PARSONS CREEK WATERSHED
WATER QUALITY REPORT

November 2019

PREPARED FOR

Town of Rye

10 Central Road

Rye, NH 03862

PREPARED BY

FB Environmental Associates

170 West Road, Suite 6

Portsmouth, NH 03801

TRACKING FECAL CONTAMINATION

Current Tools and Challenges

STATEWIDE FECAL CONTAMINATION ISSUE

Surface waters near developed areas are impacted by fecal contamination from polluted stormwater runoff, malfunctioning septic systems, pet, livestock, and wildlife waste, leaky sewer lines, and other aging infrastructure on residential, municipal, and commercial properties. The State of New Hampshire lists over 300 river and estuarine segments as impaired for fecal indicator bacteria (FIB). These impaired waterbodies are particularly concentrated in the populated Seacoast Region. This fecal contamination generates a significant threat to water quality, public health, and the local economy.

TRACKING FECAL SOURCES IS DIFFICULT

Monitoring, tracking, and managing pathogens in fecal matter is extremely difficult, particularly when fecal indicators (e.g., *E.coli,* Enterococci, or fecal coliform) are also highly variable to track and measure. FIB are used to detect fecal contamination and the pathogens associated with fecal matter in surface waters. Previous studies of beaches impacted by point sources of sewage discharge found a significant correlation between FIB and the probability of gastrointestinal (GI) illness in swimmers. However, there are some limitations to using FIB to track pathogens in fecal matter. Bacteria and viral pathogens react differently in the natural environment, so that external factors (temperature, sunlight, proliferation, etc.) may influence the concentration of FIB, but not the viral pathogens of interest for protecting public health. In addition, laboratory analysis of FIB can be highly variable due to the biological nature of the bacteria. For instance, laboratory and field duplicates can vary up to 200% or more, particularly at lower concentrations. As such, bacteria results should not be interpreted as absolute numbers, but as a rough estimate of concentration. New indicators are currently being tested that help address these issues, but until then current FIB must be interpreted with some caution when determining its actual threat to public health.
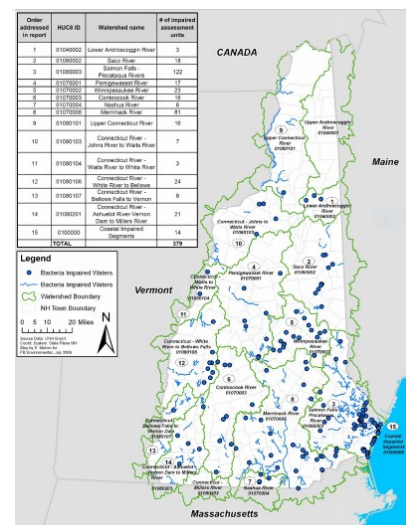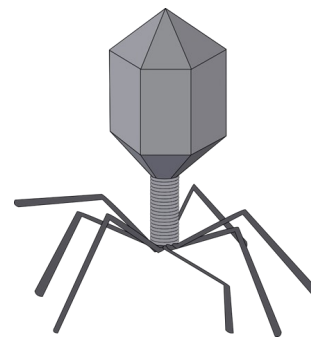

Figure 1-1: Map of Bacteria Impaired Waters in New Hampshire, by HUC 8 Watershed.

