**Watershed Investigation**

**Day 1 – Lesson Plan – Rainwater Assessment**

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| **NGSS Dimensions:**  |
| Disciplinary Core Idea:  |
| * ESS3: Earth and Human Activity
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| Sub-Idea:  |
| * ESS3.C: Human Impacts on Earth Systems
	+ HS1: The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
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| Crosscutting Concept:  |
| * CCC4: Systems and system models: Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.
	+ HS2: When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.
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| Science and Engineering Practice:  |
| * SEP1: Asking questions (for science) and defining problems (for engineering)
	+ HS1: Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
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| **Lesson Overview:** |
| Students trace the flow of rainwater on school grounds.  |
| **Lesson Objective(s):**  |
| Students will determine what happens to rain that falls on the school grounds by making observations and mapping the water flow. |
| Essential Questions: |
| * Where does rainwater go?
* What does rainwater carry with it?
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| Materials: |
| * student worksheet: *Where does rainwater go?*
* stopwatches or smart phones
* water
* 150 mL containers (does not need to be exactly 150 mL, just needs to be a consistent amount of water)
* storm water collection device (being designed, built, or purchased through Blue Water Baltimore)
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| **Warm Up:** |
| * Where does our drinking water come from? [It is fine if students don’t know the answer, but they should formalize their current thinking/best guess.]
	+ Possible student answers: water from rain and snow is collected in Liberty Reservoir, Loch Raven Reservoir, and Prettyboy Reservoir, sent to a water filtration plant, and then pumped to homes, schools, and businesses. <http://cityservices.baltimorecity.gov/dpw/waterwastewater02/waterquality4.html>
* Name three places where rainwater goes when rain falls on the school grounds.
	+ Possible student answers: grass, parking lot, school building, storm drain…
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| **Engagement:** Describe how you will capture students’ interest.  |
| * Students should be asked: What is a Watershed? Allow students to answer the question to the best of their knowledge. Permit student to express what they know through words and through sketches. Use some of the sketchs for discussion and transition into the Paper Watershed Activity. Maintain these sketches for revisiting at the conclusion of the lesson.
* Have students [Create a Paper Watershed](https://cityschools2013.sharepoint.com/sites/curriculum/science/high/biology/unit7/watershed/_layouts/15/guestaccess.aspx?guestaccesstoken=dmojMF9qoWmQq4xApkx1nK4OjogQuL1MKoqEus3B%2fCI%3d&docid=1f7bd6ff6caa7495dac8ed6249feb2d19&rev=1) in order to model its characterisitics and create explanations for phenomenon such as stormwater runoff, erosion, and etc. Video tutorial for teacher use only is at <https://www.youtube.com/watch?feature=youtu.be&v=7rdmzlSFGYM&app=desktop>
* Video from the [Waterfront Partnership of Baltimore](http://baltimorewaterfront.com/)
	+ *Introduction to Stormwater Runoff Pollution* (4:08): <https://www.youtube.com/watch?v=J3WOVSwIWn8>
* Video from the [Chesapeake Bay Partnership](http://www.chesapeakebay.net/)
	+ *Bay 101: Stormwater Runoff* (1:25): <https://www.youtube.com/watch?v=BwH2IhU-9gc>
* Video from [WBAL](http://www.wbaltv.com/)

*Baltimore City testing screens on storm drains to keep waterways clean* (1:53): <http://www.wbaltv.com/news/baltimore-city-testing-screens-on-storm-drains-to-keep-waterways-clean/38934852> |
| **Exploration:** |
| * Prior to the lesson, the teacher makes or creates a map of the school yard.
	+ [Google Maps](https://www.google.com/maps) or [Google Earth](https://www.google.com/earth/) can be used to create a map of the school yard.
* Students lookup definitions of pervious, impervious, and watershed.
	+ Real dictionaries or an online dictionary such as [Merriam-Webster](http://www.merriam-webster.com) may be used.
* Students go to various sites to trace the path of rainwater that falls on school grounds.
	+ Look for evidence for the path of rainwater
		- Pouring water on the ground can help determine the direction of water flow.
		- If students think they know where the water from a storm gain goes they can drop kernels of popped popcorn (biodegradable) into the storm drain and see where they come out.

Prior to the lesson the teacher can choose to setup a scavenger hunt with pieces of paper or a photo scavenger hunt with cell phones, where each team takes pictures of key features (like downspouts or storm drains). |
| **Explanation:** Describe how students will make sense of their exploration.  |
| * Students calculate the area of the entire school yard, the pervious surfaces, and the impervious surfaces.
	+ Students can draw rectangles (or other geometric shapes) and calculate areas in square centimeters.
* Students can then add up all the areas and calculate percentages.
* Students describe the path of rainwater from school grounds to the Chesapeake Bay.
* Map of Baltimore Area Watersheds created by [Bluewater Baltimore](http://www.bluewaterbaltimore.org/): <https://maps.google.com/maps/ms?msa=0&msid=205229076690976185213.0004c1a8438c9370a2c76&ie=UTF8&t=m&ll=39.336422,-76.620026&spn=0.254917,0.439453&z=11&source=embed&dg=feature>
 |
| **Elaboration:** Describe how students will develop a more sophisticated understanding. |
| * What does the rainwater carry with it?
	+ Students look around the school yard to gather evidence to answer the question,
		- Sites to examine: dumpsters, storm drains, curbs, plantings (fertilizers & weed killers)
	+ Where does the trash come from?
		- Do you know anybody who litters? Have you said anything to them?
	+ Where does the trash go?
		- Trash Wheel on the Jones Falls: <http://baltimorewaterfront.com/healthy-harbor/water-wheel/>
		- How does litter affect the organisms that live in the bay?
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| **Evaluation:** Describe how students will demonstrate that they have achieved the lesson objective(s). |
| * Teacher circulates from group to group, asking questions and answering questions.
* Pose the “What is a Watershed?” question to the students allowing them to use the rainwater paths that they drew on their maps, and the evidence they collected to justify them. The most important thing to look for is that the evidence supports the claims and that there is an improved conceptual understanding of a Watersheds.
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| **Homework:** Describe how students will reinforce past learning and/or prepare for future learning. |
| * Reading from the [Baltimore Sun](http://www.baltimoresun.com), make 5 annotations per page and be ready to discuss tomorrow.
	+ *Maryland's storm-water pollution efforts faulted* (759 words): <http://www.baltimoresun.com/features/green/blog/bal-marylands-stormwater-pollution-efforts-faulted-by-environmentalists-epa-20140711-story.html>
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