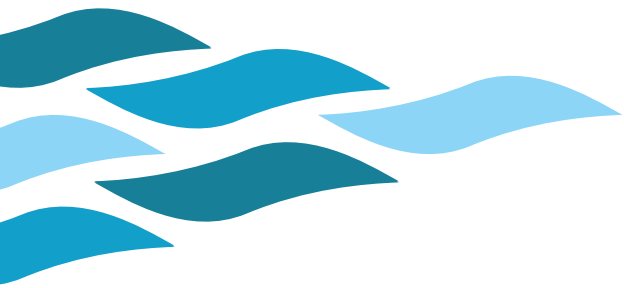




ENSEMBLE
planifions l'avenir
autrement

PARTICIPANT'S HANDBOOK



Co-ordination and editing

This publication was prepared by the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques of Québec.

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www.foruminondations2017.gouv.qc.ca

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MESSAGE FROM THE MINISTER OF SUSTAINABLE DEVELOPMENT, ENVIRONMENT AND THE FIGHT AGAINST CLIMATE CHANGE, DAVID HEURTEL



In the spring of 2017, high water hit Québec with a vengeance, leading to devastating flooding.

In a context where scientific analysis tells us that climate change will make extreme precipitation more frequent, the flood management status quo is no longer viable. The rising waters have served notice on us that fighting climate change and adapting to its human, environmental and economic impact is an urgent matter.

The forum to which you have been invited provides an opportunity for deep reflection on planning the future differently and overcoming the challenge of improving our resiliency to floods.

During the two days of the Forum, the members of the Main Table that I chair will listen to and dialogue with experts that have a variety of perspectives and origins, knowing that flood management is not exclusively a Québec challenge.

The process of sharing information and good flood management practices that have been implemented both locally and elsewhere in the world will, I am certain, be both illuminating and inspiring.

Let's work together to identify areas of potential solutions to improve Québec's resilience to flooding. Let's work together to plan the future differently and ensure our own security and the security of our children.

Let's do it for them!

The Minister,



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A HANDBOOK TO STIMULATE REFLECTION

The Forum Inondations 2017 *Participant's Handbook* puts recent events into perspective and presents the themes of the planned Plenary Sessions and the main focal points for each one.

Many reference documents that complement the Handbook's contents are available online. You are invited to view them on the Forum's website at the following address:

www.foruminondations2017.gouv.qc.ca.





PROGRAM OCTOBER 6, 2017

This program is subject to change.

7 am	Participant reception <i>A continental breakfast will be available.</i>
8 am	Opening ceremony. David Heurtel, Minister of Sustainable Development, Environment and the Fight against Climate Change
8:20 am	Recap of events, Ministère de la Sécurité publique
8:30 am	Québec floods in a climate change perspective. Alain Bourque, Executive Director, Ouranos Inc.
9:10 am	Question period



Plenary session—Integrated watershed management

9:30 am	Integrated watershed management and Québec floods. Antoine Verville, acting General Manager, Regroupement des organismes de bassins versants du Québec
10 am	Question period
10:15 am	Break
10:30 am	The role played by dams in integrated water management in Québec. Julie Lafleur, Operations Manager of Public Dam, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), and Bernard Poulin, Vice-President, Production Equipment Operations, Hydro-Québec
10:50 am	Question period
11 am	Existing solutions at the watershed level. Nicolas Milot, Associate Professor, Institut des sciences de l'environnement, Université du Québec à Montréal
11:30 am	Question period
11:45 am	Break

Noon	Lunch <i>Lunchboxes will be available for all participants.</i>
12:15 pm	Luncheon conference by Henk Ovink , Special Envoy for International Water Affairs, The Netherlands
12:55 pm	Question period
1:15 pm	Break
 Plenary session–Flood-risk areas mapping and management	
1:45 pm	The Québec normative framework for flood zone management. Pascal Sarrazin, Team Leader, Development and Hydric Environments, and Jean Francœur, Chief Engineer (floodplains), Hydrology and Hydraulics Department, MDDELCC
2:15 pm	Question period
2:30 pm	Flood risk management in Canada in the era of climate change. Daniel Henstra, Associate Professor, Department of Political Science, and Jason Thistlethwaite, Assistant Professor and Director of the Climate Change Adaptation Project, University of Waterloo
3 pm	Question period
3:15 pm	Break
3:30 pm	Best practices for resilient, legitimate and efficient flood risk governance. Sally Priest, Head of the Flood Hazard Research Centre, Middlesex University, London
4 pm	Question period
4:15 pm	Mapping flood risk–Its role in improving flood resilience in England. Catherine Wright, Director of Digital and Skills, Flood and Coastal Risk Management within the UK Environment Agency
4:45 pm	Question period
5 pm	Networking activity



PROGRAM

OCTOBER 7, 2017

8 am	Reception <i>A continental breakfast will be available.</i>
	Plenary session—Land-use and urban planning: Reviewing flood-risk areas regulation
8:45 am	Introduction. David Heurtel
9 am	Natural infrastructures: A strategy for adapting to climate change. Jérôme Dupras, Professor, Département des sciences naturelles, Université du Québec en Outaouais
9:40 am	Question period
10 am	Using the land sustainably to cope with floods. David Paradis, Urban Planner, Vivre en ville
10:20 am	Question period
10:30 am	Break
10:45 am	New pathways for the future. Pierre Thibault, Architect, Atelier Pierre Thibault
11:15 am	Question period
11:30 am	Returns on resilience: Value generation through resilient design and water management. Katharine Burgess, Director, Urban Resilience, Urban Land Institute, Washington, DC
Noon	Question period
12:15 pm	Lunch <i>Lunchboxes will be available for all participants.</i>
12:45 pm	Luncheon conference by Jessica Grannis , Adaptation Program Director for the Georgetown Climate Center and Staff Attorney and Adjunct Professor at the Harrison Institute for Public Law, Washington, DC
1:25 pm	Question period
1:45 pm	Break
2 pm	Flood management in Alberta. Andre Corbould, Alberta Deputy Minister of Environment and Parks
2:30 pm	Question period
2:45 pm	Development of well-balanced strategies to enhance flood resilience. Herman van der Most, Flood Risk Management Strategy Specialist (Deltares) The Netherlands
3:25 pm	Question period
3:45 pm	Conclusion and acknowledgements



FLOODING IN QUÉBEC IN THE CONTEXT OF CLIMATE CHANGE

INTRODUCTION

The spring 2017 floods require that we ask questions about how we do things and live on our land, given the anticipated impact of climate change in Québec. The potential impacts include increased frequency and intensity of extreme hydroclimatic events such as flooding and heavy rainfall^{1,2,3}. In addition to the latest floods, the summer 1996 Saguenay flood and the spring 2011 rivière Richelieu overflow demonstrates just how vulnerable we are to an upsurge of this type of event.

The 2011 and 2017 floods in figures

2011 RIVIÈRE RICHELIEU ⁴	SPRING 2017
40 municipalities affected in 2 regions	286 municipalities affected in 15 regions
2,535 primary residences flooded	5,371 primary residences flooded
1,651 evacuees	4,066 evacuees

The “Together, let’s plan the future differently” theme of the Forum Inondations 2017 provides an opportunity for a comprehensive process of reflecting on managing flood risk in Québec aimed at ensuring public health and safety. At the beginning of the Forum, the Ministère de la Sécurité publique will recap the flooding that struck Québec in the spring of 2017. The Ouranos research consortium on regional climatology and adaptation to climate change will then review the state of science and knowledge in its area of expertise. Back-and-forth discussions among participants will mainly take place during the following three half-day Plenary Session at the Forum Inondations 2017:

- Integrated watershed management
- Flood-risk areas mapping and management
- Land-use and urban planning: reviewing flood-risk areas regulation

1 Government of Québec, *2013-2020 Climate Change Action Plan*, p. 4.

2 Ouranos, *Vers l’adaptation. Synthèse des connaissances sur les changements climatiques au Québec*, Montréal, 2015, 415 p.

