DISTRICT OF COLUMBIA
PUBLIC SCHOOLS

High School Environmental Science Scope and Sequence for the

NEXT GENERATION SCIENCE STANDARDS

1200 First Street, NE | Washington, DC 20002 | T 202.442.5885 | F 202.442.5026 | www.dcps.dc.gov

A Guide to Reading the DCPS Science Scope and Sequence

In response to the adoption of the Next Generation Science Standards (NGSS)[1] by the State Board of Education in December 2013, the District of Columbia Public Schools (DCPS) Office of Teaching and Learning convened a group of science teachers – the STEM Master Teacher Corps – to develop a new scope and sequence (SAS) for science for grades K-12. The inaugural STEM Master Teacher Corps consisted of the following dedicated educators:

- Gloria Allen – Hardy Middle School
- Erica Banks – Cardozo Education Campus
- Sydney Bergman – School Without Walls High School
- Jessica Buono – DCPS Office of Teaching and Learning
- Megan Fisk – Eastern High School
- Rabiah Harris – Kelly Miller Middle School
- Trilby Hillenbrand – Jefferson Middle School Academy
- Leslie Maddox – Wilson High School
- Amanda Oberski – Ludlow-Taylor Elementary School
- Lola Odukoya – Langdon Education Campus
- Ericka Senegar-Mitchell – McKinley Technology High School
- Stephen Sholtas – Brookland Education Campus
- Molly Smith – Cardozo Education Campus
- Angelique Sykes – Dunbar High School

The principal goal was to reorganize the complex NGSS architecture into instructional units that would make the most sense to teachers.

All scope and sequences begin with a **Grade Level/Course overview** that summarizes what students will learn for the year, followed by a **"School Year at a Glance"** that summarizes the order of the units and a suggested timeline for their implementation. All SAS assume a full year of science for a minimum of 225 minutes per week for all grade levels.

[1] A full copy of the NGSS can be downloaded from the NGSS website at http://www.nextgenscience.org.

1200 First Street, NE | Washington, DC 20002 | T 202.442.5885 | F 202.442.5026 | www.dcps.dc.gov

Following the grade level/course overview and year at a glance, each unit is broken out into several sections beginning with the **Disciplinary Core Ideas (DCIs)** and **Crosscutting Concepts** (**"What to Teach"**) and the **Science and Engineering Practices** (**"What Students Do"**) for that unit. This was done to emphasize that the Science and Engineering Practices are the way that students experience the content so that they think, speak, act, and write the way scientists and engineers do. Teachers should also refer to Appendix F of the NGSS to learn more about how these practices are articulated across grade levels.

Student Performance Expectations follow the Disciplinary Core Ideas, Crosscutting Concepts, and Science and Engineering Practices section of the unit breakdown. Student performance expectations provide a brief explanation of what students who demonstrate understanding of the content are able to do.

Links to the **Common Core State Standards (CCSS) for ELA/Literacy and Mathematics** (including the Standards for Mathematical Practice) are included in every unit breakdown to emphasize the connections between CCSS and the NGSS so that teachers can more readily identify entry points for integration of science across subject areas. Teachers should also refer to the full NGSS document for additional connections to other DCIs and for information about articulation of DCIs across grade levels.

Finally, connections to the ***former* DC Science Standards** are included with every unit to serve as an unofficial crosswalk between the NGSS and the former standards. Teachers should be advised that inclusion of these standards does not imply that they are exactly parallel to the NGSS, but rather are related in some way to the Disciplinary Core Ideas, Crosscutting Concepts, and/or Science and Engineering Practices that make up the NGSS Performance Expectation(s) for that unit. More importantly, teachers should know that inclusion of the former standards is not intended for the purpose of continuing to teach with these standards, but rather so that teachers can more readily see how the content in the NGSS differs from that of the former standards.

A list of resources to help teachers plan to teach each unit of the scope and sequence are available in the **digital version** of this document, located on the **Elementary and Secondary Science Educators Pages of the DCPS Educator Portal**[2]. Be sure to check the Educator Portal frequently for subsequent updates to this document.

For more information about the NGSS, please contact James Rountree, Science Curriculum Specialist (e-mail: james.rountree@dc.gov, phone: 202-442-4643).

[2] To access the Educator Portal, visit http://www.educatorportalplus.com.

High School Environmental Science
Overview and Scope and Sequence SY14-15

Course Overview: Central to the study of this course is an examination of the mechanics and the health of the Chesapeake Bay watershed. Students choose a target problem and then gather as much evidence as possible about the cause and its likely effects. They compare environments across the planet and evaluate their capacity to sustain changes introduced by human populations and their consumption, waste, and distribution of limited resources. They examine data and interpretations for global warming, evaluate the various kinds of fuel available for consumption, and assess the sustainability of using some fuels over others. Utilizing all that they have learned, students evaluate and design programs that seek to create a balance between resource consumption and the sustainable health of the ecosystems involved.

