



## ESSENTIAL QUESTION 1

Why Should We Care About Lake Winnipeg?



# ESSENTIAL QUESTION 1: WHY SHOULD WE CARE ABOUT LAKE WINNIPEG?

## Introduction

Lake Winnipeg is the sixth largest freshwater body in Canada. Approximately 25 percent of the Manitoba population lives on or around the lake, and many more spend their summer at nearby cottages and campgrounds. Due to the enormous size of the lake, its physical characteristics, and its economic and recreational uses, it is undergoing some changes. This section of the resource helps students understand why the lake is important to them by exploring their own environmental ethics, reviewing characteristics of watersheds, and deciding how they would “grade” the efforts to protect Lake Winnipeg.

## Resources to Plan Your Teaching

Duguid, Terry, & Norm Brandson. *Restoring the Health of Lake Winnipeg, Technical Annex, Canada's Sixth Great Lake*. Winnipeg, MB: Lake Winnipeg Implementation Committee, 2005. Available online at [http://manitobawildlands.org/water\\_lakewpg.htm](http://manitobawildlands.org/water_lakewpg.htm). Please refer to pages 2–8 of this resource. You may wish to have the students read these pages as well.

Postel, S., L. Mastny, & Worldwatch Institute. *Liquid Assets: The Critical Need to Safeguard Freshwater Ecosystems*. Washington, DC: Worldwatch Institute, 2005.

Schindler, D.W., & J.R. Vallentyne. *The Algal Bowl: Overfertilization of the World's Freshwaters and Estuaries*. Edmonton, AB: University of Alberta Press, 2008.

UNESCO, & World Water Assessment Programme (United Nations). *Water: A Shared Responsibility* [Table of contents only]. United Nations Educational Berghahn Books, 2006. Available online at [www.loc.gov/catdir/toc/fy0710/2006299804.html](http://www.loc.gov/catdir/toc/fy0710/2006299804.html) and <http://unesdoc.unesco.org/images/0014/001454/145405E.pdf>.

Wall-sized maps displaying Canada's watershed (*Discover Canada's Watershed Map*), are available by contacting Anne MacDiarmid, ESD Consultant for Manitoba Education, Telephone: 204-945-6943, Toll-Free: 1-800-282-8069, ext 6943, Email: [anne.macdiarmid@gov.mb.ca](mailto:anne.macdiarmid@gov.mb.ca)

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## Notes

# Lesson: Beautiful Lake Winnipeg! A Conservation Ethic

## Specific Learning Outcomes

- **SLO B2:** Recognize that decisions reflect values, and consider their own values and those of others when making a decision. *Examples: maintaining/preserving the environment, generating wealth, maintaining personal and economic freedoms, maintaining health and well-being...*
- **SLO C19:** Elicit, clarify, and respond to questions, ideas, and diverse points of view in discussions.
- **SLO D2:** Integrate knowledge from various disciplines beyond the natural sciences, as necessary, in order to complement and represent the scientific world view. *Examples: the arts, mathematics, language arts, social studies...*

## Introduction

In this lesson, students will look at how their own decisions reflect their values in terms of environmental conservation.

## Objectives

Students will identify their own environmental ethics in the context of Lake Winnipeg geography.

## Teacher Background

There are various justifications for why it's important to protect the environment. These environmental beliefs may be based in the ecological, social, spiritual, or economic significance a space or place has; it might also be a combination of these viewpoints. Alternatively, these values may be further categorized as utilitarian, ecological, aesthetic, moral, or spiritual. These are all part of a new discipline called *environmental ethics*.

**Utilitarian perspectives** view the environment as a necessity for survival, and often include justifications that argue that the environment should be conserved for survival and economic benefit.

**Ecological perspectives** view the environment as a contributor to specific functions that are necessary for the persistence of life.

**Aesthetic perspectives** view the environment as beautiful and that beauty is of profound importance and value to people.

**Moral perspectives** view the environment as having a right to exist and that it is our moral obligation to protect and conserve it.

**Spiritual perspectives** view the environment as a creation that must be respected and preserved.

**Aboriginal perspectives** are diverse and can be looked at individually, such as in the following quotation: “teachings describe the relations all around—animals, fish, trees, and rocks—as our brothers, sisters, uncles, and grandpas. Our relations to each other, our prayers whispered across generations to our relatives, are what bind our cultures together. The protection, teachings, and gifts of our relatives have for generations preserved our families. These relations are honored in ceremony, song, story and life that keep relations close—to buffalo, sturgeon, salmon, turtles, bears, wolves and panthers. These are our older relatives—the ones who came before and taught us how to live. Their obliteration by dams, guns, and bounties is an immense loss to Native families and cultures. Their absence may mean that a people sing to a barren river, a caged bear, or buffalo far away. It is the struggle to preserve that which remains and the struggle to recover that characterizes much of Native environmentalism. It is these relationships that industrialism seeks to disrupt.”

LaDuke, Winona. *All Our Relations, Native Struggles for Land and Life*. Cambridge, MA: South End Press, 1999.

## Resources to Plan Your Teaching

### Environmental Ethics

- “The Voice of the Lake, part 1 and part 2.” *The Sharing Circle* (season 14, episodes 16 and 17): These episodes document the journey of a high school music teacher who was commissioned to create a musical composition to heal Lake Winnipeg. These episodes involve the personal journey of the teacher in finding his Aboriginal identity while creating the composition. This story provides one example of a spiritual ethic.
- Santa Clara University, the Jesuit University in Silicon Valley, Ethics Department: This site provides 12 short environmental ethics lessons. The background information could be useful. Available online at [www.scu.edu/ethics/practicing/focusareas/environmental\\_ethics](http://www.scu.edu/ethics/practicing/focusareas/environmental_ethics).
- Environmental Ethics, compiled by Prof. Ron Epstein: Available online at <http://online.sfsu.edu/~rone/Environ/Enviroethics.htm>.

