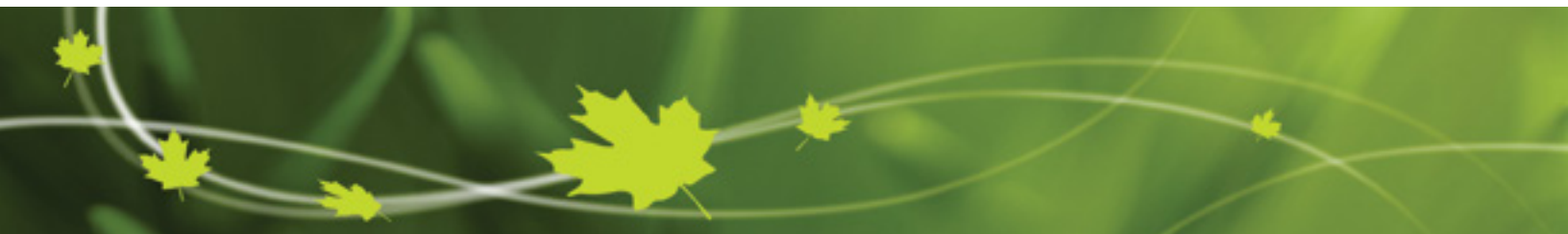




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Riparian Revegetation Project Planning and Submission Guide

Under Community Action Programs for the Environment
Environment Canada, Quebec Region

January 2013



Canada 

This guide is based on the experience acquired by Terraformex in planning, implementing and supervising environmental projects; the experience of Environment Canada's funding program team in the Quebec Region; and the results of many riparian revegetation projects carried out over the past 10 years.

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1. Why and how to use this guide

1.1. Is the guide intended for you?

This guide is primarily intended for

- community environmental groups
- riparian landowner associations
- riparian organizations
- partners

In other words, this guide is addressed to groups eligible for funding for a riparian revegetation project under Environment Canada's funding programs.¹ This guide **complements Environment Canada's official guides**.

1.2. Why this guide is useful

This guide is designed to **help proponents of revegetation projects prepare applications for funding**. It provides a **process** for preparing a funding application, along with **relevant information and references** on riparian revegetation projects.

This guide will help proponents

- **Improve the choice and quality of the information** they provide in the funding application form
- **Collect and structure relevant information** that can contribute to the success of the project
- **Obtain quantifiable environmental benefits** directly connected with performance indicators specific to the selected funding program
- **Promote a better match** between investment and environmental benefits

1.3. How to use this guide

Section 2 provides a list of the steps involved in preparing a riparian revegetation project. Relevant cross-references found elsewhere in the document are indicated in the right-hand column of the tables in Section 2 below. Readers are therefore advised to read the referenced information in the guide to enhance their understanding. Doing so will ensure you cover all **important elements** in the funding application form and its appendices.

Less experienced proponents are advised to read through the guide and become familiar with the reference documents listed in Chapter 10. It is recommended that you work through this learning process before preparing your funding application.

2. Preparing your project

You should start planning your project a few months before the proposal submission deadline. This will allow you the time you need to ensure your partners buy into the project. You are advised to refer to the target program guide.

A logical process for preparing your funding application is outlined in the table below. This planning tool is divided into two blocks. If there are any steps that do not apply to your situation, simply move on to the next step.

Block 1 – Preparing Your Funding Application

Block 2 – Best Practices for Riparian Revegetation

Block 1 outlines an effective step-by-step process for structuring your project. Block 2 is useful for planning your planting activities. Good planning is essential for determining the financial cost of field activities, the main part of the budget. Blocks 1 and 2 are interdependent. While reading through Block 1, you may at times need to refer to Block 2 and other sections in the guide.

1. For further information on Environment Canada's funding programs, visit www.ec.gc.ca under the Funding tab or contact an officer at 1-800-463-4311.

BLOCK I – Preparing Your Funding Application

Basic Questions	Choices and Actions	Section in Guide / Reference
<p>1. You become aware of an environmental problem involving a lake or watercourse and related components. What exactly is at issue?</p> <ul style="list-style-type: none"> • blue-green algae • shoreline erosion • loss of riparian and aquatic biodiversity • intensive agriculture • new urban development • other 	<ul style="list-style-type: none"> • Obtain and analyze information from shoreline residents, community representatives or specialists who reveal situations involving poor water quality and the degradation of the aquatic ecosystem at one or more target sites. • Read and understand Quebec's Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains (PPRLPI). • Visit the site to confirm initial concerns. Take photos and notes. • Discuss the problem with regional specialists (DFO, MDDEFP and MRN representatives, university researchers) to validate or refute the issue. • Assess municipal bylaws governing riparian strips (contact the person responsible for watercourses at the RCM). Only projects in riparian areas not covered by municipal bylaws are eligible for funding under the program. • Read and understand Environment Canada's official guide for the targeted funding program. Contact the program officer if necessary. 	<p style="text-align: center;">–</p> <p style="text-align: center;">MDDEFP (2007a)</p> <p style="text-align: center;">–</p> <p style="text-align: center;">–</p> <p style="text-align: center;">11.3</p> <p style="text-align: center;">7.3</p>
<p>2. Ask yourself whether the riparian strip is degraded.</p>	<ul style="list-style-type: none"> • Is the environmental problem completely or partially connected with a degraded or non-existent riparian strip? • After preliminary analysis, determine what might have caused the degradation of the aquatic environment. • Draft an initial description of the environmental problem and the issue, ideally a one- or two-page summary. • Would the revegetation project include stabilization works below the high water mark? If so, make sure you are aware of the complexity and high cost of such work (soil bioengineering, riprap, etc.). 	<p style="text-align: center;">11.1</p> <p style="text-align: center;">11.2 and Gagnon (2007)</p> <p style="text-align: center;">3.1</p> <p style="text-align: center;">11.3</p>
<p>3. Is your project eligible for funding under Environment Canada's funding programs (EcoAction, Community Interaction, etc.)?</p>	<ul style="list-style-type: none"> • Does the long-term environmental restoration of the target ecosystem involve one or more of the objectives of the project? • Contact a program officer two to three months before the project submission deadline to discuss the environmental problem, the restoration objective and the planned activities. • Study the program officer's recommendations and incorporate them into your funding application. 	<p style="text-align: center;">3.2</p> <p style="text-align: center;">7.3</p> <p style="text-align: center;">–</p>

BLOCK I – Preparing Your Funding Application

Basic Questions	Choices and Actions	Section in Guide / Reference
4. Is your project located along an eroding shoreline or on a floodplain ?	<ul style="list-style-type: none"> • If a site visit shows there is no eroding shoreline or floodplain, go to question 5. • If signs of erosion are visible, but only in small areas on the shoreline, and no intervention is required, go to question 5. • If the erosion observed requires stabilization work below the high water mark, describe the environmental problem caused by the shoreline erosion and the riparian vegetation. • Determine the relevance of revegetating the shoreline if there is a substantial risk of erosion on the lower part of the bank. Riparian revegetation is probably not the right solution for controlling erosion. • Is the project on a floodplain? If the project is located on a plain that is flooded fairly regularly in spring, locally appropriate sustainable intervention is called for. 	<p style="text-align: center;">–</p> <p style="text-align: center;">–</p> <p style="text-align: center;">11.3</p> <p style="text-align: center;">11.3</p> <p style="text-align: center;">11.3</p>
5. The environmental problem has been confirmed and the solution or one of the potential solutions is riparian revegetation.	<ul style="list-style-type: none"> • Locate the watershed and target the sources of disturbance as well as the project area on a map (<i>Google Earth</i>). • Characterize the riparian strip to expand upon the environmental problem using valid data. Measure the areas to be revegetated. Locate the project in the context of the watershed. Prepare fact sheets for each project site. • Identify vegetation in undisturbed riparian strips near the project area in order to select species for the revegetation work. • Locate areas to be revegetated on a map and identify priority riparian stretches, indicating why they were selected. 	<p style="text-align: center;">5</p> <p style="text-align: center;">6</p> <p style="text-align: center;">6</p> <p style="text-align: center;">5</p>
6. Get ready to draft your funding application.	<ul style="list-style-type: none"> • Draft a summary of the project including the following four elements: 1) the environmental problem, along with the origin or causes of the problem; 2) the objective of project; 3) the activities required to implement the project; and 4) a realistic schedule. Later, once the characterization is complete, provide data in support of the project. • Identify potential partners and draw up a list. • Select at least one of the environmental indicators in the list provided as part of the target program and quantify the environmental benefits of your project. • Refer to the appropriate Environment Canada guide to ensure you comply with administrative aspects of the funding application. • Have the summary reviewed by appropriate area specialists and the program officer, ideally at least one and a half months before the application deadline. 	<p style="text-align: center;">3.1 to 3.4</p> <p style="text-align: center;">7</p> <p style="text-align: center;">4</p> <p style="text-align: center;">–</p> <p style="text-align: center;">–</p>

BLOCK I – Preparing Your Funding Application

Basic Questions	Choices and Actions	Section in Guide / Reference
7. Confirm your partnerships.	<ul style="list-style-type: none"> • Contact your potential partners and forward the project summary to them. 	7.2
	<ul style="list-style-type: none"> • Make every effort to obtain a maximum number of letters confirming partner participation. Obtain in writing the value of their contribution and a description of the goods and services they will contribute to the project. 	–
	<ul style="list-style-type: none"> • Obtain written authorization from riparian landowners. 	7.5
	<ul style="list-style-type: none"> • Follow up personally with partners and landowners to confirm that they submitted their partnership letters. 	–
	<ul style="list-style-type: none"> • Conduct a realistic assessment of the proponent's contribution. Ensure it accounts for the organization's actual capacity to contribute to the project and presents fair market and cash value of contributions in goods and services, specifically the salaries paid to employees by the proponent. 	7.4
8. Prepare a work plan for each project activity and a more detailed plan for the revegetation work.	<ul style="list-style-type: none"> • What needs to be done to achieve the project objective? Select and describe the project activities. Provide a detailed description of revegetation activities (see example in guide). 	3.3
	<ul style="list-style-type: none"> • Prepare a project schedule in table format. Be careful to ensure the project start-up date coincides with a realistic date for the signing of the financial contribution agreement. 	3.4
	<ul style="list-style-type: none"> • If necessary, design an awareness program that is adapted to the target area and clients, supports the project objective and ensures the sustainability of revegetation efforts. 	7.6
9. Prepare a detailed budget for the project, ideally by activity.	<ul style="list-style-type: none"> • Prepare an activity-specific budget, placing the focus on revegetation-related activities (the most important section). The project budget is primarily based on the following items: 	
	1. Revegetation approach	8.1, 8.2, 8.6, 9.1 and 9.2
	2. Difficulty accessing project sites	–
	3. Plant purchases (quantity, size and type)	8.3 to 8.5
	4. Cost of awareness campaign	7.6
	5. Budget for maintaining and replacing dead plants in the years following planting	9.3 and 9.4
	6. Other project-related costs (administration, communications, environmental precautions, etc.)	7.6 and 9.6
	<ul style="list-style-type: none"> • Indicate all amounts in cash and in kind (goods and services). • Balance revenues and expenses both in cash and in kind. 	– –

