Summary Profile of the Rivière des Outaouais Watershed

May 2015

Direction générale des politiques de l'eau

Québec

Credits page

Coordination and writing
This publication was produced by the Direction générale des politiques de l'eau in collaboration with the Direction régionale de l'analyse et de l'expertise de l'Outaouais, the Direction du Suivi de l'état de l'environnement of the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), and the Direction du Centre d'expertise hydrique du Québec.

Information
For information, contact the Information Centre of the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques.

Phone: 418 521-3830
1 800 561-1616 (toll free)
Fax: 418 646-5974
Email: info@mddelcc.gouv.qc.ca
Web: www.mddelcc.gouv.qc.ca

To obtain a copy of the document:
Direction générale des politiques de l'eau
Ministère du Développement durable, de l'Environnement
et de la Lutte contre les changements climatiques
675 René-Lévesque Boulevard East, 8th Floor, Box 42
Québec, Québec G1R 5V7
Phone: 418 521-3885

Or

Visit our website
http://www.mddelcc.gouv.qc.ca/eau/bassinversant/bassins/outaouais/portrait-sommaire-en.pdf

Reference to be cited
Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques. *Summary Profile of the Rivière des Outaouais Watershed*. 2015. 57 pages. [online]. http://www.mddelcc.gouv.qc.ca/eau/bassinversant/bassins/outaouais/portrait-sommaire-en.pdf (page consulted on day/month/year).

Legal deposit – 2015
Bibliothèque et Archives nationales du Québec
ISBN 978-2-550-73028-6 (online)

All rights reserved for all countries.

© Gouvernement du Québec - 2015

Contents

List of Figures

List of Tables

1 Background

Québec has common borders with Ontario, Labrador, New Brunswick and the American states of New York, Vermont, New Hampshire and Maine, with all of which it shares, to different degrees, cross-border drainage basins. Some of the latter are the subject of specific cooperation agreements between the governments concerned: examples include Lac Memphrémagog (Québec-Vermont), Lac Champlain (Québec-Vermont-New York) and the Great Lakes and St. Lawrence River Basin (Québec-Ontario-eight adjacent American states). For others, general agreements for environmental cooperation, in which cross-border matters related to water are addressed, have been signed between Québec and its neighbours (e.g. New Brunswick, Ontario). Additionally, Ontario and Québec intend to intensify their cooperation regarding Rivière des Outaouais.

It is in that context that the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC) has prepared the present summary of the information available on the Québec portion of the Rivière des Outaouais watershed. It briefly describes the characteristics of the watershed that are of interest for integrated water management, while also outlining its physical, economic and social environment.

As much as possible, information is presented from the perspective of integrated management by drainage basin. However, certain data may be presented on a sectoral basis, by administrative boundaries or for the main section of the river as opposed to the entire watershed.

2 General presentation of the watershed

2.1 Location and description

Rivière des Outaouais is the principal tributary of the St. Lawrence River. Its watershed extends upstream from Lac des Deux Montagnes over an area of 146 334 km², of which 92 203 km² (65%) are in Québec, the rest (35%) being in Ontario. Rivière des Outaouais arises from Lac Capimitchigama, north of the Outaouais region. From there it flows for about 1130 km to its mouth at Carillon, where Hydro-Québec operates a hydroelectric plant. Over most of its length, Rivière des Outaouais forms the natural border between Québec and Ontario (MDDELCC, 2000).

The territory of the Rivière des Outaouais watershed covers six administrative regions, namely Outaouais, Laurentides, Abitibi-Témiscamingue, Lanaudière, Montérégie and Mauricie (Figure 1). It wholly or partly includes the territories of 20 regional county municipalities (MRCs). At the local level, there are 187 municipalities, 37 unorganized territories (6 of them aquatic) and 9 territories of Aboriginal communities.

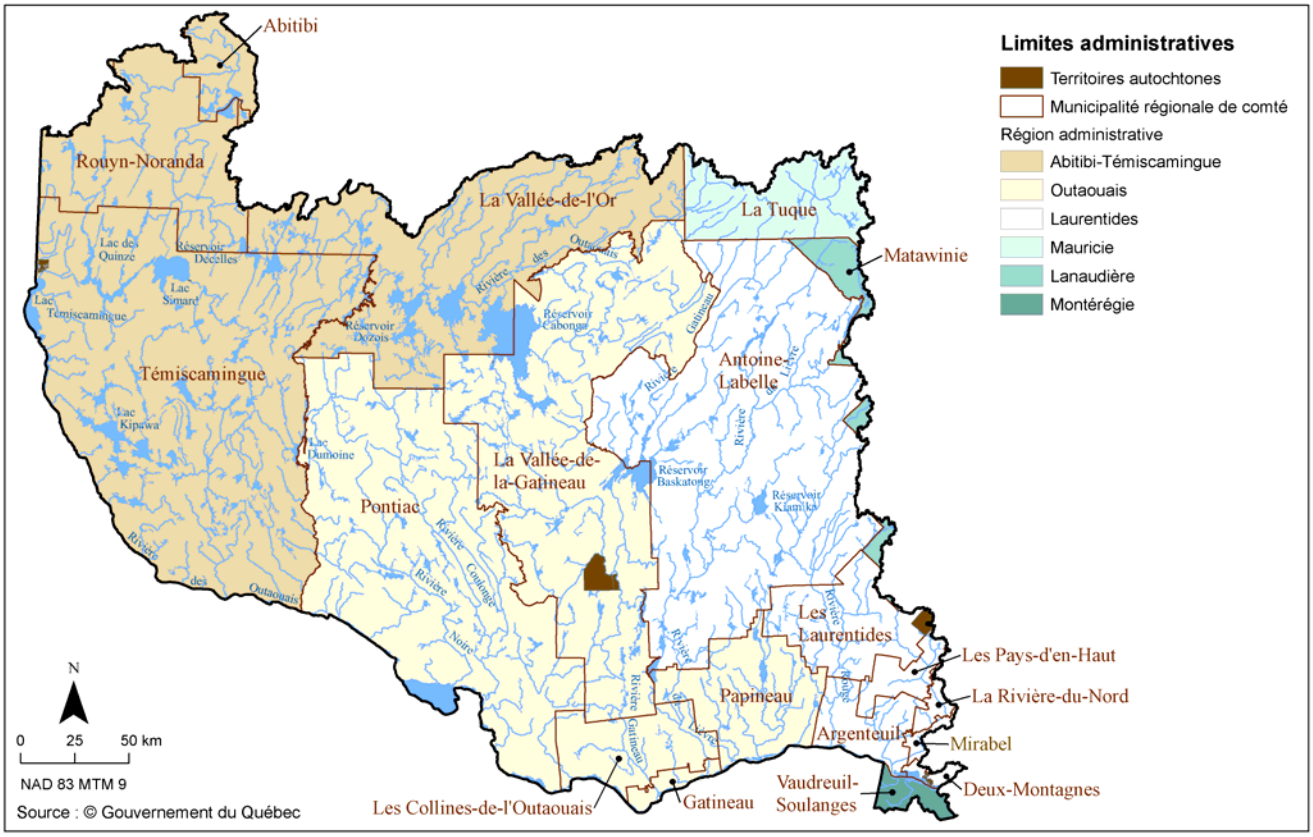

Figure 1. Administrative boundaries in the Rivière des Outaouais watershed.

The administrative regions of Outaouais and Laurentides lie completely (or 96% in the case of Laurentides) within the Rivière des Outaouais watershed. Abitibi-Témiscamingue is 57% within the watershed, while the remaining administrative regions overlap the basin only marginally. In Montérégie however, where 44% of the MRC of Vaudreuil-Soulanges is in the watershed, that portion is fairly populous, with nearly 64 000 inhabitants (Table 1).

Table 1. Demographic and territorial characteristics of administrative regions and regional county municipalities (MRCs) in the Rivière des Outaouais watershed (ISQ, 2014).

Administrative Region MRC	Population density (inhab./km²)	Population (inhab.)	Area (km²)	Proportion in the Outaouais watershed
Outaouais	**12.5**	**381 200**	**30 472**	**100%**
Les Collines-de-Outaouais	24	48 717	2026	100%
Gatineau	802.2	274 367	342	100%
Papineau	7.9	22 781	2905	100%
Pontiac	1	14 331	12 827	100%
La Vallée-de-la-Gatineau	1.7	20 914	12 373	100%
Laurentides	**28.3**	**580 966**	**25 544**	**96%**
Antoine-Labelle	2.4	35 235	14 793	100%
Argenteuil	26.5	32 650	1231	100%
Deux-Montagnes	412.8	99 891	242	60%
La Rivière-du-Nord	273.3	122 436	448	54%
Les Laurentides	18.6	45 804	2462	100%
Les Pays-d'en-Haut	62.2	41 415	677	100%
Mirabel	94.8	45 888	484	36%
Lanaudière	**39.7**	**488 927**	**12 309**	**7%**
Matawinie	5.4	50 917	9433	9%
Abitibi-Témiscamingue	**2.6**	**147 931**	**57 349**	**57%**
Témiscamingue	1	16 346	16 329	100%
Rouyn-Noranda	7	41 904	5968	85%
Vallée-de-l'Or	1.8	43 813	24 108	39%
Abitibi	3.3	24 820	7620	15%
Montérégie	**134.9**	**1 499 088**	**11 111**	**4%**
Vaudreuil-Soulanges	170.4	145 514	854	44%
Mauricie	**7.5**	**266 542**	**35 448**	**7%**
La Tuque	0.6	15 195	25 965	9%

2.2 Socio-economic profile

The total permanent population of the Rivière des Outaouais watershed is approximately 1 138 200. Table 1 presents the population estimate for each administrative region and MRC that is wholly or partly in the basin. As can be seen, Outaouais and Laurentides have the most inhabitants in the watershed, respectively 381 200 and 580 966. The highest concentration is in the urban agglomeration of Gatineau-Ottawa, with a total population of approximately 1 282 500. On the Québec side, the city of Gatineau is the most heavily populated in the watershed, with over 274 000 inhabitants. The demographic data shows that the population is not uniformly distributed in the watershed.

2.3 Biophysical environment

The landscape of the Rivière des Outaouais watershed is defined primarily by the southern Laurentians, the Abitibi lowlands in the upper portion, and the St. Lawrence lowlands further downstream.

Bioclimatic domains represent areas in which there is a particular type of vegetation due to specific climate conditions. Figure 2 shows that 85% of the watershed is deciduous forest and mixed forest, while 15% is boreal forest (balsam fir-white birch). From south to north, the basin is subdivided into five bioclimatic domains:

- Sugar maple-bitternut hickory

  This bioclimatic domain is characterized by a southern flora with highly diversified forests. The characteristic species are bitternut hickory, black maple, swamp white oak, rock elm, pitch pine and numerous shrubs and herbaceous plants. Sugar maple, balsam fir and spruce are also found.

- Sugar maple-basswood

  The flora of this bioclimatic domain is very diversified, including basswood, American ash, hop-hornbeam, butternut and sugar maple.

- Sugar maple-yellow birch

  This bioclimatic domain lies further to the north. It is less diversified, with yellow birch and sugar maple in abundance. American beech, red oak and Eastern hemlock also grow in this zone.

- Balsam fir-yellow birch (mixed forest)

This domain is characterized by mixed stands of yellow birch and softwoods, such as balsam fir, white spruce and white cedar. Sugar maple are also found.

- Balsam fir-white birch (boreal forest)

  This domain occupies the most northern part of the territory. It is dominated by stands of balsam fir and white spruce mixed with white birch. Also found are yellow birch and red maple in the southern portion. Here as in the balsam fir-yellow birch domain, forest fires and outbreaks of spruce budworm ensure forest regeneration.

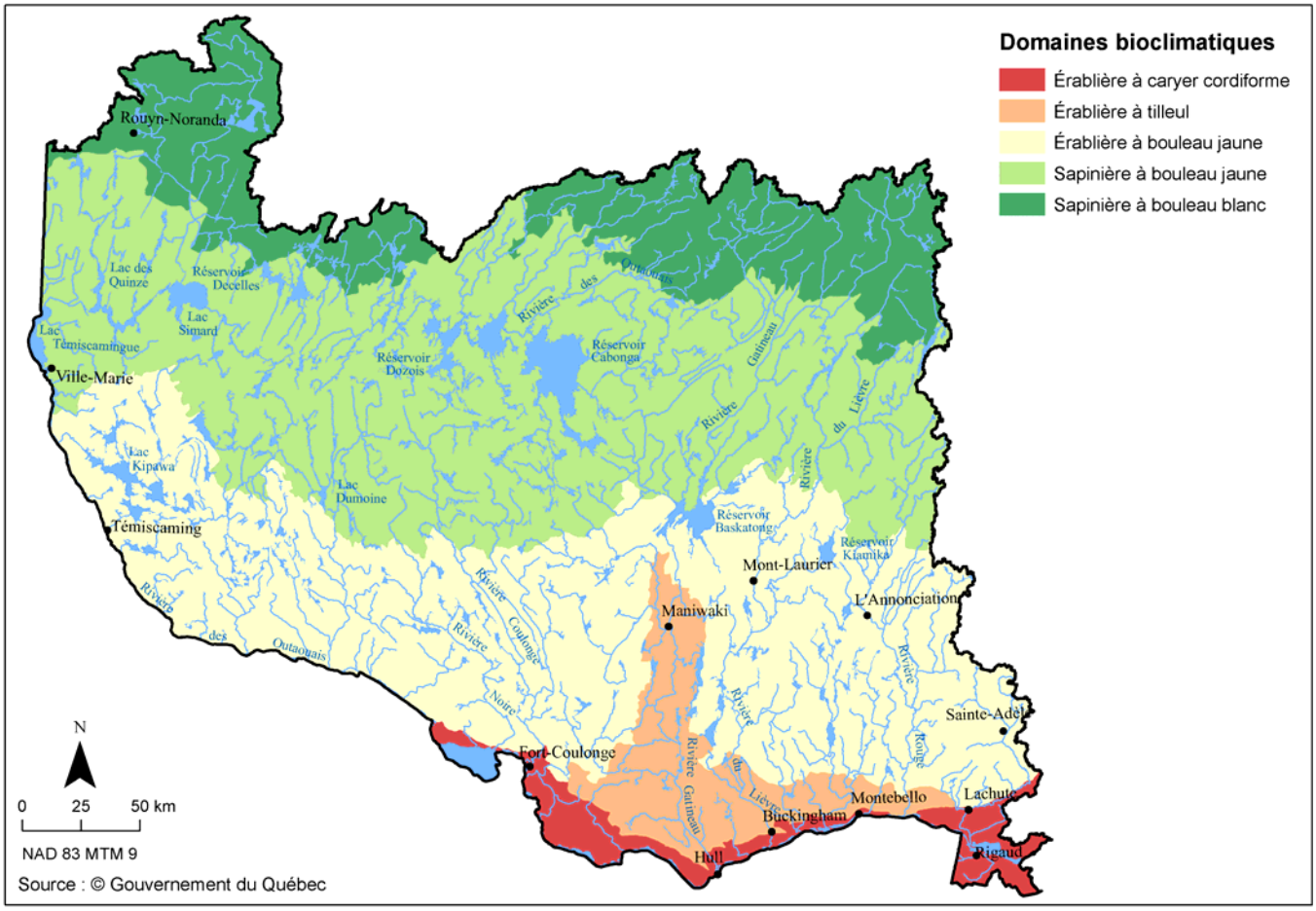

Figure 2. Bioclimatic domains in the Rivière des Outaouais watershed.

2.4 Land use

Figure 3 presents the geographical distribution of land uses (MDDELCC, 2014k). As is clear from the map, forests dominate, covering 73% of the territory. Areas of harvested and regenerating forest add 4% to that figure.

The hydrographic network (rivers, lakes, wetlands) occupies 19% of the watershed. Agriculture is generally conducted furthest downstream, occupying 3% of the territory. Urbanized areas are also downstream, accounting for 1% of the territory. As mentioned earlier, the highest population density is in the Gatineau-Ottawa area. This is where most problems with water quality occur.

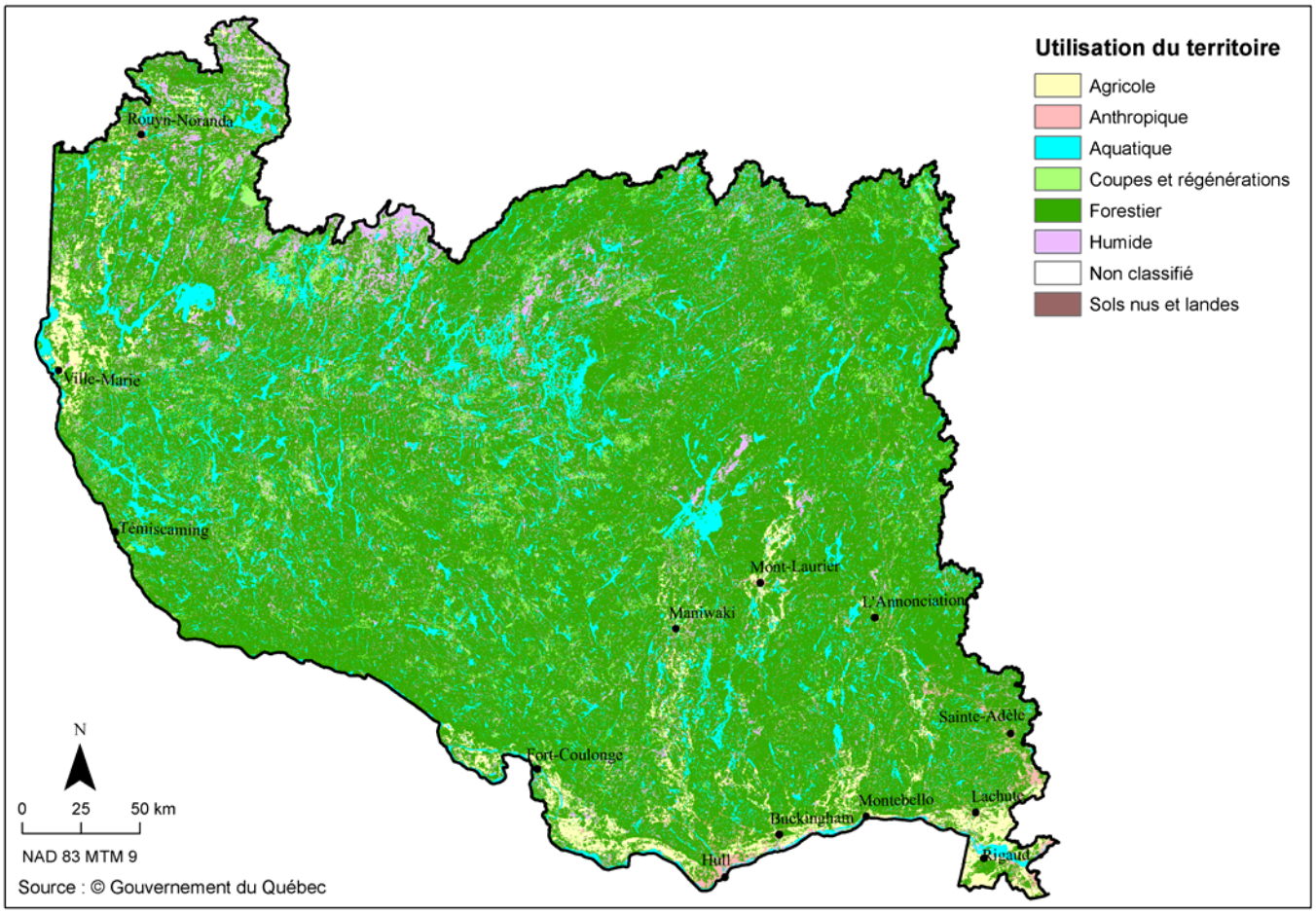

Figure 3. Land use in the Rivière des Outaouais watershed (MDDELCC, 2014k).

