Project WET's Lesson Plan to Support Educators in the 2017/2018 *FIRST*® LEGO® League Challenge on Hydro-Dynamics

Project WET®

Water Education for Teachers

For more information contact the Project WET Foundation at
301 N. Willson Ave. Bozeman, MT 59715
+1-406-585-2236; 866-337-5486
infor@projectwet.org
www.projectwet.org

ABOUT THIS LESSON PLAN

In response to requests from Project WET educators asking for lessons to support the 2017/2018 *FIRST*® LEGO® League Challenge on Hydro-Dynamics, we have assembled the following lesson plan. It is designed to increase understanding about various components of the Human Water Cycle to help students better address this year's challenge. **Please note that this lesson plan is not endorsed by the *FIRST*® LEGO® League Challenge.** It is simply a tool to help educators involved in the Challenge teach students about water by using engaging and hands-on activities.

Several of the activities listed in the lesson plan are available for immediate download on the Project WET Store or from the *Bozeman Water Conservation and Storm Water Management Educators Guide.* Other activities are found only in the *Project WET Curriculum and Activity Guide 2.0*, available to educators who have completed a workshop with a local Project WET partner. Contact your local Project WET Coordinator for information on workshops near you.

All activities are correlated to NGSS standards, and the lesson plan is laid out by grade level as defined by NGSS standards. Detailed correlation explanations are available to educators who have a copy of the Project WET Curriculum and Activity Guide 2.0 and access to the Educators Portal, where standards are listed under each activity.

For more information about the *FIRST*® LEGO® League Challenge visit www.firstlegoleague.org/challenge.

Photo © Project WET Foundation

EDUCATIONAL STANDARDS CORRELATIONS

Name of WET Activity	Correlates to NGSS as written				Supports NGSS PE as written			Correlates to and/or Supports NGSS PE with adaptations				Common Core State Standards
	K-2	3 to 5	MS	HS	K-2	3 to 5	MS	HS	K-2	3 to 5	MS	HS	
8-4-1, One for All				HS-ESS3-1									RI.3-12.2; RST.6-12.2; RST.6-12.3; SL.3-12.1; SL.3-12.4; SL.3-12.5; SL.3-6.2; W.3-5.3; WHST.6-12.1
Common Water	K-LS1-1, K-ESS3-1, K-ESS3-3	5-ESS2-1, 5-ESS3-1											RI.K-2.7; RST.6-8.3; SL.K-2.3; SL.6-7.2; W.K-1.3; WHST.6-8.7
Energetic Water (p. 242)		4-PS3-4	MS-PS3-5										no data available
Is There Water on Zork?							MS-PS1-2, MS-PS1-6						L.6-8.6; SL.6-8.1c; SL.6.2; WHST.6-8.7
Price Is Right (The)				HS-ESS3-2, HS-ESS3-4, HS-EST1-1, HS-EST1-3									RST.9-12.3; RST.9-12.7; SL.9-12.1
Pucker Effect (The)				HS-ESS2-5			MS-ESS3-3						RST.6-12.3; SL.6-12.1; SL.6-12.4
Reaching Your Limits				HS-ETS1-1									SL.6-12.1
Sparkling Water (p. 348)		5-ESS2-1, 5-ESS3-1, 3-5-ETS1-1	MS-PS1-2, MS-LS2-1, MS-LS2-5, MS-ESS2-4, MS-ESS3-3							3–5-ETS1-1, 3–5-ETS1-2, 4-ESS3-2, 5-ESS2-1, 5-ESS3-1			no data available
Storm Water						3–5-ETS1-1, 3–5-ETS1-2, 4-ESS3-2	MS-ESS3-3, MS-LS2-5, MS-ETS1-2						RST.6-8.1; RST.6-8.2; RST.6-8.3; RST.6-8.4
Super Bowl Surge		5-ESS3-1					MS- ESS3-3, MS-ETS1-1, MS-ETS1-2	HS-LS2-7, HS-ETS1-3		3–5-ETS1-2			RST.6-12.1; RST.6-12.2; SL.6-12.1; SL.6-12.4; SL.6-12.5; WHST.6-12.10
Urban Waters		5-ESS3-1											RST.6-12.4; WHST.6-12.10

UPPER ELEMENTARY (GRADES 3-5)

Storm Water (pg. 395)

Where does storm water come from? And where does it go?