BLOCK I – Preparing Your Funding Application

Basic Questions	Choices and Actions	Section in Guide / Reference
10. Assess financial feasibility.	Estimate the total cost of the project. Does the budget respect the maximum funding limit set by the program and requirements regarding additional funding from other partners?	7.6
	<ul style="list-style-type: none"> If so, go to the following question. If not, there are three possible solutions for setting up the project: 	
	1. Find more efficient and less costly ways of carrying out the project by redesigning the activities (see question 5).	–
	2. Find more financial partners (cash and in-kind contributions) (see question 5).	–
	3. Subdivide the project into several separate funding phases (see question 6), for example, by targeting smaller areas. In this case, describe the general plan and the various phases, and specify which ones are covered by the current funding application.	3.2
11. Prepare the revegetation activity.	• Determine the level of volunteer participation.	7.5
	• Prepare a detailed revegetation work plan, step by step.	9.5
12. Support your proposal.	• Present external sources of information (documents, studies, etc.).	10
	• Prepare a photo album and fact sheets on degraded riparian strips, indicating their location.	–
	• Prepare a diagram and cross-section for the revegetation work.	9.5
13. Ensure you meet all the administrative requirements of the relevant funding program.	• A few weeks before the application deadline, have the preliminary proposal reviewed by a program officer , who could point out potential areas for improvement.	7.3
	• Take note of the application deadline for the selected program.	–
	• Submit your funding application along with the appendices and partnership confirmations.	–
	• Immediately forward any letters of partnership confirmation received after the project application is submitted.	–
14. Sample appendices	• Project schedule	Table 1
	• Performance indicators	Table 2
	• Plant mortality rate	Table 4
	• Planned plant purchases	Table 5
	• Revegetation maps	Maps 1 and 2
	• Sample revegetation cross-section and diagram	Figure 2
	• Sample revegetation work plan	3.3
	• Revegetation strategy	9.5

BLOCK 2 – Best Practices for Riparian Revegetation

Questions	Your Choices and Actions	Section in Guide
1. Plants	• Identify native plants in a non-degraded riparian area near the site to be revegetated.	8.6
	• Establish a selection of native plants based on the previously identified species (suitable for riparian strips).	–
	• Assess the planting parameters (density, area and plant size).	8.2, 8.4 and Appendix 3
	• Determine the quantity of the plants .	8.3
	• Evaluate the cost of the plants .	8.5
2. Revegetation	• Prepare a revegetation strategy in keeping with the specified requirements.	8.1 and 9.5
	• Prepare an efficient revegetation method .	9.2
	• Determine tools and materials requirements .	9.1 and Appendix 2
	• Provide any required plant protection equipment .	9.3
	• Determine the planting period .	Appendix 1
	• Provide a budget for replacing dead plants .	9.2
	• Plan for the removal of invasive plants , if necessary.	9.6
	• Propose environmental protection measures , if necessary.	9.6

3. Define your project

The way you present the rationale for your project in the application is a determining factor in the project selection process. Here is a three-step method you can use to structure the content:

1. Describe the environmental problem² and the issue (cause of the problem).³
2. Determine the objective of the project.
3. Identify the activities planned to achieve the project objective.

Tips and tricks: Be sure to provide an accurate description of the environmental problem and the target issue. Then describe how your project can correct the situation.

Questions to ask yourself: In the case of a pollution control project, will your riparian revegetation project significantly decrease the sources of contamination in the water body?

If the answer is yes, then what supporting arguments do you have?

If it's no, then you may well have to come up with other types of intervention.

2. **The environmental problem** represents a situation where nature is out of balance. Humans may be the cause of this disequilibrium. The presence of pollution, erosion or any other abnormal degradation of the natural environment is generally observed.

3. **The issue** is defined as the cause-and-effect relationship between the land occupied by humans, including protected natural environments, and the environmental problem. If there are no environmental problems, there are no issues. And if there is an environmental problem but no human presence, there is no issue. All issues lead to consequences that may be negative or positive for humans and the environment where they live.

3.1. Description of the environmental problem and the issue

It is essential to pay special attention to this section of the guide. It explains why your project is necessary. First, describe the context of the environmental problem identified. For example, is it a watershed problem? Next, **list the sources of pollution**

(agricultural environment, septic bed, erosion, etc.) associated with the local environmental problem. The questions below should be addressed in the funding application.

- Describe the locally observed environmental problem. Is it part of a regional or national issue?
- What elements (cause and issue) are causing the identified problems?
- Describe the link between the observed problem and the cause. How does this cause contribute to the environmental problem?
- What role do you think the riparian strip would play in eliminating or decreasing the effect of the environmental problem on the target site?
- Are there any data to support your working assumption? Refer to studies such as Gagnon (2007).
- Carefully think through all the components that could help maximize the environmental benefits of your project.

The connection identified between the **environmental problem and the issue should be consistent and unequivocal.**

Examples of issues or causes of degradation:


substandard septic facilities, intensive agriculture without vegetated riparian strip, soil erosion, silting, lack of shade, lack of wildlife shelter, loss of biodiversity.

3.2. Project objective

From an environmental perspective, the objective of your project could take on different but complementary directions. For example, your goal could be to improve water quality by improving the filtering of eroded particles associated with surface runoff. Alternatively, it could be to improve the plant diversity of the riparian strip through revegetation or the wildlife diversity by creating wildlife shelters. What matters is to ensure that your project objectives address the environmental problem you have documented.

Once the environmental problem and the issue have been identified, a riparian revegetation initiative can be designed. From a funding perspective, the proposed project could take two different forms:

- The project could involve a long-term process consisting of several successive projects (steps 1 to 4).
- The project could be a one-time effort designed to directly resolve the environmental problem (steps 2 and 4).

- 
1. Present major actions designed to resolve the environmental problem. The combined actions could lead to more than one project requiring funding.
 2. Provide a one-paragraph description of the objective of the project submitted for funding.
 3. Explain how the activities you are proposing (section 3.3) will help you achieve the project objective.
 4. Review the project objective until you are completely satisfied with it by asking yourself the following questions:
 - Is the objective of the project **relevant** (will resolve the problem), **achievable** (in terms of funding and duration), **timely** (at the right time) and **measurable** (using a performance indicator)?

It is always helpful to discuss the logic of your project rationale with your colleagues, main partners and a program officer.

Maximize your efforts: It may be preferable to

concentrate your efforts on one area or some priority areas. Spreading your efforts across a number of areas distant from one another can dilute the environmental benefits of the project.

3.3. Work plan

The detailed work plan should lay out the path you plan on taking to achieve your objective. The work plan is an often neglected aspect of funding applications. It is essential, for example, to specify whether your project aims to increase the density of existing riparian vegetation or restore a completely degraded riparian strip. In order for project officers to see that the project is adequately planned, each project step has to be described. It is recommended that you develop the work plan by describing each of the activities, zeroing in on how they will be carried out to successfully complete the project.

Each proponent needs to determine how to organize the project, taking into account the organization's strengths and the socio-economic and environmental characteristics of the project area. Below are a few examples of activities that may be included in a work plan:

- Revegetation activities (site preparation, plant selection and ordering, appropriate plant reception and storage, revegetation work, watering if necessary, and erosion control activities)

- Awareness campaign in support of the revegetation activities (identify target audience: riparian landowners, elected municipal officials, farmers, etc.; prepare awareness documentation; meet with target clientele; have moral commitments signed; conduct surveys to assess changes in behaviour, etc.)
- Annual follow-up over one, two or three years for plant maintenance and replacement of dead plants
- Project management

Tips and tricks: There are several strategies for establishing a detailed work plan for a revegetation project. Some are more effective than others. Consult with your partners to determine the best strategy for your situation.

Each activity can generally be described in just a few paragraphs. In the above list, revegetation is the most important activity. It is in your interest to devote special attention to this component, because a large proportion of the expenses will be allocated to this activity. Savings may be garnered in terms of the project implementation strategy you select (e.g. seeking donations in kind for revegetation materials, finding the least expensive planting stock by comparison shopping, or using different methods of revegetation). Below is a sample **work plan** for a typical **revegetation campaign**:

1. Organize meetings with target riparian landowners ensuring efficient coordination of these meetings.
2. Carry out site visits and meet with landowners to explain the project and hoped-for collaboration, make them aware of best practices for riparian protection and revegetation and conduct pre-work surveys.
3. Prepare standard plans and have them approved by a specialist.
4. Jointly draw a revegetation plan for each riparian landowner. Remind landowners that the goal of the project is not to landscape their land but to develop a riparian strip with environmental objectives. Estimate total costs and identify the riparian landowner's financial and in-kind contribution. The riparian landowner and the proponent's representative sign off on the plans, with the signed drawing serving as an official contribution agreement, and the plant purchase order.
5. Order the plants from nurseries.
6. Riparian landowners pick up the planting stock from the nursery and submit cheques. An appointment is scheduled with a technician.

7. The technician visits the riparian landowner to prepare for the revegetation work, specifically by marking planting sites as specified in the drawing.
8. The revegetation is carried out by the landowner and volunteers, who prepare the ground and plant the specimens.
9. Follow-up site visits are conducted in the days following the revegetation, and corrective action is carried out if necessary. Snapshots of the riparian landowners' current practices are taken, and a list of behaviours to be adopted is presented to the owners. Riparian owners are asked to specify what their objectives are and to sign a moral commitment.
10. Visit the site the following spring for maintenance and replacement of dead plants. Conduct post-work survey to assess improvement in riparian landowner behaviours.

Tips and tricks: Calculate the number of hours of work for each activity, step by step. Provide greater detail for the revegetation activity, to ensure you keep within the proposed budget.

Appropriate awareness activities: When you meet with cottagers to set up a planting layout, **take the opportunity** to inform them about how to reduce phosphorus inputs. When you revisit the site the following year to assess plant mortality, ask them if they have reduced their inputs. Keep statistics to demonstrate the effectiveness of your awareness activities.

If an awareness campaign is planned in support of the revegetation project, ensure that it is effective (accurately targeting the right audience and using appropriate means for contacting them) and that it incorporates measurable indicators (elimination of the use of phosphate-based soap and fertilizers, etc.). **In a revegetation project, it is appropriate for the awareness campaign to support the project objective but this should not be the main thrust of the campaign.**

3.4. Schedule

A **project schedule** must be developed. It can be in diagram or table format. A sample schedule is provided in Table 1. The schedule should include all project activities. A bar graph schedule makes it possible to readily assess the feasibility of the project. Make sure that you take into account the date at which expenses become eligible under the program. Ask a program officer about it, and the program officer will be able to advise you when the funding contribution agreements are likely to be signed.

Table 1. Sample schedule for a riparian revegetation project

Sample Schedule – Riparian Revegetation Program for a Lake											
Project Activities	First Year								2nd Year	3rd Year	
	Spring		Summer		Fall		Winter		June	June	
Project administration	Finalization of agreement (April)										
• Negotiations and final agreement with funding agency											
• Administrative and accounting follow-up											
• Submission of progress reports and final report											
Communication and awareness activities											
• Preparation of communications plan											
• News releases and press conferences											
• Preparation of information and awareness documents											
• Dissemination											
• Client meetings and survey											
Planting campaign											
• Site preparation											
• Planting stock selection and ordering											
• Appropriate reception and storage of plants											
• Revegetation activities											
• Watering as required											
Maintenance and replacement of dead plants											

4. Performance indicators

You need to pay special attention to environmental performance indicators **because projects are required to produce measurable results**. Funding programs require the measurement of at least one key environmental indicator (Environment Canada 2010). Table 2 presents a few sample indicators for revegetation projects, from which you can select appropriate indicators for your project.

Reminder: What are your environmental indicators?
Every funding program provides a list of indicators.

Table 2. Environmental performance indicators for riparian strips

Performance Indicator	Description	Unit Measure
Length of riparian strip protected, stabilized or improved*	Measure length of revegetated riparian strip.	Metres
Area of riparian strip protected, stabilized or improved*	Convert the length in metres into area by multiplying the length of the revegetated riparian area by its width. Take planting density best practices into consideration.	Hectares
Number of native species planted (trees and shrubs)*	The planted stock must survive at least one winter season. Set aside a budget for replacing plants to ensure complete revegetation after one year.	Number of native plants still alive after one year
Area seeded with herbaceous plants and perennials to control erosion	The entire area actually seeded as an erosion control measure.	Hectares
Number of hectares restored, preserved or redeveloped as habitat	Sample actions: revegetation with plant species preferred by wildlife.	Hectares

Table 2. Environmental performance indicators for riparian strips (cont.)

