

## Parking Lot Investigation

Students will investigate how non-point source pollution enters waterways by studying their own school parking lot. They will map spills and stains, simulate rain with spray bottles, collect runoff samples, and trace where stormwater flows. The activity shows how everyday pollution can reach our local waterways and sparks discussion about solutions.

### MATERIALS

- Prepared pollution samples (in small, sealed jars)
- Whiteboard, markers, or chart paper (for collecting class ideas)
- Clipboards
- Blank paper or parking lot sketch template
- Pencils/colored pencils
- Gloves (disposable or reusable) for safety
- Spray bottles filled with clean water (4-5)
- Sponges or absorbent cloths (for collecting runoff)
- Extra sample jars (for runoff water collection)
- Extension: Coffee filters, funnels or cut plastic bottles to use as filter holders, sand, gravel, small pebbles
- Additional jars/cups for filtering experiments
- Photos or printouts of stormwater infrastructure

### Oregon Department of Education Goals

The *Parking Lot Investigation* activity can help teachers meet Oregon Department of Education common curriculum goals and benchmarks for grades 4-8 within the following areas:

**Science Inquiry-** Use interrelated processes to pose questions and investigate the physical and living world.

**Earth and Space Science-** Understand physical properties of the Earth and how those properties change.

**Physical Science-** Understand structures and properties of matter and changes that occur in the physical world.

**Social Science-** The study of the social sciences prepares students for responsible citizenship. It enables students to evaluate historical and contemporary issues, understand global relationships, and make connections between the past, present and future.

**Science in Personal and Social Perspectives-** Understand that science provides a basis for understanding and acting on personal and social issues.

## GOALS AND OBJECTIVES

### *Students will:*

- Students will understand the difference between point source and non-point source pollution.
- Students will observe how everyday activities contribute to water pollution in their local environment.
- Use observation skills and data recording skills to locate and record sources of non-point source pollution on their school parking lot
- Be able to name two strategies to help reduce the impact of non-point pollution sources

## BACKGROUND

### *Point Source vs. Non-Point Source Pollution*

Point source pollution comes from an identifiable source such as a pipe. Non-point source comes from wide areas such as runoff from roads and parking lots, erosion from upland activities, road building, and agricultural activities.

### *Sources of Pollution*

We often associate water pollution with point sources such as factory pipes or sewage treatment plants. These can release heavy metals, toxic chemicals, heated water, or sewage, and are usually easier to identify and regulate. But, these are not the only source of pollutants.

In terms of volume, the largest source of pollution is non-point source pollution from rain and snowmelt washing over streets, roofs, lawns, fields, and construction sites. This runoff can carry soil, trash, fertilizers, pesticides, oil, and other pollutants into streams and rivers. It is estimated that non-point sources are responsible for half or more of all nitrogen, coliform, bacteria, iron, phosphorus, oil, zinc, lead, chromium, and copper that enter the surface waters of the United States. Sediments from non-point sources alone are responsible for an estimated \$6 billion in damage per year. Even though many non-point sources alone are less toxic than some industrial wastes, they still damage fish and wildlife and their habitats, degrade drinking water supplies, promote eutrophication, and damage the aesthetics and the recreation potential of Oregon's waters.

Non-point pollution is harder to control because it doesn't come from one single place – it comes from many everyday activities. Common sources include:

- Household chemicals and soaps
- Fertilizers and pesticides from yards, farms, and parks
- Oil, antifreeze, and other car fluids from roads
- Soil erosion from fields, logging, and construction
- Failing septic systems

### *Where the Water Goes*

In Bend, stormwater either flows directly into the Deschutes River, or is naturally filtered into groundwater. Stormwater is not treated before entering these systems. To help reduce pollution, the city uses tools such as *catch basins*, *drywells*, *stormwater planters*, and *sedimentation manholes* to capture or filter contaminants before water is discharged.

### *Additional Resources:*

- See the [City of Bend Stormwater Walking Tour](#) (Newport Avenue) for more information and examples of stormwater infrastructure in action!

## KEY TERMS

**Catch Basin** – A storm drain with a grate on top that collects runoff water and directs it into underground pipes, often trapping large debris and sediment.

**Drywell** – An underground chamber that allows stormwater to soak into the ground, filtering naturally through soil instead of flowing directly into rivers.

**Eutrophication** – A process where extra nutrients (like nitrogen or phosphorus from fertilizers) cause too much algae to grow in water. When the algae die and decompose, oxygen is used up, harming fish and other aquatic life.

**Non-point Source** – Pollution that comes from many diffuse sources, such as runoff from streets, farms, or lawns, rather than one single location.

**Pollution** – Any substance introduced into the environment that harms water, air, soil, plants, animals, or people.

**Point Source** – Pollution that comes from a single, identifiable source, like a factory pipe or sewage treatment outfall.

**Sedimentation Manhole** – A stormwater structure where water slows down so sediments and heavier pollutants can settle out before the water moves into pipes or natural waterways.

## PRE-ACTIVITY

*Preparation:* To help students see the effects pollutants have on clean water, prepare small jars of common pollutants. These don't need to be exact chemicals – just items that visually represent them. Gather everyday items that can represent common sources of pollution (soil/sand – eroded sediment, cooking oil – motor oil, food coloring - chemicals, soap/detergent – household cleaners, grass clippings – yard runoff, bits of trash - litter, etc.). Place one type of pollutant in each jar. Add a small amount of clean water to jars. Seal jars. Use tape to prevent spills. Label each jar with the type of pollutant it represents.

*Discussion:* Ask students what they think of when they hear the word pollution. Write answers on your whiteboard (trash, chemicals, oil, smoke, etc.). Explain that today, they are going to be scientists investigating pollution in their everyday environment. They will learn how pollution can impact our waterways through stormwater and discuss ways to keep stormwater clean.

Introduce students to point source vs non-point source pollution. Use simple visuals (a quick sketch on the whiteboard) showing a pipe leading directly into water and another showing rain running down a street/sidewalk. Label the sketches point source and non-point source. Explain that non-point source pollution doesn't come from one single place, so it can be harder to control. Discuss how today, they will be investigating sources of non-point source pollution in the school parking lot.

Ask students to name a few examples of non-point source pollution they might find in the parking lot. Show the pollution sample jars and have a discussion about where these sources of pollution may come from.

Key takeaway: Point sources are easier to regulate and treat because they come from one place, while non-point sources are harder to track and manage because they come from *everywhere*.

### Questions:

- Where have you seen pollution in your community?
- When it rains in the parking lot, where do you think the water goes?

- Do you think the water is cleaned before it reaches the river or groundwater? Why or why not?
- Why do you think non-point source pollution is harder to control than point source pollution?
- How could pollution from everyday places (like parking lots, lawns, or streets) affect fish, wildlife, or people who use the river?

## PROCEDURE (30-40 minutes)

### *Map the Parking Lot*

1. Gather students in the chosen parking lot. Lead a brief discussion about water pollution. Let students know that over the years, a lot of progress has been made in reducing *point source pollution*.
  - Ask: *Can you think of examples of point source pollution?*
  - Examples: factory pipes releasing dyes or chemicals, wastewater from wood or food manufacturing, heated water released from power plants, etc.
  - Encourage students to think of local examples.
2. Explain that one of today's biggest challenges is *non-point source pollution*.
3. Compare point source vs. non-point source pollution.
  - *"Why do you think non-point source pollution is harder to solve?"*
  - Examples: brake pad dust, oil leaks and spills, stormwater carrying lawn fertilizers and pesticides, construction site dust, etc.
4. Explain to students they are going to take a closer look at a non-point source of pollution right here at school – the parking lot!
  - Ask them to think about how many parking lots exist in town and what impact that might have.
5. Find a spot outside where students can sit and make a quick sketch of the parking lot (stripes, drains, curbs, etc.).
  - For large lots, divide into small groups to map different sections and then share back.
  - Optional: Show example map (Figure 1)
6. After mapping the parking lot, have students mark each stain, spill, or foreign substance they see in the lot on their map.
  - Encourage guesses about what the substances might be (oil, detergent, etc.).
7. Come together as a group and tally the stains as a class. Show the prepared pollution samples again.

