



WATER PLANET ● CHALLENGE ●

Rain Check:

A Guide for Stormwater Action

Written by Cathryn Berger Kaye, M.A.



A Resource of
EarthEcho Expeditions





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About This Action Guide

This EarthEcho Expeditions Action Guide *Rain Check: A Guide for Stormwater Action* offers an opportunity to engage students in a service learning process. Participating in service learning is an ideal way for youth to increase both knowledge and skills transferrable to many learning situations. As you review the document, consider that the youth involved—whether through a classroom, an afterschool program, or a youth-serving organization—will be integrating many academic standards as they *investigate* the water issues in their everyday lives. Based on their findings and further information gathered during *preparation*, they will *develop a plan* to recommend reasonable changes, and then move to *taking action*. Throughout this process, be sure to engage students in *reflection*, as this solidifies their learning and establishes personal connections to what they are discovering. The section on *demonstration* allows students to consider all of the service learning stages they have experienced and develop ways to tell their stories.

Central to this publication is the website, www.EarthEcho.org, as well as other online resources that supplement and extend the content provided here. These are all options for further exploration during or following the implementation of this Action Guide.

If you are an educator or adult coordinator: As you are planning, consider that the time it takes to implement this Action Guide will vary. Allowing for this to be a part of your lessons over two to three weeks may be reasonable. If done as part of an afterschool program, this framework can extend from one to three weeks. In a summer intensive, one to two weeks can be spent on this unit with additional ideas to extend further.

If you are a student or youth participant: This Action Guide invites you to think about how our everyday actions impact the world around you. By looking closely at how your actions affect water, you develop essential 21st century skills and knowledge. This topic will be on center stage for decades to come, as we depend on water for every part of our lives, and for life itself.

Keep in mind this is the beginning: While this Action Guide focuses on water issues you can study at school, these ideas also belong in our homes and throughout our communities. Join in. Share your ideas and talents. Take familiar and new topics and look at them in different ways and with an open mind. Discover fresh watery ideas. Our water planet will be grateful.



Join the Expedition!

Portions of this Action Guide are excerpted or adapted from *Going Blue: A Teen Guide to Saving Our Oceans, Lakes, Rivers, & Wetlands* by Cathryn Berger Kaye and Philippe Cousteau (Free Spirit Publishing, 2010). This award-winning book is filled with additional information that opens our eyes to many water related topics.

EarthEcho International: Expeditions

This action guide is included for curriculum enhancement within the *EarthEcho Expedition: Into the Dead Zone* program. For more resources including videos, lesson plans, and Water Planet Challenge Action Guides, visit www.EarthEcho.org/Expeditions.

This Action Guide centers on the complex issue of stormwater and its impact on our waterways with the aim of leading youth to participate in service learning that results in community improvement. Be certain to examine the wide range of ideas and topics surrounding this topic. Extensive research continually adds to the body of knowledge. New ideas are being implemented in many communities. Draw upon your local and national community organizations, government agencies, and businesses to expand your resources. References are noted for this publication and additional resources can be found on page 50.

Additional books are referenced on page 50. Build a library to support student learning about water-related issues.

ARE YOU READY FOR THE EXPEDITION?

Time for a Rain Check: Knowing about Stormwater

*A Message from Philippe Cousteau
Co-founder and President, EarthEcho International*

We have conclusive evidence that our water resources are at risk all over the planet. Our global population continues to rise, though the amount of water circulating throughout the globe remains steady. Less than 2% of our global water from pole to pole is usable for supporting life. The other 98% is difficult to access because it is either saline ocean water or locked away from use in glaciers and ice. Yet we behave as if every time we turn on the tap, endless quantities of clean water will be ready and waiting. Everyday there are actions throughout the world that pollute and destroy our access to this vital resource. And we participate. We all have behaviors that we can change in order to protect our most precious natural resource. Clean, potable water is a challenge in many locales. Still, water connects us all. Can our daily actions impact other places?

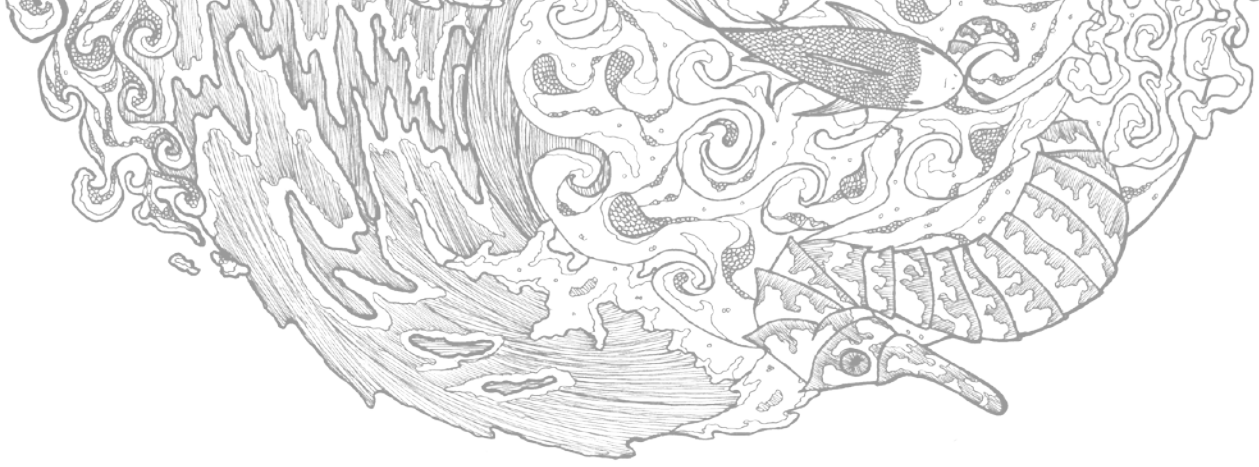
It all begins with the water cycle. We count on nature's powerful system to clean water by filtering impurities and move water through weather events. Now think about *stormwater*. What is *stormwater*? The word itself holds the clue: *storm + water*. Basically, stormwater runoff is any precipitation, be it rain, snow, sleet, or hail that flows over areas where it can *not* soak into the ground. After rain falls, or snow, sleet, or hail melt, water travels through two primary routes: either the water soaks into the ground or, as "stormwater," the water runs across the earth's surface. As you can imagine, water becomes pretty contaminated as it moves over roofs, pavement, roads, and bare earth, collecting and carrying some of what it encounters.

This is where we come into play (all of us, you and me), and this Action Guide. We make choices every day that impact our planet. Usually we just go about our lives and hardly think about some of these actions, since they are as routine as driving a car. But our actions have the ability to protect or to harm the environment. We must give thought to the choices we can make, even if a bit inconvenient, when what we may consider as small, individual changes can create significant impact for the world.

Let's take a look at cars. Unless you live in a city with an ideal public transportation system, you likely depend on cars to get from place to place when it's too far to walk or bike. We need cars, absolutely. So what's the problem? Have you ever noticed a dark residue in a driveway or school parking lot? That's oil! The oil pollution entering our streams and rivers through stormwater continues on a daily basis and makes a consistent impact on the environment and water systems in our local areas. Now think about how a car is washed, perhaps with some heavy duty abrasive cleaners. Unless you use a car wash, all the soaps and residues are hosed down to enter *storm drains*, creating more hazards for our waters.

Even our community sports fields or well manicured neighborhoods can have dramatic impacts on our water resources. Chemicals we use to keep those areas lush, green, and insect-free can leave the places where we apply them, handily carried off by stormwater. Where do the chemicals end up? Often in the same waterways we use for recreation and, gasp, drinking water.

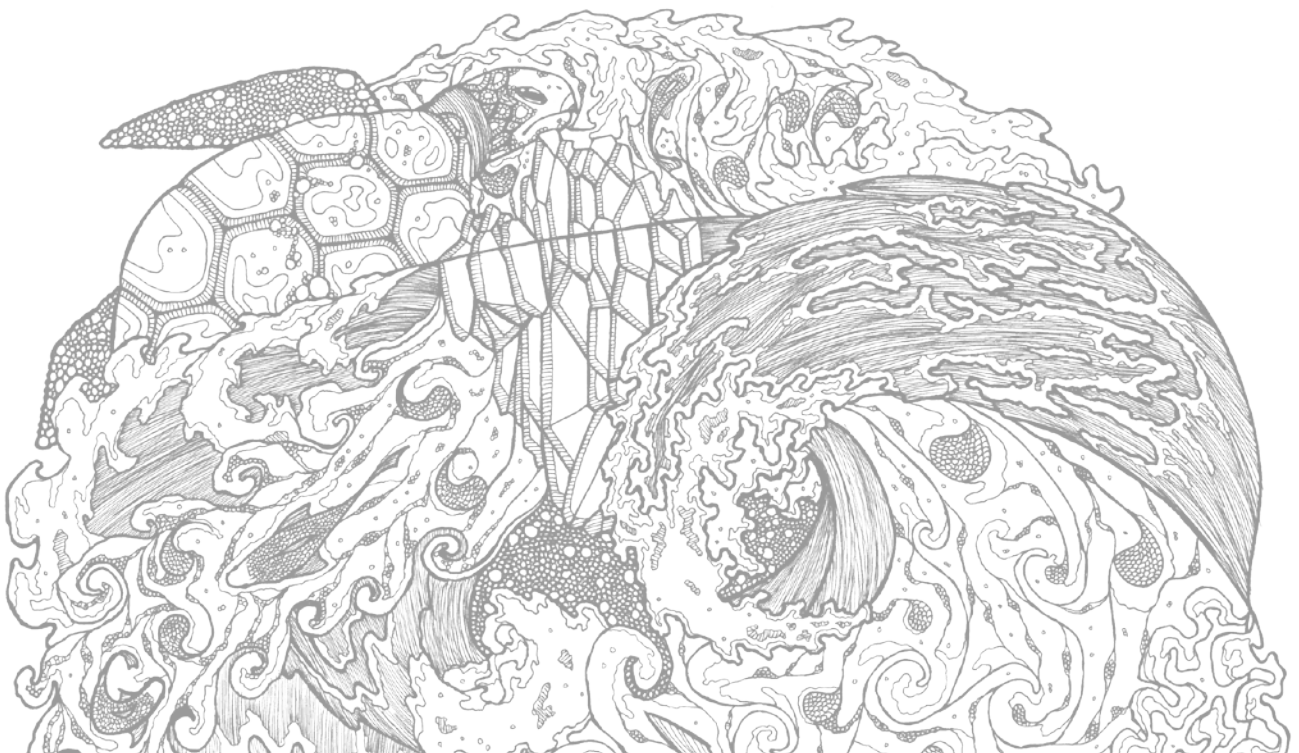
Stormwater carries nonpoint source pollution from impervious surfaces, nutrients from nurseries and our lawns, from our pet's waste, from the eaves of our homes, all ending up concentrated in our drainage systems. The impact we cause along with all forms of



transportation, industry, energy production, and agriculture cause havoc to our waters. As these nutrients and contaminants continue to enter our waterways, we are now developing dead zones in our oceans, lakes, and other bodies of water all over the world. The National Oceanic and Atmospheric Administration (NOAA) describes a “dead zone” as an area having little to no oxygen dissolved in the water that results in most aquatic life either dying, or, if mobile like fish, leaving the area. I have seen dead zones that would otherwise be filled with living plants and animals resembling more of a watery desert. Water tinged with the color of massive algal blooms choke out what would be living beneath the surface of the water. While dead zones can happen naturally, they have increased in numbers and size due to human activity. Our activity. We help make this worse. The good news is we can also be part of the solution.

In the 1500s, a Dutch scholar Desiderius Erasmus said, “Prevention is always better than treatment.” That’s where we can all start. Open your eyes. Take time for a “rain check”—to explore what happens with stormwater. Begin with the Rain Check School Stormwater Management Audit (learn more on page 10). This audit process will help you observe and discover what is going on in your school environment that may be causing unnecessary harm. Once you identify the problems, then you can begin to make changes that benefit everyone (including our watery planet).

Throughout the EarthEcho International Action Guide *Rain Check: A Guide for Stormwater Action* you will discover up-to-date information and resources to guide you. With ideas, and examples from youth, like you, who are generating responses to every day challenges by taking action, you will be equipped to lead and inspire others.



Service + Learning = Service Learning

Service: Service means contributing or helping to benefit others and the common good.

Learning: Learning means gaining understanding of a subject or skill through study, experience, or an exchange of ideas.

Service Learning: The ideas of service and learning combine to create *service learning*. Investigation, preparation, action, reflection, and demonstration are the five stages of service learning. By understanding how each stage works, you can be more effective in making plans to help in your community.

The Five Stages of Service Learning

Stage 1: Check It Out → INVESTIGATE: Begin the service learning process by asking, “What resources do we have in our group? What are our skills and talents?” Then investigate further by using newspapers, interviews, surveys (what do people at school know about this topic?), and especially by observing stormwater issues in your surroundings.

Stage 2: Dive In → PREPARE: What do you need to know to be well informed about the topic? Finding out might involve talking with other people and organizations, reading newspapers, watching a video, or attending a community meeting. What skills do you need to be effective? The ability to listen well, document what you learn, and select a way to take action as an informed advocate all come into play. All this preparing leads to knowing what form of action you will take. Then you are ready to . . .

Stage 3: Get Going → ACT: Create your plan and set your ideas in motion. Remember that action is the total of many small parts of a well-designed plan. Implementing your ideas for reducing stormwater impact through everyday actions and involving others around you can look like:

- **Direct Service:** installing rain barrels on your school campus.
- **Indirect Service:** posting reminders about checking for car leaks in the school parking lot.
- **Advocacy:** creating a public service announcement for a television station to educate others and influence behavior toward greater awareness of reducing stormwater impact in your community.
- **Research:** collecting data that informs your school district about recommendations for your campus and other schools so your good ideas can have widespread impact.

