Corporation of the City of London

London
CANADA

IN ASSOCIATION WITH

UPPER THAMES RIVER
CONSERVATION AUTHORITY

Environmental Assessment Report

Springbank Dam Rehabilitation

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prepared by

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International

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1.2 Background and Need for the Project

Springbank Dam is situated on the Thames River in the southwest corner of the City. The dam was originally constructed to provide a reservoir for domestic water supply and recreation for the City. Prior to construction of Springbank Dam, another dam, constructed sometime earlier in the 19th century, existed a short distance upstream, also for the purpose of providing a water supply reservoir for the local community. A steam plant was also built at the site in 1882. This original dam was washed out in 1883. Subsequent reconstructions of this original dam were again washed out in 1899 and 1917. Following the last washout in 1917 and prior to construction of the existing Springbank Dam in 1929, no dam existed in this area of the river.

Springbank Dam was originally constructed with three concrete piers and two abutments, resulting in four bays each with a clear span of 15.24 m. Between the concrete piers, five bays of timber stop logs were set, with support provided by four vertical steel stop-log gains. Thus, the dam originally had a total of 20 sluices, each containing three sets of timber stop-log panels. The dam is not built on bedrock, but instead is supported by a concrete base slab constructed on top of glacial till. Rehabilitation works initiated in 1968 included concrete repairs, installation of a new pier in the south bay, installation of an automatic vertical sluice gate, construction of a sheet-pile wall on the left (south) abutment, concrete cribwork on the right (north) abutment and downstream revetment work in the riverbed. The current (2003) structure is 67 m long and 9.8 m high, and consists of a series of timber stop-log panels, three automatic overflow flap gates and a powered, vertical lift sluice gate (Figure 1.2). With all the stop logs in place, the dam has a normal head difference of 5.5 m, creating a 55-ha reservoir, which extends 7 km upstream to the confluence of the North and South branches of the Thames River (the ‘Forks’). Photographs of the dam and reservoir are presented in Figure 1.3.

The UTRCA operates the dam for a variety of purposes including recreation, flood handling, and fisheries protection. Figure 1.4 depicts operating water levels and mean monthly flows at the Springbank Dam. Each fall, beginning in late-October, all of the stop logs are removed from the structure, and the top-hinged steel gains are swung up and attached to the underside of the deck to provide free passage for winter ice and higher spring flows.

The stop logs are reinstalled in the spring in a two-step process aimed at facilitating the passage of upstream migrating fish past the dam. Near the beginning of May, the first set of stop-log panels is installed, with the final two rows of panels installed prior to the Victoria Day long weekend. However, actual installation dates are dependant on fish migration times, river flows and construction activities. During the summer, the dam is operated to provide a consistent upstream water level of ±229.4 m for recreational purposes, using the automatic water level control provided by the three overshot gates, supplemented with removal of stop-log panels and the vertical lift gate, as required, to deal with rainfall events.

Parklands, including Springbank Park and Greenway Park, border much of the length of the reservoir. The reservoir, in conjunction with the adjacent parklands, supports a variety of land and water-based recreational activities including hiking, biking and inline skating on the many trails found throughout the park, canoeing, rowing and fishing on the reservoir, and picnicking and wildlife viewing throughout the many natural areas of the park and along the reservoir shoreline.

The Thames River was formally designated as a Canadian Heritage River in 2000, in recognition of its importance to the country's cultural heritage and recreational opportunities (Canadian Heritage Rivers System, 2003). The Thames River flows approximately 273 km from its headwaters northeast of London to its mouth at Lake St. Clair (Thames River Coordinating Committee, 1998). The Thames watershed, the second largest watershed in southern Ontario, drains a total area of 5825 km^2 (Thames River Coordinating Committee, 1998). The Thames, due to its southerly location spanning the Carolinean and Great Lakes-St. Lawrence forest regions, supports an extremely rich floral and faunal diversity. Many rare plant species found nowhere else in Canada exist within the watershed, while 88 fish species, 30 species of freshwater mussel, 36 mammal species and 157 bird species have been recorded throughout the area (CHRS, 2003).

Following installation of the screw operated vertical lift gate in the south sluice in 1968 and subsequent replacement with a cable hoisted gate, erosion problems developed along the south bank of the river. Due to the ease of operating this powered gate and the installation of automatic level control, it was used preferentially for spilling water from the reservoir. This resulted in a more concentrated flow and higher velocities near the south bank. This high velocity flow has caused the development of scour holes near the bank and reduced the overall stability of the bank. This erosion has prevented the use of the gate to automatically control the water level in the reservoir. Erosion protection measures including grouted riprap and grouted geo-membrane were installed in an attempt to control this erosion. Various efforts were made to extend, repair and improve the erosion control measures.

Work was planned in 2000 to repair the concrete on the north abutment. This work was deferred to be included with the rehabilitation efforts discussed in this proposal. The UTRCA has also begun the phased replacement of the wooden stop-log panels. These panels have been repaired a number of times since they were last replaced in 1969, but the wooden portions of the panels have since deteriorated further and have begun to fail. Panels in poor condition have been replaced with new steel panels. Over the next 5 years it is anticipated that all stop-log panels would have to be replaced.

In July 2000, a major flood event occurred in the Upper Thames watershed resulting in an accumulation of debris that prevented the removal of an adequate number of stop logs and subsequent blockage of the spillway. These factors reduced the discharge of the dam and led to high water levels that overtopped the wing wall and shoulder on the south embankment. This overflow eroded the top of the embankment and eroded a channel in the downstream bank. Additionally, the automatic sluice gate was opened beyond its 2.13 m limit, in an attempt to provide increased flood handling capacity, resulting in significant erosion along the toe of the south bank, which, combined with wet conditions, resulted in a slope failure. Following this major flood event, and resultant damage to the south abutment, an erosion control repair study was undertaken for the dam (Acres, 2000). Conclusions and recommendations resulting from that study included the following:

- The grouted riprap on the south bank that extends approximately 30 m downstream from the dam had degraded, exposing the underlying foundation in several locations. It is proposed that this entire section of riprap would have to be removed and replaced.

- Undermining at the toe of the grout-filled nylon mattress that extends from approximately 30 to 55 m downstream from the dam has occurred resulting in cracking and slumping of the lower portion of the mattress, thereby reducing its effectiveness. The entire section of the grout-filled mattress along this reach of the bank would require replacement.

- Confirmed that the Inflow Design Flood (IDF) for the dam should be the 1:100-yr flood.

- During this flood, water would flow over the south bank, which would have to be designed to accommodate this condition.

- Flows over the south bank might also occur for lesser summer flood events if the stop logs are not all removed.

- Protection of the dam foundation at the end of the apron slab would be necessary.

- While flood handling could be achieved with the existing stop-log system, the problems with debris blockage and erosion inherent with the vertical lift gate suggest another gate system might be better suited to the site.

In 2001 and 2002, a dam safety review was undertaken (Acres, 2002) in accordance with the Draft Ontario Dam Safety Guidelines (ODSG, 1999). The objective of the assessment was to determine the adequacy of the dam and associated water retaining components with respect to flood handling, stability and safety. In addition, a basic condition assessment was made. On the basis of these evaluations, the Springbank Dam was found to be in good condition and to generally satisfy dam safety criteria. However, the downstream grouted riprap erosion protection in the riverbed was found to be cracked, broken and undermined in enough locations that it had essentially failed. Due to the potential for debris to block the spillway and hinder the removal of stop logs, the study concluded that there was a risk the dam could be overtopped as happened during the July 2000 flood event.

Key recommendations resulting from the dam safety study included the following:

- Repair the downstream grouted riprap erosion protection in the riverbed.

- Rehabilitate the south bank erosion protection.

- Consider new spillway overflow gates to allow more reliable dam operations.

- Make the dam capable of passing debris freely to avoid blockage and overtopping.

1.3 Problem Statement

As noted in Section 1.2, recent studies (Acres 2000, 2002), following the July 2000 flood event at the damsite, have identified the following structural, operational and safety concerns associated with the dam and surrounding erosion protection measures:

- Operation of the dam (i.e., stop-log removal) is required to safely pass summer flood flows through the Springbank Dam. Although the dam can pass the required inflow design flood, debris blockage of the sluiceways can make the entire flood handling operation unpredictable, uncontrollable and potentially unsafe for dam operating personnel. Debris blockage of the sluiceways can impair the ability to remove stop logs during a flood event, resulting in a decreased discharge capacity of the dam to pass flood flows. This has resulted in overtopping of the south bank of the dam, causing erosive damage to the downstream bank protection works, hazardous conditions for operational staff trying to access the dam as well as public safety concerns.

- The downstream riprap shoreline and riverbed erosion protection measures have essentially failed, resulting in undermining of the toe of the south shoreline slope and shoreline slumping. Unless repaired/rehabilitated, channel and streambank erosion will continue to the point that the structural integrity of the dam may be compromised.

It is apparent that the existing Springbank Dam requires

- rehabilitation to the dam to replace deteriorated stop logs, improve the existing hoisting equipment and/or to modify the dam to improve its debris passage ability during flood events to avoid blockage of the sluiceways and overtopping of the dam

- repairs to the downstream erosion protection works to ensure an adequate erosion protection system is in place.

The objectives of the corrective rehabilitation measures are to ensure the integrity and safe operation of the dam, and to minimize future operational and maintenance requirements.

1.4 Municipal Class EA Process

1.4.1 Overview

The Municipal Class EA (MEA, 2000) provides an approved planning process whereby municipal infrastructure projects can be planned, designed, constructed, operated, maintained, rehabilitated and retired without having to obtain project specific approval under the *Environmental Assessment Act* (EAA) provided the approved process is followed. The Municipal Class EA applies to municipal infrastructure projects undertaken by a municipality, Public Utilities Commission, Ontario Clean Water Agency or private sector developer or landowner acting as the proponent.

As part of this project's initiation, a review of the Municipal Class EA was conducted to confirm that the Municipal Class EA was applicable to the planned Springbank Dam undertaking. This information was summarized in the form of a Discussion Paper (Appendix A), which was forwarded to the Ministry of Environment's Environmental Assessment and Approvals Branch.

Figure 1.5 depicts the Municipal Class EA Planning and Design Process that consists of up to five phases, depending on the Class of Undertaking (i.e., Schedule A, B or C projects). Phase 1 consists of identifying the problem or opportunity that serves as the impetus for project implementation, while Phase 2 identifies alternative solutions to the problem or opportunity. Completion of Phase 2 allows for the identification of the Schedule that the project falls under and provides guidance on the further Class EA study requirements. For example, Schedule B projects, which generally include improvements and minor expansions to existing facilities, may be considered approved following completion of Phase 2 requirements. This requires a screening of alternative solutions and mandatory public and agency consultation. In comparison, Schedule C projects, which generally include construction of new facilities or major expansions to existing facilities, must proceed to Phases 3 and 4. This requires preparation of a more detailed Environmental Study Report (ESR) and the need to conduct additional public and agency consultation.

1.4.2 Identification of Alternative Solutions

The identification of alternative solutions was based on the requirements to address the problem statement (Section 1.3). The alternative solutions identified could reasonably be expected to achieve the desired result, giving consideration to the environmental and socioeconomic aspects of the study area.

The following alternative solutions were identified for the Springbank Dam undertaking:

- Maintain the status quo (i.e., 'do nothing').

- Conduct maintenance repairs to the dam, replace stop logs, improve hoist facilities, implement a debris management system and rehabilitate the erosion protection works.

- Replace the existing stop logs and gates with overflow gates to allow debris passage and rehabilitate the erosion protection works.

- Remove the existing stop logs and gates, install an overflow rubber dam downstream of the existing piers and rehabilitate the erosion protection works.

- Decommission and remove the dam.

Descriptions of these alternative solutions are provided in Section 3.

The following alternative solutions were identified for the damaged south bank protection works:

- Alternative 1 – Maintain the status quo (i.e., 'do nothing')
- Alternative 2 – Repair using riprap
- Alternative 3 – Repair using gabions
- Alternative 4 – Repair using a grout-filled mattress system
- Alternative 5 – Repair using riprap and selective use of armour stone.

