved oxygen as an indicator, and 0.32 mg/L using eelgrass as an indicator (EPA Region 1, 2023).

Over the study period, USGS modeled approximately 5,900 kilograms of total nitrogen, and about 780 kg of nitrate, entered the estuary. Atmospheric deposition contributed roughly 85 kg of nitrogen, accounting for only 1% of the total nitrogen load and less than 10% of inorganic nitrogen inputs.

Nitrogen yields varied among the tributary watersheds, ranging from 130–270 kg/km^2/year for total nitrogen and 13–44 kg/km^2/year for nitrate. For both Total N and nitrate, the Stony Brook site had the highest yield and Aunt Betsey's Brook had the lowest. USGS suggests these variations likely reflected differences in land use, including the density and age of septic systems, agricultural activity, and natural factors like soil characteristics and burn history. The authors noted that the Stony Brook basin had a larger population, older homes and septic systems, a large pond (Hamilton Pond), and more agricultural activity compared to the other basins. For context, all the basins' yields were well below the northeastern U.S. median of 520 kg/km^2/year and significantly lower than the >1,000 kg/km^2/year observed in the most urbanized basins, at the time the Nielsen (2002) study was published.

Importantly, no signs of nutrient-related degradation, such as algal blooms or the loss of submerged aquatic vegetation, were observed during the study. The estuary, dominated by healthy beds of *Ruppia maritima* (widgeon grass), remained in an oligotrophic (nutrient-poor) state. The study established a valuable baseline for monitoring future changes and concluded with the warning that ongoing development could increase nutrient inputs, threatening water quality and ecosystem health in the future.

A subsequent study by Nielsen & Kahl (2007) expanded upon the earlier work by Nielsen (2002) by incorporating the same Northeast Creek dataset along with nutrient export data from other sub-watersheds across Mount Desert Island. This study found that sub-watersheds entirely within Acadia National Park exported significantly less total N and total P than those partially or entirely outside of the park boundaries, likely due to human land-based nutrient sources. Nitrate (as nitrogen) transport exports did not differ significantly between the two watershed categories, suggesting that atmospheric deposition, rather than land use, is the dominant source of nitrate on the island.

An additional outcome of the Nielsen (2002) study was the development by USGS and Acadia National Park of the Nutrient Load and Estuarine Response Decision Support System (DSS) model, which the Town of Bar Harbor subsequently used to guide land use planning and regulations. This model has recently become obsolete because it runs on ESRI's discontinued ArcView software.

GROUNDWATER HYDROLOGY AND CHEMISTRY OF FRESH MEADOW WETLAND (CARON, 2005)

This 2005 University of Maine Master of Science thesis evaluated subsurface inputs to the Northeast Creek wetland complex to assess the role of shallow groundwater in transporting nutrients to the waterbody. Specifically, the study quantified groundwater flow rates, measured nutrient concentrations in groundwater, and calculated the nitrogen flux to Aunt Betsey's Brook, a subwatershed that had experienced recent development at the time of the study. Results indicated a higher nitrogen concentration in the groundwater samples compared to precipitation and surface water samples. However, the overall nitrogen flux to Aunt Betsey's Brook from the groundwater in the study area was not significant (0.01 kg/month).

USGS HYDROLOGIC & WATER QUALITY DATA SUMMARY (CALDWELL & CULBERTSON, 2007)

The USGS and Acadia National Park conducted an intensive field study from May to November of 2000 and 2001 to establish baseline estuarine water quality conditions in the Northeast Creek estuary. This effort built upon the 1999–2000 watershed-scale nutrient study by shifting focus downstream of the tributaries to better understand in-estuary nutrient dynamics, salinity patterns, and seasonal variability.

The study involved continuous monitoring at five stations along Northeast Creek in the Fresh Meadow wetland complex, and one additional site seaward of the estuary mouth at the Route 3 bridge. Key parameters such as water temperature, specific conductance (as a proxy for salinity), and water level were recorded, while discrete biweekly sampling assessed nutrient concentrations (including various nitrogen parameters), chlorophyll-a, and other indicators of water quality.

The key findings of this study include:

- **Dynamic salinity regime**: Salinity levels in the estuary were highly variable and influenced by strong seasonal freshwater inputs and restricted seawater exchange caused by the narrow Route 3 bridge at the estuary outlet. Oligohaline conditions (i.e. low salinity; 0.5–5 PSU) often extended from the upstream stations to the estuary mouth, while mesohaline (5–20 PSU) and even polyhaline (highly saline; 20–35 PSU) conditions were observed during periods of low freshwater input (i.e. during dry periods).

- **Stratification and saltwater wedge**: During dry summer months, a saltwater wedge formed along the estuary bottom, migrating upstream beneath the freshwater layer as summer progressed. This stratification likely contributed to nutrient retention in bottom waters during periods of low flow.
- **Seasonal nutrient and chlorophyll-a trends**: Nutrient and chlorophyll-a concentrations followed consistent seasonal patterns, peaking in early summer and fall (times of reduced freshwater flow and increased water residence time). These conditions may promote biological productivity and temporarily concentrate nutrients.
- **Relatively healthy baseline conditions**: Despite natural variability, the study found no signs of significant nutrient impairment. Overall, water quality was considered good, aligning with earlier findings from Nielsen (2002). The results provide an important baseline to detect future changes related to land use or climate-driven shifts in watershed hydrology; they are summarized along with other USGS datasets in Table 2.

