THE 2005 CORNWALL SEDIMENT STRATEGY

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On the recommendation of the St. Lawrence River Institute of Environmental Sciences, a commitment has been made to implement a comprehensive ongoing monitoring program to track environmental conditions and sediment stability and report regularly on results. If new information comes to light that necessitates a revision to prior decisions, the Administrative Controls Protocol can be opened up by the Parties signatory to the accord and revised if necessary.

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The main part of this report was drafted in 2005 and reflects the science and decisions made at that time, but was subsequently finalized in 2010 for publication.

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BACKGROUND/OVERVIEW

Dealing with historically contaminated sediments is an issue common to many industrialized waterfront communities and Cornwall, Ontario is no exception. The evolution of environmental awareness and tremendous advances in science have allowed us to recognize and better understand the impacts of pollution on the environment. As a result of that knowledge, governments have developed and continue to refine regulations to prevent and control pollution. Dealing with the legacy of our industrial past is a challenge of another sort.

In order to deal effectively with the legacy of contaminated sediments in the St. Lawrence (Cornwall) Area of Concern, work on a sediment management strategy began in June 2000 and continued until 2005, which is what this report is based on. Please note that the main part of this report was drafted in 2005 and reflects the science and decisions made at that time, but was not finalized for publication until 2010.

An Environmental Legacy

Cornwall, Ontario has been a centre of industrial activity since around the turn of the 20th century. A cluster of industries developed on the north shore of the St. Lawrence River, taking advantage of the large volume of fresh water available for industrial processes and transportation.

Three main companies operated plants at the Cornwall waterfront—a pulp and paper mill owned by Domtar Fine Papers (previously Howard Smith Paper Mill), a chlor-alkali plant owned by ICI Canada Incorporated (previously CIL Cornwall Works) and a rayon facility owned by Courtaulds Fibers Canada.

Over the decades of industrial operations at Cornwall, contaminants such as mercury were directly discharged from these and other smaller industries to the St. Lawrence River. The river also received contamination from other sources such as urban and rural surface runoff, atmospheric deposition and sources upstream of Cornwall. Four depositional zones within the river were investigated for mercury contamination, with the result being the identification of sediments contaminated with mercury in zones 1, 2 and 3 along the Cornwall waterfront (Figure 1).

Environmental regulations and industrial practices have changed significantly over the last 30 years. Government regulations have evolved along with scientific understanding of the potential impacts of contamination on health and the environment.

As regulations evolved, environmental control measures were implemented at Cornwall, starting in the late 1960s. The Ontario Ministry of the Environment initiated an industrial effluent regulatory program and spills reporting legislation in the 1980s.

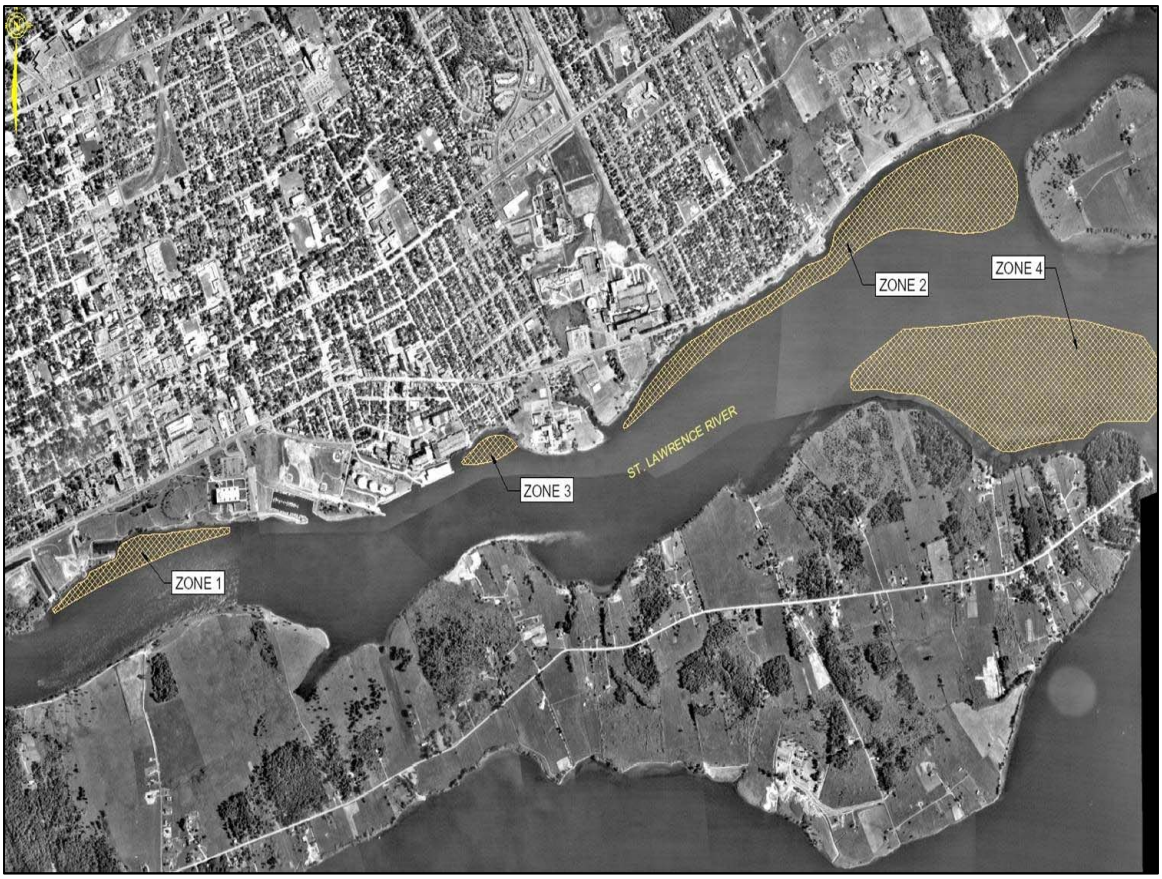

Figure 1: Depositional Zones along the Cornwall Waterfront (Golder Associates 2004)

ICI ceased operating its mercury cell chlor-alkali plant in 1995 and demolished this facility in 1996. The entire site was remediated to the "commercial/industrial" standards of the day when Courtaulds closed. The property has been subdivided such that there are now several owners of the original site. Akzo Nobel Inc. retained ownership of the closed Waste Disposal Site (WDS) on the northern part of the property and the area where a historic Underground Storage Tank (UST) was located. Akzo Nobel has conducted ground water monitoring to define any off-site movement of contaminants. Based on their findings, it has been determined that although there is some off-site movement of contaminants, no discharges to the St. Lawrence River have been identified. Domtar has not used mercury-based products at its facility since the early 1960s and in the early 1990s a secondary wastewater treatment process was installed for added environmental protection. Domtar ceased operation in 2006 and decommissioning of the site is underway. Today, there are no industrial releases of mercury to the St. Lawrence River at Cornwall.

In 1985 the International Joint Commission designated the Cornwall area of the St. Lawrence River as an Area of Concern (AOC). Along with 41 other AOCs in the Great Lakes, the Cornwall AOC was flagged as an area where, for a number of reasons, environmental degradation was occurring.

In order to address the problems identified in the St. Lawrence River (Cornwall) AOC, Environment Canada and the Ontario Ministry of the Environment took the lead in assembling a group of representatives from the community, local environmental groups, the Mohawks of Akwesasne, and other federal, provincial and municipal government agencies to develop a plan of action called a Remedial Action Plan (RAP). This plan outlines goals, detailed objectives and actions needed to help restore beneficial uses of the river at Cornwall. The RAP objectives are called delisting criteria, which have targets and measures by which to measure progress and determine when the ecosystem component is no longer degraded, or impaired.

In 1997 the RAP Stage 2 report "Great Lakes, Great River" was released. It contains 64 recommendations for dealing with environmental issues in this area, including two recommendations with respect to contaminated sediments. The recommendations committed the federal and provincial governments to work together to develop a management strategy for dealing with historically contaminated sediments along the Cornwall waterfront.

Environment Canada (EC) and the Ontario Ministry of the Environment (MOE) are the responsible agencies for the development and implementation of the remedial action plan and, in the spirit of the RAP process, invited community partners, local environmental groups, the Mohawks of Akwesasne and industries to join them in developing a sediment management strategy for this area.

Work on the sediment management strategy began in June 2000 and continued until 2005. During that time the partners reviewed the science, including 30 years of environmental studies. Environment Canada and the Ministry of the Environment funded additional studies on biomagnification to determine mercury levels in sediments along the Cornwall waterfront and whether mercury was being transferred from the sediments through the food chain. Underwater videography and other techniques were used to characterize the extent and nature of the sediment deposits, verify rates of sediment accumulation and determine the ability of the sediment to resist remobilization.

The information collected about the sediments and the potential for environmental impacts were used to examine all feasible options for managing the sediments. A consultant was engaged to conduct an independent review of sediment management options. Based on a detailed review and analysis of all of this information, the sediment working group arrived at a consensus for a preferred sediment strategy (Environment Canada and Ontario Ministry of the Environment 2003).

The Sediment Strategy Working Group acknowledges the request from the St. Lawrence River Restoration Council to provide regular reports on the progress and implementation of the Cornwall Sediment Strategy. If new information comes to light through monitoring and assessment which would have an impact on the Sediment Strategy, then the Strategy can be opened up by the Parties signatory to the Accord and revised if necessary.

CORNWALL SEDIMENT STRATEGY

After 5 years of working collaboratively through a detailed science review, conducting additional studies to fill information gaps and evaluating sediment management options,

federal and provincial government agencies along with the Sediment Strategy Working Group have developed a sediment strategy for the Cornwall waterfront. Key components of this strategy are:

- Contaminated sediments should be left in place. As they currently exist, the historically contaminated sediments in the three zones (1, 2 and 3) along the Cornwall waterfront are stable and covered with a cleaner layer of sediment and therefore do not pose a significant ecological risk.
- Effective Administrative Controls to protect the sediments from being disturbed are implemented. This ensures the natural cap is maintained and allows continued deposition of cleaner sediment particles which will further cover and isolate the deeper more contaminated material.
- The implementation of a long-term comprehensive monitoring program to track environmental conditions and sediment sustainability, to ensure that conditions continue to improve.
- Public reporting on the progress of the sediment strategy and the ability to change the strategy as further information is gained.

This is supported by extensive and detailed scientific study, input from local community representatives and consultation with nationally and internationally recognized experts in mercury research and ecological assessment of contaminated sediment.

The following sections of this report provide a summary of the environmental science, an evaluation of sediment management options, an outline of the administrative controls protocol and a long-term monitoring plan. Full reports on 30 years of science pertaining to sediment within the St. Lawrence AOC and the additional studies that were undertaken as part of the development of the Cornwall Sediment Strategy are referenced in this report.

Please note that the main part of this report was drafted in 2005 and reflects the science and decisions made at that time, but was subsequently finalized in 2010. The monitoring plan as outlined in Appendix 2: Monitoring Plan for the St. Lawrence River at Cornwall Area of Concern: Recovery of the Benthic Environment to Reference Conditions by Lee Grapentine (2007) was also drafted in 2005 but the document was not finalized until 2007.

SCIENTIFIC EVALUATION AND CONCLUSIONS

Early in the public consultation process to develop a Cornwall Sediment Strategy, the larger group of EC, MOE, community partners, local environmental groups, the Mohawks of Akwesasne and industries decided by consensus that a smaller Sediment Strategy Working Group should be formed to address specific technical questions. The Working Group was also tasked with working with MOE and EC to develop recommendations for a sediment strategy that would be reviewed by the larger stakeholder group. The Working Group includes representatives from the St. Lawrence River Institute of Environmental Sciences, St. Lawrence River Restoration Council (SLRRC), Cornwall District Environment Committee, the City of Cornwall, three historical waterfront industries, existing industry and SLRRC scientific experts as well as scientists and staff from Environment Canada and the Ministry of the Environment.

To assess the sediment contamination issue, the Working Group used a weight of evidence approach to reach conclusions on what the science is telling us with respect to the environmental risk posed by the Cornwall waterfront sediments. The weight of evidence approach is described in Appendix 3. The underlying philosophy of this approach is that "observations of elevated concentrations of contaminants in sediments alone are not indications of ecological degradation. Rather, it is the biological responses to those contaminants that are the concern". Four lines of evidence were first evaluated: sediment chemistry, laboratory sediment toxicity, benthic invertebrate community structure and the potential for biomagnification. Sediment stability was also evaluated to help in the determination of an appropriate management option.

Detailed mapping of sediment types in each of the four depositional areas or zones (see Figure 1) was performed by the National Water Research Institute (Rukavina 2000). They contain fine grained deposits that are generally associated with higher levels of contaminants. The sediment quality, biological effects and the stability of the sediments from these areas were assessed by the Working Group using the weight of evidence approach.

A summary of the physical attributes of each of the zones is provided in Table 1. Additional detail on sediment grain size, bathymetry, volumes and area covered by the different grain size materials and mapping of sediment types is provided in Dreier (2000) and Rukavina (2000).

Table 1: General Description of Physical Attributes of Depositional Zones

Zones	Description of Physical Attributes
Zone 1	• Fine-grained sediments cover an area 500 metres (m) long and 100 m wide, at a depth of 4-8 m, 50-100 m off shore. • Sediment deposits in this area are typically less than 10 cm thick but can exceed 70 cm.
Zone 2	• Fine-grained sediments are generally located at depths between 4 and 11 m, and form a ribbon-like deposit 2200 m long and 50-200 m wide. • Sediment thickness varies from less than 10 cm to greater than 50 cm. • By the shore, the bottom is hard and weedy.
Zone 3	• Fine-grained sediments are found at depths less than 6 m. • The sediment deposit extends about 700 m along the shoreline and ranges in width from 100-200 m. • Sediment thickness ranges from 10 to >70 cm in the north–central part of the area and is less than 10 cm elsewhere.
Zone 4	• Fine-grained sediments are in a basin 1700 m long and 100-350 m wide. • It is located 50 to 100 m offshore at its western end and 100-600 m offshore at its eastern end from Cornwall Island. • The deposit is located in water depths that are generally greater than 7 m. • No cores were taken from this area but the measured thickness of the deposit varies from 0 to >70 cm.

Sediment Chemistry

Sediment chemistry allows for a preliminary screening of risk posed by sediment associated contaminants. This preliminary screening is performed through the comparison of contaminant concentrations to three "effect levels" defined in Ontario Ministry of Environment *Provincial Sediment Quality Guidelines* (Persaud et al. 1992). These levels relate concentrations of specific contaminants to their potential effect on benthic (sediment-dwelling) organisms, as follows:

No Effect Level (NEL)	The contaminant concentration which is expected to have no effect on benthic organisms.
Lowest Effect Level (LEL)	The contaminant concentration that can be tolerated by the majority of benthic organisms. If the concentration is above this level, the benthic community may be impaired.
Severe Effect Level (SEL)	The contaminant concentration that is expected to be detrimental to the majority of the benthic species.

In Ontario, when a SEL guideline value is exceeded, the assessment of sediment associated biological effects is triggered to determine the effect that the contaminant is having on the benthic organisms. In Cornwall, several locations exhibited concentrations of mercury and other contaminants (zinc, copper, lead) which exceeded their respective severe effect guideline value (Dreier 2000). Based on these comparisons, sediment toxicity tests and benthic community assessments were performed to determine whether the elevated levels of compounds in the sediments were causing any negative biological responses.

Note: Although no contaminant concentrations in sediment from zone 4 exceeded the SEL guideline values, this area had not been previously assessed in detail. For this reason, zone 4 sediment was also subjected to an assessment of biological effects.

Biological Assessments of Sediment

While the analysis of sediment chemistry helps to identify contaminants of concern and to focus further study, it does not consider the bioavailability of contaminants or provide reliable information on the toxicity of sediment associated contaminants. Sediment toxicity testing and the evaluation of benthic community structure are used to assess whether chemical contaminants are available and are causing negative biological effects.

In the assessment of Cornwall sediments, the biological sediment guidelines developed by the National Water Research Institute (NWRI) and Ontario Region of Environment Canada (Reynoldson and Day 1998) were used to assess benthic community structure and sediment toxicity and to provide the empirical evidence needed to determine whether the Cornwall sediments posed a risk to sediment dwelling organisms. This approach uses a database of 252 Great Lakes reference sites to predict the expected community at any test site and a database of 170 Great Lakes reference sites to assess the toxicity expressed in laboratory bioassays. The protocol can determine how the test sediment differs from regional Great Lakes reference sites and whether the results found are within the normal range of variation or if a statistical difference exists.

Laboratory Toxicity Tests

Laboratory toxicity tests (bioassays) are used to provide an indication of the toxic effects of sediment associated contaminants on sediment dwelling (benthos) and water column organisms. The results of these tests need to be interpreted carefully and may be affected by a number of factors such as physical characteristics of the sediment, water quality and the presence of indigenous species (Jaagumagi and Persaud 1996). Sediment toxicity tests usually reflect worst case exposure and do not duplicate the natural conditions under which the sediments exist due to the handling and mixing of sediment samples and the controlled laboratory conditions.

Sediment toxicity tests were performed by both EC (Reynoldson 1998) and MOE (Bedard 1999) on the Cornwall sediments. Environment Canada undertook toxicity tests on four different invertebrate species that were exposed to Cornwall sediments and assessed for ten toxicity endpoints. The MOE used three species and tested for six endpoints. Table 2 provides a list of test organisms and endpoints. The organisms in these tests represent pollution tolerant as well as intolerant species and the endpoints tested cover a range of lethal to sub-lethal effects under acute and chronic exposures.

A review of both the MOE and EC toxicity data showed that organism survival (mortality) was not affected at any of the test sites and most organisms were unaffected. Growth of mayfly nymphs (*Hexagenia limbata*) was reduced at two sites, in tests conducted by MOE, weights of these organisms were 47% and 28% smaller than the reference animals. Toxicity tests performed by Environment Canada showed that mayfly nymph growth (*Hexagenia limbata*) was unaffected at all of the test sites.

The Environment Canada data (Reynoldson 1998) showed that five out of twelve test sites exhibited some minor effects on the reproduction of the oligochaete worm *tubifex tubifex* (reduction of egg hatch and fewer young per adult) under laboratory conditions. However, no other species appeared to be affected and the difference in reproduction effects between the test sites and reference sites was considered to be insignificant (see final conclusion on biological effects).

Table 2: Toxicity tests performed on St. Lawrence River sediment from the Cornwall area

Test Organism	Test Endpoint	Organization
Chironomids *Chironomus riparius* (Lake fly midge)	• Percent survival • Growth (dry weight increase/individual)	Environment Canada
Chironomids *Chironomos tentans*	• Percent survival • Growth (dry weight increase/individual)	Ontario Ministry of Environment
Oligochaete worm *Tubifex tubifex* (Sludge worm)	• Percent survival • Percent hatch of cocoons • Numbers of cocoons/adult worm • Number of live young/adult worm	Environment Canada
Amphipod *Hyalella azteca*	• Percent survival • Growth (dry weight increase/individual)	Environment Canada

Mayfly nymph *Hexigenia rigida*	• Percent survival • Growth (dry weight increase/individual)	Environment Canada
Mayfly nymph *Hexigenia limbata*	• Percent survival • Growth (dry weight increase/individual)	Ontario Ministry of Environment
Fathead minnow Pimephales promelas	• Percent survival • Inorganic uptake	Ontario Ministry of Environment

Benthic Community Structure

Benthic community structure is a measure of the health of benthic invertebrates in sediments *in situ*. Benthic invertebrates experience continuous exposure to sediment associated contaminants. For this reason the assessment of benthic community structure provides strong evidence as to whether the contaminants are causing a toxic effect under actual environmental exposure conditions. The NWRI protocol determines how the Cornwall test sediment differs from regional Great Lakes reference sites and whether the results found are within the normal range of variation or if there is a statistical difference that is an effect. The Cornwall sites were compared to Group 2 Great Lakes reference sites and while the majority of these sites are located in Georgian Bay, the Group also includes sites from lakes Erie (eastern basin), Ontario, Michigan and Lake Huron's main basin and North Channel. In comparing the Cornwall sites to these sites, Reynoldson (1998) found that the diversity and abundance at the Cornwall sites to be "well within the range observed at the reference sites and a general trend to greater diversity and abundance". That is, despite some marginal toxicity results detected in the laboratory tests, under natural conditions the Cornwall sediments support healthy and thriving communities of benthic organisms.

Conclusion on Biological Effects of Sediment

The Working Group considered both the sediment toxicity and benthic community evidence and concluded that although some impairment to benthic organisms was detected through the toxicity testing, these tests do not duplicate the natural conditions under which the sediments exist. The laboratory conditions may reflect a worst case exposure to the metal contaminants in these Cornwall sediments (Richman 2007). Even so, the sediments exhibited only marginal toxic effects and the majority of Cornwall sediments have benthic community structures that are similar to reference sites. For those that were considered possibly different, the difference was due to increased diversity and abundance which is evidence that under natural conditions these sediments do not pose a toxicity risk.

Biomagnification Study

While the Review of Environmental Studies from 1970 to 1999 (Dreier 2000) provides a thorough examination of the environment along the Cornwall waterfront and insight into the first three lines of evidence, information was lacking on the availability of sediment bound mercury and its ability to bioaccumulate in benthic invertebrates and thereby enter the aquatic food chain.

To address this information gap a biomagnification study was designed by Dr. L. Grapentine (Grapentine et al. 2003) of the National Water Research Institute with input from the Working Group. The purpose of the study was to determine if mercury from sediments could potentially be transferred through sediment-dwelling organisms (benthic invertebrates) to fish and wildlife. In other words, "is there evidence that mercury biomagnification is an environmental issue of concern?" This study involved both the analyses of relationships of total and methyl mercury concentrations in benthos to those in sediment, and predictions of concentrations of total and methyl mercury in representative consumers of benthic invertebrates and their predators using a conservative screening level biomagnification model. Methyl mercury is the form of mercury that most readily bioaccumulates up the food chain, whereas concentrations of total mercury tend to decrease with each step up the food chain. Therefore, bioaccumulation of mercury is typically modelled based on methyl mercury concentrations.

Predicting Potential Risk Posed By Mercury Biomagnification – Method

The study used a trophic transfer model to predict the potential for biomagnification of methyl mercury in organisms in the local food chain. Five different species from four levels of the food chain were chosen to be part of the model. The species used in the prediction were:

1. White sucker (which feeds on sediment-dwelling organisms)
2. Adult yellow perch (a small fish which feeds other fish)
3. Walleye (a large fish which feeds on other fish)
4. Great blue heron (which feeds on fish)
5. Mink (which feeds on small fish)

Using actual levels of methyl mercury found in sediment-dwelling organisms, the model then multiplied those levels using pre-determined "biomagnification factors" derived from scientific literature in order to predict concentrations in higher food chain organisms.

Predicted mercury concentrations in organisms were then compared to the reference sites (i.e. those areas not exposed to local historical discharges). The predicted values were also compared to mercury guidelines[1] established for the protection of higher organisms, specifically for mink. The predictions of the mercury concentrations in higher food chain organisms focused on methyl mercury because it is the available form of mercury that magnifies through the food chain.

In predicting the potential for biomagnification, a preliminary screening level risk assessment approach was used. This approach assumes a conservative, "worst case" scenario in order "test the water" to determine if there is potential for food chain impacts and whether further study is required. The approach is conservative in that it assumes that all organisms are always and only feeding on, and taking into their tissues, the highest level of contaminants found in an area of study.

[1]Guidelines refer to the Canadian Tissue Residue Guideline for the protection of wildlife consumers of aquatic biota– methyl mercury, February 2000.

In this study, for example, to assess potential bioaccumulation in the great blue heron it was assumed that the bird feeds only on fish from our study zones along the Cornwall waterfront, and that those fish only feed on sediment-dwelling organisms from that area (at one sampling station).

It must be remembered, however, that fish are not limited to individual sampling sites to the same degree as contaminants and sediment-dwelling organisms. On a site per site basis, fish biomagnification predictions remain theoretical.

The range of predicted methyl mercury concentrations in each of the receptor species were calculated using minimum, intermediate and maximum biomagnification values obtained from the literature. The results of this screening level assessment are summarized in Table 3 and show that a potential risk posed by the biomagnification of mercury was identified under the intermediate and maximum scenarios. No risk of ecological or human health impact was identified under the minimum biomagnification scenario.

Note: It is important to remember that this study looked at the *potential* for biomagnification. It does not reflect *actual, observed* biomagnification along the Cornwall waterfront.

Table 3: Results of Biomagnification Predictions

Organism	Model prediction based on minimum exposure scenario	Model prediction based on intermediate exposure scenario	Model prediction based on maximum exposure scenario
	Sampling sites where methyl mercury concentrations in the organism could be both: higher than guidelines *AND* higher than all reference sites.		
White sucker	None	None	None
Adult yellow perch	None	*Overall*: 5 out of 22 test sites or 23 % *In each zone:* Zone 1 - 1/4 sites (= 25%) Zone 2 - 1/10 sites (= 10 %) Zone 3 - 2/2 sites (= 100 %) Zone 4 - 1/5 sites (= 20%)	*Overall:* 9 out of 22 test sites or 41 % *In each zone:* Zone 1 - 1/4 sites (= 25%) Zone 2 - 5/10 sites (= 50%) Zone 3 - 2/2 sites (= 100 %) Zone 4 - 1/5 sites (= 20 %)
Walleye	None	*Overall:* 9 out of 22 test sites or 41 % *In each zone:* Zone 1 - 1/4 sites (= 25%) Zone 2 - 5/10 sites (= 50%) Zone 3 - 2/2 sites (= 100 %) Zone 4 - 1/5 sites (= 20 %)	*Overall:* 9 out of 22 test sites or 41 % *In each zone:* Zone 1 - 1/4 sites (= 25%) Zone 2 - 5/10 sites (= 50%) Zone 3 - 2/2 sites (= 100 %) Zone 4 - 1/5 sites (= 20 %)
Great blue heron	None	None	None
Mink	None	None	None

In looking at the relationship between methyl mercury in sediment and methyl mercury in the sediment dwelling organisms, the study found that sediment dwelling organisms in areas of higher methyl mercury contamination were not taking up higher levels of methyl mercury into their tissues. The study could not, therefore, establish a strong connection between methyl mercury in sediment and methyl mercury in sediment dwelling organisms. What that means is that the study could not demonstrate that bioaccumulation of methyl mercury was mainly occurring from sediment to sediment-dwelling organisms.

To further assess whether the bioaccumulation/biomagnification of sediment bound mercury was posing an actual ecological or human health risk, supplemental studies which assessed mercury in fish were conducted (Ridal et al. 2003, D. Lean, pers. comm. June 2004). Overall, these studies showed that fish along the Cornwall waterfront had levels of mercury that were slightly higher than levels in fish from upstream reference sites. The actual measured levels of mercury in fish from the Cornwall waterfront did not exceed human consumption limits and were well below the theoretically predicted values.

Table 4: Mercury concentrations in fish within the AOC.

		2003 Hg levels in fish		Human Health Fish Consumption Guidelines	
Sites	Fish species	Minimum parts per billion	Maximum parts per billion	For women of child-bearing age and children under 15 (units are parts per billion)	For the general population (units are parts per billion)
Zone 1	Yellow Perch	40	340	260	610
	Brown Bullhead	60	270	260	610
	Walleye	n/a	n/a	n/a	n/a
Zone 2	Yellow Perch	40	100	260	610
	Brown Bullhead	40	90	260	610
	Walleye	n/a	n/a	n/a	n/a
Zone 4	Yellow Perch	30	80	260	610
	Brown Bullhead	60	110	260	610
	Walleye	n/a	n/a	n/a	n/a
Lake St. Francis	Yellow Perch	53	262	260	610
	Brown Bullhead	n/a	n/a	n/a	n/a
	Walleye	32	291	260	610

These studies showed that fish from zone 1 accumulated slightly more mercury than fish from zones 2 and 4 (no fish were collected in zone 3). This information suggests a greater availability of mercury in zone 1 verses the other two locations. However, the levels of methyl mercury in chironomids and amphipods from zone 1 were equivalent to reference sites. Both chironomids and amphipods occupy habitats in and on the sediment and are directly exposed to methyl mercury in the sediment, sediment pore water and their food. Therefore the source of mercury

in fish is unclear and it appears that the “sediment to benthos to fish” route is not the main driver of mercury in fish.

After a review of all of the information on the biomagnification/bioaccumulation potential of mercury from sediment, the Working Group concluded that while there is a potential concern from conservative predictions of biomagnified methyl mercury in yellow perch and walleye along the Cornwall waterfront, the empirical evidence does not support these calculations. Also, the lack of a strong relationship of methyl mercury in sediment and methyl mercury in the sediment dwelling organisms led the Working Group to conclude that there is a low concern with respect to the bioaccumulation of mercury from these Cornwall sediments.

In addition, the slightly higher levels of mercury in fish from zone 1 versus the other zones led the Working Group to conclude that there may be a potential source of mercury to the St. Lawrence River in this area of the Cornwall waterfront. To address this concern an additional study, “Cornwall Mercury Trackdown”, was implemented over a three year period (2005-2008). The Mercury Trackdown initiative is further described later in this report.

Sediment Stability

The physical properties and stability of Cornwall waterfront sediment were studied intensively for six years beginning in 1993 by N. Rukavina, Environment Canada, National Water Research Institute (NWRI). Information on the location, thickness, volume and stability of fine-grained sediments was obtained from a combination of acoustic mapping, sediment grab and core sampling, underwater video recording, diver observations, continuous monitoring of the riverbed elevations (Rukavina 2000) and the testing of the sediment for its potential to erode (Krishnappen et al. 2001). Although the sediment types along the Cornwall waterfront were mapped and some physical measurements were made in zones 1, 3 and 4, much of the original analysis of the physical properties and stability of sediment focused on zone 2. The original investigation showed that the sediment deposit in zone 2 was stable due to its location away from the main channel currents, in an area of the river where water movement consists of back eddies too slow to cause sediment erosion or transport (Dreier 2000).

Detailed information on the physical properties and stability of sediments in zones 1 and 3 was identified as a data gap by the Working Group. In addition, the Working Group was also concerned with the potential for boat traffic to disturb and re-suspend the sediment in zone 2. Similar study methodologies that were applied in zone 2 were also applied to zones 1 and 3 to determine whether these sediment deposits were stable. In order to assess the impact of boat traffic on the sediments of zone 2, two small open patches of fine grain sediment were subjected to increasingly aggressive maneuvers from a large 30 foot twin engine landing-craft type vessel. The impact of these maneuvers on the sediment was recorded using underwater video equipment (Biberhofer and Rukavina 2002).

The additional sediment stability studies found that sediments in zones 1 and 3 are stable. The stability of these sediments is due to fact that the deposits are situated in basin-like formations which shield them from the main river currents. Tests on the potential for sediment re-suspension by boat traffic in zone 2 were conducted in the fall of 2001 when aquatic plants were present on the bottom of the river and surrounded the two open patches. Under these conditions, the study found that there is little potential for sediment re-suspension. However, the potential for disturbance of sediments by boat wake during winter or spring, when aquatic plants are not present, has not been evaluated (Biberhofer and Rukavina 2002).

