**Watershed Investigation**

**Day 3 – Lesson Plan – Measuring Local Water Quality**

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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
	+ 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:  |
| * SEP3: Planning and carrying out investigations
	+ HS2: Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
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| **Lesson Overview:** |
| Students walk to a local water collection spot, make observations, and take water quality measurements.  |
| **Lesson Objective(s):** |
| Students will make observations and take water quality measurements of dissolved oxygen, pH, conductivity, turbidity, and nitrates in order to calculate the water quality. |
| Essential Questions: |
| * How does our neighborhood affect the water quality of the Chesapeake Bay watershed?
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| Materials: |
| * Water Access Map <http://tiny.cc/bcpss-map>
	+ Google map from Blue Water Baltimore that shows the nearest water access points and storm drains for all Baltimore City high schools
* Storm drain water collection device for schools that are not within walking distance of a local waterway
* Directions for deploying water collection device:
	+ See <http://tiny.cc/bcpss-instructions> OR on the link above see “CLICK HERE FOR MORE INFO”
	+ Have to wait for rain
* Containers for water samples (1 per group of 3 students)
	+ buckets, bottles, even beakers (preferably plastic)
* Vernier LabQuest (1 of either type of interface per group of 3 students)
	+ [LabQuest 2](http://www.vernier.com/products/interfaces/labq2/) (no computer required)
	+ [LabQuest Mini](http://www.vernier.com/products/interfaces/lq-mini/) & a computer with [LoggerPro](http://www.baltimorecityschools.org/Page/30076) installed
* Vernier sensors (1 of each type of sensor per group of 3 students)
	+ [optical dissolved oxygen sensor](http://www.vernier.com/products/sensors/dissolved-oxygen-probes/odo-bta/)
	+ [pH sensor](http://www.vernier.com/products/sensors/ph-sensors/ph-bta/)
	+ [conductivity sensor](http://www.vernier.com/products/sensors/conductivity-probes/con-bta/)
	+ [turbidity sensor](http://www.vernier.com/products/sensors/trb-bta/)
	+ [temperature sensor](http://www.vernier.com/products/sensors/temperature-sensors/go-temp/) (optional)
* LaMotte [nitrate nitrogen test kit](http://www.lamotte.com/en/drinking-water/individual-test-kits/3354-01.html) (1 per group of 3 students)
* Stopwatches or equivalent (1 per group of 3 students)
* Handouts of *Measuring Local Water Quality* (based on experiment #4 from [*Investigating Environmental Science through Inquiry*](http://www.vernier.com/products/books/esi/)) See on SharePoint:
	+ *Day 3\_Activity\_Measuring Local Water Quality.doc*

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| **Warm Up:** |
| * What is the highest possible water quality index?
* What was the highest water quality index that you measured and where was it from?
* What was the lowest water quality index that you measured and where was it from?
* What do you expect the water quality to be in a nearby stream or storm drain?
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| **Engagement:** Describe how you will capture students’ interest.  |
| * Walk to the nearest local water collection location – either a stream or after a rain event to a storm drain with a collection device installed.
* Collect water in containers to take back to the school.
* Make observations of the conditions of the streams and any factors that may be affecting it.
* Walk back to the school
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| **Exploration:** Describe what hands-on/minds-on activities students will be doing. |
| * Students measure the water quality of the water samples, lookup weighted Q-values, and calculate the water quality index (WQI).
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| **Explanation:** Describe how students will make sense of their exploration.  |
| * Students compare the quality of the local waterway to the samples they measured during the previous lesson.
* Lab groups discuss what their measurements mean.
	+ The teacher circulates, listening in and interjecting questions.
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| **Elaboration:** Describe how students will develop a more sophisticated understanding. |
| * Brainstorm possible causes for problems measured in the local waterway.
* Add to and refine a list of questions to investigate further.
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| **Evaluation:** Describe how students will demonstrate that they have achieved the lesson objective(s). |
| * Students compare the quality of the water in the local waterway to the samples they measured during the previous lesson.
* The teacher continuously circulates and observes student groups.
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| **Homework:** Describe how students will reinforce past learning and/or prepare for future learning. |
| * Complete the questions from the *Measuring Local Water Quality* handout including:
	+ What do you see as the primary factor negatively impacting the quality of the water that you measured? Make a claim, cite evidence, and explain your reasoning.
	+ What water related question are you going to research next?
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