Together, these observations underscored the ecological sensitivity of the Northeast Creek estuary and the importance of long-term monitoring to track changes in nutrient dynamics, salinity regimes, and water quality over time.

STRATEX BUILD-OUT STUDY (2007)

As part of Bar Harbor's 2007 Comprehensive Plan Update, the Town commissioned Stratex Strategic Consulting to evaluate groundwater resources, assess potential impacts from residential development, and provide strategies to protect water quality and quantity, especially in sensitive watersheds such as Northeast Creek. The study is summarized below.

Groundwater Quality Concerns

- Although regional groundwater quantity was generally sufficient to meet projected 2034 demand, groundwater quality posed a greater concern, especially in areas relying on onsite septic systems and private wells.
- Stratex reviewed nitrate-nitrogen data from 1991-2001 from 236 tests conducted on private wells in Bar Harbor, which represents annual water quality testing for roughly 24 wells or 2% of all wells in the Town (wells were not limited to the Northeast Creek watershed). Nitrate (as nitrogen) was identified as a primary contaminant of concern, originating from septic systems, particularly in marginal areas with shallow soils, exposed bedrock, and groundwater recharge zones (upper third of watershed).
- Although the mean (0.6 mg/L) and median (0.2 mg/L, which is the method detection limit) nitrate concentration in private wells were well below the EPA limit of 10 mg/L, localized elevated values up to 7.9 mg/L suggested contamination from nearby sources like septic systems or manure piles.

Development and Nutrient Loading

- The Stratex study incorporated the 2002 USGS nitrogen-loading model for Northeast Creek to project future impacts of development.
- Despite modest changes in land cover, the study emphasized that population growth and increased septic system density could significantly elevate nutrient (especially nitrogen) inputs to groundwater and surface water systems.

Northeast Creek was highlighted as a watershed where nutrient increases from future development were likely without policy intervention. The study underscored the need for land use planning to:

- Limit nutrient export to sensitive receiving waters;

- Preserve recharge areas;
- Encourage cluster development served by public water/sewer over large-lot, septic-dependent subdivisions; and
- Require developers to demonstrate "no impact" to water quality and optimize system design and placement.

COLLEGE OF THE ATLANTIC WATER QUALITY STUDIES (2011–2012)

In May 2011, students collected 18 water samples at low tide over the course of a week to test for *E. coli* contamination in Thomas Bay (CoA, 2011). Processing the samples with the Maine DMR Fecal Coliform Membrane Filtration Method, they investigated potential sources of bacterial pollution. Results indicated that *E. coli* was entering Thomas Bay through both Northeast Creek and an ephemeral stream that runs past the Willowind Therapeutic Horse-Riding Center. While the specific source of contamination in Northeast Creek could not be pinpointed, runoff from a manure pile located less than 100 feet from the ephemeral stream on the Willowind property was identified as the likely source in that area. To explore the influence of rainfall on bacterial transport, four repeat samples were taken from a culvert site throughout the week. These showed a correlation between rainfall and *E. coli* levels, suggesting runoff as a likely pathway, though the dataset had a limited sample size. The possibility of tidal influx from the bay as a source of contamination could not be ruled out. While the study provides useful insights, its limited scope—particularly the lack of additional tributary sampling—precludes any firm conclusions or further analysis. *E. coli* is also limited as a fecal indicator in high salinity environments due to its low salt tolerance, which causes it to die off quickly and become non-culturable in laboratory conditions.

Follow-up studies were conducted by CoA students in fall 2011, spring 2012 and fall 2012 Marine Policy classes (CoA, 2011b; 2012a; 2012b). CoA (2011b) students sampled *E. coli* levels at eight locations along Northeast Creek over four dates in October-November 2011. Most sites were along the main stream between Route 3 and Crooked Road, with the exception of one site in the estuary below the Route 3 bridge and another at the Old Mill Brook crossing beneath Norway Road. Results showed elevated bacteria levels at all sampling sites, suggesting multiple potential sources, some located farther upstream in the watershed than the sites in the previous CoA study.

The following spring, students monitored the same sites over six sampling days and added a ninth site at a clam flat downstream of the creek outlet in Thomas Bay. Bacteria levels were relatively low, except on a day following an inch of rainfall within 48 hours, suggesting that runoff may be an important pathway for bacteria contamination. The study concluded that Northeast Creek is a highly variable system with no single pollutant source. A similar conclusion was reached in the Fall 2012 study, which collected *E. coli* data at the same nine sites over two days in October. In that study, bacteria levels remained elevated during both wet and dry conditions.

