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Dear Teachers;

According to Alberta Education, science education in Alberta will:

- Encourage students at all grade levels to develop a critical sense of wonder and curiosity about scientific and technological endeavours.
- Enable students to use science and technology to acquire new knowledge and solve problems, so they may improve the quality of their lives and the lives of others.
- Prepare students to address critically science related societal, economic, ethical and environmental issues.
- Provide students with a foundation in science that creates opportunities for them to pursue progressively higher levels of study, prepares them for science-related occupations, and engages them in science-related hobbies appropriate to their interests and abilities.
- Enable students, of varying aptitudes and interests, to develop knowledge of the wide spectrum of careers related to science, technology and the environment.

The North Saskatchewan Watershed Alliance hopes the ***Atlas of the North Saskatchewan River (NSR) Watershed in Alberta*** and the **Integrated Watershed Plan (IWMP) for the North Saskatchewan River in Alberta** will be useful in helping to attain these goals.

These resources contain data particularly suitable for science teachers and students in junior high schools in Alberta. Both documents offer real-life, western Canadian examples of the kinds of watershed issues explored in science classrooms.

Early in 2013, NSWA plans to create a series of lesson plans for grades 7, 8 and 9, based on these documents, so check back then. We will make the lesson plans available free of charge.

www.nswa.ab.ca

Suggested uses for the Watershed Atlas & IWMP in Alberta Junior High School Curriculum: Grade 7

Unit A: *Interactions and Ecosystems* (Social and Environmental Emphasis)

- In exploring the question: **How do human activities affect ecosystems?**
 - Atlas **page 3** – This page puts this question in context. We all live in a watershed. What we do when we live, work and play often affects ecosystems in ways that impact both water quality and quantity.
 - Atlas **page 4** – This page shows how far, geographically, impacts to watershed ecosystems are felt.
 - Atlas **page 15** – This page explains the function of riparian areas. Human activities that disrupt riparian function can impact riparian ecosystems negatively.
 - Atlas **pages 24 & 25** – These pages illustrate where drinking water, obtained from surface water, originates in the North Saskatchewan River (NSR) watershed. Every type of human activity has the potential to affect ecosystems that support the collection and dissemination of water in this watershed system.
 - Atlas **pages 28 & 29** – These pages show the increase in population within the NSR watershed in Alberta from 1905 to 2005. More people put more pressure on ecosystems in many ways. The following pages illustrate this.
 - Atlas **pages 36 & 37** – These pages illustrate what happens to wastewater created by human activity in the NSR watershed in Alberta.
 - Atlas **pages 38 & 39** – These pages show the extent of linear disturbance caused by human activity in the NSR watershed in Alberta.
 - Atlas **pages 40 & 41** – These pages show oil and gas well density in the NSR watershed in Alberta. This human activity affects ecosystem function in many ways.
 - Atlas **pages 44 & 45** – These pages show the percentage of agricultural land receiving manure application in the NSR watershed in Alberta. This human activity, part of the process that puts food on our plates, impacts many different ecosystems.
 - Atlas **pages 46 & 47** – These pages explain the potential risk of groundwater contamination that can result from human activity.
 - Atlas **pages 52 & 53** – These pages illustrate the extent to which Best Management Practices can reduce impact to watershed ecosystems.
 - Atlas **page 56** – These pages explain the purpose and make-up of Watershed Planning and Advisory Councils in Alberta and how they encourage stewardship activities.
 - IWMP **pages 12 to 15** – Goal 3: Aquatic ecosystem health in the NSR watershed is maintained or improved. The actions in this section point to watershed areas where human activity affects aquatic ecosystem health.

Suggested uses for the Watershed Atlas & IWMP in Alberta Junior High School Curriculum: Grade 8

Unit E: *Freshwater and Saltwater Systems* (Social and Environmental Emphasis)

- In exploring the question: **How do water, land and climate interact?**
- In describing the **distribution and characteristics of water in local and global environments.**
- In identifying the **significance of water supply and quality to the needs of humans and other living things.**
 - Atlas **page 3** – This page describes the hydrologic cycle and the structure and function of a watershed. Understanding these processes is foundational to understanding how water, land and climate interact.
 - Atlas **pages 6 & 7** – These pages show the distribution and characteristics of water in the NSR watershed in Alberta (local environment).
 - Atlas **page 8** – This page shows a table listing the trophic status of major lakes in the NSR watershed in Alberta. The trophic status of a lake is determined by the concentration of nitrogen, phosphorus and other biological nutrients in the water.
 - Atlas **pages 10 & 11** – These pages illustrate the characteristics, function and importance of wetlands in maintaining water quality and quantity in a watershed.
 - Atlas **page 12** – This page shows wetland status in one of the twelve sub watersheds in the NSR watershed in Alberta.
 - Atlas **pages 13 & 14** – These pages explain groundwater discharge and recharge and illustrates the location of groundwater discharge and recharge areas in the NSR watershed in Alberta.
 - Atlas **pages 16 to 20** – These pages explore the connection between climate and water yields.
 - Atlas **pages 30 to 33** – These pages discuss and illustrate water distribution and use in the NSR watershed in Alberta.
 - Atlas **pages 24 & 25** – These pages discuss and illustrate surface water supply in the NSR watershed in Alberta.
 - Atlas **pages 34 & 35** – These pages discuss and illustrate the distribution of water wells (ground water use) in the NSR watershed in Alberta.
 - Atlas **pages 46 & 47** – These pages discuss and illustrate the potential risk of groundwater contamination in the NSR watershed in Alberta.

