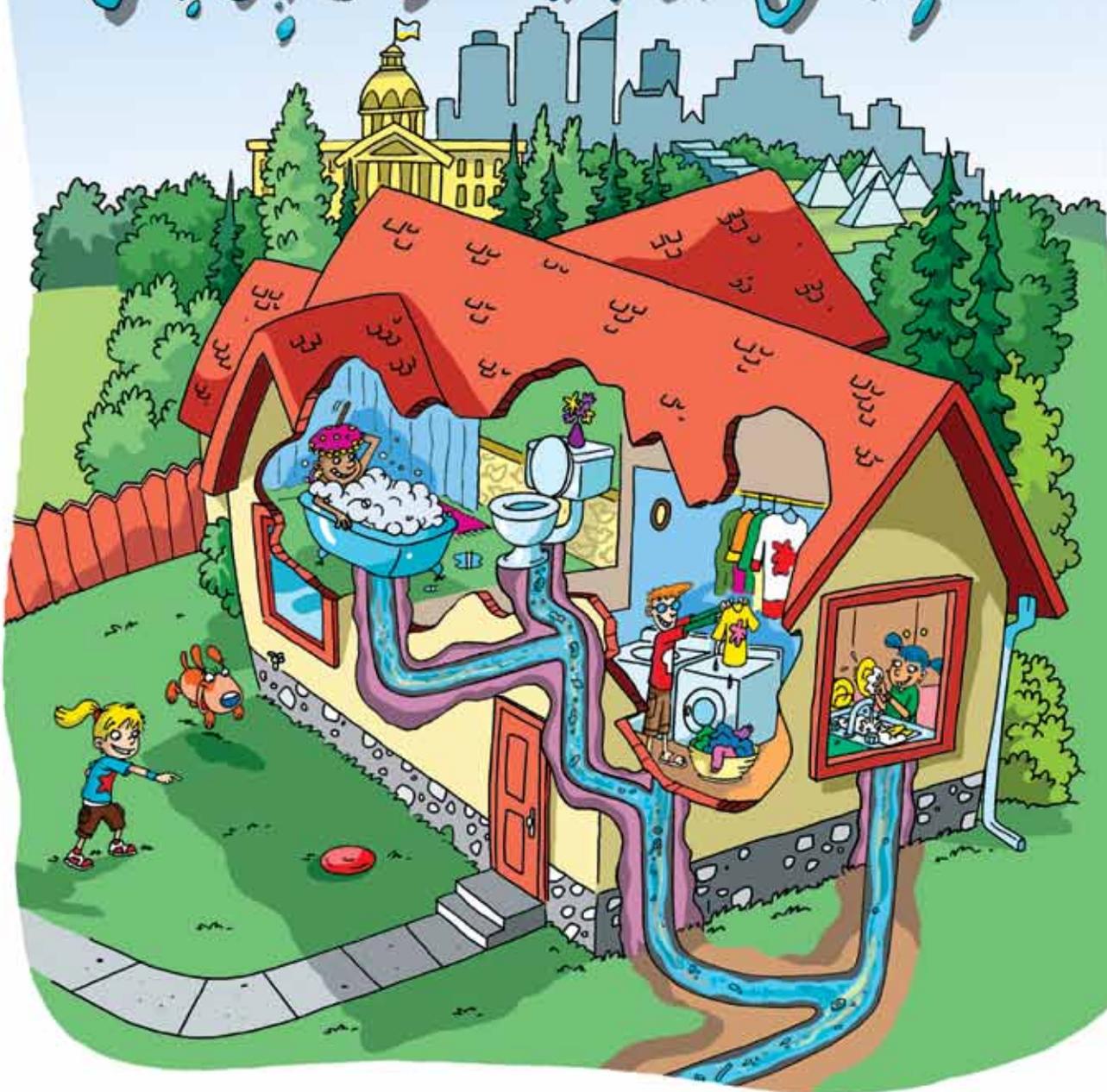


Treat it Right[®] Wastewater



Teacher's Guide

Treat it Right!®

A wastewater program (Grade 4)

Acknowledgements

The City of Edmonton wishes to acknowledge the assistance of Edmonton Public and Edmonton Catholic School Boards in the development of this program. The City of Edmonton also acknowledges and thanks Sherry Taylor for her assistance with the development and review of the program and her Grade 5 Class at George Luck School for their participation in focus testing the design. As well, other sources and organizations have been consulted, including Alberta Education.

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Disclaimer: Every effort has been made to ensure the accuracy of the material. Any errors or omissions should be directed to the project manager.

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The Treat it Right!® Program includes:

Treat it Right!® Wastewater (Grade 4) (English and French)

Treat it Right!® Storm water (Grade 5) (English and French)

Treat it Right!® LID (Grade 7)

Treat it Right!® Wastewater (Grade 8)

Treat it Right!® Storm water (Grade 8)

Treat it Right!® Puppet Show (Grades 2 and 4)

Treat it Right!® Constructed Wetland Field Trip (Grade 5)

Visit our website at: www.edmonton.ca/drainage/education

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Curriculum Fit

Correlation with Alberta Education Grade 4 Programs of Study*

*Teachers will find aspects of the following SLEs in this teacher's guide.

Science - Waste and Our World Students will:	Lesson			
	1	2	3	4
Identify and classify wastes that result from human activity.	✓			
Describe alternative methods of disposal, and identify possible advantages and disadvantages of each.	✓	✓		✓
Distinguish between wastes that are readily biodegradable and those that are not.	✓			
Identify methods of waste disposal currently used within the local community.		✓		✓
Identify kinds of wastes that may be toxic to people and to the environment.	✓			
Identify actions that individuals and groups can take to minimize the production of wastes; to recycle or reuse wastes; and to ensure the safe handling and disposal of wastes.	✓	✓	✓	✓
Develop and implement a plan to reduce waste, and monitor what happens over a period of time.			✓	
Students will show growth in acquiring and applying the following traits: - a sense of responsibility for personal and group actions. - respect for living things and environments, and commitment for their care.	✓	✓	✓	

Social Studies – Alberta: A Sense of the Land Students will:
Value Alberta's physical geography and natural environment. - demonstrate care and concern for the environment through their choices and actions.

Language Arts

Students will:

Comprehend new ideas and information by responding personally and discussing ideas with others.

Monitor understanding by confirming or revising inferences and predictions based on information in text.

Use text features, such as headings, subheadings and margin organizers, to enhance understanding of ideas and information.

Ask relevant questions and respond to questions related to particular topics.

Organize ideas and information using appropriate categories, chronological order, cause and effect, or posing and answering questions.

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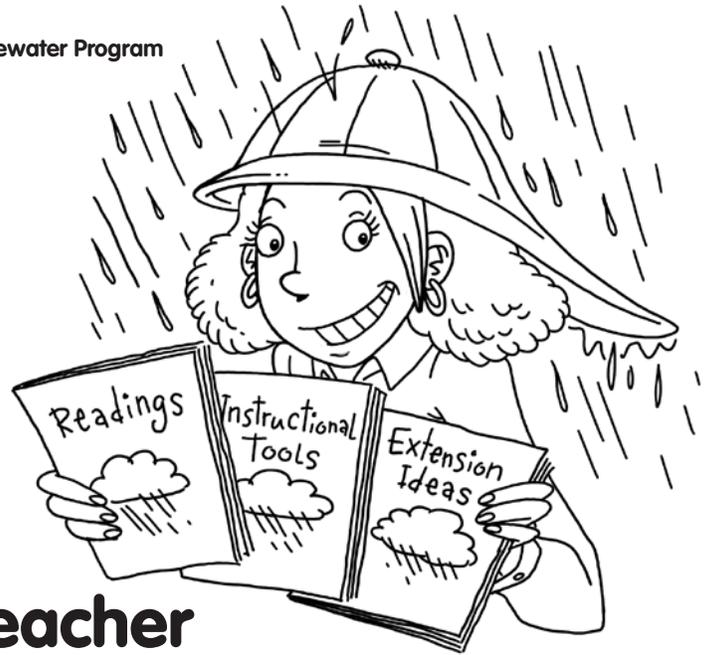
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Instructions for the Teacher

This **Treat it Right!**® teacher's guide develops the personal action concepts of the Grade 4 Science **Waste and Our World** topic by investigating how wastewater is managed and treated in Edmonton.

These concepts are explored through a series of four lessons that will integrate easily with most **Waste and Our World** units.

The **first lesson** develops the concept of wastewater in general and explores the idea of biodegradability with respect to the materials that end up in wastewater.

The **second lesson** looks at the way wastewater is managed and treated within the Edmonton community.

In the **third lesson**, students identify actions that they and their families can take to minimize their negative impact on wastewater.

In the **fourth lesson**, students will have the opportunity to look at some of the ways that wastewater has been managed historically in Edmonton and in other countries.

The teacher's guide includes duplicating masters; the **Masters** are organized as **Readings, Instructional Tools, and Extension Ideas**. Links to the science curriculum, other subject areas, home, and other programs of interest are included.

The lesson plans include suggestions for the students to develop a game that can be used for assessment of the students' learning and as an enjoyable culminating activity that will continue to reinforce the personal action message of this unit.

This program will supplement your science program and help students learn that their actions can have a significant impact on the environment.

Lesson 1

What is Wastewater?

Teacher Background

In the first lesson, students are introduced to the topic of **wastewater**. Students will learn that when they flush the toilet, brush their teeth, take a shower, or wash the dishes, all of that water and waste go down the drain to a pipe under their houses and then to a much larger pipe located under the street. All of this water and waste is called wastewater or sanitary sewage.

They will learn that some of the wastes that they put down the drain or in the toilet are biodegradable and that some wastes are not. They will learn that some wastes are harmful and these wastes should not be put down the wastewater system.

Objectives

Students will:

- identify and classify wastes that result from human activity
- know the difference between biodegradable and nonbiodegradable
- identify that some products that go down the drain or toilet are harmful to the environment

Materials

- KWL Chart
- What is Wastewater?
- What is in Wastewater? Master and Key
- What should not be in Wastewater
- Helpful Actions / Harmful Actions Cards



Introduction

Recently, we have been studying about plant and animal wastes and how they are recycled in nature. Have you ever wondered about all of the waste and wastewater that we produce every day? What happens to it and where does it go? Do you know what wastewater is? What is in it? Do you know what should be in wastewater and what should not be there?

Activities

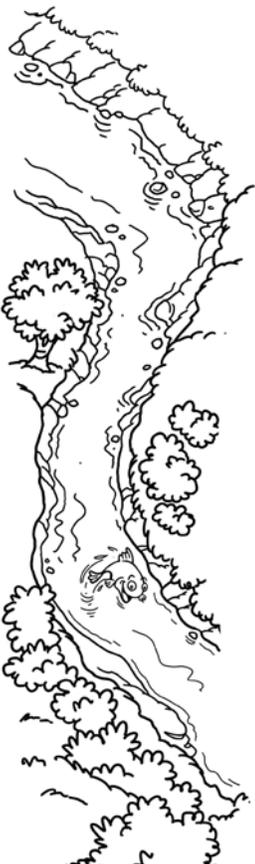
1. Wastewater Discussion

- Discuss. Have you ever looked under the sink in the bathroom or in the kitchen and seen the pipe under there? What do you think is the purpose of that pipe? What goes down there? Where does the water come from and what else goes down there besides water? What about the toilet, shower, and dishwasher? Where do you think all that water and waste go? Where do you think these pipes go? What do you think happens to all of that **wastewater**? Where do you think it eventually ends up? What do you think is thrown down the drain or flushed down the toilet that shouldn't be put there?