USGS DENITRIFICATION RATES AND HYDROLOGIC DATA (HUNTINGTON ET AL., 2011)

In response to concerns about nutrient enrichment and eutrophication in Acadia National Park's estuaries, USGS alongside the National Park Service conducted a study during the 2008 and 2009 summer seasons to better understand nitrogen removal through microbial denitrification in marsh soils at two sites on Mount Desert Island. While water-quality degradation had been observed in Bass Harbor Marsh, conditions in the Northeast Creek estuary remained relatively undisturbed at the time of study.

This research built on the earlier USGS studies that had estimated nutrient inputs from atmospheric deposition and surface runoff, and introduced shallow groundwater as a potential nutrient source. However, the actual rate at which marsh soils remove nitrogen via denitrification—a key natural process that transforms nitrate into nitrogen gas—had not been directly measured before.

Denitrification rates were assessed in situ in marsh soils within the Northeast Creek watershed. Measurements were taken under both natural conditions and with added nitrogen and glucose to estimate potential denitrification capacity. Additional lab incubations were used to evaluate the production of nitrous oxide (N_2O) relative to total nitrogen gas, using acetylene inhibition techniques.

Water samples from surface and groundwater were analyzed for nutrient content, and environmental parameters such as temperature, specific conductance, dissolved oxygen, and water level. Sites were monitored throughout the growing season in the Fresh Meadow Marsh, the wetland complex associated with Northeast Creek. Between Aunt Betsey's Brook, French Hill Brook and Old Mill Brook, Aunt Betsey's Brook had the highest mean ammonia, nitrate and total nitrogen values in the 2008-2009 season, but only marginally.

The study provided valuable data on nitrogen cycling in estuarine marshes and helped to assess the natural capacity of these wetlands to mitigate nutrient loads. It also added baseline water quality data for various streams in the watershed, for parameters such as dissolved oxygen and specific conductance.

USGS AMBIENT AND POTENTIAL DENITRIFICATION RATES (HUNTINGTON ET AL., 2012)

Building on earlier work (Huntington et al., 2011), Huntington et al. (2012) summarize key findings from groundwater and surface water samples collected in Fresh Meadow Marsh and Bass Harbor Marsh during the summers of 2008 and 2009. Their analyses indicate that under ambient conditions, denitrification rates in Northeast Creek are low, but increase significantly with added nitrogen and glucose. This suggests that nitrate availability—not denitrification capacity—is the limiting factor, and that eutrophication in the estuary is unlikely to result from nitrogen inputs exceeding the marsh's processing ability. The authors propose that if terrestrial nitrogen inputs are contributing to eutrophic conditions (as observed in Bass Harbor Marsh, but not yet in Northeast Creek), the nitrogen likely bypasses the marsh via channelized surface flow or shallow groundwater seepages entering the estuary directly.

The Huntington et al. (2011, 2012) studies contributed valuable baseline water quality data, namely groundwater data for six sites in Northeast Creek, and surface water data for five sites, including groundwater measurements from six sites in Northeast Creek and surface water data from five sites—one of which, at Old Mill Brook at Old Norway Drive, is not covered in other USGS reports.

USGS ASSESSMENT OF DECADAL CHANGE IN NITROGEN LOADING (NIELSEN, 2013)

A decade after initial research into the link between land use and nitrogen loading in the Northeast Creek watershed, USGS, in collaboration with the National Park Service and the Town of Bar Harbor, conducted a follow-up study to evaluate how development and climate conditions had affected nutrient inputs to the estuary. From 2008 to 2011, water quality sampling and streamflow measurements were repeated at key tributaries to reassess total nitrogen loads and test the accuracy of model predictions based on updated land use. The same sampling sites were used, with the addition of a site at the Hamilton Pond inlet.

Watershed land use changes were analyzed using revised GIS data and the same classification scheme as the original study by Nielsen (2002). Although the number of rural houses increased by 40% between 2000 and 2008, this translated to only a 2.6% shift in land use categories, primarily from forest or agricultural land to urban/suburban development. Nitrogen loading simulations based on this land use change projected a 7% increase in nitrogen export to Northeast Creek, from 1.98 to 2.12 kg/ha/yr.

However, actual measurements of nitrogen loads from the five tributary sites showed a different outcome: average total nitrogen loads rose sharply, from 1.89 kg/ha/yr in 2000 to 3.12 kg/ha/yr during the later sampling period—a 66% increase. The study concluded that this large increase was primarily due to wetter-than-average conditions between 2008 and 2011, which enhanced runoff and stimulated nitrogen export through both physical transport and increased biogeochemical activity in soils.

While the findings reaffirmed the usefulness of land use models for estimating changes due solely to development, they also demonstrated that climate variability—especially increased precipitation—can strongly influence nutrient loading. Moreover, the results suggest that even modest land use changes, such as increased housing and septic systems, may now be contributing to measurable water-quality impacts.

Despite this uptick in nitrogen loading, there was no evidence of severe eutrophication at the time of the study. Nevertheless, the report underscored the watershed's sensitivity to both climate and development pressures, reinforcing the need for long-term monitoring and informed land-use planning.

