



**enviroscape®**

Hands-on Products for Environmental Education

# **Ecological Restoration**

## **Wetland & Floodplain Management**

# **USER'S GUIDE**



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Hands-on Products for Environmental Education

Many thanks to our Review Committee — those who participated in the initial development and guide, and those who helped make improvements to the product.

## ECOLOGICAL RESTORATION REVIEW COMMITTEE

Sally Adkins, Stormwater Specialist,  
Gainesville, FL

Susan Asmus, National Association of Home  
Builders

Diana Athnos, Florida Department of  
Environmental Protection

Mark Biddle, Delaware Division of Water  
Resources

Ross Braun, USDA Natural Resources  
Conservation Service

Pearl Burbage, Delaware Division of Water  
Resources

Jim Collins Jr., North Dakota Department of  
Health

Mary Cressel, USDA Natural Resources  
Conservation Service

Thomas E. Davenport, U. S. EPA Region 5

Karen Day, Delaware Estuary Project

Jeffrey C. DePew, Arrowhead International  
Field School

Belinda Duke, Gulf of Mexico Program Office

Bob Dunlevy, U. S. EPA Region 7

Glenn Eugster, U. S. EPA Chesapeake Bay  
Program

Jennifer Fields, Broward County Department  
of Natural Resource Protection

Tim Gates, Washington State Department of  
Ecology

Rick Georgeson, New York State Department  
of Environmental Conservation

Gerard J. Gonthier, USGS, Water Resources  
Division

Hollie Greer, Environmental Specialist,  
Alachua County, FL

Chantal Greffer, AP Biology, Colonia High  
School

Jay Gregg, Crows Nest Preserve Natural  
Lands Trust

Derek Guest Eastman Kodak Company

Sharon Haines, International Paper

B. C. Hanson, Louisiana Geological Survey

Sarah Heck, City of Ann Arbor, MI

Tom Hruby, Washington State Department  
of Ecology

Ray Hunt, Delaware Fish and Wildlife

Rhonda Hunter, Washington State  
Department of Ecology

Jane Jones, Arkansas Natural & Scenic Rivers  
Coalition

Sandy Jurban, South Florida Water  
Management District

Laura Kasley, Tetra Tech

Caroline Knight, Florida Department of  
Community Affairs

Virginia A. Kopp, USDA Natural Resources  
Conservation Service

Gary Kreamer, Delaware Fish and Wildlife

Judy Krebs, Clermont Soil & Water  
Conservation District

Eric Livingston, Florida Department of  
Environmental Protection

Kathryn Loxley, Jackson County Soil & Water  
Conservation District

Wayne Lukert, Shawnee County  
Conservation District

Kathy McGlaulin, North American  
Association for Environmental Education

Barbara Morton, Wildlands Conservancy

Paul Muhlberger, Culpeper Soil & Water  
Conservation District

Missy Parker, Capitol Hill Day School

Patricia Paul, USDA Natural Resources  
Conservation Service

Nancy Phillips, Environmental Consultant

Dorothy Ponte, Science and Social Studies  
Department Head, Colonia High School

Patti Sanzone, Florida Department of  
Environmental Protection

Gary L. Schetrompf, Washington County Soil  
& Water Conservation District

Sue Schlemmer, Lagrange County Soil &  
Water Conservation District

Rita Schmidt, Sudman Water Education  
Foundation

Bill Sharff, North Dakota State Water  
Commission

Zachary M. Simmons, Biologist, Senior  
Project Manager U. S. Army Corps of  
Engineers, Sacramento District

Cindy Smith, Prince William Soil & Water  
Conservation District

Mia Smith, Lapeer County Soil & Water  
Conservation District

Judith F. Taggart JT&A, inc.

Dennis Tierney, CIBA Crop Protection

John Tobe, Florida Department of  
Environmental Protection

Eileen Tramontana, Suwannee River Water  
Management District

Elbert Traylor, Nebraska Department of  
Environmental Quality

Don Schuster, USDA Natural Resources  
Conservation Service

Holly Utrata-Halcomb, Hamilton Soil & Water  
Conservation District

Joel Van Roekel, Warren County Conservation  
Board

Manjunath Venkatanarayana, State of  
Texas Natural Resources Conservation  
Commission

Suzanne S. Wade, University of Wisconsin  
Cooperative Extension

Becky Watts, RCD of Greater San Diego  
County

Anne Weinberg, U. S. EPA Office of Water

Mary Wright-McIntosh, City of Eugene Public  
Works Administration

Steve Young, Missouri Department of  
Conservation



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## ☒ CHECK FOR CONTENTS!

### AGES 5 AND OVER

The following components are included with the EnviroScape® Ecological Restoration model (item 4850). Use this list to verify all items are included. Should any item be missing, notify us within 10 business days at 703-631-8810 or [learn@enviroscapecom.com](mailto:learn@enviroscapecom.com). Thank you and enjoy learning with EnviroScape!

Make sure your **EnviroScape® ECOLOGICAL RESTORATION (Wetlands) model includes:**

- |  |  |
|--|--|
| <input type="checkbox"/> 1 Landscape Map w/ 2 Storm Pipes (Tubing) [6017]          | <input type="checkbox"/> 1 Clay Stick [5052]   |
| <input type="checkbox"/> 1 Clear Rectangular Base [5058]                           | <input type="checkbox"/> 2 Round Trees [5005]  |
| <input type="checkbox"/> 1 User's Guide [electronic PDF download]                  | <input type="checkbox"/> 12 Tall Trees [7009]  |
| <input type="checkbox"/> 1 Shopping Center Building w/Parking Lot [9-5030, 9-5099] | <input type="checkbox"/> 1 Squirt Bottle W/Cocoa [6022]  |
| <input type="checkbox"/> 1 Ranch House [5010]                                      | <input type="checkbox"/> 1 Water Tray [6038]   |
| <input type="checkbox"/> 1 Apartment Building [5021]                               | <input type="checkbox"/> 1 Rubber Plug (#2)  |
| <input type="checkbox"/> 1 Marina Building 5029 w/ 1 Boat Slip [9-6100]            | <input type="checkbox"/> 1 Measuring Cup [6018]  |
| <input type="checkbox"/> 1 Factory w/Clear Tube Connected [5014]                   | <input type="checkbox"/> 3 Round Shaker Containers containing Green & Red Drink Mix, & Cocoa [6023]                                |
| <input type="checkbox"/> 1 Barn [5012]   | <input type="checkbox"/> 1 Spoon and Sponge [5060]   |
| <input type="checkbox"/> 1 Small Plastic House (white)                             | <input type="checkbox"/> 1 Cotton Swab Pack (Wetland Plant Roots)  |
| <input type="checkbox"/> 2 Vehicles [6021]   | <input type="checkbox"/> 1 Water Trough (small plastic lid) [5009]   |
| <input type="checkbox"/> 1 Boat [5088]   | <input type="checkbox"/> Constructed Wetlands & Vegetation Pack (6 small thin oval, 10 thin rectangular sponges) [9-5042]          |
| <input type="checkbox"/> 1 Farm Animal Pack [9-7035]                               | <input type="checkbox"/> Natural Wetlands Pack: (6 small thick ovals, 4 large oval sponges, 10 thick rectangular sponges) [9-5045] |
| <input type="checkbox"/> 1 Wetland Animal Pack [9-7030]                            | <input type="checkbox"/> 10 Large Vegetation Pieces (Large Felt)   |
| <input type="checkbox"/> 1 Construction Vehicle [6013]                             | <input type="checkbox"/> 3 Plastic Cups (9 oz)   |
| <input type="checkbox"/> 2 Golf Flags [5004]                                       | <input type="checkbox"/> 1 EnviroScape Vinyl Zipper Bag for accessories  |
| <input type="checkbox"/> 1 Fence Piece [5093]                                      | <input type="checkbox"/> 5 Small Plastic Plugs [9-5061]  |
| <input type="checkbox"/> 3 Bridges [5002]  | <input type="checkbox"/> 1 Mesh Bag [9-6142]   |
| <input type="checkbox"/> 2 Spray Bottles (8 oz) [6020]                             |  |
| <input type="checkbox"/> 1 Eco-Spout [5015]  |  |

**Replacement parts** can be purchased at your local stores or at [www.enviroscapecom.com](http://www.enviroscapecom.com).

**30-day money back guarantee!** We are pleased to offer a 30-day money back guarantee on products received unused and in original packaging within 30 days from when product shipped. Refund applies to merchandise and not shipping charges and you are responsible for shipping product to us. A RETURN AUTHORIZATION is required before returning your product and can be secured by sending email with Subject Line RETURN AUTHORIZATION to [info@enviroscapecom.com](mailto:info@enviroscapecom.com).

# NOTES

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**Thank you for choosing EnviroScape® Ecological Restoration** — one in a series of EnviroScape® environmental education models designed to teach the functions and values of wetlands, floodplains and restoration.

- **The Main Demonstration: *Impacts & Restoration*** is divided into Demo I & II, and is a great option if you have a time limit. DEMO I is a quick demonstration showcasing the pollution and flooding that may occur after unplanned development. DEMO II explores the functions and values of ecological restoration and wetlands.
- **The Alternative Demonstration: *Natural Environment to Modern Times*** is a story style demonstration developed for those with more than 30 minutes. Part 1 begins with the natural environment; Part 2 progresses to unplanned development; and in Part 3 we learn the value of smart land use and ecological restoration.

***We recommend each facilitator read through the guide at least once before demonstrating the model.***

**PLEASE NOTE THE FOLLOWING:**

- **A storm-drain tube is provided as a visual aid if desired**, to be placed where the storm drain pipe is silk screened on your model.
- **Use damp sponges on the model**, they will lay flat and are more effective when damp.
- **Before demonstrating you will need scissors** to cut one of your thin rectangular sponges length wise for use as a created wetland by the factory!

**We value our customers and want to hear about your experience with EnviroScape Ecological Restoration!** Send us any hints, suggestions or improvements you may have along with photos and stories of your events – so we can share with others!

**Visit our website at [www.enviroscales.com](http://www.enviroscales.com) and join our email list for stories, user tips, coupons & special offers.** Find us on Facebook @EnviroScales & follow us on Twitter @enviro\_scale. We look forward to hearing about your experience with EnviroScape, and helping you meet your environmental education needs.

Sincerely,

*Carlene Bahler, President*

**EnviroScape, c/o JT&A, inc. , 2201 Cooperative Way, Suite 600, Herndon, VA 20171  
703-631-8810 • [learn@enviroscales.com](mailto:learn@enviroscales.com) • [www.enviroscales.com](http://www.enviroscales.com)**

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# A Brief Overview of Wetlands

Wetlands are found in all parts of the world except Antarctica. Wetlands occur in various landscapes; near oceans, lakes, and rivers, or in the middle of fields and forests. Because wetlands are found in so many places, they can be difficult to define. A simple way to describe wetlands is as a coastal wetland or inland wetland.

■ **Inland wetlands** — include wet prairies or meadows, northern peatlands, bogs, southern deepwater swamps and other forested wetlands, freshwater and brackish marshes, or riparian ecosystems. Many wetlands in the United States are inland wetlands.

■ **Coastal wetlands** — include salt and freshwater marshes, mangrove swamps, estuaries and more.

## **Recognize wetlands by looking for the following characteristics:**

We can identify wetlands and determine the type, value and function of a wetland by looking at the water, soils, vegetation, and species. Each of these components interact with and influence the other – creating a unique wetland ecosystem.

■ **Water:** Water on the surface or in the root zone of the soil creates the flooding, ponding or spongy, saturated conditions that we associate with many types of wetlands. Standing water may not always be observed in some wetlands, but the root zone of wetland vegetation will be saturated during some portion of the growing season.

■ **Soils:** Wetland soil will often look and feel wet (hydric soil). Wetland soil holds water longer than other soils, and often lacks oxygen (anaerobic). Wetland soils occur in areas with high water tables or where frequent, long-lasting flooding or ponding occurs. Wetland soils are commonly high in clay or peat content, but some will have sandy soils even though sand does not hold water as easily as other soils do. The hydric soils in a wetland support a certain type of vegetation.

## A BRIEF OVERVIEW OF WETLANDS

- **Vegetation:** Most Plants, trees or shrubs that grow in a wetland are hydrophytes (water-loving plants) and can grow only in soils that are periodically or permanently saturated with water or can adapt to alternating wet and dry conditions. Some wetland plants and trees cannot grow anywhere else. The plants, trees, or shrubs that grow in the wetlands influence the quality of the water and soil resources.
- **Habitat:** Wetlands are considered the most productive and biologically diverse ecosystems on our planet. Wetland ecosystems provide habitat for many species; microbes, plants, amphibians, birds, fish, mammals and reptiles all depend on wetlands. Microbial activity within a wetland creates a “biological supermarket” that supports a rich variety of plants and animals. Wetland ecosystems are vital to the food chain and biodiversity. Animals use wetlands for breeding, nesting, and feeding, and even as escape routes. Nearly half of our threatened and endangered species, such as the whooping crane and the prairie fringed orchid, live in wetlands or depend on them.
- **Wetland Disturbances:** Wetlands can be negatively impacted by natural conditions, like extended drought and human activities like land clearing, unplanned agriculture and development, and the introduction of nonnative species.
- **Wetlands role in the Water Cycle:** Wetlands receive, store, and release water both physically through groundwater & surface water, and also biologically through transpiration by vegetation. This makes wetlands an important part of the water cycle!

# Wetland Connections to Groundwater

The connections between groundwater and wetlands are constant and complicated because wetlands are common areas for groundwater recharge and discharge.

