Notes from the Ontario Sailing/Row Ontario Seminar on Great Lakes Water Levels - National Yacht Club, Toronto - February 15, 2020

About 70 people attended the meeting which lasted from 9:00 am to approximately 1:30 pm. They heard a series of presentations and also had a chance to ask questions.

Links to the presentations are available on the Row Ontario website.

What follows are notes on all the sessions in the order in which they occurred. Thanks to Row Ontario President Chris Waddell for attending the session and providing these summary notes.

Jane Graham - Shoreplan Engineering Ltd (www.shoreplan.com)

Jane is a coastal engineer who has worked on many marina projects on Lake Ontario including the recent Trent Port marina.

In the past few years there has been a lot of high water meaning shoreline protection or unprotected banks are attacked by wave action, resulting in slope instability, losing decks and leaving house foundations exposed. At marinas, fixed docks are a particular problem and dock walls too are a problem as they are too low so that electrical service for anchored boats is often below water meaning it has to be shut off.

There are also examples of fixed docks being under water and in 2017 some marinas stayed shut as they had no electricity - it was all under water.

As an example of what is being done, she noted Bronte Harbour inner harbour redevelopment where old structures needed to be replaced taking account of the high water 2017. A lot of work was done to keep marina open.

<u>What does an engineering firm do for a project?</u>

It first reviews existing conditions including doing soundings for water depths and views projects in terms of 25 year cycles with both high and low water levels such as have happened on Georgian Bay. They look at a facility's structures and docks, electrical service, pump outs, fleet at a marina for instance which includes vessel lengths for dock lengths and maneuverability within the harbour and its docks.

Then they assess coastal conditions which includes water depth, shorelines, wind and wave action, ice buildup and dock anchoring. After which they prepare a preliminary design on size, slips, dredging etc. and bring it to the club or marina for review, discussion and approvals that leads to the drafting of tender documents and then putting the project out to tender.

Typically they now design for two-metre water fluctuation and take that into account when building ramps and anchoring them to the shore as clubs need facilities that can adapt to changing conditions.

Once the project is under way the engineering company can oversee construction and also do monitoring of the finished project to ensure everything is operating as planned.

Bronte was constructed in 2018 and then the water levels rose even more. It was designed with a bit of a guess for an additional eight inches in height and that has turned out well.

Who is involved is the approval process for dock/shoreline reconstruction?

All these groups must approve any construction with different rules for shoreline activity and if there is construction in the water:

- Local Conservation Authority - oversees shoreline hazards, flooding and erosion
- Ontario Ministry of Natural Resources - public lands act but if owned by a city don't need it but usually best to submit plans to MNR and get confirmation that it isn't needed
- Ontario Ministry of the Environment - confirm no endangered species would be affected
- Fisheries and Oceans Canada - fisheries act
- Transport Canada - navigation protection.

If your club is within a Port Authority's jurisdiction then you need its permission as well.

Municipalities don't review shoreline projects but you will need a building permit from them for electrical, plumbing and that sort of construction work

With fish spawning, there are seasons that are off limits for in-water construction and usually tight windows on when in-water work must be done so anyone doing in-water needs to clarify those parameters before starting.

Dredging approval is challenging but doable. If you have done it in the past you can get approval to do it again but here as well, there are timing issues for fish spawning etc

An engineering firm can do all the permitting work at a cost but clients sometimes do it themselves. If you are just raising dock levels that may be all right but you will need conservation authority approval for shoreline work and other approvals if you are working in the water.

Wave protection projects require in-water approvals. Floating breakwaters can work in protecting shorelines but that depends on wave height and wave length so you need to check all that out to determine what is needed.

Lake Ontario water level construction is based on a 1989 MNR 100 year level but projects are now working with an estimate of 0.2 or 0.3 metres above that level. In Toronto, 75.8m is the level that is being planned for with many projects increasing heights and water levels. By comparison, 74.2m is the 1989 100-year level for Lake Ontario

Most clubs are going to floating docks as it is hard to design fixed docks that would be operable over a two-metre range of water height. Steel or stone seawalls are usually best but some wood walls are still being used. When converting from fixed to floating docks in most cases any pilings and pylons are removed.

There is so much demand that at the moment prices for shoreline work are very high. The demand is also causing a limited availability of experts which means projects are taking longer to complete as well.

How do municipalities deal with access when there is high water (i.e. can't get to club as pathways etc. are flooded)? This is done on a site-by-site basis with no consistent response among municipalities.

Jordan Kropf - Kropf Industrial - Parry Sound, Ont.

Jordan is a dock manufacturer in Parry Sound. His participation was generic, talking about dock issues rather than trying to promote the products of his company.

Advantages & disadvantages between fixed vs floating docks:

Fixed Docks - have stability and service life so tighter walkways are possible but drawbacks include intensive permit process with piling, cribs and caissons are even tougher. Water levels and ice conditions cause problems for fixed docks and even more these days when water levels change and the speed of that change is a problem.