Performance Indicator	Description	Unit Measure
Decrease contaminants at source	Using a survey as part of the awareness campaign, measure the actual change in riparian landowners' use of phosphorus and other substances detrimental to aquatic environments.	Kilograms eliminated at source/year
Amount of waste removed from riparian strip	As part of the revegetation process, record the amount of waste removed from the riparian strip.	Mass (kg) or volume (m ³) of waste collected
Number of people informed (1) and committed to changing their practices (2)	Implement an awareness strategy and determine how to record the number of people who change undesirable practices.	Number of people (1) informed (2) committed to changing undesirable practices

* Mandatory indicator for riparian revegetation projects.

In the appropriate section on the form, you must explain how you will measure the indicators you have selected. For example, if awareness actions are planned, a strategy for measuring changes in user behaviours must be proposed. The strategy for conducting a survey must be documented in the work plan, budgeted for and incorporated into the project schedule for it to be considered a realistic option.

Tip: In the application, explain your strategy for measuring the indicators you have selected. Allow for time during project implementation to validate your indicators.

5. Map project sites and activities

To facilitate the evaluation of your project, you will need to specify the location of planned activities. The following maps should be appended to the funding application form:

1. a regional map of the watershed (approximation) indicating the project location
2. a local map of the various project intervention sites

You are advised to use *Google Earth* to create these maps. This software allows you to map project sites, measure distances and areas, determine geographic coordinates and print the maps (aerial photos) or transfer the map images to word processing software. Sample regional and local maps are provided below.

Keep in mind: Funding programs do not fund work performed twice in the same location.

Tips and tricks: *Google Earth* can be used to create a map showing locations and to measure distances.

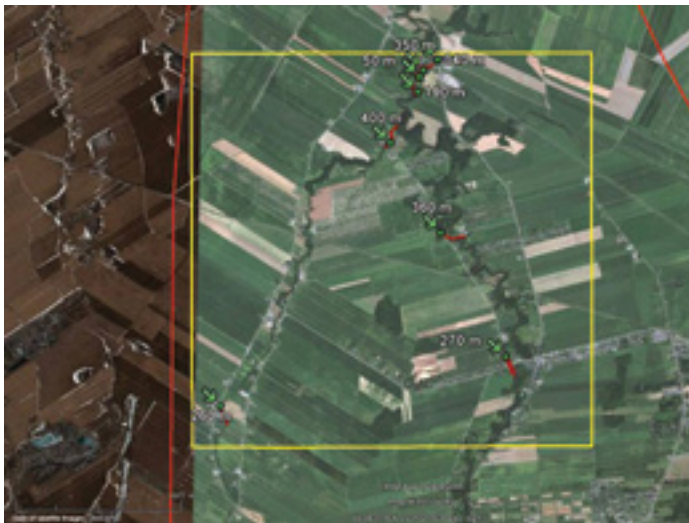
Map 1. Regional map



- Study area
- Watershed (approximate)
- Main watercourse in watershed

For some areas, *Google Earth* does not provide high-resolution aerial photographs. Another solution will therefore need to be found. If this is the case for your project, you could obtain the most recent aerial photographs from the Photocarothèque québécoise. It will cost from \$30 to \$100. Another option would be to acquire a large-scale topographical map (at a cost of \$15 to \$20 from the Photocarothèque québécoise and other suppliers). Also, your RCM or municipality may possibly have other maps you could use.

Map 2. Sample local map



- Study area
- Riparian area to be revegetated, length in metres (m)

6. Characterizing riparian strips

The goal of characterizing riparian strips is to

1. Determine the exact area that needs to be revegetated to restore the water body
2. Confirm the environmental problem (Section 3.1) of the project with supporting data and photos
3. Identify local indigenous plants
4. Prioritize the various sectors in terms of the condition of the riparian strips

Characterizing the riparian strip involves measuring the length of each type of riverbank and identifying areas with degraded or no riparian strips. Any available environmental studies for the project area could provide this information. A field campaign will be required at this step in the process. It is strongly recommended that you enlist a guide who is knowledgeable about the water body and its history (for example, the president of the lake association).

You will require the following equipment for the field visit:

- Camera, map and aerial photos, ruler and GPS, measuring tape
- Notepad, pencils, calculator and Ziploc bag in case of rain
- Motorboat, safety equipment and lunch

The ideal would be to plot, directly on the map, the degraded areas, their width and length, and the type of riparian strip. In marine environments, visiting the site on foot during low tide is the best approach. Here are the main steps:

- Obtain an appropriate aerial photo in an easy-to-use scale.
- Locate homogeneous sections of riverbank (natural, agricultural, cottage, urban) and measure their length.
- Locate and photograph stretches of riparian strips and the approximate width to be revegetated at a given density (low, medium, high), as well as eroded riparian areas, where applicable.
- Characterize the vegetation on undisturbed riparian strips so as to identify the main native species in the area.
- At the office, classify degraded stretches in terms of action priority and select the areas to be revegetated as part of your project.

- Identify areas selected for the project and those intended for future work on a map in an appropriate scale (e.g. Map 2).
- Compile a list of landowners involved in the project, and their addresses.
- Prepare a photo album and fact sheets for the areas to be revegetated to confirm the sectors to be restored.

For further information on characterization methods, see the easy-to-read protocol posted by the Conseil régional de l'environnement des Laurentides on its website (www.troussedeslacs.org).

Tips and tricks: In the application, indicate **the length of the riparian ecosystem** and the proportion of degraded riparian strips (low, moderate, high). Also specify **the proportion of shoreline** in forest, agricultural, urban and cottage areas.

7. Partnerships

7.1. The importance of partners

Successful community projects are based on the participation of local stakeholders and citizens. The number and diversity of partners involved in the project represent useful information for project evaluation.

Remember that **their involvement in the project must be demonstrated in the application!** Moral support in the form of a letter does not mean that much to a financial backer. It is recommended that you **ask local stakeholders to commit in writing to contributing goods, services or cash.**

Tips and tricks: Volunteer and financial support from riparian landowners and the municipality are essential to demonstrating local acceptance of your project. The more support you have (in writing), the more likely you are to obtain funding.

7.2. Choice of partners

Table 3 provides a list of stakeholders who could potentially contribute to your riparian revegetation project.

Table 3. Partners for riparian revegetation projects

Areas		Examples
1. Government	Federal	Fisheries and Oceans Canada, Service Canada (worker reintegration, summer student internships), Environment Canada
	Provincial	MAPAQ (Programme Prime-Vert), MRN, MDDEFP, MAMROT, Emploi Québec, Pacte rural
	Municipal	Municipalities and RCMs, regional conferences of elected officials, urban communities (Montréal and Québec)
	Aboriginal	Band councils
2. Schools		Primary and secondary schools, classes, teachers, CEGEPs (wildlife technician and ecology programs), school boards
3. Associations		Lake associations and federations, watershed associations, ZIP committees, regional environmental boards, local environmental protection organizations, scouts, youth centres, hunting and fishing associations, forestry associations, seniors clubs, recreational centres, development corporations
4. Funds and foundations		Shell Environmental Fund, Hydro-Québec foundation for the environment, Mountain Equipment Co-op's Endowment Fund for the Environment, Fondation de la faune du Québec, IGA Ecomunicipality Fund, Fonds d'action québécois pour le développement durable (FAQDD)

Table 3. Partners for riparian revegetation projects (cont.)

Areas	Examples
5. Industrial and commercial	Nurseries, large industrial companies, agricultural producers, dam owners, the media (local newspapers, radio), accounting firms, environmental consulting firms, local credit unions
6. Universities	Universities and departments, researchers, students, interns, research centres (e.g. INRS ETE, research chair in coastal erosion)
7. Citizens	Individual or group volunteers, committees of citizen volunteers
Other potential partners	Office franco-québécois pour la jeunesse (internship), Canada World Youth

7.3. Relationship with funding agency

As a proponent, you must carefully consider your relationship with the funding agency, both in preparing the application and in implementing the project once it is underway. This relationship is forged during initial discussions and the funding phase and continues until you submit your final report. Once the project is underway, it is essential that the relationship be maintained in an atmosphere of mutual respect and trust. To achieve this, it is vital to keep your program officer informed of progress in the project, successful milestones and especially **any difficulties you encounter**. The program officer can provide advice and help you minimize adverse impacts on the project's progress. You should **keep your program officer informed without delay of any possible changes to the work plan and any difficult situations you encounter**. There may be financial consequences if you wait until the progress report or final report stage to inform the officer of choices you have made without prior notification.

Tips and tricks: Stay in touch with your program officer to avoid difficulties. Plan ahead and discuss potential project changes with him or her.

7.4. Partnership with proponent

As a proponent, the association submitting the funding application may propose an investment in goods and services or in cash. Note that investments in goods and services must be assessed according to their fair market value. In addition, the proponent must account for manager and employee salaries as cash contributions. Only time clocked by volunteers may be recorded as an in-kind contribution.

7.5. Landowners' role and contribution

Target riparian landowners must at the very least authorize the work and should participate actively in the project. Ideally, they should be approached before the funding application is

submitted. It is recommended that the proponents contact them initially by telephone and then in writing with a view to **obtaining a letter from a significant number of landowners confirming their participation**. It may be preferable to meet them at an association meeting or, in the case of farmers, individually. The solicitation letter addressed to them should outline the environmental problem involved, the goal of the project and, where appropriate, the partners who have confirmed their participation as well as those who will be approached. While the focus will be on common goals, a few arguments in favour of their involvement could make all the difference.

When the riparian strip is on public land, **you will need to obtain approval from the land manager** before pursuing the project. The manager generally provides the project proponent with technical or financial support.

In the case of projects where **the riparian strip belongs to private landowners**, the question is to determine what would be a fair contribution on their part. Although a riparian revegetation project involves environmental benefits for all riparian landowners as well as those who live downstream, the landowners also benefit individually. It would be desirable for the project to be partially funded by riparian landowners, either in cash or in goods and services.

A number of community action projects, for example, plan to have riparian landowners pay from 30% to 50% of the cost of planting stock. Such a contribution from landowners is desirable for at least two reasons: it promotes a better distribution of project costs between partners and the funding program; and it guarantees a better plant survival rate. Landowners are more likely to focus on ensuring the success of the initiative and to take better care of the plants if they have made a financial contribution to the project.

Some landowners may claim a loss of enjoyment in their property owing to the presence of a riparian strip that reduces access to and views of the water. However, it is also possible that negative

publicity on the presence of blue algae and poor quality of lake water will also have a negative impact on the value of riparian properties. It is recommended that you carefully prepare your pitch before contacting landowners.

7.6. Proportion of financial management, field work and awareness efforts

Given that every project is quite different, it is difficult to define what represents a balanced distribution of efforts for riparian revegetation projects. You therefore need at the outset to consider whether the project is properly balanced in terms of **management, awareness activity and revegetation costs**.

You are advised to break down your expenses using these three classes of expenses. If the proportion of your budget allocated to revegetation activities is too low, your project could be seen as an awareness program that includes field work—which could lead to your losing valuable points in the comparative analysis of competing projects. The higher the percentage of funding allocated to actual revegetation activities, the greater the direct environmental benefits and the better the assessment of the value of your proposal.

Good riparian revegetation projects incorporate an awareness component. These awareness efforts have the advantage of being carried out simultaneously with field activities, providing travel- and labour-related savings.

8. Planning revegetation work

This section covers the technical aspects of a revegetation project, including revegetation area and density, plant sizes, plant selection and estimated cost of planting stock.

When planning revegetation work, it is essential to **take into consideration the three vegetation strata**:

- herbaceous and perennial species
- shrubs
- trees

8.1. Revegetation approaches

The first step in project design and budget planning is to determine the type of revegetation that should be carried out. The type of revegetation required is determined by evaluating the existing condition of the target riparian ecosystem. This involves determining the most appropriate revegetation approach and then the type, size and quantity of planting stock and other materials.