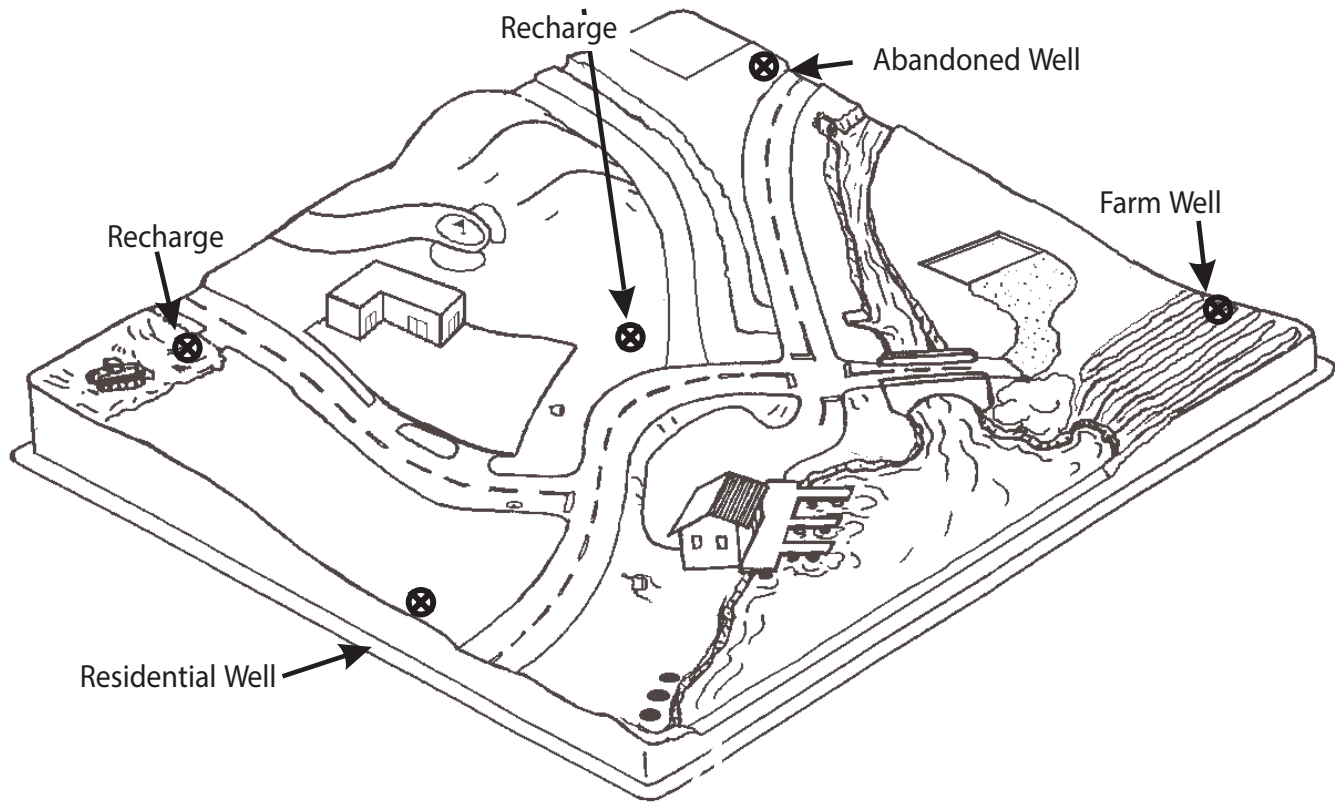
**When water flows into our groundwater, the process is referred to as recharging groundwater.** Wetlands may prevent some pollutants (e.g., soil, phosphorus, heavy metals) from entering groundwater allowing the groundwater to recharge at a better quality. However, flow from a wetland that recharges groundwater can also contaminate groundwater (especially if the wetland is degraded). Contamination occurs when the recharge water carries excess solvents, gasoline, pesticides, nitrates or other contaminants.

**When groundwater flows into a wetland, the process is called groundwater discharge.** The groundwater may contain nutrients of use to wetland plants. Water that discharges to the wetland (or other surface areas), if not consumed by the plants, eventually flows to surface waterbodies or evaporates.

***Optional Use with the Groundwater Component.*** In this guide you will find a valuable coupon for the purchase of the EnviroScape Groundwater component available for use with your model. There are holes drilled in the Wetlands landscape map for use with the groundwater component. (See diagram on next page where these specific holes are.)

✓ ***If you will not be using the groundwater component, simply cover the holes with clay or the small plastic plugs included.***

## WETLAND CONNECTIONS TO GROUNDWATER



⊗ Holes for use with EnviroScape Groundwater Component.

Not demonstrating groundwater?

Plug these holes with the small plugs provided or with clay.

\*\*\* **COUPON** \*\*\*

use code **WET** to received 10% off the purchase  
of a Groundwater Liner Kit.

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

# Suggested Activities

EnviroScape Ecological Restoration can be used to demonstrate all types of wetlands.

- **Have students research types of wetlands, wetland plants, and animals** native to your area. Students can present their findings by drawing or coloring native plants and animals, and placing them on the model.
- **Find out your local rainfall amounts and patterns.** When do heavy rains occur? What is your local average amount of rainfall?
- **Explore wetlands in art and literature** such as John James Audubon's many portraits of wetland birds.
- **Invite a representative to talk to your group about wetland features** found in local wetland landscapes. Consider your local Extension Service, Natural Resources Conservation Service, parks department, or local government environmental offices. State and federal agencies such as the Environmental Protection Agency, the Fish and Wildlife Service, and state departments of natural resources are also good resources.
- **The alternative expanded story style demonstration** helps you demonstrate the model with a story — invite your students to describe what they think this landscape was like 50 or 100 years ago. Tell a story about land uses.

# **Check Awareness**

 **Ask your audience what they think of when they hear the word “WETLAND.”**

Their answers should give you a good indication of their perceptions and cognitive levels.

 **SUGGESTION: ask students to write down what they think a wetland is and share their answers with one another.**

## **Why are wetlands important?**

**Because these areas have unique  
functions and values.**

 **Begin your demonstrations with a list of the values and functions of wetlands (see next page).**

### **Following the demonstrations —**

- Have students list the functions and values of wetlands that were demonstrated on the model.
- What other wetland values could we demonstrate?
- What types of wetlands can be found in your local area, in your region or state?
- List local birds and animals that depend on wetlands.

# Functions & Values of Wetlands

## ✓ **Functions** (*processes performed by wetlands*)

- Storage of water (absorb and hold water)
- Replenish surface and groundwater supplies
- Intercept and filter stormwater runoff
- Remove or retain inorganic nutrients
- Process and decompose organic pollutants
- Trap sediment (wetland vegetation binds soil to its roots)
- Absorb the energy of waves
- Break up the flow of stream or river currents
- Control increases in the rate and volume of runoff in agricultural, suburban and urban areas
- Biodiversity: wetlands support many species from microbes to mammals
- Provide habitat for fish, wildlife, and plants (including threatened and endangered species)
- Wetlands are important for breeding and egg deposition, and provide safe nursery areas
- Wetland conditions allow for development of organisms that form the base of our food web
- Wetlands are biological supermarkets — Produce great quantities of food for plants, animals and humans!
- Atmospheric (climate) maintenance — Wetlands store carbon in their plant biomass instead of releasing it as carbon dioxide into the environment

## ✓ **Values** (*benefits that wetlands provide*)

- Flood storage and control
- Buffer storm surges by dissipating wave energy before impact to man-made structures
- Protect shorelines and stream banks against erosion
- Moderate global climate conditions
- Improve water quality
- Remove nitrogen and phosphorus from surface water
- Reduce environmental problems, such as algal blooms, dead zones, and fish kills, that are generally associated with excess nutrient run-off
- Provide recreational opportunities, nature walks, birdwatching, camping, boating, hunting, hiking, and fishing
- Environmental and ecological education opportunities and research
- Photography, art, and literature is often inspired by wetlands!
- Reduce the likelihood of flood damage to homes, businesses, and crops in agricultural areas
- Preserving and restoring wetlands can often provide flood protection without the need for expensive levees
- Nature-related recreation is the fastest growing activity of the tourism industry
- Fishing and shell fishing industries harvest wetland-dependent species
- Crops such as blueberries, cranberries, mint, and wild rice are produced in wetlands
- Wetlands support timber resources
- Some medicines are derived from wetland soils and plants
- Commercial fur-bearers like muskrat, beaver, otter, and mink, as well as reptiles such as alligators call wetlands home
- Coastal wetland-dependent recreational fishing generates tourism \$

## NOTES

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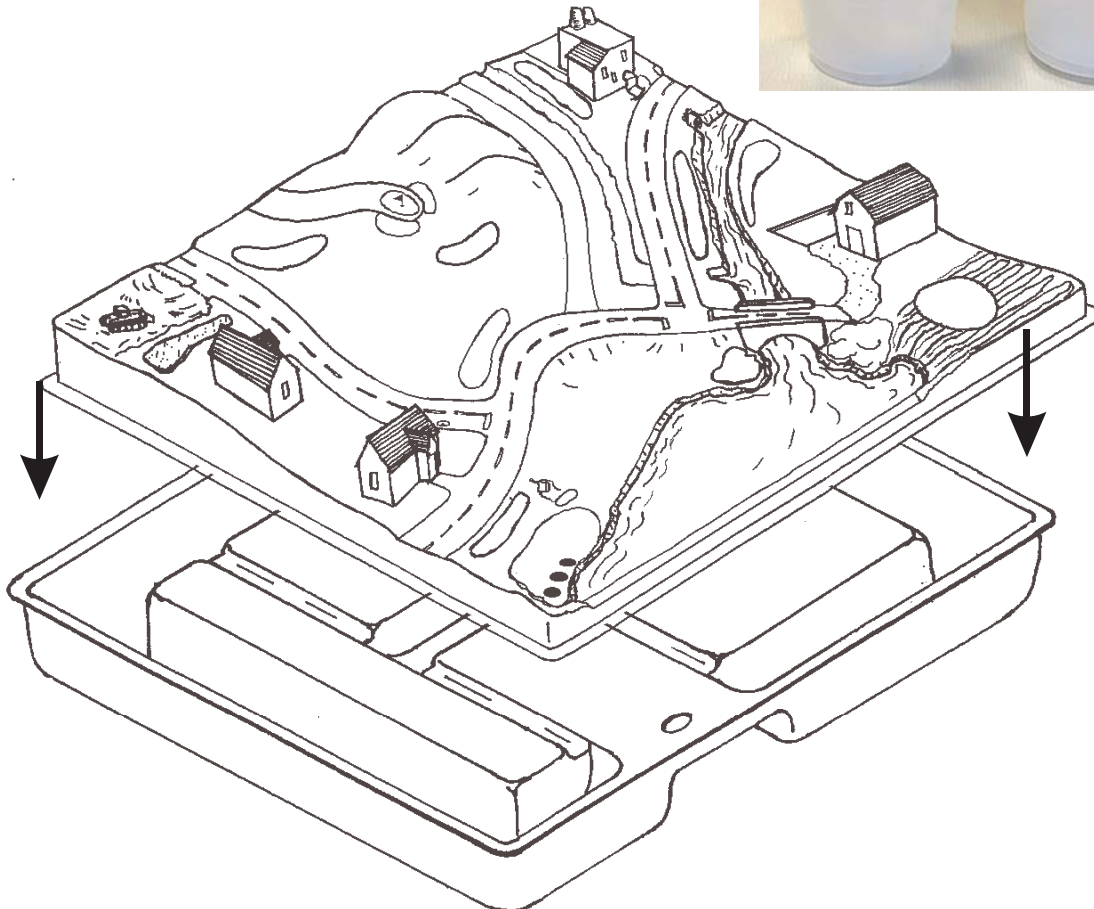