Designed by L. Diemer, FBE
Graphic credit: OpenClipArt

2

BEACH MONITORING

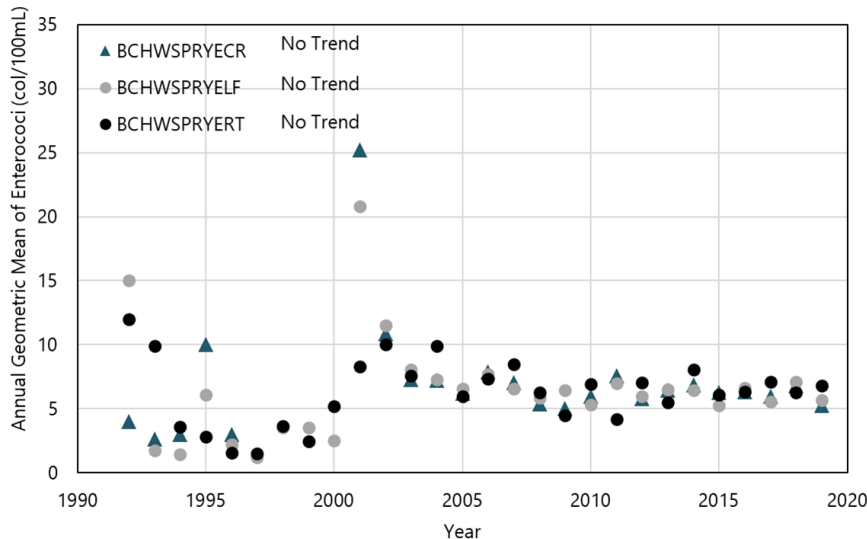Wallis Sands State Beach and Wallis Beach, Rye, NH
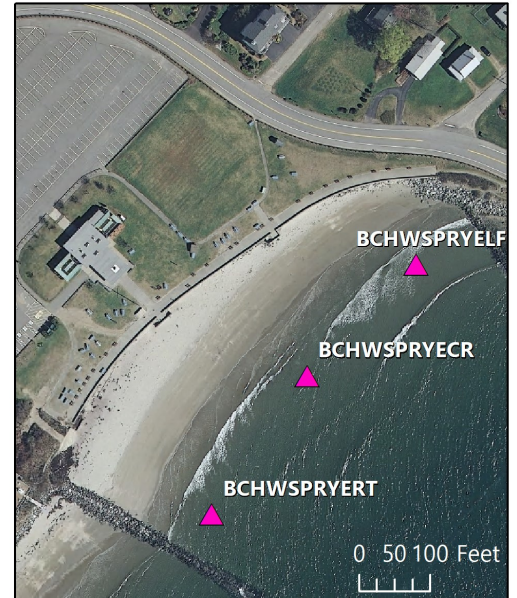
NHDES BEACHES PROGRAM

NHDES conducts regular sampling of freshwater and coastal beaches and issues advisories if FIB counts exceed water quality criteria established for the protection of public health. The annual geometric means for the six monitored beach sites were well within acceptable limits for NHDES water quality criteria, but one site (BCHPICRYELF) on Wallis Beach showed a statistically-significant degrading trend from 1997-2019. Wallis Sands State Beach has been issued one advisory in 2017; Wallis Beach has been issued seven advisories in 2018, 2017, 2014, 2010, 2009, 2008, and 2006. There were no advisories issued in 2019 at either beaches. However, FIB counts were elevated (>104 mpn/100mL) at site BCHPICRYERT on two sample dates in 2019 (7/8/19 and 8/14/19).

Historically and in 2019, Wallis Beach has shown elevated FIB counts in the swimmable wading zone, particularly at BCHPICRYERT near the outlet of Parsons Creek.
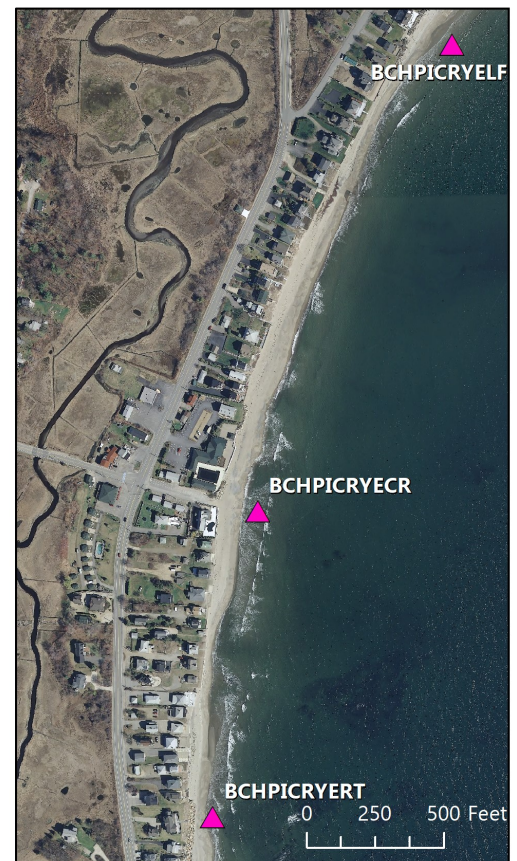
Wallis Sands State Beach

