

2014 South River Watershed



Healing the South River in One Generation



Dear Friends of the South River,

We present to you our first *South River Watershed Report Card!*

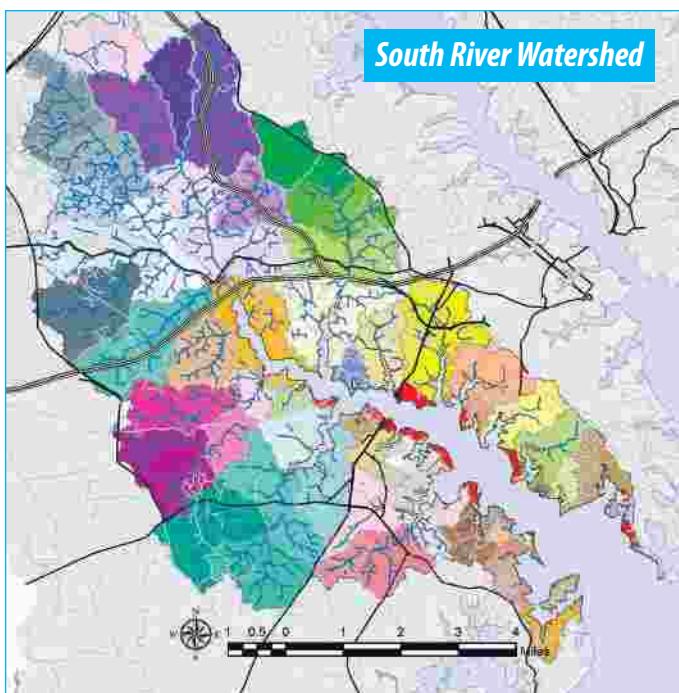
This year's report card summarizes the water quality assessment in 2014 for the entire South River Watershed. For the first time we

bring to you the water quality assessment of both the streams and tidal section of the South River watershed. In 2014, my team and I performed water quality and physical characteristics monitoring at 21 tidal stations and 22 streams weekly to biweekly from April through October.

Our research and monitoring also has expanded to include the effectiveness of our stream restoration projects, storm monitoring, and tidal sediment "muck" remediation research. This new annual watershed based report card will now help to keep you informed of our progress toward healing the South River Watershed.

The South River has been making an incredible comeback, through the restoration projects that have been going into the ground, in part due to money from the Stormwater Utility Fee. I am proud to report that some of the water quality metrics in the South River's tidal portion have statistically improved over time.

- The water clarity in 2014 improved from the previous year and the overall long-term trend improvement shows a constant and steady improvement.
- Selby Bay, for the first time, has Atlantic Ribbed Mussels due to the installation of living shorelines, stormwater retention cells and a bioswale.
- Underwater grasses have been resilient and growing in acreage every year.
- Indicator species such as yellow perch, macrobenthic invertebrates, such as the Devil's Crawfish, and river otters have been increasing in population.
- The bacteria levels at our swimming beaches have dramatically improved this year, placing them in good condition.



The dissolved oxygen and pH levels in our streams are in good condition, with phosphorus and sediment being a large contributing factor to the poor health of the streams. The poor health of our streams is due to the uncontrolled polluted runoff during rain events; however, the restoration efforts at controlling polluted runoff is showing signs of rehabilitating the non-tidal sections. The scientific monitoring suggests that improvements are beginning to show habitat improvements and decreased sediment and nutrients.

The South River Watershed is making a positive turn for the better and is healing and we cannot stop now!

Fix the creeks, fix the River, fix the Bay!

This is our South River, and together we can make it swimmable and fishable in one generation!

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Thanks to Our 2014 Funders and Volunteers!

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Anne Arundel County Watershed
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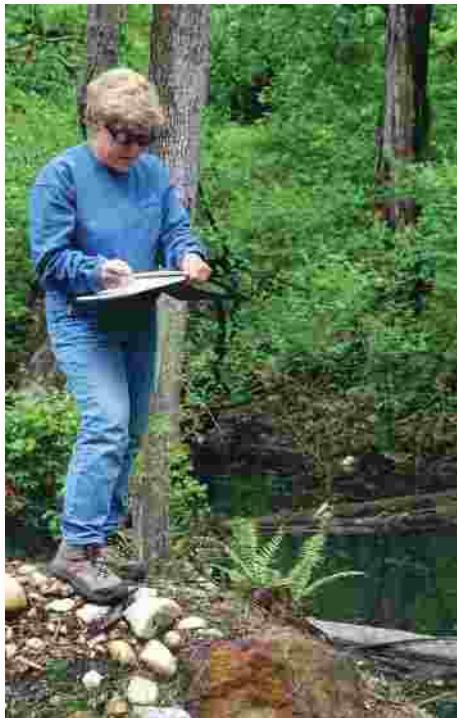
Marlene Rice — Rice Graphics
Rouse Foundation

South River Federation's Stream Team
and Savvy Storm Samplers

South River Federation Team and
Board of Directors

Town Creek Foundation

And all of our generous donors!



South River Watershed Report Card



The Scientific Research and Monitoring Division within the South River Federation, under Captain Diana Muller's direction, has implemented EPA's Scientific Integrity Policy to assure that all monitoring, research, and analysis is performed and communicated with integrity. All tidal water quality data that is collected is reported to EPA Chesapeake Bay program and the Maryland Department of the Environment on a regular basis. All monitoring and research is performed using a Quality Assurance Project Plan, and is reviewed by a third party.