# DEMO I: UNPLANNED LAND USE

## Pollution and Flooding in Your Watershed

### STEP 1: Prepare the Model

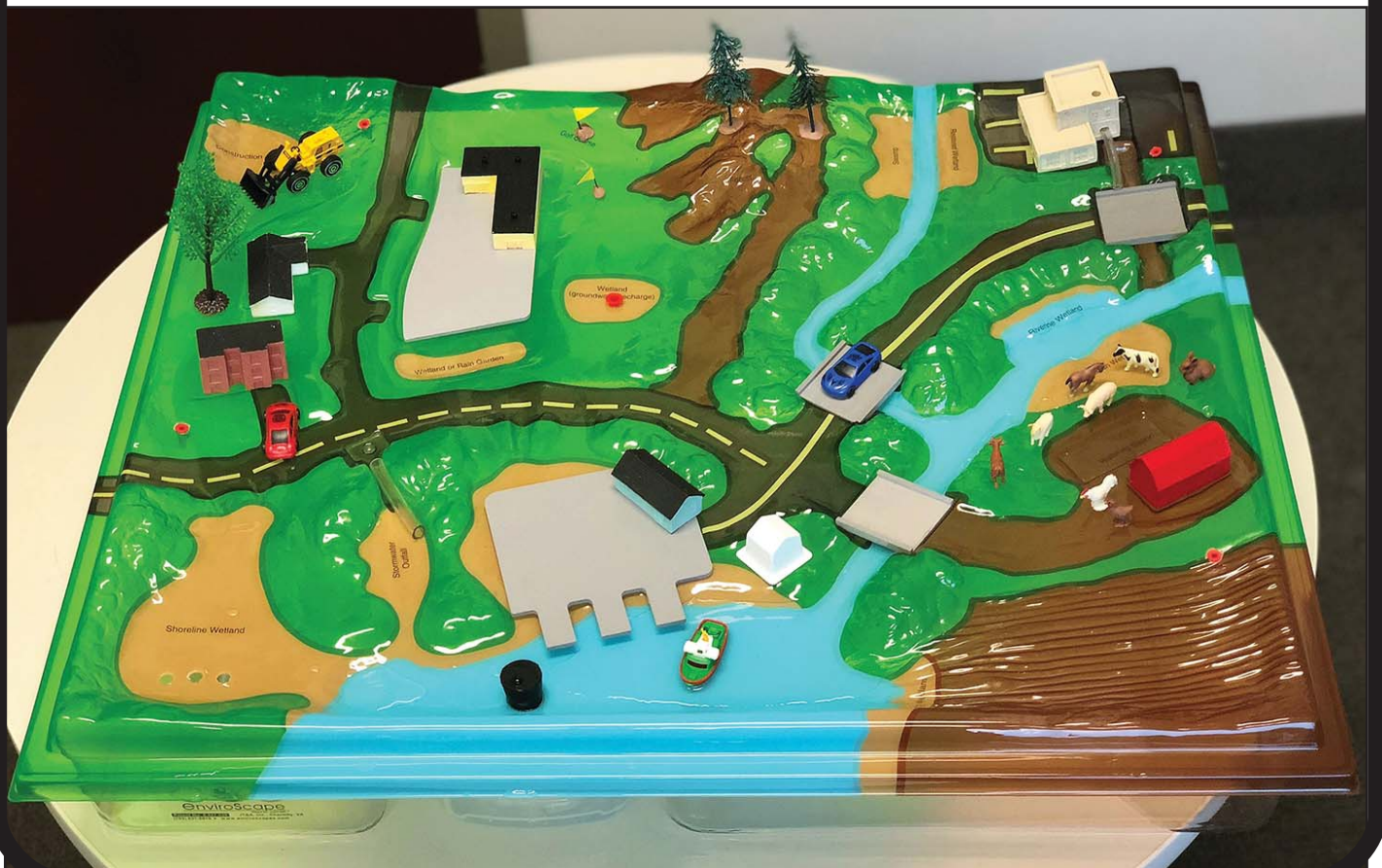
1. Remove all items from the case or box.
2. *If demonstrating with EnviroScape® Groundwater.* Place groundwater liner in the base of the model as instructed in the EnviroScape® Groundwater operating guide.
3. Place the EnviroScape® landscape on the base as shown below.
4. IMPORTANT! Slide the water tray under the drain in the bottom of the waterbody.
5. Label two plastic cups "Unplanned Land Use" and "After Restoration."



## DEMO I: UNPLANNED LAND USE – POLLUTION & FLOODING

6. Put the plug in the waterbody's drain. (Do not force the plug.)
7. Use the measuring cup to fill the waterbody with 4 fl. oz (1/2 cup) of water.
8. Fill each of your 8 ounce bottles with water, making sure they are equal in measure. Place Eco-Spout or Rain Cloud sprinkler head on one water bottle, and set the other aside.
9. Place the buildings, marina and shopping center pavement pieces on the model as shown in photo below.
  - 9a. Place trees on model. Use clay to form 3 tree trunks. Place 2 trees in the forest and place 1 tree in the residential area.
  - 9b. Add bridges, vehicles and golf flag (use clay to form a mound and insert golf flag).
  - 9c. Place farm animals by the stream near area marked "riparian wetland."
10. After set-up, your model should look like the photo below.

✓ **NOTE: If not using EnviroScape Groundwater, use clay or plastic stoppers to cover recharge hole area.**



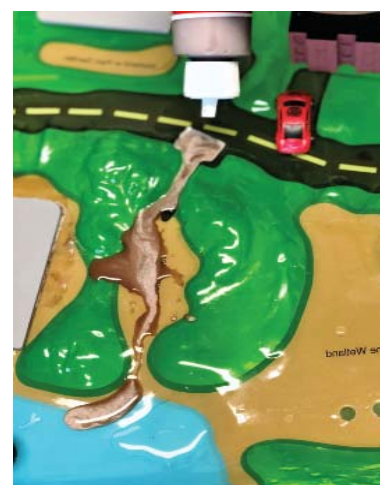
## STEP 2: Perform Activities

To understand the importance of restoring our environment and the functions and values of wetlands, let's explore what our environment would be like without wetlands. Most unplanned land development occurred before humans understood the importance of wetlands, vegetation, and sustainability. The functions and values of wetlands improve water quality, decrease flooding, provide habitat to animals, and improve our quality of life!

### ACTIVITY 1. IDENTIFY POTENTIAL POLLUTION SOURCES

- ✓ ***To illustrate the harm of storm drain dumping and how storm drains discharge directly in to our waterways, squirt sludge mixture in the top of the storm drain allowing sludge to discharge into the waterway.***

DISCUSS Storm drain systems help reduce flooding and control stormwater during heavy rains. Storm drains in most cases carry rainwater directly to a waterbody. Dumping in a storm drain is against the law and contributes to water pollution.



- ✓ ***To illustrate the discharge of possible pollutants from the industrial site squeeze sludge mixture through hole in the top of the factory allowing sludge to discharge into the waterway.***

DISCUSS Some factories release a cleaned, regulated wastewater into the environment, spills can happen and impact water quality.

- ✓ ***To illustrate soil, sprinkle 1/2 tsp of cocoa on the construction site, the farm field, the forest, the dirt roads and on the banks above and along the shoreline and waterways.***

DISCUSS Excess soil erosion occurs when construction, agriculture or forestry practices remove the vegetation that is holding the soil in place. Soil is an important natural resource on the land, but in the water, it becomes a pollutant.





## DEMO I: UNPLANNED LAND USE – POLLUTION & FLOODING IN WATERSHED

- ✓ ***To illustrate pesticides (red drink mix) and fertilizer (green drink mix), sprinkle 1/2 tsp of each on lawns, farm field, and the golf course.***

**DISCUSS** Overuse or improper application of pesticides and fertilizer (such as on frozen land, or application of pesticides and fertilizer right before a rainstorm) can run off the land in stormwater, and cause water pollution. Plants can use fertilizer on the land but in the water, it becomes a pollutant.

- ✓ ***To illustrate oils and grease, squirt a few drops of the “Oil and Sludge Mixture” on roads, parking lots, boat dock, and driveways.***

**DISCUSS** Vehicles like cars, trucks and boats can leave oil and gas residue on impervious paved surfaces such as roads, parking lots, boat docks and driveways.

### **ACTIVITY 2. MAKE IT RAIN TO DEMONSTRATE POLLUTION & FLOODING** ***(Get Your Students Involved in this Activity)***

- ✓ ***Using the 8 oz bottle with the Eco-Spout, make it rain over the entire model. Continue the rain until the bottle is empty.***



**REVISIT THE POLLUTION SOURCES DESCRIBED ABOVE AS NEEDED, and continue to next page to explore the effects of rain and runoff after unplanned land use.**

## DEMO I: UNPLANNED LAND USE – POLLUTION & FLOODING IN WATERSHED

### **Point at the pollution sources traveling to the main waterbody after the storm.**

**DISCUSS** Stormwater is carrying possible pollutants to our main waterbody. Soil erosion from construction, agriculture, and forestry practices has run off the land, contributing to stormwater pollution. Pesticides and fertilizers have traveled in the stormwater from the golf course, lawns, and farmland to our main waterbody.

### ✓ **Note the flooding on the floodplain. Point to the flooded home and marina.**

**DISCUSS** Impervious paved surfaces such as roads and parking lots replace vegetation in developed regions. Wetland plants slow the flow of water off the land and this allows time for the precipitation to soak into the ground. Without wetlands, more stormwater runs off the surface of the land, at a greater speed and this increases the rate and intensity of flooding. Oil and gas buildup on the roads, parking lot and dock may also run off the land during the rain event and contribute to stormwater pollution.



*Ask your students why the home was flooded? Why are the other residential areas on the model not flooded?*

### ✓ **Point to the shopping center parking lot. A standing pool of water has formed at the base of the shopping center parking lot.**

**DISCUSS** Flat, impervious surfaces like the shopping center parking lot increase the rate of runoff, and the concentration of buildings and human activity in the area increases the amount of sediments and other contaminants in the runoff.

*Ask your students if they have seen or experienced flooding. Where? Why do they think the flooding occurred.*



**ACTIVITY 3. COLLECT A WATER SAMPLE**

Pull the plug and drain the waterbody into the water tray. Pour the water collected into the clear plastic cup marked “Unplanned Land Use.”

Have your audience note the amount and clarity of the water collected.

Set the filled cup aside. We will need this for comparison later.

**👉 Ideas for Student Engagement**

- Tie the lesson to local issues familiar to your students. Ask questions to get the conversation started.
- Does flooding (or pooling water) occur on school grounds? Why? Have they seen water running to a storm drain after a heavy rain? Where does this stormwater go?
- Ask them to name sources of pollution. Let your students add these to the model (litter can be tiny pieces of paper).
- Ask students if they have seen construction sites in their community. Can they name erosion control methods commonly used on construction sites?
- After completing demonstrations ask students for local restoration ideas.

# **DEMO II: BENEFITS OF WETLANDS & ECOLOGICAL RESTORATION**

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## **STEP 1: Prepare the Model**

1. IMPORTANT! Slide water tray back under drain in waterbody.
2. Keep all buildings, trees and wetlands on model as they are, and use a sponge to wipe excess water and pollutants from the waterways and water tray only.
3. Put plug in the waterbody's drain. (Do not force the plug.)
4. Use the measuring cup to fill the waterbody with 4 fl. oz (1/2 cup) of water. Begin each demo with the same measure of water in the waterbody. At the end of the lesson we will compare water samples.
5. Place Eco-Spout on the other full 8 oz bottle.

## **STEP 2: Perform Activities**

### **Wetlands work to improve the environment**

Before the land ends and water begins, we find wetlands. Wetlands are the link between land and water. Imagine traveling across higher, dry land, towards the shoreline: before reaching the shore we would pass through wetlands(land that is permanently or seasonally flooded). An area between water and dry land is considered a wetland if it is saturated (soaked through) with water long enough during the growing season to influence the vegetation and soil.



## DEMO II: BENEFITS OF WETLANDS & ECOLOGICAL RESTORATION

### ACTIVITY 1. EXPLORE WETLAND TYPES — WHAT IN THE WORLD ARE WETLANDS?

 **Place sponges on model & describe the wetlands they represent.**

✓ **PLACE SHORELINE WETLAND**  
**(large oval sponge w/roots)**

Insert 3 wetland plant roots (cotton swabs) through slit in Shoreline Wetland (large oval sponge). Place shoreline wetland (sponge with swabs) on landscape map, with the top half of each plant root (swab) above the model and the bottom half inserted through map holes, showing through the base. Add trees if that is a feature of your shoreline.



**DISCUSS** Shoreline wetlands help to slow waves and provide a barrier between the land and the water. During heavy storms this wetland function protects people and their property from flooding and storm damage. The roots of wetland plants on the shore help to lessen erosion and hold the shoreline together, while absorbing possible pollutants and providing important habitat.

✓ **Add SWAMP (small thick rectangular sponge with trees)**

**DISCUSS** When a wetland is wet all the time and dominated by trees, we call that wetland by a special name – a swamp. Depending on the location; a swamp can be freshwater, seawater or brackish (a place where salt water and fresh water mix). Swamps are often located on the banks of rivers, and are fed by the fluctuations in the amount of water flowing through the river. Wetlands near the forest helps to support a wide range of wildlife. The swamp also protects the stream from an overload of sediment, improving water quality.



*Ask students if they have ever been to a swamp, what kind of animals live there?*



## DEMO II: BENEFITS OF WETLANDS & ECOLOGICAL RESTORATION

- ✓ **Add the WETLAND/GROUNDWATER RECHARGE (small thick oval sponge) to area marked “Wetland/Groundwater Recharge”**

**DISCUSS** Even small wetlands can have important functions, such as recharge areas for groundwater in aquifers. The wetland filters the rain water as it slowly seeps underground and is stored under the surface of the land as groundwater. (For more demonstrations of groundwater consider the EnviroScape Groundwater Liner Kit).

Ask students if they get their water from a well.  
Well water is groundwater.

Where does drinking water in your local community come from?



- ✓ **Add the RIPARIAN WETLAND (thick rectangular sponge) to area marked “Riparian Wetland.”**  
**Add trees to area if they are a feature of riparian zones/wetlands in your community**

**DISCUSS** Riparian wetlands occur on the banks of rivers, creeks and streams. These wetlands provide a vegetative border between upland land uses and the waterway. Riparian wetlands have vegetation such as trees, shrubs and grasses. The vegetation of the riparian zone helps slow the rate of flooding, provides habitat, and filters sediment and nutrients. Some but not all riparian areas are designated as wetlands.



- ✓ **Add the RIVERINE WETLAND (thick rectangular sponge) to area marked “Riverine Wetland”**

**DISCUSS** Riverine wetlands are found within the channel of moving water (such as a river, creek, or stream).

Riverine wetlands are permanently flooded and are important sources of water and habitat for animals and birds especially during a drought or dry season. The vegetation in a riverine wetland consists of floating plants, and plants that are underwater during some of the growing season. Riverine wetlands slow the rate of flowing water (a helpful control during heavy rains), and they act as sediment filters, keeping the stream clean.