There are two possible options. The first is a densification operation, which is recommended in cases where the herbaceous

stratum is well established and the goal is to accelerate plant succession on the riparian strip by planting trees and shrubs. The second option would be complete revegetation of the riparian strip, which applies to bare areas or areas colonized by undesirable species that need to be removed.

Projects involving densification would not need to include revegetation of the herbaceous stratum. If this applies in your case, make sure to specify this in your funding application. However, if the characterization of the riparian strip indicates there is no herbaceous layer or it needs to be replaced, you will need to plan for seeding as part of your revegetation work. Seeding produces quick, effective results in the control of soil erosion.

8.2. Revegetation area and densification

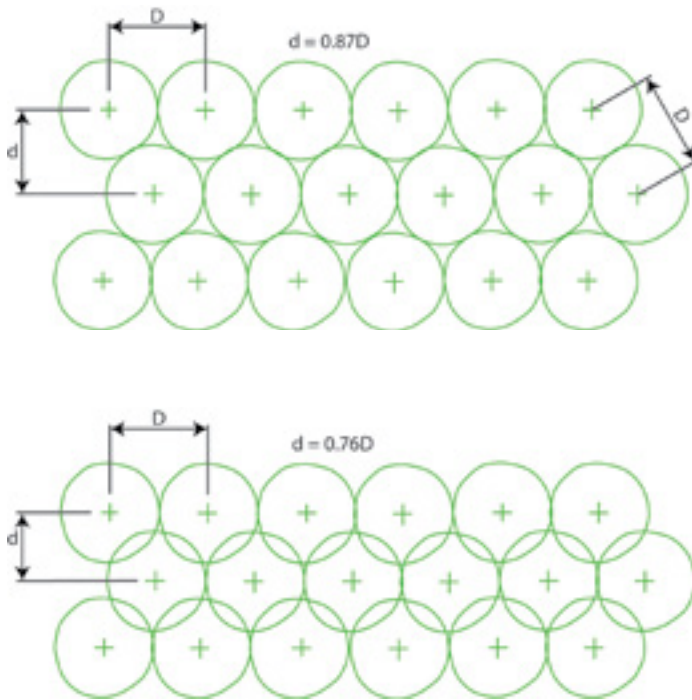
To calculate the area to be revegetated, two parameters, i.e., the width and length of revegetation areas, have to be measured. This involves **identifying and measuring (or estimating as accurately as possible) all bare surfaces to be revegetated**. Then a third parameter, planting density, needs to be addressed.

In general, the proposed **width** of the riparian strip in your project should be equivalent to that recommended in Quebec's Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains (PPRLPI), specifically a minimum of 3 m in agricultural areas, or 10 or 15 m elsewhere. This may of course vary locally owing to barriers, relief, and water filtration requirements. Also, a wider riparian strip should be developed in areas where, for example, runoff is concentrated. An average width may be established for all planned revegetation work.

The length of the riparian strip to be revegetated represents the sum of the lengths of all the revegetation sites. This measurement must be accurate to ensure an accurate assessment of planting stock requirements.

The plant **density** should aim to reproduce the natural environment. In ecology, competition among species is what determines the space they occupy. To ensure leaf cover of the soil surface using a minimum number of plants, use a quincunx (or staggered) pattern (Figure 1). To quickly obtain complete coverage with no partial openings between plants, a 0.76 ratio should be used instead of a 0.87 ratio, thereby increasing the number of plants per square metre.

Figure 1. Quincunx or staggered planting pattern



To calculate the number of plants required for a given area, you will need to calculate the number of plants per row and the number of rows, taking into consideration that spacing between the rows is 87% (or 76%) of the distance between the plants. In the case of densification projects, the density you use should be lower than recognized standards to take into account the presence of existing vegetation.

For freshwater riparian strips, the MDDEFP recommends a revegetation distance of 0.5 to 1 m centre to centre for shrubs and 2 to 5 m centre to centre for trees (MDDEFP 2009a). Of course, some species will require more or less space to reach their full potential. The optimal spacing will depend on the species selected (8.6).

Now that you have specified these three parameters, you can calculate the number of plants you will need for your project (Section 8.3). If you opt for a different planning model, you need to justify your choice. A simple way of determining the right number of plants required is to prepare a scale drawing for each revegetation area.

8.3. Estimating plant quantities

Your funding application must specify the required quantities of native shrubs and trees, indicating the number of plants along with container sizes. Quantities may be specified by species of

the same size. This is not a requirement because, barring exceptions, there is generally little variation in price among plant species of the same size.

Final revegetation plans, which are generally developed during the course of the project, will specify the final selection of species in terms of local criteria, which can only be determined on site. Nevertheless, a specific quantity of planting stock needs to be indicated in the funding application, along with the final budget.

For herbaceous and perennial species, seed requirements need to be determined for the area to be covered. Seed suppliers generally specify kilogram per hectare rates.

In short, you need to specify the following three quantities:

1. Number of trees (by species, if you wish) of each size
2. Number of shrubs (by species, if you wish) of each size
3. Kilograms of herbaceous and perennial seed to cover bare areas

Appendix 4 presents an established calculation method for quincunx (or staggered) planting.

8.4. Plant size

The size of the plants (trees and shrubs) is one of the key elements for ensuring the success of your revegetation initiative. There will be competition between the stock you plant and the existing plants, specifically herbaceous species. If you opt for small trees and shrubs (in cell packs less than 300 cm³), they will have to compete more with the herbaceous species on site. In addition, weeding will be more difficult because the planted specimens will be less visible. By contrast, large plants cost more, but the survival rate will be higher and maintenance less onerous.

For successful revegetation, you need an effective strategy. **The better developed the existing plants are, the larger the planting stock should be (e.g. plants in one-gallon containers) to ensure they have an advantage over existing vegetation.** If there are practically no existing plants, it is recommended that you use a mix of small, medium and large plants. In addition, never underestimate the benefits of herbaceous and perennial species when it comes to effective and rapid soil erosion control. Section 9.2 outlines other strategies for overcoming competition from existing vegetation, and Section 9.3 describes plant maintenance and protection measures to ensure a successful outcome.

8.5. Estimating planting stock costs

To establish a budget for plant purchases, the unit cost per size must be estimated. Barring exceptions, unit prices vary with the size of the plants, but remain relatively similar for different species of the same size. To come up with a realistic estimate, follow the steps below:

1. Calculate the total area to be revegetated.
2. Evaluate the proportion of the total area to be planted with trees and shrubs.
3. Determine the fraction of this area to be planted with the different sizes of trees and shrubs (Section 9.2).
4. Convert each of these areas to plant and seed quantities using the proposed formula (Appendix 4).
5. Determine the average cost per plant size (Appendix 5). Pay special attention to unusual plants that may cost far more and could lead to a substantial error in the estimate.
6. Multiply the average price by the number of plants of each size or the quantity of seed required.
7. Add up the individual amounts to determine the total cost for the budget.

These are estimated amounts. The quantities may vary slightly once the project is underway and according to what is available at the time. You will nonetheless have to work within the overall budget specified in your application; hence the need to be as accurate as possible in the planning stage.

8.6. Selecting plants

The plants you select **should be native species suited to the environmental conditions** in the riparian strip to be restored. If you are not knowledgeable in this regard, you would do well to consult a botanist. You are advised to follow the steps below:

- Identify species in non-degraded riparian strip zones near the area to be revegetated.
- Check whether the species observed appear on the MDDEFP's recommended plant list (FIHOQ 2008) for shoreline revegetation by consulting its online listing (<http://fihq.qc.ca/recherche-plantes.html>).
- Ensure the selected plants are suitable for the soil, relative humidity, shade and other conditions.
- Vines growing over walls and riprap could increase the albedo effect and hence reduce warming of the water.
- Consider plant species that attract fauna such as butterflies, bees or birds.
- Give priority to trees, especially on the top of slopes. Some species have a root system that provides excellent soil stabilization and good surface water filtration.

- For bare soil areas, plan to seed native herbaceous and perennial species adapted to riparian environments.
- Give preference to plants from local nurseries to avoid significant genetic and climatic variations.

Extensive documentation exists on plants available for revegetation purposes. A selection of references is provided to facilitate your research (Section 9.2).

Some species, such as willow (*Salix*) and dogwood (*Cornus*), are easily propagated by **cuttings**. To ensure success, however, you need to start the process at the right time. You should also remove only a fraction of the branches. Don't forget to obtain prior authorization from the landowner.

When the riparian strip has to be redeveloped, **transplanting** plants to the redesigned area is a potential strategy. For successful transplanting, you need to remove plants along with a large root ball, heel them in temporarily and water generously until they are transplanted.

In coastal environments, some groups recommend transplanting species such as Sand Ryegrass (*Elymus arenarius*) and Beachgrass (*Ammophila breviligulata*). In such cases, the clumps from which you take specimens must be large and very dense.

Note that Renaud (2005) describes an interesting technique for selecting plant species. She recommends selecting plants in terms of the ecological niche of the area to be revegetated. This approach is a sure way of increasing the survival rate of planting stock.

Tips and tricks: If you opt to collect cuttings, make sure you obtain prior permission from the landowner and inform the relevant authorities (MDDEFP and municipality) about this initiative. Prepare a cutting protocol to present to them.

9. Best practices

The best practices described in this section should be used in conjunction with information from the various riparian revegetation guides available. The most up-to-date guides are listed in Section 11. These documents are identified according to the various environments to which they apply and their main theme. Most are downloadable. Scan through them to find the one that best meets your needs.

9.1. Field equipment and materials

The equipment and materials you will need for your revegetation project are presented in Appendix 2. The list is extensive and it is likely you will require only some of the items listed. The purchase of materials and the loan, rental or purchase of equipment should be detailed in the funding application. You must determine unit costs and estimate required quantities for each element. Finally, also remember to indicate transportation costs.

Note that only a portion of the total cost of loaned equipment can be allocated to the project budget. The budgeted amount should reflect the extent to which this equipment will be used in the project in relation to its total service life (depreciation).

9.2. Revegetation method

Promoting volunteer involvement in revegetation tasks is recommended. This is also a good way of securing the commitment of landowners and partners. However, volunteers need to be trained and mentored by a field coordinator who is qualified in horticulture.

To ensure the success of the riparian revegetation project, it is recommended that you address **all three plant strata, specifically the herbaceous, shrub and tree layers**. The plants should be arranged according to a quincunx (staggered) pattern or other pattern that mimics a natural planting scheme. The Fondation de la faune (Limoges 1996) recommends grouping 5 to 25 specimens of the same species of trees and shrubs to promote local wildlife use of the riparian strip.

It is preferable to do the revegetation early in the year once the spring flood is over to increase the survival of the planting stock. Good results can nevertheless be obtained by planting larger stock in summer and watering the plants as necessary.

Planting in spring gives the plants an opportunity to develop a root system during the growing season before their first winter. If planting is done in the fall, the plants may not have time to develop a solid root system, and they could be washed away in the spring flood or by the movement of ice (MDDEFP 2009a). Given that contributions from funding programs are generally announced in the spring, it could be difficult to start the revegetation work during the first spring. There are certain options:

1. Carry out summer and fall revegetation taking the necessary precautions.
2. Plan to carry out most of the revegetation in the spring of the second year of the project.
3. In the first year, revegetate the upper part of the riparian strip and, the following spring, after the spring flood recedes, work on the lower part.

The second and third options have the advantage of allowing for more extensive planning of field operations. You should therefore take these possibilities into account when planning your work schedule (Section 3.4).

Extensive literature exists on planting methods. Of the references listed in Section 10, we recommend the following:

- For lakeshores and riverbanks, the MDDEFP (2009a) and CBVBM (2008) guides are recommended.
- The table provided by the MDDEFP (2009a) shows planting periods and methods along with the pros and cons of various plant sizes.
- The RAPPEL (2005) guide on riparian naturalization for lake and riverside landowners interested in working on their property independently is recommended. Using images and photos, the guide provides riparian development plans, lists recommended plants, and describes various techniques and strategies.
- For comprehensive information on planting techniques, the plant landscaping standards document NQ 0605 100-2001 (Bureau de normalisation du Québec 2001) is recommended.
- The Fondation de la faune du Québec (FFQ 2010) has published a specific guide for agricultural environments. This guide, which draws on several projects that were implemented, has become an essential reference for those interested in undertaking community action projects in agricultural areas. Careful reading of this guide is recommended.
- For marine environments, the *Guide de restauration et de protection des dunes des îles de la Madeleine* (Attention Fragiles 2004) is recommended reading for project planning. A technique for transplanting herbaceous dune plants is described in detail.

