

Locally Developed Course
Grande Yellowhead Public School Division

Water Experience
25

Parks Canada (Palisades) Stewardship Education Centre
Pre-Immersion Course Package



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Overview of Water Experience Course

The objectives of this course are to build water navigation skills, aquatic ecosystem knowledge and leadership skills in a context of critical thinking. We feel that this is particularly important as we strive to better educate youth for their own safety and as ambassadors for our wild places. It also highlights best practise methods for inquiry research, problem solving and analysis.

General Outcomes

1. Students will demonstrate understanding of potential hazard awareness and mitigation in mountain recreation activities.
2. Students will understand and communicate ecological integrity as it relates to the long term functioning of protected lands and watersheds.
3. Students will recognize the historical importance for Alberta and Canada of the Rocky Mountain natural region.
4. Students will apply a variety of specialist technology and/or equipment to understand, collaborate, communicate and increase skill development.
5. Students will develop an understanding that demonstrates an appreciation and value for the mountain parks environment.

Pre-immersion sessions: Four hours of classroom-based sessions. Included in this teacher package is a PowerPoint presentation divided into 5 sessions for use during the pre-immersion course. Other resources needed for the delivery of the course can be found in more detail in the Instructor Notes that follow.

Immersion sessions: Delivered on-site at the Parks Canada Palisades Stewardship Education Centre near Jasper, Alberta, these sessions will require students to stay in residence at the PSEC site for four days of programming, usually running 8h00 to 21h00. This portion of the course is very hands-on and will require full participation by students. PSEC staff, including interpreters and other Parks Canada personnel, will be on-site to deliver the programming, but teacher chaperones will be needed as well during this time. The 35 level course mainly takes place off-site and is described as a journey. Exact locations will be decided upon by the PSEC facilitators who will base their decision on the weather, group's abilities, and other safety factors.

Post-immersion sessions: Three more hours of classroom-based sessions will be facilitated in the same way as the pre-immersion sessions. Students will link what they experienced and learned in Jasper with what is happening in their home communities or regions. A major culminating project is part of the final student assessment and will usually involve sharing with people outside the course.

Water Experience 25: PRE-IMMERSION Instructor Package

The following plans and activities are to be completed prior to the students' visit to the Palisades Centre. Within this Pre-Immersion package, you will find activities that will cover approximately 4 hours of classroom work. Students will end the Pre-Immersion sessions with a Field Course Briefing by a Parks Canada/Palisades Centre representative.

Technology

In the following activities, students will need some access to various technologies such as videoconferencing and/or SmartBoard where presentations can be shown. Make sure students are situated in the home school appropriately to allow access to this technology. Organizers of this part of the Water Experience course should give videoconference speakers ample time to organize their presentations.

Recommended Course Materials

It is suggested that students keep a binder or folder that they will devote to the Water Experience 25 course (Pre-Immersion, Immersion and Post-Immersion activities). There will be a series of handouts that students will be expected to keep and look back on as the course progresses. As part of their reflection exercises throughout the program, students are encouraged to take photographs of activities that they take part in and other ideas relating to the Water Experience course.

Recommended Course Materials List

- Journal/notebook or binder and writing utensils & cameras
- *Eau Canada*, Edited by Karen Bakker (2007) to be used in WE 15 and WE25.

Assignments

Any reflection assignments or notes are to be kept in the student's folder and can be used to evaluate the student in the course. Some handouts will be collected by the course administrator or teacher to be used in the student's evaluation. Share the information on the weighting of the assignments (pages 40 & 41 in this document) with the students.

Session 1

Topics this first class will cover:

- Introductions
- Topics to be covered during the 15, 25 and 35 level courses, with emphasis on the 25 level course
- Course readings & other materials
- Schedules for the three components of the course (pre, post, and immersion)
- Questions the students may have about the course or that the instructor may have of the students

Learning outcomes:

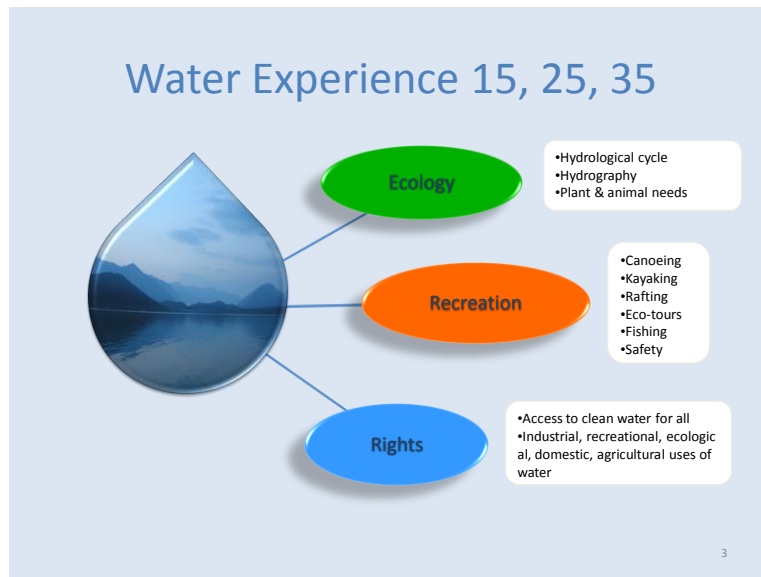
- Students will understand the basic framework of the Water Experience courses.
- Students will understand the major learning themes for the 200 level course.
- Students will create and organize their 'Water Experience' folder (or get reacquainted with their folder from Water Experience 15).
- Students will understand that there are pros and cons to dams and water diversions.
- Students will research and share information on a non-motorized watersport.

Lesson Preparation & Resources Needed:

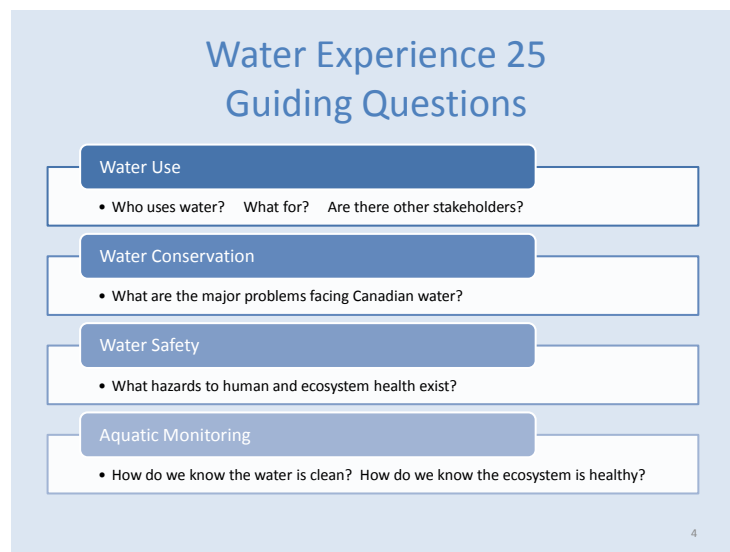
- National Geographic video-clip & 49 Megawatts movie, ready to be played.
- All student handouts are included in this Instructor's Notes package. Copies will need to be made before the course starts.
- There is also a **PowerPoint** file that is to be used during the pre-immersion classroom sessions. Slides from that document have been inserted here for your information. They are all in blue squares.

1. Put up the first PowerPoint slide. Explain to the students that there are three main water topics that will be covered in this course. Take 5 minutes to explain and discuss the following:

- Water Ecology refers to the hydrological cycle, hydrography (where the water is) and basic plant and animal needs related to water. This has been discussed briefly in Water Experience 15 but will be the main focus in the 25 level course.
- Water Recreation will be present throughout the three levels, but will of course take place mainly during the Immersion portion of the course. In the 15 level, students were introduced to canoeing, kayaking, and rafting. In the 25 level, students will be kayaking and canoeing while working on ecosystem monitoring activities. In the 35 level course the main activity of the Immersion portion will be the planning and execution of a two night trip on Maligne Lake while kayaking or canoeing.
- Water Rights will also be a main area of concern during all three levels, and we will be looking at some heavy issues in the pre and post portions of the courses. One of the main resources that will be referred to during Water Experience 15, 25 & 35 is *Eau Canada*, a Canadian book from 2007, edited by Karen Bakker.



2. The following diagram shows the topics that will be covered in the first four pre-immersion sessions. The fifth session will be a video-conference with the Parks Canada Palisades Stewardship Education Centre (PSEC) staff to brief the students on what they need to know and bring for the Immersion portion of the course. Discuss this overview briefly, and try to get a feel for what the students already know about these issues and if one issue in particular is of great interest to them.



