STORM DRAIN DETECTIVES

A Stormwater Education Unit

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Introduction

Summary

In this Kitsap County Public Works (KCPW)-supported project, students will receive a tour of the school's stormwater system and work in teams to regularly monitor the storm drains on the school's property for debris, trash, and sediment. Each team will monitor one storm drain to include observation of water flow and potential pollutants; inspection for sediment level; and regular recording of their data. At the end of the year, a KCPW Educator will return to the classroom to work with students on analyzing their data. They will review their claims, evidence, and reasoning. Teachers will then work with students to summarize and graph their results in a letter to the school's maintenance staff explaining their findings. Through their investigations with these NGSS-aligned lessons, students share the evidence-based information they have obtained with their community in order to contribute to protecting the Earth's resources and environment.

Objectives

1. Apply map skills to identify the location of specific storm drains on school property
2. Observe and record how water flows on school grounds and in storm drains
3. Observe and record identified pollutants and litter
4. Observe and record measurements of the amount of sediment in storm drains
5. Explain why storm drains should be inspected regularly and cleaned as needed
6. Explain why school playgrounds and parking lots could impact water quality in local streams
7. Analyze the collected data to determine the current status of storm drains
8. Communicate in the form of a letter to the school or district's maintenance staff; summarize findings with a claim, supporting evidence and reasoning

Standards

Next Generation Science Standards

- 5-ESS3-1 Earth and Human Activity: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Common Core State Standard Connections

- Refer to 5-ESS3-1 for a complete list of connections to Common Core State Standards for ELA and math that support the work in this NGSS standard. For example, in this unit there are opportunities to utilize the mathematical skills found in "M.P.4: Model with Mathematics: identifying important quantities in a practical situation and map relationships using tools such as…graphs." and "Analyze relationships mathematically to draw conclusions." Additionally, opportunities are present to use the writing skills found in "W.5.8: Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources."

Getting Ready

Teacher Training

When possible, the KCPW Educator will offer teacher training in the spring or summer for those teachers participating in the Storm Drain Detectives project. This training may be in-person or may be a hybrid of a Zoom meeting and in-person demonstration.

Project Feasibility

Before committing to the project, teachers should contact the KCPW Educator to determine if the school campus has a sufficient stormwater system to support the full project. A 1-2 day lesson can be offered as an alternative for those school campuses without a sufficient stormwater system on site to conduct monitoring.

School Administration Approval

This project requires multiple days of data collection—basically on-campus field trips—and support from adult volunteers. In addition, school custodial staff may be able to be of some assistance during the project as well. It is suggested that teachers review the full project with their school administration prior to project commitment.

Program Registration and Project Agreement

- Complete the online Teacher Program Registration.
- Read and sign the Project Agreement and Expectations explaining the expectations for teachers and for the KCPW Educator to ensure student success. Available in Blackline Masters section of these materials.

Volunteer Recruitment

This project requires adult supervision of multiple student teams outside on campus. Adult volunteers should be recruited that can be trained on the tasks and participate monthly for at least 3 months, or however many monitoring days there are. There are two suggested options for arranging Field Monitoring Days and volunteers:

1. **Single Volunteer; multiple teams pulled out from class**: One adult volunteer works individually with each Storm Drain Team one day per month over 3-5 months to complete the monitoring for all teams. With this option, time should be allotted the following day for all teams to work on their in-class calculations.
2. **Multiple Volunteers; all teams monitor at once (full class field trip)**: All Storm Drain teams have a separate adult volunteer. All volunteers come in the same day once per month over 3-5 months to monitor the drains with their team. Once all teams return to class, provide time for teams to complete their in-class calculations.

Field Trip Logistics

The field work associated with this project is all on the school campus. However, your school administration may still require field trip paperwork for each monitoring day. Consult with your school administration, complete all required field trip forms, and distribute and collect field trip permission slips when required.

Consider planning all field trip dates at the beginning of the project so you, the KCPW Educator and the adult volunteers can all have those dates on their calendars. Arrange to have all equipment delivered by KCPW Educator prior to monitoring days. Have available for pickup when monitoring is complete.

Background Information

Storm drains collect water from rainstorms and move it away from our roads and buildings. However, they can also collect pollutants, trash, dirt, and other debris. Storm drains consist of a grate that we see on the surface, but underneath is an area called a catch basin. The catch basin is where pipes connect and carry the water underground to other parts of the stormwater system. This could be another storm drain, a stormwater pond, an underground tank, or a body of water (stream, lake, Puget Sound). There is also a sump at the bottom that collects debris, trash and sediment and can also hold some water. Some catch basins act as oil water separators, providing an opportunity for the oil to float on top of the water instead of flowing to waterways. For simplicity in our project, we will call the grate and catch basin together a storm drain.

The sumps in storm drains need to be cleaned out periodically to remove trash and sediment—the soil and small dirt particles that collect in the bottom—and the associated pollutants. If the sumps under storm drains do not get cleaned regularly, then the pollutants, trash, dirt and other debris can end up in our local waterways.

Your students will split into teams, which each team regularly observing and inspecting one of the storm drains on your school grounds.

For each drain they will:

- Check the sediment level in storm drains
- Identify water flow and pipes in storm drains
- Check for evidence of trash and other pollutants
- Record their findings as a team and as a class
- Analyze and graph the data they have collected
- Summarize and communicate findings to school or district maintenance staff

NOTE: It is recommended that students monitor the drains monthly for at least 3 months. Any obvious concerns with the drains should be reported to the school or district maintenance staff immediately (flooding, dangerous pollutants, loose grates, etc.)

Acknowledgements

The lessons in this curriculum were developed or modified by Lori Reynolds, Instructional Design and Development, and Pat Kirschbaum, Kitsap County Public Works (KCPW). These lessons are designed to support Next Generation Science Standards (NGSS), Common Core State Standards (CCSS), and meet the goals of the Kitsap County Public Works Stormwater Program.

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Outline and Schedule				
Section/Lesson	**Topic/Task**	**Approximate Time Required**	**Schedule**	**Lead**
Getting Ready - Teacher Only	Teacher Training	Can vary. 60 - 180 minutes	Spring Prior or Summer	KCPW Educator
	Project Feasibility	30 minutes	Spring prior or Aug/Sept	Teacher
	School Administration Approval	30 minutes	August/ September	Teacher
	Program Registration and Teacher Agrmt	15 minutes	September	Teacher
	Volunteer Recruitment	1-2 weeks	September	Teacher
	Field Trip Logistics (Permission slips, etc.)	1-2 weeks	September-October	Teacher
Lesson 1	- Formative Assessment Probe/Review - Pre-Visit Introduction & Expectations - Assign storm drain teams	45 minutes	Start of Unit	Teacher
Lesson 2	Introduction to Stormwater - Probe re-cap - Phenomena/What is Stormwater -Tour of School's Stormwater System	60 - 90 minutes	1-2 weeks prior to first monitoring day	KCPW Educator
Lesson 3	Model Storm Drain Inspection - Phenomenon revisit - Investigative Question - Model Storm Drain Inpsection	60-70 minutes	1-2 weeks prior to first monitoring day	KCPW Educator
Lesson 4	Field Monitoring Days	30-60 minutes per team	Monthly	Teacher/Volunteer
Lesson 5	Data Summary and Analysis	60-70 minutes	April	KCPW Educator
Lesson 6	Communicating Results	Multiple days	April-May	Teacher
Lesson 7	Revisiting Probe	30-60 minutes	End of Unit	Teacher
Blackline Masters	A Note for Home			
	Adult Volunteer Guidelines			
	Daily Data Summary			
	Probe: Formative Assessment			
	Science Door Sign			
	Storm Drain Detectives Analysis Sheet			
	Storm Drain Detectives Instruction Book			
	Storm Drain Detectives Recording Book			
	Storm Drain Photo			
	Task 5: Measure Depth of Storm Drain Sump			
Vocabulary and Resources				
KCPW Educator Masters	Phenomenon			
	Project Agreement and Expectations			
	Storm Drain Cutaway			
	Storm Drain Detectives Power Point			

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Lesson 1 – Formative Assessment Probe, Review and Expectations

Method
Teacher led

Time Required
Approximately 45 minutes

Objective
- Explain where water goes once it enters a storm drain based on evidence and reasoning from prior knowledge.

Materials
Provided by classroom teacher:

- Copies from provided blackline masters of:
  - Formative Assessment Probe, Where is This Water Going?
- Pencil for each student
- Poster Paper

Procedures – Classroom Teacher
- Read the probe, Where is This Water Going? to students as they follow along.
- Provide time for students to respond to the probe independently.
- With a show of hands, tally the number of votes for each answer and record across the top of the poster paper.
- Using student probes, call on students and capture student ideas about where they think the water in the image is going, their reasoning, and questions they have. Record this information on a piece of poster paper to share with the KCPW Educator for use during Lesson 2. This is a pre-assessment opportunity to observe and capture student prior knowledge, pre-conceptions and any wonderings they may have.
- Collect the probes and save them, along with the poster paper summary, for the KCPW Educator to review with students during their classroom visit in Lesson 2.
- Email scanned copies of the completed student probes and a photo of the poster paper summary to the KCPW Educator.
- Share the Pre-visit Introduction and your Expectations with your students.

NOTE FOR TEACHERS ONLY: The correct response: Tatyana has the correct response, "I think it goes out to streams and to Puget Sound." Please do not share this with students yet. As they learn about stormwater and complete their investigations, their answers and thoughts about the probe will change.

This probe will give you valuable formative information about students' understanding of how the science ideas behind a storm drain help protect your local resources and environment.

There will be opportunities for future reference and use, including summative assessment, later in this unit so be sure to retain your students' probes.

Pre-Visit Introduction and Expectations

Introduce the KCPW Educator and the focus of the work ahead based on *NGSS* by sharing the following with your students:

- Kitsap County Public Works protects people, property and the environment by managing flooding and preventing water pollution. They offer education programs that help us understand what happens to the water where we live. (KCPW Educator's Name) is from the Stormwater Division and she/he will be visiting our classroom to share real-life, local examples of what happens to the water where we live so that we can understand ways we can use science ideas to protect this valuable resource in our area.
- Throughout the course of their Storm Drain investigations students will be working with and listening to a guest speaker from Kitsap County Public Works as well as adult volunteers, working indoors and outdoors, working in groups, using scientific tools, gathering data, recording evidence accurately, using science, reading, writing and math skills and sharing information with each other, the class and others in their school and/or district. Share your expectations with them for the work ahead.
- Assign students to Storm Drain Teams. Four (4) students per team is best, but 3 or 5 can work if needed. No more than 5 students per team. Students will work in these teams in class and in the field throughout the project.
- Provide time for students to come up with a team name. Encourage them to think of a good fit for something along the lines of how people in their community use science ideas to protect their water resources. (Storm Drain Engineers, Team Clean Water, Stormwater Sleuths, Team Pollution Solutions, etc.)

Lesson 2 – Introduction to Stormwater

Method
KCPW Educator-led; student discussion; stormwater system tour

Time Required
Approximately 60 - 90 minutes

Objectives
- Discuss Probe answers and student reasoning for their answers
- Explain what stormwater is
- Identify and observe how water flows on the school grounds and in storm drains

Materials
Provided by classroom teacher:

- Student-completed copies of the Probe, Where is This Water Going?
- Poster paper summary of student Probe answers and reasoning, posted for class to see
- Document camera for use by KCPW Educator
- Copies from provided blackline masters of:
    - Science Door Sign. One copy for classroom door

Provided by KCPW Educator:

- Stormwater Power Point:
    - Phenomenon photo
    - Storm Drain Cutaway graphic
- Catch Basin model
- Storm Drain cutaway graphic
- Map of school's stormwater system
- Drain puller
- Drain Inspection Rod

Procedures - Classroom Teacher
- Have students sitting with their Storm Drain Teams.
- Ensure each student has their copy of Where Is This Water Going? Probe from Lesson 1.
- Post Science Door sign on classroom door to go outside.
- Revisit probe with students after the stormwater system tour.

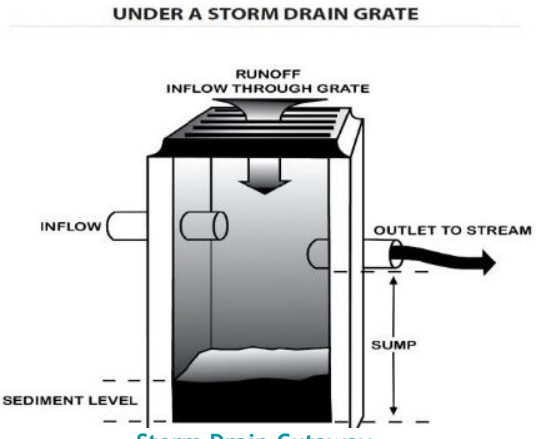
Procedures – KCPW Educator

- Review the poster paper summary of student probes with students and capture any additional prior knowledge, pre-conceptions and wonderings students may have.
- Introduce the Phenomenon: Show students the photo of suds in the bay. Have them talk in their Storm Drain Teams.
    - What do you see?
    - What is it from?
    - How did it get in the bay?
- Come together and share ideas as a class.
- This phenomenon will be revisited again in Lesson 3.

Phenomenon: Suds in Bay

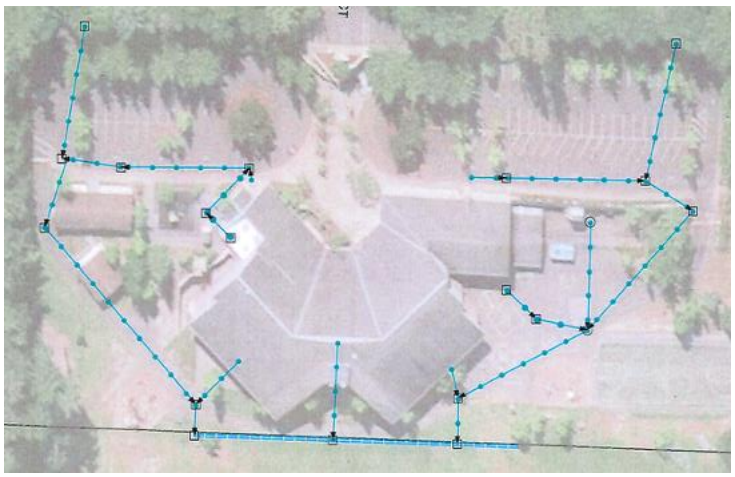
NOTE: For productive discourse here and in following discussions, give time to think and then ask questions such as: Can you give an example?, Who can repeat what was just said or put it in their own words?, Why do you think that?, What's your evidence?, Does anyone want to respond to that idea?

- Ask students what happens when it rains? Water hits the ground and:
    - soaks in
    - runs across the ground to streams
    - puddles up and evaporates
    - flows into storm drains and ditches
- Explain that we build stormwater systems to collect water so roads, buildings, etc. do not flood. Show slides of various parts of the stormwater system and briefly explain each: Ditches, culverts, drains, ponds, outfalls.
- Where does water from the storm drains go? Streams
- Using the storm drain cutaway graphic and the Catch Basin model, explain how the catch basin part of the storm drain works – pipes, sump, etc.
- Give students time to discuss the following in their Storm Drain Teams, then discuss as a class:
    - What could happen that would keep the storm drain from working properly? Leaves, trash and debris cover the grate; pipes get clogged; sump fills with sediment, etc.