What Do the Grades Mean?

- A** 90-100% These regions of the South River or streams are considered in "healthy" condition. This means there is water quality capable of sustaining fish and other aquatic life.
- B** 80-89% South River and its streams are in "good" condition most of the time.
- C** 70-79% The water quality conditions tend to be in "fair" condition.
- D** 60-69% The conditions in the South River and its streams are considered "highly degraded."
- E** 59% and less means the water quality conditions are "degraded" and are not sustainable for fish or other aquatic animals.

South River Watershed Report Card Grades 2014

Tidal Water Quality Indicators	Percent—2014 Grade	Percent—2013 Grade	Change from 2013
Dissolved Oxygen	50%—E	60%—D	worse
pH (surface)	61%—D	50%—E	better
pH (bottom)	92%—A	72%—C	better
Temperature (surface)	54%—E	59%—E	better
Temperature (bottom)	60%—D	65%—D	better
Total Nitrogen	95%—A	91%—A	better
Total Phosphorus	12%—E	8%—E	better
Chlorophyll a, Spring	19%—E	16%—E	better
Chlorophyll a, Summer	1%—E	0%—E	better
Water Clarity	26%—E	19%—E	better
Underwater Grasses	3%—E	2%—E	better
Human Health Indicator			
Bacteria	87%—B	71%—C	better

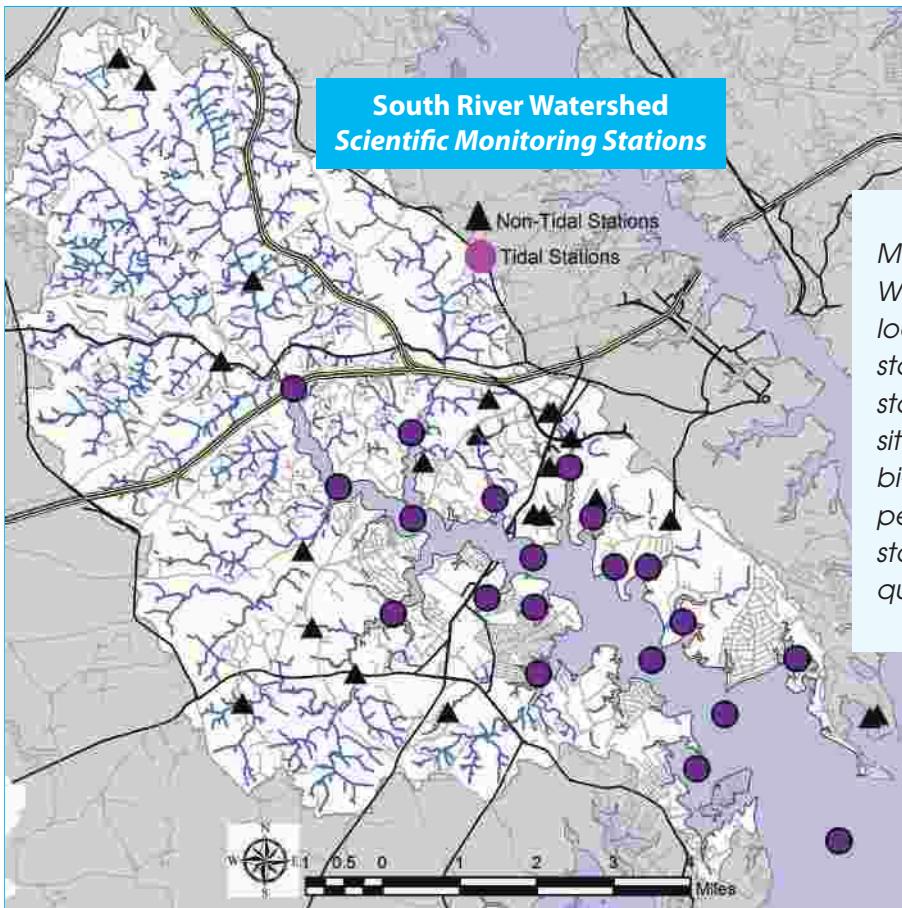
Non-Tidal Water Quality Indicators	Percent—2014 Grade
Dissolved Oxygen	80%—B
Total Nitrogen	74%—C
Total Phosphorus	12%—E
pH	85%—B
Temperature (90°F)	100%—A
Temperature (75°F)	98%—A
Chloride	66%—D



South River Watershed Report Card



South River Watershed Grade: **D**



Map of the South River Watershed and the location of the monitoring stations. We have 21 tidal stations and 22 stream sites monitored weekly to bi-weekly, as weather permits. We also monitor storm events for water quality conditions.



Tidal: South River estuary that is directly affected by the tides and is considered saltwater. The South River is a tributary of the Chesapeake Bay.

Non-Tidal: Freshwater streams that feed into the tidal portion of the South River. The South River Watershed has 543 miles of non-tidal streams.



South River Watershed Report Card

Dissolved Oxygen



Tidal: 50% — **E**

Non-Tidal: 80% — **B**

Dissolved oxygen is important in the water column for fish and other aquatic organisms to breath. Underwater grasses and the atmosphere are the ways that oxygen gets into the water column. The legal and healthy criterion for dissolved oxygen is 5mg/l or greater. In 2014, the South River's tidal surface median dissolved oxygen was 7.8 mg/l and the median bottom dissolved oxygen concentration was 4.8mg/l, with 50% of the measurements passing.

