

2.9 Hydroelectricity on the Ottawa River

The Riverman's Fancy

By Fred Coyne

The seven chutes of Calumet
Are flooded deep from view,
And muffled is the rapid's roar,
Along the Rocher Fendu.
Since hydro power dams have stemmed
The Ottawa, to change,
Portage du Fort's rock-riven shore
Is soundless now, and strange.

Old Devil's Elbow crooks unseen;
Grand Sable lifts no sound;
Gray Mountain Chute is deadly mute
Like D'Argis Rapids drowned;
Wild cataracts from Lac Coulonge
Lie listless in a lake
Where once the lunging River's plunge
Made rocky ravines quake.

Des Chats, Chenaux, la Rocher Fendu,
Des Joachims and La Cave;
Those waters leapt the Laurentides,
Are docile now and suave;
But somehow from the whirling wheels
Of hydro plants we hear
The power song we know belonged
To Chutes of yesteryear (from *Finnegan* 205).

Today it is hard to imagine that most of the Ottawa River once resembled the Rocher Fendu section, with raging rapids at sudden drops along its whole length. But the days of the voyageurs are over and the river has seen its most significant changes over the past 100 years - from the harnessing of its power for hydroelectricity. Hydro dams have now been built at most of the great cataracts of the Ottawa River. Although the Ottawa has always been a series of elongated reservoirs separated by sudden drops in elevation, massive concrete dams now flood and silence the rapids at their narrow junctions.

Early dams on the Ottawa River were built to drown out rapids and to harness hydraulic power. From the 1880s until 1964, seven hydroelectric dams were constructed between Carillon and Lake Temiskaming (Haxton and Chubbuck i). In all there are 43 dams in the Ottawa River watershed, forming 14 billion cubic metres of water storage capacity. All of these dams and reservoirs make the Ottawa River one of the most highly regulated catchments in Canada (Haxton and Chubbuck 1). The combined capacity of the Ottawa basin's hydroelectric generating stations is about 3,500 megawatts. The value of the electricity averages about \$1 million per day (ORRPD: "Managing the Waters").

On a national scale, the Ottawa River is one of three rivers that played a crucial role in the early development of hydroelectricity in Canada, along with the St. Lawrence and Niagara Rivers (Canadian Public Works Association 174). Currently, hydroelectricity accounts for 61% of Canada's electricity (CCE). The development of hydroelectricity on the Ottawa River was intertwined with the rise of the pulp and paper industry, which needed a ready supply of electricity. Settlement followed this industrial and energy development that was crucial to the growth of the economies of both Quebec and Ontario. That the river follows the Quebec-Ontario boundary for much of its length has meant a shared responsibility for hydroelectric power development between the two provinces.

2.9.1 Paper and Power – Developing Hand in Hand

Economic development and industrialization along the Ottawa River were closely linked to hydroelectric resources and the forest industry. People were encouraged to settle around factories - first around sawmills and then pulp and paper mills. Urban areas such as Hull, Buckingham and Gatineau resulted from these first mill-driven settlements (Gaffield 259).

As early as the 1850s, people used water wheels and turbines to drive machinery in sawmills and flourmills (CCE: "Hydro Timeline"). As the lumber industry began to decline at the end of the 19th century, pulp and paper became the main industry in Quebec (Gaffield 261). Sawmills consumed more and more energy, as did the factories to process raw materials. Large sawmills set up close to falls and rapids, at first harnessing hydraulic waterpower directly, and then consuming hydroelectric energy to operate (ORIDP 16). In 1886, large-scale industries in the Outaouais region began depending on the energy-hungry pulp and paper sector. This situation continued until 1940 (Gaffield 259).

Canadian and provincial governments encouraged the development of forest and energy resources to take advantage of the American demand for pulp and paper (Gaffield 260). With wood, workers and hydropower, the paper business was well positioned to flourish in the Outaouais region.

