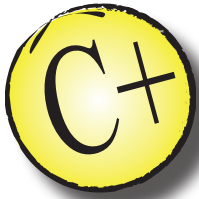




2013 NANTICOKE RIVER REPORT CARD

River Final Grade



- Oxygen scores were generally good.
- Water clarity scores were poor for the Upper and Lower Nanticoke
- Nitrogen scores were poor, particularly in the Upper Nanticoke.

Creeks Final Grade



- Oxygen scores were very good in all creek regions.
- Water clarity scores were good for all regions, except for the Lower Creeks in Maryland.
- Nitrogen scores were poor in all creek regions, especially in Broad Creek, the Delaware Headwaters, and Marshyhope Creek.

Two final grades were calculated: Rivers and Creeks. The "River" grade is a measure of the health of the mainstem of the Nanticoke River. The "Creeks" grade assesses the health of the creeks that feed into the Nanticoke. Both grades are important indicators of the overall health of the watershed.

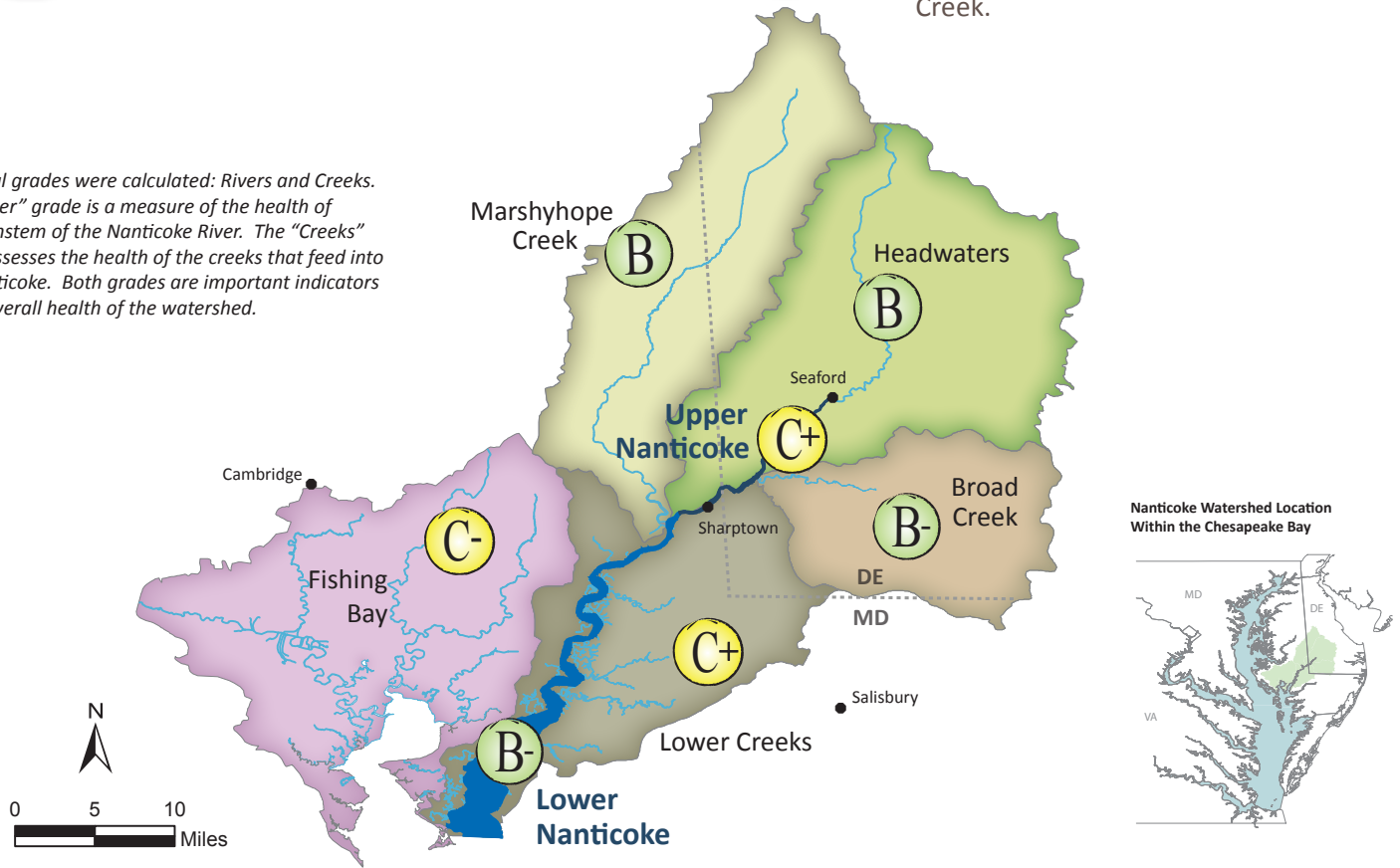


Figure 1: Report card grades for the Nanticoke River, its creeks, and Fishing Bay in 2013. The water quality grades are based on data collected by Nanticoke Creekwatchers, volunteer citizen scientists for the Nanticoke Watershed Alliance. Additional Nanticoke River watershed data comes from the Chesapeake Bay Program, including sites monitored by the Delaware Department of Natural Resources and Environmental Control and the Maryland Department of Natural Resources. Blackwater National Wildlife Refuge provided data from their volunteer program for the Fishing Bay watershed.

What Do the Grades Mean?



All water quality indicators meet desired levels. Quality of water in these locations tends to be very good, most often leading to very good habitat conditions for fish and shellfish.



Most water quality indicators meet desired levels (60-79%). Quality of water in these locations tends to be good, often leading to good habitat conditions for fish and shellfish.



There is a mix of healthy and unhealthy water quality indicators (40-59%). Quality of water in these locations tends to be fair, leading to fair habitat conditions for fish and shellfish.



Some or few water quality indicators meet desired levels (20-39%). Quality of water in these locations tends to be poor, often leading to poor habitat conditions for fish and shellfish.