### Pictures of the Lake Winnipeg Region

- Geological Survey of Canada: The above link provides pictures of the following locations in and around Lake Winnipeg: Grand Beach, Sandy Bar, Netley Marsh lagoon, Limestone Bay, Grand Marais, and Willow Point. Available online at [http://gsc.nrcan.gc.ca/landscapes/provinces\\_e.php?SelectedProvince=&SelectedGlossary=&SelectedKeyword=Lake+Winnipeg&SelectedKeywordb=&SelectedKeywordc=&SelectedKeywordd](http://gsc.nrcan.gc.ca/landscapes/provinces_e.php?SelectedProvince=&SelectedGlossary=&SelectedKeyword=Lake+Winnipeg&SelectedKeywordb=&SelectedKeywordc=&SelectedKeywordd).

- Canadian Parks and Wilderness (CPAWS), Manitoba Chapter: Canadian Parks and Wilderness (CPAWS) is a national Canadian environmental organization working to protect our natural areas through grassroots efforts. The CPAWS site provides many photographs of the Lake Winnipeg region. These can be found in the site’s “photo galleries” drop-down menu. Available online at <[www.cpawsemb.org](http://www.cpawsemb.org)>.
- Wilderness Committee (WC), Manitoba Chapter: The Wilderness Committee works throughout Canada to preserve wilderness species and areas through public education, research, and grassroots campaigns. The WC site offers a photo gallery of various places in the Lake Winnipeg region, including photos of some of the issues affecting Lake Winnipeg, such as clear-cut logging. Available online at <[www.wildernesscommittee.mb.ca](http://www.wildernesscommittee.mb.ca)>.

### The Three A’s

**Activate:** Ask students whether they have considered why they are interested in learning about environmental stewardship. Have them write down their primary reason(s) for wanting to learn about Lake Winnipeg.

**Acquire and Apply:** Watch the video *Lake Winnipeg’s Paradise Beaches* by George Siamandas. This video can be purchased through Prairie Public Television at <<http://archive.prairiepublic.org/features/beaches/index.htm>> or borrowed from the Winnipeg Public Library (VHS 917.1272). A video script is available online at Winnipeg-based photographer George Siamandas’ website at <[http://siamandas.ca/wp1/?page\\_id=68](http://siamandas.ca/wp1/?page_id=68)>. Follow this page’s link or visit <[www.siamandas.com](http://www.siamandas.com)> to find many gorgeous photos of Lake Winnipeg attached to a poem entitled “The Many Moods of Lake Winnipeg” by George Siamandas. The poem and photos are found under the website’s photo gallery “Lake Moods” section. Alternatively, select a few YouTube clips that represent a variety of views about Lake Winnipeg.

Have students point out the landscape features in the film that they found appealing and unique. Introduce students to some of the defining features of the greater Lake Winnipeg basin by passing around some sample photos. Ask students what they think and feel when they look at the photos. Have students write down reasons for why they think these sites should be protected or conserved.

### Probing Questions

1. Are there more photos of destruction or of landscapes that appear intact?
2. Which do they think would be more effective in stating their viewpoint?
3. What percentage of the class pictures are of land, animals, and water?
4. What do students identify and connect with? Why?

5. Do we need environmental ethics for conservation?

Using the videos, photos, and student-provided reasons as a context, present to students the various moral justifications for protecting the environment. Discuss the various environmental justifications. Have students evaluate their own reasons for protecting Lake Winnipeg using different ethical perspectives. Hold a discussion with students. Do they share similar views?

Split students into five groups and provide each group with one article, a section of an article, or a quote. Have students read the material and decide the perspective the author uses to make his or her point (see samples provided). Student groups can present their opinion to the rest of the class.

Have students find two photos that they feel represent their ethic for environmental protection. Ask students to write a letter (e.g., poetry, prose, academic writing, etc.) using this perspective to an individual of their choice on the back of the card. The letter should identify why the lake is important to them. Have students email/mail the cards to other classmates or an individual of their choice to initiate further discussion on identifying views and how others interpret protection.

## Assessment

*Assessment for Learning:* Provide students with feedback on their participation in the discussion. Ask students to submit an exit slip that describes the environmental ethic they agree with the most.

*Assessment of Learning:* Assess students on the clarity of their letter using the following criteria:

1. Identifies why Lake Winnipeg is important to him or her
2. Clearly identifies the ethic depicted in the postcard
3. Provides a justification for assigning the ethics to the picture

## Response Pieces

### Example 1

“With its beautiful beaches and wide open waters, Lake Winnipeg is one of Manitoba’s greatest freshwater resources. The world’s 10th largest freshwater lake plays a critical role in tourism, recreation, commercial and sport fisheries, and hydroelectric generation in Manitoba. The lake is home to abundant aquatic life including fish, invertebrates, and plants. Over 23,000 permanent residents live in 30 communities along the shores of Lake Winnipeg. Lake Winnipeg’s world-class beaches attract many visitors to the province and opportunities for swimming, paddling, sailing, and windsurfing can be found on the east and west shores. Each year, approximately 800 commercial fishers operate on Lake Winnipeg, catching a variety of species including world-class pickerel, goldeye, sauger, whitefish, plus others. Sport anglers find many places to drop a line while enjoying the lake’s beauty. Lake Winnipeg is also the world’s third largest reservoir, generating hydroelectric power for all Manitobans.”

Manitoba Water Stewardship, retrieved from  
<[www.gov.mb.ca/waterstewardship/water\\_quality/lake\\_winnipeg/index.html](http://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/index.html)>.

