WEST NOSE CREEK WATERSHED RESEARCH NEWS

February 2007

UNIVERSITY OF CALGARY

"Monitoring is key to sustainable management"

Groundwater is an integral part of the hydrological cycle and represents a series of complex relationships between creeks, wetlands, precipitation, and the water in our homes. These relationships are dynamic, meaning that they change from season to season, year to year, and place to place. A thorough understanding of these relationships is required to understand groundwater availability and manage groundwater in a sustainable way.

Sustainability can be defined as: meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. Thus, sustainable management requires long-term thinking, and long-term monitoring. This is especially true with respect to groundwater, where natural drought and climate cycles can make for large fluctuations in groundwater levels which even out over the long-term.

Our well network has been gaining attention as a low-cost and effective way of monitoring groundwater levels on a continual basis. Over the past few months, Masaki has presented some of our findings at a watershed meeting at Big Hill Springs, and at a municipal council meeting for the MD of Rockyview. There is significant interest in setting up similar monitoring programs in other watersheds within the MD of Rockyview, with work potentially beginning as early as this summer.

Thank you for your continued support in this ongoing project and for helping to set a standard for watershed monitoring, modeling and management in Alberta.

Surface and Groundwater Interaction

Water Table: level below ground where sediments are saturated with water

Recharge: precipitation or runoff that infiltrates the soil to the water table.

Discharge: the process of groundwater flowing to the surface. Discharge occurs where the water table intersects the ground surface.

Groundwater and surface water are interconnected. The creek is in a discharge area, which means that the minimum summer flow, or base flow, is controlled by springs flowing into the creek and groundwater entering through the creek bed. The photo above shows researchers measuring the base flow at West Nose Creek.

Chemistry and Recharge Areas

Chemical analysis of water samples taken as part of Lisa Grieef's thesis indicate that water used for domestic purposes within the watershed makes up a local, relatively young flow system. This means that groundwater is being re-charged within the watershed or its viscinity rather than recharging on a more regional scale some-where further to the west.

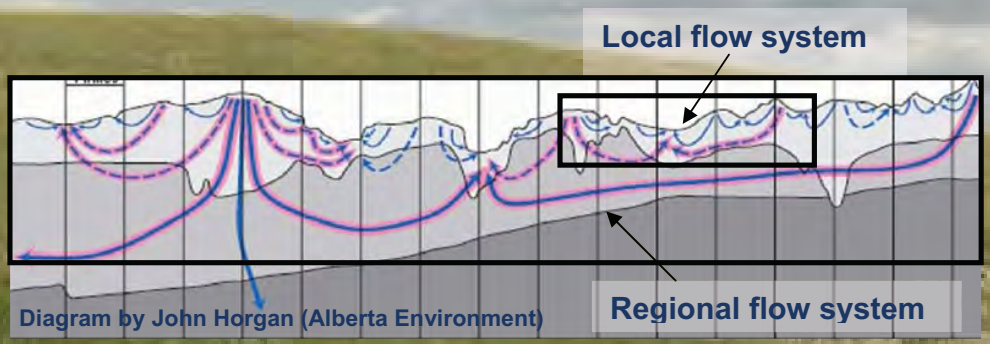
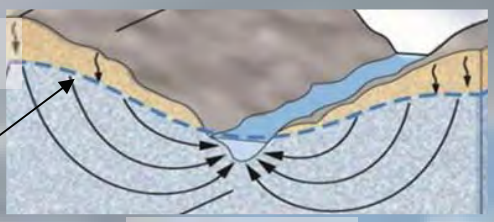


Diagram by John Horgan (Alberta Environment)

Potential recharge areas in the watershed include upland depressions located on pastures (below, left) or croplands (below right).

Recharge is influenced by human activities, both in terms of the quality and quantity of water. Lisa's research found that some of the domestic well water in the watershed contains water that is about 50 years old. This is young water that was recharged relatively recently and may be vulnerable to human pollution. Because the water is recharged within the watershed, local land-use is important to the quality and availability of groundwater. Consequently, the implementation of measures to protect source water would be beneficial in the watershed.

