



High School Virtual Stormwater Management Curriculum

Day 1: Human Impact on Watersheds

- Pre-Test: Baseline of what students know about stormwater management prior to the first lesson
 - Pre-test document: see attached curriculum lessons folder
- Watershed Demonstration using 3-D EnviroScape Model
 - This recorded presentation will teach students:
 - 1) what a watershed is
 - 2) the difference between point source and non-point source pollution
 - 3) the various types of non-point source pollutants flowing into rivers and streams
 - https://drive.google.com/file/d/1Wf6Zo-aYRb4pA_cOP1fR0IqUh2WVsUd4/view?usp=sharing

Day 2: Human Impact on Watersheds

- Using materials found in their homes, students will create their own watershed model 1) to observe how rain and snowfall become runoff in urban and suburban environments and 2) to reinforce student understanding that stormwater also picks up pollution and causes erosion as it moves through human dominated landscapes.
 - Homemade Watershed Model Lab Directions: see attached curriculum lessons folder
 - Homemade Watershed Model Questions for Review: see attached curriculum lessons folder

Day 3: Introduction to Stormwater Pollution and Green Infrastructure

- "Stormwater Pollution and Green Infrastructure Solutions" Video
 - In this video produced by the Nassau County Soil and Water Conservation District and the New York State Department of Environmental Conservation, students will learn what stormwater runoff is and how we can effectively manage it using nature-based stormwater solutions.
 - "Stormwater Pollution and Green Infrastructure Solutions" Worksheet: see attached curriculum lessons folder
 - <https://www.youtube.com/watch?v=ATNy-vaIPXI>
- Introduction to Different Green Infrastructure Project Options
 - Students will complete the following worksheet to learn about the pros and cons of different green infrastructure stormwater management strategies.
 - Direct students to begin their green infrastructure performance evaluation using the EPA's website (<https://www.epa.gov/green-infrastructure/performance-green-infrastructure>) and the Center for Neighborhood Technology's Value of Green Infrastructure guidebook (https://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf)
 - Pros and Cons of Different Green Infrastructure Project Options Worksheet: see attached curriculum lessons folder

- Model My Watershed Site Storm Model
 - Stroud Water Research Center interactive model created to show the effects that different stormwater best management practices can have on water infiltration and runoff rates.
 - <https://modelmywatershed.org/>
 - Questions about the model? See attached Model My Watershed Training Manual

Day 4: Runoff and Storage Calculations

- Runoff calculations
 - Students will calculate the runoff coming off of their driveways during a 1inch storm event, allowing them to visualize the significant volume of runoff generated during each rainfall event.
 - Runoff calculator student worksheet: see attached curriculum lessons folder
- Porous Paver Reservoir Volume Calculation
 - In direct contrast with the previous activity, students will now determine the number of gallons of stormwater being stored and slowly infiltrated into the soil beneath a porous pavement surface.
 - Porous Pavement Reservoir Volume Worksheet: see attached curriculum lessons folder