*(continued)*

## BLM 1-1-1 (continued)

### Example 2

lake winnipeg in april  
the earth shivers beneath snow and frozen stone  
cherry branches bend sharp and brittle against  
the azure of manitoba sky  
winter's freeze has penetrated much too deeply  
inside my soul the april sun moves  
low on the horizon and whispers  
*you will be sufficient for all that comes to you*  
my boots trample the brown withered  
leaves of the blue flag iris  
*greek goddess of the rainbow*  
i am it's seed tiny enough to be  
insignificant tiny enough to have lost  
the ancient memory, the push into the cool  
moist soil, the warmth of sun  
the softening of rain  
the reaching down of roots  
the reaching up of leaves and flowers  
i stumble on toward the lake  
slipping on cold and slush  
i am the bud on the wild cherry bush  
tightly wound and wounded  
my first small birthing breath is mostly  
foolhardy faith and yet  
the swelling grows within  
and i can almost taste  
soft color, beauty, fragrance  
i am a drop of water one of billions  
in this lake frozen into mute expanse  
from somewhere deep inside  
i hear a first clear crystal note a rumbling  
a rushing all around and underneath  
i feel the energy of water the push  
of ice expanding a symphony  
beginning in lone notes and growing  
to vibrations strong enough to move  
this formless void  
Creation never dreamed in frozen sleep  
i move in rush of crystals long and  
beautiful pushing glittering in the sun  
lifting up into a shimmering wall  
huge boulders ten feet tall  
ice chiming into mountains  
ice on ice and snow on snow  
crystal water piling up to make a  
space for all believers in new beginnings  
to pass in safety to the other side  
to leave the slavery and death of  
insignificance, of being lost  
to walk through this new path to  
sing the song the song that rings in  
glorious harmony  
*you will be sufficient for*  
*all that comes to you and what it is*  
*is life.*

madeleine enns

"lake winnipeg in april" by Madeleine Enns. Reprinted with permission from the author.

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### Example 3

“Following the 1997 Red River Flood and the 1998 International Joint Commission study of flooding impacts on Lake Winnipeg’s south basin, a handful of researchers at the Freshwater Institute, Department of Fisheries and Oceans (DFO), and the University of Manitoba (UM) reached a consensus that flooding impacts on the entire lake needed study. They agreed that the lack of a scientific understanding required a research plan similar to the long-term programs established for the Laurentian Great Lakes. Not since the Lake Winnipeg surveys in 1969 by the Fisheries Research Board of Canada had any intensive limnological studies been undertaken, in spite of considerable economic development occurring throughout the watershed over the intervening 30 years. The LWRC 1999 survey, enabled by funding from Manitoba Hydro and provincial and federal sources, revealed that the Lake Winnipeg ecosystem had changed substantially since 1969—particularly its north basin phytoplankton community, which had become dominated by surface-forming cyanophyte (bluegreen algae) blooms. New exotic biota had entered the lake and their impacts on the food web were unknown. The 1999 survey findings were followed by several media reports and government deliberations. In February 2003, the Lake Winnipeg Action Plan was announced by Manitoba Water Stewardship.”

Lake Winnipeg Research Consortium. *2007 Annual Report*. Retrieved from <[www.lakewinnipegresearch.org/pdf%20files/LWRC2007ReportFinal.pdf](http://www.lakewinnipegresearch.org/pdf%20files/LWRC2007ReportFinal.pdf)>.

### Example 4

The article “Perspective: Pale green: On matters environmental, we fade to the back of the pack” by Mary Agnes Welch and Lindsay Wiebe was posted 04/05/2009 in the *Winnipeg Free Press* (online edition). The article examines a number of environmental issues. Go to the website at <[www.winnipegfreepress.com/local/Pale-green-42494747.html](http://www.winnipegfreepress.com/local/Pale-green-42494747.html)> and scroll down to the heading “Lake Winnipeg.” The article mentions Lake Winnipeg issues, including phosphate-free soap, the hog barn ban, and the City of Winnipeg sewer system.

### Example 5

The article “Keep east side pristine” by David W. Schindler was printed on 01/11/2008 in the *Winnipeg Free Press* (print edition). This article examines the issue of running a power line east of Lake Winnipeg. It is available at <[www.winnipegfreepress.com/historic/32670029.html](http://www.winnipegfreepress.com/historic/32670029.html)>.



# Lesson: Identifying the Importance of Lake Winnipeg as a Freshwater Ecosystem

## Specific Learning Outcomes

- **SLO B1:** Identify and explore a current STSE issue. *Examples: clarify what the issue is, identify different viewpoints and/or stakeholders, research existing data/information...*
- **SLO C1:** Identify and investigate questions that arise from practical problems and issues.
- **SLO C2:** Clarify problems and refine testable questions to facilitate investigation. *Examples: develop a testable question appropriate to circumstances; define and delimit the kind and number of inquiry pathways...*
- **SLO C11:** Synthesize information obtained from a variety of sources.
- **SLO C18:** Collaborate with others to achieve group goals and responsibilities.
- **SLO C19:** Elicit, clarify, and respond to questions, ideas, and diverse points of view in discussions.
- **SLO D2:** Integrate knowledge from various disciplines beyond the natural sciences, as necessary, in order to complement and represent the scientific world view. *Examples: the arts, mathematics, language arts, social studies...*

## Introduction

In this lesson, students will look at the various ways Lake Winnipeg is used, and identify how the uses of the lake affect its ecosystem. This lesson is important, as it begins to look at the complexity of the lake ecosystem.

## Objectives

Identify factors that affect the Lake Winnipeg ecosystem by creating questions that probe environmental, economic, and socio-cultural activities on the lake.

## The Three A's

**Activate:** Brainstorm in a group or as a class all the different ways Lake Winnipeg and its water is used.

**Acquire and Apply:** Show students the video *Fat Lake: How Too Much of a Good Thing is Hurting Lake Winnipeg*, written and directed by Lynsay Perkins (available from the Manitoba Education Library). Have student groups identify the many uses of Lake Winnipeg and its water, as well as the characteristics of the lake ecosystem, and put each use on a sticky note or separate piece of scrap paper. As a class, create a master list of the many uses of Lake Winnipeg and

its water. Add items to the list that were not necessarily in the video. Discuss how the list of characteristics and uses could be grouped. Have the student groups create a cluster diagram showing how they have grouped the identified uses of the lake.