The median freshwater streams surface dissolved oxygen concentration was 7.2 mg/l, with 80% of the measurements passing.

Capt. Diana Muller at Church Creek with a YSI EXo2 continuous monitoring meter, which is capable of taking measurements every 15 minutes.

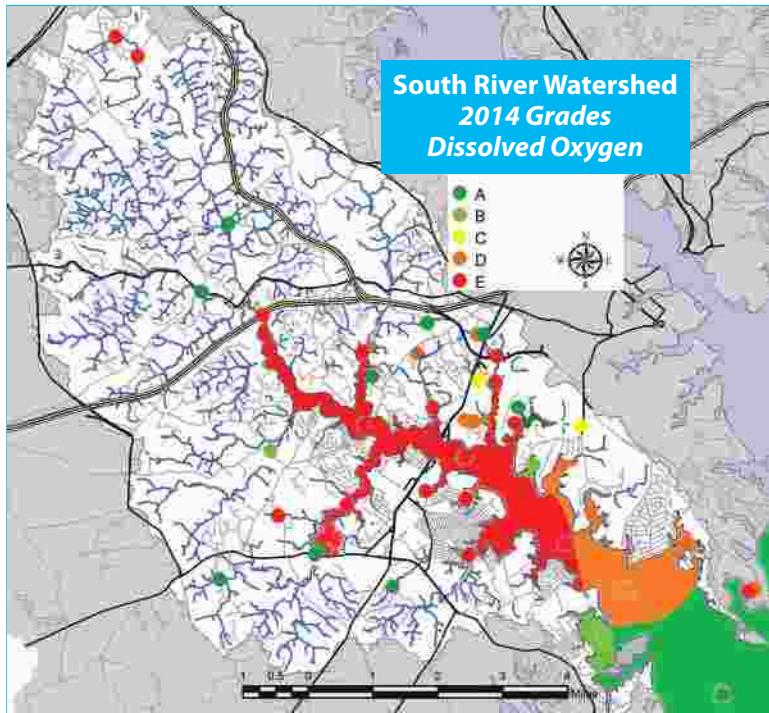
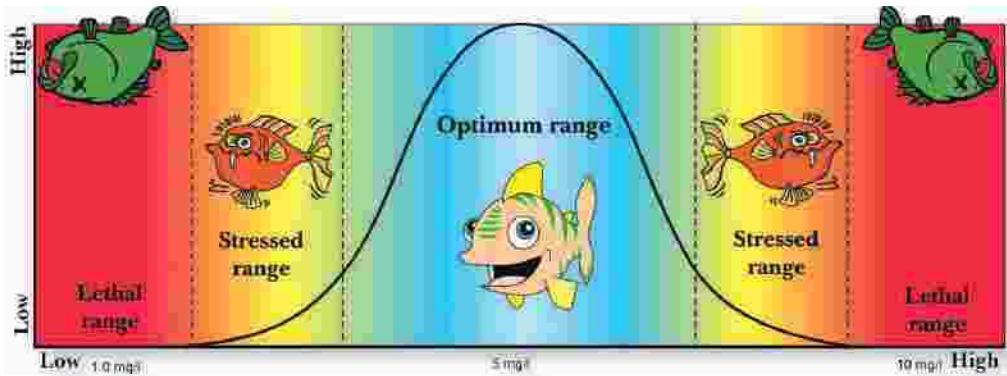


Diagram of Dissolved Oxygen

5 mg/l is healthy, 2mg/l and lower is lethal, greater than 10mg/l is lethal.



South River Watershed Report Card

pH Tidal: Surface 61% — **D** Bottom 92% — **A** Non-Tidal: 85% — **B**



The criterion for pH is between 6.5 and 8. The South River's tidal surface median pH was 7.97 and the median bottom pH was 7.57. The median non-tidal streams surface pH was 6.89 with 471 measurements from April through October. The maps show the grades of pH throughout the watershed.

Measuring pH and alkalinity in the South River and throughout the South River watershed are extremely