Shore erosion in coastal environments is often a major limiting factor for riparian revegetation, and can in fact represent a major obstacle to the success of such projects. The majority of revegetation projects funded in coastal environments are located in low wave-energy areas, such as estuarine and dune environments, and are designed to maintain ecosystems that stabilize beach sand deposits.

9.3. Plant protection and maintenance

Since the planting stock selected should be suitable for the planting site, minimal maintenance should be required. Some maintenance will still be required but will decrease over time. For trees and shrubs, monitoring and maintenance will be required ideally for two to three years, until the plants are completely acclimatized.

Weeding around the plants should be done in the first summer to prevent herbaceous growth from choking the new planting stock, and should ideally be repeated in the second and possibly the third summer. Monitoring is needed to ensure normal plant development in the first three years. You should prune damaged or dead branches, and in the spring check for uprooting of plants caused by frost heaving.

To ensure proper root development, watering is required in summer following revegetation, especially in periods of drought.

To protect the plants and help prevent competition from other species, trampling or browsing by animals, techniques should be used to minimize plant mortality. You may want to consider using mulching discs or ramial chipped wood (RCW) to prevent your plantings from being choked out by herbaceous species. These materials can help decrease or even eliminate the need for weeding.

If you anticipate the presence of rodents or herbivores such as cervids or domestic animals, tree guards and repellents may be used. Also, some plant species are less attractive to these animals. For trees taller than two metres, stakes and guy wires should be used for protection from the adverse effects of wind. These devices should be removed after a certain period of time.

Your funding application should include human resources (salaried or volunteer) to install these devices and carry out maintenance tasks. If you prefer to keep maintenance to a minimum, it is advisable to select large planting stock and use protection devices to limit competition from herbaceous species. In some cases, this information can be passed on to landowners so that they look after any maintenance work. These steps must also be incorporated into the project schedule.

9.4. Replacing dead plants

Ideally, planted stock should have a high survival rate; however, some plant mortality can be expected in riparian revegetation projects. Funding programs generally allocate funding for more than one year. This time span allows for maintenance work and the replacement of any dead plants, at least in the first year after revegetation. The maintenance and replacement period should be one to two years, with the ideal being three years.

It is recommended that you budget for the purchase of replacement stock, at least for the first year following revegetation. Funds should also be allocated to cover the cost of replacing dead planting stock in accordance with the rates indicated in Table 4.

Table 4. Plant mortality rates after one season

Pot Size	Average Mortality Rate
Multicell plugs 45–110 cm ³	20–40%
Multicell plugs – LSS (e.g. 320 cm ³)	15–30%
1-litre pot	10–25%
1-gallon pot	5–20%
3-gallon pot	5–15%

Travel, equipment and human resource costs associated with replacing dead planting stock must also be considered. Wait until the leaves unfurl at the end of spring before replacing plants, because bud break may be delayed in newly planted stock. You might think they are dead when they are just behind compared with other plants in the area.

9.5. Recommended revegetation strategy

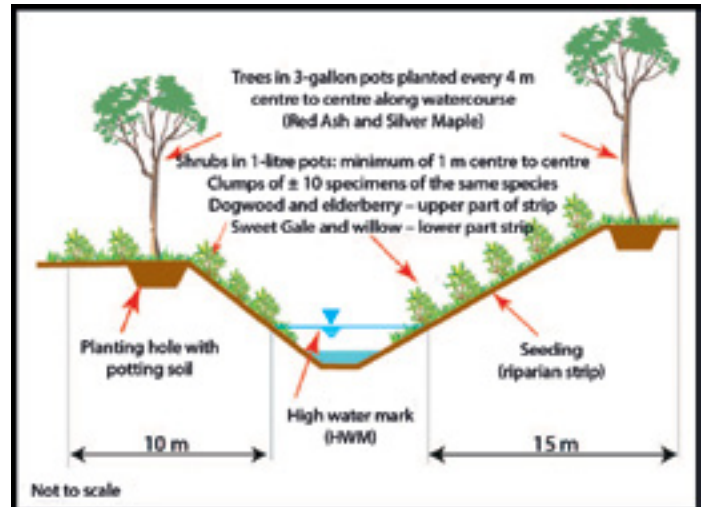
A revegetation strategy is recommended below. Since every project is unique, you as the proponent have to define your own strategy. The strategy outlined below is therefore provided as an example only.

Revegetation planning must balance the financial investments required to purchase planting stock and the survival rate associated with each plant size. The following recommendations generally apply:

- For shrubs, avoid small plugs and select at least large stock grown in containers 320 cm³ or larger.
- For trees, ideally select large stock (e.g. 3-gallon pots) for planting along the top of the slope.
- For each clump of shrubs of the same species, divide the planting stock as follows: 1/3 large-size plugs, 1/3 stock in 1-litre pots, and 1/3 stock in 1-gallon pots.
- Within homogeneous clumps, plan for clumps of a variety of species to develop heterogeneous clumps (diversity will help prevent infections and disease) with a variety of plant sizes.
- Protect and maintain the revegetated area for at least one year, and ideally up to three years.

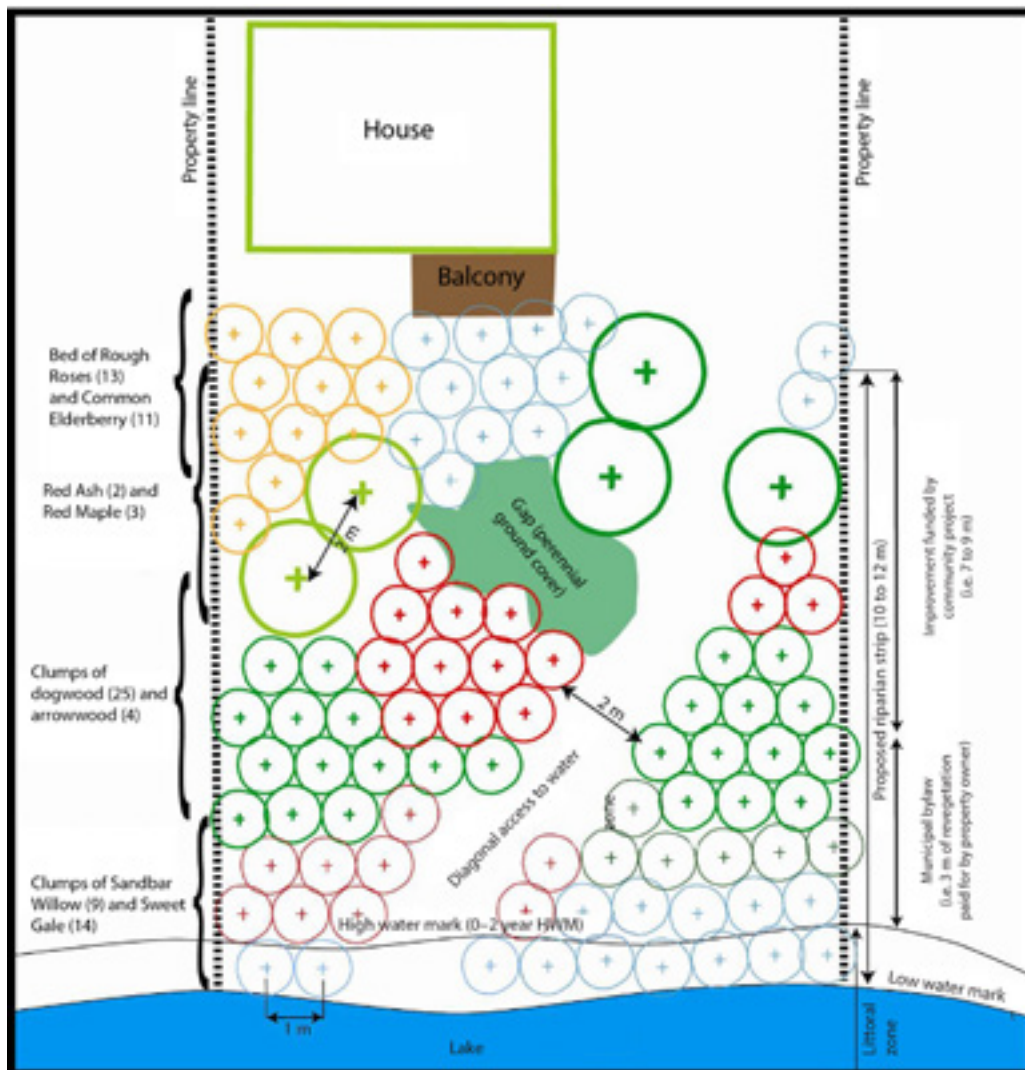
Figure 2 presents an example of a cross-section of a riparian development and Figure 3 provides another example of a planting pattern. Ideally, you should prepare similar diagrams adapted to your project. For the revegetation approach, you are advised to follow the techniques proposed in the various guides (see reference list in Section 10). Appendix 1 summarizes the essential elements to be considered in designing a planting layout.

Figure 2. Example of a cross-section of a riparian planting layout



A picture is worth a thousand words: Layouts can be produced using software or freehand. The main object is to illustrate your revegetation concept.

Figure 3. Standard revegetation layout. Minimum of 1 m centre to centre for shrubs and 2 m for trees



9.6. Environmental precautions

Various measures can be planned to prevent adverse environmental impacts resulting from the project. The funding and human resources required to carry out such work must also be allocated.

If, for example, motorized equipment is used near bodies of water to transport planting stock and earth, the environmental precautions to be taken must be specified in the funding application. One such precautionary measure would be inspecting the machinery prior to starting the work. Machinery that runs with plant-based lubricants and grease should be given priority. Gas tanks should be filled a reasonable distance away from the water body. Avoid driving repeatedly on the shoreline to minimize the risk of erosion and avoid soil compaction. Have absorbent material on hand to minimize the spread of contaminants in the event of a spill.

If the vegetation does not provide effective erosion control, you must plan on using sedimentation barriers or biodegradable erosion control blankets on the slope to control the impact of runoff. Bare soil should be seeded as quickly as possible. Various sediment control measures are presented in the RAPPEL (2003) environmental best practices guide.

If an access path to the water is developed in the riparian strip, you are advised to use herbaceous cover and develop the path in such a way that it will not become a preferential flow route for runoff.

In depressions and wet areas, it is advisable to broaden the riparian strip.

Finally, it is essential to control invasive species (Buckthorn (*Rhamnus frangula* or *Rhamnus cathartica*), Common Water Reed (*Phragmites australis*) and Japanese Knotweed (*Fallopia japonica*), etc.). Set aside time each year for this task.

10. Relevant documentation

Various documents that could prove useful in carrying out your riparian revegetation project are presented below under the following themes: government guides and practices; plant lists; and scientific and legal aspects. The references were selected based on their relevance to this guide; hence this is not a comprehensive list.

Finally, nothing can replace guidance from an experienced grower or the director of an organization with considerable experience in riparian revegetation. If you have no such contacts, a program officer could put you in touch with other proponents and hence promote the transfer of knowledge among organizations.