Alternatively, teachers could have the students pose these questions themselves either individually or in small groups and then discuss possible answers as a class.

2. Wastewater Contents

- For the next few lessons, we are going to learn about wastewater and what is in it. Let's start with what you already know about wastewater.
- Have the students complete the first two columns of the **KWL Chart** on wastewater independently or as a class. Discuss what they would like to find out.
- Read **What is Wastewater?** together to find out about what is usually flushed or put down the drain.
- Discuss the new ideas found in this Reading. During the discussion, calculate the amount of wastewater each Edmontonian produces each day. (Hint: Take the number of mega litres produced by all Edmontonians; calculate how many litres that is; and divide by the population of Edmonton.)



- Using a blank overhead of the **What is in Wastewater? Master**, start a list of the materials that are found in wastewater. Ask the children what possible harmful effects to the environment might be caused by those materials. (A sample **Key of What is in Wastewater?** has been included and may be a useful reference for you.) If you wish, copy the **What is in Wastewater? Master** for the students to fill in as they progress through the Readings and other activities.
- Ask the students to predict some of the things that might be flushed or poured down the drain that shouldn't be, and why they shouldn't be. Read and discuss **What should not be in Wastewater**.
- Add new items to the **What is in Wastewater? Master** and discuss additional information that they have learned about why some materials may be harmful.
- Explore in more depth the idea of **biodegradability** and the problems that happen when some materials aren't easily broken down and returned to nature. Using thumbs up and thumbs down, ask the children to indicate whether or not things that are flushed or rinsed down the drain are **biodegradable** or **nonbiodegradable**.

3. Culmination Ideas

- Have the students summarize their new knowledge in their **KWL Chart**.
- **Board Game** - We are going to make a board game using what we learn about the proper treatment of wastewater. We are going to start today by making up some **Action Cards** for the game. Can you think of some "Helpful Actions" from what we have learned so far? (Throw dental floss in the garbage.) What would be a "Harmful Action"? (Throw plastic wrappings in the toilet.) Using the **Good Actions / Harmful Actions Cards**, see how many cards you can make from what you have learned today.
- **Ticket Out of the Classroom** - Each student writes his or her name on a yellow stickie, then writes down one material that is found in wastewater. As they leave the classroom, they place their stickie under the appropriate column on the blackboard: **Biodegradable** or **Nonbiodegradable**. The stickies can be used as a quick gauge of basic understanding of the concept.

Lesson 2

Where Wastewater Goes and What Happens to It

Teacher Background

In the *second lesson*, students learn about the flow of wastewater from their homes and school to the Gold Bar Wastewater Treatment Plant and then on to the North Saskatchewan River.

Students will learn that all of the sanitary sewage or wastewater goes to the Gold Bar Wastewater Treatment Plant where it is cleaned and treated before it goes to the North Saskatchewan River.

They will learn that wastewater is cleaned and treated through a series of steps. They will learn that not all things can be cleaned out of the water so they must be careful of what and how they dispose of things.

The Gold Bar Wastewater Treatment Plant is owned and operated by EPCOR which is wholly owned by the City of Edmonton.

Objectives

Students will:

- understand that there are many steps to cleaning and treating wastewater before it goes to the North Saskatchewan River
- survey home practices related to wastewater

Materials

- Wastewater Flow Chart
- Cleaning and Treating Wastewater
- The Steps to Cleaning Wastewater
- Board Game Master and Instructions
- Board Game Key
- Treat it Right at Home!

Introduction

To review the previous lesson, ask each student to tell another student three products that are acceptable to put into the wastewater system and three that are not.

Tell the students that the City of Edmonton collects wastewater and sends it to Gold Bar where it is cleaned and treated at the Gold Bar Wastewater Treatment Plant. In this lesson, they will learn how the wastewater gets from their house to the plant and from the plant to the North Saskatchewan River. They will also learn why we clean wastewater and the steps taken to do that.

At the end of this lesson, send the children home with the **Treat it Right at Home!** survey and have them check the descriptions of what happens at their homes.

Activities

1. Cleaning and Treating Wastewater

- There are many things in wastewater that shouldn't be there when we send our wastewater down the drain or down the toilet. Think back to what you learned during our last lesson. What is the first step of removing some of those materials from wastewater? (Screening and removal of solid materials to the landfill.) What other things might need to be done to be sure the water is clean enough to be returned to the river?
- Read together **Cleaning and Treating Wastewater**. Add new information to the **What is in Wastewater? Master**.

2. Treating Wastewater in Edmonton

- Hand out the **Wastewater Flow Chart**. Ask the students to look at it by themselves and then with a partner to see what they notice about the flow of the wastewater.
- Use a combination of resource materials (**The Steps to Cleaning Wastewater** and the **Wastewater Flow Chart**) to review the process of cleaning wastewater. (Use your smart board. This program is online at www.edmonton.ca/drainage/education) Add any new information to the **Master of What is in Wastewater?**

3. Board Game (continued)

- Today we are going to continue making our board game. Using the **Board Game Master**, ask the students to fill in the steps of the water treatment process that we have just learned. Discuss how the game could be decorated to highlight and enhance the information. For example, positive outcomes from the plant could be coloured one colour, and little cartoons of good bacteria could be added at step three.

4. Treat it Right at Home!

- Discuss the **Treat it Right at Home!** survey and have the students take it home so it is completed for the next class.

5. Extension Activities

- Find the location of the Gold Bar Wastewater Treatment Plant on a map of Edmonton. Locate your school. Using the scale on the map, calculate how far the wastewater would have to travel from your school to the plant. Gold Bar is located at 10977 – 50 Street.



Lesson 3

Your Actions Matter

Teacher Background

In the third lesson, students assess what is done at home that might have a positive or negative impact on wastewater. During the lesson, there is the opportunity to discuss everyday practices that are helpful to the environment, such as the proper disposal of grease and oil. With the new information they have learned from one another, and from the discussions, the students make an action plan for change. They also can anticipate possible obstacles to change, and discuss how they might be overcome. As a further “action” project, the students can mix up some natural cleaners using the recipes provided in the **Extension Ideas**.

Objectives

Students will:

- discuss the kinds of disposal used at home
- learn about choices they can make and how they can help their families change their behaviors for the good of the environment

Materials

- Treat it Right at Home!
- Family Plan



Introduction

Yesterday you surveyed your family to find out what things are put down the drains in your home. Share the results of your **Treat it Right at Home!** survey in small groups.

The students will then report on their observations and conclusions to the whole class. What did they find out happens at their homes? What kinds of changes do their families wish to make?

Activities

1. We are All in This Together!

- You and your families had some ideas of what you could do to be careful with what you flush down the toilet and dump down the drain. What are some of those ideas? Perhaps there are some things you didn't know. For instance, did you know that cooking fats, oils, and greases (FOG) get thick almost as soon as they begin to move down the drain. Eventually, this FOG will start to plug your wastewater system in your house or on your property. Pouring hot water down with the FOG does not help. Pour the grease into a tin, keep it in the fridge, then throw the grease in the garbage when it is full. Wipe out your cookware with a paper towel that you put in the garbage. Don't pour FOG down the garbage disposal; it will clog it up too. Instead, use left over fruit and vegetable scraps to make compost which can be used as a natural fertilizer for your garden.
- After our discussion, is there anything else that you would like to add to your list that you would personally like to see happen in your house?

What obstacles might you run into in encouraging change and what could you do to overcome them? Discuss these ideas with other students and record possible ways of convincing others of your plan. Take home the **Family Plan** and decide with your family how you will follow through. Decide as a class on a follow-up date.

2. Board Game

- Have the children finish their **Helpful Actions / Harmful Actions Cards**. They could also finish *decorating* their game boards.

3. Extension Ideas

- Make up some *natural cleaners* to take home and to use in the classroom, using the recipes found in the **Extension Ideas**.



Lesson 4

Drains: Then and Now

Teacher Background

In this final lesson, the students will learn about the three drainage systems in the City of Edmonton: the wastewater system, the storm water system, and the combined system.

Students will have the opportunity to explore some historical aspects of drainage systems. They will also look at different ways that wastewater is treated in different parts of the world.

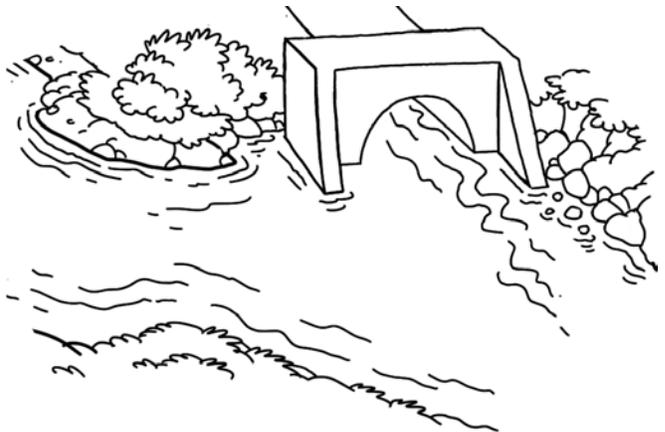
Objectives

Students will:

- understand that there is an extensive network of pipes in the three drainage systems in Edmonton
- learn that there is long history to sewage treatment and that some sewer systems are famous

Materials

- Pipes and More Pipes
- Before and After Outhouses



Introduction

Just imagine, there is a complicated system of pipes under our city that drains water away from our homes and streets. In fact, there are nearly 2 354 km of wastewater sewers. That's about as long as going back and forth from Edmonton to Calgary three times!! That's a lot of pipes. However, those aren't the only pipes under our city.

Activities

1. Under the Street

- Read **Pipes and More Pipes** to find out about the other pipes beneath our feet, and who takes care of them. Ask each student to share something new he or she learned with another student.

2. Sewer Systems in the Past

- People have always had to deal with their waste, especially when they lived together in groups. There weren't always extensive systems of pipes and complicated treatment plants to make sure our water is clean. Throughout history, civilizations have had various ways of dealing with wastewater. Often waste was thrown in nearby rivers and lakes. Some civilizations in the past, simply threw their human waste onto the street! This still happens in some places in the world today.
- Other civilizations such as the Ancient Greeks and Romans were highly advanced in how they handled waste and, in some cases, these systems are still in use today.

3. Before and After Outhouses

- There is also a history to wastewater treatment in Edmonton. Read **Before and After Outhouses** to learn about what happened in Edmonton before the Gold Bar Wastewater Treatment Plant was developed. Based on what you read today, are there any new **Harmful or Helpful Action Cards** that you could make for your game?

