



Transport  
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# A new **bridge** for the St. Lawrence

**Environmental Assessment**

**Summary Report**

**Project and Environmental Description**



March 2013

Canada 



**Transport Canada**

**New Bridge for the St. Lawrence  
Environmental Assessment**

**Summary Report**

**Project and Environmental Description**

*March 2013*



## EXECUTIVE SUMMARY

This report constitutes the initial stage of the environmental assessment process. It consists of the description of the project and of the environment. A second report completes the assessment by describing the project's environmental impacts and the proposed mitigation measures.

Upon reviewing the conclusions of expert reports on the current state of the bridge's deterioration and the estimate of the increasingly higher maintenance costs needed to maintain the required level of safety, Transport Canada has decided to build a new bridge (the "New Bridge for the St. Lawrence") to replace the components of the current Champlain Bridge.

When it was launched, the New Bridge for the St. Lawrence project was subject to the Canadian Environmental Assessment Act (CEAA). Although the former CEAA was repealed in 2012, because of a transitional provision, this environmental assessment (EA) will continue under the former Act. Transport Canada, Fisheries and Oceans Canada and Environment Canada are the authorities in charge of this EA.

The project part of this EA consists of the following: construction of the New Bridge for the St. Lawrence and the Nuns' Island Bridge, reconstruction and widening of Highway 15, road work on Nuns' Island, the alignment with Highway 10 on the South Shore, and deconstruction of the existing Champlain and Nuns' Island bridges. Pre-construction and post-construction work along with the project operation will also be included in the EA.

Regarding the description of the physical environment, some "contaminated" soil and groundwater are found in certain sectors of the project. With respect to surface water, the St. Lawrence River's water quality has been monitored since the 1980s. There are no sampling stations in the study area; however, there are stations both upstream and downstream of the study area. According to the assessments, none of the measured parameters exceeds the water quality criteria for the protection of aquatic life. With respect to air quality, despite the direct and indirect impacts of transportation-related pollution on the quality of life and human health, current conditions for both greenhouse gas emissions and those related to the main atmospheric contaminants show that air quality is not a significant issue for the project.

Regarding the description of the biological environment, though they were not all observed in the study area, there are five species of fish that could potentially be found in the study area with special conservation status. The American eel, chain pickerel, lake sturgeon and rosyface shiner are all likely to be designated threatened or vulnerable at the provincial level, while the American shad is a vulnerable species at the provincial level. The brown snake, a wildlife species likely to be designated threatened or vulnerable in Quebec, was the only notable reptile that was sighted. Regarding birds, only one species should be mentioned, the peregrine falcon, which was sighted during the inventories and is nesting on the present bridge. This species is designated as

vulnerable in Quebec and has the status of species of concern in Canada. The study area is characterized by a migratory bird sanctuary that is under federal jurisdiction, known as Couvée Island. However, the colony of ring-billed gulls found on this island has been continuously declining in the past decades. The study area also contains a waterfowl concentration area, La Prairie Basin, and Nuns' Island. Lastly, in terms of flora, plant inventories were used to identify two species of water-horehound likely to be designated threatened or vulnerable, i.e. the St. Lawrence water-horehound and the rough water-horehound.

Regarding the description of the human environment, the Aboriginal community of Kahnawake is located a dozen kilometres southwest of the footprint of the New Bridge for the St. Lawrence. There is no commercial fishing in the study area; however, there is recreational fishing all over the waterway. As for navigation, the St. Lawrence, in the study area, is not suitable for navigation, with the exception of the seaway. There are about 15 bicycle paths in the study area. There is also a real estate development project on Nuns' Island very close to the proposed footprint of the new bridge. Lastly, there are two sites of archeological interest on Nuns' Island in the proposed footprint of the new bridge.

The elements described above shed light on the context in which the project is being carried out. The second report highlights the project's environmental impacts and covers the mitigation measures.

## TABLE OF CONTENTS

<b>GLOSSARY</b> .....	<b>IX</b>
<b>1 INTRODUCTION</b> .....	<b>1</b>
1.1 PROJECT BACKGROUND AND LOCATION .....	1
1.2 LEGAL FRAMEWORK FOR THE ENVIRONMENTAL ASSESSMENT.....	2
<b>2 PROJECT DESCRIPTION</b> .....	<b>7</b>
2.1 PLANNED COMPONENTS AND VARIATIONS.....	7
2.1.1 <i>Reconstruction and expansion of Highway 15 (Component A)</i> .....	7
2.1.2 <i>New Nuns' Island Bridge (Component B)</i> .....	11
2.1.3 <i>Work on Nuns' Island (Component C)</i> .....	11
2.1.4 <i>The New Bridge for the St. Lawrence (Component D)</i> .....	11
2.1.4.1 Components D1a and D1b: crossing the St. Lawrence River between Nun's Island and the Seaway and the Lesser La Prairie Basin.....	12
2.1.4.2 Component D2: crossing the Seaway.....	12
2.1.5 <i>Alignment with Highway 10 (Component E)</i> .....	12
2.1.6 <i>Deconstruction of existing Champlain and Nuns' Island Bridges (Components F             and G)</i> .....	13
2.1.7 <i>Pre-construction work: set-up of jobsites</i> .....	13
2.1.8 <i>Post-construction work</i> .....	16
2.1.9 <i>Operation of new infrastructure</i> .....	16
2.2 SCHEDULE.....	17
2.3 TRAFFIC MANAGEMENT .....	17
<b>3 DESCRIPTION OF THE ENVIRONMENT AND OF VALUED ENVIRONMENTAL COMPONENTS</b> .....	<b>19</b>
3.1 SCOPE OF ENVIRONMENTAL ASSESSMENT.....	19
3.2 GENERAL DESCRIPTION OF THE PHYSICAL ENVIRONMENT .....	23
3.2.1 <i>Soil and sediment quality</i> .....	23
3.2.1.1 The banks of the Island of Montreal and Nuns' Island .....	23
3.2.1.2 The South Shore.....	24
3.2.1.3 Sediments.....	24
3.2.2 <i>Surface water and groundwater characteristics</i> .....	30
3.2.2.1 Surface water.....	30
3.2.2.2 Groundwater .....	35
3.2.3 <i>Air quality</i> .....	35
3.2.4 <i>Key issues of the physical environment</i> .....	37
3.2.4.1 Soil and sediment quality .....	37
3.2.4.2 Quality of surface water and groundwater .....	38

## TABLE OF CONTENTS

3.2.4.3	Air quality .....	38
3.3	GENERAL DESCRIPTION OF THE BIOLOGICAL ENVIRONMENT .....	39
3.3.1	<i>Fish and fish habitat</i> .....	49
3.3.1.1	Lesser La Prairie Basin habitats .....	52
3.3.1.2	Greater La Prairie Basin habitats .....	53
3.3.1.3	Special status species .....	53
3.3.2	<i>Wildlife and wildlife habitat</i> .....	57
3.3.3	<i>Migratory birds and their habitats</i> .....	58
3.3.3.1	Migratory bird sanctuary and other protected habitats .....	59
3.3.4	<i>Special status flora and fauna species</i> .....	60
3.3.5	<i>Key issues of the biological environment</i> .....	63
3.3.5.1	Flora .....	63
3.3.5.2	Fish and fish habitat .....	63
3.3.5.3	Amphibians, reptiles and their habitats .....	63
3.3.5.4	Birds and their habitats .....	63
3.4	GENERAL DESCRIPTION OF THE HUMAN ENVIRONMENT .....	64
3.4.1	<i>Aboriginal communities</i> .....	65
3.4.2	<i>Navigation</i> .....	65
3.4.2.1	Seaway .....	65
3.4.2.2	Greater and Lesser La Prairie Basins .....	66
3.4.2.3	Fishing and nautical activities .....	67
3.4.3	<i>Sound environment</i> .....	67
3.4.4	<i>Heritage resources</i> .....	68
3.4.5	<i>Aesthetic and visual aspects</i> .....	68
3.4.6	<i>Key issues of the human environment</i> .....	71
3.4.6.1	Navigation .....	71
3.4.6.2	Recreational/tourist activities .....	72
3.4.6.3	Sound environment .....	72
3.4.6.4	Heritage resources .....	72
3.4.6.5	Aesthetic and visual aspects .....	72
4	<b>BIBLIOGRAPHY</b> .....	<b>75</b>



## TABLE OF CONTENTS

### Tables

Table 1	Tentative list of valued environmental components selected for this project .....	20
Table 2	Comparison of metal concentrations in sediment samples from the Lesser La Prairie Basin in 1976, 1987 and 2012 with current MDDEP criteria .....	29
Table 3	Air quality standards in Quebec and in the MMC for the principal contaminants associated with highway transportation .....	36
Table 4	Description of plant populations in the study area .....	39
Table 5	Fish species found or likely to be found in the study area .....	49
Table 6	Mammals sighted during study area inventories .....	57
Table 7	Summary of amphibian and reptile species inventoried and observed in the study area .....	58
Table 8	Bird inventory result per observed species .....	59
Table 9	CDPNQ list of occurrences of special status plant species and possible use of study area based on habitat availability .....	61
Table 10	List of special status species listed by the CDPNQ and identified in the inventories .....	62
Table 11	Overview of the main features of the human environments in the study area .....	64
Table 12	Requirements for ships transiting the Seaway .....	65
Table 13	Commercial vessel and pleasure craft traffic .....	66
Table 14	Commercial traffic, Montreal-Lake Ontario section .....	66
Table 15	Known archaeological sites in the study area .....	68

### Figures

Figure 1	Project location – New Bridge for the St. Lawrence .....	3
Figure 2	Project components – New Bridge for the St. Lawrence .....	9
Figure 3	Jobsite location – Nuns’ Island .....	14
Figure 4	Jobsite location – Dike .....	14
Figure 5	Jobsite location – South Shore .....	15
Figure 6	Jobsite location – Montreal and Nuns’ Island .....	15
Figure 7	Preliminary schedule .....	17
Figure 8	Biological and human environments distribution map .....	21
Figure 9	Soil environmental quality .....	25
Figure 10	Composition of surface substrate .....	27
Figure 11	Velocity fields and flow trajectories (Leclerc et al. 1987) .....	31
Figure 12	Bathymetry and flow facies .....	33
Figure 13	Changes in the concentration of ozone (O <sub>3</sub> ) at Station 68-Verdun on an hourly average and a 24-hour average .....	37
Figure 14	Floristic composition of the study area .....	41
Figure 15	Locations of fish habitats .....	55



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## GLOSSARY

Aquatic plant community:	Sea or riverbed with vegetation.
Ash stand:	Area planted with ash trees.
Bathymetry:	Measurement of water depths to determine the topography of sea or riverbeds.
Cantilever:	Bridge whose main beams extend beyond and overhang and in turn support a shorter beam.
Civil engineering structures:	Bridges and crossing structures.
Climate change:	Changes in climate that are directly or indirectly attributed to a human activity that alters the composition of the Earth's atmosphere and exacerbates the natural variability of the climate observed over comparable periods of time.
Deck:	Horizontal part of the frame of a bridge located beneath the roadway.
Downstream:	Occuring after the bridge, in the direction from which water is moving.
Draught:	Quantity or volume of water displaced by a ship.
Flat:	Piece of land that is relatively level, without a defined water flow network, forming a transition between a relief and a valley bottom or body of water.
Heterogeneous:	Made up of elements differing in nature and form.
Hibernaculum:	Winter habitat of certain small animals and insects.
Lentic:	Characterizing freshwater in which the water circulates slowly or not at all (lakes, ponds, canals, etc.).
LeqT:	Equivalent continuous noise level. This parameter corresponds to the level of continuous noise with the same sound energy as discontinuous noise during a time interval (T). It therefore makes it possible to take into account dynamic fluctuations in noise level. The parameter is largely used in environmental noise, because noise sources are often variable, such as the noise generated by vehicles travelling over highway infrastructures.

LX% :	Statistical noise parameters. Statistical analysis makes it possible to measure variations in noise levels for an analysis period. The statistical values are usually indicated as a percentage of the measurement period. The values commonly used are: L1%, L10%, L50%, L90%, L95% and L99%. For instance, L1% is the noise level reached or exceeded during 1% of the analysis period, i.e. for 1% of the time, the noise level was above this value and for 99% of the time, the noise level was below that value.
Lithophilous species:	Species that spawn on a coarse substrate (gravel, rock, blocks) or in fast-flowing water.
Median:	In a series of data in order of size, the figure in the middle of the series, dividing the two series in equal halves.
Navigation clearance:	Maximum space provided by a navigable waterway for passage of vessels.
Pier:	Intermediate supports of a bridge's deck.
Private partner:	Company that takes responsibility for completing and operating the New Bridge for the St. Lawrence. The private partner will be supported by contractors during the construction period.
River sand:	Sand carried by a watercourse, characterized by specific forms related to transportation capacity, erosion and sedimentation of the watercourse.
Special status species	Species protected under the <i>Species at Risk Act</i> or <i>the Loi sur les espèces menacées ou vulnérables</i> (Threatened or Vulnerable Species Act).
Substrate:	Layer that serves or once served as a support.
Survey:	In the archeological sense, a local exploration technique used in an area to detect the presence of relevant and useable elements from a historical standpoint.
Turbidity:	Characteristic of water with reduced transparency due to the presence of fine suspended particles of natural origin or due to pollutants.
Upstream:	Occuring before the bridge, in the direction from which water is moving.

# 1 INTRODUCTION

The details regarding the specifics of the project components presented in this report are provided solely for illustrative purposes. This project description does not constitute a final decision by the proponent. Changes to these details may be made based on the results of this environmental assessment and as the concept for the New Bridge for the St. Lawrence develops.

It should also be noted that this report summarizes the information found in the first report for the New Bridge for the St. Lawrence project. The first report addresses the description of the project and the environment. A second report completes the analysis by providing a description of the project's effects on the environment and proposed mitigation measures. This report takes into account comments made during the planned public consultation period.

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## 1.1 PROJECT BACKGROUND AND LOCATION

The Champlain Bridge has been in operation since 1962 and is the busiest bridge in Canada. It provides a link between the Island of Montreal and the South Shore, the eastern United States and western North America. It is also an important route for transporting freight and a strategic link in the Port of Montreal transportation network, which has an area of influence extending as far as the American Midwest (Transport Canada, 2012).

Given the conclusions of expert reports regarding the current state of deterioration of the bridge and the increasing estimated cost of maintenance to maintain required safety levels, Transport Canada has decided to build a new bridge (hereafter referred to as the "New Bridge for the St. Lawrence") to replace the components of the existing Champlain Bridge.

As such, the Champlain Bridge will be kept in operation for another 10 years while the New Bridge for the St. Lawrence is built. It will then be dismantled in sections.

The Nuns' Island Bridge, built in 1960, sits alongside Champlain Bridge and connects the Island of Montreal and Nuns' Island. The Nuns' Island Bridge has also reached the end of its useful life. Replacement of Nuns' Island Bridge is also therefore unavoidable. It will be deconstructed and a new bridge built in the same location. The corridor of the New Bridge for the St. Lawrence also includes the federal portion of Highway 15 and the Highway 10 bridge approach on the South Shore.

The New Bridge for the St. Lawrence will be built approximately 10 metres downstream (to the north) of the Champlain Bridge in order to minimize the impact of the new route on Nuns' Island, facilitate temporary installation work during construction, facilitate the connection to the existing transportation network and protect the temporary structures from ice. The study area identified for the project covers an area around the existing and planned bridges that is sufficiently broad to take into account the potential direct and indirect effects that the project may cause. The corridor for the New Bridge for the St. Lawrence project is presented in Figure 1.

## 1.2 LEGAL FRAMEWORK FOR THE ENVIRONMENTAL ASSESSMENT

When it was launched, the New Bridge for the St. Lawrence project was subject to the *Canadian Environmental Assessment Act*; S.C. 1992, c. 37 (CEAA). This legislation was replaced in 2012 by a new version that responds to Canada's current economic and environmental context. A *Canadian Environmental Assessment Act (2012)* S.C. 2012, c.19, s. 52 transitional provision allows the Environment Minister to authorize continuation of the environmental assessment of a project begun before the Act came into effect in 2012. Thus, the federal environmental assessment of the New Bridge for the St. Lawrence project which was designated under the 2003 CEAA must continue under this Act.

The CEAA applies, among other things, to an undertaking in relation to a physical work (including operation, modification, decommissioning or abandonment). The project for the New Bridge for the St. Lawrence entails the decommissioning of structures and, consequently, meets the definition of "project" within the meaning of the CEAA. Furthermore, the project is not an excluded project as provided for in Section 7 of CEAA and the *Exclusion List Regulations, 2007*.

