

## Water Clarity & Chlorophyll-a

Increased algae blooms correlate with higher chlorophyll-a levels and lower water clarity leading to lower light availability. The duration of time and magnitude of exceedance of water clarity and chlorophyll-a targets are assessed together to track progress toward water quality goals.

### **Stop Light Graphic of Combined Water Clarity and Chlorophyll-a at Peconic Estuary SCDHS Stations by Estuary Segment**

1990-2024

*Segments: 1a-Western-River Influence, 1b-Western, 2-Central and 3-Eastern*

The Stop Light Graphic reflects the combined outcomes for chlorophyll-a and water clarity based on analysis of exceedance duration and magnitude of targets for each parameter. Water clarity and Secchi disk depth median values during the growing season at SCDHS stations were averaged within the Estuary segment. Tracking the attainment outcomes provides the framework from which Estuary management actions can be developed and initiated. For each year and segment, a color-coded management action is assigned. Segment 3 consistently meets PEP's water quality goals and has since 1990. Segment 2 has inconsistently met PEP's water quality goals since 1990 but has met those goals consistently since 2019. Segment 1b has inconsistently met PEP's water quality goals since 1990 and has received a cautionary categorization since 2015. Segment 1a has consistently failed to meet water quality standards since 1995. Management action is in place for segment 1a and 1b.

## Water Clarity

Higher water clarity means that more sunlight can reach submerged aquatic vegetation (SAV), such as eelgrass, which need sufficient sunlight in order to grow and survive. SAV provides important habitat for fish, shellfish and invertebrates. Reduced water clarity can be caused by algal blooms, eroded sediments from runoff, or disturbed bottom sediments from wind or human activities. Water clarity is measured by the depth at which a Secchi disk is visible from the water's surface at SCDHS marine monitoring stations in the Peconic Estuary. A Secchi disk is a white and black disk that is lowered down into the water - the depth at which the disk is no longer visible is taken as a measure of the how clear the water is. Higher water clarity is signified by greater Secchi disk depths.

**The PEP's target for water clarity: Median Secchi disk depths should be 2 meters (m)/ 6.5 feet (ft) or greater during the April 1 through October 31 growing season.**

### **Water Clarity at SCDHS Stations per Peconic Estuary segment**

Segments 2 and 3 have consistently met PEP's water quality target of a Secchi disk depth greater than 2m from 1990 to 2024. In segment 1b the segment has not consistently met the PEP's water quality target since 1990, but has had a Secchi disk depth that is greater than 2m since 2020, suggesting overall water quality improvement. For segment 1a, it has not consistently met PEP's water quality target since 1990, and the last two years segment 1a has had a Secchi disk depth less than 2m.

# Chlorophyll-a

The concentration of chlorophyll-a, the pigments in plants that absorb sunlight and facilitate photosynthesis, in the water is an indicator of the amount of algae in the water. Chlorophyll-a measurements can be used as an indirect indicator of algal presence and growth and interfered nutrient levels. Chlorophyll-a samples are collected at SCDHS marine monitoring stations in the Peconic Estuary.

**The PEP's target for chlorophyll-a: Median chlorophyll-a concentrations should be no greater than 5.5 ug/L during the April 1 through October 31 growing season.**

Segments 1b, 2, and 3 have consistently met PEP's target of chlorophyll – a less than 5.5 µg/L since 1990. Segment 1a has consistently not met the PEP's target and has experienced median chlorophyll-a values of above 5.5 µg/L since 1990 including during 2024.

## Chlorophyll-a concentrations at SCDHS Stations per Peconic Estuary segment

## Methodology

The water clarity and chlorophyll-a data analysis utilized the **The Suffolk County Department of Health Services (SCDHS) Surface Water Monitoring** data set. More detail on how the analysis was completed using the Peconic R-based open science package can be found [here](#).