E.B. Eddy and the Chaudiere Falls

The tumultuous Chaudiere Falls has always been seen as an ideal spot to built mills and was used for hydraulic power for regional lumber companies since the 1850s. Set up at the Falls, entrepreneur E.B. Eddy harnessed the power of the Ottawa River to drive his sawmill built in 1866 (ORIDP 16). In 1886, Eddy formed the E.B. Eddy Manufacturing Company to produce matches and other items made of wood. Soon, along with J.R. Booth, another lumber giant turned paper producer (on the Ontario side of the Chaudiere Falls), Eddy became one of the biggest producers of paper in the Ottawa Valley (Gaffield 261, 268). These pulp and paper mills generated regular factory jobs and employment in logging and transportation in the region (Gaffield 265-266).

The E.B. Eddy industrial complex and the hydroelectric resources needed to operate these factories grew hand in hand. In 1913 the company built its own electricity generating plant. This followed a 1907 agreement between Ontario and Quebec to share the hydroelectric potential of the Chaudiere Dam, built in 1909. Indeed, at the Chaudiere Falls, the Ottawa River served as a boundary – but it also helped integrate the regional economy of both provinces (Gaffield 267).

Pulp and paper mills also led to power plants on the tributaries of the Ottawa River, such as the Lièvre,

where the Maclaren brothers built a small power plant for their pulp and paper mills at the beginning of the 20th century (Gaffield 269).

The Ottawa River basin experienced a second phase of hydroelectric construction when Canadian International Paper (CIP) bought up pulp and paper companies in the region (Gaffield 270). CIP was a subsidiary of International Paper and Power Co. (IPP), which became the world's leading electricity and paper producer after investing in hydroelectricity and timber concessions in Quebec from 1924 to 1930 (Gaffield 270).

Gatineau Power, a subsidiary of CIP, swallowed up local firms on the Ottawa basin, controlling nearly all the hydroelectric developments in the Ottawa Valley except E.B. Eddy's plants on the Ottawa and the Maclarens on the Lièvre. Gatineau Power built massive brick dams and generating stations, and reservoirs upstream on the Gatineau River (Gaffield 273).

2.9.2 Electricity Takes to the Streets – Lighting and Tramways

In the 1860s, some mill owners began to install small generators for electric lighting. In 1862, McAllister's mills generated electricity for sale in Pembroke, considered a first for Canada. The Ottawa Electric Light Company later built a small waterwheel at the Chaudiere Falls for street lighting. This was possibly the first hydraulic generator in Canada. The major power companies that later developed in many cases started out as gas companies for streetlights (Canadian Public Works Association 175).

But the largest early use of hydraulic energy was for traction motors on street cars (Canadian Public Works Association 170). In 1896, Deschênes Electric Company built a dam and hydroelectric plant near Robert and William Conroy's sawmill near the Deschênes Rapids. This became the Hull Electric Company that supplied electricity to streets in Hull and the villages of Aylmer and Deschênes, as well as to the Hull and Aylmer tramways (ORIDP 18).

Hydroelectric resources helped encouraged growth of manufacturing activities in Hull, including a meatpacking plant, textile company, cement factory, iron and steel works etc. (Gaffield 277).

2.9.3 Building Dams and Generating Electricity

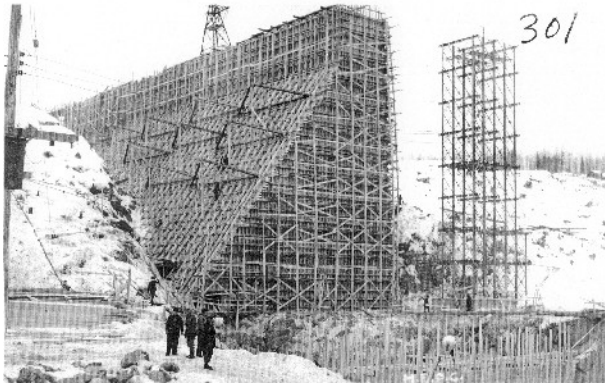
The first reservoirs on the Ottawa River were built to aid navigation, augment low flows and provide some flood control. Next, reservoirs were built with hydroelectric energy production as their primary purpose. Today the greatest needs are hydroelectric generation, domestic water supply, wastewater dilution, and recreational boating (ORRPB: "Flow Regulation").

On the Ontario side of the river, hydroelectric power generation began in 1885, although not much electricity was produced before 1914 (Gaffield 267). Regulating dams upstream of Lac la Cave were built from 1911 to 1914 by the Canadian government to increase the volume of flow during low water. The dams were built above Quinze Rapids (upstream of Lake Temiskaming), at the outlet of Lake Temiskaming and on the Kipawa River (Haxton and Chubbuck 55).

