Water Quality Trends for Conscience Bay

2020

This report summarizes water quality data for fecal coliform and total coliform in Conscience Bay for the years 1998-2020.

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Introduction

The majority of Conscience Bay has long been closed (uncertified) to shellfishing by the New York State Department of Environmental Conservation (NYSDEC) due to water quality concerns. This area is permanently off-limits to shellfishing due to the proximity to actual or potential sources of pathogenic bacteria from marinas and high-density mooring areas. However, it should be noted that the bacteria levels in Conscience Bay have been trending downward considerably over the past ten-plus years, which have coincided with the NYSDEC's designation of Conscience Bay as a No Discharge Zone for boat sewage waste and the introduction of stormwater management regulations.
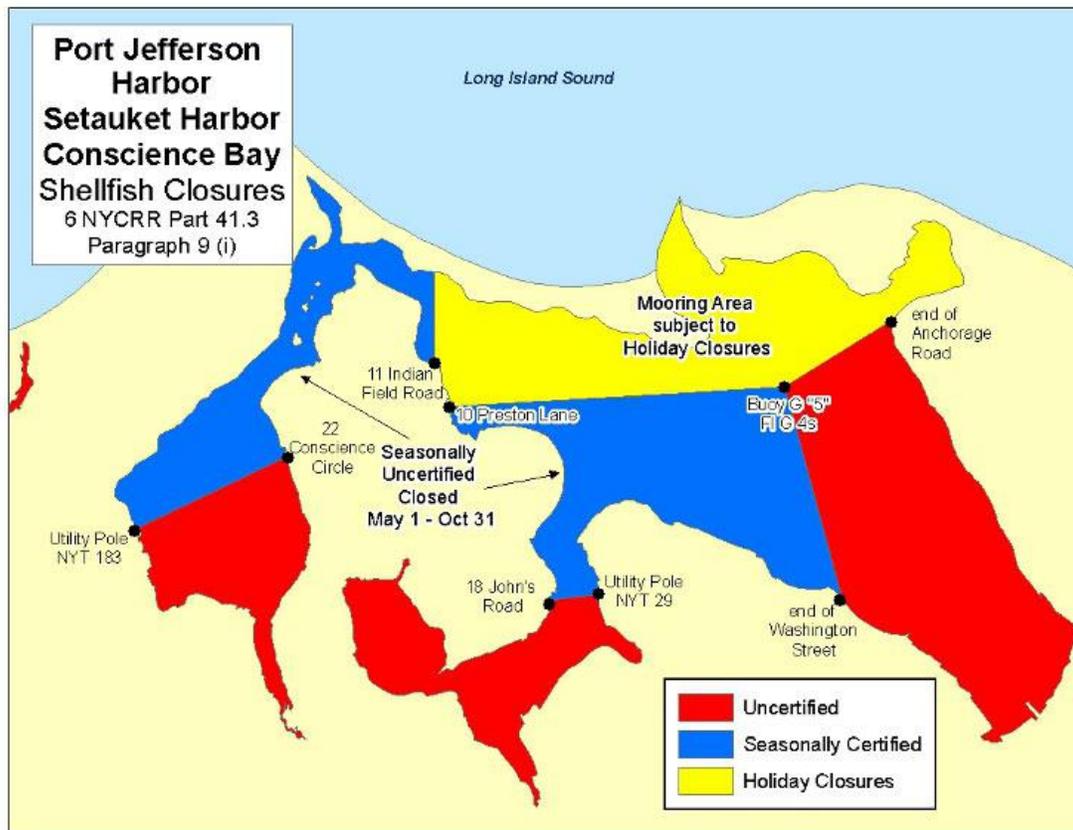
As part of the Village of Old Field's "*Stormwater Management Program Plan*" (2015), the Village of Old Field reviews collected microbiological indicator data to assess progress toward the goals of the Total Maximum Daily Loads (TMDL) for pathogens.

Fecal coliform and total coliform are considered to be microbiological indicator organisms, which are assumed to indicate the presence of pathogenic organisms associated with fecal material from warm blooded animals.

Sample Collection

Water samples are collected from the Port Jefferson Harbor Complex by the Suffolk County Department of Health Services (SCDHS) and analyzed for various water quality parameters. Sampling locations are shown below.

For the purposes of this water quality trend report, one location (Station 040180) was selected for Conscience Bay.

