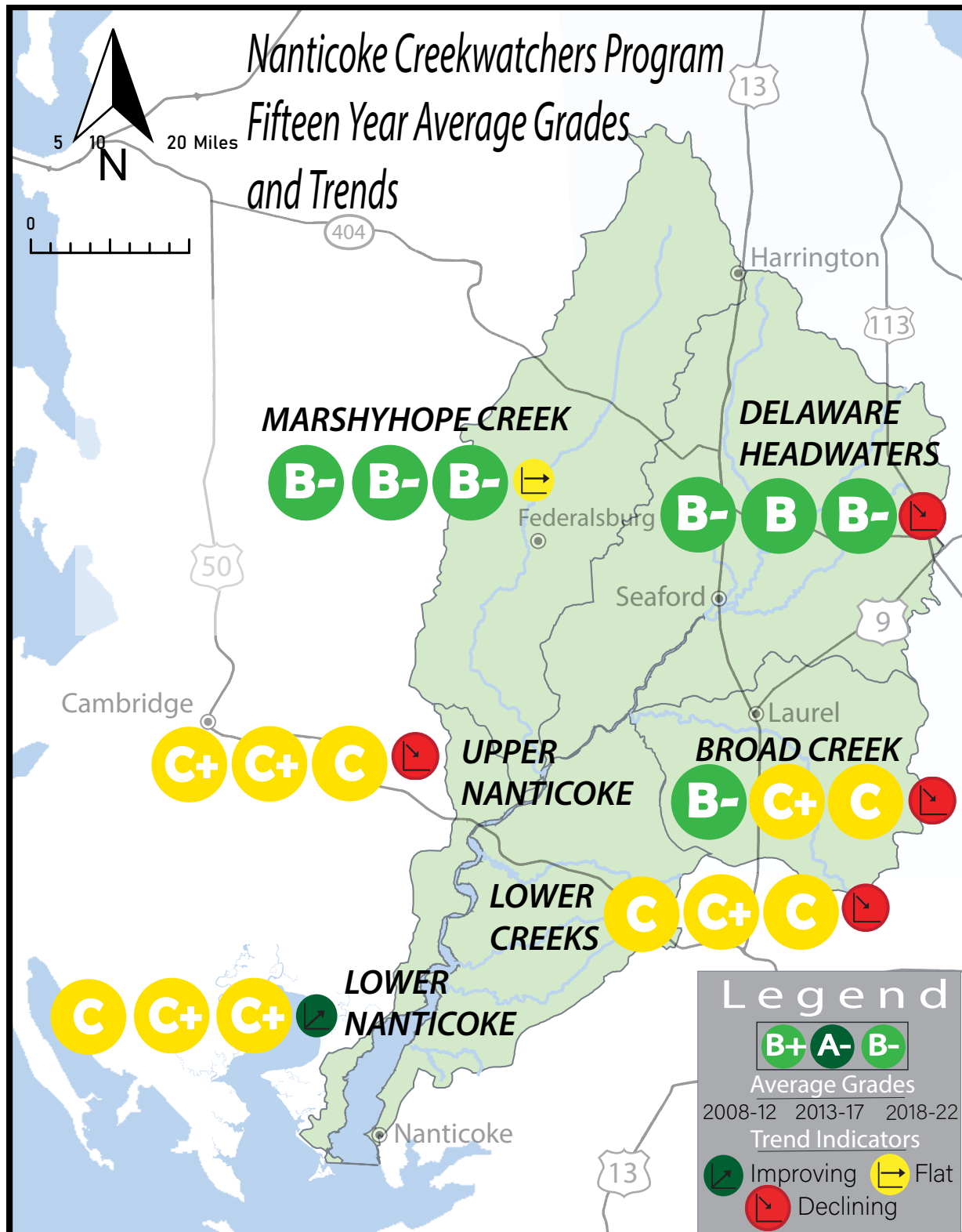




FIFTEEN YEAR NANTICOKE RIVER REPORT CARD

www.NanticokeRiver.org

The Nanticoke Creekwatchers Program began collecting water quality data in six Nanticoke River regions (Upper Nanticoke, Lower Nanticoke, Delaware Headwaters, Broad Creek, Marshyhope Creek, and Lower Creeks) in 2008. This report card examines findings from the program's first fifteen years of data collection. Below, the map (Figure 2) shows the seven regions, their average grades during the program's first ten years, and trend indicators for each region. The map on the right shows the sites used in the creation of this report card. Delaware Headwaters and Marshyhope Creek continue to be the healthiest regions, although the Lower Nanticoke is the only region that is trending toward slightly improved water quality conditions. Broad Creek has declined the most dramatically out of the regions and has steadily trended downward during this fifteen year period.



