ECO MEET STUDY PACKET 2023

COLLABORATION IN STORMWATER EDUCATION BY

AIKEN COUNTY, CITY OF AIKEN, AND CITY OF NORTH AUGUSTA

State Standards Include:

Georgia: S6E3; S6E4, S6E6b; S7Ld; S8P1b

South Carolina: 6.E.2A.3, 6.S.1A.1, 6.S.1A.4, 6.S.1A.7; 7.S.1A.4, 7.S.1A.6, 7.EC.5A.1; 8.S.1A.4, 8.E.5A.1

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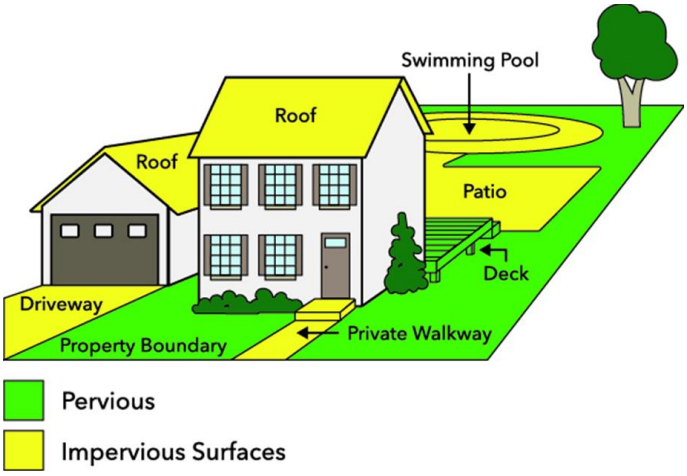
WHAT IS STORMWATER?

Stormwater is water that originates from precipitation and includes rainwater and the meltwater, from snow and hail. Stormwater that **infiltrates**, or absorbed, into **pervious surfaces**, is filtered as it makes its way into groundwater or flows into a nearby waterbody. During large rain events, the soil becomes saturated causing excess stormwater to runoff. **Stormwater runoff** then flows across the **watershed** into storm drains, piping systems, and conveyance systems like roadside ditches. **Impervious surfaces** don't allow rainwater to percolate and can increase the amount of stormwater runoff during a rain event, Examples of pervious and impervious surfaces are shown in the image to the right. Stormwater runoff water collects and carries pollutants like sediment, chemicals, bacteria, and litter into the nearest water body. Increased stormwater runoff can cause increased pollutant loads entering nearby waterbodies.



CALCULATING IMPERVIOUS SURFACE PERCENTAGES

According to the Environmental Protection Agency (EPA), stream channels begin to **erode** when the percentage of imperivous surfaces in a watershed reaches 10%. When the imperviousness reaches or exceeds 25%, **habitat degradation,** though **sedimentation** and **erosion,** can harm wildlife and potentially contaminate drinking water. To determine the percentage of impervious surface, start by calculating the total square footage of the **tract (step 1)**. Next, identify and calculate the total square footage of each impervious surface **(step 2)**. Add each impervious surface together to get a total **(step 3)**. Then divide the total impervious square footage by the total impervious surface square footage **(step 4).** Multiply that number by 100 to calculate the percentage **(step 5).** There is an example of each step on the next page. You will be given similar questions on the test – more information will be provided then you need so, remember to identify the impervious surfaces and include only impervious surfaces in your calculations.