Descriptions of these alternative solutions are provided in Section 3.

1.4.3 Selection of Class EA Project Schedule

Following the identification of alternative solutions, an assessment of the appropriate project Schedule that the undertaking could fall under was conducted. The Municipal Class EA (MEA, 2000) provides the following guidance on the assignment of dam-related projects to a particular schedule:

Schedule A – Reconstruct an existing dam or weir at the same location and for the same purpose, use and capacity.

Schedule B – Reconstruct an existing dam or weir at the same location where the purpose, use and capacity are changed. Also identified are works undertaken in a watercourse for the purpose of flood or erosion control, which may include bank or slope regrading, channelization of a watercourse and/or revetment works, among others.

Schedule C – Construct a new dam in a watercourse.

For the Springbank Dam undertaking, the Schedule C classification is not applicable since none of the project alternatives propose construction of a new dam. However, given the potential for significant environmental effects, if the dam was to be removed, this could indicate that a Schedule C may be applicable if dam removal was selected as the preferred solution.

The Schedule A classification may be applicable since the dam may be reconstructed (i.e., repaired and improved) at the same location and for the same purpose and use. However, it is possible that the inclusion of new overflow gates at the dam to improve its debris handling capacity could be construed as changing the dam’s existing capacity by increasing its flood passage ability. This suggests that a Schedule A classification may not be entirely appropriate. Also, even if the dam’s capacity did not change with the installation of new overflow gates, it is anticipated that the required repairs to the downstream erosion protection works may not be adequately addressed under a Schedule A classification.

Alternatively, a Schedule B classification is considered to be more appropriate since it includes dam reconstruction works where the capacity may change and also applies to works undertaken in a watercourse for flood and erosion control such as bank or slope regrading, channelization and construction of spillway facilities (MEA, 2000).

Given the preceding arguments, the project's moderate level of complexity and the potential for some environmental effects, a Schedule B classification was deemed the most appropriate project Class EA category for the Springbank Dam rehabilitation project.

2 Existing Environment

The following section documents the physical description of the study area in the vicinity of the Springbank Dam and provides a general description of existing natural and socioeconomic features within this defined area.

2.1 Study Area

The study area is defined as the geographical area that could be affected by any of the project alternatives. In this case, the study area extends along the Thames River and the adjoining valleylands from the upstream-most extent of the Springbank Dam reservoir (i.e., the confluence of the North and South Thames River branches) to downstream of the dam at the Boler Road Bridge (Figure 2.1). This study area was defined on the basis of the expected range of social and natural environmental effects associated with water level and flow changes that could be affected by dam operations or changes to the dam.

2.2 Natural Environment

2.2.1 Climate

Environment Canada has recorded air temperature and precipitation data at the London Airport monitoring station since 1976 (Environment Canada, 2003). Daily mean temperature at the station is 7.5°C, ranging from a high of 20.5°C in July to a low of –6.3°C in January. The highest recorded temperature on record was 38.2°C, which occurred in July 1988, and the lowest recorded temperature was –31.7°C, which occurred in January 1970. Average annual precipitation in the area is 987.1 mm, of which 82.8% falls as rain and 17.2% as snow. September and November are typically the wettest months, and February is typically the driest month. Precipitation greater than 0.2 mm occurs approximately 170 d/yr.

2.2.2 Physiography, Geology and Soils

The Springbank Dam study area lies within the physiographic region referred to as the Caradoc Sand Plains and London Annex (Chapman and Putnam, 1984a). This region generally consists of gravelly alluvium spread over the terraces of the river, with three main physiographic units identified within the study area. These include Till Moraine, Undrumlinized Till Plain and Spillway units (Chapman and Putnam, 1984b), with percentages of these units in the Forks watershed being 18, 7 and 54%, respectively (UTRCA, 2001). Spillway, i.e., the abandoned channel of a glacial melt-water stream, predominates in the area of the dam and reservoir. The underlying bedrock of the area is classified as Middle Devonian, composed of limestone, dolomite and shale (Ontario Geological Survey, 1991).

2.2.3 Surface Water Resources

The Thames River flows approximately 273 km from its headwaters northeast of London to its mouth at Lake St. Clair (CHRS, 2003). The two main branches of the Thames River, the North Branch and the South Branch, join together in London at the confluence point known locally as 'the Forks', approximately 7 km upstream from the Springbank Dam. The two branches of the Thames are fairly steep in gradient, with the North Branch falling over 120 m from its headwaters to the confluence, with the South Branch nearly as steep (Chapman and Putnam, 1984). However, downstream of the confluence, the river gradient flattens as it traverses through fairly level lake plains in a small valley, descending approximately 50 m over its remaining 140 km length (Chapman and Putnam, 1984).

2.2.3.1 Surface Water Quantity

Water Survey of Canada (WSC) maintains a network of hydrometric stations used to record streamflows at various locations throughout the Thames River watershed. The closest WSC hydrometric station to the Springbank Dam is Byron Station (02GE002), which is located 600 m downstream of the dam. At this location, the station records Thames River flows associated with a 3097-km^2 upstream drainage area.

Table 2.1 summarizes the mean monthly and maximum instantaneous flows recorded at the Byron Station based on long-term WSC flow records from 1922 to 2000. The mean annual flow of the river at this location is 38.8 m^3/s, with an average of the maximum monthly flow of 63.9 m^3/s and an average of the minimum monthly flow of 15.3 m^3/s. Flood events for the Thames River at the Springbank Dam generally occur during the period of January to April, but can also occur in the summer as evident by the high July flows (Table 2.1).

Table 2.1
Summary of Flow Data (Station 02GE002)
Thames River at Byron

Month	Mean Flow (m^3/s)	Maximum Instantaneous Flow (m^3/s)
January	38.1	735
February	48.8	852
March	107.0	1010
April	79.0	1200
May	31.8	595
June	17.0	279
July	13.8	751
August	12.1	208
September	16.5	353
October	19.9	460
November	36.3	584
December	44.5	529
	Mean Annual 38.8	**Maximum Recorded 1200**

Spring floods are generally a result of snowmelt, rainfall or a combination of both and runoff is generally rapid with major peaks occurring within a day of extreme warm temperatures or heavy rainfall (Acres, 2002). Summer floods occur as a result of heavy rainfall events and are generally less severe than spring floods in terms of peak flows and flood volumes. However, during the summer, the stop logs are installed in the dam and the upstream water level is thus higher. Given this fact, and the potential for debris blockage through the sluiceways, flow passage through the dam can be impeded, resulting in higher upstream water levels for summer floods than for spring flood conditions when the dam is completely open.

A flood frequency analysis has been conducted to determine the flows at the dam associated with various return periods (Acres, 2002). Due to the various combinations of stop-log settings at the dam, both a spring rain or snowmelt and a summer storm have been modeled using the normal stop-log configuration that would be present at such a time. Table 2.2 provides a summary of this information as well as the resulting peak water levels in the Springbank Dam reservoir during such events.

Table 2.2
Peak Flows and Water Levels at Springbank Dam

Event Timing	Storm Return Period (yr)	Peak Outflow (m^3/s)	Peak Water Level (m)
Spring Rain or Snowmelt*	2	580	228.58
	5	821	229.65
	10	979	230.39
	20	1130	230.92
	50	1330	231.72
	100	1470	232.04
	250	1667	232.51
	500	1820	232.66
	1000	1969	232.90
Summer Storm**	2	189	230.30
	5	344	231.20
	10	460	231.71
	20	584	232.20
	50	765	232.70
	100	916	233.00
	250	1080	233.61
	500	1330	234.22
	1000	1534	234.62

1 Dam deck is at elevation 233.30 m.
* All stop logs and support beams removed for winter.
** All stop logs in place and vertical lift gate open.

Figure 2.2 depicts a longitudinal profile of the 7.3-km long Thames River study reach through the study area based on the results of HEC-2 computer modeling (Acres, 2002). The figure shows the various water surface profiles along the waterway for the following scenarios:

- Normal summer regulated water level with all stops logs installed in the dam and the vertical lift gate closed.

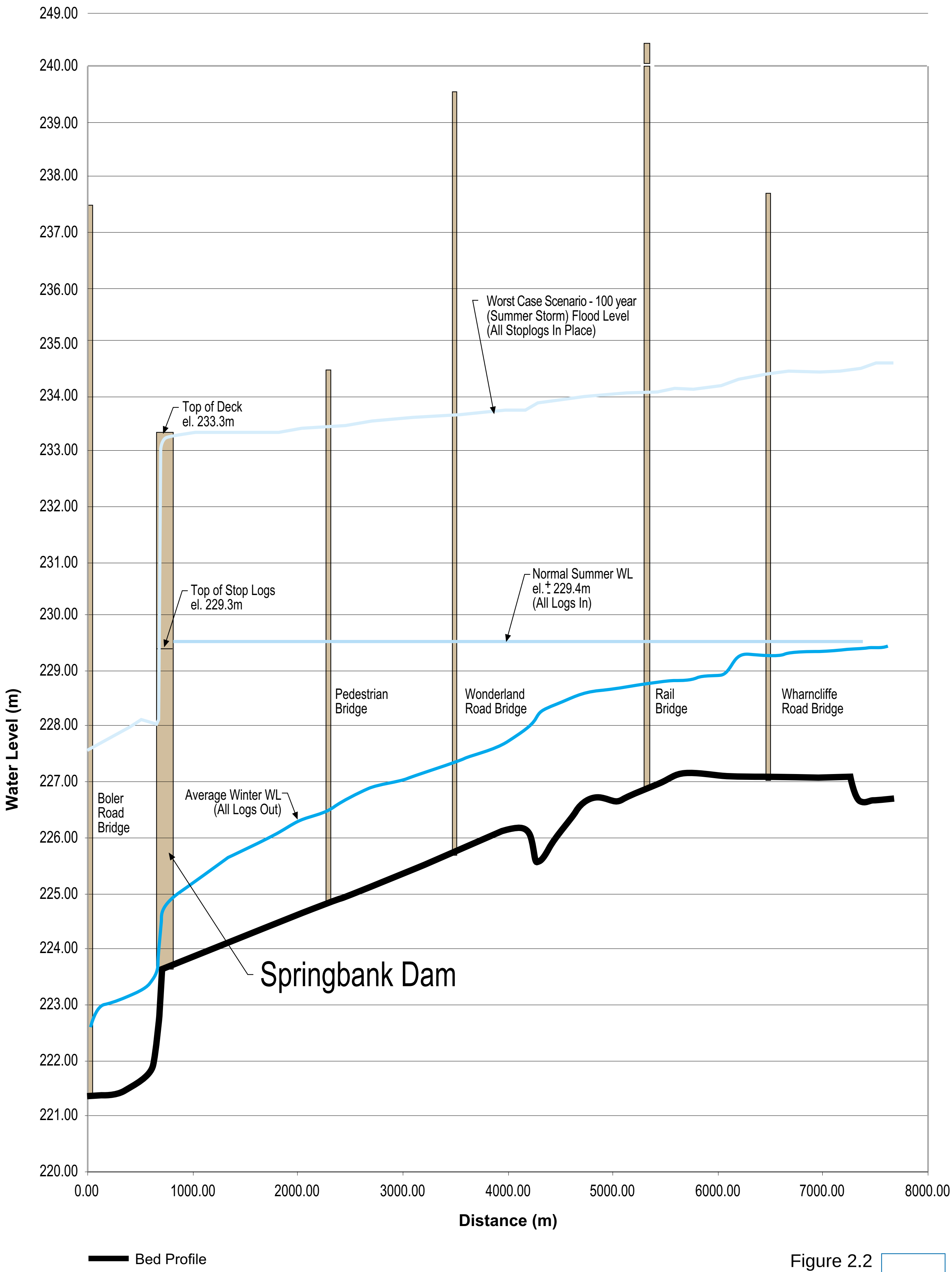

Figure 2.2
Corporation of the City of London
Springbank Dam Rehabilitation Class EA
Longitudinal Profile of Thames River Through Study Area

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- Average winter unregulated water level with all stops logs removed from the dam and the vertical lift gate open.