2.5 Historical background

As a navigable waterway, Rivière des Outaouais has always served to provide access to the interior. The First Nations and settlers used it extensively for travel and the fur trade.

In 1791, when the Constitutional Act came into force, Rivière des Outaouais became the dividing line defining the border between Lower Canada and Upper Canada (Outaouais Tourism, 2014). In the early 1900s a period of strong economic growth began as Philemon Wright developed the forest industry. Rivière des Outaouais and its

main tributaries were used for timber floating, an activity that continued until 1994 when floating activities finally stopped on Rivière du Lièvre.

The first industrialists quickly perceived the river's hydroelectric potential. In 1902, E. B. Eddy built the first dam on Rivière des Outaouais, at Chutes de la Chaudière in the heart of what is now Gatineau. From Témiscamingue to the mouth of the Outaouais, the river and its tributaries still feature today a total of 43 dams. Construction of the Carillon dam in the 1960s altered the landscape significantly, deepening inlets and flooding forests.

3 Surface water

3.1 Quantitative profile

3.1.1 Hydrographic network

The hydrographic network of Rivière des Outaouais includes 19 sub-watersheds over 2000 km^2 in size (Figure 4). On the Québec side, the main tributaries are the Gatineau, du Lièvre, Kipawa and Rouge rivers. Tributaries on the Ontario side include the Madawaska, Montréal, Blanche and Petawawa rivers. The sub-watersheds of the Rideau, Mississippi and South Nation rivers, though smaller, are important in socio-economic terms.

3.1.2 Lakes

The Rivière des Outaouais watershed contains over 90 000 lakes, of which fewer than 300 are more than 2 km^2 in size (MDDEFP[1], 2011). Among the largest are lakes Preissac, Dumoine, Opasatica and Trente et Un Milles, each being over 50 km^2 in size.

Most lakes in the watershed are on public lands. Some are on the territory of controlled zones (ZECs) or in the wildlife reserves of La Vérendrye and Papineau-Labelle.

Besides the natural lakes, there are some sixty reservoirs over 300 km^2 in size, including the Cabonga, Des Quinze, Baskatong, Témiscamingue and Dozois reservoirs (Table 2).

[1] The Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), formerly known as the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) and as the Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP).

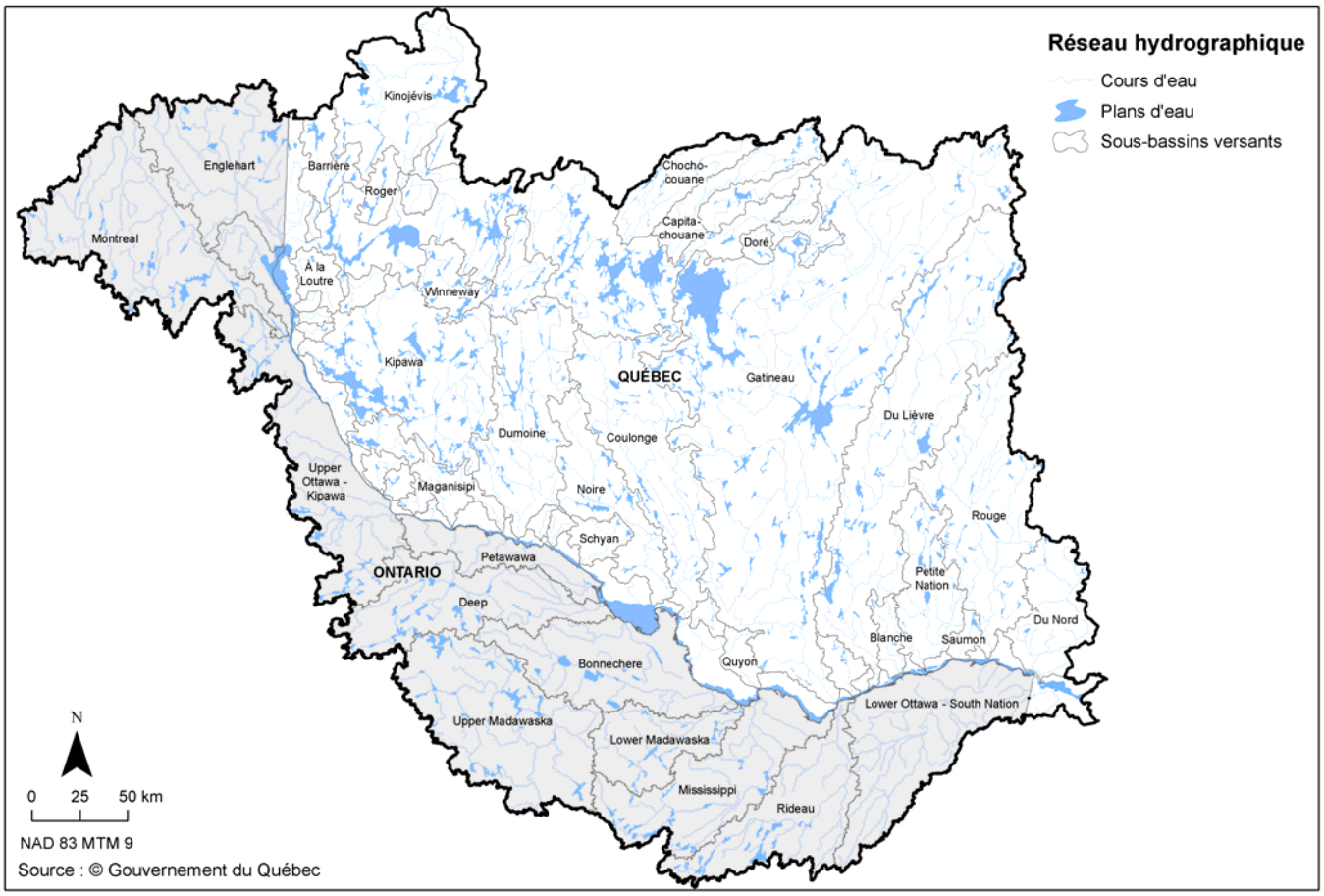

Figure 4. Hydrographic network of the Rivière des Outaouais watershed.

3.1.3 Reservoirs and dams

Reservoirs

The Rivière des Outaouais watershed contains 30 reservoirs that have a combined capacity of more than 14 billion cubic metres, resulting in the flow of the river being highly regulated. These reservoirs help control flooding and reduce the damage caused by it. However, more than 50% of the storage capacity is in the upper part of the watershed, making flood management in the lower part (the downstream) harder to achieve. Table 2 lists the 13 reservoirs with the greatest storage capacity.

Table 2. Principal reservoirs of the Rivière des Outaouais watershed (from: Ottawa River Regulation Planning Board, 1984).

River	Reservoir	Capacity (millions of m^3)
Outaouais	Dozois	1863
Outaouais	Rapide 7	371
Outaouais	Quinze	1308
Outaouais	Témiscamingue	1217
Outaouais	Des Joachims	229
Montréal	Lady Evelyn	308
Kipawa	Kipawa	673
Madawaska	Bark Lake	374
Gatineau	Cabonga	1565
Gatineau	Baskatong	2649
Lièvre	Mitchinamecus	554
Lièvre	Kiamika	379
Lièvre	Poisson Blanc	625

In 1983, the Ottawa River Regulation Planning Board was established by the governments of Canada, Québec and Ontario to ensure integrated flow management of the principal reservoirs of the Rivière des Outaouais watershed. The goal was to provide protection from flooding along the Rivière des Outaouais and its tributaries, particularly in the Montréal region, while maintaining the interests of the various users, particularly with regard to hydroelectric energy production.

The Board is composed of seven members, each with an alternate, representing Canada (3), Ontario (2) and Québec (2). The authority of the Board is defined in the *Agreement Respecting Ottawa River Regulation*. To learn more about the Ottawa River Regulation Planning Board, go to http://ottawariver.ca.

Dams

The *Répertoire des barrages du Québec* (inventory of Québec dams) (CEHQ, 2014b) lists 1093 dams in the Rivière des Outaouais watershed. Table 3 shows the number of dams in each category defined in the *Dam Safety Act* (CQLR chapter S-3.1.01): small dams, low-capacity dams, high-capacity dams and ancillary dams. Ancillary dams are those that are on the same reservoir as another that is a main dam. For more information, see http://www.cehq.gouv.qc.ca/barrages/guides/guide_fiche_technique.pdf (French).

Table 3. Number and types of dams in the Rivière des Outaouais watershed (CEHQ, 2014a)

Dam Types	Number
Small dam	207
Low capacity	466
Low capacity (ancillary)	2
High capacity	398
High capacity (ancillary)	20
Total	**1093**

The dams of the Rivière des Outaouais watershed serve a variety of purposes. As is evident from Table 4, most primarily serve recreational needs, followed by hydroelectric production and flow regulation.

Table 4. Categories of dam uses in the Rivière des Outaouais watershed (CEHQ, 2014b)

Use Category	Number
Recreation	577
Hydroelectric production	125
Regulation	106
Wildlife	61
Other or unknown	61
Log rafting (formerly)	52
Water catchment	45
Flood protection	33
Fish farming	12
Fire fighting	10
Agriculture	8
Historical site	2
Total	**1093**

3.2 Qualitative profile

3.2.1 Water quality

Data collected over the 2011-2013 sampling period showed good overall quality in the main course of Rivière des Outaouais, in terms of conventional physicochemical parameters. The data was collected in five stations along the

main course of the river and nine tributaries on the Québec side. From upstream down, the sampling stations in Rivière des Outaouais are at Notre-Dame-du-Nord, **Témiscaming**, Portage-du-Fort, the Masson ferry crossing and Carillon. The main tributaries monitored, again from upstream down, are the **À la Loutre, Coulonge**, Gatineau, **Blanche (Templeton),** Du Lièvre, **Blanche (Thurso),** De la Petite Nation, **Saumon** and Rouge rivers (Figure 5). The stations named **in bold** entered service in the summer or fall of 2012, so the data from them primarily reflects the physicochemical conditions of 2012-2013 (MDDELCC, 2014b).

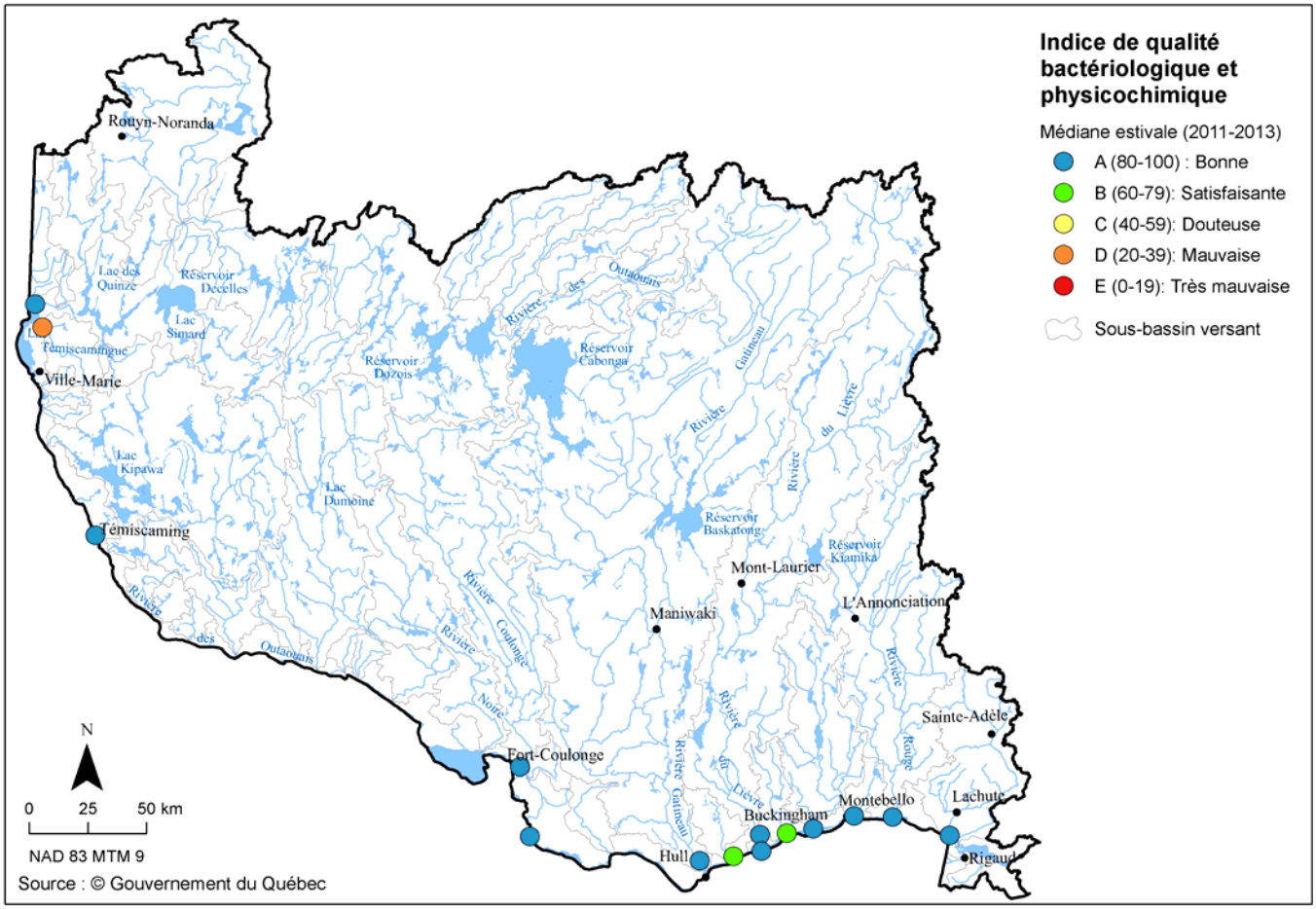

Figure 5. Bacteriological and physicochemical quality indices ($BPQI_6$) at water quality sampling stations in the Rivière des Outaouais watershed (MDDELCC, 2014b).

Analysis of the data shows that water quality was good in six of the nine tributaries of Rivière des Outaouais. The exceptions were the two Blanche rivers (at Templeton and Thurso respectively), where quality was satisfactory, while quality was poor in Rivière à la Loutre, primarily due to concentrations of suspended matter.

In the watershed as a whole the bacteriological quality was generally good. There were no violations of the quality criterion for indirect contact activities (1000 UFC/100 ml). Violations of the quality criterion for direct

contact activities (200 UFC/100 ml) were only observed in five stations over the summer period (May to October), and generally in fewer than 20% of the samples taken (MDDELCC, 2014b).

The generally good quality of water in Rivière des Outaouais and its tributaries is a reflection of the considerable efforts devoted to improving urban sanitation (sewage treatment) over the last 35 years. In the tributary watersheds there is limited pollution pressure from diffuse sources of agricultural pollution, so residual pollution in these watercourses is relatively low, as shown by their low concentrations of nutrient elements.

It is important to note that a good deal of the improvement in the quality of the water in Rivière des Outaouais is thanks to efforts on the Ontario side.

3.2.2 Cyanobacteria

In September 2007 the Government of Québec announced its *Plan d'intervention sur les algues bleu-vert* (intervention plan on blue-green algae). The intervention plan is a response to public concerns about outbreaks of blue-green algae (cyanobacteria) affecting a number of Québec water bodies. Since 2008, the MDDELCC has defined a bloom of blue-green algae as a concentration of at least 20 000 cells/ml of water. Data from before 2008 has been updated in accordance with this threshold.

From 2004 to 2012, based on the new threshold, blue-green algae blooms occurred in 178 water bodies in 14 sub-watersheds of the Outaouais (Figure 6; MDDEFP, 2014). The sub-watershed most affected is that of Rivière du Nord (44 water bodies), followed closely by Rivière Rouge (43), while 26 water bodies were affected in the sub-watershed of Rivière Gatineau (Figure 7).