Stage 4: Think Back → REFLECT: During ALL of the stages it is important to pause and consider: How is this going? What am I learning? Does anything need to be changed? Checking in through reflection keeps us on track as we connect our thoughts, feelings, and actions.

Stage 5: Tell it → DEMONSTRATE: Tell the story of what happened as you learned and took action regarding stormwater. This is when you showcase the service learning process. Remember to document every stage of service learning, beginning with *Investigate*, so that you will have all you need to present your complete journey. Consider who would want to know what you did, what skills you learned, the interests you developed, and the results. Include your reflections. Remember that your success can inspire other youth to do the same. Be bold! Share the learning AND the service! Your story may be featured on EarthEcho Expeditions website.

Stage 1: Check It Out → INVESTIGATE

Why Stormwater Matters

Consider what your community looked like before you had paved roads, skyscrapers, malls, supermarkets, apartment buildings, and movie theaters. The landscape was completely different. Most of what people used came from the local environment. People grew the crops they needed to feed their families, perhaps with extra to share or sell. Animal agriculture was on a small scale, with animal waste integrated into farm life as manure. Without refrigeration, simple methods were employed to preserve food. Without electricity, people went to sleep and awoke according to the natural rhythms and cycles of the day. They created their communities around access to water— surface water and ground water for wells. Rain was critical for survival. Rain filled creeks, rivers, streams, and ponds. Rain soaked into the ground, with soil acting as a natural filtering system, to fill our underwater systems of seemingly invisible waterways.

How different our world is today! Every element of that description needs a rewrite to fit into what we see in our neighborhoods and communities, or what we know to be true about industry of all forms. We live in a world of abundance. Manufacturing is on a huge scale as is agriculture to feed the growing global populace, now over 7 billion people.

Fortunately, there is an international recognition and acknowledgement that our natural planetary resources are limited. The “green” movement of eco-awareness is global, with many countries adopting protective policies. While going green is of tremendous importance, keep in mind that all things green can only grow with blue: water.

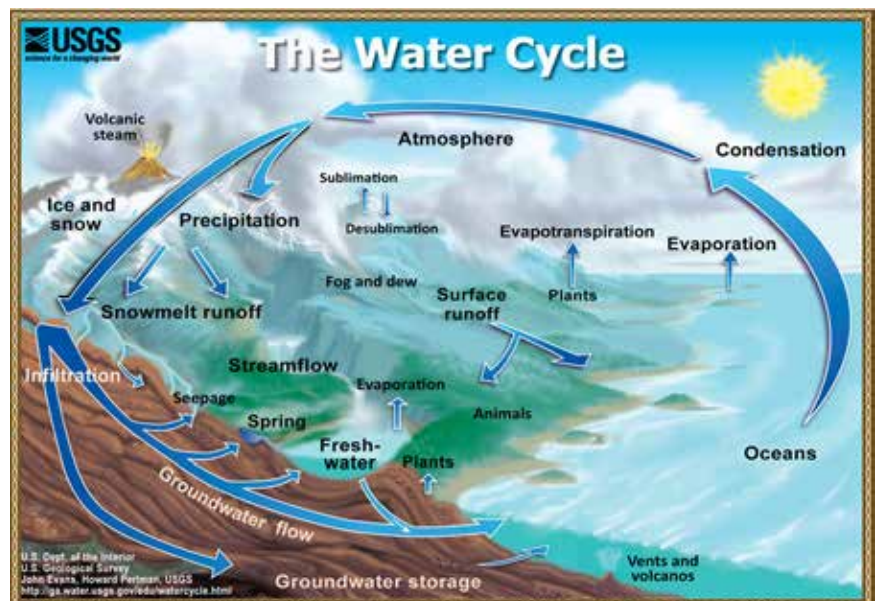
Worldwide awareness of looming water crises has stirred discussion in all parts of the globe. Unpredictable weather conditions have caused unexpected long-term droughts. Pollutants taint once pure streams. Today, every water resource is at risk from contaminants that seep into our groundwater or pour from storm drains or pipes into rivers and waterways.

You have already heard that the amount of water on earth remains the same, regardless of the population. In school the science of water is taught repeatedly at many grade levels as the *hydrologic cycle*, the ongoing exchange of precipitation and evaporation. Water evaporates from the earth’s surface and falls back as precipitation—rain, snow, sleet—back onto the land, oceans, and interconnected systems of waterways. The water returns to the oceans either on the surface as river runoff and or beneath the surface of the earth as groundwater flow.

Common sense tells us that with a

Investigating Your Skills and Talents!

As you begin to learn more about stormwater issues, find out, also, the unique abilities of every member of your group. Conduct a **Personal Inventory** by interviewing each other about your interests, skills, and talents. Make a list. Refer to this list as you develop your plan of action. Any photographers? Great for documentation. Does someone like to write? Ideal for composing a press release. Any artists? Excellent for graphic designs. Find a Personal Inventory document on page 28.



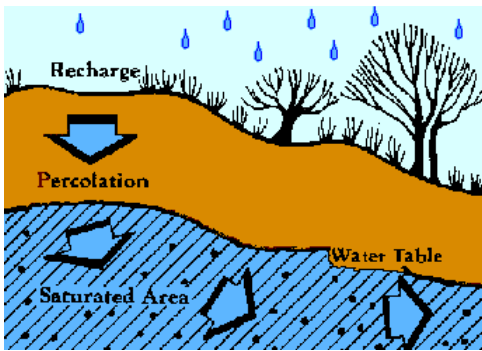


image from
<http://academic.evergreen.edu/g/grossmaz/KIEPERME/IMAGES/recharge.gif>

limited supply of something as precious as water, we would all make a concerted effort to protect every drop. Instead, our way of life interrupts the hydrologic cycle. The key rainstorms that in days long past would soak into the ground replenishing our groundwater are obstructed. What are these impediments? Pavement. Concrete. The *built* environment keeps water from this natural and critical ongoing exchange.

While we often see the hydrologic cycle in its simplest depiction with water from the oceans *evaporating* to the clouds, then *precipitating* on land to be brought to the sea through rivers and streams, this model is oversimplified. The urbanization of the hydrologic cycle has deep impact on our ecosystems by diverting water from pathways that are critical to water purity and storage. What are some of these concerns?

- **Infiltration:** Due to pavement, concrete, impaction, or other impervious surfaces, rainwater often cannot *infiltrate*, or penetrate the ground thereby absorbing into soil and filling the spaces between soil particles. As a result, the land and the area underneath it become uninhabitable by plants because there is no water stored in the soil for plants to use. Plants not only utilize water for respiration and photosynthesis, they release water vapor back into the atmosphere through *evapotranspiration* as part of the hydrologic cycle. Additionally, rainwater must infiltrate to begin the process of *percolation*, another critical pathway for water within the hydrologic cycle. As you will learn by reading more of this Action Guide, communities are promoting keeping water where it falls, infiltrating into the soil, and avoiding runoff.
- **Percolation:** We need *percolation*, the slow movement of water through the porous spaces of soil and permeable rock so our *aquifers* are recharged and refilled. While we may think more about the bodies of water we *do* see, these underground reservoirs matter and some are quite deep.
- **Groundwater recharge:** *Groundwater recharge* is water that has successfully soaked into (infiltrated) the ground, and moved through pores and fractures in soil and rock (percolated) to the water table. The *water table* is the depth at which soil and rocks are fully saturated with water. Recharge maintains the supply of fresh water that flows through the groundwater system to wells, streams, springs, and wetlands.
- **Evapotranspiration:** Water has to get back to the atmosphere to keep this hydrologic cycle ongoing. Evapotranspiration is the sum total of *evapo* + *transpiration*, or evaporation + plant transpiration, the water moving through the plant's roots system and being released as vapor through the leaves. All of nature depends on a balance. Too much evapotranspiration can negatively impact the amount of groundwater recharge. All is connected. The hydrologic cycle works best when, in healthy ecosystems, precipitation can travel through a variety of pathways. By blocking these natural pathways for water with concrete, asphalt, and roofing materials, we have created unnatural circumstances. Stormwater runoff is a result of our intrusion into what Mother Nature had designed.

Check the Glossary on page 49 for more key words that relate to stormwater found throughout this guide.

So what happens instead of what Mother Nature had in mind? In many of our cities, stormwater moves quickly along impervious surfaces, such as roads and roofs, where water cannot penetrate. Along the way that water picks up a variety of contaminants like plastic bottles, brake dust from cars, and pet feces that is carried along until it eventually reaches a *storm drain*. Storm drains are essentially holes or cut outs in our roads and curbs that have a variety of designs. All are connected to underground pipes and most are made to keep large debris out while allowing water to pass and not pool on streets or parking lots. Once in

the storm drain, stormwater from many places is combined and channeled through a system of tunnels to an *outfall*. Outfalls are the points where stormwater or drainage discharges from a sewer pipe, ditch, or other means to a receiving body of water. The stormwater from multiple sources with multiple contaminants empties into a body of water. This polluted water is labeled as *nonpoint source (NPS) pollution* since there is no single, identifiable source of the nutrients or toxins that are present in the stormwater.

As you would expect, chemical contaminants like oil and pesticides have a negative impact on aquatic ecosystems in the streams, rivers, and lakes that receive stormwater. More surprising is that some of the most debilitating impacts come from sources that occur naturally. While nutrients like nitrogen and phosphorus are essential for plant growth both in the water and on land, the amount of these nutrients that are available limits plant growth in most aquatic ecosystems. Nutrient levels fluctuate depending upon a variety of factors including periodic flushing of nutrients through the ecosystem during large rain events. But high nutrient concentrations can also be brought to aquatic ecosystems through stormwater and agricultural runoff. These high concentrations cause imbalance within the ecosystem that often results in *eutrophication* of the water body. Eutrophication is characterized by sudden bloom, or increase, in phytoplankton (microscopic plants and algae) that results in a dramatic reduction in the dissolved oxygen available for plants and animals. So for our rivers, lakes, and oceans more is certainly not better where nutrients are concerned. As a matter of fact, these excess nutrients result in *dead zones* where only bacteria can live. These huge volumes of nitrogen and phosphorus regularly enter our waterways through the inappropriate application of commercial fertilizer and manure, uncontrolled domestic animal waste from livestock and pets, and untreated wastewater from homes and businesses.

Why does stormwater matter? For the same reason our planet matters: this is our home.



DEAD ZONES: Where in My world?

According to the National Oceanic and Atmospheric Administration (NOAA), a dead zone can occur in oceans and lakes all over the world where little to no oxygen is dissolved in the water. Most aquatic life either dies, or, if mobile like fish, leaves the area. Do some investigating: find the dead zone closest to where you live.

Get Ready for Action Research

These days the Internet and a search engine are often seen as a one-stop shop for doing research. Not so fast! While the Internet certainly is helpful, it's filled with other people's research. To conduct your own, participate in these four methods:

- Media
- Interview
- Survey
- Observation and Experience

You can apply this method of action research to any topic. Instead of simply repeating the research of others, develop your own findings and uncover an authentic community need. This process of investigation is the foundation for service learning.

And when we create problems for the water we depend on for drinking, growing food, and maintaining our quality of life, that's a big problem for all of us. That's a reason to stop and reconsider our actions. Here's the big picture: provoked by rain, whatever enters the stormwater system is usually discharged untreated into the waterways we use for swimming, fishing, and drinking. Now it's your turn!

Ready for Investigation

With this basic knowledge of why stormwater matters, you are ready for *investigation*. During this first stage of service learning, you get to check out how this information applies in your own backyard, and how you are interconnected with other communities across the globe. This is the foundation for getting further prepared and ultimately coming up with a plan for action.

Keep in mind that protecting the hydrologic cycle, and controlling stormwater and related issues

are the concern of our governments, community agencies, neighbors, and our schools. How will you find out? Through *action research*. Use the Gathering Information About a Community Need two-page organizer on pages 29-30 to help you learn more about the big picture and how this informs what is happening in your own backyard. Brainstorm methods of finding out, plan what you will do, and investigate the answers to your essential questions. Use the following methods to gather information about what is working well in your community related to supporting our natural water systems, and what is challenging due to stormwater. Read on!

Hint: While each of these approaches to action research will provide significant and helpful information, the **Rain Check School Stormwater Management Audit** (see pages 33-36) provides unique observation and experience data that can drive your other action research approaches. With this as a basis, augmented by the other three approaches, you will be ready to further prepare and take action.

Media: Newspapers, television, film, magazine and journal articles, the Internet, photographs, and similar resources are all media tools to use for investigation. Begin with the *EarthEcho Expedition: Into the Dead Zone* video entitled *What Happens When We Build Cities?* Can you identify issues from the video that apply to your community? Explore available newspapers. Find articles that have to do with stormwater issues. Where are torrential rains causing surprise flooding? Or if this is the first rain of the winter, perhaps there is an article about *first flush* monitoring (see page 11). You might read about a community event that is making sure to be litter free to prevent storm drain clutter. Or you might see an article related to agricultural pollutants, dead zones, or a swirling gyre of garbage (some as a result of stormwater) that's polluting all of our oceans. Cut out articles that address these and other related concerns. Sort the articles into categories. This might include neighborhood concerns, local initiatives, policy, legislation, expenditures, and environmental and social impacts on a city, state, region, national, or international scale. Read, discuss, and consider: What are all the topics connected to stormwater that are in the news? What issues seem most important in your community?

For any news story, the byline tells you who wrote that story. If this is a local news story on TV or in print, there may be an environmental reporter who could be an excellent contact. Often reporters are available to answer questions about what they cover by email or in person. Inquiring about how they delve into a topic can help you wade deeper into stormwater.