## Probing Questions

1. How do your recreational activities in a lake affect the activity of fish, birds, and other mammals?
2. How does commercial fishing affect aquatic plants?

After creating a more complete set of uses, have students individually create five questions examining the inter-relationship between categories that they would want to try to answer while in the course. *For example: How do the recreational activities affect the ecology of the lake? (socio/cultural; environment) How do the farming activities surrounding the lake affect the nutrient load in the lake? (socio-cultural; environment).*

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### TEACHER'S NOTE:

This could easily become an inquiry-based essay assignment where students conduct their own research and produce a research essay on one of the questions they have identified.

## Assessment

*Assessment for Learning:* Provide students with feedback on their participation in the discussion.

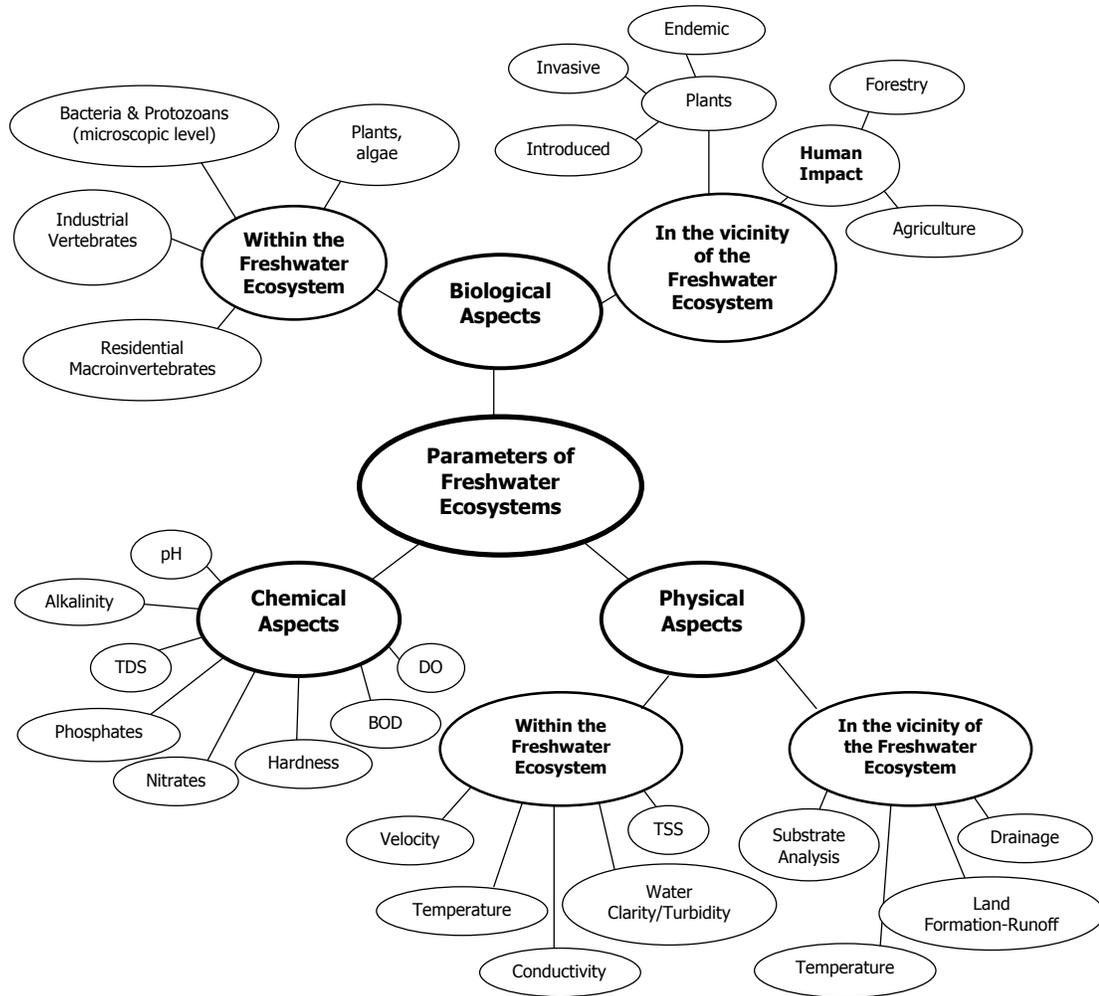
*Assessment of Learning:* Assess students on the clarity of their questions.

**Brainstorm Examples of Characteristics and Uses of Lake Winnipeg:**

- Swimming
- Fishing
- Photography
- Relaxing
- Drinking
- Boating
- Suntanning
- Tourism
- Holidaying
- Cottaging
- Sailing
- Water-skiing
- Appreciating
- Habitat for fish
- Breeding areas for water birds
- Habitat for mammals like beaver and muskrat
- Electricity
- Habitat for aquatic plants and algae
- Providing oxygen
- Wetlands
- Rare species habitat: piping plover, snail



SAMPLE CLUSTER DIAGRAM



Source: "Freshwater Studies" by Brian Lewthwaite. For more information, see <<http://home.cc.umanitoba.ca/~lewthwai/mwp/mainpage.html>>.



# Lesson: What is a Watershed? What Water Systems Characterize Lake Winnipeg?

## Specific Learning Outcome

- Integrate knowledge, as necessary, from various science specialties in order to address an issue, engage in problem solving, or conduct scientific inquiries.

## Introduction

This is a review of material that was covered in Grade 8: Water Systems, where students studied watersheds and standing and flowing water formations. It is important to review or ensure that students still have a good grasp of the concepts of watershed and watershed dynamics. In order to understand the complex issues involved in Lake Winnipeg, they need to understand that the watershed for Lake Winnipeg is immense. This lesson looks at how the watershed parameters are determined.

## Objectives

Discover how to delineate a watershed.

