

Performance Indicator Summary

Performance indicator: Infrastructure PI

Technical Workgroup: Water Uses TWG

Research by: Carrière and Barbeau.

Modeled by: Bill Werick in the STELLA Shared Vision Model

Activity represented by this indicator: Drinking water production plants infrastructure costs required to adapt to levels lower than the critical level identified.

Link to water levels: The drinking water production plants are directly linked to water levels with regard to the availability of water for withdrawal. For the nominal production of the plants (maximum), critical River levels were calculated. Below these levels, plants would have to modify their infrastructure to maintain design withdrawal. As the actual levels are smaller than the maximum levels, the reach of the critical level can be seen as an alarm that triggers the investment costs. Although the costs associated to this PI were not systematically invested during past events that triggered the PI, major investment took place and those events were considered serious alarm signs.

Importance: Drinking water production plants are of primary importance for society. This performance indicator presents the costs of adaptation, which is possible but takes some time, to place this interest in perspective with the others. This indicator is very important but the vulnerability is quite low (high risk, low vulnerability).

Performance Indicator Metrics: The PI is expressed in terms of \$Can for various water levels at Pointe-Claire (m).

Temporal validity: It is valid all year long.

Spatial validity: Valid for the Lower St. Lawrence between Lake St. Louis and Lake St. Pierre.

Links with hydrology used to create the PI algorithm:

Critical water levels can be reached in two different ways (Figure 1):

- 1) Low water levels in the River limit the depth of water in the wells, thus reducing the pumping capacity and finally the production of drinking water. The greater the flow withdrawn, the larger the difference between the level in the River and in the well. A minimum depth of water must be maintained in the well for the proper operation of pumps.
- 2) Low water levels can also result in the emergence of intake structures in very shallow areas, thus impeding withdrawal.

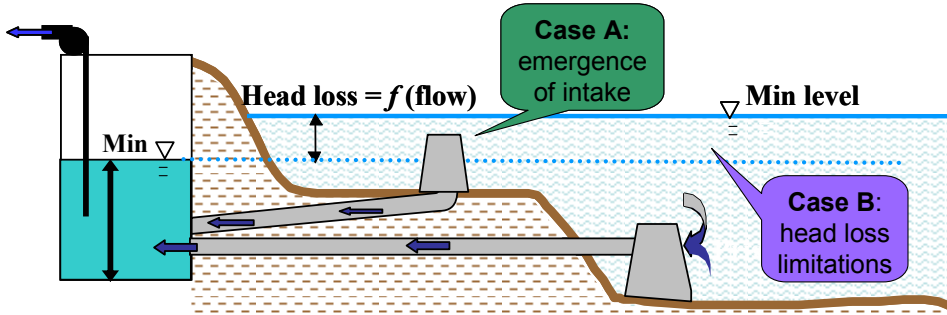


Figure 1: Conditions limiting water levels for water treatment plants

The costs of modifying the infrastructure to accommodate lower water level were calculated for the 6 most vulnerable plants. These costs are presented on Figure 2 as a relation to the water level at Pointe-Claire. The hydraulic model produced by Environment Canada was used to convert critical water levels to levels at Pointe-Claire.

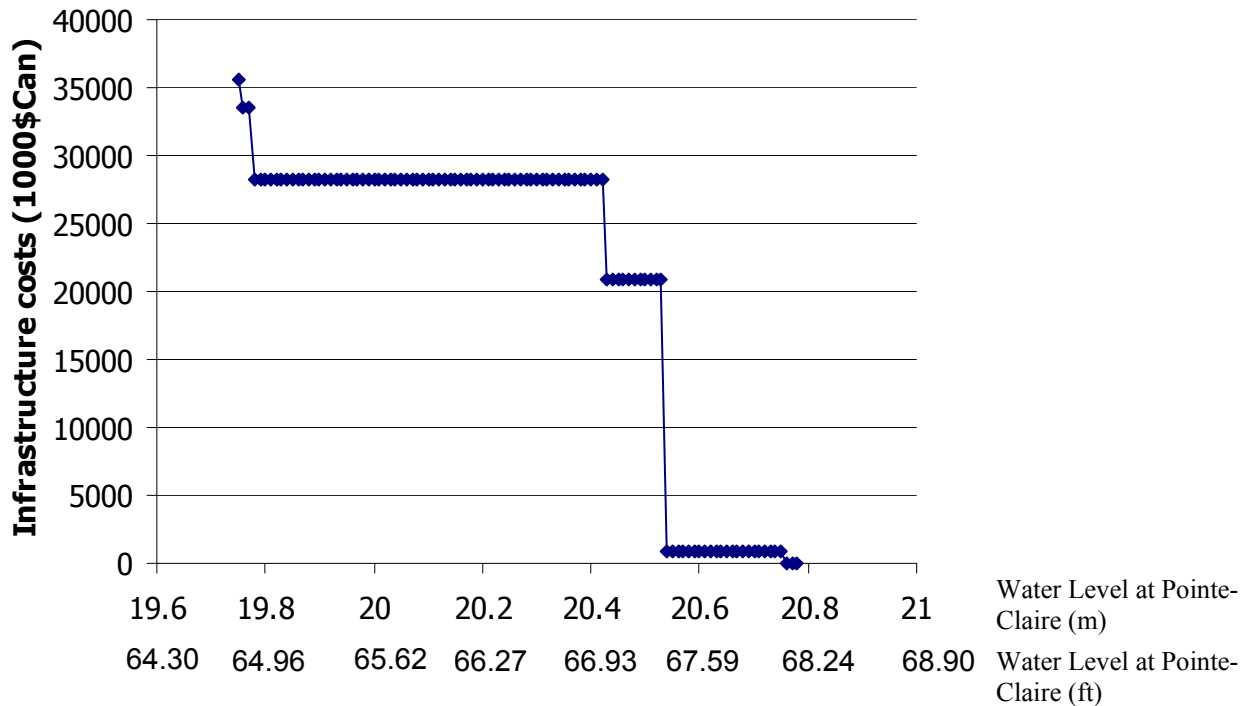


Figure 2: Infrastructure costs associated to water levels at Pointe-Claire

Validation: The validation of the critical level calculations was done based on data couples gathered in 2003 (water levels and pumped flow). The cost information was obtained from an EPA report on infrastructure costs and are only estimates. One cost was provided separately, the infrastructure cost for the Montreal plant (Gagné, 2003).

Documentation and References:

The Cadmus Group, Inc. 2001. *1999 Drinking Water Infrastructure Needs Survey, Modeling the Cost of Infrastructure*. Report presented to the Environment Protection Agency Office of Ground Water and Drinking Water.

Barbeau, B. & Carrière, A. 2003. *Impacts of level fluctuations in the St. Lawrence River on water treatment plant operation*. Report presented to the International Joint Commission.

Gagné, M. 2003. Personal communication. Director of the Montreal drinking water treatment plants.

Risk and uncertainty assessment: This PI is a good estimate of the impacts of water levels on municipal drinking water plants. The total costs could be used to evaluate the various plans. However, this PI should also be used:

1. to highlight the low vulnerability but the high risk impacts of low water levels on infrastructure
2. to prepare for eventual (potential) situations. Adaptations measures represent an alternative but need to be planned ahead of time.

This PI can be used to distinguish a good 101 years from a bad 101 years. This PI does not take into consideration other adaptation measures that could lower vulnerability such as reducing water demand for the sake of equity among the various interest groups. Those strategies are however considered simultaneously at a different action level.