This location was selected to coincide with the sampling stations that exhibited exceedances for fecal and/or total coliform as presented in the "*Final Report for Shellfish Pathogen TMDLs for 27 303(d)-listed Waters*", prepared by Battelle (2007).

Water Quality Standards

New York State participates in the National Shellfish Sanitation Program (NSSP) which recommends strict bacteriological water quality standards for shellfish harvesting areas to be designated as approved, or certified, for the harvest of shellfish for human consumption. The NSSP standards for fecal coliform and total coliform are as follows:

- Fecal Coliform – The geometric mean of samples shall not exceed 14 MPN / 100 mL
- Fecal Coliform – The 90th percentile value of the samples shall not exceed 49 MPN / 100 mL
- Total Coliform – The geometric mean of samples shall not exceed 70 MPN / 100 mL
- Total Coliform – The 90th percentile value of the samples shall not exceed 330 MPN / 100 mL

Data Analysis Methodology and Results

A 23-year record (1998 – 2020) of fecal coliform and total coliform data was used to calculate the statistical geometric mean ("geomean") and 90th percentile values.

The main benefit of using geometric means for trend charts (see Figures 1 through 3) is that they help smooth out the effects of occasional very high or very low values. It is common in microbiology to use a rolling geometric mean to analyze trends. For this report, data from the previous 30 sampling events are used to create one data point for the rolling geometric mean. A sample size of 30 is typically used in statistical analyses to reduce statistical errors.

The 90th percentile is a measure of statistical distribution. The 90th percentile tells you the value for which 90% of the data points are smaller and 10% are bigger. For this report, data from the previous 30 sampling events are used to create one data point for the rolling 90th percentile. A sample size of 30 is typically used in statistical analyses to reduce statistical errors.

Some of the SCDHS sampling data was expressed as "<20", indicating the minimum detection level. Since the actual measurement is not known, and choosing one would be random and arbitrary, a value of "19.9" was selected.

Some of the SCDHS sampling data was expressed as ">16000", indicating the maximum detection limit. Since the actual measurement is not known, and choosing one would be random and arbitrary, a value of "16001" was selected.

For dates in which two samples were collected in one day (e.g., morning and afternoon), the higher values of the set were used in the analyses.

The most recent 30 sample data points used to generate the geometric mean and 90th percentile data are presented in Table 1 below and are inclusive of data from 2011 to 2020.

Table 1. Summary of Stations for Fecal and Total Coliform – Rolling Data

Station ID	Fecal Coliform (MPN/100 mL)		Total Coliform (MPN/100 mL)		No. of Samples	Effective Date
	Geomean (>14 MPN)	90th Percentile (>49 MPN)	Geomean (>70 MPN)	90th Percentile (>330 MPN)		
040-180	**27.10**	**70**	35.0	100	30	1/7/2020

Notes: Bold values indicate concentrations higher than the NSSP Standards
* - Beginning in 2019, the method detection limit for SCDHS analyses was 18 MPN / 100 mL.

Water Quality Trends

Trending charts for fecal coliform and total coliform are provided below.