In order for the federal environmental assessment process to apply, there must, in addition to a project, be a trigger within the meaning of subsection 5(1) of CEAA. In this case, a number of triggers are present:

- ▶ Transport Canada, pursuant to:
  - Paragraph 5(1)(a) of the CEAA: TC is the project proponent; and
  - Paragraph 5(1)(d) of the CEAA: project approval is required under section 5 of the *Navigable Waters Protection Act*, which is named in the *Regulations on Designated Legislative and Regulatory Provisions*.
- ▶ Fisheries and Oceans Canada, pursuant to:
  - Paragraph 5(1)(d) of the CEAA: authorization to modify the fish habitat as a result of the project is required under subsection 35(2) of the *Fisheries Act*, which is subject to the *Regulations on Designated Legislative and Regulatory Provisions*.
- ▶ Environment Canada, pursuant to:
  - Paragraph 5(1)(d) of the CEAA: permits are required for the project under subsection 9(1) of the *Migratory Bird Sanctuary Regulations*, which is subject to the *Regulations on Designated Legislative and Regulatory Provisions*.





- Federal Government property limit
- Study area
- Proposed infrastructure right-of-way
- Municipal limit

SOURCE :  
- Property and right-of-way limit : Transports Canada, 2012



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Project  
**New Bridge for the St. Lawrence  
Environmental Assessment**

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**Figure 1  
Project Location for the New Bridge for the St. Lawrence**

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SIZE 11x17



Lastly, because the project to build a new bridge for the St. Lawrence is not described in the *Comprehensive Study List Regulations*, the environmental assessment must be performed using the screening method and must meet the requirements set forth in Section 18 of 2003 CEEA.

Since the pre-feasibility study completed in 2011 showed how diverse the options are for construction of the New Bridge for the St. Lawrence, Transport Canada decided to opt for an objective-based approach for the environmental assessment. This approach was selected because it is suitable for projects where certain details are not yet defined or will be identified at a later date.

Both parts of the Environmental Assessment Report were completed using this proven approach, which makes it possible to achieve environmental objectives without delaying the project. The mitigation measures are set out in the report in the form of objectives to be achieved rather than specific parameters that must be met. The result, ultimately, is the same, i.e. sensitive environmental components are protected and the environment is taken into consideration in subsequent stages of the project.



## 2 PROJECT DESCRIPTION

In 2012, Transport Canada accorded the joint venture led by PricewaterhouseCoopers a three-year mandate to complete, among other tasks, the project's preliminary design and costing. The following sections present, for information purposes only, details on elements related to the project components. This project description does not constitute a final decision by the proponent. Changes to these details may be made based on the results of this environmental assessment and as the concept for the New Bridge for the St. Lawrence develops.

Therefore, the environmental assessment for the New Bridge for the St. Lawrence construction project will be based on the engineering and technical information in the reports of the pre-feasibility studies conducted in 2010 and 2011 for Jacques-Cartier and Champlain Bridges Inc. and the Quebec Ministry of Transport (MTQ). The information concerns the construction of the New Bridge for the St. Lawrence and the Nun's Island Bridge, reconstruction and expansion of Highway 15, road work on Nun's Island, alignment with Highway 10 on the South Shore and deconstruction of the existing Champlain and Nun's Island Bridges (see Figure 2). For more information on the project description, please consult the pre-feasibility study, available on the Transport Canada website.<sup>1</sup>

### 2.1 PLANNED COMPONENTS AND VARIATIONS

#### 2.1.1 Reconstruction and expansion of Highway 15 (Component A)

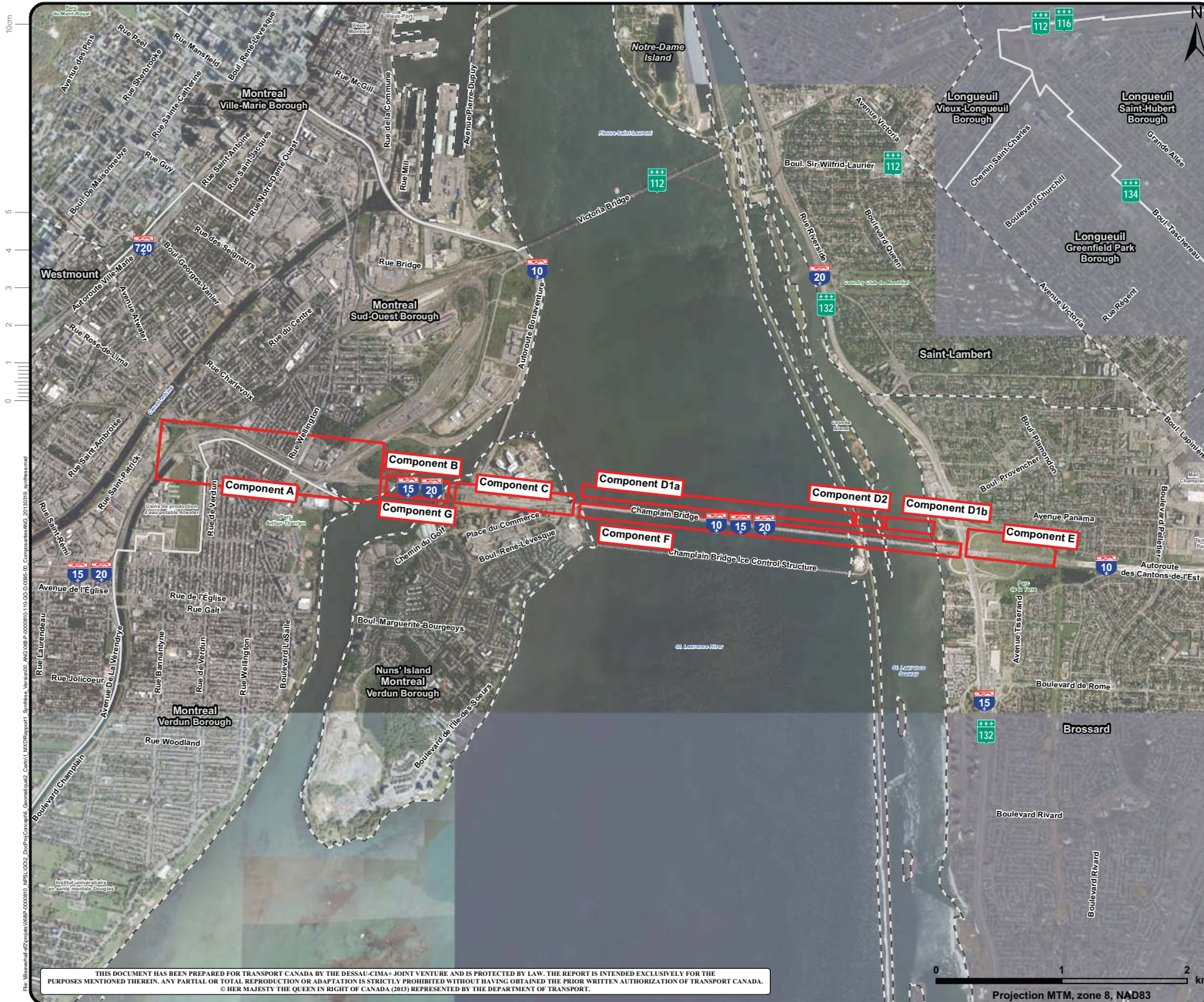
The federal segment of Highway 15, that part between the Nun's Island Bridge and the Atwater Avenue off and on ramps, will be rebuilt due to structural conditions.

This work would involve enlarging the current highway in order to increase the number of traffic lanes as well as reconfiguring the Atwater Avenue/Wellington Street – Highway 10 East/Downtown interchange. Depending on the route chosen, weaving lanes must also be constructed for use by the public transit system. The decision on the public transit route will be made by the provincial government. The options share the advantage of having been designed with possibility of integrating Light Rail Transit rather than Bus Rapid Transit.

---

<sup>1</sup> Accessible via: <http://www.tc.gc.ca/eng/programs/bridges-new-bridge-for-the-st.lawrence-2775.htm>





**Legend:**

- Project Components (Red outline)
- Municipal limit (Dashed line)
- Borough limit (Solid line)

**SOURCES:**

- Components : Un nouveau pont pour le Saint-Laurent. Lignes directrices finales pour l'évaluation environnementale (incluant la portée de l'évaluation environnementale) page 11, Transport Canada, 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011
- Satellite images : (c) 2010 Microsoft Corporation and its data suppliers



**Client:** Transport Canada / Transports Canada

**Project:** New Bridge for the St. Lawrence Environmental Assessment

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## 2.1.2 New Nuns' Island Bridge (Component B)

Five road geometry scenarios were developed for the replacement of the Nun's Island Bridge in the pre-feasibility study prepared for Jacques-Cartier and Champlain Bridges Inc. No scenario has yet been adopted. The solution chosen for the new bridge could very well differ from the scenarios developed in the pre-feasibility study.

The work will involve building a temporary causeway to maintain traffic flow during deconstruction of the existing bridge and construction of the new bridge(s). Jacques Cartier and Champlain Bridges Inc. is responsible for the work associated with the building of the temporary causeway and will therefore be covered by a separate environmental assessment.

The preferred solution for each direction would include:

- ▶ Three lanes for automobile traffic;
- ▶ One reserved lane for public transit;
- ▶ One multi-use path.

## 2.1.3 Work on Nuns' Island (Component C)

Based on the pre-feasibility studies, there are two construction options for the Nun's Island sector, depending on the scenario finally chosen for public transit service. In principle, the cross-section of the highway on Nun's Island would be similar to the cross-section for the Nun's Island Bridge and for the New Bridge for the St. Lawrence. There would be three traffic lanes.

With regard to the space required for public transit, the route could either follow the Nun's Island Bridge or leave the centre of the highway on Nun's Island, run beneath the highway going west, cross the river via an independent bridge and join the route proposed in the Agence métropolitaine de transport (Montreal Transportation Agency) (AMT) February 2007 preliminary study for the light-rail transit system in the Highway 10 corridor between the South Shore and downtown Montreal.

As the New Bridge for the St. Lawrence is planned to be downstream from the current bridge and the Nun's Island Bridge is to be built along the same route as the existing bridge, the proposal would retain most of the existing infrastructure apart from the partial relocation of René-Lévesque Boulevard.

## 2.1.4 The New Bridge for the St. Lawrence (Component D)

To date, no solution, either in terms of location (route and profile) or structural solution (bridge type) has been officially chosen. Therefore, all options described below are still possible, and since more detailed studies are or will be undertaken, other solutions may be proposed.

The location proposed for the New Bridge for the St. Lawrence in the pre-feasibility study is approximately 10 m downstream (north side) from the existing Champlain Bridge. It would be about 3.5 km long and could be divided into three segments:

- ▶ Section 1: crossing the St. Lawrence River between Nun's Island and the Seaway, approximately 2,300 m;
- ▶ Section 2: crossing the Seaway, approximately 400 m;
- ▶ Section 3: crossing the Lesser La Prairie Basin, approximately 800 m.

The bridge proposed in the pre-feasibility study would consist of two identical decks each supporting three automobile traffic lanes and one public transit lane. To encourage active transportation, the proposed bridge would also have to include a bicycle path and sidewalks. These facilities would be integrated into the existing networks on either side of the proposed bridge.

Although the number of lanes would increase from six to eight, including public transit, the morning and afternoon peak-period capacity will not be increased. In fact, vehicles will still have access to three lanes in the rush-hour direction. The additional lane will ensure more fluid traffic in the opposite direction. Furthermore, the rapid transit lanes will eliminate the use of a lane for oncoming bus traffic and increase traffic safety.

#### *2.1.4.1 Components D1a and D1b: crossing the St. Lawrence River between Nun's Island and the Seaway and the Lesser La Prairie Basin*

The span lengths proposed in the pre-feasibility study for crossing the river and the Lesser La Prairie Basin are 80 m. This was determined based on:

- ▶ The reduction in the number of piers compared to the current number (elimination of one pier out of three);
- ▶ Economic length for the type of structure considered.

#### *2.1.4.2 Component D2: crossing the Seaway*

Based on the data in the pre-feasibility study, the Seaway crossing would require a span of at least 200 m in order to meet the navigation clearance given the angle between the structure and the canal.

### **2.1.5 Alignment with Highway 10 (Component E)**

For this last segment of the corridor under study, which provides a connection to the existing Highway 10 on the South Shore, the planned solution would include three lanes in each direction and two reserved public transit lanes (Light Rail Transit or dedicated bus lane, as on the new bridge). Highway 10 would be brought closer to the residential sector north of the current bridge to align with the New Bridge for the St. Lawrence.

### **2.1.6 Deconstruction of existing Champlain and Nuns' Island Bridges (Components F and G)**

For both bridges, the proposed deconstruction method could be based on the principle of sawing the concrete spans and piers using diamond-encrusted wire cables and dismantling the entire steel spans, and then dismantling various other elements singly. The blocks would then be transported by barge or truck.

The deconstruction of the Champlain Bridge structure would generate approximately 165,000 tonnes of concrete and 13,300 tonnes of steel (6,500 in the structure and 6,800 in the deck). Reclamation would always be the preferred option.

Deconstruction of the Nuns' Island Bridge would occur after a temporary causeway has been built downstream of the existing bridge. There are approximately 16,500 tonnes of concrete decking to be demolished, approximately 18,000 tonnes of concrete in the piers and 16,200 tonnes of concrete in the bases.

### **2.1.7 Pre-construction work: set-up of jobsites**

Regardless of the solution that is ultimately chosen, a project of the scope of the New Bridge for the St. Lawrence will require the establishment of a very large jobsite, which must be carefully planned out in advance. Specific areas have been identified on Figures 3 to 6 by the Dessau-Cima joint venture. A portion of the jobsite will possibly be supplied via the river. The contractor may consider constructing a new wharf near the jobsite. Approvals will be required for all temporary work, and the locations of these sites will need to be submitted for approval, as will their detailed plans.