Very few or no water quality indicators meet desired levels. Quality of water in these locations tends to be very poor, most often leading to very poor habitat conditions for fish and shellfish.

Overall health index grades for the six regions within the Nanticoke Watershed ranged from B to C+ (Figure 2-right).

The Upper Nanticoke region continues to experience a steady decline, falling to a C+ for the first time in the program’s history. Poor water clarity, which can be caused by excessive boat wakes, shoreline erosion, and sediment runoff, continues to act as one of the major sources of water quality issues in this region. The Fishing Bay Watershed, a neighboring body that influences the Nanticoke River system, received the poorest score, a C-, which is in-line with previous years.

As in the past, surface dissolved oxygen continued to score well in most subwatersheds. Poor water clarity exists throughout the navigable mainstem of the river, as well as in the Lower Creeks and in Fishing Bay. Total phosphorus was fairly low, although measurements spiked following heavy rain events during the summer. Total nitrogen, the other major nutrient, remained excessive throughout the watershed. Nitrogen may take many years to work its way through the groundwater system; however, that does not eliminate the need to reduce current nitrogen loads. Excessive nutrients cause algae blooms, which in turn produce a number of water quality issues, including fish kills and dead zones. Homeowners, large-acreage landowners, schools, and businesses can all take measures to reduce water pollution and to improve water quality. See page 5.

River Region	Dissolved Oxygen	Water Clarity	Total Nitrogen	Total Phosphorus	Overall Health Index	Trend
DE Headwaters	A+	A	F	A	B	→
Marshyhope Creek	A+	B+	F	B	B	→
Lower Nanticoke	A+	D+	D-	A-	B-	↗
Broad Creek	A+	A-	F	B	B-	↘
Lower Creeks	A-	C	D	B	C+	↗
Upper Nanticoke	A+	C	F	A-	C+	↘
Fishing Bay**	C	C	D	D	C-	↗

Figure 2: A breakdown of grades for each reporting region, by water quality indicator. The Overall Health Index (total score) is calculated by averaging the numeric scores of all indicators. The trend column shows if the score improved, declined, or remained steady from the previous year.