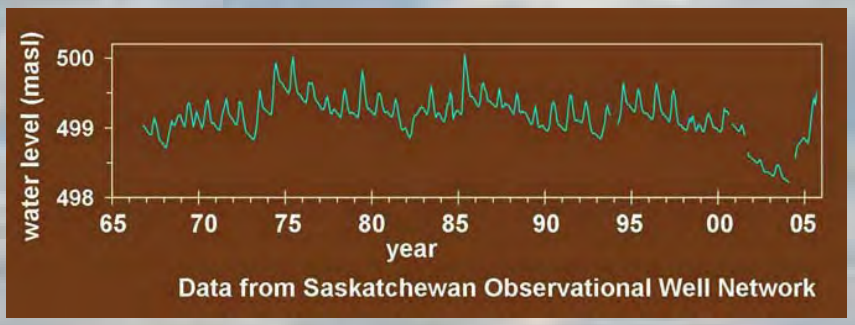
WATER BALANCE: THE BASIS OF SUSTAINABILITY



Recharge – Discharge
=
Storage Change
(Water table moves up or down)

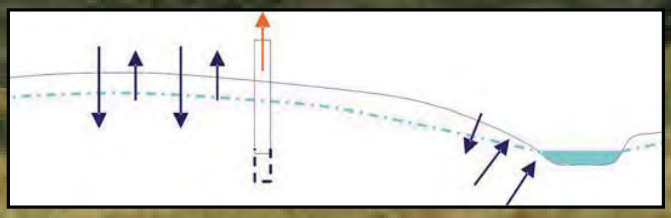
Over the long term, the undisturbed aquifer reaches a steady-state where:
Recharge – Discharge = 0

The graph to the right shows water levels in an 'undisturbed' prairie aquifer in Saskatchewan. Levels fluctuate over the years, but over the long term they are reasonably steady.



When Pumping is added, the water balance changes:

Recharge – Discharge –
PUMPING
=
Storage Change (up or down)



Over time, a new steady state is reached, although the average water level will be lower. It could drop low enough that there is a significant reduction in natural discharge, which would decrease surface water levels and flows in creeks, springs and wetlands.

The graph to the left shows water levels in the Irricana well east of the Nose Creek Watershed. This is an example of consistently dropping water levels as a result of unsustainable pumping.

In order for a steady state to be reached, pumping must remain substantially smaller than recharge. At steady state, over the long-term:
Recharge – Discharge – Pumping = 0

Any change in conditions, such as changes in land use, urbanization, locations of wells, incorporation of new water supplies or climate change will affect the water balance and the sustainable pumping rate. This is why continued monitoring, analysis and reassessment are necessary to understanding water availability. This understanding is important in the development of management plans that ensure water availability for generations to come.

Contact Information:

Karen Miller
(403) 220-2495
kmiller@ucalgary.ca

Dr. Masaki Hayashi
(403) 220-2794
hayashi@ucalgary.ca

Please feel free to contact us if you have any questions!

Where to learn more:

- Alberta Stewardship Network: http://www.ab.stewardshipcanada.ca/stewardshipcanada/home/scnABIndex.asp
- Nose Creek Watershed Partnership: http://www.airdrie.com/Content/environment/nosecreek/home.html
- Cows and Fish: http://www.cowsandfish.org/
- Prairie Water News: http://www.quantumlynx.com/water/
- Focus on Groundwater: http://environment.gov.ab.ca/info/library/Focus_On_Groundwater.pdf

We would like to acknowledge the following for their funding and support: Alberta Environment Climate Change Research User Group, Alberta Ingenuity Centre for Water Research, Canada-Alberta Water Supply Expansion Program, Environment Canada Science Horizons Program, Geological Survey of Canada, Natural Sciences and Engineering Research Council, and Prairie Farm Rehabilitation Administration Rural Water Development Program. We would also like to thank Tim Dietzler from the MD of Rockyview.

Most of all, we'd like to thank the rural well owners and community members of the West Nose Creek Watershed.