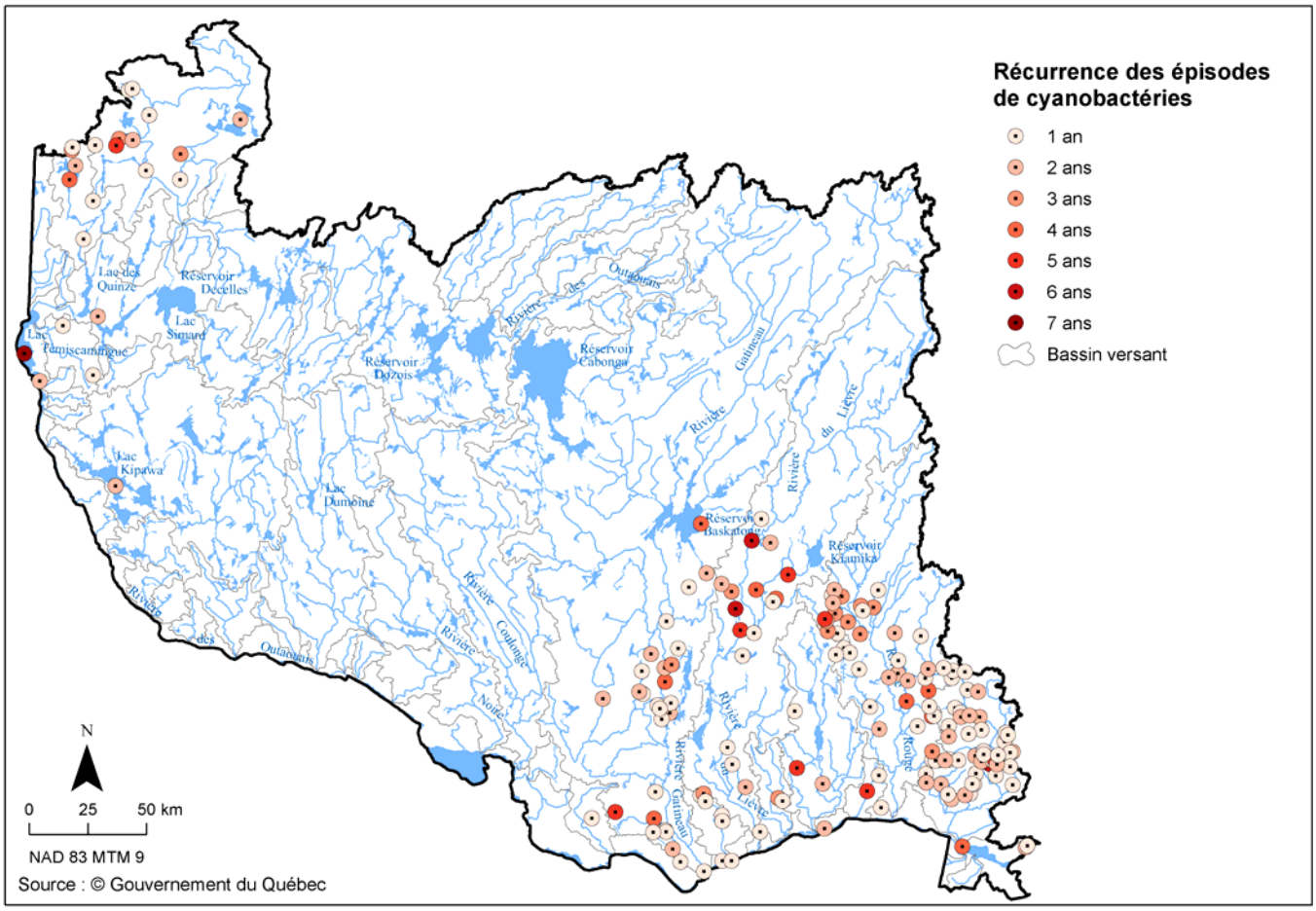

Figure 6. Recurrence of cyanobacteria outbreaks in water bodies of the Rivière des Outaouais watershed (MDDEFP, 2014).

Recurrence refers to consecutive years in which cyanobacteria are observed in a given water body. Over the period from 2004 to 2013, Lac Témiscamingue was affected every year from 2007 to 2013 (recurrence of seven years). The three lakes with the next highest recurrence (six years) are in the Laurentians, in the sub-watersheds of Rivière du Nord (Lac Johanne) and Rivière du Lièvre (Lac Ouellet and Lac des Îles) (MDDEFP, 2014).

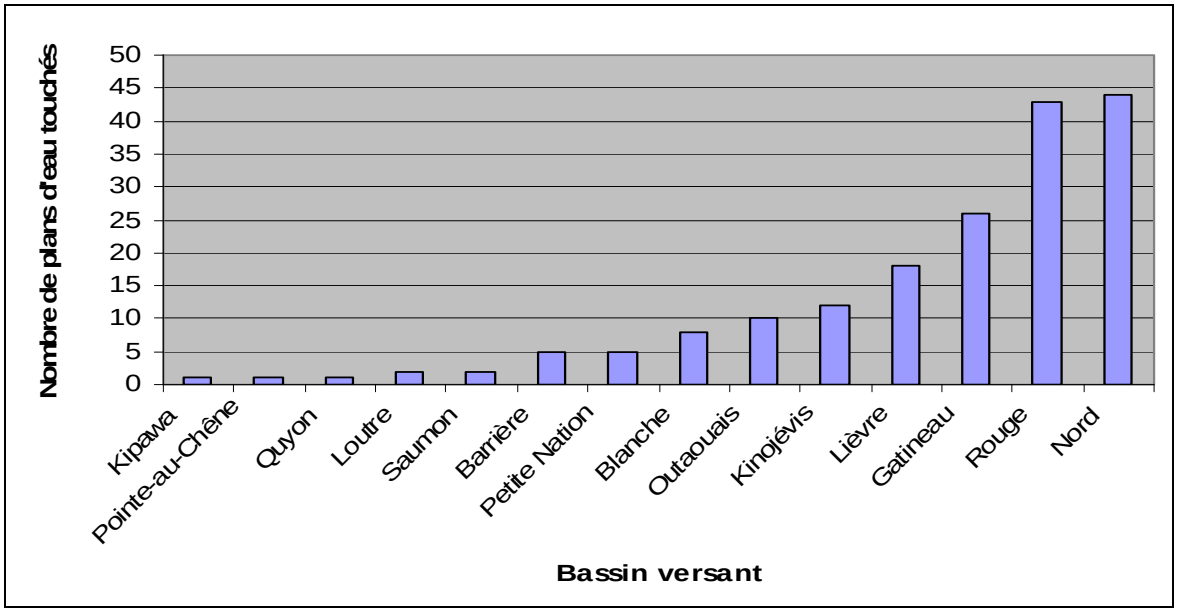

Figure 7. Number of water bodies affected by blue-green algae, by watershed (MDDEFP, 2014).

3.2.3 Lake acidity

Lake acidity may be of natural or human origin. Human caused acidification mostly occurred over the last 40 to 100 years, while lakes that are naturally acidic have been that way for millennia. Due to the geological nature of its soils, the Outaouais region is strongly affected by lake acidification. Out of 178 lakes tested, 14.5% were found to be acidic (pH $\leq$ 5.5), the percentage rising to 38.8% when transition lakes are included (pH 5.5-6), the level at which biological damage can occur (MDDELCC, 2000). Figure 8 illustrates the problem of acid lakes in the Outaouais rgion in comparison with the situation across Québec as a whole. The Laurentian region is somewhat less affected by acidification: there are only 9.4% acid lakes and 20.8% transition lakes, compared to 69.8% non-acid lakes out of the 96 tested.

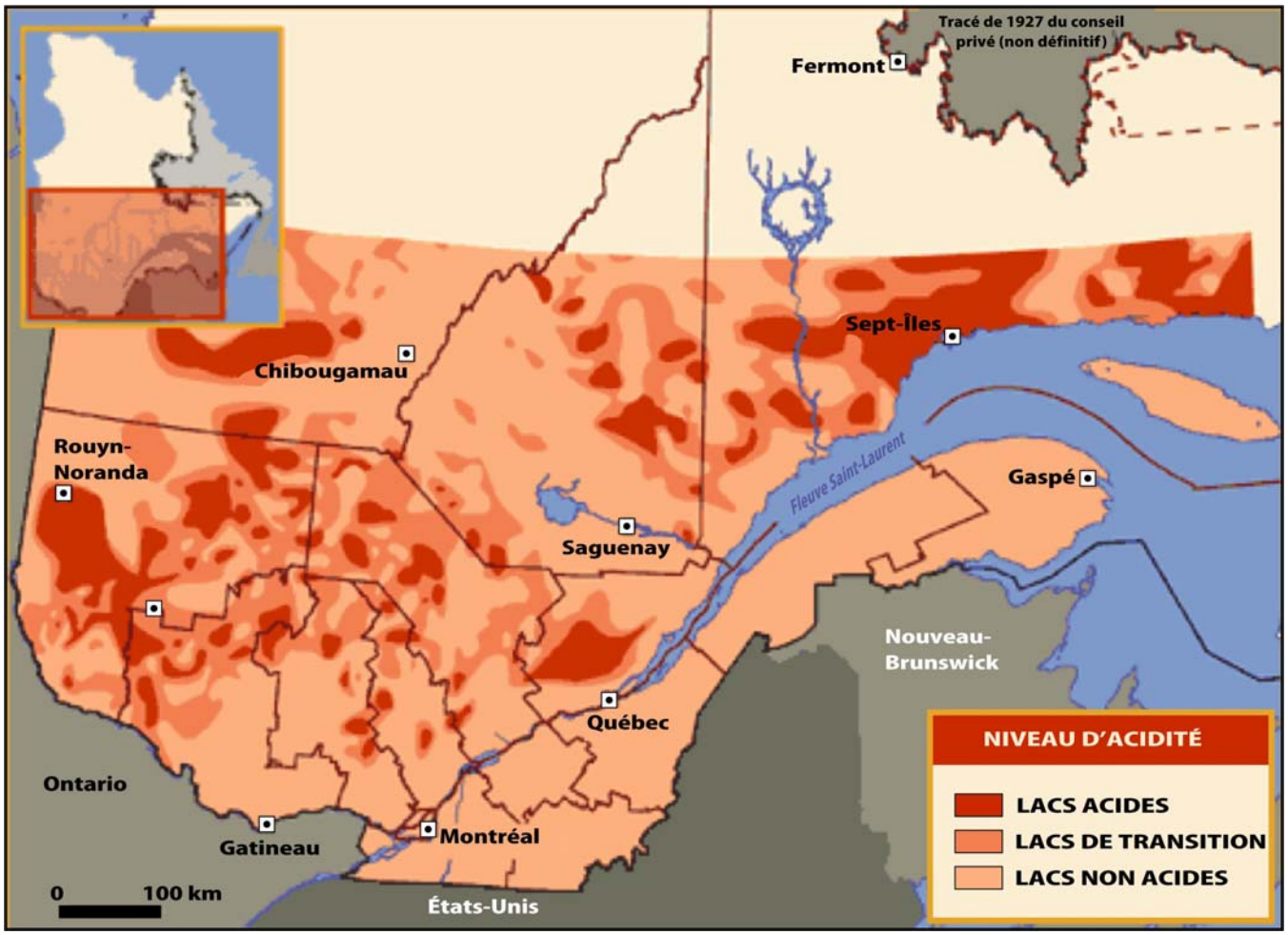

Figure 8. Levels of lake acidity in southern Québec (from Dupont, 2004).

To address the problem of lake acidification at source, Québec has joined with other industrialized states, including Canada and the United States, in launching extensive programs to reduce emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) at source. These programs have succeeded in lowering SO_2 emissions by 50% to 70%, and the intended effects have begun to appear. However, while water quality has improved in many acid lakes over the last decade, the problem persists in a great number of very sensitive lakes. In Québec, the recovery of acid lakes is held back by three main factors: acid deposition rates that continue to exceed the lakes' capacity to maintain sufficiently high pH; the greater sensitivity of forest soils; and the increasing impact of nitrate fertilizers (Dupont, 2004).

4 Groundwater

Under the *Programme d'acquisition de connaissances sur les eaux souterraines* (PACES – knowledge acquisition program on groundwater), the MDDELCC mandated Université Laval to conduct research on all municipalized territories in the Outaouais region (13 488 km²), in order to get an accurate portrait of the groundwater resource in these parts and to fill the lack of information on these groundwater resources.. The ultimate goal is for the knowledge obtained to serve in the protection and sustainable use of groundwater resources.

The territory examined for the study had a total area of 13 762 km^2 and a population of over 341 000 (Comeau and collab., 2013). Total annual water consumption was estimated at 94.9 million cubic metres (mcm) per year, of which 19.4 mcm came from groundwater (about 20.4%). In the MRC of Papineau and the city of Gatineau, most water is drawn from the surface supply, while in the other MRCs groundwater meets about 80% of needs. Over the territory as a whole, groundwater is primarily used for residential purposes (71%), coming from individual wells (63%) and municipal water systems (8%).

The findings and recommendations of PACES Outaouais provide a solid basis for reflection on the issues of the Rivière des Outaouais watershed, particularly the lower section where the population is concentrated. The project also produced a number of maps that display, among other things, the region's geological formations, the principal aquifers, their recharge zones and zones of high vulnerability to contamination. The maps also provide information about the quality of groundwater supplies. For more information about the conclusions of PACES Outaouais, go to http://rqes-gries.ca/fr/archives-et-documents/rapports-memoires-et-cartes/282-paces-outaouais.html (French).

5 Biodiversity

5.1 Special-status species

The *Centre de données sur le patrimoine naturel du Québec* (CDPNQ – data centre on Québec's natural heritage) collects, analyses and publishes data on the elements constituting biodiversity, especially plant and wildlife species of particular value. The data reveals, for the Rivière des Outaouais watershed, that 55 wildlife species (CDPNQ, 2014a) and 213 plant species (CDPNQ, 2014b) have a status defined under the *Act respecting threatened or vulnerable species* (CQLR chapter E-12.01). To learn more about the biodiversity of the Rivière des Outaouais watershed, see Appendix I of this document and the *Atlas de la biodiversité du Québec: les espèces menacées ou vulnérables*, at http://www.cdpnq.gouv.qc.ca/pdf/Atlas-biodiversite.pdf (French)

5.2 Forest wetlands

Based on data from ecoforestry maps in the third ten-year inventory, Ducks Unlimited Canada has mapped (1/2 000) the wetlands of the Rivière des Outaouais watershed (Canards Illimités Canada, 2009; Figure 9). They cover a total area of approximatively 9164 km^2, or 8% of the entire watershed. As shown by Figure 10, most of the wetlands are ponds or pools (33%). However, 28% of the wetland area consists of herbaceous meadows (Figure 11). For more information on types of wetlands, see Appendix II.

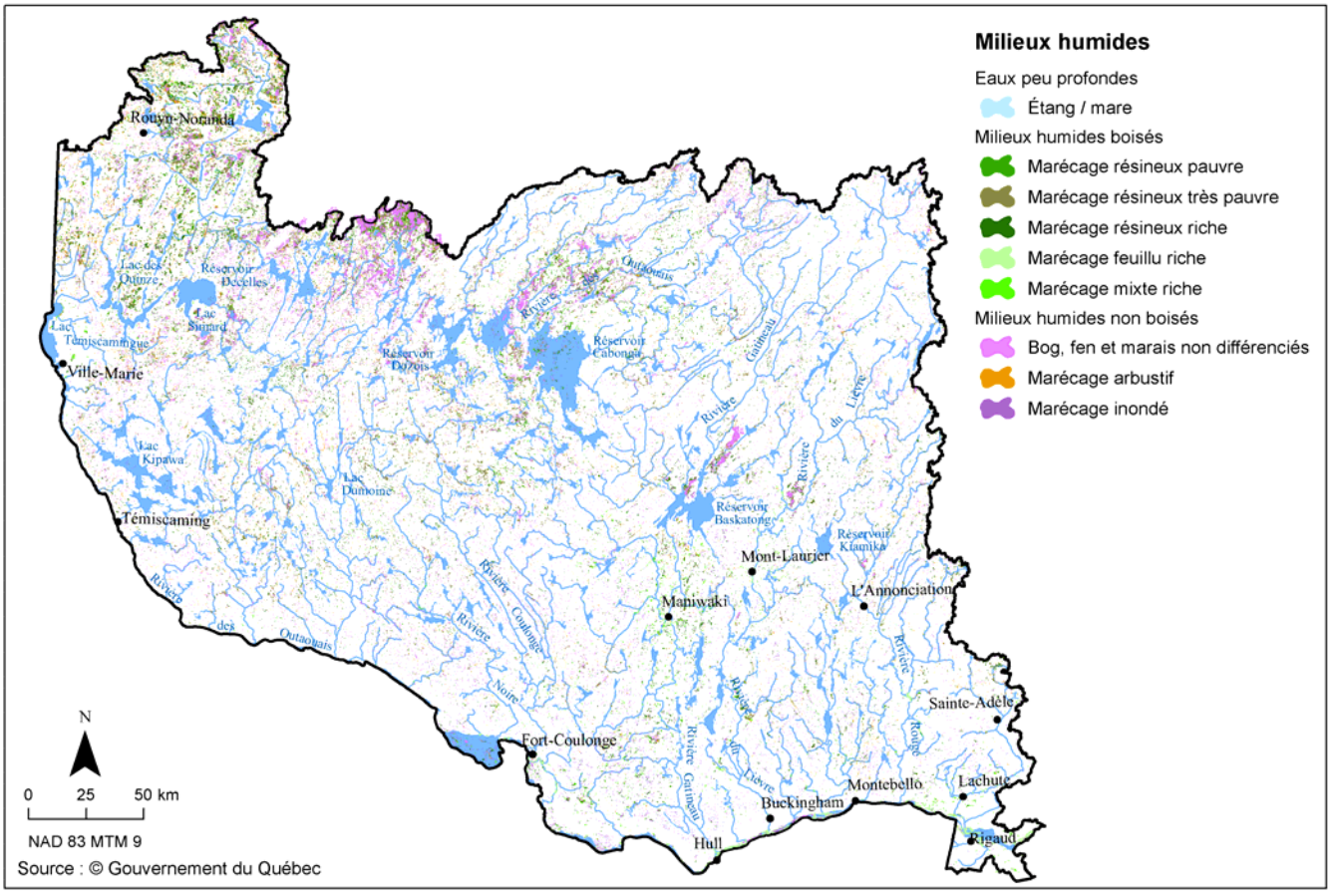

Figure 9. Wetlands in the Rivière des Outaouais watershed (Ducks Unlimited Canada, 2009)

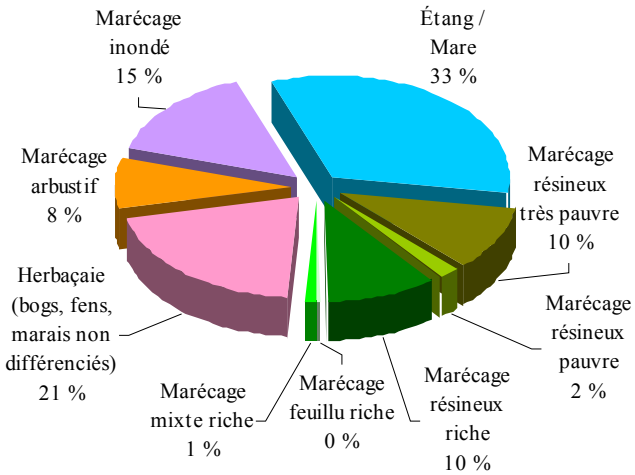

Figure 10. Relative numbers of wetland types in the Rivière des Outaouais watershed.

