Sea Level Rise Impacts

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YESS Youth Exploring Sea level rise Science

Green Infrastructure Planning for Your School Community

Grade levels: 9-12
Duration: 170 minutes

This lesson plan developed by Flows To Bay, the San Mateo Countywide Water Pollution Prevention Program, aims to teach students about stormwater, water quality, and one of the means of managing stormwater as a resource in their own communities and school campuses—through the use of green infrastructure.

Objectives:

Students will be able to:

- Describe the problem of stormwater runoff
- Identify opportunities to capture, store, route, filter and/or harvest and reuse stormwater
- Observe key areas on their school campus which can benefit from green infrastructure
- Propose and design a green infrastructure plan for their school

Key Concepts

Global Climate Change

Natural Hazards

Weather and Climate

Skills

Designing solutions

Evaluating information

Planning and carrying out investigations

Background:

The National Climate Assessment released on November 23, 2018[1] found that climate change is affecting the natural environment, water resources, and human health and welfare across the U.S. This includes sea level rise and heavier downpours, which can lead to more local flooding events.

A flood is defined as any high flow, overflow, or inundation by water that causes or threatens damage.[1] Floods are caused or amplified by both weather- and human-related factors. Major weather factors include heavy or prolonged precipitation and debris jams. Human factors include structural failures of dams and levees, altered drainage, and urbanization. **Urbanization** creates large areas of **impervious** surfaces (such as roads, pavement, parking lots, and buildings) that increase immediate **stormwater runoff**. In the United States, floods caused 4,586 deaths from 1959 to 2005 while property and crop damage averaged nearly 8 billion dollars per year over 1981 through 2011.[1] The risks from future floods are significant, given expanded development in coastal areas and floodplains, unabated urbanization, land-use changes, and human-induced climate change.

Part of the solution to building communities that are safe, sustainable, and resilient to sea level rise and other precipitation-based impacts of climate change means transforming rainwater into a resource by bringing the natural and built environment together through **Green Infrastructure**.[2]

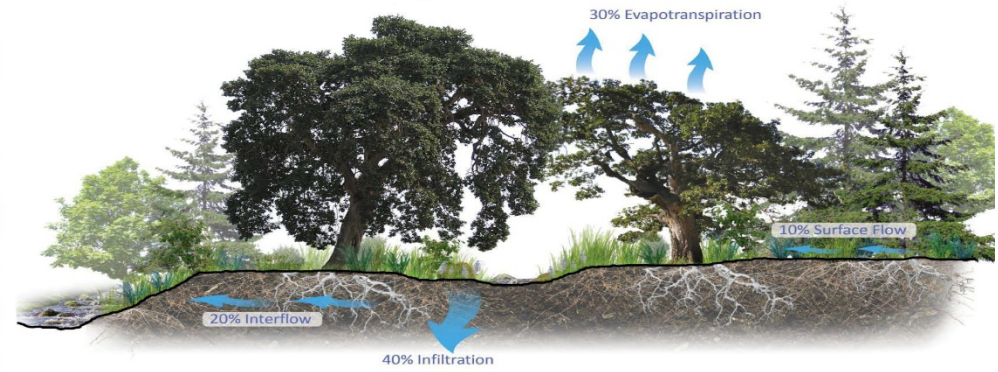
[1] https://nca2018.globalchange.gov
[2] https://nca2018.globalchange.gov/chapter/24/

Green Infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments. When nature is harnessed by people and used as part of the community infrastructure, it is called "green infrastructure."[3] Green Infrastructure can be scaled from small to large projects. At the city or county scale, green infrastructure is a patchwork of natural areas that provide habitat, flood protection, as well as cleaner air and water. Examples may include the preservation and restoration of natural landscapes such as wetlands and creeks. At the neighborhood or site scale, green infrastructure can look like **rain gardens**, **permeable** pavements, **green roofs**, **bioswales**, trees, and rainwater harvesting systems such as rain barrels and **cisterns**.