- Worst case scenario - 100-yr (summer storm) flood water level with all stops logs installed in the dam and the vertical lift gate open.

2.2.3.2 Surface Water Quality

UTRCA classifies surface water quality within the Upper Thames River according to a number of indices including benthic invertebrates (Family Biotic Index), phosphorus concentrations, bacterial concentrations and conductivity. According to the 2001 Upper Thames River Watershed Report Card (UTRCA, 2001), surface water quality within the Forks watershed (i.e., Springbank Dam upstream to the base of Fanshawe Dam) is poor, with an overall grade of D (on an A to E scale, with A being the best). The report indicates that the measured surface water quality metrics show a significant decline as water flows through the Forks area.

The Benthic Score for this section of the river was 6.17, compared to the overall watershed score of 5.66 (on a scale from 1 to 10, with 1 indicating a pollution sensitive benthic community and 10 indicating a pollution tolerant benthic community), indicating the presence of invertebrate species tolerant of polluted conditions. The phosphorus concentration, based on a 10-yr average (1990 to 2000), was found to be 0.18 mg/L, six times higher than the Provincial Water Quality Objective of 0.03 mg/L, identified to eliminate excessive plant growth in rivers and streams (MOEE, 1994). UTRCA indicates that the high phosphorus concentrations recorded through this section of the river suggest inputs of materials such as fertilizers, eroded soils, spills and other effluent. Three pollution control plants (Adelaide, Greenway and Vauxhall) discharge treated effluent into this section of the river. Additionally, a number of properties in the vicinity of Springbank Drive are serviced by septic systems.

Ten years (1990 to 2000) of monitoring has indicated average fecal coliform bacterial concentrations of 690 organisms per 100 mL, which is nearly seven times the allowable amount for recreational swimming. Average bacterial concentrations throughout the Upper Thames River watershed over this same time period were 304 organisms per 100 mL. UTRCA indicates that bacterial levels are relatively low prior to flow through this section of the river. High fecal coliform levels generally indicate contamination from human/animal waste (UTRCA, 2001). Combined sewer overflows (i.e., when combined sanitary and storm sewage is discharged directly to the river during flood events) may be a source of such waste.

Conductivity, used as an indicator of the level of dissolved solids and pollutants in the river, measured 585 µs/cm, compared to the watershed average of 642 µs/cm, resulting in a score of C for this metric.

Surface water quality within the section of river downstream from the Springbank Dam (i.e., 'River Bend') was also classified as poor, scoring a grade of D, in the 2001 watershed report card. Due to its location in the lower reaches of the Upper Thames River watershed, water quality through this reach is heavily influenced by activities occurring throughout the rest of the watershed. UTRCA reports that water quality has deteriorated in the last 30 years, with a number of parameters, including nitrates, suspended solids, conductivity and phosphorus, all increasing. Benthic indicators in this section of the river are poorest in the area immediately downstream from the Springbank Dam, although they improve farther down the river system.

2.2.4 Aquatic Ecology

2.2.4.1 Fisheries Resources

The UTRCA has produced comprehensive listings of all fish species recorded in sampling throughout the watershed (i.e., Municipal Drain Fisheries Surveys, Royal Ontario Museum Fish Sampling Database). A total of 30 species of fish have been recorded in the Forks watershed upstream from Springbank Dam, while 58 species have been recorded in the River Bend watershed downstream of the dam. Table B1 (Appendix B) provides a checklist of species captured in these two areas, although it should be noted that some of the data comes from areas outside the study area for this project (i.e., on the Thames River upstream or downstream from the study area, or within tributaries of the main Thames River). Additionally, two common carp (*Cyprinus* carpio) were observed upstream from the dam during the field survey on July 24, 2003, although this species is not listed as occurring in the Forks watershed. Gamefish species present in the Thames River include northern pike (*Esox lucius*), Smallmouth Bass (*Micropterus dolomieui*), and migratory walleye (*Stizostedion vitreum*) and salmonids.

The dam, due to its seasonal operation pattern (i.e., all stop logs are in place from late spring to early fall) represents a temporal barrier to fish movement between the reservoir and downstream areas. One of the primary objectives associated with operation of the Springbank Dam is to ensure effective passage of spring-spawning walleye, which migrate upstream from Lake St. Clair, the St. Clair River and Lake Huron, a distance of over 140 km, past the dam to spawning sites in upstream reaches of the Thames (MacLennan, pers. comm., 2003). Fanshawe Dam on the North Thames River and Hunt Dam on the South Thames River represent the next upstream barriers to fish migration and the upstream limit of walleye migration. Migration commencement and spawning times are generally related to water temperatures in the river, with most runs beginning when temperatures reach 7 to 10°C (MacLennan, pers. comm., 2003). Walleye fry hatched in the London area of the Thames River are only typically resident in the river for approximately 15 to 24 hours before drifting down into Lake St. Clair (MacLennan, pers. comm., 2003). The Thames River walleye spawning is relatively large, although declining (J. Schwindt, pers. comm., 2003). MNR index netting surveys conducted at the mouth of the Thames River have been used to estimate the size of the spawning population, with catch decreasing substantially since 1982 (MacLennan, pers. comm., 2003).

The Thames River supports a very diverse fish community, totaling 88 species over its entire length, including a number of rare species in the immediate vicinity of the Springbank Dam. Greenside darter (*Etheostoma blennoides*), found abundantly both upstream and downstream from Springbank Dam, are listed as Special Concern by the Committee on the Status of Endangered Wildlife In Canada (COSEWIC). Greenside darters typically inhabit rocky riffle areas in creek and rivers, and are highly specialized in their spawning habitats, utilizing algae covered rocks in riffles (UTRCA, 2003). Black redhorse (*Moxostoma dequesnei*), listed as Threatened by COSEWIC, are fairly common upstream from the dam (J. Schwindt, pers. comm., 2003). Black redhorse are generally found in medium-sized rivers over bottoms of sand, gravel or bedrock, in areas free of siltation (UTRCA, 2003). Silver shiners (*Notropis photogenis*) are found in the London area both upstream and downstream from Springbank Dam, although in sparse numbers (J. Schwindt, pers. comm., 2003). Silver shiners, which inhabit medium to large, clear, swift streams, are listed as a species of Special Concern by COSEWIC. Eastern sand darter (*Ammocrypta pellucida*), listed as Threatened by COSEWIC, is found downstream from the dam, although in very sparse numbers. This species inhabits sandy bottom areas of streams and rivers (UTRCA, 2003).

2.2.4.2 Benthic Community

UTRCA has conducted benthic community sampling in the Upper Thames River for a number of years in order to monitor water quality conditions within the river. Sampling conducted within the river reach through Springbank Park in 1997, at a site immediately downstream from Springbank Dam, found a total of eight families of benthic invertebrates including mayflies (Ephemeroptera), midges (Chironomidae), caddisflies (Trichoptera), true flies, worms (Oligochaeta) and fingernail clams. The Family Biotic Index (FBI) rating for this site indicated Fair stream health based on the composition of the benthic community and their overall pollution tolerance. Sampling data from the Thames River farther downstream from the dam at the west end of Oxford Street is available for 3 years (1999 to 2001). Stream health, based on the results of the benthic analysis, was rated as Fairly Poor in both 1999 and 2000, with corresponding FBI scores of 5.78 and 6.09, respectively, while in 2001 stream health was rated as Fair, with an FBI of 5.31. Samples from this site generally included high numbers of pollution tolerant oligochaete worms, and moderately tolerant chironomid midges. Stream health ratings from a sampling site in the South Thames River (off Watson Street, upstream from the confluence of the north and south branches) ranged from Poor in June 1999 (FBI 7.04) to Good in October 2001 (FBI 4.82). The Good rating was generally accompanied by high abundances of moderately pollution sensitive net-spinning caddisflies and low numbers of oligochaete worms. However, the June 2001 sampling event resulted in a Fairly Poor rating, due in part to high numbers of tolerant oligochaetes, indicating a seasonal trend in benthic community composition and resulting stream health values.

2.2.4.3 Aquatic Habitat

The Thames River study area upstream from Springbank Dam to the Forks is relatively wide (approximately 50 to 75 m), deep and slow moving. This is due in part to the low gradient nature of the river, but mostly due to the presence of the dam. During the summer months when all the stop logs are placed in the dam, the river maintains a deeper center channel bordered by relatively steeply sloping banks. Shoreline substrate is generally a mix of cobble, gravel and sand, although most areas have a covering of fines and periphyton, which is generally indicative of the depositional nature of this reach during the summer. Shorelines are, for the most part, vegetated with overhanging shrubs and trees predominating, although forbs are also present. Several large deadfall trees were observed along the shoreline. No aquatic macrophytes were observed during the field survey conducted on July 24, 2003. Water visibility, although not measured during the field survey, was observed as relatively low.

Aquatic habitat during the fall, winter and early spring months differs markedly from the summer months, as all stop logs are removed from the dam and the Thames River assumes its natural level through the upstream reach.

Downstream from the dam, a complex of three small islands divides the flow of the river into three separate channels. The head of the island appears to represent a vertical control for this section of the river as each channel drops in gradient over a series of rocky riffles (dominated by small boulders and cobbles), until the convergence of flow downstream from the islands. The river then assumes its low gradient characteristics as it flows farther downstream.

2.2.5 Terrestrial Ecology

2.2.5.1 Riparian Vegetation and Habitat

The Thames River valley is situated within the biologically rich Carolinean forest area of southwestern Ontario and is home to many floral species rarely found elsewhere in Canada (Thames River Coordinating Committee, 1998). However, forest conditions within the Forks Watershed of the river, situated within the highly developed City of London, scored a D grade in the 2001

Watershed Report Card, due to its low percentage of forest cover, sparsely interconnected nature of remaining forested areas and almost nonexistent interior forest cover (UTRCA, 2001). Much of the forested land within this section of the watershed, does however, exist along the banks of the Thames River. Springbank Park, an 87.7-ha urban park consisting of a variety of natural features including woodlots and meadows, occupies much of the riparian zone of the Springbank Dam reservoir. The park and associated bike and multiuse trail network runs from the Boler Road Bridge, along the shorelines of the river, upstream to the forks of the Thames. Although much of the park is highly manicured (i.e., landscaped grassy areas), the area contains a considerable amount of treed area, including most of the riparian zone immediately adjacent to the river. The park's vegetated areas range in size from a narrow band of approximately 50 m along the shoreline, to a wide band of nearly 200 m. No rare vegetation species are known to exist along the riparian zone within the study area.

2.2.5.2 Wildlife

A total of 36 species of mammals have been recorded within the Thames River watershed (Thames River Coordinating Committee, 1998), although it is unlikely, given the highly disturbed and urbanized nature of the much of the study area, that many of these species would make use of the habitats present in the Springbank Dam area.

Approximately 157 bird species have been recorded in the entire Thames River watershed including a number of species dependant upon aquatic environments, such as Great Blue Heron (*Ardea hirodeas*), belted kingfisher (*Ceryle alcyon*) and many waterfowl species (Thames River Coordinating Committee, 1998). A vast number of ducks (e.g., mallards) and Canada geese were observed in Springbank Park during the field survey of July 24, 2003. Additionally, two adult trumpeter swans (*Cygnus buccinator*) with two young were observed in an isolated side channel pool on the south shore of the river.

Approximately 30 reptile and amphibian species inhabit the Thames River. The area within 100 metres, both upstream and downstream, of the Springbank Dam is home to eight reptile and amphibian species. These include

- Common Snapping Turtle (*Chelydra serpentina serpentina*)
- Midland Painted Turtle (*Chrysemys picta marginata*)
- Eastern Spiny Softshell Turtle (*Apalone spinifera spinifera*)
- Northern Map Turtle (*Graptemys geographica geographica*)
- Eastern Garter Snake (*Thamnophis sirtalis sirtalis*)
- Northern/Midland Brown Snake (*Storeria dekayi dekayi*)
- Green Frog (*Rana clamitans*)
- American Toad (*Bufo americanus*).