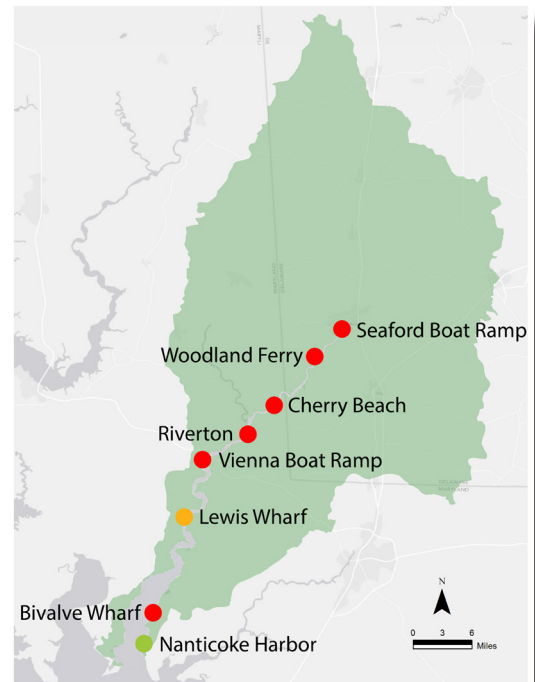
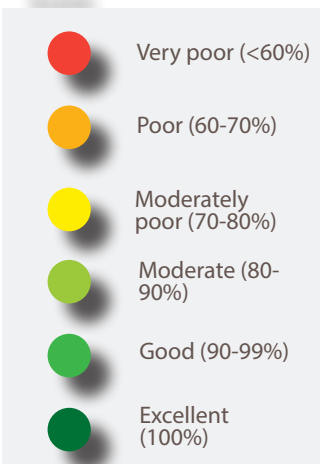
**Scores for Fishing Bay Watershed were included in this report due to its relevance and proximity to the Nanticoke but were not included in calculations for the Rivers and Creeks “Final Grade.” For the first time since issuing report cards, the NWA included data provided by Blackwater National Wildlife Refuge’s volunteer water monitoring program to provide a more complete view of Fishing Bay’s health. The trend evaluation should be taken in this context.

BACTERIA

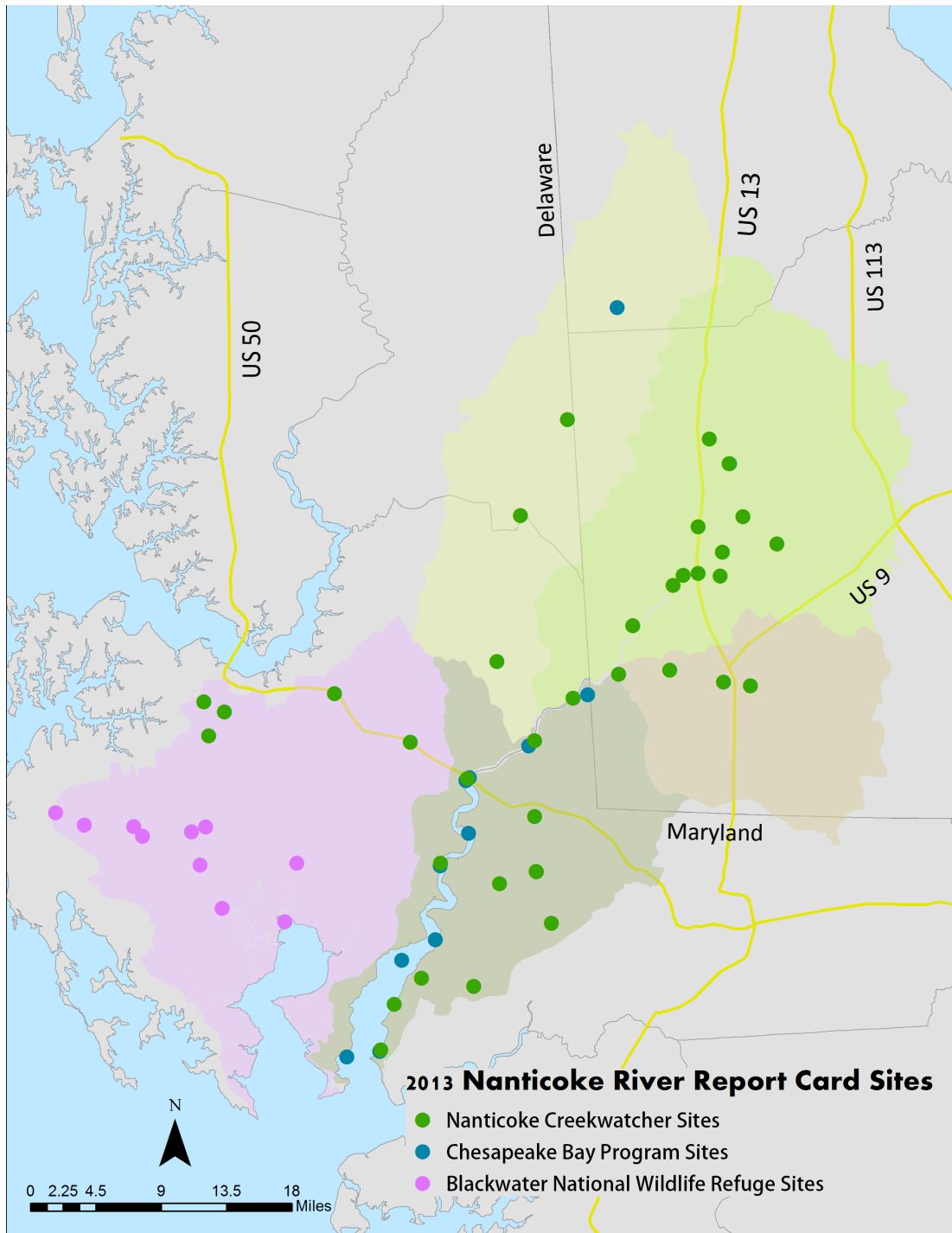
Nanticoke Creekwatchers take bacteria samples throughout the watershed. For the purposes of the report card, we examine bacteria results at seven sampling sites on the mainstem of the river from the Seaford Boat Ramp to Nanticoke Harbor due to recreational use potential. Data from Memorial Day through Labor Day are assigned a pass/fail rating and each site receives a passing percentage.