School Year At a Glance

Advisory	Units	Timeline
Advisory 1	Ecosystems: Interactions, Energy and Dynamics	9 weeks
Advisory 2	Earth's Systems	9 weeks
Advisory 3	Earth and Human Activity	9 weeks
Advisory 4	Chesapeake Bay and Anacostia Watershed Analysis	9 weeks

Advisory 1

<table>
<tr><th colspan="3">Unit 1: Ecosystems: Interactions, Energy, and Dynamics</th></tr>
<tr><th colspan="2">What to Teach</th><th>What Students Do</th></tr>
<tr><th>Disciplinary Core Ideas</th><th>Crosscutting Concepts</th><th>Science & Engineering Practices</th></tr>
<tr>
<td>LS2.A: Interdependent Relationships in Ecosystems
Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1, HS-LS2-2)
LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)
Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy</td>
<td>Cause and Effect
Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8)
Scale, Proportion, and Quantity
The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)
Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)
Systems and System Models
Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS2-5)
Energy and Matter
Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS2-4)
Energy drives the cycling of matter within and between systems. (HS-</td>
<td>Developing and Using Models
Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5)
Using Mathematics and Computational Thinking
Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1)
Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2)
Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4)
Constructing Explanations and Designing Solutions
Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the</td>
</tr>
</table>

1200 First Street, NE | Washington, DC 20002 | T 202.442.5885 | F 202.442.5026 | www.dcps.dc.gov

Unit 1: Ecosystems: Interactions, Energy, and Dynamics		
in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4) • Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e.,	LS2-3) **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6, HS-LS2-7)	future. (HS-LS2-3) • Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7) **Engaging in Argument from Evidence** • Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6) • Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. (HS-LS2-8) **Asking Questions and Defining Problems** • Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1) - ***Connections to Nature of Science*** **Scientific Knowledge is Open to Revision in Light of New Evidence** • Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2), (HS-LS2-3) • Scientific argumentation is a mode of

Unit 1: Ecosystems: Interactions, Energy, and Dynamics		
the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2, HS-LS2-6) • Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7) **LS2.D: Social Interactions and Group Behavior** • Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8) **LS4.D: Biodiversity and Humans** • Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(Secondary to HS-LS2-7)* • Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation,		logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation. (HS-LS2-6), (HS-LS2-8)

1200 First Street, NE | Washington, DC 20002 | T 202.442.5885 | F 202.442.5026 | www.dcps.dc.gov

Unit 1: Ecosystems: Interactions, Energy, and Dynamics		
habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. *(Secondary to HS-LS2-7) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)* **PS3.D: Energy in Chemical Processes** • The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. *(Secondary to HS-LS2-5)* **ETS1.B: Developing Possible Solutions** • When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. *(Secondary to HS-LS2-7)* **ETS1.A: Defining and Delimiting Engineering Problems** • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk		

1200 First Street, NE | Washington, DC 20002 | T 202.442.5885 | F 202.442.5026 | www.dcps.dc.gov

Unit 1: Ecosystems: Interactions, Energy, and Dynamics		
mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) • Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)		

What to Assess:
Student Performance Expectations

Students who demonstrate understanding can:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [*Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.*]

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [*Assessment Boundary: Assessment is limited to provided data.*]

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [*Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.*]

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through

Unit 1: Ecosystems: Interactions, Energy, and Dynamics	
ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [*Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.*] **HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.** [Clarification Statement: Examples of models could include simulations and mathematical models.] [*Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.*] **HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.** [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.] **HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*** [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.] **HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.** [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.] **HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.**	
Integrated Common Core State Standards	
For ELA/Literacy **RST.9-10.8** Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8) **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-1), (HS-LS2-2), (HS-LS2-3), (HS-LS2-6), (HS-LS2-8) **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8) **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions	**For Mathematics** **MP.2** Reason abstractly and quantitatively. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4), (HS-LS2-6), (HS-LS2-7) **MP.4** Model with mathematics. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4) **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4), (HS-LS2-7) **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4), (HS-LS2-7) **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1), (HS-LS2-2), (HS-

Unit 1: Ecosystems: Interactions, Energy, and Dynamics	
in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8) **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-1), (HS-LS2-2), (HS-LS2-3) **WHST.9-12.5** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3) **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)	LS2-4), (HS-LS2-7) **HSS-ID.A.1** Represent data with plots on the real number line. (HS-LS2-6) **HSS-IC.A.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6) **HSS-IC.B.6** Evaluate reports based on data. (HS-LS2-6)
Connections to *Former* DC Science Standards	
Populations: E.4.1-4 **Ecosystems:** E.3.1-13	