3. Recreational activities such as whitewater kayaking, rafting or canoeing are surely the most exhilarating way to "use" water. Although the parts of the Athabasca River that the students will have the chance to explore in the Immersion portion of this course are not quite Class V (they are class I to III), they will be exciting.

Not surprisingly, some of the biggest supporters of river protection initiatives are the people who use the rivers. Show the students the following 4 min. 17 sec. video clip from National Geographic. You will have to have a good internet connection. Click on the link at the bottom of the PowerPoint slide.

Final Ride on Yangtze River Rapids? (April 23, 2009)

<http://news.nationalgeographic.com/news/2009/04/090423-yangtze-ride-video-wc.html>

After watching the clip, discuss some of the following questions and come up with more of your own based on the responses of the students:

- How do you feel after watching this clip?
- Is China justified in creating so many massive dams? Why or why not?
- In other areas where rivers flow through several different countries, is a country upstream justified in building a dam to provide water (or electricity) for its people? What would you do if you were a country downstream of a massive project?
- What steps do you think need to be followed when considering building a dam or diversion on a river?
- What benefits can eco-tourism provide for a community?
- Can ecological health, eco-tourism, and conservation outweigh the benefits gained by building dams?

Other related NG articles & videos you may want to show:

Article: *Last River Porpoises Dying in Polluted Yangtze*

Video: *Glen Canyon Controversy*

Video: *Great Lakes Cleanup*

4. Start the video *49 Megawatts*, (5 min clip - <http://www.youtube.com/watch?v=WPtddgUqr4o>) a documentary made about the damming of the Ashlu River in B.C. It will last 31 minutes, so watch about half this class and finish it next time. Let the students know that next class they will be asked to write a reflective piece based on this video and that they will need to take notes while they watch. After seeing half of the movie, stop and let the students have 5 - 10 minutes to write independently, focusing on the issues raised by Bryan Smith. Look at the response journal guidelines handout (you will go into this in more detail next class).
5. With 5 - 10 minutes left in the class, hand out the homework assignment for today (Recreational Opportunities). Read it over together and ensure that the students understand what they are being asked to do. Review the assessment rubric.

There are a lot of recreational activities that take advantage of water environments. Think back to WE 15 and **research** one of the following non-motorized sports:

- Canoeing: flatwater or whitewater
- Kayaking: slalom, freestyle, kayak polo, ocean or lake touring
- Rafting
- Stand up paddle boarding
- *or* suggest another appropriate sport (discuss it with your instructor first)

1. Tell us why you chose to profile this sport.

- What experience do you have with this sport?
 - Show us any pictures or video you may have of yourself engaged in it.
 - Tell us about someone you know who participates in this sport.
- If this sport is totally new to you, what have you seen or heard that makes you interested?

2. Try to find the following information:

- Who are some of the champions of the sport?
- How do you know about them?
- What do they do to earn the title of "champion"?
- Is it a competitive sport? If so, at what level could you compete at? (Local? International?)

Be prepared to share what you discover next class. You can do a simple oral presentation with a few visual aids (photos, etc.), or make use of some form of technology to present your findings. Make it interesting!

Session 2

Topics this second class will cover:

- Water diversions & dams and the politics associated with water management decisions
- Watersports and training or careers in these sports

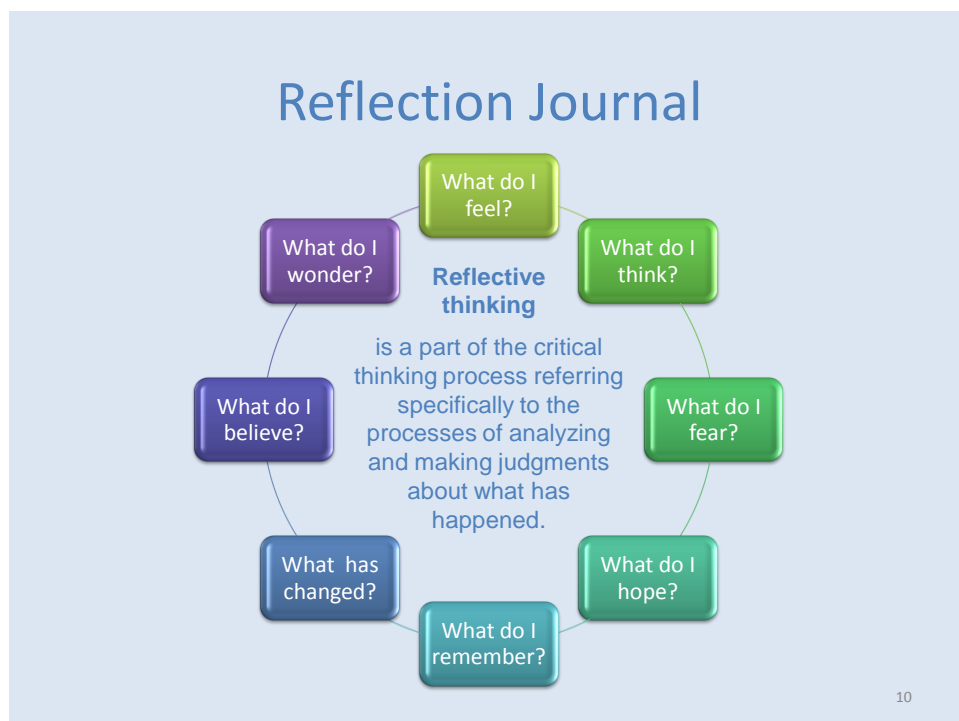
Learning outcomes:

- Students will gain understanding in the complexities of dam and diversion schemes.
- Students will reflect on their own beliefs related to dams and hydropower in Canada.
- Students will understand the career & training opportunities available in the featured watersports.

Lesson Preparation & Resources Needed:

- 49 Megawatts movie

1. Reflective journaling will be a big part of the Immersion and Post-immersion portions of the course, and students should be encouraged to write down any insights they have at any time. Go over the Response journal guidelines handout, as well as the PowerPoint slide on reflective thinking.



2. Continue with the 49 Megawatts video. Remind students that the reflection piece they will need to write after this class (or during class, if there is enough time) will need to describe what they have felt and thought about as they watched this video.

3. After the video, give the students 5 - 10 minutes to discuss and ask questions. The length of the written response needn't be overly long, and may include sketches or be in any format that the instructor chooses. Show the students the following assessment rubric to guide them:
4. The *49 Megawatts* movie looked at the impacts of micro-hydro development on recreational opportunities in B.C. Now, lighten the mood by having each student present their findings on Recreational Opportunities related to one of the watersports that they will be trying out at the PSEC in the Immersion portion of this course.

If the class is especially large, divide it in two and have only some of the students present today, or have them present to each other simultaneously in smaller groups. The assessment can be completed by the instructor or by the students themselves. Ask students to take brief notes on what the others have discovered, as this information may be useful for the post-immersion assignments.

"Our reflections are the making of deeper meaning and richer understandings. Our reflections are our dreams, our ideas, our questions, our initiatives, our visions – our journeys of lifelong learning and teaching." (Schwartz & Bone, 1995)



- Take time to write down anything in relation to what you have experienced. If you're intrigued by certain statements or if you're attracted to issues or problems, write your response. Try to take at least five minutes to write when you've finished an activity or assignment.
- Make connections with your own experience. What does the reading make you think of? Does it remind you of anything or anyone?
- Make connections with texts or concepts or events. Do you see any similarities or differences?
- Ask yourself questions: What perplexes you about a particular issue / event / text? Try beginning, "I wonder why..." or "I'm having trouble understanding how.." or "It perplexes me that.." or "I was surprised when..."
- Try agreeing with the writer / speaker. Write down the supporting ideas. Try arguing with the writer / speaker. On what points, or about what issues, do you disagree? Think of your journal as a place to carry on a dialogue. Ask questions; have the writer / speaker respond. What happens when you imagine yourself in his/her shoes?
- Write down striking words, images, phrases, or details. Speculate about them. Why did the author /speaker choose them? What do they add to the story? Why did you notice them? Divide your notebook page in half and copy words from the text onto the left side; write your responses on the right. On a first reading you might put checks in the margin where the passages intrigue you; on the second reading, choose the most interesting ideas, then write about them.
- Describe the author / speaker' point of view. How does his / her attitude shape the way s/he presents the material?
- - Tell about what happened.
 - Ask questions about things that confuse you or that you wonder about.
 - Describe your feelings about the events.
 - Describe your feelings about people you have met / heard from.
 - Copy down a quote from a speaker and tell why you think it's meaningful.
 - Describe your favourite part of a text / movie / presentation / activity.
 - Make a prediction about what will happen in the future.
 - Tell how you would react if you were one of the "characters" in the story.
 - Describe something that surprised you.
 - Write a letter to the author / speaker / character.
 - Draw pictures or create graphic organizers.

