

# Treat it Right<sup>®</sup> Storm Water



## Teacher's Guide

# Treat it Right!®

## A storm water program (Grade 5)

### Acknowledgements

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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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**Treat it Right!® Storm Water** (Grade 5) is available in English and French. A program for Grade 4, **Treat it Right!® Wastewater**, is also available in English and French. **Treat it Right!®** includes two programs for Grade 8 – **Treat it Right!® Storm Water** and **Treat it Right!® Wastewater**. As well, there is a program for Grade 7 – **Treat it Right!® Low Impact Development (LID)**.

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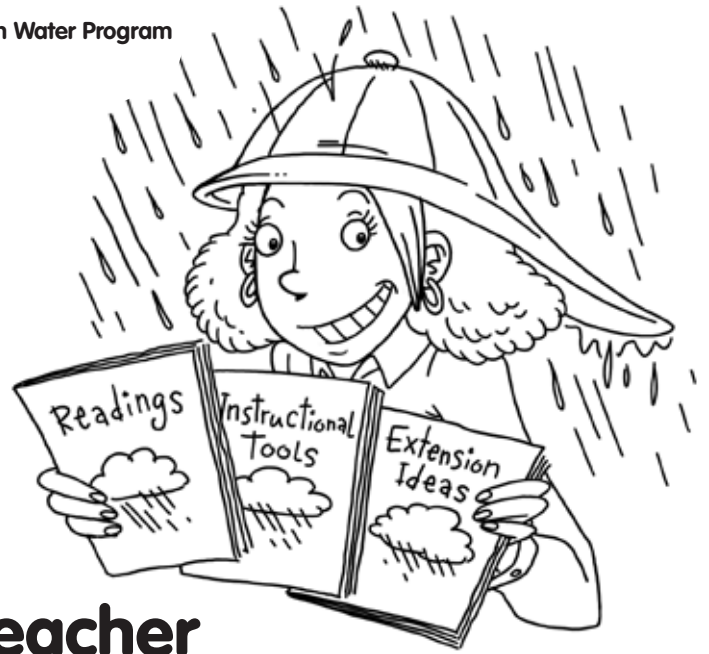
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## Instructions for the Teacher

The **Treat it Right!**® teacher's guide develops the human action concepts of the Grade 5 Science Wetlands topic by exploring how storm water is managed in Edmonton.

These concepts are explored through a series of four lessons that will integrate easily with most **Wetlands** units and that will review some Grade 5 Chemistry topics as well.

The **first lesson** (two parts) develops the concept of how natural drainage from precipitation is altered within a city and why this storm water must be managed to prevent flooding. The students learn about the man-made part of the drainage system that takes care of storm water in Edmonton. Students compare constructed wetlands to natural wetlands, including their flood management roles.

In the **second lesson**, students explore the issue of wastes that may end up in storm water. They will determine what personal actions they can take to prevent such wastes entering the river and wetlands. They will use this knowledge at home as they work with their parents to assess what is done at home and what kinds of new actions they can take as a family. This will consolidate their understanding of the role of human actions in maintaining healthy wetland environments.

In the **third lesson**, students will perform some basic chemistry tests to help them understand that storm water is monitored and tested for contaminants. This will reinforce the understanding that what we put into the storm water eventually goes into the environment.



In the **fourth lesson**, students take a more in-depth look into what the City of Edmonton does to handle storm water. Students explore some jobs involved in doing this work. They are introduced to the concept that Edmonton is part of the North Saskatchewan Watershed and that the North Saskatchewan River and the entire watershed environment are linked.

This package contains a teacher's guide complete with duplicating masters. The masters are organized by Readings, Instructional Tools, and Extension Ideas.

The lesson plans include ideas for assessment of the students' learning, suggestions for a home link, and a variety of extension activities in other subject areas. The lessons also highlight opportunities to reinforce ideas from the Grade 4 Science topic, **Waste and Our World**. The program links to specific learning objectives in science, social studies, mathematics, and language arts in Grade 5.



# Curriculum Fit

Correlation with Alberta Education Grade 5 Programs of Study

Science Students will:	Lesson			
	1	2	3	4
<b>Wetland Ecosystems</b> Recognize and describe one or more examples of wetland ecosystems found in the local area.	✓			
Identify human actions that can threaten the abundance or survival of living things in wetland ecosystems.		✓		
Identify individual and group actions that can be taken to preserve and enhance wetland habitats.		✓	✓	
Recognize that changes in part of an environment have effects on the whole environment. 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.		✓	✓	✓
<b>Classroom Chemistry</b> Distinguish substances that will dissolve in a liquid from those that will not, and demonstrate a way of recovering a material from solution.			✓	
Recognize that the surface of water has distinctive properties, and describe the interaction of water with other liquids and solids.			✓	
Use an indicator to identify a solution as being acidic or basic.			✓	

## Social Studies – Physical Geography of Canada

Students will:

Value Canada'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, taking notes and discussing ideas with others.

Use text features, such as maps, diagrams, special fonts and graphics, that highlight important concepts, to enhance understanding of ideas and information.

Summarize important ideas orally, in print, or using other media texts; express opinions about them.

Record ideas and information in relevant categories.

Communicate ideas and information in a variety of oral, print and other media texts.

Contribute ideas to help solve problems, and listen and respond constructively.

**Mathematics**

Students will:

Use estimation strategies in problem-solving contexts.

# Links

You may wish to check these program and organizational links for additional 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 (NSWA)

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

Partners FOR the Saskatchewan River Basin

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

Telus World of Science

[www.telusworldofscienceedmonton.com](http://www.telusworldofscienceedmonton.com)

Yellowfish Road

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

## Third Party Disclaimer:

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# Lesson 1

## Storm Water

### Teacher Background

In the first lesson, a review of the water cycle introduces students to the topic of **storm water**. They will understand the source of storm water and its flow in both rural and urban areas. The students will see that **permeable** and **impermeable** surfaces influence the flow of storm water and that storm water returns to the environment in different ways depending upon one's surroundings.

Students will learn that managing storm water in the City of Edmonton involves the construction of special facilities called **storm water management facilities**. Learning about these facilities and comparing them to natural wetlands is an innovative way to further the **Wetlands** topic.

**Wet ponds, dry ponds, and constructed wetlands** (examples of storm water management facilities) are built to control flooding. Constructed wetlands have a further beneficial effect on our environment by cleaning storm water runoff and by making our communities more beautiful.

Natural wetlands control flooding by collecting the excess water from heavy rains and snowmelt. Some of the water will evaporate; some will simply stay in the natural wetland making a home for all kinds of plant and animal life; and some will be absorbed by the land.

### Objectives

#### Students will:

- identify the source of storm water and its connection to the water cycle
- understand that storm water is managed to prevent flooding
- describe the path that storm water takes to the North Saskatchewan River
- compare constructed wetlands to natural wetlands



## Materials

- Storm Water Flow Chart
- Rain and Melted Snow
- Wet Ponds
- Dry Ponds
- Constructed Wetlands
- Natural Wetlands
- KWL Chart
- Venn Diagram Master
- Venn Diagram Keys



## Part I – What is Storm Water?

### Introduction

Recently, we have been studying about wetlands and, of course, in order to have a wetland, you have to have water. Water moves in a giant cycle that you have learned about in past years of school.

**Link: Review Grade 5 Science – Weather Watch (The Water Cycle)**

We are going outside on a mini-field trip to see something that you have probably walked by every day but maybe you haven't thought about too much. Your challenge is to see what connection this object might have to the water cycle.

### Activities

#### 1. Catch Basin Observation

- Take the students outside to see a catch basin. Discuss the ideas they have about it. You may introduce the use of the term storm water during the discussion, but don't use this as a teaching session just let them explore their own ideas.

- **Discuss.** What do you think is the purpose of that hole? Why do you think it has bars across it? What goes down there? Where does the water come from? Where do you think the water goes from here? Where do you think the storm water ends up? What do you think would happen if we didn't have places for the storm water that runs off onto our roads to go? How is a city or urban area different from a rural area when it comes to runoff? (Hard surfaces as opposed to soft; permeable versus impermeable surfaces.) What else besides storm water do you think goes down there? Do you think any of those things might be harmful to the environment?

## 2. Storm Water Management KWL Chart

- **Go back inside.** For the next few lessons, we are going to learn about storm water and how we manage it in Edmonton. You will be able to see how our daily actions can have a significant effect on the river and on other wetland environments. Let's start with what you already know about storm water and how it is handled.
- Have the students complete the **KWL Chart** on storm water management independently or as a class.
- Read **Rain and Melted Snow** together to find out about storm water.
- Have the students add their new knowledge to their **KWL Chart**.





# Part 2 – Wet Ponds, Dry Ponds, and Constructed Wetlands

## Introduction

Ask the students what happens when there is a huge rainstorm and if anyone has ever had their basement flooded.

Tell the students that the City of Edmonton builds special facilities to help prevent flooding and to handle all of the heavy runoff from big storms and snowmelt. All of these special facilities are called **storm water management facilities** and they are all part of the **storm water system**.



## Activities

### 1. Storm Water Flow Chart – Think, Pair, Share

- Hand out the **Storm Water Flow Chart** and ask the students to look at it by themselves and then with a partner to see what they notice about the flow of the water.
- As a class, discuss the various structures (**wet ponds, dry ponds, and constructed wetlands**) that they found on the chart.

### 2. Comparing Natural Wetlands and Wet Ponds – Venn Diagram

- Read together **Wet Ponds** and **Natural Wetlands**.
- As a group, complete a Venn Diagram comparing a wet pond to a natural wetland. This will allow you to model the use of the Venn Diagram and to review the characteristics of a natural wetland. A key is provided for your assistance.
- Divide the students into groups of four. Two students from each group are going to become experts in Dry Ponds and two will become experts in Constructed Wetlands. Have the “expert groups” read the materials and compare their particular type of storm water management facility to a natural wetland using a **Venn Diagram** (following the modeling you have done earlier). Use the Readings, **Dry Ponds** and **Constructed Wetlands**. Keys are provided for your assistance.

- The experts then report to the home group, sharing the information from their **Venn Diagrams**.
- Discuss as a class to ensure the main points have been recorded.
- Each group can mount their three **Venn Diagrams** on a poster board.

### 3. Concluding / Assessment Activities

- **Exit Ticket!** Using a post-it note, each student answers a question such as, “Describe how wet ponds, dry ponds, or constructed wetlands are used to manage storm water” or “Tell one important similarity and one important difference between a natural wetland and a wet pond.” These tickets could be collected to assess the children’s learning. The children could also complete a self-assessment by placing their post-it note next to a descriptor written on the blackboard that describes their understanding of the topic so far. (**Right On** – I understand everything; **On the Way** – I understand most of what we talked about; or **Not Quite** – I need a little more information and review.)
- **Journal Writing** Alternative to above.

### 4. Extension Ideas

- **Constructing a Model** Build a model of one of the kinds of ponds you have learned about using plasticene and drinking straws for the pipes. Write a descriptive paragraph about it on a card that could be used as part of a display. This could be a small group project.
- **Let’s Figure It Out!** This math exercise connects all three kinds of facilities. Complete Part 1 of this exercise.
- **Life of a Raindrop** Have students imagine they are a raindrop and write a story in the first person about the path they take to the river.



# Lesson 2

## Wastes in Storm Water

### Teacher Background

In the *second lesson*, students learn about the wastes that can find their way into storm water and the effect those wastes have on the North Saskatchewan River and other wetland environments.

Since storm water flows to the river without being treated, human actions can have a very important and direct impact on river and wetland environments. The students explore the role that they and their families can play in ensuring that storm water is as clean as possible before it enters the river. This is done through classroom research and a home survey.

**Link: Grade 4 Science – Waste and Our World (Identify actions to minimize and ensure safe handling of wastes.)**

### Objectives

#### Students will:

- identify the kinds of wastes that go into the storm water
- predict and verify the effects of a variety of wastes mixed with storm water
- propose solutions to problems caused by wastes in storm water and predict and verify their own role in protecting storm water

### Materials

- Map of Edmonton
- What's in It? Contaminant Cards
- Is Rainwater Dirty?
- Treat it Right at Home!
- What's in It? Chart
- What's in It? Key



## Introduction

To review the previous lesson, ask each student to tell another student three ideas that she remembers from the previous class.