Interview: Through the interview process you gain personal knowledge from an individual with expertise in the topic you are investigating. Who would know about stormwater issues at your school and in your community? Who might be part of developing a plan of action for improving and protecting our water resources, and who would know what *is* working well? Once you determine who you will be interviewing, use the Preparing for an Interview document as you compile your questions, and An Interview with... document during the actual interview, on pages 31–32.

Students have found maintenance professionals at their schools to be most knowledgeable about pervious and impervious surfaces on campus, and able to offer insight into drainage systems that are in tip-top shape or that may require updating. Many water companies have an education division that can schedule time for school visits. Be sure to communicate what you are interested in learning through an interview in order to identify the right expert. When possible, aim for several interviews to gain multiple perspectives.

Survey: A survey can help you quickly determine what concerns people in your school community and how they may be willing to be involved. Are people “in the know” about stormwater? Are they aware of compelling facts that you know or shrug off the idea that stormwater is critical? Anyone need a refresher on the importance of the hydrologic cycle or the value of rainwater? A survey can help you find out and may help you determine your plan of action. Develop a few basic questions to start. Decide whether your survey will be carried out in-person—for example, during school lunch to get data about what students, teachers, and administrators know or think—or if you will want to survey a more general population at the mall. Some students create an online survey to involve large numbers of respondents and then use this to establish community buy-in. by basing their plan of action on data from their survey analysis. When designing your survey, consider asking several general questions and then target *stormwater*.

Observation and Experience: Time to get up and get moving. During this action research method, you will take a look at what is all around you with new eyes. What do you notice that may have appeared insignificant before? How much oil is collecting in the parking lot? What litter on campus seems to be overlooked? When it rains, where do puddles collect? The Introduction to the Rain Check School Stormwater Management Audit will assist you in organizing how to collect usable data about your school environment. Then you will be ready to implement the Rain Check School Stormwater Management Audit found on pages 33-36. Be sure to take a camera along!



FIND YOUR “KEEPER”

Is there a local Waterkeeper or Riverkeeper in your community? These guardians of our waterways can provide a wealth of knowledge about the history and current challenges facing local waters. Check the Waterkeeper Alliance website at www.waterkeeper.org.

Introduction to the Rain Check School Stormwater Management Audit

Audits give you a way to collect information by making observations, asking questions, and documenting findings with photographs. This audit will focus on the stormwater and runoff around your school property, including how it moves over the land, where it goes, and the surfaces that affect the water cycle. To begin the Rain Check School Stormwater Management Audit, take time to prepare as a group.

Know Your Boundaries: Make an appointment to speak with someone at school who can clarify the boundaries of the school property. You might consult with the principal, another school administrator, or a school maintenance or custodial staff member.

Select Your Approach: There are different ways to approach the stormwater audit as a class. Select one of the methods below:

1. Create a list of all current stormwater management practices and issues using the worksheet Rain Check School Stormwater Management Inventory on pages 33 & 34 as a guide.
2. Construct a scale map of school grounds using graph paper. Once the map is constructed, follow the audit instructions using your paper map.
3. Create an interactive map using Google Maps Engine and/or Google Earth. Audit instructions will follow this method. Instructions on how to use Google Maps Engine and Google Earth can be found on pages 37-39.

While you can utilize the list of Stormwater Capture and Low Impact Development Features found in the Rain Check School Stormwater Management Inventory without using a mapping component, the maps associated with this audit are used as an ongoing reference as you move through the service learning process. Whichever approach you choose, the information you record will help you to collect and analyze data, identify problem areas on school grounds, evaluate options, and determine how stormwater management can be improved.

Get Organized: There are four different types of data that need to be collected from all areas of your school grounds. How will you divide the tasks? Here are some suggestions:

- Divide into groups with each group completing a map and the entire audit. The groups then compare findings.
- Divide into groups with each group collecting a certain type of data such as stormwater capture features, low impact development (LID) features, poor water flow indicators, or impervious surfaces. Compile or aggregate all

information into a single class map.

- Divide into groups with each group responsible for collecting data from a section of the school property. This is then compiled onto a single class map. This is best for schools with expansive grounds.

Conduct the Audit: Complete the Rain Check School Stormwater Management Inventory on pages 33-36. This should ideally be completed directly following a rain event so the effects of stormwater can be readily seen.

Interpret the Audit: Once you have created your map using the Rain Check School Stormwater Management Inventory, you will begin to identify and prioritize areas of the school property where you can have the largest impact. Discuss ways you can slow down stormwater on your school property and return rainwater to its natural cycle. Use the Rain Check School Stormwater Management Assessment section on page 40 as a guide to advance your understanding and to explore options. Use the formula on this assessment document to determine the volume of how much stormwater is being displaced on your school grounds. Generally, 10-15% impervious surfaces results in a decrease in water quality in local bodies of water. When an area has greater than 25% impervious surface, the runoff that enters an aquatic or marine ecosystem may be toxic to many organisms. What can you do to slow water and capitalize on the direction water is already moving in? With your map and assessment calculations, you will be better able to target problem areas, develop recommendations, assist with implementation, and conduct a follow-up audit to monitor effectiveness.

Read on! Check out the examples of ideas and strategies communities (including youth) are doing to further your planning and *action*.



A picture is worth a thousand words!

Using photos and video to record your audit findings provide detailed documentation easily referenced as you evaluate options for improvement and make a case to others.

Snapshot:

Students Investigate First Flush in San Leandro, California

In San Leandro, students attending John Muir Middle School see storm drains along the sidewalks that outflow a mile down the road into Oyster Bay Regional Shoreline. This shoreline area is a former landfill, closed in the 1980s that now is home to many species of birds—marsh hawks, black-shouldered kites, red-tailed hawks—and spectacular views. Runoff was one of the issues being considered as experts considered converting this landfill into a park.

In Alice Skuce's 6th grade earth science class, studies include looking at erosion, different forms of pollution, and runoff. To connect these topics, classes went on a walk to observe the *first flush* of the season. The central questions were: What's going on in the Bay? How might we be contributing? On the walk the class paused at Doolittle Street where the wetland area used to end before the land was filled in. Students tried to imagine what this change in landscape caused. What happened to the oysters that used to be in the Bay? Many of their own homes rest over what used to be oyster beds. Once they arrived at the park, they observed the runoff from the storm drain heading directly into what is now a small salt marsh, a reluctant recipient of what students see—all kinds of litter and oil. Their automatic response was *Let's remove the trash!* They immediately realized that litter from their school campus may be dumping into their Bay right before their eyes. What's next? A school litter clean up and continued investigation.

Next Step: Investigation, the first stage of service learning, gives you the essential information you need to construct a plan of action. Investigation also raises more questions and leads you to the second stage of service learning: preparation. All of this will lead you to action.



A PAUSE TO REVIEW

Discuss in pairs or small groups:

- What did you like best about investigation?
- What facts or ideas are most memorable? Who would benefit from knowing this information? Share with others.
- Identify a skill or ability you have that will be helpful as you move forward in preparing and taking action. What skill do you want to improve or develop? Come up with a first step to make this happen.
- What about this investigation method can help you with

What is first flush?

"First flush" is the runoff that occurs at the beginning of a rainstorm. This generally carries more pollutants that have accumulated during the time between storms. If only a day has passed, perhaps not too much has accumulated. If it's been several months since a substantial storm, the nonpoint source pollution could be considerable.

Done, But Not Over

As you move from **investigation** to **preparation**, keep in mind that all of the information you uncovered through exploration of **media**, conducting **interviews**, polling the populace through **surveys**, and gathering details by **observation** with the **audit** will be referenced as you continue to prepare and plan.

Stage 2: Get Ready → Prepare

The Impact of Urbanization

Through investigation you have gained understanding of key concerns regarding stormwater. You have been taking a look at your school setting. Now let's enlarge the picture and consider *urbanization*.

Urbanization, the building of towns, villages, and cities, is generally caused by the centralization of businesses and industry. In Europe and the United States, rapid urbanization occurred during what is called the Industrial Revolution. Now we are in a technology age, and urbanization continues globally, especially with the increase in populations. Can you think of all the ways urban areas create challenges for our water resources?

We have made advances. There was a time when erroneous assumptions about water comprised our natural resources. Water was considered an easy disposal system for trash and waste, leading to the pollution of wetlands, streams, lakes, and oceans. We know better. Today, municipalities have departments with staff whose job it is to ensure that water quality is protected, and to look ahead to improvements that preserve our resources for the future.

There is also a growing concern about how stormwater-related challenges make flooding more likely in communities everywhere. Increased development and infrastructures in need of upkeep and repair can create situations where even a modest rainstorm can cause havoc. Neighborhood creeks that were scenic can overflow. Clogged storm drains can cause flooding in nearby homes.

Atlanta, Georgia, a large metropolis, replaced absorbent grasslands and forests with 91,000 acres of impervious surface over the course of ten years. This is estimated to be the size of 69,000 football fields. Runoff then overloaded metro streams. When the impervious surfaces covered 30% of the region, runoff impact created water flows where they were not expected—in people's front yards. Along with the shift in the flood plains, Atlanta has been addressing the issue of stormwater with plans to mitigate these challenges.

Now let's take a look at Washington, DC, a city aiming to improve stormwater concerns with a variety of strategies. The District Department of the Environment's Watershed Protection Division works to ensure that clean water is available for human and animal life, for commerce and industry, and for recreation. The main area waterways for Washington, DC, are the Potomac and Anacostia Rivers and Rock Creek. The District is also part of the Chesapeake Bay Watershed.

An Interview with Stephen Peiling, Grace Manuban, and Trinh Doan, Environmental Protection Specialists, District Department of the Environment, Washington, DC

What are the stormwater-related challenges facing urban areas like Washington, DC?

The city of Washington, DC, was built on a swamp. We are very low. There was a major flood years ago. We deal primarily with stormwater and implement practices to mitigate all kinds of flooding from low lying parts of the city. With the more severe and unpredictable weather conditions we are currently experiencing, we have to be proactive about flood protection. We don't have a water scarcity issue here. Our need is to prevent excess waters from entering our systems and avoid overflow with runoff into streams and rivers.

Years ago, plans for cities were designed to get stormwater out of the way and off the streets. The easiest way was to put stormwater directly into receiving streams through a system of tunnels. Now we have more and more impervious surfaces with buildings and parking lots that were constructed in the era before regulation. As a result, we are getting runoff that's more toxic and hard to control. This same challenge is evident with a lot of older cities. The sewers were one pipe. All the sanitary and stormwater went together through this pipe to a treatment plant, and all was treated in one place. As cities grew in size, parking lots and other areas that don't absorb stormwater increased. The water volume entering the system is larger, though the pipe is the same size. This led to many overflows that impact the Anacostia and Potomac Rivers and Rock Creek. We still have overflows, where raw sewage and other pollutants from the streets run off into these waterways.

Keep in mind that some of the pipes in DC are over 100 years old. With this aging infrastructure come leaks and breakages. In several areas of Washington, DC, we have a multiple piping system. This means there are some pipes that lead to the waste treatment facility and separate pipes that carry stormwater away. This results in stormwater pouring directly into our waterways without first being cleaned, so this is not an effective solution. The current thinking is to keep the stormwater onsite, where it falls, to recharge groundwater and mimic what was naturally done before cities. We have considerable challenges with this. Washington, DC, has national parks with federal oversight, private land owners, and residential buildings of all kinds in a dense city center. Getting all of the stakeholders to agree to the same strategies is a challenge.

Green vs. Grey Infrastructure: Are these so different?

Green infrastructure, from a stormwater perspective, is using nature to absorb rainwater onsite to replenish the ground water levels and filter out the associated pollutants. Green roofs, water retention, or rain gardens are a naturalized way to treat stormwater.

The gray infrastructure can be seen with the old concrete pipes, often with sand filters and different manholes that separate oil and grease from water. Gray is basically a system of larger underground tunnels intended to store the water when big rains occur. Then when the rain subsides the pipes carry the water to the treatment plant or have a direct pour into lakes, bays, streams, or whatever is nearby. DC Water is taking on one of the biggest gray infrastructure projects ever for stormwater by constructing a 13 mile long series of pipes specifically intended to hold stormwater overflows until they can be safely treated.

To find out more about this project visit www.dewater.com/workzones/projects/Lady_Bird_TBM.cfm.

We know that a gray infrastructure with stormwater sent directly to streams doesn't work.



Who are the stakeholders?

These are people invested in water quality in the community—this should be *everybody*. You can target your message to different stakeholders as you plan your action.

This results in a direct outpour into major rivers and smaller streams that make their way into the rivers and the bay. The stormwater delivers nutrients, heavy metals, asbestos, oil, grease, and trash straight to the streams. The single pipe at least gets the stormwater cleaned, though you are sending it to a treatment plant and then directly to the bay, and missing out on the hydrologic cycle. When the hydrologic cycle is interrupted, the base flow of streams is reduced. Our groundwater is reduced. With green infrastructure you have the hydrologic cycle supporting our ecosystem and this supports a more natural habitat as well—wildlife is attracted to the green, and bioentention attracts bugs, butterflies, and other animals.

What about new strategies to support this green infrastructure?

Many locales are aiming for diverse strategies. In the DC area, one approach is the Riverside Home Programs, in which residents opt for a small co-pay for rain *dayscaping*. This involves planting regional natives with long root systems that prevent erosion and stormwater. This is so new it's inconclusive at the moment; we do anticipate improvements with more homes participating and the more streams restored.

Another program, River Smart Schools, is offered within the District of Columbia. Our division offers educational resources and support for construction and installation of BMP's, best management practices. Through a competitive application process, 35 schools and their students are now stormwater gardening with our help. To emphasize how the school is connected to the rivers, we begin with a classroom experience. We talk about stormwater and teach about our local watershed. Then the class goes on a pontoon boat ride on the Anacostia River. That's an eye opener, because in addition to the wildlife, they always see trash floating. This leads to water quality testing and thoughtful, reflective conversations about how to clean the stream.