Wallis Beach
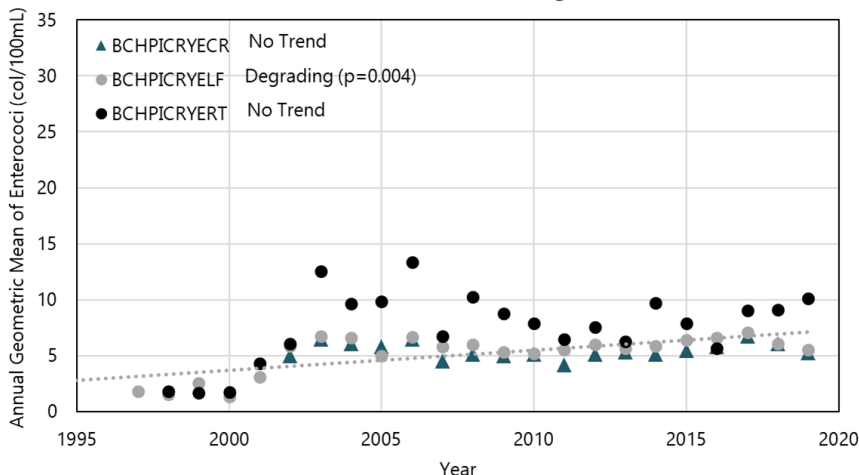

Wallis Sands State Beach Monitoring Sites

Wallis Beach Monitoring Sites
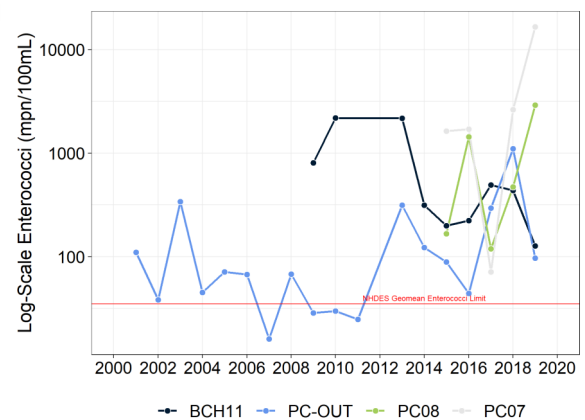
WATERSHED MONITORING

Four sites (PC07, PC08, BCH11, and PC-OUT) within the Parsons Creek watershed were sampled for Enterococci six times at low tide during wet and dry weather conditions from June through October 2019. These sites have showed historically-elevated levels of Enterococci for multiple years and have been positive for human fecal contamination by either ribotyping or canine detection or both. The Town of Rye has identified several septic systems in failure within the watershed, which may be contributing to elevated levels of Enterococci at these sites.

All sites exceeded the state criterion for geometric mean (35 mpn/100mL) in 2019. All but 7 out of 24 samples (PC-OUT on 6/10/19, 7/11/19, and 10/8/19, BCH11 on 6/10/19, 9/19/19, and 10/8/19, and PC07 on 6/10/19) surpassed the state criterion for instantaneous level (104 mpn/100mL) in 2019. Refer to Appendix A for data and Appendix B for methods.

Similar to previous years, fecal indicator bacteria counts exceeded state criteria at multiple locations in the upper east branch of Parsons Creek (PC07, PC08, BCH11). Fecal indicator bacteria counts measured at PC08 and PC07 were especially high in 2019 compared to historic levels while BCH11 and PC-OUT showed some improvements.
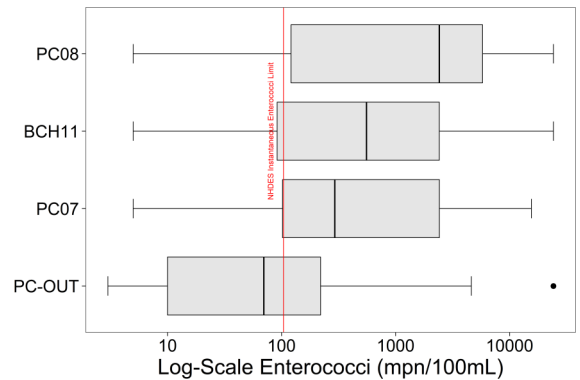
All data (2001-2019) distribution for the four sites monitored in 2019. Sites ordered from highest to lowest median value.

