

# "Water Journey"

Grades 1, 2, 3 (30 minutes)

## Materials

- blow-up globe
- wooden apple model
- sample containers of chemicals used to treat water at DMWW
- laminated photo cards of water journey and processes (mounted on black posterboard)
- "Water Goes Round and Round" worksheet for each student
- teacher follow-up packet

## Lesson Objectives

Students will become aware of how little water we have available for our use on earth. Students will gain a basic understanding of where water comes from and where it goes -- how it gets from rain to wastewater treatment and back into the river. Students will understand what kinds of things pollute water, how these pollutants get into the water, and some ways that pollution can be prevented.

## Lesson Overview

Using a globe and apple model of the earth, students will see how little water is available for us to drink and use. Students will view water's journeys through use of picture cards showing water from rainwater to storm sewers, to the river, to DMWW and its treatment process, to homes and businesses, to WRF and its treatment process, and back into the river.

## Procedures

To discuss the earth's water supply, hold up the globe and ask students whether our earth has more land or water (water). Tell them that even though we have more water than land on our earth, we cannot drink or use most of that water. Ask them if they know why (because most of the water is salty ocean water that would be poisonous to drink with so much salt in it and is too expensive to get the salt out of). Tell them that we must get our water from fresh water places. Ask them if they know where we can find "fresh" water (lakes, rivers, streams, ice, ponds, underground).

Demonstrate the relationship of these amounts by sharing the wooden

apple model. Tell students that the apple stands for the whole world. Remove the 1/4 piece and tell them that the large piece (3/4) stands for how much water there is on our earth and the 1/4 piece for how much land there is. Take out the thin slice, hold it up, and tell them that this piece stands for how much fresh water there is that is available for people to use. Since we have so little fresh water, we need to be sure to take good care of it and keep it as clean as possible. Ask students if they know where water comes from (they will say things like sky, rain, faucet, rivers, lakes, pools, hoses, etc.). Tell them that they are going to learn about where water comes from and where it goes on its journeys through Des Moines.

Using the picture cards and questioning techniques, students will be walked through the steps of water journeys. Ask students if they know what Des Moines Water Works or Wastewater Treatment Plant does with water (clean water). Tell students they are going to help you tell the story of where water comes from and where it goes. Tell them that some of them will be sharing picture cards and some with the sharing of treatment chemicals. Distribute laminated picture cards 1-3 and have those students come to the front of the class and face their class with their cards.

### **Card 1 -- rain traveling down driveway**

Ask students what they see and how they think water got in the street and where they think it is going. (It rained and water is running downhill into a storm sewer-hole in the curb where rainwater goes.)

### **Card 2 -- rain going into stormwater sewers**

Ask students what they see happening and where water is going. (Water is going down the storm sewers and is taking debris and garbage along with it.) Ask students what kinds of things they think get in our storm sewers when it rains (leaves, trash, dirt, sand, grass clippings, lawn chemicals, oil ,etc.). Ask students what they think the water goes into after it goes down the sewer hole (underground pipes).

### **Card 3 -- river**

Ask students where water goes after it leaves the storm sewer pipes. (The storm sewer pipes lead to rivers and streams.) Ask students what pollution

was brought into the river through the storm sewer pipe (all the things they mentioned before as going into the storm sewer).

**Collect the cards and distribute cards 4-6 and have those students come to the front.**

#### **Card 4 -- Des Moines Water Works intake on the Raccoon River**

Ask students what they think is happening to water in this picture of the Raccoon River. (Students will probably not be able to figure this out.) This is the intake to DMWW on the Raccoon River. The Raccoon River is one of the rivers DMWW gets their water from. Water is sucked in through the screens into a pipe that leads to DMWW. Ask students what other river runs through Des Moines besides the Raccoon River (Des Moines River). Tell students that there is a similar intake on that river, and water travels through a 5-mile pipe to reach DMWW. Ask students why they think there is a screen on the intake (to keep large debris, like leaves, fish, rocks, and branches from coming into DMWW). Have a student share the sample bottle of river water, and remind students that DMWW will have to get all of the pollutants that are in the river out of the water to make it safe for drinking.