It is virtually impossible to make fixed docks adjustable. Ice can also cause problems causing pilings to bend and dock systems may move. Ice suppression (bubblers) can be used but it is intensive and a lot of work.

Floating Docks - for sailing need to design with a freeboard from 18 to 36 inches (rowing is more like three or four inches of freeboard). Dock width etc. is also important - there is average width for most docks but going beyond that can create both dock stability and storage problems.

The more dynamic the ice movement is in the winter, the more you need to have an ability for docks to move if you are leaving them in the water. Floating dock will freeze in static ice with no problem but when the ice starts moving there are problems so you need to think about how to avoid damage - bubbler systems at key areas perhaps?

You need to think as well about anchor points on shore for ramps to avoid having them ripped out by moving ice or covered with water in high water periods.

An important thing to keep in mind in all this is there is a huge liability problem with temporary solutions to high water if anyone is injured, boats damaged etc. by those temporary solutions.

As an example of the demand for dock work, his company is currently looking at Spring 2021 for deliveries of dock systems ordered now.

In response to questions about floating breakwaters, he suggested that floating breakwaters work best in an environment of three-foot swells and three-second wave periods. Beyond that he suggests you get into size problems with the floating equipment.

Pierre Beland - Canadian Co-Chair - International Joint Commission

Pierre started with a brief history of the IJC and its role in managing boundary waters. It helps regulate the system of the Great Lakes, St Lawrence Seaway and the watersheds that cover an area that includes the Ottawa Rover and Buffalo to Trois Rivieres.

He noted there is a dam at the outlet of Lake Superior to Lake Huron that allows water to flow around fish spawning, there are locks there and a small hydro plant but that dam can't control level of Lake Superior as the lake is just too large.

The only other dam on the whole Great Lakes - St Lawrence system is the Moses-Saunders dam near Cornwall that can regulate water levels in Lake Ontario but only to a degree.

Lake Ontario is 340 km long and 65 km wide. All its water flows through the St Lawrence River and ends up passing Montreal then down past Quebec City to the Gulf of St Lawrence. Placed over Quebec Lake Ontario would stretch from Montreal to Malbaie and when water is flowed out of Lake Ontario it has to be done carefully to avoid flooding downstream.

The Ottawa River basin is larger than the basin of Lake Ontario but the majority of surface area in the Ottawa watershed is in the north. There are a few dams in the north controlled by Hydro-Quebec but lower down the Ontario-Quebec dams tend to be run-of-the-river dams with no ability to retain much water behind them. Dams in Quebec have very small capacity and spring run-off and Hydro Quebec means dams have to be opened at some point. Sometimes flooding on the upper and lower Ottawa happen at the same time such as the record flooding of Ottawa River in 2017.

On the St. Lawrence, Lake St Pierre gets the worst of flooding downstream east of Montreal as it has both St Lawrence and Ottawa water feeding into it but the IJC has to consider Montreal, the Ottawa River and Lake St. Louis just below the Moses-Saunders dam in controlling flooding. In all that, there are things the IJC can do and things that are impossible for it to control.

The Moses-Saunders dam is 160 km from the exit of water from Lake Ontario after Kingston and there is a difference in height of about 100 feet on that run. The Moses-Saunders dam has a spillway and through 2017 and 2019 most of the water was going through the spillway as there was more water than the dam could handle for electricity production. Ironically the area upstream of the dam was not flooded back to Iroquois, Ontario and the water there was lower than normal because of the way the system is built. In January 2020, the flow rate through the spillway was 10,700 cm per second - the highest flow rate ever.

The reservoir behind the Moses-Saunders dam is actually Lake Ontario but it is 160 km upstream. There has to be a slope downhill for the water to run but the more water you let run through the dam and spillway the slope decreases and the amount of water flowing decreases. If they flow a lot then the Lake goes down and the river can't flow as much. The spillway bypasses the dam but if the dam was built higher it would flood Cornwall.

In the late 1950s both Canada and the United States wanted to generate electricity and build the Seaway to let ocean-going vessels into the Great Lakes basin. The channel of the river was changed, communities were moved and the agreement with Quebec at the time was that water flow would not lead to worse flooding downstream from the dam than had occurred in 1958 when there was no dam. So when the Ottawa River is at maximum flow rates (and there are no dams to control flow on the Ottawa River below Ottawa) the flow rate at Moses-Saunders has to be reduced to prevent downstream flooding and maintain water system levels. If the dam is operated in a way that leads to downstream flooding it will create other problems as a flood created by opening the dam is not an act of god which can then invalidate insurance policies. In fact in the past year the IJC has been flowing so much water through Moses-Saunders in the winter that some of 1950s villages that have been flooded since then, have been exposed due to the suction effect which turns some areas above the dam dry and residents have not been able to use boats as their docks are landlocked. On two weekends in October the IJC now raises water levels behind the dam to let people get their boats out of the water at the lower levels.