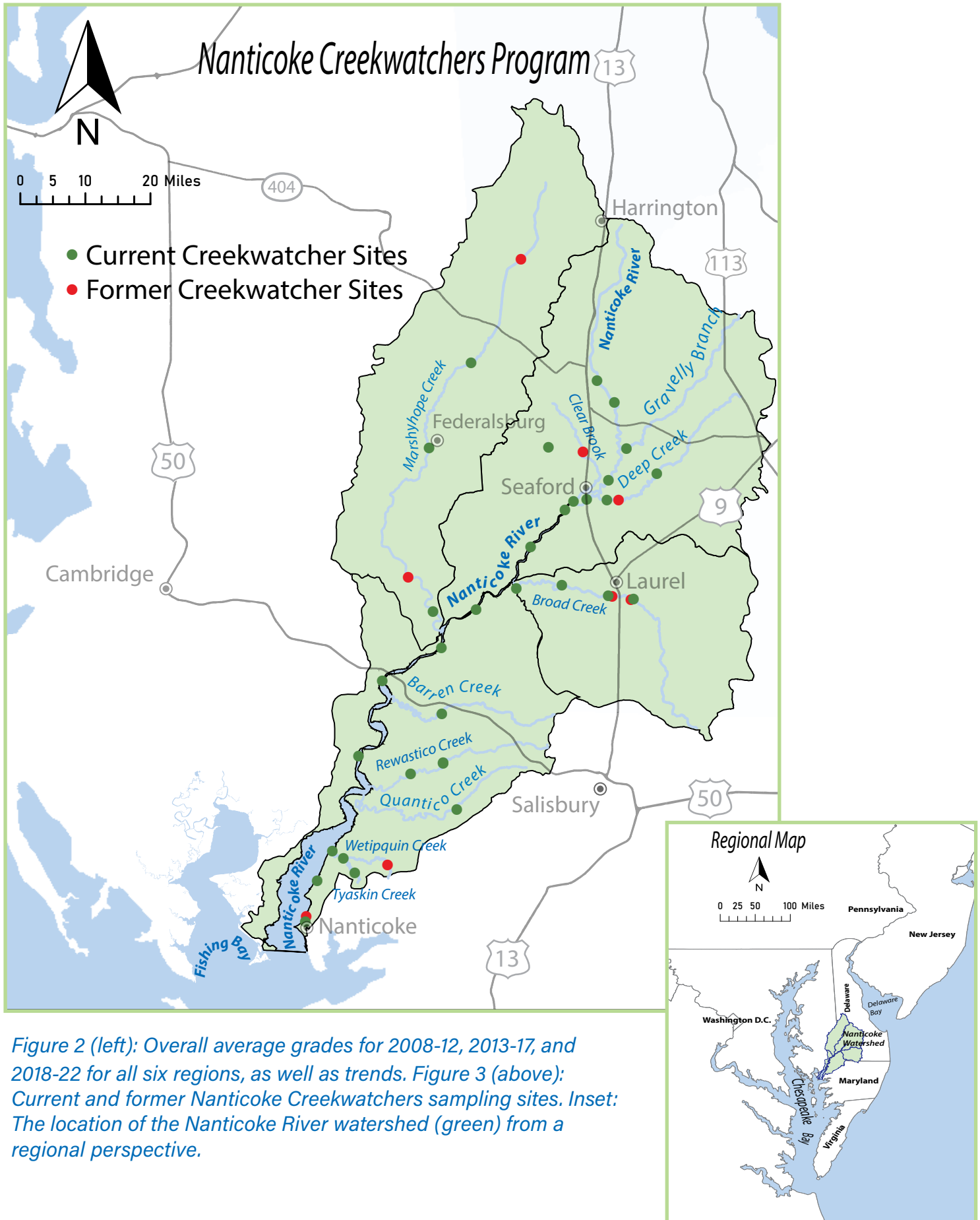


Figure 2 (left): Overall average grades for 2008-12, 2013-17, and 2018-22 for all six regions, as well as trends. Figure 3 (above): Current and former Nanticoke Creekwatchers sampling sites. Inset: The location of the Nanticoke River watershed (green) from a regional perspective.

