

# Clean Water Act



The Clean Water Act (CWA) was established in 1977 by the US Environmental Protection Agency (EPA) and is called the cornerstone of surface water quality protection. This act was set forth to regulate pollution discharged into United State's waters to protect wildlife, recreation, and surface water quality.

The CWA sets standards for industrial wastewater discharge and sets water quality standards. The Act made it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit was obtained from EPA. The CWA also recognized the need for planning to address the critical problems posed to water quality by non-point source pollution; such as toxic surface run-off and storm sewer systems

# Shore Protection Act

Established in 1992 by the Georgia Department of Natural Resources, the Shore Protection Act protects and manages Georgia's shoreline including sand dunes, beaches, sandbars, and shoals.



Sand dunes, offshore sand bars, and shoals are easily disturbed by human and natural actions which can either harm or inhibit their natural development. Valuable resources, these sand structures offer great habitat and coastal protection from high tides and storm surges. To protect these, the Shore Protection Act regulates beach renourishment, groins, jetties, rock revetments, and sand dune crossovers on a permit basis, while the Act prevents boat basins, docks, marinas, and boat ramps in these areas.

The Shore Protection Act also states that these inshore and offshore sand structures are additionally protected as they are actively participants in the sand sharing system of the Georgia coast and Eastern Seaboard. If sand is removed from the sand sharing system, then coastal areas within the network are effected.

For instance, sand from Hilton Head, South Carolina, migrates southward along the shore via the longshore current and comes to rest on Tybee Island's north end. Over time, the sand from Tybee Island's north end migrates down the coast until it reaches Little Tybee Island's north end. This southernly movement continues. The sand sharing system ultimately means that sand can travel from the northern reaches of Maine to the tip of the Florida Keys. At any point that sand is removed from the system, such as settlement into dredged rivers or inlets, an island or coastal area south of that point can be greatly effected with decreased amounts sand from the natural renourishment process of the sand sharing system.

### References & Photo Credits:

Environmental Protection Agency - <http://www.epa.gov/>

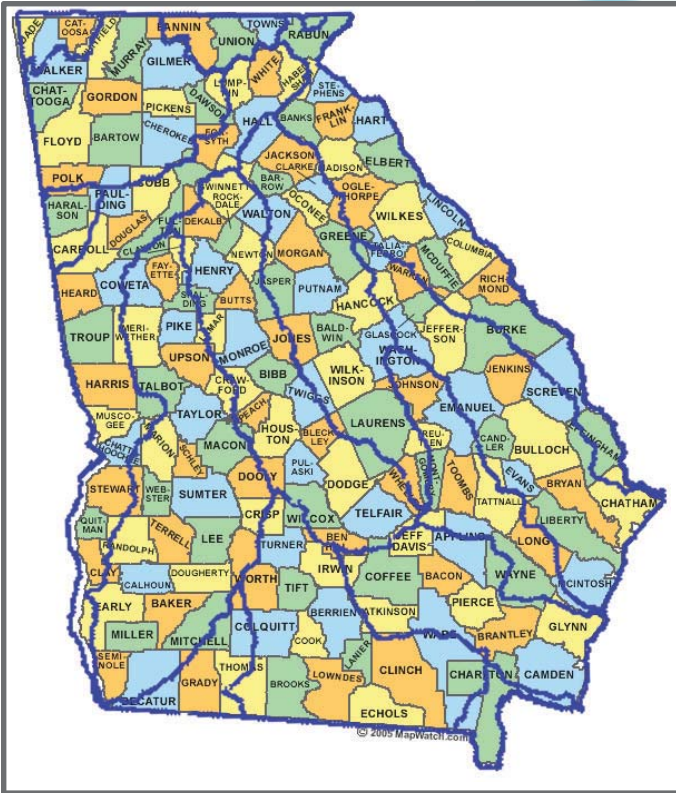
Georgia Department of Natural Resources - <http://crd.dnr.state.ga.us>