- *How many stained places did they find? What did they think most of the substances on the parking lot are? Do any of them match the pollution samples?*

### *Pollution Investigation*

1. After you have completed a tally, have the students choose 1-3 spots to investigate further.
2. Ask students to make observations of the water in the spray bottles. (They should note that the water is clean).
3. Have students spray the parking lot spot with spray bottles and observe what happens to the water (record on sketches/data sheets).
4. Wearing gloves, have students soak up the runoff with sponges and wring it into a sample jar.
5. Discuss how the water looks different from the clean water you started with. Set the jar aside.
6. Have students look around the parking lot to determine where water is directed during rain events.
  - *Where does the parking lot drain?*
7. Have students trace where water flows during rain and mark drains or runoff paths on their sketches.
8. Discuss how the drainage system that's in place is connected to the local watershed.
  - *Where does all this water go? Is it treated/cleaned? Does it go to a river or stream?*

## **DISCUSSION**

Lead a group discussion to highlight the importance of keeping trash and pollution out of our storm drains. Brainstorm some personal and community solutions.

Questions to consider:

- What are some ways people can help prevent parking lot pollution?
- What could cities or communities build to help keep stormwater clean?
- How does this activity change the way you think about rainwater or storm drains?

## EXTENSION IDEAS

### **Filtering Water**

1. Challenge students to filter the dirty water from the parking lot. They can use coffee filters, sand, gravel, etc.
  - *Does this help clean the water?*
  - *Does it remove everything?*
  - *What are real examples of filters in the stormwater system?*
2. Show photos of catch basins, drywells, and sedimentation manholes. These are examples of stormwater infrastructures that are meant to filter pollutants before water enters the system.
3. Discuss how trees and native plants are also amazing natural filters that improve water quality by absorbing and filtering rainwater.

### **Writing Prompts**

*Observe the Rain:* Have you ever watched water run down the street or parking lot during or after a storm? What does the water look like? Do you see any trash, oil, or other substances washing along with it? Describe what you notice about the water in your community.

*A Fish's Perspective:* Imagine you are a fish living in a nearby stream. Look around your watery home. What does the water look like? Is it clean or dirty? Warm or cold? Write a short story about your life as a fish and how the water affects you.

*Local Connections:* How far is your school from the nearest river or stream? Do you think runoff from your school parking lot or nearby streets affects the water in the stream or river? Explain your thoughts.

*Be a Water Scientist:* Invite a water quality expert like someone from the Oregon Department of Environmental Quality to visit your class. Write a list of at least five questions you would ask them about protecting local water and preventing pollution.

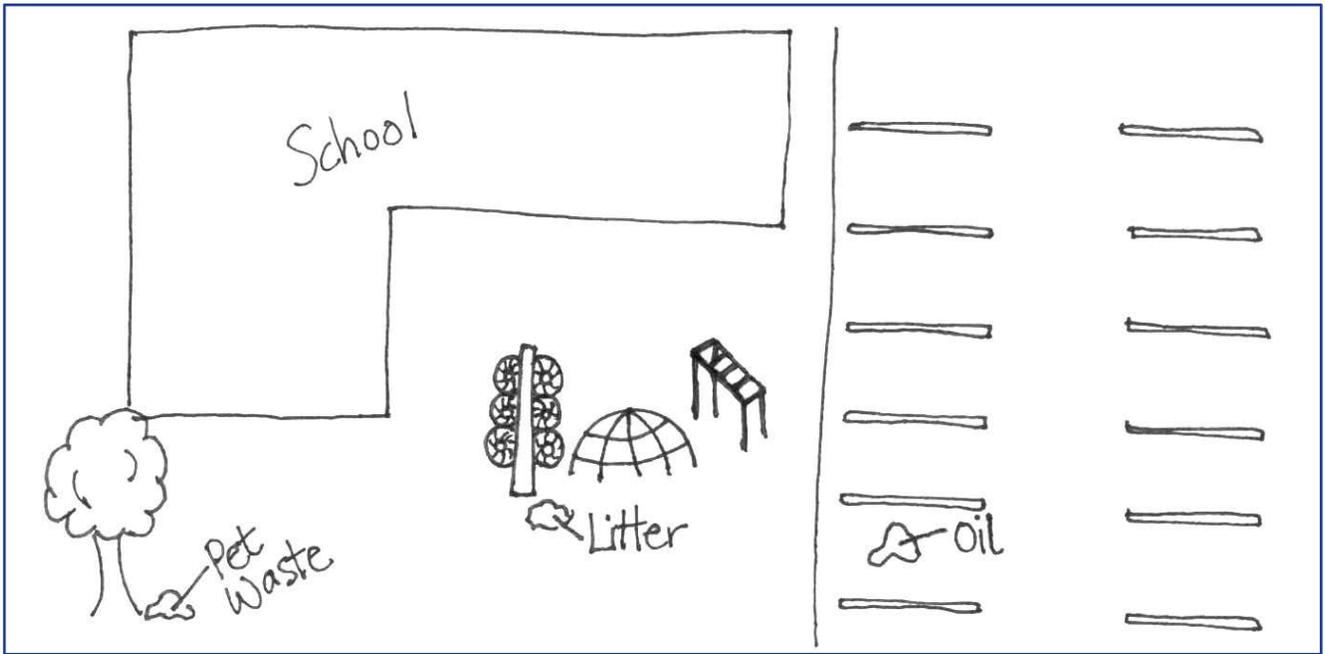


Figure 1. Example of student parking lot drawing

## STUDENT DATASHEET — Parking Lot Investigation

How many oil spots, stains, or other foreign materials do you see in the parking lot?

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What do you think these materials are (oil, antifreeze, trash, food, soil, fertilizer, etc.)?

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***Spray water on the areas you identified. Record what happens to the water.***

Area 1:  Runs off  Stays in place  Changes color  Other: \_\_\_\_\_

Area 2:  Runs off  Stays in place  Changes color  Other: \_\_\_\_\_

Area 3:  Runs off  Stays in place  Changes color  Other: \_\_\_\_\_

***After collecting runoff water in jars, compare it to the clean water you started with. Note changes in color, clarity, smell, or presence of solids.***

Sample 1:  Clear  Cloudy  Colored  Has solids

Sample 2:  Clear  Cloudy  Colored  Has solids

Sample 3:  Clear  Cloudy  Colored  Has solids

### ***Filtering Test (optional)***

Did the filter (coffee filter, sand, gravel, etc.) make the water cleaner?

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Did it remove everything?

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### ***Stormwater Connections***

Would you drink this water? Why or why not?

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Where do you think water from this parking lot goes when it rains?

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Are there features nearby that might help filter the water (plants, trees, catch basins, etc.)?

