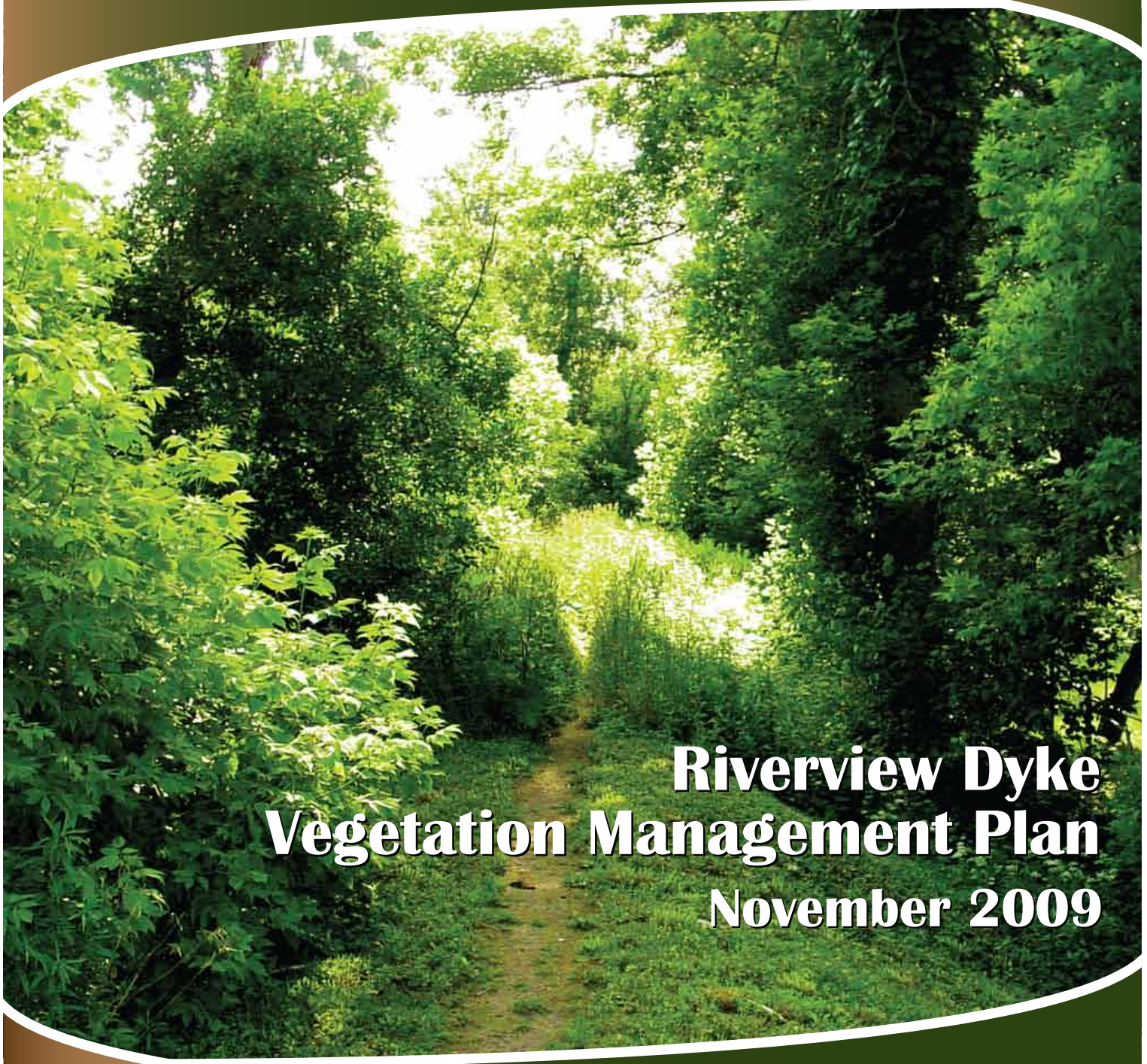

Riverview Dyke Vegetation Management Plan

November 2009

UPPER THAMES RIVER
CONSERVATION AUTHORITY

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- Brenda Gallagher (Forestry and Vegetation Assessment Technician)

Hazard Tree Field Work:
- Brandon Williamson (Environmentally Significant Areas Operations Assistant)
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1. Project Overview

1.1. Purpose of the Dykes

The Upper Thames River Basin is located in south-western Ontario and has a drainage area of 3,450 km^2. The physiographic region of southwestern Ontario is known as the London Annex of the Caradoc Sand Plain of late Wisconsin Age. The site consists of spillway deposits bounded on the north and south by glacio-lacustrine and glacio-fluvial deltaic deposits from Lake Maumee II and Lake Maumee III. The river has eroded to its present level leaving extensive alluvial deposits of sands and gravels in the flood plain.