You may wish to refer to the Storm Water Flow Chart from the previous lesson and review the three storm water management facilities on the chart: wet ponds, dry ponds, and constructed wetlands.

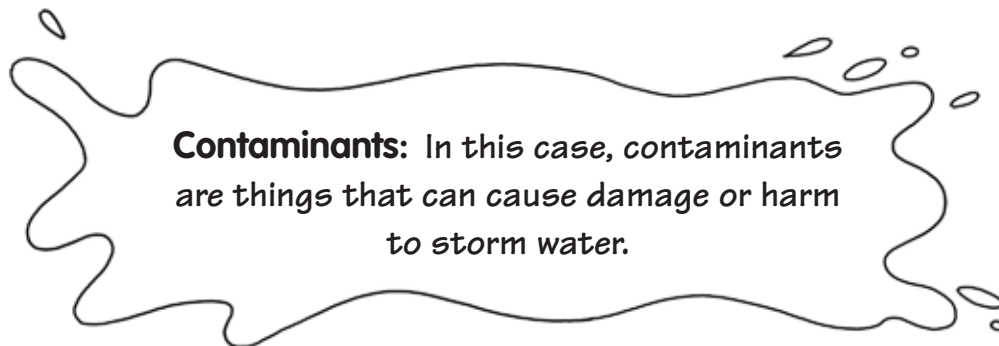
You may also wish to show the Map of Edmonton with some of the wet ponds, dry ponds, and constructed wetlands marked on it.

## Activities

### 1. Predictions – What’s in Storm Water?

**Link: Grade 4 Science – Waste and Our World (Identifying wastes from human activity and their possible toxicity to the environment.)**

- The storm water and everything that is in it go to the North Saskatchewan River. What do you think might be in it besides water? Make a class list of the ideas the students have.
- Read together **Is Rainwater Dirty?**
- As a group, mark the predictions with symbols (check marks for **We Knew It!** and question marks for **We still aren’t sure!**) and add in items that were missed. Introduce the term contaminants.



## 2. What's in It?

- Give a blank master of **What's in It? Chart** to every student.
- Divide the children into groups. Cut out and distribute the **What's in It? Contaminant Cards**. Determine the size of the groups and the number of cards that each group gets based on your own students and the time you have available.
- Each group reads their cards and makes notes in the appropriate sections of their **What's in It? Charts**.
- The small groups report to the large group and everyone completes their charts. An overhead transparency made of this chart may facilitate this process. A key is provided for your assistance.
- **What's My Role?** With a highlighter pen, mark the areas in the solution column with actions that you can take to keep storm water clean.

## 3. Home Link

- Review the **Treat it Right at Home!** survey so the children understand their task that evening.

## 4. Extension / Assessment Activity

- In small groups, have the children prepare a skit to be presented to the class at the beginning of the next lesson that would illustrate one of the storm water contaminant problems and accompanying solutions.





# Lesson 3

## Testing Storm Water

### Teacher Background

Storm water is monitored and tested by the City of Edmonton on a regular basis. During this lesson, the students will perform some basic chemistry tests on water samples to reinforce their understanding of the monitoring that is done by inspectors working for the City. Storm water is tested but it is not treated. Only the wastewater from our homes is treated before it goes to the river.

### Objectives

#### Students will:

- use their knowledge of basic chemistry tests to analyze samples of water that contain a variety of contaminants
- understand that storm water is not treated but that it is monitored by inspectors before it enters the river ecosystem

### Materials

- We are all in this together!
- Testing for Contaminants
- Testing for Contaminants Key
- Water samples including these contaminants:
  - Grass
  - Dirt
  - Sand
  - Vinegar
  - Baking soda
  - Dish soap
  - Cooking oil
  - Salt



- Testing materials including:
  - Funnels and containers for mixing and evaporating
  - Filter paper or paper towels
  - Sieves
  - Litmus paper

## Introduction

Students can either report the results of their **Treat it Right at Home!** activity in small groups or to the entire class. Have students share ways that they will help their family to treat storm water carefully. What new behaviours and actions will they encourage at home?

Provide each student with a copy of **We are all in this together!** to take home to help the family keep track of new behaviours and actions.

Tell the students that although storm water is not treated before it goes into the river, it is tested. Inspectors who work for the City of Edmonton regularly monitor the water that comes out of the four biggest outfalls for contaminants that may be in the water. This is done every two weeks if the weather is dry. The tests are done every day if the weather is wet.

**Note to teacher:** If something serious is found, the problem is rectified by Drainage Services.



## Activities

### 1. Testing for Contaminants

- Tell the students that they are going to perform chemistry tests on some water samples, just like the inspectors do, to see what kinds of contaminants there may be in the water. Reassure them that they will be working only with safe materials and nothing that is poisonous to them.
- Review the list of contaminants and, as a group, determine what testing might be done for a few of them. Then let each group continue this process by filling in the blanks on the activity sheet, **Testing for Contaminants**. Depending on your group and the chemistry experiences they have had, you may provide additional support. A key is provided for your assistance.
- Students independently do their tests and draw their conclusions.
- Share as a group and reveal the actual contaminants.

### 2. Assessment

- Use this opportunity to circulate among your students to observe their ability to apply what they have learned in a previous unit to a new situation.
- As you circulate, encourage and observe discussions about how important it is to be very careful about what goes down storm drains.
- The written report on the testing, including the reflections that the students have made, will also give you an idea as to the depth of their understanding.



# Lesson 4

## Drainage Systems

### Teacher Background

There are three drainage systems in the City of Edmonton: the storm water system, the wastewater system (which includes the Gold Bar Wastewater Treatment Plant) and the combined system. (Gold Bar Wastewater Treatment Plant is owned and operated by EPCOR Water Services.)

**Link: Grade 4 Science – Waste and Our World (Identifying methods of waste disposal currently used within the local community.)**

These systems are operated by many different people who are employees of Drainage Services, City of Edmonton. These people plan, build, operate, and maintain all the parts of the collection systems. As we have seen, these people also monitor and test the storm water.

Our storm water flows to the North Saskatchewan River – the major body of water in our community. Edmonton is part of the North Saskatchewan River Watershed and there are many other urban and rural communities in our watershed. What you put in the storm water in Edmonton may eventually end up in Saskatoon.

The North Saskatchewan River flows more than 1 000 km from its source at the Saskatchewan Glacier in the Columbia Icefield in Banff National Park. Eventually, the North Saskatchewan River joins the South Saskatchewan River and they become the Saskatchewan River, which eventually empties into the Hudson Bay.

### Objectives

#### Students will:

- describe the role of Drainage Services
- understand that there are three drainage systems in Edmonton
- identify that Edmonton is part of a watershed, and that storm water and everything that goes into the river can affect the entire watershed

## Materials

- Drainage is a Big Job
- Drainage is a Big Job Anticipation/Reaction Guide
- Edmonton is Part of a Watershed
- North Saskatchewan Watershed Map
- FQR Strategy Master



## Introduction

Link this lesson to the previous one by discussing the many people who play a role in protecting our water. There are not only scientists who test the water but also people who build the ponds, lay down the pipes, and take care of them. The team of people who take care of our storm water system work for Drainage Services, City of Edmonton.

## Activities

### 1. Who Takes Care of Our Storm Water?

- **Brainstorm** some of the other kinds of jobs that would have to be done to keep the storm water system operating. The list could include chemists, engineering technicians, engineers, computer technicians, safety staff, equipment operators, drivers, and mechanics.
- **Drainage is a Big Job Anticipation/Reaction Guide** Ask the students to read the statements in the Guide and then fill in “Agree” or “Disagree” in the “Before” columns. Then read the statements together and ask students to show their opinions by using thumbs up or thumbs down.
- **Read Drainage is a Big Job.** Have the students mark the text as they read. (Use a check mark for important information about the role of the City of Edmonton; a question mark for **questions** they may have; and an exclamation mark for **personal responses** such as relating and making inferences.) You may want to review the lists on what the storm water and wastewater systems include from the first lesson Reading.



- Have the students review the statements on the **Anticipation/Reaction Guide** and change any responses they made earlier that may conflict with the information they have read.

## 2. North Saskatchewan Watershed

- Remind students about the water cycle and where storm water eventually goes. Ask the students where the North Saskatchewan River comes from and where it goes. Use the **North Saskatchewan Watershed Map** so students can find the source of the North Saskatchewan River, the path it takes, and where it eventually ends.
- Read **Edmonton is Part of a Watershed**. Have the students mark the text to indicate important information related to the name and location of the watershed (check mark); questions that they might have (question mark); and personal responses such as relating and making inferences (exclamation mark).
- Students transfer the marks that they made to the **FQR Chart (Fact, Question, Response)**. Students share with a partner and/or the whole class at least one fact, question, and/or response from their chart.
- Again using the map, ask the students to identify the other communities and people who live in the watershed that will be affected by what goes into the storm water system here in Edmonton.
- Have the children colour the North Saskatchewan Watershed on the map.

## Unit Culmination / Extension Ideas

- **Let's Figure It Out** Do Part 2 of the mathematics exercise.
- **Persuasive Letter** Write a persuasive letter to the editor about the importance of the storm water system and how people should be careful about what they put down the storm drain.
- **Brochure** Develop a brochure that combines visuals with informative / persuasive writing about the importance of caring for storm water.
- **Crossword Puzzle** See Extension Ideas.
- **Poster** Make a poster showing important ways we can keep our storm water clean.

- **Role Playing** Imagine that you have the job of helping two neighbours solve a problem. Neighbour A dumps all kinds of things down the storm drain and Neighbour B is very upset about this behavior. Neighbour B wants you to help her to convince Neighbour A to do the right thing and not dump things down the storm drain.

# 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 the Wetlands topic and/or Chemistry topics:

☐ well

☐ poorly

☐ I would add or delete: \_\_\_\_\_

## 4. I appreciated having a good selection of Readings.

☐ yes

☐ no

- 5. The activities I found the most useful are (please say why they were useful):**

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- 6. Should the estimated amount of time for the activities be included?**

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

☐ *clear and understandable*

☐ *unclear and not understandable*

☐ *I would change or add:* \_\_\_\_\_

- 8. The integration with Mathematics, and Language Arts were:**

☐ *good and should be included*

☐ *should not be included*

☐ *should be changed by:* \_\_\_\_\_

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

☐ *dvd*

☐ *games*

☐ *in-class presentation by experts*

☐ *web-based resources and activities*

☐ *more activities in* \_\_\_\_\_  
*(math, 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.** \_\_\_\_\_

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Please print and complete this evaluation and fax or mail it. You can also complete the evaluation online at: [www.edmonton.ca/drainage/education](http://www.edmonton.ca/drainage/education) and send it by e-mail. Thank you.

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\_\_\_\_\_

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# Readings

## Rain and Melted Snow

Nearly every year in Edmonton, approximately **130 mm** of snow falls in the winter and about **346 mm** of rain falls in the spring and summer. All of this melted snow and rain is called **storm water**. If all of this water fell into a swimming pool, it would go past your knees. That is a lot of water.

In the rural areas, most of this storm water soaks into the ground or runs into ponds, streams, and the river. The ground is a **permeable** surface so water can soak in. In urban areas such as the City of Edmonton, some of the storm water runs into ponds, streams, and the river and some of it soaks into the ground. However, most of the storm water runs off hard surfaces like driveways, streets, sidewalks, and the roofs of houses and buildings. The street and sidewalks are **impermeable** surfaces because the water can't soak in.

This storm water then runs down the street, along the gutters, and through the **catch basins** in the side of the street. From there, it falls into a huge pipe under the street that flows to an **outfall** in the river bank and then directly to the North Saskatchewan River.



The system used to manage storm water includes manholes, catch basins, outfalls, and a large underground pipe. It also includes special ponds and constructed wetlands. This whole system is used to manage the serious flooding that can occur when there are heavy rains and large amounts of melting snow. It is called the **storm water system**.