For more information on nature-based solutions and green infrastructure, explore the article *Accessing Urban Environmental Education Opportunities via Green Infrastructure* found here: http://www.thenatureofcities.com/2016/07/03/accessing-urban-environmental-education-opportunities-via-green-infrastructure/

Stormwater runoff is the rain that falls over a town or city, sliding off roofs, down storm drains and over driveways and streets. When rain passes over these surfaces, it picks up pollutants, including sediment, motor oil, pesticides, and fertilizers. The water that we use to wash our cars and water our gardens can also contribute to urban runoff. Because of the pollutants it contains, urban runoff can harm the larger bodies of water into which it drains, like San Mateo County creeks and the San Francisco Bay. Conversely, rainwater that falls in a natural habitat runs over the soil surface and slowly percolates through the soil strata (layers), which removes contaminants via filtration before it goes into a water body.

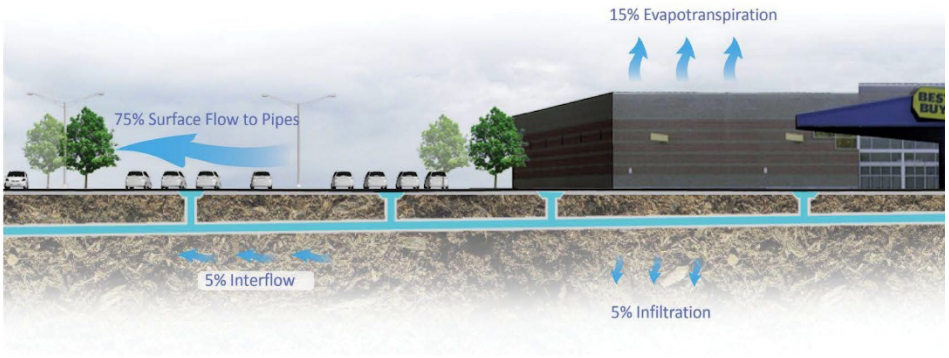
PRE-URBAN DEVELOPMENT



In undeveloped landscapes, as little as 10% of precipitation is surface flow (runoff), with the remaining 90% infiltrating the ground and being released into the atmosphere through evapotranspiration of plants.

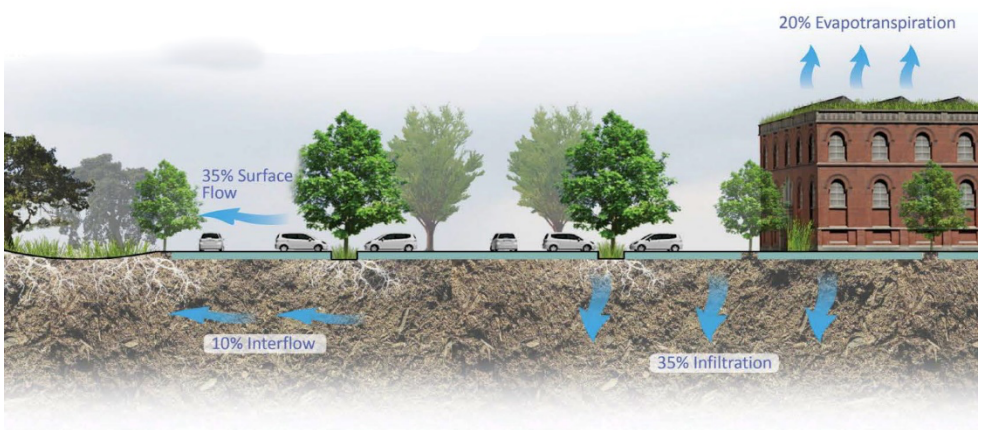
[3] Benedict, Mark A. & McMahon, Edward T. (2006). Green Infrastructure: linking landscapes and communities

URBANIZATION



The growth of cities, through the increase in land surfaces that are covered with buildings and pavement, decreases the amount of rain that infiltrates into the ground and decreases evapotranspiration due to the lack of vegetation. With urbanization comes a substantial increase in runoff, where in highly urban settings, as much as 75% of rainfall can turn into runoff due to the large impervious areas..

