

Performance Indicator Summary

Performance indicator: Number of flooded residential buildings

Technical Workgroup: Coastal TWG – Lower river

Research by: Environment Canada, Meteorological Service of Canada – Hydrology (Bernard Doyon *et al.*)

Modeled by: B. Doyon (in the Flood Damage Assessment System), and also B. Werick (in the STELLA Shared Vision Model)

Activity represented by this indicator: For a given water level, this Performance Indicator allows the appraisal of the number of flooded residential buildings among properties located within the St. Lawrence River 100-year floodplain. Thus, when used in conjunction with the PI allowing assessment of the damage on residential buildings, this PI gives a better understanding of the extent of the damage.



Link to water levels: A residence is considered to be flooded when it is partially or entirely surrounded by water, **and** when the water level is equal to or higher than the elevation of the residence's lowest opening – allowing the water to flow into the house.

Importance: We believe that economic PI are not sufficient to fully describe the impacts of a flood on communities and therefore societal PI – such as the number of flooded residences – have been established to form the basis of a socio-economic assessment tool for flooding. As a result, some PI measure the damage in terms of dollars while others account for societal aspects of the damage. However, they all reflect direct damage.

Performance Indicator Metrics: Number of residences.

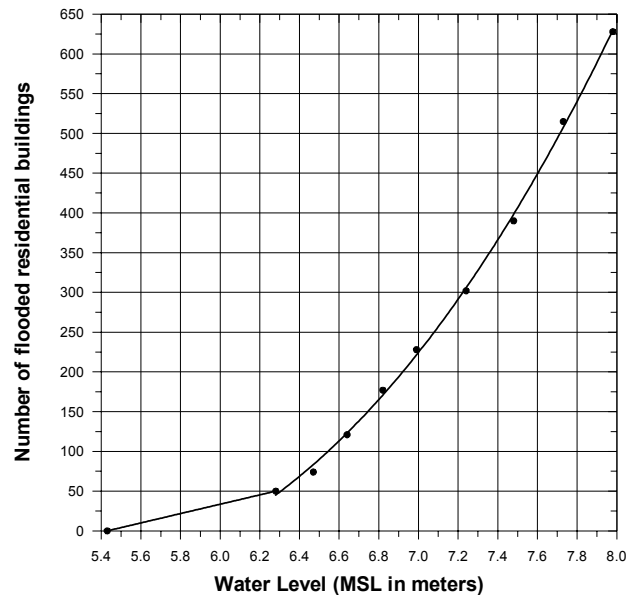
Temporal validity: We recommend using this PI in conjunction with the PI allowing assessment of the damage on residential buildings. Therefore, the temporal validity of this PI is limited to the temporal validity of the latter, *i.e.* usually around 15 to 20 years. It is important to note that this PI loses some accuracy as time goes by because the owners gradually apply mitigation measures against flooding to their property – such as raising the house or building an appropriate dike.

Spatial validity: Exactly the same as the PI allowing assessment of the damage on residential buildings, *i.e.* that one impact function has been developed for every

municipality where at least one building lies within the 100-year floodplain. Each impact function is geo-referenced and associated with a specific hydrometric station. The impact functions are not interchangeable.

Links with hydrology used to create the PI algorithm: Each impact function is constructed by aggregating the number of flooded residential buildings of a given municipality for different water levels. Once the curve is complete, the number of flooded residences for a municipality is simply obtained by reading on the graph the number of flooded houses corresponding to the water level observed at the associated hydrometric station.

As with the other flooding PI, each impact function is site-specific, *i.e.* it allows the appraisal of the number of flooded residences for a given municipality. Thus, the function must be solved at the location of its corresponding hydrometric station.



The Algorithm: The number of flooded houses can be evaluated at any time during a simulation and for any water level. However, it is more appropriate to use this PI in conjunction with the PI allowing assessment of the damage on residential buildings. Therefore, the number of flooded houses should be evaluated when the water level is peaking. Assessing the number of flooded residential buildings associated with the maximum water level provides a better understanding of the extent of the damage.

Validation: The PI allowing the assessment of the number of flooded residential buildings has been validated with the data coming from the last major flood event of 1998. The data used for the validation were based on an interview survey of riparian owners who experienced the 1998 spring flood. Other data also came from the municipalities involved in the 1998 flood. The impact functions gave results that compared favorably to the number of flooded properties observed during the flood.

Documentation and References:

Doyon, B., Dallaire, É., Roy, N., Morin, A. and J.-P. Côté (2004). Estimation des dommages résidentiels consécutifs aux crues du fleuve Saint-Laurent. Technical Report MSC Quebec Region – Hydrology RT-133, Environment Canada, Ste-Foy, 41 pages (in French).

Doyon, B., Morin, A., Roy, N., Dallaire, É. and J.-P. Côté (2004). Assessment of Flood Damage: Impact Functions for the Lower St. Lawrence. Technical Report MSC

Quebec Region – Hydrology RT-128, Environment Canada, Ste-Foy, 27 pages + Appendix.

Risk and uncertainty assessment: We are confident that this PI will allow a good appraisal of the number of flooded residential buildings for most municipalities. However, it is important to underline the fact that not every municipality provided us with data on the 1998 flood – some of them did not keep track of this information while others simply did not get flooded during the spring of 1998. Therefore, some impact functions representing this PI could not be directly validated. However, all the impact functions were constructed using the same technique which should prevent any bias.