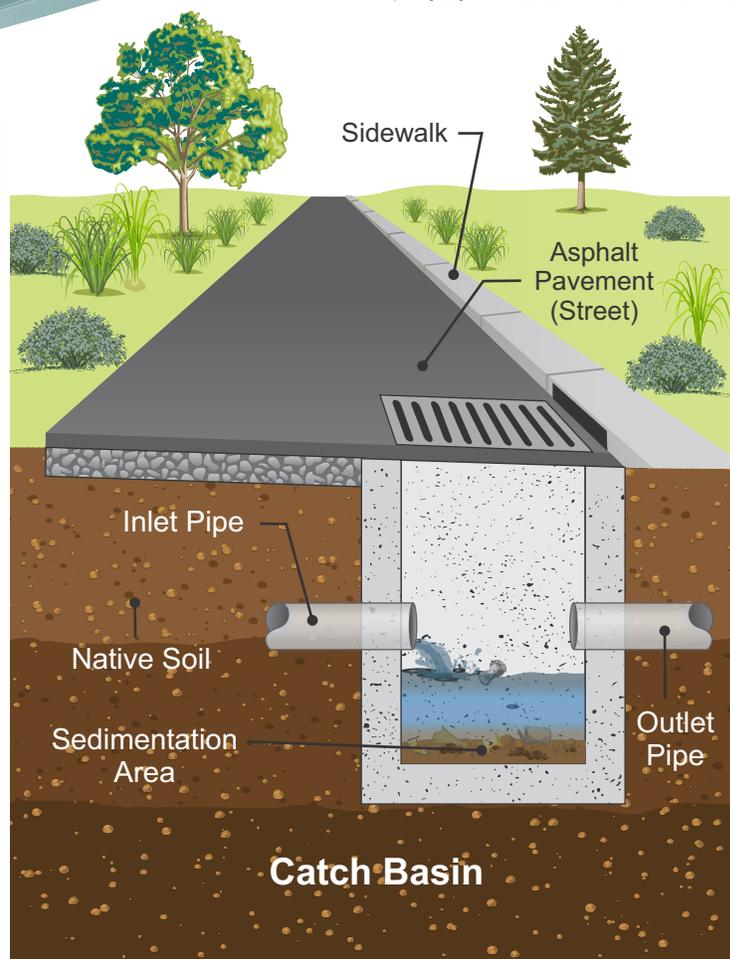
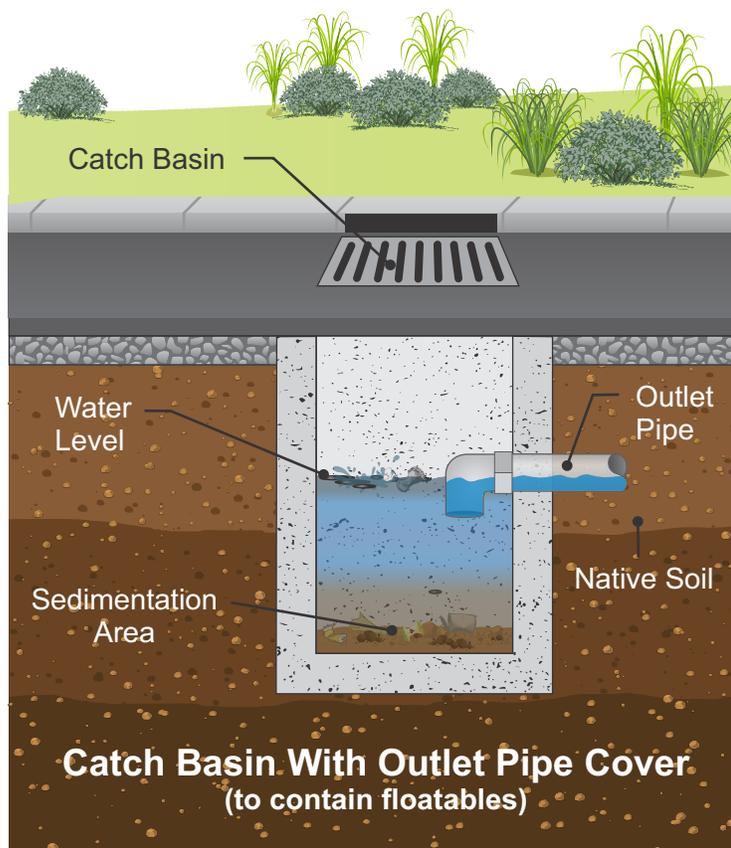
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# CATCH BASIN

## Maintenance Guideline



UTILITY DEPARTMENT



### What does your Catch Basin do? Why is it important?

Catch basins are designed to trap sediment, debris, and potentially oil/floatables in the case of catch basins with outlet pipe covers, before discharging stormwater to a disposal point. The catch basin(s) on your property makes a significant positive impact on water quality by being the first line of defense in preventing pollutants from entering our beloved Deschutes River and underground drinking water supplies. If maintained correctly, they also help prevent clogging of our stormwater facilities and thus prevent localized flooding.

### Why is it important to maintain your Catch Basin(s)?

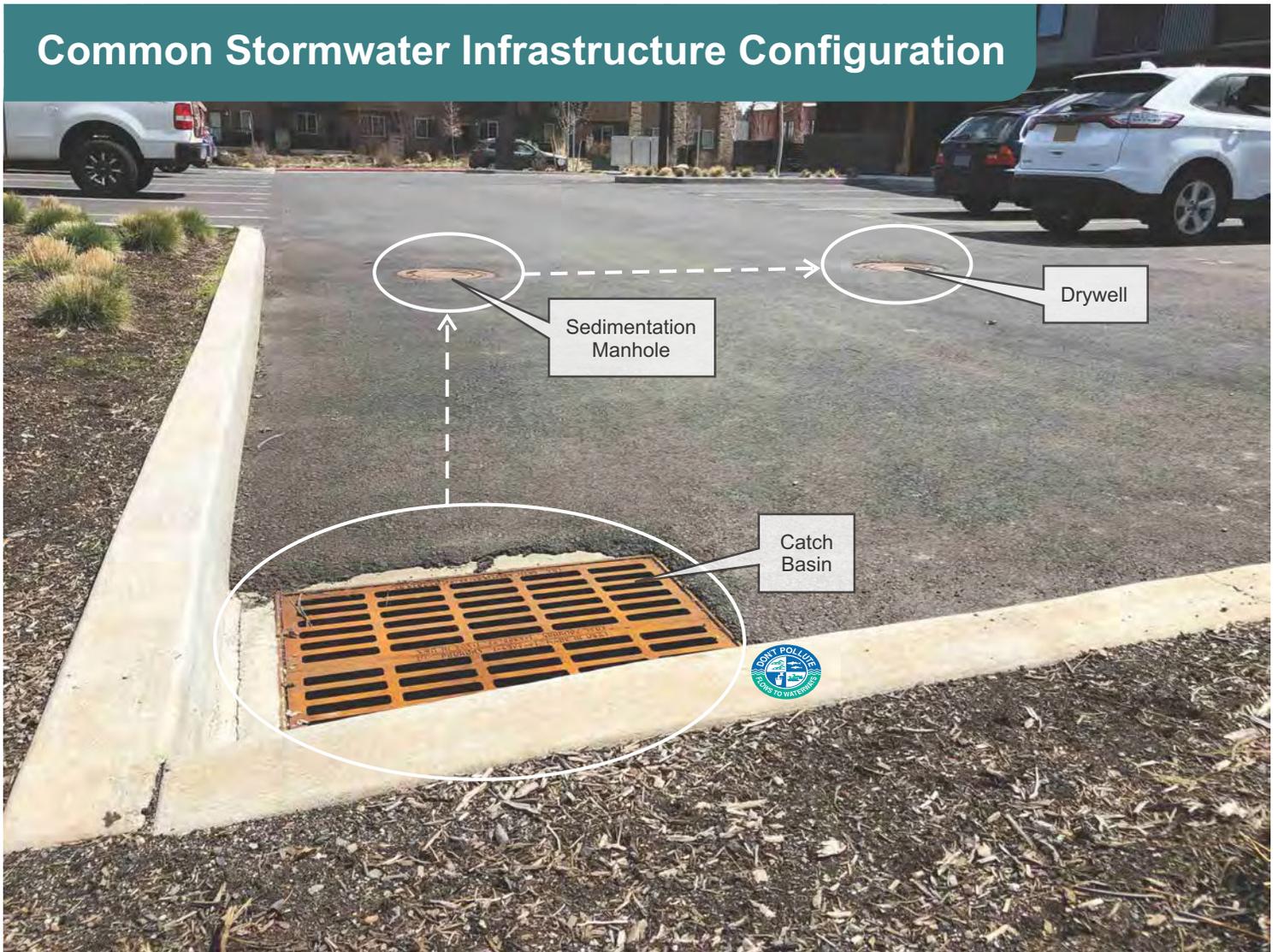
Without proper maintenance, catch basins will fail to trap sediments and pollutants which could result in facility clogging and localized flooding. It is important to ensure that catch basins do not become too full of sediments or floatables. In Bend, our stormwater facilities serve an important function and property owners are required to keep and maintain them per Bend Code Title 16. Just remember, a few things will go a long way in the effort to keep our waters clean and to prevent localized flooding. Start by inspecting your catch basins in the spring and fall each year, and adjust to more often if site conditions warrant.