Back at school, students investigate the plants and help plant rain gardens. In several schools, students designed the shape of the rain garden, and two have butterfly shapes. Students stay involved all year through classes, clubs, and even the parent-teacher organization participates in summer garden maintenance.

Why is it important for youth to get involved in these initiatives?

DC Mayor Vincent Grey aims to engage 50 percent of the students in environmental education over the next twenty 20 years. Programs like these help students become more connected to what sustainability and environmental stewardship means and provides a real world context for examining and resolving problems. When you think of stormwater and stormwater pollution, it's hard to imagine how a rain garden can make a difference; however, a learning experiment to calculate how much stormwater the garden can absorb creates an effective outdoor classroom right at your school.

Can you imagine how many activities and learning opportunities exist in a rain garden? For art projects, students make signage using recycled materials. Some schools combine stormwater reduction with edible gardening efforts. Food and nutrition are huge in school gardens in response to the Healthy Schools Act passed in 2010. We've seen potatoes growing in recycled containers. Creativity is all over the city.

We have encouraged new and recently renovated schools to modernize with toilets using stormwater to flush and include green roofs on schools. There is much innovation in the school district. We are motivated to improve the Chesapeake Bay.

What other programs are educating the community and helping with stormwater?

We also restore natural streams, which supports a more natural way for rain to continue the hydrologic cycle. Some people don't even know these streams are running through their property because they are piped and underground! Now we understand that we should *daylight* these streams—take them out of the pipes and expose them to sunlight to promote natural biological processes and improve water quality. This idea is spreading, maybe within your community. Find out!

Our urban environment will not support a perfect system for stormwater infiltration, but we want to get to a more normal level and appropriate flood plains—the way a stream valley has a natural form of terracing. When a storm causes water to spill into the flood plane, there is a resilient ecosystem in place to manage these events.

Another new stormwater-centric idea involves two fire stations. We have installed a cistern at each station to capture the water from runoff and roofs. Now this water is being used to wash and prime the trucks. We are monitoring and looking at how often the water is reused and what pollutants are in the water as a test. Some people are hesitant about reusing water even to irrigate. What if someone is splashed with the water that is toxic from roof shingles? We want to replace misinformation with accurate data, so we are studying what pollutants are present in order to be more informed and to inform others.

Any words of advice?

Keep trash from getting into catch basins! Learn about your local water bodies! Keep litter off the streets! There really is no one to clean up after you. Visit the outfalls, the places where stormwater reaches the streams or any other waterway. See the amount of waste coming through and entering our systems. And remember the hydrologic cycle. Wherever you are in the land of cities, if water can't get back into the ground, this cycle is broken. We can do better.

A PAUSE TO REVIEW

Washington, D.C. is one of many global cities striving for infrastructure improvements. Usually we take the inner workings of our towns and cities for granted. So take a quick pause to consider, from what you've read:

- What stands out as innovative?
- What do you want to know more about?
- How can this information assist you in your school to address stormwater issues?

Keep these ideas in mind for an upcoming Discussion Circle. However, first ...

What's a school to do?

Depending on school location, the size, the amount of green space, and many other considerations each school develops their own course of action, their plan, for reducing the impact of stormwater. Review these strategies. Would any be possible for your school? You might be surprised that even an unlikely idea, with education and understanding of benefits, surprising change can happen.

Installing Pervious Surfaces. This involves changing any solid cement or concrete areas such as walkways, patios, and parking lots into pervious surfaces. This often happens when an area is in poor condition and in need of an upgrade. With any new construction, this makes sense from the start.

Green Roofs. Have you seen a roof covered in plants that are specifically placed there to reduce stormwater from running off the building? An added bonus is usually increased insulation, and lowering of the heating and cooling costs. Green roofs are growing in many spaces, including government office buildings, museums, corporate headquarters, apartment complexes, and schools.

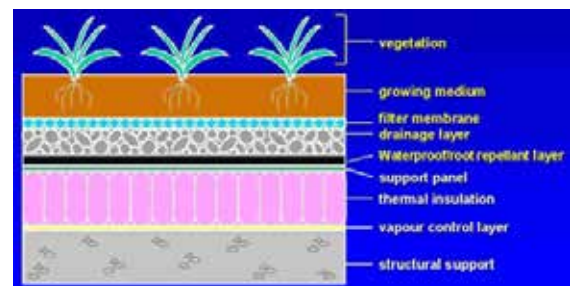


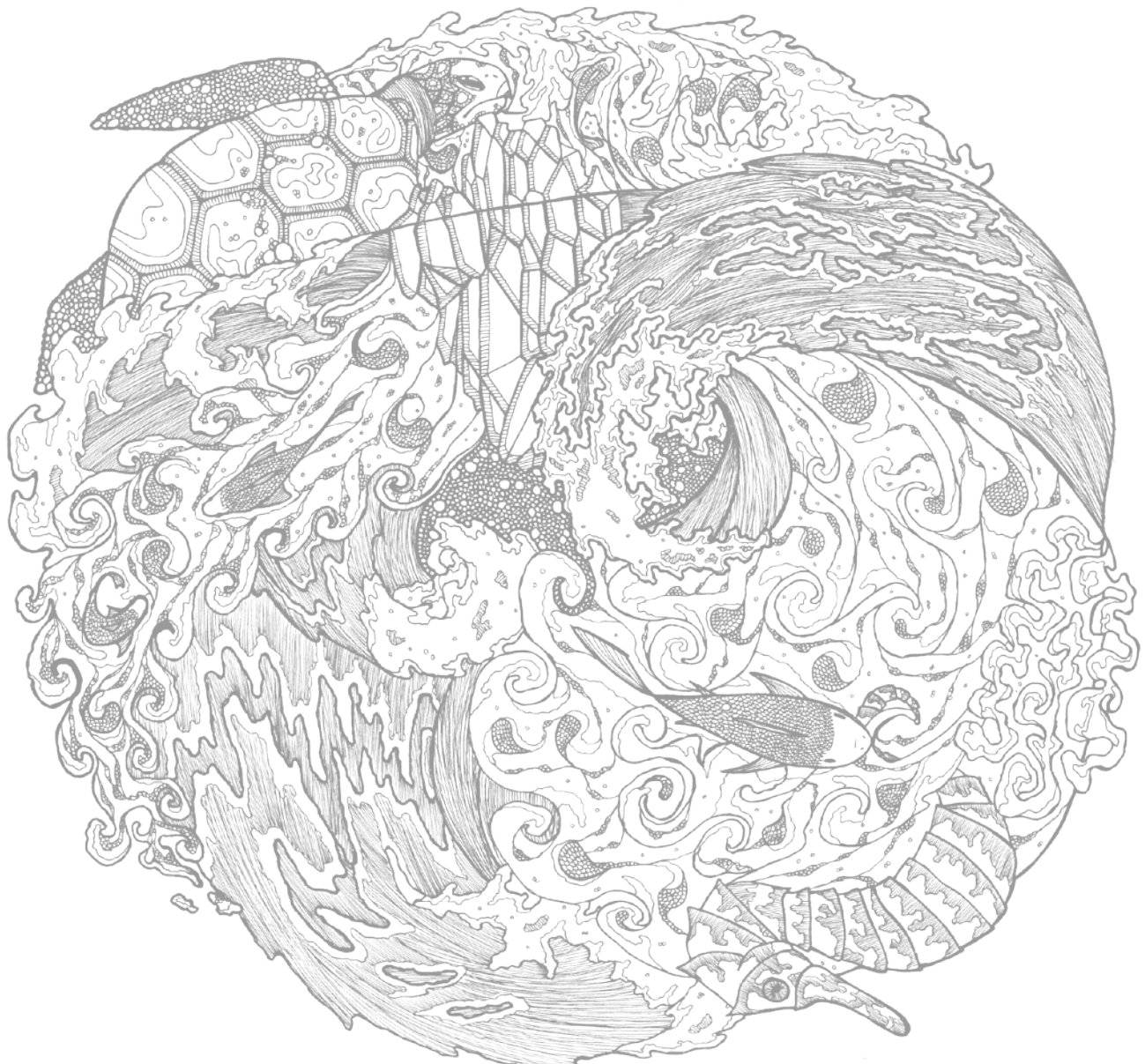
image from
<http://www.greenroofs.org/index.php/about/aboutgreenroofs>

Cisterns. Simply put, these are catchment devices that collect and store rainwater that runs off of impervious surfaces. Designs for cisterns vary and can include filters, pumps, and screens to keep debris out of the holding tank. Many cisterns are located underground to keep water cool and reduce evaporation.

Rain Barrels. This is a small-scale rainwater harvesting technique that catches whatever rain would otherwise be contributing to runoff. These are most often attached to a downspout near a garden or flower bed with a soaker hose that passively waters the planted area. A plan needs to be in place to drain the barrels as required.

Biocapscaping or Native plant Gardens. Environmentally sound landscaping can protect an area from erosion and reducing sediment in runoff. This type of landscape design greatly reduces the need for pesticides and herbicides since native plants are often uniquely adapted to the area.

Rain Gardens. Imagine a garden that is purposely designed in construction and plant selection to use rainfall and stormwater runoff. That's a rain garden, and the size varies from quite small to a more substantial plot of land. When properly designed, a rain garden can absorb excessive nutrients such as nitrogen and phosphorus found in stormwater runoff. How? Placement near the source of the runoff helps, and, through the slope, the stormwater is slowed down and infiltrates the soil causing less erosion. Below the garden's surface, processes we can't see are mimicking the hydrologic action of a healthy forest.



A Rain Garden Story

What's all this talk about rain gardens? What are they and what do they do? And how do we know they work? As an 8th grader, McKalee Steen did a study to find out.

An Interview with McKalee Steen, 10th grader at Grove High School, Grove, Oklahoma

Tell us a bit about where you live.

Grove, Oklahoma, is in the northeastern part of the state. We're near Oklahoma State University, and also about 25 miles south of Tar Creek, a Superfund site. Tar Creek doesn't run through Grove, but the mining waste that has poisoned the land, water, and air in this region has made a huge impact. One of the communities, Pitcher, is practically a ghost town. This unfortunate situation has led me to want to know more about pollutants. It's an issue that affects many lives, and I would like to help fix this for our community.

In 8th grade you conducted a research study called "Rain, Rain Come This Way: Testing the effectiveness of rain gardens through chemical analysis, daphnia toxicity & planarian regeneration rate." What got you interested in rain gardens?

I had noticed the rain gardens around town. There are eight of them installed by Oklahoma State University (OSU). I wanted to know more about how they functioned and see if they were fulfilling their purpose and, if so, how well. We are required to do a science fair project, so I decided on this study.

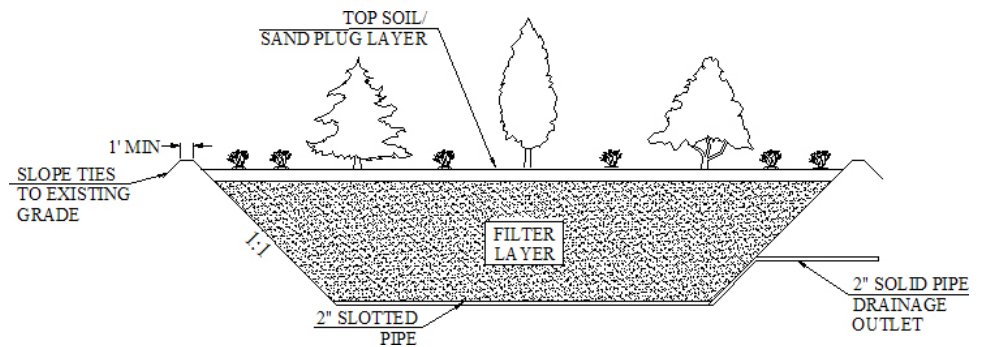
How do rain gardens work?

While there are different types of rain gardens that are specific to the geology and hydrology of an area, all rain gardens serve the same purpose. With every rain there is stormwater that comes off of buildings and impervious surfaces. This water enters the rain garden and will

sit on the surface for a while because they have sand plugs or other design features on the top to catch the water. This allows the water to slowly enter the filtering layer, in this case a layer of fly ash and charcoal, at a proper pace; if it came through too quickly the filtering would not be effective. That's the basics. The cleaner water then empties through a drain, moving toward a creek, stream, or waterway if one is nearby.

How did you plan this experiment?

I first contacted Rebecca Chavez at Oklahoma State University. She had information on how the rain garden in our community worked. That was helpful. My mom, also a science teacher, helped me with the ideas for the experiment. She helped me balance my curiosity and creativity with the scientific method. My plan was to capture water samples before and after being filtered in two different rain garden locations following two different rains. I planned to collect samples at the rain garden at school and the rain garden by the Cherokee Queen, an area with lots of restaurants. Once the samples were collected, I could use the Smart2 colorimeter at our school to determine the amounts of heavy metals and phosphorous in each sample; I tested for cadmium, zinc and nickel, lead, and copper. I also tested for pH and total dissolved solids (TDS) using a pH meter and a TDS meter.





Were there any challenges?

Waiting for the rain! That was the hardest part. I had to wait to see that there would be runoff. Then I would collect water off the parking lots before it entered the rain garden—that was one set of samples from each of two locations. Then I would wait for the stormwater to go through the rain garden filter and collect another sample from the drainage pipe. With those samples, I ran my testing.

Any surprises?