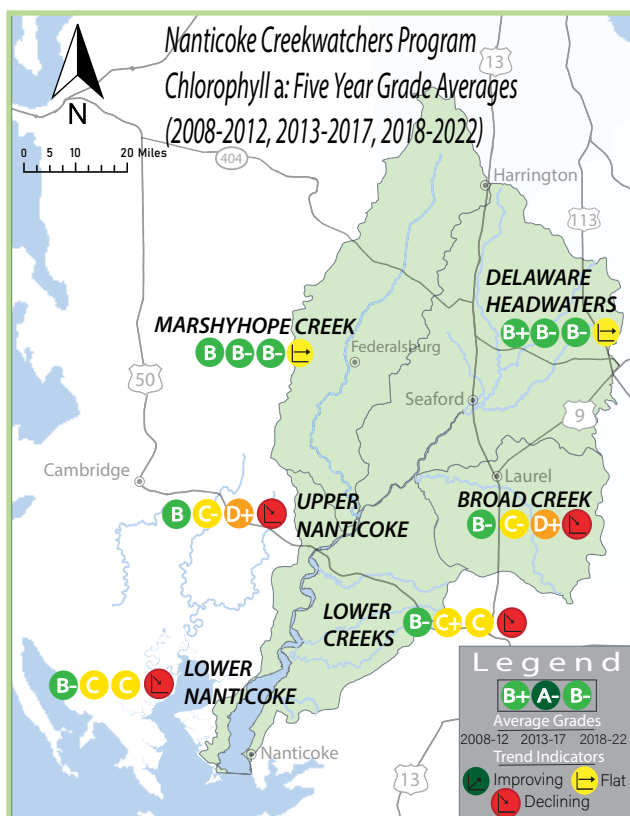


Figure 4 (above): Average chlorophyll a grades for 2008-12, 2013-17, and 2018-22 for all six regions.

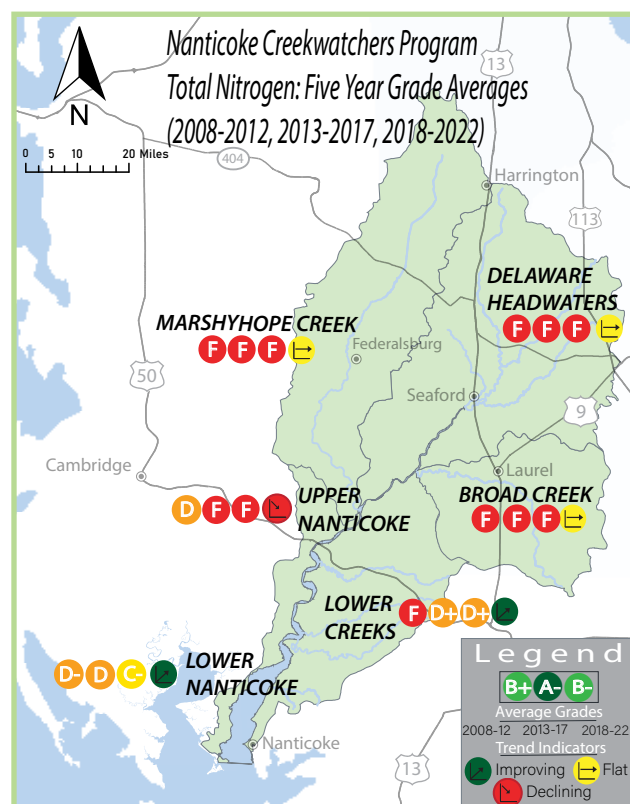


Figure 5 (above): Average total nitrogen grades for 2008-12, 2013-17, and 2018-22 for all six regions.

CHLOROPHYLL A (upper-left) is a measurement of algae present in tidal waterways. The program measured chlorophyll a in 2008 and again from 2014 until the present, so the first five-year block only reflects a single year. Chlorophyll a grades peaked in 2008, except for Marshyhope Creek (2020) and Lower Creeks (2014).