4. Extension Ideas

- *Google Water Environment Federation and Click on About Water and Sanitation. Click on Public Information; Click on Students & Teachers K-12; and Click on Acqua Venturer® Time Machine and try out the interactive timeline and database.*

<http://www.wef.org>

- *More Historical Research - Divide the students into small groups. Have each group research a topic such as the following:*
 - * *A famous sewer*
 - * *The history of drainage*
 - * *A toilet museum*
 - * *When were flush toilets invented?*
- **Word Search (Ready-made or Do It Yourself)**

5. Culmination Activities

- *Go back to the KWL Charts and add new information in a summarized form. Then have fun playing the games!*



Links

You may wish to check these links for educational programs and materials.

Alberta Council for Environmental Education

<http://www.abcee.org/>

Alberta Environment

<http://www.environment.gov.ab.ca/edu>

Ducks Unlimited

<http://www.ducks.ca>

EPCOR

<http://www.epcor.ca> (click on Community Investment - Education)

Inside Education

<http://www.insideeducation.ca/>

North Saskatchewan Watershed Alliance

<http://www.nswa.ab.ca/>

Partners FOR the Saskatchewan River Basin

<http://www.saskriverbasin.ca/>

Water Environment Federation

<http://www.wef.org/>

Yellowfish Road

<http://www.yellowfishroad.org/>

Third Party Disclaimer:

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Evaluation

Your participation in this evaluation will help us to further develop and improve this program. Thank you for your assistance.

School Name: _____

Teacher Name: _____

Grade: _____

1. The Instructions to the Teacher are:

clear

unclear

could be improved by: _____

2. The objectives are clear and fit the curriculum:

yes

no

could be improved by: _____

3. The information works with the curriculum and fits Waste and Our World:

well

poorly

I would add or delete: _____

4. I appreciated having a good selection of Readings.

Yes

No

5. The activities I found useful include and why.

6. The activities that didn't work well include and why not.

7. The graphics, charts, illustrations, and drawings were:

- clear and understandable
- unclear and not understandable
- I would change or add: _____

8. The time needed to complete the activities was:

- about right
- too much
- should be changed by: _____

9. I would add the following materials to the program:

- dvd
- games
- in class presentation by experts
- distance or e-learning component
- more activities in _____
(science, reading, social studies, other)

10. I would like to have this program in another language. Please indicate:

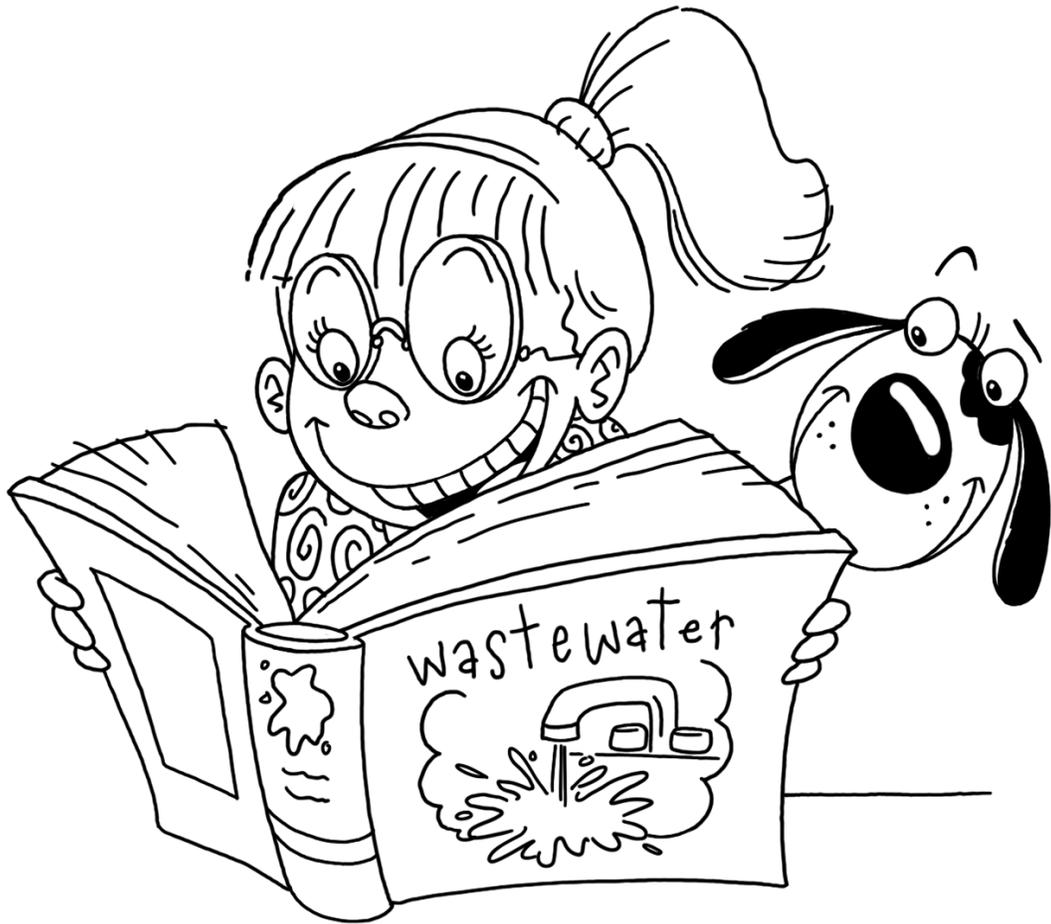
- Spanish
- German
- Chinese (Cantonese) _____ (Mandarin) _____
- Korean
- Other

Please provide any other comments you may have. All suggestions are welcome. _____

Please print and complete this evaluation and fax or mail it. You can also complete the evaluation on line at: www.edmonton.ca/drainage/education and send it by e-mail. Thank you.

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Readings

What is Wastewater?

In the City of Edmonton, there are approximately 878,000 people (2014 Census) and every day those people take a shower or bath, do the dishes, and flush the toilet. All of that water and waste that they produce is called wastewater or sanitary waste.



What is in that waste? We know there is human waste that is the natural waste that our bodies produce every day (poop and pee). Water from our showers, laundry, brushing our teeth, and dish washing includes tooth paste, soap and detergent. As well, there are all the cleaning products that we use to wash the floors and clean the sinks, tub, toilet, and shower. In the toilet, we also flush toilet paper.

In fact, all Edmonton residents combined produce approximately 280 mega litres of wastewater or sanitary waste every day.

Math link:

1 mega litre (ML) = 1 million litres (enough to fill the Kinsmen Pool about 100 times). (Kinsmen is an Olympic sized pool.)

So how many litres of wastewater or sanitary waste are produced every day?

All of that water and waste goes the drain and through underground pipes that lead to the Gold Bar Wastewater Treatment Plant. The wastewater flows through the pipes by gravity. Depending upon where you live, it takes about 4 to 6 hours from when it leaves your house until it gets to Gold Bar Wastewater Treatment Plant.

Once it gets to Gold Bar, it undergoes a long process of cleaning and treating before it goes to the North Saskatchewan River.

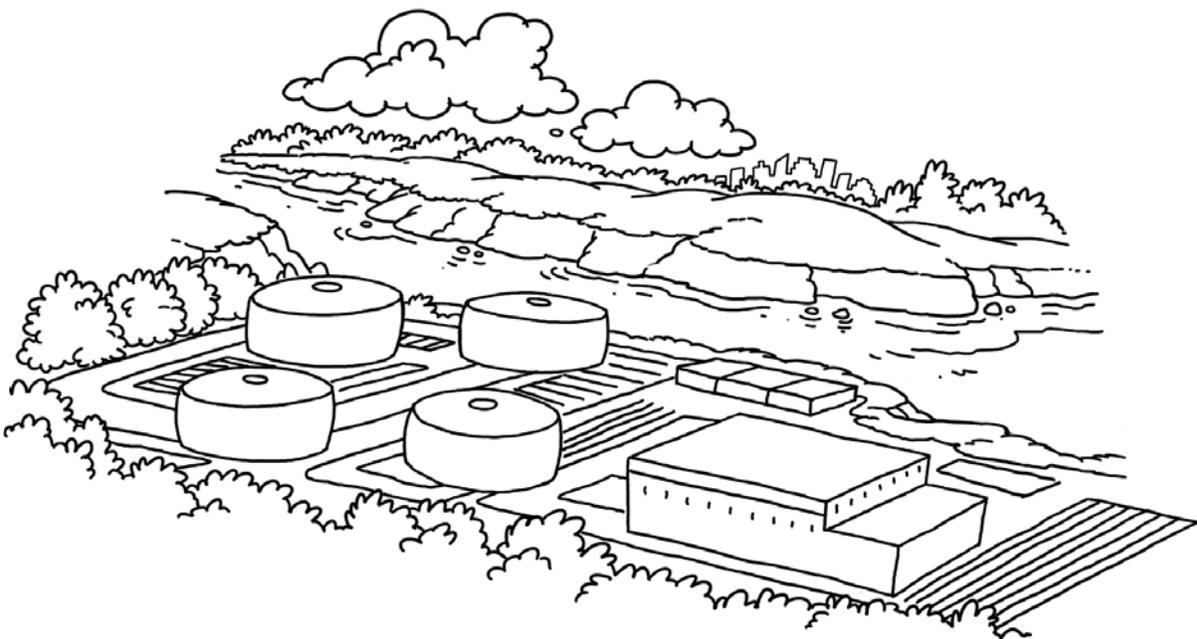
What should not be in Wastewater

All of the wastewater flows through the pipes to Gold Bar Wastewater Treatment Plant. Once it gets there, it goes through a step-by-step process of cleaning and treatment before it goes to the North Saskatchewan River.

One of the first things that happens to the wastewater is all of the garbage has to be sifted out. People put all kinds of things down the drain or they flush things down the toilet that they shouldn't. Sometimes, they do this by accident and other times, they just think "out of sight out of mind." People put all kinds of things down the drain... diapers, cigarettes, small toys, containers, wrappings. All of this garbage is removed from the wastewater using a huge screen. The garbage is trucked to the landfill site at Clover Bar where Edmonton's other garbage is taken.