USGS STREAMFLOW ESTIMATION IN ACADIA NATIONAL PARK (LOMBARD, 2022)

This USGS study aimed to extend base flow records at several stream-gauging stations in Acadia National Park that had only partial data. Of the 14 stations evaluated, only one—Lake Wood Outlet Stream—is located within the Northeast Creek watershed. The nearby Otter Creek station in Bar Harbor, which has continuous flow records, was used for correlation. However, the correlation between Otter Creek and Lake Wood Outlet Stream was only 0.59, falling short of the study's threshold of 0.79, so no extrapolation equation was developed. The study did not include or reference any water quality data.

MAINE DEPARTMENT OF MARINE RESOURCES (ONGOING)

The Maine Department of Marine Resources' (DMR) Shellfish Growing Area Classification Program classifies shellfish areas as Approved, Conditionally Approved, Restricted, Conditionally Restricted or Prohibited using standards set by the National Shellfish Sanitation Program (NSSP) (DMR, 2025). All classifications are based on two factors: the results of a shoreline survey that investigates the presence of pollution sources, and fecal coliform monitoring results. Two statistical values are calculated from the most recent 30 fecal coliform scores: the geometric mean (geomean) and the 90th percentile (P90). The standards for Approved classification are 14 CFU or less (geomean) and 31 CFU or less (P90). The standards for Restricted are 88 CFU or less (geomean) and 163 CFU or less (P90). The standards for Prohibited are greater than 88 CFU (geomean) and greater than 163 CFU (P90).

One of DMR's sample sites is the station "EI034.20", located where the Mount Desert Narrows drains to Thomas Bay. This site reached Restricted status in 2011, and remained at this classification until 2015 (DMR, 2016a). Shellfish harvesting was thus restricted within Pollution Area 47 (B.2) – Thomas Bay at the mouth of Northeast Creek during these four years (DMR, 2016b). Since 2015, the site has met the Approved classification, and the 36-acre pollution area has been open for shellfish harvesting.

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION (ONGOING)

Northeast Creek has been assigned Class AA status for its segments within Acadia National Park, Class B for reaches outside of the park boundary, and Class SB for the estuarine reaches. The Maine DEP Biomonitoring Program conducts macroinvertebrate surveys at the "Lake Wood Outlet Stream – Station 855" in the eastern portion of the Northeast Creek watershed. This site's attainment of its AA statutory class has been indeterminate in the last two years of monitoring (2017 and 2021) but attained Class B status in the previous three survey years. While data was collected in 2023, no report has been released.

French Hill Pond is listed as at risk of having an algal bloom by the Maine Department of Environmental Protection, with its last bloom occurring in 2018 and a bloom frequency status of 'often', and therefore a high likelihood of future blooms.

LAKE STEWARDS OF MAINE (ONGOING)

The Lake Stewards of Maine (LSM) is a nonprofit organization dedicated to protecting Maine's lakes through citizen science. The group trains and supports volunteers who, among other activities, monitor water quality, making it a primary source of lake data in the state (LSM, 2025). Although the Northeast Creek watershed does not contain any major lakes, as of 2022 nutrient samples have been collected at three of its ponds.

Hamilton Pond

Only one total phosphorus (TP) sample has been collected for Hamilton Pond, in 2012. This epilimnion core sample measured 91 µg/L, which is on the higher end for Maine lakes. Average Secchi disk transparency measured 1.6 m and average chlorophyll-a was recorded as 172 µg/L, much higher than the state mean of 5.4 µg/L (LSM, 2022). No dissolved oxygen-temperature profiles have been recorded for this waterbody. Note: the Lake Stewards of Maine refer to this waterbody as Hamilton Lake.

Lake Wood

Average TP, collected as an epilimnion core, for Lake Wood is 9.4 µg/L based on eight samples collected between 1995 and 2019. This is below the state mean for 2022, 11.1 µg/L (LSM, 2022). Secchi disk transparency has an average of 3.6 m and the average chlorophyll-a concentration is 2.9 µg/L, below the state mean. The most recent dissolved oxygen and temperature profile was collected in September 2019.

Of the three ponds sampled by LSM in the Northeast Creek watershed, Lake Wood has the most water quality data and consistently shows the highest water quality, with the lowest epilimnetic phosphorus and chlorophyll-a concentrations, and the greatest water clarity.

Fawn Pond

While Fawn Pond is listed on the LSM website, the only water quality data collected for this waterbody are two alkalinity and conductance values recorded in 2004 and 2005. Both parameters were below the state means.

French Hill Pond

French Hill Pond has an average surface grab TP concentration of 34 µg/L, based on two samples collected in 2009 and 2016. It has an average Secchi disk transparency of 1.1 m, and its only chlorophyll-a sample, recorded in 2016, measured 15 µg/L, which classifies the pond as eutrophic. The most recent dissolved oxygen and temperature profiles were taken in August and September 2020.