## Teacher Background

A drainage basin or watershed is an area that drains all forms of precipitation (above and below ground sources) into one area (river, lake, ocean). For example, Lake Winnipeg is part of the Nelson River drainage basin. The Nelson River drainage basin is one of 23 basins that drain into Hudson Bay. This area can be further divided into the Lake Winnipeg watershed, then into the following sub-basins or watersheds: Saskatchewan River, Lake Manitoba, Assiniboine River, Red River, Winnipeg River, and Lake Winnipeg. These can be further divided into smaller sub-basins or watersheds. Please see this lesson's maps:

**Delineation of a Watershed:** The parameters of a watershed are determined by identifying a point of interest (e.g., a point on Lake Winnipeg where a monitoring station would be, or the location of a school), and then looking at the contour lines on a contour map and drawing drainage lines.

To be consistent within the curriculum, when referring to the Lake Winnipeg watershed we are referring to all of the drainage areas that flow into Lake Winnipeg (including the Saskatchewan River, Lake Manitoba, the Assiniboine River, the Red River, and the Winnipeg River).

For a detailed description of the Lake Winnipeg watershed, refer to pages 2–9 of *Restoring the Health of Lake Winnipeg, Technical Annex, Canada's Sixth Great Lake* by Terry Duguid and Norm Brandson. Available online at <[http://manitobawildlands.org/water\\_lakewpg.htm](http://manitobawildlands.org/water_lakewpg.htm)>.

## Resources to Plan Your Teaching

### Maps

1. Hudson Bay Drainage Basin  
<http://atlas.nrcan.gc.ca/site/english/maps/environment/hydrology/watershed>
2. Nelson River Drainage Basin  
<http://atlas.nrcan.gc.ca/site/english/maps/environment/hydrology/drainagebasins>
3. Lake Winnipeg Watershed  
[www.lakewinnipeg.org/web/downloads/LakeFacts\\_Watershed.pdf](http://www.lakewinnipeg.org/web/downloads/LakeFacts_Watershed.pdf)
4. Lake Winnipeg Drainage Basins  
[http://mbeconetwork.org/lake\\_winnipeg\\_watershed/](http://mbeconetwork.org/lake_winnipeg_watershed/)
5. Manitoba Basins and Watershed Boundaries  
[www.gov.mb.ca/waterstewardship/waterstrategy/pdf/index.html](http://www.gov.mb.ca/waterstewardship/waterstrategy/pdf/index.html)  
(Download the full *Manitoba Water Strategy* pdf to view the large map in its appendix.)
6. Watersheds of Manitoba  
[www.cier.ca/information-and-resources/publications-and-products.aspx?id=1048](http://www.cier.ca/information-and-resources/publications-and-products.aspx?id=1048)
7. East Side of Lake Winnipeg Watersheds  
[www.gov.mb.ca/conservation/wno/status-report/index.html](http://www.gov.mb.ca/conservation/wno/status-report/index.html)  
(found under reference maps) or  
[www.gov.mb.ca/conservation/wno/maps/index.html](http://www.gov.mb.ca/conservation/wno/maps/index.html)  
(found under Boreal Forest)
8. Sub-basins of the Red River Basin  
[www.pca.state.mn.us/water/basins/redriver/subbasins.html](http://www.pca.state.mn.us/water/basins/redriver/subbasins.html)

### Introductory Watershed Resources

*Water on the Web* is a great resource for water-related information and activities at the high school level. It can be found at <http://waterontheweb.org/under/watersheds/index.html>.

The Manitoba Eco-network has a great web page on Lake Winnipeg and the major drainage basins that are part of its watershed. The site is located at [www.mbeconetwork.org/water/LWpgmain.php](http://www.mbeconetwork.org/water/LWpgmain.php). Another useful Manitoba Eco-Network resource is its Water Caucus's publication page, which can be found at <http://mbeconetwork.org/publications/>. *Around the Lake Winnipeg Watershed* is one of the Water Caucus's water tabloid publications that provide great graphics and an overview of the Lake Winnipeg watershed.

The Environment Canada Research site found at <http://map.ns.ec.gc.ca/reseau/en/> is also useful for conducting research, as are the local and regional watersheds. Students can enter their city or town name and get some maps and information about the local watershed.

## The Three A's

**Activate:** Review with students the definition of a watershed.

Using the maps available and displayed, ask students what criteria they might use to delineate a watershed.

**Acquire and Apply:** Using the above resources, have students delineate their local watershed, and answer questions about the importance of the watershed on the health of Lake Winnipeg.

## Assessment

*Assessment for Learning:* Have students submit answers to questions, and provide feedback.

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## Notes

**Student Handout: Lake Winnipeg Questions**

1. The Saskatchewan River is constantly under threat of more hydro development, which would result in reduced inflow of water to Lake Winnipeg. According to David Schindler, the Saskatchewan River basin is important to the control of algal blooms in Lake Winnipeg because...

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2. In the Lake Winnipeg basin, what are two important sources of nutrient loading?

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3. In the Lake Winnipeg basin, what are the effects of leaching and erosion from forestry or wildfires?

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**BLM 1-3-1 (continued)**

4. Why is the Red River drainage basin so important in understanding the source of nutrients in Lake Winnipeg?

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5. Why does the Red River basin provide such a large source of phosphorus to Lake Winnipeg?

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## Lake Winnipeg Questions Answer Key

1. The Saskatchewan River is constantly under threat of more hydro development, which would result in reduced inflow of water to Lake Winnipeg. According to David Schindler, the Saskatchewan River basin is important to the control of algal blooms in Lake Winnipeg because...

