

Chapter 3

Natural Heritage Values

The following describes the outstanding natural heritage features that the Ottawa River would contribute to the CHRS. This description is organized according to the six themes of the *Framework for the Natural Values of Canadian Heritage Rivers, 2nd Edition, 2001*.

3.1 Description of Natural Heritage Values

3.1.1 Hydrology

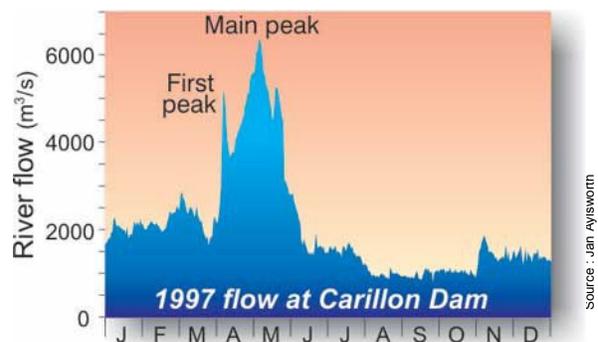
Drainage Basins

Stream numbers distinguish between rivers flowing directly into the ocean and those flowing into other rivers. The Ottawa River is a stream number 2 because it flows directly into the St. Lawrence River (a stream number 1), which in turn flows into the Atlantic Ocean. The Ottawa is the largest tributary to the St. Lawrence, making it an important component of North America's Atlantic "drainage basin." The Atlantic Ocean basin drains 15% of Canada's land surface. The Ottawa River's drainage basin occupies 146,300 km² of territory, making it the 12th largest drainage basin located in Canada. The Ottawa River's drainage basin accounts for approximately 11.2% of the total drainage area of the St. Lawrence.

Seasonal Variation

"Seasonal variation" of the Ottawa River is characterized by the river's "high flow" regime from March to June (inclusive), and "low flow" regime between July and February, with peak flows occurring in April and again in May and low flows occurring in February. The Lower Ottawa River experiences two peak flow periods in springtime. Spring arrives earlier along the southern unregulated tributaries, causing the Ottawa River to rise to its first peak. The second, usually higher flow peak occurs about three weeks later as a result of snowmelt in the northern regions of the basin. The average maximum monthly flow over the past 40 years has been 5374 m³/s, while the average minimum monthly flow has been 736 m³/s. The degree of seasonal variation of the Ottawa River's flow has been reduced by the reservoirs and dams along the river. In 1870, the ratio of maximum to minimum flow was about 10:1, while by 1930 it was reduced to 5:1 (Legget 16).

Figure 3.1 Peak Flow of the Ottawa River



Water Content

In terms of the Ottawa's "physical properties", some stretches of the river possess "high turbidity" due in particular to suspended clay material. In terms of the Ottawa's "chemical properties," its pH is low (slightly acidic) around Lake Timiskaming. The pH increases along the course of the river, and gradually becomes slightly alkaline. According to the Quebec Ministry of Sustainable Development, Environment and Parks, the total suspended solids along most of the Ottawa River, including calcium, magnesium, bicarbonates, sodium, sulphates and chlorides, is less than 6 mg/L. This is considered to be a small amount. The water of the Ottawa River is somewhat coloured due to relatively high concentrations of organic substances, such as the humic acids produced by decomposing plants. According to Environment Canada's Saint Lawrence Centre, suspended particulate matter in Ottawa River water, measured between 1985 and 1990 at Carillon, was found to be 6.0 mg/L. Turbidity at the same location was found to be 4.2 NTU. Causes of suspended particulate matter include spring runoff, erosion, shoreline wind action, cattle trampling, etc., which play a role in reducing spawning grounds and fish habitat along the Ottawa.

River Size

In terms of "flow volume," the Ottawa is a "large river." The Ottawa River ranks 8th in terms of discharge volume among Canadian rivers, and is Canada's 12th longest river.

3.1.2 Physiography

Physiographic Region

The Ottawa River is a major waterway within the Laurentian "physiographic region" of Canada.