References	Focus
Environment Canada Guides	
Environment Canada. 2010. <i>EcoAction – Applicant's Guide</i> . www.ec.gc.ca/ecoaction/default.asp?lang=En&n=EF4E94E3-1&offset=10&toc=show	Official applicant's guide for the EcoAction program. This guide is mandatory reading for preparing a funding application for this program.
Community Interaction Program. Financial and technical assistance program promoting community projects related to the St. Lawrence ecosystem. http://planstlaurent.qc.ca/en/community_interaction.html	Official applicant's guide for the Community Interaction Program. This guide is mandatory reading when preparing a funding application for this program.
Environmental Damages Fund. www.ec.gc.ca/edf-fde/default.asp?lang=En&n=BD1220D8-1	Official website for potential applicants for funding from the Environmental Damages Fund. This site is mandatory reading when preparing a funding application for this program.
Practical Guides	
Attention Fragîles. 2004. <i>Guide de restauration et de protection des dunes des Îles de la Madeleine</i> [guide for the restoration and protection of dunes on the Magdalen Islands]. 134 pages. www.attentionfragiles.org/fr/qui-nous-sommes/produits-et-publications/73-le-guide-de-restauration-et-de-protection-des-dunes-des-iles-de-la-madeleine.html	Guide for municipalities, organizations, residents and visitors who are interested in learning more about dune environments and taking action to protect and restore them.

References	Focus
Attention Fragîles. Undated. <i>Fiche terrain sur les dunes des Îles de la Madeleine</i> [fact sheet on the dunes of the Magdalen Islands]. 8 pages. www.attentionfragiles.org/docs/fichiers/thousand-gilles/final/af_fiches_final_lowres.pdf	Fairly comprehensive brochure on sand dunes, dune ecology, pioneer plants including beachgrass, and how to restore dunes.
Bureau de normalisation du Québec (BNQ). 2001. <i>La méthode d'aménagement paysager à l'aide de végétaux</i> [plant landscaping method] NQ 0605 100-2001. www.bnq.qc.ca	Reference for horticultural projects. This document provides a step-by-step description of a successful planting technique.
Corporation Bassin Versant Baie Missisquoi (CBVBM). 2008. <i>Guide de mise en valeur riveraine. Protéger la qualité de vie des lacs et des cours d'eau</i> [Riparian development guide. Protecting the quality of lakes and watercourses]. 67 pages.	Excellent, straightforward guide with illustrations.
Corporation de l'aménagement de la rivière L'Assomption (CARA). 2008. <i>Guide de revégétalisation de la bande riveraine</i> [riparian revegetation guide]. 13 pages. www.cara.qc.ca	Easy-to-use guide. General technical concepts. List of recommended plants for the Lanaudière region. Perfect for getting started.
Comité zone d'intervention prioritaire (ZIP) de la rive nord de l'estuaire. 2004. <i>Guide de formation sur les habitats littoraux</i> [littoral habitats training guide]. www.zipnord.qc.ca	General information on coastal environments. Outlines steps for a conservation and development project. Primarily a training tool.
Comité zone d'intervention prioritaire (ZIP) Côte-Nord du Golfe. 2007. <i>L'érosion des berges au Québec maritime</i> [shore erosion in maritime Quebec]. 45 pages. www.zipcng.org/documentation/Doc_rosion_des_berges_Qc.pdf	General information document on erosion dynamics in coastal environments. Covers vulnerable coastal environments; means for protecting the coastline; and the environmental impacts of erosion control structures.
Conseil régional de l'environnement des Laurentides (CREL), 2007, édition 2009. <i>Protocole de caractérisation de la bande riveraine</i> [protocol for riparian strip characterization]. 22 pages.	Good, straightforward guide to help groups plan riparian revegetation work.
Fondation de la faune du Québec (FFQ). 2010. <i>Manuel d'accompagnement pour la mise en valeur de la biodiversité des cours d'eau en milieu agricole</i> [reference manual for promoting watercourse biodiversity in agricultural environments]. Fondation de la faune du Québec and MAPAQ. 136 pages. www.coursdeauagricoles.ca/accueil.html	Excellent reference material for preparing a community action project in an agricultural environment. Information on all types of riparian work in agricultural environments. Good reference for wildlife management.
Limoges, B. 1996. <i>Critères de conception pour une haie brise-vent ou une bande riveraine pour la faune</i> [design criteria for a windbreak or a riparian strip for wildlife]. Fondation de la faune du Québec. 7 pages.	Various types of advice are provided on developing riparian strips in agricultural environments while taking wildlife into account.

References	Focus
MDDEFP. 2007. <i>Guide d'élaboration d'un plan directeur de bassin versant de lac et adoption de bonnes pratiques</i> [guide for developing a lake watershed master plan and applying best practices]. 139 pages. www.mddefp.gouv.qc.ca/eau/eco_aqua/cyanobacteries/guide_elaboration.pdf	General reference addressing integrated management, planning, characterization, scientific aspects and types of work.
Regroupement des associations pour la protection de l'environnement des lacs et des cours d'eau de l'Estrie et du haut bassin de la rivière Saint-François (RAPPEL). 2005. <i>Rives et nature – Guide de renaturation</i> [shorelines and nature – renaturalization guide]. 2nd revised and expanded edition. 29 pages. Available on request. www.rappel.qc.ca/outils.html	Practical guide for developing shorelines in an environmentally responsible manner. Development of plant barriers that decrease shore erosion, filter pollutants and renew the shoreline.
Regroupement des organismes de bassins versants du Québec (ROBVQ). 2010. <i>Aménagement et entretien des propriétés résidentielles</i> [development and maintenance of residential properties]. 34 pages.	Document including general advice. Useful for understanding the dynamics of riparian residential properties. General awareness tool for the general public.
Regroupement des associations pour la protection de l'environnement des lacs et des cours d'eau de l'Estrie et du haut bassin de la rivière Saint-François (RAPPEL). Les pratiques riveraines [riparian best practices]. Website. www.rappel.qc.ca/vie-riveraine.html	Website outlining riparian best practices. Many good tips. Easy to read and understand.
Regroupement des associations pour la protection de l'environnement des lacs et des cours d'eau de l'Estrie et du haut bassin de la rivière Saint-François (RAPPEL). 2003. <i>Guide de bonnes pratiques environnementales</i> [environmental best practices guide].	Excellent guide, well illustrated, describing a number of erosion control techniques for shoreline projects.
Renaud, M. 2005. <i>L'art d'aménager des écosystèmes</i> [the art of ecosystem management]. Bertrand Dumont éditeur. 352 pages.	Useful book for understanding the interaction between plants and the host environment so as to ensure successful planting.
AQPERE. 2010. <i>Guide d'implantation de projets de mise en valeur du Saint-Laurent</i> [guide for St. Lawrence enhancement projects]. 25 pages. www.aqpere.qc.ca/campus/projetsB01.htm	Guide outlining the various steps for implementing a community project to enhance the St. Lawrence shoreline. Some aspects are relevant to revegetation projects.
Indigenous Plant Lists	
Fédération interdisciplinaire de l'horticulture ornementale du Québec (FIHOQ). 2008. <i>Répertoire des végétaux recommandés pour la végétalisation des bandes riveraines du Québec</i> [list of plants recommended for riparian vegetation projects in Quebec]. 19 pages. www.fihq.qc.ca/medias/D1.1.5B-1.pdf	List of plants sold in Quebec nurseries. The most up-to-date and most cited reference. Recommended by the MDDEFP.
Regroupement des associations pour la protection de l'environnement des lacs et des cours d'eau de l'Estrie et du haut bassin de la rivière Saint-François (RAPPEL). 2006. <i>Liste des végétaux pour la renaturation des rives</i> [list of plants for shoreline renaturalization]. 31 pages. www.rappel.qc.ca/IMG/pdf/listedesvegetaux2006-3.pdf	Classification of plants by various biophysical criteria in the host environment.

References	Focus
Bertrand Dumont. 2005. <i>Les niches écologiques des vivaces et plantes herbacées</i> [ecological niches for perennials and herbaceous species] Bertrand Dumont éditeur. 446 pages.	Books featuring detailed lists of plants with various planting parameters (plant hardiness zone, ecological niche, shade, soil acidity, etc.). A reference that provides useful information for ensuring the success of planting projects.
Bertrand Dumont. 2005. <i>Les niches écologiques des arbres, arbustes et conifères</i> [ecological niches for trees, shrubs and conifers]. Bertrand Dumont éditeur. 414 pages.	
A. Vézina, Desbiens, P. and Nadeau, N. 2007. <i>Choix et arrangement des végétaux en haies brise-vent et en bandes riveraines</i> [selection and layout of plants for windbreaks and riparian strips]. Institut de technologie agroalimentaire campus de La Pocatière. 113 pages. www.ccse-swcc.nb.ca/AgroFor/Guide_En.pdf	Comprehensive fact sheets on plants suitable for riparian strips.
Scientific and Legal Aspects	
Gagnon, E. and G. Gangbazo. 2007. <i>Efficacité des bandes riveraines : analyse de la documentation scientifique et perspectives</i> [effectiveness of riparian strips: analysis of documentation and perspectives]. Québec, MDDEFP. Water Policy Directorate. ISBN: 978-2-550-49213-9, 17 pages. www.mddefp.gouv.qc.ca/eau/bassinversant/fiches/bandes-riv.pdf	Excellent summary of the benefits and drawbacks of developing riparian strips as part of ecological rehabilitation projects.
MDDEFP. 2007a. <i>Guide d'interprétation, Politique de protection des rives, du littoral et des plaines inondables, ministère du Développement durable, de l'Environnement et des Parcs du Québec, direction des politiques de l'eau</i> [guidelines pertaining to the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains (PPRLPI), Quebec ministère du Développement durable, de l'Environnement et des Parcs, Water Policy Directorate]. 148 pages. www.mddefp.gouv.qc.ca/eau/rives/index.htm#guide	Reference for understanding Quebec's Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains (PPRLPI).
MDDEFP. 2007b. <i>Délimitation de la ligne des hautes eaux – Méthode botanique simplifiée</i> [delineation of high water mark – simplified botanical method]. www.publicationsduquebec.gouv.qc.ca/fre/products/978-2-551-19738-5	Simple, effective tool for identifying the high water mark with acceptable accuracy.
MDDEFP. 2009a. Guide d'analyse des projets d'intervention dans les écosystèmes aquatiques, humides et riverains assujettis à l'article 22 de la Loi sur la qualité de l'environnement – <i>Végétalisation de la bande riveraine</i> [riparian revegetation] www.mddefp.gouv.qc.ca/eau/rives/vegetalisation-bande-riveraine.pdf	Legal aspects and fundamental concepts for riparian revegetation projects.
MDDEFP. 2009b. Guide d'analyse des projets d'intervention dans les écosystèmes aquatiques, humides et riverains assujettis à l'article 22 de la Loi sur la qualité de l'environnement – <i>Délimitation de la ligne des hautes eaux (LHE)</i> [guide for the analysis of aquatic ecosystem, wetland and riparian projects subject to section 22 of the Environment Quality Act – delineation of the high water mark (HWM)] www.mddefp.gouv.qc.ca/eau/rives/delimitation.pdf	Legal aspects and fundamental concepts for the delineation of the HWM in freshwater environments.

References	Focus
Fisheries and Oceans Canada (DFO). Tides, Currents and Water Levels. www.waterlevels.gc.ca/eng	Website featuring tide, current and water level data.
Relevant Websites	
Fédération interdisciplinaire de l'horticulture ornementale du Québec (FIHOQ). Search engine and downloadable document. http://vegetaux.fihq.com .	Plant search engine that is regularly updated. A very useful tool for preparing your project and selecting plants based on a number of relevant criteria. Recommended by the MDDEFP.
Conseil Régional de l'environnement Laurentides (CREL). 2009. <i>Trousse des lacs</i> [lake information kit] www.troussedeslacs.org	Tool designed to raise awareness and educate people interested in improving water bodies. Useful, practical, easy to use and continuously updated.
Laboratoire de dynamique et de gestion intégrée des zones côtières [coastal dynamics and integrated management laboratory]. http://dgizc.uqar.ca	Website featuring a broad range of scientific information on coastal dynamics.
Côtes à côtes. Comité Zone d'intervention prioritaire (ZIP) du Sud-de-l'Estuaire [Sud-de-l'Estuaire priority intervention zone committee]. www.cotesacotes.org	Website for comparing the benefits and drawbacks of various types of intervention.
MDDEFP. Riparian strip characterization website. www.mddefp.gouv.qc.ca/eau/eco_aqua/IQBR/index.htm	Website providing a protocol and tools for rationally characterizing riparian habitat quality. The site refers to very good guides, examples and tools for determining the ecological value of a revegetation project.
Regroupement des associations pour la protection de l'environnement des lacs et des cours d'eau de l'Estrie et du haut bassin de la rivière Saint-François (RAPPEL). <i>Les pratiques riveraines</i> [riparian practices]. www.rappel.qc.ca/vie-riveraine/pratiques-riveraines.html	Website that covers riparian practices and causes of erosion and provides detailed lists of plant fact sheets.

