



Schoolyard Hydro-Ecology Teachers' Handbook

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with contributions from
 Parks and People Foundation
 Living Classrooms Foundation
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- Institute of Ecosystem Studies (The Mary Flagler Cary Charitable Trust)
- Parks and People Foundation
- Living Classrooms Foundation

Key Collaborators

The original impetus for this Handbook was a 2003 grant award from the Chesapeake Bay Trust to the Parks and People Foundation and the Living Classrooms Foundation with collaboration from the Baltimore Ecosystem Study. Each of these organizations has a unique and complementary role to play in helping teachers and students learn in their schoolyards as they also work together on meaningful restoration projects.

The **Baltimore Ecosystem Study (BES)**, funded by the National Science Foundation, is a long term study of Baltimore as an ecological system. The program brings together researchers from the biological, physical, and social sciences to collect new data and synthesize existing information on how both the ecological and engineered systems of Baltimore work. Many of our participating scientists study hydrology in Baltimore. Education is an integral part of BES; with professional development work with teachers a priority! BES will continue to create curriculum materials which will bring BES data and science education approaches into the classroom. (For more information visit: www.beslter.org)

The **Parks and People Foundation (PPF)** is dedicated to improving the quality of life in Baltimore's neighborhoods. Its vision of a healthy environment where people live, work, learn and play, includes a focus on the schoolyard; as a place to learn and a landscape that can have a positive impact on reducing storm water runoff. PPF has several programs that work with teachers and schools; from sports to after-school ecology education, from tree plantings to a community grants program that can help schools create gardens. (For more information visit: www.parksandpeople.org)

The **Living Classrooms Foundation (LCF)** is committed to providing hands-on education and job skills training for students from diverse backgrounds. By using a "Learning by Doing" philosophy, many LCF programs combine environmental education with community revitalization. LCF's schoolyard greening programs are an excellent example of this model. (For more information visit: www.livingclassrooms.org) .

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CURRICULUM LINKS

Voluntary State Curriculum - Indicators and Objectives – Grade 7

Content Standard	Indicator Statement	Rationale
<p>ENVIRONMENTAL SCIENCE: Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.</p>	<p>Flow of Matter and Energy: Recognize and explain how matter is transformed between the physical environment and organisms</p>	<ol style="list-style-type: none"> 1. Students will learn through this unit how interconnected the water they drink is with the rain that hits the land, and the water in the Chesapeake Bay. 2. From a slightly different perspective, through the concept of runoff, students will learn how the trash they dump on the ground can impact the overall health of the environment (when it ends up in storm sewers, etc).
	<p>Interdependence of Organisms: Recognize and describe how biotic and abiotic factors influence an environment</p>	<ol style="list-style-type: none"> 1. Students often do not understand exactly what the impact of something as simple as a rainstorm has on their environment. By looking at the bigger picture (factoring in runoff, flash-flooding, etc) they will learn that natural events that may not have such an impact in a less urban, impervious-surface covered setting can have a large impact in the city.
	<p>Natural Resources and Human Needs: Recognize and compare how different parts of the world have varying amounts and types of natural resources and how the use of those resources impacts environmental quality</p>	<ol style="list-style-type: none"> 1. Natural processes are impacted by human changes such as development and construction. Watershed 263 is covered fairly exclusively by impervious surfaces, which influences the flow of water in the immediate area. By changing the environment to fit human needs, we have an impact on the overall quality of our environment.

	<p>Environmental Issues: Recognize and explain that human-caused changes have consequences for the immediate environment as well as for other places and future times.</p>	<ol style="list-style-type: none"> 1. Issues that may seem to be "local" can impact other places. For example, the fertilizers used in agriculture out in the county have a significant impact on the overall level of nitrogen in the water that runs into the Chesapeake Bay. Also, the trash that students dump on the ground may travel via runoff into a storm sewer and further degrade the quality of our water. 2. Students need to be able to analyze decisions and actions taking place in one area and demonstrate that they may have consequences for others in different areas.
<p>LIFE SCIENCE: The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time.</p>	<p>Ecology: Identify and describe factors that influence the size and stability of populations and ecosystems.</p>	<ol style="list-style-type: none"> 1. Students will learn that a city develops an infrastructure to deliver and dispose of water in order to support an increasing number of people in the area over time. Even with this infrastructure, there are only so many people that an area can effectively support without having an overall negative influence on the environment. 2. The environment can be impacted by human activities, such as resource acquisition and land use, land use decisions (agriculture, mining and development), recycling, and waste disposal. This unit shows students how the changes to the landscape in Baltimore in order to support human needs have impacted the greater watershed.