It is the job of Drainage Services, City of Edmonton to plan, build, operate, and maintain this huge system.

A catch basin is the grill in the side of the street where rain and melted snow drain into the storm water system.

An outfall is the outlet from a huge underground pipe in the riverbank that discharges to the river.



## Components of the Drainage System

### In Edmonton, the storm water system includes:

- 2 411 km of storm sewers (about the distance from Edmonton to Whitehorse, Yukon)
- 82 wet ponds
- 40 constructed wetlands
- 75 dry ponds
- 242 outfalls
- 69 606 manholes
- 56 163 catch basins
- 26 storage tanks

### In Edmonton, the wastewater or sanitary system includes:

- 2 219 kilometres of sanitary sewers (about 1.5 times the distance between Edmonton and Winnipeg)
- 946 kilometres of combined sewers (sanitary and storm water) (three times the distance between Edmonton and Calgary)
- \* Gold Bar Wastewater Treatment Plant

\*Figures are current as of 2013.

## Wet Ponds

There are **82 wet ponds** in Edmonton.

### Description

- Depth: 2.5 – 3.5 metres (This is a little higher than the ceiling of your classroom.)
- Size: minimum 2 hectares (2 ha) (about 4 football fields) (NFL size)
- Shape: almost any size and shape
- Bottom: mud (a clay liner is installed to prevent groundwater seepage)
- Shoreline: rocks, stones, cattails, and sometimes grass
- Water source: rain, snowmelt, and storm water system



### Purpose

- help to control the quantity of water that comes after a heavy storm or snowmelt to prevent flooding
- help to add to the beauty of our neighbourhood
- help enhance the quality of storm water before it flows into a creek, stream, or river

## How Wet Ponds Work

In a wet pond, there are several inlet pipes and only one outlet pipe. (Sometimes, one pipe is used as the inlet and outlet pipe.)

These pipes range in size from 200 mm to 900 mm in diameter (some of them are 1 200 mm in diameter) depending upon the slope of the land. The pipes allow storm water to come in and out of the wet pond.

The outlet pipe is set below the normal water level and sloped towards the interior of the pond. If there is a heavy rain, the water level in the pond will rise. As it reaches towards the high water level, water will flow out of the outlet pipe and into the main storm water pipe that leads to the river. This helps to prevent flooding on the streets and in your house.

## Dry Ponds

There are **75 dry ponds** in Edmonton.

### Description

- **Size:** 1.5 to 3 metres deep (If a dry pond were full of water, it would go over a tall grade 5 student's head. Some dry ponds are deep enough that the water might even go over the head of one student standing on another's shoulders.)
- **Shape:** any width or length
- **Features:** gently sloped, covered in grass

Dry ponds are depressions and are often built in a park or recreation area. When they are dry, they are often used as sports fields or for tobogganing in the winter.

### Purpose

- hold extra rainwater when the main storm water pipe is full

## How Dry Ponds Work

Dry ponds have just one pipe. This one pipe is used for letting the water in (inlet pipe) and for letting the water out (outlet pipe). The pipe can be anywhere from 200 mm to 450 mm in diameter depending upon the slope of the land.

During a heavy storm, the main pipe under the street in the storm water system becomes full of water. This water then flows through the inlet/outlet pipe into the dry pond and the pond slowly fills with water.

Once the rain has stopped, the water will slowly go back through this pipe and the pond will dry out again. Usually, this takes fewer than 24 hours. When there is just a small rainstorm, the rainwater does not collect in the dry ponds.



## Constructed Wetlands

There are **40 constructed wetlands** in Edmonton.

### Description

- Depth: 0.1 – 0.6 metres (shallow part) to 2.5 metres (deep part).  
(The deepest part would be about the same height as your classroom.)
- Length: varies but at least three times the width  
**length = 3 times the width** (because of the shape,  
the water stays in the wetland longer and thus  
becomes cleaner)
- Size: minimum size 2 hectare (2 ha) (about four football fields) (NFL size)
- Features: all kinds of plants, animals, and insects live in or near them

### Purposes

- manage the quantity of water
- prevent flooding
- clean the water
- provide a home for wildlife
- protect the environment



## How Constructed Wetlands Work

To manage the quantity of water that comes from a major storm, a constructed wetland has several inlet pipes and only one outlet pipe (the same as a wet pond). The storm water comes in through the inlet pipes and travels through the constructed wetland. It then flows through the outlet pipe to a creek or to the North Saskatchewan River. These pipes range in size from 200 mm to 450 mm, depending upon the slope of the land.

## Constructed Wetlands help the Environment

Constructed wetlands are planted with all kinds of vegetation that is native (called indigenous plants) to our area. Constructed wetlands are home to all kinds of aquatic animals, birds, and insects.

Constructed wetlands help to clean storm water. Certain kinds of plants in a constructed wetland actually take contaminants from the water (nutrients from fertilizers, pesticides, heavy metals from the natural degeneration of cars, highways, etc.) and store them in their root and leaf systems.

An example of such a plant is a bulrush. As you know, plants take in carbon dioxide and give off oxygen. Plants are extremely important to a healthy environment.



## More about Constructed Wetlands

Constructed wetlands are built by man and are planted with all kinds of vegetation. After about three to five years, the constructed wetlands become very diverse ecosystems with all kinds of plants, insects, birds, amphibians, and other animals. After the wetland is established, diverse animal and plant life comes naturally by the wind, birds, and animals. Constructed wetlands are built in urban settings. They help to control flooding and to clean the water of contaminants. They also help to beautify our neighbourhoods.

## Natural Wetlands

Natural wetlands are much more diverse than constructed wetlands because they are very, very old. In fact, they can be hundreds of years old. There is much more vegetation and a large variety of plants, animals, and insects. Natural wetlands are not near an urban setting. They are found in a rural setting or in the wilderness. They function as a home to all kinds of life. They can be any size and provide a natural flood control role in that they hold excess water from heavy rains and snowmelt. As the surrounding ground dries out, the water seeps out slowly.



## Is Rainwater Dirty?

Rainwater isn't dirty but our atmosphere is filled with contaminants from things such as exhaust from our cars; industrial pollution (caused by businesses that don't use pollution controls); normal wear and tear from our highways, cars, and buildings; and dust in the air.

As rainwater falls to earth, it collects these contaminants. In some places where industrial pollution is severe, there is acid rain. The contaminants fall on the land and into bodies of water (lakes, rivers, streams, oceans, and our ponds and wetlands).

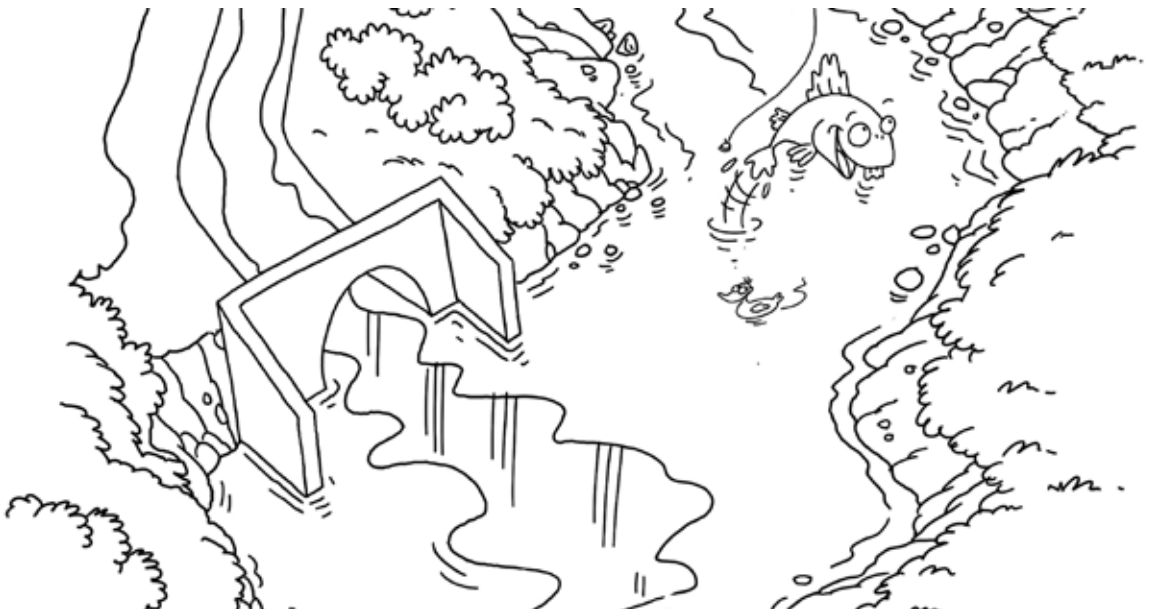
After a rainstorm or snowmelt, everything on the street or on your lawn and garden will wash down the drains in the street or straight into a lake or pond. Eventually, it goes to the North Saskatchewan River.



## We are All in This Together!

We all need to do our part to treat our storm water right. After all, this water goes back to the North Saskatchewan River. As you know, we get our drinking water from the river, and the water in the river flows downstream to neighbouring communities and provinces. So Treat it Right!

1. Reduce the use of pesticides and fertilizers on the lawn and garden, especially just before a heavy rainfall.
2. Don't pour hazardous fluids down the catch basins. Take them to the Eco Station.
3. Pick up any garbage in the street that might go down the drain.
4. Wash your car at the car wash not in the driveway!
5. Clean up after your pets.
6. Bag your leaves or compost them in the fall.
7. Don't let grass clippings go down the catch basins.
8. Don't water the sidewalk! Water the grass and garden.
9. Dispose of hazardous products at the Eco Station.
10. Be interested and help your family, friends, and neighbours learn about treating our environment right!





## Drainage is a Big Job

In the City of Edmonton, there are three major systems that drain water from our streets and homes:

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

Here is some information about all three systems.

We have already learned quite a bit about the storm water system. It takes care of runoff from our streets, but there is also other water that needs to be taken care of.

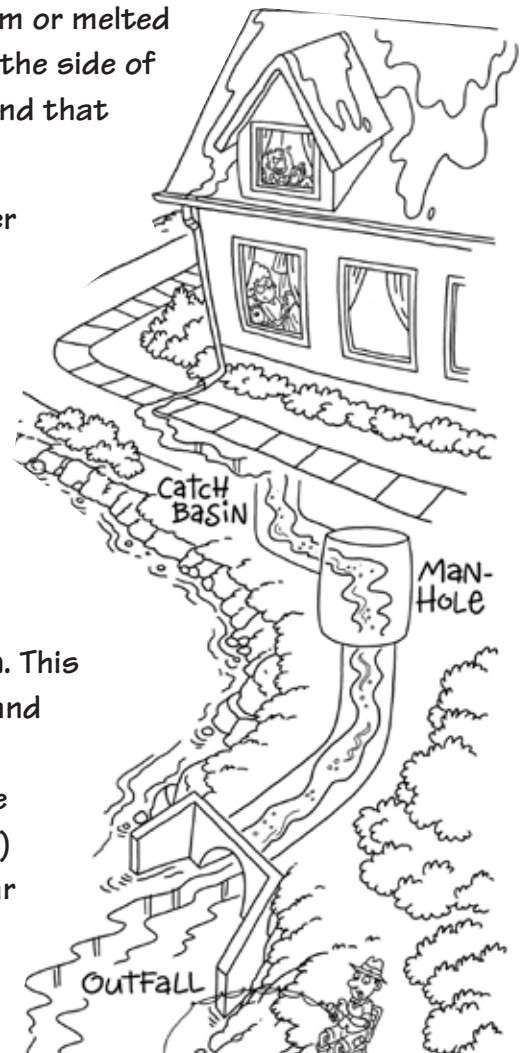
## Storm Water System

In the street, all of the storm water runoff from a rainstorm or melted snow runs down the street and into catch basins (grills in the side of the street). From there it goes into a large pipe underground that leads to the river.