CALCULATING IMPERVIOUS SURFACE PERCENTAGES EXAMPLE

- Citizen's Park in Aiken, South Carolina

Total Acreage: 75 Acres

How many square feet are in an Arce? **(Step 1)**

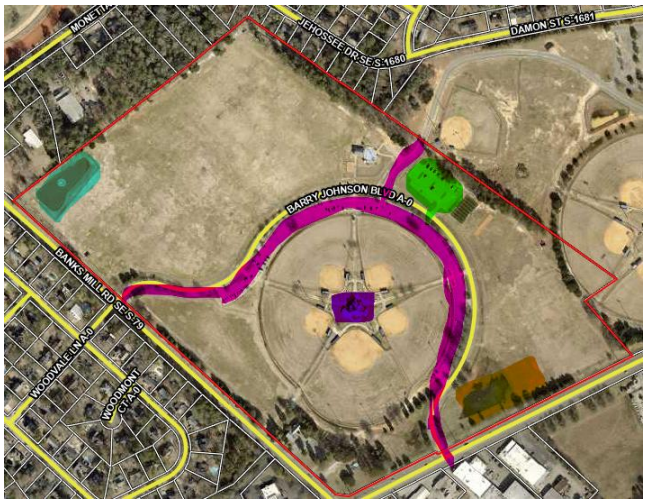
43,560 sq. ft in an Acre

SO,

75 Acres * 43,560 sq. ft =

3,267,000 Square Feet Total

Next, identify the impervious surfaces and determine the square footage of each surface.



Pink (Paved Road): 6 Acres

Green (Paved Lot): 0.5 Acres

Orange (Pond): 1 Acre

Purple (Building): 0.5 Acre

Blue (Pond): 1 Acre

Which surfaces are impervious?

***Pink*, *Green*, *Purple*.**

(Step2) Determine the square footage of impervious areas:

6 Acres * 43,560 sq. ft = 261,360 sq. Ft

0.5 Acre * 43,560 sq. ft = 21,780 sq. ft

0.5 Acre * 43,560 sq. ft = 21,780 sq. ft

Total = 304,920 sq. ft **(Step3)**

What is the percentage of imperviousness on this tract?

(Impervious Square ft = 304,920) ÷ (Total square ft = 3,267,000) **(Step 4)**

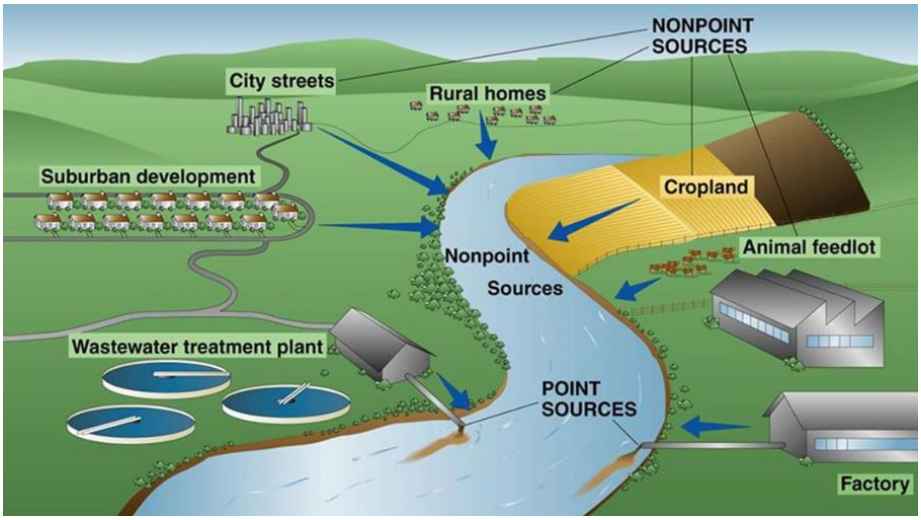
= 0.09

Make into Percentage = 0.09 * 100 = 9% **(Step 5)**

This tract has 9% impervious surface.

