

Runoff Footprint

#FLOODED
Grades 3 - 12
Activity



Main Objective

This activity shows learners how to determine whether a study area is permeable, semi-permeable, or non-permeable. Understanding this allows learners to estimate how much rain is soaking into the ground and how much is running off into sewers, drains, and ditches. This is called a Runoff Footprint.

Learning Outcomes

By the end of this activity learners will:

- Calculate how much of your study area is a permeable, semi-permeable or a non-permeable surface
- Utilize these calculations to understand what is known as the Runoff Footprint

Length of Activity: 1 - 2 hours

Step 1: Intro to surface permeability

Step 2+3+4: Calculate permeability percentage, runoff footprint, rainfall amount

Materials Required

- Internet-enabled device
- Assessment Rubric
- Flood:ED Backgrounder
- Runoff Footprint Worksheet

Activity

Step 1: Measuring the Permeability of Surfaces

Look over the definitions of permeable, semi-permeable and non-permeable. Review your Study Area map from your Flooding Mapping Tour. You will be calculating the surface area of each section of your study area. This can be done by:

- Measuring the section and calculating the area (see below)
- Using Google Maps
- Using the online tool at:

 <https://www.calcmaps.com/map-area/>

CalcMaps will allow you to estimate distances from the satellite view of your study area. For the purposes of our work and to simplify our calculations we are going to reduce each area we measure to a rectangle or a square. This way we can use the simple area formula of Length times width equals area squared to calculate the area of non-permeable, semi-permeable and permeable areas of our Study Area.

If you are trying to calculate the area of oval shapes, or circles reduce them to squares or rectangles. L shaped areas can be reduced to two rectangles and triangles can be measured as half a square. Be creative, breakdown shapes to manageable sizes and estimate areas as best you can.

Calculating Area

Remember that the basic formula for measuring a rectangular area is $\text{area} = \text{length} \times \text{width}$. There are three basic ways that you can get your length and width measurements if you are doing it without a computer:

- Use a long tape measure
- Use rope or string: cut, measured or bought to a known length like 1 meter or 10 meters.
- Pace out distance by measuring your pace (from front foot toe to the heel of your back foot) based on a regular step.

Do your measurements in meters. Record your answers in Part A of the Runoff Footprint Worksheet.

Step 2: Calculate Permeability Percentages

Review the Understand Flooding activity, mainly the negative impacts of runoff. Where the rain falls is important to the impacts of stormwater. Permeable surfaces handle the stormwater. Non-permeable surfaces pass the water on to the stormwater infrastructure to handle.

Calculations of percentages of the permeable, semi-permeable and non-permeable surface will show how well your study area will handle rainfall runoff.

Your Permeability Map shows you key information:

- The different types of stormwater infrastructure, how many and where they are located.
- The location and permeability of all surfaces.
- A series of observations (collected before, after and during rainfall events) about where issues of flooding, pooling, erosion and pollution exist.

Based on your answers on Part A of the Runoff Footprint Worksheet, complete Part B titled Permeability Percentage Table.

Discuss with the class these questions:

1. What area of your Study Area is total runoff?
2. What impacts will all this runoff have?
3. If you think your non-permeable percentage is high, what impact does that have?
4. If you decrease your non-permeable percent by 10% what change would that cause in the other two percentages?
5. What do you think your school could do to improve its percentages?

Step 3: Calculate Rainfall Amounts

The next step is to calculate the amount of rainfall in your area. The more rain your area receives the more important it is that you have a high percentage of permeable surface. Fill in the chart on Part C of the Runoff Footprint Worksheet using the data sources that are suggested below:

Historical Rainfall Data

- You can find the data for the Rainfall Chart at the Government of Canada website:

 http://climate.weather.gc.ca/historical_data/search_historic_data_e.html

- You can get help using this Government of Canada site in their How To document

 http://climate.weather.gc.ca/doc/Historical_Data_How_to_Use.pdf

- You can also find rainfall data at:

 www.weatherstats.ca

Real Time Storms:

- You can use radar and weather reports to view, study and track storms online, in real time as they happen. This site will show you mm of rain per hour in real time as you track the storm as it moves across your area:

 <https://www.wunderground.com/wundermap?lat=43.85&lon=-79.37&radar=1>

Step 4: Calculate Runoff Footprint

You are now ready to calculate the Runoff Footprint of your Study Area. This footprint is basically how much rain falls on your Study Area and runs off into sewers, drains and ditches.

All the water runs off non-permeable surfaces. The tricky part is calculating the runoff from semi-permeable surfaces. For this activity, consider that if a surface is semi-permeable, half of the water soaks in and half runs off. Permeable surfaces absorb all the rain that falls on them.

The Runoff Footprint is the total volume of rain that runs off your Study Area. It is calculated by multiplying the amount of rain by the total area of permeable surface and half the area of semi-permeable surface.

Complete Part D of the Runoff Footprint Worksheet, which utilizes the data from Part B and C.

Discuss with the class these questions:

1. Which number do you feel best represents the runoff footprint of your Study Area?
2. What surprised you about the amount of water that falls in one rain event?
3. Take your rainfall amounts and compare it to some everyday things (carton of milk 1L, bathtub 80L, refrigerator, bedroom, house).
4. What are the three biggest areas of non-permeability in your Study Area?
5. Why is the amount of water runoff such a big problem?
6. List any solutions to runoff that you observed in your tour or marked on your map.