These detailed studies on the physical properties and stability of sediments provided sufficient evidence for the Working Group to conclude that the fine grained deposits along the Cornwall waterfront are stable under natural conditions.

EVALUATION OF SEDIMENT MANAGEMENT OPTIONS

Environment Canada and the Ministry of the Environment commissioned an independent assessment and review of all possible sediment management options for the Cornwall waterfront (Golder Associates 2004). To concentrate the detailed assessment on sediment management options that could realistically be applied to the Cornwall waterfront, a screening process that focussed on technical feasibility of the options to the Cornwall area was used to identify a short list of preferred options. The details of the screening process and the various management options that were screened are provided in Golder Associates (2004). Three main sediment management options were identified:

- Natural Recovery, which would be technically feasible in all three zones;
- Capping, which would be technically feasible in parts of each zone, but would require additional geotechnical information before it could be implemented; and
- Removal by dredging, using either environmental clamshells or hydraulic dredging, followed by dewatering and disposal of dredged material in a landfill.

A detailed evaluation of the technical feasibility, environmental effects, socio-economic impacts and ability to satisfy the RAP delisting criteria was undertaken for each of the preferred options. Long-term plans for development of the Cornwall waterfront were also reviewed to assess whether any of the options could adversely affect development activities and result in socio-economic impacts to the community.

The RAP delisting criteria pertaining to the sediment contamination are based on issues directly associated with mercury levels in benthos and fish and are related to implications on human health and wildlife that consume fish from this area.

The following is the delisting criteria which pertain to the contaminated sediment issue:

Beneficial Use Impairment	Delisting Criteria
Restrictions on fish and wildlife consumption	Contaminant levels in fish in the AOC are the same or less than those in upstream non-AOC areas in the St. Lawrence.
Degradation of Benthos	Benthic community structure, diversity and abundance are comparable to sites with similar habitat in the AOC at locations upstream and downstream of Cornwall industrial and municipal discharges, and/or in comparison to suitable reference sites. Furthermore, acute and/or chronic effects on

	benthos attributable to trace metals or organics should not be evident at sites within the AOC.
	Benthic invertebrate tissue contaminant concentrations are comparable within the AOC at locations upstream and downstream of Cornwall industrial and municipal discharges for the contaminants of concern, or in cases where benthic invertebrate tissue contaminant concentrations are greater than upstream sties but are below concentrations considered to impair the beneficial uses associated with the consumption of wildlife.

The ability of each sediment management option to meet the RAP delisting criteria was assessed using a bioaccumulation model (*Fish Bioenergetics 3.0*, University of Wisconsin). The intent of the model was to assess whether mercury in the sediment was responsible for the measured levels in the fish and, if so, to assess whether implementation of the remedial options would result in a reduction of fish mercury levels in the three zones. The modelling approach used site-specific data from each of the three zones to ground-truth the model predictions. Since yellow perch forage less widely than larger predator fish and is found in good abundance along the Cornwall waterfront it is the only fish species that was modelled. In addition, yellow perch are known to consume benthic invertebrates, which establishes a sediment mercury pathway of exposure.

Further detail on the model approach taken and the findings of the evaluation of sediment management options are included in Golder Associates (2004). A summary of the conclusions of the detailed assessment of preferred options are provided below:

Dredging:

- Dredging was considered technically feasible for sediment removal in all three zones of sediment contamination along the Cornwall waterfront.
- The process of dredging would destroy local fish habitat and communities of sediment-dwelling organisms.
- The dredging process could also result in a release of contaminants to the water column and downstream areas if a high level of preventative measures were not put in place and monitored.
- It is commonly accepted that dredging never results in a 100 per cent removal of contamination. There are always residual contaminants left behind. In this case, dredging would remove the bulk of the contaminated material, but could also leave behind residual materials that may contain higher levels of mercury. This in turn may expose sediment-dwelling organisms and fish to higher levels of mercury.
- To counter the negative impact caused by residual materials, a combination of additional dredging and capping would be required to remove and cover the remaining residuals. This in turn would greatly increase the cost of the operations.
- The dredging process would require a great deal of handling of the sediments, for dewatering and final transport to the disposal site. This could result in releases of the contaminated sediment to the environment.

- RAP delisting: The modelling of mercury levels in fish concluded that the sediments were not the main source of mercury in fish along the Cornwall waterfront. Dredging will therefore not result in reducing mercury levels in fish. An initial increase in mercury levels in sediment dwelling organisms could occur if residual materials are not removed or isolated. As cleaner material accumulates from upstream, the mercury levels in sediment dwelling organisms would be expected to decrease to near background levels (this option does not differ significantly in outcomes from the Natural Recovery option, except for the removal of the main mass of contaminated sediments).

Capping:

- Capping was only considered to be technically feasible for certain areas within each of the 3 zones along the Cornwall waterfront. Some areas could not be capped due to steep slopes in parts of each zone. The sloping could result in slumping of the sediments into the main channel. This disturbance of sediments could result in exposure of deeper, more contaminated materials to the water.
- Capping would destroy existing habitats and communities of sediment-dwelling organisms within the areas capped, although this would recover in the long term.
- While capping offers the advantage of covering contaminated sediments in a shorter period of time than would occur with the Natural Recovery option, this is offset by the destruction of local habitat and biotic communities.
- Use restrictions would be necessary in any capped area to avoid disturbing the cap.
- RAP delisting: Capping may not result in a reduction in fish mercury levels, since sediments are not the major contributor of mercury in fish. A reduction in benthic organism tissue residues is anticipated following capping as any sediment sources of mercury to benthic organisms are removed. Benthic organism tissue residues could reach background levels as cleaner sediments accumulate from upstream.

Natural Recovery:

- Natural Recovery is considered a suitable option only where contaminants do not pose an immediate hazard to aquatic life. Stable physical conditions are a prerequisite for this option.
- Since contaminated sediments along the Cornwall waterfront are not toxic to sediment-dwelling organisms and fish, since the sediments are stable and there is no risk to people or the environment, natural recovery was considered a suitable option for the three zones.
- In using the natural recovery method there would be no loss of habitat and no danger of disturbing the sediments.
- This option assumes that contaminated sediments will be covered naturally and gradually with cleaner sediments. However, since sediments accumulate slowly, potential exposure of sediment-dwelling organisms to mercury will continue until a sufficient cover of cleaner sediments has accumulated. Based on current accumulation rates this could range from 4 to 30 years.
- Leaving the sediments in place could result in some use restrictions in the three zones and measures would need to be taken to avoid exposing or releasing these sediments.
- RAP delisting: Natural Recovery could allow the RAP delisting criteria for fish to be met with minimal environmental and social disruption. Delisting criteria for sediment-dwelling organisms (benthos) have already been met. There is no immediate change anticipated, with a gradual reduction in mercury tissue levels to background over the long term as cleaner materials accumulate in each of the zones.

Conclusion of the assessment of options: There would be no environmental benefit from dredging or capping. Capping may reduce exposure of sediment-dwelling organisms to mercury more quickly than under the Natural Recovery option, but at the cost of habitat destruction, potential release of contaminated materials and significantly higher financial costs. Since mercury in sediment is not a major contributor to mercury in fish, to dredge or cap the sediments would not result in a measurable benefit to the fish. Thus the Natural Recovery option is the most suitable option for dealing with the contaminated sediments within the St. Lawrence (Cornwall) AOC.

ADMINISTRATIVE CONTROLS

The results of the science review concluded that the historically contaminated sediments in the three zones along the Cornwall waterfront are stable and covered with a cleaner layer of sediment and therefore do not pose a significant ecological risk. However, concern was raised that human activities within these areas could potentially disturb, expose or re-suspend the deeper more contaminated sediments. In response to this concern it was recommended that Administrative Controls be implemented as a key component of the Cornwall Sediment Strategy to ensure that the deeper, more contaminated sediment deposits are protected from being disturbed, exposed or re-suspended by human activities. It should be noted that the potential impact caused by re-suspension or remobilization of the deeper more contaminated sediments is unknown.

Administrative controls are the planning, approval and permit control mechanisms which municipal, provincial and federal governments and the Mohawk Council of Akwesasne can apply to regulate activities along the waterfront. These planning, approval and permitting mechanisms were first evaluated to assess whether they could be effective at protecting human activities from disturbing, exposing or re-suspending the contaminated sediment along the Cornwall waterfront. This evaluation made a number of recommendations on how the agencies could best coordinate and harmonize their administrative control mechanisms in an effective manner for the long-term protection of the sediments (French 2003).

To implement the recommendations, seven agencies have acted in a cooperative manner to develop the Cornwall Sediment Strategy - Administrative Controls Protocol (Environment Canada and Ontario Ministry of the Environment 2005):

- Environment Canada (EC)
- Ontario Ministry of Environment (MOE)
- Department of Fisheries and Oceans (DFO)
- Ontario Ministry of Natural Resources (MNR)
- Raisin Region Conservation Authority (RRCA)
- City of Cornwall (CC)
- Mohawk Council of Akwesasne (MCA)

The intent of this protocol is to ensure the integration of the efforts of the agencies that have the mandate and authority to regulate activities that may disturb, expose or re-suspend mercury-contaminated sediments in three zones along the Cornwall waterfront. This integration of regulatory responsibilities is achieved by:

- Creating a common administrative approach to ensure contaminated sediments are not disturbed, exposed or re-suspended;
- Harmonizing agency mandates and strengthening and coordinating common review process for regulating activities that have potential to disturb sediments;
- Establishing principles that will guide decisions; and
- Clearly articulating the roles and responsibilities for each party to this protocol.

The Administrative Controls Protocol is an inter-agency commitment to the long-term protection of sediments along the Cornwall waterfront. To confirm their commitment to protect the St. Lawrence River ecosystem the parties signed the Cornwall Sediment Strategy Accord. The Accord is included as part of the Administrative Controls Protocol document.

With the Administrative Controls in place, all permit applications and proposed projects along the Cornwall waterfront will be reviewed by the participating agencies and controlled in a manner that protects the deeper more contaminated sediments from being disturbed, exposed or re-suspended.

LONG-TERM MONITORING

An important element of the Cornwall Sediment Strategy is the commitment by Environment Canada and the Ontario Ministry of the Environment to implement a comprehensive ongoing monitoring program to ensure continued natural recovery and sediment stability. Environment Canada and the Ontario Ministry of the Environment will monitor each of the lines of evidence used to evaluate the environmental risk posed by the waterfront sediment. This level of scrutiny provides the type of detail needed to ensure that these sediment deposits are not posing a risk to the environment. The long-term monitoring components are provided below and the details are provided in Appendix 2: "Monitoring Plan for the St. Lawrence River at Cornwall Area of Concern: Recovery of the Benthic Environment to Reference Conditions". Note that although this document has a published date of 2007, the monitoring had been occurring prior to 2005.

1. Sediment Chemistry: Surface sediments will be analyzed for a range of parameters including total and methyl mercury to determine spatial differences between contaminated and reference sediments, and temporal differences before and after 2001.

2. Sediment Toxicity and Invertebrate Community Structure: The biological effects of the sediment will be assessed using Environment Canada's Biological Sediment Guideline methodology (Reynoldson and Day 1998) to ensure the sediments remain non-toxic.

3. Bioaccumulation/Biomagnification: Fish and invertebrate mercury tissue levels will be used to assess changes in the availability of sediment associated mercury.

4. Mercury in Sport Fish: To address concerns about mercury accumulation in fish, sport fish will be sampled as part of the ongoing Ontario Ministry of Environment and Natural Resources Sport Fish Contaminant Monitoring Program. The Program monitors persistent toxic contaminants in sport fish from over 1700 locations in the Great Lakes and inland lakes and rivers. The contaminant levels are analyzed and used to develop sport consumption advisories (recommended meals per month) based on health protection guidelines from Health Canada. The program advises the public on safe levels of sport fish consumption

through the biennial production of the Guide to Eating Ontario Sport Fish and related publications.

5. Sediment Stability: The physical properties and stability of Cornwall waterfront sediment were intensively studied for 7 years beginning in 1993 by N. Rukavina and J. Biberhofer (Environment Canada, National Water Research Institute). The results of this long term assessment were used to determine that sediments are stable under natural conditions in the St. Lawrence River. Based on this information, no further monitoring of stability is considered necessary unless there is a change in natural physical characteristics of the river (e.g.: flow pattern, velocity, bathymetry, shoreline configuration).

This long term monitoring program will be conducted on a three-year cycle beginning in 2007. A three year monitoring period has been selected to allow a sufficient lapse of time to detect changes in sediment conditions and provide a short enough time period to ensure environmental protection. The first monitoring cycle will provide a basis for measuring change over the following three years. For example, the 2010 data will be evaluated against the 2007 base year. If conditions are improving, then modifications to the monitoring plan may be considered. For example, the monitoring cycle could be changed from 3 to 5 years; or if sediment toxicity remains a non-issue, it could be removed as a component of the monitoring program. However, the long-term monitoring of mercury biomagnification in fish from this AOC will be maintained.

The cyclical manner by which the components (sediment quality, biological effects and biomagnification of mercury) of the long-term monitoring plan will be studied provides a sound basis to ensure that natural recovery of the sediment continues and environmental and human health is protected.

CORNWALL MERCURY TRACKDOWN

A number of studies undertaken as part of the Cornwall Sediment Strategy suggested there may be an ongoing local source of methyl mercury to the river. To find the source of that mercury, Environment Canada and the Ministry of the Environment, together with the City of Cornwall, Raisin Region Conservation Authority, Domtar, ICI and the St. Lawrence River Institute of Environmental Sciences, undertook a mercury trackdown project. This environmental investigation was initiated in the spring of 2005 and completed in the summer of 2008.

Under the Mercury Trackdown project a number of potential sources close to and along the Cornwall waterfront were sampled and tested for trace levels of methyl mercury and total mercury. These potential sources and sampling efforts included:

- City of Cornwall storm sewers and combined sewer over flows (CSO)
    - Both heavy run-off, combined sewer over flow events and dry weather flows from the storm sewer outfalls along the Cornwall waterfront.
- Old Cornwall Canal
    - Sediment samples at locations upstream and downstream of storm sewers that discharge to the canal and water samples on a twice monthly basis from upstream and downstream locations in the canal.

- Groundwater
    - Monitoring wells located on the properties of ICI and Domtar as part of the groundwater component to this study.
- Cornwall snow disposal area
    - Soil and runoff samples from the Cornwall snow disposal area, located just upstream of zone 1 near the shore of the St. Lawrence River from at least four locations.

A final report on the results of the Mercury Trackdown project was completed in 2010.

CONCLUSION

The Cornwall Sediment Strategy demonstrates Environment Canada's and the Ontario Ministry of the Environment's commitment to the St. Lawrence River (Cornwall) Remedial Action Plan. It also demonstrates the great commitment and dedication of local community partners to work closely with the government agencies to implement Remedial Action Plan recommendations regarding contaminated sediment.

In developing the Cornwall Sediment Strategy, community and agency partners used a science-based decision-making framework (Grapentine et al. 2002) which employs a "weight of evidence" approach. Using this approach, multiple lines of evidence including sediment chemistry, toxicity, health and abundance of bottom dwelling organisms and the potential for contaminant biomagnification in the food chain were considered in combination to reach a determination about the need for remediation. Through the use of an open and transparent consultation process, all views and concerns were listened to and fully addressed. Where information gaps were identified, scientific studies were designed and undertaken to provide this information. The result is a science-based consensus on the most appropriate course of action for dealing with contaminated sediments along the Cornwall waterfront: the Natural Recovery approach. Those most affected by the decisions regarding management of sediment contamination along the Cornwall waterfront have been consulted and fully involved in all aspects of this undertaking.

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APPENDIX 1: CORNWALL SEDIMENT STRATEGY WORKING GROUP MEMBERSHIP

WORKING GROUP MEMBERS AND AFFLIATION

Name	Affiliation
Dr. Brian Hickey and Dr. Peter Hodson	**St. Lawrence River Restoration Council**
Elaine Kennedy	**Cornwall District Environmental Committee**
Dr. Jeff Ridal	**St. Lawrence River Institute of Environmental Sciences**
Dr. David Lean	**University of Ottawa**
John Doyle, Richard Kenno, Dr. Ralph Turner and Dr. George Dixon	**ICI Canada Inc.**
Mariam Tehrani and Dr. Peter Chapman	**Akzo Nobel**
Douglas Craig	**Domtar Papers**
Colin Kirkman	**Developer**
Morris McCormick	**City of Cornwall**
Janette Anderson	**Environmental Conservation Branch, Environment Canada**
Dr. Trefor Reynoldson, Dr. Lee Grapentine and Hans Biberhofer	**National Water Research Institute, Environment Canada**
Anne Bendig	**Ontario Ministry of Natural Resources**
Dr. Greg Mierle, Lisa Richman, Heather Hawthorne and Conrad deBarros	**Ontario Ministry of the Environment**

APPENDIX 2: Monitoring Plan for the St. Lawrence River at Cornwall Area of Concern: Recovery of the Benthic Environment to Reference Conditions

Lee Grapentine

Environment Canada, Burlington, Ontario

August 2007

INTRODUCTION

Purpose of the Plan

The purpose of this monitoring plan is to assess benthic conditions (i.e., sediment contaminant concentrations, sediment toxicity, benthic invertebrate communities and benthic invertebrate tissue mercury residues) in zones 1, 2, and 3 of the Cornwall waterfront and to determine the degree to which these conditions differ from those of reference locations. The overall goal of the plan is to evaluate whether benthic conditions along the Cornwall waterfront continue to improve over time.

OBJECTIVES AND APPROACH

1. The assessments of Reynoldson (1998) and Grapentine et al. (2003) offer the most recent and extensive data against which changes in benthic conditions through time can be compared. These data were also referenced in the "Findings and Recommendations" of the Cornwall Sediment Strategy Working Group (Environment Canada and Ontario Ministry of the Environment 2003) regarding sediment management. The objectives of the monitoring plan are to examine benthic conditions at previously sampled stations to assess:

(a) spatial differences between contaminated and reference sediments, and

(b) temporal differences between conditions before and after 2001.

The monitoring plan will involve the same methods applied by Reynoldson (1998) and Grapentine et al. (2003). These include assessments of sediment chemistry and grain size, sediment toxicity, and benthic invertebrate community composition based on the original "BEAST" methodology (Reynoldson et al. 1995, 2000; Reynoldson and Day 1998); and comparisons of measurements of mercury levels in benthos provided in Grapentine et al. (2003) with current levels. Integration of these data and assessment of overall benthic conditions will follow the frameworks of Grapentine et al. (2002) and Chapman and Anderson (2005).

STUDY AREA

Background information on environmental conditions in the Cornwall AOC is given in Dreier (2000). As in previous assessments in the Cornwall AOC, sampling will be in depositional areas identified by acoustic mapping of the river bed (Fig.1, Rukavina 2000). Stations sampled for the 1997 survey of Reynoldson (1998) are shown in Fig. 2, and those sampled in 2001 by Grapentine et al. (2003) are shown in Fig. 3. All stations (sites) sampled in 1997 were revisited (as closely as possible) in 2001 (Table 1). Although some stations in zone 2 do not overlap between studies, the area covered is essentially the same.

Local reference areas situated outside of areas historically exposed to industrial effluents were identified for the 2001 study upstream of the Cornwall waterfront in Lake St. Lawrence, above zone 1 (below the dam) and off the southern sides of Cornwall and

St. Regis Islands where the water flow is from the south channel of the river. Stations in these areas provided data on background mercury concentrations in sediment and biota relevant to the AOC.

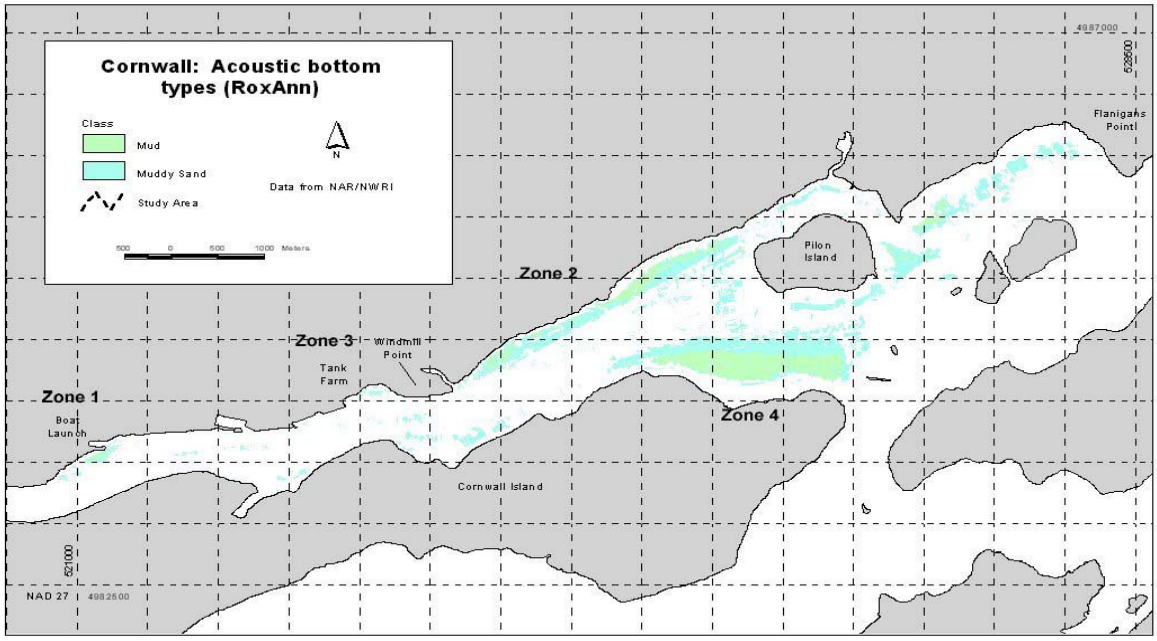

Figure 1: Location of zones 1, 2 and 3 and associated fine-grained sediment deposits in the St. Lawrence River at Cornwall (Rukavina 2000).

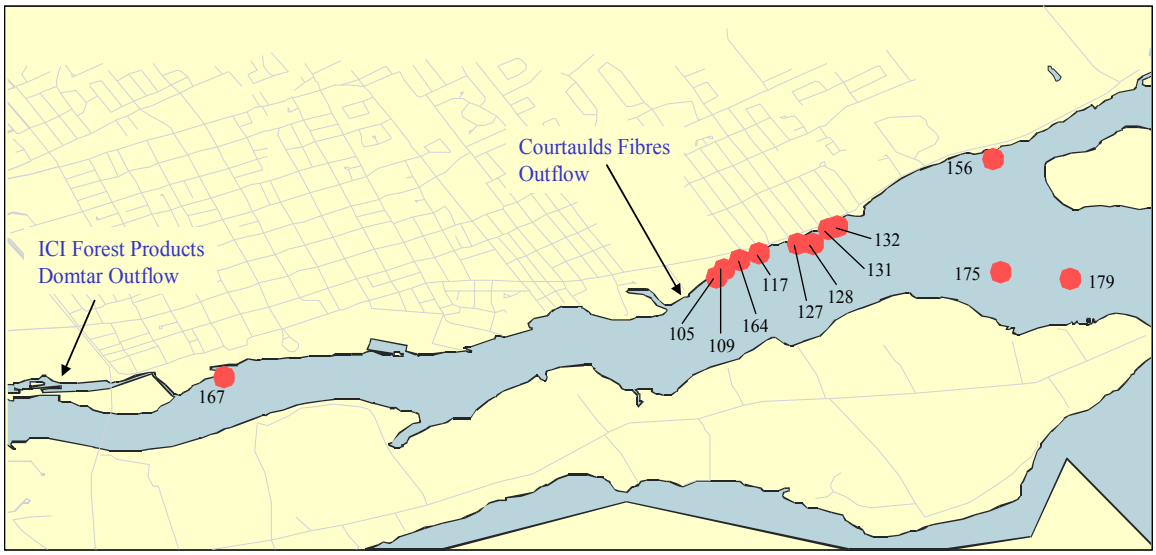

Figure 2: Invertebrate and sediment sampling locations of assessment by Reynoldson (1997).

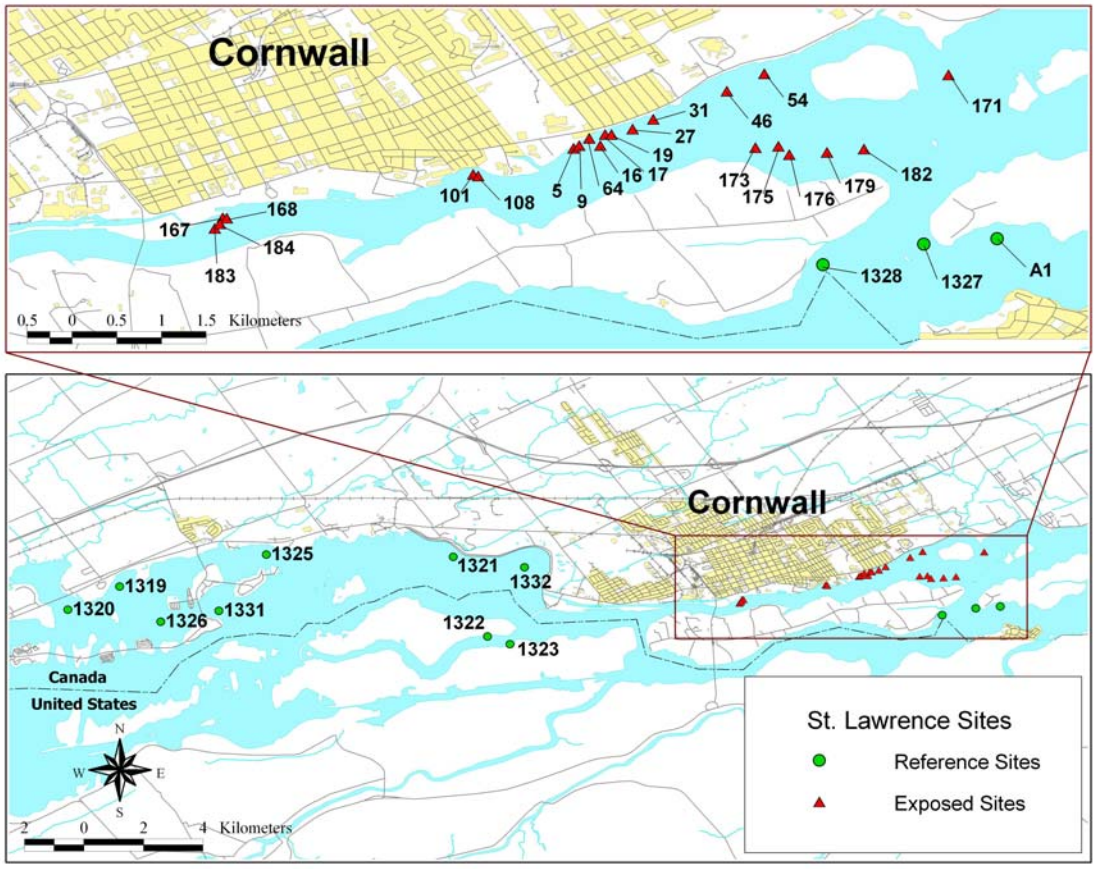

Figure 3: Invertebrate and sediment sampling locations for assessment of Grapentine et al. (2003).

Table 1: Comparison of 1997 and 2001 sampling sites. Sites in the same row are in the same or similar locations.

	1997				2001			
Area	Site	Sampling Device	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Site	Sampling Device	Easting	Northing
Upstream Ref.					1319	Mini-Box Core	506371.1	4984680.3
					1320	Mini-Box Core	505141.8	4983905.1
					1321	Ponar	514300.8	4985690.5
					1322	Mini-Box Core	515122.9	4983020.4
					1323	Mini-Box Core	515657.4	4982764.2
					1325	Mini-Box Core	509857.1	4985759.0
					1326	Mini-Box Core	507351.4	4983503.2
					1331	Mini-Box Core	508732.5	4983873.6
					1332	Mini-Box Core	515998.5	4985347.7
Downstream Ref.					1327	Mini-Box Core	526730.9	4984006.7
					1328	Mini-Box Core	525933.5	4983770.6
					A1	Mini-Box Core	527311.7	4984070.2
Zone 1	167	Mini-Box Core	45.0115000	-74.7316111	167	Mini-Box Core	521173.8	4984281.9
					168	Mini-Box Core	521206.9	4984278.2
					183	Mini-Box Core	521111.5	4984161.8
					184	Mini-Box Core	521151.7	4984213.0
Zone 3					101	Mini-Box Core	523157.5	4984774.4
					108	Mini-Box Core	523196.2	4984755.9
Zone 2	105	Mini-Box Core	45.0183889	-74.6961944	5	Mini-Box Core	523952.5	4985067.8
	109	Mini-Box Core	45.0189167	-74.6956667	9	Mini-Box Core	523996.8	4985100.2
					16	Mini-Box Core	524163.8	4985100.4
	117	Mini-Box Core	45.0200833	-74.6930833	17	Mini-Box Core	524201.9	4985223.3
					19	Mini-Box Core	524252.2	4985223.2
	127	Mini-Box Core	45.0206389	-74.6904167	27	Ponar	524419.3	4985285.2
	128	Mini-Box Core	45.0206389	-74.6893056				
	131	Mini-Box Core	45.0215833	-74.6881667	31	Ponar	524582.0	4985396.2
	132	Mini-Box Core	45.0218056	-74.6874722				
					46	Mini-Box Core	525164.5	4985713.7
	156	Mini-Box Core	45.0264722	-74.6762500	54	Mini-Box Core	525459.7	4985909.0
	164	Mini-Box Core	45.0195556	-74.6945000	64	Mini-Box Core	524075.0	4985179.5
Zone 4	175	Mini-Box Core	45.0186944	-74.6758056	175	Mini-Box Core	525574.2	4985096.4
	179	Mini-Box Core	45.0181944	-74.6707778	179	Mini-Box Core	525959.6	4985031.3
					173	Mini-Box Core	525392.8	4985081.3
					176	Mini-Box Core	525662.2	4985004.5
					182	Mini-Box Core	526254.2	4985068.8
Far-field Downstr.					171	Mini-Box Core	526920.2	4985901.2

EXPERIMENTAL DESIGN

Sampling Design

The sampling design will mostly repeat the array applied in 2001 (Grapentine et al. 2003), except for the zone 4 and far-field downstream stations, which will be dropped. Samples will be collected from all or from a subset of 2001 stations in zones 1, 2, and 3 and in the upstream and downstream (outside former effluent exposure areas) reference locations. In total, 22 stations (7 reference + 15 test) will be sampled for benthic invertebrate tissue and sediment and overlying water chemistry. This sampling design will allow analyses of both spatial patterns and temporal trends in benthic conditions. Sites proposed for sampling are provided in Table 2. Sites selected from zone 2 include those where amphipods were found and where the highest invertebrate methyl mercury concentrations were noted from 2001 samples. To further characterize sediments of zone 1, an additional 2-3 sites will be sampled providing coverage in the eastern portion of the zone. These are sites where high or low gas bubbling was noted in research studies conducted by the St. Lawrence River Institute of Environmental Sciences (SLRIES) in conjunction with Queens and Ottawa Universities (R. Razavi, pers. comm.). Zone 1 sampling sites are shown in Fig. 4.