THE CLEAN WATER ACT & REGULATORY BACKGROUND

Before the **Clean Water Act** was passed in 1972, there was no regulation on dumping pollution into **navigable waters** from point sources. **Point source pollution** is pollution that is discharged from a single, observable source such as a pipe from a textile mill, wastewater plant, or an oil refinery. The Clean Water Act set restrictions through a program called the **National Pollutant Discharge Elimination System (NPDES)**. This is a system that puts permits on **discharges** from pipes, from industrial waste facilities, and city wastewater plants to help prevent pollution and keep the waterways throughout the United States drinkable, fishable, and swimmable. The **Environmental Protection Agency (EPA)** helped to enforce these regulations and encourage each state to create their own permitting programs. The NPDES permits are reissued or re-written every 5 years to eliminate pollution over time. With each new permit, there are more restrictions, making slow progress to eliminate pollution over time. This allows companies and towns the time to install **best management practices**, control structures, and build systems to eliminate the waste. It also helps to include new and upcoming identified sources of pollution.



STORMWATER PERMITS: HELPING TO REDUCE THE POLLUTION

In 1987, the **Water Quality Act** was added by congress to include other pollution sources, like stormwater, into the permitting program to be regulated as nonpoint source pollution. These new regulations were created in two phases, the NPDES Phase I and Phase II permitting programs. **Nonpoint source pollution** comes from many different sources such as runoff from land, precipitation, deposits from the atmosphere, drainage, or any other water seepage. Stormwater permit programs were developed across the nation to address different sources of these pollutants including industrial facilities, city government's streets and drains, agriculture, and construction site **stormwater runoff**.

THE HISTORY OF STORMWATER PERMITS

1972 Clean Water Act	• Stormwater includes storm and rain runoff, snow melt, surface runoff, and drainage. • Generally, only regulating major manufacturing facilities with known contaminated stormwater runoff that had a history of polluting waterways.
1987 Water Quality Act	• Developing a system to require stormwater permits for cities with 100,000 people or more (large cities only) • New classifications including 2 new phases of stormwater permits: municipal and industrial. Municipal for cities and towns, and industrial for companies.
1990 Phase I Stormwater NPDES	• Phase I - Municipal stormwater discharge permits issued for cities with populations over 100,000. Large municipalities are over 250,000 and medium municipalities are between 100,000 to 250,000.
1999 Phase II Stormwater NPDES	• Phase II Municipalities, industries, and construction sites now regulated and permit programs began development. • Small municipal stormwater systems added for urban areas under 100,000 people. Permits first issued in 2003. • Stormwater Management Plans must be created with 6 minimum control measures and Stormwater Pollution Prevention Plans.

