Quinte West
Waterfront Regeneration Plan

APPENDIX E

ROBERT PATRICK MARINA
ENHANCEMENT PROJECT
CONCEPT PLAN

December, 2000

Prepared by:
Lower Trent Conservation

The Quinte West Waterfront
--clean, green, diverse, healthy--a natural edge for the City!
APPENDIX E

Robert Patrick Marina Enhancement Project Concept Plan

Prepared by:

Jeff Brinsmead

LOWER TRENT CONSERVATION
December, 2000
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ROBERT PATRICK MARINA ENHANCEMENT
-CONCEPT PLAN-

PROPOSED CONCEPT
The Robert Patrick Marina, which is owned by the City of Quinte West, is used for recreational boat docking. It is located on the east side of the Trent River (in Centennial Park) where the river discharges to the Bay of Quinte (Figure 1). Considering the prime location of the marina along the waterfront at the west end of Centennial Park, it should become a key focal point for the waterfront. Any redesign of this area should, in addition to being resistant to shoreline forces, contribute to the attractiveness of the waterfront, and provide additional habitat for fish and wildlife.

A number of issues along the shoreline adjacent to the marina have been identified. The present configuration of the inlets and outlets from the Trent River and the Bay of Quinte to the marina does not permit adequate water flow through the marina basin. Currently, there are two culverts that connect the marina basin to the river, one culvert that connects the marina to the bay, and a channel (for boat traffic) that enters at the mouth of the river. Other issues at the marina site include erosion and a lack of suitable habitat for wildlife.

The inlet/outlet culvert on the bay side of the marina has been filled with sediments from the bay and does not currently convey water to or from the marina (Photo 1). Simply cleaning out the sediments and lowering the culvert is not an acceptable solution because the wave action of the bay would cause the culvert to be rapidly refilled. As well, the culverts that connect the marina to the river convey very little water because they are located in a position where there is minimal flow (Photo 2). As a result, the marina area suffers from sedimentation, excessive weed growth (that must currently be controlled with herbicides), and frequent algal blooms in the summer.

Bank slumping and sheet erosion are problems at several sites along the length of the berm on both the marina and open water sides (Photo 3). Erosion along the berm is aggravating the aforementioned sedimentation problem in the marina, and contributes additional nutrients to the marina basin, the river and the bay. The interior of the berm is currently lined with concrete slabs which are meant to prevent erosion of the bank. In many places these slabs are listing, and this has resulted in bank slumping and additional erosion. The listing slabs themselves are unsightly and may be unstable (Photo 4).

Finally, given the present state of the lands surrounding the marina, there is very little habitat available for fish and wildlife in this area. While there are scattered shrubs and native grasses on the slope of the berm, the top is covered by a lawn area with a few isolated trees.

The preferred approach for alleviating the above problems would include repositioning the culverts between the river and the marina, replacing the culvert on the bay side with a full span bridge, and naturalizing the top and sides of the berm. The Plan View for the preferred option is shown in Figure 2. Further details for this proposal are given below.
Quinte West Waterfront Regeneration Plan

Figure 1  Location of Robert Patrick Marina

Produced by Lower Trent Conservation under licence with the Ontario Ministry of Natural Resources. Copyright: Queen's Printer, 2000.
Figure 2
Marina Enhancement Plan

LEGEND
- culvert to be removed
- proposed new culvert
- proposed open channel/bridge

Source: 1999 Airphotos

for Planting Plan, see Appendix 2
Prior to finalizing the design of the preferred approach, it will be necessary to complete a study of the hydrology and hydraulics of the marina basin. Background information that needs to be established includes typical water levels in the marina, an estimated volume of the basin, present flows, and the flushing time for the basin based on the current rate of water exchange. Furthermore, expected changes to the flow through the marina (and hence, the flushing time of the basin) should be predicted based on the various culvert and bridge designs considered.

The following design was selected as the preferred approach, based on environmental benefits and cost effectiveness. Of the culverts connecting the marina basin to the river, the one that is located closest to the shoreline (i.e. the one that is furthest north) would be moved approximately 10 m to the southwest. In its present location, the culvert is in a backwater area and catches virtually no current. Moving this culvert will make it more functional. The other existing culvert, between the marina and the river, needs to be flushed of accumulated sediments and should be replaced in its current location at a lower grade. It is recommended that a third culvert be added to further connect the marina and the river. This culvert would be positioned an additional 5-10 m to the southwest of the existing culverts near the "elbow" of the berm.

On the bay side of the marina, the culvert that has filled with sediments should be removed, and a full span bridge with a 10 m wide channel should be installed. Simply adding a larger culvert at this location is not a viable option, as the new culvert would rapidly fill with sediments again. Based on the flow values obtained from the aforementioned hydrologic study, it would be necessary to tailor the design of the open channel to convey a flow that is similar to that of the three culverts on the river side of the marina.

