STORMWATER RUNOFF MAPPING

VLAWMO
Vadnais Lake Area
Water Management Organization

Purpose & Goals

Purpose: To understand how water runs off the landscape and to think like an engineer in making water resource decisions.

Goals:

1) Refer to data collection, watershed concepts, and calculations able to make decisions about water resources and land use on the school yard.

2) Compare and contrast between the needs of the water resource, wildlife, and human community.

Standards

STEM Science: 4.1.2.1.1., 4.1.2.2.1., 4.3.2.3.1., 4.3.4.1.1., 5.1.1.1.4., 5.3.1.2.2., 5.1.3.4.2., 6.1.2.1.1., 7.1.3.4.1., 7.1.3.4.2., 8.1.3.4.2., 8.3.2.3.1., 8.3.2.3.2., 8.3.4.1.2., 9.1.2.2.2.

Time: 1 hr

Grades: 4-8

Preparation & Materials

Provided by VLAWMO:

- Arial maps of the schoolyard
- 5-8 milk gallon jugs full of water
- Clipboards for each group
- Surface cover measurements and runoff coefficients table.
- Photos of stormwater best management practices (BMP's)

Provided by classroom:

- Markers, pencils
- Calculators
- Any preparations for outdoor field work.
- SmartBoard or projector screen

Terms

Best management practice (BMP): A strategy to collect, store, and treat stormwater.
Impermeable: A surface that doesn't allow water to soak into the ground.
Permeable: A surface that allows water to soak (permeate) into the ground.
Runoff: Water that runs off a surface during a rain event, into a stormdrain or water body.
Runoff Coefficient: A percentage of water that runs off a surface according to that surface type. For example, pavement has a high runoff coefficient because all of the water that falls on it either runs off or evaporates.
Surface Cover Measurement: Square foot measurements of various land surface covers on the school yard.
Water table: The level below the ground which is saturated with water The water table can move up and down depending on rainfall from year to year. A high water table means saturated soil is closer to the surface.
Gunk: The general term for everything picked up by stormwater runoff: leaves, sediment, oil, salt, trash, grass clippings, etc.

Procedure

1. Introduce the activity using a map of the schoolyard. Inquire to the class about which surfaces generate stormwater runoff, and what the runoff may contain (excess nutrients, salt, or other pollution such as motor oil or garbage).
2. Divide students into groups of 2-3, each equipped with a gallon of water, a marker, a map, and a clipboard.
3. Send students around the schoolyard to pour the water on a variety of surfaces. With clipboard, students draw arrows to depict the directions runoff drains. Students cover a variety of surface types (pavement, turf grass, sand/gravel, long grass or wooded areas) and note how much water is running off the surface and how much soaks into the ground.
4. Students return to the classroom. Use pre-calculated surface cover measurments and runoff coefficients from VLAWMO to have students calculate the ammount of runoff that's generated on the schoolyard during a 1" rain event. Runoff volume = surface (sq ft) * coefficient (decimal) * rainfall (ft). Refer to aerial map projected in front of the classroom. Groups may focus on individual surface covers, compiling them as a class.
5. Analyze completed field maps and discuss where to place BMP's on the school yard based on findings of water drainage. Describe and hand out BMP sample cards for reference. Students may present selections at the front of the class.
6. Students present their findings or combine their findings on a collective map to cover all areas of the schoolyard that were surveyed in step 3. A complete map to include arrows for drainage and BMP cards taped up at their expected locations.

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Best Management Practice (BMP) Cards: See supplementary page for print version.

Detention basin/swale

Green roof

Raingarden

Permeable pavers

Underground retention basin

Stormpond

Surface Covers and Runoff Coefficients

A runoff coefficient is a number that represents the percentage of runoff generated on a given surface cover. For example, pavement has a .98 runoff coefficient because almost 100% of the water that falls on it runs off the surface (some lost to evaporation). To calculate the runoff generated on a surface, we multiply the coefficient by the surface area expressed in ft^2, multiplied by the rainfall. Most estimates target a 1.1" rainevent, expressed as .09 ft. VLAWMO is available to help calculate square footage of surface covers using the VLAWMO ArcGIS web map (vlawmo.org - link at bottom of page).

Example: 1,000 ft^2 of pavement x .98 x .09 ft = 90 ft^3 of runoff.

90 x 7.48 = 672 gallons of runoff. ($1ft^3$ = 7.48 gallons, 1 bathtub = 40 gallons)

Surface type	Surface area (sq ft)	Runoff Coefficient
Pavement/rooftop	0	0.98
Turfgrass - flat	0	0.2
Turfgrass - sloped	0	0.3
Raingarden	0	0
Open water	0	0
Gravel/baseball field	0	0.4
Playground	0	0.2
Tree cover	0	0.15
Open space	0	0.15

Reflection

1. Which surfaces shed water quickly? How far did it go from where it was poured? How fast did it go?
2. What will the fast runoff surfaces look like during a rain event? Did you see evidence on the schoolyard? (sand piles, eroded soil, etc.)
3. Which section of the schoolyard has the most runoff? Which area has the least?
4. Imagine you're the building planner at your school before it was built. Where do you want runoff to go considering the hills and natural features of the area?
5. What are the positives and negatives of fast runoff drainage?
6. What's the nearest water body that would receive runoff from your school yard? How does this knowledge change your plan for the schoolyard?
7. Which surfaces would you create more of, which would you create less of?
8. What BMP's would you build on your schoolyard? Does it hold potential for other uses besides stormwater?
9. What stormwater BMP's are already on the school yard? Are they in the right place according to your findings?

Assessment

At the end of the activity, students will have assigned locations for each BMP and be able to cite a reason for their placement. They may hand in their map, their completed runoff calculations, or both.