▼ Summary

Students learn how water travels through a community and how it can be managed. Students learn methods that city planners, water managers and land owners use that can reduce the impact of Storm Water runoff. Students use household sponges to simulate how storm water runoff can be captured, stored and released.

▽ NGSS Standards

Supports: 3–5-ETS1-1, 3–5-ETS1-2, 4-ESS3-2

▽ Common Core*

RST.6-8.1; RST.6-8.2; RST.6-8.3; RST.6-8.4

*MS correlations only

Objectives

Students will:

- list ways that humans alter and modify the physical environment.
- identify how humans impact water quality.
- list, describe and compare solutions for managing storm water runoff.
- explain how storm water impacts a natural landscape and a human-made cityscape.
- describe how solutions that mimic nature can capture, store and filter water.

Energetic Water (Guide 1.0 download)

**Download from the Project WET Store

What works without moving a muscle or breaking into a sweat?

▼ Summary

Students invent devices or create activities that demonstrate how moving water can accomplish work.

▽ NGSS Standards

4-PS3-4

Objectives

Students will:

- identify the forms of energy in water.
- demonstrate how water can be used to do work.

Common Water (pg. 249)

What do you, your parents, your neighbors, a plant in your home, a squirrel in the park and your classmates have in common?

▽ Summary

Students analyze the results of a simulation to understand that water is a shared resource and is managed.

▽ NGSS Standards

5-ESS2-1, 5-ESS3-1

▽ Common Core*

RST.6-8.3; SL.K-2.3; SL.6-7.2; W.K-1.3; WHST.6-8.7

*K and MS correlations only

Objectives

Students will:

- illustrate how multiple users of water resources can affect water quality and quantity.
- examine the complexities of providing water for all water users.

Adding Up Storm Water Pollution (pg. 30 of Bozeman Guide)

**Download at www.projectwet.org/bozeman

We all play a role in the quality of our water and the quality of the water we send downstream.

This is an activity from the place-based curriculum, *Bozeman Water Conservation and Storm Water Management Educators Guide*. Educators will need to adapt the lesson for their location.

▽ Summary

Students demonstrate how runoff carries nonpoint source pollution into Bozeman's storm water sewer system and ultimately into our waterways, and how everyone contributes to the pollution of water as it flows through the City of Bozeman. Students recognize that through individual and group action, the amount of pollution can be reduced.

▽ NGSS Standards

5-ESS3-1

▽ Common Core*

RI.3-6.7; W.3-6.4; W.3-6.7

Objectives

Students will:

- model how runoff from rain and snow can move pollutants from land to storm water drains and local waterways.
- differentiate between point and nonpoint source pollution.
- recognize that everyone contributes to and is responsible for Bozeman's water quality.
- identify Best Management Practices to reduce nonpoint source pollution.

Storm Water Hike (pg. 22 of Bozeman Guide)

**Download at www.projectwet.org/bozeman

What's the connection between puddles on your playground and a nearby river?

This is an activity from the place-based curriculum, *Bozeman Water Conservation and Storm Water Management Educators Guide*. Educators will need to adapt the lesson for their location.

▼ Summary

Students are introduced to city watershed concepts and the Bozeman Storm Water Distribution System through an investigation of water flow on their school grounds.

▽ NGSS Standards

4-ESS2-1, 4-ESS2-2, 4-ESS3-2, 5-ESS2-1, 5-ESS3-1

▽ Common Core*

RST.6-8.2; RH.6-8.2; RH.6-8.2

*MS correlations only

Objectives

Students will:

- identify where in the Municipal watershed their school is located.
- use mapping skills to create a map of the school grounds.
- map storm water flow in their schoolyard.
- discuss factors that affect water movement (speed and direction) on the school grounds.
- list point and nonpoint source contaminants.
- write summaries describing the general pattern of surface water as it flows across the school grounds. interpret the relationship between the storm water on your school grounds and bodies of water in the Municipal watershed.

Urban Waters (pg. 413)

**Download from the Project WET Store

Did you know that you are part of the urban water cycle and that hundreds of water professionals work around the clock every day of the year to make sure you have all the water you need?