As is typical with the Nanticoke watershed, most of the sites fail the EPA’s bacteria criteria of less than 104 colony forming units (CFUs). Bivalve Wharf, which normally passes 80-100% of the time during a typical summer, instead performed very poorly during 2013. This may be due to construction that occurred on Bivalve Wharf during the early summer season, which disrupted the sampling area and placed the sampling site closer to the shore than it normally would be. Lewis Wharf performed slightly better than it has in previous years.

Understanding Bacteria Scores

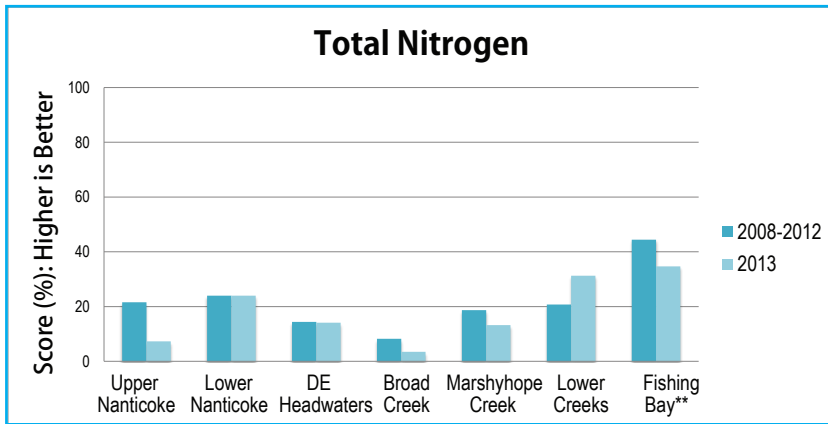


Figures 3-4: “Understanding Bacteria Scores” (Figure 3) provides a legend to the (Figure 4) map of the mainstem Nanticoke River sites that included in bacteria analysis.