Urban growth, centered along the Thames River and its tributaries, is vulnerable to flooding. Historically, the Thames River has experienced several severe flooding events. In July 1883, severe flooding along the Thames River killed 17 people in London and caused extensive damage, prompting the City of London to build a series of dykes to protect properties in low-lying areas along the river. This study focuses on the Riverview Dyke, which is located on the south side of the Upper Thames River, near the confluence of the north and south branches (**Figure 1**). The Riverview Dyke runs behind nine private residential houses on Riverview Avenue and ends south of Evergreen Avenue, 600 m west of Wharncliffe Road (**Figures 2** & **3**).

1.2. Purpose of Phase II Dyke Management Plan

The purpose of the Phase II Management Plan is to provide site specific analysis of the environment on and adjacent to the Riverview Dyke, as well as mitigation measures to restore and minimize further risks to the structural integrity of the dyke. The management plan will consider:

- all previous background research completed on the dyke
- summer to fall vegetation survey with plant community classification to the ecosite and / or vegetation type level (where possible) collected in 2007 and 2008
- hazard tree identification and assessment collected in 2007 and 2008
- inventory of site features

This information will be used to characterize the health and diversity of habitats, identify risks and opportunities with respect to existing vegetation, and prioritize the vegetation that is hazardous to the integrity of the dyke. Site-specific mitigation measures will be developed based on the detailed analysis of the environmental findings.

1.3. Project Chronology

1983: Biological Assessment of the Thames Dykes by Ecologistics that inventoried the dyke system

2004: Stantec and Golder inspection and prioritization of the structural integrity of the dykes in London

2007: Thames Valley Corridor Plan Phase I

2005: TOR developed by UTRCA for London Dykes Vegetation Management Plan – Preliminary Investigation (Phase I)

2006: London Dykes Vegetation Management Plan – Preliminary Investigation (Phase I) Final Report prepared by Dougan & Associates for UTRCA

2007: Legal topographic survey by AGM for UTRCA to determine property boundaries with respect to position of Riverview dyke

2008: Geotechnical Review by Golder Associates to assess the present condition of the dyke and an Erosion Monitoring Program by Stantec to address erosion concerns along specific areas of the dyke

The Upper Thames River Conservation Authority (UTRCA) is responsible for coordinating the 2009 Riverview Dyke Management Plan.

2. Environmental Description

2.1. Landscape Connectivity

Although Riverview Dyke is not within the vegetated corridor identified as part of the Carolinian Canada Big Picture Corridor Project (**Figure 4**), it is part of a riparian corridor that stretches intermittently along the south branch of the Upper Thames River. The width of the vegetated floodplain corridor near the Riverview dyke on the south side of the Thames is much narrower than the floodplain corridor across the river on the north side of the Thames. The Riverside dyke, Wharncliffe Road Bridge, residential houses, train bridge, sewage treatment plant, and soccer fields restrict the floodplain on the south side of the river in this area.

2.2. Property Ownership Considerations

Legal surveys in 2007 by AGM show that a large portion of the Riverview dyke occurs in the backyard of nine residential properties north of Riverview Avenue (**Figure 3**). The Riverview Dyke has been highly disturbed by the development of trails on top of the dyke, as well as small structures and decks. Docks, stairs and fences have been built on the slope of the dyke, despite the steep and hazardous angle from the top of the dyke to the edge of the river. Garbage, such as broken glass, metal, concrete blocks, asphalt, old lumber, and tires, has been thrown over the bank. Compost, garden material and brush have also been pushed over the slope by local landowners. Noise from the railway, the surrounding residential neighbourhood and the road / bikeway can disturb the wildlife that uses the vegetated corridor.

UTRCA acquired property in the floodplain under Scheme 43. Scheme 43 was a provincial program to acquire flood plain lands, in cooperation with participating municipalities, throughout the watershed. Funding arrangements for acquisitions were usually a 50/50 split between the province and the municipality, with the UTRCA maintaining title. The Scheme 43 agreement permits the City of London to develop and maintain the land for park and recreational purposes, subject to approval by the UTRCA.