However, if you live near a lake or pond (called a storm water management facility), all of the storm water pipes underground lead to it. Each facility has approximately three to five inlet pipes but only one outlet pipe. The outlet pipe will then lead back to the main storm water pipe and then to the river.

## Sanitary or Wastewater System

In your house, the **wastewater** from the toilet, sink, shower, kitchen, and laundry goes into the **sanitary drainage 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. (This is a **separate** pipe from the storm water pipe.) This large pipe carries 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.



## Combined System

In the older, central part of Edmonton, there is a third system called the combined sewage system. This is made up of one large pipe that collects both sanitary and storm water and takes it to the Gold Bar Wastewater Treatment Plant. During a big rainfall or spring snowmelt, that pipe cannot hold all of the water. To prevent flooding of residents' basements and the city streets, the extra water flows through the combined sewer overflow directly into the North Saskatchewan River. There are 18 combined sewer overflows in the City. All of the newer areas of the City of Edmonton have two separate systems.

## Who does this job?

Drainage Services, City of Edmonton plans, designs, builds, operates, and maintains all of the pipes and sewers in the City of Edmonton. The City of Edmonton delivers wastewater to the Gold Bar Wastewater Treatment Plant (which is owned and operated by EPCOR Water Services). In fact, Drainage Services collects and transports all of the storm water and wastewater in the City. Let's learn a little bit more about how the many people who work for Drainage Services take care of our storm water.



## Monitoring Storm Water

To monitor the system for contaminants, the City of Edmonton samples and tests the storm water that comes from the four largest outfalls (large pipes that discharge directly to the river). Tests are done on a biweekly basis if the weather is dry. If the weather is wet, tests are done every day. They also measure how much water is going to the river.

## Maintaining, Cleaning, and Operating the Storm Water System

To maintain, clean, and operate the system, the City of Edmonton keeps the catch basins clean of debris. They respond to calls about plugged drains on the street.

Remember that the storm water is not cleaned or treated. You can see how important it is to be careful about what you pour down the drains and what you put on your lawn, garden, and driveway!

Sometimes the ponds and lakes get too many plants and weeds growing in them so Drainage Services cuts or harvests these plants. Sometimes there is too much algae from an algae bloom. This makes the water very green and causes a bad odour so Drainage Services treats the water for the algae bloom.

As well, there might be too much sediment at the bottom of a wet pond or a constructed wetland. The sediment collects many kinds of contaminants so when necessary, Drainage Services will clean out the sediment and take care of the inlet and outlet pipe. They also collect the garbage and litter around the ponds and constructed wetlands.



## Low Impact Development

Because of all of the hard, impermeable surfaces that are part of the way our cities are built, flooding can be problem for residents when there is a heavy runoff from a major storm or heavy snowmelt. **Low Impact Development (LID)** is a kind of urban development that helps to control runoff which can cause serious flooding. Examples of LID include rain gardens, rock gardens, green roofs, and streets with lots of trees and grass. This kind of development absorbs rainfall and snowmelt rather than having it all run down the streets and gutters and into the storm water system. Low Impact Development (LID) is covered by the **Grade 7 Treat it Right!®** teacher's guide.





## Edmonton is Part of a Watershed

What is a watershed? A watershed can be a small or very, very large area of land. All of this land drains into a local body of water such as a river, stream, lake, pond, or the ocean. All of the erosion and storm water runoff flows or drains into the local body of water. In the City of Edmonton, the local body of water is the North Saskatchewan River. Our watershed is called the North Saskatchewan River Watershed.

The North Saskatchewan River Watershed (NSRW) covers about 12.5 percent of Alberta's land area and is about 80,000 square kilometres.

The North Saskatchewan River flows through the NSRW.

The North Saskatchewan River starts at the Saskatchewan Glacier in the Columbia Icefield in Banff National Park. It flows more than 1 000 kilometres to the Alberta/Saskatchewan border.

Before the water reaches the Hudson Bay, it will travel an additional 1 797.5 km. Here is the path:

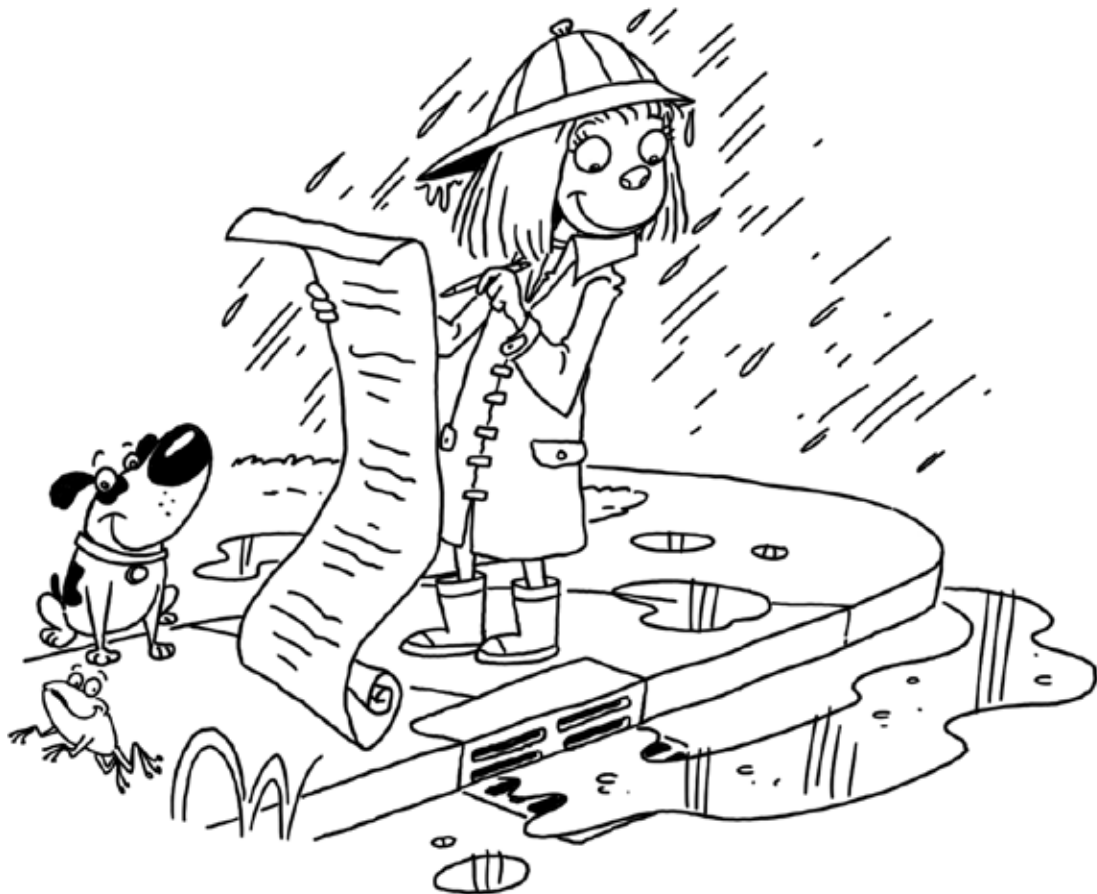
- From the Alberta/Saskatchewan border, the North Saskatchewan flows to The Forks in Saskatchewan, a distance of 492.1 km.
- At The Forks, the North Saskatchewan River and the South Saskatchewan River join forming the Saskatchewan River.
- The Saskatchewan River now flows to Lake Winnipeg, a distance of 642.1 km.
- The water now flows via the Nelson River from Lake Winnipeg to the Hudson Bay, a distance of 661.3 km.

Altogether, the water flows approximately 2 797.5 km from the Saskatchewan Glacier to the Hudson Bay.

All of the people and all of nature is part of the watershed. It is very important that all of us be careful of what we put in our water because it affects all of the life in the watershed both upstream and downstream of where we live.



In Alberta, there are 17 major watersheds.