Day 5: Home Stormwater Inventory

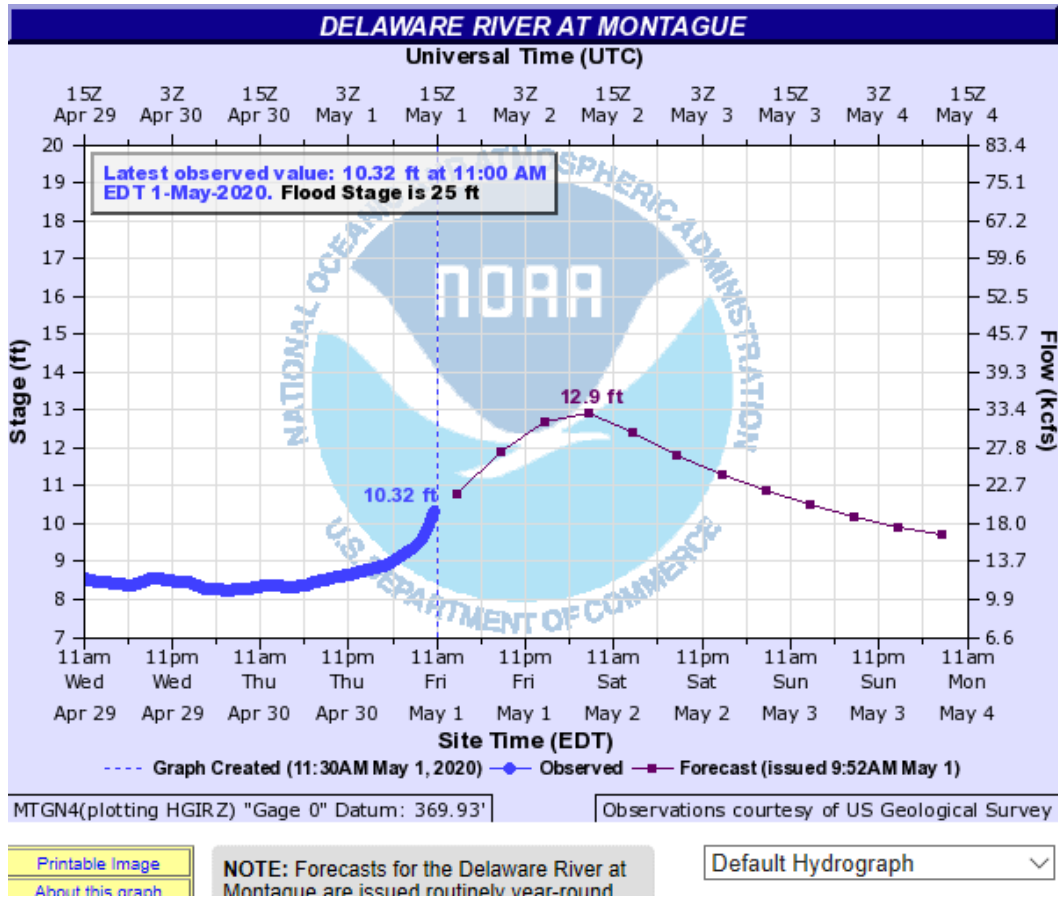
- Site inventory of their homes
 - Students will observe the conditions around their homes and create a map of the specific features of their properties that would affect stormwater runoff.
 - Students should make note of where the water is currently flowing, the location of trees and other types of vegetation, areas with shade and sunlight, wildlife habitat, any hills or changes in elevation, impervious surfaces (driveways, decks, pavers, rooftops), and the location of their gutters and downspouts.
 - How-to Directional Video for Yard Site Inventory:
<https://drive.google.com/file/d/1yGbTCRFP7v9dtnsTiPkj3Y4x1yBYxo80/view?usp=sharing>
 - Sample Yard Site Inventory: see attached curriculum lessons folder
- Backyard Analysis
 - Using the provided list of possible green infrastructure project options and the home inventory diagram that they just completed, students will brainstorm stormwater management projects that can reduce stormwater runoff at their homes.
 - Have students either update their home inventory map or create a new sketch to identify where their projects would be installed.