Figure 3.2 Dykes of Pegmatite and Aplite



Dykes of pegmatite and aplite that were injected in a molten state along fractures in mafic metamorphic host rocks. Roadcut on the east side of Highway 17, 15 kilometres north-west of Deep River.

Geological Processes

The present physical characteristics of the Ottawa River Valley represent more than 3 billion years of geological processes, including significant modification within glacial and post glacial environments, including the Champlain Sea.

The source of the Ottawa River lies within the Superior Structural Province of the Canadian Shield, one of two large blocks of Achaean igneous and metamorphic rocks containing the oldest rocks in North America. Gneisses in this region are evidence of "bedrock formation: metamorphism" and of "bedrock formation: folding." Granite and other igneous rocks provide evidence of "bedrock formation: intrusions." At a point approximately due east of Temagami, Ontario, Achaean rocks of the Superior Province are truncated by a block of younger

metamorphic Precambrian rocks of the Grenville Province, uplifted more than 1 billion years ago.

“Bedrock formation: volcanism” is illustrated by Achaean greenstone belts that represent volcanic edifices formed over 2.5 billion years ago. These solidified basaltic lavas are exposed along both shores of Lake Timiskaming. They contain abundant pillow structures formed when liquid rock material (magma) erupted under the sea and became enshrouded in a glassy outer rim on contact with the cold sea water.

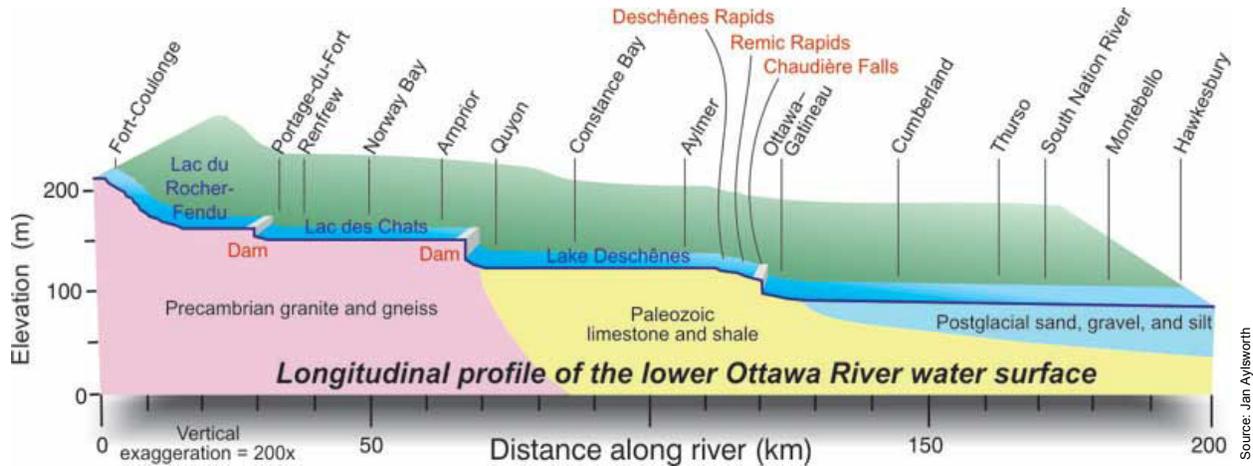
“Bedrock formation: sedimentation” is evidenced in the numerous sedimentary rocks, sandstones, limestones, and shales of the river valley. Lake Timiskaming is bordered by Huronian strata that belong to the Gowganda Formation, a classic example of one of at least four episodes of continental glaciation that took place more than 2.2 billion years ago, long before the last Ice Age with which we are familiar. The ancient Precambrian ice sheet was responsible for the deposition of the Gowganda sediments, and thus also represents *“surficial material formation: glacial transport;”* unlike glacial deposits of the recent Ice Age, these deposits are lithified. At the base of the Huronian sequence at Lake Timiskaming, an ancient soil profile known as a paleosol is locally preserved beneath a major unconformity (a gap in the rock record) representing over 300 million years.