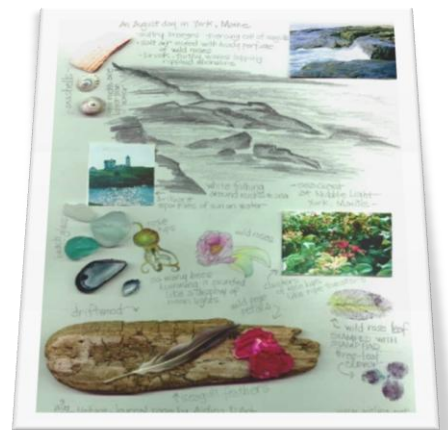
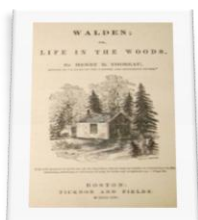


More prompts that may be useful during pre-immersion reflection assignments and during future journal writing time at the PSEC:

- Today I explored..... and found.....
- I think it is important to know about.....because...
- Today I discovered..... and.....
- With the learning I did today I will be able to...
- Today I learned
- I wonder how?
- I wish.....because...
- I feel..... because...
- The most challenging thing I did today was...
- Today I found out...
- I smiled today when...
- This new learning will affect me in the following ways..
- I think the causes of..... are.....
- I could use these strategies to solve the problem of...
- The consequence of the changes I have suggested would be...
- I want to know more about ... and I will find out more by firstly..... then and perhaps...
- The work we did today built on the work we did(insert time)..... in that it...(explain how),
- At the end of today I am still uncertain about.. I get the bit about.. but need to clarify the bit about..
- The learning we did in relates to our previous learning in the following ways...
- I left class today knowing several things that I didn't know when I arrived this morning....(list them)
- I will use the skills gained intoday in my everyday life (list the ways)
- The biggest obstacle I overcame today was..... I did this by.....
- (insert famous person) would say that... (insert issue/concept/learning) is because.....
- I feel that the six most important learnings from today in order of importance were..... because...
- In my opinion the following changes need to be made as
- My understanding of..... is...
- I can now explain why/how... it...
- I agree with the statement '.....' because...
- I disagree with the statement '.....' because ...
- The difference between& is.....
- I would like answers to the following questions...
- I know because...
- Today I asked... and discovered...
- The strengths and weaknesses of are...
- Today I explored..... and feel.....
- I believe...

Consider keeping a nature journal

1. Firsthand experience is crucial to connecting with nature.
2. Develop a routine or schedule for recording observations.
3. Always have a notebook with you to record and sketch your observations.
4. Make very simple sketches, maps and diagrams to enhance your learning and jog your memory.
5. Use your observations to write finished essays or create finished drawings or other creative work.



Session 3

Topics this third class will cover:

- Micro-hydro development in Canada
- Aquatic monitoring

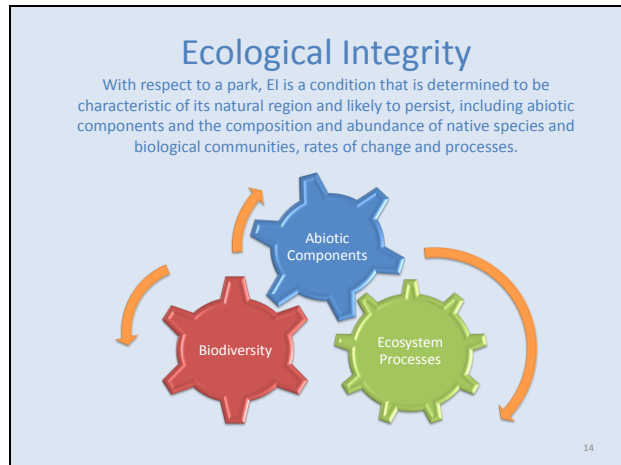
Learning outcomes:

- Students will define their changing beliefs and understanding of water related issues.
- Students will understand the concept of interbasin water transfers.
- Students will be able to define the components of ecological integrity and know how aquatic monitoring fits into the process.

Lesson Preparation & Resources Needed:

- *Eau Canada* texts or photocopies of "Drawers of Water: Water Diversions in Canada and Beyond" By Frédéric Lasserre, chapter 7, pages 143 - 162.
- EPA Water Info Brochure for Youth (*What's Up With Our Nation's Water?*), one copy for 2 - 3 students. If the group is large, you may want to also hand out the Waste Water Treatment *Following the Flow* booklet. You may want to access the Water Matters website if the students have access to the internet.

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1. Introduce the students to their next reading assignment "Drawers of Water: Water Diversions in Canada and Beyond" By Frédéric Lasserre, chapter 7, pages 143 - 162 in *Eau Canada* (2007). Hand out the Anticipation Guide to the students and have them complete it prior to beginning to read. An anticipation guide is a tool that has statements that may be true (taken directly from the text) or false. It will give the students an idea of what they are about to read and will introduce some of the key concepts. It also gets the students making judgments before reading and also after reading. It is a good way to see the shifting beliefs as students gain more understanding. Discuss as you go and feel free to spend less time on certain parts and more time on others that the students find interesting.
 2. After reading the chapter together or individually, look at the anticipation guide from again to see if the students' beliefs have changed after reading the text. Discuss if there have been changes and if there have been, were there significant changes? Since the beginning of this course, have the students changed their minds about any water-related issues?
 3. Now we begin learning about a major component of the Water Experience 25 level course: Aquatic Monitoring. Look at the PowerPoint slides and discuss what the students already know about ecological integrity and monitoring techniques. Do they know what scientists look for when they "measure" water?



Abiotic Components

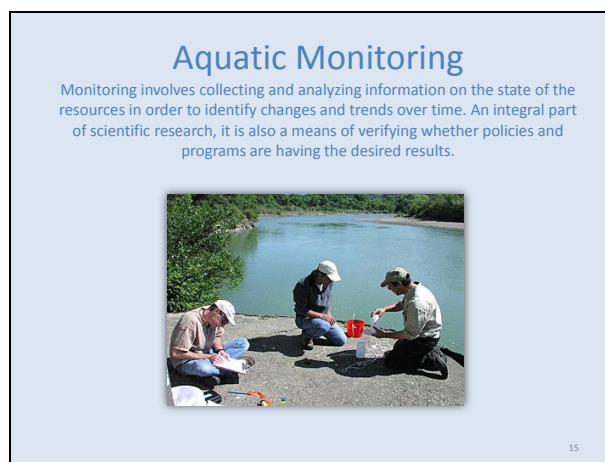
- The physical elements in an ecosystem.
- For example: water, rocks and nutrients.

Biodiversity

- The composition and abundance of species and communities in an ecosystem.
- For example: tundra, rainforest and grasslands represent landscape diversity.
- For example: black bears, brook trout, ruffed grouse and black spruce represent species diversity.

Ecosystem Processes

- The engines that make ecosystems work.
- Usually associated with natural events.
- Are needed to sustain ecosystems.
- For example: fire, flooding and predation.



4. Hand out the vocabulary worksheet and that these topics will be discussed in depth and the students may have much more to add to the worksheet after their experiences at the PSEC, on the river, and at the waste water treatment plant.

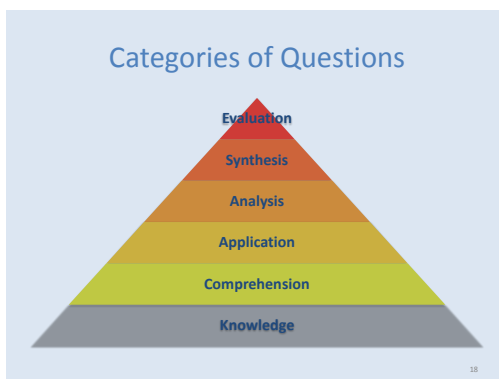
5. Reading assignments (3 possibilities to choose from):

- Hand out several copies of the EPA Water Info booklet for Youth: **What's Up With Our Nation's Water?** one copy for 2 - 3 students. This brochure is from the US and is designed for youth, but it still gives a simple yet complete overview of water monitoring and ecosystem health.
- If the group is large, you may want to also hand out the Waste Water Treatment **Following the Flow** booklet to give students more to work with. This brochure is much more complex and would be a challenging text for some. It does, however, have excellent information on wastewater treatment.
- If you have access to the internet for each group, you could have them read some of the **Water Matters** site (an NGO site dedicated to protecting Alberta's Watersheds) at <http://www.water-matters.org/program/share-the-water>. Click on **Learn**.