3 Centre d’expertise hydrique du Québec (CEHQ), *Hydroclimatic Atlas of Southern Québec – The Impact of Climate Change on High, Low and Mean Flow Regimes for the 2050 horizon*. Québec, 2015, 81 p.

4 Ministère de la Sécurité publique,
[online], <http://www.securitepublique.gouv.qc.ca/securite-civile/publications-et-statistiques/inondations-monteregion-2011/en-ligne.html>.

The goal of the Forum is to identify potential solutions and feed into the government's process of reflection, helping to prepare Québec to improve its resilience to flooding.

Participants are invited to the Forum on the basis of their competency and involvement in land management and flooding issues.

PLENARY SESSIONS AND THE ROLE OF PARTICIPANTS

Each Plenary Session will begin with presentations by guest speakers, who will share their experience on the theme of the session. There will then be a question period with members of the Main Table.

In addition to these plenary sessions, special conferences are planned, where experts in flood-related fields will share their experience.

The members of the Main Table are representatives from government, municipal and regional decision makers, scientists and members of environmental organizations and indigenous communities. The mission of the Members is to listen to the invited experts and stimulate discussions by asking questions drawn from their fields of expertise. The Main Table will be chaired by the Minister of Sustainable Development, Environment and the Fight against Climate Change.

Audience members will have observer status and be able to speak following the members of the Main Table. Web viewers will be able to share their questions and comments by means of a dedicated platform.

In order to be fully prepared for the Forum, all participants are asked to work through the Forum's website at www.foruminondations2017.gouv.qc.ca.

GLOSSARY

Climate hazard

Climate phenomenon likely to cause loss of life or injury, property damage, social and economic disturbances and environmental deterioration⁵.



Resiliency

The degree to which a system is favourably or unfavourably affected by climate variability or climate change; depends on internal properties, such as whether buildings or infrastructures are new or in a state of deterioration.



Impact

Consequences of climate hazards on the built or natural environment, health and the economy.



Adaptive capacity

The ability of systems, institutions, humans and other organisms to adjust to potential damage, take advantage of opportunities, or respond to consequence⁶.



The adaptive capacity of a system is an ability to efficiently respond to change. A highly adaptive system would be able to confront climate change and perhaps even take advantage of it, while a frail adaptive system would be more likely to suffer impairment from the same changes⁷.

Resilience

The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation to stress and changes⁶.

Residual vulnerability

Condition resulting from a combination of physical, social, economic and/or environmental factors that predisposes exposed structures to prejudice and/or damage. Vulnerability reveals the incapacity or unfitness of an environment and its component parts to resist a hazard or respond when it materializes⁵.



- 5 Morin, M., Ministère de la Sécurité publique, *Concepts de base en sécurité civile*, 2008, Québec, 60 p., [online], http://www.securitepublique.gouv.qc.ca/fileadmin/Documents/securite_civile/publications/concepts_base/concepts_base.pdf.
- 6 Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Synthesis Report*, 2008, Geneva, Switzerland, 203 p., [online], http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm.
- 7 Natural Resources Canada, *Key Concepts – Climate Change Resources (CCR)*, 2008, [online], <http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/ch2/10319>.



INTEGRATED WATERSHED MANAGEMENT

INTRODUCTION

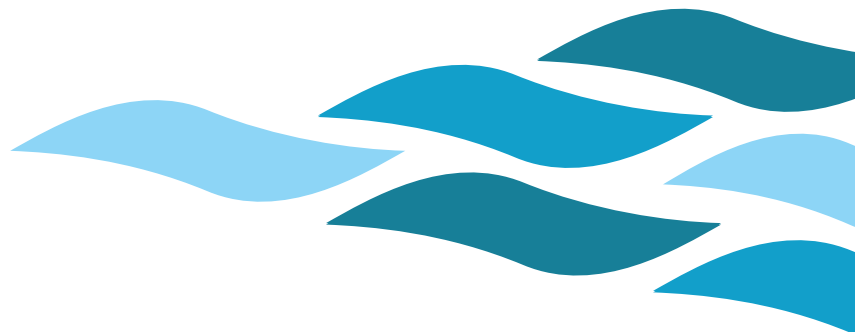
Flood risk management and prevention requires that water management be considered at the watershed level. In fact, integrated watershed management (IWM) has been a central part of the Government of Québec's concerns for more than 20 years.

Integrated watershed management is a management mode that takes account of all activities that impact the water resource, including natural phenomena just as much as human endeavour. This approach enables a comprehensive upstream to downstream vision to be built of the various uses made of the watershed, in order to preserve them for the future. IWM also makes it possible to set priorities for action in better and concerted ways, by accounting for cumulative impact. As such, it is critical to flood management.

Quantitatively speaking, flow and water level fluctuations can have serious and sometimes destructive impacts on shoreline property and human activity. The spring 2017 floods caused by heavy rain combined with upstream snow melt bear witness to this very fact. Such phenomena can become exacerbated in the context of climate change. Various types of human activity such as waterproofing soil also influence water flow.

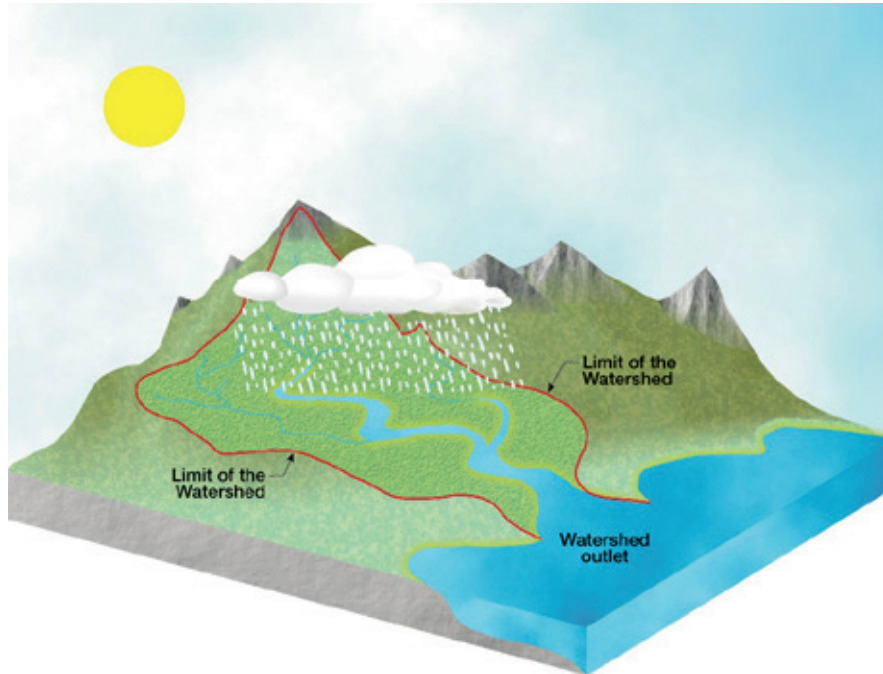
In a different perspective, natural watershed environments are sources of multiple benefits: Wetlands, for example, have the power to store excess water that earth is unable to absorb, and play a major role in regulating high water flow by acting as sponges and mitigating flood phenomena. Moreover, the fauna and flora found in shorelines, littoral zones and floodplains vary widely, and their components interact to form balanced ecosystems. As a consequence, the conservation of natural watershed environments is a source of multiple benefits to the population, both local and national.

The aim of this Plenary Session is to reflect on how to revisit our practices and behaviour in the medium- and long-term to optimize watershed level water management and help reduce the impact of flooding on our living environments.



WHAT IS THE DEFINITION OF A WATERSHED?

Watersheds designate territorial units in which all surface water flows naturally toward a single point called the watershed outlet. The physical boundaries of these units are defined by the lines that follow mountain, hill and highland ridgelines, also called divides.



THE QUÉBEC LEGISLATIVE AND REGULATORY ENVIRONMENT

WATERSHED ORGANIZATIONS AND REGIONAL ROUND TABLES

With the adoption of the [Politique nationale de l'eau](#) in 2002, Québec undertook to no longer manage the water resource by sector, but instead in a coordinated manner, moving toward the goal of integrated management. Implementing IWM was in fact a major Québec Water Policy commitment.