1200 First Street, NE | Washington, DC 20002 | T 202.442.5885 | F 202.442.5026 | www.dcps.dc.gov

Advisory 2

Unit 2: Earth's Systems		
What to Teach		**What Students Do**
Disciplinary Core Ideas	**Crosscutting Concepts**	**Science & Engineering Practices**
ESS1.B: Earth and the Solar System • Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. *(Secondary to HS-ESS2-4)* **ESS2.A: Earth Materials and Systems** • Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-1, HS-ESS2-2) • Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS2-4) **Energy and Matter** • The total amount of energy and matter in closed systems is conserved. (HS-ESS2-6) • Energy drives the cycling of matter within and between systems. (HS-ESS2-3) **Structure and Function** • The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5) **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS2-7) • Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are	**Developing and Using Models** • Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-1, HS-ESS2-3, HS-ESS2-6) • Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4) **Planning and Carrying Out Investigations** • 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. (HS-ESS2-5) **Analyzing and Interpreting Data** • Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-ESS2-2) **Engaging in Argument from Evidence** • Construct an oral and written argument or counter-arguments

Unit 2: Earth's Systems		
the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. (HS-ESS2-3) • The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. (HS-ESS2-3) • Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor	irreversible. (HS-ESS2-1) • Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS2-2) - ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS2-3) **Influence of Engineering, Technology, and Science on Society and the Natural World** • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)	based on data and evidence. (HS-ESS2-7) - ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based on empirical evidence. (HS-ESS2-3) • Science disciplines share common rules of evidence used to evaluate explanations about natural systems. (HS-ESS2-3) • Science includes the process of coordinating patterns of evidence with current theory. (HS-ESS2-3) • Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS2-4)

Unit 2: Earth's Systems		
features and for the distribution of most rocks and minerals within Earth's crust. (HS-ESS2-1) **ESS2.C: The Roles of Water in Earth's Surface Processes** • The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5) **ESS2.D: Weather and Climate** • The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-2, HS-ESS2-4) • Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6, HS-ESS2-7)		

Unit 2: Earth's Systems		
• Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6, HS-ESS2-4) **ESS2.E Biogeology** • The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it. (HS-ESS2-7) **ETS1.B: Developing Possible Solutions** • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)		

What to Assess:
Student Performance Expectations

Students who demonstrate understanding can:

HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. [Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [*Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.*]

HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the

Unit 2: Earth's Systems
wetland extent.] **HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.** [Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.] **HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.** [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [*Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.*] **HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.** [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.] **HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.** [Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples of include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.] [*Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.*] **HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.**

Integrated Common Core State Standards	
For ELA/Literacy	**For Mathematics**
RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS2-2), (HS-ESS2-3) **RST.11-12.2** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in	**MP.2** Reason abstractly and quantitatively. (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6) **MP.4** Model with mathematics. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6) **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units

Unit 2: Earth's Systems	
a text by paraphrasing them in simpler but still accurate terms. (HS-ESS2-2) **WHST.9-12.1** Write arguments focused on discipline-specific content. (HS-ESS2-7) **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-ESS2-5) **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4)	consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6) **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6) **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6)
Connections to *Former* DC Science Standards	
Environmental Systems: E.2.1-4 **Energy in the Earth System:** E.7.1-6	

Advisory 3

<table>
<tr><th colspan="3">Unit 3: Earth and Human Activity</th></tr>
<tr><th colspan="2">What to Teach</th><th>What Students Do</th></tr>
<tr><th>Disciplinary Core Ideas</th><th>Crosscutting Concepts</th><th>Science & Engineering Practices</th></tr>
<tr>
<td>ESS2.D: Weather and Climate
Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (Secondary to HS-ESS3-6)
ESS3.A: Natural Resources
Resource availability has guided the development of human society. (HS-ESS3-1)
All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2)
ESS3.B: Natural Hazards
Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of</td>
<td>Cause and Effect
Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1)
Systems and System Models
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. (HS-ESS3-6)
Stability and Change
Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3, HS-ESS3-5)
Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)
- -
Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World
Modern civilization depends on</td>
<td>Analyzing and Interpreting Data
Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)
Using Mathematics and Computational Thinking
Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)
Constructing Explanations and Designing Solutions
Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)
Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past</td>
</tr>
</table>