2.3. Climate

Floods and droughts are the main hydrologic hazards in the Upper Thames River Basin. Historically, snowmelt has been the major flood producing factor, frequently generating flood events in March. Periods of low flow usually occur during the summer and the risk of droughts is highest in the months of July and August.

2.4. Hydrology and Erosion

Stantec Consulting provided a progress report dated September 2008 on specific erosion monitoring of the banks of the Thames River at locations below the Riverview Dyke. In December 2007, erosion pins were established between the top and the toe of the banks at five locations along the dyke. The pins were established mostly west of the private properties along the bank in the most erosion prone section of the bank. One section of pins was located at the property just east of the storm sewer outlet. Measurements were taken of pin exposure from the bank in December 2007 and April 2008. Up to 50 mm of erosion had occurred at some toe locations, however, up to 45mm of sediment accumulation had also occurred at two locations.

Additional measurements are expected in 2009 to confirm measurements. The steepness of the riverbank was also measured and found to be approximately 35 to 45 degrees from horizontal in the area of greatest erosion, west of the storm sewer outlet.

A review of historical topographical mapping by Golder Associates in 2009 indicated that the riverbank has eroded as much as 12 metres for a 90 metre section immediately west of Wharncliffe Road. From 90 metres west of Wharncliffe to 420 metres west, there was only minor changes in erosion. However, westerly from 420 metres, and extending beyond the westerly limit of the dyke, the toe of the south riverbank had receded an average of 0.15 metres per year since 1926. This is also reflected in the slope angles. In 1984, Golder Associates noted that dyke slope angles ranged from 24 to 38 degrees with localized, relatively minor erosion. In 2008, Golder Associates noted slightly steeper measurements, in addition to various signs of ongoing movements and localized toe erosion. Problems in this area are similar to those associated with an eroding natural bank.

The proximity of Riverview dyke to the Thames means there is not much floodplain vegetation, especially along the portion of the dyke that is located behind the houses on Riverview (**Figure 2**). Therefore, it is not surprising that scouring is occurring at the toe of the slope and that tree roots are becoming exposed by soil erosion due to the strong river current. Only the vegetation communities west of the dyke have a more natural hydrological connection to the water. Here there is evidence of flooding and ice damage.

2.5. Vegetation

Three vegetation inventories were conducted on the dykes and in the floodplain / riparian areas. Dougan and Associates (2006) and Ecologistics (1982, 1983) surveyed all seven dykes, and in 2006 and 2007 the UTRCA surveyed the Ada and Riverview dykes. **Appendix A** contains the UTRCA plant inventory and methodology. The following vegetation summary of the Riverview Dyke is based on the findings of these four studies. In total, the UTRCA recorded 167 species of herbaceous plants in the floodplain and anthropogenic dyke communities, Ecologistics recorded 85 species, and Dougan and Associates found only 23 plant species.

There are no significant vegetation communities on or adjacent to the Riverview dyke. The vegetation communities are comprised of disturbed (cultural) meadows and semi-natural deciduous forests dominated by Manitoba maple and black walnut. There is very little floodplain remaining, and most of it is west of Riverview dyke in an open cultural meadow with a few scattered black walnut, silver maple, and Manitoba maple (Community 2 in **Appendix A** and **Figure 5**). A small group of green ash had been planted in the northeastern corner of this area by a community group. Green ash trees had also been planted southwest of the dyke in the centre of a lowland deciduous forest dominated by an open canopy of black walnut, Manitoba maple and cottonwood (Community 1 in **Appendix A** and **Figure 5)**.

Vegetation on the dyke (Communities 3 and 4 in **Appendix A** and **Figure 5**) is primarily a narrow band of open canopy dry-fresh deciduous forest with Manitoba maple, Norway maple, sugar maple, black walnut, willows, scattered elms and poplar species on a very steep slope. The understory is primarily buckthorn, with some canopy species. Those forest communities have become highly disturbed by anthropogenic activities from the houses on Riverview Avenue, and are of poor quality with poor cover. West of the residential houses the dyke turns south.

Communities 3 and 4 had similar basal areas of 21.5BA/ha and 22BA/ha respectively. In community 3, the basal area was comprised mainly of Manitoba maple, most of which were smaller pole wood (10-24cm DBH). In community 4, most of the basal area was made up of Norway maples, hackberry, and Manitoba maples that were either polewood (10-24cm DBH) or small trees (26-36cm DBH). In both communities, trees > 50 cm DBH were underrepresented.