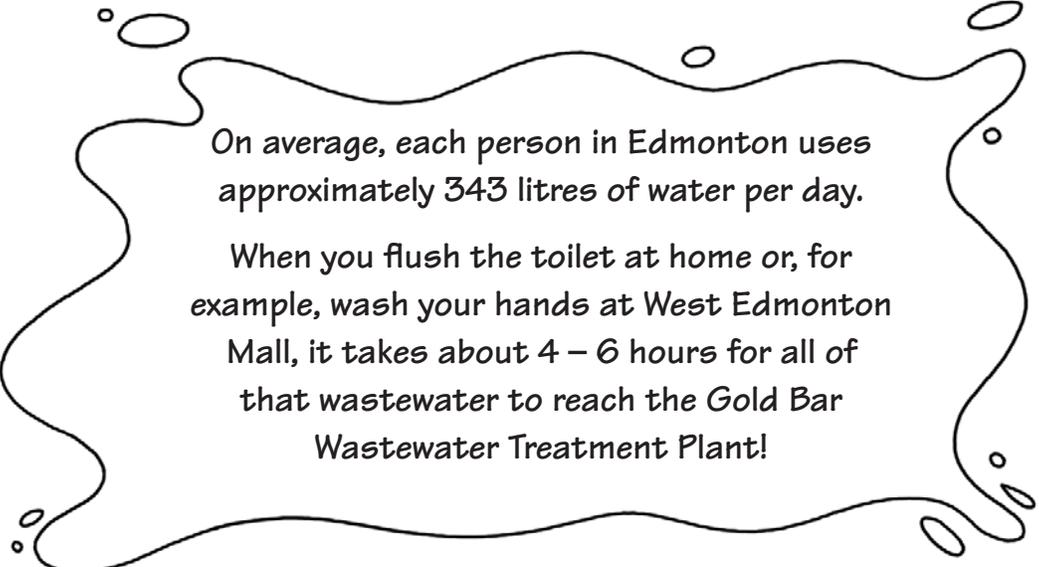
Many of the things that go down the toilet or sink are **biodegradable**. That means that they break down in nature and return to the natural cycles, often by becoming soil. Some of the material that is taken to the landfill site is biodegradable but most of it is not and it never breaks down. These things are **nonbiodegradable**.

Sometimes people put things down the wastewater system that are **toxic** or **poisonous**; one example would be the paint thinner that is left over from cleaning



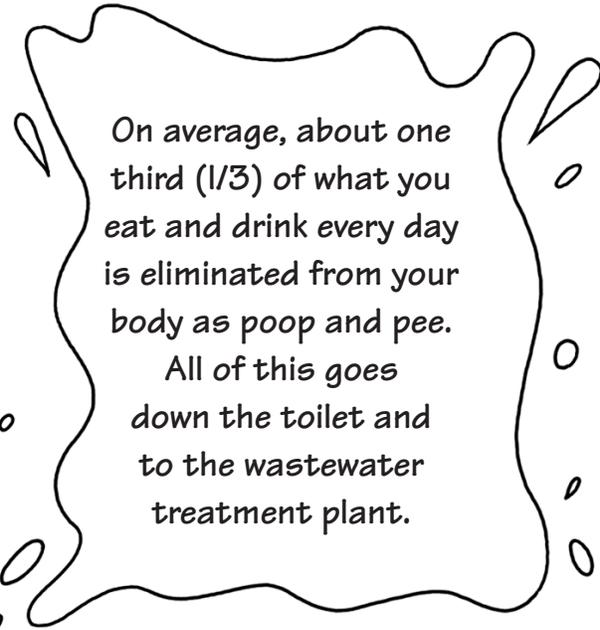
paint brushes. Products that are toxic can harm the environment because they are dangerous for plants, animals, fish, and birds.

There are also harmful wastes like hair, oil and grease. A major problem for the sanitary system is people dumping cooking fats, oils, and greases down the sink and the toilet. These materials clog up the systems.



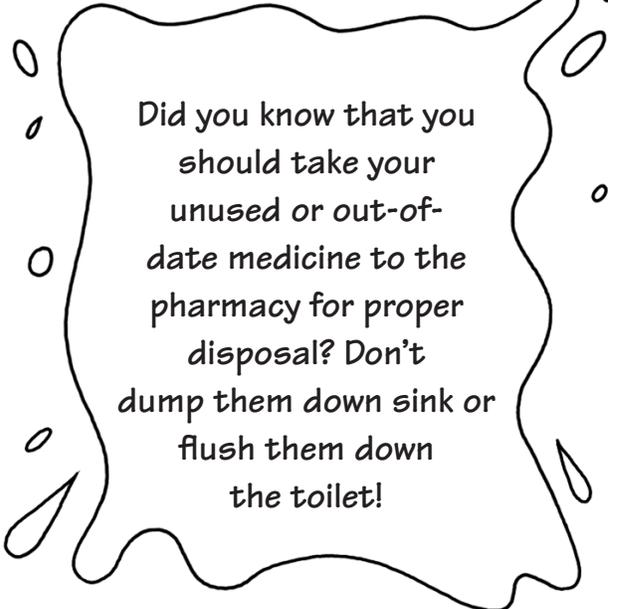
On average, each person in Edmonton uses approximately 343 litres of water per day.

When you flush the toilet at home or, for example, wash your hands at West Edmonton Mall, it takes about 4 – 6 hours for all of that wastewater to reach the Gold Bar Wastewater Treatment Plant!



On average, about one third (1/3) of what you eat and drink every day is eliminated from your body as poop and pee.

All of this goes down the toilet and to the wastewater treatment plant.



Did you know that you should take your unused or out-of-date medicine to the pharmacy for proper disposal? Don't dump them down sink or flush them down the toilet!

Cleaning and Treating Wastewater

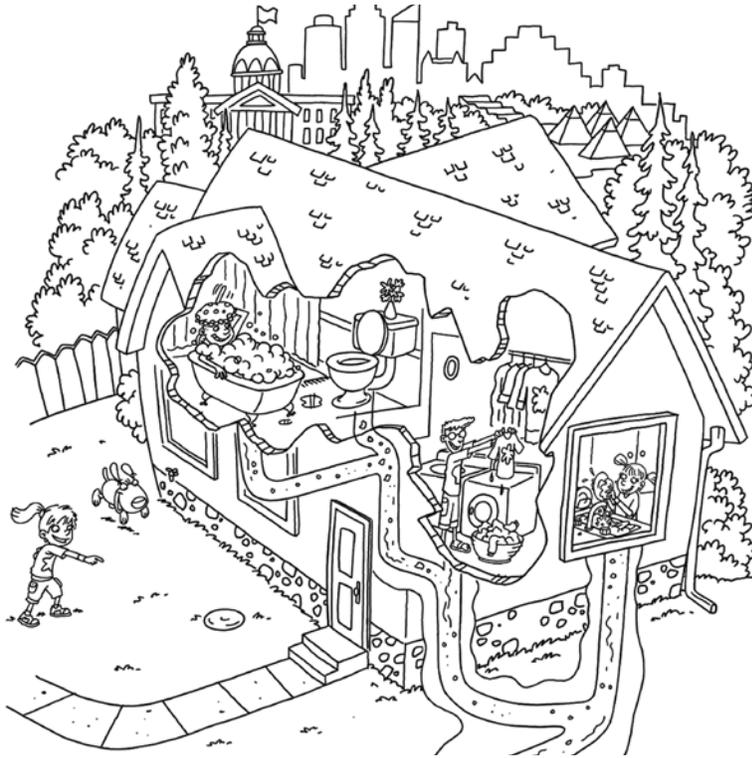
Wastewater is made up of whatever we flush or rinse down the drain. The only things that should go down there are human waste, water, and toilet paper.

As you know, we use different products when we take a shower, wash our hair, do the laundry, wash the dishes, brush our teeth, and clean the house. Some of these products have a harmful effect on the environment.

For instance, one of the products that goes down the drain is the **detergent** we use to wash our dishes and our clothes. Detergents often contain a chemical called **phosphorus**. Too much phosphorus stimulates the growth of plant life such as algae. Too much algae uses up the oxygen in the water so that the fish can't breath.

Ammonia, which occurs naturally in our urine, is also dangerous to fish so it must be cleaned up too.





Human solid waste – what you call poop – contains harmful bacteria that can cause disease. That is why it is so important that you wash your hands after you go to the bathroom. It is also the reason that wastewater is cleaned and treated at Gold Bar. All of the bacteria is cleaned out of the wastewater and all of the chemicals that can be removed are cleaned out of the wastewater too.

From your house, all of the water and waste goes down the drain and through underground pipes that lead to the Gold Bar Wastewater Treatment Plant. The wastewater flows through the pipes by gravity. Depending upon where you live, it takes about 4 to 6 hours from when it leaves your house until it gets to Gold Bar Wastewater Treatment Plant.

Once it gets to Gold Bar, it undergoes a long process of cleaning and treating before it goes to the North Saskatchewan River. This process takes about 17 hours.

As you know, the cleaned and treated water goes back to the North Saskatchewan River and flows downstream to our friends and neighbors. Many people live along the river. As well, plants, animals, and birds rely on the water in the river so they can live and breed. We all must have clean water in order to live.

The Steps to Cleaning Wastewater

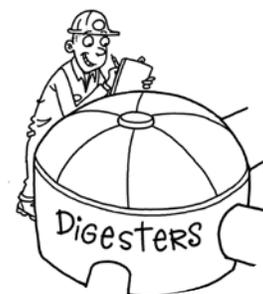
Here are the steps taken at Gold Bar to clean the wastewater and here are the results of all that cleaning. Keep in mind this whole process is natural.

Step 1: Wastewater comes from your house and school through a huge underground pipe to very large tanks (**grit tanks**). Heavy waste sinks to the bottom of the tanks. Light waste stays in the water. Then it goes through a huge screen and all of the garbage is taken out and trucked to the landfill. The **grit tanks** and **screens** are next to each other.



Step 2: Then the water goes to another big tank (**a primary clarifier**) and the heavy waste all sinks to the bottom. This is called **sludge**. The light waste on the top is called **scum**. Light waste includes things like oil and grease. At this point, 50 percent of the waste has been removed. However, the water is still not safe.

The **scum** and **sludge** go to another tank called a **digester** where it decomposes because it is heated and because there is no oxygen in the digester. This destroys some of the harmful bacteria and the sludge is now not so smelly. The sludge is pumped to the **Edmonton Waste Management Centre** where it eventually becomes compost and fertilizer.



In addition, at this stage, a **methane** gas is produced and this gas is used to help heat the Gold Bar Wastewater Treatment Plant. The gas is called **biogas**.

Step 3: All the water now goes to a third tank (**a bioreactor**). Air bubbles are blown into the water. These bubbles cause the good bacteria to wake up and eat many of the remaining **contaminants** in the water.

Most of the phosphorus and ammonia are also removed and other harmful elements are taken out too.

Step 4: All of the clean water and fat healthy bacteria now move along to a fourth tank. This is called a **secondary clarifier**. The fat bacteria sink to the bottom and become sludge that is cleaned out and pumped to the **digesters** and then it goes to the **Edmonton Waste Management Centre**.

Step 5: The last step. The water is now disinfected using ultraviolet light. Ultraviolet light (sunlight) kills any remaining harmful bacteria that might hurt people or other living things. The water now goes to the North Saskatchewan River.



Results of all that cleaning

The water is 99.9 percent free of bacteria. The Gold Bar Wastewater Treatment Plant cleans an average of 280 million litres of water every day (enough to fill the Kinsmen Pool 280 times). The cleaned water now goes to the North Saskatchewan River where it can be used for:

- cooling water for industry
- filling the ponds in the parks
- making artificial snow



Important note: This water not safe for drinking. The water that is cleaned and treated at Gold Bar Wastewater Treatment Plant is not drinking water. The water that we release travels downstream to our friends and neighbors and to the watershed and the natural environment. The City of Edmonton meets and exceeds government requirements for the quality of water that is returned to the North Saskatchewan River. Downstream, other municipalities clean their drinking water before they use it, just as we do in Edmonton.