BALANCED DEVELOPMENT UTILIZING GREEN INFRASTRUCTURE



The use of green infrastructure allows for a balanced approach to urban development, as it accommodates existing infrastructure while minimizing the detrimental effects on the natural system. The use of green infrastructure such as permeable surfaces, bioswales, and green roofs allows for greater infiltration and increased evapotranspiration through increased vegetation cover. As a result, runoff is essentially cut in half; it is reduced from 75% of rainfall with traditional infrastructure to 35% with the use of green infrastructure designs.

Did you know?

There are many types and examples of green infrastructure projects currently in development in San Mateo County. Most green infrastructure projects are smaller vegetated basins, sometimes called “rain gardens” or “bioswales,” which capture, store and filter water flowing over streets, parking lots and buildings. Other types can include rain barrels or other rain harvesting systems that are linked to a near-by landscaped area. The City of Half Moon Bay recently constructed three bioswales at an intersection near the new public library, which integrated the green stormwater infrastructure with bike and pedestrian improvements to support the Safe Routes to School program.

Vocabulary:

- **Bioswale -** Similar to rain gardens, bioswales collect and filter runoff. However, they are designed to handle a large amount of runoff from a street or parking lot. A bioswale slows the speed of stormwater runoff and stores water until it can be filtered by the vegetation and soil in the bioswale.

- **Cistern -** A cistern functions to store rain water, in the same manner as a rain barrel with the main difference in its capacity. Some cisterns can store up to 20,000 gallons of water.

- **Green infrastructure -** The range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters.[4]

- **Green roof -** A green roof replaces a standard roof with vegetation and soil and/or gravel over a waterproof membrane. The roof's soil and vegetation capture rainfall, which either evaporates, evapotranspires, or is slowly filtered and discharged to the stormwater system.

- **Impervious -** These are non-porous surfaces that do not allow precipitation to move through them into the soil below.

- **Permeable -** Permeable surfaces are porous surfaces which catch precipitation and runoff, slowly allowing it to infiltrate into the soil below.

- **Rain garden -** Rain gardens collect and filter runoff in a shallow depression before it reaches natural bodies of water, absorbing up to 30% more runoff than a traditional lawn.[5] They are typically landscaped with native plants that attract pollinators and provide habitat for urban wildlife.

- **Stormwater runoff -** Runoff generated from precipitation or snowmelt that flows over land or impervious surfaces, including paved streets, sidewalks, parking areas and building rooftops, that does not soak into the group.[6]

- **Urbanization -** An increase in percentage of the population that is living in urban areas.

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[4] https://www.epa.gov/green-infrastructure/what-green-infrastructure
[5] https://prc.org/learn-act/watersheds-rain-barrels-rain-gardens/
[6] https://www.epa.gov/npdes/npdes-stormwater-program

Standards Correlation:

Performance Expectation	Description	Correlation with Lesson
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	Students will learn about, investigate, and propose green infrastructure solutions to urban stormwater runoff while also learning the key benefits of those green infrastructure solutions.
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.	Students will be able to identify and suggest green infrastructure solutions on their school campus after surveying and identifying existing problem areas with respect to water accumulation or missed opportunities to improve drainage and landscaping.
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.	Students will learn about stormwater runoff problems and suggest key green infrastructure solutions taking safety, aesthetics, as well as social and environmental impacts into consideration after their research and investigation.
Principle II	The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies.	Urbanization affects the natural hydrologic system and exacerbates the effects of flooding. Students analyze the effects of traditional “grey” infrastructure versus green infrastructure design.
Principle IV	Decisions affecting resources and natural systems are complex and involve many factors.	Students examine a variety of green infrastructure designs and discuss their impacts on ecosystems and society. Using their own school campus, students explore the design and implementation of green infrastructure projects.