The process of *“sedimentation”* is also evidenced by numerous fossils of invertebrates such as corals, stromatoporoids, bryozoa, brachiopods, palecypods, cephalopods and gastropods that are preserved in the Paleozoic rocks of the river valley. Stromatolites are exposed in several places on both shores of the River. These biosedimentary structures were formed by Earth’s oldest life forms, the cyanobacteria, that once thrived in tropical seas before the appearance of animal life. Stromatolites are still forming today, but in restricted environments free of more advanced organisms that dine on cyanobacteria.

The Nipissing Diabase is a hard, resistant rock responsible for much of the rugged topography north of the Grenville Front. A striking example of landscape created by the Nipissing Diabase is Spirit Rock, which displays a spectacular cliff rising more than 100 metres above the west shore of Lake Timiskaming.

Examples of *“surficial material formation: glacial melting and glacial transport”* reflect the advance and retreat of the Wisconsinan ice sheet that covered most of the region approximately 20,000 years ago. Elements present along the river include glacial till, drumlins, moraines, raised beaches, glacial outwash (such as sand and gravel in floodplains, deltas and eskers) as well as vast accumulations of silt and clay along the river valley. These were deposited during the waning stages of the last Ice Age within both freshwater lakes and the Champlain Sea, a marine estuary of the Atlantic Ocean that extended up the Ottawa River beyond Pembroke. Unconsolidated glacial deposits are responsible for the rich farmlands of the lower Ottawa River Valley.

Figure 3.3 Longitudinal Profile of the Lower Ottawa River



Hydrogeology

The river bed and valley contain a wide range of geological materials, a testament to the rich geological heritage.

North of Pembroke, the bedrock is dominated by impervious metamorphic and igneous rocks of the Canadian Shield, and is characterized by abundant rock outcrops. From Pembroke southward, discontinuous plates of Paleozoic rocks such as sandstone, limestone, dolostone and shale begin to take over the bedrock landscape. The Ottawa-Gatineau region is underlain by three different geological materials. The resistant rocks of the Canadian Shield form highland areas. Flat-lying Paleozoic rocks underlie lowland plains and low hills, and outcrops are confined largely to low scarps and riverbanks. Much of the region is covered by a blanket of Quaternary sediments, which form landscapes that range from gently undulating plains and low hills of glacial deposits to the flat plains of the Champlain Sea. Downstream of the Gatineau River, the landscape differs as the Ottawa's course takes it over Quaternary sediments.

The sand and gravel deposited in the river's floodplains, deltas and eskers are examples of "*surficial unconsolidated materials*" of medium porosity, while the river's vast accumulations of silt and clay, including deposits of Leda clay in the southern region of the river valley, are much less porous. Raised boulder beaches, including a beach 8 kilometres west of Haileybury, Ontario, mark the highest level of the post-glacial Lake Barlow-Ojibway.

Topography

Over its 1,271 kilometre course, the river falls about 335 metres, giving it a "*significant*" average "*gradient*" of 0.264 m/km. The river's gradient changes considerably along its course. As the water flows over resistant bedrock outcrops, it creates "*rapids*" and "*waterfalls*." The river's 7 dams are built at these strategic locations for their hydroelectric potential. Most notable of these are the generating centres at Otto Holden, Des Joachims, Chenaux, Chats Falls, Chaudière Falls, and Carillon. In these areas, as well as at other rapids such as Rocher Fendu, the river possesses a "*steep*" gradient.

In terms of its “*relief*”, the River begins at about 355 metres above sea level, and falls to about 20 metres above sea level at its confluence with the St. Lawrence.

3.1.3 River Morphology

Valley Types

Profiles of the “*valley walls*” vary remarkably, but are mainly subdued and convex. The “*valley floors*” range from nonexistent to low, moderately narrow flood plains. There are few “*interfluves*” along the river. These range from low but rugged in the upper reaches to low and flat in segments such as at Calumet and Morris Islands.

Channel Patterns

In terms of “*stream configurations*,” the Ottawa River exhibits channel patterns that are “*straight, meandering, and branching*.” This range reflects the varying nature of the river along its course.