Two other products that come from all that cleaning

Remember all of that sludge that we talked about? The sludge is pumped to Edmonton Waste Management Centre at Clover Bar where some of it is further treated to become a product that farmers spread onto their fields. The rest of it is **pasteurized** (the bacteria are killed) and made into **compost**, a natural fertilizer. This compost is then used by the City of Edmonton and local residents for landscaping, gardening, and lawn care.

Remember, during the cleaning of the wastewater, a gas is produced. This gas, called biogas, is used to heat some of the Gold Bar Wastewater Treatment Plant.

Gold Bar Wastewater Treatment Plant is one of the top five wastewater treatment plants in Canada. The City of Edmonton is known for its excellent drainage system and wastewater treatment plant and for the excellent quality of water that is returned (discharged) to the river.

Pipes and More Pipes

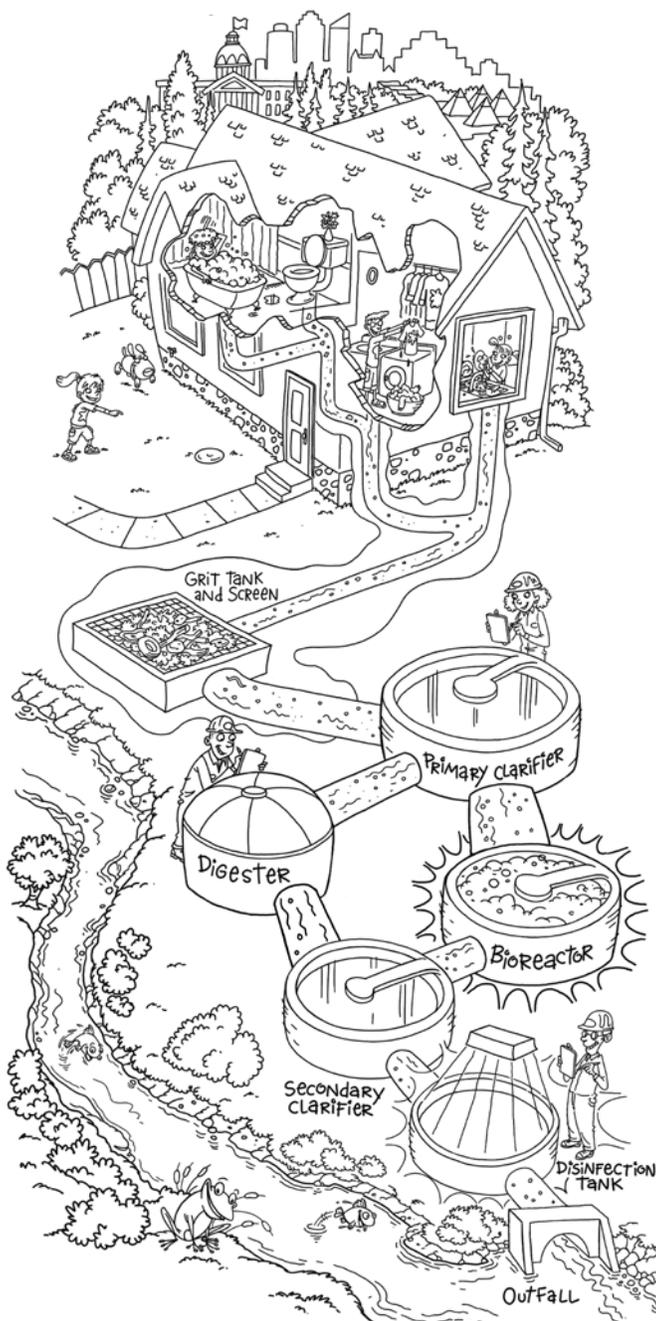
In the City of Edmonton, there are a lot of pipes that drain water from our homes and streets. In fact, there are three systems of pipes under our feet!

- the wastewater or sanitary system
- the storm water system
- the combined system

Here is some information about all three systems.

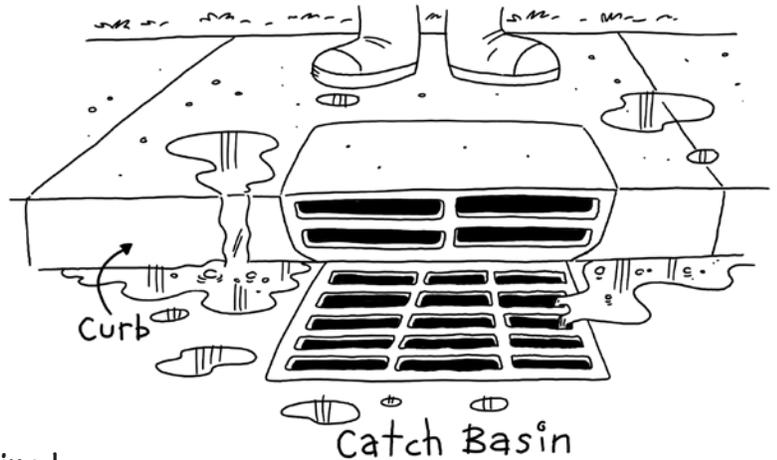
Wastewater or Sanitary System

You already know a lot about this system. In your house, the **wastewater** from the toilet, sink, shower, kitchen, and laundry goes into the **sanitary sewage system**. This wastewater contains products such as soaps, cleansers, and cleaning products that go down the drain. The wastewater flows through a pipe in your house to a large pipe under the street. These large pipes carry all of the wastewater to the Gold Bar Wastewater Treatment Plant where it is treated or cleaned before it is returned to the North Saskatchewan River. As your teacher mentioned, if you laid these pipes out, they would stretch to Calgary and back again three times!



Storm Water System

All of the storm water that runs off from a rainstorm or from melting snow flows down the street and into catch basins (those grills that you see in the side of the street). From there it goes into large pipes under ground that lead to the river. So now, we have even more pipes...in fact if you laid these storm pipes out, they would stretch the distance from Edmonton to Whitehorse, Yukon.

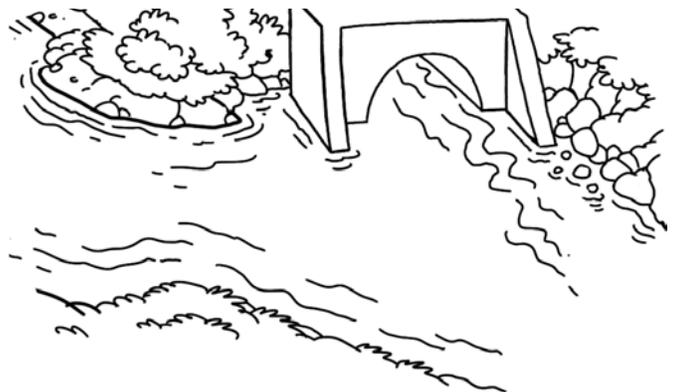


Combined System

In the older, central part of Edmonton, there is a third system called the combined drainage system. This is made up of one large pipe that collects both sanitary and storm water. During a big rainfall or spring snowmelt, the pipes cannot hold all of the water. To prevent flooding of people's basements and the city streets, the extra water is allowed to overflow into the North Saskatchewan River. All of the newer areas of the City of Edmonton have two separate systems. The combined system of pipes could stretch from Edmonton to Calgary three times. There are about 946 km of combined sewers.

So altogether, there are 2 354 km of wastewater or sanitary sewer (1.5 times the distance between Edmonton and Winnipeg) and 2 559 km of storm sewer that take the storm water away from our streets and homes in Edmonton. That's a lot of pipes to take care of, and the men and women who work for Drainage Services for the City of Edmonton do that important job. They decide where the new pipes should go; they build them and take care of them.

At the Gold Bar Wastewater Treatment Plant that we have learned about, there are also many people who make sure the water is cleaned. There are men and women who operate the equipment, labourers, technicians, computer people, and engineers. Gold Bar Wastewater Treatment Plant is very important and operates 24 hours a day, 7 days a week, 365 days per year.





Before and After Outhouses

Have you ever thought about what happened to human waste before there was wastewater treatment such as our Gold Bar Wastewater Treatment Plant? Years ago, people used to throw their waste out the window. They used to just shout “Look out below” or “Look out for the water.” Good luck if you were walking below.

Years later, people built outhouses but after a while there were so many people and so many outhouses that the waste began to seep into the ground and threaten the drinking water. As you know, human waste carries bacteria that are dangerous to our health.

To avoid this danger, pails were hung in the outhouses to collect the waste and these pails were collected regularly and taken away by horse-drawn **honey wagons**.

Finally, in the early 1900s, Edmonton’s population became too large, and there was too much waste for the honey wagons to handle. Sewer lines were built under many city blocks to collect the sewage and carry it to the North Saskatchewan River.

The next problem was that all of this raw sewage was being dumped in the river. This was not a healthy situation for people, fish, wildlife, birds, or plants. The City decided that wastewater had to be cleaned before it went to the river so in 1916 Edmonton opened its first wastewater treatment plant.

Today a large system of underground pipes lead to the Gold Bar Wastewater Treatment Plant where human waste is collected, treated, and disposed of.





Instructional Tools



KWL Chart _____

K What I Know	W What I Want to Learn	L What I Learned



What is in Wastewater? Master

Materials found in Wastewater	Possible Harmful Effects	Biodegradable	Non-Biodegradable