Storm Drain Cutaway

  - Is that ok? Discuss impacts to infrastructure and streams/Puget Sound—pollutants that could end up in streams and Puget Sound.
  - How do we keep that from happening? Inspect/clean
- Based on our work together, you'll be developing some claims, evidence and reasoning to determine if your school's stormwater system is operating properly.
- Show map of the school's stormwater system.
- The KCPW Educator will take the class on a tour of the school's stormwater system.
- The cover of one storm drain will be removed and two Storm Drain Teams at a time will take turns looking into the storm drain with the KCPW Educator to learn about what is inside.
- The KCPW Educator will show students the observations to look for and, if time permits, how to inspect the storm drains for sediment in the field. (This will be done in-depth in the classroom in the next lesson.)



Sample Map of School Stormwater System

- The KCPW Educator will also note which drains will be inspected by students.
- Point out the Science Door sign to students before leaving the classroom so they have a mindset for learning while outside.

TEACHERS: This would be a good time to revisit the probe with your students to gauge their thinking.

NOTE: Plan your field work during times when there is the least amount of bus and vehicle traffic.

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Lesson 3: Model Storm Drain Inspection

Method

KCPW Educator-led, group work

NOTE: This lesson can be done as a stand-alone lesson in place of the multi-day project if the school does not have a storm drain system.

Time Required

60-70 minutes

Objective

- Develop an investigative question
- Perform a mock inspection in class using a Storm Drain Detectives Practice Model

Materials

Teacher Provided:

- Clipboards, 1 per student
- Pencils, 1 per student
- Adult volunteers for each storm drain team
- Copies from provided Blackline Masters of:
    - Storm Drain Detectives Instruction Booklet, 1 per student (laminating at least one copy of this booklet for field monitoring is recommended.)
    - Storm Drain Detectives Recording Booklet, 1 per student
    - Storm Drain Detectives Monitoring Team Master, 1 copy completed by teacher
- Document camera for use by KCPW Educator

KCPW Educator Provided:

- Storm Drain Detectives Model Inspection Kit:
    - Storm Drain Detectives Practice Model, 1 per Storm Drain Team
    - Chalk, 1 piece per Storm Drain Team
    - Inspection rod
    - Measuring tape
    - Cloth wipe
- Catch basin model
- Copy of phenomenon photo to project
- Power Point slides for model inspection

Procedures – Classroom Teacher

- Have students get into their Storm Drain Teams with their adult volunteer, if they are available.
- Distribute the instruction booklets and recording booklets, one per student.

Procedures – KCPW Educator

- Show students the photo of the suds in the bay again. Explain that the suds came from a car washing station in the parking lot of a local apartment complex. It was removed by the apartment manager, but weeks later, the Health District got another call about suds in the bay. They went back to the same location-what do you think they found? (Give students a chance to answer.) Soap residue had accumulated in the sediment at the bottom of the storm drain, so when it rained, the water flowing into the storm drain caused the soap residue to bubble up and those bubbles flowed through the system to the bay. What could have been done to keep this from happening? (storm drain could have been inspected and cleaned out.)

Investigative Question

- Before getting started with our investigation, we need to develop an investigative question. Storm drains need to be maintained. That means they are inspected regularly and cleaned when needed. What do we want to know about the drains at the school? (Are they maintained regularly, enough, etc.) Examples of questions you could develop are: Do the storm drains at _____have too much sediment in them?, Are the storm drains at _____maintained regularly?
- After brainstorming and working with students, write the class's investigative question on the board.

Recording Booklet Cover Page

- Project the Recording Booklet cover page on the screen and fill out the page with students. This is our record of our monitoring, so if you need to change something from the previous monitoring day, cross it off—do not erase.
    - Investigative Question
    - School
    - Teacher
    - Detectives in their Group
    - Storm Drain Number: This will be assigned after the model inspection
    - Team Name
    - Have teams determine and record date, time, weather, temperature and 24 hour rainfall. Scientists record this kind of evidence to help them track events and look for patterns.

Instruction Booklet

- Project the Instruction Booklet on the screen and go over the assigned jobs while students follow in their copy. Give students a minute to decide who will do what for this practice. Explain that everyone will record today so all can learn how to do it, but the Recorder will make sure everyone has the correct information. Field jobs will be assigned later.
- Review the check equipment and recording information sections under Before You Start on page 2. Have students check their equipment.
- Demonstrate the inspection procedure with students watching and following along in their instruction booklet under Task 1.

Recording Booklet and Model Inspection

- Recording Booklet, Task 1.
    - Project the Recording Booklet and show students where they will record their data for Task 1.
    - Ask the teacher if students will be using fractions, decimals, or rounding to the nearest whole number. Have students circle the correct one under Task 1.
    - Review the Example with students.
    - Have teams write the date in the Practice column of Task 1.
    - Give each monitoring team a Storm Drain Detectives Practice Model and Inspection Kit.
    - Have teams take their 3 measurements in the center, left, and right of their drains.
    - Once all data has been collected and recorded, complete the calculations together for Task 1. Results should be similar and no drains needing to be cleaned.
- Recording Booklet, Tasks 2, 3 and 4
    - For Monitoring Day # and Date, have students put “Practice” and the current date in their Recording Booklet.
    - Open the Power Point presentation.
- Recording Booklet, Task 2
    - Slide 21: storm drain with the building visible.
    - Have students write “school” at the top of the Task 2: Outside Storm Drain photo to indicate where the building is.
    - Discuss with students if they see water or any evidence of water flowing into the drain. Note the mossy looking marks to the left—could indicate pooling. Use the key to mark their papers.

- Recording Booklet, Task 3
  - Slide 22: photo of inside a storm drain.
  - Have students mark an "X" in each "pipe" on their paper to show where there is a pipe in the photo. (4 pipes—one on each side.)
  - Using the key, have students indicate if they observed any water flowing, water in pipes, or sediment in pipes.
    - Right pipe: water flowing out of pipe; rust stains are evidence of water flowing
    - Left pipe: rust stains are evidence of water flowing. This is probably where water flows out because it is the lowest pipe.
    - Bottom pipe: possibly some rust, but hard to tell.
    - Top pipe: Where do students think pipe comes from? Remember where the building was on the last photo. It is probably a building downspout since that's where the school is.
- Recording Booklet, Task 4
  - Slide 23: close up of drain.
  - Ask students what they observe around the drain that should not be there and record it under Task 4 on their paper. (Pencil, plastic bag, candy wrapper, etc.)
  - Explain to students that in the field the recorder will capture the team's evidence in their own recording booklet and that the rest of the team will use that record to transfer the evidence to their recording booklets back in class.

Daily Data Summary

- Show students the Daily Data Summary Sheet provided by the teacher as a regular sized copy of the sheet from the blackline master, an enlarged poster size, or captured electronically.
- If time permits, enter each group's results on the Daily Data Summary Sheet and discuss results.
- Explain how data will be captured here by the recorder after each monitoring day to be used for class discussions and student reference.

Wrap up (if monitoring storm drains on school property)

- Save Instruction and Recording Booklets for the future field monitoring days.
- Explain to students they will be following these same steps when they inspect their drain on the school campus.
- After the practice, the KCPW Educator will walk the site with the adult volunteer(s) to ensure they know where each storm drain is located and how they are numbered.

Lesson 4 Field Monitoring Day

Method

On-campus field work; teacher and adult volunteer-led with KCPW assistance as needed and available.

Time Required

- 3-5+ field monitoring days
- Once per month for **at least 3 months**, but can be up to 5 months or more, as long as monitoring is completed and data is sent to KCPW Educator before Spring Break.
- 10-20 minutes to organize groups and distribute materials
- 20–30 minutes field work **per team** to complete an inspection of one drain
- 20-30 minutes in-class time **per team** for math calculations
- 10-20 minutes in class time **per team** to transfer field data to their own recording booklet and post findings on the Class Daily Data Summary

There are two suggested options for arranging Field Monitoring Days and volunteers:

1. **Single Volunteer; multiple teams pulled out from class**: One adult volunteer works individually with each storm drain team one day per month over 3-5 months to complete the monitoring for all teams. With this option, monitoring could take 2-3 hours, depending on how many teams, especially at the beginning. Time should be allotted the day after monitoring for all teams to work on their in-class calculations.
2. **Multiple Volunteers; all teams monitor at once (full class field trip)**: All storm drain teams have a separate adult volunteer. All volunteers come in the same day once per month over 3-5 months to monitor the drains with their team, so the whole class is outside at the same time. Once all teams return to class, provide time for teams to complete their in-class calculations.

Objective

- Apply map skills to identify the location of specific storm drains on school property
- Observe and record how water flows on school grounds and in storm drains
- Observe and record identified pollutants and litter
- Observe and record measurements of amounts of sediment in storm drains
- Apply math concepts to complete calculations

Materials

Provided by classroom teacher

- 1 clipboard per team
- 1 pencil per team
- Completed Storm Drain Detectives Monitoring Teams Master from Lesson 3
- Copies from provided blackline masters of:
    - Storm Drain Detectives Instruction Booklet, 1 per student (laminating at least one of these per team is recommended)
    - Storm Drain Detectives Recording Booklet, 1 per student (Team Recorder should have their copy in the field)
    - Daily Data Summary sheet: can be blackline master size, enlarged to poster size or captured electronically. Data needs to be available for group discussions and student reference. 1 copy in class for each monitoring day.
    - Storm Drain Detectives Adult Volunteer Guidelines
    - Task 5: Measure Depth of Storm Drain Sump (if needed)
- Determine a signal so students and adult volunteers know when to return to class.

Provided by KCPW Educator:

- Storm Drain Detectives Field Inspection Kit
    - student and adult volunteer vests
    - flashlight
    - inspection rod
    - measuring tape
    - wipe-off marker or chalk
    - cloth
    - map of school's stormwater system

Procedures – Classroom Teacher - Getting Ready

- At the beginning of the project:
    - Determine how many monitoring days and the dates
    - Arrange for adult volunteer(s) and share guidelines.
    - Arrange for KCPW Educator to deliver kits for monitoring days and provide assistance the day of monitoring, if needed.
- Gather the materials needed for each team: Storm Drain Detective Field Inspection kit, clipboard and pencil.
- Be sure students have their instruction and recording booklets.
- Have Daily Data Summary sheets in your preferred form ready for each monitoring day.

- Get students into storm drain teams and assign a drain number from the Master Map.
- Be sure students have captured the investigative question on their recording booklet.
- Assign jobs to each team member or let teams choose. Decide if jobs will rotate each time you monitor. If needed, read through job descriptions as students follow along in their instruction booklet.
- Have team recorders capture names for each job on their team.

NOTE: If there are 5 students on a team, split the Recorder job: Recorder in the Field: records evidence in the field; Recorder in class: records evidence on the Daily Data Summary sheet upon return to class and ensures all teammates record data on their Recording Sheets.

Procedures – Each Storm Drain Monitoring Day

In the Field

- On the front page of the recording booklet record the date, time, weather description, temperature and amount of rainfall in the last 24 hours.
- Task 1: Follow the directions for Task 1 Inspect the Storm Drain section in the Instruction Booklet to measure the sediment and free space in the storm drain. Record the information accurately in the recording booklet on page 2, Task 1, Does the Drain Need to be Cleaned? Drain Inspection Data Collection section.
- Tasks 2-4: Follow the directions for Tasks 2, 3 and 4 in the Instruction Booklet to record your observations and evidence accurately.
- Task 5 (if needed, available from teacher): If the amount of free space is LESS THAN 6”, students should use Task 5 to measure the depth of the storm drain sump.

Back in class, in teams

- All team members should record the field data on their own recording booklet.
- As a team, complete the Task 1, Back in Class calculations at the bottom of Page 2.
- The recorder records their team’s data on the class Daily Data Summary sheet provided by the teacher as a sheet, poster, or electronically.

As a Class

- Discuss the evidence captured on the Daily Data Summary sheet.
- If time, graph the results and discuss as a class.
- Repeat for remaining monitoring days.

Teacher Follow-up

At the end of each field monitoring day, send the Daily Data Summary Sheet to KCPW Educator to review and use in Lesson 5, Data Summary and Analysis.

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Lesson 5 Data Summary and Analysis

Method
KCPW Educator-led; group work

Time Required
60 – 70 minutes in class

Objectives
- Explain why storm drains should be inspected regularly and cleaned as needed.
- Explain why school playgrounds and parking lots could impact water quality in local streams.
- Analyze the collected data to determine status of storm drains.

Materials
Provided by Classroom Teacher

- Daily Data Summary sheets for each monitoring day sent to KCPW Educator after each monitoring day
- Storm Drain Detectives Recording Booklets used by students during project, 1 per student
- Copies from provided blackline master of:
    - Storm Drain Detectives Analysis Sheet, 1 per student

Provided by KCPW Educator

- A class summary of all monitoring results for each storm drain based on Daily Data Summary sheets sent by teacher.
- Example graphs of free space results to show students.

Procedures - Classroom Teacher
- Send the Daily Data Summary sheets for each monitoring day to the KCPW Educator prior to spring break.
- Arrange a day after spring break with the KCPW Educator to return to class for data summary and analysis.
- Prior to arrival of KCPW Educator, group students in their Storm Drain Detectives teams.

Procedures – KCPW Educator

- Distribute Storm Drain Detectives Analysis sheet, 1 per student.
- Review the Investigative Question with students and have them record it on their Storm Drain Analysis sheet.
- Remind students of what we want to ultimately do:
    - use science ideas to protect Earth's resources by communicating information we have learned during our project to the school and/or district maintenance staff so they know whether or not the drains at the school need maintenance.
- Share the class summary of the monitoring results for each team/storm drain with the class and discuss the following. NOTE: This discussion will serve as student evidence to support their claim.
    - MAP: Put up the map and number storm drains correctly
    - Show the overall data summary and discuss
    - Are there any trends?
    - Are there any patterns?
    - Did lower free space correspond with anything else?
    - Were there any major weather events – snow, heavier than normal rain?
    - MAP and Data Summary: Does one drain's free space appear to be connected at all with any others? Does location matter?
    - What else do students come up with?
- Claim: Ask students how they would answer the Investigative Question--what is their claim? Have them capture their ideas for this on their Storm Drain Detectives Analysis sheet. (Our storm drains are well maintained/could use some help/need to be cleaned, etc.)
- Evidence: What is our evidence to support this claim? Review what was discussed when looking at the class summary.
- Have students capture their ideas under evidence on their Storm Drain Detectives Analysis sheet.
- Data Presentation: How can we present this data?
    - Have students work in groups to brainstorm how to present:
        - individual storm drain data.
        - overall class data. Since this is a system, each drain is dependent on the other, so rather than just clean one drain, maintenance usually cleans the entire system.
    - Come back together as a group and share ideas. How many came up with a bar graph, line graph, etc.
    - Have students capture ideas on their Storm Drain Detectives Analysis sheet.
    - Share graphs created by KCPW Educator with class data.

