The Trent-Severn Waterway

From birth to the present…

Construction of the Trent-Severn Waterway

Building of the Trent-Severn Waterway National Historic Site of Canada began in the late 18th century with construction of small dams and water powered mills at many locations throughout south central Ontario. The emergence of a logging industry in the early part of the 19th century added to the number of dams with large associated timber slides to move logs from the interior of Upper Canada to Lake Ontario for shipment to Great Britain and the United States.

The vision of a navigable waterway stretching from Lake Ontario to Georgian Bay emerged gradually as settlement of Upper Canada expanded and took greater root in the post War of 1812-14 period when alternatives to moving people and goods along the common border between the United States and Upper and Lower Canada were thought to be strategically prudent.

The first lock in what was to become the Trent-Severn Waterway was constructed at Bobcaygeon in 1833 followed by dams and locks to permit navigation between the Kawartha Lakes and also between stretches of the Trent River. Lock and dam construction and reconstruction continued intermittently for a number of decades as legislatures voted funds for various projects. Although the vision for through navigation always existed, it was not until the late 1880's that this vision was confirmed by government as a result of recommendations of a Commission established by Prime Minister John A. MacDonald.

Construction of all the dams and locks to permit through navigation was completed in 1920 with the opening of the section between Lake Simcoe and Georgian Bay along the Severn River. The result was a 386-kilometre waterway comprising 42 conventional locks, two large flight locks, two hydraulic lift locks and a marine railway. It crosses two large southern Ontario watersheds following the courses of the Trent, Otonabee and Severn Rivers. Only a small portion of the waterway is a "made" system with constructed canals. Most of the waterway traverses natural lakes and rivers where navigation levels are maintained by dams associated with the locks.

Managing Water for the Trent-Severn Waterway

Background

In the pre-settlement period, navigation for any distance between the lakes and along the rivers was not possible except for shallow draught vessels. To overcome this, a network of dams was constructed, later in association with locks, to raise water levels. These dams were initially crude affairs constructed to facilitate the movement of logs however they were gradually replaced by dams more suited to the requirements of navigation.

These dams did not, however, address the seasonal fluctuations of water levels throughout the watersheds. High Spring freshet water levels dropped gradually through summer evaporation of sometimes as much as 2 cm. a day to lower levels as the summer navigation season progressed. Without active intervention, water levels would have generally declined in most sections of the waterway to below minimum navigation levels.

The architects of the system recognized by the mid 19th century that a reservoir system would be required to recharge the lakes and rivers of the main system in the later summer if navigation was to continue during that period. This recognition was formalized in 1905 and 1906 through the

transfer of a series of dams and other works in the northern portion of the watersheds from the Province to the Federal Government. The Orders-in-Council that transferred this works explicitly acknowledged that the transfers were to benefit operation of the Trent-Severn Waterway. The Orders-in-Council also designated the waters in the lakes and rivers listed in these instruments as "reservoirs" for the Trent-Severn Waterway.

The Broad Cycle of Water Management

Altogether there are approximately 160 water control structures along the main system of the waterway and associated with the lakes and rivers that make up the reservoir system. These structures include dams that may be adjusted to maintain water levels by regulating flows and levels. The vast majority of these dams were constructed many decades ago and are adjusted manually through the addition of one-foot stop logs with the capacity in some instances to add a single six-inch stop log. Some more recent dam reconstructions have substituted the manual stop log approach with hydraulic gates that may be adjusted more finely.

The other water control structures are fixed barriers that may not be adjusted but are necessary to block off subsidiary outflow streams to maintain lake and river levels.

Active water management takes place on both an annual cycle and in response to changing meteorological conditions throughout the watershed. In the annual cycle lakes are drawn down in the fall and early winter in order to accommodate the spring freshet and avoid flooding. In late winter and early spring, the lakes are recharged from the freshet. As the summer progresses, evaporation reduces levels in the main system and water is drawn from the reservoir lakes to maintain navigation levels along the navigation route. Draw down of the reservoir lakes is formula driven based on an equal percentage drawdown of each lake in order to share the draw down impact among the many lakes. Of course, this has different visual and other impacts according to the bottom profile of the lake.

Water management staff uses a variety of tools to guide their decision-making. Formal "rule curves" have been developed for the Lake Simcoe/Severn River watershed. For the Trent River watershed, less formal "Annual Cycle Models" have been developed for most of the major lakes that plot the target levels over the course of a year. These "models" have resulted from analysis of more than 80 years of water level records and adjusted to reflect a range of local conditions and experiences. Second, staff rely on a network of water level gauges that are monitored – some manually but most remotely. The real time data from many of these gauges may be found on the Trent-Severn website.[1] Snow pack monitoring occurs over the winter in an effort to predict the amount of spring run-off.

