# Unit 7: Environmental Engineering

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 4**
Length: **15 days**
Status: **Published**

## Summary


**Introduction:**

Students will explore why New Jersey has a zero-runoff requirement. Students will study the impacts of excessive water runoff and causes. They will develop plans for a rain garden in CAD for a proposed house. Student plans will be based on information garnered from a design manual from Rutgers University.

**Revision Date:** July 2020


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| SCI.HS-ESS3 | Earth and Human Activity |
| SCI.HS-ESS3-4 | Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems. |
| | 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). |
| SCI.HS-ETS1 | Engineering Design |
| SCI.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. |
| SCI.HS.ETS1.B | Developing Possible Solutions |
| | Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. |
| CS.9-12.ED | Engineering Design |
| CRP.K-12.CRP1 | Act as a responsible and contributing citizen and employee. |
| CRP.K-12.CRP1.1 | Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good. |
| CRP.K-12.CRP2 | Apply appropriate academic and technical skills. |

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| CRP.K-12.CRP2.1 | Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation. |
| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP4.1 | Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome. |
| CRP.K-12.CRP6 | Demonstrate creativity and innovation. |
| CRP.K-12.CRP6.1 | Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization. |
| CRP.K-12.CRP8 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP8.1 | Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others. |
| CRP.K-12.CRP11 | Use technology to enhance productivity. |
| CRP.K-12.CRP11.1 | Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks. |
| SCI.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. |
| SCI.HS-ESS3-4 | Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. |
| SCI.HS-ESS3 | Earth and Human Activity |
| WRK.9.2.12.CAP | Career Awareness and Planning |
| TECH.8.1.12 | Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. |
| TECH.8.1.12.A | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations. |
| TECH.8.2.12 | Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. |

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| TECH.8.2.12.A | The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live. |
| TECH.8.2.12.A.1 | Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation. |
| TECH.8.2.12.A.2 | Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste. |
| TECH.8.2.12.A.CS1 | The characteristics and scope of technology. |
| TECH.8.2.12.A.CS2 | The core concepts of technology. |
| TECH.8.2.12.B.4 | Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants. |
| TECH.8.2.12.B.CS4 | The influence of technology on history. |
| TECH.8.2.12.C | Design: The design process is a systematic approach to solving problems. |
| TECH.8.2.12.C.1 | Explain how open source technologies follow the design process. |
| TECH.8.2.12.D | Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems. |
| TECH.8.2.12.D.1 | Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review. |
| TECH.8.2.12.D.CS1 | Apply the design process. |
| TECH.8.2.12.D.CS2 | Use and maintain technological products and systems. |
| TECH.9.4.12.CI | Creativity and Innovation |
| TECH.9.4.12.CT | Critical Thinking and Problem-solving |
| TECH.9.4.12.DC | Digital Citizenship |
| TECH.9.4.12.TL | Technology Literacy |
| | There are strategies to improve one's professional value and marketability. |
| | Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints. |
| | Securing an income involve an understanding of the costs and time in preparing for a career field, interview and negotiation skills, job searches, resume development, prior experience, and vesting and retirement plans. |
| | Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization. |

## Essential Questions/Enduring Understandings

### Essential Questions:

What is environmental engineering?

What factors have driven the development of environmental engineering?

How does climate change effect environmental engineering?

**Enduring Understandings:**

Environmental engineering falls into one of three categories-an engineering discipline by itself, a specialty within chemical engineering or a specialty within civil engineering.

Environmental engineering problems are large scale and generally relate to air and  water.

## Objectives

**Students Will Know:**

environmental engineers with a chemical engineering concentration tend focus environmental problems with air.

environmental engineers with a civil engineering concentration tend to focus on problems relating to water.

environmental engineers are involved with remediation of problems like air and water pollution.

impact assessments are performed when projects may affect the environment.

vocabulary and terms: zero-runoff, contour line, drainage, rain garden, slope, grade, elevation, EPA (Environmental Protection Agency), pollution, hydrology, sanitation engineer, environmental impact study, conservation, acid rain, ozone, green house effect, global warming, climate change, waste management, and vocabulary that is project specific.

**Students Will Be Skilled At:**

Designing a rain garden.

Using a technical manual to follow a procedure.

Making a technical drawing.

## Learning Plan

Preview the essential questions and connect to learning throughout the unit.

Formative assessments will be conducted throughout the process using class discussion, student writing and practice quizzes.

Formative assessments will be conducted to determine knowledge of computers, robotics and mechanical engineering.

Lectures and lessons will be provided to develop understanding of environmental engineering.

Invite and connect with local experts on the topic to provide lectures.

Plan field trips to the Rahway river for students to make on-site observations.

Formative assessments will be conducted throughout the design process.

Suggested problem or project based learning activity: the design of a rain garden for a house in New Jersey to meet zero-runoff statutory requirements. Students will use primary sources for design requirements, make their design in CAD. Students will provide computations.

Summative assessments will be conducted throughout to evaluate skills acquisition.

Design logs will be maintained to document the application of the design loop.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem.

Complete unit test and/or quiz.

Complete writing prompt.

## Assessment

**Formative Assessment:**

participation in discsussions on environmental engeineering

teacher feedback on rain garden designs

exit tickets

proper use of vocabulary as it relates to environmental engineering

**Summative evaluation**:

perform a problem based learning activity: the design of a rain garden for a house in New Jersey. Solutions to meet the requirements of a rubric.

complete writing prompts: "As the Rahway River travels through many towns, building has had a significant impact on its vitality, this includes:…strategies for remediation include…."

answer the essential questions.

**Alternate Assessment:**

Presentation on original rain garden design

**Benchmark evaluation**:

Final exam.

## Materials

AutoCAD and CAD LAB

Teacher e-board. The e-board contains descriptions and research information about the first surgeries in the series.

Students will use WEB 2.0 applications like Google Docs to collaborate on projects.

Email and e-board

Web sites

SmartBoard use for teacher presentation and interactive lessons

SmartBoard use for student presentations.

## Integrated Accommodation and Modifications...

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education and those with 504s