- Reasoning: What is Our Reasoning? How does the evidence support your claim? Examples:
    - We don't feel the system needs to be cleaned at this point because:
        - although there is some trash, it is not excessive and not interfering with function
        - pipes do have some sediment in them, but it does not appear to be interfering with water flow
        - none of the storm drains had less than 6" of free space, so they do not need to be cleaned
    - We feel the system needs to be cleaned at this point because:
        - state how many storm drains have less than 6" free space
        - any other evidence that supports cleaning the system
    - Have students capture their ideas on their Storm Drain Detectives Analysis sheet.
- Save students' Storm Drain Detectives Analysis sheets for use in Lesson 6, Communicating Results.

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Lesson 6 Communicating Results

Method
Teacher led; individual or group work, depending on learning targets

Time Required
Several hours over multiple days to draft and finalize letter

Objectives
- Summarize findings with a claim, supporting evidence, and reasoning
- Communicate their results:
  - in the form of a letter to the school's or district's maintenance staff
  - to their parents through "A Note for Home"

Materials
Provided by Classroom Teacher

- Completed copies of Storm Drain Detectives Analysis Sheet
- Copies from provided blackline masters of:
  - A Note for Home, 1 per student
- Computer or draft paper
- Writing guidelines for the class

Procedures – Classroom Teacher

Letter
- Have students use the ideas they recorded on their Storm Drain Detectives Analysis sheet to communicate in the form of a letter to the school's or district's maintenance staff. The letter should summarize their findings about the current status of the school's storm drains and include, at a minimum:
  - The investigative question they were trying to answer
  - Their claim, supported by their evidence and reasoning
- Letters can be written as a team or as individuals depending on your learning targets.

NOTE: This letter provides multiple opportunities for the summative assessment of NGSS and CCSS standards.

Home Connections

- Distribute A Note for Home and review with students.
- Model how to create the diagram with labels for your students.
- Students can complete this independently or in their storm drain teams.
- Have students share this document at home.

School Connections

- As an extension, students can write a short story to share with younger students in the school. It could be from the perspective of a water drop or some other character and include:
    - information about the school's stormwater system.
    - what a storm drain is.
    - where the water goes once it goes down a storm drain.
    - what can happen to litter or pollutants left on the ground when it rains.

Lesson 7 Revisiting the Probe

Method
Teacher led

Time Required
30-60 minutes

Objectives
- Explain where water goes once it goes down a storm drain based on evidence and reasoning from information learned throughout this project.

Materials
Provided by the classroom teacher:

- Student-completed copies of the Probe, Where is This Water Going? From Lesson 1
- Poster paper summary of student Probe answers and reasoning, posted for class to see

Procedures
- Revisit the probe Where is This Water Going? given in Lesson 1.
- Have students review their initial response to the probe and ask them if they have any new thinking they would like to capture or any new questions.
- Explain to students that, just like scientists never erase any of their notes—they might become important evidence later—they won't be erasing their earlier notes but using the same copy of the probe they used in Lesson 1. It's not about getting the "right answer"; it's about capturing the thinking at the time.
- To show their different thinking, students can:
    - draw a line where their thinking left off last time (a "line of learning") and continue with their current thinking. OR
    - add new information in a different color pen or pencil.
    - add a date to each entry, if desired
- Lead a class discussion on how student learning and understanding changed from the first day of the project to now. Concepts to make sure students understand:
    - Stormwater runoff or runoff is water that runs across the ground after a rainstorm. It can pick up pollutants left on the ground and wash those pollutants into the nearest body of water—streams, lakes and Puget Sound.
    - Storm drains collect water after a rainstorm, directing it to the nearest body of water and away from roads and buildings to avoid or minimize flooding.

  - Storm drains collect water, but they also can collect trash, sediment (dirt, sand, rocks) and pollutants in the sump at the bottom of the drain, so storm drains need to be cleaned periodically.
  - Storm drain systems are usually made up of several storm drains that are connected by pipes underground. The system can also include other parts like a detention or retention pond.
  - Too much sediment in a storm drain can
    - reduce the amount of water that can be held in a storm drain
    - get washed into pipes, potentially clogging the pipe
    - get washed into streams and be suspended in the water, potentially clogging the gills of aquatic life like salmon
- At this point in the unit, this probe could be used as a summative assessment.

Teacher Follow up

- Send updated copies of the probe to the KCPW Educator. Copies can be scanned and emailed or copied and mailed. This data helps to improve the school programs provided by Kitsap County.

NOTE: Revisiting the probe can give you and your students valuable information about their conceptual development toward a learning target. In the case of this probe, do students understand how a storm drain system works? Do they understand other information they have learned throughout their Storm Drain Detectives investigations? Do they understand how the science ideas behind storm drains are used to protect their local resources and environment?.

Blackline Masters

A Note for Home

Adult Volunteer Guidelines

Daily Data Summary

Probe: Formative Assessment

Science Door Sign

Storm Drain Detectives Analysis Sheet

Storm Drain Detectives Instruction Book

Storm Drain Detectives Recording Book

Storm Drain Photo

Task 5: Measure Depth of Storm Drain Sump

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A Note For Home

The Kitsap County Stormwater Program has been working with our classroom to learn ways we can use science ideas to protect our local water.

Our Investigative Question--what we were trying to answer.

What we observed.

What we learned.

How we shared what we learned.

A STORMWATER EDUCATION LESSON

Storm Drain Detectives

This is a diagram with labels of the storm drain I investigated

Ways we can help at home include picking up pet waste, washing our car at a car wash or on the grass, preventing car leaks, keeping tires properly inflated, and not overusing lawn and garden chemicals. These activities by themselves may not be a problem. However, since all the water drains to the same bodies of water the effect of these activities together can add up to a pollution problem. If you have any questions or would like more information, please contact Kitsap1 at 360-337-5777.

Your Storm Drain Detective, _____

Student Name

Storm Drain Detectives
Adult Volunteer Guidelines

Thank you for being an adult volunteer with the Storm Drain Detectives project. The students could not do this project without your support. Provided below is a general description of the project and what you may be doing as an adult volunteer.

Summary of Project

Students will be learning about stormwater, the stormwater system on the school property, and will be monitoring the storm drains on the school property by measuring the sediment and using observation skills to note any potential pollutants around their drain. An educator from Kitsap County Public Works (KCPW Educator) will be providing training to students and adult volunteers. Monitoring will occur once per month for at least 3 months.

Time Commitment

At least 2-3 hours each day, depending on the size of the class and the field monitoring option chosen by the teacher. Includes one day in class and 3-5 monthly field monitoring days.

Adult Volunteer Responsibilities

- Follow all volunteer guidelines of the school
- Attend the class for Lesson 3, Model Storm Drain Inspection. Meet with the KCPW Educator after the lesson to walk the stormwater system on the school property.
- Attend 3-5 Field Monitoring Days.
- Dress appropriately for the weather.
- At each Field Monitoring Day, provide support to student group(s) to:
    - Identify who is doing what job
    - Help them identify that they have all the materials/equipment they need
    - Ensure students stay together as a group
    - Make sure students monitor the correct storm drain
    - Accurately follow steps in the Instruction Booklet
    - Help ensure each student has an opportunity to complete their job
    - Ensure the Recorder records the data accurately on the Recording Booklet
    - Be sure students stay safe while conducting monitoring (watch for vehicles, stay on sidewalks, etc.)
- Back in class, support students and the teacher to ensure:
    - All team members record the field data on their own recording booklet
    - As a team, students complete the Task 1, Back in Class calculations at the bottom of Page 2.

- The recorder records their team's data on the class Daily Data Summary sheet provided by the teacher as a sheet, poster, or electronically.

Field Monitoring Days

There are two suggested options for arranging Field Monitoring Days and volunteers. Check with the teacher to see which option will work for their class.

- **Single Volunteer; multiple teams pulled out from class**: One adult volunteer works individually with each storm drain team one day per month over 3-5 months to complete the monitoring for all teams. With this option, monitoring could take 2-3 hours, depending on how many teams, especially at the beginning. Time should be allotted the day after monitoring for all teams to work on their in-class calculations.

- **Multiple Volunteers; all teams monitor at once (full class field trip):** All storm drain teams have a separate adult volunteer. All volunteers come in the same day once per month over 3-5 months to monitor the drains with their team, so the whole class is outside at the same time. Once all teams return to class, provide time for teams to complete their in-class calculations.

Daily Data Summary - Storm Drain Detectives

After each monitoring day, enter your data into the form below for your group's storm drain. This will help in analyzing the results. There will be one sheet for each

* Rainfall data available at kpudhydrodata.kpud.org

School Name: _____

Teacher Name: _____

Field Work Date: _____

			Task 1	Tasks 2 and 3	Task 4 Observations
Storm Drain Number	Weather and Temp	Rainfall*	Amount of Free Space	Water flowing into or inside? Sediment seen in pipes?	Pollutants and/or Safety Issues Observed

RECOMMENDATIONS

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Name_____

Probe: Where Is This Water Going?

Three friends noticed water flowing into a storm drain in their school parking lot. They wondered where the water would go after it entered the drain. This is what they said:

Emma: " I think it goes somewhere to get cleaned."

Maddox: " I think it flows into the sewer system inside buildings."

Tatyana: " I think it goes out to streams and to Puget Sound."

Which friend do you agree with? _____

Describe your thinking. Explain the reason for your answer.

_____

_____

_____

_____

_____

_____

Questions I have:

_____

_____

_____

_____

_____

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Science Door

- Do I have my investigation materials?
- Do I know the directions for the investigation?
- Do I know the signal for returning to class?

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Storm Drain Detective_____

Storm Drain Detectives Analysis

Investigative Question: (What is the question we are trying to answer?)

Claim: (What is my response?)

Evidence: (What evidence did we find to support my response?)

My ideas for presenting my evidence: (Graphs, etc. Use other side to draft graphs and tables)

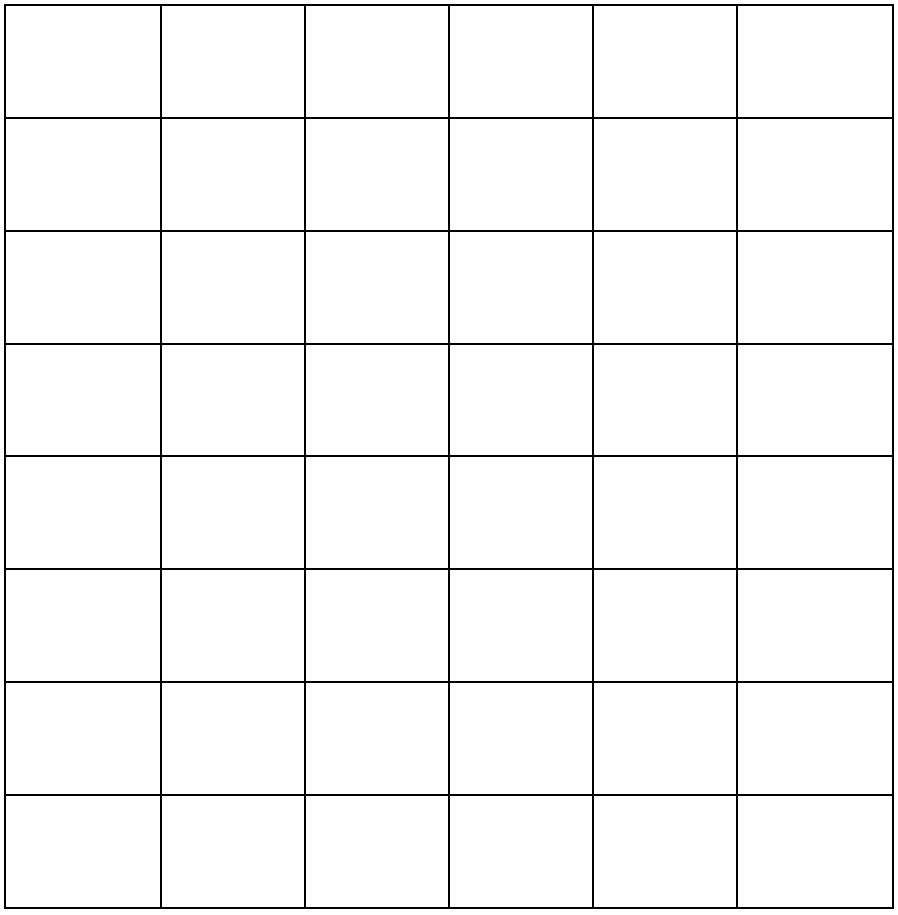
My reasoning: (How my evidence supports my response. Why is what I say true?)

Use the space below to draft a graph of your data. Be sure to include a title, labels for your x and y axis, and values for each axis (ex. Date, numbers, etc.). Make additional copies as needed.

_____

Title

Y-Axis Label



_____

X-Axis Label

STORM DRAIN Detectives

Instruction Booklet

Kitsap County Public Works
Stormwater Division

BEFORE YOU START

Assign Jobs: Decide who is going to do each of the following jobs: (These can rotate each time you monitor)

1. **Supervisor:** Makes sure steps are being followed properly. Shines flashlight into the storm drain as needed.
2. **Measurer:** Places marks; takes measurements with measuring tape.
3. **Inspector:** Puts the rod into the grate and moves as needed.
4. **Recorder - In the field:** Records evidence in the field.
   In class: Records evidence on the Daily Data Summary.
5. **Observer:** ALL. Looks for pollutants and trash in or around the storm drain.

NOTE:If there are 5 students in a group, split the Recorder job.

Check Equipment: Make sure your group has all the equipment you need.

4-6 safety vests (one for each person)
1 Flashlight
1 Clipboard with the Supervisor's Storm Drain Detectives Instruction Booklet
1 Clipboard with the Recorder's Storm Drain Detectives Recording Booklet
1 Pencil
1 Inspection Rod (may be in pieces to put together)
1 Measuring Tape
1 Marker
1 Map of the school's stormwater system

Recording Information

- The KCPW Educator will help you complete the *Investigative Question, School, Teacher, Detective Names, and Storm Drain Number* on the Recording Booklet Cover Sheet.
- Each monitoring day, complete the date , time, temp and weather. When recording rainfall, get the rainfall data for the day from Kitsap PUD's website *kpudhydrodata.kpud.org*.

TASK 1: Inspect the Storm Drain

Storm drains have storage space called a sump. It collects water, dirt and pollutants. Most storm drain sumps are 18" deep. Storm drains need to be cleaned when the sump is more than 60% full—usually less than 6" of free space. This way, the sediment and pollutants don't wash into waterways. Inspecting them lets us know when they should be cleaned.

Directions:
Complete the steps listed below to inspect your group's storm drain(s).

1. Assemble the inspection rod.
2. Put the inspection rod through the center of the storm drain grate. Hold it straight up and down and push all the way down until you hit the bottom.
3. Mark the rod where it comes out of the grate with the marker.
4. Pull the rod out of the water.
5. Push the rod down again. This time, stop as soon as you feel resistance from the dirt (sediment) in the drain. Remember to keep the rod straight.
6. Mark the rod where it comes out of the grate with the marker.
7. Pull the rod out of the storm drain.
8. Lay the rod on the ground. Measure the distance between the two marks. (make sure not to wipe off the marks) This is the amount of sediment that's in the bottom of the storm drain.
9. Record the amount in the Task 1 In the Field table on your Recording Booklet. Be sure to record on the correct date, include the unit of measurement, and indicate if you are using fractions, decimals or rounding to the Nearest Whole Number.
10. Repeat these steps a total of 3 times-once each in the center, left, and right. Record your results.
11. When you return to your classroom, complete the Task 1 Back in Class calculations.
12. If the average Amount of Free space is greater than or equal to 6", your team is done. If it's less than 6", ask your teacher for Task 5, "Measure the Depth of the Storm Drain Sump" and make arrangements to complete this task.
13. Continue with Tasks 2, 3 and 4.

