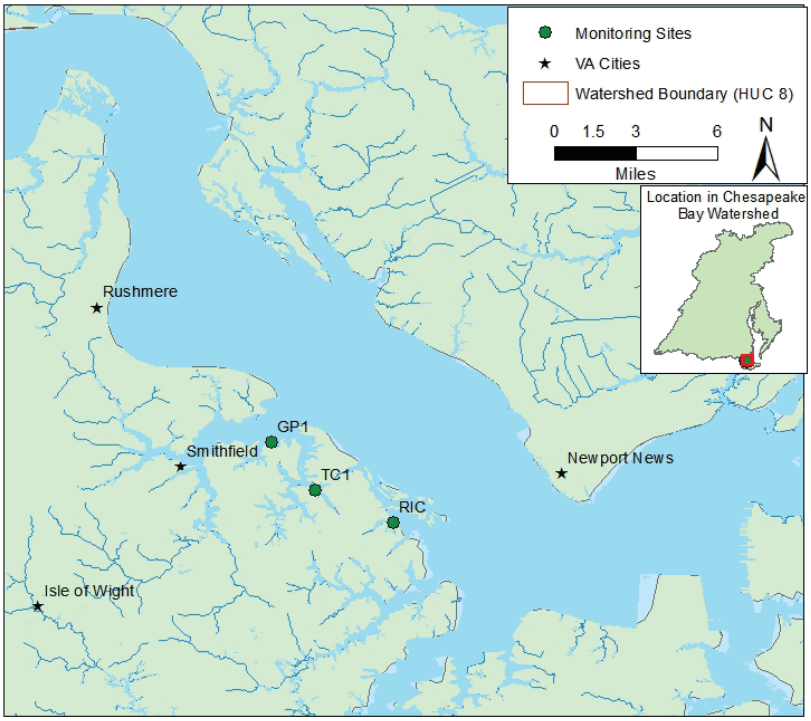
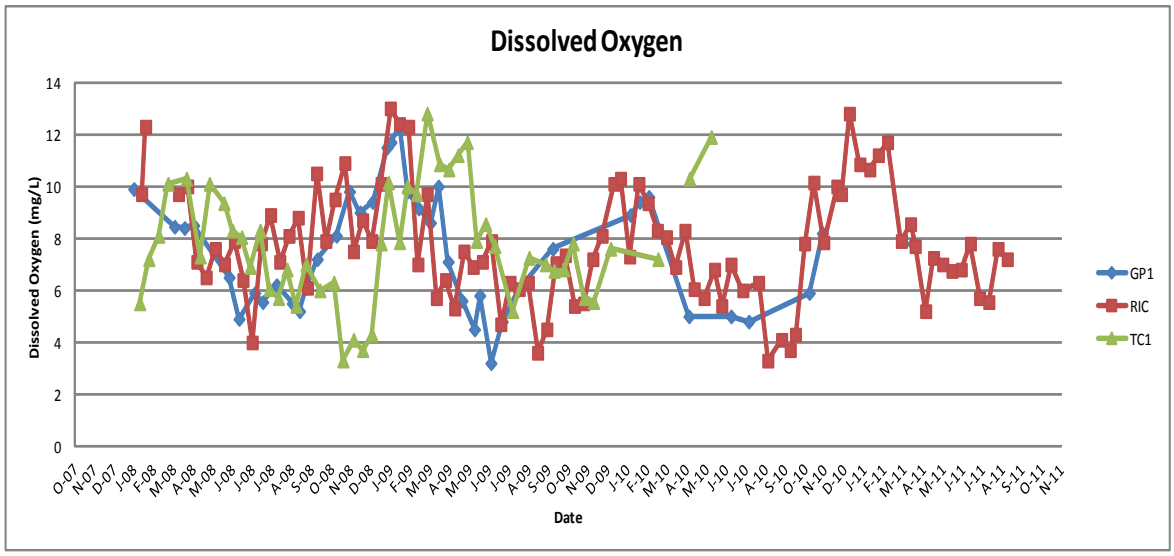
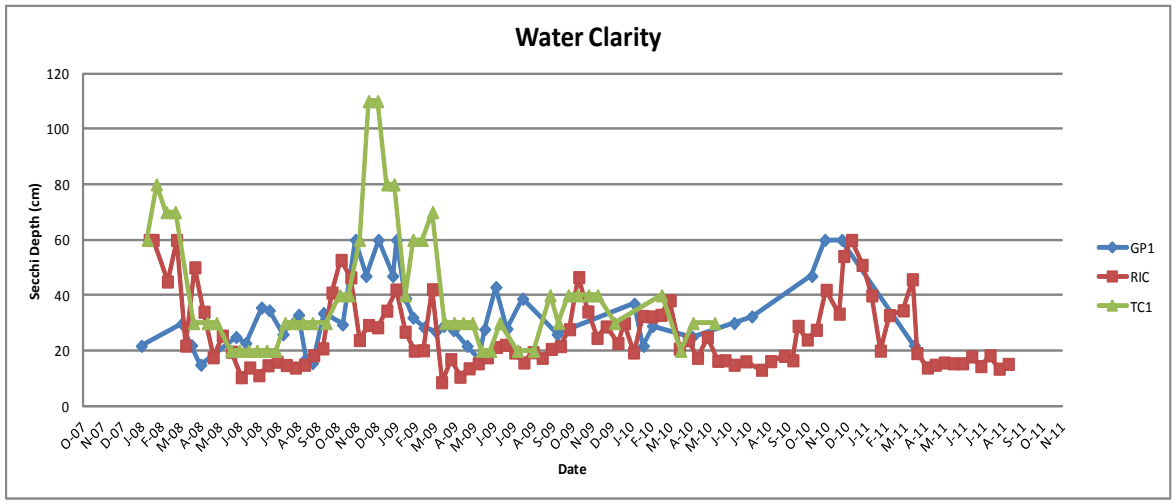
Dissolved Oxygen & Water Clarity in the Lower James River