Annual geometric mean from 2001-2019 for the four sites monitored in 2019.

View of the upper east branch of Parsons Creek near PC07 and PC08. Photo Credit: FBE.

View of site BCH11. Photo Credit: FBE.

2019 Water Quality Results
Parsons Creek, Rye, NH

0   0.25   0.5 Miles

N

Legend

△ Dry Weather Geomean
○ Wet Weather Geomean
□ All Weather Geomean

Entero Geomean (MPN/100mL)

■ 0-35 (blue)
■ 36-500 (green)
■ 501-1000 (yellow)
■ 1001-2000 (orange)
■ 2000+ (red)

⬭ Parsons Creek Watershed
— Rivers/Streams
— Roads

Source: New Hampshire GRANIT,
FB Environmental, ESRI,
Watershed Area from NHDES. Projection:
NAD 1983 New Hampshire State Plane FIPS 2800.
Created by FB Environmental
(C. Bunyon), November 2019

WET/DRY WEATHER ANALYSIS

Similar to historical patterns, wet weather in 2019 generated higher counts of Enterococci in surface waters compared to dry weather (though the geometric mean was exceeded during both wet and dry weather at BCH11, PC07, and PC08), suggesting that sources of fecal contamination were largely from stormwater runoff. However, during significant rain events (several inches) and spring tides, the water table may rise and intercept leachfields, which flush out fecal contamination in groundwater to nearby waterbodies.

Historically and in 2019, fecal indicator bacteria counts exceeded state criteria during both wet and dry weather, suggesting that both stormwater runoff and groundwater are significant sources of contamination to Parsons Creek and the beach. The low-lying topography and high groundwater table in the watershed make leachfields susceptible to malfunction, which is likely the primary source of fecal contamination in the watershed and at the beaches.
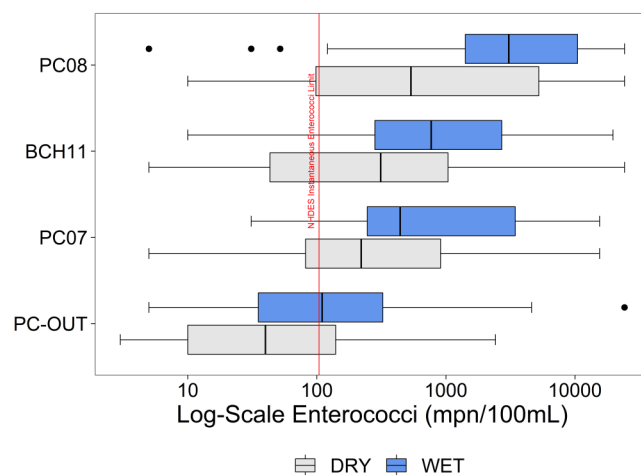
All data (2001-2019) distribution for the four sites monitored in 2019 by weather condition (dry and wet).
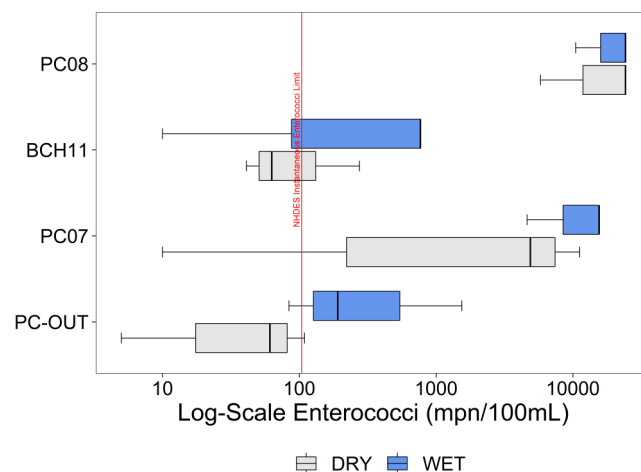
2019 data distribution for the four sites monitored in 2019 by weather condition (dry and wet).

BCH11 during wet weather (top) and PC-OUT during dry weather (bottom). Photo Credit: FBE.