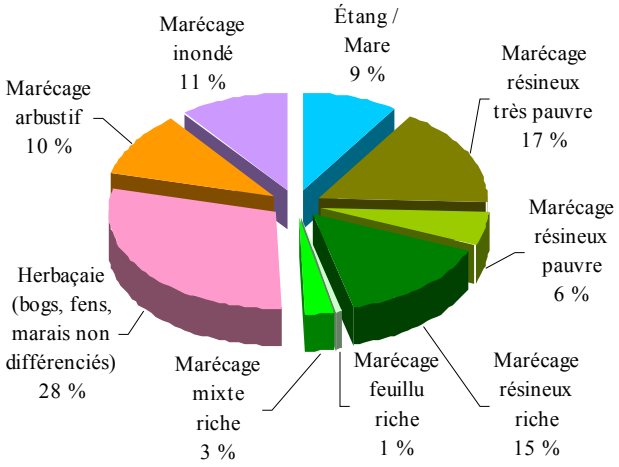

Figure 11. Relative area (km^2) of wetland types in the Rivière des Outaouais watershed.

5.3 Designated protected areas

In December 2002, the Government of Québec adopted the *Natural Heritage Conservation Act* (CQLR c C-61.01) with the aim of contributing to the objective of safeguarding the character, diversity and integrity of Québec's natural heritage. Protected areas are designed primarily to ensure the conservation of species and their genetic diversity as well as the maintenance of the natural processes and ecosystems that are required for their survival. No activity carried out in all or part of the territory of a protected area may alter the essential biological character of that area.

Additionally, section 5 of the Act provides for the keeping of a register of the various protected areas. The register is available for public consultation on the MDDELCC's website, with information as to the purpose and characteristics of the different categories of protected areas (MDDELCC, 2014e).

The Rivière des Outaouais watershed contains, in whole or in part, a number of designated protected areas with various vocations. The total area they protect is approximately 7650 km² (Table 5),that is approximately 5% of the Rivière des Outaouais watershed. Dedicated to the conservation and enhancement of the natural heritage, they are primarily on lands in the public domain (Figure 12).

Table 5. Protected areas in the Rivière des Outaouais watershed (MDDELCC, 2014c)

Protected Areas by Designation	Number	Area [1] (km^2)
Exceptional forest ecosystem	72	75.75
Habitat of a threatened or vulnerable plant species	4	1.91
Wildlife habitat		
Waterfowl gathering area	75	217.70
White-tailed deer yard	25	788.43
Island or peninsula inhabited by a colony of birds	15	0.03
Heronry [2]	53	14.98
Muskrat habitat	55	30.35
National park of Canada (Parc de la Gatineau)	1	361.31
National parks of Québec Parc national de Plaisance Parc national d'Oka Parc national d'Aiguebelle (in part) Parc national du Mont-Tremblant (in part) Parc national d'Opémican	5	2082.70
Biological sanctuary	692	836.50
Migratory bird sanctuary (Île de Carillon)	1	4.65
Proposed aquatic reserve Vallée-de-la-Haute-Rouge Rivière-Dumoine	2	1587.03
Biodiversity reserve	18 (inc. 16 proposed)	2867.74
Ecological reserve	19 (inc. 1 proposed)	136.61
Recognized nature reserve	19	18.85

[1] Total official size of protected area (may include a portion outside the Outaouais watershed).

[2] Protected area including buffer strips of 0 to 200 m.

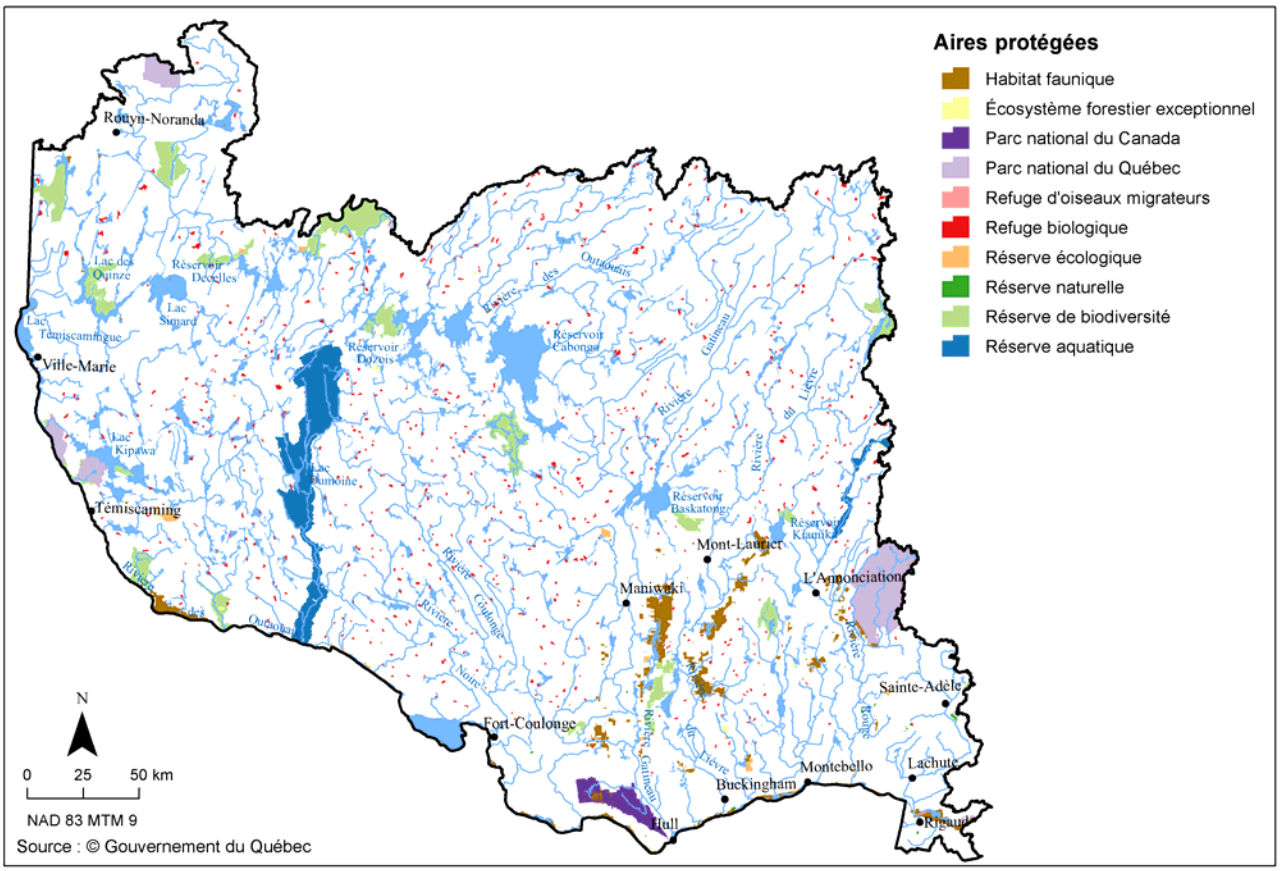

Figure 12. Protected areas listed in the *Registre des aires protégées par désignation* (MDDELCC, 2014c).

6 Uses of the watershed

6.1 Drinking water

6.1.1 Administrative region of Outaouais

The Outaouais region has eight municipalities that are supplied by surface water. Their population comes to around 277 500 people, or 72.8% of the total for the region. Most of their water is drawn directly from the main section of Rivière des Outaouais. Their drinking water treatment plants were modernized recently, with the help of various government support programs.

6.1.2 Administrative regions of Abitibi-Témiscamingue and Laurentides

Upstream, in the Abitibi-Témiscamingue region, and downstream in the Laurentides region, no treatment plants take their water from the main section of Rivière des Outaouais.

6.2 Municipal wastewater

6.2.1 Rivière des Outaouais watershed

Most municipalities in the watershed have a municipal sewer system. However, at present there are eight that discharge their untreated wastewater into 12 outfall structures (MDDELCC, 2014a). The outfalls are in Abitibi-Témiscamingue (8), Laurentides (1) and Mauricie (3). The sub-watersheds affected by the discharges are those of the Kipawa, À la Loutre, Des Outaouais, Gatineau, Fraser, Blanche and Kinojévis rivers, along with Ruisseau Bryson.

6.2.2 Administrative region of Outaouais

Due to its character as a metropolitan region and its proximity to Canada's capital, the city of Gatineau contains over two thirds of the population of the Outaouais region. Most of the industries present, including the agri-food sector, are served by the city's wastewater collection system.

Gatineau operates a wastewater treatment plant constructed in 1982 that has been upgraded over the years. The plant's purification performance is very good, with a score of 100% in 2013 for discharge requirements, noted in the annual performance evaluation report from the Ministère des Affaires municipales et de l'Occupation du territoire (MAMOT, 2014).

The report also notes another reality, however: the presence of 92 overflow structures upstream of the wastewater treatment plant. These structures are found in older parts of the city, on combined sewers, which collect not only domestic sewage but also rainwater and snowmelt.

The discharging of untreated wastewater from overflow structures directly into the river (by both Gatineau and Ottawa), and the discharging of non-disinfected wastewater by Gatineau, are the main issues in the water quality protection plan for Rivière des Outaouais. Note however that authorization has been given for the installation of ultraviolet disinfection equipment in Gatineau's treatment facility. It is expected to enter operation by December 2015.

6.3 Industrial wastewater

6.3.1 Administrative region of Outaouais

Forest harvesting and the associated processing industries, which are important components of the region's industrial infrastructure, are independent when it comes to wastewater treatment. Of all industries in the administrative region, pulp and paper mills use the most water and generate the most effluent.

The four such mills in the region are subject to effluent standards set out in the *Regulation respecting pulp and paper mills* (CQLR chapter Q-2, r. 12.1). Thus, their wastewater is only discharged into the environment after treatment.

Additionally, pursuant to division IV.2 (Depollution Attestation) of the *Environment Quality Act* (CQLR chapter Q-2) and the *Regulation respecting industrial depollution attestations* (CQLR chapter Q-2, r. 1.01), there is an economic motivation for such companies to reduce the amount of pollution they release, thanks to the duties charged under the Regulation

6.4 Water withdrawals

With the adoption of the *Act to Affirm the Collective Nature of Water Resources and Provide for Increased Water Resource Protection* (CQLR chapter C-6.2), known as the Water Act, a new authorization regime was established for water withdrawals. The regime recognizes that priority must be given to the needs of the population, followed by balancing the needs of ecosystems and economic activities. Under the Act, water withdrawal authorizations are valid for a period of 10 years, with certain exceptions.

The *Water Withdrawal and Protection Regulation* (WWPR) (CQLR chapter Q-2, r. 35.2) was adopted on July 16, 2014. It completed the coming into force of the Water Act by implementing the new authorization regime that the Act had introduced into the *Environment Quality Act* (CQLR chapter Q-2). With the provisions in its chapters V and VI, the Regulation strengthens the protection of drinking water supply sources (MDDELCC, 2014g).

Of all industrial sectors in the Rivière des Outaouais watershed as a whole, the mining industry figures amongst the ones who withdraw the most water.

6.5 Hydroelectricity

The Rivière des Outaouais watershed has around 43 hydroelectric plants with a generating capacity of over 3500 megawatts. For comparison, the Robert-Bourassa generating station has an installed capacity of 5616 megawatts, and can supply 1.4 million people (Hydro-Québec, 2010). The industry is thus a significant contributor to the economy of Québec and Ontario (Ottawa River Regulation Planning Board, 1984).

6.6 Industry

6.6.1 Primary sector

In the primary sector, mineral extraction is represented by numerous quarries and sandpits (325 according to data from the MDDELCC, of which 25 are significant according to the Ministère de l'Énergie et des Ressources naturelles – MERN). Generally speaking, quarry and sandpit operations have little impact on groundwater, except the lowering of the phreatic level when the extraction occurs below this level. Wastewater produced in the operation of a quarry or sandpit or by a crushing or screening process must respect the standards for contaminant concentrations specified in the *Regulation respecting pits and quarries* (CQLR chapter Q-2, r. 7).

It should be noted that fairly close to Rivière des Outaouais, there is an abandoned mine that generates acid mine drainage. This is the 16-hectare site of the former New Calumet lead and zinc mine. In 2013 the MERN performed a site characterization, and it is currently working on a remediation plan (MERN, 2014).

The primary sector also includes forestry operations, including logging and the floating of timber down rivers. Although timber floating has been abandoned, it degraded the banks and beds of many rivers, many of which have not been properly cleaned. As well, certain forestry companies have abandoned logging camps, piers and docks without restoring the banks they degraded.

6.6.2 Secondary sector

Since the 1970s, various steps have been taken by the Government toward cleaning up industrial wastewater. These include: the requirement for authorization before setting up any industrial establishment; the adoption of regulations governing the pulp and paper and oil refining sectors; and the creation of specific intervention programs, notably the *Programme d'assainissement des eaux du Québec* (PAEQ – wastewater purification program), the *Plan d'action Saint-Laurent* (PASL – St. Lawrence action plan) and the *Programme de réduction des rejets industriels* (PRRI – industrial emissions reduction program). For any establishment that discharges effluent directly into the environment, the MDDELCC determines the level of treatment required (based on the

quality criteria for surface water), and sets environmental discharge objectives accordingly, with consideration given to the technology available and economically acceptable. As for the municipal level, by-laws governing the discharge of industrial effluent into sewer systems have paralleled the construction of treatment plants.

6.6.3 Pulp and paper sector

As mentioned earlier, of all the industries in the Outaouais administrative region, pulp and paper mills use the most water and generate the most effluent. Each mill discharges 0.3 to 54 million cubic metres of water per year (2012 report, publication forthcoming). There are also two landfill sites containing waste from the mills; they discharge respectively 75 000 and 971 000 m^3/year of leachate into the environment. Table 6 below presents the five pulp and paper mills in the region[2], indicating the location of their intake and discharge points, the average discharge flow and the type of treatment applied to their wastewater. These companies are subject to industry standards for effluents under the *Regulation respecting pulp and paper mills* (CQLR, chapter Q-2, r. 27). Their process waters are only released into the environment after treatment, considerably reducing the impact on the receiving environment. For more information, including the companies' emissions and environmental compliance performance, see the annual environmental compliance reports on the pulp and paper sector at http://www.mddelcc.gouv.qc.ca/milieu_ind/bilans/pates.htm (French).

Further, pursuant to division IV.2 (Depollution Attestation) of the *Environment Quality Act* (CQLR, chapter Q-2) and the *Regulation respecting industrial depollution attestations* (CQLR, chapter Q-2, r. 5), such companies must prepare and implement gradually depollution plans to comply with supplementary standards based on the receiving environment. Besides, it is to their economic advantage to reduce the amount of pollution they release, thanks to the duties charged under the Regulation. Determined on the basis of the weight of contaminants emitted, not the volumes of water withdrawn or discharged, the duties are payable each year after the first depollution attestation is delivered.

Further still, since the coming into force of the *Regulation respecting the charges payable for the use of water* (CQLR chapter Q-2, r. 42.1), all industries that withdraw or use 75 m^3 or more of water per day, whether directly from the resource or from a water distribution system, must pay a charge per cubic metre of water used (MDDELCC, 2014f).

[2] Though located in the municipality of Témiscamingue, Tembec's pulp and paper mill is included in the table because it withdraws and discharges its water upstream from Rivière des Outaouais.

Table 6. Characteristics of the five pulp and paper mills in the Outaouais region (2012 report, publication forthcoming)

Industrial establishment **MUNICIPALITY**	**Intake point**	**Discharge point**	**Final effluent (discharge) Flow in m³/yr (2012)**	**Treatment of process wastewater**
Resolute Forest Products Inc., Gatineau Division **GATINEAU**	Rivière des Outaouais	Rivière des Outaouais	0 (operation suspended since 2010)	Settling and biological treatment (activated sludge)
Fortress Specialty Cellulose Inc. **THURSO**	Rivière des Outaouais	Rivière des Outaouais	27 513 178	Settling and biological treatment (activated sludge)
Whitebirch (Papier Masson Ltée) **GATINEAU**	Rivière du Lièvre	Rivière du Lièvre	8 248 215	Settling and biological treatment (activated sludge)
Kruger Products L.P. **GATINEAU**	Rivière des Outaouais	Rivière des Outaouais	5 586 016	Settling
Tembec, pulp and paper mill **TÉMISCAMING**	Rivière des Outaouais	Rivière des Outaouais and Ruisseau Gordon	53 575 132 and 8 248 215	Settling and biological treatment (activated sludge)

6.6.4 Lumber and wood products sector

Another important industrial sector in the Outaouais region is that of harvesting and processing wood. In 2009, according to data from the MERN, some twenty large companies discharged 2000 to 900 000 m^3 of water into the environment.

6.6.5 Mines

In 2012 there were 16 mining projects in the Rivière des Outaouais watershed, most being in the Abitibi-Témiscamingue region (11), along with four in Laurentides and one in Outaouais (Table 7; MERN, 2012). Their location and status are presented in Figure 13. A "development" status means that a project has reached the stage during which mining facilities are built and production begins, while a "Pre-development" status means that a project is at the stage during which extensive, detailed studies are carried out.