Day 6: Effect of Soil Class on Runoff

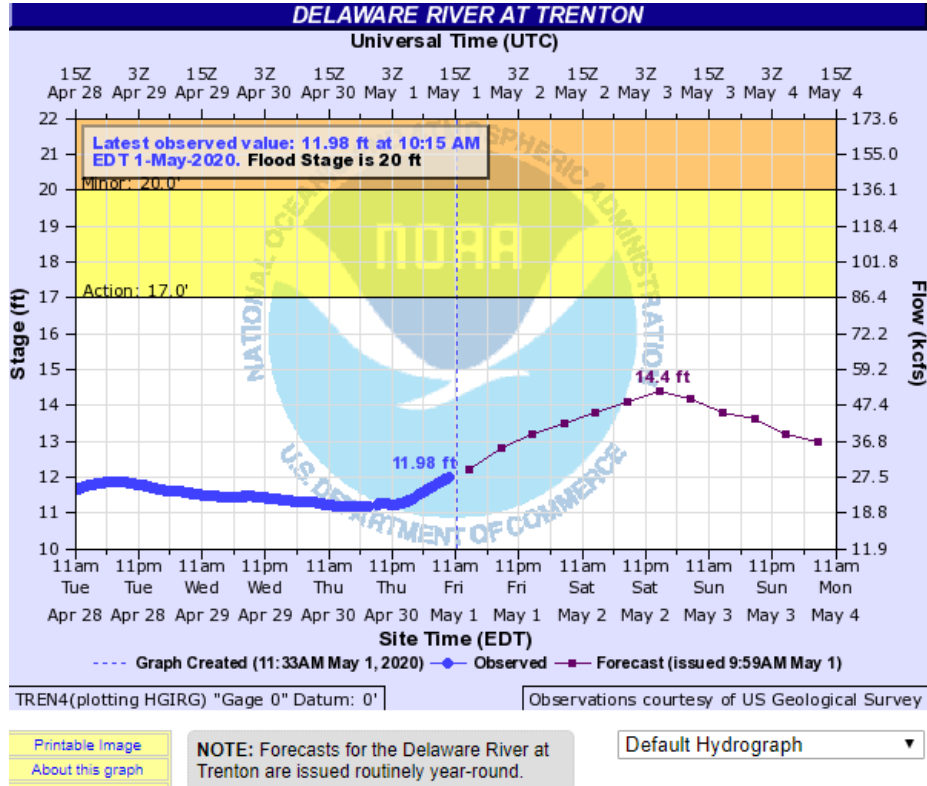
- Soil testing: allows students to see the multi-faceted levels of planning that are necessary when planning stormwater management projects
 - Step 1: Use the Natural Resources Conservation Service guide to soil texture chart to learn how to classify soil by texture in your yard:
 - https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311
 - Step 2: Soil Percolation Test
 - Used to see if a rain garden will infiltrate water in your yard
 - Soil Percolation Test Directions (from Rutgers Rain Garden Manual): see attached curriculum lessons folder

Day 7: Hydrograph Analysis

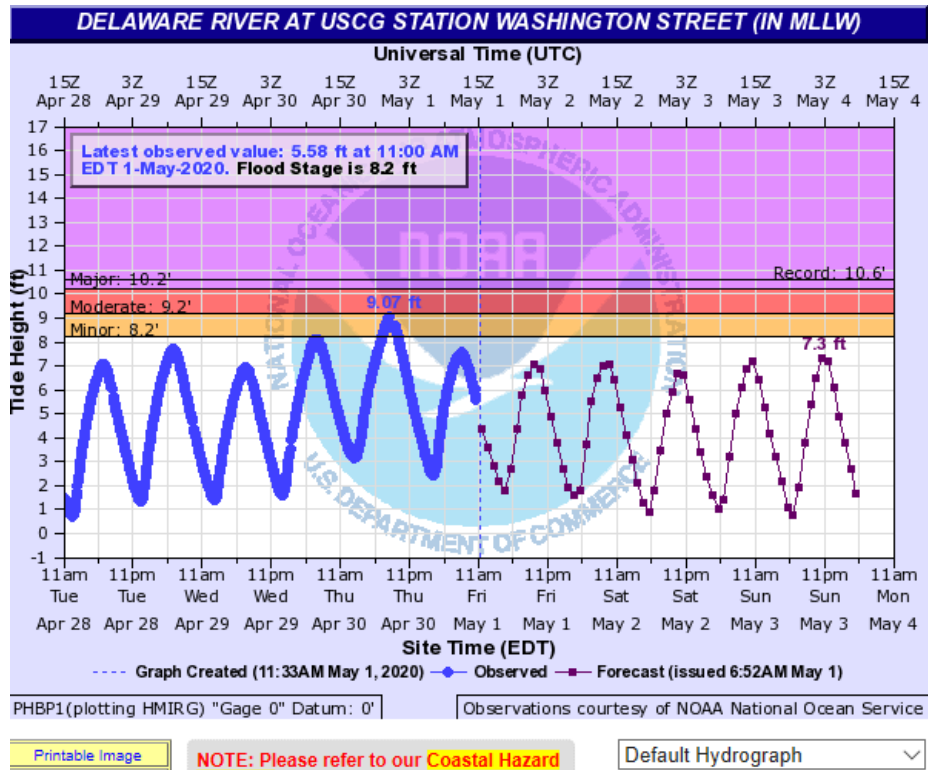
- Students will learn about the effects of stormwater runoff on stream health by examining hydrographs to show how runoff volumes differ depending upon the land use/land cover, soil type, and topography of a watershed.
 - Students will compare three hydrographs of the Delaware River in real time and make observations about how the hydrographs are different. Then, using the graphs, they will hypothesize what watershed characteristics account for a graph displaying rapid peak discharge after a storm versus a graph with a long lag time between the start of the rainfall event and the watershed's peak discharge.
 - Factors to consider in the analysis are:
 1. presence of vegetation/trees
 2. percentage of paved, impervious surfaces
 3. slope of the landscape
 4. soil type
 5. level of current soil saturation
 - This activity will be most effective if completed during or soon after a rainfall event so students can observe the drastic discharge differences among the three watersheds.
 - As an alternative to this activity, have students compare hydrographs in different regions of the U.S. <https://water.weather.gov/ahps/>
 - Hydrograph 1: Delaware River at Montague (Sussex County, NJ)
<https://water.weather.gov/ahps2/hydrograph.php?wfo=bgm&gage=mtgn4>