Figure 3 Jobsite location – Nuns' Island



Figure 4 Jobsite location – Dike

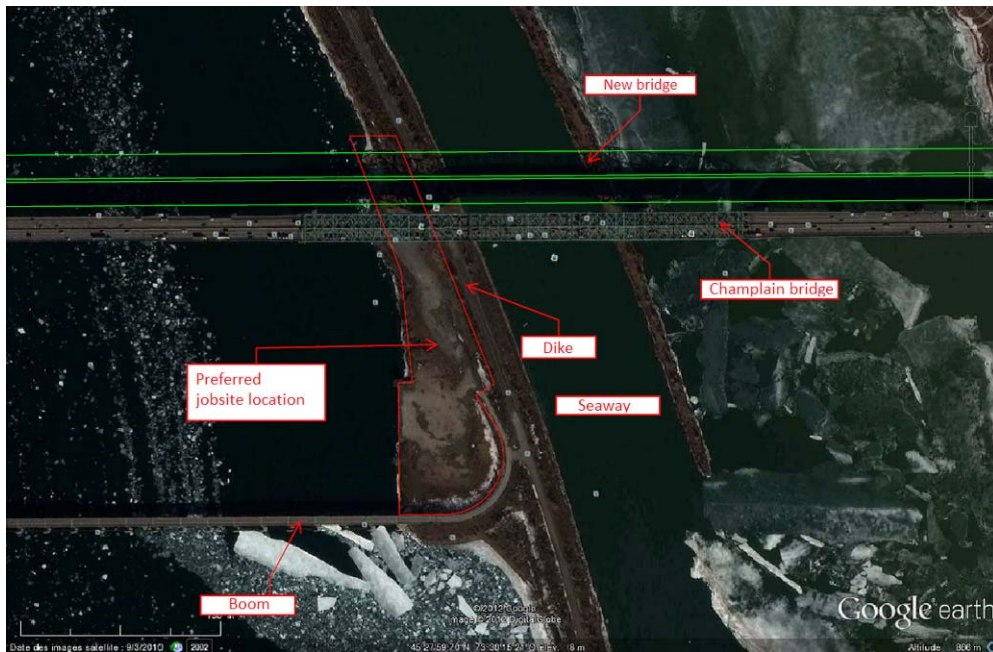


Figure 5 Jobsite location – South Shore

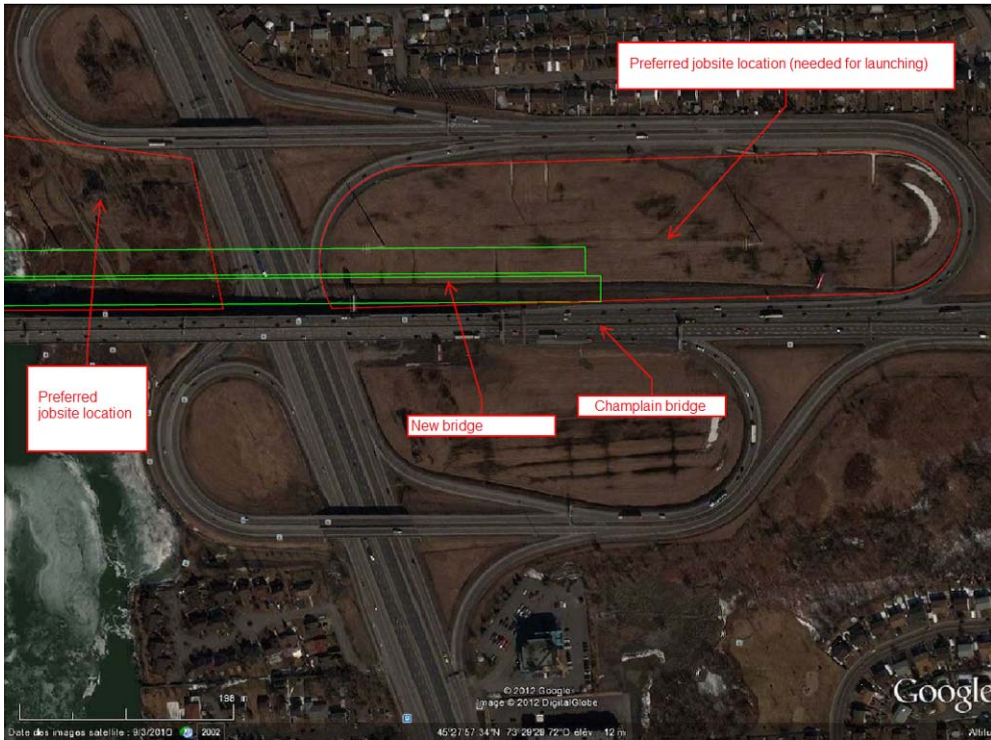
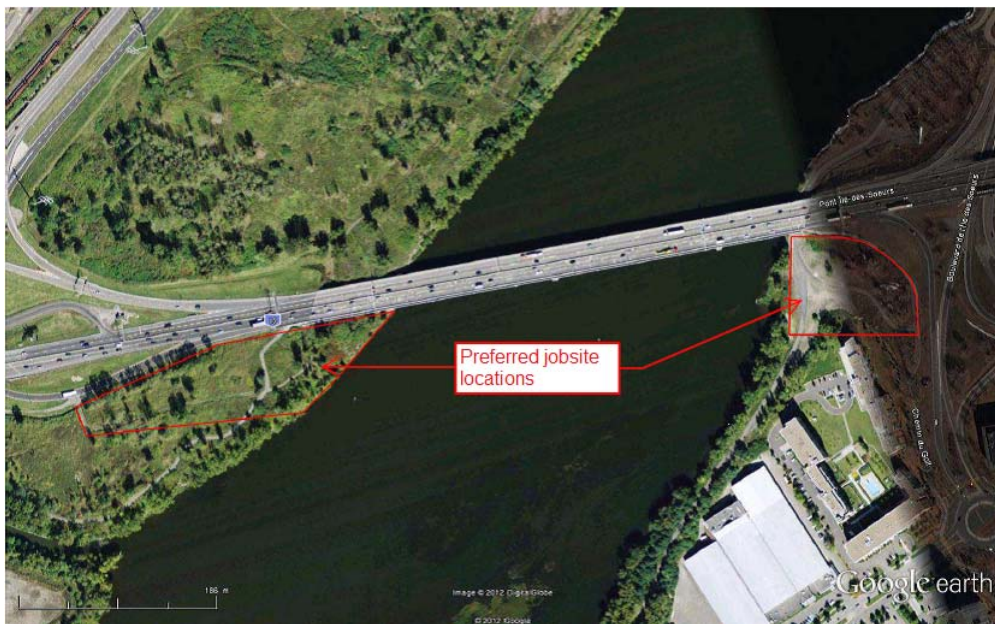


Figure 6 Jobsite location – Montreal and Nuns' Island



## 2.1.8 Post-construction work

Once construction has been completed (in full or a major section), the jobsite facilities will be dismantled. Areas used by the contractor for its jobsite (pre-fabrication area, launch area, etc.), will have to be returned to their original or equivalent condition, based on requirements set out by the property owners or contained in performance specifications.

## 2.1.9 Operation of new infrastructure

Inspections will be required at regular pre-defined intervals specified by the operating authorities. As a general rule, there are two inspection levels: general inspections and detailed inspections. General inspections are carried out annually, while detailed inspections are done every four to five years. These inspections make it possible to monitor any changes in the structure and to plan maintenance.

To ensure longevity of the structures, they will require regular maintenance.

Routine maintenance encompasses the routine activities that are carried out at regular intervals on structures, for example:

- ▶ Replacement of bearings;
- ▶ Replacement of expansion joints;
- ▶ Painting.

Heavy maintenance includes repairs, the scope of which require more in-depth investigation and are more difficult to perform:

- ▶ Replacement of the slab;
- ▶ Replacement of the stay cables;
- ▶ Repairs to the concrete.

It is important to note here that a structural design that includes, from the outset, studies on the problems associated with maintenance could greatly simplify future operations, or at least reduce their frequency and the impact on users.

Numerous maintenance operations, such as replacement of the joints or the asphalt, will require traffic on the structures to be interrupted.

## 2.2 SCHEDULE

The total estimated time required to prepare plans and specifications and to build the New Bridge for the St. Lawrence is five years. Deconstruction of the existing bridge is estimated to take three years. Figure 7 presents the schedule of the various project stages.

Figure 7 Preliminary schedule

MAJOR COMPONENTS	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Environmental assessment	■	■											
Preliminary design and financial analysis		■	■										
Preliminary engineering and development of specifications			■	■									
Invitation to tender for construction and contract award				■	■								
Final plans and specifications and construction (by bridge constructor)					■	■	■	■	■	■			
Deconstruction of the old bridge (by bridge constructor)											■	■	■

\* This is a preliminary timeline that will be refined over the coming months

## 2.3 TRAFFIC MANAGEMENT

The Champlain Bridge corridor is one of the busiest in the country with over 57 million crossings per year. It is essential to maintain traffic flow throughout the entire construction period. As each project component is constructed, traffic management measures will be implemented:

- ▶ Partial closing of ramps and lanes while maintaining at least two lanes open in either direction;
- ▶ Complete closing at night with detours publicized;
- ▶ Temporary lane changes;
- ▶ Uninterrupted service on Champlain Bridge during construction;
- ▶ Phasing of construction work that could disrupt traffic;
- ▶ Development of temporary traffic configurations.





### 3 DESCRIPTION OF THE ENVIRONMENT AND OF VALUED ENVIRONMENTAL COMPONENTS

#### 3.1 SCOPE OF ENVIRONMENTAL ASSESSMENT

CEAA 2003 specifies the factors that must be considered in a "screening type" environmental assessment:

- a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- b) The significance of the effects referred to in paragraph (a);
- c) Comments from the public that are received in accordance with this act and the regulations;
- d) Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and;
- e) Any other matter relevant to the screening [...] that the responsible authority [...] may require to be considered.

The factors below will also be assessed within the study area as part of the environmental assessment of the New Bridge for the St. Lawrence:

- ▶ The effects of the project on the environment
- ▶ The effects of the environment on the project;
- ▶ Assessment of accidents and malfunctions; and
- ▶ Assessment of likely cumulative effects.

The CEAA (2003) defines *environment* as:

All the components of the Earth, including:

- a) land, water and air, including all layers of the atmosphere;
- b) all organic and inorganic matter and living organisms; and;
- c) the interacting natural systems that include components referred to in paragraphs (a) and (b).

Delivering the project will have an impact on environmental components. The environmental assessment will have to demonstrate what impact the project will have on these components. During preparation of the environmental assessment guidelines, 12 components were identified and will be given special attention throughout the process (table 1). Results of the impact

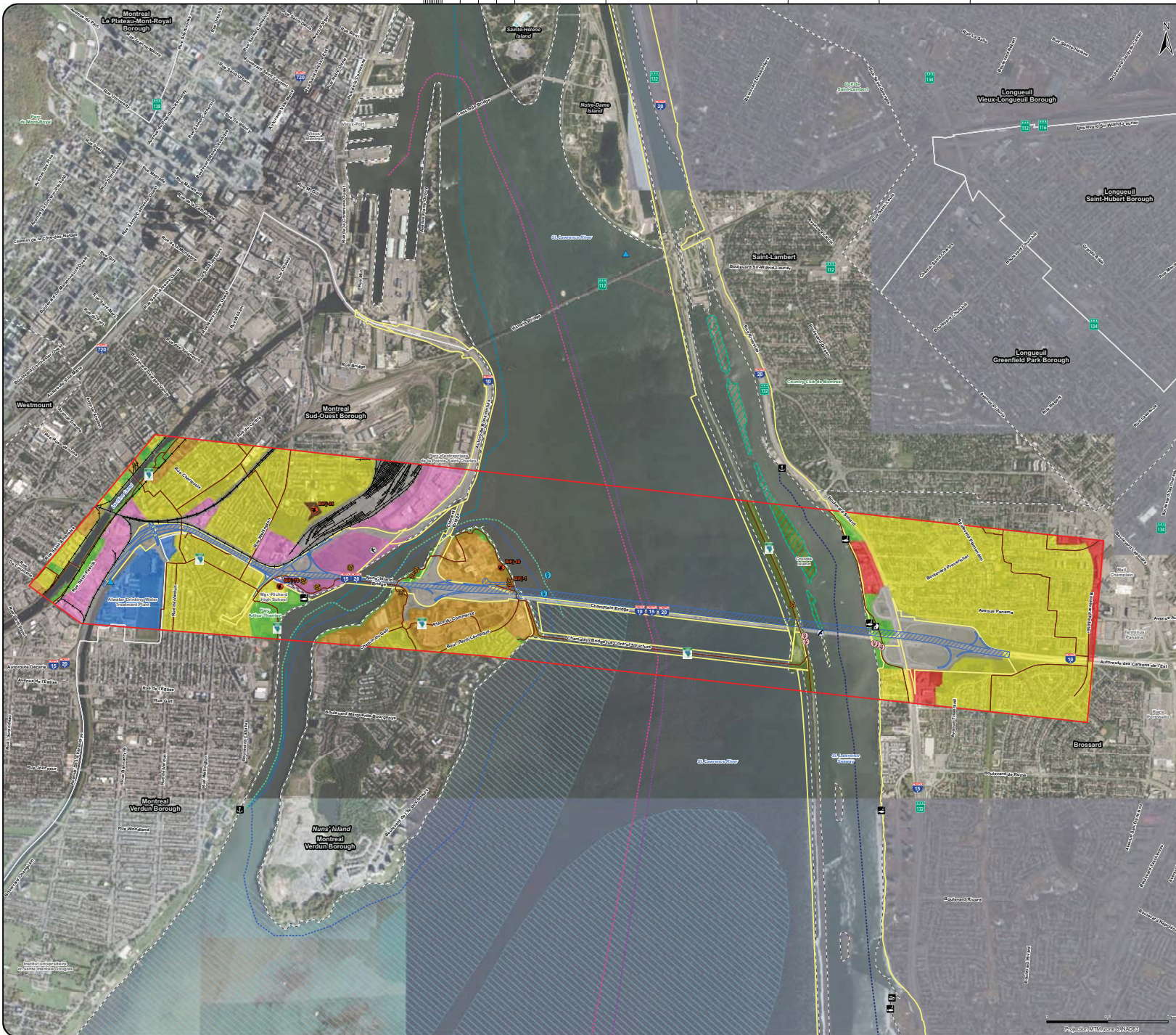
assessment are presented in Part II of the Environmental Assessment Report on the assessment of effects and mitigation measures.

Table 1 Tentative list of valued environmental components selected for this project

ENVIRONMENT	VALUED ENVIRONMENTAL COMPONENTS
Physical environment	Water quality/hydrology; Soil and sediment quality.
Biological environment	Fish and fish habitat; Migratory birds and their habitats (protected areas); Precarious plant, wildlife and aquatic species; Amphibians and reptiles (herpetofauna).
Human environment	Navigation; Physical and cultural heritage resources; Quality of life*; Aesthetic and visual aspects; Sound environment; Air quality.

\* Note that the component “Quality of life” will be approached through other valued environmental components relating to biodiversity and to elements that support it, such as “Water quality” or “Fish and fish habitat”, as well as to human activities such as “Navigation” or nuisance factors that may be associated with the sound environment, for example.

Figure 8 shows the study area’s overall biological and human environments distribution.



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Human environment		Limits	
Residential	Planned infrastructure right-of-way	Federal government property limits	Study area
Commercial and services	Municipal limits	Natural environment	Special status flora and fauna
Industrial	Large green space or near park	Conservation	Plough engineered
Mixed area (commercial/residential)	Large transport right-of-way	Public infrastructure	Laurentian Endangered
Large green space or near park	Public infrastructure	Convert, monetary or place of worship	Brown snake
Conservation	Convert, monetary or place of worship	Archaeological site	Peregrine falcon
Large transport right-of-way	Archaeological site	Windurfing area	Chimney shaft
Public infrastructure	Windurfing area	Fishing area	Area of special interest for wildlife
Convert, monetary or place of worship	Fishing area	Boat launching ramp	Migratory and sanctuary
Archaeological site	Boat launching ramp	Muriets	Waterfowl concentration area
Windurfing area	Muriets	Route Bleue-La Prairie Lower Basin path	
Fishing area	Route Bleue-La Prairie Lower Basin path	Route Bleue-La Prairie Upper Basin path	
Boat launching ramp	Route Bleue-La Prairie Upper Basin path	Kiosque kayak path	
Muriets	Kiosque kayak path	Point de Mira Youth Centre path	
	Point de Mira Youth Centre path	Hiverneaux path	
	Hiverneaux path	Saute-Mouton path	
	Saute-Mouton path	Bike path	
	Bike path	Bike path - Plaque Verte	
	Bike path - Plaque Verte	Aquatic (CM)	
	Aquatic (CM)	Water Intake Approximate Location	

NO	DATE	Final Issue	CL	VM
08	13-03-19	Final Issue	CL	VM
0C	12-11-09	Issue for comments	CL	CP
0B	12-10-16	Issue for comments	CL	CP
0A	12-10-11	Issue for comments	CL	CP
REV.	NO - 08	DESCRIPTION	CL	CP
	DATE		Prepared By	Checked By

**ISSUES - REVISIONS**

ALL DIMENSIONS MUST BE TAKEN AND CHECKED BEFORE BEGINNING THE WORKS



Client

Client's references: T8080-110362

**Project**

**New Bridge for the St. Lawrence**

**Environmental Assessment**

Title: **Figure 8**

**Inventory Map of Natural and Human Environments**

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Rev. char.	Project	W/S	Disc.	Type	Drawing No.	Rev.
068	P-0000810	110	GO	D	0100	00



## 3.2 GENERAL DESCRIPTION OF THE PHYSICAL ENVIRONMENT

The Champlain Bridge corridor is located between Montreal Island and Nun's Island on one side and the City of Brossard on the other. It crosses, from west to east, the Greater La Prairie Basin, or the main part of the St. Lawrence River, the Seaway and the Lesser La Prairie Basin. The surface of the land adjacent to the bridge is relatively flat. The average elevation above sea level is approximately 16 m on the Island of Montreal, 14 m on Nuns' Island and 15 m on the South Shore.

The geology of the basement rock in the area is identified as Utica black shale dating from the middle Ordovician epoch. Soils are solely composed of glacial till, including on Nuns' Island; zones of till covered by sea clay, including along the natural shoreline of the St. Lawrence on Montreal Island; and zones of limited extent covered by river sand, between 6 and 12 m thick. On the South Shore, the natural unconsolidated deposits over the basement rock are about 8 m in total thickness, and consist of clayey sediment topped by a thin horizon of sand.

Climate conditions are representative of the Montreal region. The annual average daily temperature, recorded at the Montreal-McGill station, is 7.4°C, with an annual average daily maximum of 11.1°C and an annual average daily minimum of 3.6°C. Annual precipitation was just over 1,000 mm. Prevailing winds are from the southwest. Although fairly consistent on an annual average, they are stronger in the winter from November to March. Prevailing winds average between 11.5 km/h and 15.6 km/h depending on the meteorological station. They are mainly west-south-west, west and north-east depending on the time of the year. On average, wind speed of 83 km/h is exceeded once every 10 years, and wind speed of 69 km/h is exceeded once a year. Visibility is generally good, below 1 km less than 1% of the time.

### 3.2.1 Soil and sediment quality

#### 3.2.1.1 *The banks of the Island of Montreal and Nuns' Island*

Of all the areas included in the footprint of the New Bridge for the St. Lawrence, the soils near the St. Lawrence shore of Montreal Island to the west of the Pointe-Saint-Charles Technoparc potentially represent the most complex environmental conditions by far. These soils contain earth fill and waste materials up to 12 m thick that were placed in the course of the operation of various riverside dumps spanning a period of 100 years (1864-1965).

Soil sampling campaigns have been conducted in some sectors of the Island of Montreal and Nun's Island. In general, most samples (Figure 9) indicate contamination levels higher than the BC range as defined in the *Politique de protection des sols et de réhabilitation des terrains contaminés (Policy on Soil Protection and Rehabilitation of Contaminated Land)*, issued by the Ministère du Développement durable, de l'Environnement et des Parcs (Quebec Ministry of Sustainable Development, Environment and Parks). Contamination is mainly due to the presence of petroleum hydrocarbons, polycyclic aromatic hydrocarbons and metals.

In addition, anaerobic degradation of waste material on the shore of the Island of Montreal area produces important concentrations of methane gas (CH<sub>4</sub>).