In 2009, the National Assembly of Québec unanimously adopted the *Act to Affirm the Collective Nature of Water Resources and Provide for Increased Water Resource Protection* (Water Act), which was [updated](#) in 2017.

The *Water Act* oversees the mechanisms used for the integrated management of water resources in Québec. It empowers the Minister of Sustainable Development, Environment and the Fight against Climate Change and the organizations that are committed to implementing IWM (watershed OBV groups and regional round tables) in the integrated management zones of the St. Lawrence River.

Fourty watershed organizations are responsible for implementing watershed-level management within their individual management zones. A total of 12 regional round tables will be progressively set up in the St. Lawrence River and Gulf of St. Lawrence sectors. Their mission: implementing the integrated management of the St. Lawrence in their management zone.

The dialogue approach calls for each watershed organization to produce a master water plan, called the PDE, while the round tables are responsible for developing the regional integrated management plan, called the PGRI. These plans assemble the information needed to comprehend the issues and challenges in their management zone. They define priorities and required action, particularly with respect to protecting, restoring and developing water resources. Among the responsibilities of the watershed organizations and regional round tables are promoting the implementation of the planning document tasks to the zone's actors, and monitoring results.

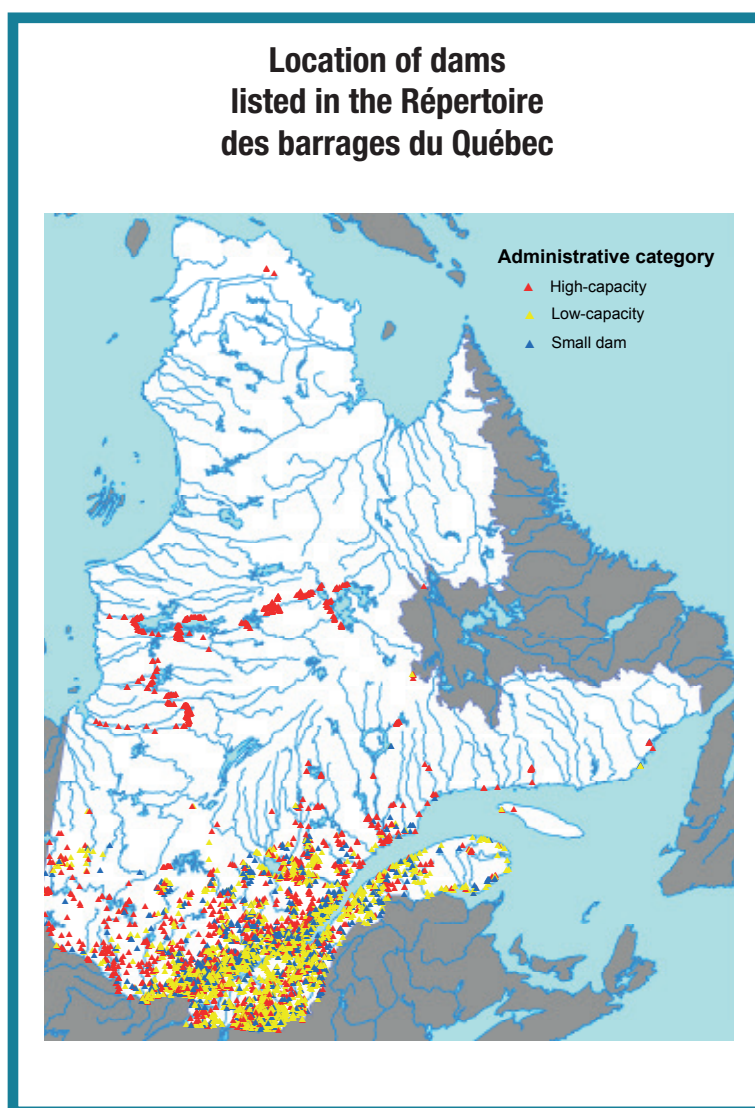
In June 2017, the Government of Québec adopted the *Act respecting the conservation of wetlands and bodies of water* that entrenches the “no net loss” principle. This makes it possible to conserve and restore these areas or create new environments to counter the inevitable loss of wetlands and bodies of water and plan land development in a watershed perspective by taking greater account of the functions of these essential environments.

DAMS

Nearly 6,000 dams of one or more metres in height are listed in the Répertoire des barrages du Québec (*Québec dam repertory*). These dams are subject to the *Dam Safety Act* and its implementing regulation. Dam owner obligations vary among dam categories, which depend on water volume retention and facility height, as follows:

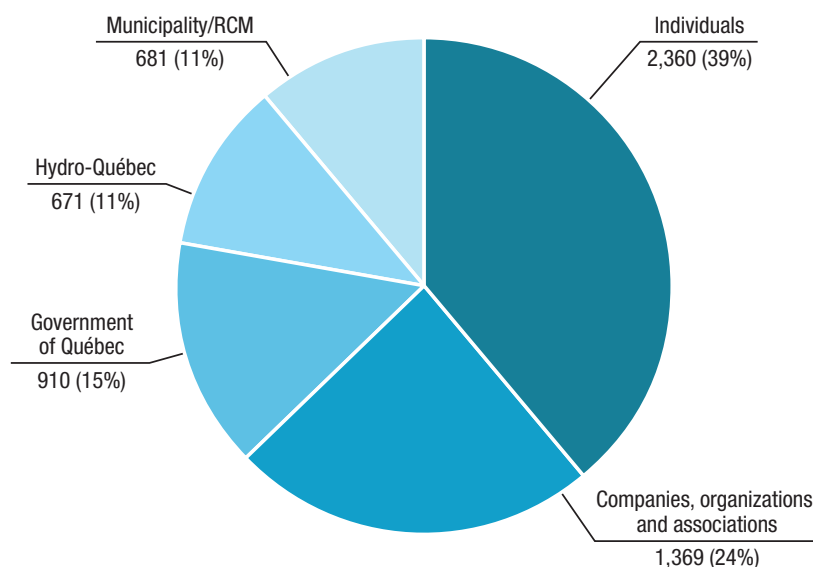
- High-capacity (2,019 listed)
- Low-capacity (2,822 listed)
- Small dam (1,139 listed)

The main obligations of the *Dam Safety Act* relate to high-capacity dams, which must be designed to resist a minimum safe flood level, whose recurrence is set on the basis of the consequences of dam rupture. Dams must be able to endure the safe flood level in exceptional conditions, without bursting. Slightly more than 700 high-capacity Québec dams have levels of consequence that vary from “average” to “considerable.”



LEVEL OF CONSEQUENCES	SAFE FLOOD LEVEL (PROBABILITY OF RECURRENCE)
Minimum/weak	1:100 years
Average/important	1:1,000 years
Very important	1:10,000 years or ½ PMF
Considerable	Probable Maximum Flood (PMF)

The following chart illustrates the distribution of categories of owners of dams covered by the *Dam Safety Act*:



MANAGING HYDRAULIC FACILITIES TO REDUCE FLOODING RISKS

All dams do not equally contribute to flood control. In order to significantly reduce the outflow from a dam, major volumes of water must be stored. This is the case for reservoir dams. In order to contribute more to reducing the risk of flooding, reservoir water level is reduced to its lowest point in winter so as to store significant volumes of water from spring rain and snow melt. It follows that individual dam contribution to flood control is a direct function of its water storage capacity.

Waterline dams, on the contrary, cannot accumulate significant volumes of water: all upstream water that feeds into the dam must be continually evacuated. Waterline dams can have fixed thresholds only or include outflow equipment.

The great majority of Québec dams have fixed thresholds and no ability to change outflow. In high water periods, outflow increases in proportion to the retained water level.



Sample fixed threshold dam

Among dams that are equipped with evacuation equipment (control valves or throughfares), a minority (including the most important ones) have reservoirs that make it possible to store water and reduce the risk of flooding.