All of these species are either aquatic or use the shoreline for feeding, cover or breeding.

The eastern spiny softshell turtle is listed by COSEWIC as Threatened in Canada and by the MNR as Threatened in Ontario. The northern map turtle is listed by COSEWIC as a species of Special Concern in Canada. Both of these species have been observed in close proximity to the dam (within 20 m). It is unknown if hibernation sites occur nearby.

2.2.6 Significant Natural Areas

No significant natural areas are located within the defined boundaries of the study area for this project, although two significant natural areas exist within the general vicinity of the study area: Sifton Bog and The Coves. Sifton Bog is an 85-ha natural area, dominated by a 30-ha interior kettle bog, located approximately 1.5 km north of Springbank Dam. This site has been designated as a Regionally Significant Life Science Area of Natural and Scientific Interest (ANSI) by the Ontario Ministry of Natural Resources and an Environmentally Significant Area (ESA) by the City of London, as well as being designated as an International Biological Program Site (MNR, 1998a; MNR, 1998b). The bog sits in a depression in the morainic plain along the upper terraces adjacent to the Thames River Valley and consists of a small open water center, fringed by a floating bog-mat, and ringed by swamp shrub thicket and upland forest. The site is significant as it is one of the few floating mat-bog communities remaining in southwestern Ontario, and has been the subject of a vast amount of research into its natural history and community composition. This site is hydrologically (surface water) isolated from the Thames River.

The Coves is a 15- to 20-ha area located approximately 200 m south of the Horton Street River crossing over the Springbank Dam reservoir. The site is designated as a Life Science Site by the MNR and consists of three ponds occupying an abandoned oxbow of the Thames River (MNR, 1998c). A small creek gully runs into the ponds, with surrounding vegetation communities dominated by upland forest consisting of large sugar maple (*Acer saccharum*), red oak (*Quercas rubras*) and blue beech (*Carpinus carolineana*) (MNR, 1998c). Surface drainage from the Coves area outlets into the Thames River within the study area, with the flow of water from the Thames River back into the Coves during flood events controlled by flap gates. The operation of the flap gates is affected by the backwater elevation of the Thames Rivers, which in turn, is affected by the operations of the Springbank Dam. In addition, dykes protect the area from flooding from the Thames River.

2.3 Socioeconomic Environment

2.3.1 Land Use and Zoning

A variety of land uses occur within the study area along the shorelines of the Thames River. Parklands owned and managed by the City of London dominate the land use within the study area, although other uses in the area include

- Greenway Pollution Control Plant (PCP)
- two cemeteries
- Storybook Gardens children’s play area
- City of London Heritage Waterworks building
- City of London Parks and Recreation greenhouses
- Thames Valley Golf Course
- Wonderland Gardens and Riverview Restaurant
- London Canoe Club
- London Rowing Club
- urban residential areas
- municipal roads network
- railway line corridor.

Some sections of the northern shore of the river along the reservoir are privately owned, with private residential lots backing directly onto the shoreline of the river. Several docks were observed along this shoreline during the field survey on July 24, 2003.

The UTRCA currently maintains a License of Occupation (LOO), License No. 9497 for the right to occupy the riverbed by Springbank Dam.

2.3.2 Municipal Infrastructure

The study area is situated within the City of London proper, and, as such, exhibits municipal infrastructure consistent with that of a large urban city. Infrastructure existing in the vicinity of the river includes

- Boler Road Bridge crossing
- Springbank Dam
- Springbank Footbridge river crossing connecting Springbank Park with the Thames Valley Golf Course
- Wonderland Road Bridge crossing
- railway bridge river crossing
- Coves flood gate
- Wharncliffe Road Bridge crossing
- Queens Avenue and York Street Bridge crossing upstream of the Forks
- various dikes
- numerous storm sewer outfalls discharging into the Thames River.

2.3.3 Heritage Resources

The Thames River has a longstanding history of cultural use, first by First Nations and then later by colonizing Europeans. First Nations utilized the river and surrounding valley lands as an important travel route from Lake Ontario to the river crossing on the Detroit River (Bowles, 1998). They likely utilized the surrounding valley lands as resting, hunting and gathering areas due to the rich floral and faunal bounty provided by the highly diverse Carolinean forest. Europeans first began to utilize the river during the late 1700s both as a travel route between developing colonies in southwestern Ontario and for industrial purposes such as shipping timber downstream to developing markets such as Detroit (Bowles, 1998).

Although little specific information regarding the cultural heritage features of the study area was available during production of this report, it is undeniable that the damsite (the existing dam in conjunction with the original dams at the site), represents a significant historical icon to the City of London. A dam was first constructed at the site in 1882, and, although washed out several times prior to construction of the existing dam in 1929, represented an important resource in terms of the benefits it provided (i.e., water resource, steam plant and recreation). The former waterworks/water pumping station, now utilized as a City of London Parks and Recreation workshop/storage area, located on the southern shore of the river approximately 700 m upstream from the dam has been designated as a City of London Heritage Property.

2.3.4 Parks and Recreation

The City of London's Vision Statement, used to guide development of the City's Parks and Recreation Strategic Master Plan, states that "recreation is essential to the social, cultural, and economic well being of the community and shall be a core service of the City of London" (Monteith Planning Consultants et al., 2003). Indeed, public consultation activities conducted during development of the Master Plan found that city residents felt that the parks, trails and open space system are the City's greatest asset (Monteith Planning Consultants et al., 2003). One of the Guiding Principles of the plan was that maintenance and enhancement of the parks and pathways of the city should remain the primary recreation and leisure infrastructure priority (Monteith Planning Consultants et al., 2003).

Many of the City's parks and pathways focus on the natural lands surrounding the Thames River. The Master Plan states "the valley lands of the Thames River and its tributaries shall continue to be regarded as the primary open space resource in the City" (Monteith Planning Consultants et al., 2003). The land uses surrounding the Thames River within the study area encompassed by this Class EA are dominated by parkland. Springbank Park, located on the southern shore of the river adjacent to and upstream from Springbank Dam, is the largest of the parks in the study area, although several others, including Greenway Park, McKillop Park, Kensal Park, Riverforks Park and Labatts Park, are also located within the vicinity of the riverbanks through the study area (Figure 2.1).

Springbank Park, first established in 1878, is a well-used, 87.7-ha recreational/natural area supporting a variety of recreational pursuits including biking, inline skating and hiking on a paved network of trails, picnicking in the park, canoeing, rowing and fishing in the reservoir, and sports (e.g., soccer fields and baseball diamonds). The City of London classifies Springbank Park as a Citywide or Regional park due to the fact that it attracts not only city residents but also tourists (Monteith Planning Consultants et al., 2003). The Strategic Master Plan states that parks of this nature will be a focus as the city continues to maintain and improve parks on an annual basis (Monteith Planning Consultants et al., 2003).

The London Canoe Club and the London Rowing Club both make extensive use of the Springbank Dam reservoir during the months of May to October. The Clubs share a boathouse leased from the City of London and jointly promotes the recreational and sporting benefits of paddling and rowing. The London Canoe Club has 2000 members and 6000 users, and is the largest canoe club in North America. The London Rowing Club has 1000 members (Sauder, pers. comm., 2003). The Clubs hold numerous canoeing and rowing events on the waterway through the study area each year including dragon boat racing and regattas.

The study area also incorporates an extensive trail and pathway network extending along the entire southern bank of the river and along much of the northern bank in the upstream section of the study area. This multi-use trail/pathway links the network of parks located in the study area and continues along much of the North and South Branches of the Thames River upstream from the study area. This pathway is heavily used by the local community and tourists alike, and becomes all the more significant in the citywide context as local residents have indicated that improving the pathway network within the city should be a top priority (Monteith Planning Consultants et al., 2003).

3 Alternative Solutions and Evaluation

The identification of alternative solutions for the Springbank Dam was based on the requirements to address the problem statement (Section 1.3). This included the need to establish corrective solutions to, (i) repair the damaged south bank erosion protection works and to, (ii) rehabilitate the dam to make repairs to the dam structure and tailrace, and to provide for the safe passage of debris through the dam. The following sections discuss the identification and evaluation of alternative solutions and the identification of a recommended solution for each of the above aspects.

3.1 South Bank Erosion Protection Works

3.1.1 Identification of Alternative Solutions

In regards to the downstream south bank erosion protection works, a previous study (Acres, 2000) had examined potential alternative methods to repair the damage caused by the July 2000 flood. The repair options focused on two different sections of the existing south bank erosion protection works, namely:

- Section 1, which refers to the grouted riprap that extends from the dam abutment to a distance of approximately 30 m downstream (Figure 1.2). This section of the erosion protection measures was constructed in 1971 and consists of a single layer of large-sized riprap stone under laid by graded bedding materials consisting of a sand and gravel blanket. The riprap stone was grouted with concrete. Over the years, as a result of freeze-thaw and other problems, the riprap degraded, locally exposing the underlying foundation. This section was extensively damaged during the July 2000 flood.

- Section 2 refers to the grout-filled nylon mattress that extends from the end of the grouted riprap to a distance of approximately 55 m downstream from the dam (Figure 1.2). This section of the erosion protection dates to 1981 and was repaired in 1986. It currently is undermined at the toe, resulting in cracking and slumping of the lower portion of the mattress. It is also slightly undermined at the crest due to the July 2000 flood.

As part of the 2000 Erosion Repairs Study (Acres), the following remedial repair/rehabilitation options were identified and assessed in order to address the damaged south bank erosion protection works:

- Option 1 - Repair using riprap in Sections 1 and 2
- Option 2 - Repair using a grout-filled mattress in Sections 1 and 2
- Option 3 - Repair using gabions in Sections 1 and 2
- Option 4 - Repair using riprap in Section 1 and a grout-filled mattress in Section 2
- Option 5 - Repairs using gabions in Section 1 and a grout-filled mattress in Section 2

The previous study recommended that Option 1 – Repair using a riprap revetment for both Sections 1 and 2 be considered as the recommended method of resolving the damaged south bank erosion protection works. It was cited as providing better advantages in terms of aesthetics, maintenance and life expectancy.

As part of this Class EA, the previously examined erosion repair options noted above were reviewed, as was an additional option of selectively using armour stone. Based on the review, the following final alternative solutions were identified to repair the south bank erosion protection works:

Alternative 1 - Maintain the status quo (i.e., ‘do nothing’).

Alternative 2 - Repair the south bank erosion protection works using riprap.

Alternative 3 - Repair the south bank erosion protection works using gabions.

Alternative 4 - Repair the south bank erosion protection works using a grout-filled mattress system.

Alternative 5 - Repair the south bank erosion protection works using riprap and selective use of amour stone.

3.1.1.1 Alternative 1 – Status Quo (‘Do Nothing’)

This alternative involves continuing with the existing south bank erosion protection works in their current condition. This conceptual alternative provides a baseline condition with which to compare each of the other alternatives and also considers the potential ramifications of undertaking no rehabilitation to the damaged south bank erosion protection works.

3.1.1.2 Alternative 2 - Repair the South Bank Erosion Protection Works Using Riprap

This alternative would involve the removal of the existing grouted riprap on the south bank, a distance of approximately 30 m downstream of the dam and the removal of the grout-filled mattress located immediately downstream of the grouted riprap for a distance of about 25 m (55 m total). The south bank slope would then be regraded in order to construct proper bedding and filter layers for the proposed new riprap, which would be laid on top. In addition to these works, the south abutment would be elevated to the level of the adjacent concrete cap to reduce the potential for erosion damage associated with overtopping, and the existing south roadway would be regraded to create a training dike to direct any future overtopping flows safely down the south bank and into the river channel immediately downstream of the dam.

3.1.1.3 Alternative 3 - Repair the South Bank Erosion Protection Works Using Gabions

Gabions consist of wire baskets tied together, filled with selected sized rock fill. The south bank slope would also have to be regraded in order to place new proper granular bedding. The toe would be constructed using gabions to form a protective wall.