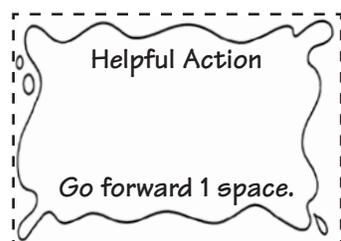
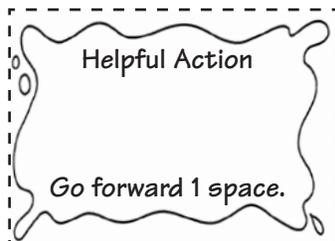
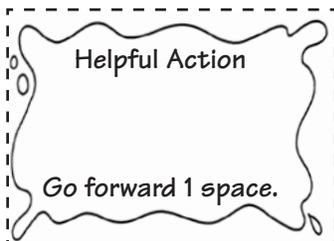
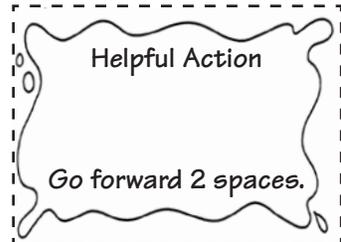
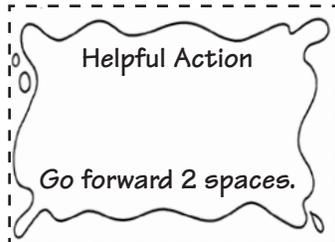
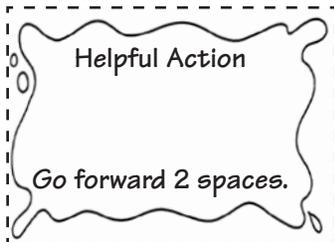
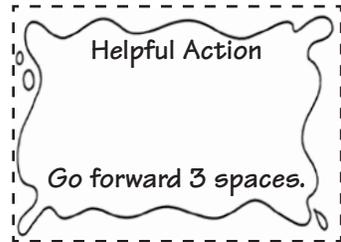
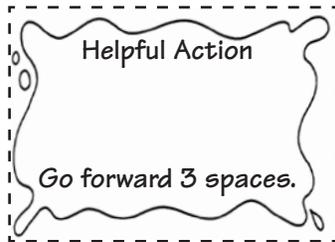
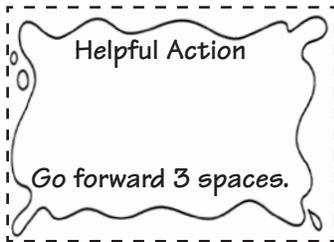
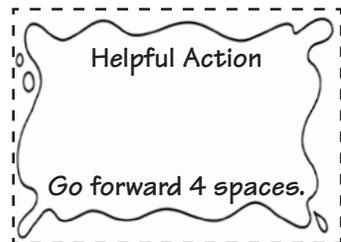
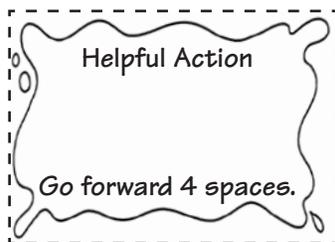
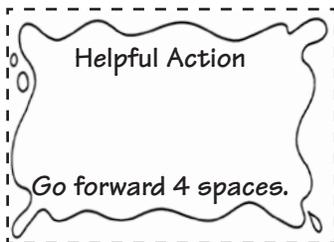
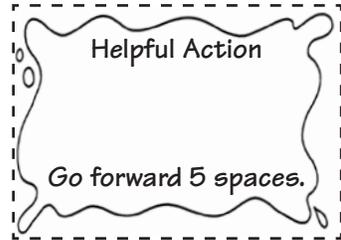
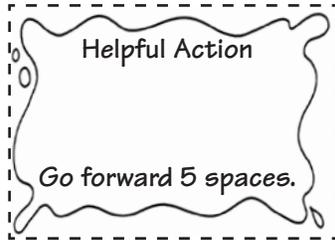
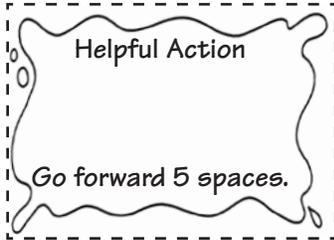


What is in Wastewater? Key

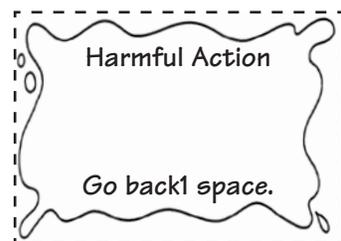
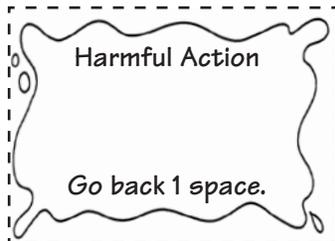
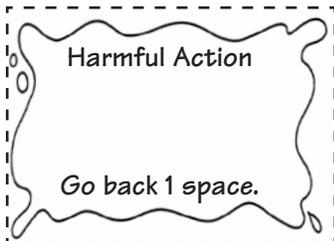
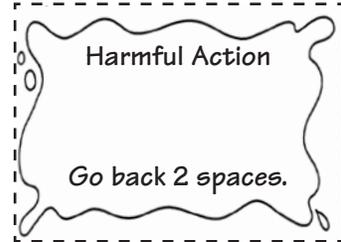
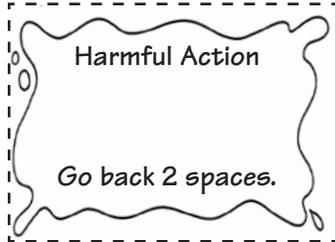
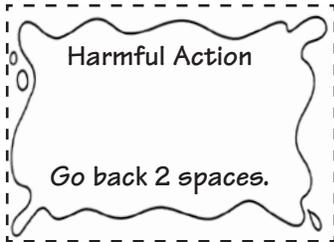
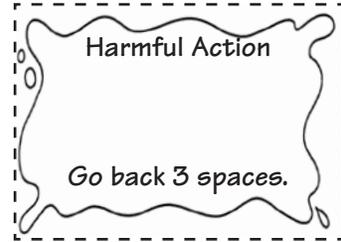
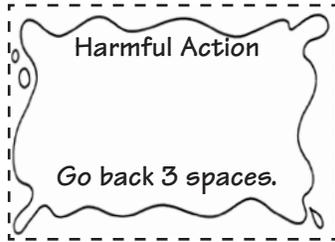
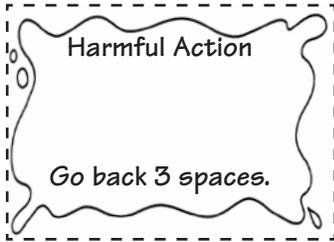
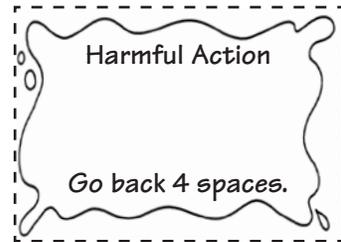
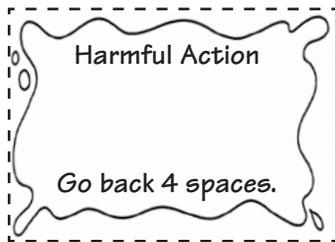
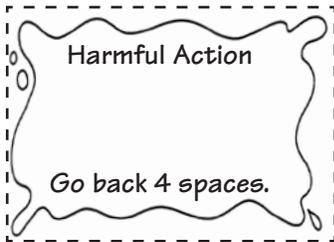
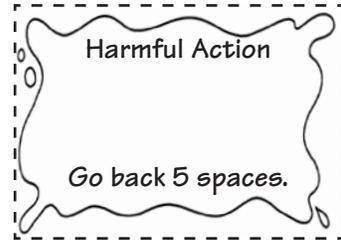
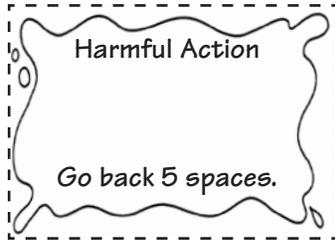
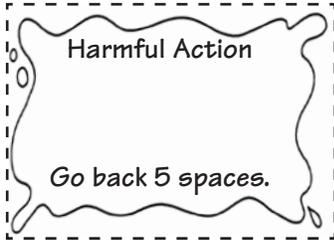
Materials found in Wastewater	Possible Harmful Effects	Biodegradable	Non-Biodegradable
human waste	bacteria can cause diseases	✓	
toothpaste		✓	
soap	contain phosphorus, increases algae, kills fish	✓(some brands)	✓(most brands)
detergent	contain phosphorus, increases algae, kills fish	✓(some brands)	✓(most brands)
cleaning products	contain chemicals that can harm plants and animals	✓(some brands)	✓(most brands)
toilet paper		✓	
diapers	need to be screened out of wastewater and taken to the landfill site	✓(absorbent materials)	✓(plastic liner)
cigarettes	need to be screened out of wastewater and taken to the landfill site	✓(paper, tobacco)	✓(filter)
small toys	need to be screened out of wastewater and taken to the landfill site		✓

Materials found in Wastewater	Possible Harmful Effects	Biodegradable	Non-Biodegradable
plastic wrappers	need to be screened out of wastewater and taken to the landfill site		✓
cardboard wrappers	need to be screened out of wastewater and taken to the landfill site	✓	
hair	clogs up drains	✓	
cooking oils and fats	clog up drains, pipes, and garberators	✓	
dental floss	may catch on drain mechanism		✓
leftover medicine	may harm wildlife, fish, and plants		✓
hazardous products (e.g. paint thinner)	can poison plants and animals		✓