TASK : 2, 3 and 4

Directions:
For each Monitoring Day:

1. Have the recorder for that day bring their copy of the instruction booklet and recording booklet, a clipboard and a pencil. (The rest of the team will record the evidence in their recording booklets back in class.)
2. Write monitoring day number (1, 2, 3, etc.) and the date.
3. Write "School" where the school is on the Task 2 & 3 storm drain picture and diagram.

Task 2: Outside the Storm Drain

1. Stand in a circle about a foot away from the storm drain.
2. Record your observations on the Task 2 storm drain picture.
   - Is there any water flowing into the storm drain? Use the key to show evidence of water flow into or around the storm drain. Where is it coming from? Is there a lot or a little?
   - If there is no water currently flowing, is there any evidence that water ever flowed into the storm drain? If yes, use the key to record the evidence.

Task 3: Inside the Storm Drain

1. Have the Supervisor point the flashlight into the storm drain.
2. Look for pipes on the sides of the drain.
3. Record your observations of the number of pipes and their location on the Task 3 storm drain diagram by putting an X in each circle where there is a pipe.
4. Look for water flowing into or out of the pipes. Note with a W on the diagram. Use an arrow next to the W to show the direction of flow.
5. Look for sediment (dirt and sand) IN each of the pipes and record with an S where found.

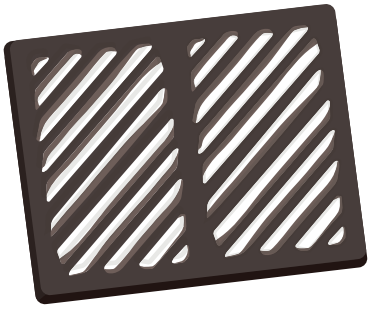
Key:

School: Indicates where the school is

→ :	Indicates water flow and direction	**X:**	Pipe in storm drain
≈:	Water flowing into storm drain	**S:**	sediment (dirt or sand) in pipe
E:	evidence of water flowing	**W:**	water in pipe

Task 4: What's Around the Storm Drain?

1. Observe the storm drain grate and the area about 5 feet around it.
2. Record pollution and debris on your recording sheet under Task 4: What's Around the Strom Drain?



RECORDING BOOKLET
Storm Drain Detectives

Investigative Question _____

_____

_____

School _____

Teacher _____

Detectives in the Group _____

Storm Drain Number _____

Team Name _____

Date:	**Time**:	**Today's weather Description** (sunny, cloudy, light rain, heavy rain, snow)	**Temp**:	**Amount of Rainfall** (from Kitsap PUD site *kpudhydrodata.kpud.org*)

TASK 1: Does the Drain Need to be Cleaned? Drain Inspection and Data Collection

IN THE FIELD

Use the chart below as you inspect your storm drain to collect the data you'll need back in class.

	Dates	*Example* *11/15/21*	Practice __/__/__	__/__/__	__/__/__	__/__/__	__/__/__	__/__/__
Measurement #		**Amount of Sediment (include unit of measure)** Circle one: fractions decimals round to nearest whole number						
	1 Center of drain	2 in						
	2 Left side of drain	3 in						
	3 Right side of drain	3 in						

BACK IN CLASS

On another sheet of paper, use the data you recorded above to complete the calculations below to determine whether or not your storm drain needs to be cleaned.

Average Amount of Sediment for each Date
(Total of 3 Measurements for each date ÷ 3)

	Dates	*Example*	Practice					
		(2+3+3) ÷ 3 = ***2 2/3***						

Amount of Free Space for each Date

18 inches — _____ = _____

Average Sump Depth — Average Amount of Sediment — Amount of Free Space

	Dates	*Example*	Practice					
		18 – 2 2/3 ***= 15 1/3***						

Does the Drain Need to be Cleaned?
If the Free Space is ≥ 6" = No
If the Free Space is < 6" = Yes,. Ask for Task 5

		No *15 1/3 ≥ 6*						

TASK : 2, 3 and 4 Record Your Observations for each Monitoring Day

Key:

School: Indicates where the school is

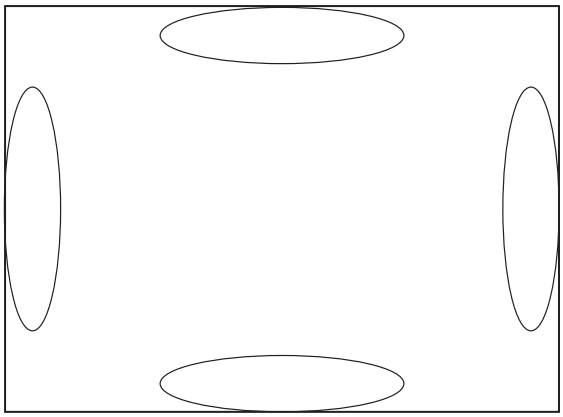
→ :	Indicates water flow and direction	**X:**	Pipe in storm drain
≈:	Water flowing into storm drain	**S:**	sediment (dirt or sand) in pipe
E:	evidence of water flowing	**W:**	water in pipe

Monitoring Day #_____

Date _____

Task 2: Outside the Storm Drain

Task 3: Inside the Storm Drain



Task 4: What's Around the Storm Drain?: What do you observe near or 5 feet around the storm drain. Specify what: trash, grass clippings, leaves, oil spots, pet waste, etc.

_____

_____

Key:

School: Indicates where the school is

→ : Indicates water flow and direction

≈: Water flowing into storm drain

E: evidence of water flowing

X: Pipe in storm drain

S: sediment (dirt or sand) in pipe

W: water in pipe

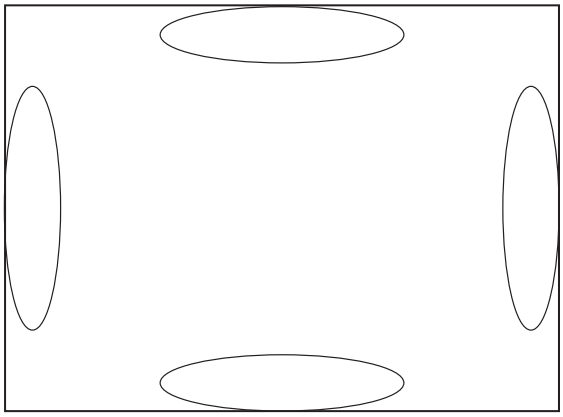
Copy this page for additional monitoring days

Monitoring Day #_____

Date _____

Task 2: Outside the Storm Drain

Task 3: Inside the Storm Drain



Task 4: What's Around the Storm Drain?: What do you observe near or 5 feet around the storm drain. Specify what: trash, grass clippings, leaves, oil spots, pet waste, etc.

_____

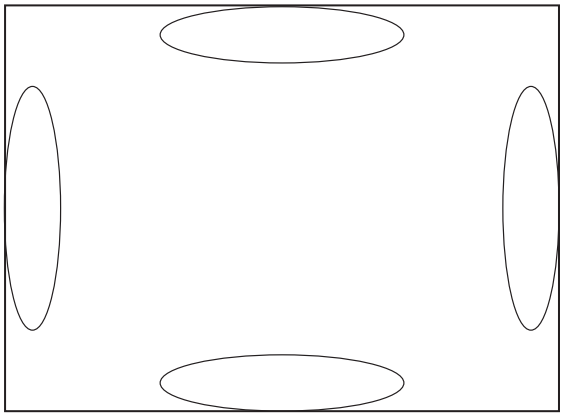
_____

Monitoring Day #_____

Date _____

Task 2: Outside the Storm Drain

Task 3: Inside the Storm Drain



Task 4: What's Around the Storm Drain?: What do you observe near or 5 feet around the storm drain. Specify what: trash, grass clippings, leaves, oil spots, pet waste, etc.

_____

_____

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Task 5: Measure Depth of Storm Drain Sump *(if needed)*

NOTE: MAKE A COPY OF THIS PAGE TO RECORD RESULTS

If the amount of free space in any of your drains is less than 6", follow the steps below to determine the actual sump depth. If it is 18" or less, please notify your school or district maintenance staff that it needs to be cleaned.

1. Push the inspection rod all the way down until you hit the bottom.
2. Mark the rod where it comes out of the storm drain grate.
3. Pull the rod out of the water.
4. Put the rod down into the storm drain again. This time, stop at the bottom of the lowest pipe.
5. Mark the rod where it comes out of the storm drain grate.
6. Pull the rod out of the storm drain.
7. Lay the rod on the ground. Measure the distance between the marks.
8. Record the amount in the table below.
9. Repeat these steps three times and average your results.
10. Complete the questions below the table.

Date: _____ Storm Drain #: _____

Measurement #	Depth of Storm Drain Sump (include unit of measurement)
1	
2	
3	
Average Depth - Storm Drain Sump	

Does the storm drain need cleaning? (check the correct line)

_____ Average Depth of Sump ≥ 18" – No cleaning is required.

_____ Average Depth of Sump is < 18" – Cleaning is required. Notify school staff.

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Vocabulary and Resources

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Vocabulary

The following vocabulary words are compiled from KCPW program goals and OSPI NGSS Vocabulary used in the Washington Comprehensive Assessment of Science (WCAS) in grade 5, in alignment with this unit. Those words with a * are also on the WCAS vocabulary list.

- Catch basin: another name for a storm drain. It collects rainwater that runs across the ground after a rainstorm and directs it to the nearest body of water with little or no treatment.
- Conclusion*: your final thoughts and words summarizing your project.
- Data*: information collected and used to help make decisions.
- Decrease*: make something smaller in size or quantity.
- Evidence*: something that gives proof or reason to believe.
- Groundwater*: water held underground in soil or pores and crevasses in rock. It completely fills the air spaces between rock and soil particles.
- Impact*: a strong and powerful effect.
- Increase*: make something get larger in size or quantity.
- Information*: facts provided or learned about something or someone.
- Input*: what is put in, taken in, or operated on by any process or system.
- Investigation*: to study by close examination and structured inquiry.
- Measure*: determine the size, amount, or degree of something by using a tool or device marked with standard units or by comparing it with an object of a known size.
- Model*: a three-dimensional representation of a person, thing or proposed structure, typically on a smaller scale than the original.
- Observation*: the act or an instance of perceiving the environment through one of the senses; a comment or remark.
- Output*: the amount of something produced by a person, machine, or industry.
- Pollution*: the presence of a substance or thing that has harmful or poisonous effects on the environment.
- Pollutants: something that makes another thing, especially water or the atmosphere, physically impure or unclean.
- Precipitation*: rain, snow, sleet or hail that falls to the ground.
- Quantity*: a certain, usually specified amount of number of something.
- Reduce*: make smaller or less in amount, degree, or size.
- Research*: studious inquiry or examination to collect information about a particular subject.
- Resistance: the slowing or stopping effect exerted by one material thing on another.

- Runoff: The draining away of water and the substances carried in it from the surface of an area or land. Also known as stormwater or stormwater runoff.
- Sediment*: small, solid particles of material from rock or organisms which are moved by water or wind resulting in erosion and deposition.
- Storm drain: another name for a catch basin. It collects rainwater that runs across the ground after a rainstorm and directs it to the nearest body of water with little or no treatment.
- Stormwater: The water and substances carried from the surface after a storm event. Also known as runoff or stormwater runoff.
- Stormwater System: a series of pipes, storm drains, and other structures that collect and direct runoff from the highest points on the land down to the receiving body of water

Resources

The following resources provide additional opportunities to develop student understanding of the concepts learned during their participation in this project.

- Performance Tasks
    - Stormwater Pollution
    - Stormwater Engineers

  Included with this unit are two ELA Performance Tasks that are a good fit for supporting the CCSS ELA skills students need to access the science concepts worked with in Storm Drain Detectives. These performance tasks are included with permission from Pacific Education Institute based in Olympia, Washington.

  These performance tasks use environmental problems or issues as the context while students apply English language arts (ELA) skills of reading, writing, and researching to complete the work. Performance tasks are tailored to assist educators in integrating locally relevant, complex texts with the Next Generation Science Standards (NGSS) and Common Core while providing frameworks for constructing meaningful field experiences for students.

  Feel free to use these Performance Tasks throughout your Storm Drain Detective investigations to provide additional research for your work or use them after the investigations to continue to develop your students' conceptual understanding of the concepts addressed.

  For information about Pacific Education Institute and for access to their resources visit their website at pacificeducationinstiute.org.

- Good Fit Books
    - Contact your school librarian for trade book suggestions that support the learning targets of this investigation. Some examples are:
        - All the Way to the Ocean by Joel Harper (available for loan from KCPW Educator)
        - You Wouldn't Want to Live Without Clear Water by Roger Canavan
- *Puget Sound Starts Here* website: Resources for educational information about stormwater and Puget Sound

- Good Fit Videos
  - **Bringing Clear Creek Back to Life, 2018**. Overview of how development in Silverdale impacted Clear Creek and recent projects completed to restore the creek and habitat. *NOTE: The Clear Creek Floodplain Project area is where students raising salmon as part of the Clear Creek Salmon in the Classroom program will release their salmon.*
    https://www.youtube.com/watch?v=OAwakWFGcMs&list=PLQJx9SWWfqRph9MGU29BQPyXeLHvkWXbq&index=5.
  - **Manchester Stormwater Park, 2016.** This public park provides water quality treatment of stormwater for approximately 100 acres of the Manchester community, improving water quality for salmon and other aquatic life.
    https://www.youtube.com/watch?v=k6CQbin4czU&list=PLQJx9SWWfqRph9MGU29BQPyXeLHvkWXbq&index=6
  - **Stillhope Productions**. John Williams is a local videographer. His short videos on nature and the environment are a great learning resource for you and your students. *https://vimeo.com/stillhope/videos/page:1/sort:date*. A few videos geared specifically for the younger age group include:
    - **Is This Where Puget Sound Starts?**, 4 minutes. Ron Hirschi, local biologist and author, explores 2 creeks in Poulsbo.
      https://vimeo.com/98827239
    - **Who Uses the Rain?**, 4 minutes. See how water flows from Klahowya Secondary school in Central Kitsap down to Chico Creek and how animals and runoff have an impact on the stream.
      https://vimeo.com/98827663
    - **Who Swims in the Rain?**, 4 minutes. Students from Olalla Elementary School share ways to protect streams like Olalla Creek,
      https://vimeo.com/98826947.
  - **The Hidden Treasures of Kitsap County, 2008.** Join Community Forester Jim Trainer to learn about trees of Kitsap County and their cultural and habitat importance.
    https://www.bing.com/videos/search?q=jim+trainer+bremerton+video&docid=607998383985132390&mid=8CF35F011799237A664A8CF35F011799237A664A&view=detail&FORM=VIRE

Performance Task: Stormwater Pollution

PART 1: RESEARCH

Student Directions:

Your Task:

The PTA at your school is sponsoring a Stormwater Information Night to help protect our local waters. They have asked each child to write an essay explaining what stormwater is, how stormwater gets polluted, and two actions we can take to keep the stormwater clean. You will read an article, view a video, and study a diagram to build your knowledge of stormwater pollution. Then you will write an essay to share at the Parent Information Night.