Pre-Lesson Assessment (60 minutes):

1. Have students research and evaluate five different types of green infrastructure solutions: rain gardens, bioswales, rain barrels/cisterns, green roofs, and permeable pavement using the below table as guidance:

Green Infrastructure (GI) Solutions	Key Benefits and functions	Does this GI solution remove pollutants from the water?	What is needed to maintain this GI solution?	Does this GI capture water, filter water, store water, or a combination of these?	Are there any additional benefits to the school with this GI (i.e. provides a learning environment, habitat, etc.)?
Rain Gardens					
Bioswales					
Rain Barrels /Cisterns					
Green Roofs					
Permeable Pavement					

2. Discuss what students have learned from their research, and review supporting videos and case study below:
    a. Sustainable Cities: Nature-based solutions in urban design (7:53) https://vimeo.com/155849692
    b. Green Infrastructure Improves Communities (4:09) https://www.youtube.com/watch?v=unODbqnznWI
    c. Case Study: Laurel Elementary School, San Mateo https://www.flowstobay.org/blog/2016/08/laurel-elementary-school-safe-green-streets

3. Discuss and assess the feasibility and practicality of each green infrastructure solution prior to students developing green infrastructure plan for their school. What are the opportunities and barriers?

Lesson Introduction:

Students are encouraged to work on their green infrastructure plans in small groups to build teamwork skills and to also challenge one another's ideas. While students can do this portion on dry days, going out on a rainy day will prove incredibly valuable to see the "water in action" around campus.

Suggested Lesson Schedule:

Section	Activity Description and Time
Lesson - Activity 1 (total duration: 170 minutes)	Pre-Lesson Assessment (Time: 60 minutes): • Students research and evaluate five different types of green infrastructure solutions. • Students complete discussion questions and review supporting videos and case study. Procedure and Worksheet (Time: 60 minutes): • Part 1: Students will complete an assessment of stormwater runoff in several regions on their school grounds and record their findings on Stormwater Runoff Worksheet Part 1. • Part 2: Using the results from Part 1, students will design their own plan for green infrastructure design solutions. They will use Stormwater Runoff Worksheet Part 2 to complete this section. Follow Up (Time: 20 minutes): • Students will address questions a-h regarding their observations. Follow Up Discussion (Time: 30 minutes): • Students will break into groups and discuss their results. They will use the questions from the Follow Up section to aid in the creation of a presentation of their findings.

Materials:

- A map of the school grounds for each student
- Urban Runoff Part 1 Student Handout
- Sharpie markers
- Clipboards
- Page protectors (optional) to keep map dry while outdoors

1. Procedure (60 minutes):

PART 1 – Discovering stormwater runoff on school grounds

a. Prior to class, prepare paper maps of the school grounds and Stormwater Handout Part 1 for

students. If you don't already have a map of your school grounds, you can map your school on Google Maps and then print the screen. You can either include the entire map or divide the map into different sections to assign to different members of the group.

b. Assign students to groups based on class size and conduct a schoolyard tour to examine and chart how stormwater flows on school grounds. Previous observations and knowledge can be combined with the tour to determine how stormwater interacts with the school grounds. (Optional: Take the school grounds tour during a rain event so students may see the impact in real time.)

c. Choose four or more areas of the school grounds that you would like to explore with your students. Based on the size of your school grounds and the number of students, you can create sections on the map and send student groups to these sections instead of having them survey the whole area. Recommended areas: near downspouts, gathering areas, landscaped areas, a parking lot, a driveway, a playing field, or a school garden.

d. Distribute copies of the maps and the Urban Runoff Part 1 student handout. Students can follow the instructions on the handout and complete their assessment outside.

e. During the next class period, review the Follow Up Discussion questions with students. Groups can share their maps with the class on a projector or document camera. Students will discuss their findings.