- Hydrograph 2: Delaware River at Trenton, NJ
<https://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=tren4>



- Hydrograph 3: Delaware River between Philadelphia, PA and Camden, NJ
<https://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=phbp1>



Day 8: Using Plants to Manage Stormwater- NJ Natives and Invasives

- Present information about the differences between native and invasive plants using the Jersey-Friendly Plant Database
 - <https://www.jerseyyards.org/plant/>
- Have students make a poster about a specific invasive plant and virtually share with the class.
 - Japanese barberry sample poster: see attached curriculum lessons folder
 - Have students use these websites to create their posters:
 - <https://www.jerseyyards.org/jersey-friendly-plants/invasive-plants/>
 - <https://www.fohvos.info/invasive-species-strike-team/fact-sheets/>

Day 9: Rain Garden Design and Cost Estimates

- Rain Garden Design/Plant Layout
 - Learn how plants are placed in a rain garden by level of dryness
 - Students will design their own rain gardens using native plants
 - http://water.rutgers.edu/Rain_Gardens/RGWebsite/misc/7_Appendix_52-68.pdf
 - Begin at page 9 of Rutgers rain garden manual to see appropriate plants to install in each zone of the garden
 - Sample rain garden design: see attached curriculum lessons folder
 - <http://www.stormwater.allianceforthebay.org/yard-design>
 - This link runs through the specifics of rain garden installation for your yard.
- Calculate cost of rain garden installation, including plants, mulch, and excavation with a rototiller.
 - Compare rain garden costs to traditional gray infrastructure costs.
 - Which is more expensive and why?
 - Have students brainstorm different mechanisms to bring down rain garden costs even further.
 - Examples: beginning a community-wide program so homeowners can save money on plant delivery and excavator rental costs, seek grant money to help pay for rain garden projects, partnering with local organizations for in-kind donations, etc.

Day 10: Design Your Own Green Infrastructure Project

- Green Infrastructure Design Challenge
 - Students will work in small groups to propose stormwater management solutions for the provided images. To do this activity in a virtual setting, students can work individually and then either share their solutions with the class electronically or through a live, virtual classroom update.
 - Proposed green infrastructure solutions should take into account the project's cost, effectiveness, and ability to meet the needs of people and animals.
 - Green infrastructure design challenge lesson plan: see attached curriculum lessons folder
 - Green infrastructure design challenge images
- Post-test: Repeat the same assessment from the beginning of the unit so students can demonstrate how much they learned.
 - Post-test document: see attached curriculum lessons folder