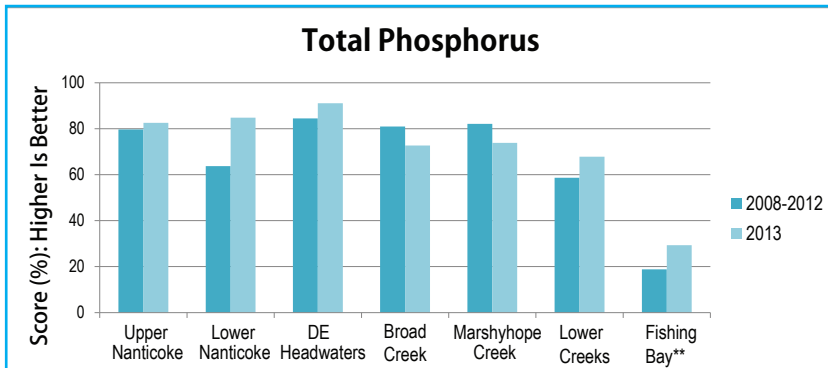
The Nanticoke Watershed Alliance included 60 sites in data analysis for the 2013 Nanticoke River Report Card (Figure 5-above). Data derived from the 36 Nanticoke Creekwatchers sites, ten sites from the Blackwater National Wildlife Refuge’s volunteer monitoring program, and fourteen Chesapeake Bay Program sites (two in Delaware, twelve in Maryland). Some of the CBP sites overlap or closely match existing Nanticoke Creekwatchers sites and may not be visible on the map. All sites are noted on the 2013 Nanticoke River Report Card Sites map. The NWA used data from the four key indicators used in this report card, along with salinity data, for data analysis purposes.

The NWA uses a multithreshold system provided by the Mid-Atlantic Tributary Assessment Coalition. The Tidal Protocol, Bacteria Addendum, and Nontidal Protocol documents can be viewed at the University of Maryland’s Center for Environmental Science’s Integration and Application Network’s website at <http://ian.umces.edu/>.



Total nitrogen is a long-term issue throughout the watershed, with consistently excessive amounts throughout the northern half of the watershed. Fishing Bay performs best in terms of this indicator. During the 2013 season, total nitrogen scores were poorer than average except in the Lower Creeks, which improved, and in the Lower Nanticoke and the Delaware Headwaters, whose scores remained steady.

Total phosphorus improved against the five year average score in most areas or remained relatively flat, which stands out as a positive due to the amount of heavy summer rainfall events. Fishing Bay, which has the highest concentration of total phosphorus, showed minor improvement during the 2013 season.



Figures 6-7 (left) show charts that compare five-year average total nitrogen and total phosphorus scores with average scores for each subwatershed during the 2013 season. These scores are based on a multithreshold criteria. Scores may range from 0-100; the higher the score, the better the water quality.

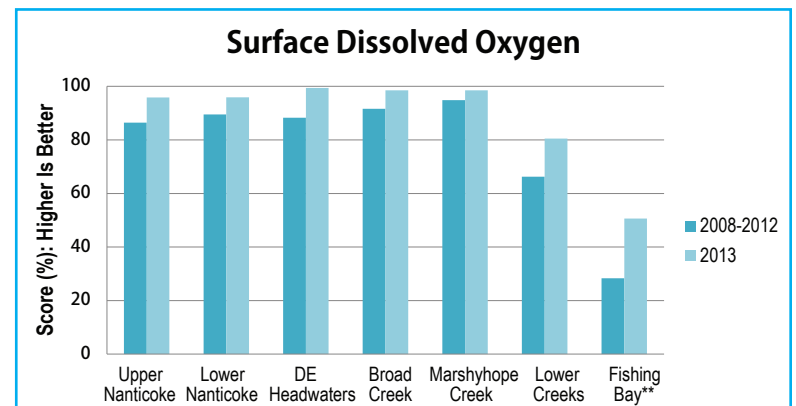
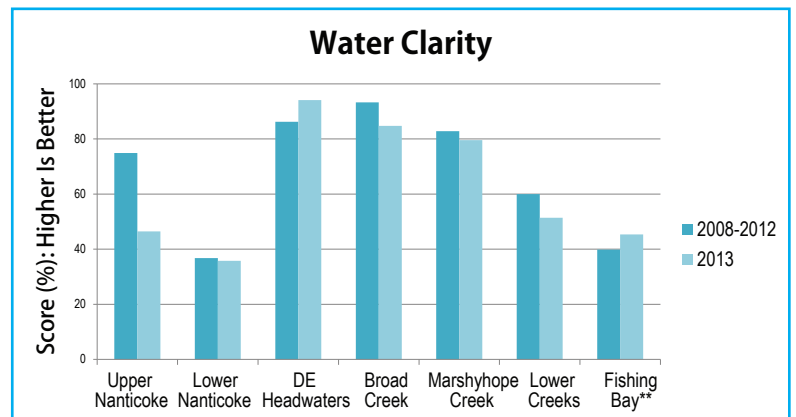
WATER CLARITY AND DISSOLVED OXYGEN IN 2013