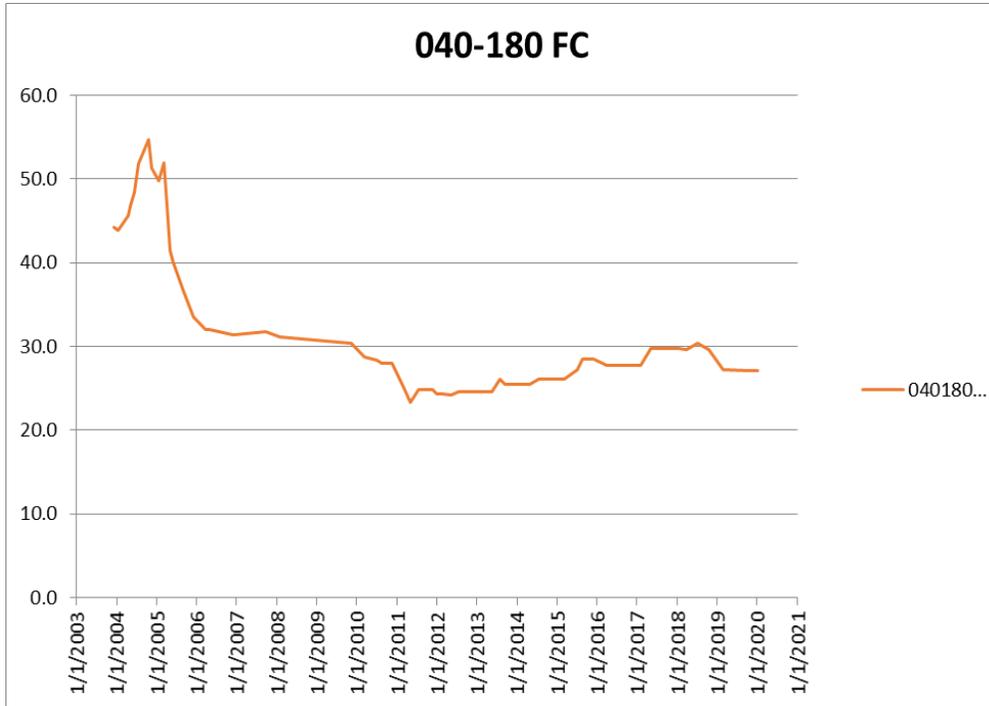**Figure 1. Fecal Coliform Data – Rolling Geometric Mean for Stations 040180**
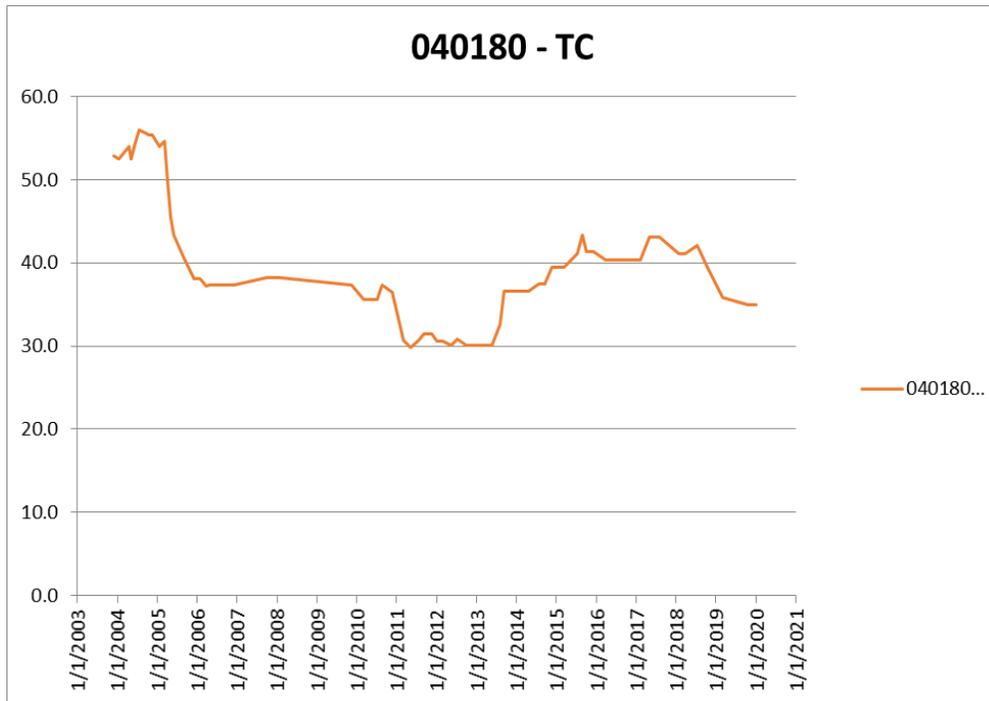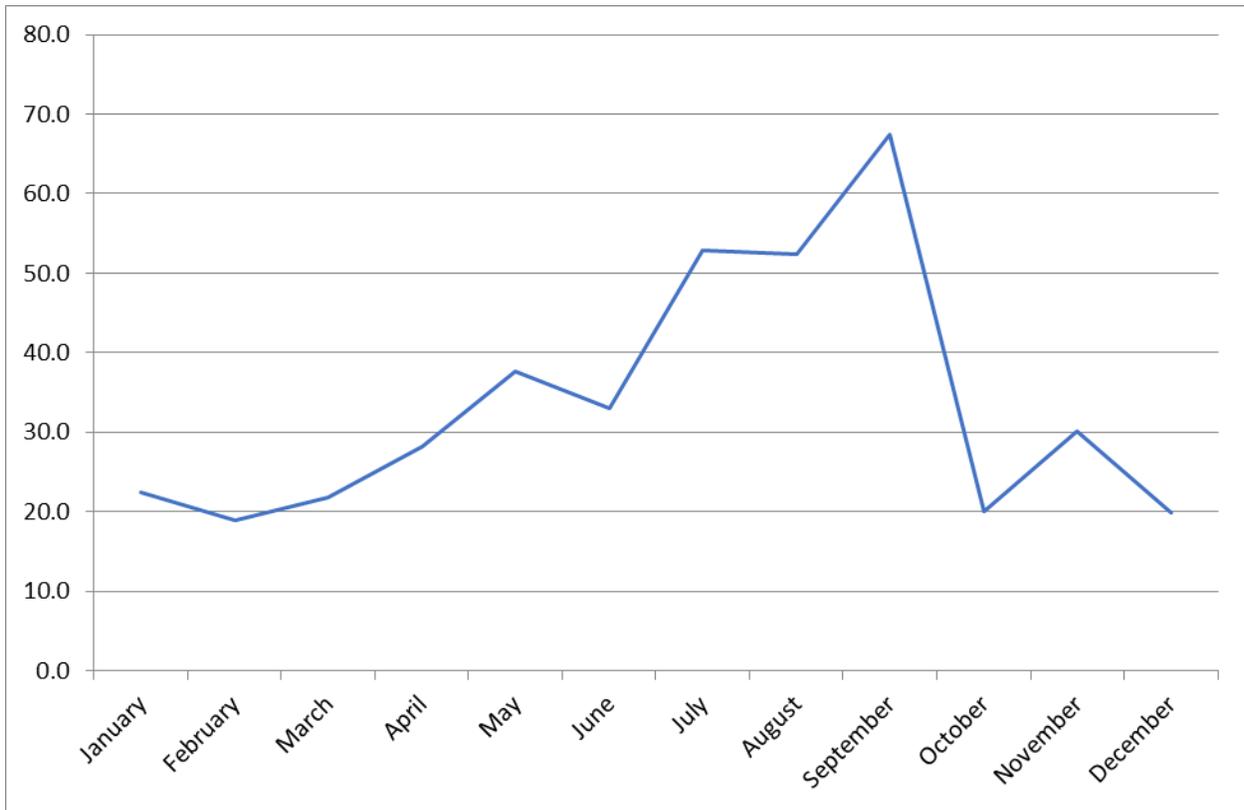