SUMMARY

Snapshot of Results

Overall, the Town of Rye, the NHDES Beaches Program, the NHDES Watershed Assistance Section, the NH Shellfish Program, FB Environmental Associates, the Jackson Laboratory, and Environmental Canine Services have done a considerable amount of work to track sources of fecal contamination in both surface water and groundwater within the Parsons Creek watershed and along the beach. This work has generated a long-term dataset for analysis and interpretation for determining next steps in dealing with this issue. A summary of results is provided below.

Beach Results

⇒ There were no advisories issued in 2019 at Wallis Sands State Beach or Wallis Beach. However, FIB counts were elevated (>104 mpn/100mL) at site BCHPICRYERT at Wallis Beach on two sample dates in 2019 (7/8/19 and 8/14/19). Historical results have shown the critical connection between Parsons Creek water quality and protection of public health at the beach.

Watershed Monitoring Results

⇒ Elevated FIB counts continue to be measured in Parsons Creek. Historical investigations by human waste tracking canines showed that human fecal contamination is a diffuse problem throughout the watershed due to the area's low-lying topography and high groundwater table that likely intercept leachfields on a regular basis during storm events and/or spring tides. Even if a high water table is not the issue, sandy soils would allow for fast percolation rates of contaminated leachfield water to groundwater and ultimately surface waters without adequate treatment of pathogens.

⇒ As part of the new health regulation, several septic systems near or contributing to the area around these hotspot sites have been found to be malfunctioning and possibly contributing to human fecal contamination in Parsons Creek.

⇒ FIB counts were especially elevated in 2019 compared to historical levels at PC07 and PC08.

Wet/Dry Weather Analysis

⇒ Historically and in 2019, FIB counts exceeded state criteria during both wet and dry weather, suggesting that stormwater runoff and groundwater are significant sources of fecal contamination to Parsons Creek and the beach. The low-lying topography and high groundwater table in the watershed make leachfields susceptible to malfunction, which is likely the primary source of fecal contamination in the watershed and at the beaches.

NEXT STEPS

Recommendations and Priorities

✄ Address groundwater sources of fecal contamination

⇒ Update the septic system database on a regular basis.

⇒ Continue to enforce the septic system health regulation that requires pump-outs every 3 years.

⇒ Continue evaluation of individual properties for septic system functioning near hotspots.

⇒ Consider incorporating stricter guidelines for septic system replacement or installation to town ordinances.

⇒ Consider a town sewer system to connect homes in low-lying areas along the marsh and beach.

✄ Address surface runoff sources of fecal contamination

⇒ Continue to locate candidate sites for BMP implementation to address stormwater runoff.

⇒ Continue to secure funding that implements these candidate BMP sites.

⇒ Continue to track and monitor existing BMP conditions and fix or improve sites, as necessary.

⇒ Maintain installed pet waste signs.

✄ Enhance public outreach program

⇒ Post and maintain an advisory at the beach.

⇒ Continue to distribute educational materials and reports to the public via the town's website.

⇒ Continue to educate homeowners on proper disposal of pet waste and maintenance of septic systems.

⇒ Continue regular meetings with the Parsons Creek Water Quality Committee.

✄ Continue monitoring program

⇒ Continue water quality sampling throughout the Parsons Creek watershed under varying weather conditions to track changes in FIB over time, especially as failing septic systems are replaced.

⇒ Expand sampling program by including co-indicators along with FIB to better pinpoint human sources of fecal contamination. Co-indicators include optical brighteners and inorganic nutrients present in human wastewater, as well as microbial DNA source tracking methods such as PhyloChip®.

⇒ Complete a groundwater testing study of the marsh area draining to BCH11.

⇒ Retest the area around the large marsh pool to determine whether the elevated fecal indicator levels are from wildlife or possibly remnant from a failing septic system that was recently replaced on a property draining to the large marsh pool.

⇒ Consider updating the 2011 Parsons Creek Watershed Management Plan.

