

# Storm Drain Collector Lesson Plan

## Grades 9-12

### NC Curriculum Standards for Earth and Environmental Science:

EEn.2.4.2 Evaluate human influences on water quality in North Carolina's river basins, wetlands and tidal environments.

- Analyze non-point source pollution and effects on water quality (sedimentation, stormwater runoff, naturally and human induced occurrences of arsenic in groundwater).

### Connections to AP and Environmental Science Topics:

- **Unit 1:** The living World: Ecosystems- the water cycle
- **Unit 4:** Earth Systems and Resources- watersheds
- **Unit 5:** Land and water use- impacts of urbanization, methods to reduce urban runoff
- **Unit 8:** Aquatic and Terrestrial Pollution: Sources of pollution, human impacts on ecosystems
- **Science practices:**
  - Visual representation- students collect data from storm drains to visualize and analyze the human constructed systems that manage stormwater runoff

### Objectives:

- Students are introduced to the wide-ranging applications of GIS to various fields of study and how it relates to class topics and potential career fields
- Students can define stormwater and are familiar with the basics of stormwater infrastructure
- Students investigate the stormwater infrastructure system in their school parking lot in order to draw connections to how urbanization impacts stormwater quality and quantity
- Students familiarize themselves with a data collection process modeled after the methods used by stormwater professionals

### Materials:

- [Survey 123 link](#)
- One per group of 3 students:
  - phone with GPS capability
  - tape measure
  - compass
  - flashlight

- worksheet and pencil
- traffic vests (optional)

### **Lesson Prep:**

- post this QR code to the survey so that students can access it:



The survey can also be accessed with the following link:

<https://arcg.is/1vWf1T>

- have students bring their phones/ tablets to class
- scope out the school parking lot and surrounding streets prior to the lesson to get a sense of where the class should go. Try to pick a part of the parking lot or street with a high density of storm drains so students can be grouped together

### **Optional intro lesson (20 minutes):**

- Introductions and announcements
- Has anyone ever heard of GIS? GIS stands for global information system. Who has ever played Pokémon Go or used google maps to navigate somewhere? Then you've used GIS. GIS has wide-ranging applications, from helping model crop yields and future food demands, to urban planning, to showing which areas of a state or region are most vulnerable to natural disasters.

### **Engage (3 minutes):**

- Watch [this video](#) about how a high school student in L.A. used GIS in a school project to map prison vs. education spending by state in the U.S

### **Explore/ Explain (15 minutes):**

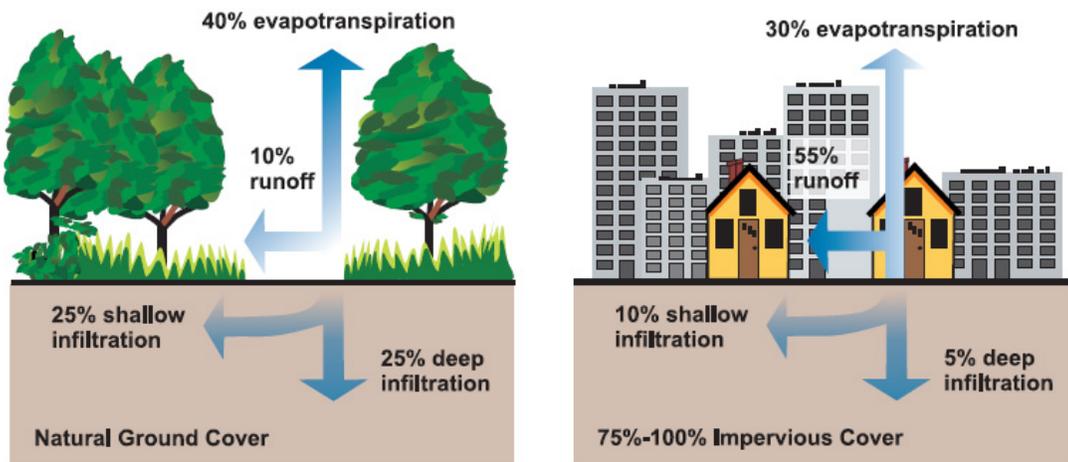
- Have students explore the ESRI "What is GIS?" [webpage](#). Guiding Questions:
  - The "what is GIS" section outlines several ways GIS can be used to communicate data, analyze issues and visualize trends/ impacts. Identify one specific example from the webpage and explain how/why GIS is being used in the example.
  - In the "who uses GIS?" section, select an area that you are interested in for a future career. Explore the webpage to better understand how this field uses GIS technology.

- o How could GIS answer a question you have, help solve an issue you care about, or help you better understand a topic you are interested in?