Table 2: Proposed sampling sites for each zone.

Reference	Zone 1	Zone 3	Zone 2
1327	183	101	5
MA1	184	108	16
1320	167		17
1321	168 or MS-LB (SLRI)		19
1322	MS-HB (SLRI)		27
1331	EHB-1 (SLRI)		31
1332			64

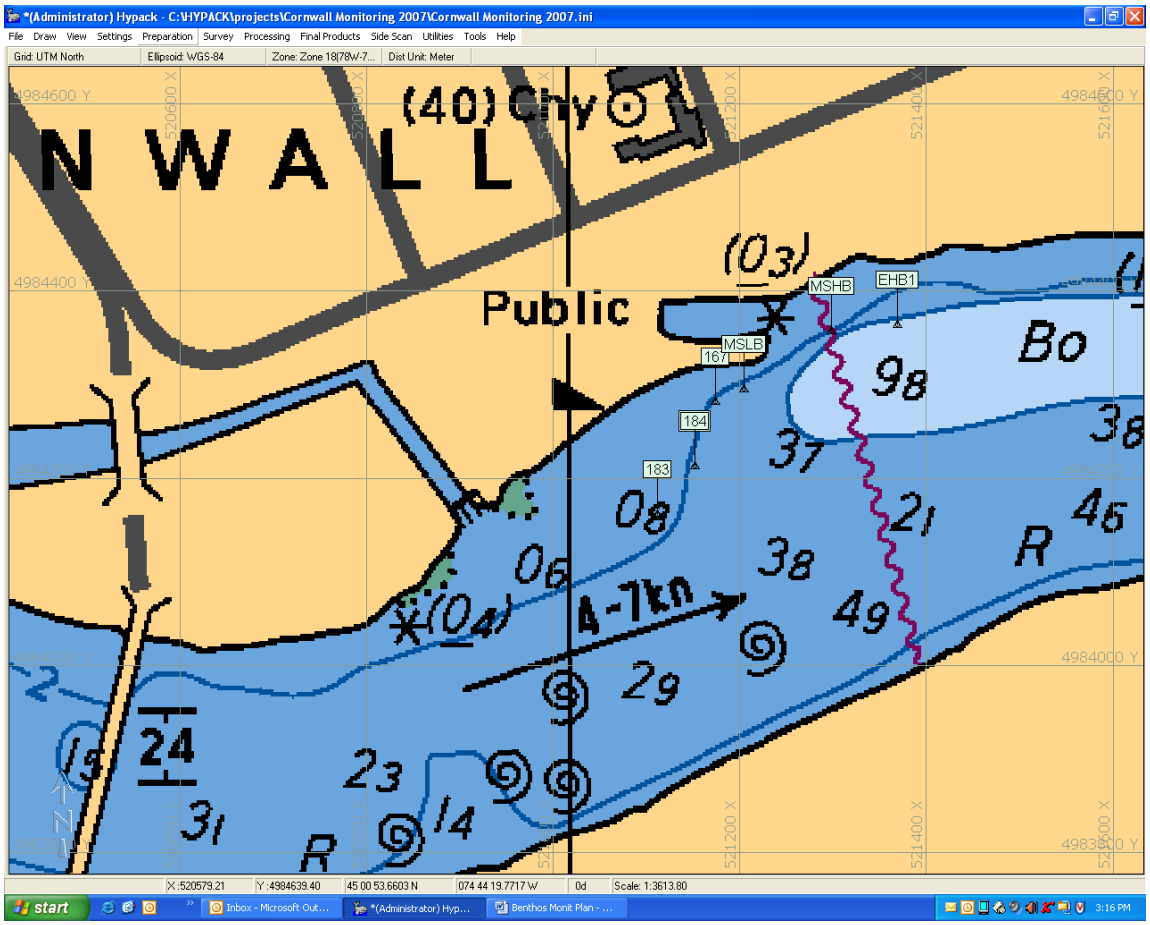

Figure 4: Proposed invertebrate and sediment sampling locations for zone 1.

Measurement Endpoints

At each site, sediment, water and invertebrates will be collected for (a) chemical and physical analysis of sediment and overlying water, (b) analysis of benthic invertebrate community structure, (c) whole sediment toxicity tests and (d) measurements of mercury

concentrations in invertebrates. Sediment will be obtained from the top 0 - 10 cm layer of river bed. Environmental variables to be measured are shown in Table 3.

Table 3: Environmental variables measured at each site.

Field	Water	Sediment
Latitude	Alkalinity	Major Elements (including total Hg)
Longitude	Conductivity (on site)	Methyl Mercury
Site Depth	Dissolved Oxygen (on site)	Total phosphorus, Total Kjeldahl Nitrogen
	pH (on site)	Total Organic Carbon, LOI
	Nitrate+Nitrite-N	% Clay, Silt, Sand, & Gravel
	Ammonia-N	Total Sulphides/Sulphates
	Total Kjeldahl Nitrogen	
	Total Phosphorus	
	Temperature (on site)	

Benthic community structure (taxonomic composition and relative abundances) will be described based on family-level identifications of macroinvertebrates. Sediment toxicity will be quantified based on acute and chronic responses of 4 invertebrate taxa (10 endpoints in total) in laboratory tests. For assessment of mercury bioaccumulation and potential biomagnification, 3 invertebrate taxa will be targeted for collection from each location: snails, amphipods and midges. Analyses of total and methyl mercury will be performed on samples composited from organisms within each taxon (i.e., taxa will be analyzed separately). Gut clearing will be done.

METHODS

Sample Collection and Handling

Methods for the collection of all samples will be the same as those of Reynoldson (1998) and Grapentine et al. (2003). These are briefly described below.

Prior to sediment collections, water samples will be obtained using a van Dorn sampler, taken from 0.5 m above the bottom. Temperature, conductivity, pH and dissolved oxygen will be measured in situ using YSI apparatus. Samples for alkalinity, total P, total Kjeldahl N, nitrate+nitrite-N and ammonia-N will be dispensed to appropriate containers and stored for later analysis.

A mini-box corer (40 cm X 40 cm) will be used to obtain sediment for the benthic community and sediment physico-chemical analyses. At each site, five benthic community subsamples will be taken from the box core using 10 cm long × 6.5 cm diameter acrylic tubes. Samples will be sieved through a 250-µm mesh screen and the residue preserved with 10% formalin for a minimum of 72 hours and then transferred to 70% ethanol. Approximately 2 L of the remaining top 10 cm of sediment from each box core will be removed, homogenised in a Pyrex dish and allocated to containers for chemical and physical analyses of sediment. At sites where a mini-box core cannot be used because of high proportion of sand or compact clay in the sediment, a Ponar sampler will be used to obtain the sediment samples. Separate grabs will then be taken for benthic invertebrate community samples. A mini-Ponar sampler will be used to obtain sediment for toxicity tests (five replicates/grabs per site). Each sediment grab will be placed in a plastic bag, sealed and stored in buckets. All samples will be kept at 4ºC.

Benthic invertebrates and sediment for analyses of total and methyl mercury will be collected using a Ponar sampler. At each site, between 15 and 20 grabs may be required to obtain a sufficient number of invertebrates (minimum of 1 g tissue per taxon). From each Ponar grab, a representative sample of the top 10 cm of sediment will be taken. These will be pooled in a glass tray, homogenized and subsampled to provide a composite sediment sample of all grabs from each site for total and methyl mercury analyses. Sediment for mercury analyses will be frozen at -20ºC. The remaining top 10 cm of sediment in each grab will be placed in a 68-L tub. When the tub is full, invertebrates will be removed from the sediment by wet sieving with lake water using 12" stainless steel sieves (500-µm mesh). Biota collected on the sieve will be sorted into separate taxa in glass trays using stainless steel instruments. Biota will be rinsed with deionized water and placed in pre-weighed and pre-cleaned (10% HCL) 5 -mL scintillation vials, weighed and frozen on site (-20°C). A layer of parafilm will be placed between vial and cap. Invertebrate samples will be later freeze-dried and reweighed. The wet:dry ratios will be used for converting invertebrate mercury concentrations from a dry weight to wet weight basis. Stainless steel sieves and instruments will be detergent-washed between stations. If organic matter remains on the sieve after the detergent wash (on visual inspection), a more aggressive cleaning solution will be implemented (caustic ethanol). Homogenizing and sorting trays and scoops will be detergent washed, rinsed in 20% HCl, and rinsed with river water between sites.

Sample Analyses

Sediment and Water Physico-Chemical Analyses

Analyses of alkalinity, total phosphorus, nitrate+nitrite-N, ammonia-N and total Kjeldahl N in water samples will be performed by procedures equivalent to those of the Environment Canada's National Laboratory for Environmental Testing (NLET) (Burlington, ON) as described in Cancilla (1994) and NLET (2000).

Freeze dried sediment will be analyzed for total mercury, 29 trace elements, major oxides, loss on ignition (LOI), total organic carbon (TOC), total phosphorus (TP) and total Kjeldahl nitrogen (TKN) using standard techniques outlined by the USEPA/CE (1981). Particle size analysis will be performed following the procedure of Duncan and LaHaie (1979).

Taxonomic Identification

Macroinvertebrates will be removed from the benthic community samples using a low power stereo microscope (16X with 10X eye piece), identified and sorted by family. Slide mounts will be made of oligochaetes for family identification under a high power microscope. Numbers of individuals for each taxon per sample will be recorded, except for poriferans, nematodes, copepods and cladocerans. Counts from Ponar grabs will be adjusted for differences from box corer in sampler area and efficiency.

Sediment Toxicity Tests

Four sediment toxicity tests will be performed: *Chironomus riparius* 10-d survival and growth, *Hyalella azteca* 28-d survival and growth, *Hexagenia* spp. 21-d survival and growth and *Tubifex tubifex* 28-d survival and reproduction. Sediment handling procedures and toxicity test methods are described elsewhere (Borgmann and Munawar 1989; Borgmann et al. 1989; Krantzberg 1990; Reynoldson et al. 1991; Reynoldson et al. 1998). All tests should pass acceptability criteria for their data to be used in the site assessments. The criteria are based on percent control survival in a reference sediment (Long Point Marsh, Lake Erie): i.e., ≥ 80% for *H. azteca* and ≥70% for *C. riparius;* ≥80% for *Hexagenia* spp., and ≥75% for *T. tubifex* (Reynoldson et al. 1998).

Water chemistry variables (pH, dissolved oxygen, conductivity, temperature and total ammonia + ammonium) will be measured for each test in each replicate test beaker on day 0 (start of test – prior to introduction of organisms) and at completion of the test (day 10, day 21 or day 28). Tests will be run under static conditions in environmental chambers at 23 ±1 °C, under a photoperiod of 16L: 8D and an illumination of 500 - 1000 lux, with the exception of *T. tubifex* test which was run in the dark. Methods for each test are outlined below.

***Hyalella azteca* 28-day survival and growth test**
The *H. azteca* test is conducted for 28 days using 2 -10 day old organisms. On day 28, the contents of each beaker are rinsed through a 250-μm screen and the surviving amphipods counted. Amphipods are then dried at 60 °C for 24 hours and dry weights recorded. (Initial weights are considered negligible.)

***Chironomus riparius* 10-day survival and growth test**
The *C. riparius* test is conducted for 10 days using first instar organisms. On day 10, the contents of each beaker are wet sieved through a 250-μm screen and the surviving chironomids counted. Chironomids are then dried at 60 °C for 24 hours and dry weights recorded. (Initial weights are considered negligible.)

***Hexagenia spp.* 21-day survival and growth test**
The *Hexagenia* spp. test is conducted for 21 days using preweighed nymphs (5 - 8 mg wet weight/nymph). On day 21, the contents of each jar are wet sieved through a 500-μ m screen and surviving mayfly nymphs counted. Nymphs are then dried at 60 °C for 24 hours and dry weights recorded. The relationship of mayfly wet:dry weight is determined previously by regression analysis. Initial dry weights are calculated using the following equation: Initial dry weight = (wet weight + 1.15)/ 7.35. Final growth is determined as final dry weight – initial dry weight.

***Tubifex tubifex* 28-day reproduction and survival test**

The *T. tubifex* test is conducted for 28 days using sexually mature worms (gonads visible). On day 28, the contents of each beaker are rinsed through a 500-μm and 250-μm sieve sequentially. The number of surviving adults, full cocoons, empty cocoons and large immature worms are counted from the 500-μm sieve and the numbers of small immature worms are counted from the 250-μm sieve. Reproduction is assessed with four endpoints: number of surviving adults, total number of cocoons per adult, percent cocoons hatched and total number of young per adult.

Sediment and Tissue Mercury Analyses

Procedures for analyses of mercury (total and methyl) in sediment and invertebrate tissues will be based on Bloom and Crecelius (1983), Horvat et al. (1993) and Liang et al. (1994). These can be performed by Flett Research Ltd. (Winnipeg, MB) and are summarized below. Detection limits will be determined.

Total mercury in sediment

Between 100 and 1000 mg of thawed sediment sample (or spiked sediment, blanks or reference material) is digested overnight (16-18 hours) in 3 mL of 7:3 nitric/sulfuric acid at 150°C. After cooling, the sample is diluted to 25 mL with low-mercury deionized water, spiked with BrCl and allowed to react. The residual BrCl is then destroyed by addition of hydroxylamine hydrochloride. An aliquot of the sample (100 µL - 2 mL) is placed into a sparging vessel, to which is added stannous chloride. The elemental mercury produced is purged onto a gold trap with Hg-free nitrogen. The gold trap is heated with UHP argon carrier gas passing through it and the mercury released is measured by a Brooks-Rand CVAFS model-2 detector.

Total mercury in biota

The same procedure as described for analysis of total mercury in sediment is used for biota, with the following differences in the sample digestion: up to 100 mg of invertebrate sample (or spikes, blanks or reference material) is digested for 6 hours in 10 mL of 1:2.5 nitric/sulfuric acid at 250°C; after cooling, the sample is diluted to 25 mL with low mercury deionized water, spiked with BrCl and allowed to react.

Methyl mercury in sediment

Sediment is prepared for analysis by distilling 200-300 mg of homogenized sample (or spikes or blanks) in ~45 mL of low-mercury deionized water. Approximately 40 mL of distillate is collected and acidified with KCl/H_2SO_4. (Note: It should be verified that an insignificant amount of methyl mercury production is occurring in the distillation process, in which case all samples can be processed by distillation.) An aliquot of the prepared sample (1-2 mL, depending on observed interferences from the matrix) is ethylated in solution (final volume ~ 40 mL) using sodium tetraethyl borate. The solution is buffered to pH 5.5. The resulting ethylmethyl mercury is purged onto a Tenax trap with mercury-free nitrogen. The trap is heated, purged with UHP argon onto a GC column (for separation of the ethylmethyl mercury from Hg° and diethyl mercury), run through a pyrolizer (to reduce all mercury to Hg°) and then sent to a cold vapour atomic fluorescence analyser for detection. (GC oven: Perkin Elmer 8410 GC; column: chromasorb WAW-DMSC 60/80 mesh with 15% OV-3; detector: Brooks-Rand CVAFS model-2).

Methyl mercury in biota

Freeze dried biota (5-10 mg of homogenized sample, spike, blank or reference material) are digested overnight with ~500 μL of KOH/methanol at 75 °C. Sample aliquots (50-60 μL) are then treated and analysed as described above for the ethylation and subsequent steps in the determination of methyl mercury in sediment.

DATA ANALYSES AND INTERPRETATION

Two main goals for the data analyses will be to assess (a) spatial differences between contaminated and reference sediments, and (b) temporal differences between conditions before and after 2001. Conditions at historically contaminated sites in zones 1-3 can be compared to two groups of references sites: (1) those in the Great Lakes, using the BEAST (except for the bioaccumulation data), and (2) local reference sites in the St. Lawrence River. The validity of using lacustrine sites as reference in approach 1 can be checked by the degree to which Cornwall area reference sites are similar (i.e., within the range of natural variability).

The sampling design and analytical methods will allow for the same data handling and analyses as in Reynoldson (1998) and Grapentine et al. (2003). These are outlined below. However, alternate methods could be used to address the assessment questions of the monitoring plan.

BEAST Analyses

The procedures used in the Benthic Assessment of Sediment (BEAST) approach are described in detail elsewhere (Reynoldson et al. 1995, 2000). Briefly, the methodology involves the assessment of sediment quality based on multivariate techniques using data on the physical and chemical attributes of the sediment and overlying water, benthic community structure (the type and number of taxa present), and the functional responses (survival, growth and reproduction) of laboratory organisms in toxicity tests. Data from test sites are compared with Environment Canada's biological guidelines, which were developed from responses of both field and laboratory benthic invertebrates to reference site sediments.

For benthic community data, multiple discriminant analysis is used to predict the test sites to one of five reference community groups using five habitat descriptors (latitude, longitude, depth, total organic carbon and alkalinity). Assessments conducted at the family level of taxonomic identification have been shown to be sensitive for the determination of stress (Reynoldson et al. 2000). To describe the dominant patterns of variability (structure) among benthic communities, data are ordinated using hybrid multidimensional scaling (HMDS, Belbin 1992), applied to a Bray-Curtis distance matrix. Toxicological responses are ordinated using HMDS applied to a Euclidean distance matrix of range-standardized data. Principal axis correlation is used to identify relationships between habitat attributes and community data or toxicity descriptors. Invertebrate families, toxicity endpoints and environmental attributes important in accounting for the overall structure in the data are identified using Monte-Carlo permutation tests. Test (Cornwall) sites are assessed by comparison to confidence bands of appropriate reference sites (Fig. 5).

Test data should be analyzed in subsets, with the number of test sites analyzed in any ordination numbering ≤10% reference sites (i.e., if there are 100 reference sites, then a subset of ≤ 10 test sites should be ordinated at one time). Multiple discriminant analysis and probability ellipses are produced using the software SYSTAT, and HMDS was performed using PATN (Belbin 1992).

In addition to BEAST analysis of toxicological endpoints, the relationship between sediment toxicity (using integrated toxicity descriptors and individual toxicity test endpoints) and contaminant concentrations can be assessed both graphically and by regression analysis. Initially, to examine general and dominant patterns in the data, comparisons between the toxicity responses and contaminant conditions are made based on the integrative, compound variables from ordinations. After this, to better detect less dominant (though significant) relationships between two or a few variables, analyses are conducted using the original measured variables (i.e., the 10 toxicity endpoints and concentrations of individual compounds).

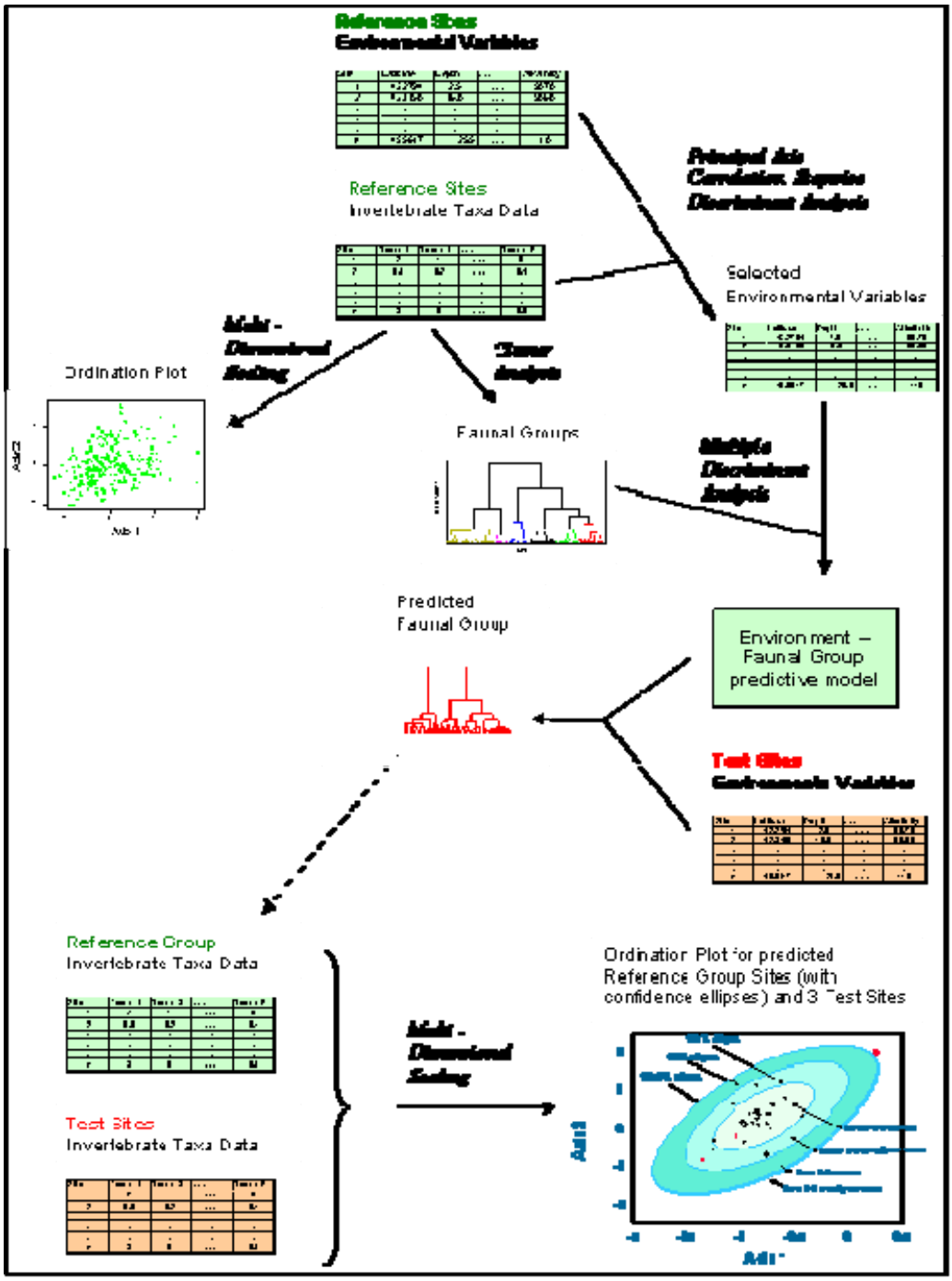

Figure 4. Statistical steps for BEAST analyses of benthic community data.

Mercury Distribution in Sediment and Biota

Sites in which concentrations of mercury in invertebrates ($[Hg]_{inv}$) are significantly elevated above reference levels for the study area will be identified by comparing $[Hg]_{inv}$ for effluent-exposed sites to the 99th percentile value (= maximum) for the reference

locations. This will be done separately for methyl mercury and total mercury and for each invertebrate taxon.

Relationships between concentrations of mercury in sediment and invertebrates will be determined using regression analysis, again separately for methyl mercury and total mercury and for each invertebrate taxon. Simple linear regression (ordinary least squares) will be used for a single predictor ($[Hg]_{sed}$) model. "Best subset" multiple linear regression procedures will be used for the fitting of multiple predictor models. A set of the environmental variables expected to potentially influence uptake of mercury from sediment by biota were identified from the group of measured variables by Grapentine et al. (2003) based on literature reviews. These included sediment concentrations of total organic C, total P, total N, total sulphides, Fe, and Mn; sediment particle size fractions of sand, silt and clay; overlying water concentrations of total P, nitrate/nitrite-N, ammonia-N, total Kjeldahl N, dissolved O_2; and overlying water alkalinity, pH and conductivity.

All models fitted to the data will include $[Hg]_{sed}$ as a free predictor (i.e., it is not forced to be in the model). The specific null hypothesis of interest is that "the effect of $[Hg]_{sed}$ on $[Hg]_{inv}$ = 0, after accounting for effects of other predictors". For the best subset regressions, models will be fitted for all combinations of predictors. Determination of the "best" model is based on several criteria (Draper and Smith 1998):

- maximum $R^2_{adjusted}$
- significance of partial *F*-tests (= *t*-tests) for predictors (especially $[Hg]_{sed}$)
- significance of *F*-test for regression
- variance inflation factors (VIFs) for predictors < 10
- homoscadastic and normally distributed residuals
- Mallow's C_p statistic not >> number of predictors

Comparison of mercury concentrations in invertebrates from 2001 to those from later dates

Because invertebrates will be collected for the monitoring plan from the same locations as in 2001, site-by-site changes in total and methyl mercury body concentrations will be determined. This will be done separately for methyl mercury and total mercury and for each invertebrate taxon. Average differences between years for each zone will also be shown. Differences in the sediment – invertebrate tissue relationships for each taxon will be examined by analysis of covariance.

QUALITY ASSURANCE/QUALITY CONTROL

Field
Two randomly chosen test sites and two reference sites will be chosen as QA/QC stations. At these stations, triplicate sediment, water and benthic community samples will be collected for determination of within-site and among-sample variability. Coefficients of variation (CV = standard deviation ÷ mean x 100) will be examined for the analytical data. Variability in family counts between box core samples will be examined by comparing positions of sites in the ordination plots.

Laboratory

Flett Research Ltd. conducts determinations of total and methyl mercury in sediment and benthic invertebrates. QA and QC evaluation for these procedures includes analyses of sample duplicates, matrix spikes and certified reference materials, as well as evaluations of sample recoveries. For sediment, sample duplicates are analyzed at least once every 15 samples and matrix spikes are performed on every tenth sediment sample to determine mercury recoveries. The NRC certified sediment reference material "MESS-2" is concurrently digested and analyzed for total mercury. For biota, duplicate "DORM-2" reference material, "MQAP fish check samples" and spiked matrix duplicates are analyzed for total and methyl mercury with each lot of 10 - 20 samples. Each invertebrate taxon is represented in the analyses of sample duplicates and matrix spikes.

To evaluate control measures for benthic invertebrate enumeration, each month the remaining material from each picked sample replicate is stored. One sample is randomly selected each month and re-picked, and the number of new organisms found is counted. The percent of organisms missed *(%OM)* is calculated using the equation:

$$\frac{\text{\# Organisms Missed}}{\text{Total Organisms Found}} \times 100 = \%OM$$

If % *OM* $>$ 5%, two more samples are randomly selected and the % OM will be calculated for both. The average *%OM* is calculated based on the three samples re-picked and represents the standard sorting efficiency for that month (based on only one sample if %OM is $<$ 5%).

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APPENDIX 3: WEIGHT OF EVIDENCE APPROACH

The following is an excerpt from the document *Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment* (2008). Although published in 2008, the framework was developed earlier and was used in the St. Lawrence AOC in 2005.

1.0 Introduction

1.1 Background

Contaminated sediment has been identified as one of the major impediments to the restoration of Areas of Concern (AOCs) in the Great Lakes. AOCs comprise locations where the International Joint Commission (IJC) has determined that the aquatic environment is severely degraded.

There is a need for an objective, transparent, pragmatic decision-making framework for contaminated sediments for use in the Great Lakes (and possibly elsewhere). In fact, a sediment decision-making framework for AOCs in the Great Lakes was a commitment made by the federal and provincial governments in the 2002 Canada-Ontario Agreement Respecting the Great Lakes Ecosystem (COA) which led to the development of the *Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment*.

The presence of substances in sediments where they would not normally be found, or at concentrations above natural background levels, does not necessarily mean that adverse biological effects are occurring. Other factors, such as the total concentration or the bioavailability of a substance, are more important in assessing if adverse biological effects may occur. The *Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment* provides the requisite framework to differentiate between those scenarios where elevated concentrations of contaminants are associated with adverse biological effects and those scenarios where they are not. It is the intention of Environment Canada and the Ontario Ministry of the Environment to use this framework to assess contaminated sediments in the Great Lakes and other waterbodies in the Province of Ontario. An overview of the entire framework is provided in Section 2.

The framework is explicitly based on ecological risk assessment (ERA) principles. Sections 3-7 provide additional details of key framework components in the context of the different phases of an ERA. References are provided in Section 8.

1.2 Purpose

The purpose of this document is to provide a decision-making framework for contaminated sediments explicitly based on ERA principles, and which also has applications to contaminated sediments in other (freshwater, estuarine and marine) areas. The framework is intended to be sufficiently prescriptive to standardize the decision-making process, but without using a “cook book” assessment approach that would fail to acknowledge the influence of site-specific conditions on the outcome of the decision-making framework, nor allow for appropriate use of best professional judgment. The framework is intended to be:

- objective;
- transparent;
- scientifically rigorous; and,
- readily understandable.

The framework is also intended to be rigid enough, without being inflexible, so that:

- There is consistency between different contaminated sediment assessments
- Site-specific considerations can be appropriately addressed;
- The localized risks from contaminated sediments are determined;
- The regional risks from contaminated sediments are determined.

Although the basic framework is not expected to change over time, new knowledge is expected to change and improve the tools that comprise the different Lines of Evidence (LOE) within the framework. Accordingly, the best available science should be used in applying the framework. This will require suitable state-of-the-art expertise in the various disciplines comprising the framework.

The decision-making framework is specific for environmental concerns associated with contaminated sediment, including human health concerns related to biomagnification. However, the framework is not otherwise concerned with human health risk assessment (HHRA): it does not address situations where potential human health concerns are associated with dermal contact to contaminated sediment (e.g., swimming, wading), or by other exposure routes (e.g., flooding resulting in aquatic sediments contaminating residential soils or gardens). Nor does it address the issue of unacceptable levels of contaminants that do not biomagnify, such as Cd, Pb, PAHs, in fish or shellfish. In such situations, a screening level HHRA should be considered to assess potential risks and inform the public.

2.0 The Sediment Decision-Making Framework

2.1 Guidance for Implementation

The primary guidance for implementation of this strategy is that it shall be applied within the context of common sense. In other words, it will not be applied inflexibly. There are four other guidance "rules" for the use of this Framework:

1. Sediment chemistry data (e.g., sediment quality guidelines [SQGs]) will not be used alone for remediation decisions except for two cases. The first case involves "simple contamination where adverse biological effects are likely… when the costs of further investigation outweigh the costs of remediation, and there is agreement to act instead of conducting further investigations." (Wenning and Ingersoll 2002). This first case is intended to apply to small sites with a limited number of contaminants present at extremely elevated concentrations (e.g., well above predicted effects levels). The second case involves sites subject to regulatory action.

2. Accordingly, any remediation decisions will be based primarily on biology, not chemistry since chemical SQGs are not clean-up numbers by themselves, and need to be used in a risk assessment framework.

3. LOE (lines of evidence, e.g., laboratory toxicity tests, models) that contradict the results of properly conducted field surveys with appropriate power to detect changes (e.g., see Environment Canada 2002) “are clearly incorrect” (Suter 1996) to the extent that other LOE are not indicative of adverse biological effects in the field.