Once the preceding works are completed, it would be necessary to stabilize sections of the berm adjacent to the construction activities and in areas where previous erosion and bank slumping is evident. Generally, this involves reestablishing the vegetative cover on the slope, but may also include the placement of hard structures (such as rip rap) to prevent future erosion. Where possible, maintained grassy areas on the berm should be left to naturalize, and native shrubs should be planted. This type of a revegetation scheme will create additional wildlife habitat, demobilize excess nutrients in runoff, and prevent erosion along the berm (see Appendix 2 - Planting Plan for the Quinte West Shoreline).

The listing concrete slabs located on the interior side of the berm may, in some cases, be repaired by lifting them back into place using a large backhoe, and adding a new granular base below the water level using a second backhoe or from a barge. Planting vines along the top of the concrete slabs would improve the aesthetics. Although the above solution may be sufficient in many places, a more naturalistic approach would be preferred. The concrete slabs could be removed altogether, and fill would be placed in the footprint. This fill would be stabilized using filter cloth and by placing variable sized field stone rip rap overtop. Live stakes could be pushed through the filter cloth to establish vegetation on the slope of the berm, while shrubs and live cuttings could be used at the top of the bank to establish a vegetated riparian zone.
### ESTIMATED COSTS FOR MARINA ENHANCEMENT PROJECT

<table>
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<tr>
<th>Project Component</th>
<th>Amount</th>
<th>Unit Cost</th>
<th>Component Cost</th>
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<tbody>
<tr>
<td>Soils Testing</td>
<td>2 samples</td>
<td>$750/sample</td>
<td>$1500</td>
</tr>
<tr>
<td>Study of hydrology and hydraulics</td>
<td></td>
<td></td>
<td>5000</td>
</tr>
<tr>
<td>Preparation of Detailed Plans (including agency review and Class EA - if necessary)</td>
<td></td>
<td></td>
<td>5000</td>
</tr>
<tr>
<td>Move existing culvert &amp; add one culvert - large backhoe</td>
<td>2 days</td>
<td>$85/hr</td>
<td>1360</td>
</tr>
<tr>
<td>- dump truck</td>
<td>2 days</td>
<td>$50/hr</td>
<td>800</td>
</tr>
<tr>
<td>- small backhoe</td>
<td>1 day</td>
<td>$45/hr</td>
<td>360</td>
</tr>
<tr>
<td>Culvert (1400 mm; 12 gauge)</td>
<td>10 m</td>
<td>$207.60/m</td>
<td>2076</td>
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<tr>
<td>Install field stone rip rap in erosion prone areas</td>
<td>2 days</td>
<td>$45/hr</td>
<td>720</td>
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<tr>
<td>- small backhoe</td>
<td></td>
<td>$250/load</td>
<td>7500</td>
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<tr>
<td>- field stone rip rap for approx. 100 m of shoreline</td>
<td></td>
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<td></td>
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<tr>
<td>Realign/Replace interior concrete slabs</td>
<td>2 days</td>
<td>$85/hr</td>
<td>1360</td>
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<tr>
<td>- large backhoe</td>
<td>3 days</td>
<td>$45/hr</td>
<td>1080</td>
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<tr>
<td>- small backhoe</td>
<td>for approx. 150 m of shoreline</td>
<td>$250/load</td>
<td>12500</td>
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<tr>
<td>- field stone rip rap</td>
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<tr>
<td>Plantings - topsoil</td>
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<td>- grass seed</td>
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<td>Engineering plans for bridge (approximate)</td>
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<td>Bridge - materials and construction (approximate)</td>
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<td>Project Management &amp; Contingency</td>
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<td>$64945</td>
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ADVANTAGES OF PROPOSED CONCEPT
There are a number of advantages to adopting the preferred design described above. By flushing additional water through the marina basin, excessive suspended sediments and nutrients will be removed, which will reduce the incidence of unsightly algal blooms. By establishing buffer strips, or a more naturally vegetated berm, sediment and nutrient inputs to the bay and the marina will be further reduced, and habitat for terrestrial animals will be provided. Fish habitat structures could be installed along the open water side of the berm (as previously described in Appendix D - Trent River Bank Stabilization Project Concept Plan). Fish habitat should not be encouraged within the marina basin, because it will likely be necessary to continue applying herbicides to control aquatic plants. The accumulated sediments in the marina basin will continue to provide a high nutrient environment for some time, and increased water clarity will likely make conditions more favourable for macrophyte growth in the future.

