TEACHER OVERVIEW

Human Systems

3rd — 5th Grade

Nature Vision Student Packet

The materials contained within have been created by Nature Vision, an environmental education nonprofit organization that brings programming to schools and local greenspaces for over 70,000 PreK-12th grade students each year in King and Snohomish Counties. This work from home curriculum materials packet is designed to foster an understanding of the importance of water and its integral role in supporting life and shaping our planet. Packets can be completed either independently or with the help of an adult caregiver. Each day of the week offers materials building on previous days learning, offering a variety of activities including, art, writing, field exploration, and kinesthetic activities.

These materials are provided to you by City of Auburn Utilities, City of Bothell, City of Lynnwood, and grants from King County Flood Control District, and King County Wastewater Treatment Division. Learn more by visiting:

- City of Auburn Utilities: https://www.auburnwa.gov/city_hall/public_works
- City of Bothell: http://www.bothellwa.gov/surfacewater
- City of Lynnwood: https://www.lynnwoodwa.gov/Home
- King County Flood Control District: https://www.kingcounty.gov/services/environment/water-and-land/flooding/flood-control-zone-district.aspx
- King County Wastewater Treatment Division: https://www.kingcounty.gov/depts/dnrp/wtd.aspx

Thanks to Cascade Water Alliance for providing the accompanying series of student packets: Ecosystems, Watersheds, and Humans and Water. To learn more please visit: https://cascadewater.org/.

This unit supports NGSS Performance Expectations across various disciplines, as well as supporting K-12 Integrated Environmental and Sustainability Standards. These are listed at the bottom of this page. Teachers will be supplied with PDF formats of materials to be emailed to families, or teachers may print and send to students to complete at home.

Students begin with an overview of our stormwater system, and are prompted to design their own solutions to stormwater problems. Students will learn about the differences in our wastewater system and how access to sanitation varies around the world. Lastly students will learn the importance of communities working together to care for our water resources.

If you have any further questions or concerns regarding this packet, please email our Office Coordinator at info@naturevision.org.

Grades 3-5

Supports NGSS Performance Expectations: 3-LS4-4, 3-ESS3-1, 4-ESS3-2, 4-ESS3-2, 5-ESS2-1, 5-ESS3-1, 3-5-ETS1-2.

Grades 3-5
Day 1 - Stormwater Basics
Day 2 - Engineering Stormwater Solutions
Day 3 - Wastewater Basics
Day 4 - Engineering Wastewater Solutions
Day 5 - Stewardship

Stay connected with Nature Vision! Follow us for updates @naturevisionorg

PARENT/CAREGIVER OVERVIEW

Human Systems
3rd — 5th Grade

Welcome to Nature Vision's student packet for home use. Nature Vision is an environmental education nonprofit organization that brings programming to schools and local greenspaces for over 70,000 PreK-12th grade students each year in King and Snohomish Counties. We are excited to be offering this version of our programming directly to students at home!

This packet is designed to be completed over the course of one week, with each day focusing on a different aspect of environmental science and stewardship. The majority of these materials can be completed independently, but we thought it would be important to provide background information for any adults who may be helping to complete or answer questions. We've included the basic learning objectives for each day along with some vocabulary.

These materials are provided to you by City of Auburn Utilities, City of Bothell, City of Lynnwood, and grants from King County Flood Control District, and King County Wastewater Treatment Division. Learn more about caring for our water by visiting:

- City of Auburn Utilities: https://www.auburnwa.gov/city_hall/public_works
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- City of Lynnwood: https://www.lynnwoodwa.gov/Home
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- King County Wastewater Treatment Division: https://www.kingcounty.gov/depts/dnrp/wtd.aspx

Challenge yourself to post all the things you are doing with your friends and family to prevent pollution and protect our water!

- City of Auburn Utilities: Tag @auburnwa and include the hashtag #auburnwa
- City of Bothell: Tag @BothellWaUSA and include the hashtag #PugetSoundStartsHere
- City of Lynnwood: Tag @LynnwoodWA and include the hashtag #Lynnwood
- King County Flood Control District: Tag @KingCountyDNRP
- King County Wastewater Treatment Division: Tag @kingcountywtd

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NOTE: Students may require support in reading directions and/or completing some tasks. While many activities in this packet are creatively oriented and open ended, you may consult the answer key located at the back of the packet for additional assistance or guidance.

Unless otherwise noted, images courtesy of freepik.com

PARENT/CAREGIVER OVERVIEW: DAY 1

Stormwater Basics

Background Information: Unlike the water that leaves our homes through indoor drains, stormwater is not filtered. It runs into our storm drains and carries many different kinds of pollution with it to our freshwater sources nearby.

Learning Objectives: Students will explore how our stormwater systems work. They will learn about the problems that these systems solve and some that they create.

Main Activity: Down the Drain

- ***Overview****:* Students write a story from the perspective of a raindrop as it travels through our stormwater system
- ***Parent/Caregiver Tasks****:* None

Optional Activity: Stormwater Maze

- ***Overview****:* Students attempt to guide a drop of water from the street to the ocean with as little contact with pollution as possible
- ***Parent/Caregiver Tasks****:* None

Optional Activity: Stormwater Stewardship Challenge

- ***Overview****:* Students complete a daily stewardship challenge related to pollution prevention
- ***Parent/Caregiver Tasks****:* If needed, help the student share their work on social media

PARENT/CAREGIVER OVERVIEW: DAY 2

Engineering Stormwater Solutions

Background Information: Because our stormwater is not filtered, it's important that we design ways to keep this water as clean as possible. This way, it does not impact our environment in negative ways. People have designed many different solutions to the problem of polluted stormwater.

Learning Objectives: Students will analyze existing ideas for cleaning stormwater and design their own system.

Main Activity: Compare and Contrast

- ***Overview****:* Students learn about two different ideas for capturing litter and other contamination while exploring how they are similar and different
- ***Parent/Caregiver Tasks****:* Offer direction and support

Optional Activity: Design Your Own Storm Drain Solution

- ***Overview****:* Students use what they have learned to create their own stormwater solution
- ***Parent/Caregiver Tasks****:* None

Optional Activity: Stormwater Stewardship Challenge

- ***Overview****:* Students complete a daily stewardship challenge related to pollution prevention
- ***Parent/Caregiver Tasks****:* If needed, help the student share their work on social media

PARENT/CAREGIVER OVERVIEW: DAY 3

Wastewater Basics

Background Information: Not everything that goes down the drains in our home can be cleaned properly from our wastewater, and some of it can cause big problems for water treatment plants and the environment.

Learning Objectives: Students will learn the basics of our wastewater treatment systems and what they can do to help keep them running smoothly and keep our water clean as it is sent back to the environment.