Water clarity and Secchi disk depth median values during the growing season (April 1 through October 31) at SCDHS stations were averaged within the Estuary segment. An outcome integer from zero to three is assigned to each Estuary segment for each annual estimate of chlorophyll-a and secchi depth. These outcomes are based on both the exceedance of the annual estimate above the threshold and duration of the exceedance of the threshold for the years prior. The following graphic describes this process:

The final Stop Light Graphic created reflects the combined outcomes for chlorophyll-a and secchi depth. Tracking the attainment outcomes provides the framework from which bay management actions can be developed and initiated. For each year and segment, a color-coded management action is assigned, in this analysis secchi depth is used instead of light attenuation values.

Refer below the median annual chlorophyll-a and secchi disk values in relation to the PEP targets for these parameters and the resulting outcome Stop Light Graphic for each Estuary segment. The blue threshold line is at 5.5 µg/L for each chlorophyll-a graph and 6.5 ft for each Secchi disk graph. The middle stoplight chart indicates the threshold outcomes each year for chlorophyll-a, Secchi disk, and the combined water quality outcome.

## Total Nitrogen

### **Median Total Nitrogen (TN, mg/L) at SCDHS surface water quality stations within the Peconic Estuary for 2024.**

The concentration of total Nitrogen in surface water, which is a vital nutrient for algae and plant metabolism (photosynthesis) is an indicator of the amount of algae in the water, and it has been shown in the scientific literature that it directly correlates with impaired water quality. The United States Environmental Protection Agency's (EPA) National Coastal Condition Assessment (NCCA) uses **0.40 mg/L** as a TN endpoint (threshold), which PEP has adopted. This value is based on the amount of TN in surface waters that would allow current eelgrass populations to survive. If the goal is to restore and recover the eelgrass populations within the estuary, a threshold of 0.30 mg/L is recommended.

## Boxplots for the Peconic Estuary segments of Median Total Nitrogen with the data for 2024 highlighted in red

Segments: 1a-Western/River Influence, 1b-Western, 2-Central and 3-Eastern

For the 2024 data, the highest TN values are in the 1a segment and the values get lower as the segments move Eastward from 1a to 3. The TN values are close to the 0.40 mg/L threshold in segment 1a throughout the year with higher values during the summer and lower values during the winter. Note that the Meetinghouse Creek station is slightly “off the chart” based on the scale presented in the legend (0.71 mg/L). The TN values in segment 1b are overall lower than segment 1a and only near the threshold in the summer and in March. The TN values in segment 2 are consistently lower than the 0.40 mg/L threshold throughout 2024, with higher values in the summer and lower values in the winter. The TN values in segment 3 are similar to segment 2 where the 2024 values are consistently below the threshold, with values that are higher in the summer and lower in the winter.

## Dissolved Oxygen

### Stop Light Graphic of Maximum Sequential Days Monthly Below DO Concentration Target at Peconic Estuary USGS Stations 2013-2024

The Stop Light Graphic reflects the sequential number of days with a 24-hour mean measurement below 4.8 mg/L at Peconic River and Orient Harbor Stations, which is considered chronic low DO. For each month and station, a color-coded management action is assigned.

Dissolved Oxygen (DO) in the water column is necessary for fish and other aquatic organisms to live. Concentrations can be impacted by the amount of algae that is in the water column, the associated photosynthesis and decomposition rates, natural variations in temperature, and wave action and mixing. DO concentrations indicate the amount of oxygen available for aquatic organisms in the Peconic Estuary. DO concentrations are measured every 6 minutes at the two USGS Continuous Water Quality Monitoring stations in the Peconic Estuary.

**The PEP's target for DO: DO concentrations should comply with New York State's acute (never less than 3 mg/L) and chronic (> 4.8 mg/L as daily average in 90% of measurements) DO criteria.**

The below graph shows annual cycles of DO, where DO decreases during the spring and summer and increases during the fall and winter. The main difference here is that the Peconic River DO levels are below the NYSDEC chronic and acute low DO thresholds during summer. Conversely, Orient Harbor remains above the acute threshold year-round and above the chronic threshold during much of the year.

## Methodology

The DO data analysis utilized the USGS **Orient\_Harbor** and **Riverhead** Continuous Water Quality Monitoring Stations data set. More detail on how the analysis was completed using the Peconic R-based open science package can be found [here](#).