Table 7. Characteristics of mining projects in the Rivière des Outaouais watershed in 2012 (MERN, 2012)

Mine Name	Status	Proponent	Minerals
Francœur	Development	Richmont Mines Inc.	Gold, silver
Westwood	Development	IAMGOLD Corporation	Gold
Mouska	Active mine	IAMGOLD Corporation	Gold, silver, copper
LaRonde	Active mine	Agnico Eagle Mines Ltd.	Gold, silver, copper, lead, zinc
Othmer	Active mine	Dentsply Canada Ltd.	Feldspar
Lac des Îles	Active mine	TIMCAL Graphite & Carbon	Graphite
Saint-Canut	Active mine	Unimin Canada Ltd.	Silica
Saint-Rémi-d'Amherst	Active mine	Société Minière Gerdin Inc.	Silica, kaolinite
Belleterre	Pre-development	Ressources Conway Inc.	Gold
Joanna	Pre-development	Aurizon Mines Ltd.	Gold, silver
Lac Pelletier	Pre-development	Corporation Minière Alexis	Gold
Wasamac	Pre-development	Richmont Mines Inc.	Gold
Dumont Nickel	Pre-development	Royal Nickel Corporation	Nickel
Zeus	Pre-development	Matamec Explorations Inc.	Rare earths, yttrium, zircon
Authier	Pre-development	Glen Eagle Resources Inc.	Lithium ores
Niocan	Pre-development	Niocan Inc.	Niobium

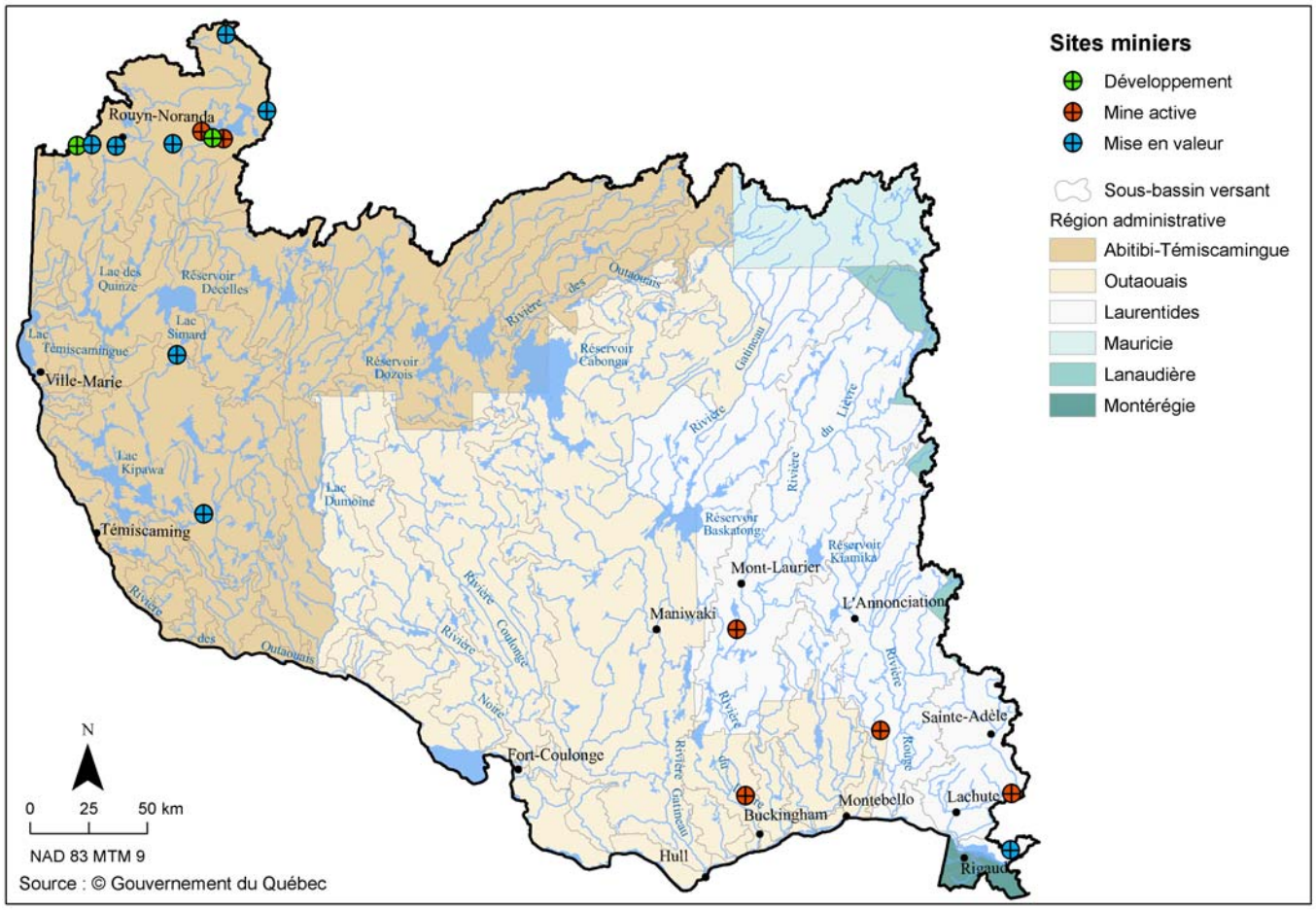

Figure 13. Location and status of mining sites in the Rivière des Outaouais watershed (MERN, 2012).

6.7 Agriculture

Québec's *Agricultural Operations Regulation* (CQLR chapter Q-2, r. 26) is the main regulation aimed at protecting the environment, particularly water and soil, against pollution caused by certain agricultural activities. To resolve the problem of diffuse pollution from manure, fertilizer etc., the Act emphasizes the importance of a proper phosphorus balance in soil (MDDELCC, 2014h). This approach takes into account the nutrient needs of plants for healthy growth, and requires farmers to calculate the actual quantities of manure produced on the farm.

Agriculture practised in the watershed is concentrated in the relatively narrow valleys of rivers and in the area around Lac Témiscamingue. In 2013 there were nearly 2700 farms, for a total cultivated area of 2900 km^2. The area under cultivation thus amounts to less than 3% of the Québec part of the Rivière des Outaouais watershed (MDDELCC, 2014k).

Most of the watershed's farmland consists of meadows and pastures. In the southern part, in the administrative regions of Outaouais and Laurentides, around 15% of the farmland is in field crops (corn, soy, grains), which account for just 5% of the farmland around Lac Témiscamingue (Abitibi-Témiscamingue region) (MDDELCC, 2014k).

Nearly 10% of the watershed's farmland is in the sub-watershed of Rivière du Nord, near Lac des Deux Montagnes. Phosphorus concentrations at the mouth of that river exceed the water quality criterion of 0.03 mg/l, whose purpose is to avoid excessive growth by algae and aquatic plants. To limit environmental pressure due to agriculture, since 2005 it has been prohibited to increase the area under cultivation in the municipalities concerned.

In the Rivière des Outaouais watershed, 42% of the nutrient load in manure could potentially be stored directly on the ground. This method of storage (piling manure in the field) creates a risk that part of the contaminants (nitrates, bacteria, etc.) will enter groundwater aquifers by percolating through the soil, or that heavy rain or snowmelt will transport ammoniacal nitrogen, nitrates, phosphorus, bacteria, suspended matter, etc. into surface waters (MDDELCC, 2014j).

Direct access to watercourses by cattle contributes to surface water contamination and causes erosion. However, under the *Agricultural Operations Regulation* unrestricted access to watercourses by livestock has been prohibited since 2005. In 2014 fewer than 2% of raising sites in the Outaouais, Abitibi-Témiscamingue and Laurentides regions had livestock that could potentially have such access.

6.8 Recreational and vacation activities

Vacation activities are of considerable importance in the Rivière des Outaouais watershed, largely due to the proximity of the Gatineau-Ottawa population pool. Densely inhabited shores around water bodies contribute heavily to the deterioration of water quality and the eutrophication of lakes.

As mentioned earlier, forest covers 73% of the watershed. It is reasonable to suppose that proximity to this forest encourages the development of recreational activities. There are 83 areas devoted to recreation in the watershed, covering a total of more than 41 000 km^2 (MRNF, 2012). Figure 14 displays their geographical location.

Table 8. Recreational territories in the Rivière des Outaouais watershed (MRNF, 2012)

Recreational Territory	Number	Area (km^2)
Community wildlife area (Réservoir Baskatong)	1	332.92
Regional park (Parc régional du Poisson Blanc)	1	41.75
Outfitter with exclusive rights	61	7577.58
Wildlife reserve La Vérendrye Rouge-Matawin (in part) Papineau-Labelle	3	14 756.02
Controlled zone (ZEC)	17	18 505.76

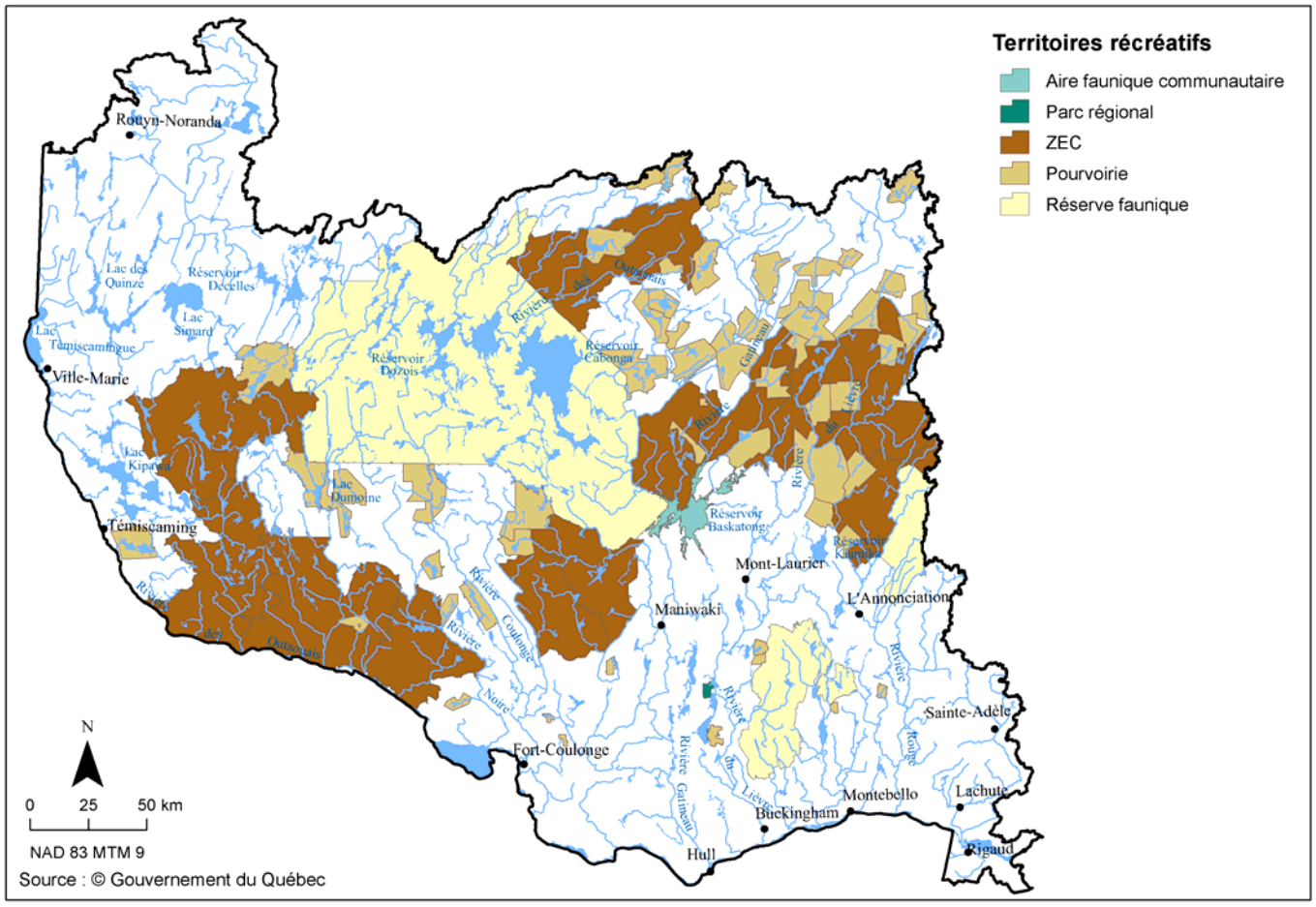

Figure 14. Recreational territories in the Rivière des Outaouais watershed (MRNF, 2012).

6.9 Wildlife harvesting activities

Several administrative regions in the Rivière des Outaouais watershed are known for their fishing, hunting and trapping activities, since they have an abundant and varied wildlife resource. On this count, there are 8 hunting zones, 9 fishing zones and 30 furbearer management units. The popularity of these activities has led to the creation of structured territories including outfitters, controlled zones (ZECs) and wildlife reserves. Note that although forestry companies must comply with the *Regulation respecting standards of forest management for forests in the domain of the State* (CQLR chapter A-18.1, r. 7), their operations can still have an impact on aquatic ecosystems, and thus on wildlife harvesting activities, depending on the size of logging areas and their distribution in the watershed (MFFP, 2014).

Figures 15, 16 and 17 demonstrate the importance of the economic benefits of wildlife harvesting activities in the regions of the Rivière des Outaouais watershed (Outaouais, Laurentides, Abitibi-Témiscamingue).

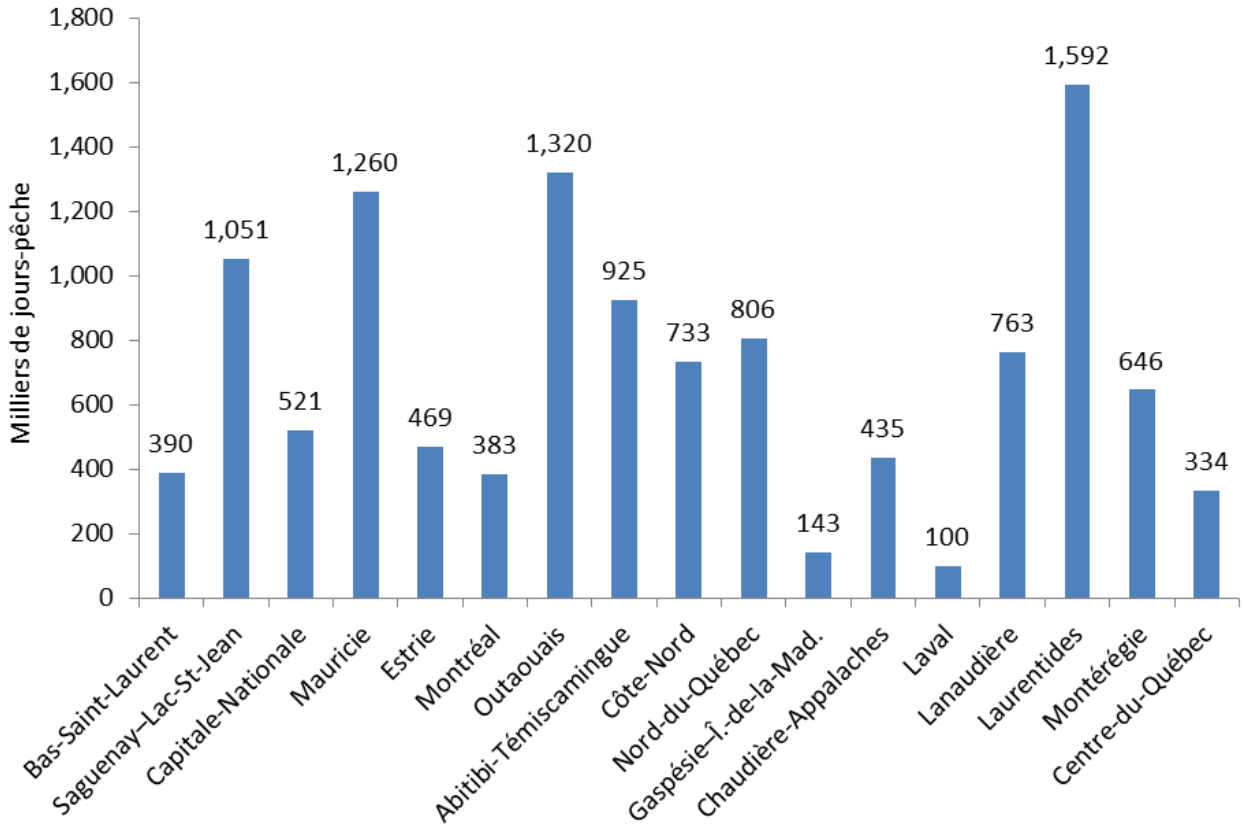

Figure 15. Number of fishing days per administrative region in 2012 (from ÉcoRessource, 2014).

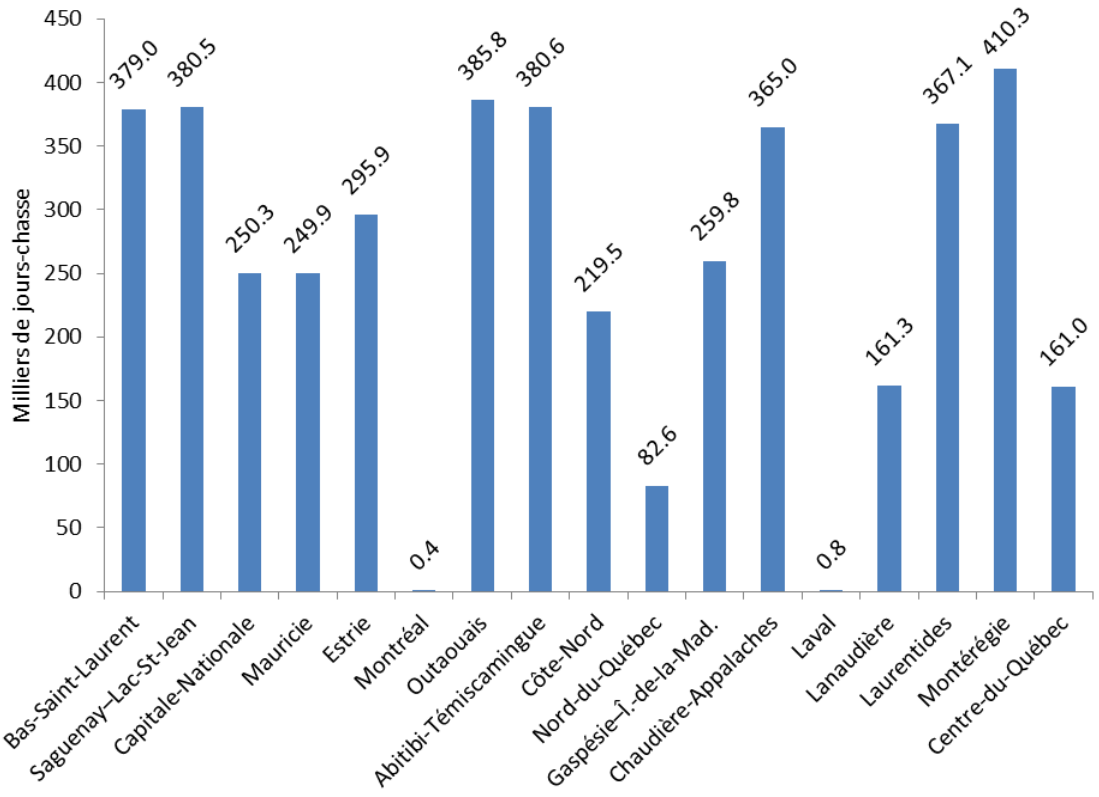

Figure 16. Number of hunting days per administrative region in 2012 (from ÉcoRessource, 2014).