3.1.1.4 Alternative 4 - Repair the South Bank Erosion Protection Works Using a Grout-Filled Mattress

A grout-filled nylon mattress system, similar to the existing protection layer on the south bank, would be placed on top of new granular bedding. The toe of slope (wall) would likely be constructed using riprap or armour stone.

3.1.1.5 Alternative 5 - Rehabilitate the South Bank Erosion Protection Works Using Riprap and Selective Use of Amour Stone

This alternative would be similar to Alternative 2, in that riprap would be used on the bank slope, but would also include the selective use of armour stone to construct the toe of slope and to create a stepped pedestrian access that would extend down the south bank slope from the roadway to the toe of slope wall. The use of armour stone may provide additional aesthetic benefits and allow for safer foot access to the river for fishermen, and for canoers/kayakers seeking a portage around the dam.

3.1.2 Evaluation of Alternative Solutions

In order to identify the most appropriate solution for the rehabilitation of the damaged south bank erosion protection works, the potential alternatives were compared in terms of their overall effectiveness, estimated cost, and net environmental effects. This process is summarized in Table 3.1 and the key points are discussed in the following section.

3.1.2.1 Alternative 1 – Status Quo ('Do Nothing')

The Do Nothing alternative is not an effective solution to address the dam safety issues associated with the deteriorated state of the south bank erosion protection works. Since no repairs are associated with this alternative, it is the least capital cost alternative. However, without repairs to the erosion protection works, increasingly expensive maintenance and repairs will continue into the foreseeable future.

Since no repairs are proposed for this alternative, no constructed related effects are anticipated to the natural or social environments. However, without rehabilitation repairs to the downstream erosion protection works, potential undermining of the south bank toe of slope could continue under flood conditions, jeopardizing its stability and integrity. If left unrepaired, the south bank area would need to continue to be fenced-off for reasons of public safety. This would negatively affect the public (i.e., fishermen, canoeists, etc) trying to access the river immediately downstream of the dam.

Overall, Alternative 1 is not a viable solution.

3.1.2.2 Alternative 2 - Repair the South Bank Erosion Protection Works Using Riprap

Alternative 2 would be an effective repair solution to resolve the deteriorated condition of the damaged south bank erosion protection works. The use of riprap is considered to be more aesthetically pleasing, and would have a longer-life span and require less maintenance than gabions (Alternative 3) or a grout-filled mattress (Alternative 4). However, pedestrian access down a riprap slope would be considered somewhat unsafe although not as hazardous as a grout-filled mattress slope under wet conditions.

The potential natural and social environmental effects resulting from the implementation of this alternative would be similar to those of Alternatives 3, 4 and 5. Short-term disruption of the natural environment (e.g., in-stream construction work, possible cofferdam installation and dewatering) and of the social environment (e.g., construction noise and traffic, disruption of park usage) could be expected to occur. However, standard construction site management measures (e.g., in-water construction timing restrictions, erosion and sediment controls, security fencing and safety signage, construction scheduling and site restoration) would mitigate much of the magnitude of the potential effects. Overall, the long-term land and water based recreational uses of the south bank area would continue for the foreseeable future.

The estimated construction cost of this alternative is slightly lower than Alternatives 3 or 4, but public safety concerns associated with pedestrian access down the riprap slope make it less favorable than Alternative 5.

3.1.2.3 Alternative 3 - Repair the South Bank Erosion Protection Works Using Gabions

Alternative 3 would be an effective repair solution to resolve the deteriorated condition of the damaged south bank erosion protection works. Although it is plausible that the gabions could be constructed to create a stepped pedestrian access down the slope, gabions are considered to be the least aesthetically pleasing of all alternatives and would be susceptible to vandalism and increased maintenance compared to the other alternatives. Overall, the potential natural and social environmental effects resulting from the implementation of this alternative would be the same as those of Alternatives 2, 4 and 5.

The estimated construction cost of this alternative is higher than Alternatives 2, 4 or 5, and its potentially high maintenance costs make it an inferior alternative and difficult to justify.

3.1.2.4 Alternative 4 - Repair the South Bank Erosion Protection Works Using a Grout-Filled Mattress System

Alternative 4 would be an effective technical repair solution to resolve the deteriorated condition of the damaged south bank erosion protection works. The use of a grout-filled mattress would blend into the south bank surroundings since it would match the existing downstream south bank erosion protection works. A grout-filled mattress would have a moderately long-life span, but if settlement and cracking were to occur, maintenance and repair costs would be significantly higher than with the riprap (Alternatives 2 or 5). Also, pedestrian access down a grout-filled mattress slope would be considered unsafe especially during wet conditions due its to slippery surface. This disadvantage aside, the overall potential natural and social environmental effects resulting from the implementation of this alternative would be similar to those of Alternatives 2, 3 and 5.

The estimated construction cost of this alternative would be slightly higher than Alternatives 2 or 5. Its potentially high maintenance costs and unsafe nature for pedestrian access make it less desirable than Alternatives 2 and 5.

3.1.2.5 Alternative 5 - Repair the South Bank Erosion Protection Works Using Riprap and Selective Use of Amour Stone

Alternative 5 would be highly effective at resolving the deteriorated condition of the damaged south bank erosion protection works. As noted for Alternative 2, the use of riprap is considered to be more aesthetically pleasing, and would have a longer-life span and require less maintenance than gabions (Alternative 3) or a grout-filled mattress (Alternative 4). The concern for safe pedestrian access down the riprap slope could be resolved through the use of armour stone to create a stepped pedestrian access from the road to the toe wall. Armour stone may also be used for the toe of slope wall. Armour stone would provide additional aesthetic benefits. The overall potential natural and social environmental effects resulting from the implementation of this alternative would be similar to those of Alternatives 2, 3 and 4.

The estimated construction cost of this alternative would be similar to Alternative 2. This, and the added aesthetic appeal and the benefit of a safer pedestrian access/canoe portage provided by the use of armour stone, make it an effective solution.

3.1.3 Selection of the Recommended South Bank Erosion Protection Works Solution

The recommended solution for the rehabilitation of the damaged south bank erosion protection works is **Alternative 5 – Repair the south bank erosion protection works with riprap and selective use of armour stone**. This alternative would be effective at resolving public and environmental safety concerns, at reducing long-term maintenance costs, and at minimizing negative impacts to the environment.

The use of riprap would provide a more natural, aesthetically pleasing solution at the damsite and would provide advantages in terms of a long-life span and reduced maintenance. The concern for safe pedestrian access down the riprap slope could be resolved through the use of armour stone to create a stepped pedestrian access from the road to the river. Armour stone could also be used for the toe of slope, and may provide additional aesthetic benefits. Construction impacts on the existing environment can, for the most part, be mitigated by implementation of standard construction site best management, erosion and sediment controls, and proper site restoration. The existing land and water based recreational uses of the river and the south bank area would not be adversely affected, but rather would benefit from the improvements proposed for safer pedestrian access to the river.

Overall, this alternative represents a cost-effective means of resolving the stated problems, while minimizing impacts to the local natural and social environments.

3.2 Dam Rehabilitation Works

3.2.1 Identification of Alternative Solutions

The following alternative solutions were identified for the Springbank Dam to rehabilitate the structure to improve its debris passage ability and to repair the deficiencies such as the in-stream and north bank erosion protection works:

Alternative 1 - Maintain the status quo (i.e., 'do nothing').

Alternative 2 - Conduct maintenance repairs to the dam, replace stop logs, improve hoist facilities, implement a debris management system.

Alternative 3 - Replace the existing stop logs and gates with overflow gates.

Alternative 4 - Remove the existing stop logs and gates, install an overflow rubber dam downstream of the existing piers.

Alternative 5 - Decommission and remove the dam.

Other dam rehabilitation alternatives were considered to address the objective of improved debris passage through the structure. These alternatives included converting the dam to a concrete overflow weir or replacing the existing stop logs and gates with either vertical lift gates or emergency-fail stop logs. However, based on the considerable disadvantages associated with these alternatives, these alternatives were removed from further consideration as feasible solutions.

In addition to the damaged south bank erosion protection works, previous studies (Acres, 2000; Acres, 2002) have reported that the riverbed has a number of erosion holes and that there is the possibility of erosion extending beneath the tailrace apron slab. Also, the erosion of the riverbed has been assessed as contributing to the south bank slumping problems at the toe of the slope. Thus, for future remedial works, it is essential that the foundation be adequately treated. The riverbed/tailrace erosion repairs are considered part of the Dam Rehabilitation Works.

3.2.1.1 Alternative 1 – Status Quo (‘Do Nothing’)

This alternative involves continuing with the existing Springbank Dam in its current condition, with no significant changes to the dam or its operational management. This conceptual alternative provides a baseline condition with which to compare each of the other alternatives and also considers the potential ramifications of undertaking no substantive rehabilitation to the dam structure. Thus, the regular routine maintenance schedule would be observed and the dam would continue to be operated in its current regime.

3.2.1.2 Alternative 2 – Conduct Maintenance Repairs to the Dam and Hoist Facilities, and Implement a Debris Management System

This alternative would involve maintenance and dam safety repairs to the structure including the replacement of the failing stop logs, concrete repairs, replacement of deficient handrails, and works to upgrade the stop-log hoist to ensure safer and more reliable operation. These works would be coupled with the implementation of a debris management system such as a log boom upstream of the dam to trap floating debris to address the issue of debris build-up in the dam. To address deficiencies associated with the tailrace in-stream erosion protection works and the north downstream shore, the damaged grouted riprap downstream of the apron would be repaired, the failing shotcrete surface at the north retaining wall would be refaced, and the surface of the north abutment fill area would be cleared of vegetation and regraded to direct flow off the surface.

3.2.1.3 Alternative 3 - Replace the Existing Stop Logs and Gates with Overflow Gates

This alternative would involve removal of all stop-log gains, overshot gates, gantry hoist/crane, vertical sluice gate and the intermediate steel piers, in order to install overflow gates in each of the four main sluiceways, which would allow the passage of debris through the dam. As with Alternative 2, the necessary repair works to rehabilitate the damaged tailrace in-stream and north bank erosion protection measures would also be conducted.

Examples of possible overflow gate types would include hinged flap gates controlled hydraulically or by a cable system, or an Obermeyer-type gate, which utilizes a hinged flap gate controlled by an inflatable bladder. The installation of overflow gates (each a full bay width between concrete piers) would eliminate the existing vertical steel stop-log gains, which would vastly improve the debris passage capability of the dam. Overflow gates would still allow for the fall/winter drawdown of the river, thereby maintaining seasonal fish migration through the dam as well as the safe passage of spring flood flows. During the summer, the overflow gates would be operated to maintain the upstream water levels at existing levels, thereby maintaining the recreational uses of the river, but could be quickly opened to respond to summer floods.

3.2.1.4 Alternative 4 – Remove the Existing Stop Logs and Gates, Install an Overflow Rubber Dam Downstream of the Existing Piers

This alternative would involve the removal of all stop-log gains, overshot gates, gantry hoist/crane, vertical sluice gate and the intermediate steel piers, and the installation of a new overflow rubber dam on the existing base slab immediately downstream of the existing piers. As with Alternative 2, removal of the existing vertical steel stop-log gains would vastly improve the debris passage capability of the dam. An overflow rubber dam would still allow for the upstream impoundment of water, thereby maintaining the existing summer water levels for recreational uses. During the fall and winter months, the rubber dam would be deflated to the base slab, thereby allowing for fish passage through the structure. As with Alternatives 2 and 3, rehabilitation of the damaged tailrace in-stream erosion protection works would also be conducted.