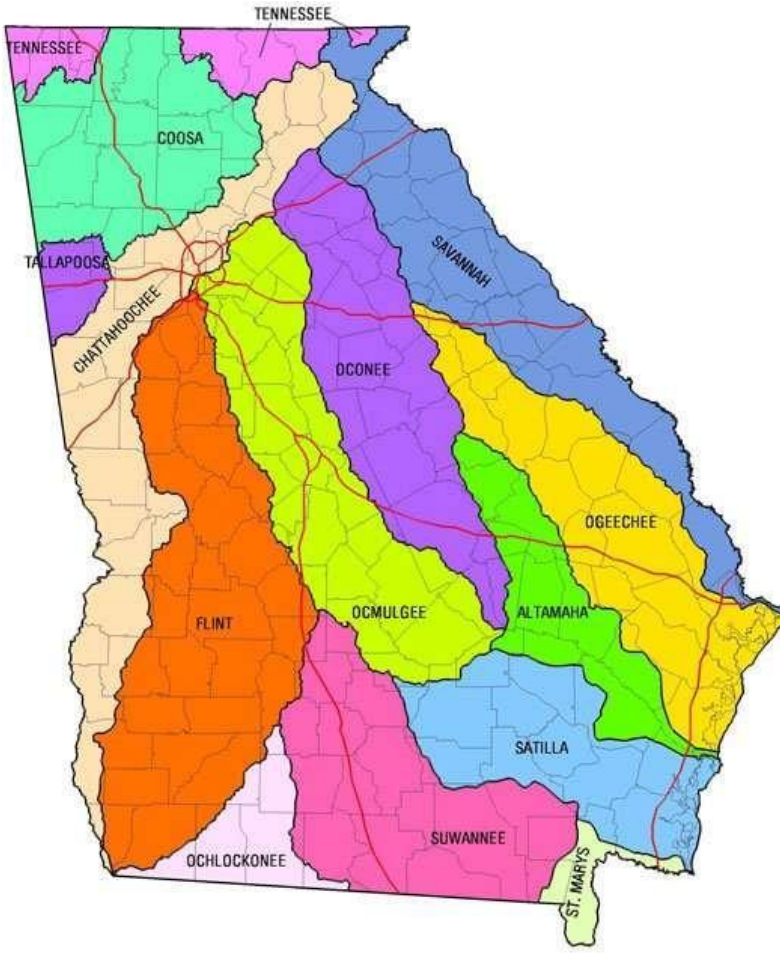
SOUTH CAROLINA STATE WATER FACTS

South Carolina has almost 30,000 miles of stream and they discharge an average of 31 billion gallons of water everyday into the Atlantic Ocean. South Carolina has about 50,000 lakes that impound 15 million acre-feet (4.9 trillion gallons) of water. South Carolina receives an average of about 48 inches of water per year from precipitation. **Groundwater** is important and abundant in the state. About 70% of the state's population gets their drinking water from **surface water** and 30% of the population receives their drinking water from groundwater. The largest groundwater uses in the state are for public water supply and irrigation. The largest surface water use in the state is for hydroelectric power, being that 91% of all the surface water is used for hydroelectric power. South Carolina has **8 major river basins**. South Carolina's environmental regulatory agency is the **Department of Health and Environmental Control, or DHEC.**

Broad
Catawba
Edisto
Pee Dee
Salkehatchie
Saluda
Santee
Savannah

GEORGIA STATE WATER FACTS

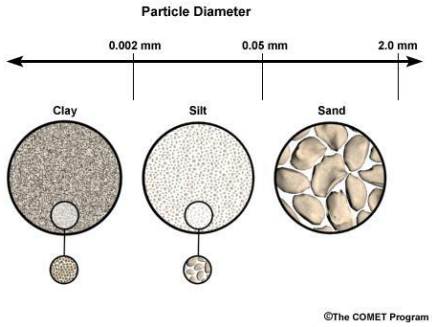
Georgia has 70,150 miles of rivers and streams that wind their way across the state. The U.S. Environmental Protection Agency estimates that Georgia has 44,056 miles of perennial streams, 23,906 miles of intermittent streams, and 603 miles of ditches and canals. Georgia has 4.8 million acres of wetlands, 425,382 acres of public lakes and reservoirs, 854 square miles of estuaries, and 100 miles of coastline. In the state of Georgia, the regulatory environmental agency is the **Environmental Protection Division, or EPD**. Groundwater usage is 22% of the public water supply in the state. About 76% of irrigators use groundwater. Outside of major cities, groundwater is the dominant source of drinking water. Georgia has **14 major river basins**. The Largest Swamp in North America is located in Georgia! The Okefenokee Swamp covers 700 square miles of land and is the largest black-water swamp in North America. Over 6500 years old, the incredible Okefenokee Swamp has been around for a very long time. In 1974, this large swamp became a National Natural Landmark.



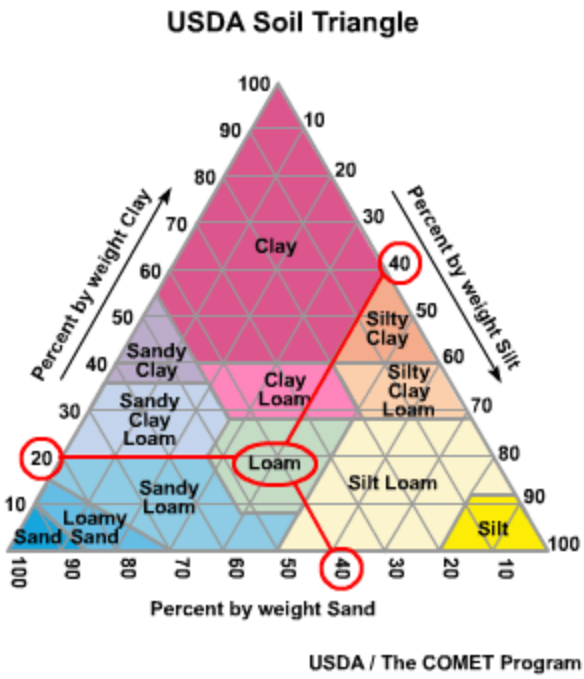
Altamaha
Chattahoochee
Coosa
Flint
Ochlockonee
Ocmulgee
Oconee
Ogeechee
Satilla
Savannah
Suwanee
St. Marys
Tallapoosa
Tennessee