Several environmental issues were also identified in connection with the lands adjacent to the right-of-way of Highway 15, to the west of Wellington Street. Industrial activity in this area dates back in some cases to the early 20<sup>th</sup> century (Consumer Glass, Montreal Light Heat & Power, oil depots and metals industries along the Lachine Canal, etc.). No data on these sites are currently available.

Assessment and management of contaminated soils will be clarified in subsequent development stages of the New Bridge for the St. Lawrence.

### 3.2.1.2 *The South Shore*

On the South Shore, aerial photos from as early as 1957 indicate that before the highways leading to the bridge were built, the properties under and adjacent to the present-day roads were farmland. Similarly, few environmental concerns are associated with the historical uses on the eastern part of Nuns' Island.

Irrespective of any historical or neighbouring activities, the mere presence of the bridge, on- and off-ramps and the freeways connected to it represent in and of themselves an environmental issue. Residues of metals and hydrocarbons produced by vehicles and the degradation of the bridge structures and coatings are likely to have affected the environmental quality of the surface soils within the footprint since it was built about 50 years ago.

### 3.2.1.3 *Sediments*

A coarse substrate made up of pebbles and blocks is scattered over the main sector of the Greater Basin. At Nuns' Island, there is a flat of sedimentary rocks downstream from the Champlain Bridge, continuing to a small formation of islets. The section along the other side of these islets is made up of pebbles and blocks and becomes coarser (blocks and sedimentary rocks) the farther you get from the islets. On the left bank of Nuns' Island, between the two bridges, is found a mixture of pebbles and blocks with lenses of coarse sand and small gravel. The substrate downstream from the Clément Bridge gets coarser, ranging from stones and pebbles near the Clément Bridge to pebbles and blocks near the point of Nuns' Island, while blocks and sedimentary rock are characteristic of the extreme east of the island. On the South Shore of the Greater Basin, the substrate is composed of stones, gravel and pebbles (Figure 10).



Maximum concentration range<sup>1</sup>(all depth intervals and analysis parameter mixed together)

- ⊕ Not analyzed
- ◆ <A>
- ◆ AB
- ◆ BC
- ◆ >C
- ⊔ Municipal limit
- Borough limit

<sup>1</sup> Range of contamination for the soil protection and contaminated land rehabilitation policy, Quebec Ministry of Sustainable Development, Environment and Parks (MDDEP) 1998, revised criteria from the MDDEP e-portal

SOURCES :  
 - Boreholes : Dessau, 2008; Inspec-Soil, 1993 et 1996; Technorem, 2007 et 2011; Tecsult, 2005  
 - Orthophotographs : © Montreal Metropolitan Community, 2005-2011



Client	
Project	<b>New Bridge for the St. Lawrence</b> Environmental Assessment
Title	<b>Figure 9</b> Environmental Soil Quality

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Serv. char.	Project	Wbs	Disc.
<b>068</b>	<b>P-0000810</b>	<b>110</b>	<b>GO</b>
Type	Drawing No.	Rev.	
<b>D</b>	<b>0096</b>	<b>00</b>	

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SIZE 11x17







**Surface substrate**

- Organic - Sand
- Pebbles - Gravel
- Cobble - Boulder
- Cobble - Boulder - Sand intrusion
- Pebbles - Cobble
- Boulder - Sedimentary rock
- Sedimentary rock

Bathymetry study area and surface substrate

Municipal limit

Borough limit

SOURCES :

- Surface substrate : Environnement Illimité inc., 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011



**Client** **Transport Canada** **Transports Canada**

**Project**  
**New Bridge for the St. Lawrence**  
**Environmental Assessment**

**Title**  
**Figure 10**  
**Composition of the Surface Substrate**

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Project manager	Sylvie Côté	Sequence No.	<b>01 of 01</b>

Serv. char.	Project	Wbs	Disc.	Type	Drawing No.	Rev.
<b>068</b>	<b>P-0000810</b>	<b>110</b>	<b>GO</b>	<b>D</b>	<b>0098</b>	<b>00</b>

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SIZE 11x17



Results of the various soil characterization campaigns tend to show a significant level of historic contamination on the north shore of the Basin. Heavy metal levels over the minimal effect threshold were found in samples near the study area in 1975. In 2012, during the sampling campaign for the New Bridge for the St. Lawrence project, only one sediment sample could be collected under the Champlain Bridge near the Nuns' Island Bridge. Sediments are scarce in that area because of the rocky substrate. Sample showed heavy metal contamination (chromium, copper, nickel, lead and zinc, along with polycyclic aromatic hydrocarbons and polychlorinated biphenyls. These contaminants come from the Pointe-Saint-Charles Technoparc developed in the early 1990s on contaminated fill (Bibeault et al., 1997) and leaks of waste oil.

Unlike the Greater Basin, the Lesser La Prairie Basin is composed of a thick, relatively uniform, layer of fine sediments built up since construction of the Seaway dike between 1955 and 1959. A major proportion of these sediments come from the Châteauguay River. Its waters flow along the right bank of the river from the time they enter Lake Saint-Louis (St. Lawrence Centre, 1993). Studies (Hardy et al. (1991) and St. Lawrence Centre (1996)) show that this sector is characterized by lacustrine conditions and heavy sedimentation of fine particles. A silty substrate is scattered throughout the Lesser Basin, and there are shell fragments from the decomposition of zebra mussels. The substrate in the navigation channel is coarser, with a lot of mussels and mussel fragments.

Based on the data from 1976, 1987 and 2012, the portrait of contamination in the Lesser La Prairie Basin indicates the existence of moderate contamination distributed throughout the Lesser Basin with higher individual sources in some places. The main contaminants are heavy metals and polychlorinated biphenyls (see Table 2).

Table 2 Comparison of metal concentrations in sediment samples from the Lesser La Prairie Basin in 1976, 1987 and 2012 with current MDDEP criteria

Parameter	Sérodes, 1978		Hardy <i>et al.</i> , 1991		Study for the New Champlain Bridge, 2012		* OME Criterion (mg/kg)	** MDDEP and EnvCan Criterion (mg/kg)				
	Median (mg/kg)	Effective (n)	Median (mg/kg)	Effective (n)	Median (mg/kg)	Effective (n)		≤ COE	COE <sup>2</sup>	> COE and ≤ CFE	CFE <sup>3</sup>	> CFE
Mercury (Hg)	0.46	17	0.34	18	0.21	12	0.3	Class 1	0.25	Class 2	0.87	Class 3
Arsenic (As)	-	-	9.82	18	5.00	12	8		7.6		23	
Cadmium (Cd)	9	17	1	18	1.15	12	0.1		1.7		12	
Chromium (Cr)	73	17	105	18	49.00	12	25		57		120	
Copper (Cu)	55.3	17	62.9	18	57.50	12	25		63		700	
Nickel (Ni)	48.4	17	41.1	18	41.00	12	25		47		-	
Lead (Pb)	48	17	137	18	98.50	12	50		52		150	
Zinc (Zn)	315	17	392	18	270.00	12	100		170		770	
PCB (total)	-	-	0.651	18	0.19	12	-		0.079		0.78	

\* Criteria from the Ontario Ministry of the Environment, 1979 (used in the report by Hardy et al., 1991).

\*\* Criteria from Environment Canada and the Quebec Ministry of Sustainable Development, the Environment and Parks (MDDEP), 2007.

Class 1- [Substance] ≤ COE: sediments may be released in open water;

Class 2- COE < [Substance] ≤ CFE: release in open water may be considered, but toxicity tests are required;

Class 3- [Substance] > CFE: release of sediments in open water is prohibited.

PCB: Polychlorinated biphenyls

## 3.2.2 Surface water and groundwater characteristics

Since the 1980s, the water quality has been monitored in the St. Lawrence River. There is no sampling station in the study area; however, stations are located upstream and downstream. Analyses found that none of the measured parameters exceeded the water quality criteria for the protection of aquatic life. (MDDEP, 2012; CCME, 2012).

The La Prairie Basin is divided into two sections, the Greater La Prairie Basin, which includes the main part of the river, and the Lesser La Prairie Basin, including the shipping channel of the St. Lawrence Seaway.

### 3.2.2.1 Surface water

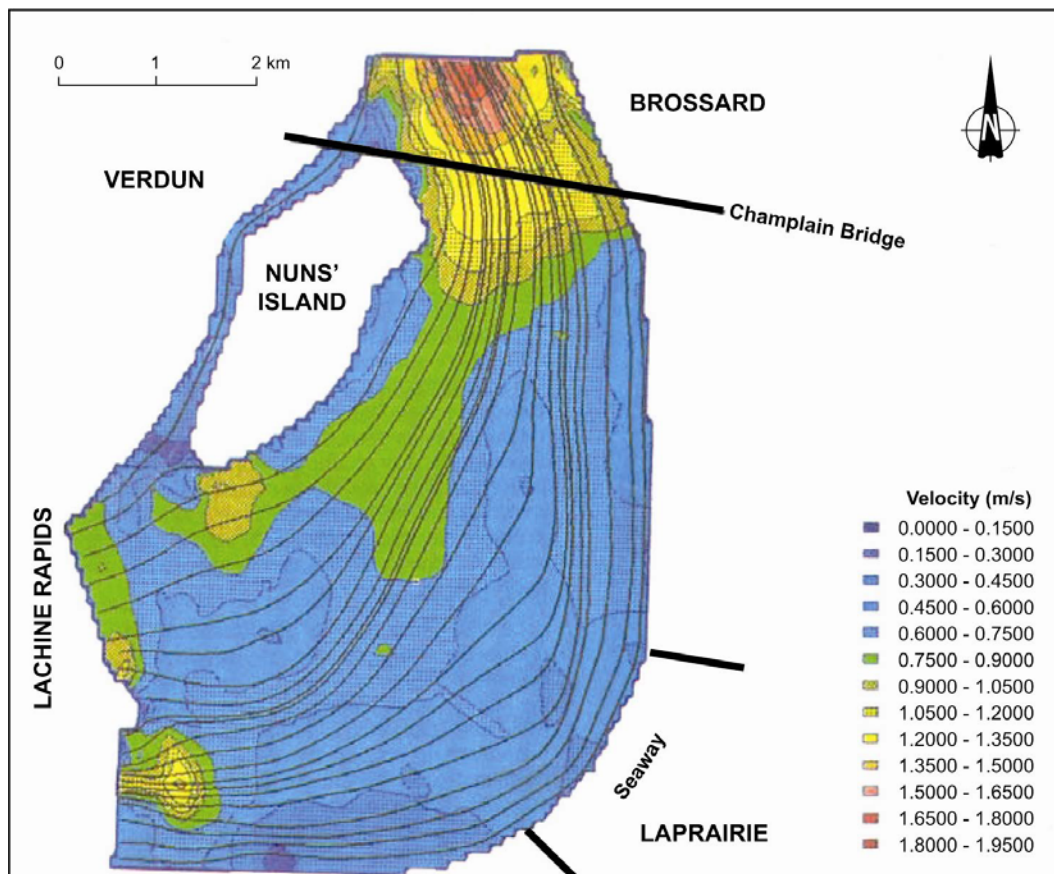
#### 3.2.2.1.1 The Greater La Prairie Basin

The Greater La Prairie Basin flow is influenced by inflow from the St. Lawrence River and the Ottawa River. These are controlled by several dams in their upper reaches. Average streamflow in the St. Lawrence is 7,060 m<sup>3</sup>/s (Bouchard et al., 2000), and it can vary from 6,000 to 9,000 m<sup>3</sup>/s. As for the Ottawa River, streamflow averages 2,000 m<sup>3</sup>/s, and can vary from a low of 800 m<sup>3</sup>/s and a peak of 6,500 m<sup>3</sup>/s, depending on the season. These bodies of water tend to mix very little. One observes therefore a mass of blended water (Ottawa and St. Lawrence) along the north shore, while the centre and the south shore are characterized by water typical of the Great Lakes

At the Champlain Bridge, current speed in the channel ranges from 1.2 to 1.35 m/s (Leclerc et al., 1987). Outside the channel, the current ranges from 0.9 to 1.2 m/s (Leclerc et al., 1987). Below the bridge lies a zone where speeds range from 1.8 to 1.9 m/s in the channel (Leclerc et al., 1987). In the left arm at Nuns' Island, current speed ranges from 0.3 to 0.45 m/s (Leclerc et al., 1987). Figure 11 presents flow and trajectories.

In this section of the St. Lawrence, current speeds in the centre (flow channels) are over 0.3 m/s and therefore not conducive to the sedimentation of fine particles. As a consequence, fine suspended particles are not deposited at the foot of the rapids, where only coarser materials come to rest: gravel, pebbles or cobbles. Fine particles are deposited in grass beds or close to the banks, where the current speed is under 0.1 m/s. At these current speeds, particles can form sedimentary deposits, but often only temporarily, as the current gains speed during the spring runoff.

Figure 11 Velocity fields and flow trajectories (Leclerc et al. 1987)



Under the Champlain Bridge, at the time of the surveys the water depth varied from 3 to 6 m on average, from the centre to the left bank, with one main channel varying from 7 to 9 m deep. Along the right bank of the basin, depths varied from 1 to 3 m. The left bank sector, at Nun's Island, shows more variation. Upstream of the island, depths varied from 0 to 2 m, precluding navigation during low-water periods. Under the bridge (left arm), depths varied from 1 to 3 m, in general, allowing careful navigation, as some rocky islets or sills were almost exposed in this area (see Figure 12).

Ice conditions in the Greater La Prairie Basin differ from those in the Lesser La Prairie Basin. Ice concentration is, in fact, lower in the Greater La Prairie Basin for the following reasons:

- ▶ In the Seaway, currents are very weak, especially in winter when the locks remain closed;
- ▶ In the Greater Basin, the water flows all winter and moves the ice.

## 3.2.2.1.2 Lesser La Prairie Basin

The Lesser La Prairie Basin is separated from the Greater La Prairie Basin by the dyke between Kahnawake and Longueuil and is mainly fed by the Great Lakes. The average streamflow at the inlet of the Lesser Basin is evaluated at 149 m<sup>3</sup>/s (St. Lawrence Centre, 1991). Inflow from the three tributaries in the Lesser Basin is minimal, at 7 m<sup>3</sup>/s, or less than 7% of the river streamflow (Robitaille, J., 1997). Average current speed is 0.1 m/s (St. Lawrence Centre, 1991).

This is a lentic flow zone. The low current speeds in this area are conducive to the sedimentation of fine particles on the riverbed, forming a layer of silt. The Lesser Basin acts a sort of sediment trap (St. Lawrence Centre, 1996).

A navigation channel with a depth of 8.6 m on average was dredged along the dike that separates the two basins, near the right bank, and the dredged material was used to create islets, thereby separating the shipping channel from the rest of the Lesser Basin (St. Lawrence Centre, 1996). The channel is maintained at a depth of about 8.6 m by the Seaway Management Corporation so that vessels can navigate. The depth of the Lesser Basin at the time of the surveys averaged 2.5 m, with depths ranging from 1 to 3 m (see Figure 12).



**Flow facies**

- Lotic – Whitewater
- Laminar lotic
- Lentic
- Flow facie limit

**Depth (m)**

- 0 - 2
- 2 - 5
- 5 - 15
- Over 15

Bathymetric study area and surface substrate

Municipal limit

Borough limit

**SOURCES :**

- Bathymetry :  
St. Lawrence Seaway, 2010  
The Jacques Cartier and Champlain Bridges inc., 2007, 2010 et 2011  
Environnement Illimité inc., 2012
- Flow facies : Environnement Illimité inc., 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011.



**Client** Transport Canada / Transports Canada

**Project** **New Bridge for the St. Lawrence  
Environmental Assessment**

**Title** **Figure 12  
Bathymetry and flow facies**

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Project manager	Sylvie Côté	Sequence No.	<b>01 of 01</b>

Serv. char.	Project	Wbs	Disc.	Type	Drawing No.	Rev.
068	P-0000810	110	GO	D	0097	00

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SIZE 11x17





### 3.2.2.2 *Groundwater*

The flow of groundwater on lands adjacent to the Champlain Bridge is directly influenced by the St. Lawrence River, into which this water migrates. As a result, the groundwater flow in the part of Montreal Island concerned here is generally toward the southeast, while the flow on the South Shore is presumed to be toward the west. According to the piezometric data, the average depth of the groundwater is on the order of 6.5 m below grade, which places it generally within the fill materials that characterize the river shore.

The previous characterization studies provide a substantial quantity of relevant hydrogeological information about the lands adjacent to Champlain Bridge on the Montreal side. All groundwater samples collected from the area of fill on the Montreal shore exceed the levels prescribed by the Montreal Metropolitan Community (CMM) for at least one parameter. In most cases, exceedence was noted for metals, manganese and/or barium or polycyclic aromatic hydrocarbons. Similar data do not exist for the South Shore.

### 3.2.3 **Air quality**

The New Bridge for the St. Lawrence project is not subject to provincial and municipal regulation, but in the absence of federal regulation these documents may serve as a reference framework (see Table 3).