Main Activity: What Not to Flush

- ***Overview****:* Students create a model showing the importance of keeping things like tissue and paper towels from our wastewater as they can be harmful to the treatment system
- ***Parent/Caregiver Tasks****:* Provide supervision

Optional Activity: Sorting Waste

- ***Overview****:* Students decide on the correct way to dispose of various materials
- ***Parent/Caregiver Tasks****:* None

Optional Activity: Stormwater Stewardship Challenge

- ***Overview****:* Students complete a daily stewardship challenge related to pollution prevention
- ***Parent/Caregiver Tasks****:* If needed, help the student share their work on social media

PARENT/CAREGIVER OVERVIEW: DAY 4

Engineering Wastewater Solutions

Background Information: Wastewater is something that people all around the world need to deal with, and depending on what resources they have available, can be very different from place to place. Being able to clean our water after we have used it is one of the most important things we can do for the environment.

Learning Objectives: Students learn the importance of and difficulties surrounding wastewater treatment.

Main Activity: Design a Treatment

- ***Overview****:* Students create a model of wastewater to find the most efficient way to clean that water
- ***Parent/Caregiver Tasks****:* Provide supervision

Optional Activity: Water Treatment Access

- ***Overview****:* Students consider access to clean and healthy ways to use the bathroom around the world and the impacts that each can have on our water resources
- ***Parent/Caregiver Tasks****:* None

Optional Activity: Stormwater Stewardship Challenge

- ***Overview****:* Students complete a daily stewardship challenge related to pollution prevention
- ***Parent/Caregiver Tasks****:* If needed, help the student share their work on social media

PARENT/CAREGIVER OVERVIEW: DAY 5

Stewardship

Background Information: Stewardship is how we care for the world around us. Sometimes this means taking direct action to solve a problem, and sometimes this means that we can help solve a problem by encouraging other people to care about the issue. The way that we all treat our stormwater and wastewater has a big impact on the environment and the health of people and animals.

Learning Objectives: Students learn about the importance of caring for the natural world and some of the work that people have done in our region to help make our bodies of water cleaner and healthier.

Main Activity: Persuasive Writing

- ***Overview****:* Students write a letter to convince the mayor of Victoria, B.C. about the importance of wastewater treatment for our shared bodies of water
- ***Parent/Caregiver Tasks****:* None

Optional Activity: Video

- ***Overview****:* This short video recaps the ways our water impacts the oceans and what we can do to help
- ***Parent/Caregiver Tasks****:* Provide technical support and permission

Optional Activity: Stormwater Stewardship Challenge

- ***Overview****:* Students complete a daily stewardship challenge related to pollution prevention
- ***Parent/Caregiver Tasks****:* If needed, help the student share their work on social media

PARENT/CAREGIVER OVERVIEW: VOCABULARY

DAY 1
Catch basin: A reservoir for collecting surface drainage or runoff
Pollutants: A substance that makes something (i.e. air or water) impure and often unsafe
Storm drain: An outside drain that carries water from neighborhoods to streams
Water runoff: Excess water draining away from land or buildings (i.e. the overflow of water that drains off of your driveway)

DAY 2
Chemicals: Possibly dangerous materials, generally used for cleaning or industry
Drain sock: A design to that goes directly on the pipe to help clean stormwater by catching trash
Engineered Solutions: A way to solve a problem
Water goat: A design that floats and collects trash to help clean stormwater before it goes to large bodies of water

DAY 3
FOG: Fats, Oils, and Grease from cooking that can clog our pipes and drains
Treatment plant: Where our wastewater is cleaned before being sent back to nature
Wastewater: The water that comes from the drains in our homes

DAY 4
Biosolid: Fertilizer made from human waste
Digester: Area where biosolids are created
Engineers: People who design water systems
Membrane filters: Filters that remove bacteria and 99% of water contamination
Microbes: Good bacteria that help to break down parts of our wastewater
Settling tank: Where the light and heavy parts of wastewater are separated

DAY 5
Coalition: Group of different people
Stewardship: Caring for the world around us; being a protector

DAY 1

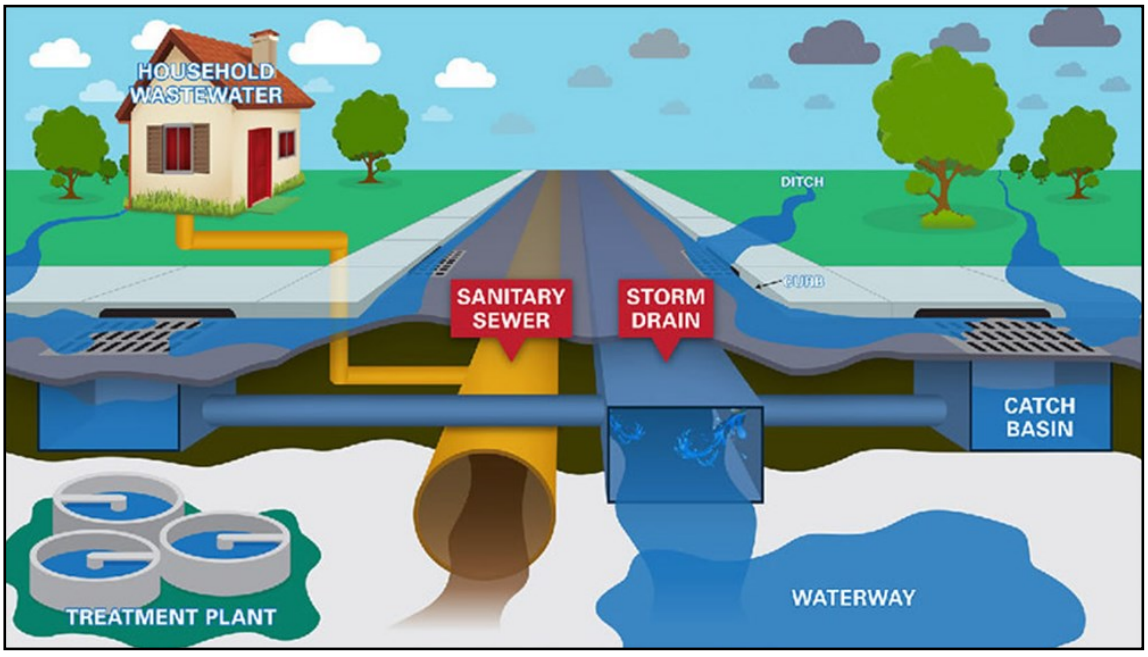
Stormwater Basics

We take care of a lot of water in our communities. There is water that moves through our neighborhoods outside from rain, and there's water that moves through our neighborhoods inside from our showers, toilets, and sinks. Did you know that the pipes inside our homes and outside our homes take water to different places? They are both underground and involve water flowing through pipes, but they are not the same.