SOILS

Soil covers the Earth's surface. It is composed of minerals, organic matter, living organisms, air, and water. Sand, Silt, and Clay are the mineral particles that make up soil and can range in size.



Clay is the smallest particle and leaves little pore space for air and water. **Silt** is made of medium sized particles that are larger than clay but smaller than sand. **Sand** is the largest particle allowing water to drain and infiltrate quickly because of the large pore space. The term **soil texture** is used to define the proportion or percentage of sand, silt, and clay present in soil. Soil texture is important because it can affect the **water-holding capacity** of soil, the perviousness or permeability of soil, the ability to grow vegetation, and overall drainage. The **United States Department of Agriculture (USDA)** soil triangle is used as a reference tool to classify soil based on the composition of its texture. To classify a soil sample, you find the intersection of the three lines that correspond to the three proportions or percentages. On the chart to the right, all of the percentages will add up to 100%. Begin on the Clay Axis, then the Silt axis, and then the Sand Axis – the soil texture is defined where the 3 lines intersect.



*For example, if you take a soil sample and it is roughly 20% clay, 40% silt, and 40% sand, the soil classification is "Loam". **Loam** contains some of all 3 particle sizes.*

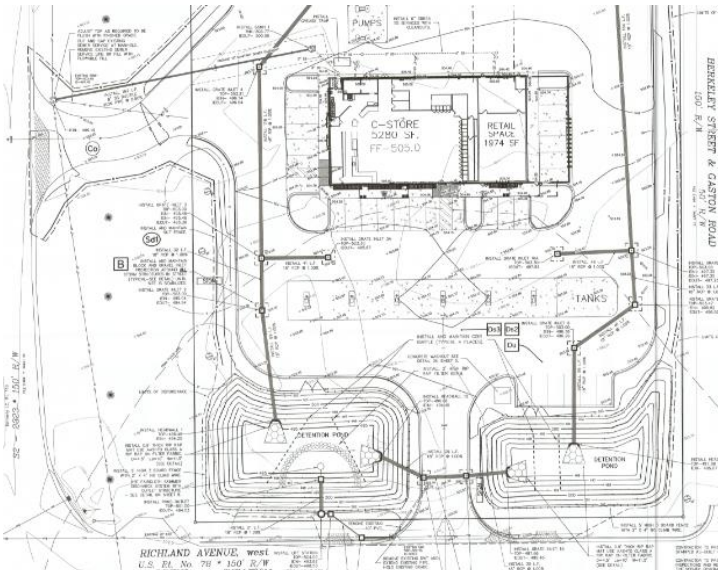
CLAY, SILT, SAND %	SOIL TEXTURE TYPE
40, 20, 40	**Clay Loam**
80, 10, 10	**Clay**
10, 20, 70	**Sandy Loam**

STORMWATER MANAGEMENT

The purpose of stormwater management is to protect people, to protect property, and to protect or enhance the environment. Stormwater management addresses the water **quantity** (amount) and the **quality** (condition) of stormwater during rain events. Development causes an increase in the amount of stormwater runoff and decreases the amount of pervious surfaces that can infiltrate due to land use changes. Engineers, technicians, scientists, stormwater professionals, and local governments work together to manage the effects of stormwater runoff and to prevent pollution. Stormwater management facilities function by collecting and removing stormwater runoff and conveying it away from structures and off roads. See the diagram below.