Present air quality in Montreal is generally acceptable. According to the 2011 Air Quality Report for Montreal, there were 69 days with poor air quality in Montreal in 2011. Fine particles are the main cause of days with poor air quality (68 of the 69 days declared). This is relatively similar to previous years, with 68 days with poor air quality in 2008, 69 days as well in 2009 and 65 days in 2010.

Table 3 Air quality standards in Quebec and in the MMC for the principal contaminants associated with highway transportation

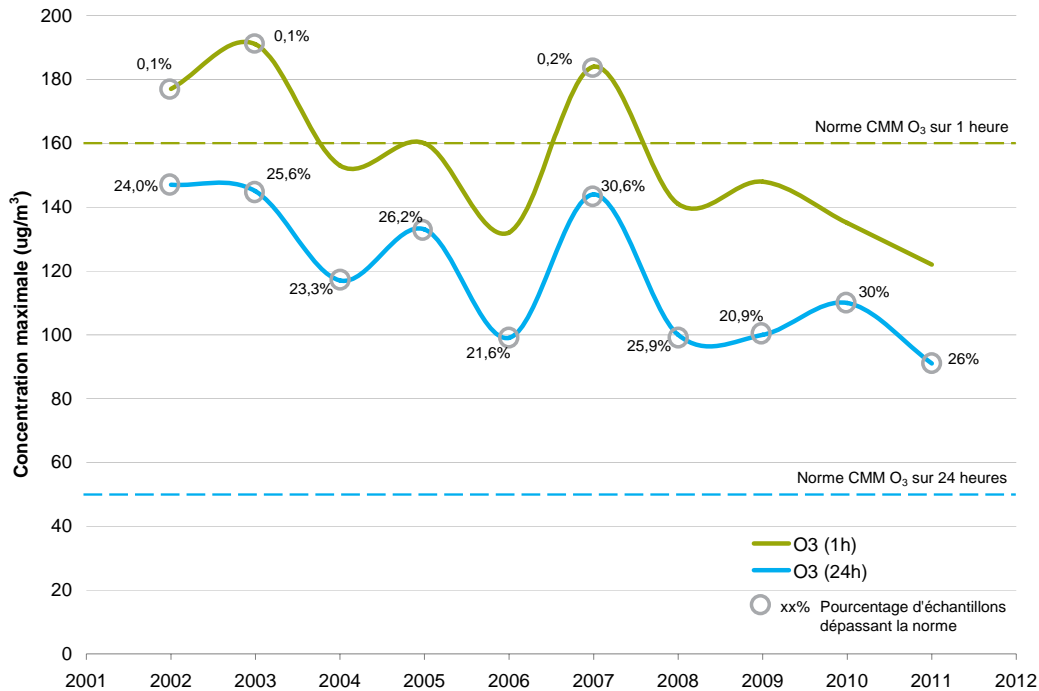
POLLUTANT	PERIOD	CLEAN AIR REGULATION	MMC REGULATION 2001-10
Total particles in suspension	24 hr	120 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>
	1 yr	None	70 µg/m <sup>3</sup>
Particles in suspension under 2.5 microns (PM <sub>2,5</sub> )	24 hr	30 µg/m <sup>3</sup>	None <sup>2</sup>
Nitrogen dioxide (NO <sub>2</sub> )	1 hr	414 µg/m <sup>3</sup>	400 µg/m <sup>3</sup>
	8 hr	None	253 µg/m <sup>3</sup>
	24 hr	207 µg/m <sup>3</sup>	200 µg/m <sup>3</sup>
	1 yr	103 µg/m <sup>3</sup>	100 µg/m <sup>3</sup>
Carbon monoxide (CO)	1 hr	34,000 µg/m <sup>3</sup>	35,000 µg/m <sup>3</sup>
	8 hr	12,700 µg/m <sup>3</sup>	15,000 µg/m <sup>3</sup>
Sulphur dioxide (SO <sub>2</sub> )	15 min	None	860 µg/m <sup>3</sup>
	1 hr	None	1,300 µg/m <sup>3</sup>
	8 hr	None	490 µg/m <sup>3</sup>
	24 hr	288 µg/m <sup>3</sup>	260 µg/m <sup>3</sup>
	1 yr	52 µg/m <sup>3</sup>	52 µg/m <sup>3</sup>
Ozone (O <sub>3</sub> )	15 min	None	265 µg/m <sup>3</sup>
	1 hr	160 µg/m <sup>3</sup>	160 µg/m <sup>3</sup>
	8 hr	120 µg/m <sup>3</sup>	75 µg/m <sup>3</sup>
	24 hr	None	50 µg/m <sup>3</sup>
	1 yr	None	30 µg/m <sup>3</sup>

Sources: Clean Air Regulation (Q-2, r.4.1)

CMM regulation 2001-10 ([http://www.cmm.qc.ca/fileadmin/user\\_upload/reglements/09\\_1.pdf](http://www.cmm.qc.ca/fileadmin/user_upload/reglements/09_1.pdf))

<sup>2</sup> However, this pollutant is sampled by the City of Montreal's air quality monitoring network and the proposed limit value for a mobile average of three hours is 35 µg/m<sup>3</sup>.

Figure 13 Changes in the concentration of ozone (O<sub>3</sub>) at Station 68-Verdun on an hourly average and a 24-hour average



## 3.2.4 Key issues of the physical environment

Although effects and mitigation measures are covered in a separate report, this section provides an overview of the highlights of the environmental components and the factors to be considered in the next steps of the project.

### 3.2.4.1 Soil and sediment quality

Construction of the new infrastructure does not require decontamination of the land it crosses, particularly the Pointe-Saint-Charles Technoparc. However, the soil and other excavation material that will result from the construction work will need to be managed based on their environmental quality and in compliance with prevailing regulations.

Among the factors to be considered in the design of new infrastructure and during subsequent stages are:

- Identification of excavation/fill zones for the entire construction site is required during the preliminary design phase in order to determine which zones need characterization to ensure adequate environmental management of excavated material;

- ▶ The possible presence of methane in the soil must be taken into account in the structural design of the new infrastructure. Situations likely to cause gas to accumulate in an area or in an enclosed space where there is also an ignition source or in a space or premises even occasionally occupied by a worker or any other person must be avoided;
- ▶ Construction of the new infrastructure must be preceded by interventions designed to mitigate the problem of contamination in the Pointe-Saint-Charles Technoparc and the migration of contaminants to the river. However, if this sequence is not followed, the design and execution of work for the new infrastructure must not constitute an obstacle to future action to deal with this problem

With regard to work in the water of the Greater La Prairie Basin, it is not an issue with respect to dispersion of contaminated sediment, but careful attention must be paid to the work that will take place in the Lesser La Prairie Basin. Measures to control the resuspension of sediments are required, though this should not be difficult given the low flow conditions.

#### 3.2.4.2 *Quality of surface water and groundwater*

The main issue with regard to surface water quality relates to variations in turbidity and suspended solids. One year prior to the start of work, when the concept for the new bridge and the construction techniques are more clearly defined, separate sampling on either side of the river as well as a central station should be planned in order to determine the influence of the two bodies of water in the area (the influence of the St. Lawrence River on the left bank and the Ottawa River on the right bank). Following periods of heavy rainfall data on suspended solids should also be gathered in order to learn the high values of the range for suspended solids and for turbidity under natural conditions.

With regard to groundwater, the only factor to be taken into account in the design of the new infrastructure and in subsequent stages associated with groundwater is:

- ▶ Any groundwater pumped during construction work in the Montreal shore sector must be treated prior to discharge.

#### 3.2.4.3 *Air quality*

Despite the direct and indirect effects of transport-related pollution on quality of life and human health, current conditions for both criteria air pollutants and greenhouse gases leave reason to believe that although air quality is a significant issue for the project, no significant effect is expected.

Once the final geometry of the infrastructure is known, a dispersion simulation for criteria air pollutants should be conducted in order to validate whether the project's impact is marginal on pre-defined sensitive areas (schools, seniors' residences, daycares, hospitals), mainly under prevailing winds.

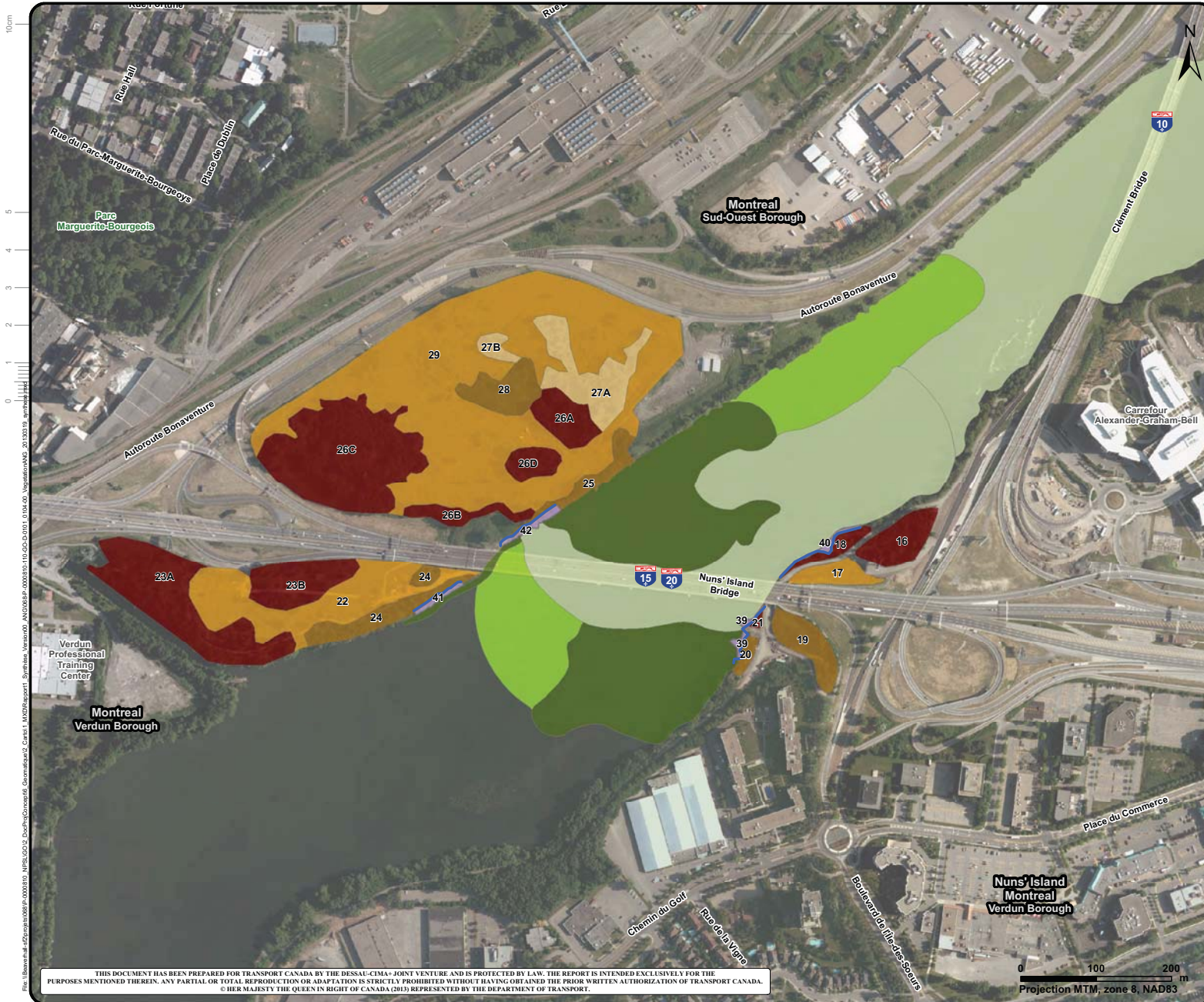
**3.3 GENERAL DESCRIPTION OF THE BIOLOGICAL ENVIRONMENT**

The area around the Champlain Bridge site consists mainly of herbaceous fields and stands of eastern cottonwood poplar representing, respectively, 46.3% and 21.3% of the vegetated area. Table 4 and Figure 14 present the different plant populations found near the site. Wetlands are found mainly along the river and near the Highway 10 ramps on the South Shore.

Table 4 Description of plant populations in the study area

ENVIRONMENT TYPE	AREA (M <sup>2</sup> )	% AREA OF PLANT COVERAGE
<b>Terrestrial environments</b>		
Eastern cottonwood poplar stands	72,450 m <sup>2</sup>	21.3%
Black locust stands	33,233 m <sup>2</sup>	9.8%
Red ash stands	52,724 m <sup>2</sup>	15.5%
Staghorn sumac fields	23,592 m <sup>2</sup>	6.95%
Herbaceous fields	157,296 m <sup>2</sup>	46.3%
<b>Wetlands</b>		
Aquatic plant communities	n/a	
Pond	1,555 m <sup>2</sup>	
Tree swamp	15,458 m <sup>2</sup>	
Emergent nearshore marsh	n/a	





— High water line

**Wetland**

- Pond
- Emergent shoreline marsh
- Common reed marsh
- Treed swamp

**Terrestrial environment**

- Staghorn sumac shrublands
- Herbaceous fields
- Red ash stands
- Black locust stands
- Eastern cottonwood poplar stands

**Aquatic vegetation cover (in %)**

- 0-25
- 25-50
- 50-75
- 75-100

SOURCES :

- Vegetation units and High-water line : field inventory, CIMA 2012
- Aquatic vegetation : Environment Illimité inc., 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011



Client Transport Canada / Transports Canada

Project **New Bridge for the St. Lawrence Environmental Assessment**

Title **Figure 14a Floristic Composition of the Wetlands and Terrestrial Environments**

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Checked	Ghyslain Pothier	Date	2013-03-19
Project manager	Sylvie Côté	Sequence No.	<b>01 of 01</b>
Serv. char.	Project <b>068 P-0000810</b>	Wbs	110
		Disc.	GO
		Type	D
		Drawing No.	0101
		Rev.	00

Projection MTM, zone 8, NAD83

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SIZE 11x17







— High water line

**Wetland**

- Pond
- Emergent shoreline marsh
- Common reed marsh
- Treed swamp

**Terrestrial environment**

- Staghorn sumac shrublands
- Herbaceous fields
- Red ash stands
- Black locust stands
- Eastern cottonwood poplar stands

**Aquatic vegetation cover (in %)**

- 0-25
- 25-50
- 50-75
- 75-100

SOURCES :

- Vegetation units and High-water line : field inventory, CIMA 2012
- Aquatic vegetation : Environment Illimité inc., 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011



Client Transport Canada / Transports Canada

Project **New Bridge for the St. Lawrence Environmental Assessment**

Title **Figure 14b Floristic Composition of the Wetlands and Terrestrial Environments**

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Serv. char.	Project <b>068 P-0000810</b>	Wbs	110
		Disc.	GO
		Type	D
		Drawing No.	0102
		Rev.	00

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SIZE 11x17





— High water line

**Wetland**

- Pond
- Emergent shoreline marsh
- Common reed marsh
- Treed swamp

**Terrestrial environment**

- Staghorn sumac shrublands
- Herbaceous fields
- Red ash stands
- Black locust stands
- Eastern cottonwood poplar stands

**Aquatic vegetation cover (in %)**

- 0-25
- 25-50
- 50-75
- 75-100

SOURCES :

- Vegetation units and High-water line : field inventory, CIMA 2012
- Aquatic vegetation : Environnement Illimité inc., 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011



Client Transport Canada / Transports Canada

Project **New Bridge for the St. Lawrence Environmental Assessment**

Title **Figure 14c Floristic Composition of the Wetlands and Terrestrial Environments**

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Project manager	Sylvie Côté	Sequence No.	<b>01 of 01</b>

Serv. char.	Project	Wbs	Disc.	Type	Drawing No.	Rev.
<b>068</b>	<b>P-0000810</b>	<b>110</b>	<b>GO</b>	<b>D</b>	<b>0103</b>	<b>00</b>

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SIZE 11x17





— High water line

**Wetland**

- Pond
- Emergent shoreline marsh
- Common reed marsh
- Treed swamp

**Terrestrial environment**

- Staghorn sumac shrublands
- Herbaceous fields
- Red ash stands
- Black locust stands
- Eastern cottonwood poplar stands

**Aquatic vegetation cover (in %)**

- 0-25
- 25-50
- 50-75
- 75-100

SOURCES :

- Vegetation units and High-water line : field inventory, CIMA 2012
- Aquatic vegetation : Environnement Illimité inc., 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011



Client Transport Canada / Transports Canada

Project **New Bridge for the St. Lawrence Environmental Assessment**

Title **Figure 14d Floristic Composition of the Wetlands and Terrestrial Environments**

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Project manager	Sylvie Côté	Sequence No.	<b>01 of 01</b>

Serv. char.	Project	Wbs	Disc.	Type	Drawing No.	Rev.
<b>068</b>	<b>P-0000810</b>	<b>110</b>	<b>GO</b>	<b>D</b>	<b>0104</b>	<b>00</b>

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SIZE 11x17



## 3.3.1 Fish and fish habitat

The waters of the Greater and Lesser La Prairie Basins are home to a wide variety of fish species. Studies in this sector have identified 44 fish species (Table 5) out of the hundred counted in the extended area of 15 km upstream and downstream from the Champlain Bridge corridor.