Ask the students to read over the information in their booklet / on the site together. After the students have read, have them create questions to test the other students (or instructor). Discuss the difference between a simple question (at the bottom of the pyramid) and a complex one before letting them begin. See the following information sheet on Bloom's taxonomy.

Students must have the answers to their questions ready. Ask students to come up with simple, straight-from-the-text questions as well as higher-level questions which ask for opinions and justifications (which will not necessarily come from the text).



6. After 10 - 15 minutes, if there is time this class, play a Jeopardy-style game with the questions that were developed. Teams score points for correct answers and also for developing great thought-provoking questions. Save this activity for the next class if there is not enough time.

Bloom's Taxonomy

Competence	Skills Demonstrated
Knowledge	observation and recall of information knowledge of dates, events, places knowledge of major ideas mastery of subject matter <i>Question Cues:</i> list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where
Comprehension	understanding information grasp meaning translate knowledge into new context interpret facts, compare, contrast order, group, infer causes predict consequences <i>Question Cues:</i> summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss
Application	use information use methods, concepts, theories in new situations solve problems using required skills or knowledge <i>Questions Cues:</i> apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover
Analysis	seeing patterns organization of parts recognition of hidden meanings identification of components <i>Question Cues:</i> analyze, separate, connect, classify, arrange, divide, compare, select, explain, infer
Synthesis	use old ideas to create new ones generalize from given facts relate knowledge from several areas predict, draw conclusions <i>Question Cues:</i> combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite
Evaluation	compare and discriminate between ideas assess value of theories, presentations make choices based on reasoned argument verify value of evidence recognize subjectivity <i>Question Cues:</i> assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize

<http://www.coun.uvic.ca/learning/exams/blooms-taxonomy.html>

by Frédéric Lasserre pages 143 - 162 in *Eau Canada* (2007)

Directions: On the continuum in front of each of the numbers, place an “x” that indicates where you stand in regard to the statement that follows. Be prepared to defend and support your opinions with specific examples. After reading the text, compare your opinions on those statements with the author’s implied and/or stated messages.

Strongly Agree

Strongly Disagree

- | | |
|--|--|
| | 1. Large scale water diversions (taking water from one watershed and putting it into another) are necessary to the growth and development of Canada. |
| | 2. Canada is one of the largest water diverters in the world. |
| | 3. Most water transfer schemes are designed to produce power, rather than to irrigate or to provide water for domestic use. |
| | 4. Diverting water that normally crosses political boundaries would be a political nightmare. |
| | 5. Canada has a strong case when it says that water exports (to other countries) should be prohibited based on environmental grounds. |
| | 6. When the states in the Columbia & Mississippi watersheds refused the idea of exporting their water to other states, engineers started looking North to Canada's water. |
| | 7. Political opposition has played an important role in discouraging water exports. |
| | 8. Water demand has been stagnating in the U.S for the past two decades, resulting in an end to new diversion schemes. |
| | 9. It would be a good idea if Canada and the U.S. considered pooling their natural resources: energy, wood, minerals, and water. |
| | 10. Small diversions to supply drinking water are no big deal and should always be allowed. |
| | 11. The fear is that if one province allows bulk water exporting, then all provinces will have to consider water as a tradable good under the North American Free Trade Agreement. |
| | 12. We are on the right track when we implement laws that prohibit interbasin water transfers. |
| | 13. Water diversions & transfers are no longer a major concern. |

Use words and sketches to define the following terms. Use the following websites (or any other ones that you trust) in addition to what you already know to complete this assignment.

This assignment must be handed in during the second post-immersion class as you may want to add to your definitions during your time at the PSEC.

Ecological Integrity Concepts

Parks Canada: http://www.pc.gc.ca/apprendre-learn/prof/sub/edukit/activities/index_2_e.asp#1

Biodiversity:

Carrying capacity:

Ecosystem stressors:

Sustainable development:

Traditional ecological knowledge:

<http://www.pc.gc.ca/eng/progs/np-pn/ie-ei.aspx>

- 1.
- 2.
- 3.

[illegible]

Access Water Knowledge at: <http://www.wef.org/awk/default.aspx>
Glossary of Water Terms: <http://www.wef.org/PublicInformation/page.aspx?id=139>

[illegible]

Watershed management:

Collection system:

Water reuse:

Common Water Measurements

<http://ga.water.usgs.gov/edu/characteristics.html>

Temperature:

pH:

Turbidity:

Dissolved oxygen:

Hardness:

Use words and sketches to define the following terms and explain their significance to water ecology. Use the following websites (or any other ones that you trust) in addition to what you already know to complete this assignment. *This assignment must be handed in during the second post-immersion class as you may want to add to your definitions during your time at the PSEC.*

Ecological Integrity Concepts

Biodiversity: The variety of plant and animal species and the variety of characteristics within those species. The total genetic, species, and landscape variation within a given ecosystem.

Carrying capacity: Carrying capacity is the equilibrium established between any life form and its environment. It is frequently expressed as a number indicating the population of any given animal a given area can support.

Ecosystem stressors: Events and actions (often the results of modern human activities) that have direct or indirect effects on biodiversity because of changes to the ecological processes that maintain biodiversity.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. In other words, development is essential to satisfy human needs and improve the quality of human life. At the same time, development must be based on the efficient and environmentally responsible use of all of society's scarce resources - natural, human, and economic.

Traditional ecological knowledge: Knowledge that derives from, or is rooted in the traditional way of life of aboriginal people...the accumulated knowledge and understanding of human place in relation to the universe. This encompasses spiritual relationships, relationships with the natural environment and the use of natural resources, relationships between people, and is reflected in language, social organization, values, institutions and laws.

Ecological integrity: List the 3 components of ecological integrity. Include a brief definition and some examples of each:

1. **Abiotic components:** physical elements in an ecosystem. i.e. rocks, water, nutrients
2. **Biodiversity:** Composition and abundance of species and communities in an ecosystem. i.e. tundra, elk
3. **Ecosystem processes:** The processes needed to sustain ecosystems. i.e. fire, flooding, predation

Water Treatment Concepts

Greywater: Domestic wastewater that does not contain human wastes such as tub, shower, or washing machine water.

Biosolids: Solid materials resulting from wastewater treatment that meet government criteria for beneficial use, such as for fertilizer.

Nutrients: Nutrients are needed to sustain life, but too many nutrients in aquatic environments lead to the depletion of oxygen, potentially leading to poor water quality or "dead zones" that cannot sustain life. Wastewater treatment plant effluent is one of several sources of nutrients in the aquatic environment.

Microconstituents: Miniscule particles of natural and manmade substances, such as pharmaceutical and personal care products, pesticides, and industrial chemicals, which have been detected within water and the environment.

Watershed management: A watershed planning and management approach, which is key to meeting clean water goals, represents a comprehensive and integrated way to protect all water resources, including uplands, drainage basins, wetlands, surface water, and groundwater.

Collection system: Refers to the system of underground pipes and maintenance structures that are used to convey wastewater to a wastewater treatment facility.

Water reuse: In addition to the use of reclaimed water for non-potable purposes, water quality experts support the consideration and use of highly treated reclaimed water for indirect potable reuse. The reuse of municipal wastewater for beneficial purposes is an important aspect of the world's total water resources management.

Common Water Measurements

Temperature: The temperature of the released water can affect downstream habitats. Temperature also can affect the ability of water to hold oxygen as well as the ability of organisms to resist certain pollutants.

pH: A measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water. Water that has more free hydrogen ions is acidic, whereas water that has more free hydroxyl ions is basic. Since pH can be affected by chemicals in the water, pH is an important indicator of water that is changing chemically. pH is reported in "logarithmic units," like the Richter scale, which measures earthquakes. Each number represents a 10-fold change in the acidity/basicness of the water. Water with a pH of 5 is ten times more acidic than water having a pH of six. Pollution can change water's pH, which in turn can harm animals and plants living in the water.