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# Counties and Watersheds



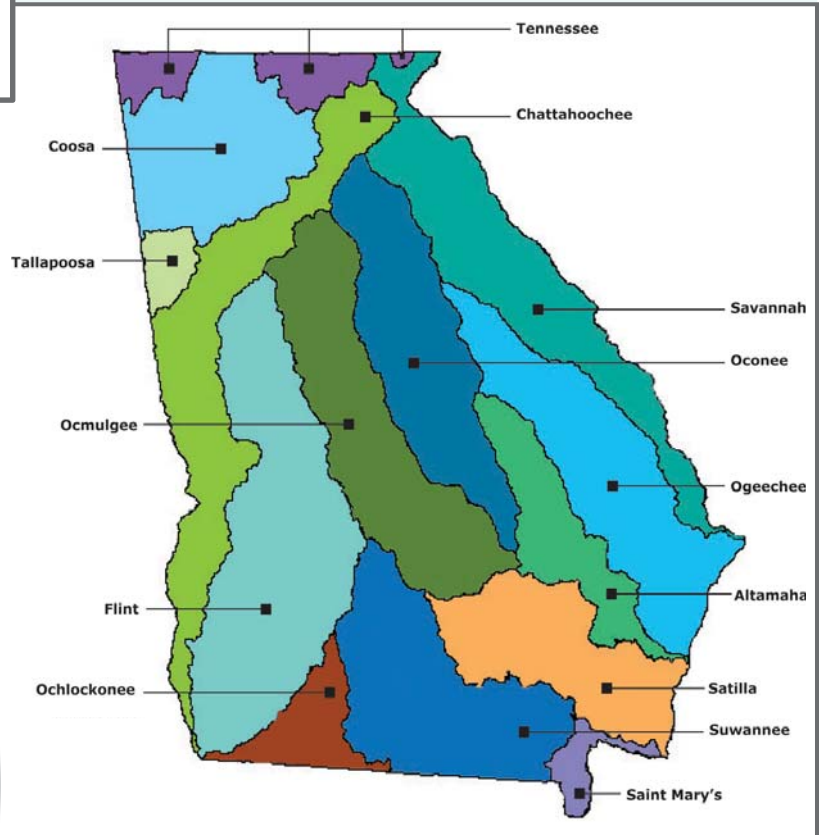
## What is a Watershed?

Watersheds are divisions or regions that come in random shapes and sizes. As watersheds are dictated by geographical features such as mountain ranges and rivers, they tend to cross state and national boundaries. Due to the connectedness of watersheds, it is important to work along fellow communities, states, or countries as all of the water contained within a watershed flows the same direction eventually ending up in one of the earth's oceans. Pollution or overconsumption by those communities upstream can greatly affect water quality and water availability to the communities downstream.

In Georgia, there are 14 major watersheds (Tennessee, Chatahoochee, Coosa, Tallapoosa, Savannah, Oconee, Ocmulgee, Ogeechee, Altamaha, Flint, Satilla, Ochlockonee, Suwanee, and St Marys).

The map above shows each of the 159 counties in Georgia. The blue outlines represent the borders of Georgia's 14 major watersheds.

The map to the right depicts the 14 major watersheds located in Georgia. In which watershed do you live?



### References and Photo Credits:

Skidaway Institute of Oceanography  
<http://www.skiop.peachnet.edu/>

US Census Bureau - [http://quickfacts.census.gov/qfd/maps/georgia\\_map.html](http://quickfacts.census.gov/qfd/maps/georgia_map.html)

US EPA - <http://www.epa.gov/owow/watershed/>



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# Marsh Zones



Sound



Tidal creek and mud flat



Low marsh



High marsh, salt pan, and hammock

## Georgia Marsh Zones (from Ocean to Mainland):

A **sound** is the deepest zone of the saltwater marsh and is distinguishable as a large aquatic inlet or deep bay protected by barrier islands and influenced by tides and storm surges. Examples situated along Georgia's coast include Ossabaw Sound, Wassaw Sound and Doboy Sound.

**Tidal creeks** vary in width, depth, and length. These naturally channelized marsh areas experience drastic changes in water depths and salinities due to tidal variation, rainfall events, and storm surges. Tidal creeks can be lined with oyster reefs, mud, or *Spartina*. Various birds, such as mergansers and buffleheads, frequent these creeks along with sea turtles and dolphins.