Storm Drain

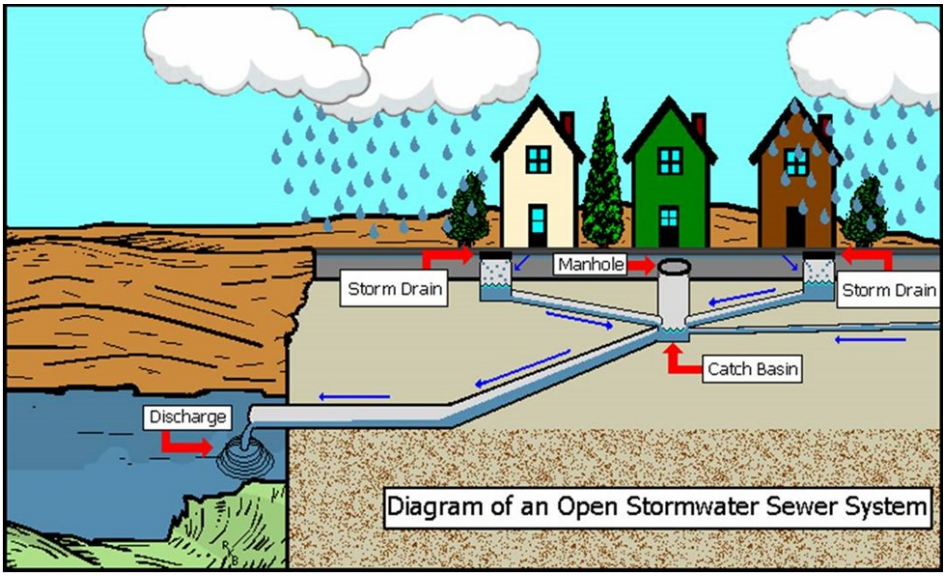
Sewer Cover

Both **<u>storm drains</u>** and sewer systems involve water moving through pipes but the similarity ends there. What happens to the water in the two systems is very different.



Source: http://onetruckeeriver.org/2019/03/rain-rain-go-away-in-the-storm-drain/

The storm drain system is designed to carry extra water from streets into **catch basins** when it rains. When there is too much water for the soil to soak up, the water needs someplace to go. This is why engineers have installed storm drains! They also carry other **water runoff** from activities like washing your car and gardening. Storm drains are not designed to carry sewage or dangerous waste. The runoff is carried through an underground system that ends up in nearby streams, rivers, creeks, and the Puget Sound. The water in a storm drain system contains untreated water, so the water that enters a stream, river, sound, or ocean is the same water that entered in the storm system plus any **pollutants** that are picked up along the way. The water has not been cleaned, so you can see how important it is to think about the things that you use in your yard and what gets on the streets because it will all end up in the storm drain.



Source: https://www.bellinghamma.org/department-public-works/pages/stormwater-information-updated

What can you do to help the different systems stay clean and working well?

- Let only rainwater go down the storm drains
- Avoid littering in stormwater drains
- Repair leaks in your vehicle (e.g. oil, antifreeze)
- Recycle motor oil, and properly dispose of dangerous waste materials
- Pick up after your pet (scoop that poop and put it in the trash!)
- Don't pour paints, cleaners, or household chemicals into any drain
- Use the commercial car wash instead of washing cars on the street /driveway
- Use compost instead of chemical fertilizers
- Never pour anything into a storm drain

Vocabulary

Catch basin: A reservoir for collecting surface drainage or runoff
Pollutants: A substance that makes something (i.e. air or water) impure and often unsafe
Storm drain: An outside drain that carries water from neighborhoods to streams
Water runoff: Excess water draining away from land or buildings (i.e. the overflow of water that drains off of your driveway)

Main Activity

Down the Drain

It is estimated that 118 billion gallons of polluted stormwater washes directly into our waterways each year in King County and is a problem for water in our ecosystems. The stormwater carries motor oil, pesticides, pet waste, and more. This pollution is hurting salmon and threatening the survival of orcas. You have now read about the different systems that were developed by engineers to manage when we have too much stormwater. Using this information, write a story that involves one of these two systems that deal with water.

Materials: Writing utensil

On the next page, write a story from the perspective of an item that has traveled through storm drain pipes.
Describe your adventure through the pipes. When brainstorming what to write, ask yourself questions like this:

- What kind of object are you?
- What happens to you?
- Where do you go?

Use facts that you have learned from the above lesson and add your imagination! After you have finished writing your story, add a picture of your adventure.

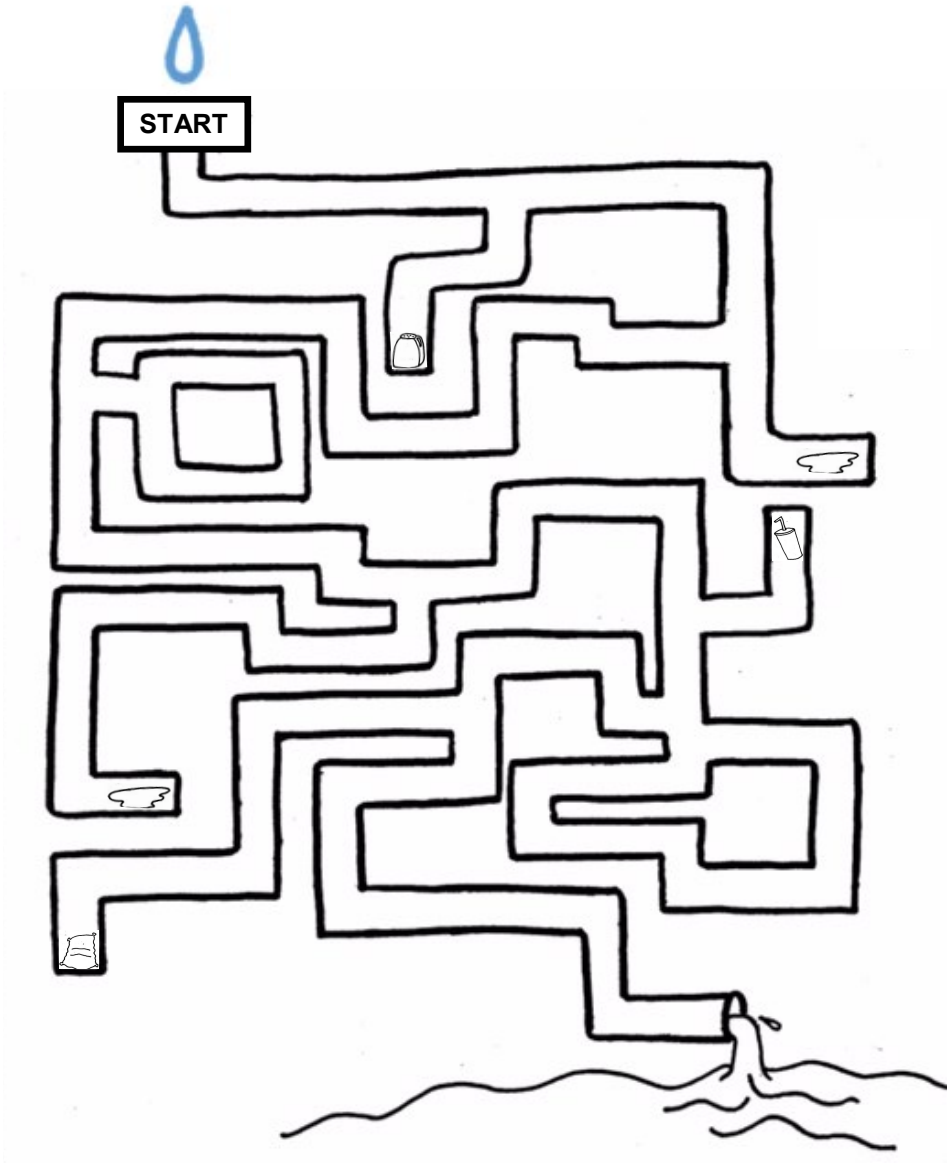
Story Drawing:

Optional Activity

Stormwater Maze

Nothing should go through stormwater drains other than rainwater. Drawing on what was learned previously about how materials are treated (or not treated) and where storm drains send water, complete the following maze. Help the water drop get through the pipe while avoiding any oil or litter. After you've finished the maze, answer the questions on the next page!

Materials: Writing utensil



Questions:

Can you help get the water through the water system while avoiding as much pollution as you can?

What do you think happens when stormwater runs into pollution inside our system of pipes?

What happens to any of the materials that the water carries with it when it gets to the ocean?

If you cannot avoid carrying any pollution, do you think it is better to pick up something like oil or something like litter? Why?

Optional Activity

Stormwater Stewardship Challenge for Day 1

Today you learned about how water from storm drains can make our waterways unhealthy. One of the first steps to solve the pollution problem is to find the people that can help be part of the solution. A person or group of people that are interested in a problem are called stakeholders. A stakeholder is someone who has information or an opinion, and they are someone who cares about the problem being solved! Your friends, family, neighbors, teacher, classmates, city leaders, and you can be a stakeholder.

Materials: Writing utensil, computer/phone/tablet, internet connection

With an adult, make a list of three people you know that can be a stakeholder related to the stormwater pollution problem. One stakeholder can be someone who you think might not be aware of this issue but would be interested in learning from you. The second stakeholder can be someone who you think is already aware of this issue and would help you come up with solutions. The third stakeholder can be someone who you think will provide more information and facts.

Write the stakeholders' names in the table below. With an adult, record the best way to contact them.

Stakeholders!	Name	Best way to contact with an adult?
1. First Stakeholder: *Someone who might be interested in learning about stormwater pollution*		
2. Second Stakeholder: *Someone who is interested in helping you come up with solutions*		
3. Third Stakeholder: *Someone who will provide you with more information and facts*		

To share your work, post your challenge to Facebook and/or Instagram (***with an adult***) so other people in your community can learn, too! Don't forget to tag @naturevisionorg in your post! Do you live in Auburn, Bothell, Lynnwood, or King County? Use the hashtags and tag the city or county group below. They want to see all the work you are doing to keep our water clean!

- If you live in City of Auburn: Tag @auburnwa and include the hashtag #auburnwa
- If you live in City of Bothell: Tag @BothellWaUSA and include the hashtag #PugetSoundStartsHere
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- If you live in King County: Tag @KingCountyDNRP and @kingcountywtd

DAY 2

Engineering Stormwater Solutions

Now that we have learned what storm drains are and why they are important, let's think about a few problems related to storm drains. Our stormwater does not get filtered or treated, so it carries pollution into our local water sources. Any litter, oil, or **chemicals** that are on our roads and driveways can make their way into a storm drain during a rain event. If stormwater runoff collects large pieces of trash, dead leaves, and soil, the storm drains can become clogged or blocked. Blocked storm drains can stop water from flowing through the pipes to the water sources, which can lead to flooding on our streets.

People have come up with a few different **engineered solutions** to these pollution problems with stormwater. One solution is called the **water goat**. The water goat is a floating system placed in the water to collect litter before it continues into our larger waterways. It can catch and hold the items that are floating on the top of the water.

Source: http://www.planhillsborough.org/have-you-seen-a-water-goat/

Another solution that people have made is called a **drain sock**. A drain sock is a net that has been fitted to the mouth of a storm drain outlet to trap litter and debris that washed into the system after a rainstorm. This design catches trash and is later emptied. These materials are then thrown away, recycled, or composted.

Source: https://www.abc.net.au/news/2019-06-09/drain-sock-kwinana-pollution-solution-takes-world-by-storm/11190266?nw=0

Vocabulary

Chemicals: Possibly dangerous materials, generally used for cleaning or industry
Drain sock: A design to that goes directly on the pipe to help clean stormwater by catching trash
Engineered Solutions: A way to solve a problem
Water goat: A design that floats and collects trash to help clean stormwater before it goes to large bodies of water

Main Activity

Compare and Contrast

We just learned about water goats and drain socks. Now, let's compare these two storm drain pollution solutions! Fill out your answers to the questions in the chart below and on the next page.

Materials: Writing utensil

Similarities How are the water goat and the drain sock the same?	**Differences** How are the water goat and the drain sock different?

	Water Goat	Drain Sock
How does this storm drain solution help the water?		
How could this storm drain solution cause a problem?		