#### **Card 5 -- DMWW pump station front**

Ask students what they see in this picture ( Des Moines Water Works building). Tell students that they are going to be seeing pictures of some of the processes DMWW uses to clean water.

#### **Card 6 -- topside of presedimentation basins**

Ask students what they see and what they think is happening to water here (grassy area with pumps on top where water begins the treatment process in underground tanks). Tell students that this is the topside of 2 underground tanks that river water is brought into. Tell them that each tank holds 4 million gallons of water. The tanks are as big as a football field and as tall as a 2-1/2- story building. The first things that happen to the water are that 2 chemicals are added to remove bad tastes and odors, pesticides, and dirt. Ask them if they know what a pesticide is (a chemical that kills bugs or weeds and is poisonous if left in the water). Ask students how they think dirt and pesticides get in the water. (Loose dirt gets washed

in because people haven't planted grass and trees to hold it in place, and pesticides that people put on farm fields, lawns, and gardens get washed in, too, when it rains.) Have a student come to the front to hold up powdered activated carbon and ferric chloride, the two chemicals used in the first treatment step. Tell them that ferric chloride makes all of the bad odors, bad tastes, pesticides, and dirt form heavy clumps. Ask them what will happen to something heavy that is in water. (It will sink.) Tell them that the motors they see in picture 6 are for powering the flight boards that run along the bottom of the tanks. They look kind of like a row of snowplows, and they scrape the dirt and other stuff into a pipe so we can get rid of it. Now water is ready to move on to the next step.

**Collect the cards and distribute cards 7-10.**

### **Card 7 -- inside softening basin**

Rather than ask students about this picture, it will probably be best to tell them that this is what the inside of part of the first set of tanks and second set of tanks looks like when the water is out of them. This level is called the "ballroom." This is the inside of a softening basin. This is the second step of the treatment process and water from underground water in Water Works Park is combined with the river water from the first step. There are 4 basins that each hold 4 million gallons, and here we do something called "softening" the water. "Hard" water has lots of minerals dissolved in it, so it is hard to clean with. We soften the water to make it easier to clean with. Have a student come to the front to share the lime slurry, the chemical used for softening the water and also the bottle containing water and sludge that has clumped and settled to the bottom after adding ferric chloride again.

### **Card 8 -- sludge dome and dewatering presses**

Tell students that DMWW recycles the sludge that settled to the bottom in the softening process. Ask students what it means to "recycle" (use something again). Tell students that the sludge is sent to the silver dome building to thicken and then to the dewatering building so the huge presses can squeeze water out of the sludge to make sludge cakes that can be recycled. Have a student walk around the class with the baggie containing a sludge cake. The sludge presses open up and drop huge

sludge cakes into semi-trucks on the lower level. The company that takes the sludge cakes sells them to co-ops to sell to farmers as Aglime. Aglime is good for the soil. About 12 semi loads of sludge cakes are hauled out each day.

### **Card 9 -- filter pool and sand a gravel model**

Ask students what they think might happen to water in this next step. Tell students that this next step is called "filtering." There are 16 pools just like this one. Water is brought in from the softening basins and sinks down through about 2 feet of sand and 2 feet of gravel. Have a student come to the front to share the sample sand and gravel container. Sand and gravel are good at trapping any dirt or lime that is still in the water. Underneath the sand and gravel are large pipes to catch the clean water.

### **Card 10 -- nitrate tanks**

Ask students what they think DMWW might still have to get out of the water that we haven't. (They probably will not guess fertilizer, so you will probably have to tell them that fertilizer, a chemical used to help plants grow better, turns into a chemical called nitrate that is poisonous to babies, so we have to get rid of it.) Have a student hold up the baggie containing nitrate resin and tell students that these tanks are filled with this nitrate resin that is good at trapping nitrate.

### **Collect the cards and distribute cards 11-12.**

### **Card 11 -- DMWW laboratory**

Ask students what they think the men in these pictures are doing (lab workers checking for harmful things in the water, like germs and certain chemicals).

