Ottawa River Regulation Planning Board

Commission de planification de la régularisation de la rivière des Outaouais

2019 Spring Flood – Questions and Answers

Message from the Ottawa River Regulation Planning Board

The 2019 spring flood has been challenging and difficult to say the least, affecting thousands of people's lives. Many concerned citizens have reached out to us since the start of the spring flood to share their experience and seek answers to their questions. Many people enquired about the causes of the spring flood, trying to have a better understanding of the regulation of flows in the Ottawa River Basin and what means, if any, could be used to further alleviate the flood impacts.

In order to respond to these enquiries, we are happy to be releasing today a series of questions and answers that will address some of the most often asked questions during the spring flood of 2019. We consider these answers to be 'preliminary' as the member agencies will require time to conduct the post spring flood analyses. In the months to come, we will be reviewing conditions of the spring flood and will be preparing a summary document about the 2019 spring flood conditions, similar to the document[1] we had prepared following the 2017 flood.

In Ontario and Quebec, governments at all levels, federal, provincial, and municipal levels, take part in the protection of the residents against flooding. Our part, which deals with management of the flow from the principal reservoirs, can sometimes be difficult to explain. We have done our best to explain it in plain words in this document and hope that you will find it informative.

Ottawa River Regulation Planning Board

[1] Document available at http://www.ottawariver.ca/docs/2017_Spring_Flood_Summary.pdf.

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Note: The terms *drainage basin, freshet, reservoir, runoff, run-of-river station, tributary,* and *watershed* are described in a glossary at the end of this document.

1- Question: What causes flooding? Can too much snow and rain really cause all this water to flow into the river?

Answer: Flooding occurs when the volume of water flowing in a river or stream exceeds the capacity of the channel. Snowmelt runoff floods are the most common type of flooding in Canada. *Government of Canada – Snowmelt Runoff* https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/causes-of-flooding.html#snowmelt)

Explanation: Numerous factors affect streamflow and, therefore, the potential for flooding. The most important factors are the amount and type of precipitation, the nature and condition of the drainage basin (or watershed), and climate. During the Canadian winter, most of the precipitation is simply stored as snow or ice on the ground. During the spring melt, large quantities of water are released and can combine with rainfall, which can lead to heavy spring flow and flooding. This is called **freshet**.

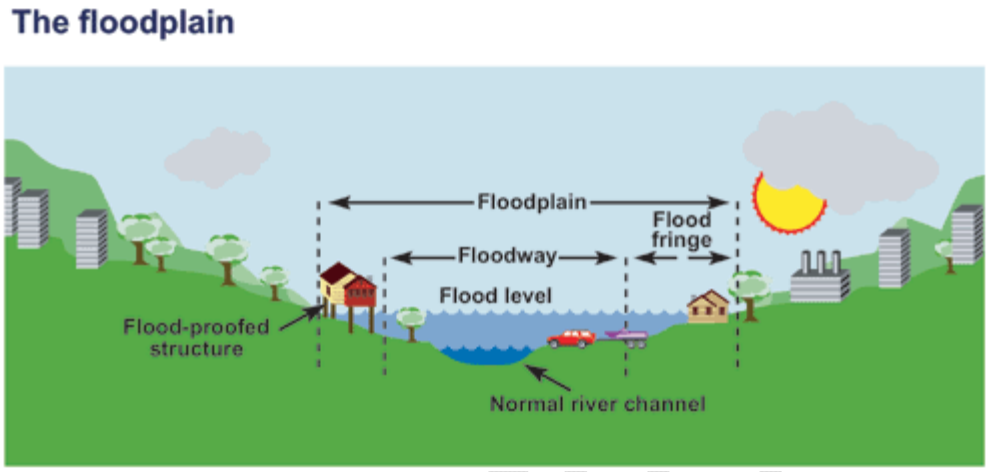
In spring when the soil is saturated and still partly frozen, the rapid melting of snow means that there's little opportunity for the water to be absorbed. The majority of the water contained in the snow ends up in the river. In addition, when rainfall occurs along with the snow melt, the bulk of rainfall runs off on the ground surface to low lying areas and streams.

