

Activity Theme: Water Distribution

Grade 5

Activity Type: Experiential 

Under Pressure

Activity Overview: In this activity, students are introduced to Peel’s extensive tap water network. Students will then pretend that they are Peel Region workers sent out to repair a broken “water main” as fast as they can.

Objectives:

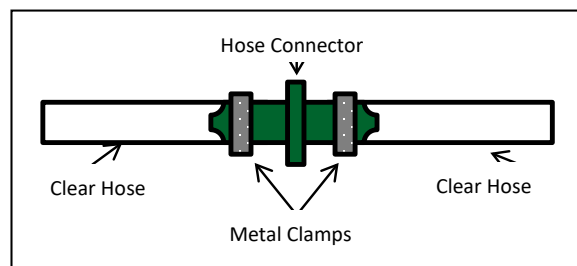
- Learn the purpose of water mains and be able to identify the materials they are made from
- Identify how and why a water main can break as well as discuss the role of water pressure

Materials:

- Water Main Model (consisting of bin for water source, submersible pump, clear hose with hose connectors, catch basin – all secured to a base with tarp)
- 3-5 screwdrivers
- Samples of water main materials
- Posters of water main breaks

Set-up (on table):

- Place the large model on the table. Stick the pump to the bottom of the container. Make sure the valve on the container is closed. Fill the container about half full of water and proceed to plug in the pump and suction it to the bottom of the container.
- Make sure the Hose Connectors are loose so that water can flow out of the pipes freely and leak into the catch basin below.
- If the posters have yet to be put up, please place the posters up so that students can see.
 - Have the materials ready to show the students by placing them on the table.



Takedown:

- At the end of the day, please make sure all materials listed above are still present.
- Take down posters

Safety: Please ensure that there is no horseplay when students are putting together the “water mains”, especially when handling the screwdrivers.

What will I be doing? (Procedure)

Before you start your presentation check with the teacher or chaperone that the entire group is present and ready to start.

Remember that **doing** an experiment and **discovering** the answer is more powerful than watching and listening to someone, so try to involve as many children as possible.

Part 1 (Intro)

Say: *"Hello and welcome to 'Under Pressure!' My name is ____."*

Part 2 (Warm up questions)

Ask: *"Have you visited the 'Pioneer Water Race' activity yet? (Wait for response)"*

Say: *"This activity talks about having to carry water in buckets into the home"*

Ask: *"How does water get to our homes and schools today?"*

ANSWER: We turn on the tap – in the kitchen, bathroom or outside, and water flows out. Water flows through a network of pipes, called the distribution system. A water main, part of the distribution system, delivers clean water from the water treatment plant to your home.

Ask: *"Where do you find water mains?"*

ANSWER: Most water mains are buried at least 6 feet or deeper underground so that they don't freeze in the winter. The large water mains are connected to progressively smaller pipes, which eventually connect to our homes, schools, and businesses. They are usually under roads, so we can get to them if they require maintenance and repairs. There are over 4000 kilometers of water mains in Peel Region.

Say: *"If we look at this map, we can see the Water Main Trunks which are the largest water mains that carry water from the treatment plant to small water mains that lead to our houses and schools. In this picture we are here (show zoomed out picture), Heart Lake, and these are the large water mains. As we zoom in closer to Heart Lake (show zoomed in picture) we can see the smaller blue lines which are smaller water mains that bring the water to our homes and schools."*

Ask: *"What do you think these pipes were made of 100 years ago in North America?"*

ANSWER: Wood

Ask: *"What are water mains made of today?"*

ANSWER: Our pipes are made from 4 materials today: cast iron, concrete, ductile iron, and heavy-duty plastic (PVC).

Ask: *"What are the advantages and disadvantages of each type?"*

ANSWER: Concrete water mains are used for directing the water straight from the water treatment plant and are the largest of the four types. They can handle the pressure of a lot of water. Cast iron is also used. Heavy-duty plastic (PVC) pipes are used for smaller diameter pipes. The pipe leading into your house are either copper or plastic.

Ask: *"How big around (diameter) should a water main be?"*

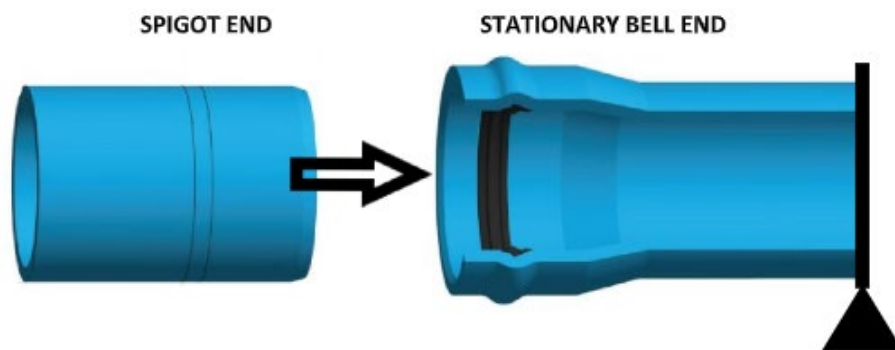
ANSWER: This depends on how much water is expected to be flowing through the pipe, but they can be anywhere from half an inch to three metres in diameter (demonstrate size with your hands). Some are so large, you could float a small boat through them but for safety reasons, you never would! ***point to large photo***

Ask: “Will these pipes last forever in the ground?”