When there is a requirement to adjust levels and flows, staff add or remove stop logs and adjust the hydraulic dams. During the navigation season, this is done by lock staff and a relatively high level of coordination can be achieved particularly for the dams found in conjunction with the locks. Dams in the reservoir lakes are sequentially adjusted by a Haliburton-based crew that travels by vehicle and sometimes by boat to reach dams spread out over a large geographic area. In the non-navigation season, staffing levels only permit sequential adjustment on the main system.

Water is also actively managed in response to significant events that can be watershed-wide or very localized. These events can include heavy rains, mid winter thaws or extreme cold that results in the build up of frazil ice at some locations along the Otonabee and Trent Rivers. In response to these conditions, essentially the same process occurs although more rapidly.

A Changing Operating Environment – The Competition for Water

Competition for water has always been a feature of waterway operation, as have concerns about flooding and water level fluctuations. Research by the Panel on the Future of the Trent-Severn Waterway documented disputes over water privileges as far back as the 1840's to 1870's. "Millers, loggers and steamboat operators pressured government to regulate to suit their own specific needs."[2]

Over the decades, however, the operating environment for water management has become increasingly complex. When the reservoir lakes were conceived, for example, there was little permanent settlement in the Haliburton region. Since the 1930's, the Haliburton lakes have become one of the most important cottage regions in the Province and, more recently, significant shifts toward year round residency on these lakes have been occurring. The rustic cottage has given way to high value real estate. Similar development has been occurring along the main system with farmlands and natural areas being replaced by cottages and resorts and, more recently, by permanent residences.

Proximity to the shoreline confers very high property value along the thousands of kilometres of shoreline. The resident of a home along the shoreline who has paid hundreds of thousands if not millions of dollars for their property is understandably anxious to insure that they have water, and those in the reservoir lakes are less pleased to see their water moved south to provide for navigation for boaters and maintenance of water levels for other home owners.

Cities and towns, more than 50 of them, have developed along the shores of the lakes and rivers with associated infrastructure and increasing demands to draw water from the system for domestic and commercial use. Public use of the system for more than just through navigation has also increased at a similar pace. The Trent-Severn region fishery is one of the most important in the Province with an economic value estimated at hundreds of millions of dollars annually.

Economic development agencies in the Lake Simcoe area have estimated the economic value of the Lake at over a billion dollars. More than 2000 businesses can be found along the nearly 5,000 linear kilometres of shoreline in the main system serving hundreds of thousands of visitors and more than a million permanent residents.

Natural ecosystems and habitats have emerged in recent decades as values of great importance to Canadians. A broad range of federal and provincial legislation has been enacted to protect these values with associated demands on how water is managed. Similarly, concerns about global warming and climate change have led to an interest in developing the water power resources of waterway system dams as a source of renewable energy.

In addition to complexities resulting from increased human use, development and economic activity, the issue of climate change has also been suggested as an emerging factor that should be given more consideration in water management with evaluation of a number of associated parameters including:

- an increase in the number of significant meteorological events with associated heavy rainfall over short periods of time;
- increases in annual precipitation in some regions and decreases in others affecting overall water availability; and,
- regional warming in some areas resulting in increases in water temperatures and some life cycle impacts on aquatic and wetland species and habitats.

Recent Study Recommendations

These changes in the operating environment of Trent-Severn Waterway water management have been acknowledged and commented on in two recent studies that offered similar conclusions. A major public and interagency analysis of water management on the system was conducted by a consulting company in 2006 and 2007. [3] This study focused on public and institutional perspectives, integrated decision-making and communications. It catalogued a complex array of "obligations and expectations" that far exceeded the goals of designers and current operators of the system.

The Ecoplans consultations generated a number of issues and concerns with current water management practices captured under the following categories:

- Ecological
- Access
- Public safety
- Flood mitigation
- Green energy
- Water and sediment quality
- Economic impact
- Effects of climate change
- Operations
- Participation in future decision-making

Building on the Ecoplans work, a public Panel appointed by the Minister of Environment recognized the increasingly diverse and sometimes conflicting demands and expectations facing those responsible for water management.[4] The Panel endorsed the ideas advanced by the Ecoplans study and added its own somewhat more technical recommendations. They included automated monitoring of levels and flow, development of a new allocation and management model, enhanced stakeholder engagement, an automated watershed control centre, modernized dams and a water conservation strategy.

Acknowledgement

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References

[1] http://www.pc.gc.ca/lhn-nhs/on/trentsevern/visit/ne-wl/trent_e.asp

[2] Report of the Panel on the Future of the Trent-Severn Waterway, "It's All About the Water", March 2008, p. 30.

[3] Ecoplans Limited, A Study of the Past, Present and Future of Water Management on the Trent-Severn Waterway National Historic Site of Canada, May 2007.

[4] Report of the Panel on the Future of the Trent-Severn Waterway, "It's All About the Water", March 2008.