Overall, a land area twice the size of New Brunswick drains to the Ottawa River. As an example, assuming that 50 mm of rainfall were to be received over much of the watershed and that half of this rainfall would run off to the river, this would represent an additional volume of 3,650 million cubic metres of water into the river. That's more water than needed to fill 1,000,000 olympic-sized swimming pools.

2 - Question: Why is the Ottawa River Regulation Planning Board not preventing or stopping the flooding?

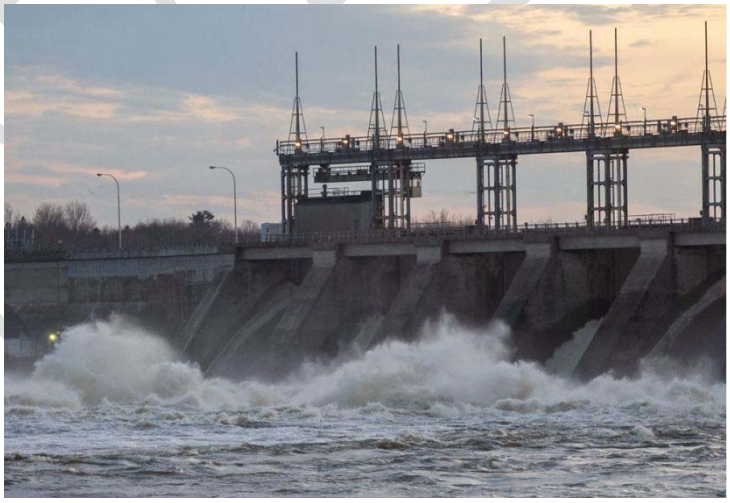
Answer: In years where spring runoff is significant, it is not possible to prevent flooding.

Explanation: The primary way to prevent or reduce flooding is to hold on to spring melt or runoff in large reservoirs. By storing or keeping water in these reservoirs, the volume of water (or river flow) is reduced downstream. Reservoirs in the Ottawa River basin are large enough to hold on to approximately 40% of the average spring runoff. By using the reservoirs in this way, it is possible to prevent significant downstream flooding in most years.



Flooding occurs on the main stem of the Ottawa River when:

- *The spring runoff greatly exceeds the size of the reservoirs* — Each year, reservoirs are emptied over the course of every winter and then filled during the spring flood period. Once full, reservoirs must allow excess spring runoff to pass to downstream areas.
- *There is significant spring runoff in areas where there are no reservoirs* —Dams on the Ottawa River in the central and southern parts of the watershed have very little ability to store spring runoff as they are run-of-river dams[2]. These dams allow the river to flow through, or to flow freely, in order not to the make natural occurring flooding any worse in the upstream river areas.



Carillon Dam located in the southern portion of the Ottawa River on April 25, 2019.

[2] Des Joachims generating station is managed like a run-of-river facility for reasons explained in FAQ no. 5.1 – http://www.ottawariver.ca/faq.php#q5.1

3 - Question: What is the goal of the Ottawa River Regulation Planning Board?

Answer: The Planning Board's mandate is to ensure the integrated management (operation) of the flow from the principal reservoirs of the Ottawa River Basin. In practice this means that operators of dams work together to ensure that available storage in reservoirs is used to minimize downstream flooding. It also ensures that relevant hydrological information, for example forecasts of river flows along the Ottawa River are made available to the public and government organizations.

Explanation: The term "integrated management" describes the process by which the thirteen principal reservoirs in the Ottawa River basin are cooperatively operated to maximize the benefit of the limited reservoir storage available. The Planning Board ensures the integrated management of the flow from these reservoirs to minimize flood and drought impacts along the Ottawa River, its tributaries, and in the Montréal Region, while maintaining beneficial water uses in the basin. The Planning Board also ensures that relevant hydrological information such as forecasts of river flows along the Ottawa River are made available to the public and government organizations, especially provincial agencies given that the preparation and issuance of flood-related messages along the Ottawa River are a provincial responsibility.

The principal reservoirs that are subject to integrated management under the policies of the Planning Board are operated by the four agencies that comprise the Ottawa River Regulating Committee (the Regulating Committee). The intent of "integrated management" is that by sharing hydrological information and establishing agreement on appropriate regulation strategies, the best possible use of the limited reservoir storage will be accomplished cooperatively by these four agencies.