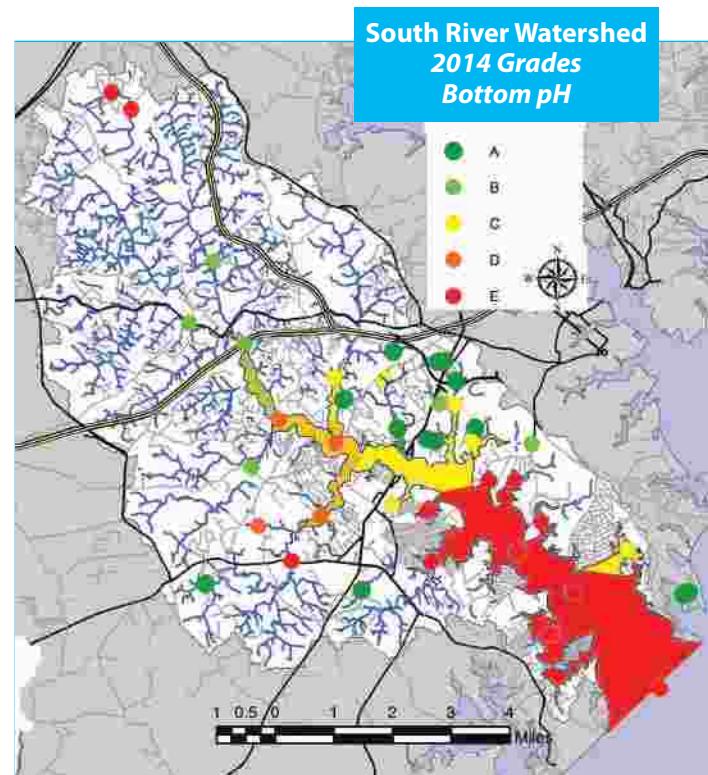
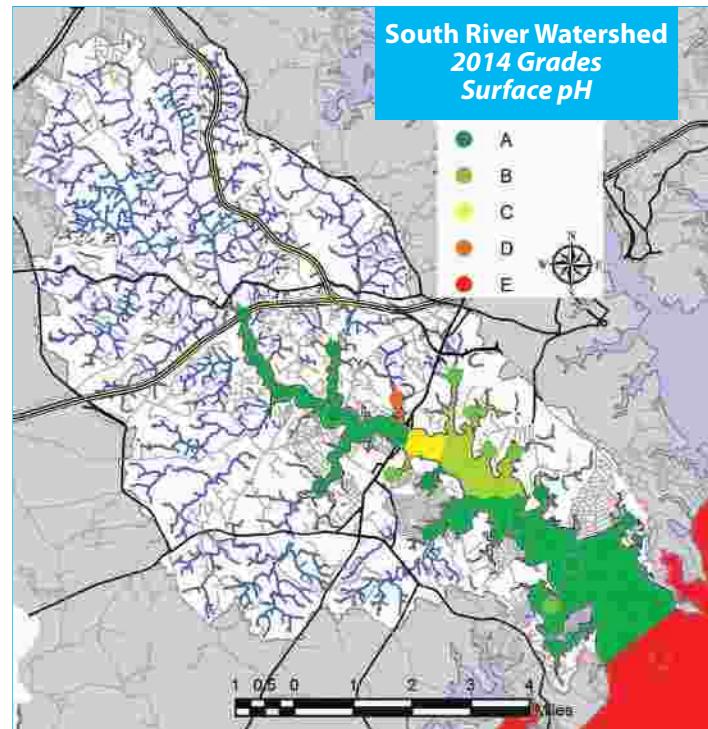
important to understanding its overall health. Biological activity can significantly alter pH in aquatic ecosystems. Through photosynthesis, plants remove carbon dioxide (CO_2) from the water and expel oxygen (O_2). Since CO_2 becomes carbonic acid when dissolved in water, the removal of CO_2

results in a higher pH, and the water becomes more alkaline. When algae naturally begin to increase in estuaries during the spring, pH levels tend to rise. An overabundance of algae (called an algal bloom) may cause pH levels in the river to rise significantly, and this can be lethal to

aquatic animals. The increase in pH peaks shortly after the chlorophyll and/or blue-green algae blooms. These increases in pH have generally been occurring in the late spring through the summer. However, due to the high nutrient concentrations and climatic events, blooms have also been occurring in the fall and early winter. The impact is that aquatic animals could become stressed or killed by the pH fluctuations.



Caroline Rodriguez
monitoring the water
with a Hydrolab DS5.



South River Watershed Report Card



Temperature

Tidal: Surface 77°F, 54% — **E**

Bottom 77°F, 60% — **D**

Non-Tidal: 90°F, 100% — **A**

77°F, 98% — **A**



Diana teaching summer kids the importance of temperature measurements in streams.

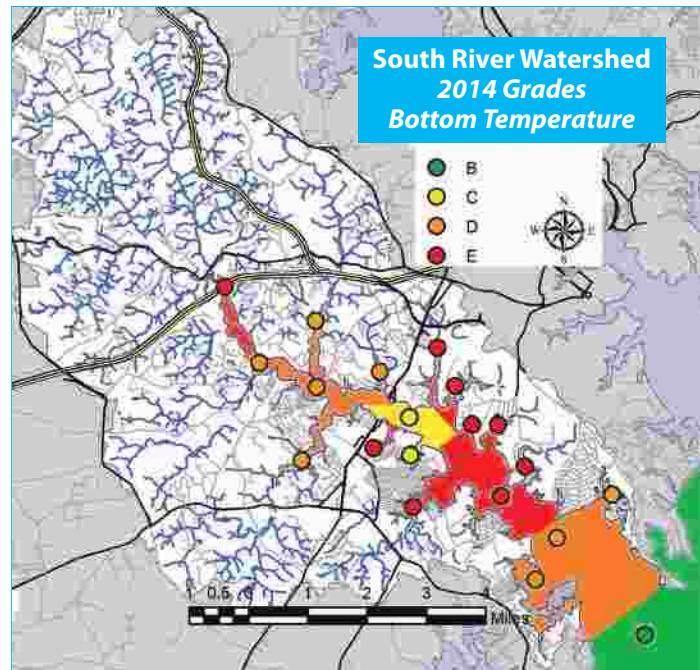
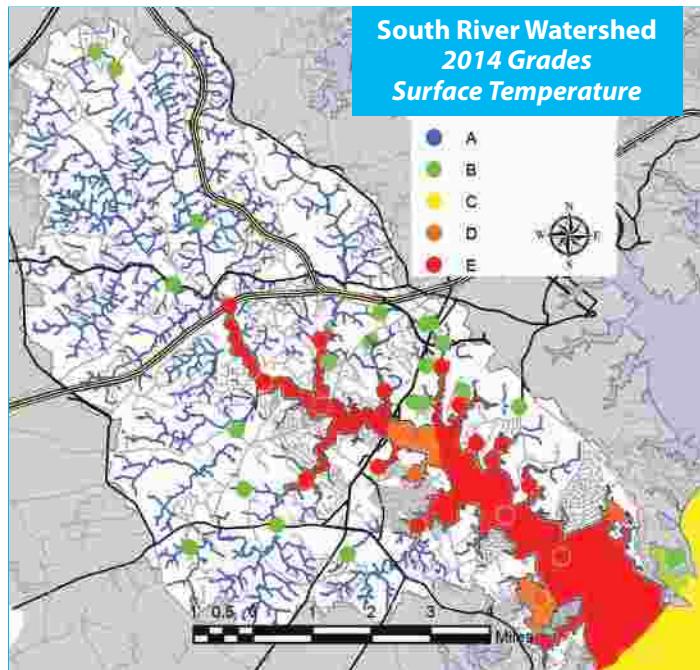
the largest rain events of the year in August with approximately six inches of rain. The rain hits the hot roadway, parking lots and sidewalks and enters the local streams as very hot water—over 80°F. This hot water is considered a thermal pollutant and can be lethal to freshwater organisms.