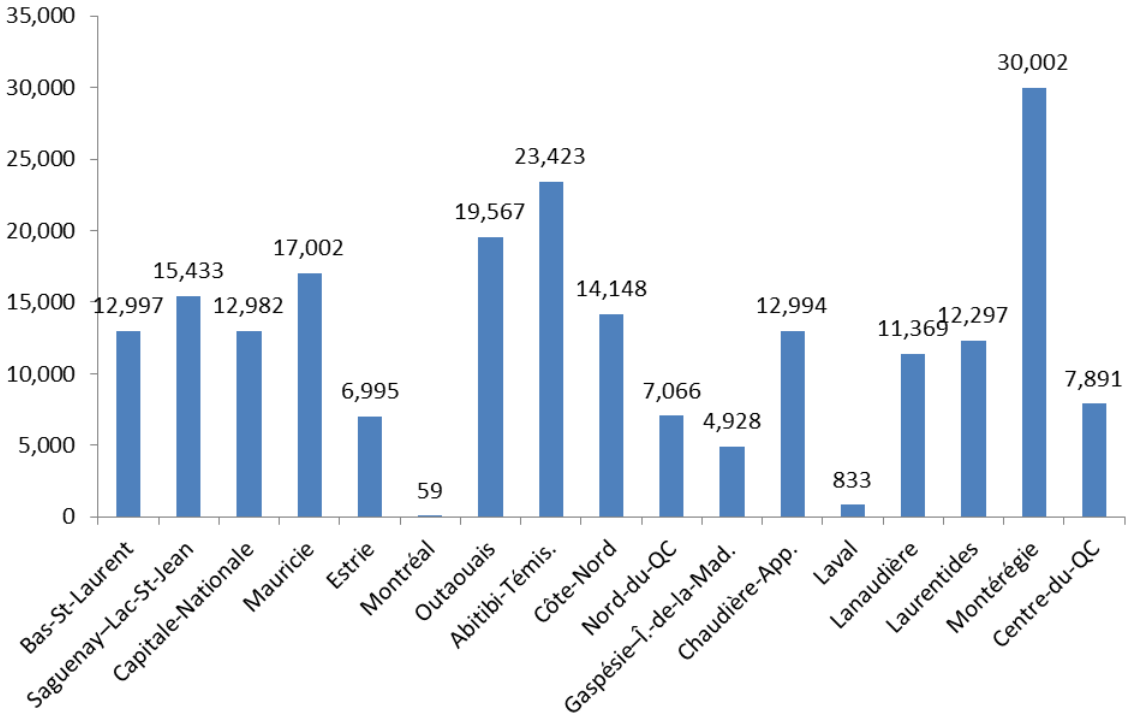

Figure 17. Number of captures per administrative region in 2012 (from ÉcoRessource, 2014).

7 Government measures

The Government of Québec recognizes that the goal of achieving integrated water management across Québec presents major challenges. Some of the issues identified in this brief profile will soon be governed by new regulations, or are already. The following are two recent examples of government measures that should contribute significantly to the protection of water resources.

7.1 Measures to reduce the discharge of untreated wastewater

Wastewater of municipal origin can be a major source of pollution in rivers, lakes and the St. Lawrence River. This is true for multiple reasons: sewer systems that overflow when there is heavy rain or rapid snowmelt; treatment plants that are not equipped with disinfection equipment; the complete absence of sewage treatment plants in many small municipalities; and so on.

In accordance with the *Canada-wide Strategy for the Management of Municipal Wastewater Effluent*, developed by the Canadian Council of Ministers of the Environment, Québec's *Regulation respecting municipal wastewater treatment works* (RMWTW; CQLR chapter Q-2, r. 34.1) sets out rules on discharges and the frequency of overflows from sewer overflow structures. It also provides a framework for the delivery of depollution attestations to establish site-specific discharge and overflow requirements based on the sensitivity of the receiving environment (MDDELCC, 2014i).

Implementation of the RMWTW, which came into force on January 11, 2014, is expected to reduce wastewater overflows and improve the quality of municipal effluents. The Regulation introduces new administrative and technical obligations for the operators of municipal wastewater treatment works. These include performing an initial effluent characterization, meeting general and specific discharge standards, producing overflow reduction plans, and carrying out the work set out in those plans. Existing treatment facilities that are unable to meet the discharge standards will have until 2030 or 2040 to achieve compliance, depending on the level of risk to the receiving environment. Municipalities with no treatment facility, or with only a screening system for raw sewage, will have until 2020 to comply with the standards in the Regulation.

7.2 Measures to protect water supply sources and drinking water quality

A variety of measures have been taken in recent years to protect water supply sources and drinking water quality. The *Regulation respecting the quality of drinking water* (CQLR chapter Q-2, r. 40) has been strengthened by several amendments, and the *Water Withdrawal and Protection Regulation* (WWPR; CQLR chapter Q-2, r. 6)

was adopted on July 16, 2014. The latter requires the officials responsible for municipal withdrawals to produce, and update every five years, a report on the vulnerability of their water source.

8 Governance

8.1 Intergovernmental

There is a multi-sectoral framework for cooperation with Ontario. Exchanges are conducted under the *Ontario-Québec Trade and Cooperation Agreement*, signed in September 2009 and updated in August 2011. Annex 2.5 of the agreement lists areas in which the two governments wish to establish specific cooperation agreements. Environmental cooperation is one of them. The *Agreement Concerning Transboundary Environmental Impacts*, signed on June 2, 2006, is just one of 19 specific agreements. The objective is to work together on transboundary environmental issues by giving priority to the promotion of information exchange and joint cooperation mechanisms. The themes covered are fairly broad, addressing air quality, surface water management, pollution reduction in watercourses, and so on. As a result of Annex 2.5 of the Agreement and the specific agreement, a variety of working groups are in place. In the area of water management specifically, there are currently two joint working groups:

- Transboundary water: cyanobacteria in lakes Abitibi and Témiscamingue;
- Transboundary water: Rivière des Outaouais.

Beyond their bilateral cooperation, Québec and Ontario also collaborate under the *Great Lakes–St. Lawrence River Basin Sustainable Water Resources Agreement* (see Figure 18). Pursuant to this agreement, the premiers of the two provinces and the governors of the eight states adjoining the Great Lakes, or their representatives, form the Great Lakes-St. Lawrence River Water Resources Regional Body, whose mandate is to ensure the coherent application and monitoring of the agreement. The application of this agreement is crucial for Québec. Since the St. Lawrence River is downstream from the Great Lakes, it is sensitive to variations in water level and to the cumulative impacts of withdrawals upstream. Water levels have significant effects on vessel traffic in the shipping channel, on public water supplies and on the viability of aquatic habitats. It should be noted that the *Act to Affirm the Collective Nature of Water Resources and Provide for Increased Water Resource Protection* (CQLR chapter C-6.2), adopted on June 11, 2009, includes provisions enabling implementation of the agreement on Québec territory, notably with regard to three issues: the prohibition against diversions outside the Great Lakes-St. Lawrence River Basin above Trois-Rivières; the management criteria for water withdrawals within the basin; and the publishing of information about withdrawals.

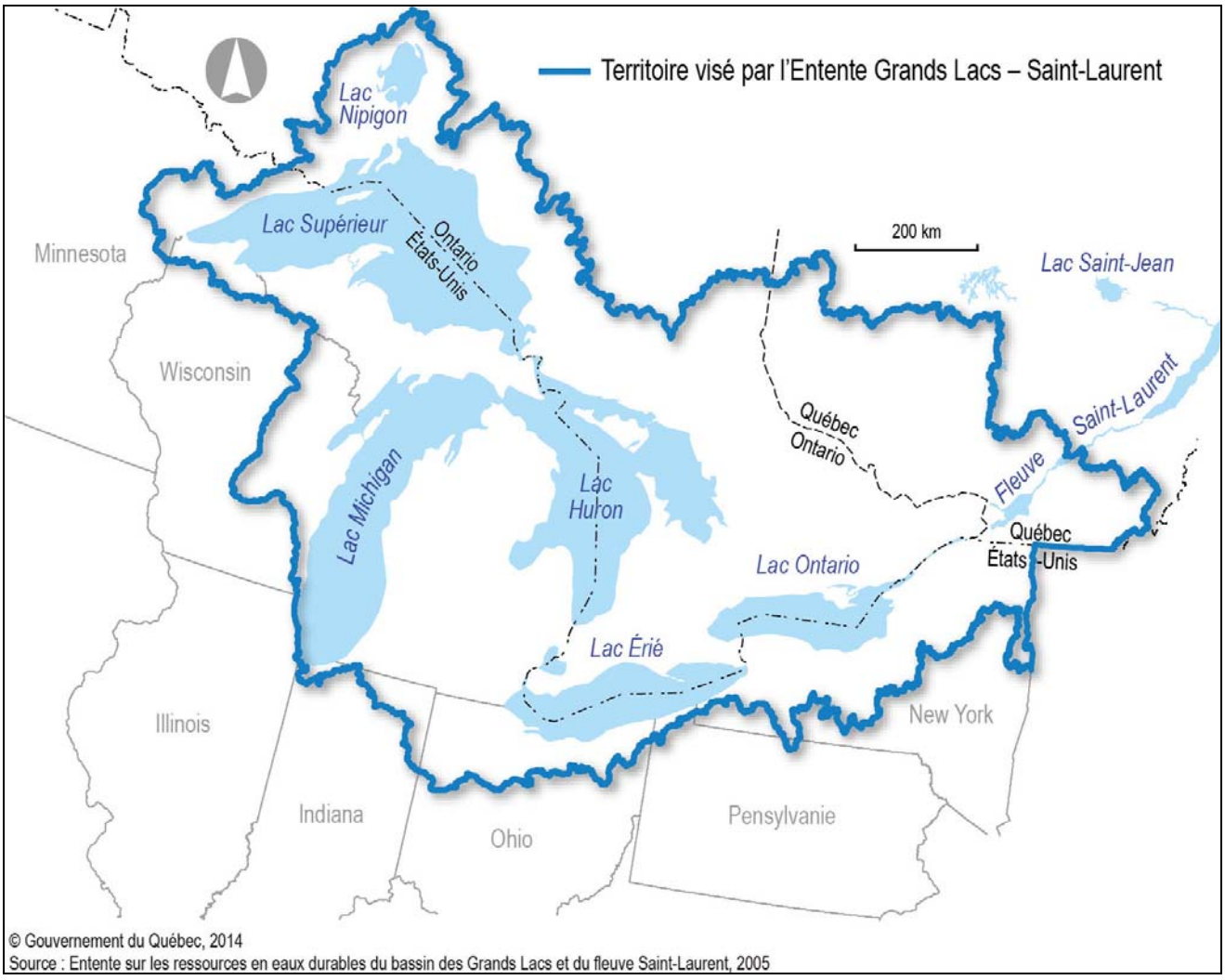

Figure 18. Territory concerned by the *Great Lakes–St. Lawrence River Basin Sustainable Water Resources Agreement* (from MDDELCC, 2014d).

8.2 Regional

At the regional level, the Rivière des Outaouais watershed is subdivided into eight integrated water management zones (Figure 19). Within these zones, collaborative efforts are led by watershed councils that are officially recognized by the Government of Québec. Their mission is to promote the mobilization, collaboration and active participation of citizens and water stakeholders, while ensuring the balanced representation of different interests. To do so, watershed councils draw up a water master plan whose implementation they will subsequently promote, coordinate and monitor. Water master plans provide a detailed vision of issues at the regional level, and facilitate the setting of priorities (in consultation with stakeholders) on actions to undertake. As of April 1, 2014 all of the region's watershed councils had submitted their master plan to the MDDELCC. In the coming months, after

analysis by the various departments involved in the integrated management of water resources, the plans should receive the Minister's approval.

The watershed councils on the territory of the Rivière des Outaouais watershed are as follows:

- Agence de bassin versant des 7 (ABV des 7) – abv7.org/;
- Comité du bassin versant de la rivière du Lièvre (COBALI) – www.cobali.org/;
- Organisme de bassin versant Abitibi-Jamésie (OBVAJ) – obvaj.org/ (French);
- Organisme de bassin versant de la Rivière du Nord (ABRINORD) – www.abrinord.qc.ca/ (French);
- Organisme de bassins versants des rivières Rouge, Petite Nation et Saumon (OBVRPNS) – www.rpns.ca/ (French);
- Organisme de bassin versant du Témiscamingue (OBVT) – www.obvt.ca/;
- Conseil du bassin versant de la région de Vaudreuil-Soulanges (COBAVER-VS) – www.cobaver-vs.org/ (French);
- Conseil des bassins versants des Mille-Îles (COBAMIL) – www.cobamil.ca/ (French).

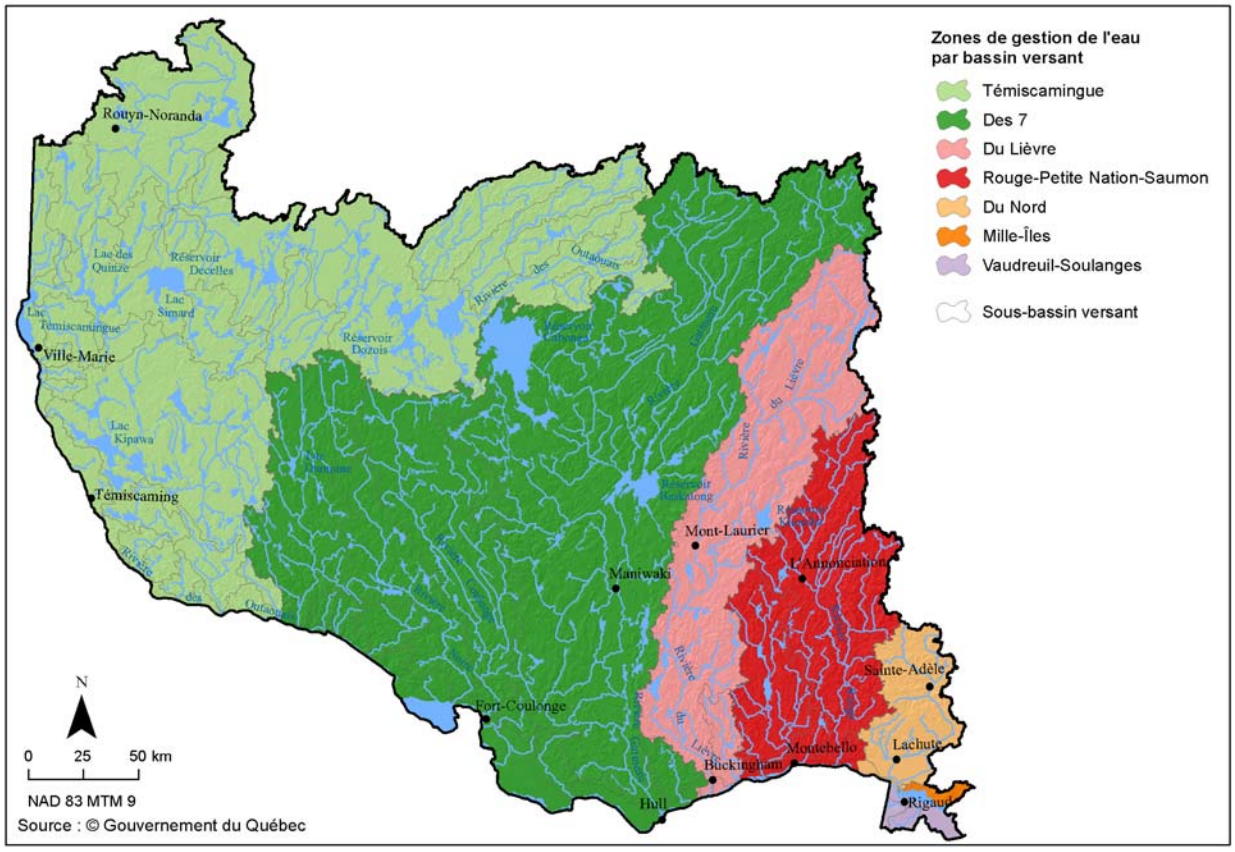

Figure 19. Water management zones in the Rivière des Outaouais watershed.

On the Ontario side, there are 36 Conservation Authorities (Conservation Ontario, 2013), all of which are members of Ontario Conservation. Governed by Ontario's *Conservation Authorities Act* (1946), they play a role similar to that of Québec's watershed councils. The conservation authorities are non-profit organizations, each with its own board of directors whose members are designated by local municipalities, most being elected municipal officials. Their mandate is to oversee at the watershed level the conservation, restoration and responsible management of aquatic habitats, lands and natural resources of Ontario, while balancing environmental, economic and human needs.

These initiatives are complemented on both sides of the border by those of other, non-governmental bodies, including:

- Ottawa Riverkeeper / Sentinelle Outaouais – http://ottawariverkeeper.ca/;
- Fondation de Gaspé Beaubien – www.fondationdegaspebeaubien.org/.

9 Bibliography

CANARDS ILLIMITÉS CANADA (2009). Classification des milieux humides et modélisation de la sauvagine dans le Québec forestier, Québec, Canards illimités Canada.

CDPNQ (2014a). Extraction du système de données pour le territoire du bassin versant de l'Outaouais, Centre de données sur le patrimoine naturel du Québec (CDPNQ), Québec, Ministère des Forêts, de la Faune et des Parcs.

CDPNQ (2014b). Extraction du système de données pour le territoire du bassin versant de l'Outaouais, Centre de données sur le patrimoine naturel du Québec (CDPNQ), Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques.

CEHQ (2014a). Guide d'interprétation de la fiche technique d'un barrage, Québec, Centre d'expertise hydrique du Québec (CEHQ), Direction de la sécurité des barrages, 20 p. Available at: http://www.cehq.gouv.qc.ca/barrages/guides/guide_fiche_technique.pdf.

CEHQ (2014b). Répertoire des barrages, [Online], updated December 10, 2014. Centre d'expertise hydrique du Québec (CEHQ), Direction de la sécurité des barrages, [http://www.cehq.gouv.qc.ca/barrages/default.asp] (Accessed December 17, 2014).

COMEAU, G., and collab. (2013). Projet d'acquisition de connaissances sur les eaux souterraines en Outaouais : rapport final, Université Laval, Département de géologie et de génie géologique, July, 148 pp., 24 app., 25 maps.

OTTAWA RIVER REGULATION PLANNING BOARD (1984). Information brochure, [Online], May. [http://ottawariver.ca/information-brochure.php] (Accessed March 1, 2015).

CONSERVATION ONTARIO (2013). Conservation Authorities of Ontario Mandate, [Online]. [http://www.conservation-ontario.on.ca/about-us/conservation-authorities] (Accessed December 17, 2014).