All electric distribution systems used direct current (DC) at first (CCE: "Hydro Timeline"). The early generators couldn't transit direct current (dc) over large distances, leading to high prices (Canadian Public

Works Association 171). By the 1920s, the best sites near to urban centres had been developed (CCE: "Hydro Timeline"). Electric power usage increased greatly when alternating current (ac) was adopted, and transmitting the electricity over long distances became possible (Canadian Public Works Association 171).

Figure 2.71 Dam Construction at Rapides-des-Joachims



Source : Courtesy of Joe and Kathy Lance and CEDEC.

Figure 2.72 Divers Building the Dam at Rapides-des-Joachims



Source : Courtesy of Joe and Kathy Lance and CEDEC.

Temporary Settlement in the Hydro Camps

In the 1940s and 1950s, colonies and camps were built to house workers building hydroelectric dams and generating stations on the Ottawa River. Most of these communities eventually dispersed. For instance, a mini company town at Fitzroy Harbour housed staff at the Chats Falls Generating Station. Run by Ontario Hydro, it became too costly to maintain by the 1970s (OPG: “Chats Falls”).

Figure 2.73 Lunchroom, Des Joachims



Source : Courtesy of Joe and Kathy Lance and CEDEC.

Figure 2.74 Housing, Des Joachims



Source : Courtesy of Joe and Kathy Lance and CEDEC.

A large construction camp near the Chenux Generating Station provided accommodation for 1,500 men! This camp had bunkhouses, a cafeteria, engineering and administrative offices, a camp hospital, recreation hall, and storage quarters. The Des Joachims Generating Station project housed personnel in three separate camps, one of which housed 900 men and included a thirty-bed hospital. The Otto Holden Generating Station was built by staff housed in a colony set up in Mattawa (OPG: “Otto Holden GS”).

2.9.4 Flood Control in the Ottawa River Basin

Despite thirty storage reservoirs with a tremendous capacity of 14 billion cubic metres in its basin, the Ottawa River still sometimes experiences damaging floods. Many studies for the construction and operation of specific dams have been carried out in the basin, but few have considered the system as a whole. Various different federal and provincial agencies as well as private companies own the many dams and generating stations in the basin.

In 1983, the governments of Canada, Quebec and Ontario established the Ottawa River Regulation Planning Board (ORRPB) to “ensure integrated management of the principal reservoirs of the Ottawa River Basin”. This serves to protect against flooding along the Ottawa River and its tributaries while maintaining the interests of various users - with an emphasis on hydroelectric energy production (ORRPB: “Organization and Purpose”).

Most of the Ottawa River reservoirs are located on its upper section. The Ottawa River experiences a first flood peak in the spring from unregulated flows from its southern tributaries. A second peak results from high flows from tributaries along the north shore and from the partially regulated headwater areas. Reservoirs store much of the spring runoff, reducing this second peak. Flooding is of particular concern in the Montreal region (ORRPB: “Flow Regulation”).

2.9.5 Quebec and Ontario – Sharing a Rich Resource

Sharing the rich potential of the Ottawa River has always been a source of concern, beginning with the Chaudiere Falls, which was controlled by monopolies as early as the mid-19th century. Sawmill owners held these monopolies and discouraged the development of other sectors (Gaffield 267). Early 20th century entrepreneurs in both provinces launched many court actions over the ownership of the hydroelectric potential of the Chaudiere Falls. In 1907, Ontario and Quebec reached an agreement to share the rights for the hydroelectric potential of a Chaudiere dam, splitting the power generated equally. The Chaudiere dam was completed in 1909, and was fed by storage reservoirs upstream. The federal government built these reservoirs at the headwaters, as well as the Temiskaming and the Quinze reservoirs (1912-1913) (Gaffield 267).

In 1943, Ontario and Quebec signed the *Interprovincial Agreement*, giving them equal rights at potential hydro sites along their boundary, from Point Fortune up to Lake Temiskaming. Under the agreement, one province can lease its half to the other, allowing it to control and develop the generator. Quebec controls sites at Carillon and Rocher Fendu, and Ontario controls Chenaux, Des Joachims and Otto Holden. Sites located above Lake Temiskaming are entirely in Quebec, and so fall outside the agreement, as does the Chaudiere site, leased by the Government of Canada many years ago.