3.2.1.5 Alternative 5 – Decommission and Remove the Dam

This alternative would involve the decommissioning and removal of the existing dam and appurtenant structures, restoration of the damsite and the waterway including stabilization of shoreline areas susceptible to erosion and the creation/enhancement of riverine fish habitat. The removal of the dam would result in the elimination of the upstream head pond that would revert the river back to its natural ‘pre-dam’ riverine state. In this regard, removal of the dam would eliminate concerns over debris passage and the damaged erosion protection works. Since the dam does not provide significant flood control/protection benefits, its removal is considered plausible; however, the potential loss of the water-based recreational use of the waterway and the effects on the various social amenities intrinsic with the numerous parks situated along the reservoir may not be acceptable.

3.2.2 Evaluation of Alternative Solutions

In order to identify the most appropriate solution for the rehabilitation of the Springbank Dam, the potential alternatives were compared in terms of their overall effectiveness in satisfying the project objectives, estimated cost, and net environmental effects. This process is summarized in Table 3.2 and key points are discussed in the following section.

3.2.2.1 Alternative 1 – Status Quo ('Do Nothing')

The Do Nothing alternative is not an effective solution to address the dam safety issues, including public and operator safety concerns associated with ensuring the dam has adequate flood handling capability related to the safe passage of debris through the dam, nor does it address the deteriorated state of the in-stream or north bank erosion protection works. Since no repairs or improvements are associated with this alternative, it is least capital cost alternative. However, without significant rehabilitation repairs to the dam including the in-stream and north bank erosion protection works, increasingly expensive maintenance and repairs will continue into the foreseeable future.

Since no repairs or modifications to the existing dam structure are proposed for this alternative, no constructed related effects are anticipated to the natural or social environments. However, without improvements to the dam's debris passage ability, the potential for debris blockage of the sluiceways and dam overtopping around the south embankment similar, to that which occurred during the July 2000 flood, would not be resolved. If left unresolved, future flooding could lead to negative impacts including damage to the dam structure and/or surrounding area, potential property damage, environmental impacts and personal injury. There would likely be no mitigation to minimize or eliminate the impacts associated with flooding induced by debris blockage at the dam.

Overall, Alternative 1 is not a viable solution.

3.2.2.2 Alternative 2 - Conduct Maintenance Repairs to the Dam, Replace Stop Logs and Improve Hoist Facilities, Implement a Debris Management System

Alternative 2 would be effective at resolving the deteriorated condition of the dam, including the tailrace in-stream and north bank erosion protection works; however, this alternative would not likely be an efficient solution to resolve the dam safety concerns associated the insufficient debris handling of the existing structure. Although a debris management system such as a floating log boom upstream of the dam would be less complex and less costly than modifying or removing the dam (i.e., Alternatives 3, 4 or 5), manual removal of built-up debris from a log boom would be technically challenging as well as potentially dangerous to personnel. In fact, removal of debris that builds up at a log boom during a high flow event may actually be impossible if the debris has already begun to result in high flood conditions similar to the July 2000 flood event. Further, a previous study of alternatives to minimize public hazards at the Springbank Dam (Delcan, 1997) concluded that a floating boom or fixed cable system may "…create additional, unforeseen problems [i.e., public hazards] at the dam…" and was not recommended. The replacement of the failed stop logs with new steel panels and upgrades to the existing gantry hoist to make it more reliable during emergency situations would improve operator safety and flood handling. Retaining the existing closely spaced stop-log gains would not fully eliminate the potential for debris buildup at the dam and the potential for overtopping during a flood event. Also, retaining the existing stop log and hoist configuration would still require a City crew be available to install and remove the stop logs in the future. This would not address the objective to reduce the dam's operational and maintenance costs.

Overall, the potential natural and social environmental effects resulting from the implementation of this alternative would be similar to those of Alternatives 3 and 4. Short-term disruption of the natural environment (e.g., in-stream construction work, possible cofferdam installation and dewatering) and of the social environment (e.g., construction noise and traffic, disruption of park usage) would occur, although standard construction site management measures (e.g., in-water construction timing restrictions, erosion and sediment controls, security fencing and safety signage, construction scheduling and site restoration) would likely mitigate much of the magnitude of potential effects.

Long-term land and water based recreational uses of the reservoir and surrounding parkland would continue for the foreseeable future.

The estimated construction cost of this alternative is lower than Alternatives 3, 4 or 5, but the overall ineffectiveness of the alternative to provide an adequate solution to the dam's debris passage problem makes it typically inferior and difficult to justify.

3.2.2.3 Alternative 3 - Replace the Existing Stop Logs and Gates with Overflow Gates

Alternative 3 would be an effective solution to address the debris passage concerns at the dam. The removal of the existing intermediate steel stop-log gains between piers and their replacement with overflow gates would greatly improve the debris passage ability and hence, the flood handling capacity of the dam since a clear opening width of 15.2 m within each sluiceway would be achieved instead of the current 3.0-m wide openings provided between the existing intermediate stop-log gains. In addition, the installation of overflow gates would provide significantly improved water level and flow control at the structure since the overflow gates could be raised or lowered automatically, more reliably and with greater precision than with the existing stop log hoist system. Implementation of this alternative would eliminate existing operator safety concerns and the long-term operating costs associated with the manual manipulation of stop logs.

Overall, the potential natural and social environmental effects resulting from construction associated with this alternative would be similar to those of Alternatives 2 and 4. Short-term disruption of the natural environment (e.g., in-stream construction work, possible cofferdam installation and dewatering) and of the social environment (e.g., construction noise and traffic, disruption of park usage) would occur, although standard construction site management measures (e.g., in-water construction timing restrictions, erosion and sediment controls, security fencing and safety signage, proper construction scheduling and site restoration) would likely mitigate much of the magnitude of potential effects. The long-term effects to the existing land and water based recreational uses of the reservoir and surrounding parkland would be relatively unaffected and would continue as is for the foreseeable future.

The estimated construction cost of this alternative would probably be higher than Alternative 2, but similar to Alternative 4.

3.2.2.4 Alternative 4 – Remove the Existing Stop Logs and Gates, Install an Overflow Rubber Dam Downstream of the Existing Piers

Alternative 4 would be an effective solution to address the debris passage concerns at the dam. Similar to Alternative 3, the installation of an overflow rubber dam would greatly improve the water level and flow management capacity of the structure since the rubber dam could be raised or lowered much faster, more reliably and with greater precision than with the existing stop log gantry hoist system. Implementation of this alternative would eliminate existing operator safety concerns associated with removal/addition of stop logs and eliminate long-term operating costs associated with the manual manipulation of stop logs. The rubber dam could be installed on the existing base slab immediately downstream of the existing piers thereby retaining the existing dam for operator and/or maintenance access across the existing dam deck.

Overall, the potential natural and social environmental impacts resulting from construction associated with this alternative would be similar to those of Alternatives 2 and 3. Short-term effects could include disruption of the natural environment (e.g., in-stream construction work, potential cofferdam installation and dewatering) and of the social environment (e.g., construction generated noise and traffic, disruption of park usage), although standard construction site management measures (e.g., in-water construction timing restrictions, erosion and sediment control, security fencing and safety signage, and site restoration) would likely mitigate much of the magnitude of potential effects. Long-term residual negative environmental effects are not foreseen for this alternative. It is expected that the existing land and water based recreational uses of the reservoir and surrounding parklands would be relatively unaffected and would continue as is for the foreseeable future.

The estimated construction cost of this alternative would be higher than Alternative 2, but similar to Alternative 3.

3.2.2.5 Alternative 5 – Decommission and Remove the Dam

Alternative 5 would be an effective solution to resolve the debris passage concerns associated with the existing dam and the deficient in-stream and north bank erosion protection works, since dam removal would eliminate these concerns. In addition, removal of the dam would eliminate ongoing maintenance, operation and liability concerns/costs. Restoration of the river's pre-dam physical state and removal of the physical in-stream barrier would also likely improve water quality and habitat conditions within the existing reservoir and downstream areas.

The potential natural and social environmental impacts resulting from construction associated with this alternative will be quite similar to those of Alternatives 2, 3 and 4. Short-term disruption of the natural environment and of the social environment would occur, although standard construction site management measures would likely mitigate much of the magnitude of potential effects.

However, the long-term effects to the existing land and water based recreational uses of the reservoir and surrounding parkland would be changed due to the permanent lowering of the reservoir. The loss in lacustrine-like conditions would eliminate/restrict recreational uses such as canoeing, rowing, boating and fishing which are acknowledged as highly valued benefits. Further, the permanent exposure of parts of the existing channel bed would create temporary aesthetic concerns and, depending on long-term uses of the exposed area, possible reduction in the overall aesthetics of the surrounding parklands. Removal of the dam and lowering of the river could reduce the local value of adjacent parklands as natural, historic and local tourist attractions.

For this alternative, the estimated costs to remove the dam alone make it similar in range to Alternative 2 but less than Alternatives 3 and 4. However, the overall cost for this alternative is expected to be potentially much higher given the extent of mitigation, restoration and compensation (i.e., private landowners) measures required and the economic losses resulting from the elimination of recreational uses associated with the loss of the upstream reservoir.

3.2.3 Selection of the Recommended Dam Rehabilitation Solution

The recommended alternative for the rehabilitation of Springbank Dam is **Alternative 3 - Replace the Existing Stop Logs and Gates with Overflow Gates**. This alternative would be very effective in terms of improving the debris passage and flood handling capability of the dam while eliminating associated operator, public and environmental safety concerns, reducing long-term capital, operating and maintenance costs, and minimizing negative impacts to the environment. Construction impacts on the existing natural and social environs can, for the most part, be mitigated by implementation of standard construction site best management and erosion/sediment control practices, as well as implementation of an ecologically friendly site restoration plan. Long-term effects on the existing land and water based recreational use of the reservoir and surrounding parkland would not change into the foreseeable future. Overall, this alternative represents a cost-effective means of resolving the stated problems, while minimizing impacts to the local natural and social environments.

Alternative 1 (Do Nothing) was rejected for reasons pertaining to the continued safety of dam operators and the public, and the fact that this alternative does not address the potential for flooding associated with debris blockage at the dam or the deteriorated nature of the in-stream and north bank erosion protection works. Future flood events could lead to continued degradation of the dam and erosion protection, as well as possible environmental or property damage or personal injury. Although there would be no capital cost associated with this alternative, continued deterioration of the dam would necessitate some form of rehabilitation in the near future. For these reasons the Do Nothing alternative is not considered feasible.

Alternative 2 would be effective in repairing the deficient stop logs, improving the hoist facilities to make stop-log operations more reliable and repairing the damaged in-stream and north bank erosion protection works. However, the implementation of a debris management system and retaining the closely spaced intermediate steel stop log gains would not guarantee that debris blockage of the dam and accompanying flooding would not occur in the future. Although the capital cost of this alternative is lower than Alternative 3, the potential for flooding, as well as the technical and personal safety issues associated with the debris management system, make this a technically inferior solution.

Alternative 4 would be an effective means to address the debris build up and the deteriorated dam condition, including the damaged in-stream and north bank erosion protection works issues. In comparison to Alternative 3, Alternative 4 would have similar potential environmental effects and estimated construction costs. However, the hydraulic operation of the rubber dam would not offer the same degree of flexibility and operational management of flows compared to the overflow gates (Alternative 3). In addition, a rubber dam would have a shorter lifespan resulting in a higher overall life-cycle cost. For these reasons, a rubber dam is a less preferred solution than overflow gates.

Alternative 5 (Decommission and Remove the Dam), while being an effective option to resolve the public and environmental concerns associated with debris blockage, accompanying flooding and the deteriorated condition of the erosion protection works, represents the greatest change to the local natural and social environment. The high cost associated with the dam removal and the potential additional costs for mitigation, restoration and compensation (i.e., private property) measures could potentially make this option the highest cost alternative. In addition, the loss of recreational amenities associated with the reservoir and the potential economic losses to the local recreational and tourism resources and values was an overriding factor leading to the rejection of this alternative.

3.3 Selection of the Preferred Solution

Based on the identification of the recommended solutions for the Springbank Dam Rehabilitation in the preceding text, as well as after having given due consideration to the various comments, input and concerns expressed by members of the public, potentially affected stakeholders and government agencies, the following preferred solutions were selected for Springbank Dam.