**The Saskatchewan River basin is a major contributor to the quantity of water that goes into Lake Winnipeg, and there is a possibility that this quantity of water will drop off. This would have the same effect as increasing the amount of nutrients that go into the lake, because the reduction in water would increase the concentration of nutrients.**

2. In the Lake Winnipeg basin, what are two important sources of nutrient loading?

**Livestock production in and around the lake and inadequate cottage sewage systems are two important sources of nutrient loading to Lake Winnipeg.**

3. In the Lake Winnipeg basin, what are the effects of leaching and erosion from forestry or wildfires?

**Both leaching and erosion cause dissolved organic matter and nutrients to go into the water. Phosphorus is one example of a nutrient that contributes to an increase in blue-green algae. Other effects are less clarity in the water (greater turbidity) and lower oxygen levels.**

4. Why is the Red River drainage basin so important in understanding the source of nutrients in Lake Winnipeg?

**The Red River drainage basin is the most significant because it contributes much of the nitrogen and phosphorus found in Lake Winnipeg.**

5. Why does the Red River basin provide such a large source of phosphorus to Lake Winnipeg?

**The Red River travels through very active agricultural areas, and it receives water from tributaries such as the Seine River, which travels through sections where there is a great deal of hog farming.**



## Lesson: Characteristics of Lake Winnipeg; Lake Winnipeg Portfolio Assignment and Report Card

### Specific Learning Outcomes

- **SLO C9:** Analyze data or observations in order to draw conclusions consistent with the available results of an investigation, and identify the implications of these results. *Examples: cause and effect relationships, alternative explanations, support for or rejections of a hypothesis or prediction statement.*
- **SLO C10:** Identify new questions or problems that arise from an investigation.
- **SLO C11:** Synthesize information obtained from a variety of sources.
- **SLO C14:** Communicate information in a variety of forms appropriate to the purpose, audience, and context. Include: technical science writing (*e.g., proposals, laboratory reports, research reports...*), popular science writing (*e.g., magazine articles, comics, short stories, poetry...*).
- **SLO C17:** Select and use appropriate media to communicate information/data/ideas. *Examples: software, video, photography, visual arts...*
- **SLO C21:** Demonstrate confidence in their ability to carry out investigations and to address STSE-related issues.
- **SLO C22:** Value skepticism, honesty, accuracy, precision, perseverance, and open-mindedness as scientific and technological habits of mind.

### Introduction

There are many environmental organizations that monitor the effectiveness of governments in following through with initiatives and policies established to ensure that the health of an ecosystem is maintained. Students have previously explored the Lake Winnipeg watershed and identified certain characteristics. They have identified the social, economic, and environmental issues of the lake, and have identified some issues associated with caring for the lake. Through the remainder of their study of Lake Winnipeg, students will be compiling a report card on the progress of recommendations made by the Lake Winnipeg Stewardship Board.

### Objectives

Identify some of the characteristics of the Lake Winnipeg watershed, and evaluate the effectiveness of the policies established to protect the lake.

### Teacher Background

This lesson is part of a cumulative activity, stretching through the next three sections of this resource. Throughout the duration of their study of

Lake Winnipeg, students will use information gathered in this lesson and subsequent lessons to build a portfolio on the watershed, water quality, and ecosystem health of Lake Winnipeg. The final activity will be the completion of a report card on the health of Lake Winnipeg. Students will need to keep all assignments, as these can be used as their reference material in creating the report card. Students should be encouraged to seek out other publications as reference material. Students will be given the assignment shown below to create the report card.

## Resources to Plan Your Teaching

- *How Canada Performs: A Report Card on Canada*  
This website identifies indicators used to evaluate how Canada performs in relation to 17 other countries, and gives Canada a grade on economy, innovation, environment, education, health, and society. The environmental link is especially useful as it provides the indicators for creating the grade.  
[www.conferenceboard.ca/HCP/default.aspx](http://www.conferenceboard.ca/HCP/default.aspx)
- *Waterproof 2: Canada's Drinking Water Report Card*  
This report identified how the regional treatment of water varied in Canada, and evaluated each province on the treatment of its drinking water resources.  
[www.waterquality.ec.gc.ca/web/Environment~Canada/Water~Quality~Web/assets/PDFs/waterproof.II.report.pdf](http://www.waterquality.ec.gc.ca/web/Environment~Canada/Water~Quality~Web/assets/PDFs/waterproof.II.report.pdf)
- *Canada's National Sewage Report Card 2*  
This report describes and grades the wastewater treatment for 21 cities in Canada.  
[www.ecojustice.ca/publications/reports/the-national-sewage-report-card-ii?searchterm=report+card](http://www.ecojustice.ca/publications/reports/the-national-sewage-report-card-ii?searchterm=report+card)
- *The Nottawasaga Valley Conservation Authority Watershed Report Cards* (see <[www.nvca.ca](http://www.nvca.ca)>) These are good examples of the types of report cards that can be created for the Lake Winnipeg watershed or a sub-watershed. The reports are simple to understand, provide a summary of the grades on the front page, and then go into more detail for each of the areas graded. The following link is a report on a sub-watershed that could be used as a sample.  
[www.town.bradfordwestgwillimbury.on.ca/ws\\_par/groups/public/@pub/@nvca/documents/web\\_content/wspar\\_01671](http://www.town.bradfordwestgwillimbury.on.ca/ws_par/groups/public/@pub/@nvca/documents/web_content/wspar_01671)

## The Three A's

**Activate:** Ask students whether they have been on or along the shores of Lake Winnipeg, or to bring in pictures they may have of a part of Lake Winnipeg. Have each student provide a description of the lake and post some of the features so the class can see. Show a map of the lake, and have students add other characteristics to the list already posted.

**Acquire and Apply:** Have students read the description on pages 4–6 of the Lake Winnipeg Stewardship Board report to the Minister of Water Stewardship, *Reducing Nutrient Loading to Lake Winnipeg and Its Watershed: Our Collective Responsibility and Commitment to Action* (see <[www.lakewinnipeg.org/web/downloads/LWSB\\_December\\_2006\\_Report\\_3.pdf](http://www.lakewinnipeg.org/web/downloads/LWSB_December_2006_Report_3.pdf)>). This document provides a short and clear description of the physical characteristics of Lake Winnipeg. Have students identify all the physical characteristics of the lake by underlining or highlighting the features. As well, provide students with a map of the Hudson Bay watershed. A map entitled *Discover Canada's Watershed* can be ordered at no cost from the Canadian Wildlife Federation (see <[www.wildeducation.org/programs/oceans06/watershed\\_map.html](http://www.wildeducation.org/programs/oceans06/watershed_map.html)>).