NATIONAL PARK SERVICE & USGS NEW ENGLAND WATER SCIENCE CENTER (ONGOING)

In 2024, Acadia National Park submitted a Statement of Need to the USGS New England Water Science Center to propose redevelopment of Bar Harbor's 2004 decision support system (DSS), which models nitrogen loading in response to land use changes. The original DSS has become obsolete due to the discontinuation of ArcView software by ESRI. The proposal also includes the collection of new streamflow and nutrient data from selected streams draining to Northeast Creek, with the goal of verifying or updating existing nutrient concentration estimates. This request was submitted but was not funded.

BAR HARBOR WELL INVENTORY (ONGOING)

The Town of Bar Harbor maintains a well inventory database with 461 entries, 157 of which fall within the Northeast Creek watershed. Nearly all wells are drilled into bedrock, with the exception of one gravel-packed well. Where specified, all wells are listed for domestic use, except for a single well on Gilbert Farm Road designated as "Farm." Drilling dates range from 1968 to January 2024. Well depths vary from 80 to 600 feet, with an average depth of 235 feet. Reported water yields range from 1 to 100 gallons per minute, with an average of 10.4 gpm. Wells are concentrated along major roads in the watershed, particularly to the south of the estuary. Hotspots in the northern portions include residences off Seabury Drive and Stony Brook Way (see Figure 2).

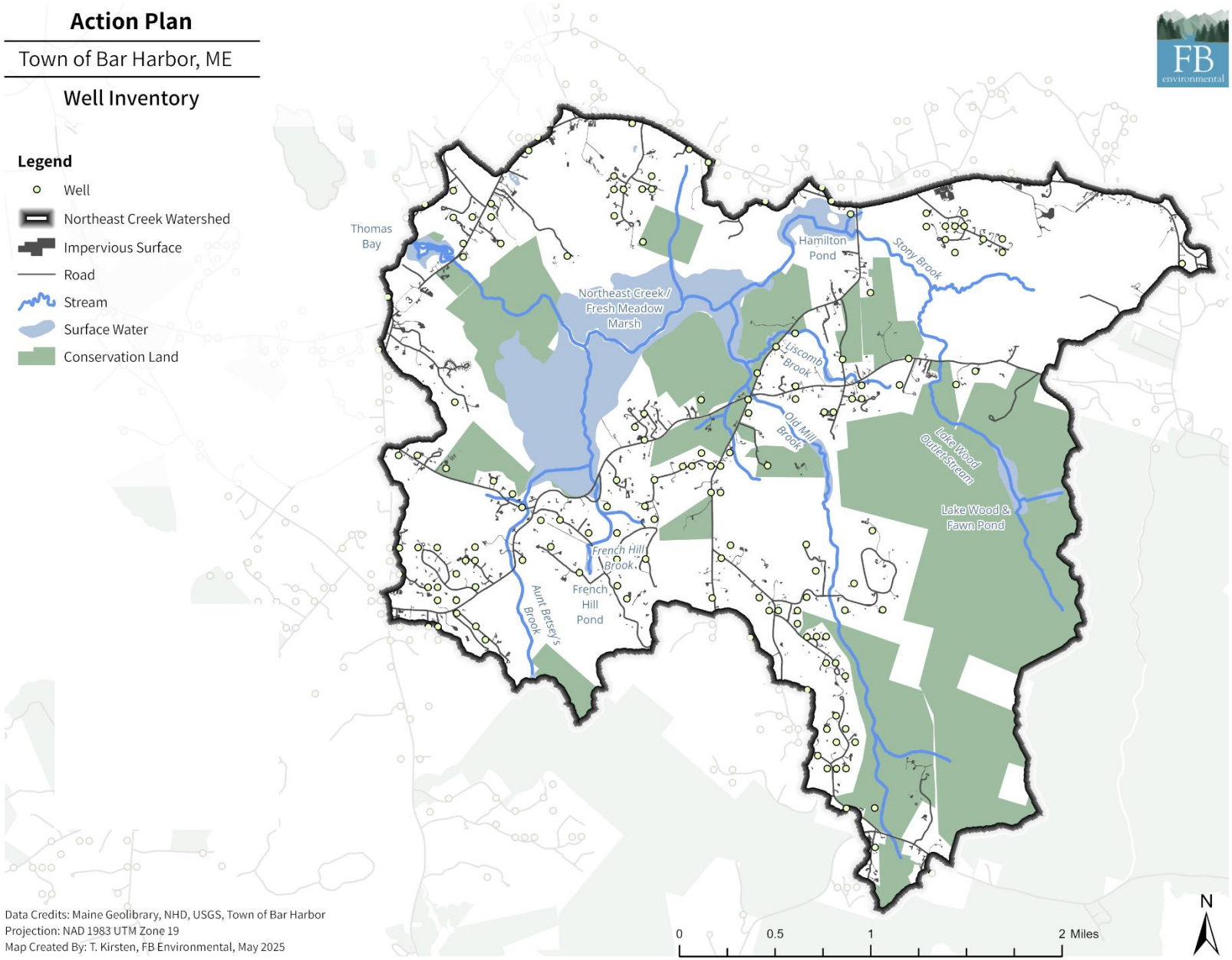

Figure 2. A map of groundwater wells in the Town of Bar Harbor's well inventory database within the Northeast Creek watershed.

