Case Study: Surface Runoff in Saskatoon

Objective: compare the land water management of Walter Murray School with Market Mall to better understand the impacts that different types of surfaces like grass, gravel, pavement and rooftops, have on runoff during a rainstorm.

In the classroom

What you'll need:

- Pencil and eraser
- Ruler (cm)
- Runoff Maps
- Calculator (optional)

Background: On a June afternoon in Saskatoon, there is heavy rainfall for 2 hours. The nearby Acadia Reservoir rain gauge, measures 15mm of rainfall over a 2-hour period.

Walter Murray Collegiate and Market Mall have large surface areas in the same neighbourhood and therefore, receive a lot of rain. The two sites consist of three types of surfaces: hard surface, that is mostly impermeable surface like parking lots and roof tops; permeable gravel; and highly permeable green surface like grass parks, gardens, and soil. Storm system designers assume:

- **90%** of rain runs off **hard surfaces**
- **25%** of rain runs off **gravel surfaces**
- **10%** runs off **green surfaces**

The storm system in the area is a network of pipes that eventually take water to the river. Designers need to consider how much water will run off from surfaces when designing the storm systems. More runoff means more, or larger **pipes**, or more **storm ponds** are needed.

Question 1 – Walter Murray and Market Mall comparison

Estimate how much runoff there will be from:

1. Walter Murray property
   Assume three surface types: hard, gravel, and green
2. Market Mall (including parking lot)
   Assume one surface type: hard

Steps:

1. Calculate the total areas of hard, gravel and green surface. Break up the areas up into easy-to-calculate shapes like rectangles and triangles. See an example of a rectangle section of green space on page 3. Below are instructions on **how to use the scale**.
2. Estimate the volume of rain that fell on each land space.
3. Estimate the volume of runoff from each land space.

How to use the scale:
Use the scale on each photo to measure the dimension of the areas.
- Using your ruler, measure the length of the scale line 0 – 100m in centimeters
- On your worksheet, divide 100m by that number of centimeters to get m/cm. This is your scale factor.
- Measure dimensions on the photos in centimetres.
- To convert the lengths from centimetres on the page to meters in real life, multiply cm by the scale factor (m/cm)

Storm Systems

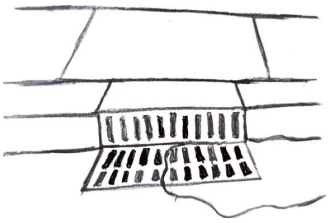
The city of Saskatoon has a major and minor storm system

The minor storm system consists of underground pipes that transport water from city's aboveground surfaces to the river. See the sequence below.

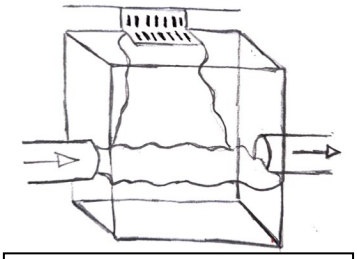
The major storm system consists of wet and dry ponds. During large storms, these ponds complement the minor system by taking excess water.

Wet pond example: Lakeview Park or Peter Zakreski Park (Stonebridge)
Dry pond example: W.W. Ashley Park

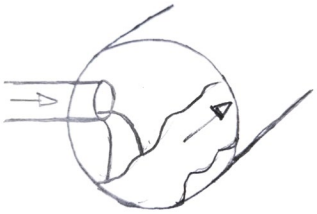
Minor Storm System



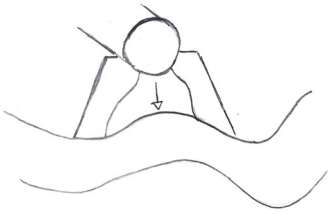
1. Runoff is collected by street drains



2. Water falls into a catch basin and then into network of underground pipes



3. Pipes carry water to storm sewer "mains"



4. Water is carried to waterway (river)

Question 2 – Depaved area

The Depave Paradise project at Walter Murray converts 350 m^2 of paved tennis court to a garden space.

Estimate how much runoff is reduced by converting the space from hard to green space during the first hour of this storm. Assume the rain fell at a constant rate during the storm.

Outside

What you'll need:

- Clipboard
- BMP & Pacing Map – Walter Murray
- Pencil and eraser
- Paper
- Measuring tape
- Calculator (optional)

1. **Water management practices**
   The newly developed Depave Paradise garden is an example of a Best Management Practice. Consider what else could be added on school grounds to control the quantity and quality of runoff. Write where they could be added on your BMP & Pacing Map.

Best Management Practices

BMPs are installations that help control the quantity and quality of runoff

- Parking lot storage
- Underground storage tanks
- Roof-top storage
- Storm water ponds
- Cisterns

BMPs can also be natural spaces that increase water infiltration and evapotranspiration:

- Rain gardens
- Bioswales
- Ditches
- Drainage swales
- Green roofs / roof gardens

2. **Pacing**
   Estimate one area of the school grounds (hard/gravel/green spaces) using pacing. Eg. parking lot.

