



WHERE DOES THE WATER GO?

 11-14 years  20-30 minutes per station

Introduction

Fresh water is a vital resource for all living things. People need freshwater for drinking, washing, and irrigating crops as well as recreation. Many plants and animals also need fresh water to survive.

It is important that lakes and rivers, which provide humans with most of the freshwater they need, do not become polluted as this affects the quality of the water and can adversely affect the plants and animals that live in that habitat. Rivers can become polluted in many ways. For example, sewage from water treatment plants can be released into rivers or chemicals such as fertilisers, insecticides, herbicides can be washed off surfaces such as fields when it rains and into drainage systems, called storm drains, which feed directly into lakes and rivers. If river and lake water becomes polluted it can cause plants and animals in and around the rivers to die and lead to a reduction in biodiversity which is not good for the environment.

In this session students will learn the difference between foul water drains (sewers), which are used for household water waste (including students' excrement) and storm drains. They will learn how surface water, which appears after it has rained or when a watering system is used, runs into storm drains which then flows into lakes and rivers without any treatment. This untreated water can pollute the rivers and lakes causing harm to plants and animals that live there. They will understand how greenkeepers try and reduce the amount of pollutants like fertiliser that are washed into storm drains and why it is important to do this.

Student Learning Objectives

By the end of the session students will:

- » Describe where water from rain or hoses goes when it falls on the ground
- » Explain the difference between storm drains and foul water drains
- » Describe how greenkeepers prevent pollutants washing into storm drains
- » Explain why it is important that pollutants are not washed into storm drains
- » Measure the pH of water from sources on the golf course (only for secondary students)

What is needed for the session

Item	Who will provide it
Water bags	Golf course to identify
Buckets of water from different locations around the golf course (collected prior to the session)	Golf course
Water pH testing kits	Golf course or school
Hi-visibility jackets for all students (not essential)	School
Pencil and clipboard for every student (not essential)	School
Printed worksheet for each student (only if using worksheets as agreed with school)	Golf course

What the greenkeeper needs to do

In advance, plan a suitable walking route of the golf course and identify where there are water features, storm drains, bioswales, equipment wash-off stations (if applicable).

Prior to the session, fill large buckets with water from different locations around the site and label each bucket.

Activity	Equipment	Questions to ask
<p>1. Take the students on a tour of the golf course and point out where water occurs naturally and where there are man-made water features. Explain that water from the golf course runs into these water features when it rains. Also point out any storm drains and explain that when it rains or a watering system is used any excess water runs into these drains which then flows directly into rivers without treatment.</p>		<p>Where does water go when it rains?</p> <p>Why is the quality of water in ponds, streams, rivers etc important?</p> <p>Where else have you seen storm drains?</p>
<p>2. Tell the students that there are 2 types of drains. Foul water drains/sewers take household water waste, including from the toilet, to sewage treatment works to clean it before it is released into rivers. Storm drains, often found on road-sides, remove excess surface water when it rains or from other sources, such as hoses, into pipes underground which flow directly into rivers without treatment.</p> <p>Explain to the students that if water, maybe from a hose, and car-wash detergent is used to wash a car on the road, the detergent will be washed into the storm drain and then a river. Too much detergent in the river can harm the plants and animals that live there.</p>		<p>When you go to the toilet where does the water and waste go?</p> <p>Who has washed a car/bike at home?</p> <p>Why do you think sewage and chemicals should not flow into rivers?</p> <p>What other chemicals do you think could be washed into a storm drain? (Spilt oil/petrol)</p> <p>How can you stop chemicals flowing into a storm drain?</p>

Activity	Equipment	Questions to ask
<p>3. Tell the students about the products that greenkeepers use, that potentially could adversely affect the quality of the water and explain that if these are used on the course they may wash into the storm drains and water-features on the golf course which can then negatively affect plants and animals in the water.</p>		
<p>4. Explain to students how greenkeepers prevent chemicals and pollutants from washing into the water-features and storm drains. Such as:</p> <ul style="list-style-type: none"> » covering drains and removing product from cart paths when applying dry fertilizer » growing healthy turfgrass (reduces use of harmful products) » no spray zones » bioswales for drainage » high-tech spray equipment with timing and application methods to reduce use of harmful products » use weather data to determine the ideal time to use the products » equipment wash-off stations » water-oil separators » water-quality testing. 		<p>Explain some of these techniques and where possible, show them in action.</p> <p>How do greenkeepers prevent harmful substances washing into water-features and storm drains?</p>
<p>5. Explain that students can do the following things at home to prevent harmful substances getting into rivers.</p> <ul style="list-style-type: none"> » Don't drop litter in the street, like plastic. This washes into drains and then into rivers. » Scoop the poop so pet waste does not end up in storm drains » Allow nothing but rain down a storm drain. 		<p>What can you do to prevent harmful substances washing into storm drains?</p>
<p>6. Tell the students about the different ways that the quality of water can be tested:</p> <ul style="list-style-type: none"> » Nutrient content in the water (nitrates, ammonia, and phosphorus), » dissolved oxygen » temperature and pH value 		<p>What happens when there are too many nutrients in the water in a river/pond?</p> <p>(This causes algae to grow on the surface of the water which cuts out light to the bottom of the river/pond which then leads to many other plant and animal species dying out. This is not good for biodiversity.)</p> <p>How might dissolved oxygen levels affect organisms living in a water feature?</p> <p>(If levels are too low fish die)</p> <p>How might pH levels affect organisms living in a water feature? (Some plants and animals may not be able to survive in a pH which is too high or low.)</p>
<p>7. Give the students a water bag and a pH testing kit and tell them that they are going to measure pH of the water. Get them to fill their bag from the bucket.</p>	<p>Water bag</p> <p>pH testing kit</p>	<p>What pH value would you expect the pond water to have?</p>