Both Dougan and Associates and the UTRCA found that the most prevalent species in the understory of all vegetation communities were buckthorn, chokecherry, hackberry and saplings of Manitoba maple, black walnut, and Norway maple. The UTRCA also recorded basswood and green ash saplings. The UTRCA also found that the sub canopy of the floodplain communities (communities 1 and 2) was less diverse than reported by Dougan and Associates (2006), consisting only of a sumac thicket along the south side and a small group of green ash. It is important to note that Ecologistics (1982, 1983) recorded burning bush (*Euonymus atropurpureus*), a nationally and provincially rare species, at the Riverview dyke, although it was not seen during the UTRCA 2006 and 2007 vegetation surveys.

A large component of the vegetation is escaped ornamentals and invasive species that disrupt the natural succession of native species. Both studies found a large number of invasive and aggressive non-native species in the ground cover. Dougan and Associates, as well as Ecologistics, found slightly more non-natives on the dyke than in the floodplain communities, while the UTRCA found more non-native species in the floodplain. However, the differences between floodplain and dyke communities are very slight. Instead, it is more important to note that non-natives make up between 50 - 66% of the species recorded on either the dyke or the adjacent floodplain.

2.6. Hazard Trees

Hazard trees are defined as trees with structural or growth defects that have the potential to fail in all or part of the tree and cause personal injury or damage to property. Although dying and falling trees are important in the development of forests, they are not appropriate in high use recreation areas or on flood structures such as dykes, where they risk human life and property. Hazard trees on the dykes are the biggest concern to the integrity and structure of the dyke. Therefore, addressing hazard trees should be of high priority.

Two hazard tree inventories were conducted on the dyke, one by Dougan and Associates (2006) for all seven dykes and one in 2007 by UTRCA for the Ada and Riverview dykes. **Appendix C** contains a description of the methodology and criteria used by the UTRCA to identify and prioritize hazard trees on the dyke. The UTRCA criteria incorporate the hazard tree risk factors used by Dougan and Associates. Hazard categories evaluated were:

a. Type of Species
b. Diameter Size
c. Lean
d. Root Exposure
e. Insect / Disease Damage
f. Decay
g. Damage to Public / Private Property
h. Position on Dyke
i. Presence of Wildlife
j. Effort to Remove

Appendix D shows the UTRCA hazard rating for each criterion, as well as the final hazard rating score, for each tree on the Riverview dyke. Many trees on the steep slopes had significant lean or had fallen over. **Chart 1** shows that of the 174 trees on the Riverview dyke, 18 trees were ranked high (10%), 130 trees were ranked medium (75%) and 26 trees were ranked low (15%) in terms of their priority for removal.