Steps you will be following:

To plan and write your essay, you will do all the following:

1. Read an article and study a diagram.
2. Watch one video.
3. Answer three questions about the sources.
4. Plan and write your essay.

Directions for beginning:

You will now watch the video and read the article and the diagram. Take notes because you may want to refer to your notes while writing your essay. You can look at the sources as often as you like.

Source Information:

Article: *Let's Visit Stormville!* Sources: Dallas Stormwater Education for Kids, Chittenden County Vermont Regional Stormwater Education Program, City of Bellevue Stormwater Education Program

Illustration: *The Culprits* Drain Ranger Curriculum Resource

Video: *Fifteen to the River: Explaining Stormwater Runoff* (1:49)
https://youtu.be/c_6UkHuHGGA

Use the notetaking graphic organizers to take your notes on both sources.

My Notes

Source	What Stormwater is	How Stormwater gets polluted	What we can do to keep the water clean
Video: Fifteen Minutes to the River: Explaining Stormwater Runoff			
Article: Let's Visit Stormville!			

My Notes

Source	What Stormwater Is	How Stormwater gets polluted	What we can do to keep the water clean
Illustration: The Culprits			

Your notes will not be scored. You may use them to answer questions and to write your essay.

Let's Visit Stormville!

What is Stormwater?

Washington is called the Evergreen State for a reason. Over half of the land in our state is covered by forests. When rain falls in a forest, most of the water is soaked into the ground, evaporated back into the air, or absorbed by trees.

The forest acts like a sponge, capturing and holding the rainwater before it can enter streams and lakes. But when forests are replaced with hard surfaces, like streets, buildings, and parking lots, the water from the rain runs off because it can no longer soak into the ground.

This rain that does not soak into the ground is called stormwater runoff. Stormwater runoff flows into storm drains, which carry the stormwater in pipes and ditches to local streams, lakes, and Puget Sound. Most of the time, the stormwater goes into these natural bodies of water without being treated.

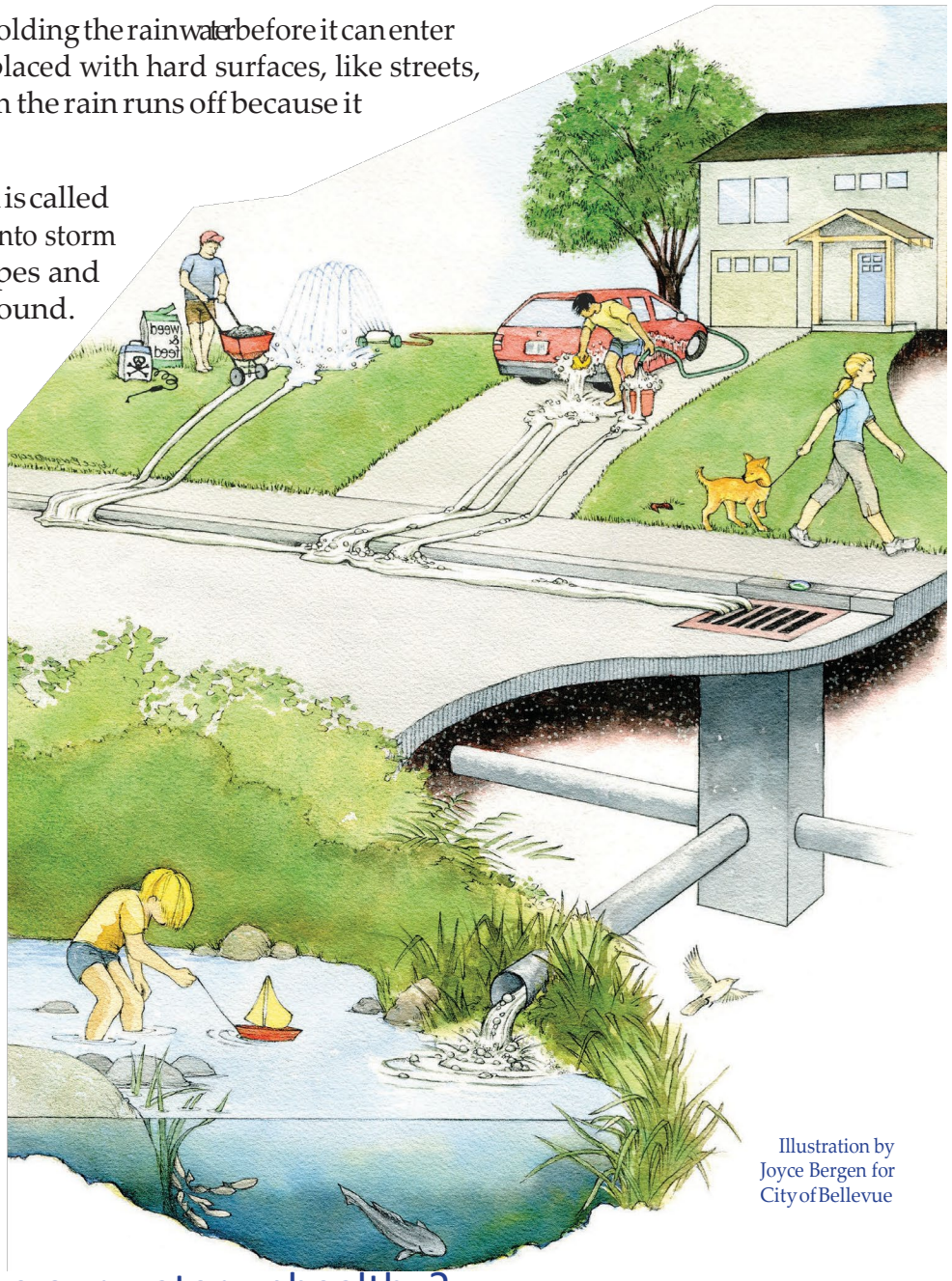


Illustration by Joyce Bergen for City of Bellevue

What is Stormwater Pollution?

As stormwater flows over land, it can pick up pollution. Some of this pollution we can see, like trash, oil, and dirt. Other pollutants we can't see like chemicals sprayed on lawns, bacteria from pet waste, and chemicals leaked from cars and trucks.

Since stormwater runoff is not treated, the pollution in stormwater can enter directly into nearby streams, lakes, or Puget Sound. The pollution can then harm animals in the water or make playing and swimming in it unsafe for people.

75% of all pollution in Puget Sound comes from stormwater runoff that starts in our neighborhoods.

What types of pollution can get into storm drains and make our water unhealthy?

To help us learn about the different types of stormwater pollution, let's visit Stormville!

Stormville is a typical town located near a beautiful lake. The people in the picture live in Stormville and are taking care of their home and car, but they may not realize that they are doing many things that can make water unhealthy. Look at the picture above. What do you see that might cause stormwater pollution?

Let's learn about three different types of stormwater pollution: car washing on pavement, pet waste, and yard chemicals.

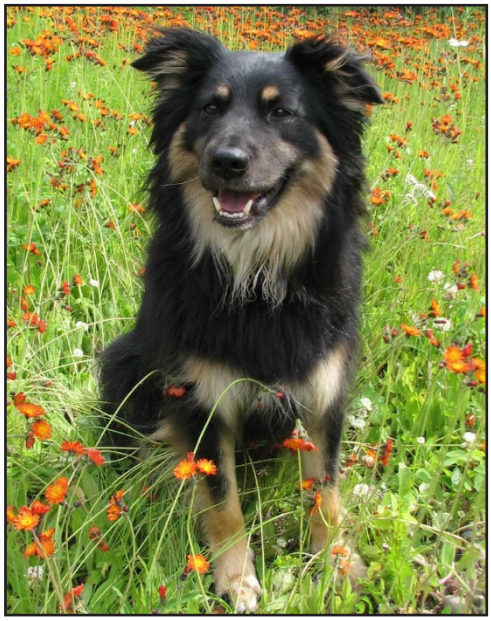
Car Washing on Pavement

When you wash the family car on pavement, the soap, oil, and other pollutants are washed into the storm drain and directly into our waterways.

Soap, oil, and other pollutants in the wash water are harmful to fish and other animals that live in the water. These pollutants can destroy the protective covering on fish and injure or even kill them and their eggs. Even biodegradable soap pollutes water because it needs to go through soil to properly break down.

Here's what you can do!

Suggest that your family take the car to a commercial car wash. These facilities filter the dirty wash water and send it to the sewer treatment plant to be cleaned.



Pet Waste

No one wants to swim in poop! Dog poop carries harmful bacteria and diseases that can make people very sick. Beaches are often closed because bacteria from poop has made the water unsafe to swim.

When it rains, pet waste that is left on the ground melts into the stormwater. The polluted stormwater flows into nearby storm drains and then into waterways like streams, lakes, or Puget Sound. Too much poop in the water means people can't swim, walk, or play in the water and they can't harvest shellfish to eat.

Here's what you can do!

Scoop the poop, put it in bag, and place it in the trash. When walking your pet, take bags with you to clean up their poop.

Yard Chemicals

Many people use fertilizers and pesticides to improve their green lawns and flower gardens. However, stormwater runoff can carry these chemicals into storm drains and waterways.

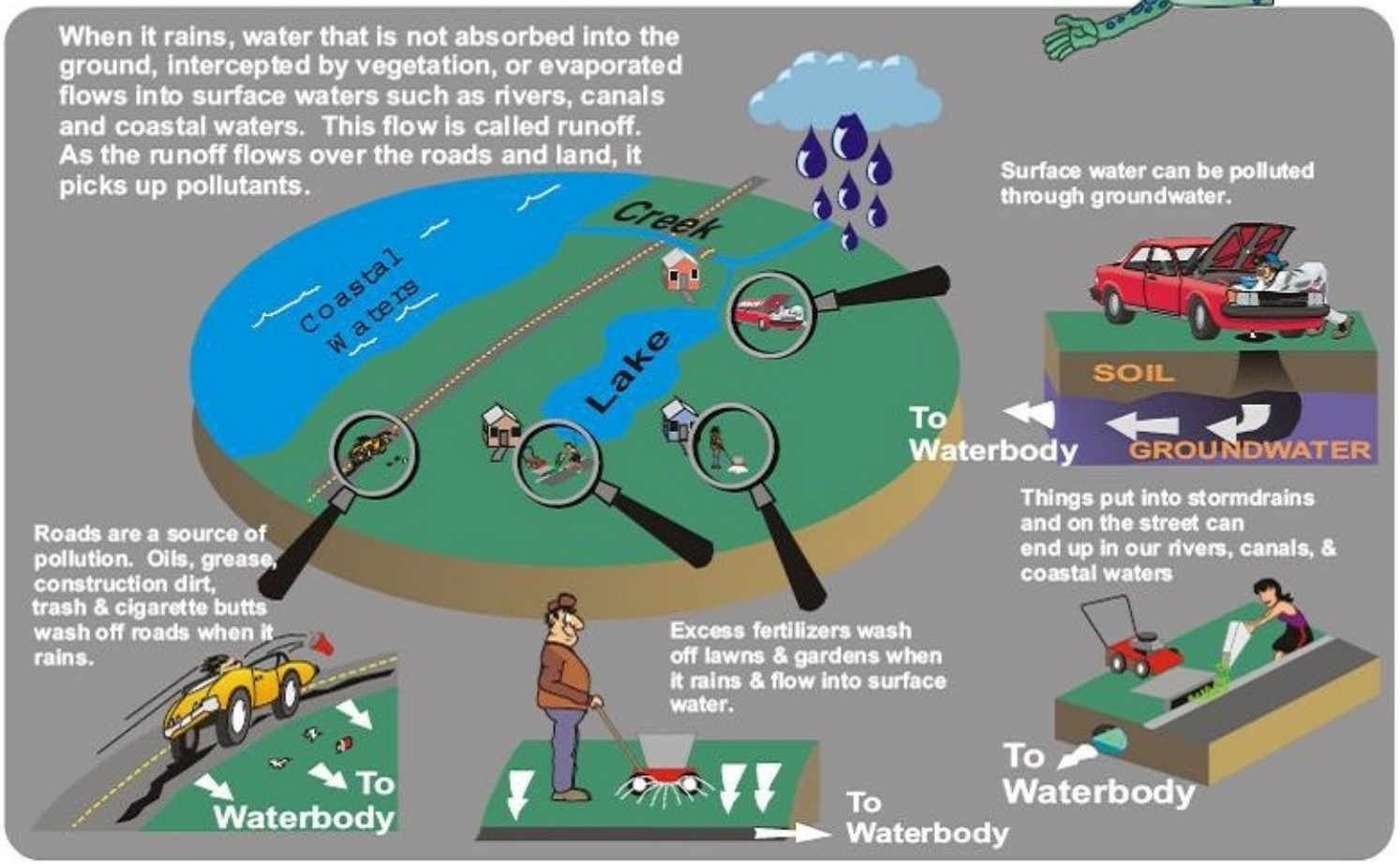
People use pesticides to kill unwanted plants and bugs in their yards. But when pesticides get into a lake or stream, they harm good fish and wildlife too.

Here's what you can do!

Ask the adults in your household to only use yard chemicals when necessary. Ask them to read the labels on yard care products and follow the instructions. Also, make sure that any yard chemicals are put away correctly so that they can't leak or spill.

Thanks for visiting Stormville! Take what you have learned from this visit and use it to make good decisions that protect the health of our rivers, lakes, and streams. Thank you for helping stop stormwater pollution!

The **CULPRITS**



Performance Task: Stormwater Pollution

Questions

1. What is stormwater runoff? Be sure to name your source. ***(Claim 4, Target 2)***

2. What do you learn in the article about types of stormwater pollution that you do not learn in the diagram? (***Claim 4, Target 3)***

3. Defend this statement using information from two of the sources. Be sure to name your sources. *"We can make a difference in keeping our water clean and healthy."* ***(Claim 4, Target 4)***

Part 2: FIELD INVESTIGATIONS

Teachers are encouraged to have students to map the school campus, looking for possible problem areas for stormwater pollution. Project WET offers lessons for both a rainy-day hike on the school campus and a fair-weather hike. These lessons are also included in the Grade 3 Rain Garden curriculum available for download on the PEI site.) Students look for where water collects and think about possible ways to redirect the water, so it is filtered by grass or other vegetation before entering the storm drains. They can also explore a variety of stormwater solutions like rain barrels and pervious concrete.

Discussion questions might include the following:

- What is Stormwater and how does it get polluted?
- Where does the stormwater go on our school campus?
- What are actions we can take to reduce stormwater pollution?
- How might we inform the community of actions we can take to keep our waters clean?

In addition, teachers may want to consider one or more of the following field investigations:

- Drain Rangers-Engineering Design: http://www.pugetsoundstartshere.org/drain-rangers
- FI-Soils as Sponges: http://www.pltwa.com/field-study-investigations.html
- Aquatic WILD: Where Does Water Run? P44
- Seattle Utilities: http://www.seattle.gov/Util/EnvironmentConservation/Education/index.htm
- Tahoma SD Grade 5 Stormwater Curriculum: Mapping Our School Campus
- Stormwater Solutions: pg. 85 (available on the PEI website)

Other ideas for field investigations:

Performance Task: Stormwater Pollution

PART 3: ESSAY

Student Directions:

You will now have time to review your notes and sources, plan, draft, and revise your essay.
While you may use your notes and refer to the sources, you must work on your own. Now read your assignment and the information about how your essay will be scored, and then begin your work.