The Ministry of Natural Resources and Forestry of Ontario is an associate member of the Regulating Committee. It contributes important hydrometeorological information and plays a key role is disseminating information in Ontario.

It should be noted that the Planning Board role is often misconstrued to be that of a "control board," which it is not. The Planning Board does not have legal authority over the decisions of the operators of the principal reservoirs. Each operator remains responsible for the operational strategies and decisions at its facilities.

The locations of the reservoirs are shown on the Planning Board website at http://www.ottawariver.ca/reservoir-levels-discharges.php .

4 - Question: **How is integrated management of the principal reservoirs providing protection against flooding?**

Answer: The integrated operation of the principal reservoirs protects residents along the Ottawa River and its major tributaries against flooding because it allows for optimal use of the available storage to mitigate flooding downstream. Flooding extent and duration is always reduced and, in many years, eliminated. In addition, providing timely flow forecasts to responsible authorities enables flood preparedness and response.

Explanation: The reservoirs that are used to mitigate flooding can store a large portion of the spring runoff, which is sufficient in most years to prevent flooding. In years where spring flow is significantly larger than the reservoir capacity it is not possible to prevent damaging flooding but the amount of storage available still plays a significant role in preventing even higher flood levels from occurring.

In Ontario, Conservation Authorities and District Offices of the Ministry of Natural Resources and Forestry issue flood related messages and information to municipalities and other key agencies involved in flood preparedness and response. Current flood related messages can be viewed on-line on the individual conservation authority websites and on the provincial flood webpage: https://www.ontario.ca/flooding.

In Québec, the Centre des opérations gouvernementales du Québec and the Sécurité civile collaborate with municipalities to protect residents. Monitoring of flood conditions can be viewed at https://geoegl.msp.gouv.qc.ca/adnv2/ .

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5 - Question: **Who regulates water levels on the Ottawa River?**

Answer: Given the multi-jurisdictional nature of the Ottawa River (shared between Ontario, Quebec and Canada), there is no one agency responsible. A group of agencies, who comprise the Ottawa River Regulating Committee, work together with the purpose of integrating the management of the flow from the 13 principal reservoirs in the Ottawa River basin. During the spring, the goal of this management is to mitigate the impacts of flooding as much as possible.

Explanation: The Ottawa River Regulation Planning Board is not a control board. It is a board created by governments for the purpose of ensuring that the flows from the principal reservoirs are managed in a coordinated way by the four agencies that own and operate them. These agencies are Ontario Power Generation, Hydro-Québec, the government of Canada[3] and the government of Québec[4]. The Ottawa River Regulation Secretariat, composed of two staff engineers, support the work of the Regulating Committee

[3] Public Services and Procurement Canada
[4] Ministère de l'Environnement et de la Lutte aux changements climatiques of Québec

and the Planning Board and communicate with the media, public and government agencies on water flow and level conditions on the Ottawa River. Each of the four agencies remains responsible for water management at its facilities.

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6 - Question: Why are dam operators not making water levels go down on the Ottawa River when levels are causing flooding?

Answer: Operators would make water levels go down where there's flooding on the Ottawa River if they could. However, it is not physically possible to do so.

Explanation: In the spring, water levels on the river increase naturally because the volume of water that flows into the river is increased by the natural runoff from snow melt and rainfall. The natural constrictions on the river and other features such as islands restrict the flow of water, causing water to back-up when there are high flows.

Dams are structures capable of restricting the flow of a river in order to raise the river water above them. During flood periods, dams on the Ottawa River are managed in a manner that ensures that flooding is in no way worsened over what would occur without the dam in place.

On the Ottawa River, between Lake Timiskaming and its outlet at Deux-Montagnes, dams are considered to be run-of-river facilities. These facilities cannot hold back water flow in the river given that they have minimal storage ability. At these facilities, during high flow periods when flooding is occurring, dam operators stop restricting the flow of the river in order to ensure that upstream, naturally occurring, flooding is not made any worse by the presence of the dam. Dam operators typically describe this operation as 'passing the river flow', meaning that any water that arrives at the dam is let through, essentially unrestricted. Operators open the gates of the dam more as the arriving river flow increases, and similarly, they close the gates more when the flow of the river recedes.