PART 2 - Designing a green infrastructure plan for stormwater runoff

a. Have students get into their original teams that they were in for the mapping exercise.

b. Using findings from the mapping exercise, students will design green infrastructure solutions for the school facility to improve the way water is managed before it drains into the larger stormwater system.

c. Have students work through the questions on the Urban Runoff Student Handout Part 2, page 1 and identify the areas on the map where they would like to implement a green infrastructure solution. You may wish to go over the green infrastructure solutions again from the pre-lesson assessment and activity in more detail before students develop their plan.

d. After students have created their plan, have them answer the assessment questions on page 2 of the handout. These will form the basis of their presentation to the class. Per your direction, students may create a PowerPoint or other format when presenting.

e. (Optional) You might also have students do a feasibility study to determine if these types of projects are acceptable in your school or School District and to determine the associated costs. Be sure to have them include this information in their presentations. If you have the time and resources to implement the projects, these presentations could serve as the initial vetting process for the actual project.

2. Follow Up (20 minutes):

Have students address the following questions:

a. If rain conditions were observed, does the water flow to one place? More than one place? Where does the water go?
b. Where does the system of storm drains on your school building channel the stormwater? Does the water flow consistently on hard/paved surfaces, or are there places where water is channeled to vegetated areas? How does the water ultimately leave the campus? Do you see pipes that flow underground?
c. Where does stormwater flow in the school parking lot? Does it lead to a garden? Is it routed through a bioswale? Does it run rapidly to a low point in the parking lot or a drain?
d. If you identified any pollutants, what were they and where might they originate?
e. Describe your guess about the flow and impact of these pollutants beyond the school to places where they may cause damage. What parts of your local watershed could be impacted? *This is a key question because it allows students to communicate that they understand the broader impact of urban runoff beyond their school. Students MUST be able to identify, and discuss solutions to, the larger scale problem.*
f. Is your school using stormwater capture/treatment alternatives such as bioswales, stormwater planters or green roofs to store, route, and filter stormwater?
g. What is one thing you could do to capture/store/filter/reuse stormwater runoff at your location?
h. How might stormwater runoff affect the larger community?

Follow Up Discussion (30 minutes):

After students have completed the worksheets for both Part 1 and 2, have them work in groups to prepare a presentation of their stormwater management plan for the class. Be sure the students address the nine questions in the assessment section of the worksheet for Part 2, as this information will form the basis of their presentation.

Furthering the Lesson:

Green Plan-IT: GreenPlan-IT, created by the San Francisco Estuary Institute (SFEI), is a planning level toolkit which help municipalities with green infrastructure planning, assessment, and reporting. Learn more about it here: https://www.sfei.org/news/greenplan-it-site-locator-tool-v21-update#sthash.YVOC1xWs.dpbs

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What can I do?

What about the rainwater runoff at your residence? Where does all the rainwater flow to? Complete these two short activities to answer these questions.

Assess rainwater runoff at your home. Would it be possible to create a bioswale or cistern to collect rainwater? If you are in a multi-family dwelling, are there areas that a rain barrel could be used to collect rainwater?

Research how to set up a simple rainwater collections system at your home. See the link for more information (https://rockinwhomestead.com/rainwater-collection/). Did you know that you may be eligible for a rebate of up to $200 with the purchase and installation of some rain barrels? Find the details at http://bawsca.org/conserve/rebates/barrels

Are you interested in making your own rain barrel for **less than $15**? With a little searching and few tools, you can make your own rain barrel, find the details at https://www.instructables.com/id/How-to-make-a-rain-barrel-1/

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Appendix:

STORMWATER RUNOFF WORKSHEET PART 1: Discovering stormwater runoff on school grounds

