WATER POLLUTION IN OUR COMMUMNTY: WATERSHED TABLE PART 2

Keep Omaha Beautiful

Description:

Students revisit the watershed model and develop green infrastructure engineering solutions to reduce water pollution.

Objective:

- Participants will understand how Omaha's local watershed contributes to regional, national, and worldwide water bodies.
- Participants will discover how individual's actions impact water pollution.
- Participants will brainstorm ways to mitigate water pollution and build a model to test their theories.

Standards:

All Grade Levels

- SS X.3.3 Describe relationships between humans and the physical environment.
- SS X.1.2.a Identify and model rights and responsibilities of citizens at the community level.

2nd Grade

- SC.2.13.3.B Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

3rd Grade

- SS 3.3.3.c Explain the importance of Earth's natural resources.

4th Grade

- SC.4.13.4.D Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
- SS 4.3.5 Use geographic skills to make connections to issues and events.

5th Grade

- SC.5.13.4.C Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- SC.5.13.4.D Define a simple design problem that can be solved by applying scientific ideas about the conservation of fresh water on Earth.

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Materials:

- Watershed table model and accessories
- Two sponge sheets per group/pair of students (one of each style)
- Scissors – one per pair/group of students

Background Info:

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits. It means planting trees and restoring wetlands, rather than building a costly new water treatment plant. It means choosing water efficiency instead of building a new water supply dam. It means restoring floodplains instead of building taller levees.

Green infrastructure incorporates both the natural environment and engineered systems to provide clean water, conserve ecosystem values and functions, and provide a wide array of benefits to people and wildlife. Green infrastructure solutions can be applied on different scales, from the house or building level, to the broader landscape level. On the local level, green infrastructure practices include rain gardens, permeable pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting systems. At the largest scale, the preservation and restoration of natural landscapes (such as forests, floodplains and wetlands) are critical components of green infrastructure.

Some types of Green Infrastructure are:

- Downspout disconnection: This simple practice reroutes rooftop drainage pipes from draining rainwater into the storm sewer to draining it into rain barrels, cisterns, or permeable areas. You can use it to store stormwater and/or allow stormwater to infiltrate into the soil. Downspout disconnection could be especially beneficial to cities with combined sewer systems.

- Rainwater harvesting: Rainwater harvesting systems collect and store rainfall for later use. When designed appropriately, they slow and reduce runoff and provide a source of water. This practice could be particularly valuable in arid regions, where it could reduce demands on increasingly limited water supplies.

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Background Info Cont:

- Rain gardens: Rain gardens are versatile features that can be installed in almost any unpaved space. Also known as bioretention, or bioinfiltration, cells, they are shallow, vegetated basins that collect and absorb runoff from rooftops, sidewalks, and streets. This practice mimics natural hydrology by infiltrating, and evaporating and transpiring —or “evapotranspiring”—stormwater runoff.

- Planter boxes: Planter boxes are urban rain gardens with vertical walls and either open or closed bottoms. They collect and absorb runoff from sidewalks, parking lots, and streets and are ideal for space-limited sites in urban areas.

- Bioswales: Bioswales are vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, they are particularly well suited to being placed along streets and parking lots.

- Permeable pavements: Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. This practice could be particularly cost effective where land values are high and flooding or icing is a problem.

- Green streets: Green streets are created by integrating green infrastructure elements into their design to store, infiltrate, and evapotranspire stormwater. Permeable pavement, bioswales, planter boxes, and trees can be woven into street design.

- Green parking: Many green infrastructure elements can be seamlessly integrated into parking lot designs. Permeable pavements can be installed in sections of a lot and rain gardens and bioswales can be included in medians and along the parking lot perimeter. Benefits include mitigating the urban heat island and a more walkable built environment.

- Green roofs: Green roofs are covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. They are particularly cost-effective in dense urban areas where land values are high and on large industrial or office buildings where stormwater management costs are likely to be high.

- Urban tree canopy: Trees reduce and slow stormwater by intercepting precipitation in their leaves and branches. Many cities have set tree canopy goals to restore some of the benefits of trees that were lost when the areas were developed. Homeowners, businesses, and community groups can participate in planting and maintaining trees.

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Activity:

1. Have the students help set up the city – storm drain in the drain holes first, then houses in the neighborhood with the trash can and raccoon; dog in the park area, bridges, restaurant, trees, etc. (Do NOT at the felt pads or sponges at this time.)
2. Add about an inch of clean water to the "lake" (one of the small, clear plastic bins) and put the fish and turtles in it before putting it in its spot under the watershed table.
3. As you are assembling the city, review what students learned in the previous watershed model activity. How did pollution get into the city? What could we do differently to reduce pollution?
4. Review with students of the different types of green infrastructure presented during the Keep Omaha Beautiful discussion.
    a. Rain gardens
    b. Green roofs
    c. Permeable pavement
    d. Retention ponds
    e. Trees, Parks, and Gardens
5. Instruct students that they will be designing green infrastructure to mitigate the pollution in the city.
    a. BEFORE cutting their sponges, students should consider where there are issues with pollution traveling along hard surfaces and flowing into the waterways. They should also consider what is realistic for their green infrastructure. For example, a rain garden might help slow the flow of runoff from a main road, but you cannot simply stick a rain garden in a road – it needs to be in an appropriate spot in a grassy area.
    b. The solid sponge represents green infrastructure that would hold water, such as a retention pond or a rain garden.
    c. The loose-fiber sponge represents green infrastructure that would slow down the flow of water, such as trees, green roofs, and gardens.
    d. Students should consider the watershed table carefully – they get ONE chance at designing their green infrastructure for this project. After considering their options and designing a plan, students should use their scissors to cut their sponges to fit their design.
6. Have one group bring up their sponge pieces and add them to the watershed table. Sprinkle pollution on the watershed table, as you did with the first activity, and spray with water. Discuss as a class how the student's green infrastructure affected the pollution entering the watershed. What worked well? What didn't work as anticipated? What could the students have done differently to improve their design? Encourage all the students in the class to assist with this discussion.

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Activity Cont:

7. Repeat the process with each group. You may need to wipe off the watershed table between each use to see how the green infrastructure affects the pollution. You may also want to break this into a few sessions, depending on how many groups you have presenting their designs.

8. After every group has demonstrated their designs and tested them, discuss the following questions as a class:
    a. Which features worked well?
    b. Which features did not seem to work?
    c. How do you think this would translate to real world applications? Could we do this on our real streets?
    d. Why do you think we don't have this type of infrastructure everywhere?
    e. How would installing green infrastructure help Omaha?
    f. How would installing it in Omaha help waterways around the world?

9. Instruct groups to complete their student handout pages.

Assessment:

- Student presentations
- Classroom discussion
- Completed student handout pages