There is no way to force water flow through the river system. It must flow out of the river section naturally, at a speed that is governed by the physical characteristics of the river (e.g. slope of the river bottom, natural narrows such as rapids, width of the river, river-bed and bank type such as rocks or sand).

During a period of high flows that cause flooding the main stem of the river is considered unregulated because the water levels cannot be lowered by dam operations. (Refer to FAQ no. 5 http://www.ottawariver.ca/faq.php#q5 to find out where the few locations on the river where water can be lowered are.)

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7 - Question: **Why is the water level on the Ottawa River not lowered sooner, for example in February, to prevent flooding?**

Answer: Lowering water levels sooner would not change the degree of flooding in the spring.

Explanation: Flows from the upstream reservoirs in the Ottawa River are reduced to a minimum at the end of March, prior to the beginning of the usual snow melt period. The remaining flow in the river is the total of all of the natural tributaries in the system and is termed the base flow. This base flow varies naturally depending on overwinter conditions and thaw cycles.

Operators of run-of-river facilities have small amounts of upstream storage and it requires only a few days to lower the level of the water impounded above their dams. In the spring, operators follow river condition forecasts very closely and, in order to prevent backwater effects above the dam, lower the water levels over a period of a few days, just as the river flows are increased naturally with snow melt runoff. This can be observed above some of the run-of-river dams on the river by the low levels seen just above all these dams. Lowering water levels at the run-of-river facilities in February would result in low water levels for an extended period of time, possibly a period of ten weeks, and would not reduce flooding during the spring melt. The storage volumes above the run-of-river dams are very small compared to the overall flow volume during the freshet period. That's why they do not provide any significant reduction in flows or levels during the spring melt.

At the principal reservoirs, water levels are lowered progressively from approximately mid-December to the end of March. Des Joachims reservoir, which has the smallest reservoir, requires only one month to empty. Its reservoir is emptied every year during the month of March. Water that was stored in these reservoirs flows out of the river before natural runoff could cause flooding to downstream locations or local communities. People can follow the emptying and filling of the principal reservoirs every year on the ORRPB's website at http://www.ottawariver.ca/reservoir-levels-discharges.php .

8 - Question: How much did dams factor in to the 2019 flooding?

Answer: Dams that hold water in the principal reservoirs help reduce flooding in downstream locations by keeping large volumes of water out of the lower river sections, thereby mitigating the downstream flooding. Run-of-river dam facilities located along the length of the Ottawa River do not cause flooding or make naturally occurring flooding any worse (refer to FAQ 5 and 5.1 (http://www.ottawariver.ca/faq.php).

Explanation: During the 2019 spring freshet, the regulation strategy consisted of reducing water flow from the principal reservoirs while southern tributary rivers such as the Petawawa, Dumoine, Coulonge, Mississippi, Petite Nation and Rouge rivers reached their peak and started to recede. It is estimated that by optimizing the use of storage during this year's flooding that peak water levels along the main stem of the river were reduced by a minimum of 40 cm in all locations.

More detailed analysis that provides specific values for reductions in water levels will be provided in the *Summary of the 2019 Spring Flood* document that will be prepared by the Regulating Committee.

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9 - Question: Are hydro companies making a profit out of flooding conditions?

Answer: No. To optimize hydro-power generation, one needs a high water level upstream of the dam and low water levels downstream of it. During a flooding event, the opposite occurs.

Explanation: Flood mitigation is the main focus of water management activities by Hydro-Quebec and Ontario Power Generations during the spring melt. Public safety is the top priority. Flood conditions are inefficient for producing hydro power and excess water flow is passed through dam spill gates with no benefit to the production of electricity.

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10 - Question: Are communities along the shore of the Ottawa River being sacrificed to protect the Montréal region?

Answer: No. All communities located downstream of the principal reservoirs benefit from the water that is stored and therefore prevented from flowing downstream.