11. Relevant information

11.1. Definition of a riparian strip

A riparian strip is permanent plant cover consisting of a mix of herbaceous, shrub and tree species located on an area adjacent to a watercourse, lake or the sea. This riparian zone is always above the natural high water mark, and it represents the transition between aquatic and terrestrial ecosystems. Being at the junction of two different environments and subject to natural disturbances, the riparian zone hosts particularly dynamic and diverse wildlife and flora (Gagnon 2007).

There is no predetermined width for a riparian strip that would fulfill a given ecological function (Gagnon 2007). In practice, it is therefore difficult to specify an ideal width for a given strip and hence to determine whether a wider strip would be better to support various ecological functions more effectively. The ideal width for a riparian strip also depends on adjacent human activities, since the object is to ensure the riparian strip buffers the adverse impacts of these activities. Finally, the type of slope and soil are also important factors in determining the “effective” width of the ideal riparian strip.

Freshwater



Riparian strips differ depending on whether they are located in agricultural, forest, urban or cottage areas. In recent decades, the considerable degradation of riparian strips in agricultural and cottage areas has been observed.

Community revegetation programs are being implemented in these degraded riparian areas. The largest number of community action projects have targeted shorelines, primarily lakeshores in cottage areas, followed by riparian projects along watercourses in agricultural and urban environments.

- Urban environments and cottage areas

Most of the community riparian revegetation projects have been carried out on the St. Lawrence Plain and foothills, notably in Estrie, the Outaouais and the Laurentians, the Lake Saint-Jean region and the Appalachians. A number of practical guides

suggest intervention strategies suited to these areas, including the Trousse des lacs (www.troussedeslacs.org) and the RAPPEL website on riparian practices (www.rappel.qc.ca/vie-riveraine.html). These two websites provide a range of tools and guidelines for riparian revegetation projects. Other non-technical documents are also available, including those by ROBQ (2010), CARA (2008) and CBVBM (2008).



- Agricultural environments

Agricultural environments have many degraded riparian strips attributable to intensive agricultural use. The land involved mostly belongs to farmers and is located primarily in the St. Lawrence Plain, but also in the Beauce, Lake Saint-Jean, Abitibi and other regions of Quebec. The most up-to-date guide for community action projects in agricultural areas is the reference manual for promoting watercourse biodiversity in agricultural environments (*Manuel d'accompagnement pour la mise en valeur de la biodiversité des cours d'eau en milieu agricole*) (www.coursdeauagricoles.ca/accueil.html).



Saltwater

Carrying out a riparian rehabilitation project in a coastal environment involves completely different issues than those in a freshwater project. First, there is less pollution owing to the smaller and more dispersed population. Second, the impacts on the marine environment are reduced owing to the considerable dilution capacity of the sea.

Coastal erosion caused by wave action during storms and high tides is such a powerful process that the riparian revegetation approaches and the plant-based engineering techniques used in freshwater environments are essentially ineffective for stabilizing coastlines. Before revegetating a riparian strip in a marine environment, the extent of coastal erosion must be determined. The coastal erosion research chair at the UQAR has a major shoreline erosion monitoring program. Members of the team may be contacted for scientific data on shoreline erosion (<http://dgizc.uqar.ca>).



Valid reasons for taking action targeted to coastal riparian strips include ecosystem and biodiversity restoration or the reduction of **anthropogenic erosion**, i.e., the erosion caused by human activities, which differs from the above-mentioned coastal erosion caused by wave action in that it occurs in fragile environments such as sandy backshores or dune environments. This type of erosion is caused by repeated pickup truck and ATV traffic and even by people walking. The training guide on revegetation projects in salt marshes (*Guide de formation sur les habitats littoraux*) produced by the Comité ZIP de la rive nord de l'estuaire (2004) provides a good overview of what can be done.

Riparian strips in some riparian ecosystems in transition, specifically those in estuaries and lagoons may, under certain conditions, be the object of erosion control projects using plant-based engineering and revegetation approaches. These environments are characterized by lower wave-energy conditions in comparison with directly exposed coasts.



For more information on the maritime littoral environment, the Côtes à côtes website (www.cotesacotes.org) and the Quebec coastal shoreline erosion guide (*L'érosion des berges au Québec*

maritime – ZIP CNG 2007) are good references. These sources of information shed light on the issues pertaining to the protection and enhancement of maritime shorelines.

11.2. Environmental arguments in favour of riparian revegetation

There are various well-known, science-based reasons for revegetating riparian strips. The reasons are based on water filtering and ecological functions and scientific documentation issues recognized in Quebec (MDDEFP 2007a; Gagnon 2007). The primary reasons for revegetating and maintaining riparian strips are to

- Create habitats for fauna and flora
- Create ecological corridors
- Promote the retention of nutrients and sediments by reducing leaching of pollutants
- Provide a barrier to soil and shore erosion, thereby reducing siltation of spawning grounds and the development of algal blooms, and improving water transparency
- Mitigate the effect of wind and reduce wind erosion
- Provide more shade for the water body and reduce the water temperature and the loss of habitat for freshwater fish
- Control the water cycle and hence reduce the risk of severe flooding and drought

Note that riparian revegetation is just one strategy for mitigating the impact of pollution on water bodies. In the rationale for your project, you are advised to keep in perspective the relative effect of the proposed riparian strip on the protection of the aquatic environment.

Also note that there are economic reasons you can present for improving lake water quality. These may have a major influence on the riparian landowners' reasons for participating (decrease in property values) or the municipality's motivation (decrease in property taxes).

11.3. Regulations Riparian strips

In Quebec, the recommended width of riparian strips as set out in Quebec's Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains (PPRLPI) depends on the slope and height of the bank, giving a width of up to 10 or 15 m measured horizontally (Figure 4). In agricultural environments, the policy permits agricultural use of the riparian strip starting 3 metres from the high water mark, excluding in some cases at least one metre of bench—see 3.2.f of the PPRLPI (Figure 5). These

recommended widths should not be interpreted as appropriate criteria for the protection or restoration of aquatic and riparian ecosystems. The goal of these widths is to ensure minimum protection (Gagnon 2007). Given that these are minimum protection guidelines, some Quebec municipalities have

incorporated larger widths into their bylaws. Revegetation projects can therefore exceed these recommended widths. In all cases, the riparian strip is measured from the high water mark in an inland direction.

Figure 4. Widths of riparian strip – river and marine environments (MDDEFP 2007a)

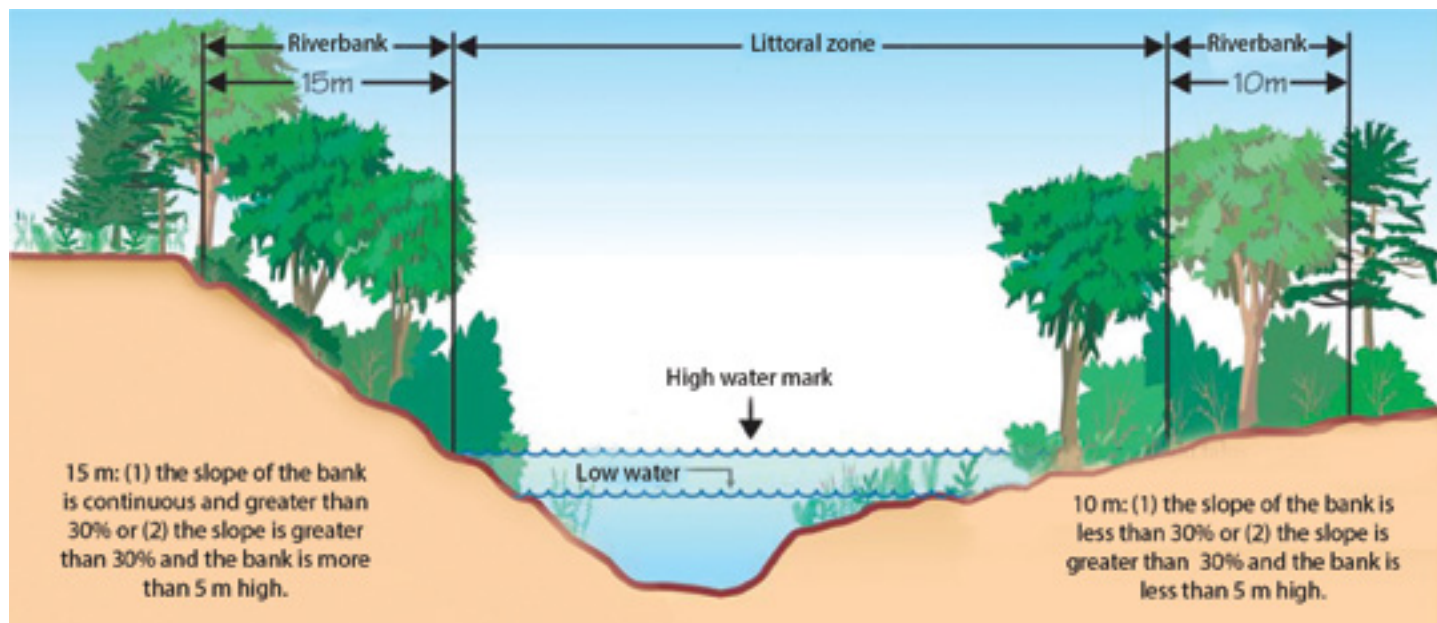
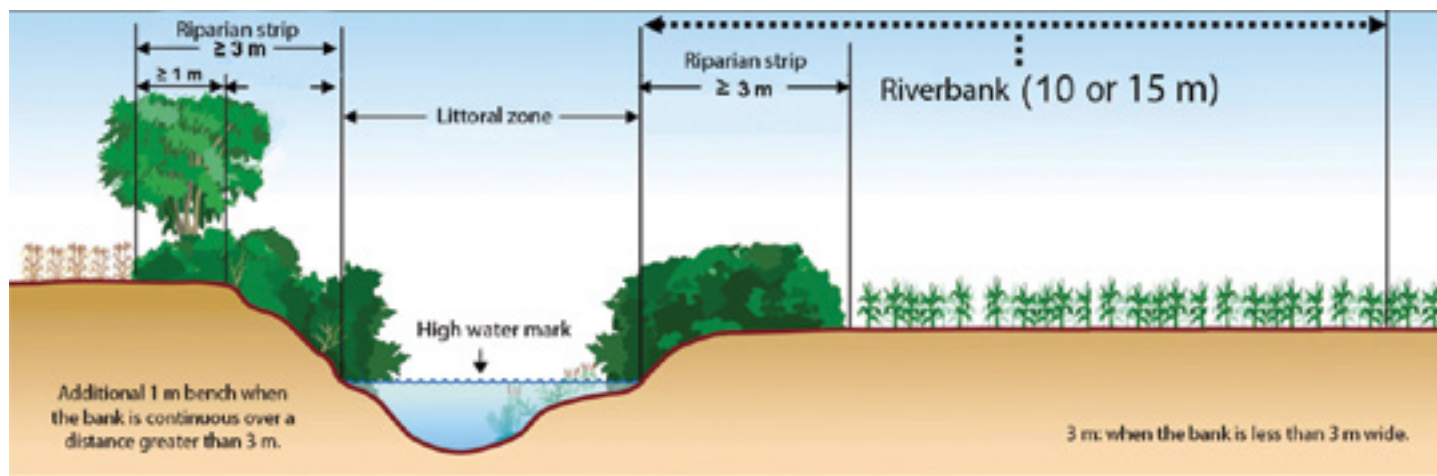


Figure 5. Widths of riparian strip – agricultural environments (MDDEFP 2007a)



IMPORTANT: In your funding application, you need to discuss municipal bylaws governing riparian strips. In this regard, contact the person responsible for watercourses at the RCM.