APPENDIX A: EXISTING CONDITIONS SUMMARY TABLES

Tables 2 and 3 below summarize surface water and groundwater quality data available through the USGS data portal.

Table 3. Summary statistics for USGS surface water sites in the Northeast Creek watershed. Values in bold indicate the highest or lowest values (whichever indicates worse water quality) per parameter, except for specific conductance which varies depending on estuarine/freshwater conditions. Red values indicate the value does not meet state Class B standards. Class AA waters do not have a specific numerical threshold. * indicates that there is no applicable state threshold for the parameter. Total Nitrogen is measured as the sum of nitrate, nitrite, ammonia, and organic nitrogen. SD is standard deviation. Refer to Figure 1 for site locations. Aunt Betsey's Brook: Site 1. French Hill Brook: Site 12. Old Mill Brook below Crooked Rd: Site 14. Old Mill Brook at Old Norway Rd: Site 15. Stony Brook above Hamilton Pond: Site 10. Stony Brook below Hamilton Pond: Site 8. Northeast Creek at Rt 3 Bridge: Site 3. Northeast Creek Monitoring Station 100: Site 2; Station 102: Site 4; Station 103: Site 5; Station 104: Site 6; Station 105: Site 7.

Site	Mean	SD	Number Samples	Years Sampled
Dissolved Oxygen (mg/L)				
Aunt Betsey's Brook	10.09	3.19	36	1999, 2000, 2010, 2011
French Hill Brook	9.94	2.89	33	1999, 2000, 2010, 2011
Northeast Creek at Rt 3 Bridge	9.14	2.88	47	2000, 2001
Northeast Creek Monitoring Station 100	8.65	2.06	25	2000, 2001
Northeast Creek Monitoring Station 102	8.67	2.13	47	2000, 2001
Northeast Creek Monitoring Station 103	8.13	2.50	40	2000, 2001
Northeast Creek Monitoring Station 104	8.67	2.61	45	2000, 2001, 2005
Northeast Creek Monitoring Station 105	7.18	2.55	45	2000, 2001
Old Mill Brook below Crooked Rd	**6.31**	3.44	45	1999, 2000, 2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	9.73	2.43	27	1999, 2000, 2008, 2009, 2010
Stony Brook above Hamilton Pond	7.16	2.29	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	9.30	2.27	42	1999, 2000, 2008, 2009, 2010, 2011
Dissolved Oxygen Saturation (%)				
Aunt Betsey's Brook	85.79	20.73	33	1999, 2000, 2010, 2011
French Hill Brook	87.16	16.72	31	1999, 2000, 2010, 2011
Northeast Creek at Rt 3 Bridge	110.94	42.14	47	2000, 2001
Northeast Creek Monitoring Station 100	103.24	31.67	25	2000, 2001
Northeast Creek Monitoring Station 102	104.38	30.46	47	2000, 2001
Northeast Creek Monitoring Station 103	94.28	27.78	40	2000, 2001
Northeast Creek Monitoring Station 104	100.16	35.85	44	2000, 2001
Northeast Creek Monitoring Station 105	81.93	31.78	45	2000, 2001
Old Mill Brook below Crooked Rd	**55.81**	24.16	42	1999, 2000, 2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	88.43	13.89	23	1999, 2000, 2008, 2009, 2010
Stony Brook above Hamilton Pond	64.59	15.64	27	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	87.79	10.74	39	1999, 2000, 2008, 2009, 2010, 2011
Specific Conductance (µS/cm at 25°C)*				
Aunt Betsey's Brook	**143.87**	129.89	52	1999, 2000, 2010, 2011
French Hill Brook	45.26	15.1	46	1999, 2000, 2010, 2011
Northeast Creek at Rt 3 Bridge	26,656	18,895	47	2000, 2001
Northeast Creek Monitoring Station 100	38,270	15,255	25	2000, 2001
Northeast Creek Monitoring Station 102	18,377	16,809	47	2000, 2001
Northeast Creek Monitoring Station 103	15,747	15,971	40	2000, 2001
Northeast Creek Monitoring Station 104	10,758	12,730	45	2000, 2001, 2005
Northeast Creek Monitoring Station 105	9,5823	12,472	45	2000, 2001
Old Mill Brook below Crooked Rd	71.93	58.72	62	1999, 2000, 2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	56.77	13.02	49	1999, 2000, 2008, 2009, 2010