Write the following question on the board:

**How do the unique characteristics of Lake Winnipeg impede or assist our ability to become better stewards of the lake?**

Discuss the question, and then explain the following scenario:

### Lake Winnipeg Report Card: A Problem-Based Assignment

Since 1993, the Sierra Club of Canada has written a report card for the Canadian federal and provincial governments on commitments they made at the 1992 Earth Summit in Rio de Janeiro. In the case of the Sierra Club report card, the provinces are graded on their commitments to climate change and biodiversity (see <[www.sierraclub.ca/national/rio/](http://www.sierraclub.ca/national/rio/)>).

### Scenario

The Lake Winnipeg Stewardship Board (LWSB) is currently designing a report card system to evaluate their commitment to improving the state of Lake Winnipeg. In its December 2006 publication *Reducing Nutrient Loading to Lake Winnipeg and Its Watershed: Our Collective Responsibility and Commitment to Action* (see <[www.lakewinnipeg.org/web/downloads/LWSB\\_December\\_2006\\_Report\\_3.pdf](http://www.lakewinnipeg.org/web/downloads/LWSB_December_2006_Report_3.pdf)>), the LWSB identified 38 sets of recommendations that need to be addressed in order to take care of Lake Winnipeg and its watershed. Manitoba Water Stewardship released this report on February 6th, 2007. The stewardship board, which is now responsible for monitoring how these recommendations are undertaken, will create a grading system that helps them monitor how effective they are in dealing with the recommendations that describe the health of the watershed, water quality, and the Lake Winnipeg ecosystem. It is your job to create a report card for the state of Lake Winnipeg using some of these recommendations. The report card will be based upon the parameters that you select as the most important indicators of watershed, water quality, and ecosystem health.

The report card assignment will be set up as a portfolio with a few mandatory entries. The select entries provide evidence for your grading of the

parameters you select to include in the report card. In the following weeks, you will be looking at Lake Winnipeg from a watershed, water quality, and biological perspective, and will explore different parameters for each of these approaches. After each section, you will be expected to develop grades for three different parameters that will then be included in a final report (a total of nine parameters must be included in the portfolio). Your final report will grade a minimum of three parameters each for watershed, water quality, and ecosystem health. For each grade assigned, you need to provide a summary description of the parameter and a justification for the grade by using classroom-obtained data, experiments conducted on your own, and/or readings, articles, or interviews. You will create a presentation (this could be a bulletin board assignment as well) that outlines your report and the grading system you used.

Using information from the hydrology section (found as subsection of Environment) on the *Atlas of Canada* website (see <http://atlas.nrcan.gc.ca/site/english/index.html>), identify your drainage basin and create thematic maps for any of the following:

- Drainage Basins Map
- Watersheds Map
- Physical Components of Watersheds Map
- Human Components of Watersheds Map
- Current Water Levels Map

Using this information, create the first five entries of the Lake Winnipeg portfolio assignment. For each entry, discuss your findings in small groups.

**TEACHER'S NOTE:**

The provided maps (which can be found in the following student handout) can be used to complete entry 2 of the portfolio assignment, as the relief is shown in much more detail.

The first five entries to the assignment will be a general description of the Lake Winnipeg watershed and serve as an introduction to the report card.

## Assessment

*Assessment for Learning:* Provide feedback to students as they progress through the report card assignment.

*Assessment of Learning:* Use the provided rubric to assess the report card. The summative assessment would not be complete until the end of the course.

## Rubric for Report Card Assignment

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Information Seeking, Selecting, and Evaluating</b>	Information gathered lacked relevance, quality, depth, and balance.	Information was gathered from a limited range of resources and displayed minimal effort in selecting quality resources.	Information was gathered from a variety of quality electronic and print resources.	Information was gathered from a variety of quality electronic and print resources. Sources are relevant and balanced and used to justify the grading system used in the report.
<b>Analysis</b>	Conclusions were not supported by any evidence.	Conclusions could be supported by stronger evidence.	Good effort was shown in analyzing the information and making conclusions or inferences to support grading system.	Student carefully analyzed the information and drew appropriate conclusions or inferences to support grading system.
<b>Synthesis</b>	Student work in not logically or effectively structured.	The information is organized but greater effort could have been made to draw connections between ideas.	The information is logically organized and there are good connections made among ideas.	The information is logically and creatively organized with smooth transitions. The justification for grades assigned is clear and well supported.
<b>Documentation</b>	Documentation of sources was absent.	Documentation of sources was poorly constructed or absent.	Sources are documents with some care and citations in-text and in works cited are mostly accurate.	All sources are clearly documented. Sources are properly cited in-text and on Works Cited page.
<b>Product</b>	Student showed little evidence of thoughtful research. The report card does not convey ideas effectively.	Student needs to work on communicating ideas more effectively. The report card is unclear.	The report card effectively communicates the information to the audience.	The report card is visually creative and original. The presentation of information is organized and clear.

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## Notes

**Student Handout: Portfolio Assignment:  
A Lake Winnipeg Report Card**

Since 1993, the Sierra Club of Canada has written a report card for the Canadian federal and provincial governments on commitments they made at the 1992 Earth Summit in Rio de Janeiro. In the case of the Sierra Club report card, the provinces are graded on their commitments to climate change and biodiversity (see <[www.sierraclub.ca/national/rio/](http://www.sierraclub.ca/national/rio/)>).