Tracking temperature is vital, especially considering climate variability, land subsidence (sinking), and sea level rise. When water temperatures become too hot, animal and plant species become stressed and either relocate or die. Temperature is another factor that contributes to the dissolved oxygen decrease. The combination of nutrient enriched water and hot temperatures fuels the algae blooms, causing the bottom dissolved oxygen to decrease.

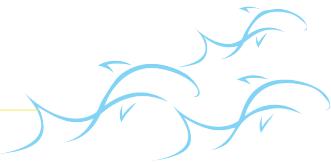
The criterion for tidal temperature is 25°C (77°F) or less. The South River's tidal surface median temperature was 22°C (72°F) and the median bottom temperature was 21°C (70°F). The criterion for warm water streams is 32°C (90°F) or less and the criteria for fish are 25°C (77°F) or less. The median freshwater streams temperature was 14°C (57°F) with 471 measurements from April through October. The maps below indicate the grades from streams, tidal surface water and tidal bottom water.

In July and August 2014, the temperature became hot in the tidal waters of the South River, causing fish to migrate to cooler waters, dissolved oxygen level to decrease, and algae to grow in large mats. We also experienced one of

When water temperatures become too hot, animal and plant species become stressed and either relocate or die.



South River Watershed Report Card



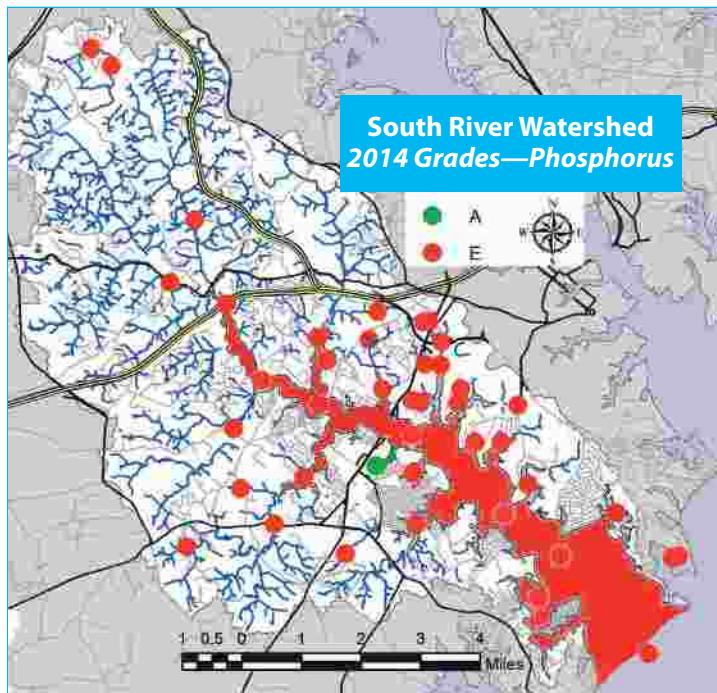
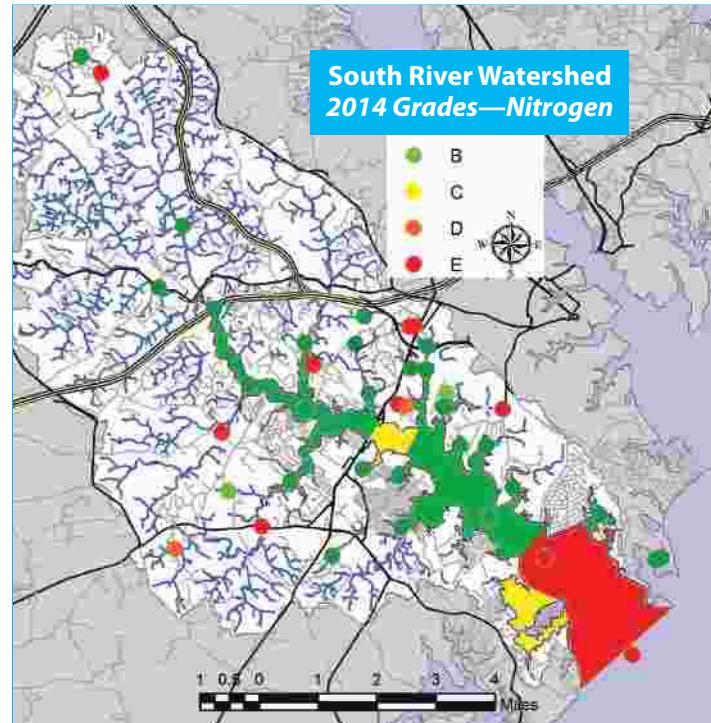
Nutrients