<p>EARTH/SPACE SCIENCE: Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe over time.</p>	<p>Materials and Processes that Shape a Planet: Identify and describe that some changes in Earth's surface occur rapidly while other changes occur very slowly.</p>	<ol style="list-style-type: none"> 1. While not stressed in the unit, the re-routing of the path of water can cause changes to the surface of the land, be it by flash-flooding or gradual erosion of surfaces.
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VSC Indicators and Objectives – Grade 7

Content Standard	Indicator Statement	Rationale
ENVIRONMENTAL SCIENCE: Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.	Natural Resources and Human Needs: Recognize explain the impact of a changing human population on the use of natural resources and on environmental quality	2. Natural processes are impacted by human changes such as development and construction. Watershed 263 is covered fairly exclusively by impervious surfaces, which influences the flow of water in the immediate area. By changing the environment to fit human needs, we have an impact on the overall quality of our environment.
	Environmental Issues: Recognize and explain that environmental changes can have local, regional, and global consequences	2. Students will realize by looking at the watershed as an example that the choices people make about how to shape their environment can have a much larger-scale impact than just changing their own way of life.
LIFE SCIENCE: The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time.	Biochemistry: Recognize and describe that food, water, and air provide substances needed to build and maintain cells and perform life functions.	1. This is a stretch, but some classes may want to tie this into water-quality testing, and look at how nitrogen content of the water (as well as presence of potentially harmful bacteria, etc) can impact the organisms that live near it, drink it, and grow in it.
EARTH/SPACE SCIENCE: Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe over time.	Materials and Processes that Shape a Planet: Recognize and explain that physical weathering, chemical weathering, and erosion cause changes to Earth materials.	3. In a city setting where most surfaces are impervious, the areas of pervious surfaces can easily be washed away when runoff picks up speed and erodes areas. Moving water can transport materials on Earth's surface to other locations. 4. The concentration of impervious surfaces itself creates a greater potential for flash-flooding in the event of a significant rainstorm, or even something as simple as a pipe-burst.

VSC Indicators and Objectives – Grade 8

Content Standard	Indicator Statement	Rationale
<p>ENVIRONMENTAL SCIENCE: Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.</p>	<p>Environmental Issues: Recognize and explain how human activities can accelerate or magnify many naturally occurring changes.</p>	<ol style="list-style-type: none"> 1. Students will learn the impact of flash-flooding, erosion, sedimentation in watersheds, and other natural processes impact the world around them. This is particularly interesting to look at in a non-natural setting such as a city, and realize that the same natural processes still take place, but on a different level. 2. Students will learn to describe how human activities produce changes in natural processes, such as climate change (acquisition, use, and distribution of energy resources), development (erosion, habitat destruction and fragmentation, and deforestation), extinction (habitat destruction and introduction of new nonnative species) and cycling of matter (waste disposal practices). The changing of water pathways that take place as cities develop alter the natural processes such as the water cycle, for example.
<p>EARTH/SPACE SCIENCE: Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe over time.</p>	<p>Interactions of Hydrosphere and atmosphere: Describe the properties and structure of the hydrosphere and atmosphere</p>	<ol style="list-style-type: none"> 5. Students will describe Recognize and describe the circulation of Earth's water through surface water, ground water, oceans, and atmosphere (water cycle). 6. Students will learn to describe and (in some cases) construct tools to collect data about precipitation, evaporation, soil moisture content, and runoff.

Benchmarks for Science Literacy

(American Association for the Advancement of Science)

Benchmark 4B grades 6-8 # 7

The cycling of water in and out of the atmosphere plays an important role in determining climatic patterns. Water evaporates from the surface of the earth, rises and cools, condenses into rain or snow, and falls again to the surface. The water falling on land collects in rivers and lakes, soil, and porous layers of rock, and much of it flows back into the ocean.

4B 6-8 #8:

Fresh water, limited in supply, is essential for life and also for most industrial processes. Rivers, lakes, and groundwater can be depleted or polluted, becoming unavailable or unsuitable for life.

4B 6-8 #11

The benefits of the earth's resources - such as fresh water, air, soil, and trees - can be reduced by using them wastefully or by deliberately or inadvertently destroying them. The atmosphere and the oceans have a limited capacity to absorb wastes and recycle materials naturally. Cleaning up polluted air, water, or soil or restoring depleted soil, forests, or fishing grounds can be very difficult and costly.