Broad Creek and the Upper Nanticoke regions have consistently reported the highest concentrations of algae and the worst chlorophyll a grades. This downward trend follows broad degrading water quality in these two regions. Unfortunately, algae is also increasing in both the lower watershed regions.

NITROGEN (lower-left) is a naturally-occurring element that is required for plants to grow and is commonly found in lawn and garden and agricultural fertilizers. Like phosphorus, excessive amounts of nitrogen in waterways can help fuel algal blooms (some of them harmful to human and animal health) and cause low dissolved oxygen and fish kills. Excessive nitrogen in the form of nitrates can also cause health issues. **Unfortunately, the Nanticoke River in general has scored very poorly during the first fifteen years of the program, with excessive amounts of nitrogen throughout all six regions.** However, both the Lower Creeks and Lower Nanticoke regions in Maryland have shown improvement in this parameter.

PHOSPHORUS (upper-right) is the other major nutrient responsible for algal blooms and a number of water quality-related issues in waterways, along with nitrogen (page 4). **Phosphorus grades are currently trending downward in all six regions, although all regions except for the Upper Nanticoke and the Lower Creeks have healthy average phosphorus grades.**

Fifteen Year Highlights

- **CHLOROPHYLL *a*** grades have declined in every region except for the Delaware Headwaters and Marshyhope Creek. Broad Creek and the Upper Nanticoke's grades dropped the most.
- Although **NITROGEN** remains highly excessive throughout the watershed, the Lower Nanticoke and Lower Creeks saw improvements.
- **PHOSPHORUS** grades are declining in all six regions. However, grades remain healthy or moderate in all regions.
- **WATER CLARITY** grades are declining in all regions except for the Lower Nanticoke, where grades are flat. Water clarity is healthy in the Delaware Headwaters and Marshyhope Creek. Broad Creek showed the biggest downward trend in water clarity over the fifteen year period.
- **DISSOLVED OXYGEN** remains healthy in all six regions.

WATER CLARITY (lower-right) is related to nutrient pollution, as storm-related runoff can easily overwhelm waterways with soil, chemicals, and nutrients. Murky waterways are unable to support aquatic life such as freshwater mussels, oysters, and aquatic grasses.

Water clarity has declined in all regions except for the Lower Nanticoke, where it is flat. Water clarity continues to be healthy in the Delaware Headwaters and Marshyhope Creek. The other regions all have moderate or moderately poor averages from 2018-22.

The Nanticoke Watershed Alliance uses multithreshold criteria developed by the Mid-Atlantic Tributary Assessment Coalition (MTAC) to analyze and grade sites and regions. See ian.umces.edu for more information.

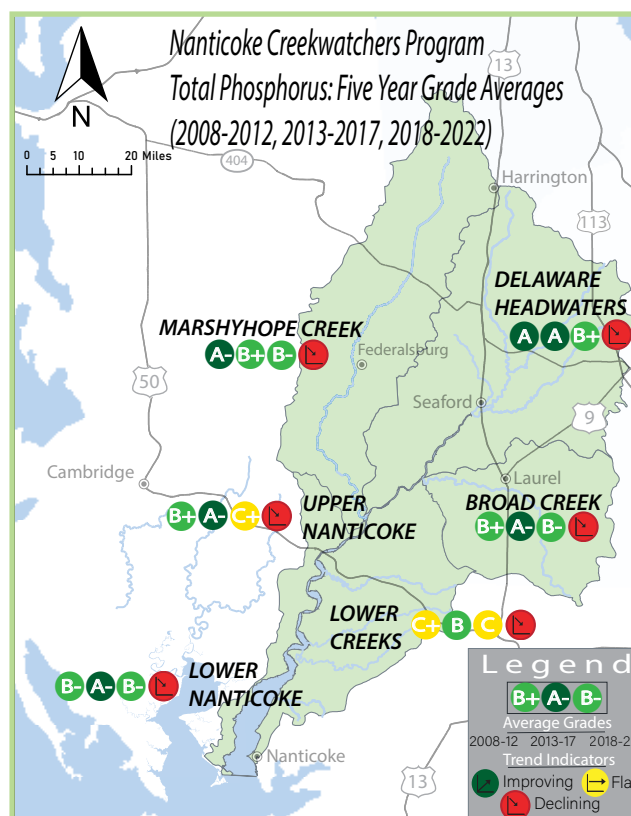


Figure 6 (above): Average total phosphorus grades for 2008-12, 2013-17, and 2018-22 for all six regions.