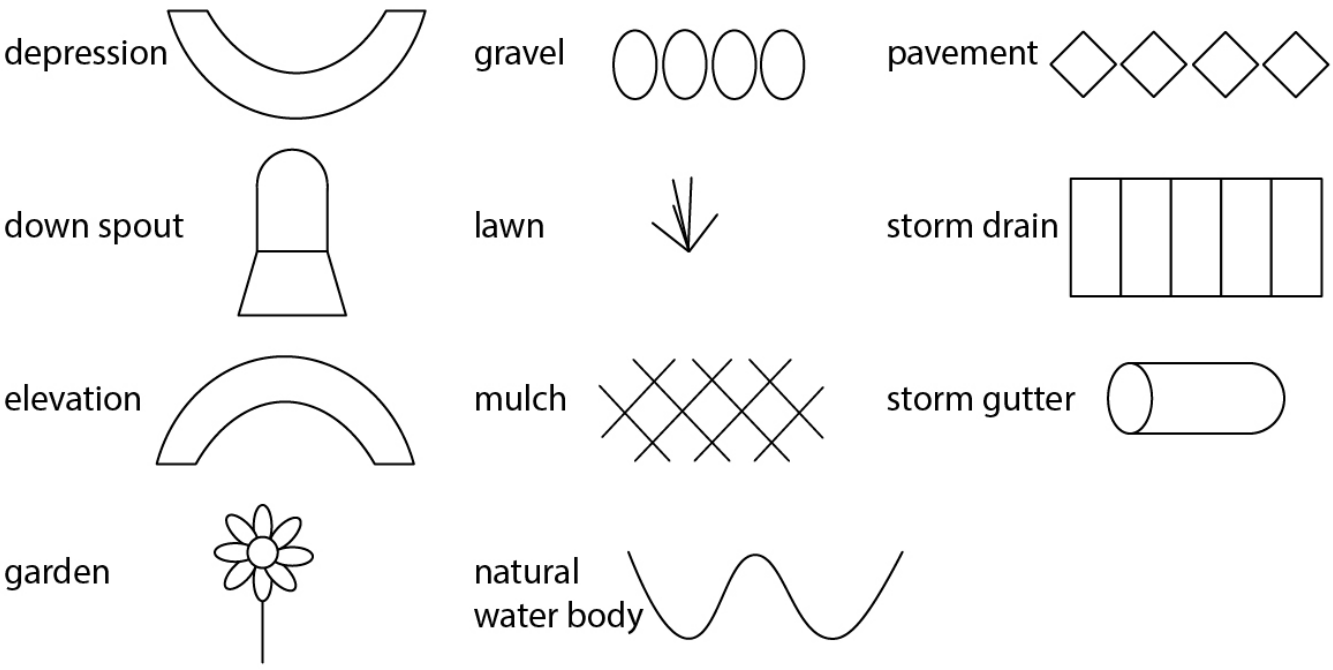
Name:

Date:

Directions:

Draw and note your findings on a map of your school property using the symbols on the legend below. You will generate a list of possible pollution sources and determine the symbols with your classmates. Draw the final symbols in the space below.

Map Legend



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STORMWATER RUNOFF WORKSHEET PART 1: Discovering stormwater runoff on school grounds

Directions:

1. On your map, locate the **storm gutters** and the **downspouts**. Where do the downspouts end? In a **drain** in the ground or on **gravel**, onto a **paved surface** or into a **garden**? Draw these on your map using the appropriate symbols from the legend.

2. Are there any city **storm drains** (pictured below) in the mapped area? Storm drains are drains built to carry away excess water in times of heavy rain. Mark them on the map using the appropriate symbol.

3. Mark any **lawn**, **gravel**, **mulch** or **pavement** on your map using the symbols from your key.

4. Is water running through the vegetation? Indicate the path of the water using a dotted line. Use an arrow to indicate the direction of flow along the ground. It should look like this:

5. Identify any **natural bodies of water** on the school property by drawing them on your map or draw directional arrows to known water bodies, i.e., ocean, bay, creek.