CONSIDERATIONS

Public Safety:
During the construction phase of the project, public safety issues must be addressed by any contractor retained by the City of Quinte West. Public safety in the marina area and in the adjacent parklands should not change as a result of the project. For example, there may be an upper limit for the degree of flow through the marina that is desirable, as the site hydrology must not interfere with navigation in the confined space of the marina basin.

Environmental Assessment:
As the marina enhancement plan is a municipal project, it may be necessary to complete a provincial Environmental Assessment under the Municipal Engineers Association Class EA for Municipal Water and Wastewater Projects (June 1993). Erosion control projects, such as the current proposal, generally proceed as a "Schedule B" project. For a "Schedule B" project, the proponent is required to undertake a screening process involving mandatory contact with directly affected public parties and relevant government agencies.

Before proceeding, the project would require approval from Lower Trent Conservation (LTC) under Section 28 of the Conservation Authorities Act, for the placement of fill. Approval will also be necessary from the Department of Fisheries and Oceans (DFO) under the federal Fisheries Act. A project that is subject to the federal Fisheries Act may also invoke the Canadian Environmental Assessment Act (CEAA). The necessary documentation for this process is usually completed internally by the concerned federal agency (DFO in this case). Other agencies that should be included in the review of the project are the Ontario Ministry of Natural Resources, the Trent-Severn Waterway and the Canadian Coast Guard.

Detailed Plans:
Detailed site grading plans will need to be prepared to provide final construction details and to establish final costs.

POTENTIAL FUNDING PARTNERS:
City of Quinte West        ecoAction
ALTERNATIVE OPTIONS:

1. Remove, dredge and replace the culvert between the bay and the marina. Move the culvert that is closest to shore, and connects the river and the marina, so that it is closer to the “elbow” of the berm and catches more of the flow from the river. This option is not a preferred approach because the culvert between the bay and the marina will rapidly fill with sediments again.

2. Move the culvert that is closest to shore, and connects the river and the marina, so that it is closer to the “elbow” of the berm and catches more of the flow from the river. Replace the culvert between the bay and the marina with a larger culvert, at an elevation that is below the low water level of the bay. This option is not a preferred approach because the larger culvert will eventually become blocked with silt as well.

3. Move the culvert that is closest to shore, connecting the river and the marina, so that it is closer to the “elbow” of the berm and catches more of the flow from the river. Remove, dredge and replace the culvert between the bay and the marina. Install a structure to catch the silt in front (on the bay side) of the culvert, or place the culvert on an angle to reduce the collection of sediments. This option is not a preferred approach because sedimentation is only delayed, and the flow of water through the culvert would be greatly reduced compared to the preferred option.

4. The culverts on both the bay and river side of the marina could be replaced with full span bridges. If the width of the channel required to achieve the desired flow through the marina is particularly large, tandem bridges could be used both on the bay and river sides (see Figure 3). Although installing full span bridges is more costly than using culverts, the bridges would be more aesthetically pleasing, provide additional bottom surface area (aquatic habitat), maximize flow through the marina, and provide better fish passage.

5. Completely redesigning the entire marina would allow a number of issues to be addressed at once. Water circulation, failing retaining walls, and fish and terrestrial habitat issues could all be addressed at the same time. Although there is a greater initial cost to this option, costs associated with maintenance and on-going problems will be reduced, and a piecemeal approach to land and water resource management is avoided.
The existing wooden bridge is sagging and may not support maintenance or emergency vehicles.

The single existing metal culvert cannot convey sufficient water to keep the marina area fresh.

The rough shoreline of concrete slabs is unattractive and ecologically deficits.

A prefabricated metal bridge would allow for maintenance and emergency vehicles as well as pedestrian use. The proposed improvement will allow about seven times the existing culvert volume and provide additional aquatic habitat area. Canoes or paddleboats could also gain access to the Centennial Park shoreline from the Marina.

A second or longer span could be installed for even greater flow-through.

The existing wooden bridge is sagging and may not support maintenance or emergency vehicles.

The rough shoreline of concrete slabs is unattractive and ecologically deficits.

A prefabricated metal bridge would allow for maintenance and emergency vehicles as well as pedestrian use. The proposed improvement will allow about seven times the existing culvert volume and provide additional aquatic habitat area. Canoes or paddleboats could also gain access to the Centennial Park shoreline from the Marina.
Photo 1: The culvert that connects the Bay of Quinte and the marina is too high, and has been partially filled with sediments and other debris.

Photo 2: The two culverts connecting the Trent River to the marina are located in a backwater area, where there is very little water exchange. Sedimentation of the culverts is also an issue.
Photo 3: Sheet erosion and bank slumping amongst the broken concrete slabs occurs at a number of locations along the marina berm.

Photo 4: The concrete slabs lining the interior of the marina berm are listing in many locations, resulting in additional bank slumping and erosion. The listing slabs are unsightly and unstable.