Table 5 Fish species found or likely to be found in the study area

FISH SPECIES FOUND OR LIKELY TO BE FOUND IN THE STUDY AREA									
SPECIES	FAMILY	SPECIAL STATUS		STUDY AREA (VILLE-MARIE ZIP)				UPSTREAM (HAUT-RICHELIEU ZIP)	DOWNSTREAM (JACQUES-CARTIER ZIP)
		PROVINCIAL	FEDERAL	ALL	GREATER LA PRAIRIE BASIN	LESSER LA PRAIRIE BASIN	LACHINE RAPIDS		
Largemouth bass	CENTRARCHIDAE			x	x	x	x	x	x
Smallmouth bass	CENTRARCHIDAE			x	x	x	x	x	x
Gizzard shad	CLUPEIDAE			x				x	
American shad	CLUPEIDAE	Vulnerable		x			x	x	x
America eel	ANGUILLIDAE	LDTV	Of concern	x	x	x	x	x	x
White bass	PERCICHTHYIDAE							x	
Striped bass	PERCICHTHYIDAE								x
Brown bullhead	ICTALURIDAE			x	x	x	x	x	x
Stonecat	ICTALURIDAE			x				x	x
Channel catfish	ICTALURIDAE			x		x		x	x
White perch	PERCICHTHYIDAE			x	x	x	x	x	
Splitnose rockfish	CYPRINIDAE			x			x	x	x
Redfin pickerel	ESOCIDAE								x
Chain pickerel	ESOCIDAE	LDTV		x					x
Grass pickerel	ESOCIDAE	LDTV	Of concern					x	x
Crucian carp	CYPRINIDAE								x
Carp	CYPRINIDAE			x	x	x	x	x	x
Mottled sculpin	COTTIDAE			x	x		x	x	x
Slimy sculpin	COTTIDAE			x					x
Tadpole madtom	ICTALURIDAE					x		x	x
Golden shiner	CYPRINIDAE			x					
Silver redhorse	CATOSTOMIDAE								x

Table 5 (Cont'd) Fish species found or likely to be found in the study area

FISH SPECIES FOUND OR LIKELY TO BE FOUND IN THE STUDY AREA									
SPECIES	FAMILY	SPECIAL STATUS		STUDY AREA (VILLE-MARIE ZIP)				UPSTREAM (HAUT-RICHELIEU ZIP)	DOWNSTREAM (JACQUES-CARTIER ZIP)
		PROVINCIAL	FEDERAL	ALL	GREATER LA PRAIRIE BASIN	LESSER LA PRAIRIE BASIN	LACHINE RAPIDS		
Copper redhorse	CATOSTOMIDAE	Threatened	Endangered						X
River redhorse	CATOSTOMIDAE	Vulnerable	Of concern						X
Greater redhorse	CATOSTOMIDAE								X
Shorthead redhorse	CATOSTOMIDAE								X
Quillback	CATOSTOMIDAE			X				X	X
Longear sunfish	CENTRARCHIDAE	LDTV							X
Bluegill	CENTRARCHIDAE								X
Rock bass	CENTRARCHIDAE			X	X	X	X	X	X
Pumpkinseed	CENTRARCHIDAE			X	X	X	X	X	X
Brook silverside	ATHERINIDAE			X				X	X
Yellowbelly	PERCIDAE				X			X	X
Rainbow darter	PERCIDAE	LDTV						X	X
Fantail darter	PERCIDAE			X			X	X	X
Eastern sand darter	PERCIDAE	Threatened	Threatened						X
Walleye	PERCIDAE			X	X	X	X	X	X
Sauger	PERCIDAE			X	X	X	X	X	X
American smelt	OSMERIDAE			X		X	X	X	X
Brook stickleback	GASTEROSTEIDAE			X			X	X	X
Threespine stickleback	GASTEROSTEIDAE								X
Lake sturgeon	ACIPENSERIDAE	LDTV		X	X			X	X
Atlantic sturgeon	ACIPENSERIDAE	LDTV							X
Banded killifish	CYPRINODONTIDAE			X	X	X	X	X	X
Channel darter	PERCIDAE	Vulnerable	Threatened					X	X
Logperch	PERCIDAE			X	X	X	X		X
Alewife	CLUPEIDAE			X		X		X	X
Northern pike	ESOCIDAE			X	X	X	X	X	X



Table 5 (Cont'd) Fish species found or likely to be found in the study area

FISH SPECIES FOUND OR LIKELY TO BE FOUND IN THE STUDY AREA									
SPECIES	FAMILY	SPECIAL STATUS		STUDY AREA (VILLE-MARIE ZIP)				UPSTREAM (HAUT-RICHELIEU ZIP)	DOWNSTREAM (JACQUES-CARTIER ZIP)
		PROVINCIAL	FEDERAL	ALL	GREATER LA PRAIRIE BASIN	LESSER LA PRAIRIE BASIN	LACHINE RAPIDS		
Lake whitefish	SALMONIDAE								X
Silver lamprey	PETROMYZONTIDAE			X	X			X	X
Lamprey	PETROMYZONTIDAE							X	X
Mooneye	HIODONTIDAE			X					X
Longnose gar	LEPISOSTEIDAE			X				X	X
Burbot	GADIDAE			X				X	X
Freshwater drum	SCIAENIDAE							X	X
Black crappie	CENTRARCHIDAE			X	X	X		X	X
Muskellunge	ESOCIDAE			X	X	X	X	X	X
Redfin shiner	CYPRINIDAE			X	X	X	X	X	X
Spotfin shiner	CYPRINIDAE			X				X	X
Silver minnow	CYPRINIDAE			X		X		X	X
Bridle shiner	CYPRINIDAE	Vulnerable	Of concern					X	X
Emerald shiner	CYPRINIDAE			X		X	X	X	X
Golden shiner	CYPRINIDAE					X	X	X	X
Sand shiner	CYPRINIDAE			X				X	X
Mimic shiner	CYPRINIDAE			X		X	X	X	X
Blackchin shiner	CYPRINIDAE			X			X	X	X
White sucker	CATOSTOMIDAE			X	X	X	X	X	X
Northern sucker	CATOSTOMIDAE			X	X		X	X	X
Creek chub	CYPRINIDAE			X			X	X	X
Pearl dace	CYPRINIDAE					X			X
Blacknose shiner	CYPRINIDAE							X	X
Longnose dace	CYPRINIDAE			X	X		X	X	X
Blacknose dace	CYPRINIDAE							X	X
Brook trout	SALMONIDAE			X			X	X	X
Arctic char	SALMONIDAE								X
Trout-perch	PERCOPSIDAE			X				X	X
Fallfish	CYPRINIDAE			X			X	X	X

Table 5 (Cont'd) Fish species found or likely to be found in the study area

FISH SPECIES FOUND OR LIKELY TO BE FOUND IN THE STUDY AREA									
SPECIES	FAMILY	SPECIAL STATUS		STUDY AREA (VILLE-MARIE ZIP)				UPSTREAM (HAUT-RICHELIEU ZIP)	DOWNSTREAM (JACQUES-CARTIER ZIP)
		PROVINCIAL	FEDERAL	ALL	GREATER LA PRAIRIE BASIN	LESSER LA PRAIRIE BASIN	LACHINE RAPIDS		
Yellow perch	PERCIDAE			X	X	X	X	X	X
Bowfin	AMIIDAE			X	X			X	X
Spottail shiner	CYPRINIDAE			X	X	X	X	X	X
Tesselated darter	PERCIDAE			X				X	X
Johnny darter	PERCIDAE			X	X	X	X	X	X
Atlantic salmon	SALMONIDAE								X
Coho salmon	SALMONIDAE			X			X	X	X
Chinook salmon	SALMONIDAE								X
River redhorse	CATOSTOMIDAE			X				X	X
Silver redhorse	CATOSTOMIDAE			X	X	X	X	X	X
Copper redhorse	CATOSTOMIDAE							X	X
Greater redhorse	CATOSTOMIDAE			X				X	X
Shorthead redhorse	CATOSTOMIDAE			X	X	X	X	X	X
Roseyface shiner	CYPRINIDAE	LDTV		X		X		X	X
Fathead minnow	CYPRINIDAE			X		X		X	X
Lake trout	SALMONIDAE							X	X
Rainbow trout	SALMONIDAE			X	X	X	X	X	X
Sea trout	SALMONIDAE			X	X	X	X	X	X
Cutthroat trout	SALMONIDAE			X			X		X
Central mudminnow	UMBRIDAE			X	X			X	X
Northern redbelly dace	CYPRINIDAE							X	X
Bluntnose minnow	CYPRINIDAE			X	X	X	X	X	X

Source: Armellin et al. (1994, 1995, 1997), Dumont et al. 2005, Ministère des ressources naturelles et de la faune – MRNF (Ministry of Natural Resources and Wildlife) (2011), Government of Canada, 2012

### 3.3.1.1 Lesser La Prairie Basin habitats

When characterization was carried in August 2012, the water level in the Lesser La Prairie Basin was nearly 2 m higher than in the Greater La Prairie Basin. There are 36 species from 12 families in the Lesser La Prairie Basin, (Armellin et al. 1997; see Table 5) and these are largely dominated by cyprinids, percidae and centrarchidae.

As stated above, the Lesser La Prairie Basin has a lentic flow and comprises three habitat types (figure 15). The substrate is fine-textured, there is little vegetation and the depth ranges from 2 to 5 m in over 63% (122,180 m<sup>2</sup>) of the area of this sector (see Figure 15). In the shallow areas, there are large aquatic plant communities (16,570 m<sup>2</sup>) such as the one along the south shore of the basin. This habitat is a favourable breeding zone for many phytolithophile species such as bass, perch and even some members of the carp family. The Seaway canal covers 25% of this sector. The canal is deeper (8.6 m) and is colonized, for the most part, by zebra mussels on a gravel substrate. Many fish were observed during characterization in the Seaway canal. These species include the American eel and the rosyface shiner, both likely to be designated threatened or vulnerable at the provincial level. It is possible that the passage of commercial vessels stirs up particles that attract certain invertebrates, including zebra mussels, which in turn attract fish in search of food.

### 3.3.1.2 *Greater La Prairie Basin habitats*

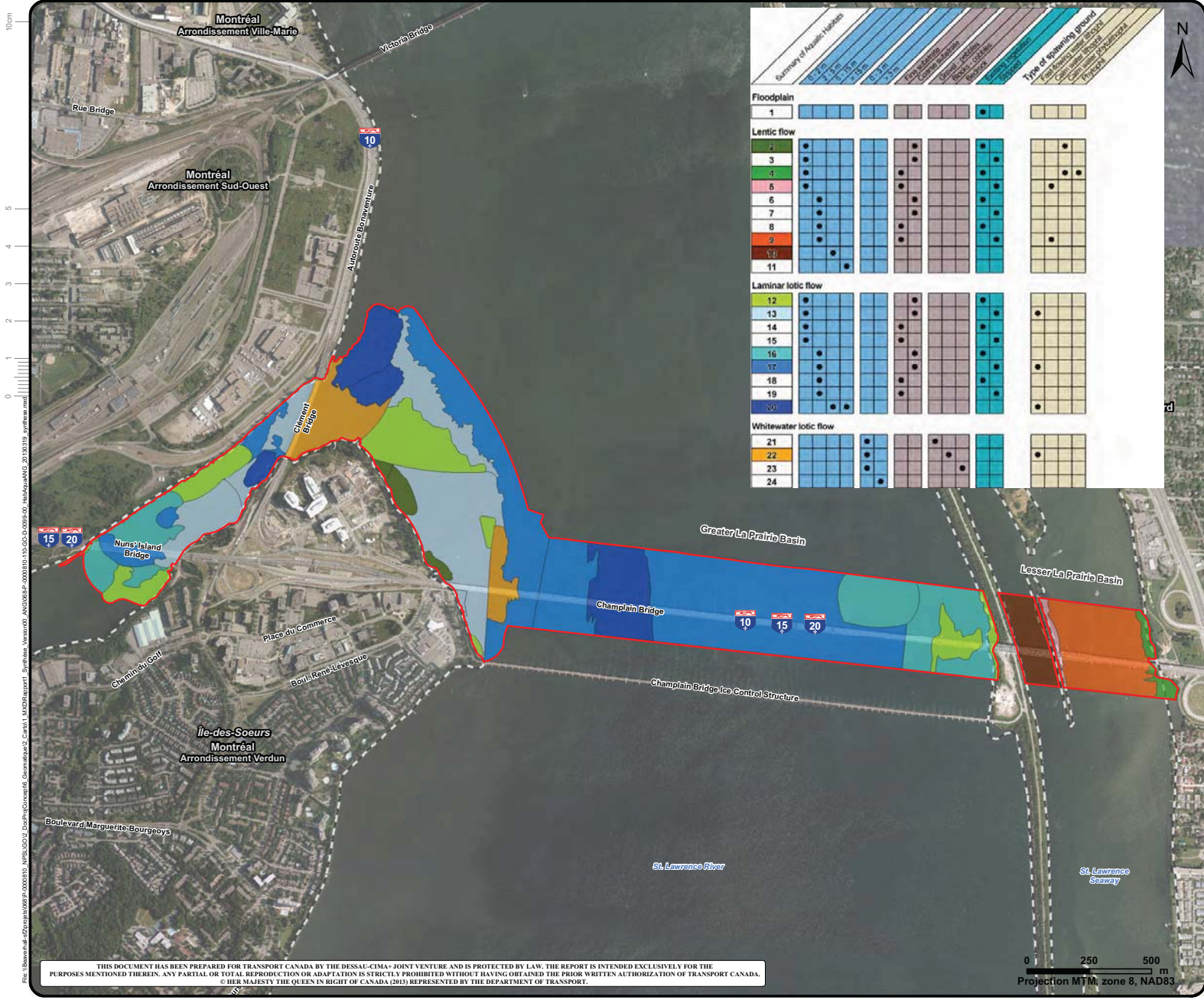
The Greater La Prairie Basin, including the channel between Nun's Island and the Island of Montreal, hosts 33 species among 15 families (Armellin et al. 1997; see table 5). The largest families are the percidae, followed by cyprinidae and centrarchidae. Among the species inventoried in the study area, the Lake sturgeon and the American eel are both likely to be designated threatened or vulnerable at the provincial level (table 5).

Approximately 50% of the Greater La Prairie Basin is composed of coarse substrate bare of vegetation, as is the central section extending under the Champlain Bridge (see figure 15). The depth of this sector, which presents a laminar water flow pattern, varies between 2 m and 15 m. Two areas along Nun's Island downstream from Clément Bridge are worthy of note. Effectively, the combination of coarse substrate, a depth of less than 3 m and the fast-flowing cross current has created two zones that are favourable spawning conditions for several fast-flowing water lithophile species such as walleye and catostomidae. There are also several areas of aquatic plant communities in the Greater La Prairie Basin including the South Shore, with a plant bed of approximately 178,360 m<sup>2</sup>. The channel between Nun's Island and Montreal contains a variety of intermingled habitats of varying depths (0 to 5 m) and vegetation density. This diversity has created a favourable feeding area for many fish species. Other areas of plant beds, where the current is slower, are found along Nun's Island, and serve as refuges, feeding areas and even spawning grounds for some phytolithophile species. Two especially deep sectors were also observed, one along Montreal Island and the other, smaller one, along the north shore of Nun's Island. These depressions were probably created artificially during backfilling work.

### 3.3.1.3 *Special status species*

Although they have not all been observed in the study area, there are five special status species that could potentially be found in that area. The American eel is a species of concern under the *Species at Risk Act*, while four species are protected under the Quebec's legislation (American shad, chain pickerel, lake sturgeon and rosyface shiner).





**Legend:**

- Bathymetric study area and surface substrate
- Municipal limit
- Borough limit

**SOURCES:**

- Aquatic habitats : Environnement Illimité inc., 2012
- Orthophotographs : © Montreal Metropolitan Community, 2005-2011



**Client:** Transport Canada / Transports Canada

**Project:** New Bridge for the St. Lawrence Environmental Assessment

**Title:** Figure 15 Summary of Aquatic Habitats

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SIZE 11x17



3.3.2 Wildlife and wildlife habitat

There are 15 to 20 species of mammals in the study area, consisting of species mainly associated with urban and peri-urban environments. No special-status species were sighted or inventoried. During the inventories in 2012, the presence of 13 species was confirmed (Table 6). These are common species for the most part, and most have adapted well to urban and somewhat open environments.