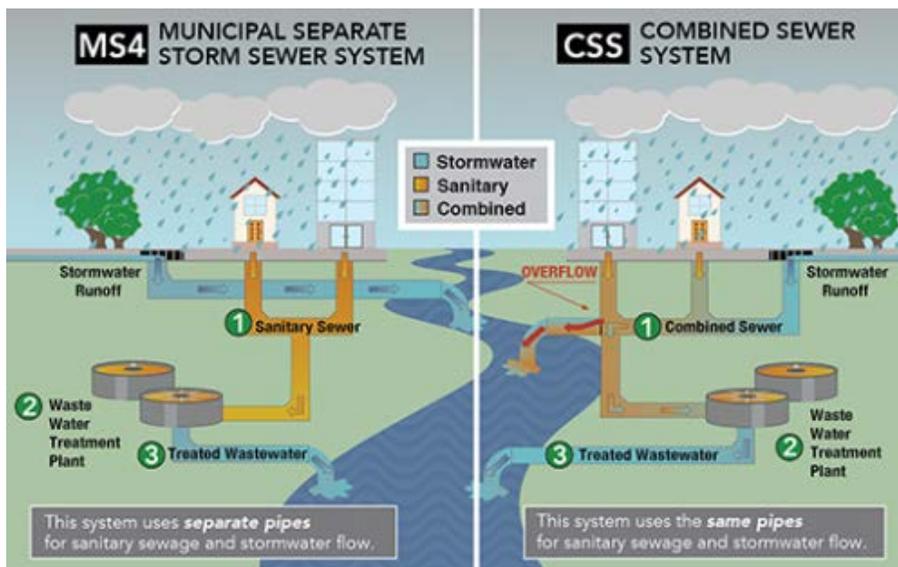
**Storm Drain Lesson Overview:**

**Stormwater Background Information**

- **What is stormwater runoff?** Stormwater runoff is rainfall that flows over the ground surface. It is created when rain falls on impervious surfaces that do not allow water to soak into the ground.
- The infographic below shows the **relationship between urbanization and stormwater runoff**. As the amount of impervious surface increases, the amount of stormwater runoff increases and the amount of infiltration decreases.



- There are two main types of sewer systems: separate and combined, as illustrated by the infographic below:



**North Carolina has a separate storm sewer system.** Unlike wastewater from homes and buildings, **stormwater runs straight from storm drain pipes to local waterways.** There are a few specific differences between the two systems:

- **Pollution:** In a separate system, stormwater picks up pollutants like motor oil, litter, car soaps, and yard waste which travel directly to creeks and streams. In a combined system, polluted stormwater is treated with wastewater from homes and buildings at a wastewater treatment plant before being piped to waterways.
- **Large rain events:** in a separate system, stormwater is piped down storm drains and into creeks and streams, which can cause localized or downstream flooding. In a combined system, large rain events can overload the wastewater treatment plant, activating the overflow system. When this happens stormwater and raw sewage can be diverted directly into creeks and streams.

**The number one stormwater pollutant in NC is sediment** from construction sites, disturbed soil, and erosion. Sediment can fill up/ block storm drains which increases potential for flooding, clog fish gills, prevent natural vegetation from growing, and alter the flow and depth of the water.

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## **Explain/ Elaborate- Storm Drain Data Collection Lesson**

### **Introduction**

- Start with a basic overview of stormwater and stormwater infrastructure (*can use powerpoint in the google folder if desired*)
- show [this](#) example of mapping a stormwater drainage system (ArcGIS, Clarkstown, New York) to introduce stormwater infrastructure, mapping, and GIS connections
  - **Show the infographic at the top of the webpage.** Ask the students what kind of stormwater system we have in North Carolina: separate or combined? The answer is **separate** (more info about this in the above section).
  - **Group discussion:** What kinds of issues can stormwater cause- how is it related to flooding, water quality, pollution, human behavior? What were the benefits of Clarkston transitioning to a GIS database to track storm drain infrastructure?
- Transition into storm drain survey activity
- Have everyone access the storm drain survey with QR code/link above and project it at the front of the class. Run through each field to explain what the students will be doing, making sure they remember that the **MOST** important piece of data to collect is their location, otherwise the data won't populate on the map
- break students into groups of 3-4 with the following roles:

- **data entry specialist:** this person needs a phone or tablet to access the survey 123 link. They will be filling out the survey fields. *Make sure this person pulls up the survey before heading outside.*
- **scribe:** this person has the worksheet to record pipe numbers and flow and help determine type of catch basin/ pipe material. Make sure they have something to write on and something to write with.
- **orienteer/ measurer:** this is the person with the compass, flashlight and tape measure. They measure the catch basin depth, grate length and width, and direction of flow. *You may have to show the orienteer how to use a compass. "put red in the shed" to find north!*
- **Have a safety talk** with the students including the following:
  - Stay on the sidewalk as much as possible
  - The data entry specialist is in charge of making sure there are no cars in the vicinity when the orienteer is looking down the storm drain
  - Make sure all personal items are secure before leaning over into the storm drain- only bring items you will need for the lesson
  - Do not stick the flashlight or anything else down the storm drain, except for the tape measure. Make sure you have a good grip on the tape measure before lowering it down.
  - The data entry specialist should never lean over the storm drain with their phone.
- Head outside with the groups and **assign them to storm drains** as you approach. Make sure all adult supervision is equally spread out between groups in case students need help
- **Have students use the survey link and the equipment to collect storm drain data** in designated area (20-30 minutes, students will probably have time to collect data on no more than 4 storm drains)
- If possible, **begin or end the lesson by visiting the pipe/ retention pond, etc. where all the parking lot stormwater drains** so students can better visualize the system. This can be found via google maps or by asking campus facilities staff.

**Evaluate ( 5-10 minutes):**

- Show data collected on the map using [this link](#)
- Return to classroom for lesson reflection. Discuss the following:
  - What went well? What was difficult?
  - How could the data collection process be improved in the future?
  - Who might benefit from this data? Why might it be important to collect?