Your Assignment:
The PTA at your school is sponsoring a Stormwater Information Night to help keep our local waters healthy. They have asked each child to write an essay explaining what stormwater is, how stormwater gets polluted, and two actions we can take to keep the stormwater clean. Write your essay using information from the three sources, naming the sources you use. Your essay will be shared at the Parent Information Night.

How your essay will be scored:

The people scoring your essay will be assigning scores for

1. ***Statement of Purpose/Focus*** – how well you clearly state and maintain your controlling idea or main idea.
2. ***Organization*** – how well the ideas progress from the introduction to the conclusion using effective transitions and how well you stay on topic throughout the essay.
3. ***Elaboration of Evidence*** – how well you provide evidence from sources about your topic and elaborate with specific information.
4. ***Language and Vocabulary*** – how well you effectively express ideas using precise language that is appropriate for your audience and purpose.
5. ***Conventions*** – how well you follow the rules of usage, punctuation, capitalization, and spelling.

Now begin work on your essay.
Manage your time carefully so that you can:

- Plan your essay
- Write your
- Revise and edit for a final draft

Organizing My Essay: Stormwater Pollution

Introduction	
What Stormwater is	
How stormwater gets polluted	
What we can do to keep stormwater clean? Idea #1	
What we can do to keep stormwater clean? Idea #2	
Conclusion	

Scoring Notes: Stormwater Pollution

Question 1: What is stormwater runoff? Be sure to name your source. (Claim 4, Target 2)

	ANALYZE / INTEGRATE Information Rubric Claim 4, Target 2
	• The response gives sufficient evidence of the ability to gather, analyze and integrate information within and among multiple sources ofinformation.
	• The response gives limited evidence of the ability to gather, analyze and integrate information within and among multiple sources of information.
	• A response gets no credit if it provides no evidence of the ability to gather analyze and integrate information within and among multiple sources of information.

Scoring Notes

Let's Visit Stormville!: Rain that doesn't soak into the ground. The runoff carries pollutants into pipes that lead to the sea.

The Culprits: Rainwater that is not absorbed into the ground, intercepted by vegetation, or evaporated. This water flows into our streams, lakes and ocean carrying pollutants.

The Video: Rain landing on our pavements and flows into our storm drains. This water picks up pollutants.

2---point Response

- Defines stormwater runoff as rainwater that is not absorbed into the ground and carries pollutants to our lakes, rivers, and ocean.
- Cites at least one of the three sources.

1---point Response

- Correctly defines stormwater runoff
- Does not name a source.

0---point Response

- Incorrect definition or Off Topic

Sample 2 Point Responses:

The meaning of stormwater runoff is rain that doesn't get soaked into nature. The stormwater flows and picks up pollution that goes into pipes and storm drains and is sent to lakes and rivers. The article says about stormwater that "…rain that does not soak into the ground is called Stormwater runoff" Source: Let's Visit Stormville! Pg.1

Stormwater runoff is when rain falls, and it collects pollutants, pesticides, animal waste, salt, oil, and litter. This stormwater runoff goes into storm drains where it travels to underground pipe that goes directly into rivers. I found his information from the video "It takes 15-30 min. from the pipes to the river."

Sample 1 Point Responses:

A stormwater runoff is when water does not get soaked up and gets on dirty surfaces. And it picks up all the pollution around it. Then it gets into pipes. The stormwater with pollution gets into lakes, rivers, or even the ocean. Which makes it very unhealthy to swim in it for humans and fish. (Does not name the source of the information)

A stormwater runoff is a rain that does not soak into the ground. Stormwater goes into storm drains that carry pipes and ditches to local streams like lakes and Puget Sound. Storm water runoff flows into storm drain and travels into rivers. (No mention of carrying pollutants.
Source is not named.)

Sample 0 Point Responses:

A Stormwater runoff are like canals, ditches, or storm drains. (Let's Visit Stormville!) (Culprits) (Fifteen Minutes to the River) (Incorrect definition)

Soap, oil, and other pollutants in the wash water are harmful. Fish and other animals that live in the water. These pollutants can destroy the protective covering in fish and injure or even kill them. And they are animals that live in the waters. (Off topic response)

Scoring Notes: Stormwater Pollution

Question 2: What do you learn from the article about types of stormwater pollution that you don't learn in the diagram? *(Claim 4, Target 3)*

	EVALUATE Information/Sources Rubric Claim 4, Target 3
	• The response gives sufficient evidence of the ability to evaluate the credibility, completeness, relevancy, and/or accuracy of the information and sources.
	• The response gives limited evidence of the ability to evaluate the credibility completeness, relevancy, and/or accuracy of the information and sources.
	• A response gets no credit if it provides no evidence of the ability to evaluate the credibility, completeness, relevancy, and/or accuracy of the information and sources.

Scoring Notes

Pet waste is a major source of pollution. Car washing

can also pollute.

2---point Response

Names either pet waist or car washing as another source of stormwater pollution.

1---point Response

Names a difference between the two sources, but not focused on types of stormwater pollution.

0---point Response

No reference to differences in the two sources and/or off topic Inaccurate

information

Sample 2 Point Responses:

Types of stormwater pollution that I learn in the article but are not mentioned in the diagram are bacteria in pet waste and chemical results made from car washing. Pet waste bacteria that is not picked up can end up being taken by stormwater runoff and go to natural bodies of water. Car washes can drop soap, oil, and other things which can end up in rivers, lakes, and streams from stormwater runoff.

We learn about pet waste in the article. The diagram does not talk about pet waste. (Let's Visit Stormville! Pg.2) We also learn how to help or prevent it from happening.

You learn that water also picks up chemicals that we can't see like chemicals sprayed on lawns and bacteria from pet waste and chemicals leaded from cars and trucks.

Sample 1 Point Responses:

What I learned in the article about types of stormwater pollution that I didn't learn in the diagram was that stormwater pollution is 75% of all pollution in Puget Sound comes from stormwater runoff that starts in our neighborhoods. (Let's Visit Stormville! Pg. 1) (Names a difference between the two sources but not related to types of stormwater pollution.)

In the article "Let's visit Stormville!" there are headings that teach us how we can prevent pollution in stormwater runoff. In "The Culprits" it shows us a diagram about how stormwater gets polluted, but they don't show how to prevent it. (Accurate comparison but not related to types of stormwater pollution.)

Sample 0 Point Responses:

What I learned in the article about types of stormwater pollution was that the three different types of stormwater pollution are car washing on pavement, pet waste, and yard chemicals and what I didn't learn in the diagram is that how storm water gets polluted. (No comparison of types of pollution named in both sources; inaccurate information about diagram which does show how stormwater is polluted.)

In the diagram the same types of stormwater pollution is pesticides, litter, animal wastes, salts, oil. I learned that many of them pollute our lakes and rivers. (No comparison between sources.)

Scoring Notes: Stormwater Pollution

Question 3: Defend this statement using information from two of the sources. Be sure to name your sources. *"We can make a difference in keeping our water clean and healthy."* (Claim 4, Target 4)

	USE EVIDENCE Rubric Claim 4, Target 4
	• The response gives sufficient evidence of the ability to cite evidence to support arguments and/or ideas.
	• The response gives limited evidence of the ability to cite evidence to support arguments and/or ideas.
	• A response gets no credit if it provides no evidence no evidence of the ability to cite evidence to support arguments and/or ideas.

Scoring Notes

Article: Wash your car at a car wash; scoop pet waste; use only what you need for lawn chemicals

Video: Use rain barrels; create more green space; use porous pavement; limit the amount of dense, impermeable surfaces; put in less pavement

Diagram: We can infer the following: Avoid using too much lawn fertilizer; keep roads clean by not littering and picking up trash; don't put grass clippings into storm drains; don't work on your car on grass because oil can leak out and pollute the ground water.

2---point Response:

- Names two specific things we can do to prevent stormwater pollution
- Uses two of the three sources for information
- Cites each source

1---point Response:

- Names two things we can do to prevent stormwater pollution but draws from just one source or does not cite any source
- Names only one thing we can do to prevent stormwater pollution

0---point Response:

Off Topic or makes general statements with no specific examples of what we can do to prevent water pollution

Scoring Notes: Stormwater Pollution

Sample 2-point Responses:

In "Fifteen Minutes to the River," to help make a difference in keeping our water clean and healthy is limit the amount of dense surfaces in your community and having rain gardens. In "Let's Visit Stormville!" to help make a difference in keeping our water clean and healthy is to only use fertilizer and pesticides when absolutely necessary so when it rains all the chemicals won't go into the storm drain and hurt the wildlife in the se, lakes or rivers.

I believe that we can make a difference in keeping out water clean and healthy because in the article Let's Visit Stormville" it gives solutions for some of the most everyday things people do such as washing your car, fertilizing your plants, and even pet waste if you have a pet. I learn to not use too many chemicals and to pick up pet waste. In the video, it helps me believe that we can make a difference because it tells me how we can keep storm water from being polluted and into bodies of water by simply catching the water in a rain barrel and pouring it into the natural ground to help grow plants.

Sample 1-point Responses:

First source, Let's Visit Stormville says you should use the car wash because its cleaner, pet waste you should clean it up with a small plastic bag. Last, yard chemicals you don't use it every day because it's bad for wild life and real people. Next source, the video, talks about what happens to the bad rain and it tells some ways to help things. (Has specific examples from one source but not from the second source.)

We can make a difference in keeping our water clean and healthy by taking "your family to take the car to a commercial car wash." (Let's Visit Stormville! Pg.2) Another thing you can do is "Scoop the poop. Put it in a bag and place it in the trash." (Let's Visit Stormville! Pg. 2) (Names two ways we can help but only draws information from one of the sources.

Sample 0-point Responses:

"We can make a difference in keeping our water clean and healthy" about the information is that "what types of pollution can get into drains and make our water unhealthy." Helping the water to be clean is also "Here's what you can do!" paragraphs. (Does not name any specific things people can do to make a difference in keeping the water clean.)

Pet waste- when it rains pet waste is left on the ground and melts into the stormwater. The pollution stormwater flows into nearby storm drains and then into waterways like streams, rivers, or Puget Sound. (Off topic: does not directly focus on what we can do to make a difference in keeping our water clean)

Informative / Explanatory
Performance Task Writing Rubric (Grades 3-5)

Score	4	3	2	1
Statement of Purpose/Focus	**The response is fully sustained and consistently and purposefully focused:** • controlling or main idea of a topic clearly communicated, and the focus is strongly maintained for the purpose, audience, and task	**The response is adequately sustained and generally focused:** • controlling or main idea of a topic is clear, and the focus is mostly maintained for the purpose, audience, and task	**The response is somewhat sustained and have a minor drift in focus:** • controlling or main idea may be somewhat unclear, or the focus may be insufficiently sustained for the purpose, audience, and task	**The response has little or no discernable organizational structure:** • controlling or main idea may be confusing or ambiguous; response may be too brief or the focus may drift from the purpose, audience, and task
Organization	**The response has a clear and effective organizational structure creating unity and completeness:** • consistent use of a variety of transitional strategies to clarify the relationship between and among ideas • effective introduction and conclusion • logical progression of ideas from beginning to end; strong connections among ideas with some syntactic variety	**The response has an evident organizational structure and a sense of completeness, though there may be minor flaws and some ideas may be loosely connected:** • adequate use of transitional strategies with some variety to clarify the relationship between and among ideas • adequate introduction and conclusion • progression of ideas from beginning to end; strong connections among ideas	**The response has an inconsistent organizational structure, and flaws are evident:** • inconsistent use of transitional strategies and/or little variety • introduction and conclusion, if present, may be weak • uneven progression of ideas from beginning to end; and/or formulaic; inconsistent or unclear connections between and among ideas	**The response may be related to the topic but may provide little or no focus:** • few or no transitional strategies are evident • introduction and/or conclusion may be missing • frequent extraneous ideas may be evident; ideas may be randomly ordered or have an unclear progression
Elaboration of Evidence	**The response provides thorough and convincing support/evidence for the controlling idea and supporting idea(s) that includes the effective use of sources, facts, and details:** • comprehensive evidence from sources is integrated; references are relevant and specific • effective use of a variety of elaborative techniques*	**The response provides adequate support/evidence for the controlling idea and supporting idea(s) that includes the use of sources, facts, and details:** • adequate evidence from sources is integrated, some references may be general • adequate use of some elaborative techniques*	**The response provides uneven, cursory support/evidence for the controlling idea and supporting idea(s) that includes partial or uneven use of sources, facts, and details:** • some evidence from sources may be weakly integrated, imprecise, or repetitive; references may be vague • weak or uneven use of elaborative techniques*; development may consist primarily of source summary	**The response provides minimal support/evidence for the controlling idea and supporting idea(s) that includes little or no use of sources, facts, and details:** • evidence from the source material is minimal or irrelevant; references may be absent or incorrectly used • minimal, if any, use of elaborative techniques*
Language	**The response clearly and effectively expresses ideas, using precise language:** • vocabulary is clearly appropriate for the audience and purpose • effective, appropriate style enhances content	**The response adequately elaborates ideas, employing a mix of precise and more general language:** • vocabulary is generally appropriate for the audience and purpose • generally appropriate style is evident	**The response expresses ideas unevenly, using simplistic language:** • vocabulary use is uneven or somewhat ineffective for the audience and purpose • inconsistent or weak attempt to create appropriate style	**The response is vague, lacks clarity, or is confusing:** • vocabulary is limited or ineffective for the audience and purpose • little or no evidence of appropriate style

Score	2	1	0
Conventions	**The response demonstrates an adequate command of conventions:** • adequate use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling	**The response demonstrates a partial command of conventions:** • limited use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling	**The response demonstrates little or no command of conventions:** • infrequent use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling

NS	**Unintelligible, in a language other than English, off-topic, copied text. (Off-purpose writing will still receive a score in Conventions.)**

*Elaborative techniques may include the use of personal experiences that support the controlling idea.

Performance Task: Stormwater Engineers

PART 1: RESEARCH

Student Directions:

Your assignment:

Engineers are a key to problem solving in our environment. You will watch two informational videos about stormwater management and read the job description for a stormwater engineer, taking notes on these sources. Then you will respond to three research questions and write an article explaining the important work of a stormwater engineer.

Steps you will be following:

To plan and write your essay, you will do all the following:

1. Watch two videos and read a job description for a stormwater engineer.
2. Answer three questions about the sources.
3. Plan and write your article.

Directions for beginning:

You will now watch two videos and read a job description, taking notes from these three sources. You may use these notes in responding to the three questions and in writing your article. You can refer to any of the sources as often as you like.