Explanation: Flood impacts in the Montréal Archipelago are mitigated by holding (or storing) spring runoff in the principal reservoirs to reduce the peak of flood flows. Since the major reservoirs are located primarily in the northern sectors of the Ottawa River basin and with water flowing north to south, all river sections benefit from water storage during the same flood event. With peak flows occurring at different locations along the length of the river within two to three days of one another the benefits of the use of reservoir storage to reduce peak levels is applicable to the whole length of the river. For instance, on the upper Ottawa River, the town of Mattawa benefits from the presence of the six reservoirs located in the Abitibi-Timiskaming area, with flood flows being lower than would have occurred without the presence of the reservoirs. Similarly, downstream residents in communities such as Constance Bay on Lac Deschenes benefit from eight reservoirs storing water. With two reservoirs located on the Gatineau River and three located on the Lievre River that feed into the Ottawa River downstream of Lake Deschenes, the lower reach

of the river between Lake Deschenes and the Hawkesbury – Grenville area benefits from the thirteen principal reservoirs, in the same way that the Montréal region eventually does.

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11 - Question: Over the 2019 Easter long weekend, the Regulating Committee's freshet forecast changed from being an above average spring flood to being a large-flooding event. Why did this occur?

Answer: Two major rainfall events from Colorado and Texas merged to bring 20 to 50 mm of precipitation over much of the Ottawa River Basin, at a time when spring snow melt runoff had already caused water levels to exceed major flood levels in most flood-prone areas along the Ottawa River. These weather events were the first of several that would hit the watershed and increase flood levels.

Explanation: Unfortunately, it is not possible to forecast precisely the quantity of precipitation that storm systems will bring more than a few days before they occur. Three days before the low pressure system arrived, on April 16, 2019, the Regulating Committee published a News Release to caution residents that based on the forecast rainfall and temperatures, levels and flows along the Ottawa River between Lac Coulonge and the Montréal Region could reach conditions observed during the first peak of the 2017 flood. However, two days later and one day before the rain began, weather forecasts were calling for much more rain. This is why on April 18th, the Regulating Committee issued a further News Release informing residents of an increased risk of flooding, with river conditions possibly as severe as in May 2017 to be expected.

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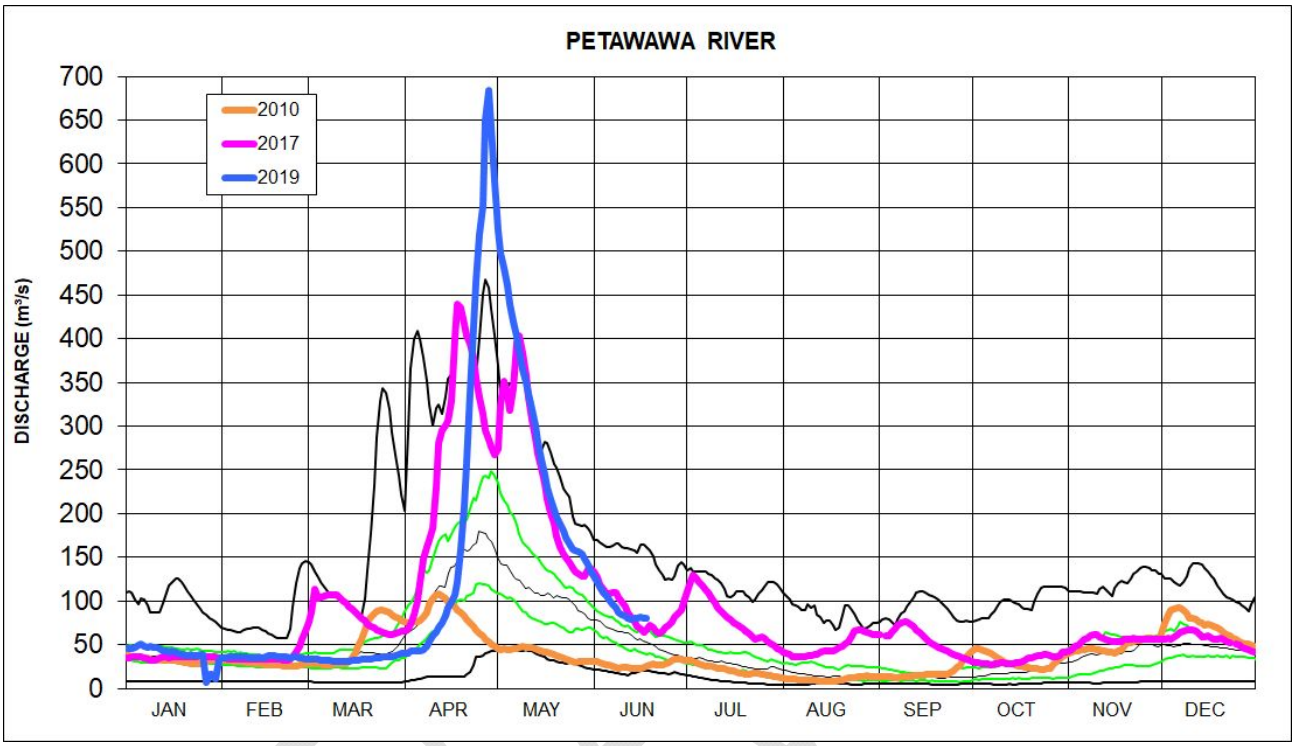
12 - Question: Were weather conditions really that bad this year?