To rehabilitate the damaged south bank erosion protection works, **Alternative 5 – Rehabilitate the south bank erosion protection works with riprap and selective use of armour stone** was selected as the preferred solution.

To rehabilitate the dam (including the deteriorated in-stream and north bank erosion protection works) and provide for improved debris passage, **Alternative 3 - Replace the existing stop logs and gates with overflow gates** was selected as the preferred solution.

3.4 Scheduling Options for the Preferred Solution

Following the selection of the preferred solution, two (2) different construction-scheduling options were identified (Figure 3.1) as follows

Alternative A - This option would involve completing the work on the dam over the two consecutive fall/winter periods of 2004 and 2005, with the reservoir lowered from early October to the end of March inclusive. Repairs to the damaged erosion protection works could be done under a separate contract during low flow months (July/August) in 2004.

Alternative B - This option would involve completing the work on the dam over an extended one-time period from approximately July 2004 to April 2005. This would enable all construction work to be completed within one continuous period. Rehabilitation of the damaged erosion protection works could be done either as part of the contract for the dam or under a separate contract.

The Alternative A construction schedule offers the advantage of minimizing negative impacts on the water-based recreational users of the upstream reservoir, namely the members of the London Canoe Club and the London Rowing Club, among others, since the proposed in-water construction activities that would require lowering of the head pond would take place over the fall/winter months. This time period essentially corresponds to the same time period that the reservoir is normally lowered as part of the winter drawdown. However, the proposed head pond lowering for Alternative A would begin about 4weeks sooner, starting at the beginning of October, as opposed to the normal head pond lowering that typically begins in late October/early November. Thus, under this scheduling scenario, there could be some loss of the water-based recreational use (i.e., canoeing, rowing, etc.) of the head pond during the month of October that is not normally experienced. However, given that the number of canoeists/kayakers using the head pond during the month of October is significantly less than the summer months, this temporary, 4-week loss of recreational usage of the head pond is not considered to significantly adverse. An additional disadvantage of Alternative A is that there would be slightly higher project construction costs due to the need for a second mobilization and demobilization.

The Alternative B construction schedule offers the advantage of slightly reducing the project construction costs since the single extended construction season would only require the need to mobilize and demobilize the construction activities once, and the project could be completed earlier (than under the Alternative A schedule). The disadvantage of this alternative is that the proposed schedule would negatively affect (i.e., temporarily displace) the water-based recreational users, who would have to go to another location, such as Fanshawe Lake during the summer construction months.

The above-noted construction scheduling options were presented to the public at the October 22, 2003 Open House. Several persons commented in general during the Open House (i.e., as part of the presentation question and answer period) that they would be concerned about not being able to canoe, row, etc., on the head pond during the summer months of 2004 if Alternative B was selected as the preferred construction schedule. However, of the five comments forms received from the public at the Open House, only one person stated a preference for a particular construction schedule option, that being for Alternative A.

Based on the comments provided at the Open House and additional public comment provided by follow-up stakeholders meetings, which occurred after the Open House, Alternative A was selected as the recommended scheduling option for the implementation of the preferred solution on the basis that it would result in the least amount of negative impacts to the water-based recreational users of the head pond.

3.5 Confirmation of Project Category

Based on the findings of the evaluation of alternative solutions and the selection of Alternative 3 for the Dam Rehabilitation Works (Replace the Existing Stop Logs and Gates with Overflow Gates), and, Alternative 5 for the South Bank Erosion Protection Works (Repair Using Riprap and Selective Use of Armour Stone) as the preferred solution, the status of the project was confirmed to be a Schedule B project pursuant to the Municipal Class EA (MEA, 2000).

4 Preferred Solution: Project Details

The following sections describes the project-specific details associated with implementation of the preferred solution for rehabilitation of Springbank Dam, namely, to replace the stop logs, gains and gates with overflow gates and, to rehabilitate the damaged south bank erosion protection works using riprap and selective use of armour stone.

The preferred solution is shown in Figure 4.1, and would involve i) rehabilitation of the south bank, in-stream and north bank erosion protection works; (ii) removal of the stop logs, gains and gates from the existing dam structure; (iii) installation of operable overflow gates; iv) dam safety repairs to correct deficiencies such as concrete repairs, replacement of deficient handrails, etc.; and, (v) environmental monitoring of the construction process.

The major aspects of the project are discussed in the following sections.

4.1 Net Environmental Effects and Mitigation

The net negative environmental effects associated with the installation of overflow gates in the dam and rehabilitation of the erosion protection works (Alternative 3) were discussed in Section 3 and are summarized as follows:

- Installation of temporary cofferdams and dewatering of work areas will result in the temporary loss of fish habitat during the construction period. *No mitigation identified, other than observance of fisheries timing window since the area immediately surrounding the dam is not assessed as providing any specialized fish habitat. Strict adherence to an in-stream construction timing restriction of March 15 to June 30 to protect fisheries reproduction periods should be followed. Following the completion of in-water construction activities, all cofferdams should be removed from the river to allow free passage during the spring walleye spawning period.*

- In-water construction works (e.g. cofferdam construction, erosion protection repairs, etc) could result in potentially harmful releases of sediment and/or other materials to sensitive downstream fish/invertebrate habitats. *Mitigation, by means of an approved sediment and erosion control plan should be prepared and implemented to minimize excessive sediment releases to downstream areas. In addition, standard construction site best management practices with respect to work in/around water should be implemented.*

- The dam will continue to seasonally restrict fish passage in the Thames River during the late spring to early fall period. *No mitigation identified since this process has been ongoing for over 70 years due to the existing dam and will not be worsened by the installation of new overflow gates. The proposed operation of the overflow gates will be the same as the operation of the existing dam with stop logs, in that, the head pond will continue to be drawn down between late October to the end of March. During this period, the overflow gates would be completely open (i.e., in the down position) to allow free passage through the dam for fish migration, as is currently the case.*

- Construction activities associated with the south bank erosion protection repairs may disturb a small amount of landscaped area and the vegetation clearing associated with concrete repairs to the north abutment will result in a loss of a small amount of forested area. *Mitigation by means of general site restoration should be conducted following construction and should include the replanting of any vegetation removed or disturbed at the damsite.*

- Construction at the damsite will temporarily displace the water-based recreational usage (e.g., canoeing, rowing, etc) of the head pond due to its planned lowering 4 weeks earlier (i.e., beginning in early October instead of late October). This would be a one-time occurrence. *No mitigation is identified since the recreational usage of the head pond during the month of October is small compared to the usage during the summer months and alternate venues, such as Fanshawe Lake, are available in close proximity.*

- Construction at the damsite could temporarily impact the land-based recreational usage of the nearby parkland due to public safety concerns, construction traffic, noise, dust, etc. *Mitigation by means of standard construction site best management practices (e.g., security fencing, safety signage, traffic management) should be implemented to minimize the impact on the local community. For the most part, the planned winter construction is expected to avoid major disruptions of park usage during the summer.*

- Public access across the dam will not be allowed. *No mitigation identified. To date, public access across the dam has not been allowed by the City for safety reasons. Cross-river access is available immediately downstream of the dam via the Boler Road bridge and upstream of the dam via a pedestrian bridge. Implementation of the preferred solution to install overflow gates in the existing dam would not preclude the future potential to allow public access across the dam, if this were to become a consideration by the City.*

Mitigation measures are not required or cannot be applied to some of the effects noted above, measures for other effects are noted in the following sections.

4.2 Scheduling of Works

The preferred project construction schedule is Alternative A (Figure 3.1). This schedule is based on two consecutive fall/winter construction periods. The major construction aspects of the project and their anticipated scheduling periods are

Year 1 Construction Activities	
Repair South Bank Erosion Protection Works	July/August 2004
Mobilization and Construction Access (General Contract)	September 2004
Head Pond Lowering	October 2004
Stop Log, Gate and Gain Removal (Sluiceways 1 & 2)	October 2004
Installation of Overflow Gates (Sluiceways 1 & 2)	Nov 2004 to Jan 2005
Site Clean up and Restoration	February 2005
Demobilization	February 2005
Year 2 Construction Activities	
Mobilization and Construction Access (General Contract)	September 2005
Head Pond Lowering	October 2005
Stop Log, Gate and Gain Removal (Sluiceways 3 & 4)	October 2005
Installation of Overflow Gates (Sluiceways 3 & 4)	Nov 2005 to Dec 2005
Site Clean up and Restoration	December 2005
Demobilization	December 2005
Environmental Monitoring	
Construction (Year 1)	July 2004 to February 2005
Construction (Year 2)	September 2005 to December 2005
Operational (Erosion Protection Works, Site Restoration)	Spring 2006 & 2007

4.3 Environmental Approvals, Authorizations and Permitting

The implementation of all project activities is premised on the assumption that all necessary federal, provincial and municipal permits, approvals and/or authorizations will be obtained by the City (and/or its agency) prior to initiating the project works. The following identifies the anticipated agency-specific environmental approvals that are expected to be required. These should be carefully reviewed for completeness prior to the onset of construction.

4.3.1 Department of Fisheries and Oceans

Construction at the damsite, specifically the installation of cofferdams and dewatering of work areas for the repair of the downstream erosion protection works will result in minor temporary loss of fish habitat in the downstream vicinity of the dam. This area of the river is not known to represent any significant fish habitat, and the in-stream erosion repair works are anticipated to take place in July and August when river flows are low. This timing would comply with the March 15 to June 30 fisheries restriction for no in-water work and all temporary in-water structures would be removed prior to the spring spawning season to allow the upstream migration of walleye. Based on this, it is not anticipated that these works would constitute a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat. However, Fisheries and Oceans Canada (DFO) should be consulted (i.e., through the UTRCA's referral process) to provide an assessment of the proposed works to determine if it constitutes a HADD. If so, authorization from the DFO under Section 35(2) of the *Federal Fisheries Act* will be required.

4.3.2 Ministry of Natural Resources

The Ministry of Natural Resources (MNR) should be consulted to ensure that their requirements under the Lakes and Rivers Improvement Act (LRIA) are being met for the proposed dam rehabilitation and in-water works. For dams and works conducted in a river, the MNR typically requires that an application for approval of the plans and specifications will be required. In this regard, the MNR should be consulted to ascertain their specific approval requirements.

4.3.3 Canadian Coast Guard

At this point in the Class EA process, the Canadian Coast Guard (CCG) has not indicated if Formal Approval, pursuant to Section 5(1) of the *Navigable Waterways Protection Act*, will be required for the proposed works. Although the rehabilitated structure will maintain the same navigability as the existing dam, similar undertakings have resulted in such a request from the CCG. Accordingly, prior to the start-up of construction, the CCG should be consulted to ascertain their approval requirements.

4.3.4 Upper Thames River Conservation Authority

Construction at the damsite including the temporary in-water works (e.g., installation of cofferdams, dewatering of work areas) to repair the damaged erosion protection works will necessitate that an Application of Consent be obtained from the UTRCA pursuant to their administration of the Fill, Construction and Alteration to Waterways Regulation pursuant to the *Conservation Authorities Act* (R.S.O. 1990 Chapter C. 27).

4.3.5 Canadian Environmental Assessment Agency

The provision of federal funding for the project will subject the proposed dam construction works to a federal environmental screening pursuant to the Canadian Environmental Assessment Act (CEAA). Also, federal approval from the Canadian Coast Guard under the *Navigable Waterways Protection Act*, and any DFO authorization under the *Federal Fisheries Act*, will necessitate a federal screening, pursuant to CEAA. Most likely, the CCG (or possibly, DFO) will be identified as the Responsible Authority to conduct an internal screening in consultation with DFO and Environment Canada based on information contained in this document.

4.4 Pre-Construction Activities

4.4.1 Site Access

Road access to Springbank Dam is available from Springbank Drive via paved roads within Springbank Park. Springbank Drive is subject to moderate commercial and public vehicular use. The roadways situated within the park tend to be narrower and one-way. Although they are subject to lighter vehicular use, there tends to be greater numbers of persons walking, rollerblading or cycling. Accordingly, caution must be exercised when construction vehicles are using these roads. Appropriate warning signs and, if necessary, flagmen should be used to enhance public safety. The condition of the roads in proximity to the damsite should be monitored during the construction to ensure that excessive sediment and mud is not tracked onto the roadways from the construction site. If necessary, consideration should be given to establishing a truck-washing area at the construction site.