Source Information:

Source #1: Video #1	**Stormwater Runoff 101** *(3:07)* https://www.youtube.com/watch?v=V6DggjiWrTs
Source #2: Video #2	***Water Resources Engineer CAREERwise Education*** *(4:50)* https://www.youtube.com/watch?v=jQCKhGVp8c0
Source #3 Reading	City of Happyville Stormwater Engineer Job Posting

NOTE TAKING TOOL

	What stormwater is	Why stormwater pollution is a problem	Ways to manage stormwater pollution
Video #1: Stormwater 101			
	What a Stormwater Engineer does	**Why this job is important**	**Key Qualifications**
Video #2: Water Resource Engineer			
Reading #1: Job Posting			

Job Posting: Stormwater Engineer

Department: **Public Works, City of Happyville, USA**
Start Date: **Immediately After Hiring**
Salary Range: **$64,776 to $85,356**

Job Description:

The stormwater engineer is responsible for designing solutions to complex stormwater management problems. This person will provide leadership for managing surface water runoff including designing gray and green stormwater solutions. Gray solutions may include storm drains, culverts, and pervious pavement; green solutions may include rain gardens, green roofs and bioswales to name a few. The stormwater engineer will manage all projects within the local watershed including watershed planning and stream restoration.

Qualifications:

Candidates must have knowledge of the following:

- Stormwater drainage systems and erosion control
- Gray and Green stormwater solutions
- Federal, state, and local laws and codes related to stormwater management including water quality standards and the Endangered Species Act
- Water quality testing methods
- Best Management Practices (BMP's) for maintaining a clean and healthy environment
- Computer programs including computer aided drafting and design software and Geographic Information Systems (GIS)
- Principles of environmental science
- Office software programs such as Outlook, Word, Excel, and PowerPoint

Skills and Abilities:

- The ability to analyze problems and come up with creative solutions (Complex Thinker)
- Exceptional communication and interpersonal skills, both written and verbal (Effective Communicator)
- The ability to read and interpret civil engineering plans and designs (Effective Communicator)
- The ability to work as a member of a team (Collaborative Worker)

Education and Experience:

- Bachelor's Degree in Civil Engineering or Environmental Science or other education and training that results in the ability to demonstrate the knowledge and skills outlined in this job description
- Two years prior experience working in a public works or stormwater environmental department

Questions

Use the remaining time to answer the questions below. Your answers to these questions will be scored. Also, they will help you think about the sources you have read and viewed. You may refer to the sources or your notes when you think it would be helpful. Answer the questions in the spaces provided below them.

1. Explain the importance of stormwater management. Use details from at least two of the three sources to support your answer. Cite your sources. ***(Claim 4, Target 2)***

2. Evaluate which source, the job description or the water resources engineer video, best explains what a stormwater engineer does. Use details from the two sources to support your answer. Cite your sources. ***(Claim 4, Target 3)***

3. Would you consider a career as a stormwater engineer? Use information from the videos and the job posting in your response. Include three reasons to support your choice. Cite your sources. ***(Claim 4, Target 4)***

PART 2: FIELD INVESTIGATION

Teachers are encouraged to engage the students in mapping the school campus for grey and green stormwater solutions. Directions for mapping the campus can be found in Drain Rangers *Engineering Solutions* published by PEI and free to download from the website. This guide provides lessons in stormwater engineering where students design solutions for stormwater problems on their school campus.

Discussion questions might include the following:

- What is stormwater runoff and how can we monitor this on our school campus?
- Why are stormwater engineers important to a community?
- Does our community have a stormwater engineer and if so, who is this person?
- How are engineers different from scientists?
- What can we as individuals do to support the goal of clean water?

In addition, teachers may want to consider one or more of the following field investigations:

- Engineering Solutions-Engineering Design Puget Sound Starts Here: http://www.pugetsoundstartshere.org/drain-rangers
- Aquatic WILD: Where Does Water Run? P44
- Permeability study: http://www.pltwa.com/soils-as-sponges-fi-and-assessment.html
- Seattle utilities: http://www.seattle.gov/Util/EnvironmentConservation/Education/index.htm

Other ideas for field investigations:

PART 3: ESSAY

Student Directions:

Take time to review your notes and sources, and plan, draft, and revise your article. You may also refer to the answers you wrote to the questions in Part 1, but you cannot change those answers. Now read your assignment and the information about how your essay will be scored.

Your assignment:

You have been asked by the City of Happyville to write an article for hiring a stormwater engineer. Your article should explain what a stormwater engineer does and why this job is important to the wellbeing of the environment. Include the following information:

- Problems we face from stormwater pollution
- Role of the engineer in solving these problems (stormwater solutions)
- Important qualities stormwater engineer needs to be successful in the job

Essay Scoring

How your essay will be scored:

The people scoring your essay will be assigning scores for

a. ***Statement of Purpose/Focus*** – how well you clearly state and maintain your controlling idea or main idea

b. ***Organization*** – how well the ideas progress from the introduction to the conclusion using effective transitions and how well you stay on topic throughout the essay

c. ***Elaboration of Evidence*** – how well you provide evidence from sources about your topic and elaborate with specific information

d. ***Language and Vocabulary*** – how well you effectively express ideas using precise language that is appropriate for your audience and purpose

e. ***Conventions*** – how well you follow the rules of usage, punctuation, capitalization, and spelling

Now begin work on your essay.

Manage your time carefully so that you can:

- Plan your essay
- Write your essay
- Revise and edit for a final draft

PLANNING MY ESSAY

Introduction—Statement of Purpose:
Problems we face from stormwater pollution:
Role of the engineer in solving these problems (stormwater solutions):
The most important qualities a stormwater engineer needs to be successful in the job:
Conclusion:

Scoring Notes: Stormwater Engineers

1. **Explain the importance of stormwater management. Use details from at least two of the sources to support your answer. Cite your sources. *(Claim 4, Target 2)***

Analyze/Integrate Information Rubric (Claim 4, Target 2)	
2	• The response gives sufficient evidence of the ability to gather, analyze, and integrate information within and among multiple sources of formation.
1	• The response gives limited evidence of the ability to gather, analyze, and integrate information within and among multiple sources of information.
0	• A response gets no credit if it provides no evidence of the ability to gather, analyze, and integrate information within and among multiple sources of information.

Scoring Notes:

- **Video #1: Stormwater management helps to prevent pollution in the waters, keeping people healthy and the economy strong. It also leads to creating ways to collect the water before it becomes polluted like rain barrels and permeable concrete.**
- **Video #2: Stormwater management helps to prevent urban flooding. Stormwater management also keeps our environment healthy for the future. Tools used help to monitor the water quality.**
- **Job Description: Stormwater management keeps our water safe, helps to control erosion, and protects the environment from pollution. The stormwater manager also designs solutions for stormwater runoff. (Other possibilities on job description)**

2 Points:

- **Provides two specific details that explain the importance of stormwater management.**
- **References two of the three sources.**
- **Names the sources.**

1 Point:

- **Provides one detail from one or two of the sources that explains the importance of stormwater management.**
- **May or may not name the source.**

0 Points:

- **No connection is made to stormwater management**
- **No relevant details are provided.**
- **Off topic response**

Scoring Notes: Stormwater Engineers

Sample 2 Point Responses:

Example #1: From video #1 it says that stormwater management is important because it tries to stop the rain from getting polluted and makes things like concrete that absorbs water and putting barrels underneath gutters so that they collect the water. Form the text, it says that the stormwater management is responsible for designing solutions to complex stormwater problems. This includes water runoff. From video #2, it says that stormwater management is supposed to make the water clean and healthy using tools like the turbidity tool for monitoring and make it so the water doesn't overflow the streams.

Example #2: Stormwater management is important to our community. In Video #1, rainwater hits our pavements and gets into our storm drains and picks up litter such as car oil, trash, water bottles, and paper. All that litter gets into our storm drains. In Video #2, GIS software and computers also help very much to test water. Turbidity meters that use light check the clarity of the water. All these tools help to monitor the water, so we can drink it.

Example #3: Stormwater management is important for many reasons. In video #1, it says you can get sick form stormwater runoff. In video #2, it says everyone needs water to live. So, I personally think we need stormwater management to stay healthy and be able to drink the water.

Sample 1 Point Responses:

Example #1: If we did not do stormwater management the runoff would pick up pollutants such as trash and car oil. That would then flow into oceans and if we swim, we can get sick. (Provides only one detail. Does not name the sources.)

Example #2: Stormwater management is important because stormwater polluted water that affects water bodies. And if we don't stop stormwater, we won't have any clean water. And if we don't have clean water or any water we won't live right. Permeable pavement and rain barrels will help with stormwater management. In Water Resources Engineering video, they use a turbidimeter and transparency tube to measure water clarity. (Only one source is referenced.)

Sample 0 Point Responses:

Example #1: There are many problems we face with stormwater runoff. Car oil gets picked up by runoff and is carried to streams where it in turn kills millions of fish. People can get sick swimming in polluted beach. (No connection is made to stormwater management.)

Example #2: Pollution and stormwater because pollution kills, and stormwater takes pollution with it. Then the pollution kills fish. Also, then you can't swim at beaches. (No connection is made to stormwater management.)

Scoring Notes: Stormwater Engineers

2. **Evaluate which source, the job description or the water resource engineer video, best explains what a stormwater engineer does. Use details from the sources to support your answer. Cite your sources.** ***(Claim 4, Target 3)***

Use Evidence Rubric (Claim 4, Target 3)	
2	The response gives sufficient evidence of the ability to distinguish relevant from irrelevant information such as fact from opinion.
1	The response gives limited evidence of the ability to distinguish relevant from irrelevant information such as fact from opinion.
0	A response gets no credit if it provides no evidence of the ability to distinguish relevant from irrelevant information such as fact from opinion.

Scoring Notes:

- Students must select either the job description or the Water Resource Engineer video and not both.
- Arguments for the video may include the following:
  - The video shows us what a stormwater engineer does rather than just telling us as in the job description. We see things like water testing and using technology on the job.
- Arguments for the job description may include the following:
  - The job description provides lots of details regarding what a stormwater engineer does. For example, we learn that a stormwater engineer must solve complex problems, work with city government, manage stormwater runoff, design gray and green infrastructures, do watershed planning, and stream restoration maintenance.

2 Points:

- Selects either the job description or the video.
- Provides a general statement arguing for the resource selected.
- Includes at least one specific example from that source.
- References the other source in comparison.
- References the sources.

1 Point:

- Selects one of the sources.
- Does not compare the source selected to the other source.
- Provides a general statement with no specific example from the source selected.
- May or may not reference the sources.

0 Point:

- Unclear which source is selected or a source is selected with no rationale.
- Off topic response

Scoring Notes: Stormwater Engineers

Sample 2-point responses:

Example #1: I think video 2 for water resource engineer video explains best because it shows you what you need to do or must be able to do to be a stormwater engineer. The job description lists qualifications but doesn't show what it looks like to do the job. In the video, the engineer uses GIS (Geographic Information software)**.** She also uses a transparency tube which allows you to see how clear the water is and a turbidimeter which is a small machine that uses light to also measure water clarity.

Example #2: I think video 2 is the best source. I think video 2 is best because it's coming from an actual stormwater engineer and we see what she does. The job description says stormwater engineers design solutions to complex stormwater management problems. But video 2 says two things about what a stormwater engineer does. #1: They locate bad or polluted waters. #2: They fix the stormwater problems. I hope you understand that video the best resource to understand what stormwater engineer does.

Example #3: I think the job description best explains what a stormwater engineer does because it just explains exactly what the job responsibilities are. In the video 2 it says a lot of what most stormwater engineers do but it also says a lot of what she does like she said, "I use a computer every day." And maybe not all stormwater engineers use a computer every day. The job description, on the other hand, is very detailed and specific.

Sample 1-point responses:

Example #1: I think it was video 2 because she was an engineer herself. And what I learned from it was that she used a thing to see how clear the water was, and she used another thing where you put water in it and it uses light to check the water. (Provides a reasonable rationale for selecting video 2 (she was an engineer herself) but does not reference the job description.)

Example #2: The article best explains what a stormwater engineer does. It says a stormwater engineer designs solution to stormwater management problems and will review and assure the quality of the problems. (Does not reference the other source in comparison.

Sample 0-point responses:

Example #1: A stormwater engineer is responsible for designing solutions to complex stormwater management problems. A stormwater engineer will engineer, review, and assure the quality of project designs for county stormwater management. (Off topic response. Does not select one of the sources as best explaining what a stormwater engineer does. Lists information in a source but does not answer the question.)

Example #2: In video 2, it says stormwater engineers work on water quality in their states. Readings. Also, it says that stormwater engineers design solutions to complex stormwater management problems. And quality control on all storm water management. (Does not select one source as better than the other with reasons.)

3. **Would you consider a career as a stormwater engineer? Use information from the videos and the job posting in your response. Include three reasons to support your choice. Cite your sources.** ***(Claim 4, Target 4)***

Use Evidence Rubric (Claim 4, Target 4)	
2	• The response gives sufficient evidence of the ability to cite evidence to support arguments and/or ideas.
1	• The response gives limited evidence of the ability to cite evidence to support arguments and/or ideas.
0	• A response gets no credit if it provides no evidence of the ability to cite evidence to support arguments and/or ideas.

Scoring Notes:

- States a position: "Yes, I would consider a career as a stormwater engineer" or "No, I would not consider a career as a stormwater engineer." Or "I don't know because…."
- Provides at least three specific reasons for the position stated.
- Uses information from at least one of the videos and the job posting in the response.
- References the sources

2 Points:

- Includes all of the above

1 Point:

- States a position
- Provides one or two specific reasons for the position stated.
- Uses information from only one source.
- May or may not reference the sources.

0 Points:

- No clear position is stated, or a position is stated with no specific evidence to support it.
- Sources are not referenced.
- Off topic.

Sample 2-point responses:

Example #1: Yes! Yes! Yes! I would love to be a stormwater engineer. I love to do STEM science, technology, engineering and math and all of these are included in being a stormwater engineer. I would get to use technology on the job. Also, the posting states you need skills and have the responsibility for the design and testing of projects. I like design work. When video 2 told me that the engineers have to work hard, I still wanted the job!

- **Example #2:** I would consider this a career because I like to solve problems. In the article, they said that stormwater engineers are always responsible for stormwater problems. They also manage surface water runoff designing green and gray infrastructures. In video #1, they said that this awesome pavement can really soak in water, so this polluted water will soak in the water and if they plant more grass they can improve the environment. I like improving the environment. In video 2, they explained that they try to monitor water even close to a ¼ of an inch. Also, a lot of people get their master's degree and I would like to get a master's degree too. Another example from video #2 is that they use a lot of technology to test the water quality and I like using technology.

Example #3: I would not consider a career as a stormwater engineer. The article says that you need to know the stormwater engineering principles and it's kind of hard for me to remember things. I understand that this job is very important, as both the article and video 2 states. But both the article and video 2 also states that you need experience or training and I don't know where I would get it. This job just does not interest me.

Sample 1-point responses:

Example #1: No because it involves getting dirty and because you have to be good at math which I am not. You also need to be able to communicate with people you work with and the people you work for. I can't communicate well with others. (Three reasons but does not reference the sources.)

Example #2: I don't really know. I kind of would but I kind of don't because you have to know a whole lot of things like surface water design, computer application for stormwater and much more. But why I think it would be a good job because you get paid a lot of money. (States a position ("I really don't know.") with two reasons, not three. Fails to reference the sources.)