ANSWER: No. They can last over 50 years, but eventually they will need to be replaced. This may be due to cracks along the pipes. Peel Region tests for leaks in pipes and repairs and replaces old water mains and water services going into peoples homes. If anyone has ever had the water mains on their street replaced, you would have noticed lots of big trucks, huge pipes piled up, and large holes dug in the roads.

Ask: “What might cause a water main to break?”

ANSWER: Water mains are under constant pressure. There is pressure on the outside of the pipe, from the dirt, gravel, and pavement piled above it, plus the weight of cars and trucks driving along the road. Over time, the pipes will start to break down, especially at joints where they connect- this is where they are weakest.



Ask: “How much water can be lost if a water main breaks?”

ANSWER: It depends on the size of the water main. Hundreds to thousands of litres could leak out underground or spill out onto the street before workers are able to repair it. It's important that we try to prevent leaks and breaks in water mains because water is a very limited resource and we are very lucky where we live to have access to so much clean and fresh water.

Ask: “Is it possible to prevent water main breaks from happening in the first place?”

ANSWER: Sometimes, but not always. Peel Region workers replace old water mains before they crack and check for leaks to fix them when they are small, before they lose a lot of water.

Part 3 (Activity - 6 mins)

Have 3 students ready to work at the same time stand in front of the model, with one student by each hose connector.

- Explain that the hose represents a section of a water main; but that real water mains are much larger and made of a different material
- **Ask** the students “what is one of the biggest differences between the piece of plastic hose and a real water main (apart from its size)’ - the hose is flexible, real water pipes are not.

- Explain that the hose represents a broken water main. Water should drip out from the first hose connector and will not make it to the last bucket.
- **Say:** *"If one point in the water main is broken, water will not make it through Peel Region to all of our homes."*
- Have them pretend they are repair people who have been called out in the middle of winter to repair a water main break on the street in front of their home. It is important to repair it quickly so the families on the street have water.
- Show them how to place the hose clamp over the crack and screw it in tight.
- Explain that if they have garden hoses at home that have cracked and sprung a leak, they can fix them using these same clamps (that is what they were designed for).
- Once all the children have "repaired" their water mains, use the hose to run water through and check for leaks. After this, be sure to have the students unscrew the water mains so they are no longer tight and put the water from the second bucket back into the first. Check that no one has lost the screws!

Part 4 (Summary/key concepts review - 2 mins)

Ask: *"What is a water main for and what materials are they made from?"*

Ask: *"How and why can a water main break and what role does water pressure play?"*

Go over answers.

Background Information:

Over one hundred years ago, if you needed water for cooking, cleaning, or drinking, you had to go outside and pump it from your well into a bucket and carry it. Fortunately, today water is pumped into our home through underground pipes and we have the convenience of water at the turn of a faucet.



A water main is a large pipe buried underground that carries clean, safe drinking water from a drinking water treatment plant, and connects along the way to smaller pipes that eventually lead to our home, school or business. Water mains are usually buried under roads so they can be easily accessed for maintenance. They can be made from iron, steel, heavy duty plastic, or concrete. They can range in size from ten centimetres in diameter to over three metres in diameter.



In Peel Region, we have over 4000 kilometres of water mains running underground with water constantly flowing through them. You may sometimes hear on radio traffic reports that a street is closed due to a water main break. These huge pipes are always under tremendous pressure from the force of the water flowing through them, plus the weight of the ground above them. Over time, small cracks may appear especially at joints or connections.

When water is seen coming up from under the road, a work crew is sent to investigate. First, the water main is "controlled", by closing nearby valves that allow water to flow through the mains. Depending on the type of leak, this will either reduce the flow of water to the affected water main or shut it off completely.

Once the general repair location has been identified and the water main is shut off, special equipment is used to find the precise location of the leak. Then, construction crews are dispatched to the location to begin the repairs. Prior to any excavation, the crews must identify the location of all utilities to ensure the repair can be done without damaging other utilities or endangering staff or the public.

Vocabulary:

Water Main – Pipes that deliver clean water from the water treatment plant to our homes, schools, businesses, and stores. They are found buried several meters underground and vary in diameter and composition.