Optional Activity

Design Your Own Storm Drain Solution

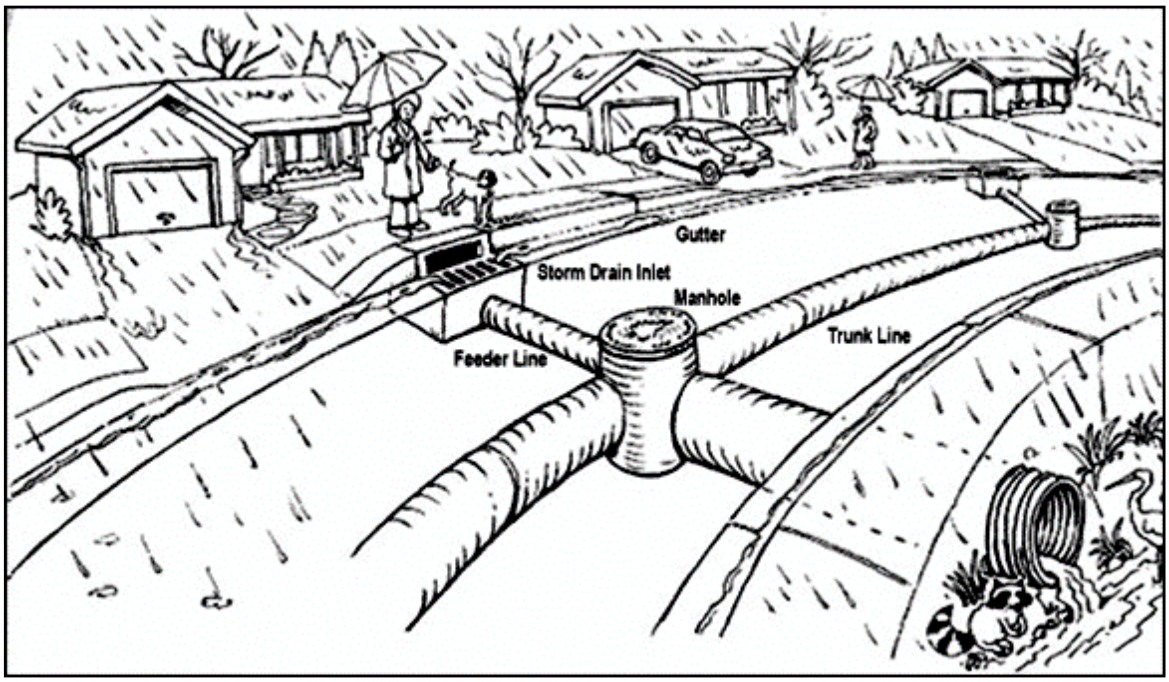
Now it's time to design our own storm drain pollution solution! Draw your own solution on the picture below. Afterwards, answer the questions to explain your pollution solution.

Materials: Writing utensil, crayons/markers/colored pencils

Can you think of any other ways to help keep our waterways clean and remove litter and other pollution from our stormwater?

Will you clean the water before it enters the drain, once it's inside the pipes, or when it gets to the water?

Can your design clean litter and chemicals? How will your design make things safer and cleaner for people and animals?



Source: https://www.stancounty.com/publicworks/storm/storm.shtm

Optional Activity

Stormwater Stewardship Challenge for Day 2

Some of the most famous environmental heroes wrote poetry as a way of sharing their love for nature. Through their art, they were able to influence many people and help pass laws that protect our environment even now!

Materials: Writing utensil, computer/phone/tablet, internet connection

Poems are a short piece of writing that make you feel or imagine in a certain way. A lot of times they rhyme, but they don't have to. Poems don't have to make a lot of sense. The writer sometimes puts odd words together because they help you to imagine or feel something.

Here are two examples of poems:

There are holes in the sky
Where the rain gets in,
But they're ever so small,
That's why rain is thin.
-Spike Milligan

I'm glad the sky is painted blue,
And the earth is painted green,
With such a lot of nice fresh air
All sandwiched in between.
-Anonymous

Following their example, write a short poem below to help inspire the people you share it with to care more about stormwater and its effect on pollution and our environment.

To share your work, post your challenge to Facebook and/or Instagram (***with an adult***) so other people in your community can learn, too! Don't forget to tag @naturevisionorg in your post! Do you live in Auburn, Bothell, Lynnwood, or King County? Use the hashtags and tag the city or county group below. They want to see all the work you are doing to keep our water clean!

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DAY 3

Wastewater Basics

Information and images adapted from curriculum by
King County Wastewater Treatment Division

We've learned about where our stormwater goes and how water is moved from our streets. We've also thought about ways that we can clean and improve that water. Next, we'll think about where water goes from our homes and how we can keep that water clean as well. Think about all the drains inside of your home like your sink, toilet, shower, and washing machine. All of the water that goes down those drains is called **wastewater**. Unlike our stormwater, this wastewater is sent from our homes to a **treatment plant** to be cleaned.

We'll learn more about how this water is cleaned later on in the packet. For now, we'll think about what is in our wastewater when it leaves our homes. Besides the water, lots of other things also go down our drains. Litter, pieces of food, chemicals like soap, toothpaste, and mouthwash, and even things like toys can make their way into our wastewater. Below is a table of the different drains that might be in your home. Your job is to think about all of the things that could end up going down them.

Drain Location	**What Goes Down the Drain**
Shower	Water and…
Kitchen Sink	Water and…
Toilet	Water and…
Dishwasher	Water and…
Washing Machine	Water and…
Bathroom Sink	Water and…

Now that you've thought about what might go down the drain, we can think about what we can remove from the water, what we can't, and how we can help keep this water as clean as possible for its journey back to nature.

One of the easiest things that we can do to make sure that our water is clean is to make sure that only the things that wastewater treatment plants are prepared to clean and take care of make it down the drain. The things that we are prepared to remove are things that come from our bodies (e.g. poop, pee and puke) as well as toilet paper. We call these things the 4 P's. Everything else falls into one of these other categories:

1. **Chemicals:** Materials that come from your shampoos, cleaning products, personal care products, makeup, medications, hair gel, etc. These are almost impossible to take out of the water once they are inside it, so the best thing we can do is to use gentle soaps and "earth friendly" products.

2. **Organics:** Food and everything that can break down in the water. Organics are materials that come from living things. They include our poop and pee, as well as things like bugs or goldfish. However, there is one type of organic that can cause a problem, and it is called FOG.

3. **<u>FOG</u>:** is the ***F***ats, ***O***ils, and ***G***rease that we use for cooking. These things can clog our pipes. Any cooking oils should be cooled and thrown away to avoid drain problems.

4. **Trash:** Litter found in the water, like wipes, paper towels, toys, Q-Tips, and cotton balls. All of these things need to be removed from the water, and would be much better off going into the trash where they belong in the first place. These things can cause clogs in the pumps and pipes of the wastewater treatment plant.

Vocabulary

FOG: Fats, Oils, and Grease from cooking that can clog our pipes and drains
Treatment plant: Where our wastewater is cleaned before being sent back to nature
Wastewater: The water that comes from the drains in our homes

Main Activity

What Not to Flush

Information and images adapted from curriculum by King County Wastewater Treatment Division

Everything that gets into our wastewater can be a big problem when it shouldn't be there in the first place. This activity will help you see firsthand how even some items that we think will be okay in our systems do not break down and can cause big problems.

Materials: Tissue, paper towel, "flushable" wipes, toilet paper, containers with lids, writing utensil

Using a container with a secure lid, we'll explore how even some things that we think would be okay to go into the toilet are not good for the system because they don't break down the same way as toilet paper.