### **Card 12 -- inside and outside pumps**

Tell students that a little chlorine for killing germs and a little fluoride for healthy teeth is added, and the water is put in a 10-million gallon underground tank. Ask a student to hold up the container of clean DMWW tap water. Then we need what they see in these pictures. Ask them what they think these are for (pumps for pumping water to all of our customers).

**Collect the cards and distribute cards 13-15.**

**Card 13 -- sink**

**Card 14 -- drinking fountain**

**Card 15 -- toilet**

Ask students what is happening in these 3 pictures. (Water is being used and going down a drain.) Ask students if they know where water goes next after it goes down the drain or gets flushed. If they do not know, they will find out in the next set of pictures.

**Collect the cards and distribute cards 16-18.**

**Card 16 -- front of Wastewater Reclamation Facility (WRA)**

Tell students that this is the place water goes after it goes down drains. Ask them if they know what will be done here. (Wastewater will be cleaned up.)

**Card 17 -- bar screens**

Ask students what they think this machine is doing with wastewater. (Fork-like structures lift and separate large pieces of debris, like diapers, sticks, rags, leaves, and coins -- things people should not be putting down drains). From here, the solid garbage that has been removed is mixed with a chemical to remove bacteria and bad smells and hauled to the landfill, and the rest of the wastewater continues through the treatment process.

**Card 18 -- grit chamber and primary clarifier**

Ask students what they think is happening to wastewater in these 2 pictures. (Water is sent through a channel of fast-moving water where they can measure how much water has come into the plant and can also allow sand and gravel to settle to the bottom and be removed.) The water is then sent to one of 6 primary clarifiers where solids (sludge) settle to the bottom of the tank where they can be scraped away for recycling, and oil is skimmed off of the top so it can be taken to the landfill.

**Collect the cards and distribute cards 19-21.**

### **Card 19 -- aerators**

Ask students what they think is happening next. (Water begins secondary treatment in the aerators). If students haven't noticed the bubbles yet, ask them why they think there are bubbles in the water. (Air is pumped in for the organisms that are feeding on harmful waste materials in the water, the water winds through 4 channels like this before it goes on to the next step.)

### **Card 20 -- laboratory**

Ask students what they think this is a picture of (WRA laboratory where they test the water in each step of the process to make sure they are removing harmful substances).

### **Card 21 -- secondary clarifier and chlorine addition channel**

Ask students what they think is happening in these pictures. (Sludge waste gets settled to the bottom in 6 circular secondary clarifiers, just like it did in the primary clarifiers; this sludge is sent to the sludge processing plant to be recycled; chlorine is added to kill harmful bacteria.)

### **Collect the cards and distribute cards 22-24.**

### **Card 22 (same as card 3) -- river**

Ask students where the cleaned up wastewater goes (into the Des Moines River; the cleaned up wastewater is cleaner than the river water it goes into). Ask students what they think happens to the water after it goes in the rivers. (Some of it evaporates and becomes clouds and rain, some of it will continue down the river to other towns that use river water for drinking water; the Des Moines River empties into the Mississippi River and finally the Gulf of Mexico.)

### **Cards 23 and 24 -- power generation building and storage sphere, sludge processing, and sludge spreading truck**

Tell students that both of these last pictures involve recycling of sludge at WRA. Have a student hold up the container with the settled sludge. Ask students what they think this sludge might be used for. (They can collect gases given off by the sludge and use it to make electricity. They also squeeze most of the water out of the sludge in belt filters -- top of picture 24

-- and sell it to farmers to spread on their fields to help their crops grow better. The trucks take the sludge to the fields.)

## **Follow up**

Follow up with a discussion of what kinds of things (pollutants) may get in the water on its journey (oil, leaves, dirt, pesticides, fertilizer, garbage, hazardous chemicals, etc.) and how we can prevent them from getting in the water.

Offer the follow-up worksheets, follow-up information packet, and evaluation form to the teacher.