Tidal: Total Nitrogen 95% — **A**
Total Phosphorus 12% — **E**

Non-Tidal: Nitrate 74% — **C**
Phosphate 12% — **E**

Nitrogen and phosphorus cycling in estuaries is an extremely complex process. Therefore, when grades for nitrogen indicate an "A," it appears to be a "good" thing; however, this can be particularly misleading. The reason nitrogen appears low is that the phytoplankton (microscopic plants and algae) quickly metabolize nitrogen first, in the presence of phosphate. When there are excess concentrations of phosphorus, the phytoplankton use up all of the available nitrogen and grow explosively. This causes an increase in the chlorophyll a concentration (see *chlorophyll* section). The South River has what is known as "rolling" algae/phytoplankton blooms from May through October, which result in low dissolved-oxygen levels, which in turn fuels the release of nutrients from bottom sediments.

Nutrients in the South River come from stormwater runoff, leaky septic systems, broken sewer lines, eroding stream banks and lawn fertilizers. Some nutrients are recycled from bottom sediments during low oxygen (hypoxic) events.



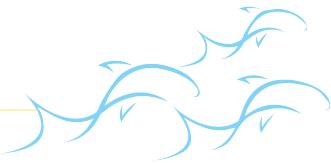
Chlorophyll a Tidal:

Chlorophyll Spring 19% — **E**
Chlorophyll Summer 1% — **E**

Chlorophyll a is the green pigment found in phytoplankton and algae (small to microscopic plants), and is used as the indicator to estimate the concentration of phytoplankton and algae. These plants are found naturally in the South River and Chesapeake Bay. The excessive amount of nutrients, coupled with phosphorus-laden sediments, leads to an explosive growth of algae blooms or mats. The algae blooms not only photosynthesize during the day, but also respire during the night. It is during the respiration phase that oxygen is utilized in the water, which leads to hypoxic and/or anoxic conditions.



South River Watershed Report Card



Water Clarity

Tidal only 26% — **E**

When the water's clarity is reduced, underwater grasses do not receive the sunlight they need to grow. If the grasses do not grow, then they cannot produce the oxygen needed for the water.

Excellent news! The long-term trend in water clarity shows improvement. Out of 251 observations 26% passed the criterion of 1 meter (3.3 feet). Last year the attainment was only 19%, and lower in previous years.

Water clarity is a measurement of how far down the water column light can penetrate. This is of extreme importance because if sunlight cannot reach the underwater grasses, they will not grow.

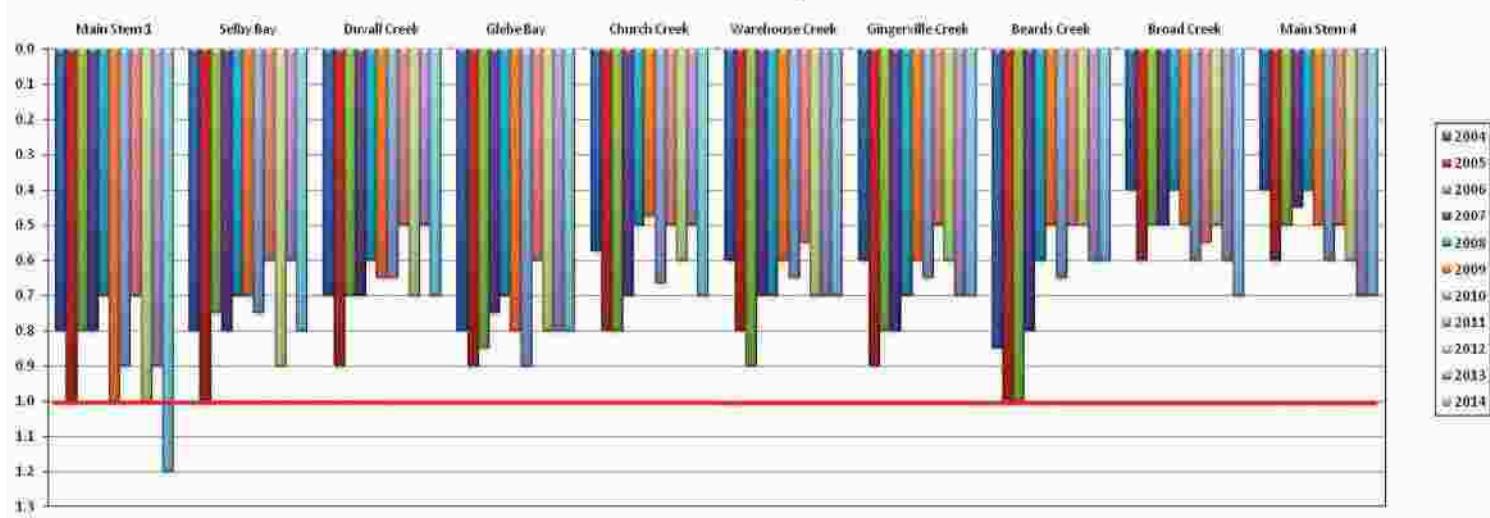


Mills-Parole Elementary students learning about water clarity.