CONSTRUCTION AND BMPS

What is a BMP? BMP stands for **Best Management Practice**. A best management practice is any acceptable practice that could be put in place to protect water quality by preventing or reducing the amount of pollution coming from nonpoint sources. Before a construction project begins, there are several phases of meetings and planning between developers, builders, contractors, and local government officials. Once there is a good plan in place and a site plan has been approved by the local or state government, building can begin. A **site plan** includes detailed drawings and notes of exactly what is to be built. When a construction site is ready to begin construction, the first step to prepare the land for construction is installing all **sediment and erosion control** BMPs shown on the site plan.



SITE PLAN SHOWING 2 DETENTION

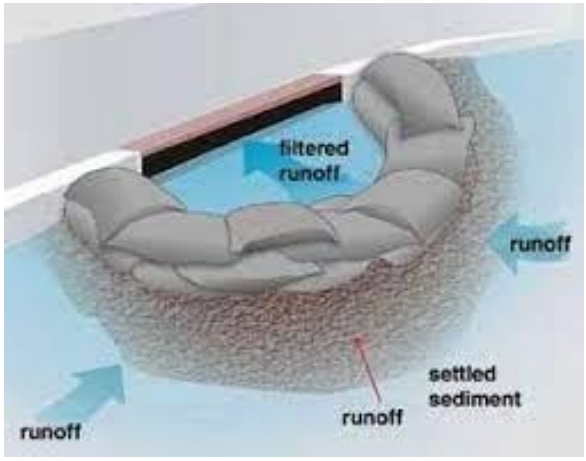
SILT FENCE


SILT FENCE

Silt fence is one of the most widely used BMPs for nonpoint source pollution protection. Silt fence is typically a black/gray in color that is used as a **temporary sediment control device** to protect neighboring property from the impacts of moving sediment from a construction site (pictured left). When installed correctly, silt fence is tucked into the ground at the bottom at least 6" deep with posts that are spaced 6' apart. Depending on the location of a job site and the regulations in the municipality, silt fence posts can be wooden or metal and sometimes the fence is reinforced with wire or mesh backing to give it more strength. To function properly, silt fences require constant monitoring and maintenance. The main purpose of silt fence is not to filter water, but serve as an area where sediment-laden water can pond up. This allows the sediment to fall out, settling at the base of the fence, and separate from the runoff water.

INLET PROTECTION

Inlet protection is another common BMP you may find on a construction site. As the name implies, this BMP provides protection from pollutants in a variety of ways to inlets including storm drains, catch basins, curb inlets, grates, yard inlets, and other drop structures. A stormwater **inlet** is placed at the low point of an area to direct runoff into the storm sewer or other underground drainage system. Inlets can look very different depending on where the inlet is located like on the road versus in a yard or depending on which city you are visiting. A **storm drain** is a common name for an inlet but other names include ones mentioned earlier like catch basins, curb inlets, grate inlets, yard inlets, and other drop structures. The types of inlet protection is just as variable as the types of inlets that can be found on a construction site. The main purpose of **inlet protection** is to prevent sediment and debris from entering storm drains during construction. Inlet protection is usually temporary and will be removed when the construction site is fully stabilized with grass, mulch, and other forms of vegetation. Above is an example of inlet protection around a grate inlet. The gray mounds are bags of rock that act to filter the water before the runoff flows into the drain and into the **storm sewer system**. Inlet protection also requires constant monitoring and maintenance during construction. One common inlet protection, called a silt fence sediment barrier, is just a silt fence that is wrapped around the inlet in the shape of a square and fastened to posts as in the image to the right. In the left photo, there is a grate inlet without any inlet protection. On the right, there is a grate inlet with inlet protection that is damaged on the front side. For this drop inlet protection to function, the entire silt fence needs to be standing upright without holes or gaps in the fence and attached to the posts with heavy duty staples, metal ties, or zip-ties.