The lower James River is a tidal tributary that feeds into the Chesapeake Bay. For the past few years, the Alliance's RiverTrends volunteer monitors have been collecting data at a few streams that feed into the James River. Data shows the seasonal variations of dissolved oxygen and water clarity. Both dissolved oxygen and water clarity are generally lower in the summer months. In fact, all of these streams and the James River have been listed as impaired for not meeting dissolved oxygen standards. This area consists of agricultural farms and urban areas. Nonpoint source runoff is potentially contributing to this impairment by adding nutrients such as nitrogen and phosphorus to the streams during rain events.





Dissolved Oxygen & Water Clarity:
Key Indicators of Water Quality

Dissolved Oxygen (DO)

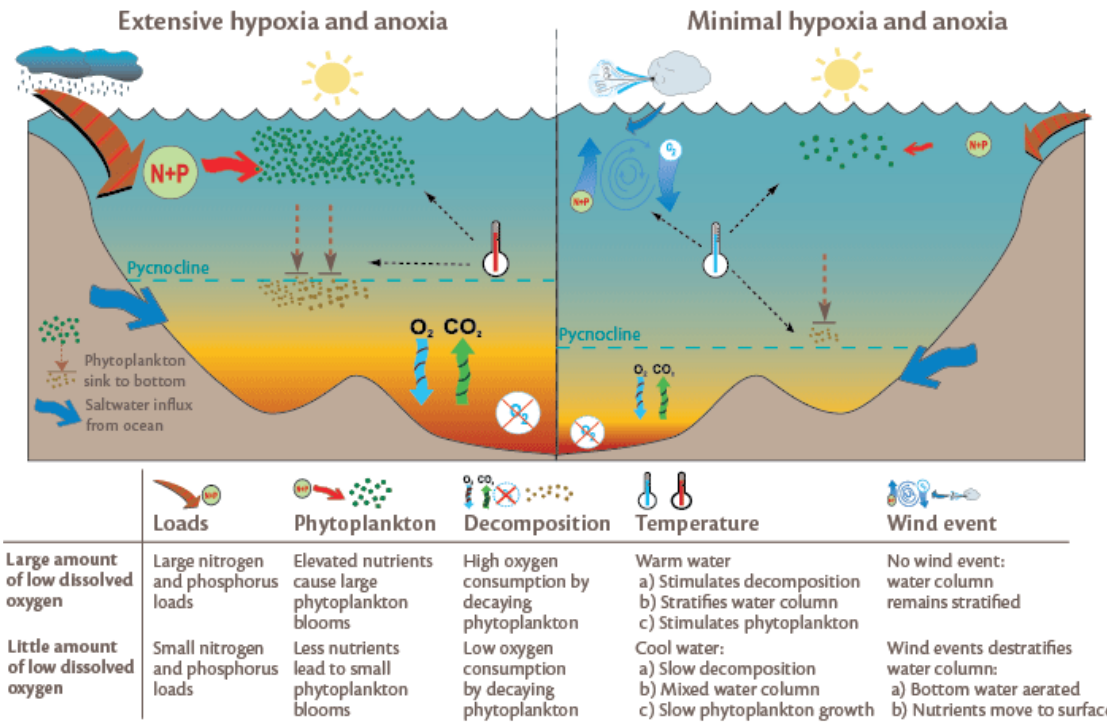
Definition: Amount of oxygen dissolved in the water, measured in milligrams per liter (mg/l). When levels drop below 2.0 mg/L, the water is hypoxic, and when they drop below 0.2 mg/L the water is anoxic

All aquatic life needs DO to survive.