6. Where does water collect on school property? Indicate these places on your map using the symbol for **depressions**.

7. Are there high points on the school property from which the rainwater is flowing down? Indicate these on your map using the symbol for **elevations**.

8. Identify any pollutants you see and mark them on the map.

9. **Digging deeper:** In the space below, describe your understanding of the potential impacts of stormwater runoff pollutants beyond the school to places where they may cause damage.

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STORMWATER RUNOFF WORKSHEET PART 2: Designing a plan for stormwater runoff

Name:

Date:

Directions:

1. Review the stormwater map you created. Determine areas of flooding or potential flooding as well as areas where you think the stormwater runoff is the most polluted. **Choose one specific area and circle it on the map.** This will be the basis for your stormwater runoff plan.

2. What is the best way to manage the stormwater here? Why? Consider the various options, including rain barrels/cisterns, rain gardens, bioswales, permeable pavement, and green roofs. Describe your thinking below.

3. Identify opportunities for re-landscaping your site or using other green infrastructure techniques to modify the flow of stormwater and improve water capture and filtration. Will you use special plants? Why or why not?

4. Identify barriers to implementing your improvement. Is there adequate space? How would you go about making space? What materials will you need? Will there be any monitoring or maintenance requirements to keep the new green infrastructure in good shape?

5. Draw your improvements on the map. Create a legend symbol for the green infrastructure elements you are including (rain barrels/cisterns, rain gardens, bioswales, permeable pavement, and green roofs). Once you are done with your changes, use different colored arrows to indicate how stormwater flow will be modified as a result of your design changes.

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STORMWATER RUNOFF WORKSHEET PART 2: Designing a plan for stormwater runoff

Assessment: You will develop a presentation showcasing and defending your stormwater management plan. Answer the following questions thoroughly with your partner. These answers will form the basis for your class presentation. The stormwater plan map will be a visual aid. For some examples please visit https://www.stormwaterguide.org/static/HomeownersGuide.pdf

1. What is your major change or improvement?

2. Why did you choose this particular area for improvement? Indicate any quantitative or qualitative measures of benefit you evaluated for your solutions.

3. Where is the stormwater being routed? What is filtering the stormwater, if a filtering process is used?

4. How is your site used? How did students, teachers, and staff use your site before you redesigned it? Is there enough space for the same number of students and teachers to use your redesigned site? Are there new uses for the site?

5. What other things might need to be redesigned as a result of your proposed changes in stormwater management (e.g. changes in transportation or parking structures or the use or design of playing fields, or other recreational or gathering areas)?

6. If you were pitching this plan to the school principal, would you foresee any resistance to the changes you propose?

7. How might you develop a marketing plan or proposal pitch for your project?

8. Who will be responsible for maintaining the overall green infrastructure project for years to come? What kind of activities will be needed for maintenance and how often?

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Resources:

Rain Gardens: Rain gardens collect and filter runoff in a shallow, depression before it reaches natural bodies of water. They can absorb up to 30% more runoff than a traditional lawn. They are typically landscaped with native plants that attract pollinators and provide habitat for urban wildlife.

Bioswales/Bioretention Areas: Similar to rain gardens, bioswales collect and filter runoff. However, they are designed to handle a large amount of runoff from a street or parking lot. A bioswale slows the speed of stormwater runoff and stores water until it can be filtered by the vegetation and soil in the bioswale. By serving as a temporary storage, a bioswale reduces the volume of runoff during a storm. Bioswales are often 200 feet in length and 6 feet in width, but dimensions will vary depending on the site and soil conditions.

Rain barrels/Cisterns: Rain barrels can serve multiple purposes. When rain lands on an impervious surface like your rooftop, the rain washes down into gutters, exits the downspouts, and pours out onto the ground. Then it either soaks in or makes its way to the nearest sewer drain and/or body of water. A rain barrel collects rain from a downspout and prevents this from happening. It also allows you to store water for the next time you need it—you can use this harvested water in your garden! A typical rain barrel holds about 50-75 gallons of water. A cistern functions in the same manner as a rain barrel with the main difference in its capacity. Some cisterns are able to store up to 20,000 gallons of water.