Turbidity: The amount of particulate matter that is suspended in water. Turbidity measures the scattering effect that suspended solids have on light: the higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid include: clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton, microscopic organisms.

Dissolved oxygen: The oxygen dissolved in lakes, rivers, and oceans is crucial for the organisms and creatures living in it. As the amount of dissolved oxygen drops below normal levels in water bodies, the water quality is harmed and creatures begin to die off. Indeed, a water body can "die", a process called eutrophication.

Although water molecules contain an oxygen atom, this oxygen is not what is needed by aquatic organisms living in our natural waters. A small amount of oxygen, up to about ten molecules of oxygen per million of water, is actually dissolved in water. This dissolved oxygen is breathed by fish and zooplankton and is needed by them to survive.

Rapidly moving water, such as in a mountain stream or large river, tends to contain a lot of dissolved oxygen, while stagnant water contains little. Bacteria in water can consume oxygen as organic matter decays. Thus, excess organic material in our lakes and rivers can cause an oxygen-deficient situation to occur. Aquatic life can have a hard time in stagnant water that has a lot of rotting, organic material in it, especially in summer, when dissolved-oxygen levels are at a seasonal low.

Hardness: The amount of dissolved calcium and magnesium in water determines its "hardness."

Session 4

Topics this fourth class will cover:

- Aquatic monitoring for ecological and human health
- Conflicts over water use and abuse (*Water Wars*)

Learning outcomes:

- Students will understand the need for aquatic monitoring to protect ecological and human health.
- Students will be able to define the components of ecological integrity and know how aquatic monitoring fits into the process.
- Students will define some of the potential and actual conflicts pertaining to water use.

Lesson Preparation & Resources Needed:

- Arrange for a 30 minute video-conference session with Ducks Unlimited in Manitoba. Contact GYPSD video conference coordinator (780 723 4471) to assist you in arranging this.
- Photocopies of the short excerpts from *Water Wars* and *Bottlemania* for each student.

-
1. Arrange for a video-conference with a Ducks Unlimited educator who could talk about ecological integrity and wetland conservation. This session should last 30 minutes, more or less, and should have time at the end for students to ask questions.
 2. Ask students to write in their notebooks following the videoconference session. Have them reflect on the presentation and what they have learned about in the past few classes. They can use the writing prompts handed out earlier or you can ask them specific questions which relate to the presentation in which they just participated.
 3. Hand out the photocopies which pertain to Water Conflicts. (When printing, choose to print p. 34-39, 2 sided, flip on long edge. Fold each booklet in half and staple in the middle.) The first excerpt is from *Water Wars*, by Vandana Shiva. The second is from *Bottlemania*, by Elizabeth Royte. More info about the authors is available from the backs of the books. Put up the slide with the key terms so students know that this is what will be discussed during and after reading the two texts.
 4. Research the key terms further if you have time. After everyone is done reading, put up the next slide and play Super Hero or Super Villain. Discuss each one of the following concepts / organizations / inventions and decide if it is good, bad, or both, and reasons why:
 - World Bank
 - Irrigation
 - Community control of water
 - Government control of water
 - Corporate control of water
 - Groundwater pumping
 - Hoover Dam (Colorado River)
 - Bottled water

Alternately, give this as a homework assignment and have students share their opinions next class.

Session 5

Topics this last pre-immersion class will cover:

- Water infrastructure
- Preparation for the Immersion portion of Water Experience 25.

Learning outcomes:

- Students will understand the three components of municipal water infrastructure and the role that citizens play in protecting our water resources.
- Students will understand what they will need to bring in terms of gear, clothing, etc. for their stay at the Palisades Centre.
- Students will ask questions they may have about their upcoming visit to the PSEC.

Lesson Preparation & Resources Needed:

- Liquid Assets overview video clip, ready to play:
<http://www.liquidassets.psu.edu/index.html#overview>
- A videoconference session with a Parks Canada PSEC staff member will take place during this session. This should last about 20 minutes. Contact the Palisades Centre to set this up in advance.

1. The first activity will be to look at a 16 minute video clip on water infrastructure. Go to <http://www.liquidassets.psu.edu/index.html#overview> to see the Overview clip. The entire documentary (90 minutes) is available to order if you like. Remind students to take notes in their folders as this may be something they want to comment on in the post-immersion assignments. After viewing the clip, tackle some of the following questions:

- Does it make sense for communities with an abundant water supply to follow the same kind of water conservation policies and practices as a desert community? Why or why not?
- If a growing community in the Sahara decides to follow the example of Las Vegas in conserving its water, to what extent can this be possible? Suggest some alternatives by which it may stretch its water resources.
- A city with sufficient amount of water resources has decided to cut down on its water usage in view of future depletion. Your class is one of the citizen action groups it consulted. What would you advise the citizens and the government to do?
- What can citizens do to help sustain their water resources?
- The environmental group in this video educates people through community meetings. What other modes do you think should be employed for effective communication?
- Should citizens be responsible for or should they cooperate in the management of water resources?
- What are the different reasons for which a regular supply of water is important to a civilized community?
- “Water supply is set to become a bone of contention among communities”. Research the validity of this statement and discuss it with your classmates.

- Investigate your local water supply system. How is it similar to and/or different from the supply system discussed in this segment of Liquid Assets?
- Identify the different infrastructure components that are involved in the transportation of water from the source to you.
- Why is it important to take wastewater away after it is used?
- What are the direct or indirect causes of water pollution today?
- What are some of the age-old methods of water purification?
- Discuss the possibilities and modes of a global impact of local water pollution.
- This segment of Liquid Assets discusses the impact of unsafe water on the citizens who consume it. But human beings are only one part of the ecosystem this water reaches. List the other parts and discuss the possible impact on them.
- How do runoff, sewage and trash become a part of our watershed?
- What is the impact of watershed pollution on the environment?
- What can citizens do to avoid watershed pollution?
- How far does the impact of watershed pollution reach?

If desired, have the students write down their thoughts about these questions, or discuss as a group.

2. In Canada, some of the same infrastructure problems exist, especially in small communities and on First Nation reserves. The following websites give some background information on the First Nations Reserves situation:

Health Canada information on Water Quality issues on First Nation Reserves

<http://www.hc-sc.gc.ca/fniah-spnia/promotion/public-publique/water-eau-eng.php>

Indian and Northern Affairs Canada

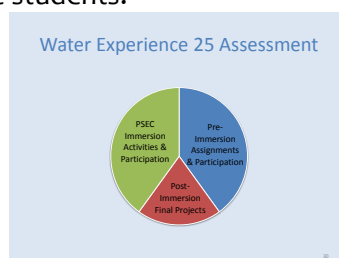
<http://www.ainc-inac.gc.ca/enr/wtr/index-eng.asp>

Canadian Medical Association Journal articles

<http://www.cmaj.ca/cgi/content/full/178/8/985>

<http://www.cmaj.ca/cgi/content/full/178/10/1261>

3. The instructor should give an overview of how students will be assessed during the remainder of the course, including what will be assessed at the PSEC and what the final projects will entail. This will help students plan for their final project as they immerse themselves in the hands-on activities. Make sure the assignments that have been completed in the previous sessions have been marked and returned to the students.



4. The optional videoconference session should begin with an introduction from the Palisades Ed team, and a very brief overview of what Parks Canada's role is in the conservation & protection of water resources. They should then outline what the students need to know about their upcoming visit, and should give a general schedule of events for the 4 day camp. Items that the students need to bring from home will need to be discussed, as well as things that should be left at home. Time should be left for questions from the students and the instructor.
5. Before leaving, ensure that the students know that they should bring their Water Experience folders with them to the PSEC.

Water Experience 25 Student Handouts

The following student handouts are already included in the Instructor Notes above, but are also included here for ease of photocopying. The readings from *Water Wars* and *Bottlemania* for session 4 have been scanned and included here as well.

There are a lot of recreational activities that take advantage of water environments. Think back to WE 15 and **research** one of the following non-motorized sports:

- Canoeing: flatwater or whitewater
- Kayaking: slalom, freestyle, kayak polo, ocean or lake touring
- Rafting
- *or* suggest another appropriate sport (discuss it with your instructor first)

1. Tell us why you chose to profile this sport.

- What experience do you have with this sport?
 - Show us any pictures or video you may have of yourself engaged in it.
 - Tell us about someone you know who participates in this sport.
- If this sport is totally new to you, what have you seen or heard that makes you interested?