Moving to higher elevated parts of the marsh, the **low marsh** is typically dominated by salt tolerant marsh grass (*Spartina*). Many vertebrate and invertebrate species such as stone crabs and diamondback terrapins frequent this zone to prey on the periwinkle snails and Atlantic ribbed mussels. The low marsh zone provides habitat for many bird species such as the marsh wren and the red-winged blackbird.

Often times, **mud flats**, can be exposed within tidal creeks and the low marsh zone at low tides to reveal a plethora of mud snails, fiddler crabs, and tube worms that are predated on by egrets, herons, and diamondback terrapins.

The **high marsh** is the next zone and, as its name implies, it is higher in elevation than the low marsh. The high marsh has sandier soils and more access to freshwater run-off after rainfall events. Plants that grow in the high marsh zones include sea lavender, sea oxeye daisy, and black needlerush. Only covered by a spring high tide, the exposed soil of the high marsh is subject to evaporation and areas of very high salinity, known as "**salt pans**", develop. Salt pan soil is so saline that it prevents all plant growth and appears as sandy patches as seen in the picture at the bottom left.

The **hammock**, which is also known as a maritime forest, is the most inland edge of the marsh and is typically untouched by normal high tide events. The freshwater from rainfall events allows for several tree species to thrive, such as live oaks, palmettos, and yaupon holly. Due to the higher elevation and beautiful scenery, hammocks are the most developed marsh zone.

## References & Photography Credits:

Sapelo Island National Estuarine Research Reserve - [www.sapelonerr.org/](http://www.sapelonerr.org/)  
University of Georgia - <http://www.marex.uga.edu/shellfish>



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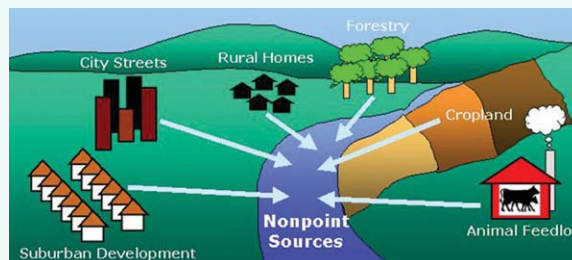


# Non-point Source Pollution

Non-point source pollution, unlike point source pollution, comes from many diffuse sources and is difficult to regulate or permit. Whether it comes from cars, pets, yards, or wildlife, non-point source is the leading cause of poor water quality in coastal wetlands. Non-point source pollution enters coastal waters through rainfall events and runoff. With increasing coastal populations and development, there is great concern on preventing non-point source pollution.

## Sources of Non-point Source Pollution

- Excess fertilizers, herbicides, and insecticides from residential areas
- Excess nutrients from animal wastes and fertilizers from agricultural areas
- Oil, grease, and toxic chemicals from vehicles and marine vessels
- Sediment eroded away from improperly utilized land
- Salts from irrigation practices
- Acidic leaching from abandoned mines
- Bacteria from livestock waste, pet waste, and faulty septic systems.



## Effects of Non-point Source Pollution

- Closed recreation areas and beaches due to *Enterococci* and *E. coli* levels
- Detergents from washing the car increases nitrate levels which promotes plant and algal growth
- Tainted seafood due to algal blooms from excess nutrients
- Oily film or foul smelling wetlands from leaking boats and cars
- Sick or declining bird populations due to improperly used bug sprays
- Fish dying from sediment clogged gills
- Aquatic invertebrates fleeing or dying due to increased salt levels

## WE ALL CAN PREVENT NON-POINT SOURCE POLLUTION!

- Keep litter and debris out of the environment and out of storm drains
- Apply garden chemicals at the proper time and in the proper dose
- Dispose of used oil, antifreeze, paints, and other chemicals properly.
- Control soil erosion by planting ground cover or utilizing silt fences
- Have your septic system inspected and pumped at least every 3-5 years
- Pick up pet waste and dispose of properly in the garbage
- Participate in coastal and local clean up events



### References and Photography Credits:

Clean Water Campaign - <http://www.cleanwatercampaign.com>  
 U.S. Environmental Protection Agency website - <http://www.epa.gov/owow/nps>



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# Marshlands Protection Act

Marshlands and estuaries along Georgia's coast provide vital resources for terrestrial and aquatic organisms from birds to sea turtles to humans. Beyond immediate resources such as oxygen, food supplies, and protective habitats, marshes also provide a buffer zone that shelters inland areas from storm surge impacts.