**Scenario**

The Lake Winnipeg Stewardship Board (LWSB) is currently designing a report card system to evaluate their commitment to improving the state of Lake Winnipeg. In its December 2006 publication *Reducing Nutrient Loading to Lake Winnipeg and Its Watershed: Our Collective Responsibility and Commitment to Action* (see <[www.lakewinnipeg.org/web/downloads/LWSB\\_December\\_2006\\_Report\\_3.pdf](http://www.lakewinnipeg.org/web/downloads/LWSB_December_2006_Report_3.pdf)>), the LWSB identified 38 sets of recommendations that need to be addressed in order to take care of Lake Winnipeg and its watershed. Manitoba Water Stewardship released this report on February 6th, 2007. The stewardship board, which is now responsible for monitoring how these recommendations are undertaken, will create a grading system that helps them monitor how effective they are in dealing with the recommendations that describe the health of the watershed, water quality, and the Lake Winnipeg ecosystem. It is your job to create a report card for the state of Lake Winnipeg using some of these recommendations. The report card will be based upon the parameters that you select as the most important indicators of watershed, water quality, and ecosystem health.

This assignment will be set up as a portfolio with a few mandatory entries. You will then provide evidence for the grades you assign each of the parameters you select to include in the report card.

In the following weeks, you will be looking at Lake Winnipeg from a watershed, water quality, and biological perspective, and explore different parameters for each of these approaches. After each approach is covered, you will be expected to develop grades for three different parameters that will then be included in a final report (a total of nine parameters must be included in the portfolio). Your final report will grade a minimum of three parameters each for watershed, water quality, and ecosystem health. For each grade assigned, you need to provide a summary description of the

(continued)

## BLM 1-4-1 (continued)

parameter and a justification for the grade by using classroom-obtained data, experiments conducted on your own, and/or readings, articles, or interviews.

You may be required to create a presentation or bulletin board that outlines your report and the grading system you used.

### Portfolio Layout

For an outline of all the entries required for the portfolio, see Table 1.

For the initial entries into your portfolio, you will explore the physical geography of Lake Winnipeg by creating five different maps.

Go to the Atlas of Canada website (see <<http://atlas.nrcan.gc.ca/site/english/index.html>>). Using the site's hydrology section (which is a subsection of Environment), you will be able to identify your drainage basin and create thematic maps for any of the following:

- Drainage Basins Map
- Watersheds Map
- Physical Components of Watersheds Map
- Human Components of Watersheds Map
- Current Water Levels Map

Using this information, create the first five entries of the Lake Winnipeg portfolio assignment. For each entry, discuss your findings in small groups.

**Table 1: Portfolio Requirements**

Entry	Map	Small Group Discussion	Individual Entry
1	Map showing Lake Winnipeg watershed/drainage basin	When looking at the size of the watershed/drainage basin, discuss the challenges that governments, researchers, and water stewards have in monitoring pollutants entering Lake Winnipeg.	Reflect on the group discussion and provide a personal view of the most difficult challenges water stewards will have in monitoring pollutants entering Lake Winnipeg.

*(continued)*

**BLM 1-4-1 (continued)**

Entry	Map	Small Group Discussion	Individual Entry
2	Relief map of the land surrounding the entire lake or a section of the lake. Draw drainage arrows onto the map.	When looking at the topography of Lake Winnipeg and the drainage, discuss the challenges to monitoring and preventing pollutants from entering the lake.	Reflect on the group discussion and provide a personal view of the most difficult challenges water stewards will have in monitoring pollutants entering Lake Winnipeg.
3	Select two other maps under the physical components of the watershed.	Discuss how the physical components of the lake may affect the way we can take care of the lake.	Summarize or discuss how the two physical components affect the way we take care of the lake.
4	Human components of the watershed: create a map of the agricultural areas in the watershed.	Discuss how the distribution of agricultural activity can affect the lake and the challenges to looking after Lake Winnipeg.	Reflect on the group discussion and suggest some possible way to reduce the impacts of agriculture on the Lake Winnipeg watershed.
5	Select two other maps under the human components in the watershed.	Discuss how these human components of the watershed may affect the way we can take care of the lake.	Summarize or discuss how the two additional human components affect the way we take care of the lake.
6-8	Provide at least three entries identifying the parameters for the watershed that will be indicators for the report card.		In these entries, include research, experiments, interviews, etc., that were conducted to explore the parameters further.
9-11	Provide at least three entries identifying the parameters for the chemistry of the lake that will be indicators for the report card.		In these entries, include research, experiments, interviews, etc., that were conducted to explore the parameters further.
12-14	Provide at least three entries identifying the parameters for the biology of the lake that will be indicators for the report card.		In these entries include research, experiments, interviews etc. that were conducted to explore the parameters further
15	Report card		Provide a summarized account of the watershed and the chemical and biological parameters examined, and give each a grade.



## Sample Entry:

## THE LAKE WINNIPEG WATERSHED



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### The Hudson Watershed

The Lake Winnipeg watershed is almost one million square kilometres. Over six million people live in this area, stretching from the Rocky Mountains across the prairies, its wetlands, and the taiga. It is an area of enormous human activity. Human population numbers and the resulting human activities, such as agriculture, make up just part of the many challenges that water stewards face.

As the watershed crosses First Nations territories, four provinces, and four US states, monitoring the incoming water is an issue. Also, water is a provincially controlled resource. As such, the quality and care are causes for concern, as watersheds flow through and are not regulated by political boundaries.



## Sample Report Card:

**A Report Card on the Health of Lake Winnipeg**

This sample report card lists some of the parameters students can use to assess the health of Lake Winnipeg.

**The Watershed**

Grade	Parameter	Justification/Comments
	Red River flood management	
	Cooperation and collaboration	
	Livestock management	
	Public education and outreach	

**Water Quality**

Grade	Parameter	Justification/Comments
	Cosmetic use of pesticides	
	Sewage	
	Nutrient reduction	

**Ecosystem Health**

Grade	Parameter	Justification/Comments
	Boreal forest conservation	
	Wetland conservation	
	Endangered species	