### What tools do you need?

Maintenance schedules for catch basins vary depending on flow volumes and sediment loading. Routine maintenance requires the use of a vacuum designed to suck up the water and sediment. In most places, there are local contractors that provide this service for a fee. Regularly inspecting your facility to monitor sediment and floatable levels is critical. Carrying the attached checklist, pen, a copy of your site plan, lid puller, steel toe boots, flashlight and a rigid sediment measuring device is a good way to ensure a safe and complete inspection can be performed.



# Common Stormwater Infrastructure Configuration



## Bad Example



Inspect sediment level in catch basin to determine if maintenance is needed.

Debris and sediment in drainage area should be swept up to prevent clogging and flooding.

## Good Example

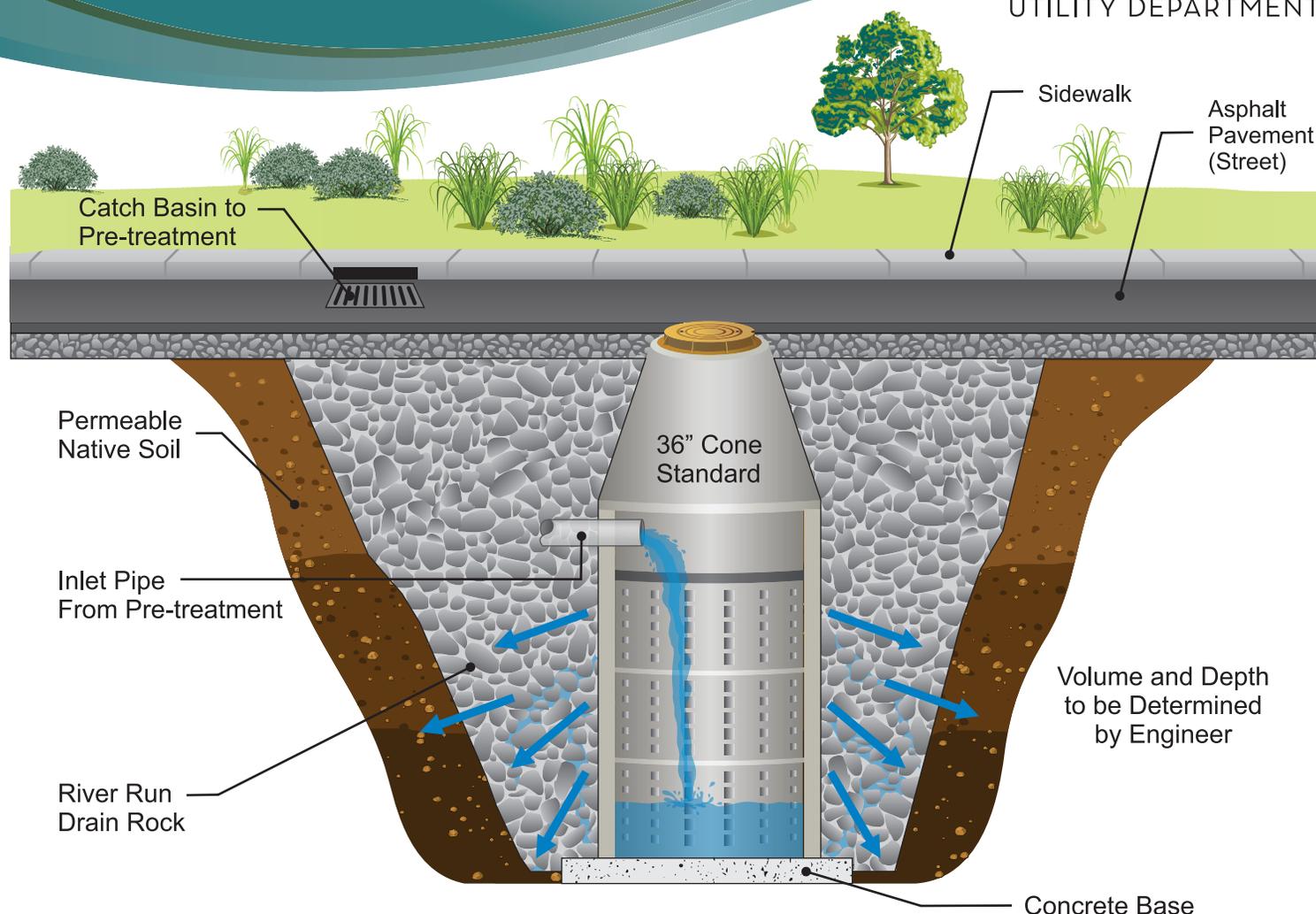


During construction prefabricated filter inserts should be used to protect catch basins from sediment and debris. These inserts need to be maintained per manufacturer recommendations and removed once permanent vegetation is established as the project is completed.

# DRYWELL Maintenance Guideline



UTILITY DEPARTMENT



## What does your Drywell do? Why is it important?

Drywells are solely designed to infiltrate water into the ground. The drywell(s) on your property makes a significant positive impact on our environment by handling runoff closer to where it is created and thus better mimicking natural conditions, reducing pollutants to our beloved Deschutes River, and recharging our underground drinking water supplies.

## Why is it important to maintain your Drywell(s)?

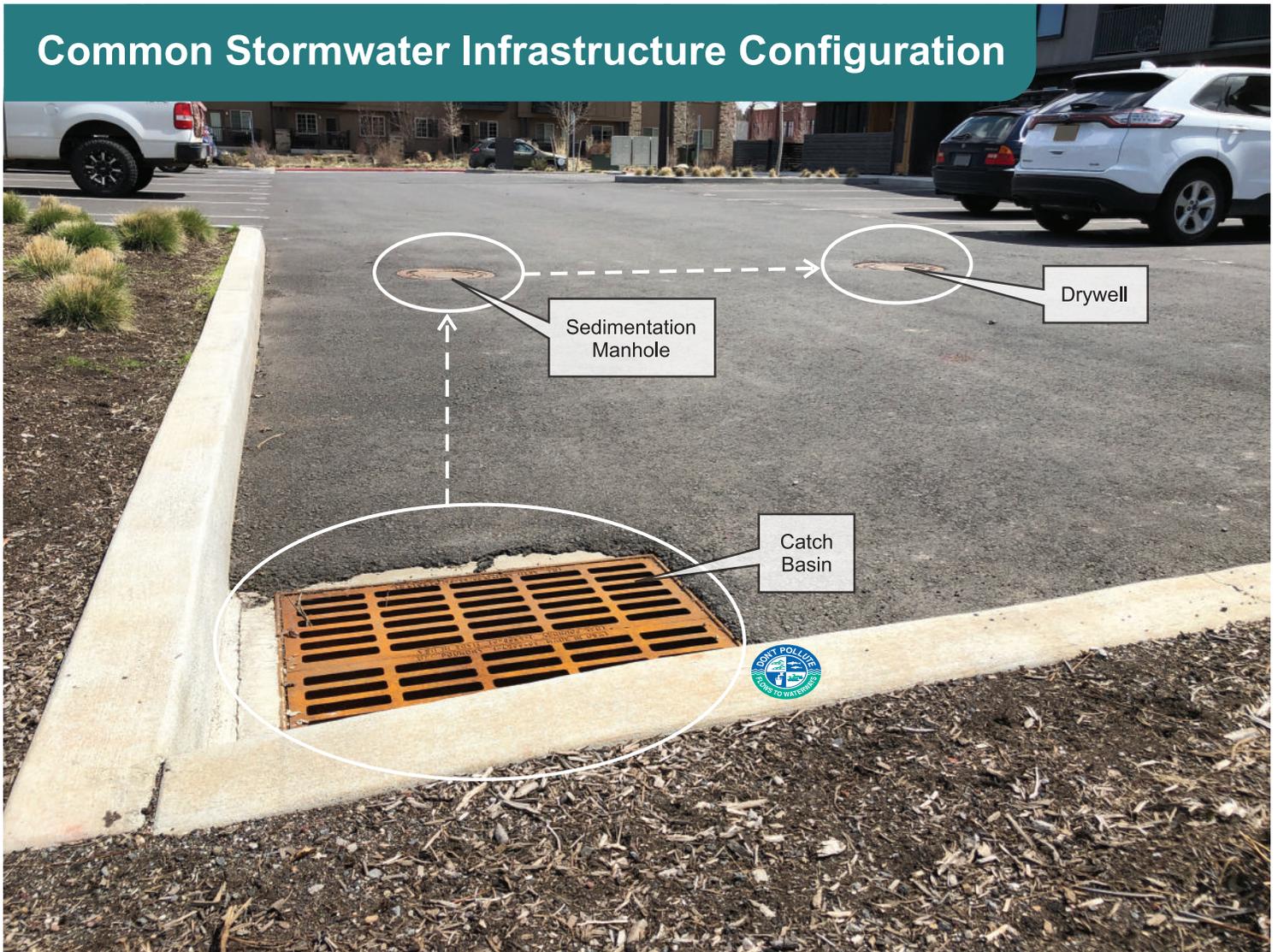
Without proper maintenance, drywells can fail, leading to drainage and flooding issues. Ensuring that sediments and other pollutants stay out of drywells is important to prevent clogging or injecting pollutants underground. In Bend, our stormwater facilities serve an important function and property owners are required to keep and maintain them per Bend Code Title 16. Just remember, a few things will go a long way in the effort to keep our waters clean and to prevent localized flooding.