Table 6 Mammals sighted during study area inventories

FRENCH NAME	ENGLISH NAME	LATIN NAME	CONFIRMED PRESENCE			
			SOUTH SHOR	COUVEE ISLANDS AND DIKE	NUNS' ISLAND	MONTREAL
Léporidé sp.	Hare or Rabbit	<i>Leporidae sp.</i>	-	-	-	Feces
Marmotte commune	Woodchuck	<i>Marmota monax</i>	-	Burrow	Burrow	Burrow
Tamias rayé	Eastern Chipmunk	<i>Tamias striatus</i>	-	-	-	Individual
Écureuil gris	Gray Squirrel	<i>Sciurus carolinensis</i>	Individual	Individual	Individual	Individual
Écureuil roux	Red Squirrel	<i>Tamiasciurus hudsonicus</i>	-	-	Individual	-
Castor du Canada	American Beaver	<i>Castor canadensis</i>	-	Brout	-	-
Souris sylvestre	Deer Mouse	<i>Peromyscus maniculatus</i>	Nest (6 young)	-	-	Nest (5 young)
Campagnol des champs	Meadow Vole	<i>Microtus pennsylvanicus</i>	-	-	-	Individual
Rat musqué	Muskrat	<i>Ondatra zibethicus</i>	-	-	Individual	-
Renard roux	Red Fox	<i>Vulpes vulpes</i>	-	-	Individual	-
Raton laveur	Raccoon	<i>Procyon lotor</i>	Tracks	-	Individual	Tracks
Vison d'Amérique	American Mink	<i>Mustela vison</i>	-	-	Individual	-
Moufette rayée	Skunk	<i>Mephitis mephitis</i>	Tracks	-	-	Tracks

According to the Atlas of Amphibians and Reptiles of Quebec (AARQ 2011), 20 species of amphibians and 18 species of reptiles have been identified within a 5 km radius encompassing the study area. However, the species inventoried in the study area are less numerous. In fact, only the leopard frog (*Lithobates pipiens*), the mudpuppy (*Necturus maculosus*), the common garter snake

(*Thamnophis sirtalis*), the painted turtle (*Chrysemys picta*) and the brown snake (*Storeria dekayi*) were identified). Field inventories were carried out in the study area. Table 7 summarizes the inventory results and habitat potential.

In general, habitats suitable for amphibians are not common in the study area. Furthermore, data obtained from the Atlas of Amphibians and Reptiles of Quebec support this conclusion and confirm that there are few amphibian species in the study area.

Table 7 Summary of amphibian and reptile species inventoried and observed in the study area

ORDER	TYPICAL SPECIES	PRESENCE OF	POTENTIAL HABITAT
Anouuran	Frogs, toads and tree frogs	No species	Minimal presence outside wetlands near bridge.
Urodela	Salamanders	No species	Minimal presence.
Testudina	Turtles	No species	Not suitable due to rocky shores.
Squamata	Snakes	Common garter snake  ( <i>Thamnophis sirtalis</i> ), Red-bellied snake  ( <i>Storeria o. occipitamaculata</i> ) Brown snake  ( <i>Storeria d. dekayi</i> )	Habitat suitable, including fields and woodland edge as well as rocky banks of the St. Lawrence River, mainly on the Island of Montreal and Nuns' Island.

### 3.3.3 Migratory birds and their habitats

Previous studies have counted up to 254 bird species near the Champlain Bridge corridor. During inventories conducted for this project, 41 bird species were observed. They are, for the most part, species common to Quebec and representative of open urbanized environments (Table 8). Bird habitats observed are usually shrublands and abandoned fields. Deciduous groves are also suitable, mainly poplars, which make up the strip along the shore of the St. Lawrence River, and the water itself, mainly used by aquatic fauna.

In 2012 surveys, the greatest number of individuals was found in the Nun's Island sector (east and west), whereas the greatest number of breeding pairs was found on the Seaway canal dyke and in the western sector of Nun's Island. Lastly, the Brossard shore held the lowest number of individuals and breeding pairs.



### 3.3.3.1 Migratory bird sanctuary and other protected habitats

The study area is characterized by the presence of a migratory bird sanctuary, protected under federal jurisdiction, called "Couvée Islands" (IBA 2012). The Couvée Islands are located within the South Shore Canal along the south bank of the St. Lawrence River, between the Champlain and Victoria Bridges. The islands were created from sediment dredged from the canal. From 1970 to 1990, the largest island sheltered a significant colony of ring-billed gulls, with approximately 30,000 pairs counted, as well as a small number of herring gulls and common terns. Since then, the colony has been in continuous decline due in part to the presence of a family of red foxes (IBA 2012).

The study area also includes the Nun's Island La Prairie Basin waterfowl concentration area (habitat number: 02-06-0167). The principal species using this area, inventoried in the fall and spring, are dabblers, such as the American wigeon, the northern pintail, the mallard and the American black duck, as well as diving ducks such as the bluebill and the common goldeneye, in addition to the ring-billed gull.

Table 8 Bird inventory result per observed species

ENGLISH NAME	LATIN NAME	NUMBER OF INDIVIDUALS			NUMBER OF BREEDING PAIRS			BREEDING PAIRS / HECTARE
		June 5	June 20	Best result	June 5	June 20	Best result	
Canada goose	<i>Branta canadensis</i>	7	40	40	3.5	0	3.5	0.08
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	1	3	3	0	0	0	0.00
Song sparrow	<i>Melospiza melodia</i>	45	37	45	42	34	42	0.93
Swamp sparrow	<i>Melospiza georgiana</i>	1	0	1	1	0	1	0.02
Gadwall	<i>Anas strepera</i>	2	1	2	1	0,5	1	0.02
Mallard	<i>Anas platyrhynchos</i>	12	59	59	6	0	6	0.13
Northern cardinal	<i>Cardinalis cardinalis</i>	0	1	1	0	1	1	0.02
Red-winged blackbird	<i>Agelaius phoeniceus</i>	149	118	149	129.5	102	129.5	2.88
American goldfinch	<i>Spinus tristis</i>	2	13	13	2	12	12	0.27
Spotted sandpiper	<i>Actitis macularius</i>	0	1	1	0	0.5	0.5	0.01
Double-crested cormorant	<i>Phalacrocorax auritus</i>	1	1	1	0	0	0	0.00
American crow	<i>Corvus brachyrhynchos</i>	11	2	11	5.5	0	5.5	0.12
European starling	<i>Sturnus vulgaris</i>	29	159	159	10.5	4.5	10.5	0.23
Peregrine falcon <sup>1</sup>	<i>Falco peregrinus anatum</i>	1	3	1	1	0	1	0.02
Ring-billed gull	<i>Larus delawarensis</i>	98	69	98	2.5	5.5	5.5	0.12
Herring gull	<i>Larus argentatus</i>	9	0	9	0.5	0	0.5	0.01
Great black-backed gull	<i>Larus marinus</i>	2	1	2	0	0	0	0.00
Great blue heron	<i>Ardea herodias</i>	4	2	4	1.5	0	1.5	0.03
Great egret	<i>Ardea alba</i>	1	1	1	0	0	0	0.00

Table 8 (Cont'd) Bird inventory result per observed species

ENGLISH NAME	LATIN NAME	NUMBER OF INDIVIDUALS			NUMBER OF BREEDING PAIRS			BREEDING PAIRS / HECTARE
		June 5	June 20	Best result	June 5	June 20	Best result	
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	77	39	77	3.5	16.5	16.5	0.37
Tree swallow	<i>Tachycineta bicolor</i>	8	13	13	5	2.5	5	0.11
Cedar waxwing	<i>Bombycilla cedrorum</i>	74	12	74	50	11	50	1.11
Chimney swift <sup>1</sup>	<i>Chaetura pelagica</i>	2	0	2	1	0	1	0.02
American robin	<i>Turdus migratorius</i>	10	7	10	4	5.5	5.5	0.12
Gray catbird	<i>Dumetella carolinensis</i>	0	2	2	0	2	2	0.04
Baltimore oriole	<i>Icterus galbula</i>	3	5	5	2.5	3	3	0.07
Black-throated blue warbler	<i>Dendroica caerulescens</i>	3	0	3	2.5	0	2.5	0.06
American redstart	<i>Setophaga ruticilla</i>	0	1	1	0	1	1	0.02
Yellow warbler	<i>Dendroica petechia</i>	87	54	87	86	53.5	86	1.91
Common yellowthroat	<i>Geothlypis trichas</i>	1	1	1	1	1	1	0.02
Downy woodpecker	<i>Picoides pubescens</i>	1	2	2	0.5	2	2	0.04
Rock dove	<i>Columba livia</i>	7	3	7	3.5	1.5	3.5	0.08
Killdeer	<i>Charadrius vociferus</i>	1	0	1	1.5	0	1.5	0.03
Common grackle	<i>Quiscalus quiscula</i>	2	3	3	2	1.5	2	0.04
House finch	<i>Carpodacus mexicanus</i>	0	1	1	0	0.5	0.5	0.01
Common tern	<i>Sterna hirundo</i>	10	16	16	0	0	0	0.00
Mourning dove	<i>Zenaidura macroura</i>	2	0	2	1.5	0	1.5	0.03
Eastern kingbird	<i>Tyrannus tyrannus</i>	4	3	4	2.5	1.5	2.5	0.06
Brown-headed cowbird	<i>Molothrus ater</i>	2	0	2	2	0	2	0.04
Red-eyed vireo	<i>Vireo olivaceus</i>	2	2	2	2	2	2	0.04
Warbling vireo	<i>Vireo gilvus</i>	10	15	15	10	14.5	14.5	0.32
<b>Total</b>		<b>681</b>	<b>690</b>	<b>930</b>	<b>387.5</b>	<b>279.5</b>	<b>426.5</b>	<b>9.48</b>

1: Special status species (see Section 4.2.2.4 for more detail)

### 3.3.4 Special status flora and fauna species

Some special status flora and fauna species were observed in the study area. The tables below identify the species that have been either listed or inventoried and indicates their legal status in Quebec and Canada.

Table 9 CDPNQ list of occurrences of special status plant species and possible use of study area based on habitat availability

VERNACULAR NAME (LATIN NAME)	OCCURRENCE	STATUS IN CANADA*	STATUS IN QUEBEC **	HABITAT	HABITAT AVAILABLE IN STUDY AREA
Green dragon ( <i>Arisaema dracontium</i> )	1	SC	T	Floodplains, natural high-water mark, silver maple stands and red ash, reed phalaris alluvial meadows	YES
American water-willow ( <i>Justicia americana</i> )	1	T	T	Stream and pond banks on gravel, sand or organic matter substrate. Prefers hard water, i.e., rich in dissolved carbonates and bicarbonates, soil rich in organic matter and swift currents	YES
Downy wildry ( <i>Elymus villosus</i> )	1	-	LDTV	Open, rocky woodlands, shores	YES
Common hackberry ( <i>Celtis occidentalis</i> )	1	-	LDTV	Tolerant deciduous forest in rich, cool limestone soil, gravel or rocky riparian gradients, steep banks; calcicole	YES
Switchgrass ( <i>Panicum virgatum</i> )	1	-	LDTV	Dry shores and alluvial deposits	YES
St. Lawrence waterhorehound ( <i>Lycopus americanus var. laurentianus</i> )	2 (2012 inventory)		S	Shorelines and shingle beaches	YES
Rough waterhorehound ( <i>Lycopus asper</i> )	7(2012 inventory)		S	Shorelines	YES

\* Status in Canada: SC: Special Concern, T: Threatened, E: Endangered

\*\* Status in Quebec: V: Vulnerable, LDTV: Likely to be Designated Threatened or Vulnerable, T: Threatened

Table 10 List of special status species listed by the CDPNQ and identified in the inventories

	ENGLISH NAME	LATIN NAME	STATUS		OBSERVATIONS	
			Provincial	Federal	CDPNQ <sup>1</sup>	2012
Amphibians and reptiles	Chorus frog	<i>Pseudacris triseriata</i>	Vulnerable	Threatened	X	
	Pickerel frog	<i>Lithobates palustris</i>	LDTV	Not at risk	X	
	Spiny softshell	<i>Apalone spinifera</i>	Threatened	Threatened	X	
	Map turtle	<i>Graptemys geographica</i>	Vulnerable	Special concern	X	
	Ringneck snake	<i>Diadophis punctatus</i>	LDTV	None	X	
	Milk snake	<i>Lampropeltis triangulum</i>	LDTV	Special concern	X	
	Brown snake	<i>Storeria dekayi</i>	LDTV	Not at risk	X	
	Smooth green snake	<i>Opheodrys vernalis</i>	LDTV	None	X	
Birds	Least bittern	<i>Ixobrychus exilis</i>	Vulnerable	Threatened	X	
	Bald eagle	<i>Haliaeetus leucocephalus</i>	Vulnerable	Not at risk	X	
	Tundra peregrine falcon	<i>Falco peregrinus anatum</i>	Vulnerable	Special concern	X	X
	Yellow rail	<i>Coturnicops noveboracensis</i>	Threatened	Special concern	X	
	Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	Threatened	Threatened	X	
	Grasshopper sparrow	<i>Ammodramus savannarum</i>	LDTV	None	X	
Fish	Bridle shiner	<i>Notropis bifrenatus</i>	Vulnerable	Special concern		X
	Lake sturgeon	<i>Acipenser fluvescens</i>	LDTV	None	X	
	Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	LDTV	None	X	
	River redhorse	<i>Maxostoma carinatum</i>	Vulnerable	Special concern	X	
	Copper redhorse	<i>Maxostoma hubbsi</i>	Threatened	Endangered	X	
	Longear sunfish	<i>Lepomis megalotisi</i>	LDTV	None	X	
	American shad	<i>Alosa sapidissima</i>	Vulnerable	None	X	
	American eel	<i>Anguilla rostrata</i>	LDTV	Special concern	X	
	Stonecat	<i>Noturus flavus</i>	LDTV	None	X	
	Channel darter	<i>Percina copelandi</i>	Vulnerable	Threatened	X	
	Chain pickerel	<i>Esox niger</i>	LDTV	None	X	
	Grass pickerel	<i>Esox americanus vermiculatus</i>	LDTV	Special concern	X	
	Rainbow darter	<i>Etheostoma caeruleum</i>	LDTV	None	X	
	Rosyface shiner	<i>Notropis rubellus</i>	LDTV	None	X	
Mollusk	Spike	<i>Elliptio dilatata</i>	LDTV	None	X	
	Elephantear	<i>Elliptio crassidens</i>	LDTV	None	X	

\* Status in Canada: SC: Special Concern, T: Threatened, E: Endangered; NA: not at risk for COSEWIC, NE: not evaluated

\*\* Status in Quebec: V: Vulnerable, LDTV: Likely to be Designated Threatened or Vulnerable, T: Threatened

<sup>1</sup> CDPNQ observations are listed in an 8 km radius comprising the study area.

### 3.3.5 Key issues of the biological environment

Although effects and mitigation measures will be covered in the next report, this section provides an overview of the highlights of the environmental components and the factors to be considered in the next steps of the project.

#### 3.3.5.1 *Flora*

During the planning phase for construction work, the location of the St. Lawrence waterhorehound and the rough water-horehound should be taken into account. As far as possible, these specimens should be protected from impact. If this is unavoidable, that impact should be minimized by, for example, transplanting the specimens outside the construction zone. These species are perennials.

Consideration should also be given to renaturalizing the natural environments disturbed by the work carried out on the shore and at the shoreline. Indigenous plant species must be available for renaturalization work to move ahead quickly with seeding and planting in order to prevent invasive species from colonizing the area.

#### 3.3.5.2 *Fish and fish habitat*

The study area possesses a range of habitats used by as many as 67 fish species, including 5 special status species. The spawning grounds in the fast-flowing water near Nun's Island and the aquatic plant communities in the study area are the habitats with the greatest potential. The spawning grounds are used in April and May while the plant beds are used year round for spawning, rearing and feeding. Limiting work in water, and respecting the crucial spring spawning periods are two measures planned to mitigate the impact of the work. In the event of permanent encroachment, compensatory measures will be proposed.

#### 3.3.5.3 *Amphibians, reptiles and their habitats*

The presence of the brown snake (*Storeria dekayi*) is the sole noteworthy element with regard to reptiles. This species, whose home range is limited, was surveyed at the stations on Nun's Island, Montreal Island and on the Seaway dyke. Suitable habitats are plentiful (abandoned fields and woodland borders). No hibernation site was confirmed in the area inventoried, but there are rock piles that could be used for hibernation. The brown snake is likely to be designated threatened or vulnerable in Quebec under the Act respecting threatened or vulnerable species (R.S.Q, c. E-12.01). However, based on the COSEWIC assessment, it is not considered endangered in Canada. If necessary, capture and relocation of individuals in suitable habitats unaffected by the work in the study area may be considered as has been done in other projects

#### 3.3.5.4 *Birds and their habitats*

One species is worth mentioning, the peregrine falcon was observed during inventories and nests on the existing bridge. This species is designated vulnerable in Quebec and has the status of a

species of special concern in Canada (Appendix 1 of the Species at Risk Act). The peregrine falcon may nest as early as the beginning of April and egg incubation and rearing of the young in the nest takes approximately 75 days. Nesting monitoring, setting a restricted radius of 250 m around the nest and relocation of the artificial nesting box are among the measures being considered to mitigate the impact of the project.