Stony Brook above Hamilton Pond	82.89	15.96	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	72.15	12.73	60	1999, 2000, 2008, 2009, 2010, 2011
Total Nitrogen, Filtered (mg/L)*				
Aunt Betsey's Brook	0.42	0.22	31	2008, 2009, 2010, 2011
French Hill Brook	0.31	0.14	31	2008, 2009, 2010, 2011
Northeast Creek Monitoring Station 104	0.42	N/A	1	2005
Old Mill Brook below Crooked Rd	0.28	0.14	28	2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	0.17	0.07	21	2008, 2009, 2010
Stony Brook above Hamilton Pond	**0.71**	0.36	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	0.48	0.18	29	2008, 2009, 2010, 2011
Total Nitrogen, Unfiltered (mg/L)*				
Aunt Betsey's Brook	0.49	0.21	37	1999, 2000, 2001, 2010, 2011
French Hill Brook	0.41	0.22	34	1999, 2000, 2001, 2010, 2011
Northeast Creek at Rt 3 Bridge	0.53	0.17	22	2000, 2001
Northeast Creek Monitoring Station 100	0.44	0.15	20	2000, 2001
Northeast Creek Monitoring Station 102	0.58	0.13	22	2000, 2001
Northeast Creek Monitoring Station 103	0.61	0.11	21	2000, 2001
Northeast Creek Monitoring Station 104	0.55	0.07	23	2000, 2001, 2005
Northeast Creek Monitoring Station 105	0.55	0.08	22	2000, 2001
Old Mill Brook below Crooked Rd	0.37	0.22	47	1999, 2000, 2001, 2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	0.21	0.08	29	1999, 2000, 2008, 2009, 2010
Stony Brook above Hamilton Pond	**0.77**	0.4	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	0.55	0.16	47	1999, 2000, 2001, 2008, 2009, 2010, 2011
Ammonia as Nitrogen (mg/L)				
French Hill Brook	0.02	0.03	31	2008, 2009, 2010, 2011
Northeast Creek Monitoring Station 104	**0.04**	NA	1	2005
Old Mill Brook below Crooked Rd	0.01	0.01	28	2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	0.01	0.01	21	2008, 2009, 2010
Stony Brook above Hamilton Pond	0.03	0.04	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	0.03	0.02	29	2008, 2009, 2010, 2011
Ammonia as Ammonium (mg/L)				
Aunt Betsey's Brook	0.09	0.16	48	1999, 2000, 2001, 2008, 2009, 2010, 2011
French Hill Brook	0.04	0.04	45	1999, 2000, 2001, 2008, 2009, 2010, 2011
Northeast Creek at Rt 3 Bridge	0.16	0.15	21	2000, 2001
Northeast Creek Monitoring Station 100	**0.25**	0.20	20	2000, 2001
Northeast Creek Monitoring Station 102	0.09	0.08	21	2000, 2001
Northeast Creek Monitoring Station 103	0.09	0.07	20	2000, 2001
Northeast Creek Monitoring Station 104	0.07	0.05	22	2000, 2001, 2005
Northeast Creek Monitoring Station 105	0.06	0.05	21	2000, 2001
Old Mill Brook below Crooked Rd	0.03	0.02	47	1999, 2000, 2001, 2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	0.03	0.02	41	1999, 2000, 2008, 2009, 2010
Stony Brook above Hamilton Pond	0.03	0.06	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	0.05	0.04	48	1999, 2000, 2001, 2008, 2009, 2010, 2011
Nitrate plus Nitrite (mg/L)				
Aunt Betsey's Brook	0.04	0.02	31	2008, 2009, 2010, 2011
French Hill Brook	0.02	0.02	31	2008, 2009, 2010, 2011
Northeast Creek at Rt 3 Bridge	**37.60**	45.82	2	2001
Northeast Creek Monitoring Station 100	7.10	NA	1	2001
Northeast Creek Monitoring Station 104	0.06	NA	1	2005

Northeast Creek Monitoring Station 105	5.10	NA	1	2001
Old Mill Brook below Crooked Rd	0.02	0.02	28	2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	0.01	0.01	21	2008, 2009, 2010
Stony Brook above Hamilton Pond	0.03	0.03	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	0.44	2.18	30	2001, 2008, 2009, 2010, 2011
Total Phosphorus (mg/L)*				
Aunt Betsey's Brook	0.59	3.45	37	1999, 2000, 2001, 2010, 2011
French Hill Brook	0.75	4.28	34	1999, 2000, 2001, 2010, 2011
Northeast Creek at Rt 3 Bridge	29.81	8.06	21	2000, 2001
Northeast Creek Monitoring Station 100	**44.11**	20.71	18	2000, 2001
Northeast Creek Monitoring Station 102	23.32	10.37	22	2000, 2001
Northeast Creek Monitoring Station 103	23	8.01	21	2000, 2001
Northeast Creek Monitoring Station 104	21.63	14.1	23	2000, 2001, 2005
Northeast Creek Monitoring Station 105	23.68	7.84	22	2000, 2001
Old Mill Brook below Crooked Rd	1.38	6.69	47	1999, 2000, 2001, 2008, 2009, 2010, 2011
Old Mill Brook at Old Norway Rd	0.01	0	29	1999, 2000, 2008, 2009, 2010
Stony Brook above Hamilton Pond	0.02	0.01	28	2008, 2009, 2010, 2011
Stony Brook below Hamilton Pond	0.75	2.96	47	1999, 2000, 2001, 2008, 2009, 2010, 2011

Table 4. Summary statistics for nutrients measured at USGS groundwater sites in the Northeast Creek watershed. Values in bold indicate the highest values per parameter. Total Nitrogen is measured as the sum of nitrate, nitrite, ammonia, and organic nitrogen. Minimum and maximum values are shown rather than standard deviation because of the small sample size. Refer to Figure 1 for site locations. Fresh Meadow Marsh GW1: Site 24. GW2: Site 20. GW3: Site 22. GW4: Site 21. GW5: Site 19. GW6: Site 23. Northeast Creek Monitoring Station 104: Site 6.