Figure 2. Total Coliform Data – Rolling Geometric Mean for Station 040180

Figure 3. Seasonal Variation at Station 040-180 for Total Coliform

Findings and Conclusions

Trends

While it would appear that fecal coliform and total coliform concentrations have been trending upward since 2012, it should be noted that seasonality plays a large role in influencing the geometric mean data. As shown in Figure 3, total coliform concentrations are generally low in the winter months and peak in the summer months. Prior to 2013, 33 percent of the coliform samples were collected between the months of June and September. In comparison, 39 percent of the coliform samples were collected during the same months from 2013 to 2020. As a result, even though use of the rolling geometric mean is meant to smooth out very high and very low data, it is reasonable to assume that a data set containing a higher percentage of elevated fecal and total coliform levels would result in higher rolling geometric means.

Comparison to NSSP Standards

Station 040-180 exceeded the fecal coliform geometric mean standard of 14 MPN / 100 mL and the fecal coliform 90th percentile standard of 49 MPN / 100 mL; but was below the total coliform geometric mean standard of 70 MPN / 100 mL and the total coliform 90th percentile standard of 330 MPN / 100 mL.

Conclusion

Analysis of the data indicates that seasonality plays a significant role in determining if surface waters meet or exceed the NSSP standards. Since the data utilized for this report is dependent upon the time of year that samples are collected by the SCDHS, the seasonal variations need to be accounted for in determining compliance with the NSSP standards.

Since seasonality plays such a large role, and the concentrations of fecal coliform and total coliform are highest during the summer months (coinciding with the boating season), it is plausible that boaters are the largest source of pathogen loading to Conscience Bay.

References

Battelle, 2007. *Final Report for Shellfish Pathogen TMDLs for 27 303(d)-listed Waters*.

Village of Old Field, 2015. *Stormwater Management Program Plan.*

Suffolk County Department of Health Services (SCDHS), 2020. Surface water quality monitoring data provided by the SCDHS Office of Ecology, Yaphank, N.Y.