 - IWMP **pages 10 & 11** – Goal 2: Instream flow needs of the NSR watershed are met. The actions in this section point out the importance of maintaining the water supply in the NSR in Alberta.

Suggested uses for the Watershed Atlas & IWMP in Alberta Junior High School Curriculum: Grade 9

Unit A: *Biological Diversity*

(Social and Environmental Emphasis)

- In exploring the question: **What impact does human activity have on biological diversity?**

*“Wetlands are among the most productive life-support systems in the world and are of immense socio-economic importance to mankind. They are critical for the maintenance of **biodiversity** and perform a great role in the biosphere. Ironically, wetlands have been perceived as wastelands associated with disease, difficulty and danger. Emphasizing the negative impacts and ignoring their importance, these habitats were considered obstacles in the path of progress and hence drained, filled, despoiled and degraded for economic gains. The wetland loss has been responsible for bringing to the verge of extinction countless species of animals and plants. Inadequate understanding of the crucial role and utility of wetlands is a matter of serious concern.”* Ramsar Convention on Wetlands

- Atlas **pages 10 to 12** – These pages give an overview of the characteristics and function of wetlands, describe the seven classes of wetlands. The map describes wetland status in the Vermilion River watershed (one of 12 sub watersheds in the NSR watershed in Alberta).
- Atlas **pages 26 & 27** – These pages discuss land cover and land use in the NSR watershed in Alberta. The map illustrates the various types of land use. Since biodiversity is generally more robust in wetland areas and in places where shrubs and trees predominate, it is easy to identify areas of the watershed where human activity has impacted biodiversity.
- Atlas **pages 28 & 29** – These pages give an overview of the increase in population in the NSR watershed in Alberta from 1905 to 2005. Increased human activity on the land increases pressure on resident natural biology. The map shows areas of the watershed where population density has most likely had an impact on biological diversity.
- Atlas **pages 38 & 39** – These pages show the density of linear features in the NSR watershed in Alberta. These include roads, railways, electrical transmission lines and pipelines. Constructing and maintaining this kind of infrastructure fragments the landscape and disturbs plant, animal, fish, bird and insect habitat. These linear features can increase public access in remote areas, which contributes to wildlife disturbance, erosion, damage to vegetation and the spread of invasive organisms.
- Atlas **pages 40 & 41** – These pages show oil and gas well density in the NSR watershed in Alberta. Increase of human activity in areas of heavy well density can contribute to a reduction in biological diversity.
- Atlas **pages 50 to 55** – This section of the atlas (Protecting the Watershed) discusses Forest Management Areas, Protected Areas, Best Management Practice Adoption and Provincial Policy and Planning Initiatives.
- IWMP **pages 8 & 9** – Goal 1: Water quality in the North Saskatchewan River watershed is maintained or improved. When human activity affects water quality in aquatic ecosystems, it impacts directly the biodiversity within those systems. This goal highlights areas where impacts of human activity in the NSR watershed need to be addressed.

Suggested uses for the Watershed Atlas & IWMP in Alberta Junior High School Curriculum:

Grade 9

Unit C: *Environmental Chemistry*

(Social and Environmental Emphasis)

- In exploring the question: **What substances do we find in local and global environments?**
- In describing **what role do substances play, and how do changes in their concentration and distribution affect living things.**
 - Atlas **pages 7 & 8** – These pages introduce the concept of how changes in phosphorus levels in recreational lakes affect their trophic ranking.
 - Atlas **pages 10 to 12** – These pages discuss wetland ability to remove chemicals (nutrients from fertilizers, chemical contaminants, metals) from the environment.
 - Atlas **pages 36 & 37** – These pages introduce the general role played by wastewater treatment. Changes in the concentration of substances both within the wastewater stream and in the products used to treat wastewater affect living things in many different ways.
 - Atlas **pages 44 & 45** – These pages illustrate the use of manure on the land within the NSR watershed in Alberta. The chemical substances in manure that benefit crops can also contaminate creeks and streams if carried away by run-off.
 - Atlas **pages 46 & 47** – These pages present the potential risk of groundwater contamination. Natural chemical substances in the environment (iron, calcium, sulfur) are found in different concentrations in groundwater. Changes in the concentrations of these substances, while not dangerous to biological health, can change the desirability of groundwater for human use. Human activity introduces other chemicals into the environment. Many of these cause contamination when found in groundwater in heavy concentrations. E.g. nitrogen, phosphorus, petrochemicals.
 - Atlas **pages 52 & 53** – These pages introduce the concept of Best Management Practices. These are adopted by the agricultural industry to balance the beneficial use of chemical substances on the landscape with the detrimental effect that can result from careless distribution and heavy concentrations of chemical substances on land and in water.
 - IWMP **pages 16 & 17** – Goal 4: The quality and quantity of non-saline groundwater are maintained and protected for human consumption and other uses. Salts enter groundwater naturally through dissolution of soil, rock, and organic material. The level of concentration of salts in groundwater determines suitability for human use.

The North Saskatchewan Watershed Alliance has other resources that may also be useful to science teachers and students in junior high school. These can be found on the NSWA website under “Resources”