The Portage-des-Roches dam

THE REGULATION OF FLOW IN THE ST. LAWRENCE RIVER AND THE INTERNATIONAL JOINT COMMISSION (IJC)

Water flow in the St. Lawrence River upstream from Montréal is controlled by the Moses-Saunders Dam in Cornwall. The dam is under the authority of the Ontario Power Generation. [The International Lake Ontario - St. Lawrence River Board](#), which functions under the authority of the International Joint Commission (IJC), manages Lake Ontario and the St. Lawrence River in accordance with Plan 2014, which was adopted after several years of in-depth studies, public consultations and, finally, assent by the governments of Canada and the United States.

THE OTTAWA RIVER AND THE OTTAWA RIVER REGULATION PLANNING BOARD

The [Ottawa River Regulation Planning Board](#) (ORRPB) is responsible for the hydrographic management of the Ottawa River, due to its complexity and numerous dam operators. The Board was established to ensure integrated management of the principal reservoirs of the Ottawa River Basin. The goal of this integrated management is to provide protection against flooding and maintain the interests of the various users, particularly in hydroelectric energy production.

The ORRPB, whose members represent the governments of Canada, Ontario and Québec, has an operational arm: the Ottawa River Regulating Committee (ORRC), which ensures the concerted regulation of the various dams in this basin. The Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), Hydro-Québec, Ontario Power Generation and Public Services and Procurement Canada all appoint dam managers to sit on this committee.

In the spring of 2017, more than 12 billion cubic metres of water were stored in the main reservoirs of the Ottawa River Basin, reducing the volume of spring flooding in the Montréal archipelago by 30%. It is estimated that in the absence of large dam integrated management, water flow in the Ottawa River would have increased by nearly 2,500 m³/s.

Hydrological forecasting

In Québec, dam managers, the Ministère de la Sécurité publique and many municipalities make use of hydrology forecasts to better anticipate and take account of climate and hydrological hazards to ensure public safety and meet the terms of management plans. As is the case for weather forecasts, some uncertainty exists in short and medium term hydrology forecasts. Hydrology uncertainty stems mainly from observed and forecast climate data such as the level and age of the snowpack, soil saturation and permeability, recent observed and forecast precipitation, etc. The uncertainty obviously increases in step with the forecast horizon. Rain forecast for tomorrow is more likely to fall than rain forecast for two weeks from today!

CHALLENGE

RECONCILIATION OF USE

Dam management is part of the integrated management of water resources since it in part enables flood-related issues to be addressed. Major reservoirs are designed and operated in ways that meet a number of goals, including flood control, energy production, support during low water flow, maintaining sufficient water levels for recreational activities and drinking water needs, all while ensuring safety and the integrity of the surrounding levees and dams. Appropriate water level in large reservoirs is defined by risk analysis, which itself is based on historical and forecast high water, as well as the above goals. In order to enable better flood control, reservoir water level has to be as low as possible to optimize the availability of water volume storage capacity during peak flow. The optimization of hydroelectric production also requires water to be stored during high runoff times and progressively released in low flow times. This may lead to lower reservoir levels during vacation periods.

Reconciling all of these goals involves challenges. In order to ensure fair sharing of the resource and take the consequences of water outflow into account, all users are called upon to compromise and dialogue in order to reach consensus with respect to these challenges.

Dam management is a part of watershed level water resource management. In addition to its inherent constraints, this type of management must also contend with anthropic pressure and natural environment conservation issues.

Dam management utilization and constraints

- Ensure structural security
- Contribute to flood control
- Meet environmental needs
- Meet recreational needs
- Meet hydroelectric production needs
- Ensure the supply of drinking water

Ontario employs a different model of integrated water resource management, for which the public sector Ontario Conservation Authorities have specific responsibilities relating to flooding, among other issues.

Ontario Conservation Authorities

The public sector Conservation Authorities of Ontario were set up in 1942 under the *Conservation Authorities Act*. These bodies work to combat erosion and flooding, produce flooding forecasts and manage flood and low water support programs. They also advise municipalities on natural danger management; operate dams and have regulatory powers relating to land development and usage restrictions within their boundaries. While assigning major importance to the integrated management of the water resource, these authorities have powers that extend to the management of all other resources in their jurisdiction (natural habitats, protected areas, wetlands, etc.). The authorities, on whose boards sit several municipal representatives, work in concert with all local watershed actors to help prevent conflict of use and protect watersheds and communities.

For good water management

In Québec, the MDDELCC funds the Rés-Alliance project that stems from the 2013-2020 Climate Change Action Plan and is coordinated by the Regroupement des organismes de bassins versants du Québec (ROBVQ). Rés-Alliance seeks to ensure knowledge transfer and experience sharing among the various communities that need to adapt to the new climate realities that affect water resource management (<https://robvq.qc.ca/resalliance/apropos>).

The MDDELCC also participated in funding the major “Acteurs locaux EAU boulot!” project:

- The first major achievement of this committee was the Répert’eau platform for sharing information between municipalities (see www.reperteau.info/);
- A self-diagnostic tool and guidebook for rainwater management were also produced. Good water management has an impact on localized flood recurrence (see <https://robvq.qc.ca/public/documents/bibliotheque/uploaded/Bod3gthz.pdf>).

For more information, please read the INTEGRATED WATERSHED MANAGEMENT section of Forum’s website: www.foruminondations2017.gouv.qc.ca.

Guest Speaker biographies and abstracts of their addresses are available on this website.



FLOOD-RISK AREAS MAPPING AND MANAGEMENT

INTRODUCTION

The spring 2017 floods affected a vast area. The frequency and intensity of such events will grow under the effects of climate change. This fact means that managing areas that are prone to floods needs to adapt to and take account of the evolution of knowledge and technology, whether this is in real time, by means of forecasting mapping or for land development purposes.

Québec already possesses modelling and floodplain maps for various of its rivers, as well as a normative framework governing the kinds of intervention that are permissible in each of these environments (the [Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains](#) [PPLRLZP]).

Nonetheless, the April and May 2017 floods revealed the need for a deeper reflection on the scope of existing tools and future needs, as well as considering the possibility of revisiting our floodplain management policy.

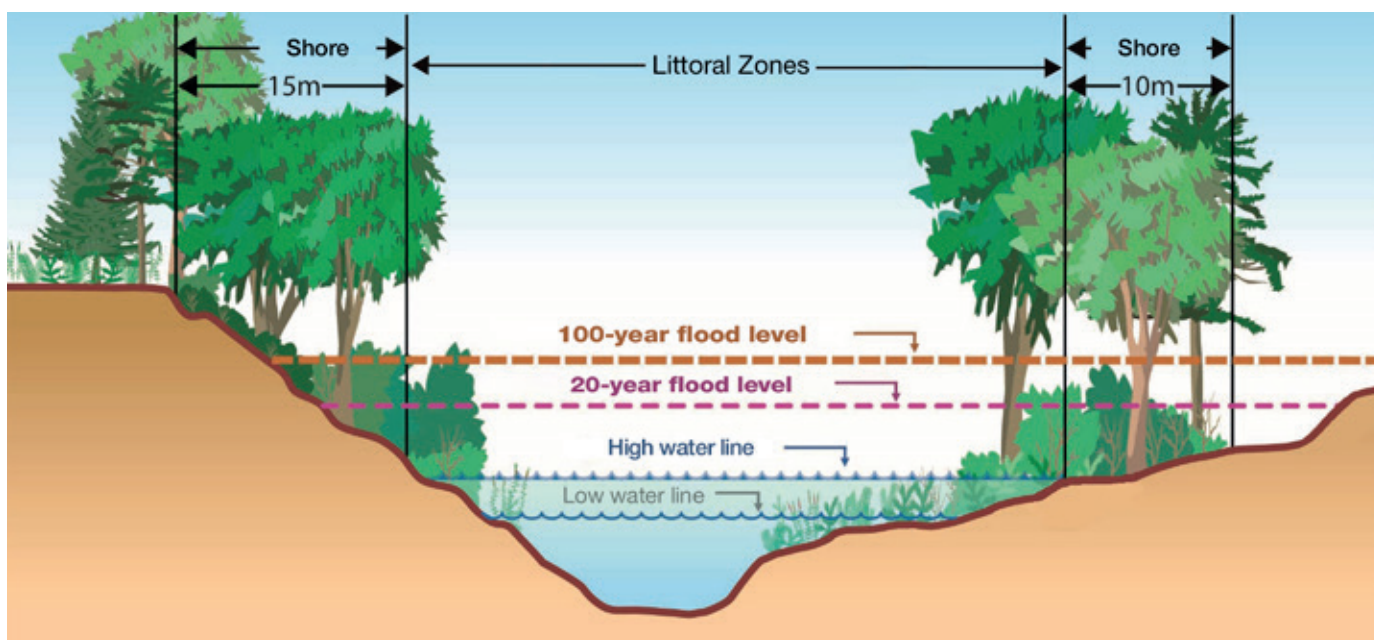
The goal of this Plenary Session is to think about the methods and measures used in Québec, in order to ensure that the floodplain framework and its management practices remain evolutionary and adaptable, and that information is widely accessible.