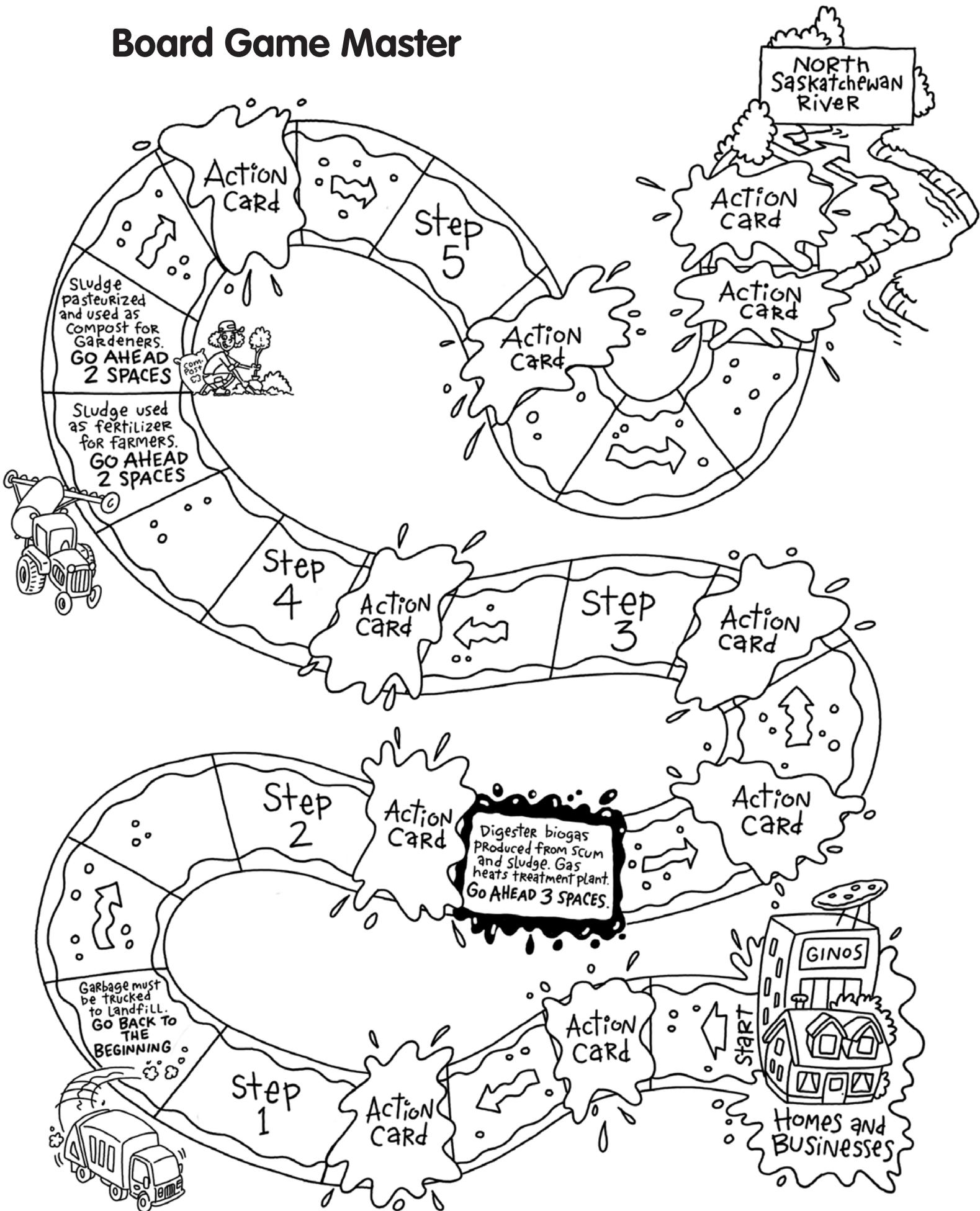
Helpful Action Cards



Harmful Action Cards



Board Game Master

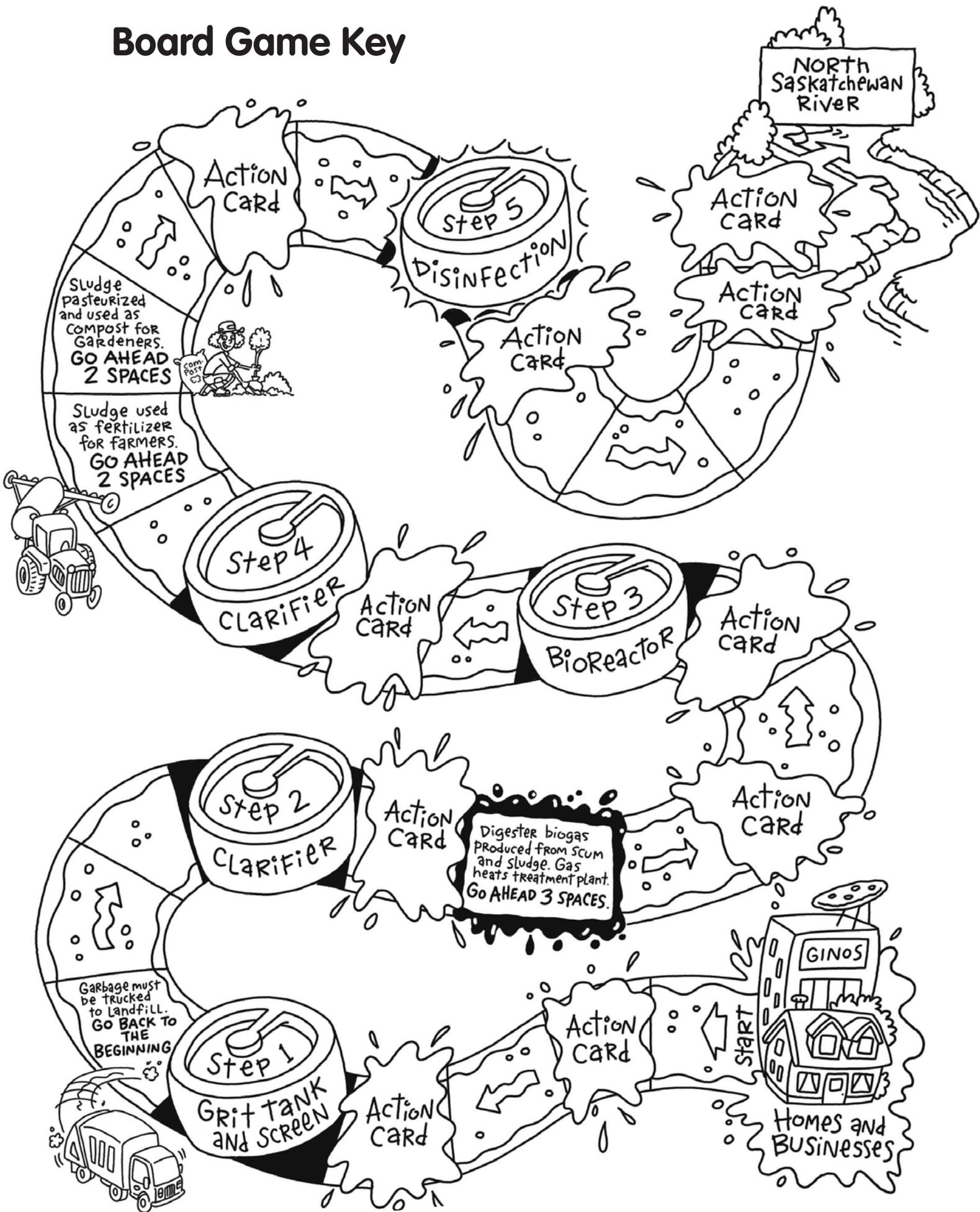


Board Game Instructions

1. Player throws dice and advances the number of spaces indicated on the dice.
2. If she lands on a numbered step in the water treatment process, she must tell what happens at that step. If she gets it right, she can go ahead the indicated number of spaces.
3. If she lands on an action square, she draws a card and reads it aloud. If it is a helpful action, she moves forward the indicated number of spaces. If it is a harmful action, she moves back the number of spaces indicated.
4. The first person to reach the North Saskatchewan River is the winner.



Board Game Key



Treat it Right at Home!

Dear Parents:

Your child is doing a survey of family members to see what they flush and dump down the drains and toilet in your house. As a result of the survey, there may be changes that your family would like to make. The children will examine their results and then will develop a plan that will suggest actions that will help to protect our wastewater and our environment. Thank you for assisting in this valuable learning process and for helping your child to experience the value of taking personal action.

Students: Interview the people in your household to find out how many family members are performing each action.

Bathroom



1. Dental Floss: Flush _____ Garbage _____
Kleenex: Flush _____ Garbage _____
2. Wipes, diapers, tampons, paper towels: Flush _____ Garbage _____
3. Brushing your teeth: Tap on _____ Tap off _____
4. Unused medication: Take to pharmacist _____ Flush it _____ Throw it out _____
5. Shower: Biodegradable soap and shampoo _____ Regular soap and shampoo _____
6. Cleaning products:
Natural _____ Biodegradable _____ Not Biodegradable _____
7. Showers: Lengthy _____ Short _____

Kitchen and Laundry

1. Dish/dishwasher/laundry soap and detergent:

Biodegradable _____ Not Biodegradable _____

2. Fats, oils, and grease:

Dump down the drain _____

Rinse down the drain with hot water _____

Pour into a tin and put the tin in the fridge and when it is full,
put the tin in the garbage _____

Wipe out greasy pans with paper towel that you put in the garbage _____

3. Cleaning products:

Natural _____ Biodegradable _____ Not Biodegradable _____

4. Food scrap disposal: Garbage Can ____ Garberator ____ Compost ____

5. Other ideas you might have:

6. After completing this survey, are there any changes
that your family would like to make?





Family Plan

1. Changes already suggested by my family:

2. After discussing the survey results with other students, are there any other changes that you would like to suggest to your family?

3. What could you do to convince others to make changes?

4. Follow-up plan to be discussed with my family:

5. Family member comments and parent signature.

Parent Signature

Follow-Up (in ___ weeks).

How are we doing with our plan?



Extension Ideas

Natural Cleaners

Glass and Tile Cleaner

1/4 cup (50 ml) white vinegar

1 litre water

Mix together and pour into a spray bottle. Use full strength vinegar where there is serious build-up.

Scouring Powder for Stainless Steel

1 part salt

1 part baking soda

Mix together and pour into a jar with a sprinkle top.

Drain Cleaner

250 ml (1 cup) baking soda

250 ml (1 cup) salt

1 litre boiling water

Blend soda and salt together and pour down drain followed by boiling water. Let sit several hours or overnight.



Oven Cleaner

3 parts baking soda

1 part water

nylon scrubber

Combine baking soda and water and use it like a paste with the scrubber and your elbow grease. For the hard parts, mix half baking soda with half salt to increase abrasiveness. Keep baking soda off the heating element.



Toilet Cleaner

Sprinkle *baking soda* into the bowl. Spray in some *white vinegar*. Let the *fizz* reaction loosen the *dirt* and *disinfect* while you clean the rest of the bathroom. Return and brush with a *toilet brush*.

Silver Cleaner

Use *toothpaste* instead of *toxic silver cleaner*. Apply on an old *soft bristled toothbrush* and dip the object in *water* before *buffing the silver*.

Pots and Pans

First, be sure to *drain all the extra oil and grease* into a *tin can* – don't dump it down the *drain*. Then *wipe out the pan with paper towel* to get the most of the *oil and grease*.

Then *soak or boil a solution of 2 tablespoons of baking soda per four cups of water* in each *pan encrusted with food*. Let stand until *particles are loosened* then *wash as usual*. Use a *mild or moderate abrasive* if *necessary*. To *clean greasy pans easily*, add *one or two teaspoons of baking soda* to the *soaking water*.



Wastewater Word Search

T S O E E E R T I L A G E M T
N U H Y P H G C E A G L A U E
E O S R T A E O I B B V L N V
G R I A W C S N L A M T L O T
R O H T W H O T D D R R C C X
E H A I C M C A E A B A A R J
T P Z N M E R M V U B A E O Q
E S A A U G F I K U R T R T L
D O R S E E O N L N A I D C L
P H D D G L A A I W C H Z A I
Z P O D E T R N E S C U M E F
X I U T T Y Y T O X I Z L R D
B L S I D N S S M Z R D K O N
S K R C L A R I F I E R T I A
X G K T W R O T S E G I D B L

ALGAE

AMMONIA

BIODEGRADABLE

BIOREACTOR

CLARIFIER

CONTAMINANTS

DETERGENT

DIGESTOR

DISINFECTION

GOLDBAR

GRITTANK

HAZARDOUS

LANDFILL

MEGALITRE

PASTEURIZED

PHOSPHOROUS

SANITARY

SCUM

SLUDGE

ULTRAVIOLET

VOCABULARY

WASTEWATER



Make Your Own Word Search!

1. Write definitions for 15 of the following words in the large spaces of the Word Search Page.
2. Using capital letters, write the words in the word search. The words can go sideways, vertically, diagonally, and backwards. Be very careful with the spellings.
3. Fill in the empty squares with random capital letters.
4. Exchange puzzles with a friend. She will write the correct terms beside your definitions, then she will search for them in the puzzle. You do the same with your friend's puzzle. Have fun!