Unit 3: Earth and Human Activity		
human populations and have driven human migrations. (HS-ESS3-1) **ESS3.C: Human Impacts on Earth Systems** • The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3) • Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4) **ESS3.D: Global Climate Change** • Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5) • Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6) **ETS1.B: Developing Possible Solutions** • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and	major technological systems. (HS-ESS3-1, HS-ESS3-3) • Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-2, HS-ESS3-4) • New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3) • Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2) • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1, HS-ETS1-3) - ***Connections to Nature of Science*** **Science is a Human Endeavor** • Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3) **Science Addresses Questions About the Natural and Material World** • Science and technology may raise ethical issues for which science, by	and will continue to do so in the future. (HS-ESS3-1) • Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4) **Engaging in Argument from Evidence** • Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2) - ***Connections to Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5) • New technologies advance scientific knowledge. (HS-ESS3-5) **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based on empirical evidence. (HS-ESS3-5) • Science arguments are strengthened

Unit 3: Earth and Human Activity		
to consider social, cultural, and environmental impacts. *(Secondary to HS-ESS3-2), (Secondary HS-ESS3-4)* **ETS1.A: Defining and Delimiting Engineering Problems** • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) • Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)	itself, does not provide answers and solutions. (HS-ESS3-2) • Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2) • Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2)	by multiple lines of evidence supporting a single explanation. (HS-ESS3-5)

What to Assess:
Student Performance Expectations

Students who demonstrate understanding can:

HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit

Unit 3: Earth and Human Activity
ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.] **HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [*Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*] **HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).] **HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.** [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [*Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.*] **HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [*Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.*] **HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.**

Integrated Common Core State Standards	
For ELA/Literacy **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-4), (HS-ESS3-5)	**For Mathematics** **MP.2** Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6) **MP.4** Model with mathematics. (HS-ESS3-3), (HS-ESS3-6) **HSN.Q.A.1** Use units as a way to understand problems and to guide

Unit 3: Earth and Human Activity	
RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5) **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5) **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-ESS3-4) **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)	the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6) **HSN.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6) **HSN.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)
Connections to *Former* DC Science Standards	
Natural Resources: E.5.1-8 **Environmental Quality:** E.8.1-7 **Populations:** E.4.5-6	

Advisory 4

Unit 4: Chesapeake Bay and Anacostia Watershed Analysis		
What to Teach		**What Students Do**
Disciplinary Core Ideas	**Crosscutting Concepts**	**Science & Engineering Practices**
LS2.B: Cycles of Matter and Energy Transfer in Ecosystems • Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3) • Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • Moreover, anthropogenic changes	**Energy and Matter** • Energy drives the cycling of matter within and between systems. (HS-LS2-3) **Systems and System Models** • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions – including energy, matter, and information flows – within and between systems at different scales. (HS-ETS1-4) **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. (HS- LS2-7) **Structure and Function** • The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5) - ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and**	**Constructing Explanations and Designing Solutions** • Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2) • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS2-3) **Planning and Carrying Out Investigations** • 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

Unit 4: Chesapeake Bay and Anacostia Watershed Analysis		
(induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7) **LS4.D: Biodiversity and Humans** • Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(Secondary to HS- LS2-7)* • Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. *(Secondary to HS-LS2-7)* **ESS2.C: The Roles of Water in Earth's Surface Processes** • The abundance of liquid water on Earth's surface and its unique	**Technology on Society and the Natural World** • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS-1) (HS-ETS1-3)	accordingly. (HS-ESS2-5) **Using Mathematics and Computational Thinking** • Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4) - ***Connections to Nature of Science*** **Scientific Knowledge is Open to Revision in Light of New Evidence** • Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or interpretation of existing evidence. (HS-LS2-3)

Unit 4: Chesapeake Bay and Anacostia Watershed Analysis		
combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5) **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2) **ETS1.B: Developing Possible Solutions** • When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. *(Secondary to HS-LS2-7)*		

What to Assess:
Student Performance Expectations

Students who demonstrate understanding can:

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [*Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.*]

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of

<table>
<tr><th colspan="2">Unit 4: Chesapeake Bay and Anacostia Watershed Analysis</th></tr>
<tr><td colspan="2">energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</td></tr>
<tr><th colspan="2">Integrated Common Core State Standards</th></tr>
<tr><td>For ELA/Literacy
RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-3)
WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-3)
WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3)
WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self---generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-ESS2-5) (HS-LS2-7)</td><td>For Mathematics
MP.2 Reason abstractly and quantitatively. (HS-LS2-4), (HS-LS2-7)
MP.4 Model with mathematics. (HS-LS2-4)
HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi---step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-4), (HS-LS2-7)
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-4), (HS-LS2-7)
HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4), (HS-LS2-7), (HS-ESS2-5)</td></tr>
</table>

Unit 4: Chesapeake Bay and Anacostia Watershed Analysis
Connections to *Former* DC Science Standards
Watersheds and Wetlands: E.6.6-13 **Ecosystems:** E.3.1, E.3.6 **Environmental Systems:** E.2.1

1200 First Street, NE | Washington, DC 20002 | T 202.442.5885 | F 202.442.5026 | www.dcps.dc.gov