4. If the impacts of a remedial alternative will “cause more environmental harm than leaving the contaminants in place”, that alternative should not be implemented (USEPA 1998).

2.2 Framework

The framework is tiered, and proceeds through the following sequential steps, with corresponding rationale. However, note that different steps do not need to be completed separately; two or more steps can (and in some cases should) be completed jointly (e.g., where this will reduce overall time and costs related to sampling and analysis). For example, if available data are insufficient to rule out management action, sediment toxicity tests may be conducted before chemical analyses are conducted for all chemicals with a SQG. If toxicity tests show that the sediment is not toxic, there would be no reason to measure concentrations of these SQGs.

Thus, the framework is linear in terms of thought processes, but that linearity is not necessarily to be followed in actions such as sample collections or analyses. For example, initial field sampling can involve all possible LOE (e.g., sediments for chemical analyses and toxicity testing; benthos for chemical analyses and taxonomy) with the recognition that, while samples for chemical analyses and taxonomy can be archived, those for toxicity testing cannot be archived and should be tested as soon as possible and no later than 8 weeks following collection (EPA/USACE 1998).

The framework is conceptually divided into a series of Steps and Decisions that correspond to different ERA tiers. Screening Assessment comprises Steps 1-3 and Decisions 1-2. Preliminary Quantitative Assessment comprises Steps 4-5 and Decisions 3-4. Detailed Quantitative Assessment comprises Steps 6-7 and Decisions 5-6. Step 7 and Decision 6 deal with deeper (than surficial) sediments. The framework is illustrated schematically in its entirety and in terms of the different ERA tiers at the start of Sections 2.2.1 (Figure 2), 2.2.4 (Figure 3), 2.2.7 (Figure 4), and 2.2.9 (Figure 5). It is described in detail in the sections that follow in terms of the nine individual steps.

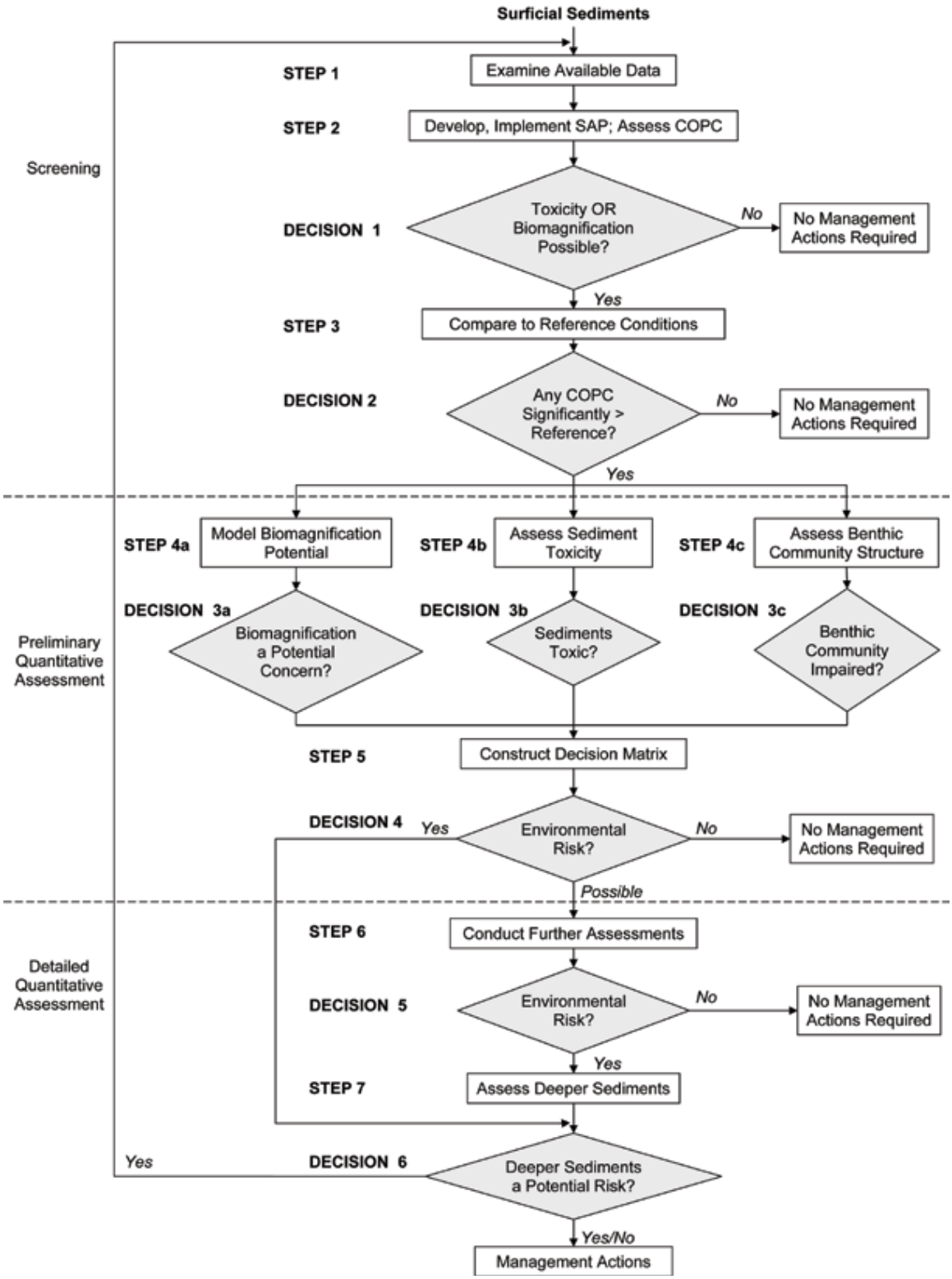

Figure 1: Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment.

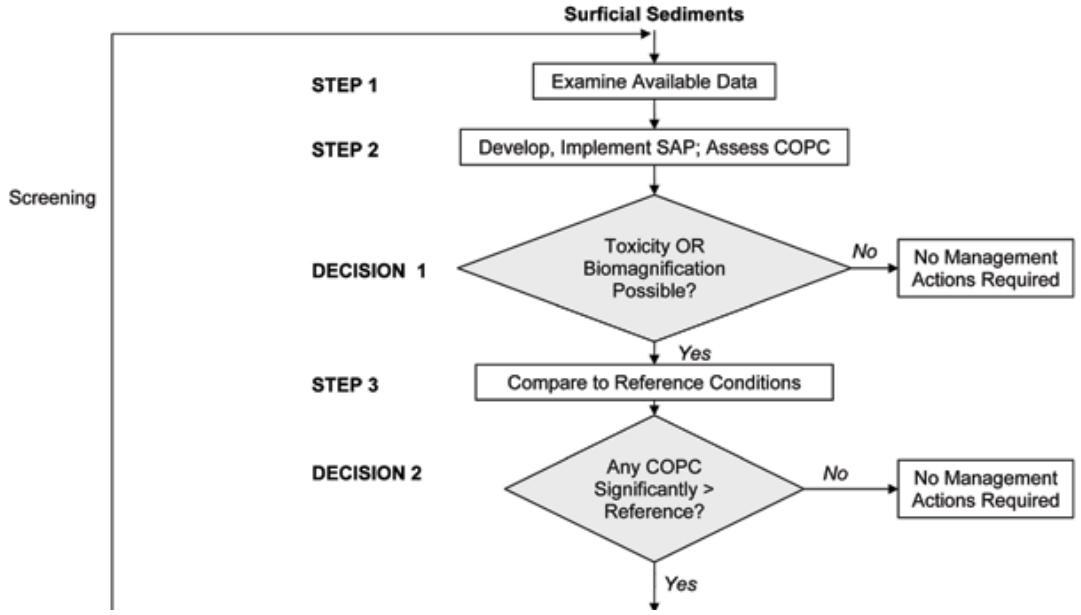

Figure 2: Initial Screening Assessment (Steps 1-3, Decisions 1-2). Conservative (worst case) assumptions are used to screen out locations and substances that are clearly not of concern and to focus on those that may be of concern.

2.2.1 Step1: Examine Available Data

Examine all readily available data for the site (see Section 3.1 re Site Definition), reports and information to determine:

- Contaminants of potential concern (COPC – see Section 3.2) and their concentrations at surface (e.g., < 10 cm) and at depth (e.g., > 10 cm);
- Receptors of potential concern (ROPC – the organisms that may be affected by COPC – see Section 3.3); this information will also assist in selection of toxicity test species;
- Exposure pathways (by which COPC may reach ROPC);
- Any human health consumption advisories;
- Sediment stability;
- Appropriate assessment endpoints (what is to be protected, e.g., benthos: organisms living in the sediments – see Section 3.4);
- Measures of effect and the level of any effects determined (what is actually measured, e.g., for benthos: species diversity, abundance, dominance – see Section 3.4);
- Appropriate reference areas/locations and their characteristics (see Section 3.5).

Determine whether the site (defined in Section 3.1) has a high level of environmental sensitivity (based on habitat, not land use), and whether contamination is only from off-site sources. A site is defined as the area under investigation which, dependent on size, COPC and other considerations, will generally require multiple samples to assess any environmental impact. Develop an initial Conceptual Site Model (CSM – showing the

interrelationships of COPC and ROPC – see Section 3.6), which will be updated as more information becomes available through further investigation.

Information gathered should consider not only surficial sediments (to about 10 cm depth), which are the initial focus, as this is where the majority of sediment-dwelling organisms live, but also deeper sediments and their contamination level and likelihood of being uncovered or even possibly moved such that they could affect surrounding areas. The status of deeper sediments (Step 7, Decision 6) should be considered as data become available. Rationale: Make use of historic information to appropriately guide subsequent sampling and analyses (which will almost always be required), and to avoid generating new data where data already exist.

2.2.2 Step 2: Develop and Implement a Sampling and Analysis Plan

Based on Step 1, above, develop a Sampling and Analysis Plan (SAP – see Section 3.7) for review and approval by stakeholders, then implement same at both exposed and reference sites. The objective of the SAP is to fill in data gaps related to both COPC and ROPC. The SAP should not necessarily be restricted to surficial sediments. A determination is required as to whether there are any COPC in the sediments that could be toxic and/or biomagnify up food chains (increase in concentrations through three or more trophic levels). Common sediment contaminants that may biomagnify include: organic mercury; PCBs; DDT; and, 2,3,7,8-TCDD. If mercury is a COPC, measure both total and methyl mercury concentrations in sediments (mercury only biomagnifies in the methylated form). If PCBs are a concern, measure total PCBs (sum of seven Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, 1260) as sediment quality guidelines are typically based on total PCBs or specific Aroclors (If a detailed quantitative assessment is conducted, congener specific information may be required for sediments contaminated with PCBs, dioxins and/or furans). If DDT is a concern, also measure DDD and DDE, its breakdown products.

Decision Point 1: Two questions now need to be addressed (i.e., are COPC levels above SQG-low levels). First, are COPC present in sediments above levels that have been shown to have minimal effects to biota living in the sediments? In other words, could the COPC possibly cause toxic effects? Typically only chemistry data will be available to characterize a site. These data are used in an initial pre-screening step to remove sites from further consideration if concentrations are below appropriate sediment toxicity thresholds. However, occasionally, biomonitoring data may be available for a site that indicates potential adverse effects are occurring. In this situation, the biomonitoring data are sufficient to suggest that additional assessment is needed regardless of the results of the screening step based on chemistry data alone. Second, do COPC present in sediments comprise substances that could biomagnify and affect the health of biological communities at higher trophic levels or of humans consuming biota contaminated with those substances? The first question is addressed by comparing COPC to an appropriate SQG-low (e.g., an SQG that predicts toxicity to less than 5% of the sediment-dwelling fauna, such as the Canadian Threshold Effect Level (TEL) or the Ontario Lowest Effect Level (LEL)). The specific SQG-low that is used for this step may vary based on both regional considerations and best professional judgement. For situations where no SQG exists, compare COPC concentrations to reference areas; sediments where concentrations exceed 20% of reference areas, and are statistically higher than reference areas, suggest anthropogenic exposure has occurred. These substances should be considered as having the potential to cause toxic effects or

biomagnify, and further assessment of the sediment is required. The second question is addressed by determining whether or not substances that can biomagnify are present at quantifiable concentrations. Two decisions are possible:

Comparison	***Decision***
All sediment COPC < SQG-low, **and** no substances present that can biomagnify	No further assessment or remediation required. **STOP**
One or more sediment COPC > SQG-low, **and/or** one or more substances present that can biomagnify	Potential risk; further assessment required. **PROCEED TO STEP 3**

Rationale: Conduct initial analyses as necessary to make a decision as to whether or not the sediments may pose a potential risk to the environment and/or to human health. By design, SQGs are typically conservative, in other words, over-protective. Thus, if sediment COPC concentrations are below SQG that predict minimal effects (SQG-low), there is negligible ecological risk. For example, Porebski et al. (1999) found that such SQG performed well as "levels below which unacceptable biological effects were unlikely to occur." Because SQGs have no role in evaluating human health risks or biomagnification (Wenning and Ingersoll 2002), and there are no such sediment guidelines, initial (conservative) decisions regarding biomagnification potential are simply based on the presence or absence of quantifiable amounts of substances that may biomagnify.

2.2.3 Step 3: Compare to reference conditions - Is there a potential risk based on contaminant concentrations?

Determine whether the concentrations of COPC exceeding SQG-low and/or concentrations of substances that can biomagnify statistically exceed reference concentrations as determined from reference area comparisons.

Decision Point 2: Two separate questions need to be addressed. First, are concentrations of COPC in sediments that are above SQG-low levels statistically different ($p < 0.05$) than reference conditions? Second, are concentrations of COPC that could biomagnify, which are present in sediments at quantifiable levels, not statistically different ($p < 0.05$) than those same COPC in reference areas? Note that in cases where there is little discriminatory power in statistical significance determinations due to very low variability in the reference areas (i.e., a very small difference from reference would be statistically significant but of arguable environmental significance), an additional comparison is possible, specifically: are concentrations of COPC less than 20% above those same COPC in reference areas? The +20% comparison is a straight arithmetic comparison of either mean or individual values, depending on site-specific circumstances (alpha = 0.05; beta = 0.10). Reference conditions include background conditions – either measured or determined from historical data. *Note, in making these comparisons, the data for an immensely contaminated (e.g., > 10 fold the SQGs that predict likelihood of toxicity), but relatively small area, should not necessarily be diluted with data from other, much less contaminated areas.*

Comparison	***Decision***
[Concentrations of all sediment COPC > SQG-low **and** substances present that can biomagnify] ≤ reference conditions and statistically no different than reference	No further assessment or remediation required. **STOP**
[Concentrations of one or more sediment COPC > SQG-low **and/or** one or more substances present that can biomagnify] > reference conditions and statistically higher than reference	Potential risk; further assessment required. **PROCEED TO STEP 4A**

Rationale: In this step, the framework is considering two possibilities: (1) either all COPC which are greater than SQG low and which can biomagnify are lower than reference (in this case there is no action required because sediment quality reflects background conditions) or (2) there is a difference from reference between one or more COPC (which exceed SQG low) and/or there is a difference from reference between one of more substances that can biomagnify. Inorganic and some organic substances occur naturally and may be naturally enriched in some areas (e.g., naturally mineralized areas, oil seeps). The focus of remediation efforts needs to be on anthropogenic (human) contamination, not natural enrichment. The additional possible determination of a difference of 20% between two sets of chemistry data is well within the bounds of typical analytical variability may not represent a true (significant) difference because it is likely a consequence of natural sediment heterogeneity (Jaagumagi and Persaud 1996), and is highly unlikely to be of any environmental concern. The additional use of reference + 20% could be useful to screen out areas of marginal environmental concern, and is the same criterion as used for sediment toxicity test results comparisons (Section 2.2.5).

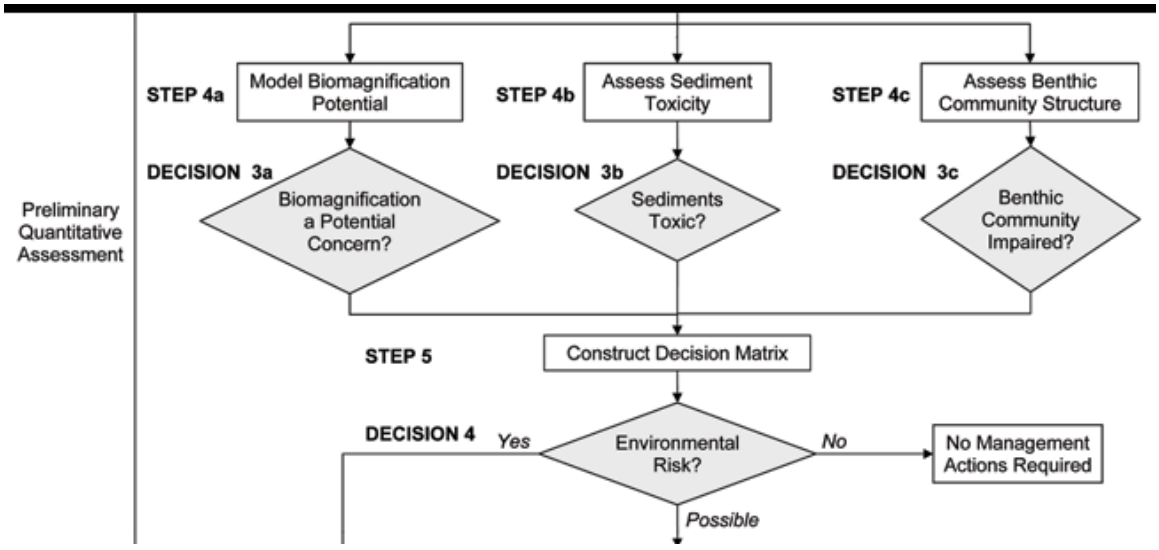

Figure 3: Preliminary Quantitative Assessment (Steps 4-5, Decisions 3-4). See also Sections 5.1, 5.2 and 6.2. Contaminated areas screened in are further investigated, preparatory to determining whether there is or is not a problem, or whether additional investigations are required.

2.2.4 Step 4a: Is Biomagnification a Potential Concern?

If substances that can biomagnify remain of concern, conservatively model concentrations in the sediments, sediment-dwelling organisms, and predators of those organisms through to top predators to determine whether or not there is a potential risk (Grapentine et al. 2003a, b – See Section 4.2). Conservative modelling includes, for example: the assumption that maximum contaminant concentrations occur throughout the exposed area; the use of maximum biomagnification factors (BMFs); the assumption that fish feeding is limited to the exposure area. Basically, worst case scenarios, some of which may be unrealistic, are used to allow environmental risks to be either screened out or identified as possibilities to be investigated further.

Decision Point 3a: Determine whether or not contaminant biomagnification is a potential concern.

Comparison	***Decision***
There is no potential for contaminant biomagnification from the sediments through aquatic food chains	No further assessment or remediation required relative to biomagnification. **PROCEED TO STEP 4B**
There is potential for contaminant biomagnification from the sediments through aquatic food chains	Potential risk; further assessment of biomagnification potential required. **PROCEED TO STEP 4B**

Rationale: Conservative assumptions inherent in such a modelling exercise (i.e., worst case assumptions) will allow a determination either that biomagnification is not a concern, or that it may be a concern. In the latter case, additional site-specific assessment may be required (Step 6).

2.2.5 Step 4b: Are the sediments toxic?

For the remaining COPC, use SQG-low and SQG-high (that predict toxicity to 50% or more of the sediment infauna) to map spatial patterns of contamination. Determine the toxicity of representative areas including those most heavily contaminated as well as those moderately and minimally contaminated, and reference areas, synoptic with sediment chemistry determinations (i.e., use subsamples of the same sample for both chemical analyses and toxicity testing). For situations where COPC are greater than SQG-low but substantially less than SQG-high, best professional judgement should be used to determine if subsequent toxicity testing or bioassessment is required. Typically, laboratory sediment toxicity tests are conducted with three or four appropriately sensitive, standardized sediment-dwelling and/or sediment associated test organisms (e.g., Hexagenia, Hyalella, chironomids, oligochaetes) that are reasonably similar to those found (or expected to be found) at the site (based on available data – Step 1), and combined end-points that involve survival, growth and reproduction (i.e., acute and chronic endpoints).

Decision Point 3b: Bulk sediment chemical analyses do not consider contaminant bioavailability, nor do they provide reliable information on the toxicity of sediment contaminants (reasonably reliable information can be obtained on the non-toxicity of sediment contaminants, cf. Decision Point 1). Thus, a determination is required as to whether or not the sediments that were previously assessed as contaminated, are toxic to individual organisms, and the extent of any toxicity.

Comparison	***Decision***
All sediment toxicity endpoints < 20% difference from reference **and** not statistically significantly different than reference	No further assessment required relative to laboratory toxicity. **PROCEED TO STEP 4C**
One or more sediment endpoints > 20% difference from reference **and** statistically significantly different than reference	Potential risk; further assessment required. **PROCEED TO STEP 4C**

Rationale: Although sediment toxicity tests have good power to detect differences between responses, a difference of 20% between controls and test/reference sediments is neither different nor environmentally relevant in short-term (e.g., 10-d), acute tests (Mearns *et al*. 1986; Washington State Sediment Management Standards [Ch173-204 WAC-17]; Suter 1996; EPA/USACE 1998; Environment Canada 1998, 1999). For this framework, sediments with less than a 20% difference between controls and test/reference sediments are not considered to be toxic, even if the difference is statistically significant.

2.2.6 Step 4c: Is the Benthic Community Impaired?

Determine whether the benthic community is significantly different from appropriate reference sites. Two questions need to be addressed. First, is it appropriate or realistic to assess the benthic community? There may be situations where benthic community structure assessments relative to possible sediment contaminant effects are not appropriate or realistically possible (e.g., shallow harbours where propeller scour, dredging or other habitat disturbances alter benthic communities independent of any contaminant effects; dynamic sediment bedflow that may alter the biological zone as a result of deposition or scour). Benthic community structure assessments will also not be possible for sediments deeper than about 10 cm because the vast majority of the sediment-dwelling organisms live in shallower depths than 10 cm although some organisms (e.g., some bivalves) can burrow much deeper. Second, is the benthic community at the site significantly different from the benthic community in reference areas? Benthic community structure is often described in terms of the diversity, abundance, and dominance of different invertebrate species living in or on the sediment. Assessment of the benthic community could include multimetric and/or multivariate analysis (as appropriate) to properly characterize it. Data interpretation using multivariate approaches are strongly recommended; however, the use of other metrics may have merit (Reynoldson et al. 1995, Hawkins et al. 2000, Barbour et al. 1999, Bailey et al. 2004, Env. Canada 2002, USEPA 2002c).

Decision Point 3c: Determine benthic community impairment.

Comparison	***Decision***
It is inappropriate to assess the benthic community	**PROCEED TO STEP 5**
Benthic community is not significantly different from reference areas	**PROCEED TO STEP 5**
Benthic community is significantly different from reference areas	**PROCEED TO STEP 5**

Rationale: Assessing the benthic community at a site, and comparing results to the community at appropriate reference areas, provides valuable information on the cumulative effect of multiple stressors on the invertebrate species that live in or on the sediment. Typically, benthic organisms reside at a site over most of their life span, and therefore integrate the effects of exposure to COPC as well as other biological and physical stressors. Alteration in the benthic community may be related to the presence of elevated substances in the sediment but may also be due to other factors either natural (e.g., competition/predation, habitat differences) or human-related (e.g., water column contamination). A properly conducted field study and selection of appropriate reference sites are crucial for accurately assessing potential adverse effects to the benthic community at the site.

2.2.7 Step 5: Develop decision matrix

Develop a decision matrix based on and ranking data from the available LOE (sediment chemistry, toxicity, benthos [if available and appropriate] and bioaccumulation potential) – Table 1 (adapted from Grapentine et al. 2002a). Samples for sediment chemistry and toxicity are collected synoptically (subsamples of the same samples); samples for

benthos are collected coincidentally (i.e., at the same locations but not on the same samples). Samples for benthos and chemistry analyses can be collected during initial field sampling and archived until and unless needed, thus reducing field costs. However, samples for sediment toxicity cannot be archived for longer than 8 weeks and should ideally be tested as soon as possible following collection (EPA/ USACE 1998). If benthos studies are not reasonably possible, fit other LOE into Table 2 and use best professional judgement in Step 6.

Decision Point 4: At this point a definitive decision may be possible. Specifically, sufficient information has now been gathered to allow for an assessment of three possibilities: (1) the contaminated sediments pose an environmental risk (see Section 7 re Risk Management); (2) the contaminated sediments may pose an environmental risk, but further assessment is required before a definitive decision can be made; (3) the contaminated sediments pose a negligible environmental risk. See Table 2 – note that definitive determinations are possible in 4 of 16 possible scenarios (two determinations of negligible environmental risk requiring no further actions; two of environmental risk requiring management actions).

Rationale: At this point definitive determinations are possible in some cases with the proviso that sediment stability may still need to be assessed (Step 7); in other cases, further assessment is needed, but can be guided by the results of this data integration. As noted by Wong (2004), SQGs do not provide definitive information for decisions regarding contaminated sediments, including remediation; a weight of evidence (WOE) approach is required. In a WOE approach, sediment chemistry data are given the least weight (Section 2.1, “rules” 1 and 2); benthic community data are given the most weight (Section 2.1, “rule” 3).

The type of WOE integration of LOE shown in Table 2 is usually applied on a station-by-station basis. Thus, although initial screening (Steps 1-3) is intended to screen out areas with relatively low contaminant concentrations, subsequent more detailed sampling of these areas may include stations with contaminant concentrations below levels of concern. Mapping of the results is one means to apply the findings on a large sample basis (i.e., to all sample locations), as a tool for expert/stakeholder groups to identify and focus on obvious problem areas/patterns.

Table 1:
Ordinal Ranking For WOE Categorizations for Chemistry, Toxicity, Benthos And Biomagnification Potential.

	■	◙	□
Bulk Chemistry (compared to SQG)	**Adverse Effects Likely:** One or more exceedances of SQG-high	**Adverse Effects May or May not Occur:** One or more exceedances of SQG-low	**Adverse Effects Unlikely:** All contaminant concentrations below SQG-low
Toxicity Endpoints (relative to reference)	**Major:** Statistically significant reduction of more than 50% in one or more toxicological endpoints	**Minor:** Statistically significant reduction of more than 20% in one or more toxicological endpoints	**Negligible:** Reduction of 20% or less in all toxicological endpoints
Overall Toxicity	**Significant:** Multiple tests/endpoints exhibit major toxicological effects	**Potential:** Multiple tests/endpoints exhibit minor toxicological effects and/or one test/endpoint exhibits major effect	**Negligible:** Minor toxicological effects observed in no more than one endpoint
Benthos Alteration (multivariate assessment, e.g., ordination)	"different" or "very different" from reference stations	"possibly different" from reference stations	"equivalent" to reference stations
Biomagnification Potential (relative to reference)	**Significant:** Based on Step 6	**Possible:** Based on Step 4a	**Negligible:** Based on Steps 4a or 6
Overall WOE Assessment	**Significant adverse effects:** elevated chemistry; greater than a 50% reduction in one or more toxicological endpoints; benthic community structure different (from reference); **and/or** significant potential for biomagnification	**Potential adverse effects:** elevated chemistry; greater than a 20% reduction in two or more toxicological endpoints; benthic community structure possibly different (from reference); **and/or** possible biomagnification potential	**No significant adverse effects:** minor reduction in no more than one toxicological endpoint; benthic community structure not different from reference; **and** negligible biomagnification potential

SQG = Sediment Quality Guideline; EC = Effective Concentration. Note That The Overall Definition Of "No Significant Adverse Effects" Is Independent Of Sediment Chemistry.

Table 2:
Decision Matrix for WOE Categorization. Based on Table 1, see text for explanation; a dash means "or". Separate endpoints can be included within each LOE (e.g., metals, PAHs, PCBs for Chemistry; survival, growth, reproduction for Toxicity; abundance, diversity, dominance for Benthos).

Scenario	Bulk Sediment Chemistry	Overall Toxicity[1]	Benthos Alteration[2]	Biomagnification Potential[3]	Assessment
1	☐	☐	☐	☐	No further actions needed
2	■ – ◘	☐	☐	☐	No further actions needed
3	☐	☐	■ – ◘	☐	Determine reason(s) for benthos alteration (Section 5.3)
4	☐	■ – ◘	☐	☐	Determine reason(s) for sediment toxicity (Section 5.3)
5	☐	☐	☐	◘	Fully assess risk of biomagnification (Section 4.3)
6	■ – ◘	■ – ◘	☐	☐	Determine reason(s) for sediment toxicity (Section 5.3)
7	☐	☐	■ – ◘	◘	Determine reason(s) for benthos alteration (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
8	■ – ◘	☐	■ – ◘	☐	Determine reason(s) for benthos alteration (Section 5.3)
9	■ – ◘	☐	☐	◘	Fully assess risk of biomagnification (Section 4.3)
10	■ – ◘	■ – ◘	☐	◘	Determine reason(s) for sediment toxicity (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
11	■ – ◘	☐	■ – ◘	◘	Determine reason(s) for benthos alteration (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
12	☐	■ – ◘	☐	◘	Determine reason(s) for sediment toxicity (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
13	☐	■ – ◘	■ – ◘	☐	Determine reason(s) for sediment toxicity **and** benthos alteration[2] (Section 5.3)

14	□	■ - ◘	■ - ◘	◘	Determine reason(s) for sediment toxicity **and** benthos alteration (Section 5.3), **and** fully assess risk of biomagnification (Section 4.3)
15	■ - ◘	■ - ◘	■ - ◘	□	Management actions required[4]
16	■ - ◘	■ - ◘	■ - ◘	◘	Management actions required[4]

[1] Overall toxicity refers to the results of laboratory sediment toxicity tests conducted with a range of test organisms and toxicity endpoints. A positive finding of sediment toxicity may suggest that elevated concentrations of COPC are adversely affecting test organisms. However, toxicity may also occur that is not related to sediment contamination as a result of laboratory error, problems with the testing protocol, or with the test organisms used.

[2] Benthos alteration may be due to other factors, either natural (e.g., competition/predation, habitat differences) or human-related (e.g., water column contamination). Benthos alteration may also be related to sediment toxicity if a substance is present that was not measured in the sediment or for which no sediment quality guidelines exist, or due to toxicity associated with the combined exposure to multiple substances.

[3] Per Table 1, significant biomagnification (■) can typically only be determined in Step 6; Step 3 only allows a determination that there either is negligible biomagnification potential or that there is possible biomagnification potential. However, there may be site-specific situations where sufficient evidence is already available from fish advisories and prior research to consider biomagnification at a site significant; this would be determined in Step 1 (examination of available data). Thus, for example, if significant biomagnification were indicated in Scenario 5, above, management actions would be required. The other three LOE do allow for definitive determinations in prior Steps of this Framework.