WHAT IS THE DEFINITION OF A FLOODPLAIN⁸?

The Protection Policy defines a floodplain or flood zone as a space that is occupied by a lake or river during flooding.

The causes of natural flooding may be complex and difficult to precisely identify (abundant precipitation, snowmelt, ice or log jams, massive accumulation of coarse sediment, avulsion, rise of the water table, soil saturation, heavy wind, wave crashing, etc.). However, they can be usefully grouped into three categories:

- Free water floods, which are exclusively caused by a substantive increase in the quantity of water (flow) in a river
- Jam floods, caused by the accumulation of ice or debris in a river segment that prevents the free circulation of water and may back water up against the current
- Submersion floods in coastal areas that are the result of a set of marine phenomena (tides, storms, winds, low pressure areas, etc.). Even though this type of flood can damage property located near the mouths of rivers, they are considered different from free water floods. In fact, damage caused by submersion flooding is often greater than free water flood damage.



Lowlands abutting or relatively close to a body of water are all at risk of flooding at some point in time. The dimensions of floodplains bordering Québec bodies of water are known and documented only in a limited number of areas that represent a marginal proportion of the territory of Québec.

Floods are measured in terms of their level and frequency and described using the “period of return” and “recurrence” expressions. The Protection Policy uses 20- and 100-year flood recurrence categories to determine the boundaries of floodplains. These categories correspond to annual floods that respectively have 1 chance in 20 (5%) and 1 chance in 100 (1%) of occurring.

Climate change has shaken up probabilistic calculation and this calls for a deeper understanding of the phenomena based on observations, as well as taking a prudent approach to urban development.

⁸ The relevant MDDELCC website for this is www.cehq.gouv.qc.ca/zones-inond/.

THE QUÉBEC LEGISLATIVE AND REGULATORY ENVIRONMENT

Adopted in 1979, the *Act Respecting Land use Planning and Development*, under the aegis of the Ministère des Affaires municipales et de l'Occupation du territoire (MAMOT), defines the planning tools (metropolitan plan, planning and development blueprint, urban planning scheme, municipal urban planning by-laws, etc.) needed for the orderly and harmonious development of living environments. The MAMOT also determines the responsibilities of political actors that work in a given area⁹.

Region County Municipalities (RCMs) and metropolitan communities must identify any part of their territory that is subject to major constraints for reasons of public safety and health or general welfare.

As a planning tool, the planning and development blueprint sets the directives used for the physical organization on the RCM. These blueprints are, above all, formulated and designed to induce a regional sustainable development vision.

In Québec, the *Environment Quality Act* (EQA) makes the Minister of Sustainable Development, Environment and the Fight against Climate Change responsible for developing a protection policy for riverbanks, littoral zones and floodplains and proposing it to the government, implementing it and coordinating its deployment. To this end, the government adopted the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains in 1987, then extended the application of the policy to all Québec lakes and bodies of water, including those located in agricultural environments (except for ditches).

Local and regional municipalities are required to comply with the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains when preparing their by-laws. They may adapt the minimum standards to the needs of their concerns but may not be more permissive than the minimum framework of the policy.

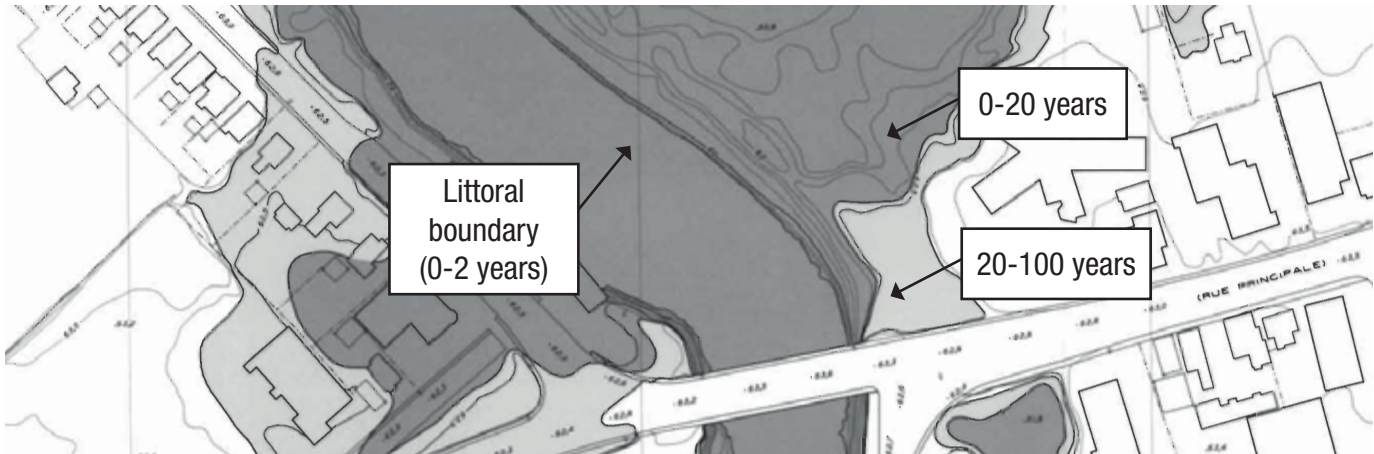
Under the *Act Respecting Land use Planning and Development*, if an RCM does not incorporate the minimum rules set out in the Protection Policy, or for a flood zone determined by the government, section 53.13 makes it possible to correct the fault. That section empowers the Minister of Sustainable Development, Environment and the Fight against Climate Change to require changes to the blueprint if in its sole judgment, the current RCM blueprint does not comply with the government's policy and/or the boundaries of a floodplain located within its territory and/or does not provide adequate protection for wetlands and bodies of water, given the particular features of the area. Section 165.2 of the *Act Respecting Land use Planning and Development* grants the same power to the Minister with respect to local municipality zoning, subdivision and building by-laws that may not comply with the Policy.

In order to better incorporate the quest for sustainable development, it is vital to take account of the principles of prevention and precaution in developing a given area. Under the *Sustainable Development Act*, the principle of prevention provides that whenever a danger is known, preventive, easing and corrective action must be taken, in priority at the source. The precaution principle provides that whenever the risk of serious or irreversible damage exists, the absence of scientific certainty cannot be used as a pretext for procrastination with respect to adopting effective measures aimed at preventing environmental deterioration.