Pictured: Rain barrel (left), Cistern (right)

Green Roofs: A green roof replaces a standard roof with vegetation and soil and/or gravel over a waterproof membrane. The roof's soil and vegetation capture rainfall, which either evaporates, transpires, or is slowly filtered and discharged to the stormwater system. Green roofs are designed to support the increased weight of the soil and vegetation. Because plants convert the sun's energy into humidity and soil moisture, green roofs keep houses cooler. Green roofs can help dampen the "urban heat island" effect, which is the increase in temperature in a city caused by the prevalence of dark surface areas that absorb the sun's energy. Green roofs also provide habitat for insects and birds. Green roof plants are low maintenance and suited to live in a shallow soil bed. They are able to tolerate harsh conditions on a rooftop, such as high sun exposure, little to no water, and high winds.

Example of green roof on the Facebook campus located in Menlo Park

Permeable Pavement: Permeable pavement is a porous urban surface which catches precipitation and surface runoff, while slowly allowing it to infiltrate into the soil below. There are many types including permeable paving, pervious asphalt, permeable pavers, and interlocking pavers, to name a few.

References:

[1] Reidmiller, D. (2018) 4th National Climate Assessment. Retrieved from https://nca2018.globalchange.gov

[2] May, C., C. Luce, J. Casola, M. Chang, J. Cuhaciyan, M. Dalton, S. Lowe, G. Morishima, P. Mote, A. Petersen, G. Roesch-McNally, and E. York (2018) Northwest. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 1036–1100. doi: 10.7930/NCA4.2018.CH24

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[4] Environmental Protection Agency (2019, Dec. 10). What is green infrastructure? Retrieved from https://www.epa.gov/green-infrastructure/what-green-infrastructure

[5] Pennsylvania Resources Council (2019, Dec. 10) Watersheds. Retrieved from https://prc.org/learn-act/watersheds-rain-barrels-rain-gardens/

[6] United States Geological Survey. (2019, Dec. 10) Runoff, surface and overland water runoff. Retrieved from https://www.usgs.gov/special-topic/water-science-school/science/runoff-surface-and-overland-water-runoff?qt-science_center_objects=0#qt-science_center_objects

Definition Cards:

Word	Definition
Bioswale	Similar to rain gardens, bioswales are depressed landscaped areas that collect and filter runoff. However, they can be designed to handle a larger amount of runoff from a street or parking lot, and often convey water over the landscape to help slow the flow and improve infiltration. A bioswale slows the speed of stormwater runoff and stores water until it can be filtered by the vegetation and soil in the bioswale.
Cistern	A cistern functions to store water runoff, in the same manner as a rain barrel with the main difference in its capacity. Some cisterns are able to store up to 20,000 gallons of water.
Green infrastructure	The Environmental Protection Agency defines green infrastructure as “the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters."
Green roof	A green roof replaces a standard roof with vegetation and soil and/or gravel over a waterproof membrane. The roof’s soil and vegetation capture rainfall, which either evaporates, evapotranspires, or is slowly filtered and discharged to the stormwater system.

Impervious	These are non-porous surfaces that do not allow precipitation to move through them into the soil below.
Permeable	Permeable surfaces are porous urban surface which catches precipitation and surface runoff, slowly allowing it to infiltrate into the soil below.
Rain garden	Rain gardens collect and filter runoff in a shallow, depression before it reaches natural bodies of water. They can absorb up to 30% more runoff than a traditional lawn. They are typically landscaped with native plants that attract pollinators and provide habitat for urban wildlife.
Stormwater runoff	Runoff generated from precipitation or snowmelt that flows over land or impervious surfaces, including paved streets, sidewalks, parking areas and building rooftops, that does not soak into the group.
Urbanization	An increase in percentage of the population that is living in urban areas.