- ✓ **Add the FARM WETLAND (small thick oval sponge to area marked "Farm Wetland")**

**DISCUSS** The transition zone between the farm field and the water body contains a wetland which acts as a natural filter for erosion and runoff from the farm field. Wetlands are sediment traps; potentially preventing up to 80% of sediment from entering surface water. This wetland traps the topsoil (a valuable natural resource on the land) and it traps nutrients like fertilizer,

and possibly pesticides used by the farmer. The wetland contains unique microscopic life that can potentially eat some pollutants, and the wetland vegetation can feed off the excess nutrients.



### ACTIVITY 2. RESTORE WETLANDS

#### **Sustainable Development and Environmental Restoration.**

Communities and businesses across our planet are realizing the important functions and values of our wetland resources. Environmental science, experience, education, and innovation has replaced unplanned development with sustainable solutions. We can benefit from our natural resources, while replenishing, restoring and respecting the interconnectedness of our environment. Humans need the services that wetlands provide, such as flood protection and naturally filtering our water.

#### **What can we do to make our community more sustainable?**

Returning a wetland as closely as possible to its natural condition is called restoration. Complete restoration is possible but may be difficult. In some cases, the best we can do will only partially restore wetland functions. Wetland science has advanced, and there is a growing industry of wetland restoration specialists, who are a great resource for learning more about restoring wetlands.

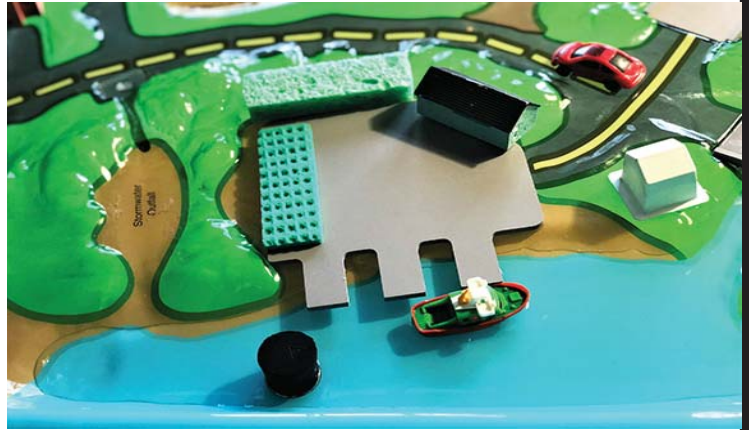


## DEMO II: BENEFITS OF WETLANDS & ECOLOGICAL RESTORATION

☞ **Let's demonstrate Wetland Restoration ideas and explore the Functions and Values they provide —**

### **RESTORE MARSH by Marina.**

- ✓ ***Place Restored Marsh (thick rectangular sponge) on Floodplain behind Marina and Boat Docks.***
- ✓ ***Place Vegetation Strip (thin rectangular sponge) on Marina Parking Lot.***



**DISCUSS** Before development, this entire floodplain was a marsh. The marsh held stormwater, which slowed the rate of runoff and controlled flood waters, while providing important habitat for wildlife. Smart city planners and developers restored this marsh area to promote wildlife, control potential flooding, increase shoreline stabilization, and reduce erosion. We need the marina for transportation and recreation yet we need the marsh too!

Restoration is possible because this area used to contain a wetland and the hydrology and soil will support the wetland vegetation (water loving plants) that we replanted here. Successful restoration of wetlands involves hard work and many details like replanting with native plants – the same type of plants and vegetation that grew here before we built the marina.

Adding vegetation to the border of the boat dock helps protect our restored marsh, by absorbing runoff and filtering stormwater that may run off the boat docks.

### **RESTORE WETLAND by the Factory.**

- ✓ ***Place a thick rectangular sponge on the “Restored Wetland” by Factory.***

**DISCUSS** Many industry leaders have realized the value of wetland areas. The wetland at the edge of the factory parking lot has been restored. This restored wetland serves as a stormwater retention pond – it helps filter and slow the rate of runoff from the parking lot. The restored wetland also provides habitat for many animals and recreational uses to employees.



### **RESTORE SEASONAL WETLAND.**

✓ ***Place small thick oval sponge on Construction Site.***

**DISCUSS** On our construction site, a seasonal wetland was being impacted by development. Wetlands that only receive water through precipitation are usually seasonal– it is wet when it rains, and when there is no rain it will dry up. Seasonal wetlands are important habitat, especially for migrating birds. This wetland filters pollutants, provides habitat and holds and stores water that is slowly released. This wetland also helps slow stormwater runoff and control flooding at the shoreline, even though it is far from shore. Wetlands are important to clean air – microscopic phytoplankton is abundant in wetlands and phytoplankton produces a lot of oxygen.



Although construction sometimes impacts wetlands, smart and sustainable development preserves wetland areas and incorporates their functions and values. Wetlands increase the aesthetic and environmental value of the area. There are strict rules in place about impacting wetlands for development.

*Ask students to describe a construction site. What is silt fencing? How is erosion controlled on construction sites near you?*

### **ACTIVITY 3. CREATE CONSTRUCTED WETLANDS USING WETLAND TECHNOLOGY**

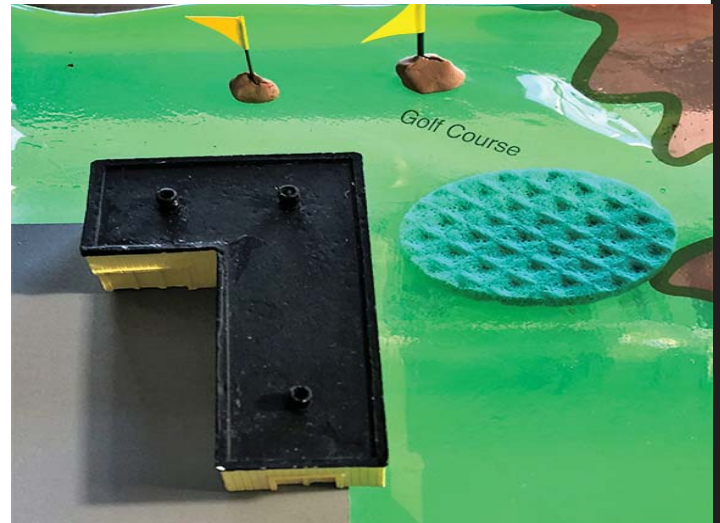
**Constructed wetlands are different from restored wetlands** because they are artificial wetlands used to treat wastewater and stormwater. These innovative wetlands use the science of wetland technology to improve the environment.

👉 **Now let's create some constructed wetlands and see how they help us manage what we do on the land.**

### **CONSTRUCTED WETLAND AT THE GOLF COURSE.**

- ✓ ***Place Constructed Wetland (one thin oval sponge) on Golf Course.***

**DISCUSS** The golf course has constructed a wetland to help control pesticide and fertilizer runoff. The constructed wetland adds aesthetic value and brings wildlife to the golf course. This constructed wetland helps protect surface waters and our groundwater recharge from possible pesticide and fertilizer contamination.



### **CONSTRUCTED WETLANDS AT THE SHOPPING CENTER.**

- ✓ ***Place one thin one rectangular sponge above shopping center parking lot, and one thin rectangular sponge below parking lot in area marked "Wetland/Rain Garden."***

**DISCUSS** The wetland plants at our created wetland garden have absorbed the pool of standing water at the base of the parking lot. (If the water table isn't high enough for a wetland garden we can plant a rain garden instead). Native plants, their roots and the soil, filter and retain stormwater. Wetland plants capture the stormwater, allowing time for stormwater to seep into the ground, nourishing plants and in some cases replenishing groundwater.



We've also created a wetland above the shopping center parking lot. This wetland helps protect our wetland garden from excess pesticide and nutrient runoff from the golf course, soil erosion from construction, and erosion from forestry activities. Native plants will flourish from the nutrients, and our surface water is protected.



### **CONSTRUCTED WETLANDS AT THE FACTORY.**

- ✓ *Lift bridge in front of the factory.*
- ✓ *Place one Constructed Wetland Pond (one rectangular thin sponge cut in half lengthwise) in the canal leading from the factory.*
- ✓ *Gently squirt sludge mixture through hole in top of factory.*
- ✓ *Watch discharge become trapped in Constructed Wetland.*
- ✓ *Replace bridge.*

**DISCUSS** Our constructed wetland pond at the factory is specifically designed to pre-treat the factory wastewater. The waste water travels slowly through the pond, and is cleaned and filtered by the vegetation and by the amazing microbial activity that occurs in wetlands. The wetland microbial “bugs” can in some cases “digest” waste products, storing, cleaning, and filtering wastewater before it is released into our environment.



### **CONSTRUCTED WETLAND AT THE STORM DRAIN OUTFALL.**

- ✓ *Place Constructed Wetland (thin oval sponge) at end of Storm Drain Outfall Pipe.*
- ✓ *Gently squeeze sludge mixture at storm drain to demonstrate how the constructed wetland traps possible pollutants.*

**DISCUSS** Constructed wetlands help us better manage what we do on the land. The constructed wetland at the storm drain outfall is a filter — it helps trap pollutants before the water reaches the waterbody. The filtering occurs before the stormwater reaches the larger wetland areas and the waterbody. If we construct wetlands as green, open spaces, they have the added benefit of attracting birds and other animals and discouraging people from dumping trash in the area.



**Get the conversation started.** *What plants and trees are native to your area? List ways that planting native vegetation can improve the environment.*

### ACTIVITY 4. PROTECT OUR WETLANDS

We have explored types of wetlands, and restored wetlands in our community. Let's protect them by preventing conditions that negatively impact wetlands. Protecting wetlands improves the wetlands ability to provide habitat for various species, control flooding and filter more pollution. When we protect wetlands, wildlife may return, and plant life should thrive!

#### **PROTECT FARM SITE WETLAND.**

- ✓ ***Use clay to create a small Dam (berm) where Farm Field drains.***
- ✓ ***Use Vegetation Strip (thin rectangular sponge) to create a Vegetative Buffer between Wetland and Field.***



**DISCUSS** As we saw earlier, runoff from this field is carrying excess nutrients and too much soil to the wetland and waterbody, impacting water quality and wildlife on the farm. This vegetative buffer helps absorb any excess nutrients and pesticides. The small dam slows the runoff, allowing time for the wetland to absorb runoff.

#### **PROTECT THE RIPARIAN WETLAND.**

- ✓ ***Add Water Trough, and build Fence between the Farm Animals and the Riparian Wetland.***

**DISCUSS** Riparian areas are found by streams and creeks and are an attractive shady place for livestock to access the stream. Over time, livestock trample and degrade the vegetation and soil of a stream bank riparian zone. If the river or stream lacks the vegetative border of a riparian buffer zone, more soil and pollutants can enter the surface water. Fish habitat depends on clear water and the shade of riparian vegetation. Our landowner protects the riparian zone by fencing off his livestock from the stream and providing a more convenient water source for his livestock. This keeps the vegetation from being trampled by livestock and the surface water cleaner. Farmers know protecting the water quality and environmental quality on their land improves the health and quality of the products they produce.



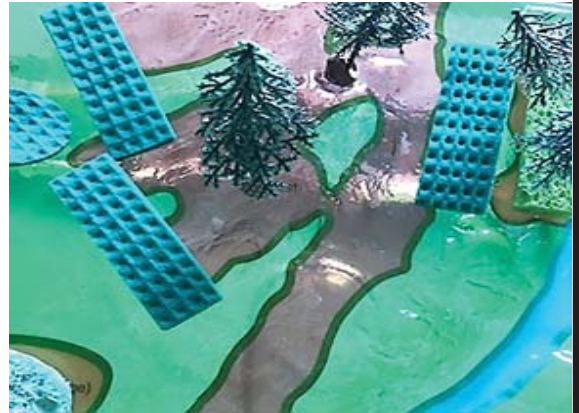


## DEMO II: BENEFITS OF WETLANDS & ECOLOGICAL RESTORATION

☞ **Let's ease up on conditions impacting the swamp and protect our created wetland at the golf course.**

- ✓ ***Place 3 Vegetation Strips (thin rectangular sponges) around base of the forest.***

**DISCUSS** By leaving a border of undisturbed vegetation at the base of the forest, or replanting vegetation, some of the sediment in the stormwater runoff will be trapped and filtered. This helps protect the swamp and other wetlands from an overload of soil.



- ✓ ***Use clay to form trunks and replant 4 trees in the Forest.***

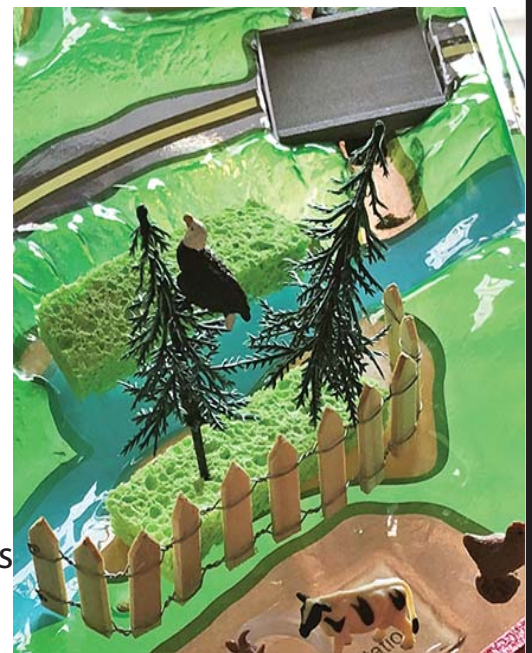
**DISCUSS** Our forested swamp protects the stream from an overload of sediment, improving water quality. But even a swamp can't handle all the sediment from forestry activities.

Modern sustainable forestry practices such as "selective forestry" ensure trees and habitat are left in the forest rather than clear-cutting. Replanting of trees is a common modern forestry practice, to ensure natural resources for the future.