9 MAMOT, www.trousse.pdza.ca/assets/telechargement/fiches_lois/LOI-01-LAU.pdf, 2017.

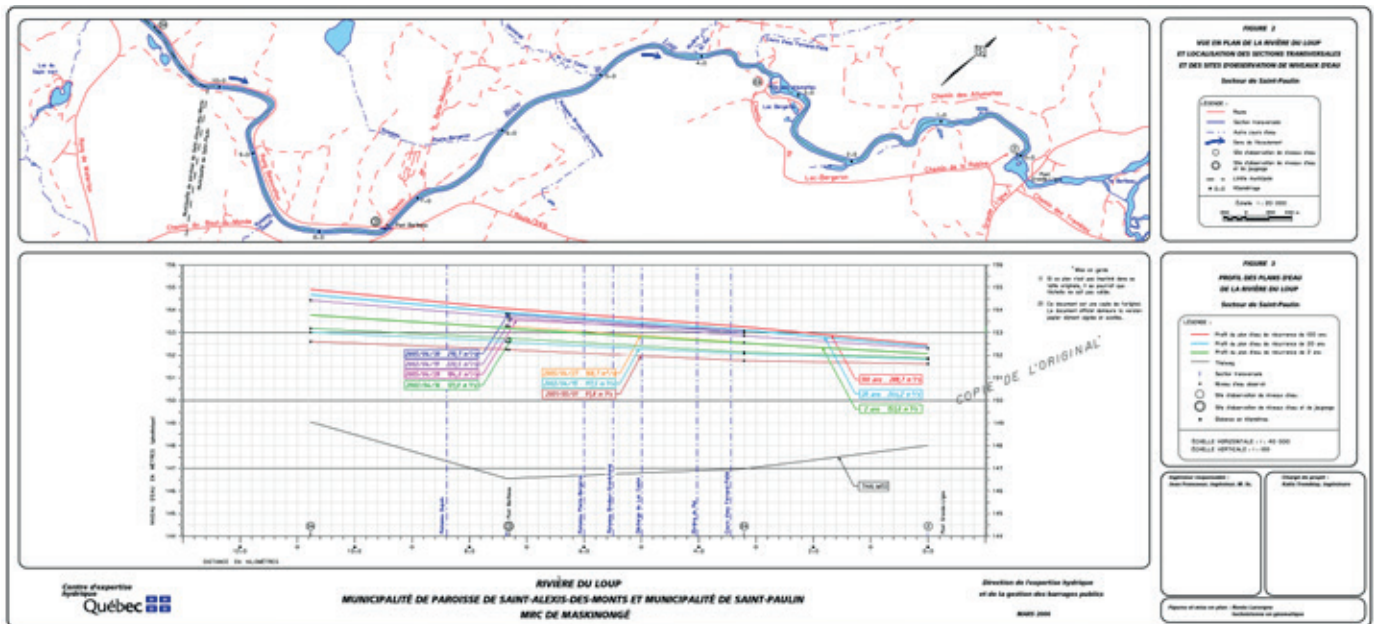
FLOOD-RISK AREAS MAPPING

In the past, the Government of Québec prepared many free water flood risk maps in the framework of the Canada-Quebec Agreement Respecting Flood-Risk Mapping Applied to Floodplain Preservation and Sustainable Development of Water Resources. Signed on October 4, 1976, this agreement particularly targeted the identification of vulnerable areas. It was amended in 1983, renewed in 1987 and 1994, and terminated on April 1, 2001.

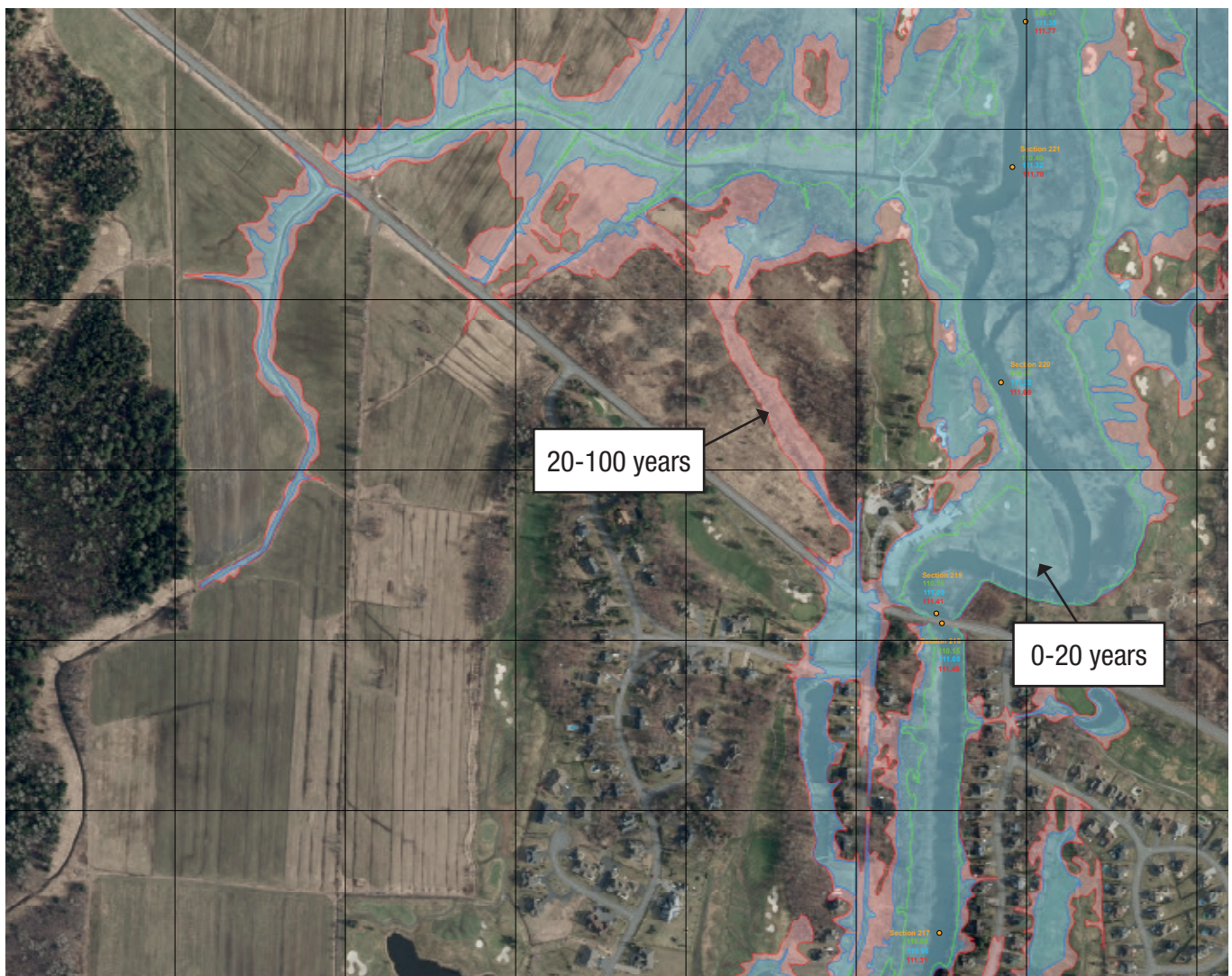


Sample floodplain map

Subsequently, the Programme de détermination des cotes de crues (PDCC) de récurrence 20 ans et 100 ans (*20- and 100-year flood recurrence ratings program*), managed by the MDDELCC, took over from the mapping program, completing the determination of flood ratings in priority sectors. In June 2000, regional authorities received the list of rivers covered by the program. No official maps exist for areas flooded following jams.



Example of flood ratings that were provided to RCM and local municipality authorities—longitudinal profiles



Example of a map produced by the MDDELCC

In other words, municipalities are in charge of mapping flood zones or determining flood ratings for rivers within their boundaries. Several RCMs and municipalities have indeed prepared maps that are incorporated into their planning tools. However, no procedures currently exist to update these maps and/or flood ratings.

The Hydroclimatic Atlas of Southern Québec

The MDDELCC has published the *Hydroclimatic Atlas of Southern Québec—The Impact of Climate Change on High, Low and Mean Flow Regimes for the 2050 horizon in Québec*. This publication, mainly addressed to actors in the field of water, was created with the goal of supporting the implementation of adaptive climate change measures.

The Atlas incorporates the latest advances made possible by research on hydroclimatic modelling (see https://www.cehq.gouv.qc.ca/hydrometrie/atlas/Atlas_hydroclimatique_2015EN.pdf).

CHALLENGES

UNCERTAINTY LINKED TO THE IDENTIFICATION OF FLOODPLAINS

Québec floodplains are mainly identified by the use of two values: the likelihood of recurrence over 20 years, and the likelihood of recurrence over 100 years. The methodology and calculations that result in these values can vary on the basis of factors such as region, available data and the hypothesis employed by the analyst. Floodplain management as currently used in Québec does not include the notion of uncertainty, which some countries have incorporated into their management modes in recent years. For example, several U.S. communities have improved their resiliency by systematically adding between 1 and 3 feet to their 100-year recurrence values, while some Canadian provinces choose to use 200-year recurrence instead of the 100-year recurrence used in Québec.