2. Try to find the following information:

- Who are some of the champions of the sport?
- How do you know about them?
- What do they do to earn the title of "champion"?
- Is it a competitive sport? If so, at what level could you compete at? (Local? International?)

Be prepared to share what you discover next class. You can do a simple oral presentation with a few visual aids (photos, etc.), or make use of some form of technology to present your findings. Make it interesting!

Rubric			
Recreational Opportunities - Depth of ideas presented			
4	3	2	1
Students demonstrate a thorough understanding of key concepts. Descriptions are complete and in depth.	Students demonstrate a good understanding of key concepts. Descriptions are complete.	Students demonstrate a general understanding of key concepts. Descriptions lack some details.	Students indicate a lack of conceptual understanding. Issues are dealt with at a superficial level and/or in isolation.

"Our reflections are the making of deeper meaning and richer understandings. Our reflections are our dreams, our ideas, our questions, our initiatives, our visions – our journeys of lifelong learning and teaching." (Schwartz & Bone, 1995)



- Take time to write down anything in relation to what you have experienced. If you're intrigued by certain statements or if you're attracted to issues or problems, write your response. Try to take at least five minutes to write when you've finished an activity or assignment.
 - Make connections with your own experience. What does the reading make you think of? Does it remind you of anything or anyone?
 - Make connections with texts or concepts or events. Do you see any similarities or differences?
 - Ask yourself questions: What perplexes you about a particular issue / event / text? Try beginning, "I wonder why..." or "I'm having trouble understanding how.." or "It perplexes me that.." or "I was surprised when..."
 - Try agreeing with the writer / speaker. Write down the supporting ideas. Try arguing with the writer / speaker. On what points, or about what issues, do you disagree? Think of your journal as a place to carry on a dialogue. Ask questions; have the writer / speaker respond. What happens when you imagine yourself in his/her shoes?
 - Write down striking words, images, phrases, or details. Speculate about them. Why did the author /speaker choose them? What do they add to the story? Why did you notice them? Divide your notebook page in half and copy words from the text onto the left side; write your responses on the right. On a first reading you might put checks in the margin where the passages intrigue you; on the second reading, choose the most interesting ideas, then write about them.
 - Describe the author / speaker' point of view. How does his / her attitude shape the way s/he presents the material?
-
- Tell about what happened.
 - Ask questions about things that confuse you or that you wonder about.
 - Describe your feelings about the events.
 - Describe your feelings about people you have met / heard from.
 - Copy down a quote from a speaker and tell why you think it's meaningful.
 - Describe your favourite part of a text / movie / presentation / activity.
 - Make a prediction about what will happen in the future.
 - Tell how you would react if you were one of the "characters" in the story.
 - Describe something that surprised you.
 - Write a letter to the author / speaker / character.
 - Draw pictures or create graphic organizers.

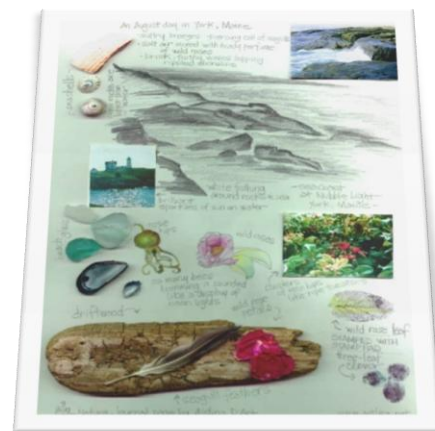
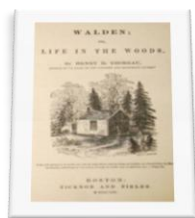


More prompts that may be useful during pre-immersion reflection assignments and during future journal writing time at the PSEC:

- Today I explored..... and found.....
- I think it is important to know about.....because...
- Today I discovered..... and.....
- With the learning I did today I will be able to...
- Today I learned
- I wonder how?
- I wish.....because...
- I feel..... because...
- The most challenging thing I did today was...
- Today I found out...
- I smiled today when...
- This new learning will affect me in the following ways..
- I think the causes of..... are.....
- I could use these strategies to solve the problem of...
- The consequence of the changes I have suggested would be...
- I want to know more about ... and I will find out more by firstly..... then and perhaps...
- The work we did today built on the work we did(insert time)..... in that it...(explain how),
- At the end of today I am still uncertain about.. I get the bit about.. but need to clarify the bit about..
- The learning we did in relates to our previous learning in the following ways...
- I left class today knowing several things that I didn't know when I arrived this morning....(list them)
- I will use the skills gained intoday in my everyday life (list the ways)
- The biggest obstacle I overcame today was..... I did this by.....
- (insert famous person) would say that... (insert issue/concept/learning) is because.....
- I feel that the six most important learnings from today in order of importance were..... because...
- In my opinion the following changes need to be made as
- My understanding of..... is...
- I can now explain why/how... it....
- I agree with the statement '.....' because...
- I disagree with the statement '.....' because ...
- The difference between& is.....
- I would like answers to the following questions...
- I know because...
- Today I asked... and discovered...
- The strengths and weaknesses of are...
- Today I explored..... and feel.....
- I believe...

Consider keeping a nature journal

6. Firsthand experience is crucial to connecting with nature.
7. Develop a routine or schedule for recording observations.
8. Always have a notebook with you to record and sketch your observations.
9. Make very simple sketches, maps and diagrams to enhance your learning and jog your memory.
10. Use your observations to write finished essays or create finished drawings or other creative work.



by Frédéric Lasserre pages 143 - 162 in *Eau Canada* (2007)

Directions: On the continuum in front of each of the numbers, place an “x” that indicates where you stand in regard to the statement that follows. Be prepared to defend and support your opinions with specific examples. After reading the text, compare your opinions on those statements with the author’s implied and/or stated messages.

Strongly Agree

Strongly Disagree

1. Large scale water diversions (taking water from one watershed and putting it into another) are necessary to the growth and development of Canada.
2. Canada is one of the largest water diverters in the world.
3. Most water transfer schemes are designed to produce power, rather than to irrigate or to provide water for domestic use.
4. Diverting water that normally crosses political boundaries would be a political nightmare.
5. Canada has a strong case when it says that water exports (to other countries) should be prohibited based on environmental grounds.
6. When the states in the Columbia & Mississippi watersheds refused the idea of exporting their water to other states, engineers started looking North to Canada's water.
7. Political opposition has played an important role in discouraging water exports.
8. Water demand has been stagnating in the U.S for the past two decades, resulting in an end to new diversion schemes.
9. It would be a good idea if Canada and the U.S. considered pooling their natural resources: energy, wood, minerals, and water.
10. Small diversions to supply drinking water are no big deal and should always be allowed.
11. The fear is that if one province allows bulk water exporting, then all provinces will have to consider water as a tradable good under the North American Free Trade Agreement.
12. We are on the right track when we implement laws that prohibit interbasin water transfers.
13. Water diversions & transfers are no longer a major concern.

Use words and sketches to define the following terms. Use the following websites (or any other ones that you trust) in addition to what you already know to complete this assignment.

This assignment must be handed in during the second post-immersion class as you may want to add to your definitions during your time at the PSEC.

Ecological Integrity Concepts

Parks Canada: http://www.pc.gc.ca/apprendre-learn/prof/sub/edukit/activities/index_2_e.asp#1

Biodiversity:

Carrying capacity:

Ecosystem stressors:

Sustainable development:

Traditional ecological knowledge:

<http://www.pc.gc.ca/eng/progs/np-pn/ie-ei.aspx>

- 1.
- 2.
- 3.

[illegible]

Access Water Knowledge at: <http://www.wef.org/awk/default.aspx>
Glossary of Water Terms: <http://www.wef.org/PublicInformation/page.aspx?id=139>

[illegible]

Watershed management:

Collection system:

Water reuse:

Common Water Measurements

<http://ga.water.usgs.gov/edu/characteristics.html>

Temperature:

pH:

Turbidity:

Dissolved oxygen:

Hardness:



Vandana Shiva is a world-renowned environmental thinker and activist. A leader in the International Forum on Globalization, Shiva won the Alternative Nobel Peace Prize (the Right Livelihood Award) in 1993. Director of the Research Foundation for Science, Technology, and Natural Resource Policy, she is the author of many books, including *Protect or Plunder?* *Understanding Intellectual Property Rights*, *Stolen Harvest: The Hijacking of the Global Food Supply*, and *Biopiracy: The Plunder of Nature and Knowledge*. Before becoming an activist, Vandana Shiva was one of India's leading physicists.