### ACTIVITY 5. DEMONSTRATE HABITAT

- ✓ ***Place Wetland Animals in the Wetland areas.***

**DISCUSS** Restoring and creating wetlands has increased the wildlife in our community! Wetlands provide unique habitat, (shelter, food and protection) for many animals, birds and endangered species including insects and microbes. Wetlands are among the most unique and productive ecosystems on our planet, and provide a home for the many "critters" that live in the water, soil, air, and vegetation. Microbial activity within a wetland creates a "biological supermarket" that supports a rich variety of plants and animals. Wetland Ecosystems contribute in very important ways to the food chain and biodiversity. Even animals who don't live exclusively in wetlands depend upon the safety and shelter of the vegetation for breeding, nesting, feeding, and even as escape routes. Nearly half of our threatened and endangered species, such as the whooping crane and the prairie fringed orchid, live in wetlands or depend on them.





### ACTIVITY 6. ADD POLLUTANTS & MAKE IT RAIN TO DEMONSTRATE HOW ECOLOGICAL RESTORATION IMPROVES THE ENVIRONMENT!

*(This is a good time to involve your students)*

- ✓ **SOIL:** Sprinkle 1/2 tsp of cocoa on the construction site, farmland, forest & dirt roads.
- ✓ **OILS & GREASE:** Squeeze a few drops of the “oil and sludge” mixture on all paved surfaces (highways, roads, parking lots and driveways).
- ✓ **PESTICIDE (red drink mix) & FERTILIZER (green drink mix):** sprinkle 1/2 tsp of each on the farmland, lawns, and the golf course.
- ✓ **Using the second water bottle w/Eco-Spout make it rain over the entire model until the bottle is empty.**



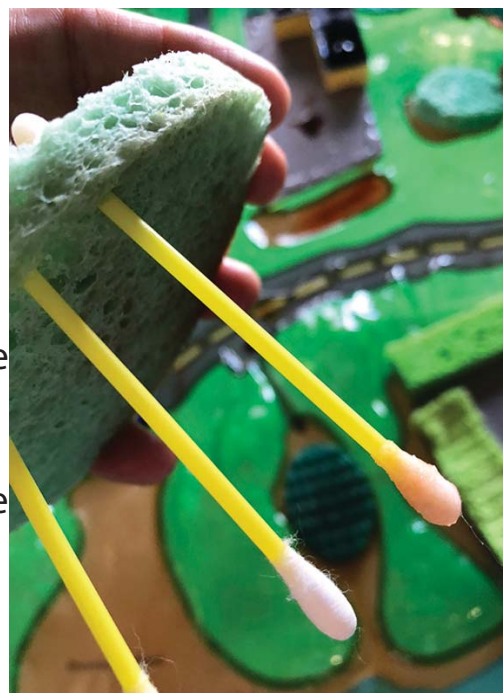
### WETLANDS IMPROVE WATER QUALITY . . .

**Did restoring and creating wetlands improve the water quality?  
How?**

#### SEDIMENT HOLDING AND FILTERING

- ✓ **Students can look through the corner of base by the shoreline wetland – or lift, show & return shoreline wetland (with roots)**

**DISCUSS** See how the wetland plants soak up some of the runoff – and how the fertilizers and sediments soak into the root structure beneath the surface. The wetland plants can use some of these nutrients and the wetland itself will hold the soil. By absorbing some of the runoff and allowing time for the sediment to settle, wetlands reduce the volume of sediments traveling to the waterbody. This is wetlands working to improve water quality! As rain soaks into each of the wetlands, the wetland traps sediment and other materials and filters out impurities, nutrients and chemicals in the water before the pollutants enter the aquifer; or travel downstream into surface waters. Wetlands help purify the environment; as someone once said, “wetlands are the kidneys of our watersheds.”



## DEMO II: BENEFITS OF WETLANDS & ECOLOGICAL RESTORATION

- ✓ ***Lift, show and replace all other Wetlands on the landscape, showing the runoff absorbed and filtered by the various wetlands.***

**DISCUSS** Excess nutrients running off the land from overfertilized lawns, recreational areas or agricultural fields are taken up by wetland plants. The nutrients help wetland plants grow and reproduce, which in turn provides food and a place to live – habitat – for wildlife. Without the wetland's capacity for using some nutrients, too many nutrients would get through, thereby potentially degrading water quality.



### **WETLANDS HELP WITH FLOOD CONTROL...**

- ✓ ***Point to the Home by the Marina. Remind students that in the first part of our demonstration “Unplanned Land Use,” this area was flooded. Ask your audience why they think there is less flooding now.***

**DISCUSS** In the first part of our demonstration, we saw the risks of development within the floodplain when the heavy rainstorm caused flooding. Ideally we should avoid building homes and businesses within the floodplain. After restoration, flood waters are controlled. The wetlands and vegetation we restored soaked up much of the precipitation, reducing the volume of stormwater runoff, reducing the risk of flooding. Wetlands serve as temporary storage for water, they empty slowly — like a clogged drain. It is this slow release that helps downstream communities plan for flood management and keeps water flowing in times of drought.

### ACTIVITY 7. COLLECT WATER SAMPLE AND COMPARE (Get Your Audience Involved)

- ✓ ***Pull the plug and drain the waterbody into the water catcher below. Pour the contents into cup marked “After Restoration.”***
- ✓ ***Show your audience the cup marked “Unplanned Development” and the cup marked “After Restoration.” ASK your audience to compare.***

Observe that the water sample after wetlands restoration looks much cleaner.

- ✓ ***Point to cup “After Restoration”***

**DISCUSS** After restoring, creating and protecting wetlands, we have less water in our second cup—this means that less of the stormwater runoff made its way to our waterbody. Why?



### **How much water do wetlands hold?**

- ✓ ***Replace plug in waterbody! Lift wetland sponges and squeeze them over the waterbody observing the amount of water that was held by the wetlands.***

**DISCUSS** The wetlands absorbed some of the stormwater — storing it and preventing flooding. We use sponges on the model to simulate wetlands because the soil and vegetation in a wetland work together, becoming like a sponge, absorbing and holding the water. Stormwater held by wetlands is released gradually, protecting the land from the negative effects of flooding. A wetland’s water-holding ability is a natural flood control during large rainstorms.

A wetland’s water-holding ability also protects water quality, as the vegetation has more time to absorb and process possible pollutants, when the water is released, it’s cleaner! Wetlands also slow the velocity or speed of runoff and help reduce streambank erosion. Wetlands do not have unlimited water storage capacity to prevent flooding, but without wetlands as we saw during the Unplanned Development demo, flooding will increase.

## **DEMO II: BENEFITS OF WETLANDS & ECOLOGICAL RESTORATION**

**Start the conversation with your students**

*How can planning before development protect and improve the environment?*

*In what ways could environmental planning save a community money?*

*What areas in your community need to be restored?*

# **Wetlands improve our water quality and quality of life!**

### **ALWAYS REMEMBER:**

**No matter where we are or what we do for a living, we must learn to manage the chemicals and other materials we put on the land!**

**WETLANDS ARE NATURAL BUFFERS,  
but don't expect them to do everything!  
They can't manage all the oils and grease,  
chemicals and fertilizers we put on the land.  
A simple rule for our activities is this:  
Use only what you need!**

**– END OF MAIN DEMO –**

# Clean-Up

## **When the enviroscape sessions are completely finished:**

- Drain the waterbody into the container beneath it.
- Remove the container and dispose of its contents in a sink.
- Clean container and plug. Dry thoroughly.
- Remove bridges, vehicles, buildings and other small components and wash separately with soap and water. Store in container when dry.
- Remove trees from their trunks and let them dry before placing in container.
- Place wet sponges and felt in the mesh bag provided and attach mesh bag to the outside of your case until dry.
- Repack small components and ingredients in the rectangular container.
- Clean model thoroughly. The unit can be washed with gentle dish soap and water, and rinsed directly under a faucet. Do not use any other detergents or cleaners.
- Let EnviroScape model dry completely before repacking it and all its components in the carrying case.

## **Again, only use dish soap and water, rinse thoroughly with water and dry completely before storing.**

# **ALTERNATIVE DEMO (3-PART)**

## **Natural Environment to Modern Times**

**PART 1. NATURAL ENVIRONMENT ..... PAGE 31**

**PART 2. UNPLANNED LAND USE ..... PAGE 39**

**PART 3. ECOLOGICAL RESTORATION AND SUSTAINABLE  
DEVELOPMENT..... PAGE 47**



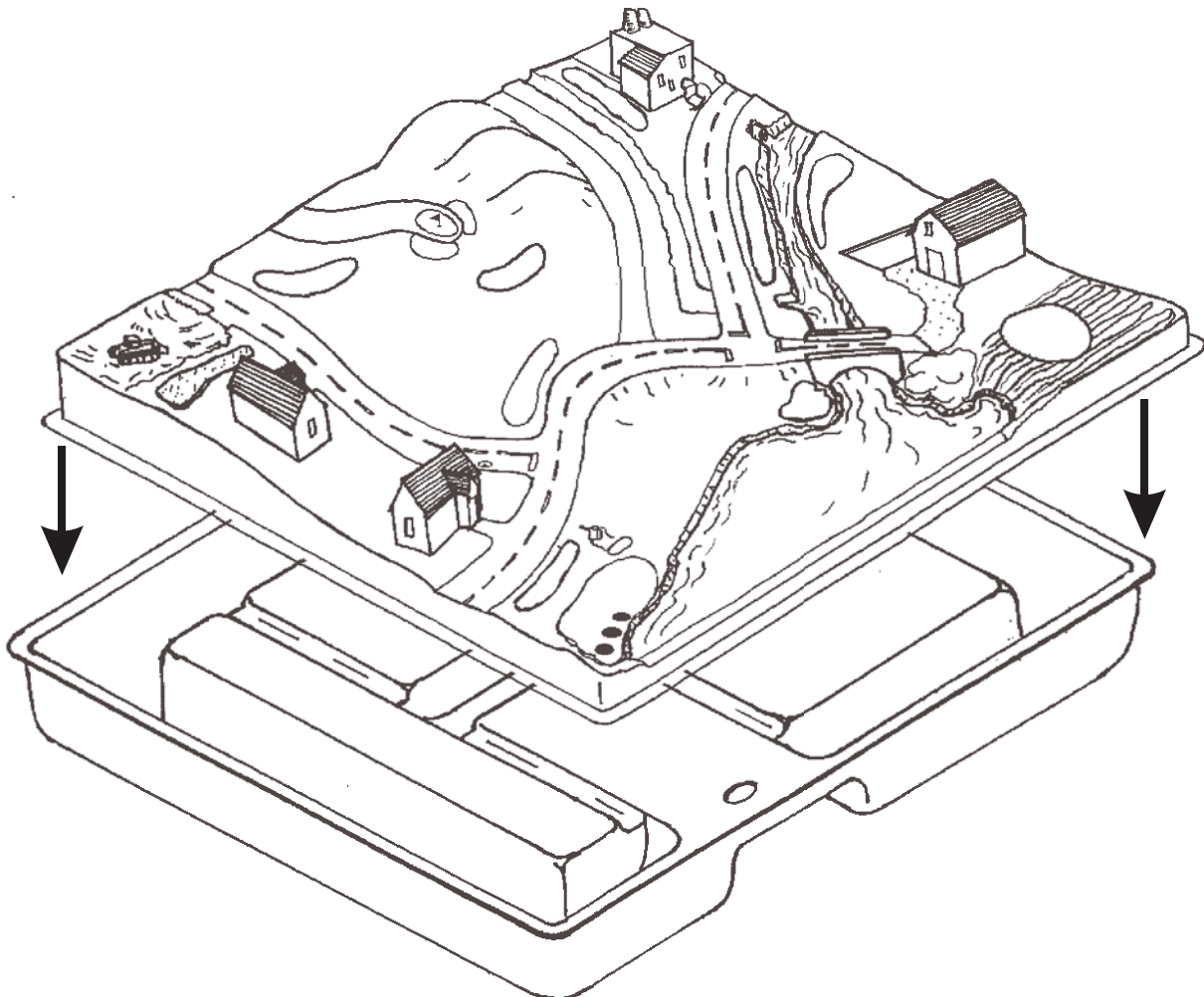
# **ALTERNATIVE DEMO PART 1.**

## **NATURAL ENVIRONMENT**

An overview of ecological services (basic functions and values) provided by wetlands and vegetation in the natural environment.

### **STEP 1: Prepare the Model**

1. Remove all items from the case or box.
2. ***If demonstrating EnviroScape® Groundwater – place groundwater liner in base as instructed in the EnviroScape® Groundwater guide.***
3. Place EnviroScape® landscape on the base as shown below.
4. **IMPORTANT!** Slide the water tray under the drain in the bottom of the waterbody.



## ALTERNATIVE DEMO PART 1. NATURAL ENVIRONMENT

5. Label the 3 cups, "Natural Environment", "Unplanned Land Use" & "After Restoration"



6. Put plug in the waterbody's drain. (Do not force the plug.)
7. Use measuring cup to fill the waterbody with 4 fl. oz (1/2 cup) of water.
8. Fill both 8 oz. bottles, making sure they are of equal measure. Place sprinkler head on one water bottle, and set the other aside.
9. Place wetland sponges on the model as shown to the right. The wetland locations are printed on the landscape map for your convenience.

- 9a. Place SHORELINE WETLAND (large oval sponge w/roots)

Insert 3 wetland plant roots (cotton swabs) through slit in Shoreline

Wetland (large oval sponge). Place shoreline wetland (sponge with swabs) on landscape map, with the top half of each plant root (swab) above the model and the bottom half inserted through map

holes, showing through the base. Add trees if that is a feature of your shoreline.