Example #3: I don't think I would want to be a stormwater engineer. I don't want to be a stormwater engineer because it's dirty. I am not the kind of person who likes to get mud all over them. I'm not saying I'm girly girl but I just don't. I'll also have to deal with pollution. I'm just going to say this. I'm paranoid to those kinds of things. It also says I have to have the ability to creatively problem solve. I can't do that. So if you're someone like me, I don't recommend it. (Has three reasons but fails to reference sources.)

Sample 0-point responses:

Example #1: No, because If you really like math and science, I think stormwater engineering would be really good to work at. I think some stormwater engineers use a GIS (Geographic Information Software) and think I really would be good at using that because I have a stream next to my house and I test is with my dad often. (Positions unclear. Sources are not referenced.)

Example #2: No. No is my answer because the job seems a little too hard, but if someone else wants the job, then fine by me! I just want to be something else and that something else is a Pop Star! But if someone else wants to be an engineer that's OK. (Position is stated with no specific evidence from the sources to support it.)

Informative / Explanatory
Performance Task Writing Rubric (Grades 3-5)

Score	4	3	2	1
Statement of Purpose/Focus	**The response is fully sustained and consistently and purposefully focused:** • controlling or main idea of a topic clearly communicated, and the focus is strongly maintained for the purpose, audience, and task	**The response is adequately sustained and generally focused:** • controlling or main idea of a topic is clear, and the focus is mostly maintained for the purpose, audience, and task	**The response is somewhat sustained and have a minor drift in focus:** • controlling or main idea may be somewhat unclear, or the focus may be insufficiently sustained for the purpose, audience, and task	**The response has little or no discernable organizational structure:** • controlling or main idea may be confusing or ambiguous; response may be too brief or the focus may drift from the purpose, audience, and task
Organization	**The response has a clear and effective organizational structure creating unity and completeness:** • consistent use of a variety of transitional strategies to clarify the relationship between and among ideas • effective introduction and conclusion • logical progression of ideas from beginning to end; strong connections among ideas with some syntactic variety	**The response has an evident organizational structure and a sense of completeness, though there may be minor flaws and some ideas may be loosely connected:** • adequate use of transitional strategies with some variety to clarify the relationship between and among ideas • adequate introduction and conclusion • progression of ideas from beginning to end; strong connections among ideas	**The response has an inconsistent organizational structure, and flaws are evident:** • inconsistent use of transitional strategies and/or little variety • introduction and conclusion, if present, may be weak • uneven progression of ideas from beginning to end; and/or formulaic; inconsistent or unclear connections between and among ideas	**The response may be related to the topic but may provide little or no focus:** • few or no transitional strategies are evident • introduction and/or conclusion may be missing • frequent extraneous ideas may be evident; ideas may be randomly ordered or have an unclear progression
Elaboration of Evidence	**The response provides thorough and convincing support/evidence for the controlling idea and supporting idea(s) that includes the effective use of sources, facts, and details:** • comprehensive evidence from sources is integrated; references are relevant and specific • effective use of a variety of elaborative techniques*	**The response provides adequate support/evidence for the controlling idea and supporting idea(s) that includes the use of sources, facts, and details:** • adequate evidence from sources is integrated, some references may be general • adequate use of some elaborative techniques*	**The response provides uneven, cursory support/evidence for the controlling idea and supporting idea(s) that includes partial or uneven use of sources, facts, and details:** • some evidence from sources may be weakly integrated, imprecise, or repetitive; references may be vague • weak or uneven use of elaborative techniques*; development may consist primarily of source summary	**The response provides minimal support/evidence for the controlling idea and supporting idea(s) that includes little or no use of sources, facts, and details:** • evidence from the source material is minimal or irrelevant; references may be absent or incorrectly used • minimal, if any, use of elaborative techniques*
Language	**The response clearly and effectively expresses ideas, using precise language:** • vocabulary is clearly appropriate for the audience and purpose • effective, appropriate style enhances content	**The response adequately elaborates ideas, employing a mix of precise and more general language:** • vocabulary is generally appropriate for the audience and purpose • generally appropriate style is evident	**The response expresses ideas unevenly, using simplistic language:** • vocabulary use is uneven or somewhat ineffective for the audience and purpose • inconsistent or weak attempt to create appropriate style	**The response is vague, lacks clarity, or is confusing:** • vocabulary is limited or ineffective for the audience and purpose • little or no evidence of appropriate style

Score	2	1	0
Conventions	**The response demonstrates an adequate command of conventions:** • adequate use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling	**The response demonstrates a partial command of conventions:** • limited use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling	**The response demonstrates little or no command of conventions:** • infrequent use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling

NS	**Unintelligible, in a language other than English, off-topic, copied text. (Off-purpose writing will still receive a score in Conventions.)**

*Elaborative techniques may include the use of personal experiences that support the controlling idea.

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KCPW EDUCATOR MASTERS

- Phenomenon
- Project Agreement and Expectations
- Storm Drain Cutaway
- Storm Drain Detectives Power Point (Slides for Lessons 2 and 3)

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Phenomenon

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Storm Drain Detectives
Project Agreement and Expectations

The Storm Drain Detectives Project is a partnership between the Classroom Teacher (Teacher) and the Kitsap County Public Works Educator (KCPW Educator). Students will receive a tour of their school's stormwater system and regularly monitor the storm drains on the school's property for debris, trash, and sediment. This will include observations and inspection for sediment level and regular recording of their data. At the end of the project, the KCPW Educator will return to work with students on analyzing their data, looking at their claims, evidence, and reasoning and making connections to the larger watershed. Students will summarize and graph their results in a letter to the school's maintenance staff.

This Project Agreement and Expectations identifies the responsibilities of each partner to ensure a successful project and experience for students.

KCPW Educator shall:

- Provide an overview of the project to the Teacher
- Provide teacher training, when possible
- Provide electronic and/or one printed copy of all lessons and blackline masters
- Conduct Lessons 2, 3 and 5 in class with students
- Assist with field monitoring day #1, Lesson 4, if needed and available
- Provide Storm Drain Detectives Model Inspection Kit and Storm Drain Inspection Field Inspection Kit
- Act as support to teachers as needed throughout project

Classroom Teacher shall:

- Complete all registration forms and agreement
- Review all materials
- Attend teacher training when available
- Communicate with and obtain any needed permission from school administration to participate in the project
- Complete any required field trip forms, make accommodations as needed, etc. for the project.
- Recruit adult volunteers to support students during the project and communicate responsibilities to them
- Provide student copies of blackline masters

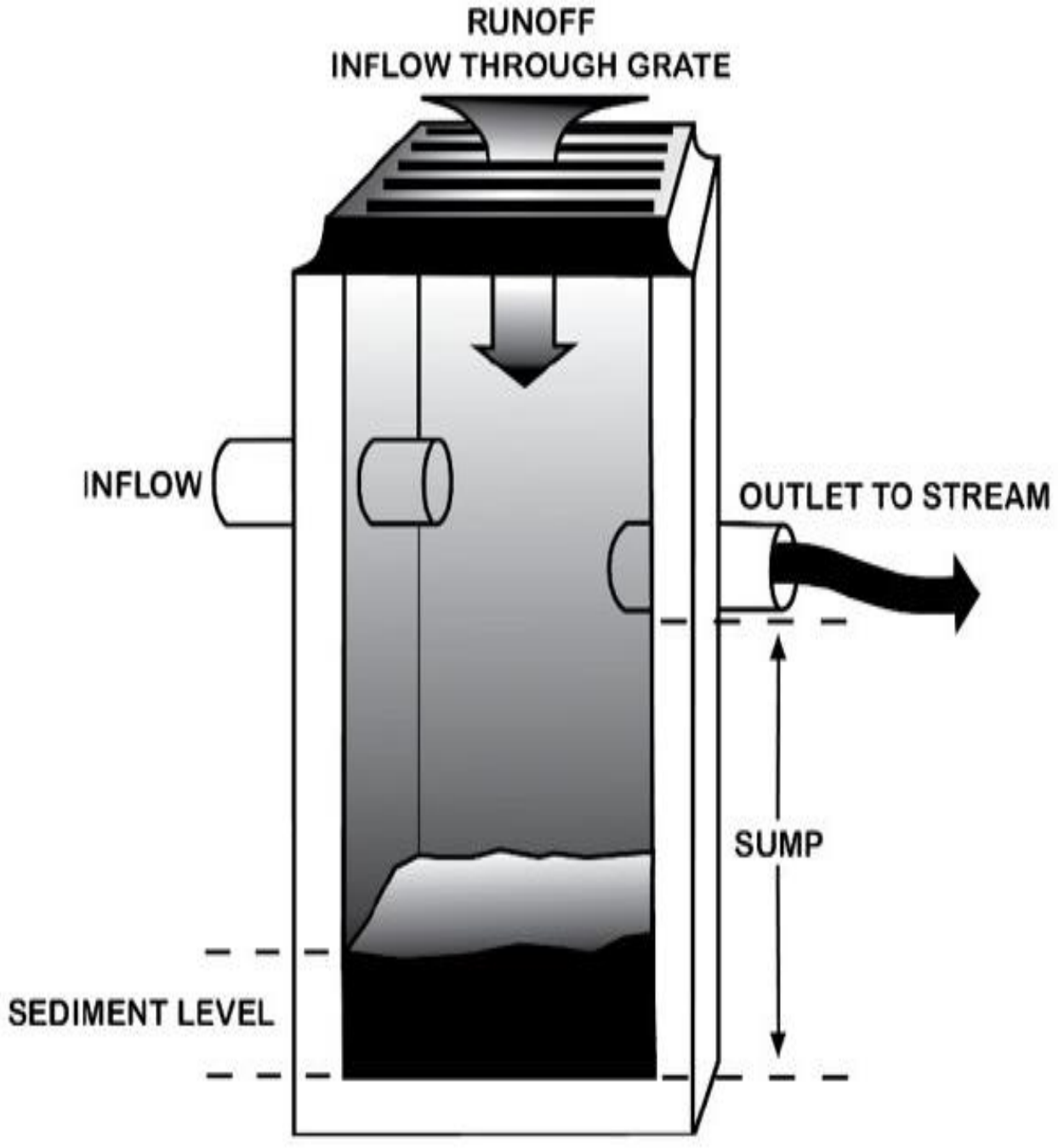
- As the teacher, personally conduct at least one storm drain inspection
- Schedule times for KCPW Educator to meet with class for Lessons 2, 3 and 5
- Request equipment from KCPW Educator as needed; keep all equipment in a safe location; and return all equipment to KCPW Educator
- Submit student completed Probes and Daily Data Summary Sheets to KCPW Educator (Lessons 1, 4 and 7)
- Commit to at least 3 days of field monitoring

_____ _____

KCPW Educator, Date

Classroom Teacher, Date

UNDER A STORM DRAIN GRATE



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STORM
DRAIN
Detectives
Pat Kirschbaum
Kitsap County
Public Works
Stormwater

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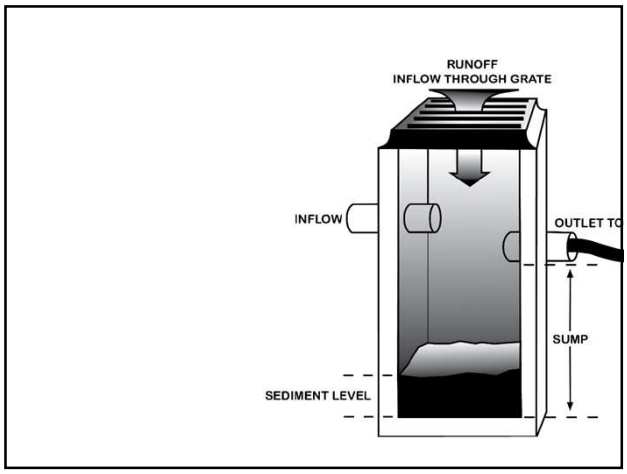

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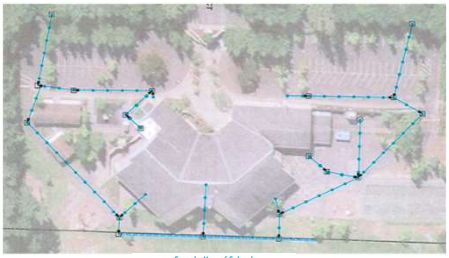
INSERT MAP OF SCHOOL'S STORMWATER SYSTEM



Sample Map of School Stormwater System

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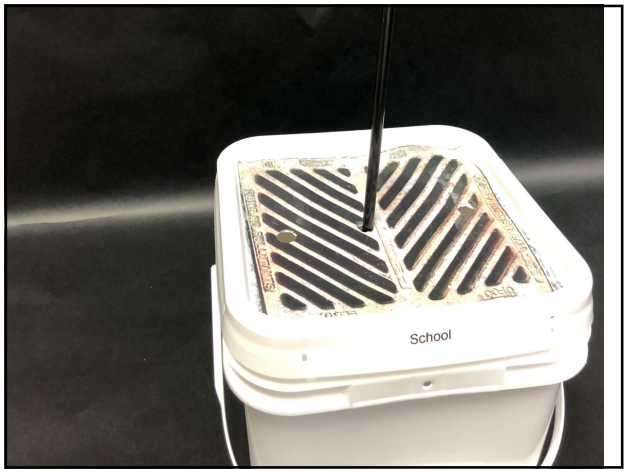

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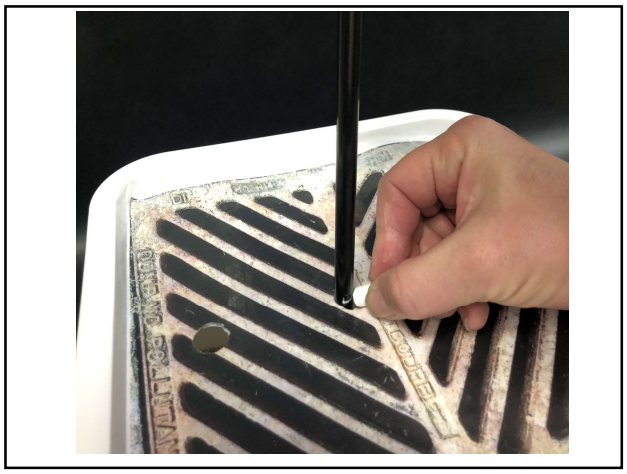

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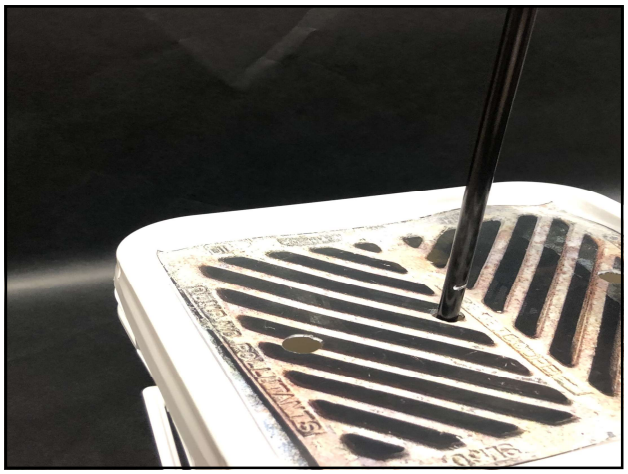

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