Site	Mean	Min	Max	Number Samples	Years Sampled
Total Nitrogen, Filtered (mg/L)					
Fresh Meadow Marsh GW1	0.49	0.09	1.39	7	2008, 2009
Fresh Meadow Marsh GW2	0.39	0.10	0.98	6	2008, 2009
Fresh Meadow Marsh GW3	0.79	0.10	1.62	6	2008, 2009
Fresh Meadow Marsh GW4	0.76	0.16	2.00	5	2008, 2009
Fresh Meadow Marsh GW5	1.07	0.22	**3.32**	5	2008, 2009
Fresh Meadow Marsh GW6	**1.20**	0.33	2.16	3	2008, 2009
Northeast Creek Monitoring Station 104	0.52	0.52	0.52	1	2004
Ammonia as Nitrogen (mg/L)					
Fresh Meadow Marsh GW1	0.27	0.0203	0.495	9	2008, 2009
Fresh Meadow Marsh GW2	0.13	0.0266	0.405	7	2008, 2009
Fresh Meadow Marsh GW3	0.45	0.0063	0.858	8	2008, 2009
Fresh Meadow Marsh GW4	0.34	0.021	1.2	8	2008, 2009
Fresh Meadow Marsh GW5	**0.46**	0.0322	1.9	7	2008, 2009
Fresh Meadow Marsh GW6	0.31	0.12	0.563	3	2008, 2009
Northeast Creek Monitoring Station 104	0.04	0.04	0.04	1	2004
Ammonia as Ammonium (mg/L)					
Fresh Meadow Marsh GW1	0.35	0.026	0.637	9	2008, 2009
Fresh Meadow Marsh GW2	0.17	0.034	0.522	7	2008, 2009
Fresh Meadow Marsh GW3	0.58	0.008	1.1	8	2008, 2009
Fresh Meadow Marsh GW4	0.43	0.027	1.51	8	2008, 2009
Fresh Meadow Marsh GW5	**0.60**	0.041	2.45	7	2008, 2009
Fresh Meadow Marsh GW6	0.40	0.155	0.725	3	2008, 2009
Northeast Creek Monitoring Station 104	0.05	0.052	0.052	1	2004
Nitrate plus Nitrite (mg/L)					
Fresh Meadow Marsh GW1	0.02	0.004	0.092	9	2008, 2009
Fresh Meadow Marsh GW2	0.02	0.001	0.043	7	2008, 2009
Fresh Meadow Marsh GW3	0.02	0.004	0.097	8	2008, 2009
Fresh Meadow Marsh GW4	0.04	0.004	0.113	8	2008, 2009
Fresh Meadow Marsh GW5	**0.09**	0.007	0.258	7	2008, 2009
Fresh Meadow Marsh GW6	0.02	0.012	0.022	3	2008, 2009
Northeast Creek Monitoring Station 104	0.06	0.06	0.06	1	2004
Orthophosphate as Orthophosphate, Filtered (mg/L)					
Fresh Meadow Marsh GW1	0.11	0.01	**0.77**	9	2008, 2009
Fresh Meadow Marsh GW2	0.11	0.01	0.64	7	2008, 2009
Fresh Meadow Marsh GW3	0.07	0.01	0.22	8	2008, 2009
Fresh Meadow Marsh GW4	0.02	0.01	0.04	8	2008, 2009
Fresh Meadow Marsh GW5	**0.17**	0.01	0.50	7	2008, 2009
Fresh Meadow Marsh GW6	0.06	0.01	0.09	3	2008, 2009
Northeast Creek Monitoring Station 104	0.02	0.02	0.02	1	2004

Orthophosphate as Phosphorus, Filtered (mg/L)					
Fresh Meadow Marsh GW1	0.04	0.00	**0.25**	9	2008, 2009
Fresh Meadow Marsh GW2	0.04	0.01	0.21	7	2008, 2009
Fresh Meadow Marsh GW3	0.02	0.00	0.07	8	2008, 2009
Fresh Meadow Marsh GW4	0.01	0.00	0.01	8	2008, 2009
Fresh Meadow Marsh GW5	**0.06**	0.01	0.16	7	2008, 2009
Fresh Meadow Marsh GW6	0.02	0.01	0.03	3	2008, 2009
Northeast Creek Monitoring Station 104	0.01	0.01	0.01	1	2004

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