▼ Summary

Students learn about different water resource occupations and place them in a sequence, from source water to delivery into homes, focusing on water's use, treatment and return to the source. Some people call this the urban water cycle.

▽ NGSS Standards

5-ESS3-1

▽ Common Core*

RST.6-12.4; WHST.6-12.10

*MS correlations only

Objectives

Students will:

- explain the major components of the urban water cycle (source water, water treatment, water use, wastewater treatment and return to nature).
- describe various water resource careers.
- sequence water-related occupations involved in the urban water cycle.

Super Bowl Surge (pg. 405)

Where do most people head at halftime?

▽ Summary

Students learn how wastewater systems can be overwhelmed and then do in-depth research and present action plans to solve the problem of increased demands on a community's wastewater treatment plant.

▽ NGSS Standards

5-ESS3-1

▽ Common Core*

RST.6-12.1; RST.6-12.2; SL.6-12.1; SL.6-12.4; SL.6-12.5; WHST.6-12.10

*MS correlations only

Objectives

Students will:

- illustrate how demands on some treatment plants cause overflow.
- explain problems with sewage overflow.
- generate solutions to a water management problem.
- recognize how presentation strategies influence public policy.

Sparkling Water (Guide 1.0 Download)

**Download from the Project WET Store

What happens to water after it swirls down the drain?

▽ Summary

Students develop strategies to remove contaminants from "wastewater."

▽ NGSS Standards

5-ESS2-1, 5-ESS3-1, 3-5-ETS1-1

Objectives

Students will:

- describe the processes for treating wastewater.
- compare how water is cleaned in the water cycle to how it is cleaned in contemporary water treatment systems.
- list nontoxic household cleaning methods.

MIDDLE SCHOOL (GRADES 6-8)

Storm Water (pg. 395)

Where does storm water come from? And where does it go?

▼ Summary

Students learn how water travels through a community and how it can be managed. Students learn methods that city planners, water managers and land owners use that can reduce the impact of Storm Water runoff. Students use household sponges to simulate how storm water runoff can be captured, stored and released.

▽ NGSS Standards

Supports: MS-ESS3-3, MS-LS2-5, MS-ETS1-2

▽ Common Core

RST.6-8.1; RST.6-8.2; RST.6-8.3; RST.6-8.4

Objectives

Students will:

- list ways that humans alter and modify the physical environment.
- identify how humans impact water quality.
- list, describe and compare solutions for managing storm water runoff.
- explain how storm water impacts a natural landscape and a human-made cityscape.
- describe how solutions that mimic nature can capture, store and filter water.

Is There Water on Zork? (pg. 27)

You're stranded on the planet Zork and you're thirsty. The Zorkians present you with a clear liquid. Is it water? Will you drink it? How in the Zork would you know?

▼ Summary

Students describe the unique characteristics of water and design investigations to distinguish water from other clear liquids.

▽ NGSS Standards

Supports: MS-PS1-2, MS-PS1-6

▽ Common Core

L.6-8.6; SL.6-8.1c; SL.6.2; WHST.6-8.7

Objectives

Students will:

- describe qualities that distinguish water from other clear liquids.
- design an investigation to test characteristics of water.
- analyze the effi ciency and effectiveness of the investigation.

Super Bowl Surge (pg. 405)

Where do most people head at halftime?

Summary

Students learn how wastewater systems can be overwhelmed and then do in-depth research and present action plans to solve the problem of increased demands on a community's wastewater treatment plant.

NGSS Standards

Supports: MS-ESS3-3, MS-ETS1-1, MS-ETS1-2

Common Core

RST.6-12.1; RST.6-12.2; SL.6-12.1; SL.6-12.4; SL.6-12.5; WHST.6-12.10

Objectives

Students will:

- illustrate how demands on some treatment plants cause overflow.
- explain problems with sewage overflow.
- generate solutions to a water management problem.
- recognize how presentation strategies influence public policy.

Energetic Water (Guide 1.0 download)

**Download from the Project WET Store

What works without moving a muscle or breaking into a sweat?

Summary

Students invent devices or create activities that demonstrate how moving water can accomplish work.