4.4.2 Work Areas

A specified work area should be established at the damsite, likely on the paved area immediately adjacent to the south side of the dam and the grassed area to the west. The work site should be posted with signage notifying the public of the ongoing work and the perimeter should be defined by fencing or other markings. All operations of the contractor should be confined to those areas, unless specific permission to exceed those limits is provided by the site supervisor/engineer. The construction activities related to the south bank erosion protection repairs and the installation of gates should be undertaken from the south side of the dam within the areas dewatered by cofferdams. It is anticipated that access to conduct any north bank erosion repairs will have to be via a barge.

4.4.3 Construction Site Management

Measures to minimize environmental disturbances at the damsite work areas during the construction and demolition activities include, but are not limited to, the following:

- Establishment of defined working areas for staging and construction.
- Proper storage of equipment, construction material, debris and fuel away from sensitive areas and open waters.
- No in-water works, unless properly scheduled and planned by the contractor and approved by the City.
- The implementation and maintenance of water control, erosion and sediment controls for disturbed areas according to a written plan prepared by the contractor and approved by the City.
- Proper disposal of all construction debris, rubble and stockpiles.
- Maintenance and/ restoration of site construction, staging and work areas, and easements during and following the completion of the works.

4.4.4 Sediment and Erosion Control Plan

Since there will be a requirement for in-water work including the installation and removal of temporary cofferdams, placement of rubble erosion protection material, as well as typical debris resulting from the construction and demolition activities, an erosion and sediment control plan will be required. The plan should be prepared and submitted by the contractor for approval by the City prior to the start of construction activities. The plan should include details of the sequencing of the construction activities to allow the construction activities to proceed in the dry as well as the details of the sediment and water control measures (e.g. gravel bags, silt curtains, etc) that will be used to minimize erosion and/or contain any releases of sediment or debris from entering the Thames River. In addition, the plan should include the details of the proposed environmental monitoring procedures.

4.5 Construction Activities

4.5.1 Erosion Protection

The in-water construction work associated with the rehabilitation of the south bank erosion protection works is envisaged to occur in July and August when river flows are low. The work would be a one-time occurrence and is anticipated to take place in ‘year 1’. In order to dewater the work area, the existing dam would be used to act as an upstream cofferdam and a temporary cofferdam could be constructed downstream of the existing dam. Details of the proposed south bank erosion repairs and the location of the recommended cofferdams are illustrated in Figure 4.1.

4.5.2 Reservoir Draining

Based on the preferred construction schedule, the construction will occur over a period of 2 years. In the first year, reservoir lowering, by removal of all stop logs from the dam, will take place beginning the first of October 2004. This would be approximately 4 weeks earlier than the normal drawdown start date of late October, but is required to maximize the winter construction period. The reservoir lowering will facilitate construction at the damsite and minimize potential environmental impacts by reducing the size of cofferdams required to allow construction to proceed in the dry. Construction will then proceed through the fall and winter seasons. In order to ensure that the stipulated fisheries window for no in-water work from March 15 to June 30 is respected, all in-water works should cease and all in-stream structures should be removed prior to the onset of this time period. Operations of the dam during the spring and summer will proceed as per the normal operation plan. The ‘year 2’ construction will then recommence following the October 1, 2005 lowering of the reservoir and will finish that winter at the end of December 2005.

4.5.3 Removal of Existing Stop Logs, Gains and Gates

The removal of existing stop logs, gains and gates should be conducted in the dry behind upstream and downstream cofferdams. It is anticipated that construction across the dam will proceed in a phased nature, with only half of the river requiring dewatering at any one time. At the outset of the construction activities, the contractor should be required to install an approved water control plan that should allow flows to be safely passed downstream. At the same time as the water control plan is implemented, the contractor should be required to install his approved sediment control scheme.

4.5.4 Installation of New Gates

As discussed in earlier sections, there are various types of overflow gates that could be installed at this site. These include Obermeyer gates (steel plates held up by air bladders) and flap gates operated by either hydraulic or cable systems located on the deck of the dam. At this point in time, cost estimates for each system are approximately the same. Both systems would require installation in the dry making use of the cofferdams installed for the erosion protection works. Both systems would utilize the existing base slab with the mechanical components of the flap gates installed over the piers, if possible. Piping work associated with the Obermeyer option would probably run along the downstream side of the deck.

4.5.5 Debris Disposal

All construction debris associated with the removal of the stop logs, gains and gates, installation of the overflow gates and rehabilitation of the erosion protection works should be removed from the site to approved disposal facilities. Waste concrete that is unsuitable for reuse on-site as fill should be transported to either the local landfill or a concrete recycling facility. Structural steel components should be sent to a scrap metal recycling facility. All wood and/or other construction debris should be removed from the site to recycling or municipal disposal facilities.

4.6 Site Restoration

4.6.1 Shoreline Stabilization and Restoration

It is not anticipated that significant disturbance of shoreline areas not undergoing rehabilitation of erosion protection works will occur. However, should such disturbance occur in small areas, they should be stabilized and restored as follows:

- Provide erosion protection such as river stone and riprap along exposed bank and shorelines susceptible to erosion.
- Seed disturbed stream banks and shoreline areas with a fast growing native seed mix using soil stabilization techniques (as required) that are appropriate for the slope.
- Allow natural regeneration of all areas.

Appropriate mitigation measures for in-water works should be applied and work should be undertaken during the fall and winter low flow periods and observing the March 15 to June 30 fisheries timing constraints. In addition, monitoring inspections of the shoreline stabilization and restoration works is recommended following the construction activities to ensure that river shorelines are stable.

4.6.2 Fish Habitat Restoration and Enhancement

No specific fish habitat restoration or enhancements works are proposed as a result of installation of overflow gates in the dam and the construction of new erosion protection works. It is anticipated that any impacts to the existing fish habitat features in proximity to the dam, such as substrate material and shoreline cover will be minimal; however habitat features and flow conditions should be assessed and monitored continuously during construction.

4.7 Environmental Monitoring

An environmental monitoring program is proposed which is comprised of two components: construction monitoring during all aspects of project implementation including the removal of existing structures, installation of new gates and mitigation measures, rehabilitation of erosion protection works, and restoration of the site; and operational monitoring, which should evaluate the post-construction, residual effects associated with the operation of the new dam and the success of the site restoration measures.

4.7.1 Construction Monitoring

Construction should be undertaken in accordance with current provincial guidelines for construction activities impacting on water resources (MOE, 1995; MNR, 1990) and current industry best site management practices.

The site engineer or his/her designate should be responsible for supervising and/or direct monitoring of the construction activities and associated mitigation measures through all aspects of the project implementation according to the contract specifications.

Some of the mitigation measures previously identified that will require monitoring through the construction phase include

- establishment of defined working areas for construction staging
- proper storage of equipment, construction material, debris and fuel away from sensitive areas and open waters
- water control, erosion and sediment controls (e.g., sand bagging, silt curtains, temporary flow diversions, etc)
- proper construction practices to minimize noise and dust, disposal of all construction debris, rubble and stockpiles
- shoreline stabilization and restorations works (e.g.. riprap, seeding and plantings)
- restoration of construction/staging areas.

Specific construction monitoring requirements for in-water works include monitoring downstream water quality for signs of increased turbidity and/or suspended solids during all phases of the construction. The site engineer or his/her designate should maintain a general record of monitoring observations and identify any specific remedial actions in a construction logbook.

4.7.2 Operational Monitoring

The objective of the operational monitoring program is to track the success of the site restoration activities and identify any effects that were not anticipated and undertake corrective measures.

For Springbank Dam, residual environmental effects are not likely as long-term flow and water level conditions will remain essentially unchanged and any river sediments should, for the most part, be undisturbed. Therefore, the operational monitoring should largely focus on those areas disturbed during construction. In this regard, the City or their designate should:

- Monitor the integrity/stability of the repairs to the erosion protection works by conducting site inspections of all constructed protection works at the damsite as well as and the natural river banks and channel section immediately downstream of the dam. Inspections should be conducted after the spring freshet in the year following construction, and thereafter at year 2 to identify any dislodgement/displacement of erosion protection material, slumps or areas of bank erosion, and/or evidence of scour holes downstream of each sluiceway. These observations would then be used to assess the need for localized remedial works, such as additional riprap placement or bank stabilization works. The results of all inspections and remedial actions should be recorded in the project file.

- Monitor the ongoing process of natural regeneration and growth of any planted seeds/vegetation at the damsite by conducting site inspections of all areas cleared or disturbed by vehicle access, work staging, construction/demolition, as well as areas subject to shoreline stabilization. Inspections should be conducted in the spring of the year following construction and thereafter at year 2 to identify the progress of the vegetative growth (both natural and planted) and to assess the need for remedial repairs, such as replanting or reseeding. The results of all observations and remedial actions should be recorded in the project file.

5 Public and Agency Consultation

Public and agency consultation activities were conducted as part of the Class EA process. Consultation activities were coordinated by the UTRCA with assistance from the City of London and Acres. During the process, agency and public contact points included a Notice of Study Commencement Newspaper Advertisement, a Stakeholder and Agency Letter Mail Out, posting of information on the UTRCA's website, Stakeholder Meetings, an Open House, a Notice of Completion Newspaper Advertisement and a Final Stakeholder and Agency Letter Mail Out.

Notice of Study Commencement Newspaper Advertisement

The Notice of Study Commencement to the public was published in the London Free Press on August 30, October 11 and October 18, 2003. The purpose of the notice was to notify the public of the study, including its purpose and status under the Environmental Assessment Act, and to notify them of the upcoming Open House. A copy of the notice is provided in Appendix C.

Stakeholder and Agency Letter Mailout

A direct letter mailing was completed during the week of September 2, 2003 to local community groups and to all relevant federal, provincial and municipal government ministries and agencies. The letter included a copy of the Notice of Study Commencement. A total of 33 letters were mailed. A sample copy of the mail out letter, as well as the stakeholder and agency mailing list, is provided in Appendix C.

Information Postings on UTRCA's Website

During the Class EA process, study information, including notices of the study commencement and completion, and downloadable copies of some of the environmental assessment report documentation was posted on the UTRCA's website at www.thamesriver.on.ca.

Stakeholder Meetings

During the Class EA process, the UTRCA met with representatives from several interested stakeholder groups that included the London Canoe Club (on October 8, 2003), the London Rowing Club (October 8 and November 5, 2003), the Tri-County Bass Masters (November 4, 2003) and the Thames River Anglers (November 12, 2003). The purpose of the meetings was to provide general study information, answer questions and identify issues and concerns. Comments raised during the meetings are summarized in Appendix C.

Open House

A public open house was held at the Byron Library Auditorium in the City of London on October 22, 2003. The purpose of the open house was to provide study information to the public, present the results of the Class EA and recommended alternative, and to receive input on the alternatives under consideration. A total of 13 people signed-in and 5 comment forms were received. The Comment Sheets received are provided in Appendix C.

Notice of Study Completion Newspaper Advertisement

The Notice of Study Completion to the public was published in the London Free Press on December 13, 2003. The purpose of the notice was to notify the public and agencies of the selection of the preferred alternative and to inform them of a 30-day review period for interested parties to review the Environmental Assessment Report and associated file information at the City of London. A copy of the notice is provided in Appendix C.

Stakeholder and Agency Letter Mailout

A direct letter mailing was completed during the week of December 13, 2003 to local community groups and to all relevant federal, provincial and municipal government ministries and agencies, and to members of the public that responded to the first notice and/or attended the public meeting. The letter included a copy of the Notice of Study Completion. Over 35 letters were mailed. A sample copy of the mail out letter, as well as the stakeholder and agency mailing list is provided in Appendix C.

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