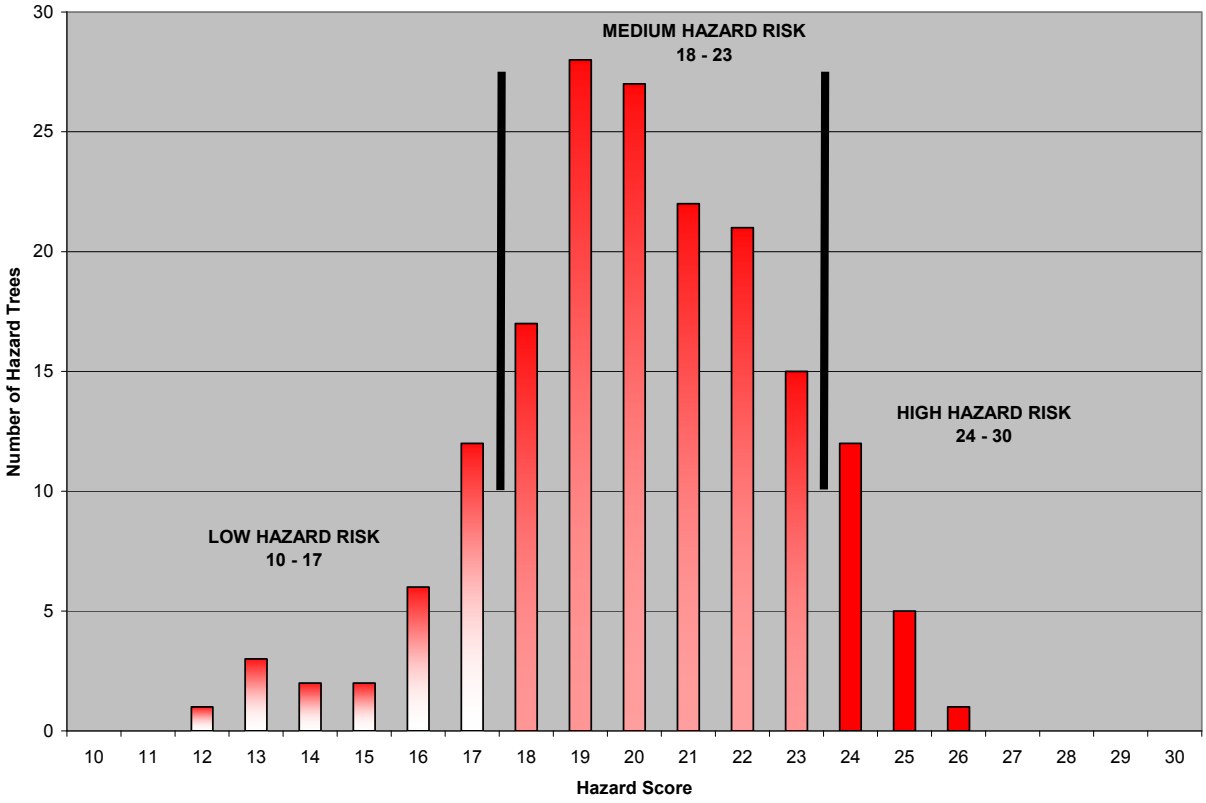

Chart 1. Distribution of Hazard Tree Scores on Riverview Dyke

Appendix D shows that out of the 174 trees on the dyke:

- 67% are species that are prone to structural defects
- 65% have a diameter >25cm DBH
- 47% have a lean of 10º or greater
- Most of the trees that show low to moderate signs of insect damage (59% and 39% respectively) also had low to moderate signs of death and decay (30% and 60% respectively)
- 10% of the trees were dead
- 65% of the trees had no signs of wildlife
- Approximately half of the 174 trees could potentially damage private / public property (i.e., 17% of the trees lean towards private / public property and are tall enough to reach it, while an additional 27% of the trees do not lean but are close enough to reach private / public property)
- Although 25% of the trees are located in the easily erodible toe section of the dyke, only 16% of the trees had exposed roots and showed signs of eroding the dyke. 33% of the trees had no root exposure, while 51% had only some exposure
- Approximately 1/4 of the trees will require a lot of effort to remove, while 38% will require moderate effort and 36% will require little effort.

2.7. Wildlife

Habitat for wildlife and evidence of wildlife occurrence was recorded by the UTRCA in the spring, summer, and fall of 2007 (**Appendix E**) and by Ecologistics in the summer of 1983. Wildlife species were noted opportunistically during the vegetative surveys and significant breeding areas for birds, amphibians and reptiles were presumed (but not confirmed) in this inventory.

No wildlife species of significance were observed. Although no terrestrial Species At Risk (SAR) were found around the Riverview dyke during the surveys, the spiny softshell turtle and other SAR have been seen in the Thames River in this area in the past. The wildlife species found on the Riverview Dyke by the UTRCA consisted of 19 different bird species, 4 mammal species and 2 butterfly species. Ecologistics found 9 species of birds, 1 species of amphibian, and 1 species of mammal at Riverview.

Many fallen logs, cavity trees and nests were found in the area. A number of burrows were also found on the dyke and in the meadow habitat. As well, there were a number of trees and shrubs that supplied either nuts or fruit for songbirds. Approximately 35% of the trees had no signs of wildlife.

2.8. Infrastructure

Riverview dyke is a 600m long earthen dyke that was constructed by placing compacted soil on top of an existing bank that reaches down to the Thames. It is typically 6 metres in height with slope inclinations of up to about 45 degrees from the horizontal. **Figure 6a** shows the topographical contours for Riverview dyke. Unfortunately, the Thames River is undercutting the vegetated slope of the dyke in some areas, threatening the structural stability. As well, the dyke is entirely located in an urban area and as such, has been highly disturbed by urbanization and periodic flooding, ice damage, and soil movement.

Residential properties are very close to the dyke (**Figure 3**), meaning that access for dyke repairs will be difficult. As well, a storm and sanitary sewer is located in the River Street road allowance and a sewer outfall is located at the north end of the River Street allowance.

Figure 7 shows the limited number of site features in this area. An informal foot path traverses the top of the earthen dyke, beginning at the west end of Evergreen Avenue and extending northward before turning eastward and running a short distance behind the houses on Riverview Avenue until it eventually tapers off. There is a steep drop to the river on the north side of the dyke. An asphalt bike trail runs south from the west end of Evergreen Avenue and links up to the City of London bicycle pathway system to the west and also extends eastward up Evergreen and Riverview Avenues to reconnect with the asphalt bike path just west of the Children's Museum.