In this picture, I was pretty amazed, because just a few minutes before there had been stormwater standing in the rain garden, but when we came back it had disappeared. It actually had just been slowed down by the sand plugs and then went through the filter. (That's me pointing to this phenomenon.) Another surprise was how these metals are in our environment simply from cars driving through parking lots. We are putting the toxins out there. Even though they are in small amounts, the toxins are present. Once the stormwater washes off the parking lot, goes through the rain garden, and comes out at the end, I confirmed reduced amounts of

metals in the nonpoint source pollution. That we get the toxins as low as possible is critical to reduce negative environmental factors. I checked the toxicity of the stormwater by doing experiments with planarian and daphnia. I was able to confirm that the cleaner rainwater made it healthier for daphnia and planarian; this is important because the water will end up in the nearby lake.

What are planarian and daphnia, and how were they a part of the process?

At our high school daphnia and planarian are kind of go-to testing animals. Planarian are flat worms. They live in aquatic environments like a lake or stream. They are pretty small. They have an amazing ability to regenerate. If you cut them in half (that sounds gruesome), the part with the head will grow a tail and the part with the tail will grow a head. I cut them in half and put specimens in the stormwater before and after it was filtered in the rain garden to see if either condition would help them regenerate faster. They did regenerate faster in the filtered water. This is a good thing because you want your head to grow back as fast as possible. And daphnia are water fleas. They are a good indicator of the toxicity of the water. I did a survival rate test with the daphnia in the stormwater collected before and after passage through the rain garden. Daphnia survived longer in the water that passed through the rain garden.

How did you use this information?

I was able to present this at several science competitions. This helps spread the word to others.

I also submitted my results to Rebecca Chavez at the university confirming the efficacy of the rain gardens and she was glad to know my findings. My study was among twelve papers selected to be published online by the Oklahoma State Science and Engineering Fair, which was a huge honor for me.



What did you gain personally from this study?

It definitely made me think about how we have an impact on the environment simply by driving our cars. We contribute to heavy metals in the environment and how important it is to fix that.

Also, this definitely helped me with my next study in 9th grade, doing research on rhizofiltration with switchgrass. I may want to find a way to implement natural grasses in Tar Creek or in our local rain gardens to

minimize heavy contamination. I am also looking at little blue stem grass to determine if they could help. Living near Tar Creek makes the issue of toxins and their impact a topic I want to address personally.

Any advice for other students who want to do research on stormwater issues in their backyard?

I think you should totally care and be involved. This is our environment and our world, and we have to also think about future generations. So don't think that a topic that interests you is insignificant. Your simple ideas can have a major impact. And a complex issue, that can also have a major impact. Don't be intimidated by science in general. It's not as scary as it looks. Go for it!

TIME FOR DISCUSSION

Use the Discussion Circle documents in the Resource Section on pages 41-42 for a sit down conversation of the interviews, videos watched, and other information introduced in this guide. Follow the directions from Discussion Circle Roles on page 41 and use the Discussion Circle on page 42 to take notes.

Investigation and preparation get you ready to begin shaping a plan for *action*. Before you turn the page and continue, take time to . . .

Reflect—Occasionally during preparation, generate different ways to reflect. A few ideas:

- You likely have heard the phrase, "It takes a village." In what way does this apply to creating a better system for managing stormwater? Who has a role to play? Can you think of other quotes or proverbs that represent how you think or feel about how we are depleting or protecting our natural resources?
- Create a mind map, a visual representation of all you have learned about stormwater so far. On poster paper, write the word *stormwater* then create a visual image or drawing about stormwater to get you started. On your own or with a group, build out from this center point with words, images, and arrows that connect different ideas about stormwater. Using drawings and words connect one part of the stormwater story to another. Step back and look at what you have created, and then add more. What thoughts or feelings do these words and images provoke?
- What did you feel when you read about the challenges we face to manage stormwater well? How do our emotions matter as you are learning and coming up with ideas for action?

From Washington D.C., to Oklahoma, Stormwater Matters. Where else in the world is stormwater a hot topic?

Is stormwater a global issue? Most definitely. The Internet is an effective tool for finding a stormwater issue on every continent, with the exception of Antarctica. As early as 800 B.C.E., Romans built sewers with open drains to carry stormwater, however this also carried all forms of waste into the water system. Now, in China, storm drains are selectively built near what the government considers to be the most important locations, and had been designed to handle one storm every five years. When a recent rainstorm dropped five inches of rain in an hour, Beijing's drainage system could only manage one-third of the water levels. [thinkprogress.com] In Buenos Aires, Argentina, development of large, expensive homes are **changing** the local landscape and preventing appropriate and natural runoff. Serious flooding is creating the need for new regulations. [globalissues.org] We do need to first think locally, however since all of our waters globally are interconnected, it makes good sense, at some point, to widen our view and recognize stormwater as a global concern for all inhabitants of this water planet, our home.

Stage 3: Get Going → ACT

Review, Plan, DO! Are you ready for action? Now is the time to review your audit and consider all the additional information you have learned about stormwater. This section guides you through the process. Plus you will read about ways students are involved. Check it out!

Getting Ready to Change the Landscape

First, review your completed Rain Check School Stormwater Management Inventory. Look at your map.

- Circle areas where you see any signs of disrupted water flow (erosion, soggy, or flooded areas) where you could eliminate runoff.
- Box out areas where you could slow down or reduce the amount of runoff from your school, such as an unused courtyard that could be the ideal size and location for a rain garden.
- Place question marks by areas with low impact development (LID), particularly where you need more information. You can also note who you might ask.

Then reference your Rain Check School Stormwater Management Assessment. Review this consolidated list of evidence and ideas you developed through this collective effort.

Now you can further develop recommendations for change to your school grounds to improve stormwater management. Use the Rain Check School Stormwater Management Assessment on page 40:

- Your top three LID features currently working effectively at your school that could be expanded or increased.
- Your top three ways to eliminate runoff from an area of your school.
- Your top three ways you could slow down or reduce the amount of runoff flow from your school.
- Your top three ways you could lessen the pollutants in the stormwater (e.g., pet feces) in your school community.

For each, complete the other categories that are noted:

- Level of difficulty to implement, easy or hard?
- Level of impact (based on volume of stormwater diverted or cleaned), low, medium, or high?
- What is required to make this happen—convincing stakeholders, acquiring funds, or changing people's behavior?

Now for the exciting part: deciding what you will do. For more ideas, read the examples below.

Four Types of Service

Before developing your plan, keep in mind there are four types of service learning action. As you read about each type, think about and discuss ways your actions can influence how people think about stormwater in your school and community. Use the Plan for Stormwater Action document on page 43 to generate ideas for each kind of action. Then select an idea to get started. Write down who will do what by when, create a timeline, and prepare a central message. Often students design plans that combine several kinds of action. This will be evident by reading the examples of students taking action.

The kind of action you decide upon may combine one or more of these four approaches to service.

DIRECT ACTION

Direct action means coming into direct eye-to-eye contact with people or having a direct influence on the environment, whether habitat or animals. By building a rain garden or planting trees or grasses to prevent erosion, your hard work preserves and protects your surroundings.

Design and Management

In East Tampa, Florida, 100 Young Middle Magnet students participated in designing and constructing a municipality scale rain garden to alleviate campus flooding, manage nonpoint source pollution, and reduce the impact of nitrogen loading to McKay Bay. They were guided by University of South Florida Civil and Environmental Engineering students. The purpose: to promote a sustainable, healthy community through science education. During this Urban Stormwater Management study, students learned techniques for managing stormwater at the source to improve and restore the hydrology to pre-development conditions. They learned green infrastructure and low impact development technologies as they assumed roles of a stormwater scientist or engineer. What a great way to inform students about engineering careers! Students investigated differences in infiltration rates between several types of native media and pervious pavement mix combinations. They selected native plant species based on evapotranspiration rates, aesthetics, and wetting and drying conditions. Next, students identified an area at school that would benefit from green infrastructure improvements, including the rain garden. Their roles involved surveying, project management, site assessment, excavation, media layer selection and installation, under-drain sample port installation, and weekly post construction tests. Data collected from this experimental system is supporting further university research.

Rainwater Harvesting is a process that catches and re-purposes rainwater, often using cisterns or rain barrels. These containers, which come in many different sizes, collect and store rainwater from rooftops. This water can be used for gardens, lawns, washing cars, or in some places to fill toilets! If you don't have a rain barrel, the rainwater runs through a downspout off the roof, onto a lawn or paved surface and eventually goes into a storm drain. Rain barrels conserve water and save money depending on your location and the amount of rain you have. An added benefit is that they reduce water pollution by reducing stormwater runoff.

For You to Do: *Where in your community are rain gardens being installed? Visit one. See how you can help and get involved. Any tree plantings scheduled for coastal areas? Dig in!*



INDIRECT ACTION

Indirect actions have benefits and results that we don't see firsthand, though we know good is being done. This can be accomplished in a variety of ways. Creating signage, publications, or contributing to websites that reach and teach others are all ways to do meaningful indirect service. Be sure to incorporate your distinct talents and abilities as you plan.

Artistic Baltimore Stormdrain Stencils!

In 2012, students attending the Green School of Baltimore, Maryland, began learning about

What Can We Do?

Baltimore has 50,000 storm drain inlets leading to 1,000 miles of storm drains with more than 350 outfalls in the Baltimore Harbor and Chesapeake Bay. According to Blue Water Baltimore, a nonprofit organization, "Our streets are our streams!" so taking action matters. What do they recommend?

- Clean up the streets.
- Put a lid on your trash cans so trash does not blow into the street/streams.
- Clean out storm drains on your block.
- Pick up after your pet.
- Avoid using fertilizer and pesticides.
- Plant trees and gardens.
- Adopt and maintain a vacant lot.
- Spread the word!

stormwater through a partnership with Blue Water Baltimore, a local nonprofit organization. After painting and installing rain barrels at school they wanted to do even more. With Herring Run Stream located just blocks from the school, they knew their actions could matter.

After Blue Water Baltimore staff led a lesson on stormwater pollution, the class moved outside to tour storm drains around their school. Looking at what was *inside* their storm drains inspired the students. Joined by another partner, Belair Edison Neighborhoods Inc, the students decided to educate the local community. They developed one-to-one communication skills to directly encourage friends and neighbors to avoid littering. They created and distributed flyers to inform the community about stormwater runoff and announced they would be creating four storm drain murals on their school grounds.

The students formed design teams and brainstormed images and slogans for their storm drains. They chose their favorite designs and on the day of their annual Green

Fair, the students were ready to get out and paint. Through teamwork, compromise, and creativity, the students completed four unique, beautiful, and educational storm drain murals!

For You to Do: Have you seen any unique storm drain art in your community? Find out from your local water district if storm drain art is going on or would be appreciated. Other ideas? Provide needed information by creating community resources and brochures about stormwater in several languages. Or write an ABCs of Stormwater book for younger kids to get them involved as young water stewards.

ADVOCACY

Advocacy is all about giving voice to a cause. What would you like others to know? What message matters to you? Who needs to hear about the reasons we all benefit reducing stormwater impact? Advocacy can be accomplished person-to-person, through media including video, letters to the editor, or posters. Also, student advocates have influenced public policy.

From New York to Denver to Abu Dhabi: Green Roof Advocates

Elton Hollingsworth and Noel Cruz did not expect to fly across the country to speak at an industry conference. These 9th graders, however, had a story to tell and an idea to advocate. Nine months before, as part of a Science Club at the Bronx Design and Construction Academy in New York City, they began conducting experiments on the school's green roof, the first built on a New York City public school. Students at the academy had built the devices and structures for their Green Roof Integrated Photovoltaic Canopy project. Hollingsworth and Cruz, as part of the Science Club, were trying to determine



whether adding a canopy of solar panels above an existing green roof would provide additional benefits beyond the cooling effect of the green roof alone. They found this approach helps to lower the building temperature by approximately three degrees and purifies the building run-off. This hybrid of technologies, however, was not being utilized within the green building industry. These students spoke to an international group of professional renewable energy practitioners and researchers at the American Solar Energy Society (ASES) World Renewable Energy Forum (WREF). After their presentation, industry professionals approached Hollingsworth and Cruz to learn more. Over the last two years these young people have spoken at international trade conferences and connected with industry leaders in renewable energy about their design in locations as far away as Abu Dhabi. Speaking publically about their ideas and project spreads the message that youth are able to be partners and collaborators and add to this global water discussion.

For You to Do: Keep in mind that adults want to hear what youth know, care about, and can do. Be certain to document your work from the very beginning. This gives you a more complete story to tell when you are ready to be an advocate, a voice for a critical cause.

RESEARCH

While you have already completed various kinds of research, consider if there is more to be done in this *action* stage. Research as action can either inform ways you can educate others, or may produce needed information or data for decision makers in your school or community. Doing research as part of your action plan will equip you to be informative and persuasive, all helpful in making change happen.

Trash Traps on the Anacostia

Youth from the Earth Conservation Corps (ECC) are not your average green team. The ECC is a youth development and environmental service organization that focuses on the restoration of the heavily polluted Anacostia River. While these youth organize clean up events and river “sweeps” throughout the year in various areas along the Anacostia River, there is always more to do. Since 2009, ECC youth have been monitoring, recording, and cleaning trash traps that they helped to install in multiple locations on the Anacostia and its tributaries. Youth have integrated themselves as “guardians” of the Anacostia by working with stakeholders in some of the most challenged communities in Washington DC. In partnership with the Anacostia Riverkeeper and the District Department of the Environment (DDOE), ECC youth compile data about solid waste carried to the river via stormwater. They maintain trash traps by recording materials captured and removing the litter and debris from the traps weekly. They also are evaluating an innovative design called a Bandalong Trash Trap, the only one of its kind in the Northern hemisphere! The ECC reports their findings to municipal partners to improve strategies for reducing nonpoint source pollution on the Anacostia River. This long-term data collection benefits the partners as ECC members build valuable skills.