[4] Definitive determination possible. Ideally elevated chemistry should be shown to in fact be linked to observed biological effects (i.e., is causal), to ensure management actions address the problem(s). For example, there is no point in removing contaminated sediment if the source of contamination has not been addressed. Ensuring causality may require additional investigations such as toxicity identification evaluation (TIE) and/or contaminant body residue (CBR) analyses (see Section 5.3). If bulk sediment chemistry, toxicity and benthos alteration all indicate that adverse effects are occurring, further assessments of biomagnification should await management actions dealing with the clearly identified problem of contaminated and toxic sediments adversely affecting the organisms living in those sediments. In other words, deal with the obvious problem, which may obviate the possible problem (e.g., dredging to deal with unacceptable contaminant-induced alterations to the benthos will effectively also address possible biomagnification issues).

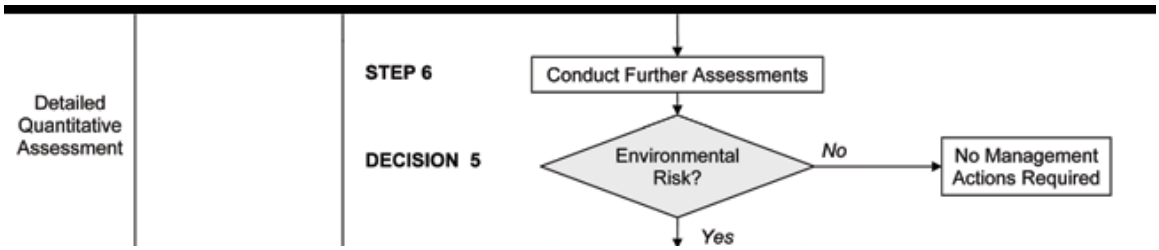

Figure 4: Detailed Quantitative Assessment (Step 6, Decision 5). See also Sections 4.3, 5.3, 6.1, 6.3 and 6.4. Decisions can be made regarding management actions for specific situations. In other situations, additional, focused investigations will be required.

2.2.8 Step 6: If necessary, conduct further assessments

As per the 16 possible scenarios in Table 2, 4 result in definite decisions and twelve possible scenarios result in a determination that the contaminated sediments may pose an environmental risk, but further assessment, outlined in Table 2, is required before a definitive decision is made.

Decision Point 5: Based on additional investigation, determine whether or not an environmental risk exists. ***This is where, in particular, and as noted in Section 2.2., it is critical that the study team include scientists with strong expertise in sediment chemistry (chemical fate, transport and speciation), sediment toxicity testing, benthic community assessment, food chain effects and environmental statistics for the design, implementation, and interpretation of both the previous and any additional investigative studies required.***

Rationale: (1) If there is no clear link between elevated chemistry (i.e., sediment contaminant concentrations > SQG-low) and biological effects (i.e., sediment toxicity and/or benthos alteration), there may be no point to sediment remediation as, if the sediment contaminants are not causative, sediment remediation will not ameliorate the biological effects. It is necessary to conduct more detailed studies to determine the cause of biological effects. (2) Observed toxicity and/or benthos alteration in the absence of elevated chemistry may be due to unmeasured contaminants or non-contaminant-related factors; either way, certainty as to causation is required (e.g., toxicity identification evaluation, TIE). (3) Modelling biomagnification only indicates whether there is no problem or may be a problem; if there is a potential biomagnification problem, more definitive assessments involving field measurements (e.g., contaminant body residue [CBR] analyses), laboratory studies, and/or more realistic modelling scenarios are required (see Section 4.3).

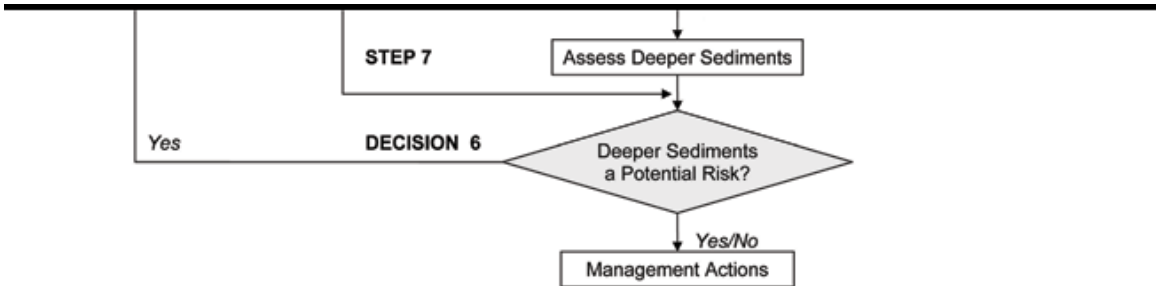

Figure 5: Assessment of Deeper (Below Surficial) Sediments (Step 7, Decision 6). If deeper sediments may pose a risk and could be exposed, the risk posed and need for management actions need to be determined.

2.2.9 Step 7: If necessary, assess deeper sediments

The previous assessments typically focus on surficial sediments (about 10 cm depth). Surficial sediments effectively cover deeper sediments, which may be similarly or differently contaminated. If so, there is a need to determine whether, under unusual but possible natural or human-related circumstances, these deeper sediments may be uncovered. Such studies involve an assessment of both sediment stability and sediment deposition rates.

Decision Point 6:

Comparison	***Decision***
Levels of COPC in deeper sediments below SQG-low and no substances present that can biomagnify, ***or*** deeper sediments very unlikely to be uncovered under any reasonably possible set of circumstances	No further assessment or remediation required. ***STOP.*** Management options for polluted surficial sediments should be determined.
Levels of COPC in deeper sediments above SQG-low and/or one or more substances present that can biomagnify, ***and*** these sediments may be uncovered under one or more reasonably possible set of circumstances	Potential risk; further assessment may be required (See Guidance, Section 1, "rule" 1). ***FOLLOW THE FRAMEWORK FROM STEP 1 (IF NECESSARY).*** Necessary information will probably already have been gathered for some initial steps.

Rationale: If deeper sediments are contaminated, and could be uncovered, they could pose an environmental risk, which needs to be evaluated. If the sediments are not likely to be uncovered, i.e., to become surface sediments, under any reasonably likely set of circumstances (e.g., a 100-year flood), then they do not require further assessment as any contaminants they contain will remain buried and there will be no exposure routes to biota.

APPENDIX 4: CORNWALL SEDIMENT STRATEGY - EVALUATION OF ADMINISTRATIVE CONTROLS

Cornwall Sediment Strategy

Evaluation of Administrative Controls

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January 16, 2003

Preamble

The St. Lawrence River provides a focus for many types of development and recreational activities and it is anticipated that there will be increased pressure in the future to use and enjoy this important resource.

Throughout the 20th century, there has been extensive industrial and urban use of the river and lands surrounding Cornwall. Past industrial discharges into the St. Lawrence River of persistent toxic contaminants such as mercury have accumulated in the sediments in the riverbed along the Cornwall waterfront.

During the past five years all levels of government (Federal, Provincial, Municipal and First Nation) and numerous industrial groups and individuals have been actively involved in the development of a sediment management strategy for the Cornwall waterfront. Scientific research has been undertaken to determine the impact that these contaminated sediments have had on the local fish, wildlife and human populations that rely on the St. Lawrence River ecosystem.

This work concluded that although sediment chemistry exceeds provincial sediment quality guidelines, there is a low level of concern because the more contaminated material is located in the deeper sediments which have been covered over by less contaminated material. An analysis of the surface sediment indicates that it is not considered toxic, has not impacted bottom dwelling organisms and does not represent a major source of mercury to the food chain.

Sediments are currently stable under natural conditions, and if left in place, it is necessary to ensure that there are effective administrative controls to prevent human disturbance or re-suspension. This approach raises a number of key questions:

- *Are there effective controls in place now?*
- *Who are the agencies involved?*
- *What activities pose the greatest threat?*
- *Are there any activities that are not presently controlled?*
- *Can the way we control activities be improved?*

The purpose of this report is investigate the answers to these questions and to determine if administrative controls are an effective way to ensure that human activities do not disturb and re-suspend the deeper contaminated sediments.

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1. Introduction

In this section you will find the:

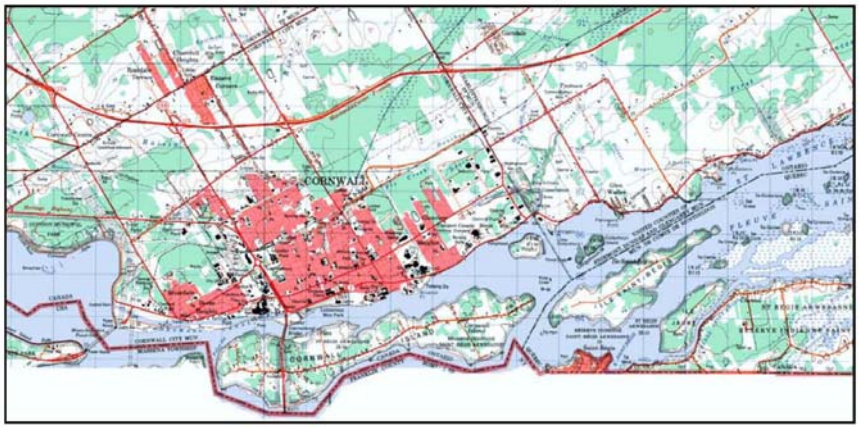
Purpose of the Report
Scope of the Study, and
A Description of Administrative Controls

The purpose of this report is to assess the effectiveness of using administrative controls to prohibit and/or regulate the disturbance of contaminated sediments in 3 zones in the St. Lawrence River near the City of Cornwall. The report is based on the findings of a workshop held with interested agencies and other groups (see Appendix 1 for list of participants), and a detailed analysis of the current administrative controls. The intent of the report is to identify the types of activities that occur along the shoreline or in the water that could disturb sediments and assess the ability of current control mechanisms to regulate these potentially harmful actions.

1.1 Overview

Over the course of more than 70 years of industrial activity along the Cornwall waterfront, contaminants such as mercury, zinc, copper and lead were discharged into the St. Lawrence River and accumulated in sediment along the waterfront. In 1985 the Cornwall-Massena section of the St. Lawrence River was designated a Great Lakes-St. Lawrence Area of Concern (AOC) by the International Joint Commission.

Map 1 – General Location of Study Area



Remedial Action Plans (RAPs) were developed for this Area of Concern for both the Canadian and U.S. sides of the border. The recommendations of the St. Lawrence River RAP were documented in the Stage 2 Report, released in 1997, including the following two recommendations dealing specifically with contaminated sediments:

> *Recommendation 16 – In areas where contaminant levels in sediment are below the severe effect level but above the lowest effect level, implement source control measures to*

prevent further contamination of sediment and allow remediation of contaminated sediment to occur by means of burial by the natural sedimentation process.

Recommendation 17 – In areas where contaminant levels in sediment exceed the severe effect level for mercury, PCBs or other persistent toxic contaminants or where the sediment is found to be acutely toxic (i.e. the "hot spots"), prevent further contamination by implementing source control measures and remediate sediment by the most appropriate state-of-the-art technology (e.g., dredging, capping, in situ treatment).

Environment Canada and MOE have made commitments to develop a sediment management strategy for the Cornwall waterfront. The strategy will consist of a series of steps to evaluate, select and implement the most appropriate actions for sediment management, congruent with Recommendations 16 and 17. Evaluation will include acquisition and review of historical and new chemical and physical data.

The Cornwall Sediment Strategy is a joint project of Environment Canada (EC) and the Ontario Ministry of the Environment (MOE). Both ministries have been working together on the development of a strategy for managing contaminated sediment in the AOC since the release of the Stage 2 Report.

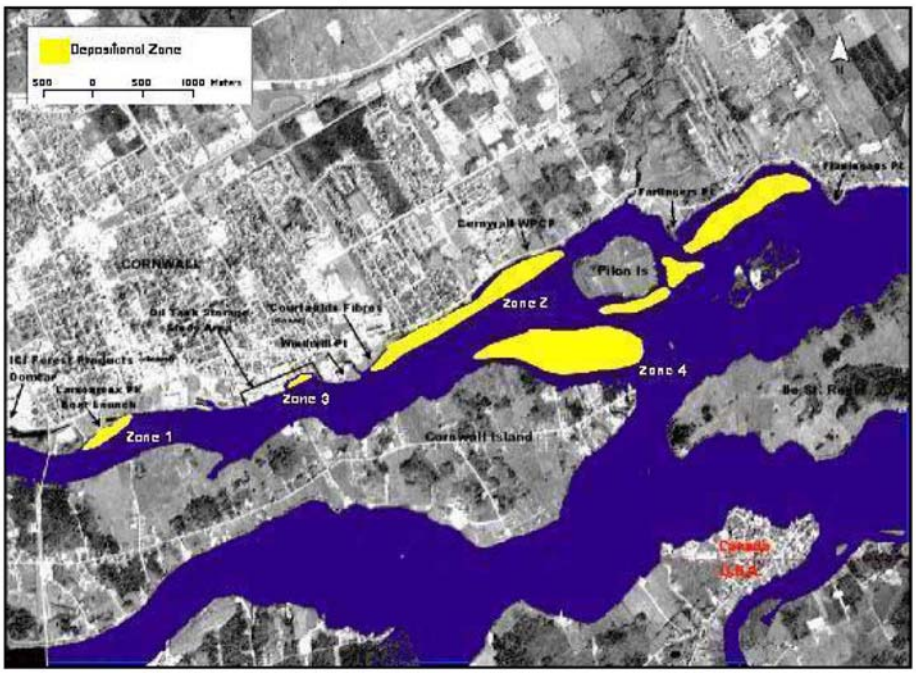
To develop the Cornwall Sediment Strategy and to address the RAP recommendations regarding contaminated sediment located in the zones along the Cornwall waterfront (Map 2), Environment Canada and the Ontario Ministry of Environment are consulting with a number of groups in Cornwall and downstream areas. The consultation process was initiated in June 2000 and includes representation from the municipality, local industry, environmental groups, the Mohawks of Akwesasne, and the public. Downstream and cross border interests, such as the Valleyfield ZIP committee, United States Environmental Protection Agency and the St Regis Mohawk First Nation, are also included in this process.

Early in the process it was decided by consensus that a smaller Working Group should be formed to address specific technical questions. This group was also tasked with working with MOE and EC to develop recommendations for a sediment strategy that would be reviewed by the entire stakeholder group. The Working Group includes representation from: the St. Lawrence River Institute of Environmental Sciences, St. Lawrence River Restoration Council (SLRRC), Cornwall District Environment Committee, the City of Cornwall, Domtar, ICI, Akzo Nobel as well as scientific experts that were contracted by the industries and SLRRC, and scientists and staff from Environment Canada and the Ministry of the Environment.

The Working Group identified and filled data gaps, reached a consensus on scientific conclusions and developed a recommended sediment management direction. Essentially the Working Group reached the following conclusions:

- Cornwall waterfront sediments are contaminated but not toxic. Lead copper, zinc and mercury are present at levels above sediment quality guideline values, but toxicity testing and biological studies on the surface sediments (to a depth of 10 cm) do not demonstrate that the deposits are toxic.

Map 2 – Location of Sediment Zones



- The deeper sediment in each of Zones 1, 2 and 3 is more contaminated than the surface sediment. No toxicity testing has been performed on the deeper material and therefore, the significance of this contamination is unclear.

- There is evidence of methyl-mercury bio-magnification from sediment dwelling organisms to fish. However, the studies did not demonstrate a strong link between sediment methyl-mercury and methyl-mercury in sediment dwelling organisms. This indicates that the sediments are likely not a major source of mercury to the sediment dwelling organisms.

- Comparison of actual methyl-mercury in Cornwall waterfront fish is similar to areas not impacted by historical discharges.

- Based on the findings, the Working Group concluded that there is a low concern for the bio-magnification of methyl-mercury from the sediment to organisms that dwell in the sediments.

- The assessment of sediment stability shows that these deposits are very stable.

Based on these scientific conclusions the Working Group drafted the following recommended sediment management direction for consideration by the larger Stakeholder Committee:

- The sediments in Zones 1, 2 and 3 be left in place and allow natural recovery (i.e. burial by natural processes) to take place thereby isolating the deeper contaminants from the environment.

- Administrative controls should be put in place to prevent human disturbance of the surface sediment that may result in exposure of the deeper, more contaminated material.

- Regular, ongoing monitoring of conditions in Zones 1, 2 and 3 should be undertaken to ensure recovery is taking place.

- Zone 4 sediments are no different than upstream un-impacted sediment and therefore no further management consideration is warranted in this area.

The scientific conclusions and recommended sediment management direction was presented to the larger Stakeholder Committee in June 2003. At this meeting much discussion and debate occurred and concerns were raised regarding the short-term and long-term effectiveness and feasibility of Administrative Controls in protecting the contaminated sediment from being disturbed. As a result EC and MOE committed to conduct a comprehensive evaluation of Administrative Controls in order to allow fuller discussion on the appropriate management strategy for the Cornwall waterfront.

1.2 Administrative Controls

Administrative Controls are the planning approval and permit control mechanisms that municipal, provincial, federal levels of government and the Mohawk Council of Akwesasne can apply to regulate development activities. Within the context of the Cornwall Sediment Strategy, the intent of these administrative controls is to prevent the exposure of deeper more contaminated sediment which may impact on the natural environment and to ensure that proper mitigation measures are considered when activities within the contaminated areas cannot be avoided.

The types of Administrative Controls considered in this assessment include environmental reviews under the *Canadian Environmental Assessment Act, Ontario Environmental Assessment, and the Mohawk Akwesasne Environmental Assessment*; planning review processes under the municipal *Planning Act*; and the permit approval processes under the federal *Fisheries Act*, the provincial *Public Lands Act*, the *Fill and Alteration Guidelines* of Conservation Authorities, and municipal zoning approvals under the *Planning Act* and building permits under the *Ontario Building Code Act*.

1.3 Scope of the Study

The geographical focus of this evaluation is limited to 3 zones of contaminated sediment deposits along the Cornwall waterfront (see Map 2). The area adjacent to the northeast shore of Cornwall Island, Zone 4, was determined to be of similar quality to upstream, un-impacted sites by the scientific Working Group and therefore does not warrant further consideration for sediment management. For this reason Zone 4 is not included in the geographical scope of this exercise. Map 2 provides a visual depiction of the geographical extent of the areas referred to as Zones 1, 2 and 3.

These 3 zones are located in or adjacent to the following areas along the Cornwall waterfront:

- Zone 1 – Lamoureux Park boat launch area
- Zone 2 – Windmill Point to Pilon Island, adjacent to the north shore
- Zone 3 – Embayment immediately upstream of Windmill Point near the oil tank storage area

The study area is a complicated area for analysis for the following reasons; the beds of the St. Lawrence River are Crown lands and are administered by the Ministry of Natural Resources; a wide range of agencies and jurisdictions are involved; this is an intensive recreational use area; past and current industrial use; and it's location in relation to the downtown core of the City of Cornwall. All levels of government are actively involved and interested in this area including Federal, Provincial, Municipal and First Nation and this includes the wide range of agencies and departments that represent these governments, including the Raisin Region Conservation Authority.

The study area is intensely used for recreational land and water based activities. The St. Lawrence River provides opportunities including boating, fishing, swimming and diving. Cornwall is a destination port for recreational boaters. As well there are numerous public parks, boat launches, a bike/walking path and water access locations provided along the shoreline.

Industries have historically located in Cornwall due to the close proximity of shipping facilities along the St. Lawrence Seaway and the abundance of fresh water needed for industrial purposes. It is also

anticipated that the redevelopment of these sites will occur for both industrial and non-industrial uses.

Due to the close proximity of the shoreline to the downtown core of Cornwall it is expected that the pressure to redevelop the city core will increase. These projects could include the canal revitalization, waterfront parks, and high-density residential developments.

1.4 Analysis Process

A workshop involving the agencies and stakeholders was held on Oct 6, 2003 at Cornwall's Civic Centre. The workshop provided a venue to share information on the current approaches to controlling human activities that could disturb sediments in zones 1, 2 and 3. Discussion at the workshop focused on the following questions:

- What are the activities that could potentially impact the sediments?
- What administrative controls exist and who has the authority?
- Are current administrative controls effective? Are there any gaps?
- Are there any overlapping jurisdictions and what are the linkages?
- What other solutions or controls are there?
- Can we improve our ability to administer controls?

The objective of the workshop was to gain a better understanding of the current administrative mechanisms. The discussion focused on "improving the use of controls to effectively regulate human activities that could result in a negative impact on the environment". Following the workshop an analysis of the information was completed and additional information on agency roles and responsibilities was received and discussed with a number of the participants. Appendix 1 provides a list of the people and agencies that participated at the workshop and in the review of this strategy.

2. Analysis of Activities

In this section you will find a description of:

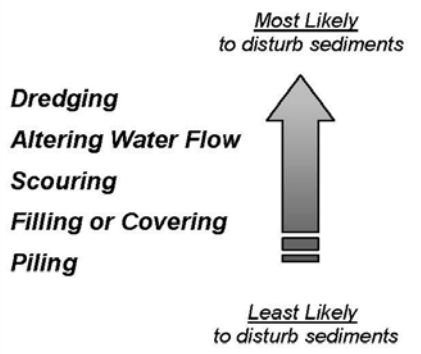
Generic Actions
Activities and Proponents, and
A Risk Assessment of Activities

2.1 Actions that Disturb Sediments

The re-suspension of sediments can result from development activities or from natural and other social causes that occur on land or in the water. A specific development activity may result in a combination of a number of independent actions and Figure 1 identifies 5 general actions that are common to many of the development and recreational activities that disturb sediments. For example the activity of building a new industrial pier could include all 5 actions (i.e. dredging, altering water flow, scouring, filling and piling), while the construction of a single residential dock may only involve piling.

Each action has a varying potential to re-suspend contaminated sediments. Activities that occur on land are less likely to disrupt sediments than activities that occur in the water. The duration, location and extent of the action will also affect the likelihood of disturbance of sediments. Based upon qualitative and best professional judgment it is generally assumed that the physical removal of sediments, such as dredging, has the greatest potential to disturb sediments.

Figure 1 – Degree or Scale of Disturbance from Human Actions



Dredging (excavation) – means the physical alteration of the river bed by the removal of mud, sand and other sediments from the bottom of the river. The purpose of such actions may be to clean out, deepen a channel or clearing an area with a dredge for the placement of a foundation or a pipeline. Without implementing proper mitigation measures dredging may significantly increase the risk of uncovering or re-suspending contaminated sediments.

Altering Water flow – means the alteration of the natural flow of water by adding an obstruction, dredging a channel, installing an inlet or outflow for water or effluent, or the increased movement of commercial ships and recreational boating. This action could significantly increase the disturbance of sediments, depending on the location, extent and duration of the activity.

Scouring (incidental disturbance) – means the moving or scraping of the top layer of the riverbed by dragging an object across the sediment surface. This action moderately increases the potential to re-suspend contaminated sediments depending on the depth of the trough that is created.

Filling (covering)– means the physical alteration of the riverbed by covering the bottom with soil, sediment, concrete, cribs or any other material. This action by itself may result in a minimal and incidental re-suspension of sediments from placing fill on the top of the riverbed. This action will make it more difficult to remove contaminated sediments once completed.

Piling (vibration) – means the driving of a beam or post into the riverbed, the purpose of which is to attach something to the top of the beam, such as a dock. The beam is often referred to as the pile. This action only slightly increases the risk of disturbing sediments through the vibration or movement of the pile into the substrate.

A brainstorming session at the October 6th, 2003 workshop resulted in the following list of unforeseen events that could also potentially disturb sediments:

- Global warming
- Terrorist acts
- Change in political support for controls
- Natural catastrophes (earthquakes)
- Dam failure
- New species introduction or fish and wildlife movement that could alter the aquatic environment through unusual habits and feeding techniques.

There are no specific controls on these types of activities, and if necessary and appropriate, mitigation measures may be required following any one of these events. While extensive studies on sediment stability of the areas of contaminated material have concluded that these deposits are very stable under natural conditions, the impact of global warming and subsequent changes in flow conditions on the stability of these deposits has not been assessed.

2.2 Description of Activities

Activities have been categorized into five groups: Public Works and Utilities, Private Development, Boating and Shipping, Recreational Activity and Other. Any one of these activities may involve a combination of the 5 general actions described in Section 2.1.

Public Works and Utilities – Development activities conducted by public works or utilities are usually done in conjunction with federal, provincial and municipal approvals and are subject to an Environmental Assessment Process (*CEAA*, *Ontario EA Act*). These activities usually involve the provision of a public service such as a bridge, highway, bell telephone or gas pipeline that result in a benefit to the general public. Public works and utility related activities often occur within the river and on adjacent shorelands.

Private Construction and Development - This type of activity usually involves a private company or interest that is constructing infrastructure for profit and gain. These types of developments can include the construction of private buildings and structures and often involves all five types of actions (i.e. dredging, scouring, altering water flow, filling and piling). These activities may occur in both the water and on the adjacent shorelands and can be major (e.g. residential subdivisions or complexes) or minor in nature (e.g. residential docks). Development on land can also cause off site impacts through an

increase in storm water runoff, but it is usually the construction of infrastructure in the water such as docks, outflow pipes, and retaining walls that will have the greatest potential to disturb contaminated sediments.

Commercial Shipping and Recreational Boating – This activity includes both commercial shipping and recreational boating, however commercial shipping is less likely to occur as the main shipping channel is located on the south side of Cornwall Island and Cornwall is not a major shipping port. Recreational boating is currently very active in this area and the potential exists to increase this activity due to the construction of recreational locks and canal, and new residential waterfront development. Potential impacts from ships and boats include propeller wash, mooring points, anchoring, change in navigational channels and shipping lanes, and increasing the depth of channels to improve navigation.

Recreational Activities – Recreational activities include swimming, fishing and scuba diving and their impact to contaminated sediments is likely very minimal. These activities are very difficult to regulate, as they require enforcement and the provision of staff resources to administer. Education may be a successful measure if recreational activities are determined to be a problem.

Other – There are other incidental activities that could also potentially disrupt contaminated sediments, including; habitat improvement, aquatic weed harvest, snow dumping (municipal and private) and aquaculture.

2.3 Proponents of Activities

There are basically two categories of proponents of development and recreational activities: private and public. Figure 2 provides a list of the potential proponents of activities (including pubic agencies that provide funding for projects) that could disturb contaminated sediments.

Figure 2 – List of Potential Proponents of Activities

Private	Public Agencies and Utilities
Industrial	Akwesasne
Shipping Industry	Federal Public Works
Private Property Owners	Transport Canada
Shoreline Residential	St. Lawrence River Seaway Authority
Developers	Raisin Region CA
Recreationalists	City of Cornwall
Business Improvement Area	Industry Canada
Commercial operators	St. Lawrence Parks Commission
	Provincial Public Works
	Pipelines/Utilities
	Ontario Power Generation
	Seaway Bridge Authority

2.4 Assessing the Risk of Activities

Due to the varying complexity of each development scenario (i.e. timing, location, duration and scope of work) and combination of actions that could be required such as dredging, altering water flow, scouring, filling or piling, it is very difficult to predetermine the exact risk associated with any specific development or recreational activity. However, it is possible to provide a general assessment of whether some activities result in a higher risk than others of disturbing contaminated sediments. The following is a simple quantitative analysis of the risk of disturbing sediments associated with activities. The intent of the analysis is to determine whether certain activities pose a high, medium or low risk of disturbance. This analysis is based on the following assumptions:

- Risk is significantly increased when dredging occurs.
- Risk is significantly increased when more than one action occurs.
- Risk is moderate if one or more of the following actions occur: covering, piling or scouring.
- Risk is minimal if only one of the following actions occur: covering, scouring or piling.

Figure 3 – Assessing Risk of Activities

Activities	Potential Actions					
	Dredging	Water flow	Scouring	Filling	Piling	*Rating*
1. Public Works and Utilities						
Water Diversions	●	●	●	●	●	*5.0*
Bridges and Tunnels	●	◐	●	●	●	*4.5*
Micro Hydro Power	●	●	◐	●	●	*4.0*
New Canal	●	●	◐	●	◐	*4.0*
Underwater Cable and Pipelines	◐	○	●	●	○	*2.5*
Docks – crib or sheet piling	○	◐	○	◐	◐	*1.5*
Docks – post or pile	○	○	○	○	◐	*0.5*
Docks – Floating	○	○	○	◐	○	*0.5*
2. Private Development						
Shoreline alteration	●	●	○	●	●	*4.0*
Marina Development	●	◐	○	●	●	*3.5*
Sewage/Stormwater Outflow	●	●	◐	●	○	*3.5*
Construct beaches (public/private)	○	○	◐	●	●	*2.5*
Water Taking (municipal & industrial)	●	●	○	◐	○	*2.5*
Diversions (divert water from river)	●	●	○	○	○	*2.0*
Filling lands under water	○	◐	○	●	○	*1.5*
Retaining Walls	◐	○	○	◐	◐	*1.5*
Docks – crib and sheet piling	○	◐	○	◐	◐	*1.5*
Docks – post or pile (not sheet piling)	○	○	○	○	◐	*0.5*
Docks – Floating	○	○	○	◐	○	*0.5*
3. Boating and Shipping						
Increasing depth of boating channels	●	●	●	○	○	*3.0*
Change in boating/shipping channels	●	◐	◐	○	○	*2.0*
Mooring Points	○	○	◐	◐	○	*1.0*
Anchoring	○	○	◐	○	○	*0.5*
Propeller wash	○	○	◐	○	○	*0.5*
4. Recreation Activities						
Fishing	○	○	◐	○	○	*0.5*
Swimming and Scuba Diving	○	○	◐	○	○	*0.5*
5. Other						
Removing the sediments	●	◐	●	◐	○	*3.0*
Habitat Creation Project	◐	○	◐	◐	○	*1.5*
Aquatic weed harvest or removal	○	○	○	◐	○	*0.5*
Snow dumping	○	◐	○	○	○	*0.5*

● Likely involved – Maximum Impact ◐ Possibly involved – Medium Impact ○ Not involved – No Impact

While it can be assumed that the actual risk of disturbing sediments is increased depending on the location (in or adjacent to the contaminated zone) and the duration of the activity, this has not been taken into account for these general activities.

Figure 3 provides a complete list of the activities that could potentially occur along the Cornwall waterfront as generated through the October 2003 workshop. An assessment of each activity was completed to determine whether one or more of the actions (dredging, altering water flow, scouring, covering, or piling) were involved. For comparison purposes, a simple weighted rating was assessed to each activity as follows: likely involved (1.0), possibly involved (0.5), and not involved (0.0). The last column in Figure 3 provides the total rating of the activity based on the number of actions that could result from any one activity.