Water clarity (or Secchi depth) remained fairly consistent during 2013, in spite of the heavy rainfall and accompanying runoff events. Notably, the Upper Nanticoke region scored poorly in water clarity. Over the first six years of the Nanticoke Creekwatchers program, the water clarity in this region has continuously declined, an alarming issue.

Surface dissolved oxygen, always a strong indicator, showed improvements in every subwatershed, including Fishing Bay.

Figures 8-9 (right) show charts that compare five-year average scores for water clarity (top) and surface dissolved oxygen (bottom) with average scores for each subwatershed during the 2013 season. Please note that the Blackwater National Wildlife Refuge Fishing Bay sites were not included in the water clarity analysis since the program did not track total water depth. Also, although Fishing Bay's dissolved oxygen average would have improved slightly over the five year average, the ten additional sites included in analysis greatly improved the 2013 average.

These scores are based on a multithreshold criteria. Scores may range from 0-100; the higher the score, the better the water quality.



Whether our runoff goes into a stormdrain or a tax ditch, our actions and decisions impact local water quality. Renters, homeowners, and large-acreage landowners can make a difference in preventing pollutants from reaching the river (and eventually, the Chesapeake Bay). The closer you are to the water, the more of an impact your actions have, although all of us have the potential to improve or degrade water quality.

Fertilize Responsibly

1. Perform a professional soil test on your lawn or garden prior to applying any amendments, including nitrogen or phosphorus-based fertilizers. Several vendors in the region provide soil tests that are applicable to the Nanticoke River Watershed, including AgroLab, University of Delaware's Soil Testing Program, and Pennsylvania Agricultural Analytic Services State University Laboratory. Some soil tests analyze for the presence of heavy metals; all of them provide detailed nutrient analyses.



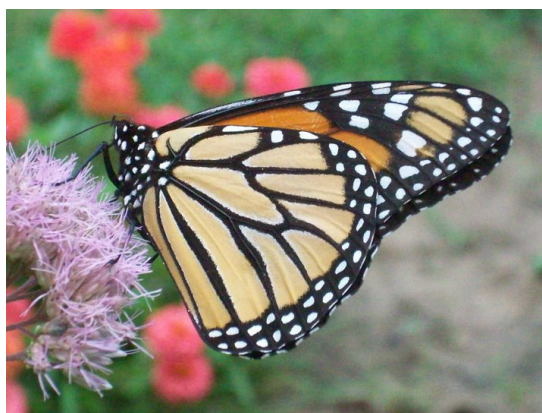
2. Feed your lawn during the appropriate season and only if needed (see above). Cool season grasses like bluegrass or fescue should be fed in the autumn. Warm season grasses like zoysia should only be fed in the summer.

3. Do not feed lawns near waterways, including ditches and shorelines. Instead, plant a grass or tree buffer or install a living shoreline to help catch runoff and prevent phosphorus and nitrogen from entering the waterway.

Delaware residents can find more information on maintaining a Nanticoke-friendly lawn at the Delaware Livable Lawns website at <http://www.delawarelivablelawns.org/>.

Marylanders should follow the new fertilizer regulations that went into effect on October 1, 2013. Visit <http://mda.maryland.gov/Pages/fertilizer.aspx> for more information about residential fertilizer restrictions.