For You to Do: Consider how research could advance your cause. Create a Research Team to dig up more information on stormwater where you are and in others locales, especially to find out how youth are involved. Adapt ideas to fit your community and culture. Be an advocate for change!

THREE KINDS OF ACTION IN EDINA

Valley View Middle School in Edina, Minnesota, is located next to a creek, a perfect learning lab. Seventh grade science teachers wove service learning into their unit on “human impact on the environment,” focusing on the local watershed. All of the 300 students found an interest that sparked action. They started with a walkabout at their school (*investigation*), mapping the school grounds looking for what was already working well and what needed to be improved.



Two areas of need surprised them: dog waste and salt. To deal with the excessive animal waste they began an *advocacy campaign* with signs to remind folks to scoop and properly dispose of the waste.

Why the salt problem? Salt is spread on sidewalks and parking lots to melt ice and snow during winter. When the students saw huge puddles gathering in the parking lots even though they had drains, they wondered if excessive salt was creating unseen problems, including adding salt to the creek, a tributary of the Mississippi River. They needed more information.

To learn more they brought in experts (*preparation*). First, they talked with the school custodians about all the salts used and learned that every application of salt was measured and recorded. They learned about the safety requirements of salt to prevent slipping, falling, and injuries. They learned that asking critical questions created new perspectives. A speaker from a local watershed organization did confirm that the salt (saline) content of the creek was unsafe.

They developed action plans, in groups, to provide service in 22 different ways. Some of their plans were a combination of different kinds of actions. Several examples from Edina include:

Direct Service:

- Planting a rain garden to decrease stormwater run off
- Cleaning up the creek and pulling out cans, shopping carts, tires

Indirect Service:

- Painting and decorating a rain barrel
- Painting a mural on campus about the watershed to be as a teaching tool

Advocacy:

- Presenting to the city council with information and a slide show urging a new policy requiring new construction to include 10% permeable surfaces
- Labeling storm drains
- Creating signage to encourage people to clean up after their dogs

They also made a video of the different types of action taken (*demonstration*) to tell the story of what they had learned and how they had served.



We Propose, We Progress

Learning to write a proposal helps you develop the skills to write short, succinct, powerful messages. Clarifying the need, your purpose, and desired outcomes synthesizes your hard work into one cohesive document that adds credibility to your ideas. This is the same proposal format used by many individuals and organizations who seek funding for their service learning ideas. Being able to write a proposal is a valuable skill you will find useful for years to come. Keep in mind that even a well thought-out proposal can change during implementation as challenges or new ideas and possibilities arise.

Activate adult and community partners to assist with your ideas. Use the Service Learning Proposal document on page 44 to write up your plan to submit for approval to your school administration. If appropriate, work with your teacher to submit a proposal for a mini-grant through EarthEcho Expeditions and their partners. Include a strategy to communicate to others what is being planned. Will you be part of a school assembly or offer daily announcements of stormwater facts—even some from this Action Guide—on the PA system? Can you schedule time at a faculty meeting to sell the idea to the teachers and even suggest ways they can make stormwater flow throughout their academic agendas?

Getting your message about stormwater across to others is an important part of being an advocate for change. Use the strategy found on the document Crafting an Elevator Speech on page 45. Knowing the reasons that reducing stormwater impact matters will be essential as you aim to reach, teach, and influence others about making the changes you are proposing. An elevator speech is a popular effective strategy to communicate an important message.

The Progress Monitoring organizer on page 46 helps you set your baseline and timeline to note what has changed. This is helpful for evaluating what is going well and what you can change as you move forward.

This is what you have been working towards throughout Investigation and Preparation—moving into Action. Be ready for the unexpected. Keep encouraging members of your team. Remember that even small actions matter can add up to significant changes. Once we all take first steps, our collective efforts add up, big time.

Even During Action, Pause for Reflection

As you implement your ideas to protect our waters by addressing stormwater issues and concerns, ask yourself:

- What about your plan gets you most eager or interested?
- How are you using your interests, skills and talents moving forward? How are you encouraging others to do the same?
- In five years, looking back, what do you hope is different because of your actions?

PHILIPPE COUSTEAU'S ELEVATOR SPEECH

If Philippe Cousteau stepped on an elevator and saw an influential elected official, how would he use the time to get a message across during their brief ride together?

1st floor: Did you know water is the most important substance on the planet?

2nd floor: Water connects every being to one another—from drinking to energy production.

3rd floor: Water is becoming the cause of the greatest crises of our century.

4th floor: Our organization, EarthEcho International, launched EarthEcho Expeditions to involve students in protecting our most important resource.

5th floor: Youth are reducing stormwater pollution by educating others through innovative strategies like planting rain gardens.

6th floor: Our everyday choices in our homes, schools, and businesses can add up to a significant impact.

7th floor: Are you ready to help? Here's what you can do . . . (Hint: The ASK! Always have an idea about how the person you're talking to can get involved.)

STAGE 4: THINK BACK → REFLECT

Yes, you have been reflecting all along. This stage of service learning, however, encourages you to make the time to bring together all of your thoughts, ideas, feelings, and questions and combine them using the Four Square Reflection Tool in the Resources section on page 47.



Let Reflection Reflect YOU!

Reflection can reflect your personality and your skills and talents. Consider how art, poetry, music, photography, a quote, movement, and asking questions can all add up to reflection.

STAGE 5: TELL THE STORY → DEMONSTRATE

What a story! Think of all you have done and all you have learned! You have put your plan into action and seen the results. Now it's time for demonstration—the stage when you show others what you've learned about advocacy for water by thinking about the hydrologic cycle, checking out what is (literally) transpiring at school and in your community, learning from experts, creating a plan, and making changes small and large through collective ideas and actions. This demonstration of your service learning can take any form you like: letters, articles, pamphlets, and artistic displays, performances, or media presentations. The Edina students made a video that documented their process and outcomes while youth from the Earth Conservation Corps shared their story on video for EarthEcho Expeditions. What will you do?

To help you make the most of your demonstration, answer these questions:

- Who is your audience?
- What do you most want to tell them about what you learned and how you learned it?
- What do you most want to tell them about how you provided service?
- Are there any community partners you might like to invite to participate in the demonstration?
- What form of demonstration would you like to use?

Consider all of the skills and talents of your group and use as many as possible as you come up with ways to demonstrate. Be sure to incorporate information and the processes you used during all the different stages. Include images—a picture is worth a thousand words. Sharing what you have learned and accomplished is a way to inform and inspire others. Sometimes students have done school or community presentations or made videos they show to others. Students have written newspaper articles and press releases, and created websites. Be sure to look at the Telling Your Story: Message Guidelines on page 48. This will also give you ideas about making an elevator speech, which is a short, bulleted talk about key ideas that you most want to communicate.

YOU'VE DONE YOUR RAIN CHECK, SO WHAT'S NEXT?

Congratulations! You have completed the EarthEcho Expeditions Action Guide *Rain Check: A Guide for Stormwater Action*. However, this is only the beginning. You may want to apply these same ideas to continue helping your community and continue to apply your talents, skills, and knowledge to creating a healthier planet.

PAIN CHECK Resources

Here are the documents mentioned throughout this Action Guide. These next pages provide tools that will help you during the different stages as you investigate, prepare, act, reflect on what you did, and tell your story during demonstration. And remember, additional resources may be found at www.EarthEcho.org.

RESOURCE LIST

1. Personal Inventory
2. Gathering Information About a Community Need
3. Preparing for an Interview
4. An Interview with _____
5. School Stormwater Management Inventory
6. Google Maps Engine and Google Earth Tutorial
7. School Stormwater Management Assessment
8. Discussion Circles Roles and Responsibilities
9. Discussion Circle
10. Plan for Stormwater Action
11. Service Learning Proposal
12. Crafting an Elevator Speech
13. Progress Monitoring
14. Four Square Reflection Tool
15. Telling Your Story: Message Guidelines

Interests, skills, and talents—we all have them. What are they?

Interests are what you think about and what you would like to know more about—for example, outer space, popular music, or a historical event like a world war. Are you interested in animals, movies, mysteries, or visiting faraway places? Do you collect anything?

Skills and talents have to do with things you like to do or that you do easily or well. Do you have an activity you especially like? Do you have a favorite subject in school? Do you sing, play the saxophone, or study ballet? Do you know more than one language? Can you cook? Do you have a garden? Do you prefer to paint pictures or play soccer? Do you have any special computer abilities?

Work with a partner and take turns interviewing each other to identify your interests, skills, and talents and to find out how you have helped and been helped by others. Then, compile a class chart of your findings. This will come in handy on your service learning journey.

Interests: I like to learn and think about . . .

Skills and talents: I can . . .

Being helpful: Describe a time when you helped someone.

Receiving help: Describe a time when someone helped you.



Gathering Information About a Community Need

INVESTIGATE

What does your community need?

Use the questions in the following four categories as guides for finding out. As a class, you might agree to explore one topic, for example, how kids get along at school, hunger and poverty, or an environmental concern. Or you might decide to learn about general needs at school or in the surrounding area. Form small groups, with each group focusing on one category and gathering information in a different way.

Finding out about:

Media

What media (newspapers—including school newspapers, TV stations, radio) in your community might have helpful information? List ways you can work with different media to learn about needs in your community.

Interviews

Think of a person who is knowledgeable about this topic in your area—perhaps someone at school or in a local organization or government office. Write four questions you would ask this person in an interview.

An interview with _____

Questions:

- 1.

- 2.

- 3.

- 4.



Gathering Information About a Community Need

INVESTIGATE

Survey

A survey can help you find out what people know or think about a topic and get ideas for helping. Who could you survey—students, family members, neighbors? How many surveys would you want completed? Write three survey questions.

Who to survey:

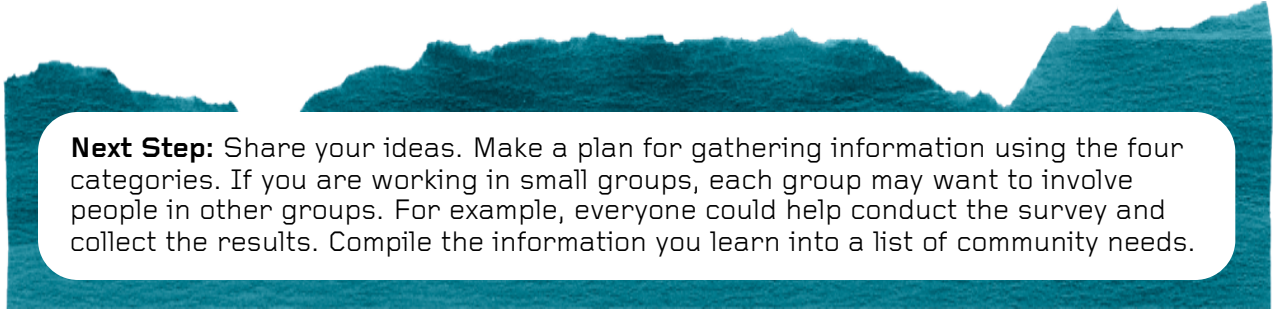
How many surveys:

Questions for the survey:

- 1.
- 2.
- 3.

Observation and Experience

How can you gather information through your own observation and experience? Where would you go? What would you do there? How would you keep track of what you find out?



Next Step: Share your ideas. Make a plan for gathering information using the four categories. If you are working in small groups, each group may want to involve people in other groups. For example, everyone could help conduct the survey and collect the results. Compile the information you learn into a list of community needs.

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Interview with _____

In groups, develop questions based on the interviewee's resume and the information you hope to learn. Each group prepares a different category of questions; several categories are provided and others may be added as is relevant for this interviewee. Review questions with the class for feedback. Decide how the interview will be conducted.

Questions

- Career Path

- Education

- Everyday Work Responsibilities

Interview Procedure

Who will do what?

Greet guest

Introduce guest

Explain the purpose to the guest

Facilitate interview

Keep time

Thank the guest

Escort from class

Write thank you letter



An Interview with...

INVESTIGATE

Interview with _____

Write your category and questions for this interview.

Key words	Notes
Summary	

Adapted from *Strategies for Success with Literacy: A Learning Curriculum that Serves* by Cathryn Berger Kaye, M.A., © 2009. Used with permission of ABCD Books, Los Angeles, CA: 310-397-0070; www.abcdbooks.org. All rights reserved.



Rain Check School Stormwater Management Inventory

To begin data collection, it is best to work from a scale map of your school but you can make observations using just the lists below. For detailed instructions on creating a scale map using Google see the Google Maps Engine and Google Earth Tutorial pages 37-39. If you are using Google Maps Engine, first outline the school property, so you have specific and clear boundaries. As you complete the audit, add different markers, either drawn or through Google Maps Engine, for each Stormwater Capture and Poor Water Flow Indicators as noted on the inventory. Objects that take up a large area, such as gardens and swimming pools, can be outlined with the line tool. Similarly outline all impervious surfaces including parking lots, athletic courts, roadways, and roofs. Pictures can be an incredibly helpful addition to your audit.

data collection is divided into four main areas:

- Stormwater Capture Features
- Low Impact Development (LID) Features
- Poor Water Flow Indicators
- Impervious Surfaces

Stormwater Capture Features

	Place Marker	Notes (How many? Are they functioning properly? Are they being maintained?)
Down Spouts		
Down Spout Catch Basins		
Storm Drains		
Stormwater Outfalls (area where many storm drains empty)		



Rain Check School Stormwater Management Inventory

Low Impact Development (LID) Features

	Place Marker	Notes (Is stormwater being utilized effectively? Can you identify ways that stormwater is directed to these areas?)
Rain barrels or cisterns to collect water		
Pervious sidewalks or lots		
Green roof or living wall structure		
Rain gardens		
Native plant gardens		
Food gardens		

Poor Water Flow Indicators

	Place Marker	Notes (Insert arrows on your map that show the direction that you suspect water may flow. Where is the water coming from?)
Soggy patches or puddles on pervious surfaces		
Puddles or standing water on impervious surface		
Evidence of erosion (bare ground, scour, channels through mulch or dirt)		
Moss or slippery wet areas on pavement		
Water damage (cracks) on pavement		
Hills or slopes		



Rain Check School Stormwater Management Inventory

Impervious Surfaces

Location/Description	Map Box Color	Measurements of approximate perimeter (L X W)	Total Area	Notes
Total Impervious Surface:				

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Google Maps Engine & Google Earth Tutorial

Google Maps Engine allows you to create a map then edit that map by adding balloons and location markers, and drawing lines or boundaries. One advantage to using Google Maps Engine as part of an audit is that multiple users can work simultaneously on the same map using mobile devices (tablet or smartphone). Since you can easily add to the map while walking the school grounds, it makes a great reference tool for the Rain Check School Stormwater Management Inventory.