Atlantic Ribbed Mussels found in Selby Bay.

South River Water Clarity 2004 to 2014



South River Watershed Report Card



Underwater Grasses

Tidal only 3% — **E**

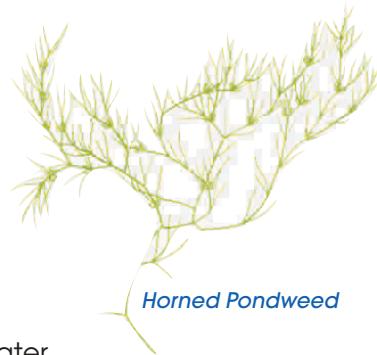


Widgeon Grass The species of grasses that we commonly see in the South River are: Horned Pondweed (*Zannichellia palustris*), Sago Pondweed (*Potamogeton pectinatus*), and Widgeon Grass (*Ruppia maritima*).

The South River's underwater grass bed has become resilient and is expanding in acreage each year.

These grasses are essential because they provide food, habitat and produce oxygen that fish and other aquatic animals need to survive. The underwater grasses are extremely sensitive to poor water clarity, high nutrient concentrations, and high temperatures. Through the South River Federation's restoration activities, we can control polluted runoff and sediment, which will improve water clarity for the underwater grass habitat.

Each year, Captain Diana Muller and an underwater grass kayak team survey, map and identify underwater grasses in the South River.



South River Watershed Report Card



Bacteria Tidal only 87% — **B**

As part of the South River Federation's "Operation Clearwater" program, bacteria samples are collected every week from Memorial Day through Labor Day. The results are available to the public within 24-36 hours of collection. In 2014, the bacteria concentration were lower than previous years due to the lack of rain. This was because the region experienced a "normal" climate, as well as residents are more aware of picking up after their pets, keeping the Canada Geese off their shorelines/beaches and maintaining their septic systems. This really helps keep the bacteria out of the South River, especially after heavy rainstorms.



How to Receive the Bacteria Information

- **SwimGuide**—on your smart phone, for installation and directions check out our website: (<http://www.southriverfederation.net/index.php/river-health/bacteria-data>)
- **Website**—www.southriverfederation.net
- **Facebook**—<https://www.facebook.com/SouthRiverFederation>
- Or, if you would like to have your community's recreational area tested, please contact our office at 410-224-3802 and request to sign-up for Operation Clearwater



South River Watershed Report Card

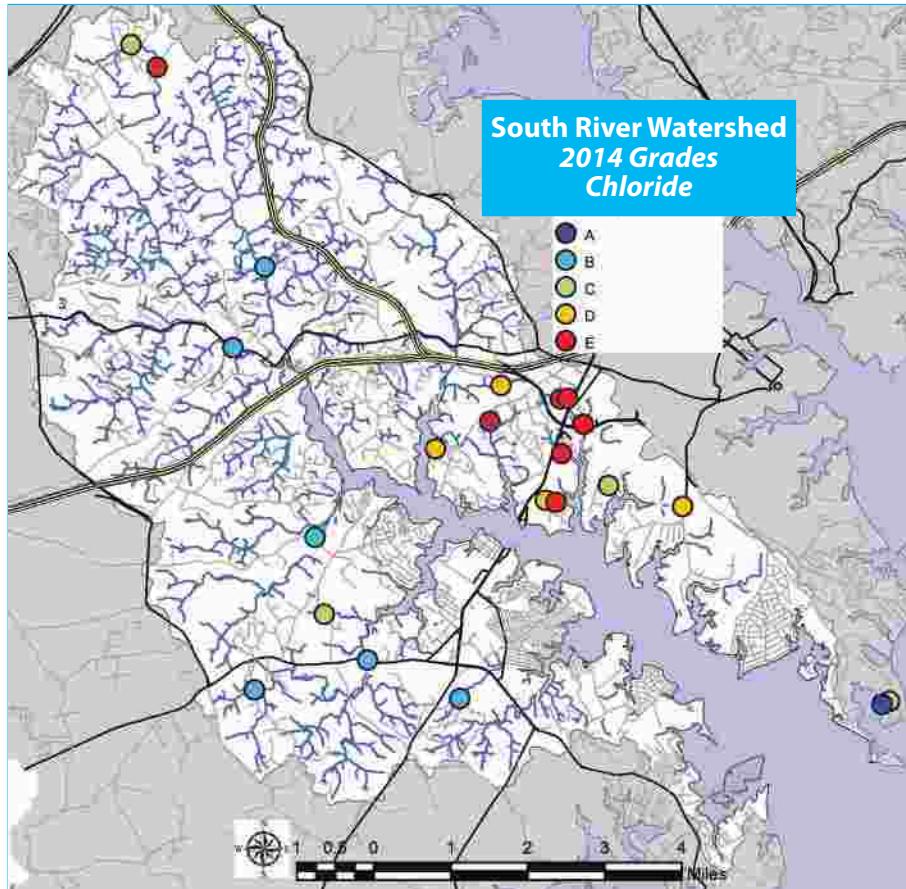


Chloride Chloride non-tidal 66% — **D**



During the winter months, the roads, parking lots, and sidewalks are covered with a substance called magnesium chloride or other chloride-based salts, which assist in keeping these areas from freezing. However, as temperatures warm and the ice melts, the salt enters the nearest stream, which is not healthy for plants and animals. Research has shown that concentrations as low as 30mg/l can damage plants, and levels at 250mg/l are lethal to freshwater invertebrates and some fish.

