Mapping Infiltration: Red and Green

Outdoor lesson, 40 minutes

May substitute for FOSS investigation # 4.1 (earth materials) and 4.3 (water from home)

Lesson Overview:

In this lesson, students will look more closely at an area they know well, the school yard. They will notice the difference among surfaces in terms of whether they look like rain would soak in, or not. They will also notice where "water use devices" are located. Water use devices is a catch-all term for things such as storm sewers, detention basins, downspouts, fire hydrants, etc. Trees are included in this list. (See bottom of lesson for a list of lesser known devices)

Materials:

site plan, enough for each team leader (divide teams as you see fit) Red and green pencils as well as gray pencils. A camera!

Objectives:

Through this lesson students will…

- become introduced to the idea that rain water interacts differently depending on the ground surfaces it encounters
- learn the difference between pervious and impervious surfaces
- Allow students to imagine a real-life job wherein they must investigate possible causes of flooding by locating those surfaces that *don't* allow water to infiltrate (soak in).

Vocabulary:

impervious
pervious
groundwater
stormwater
rainfall runoff

Ahead of time: Divide Schoolyard Site Plan into enough sections that teams of three may explore different areas of campus. **Ideally the entire school yard will be explored.**

Background:

Whether or not water ends up as ground water or surface water is a big deal because of flooding, groundwater, and pollution.

- Once rain hits the ground or a building, we call it "stormwater." Stormwater either flows over the surface of the ground or soaks in and becomes "groundwater." Stormwater that remains on the surface eventually flows into storm sewers (sometimes called storm drains), ditches, rivers and lakes. Stormwater that doesn't soak into the ground can cause **flooding** and property damage.
- Water in the ground creates what we call **groundwater.** This water is where we get well water from, and it provides water to our streams, rivers, and lakes during the winter and in between rainstorms in the summer. Without it, streams could stop flowing during droughts and over winter.

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- Anything that the stormwater picks up while flowing across lawns and parking lots or down streets, such as **litter,** cigarette butts, and motor oil, as well as air pollutants that settle from car exhaust, fertilizers, and pesticides, will all get dumped straight into streams, rivers, or lakes.

Pervious surfaces (wetlands, fields, forests, wood chips) allow water to soak into the ground (a process called infiltration). Infiltration decreases the amount of surface water, reduces the flow of water over the landscape, and increases ground water.
Impervious surfaces (roads, rooftops, parking lots, and other hard surfaces) do not allow water to soak into the ground, which means more water flows over the surface of the landscape. Increased surface flow also increases the speed at which water moves over the watershed. Impervious surfaces decrease ground water.

Cities build lots of roads, buildings, houses, driveways, parking lots, etc. All of these things are impervious surfaces that rainwater can't soak into. When rain hits these surfaces, it then flows rapidly across them and into storm sewers, instead of soaking into the ground and becoming groundwater. In many cases, storm sewers empty into streams and lakes. Stormwater in these pipes does not get treated by the wastewater treatment plant; it goes straight into natural waters.

During periods of high flow, erosion of stream banks muddies the water, degrading habitat for plants and animals that depend on clear water. Dirt in the water clogs the gills of fish, fills in the area around rocks where all the bugs, young fish, and crayfish live, and blocks light needed for plants. The dirt also settles to fill in the channels of streams, lakes, and reservoirs.

Activity:

Pass out one Site Plan for your schoolyard *with a clearly defined area of exploration* to a member of each team and ask that they get a regular pencil, and a red and green pencil and clip board or other hardback writing surface.

Gather outside and ask students to look around and describe the different ground surfaces they can see. **Whether or not water ends up as ground water or surface water is a big deal.** Point one out that is hard. If it rained on that surface, what would happen to the water? Introduce the word **Impervious**. Point out a soft surface, such as grass of wood chips. What happens when it rains on that surface? Introduce the word **Pervious.**

Who here has seen Evanston streets flood? Have you had a flood in your basement? Let's say you have been asked to help figure out why Evanston streets keep flooding when there are big storms. The floods are causing pollution to get into the Channel and Lake Michigan. Where is the rainfall runoff coming from? You need to look at the surfaces and determine which are pervious and which are impervious.

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1. In small groups, take one site plan and regular pencil and a red and green pencil and go to your assigned section of the schoolyard. What are the boundaries of your area? Define them on your map.
2. Walk around looking for water use devices— anything that holds or carries water. Put a circle on your map where you found them and describe them if you can. Trees are included.
3. Notice the ground you are walking on. Do you think rain would soak into this surface? If so, it is **pervious** and you should color it green. If rain would not soak into this surface, it is **impervious** and you should color it red.
4. If your section of the schoolyard has more than one surface, look at each sone separately and color each accordingly.

Gather the groups together and allow each group to share. Allow the group to estimate the percentage of pervious versus impervious ground surfaces on each group's property. (6th grade extension: Can the group mentally add together the percentages from each group to get a schoolyard total? Now add the rooftops of your school into the impervious calculations. What is the new percentage?)

Do you think your schoolyard contributes to the street flooding? Why or why not?

Back in the classroom, *if there is time*, create one group site map including all the water use devices. If desired, calculate the area of pervious and impervious surfaces by turning them into simple shapes and, using the scale given on the site map, convert inches into feet. If there's not time now, burt your students seem interested, consider working on this to share in April.

VOCABULARY:

Detention basin: a depressed area that collects and temporarily stores stormwater

Impervious: to not allow water to pass through. Impervious surfaces (roads, rooftops, parking lots, and other hard surfaces) do not allow water to soak into the ground, which means more water flows over the surface of the landscape. Increased surface flow also increases the speed at which water moves over the watershed. Impervious surfaces decrease ground water.

Manhole: an underground vault for access to a sewer, valve, water main, etc., the interior of which is usually not visible due to solid covers

Pervious: to allow water to pass through. Pervious surfaces (wetlands, fields, forests, wood chips) allow water to soak into the ground (a process called infiltration). Infiltration decreases the amount of surface water, reduces the flow of water over the landscape, and increases ground water.

Rainfall runoff: water moving in a horizontal direction after rain impacts the earth surface

Sewer: an underground pipe conveying stormwater, wastewater or water flowing by gravity

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Storm inlet: the grated cover on an underground vault or catch basin admitting stormwater into a sewer system; can be found in street gutters, school yards, sidewalks, outdoor stairway bottoms

Stormwater: water resulting from rain that is flowing over the earth surface; being conveyed in pipes, rivers, sewers and streams; or collected in detention areas, ponds, reservoirs, surface depressions, swales, etc.

Valve box: an underground enclosure containing the shut off valve having a 4-inch metal cover at the ground or pavement surface for smaller water users, such as, a home or small business, also known as a b-box or buffalo box

Valve vault: an underground enclosure containing the shut off valve having a 6-inch or greater metal cover at the ground or pavement surface for larger water users, such as, large business or school, often with “water” cast into the cover.