Figure 10 (above): Shoreline vegetation on Barren Creek in Mardela Springs, Maryland, prevents sediment and nutrients from entering the creek, as well as offering wildlife habitat. Figure 11 (below-left): Farmers and large-acreage landowners can plant buffer strips to reduce the amount of nutrients that reach waterways. Figure 12 (below-center): Native plants like Joe Pye Weed can be used in rain gardens, which slow down and hold runoff during rain events for a short period of time. Native plants also attract pollinators and other wildlife. Figure 13 (below, right): Rain barrels are low-cost containers that store water until needed for watering the garden or for other outdoor purposes. They are easily modified to match your personal landscape and vision. Photo taken by Creekwatcher Sandi Dew.



During the 2013 season, 32 citizen scientists participated in the Nanticoke Creekwatchers Citizen Water Monitoring Program. These volunteers monitored 36 sites in the watershed, including five in neighboring Fishing Bay watershed. Creekwatchers sampled at their sites every other week from late March through early November, gathering data and water samples and making observations. In November, the Nanticoke Creekwatchers program received a Maryland Governor's Service Award.

Envirocorp Labs Inc. continues to serve as a keystone of the program, providing over \$70,000 of lab work annually. In 2013, the Delaware Department of Natural Resources and Environmental Control funded the Delaware portion of the program, while the Chesapeake Bay Trust supported the Maryland section of the watershed. Rommel's ACE Hardware of Seaford, led by Bryan Burkholder, provided materials, and store employees served as Creekwatchers. The Community Foundation of the Eastern Shore paid for the printing of the Nanticoke River Five Year Report Card in July 2013. The Integration and Application Network at the University of Maryland Center for Environmental Science provided technical assistance.

Figures 14-15: On left, Creekwatcher Stan Shedaker braves the elements at Rewastico Pond and Creek. Photo taken by Creekwatcher Frayser Williamson. Below, Creekwatchers Ric Johansen (l) and Fred Sponseller (r) take measurements at Bethel on a far more pleasant day.



2013 Nanticoke Creekwatchers

- | | |
|------------------|--------------------|
| Richard Ball | Bonnie Kijewski |
| Megan Bock | John King |
| Bryan Burkholder | Ron Maher |
| Kelly Davis | Cyrus Marter |
| Sandi Dew | Alice Mohrman |
| Susan Good | Mike Pretl |
| Bob Heim | Bob Sellers |
| Linda Heim | Stan Shedaker |
| Dan Houghtaling | Fred Sponseller |
| Rob Hutton | Dana Svane |
| Ric Johansen | Chris Tyler |
| Amy Jones | Howard Vanderslice |
| Hope Jones | Frayser Williamson |
| Richard Julian | Nan Zamorski |
| Troy Julian | Rick Zamorski |
| Alan Kamauff | |
| Bob Kijewski | |

ABOUT THE NWA

The Nanticoke Watershed Alliance is a consortium of non-profit organizations, local businesses, industry, state and federal agencies that work together to ensure a bright future for the iconic Nanticoke River. The NWA is a venue for sharing information and creating open and honest dialogue around river issues and potential solutions. Some of our key efforts include:

- Monitoring the health of the Nanticoke River system.
- Providing outreach and workshops to watershed residents.
- Educating middle schoolers in schools and on field trips.
- Offering workshops to teachers in Delaware and in Maryland.
- Organizing river clean-ups, tree plantings, and other events.
- Encouraging recreational usage of and improving public access to the river and its tributaries.

The NWA strives to support the local community through service projects and other outreach events. If you are interested in joining the NWA in making the Nanticoke Watershed a cleaner, healthier, and more beautiful place to live, contact us online at www.nanticoke.com.

Support the NWA!

- Join our team of dedicated volunteers and help with water monitoring, restoration and clean-ups, outreach efforts, and more.
- Make a tax-deductible donation to support our work for the river and its communities.
- Become an NWA partner. Businesses and organizations can join the NWA's "Partners In Conservation" program and become a part of ongoing dialogue associated with the conservation of the Nanticoke River.
- Say hello at our office or at outreach events. Our office is located in Vienna, Maryland, and is open from 9:00 am-4:00 pm, Mondays through Fridays.

For more information, visit www.nanticoke.com

The Nanticoke Watershed Alliance would like to thank the following organizations for their contributions and support of the Creekwatchers program during the 2013 season:



Project Supervisor/Author
Beth Wasden

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