DUPONT, J. (2004). La problématique des lacs acides au Québec, Québec, Ministère de l'Environnement, Direction du suivi de l'état de l'environnement, 18 p. [Envirodoq no ENV/2004/0151, collection no QE/145]. Available at: http://www.mddelcc.gouv.qc.ca/Eau/eco_aqua/lacs_acides/2004/lacs-acides-Qc.pdf.

ÉCORESSOURCES (2014). L'industrie faunique comme moteur économique régional : une étude ventilant par espèce et par région les retombées économiques engendrées par les chasseurs, les pêcheurs et les piégeurs québécois en 2012, 42 p. + app. [Report prepared for the Ministère des Forêts, de la Faune et des Parcs].

HYDRO-QUÉBEC (2010). Electricity from the power station to the home, Hydro-Québec, 52 pp. Available at: http://www.hydroquebec.com/teachers/pdf/doc-electricity-from-the-power-station-to-the-home.pdf.

ISQ (2014). Profils statistiques par région et MRC géographiques, [Online]. Institut de la statistique du Québec (ISQ). [http://www.stat.gouv.qc.ca/statistiques/profils/region_00/region_00.htm] (Accessed December 17, 2014).

MAMOT (2014). Ouvrage de surverses et station d'épuration : Évaluation de performance des ouvrages municipaux d'assainissement des eaux pour l'année 2013, Québec, Ministère des affaires municipales et de l'Occupation du territoire (MAMOT), 44 p. + app. Available at : http://www.mamrot.gouv.qc.ca/pub/infrastructures/suivi_ouvrages_assainissement_eaux/eval_perform_rapport_2013.pdf.MDDEFP (2011). Cadre de référence hydrologique du Québec (CRHQ) [digital raster data]. MDDEFP-DPEP, 1/20 000, Québec, Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP), Direction du patrimoine écologique et des parcs (DPEP).

MDDEFP (2014). Plans d'eau touchés par des fleurs d'eau d'algues bleu-vert : récurrence au cours de la période 2004-2013 [digital raster data], Québec, Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP), Direction du suivi de l'état de l'environnement et Centre d'expertise en analyse environnementale du Québec.

MDDELCC (2000). Portrait régional de l'eau, Outaouais (région administrative 07), Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Available at: http://www.mddelcc.gouv.qc.ca/eau/regions/region07/index.htm.

MDDELCC (2014a). Banque de données sur la localisation des émissaires municipaux (LEM) compilée à partir de la banque de suivi des ouvrages municipaux d'assainissement des eaux (SOMAE) du ministère des Affaires municipales et de l'Occupation du territoire, Québec, Ministère des Affaires municipales et de l'Occupation du territoire et Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), Direction du suivi de l'état de l'environnement.

MDDELCC (2014b). Banque de données sur la qualité du milieu aquatique (BQMA), Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC), Direction du suivi de l'état de l'environnement.

MDDELCC (2014c). Base de données du registre des aires protégées au Québec [digital raster data], Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC).

MDDELCC (2014d). Rapport sur l'état de l'eau et des écosystèmes aquatiques au Québec, Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Available at: http://www.mddelcc.gouv.qc.ca/rapportsurleau/index.htm.

MDDELCC (2014e). Registre des aires protégées, Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Available at: http://www.mddelcc.gouv.qc.ca/biodiversite/aires_protegees/registre/index.htm.

MDDELCC (2014f). *Regulation respecting the charges payable for the use of water*, Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Available at: https://www.canlii.org/en/qc/laws/regu/cqlr-c-q-2-r-42.1/latest/cqlr-c-q-2-r-42.1.html.

MDDELCC (2014g). *Water Withdrawal and Protection Regulation*, Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Available at: https://www.canlii.org/en/qc/laws/regu/cqlr-c-q-2-r-35.2/latest/cqlr-c-q-2-r-35.2.html.

MDDELCC (2014h). *Agricultural Operations Regulation*, Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Available at: http://www.canlii.org/en/qc/laws/regu/cqlr-c-q-2-r-26/latest/cqlr-c-q-2-r-26.html.

MDDELCC (2014i). *Regulation respecting municipal wastewater treatment works*, Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Available at: https://www.canlii.org/en/qc/laws/regu/cqlr-c-q-2-r-34.1/latest/cqlr-c-q-2-r-34.1.html.

MDDELCC (2014j). Suivi de la pollution d'origine agricole, Système d'aide à la gestion des opérations, Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC).

MDDELCC (2014k). Land use, Québec [digital raster data], Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC).

MERN (2012). Localisation des mines actives et des projets miniers de mise en valeur et de développement répertoriés par le ministère des Ressources naturelles en 2012, Système d'information géominière du Québec, Québec, Ministère de l'Énergie et des Ressources naturelles (MERN).

MERN (2014). Liste des sites miniers abandonnés, [Online]. Québec, Ministère de l'Énergie et des Ressources naturelles (MERN). [http://www.mern.gouv.qc.ca/mines/restauration/restauration-sites-miniers-abandonnes.jsp#outaouais]. (Accessed December 17, 2014).

MFFP (2014). *Regulation respecting standards of forest management for forests in the domain of the State*, Québec, Ministère des Forêts, de la Faune et des Parcs (MFFP). Available at: https://www.canlii.org/en/qc/laws/regu/cqlr-c-a-18.1-r-7/latest/cqlr-c-a-18.1-r-7.html.

MRNF (2012). Base de données sur les territoires récréatifs du Québec à l'échelle de 1:100 000 (TRQ) [digital raster data], Québec, Ministère des Ressources naturelles et de la Faune (MRNF), Direction de la cartographie générale et administrative.

OUTAOUAIS TOURISM (2014). "History", Outaouais. Outaouais near and dear, [Online]. Gatineau, Outaouais Tourism. [http://www.tourismeoutaouais.com/en-ca/_pages/outaouais.aspx?intOngletID=2]. (Accessed March 1, 2015).

Appendix I. Special-status species (threatened, vulnerable or likely to be so designated) in the Rivière des Outaouais watershed

Wildlife species

Common name	Latin name	Group	Class	Status
Alewife floater	*Anodonta implicata*	Invertebrates	*Bivalvia*	Likely
Elephant-ear	*Elliptio crassidens*	Invertebrates	*Bivalvia*	Likely
Spike	*Elliptio dilatata*	Invertebrates	*Bivalvia*	Likely
Fragile papershell	*Leptodea fragilis*	Invertebrates	*Bivalvia*	Likely
Hickorynut	*Obovaria olivaria*	Invertebrates	*Bivalvia*	Likely
Pink heelsplitter	*Potamilus alatus*	Invertebrates	*Bivalvia*	Likely
Pickerel frog	*Lithobates palustris*	Vertebrates	*Amphibia*	Likely
Four-toed salamander	*Hemidactylium scutatum*	Vertebrates	*Amphibia*	Likely
Striped chorus frog	*Pseudacris triseriata*	Vertebrates	*Amphibia*	Vulnerable
Cerulean warbler	*Setophaga cerulea*	Vertebrates	*Aves*	Threatened
Red-headed woodpecker	*Melanerpes erythrocephalus*	Vertebrates	*Aves*	Threatened
Loggerhead shrike	*Lanius ludovicianus*	Vertebrates	*Aves*	Threatened
Yellow rail	*Coturnicops noveboracensis*	Vertebrates	*Aves*	Threatened
Caspian tern	*Hydroprogne caspia*	Vertebrates	*Aves*	Threatened
Grasshopper sparrow	*Ammodramus savannarum*	Vertebrates	*Aves*	Likely
Short-eared owl	*Asio flammeus*	Vertebrates	*Aves*	Likely
Chimney swift	*Chaetura pelagica*	Vertebrates	*Aves*	Likely
Golden-winged warbler	*Vermivora chrysoptera*	Vertebrates	*Aves*	Likely
Louisiana waterthrush	*Parkesia motacilla*	Vertebrates	*Aves*	Likely
Sedge wren	*Cistothorus platensis*	Vertebrates	*Aves*	Likely
American peregrine falcon	*Falco peregrinus anatum*	Vertebrates	*Aves*	Vulnerable
Bicknell's thrush	*Catharus bicknelli*	Vertebrates	*Aves*	Vulnerable
Least bittern	*Ixobrychus exilis*	Vertebrates	*Aves*	Vulnerable
Bald eagle	*Haliaeetus leucocephalus*	Vertebrates	*Aves*	Vulnerable
Wolverine	*Gulo gulo*	Vertebrates	*Mammalia*	Threatened
Least weasel	*Mustela nivalis*	Vertebrates	*Mammalia*	Likely
Rock vole	*Microtus chrotorrhinus*	Vertebrates	*Mammalia*	Likely
Southern bog lemming	*Synaptomys cooperi*	Vertebrates	*Mammalia*	Likely

Common name	Latin name	Group	Class	Status
Silver-haired bat	*Lasionycteris noctivagans*	Vertebrates	*Mammalia*	Likely
Hoary bat	*Lasiurus cinereus*	Vertebrates	*Mammalia*	Likely
Eastern small-footed bat	*Myotis leibii*	Vertebrates	*Mammalia*	Likely
Eastern red bat	*Lasiurus borealis*	Vertebrates	*Mammalia*	Likely
Southern flying squirrel	*Glaucomys volans*	Vertebrates	*Mammalia*	Likely
Tri-coloured bat	*Perimyotis subflavus*	Vertebrates	*Mammalia*	Likely
Copper redhorse	*Moxostoma hubbsi*	Vertebrates	*Osteichthyes*	Threatened
Stonecat	*Noturus flavus*	Vertebrates	*Osteichthyes*	Likely
Margined madtom	*Noturus insignis*	Vertebrates	*Osteichthyes*	Likely
Lake herring	*Coregonus artedi pop. 1*	Vertebrates	*Osteichthyes*	Likely
Lake sturgeon	*Acipenser fulvescens*	Vertebrates	*Osteichthyes*	Likely
Brassy minnow	*Hybognathus hankinsoni*	Vertebrates	*Osteichthyes*	Likely
Landlocked arctic char	*Salvelinus alpinus oquassa*	Vertebrates	*Osteichthyes*	Likely
American shad	*Alosa sapidissima*	Vertebrates	*Osteichthyes*	Vulnerable
River redhorse	*Moxostoma carinatum*	Vertebrates	*Osteichthyes*	Vulnerable
Channel darter	*Percina copelandi*	Vertebrates	*Osteichthyes*	Vulnerable
Bridle shiner	*Notropis bifrenatus*	Vertebrates	*Osteichthyes*	Vulnerable
Blanding's turtle	*Emydoidea blandingii*	Vertebrates	*Reptilia*	Threatened
Common musk turtle	*Sternotherus odoratus*	Vertebrates	*Reptilia*	Threatened
Spiny soft-shell turtle	*Apalone spinifera*	Vertebrates	*Reptilia*	Threatened
Ringneck snake	*Diadophis punctatus*	Vertebrates	*Reptilia*	Likely
Northern watersnake	*Nerodia sipedon*	Vertebrates	*Reptilia*	Likely
Eastern ribbon snake	*Thamnophis sauritus*	Vertebrates	*Reptilia*	Likely
Milk snake	*Lampropeltis triangulum*	Vertebrates	*Reptilia*	Likely
Smooth green snake	*Opheodrys vernalis*	Vertebrates	*Reptilia*	Likely
Wood turtle	*Glyptemys insculpta*	Vertebrates	*Reptilia*	Vulnerable
Northern map turtle	*Graptemys geographica*	Vertebrates	*Reptilia*	Vulnerable

CDPNQ (2014). Extracted from the data system for the territory of the Outaouais watershed, Centre de données sur le patrimoine naturel du Québec (CDPNQ), Québec, Ministère des Forêts, de la Faune et des Parcs.

Plant species

Common name	Latin name	Group	Class	Status
Round notothylas	*Notothylas orbicularis*	Non-vascular	*Anthocerotopsida*	Likely
Blind's bryum	*Bryum blindii*	Non-vascular	*Bryopsida*	Likely
Slender silver moss	*Anomobryum julaceum*	Non-vascular	*Bryopsida*	Likely
Beaked bow moss	*Dicranodontium denudatum*	Non-vascular	*Bryopsida*	Likely
Olive beard moss	*Didymodon tophaceus*	Non-vascular	*Bryopsida*	Likely
Pale cow-hair moss	*Ditrichum pallidum*	Non-vascular	*Bryopsida*	Likely
Serrated earth moss	*Ephemerum serratum*	Non-vascular	*Bryopsida*	Likely
Blunt pocket moss	*Fissidens obtusifolius*	Non-vascular	*Bryopsida*	Likely
Olney's grimmia	*Grimmia olneyi*	Non-vascular	*Bryopsida*	Likely
Hair grimmia	*Grimmia pilifera*	Non-vascular	*Bryopsida*	Likely
Blunt Leske's moss	*Leskea obscura*	Non-vascular	*Bryopsida*	Likely
Ohio haircap moss	*Polytrichastrum ohioense*	Non-vascular	*Bryopsida*	Likely
Mountain brook moss	*Hygrohypnum montanum*	Non-vascular	*Bryopsida*	Likely
Denticulate-leaved brook moss	*Hygrohypnum subeugyrium*	Non-vascular	*Bryopsida*	Likely
Common thelia	*Thelia hirtella*	Non-vascular	*Bryopsida*	Likely
Rough thelia	*Thelia asprella*	Non-vascular	*Bryopsida*	Likely
Tiny cedar moss	*Pelekium minutulum*	Non-vascular	*Bryopsida*	Likely
Pygmy cedar moss	*Pelekium pygmaeum*	Non-vascular	*Bryopsida*	Likely
Small twisted moss	*Tortella humilis*	Non-vascular	*Bryopsida*	Likely
Naked flag moss	*Discelium nudum*	Non-vascular	*Bryopsida*	Likely
Bordered brook moss	*Platylomella lescurii*	Non-vascular	*Bryopsida*	Likely
Somerfelt's fine wet moss	*Campylophyllum sommerfeltii*	Non-vascular	*Bryopsida*	Likely
Chalk comb moss	*Ctenidium subrectifolium*	Non-vascular	*Bryopsida*	Likely
Pale bristle moss	*Orthotrichum pallens*	Non-vascular	*Bryopsida*	Likely
Fan moss	*Forsstroemia trichomitria*	Non-vascular	*Bryopsida*	Likely
Delicate starwort	*Asterella tenella*	Non-vascular	*Jungermanniopsida*	Likely
Drummond's flapwort	*Harpanthus drummondii*	Non-vascular	*Jungermanniopsida*	Likely
Fragrant macewort	*Mannia fragrans*	Non-vascular	*Jungermanniopsida*	Likely
Rock veilwort	*Metzgeria conjugata*	Non-vascular	*Jungermanniopsida*	Likely
Pinnate scalewort	*Porella pinnata*	Non-vascular	*Jungermanniopsida*	Likely
Cavernous crystalwort	*Riccia cavernosa*	Non-vascular	*Jungermanniopsida*	Likely
Frost's crystalwort	*Riccia frostii*	Non-vascular	*Jungermanniopsida*	Likely

Common name	Latin name	Group	Class	Status
Sullivant's crystalwort	*Riccia huebeneriana ssp. sullivantii*	Non-vascular	*Jungermanniopsida*	Likely
Lizard crystalwort	*Riccia bifurca*	Non-vascular	*Jungermanniopsida*	Likely
Butterflyweed	*Asclepias tuberosa var. interior*	Vascular	*Dicotyledoneae*	Threatened
American ginseng	*Panax quinquefolius*	Vascular	*Dicotyledoneae*	Threatened
Lizard's-tail	*Saururus cernuus*	Vascular	*Dicotyledoneae*	Threatened
James' monkeyflower	*Mimulus glabratus var. jamesii*	Vascular	*Dicotyledoneae*	Threatened
Spotted beebalm	*Monarda punctata var. villicaulis*	Vascular	*Dicotyledoneae*	Threatened
Rock elm	*Ulmus thomasii*	Vascular	*Dicotyledoneae*	Threatened
Mayapple	*Podophyllum peltatum*	Vascular	*Dicotyledoneae*	Threatened
Woodland pinedrops	*Pterospora andromedea*	Vascular	*Dicotyledoneae*	Threatened
Climbing fumitory	*Adlumia fungosa*	Vascular	*Dicotyledoneae*	Likely
Catnip giant hyssop	*Agastache nepetoides*	Vascular	*Dicotyledoneae*	Likely
Hairy agrimony	*Agrimonia pubescens*	Vascular	*Dicotyledoneae*	Likely
Beautiful serviceberry	*Amelanchier amabilis*	Vascular	*Dicotyledoneae*	Likely
Collins' rockcress	*Boechera collinsii*	Vascular	*Dicotyledoneae*	Likely
Sicklepod	*Boechera canadensis*	Vascular	*Dicotyledoneae*	Likely
Reflexed rockcress	*Boechera retrofracta*	Vascular	*Dicotyledoneae*	Likely
Lakecress	*Rorippa aquatica*	Vascular	*Dicotyledoneae*	Likely
Interior white aster	*Symphyotrichum lanceolatum ssp. lanceolatum var. interior*	Vascular	*Dicotyledoneae*	Likely
Pringle's aster	*Symphyotrichum pilosum var. pringlei*	Vascular	*Dicotyledoneae*	Likely
Robyns' aster	*Symphyotrichum robynsianum -p07, p15*	Vascular	*Dicotyledoneae*	Likely
Indian milkvetch	*Astragalus australis*	Vascular	*Dicotyledoneae*	Likely
Caughnawaga thorn	*Crataegus suborbiculata*	Vascular	*Dicotyledoneae*	Likely
Smooth alder	*Alnus serrulata*	Vascular	*Dicotyledoneae*	Likely
Virginia bartonia	*Bartonia virginica*	Vascular	*Dicotyledoneae*	Likely
Largeleaf avens	*Geum macrophyllum var. perincisum*	Vascular	*Dicotyledoneae*	Likely
Spring cress	*Cardamine bulbosa*	Vascular	*Dicotyledoneae*	Likely
Cutleaf toothwort	*Cardamine concatenata*	Vascular	*Dicotyledoneae*	Likely
Shagbark hickory	*Carya ovata var. ovata*	Vascular	*Dicotyledoneae*	Likely