Instructions:

- Place a little bit of tissue in the container. Add water, secure the lid, swirl for about ten seconds and observe what happened to the tissue. Did it fall apart or stay together?

- Repeat this process with the other paper products.
    - Paper Towel: Did it fall apart or stay together?

    - "Flushable" Wipes: Did it fall apart or stay together?

    - Toilet Paper: Did it fall apart or stay together?

Some changes you might find:

- **Wipe:** The water the wipe was in might look soapy, but the wipe itself will probably look the same.
- **Paper towel:** Might look balled up or expanded, but still intact.
- **Tissue:** Might look balled up.
- **Toilet paper:** Will become totally dissolved and the water will look milky.

Because toilet paper is the only paper that dissolves in the water, it is the only paper product that should be flushed down the toilet!

Optional Activity

Sorting Waste

We've learned about what should and should not go in the toilet, but where should each of these items go? Draw a line from the item to where it should be disposed of.

Materials: Writing utensil

Facial Wipes

Apple Core

Hair

Poop

Cleaning Wipes

Toilet Paper

Grease

Dental Floss

Disposable diapers, nursing pads, & baby wipes

Optional Activity

Stormwater Stewardship Challenge for Day 3

One of the best ways to share ideas is through local news companies. Most newspapers have a “Letter to the Editor” section where readers submit their thoughts to be shared with the community. The Editor is the person who looks at all of the news and decides what should go into the newspaper or website every day.

Materials: Writing utensil, paper, computer/phone/tablet, internet connection

Using what you have learned about stormwater, write a letter to the editor and share some ways that we can protect our environment and why it matters to you. Share your letter with someone in your home.

To share your work, post your challenge to Facebook and/or Instagram (***with an adult***) so other people in your community can learn, too! Don’t forget to tag @naturevisionorg in your post! Do you live in Auburn, Bothell, Lynnwood, or King County? Use the hashtags and tag the city or county group below. They want to see all the work you are doing to keep our water clean!

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- If you live in City of Lynnwood: Tag @LynnwoodWA and include the hashtag #Lynnwood
- If you live in King County: Tag @KingCountyDNRP and @kingcountywtd. Include the hashtag #dontflushtrouble

DAY 4

Engineering Wastewater Solutions

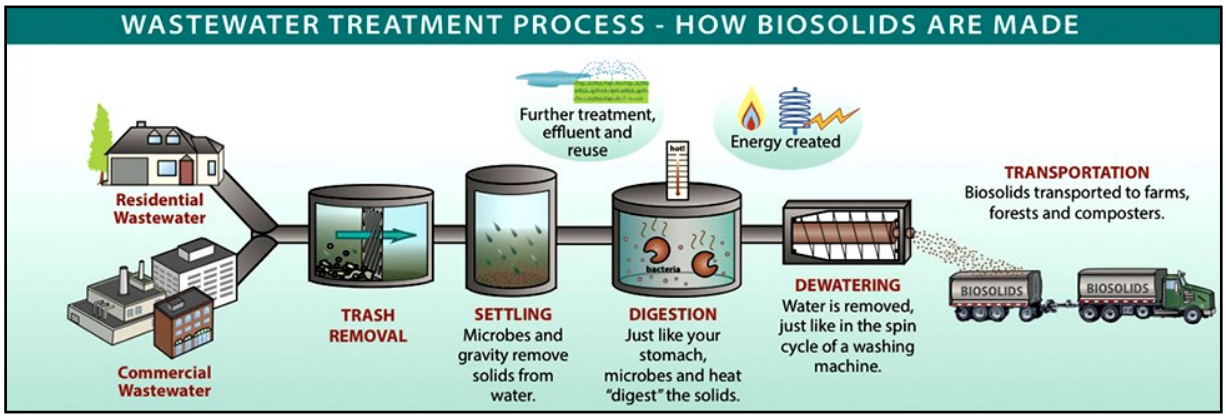
As we've learned, wastewater is treated differently than stormwater. While our stormwater goes directly to the nearest body of water, our wastewater is brought to a facility. There, it is cleaned in multiple ways to remove different elements from the wastewater that don't need to be there. To do this, **engineers** need to design and build a way for the water to be treated. They must figure out how to process a lot of water, and how to clean as much of this water as they can.

First, the water is screened to remove any of the trash that we learned about yesterday. Anything that is not one of the "4 P's" is removed by a strainer, ground into small pieces, and sent to a landfill to be thrown away.

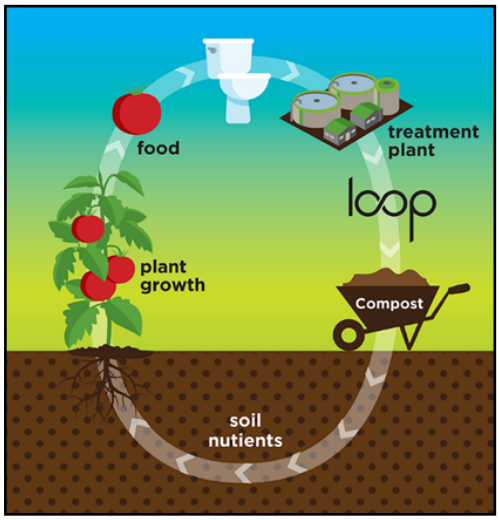
Next, the wastewater is sent to a **settling tank** where large pieces of waste and food sink to the bottom, while lighter items and FOG float to the top.

Photos sourced from Wikimedia

With gravity helping to separate these materials from the water, larger items are pushed along the bottom of the tank to be sent to a **digester**, while lighter items are scraped from the top. The digester breaks down the food and waste material into **biosolids**. These are later used as part of a fertilizer made by King County called "Loop." Loop makes the soil healthy and grow more food. So we eat food, and use our wastewater treatment to make clean, healthy soil for more food!



Source: https://nwbio solids.org/what-are-bio solids-overview



Source: https://www.kingcounty.gov/services/environment/wastewater/resource-recovery/loop-bio solids/about.aspx

After these steps, the wastewater still has smaller pieces of waste and food. The wastewater is treated further by adding hot air and **microbes** to the water. We can think of microbes as good bacteria that help to break down our waste materials much like they would in nature. The warm air in the treatment plant helps to make this process go much faster than it normally would. After the microbes break down the bacteria, all that is left in this water are any chemicals. These include what we use for cleaning, as well as anything that passes through our bodies. We cannot easily take these out of the water, so our best way to manage this is by not using harsh chemicals in the first place so that they do not enter our water.

Next, some of our treatment plants — like Brightwater in Woodinville — have another step to filter out 99% of all the contaminants in this water called **membrane filters**. These are like a collection of straws with tiny holes that block everything but water molecules.