Written in 1970 and ammended in 1992, the Coastal Marshlands Protection Act states that Georgia's 700,000 acres of coastal marshlands are vital natural resources that provide:

- Habitat and food for many terrestrial and aquatic species
- Protective areas or nurseries for economically important fish and shellfish species
- Flood and storm surge buffers for coastal communities
- Filtration of pollutants

Estuarine areas protected under the Marshlands Protection Act extend from the water's edge to 5.6 feet above mean tide level; which includes intertidal areas, tidal water bottoms, and mudflats.

This Act has aimed to protect these coastal areas by implementing a permitting process to control development and use of these ecologically important marshland areas. For those wanting to build structures like community docks and marinas, conduct dredging or channel deepening, or fill areas, a permit must be obtained. Permits and the permitting system are under the jurisdiction of the Coastal Marshlands Protection Committee and administered by Georgia's Department of Resources Coastal Resources Division.

The Coastal Marshlands Protection Committee has the authority to evaluate proposed developments then grant or deny the proposals based on the development's environmental impacts and its impact on public interest. This Act states that projects cannot do harm or alter the natural flow of navigational waters, projects cannot increase erosion in marshland areas, nor can projects interfere or negatively impact marine life or wildlife conservation efforts.

Further information can be obtained by contacting GA DNR's Coastal Resources Division at [www.dnr.state.ga.us/dnr/coastal](http://www.dnr.state.ga.us/dnr/coastal).



#### References & Photography Credits:

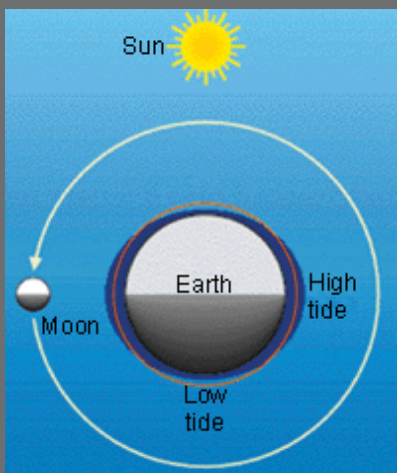
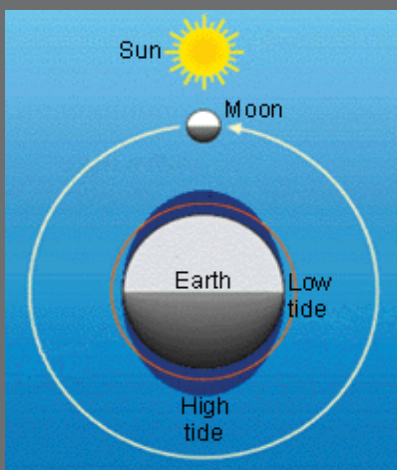
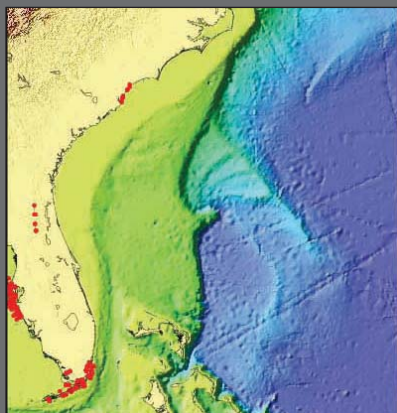
Georgia DNR Coastal Resources Division - <http://www.dnr.state.ga.us>  
University of Georgia - <http://www.marex.uga.edu/shellfish>



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# Tides



The Georgia coast experiences a semi-diurnal tidal cycle with two high tides and two low tides that are similar in highs and lows respectively throughout a lunar day or approximate 24 hour period. From this, we can extrapolate that a high tide event occurs approximately every 12 hours with a low tide occurring in between each high tide. Therefore, if a high tide occurs at 6:00am, a low tide will follow around noon, followed by a high tide around 6:00pm and another low tide around midnight.