Downstream of the dam there is water flowing and levels change a little but for the former villages above the dam, the more they flow, the more areas above get dry as shorelines recede. This has to be done carefully to avoid a problem for municipalities as some of their water pipes that draw river water for communities find themselves above water levels.

There is a dam at Beauharnois just west of Montreal but it is a run-of-river dam with limits on what can be held back. It also can't retain water that would flood land and structures behind it.

Ice is also a problem as it builds up along the intakes and sometimes water flows have to be reduced to avoid damaging the turbines at Moses-Saunders when ice is drawn through the turbines. This year has been different as there has been no ice but normally flows are reduced to allow ice to build up so that a thick layer of ice covers the river. Then water can flow under the ice into the turbines. The IJC is flowing more water in January and February as there is no ice this year and they are at record levels of water flows.

In 2017 with a series of thaws and freezes, the IJC had to reduce the water flow at Moses Saunders three times to allow ice to build up as whenever there was a thaw the ice sheet would melt. The result was the Spring season started with very high water levels.

As an example of the challenges, reducing the water level of Lake Ontario by 1 cm means raising the water level below the dam 15 cms and in Montreal 12 cms higher which has to be careful to avoid flooding. That would violate the terms of the Canada-US treaty that set up the IJC.

When Lake Ontario is 75.5 m or higher the IJC can only flow so much through Moses Saunders or there will be downstream flooding. They had to control water flows in 2017 as there was just too much water and there is a limit to how much can go into Lake St Louis before it starts widespread flooding there .

Regulating the flow of water doesn't eliminate fluctuations in water levels but in the last couple of years water levels in Lake Ontario were the highest since the dam was built. It broke records in 2017 and 2019. In 2017 the level at the start of the year was average at about 74.6. It rose to 75.9 m in 2019. So Lake Ontario started high but not at a record high in 2019.

The Summer of 2020?

The main source of water for Lake Ontario is the Niagara River which generates 85 per cent of the water in the lake. The second highest source is snow melt from the lake's basin but that basin isn't that large. It is difficult to predict when lake levels will peak based on the current level as it is too difficult to predict weather with any degree of certainly more than a week or two in advance. Other Great Lakes are very high so there is almost certain to be a lot of water running through Niagara.

The other variable is rain and there has been a lot of rain in recent years. At the moment much of the snowpack seems to be lower than previous years but winter is not yet over. As well spring rain, or rain when the ground is still frozen, leads to runoff directly to the lake (and urbanization means less water is soaking into the ground as it is covered with asphalt and concrete).

As an example of the impact rain can have, there was a huge rainstorm covering much of the region over Halloween in 2019 that raised the water level in Lake Ontario by two inches. It takes weeks to get that out of the lake by flowing water through the St. Lawrence River.

If we knew how much water will be added in the Spring to the lake then we could make a good extrapolation about what levels will be but there is no model for predicting how much water will come into the lake for the reasons noted above. So no one is sure what will happen.

Wind is also very important as strong winds can drive water levels temporarily significantly higher at either the east or west ends of Lake Ontario depending on wind direction.

Next Steps - Glenn Lethbridge - Ontario Sailing

To make our collective cases to government we need more data from rowing and sailing clubs about water levels and what is happening in their communities. This will allow us to build an aggregate profile and use the data to explain our circumstances in looking for support from governments.

In addition, clubs should be prepared for significant increases in insurance costs.

There is currently a Great Lakes Adaptive Management group (GLAM) examining issues such as the fact that the past few years have been much wetter with more rain throughout the year including in winter when it has not happened regularly in the past. If this is an ongoing trend how will we manage that? GLAM is looking at technical things, modifying regulations and laws to allow people to make adaptations as needed. Municipalities are reluctant to buy out homeowners in floodplains as it costs a lot to do that and these residents are usually some of the highest taxpayers based on their location under market value assessment (it is more desirable to live close to water under most circumstances) so buying these homeowners out could sharply lower a municipality's tax base.

There will be more of these water level sessions scheduled in the coming weeks and months to talk about the issues and adaptation.

The shipping industry understands the needs of recreational water users but the province wants more data and we need to provide it. It won't be given to the province in a club specific way but will allow for general pictures to be developed.

Clubs are where it starts as we need to decide what can and must be done collectively and we want to get data from GLAM on damage from water levels on the lakes.

Will there be regulatory easing to help clubs adapt? That is not clear but Ontario Sailing and Row Ontario will make that case by talking to all parties and both federal and provincial government. To date other than money from the federal government for Toronto Islands there is nothing designated. By contrast New York State has recently announced a $300 million fun for shoreline work.