DO naturally fluctuates with the time of day and season. DO is highest mid-day and in the winter.

Stormwater runoff can carry excess nutrients, which contribute to large blooms of phtyoplankton (a process called eutrophication). Then when the phytoplankton decomposes, DO is depleted.

Streamside trees help keep water cooler and filter out nutrients from runoff.



Conceptual diagram detailing the factors that determine the dissolved oxygen content of the tidal waters of Chesapeake Bay
Diagram courtesy of the Integration and Application Network, ian.umces.edu.

Water Clarity

Definition: Amount of light that penetrates through the water column. Secchi discs are used to measure water clarity. A monitor measures the depth at which they can barely see the disc, and records this depth in meters.

Decreased water clarity usually caused by increased sediment and algae in the water.

Low water clarity decreases a fish's ability to find food. It also interferes with the penetration of sunlight, which Submerged Aquatic Vegetation (SAVs) need for photosynthesis.

Potential sources of sediment are streambank erosion and stormwater runoff.


A volunteer monitor measures water clarity with secchi disc.


A fish swims in SAVs in Chesapeake Bay.
Photo courtesy of Chesapeake Bay Program.

Water Quality Standards:
How clean should water be for aquatic & human health?

Water Quality Standards regulate how clean a waterbody should be. Each state sets their standards and the Environmental Protection Agency (EPA) determines if they meet Clean Water Act Requirements.

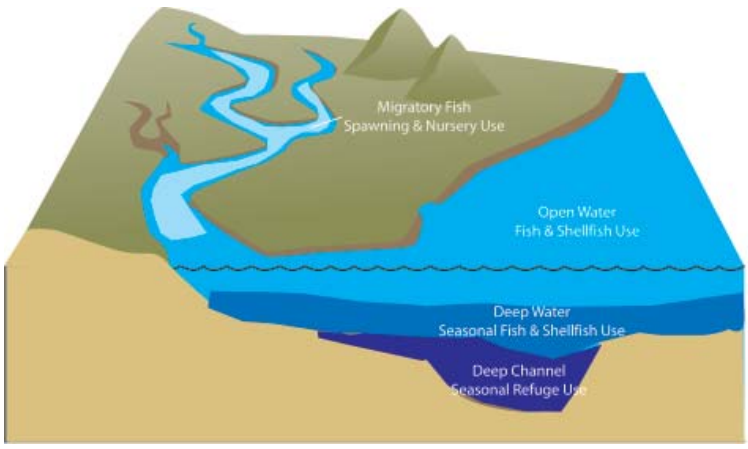
Designated Uses: Each waterbody has a designated use. Typical uses are: aquatic life, recreation, and human health.

Water Quality Criteria: A maximum concentration level for certain pollutants set to protect each designated use. This is based on data and information on the affects of pollutants at different concentrations.

Chesapeake Bay Program partners have worked together to develop tidal-water designated uses and dissolved oxygen criteria to protect aquatic life in the Chesapeake Bay and its tidal tributaries. The designated uses are based on the types of habitat provided for specific species. The associated criteria vary with seasons and duration of exposure.

Designated Use	Description	Criteria
Migratory fish spawning & nursery use habitat	Protects migratory and tidal fresh water fish during spawning & nursery season	7-day average minimum 6 mg/L Instantaneous minimum 5 mg/L February - May
Open-water fish & shellfish use	Promote growth of balanced, indigenous populations	30-day average minimum 5 mg/L (salinity 0 - 0.5 ppt); 30 day average minimum 5.5 mg/L (salinity > 0.5 ppt); 7-day average 4 mg/L; Instantaneous minimum 3.2 mg/L
Deep-water fish & shellfish use	Protect propagation & growth of balanced, indigenous populations	30-day average minimum of 3 mg/L; 1 day average of 2.3 mg/L; Instantaneous minimum of 1.7 mg/L June- September
Deep-channel seasonal refuge	Refuge for balanced populations that depend on deep channel habitats for overwintering	Instantaneous minimum 1 mg/L June-September

When a waterbody does not meet the water quality standard, a Total Maximum Daily Load (TMDL) must be developed. This is essentially a pollution diet that establishes targets for reductions of pollutants that contribute to, in this case, dissolved oxygen levels.