## What tools do you need?

Maintenance schedules for drywells vary depending on flow volumes and sediment loading. Routine maintenance requires the use of a vacuum designed to suck up the water and sediment. In most places, there are local contractors that provide this service for a fee. Regularly inspecting your facility to monitor sediment and floatable levels is critical. Carrying the attached checklist, pen, a copy of your site plan, lid puller, steel toe boots, flashlight and a rigid sediment measuring device is a good way to ensure a safe and complete inspection can be performed.



# Common Stormwater Infrastructure Configuration



## Bad Example



Perpetual stagnant water indicates that drywell has failed and needs to be thoroughly clean or replaced.

## Good Example



Bottom of drywell has little to no water.

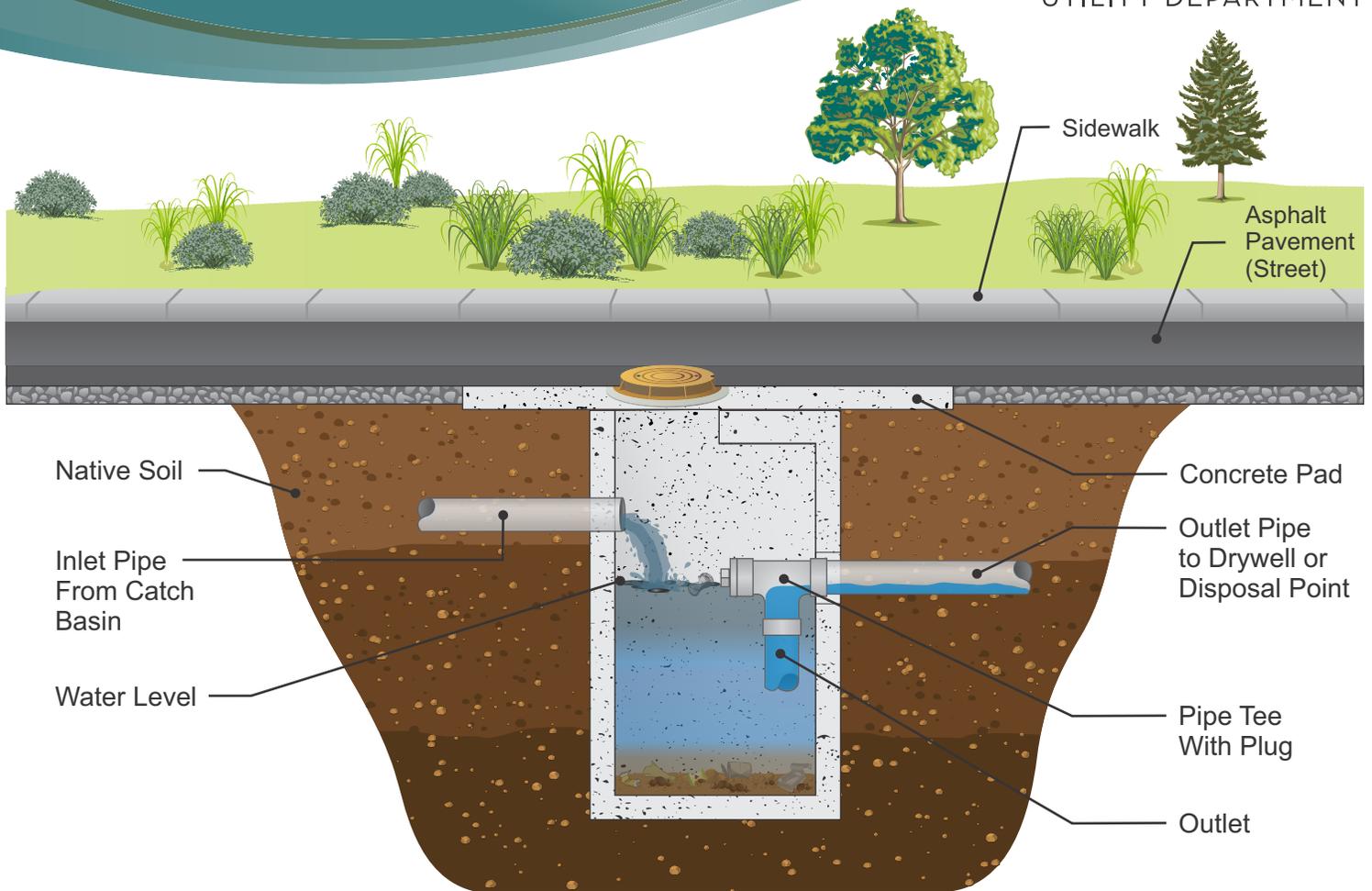
Drywell skirt fabric is in good condition; ideally should be secured at each section break and at bottom for ease of cleaning.

# SEDIMENTATION MANHOLE

## Maintenance Guideline



UTILITY DEPARTMENT



### What does a Sedimentation Manhole do? Why is it important?

Sedimentation manholes, also known as water quality manholes are designed to trap sediment, oil, other spills, and debris before discharging stormwater to a disposal point. The sedimentation manhole on your property makes a significant positive impact on water quality by preventing pollutants from entering our beloved Deschutes River and underground drinking water supplies.