# Instructional Tools

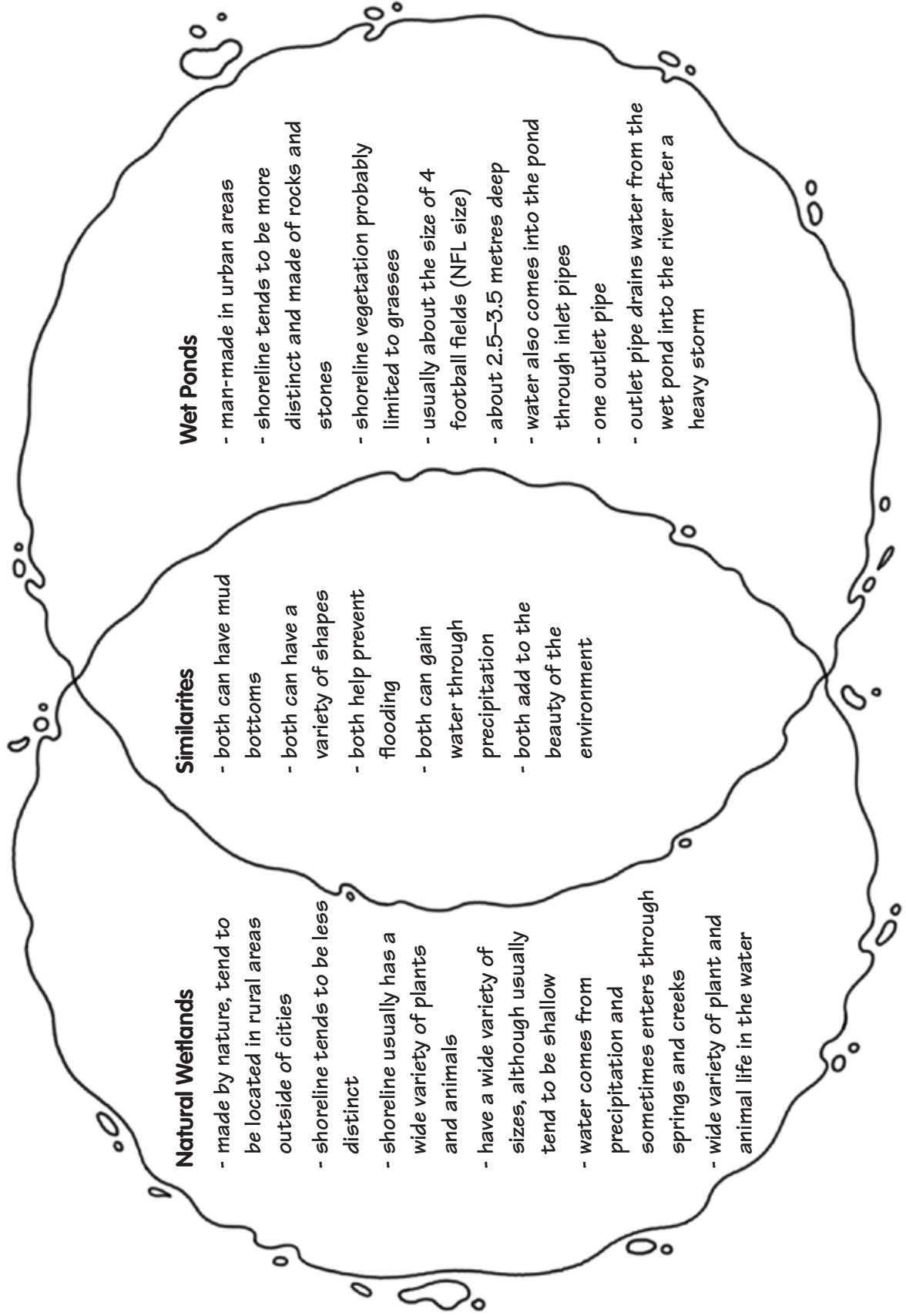


# KWL Chart

<b>K</b> What I Know	<b>W</b> What I Want to Learn	<b>L</b> What I Learned

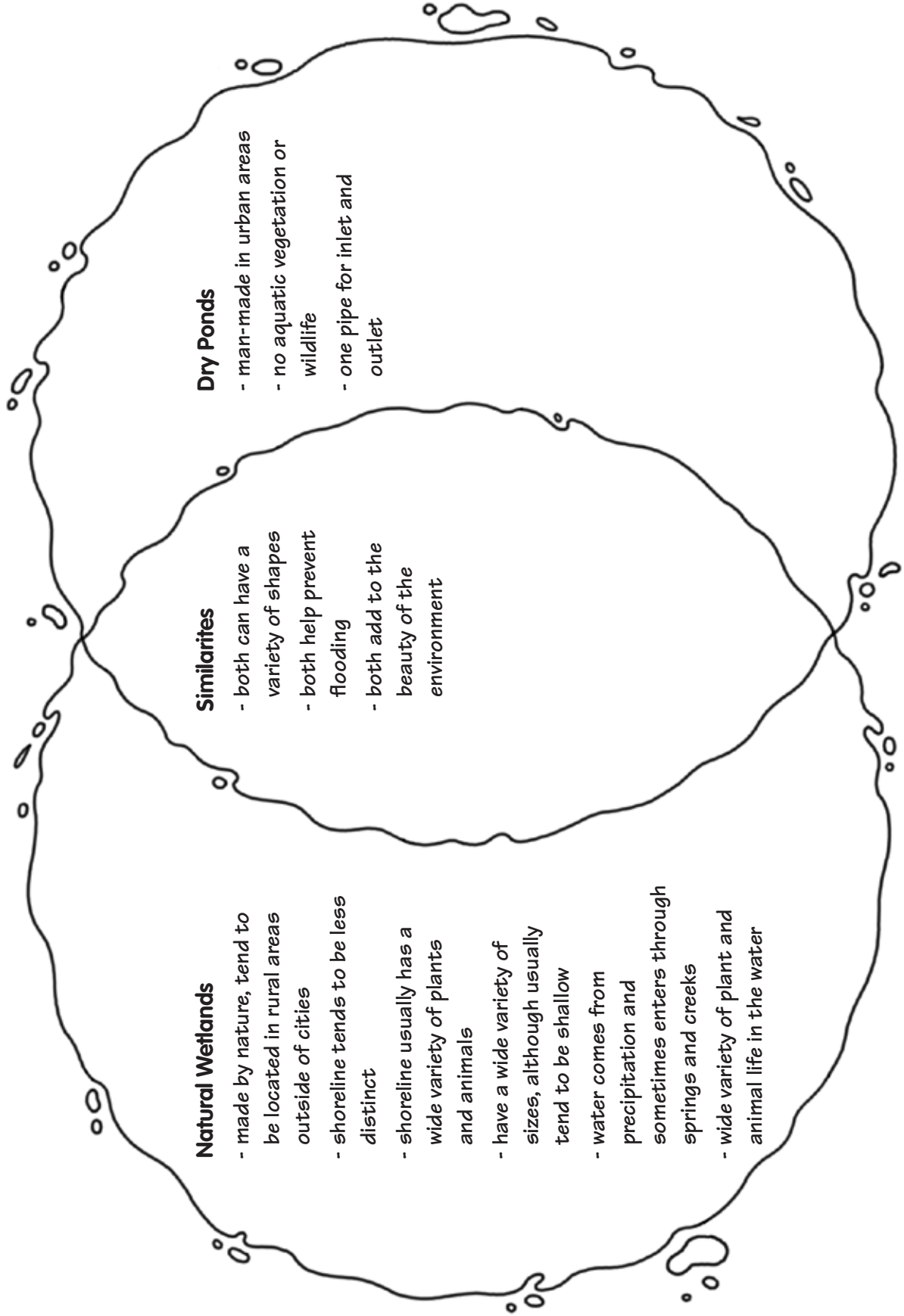


# Venn Diagram Natural Wetlands vs Wet Ponds Key

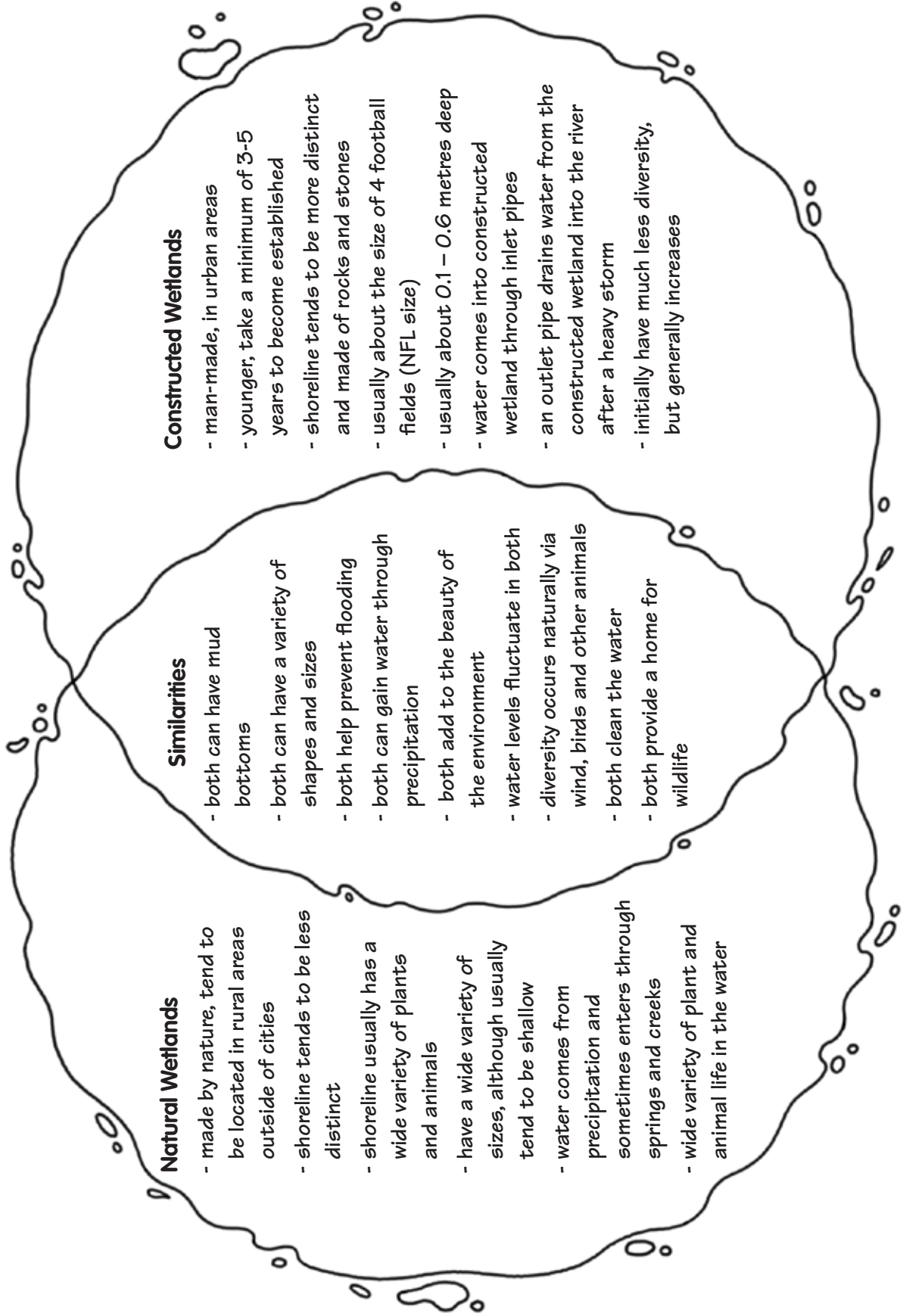


**Teacher's Note:** A Venn Diagram is a graphic organizer that helps students compare and contrast concepts and ideas. Common attributes are listed in the overlapping section. Individual attributes are listed in the other part of the circle.

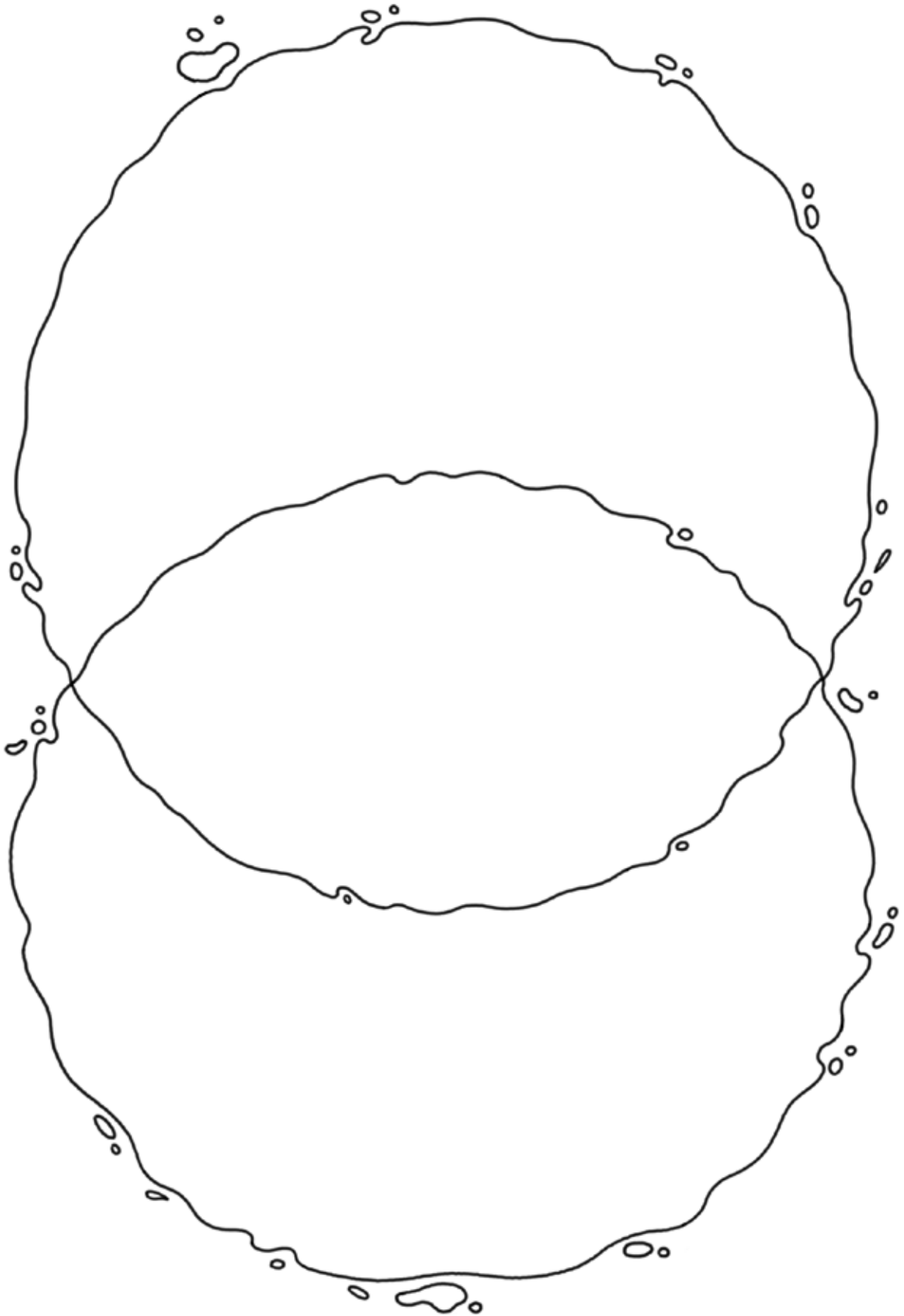
# Venn Diagram Natural Wetlands vs Dry Ponds Key