In terms of “*lake systems*,” there are 19 significant lakes and reservoirs along the river. Lake Timiskaming is the most significant, and is a remarkably long, deep, and narrow “*elongated lake*” about 108 kilometres in length, 8 kilometres in width at its maximum, and with a mean depth of 122 metres. The depth of the river is significant, lending its name to the community of Deep River. The Ottawa River is 70 metres deep at Chalk River. Large lakes formed by reservoirs exist on the Ottawa’s upper stretches, including Lac Des Quinze, Lac Grand Victoria and Baskatong Reservoir. On its lower section, significant lakes include Lake of Two Mountains, Lac Deschênes, and Allumette Lake.

Channel Profile

The Ottawa River’s channel profile is “*stepped*” at major rapids, and “*regular*” over sections with continuous rapids. Many of the major drops have been used and modified for hydroelectric development. “*Level water*” along the Ottawa River occurs at flatwater and swift water sections throughout the river’s course.

Regular rapids, which are prolonged and with a relatively continuous gradient, occur at various places along the Rocher Fendu section. Significant “*cataracts*” occur on the Main Channel of this section, with several strong eddies and whirlpools. Whitewater on this section ranges from Class I to Class V at a “*cascade*” (Garvin’s Chute), although on average the section is rated Class III. Many of the rapids of the Ottawa River have been drowned out by impoundments. Among them, the prolonged rapids at the Long Sault are said to have been impressive, stretching over a distance of 14 kilometres. Further cascades exist or have existed at Chaudière and Chats Falls.

Fluvial Landforms

The River represents a range of “*fluvial landforms*,” both “*depositional*” and “*erosional*.”

Depositional

Because the Ottawa is a young and fast-flowing river, it lacks a “delta” at its mouth, and sweeps away attempts of tributaries to build more than ephemeral deltas at their confluence with the Ottawa. Because of its coarse bedload/low suspension load, extensive floodplains and “levees” are absent.

The Petrie Islands are alluvial deposits forming a wetland complex of elongated sedimentary ridges and backwaters characteristic of the Ottawa River below the confluence with the Gatineau River. These constitute an example of “*fluvial landforms: depositional*,” where sand and clay sediments are the result of a glacial deposition and retreat.

Muskrat (near Cobden) and Sturgeon Lakes (near Chalk River) are remnants of previous channels of the Ottawa River, and as such are examples of “*oxbows*.”

In the Outaouais region, the banks of the river are generally flat terrain with associated “*terraces*.” Natural and artificial beaches are present in places along the wider, slower flowing reaches of the river. Downstream of the Gatineau River, vegetated sandbars forming low islands and marshes are common.

Erosional

There are numerous raised “*terraces*,” relics of the ice age that mark former levels of the paleo-Ottawa River, at and downstream of Petawawa. Minor “*undercuts*” are developed in Precambrian rocks at Rocher Fenou, and sporadically in Paleozoic limestone strata downstream from Constance Bay. A network of “*caves*” in Grenville marble provide underground pathways for much of the river flow along a several-kilometre stretch downstream from Pembroke. Below Deep River, the river valley forms a wide but locally steep walled valley. There are some significant “*deeps*” in Lake Timiskaming. Muskrat Lake near Cobden occupies a major “*cutoff channel*.”

3.1.4 Biotic Environments

Aquatic Ecosystems

The section of the Ottawa River being nominated for CHR status displays characteristics of middle-order and lowland zone “*riverine systems*”.

The Ottawa River flows through a series of lakes, many of which have been formed by dams. The lakes and reservoirs formed upstream of dams along the Ottawa tend to be “*eutrophic*”. Downstream of each dam, water tends to be in constant motion.