Activity	Equipment	Questions to ask
8. As an extension test the pH of three different sources of water. Tell the students information about each source so that they can make a prediction on the pH value before they test it.		What things may affect the pH value of water? How might pH levels affect organisms living in a water feature?
9. Ask the students to come up with their own ways to prevent harmful substances getting into water.		What ways can you think of to prevent chemicals getting into water?

Key words

You may have to explain some of these words as students will not be familiar with them. Check that students know their meaning before using them too much.

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|--------------------|-------------------|----------------------|-----------------|
| storm drain | sewer | nutrient | pH value |
| acidity | alkalinity | foul drain | bioswale |
| algae | run off | surface water | |

Lesson extension activities

Students could be encouraged to:

- » Test different samples of water from different sources on the golf course

Support activities

- » The activity could be completed without measuring the pH of the water.
- » Students could support the greenkeeper with the testing rather than doing it themselves

Information for the teacher

National Curriculum links

England

- » Understand the pH scale for measuring acidity/alkalinity; and indicators
- » How organisms affect, and are affected by, their environment, including the accumulation of toxic materials

Scotland

- » I have demonstrated ways of measuring and adjusting pH and can describe the significance of pH in everyday life.

Northern Ireland (Geography)

- » Develop an understanding of the interrelationships between physical and human environments>

Wales

- » I can test the pH value of different solutions to determine their acidity/alkalinity
- » How and why food webs are affected by environmental factors, e.g. light intensity, water availability, temperature, and their fluctuations
- » How human activity affects the global environment, e.g. acid rain, greenhouse effect, and the measures taken to minimise any negative effects and monitor them, e.g. by Earth observation satellites



Additional Resources that could be used to follow up the session

Click on the links below to access

- » [pH scale - Best Evidence Science Teaching](#)
- » [pH scale basics — Phet](#)
- » [Fisheries technical officer - icould](#)



Worksheet:

Where does the water go?

Date Golf Course

Student Name

What is the difference between storm drain water and foul water drains?

How can we stop pollutants and chemicals washing into storm drains at home?

Why is it important to ensure that the water in ponds and streams on a golf course are of a good quality?

What are some ways to test water quality?

How can golf courses ensure the quality of water is good in their ponds and streams?

What does pH measure?



Extension activity

The greenkeeper will give you 3 samples of water from different sources. They will tell you where the samples are from. Your job is to predict the pH value, based on the information given by the greenkeeper.

pH Value for 3 different samples of water					
Sample 1		Sample 2		Sample 3	
Predicted pH	Actual pH	Predicted pH	Actual pH	Predicted pH	Actual pH

What did you base your prediction on?		



Risk Assessment:

These are suggested risks, you will probably want to add some of your own.

School Name School Representative

Golf Club Name

Greenkeeper Name Date of Visit

What are the hazards?	Who/what is at risk?	What needs to be done to avoid accidents?	Who is to action?
There will be moving cars in the car park	Students	<ul style="list-style-type: none"> » Inform students that they must follow instructions when leaving the minibus » All student to wear high visibility jackets whilst on the golf club (if the school requires) 	Teacher Greenkeeper
Students might get lost from the rest of the group	Students	<ul style="list-style-type: none"> » All student to wear high visibility jackets whilst on the golf club (if the school requires) » Teacher to count students in every time they move between areas 	Teacher
Being hit by a golf ball	Students Teacher Greenkeeper	<ul style="list-style-type: none"> » Inform students that there are some areas of the golf course that may be dangerous, therefore they need to avoid » All student to wear high visibility jackets whilst on the golf club (if the school requires) 	Teacher Greenkeeper
Students will be handling water which may make the floor slippery if it is spilt and testing kits.	Students	<ul style="list-style-type: none"> » Tell students to carry the water with care and if any is spilt to let the greenkeeper know so it can be cleaned up. 	Teacher Greenkeeper
There will be other adults around the course	Students	<ul style="list-style-type: none"> » Students to be told to report to the teacher if they have any concerns 	Teacher Greenkeeper
Chemicals in pH testing kit	Students	<ul style="list-style-type: none"> » Inform students to wash hands after use Tell students to keep strips/ chemicals away from their mouths 	Teacher Greenkeeper



What are the hazards?	Who/what is at risk?	What needs to be done to avoid accidents?	Who is to action?
Open-water hazard (if applicable)	Students	<ul style="list-style-type: none"> » Inform students that they must stand back from the edge of the water and not try to enter the water » Ensure there is adequate supervision of students near water » Ensure that rescue devices are present 	Teacher Greenkeeper