Figure 4, Summary of Activities and Risk Disturbance, categorizes the activities into three groups, high risk, moderate risk and low risk. Activities in the "high risk" category include major development projects that involve dredging and at least one other action (weighted rating of 2.5 to 5.0). Activities with "moderate risk" are generally minor development projects that do not involve dredging but includes at least 3 types of actions such as altered water flow, scouring, covering and filling (1.0 to 2.0). "Low Risk" activities do not involve dredging and involves 1 or 2 actions that are less likely to disturb sediments such as filling or piling (weighted rating of 0.5 or less).

Figure 4 – Summary of Activities and Risk of Disturbance

	Low Risk (Rating < 0.5)	Moderate Risk (Rating 1.0 – 2.0)	High Risk (Rating 2.5 – 5.0)
Public Works and Utilities	Docks Post, Pile or Floating	Crib Docks	Water Diversions Bridges and Tunnels Micro Hydro Power New Canal Underwater Cable or Pipeline
Private Development	Docks Post, Pile or Floating	Filling Lands Under Water Retaining Walls Crib Docks	Marina Development Shoreline Alteration Beach Construction Sewage and Stormwater Outflow Water Diversions Water Taking
Boating and Shipping	Anchoring Mooring Points Propeller Wash	Change in Boating and Shipping channels	Increasing Depth of Boating Channels
Recreational Activities	Fishing Swimming and Scuba Diving	-	-
Other	Snow Dumping	Habitat Creation Project Aquatic Weed Harvest	Removing the Sediments

3. Agencies and Administrative Controls

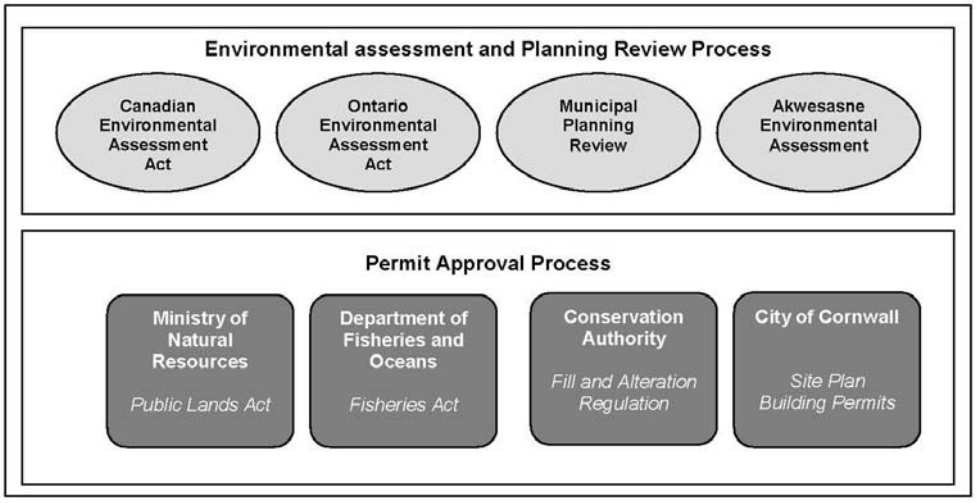
In this section you will find a summary of:

Types of Administrative Controls
Agencies Roles / Responsibilities
Description of Administrative Controls

There are two types of Administrative Controls: the Environmental Assessment or Municipal Planning Process, and the Permit Approval Process (Figure 5). The Environmental Assessment and Planning Review Process is a comprehensive planning process involving a wide range of agencies and is used to assess and mitigate potential impacts of federal or provincial government projects, or large private land developments that require an Official Plan or Zoning By-law Amendment. Permit Approval Processes (e.g. work and building permits) involve a less comprehensive review and approval process, and usually involves only one agency and has a limited scope of review.

There are four types of Environmental Assessment and Planning Reviews; the assessment process under the *Canadian Environmental Assessment Act* administered by the Canadian Environmental Assessment Agency; the Ontario Environmental Assessment process administered by the Ministry of Environment; the Akwesasne Environmental Assessment process administered by the Mohawks of Akwesasne; and the Municipal Planning Review process administered by the City of Cornwall. This planning process can impose the requirement for the preparation and assessment of a wide range of environmental impacts before final approval is granted.

Figure 5 – Agencies and Administrative Controls



There are four types of Permit Approvals that may also be required; a Work Permit, subject to the *Public Lands Act*, administered by the Ministry of Natural Resources; an Authorization for Compensation, subject to the *Fisheries Act*, administered by the Department of Fisheries and Oceans: a Fill and Alteration Permit, subject to *The Fill and Alteration Regulation*, administered by the Raisin Region Conservation Authority; and a Site Plan (*Planning Act*) or Building Permit (*Ontario Building Code Act*) administered by the City of Cornwall. The Permit Approval Process applies to most shoreline and in-water development whether or not an Environmental Assessment or Planning Review Process is required.

A fifth permit process that must be addressed, but is not common, is for in-water works potentially impacting on water levels and flows under the *International Boundary Waters Treaty Act*. The Department of Foreign Affairs and International Trade administers this Act, with assistance from Environment Canada.

3.1 Planning and Assessment Review Processes

3.1.1 Canadian Environmental Assessment Act - Federal Authorities

The *Canadian Environmental Assessment Act* (*CEAA*) is the federal legislation that requires an Environmental Assessment (EA) to be undertaken whenever a federal authority has a specified decision-making responsibility in relation to a project, which is also known as a "trigger" for an Environmental Assessment. The term federal authority refers to a federal body (e.g., a department or agency) that may have expertise or a mandate relevant to a proposed project. Ministers, departments, departmental corporations and agencies of the Government of Canada are federal authorities. Other bodies created by statute and accountable through a minister to Parliament can also be prescribed as a federal authority (e.g. port authority).

A review under the *CEAA* is triggered whenever a federal authority:

- Proposes a project,
- Provides financial assistance to a proponent to enable a project to be carried out,
- Sells, leases, or otherwise transfers control or administration of federal land to enable a project to be carried out, or;
- Provides a license, permit or an approval that is listed in the *Law List Regulations* that enables a project to be carried out.

The *CEAA* review process is a self-assessment of projects for environmental effects. Screenings, class screenings and comprehensive studies are the types of self-assessment processes available. A determination of significance must be made by the Responsible Authority (RA) or Minister of the Environment (in the case of a comprehensive study) for any project that follows one of these EA tracks.

Under a screening, a responsible authority has the greatest degree of management and flexibility over the scope and pace of the EA process. In cases where there is sound knowledge of the environmental effects and appropriate mitigation measures for a group or class of projects, the responsible authority may be able to use all or part of a class screening report. The majority of projects covered by the *CEAA* will undergo an environmental assessment through a screening.

Under a comprehensive study, the responsible authority also retains a primary management role over the EA, but has more obligations than in a screening. These include the need to consider a wider range of factors, submit the comprehensive study report to the Agency for review, take public comments into account for screenings, conduct mandatory public consultation at certain stages of the comprehensive study process and consider the need for a follow-up program. In the case of a comprehensive study the RA shall design a follow-up program and ensure its implementation.

If a screening identifies the need for further assessment, the project must move to a public review in the form of either a mediation or panel review. A mediation or panel review is to be used in certain circumstances where a project may cause significant adverse environmental effects or where public concerns are apparent.

Projects that fall within the Comprehensive Study List Regulations will have to go through an early track decision process. In these cases the public is to be consulted on the project scope and scope of assessment. The RA must report to the Minister of the Environment on the scope of the project, the factors to be considered, the results of public consultation and the ability of the comprehensive study to address issues relating to the project. The Minister will then make a determination on whether the project will go through a Comprehensive Study Process or be referred to a Mediator or Review Panel. Once a track decision is made the project cannot later be referred to another process.

The major outcome of an environmental assessment is to determine whether or not a project is likely to cause a significant adverse environmental effect. The significance of the environmental effect is determined by a combination of scientific data, regulated thresholds, standards, social values and professional judgment. It must be determined in a transparent, systematic and supportable fashion.

Environment Canada's Role as a Federal Authority

Environment Canada (EC) is a federal agency whose mandate under the Department of the Environment Act deals with:

- Preservation and enhancement of the quality of the natural environment,
- Renewable resources (including water, migratory birds and other non-domestic flora and fauna),
- Meteorology,
- Enforcement regulation arising from the advice of the Canada-U. S. International Joint Commission, and the
- Coordination of federal environmental policies and programs.

Environment Canada would only be aware of projects subject to provincial or federal EA requirements when advised of them by proponents or responsible authorities under the Canadian Act (*CEAA*). When advised, EC provides comments and recommendations on provincial and federal environmental assessments.

EC's role as a Federal Authority providing expert advice or knowledge

Environment Canada's review of environmental assessments focuses on potential adverse environmental effects of projects in its areas of interest, which include (see Appendix 2 for more info on legislation):

a) Migratory Birds - *Migratory Birds Convention Act* and the *Migratory Birds Regulations*;
b) Species at Risk - *Species At Risk Act*, *Canada Wildlife Act*, and, National Accord for the Protection of Species at Risk;
c) Terrestrial and Aquatic/Wetlands Habitat and Biodiversity - Federal Policy on Wetland Conservation, Canadian Biodiversity Strategy; A Wildlife Policy for Canada; *Migratory Birds Convention Act* and the *Migratory Birds Regulations*:
d) Water Quality - Sub-section 36(3) of the *Fisheries Act*, *Canada Water Act*, and, Federal Water Policy;
e) Air Quality and Toxic Substances - *Canadian Environmental Protection Act*, federal Toxic Substances Management Policy, Strategy for Action on Pollution Prevention.
f) Transboundary Water Management – *International Boundary Waters Treaty Act*.

EC would generally advocate avoidance of inappropriate project locations or activities causing substantial adverse effects, including cumulative environmental effects, where this is feasible.

EC's comments on project environmental assessments are generally advisory and advocative in nature. If EC's review identifies that severe environmental effects are likely to occur, its advice could influence the project design or the Responsible Authority's EA decision under *CEAA*, or approval of a provincial EA under the EAA. In providing its EA review advice, EC's primary objective is to minimize the significance of adverse environmental effects due to project implementation by promoting sound planning, credible data collection, EA practices, and compliance with its legislation and regulations

Appendix 2 provides a list of the federal legislation and policies that may be applicable to near shore and in-water federal projects having the potential to disturb contaminated sediments. In regard to the 3 zones of contaminated sediment for the Cornwall AOC, this legislation and associated regulations would provide specific reactionary outcomes associated with the disturbance of contaminated sediments. However, they could not be used in a practical way to pro-actively regulate activities or works potentially causing disturbance of contaminated sediments.

EC's role as a responsible federal authority under *CEAA*

If EC is the project proponent, or provides funding to allow a project to proceed, it would have a strong interest in promoting the best possible environmental practices in the area and have substantially more control over the project implementation, given that it would likely be the lead responsible authority under *CEAA* making a screening decision. EC would also solicit expert advice internally and from other departments as input to its *CEAA* screening or comprehensive study. EC would therefore have the ability, or a substantially increased ability, to influence the project location and implementation methodology. EC would likely require that appropriate project design

modifications be made to avoid sediment impacts, and would ensure that any mitigation identified in the *CEAA* screening are fully implemented.

Strengths and Weaknesses of the CEAA process:

- *Only applies a self-assessment of projects of federal authorities or to private projects if Federal money is involved.*
- *The review under CEAA is a comprehensive process to consider all related activities and their impacts and can impose mitigation measures.*
- *CEAA can apply to capping, removal and cleaning sediments.*
- *The teeth in application of CEAA are in other legislation (e.g. Fisheries Act). CEAA only requires that an EA screening decision be made by a RA and this may not ensure all mitigation measures recommended in the EA are implemented.*
- *Environment Canada would only be aware of projects subject to provincial or federal EA requirements, when advised of them by proponents or responsible authorities under the Canadian Environmental Assessment Act (CEAA).*

3.1.2 Ontario Environmental Assessment Act - Ministry of Environment

The Ontario *Environmental Assessment Act* (EAA) provides for the protection, conservation and wise management of the environment in Ontario by establishing a responsible and accountable process to make decisions. The EAA provides the legislative basis for the preparation, submission and review of various types of EA documents. Each of these documents is subject to public, government and agency review before the Minister makes a decision on the project. The Act defines "environment" to include all air, land, water, plant and animal life including humans; social, cultural and economic conditions; anything made by humans; or any solid, liquid, gas, odour, heat, sound vibration or radiation caused by human activities.

The Ministry of the Environment (MOE) has two separate and distinct roles in the assessment process:

(i) Administering the EAA and ensuring that the proponent meets the requirements of the Act. This includes writing the Government Review based on comments from ministries, agencies, and making it available for public comment leading to a Minister's decision.

(ii) Reviewing EA documents to ensure that proponents have adequately considered the Ministry's mandate based on the *Environmental Protection Act* (EPA), *the Ontario Water Resources Act* (OWRA), and the *Pesticides Act*; regulations under those Acts; technical procedures and guidelines; and policy and program areas including the Provincial Policy Statement issued under the *Planning Act*.

The *Environmental Assessment Act* (EAA) applies to projects being carried out by the Province, municipalities, or public bodies. Specific private sector projects may be designated by regulation passed under the Act. The EAA requires that the proponent of an undertaking subject to the Act

must submit an Environmental Assessment (EA) document to the Minister of Environment. The Minister of the Environment may, with the Lieutenant Governor in Council, make private sector activities or proposals, which are not already subject to the EAA, subject to the EAA by regulation. Anyone may make a request to the Minister that a specific project be made subject to the EAA. Ministry staff review Designation Requests and recommend whether or not Designation is warranted. If a project is designated, Cabinet must approve a Designation Regulation through an Order-in-Council, which is published in the Ontario Gazette.

The EAA prohibits the approval of a license, permit or consent required under any statute, regulation or by-law of the Province of Ontario, municipality or regulatory authority until the Environmental Assessment has been accepted and the undertaking has been approved under the EAA.

Class EA Projects

Some undertakings, which are repetitive in nature with minor or mitigable, well-known environmental effects, are approved under the EAA without the need for Individuals EAs. This is done through the development of an approved Class EA Parent Document, which is an approved planning document that defines a group of projects and establishes a process that a proponent must follow in carrying out individual projects.

Class EA Parent documents are formally submitted to the Minister for review and approval under the EAA. The review and approval process is the same as in the case of Individual EAs. Once a Parent document is approved, proponents follow the planning process outlined in the Class EA to obtain approval for each project that is subject to the Class EA.

If a project is one that is included in a Class EA Document, the proponent must follow the requirements in that document with respect to the project planning and public consultation. The proponent of a project is responsible for fulfilling the Class EA requirements outlined in the Class EA Parent Document prior to implementing their project. All projects of the type included in the class are pre-approved under the EAA, provided the proponent first verifies that the proposed undertaking is covered under the approval of the Parent Class EA document and has completed the required Class EA Process.

The Ministry of Natural Resources has in place "A Class Environmental Assessment for MNR Resource Stewardship and Facility Development Projects". Consideration of this class assessment is triggered when a disposition of right to a crown resource is required under the *Public Lands Act* or the *Lakes and Rivers Improvement Act.* MNR would review the requirements of the *Class EA for MNR Resource Stewardship and Facility Development Projects* and through this assessment, MNR would screen the project and determine the potential for environmental impacts and identify, whether further assessment, study or approval would be required. The screening would determine which category of review would be required

Category A – Low negative effect - Issue Approval
Category B – Low to medium negative effect – Notify Public
Category C – Medium to high negative effect- Require an Environmental Study Report
Category D – High negative effect - Require an individual EA

If a Canadian Environmental Assessment is necessary, its requirements would be harmonized with the Ontario Environmental Assessment.

Strengths and Weaknesses of Environmental Assessment Act

- *Requires a comprehensive analysis of environmental impacts including the re-suspension of contaminated sediments.*
- *Only applies to public agencies (e.g. provincial agencies and municipalities).*
- *Private sector activities may be made subject to the EA process provided a Designation Request is recommended by staff, and approved by Cabinet.*

3.1.3 Akwesasne Environmental Assessment – Mohawks of Akwesasne

The Mohawk Council of Akwesasne administers the Akwesasne Environmental Assessment Process. This Environmental Assessment process requires proponents of development within the Akwesasne First Nation Reserve to conduct a detailed assessment of the impacts of their activities on the natural environment and upon the community of Akwesasne. The Akwesasne Environment Department has indicated their willingness to use this process for any gaps created through other legislation.

Strengths and Weaknesses of Akwesasne Environmental Assessment

- *Akwesasne Environmental Assessment may be used to fill the gaps caused by other legislation and permitting approval processes.*
- *The perception of the non-native community being controlled by First Nations.*
- *The application of this process could be legally challenged.*

3.1.4 Municipal Plan Review Process – City of Cornwall

Municipalities play a very important role in ensuring that contaminated sediments are not disturbed under the authority of the *Planning Act* and the Provincial Policy Statement. Municipalities are the primary agency involved in local land use planning and development decisions that occur on private land.

Within all municipalities throughout Ontario, there is a hierarchy of land use policy and regulation tools. Official Plans provide the general land use policy that describes how land will be used and Zoning By-laws provide a means to regulate the use and location of buildings and structures on the land. Zoning By-laws implement official plan policy pursuant to the requirements of the *Planning Act* by identifying permitted uses, and regulating the height, size and location of buildings and structures. Other tools such as site plan control and building permits provide a means to ensure that the standards that are established in the Official Plan and Zoning By-law are adhered to.

Official Plans can contain specific policy that imposes conditions of development such as an Environmental Impact Study, Stormwater Management Plan, and Construction Mitigation Plans.

Therefore it is important that the Cornwall Official Plan provides specific direction for the mitigation of impacts for development that occurs in or adjacent to the 3 contaminated zones.

When a proposed development does not conform to the current policies of the Official Plan or Zoning By-law, the proponent must make an application to amend the applicable document. The provisions of the *Planning Act* require notification to be given to landowners within 120 m (400 ft) of the subject lands and to the Ministry of Municipal Affairs and Housing for comment from any of the affected agencies. The amendment process provides the municipality with an opportunity to identify and address the environmental impacts associated with the development.

The *Planning Act* also provides the power of subdivision control to the City of Cornwall. Applications to create new lots, either through a plan of subdivision or a consent application, are required to conform to specific matters to be regarded under the *Planning Act*, as well as the policies of the Official Plan. These applications are circulated to affected agencies in order to obtain comments related to the mandate of those agencies. Conditions can be applied requiring Environmental Impact Studies, Stormwater Management Plan, Construction Mitigation Plans, among other matters.

Strengths and Weaknesses of the Municipal Planning Process

- *Municipal Policy and Planning Review Process does not normally apply to government agencies, public authorities or utilities.*
- *Official Plan and Zoning By-law only applies to shorelands and does not normally apply to lands under water.*
- *The City of Cornwall's Official Plan does not contain specific policy regarding the imposition of mitigation measures for development in or adjacent to the 3 contaminated zones.*
- *Provincial Agencies provide minimal support in review of development proposals.*
- *Only applies to development on private land.*
- *Official Plan does not regulate development; it only provides future direction. Development must be regulated through the zoning by-law.*
- *Zoning By-laws cannot regulate the alteration of lands (i.e. filling, covering, dredging). Zoning By-laws only control the use and location of buildings and structures.*

3.2 Permit Approval Process

3.2.1 Work Permits - Ministry of Natural Resources

The Ontario Ministry of Natural Resources (OMNR) is the lead agency for fisheries management and the management of Crown land in Ontario. The Ministry's roles and responsibilities, with respect to the contaminated sediment zones, are directly linked to many Provincial Acts including:

Lakes and Rivers Improvement Act (LRIA) – The purpose of this act is to provide for the use of water and to regulate improvements on crown, municipal and private lands that forwards, holds back or diverts water. *Ontario Regulation 454/96* requires the approval of a work permit for:

- Construction or improvements of dams,
- Private water crossings draining an area> 5 sq km,

- Enclosing or covering a length of river or stream > 20 m, or
- Installation of a cable or pipeline if it results in damming, forwarding or diverting water.

No approval is required under the LRIA for water crossings when the Public Lands Act applies. According to *Ontario Regulation 454/96*, "water crossings" includes a bridge, culvert or causeway that is constructed to provide access between two places separated by water and holds back, forwards or diverts water.

Public Lands Act (PLA) – The management, sale and disposition of public lands, which includes the beds of most lakes and rivers as well as seasonally flooded areas (called shorelands), is controlled by the *Public Lands Act.* As well, the MNR may define zones as open, deferred or closed for disposition.

Pursuant to Ontario Regulation 453/96, work permits are required for the:

- Construction of a building on public land,
- Construction of a trail, road and water crossings on public lands,
- Dredging of shorelands (includes both crown and private land),
- Filling of shorelands,
- Removal of aquatic vegetation from specific shore lands, and
- Construction on shorelines that occupies more than 15 square metres.

Shorelands are defined to mean lands covered or seasonally inundated by the water of a lake, river, stream or pond. Dredge is defined to mean the removal or displacement of material from any shore lands, but does not include removal or displacement relating to the installation of service cables, heat loops or water intakes for private residences.

Work permits may be refused where proposed work is:

- Contrary to law,
- Inconsistent with an official plan, a Ministry Resource Management Plan, Ministry DLUG, or a Ministry policy or procedure, or is
- Likely to create a threat to public safety or to a natural resource including Crown lands, waters and watercourses, forest, flora, wildlife and fisheries.

Strengths and Weaknesses of the MNR Work Permit process:

- *A work permit is required for any project that requires construction, dredging, filling or removal of vegetation on Crown lands or municipal or private lands under water or seasonally inundated by the water of the St. Lawrence River.*
- *The Lakes and Rivers Improvement Act provides that any work which may forward, hold back or divert water, must receive prior approval from the Ministry of Natural Resources.*
- *Although there is no formal mechanism to require the review of a work permit application by other interested parties or agencies, MNR currently circulates work permits to other agencies for comment.*
- *Work permits are not required for floating or pole docks or crib docks that cover < 15 sq m of the riverbed.*

3.2.2 Fisheries Act - Department of Fisheries and Oceans

Fisheries and Oceans Canada is the lead federal government department responsible for developing and implementing policies and programs in support of Canada's economic, ecological and scientific interests in oceans and inland waters. This mandate includes responsibility for the conservation and sustainable use of Canada's fisheries resources while continuing to provide safe, effective and environmentally sound marine services that are responsive to the needs of Canadians in a global economy.

Fisheries and Oceans Canada (DFO) is responsible for the management of fish habitat and their jurisdiction is pursuant to the *Federal Fisheries Act,* which applies to "all waters in the fishing zones of Canada, all waters in the territorial sea of Canada and all international waters of Canada". A number of sections of the *Fisheries Act* affect proponents carrying on projects in and adjacent to water:

> *Section 34(1)* defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes."
>
> *Section 35* is the key habitat protection provision that prohibits the harmful alteration, disruption or destruction of fish habitat without an authorization from the Minister or through regulations under the Act.
>
> *Section 36* is the pollution prevention provision of the Act and renders the deposition of a deleterious an offence in Canadian fisheries waters. This section of the Act is administered by Environment Canada on DFO's behalf.

Fisheries and Oceans Canada (DFO) reviews projects to evaluate their impact on fish habitat (S.35). Although a proponent is not obligated to submit a project for review, the proponent will be liable under the *Fisheries Act,* should that project result in a HADD ("harmful alteration, disruption or destruction" of fish habitat). If it is suspected that the project may impact fish habitat, the proponent should submit a "Request for Project Review" and DFO will review the information to determine if there is fish habitat affected by the project. There are three possible processes:

1. No fish habitat - If there is no fish habitat, DFO will advise that there are no habitat concerns with respect to the Fisheries Act and no work permit or approval is required.

2. Fish habitat - but HADD can be avoided – DFO issues a letter of advice to indicate measures to mitigate the impacts by either changing location, design, timing or other measures.

3. Fish habitat - HADD cannot be avoided – In this case, DFO may determine that the HADD is unacceptable and no authorization will be granted. Alternatively if they consider the HADD to be acceptable they may issue an Authorization, which includes a requirement to compensate for the loss of fish habitat. Before DFO can issue an

Authorization, an environmental assessment must be undertaken in accordance with the *Canadian Environmental Assessment Act* (*CEAA*).

In Ontario, DFO has entered into agreements with the Conservation Authorities (CAs) whereby the CAs can conduct initial reviews of projects and the potential impacts on fish habitat. The CA can provide advice on DFO's behalf to avoid HADD. However, should the project result in a HADD the CA will forward the file to DFO for further review under the fish habitat protection provisions of the Fisheries Act.

In the case of contaminated sediments in the zones of concern, the installation of a post dock, floating dock and in some cases crib docks would not be considered a HADD and therefore would not require authorization. Should a proponent approach DFO about a project in any of the contaminated zones, they would advise that the area contains contaminated sediments and would recommend against constructing anything in these locations. However, if the project proceeds, it is unlikely that DFO would charge the individual under Section 35 of the Act.

Strengths and Weaknesses of Fisheries Act:

- *The Fisheries Act is reactionary in nature and destruction of fish habitat must occur in order for it to apply.*
- *There is no planning process to consider the impact of an activity, unless a proponent or a Responsible Agency asks DFO.*
- *The Fisheries Act does not provide good support to restrict development in the 3 zones, unless there is fish habitat that should not be destroyed.*
- *Does not apply to recreational boating or fishing.*
- *Does not restrict the construction of post and floating docks.*

3.2.3 Fill and Alteration to Waterway Regulation - Raisin Region Conservation Authority

The Raisin Region Conservation Authority (RRCA) is responsible for a number of different programs and services relating to the conservation and protection of environmentally sensitive lands in and around the City of Cornwall. With respect to the contaminated sediment zones, these responsibilities include the following:

- Provide land use planning advice to all municipalities within their watershed,
- Administer flood plain regulations (Fill and Alteration to Waterway Regulations) for the St. Lawrence River and Lake St. Lawrence Waterfront area,
- Participate in the administration of the Fisheries Act in cooperation with the Department of Fisheries and Oceans (DFO),
- Provide input into other regulatory programs as requested by an agency or as required by process,
- Participate in the preparation of resource management plans, and
- Co-ordinates proactive planning studies (e.g. urban drainage/sub-watershed planning).

The RRCA recently signed an agreement with DFO to provide a local presence in the evaluation and authorization of projects that could harmfully alter, disrupt or destroy (HADD) fish habitat. The RRCA maintains a database on shoreline resources and hazards and provides fact sheets in regard to development or shoreline property acquisition. As well the RRCA provides support and input into other regulatory programs including: Municipal Class Environmental Assessment, Work Permits and Septic System approvals. The Municipal Land Use Planning component of this program generally includes input into official plan policies, comprehensive zoning bylaws, plans of subdivision, consent and variance applications, environmental assessments, property inquiries and municipal infrastructure.

Fill and Alteration to Waterways Regulations

The land adjacent to the St. Lawrence River is subject to *Fill and Alteration Regulations (Regulation 140)* of the *Conservation Authorities Act*. All streams and rivers within the jurisdiction of the RRCA are subject to Alteration to Waterways regulations. Conservation Authorities utilize the *Conservation Authorities Act* and the *Fill, Construction and Alteration to Waterways Regulations*, to regulate development and landscape alteration within the areas surrounding lakes, rivers and streams.

The *Fill and Alteration Regulation 140* authorizes the RRCA to require a permit to be issued for the placing or dumping of fill or the straightening, changing, diverting or interfering with the existing channel of a river, creek, stream or watercourse. The RRCA can refuse the permit if, in the opinion of the Authority, these actions affects the control of flooding, the control of pollution or conservation of land.

An application for fill or alteration of the waterway must be accompanied by copies of the plan of the affected property, a description of alteration and proposed mitigation measures, the dates of the alteration and a statement of the purpose of the proposed work.

Strengths and Weaknesses of Fill and Alteration Regulations

- *Requires a permit for the placement of fill, or the straightening, changing, diverting or interfering with the existing channel of the St. Lawrence River.*
- *Able to deal with landscape alteration as well as the construction and location of buildings and structures.*
- *The Conservation Authority circulates applications for fill and alteration to other agencies for review and comment.*

3.2.4 Building Permit and Site Plan Control - City of Cornwall

Building permits are required by the City of Cornwall for the construction of buildings and structures greater than 10 square metres (108 sq. ft.) within the boundary of the municipality pursuant to the *Ontario Building Code Act*. Building permits cannot be issued unless the proposed building or structure conforms to other applicable law, especially the zoning by-law. Additional studies related to the disturbance of sediments (e.g. environmental assessments, impact studies or stormwater management plans) cannot be requested through the building permit approval process.

Site plan control is a municipal tool that is used to deal with the specific citing of buildings and structures on private land, as well as landscaping matters and stormwater management. The process requires an applicant to prepare a site plan indicating the location of proposed buildings, landscaping, parking and driveways, among other matters. The *Planning Act* provides the municipality with the authority to enter into an agreement, which is registered on title to ensure that it is binding on future owners of the property. The City of Cornwall currently applies Site Plan control to commercial, industrial, institutional and multiple residential dwellings, but does not apply to all development at the shoreline.

Strengths and Weaknesses

- *Building permits are granted only if development is in conformity with Official Plans and Zoning By-laws.*
- *Building permits and site plan control are not circulated to agencies for comments or advice.*
- *Building permits only apply to buildings and structures and cannot regulate land alteration (dredging and filling).*
- *Building permits are not required for the construction of buildings and structures under 10 square metres.*
- *Additional studies to assess impact cannot be required as a condition of granting a building permit or site plan agreement. This direction must be in the Official Plan.*
- *Site Plan Control could be used to deal with the citing of buildings and structures as well as landscaping alterations and stormwater management.*
- *Site Plan Control requires an agreement to be entered into between the proponent and the municipality and can be registered on title for future property owners.*

3.2.5 International Boundary Waters Treaty Act (IBWTA)- Department of Foreign Affairs and International Trade, and Environment Canada

Under the International Boundary Waters Treaty Act (IBWTA) and regulations, projects within international boundary waters that may have an impact on levels or flows at the border (e.g. obstructions/filling or dredging) may require approval from the Minister of Foreign Affairs. Project proponents should contact the Department of Foreign Affairs and International Trade (DFAIT) directly with respect to possible approval requirements under the Act and Regulations. DFAIT will likely require project proponents to submit a brief project description and additional information related to the possible hydraulic effects of infilling or dredging activity within the St. Lawrence River to satisfy their regulatory process. DFAIT typically relies on technical advice from Environment Canada (EC) on potential hydraulic effects of such projects.

Article IV of the Boundary Waters Treaty (BWT) (1909) between Canada and the US also stipulates that "boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other", however, no regulatory permit is required as this is a general prohibition

Strengths and Weaknesses of IBWTA:

- *IBWTA requires a license for projects having substantial hydraulic effects on water levels and flows that could potentially change flow regime in areas where contaminated sediments*

occur. Environment Canada would likely be requested by DFAIT to review the project and would be advising on all environmental issues pertinent to its mandates, not only project effects on levels and flows.