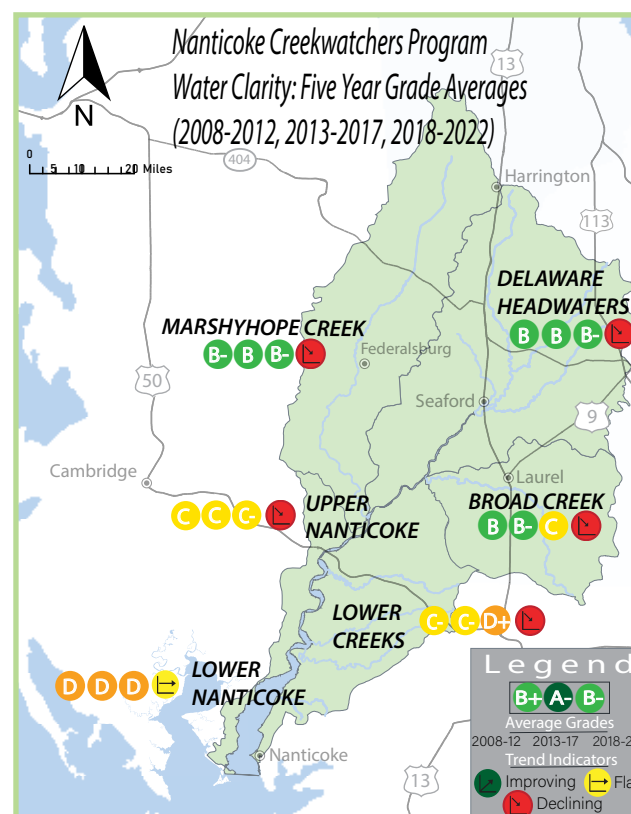


Figure 7 (above): Average water clarity grades for 2008-12, 2013-17, and 2018-22 for all six regions.

In general, **DISSOLVED OXYGEN** (right) is a strong indicator throughout the Nanticoke River region. **All regions except for the Lower Creeks have excellent dissolved oxygen grades.**

Dissolved oxygen can differ according to the water depth; Creekwatchers have been taking multiple measurements (known as a depth profile) since 2014, and these measurements are included in analysis from 2014-22.

Low dissolved oxygen can be caused by decaying algal blooms or leaf litter and extremely warm water temperatures. Waterways that feature tree buffers and mature canopy tend to have lower water temperatures and higher dissolved oxygen. Low or no dissolved oxygen can create a number of issues, including fish kills and dead zones.

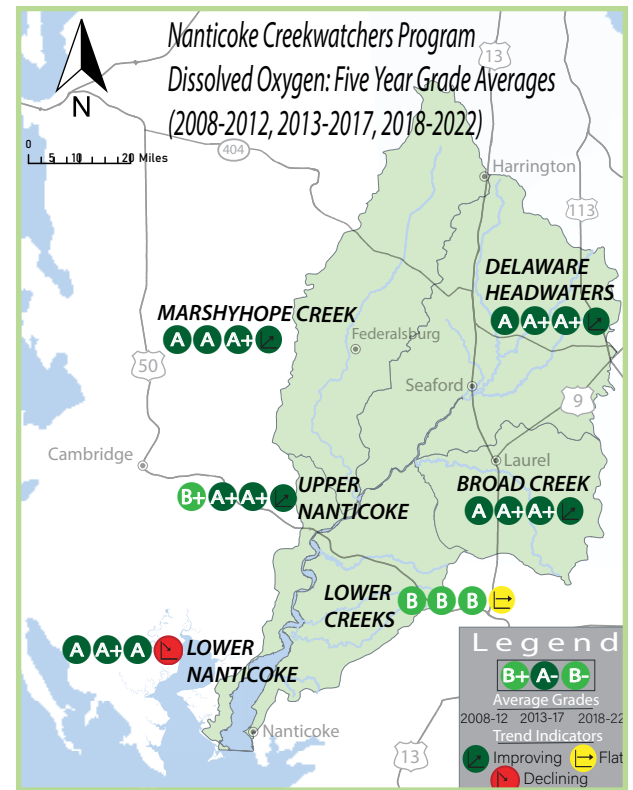
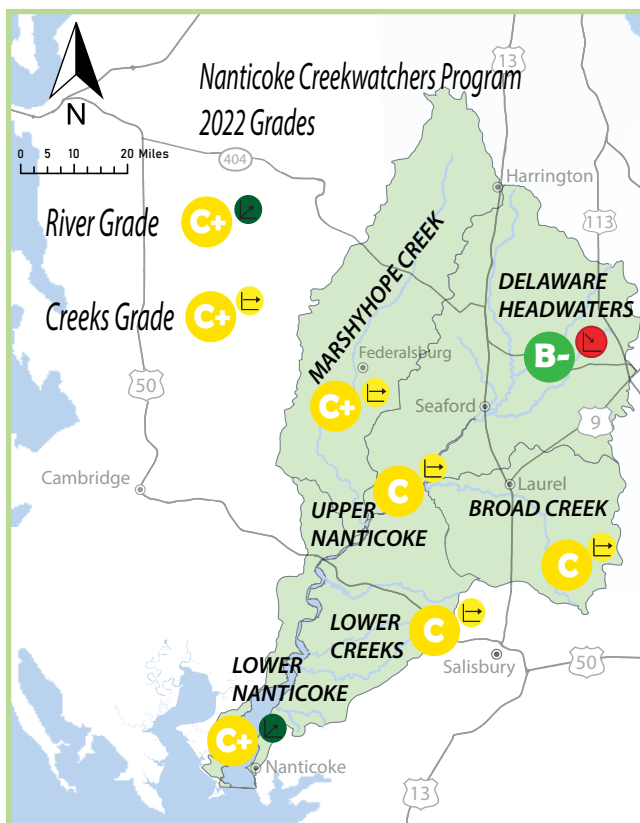