Water Wars

Privatization, Pollution, and Profit

In *Water Wars*, Vandana Shiva uses her remarkable knowledge of science and society to analyze the historical erosion of communal water rights. Examining the international water trade, damming, mining, and aquafarming, Shiva exposes the destruction of the earth and the disenfranchisement of the world's poor as they are stripped of their right to a precious common good.

Shiva reveals how many of the most important conflicts of our time, most often camouflaged as ethnic wars or religious wars, such as the ongoing Israeli-Palestinian conflict, are in fact conflicts over scarce but vital natural resources.

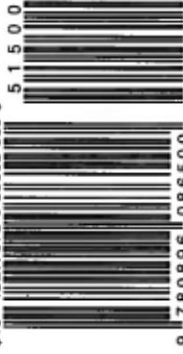
Water Wars celebrates the spiritual and traditional role water has played in communities throughout history, and warns that water privatization threatens cultures and livelihoods worldwide.

"Shiva is a burst of creative energy, an intellectual power." —*The Progressive*

"One of the world's most prominent radical scientists." —*The Guardian*

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PRIVATIZATION, POLLUTION, AND PROFIT



VANDANA SHIVA

Chapter 3

THE COLONIZATION OF RIVERS: DAMS AND WATER WARS

Public Costs and Private Gain: Dams in the American West

Water ownership did not always entail state and private involvement. For a long time, water was under community control. Throughout the world, complex water-conservation and water-sharing systems ensured sustainability and accessibility to all. Community control meant that water was managed locally and as a common resource. Such community-based systems can still be found in the Andes, Mexico, Africa, and Asia.

Community control was eroded when states took control over water resources. In the American west, the state collaborated with private entrepreneurs to acquire water rights. In the Third World, government control was facilitated by giant water-project loans from the World Bank. Dams were a particularly popular means of shifting water control from communities to central governments and colonizing rivers and people. For European colonizers who came to America, river colonization was a cultural obsession and an imperial imperative. Nature in general, and rivers in particular, were valued for their commercial benefit

percent, while it grew by 237 percent in the west; land devoted to bran cultivation fell by 449,000 acres across the United States, but doubled in the west; rice cultivation was abandoned in wet Louisiana while it expanded in the arid west.¹⁸

Dam construction in the United States was undertaken mainly by the Army Corps of Engineers. Established in 1775, the US Army Corps was once the largest engineering organization in the world. In 1981, the Corps' civil works division alone employed 32,000 civilians and 300 officers, who built over 4,000 civil works, including 538 dams. Today, the Corps operates 150 projects that supply water to industries and urban centers.

The Corps's damming activities extend beyond US borders. During the Green Revolution, dams imposed on the Third World through loan conditions were built mainly by the Army Corps. In 1965, despite a severe drought, the United States government refused to supply wheat to India unless the country altered its policies to introduce irrigation-intensive agriculture.¹⁹

The task of dam construction was of course assigned to the Army Corps. Loan terms imposed by the United States and the World Bank opened up a worldwide market for dam building. In 1966, President Lyndon Johnson, who had forced India to adopt the Green Revolution, launched a "Water for Peace" program, which called for the Army Corps to build dams in the Third World. In a 1966 speech, he proclaimed:

We are in a race for disaster. Either the world's water needs will be met, or the inevitable result will be mass starvation. . . .

If we fail, I can assure you today that not even America's unprecedented military might will be able to preserve the peace for long.²⁰

Peace and food, the justifications for monumental dam construction, left a legacy of centralized water control, violence, hunger, and thirst. Although the rationale of peace and food emerged 30 years ago, they are still used to justify the control over water by the giant corporations that have replaced the Army Corps.

and were seen as being in need of taming. John Widtsoe, an irrigation scientist with the Bureau of Reclamation, once argued:

The destiny of man is to possess the whole earth; and the destiny of the earth is to be subject to man. There can be no full conquest of the earth, and no real satisfaction to humanity, if large portions of the earth remain beyond his highest control. Only as all parts of the earth are developed according to the best existing knowledge, and brought under human control, can man be said to possess the earth. The United States . . . might accommodate its present population within its humid region, but it would not then be the great nation that it now is.¹

W. J. McGee, President Theodore Roosevelt's chief adviser on water programs, projected that the control of water was "the single step remaining to be taken before Man becomes master over Nature."² In 1944, describing the blocking of the Sacramento River to build the Shasta dam, the chief of construction, Francis Grove proclaimed: "We had the river licked. Pinned down, shoulders right on the map. Hell, that's what we came up here for."³

Rivers following their ecological path were viewed as wasteful: "It would outrage one's sense of justice if that broad stream were to roll down to the ocean in mere idle majesty and beauty."⁴ So wrote Wesley Powell, the director of the United States Geological Survey from 1881 to 1899. He also wrote that rivers were "wasting into the sea."⁵ President Roosevelt, who founded the Bureau of Reclamation in 1902, shared similar views about water waste. While advocating for the establishment of the Bureau, Roosevelt argued, "If we could save the waters running now to waste, the western part of the country could sustain a population greater than even the legendary Major Powell dreamed."⁶

Although the notion of taming nature justified the construction of massive dams, the limits set by nature did not go unnoticed even by Wesley Powell: it was he who warned against indiscriminate dryland settlement, saying, "It would be almost a criminal act to go on as we are doing now and allow thousands

and hundreds of thousands of people to establish homes where they cannot maintain themselves.”⁷ As early as 1878, Powell had acknowledged the limits to making the desert bloom, and talked of possible dangers for years to come: “I wish to make it clear to you, there is not sufficient water to irrigate all the lands which could be irrigated, and only a small portion can be irrigated,” he advised in 1893. “I tell you, gentlemen, you are piling up a heritage of conflict.”⁸

By the late 1890s, Los Angeles had already tapped its local supplies and city officials were secretly purchasing land and water rights in neighboring Owens Valley.⁹ In 1907, bonds were issued to finance a 238-mile aqueduct that would divert the eastern runoff of the Sierra Madre. This clandestine agreement to transfer water from the farms to the city led to intense conflict between Owens Valley residents and Los Angeles water users.¹⁰ Non-local residents were equipped with private and public investment and backed by the might of the army. In 1924, Owens Valley residents blasted an aqueduct to prevent water diversion to Los Angeles.¹¹ The water war had begun.

After 12 more blasts, armed guards were stationed on the aqueduct with orders to kill. In 1926, the Saint Francis Dam was built, but it broke soon after, killing 400 people. During the drought of 1929, groundwater pumping began but quickly dried up the 75-square mile Owens Lake. New scarcity had bred new conflicts. In 1976, the aqueduct was bombed again.¹²

Irrigation in the western United States was spurred by the need to provide food for gold-rush miners. By 1890, 3.7 million acres of land were irrigated. But by 1900, many water companies were facing bankruptcy, and public agencies were providing support to private developers.¹³ Water projects continued to be driven by the private sector but financed by public investments.

The Hoover Dam on the Colorado River was commissioned by the Bureau of Reclamation during the Great Depression and was completed in 1935. The 726-foot-high dam used 66 million

tons of concrete—enough to build a 16-foot-wide highway from New York to San Francisco. The reservoir, Lake Mead, could hold the river’s entire flow for two years.

The dam marked the beginning of the large dam era and the partnership between government and corporations in control over water. Six companies—Henry Kaiser, Bechtel, Morrison-Knudson, Utah Construction, MacDonald Kahn, J. F. Shea, and Pacific Bridge—were awarded the bid for the dam. The Colorado River Compact, which approved the dam, excluded local governments and communities from the negotiations and decisions. Native Americans, who had been living in the Colorado River basin for centuries, were completely shut out of the decision to dam the river. As historian Donald Worster observes, “No one asked [Native Americans] to participate in the Colorado Compact negotiations, and the Bureau of Indian Affairs, supposedly their guardian angel, failed to look out for their interests there.”¹⁴ Arizona, which considered the dam a theft of the state’s natural resources, refused to ratify the compact.