NO PROTECTION

SILT FENCE AROUND

INLETS

A **grate inlet** is usually sitting inside a curb, like the photo of the one to the right. Sometimes they are in the middle of the road or a yard like the two shown above, but grate inlets always have a heavy grate with slits in the metal to allow water to flow into the stormwater system.

A **curb inlet** is in the curb line of the road and has a large opening without a grate. These curb inlets can be called wing traps and can take water from one or both directions. The curb inlet shown here is open from two sides and could be called a **double wing trap**.

POST CONSTRUCTION BEST MANAGEMENT PRACTICES

Post construction best management practices (BMP's) are permanent stormwater control structures. A post construction BMP's purpose is to limit the amount of pollutants that could potentially be discharged during a rain event. The methods used to remove pollutants is by 1) filtering stormwater runoff, or 2) by allowing sediment to settle out of the runoff.

RETENTION AND DETENTION PONDS - BUILT TO CLEAN STORMWATER:

In the past, 30 to 40 years ago, ponds were built just to detain/hold water and release it slowly no matter how polluted. Since the stormwater rules were passed, engineers and scientists have learned of ways to use the ponds to clean pollution from stormwater. Now retention and detention ponds, in South Carolina and Georgia and other states across the country, can be required to treat stormwater before it is released. Each pond has features within them that will allow for pollution to filter out of the water. Pollution may settle out of the water by falling to the bottom of the pond. Sometimes plants are specifically placed in retention ponds or wet ponds to filter the pollution prior to the release of the water similar to the way a wetland functions.

Retention ponds also known as wet ponds are meant to hold or retain water permanently at a certain level, called full pool. These ponds help to reduce flooding downstream by using a riser structure to slowly release water when it has surpassed the holding level.

A **detention pond** is similar in function, but is known as a dry pond. They are meant to temporarily hold or detain water for a certain time frame. Typically, detention ponds are built

to slowly release the water over 24 hours. A detention pond uses an orifice or small hole on the outlet structure to slowly release all the water collected in the pond during a rain event.

Newer ponds are not usually perfectly round or oblong; they have meandering features where the water flows around islands of vegetation or over berms that use rock to filter out trash and debris. Sediment is allowed to settle to the bottom before water is discharged out to the streams. These features are proving to work very well in reducing stormwater pollution from new residential subdivisions or large department store developments.

Many communities are trying to find ways to encourage owners of older ponds to retrofit them to treat stormwater like the newer ponds do. It is up to the landowner or business owner to make these upgrades. Most are easy to add, but do require funds and time to upgrade. In the future, it will be important to upgrade as many as possible to prevent stormwater pollution in very developed areas like cities and downtown areas. Learning new ways to do stormwater pond upgrades will be good for students today. It costs money and the business or owner must see an improvement. Many towns offer reduced stormwater fees for these owners as an incentive to save money for upgrading their ponds. When owners learn they can save hundreds of dollars a month, it makes it easier to spend the money to fix the ponds.

GLOSSARY

Best Management Practice:

Clay is a soil that contains a high percentage of fine particles, it becomes sticky when it's wet.

Clean Water Act in 1972 a federal law was passed to regulate and eliminate stormwater pollution mainly focused on large manufacturing companies

Curb Inlet is a drainage inlet composed of a curb opening and a grate inlet.

Detention Pond(s) provide temporary storage of stormwater runoff. They contain an outlet structure that detains runoff and promotes the settlement of pollutants.

Discharge is a flow that refers to a volume of water that is carried through or into a given area.

Double Wing Trap accepts stormwater from both sides and has two openings for inflow.

Environmental Protection Agency (EPA) is a federal agency responsible for the protection of human health and the environment.

Environmental Protection Division (EPD) is a state agency in the Georgia Department of Natural Resources charged with protecting Georgia's air, land, and watersheds.