- *A permit issued by DFAIT could stipulate conditions that the project must follow in order to be implemented.*
- *Projects having an insignificant effect on levels and flows may not require a permit from DFAIT, however an EA review would likely be required to determine this but conditions in the EA may not be as easily enforced unless they pertain to effects on levels and flows.*
- *The areas where sediments are deposited are likely areas where impacts to water level and flows are relatively insensitive to changes in river channel hydraulics, therefore small in-water projects proposed in these areas may have negligible impacts on levels and flows and a license would not be required.*

4. Scenario Review

In this section you will find:
Scenarios of Potential Activities
Subdivisions
Utility Lines
Bridges
Waterfront Parks
Docks and Boathouses

There are many potential development scenarios that could result in the disturbance of contaminated sediments and analyzing these situations will help to assess how agencies work together and the effectiveness of administrative controls. Reviewing potential scenarios will also help to identify any gaps in regulations and determine if there are any activities that are not subject to a proper review.

The following eight scenarios represent a wide range of possible situations where development projects or other activities could potentially disturb the contaminated sediments.

Scenario 1 – Waterfront Residential Subdivision
Scenario 2 – Bell Canada Telephone Line
Scenario 3 – New International Bridge
Scenario 4 – Residential Dock and Boathouse
Scenario 5 – New Fishing Pier for Municipal Park
Scenario 6 – Major Waterfront Development and Opening of Canal
Scenario 7 – Industrial Docking Facility
Scenario 8 – Recreational Boating

Scenario 1 Waterfront Residential Subdivision

Scenario - A plan of subdivision is submitted to the City of Cornwall for a parcel of land immediately adjacent to the St. Lawrence River, within the downtown core of the city. The developer wants to construct a communal docking facility to accommodate 20 boats. This facility will be located in the river and will require some limited dredging and the construction of docks on piles. The land immediately adjacent to the river is a municipally owned bike/pathway, and the Crown owns the land under the river. Houses are to be constructed adjacent to the bike path.

The following agencies would be involved in the review of this project:

a. *City of Cornwall* – The City of Cornwall has the authority to approve or deny a Plan of Subdivision, under the auspices of the *Planning Act*. Subject to these powers and the Provincial Policy Statement the City has the authority and the responsibility, to request supporting documentation from the proponent to ensure that there are no negative impacts on adjacent properties and natural features and areas, including the contaminated sediment zones.

   The City is required by the *Planning Act* to provide notice to the general public and agencies about the proposed plan of subdivision. This provides a trigger to ensure that the appropriate agencies are involved and have an opportunity to comment.

   In this scenario, the City could request the following, as a condition of subdivision approval:

- An environmental impact study to prove no disturbance
- A stormwater management plan, with detailed information on outfall in relation to the contaminated zones
- A boating impact study and details on dock design and area to be dredged and filled
- A Subdividers Agreement (to be registered on title) requiring the implementation of specific conditions for the development of land, such as:
    - Maintenance of dredged areas for communal docking facility
    - Posting a bond to ensure that certain mitigation measures are completed
- The imposition of Site Plan Control

The Plan of Subdivision must conform to the Cornwall Official Plan, and it is important to ensure that there are specific policies in the Official Plan with respect to the regulation of activities in the contaminated sites. These policies would require a study to ensure no negative impacts and the application of proper mitigation measures. Since the City owns the land adjacent to the shoreline, they have the ultimate control on the land uses and activities that could be located there.

b. *Raisin Region Conservation Authority* – The Conservation Authority (CA) would be circulated a copy of the plan of subdivision and asked to comment. As well, the construction of the communal docking facility would require an alteration to waterway permit. The CA could impose mitigation measures such as the type of construction techniques (piling), timing requirements, and silt curtains for dredging. As well, the Conservation Authority would provide advice on whether a HADD to fish habitat would occur, and would notify DFO, should it be necessary.

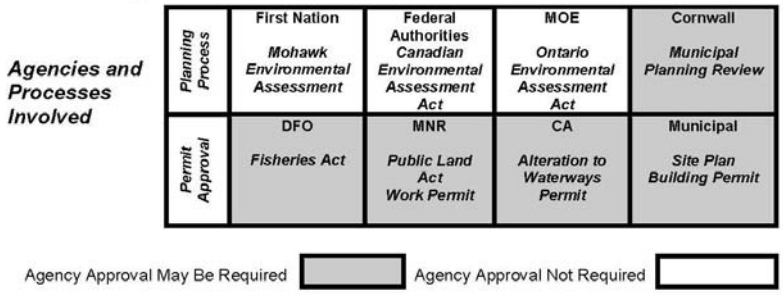
c. *Department of Fisheries and Oceans* - The Conservation Authority would review the Plan of subdivision to determine whether a HADD to fish habitat could occur and contact DFO if necessary.

d. *Ministry of Natural Resources* – The subdivision application would be circulated to the Ministry of Municipal Affairs and Housing (MMAH) for comment on behalf of all provincial agencies, but it is unlikely that it would be circulated directly to the MNR, unless MMA was aware of the contaminated sediments. The Ministry of Natural Resources owns the land under the river and a work permit would be required before the construction of a dock or any dredging or filling. A work permit is not required if the dock covers less than 15 sq m of riverbed, or if piles are used and no dredging or filling is involved.

Summary – In this scenario, the assessment of risk on potential disturbance is primarily the responsibility of the City of Cornwall, through its municipal review process. The Ministry of Municipal Affairs and Housing and the Conservation Authority would be circulated the application for plan of subdivision and provided an opportunity to comment on the proposed development and any associated impacts, as well as identify any permit requirements. The City of Cornwall would be able to request additional studies to investigate the potential for disturbance of the sediments. An MNR work permit and an alteration to waterway permit would be required. The City would provide notice to all interested agencies through the plan of subdivision process. A federal or provincial environmental assessment is not required, and it is

unlikely that the proposal would require a license pursuant to the IBWTA. Figure 6 provides an overview of the administrative controls that could be required.

Figure 6 – Scenario 1 – Waterfront Residential Subdivision



Scenario 2 Bell Canada Telephone Line

Scenario - Bell Canada proposes to remove and replace the major international telephone cable that crosses the St. Lawrence River between Cornwall (Augustus Street and Lamoureux Park) and Cornwall Island. Work involved includes removing the existing cable and relaying a replacement.

The following agencies would be involved in the review of this project:

a. Ministry of Natural Resources – The Ministry of Natural Resources owns the land under the river and a license of occupation, lease or easement may be required for installation of the telephone cable. Most large utility companies (e.g. Bell Canada, Ontario Hydro and Trans Canada Pipelines) do not require work permits depending on the project and especially for the replacement of an existing utility line.

However, a new Bell cable may require the application of the *Ontario Environmental Assessment Act* Class EA process. In this scenario, MNR would review the requirements of the *Class EA for MNR Resource Stewardship and Facility Development Projects.* Through this assessment, MNR would screen the project and determine the potential for environmental impacts and identify, whether further assessment, study or approval would be required. The replacement of an existing cable may only require notification of the project with MNR. If a lease is required, Bell and Hydro contact the Peterborough Corporate office directly.

Trans Canada Pipe Lines are exempt from Work Permit requirements, but Bell and Hydro do not have any similar process. Hydro and Bell are only exempt to the extent mentioned in Policy PL 3.03.04. The actual laying of a sub cable on the bed of a waterway does not

require a work permit, but both Bell and Hydro are required to obtain occupational authority from MNR. If dredging is involved they are exempt from work permit

requirements if the dredging is related to the installation of service cables for private residences only. Since it is unlikely that there would be a diversion, forwarding or damming of water, it is unlikely that a permit would be required pursuant to the *Lakes and Rivers Improvement Act*.

b. Mohawk Akwesasne First Nation - The Mohawk Environmental Assessment process would be required if the cable were to cross First Nation lands. The Assessment would evaluate the impact of the cable on the environment and on the community.

c. Department of Fisheries and Oceans – If an environmental assessment is required, DFO would be notified through that process. If requested, the DFO would review the proposal to determine the presence of fish habitat and identify whether a HADD is expected. If a HADD is expected, the DFO could refuse the Authorization to destroy fish habitat. If a HADD is expected, a CEA would be triggered before Authorization to compensate fish habitat would be approved.

d. Raisin Region Conservation Authority – No permit is required under the Fill and Alteration to Waterways Regulation if the proposed activity is pursuant to the *Public Utilities Act* or the *Electricity Act*. If an environmental assessment is required, the Conservation Authority would be circulated a copy of the project description and would provide comments and the Department of Fisheries and Oceans would deal with the consideration of HADD.

e. City of Cornwall – The City of Cornwall would only be directly involved if the telephone line crossed municipal land and an easement or right or way is required. If an environmental assessment were required, the City would be circulated a copy of the project description and would be provided an opportunity to identify any negative impacts to be addressed.

Summary - In this scenario, the assessment of risk on potential disturbance is primarily the responsibility of the Ministry of Natural Resources. If the cable is being replaced, then a license of occupation is required and the MNR could take the lead in notifying other agencies, especially the Conservation Authority and DFO. If a new cable is being proposed then the consideration of a provincial environmental assessment has to be made. Through this process, other agencies would be notified in order to screen the project and to determine if further assessment is required. Figure 7 provides an overview of the administrative controls that could be required.

Figure 7 – Scenario 2 – Bell Telephone Line

Agencies and Processes Involved	First Nation	Federal Authorities	MOE	Cornwall
Planning Process	*Mohawk Environmental Assessment*	*Canadian Environmental Assessment Act*	*Ontario Environmental Assessment Act*	*Municipal Planning Review*
Permit Approval	DFO *Fisheries Act*	MNR *Public Land Act Work Permit*	CA *Alteration to Waterways Permit*	Municipal *Site Plan Building Permit*

Agency Approval May Be Required Agency Approval Not Required

Scenario 3 New International Bridge

Scenario - A new low-level bridge is proposed by Transport Canada to replace the existing high-level bridge. Work is approximately in the same corridor and includes construction of new support structures and possible removal of existing structures in the river (as well as the bridge superstructure).

The following agencies would be involved in the review of this project:

a. *Canadian Environmental Assessment Act* - Transport Canada is the federal authority proposing the construction of the bridge and an environmental assessment under the *Canada Environmental Assessment Act* would be required. Other responsible authorities under *CEAA* would also be identified and EC would provide expert federal authority advice as input to the *CEAA* screening. The environmental assessment would provide a comprehensive process to consider the impacts of the new structure and to identify mitigation measures.

b. Department of Foreign Affairs and International Trade – A license pursuant to the International Boundary Waters Treaty Act would be required if the proposed work would result in an impact on water levels or flows.

c. Mohawk Akwesasne First Nation - The Mohawk Environmental Assessment process would be required if the bridge were to cross First Nation lands. The Assessment would evaluate the impact of the cable on the environment and on the community.

d. Ministry of Natural Resources – The Ministry of Natural Resources owns the land under the river and a work permit would be required for the construction of the foundation of the bridge in the river. The MNR would also have to consider the disposition of a Crown resource and both this disposition and the requirement for a work permit would trigger the application of the MNR Class EA. In this scenario, MNR would review the requirements of the *Class EA for MNR Resource Stewardship and Facility Development Projects*. Through this assessment, MNR would screen the project and determine the potential for environmental impacts and identify, whether further assessment, study or approval would

be required. Since a Canadian Environmental Assessment is already triggered, its requirements would be harmonized with the Class EA process.

If the MNR determines that the design of the bridge forwards, diverts or holds back water, a permit pursuant to the *Lakes and Rivers Improvement Act* would be required. If it is determined that both the *LRIP* and *PLA* apply, then one permit would be required to address the requirements of both Acts.

e. Department of Fisheries and Oceans – Through the environmental assessment process, the DFO would review the proposal to determine the presence of fish habitat and identify whether a HADD is expected. If a HADD is likely, DFO would also be a RA under the *Canadian Environmental Assessment Act* and the DFO can refuse the Authorization to destroy fish habitat. However, in this case, due to the overall public benefit that would be derived from the construction of a new bridge, it is very possible that DFO would grant an Authorization to compensate for the loss of fish habitat.

f. Raisin Region Conservation Authority – No permit is required under the *Fill and Alteration to Waterways Regulation* if the proposed activity is pursuant to the *Public Utilities Act* or the *Electricity Act*. If the Canada Environmental Assessment were required than the Department of Fisheries and Oceans would deal with the consideration of HADD. In either the Canada or Ontario Environmental Assessment, the CA would be circulated a copy of the project description and would provide comments to MNR and MOE.

g. City of Cornwall – The City of Cornwall would be circulated a copy of the project description through the environmental assessment process. They would also be directly involved if the bridge crossed municipal land and an easement or right or way would be required. The construction of a new international bridge would not trigger a municipal planning review process pursuant to the *Planning Act*.

Summary – The Canada and Ontario Environmental Assessment processes would provide for a comprehensive analysis of the potential impacts and associated mitigation measures as well as notification of all interested agencies. Figure 8 provides an overview of the administrative controls that could be required.

Figure 8 – Scenario 3 – New International Bridge

Agencies and Processes Involved

	First Nation	Federal Authorities	MOE	Cornwall
Planning Process	*Mohawk Environmental Assessment*	*Canadian Environmental Assessment Act*	*Ontario Environmental Assessment Act*	*Municipal Planning Review*
Permit Approval	DFO *Fisheries Act*	MNR *Public Land Act Work Permit*	CA *Alteration to Waterways Permit*	Municipal *Site Plan Building Permit*

Agency Approval May Be Required Agency Approval Not Required

Scenario 4 Residential Dock and Boathouse

Scenario - A homeowner with lot frontage on the river proposes to construct a small dock (2m X 5m) from their lot into the river. The proposal is for a wood crib filled with rock, and wood decking. The homeowner has also indicated that she wants to construct a boathouse and excavate lands above the water to create an inland boat slip.

The following agencies would be involved in the review of this project:

a. Raisin Region Conservation Authority - The construction of a single dock may not require a permit under the *Fill and Alteration to Waterways Regulation* if the proposed construction was minor or was a floating structure or built on piles. The excavation of shorelands to construct an inland boat slip or for the boathouse would require a permit. If a permit is required, the CA could impose mitigation measures such as type of construction techniques (piling), timing requirements, and silt curtains. The CA would also provide advice with respect to a HADD of fish habitat and connect DFO, if necessary.

b. Ministry of Natural Resources - The Ministry of Natural Resources owns the land under the river and a work permit would not be required for the dock as it covers less than 15 sq m of riverbed and does not require any dredging or filling. If MNR determines that the design of the dock diverts or holds back water, a permit pursuant to the *Lakes and Rivers Improvement Act* would be required, however this is unlikely. The excavation of shorelands would require a permit pursuant to the *Public Lands Act.*

c. City of Cornwall - Provided that the building and structure complies with the requirements of the Zoning By-law, a building permit would be granted. At present, single-family residential buildings and accessory structures do not require a site plan agreement and there would be no opportunity available to impose any conditions regarding an Environmental Impact Statement, Stormwater Management or Construction Mitigation Plans. The City would normally notify the CA to ensure their requirements are fulfilled.

Summary – The requirement of an MNR or CA permit for the installation of a dock will depend directly on the size and extent of the proposed dock. The excavation of shorelands would require an application for both a permit under the *Public Lands Act* (MNR) and the *Fill and Alteration to Waterways Regulation* (CA). No comprehensive planning review process is required that would automatically notify all interested agencies and solicit their comments. A notification protocol for these types of scenarios would ensure the involvement and comment of all required agencies, specifically the MNR, CA and the City of Cornwall. Figure 9 provides an overview of the administrative controls that could be required.

Figure 9 – Scenario 4 – Residential Dock and Boathouse

Agencies and Processes Involved	First Nation	Federal Authorities	MOE	Cornwall
Planning Process	*Mohawk Environmental Assessment*	*Canadian Environmental Assessment Act*	*Ontario Environmental Assessment Act*	*Municipal Planning Review*
Permit Approval	DFO *Fisheries Act*	MNR *Public Land Act Work Permit*	CA *Alteration to Waterways Permit*	Municipal *Site Plan Building Permit*

Agency Approval May Be Required Agency Approval Not Required

Scenario 5 New Fishing Pier for Waterfront Municipal Park

Scenario - As part of overall improvements to the Central Waterfront Park, a fishing/viewing pier of 20m in length is to be extended into the St. Lawrence River by the City of Cornwall. Construction of the pier is to be on piles with a steel and wooden deck. No dredging is required. Some shoreline alteration is proposed with infilling and a retaining wall.

The following agencies would be involved in the review of this project:

a. Department of Foreign Affairs and International Trade – A license pursuant to the *International Boundary Waters Treaty Act* would be required if the proposed work would result in an impact on water levels or flows.

b. City of Cornwall – The City of Cornwall would be the project proponent and would circulate the proposal to both the Conservation Authority and MNR for their consideration. An Individual EA would not apply to a small project such as a fishing pier nor would the Municipal Class EA since the later deals only with infrastructure projects such as water, sewage, and transportation.

c. Ministry of Natural Resources - A work permit is not required for the construction of a dock on piles, however the filling of shorelands may require a permit pursuant to the *Public Land Act*. Since it is unlikely that the construction of a dock on piles would alter the flow of water in the river, a permit is not required pursuant to the *Lakes and Rivers Improvement Act*.

d. Raisin Region Conservation Authority – While the municipality is not exempt from the requirements of the *Fill and Alteration to Waterways Regulation*, the nature of the construction (on piles) would not require a permit. A permit would be required for any shoreline alteration or construction of a retaining wall. The CA would also provide advice with respect to a HADD of fish habitat and connect DFO, if necessary.

Summary – Since the proponent in this scenario is the City of Cornwall, it is expected that they would contact all interested agencies to ensure that everyone's requirements are fulfilled. If the dock

involves piles or cribs < 15 sq metres in area, an MNR work permit is not required, however a permit is required from both the MNR and the CA if the proposal involves the excavation of land. Figure 10 provides an overview of the administrative controls that could be required.

Figure 10 – Scenario 5 – New Fishing Pier

Agencies and Processes Involved

	First Nation	Federal Authorities	MOE	Cornwall
Planning Process	*Mohawk Environmental Assessment*	*Canadian Environmental Assessment Act*	*Ontario Environmental Assessment Act*	*Municipal Planning Review*
Permit Approval	DFO *Fisheries Act*	MNR *Public Land Act Work Permit*	CA *Alteration to Waterways Permit*	Municipal *Site Plan Building Permit*

Agency Approval May Be Required Agency Approval Not Required

Scenario 6 Major Waterfront Development and Opening of the Cornwall Canal

Scenario - The City of Cornwall is proposing a major waterfront improvement project including the reopening of the old Cornwall Canal for recreational boat traffic. The project will include the installation of new locks, docks and parkland. Most significantly, it will involve creating a new access point into the canal, with related channel deepening and entrance basin.

The following agencies would be involved in the review of this project:

a. City of Cornwall – The City of Cornwall would be the project proponent and would circulate the proposal to all interested agencies. The Ontario Environmental Assessment process could apply to this undertaking and the City would be advised to obtain further guidance on the *EAA* implications from the MOE Environmental Assessment and Approvals Branch. If an EA were required, all interested agencies would be circulated and provided an opportunity to comment on the proposal and request specific studies and mitigation measures.

b. Ministry of Natural Resources – While the Provincial Crown (MNR) owns the land under the river, the ownership of the land under the water in the canal would have to be investigated before it was determined whether or not the *Public Lands Act* applies. If the Crown owns these lands, a work permit would be required under the *Public Lands Act* before the construction of a dock or any dredging or filling could occur in this area. A work permit is not required if the dock covers less than 15 sq m of riverbed, or if piles are used and no dredging or filling is involved. However, if the lands under the canal are privately owned and are not deemed to be shorelands, the *Public Lands Act* would not apply. The *Public Lands Act* would apply to the lands under the St. Lawrence River.

   If the MNR determines that the design of the dock or the channelization of the waterway forwards, diverts or holds back water, a permit pursuant to the *Lakes and Rivers*

Improvement Act would be required. If it is determined that both the *LRIP* and *PLA* apply, then one permit would be required to address the requirements of both Acts.

c. Raisin Region Conservation Authority – The municipality is not exempt from the requirements of the *Fill and Alteration to Waterways Regulation*, and the CA would want to review the proposed plans to determine whether or not a permit is required. The CA would also provide advice with respect to a HADD of fish habitat and connect DFO, if necessary.

Summary – The Ontario Environmental Assessment process would provide an opportunity for all interested agencies to review and comment on the proposal. Figure 11 provides an overview of the administrative controls that could be required.

Figure 11 – Scenario 6 – Major Waterfront Development and Canal

Agencies and Processes Involved

	First Nation	Federal Authorities	MOE	Cornwall
Planning Process	*Mohawk Environmental Assessment*	*Canadian Environmental Assessment Act*	*Ontario Environmental Assessment Act*	*Municipal Planning Review*
Permit Approval	DFO *Fisheries Act*	MNR *Public Land Act Work Permit*	CA *Alteration to Waterways Permit*	Municipal *Site Plan Building Permit*

Agency Approval May Be Required Agency Approval Not Required

Scenario 7 Industrial Dock

Scenario - A proposal is made to construct a dock facility on Pilon's Island to support the movement of products and livestock to support the agricultural operations and to facilitate the movement of construction materials. The excavation of shorelands may be required to provide access to the dock for vehicles. The dock is approximately 5m X 12m, steel construction on piles and covers filled lands that would occupy greater than 15 square metres of the riverbed.

The following agencies would be involved in the review of this project:

a. Department of Foreign Affairs and International Trade – A license pursuant to the *International Boundary Waters Treaty Act* would be required if the proposed work would result in an impact on water levels or flows.

b. City of Cornwall - Provided that the building and structure complies with the requirements of the Zoning By-law, a building permit would be granted. An industrial use would require a site plan agreement and this process may provide an opportunity to impose any conditions regarding stormwater management or construction mitigation.

If the project requires an amendment to the zoning by-law, the City of Cornwall would initiate the municipal planning review process and full consideration of the impacts would be considered as described in Scenario 1.

c. Raisin Region Conservation Authority - The construction of an industrial dock on fill would require a permit under the Fill *and Alteration to Waterways Regulation* and the CA could impose mitigation measures such as type of construction techniques (piling), timing requirements, and silt curtains.

d. Ministry of Natural Resources - The Crown (MNR) owns the land under the river and a work permit would be required for the construction of a dock that covers more than 15 sq m of riverbed. If the MNR determines that the design of the dock forwards, diverts or holds back water, a permit pursuant to the *Lakes and Rivers Improvement Act* would be required. If it is determined that both the *LRIP* and *PLA* apply, then one permit would be required to address the requirements of both Acts.

Summary – There is no comprehensive planning process to notify agencies or study the impacts of the proposed development, unless an amendment to the municipal zoning by-law is required. An alteration to waterway permit would be required from the CA and since the dock is located on filled lands that covers more than 15 sq metres in area, an MNR work permit is required. Figure 12 provides an overview of the administrative controls that could be required.

Figure 12 – Scenario 7 – Industrial Dock

Agencies and Processes Involved	First Nation	Federal Authorities	MOE	Cornwall
Planning Process	*Mohawk Environmental Assessment*	*Canadian Environmental Assessment Act*	*Ontario Environmental Assessment Act*	*Municipal Planning Review*
Permit Approval	DFO *Fisheries Act*	MNR *Public Land Act Work Permit*	CA *Alteration to Waterways Permit*	Municipal *Site Plan Building Permit*

Agency Approval May Be Required Agency Approval Not Required

Scenario 8 Recreational Boating

Scenario - A 32 ft cruiser anchors in a contaminated zone and the occupants swim and scuba dive from the boat. When leaving the boat's propeller scours the river bed and re-suspends the bottom sediments.

There are no administrative controls that deal with the regulation of recreational activities to prevent the disturbance of sediments.

Figure 13 – Scenario 8 – Recreational Boating

Agencies and Processes Involved

	First Nation	Federal Authorities	MOE	Cornwall
Planning Process	*Mohawk Environmental Assessment*	*Canadian Environmental Assessment Act*	*Ontario Environmental Assessment Act*	*Municipal Planning Review*
Permit Approval	DFO *Fisheries Act*	MNR *Public Land Act Work Permit*	CA *Alteration to Waterways Permit*	Municipal *Site Plan Building Permit*

Agency Approval May Be Required Agency Approval Not Required

5. Summary

In this section you will find:

5.1 Conclusions

The following matters were concluded:

Potential Risk of Impact

1. Most high-risk activities (bridges, new utility lines, water diversions, large private land developments) are subject to a comprehensive Environmental Assessment or Municipal Planning Review process. These processes provide for a detailed assessment of the potential impacts of these activities and identify measures and techniques that mitigate the impacts of development.

2. All moderate-risk activities (filling lands under water, retaining walls and crib docks that cover > 15 sq. metres of the riverbed) require the approval of the Ministry of Natural Resources, the Conservation Authority or the City of Cornwall before a permit can be issued. This permit process provides for an assessment of the risk of disturbance and identifies measures that mitigate the impacts of development.

3. Most low-risk activities such as pile or floating docks, crib docks that cover < 15 sq. metres of the riverbed, recreational boating (anchoring and maneuvering), fishing and swimming are not subject to administrative controls and there is no current means of regulating these activities or to mitigate the impacts that they may cause. Although these activities have the lowest risk to disrupt the sediments, the effect of no administrative controls could result in them having the highest potential of all activities to result in the re-suspension of sediments.

4. Development activities that include uncontained/unconfined dredging may result in the highest risk to sediment disruption.

5. The best approach to prevent disruption of sediments is through the prohibition of activities within and immediately adjacent to the contaminated sediment zones. The use of Administrative Controls will limit the risk of disruption of contaminated sediments.

6. The Environmental Assessment and the Municipal Planning Review Process provides the best method to identify and mitigate potential concerns, but they only apply to high-risk activities such as bridges, new utility lines, water diversions and large private land developments. These processes only identify potential mitigation measures and a process is necessary to ensure mitigation measures are employed. The Municipal Planning Review Process may not provide an assessment as detailed as the federal or provincial Environmental Assessment processes.

7. Permits that are approved without a coordinated environmental assessment or municipal planning review process may result in a less comprehensive analysis.

Gaps in Regulation and Guidelines

8. Some activities are not regulated, such as:
   - Recreational boating and the anchoring of boats
   - Swimming, scuba diving (not a risk)
   - Dock construction that has less than 15 sq m area of cribs (footprint of structure) and post, floating and pile docks do not require a *Public Land Act* or *Lakes and Rivers Improvement Act* work permit

9. There are no administrative controls or guidelines that provide specific regulation or guidance for the disruption of contaminated sediments. Section 36 (3) of the Fisheries Act does deal with the discharge of a deleterious substance, but this could only be used as a reactive measure of last recourse. The City of Cornwall's Official Plan should include special policy that identifies the location of the zones and provide criteria for the evaluation of specific development scenarios.

Lack of Coordinated Effort between Agencies

10. Only the Environmental Assessment and Municipal Planning Review process provides a formal coordinated effort between agencies to evaluate the impact of potential development projects. No one-window process exists for proponents who only need to apply to MNR, CA or City of Cornwall for permits.

11. There is no formal process to internally circulate applications for permits that are received independently by the various agencies (MNR, CA and City of Cornwall) and approvals can be issued independent of other agencies comments.

Lack of Awareness of the Issue

12. The approval process is very confusing and the public and agencies are unaware of the requirements.

13. There is no education program to make the public, development industry and agencies aware of the contaminated sediments, or current planning and permit review processes. Although education and awareness may produce effective results it must be considered as an on-going component in a package of options. As well, the Ministry of Municipal Affairs and Housing operates as the one window agent for provincial comments on municipal planning applications and they should be aware of this issue and contact MNR, when necessary.

Enforcement and Monitoring

14. Although the need for monitoring and enforcement of non-permitted activities may be sporadic, continual vigilance is required to identify potential problems. There is a need for a responsible agency to coordinate the monitoring of all activities within the 3 zones, as well as monitor the effectiveness of Administrative Controls.

Lack of Information

15. There is a lack of information on the impacts of recreational boating and scouring caused by "propeller wash". Only one study conducted in Zone 2 by Environment Canada investigated the potential for "propeller wash" to disturb fine-grained sediments. This study demonstrated that aggressive maneuvers of a 30-foot launch could not generate enough turbulence to disturb the sediments in this area. However, this study was conducted late in the boating season (October) when extensive macrophyte growth may have provided some protection to the sediment from the boats "propeller wash".

5.2 Recommendations

All development activities that are subject to an Environmental Assessment, Municipal Planning Review or a permit from the Conservation Authority, Ministry of Natural Resources or the City of Cornwall are subject to a review process to identify potential impacts and implement appropriate mitigation measures. Small-scale activities, such as docks and pilings, do not require a permit or process to evaluate impacts and may result in the highest potential risk of disturbance of the contaminated sediments. The following recommendations are intended to deal with these situations:

1. Identify Lead Coordinating Agency - A lead agency should be identified to coordinate the review and monitoring of all activities near the 3 contaminated zones, as well as monitor the effectiveness of administrative controls. There is a need for all agencies to identify roles and responsibilities associated with these recommendations.

2. Interagency Review Protocol - Establish a protocol for an interagency review process between permit approval agencies (MNR, CA and City of Cornwall) for all development applications. This protocol should establish a process to circulate and review any development proposal that is received for approval by any one agency. The Ministry of Municipal Affairs and Housing (MMAH) is the one window to all provincial agencies for *Planning Act* applications (e.g. subdivision, consent and re-zoning amendments). MMAH must be made aware of the concern regarding the contaminated sediments and must seek the comments of provincial agencies such as the MNR and MOE.

3. Policy - Establish appropriate policy to provide guidance on the type of activities that are permitted in or adjacent to the contaminated zones. The City of Cornwall should amend their Official Plan to identify the contaminated zones and set policy for the protection of these zones.

4. Development Guidelines - Prepare a guideline for proponents of activities to make them aware of the administrative controls and the approvals that are required. The guideline should also provide examples of mitigation measures to be considered to avoid the re-suspension of contaminated sediments.

5. New Approach for Non Permitted Activities - Consider the creation of new methods to regulate and mitigate the impacts of activities related to recreational boating, and post and pile docks.

6. Education and Awareness - Improve long-term awareness and education about contaminated sediments (content, location) and the effects of re-suspension. Periodic updating of information is necessary to reflect and deal with new and evolving circumstances. Target audiences include the general public, the development industry, and agencies and staff.

5.3 Summary

Scientific information indicated that the contaminated sediments are very stable and that there is a low concern for the bio-magnification of methyl-mercury from the sediment to organisms that dwell in the sediments. The Working Group, comprised of various representatives from the municipality, local industry, and environmental groups, concluded that the sediments in 3 zones should be left in place and natural recovery should be allowed to take place. The Working Group further recommended that administrative controls should be in place to prevent disturbance of the surface sediment and that ongoing monitoring should be undertaken to ensure that recovery is taking place.