If the slope of the riparian strip needs to be modified, you will need to contact Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP) as well as the municipality to find out about your legal obligations and the required permits. Moreover, if there are erosion hotspots, slope stabilization work must include plant-based engineering or other techniques. In such cases, it is necessary to contact various authorities regarding technical considerations and legal authorizations.

The high water mark (HWM) is not always where one might think it would be. It represents a water level that is generally reached early in spring or during significant flooding.

To determine the exact location of the HWM on a shoreline in either freshwater or saltwater environments, the simplified botanical method is used (MDDEFP 2007b). **Delineating the HWM can be done when the detailed work plan is prepared, that is, during the course of the project and not before the**

It is essential to properly site the revegetation work. Some plants have a low tolerance to exposure to water and erosion and need to be planted above the HWM. Others can withstand extended flooding and, because of their flexibility and strong root systems, they can withstand erosion and also enhance soil stability. The MDDEFP recommends revegetation based on **planting the shrub layer** at the point where the first naturally occurring rows of shrubs are observed (Sweet Gale, Green Alder, etc.). Native plant species must be used (Section 8.6). You should also consult the appropriate government authorities (MDDEFP, RCM and DFO) before proceeding with the work.

Controlling shore erosion caused by waves, currents and tides involves a number of technical and legal measures. You should assess your organization's capacity to handle all the steps in this potentially lengthy and costly process.

- Is the shore erosion severe? If so, consult with engineers, plant-based engineering specialists and environmental consultants to develop an effective and sustainable stabilization approach.
- Is the erosion due to natural processes or to human intervention? If the erosion is of natural origin, it is likely that no funding can be allocated. The programs do not cover measures to modify natural processes.
- Is protecting infrastructure the reason for the erosion control? Again, the project would not be eligible for funding from the Community Action Programs for the Environment. The project would not be eligible either if the only benefit were preserving agricultural land.
- If the objective of the stabilization work is to protect terrestrial habitat or fish habitat, you should give priority to plant-based engineering techniques. If absolutely essential, a mixed approach may be used—that is, a combination of plant-based engineering techniques and conventional civil engineering techniques. In the latter case, one of the challenges would be to argue the need for opting for this type of intervention while proposing mitigation or compensation measures.

Something to consider: If you opt to forego stabilization work on a severely eroded shore, you need to reassess the need for revegetation work on the riparian strip at this location. Ensure you select species adapted to severe erosion conditions.

Actions required to stabilize the littoral zone (below the HWM):

- Accurately define the environmental problem that requires shoreline intervention.
- Unless you have appropriate human resources within your organization, you will need to hire consultants to design a proposal that includes plant-based engineering techniques and considers measures for protecting the aquatic environment during the work.
- Specialists may be required to assist with preparing environmental impact assessments required to obtain requisite authorizations. These applications are submitted to Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP) and potentially, in the case of fish habitat, to Fisheries and Oceans Canada (DFO). Certification of compliance with municipal bylaws is also required.
- One of the government authorities involved in providing authorizations may ask you to re-evaluate certain components of the project and add mitigation measures. This may require that you reassess the cost estimates.
- Finally, you can submit the project to the community action funding programs, ideally with an approved engineering plan and government authorizations. **These documents are generally mandatory when signing a contribution agreement with Environment Canada.**⁴

Good planning will guarantee the success of your application, both in terms of funding and human resources. Support from various partners is essential. You should think through the project proposal carefully before embarking on the process.

Reminder: Be sure to have a program officer review your project schedule and identify the documents required and relevant timelines so as not to jeopardize your chances of obtaining funding.

Revegetation in floodplains

Under Quebec's policy (MDDEFP 2007a), a floodplain is the space occupied by a body of water during periods of flooding. It is identified in municipal bylaws or on a map or by flood recurrence levels issued by the Government of Quebec. Floodplains are divided into two separate zones: a high-velocity zone (0–20-year recurrence) and a low-velocity zone (20–100-year recurrence).

A project may target a shoreline area located in a floodplain. In such a case, local conditions could adversely impact newly planted stock. If this is a possibility, you should consider planting large specimens that can withstand repeated flooding. The lists of recommended species (Section 10) generally identify species adapted to this type of site.

To ascertain whether your project is located on a floodplain, contact the person in charge of watercourses at your RCM or visit the Centre d'expertise hydrique website www.cehq.gouv.qc.ca/zones-inond/cartographie/index.htm.⁵

4. Some programs, including the Community Interaction Program, provide a two-phase "study-action" funding option. This allows for the interactive submission of documents with the first step involving funding for design and authorization activities, followed by another decision rendered after the submission of the documents. For more information, visit http://planstlaurent.qc.ca/en/community_interaction.html.

5. A paper or PDF version is available for \$25.

Appendix 1. Key success factors for riparian revegetation projects

Factors	Reminders and Comments
Plant selection	<ul style="list-style-type: none"> • Native species are mandatory. • Avoid undesirable species. • Species are suited to the target site.
Plant size	<ul style="list-style-type: none"> • The denser the existing vegetation at a site, the larger the format of the planting stock should be. • The smaller the planting stock used, the higher the density of the planting should be to offset the high mortality of young plants.
Optimal revegetation periods	<ul style="list-style-type: none"> • First choice: mid-April to mid-June (allowing time for plants to develop a strong root system before winter) • Second choice: early September to mid-October (avoiding summer heat). In this case, you will need to check in spring for uprooted plants (caused by the freeze-thaw cycle). To limit damage, plant the specimens a little deeper than normal. • Third choice: summer, with appropriate watering.
Soil quality	<ul style="list-style-type: none"> • Have soil analyzed and select species suited to the soil, or apply amendments. Note that fertilizer is prohibited in riparian strips.
Quality of imported topsoil or potting soil	<ul style="list-style-type: none"> • The substrate must be suited to the soil and the site. Bear in mind that potting soil is rarely suitable for riparian strips. Also, imported topsoil could contain seeds for Common Water Reed and other invasive species.
Watering	<ul style="list-style-type: none"> • As required in the first few months and especially in summer.
Presence of prevailing winds	<ul style="list-style-type: none"> • Prevailing wind direction can be determined by observing the orientation of branches on mature trees. • Plan to position stakes for the trees in relation to the prevailing wind direction.
Presence of rodents or herbivores	<ul style="list-style-type: none"> • Plan to install guards to protect trees from rodents.

Appendix 2. List of materials, equipment and other expenses

This comprehensive list is intended to cover practically every type of riparian project. Select only those items that are relevant to your project.

Factors	Reminders and Comments
Materials	<ul style="list-style-type: none"> • Topsoil and potting soil • Herbaceous plant seed • Perennials in pots • Shrub and tree stock • Tree guards to protect against rodents and herbivores, repellents • Weed control (mulch discs, cardboard mulch or ramial chipped wood ...) • Mycorrhizae • Stakes and guy wires • Geotextiles, biodegradable erosion control blankets • Snow fences • Information panels to raise awareness • Revegetation project signs • Brochures <p>Note: Pesticides and fertilizers are not recommended owing to the risk of water contamination.</p>
Equipment (rented, loaned or purchased ⁶)	<ul style="list-style-type: none"> • Machinery, backhoe, rotary cultivator, ATV • Light equipment: shovel, digger, rake, pick, wheelbarrow, pump and watering equipment, stake hammer) • Pickup truck
Labour (employees and volunteers)	<ul style="list-style-type: none"> • Project management and administration • Operations coordinator and awareness program communications officer • Field and maintenance workers
Other costs	<ul style="list-style-type: none"> • Professional services (landscape architect, biologist, graphic designer) • Reserve fund for plant replacement • Administrative expenses: a reasonable proportion to cover office rental, electricity, office supplies and other general expenses directly related to project implementation. • Accident insurance coverage for volunteers. The CSST offers such coverage.

6. In the case of purchased equipment, refer to Environment Canada for applicable depreciation rates.

Appendix 3. Revegetation density

Herbaceous and Perennial Seeding

- Manual seeding of bare soil: 350 kg/hectare (35 g/m²)
- Sparsely vegetated soil: 200 kg/hectare (20 g/m²)

After a month, check whether the seeds have germinated. If not, add new seed in bare areas.

Shrubs and Trees

The recommended **shrub** density is at least **1 m centre to centre** (between shrubs). Small plants may be difficult to find in the herbaceous layer for tending purposes. Using coco mulch discs is advisable to provide weed protection.

For **trees**, the recommended **centre-to-centre distance is 2 to 5 m**, depending on the species selected. It is worthwhile planting large trees to promote their growth in relation to the herbaceous layer.

Appendix 4. Method for estimating plant requirements

To determine the number of plants required for a given area, an equilateral diamond or quincunx layout should be used. It is the most effective layout for minimizing the number of plants needed to cover an area:

Number of plants = number of rows multiplied by the number of plants per row

The mathematical equation is

$$\text{number of plants} = L/D \times ((W-D)/0.87D + 1)$$

where

L: length of riparian strip in metres

W: width of revegetation in metres

D: distance between plants (equidistance) in metres

0.87: coefficient that accounts for the staggered effect (diamond or quincunx layout)*

The number of plants required is very slightly overestimated by this equation, which provides a margin of error in terms of the actual requirements in the field.

* A coefficient of 0.76 could also be used, to enhance total plant coverage (see Section 8.2 for a more detailed explanation).

Appendix 5. Sample plant order and financial evaluation

Below is an example of a 7500 m² riparian revegetation project, 1/3 (2500 m²) of which will be covered by trees, and 2/3 by shrubs (5000 m²), and 1000 m² of which will have a herbaceous layer. Once the estimated quantities have been determined, the next step is to check out various nurseries for the best prices. The FIHOQ website (www.fihq.qc.ca) provides a list of horticultural suppliers.

HERE are the results using the formula in Appendix 4:

	Trees	Shrubs
L (m)	3.3 m	6.7 m
W (m)	750 m	750 m
D (centre to centre)	5 m	1 m
Area	2500 m ²	5000 m ²
Number of plants	±110	±5800

Table 5. Sample estimate of native plant purchases

Native Plants		Centre-to-Centre Distance (m)	Area (m²)	Number			Unit Cost (for information purposes)	Total
Strata	Target Species			1 Gallon Pot	1 Litre Pot	LSS ⁷ 320 cm³		
Trees	White Birch, Silver Maple Red Maple, Ash	5	1000	44			\$20	\$880
			1500		66		\$5	\$330
			2500	30	80	0	Subtotal:	±\$1,200
Shrubs and vines	Littletree Willow, Sweet Gale, Riverbank Grape, High-Bush Cranberry, Green Alder	1	2000		2300		\$4	\$9,200
			3000			3 500	\$1	\$3,500
			5000		800	5000	Subtotal:	\$12,700
Total trees and shrubs:			7500	30	835	5000		\$13,900
Herbaceous species	Riparian treatment seed mix	—	1000	—	—	—	\$1/m²	\$1,000
Total revegetation purchases:								\$14,900
Dead planting stock replacement (20%):								\$3,000

7. LSS: large-stock seedlings.

www.ec.gc.ca

Additional information can be obtained at:

Environment Canada

Inquiry Centre

10 Wellington Street, 23rd Floor

Gatineau QC K1A 0H3

Telephone: 1-800-668-6767 (in Canada only) or 819-997-2800

Fax: 819-994-1412

TTY: 819-994-0736

Email: enviroinfo@ec.gc.ca