   1. First you will need to calibrate your steps using a 10m measuring tape.
      - Lay out the measuring tape in a straight line.
      - Start at one end and walk comfortably to the other end of the tape. Count your steps. Repeat 3 or 4 times to get an average step count. Write down the average steps.
      - Your step factor is this average: _____steps / 10 meters

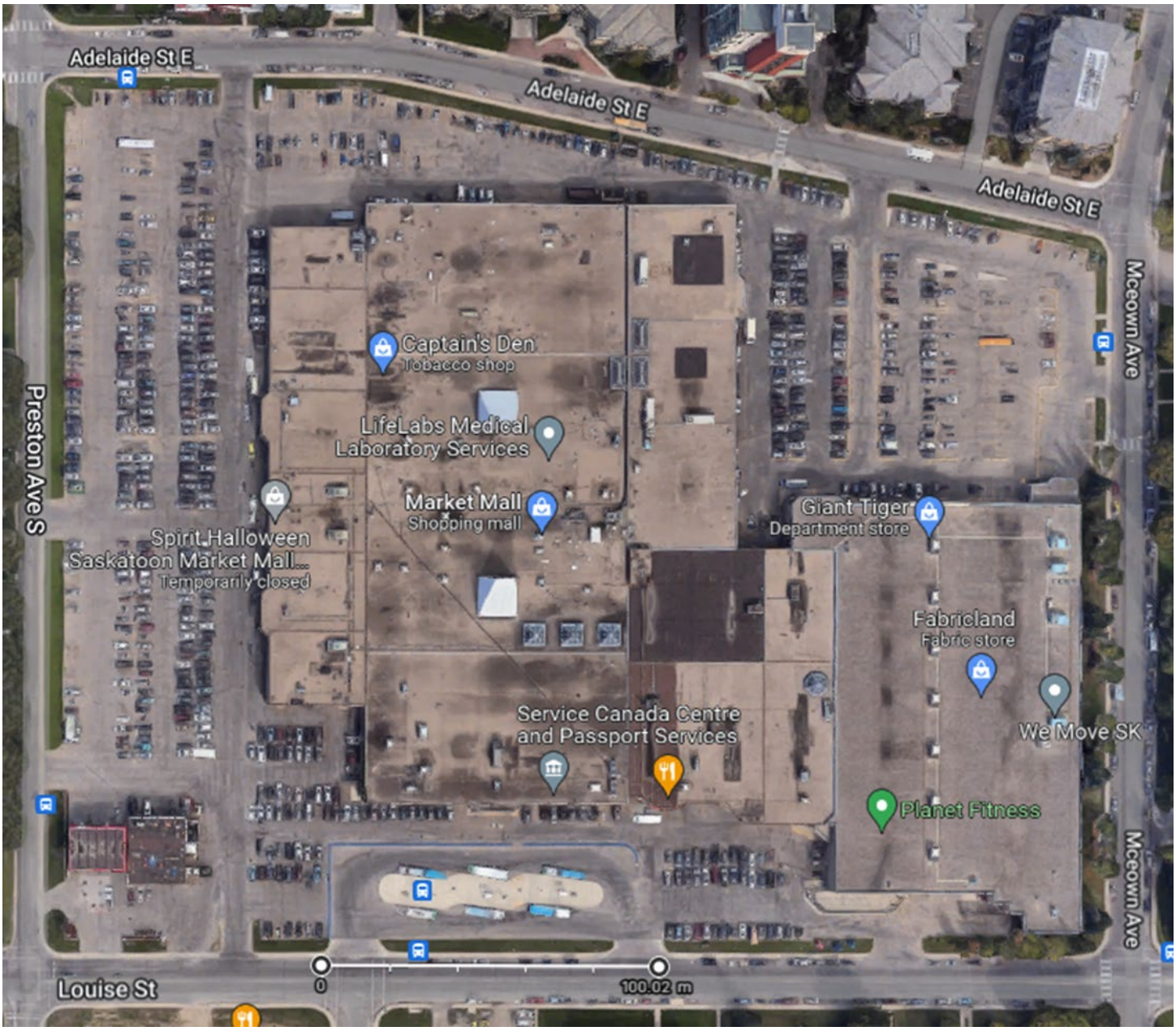
   2. Measure the dimensions of school grounds spaces
      - Start in one corner of a rectangular space and count the steps it takes to reach the adjacent corner. Record this number.
      - Use your step factor to convert steps to meters. Record this number on your map.
      - Do this for any school grounds dimensions

   3. Calculate the surface areas and compare with the calculated areas from the satellite image. Do they match?

Runoff Map – Walter Murray

Satellite image of Walter Murray Collegiate / Source: Google Maps

Runoff Map – Market Mall



Satellite image of Market Mall / Source: Google Maps

BMP & Pacing Map – Walter Murray