

WATERSHED-BASED RESEARCH



GROUNDWATER CONNECTION FACT SHEET SERIES

The importance of water resource development in Alberta

In southern Alberta, surface water is allocated through a licensing procedure. Currently there are no new surface water licenses available in some watersheds (e.g. Bow River), which suggest a potential for increased groundwater use. The majority of the rural population in Rocky View County relies on groundwater not only for domestic purposes, but for agricultural, commercial and industrial activities.

An important fact is that groundwater and surface water are connected. Therefore, to ensure sustainable development, groundwater extraction must be understood in the context of the entire water system. As groundwater is pumped for human use, a balance must be achieved to ensure enough water is available for current and future users, and aquatic ecosystems. However, since groundwater cannot be seen, research must be conducted to understand where the aquifers are located and how they respond to recharge and pumping events. This type of information is generally collected when a new well is drilled.

How much groundwater can we pump?

A pumping test is used to determine the permissible pumping rate for wells in Alberta. During this test the well is pumped for 2 to 48 hours and the drop in water level (drawdown) is recorded (Figure 1 - page 2). The pump is then turned off and the time it takes for the well to recover, to its original (static) water level, is recorded. This information is used to determine the projected drawdown in the well over the next 20 years. This allows for a pumping rate to be set, which ensures an appropriate drawdown is maintained. One challenge with this method is that it is conducted once for a short period of time, which might not represent different seasons or circumstances. In addition, the method makes an assumption of only one well located in an aquifer. With the changing landscape and increased rural development, this assumption may not be accurate anymore. Therefore, new techniques are being explored as alternative options, such as the watershed-based approach.

DRAWDOWN:

- The lowering of the water level in an aquifer due to the pumping of groundwater.

WATERSHED:

- The area of land that drains water to a particular stream, river or lake (relates to *surface water* boundaries).

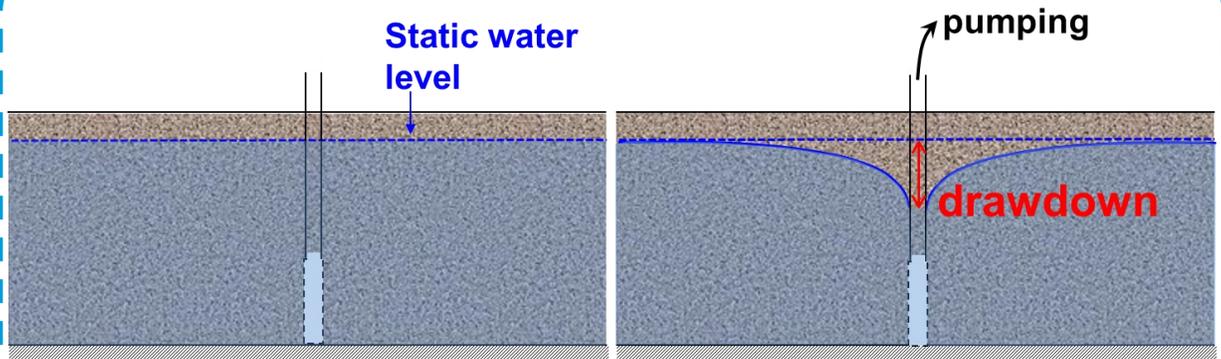


Figure 1: Illustration of a pumping test showing the rate of drawdown in an idealized aquifer with the water table close to the ground surface.

What is the watershed-based approach?

The watershed-based approach (Figure 2) is an approach that considers the water system as a whole and typically is a long-term monitoring project. The flow of groundwater within and between aquifers is considered; in addition to the groundwater-surface water interaction. Therefore, the watershed as a hydrologic unit is examined instead of a single aquifer. The watershed-based approach monitors groundwater wells at different depths, as well as surface water within the selected watershed(s).

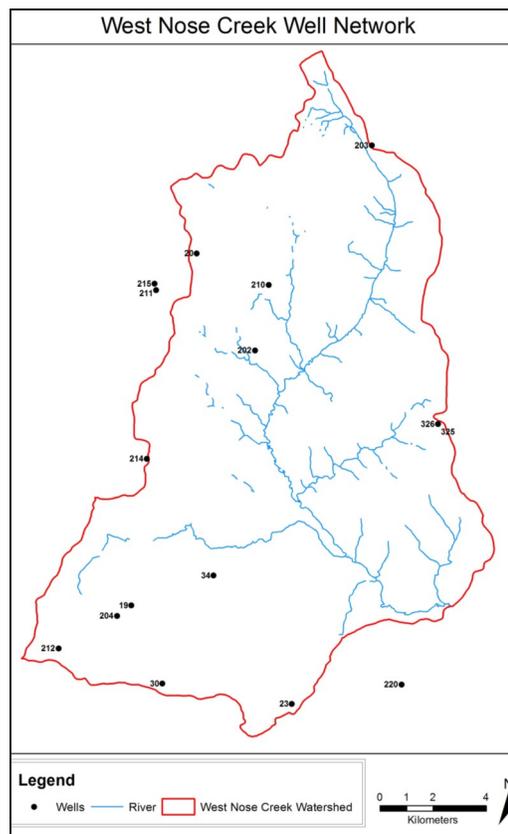


Figure 2: An example of using a watershed-based approach well network for groundwater monitoring in West Nose Creek Watershed located north of Calgary.

What are the benefits of a watershed-based approach?

The watershed-based approach takes into consideration the watershed as a whole, both surface and groundwater. It is a long-term monitoring program, which provides information about the trends in the hydrologic processes within the study area. The baseline data collected can illustrate both seasonal and inter-annual fluctuations as well as potential human impact. This data can allow for water resource concerns to be addressed prior to long-term impacts on the aquifer. This approach allows for continual monitoring of water resources, which is important for sustainable development decisions to be made.

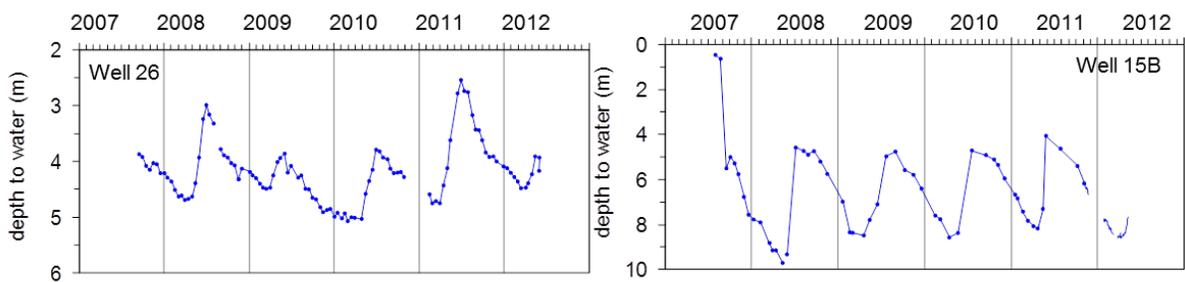


Figure 3: Graphs from a long-term monitoring project. Both graphs indicate seasonal patterns of recharge in spring and early summer and discharge during the rest of the year. The left graph also shows differences between years (inter-annual variation) due to different amounts of recharge.

What are the challenges of a watershed-based approach?

The biggest challenge with a watershed-based approach is the cost associated with a long-term monitoring project that involves both wells and a surface water location. The drilling and maintenance of monitoring wells is expensive, and the number required for a well network makes this type of monitoring system inaccessible to many municipalities. Therefore, one solution is to combine the watershed-based approach with a community-based project to use wells drilled for domestic and stock purposes.

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