The control of hydroelectricity developed differently in the two provinces, leading to a unique situation for much of the Ottawa River. Hydroelectricity was under private control for most of Quebec's history. Hydro Quebec, a provincial agency, was created in 1944 and took over plants owned by small private firms (Canadian Public Works Association 177). Today, Hydro Quebec is Canada's largest electric utility (CCE: "Hydro Timeline"), a major exporter, employer, and engine of economic growth (Canadian Public Works Association 172). Quebec relies heavily on hydroelectric power.

In Ontario, public utilities controlled hydroelectric power generation for much of the 20th century, although private companies undertook early developments. 1905 marked the incorporation of Ontario Hydro's precursor, the Hydro Electric Power Commission of Ontario (Canadian Public Works Association 179). Although Ontario Hydro had some of its own plants, it also imported electricity from Quebec. Subsidized electricity revolutionized rural farm life. Private development continued in the north, where pulp and paper companies built their own generating facilities for their own needs (Canadian Public Works Association 181).

In 1999, Ontario Power Generation (OPG), a major North American electricity generating company, acquired many generating stations on the Ottawa River basin from Ontario Hydro. OPG's Ottawa/St. Lawrence Plant Group operates ten generating stations on the St. Lawrence, Ottawa and Madawaska Rivers. Four of these are located on the Ottawa River, including Chats Falls Generating Station (shared with Hydro Quebec), Chenaux Generating Station (from which most of the others are remotely controlled), Des Joachims Generating Station and Otto Holden Generating Station (OPG: "Operations").

2.9.6 The Impact of Hydroelectricity on the Environment of the Ottawa River

Hydroelectric development has radically changed the face of the Ottawa River, through the creation of reservoirs that have flooded land upstream and dams that create a physical barrier to river life. The change in the natural flow regime has an impact on all life in and along the river (Haxton and Chubbuck 58). Hydro development has affected the diversity and distribution of fish and wildlife. Dams have

blocked migratory species such as American shad and eels. (Haxton and Chubbuck 3). Reservoirs have altered bird habitat, including the loss of historic mud flats and the creation of new habitat through wetlands. Resource users such as First Nations Peoples, canoeists, hunters and fishers have been adversely affected by these developments. Cottaging and other lake-based recreation has benefited from the creation of reservoirs (Haxton and Chubbuck 4).

2.9.7 Generating Stations, Dams and Reservoirs on the Ottawa River

Carillon Generating Station

The first dam at Carillon was built as part of upgrading the canal system in the 1870s and 1880s. The Carillon Generating Station, operational by 1964, was constructed at the site of the old dam to supply hydroelectric power to Montreal in peak hours. Raising water levels nineteen metres at Carillon, the dam flooded out rapids at Chute-à-Blondeau and the Long Sault (Haxton and Chubbuck 8). Carillon receives the full flow of the Ottawa River basin (Haxton and Chubbuck 9).

Figure 2.75 Carillon Dam



Source : Ottawa River Legacy Landmark Network

Chaudiere Dam

The Chaudiere Dam was built at the site of a boiling cauldron where the river tumbled over a limestone ledge (Haxton and Chubbuck 17). The saw mills of the early 1880s were driven by waterwheels. Early log slides were built in the 1820s and 1830s. In 1868 a diversion dam was constructed across the falls to ensure a continuous water supply for the mills. In the 1890s, two small power plants built at the falls supplied the Ottawa-Hull area with industrial and residential power. A “Ring Dam” was built in 1909 to raise the water level to feed the Chaudiere operations.

The Chaudiere Dam maintains a constant water level for power generation at the Hull 2 Generating Station, E.B. Eddy and four hydro plants at the southern end of the dam. It does not have storage capacity and did not dramatically change the shoreline of upstream Lake Deschênes (Haxton and Chubbuck 25).

The Hull 1 Power Plant built in 1902 by the Ottawa and Hull Power Manufacturing Co. Ltd. shows the transition from domestic to industrial architecture, contrasting with plants built during large-scale industrial periods (Gaffield 269).