The analysis of potential development activities and associated administrative controls has indicated that the construction of pile or floating docks, crib docks that cover < 15 sq. metres of the riverbed, recreational boating (anchoring and maneuvering), fishing and swimming may have the highest potential to re-suspend contaminated sediments because they are not subject to administrative controls. Administrative controls are necessary to ensure that the impacts of these activities can be mitigated and monitored. The recommendations presented in Section 5.2 of this report will help to regulate and monitor all activities within the 3 identified zones as well as reduce the risk of disturbing contaminated sediments.

Appendix 1 – List of Agencies and Contacts
Workshop Participants

NAME	AGENCY	ADDRESS	E-MAIL	PHONE #
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Chantal Whitaker	Raisin Region Conservation Authority	PO Box 429, County Road 2 Cornwall, ON K6H 5T2	chantalw@rrca.on.ca	(613) 938-3611
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Appendix 2 – Additional Information on Federal Legislation and Policies

The following provides a list of the Federal legislation and policies that may be applicable to near shore and in-water projects having potential to disturb contaminated sediments:

- *Department of Environment Act* - provides Environment Canada (EC) with general responsibility for environmental management and protection, and mandates EC to advocate the preservation and enhancement of the environment.

- *Fisheries Act Sub-section 36(3)* - prohibits the deposit of potentially deleterious substances into Canadian fisheries waters. Toxic spills, contaminated sediments, and substances (including sediment) that smother nesting areas or spawning grounds, or interfere with reproduction, feeding or respiration of fish, would be considered deleterious.

- *Canadian Environmental Protection Act* - provides environmental quality objectives, guidelines and codes of practice for management of toxic substances to prevent pollution; and declares certain substances are declared toxic, such as: PCBs, Benzene, PAHs, Arsenic, Mercury and Lead, etc.

- *Federal Toxic Substances Management Policy* - is a preventative and precautionary approach for the life cycle management of 'Track 2' toxic substances and virtual elimination from the environment of specific 'Track 1' toxic substances (PCB's, Dioxin, Furans).

- *Strategy for Action on Pollution Prevention* – is a precautionary approach to minimize the release of toxic substances and other pollutants into the environment);

- *Migratory Birds Convention Act* and the *Migratory Birds Regulations* - Section 6 prohibits the taking or killing of migratory birds and their nests and eggs, and sub-section 35(1) prohibits the discharge of deleterious substances affecting migratory birds.

- *Species At Risk Act (SARA)*- is intended to prevent wildlife species from being extirpated or becoming extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened)

- *Canada Wildlife Act* –provides information on species at risk.

- *National Accord for the Protection of Species at Ri*sk – identifies species at risk through the Committee on the Status of Endangered Wildlife in Canada.

- *Federal Policy on Wetland Conservation* – is a shared federal responsibility and directs all departments to sustain wetland functions in the delivery of their programs, services or expenditures.

- *Canadian Biodiversity Strategy* - responds to the United Nations Convention on Biological Diversity.

- A *Wildlife Policy for Canada* – provides a relevant goal to maintain and restore ecological processes and the diversity of ecosystems, species and genetic variability within species.

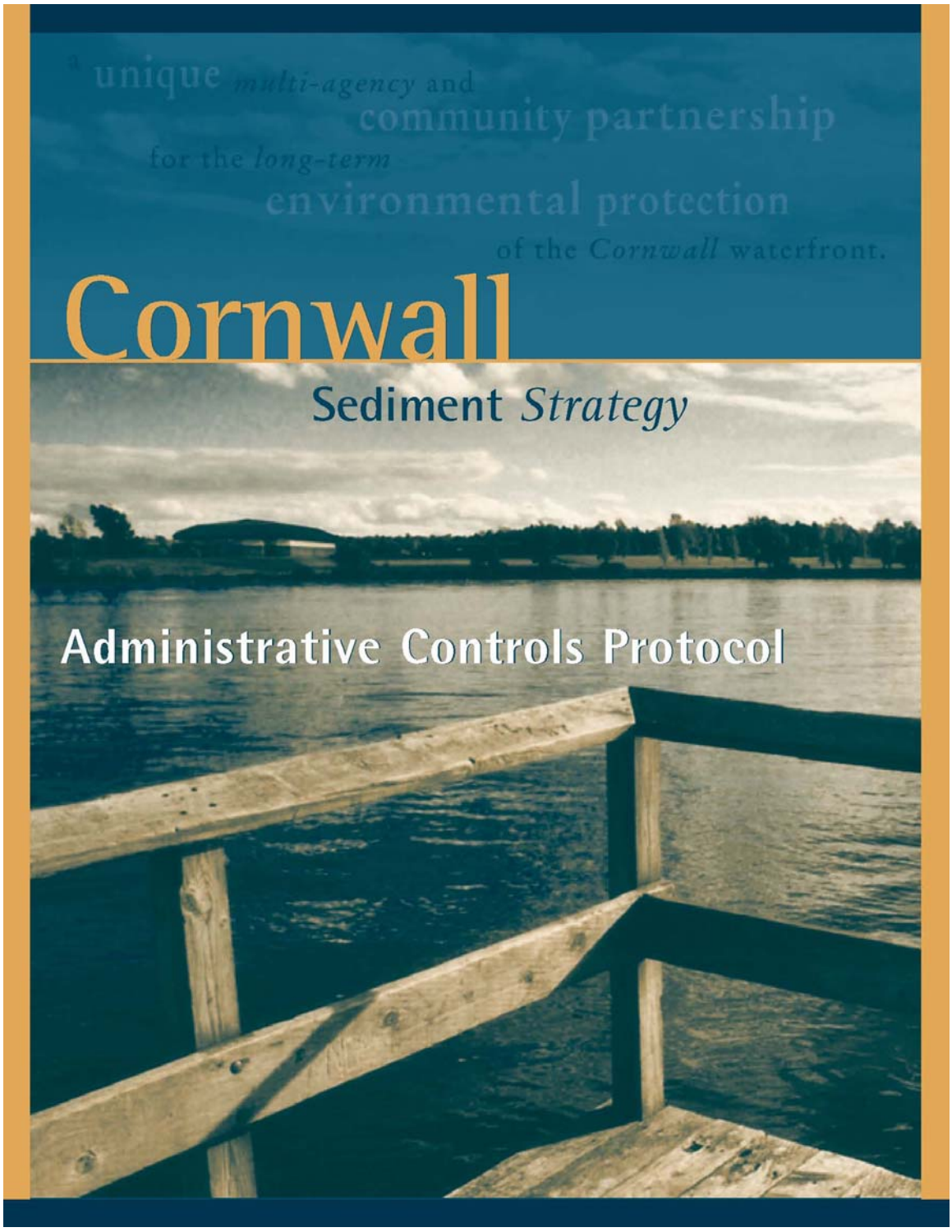
- *Great Lakes Water Quality Agreement and Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem.*

- *Canada Water Act* - provides for the management of the water resources of Canada, including the provision of information on surface hydrology, water quality, and hydrogeology.

- *Boundary Waters Treaty Act* – deals with trans boundary water management in regard to project effects on water levels and flows and water quality. Under the Act and regulations, projects within international boundary waters that may have an impact on levels or flows at the border (e.g. obstructions/in-fills or excavations) may require approval from the Minister of Foreign Affairs.

- *Federal Water Policy* - provides goals to protect and enhance the quality of the water resource, and promote the wise and efficient management and use of water in the context of the social, economic and environmental needs of present and future generations.

APPENDIX 5: CORNWALL SEDIMENT STRATEGY – ADMINISTRATIVE CONTROLS PROTOCOL


a unique multi-agency and
community partnership
for the long-term
environmental protection
of the Cornwall waterfront.
Cornwall
Sediment Strategy
Administrative Controls Protocol

Cornwall Sediment *Strategy* Accord

The Governments of Canada and the United States have committed to restore and protect the Great Lakes Ecosystem through the signing of the Great Lakes Water Quality Agreement (GLWQA) in 1978. The GLWQA was amended in 1987 with the governments of Canada and the United States further defining their commitment to address problems in the most degraded areas, designated as Areas of Concern (AOCs) in the Great Lakes, through the development and implementation of Remedial Action Plans (RAPs).

Further, the Governments of Canada and Ontario committed, through the signing of the Canada Ontario Agreement Respecting The Great Lakes Ecosystem in 2002, to working in a cooperative, coordinated and integrated fashion in order to meet Canada's obligations under the GLWQA.

Since 1987 the Governments of Canada and Ontario have worked together with the local community to develop and implement a Remedial Action Plan (RAP) for the St. Lawrence River (Cornwall) AOC. To fulfill the federal and provincial commitments to the implementation of this RAP, Environment Canada and the Ontario Ministry of the Environment have led the development of a Cornwall Sediment Strategy to address the contaminated sediment issue along the Cornwall waterfront.

The outcome of this initiative is a sediment management plan known as the "Cornwall Sediment Strategy". This sediment management plan states that the sediments along the Cornwall waterfront are to be left in place and effective Administrative Controls are to be implemented to ensure that these sediments are not disturbed or re-suspended such that the deeper, more contaminated material is exposed.

In support of the Cornwall Sediment Strategy, the Parties to this Accord have agreed to act in a cooperative manner to harmonize their approval, permitting and planning processes to ensure the sediments located along the Cornwall waterfront are not disturbed. Approval, permitting and planning processes will be coordinated in the manner outlined in the document entitled "Cornwall Sediment Strategy - Administrative Controls Protocol".

RAISIN REGION CONSERVATION AUTHORITY
OFFICE DE PROTECTION DE LA NATURE DE LA RÉGION DE RAISIN
Canada
Ontario
Cornwall
Ontario • Canada
MOHAWK COUNCIL OF AKWESASNE

By signing this Accord the parties confirm their commitment to protect the St. Lawrence River ecosystem.

HER MAJESTY THE QUEEN IN RIGHT OF CANADA (CANADA) AS REPRESENTED BY:

The Minister of the Environment, Department of the Environment
Jim Abraham, Regional Director General (acting), Ontario Region

The Minister of the Department of Fisheries and Oceans, Department of Fisheries and Oceans
D. Vic Gillman, Director, Ontario and Great Lakes Area

HER MAJESTY THE QUEEN IN RIGHT OF ONTARIO (ONTARIO) AS REPRESENTED BY:

The Minister of the Environment, Ministry of the Environment
Michael Williams, Assistant Deputy Minister, Operations Division

The Minister of Natural Resources, Ministry of Natural Resources
George Ross, Assistant Deputy Minister, Field Services Division

THE MOHAWK COUNCIL OF AKWESASNE AS REPRESENTED BY:

Angie Wahienhawi Barnes, Grand Chief

THE RAISIN REGION CONSERVATION AUTHORITY AS REPRESENTED BY:

Roger Houde, General Manager
Bill Franklin, Chairman, Board of Directors

THE CITY OF CORNWALL AS REPRESENTED BY:

Phil Poirier, Mayor
Denise Labelle-Gelinas, Clerk

Mohawk *Opening*

Seven agencies met in the spirit of cooperation to create a protocol to harmonize their permitting review processes. The ultimate goal of their efforts is to fully implement the Cornwall Sediment Strategy, a multi-agency, community partnership to promote the long-term protection of contaminated sediments in three zones along the Cornwall waterfront. What follows is the fruit of their collaboration and a testament to their commitment to environmental protection.

Ohenton Karithwatehkwen —
The Words That Come Before All Else

Haudenosaunee Greetings to the Natural World

Today we have gathered, and as we look around we can see that the cycles of life continue around us. We have all been given the duty to live in balance and harmony with each other and all living things and we share this duty to protect the St. Lawrence River and the life that is associated with it.

Let us now bring our minds together as one and turn to:

Our Mother Earth, for she continues to give us all that we need for life, supports our feet as we walk about upon her, and protects the sediments in the river, which we will now help her to protect...we agree;

The Waters of the world, which we know in many forms, quench our thirst and provide us with strength and the Fish and all the creatures that live in the waters of the world, which give their lives in order that we may gain their strength, help to cleanse and purify the water. Our duty to the river strengthens our resolve to contain the sediments on the river bed...we agree;

The Birds of the world, whose songs are music to our hearts, provide us with a sense of grace and beauty and the mystery of the far off places where they travel to complete their cycle of life, and the Animals of the river and the world, which have many things to teach us if we just take the time to watch and learn, will help warn us of impeding problems with the river...we agree;

The many kinds of Plants and Trees of this world, which add beauty to our lives, live in the waters of the river, cure and heal our weaknesses, provide us with fruits, beauty, fuel and shelter, and shade and protect the shores of the river...we agree;

The Four Winds, which cool our hottest days, bring the rains, help purify the air we breathe, and help bring on the changes in the seasons, the Thunders that bring with them the waters that renew life, our eldest brother, the Sun—the source of fire and light, and the Stars of the world, which provide us with much beauty and mystery of the night sky, the information to help with our long voyages, and demonstrate the vastness of our Creator's ability...we agree;

Our Grandmother, the Moon, who lights the night time sky, controls the cycles of life and birth and the movements of the oceans of the world, is the leader of all women, and, by her changing faces, we measure time and judge plantings and harvestings...we agree;

Our Grandfathers, the Thunders who warn us of impending danger and stab the earth with their lightening and bring us the new rains...we agree; and

The Enlightened Elders, our teachers, who share the wisdom of our ancestors and keep alive all those things that are necessary for harmony in life in order that we may gain from their knowledge. We acknowledge the knowledge of the Elders to help us keep the accord and the river safe. It is their teachings that allow us to stand here and give greetings and thanks as our ancestors have done so in the past...we agree.

We are provided with all the good things to live a good life, and to know that love is still around us is to know that there is caring going on all over creation. Let us now bring our minds together and send our best greetings and warmest thanks to the Creator for all the gifts of creation.

It gives us joy and we are grateful that they all continue to carry out their original instructions as given to them from our Creator—that we could be as constant in our responsibilities for their protection.

We can now declare this protocol officially issued as we keep these thoughts in focus as the day goes on, and may all decisions keep the next seven generations in mind. If there are any special thoughts or if I have left any thing out, let your thoughts now take care of that.

Now our minds are one.

The *Purpose* of this Protocol

The purpose of this protocol is to assist with the implementation of the Cornwall Sediment Strategy, which states that:

Contaminated sediment deposits in three zones along the Cornwall waterfront should be left in place, undisturbed, to allow natural recovery to take place; and

Administrative controls should be put in place to ensure human activities do not disturb these sediments and expose the deeper, more contaminated material.

As they currently exist, historically contaminated sediments in three zones along the Cornwall waterfront are stable and covered with a cleaner layer of sediment and therefore, do not pose a significant ecological risk. However, certain development activities requiring dredging, filling, covering, piling, or scouring have the potential to disturb, expose or re-suspend the deeper more contaminated sediments.

The intent of this protocol is to ensure the integration of the efforts of several agencies that have the mandate and authority to regulate activities that may disturb, expose or re-suspend mercury-contaminated sediments in three zones along the Cornwall waterfront. The protocol represents an inter-agency commitment to collaborate for the long-term protection of sediments along the Cornwall waterfront.

The parties to this protocol have agreed to work together in a cooperative, coordinated and integrated fashion and are committed to prevent the disturbance, exposure and re-suspension of contaminated sediments within the three zones as shown on the map "Geographic Scope of Protocol".

Participating Agencies

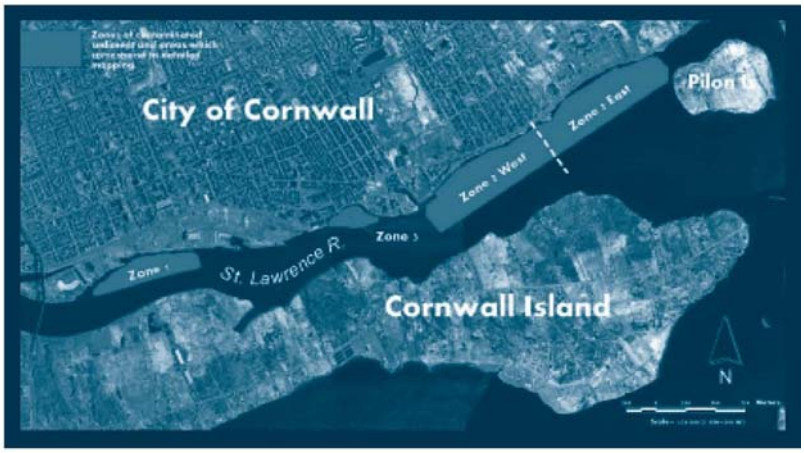
- Environment Canada (EC)
- Department of Fisheries and Oceans (DFO)
- Ontario Ministry of the Environment (MOE)
- Ontario Ministry of Natural Resources (MNR)
- Mohawk Council of Akwesasne (MCA)
- Raisin Region Conservation Authority (RRCA)
- City of Cornwall (City)

The *Objectives* of this Protocol

The objectives of this protocol are:

- To create a common administrative approach to ensure contaminated sediments are not disturbed, exposed or re-suspended;
- To harmonize agency mandates and to strengthen and coordinate a common review process for regulating activities that have potential to disturb contaminated sediments;
- To establish principles that will guide decisions; and
- To clearly articulate the roles and responsibilities of each party to this protocol.

The *Geographic Scope* of the Protocol



The *Principles* of the Protocol

The following principles will guide the decisions of the parties to this protocol:

Prevent Disturbance – There must be no disturbance, exposure or re-suspension of contaminated sediments within Zones 1, 2 and 3.

Apply Design Making Process – All projects must be assessed based upon the application of the following design criteria in decreasing order of priority: Relocate, Redesign and Remediate.

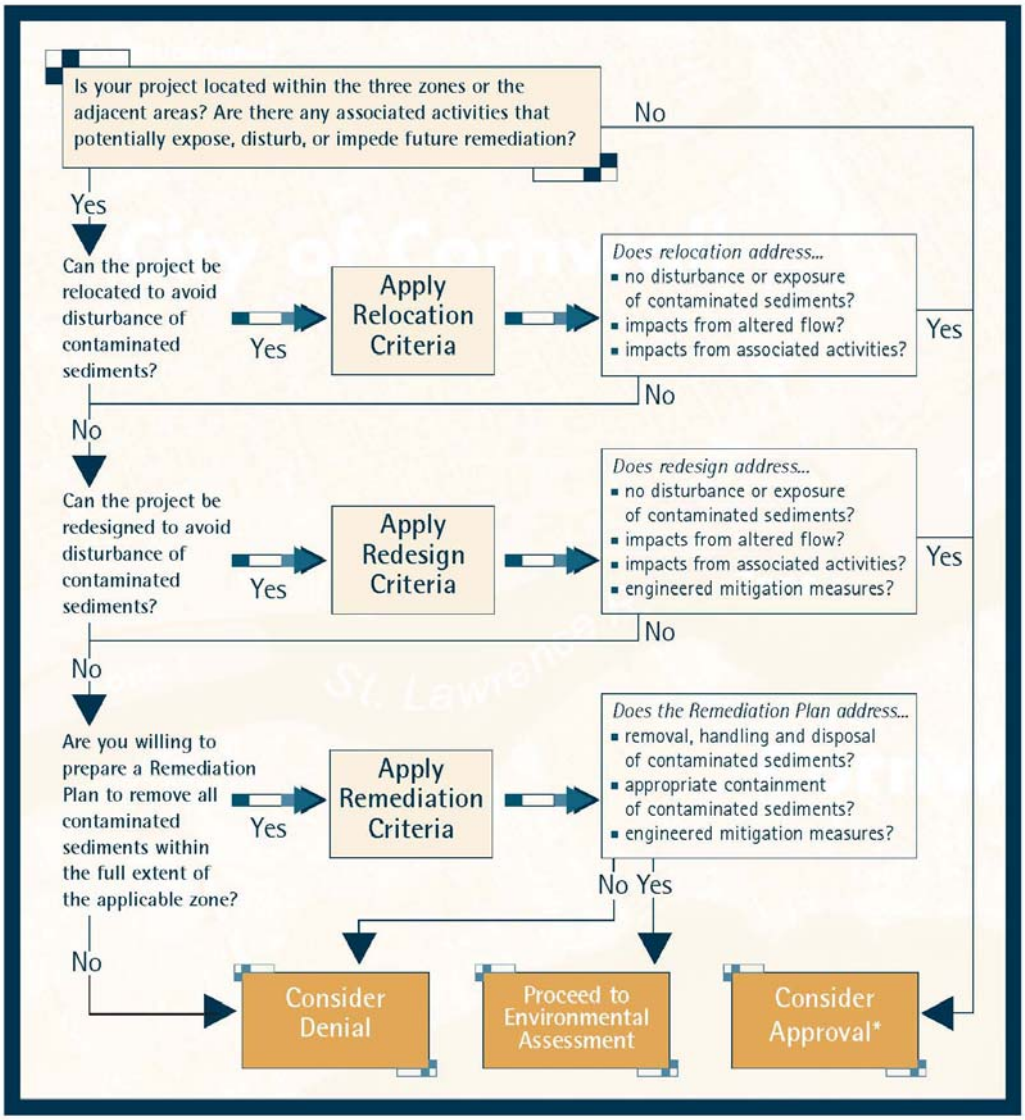
No Impediment to Future Remedial Activities – No development or activity may impede future remedial measures to address contaminated sediments.

Remediate Full Extent of Zone – Projects that cannot be relocated or redesigned and may potentially disturb any sediments must have a remediation plan that indicates how all contaminated sediments, within the full extent of the zone, will be handled, removed and disposed of in a safe and environmentally protective manner.

Proponent is Responsible for Costs – The proponent is responsible for all costs, including engineering reports and the removal, handling and disposal of contaminated sediments.

Decision Making Process

The "Decision Making Process" outlined below shall be applied to the review of all project applications involving the participating agencies located in the three zones of contaminated sediments or in adjacent areas.



* Pending consideration of applicable legislation

Roles and Responsibilities for *Harmonizing Efforts*

Through this protocol the parties confirm their commitment to work in a cooperative, coordinated and integrated fashion in order to harmonize the permit review process. To this end, the parties agree to:

- Recognize the Raisin Region Conservation Authority as the lead party that is responsible for co-ordinating the application review process, confirming the response of all agencies and notifying the proponent of decisions;
- A "No Wrong Point of Contact" approach, to provide proponents with a development guidance document to assist them through the process;
- Notify all parties when applications are received and when infractions of legislation, regulations and instruments related to this protocol are identified;
- Promote open communication and facilitate discussion between parties to review applications, exchange new information or to discuss the implementation of the Accord and Protocol; and
- Maintain a comprehensive long-term public awareness strategy.

The Protocol should not affect the normal business of any party or result in an unacceptable burden to any party. The intent of the protocol is to harmonize the permit review process and to identify opportunities to discuss and coordinate decisions.

Any party that is participating in an Environmental Assessment review process is responsible to notify all other parties.

The parties to this protocol agree to the roles and responsibilities as outlined in Figure 1.

Figure 1 - Roles and Responsibilities of Parties

	Lead	Supporting Parties					
Responsibilities	**CA**	**EC**	**MOE**	**DFO**	**MNR**	**CITY**	**MCA**
Coordinate Process							
■ Supports implementation of the Administrative Control Protocol	☑	☑	☑	☑	☑	☑	☑
■ Ensures implementation of a coordinated application review process by all parties	☑	-	-	-	-	-	-
■ Initiates meetings with all parties (once a year at a minimum)	☑	-	-	-	-	-	-
■ Participates in meetings and discussions as required	☑	☑	☑	☑	☑	☑	☑
Notification/Circulation							
■ Refers proponents to appropriate agencies	☑	☑	☑	☑	☑	☑	☑
■ Provides Development Guideline to assist proponents throughout the process	☑	☑	☑	☑	☑	☑	☑
■ Notifies lead agency and appropriate parties when applications are received	☑	☑	☑	☑	☑	☑	☑
■ Responds to requests for information in a timely manner	☑	☑	☑	☑	☑	☑	☑
Review Application							
■ Coordinates a review of applications with parties	☑	-	-	-	-	-	-
■ Reviews application in accordance with jurisdiction	☑	☑	☑	☑	☑	☑	☑
■ Provides information and data with respect to the impact of activities on contaminated sediments	-	☑	☑	-	-	-	-
■ Provides notice of decision (if applicable) to lead agency	-	☑	☑	☑	☑	☑	☑
■ Ensures review by all parties before final approval is granted and conducts meeting to review decisions	☑	-	-	-	-	-	-
■ Coordinates response and confirms Final Review Decision with all parties	☑	-	-	-	-	-	-
■ Notifies proponent of Final Review Decision	☑	-	-	-	-	-	-
Monitoring – Activities							
■ Inventories existing shoreline structures to formulate baseline data to monitor change	☑	-	-	-	-	-	-
■ Monitors activities within the 3 zones	☑	-	-	-	-	-	-
■ Monitors and reports on effectiveness of administrative controls	☑	-	-	-	-	-	-
■ Monitors compliance of activity with conditions of approval, if applicable	☑	☑	☑	☑	☑	☑	☑
■ Monitors for illegal activities and informs all parties of infractions, if applicable	☑	☑	☑	☑	☑	☑	☑
Monitoring – Sediments							
■ Updates maps as required	-	☑	☑	-	-	-	-
■ Monitors sediment and biota (benthos, fish and wildlife) to ensure that environmental conditions are improving	-	☑	☑	-	-	-	-
■ Informs all parties of new information as it becomes available	-	☑	☑	-	-	-	-
Enforcement							
■ Enforces own acts and regulations	☑	☑	☑	☑	☑	☑	☑
Communication							
■ Implements communication strategy to maintain awareness of general public, proponents and government agencies	☑	☑	☑	☑	☑	☑	☑

Administration

Amendments to Protocol and Changes in Parties - Amendments to the administrative controls protocol can be made and new parties can be added at any time provided there is consultation with and consent of the other parties.

Dispute Avoidance – The parties to this protocol are committed to working collaboratively to avoid and resolve any dispute concerning the implementation of the Accord and Protocol.

Definitions

Adjacent Areas - those areas, contiguous to the zone, where it is likely that development or an activity may disturb or expose contaminated sediments located within the zone, through associated activities or altered flows.

Covering – the act of protecting, confining, sheltering or concealing sediments by covering or enveloping them.

Development – the construction of buildings and structures requiring placement on the riverbed or adjacent areas.

Dredge – the physical alteration of the riverbed by the removal of mud, sand and other sediments through suction or scooping by machinery.

Filling – the physical alteration of the riverbed by covering the bottom with deposited soil, sediment, concrete, cribs or any other material or object.

Piling – the act of driving of a beam or post into the riverbed.

Redesign – the process of making a new design or plan for a specific project to prevent the disturbance, exposure or re-suspension of contaminated sediments.

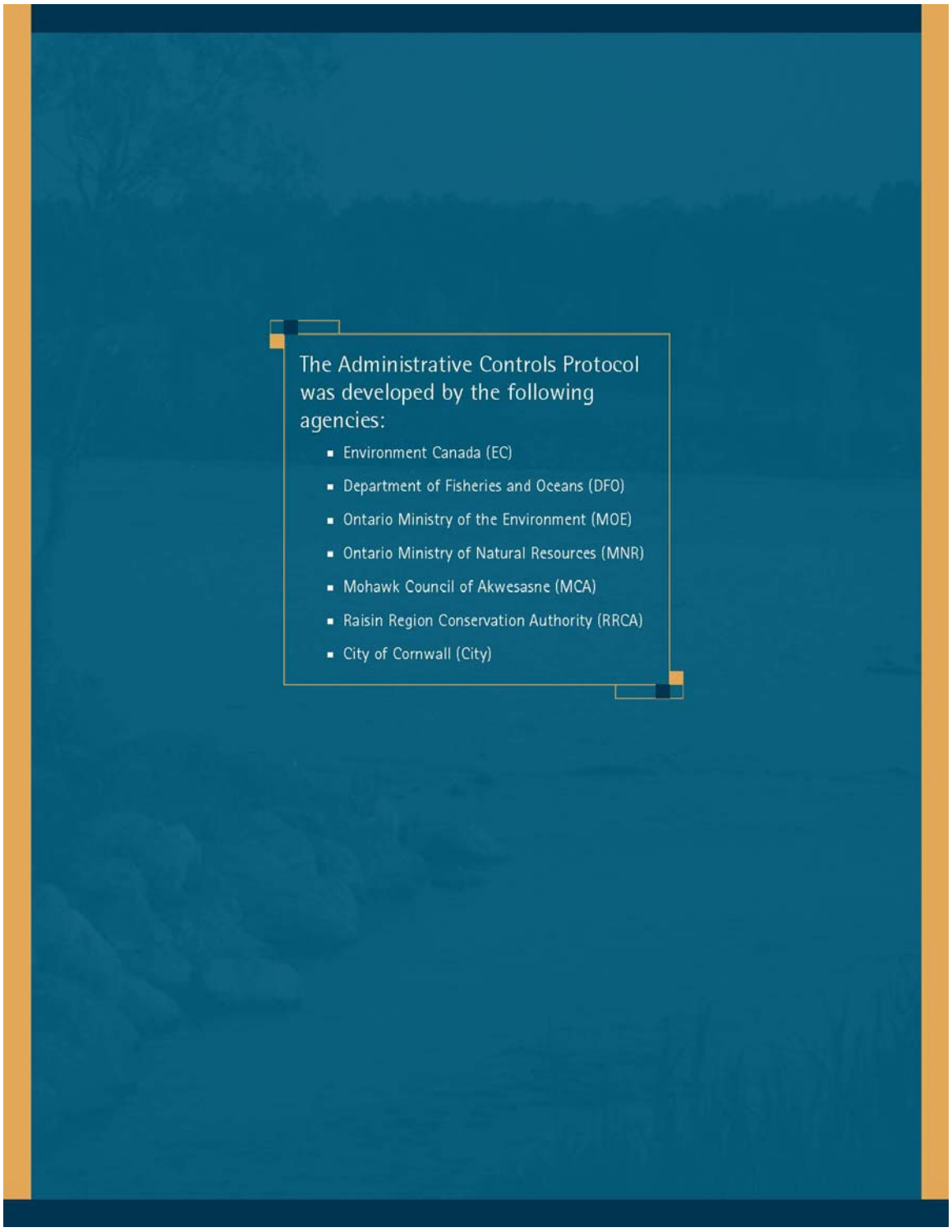
Relocation – the process of selecting another location for a development or an activity to prevent the disturbance, exposure or re-suspension of contaminated sediments.

Remediation – the cleanup or use of other methods to remove or isolate contaminated sediments.

Remediation Plan – a plan prepared by a qualified professional that indicates how to remove, handle and dispose of contaminated sediments in a safe and environmentally protective manner.

Re-suspension – the remixing of sediment particles and pollutants back into the water column.

Scouring – the moving or scraping of the top layer of the riverbed.


The Administrative Controls Protocol was developed by the following agencies:
Environment Canada (EC)
Department of Fisheries and Oceans (DFO)
Ontario Ministry of the Environment (MOE)
Ontario Ministry of Natural Resources (MNR)
Mohawk Council of Akwesasne (MCA)
Raisin Region Conservation Authority (RRCA)
City of Cornwall (City)