ALGAE

DIGESTOR

PASTEURIZED

AMMONIA

DISINFECTION

PHOSPHORUS

BIODEGRADABLE

GOLDBAR

SANITARY

BIOREACTOR

GRITTANK

SCUM

CLARIFIER

HAZARDOUS

SLUDGE

CONTAMINANTS

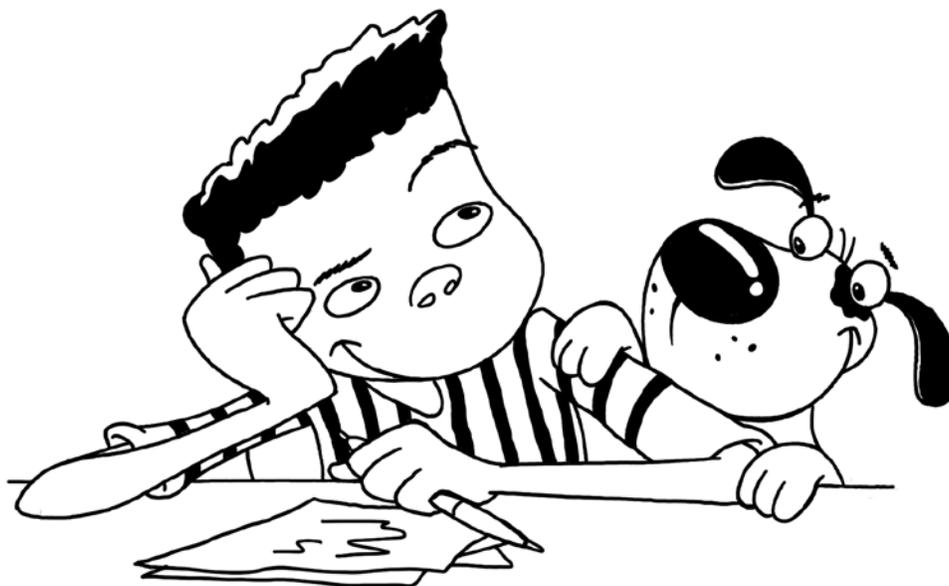
LANDFILL

ULTRAVIOLET

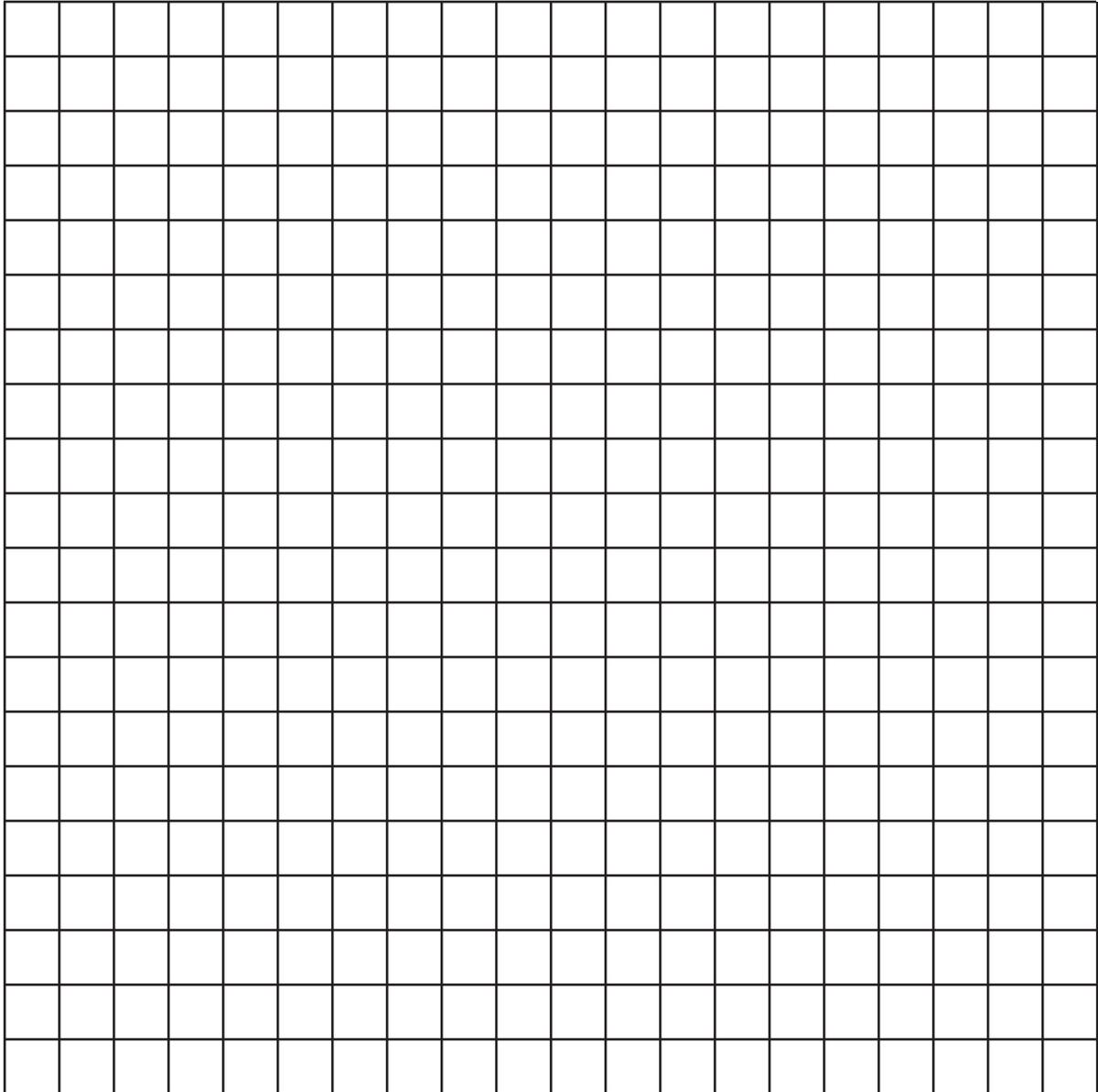
DETERGENT

MEGALITRE

WASTEWATER



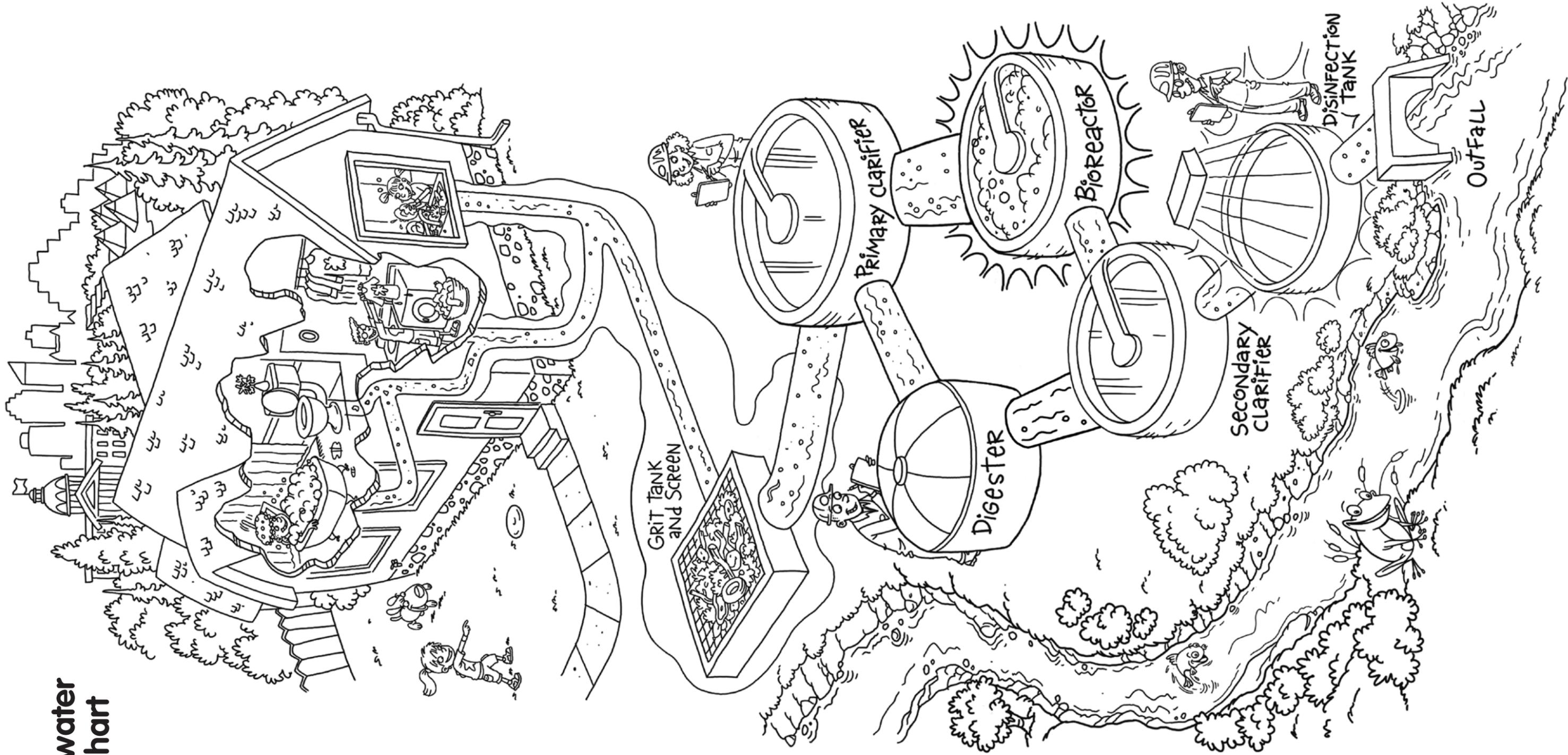
Wastewater Word Search



Sample Word Search Definitions

Definitions	Terms
water that drains from our houses into sewers	WASTEWATER
the system of pipes that carries away wastewater	SANITARY
one million litres	MEGA LITRE
sites where solid garbage is disposed	LANDFILL
able to be broken down in nature	BIODEGRADABLE
dangerous	HAZARDOUS
unwanted materials found in water that are removed from wastewater	CONTAMINANTS
Edmonton's wastewater treatment plant	GOLD BAR
soap used to clean dishes and clothes	DETERGENT
a chemical found in detergent that can cause too much algae to grow in rivers and lakes	PHOSPHORUS
a chemical in urine that is dangerous to fish	AMMONIA
tiny plants that are natural to wetland areas but which can overgrow if there is too much phosphorous	ALGAE
a tank in the wastewater treatment system where heavy materials sink to the bottom	GRIT TANK
a tank where sludge sinks to the bottom and scum rises to the top	CLARIFIER
heavy waste that sinks to the bottom of a tank of water	SLUDGE
light waste like oil and grease that floats to the top of the water	SCUM
a tank with heat but no oxygen where scum and sludge are decomposed	DIGESTOR
a tank with air bubbles that help to break down contaminants in the water	BIOREACTOR
a special wave length of light that is used in the water treatment process to destroy bacteria	ULTRAVIOLET
destruction of bacteria	DISINFECTION
destruction of bacteria in sludge to make compost	PASTEURIZATION
natural fertilizer made from sludge	COMPOST

Wastewater Flow Chart



Treat it Right!®

**Treat it Right!® Wastewater
(Grade 4) (English and French)**

**Treat it Right!® Storm Water
(Grade 5) (English and French)**

Treat it Right!® LID (Grade 7)

Treat it Right!® Wastewater (Grade 8)

Treat it Right!® Storm Water (Grade 8)

**Treat it Right!® Puppet Show
(Grades 2 and 4)**

**Treat it Right!® Constructed
Wetland Field Trip (Grade 5)**

www.edmonton.ca/drainage/education

2016



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