Significant “*wetlands*,” including “*bogs*,” “*fens*,” “*marshes*” and “*swamps*,” are found along or near the Ottawa River. Stony Swamp Conservation Area, part of the National Capital Greenbelt, and Westmeath Provincial Park both contain significant “*swamps*”. Examples of significant

Figure 3.4 Aerial View of the Outaouais



Source: Mia & Klaus

“bogs” include the Alfred and Mer Bleue bogs, boreal peat bogs situated southeast of Ottawa. The Alfred Bog is the largest of its kind in southern Ontario, and lies within an abandoned channel of the Ottawa River. Wetlands are the most productive and diversified ecosystems along the Ottawa River.

Terrestrial Ecosystems

The Ottawa River Valley lies in Canada’s “Boreal Shield” terrestrial ecozone.

3.1.5 Vegetation

Significant plant communities along the Ottawa River include “aquatic/riparian” plant species that are unique in terms of “location”: prairie and alvar vegetation supported by spring flooding grow in narrow bands along the shorelines of the Ottawa River. For instance, at Shirley’s Bay in Ottawa, there are shrubby alvars with plants such as Shrubby Cinquefoil, and prairie species such as Little Bluestem, Big Bluestem, Prairie Cord-Grass and Indian Grass.

Exceptional “trees” along the Ottawa include the mixed wood forest of the Outaouais region, considered to be the richest forest in Quebec in terms of biodiversity. Along the lower Ottawa River, trees such as Hackberry, Butternut and Bur Oak exist at the northern limit of their range. Ironwoods and Silver Maple are also notable species. White Pines at Gillies’ Grove, Arnprior, are rare remnants of the famous logging forests of the Ottawa River, and are among the tallest trees in Ontario. Pockets of old growth White Pine also exist along several tributaries of the Ottawa.

“Rare plant species” along the Ottawa include those adapted to seasonal flooding at Petrie Island, such as Gattinger’s Panic Grass, Moss-Like Love Grass and Wild Madder. There are 9 endangered vascular plant species found within the Ottawa River watershed, either provincially or federally. These include American Ginseng, Butternut, and Blunt-Lobed Cliff Fern. An additional 15 vascular plants are considered to be threatened or of special concern.

3.1.6 Fauna

The Ottawa River is home to many different ecosystems, each playing an important role in sustaining Canada’s biodiversity. More than 85 species of “fish” can be observed in the river. Of these, the River Redhorse has been listed as a species of “special concern” by COSEWIC, as has Lake Sturgeon. The population of Lake Sturgeon in the Ottawa River is the most significant in southeastern Ontario. Large specimens of Yellow Sturgeon, Muskellunge and Northern Pike have been found in the Ottawa River. Sport fishing has a long history on the Ottawa River, with common catches of Bass, Perch, Walleye (Pickerel) and Pike.

The Ottawa River is home to a unique and diverse population of freshwater mussels, including at least 14 different species, and an unusually high density on the bottom of the river. The rare Olive Hickorynut mussel exists on only four rivers across Canada, with the most important population likely on the Ottawa River. The reproduction of the Olive Hickorynut mussel involves the Lake Sturgeon, and the abundance of freshwater mussels in the Ottawa River provides a number of unique ecosystem functions and services

Unique wetlands and floodplain habitats support more than 300 species of “birds” along the river, about half of which are migratory, making the Ottawa one of the continent’s most important migratory flyways. The Ottawa River is home to the threatened Least Bittern and the Bald Eagle.

In addition, some 53 species of “mammals” inhabit the river valley. Significant mammal populations include Black Bear, Wolf, Lynx, Moose and Marten along the boreal forest of the upper reaches of the Ottawa River. Common species of the mixed wood lowlands of the river watershed include White-Tailed

Figure 3.5 Milksnake



Source : Petawawa Civic Centre

Deer, Red Fox, and Snowshoe Hare. Southern Flying Squirrel is considered to be a species at risk and its greatest population is found in the Outaouais region.

There are 33 species of “reptiles and amphibians” in the river valley, including the Eastern Spiny Softshell Turtle, one of the most rare turtles in Canada. The Spotted Turtle is endangered, and the Milksnake and Eastern Ribbon Snake are both “species of special concern.” Frogs and other amphibians are particularly diverse along the Ottawa River.