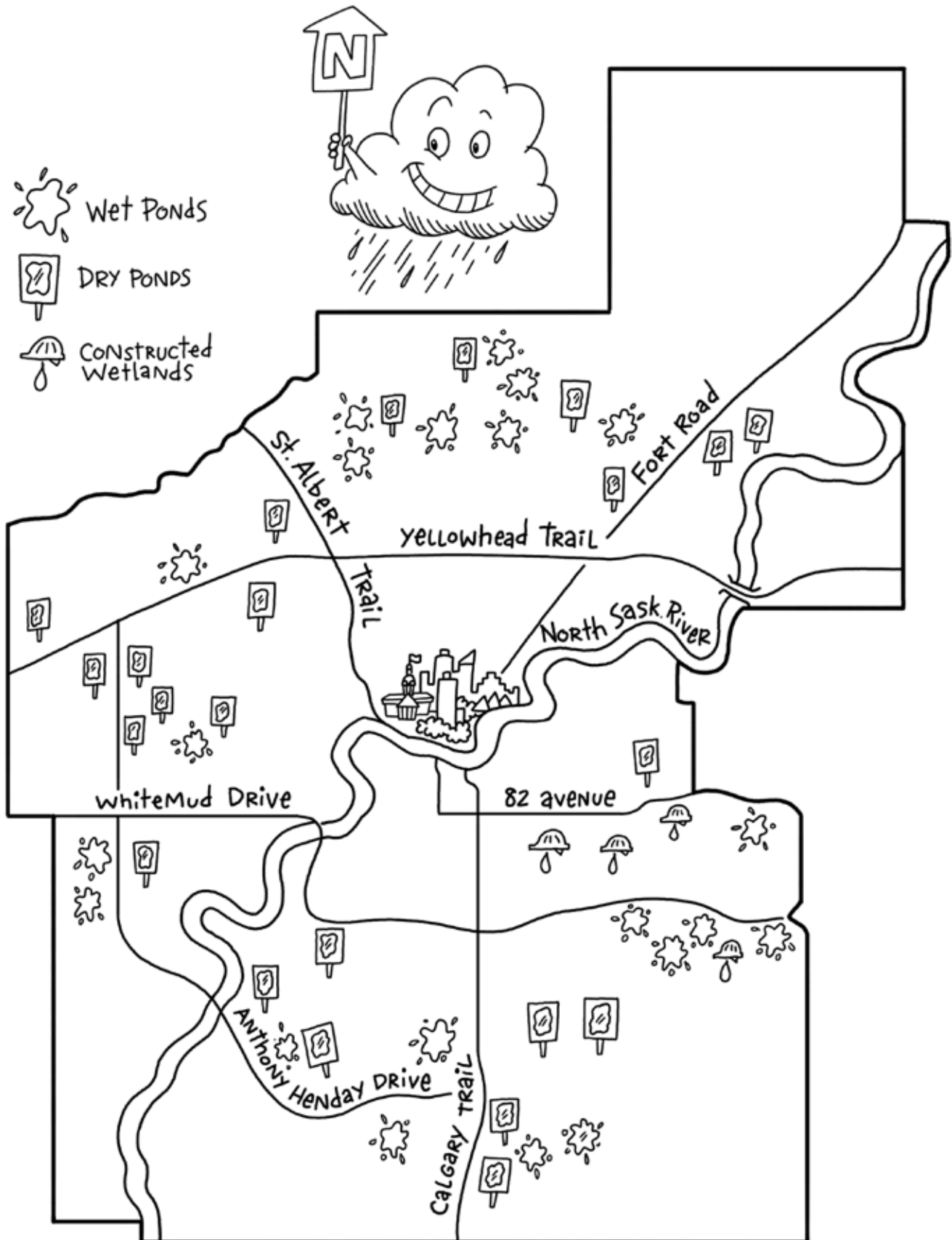


# Venn Diagram Natural Wetlands vs Constructed Wetlands Key



## Venn Diagram Master





[illegible]

# What's in It? Key

Contaminants	Source	Problem	Solution
sediment (solids) - soil - sand	erosion - natural - sand from the roads in winter construction	sediment can contain oil and gas and metals from your car and organic waste (leaves, pet waste) fish need clean gravel to spawn	pick up sand and gravel from driveways rather than washing them down the drains
nutrients - nitrogen - phosphorus	fertilizer pet wastes yard waste	causes algae bloom that has a bad odour and a greenish colour	reduce our use of fertilizers and apply them properly, and clean up pet and yard waste
bacteria	pet wastes	can cause intestinal illness so people cannot use the river for recreation	clean up after pets
pesticides and herbicides	park and garden care	disrupt normal growth and development of plants and fish	reduce our use of fertilizers and apply them properly
metals and paint	cars	heavy metals deposit in sediment	wash our cars in car washes
oil and grease	leaks and spills from cars	toxic to fish, and can cause an unattractive sheen on the surface of the water	keep our cars in good condition
hazardous fluids	car oil, paint thinner	toxic to water, plants, and animals	take these products to the Eco Station



Contaminants	Source	Problem	Solution
cleaning products	used to wash your car in the driveway	source of nutrients that encourage the algae to grow, which may block the sun (this affects the amount of oxygen in the water and is harmful to life at the bottom of the lakes, ponds, and wetlands)	wash our cars in car washes
leaves and grass clippings	your trees and lawn	can plug the storm water pipes, and are sources of nutrients	bag or compost leaves and grass

## What's in It? Contaminant Cards

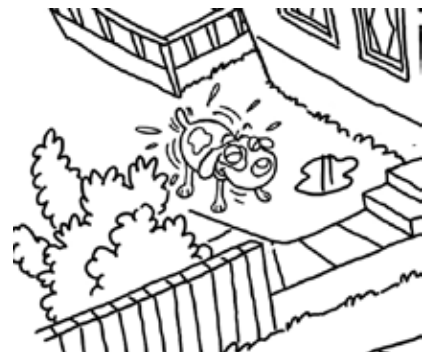
Sediment can be a serious problem for constructed wetlands and wet ponds. Sediments are solids such as sand and soil particles that end up in the water through both natural means such as erosion and through the activities of people.

For instance, some of the sand that we put on roads in the winter washes down the storm drains, into the storm water system, and then into the river. Soil from construction sites does the same thing. Oil and gas and metals come off your car and stick to the sediment in wetlands, ponds, rivers, and streams.

Sediment can be a problem because fish need clean gravel to spawn (lay their eggs). Organic waste (leaves, grass, and pet wastes) also collects in sediment. They increase the levels of nitrogen and phosphorus that can cause algae blooms. Algae blooms have a bad odour and a greenish colour.

We should sweep up the sand and gravel from our driveways so that it does not wash down into the drains.

Pet wastes should never be washed down the storm drain. Pet wastes can be filled with bacteria that can cause intestinal illness. Pet wastes can add too many nutrients to the water, causing an algae bloom that has a bad odour and makes the water look green. Pet owners should clean up after their pets, and dispose of their pet's waste in plastic bags in their garbage cans.



Yard wastes and too much fertilizer (or fertilizer that is incorrectly applied) on our lawns and gardens cause problems for the storm water system as well as for our wetlands, ponds, and the river. They produce too many nutrients in the water, causing an algae bloom that has a bad odour and makes the water look green.

We should reduce the use of fertilizers and apply them appropriately. Fertilizers should not be applied just before a heavy rainstorm because the rainwater will wash them off the lawn and into a storm water management facility such as a wet pond, dry pond, or constructed wetland.

Pesticides and herbicides are often applied incorrectly to lawns and gardens (for example just before a big rainstorm or in too large quantities). These products can wash off your lawn and garden and down into the storm water system and then to the river and wetlands. These products disrupt the normal growth and development of plants and fish. We should reduce the use of pesticides and herbicides and try to find alternate ways of controlling unwanted weeds and insects.

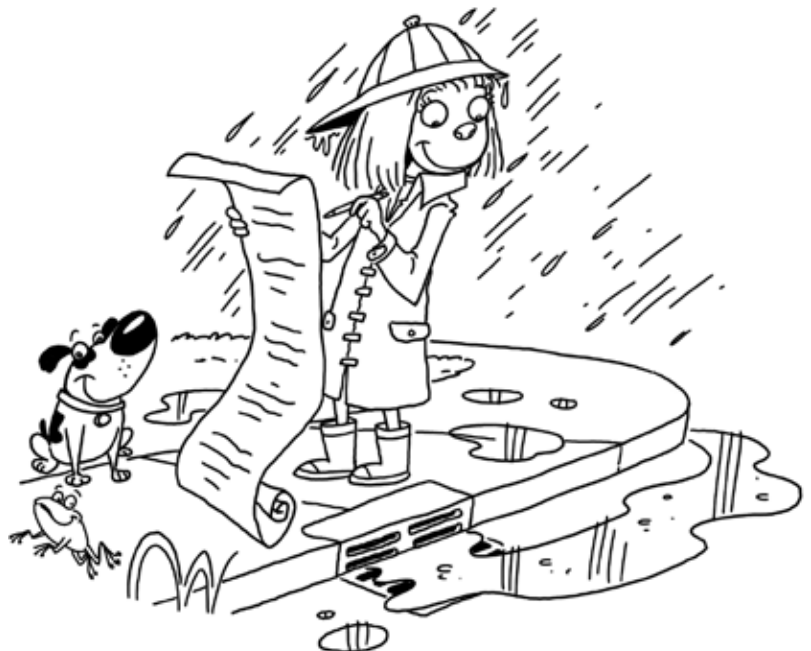
Metals and paint flake off your car in tiny, tiny pieces and deposit themselves in the sediment of our ponds, lakes, rivers, and wetlands. These heavy metals are not healthy for plants, animals, and fish. We should wash our cars in car washes rather than in our driveways. These facilities clean the wastewater so the contaminants do not go into the storm water system.

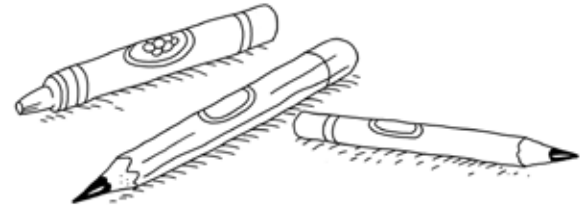
Hazardous fluids such as paint thinner are sometimes poured down the catch basins in the street. These hazardous fluids go into the storm water system and end up in our river environment. They are toxic to the water, plants, and animals. We should never pour hazardous fluids down catch basins. Take them to the Eco Station.

Oil and gas sometimes leak out of your car or are spilled on the driveway. These products wash down the street and into the storm water system. They are toxic and may kill fish. Oil and gas can also cause a sheen on the surface of the water. We should keep our cars in good condition so they don't leak dangerous products. When our sprinklers are on, we should make sure that we are watering the grass and garden rather than the driveways and sidewalks.

Cleaning products used to wash your car in the driveway also wash down the street and into the storm water system and then out to the river. These products are a source of nutrients that encourage algae to grow. The algae can block the sun. This affects the level of oxygen in the water and can be harmful to life at the bottom of the water in our lakes, ponds, and wetlands. Using a car wash helps to prevent these chemicals from contaminating our storm water.

Leaves and grass clippings that are washed down the storm drains can plug the storm water pipes. They are also a source of nutrients that can cause too much algae to grow in the wetlands where they end up. We should bag or compost our leaves in the fall and never let grass clippings go down the catch basins.





# Treat it Right at Home!

Interview your mom or dad or choose a neighbour you know. Tomorrow we will share our results, either in a small group or in a presentation to the whole class.

**Date:** \_\_\_\_\_ **Student's Name:** \_\_\_\_\_

**I interviewed:** \_\_\_\_\_

1. **Do you use pesticides?** Yes or No
2. **Do you bag your leaves in the fall?** Yes or No
3. **Do you rinse your grass clippings down the street?** Yes or No
4. **Do you make sure your sprinkler waters the grass and garden and not on the sidewalk?** Yes or No
5. **Do you have a compost, and what do you put in it? (Two-part question)**  
Yes or No

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6. **What do you do with leftover paint or paint thinner?**

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7. **Why is it best not to fertilize the lawn just before a heavy rainfall?**

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8. Why is it important to wash your car in a car wash rather than in the driveway?

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9. What things do you take to the Eco Station?

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10. What is one thing you do to help preserve the storm water that goes down the catch basins and back to the river?

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Thank you for participating in this interview.

Other questions you might have:

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# Testing for Contaminants Master

**Challenge:** Can you use the basic tests that you learned during your Chemistry unit to identify contaminants that may be present in a sample of water?

