

Sediment Budget Performance Indicator Summary

Performance Indicator: Sediment Budget

Technical Workgroup: Coastal TWG

Researched by: Baird & Associates

Modeled by: Modeling was completed by Baird & Associates with the Flood and Erosion Prediction System (FEPS) to quantify the influence of different Regulation Plans on regional Sediment Budgets. This work consisted of calculating the rate of shoreline recession for 1 km reaches (segments of shore), then converting this to a volume of sediment entering the littoral system by considering the average bluff height per km and the percentage of sand and gravel in the soil. Plans that accelerated the background erosion rate resulted in more new material entering the nearshore zone and available for downdrift beaches. This preliminary work was used to refine the concepts discussed below for the Sediment Budget Performance Indicator.

Activity represented by this indicator: Shoreline erosion is a natural process that occurs throughout the study boundaries, the entire Great Lakes system and many the world's beaches and bluff coastlines. Although water levels on Lake Ontario have fluctuated significantly in the last 10,000 years, they have stabilized in the last few thousand years to the present measured range. Consequently, natural processes have been eroding the study shoreline (lake and river) long before European settlement began. Refer to the adjacent photograph of a typical eroding bluff in Northumberland Regional Municipality, north shore of Lake Ontario. Shoreline erosion is vital for the creation of new sand and gravel for the nearshore zone, which ultimately supplies the beach/dune environments and barrier beaches. See the Barrier Beaches and Dunes PI summary for a discussion on the importance of Barrier Beaches on Lake Ontario.