### Why is it important to maintain your Sedimentation Manhole(s)?

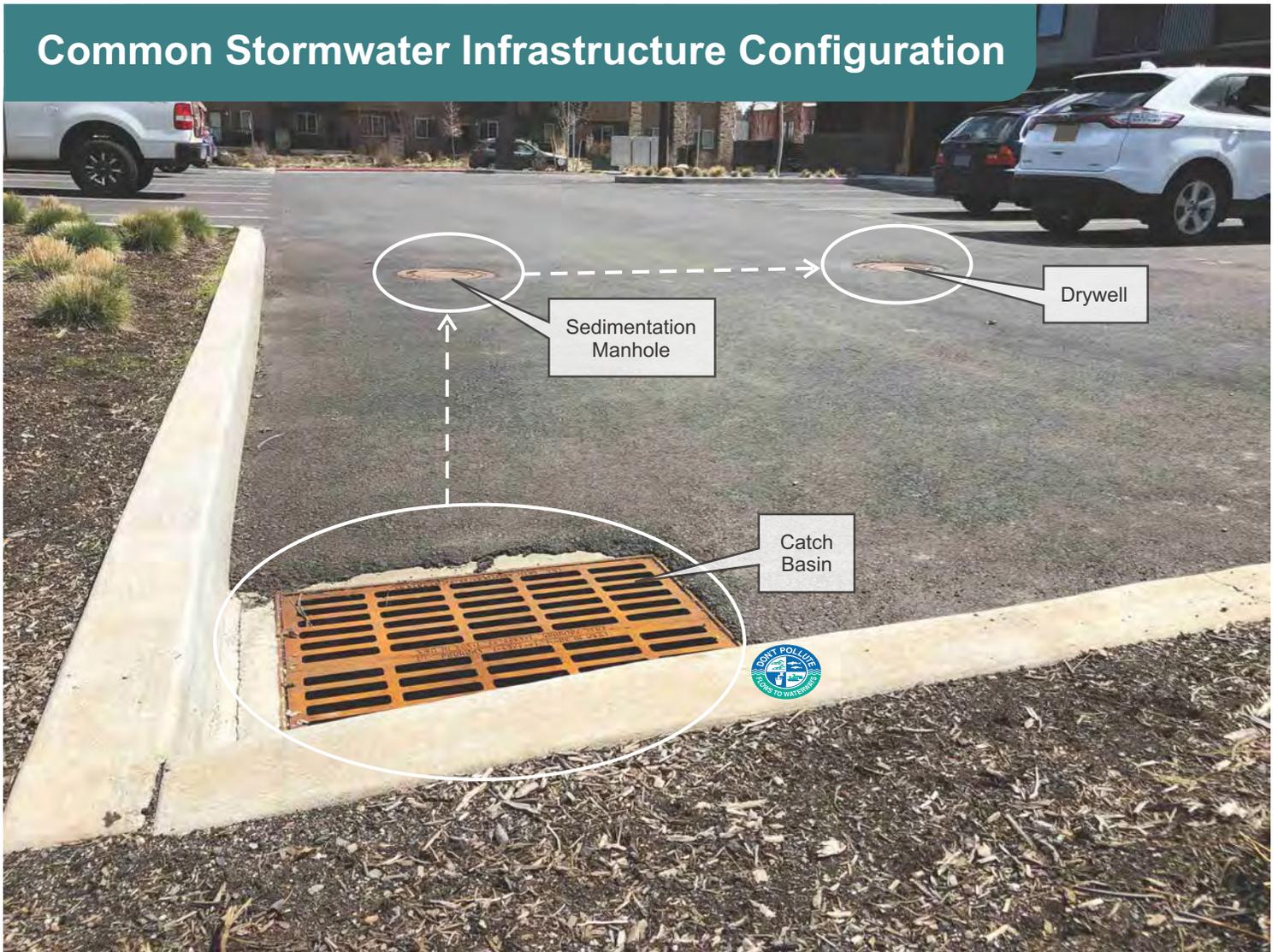
Without proper maintenance, sedimentation manholes will fail to remove pollutants. It is important to ensure that the sedimentation manhole doesn't become too full of sediment, debris, or floatables. In Bend, our stormwater facilities serve an important function and property owners are required to keep and maintain them per Bend Code Title 16. Just remember, a few things will go a long way in the effort to keep our waters clean and to prevent localized flooding. Start by inspecting your sedimentation manhole in the fall each year, and adjust to more often if site conditions warrant.

### What tools do you need?

Maintenance schedules for sedimentation manholes vary depending on flow volumes and sediment loading. Routine maintenance requires the use of a vacuum designed to suck up the water and sediment. In most places, there are local contractors that provide this service for a fee. Regularly inspecting your facility to monitor sediment and floatable levels is critical. Carrying the attached checklist, pen, a copy of your site plan, lid puller, steel toe boots, flashlight and a rigid sediment measuring device is a good way to ensure a safe and complete inspection can be performed.



# Common Stormwater Infrastructure Configuration



## Bad Example



Oily sheen on water surface. Maintenance needed per manufacturer's recommendation.

Trash and debris on water surface. Maintenance needed per manufacturer's recommendation.

## Good Example



Rim not damaged, pavement in good condition.

A rigid sediment measuring device needed for inspection.

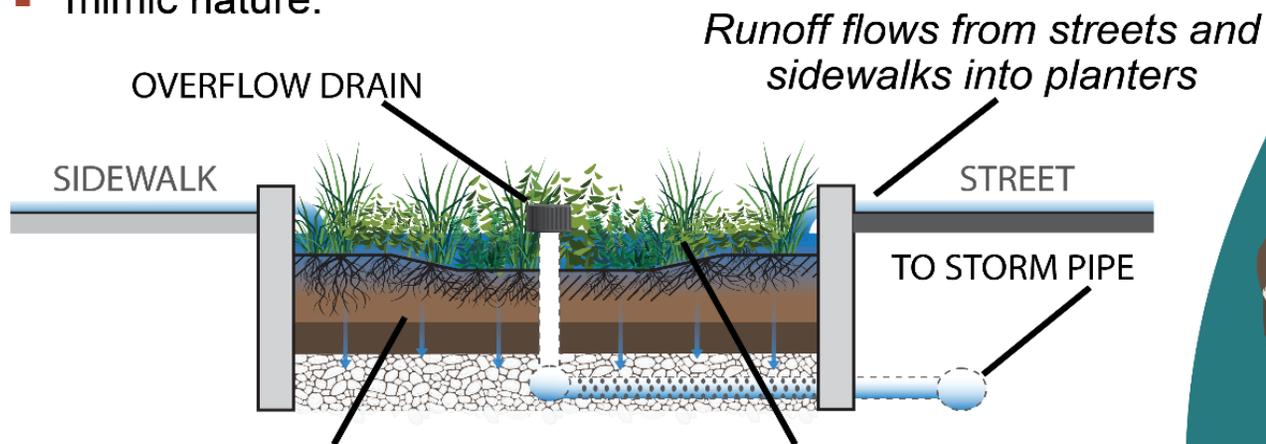
# What are the Planters All About?

*We're Protecting the River and Its Critters!*

Stormwater runoff picks up pollutants like vehicle waste, landscape materials and trash that can harm the river.

## THREE WAYS STORMWATER PLANTERS HELP

- 1 Planters catch water and help slow down flows to the river to mimic nature.



- 2 Layered soils and natural bacteria help catch and break down pollutants.

- 3 Native plants help reduce and clean the stormwater.



Scan to learn more about stormwater features and simple ways you can also help protect our river.  
[bendoregon.gov/greeninfrastructure](http://bendoregon.gov/greeninfrastructure)



## Why?

Hard surfaces like streets, sidewalks and rooftops cause stormwater runoff that can harm our river and critters living there.



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# How do Catch Basins Help Protect Our River?



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STORMWATER

Catch basins “catch” excess water from hard surfaces like streets, sidewalks and rooftops during rain storms and when snow melts. They direct the stormwater to treatment facilities like sedimentation manholes, drywells, stormwater planters and stormwater filter vaults that help clean the water before it reaches the Deschutes River or groundwater.

Grates help screen out debris like sticks, leaves and other items.

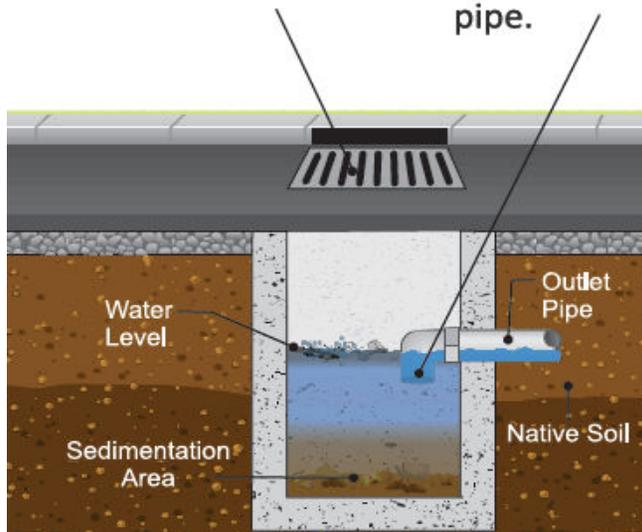
Some catch basin outlets have pipe covers to prevent small floating debris from entering the pipe.