In the water sample that you will be given, there are a variety of contaminants. Brainstorm with your group what you might do to determine whether or not a contaminant is present in the water. Decide how you will go about testing the water for as many of the contaminants as possible. Think about the best order to use for your tests.

Sample Number \_\_\_\_\_

Possible Contaminant	Test We Will Use	Observations	Conclusions
acidic materials			
basic materials			
soap			
hot water			
oil			
salt or other dissolved solids			
suspended solids			
other solids			



## Conclusion

Based on our tests, we believe that water sample \_\_\_\_\_ contains the following contaminants \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Reflections

You could include ideas such as:

- How accurate were your tests?
  - Would you do anything differently next time?
  - What did this activity make you think about storm water and wetlands?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_



# Testing for Contaminants Key

This key shows tests for each contaminant, sample observations, and conclusions if the tests are positive.

Possible Contaminant	Test We Will Use	Observations	Conclusions
acidic materials	litmus paper	red litmus stays red blue litmus turns red	water contains acidic contaminants
basic materials	litmus paper	red turns blue blue stays blue	water contains basic contaminants
soap	drop test compared with a water drop	a drop of the water is flat and spreads out	water contains a substance like soap that has reduced the surface tension
hot water	measure temperature with a thermometer and compare to a sample at room temperature	test sample ____ °C  room temperature sample ____ °C	water has been heated, likely by the addition of warm water
oil	carefully pour sample into test tube and observe for layering	layer on top of water	a liquid with a density less than water has been added, possibly oil

Possible Contaminant	Test We Will Use	Observations	Conclusions
salt or other dissolved solids	pour sample in container with large surface area and place in warm spot (this test would only be done after all the other tests, as the water itself is lost)	after evaporation, residue of white crystalline material remains	water contained a dissolved solid, such as salt
suspended solids (e.g. clay particles)	pour sample through a filter made of paper towel, set in a funnel	original water looked cloudy, and solids were left behind on filter paper when the water was filtered	water contained a suspended solid
other solids	decanting or filtering	water separated from solids	solids present (e.g. grass, sand, etc.)

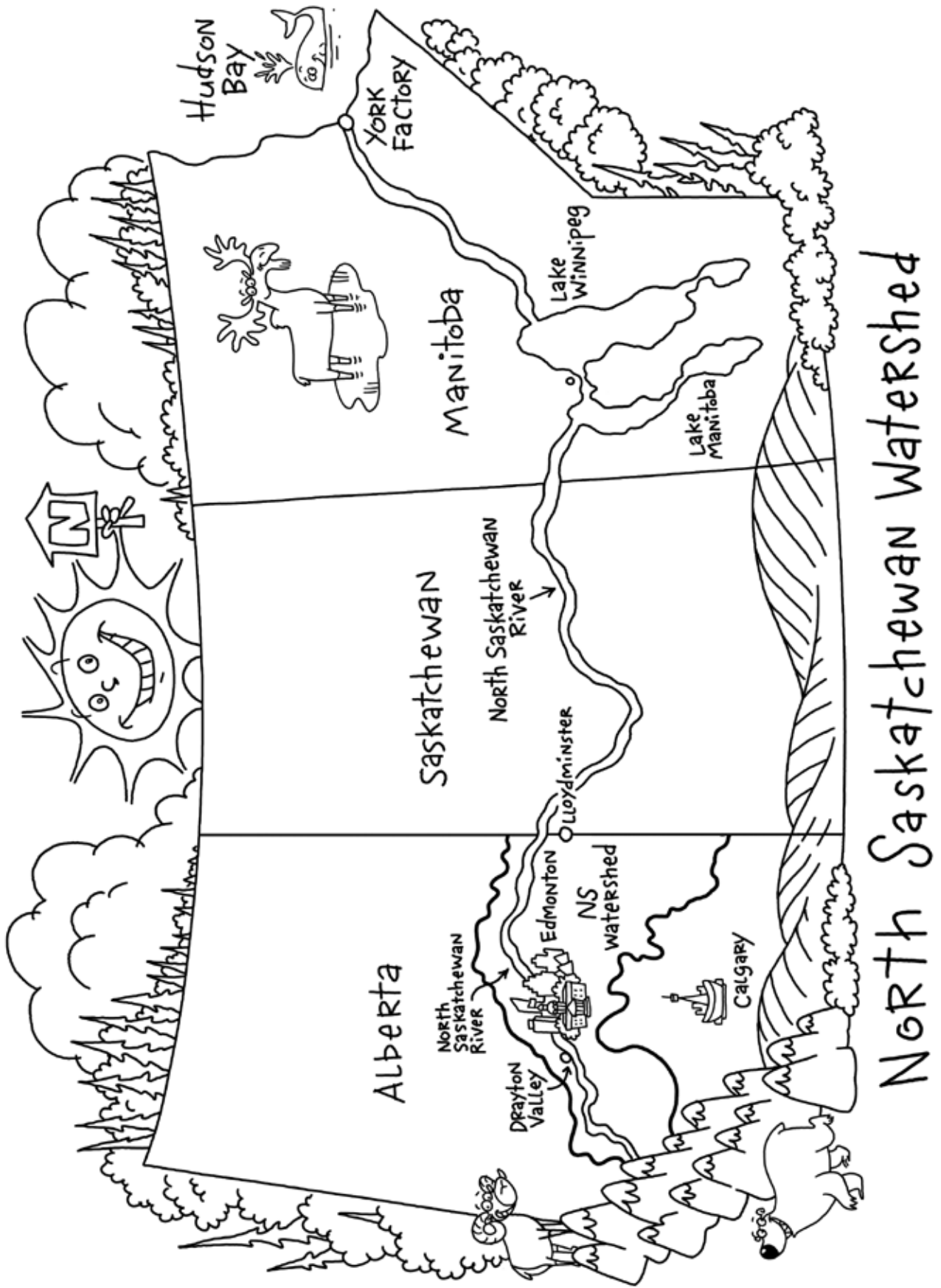


# Drainage is a Big Job

## Anticipation/Reaction Guide

In the **Before** column, place a check next to any statement with which you agree. After learning more about the topic, place a check in the **After** column next to any statement with which you now agree. Compare your original opinions to those you develop as you study and learn more about the topic.

Before	Statements	After
	<ol style="list-style-type: none"> <li>1. The water used by the residents in Edmonton comes from the North Saskatchewan River.</li> <li>2. Toilet water and rainwater are collected together in the same underground pipes.</li> <li>3. Rain water that runs down the street goes directly into the North Saskatchewan River.</li> <li>4. Drainage Services is responsible for collecting and transporting all the storm water and wastewater in the city.</li> <li>5. Drainage Services tests the storm water all year long.</li> <li>6. Everything that goes down the street to the storm water system is cleaned or treated before going back to the river.</li> <li>7. People who work for Drainage Services include safety staff.</li> </ol>	





# FQR Strategy

<b>Facts</b> Important Facts	<b>Questions</b> Questions I have about the Important Facts	<b>Responses</b> Responses I have to the Important Facts



## **Extension Ideas**



# Let's Figure it Out!

## Part 1 (no key)

Use the information in the Readings to answer these questions.

1. **There are many storm water management facilities in Edmonton.**
  - a) Estimate the total number of storm water management facilities in Edmonton. Explain how you know.
  
  
  
  
  
  
  
  
  
  
  - b) Calculate the total number of storm water management facilities in Edmonton. Show all of your work.
  
2. **How many more dry ponds than wet ponds are there in Edmonton?**  
**Show all of your work.**
  
  
  
  
  
  
  
  
  
  
3. **The deepest wet pond is how much deeper than the deepest dry pond? Show all of your work.**



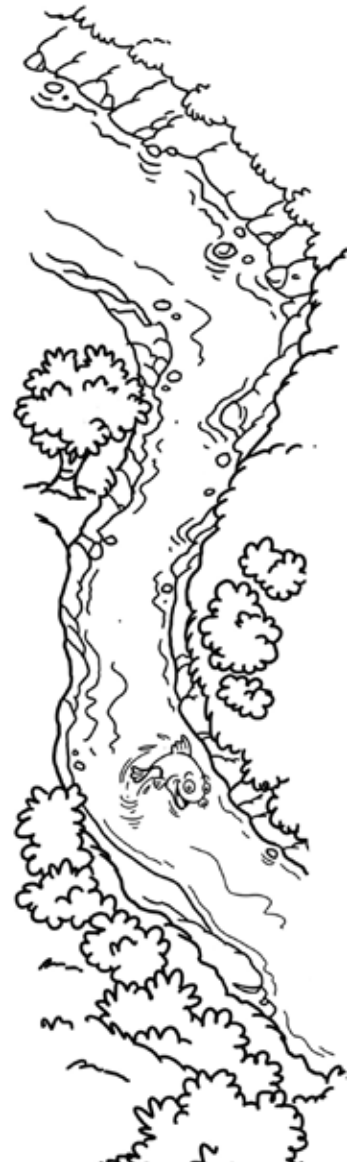
4. Draw and label segments to show the width (diameter) of the largest and smallest pipes in the wet ponds, dry ponds, and constructed wetlands. Use actual measurements.

5. If the width of a constructed wetland is 60 m, what could the length be? How do you know?



## **Part 2** (complete after Lesson 4) (key included)

1. How much longer are storm sewers than sanitary sewers?
2. Estimate and then calculate the total length of the underground pipes for storm sewers, sanitary sewers, and combined sewers.
3. Combined sewers make up about what fraction of the total length of the sewers?
4. Estimate and then calculate how many more manholes there are than catch basins.



## Let's Figure it Out! Key (part 2)

1. How much longer are the storm sewers than the sanitary sewers?

Key:  $2\,411 - 2\,219 = 192$  km

The storm sewers are 192 km longer than the sanitary sewers.

2. Estimate and then calculate the total length of the underground pipes for storm sewers, sanitary sewers, and combined sewers.

Key: Estimate  $2\,411 \rightarrow 2\,400$     $2\,219 \rightarrow 2\,200$     $945 \rightarrow 1\,000$

$$2\,400 + 2\,200 + 1\,000 = 5\,400$$

The estimated total length for underground sewers is slightly more than 5 400 km. .

$$\text{Actual length: } 2\,400 + 2\,200 + 945 = 5\,545$$

The actual length of the underground sewers is 5 428 km.

3. Combined sewers make up about what fraction of the total length of the sewers?

$$\text{Key: } 945 \rightarrow 1\,000 \quad 5\,545 \rightarrow 5\,500 \rightarrow \frac{1\,000}{5\,500} = \frac{1}{5}$$

Combined sewers make up about one fifth of the total length of the sewers.