Answer: Yes. The Ottawa River Basin was hit by heavy rainfall when the melting of the snowpack was already causing historic floods on the tributaries that feed into the Ottawa River.

Explanation: The water contained in the snowpack was approximately twice that of a normal year in early spring. The spring was late coming with below average temperatures with snow still accumulating over much of the watershed. With little sunshine and cooler than normal temperatures, there was little reduction in the snow pack during the early spring period. April was very wet with approximately twice as much rain as normal with a sequence of heavy rainfall events through April and in to May, which added additional runoff to streams that were already swollen by significant snow melt volume.

Many tributaries (Petawawa, Coulonge, Madawaska, Petite Nation and Rouge rivers)located in the central portion of the watershed had record breaking flow rates which fed exceptional quantities of spring runoff into the Ottawa River, causing the first peak to occur between April 29th and May 1st. Other tributaries such as the Mississippi and Bonnechere rivers experienced significant flooding impacting communities along the

length of their shores. Many smaller tributaries experienced rare flow quantities, washing away portions of roads and culverts.



Variation in daily flows of the Petawawa River
(Note that 5 years out of 10, the flows are within the green lines)

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13 - Question: **Why is there flooding in some years and none in others even though the weather in these years look alike?**

Answer: Meteorological conditions vary from day to day and from year to year. Spring floods are affected by multiple factors, and no two are alike. Some years may appear to have similar meteorological conditions; however, different weather patterns, over different sectors of the basin can make a big difference in the degree of flooding experienced in some locations.

Explanation:

Two years that have apparently similar weather characteristics may have very different spring floods. For example in the Lac Coulonge area, flooding occurred in 1985 and did not occur in 1984. Yet, both years had similar total precipitation. Where exactly precipitation occurs and if it is concentrated over a short or longer

period of time can lead to flooding in a particular location. In the case of flooding in the Lac Coulonge area, one such analysis would reveal that the flow rate of the Coulonge River in 1985 was about twice as large as that in 1984. Flooding on natural, unregulated tributaries, is an indication that the received precipitation was of sufficient intensity to cause downstream flooding.

Another example is the depth of the snowpack, which is used as an indicator of the amount of water available to melt in spring. Generally, the water contained in the snowpack is only an indicator of the possible river conditions during the spring given that a large portion of the snow could be lost to evaporation. For instance, in early March, the Regulating Committee reported that the snowpack in the watershed was similar to the snowpack observed in 2008. Those who remember 2008 will recall that there was no flooding that year. The reason is the rate at which the snow melts and the associated precipitation during the melt are determining factors in whether flooding will occur or not. Unfortunately, these factors are often known only a few days ahead of time.

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14 - Question: **Why is my town experiencing worse flooding than others?**

Answer: Weather conditions, the natural characteristics of the downstream river such as narrows and rapids, and a town's geographic locations compared to the principal reservoirs in the north govern the timing of and the degree to which different towns experience flooding.