## ***You can help!***

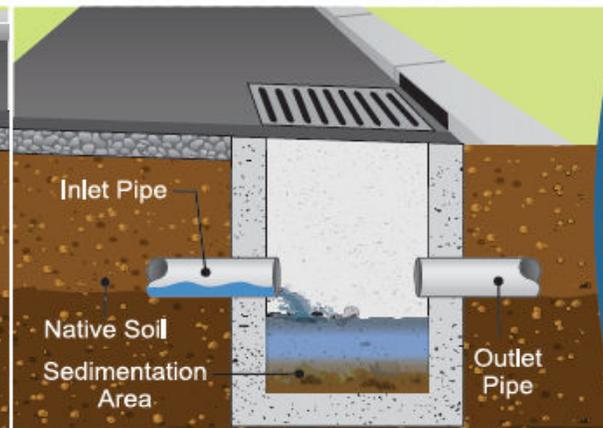
- *Never wash a car near a storm drain.*
- *Keep yard debris and litter out of the street.*



Scan to learn more about stormwater and more ways you can help protect our river.  
[bendoregon.gov/greeninfrastructure](http://bendoregon.gov/greeninfrastructure)



**Catch Basin With Outlet Pipe Cover**



**Catch Basin**



# What is Hidden Underground that Helps Protect Our River?



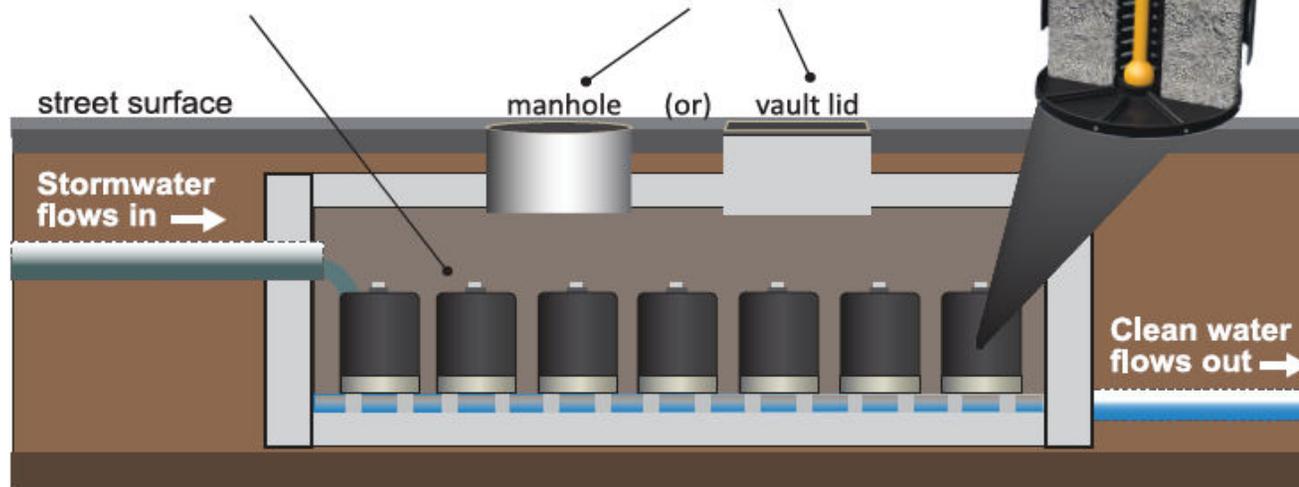
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STORMWATER

Stormwater filter vaults use cartridges that absorb and retain the most challenging pollutants (like motor oil and sediment) from stormwater and greatly improve the stormwater quality before it gets to the river.

Several rows of filters are needed to clean the large quantities of water that flow from hard surfaces.

Crews have access to the filter units for required maintenance and repairs.

Rechargeable filter cartridges absorb and retain pollutants.



Scan to learn more about stormwater features and simple ways you can also help protect our river.  
[bendoregon.gov/greeninfrastructure](https://bendoregon.gov/greeninfrastructure)



# How do Sedimentation Manholes and Drywells Work Together to Help Our River and Groundwater?



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These stormwater structures are designed to work together to protect our river and the critters who live there. Together they filter pollutants and minimize surface water discharge directly to the river.

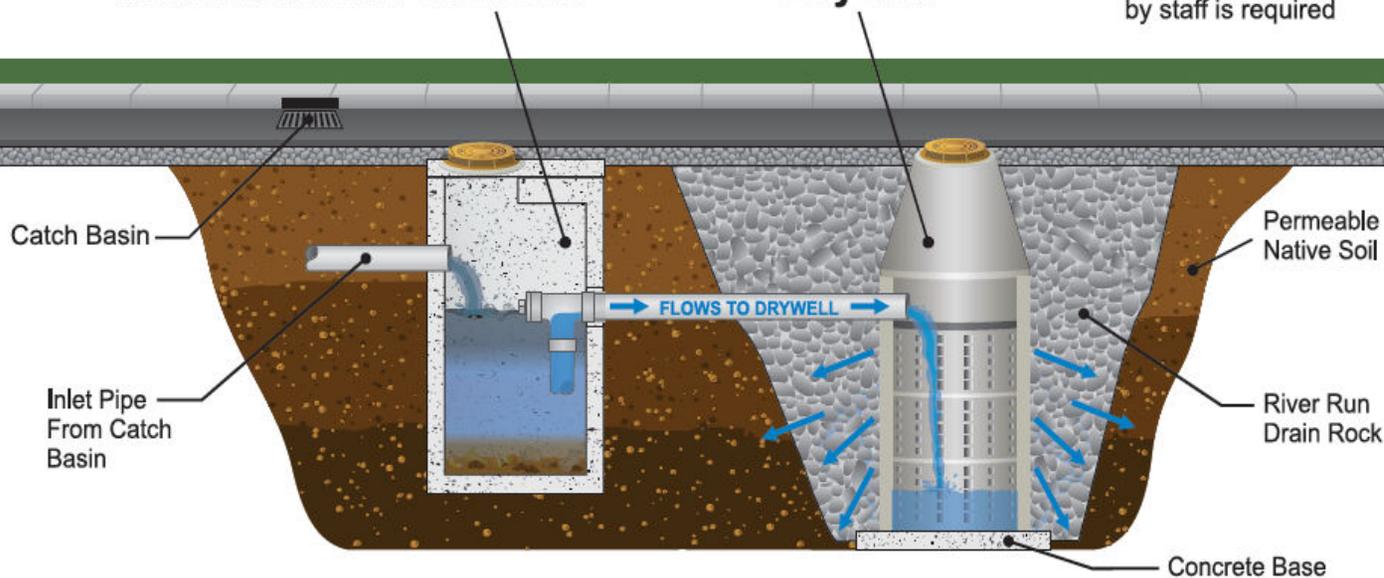
**1** Sedimentation manholes trap oils and settle out debris and sediment from stormwater runoff. The pre-treated runoff then flows through pipes to the drywells.

**2** Drywells allow the stormwater to soak into the ground in a way that better resembles the natural pre-development drainage path, filtering stormwater through the ground and recharging groundwater.

## Sedimentation Manhole\*

## Drywell\*

\*Regular maintenance by staff is required



Scan to learn more about stormwater features and ways you can help protect our river and its critters.

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# Why Native Plants?



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Native plants are adapted to the local climate and soil conditions where they naturally occur. This means they require less water and can naturally withstand Bend's hot summers and cold winters. Native plants can have long root systems that help us by capturing rainwater, reducing local flooding and preventing erosion by holding soils together.