Not all coasts experience the same tidal variation or the same tidal cycle; for instance, Seattle, Washington, located in the Pacific Northwest experiences a mixed semi-diurnal tidal cycle in that their daily high tides and low tides come in pairs, but not of equal heights. A third type of tidal cycle is experienced in the Gulf of Mexico and is known as a diurnal tidal cycle with only one high tide and one low tide throughout each day.

Other than tidal cycle, Georgia experiences a great tidal variation throughout each month with high tides and low tides differing by up to nine feet in one 24 hour period! Not as drastic as the more commonly known Bay of Fundy in Canada, but Georgia experiences the highest tidal variation on the East Coast due to its location in the Georgia Bight or South Atlantic Bight, pictured at the top left. Due to low lying elevation, the shallow continental shelf, and the GA bight, flood tide events funnel onto Georgia's coast filling in coastal estuaries and saltmarshes. The height of the highest tide can be estimated by a glance into the night's sky to look at the moon! Gravitational relationships between the sun, moon, and earth are the driving force of the tide types and heights. Below, are two types of tides commonly experienced and the gravitational relationships:

**SPRING tides**, middle left, occur when the Sun and Moon are lined up and jointly pull on the same location of the Earth. With joint efforts, the Earth's oceans are essentially pulled from areas creating extremely low tides while other parts of the oceans experience extremely high tides. Spring tides, or bulge tides, occur on Georgia's coast during full and new moons.

**NEAP tides**, bottom left, occur during waxing and waning moon phases such as crescents and half moons. Tide variation during these moon phases are not as notable as the tide heights occurring during spring tides; for instance, marsh grasses are not completely inundated with water nor are mud flats totally exposed. Remember that "NEAP" means the tides are "nearly even as possible."

#### References and Photography Credits:

National Oceanic and Atmospheric Agency - <http://tidesandcurrents.noaa.gov/> and [http://oceanservice.noaa.gov/education/kits/tides/media/supp\\_tide07a.html](http://oceanservice.noaa.gov/education/kits/tides/media/supp_tide07a.html)

Georgia Encyclopedia, Georgia Coast Geology - <http://www.georgiaencyclopedia.org>

Seaclock - <http://www.seaclock.com/anglais/forwhat.htm>



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# Oyster Reefs

Oyster reefs, also referred to as oyster bars, are intertidally submerged habitats found in near shore areas and estuaries along the coast. Created by the accumulation of spat (young oysters) growing on established oysters, oyster reefs create an important habitat within the Georgia's coastal wetlands, both ecologically and economically.



## Ecologic Importance

Oyster reefs serve important ecological roles in coastal ecosystems:

- Protect various marsh zones from shoreline erosion caused by tidal action and storm surges.
- Improve water quality and clarity by filtering estuarine waters of pollutants and excessive nutrients.
- Provide a hard substrate in the estuaries for oyster larvae and various planktonic organisms to settle and thrive.
- Provide spawning, breeding, feeding, and nursery habitat for commercial and recreational wetland species such as clams, mussels, whelks, and sheepshead, blue crabs, and shrimp.



## Economic Importance

In the early 1900's, Georgia commercially produced more oysters than any other state, but today Georgia's oyster harvests have drastically declined to a few thousands pounds due to:

- Coastal development and deteriorating water quality
- Over-harvesting and lack of hard substrate to which spat can attach
- Disease

# G.E. .R.G.I.A.

(Generating Enhanced Oyster Reefs in Georgia's Inshore Areas)

Due to the oysters' importance in maintaining a healthy coastal ecosystem, the UGA Marine Extension Service coordinates a community based oyster restoration program. Companies, communities and individuals can donate oyster shell from an oyster roast that can be utilized to build new oyster reefs along Georgia's coast.

For more information on the GEORGIA project or to donate used oyster shell for resoration projects, please visit <http://www.uga.edu/gotshell> or call 912-598-2348 ext 3.

## References and Photography Credits:

Fort Pierce Smithsonian Marine Station - [http://www.sms.si.edu/IRLspec/Oyster\\_reef.htm](http://www.sms.si.edu/IRLspec/Oyster_reef.htm)

University of Georgia Marine Extension - <http://www.marex.uga.edu/shellfish>



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