4. Estimate and then calculate how many more manholes there are than catch basins.

$$\text{Key: Estimate } 69\,606 \rightarrow 70\,000 \quad 56\,163 \rightarrow 56\,000$$

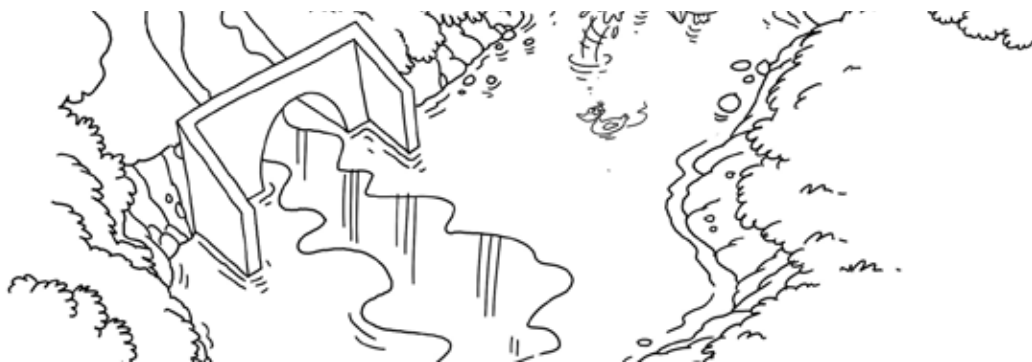
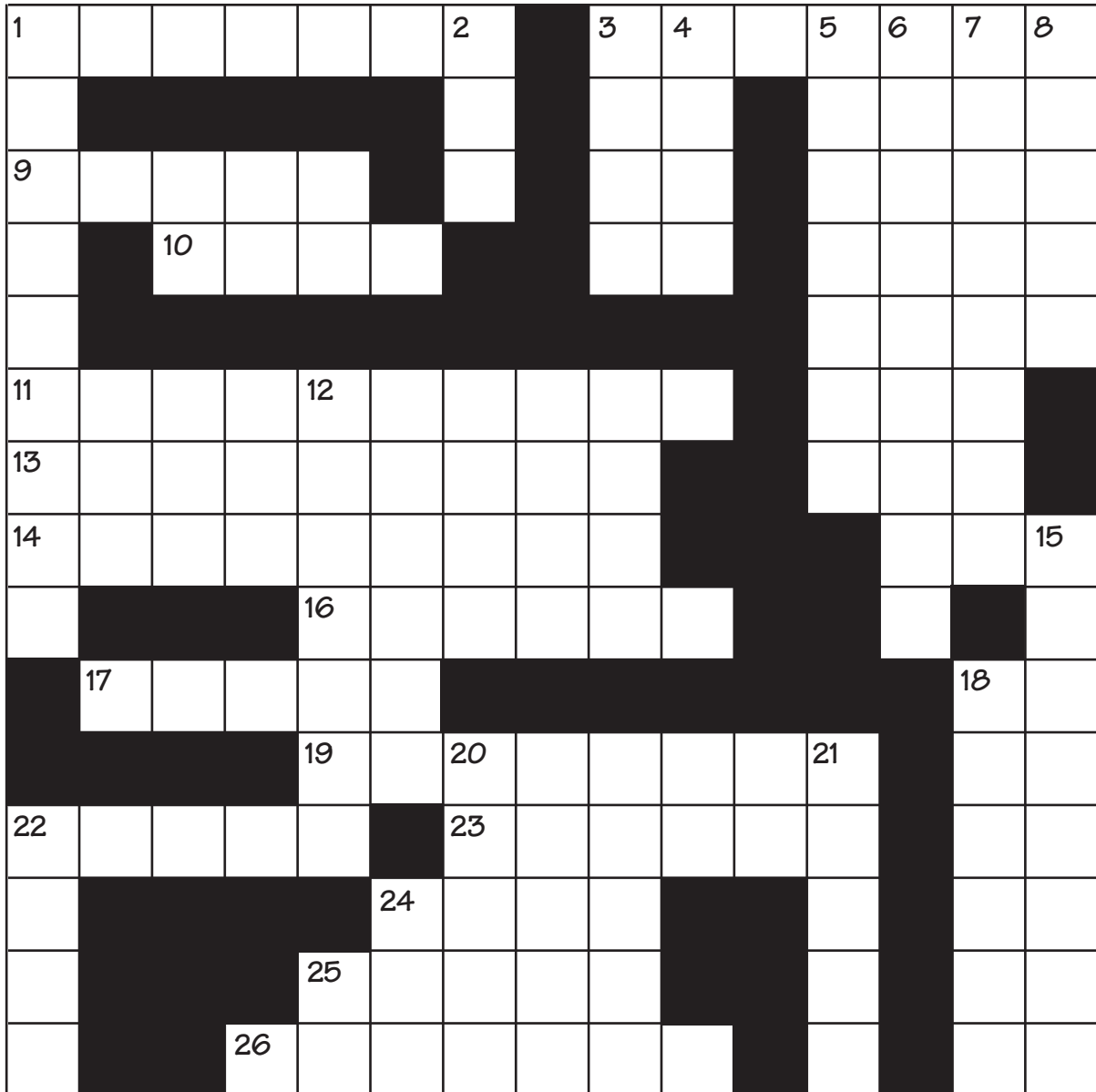
$$70\,000 - 56\,000 = 14\,000$$

There are about 22 000 more manholes than there are catch basins. This estimate is a little low.

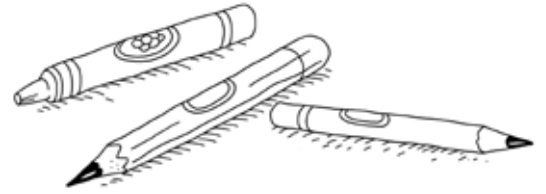
$$\text{Actual: } 69\,606 - 56\,163 = 13\,443$$

There are 13 443 more manholes than there are catch basins.

# Crossword Puzzle



# Crossword Puzzle



## Across

1. a storm water management facility constructed by Drainage Services that is also a habitat for ducks and geese
9. examples include poplar and fir
10. a plant with a beautiful flower that grows near a wetland as well as other places in Alberta
11. water that accumulates from a rainstorm or from snowmelt
13. the body of water where the North Saskatchewan River and the South Saskatchewan River empty
14. one of the groups of people who work for Drainage Services who work to plan, manage, and operate the storm water system
16. pipes through which water enters the storm water management facilities
17. an example of waterfowl that inhabits a wetland
19. pipes through which the water exits the storm water system and goes into the river
22. Everything that goes down the street to the storm water system goes back to the \_\_\_\_\_ as is.
23. To protect our storm water, we must \_\_\_\_\_ our use of fertilizers and pesticides.
24. birds that live near a wetland
25. The storm water collected on the street enters the underground pipes through a grid called the catch \_\_\_\_\_.
26. a covered hole in the ground through which the Drainage Services maintenance crew is able to enter and monitor the underground pipes of the storm water system

## Down

1. an area of land that drains into a local body of water
2. a storm water management facility, called a \_\_\_\_\_ pond, that may or may not have water in it, depending on the amount of rainfall or snowmelt
3. We must \_\_\_\_\_ for the storm water.
4. birds that live near a wetland
5. to contaminate the environment
6. Equipment \_\_\_\_\_ are needed in Drainage Services.
7. \_\_\_\_\_ collects at the bottom of the storm water management facilities and contains impurities so must be cleaned out periodically.
8. \_\_\_\_\_ it Right!® – an important message from Drainage Services.
12. Personnel from Drainage Services \_\_\_\_\_ maintain, clean, and operate storm water facilities.
15. \_\_\_\_\_ Services looks after storm water.
18. staff that focuses on preventing accidents
20. another name for garbage
21. the system into which toilet water drains
22. Water in the wet ponds and constructed wetlands comes from \_\_\_\_\_ and snowmelt.





# Crossword Puzzle Key

1	W	E	T	L	A	N	2	D		3	C	4	O	M	5	P	6	O	7	S	8	T
	A							R			A	W				O	P	E		R		
9	T	R	E	E	S			Y			R	L				L	E	D		E		
	E		10	R	O	S	E				E	S				L	R	I		A		
	R															U	A	M		T		
11	S	T	O	R	12	M	W	A	T	E	R					T	T	E				
13	H	U	D	S	O	N	B	A	Y							E	O	N				
14	E	N	G	I	N	E	E	R	S								R	T		15	D	
	D				16	I	N	L	E	T	S					S				R		
		17	C	O	O	T	S												18	S	A	
					19	O	U	20	T	F	A	L	L	21	S				A	I		
22	R	I	V	E	R			23	R	E	D	U	C	E					F	N		
	A					24	J	A	Y	S					W				E	A		
	I				25	B	A	S	I	N					E				T	G		
	N			26	M	A	N	H	O	L	E				R				Y	E		

# Crossword Puzzle Terms and Definitions

storm water	water that accumulates from a rainstorm or from melting snow
permeable	will allow substances like water to pass through it
impermeable	will not allow substances like water to pass through it
wet pond	a storm water management facility that has a limited amount of plant and animal life in the water
dry pond	a storm water management facility that may or may not have water in it, depending on the amount of rainfall or snowmelt
constructed	a storm water management facility called a _____ wetland that is also a habitat for ducks and geese
basin	the storm water collected on the street enters the underground pipes through a grid called the catch _____
outfall	pipes through which the water exits the storm water system and goes into the river
manhole	a covered hole in the ground through which workers are able to enter and monitor the underground pipes of the storm water system
wastewater	the system into which toilet water drains
monitor	to watch over something
contaminants	pollutants

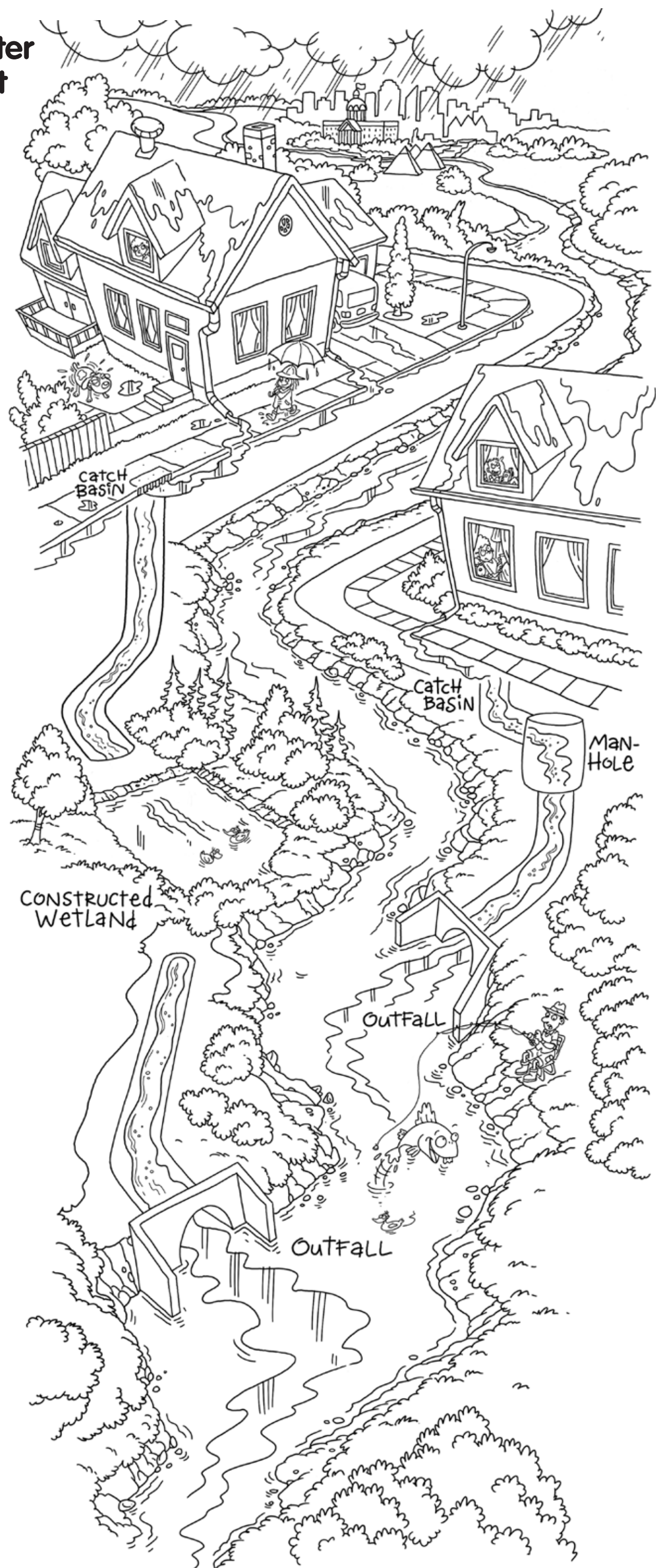


flooding	an overflow of water onto land that is normally dry
environment	our surroundings
runoff	water that flows off of one area into another
water cycle	evaporation, condensation, and precipitation
watershed	an area of land that drains into a local body of water
inlets	pipes that bring water into storm water ponds
drainage	_____ Services looks after storm water.
sediment	_____ collects at the bottom of the storm water management facilities and contains impurities so must be cleaned out periodically.
reduce	To protect our storm water, we must _____ our use of fertilizers and pesticides.





Storm Water  
Flow Chart



## **Treat it Right!®**

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

**Treat it Right!® Storm Water  
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**2015**