APPENDIX A

2019 Watershed Monitoring Data

Date	Dry/Wet	Site ID	Water Temp (°C)	DO (ppm)	Conductivity (mS/cm)	Salinity (ppt)	pH	Enterococci (mpn/100mL)
6/10/2019	Dry	BCH11	19.3	*2.6*	22.8	13.9	6.6	63
6/10/2019	Dry	PC07	19.5	14.0	4.0	2.1	7.1	10
6/10/2019	Dry	PC08	24	5.7	9.4	5.3	6.6	*5,794*
6/10/2019	Dry	PC-OUT	20.8	7.0	32.1	20	7.1	<10
7/11/2019	Dry	BCH11	23.7	*0.6*	35.3	22.2	6.5	*275*
7/11/2019	Dry	PC07	24.6	11.9	27.7	17	6.7	*11,199*
7/11/2019	Dry	PC08	25.7	*2.8*	33.4	20.9	6.5	*24,196*
7/11/2019	Dry	PC-OUT	24.2	7.6	42.6	27.4	7.3	61
7/24/2019	Wet	BCH11	23.1	*1.1*	24.8	15.1	6.7	*773*
7/24/2019	Wet	PC07	22.6	8.3	0.4	2.3	6.9	*15,531*
7/24/2019	Wet	PC08	24.7	*3.8*	8.1	4.5	6.5	*10,462*
7/24/2019	Wet	PC-OUT	23.3	8.7	19.1	11.4	7.1	*191*
8/14/2019	Wet	BCH11	20.1	*0.3*	32.6	20.4	6.6	*768*
8/14/2019	Wet	PC07	19.6	6.0	20.5	12.3	6.9	*15,531*
8/14/2019	Wet	PC08	20.1	*1.0*	27.5	17	6.8	*>24,196*
8/14/2019	Wet	PC-OUT	18.2	*4.4*	30.8		7.2	*1,541*
9/19/2019	Dry	BCH11	15.5	*0.3*	39.3	23.8	6.5	41
9/19/2019	Dry	PC07	15.7	*1.6*	40.2	24.4	6.7	*4,884*
9/19/2019	Dry	PC08	14.4	*2.7*	40.7	25.1	6.9	*>24,196*
9/19/2019	Dry	PC-OUT	14.4	*4.4*	39.1		7.4	*109*
10/8/2019	Wet	BCH11	18.2	*0.5*	38.2		6.3	10
10/8/2019	Wet	PC07	16.3	69.1	18.9		6.7	*4,611*
10/8/2019	Wet	PC08	17.5	*2.2*	39.1		6.5	*>24,196*
10/8/2019	Wet	PC-OUT	17.3	7.2	41.1		6.9	84

Italicized red text indicates exceedance of the state criterion threshold for individual samples (Enterococci = 104 mpn/100mL; DO = 5 ppm).

APPENDIX B

SAMPLING PROTOCOL

Baseline sampling was performed as documented in the *NHDES Generic Beach Program Quality Assurance Project Plan* dated April 3, 2012, RFA # 06193, Section B2.0. Samples were collected in labeled whirlpak bags and stored on ice in a cooler for transport to Absolute Resource Associates Laboratory in Portsmouth, NH for analysis of Enterococci. Water quality parameters (dissolved oxygen, temperature, salinity, and specific conductivity) were collected in the field using calibrated instruments: YSI ProODO, YSI 30, and/or YSI 85. Two duplicate samples were collected and were well within acceptable difference (9-29%, RPD).

WET/DRY WEATHER CLASSIFICATION

Wet weather was determined as: >0.1" of precipitation in the prior 24 hours; or >0.25" in the prior 48 hours; or >2.0" in the prior 96 hours. Conditions were considered dry weather when precipitation was <0.1" for each day within 72 hours.

STATISTICAL METHODS

A Mann-Kendall trend analysis was performed for beach sites with at least 10 years of data. The Mann-Kendall Trend Test is a non-parametric statistical test that determines if the central value (median) of a dataset has changed over time. A non-parametric test is appropriate here because it does not make assumptions about the normality or variability of the dataset; variation seen year-to-year or within seasons will not influence the results of non-parametric analysis the way that parametric tests can be influenced.

DATA INTERPRETATION – WATER QUALITY STANDARDS

The NHDES Consolidated Assessment Listing Methodology (CALM) describes the process and water quality standards used to assess the state's waters. This information is used to help interpret Parsons Creek water quality results and relate it to state criteria. https://www.des.nh.gov/organization/divisions/water/wmb/swqa/2014/documents/r-wd-15-9.pdf