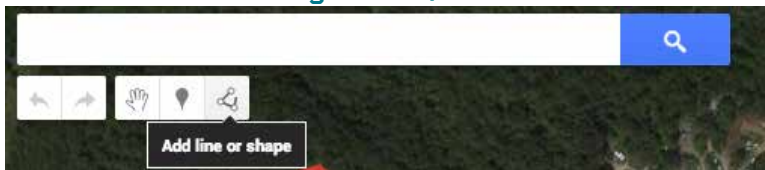
To begin, each student or team will need a Google login to use Maps Engine. Multiple maps can be generated from a single Google account so it is possible to work from a single classroom Google account or students may set up their own account if they are over 13 years of age. The Google login is created directly through the Google email platform for free at www.gmail.com.

This login can then be used to sign in to Maps Engine Lite at <https://mapsengine.google.com>.

On the Google Maps Engine homepage, choose “New Map,” and under the “Base Map” menu choose the satellite view. Search for the school address in the main search bar. Center the map on an aerial view of the school grounds and zoom in or out using the + or – tools such that the school grounds fill the map area. Name the map by clicking on “Untitled Map” and titling the map appropriately.

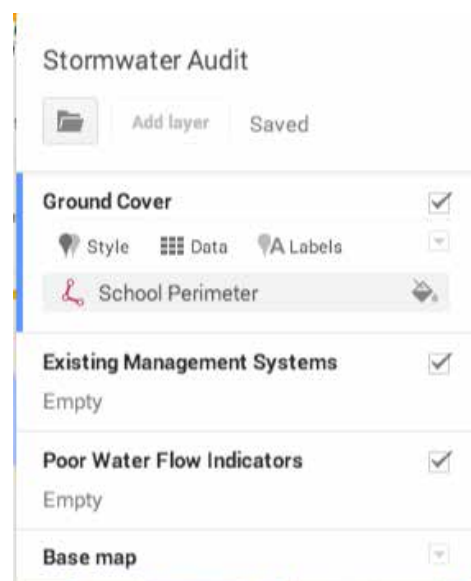


Drawing a Line/Outline



To outline the property, use the line tool located just under the main search bar. After selecting the tool, click along the perimeter of the property, one step at a time.

To enclose the shape, click back on the line tool icon or on the first circle of the line. Once your outline is complete, a dialogue box will open that shows the details of the outline. Click the title box and replace “unknown” with “Perimeter” as the title for this shape. The perimeter can be modified after it is created by picking a point (circle) on the line and dragging it to the desired location.



To make any line more visible and to highlight the area of the school campus, change it's color by clicking on the paint bucket icon in the layers panel.

This same technique should be used to outline the perimeter of each impervious surface on the school grounds. Impervious surfaces include rooftops, parking lots, driveways, roads, or any other surface that rain cannot penetrate. Title each shape to correspond with the impervious surface that it represents and color code them as needed using the paint bucket icon.

Adding Place Markers

Next, add place markers to identify Stormwater Capture Features, LID Features, and Poor Water Flow Indicators. To add place markers click once on the balloon icon (beside the line tool icon) and once on the location on the map where you want to place the balloon. When adding place markers, utilize the paint bucket icon to change the color or shape of place markers; additional options can be found under the "More Icons" button. When a place marker is added, a dialogue box appears to name and make notes about the icon. This information can be edited later by clicking on the icon, or selecting it in the Layers Panel. Be sure to create a legend or description for place markers, either in the Google Maps Engine or in the Rain Check School Stormwater Management Inventory.

Adding Layers

While all of the actions above can be done in a single layer, Google Maps Engine allows up to three layers on a map. This is only useful if there is a need to view an element of your School Stormwater Management Inventory such as "Poor Water Flow Indicators" or "Impervious Surfaces." To add layers, select the layers panel on the left. Click the "new layer" button to add a layer. Once the layer is added, it will appear in the Layers Panel as "Untitled Layer." Double click on this text to change the name of your layer. When working in a particular layer, it will be highlighted with a blue line on the side.

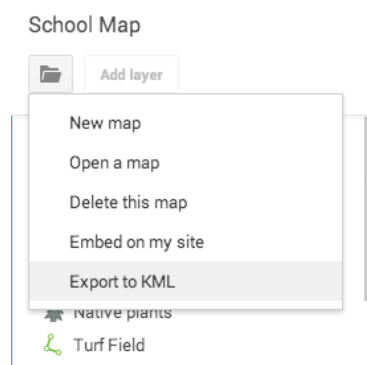
Working Within Your Map

Place markers cannot be moved from layer to layer, so insure that the correct layer is selected when adding a new place marker. In some instances, it may be beneficial to change the base map but the satellite option is preferred for generating the school grounds map.

If multiple students or classrooms will be working on the same audit, it may be helpful to share a single map. Click the "Share" button at the upper right of the map and add any Google email address to allow access to the map. All approved users can access and edit the map at the same time from different mobile devices.

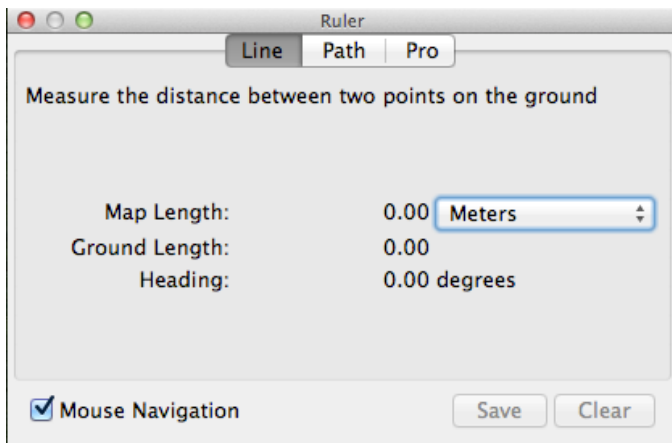
Exporting to Google Earth

In order to perform the calculations within the Rain Check School Stormwater Management Assessment, the map generated in Google Maps Engine must be converted to a Google Earth map. This can only be done if Google Earth has been downloaded and installed on the computer. To convert, click the "Folder" icon on the Layers Panel and select "Export to KML." This will download the map which can be saved and opened with Google Earth.



Google Earth Ruler Tool

The ruler tool, found in the upper tool bar, while simple to use, has limited functionality.



Select the ruler tool and open the control box opens that looks like the picture to the right. Select "Feet" from the dropdown menu as your unit of measurement. This control box also provides the readout of the measured distances. To measure the area of a shape such as an impervious surface, determine which measurements you need given the shape of the surface (length, width) and take them one at a time. To measure, click once at the starting point and once at the ending point, Google Earth generates a line between and giving the length of that line in the chosen units. Clicking on another point on the screen will begin a new measurement and eliminate the previous distance so be sure to record data in a spreadsheet or by hand. For complex shapes like

a school rooftop or curved parking lot, it may be beneficial to measure a series of smaller squares or rectangles within that shape and calculate the area of the larger surface by adding the area of the smaller shapes.

REVIEW THE AUDIT YOU HAVE COMPLETED.

Review your completed Rain Check School Stormwater Management Inventory. Look at your map.

- Circle areas where you see any signs of disrupted water flow (erosion, soggy, or flooded areas) where you could eliminate runoff.
- Box out areas where you could slow down or reduce the amount of runoff from your school, such as an unused courtyard that could be the ideal size and location for a rain garden.
- Place question marks by areas with low impact development (LID) features when you discover you have a question.

Complete the chart below using instructions from page 20.

LID Features	Easy/ Hard	Low/Medium/ High Impact	Stakeholders	Costs	Behavior/ Practices
Runoff Elimination	Easy/ Hard	Low/Medium/ High Impact	Stakeholders	Costs	Behavior/ Practices
Runoff Reduction	Easy/ Hard	Low/Medium/ High Impact	Stakeholders	Costs	Behavior/ Practices
Pollution Reduction	Easy/ Hard	Low/Medium/ High Impact	Stakeholders	Costs	Behavior/ Practices

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Form groups of four to discuss the information found throughout this guide.

Assign each person in the group one of the four “connector” roles below. Each connector’s job is to lead a portion of their group discussion about the content from a specific point of view. The student asks the questions listed (along with others that come to mind) and encourages group members to respond. Each person leads his/her share of the conversation for four minutes, allowing approximately one minute for each person to answer, and one minute for the connector to answer as well. Write notes and ideas on the *Discussion Circle* on page 42.

To begin, review these tips for effective group discussions:

- Use active listening skills.
- Ask questions.
- Take turns speaking.
- Welcome all comments.

PERSONAL CONNECTOR

Ask questions that connect the content to group members’ experiences, such as:

1. What does this information have to do with you or others you know?
2. Are you reminded of any information you knew already or ideas or situations you have heard about before?
3. How have you or people you know resolved similar situations?

STORMWATER CONNECTOR

Ask questions that connect this content to other information you know about stormwater issues such as:

1. What new ideas did you learn about stormwater and its impact?
2. What situations described are you familiar with from personal experience?
3. What additional questions do you now have about stormwater?

SERVICE CONNECTOR

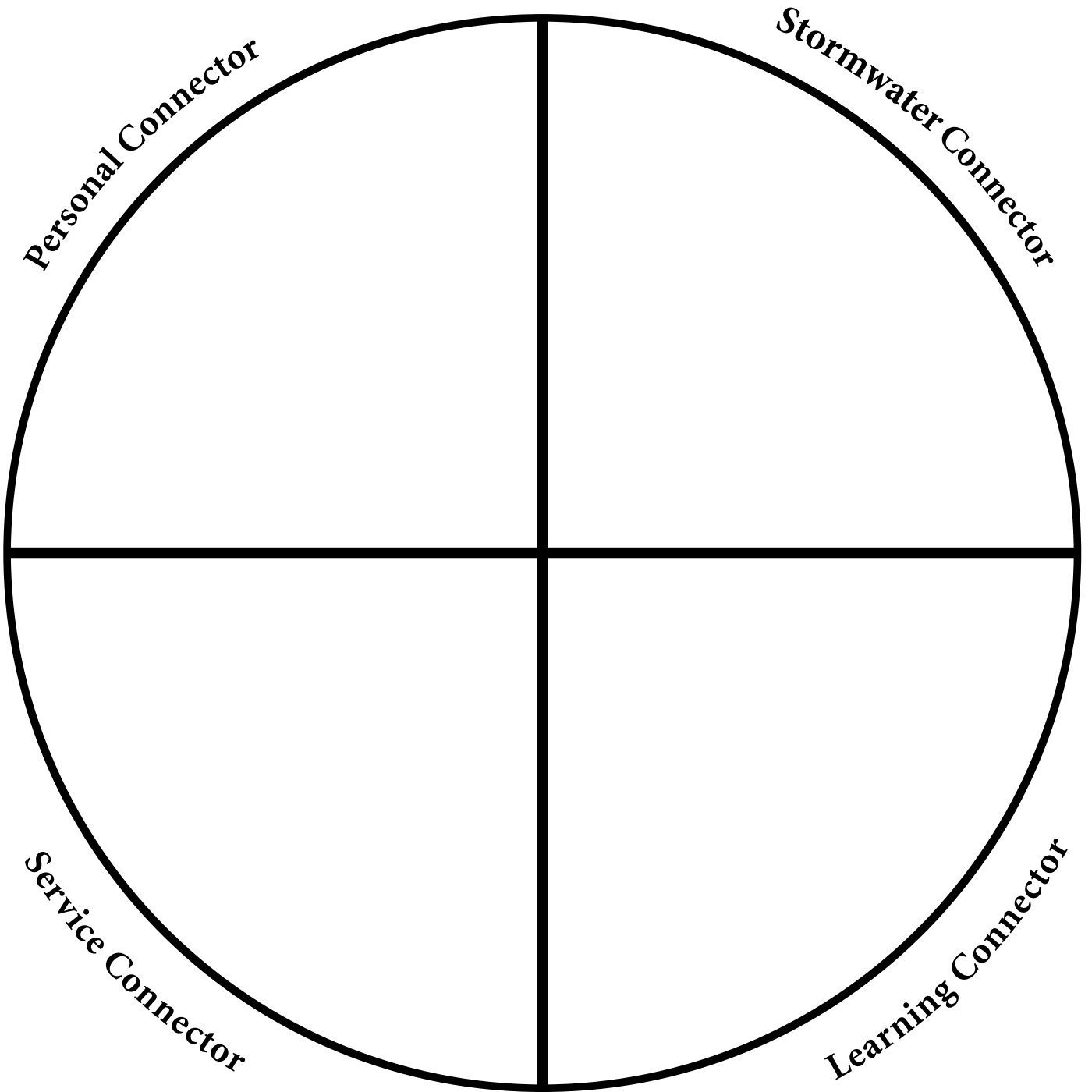
Ask questions that connect this content to ideas for service plans, such as:

1. What needs to be fixed in the situations described?
2. Did any noteworthy, helpful action take place in what you have read?
3. What service ideas did you think of when you read this?