INFORMATION UNIFORMITY AND ACCESSIBILITY

As previously mentioned, each RCM is responsible for identifying areas within its boundaries that are at risk for flooding. Methods used to achieve this end vary from one RCM to another, such as the different water levels on the left and right banks of the river and between two different RCMs, can engender some incoherence.

There also exists considerable variability with respect to available resources and tools in the various RCMs. Some employ teams of geomatics professionals and engineers that are capable of this type of study, while the resources of others are not up to the task, leading them to ask the MDDELCC for help in defining their floodplains or updating their information.

In addition, since each RCM is in charge of demarcating its areas that are at risk of flooding, it is difficult for the population to have comprehensive access to information on floodplains that have been identified throughout Québec. Such information is partitioned, and requests have to be made to each RCM on an individual basis. Also, given that not all RCMs have mapped their flood zones and that some of them only have flood likelihood values, citizens who endeavour to acquire reliable information about floodable areas of their land or learn if a river is at risk for flooding, can face an uphill battle.

TAKING THE PROTECTION POLICY FOR LAKESHORES, RIVERBANKS, LITTORAL ZONES AND FLOODPLAINS INTO ACCOUNT

Many municipalities have yet to incorporate the Policy's normative framework into their by-laws or do not comply with it. This situation has a negative impact on the environmental components of lakes, rivers and floodplains.

For more information, please see the FLOOD-RISK AREAS MAPPING AND MANAGEMENT section on the Forum's website: www.foruminondations2017.gouv.qc.ca.

Guest Speaker biographies and abstracts of their addresses are available on this website.



LAND-USE AND URBAN PLANNING: REVIEWING FLOOD-RISK AREAS REGULATION

INTRODUCTION

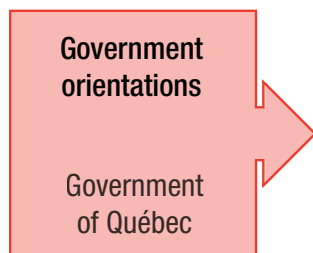
What instruments and practices should be used to fashion less vulnerable living environments? In the fields of territorial and urban planning and building and infrastructure design, how can we be sure that our choices meet the needs of the present and the future in a context where knowledge is continually evolving?

Land planning and development responsibilities are shared among various government, metropolitan community, RCM and municipal actors. The government sets the vision, goals and framework under which municipalities work. Metropolitan communities plan at the level of their boundaries, while RCMs, as previously mentioned, determine zones in which land occupancy is subject to special constraints for public health, welfare and safety reasons and to ensure environmental protection for wetlands and bodies of water. The Protection Plan is in this regard deemed supra-municipal and is applied at the local level. RCM Councils are comprised of the mayors of each municipality whose boundaries fall within the RCM, plus any other representatives of the municipalities. Finally, municipalities prepare the urban development plan, which is their most important planning document. The municipal council represents its municipality and manages its affairs.

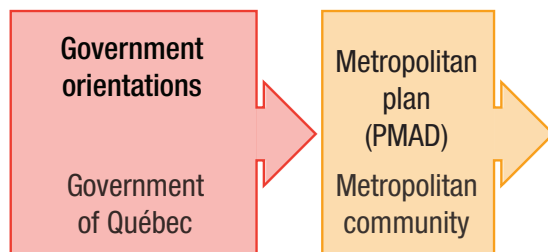
This plenary session seeks to reflect on how land planning and community development can be achieved in an integrated way, while still meeting the public affairs participation expectations of the citizenry and taking account of future climate forecasts.

THE QUÉBEC LEGISLATIVE AND REGULATORY ENVIRONMENT¹⁰

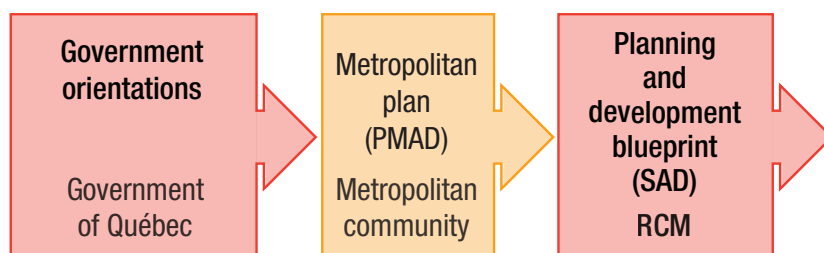
The 1979 *Act Respecting Land use Planning and Development* is used by the government to set up planning and control mechanisms such as metropolitan plans, planning and development blueprints, and urban planning schemes and regulations to ensure consistency among planning tools. Québec also uses a number of **government orientations** that express the government's vision and goals in various fields including land planning and development, which it sends to RCM towns, RCMs and metropolitan communities. The guidelines must be considered by concerned organizations in community planning.



The **metropolitan layout and development plan** (PMAD) is the land planning document used in metropolitan communities. It makes it possible to make layout and development choices and decisions that affect all RCMs, RCM towns and urban centres within a metropolitan community. Its main goal is to ensure the competitiveness and attractiveness of different areas within the metropolitan community, in a sustainable development perspective. Two metropolitan communities exist in Québec: Montréal and Québec City.



Utilized as a planning tool, the **planning and development blueprint** (SAD) sets guidelines for the physical organization of RCM or RCMs towns territories. It enables the coordination of choices and decisions that affect all municipalities within the boundaries of a given RCM, as well as the government, government ministries and designees. The blueprint also comes with a complementary document that details the minimum standards that must be stipulated by municipalities in the urban planning by-laws. These blueprints are required to comply with government orientations and with the objectives of the layout and development plan. As previously mentioned, blueprints define flood risk areas that are subject to special constraints.

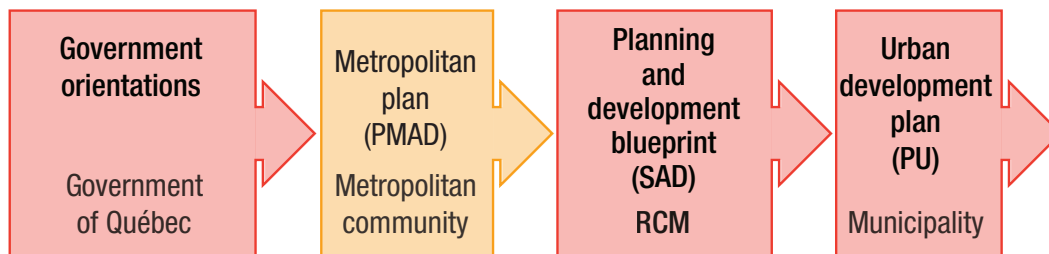


¹⁰ MAMOT, www.mamot.gouv.qc.ca/amenagement-du-territoire/guide-la-prise-de-decision-en-urbanisme et http://www.trousse.pdza.ca/assets/telechargement/fiches_lois/LOI-01-LAU.pdf.

The **urban plan** is the most important planning document used by a municipality. It sets out the comprehensive vision of planning within its boundaries, sets guidelines for the municipality's spatial and physical organization and contains the urban planning policies approved by the municipal council to guide decision-making. Like the planning and development blueprint, the urban plan has no direct legal effect on residents. As such, plan provisions cannot solely justify denial of a construction or subdivision permit. In order to justify permit denial, intentions expressed in the plan must be materialized by urban planning by-laws.

Urban plans need to include major land planning orientations, ground allocation and occupancy density requirements, as well as the current and projected roads layout. They may also include areas marked for renovation, restoration and/or protection, as well as buildings and natural or heritage sites that are recognized for their architectural and/or environmental value, and the type and location of community or public facilities.

As such, while municipalities are not obligated to identify areas subject to constraints in their urban plans, they are required to comply with the objectives and contents of the planning and development blueprint and any complementary documents, and to set rules that are as least as restrictive as the ones described therein.