Native plants also have the ability to filter pollutants from entering our rivers and groundwater, improving water quality and preserving natural habitats. Native plants provide food and habitat for a variety of insects, birds and mammals, including pollinators like bees and butterflies.



NATIVE BLANKETFLOWER  
(*Gaillardia pulchella*)



TUFTED HAIR GRASS  
(*Deschampsia caespitosa*)



GREEN RABBITBRUSH  
(*Chrysothamnus viscidiflorus*)



YARROW  
(*Achillea millefolium*)



Scan to learn more about native plants you can use and other ways you can help protect our river and groundwater.

[bendoregon.gov/greeninfrastructure](https://bendoregon.gov/greeninfrastructure)

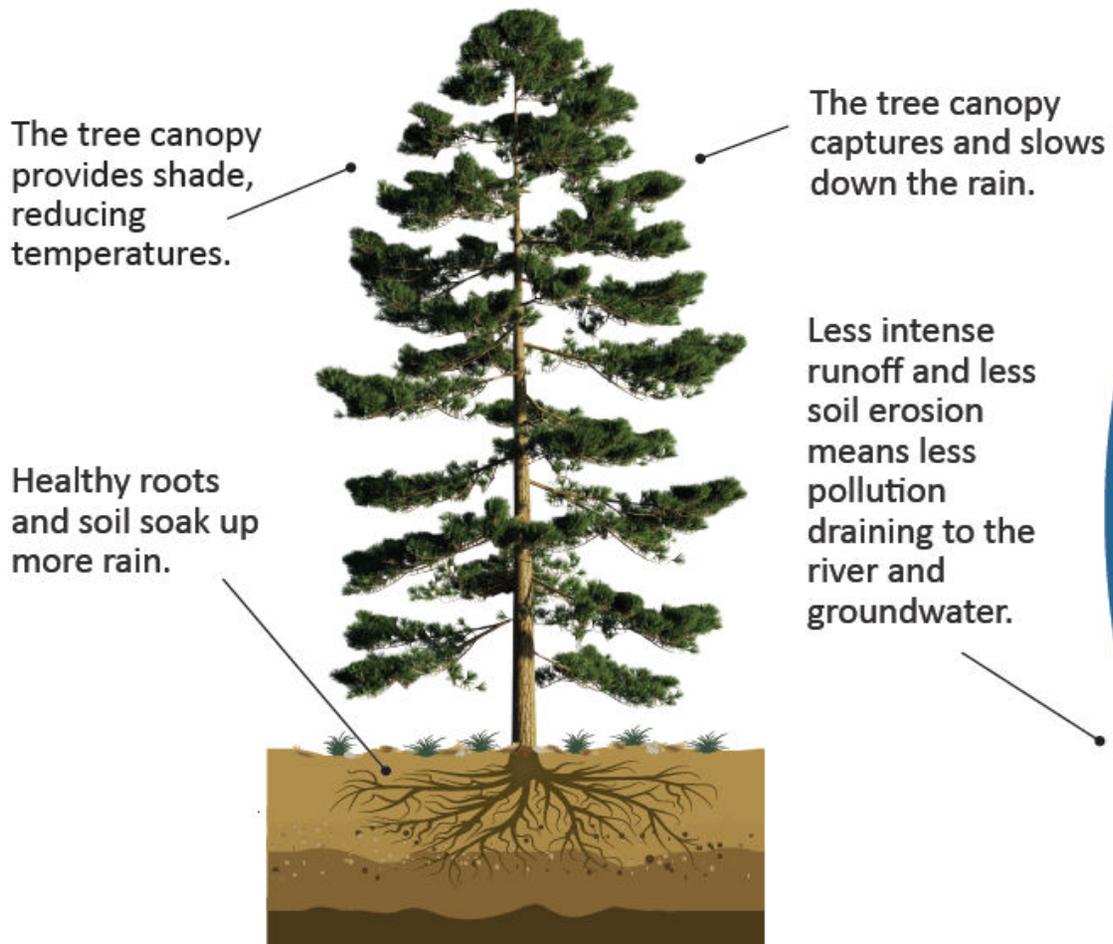


# Our Trees are Natural Managers of Stormwater



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STORMWATER

In Bend, we love our beautiful trees. They help to improve our air quality, keep soils from eroding and provide shade to help cool our environment and the river. But did you know that trees also reduce stormwater runoff and improve water quality by absorbing and filtering rainwater? Trees can transform pollutants into less harmful substances, helping to protect our river and the critters who live there.



Scan to learn more about stormwater and more ways you can help protect our river.  
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STORMWATER



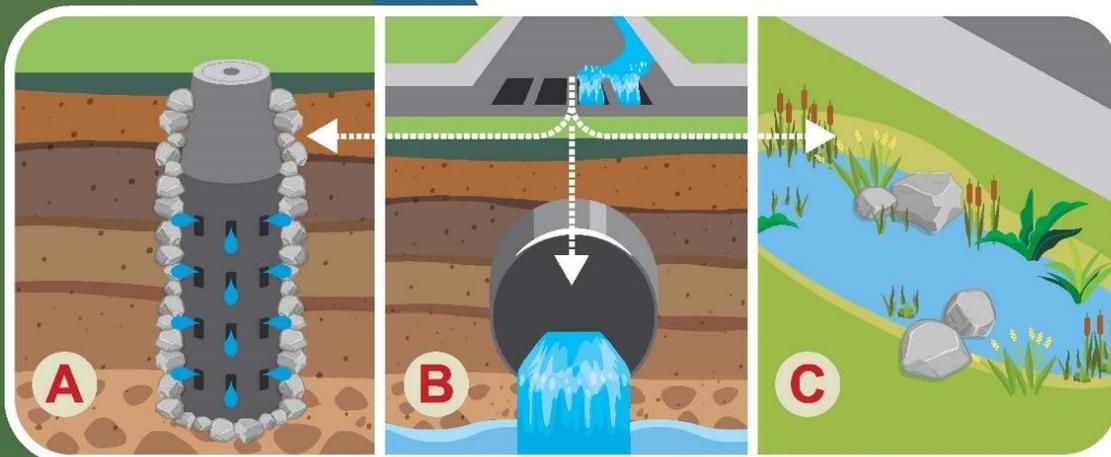
# Protecting our waters... It's All Connected

When it rains or snow melts, the "runoff" along our streets drain to:

- A** underground "injection" facilities,
- B** the Deschutes River,
- C** sometimes the runoff first drains into rain gardens or swales.



To find out more,  
scan the code!



## Reducing Floods, Removing Pollution

When it rains or snow melts, some enters the ground and the remainder is called "runoff." Streets, rooftops, driveways and other hard surfaces create more runoff than vegetated and natural areas.

Urban runoff often carries with it eroded soil and pollutants like oil, tire wear particulates, car brake metals, fertilizers, pesticides, pet waste and garbage.

The pipe outfall at the river's edge is the endpoint of the network of below- and above-ground drainage systems (Image B) that carries stormwater to the Deschutes River from this neighborhood, Newport Avenue, and even from Awbrey Butte!

Some stormwater also sinks down and recharges into the Deschutes Aquifer (Image A).

Since 2020, the City of Bend has improved the drainage system to reduce floods and remove pollution from stormwater flows before they enter the river or groundwater (Image C). Take the walking tour to learn more.



# What is an illicit discharge?

An illicit discharge is any substance that enters a storm drain that is not clean rainwater runoff. Common types include motor oils, paint, household cleaners, grease, sediment, fertilizers, construction waste and septic/sewage waste.

## Why are they bad?

Illicit discharges can harm water quality in the Deschutes River or groundwater aquifer, and they are illegal!

## What if you see an illicit discharge?

Please report discharges to the City of Bend Utility Department at 541-317-3000 ext. 2

Remember, only rain in the storm drain! Keep reading for more helpful tips to protect our water.

## Do your part to protect our waters!

Everyone's actions or inactions can impact the clarity and health of the river and groundwater. Only clean rainwater runoff should enter catch basin drains.



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