Photo sourced from Wikimedia

Lastly, all of the water that has been cleaned is finally sent to the Puget Sound (i.e. Salish Sea). Here, it can be used by plants and animals and returned to the water cycle. The really important part to remember about our water systems is that we take our water from nature and then return it to nature. Therefore, it is our job to make sure that it is as clean as possible when we are done using it!

Vocabulary
Biosolid: Fertilizer made from human waste
Digester: Area where biosolids are created
Engineers: People who design water systems
Membrane filters: Filters that remove bacteria and 99% of water contamination
Microbes: Good bacteria that help to break down parts of our wastewater
Settling tank: Where the light and heavy parts of wastewater are separated

Main Activity

Design a Treatment

Information and images adapted from curriculum by King County Wastewater Treatment Division

Treating wastewater is a complicated process, as we now know. Engineers need to think about many different things when cleaning dirty water.

Materials: Water, towels, toilet paper, tissue, flushable wipes, paper towels, floss, soap, Q-tips, mouthwash, soil (to represent human waste) measuring cup/scoop

Today you'll think like an engineer and work with a model with a model to develop your own "wastewater treatment system". The things that engineers (and you) need to consider are:

- **Cleanliness:** Having the cleanest water possible
- **Volume:** Cleaning a large amount of water
- **Time:** Water never stops coming to treatment plant, so it needs to be cleaned quickly
- **Cost:** It costs a lot of money to build a wastewater treatment plant and clean water

Based on what we've learned so far today, your job now is to think of ways to solve some of the dirty water problems. When engineers come up with solutions to problems, there are limits to what they can do. We call these **constraints**. These are things like money and time that we have to consider when thinking of a solution. Below are some examples of possible constraints for solutions that you need to be thinking about today while you try to engineer a way to clean your dirty water samples:

- **Realistic:** Needs to be something that could actually work in the real world
- **Time:** Can't take too long to complete
- **Cost:** How much money does it take and who will pay for it

Make sure to have adult permission and supervision, and be ready with towels to wipe up any spills. Be sure to dispose of all your materials properly. Do not flush or put anything except for water and toilet paper down the drain. Other items need to be strained out and thrown away.

Steps:

1. Create your own "wastewater sample." In a large plastic container, combine water, soap, mouthwash, floss, tissue, toilet paper, wipes, paper towel, Q-tips, soil, and any other materials you have to represent what might go into our wastewater.
2. Using a measuring cup or similar scoop, fill a smaller container with 2 cups of "wastewater." This is your "before" sample.
3. Choose 3 items in your home that you think will help you clean this "wastewater." You might use a fork or spoon to remove items, filter or strain the water, or use a sponge to soak water up.
4. Set a timer for 2 minutes and try to clean as much of this water as possible.
5. Save the water that you have cleaned so you can record the amount of water that you cleaned. Make observations about this water. What color is it? Does it have any debris? What does it look like? What does it smell like?
6. Repeat this process with a new sample of "wastewater." What did you learn from your first try? Will you try different tools or a new method? Or will you use the same tools and method?
7. Repeat once more, this time using only one tool. Does being able to use only one tool impact your ability to clean the water?

Optional Activity

Wastewater Treatment Access

Not everyone has access to running water or wastewater treatment. You might have used an outhouse if you have been camping or visited somewhere with few people. These toilets collect waste and break it down below the ground. Many places in Asia have squat toilets. These are very similar to the toilets we are used to, but many are not connected to running water, and need to be "flushed" by rinsing them separately after use.

Even though other options for toilets may be less comfortable to use for some people, they are still a healthy and safe way for us to be able to use the bathroom. However, sometimes people do not have access to this and must go to the bathroom directly in bodies of water, or sometimes out in the open. There are reasons that people in our communities might not have access to clean, healthy bathroom facilities. Can you think of any?

Materials: Writing utensil

Looking at the pictures below, answer the following questions:
Which of these toilet options are you most familiar with?

Which would you rather use?

What problems do you think these toilet options solve?

What problems do you think these toilet options might create?

Outhouse

Squat toilet with water for flushing

Toilet over fish pond

Open toilet near water

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Optional Activity

Stormwater Stewardship Challenge for Day 4

Water that is flushed down the toilet becomes part of wastewater and flows to a treatment plant to be cleaned. Human fluids and solids such as pee, poop, and puke are part of the four P's – toilet paper being the fourth P! The four P's are the only acceptable items to flush down the toilet. Anything else can clog the pipes and could be damaging to the wastewater treatment plant's system.

Materials: Writing utensil, crayons/markers/colored pencils, paper, tape, computer/phone/tablet, internet connection

Make a sign to remind people in your home to only flush toilet paper. You can write and color a sign on your own. You can also use the sign below to copy and color. When you're done making the sign, put your sign near the toilet for everyone to see. ***Ask an adult*** if it's okay to tape the sign onto the toilet or on the bathroom mirror.

To share your work, post your challenge to Facebook and/or Instagram (***with an adult***) so other people in your community can learn, too! Don't forget to tag @naturevisionorg in your post! Do you live in Auburn, Bothell, Lynnwood, or King County? Use the hashtags and tag the city or county group below. They want to see all the work you are doing to keep our water clean!

- If you live in City of Auburn: Tag @auburnwa and include the hashtag #auburnwa
- If you live in City of Bothell: Tag @BothellWaUSA and include the hashtag #PugetSoundStartsHere
- If you live in City of Lynnwood: Tag @LynnwoodWA and include the hashtag #Lynnwood
- If you live in King County: Tag @KingCountyDNRP and @kingcountywtd. Include the hashtag #dontflushtrouble

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DAY 5

Stewardship

Stewardship is how we care for the natural world. It includes conservation of the natural resources like water that all living things need to survive, thinking and acting carefully about how we interact with the world around us, and doing our best to make sure that we have a positive impact on the environment. Specifically, these activities are focused on what students and families can do to keep water clean for the rest of the environment.

We've learned about ways that we can help to keep our stormwater clean, and the ways that people have designed solutions to our stormwater problems. We've also looked at ways that work to keep our wastewater clean. While these sources of dirty water are different, they can cause many of the same problems. Both stormwater and wastewater can carry toxic materials to our environment and be harmful.

Vocabulary
Coalition: Group of different people
Stewardship: Caring for the world around us; being a protector

Main Activity

Persuasive Writing

The Canadian city of Victoria did not have a water treatment facility for many years. In fact, the city is currently building their first water treatment plant, and it should be completed at the end of 2020. For all the time before this treatment plant is completed, Victoria's wastewater gets sent directly to the ocean. It took a **coalition**, or group of people, to make this change happen. Some of the people who most wanted to build the wastewater treatment plant were not living in Victoria, or even in Canada. They were people living in Washington State. The map below shows Canada (green), Washington State (yellow), and Victoria (orange star). Why do you think the people in Washington State were concerned about the wastewater from Victoria going untreated?