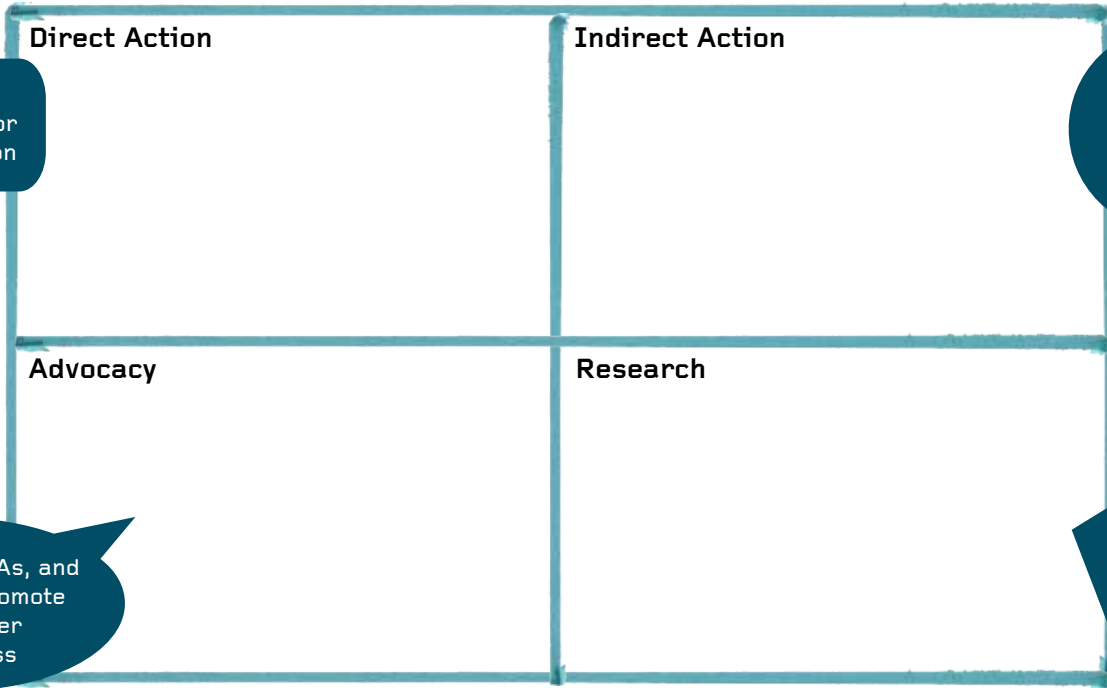
LEARNING CONNECTOR

Ask questions that connect this content to learning opportunities, such as:

1. What would you like to learn more about as a result of this content?
2. What related topics have you learned about or experienced in school?
3. What do you think people your age would learn from reading this interview or hearing these facts?



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Change your Environment or Teach a Lesson

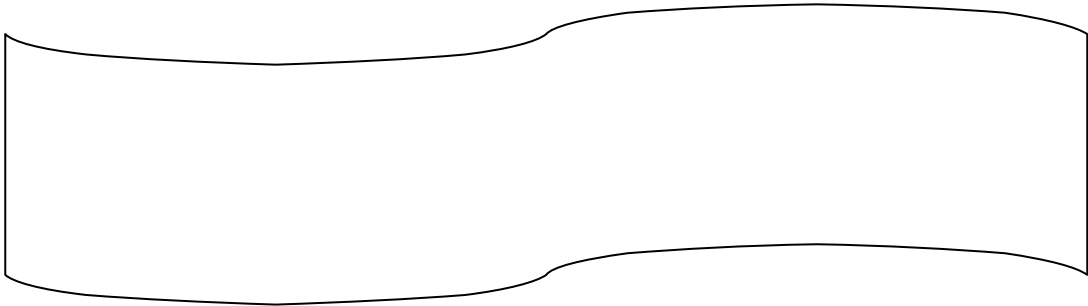
Provide a Resource for Others!

Use Media, PSAs, and Signage to Promote Stormwater Awareness

Add to the Data on Stormwater Issues and Provide to the Community

Who...	Will do what...	By when...	Supported by...

Mark Your Timeline 



Create Your Main Message on this Banner that Sells Your Ideas. Be Memorable!



Service Learning Proposal

ACT

Students or class:

Teacher: _____

School: _____

Address: _____

Phone: _____ Fax: _____ Email: _____

Project name: _____

Need—Why this plan is needed:

Purpose—How this plan will help:

Participation—Who will help and what they will do:

Students:

Teachers:

Other adults:

Organizations or groups:

Outcomes—What we expect to happen as a result of our work:

How we will check outcomes—What evidence we will collect and how we will use it:

Resources—What we need to get the job done, such as supplies (itemize on back):

Signatures:

Imagine you step into an elevator and the president of your country is there and says, "What's on your mind?" At most, you have about 7 floors that you will be traveling on the elevator together. That means about 12 seconds and 20 words per floor to tell him or her your important information. That's your "elevator speech." Be prepared: Know your key points—what you care about, what needs to happen, what you will do, and what others can do. Use short sentences that convey vivid images. Make solid eye contact. Mean what you say and say what you mean. Always tell who you are, the organization or school you represent, mention this is part of the EarthEcho International's Expeditions Program, and always have an "ask" at the end.

7th Floor:

6th Floor:

5th Floor:

4th Floor:

3rd Floor:

2nd Floor:

1st Floor:

START HERE: What's Your Elevator Speech?

For each of the Seven Floors on this elevator ride, what you would say to a politician, a peer, a child, a landscaper, or a parent to further your efforts in doing a "rain check" and lessening stormwater impact? You can use this same idea for a different initiative as well.



What progress monitoring methods will you use?

- Observation
- Data Collection
- Interviews
- Surveys

Other Methods:

-
-
-

Date _____

Step One: Establish your baseline—what is the need?

Date _____

Step Two: What noticeable changes have been made?

Date _____

Step Three: What other changes have taken place?

Date _____

Step Four: Describe evidence of your progress.

Date _____

Step Five: Provide a summary of your findings.



Four Square Reflection Tool

REFLECT

<p>What happened?</p>	<p>How do I feel?</p>
<p>Ideas?</p>	<p>Questions?</p>

Telling Your Story: Message Guidelines

If you want people to listen to what you have to say and remember the important points, tell a story. Think of your actions taken during *Rain Check: A Guide for Stormwater Action*. A helpful story is waiting to be told.

Here is a quick guide to telling memorable stories:

- **Opening:** Paint a picture with words. *Plastic bottles, plastic bags, and cigarette butts along with oil from our cars pours daily into the Santa Monica Bay.* Always remember to show the images you want them to remember. Make a memorable impression.
- **Background:** Provide the basic overview and context of the story you want to tell; be sure to include what you have done is part of EarthEcho International's Expeditions Program.
- **Create Interest:** This is part of your story that holds your audience's attention. Compelling facts, human interest anecdotes, including comments and surprising statistics capture the reader. They make your story compelling and make a lasting impression.
- **Resolution:** Every story has a strong ending. Let people know what they can do and how they can become involved. Create relevance by moving the reader toward taking action.

Communicating important messages:

- Keep your story simple.
- Be authentic.
- Make the information relevant. Give your readers a reason to care.
- Vary the length of your sentences.

Read your story aloud. Make sure this is your voice, your story, your message.

Rain Check Glossary

- **Bioretention:** The process in which contaminants and sedimentation are removed from stormwater runoff. Hooray!
- **Combined Sewer System:** Sewers that are designed to collect rainwater runoff, domestic sewage from homes and businesses, as well as industrial wastewater in the same pipe. Combined Sewer Systems are designed to carry large volumes of wastewater to treatment facilities but can overflow into rivers and streams during periods of heavy rainfall.
- **Eutrophication:** Excessive levels of phosphorous, nitrogen, and nutrients in the water, which lead to a decrease in oxygen levels. Often characterized by excessive growth of algae and aquatic vegetation, which often results in deteriorated water quality.
- **Floodplain:** Any land area susceptible to inundation by stormwater from any source.
- **Impervious Surfaces:** Impervious surfaces are defined as surfaces that cannot absorb water. This includes roads, buildings, concrete, asphalt, rooftops, and brick. Soil that is highly compacted by urban development can also be highly impervious. Soil is pervious, as are wetlands, and all other vegetated area whether natural or made by people, like gardens.
- **Municipal Separate Storm Sewer System (MS4):** is a Separate Storm Sewer System that includes anything designed to convey stormwater including storm sewers, ditches, curbs, and other similar conveyors that do not connect with a wastewater collection system or treatment plant. This system must be operated by a public agency to be Municipal.
- **Nonpoint Source pollutants (NPS):** Natural and human-made pollutants from many diffuse sources carried by stormwater, finally depositing them into lakes, rivers, wetlands, coastal waters and, sadly, our underground sources of drinking water.
- **Outfall:** The point where wastewater or drainage discharges from a sewer pipe, ditch, or other means to a receiving body of water.
- **People Pollution:** What we drop or dump on the ground that adds to polluted runoff.
- **Point Source Pollutant:** Pollutants from a single, identifiable source such as a factory, refinery, or place of business.
- **Sediment/Silt:** Soil, sand and materials washed from land into water, usually after rain. Sediment can destroy fish-nesting areas, clog animal habitats, and cloud water so that sunlight does not reach aquatic plants.
- **Storm Drain:** A slotted opening leading to an underground pipe or an open ditch carrying surface runoff. These lead directly to streams and do not go through a treatment or processing plant.
- **Stormwater:** Precipitation from a rain, snow, or storm event that flows quickly into streams or accumulates in natural or constructed storage systems. Stormwater often includes pollutants and sediment from land surfaces.
- **Stormwater Runoff:** Stormwater runoff is water from rain or melting snow that “runs off” across the land instead of seeping into the ground. In the United States, it's the number one source of water pollution.

For More Information

The Bookshelf

These titles provide an overview of diverse water-related issues.

A Cool Drink of Water by Barbara Kerley (National Geographic Society, 2002). “We live by the grace of water.” This photo essay takes us on a global journey to see water stored in clay pots and a burlap bag. We see people drink from a river, a well, and a thin tin cup. We travel from Thailand to Rome to Canada. A note on water conservation gives statistics and strategies for protecting our planet’s precious supply of water. A picture book format with great images.

Flush by Carl Hiaasen (Knopf, 2007). Noah’s father was so sure the floating casino was dumping sewage into the open water that he sank the boat and landed in jail. Now, if Noah and his younger sister can prove this dumping is still going on, his dad will be vindicated and the casino will be put out of business. Hazardous waste, a mystery man, and food coloring all add up to a raucous adventure.

Going Blue: A Teen Guide to Saving Our Oceans, Lakes, Rivers, & Wetlands by Cathryn Berger Kaye with Philippe Cousteau and EarthEcho International (Free Spirit Publishing, 2010) engages readers in exploring the interconnectedness of all our natural resources.

Protecting Earth’s Water Supply by Ron Fridell (Lerner Publications, 2008) Unless we are more cautious about our water supply, our planet is at risk. Read about innovative ideas, including one from a ten-year-old in Aluva, India, who developed her own rainwater harvesting system to help local farmers.

More Service Learning Resources

Interested in more resources about service learning? At www.EarthEcho.org/expeditions you can see a series of videos that reviews the Five Stages of Service Learning. There are several books that can also be helpful, all written by Cathryn Berger Kaye and available through Free Spirit Publishing (www.freespirit.com), including:

- ***The Complete Guide to Service Learning: Proven, Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum & Social Action*** Second Edition (Free Spirit Publishing, 2010)
- ***Going Blue: A Teen Guide to Saving Our Oceans, Lakes, Rivers, & Wetlands*** written with Philippe Cousteau and EarthEcho International (Free Spirit Publishing, 2010)
- ***A Kids Guide to Climate Change and Global Warming: How to Take Action*** (Free Spirit Publishing, 2009)
- ***Make a Splash! A Kid’s Guide to Saving Our Oceans, Lakes, Rivers, & Wetlands*** written with Philippe Cousteau and EarthEcho International (Free Spirit Publishing, 2012)

EarthEcho International is a leading environmental non-profit organization committed to youth engagement, action, and leadership through education. EarthEcho helps young people everywhere understand the critical role we play in the future of the planet through the one thing that connects us all— water. EarthEcho International was founded by siblings Philippe and Alexandra Cousteau in honor of their father Philippe Cousteau Sr., son of the legendary explorer Jacques Yves Cousteau. In 2013, the organization launched *EarthEcho Expeditions*, an exciting new initiative that leverages the rich Cousteau legacy of exploration and discovery to bring science education alive for today's 21st century learners. For more information about EarthEcho International, visit www.earthecho.org.

Author Cathryn Berger Kaye, M.A., a former classroom teacher, is president of CBK Associates, International Education Consultants. She is the author of *The Complete Guide to Service Learning* and an interactive workbook series with Free Spirit Publishing, *Service Learning for Kids: How to Take Action*. Her books *Going Blue: A Teen Guide to Saving Our Oceans, Lakes, Rivers, & Wetlands* and *Make a Splash! A Kids Guide to Saving Our Oceans, Lakes, Rivers, & Wetlands* both written with Philippe Cousteau and EarthEcho International demonstrates her commitment to caring for our planet. Known for highly engaging workshops for schools and conferences and keynote addresses, Cathryn promotes educational experiences which inspire student engagement, social and emotional development, and academic success through service learning. She works within K-12 settings, and with university faculty and youth service organizations in the United States and around the world. For more information and resources visit www.cbkassociates.com.