Figure 8 (above): Average dissolved oxygen grades for 2008-12, 2013-17, and 2018-22 for all six regions.

2022 RESULTS



Scores in 2022 **remained flat in four of six Nanticoke regions** when compared to 2021 grades. The Delaware Headwaters, typically the healthiest region, nudged down from a B to a B-, primarily due to a worsened chlorophyll a grade, which fell from a B+ in 2021 to a C in 2022. The Lower Nanticoke saw a slight improvement when compared with 2021, rising from a C to a C+, which also resulted in the River grade increasing from a C in 2021 to a C+ in 2022.

Although most regions were flat year-to-year, we observed and measured disturbing changes at the Quantico Creek site during 2022. The site showed broad declines in every parameter except for dissolved oxygen. We also saw continued issues related to excessive nutrients in the Rewastico Creek system.

Figure 9 (left): Overall grades for the River and Creeks and region grades in 2022. The trend indicators compare 2022 to 2021 grades.

Average Five Year Water Temperatures (Degrees Celsius)

DELAWARE HEADWATERS



Climate change not only impacts air temperatures but a range of conditions directly connected to water quality, including heavier downpours and accompanying runoff and sewage overflows, and higher air and water temperatures. Algal blooms, which feed off of excessive nutrients and are fueled by higher water temperatures, are also a primary concern; in particular, Harmful Algal Blooms (HABs), which threaten human and animal health, are more common in our area waterways.

Since the beginning of the program, Nanticoke Creekwatchers have tracked water temperatures in our waterways. In the early years, we measured surface water temperatures via water samples, then switched to taking measurements directly in waterways at 0.3 meter deep (one meter is 3.3 feet). Since 2014, we have conducted depth profiles, with surface measurements taken at a half meter deep and other depths taken according to site conditions.

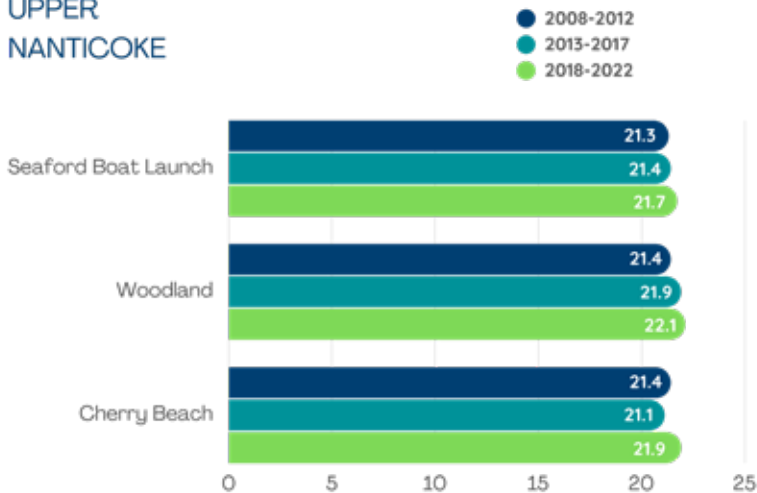
For this report card, we examined water temperature averages for sites along the mainstem of the river. The two most northern sites (Redden Rd. and Rifle Range Rd.) are nontidal; all other sites are tidal.