Materials: Writing utensil, paper (optional)

Source: https://www.humfer.net/seattlevictoria/1bcwash.gif

It took many years and many different people and organizations to convince the government of Victoria to build a treatment plant.

Your job is to pretend to be one of those people and write a letter to convince the mayor of Victoria why it is important to build a water treatment plant. Why do you think building this treatment plant will be good for the environment? Why do you think it will be good for the people of Canada and Washington? Use your own paper or the space on the next page to write your letter.

Optional Activity

Video

Two Minutes on Oceans with Jim Toomey: Wastewater: This short video shows us how untreated water can be a problem for people and animals and what we can do to help solve this problem. Watch this video and then answer the questions below. It can be found by doing a search for "Two Minutes on Oceans with Jim Toomey: Wastewater" or by following this link: https://www.youtube.com/watch?v=itCOY7VviRU

Materials: Computer/phone/tablet, internet connection

If you're unable to watch this video, some main points are:

- Wastewater that is sent to our oceans is a big problem, even in countries that have wastewater treatment plants. In other countries around the world with fewer treatment plants, as much as 80% of wastewater will go into the oceans untreated.
- Our wastewater comes from our homes (e.g. showers, toilets, and sinks) as well as from hospitals, businesses and farms.
- This wastewater contains human waste, soaps, chemical cleaning products, and sometimes even radioactive materials.
- When wastewater enters our water untreated it can make people sick, harm the environment, hurt tourism, and impact businesses like fishing.
- But wastewater can also be used to solve problems. It can be used in farming for fertilizers, used to create energy, and even in some construction projects.

1. Where does our wastewater come from?

2. What is in our wastewater?

3. What problems can wastewater cause?

4. What problems can wastewater solve?

Optional Activity

Stormwater Stewardship Challenge for Day 5

There are so many ways to protect and care for our water. At the end of every daily lesson, we will be giving a stormwater challenge to help you show off what you've learned.

Materials: (Optional) writing utensil, crayons/markers/colored pencils, computer/phone/tablet, internet connection

Using what you've learned this week on stormwater pollution, it's time to make your own Stormwater Challenge! Think about all of the things we learned this week. What new thing can you do to share what you know or new ways you've learned to keep our waterways clean?

To share your work, post your challenge to Facebook and/or Instagram (***with an adult***) so other people in your community can learn, too! Don't forget to tag @naturevisionorg in your post! Do you live in Auburn, Bothell, Lynnwood, or King County? Use the hashtags and tag the city or county group below. They want to see all the work you are doing to keep our water clean:

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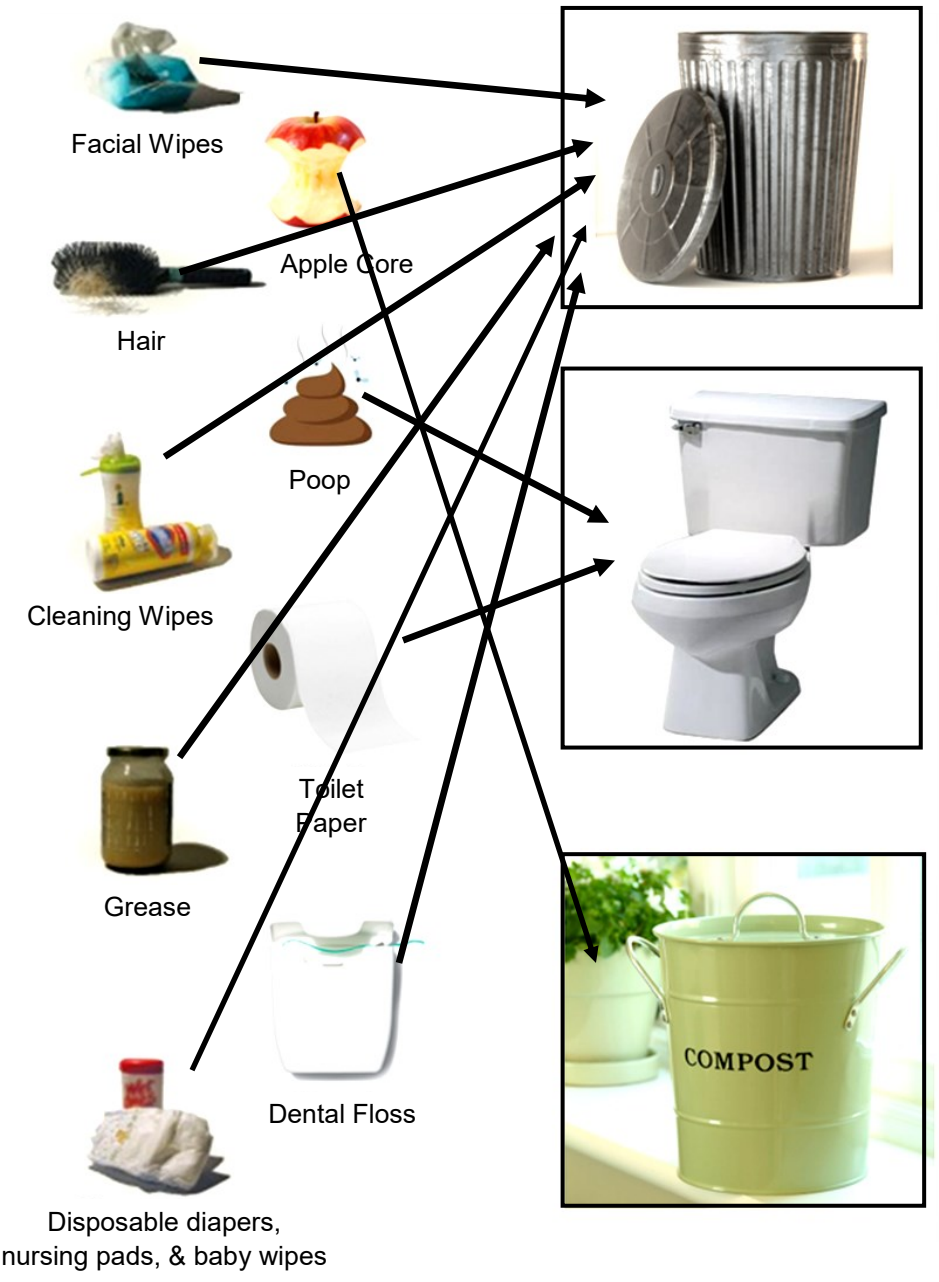
Answer Key

Day 3 Optional Activity: Sorting Waste



Answer Key

Day 1 Optional Activity: Stormwater Maze