The data collected at the Riverhead and Orient Harbor USGS Continuous Water Quality Monitoring Stations are summarized from the continuous (~6 minute observations) to daily averages. The data was analyzed relative to the **chronic threshold of 4.8 mg/L**.

Within the R package the average DO concentration for each day is calculated and a 1 (yes) or 0 (no) is assigned to each day based on if the concentration was below the threshold value at any point during a day. Additionally, the R

package calculates a cumulative tally of the number of days in each month at which DO fell below the threshold at any point during a day. The data is then summarized by month to be illustrated in the Stop Light Graphics.

The R package calculates average of all daily DO averages across the month, the proportion of days in a month when concentrations in a given day fell below the threshold (1 would mean all days had an instance of DO below the threshold, 0 would mean none), and the maximum number of sequential days in a month when concentrations in a given day fell below the threshold (30 or 31, depending on month, would indicate all days in a month had an instance of DO below the threshold).

The DO data can be summarized differently depending on how hypoxia/anoxia conditions can be described relative to potential impacts on biological resources. Biota may be stressed differently depending on the number of times hypoxia occurs vs how long it may persist. The two measures may indicate similar information, but not always depending on characteristics of the DO time series.

The Stop Light Graphic below shows the maximum number of sequential days in a month when concentrations in a given day fell below the threshold of 4.8 mg/L.

**Stop Light Graphic of the Proportion of Days Monthly Below DO Concentration Target of 4.8 mg/L at Peconic Estuary USGS Stations**  
2013-2024

The Stop Light Graphic below shows the proportion of days in a month when concentrations in a given day fell below a threshold of 4.8 mg/L.

**Stop Light Graphic of the Proportion of Days Monthly Below DO Concentration Target of 4.8 mg/L at Peconic Estuary USGS Stations**  
2013-2024

Using the same methodology, the data collected at the Riverhead and Orient Harbor USGS Continuous Water Quality Monitoring Stations can also be analyzed relative to the **acute threshold of 3 mg/L.**

The Stop Light Graphic below shows the maximum number of sequential days in a month when concentrations in a given day fell below the threshold of 3 mg/L.

**Stop Light Graphic of the Proportion of Days Monthly Below DO Concentration Target of 3 mg/L at Peconic Estuary USGS Stations**  
2013-2024

The Stop Light Graphic below shows the proportion of days in a month when concentrations in a given day fell below a threshold of 3 mg/L.

**Stop Light Graphic of the Proportion of Days Monthly Below DO Concentration Target of 3 mg/L at Peconic Estuary USGS Stations**  
2013-2024

## Pathogens

# **Pathogen Exposure Risk at Suffolk County Bathing Beaches in the Peconic Estuary**

## **2010 -2024**

Number of Samples that Exceeded Enterococcus Counts of 104 cfu/100 mL within 24 Hours at Bathing Beaches.

Pathogens are viruses, bacteria, fungi, and protozoans that cause diseases in humans, other animals or plants. It is difficult to directly measure the concentration of specific pathogens in sea water due to the variable nature of their occurrence. Instead, the potential for the presence of human pathogens in the water is measured using bacterial indicator species. Fecal indicator bacteria, total and fecal coliform bacteria, originate in the intestines of warm-blooded animals. Their presence in the water indicates that the waste of a warm-blooded animal, which may include pathogens, has entered the water. A type of fecal indicator bacteria that is monitored at the Suffolk County bathing beaches in the Peconic Estuary is Enterococcus bacteria.

**The PEP's target for pathogens: Enterococcus counts at estuarine/marine swimming beaches should not exceed 104 colony forming units per 100 milliliter water sample (104 cfu/100mL).**

**There were 14 occurrences of bathing beaches exceeding the criteria regarding acceptable levels of Enterococci adopted by the NYS Health Department (104 cfu/100mL) occurring at 10 different beaches in 2024.** The Suffolk County Bathing beaches in the Peconic Estuary are overall clean. Note the beaches represented in the Report are only those beaches that are monitored by the SCDHS as part of the Bathing Beach Monitoring Program. The Suffolk County bathing beaches in the watershed are Tier 2 and Tier 3 beaches- meaning the beaches have a moderate to low relative risk associated with their use.