Unlike the other regions, the water temperatures at the sites in the Delaware Headwaters region peaked during the 2013-17 five year block. These sites are more vegetated, with ample tree canopy at two of the sites and substantial vegetated buffers at the third. The waterways in the Headwaters are also smaller, not as deep or as broad as the river further south.

All other sites reported the highest average water temperatures in the most recent five-year block, with the oligohaline sites tending to have the highest average. (Woodland, in the tidal freshwater part of the river, also reported an average water temperature of over 22.0 °C (71.6 °F) during the 2018-22 time period.)

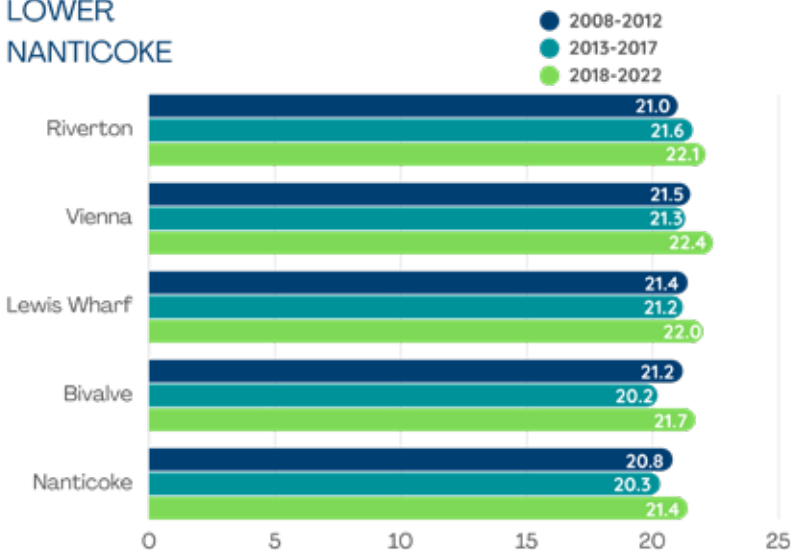
Average Five Year Water Temperatures (Degrees Celsius)

UPPER NANTICOKE



Average Five Year Water Temperatures (Degrees Celsius)

LOWER NANTICOKE



Figures 10-12: Average water temperature comparisons (2008-12, 2013-17, and 2018-22) from March-November at 11 sites along the mainstem of the Nanticoke River. All temperatures are measured in °C.

Nanticoke Watershed Alliance piloted the Nanticoke Creekwatchers Program back in 2007. With a key goal of obtaining the highest quality data possible since the program's beginning, staff have worked with the Chesapeake Monitoring Cooperative and its predecessor to achieve and maintain Tier 3 certification, the highest possible for volunteer monitoring programs. Data since 2017 is available at the Chesapeake Data Explorer and is used for policy and management decisions by public agencies.

We would like to thank everyone who has made the first fifteen years of our program possible, including:

- Over 150 community scientists, who served over 17,000 hours from 2008-2022 (service valued at nearly \$500,000),
- Current and former staff members, including Chesapeake Conservation Corps Volunteers, AmeriCorps Members, and interns,
- Delaware Department of Natural Resources and Environmental Control for providing long-term funding and technical support and Chesapeake Monitoring Cooperative for on-going technical support, and
- All of the program's funders and partners, as well as the private landowners who have allowed us to monitor on waterways that would otherwise be inaccessible.

Download or view our data
at CMC.VIMS.EDU.



Visit NANTICOKERIVER.ORG
to learn about how you can volunteer, participate
in programs, promote healthy waters and support
pollinators and other wildlife at your home, or donate.

The Nanticoke Watershed Alliance would like to thank the following organizations for their contributions and support of the Creekwatchers program during the 2022 season:



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