To this day, the primary beneficiary of the Hoover Dam has been California. In fact, the state leads the world in water consumption.¹⁵ Water from the Hoover Dam is transferred to California through a 242-mile aqueduct from the Colorado River, and nearly a third of the hydropower generated by the dam is used to pump water to the state. Although it accounts for a mere 1.6 percent of the 243,000-square-mile Colorado basin, California uses one-fourth of its water. Much of this goes to big farms.¹⁶

Large water-diversion projects are said to augment water. In reality, they take water from one community to another and from one ecosystem to another. The expansion of irrigated agriculture in the arid American west has come at the cost of agriculture in the eastern and southern parts of the country. Although cotton cultivation on lands irrigated by the Bureau of Reclamation increased by 300 percent in the west, it dropped by 30 percent in the south.¹⁷ In the north, fruit and nut cultivation declined by 50

sales of beer and milk in the United States and by 2011 are, by some analysts, expected to surpass soda, of which Americans drink more than fifty gallons per person a year.

I've come to Maine because it seems an *unlikely* battleground. The state receives about forty-three inches of rain a year (about the same as other states in the region) and has a population of slightly more than one million, among whom Poland Spring is a familiar, and at one time beloved, face. The company has been bottling water from the town of Poland since 1845. Legal history recorded no objections when Hiram Ricker began to sell water from his family farm there, though a Portland newspaper, anticipating the nuns and the Canadians, scoffed at "selling something that God gave everyone for free." In recent years Poland Spring, which was bought by Perrier in 1980 and then Nestlé in 1992, has expanded its reach into other Maine aquifers, and the objections have been hard to miss.

The epicenter of Maine's water wars is Fryeburg, about an hour to the north of Hollis. "So what happened up there?" I ask Brennan, for the third time. We're sitting at the conference table in the bottling plant, which was built atop a former potato farm. The alarm out in the woods had, we just learned, been an electronic glitch—a relief to everyone. Now Brennan glances at me, and despite his efforts to stay on message, to stay upbeat, I can sense the man's fatigue. "Yeah," he says, with a downward cast of his eyes. "The infamous Fryeburg situation." He sighs. "It got complicated up there."



Maybe the alarm has something to do with that guy, the one with the duct tape and the Labrador? I ask. Or maybe security is simply testing the system? It isn't for Brennan to say.

"Why would someone want to mess with a pump house?" I ask as Brennan puts the truck back in gear.

"You'd be surprised," he says tersely. In 2003, operatives for the Earth Liberation Front (ELF) placed four incendiary devices inside a pump station in Michigan that supplied water to a Nestlé bottling plant. The devices failed to ignite, but ELF made its point: the substation was "stealing water," the group stated in a communiqué. Clean water, it continued, "is one of the most fundamental necessities, and no one can be allowed to privatize it, commodify it, and try and sell it back to us."

Is that what's happening here? I'd come up to the town of Hollis to see how the water gets out of the famous Maine woods and into the skinny bottles with the green labels. They are ubiquitous where I live. You can't walk a block in New York City without seeing a bottle in someone's hand, their baby stroller, or bike cage, spilling from the corner litter baskets or crushed flat and gray, ratlike, in the gutters. Nationwide, we discard thirty to forty billion of these containers a year. The bottles, and the trucks that deliver them, are haunting me. Poland Spring is the bestselling springwater in the nation, even in a city with some of the best tap water in the world. Everyone is drinking the stuff, and other waters like it. In the West, it's Arrowhead and Calistoga; in the South Central region, Ozarka; in the Midwest, Ice Mountain; in the mid-Atlantic, Deer Park; and in the Southeast, Zephyrhills—all owned by Nestlé, a company with estimated profits of \$7.46 billion in

2006. Pepsi-Cola and Coke are bottling water too, and making billions.

Why this turn against the tap? And how had we gotten to the point where activists are sneaking bombs into pump houses—infrastructure devoted not to oil, but water? It isn't just Michigan: citizens in Wisconsin, Pennsylvania, California, New Hampshire, Texas, Florida, and, yes, even Maine, are in arms against groundwater pumping for bottling. Legal scholars are loudly debating water rights; the United Church of Canada has called for a North American boycott of the stuff, so has a group called Food and Water Watch. The Franciscan Federation declared to the Environmental Protection Agency that access to safe and clean water is "a free gift from God," and the National Coalition of American Nuns adopted a resolution, in the fall of 2006, that asked members to avoid drinking bottled water unless absolutely necessary. Their issue? Privatization of something so essential to life is immoral. An antiglobalization organization was traveling the country offering blind taste tests of bottled water versus tap. Their point—tap is pretty good—never fails to make the news.

Still, every week a new bottled water—offering the stuff neat or with "beneficial" additives (vitamins, herbs, laxatives, nicotine, caffeine, oxygen, appetite suppressants, aspirin, skin enhancers, or healing mantras)—hits the market. U.S. sales of bottled water leaped 170 percent between 1997 and 2006, from \$4 billion to \$10.8 billion. Globally, bottled water is a \$60-billion-a-year business. In 1987, U.S. per capita consumption of the stuff was 5.7 gallons; by 1997 it was 12.1 gallons; and in 2006, according to the Beverage Marketing Corporation, it was 27.6. Sales of bottled water have already surpassed

Water Experience 25 Assessment Rubrics

The weighting may be adjusted by the instructor. These suggestions may work for you or may not, depending on how much importance you have placed on each of the topics covered by the assignments.

- **Pre-Immersion Assignments & Participation: 40% of final mark**
- **Immersion Assignments & Participation: 40% of final mark**
(attendance & participation in activities mandatory)
- **Post-Immersion Assignments & Participation: 20% of final mark**

Session 1

Recreational Opportunities - Depth of ideas presented				This assignment is worth 5% of the final mark for the entire course. Multiply the result obtained here by 1.25 to obtain the true value. i.e. 3/4 = 3.75/5
Rubric				
4	3	2	1	
Students demonstrate a thorough understanding of key concepts. Descriptions are complete and in depth.	Students demonstrate a good understanding of key concepts. Descriptions are complete.	Students demonstrate a general understanding of key concepts. Descriptions lack some details.	Students indicate a lack of conceptual understanding. Issues are dealt with at a superficial level and/or in isolation.	

Session 2

49 Megawatts Reflection- Depth of response				This assignment is worth 5% of the final mark for the entire course. Multiply the result obtained here by 1.25 to obtain the true value. i.e. 3/4 = 3.75/5
4	3	2	1	
Reflection shows thorough thoughtfulness. Reflection has supporting details and examples. All parts of the reflection are complete and well done.	Reflection shows some thoughtfulness. Reflection has some supporting details and examples. All parts of the reflection are complete	Reflection shows little thoughtfulness. Reflection has few details or examples. Most parts of the reflection are complete.	Reflection shows no thoughtfulness. Reflection has no details. Reflection is incomplete.	

Session 3

Rubric EI & Monitoring Vocabulary - Completeness				
4	3	2	1	
Students have completed all parts of the assignment. Definitions are accurate and concise. It is tidy and easy to read and will serve well for reviewing. Sketches are very helpful in explaining the concepts.	Students have completed all parts of the assignment. Definitions are accurate. It is mostly tidy and easy to read and will serve well for reviewing. Sketches help to explain the concepts.	Students have completed all parts of the assignment. Definitions are mostly accurate. It is not tidy and easy to read and will be difficult to use for reviewing. Some sketches help to explain the concepts.	Students have not completed all parts of the assignment. Definitions are not accurate. It is not easy to read and will be difficult to use for reviewing. Sketches do not help to explain the concepts or are missing altogether.	
<p>This assignment is worth 10% of the final mark for the entire course. Multiply the result obtained here by 2.5 to obtain the true value.</p> <p>i.e. $3/4 = 7.5/10$</p>				

Session 4 or 5 (looking back on this session & previous ones)

Rubric Participation - Quality & Quantity of Dialogue / Ideas Shared				
4	3	2	1	
Students always demonstrate a willingness to share ideas on key concepts. Issues are dealt with in depth. Relevant connections to past experiences and prior knowledge are often made. In-class activities are always completed.	Students demonstrate a willingness to share ideas on key concepts. Issues are sometimes dealt with in depth. Connections to past experiences and prior knowledge are made. In-class activities are always completed.	Students sometimes demonstrate a willingness to share ideas on key concepts. Issues are not often dealt with in depth. Connections to past experiences and prior knowledge are not always relevant. Some in-class activities are completed.	Students indicate an unwillingness to share ideas on key concepts. Issues are dealt with at a superficial level. In-class activities are not completed.	
<p>Participation during the class discussions is worth 20% of the final mark for the entire course. Multiply the result obtained here by 5 to obtain the true value.</p> <p>i.e. $3/4 = 15/20$</p>				