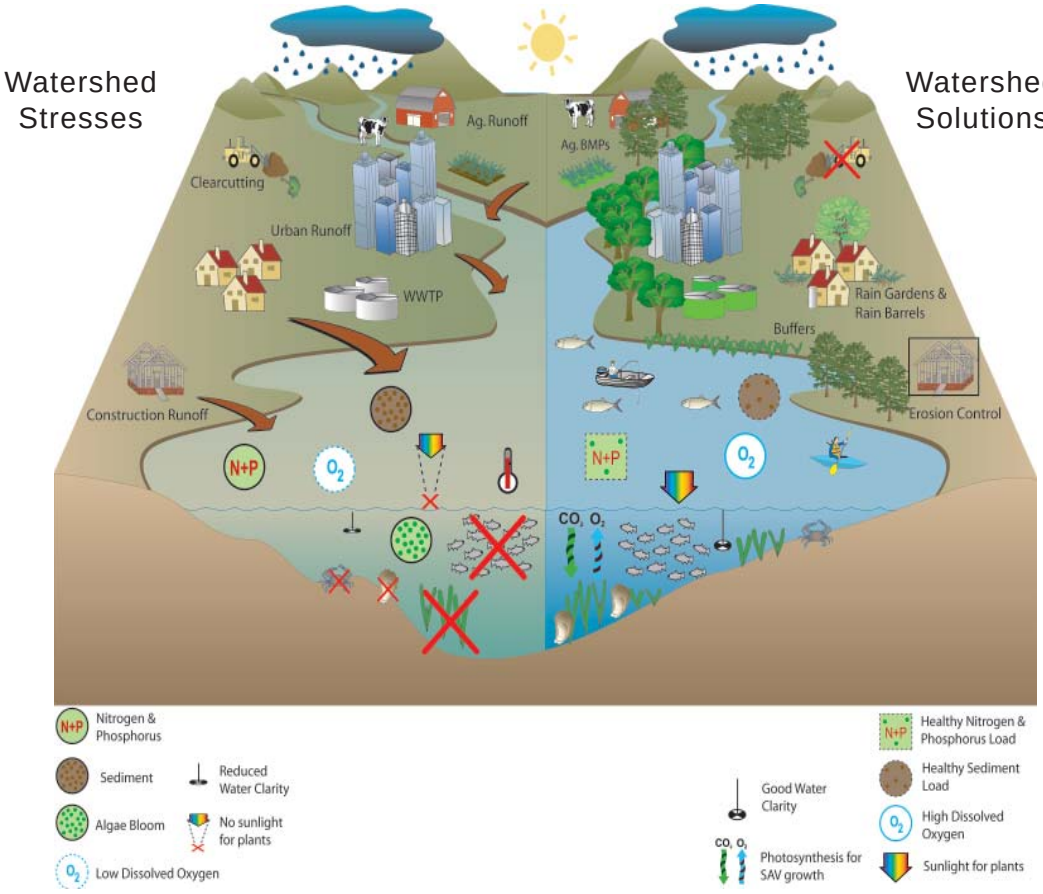
Cross-section depicting designated use zones.


Water quality standards are also set for recreational use to help protect human health.

Let's Work Together to Clean Up our Streams

Everyone can help keep pollution from entering our waterways. Here are a few tips for reducing your watershed footprint:

- Reduce fertilizer and pesticide use.
- Pick up your pet's waste.
- Install a rain barrel or rain garden and plant native species to keep stormwater on your property.
- Watch (and smell) for sewage overflows and contact your city or county.
- If you have a septic system, have it inspected and pumped regularly.
- Support sewage treatment plant and septic system upgrades.
- Farmers can implement Best Management Practices (BMPs): plant cover crops and fence livestock out of streams.
- Businesses can use green practices that are protective of water quality.
- Leave or plant tree buffers on stream banks.
- Volunteer with or form a community watershed organization.



Conceptual diagram of stormwater runoff impacts on watershed systems.
Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/).

This report was funded by a Chesapeake Bay Restoration Fund grant to the Alliance for the Chesapeake Bay (Alliance). The Alliance's mission is to restore the Chesapeake Bay through collaborative engagement with the communities that work and live in the Bay watershed. The Alliance coordinates RiverTrends, a regional volunteer water quality monitoring program.

For more water quality data collected through these efforts, please visit the Alliance's Database at http://www.acb-online.org/monitoring/data/site.cfm. To find out how to become a water quality monitor, visit www.allianceforthebay.org.

Alliance for the Chesapeake Bay

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