Chats Falls Generating Station

The Chats Falls Generating Station was built in 1931. Its associated dam drowned out the spectacular Chats Falls and rapids, described as the most beautiful on

Figure 2.76 Chats Falls, 1901



Source : James Ballantyne/Library and Archives Canada/PA-132330

the river (Haxton and Chubbuck 27). The hydro dam was built immediately upstream from the falls, creating a forty kilometre long impoundment at Lake des Chats (Haxton and Chubbuck 31). Cost of operation and the power produced are shared equally by OPG and Hydro Quebec.

Chenaux Generating Station

The Chenaux Generating Station began operating in 1951 and involved building the Chenaux and Portage du Fort Dams, as well as a discharge channel excavated through Limerick Island. The Chenaux Dam flooded 809 hectares of land; flooding extends to the base of the Bryson Dam, drowning out several sets of rapids, including the end of the famous whitewater section at Rocher Fendu (Haxton and Chubbuck 37). The Chenaux Generating Station is currently owned and operated by OPG.

Bryson Generating Station

The Bryson Generating Station was in service in 1925, located near the end of the Chenal du Grand-Calumet. Construction of the main dam began in 1923, immediately above the foot of the rapids. The Generating Station is not an integral part of the main dam – it is situated downstream and connected by a canal excavated along the western bank (Haxton and Chubbuck 39). A dam built in the Chenal du Rocher Fendu to raise water for the historic canal on the Culbute channel now ensures sufficient flow to the Bryson Generating Station (Haxton and Chubbuck 40).

Rapides-des-Joachims Generating Station

Historically, there were two stretches of rapids above Rapides-des-Joachims. Rapides-des-Rocher Capitaine, some thirty kilometres west, were the most intriguing. The 2.4 kilometres of fierce, crooked whitewater were considered to be the best on the Ottawa River (Haxton and Chubbuck 46). The Rapides-des-Deux-Rivières were located sixteen kilometres upstream of Rocher Capitaine (Haxton and Chubbuck 47).

Construction of the Des Joachims dam started in 1946 on the site of the once-flourishing lumber village of Des Joachims, Quebec, named for the Joachims brothers whose family used to own land in the area. 4,452 hectares of land was cleared between Des Joachims and Mattawa. The McConnell Lake Control Dam, an auxiliary dam, was built at the upper end of an ancient riverbed to allow excess flow to bypass, starting in 1949 (Haxton and Chubbuck 49). The Generating Station was built at the top of the Rapides-des-Joachims. Completed in 1950, the hydro dam altered or completely drowned the rapids at Des Joachims, Rocher Capitaine and Deux-Rivières, raising water levels all the way to Mattawa and flooding about 46 square kilometres. The lake-like impoundment is 92 kilometres long and created sandy beaches that are now part of Driftwood Provincial Park, 12 kilometres upstream from Des Joachims (Haxton and Chubbuck 53). The Generating Station is run by OPG but was originally built by the Hydro-Electric Power Commission of Ontario.

Figure 2.77 Building the Dam at Rapides-des-Joachims



Source: Courtesy of Joe and Kathy Lance and CEDEC.

Otto Holden Generating Station

The Otto Holden Dam, completed in 1952, flooded an area of 12 square kilometres, creating an artificial lake and drowning out the La Cave Rapids 8 kilometres north of Mattawa. Lake La Cave extends 49 kilometres upstream of the Otto Holden Dam to the Public Works Dam at the outlet of Lake Temiskaming and has surface area of 3028 hectares.

Dam construction began in 1948 and involved the clearing of 1,254 hectares of land upstream from dam, which was built at the head of the La Cave Rapids (OPG: "Otto Holden GS" and Haxton and Chubbuck 53). Built by the Hydro-Electric Power Commission of Ontario, the dam also required relocating the railway, which was flooded by the impoundment. The generating station is now owned by OPG.