The main control tools used by municipalities are **urban planning by-laws**, which materialize the goals set out in the blueprint and the urban development plan. The by-laws must comply with all legislation that affects planning (such as the *Act Respecting the Preservation of Agricultural Land and Agricultural Activities*), as well as the objectives of the blueprint.

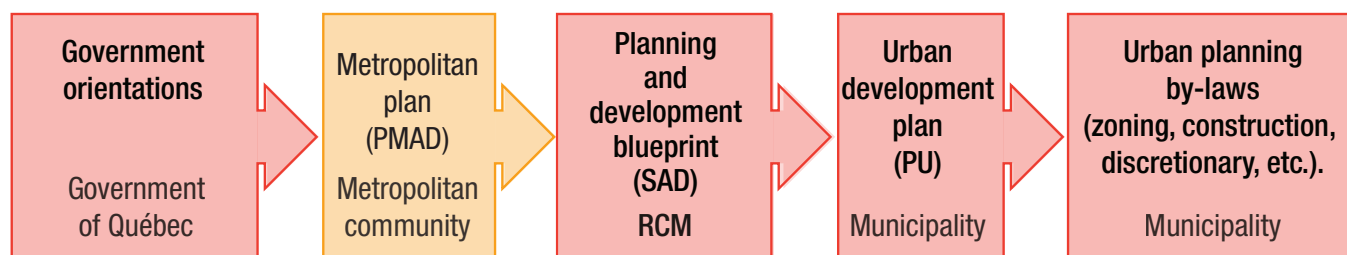
Once its urban development plan comes into force, the municipality is obligated to adopt urban planning by-laws covering zoning, subdivisions and construction. The **zoning by-law** is comprised of a series of obligations and prohibitions aimed at overseeing property rights. It sets standards for land usage, construction, facilities and cadastral operations. It permits the division of municipalized land into zones and determines their vocation in order to control the use of lands and buildings, and defines what types of installation, form and appearance of facilities are permissible. For example, the zoning by-law takes flood, rock- and landslide risk into account, as well as any other features of the area that represent a danger to public health and safety. For zones at risk of flooding, normative provisions must be at least as restrictive as the ones found in the Protection Policy.

Municipalities use **subdivision by-laws** to define standards for land subdivision and plot determination. Subdivision is usually the first step in the process of land development, and precedes construction, use or even protection. Subdividing land into plots has consequences for the future development of a given sector, since construction has to follow the objectives chosen as a function of plot dimensions and orientation, street network, integration of development into the environment, etc.

The **construction by-law** allows the municipality to control the quality, service life and structural security of a building by regulating the type of authorized materials used and the way they are assembled. In fact, the purpose is to regulate buildings as assemblages of materials. This by-law enables municipalities to cover buildings that escape the Québec Building Code.

Other **urban planning by-laws are discretionary in nature**, which means that they are based on criteria rather than standards. They provide more flexibility for project oversight, based on predetermined guidelines, and deal more with minor exceptions, conditional use, special construction projects, layout plans and architectural integration, etc.

Minor exceptions to urban planning by-laws are prohibited in zones where land occupancy is subject to special constraints for public safety reasons.



ACTOR ROLES AND RESPONSABILITIES

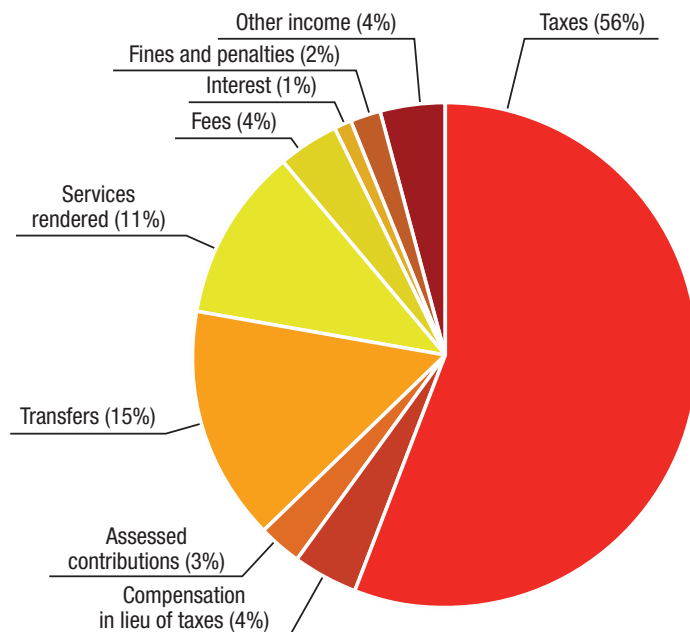
Even though elected officials in the main have legal responsibilities, reimagining cities to make them more resilient to climate hazards such as flooding necessitates the involvement of actors from many different backgrounds. For example, homeowners can decline to denaturalize riverbanks or can reduce runoff from their property; neighborhood groups and community organizations can imagine more comprehensive approaches to managing disasters; while architects can propose buildings that fit better with their environment. In short, anyone and everyone can help improve the environment in which they live.

CHALLENGES

SOURCES OF INCOME

The main sources of income for Québec municipalities are property assessment and taxation. As such, municipalities depend heavily on property taxes in order to provide and fund municipal services (general administration, public safety, transit, sanitation, etc.).

Municipal funding by source of income for all Québec cities and regional county municipalities (2012)



Source : MAMROT, Fiscal 2012 financial statement for municipalities: Consolidated income, excluding northern municipalities.

In this context, the sectors closest to bodies of water, which are generally preferred and where property value and therefore taxes are high, represent areas of interest for urban development. This type of development is an essential factor in opening new sources of funding for municipalities.

2013-2020 Government Strategy for Climate Change Adaptation and 2013-2020 Action Plan

Acting in the context of fighting climate means, first and foremost, understanding how climate change is likely to affect our living environments, to enable us to develop solutions that work for today and tomorrow and put them into practice. This is why identifying vulnerability to climate change impact is vital for anyone who wants to act in concrete ways.

By counting on the complementary of actions and the growth of partnerships, the **2013-2020 Government Strategy for Climate Change Adaptation** looks to elicit changes in the way we do things and limit the social, economic and environmental impact of climate change.

With funding from the **2006-2012 Climate Change Action Plan** for dealing with the new context, cities like Montréal, Québec, Laval, Sherbrooke and Trois-Rivières prepared plans to help them adapt to climate change.

The **2013-2020 Climate Change Action Plan** intends to continue to support municipal organizations that want to assess their vulnerabilities to the impact of climate change, adapt their planning practices and complete material projects.

Learn more:

www.mddelcc.gouv.qc.ca/changementsclimatiques/plan-action-fonds-vert-en.asp

A flood risk prevention guide for French mayors

The example of the Centre européen de prévention du risque d'inondation (CEPRI) is of interest here. It provides mayors in French municipalities that are exposed to flood risk but not required to prepare an approved flood risk prevention plan with a guide for managing urban development¹¹.

EXISTING STRUCTURES

Proximity to rivers and lakes has always been a determining factor for choosing the location of communities that evolved into our cities. Built environments located in floodplains therefore constitute a historical reality in many areas.

A flood control project that is energizing Toronto

The Toronto port land transformation project will serve to ensure critical protection from floods by creating a naturalized mouth for the Don River. The river valley naturalization work will extend over nearly 1,000 metres, and include an aquatic habitat of 14 hectares and 16 additional hectares of parkland. In addition to decontaminating soil in this underutilized industrial zone, the work will make it possible to transform it into a dynamic and resilient central urban neighbourhood. Investments in flood protection projects like this will foster the resilience of the city to climate change, in addition to encouraging economic growth and innovation.

More information: <https://www.theglobeandmail.com/life/home-and-garden/architecture/urban-design-in-the-time-of-climate-change-cle35601452/>.

For more information, we encourage Forum participants to read LAND-USE AND URBAN PLANNING: REVIEWING FLOOD-RISK AREAS REGULATION section on the Forum's website at www.foruminondations2017.gouv.qc.ca.

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¹¹ CEPRI, www.cepri.net/publications-et-documents.html.

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Québec 