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15 - Question: **Can we expect these large-floods every few years? Is flooding the new norm?**

Answer: Flooding is not expected to happen every other year. On any given year, there is 5% chance of having a medium flooding event (for example a 1:20 yr flood) and there is a 1% change of having an exceptional flood event (for example a 1:100 yr flood).

Explanation: Flows in the Ottawa River vary from year to year because the weather conditions over the watershed such as precipitation and temperatures change from year to year. The sequence of precipitation and temperatures that give rise to flooding is determined by nature. This is why the risk of flooding is often described as a probability of occurrence such as the 5% chance or 1% chance of flooding on any given year.

Some will remember the flooding that occurred in the 1970's. Serious flooding happened in 1974 and 1976 in many areas. Yet, flows over the next two decades were generally within the normal range and did not cause serious flooding. Natural variability is unfortunately easily forgotten and this is part of why exceptional floods are so often unplanned for. Significant flooding along the Ottawa River occurred in the 1920's, the 1950's, the 1970's and in the 2010's. Flooding will occur again, we just don't know when.

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16 - Question: **Are Québec agencies and Ontario agencies talking with one another**?

Answer: Quebec and Ontario agencies involved in the management of the Ottawa River flows communicate daily throughout the spring flood season to assess together current and forecast river conditions and what actions may be required to minimize flood impacts.

Explanation: Agencies with major reservoirs within the Ottawa River basin make up the Regulating Committee, a consensus based body, that implements appropriate regulation strategies that are in line with the regulation policies and criteria adopted by the Planning Board. The work of the Committee includes determining current river conditions, forecast river conditions, and operational strategies such as increasing or decreasing flows at the principal reservoirs. It is also responsible for providing relevant information to the public and other organizations on expected river conditions.

In 2019, fifty conference calls were held during the spring freshet by the Committee.

17 - Question: Are dams managed by computers?

Answer: Analyses and decisions pertaining to water management strategy are done by qualified and experienced technical staff. However, many processes are automated, for example the collection and transmission of hydrological data and the operation of some water flow control structures. In addition, various technologies are used to provide guidance and decision making support, for example meteorological and hydrological forecasting models. Modelling and forecasts are ultimately only used as input to the decision making process for the operation of the major reservoirs.

18 - Question: **What has the ORRPB done to improve its communication following 2017? What else should be done?**

Answer: Following the 2017 spring flooding, the ORRPB undertook several actions that involved communications. Given the importance of timely flow forecasts in protecting against flooding, it consulted with provincial agencies that are responsible for flood-related messaging to residents and improvements to pathways of communication were identified and implemented. The Board also heard the public desire for better access to river flow conditions and initiated a revamping of its website. Unfortunately, the website was not completed prior to the 2019 spring freshet. In addition, the Board and its member agencies, gave multiple outreach presentations to municipal officials in Ontario and Quebec to raise awareness on the

limits of regulation and ensure emergency management coordinators were aware of available forecast information.

Looking ahead, the Board recognizes that communications have evolved tremendously in the last few years with social media. To adapt to this new context, the Board will assess what new ways can be used to communicate water management strategies rapidly and efficiently, especially during major hydrological events. For example, this could include the development of educational material that informs on about the complexities of the Ottawa River and factors that govern its flows and levels along with the limitations of regulation in the basin. In addition, this may involve seeking additional resources to provide further on the ground presence and outreach in the basin.

GLOSSARY:

- **Drainage basin (or watershed):** Area of land that channels rainfall and snowmelt into a body of water or stream.

-**Freshet:** Large increase of water discharged in a river during spring months due to snow melt and sometimes rainfall

-**Reservoir:** Area upstream of a dam where water is or can be stored for a long period of time.

-**Runoff:** The excess water, from precipitation or spring melt, which isn't retained in the ground and flows into the surrounding streams.

-**Run-of-river dams:** Type of hydroelectric facility where no or little water is stored. A small dam is usually built to cause water to pond upstream, ensuring the river water is high enough to enter the pipes leading to turbines.

-**Tributary:** A small stream or river which flows into a larger lake or river.

-**Watershed (or drainage basin):** Area of land that channels rainfall and snowmelt into a body of water or stream.

June 21, 2019 version

For any questions regarding the Planning Board,
please communicate with the Ottawa River Regulation Secretariat :

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