Erosion is the geological process in which earthen materials are worn away and transported by natural forces like wind or water.

Grate Inlet is a drainage inlet composed of a grate in the roadway section or at the roadside in a low point.

Groundwater is water held underground in the soil or in pores and crevices in rock.

Habitat Degradation is the loss of habitat due to processes of human origin that make habitats less suitable or less available

Impervious Surface is a hard surface that does not let water soak into the ground or greatly reduces the amount of water that soaks into the ground.

Infiltration is the process of water on the ground surface entering the soil.

Inlet Protection is a best management practice designed to intercept or filter sediment, trash, and other pollutants.

Loam is a soil with equal proportions of sand, silt, and clay.

Major River Basin is an area of land where all the surface water drains to a certain river.

National Pollutant Discharge Elimination System (NPDES) is a system that puts permits on discharges from pipes from industrial waste facilities and city wastewater plants to help prevent pollution and keep the waterways throughout the United States fishable and swimmable

Navigable Waters are waters that are now navigable, or have been navigable at any time, or are capable of being rendered navigable by the removal of accidental obstructions, by rafts of lumber or timber or by small pleasure or sport fishing boats.

Nonpoint Source Pollution comes from many different sources such as runoff from land, precipitation, deposits from the atmosphere, drainage, or any other waste water seepage

Pervious surfaces allow water and other liquids to soak in or pass through. Examples include fields, gardens, sand, and forest floors.

Point Source Pollution is a discharge from a single discernible source such as a pipe from a textile mill, wastewater plant, or an oil refinery

Post Construction Best Management Practice are BMPs that exist following construction and are typically permanent.

Retention Pond(s) are also known as wet ponds. They have a permanent pool of water and have enough space to hold stormwater runoff above the permanent pool.

Sand is a soil type that is high in sand and little in clay, they are the largest of the soil particle sizes.

Sedimentation is the process by which eroded material is transported and deposited.

Silt is a granular material between the size of clay and sand particles.

Silt Fence is a temporary sediment control device used on construction sites to protect water quality.

Soil Texture is the relative content of particles of various sizes.

South Carolina Department of Health and Environmental Control (DHEC) is a South Carolina state agency charged with promoting and protecting the health of the public and environment.

Storm Sewer System is a system of drains and pipes that empty untreated stormwater into local creeks, streams, and wetlands.

Stormwater is water from rain, snow of other forms of precipitation that runs off of roads, roofs, sidewalks, parking lots etc.

Stormwater Runoff water that flows over or through the ground to reach an ocean, river, lake or other bodies of water.

Surface water is water that collects on the surface of the ground.

Tract is an area of land.

United States Department of Agriculture (UDSA) is a federal agency responsible for developing, executing, and enforcing federal laws relating to farming, food, rural economic development, and forestry.

Water Quality Act was established in 1987, amendment to the Clean Water Act requiring EPA to develop a program to regulate stormwater discharges under NPDES program

Water-holding Capacity is the ability of a certain soil texture to physically hold water against the force of gravity – it's how much water the soil can hold.

Watershed is an area of land where all flowing surface water converges at a single point.

ADDITIONAL RESOURCES AND SOURCES

South Carolina State Water Assessment: https://dc.statelibrary.sc.gov/handle/10827/11346

South Carolina DHEC Stormwater: https://scdhec.gov/bow/stormwater

Georgia EPD Stormwater: https://epd.georgia.gov/watershed-protection-branch/stormwater

SC Major River Basins: https://www.dnr.sc.gov/geology/esw15/basins3d.html

GA Major River Basins: https://www.georgiaencyclopedia.org/articles/geography-environment/river-basins/

EPA Stormwater: https://www.epa.gov/npdes/npdes-stormwater-program

USDA: https://www.usda.gov/

Clemson Extension Water Resources: https://www.clemson.edu/extension/water/

UGA Water Resources: https://site.extension.uga.edu/water/