Table 2.2 **Generating Stations on the Ottawa River**

	Owner	Inservice Date	Installed Capacity (MW)	No. of Units	No. of Dams
Carillon	HQ	<i>1962¹</i>	<i>752</i>	14	1
Hull 2	HQ	1920	27	4	2
E.B. Eddy	EB	n/a	9.0	n/a	n/a
Chaudiere 2 & 4	OH/EB	n/a	12.0	n/a	n/a
Chats Falls	OPG/HQ	1931/32	192.0	8	6
Chenaux	OPG	1950/51	122.0	8	3
Bryson	HQ	1925	61.0	3	2
Des Joachims	OPG	1950/51	432.5	8	2
Otto Holden	OPG	1952/53	240.0	8	1
Première-Chute	HQ	1968	130	4	n/a
Rapide-des-Îles	HQ	1966	147	4	n/a
Rapides-des-Quinze	Federal government and Minister of Public Works	1923	95	6	n/a
Rapide-2	HQ	1954	48	4	n/a
Rapide-7	HQ	1941-49	48	4	n/a

n/a = data not available

Sources: Haxton and Chubbuck 9, HQ: "Hydro Quebec Production".

¹ Numbers in italics report discrepancies between Hydro Quebec and OPG's figures. Figures taken from Hydro Quebec have been selected here since the generating stations involved (Carillon and Hull 2) are owned by Hydro Quebec.

2.9.8 The New Face of Power: Nuclear

In the 1940s, the Deep River or “rivière creuse” section of the Ottawa River was selected as an ideal spot for a developing a new type of energy: nuclear. The deep stretch of river supplied cold water for reactor cooling, and passed between well-isolated, largely uninhabited shorelines. To operate the supporting laboratory, hundreds of families were housed in a secret town site later named Deep River.

In 1956, the world’s first CANDU power reactor was established near Des Joachims at the head of the Deep River section. In 1962 it produced electrical power for the first time. This nuclear power demonstration plant was built on the site of a former dam construction colony and was closed in 1987. Water used for these power and research reactors made up one quarter of the river’s total usage (Whitlock: “Algonquins to Atoms”).

Today, the major research and development efforts of Atomic Energy of Canada Limited (AECL) take place at the Chalk River Laboratories (CRL). The laboratories have world-class expertise in physics, metallurgy, chemistry, biology, and engineering. The National Research Universal (NRU) reactor has been operating at CRL since 1957. Canada’s neutron beam research is centred here. NRU is also used for materials research and to produce a large portion of the world’s supply of medical isotopes for diagnosis and treatment of cancer and other illnesses (AECL).

Figure 2.78 Pointe au Baptême Showing the Nuclear Power Plant



Source : Cliff Baskin, Atomic Energy of Canada Limited

2.9.9 Sites Relating to Hydroelectric and Early Power Development

- Carillon Canal National Historic Site
- Centrale de la Première-Chute on the upper stretches of the Ottawa River. Open to visitors
- The E.B. Eddy Industrial Complex. Four buildings have recently been protected against demolition: E.B. Eddy Manufacturing Company’s 1866 sawmill; pulp and paper mill 1886; hydroelectric plant, 1913. Scott Paper Ltd. bought the White Swan Division from E.B. Eddy in 1989, and is now one of last vestiges of Hull’s industrial past (ORIDP 19)
- John Rudolphus Booth’s sawmill, 1858. On the south bank of Chaudiere Falls (ORIDP 17)
- Chaudiere Dam, 1850
- Ruins of the Deschênes site, Lake Deschênes: farm (built by Robert and William Conroy), sawmill and flour mill (belonging to Narcisse Cormier); dam and power plant of the Deschênes Electric Company (ORIDP 17).
- McLaurin Sawmill. Built before 1910 on McLaurin Bay (ORIDP 19)
- Hydro Electric Museum, Pembroke

Summary

Hydroelectric development over the past century has dramatically transformed the Ottawa River, impacting on its environment, economy and settlement. Dams have been built to drown out rapids to facilitate navigation and to harness the river's power. On a national scale, the Ottawa River is one of three rivers that played a crucial role in the early development of hydroelectricity in Canada, along with the St. Lawrence and Niagara Rivers. Hydroelectric development on the Ottawa was intertwined with the rise of the pulp and paper industry. Settlement followed this industrial and energy development that was crucial to the growth of the economies of both Quebec and Ontario.

That the river follows the Quebec-Ontario boundary for much of its length has meant a shared responsibility for hydroelectric power development between the two provinces. The 43 dams in the Ottawa River watershed make the Ottawa River one of the most highly regulated catchments in Canada. Today, power production in the Ottawa basin generates \$1,000,000 daily.