Common name	Latin name	Group	Class	Status
New Jersey tea	*Ceanothus americanus*	Vascular	*Dicotyledoneae*	Likely
Jersey tea	*Ceanothus herbaceus*	Vascular	*Dicotyledoneae*	Likely
Long-stalked chickweed	*Cerastium nutans var. nutans*	Vascular	*Dicotyledoneae*	Likely
Susquehanna sand cherry	*Prunus susquehanae*	Vascular	*Dicotyledoneae*	Likely
Silverberry	*Elaeagnus commutata*	Vascular	*Dicotyledoneae*	Likely
Fogg's goosefoot	*Chenopodium foggii*	Vascular	*Dicotyledoneae*	Likely
Spotted wintergreen	*Chimaphila maculata*	Vascular	*Dicotyledoneae*	Likely
Swamp white oak	*Quercus bicolor*	Vascular	*Dicotyledoneae*	Likely
Narrow-leaved springbeauty	*Claytonia virginica*	Vascular	*Dicotyledoneae*	Likely
Golden corydalis	*Corydalis aurea ssp. aurea*	Vascular	*Dicotyledoneae*	Likely
Bare-stemmed tick-trefoil	*Desmodium nudiflorum*	Vascular	*Dicotyledoneae*	Likely
Panicled tick-trefoil	*Desmodium paniculatum*	Vascular	*Dicotyledoneae*	Likely
Wood whitlow-grass	*Draba nemorosa*	Vascular	*Dicotyledoneae*	Likely
Slenderleaf sundew	*Drosera linearis*	Vascular	*Dicotyledoneae*	Likely
Robinson's hawkweed	*Hieracium robinsonii*	Vascular	*Dicotyledoneae*	Likely
Licorice bedstraw	*Galium circaezans*	Vascular	*Dicotyledoneae*	Likely
Fringed gentian	*Gentianopsis crinita*	Vascular	*Dicotyledoneae*	Likely
Carolina crane's-bill	*Geranium carolinianum*	Vascular	*Dicotyledoneae*	Likely
Cream-coloured vetchling	*Lathyrus ochroleucus*	Vascular	*Dicotyledoneae*	Likely
Golden hedge hyssop	*Gratiola aurea*	Vascular	*Dicotyledoneae*	Likely
Rough pennyroyal	*Hedeoma hispida*	Vascular	*Dicotyledoneae*	Likely
Canada frostweed	*Crocanthemum canadense*	Vascular	*Dicotyledoneae*	Likely
Woolly beach-heather	*Hudsonia tomentosa*	Vascular	*Dicotyledoneae*	Likely
Hairy lettuce	*Lactuca hirsuta*	Vascular	*Dicotyledoneae*	Likely
Highbelia	*Lobelia spicata*	Vascular	*Dicotyledoneae*	Likely
Virginia water-horehound	*Lycopus virginicus*	Vascular	*Dicotyledoneae*	Likely
Laurentian bugleweed	*Lycopus americanus var. laurentianus*	Vascular	*Dicotyledoneae*	Likely
Lance-leaf loosestrife	*Lysimachia hybrida*	Vascular	*Dicotyledoneae*	Likely
Whorled yellow loosestrife	*Lysimachia quadrifolia*	Vascular	*Dicotyledoneae*	Likely
Kalm St. John's-wort	*Hypericum kalmianum*	Vascular	*Dicotyledoneae*	Likely
Marsh St. John's-wort	*Hypericum virginicum*	Vascular	*Dicotyledoneae*	Likely
Giant St. John's-wort	*Hypericum ascyron ssp. pyramidatum*	Vascular	*Dicotyledoneae*	Likely

Common name	Latin name	Group	Class	Status
Michaux's stichwort	*Minuartia michauxii*	Vascular	*Dicotyledoneae*	Likely
Green tansy mustard	*Descurainia pinnata ssp. brachycarpa*	Vascular	*Dicotyledoneae*	Likely
Variable-leaved water-milfoil	*Myriophyllum heterophyllum*	Vascular	*Dicotyledoneae*	Likely
Butternut	*Juglans cinerea*	Vascular	*Dicotyledoneae*	Likely
Meadow evening-primrose	*Oenothera pilosella ssp. pilosella*	Vascular	*Dicotyledoneae*	Likely
Carey's smartweed	*Persicaria careyi*	Vascular	*Dicotyledoneae*	Likely
Stout smartweed	*Persicaria robustior*	Vascular	*Dicotyledoneae*	Likely
American pokeweed	*Phytolacca americana var. americana*	Vascular	*Dicotyledoneae*	Likely
Purple meadow-rue	*Thalictrum dasycarpum*	Vascular	*Dicotyledoneae*	Likely
River-weed	*Podostemum ceratophyllum*	Vascular	*Dicotyledoneae*	Likely
Red-whiskered clammyweed	*Polanisia dodecandra ssp. dodecandra*	Vascular	*Dicotyledoneae*	Likely
Racemed milkwort	*Polygala polygama*	Vascular	*Dicotyledoneae*	Likely
Seneca milkwort	*Polygala senega*	Vascular	*Dicotyledoneae*	Likely
Northern jointweed	*Polygonella articulata*	Vascular	*Dicotyledoneae*	Likely
Marsh mermaidweed	*Proserpinaca palustris*	Vascular	*Dicotyledoneae*	Likely
Virginia mountain-mint	*Pycnanthemum virginianum*	Vascular	*Dicotyledoneae*	Likely
Yellow water-crowfoot	*Ranunculus flabellaris*	Vascular	*Dicotyledoneae*	Likely
Northern dewberry	*Rubus flagellaris*	Vascular	*Dicotyledoneae*	Likely
American bladdernut	*Staphylea trifolia*	Vascular	*Dicotyledoneae*	Likely
Poison sumac	*Toxicodendron vernix*	Vascular	*Dicotyledoneae*	Likely
Yellow pimpernel	*Taenidia integerrima*	Vascular	*Dicotyledoneae*	Likely
False pennyroyal	*Trichostema brachiatum*	Vascular	*Dicotyledoneae*	Likely
Humped bladderwort	*Utricularia gibba*	Vascular	*Dicotyledoneae*	Likely
Resupinate bladderwort	*Utricularia resupinata*	Vascular	*Dicotyledoneae*	Likely
Twin-scaped bladderwort	*Utricularia geminiscapa*	Vascular	*Dicotyledoneae*	Likely
Upland white aster	*Solidago ptarmicoides*	Vascular	*Dicotyledoneae*	Likely
Water speedwell	*Veronica anagallis-aquatica*	Vascular	*Dicotyledoneae*	Likely
American vetch	*Vicia americana*	Vascular	*Dicotyledoneae*	Likely
Sand violet	*Viola affinis*	Vascular	*Dicotyledoneae*	Likely
Arrowleaf violet	*Viola sagittata var. ovata*	Vascular	*Dicotyledoneae*	Likely
Longspur violet	*Viola rostrata*	Vascular	*Dicotyledoneae*	Likely

Common name	Latin name	Group	Class	Status
Arrowleaf violet	*Viola sagittata var. sagittata*	Vascular	*Dicotyledoneae*	Likely
Southern arrow-wood	*Viburnum recognitum*	Vascular	*Dicotyledoneae*	Likely
Squawroot	*Conopholis americana*	Vascular	*Dicotyledoneae*	Vulnerable
Black maple	*Acer nigrum*	Vascular	*Dicotyledoneae*	Vulnerable
Divaricate sunflower	*Helianthus divaricatus*	Vascular	*Dicotyledoneae*	Vulnerable
Douglas' knotweed	*Polygonum douglasii*	Vascular	*Dicotyledoneae*	Vulnerable
Fragrant sumac	*Rhus aromatica var. aromatica*	Vascular	*Dicotyledoneae*	Vulnerable
Wallrue spleenwort	*Asplenium ruta-muraria*	Vascular	*Filicopsida*	Threatened
Purple-stem cliff-brake	*Pellaea atropurpurea*	Vascular	*Filicopsida*	Threatened
Broad beech-fern	*Phegopteris hexagonoptera*	Vascular	*Filicopsida*	Threatened
Blunt-lobed woodsia	*Woodsia obtusa ssp. obtusa*	Vascular	*Filicopsida*	Threatened
Narrow-leaved glade fern	*Diplazium pycnocarpon*	Vascular	*Filicopsida*	Likely
Walking fern	*Asplenium rhizophyllum*	Vascular	*Filicopsida*	Likely
Ebony spleenwort	*Asplenium platyneuron*	Vascular	*Filicopsida*	Likely
Northern oak fern	*Gymnocarpium jessoense ssp. parvulum*	Vascular	*Filicopsida*	Likely
Smooth cliff-brake	*Pellaea glabella ssp. glabella*	Vascular	*Filicopsida*	Likely
Oregon cliff fern	*Woodsia oregana ssp. cathcartiana*	Vascular	*Filicopsida*	Likely
Virginia chain fern	*Woodwardia virginica*	Vascular	*Filicopsida*	Likely
Meadow spikemoss	*Selaginella eclipes*	Vascular	*Isoetopsida*	Likely
Puttyroot	*Aplectrum hyemale*	Vascular	*Monocotyledoneae*	Threatened
False hop sedge	*Carex lupuliformis*	Vascular	*Monocotyledoneae*	Threatened
Late coral-root	*Corallorhiza odontorhiza var. odontorhiza*	Vascular	*Monocotyledoneae*	Threatened
Southern twayblade	*Listera australis*	Vascular	*Monocotyledoneae*	Threatened
Slim-flowered muhly	*Muhlenbergia tenuiflora*	Vascular	*Monocotyledoneae*	Threatened
Weak-stalked bulrush	*Schoenoplectus purshianus var. purshianus*	Vascular	*Monocotyledoneae*	Threatened
Canada garlic	*Allium canadense var. canadense*	Vascular	*Monocotyledoneae*	Likely
Narrow-leaf blue-eyed grass	*Sisyrinchium angustifolium*	Vascular	*Monocotyledoneae*	Likely
Kalm's brome	*Bromus kalmii*	Vascular	*Monocotyledoneae*	Likely
Calypso orchid	*Calypso bulbosa var. americana*	Vascular	*Monocotyledoneae*	Likely

Common name	Latin name	Group	Class	Status
Silvery-flowered sedge	*Carex argyrantha*	Vascular	*Monocotyledoneae*	Likely
Compact sedge	*Carex sychnocephala*	Vascular	*Monocotyledoneae*	Likely
Bailey's sedge	*Carex baileyi*	Vascular	*Monocotyledoneae*	Likely
Mühlenberg's sedge	*Carex muehlenbergii var. muehlenbergii*	Vascular	*Monocotyledoneae*	Likely
Sartwell's sedge	*Carex sartwellii*	Vascular	*Monocotyledoneae*	Likely
Troublesome sedge	*Carex molesta*	Vascular	*Monocotyledoneae*	Likely
Appalachian sedge	*Carex appalachica*	Vascular	*Monocotyledoneae*	Likely
Prairie sedge	*Carex prairea*	Vascular	*Monocotyledoneae*	Likely
Bur-reed sedge	*Carex sparganioides*	Vascular	*Monocotyledoneae*	Likely
Folliculate sedge	*Carex folliculata*	Vascular	*Monocotyledoneae*	Likely
Cat-tail sedge	*Carex typhina*	Vascular	*Monocotyledoneae*	Likely
Prickly bog sedge	*Carex atlantica ssp. capillacea*	Vascular	*Monocotyledoneae*	Likely
Eastern few-fruited sedge	*Carex oligocarpa*	Vascular	*Monocotyledoneae*	Likely
Yellow-fruited sedge	*Carex annectens*	Vascular	*Monocotyledoneae*	Likely
Oval-headed sedge	*Carex cephalophora*	Vascular	*Monocotyledoneae*	Likely
Dry-spiked sedge	*Carex siccata*	Vascular	*Monocotyledoneae*	Likely
Striated coral-root	*Corallorhiza striata var. striata*	Vascular	*Monocotyledoneae*	Likely
Showy lady's-slipper	*Cypripedium reginae*	Vascular	*Monocotyledoneae*	Likely
Robbins' spikerush	*Eleocharis robbinsii*	Vascular	*Monocotyledoneae*	Likely
Slender fimbry	*Fimbristylis autumnalis*	Vascular	*Monocotyledoneae*	Likely
Roundleaf orchis	*Galearis rotundifolia*	Vascular	*Monocotyledoneae*	Likely
Showy orchis	*Galearis spectabilis*	Vascular	*Monocotyledoneae*	Likely
Pale false mannagrass	*Torreyochloa pallida var. pallida*	Vascular	*Monocotyledoneae*	Likely
Greater poverty rush	*Juncus anthelatus*	Vascular	*Monocotyledoneae*	Likely
Greene's rush	*Juncus greenei*	Vascular	*Monocotyledoneae*	Likely
Smith's melic grass	*Melica smithii*	Vascular	*Monocotyledoneae*	Likely
Woodland muhly	*Muhlenbergia sylvatica*	Vascular	*Monocotyledoneae*	Likely
Philadelphia panic-grass	*Panicum philadelphicum*	Vascular	*Monocotyledoneae*	Likely
Wiry panic-grass	*Panicum flexile*	Vascular	*Monocotyledoneae*	Likely
Switchgrass	*Panicum virgatum*	Vascular	*Monocotyledoneae*	Likely
Arrow arum	*Peltandra virginica*	Vascular	*Monocotyledoneae*	Likely

Common name	Latin name	Group	Class	Status
Greater roundleaved orchid	*Platanthera macrophylla*	Vascular	*Monocotyledoneae*	Likely
Palegreen orchid	*Platanthera flava var. herbiola*	Vascular	*Monocotyledoneae*	Likely
Illinois pondweed	*Potamogeton illinoensis*	Vascular	*Monocotyledoneae*	Likely
Vasey's pondweed	*Potamogeton vaseyi*	Vascular	*Monocotyledoneae*	Likely
Small pondweed	*Potamogeton pusillus ssp. gemmiparus*	Vascular	*Monocotyledoneae*	Likely
Drooping speargrass	*Poa saltuensis ssp. languida*	Vascular	*Monocotyledoneae*	Likely
Hair-like beak-rush	*Rhynchospora capillacea*	Vascular	*Monocotyledoneae*	Likely
Small-headed beak-rush	*Rhynchospora capitellata*	Vascular	*Monocotyledoneae*	Likely
Branched bur-reed	*Sparganium androcladum*	Vascular	*Monocotyledoneae*	Likely
Slender bulrush	*Schoenoplectus heterochaetus*	Vascular	*Monocotyledoneae*	Likely
Slender flatsedge	*Cyperus lupulinus ssp. macilentus*	Vascular	*Monocotyledoneae*	Likely
Rusty flatsedge	*Cyperus odoratus*	Vascular	*Monocotyledoneae*	Likely
Case's lady's-tresses	*Spiranthes casei var. casei*	Vascular	*Monocotyledoneae*	Likely
Shining lady's-tresses	*Spiranthes lucida*	Vascular	*Monocotyledoneae*	Likely
Poverty dropseed	*Sporobolus vaginiflorus var. vaginiflorus*	Vascular	*Monocotyledoneae*	Likely
Sand dropseed	*Sporobolus cryptandrus*	Vascular	*Monocotyledoneae*	Likely
Northern dropseed	*Sporobolus heterolepis*	Vascular	*Monocotyledoneae*	Likely
Rough dropseed	*Sporobolus compositus var. compositus*	Vascular	*Monocotyledoneae*	Likely
Clinton's bulrush	*Trichophorum clintonii*	Vascular	*Monocotyledoneae*	Likely
Northern watermeal	*Wolffia borealis*	Vascular	*Monocotyledoneae*	Likely
Annual wildrice	*Zizania aquatica var. aquatica*	Vascular	*Monocotyledoneae*	Likely
Wild leek	*Allium tricoccum*	Vascular	*Monocotyledoneae*	Vulnerable
Ram's head lady's-slipper	*Cypripedium arietinum*	Vascular	*Monocotyledoneae*	Vulnerable
Downy rattlesnake-plantain	*Goodyera pubescens*	Vascular	*Monocotyledoneae*	Vulnerable
Blunt-lobed grapefern	*Botrychium oneidense*	Vascular	*Ophioglossopsida*	Likely
Narrowleaf grapefern	*Botrychium lineare*	Vascular	*Ophioglossopsida*	Likely
St. Lawrence grapefern	*Botrychium rugulosum*	Vascular	*Ophioglossopsida*	Likely
Northern adder's-tongue	*Ophioglossum pusillum*	Vascular	*Ophioglossopsida*	Likely

Common name	Latin name	Group	Class	Status
Eastern redcedar	*Juniperus virginiana var. virginiana*	Vascular	*Pinopsida*	Likely

CDPNQ (2014). Extracted from the data system for the territory of the Outaouais watershed, Centre de données sur le patrimoine naturel du Québec (CDPNQ), Québec, Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques.

Appendix II. Characteristics of different types of wetlands

Shallow and deep water

- Pond: Water body of less than 8 hectares.
- Pool: Small body of shallow, stagnant water, susceptible to drying out; also refers to the pools in peat bogs.

Non-forested wetlands

- Herbaceous meadow (bogs, fens, undifferentiated marshes): Wetlands in which trees comprise less than 25% of the plant cover. Includes meadow marshes, emergent marshes, shoreline swamps, bogs and other types of wetlands classified as "wet barrens" in the ecoforestry map of the third ten-year inventory.
- Flooded swamp: A flooded swamp or recently flooded area dominated by still-standing dead trees.
- Shrubby swamp: Swamp primarily dominated by shrubs, particularly speckled alder (*Alnus rugosa*).

Forested wetlands

- Rich deciduous swamp: Forested swamp (over 25% of tree cover more than 10 m in height) in which deciduous species comprise more than 75% of the basal area of the stand, growing on a mineral deposit, with hydric drainage and minerotrophic trophic regime.
- Rich mixed swamp: Forested swamp (over 25% of tree cover more than 10 m in height) in which deciduous species comprise from 25% to 75% of the basal area of the stand, growing on a mineral or organic deposit, with hydric drainage and minerotrophic trophic regime.
- Rich coniferous swamp: Forested swamp (over 25% of tree cover more than 10 m in height) in which coniferous species comprise more than 75% of the basal area of the stand, growing on a mineral or organic deposit, with hydric drainage and minerotrophic regime.
- Poor coniferous swamp: Forested swamp (over 25% of tree cover more than 10 m in height) in which coniferous species comprise more than 75% of the basal area of the stand, growing on a mineral deposit, with hydric drainage and ombrotrophic regime.
- Very poor coniferous swamp: Forested swamp (over 25% of tree cover more than 10 m in height) in which coniferous species comprise more than 75% of the basal area of the stand, growing on an organic deposit, with hydric drainage and ombrotrophic regime.

Développement durable, Environnement et Lutte contre les changements climatiques

Québec