Lastly, for work carried out within the migratory bird sanctuary on Couvée Island, a permit from the federal environmental authorities will have to be obtained beforehand in accordance with the Migratory Birds Convention Act, 1994 and the Regulations Respecting the Protection of Migratory Birds C.R.C., c. 1036).

### 3.4 GENERAL DESCRIPTION OF THE HUMAN ENVIRONMENT

The study area is located in the city of Montreal's boroughs of Sud-Ouest and Verdun — the borough of Verdun, it should be noted, includes Nuns' Island — and in the city of Brossard. Both cities are part of the Montreal Metropolitan Community. Demographic data on the territories are presented in table 11, along with those of the agglomeration of Montreal and the Montréalégie region.

Table 11 Overview of the main features of the human environments in the study area

		BOROUGH OF SUD-OUEST	BOROUGH OF VERDUN	MONTREAL AGGLOMERATION	CITY OF BROSSARD	MONTÉRÉGIE
Population (2011)		71,546	66,158	1,886,481	79,273	1,456,743
Density (inhab./km <sup>2</sup> )		4,562	6,809	3,779	1,753	129
Age group	0-19	18.8	18.0	20.7	21.6	23.5
	20-39	35.3	32.2	30.3	26.6	23.9
	40-59	27.7	28.9	27.8	28.6	30.7
	60-79	17.4	16.9	16.3	19.7	18.1
	80+	3.5	4.2	4.8	3.2	3.5
Average number of persons per household		2.1	2.0	2.2	2.7	2.4
Educational attainment (at least one diploma)		71%	80%	79%	83%	76%
Average personal income (\$)		26,151	36,407	32,970	26,326	26,967
Employment rates (%)		54	57	58	61	64

The residential area designation covers the largest portion of the study area but some other designation may be encountered. Figure 8 presents the various land uses and infrastructure found in the study area.

Housing stock in the Sud-Ouest and Verdun boroughs consists principally of apartments while Brossard is mainly detached and semi-detached.

The study area includes several segments of bike paths. The bike paths affected by the project are part of the #1 and #5 Route Verte (Green Route), the network of the City of Montreal and South Shore bike paths. In total, seven bike paths will be directly affected by the project.

The City of Montreal drinking water intake in the Aqueduct Canal is located inside the study area, while the Le Royer plant water intake in Longueuil is located more than 2 km downstream of the project.

### 3.4.1 Aboriginal communities

There is one Aboriginal community in the study area: Kahnawake, which is located about 10 kilometres southwest of the New Bridge for the St. Lawrence right-of-way. Specifically, it is located on the south shore of Lake St-Louis, west of the Honoré-Mercier Bridge, north-east of the City of Châteauguay. The reserve covers an area of approximately 55 square kilometres.

### 3.4.2 Navigation

#### 3.4.2.1 Seaway

The Great Lakes St. Lawrence Seaway System is a deep-draught waterway extending 3,700 km from the Atlantic Ocean to the head of the Great Lakes. The St. Lawrence Seaway portion of the System extends from St. Lambert (upstream of Montreal) to Lake Erie. The Seaway includes 13 Canadian and 2 U.S. locks.

Annual commerce on the Seaway exceeds 50 million metric tonnes. Almost 25% of the Seaway's traffic travels to and from overseas ports, primarily in Europe, the Middle East and Africa.

The ships transiting the St. Lawrence Seaway are required to adhere to certain requirements, as set out in Table 12.

Table 12 Requirements for ships transiting the Seaway

MAXIMUM BEAM	MAXIMUM LENGTH	MINIMUM LENGTH	TIRANT D'EAU MAXIMAL	MINIMUM WEIGHT	MAXIMUM HEIGHT
23.2 m	222.5 m	6 m	79,2 dm	900 kg	35.5 m above water level

Source: Joint practices and procedures respecting the transit of ships on the St. Lawrence Seaway (2012)<sup>3</sup>

<sup>3</sup> [http://www.media-seaway.com/seaway\\_handbook/seaway-handbook-fr/reglements.pdf](http://www.media-seaway.com/seaway_handbook/seaway-handbook-fr/reglements.pdf)

Each year, the St. Lawrence Seaway records over 4,000 vessel movements, the majority carrying mining products (Table 13). Pleasure craft also transit the Seaway. These craft must also meet transit requirements (Table 12).

Table 13 Commercial vessel and pleasure craft traffic

YEAR	COMMERCIAL VESSELS	PLEASURE CRAFT
2011	2,889	2,306
2010	2,631	2,201
2009	2,273	2,349
2008	2,664	2,129
2007	2,824	2,369
Average	2,656	2,271

Table 14 Commercial traffic, Montreal-Lake Ontario section

TYPE OF VESSEL		VESSEL TRANSITS	CARGO TONNES		
			Mining commodities	Agricultural commodities	Processed commodities
Ocean	Cargo	511	13,497,350 (47%)	8,303,839 (28.9%)	6,920,355 (24.1%)
	Barge	2			
	Tanker	226			
Laker	Cargo	1,135			
	Barge	327			
	Tanker	276			
Non-cargo		470			
Passenger		53			
TOTAL		3,000	28,721,544 tonnes (100%)		

Source: The St. Lawrence Seaway 2011 Traffic Report (SLSMC, 2011)

According to information obtained from the St. Lawrence Seaway Management Corporation, over the last eight years, there has been only one incident in the section between the Côte Sainte-Catherine and Saint-Lambert locks. A vessel struck bottom owing to excessive speed (St. Lawrence Seaway Management Corporation, September 24, 2012).

### 3.4.2.2 Greater and Lesser La Prairie Basins

Given the shallow water and strength of the current, the La Prairie Basins are not open to navigation and charted. However, Canadian Coast Guard hovercraft, Saute-Moutons Inc. jet boats and dozens of motor launches operate in this sector of the river. Canadian Coast Guard and Saute-Moutons vessels navigate under the Champlain Bridge and under the ice control structure,



approximately at the middle of these structures because the three central piers of the ice control structure are spaced further apart than the other piers. Other vessels that navigate under the Champlain Bridge in these sectors do so by drawing primarily on local navigation knowledge. On the Lesser La Prairie Basin, pleasure boating mainly uses the Seaway channel to cross the study zone.

### 3.4.2.3 *Fishing and nautical activities*

In addition to pleasure craft, water activities such as kayaking, canoeing, rabascaw, windsurfing, water skiing and sport fishing were identified in the study area. The Champlain Bridge Park in Brossard has been identified as an excellent location for windsurfing. Figure 8 presents the main sectors for boating and sport fishing.

## 3.4.3 **Sound environment**

A number of sensitive areas were identified within the three following areas

- ▶ **City of Montreal (three areas);**
  - Area 1 is located between Atwater Avenue and Mullin Street (Argenson Park and residential use);
  - Area 2 is located north of the highway axis, between Reading Street on the west and Wellington Street on the east (residential use);
  - Area 3 is located between LaSalle Boulevard and extends as far as the Nuns' Island Bridge (Mgr. Richard High School and residential use).
- ▶ **Nuns' Island: (1 area);**
  - Area 4: located on the north shore of the island (residential and commercial use);
- ▶ **City of Brossard: (3 areas);**
  - Area 5 is located on the south side of the axis for highways 10/15/20, between the river and the axis for Highway 15/Route 132 (residential use);
  - Area 6 is located south of the axis for highways 10/15/20, on Tisserand Avenue, Turgeon Crescent and Tchad Place (residential use);
  - Area 7 is located north of Highways 10-15-20, between Highway 20 on the west and Pinard Street on the east (residential use).

The modeling of the current sound environment has targeted three sectors as being more at risk of having a negative potential impact. They consist of:

- ▶ A few homes on Turenne Street in Brossard located near the Route 132 off-ramp toward Highway 10 southbound;
- ▶ Most homes on Voltaire Street in Brossard and a few homes on Van-Dick Street near the Highway 10 off-ramp northbound toward Route 132 east and west;
- ▶ Homes in Montreal located between De La Poudrière Street and Highway 15/20 between Wellington Street and LaSalle Boulevard.

## 3.4.4 Heritage resources

The study area contains sites of prehistoric and historic archaeological interest (Table 14). Only the sector on the eastern edge of Nuns' Island contains known prehistoric sites, i.e. BiFj-1 and BiFj-49.<sup>4</sup> 21 currently known prehistoric archaeological sites are in the immediate vicinity of the study area, which indicates more intensive occupation over the past three to four thousand years.

Three historic archaeological sites are within the study area. The Nuns' Island area directly affected by the future work holds one historical archaeological site (BiFj-1: Le Ber site) that is extremely important due to its uniqueness in the Montreal area. The two other sites, located in the Verdun (BiFj-78) and Sud-Ouest (BiFj-35) boroughs will not be appreciably affected by the project.

The South Shore contains no known site.

Table 15 Known archaeological sites in the study area

BORDEN CODE	LOCATION	DISTANCE FROM PROJECT (KM)	CULTURAL AFFILIATION
BjFj-1	Le Ber site, Nuns' Island	0	Prehistoric (Middle and Late Woodland); Euro-Quebec, 17 <sup>th</sup> and 18 <sup>th</sup> centuries
BiFj-35	Maison Saint-Gabriel	0.5	Euro-Quebec (1608-1950)
BiFj-49	Le Ber site, northern tip of Nuns' Island	0	Prehistoric (Archaic, Middle and Late Woodland); Euro-Quebec, 17 <sup>th</sup> and 18 <sup>th</sup> centuries
BiFj-78	Verdun Dyke	0.1	Euro-Quebec (1800-1950)

In light of past disturbance and the nature of the soil, the archaeological potential is considered low for the affected sectors of Montreal. On Nun's Island, known sites indicate archaeological potential along the new route of René-Lévesque Boulevard. The same is true near site BiFj-78 and near the Aqueduct Canal in the Borough of Verdun.

The current area of Brossard where the right of way for the new bridge and the access roads is located holds historical archaeological potential associated solely with an agricultural occupation dating back to the 19<sup>th</sup> century.

## 3.4.5 Aesthetic and visual aspects

The Champlain Bridge has been an icon of the Montreal landscape. For users, it provides an eloquent gateway that introduces the city's morphology, with the business centre and Mount Royal as the backdrop.

<sup>4</sup> Canadian archaeological sites are assigned an alphanumeric code number, referred to as a Borden Site Number, used to identify findspots.

The study area has four landscape units whose boundaries are broadly determined by the presence of the St. Lawrence River:

Landscape unit 1, gateway to the city of Brossard. This unit has two sub-units: the suburb and the shore. The suburb sub-unit is an essentially homogenous bedroom community on both sides of the bridge and Highway 10. The "shore" sub-unit is heterogeneous urban environment that is in a state of transformation; it fronts the Lesser La Prairie Basin.

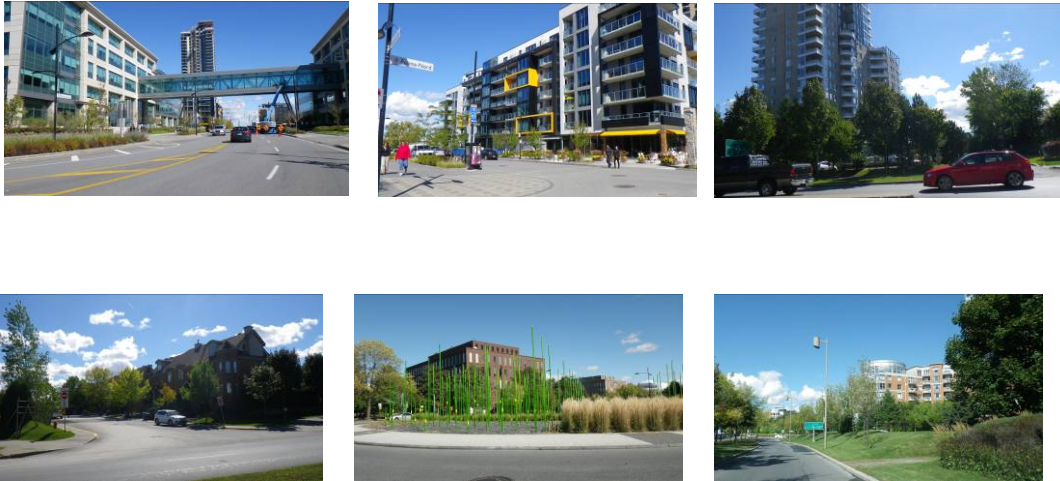


Landscape unit 2, the river is a landscape sequence that is emblematic of the nature of the Island of Montreal. The existence of the bridge and traffic across it attest to this.



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Landscape unit 3, Nuns' Island is divided into two sub-units because of the diverse uses to each side of the bridge. The southern part is dominated by a homogeneous low-density residential area, while the northern part is currently developing, with mixed uses and imposing large-scale and high-density bungalow developments.



Landscaping unit 4, gateway to the city of Montreal, includes three landscape sub-units, distinguished by their uses and the historical nature of the built environment. Overall, the unit is divided into three strips:

- The first, riverfront strip includes industrial, commercial and recreational uses.



- The second, middle strip is defined by an urban residential heritage area, the residential neighbourhood.



- The final, westernmost strip includes mixed uses around the Lachine Canal, an area dominated by industrial uses and a residential redevelopment in the vicinity of the Atwater Market.



## 3.4.6 Key issues of the human environment

Although effects and mitigation measures will be covered in the next report, this section provides an overview of the highlights of the environmental components and the factors to be considered in the next steps of the project.

### 3.4.6.1 Navigation

The elements to be considered for the Seaway are essentially obtaining the authorization by the St. Lawrence Seaway Management Corporation for work above the Seaway during the navigation season and the positioning of the new infrastructure's piers on each side of the Seaway.

For construction purposes, a technical response protocol should be developed so that an agreement on work during the navigation season can be established with the St. Lawrence Seaway Management Corporation. Concerning the location of the piers, it will be important to ensure that their installation does not affect the water-tightness of the dike and that it does not reduce the width of the current template.

With regard to river navigation, some elements to be considered include the limited knowledge of hydraulic conditions to the right of the bridge; these conditions could be altered by the presence of new piers and the removal of existing piers. The new arrangement of piers (existing and future) could also impact the sedimentary regime (erosion / sedimentation), the position and depth of the channels, and the ice regime, to say nothing of the negative impacts on navigation. These elements should be given particular attention during the next steps in the project.

Recreational boating could be maintained while work is being carried out but will require an information campaign targeting organizations and users and conducted in co-operation with the relevant authorities, as well as the application of strict navigation measures and the co-operation of monitoring and enforcement agencies to ensure the safety of boaters and workers.

### 3.4.6.2 *Recreational/tourist activities*

Like recreational boating, sport fishing could be maintained during construction but will require an information campaign targeting fishers, conducted in co-operation with the relevant authorities, as well as strict navigation measures and the co-operation of monitoring and enforcement agencies to ensure the safety of boaters and workers.

The project could result in the closure of some bike paths for fairly long periods of time, and the temporary or permanent relocation of some paths. Particular attention will have to be paid to keeping bike paths open during construction.

### 3.4.6.3 *Sound environment*

Ambient noise has been measured for different periods within various sensitive areas. Survey results, combined with traffic counts for the same periods, served to calibrate a computer model used to evaluate the configurations of current and planned roads. The results of the traffic noise simulations will be calculated based on average summer traffic flows. The project's sound impact will be determined in this fashion in each noise-sensitive area, making it possible to locate places where noise-abatement measures may need to be implemented.

### 3.4.6.4 *Heritage resources*

Four archaeological sites have been inventoried in the project footprint and areas of archaeological potential have been defined in a preliminary fashion at this stage of the project. The identification of the areas of potential makes a pre-construction archaeological inventory necessary during the next stages of the project; this will allow archaeologists to verify the presence of soil that is undisturbed by land use and the construction of the Champlain Bridge and to search for any archaeological indicators.

### 3.4.6.5 *Aesthetic and visual aspects*

The river shapes the landscape, allowing sweeping, open perspectives of the structures from the city and, conversely, of the city from the highway. With this in mind, two fundamental objectives should be considered, which are:

- ▶ The need to maintain the views of Montreal from the bridge;
- ▶ A concern for developing an infrastructure design process that ensures that infrastructure contributes in a positive way to the quality of the landscape composition of Montreal and its surrounding area.

Furthermore, the environments and landscapes already exist in a compromise with the proximity of the transportation route that crosses them. It is likely that local residents have become used to the situation over the past two generations. The Champlain Bridge is a landmark feature of the landscape. However, replacing the bridge provides an opportunity to strengthen the urban

integration by developing the approaches adequately and introducing civil engineering structures that ensure greater connectedness with the residential areas. Lastly, a number of strategic viewpoints should be taken into consideration in the project, including those from the bike path (the ice control structures, for example) and from the parks in Brossard and Montreal. The contexts of Montreal and Nuns' Island suggest that particular attention should be paid to integrating the infrastructure (site design and civil engineering structures) in order to enhance living environments that are very different but highly valued.





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