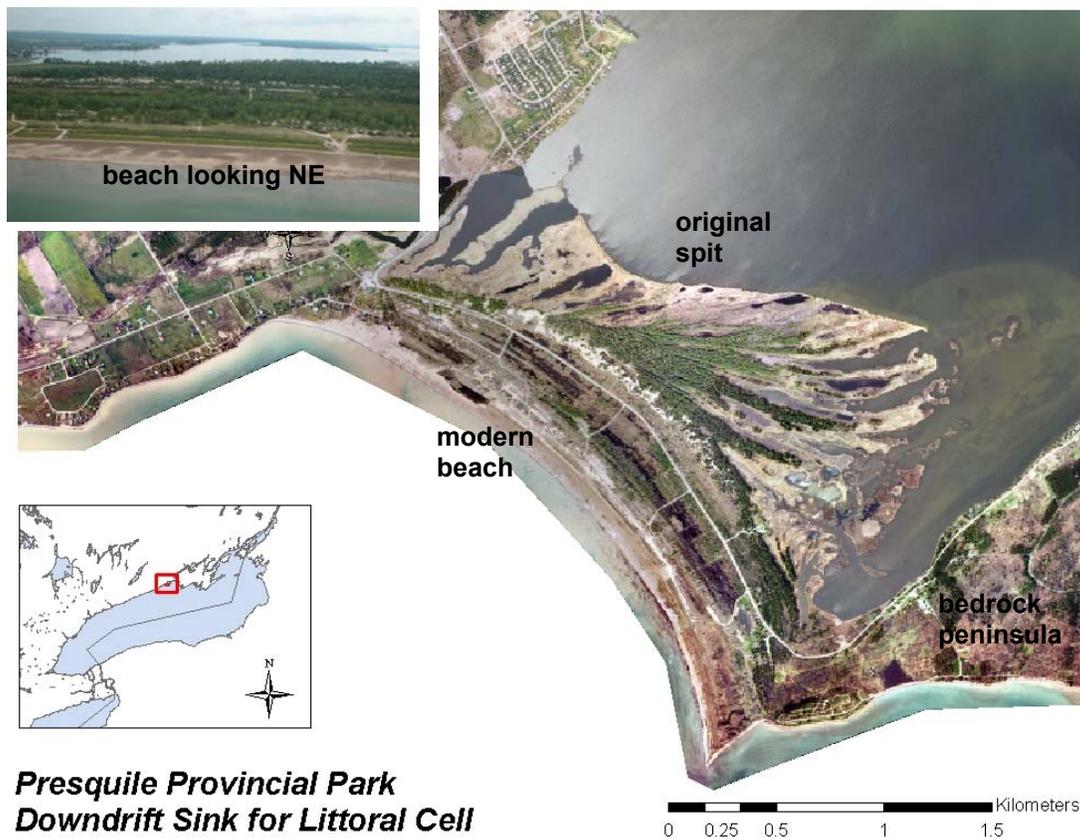


Consequently, shoreline erosion is an important natural process on Lake Ontario and it started long before the construction of the Moses Saunders Power Dam. This PI was created to educate the study participants and riparian community on the benefits of the natural background erosion rate.

When evaluating shore erosion and the creation of new sand and gravel sources in a regional context, the concept of Sediment Budgets is often used. Like a financial budget, a sediment budget is an accounting system for all the sand and gravel within a defined study boundary (spatial extents). Littoral cells are closed sediment compartments that

define the limits of all sand movement, both along the shore and onshore/offshore. Consequently, the limits of a littoral cell make good spatial boundaries for Sediment Budgets.

The term Sediment Budgets was adopted to describe this Performance Indicator, which addresses the beneficial components of shoreline erosion. For example, when storm waves strike a bluff shoreline (such as the conditions above), the driving force of the associated wave energy often exceeds the resisting properties of the soils, resulting in erosion and shoreline recession. If the eroding shoreline belongs to a riparian, there is a loss to the owner, as his total acreage decreases. Generally, shoreline recession is not reversible, and consequently the riparian will not be able to reclaim the lost land. However, for many parts of study area, such as the north shore of Lake Ontario, erosion is a natural process that supplies new sand and gravel to nourish barrier beaches and dune environments. For example, the aerial photograph below documents the progressive beach ridges of Presquile Provincial Park, which eventually attached to the bedrock peninsula to the south east. Erosion of the bluffs like the one illustrated on page one west of Presquile provided the material for this depositional feature. Wave generated currents



**Presquile Provincial Park
Downdrift Sink for Littoral Cell**

transported the sand and gravel to the east, where it eventually built the successive beach ridges in the spit. The feature provides extremely valuable habitat for shore birds and other fauna and flora. Plus the lake side of Presquile is a popular beach destination during the summer months. Without natural background erosion rates on Lake Ontario,

the north shore would no longer provide the sediment (predominantly sand) that is required for this feature to maintain its present morphology.

Link to water level: During periods of high lake levels, shorelines erode at rates greater than the long term, background rate. During these periods, additional sediment is added to the littoral system. However, during periods of low lake levels, the shoreline may be stable but the lake bed will continue to erode, although at a slower rate, and also add new sand and gravel to the littoral system. Since silt and clay size particles are not stable on beaches, they are transported and deposited to deep areas of the lake in water depths greater than 10 m or 30 ft.

Performance Indicator Metric: No metric was developed for this Performance Indicator and no criteria will be developed to accelerate background erosion rates for Lake Ontario. Rather, this PI was developed to make clear the valuable contribution of shoreline erosion to barrier beaches and dunes, and to explain the rationale for not developing a regulation plan that eliminates all shoreline erosion.

Temporal validity: All seasons.

Spatial validity: The entire shoreline of Lake Ontario. Not applicable to the Upper St. Lawrence River.

Links with hydrology used to create the PI algorithm: No links to hydrology.

The Algorithm: No PI algorithm (see discussion above on metric).

Validation: No validation required.

Documentation and References:

Baird, (in preparation). *Lake Ontario and Upper St. Lawrence River Detailed Study Sites*. Prepared for the Coastal TWG.

Baird, 2005. *Barrier Beaches and Dunes Performance Indicator*. Prepared for the Coastal TWG.

Risk and uncertainty assessment: n/a.