NGSS Standards

MS-PS3-5

Objectives

Students will:

- identify the forms of energy in water.
- demonstrate how water can be used to do work.

The Pucker Effect (pg. 363)

People in your town are suffering from contaminated drinking water and are experiencing the "pucker effect"—pursed lips and sour dispositions. Your mission is to discover the source of the contamination.

▽ Summary

Students observe how ground water transports pollutants and simulate ground water testing to discover the source of contamination.

▽ NGSS Standards

Supports: MS-ESS3-3

▽ Common Core

6-12.3; SL.6-12.1; SL.6-12.4

Objectives

Students will:

- describe how underground point source pollutants move through ground water.
- analyze data from test wells they have "drilled" to identify point source contamination.
- learn the actions that can be taken to mitigate contamination.

Sparkling Water (Guide 1.0 Download)

**Download from the Project WET Store

What happens to water after it swirls down the drain?

▽ Summary

Students develop strategies to remove contaminants from "wastewater."

▽ NGSS Standards

MS-PS1-2, MS-LS2-1, MS-LS2-5, MS-ESS2-4, MS-ESS3-3

Objectives

Students will:

- describe the processes for treating wastewater.
- compare how water is cleaned in the water cycle to how it is cleaned in contemporary water treatment systems.
- list nontoxic household cleaning methods.

HIGH SCHOOL (GRADES 9-12)

8-4-1, One for All (pg. 299)

**available to download on the Project WET store

Eight water users, four common water needs…and one river to serve them all.

Summary

Representing eight different water users, students must safely carry one water container "downstream" and must navigate through four simulated water management challenges to reach the next community of water users on the same "river."

NGSS Standards

HS-ESS3-1

Common Core*

CCSS: RI.3-12.2; RST.6-12.2; RST.6-12.3; SL.3-12.1; SL.3-12.4; SL.3-12.5; SL.3-6.2; W.3-5.3; WHST.6-12.1

*MS correlations only

Objectives

Students will:

- identify water users and their water use or product.
- describe major water user categories and how each consumes water.
- list water users' four common water needs.
- demonstrate the complexity of sharing water among all water users in a watershed.
- summarize how water managers use adaptive and integrated strategies to address river basin water challenges.

Super Bowl Surge (pg. 405)

Where do most people head at halftime?

Summary

Students learn how wastewater systems can be overwhelmed and then do in-depth research and present action plans to solve the problem of increased demands on a community's wastewater treatment plant.

NGSS Standards

Supports HS-LS2-7, HS-ETS1-3

Common Core*

RST.6-12.1; RST.6-12.2; SL.6-12.1; SL.6-12.4; SL.6-12.5; WHST.6-12.10

*MS correlations only

Objectives

Students will:

- illustrate how demands on some treatment plants cause overflow.
- explain problems with sewage overflow.
- generate solutions to a water management problem.
- recognize how presentation strategies influence public policy.

The Pucker Effect (pg. 363)

People in your town are suffering from contaminated drinking water and are experiencing the "pucker effect"—pursed lips and sour dispositions. Your mission is to discover the source of the contamination.

▽ Summary

Students observe how ground water transports pollutants and simulate ground water testing to discover the source of contamination.

▽ NGSS Standards

HS-ESS2-5

▽ Common Core*

6-12.3; SL.6-12.1; SL.6-12.4

*MS correlations only

Objectives

Students will:

- describe how underground point source pollutants move through ground water.
- analyze data from test wells they have "drilled" to identify point source contamination.
- learn the actions that can be taken to mitigate contamination.

The Price is Right (pg. 357)

When you pay your water bill, what exactly are you paying for?

▽ Summary

Students learn about economics and environmental planning as they calculate the cost of building a water development project.

▽ NGSS Standards

HS-ESS3-2, HS-ESS3-4, HS-EST1-1, HS-EST1-3

▽ Common Core*

6-12.3; SL.6-12.1; SL.6-12.4

*MS correlations only

Objectives

Students will:

- calculate the costs involved in supplying clean water to consumers and removing wastewater.
- recognize that cost and environmental considerations infl uence the planning and construction of water projects

Photo © Thinkstock_ Pixland

Project WET®

Water Education for Teachers

info@projectwet.org
www.projectwet.org
1-406-585-2236