The criterion used in this assessment was a concentration of 250 mg/l or greater, because this concentration can be harmful to freshwater organisms. The median chloride concentration was 145mg/l. The highest concentration was 1490 mg/l at Harry Truman Park and Ride.



South River Watershed Report Card



Restoring the South River Watershed



The health of the South River watershed is a direct reflection of the way that we have treated the landscape over time. In the case of the South River, and other rivers throughout the region, land clearing, wetland destruction, and hardening the surface of the landscape has created a situation in which high volumes and velocities of polluted runoff enter the South River each time that it rains. As a result, most of our stream systems do not function as they should, sending sediment and nutrients into the tidal portion of the South River. The South River's associated wetlands have been ditched and drained and left high and dry as local water tables have dropped. The South River Federation is implementing new restoration techniques in order to rehabilitate our streams into beautiful and functioning habitats, such as wetlands, marshes, ponds, and bogs to store the nutrients and sediments.



In order to monitor such innovative restoration techniques, we at the South River Federation are using sound science to monitor the restoration effectiveness. The Research and Monitoring program assesses each restoration site before, during and after implementation using innovative technologies, such as continuous monitoring devices that record information every fifteen minutes. We also realize it is important to monitor and assess the restoration sites not only for nutrients and sediment, but also for habitat biodiversity, such as macrobenthic invertebrates, amphibians, and birds.



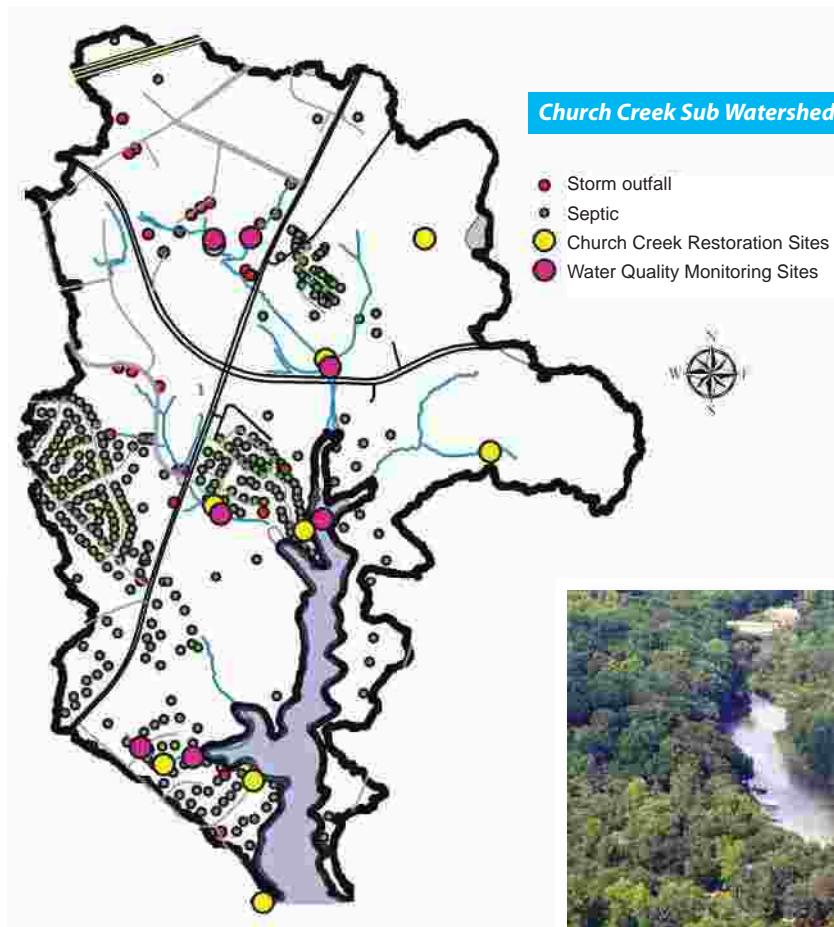
South River Watershed Report Card



Church Creek Initiative



The 1300-acre Church Creek subwatershed is located on the north shore of the South River and is approximately 47% impervious surface with 315 septic systems. The South River Federation's \$5 million Church Creek initiative, launched in 2008, will see the restoration of at least 25 degraded or eroding sites by 2016. We have already constructed \$2.1 million in projects, with an additional \$2.4 million to be constructed and planted by 2016. This will include the streams adjacent to: Harbour Center, Bywater Road, Allen Apartments, Parole Liquors, and other communities.



In 2014 the South River Federation:

- ▶ Engaged 35 students, 150 volunteers, for more than 575 hours of volunteer work
- ▶ Completed five major projects—'Wilelinor II, Church Creek at Rt. 665, Poplar Point, Subaru at Rt. 2, and the Learning Tree
- ▶ Planted over 11,700 trees and shrubs
- ▶ Performed thousands of observations in water quality, bacteria, storm, biological, amphibian, fish and invasive monitoring