## ALTERNATIVE DEMO PART 1. NATURAL ENVIRONMENT

- 9b. Place MARSH (large oval sponge) on shoreline marked "marina/floodplain," and add a small thick oval sponge to area marked "Stormdrain Outfall."



- 9c. Using 4 thick rectangular sponges add wetlands to the areas marked "Swamp", "Restored Wetland", "Riverine Wetland" and "Riparian Wetland." Add trees to wetlands if desired. Add a small thick oval sponge to area marked "Farm Wetland."



- 9d. Add Seasonal Wetland (large oval sponge) to area marked "Wetland (construction)." Place a small thick oval sponge in area marked "Wetland/ Groundwater Recharge." Place 1 thick rectangular sponge in the area marked "Wetland/Rain Garden."



## ALTERNATIVE DEMO PART 1. NATURAL ENVIRONMENT

10. Use clay to add 6 trees to the forest. Place thick rectangular sponges (with trees) over the dirt road leading to the forest. Place 3 damp thin rectangular sponges (Vegetation Strips) around the base of the forest.

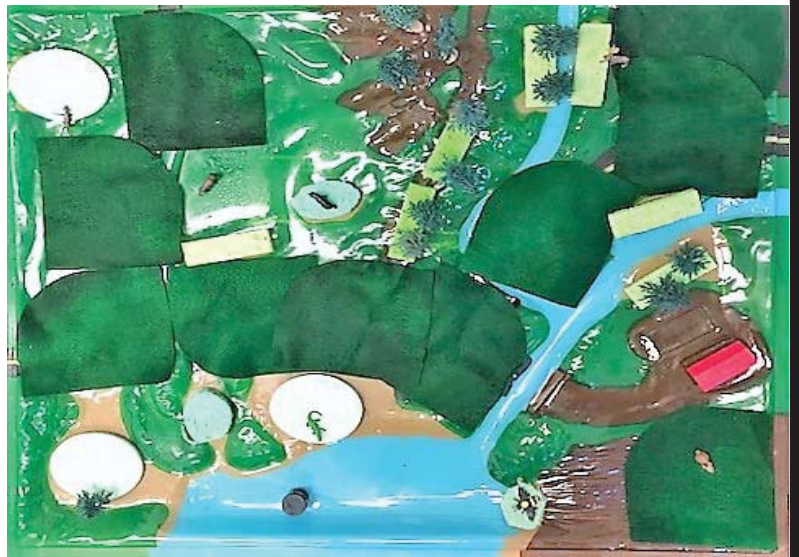
11. Place 10 vegetation pieces (large green felt pieces) on the following areas:

- Parking lot
- Paved roads
- ½ of the Farm Field
- Residential area
- Golf Course

12. Place the barn and 1 cow on the small rural farm.

13. Put remaining buildings, bridges, vehicles, golf flags & animals to the side of the model for use in the next demonstration.

14. Add Soil – sprinkle ½ tsp of soil (cocoa) on the farmland where felt is not placed, in the forest, and on the dirt road leading to the farm.



## STEP 2: Perform Activities

👉 **Let's explore wetland types.**

### **ACTIVITY 1. WHAT ARE WETLANDS? HOW DO WETLANDS WORK? WHAT ARE THE ECOLOGICAL SERVICES PROVIDED BY WETLANDS & VEGETATION?**

We begin our exploration of the ecological services provided by wetlands in their natural environment before any human activities altered the landscape. Vegetation and wetlands provide important ecological services including: the ability to stabilize shorelines, purify the water, protect against floods, recharge groundwater, and help control the flow of water in streams and rivers. Wetlands also provide habitat for fish and wildlife, including endangered species.

### ✓ *POINT TO EACH WETLAND AREA, DESCRIBE & DISCUSS*

■ **Before the land ends and water begins, we find wetlands.** Wetlands are a link between waterbodies and the land. An area between water and dry land is considered a wetland if it is saturated (soaked through) with water long enough during the growing season to affect the vegetation and soil. On one side is higher, dry land. On the other side is water. In the middle is the wetland, which is land that may be permanently or seasonally flooded.

■ **Shoreline Wetland.** Shoreline wetlands help slow waves and provide a barrier between the water and the land. This barrier is very useful during heavy storms, protecting people and their property from flooding and storm damage. The roots of wetland plants on the shore help lessen erosion and hold the shoreline together, while absorbing possible pollutants and providing important habitat.

■ **Swamp.** When a wetland is wet all the time and dominated by trees we call that wetland by a special name — a swamp. Depending on the location, a swamp can be freshwater, seawater or brackish (a place where salt water and fresh water mix). Swamps are often located on the banks of rivers, and are fed by the fluctuations in the amount of water flowing through the river. Wetlands near the forest help support a wide range of wildlife. The swamp also protects the stream from an overload of sediment, improving water quality.

■ **Wetland with Groundwater Recharge.** Even small wetlands have important functions, such as recharge areas for groundwater in aquifers. The wetland filters the rain water; it slowly seeps down and is stored under the surface of the land as groundwater.

■ **Riparian Wetlands** are found on the banks of rivers, creeks, and streams. Riparian wetlands have vegetation such as trees, shrubs, and grasses, and provide a vegetative border between upland land uses and the waterway. The vegetation of the riparian zone slows the rate of flooding, provides habitat, and filters sediment and nutrients. Some but not all riparian areas are designated as wetlands.

■ **Riverine Wetland.** Riverine wetlands are found within the channel of moving water (such as a river, creek, or stream). Riverine wetlands are permanently flooded and are important sources of water and habitat, especially during a drought or dry season. The vegetation in a riverine wetland consists of floating plants, and plants that are underwater during some part of the growing season. Riverine wetlands are not forested. They slow the rate of flowing water, a helpful control during heavy rains and act as sediment filters, keeping the stream clean.



## ALTERNATIVE DEMO PART 1. NATURAL ENVIRONMENT

■ **Farm Wetland.** On this model, the transition zone between the farm field and the water body contains a wetland which acts as a natural filter for erosion and runoff from the farm field. Wetlands are sediment traps; wetland plants can prevent up to 80% of sediment from entering surface water. This wetland traps the topsoil (a valuable natural resource on the land) and it traps nutrients like fertilizer, and possibly pesticides used by the farmer. The wetland contains unique microscopic life that potentially can eat some pollutants, and the wetland vegetation can feed off the nutrients.

■ **Seasonal Wetlands.** Wetlands that only receive water through precipitation are usually seasonal. Seasonal wetlands are wet when it rains but when there is no rain they will dry up. Seasonal wetlands are important habitat, especially for migrating birds. This wetland filters pollutants, provides habitat and holds and stores water that is released slowly. These functions slow stormwater runoff; and even though this wetland is far from the shore, it helps control flooding. All types of wetlands also are important to clean air, as the microscopic phytoplankton is abundant in wetlands and phytoplankton produces a lot of oxygen.

### ACTIVITY 2. DEMONSTRATE HABITAT

 **Place Wetland Animals in wetland areas.**

**DISCUSS** Wetlands provide unique habitat (shelter, food and protection) to many animals, terrestrial and aquatic, including insects, microbes, amphibians, birds, and endangered species. Wetlands are among the most unique and productive ecosystems on our planet. Wetlands provide a home for the many “critters” that live in the water, soil, air, and vegetation. Microbial activity within a wetland creates a “biological supermarket” that supports a rich variety of plants and animals. Wetland ecosystems contribute in very important ways to the food chain and biodiversity. Even animals who don’t live exclusively in wetlands depend upon the safety and shelter of the vegetation for breeding, nesting, feeding, and even as escape routes. Nearly half of our threatened and endangered species, such as the whooping crane and the prairie fringed orchid, live in wetlands or depend on them.

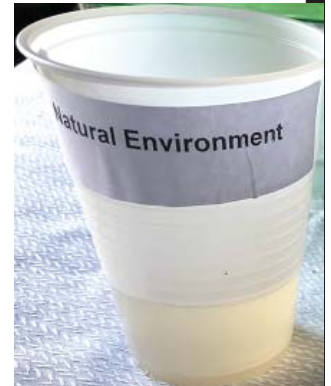


### ACTIVITY 3. MAKE IT RAIN TO DEMONSTRATE FUNCTIONS & VALUES OF WETLANDS *(Involve your students!)*

- Sediment Holding and Filtering of Possible Pollutants
- Demonstrate Flood Control
- How Much Water Did the Wetlands Hold?

- ✓ ***Using the bottle with the sprinkler head attached, rain over the entire model until the bottle is empty.***
- ✓ ***Pull the plug and drain the waterbody into the water catcher below. Pour the contents into the clear plastic cup marked "Natural Environment."***

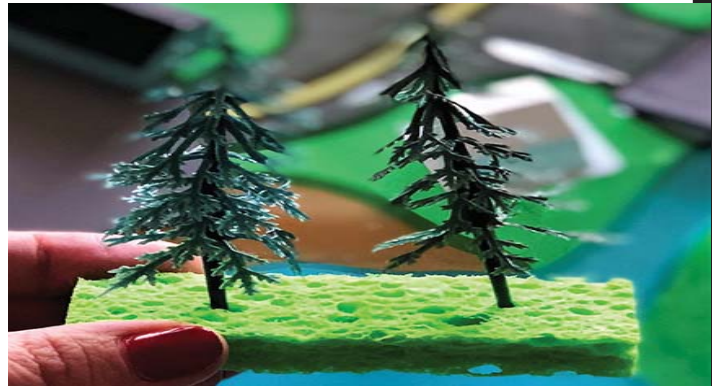
DISCUSS Have your audience note the amount of water and the clarity of the water collected. *Set this sample aside for comparison later. Replace the Plug.*



### **DEMONSTRATE SEDIMENT FILTERING**

Erosion of soil is a natural process that occurs even where there is little or no development of the land.

- ✓ ***See sediment trapped in wetlands and root mats as you lift and return the Riparian Wetland, the Swamp by the forest, and the trees with thick root mats on the dirt road to the Forest.***



DISCUSS Natural erosion control such as vegetation in and outside of wetlands—trap and hold sediment. Soil is a vital natural resource on the land, and vegetation keeps sediment from polluting our waterways. The additional benefit of wetlands is that the position of wetlands as transition zones between land and water, create the perfect filter for sediment, soil then enriches the wetland, instead of impacting water quality.

- ✓ ***Lift, show and return the Farm Site Wetland showing the runoff absorbed and filtered by the wetland.***

DISCUSS Our small farm benefits from a natural wetland separating the farm field from our main waterbody. The erosion, and possibly fertilizer from the farm field is caught and filtered through the wetland.

**DEMONSTRATE WATER-HOLDING ABSORBING CAPACITY & FLOOD CONTROL**

- ✓ *Measure the water collected in cup marked “Natural Environment” using measuring cup provided. We started with 4 fl. oz (1/2 cup) of water in the water body, our rain bottle held 8 ounces of water, yet we still have roughly 4 fl. oz (1/2 cup) of water.*

DISCUSS We began our demonstration with 4 fl. oz (1/2 cup) of water in the waterbody. It rained quite a bit over our landscape. We have the same amount of water in our waterbody as before the rainstorm.

-  **Prompt students to guess why the water level stayed the same.**

DISCUSS It's because wetlands have an amazing water holding capacity!

-  **How much water did the wetlands hold?**

- ✓ *Replace plug in waterbody!*
- ✓ *Pick up the various wetland sponges and squeeze them into the waterbody (then replace sponges).*

DISCUSS Wetlands absorbed stormwater — storing it and preventing flooding. On our EnviroScape we use sponges to simulate wetlands because the soil and vegetation in a wetland work together, like a sponge—absorbing and holding the water. When water stored in a wetland is released, it occurs gradually, protecting the land from the negative effects of flooding. A wetland's water-holding ability is a natural flood control during heavy rainstorms.

**Leave everything as it is for the next part of this demonstration, and lightly wipe down the waterways and waterbody.**

# **ALTERNATIVE DEMO PART 2.**

## **UNPLANNED LAND USE**

**This demonstration shows how unplanned land use affects wetlands, water quality and our quality of life.**

**DISCUSS** The industrial revolution altered the landscape. Rapid massive development benefited our economy and our standard of living. Most land development occurred before we understood the importance of sustainability. We need our natural resources such as clean water, fertile soil, and clean air. In the past, the interconnectedness of land and water including the microscopic components of our environment were not understood. Land and water contained vast and plentiful natural resources which appeared to have an unlimited supply. Functions and values of wetlands were not understood, and wetland areas, with their mushy soil, thick vegetation, and propensity for flooding were a hindrance to the development of a region. Wetlands were covered up, destroyed, or severely impacted wetlands to make room for industry, homes, and agriculture.

### **STEP 1: Prepare the Model**

✓ ***Fill the water body with 4 fl. oz (1/2 cup) of water.***

### **STEP 2: Perform Activities**

#### **ACTIVITY 4. DEVELOP THE LANDSCAPE**

Forestry products such as lumber and fuel are needed to build communities. Land must be cleared to build roads.

✓ ***Remove the three thick rectangular sponges with Trees from the Forest Road.***

**DISCUSS** Without the deep root mats of trees to hold the soil in place erosion increases.

## ALTERNATIVE DEMO PART 2. UNPLANNED LAND USE

- ✓ ***Remove Vegetation Strips (thin rectangular sponges) from the border of the forest, remove all but 2 Trees from the Forest. Remove the Swamp closest to the Forest, and remove Animals from Forest. Sprinkle soil (cocoa) on the Forest and on the Forest Road.***

**DISCUSS** Clear-cutting of trees provided access to large amounts of forestry products, but left the land without vegetation to hold soil, this leads to the destruction of nearby swamps/wetlands. Resulting in significant habitat loss for many plants and animals.

- ✓ Remove felt from Roadways and Parking Lot, and large oval sponge from “Marina/Floodplain.”**

- ✓ **Place Bridges, Boat Docks, and Marina building on model.**

**DISCUSS** Roads and bridges are built as transportation needs increase.

More materials and people travel by boat and roadway. Vegetation and wetlands are replaced by impervious paved surfaces. A marina is built on the floodplain replacing the marsh vegetation with a dock.



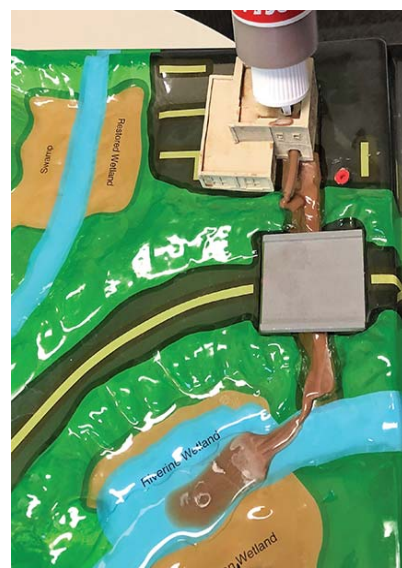
- ✓ **Add Cars and Boat—Squirt a few drops of the “Oil and Sludge” mixture on the Parking Lot, Roads and Marina Dock.**

**DISCUSS** Plentiful natural resources and good infrastructure increases development in the region. Increased transportation causes oil and gas buildup on impervious surfaces.

- ✓ Remove Swamp by Parking Lot and place Factory on model.**

- ✓ ***Squirt Sludge Mixture through hole in top of Factory allowing sludge to discharge into the waterway.***

**DISCUSS** Industry expands, bringing jobs and a healthy economy. Lack of knowledge about environmental impacts of waste products can lead to discharge and spills of pollutants to our waterways.





## ALTERNATIVE DEMO PART 2. UNPLANNED LAND USE

- ✓ **Remove Seasonal Wetland (large oval sponge) from Construction Area and add Construction Vehicle.**
- ✓ **Remove Vegetation (large felt) from the Residential Area.**
- ✓ **Place Homes and Apartments on the model and place one Small White House on the model beside the Marina. (see photo)**
- ✓ **Sprinkle Soil (cocoa) on Construction Site.**

DISCUSS The healthy economy brings jobs, the population upsurges and construction increases. As the population increases, homes need to be built. Tourism and development near the shoreline increases, homes and businesses are built within the floodplain.



- ✓ **Remove Vegetation (large felt) from Shopping Center Area and Golf Course.**
- ✓ **Place Parking Lot and Shopping Center on model.**
- ✓ **Squirt Sludge Mixture on Parking Lot.**
- ✓ **Add Golf Flags (use clay to form a mound for Golf Flag).**
- ✓ **Sprinkle Pesticide (red drink mix) and Fertilizer (green drink mix) on Residential Area and Golf Course.**

DISCUSS The grassland is replaced by a parking lot and shopping mall. A golf course is built. Suburban lawns and recreation areas replace wild vegetation and the use of pesticides and fertilizer increases.



## ALTERNATIVE DEMO PART 2. UNPLANNED LAND USE

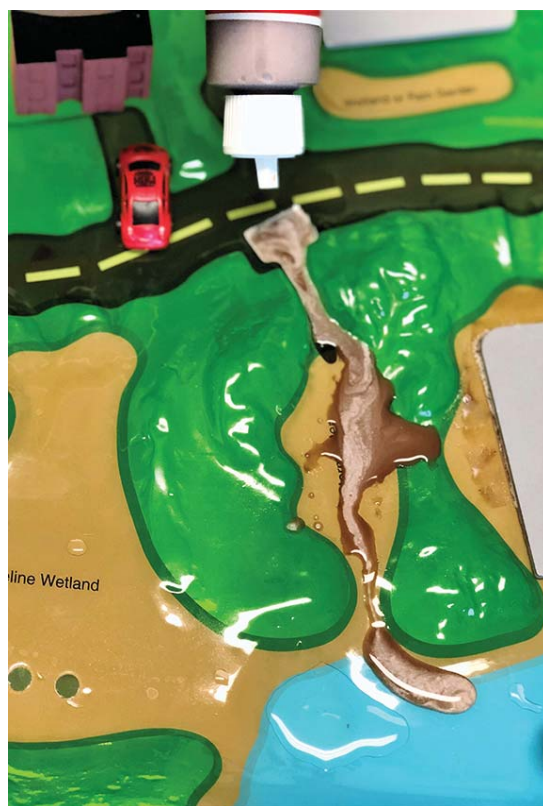
- ✓ ***Remove Farm Vegetation (large felt), Farm Site Wetland (small oval sponge) and Riparian Wetland (rectangular).***
- ✓ ***Sprinkle soil, pesticide, and fertilizer (cocoa, red and green drink mix) on Farmland.***
- ✓ ***Use cocoa to simulate Manure in the Livestock Area.***
- ✓ ***Add more Farm Animals, and add Cows to stream bank.***

**DISCUSS** As the population increases agriculture also increases. Humans depend on farmers to provide our food. Small family farms are replaced by larger agricultural operations. Land cover including wetland areas were sometimes removed to create space to grow crops.

Livestock herds also increase as the demand for food increases. The riparian wetland is impacted as herds access the stream. Over time the vegetation and topsoil are trampled by the cattle.

- ✓ ***Point to stormwater discharge pipe.***
- ✓ ***Gently squeeze sludge mixture bottle at the storm drain to demonstrate the harm of storm drain dumping and that everything that travels to the storm drain goes directly to the main waterbody.***

**DISCUSS** The increase in development results in more impervious surfaces such as structures, roads and parking lots. Plants, trees, and vegetation can help absorb precipitation. Paved surfaces result in increased stormwater runoff. Stormwater systems are built to pipe excess stormwater from roads and communities. Most stormwater systems discharge untreated stormwater into the nearest water body. Stormwater carries eroded soil, chemicals, fertilizer, and other possible pollutants into the waterbody, impacting water quality.



## ACTIVITY 5. MAKE IT RAIN TO DEMONSTRATE STORMWATER POLLUTION AND FLOODING (Let your class help make it rain!)

- ✓ **Place Eco-Spout on the Full 8-Ounce Water Bottle and rain over the entire model until the bottle is empty.**
- ✓ **Ask students why the land is flooding & the water looks more polluted?**  
DISCUSS Remind your students that it rained the same amount during Part 1 of the demonstration, yet, this time the floodplain, homes, marina, and farmland that borders the shoreline, are also being flooded.
- ✓ **Ask you students to list changes in the environment that may have contributed to the flooding.**

 **Point to pollution sources traveling to main waterbody after the storm.**

DISCUSS Stormwater is carrying possible pollutants to our main waterbody. Soil erosion from construction, agriculture and forestry practices has run off the land, contributing to stormwater pollution. Pesticides and fertilizers have traveled in the stormwater from the golf course, lawns and farmland to our main waterbody.

- ✓ **Note the flooding on the Floodplain. Point to the flooded Home and Marina.**

DISCUSS Impervious paved surfaces (such as roads and parking lots) replace vegetation in developed regions. Wetland plants slow the flow of water off the land and this allows time for the precipitation to soak into the ground. Without wetlands, more stormwater runs off the surface of the land, at a greater speed and this increases the rate and intensity of flooding. Oil and gas buildup on the roads, parking lot and dock may also run off the land during the rain event and contribute to stormwater pollution.

- ✓ **Point to Shopping Center Parking lot. A standing pool of water has formed at base of Shopping Center Parking lot.**  
DISCUSS Flat, impervious surfaces like the shopping center parking lot increase the rate of runoff, and the concentration of buildings and human activity in the area increases the amount of sediments and other contaminants in the runoff.





## ACTIVITY 6. HOW WETLANDS WORK

- ✓ ***Look at the wetland plant roots through the clear base at the corner by the Shoreline Wetland. Or lift, show & return the Shoreline Wetland (with roots).***

**DISCUSS** Wetland plants soak up some of the runoff — and fertilizers and sediments soak into the root structure beneath the surface.

The wetland plants can use some of these nutrients and the wetland itself will hold the soil. By absorbing some of the stormwater runoff and allowing time for the sediment to settle, wetlands reduce the volume of sediments traveling to the waterbody. This is wetlands working to improve water quality!

As stormwater runoff soaks into each of the wetlands, the wetland traps sediment and filters out impurities, nutrients and chemicals before this water enters the aquifer; or travels

downstream into surface waters. Wetlands help purify the environment; as someone once said, "Wetlands are the kidneys of our watersheds."



- ✓ ***Lift & Replace Wetland at area marked "Groundwater Recharge Area," and show the possible pollutants trapped by the Wetland.***

- ✓ ***(IF USING THE OPTIONAL GROUNDWATER LINER, refer to Groundwater Guide to show how this wetland filters the stormwater as it recharges the aquifer below.)***

**DISCUSS** Excess nutrients running off the land from overfertilized lawns, recreational areas, and agricultural fields are taken up by wetland plants.

This may help wetland vegetation grow and reproduce. Healthy vegetation provides food and a place to live — habitat — for wildlife. Without the wetlands capacity for using some nutrients, more nutrients would travel to the waterbody, potentially degrading the water quality. Wetlands can do a lot, but do not have an unlimited capacity to filter and absorb pollutants. In Part 3 we will do some ecological restoration and help the wetlands!



## ACTIVITY 7. COLLECT WATER SAMPLE AND COMPARE

- ✓ ***Pull the plug to drain the waterbody into the water catcher beneath model. Pour contents into an empty cup and mark this “After Unplanned Land Use.”***



- ✓ ***Ask students to compare the water samples.***

**DISCUSS** Why is there more water in our cup marked “After Unplanned Land Use”? Why does this water look more polluted?

Before unplanned development, there were more wetlands and more vegetation. Stormwater was absorbed into the ground by the vegetation, plant roots, and stored by wetlands. The stormwater that did enter the waterways was cleaner because it had been naturally filtered by wetlands. Before unplanned development, we had more forests, wetlands, plants, better water quality, and habitat for animals. If flooding occurred, it did not occur as rapidly, or as often.



***Let's move to Part 3 and explore solutions.***

[illegible]

# **ALTERNATIVE DEMO PART 3**

## **ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT**

✓ Leave everything on the model from Demo 2 and refill one of your water bottles and place sprinkler head on it.

### **STEP 1: Prepare the Model**

1. IMPORTANT! Slide the empty water tray under the hole in the bottom of the waterbody.
2. Use a sponge to wipe excess water and pollutants from the waterways and waterbody.
3. Put plug in the waterbody's drain. (Do not force the plug).
4. Use the small measuring cup provided to fill the main waterbody with 4 fl. oz (1/2 cup) of water.

### **STEP 2: Perform Activities**

 **Let's see how wetlands work to improve the environment**

#### **ACTIVITY 8. RESTORE WETLANDS**

**Sustainable development and environmental restoration.** Communities and businesses across our planet are realizing the important functions and values of our wetland resources. Environmental science, experience, education, and innovation has replaced unplanned development. Sustainable solutions now allow us to benefit from our natural resources, while replenishing, restoring, and respecting the interconnectedness of our environment. Humans need the services that wetlands provide, such as flood protection and naturally filtering our water.

**What can we do to make our community more sustainable?** Returning a wetland as closely as possible to its natural condition is called restoration. Complete restoration is possible but difficult. In some cases, the best we can do will only partially restore wetland functions. Wetland science has advanced and there is a growing industry of wetland restoration specialists.

### ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

👉 **Let's demonstrate some wetland restoration ideas and the functions and values they provide.**

#### **RESTORE MARSH BY MARINA**

- ✓ ***Place the Restored Wetland (thick rectangular sponge) on the Floodplain behind the Marina and Boat Docks.***
- ✓ ***Place one Vegetation Strip (thin rectangle sponge) on the Marina parking lot.***



**DISCUSS** Before development the entire floodplain was a marsh. Smart city planners and developers restored this marsh area to promote wildlife, control potential flooding, increase shoreline stabilization, and reduce erosion. We need the marina for transportation and recreation, yet we need the marsh too! The marsh holds stormwater, slows the rate of runoff and controls flood waters, while providing important habitat for wildlife.

Restoration is possible because this area used to contain a wetland and the hydrology and soil will support the wetland vegetation (water loving plants) that we replanted here. Successful restoration of wetlands involves hard work and many details, like replanting with native plants – meaning planting the same type of plants and vegetation that grew here before we built the marina. Adding vegetation to the border of the boat dock helps protect our restored marsh, by absorbing runoff and filtering stormwater that may run off the boat docks.

*Ask students if they have other restoration ideas, and demonstrate these on the model.*



## ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

### **RESTORE WETLAND BY FACTORY (thick rectangular sponge)**

- ✓ ***Place a thick rectangular sponge at “Restored Wetland” area by Factory***

**DISCUSS** Many industry leaders now realize the value of wetlands. The wetland at the edge of the factory parking lot has been restored. This restored wetland serves as a stormwater retention pond—helps filter and slow the rate of runoff from the parking lot. The restored wetland also provides habitat and recreational uses.



### **RESTORE WETLAND ON CONSTRUCTION SITE (thick oval sponge)**

- ✓ ***Place a small thick oval sponge on Construction Site***

**DISCUSS** On our construction site, a seasonal wetland was being impacted by development. Wetlands that only receive water through precipitation are usually seasonal, when it rains it is wet and when there is no rain it will dry up. Seasonal wetlands are important habitat, especially for migrating birds. This wetland filters pollutants, provides habitat, and holds and stores water that is released slowly. Wetlands slow stormwater runoff, so even though this wetland is far from the shore, it helps control shoreline flooding.

All wetlands are important to clean air. Microscopic phytoplankton is abundant in wetlands and phytoplankton produces a lot of oxygen.

Smart, sustainable development preserves wetland areas and incorporates wetland functions and values into the project, increasing the aesthetic and environmental value of the area. There are strict rules in place about impacting wetlands for development.



## ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

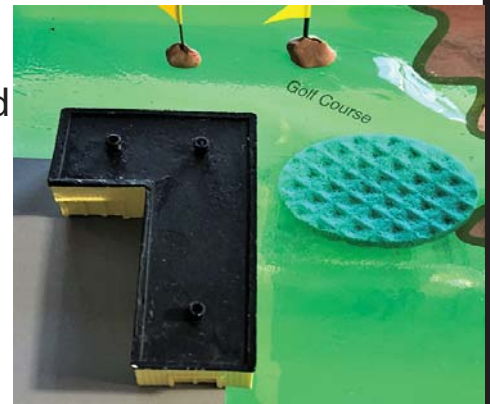
### ACTIVITY 9. CONSTRUCTED WETLANDS

Constructed wetlands are different from restored wetlands – they are artificial wetlands designed and built to treat wastewater and control stormwater. These innovative wetlands use the science of wetland technology to improve the environment. Let's see how these constructed wetlands help us better manage what we do on the land.

#### CONSTRUCTED WETLAND AT THE GOLF COURSE

- ✓ ***Place a thin oval sponge on the Golf course.***

**DISCUSS** On the golf course a wetland is constructed to help control pesticide and fertilizer runoff. The created wetland adds aesthetic value and brings wildlife to the golf course. This constructed wetland also helps protect surface waters and the groundwater recharge wetland from pesticide and fertilizer contamination.



#### CONSTRUCTED WETLANDS AT THE SHOPPING CENTER

- ✓ ***Using 2 thin rectangular sponges, place one above the parking lot of the shopping center and one in the pool of water below the shopping center parking lot.***

**DISCUSS** Watch as the wetland plants in our created wetland garden have absorbed the pool of standing water at the base of the parking lot. (If the water table isn't high enough for a wetland garden we can plant a rain garden instead). Together, the native plants, roots and soil, filter and retain stormwater. Wetland plants capture stormwater, allowing time for stormwater to seep into the ground, nourishing plants and in some cases replenishing groundwater.



Our created wetland above the shopping center parking lot helps protect our wetland garden from excess runoff from the golf course, construction, and forestry activities. The native plants we included will flourish from the nutrients and our surface water is protected.

## ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

### CONSTRUCTED WETLAND AT THE FACTORY

- ✓ *Lift the bridge in front of the factory. Cut one thin rectangular sponge lengthwise, place this Constructed Wetland in the canal leading from the Factory.*
- ✓ *Gently squirt sludge mixture through the hole in the top of Factory.*

☞ **Watch the discharge become trapped in the constructed wetland.**

- ✓ *Replace bridge.*

**DISCUSS** Our constructed wetland at the factory is designed to pre-treat the factory wastewater. The waste water travels slowly, being cleaned and filtered, by the vegetation and by the amazing microbial activity that occurs in wetlands. The wetland microbial “bugs” can in some cases “digest” waste products, storing, cleaning and filtering wastewater before it is released into our environment.

*Can you provide examples of wetlands in our community that were created to control stormwater or treat wastewater?*

*How have constructed wetlands improved our community?*

*Can you suggest areas where created wetlands might improve our environment?*





## ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

### **CONSTRUCTED WETLAND AT THE STORM DRAIN OUTFALL**

- ✓ *Place Constructed Wetland (1 thin oval sponge) and place at the end of storm drain outfall pipe.*
- ✓ *Gently squeeze sludge mixture at storm drain to demonstrate how the constructed wetland traps possible pollutants.*

**DISCUSS** Constructed wetlands help us better manage what we do on the land. The constructed wetland at the storm drain outfall is a filter—it helps trap pollutants before the water reaches the waterbody. The filtering occurs before the water reaches the larger wetland areas and the waterbody. If we construct these wetlands as green, open spaces, they have the added benefit of attracting birds and other animals and discouraging people from dumping trash in the area.



### **ACTIVITY 10. PROTECT OUR WETLANDS**

When restoring wetlands it's important to protect the wetland from negative impacts. When protected, the wetlands ability to provide habitat for animals, improve water quality, and hold excess stormwater will improve. Wildlife may return, and a diversity of plant life may begin to thrive!

### **RESTORE AND PROTECT FARM SITE WETLAND**

**DISCUSS** As seen earlier, runoff from this field is carrying too many nutrients and too much topsoil to the wetland and the main waterbody, and wildlife is no longer abundant on the farm.

- ✓ *To restore the Farm Site wetland place the small thick oval sponge on the area marked "Farm Site Wetland".*
- ✓ *To protect this wetland use clay to create a small Dam (berm) where the Farm Field drains.*
- ✓ *Use a thin rectangular sponge to plant a Vegetative Buffer between wetland and field.*



**DISCUSS** A vegetative buffer helps absorb any excess nutrients and pesticides. The small dam slows the runoff from the farm field and gives the wetland more time to absorb potential runoff.



### ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

#### **RESTORE AND PROTECT THE RIPARIAN WETLAND**

- ✓ ***Place a thick rectangular sponge with trees on the area labeled “Riparian Wetland” to restore the wetland.***
- ✓ ***Add the Water Trough, and add a Fence between the Farm Animals and the Riparian Wetland.***

**DISCUSS** Riparian zones are found by streams and creeks and are an attractive shady place for livestock to access the stream. Over time the vegetation and soil of the riparian zone can be degraded by animals trampling the stream bank. If the riparian zone lacks vegetation, the soil and pollutants can contaminate surface water. Fish habitat depend on clear water and the shade of riparian vegetation. Our landowner protects the riparian zone by fencing off his livestock from the stream and providing another, more convenient water source for his livestock. This simple fix keeps the vegetation from being trampled and the surface water cleaner. Farmers know protecting the water quality and environmental quality on their land improves the health and quality of the products they produce.



**Let's restore and ease up on conditions impacting the Swamp and protect our constructed wetland at golf course:**

- ✓ ***Restore the swamp by placing a thick rectangular sponge (with trees) in the area marked “Swamp.”***
- ✓ ***Place 3 Vegetation Strips (thin rectangular sponges) around the perimeter of the Forest.***

**DISCUSS** Replanting disturbed vegetation at the base of the forest will trap and filter some of the sediment before it reaches the swamp, or runs off the slope towards our created wetland.



### ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

#### ✓ ***Use clay to form trunks and replant 4 Trees in the Forest.***

**DISCUSS** The forested swamp protects the stream from an overload of sediment, improving water quality. But even a swamp can't handle all the sediment from forestry activities. Modern sustainable forestry practices such as selective forestry ensure that trees and habitat are left in the forest. Replanting of trees is a common sustainable forestry practice.

#### **ACTIVITY 11. DEMONSTRATE HABITAT**

#### ✓ ***Place Animals on the model in the Wetland and Forest areas.***

**DISCUSS** Restoring and creating wetlands has increased the wildlife in our community! Wetlands provide unique habitat (shelter, food and protection) to many animals, birds and endangered species including insects and microbes. Wetlands are among the most unique and productive ecosystems on our planet, and provide a home for the many "critters" that live in the water, soil, air, and vegetation. Microbial activity within a wetland creates a "biological supermarket" that supports a rich variety of plants and animals. Wetland ecosystems contribute in very important ways to the food chain and biodiversity. Even animals who don't live exclusively in wetlands depend upon the safety and shelter of the vegetation for breeding, nesting, feeding, and even as escape routes. Nearly half of our threatened and endangered species, such as the whooping crane and the prairie fringed orchid, live in wetlands or depend on them.

*What type of birds and mammals live nearby?*

*Let's try to name some native (local) plants, animals, and birds that might live in wetland areas.*

*Can anyone name an endangered species in our community, or our state?*

### ALTERNATIVE DEMO PART 3. ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT

#### ACTIVITY 12. ADD POLLUTANTS & MAKE IT RAIN TO DEMONSTRATE HOW ECOLOGICAL RESTORATION IMPROVES THE ENVIRONMENT!

- ✓ **SOIL:** Sprinkle 1/2 tsp of cocoa on the construction site, farmland, forest, dirt roads and streambanks.
- ✓ **OILS & GREASE:** Squeeze a few drops of the “oil and sludge” mixture on all paved surfaces (highways, roads, parking lots and driveways).
- ✓ **PESTICIDE (red drink mix) & FERTILIZER (green drink mix):** Sprinkle 1/2 tsp of each on the farmland, lawns, and the golf course.
- ✓ **PLACE THE ECO-SPOUT ON THE SECOND WATER BOTTLE AND MAKE IT RAIN OVER THE ENTIRE MODEL UNTIL THE BOTTLE IS EMPTY.**

#### SEDIMENT HOLDING & FILTERING OF POSSIBLE POLLUTANTS

- ✓ **Lift, show and return the various wetlands, showing the runoff absorbed and filtered by the wetlands.**

DISCUSS Excess nutrients running off the land (e.g., from overfertilized lawns, recreational areas or agricultural fields) are taken up by wetland plants to help them grow and reproduce, which in turn provides food and a place to live — habitat — for plants and wildlife. Without the wetland’s capacity for using some nutrients, too many nutrients would get through, thereby potentially degrading the water quality.



#### FLOOD CONTROL

- ✓ **Point to the home by the marina. Note to your audience that after unplanned development, this area was flooded.**  
**Ask your audience why there is less flooding now.**

DISCUSS During the heavy rainstorm in the unplanned development demonstration, we saw the risks of flooding when developing within a floodplain. Ideally we should avoid building homes and businesses within the floodplain. After restoration, flood waters are controlled. The wetlands and vegetation we restored soaked up much of the stormwater, helping to lessen the threat of floods. Wetlands serve as temporary storage for water, and they empty slowly — like a clogged drain. It is this slow release that helps downstream communities plan for flood management and keeps water flowing in times of drought.



**ALTERNATIVE DEMO PART 3.  
ECOLOGICAL RESTORATION & SUSTAINABLE DEVELOPMENT**

**ACTIVITY 13. COLLECT WATER SAMPLE AND COMPARE**

✓ *Pull the plug and drain the waterbody into the water catcher below. Pour the contents into the third cup. Mark this cup "After Restoration."*

👉 **ASK your audience to compare the cups**

**"Natural Environment"**

**"Unplanned Land Use"**

**"After Restoration"**



**DISCUSS** Observe that the water sample after wetlands restoration looks much cleaner than the cup marked "Unplanned Development."

👉 **DID RESTORING AND CREATING WETLANDS IMPROVE THE WATER QUALITY? HOW?**





## ACTIVITY 14. HOW MUCH WATER DID THE WETLANDS HOLD?

### ✓ *Point to cup marked “After Restoration.”*

DISCUSS After environmental restoration, we have less water in our second cup — this means that less of the stormwater runoff made its way to our waterbody. Why?

 **Notice how much water the wetlands held —**

### ✓ *Replace plug in the waterbody*

### ✓ *Lift the various wetland sponges and squeeze them over the waterbody.*

### ✓ *Show the amount of water held in the wetlands*

DISCUSS The wetlands absorbed some of the stormwater—storing it and preventing flooding. We use sponges on the model to simulate wetlands because the soil and vegetation in a wetland work together, becoming like a sponge, absorbing and holding the water. When stormwater is released it occurs gradually, protecting the land from the negative effects of flooding. A wetland’s water-holding ability is a natural flood control during large rainstorms.

By holding water temporarily, wetlands further protect the quality of the water because they also absorb pollutants. When the water is released, it will carry fewer pollutants with it to the waterbody. By slowing the velocity or speed of runoff, wetlands help reduce streambank erosion. Wetlands do not have unlimited water storage capacity to prevent flooding, however, without the wetlands, as we saw in Part 2 of our demonstration, flooding would increase.

# **Wetlands improve our water quality and quality of life!**

## **ALWAYS REMEMBER:**

**No matter where we are or what we do for a living, we must learn to manage the chemicals and other materials we put on the land!**

**WETLANDS ARE NATURAL BUFFERS,  
but don't expect them to do everything!  
They can't manage all the oils and grease,  
chemicals and fertilizers we put on the land.  
A simple rule for our activities is this:  
Use only what you need!**

# Clean-Up

## **When the enviroscape sessions are completely finished:**

- Drain the waterbody into the container beneath it.
- Remove the container and dispose of its contents in a sink.
- Clean container and plug. Dry thoroughly.
- Remove bridges, vehicles, buildings and other small components and wash separately with soap and water. Store in container when dry.
- Remove trees from their trunks and let them dry before placing in container.
- Place wet sponges and felt in the mesh bag provided and attach mesh bag to the outside of your case until dry.
- Repack small components and ingredients in the rectangular container.
- Clean model thoroughly. The unit can be washed with gentle dish soap and water, and rinsed directly under a faucet. Do not use any other detergents or cleaners.
- Let EnviroScape model dry completely before repacking it and all its components in the carrying case.

## **Again, only use dish soap and water, rinse thoroughly with water and dry completely before storing.**