3. Implementation Plan

The successful maintenance of the Riverview dyke requires a thorough understanding of the features and functions of floodplain ecology and how these elements affect the occurrence of vegetation that can potentially risk the physical integrity of the dyke facilities. It also requires knowledge of the physical constraints of working on the dykes, especially given that the dyke extends along the private backyards of homes located north of Riverview Avenue. Since the residential property boundaries are very close to the dyke, access to the degraded area of the dyke for repairs would be constrained. Therefore, recommendations must have regard for property ownership as well as floodplain ecology.

The four objectives of this plan are to:

1. Reduce the risk of flooding by addressing the direct risks to the structural integrity of the dyke
2. Manage the floodplain ecosystem towards a diverse and more self sustainable ecological trajectory. This will restore the functional integrity of the natural heritage matrix surrounding the dyke facilities.
3. Improve the aesthetic appeal of the riverbank
4. Create more open space

3.1. Permits

Floodplains, unstable slopes and erosion are examples of naturally occurring hazardous processes. Natural hazard planning involves planning for risks associated with these processes such as loss of life, property damage, social disruption and environmental impacts. Since there is always a risk associated with natural hazard processes, the Province sets the minimum standards for acceptable levels of risk.

Recognizing that the dyke is within the Riverine Flood Hazard or floodplain regulation limit (**Figure 8**), an Upper Thames River Conservation Authority permit through Section 28 will be required for all work in the floodplain. Additionally, a permit to take water will be required if deep excavation or dewatering (i.e., below the water table) is needed for dyke repair and rehabilitation. Water takings in Ontario are governed by the Ontario Water Resources Act and the Water Taking and Transfer Regulation. Section 34 of the Act requires anyone taking more than a total of 50,000 litres in a day, with some exceptions, to obtain a Permit To Take Water from the Ministry of the Environment.

If possible, construction work should occur in July and August, or between October – March, to avoid nesting and migratory seasons of birds and spawning seasons of significant species of fish. Yellow walleye spawn in late April to mid-May; the stoneroller in mid-May; the silver shiner in mid-June; and bass in mid-June. Most birds migrate from mid-April to mid-May and in September, and nest from mid-May to mid-July.

Ecologistics (1982, 1983) recorded burning bush (*Euonymus atropurpureus*) at the Riverview dyke, a nationally and provincially rare species. Although it was not seen during the UTRCA 2006 and 2007 vegetation surveys, care should be taken during removal of hazard trees, and / or if the dyke is to be rehabilitated, to ensure that this species is not harmed and is moved to a suitable location.

Finally, it may be necessary to acquire an easement along the dyke to facilitate access and maintenance, given how close the residential properties are to the dyke.

3.2. Public Education

Recognizing that the Riverview dyke is adjacent to residential backyards and parks, the ecosystems on and surrounding the dyke are highly disturbed by urbanization. Residents of properties near the dyke have undertaken actions such as dumping garbage, concrete blocks, fill, compost, lawn / garden waste, or excess building materials over the dyke; cultivating non-native plant species in backyard plantings that migrate to the adjoining open space areas on the dyke; contributing to noise and lighting disturbances, compacting soil by creating trails, *etc.* that indicate they do not understand the sensitive nature of the habitats adjacent to, or on, the dyke. These activities may somewhat be a contributing factor to the decline in the physical integrity of the dyke and the spread of problem species. The first step of the implementation plan is to inform the adjacent landowners and public about the project, educate them about the problems facing the dyke, and engage them in developing solutions to those problems.

Educational methods include the following:

3.2.1. Enforcement

Preventing these actions through education and enforcing them through the enactment of by-laws and fines for dumping on public lands will improve the overall vegetation management objectives.

3.2.2. Barriers

Fencing and buffer plantings can aid in reducing urban influences.

3.2.3. Trail

The closure of the informal trail on the dyke will limit the spread of soil and vegetation compaction, litter, and non-native plant species. All informal trails (especially those on the dyke) should be decommissioned and interpretive opportunities should be provided in areas frequented by pedestrians (e.g., the west section of the site). This can include information about location, routes, features, hazards, trail use regulations, purpose of the dykes, rehabilitation projects and environmental features / issues.

3.2.4. Handbook

Develop a community handbook that can be distributed as part of an awareness campaign in targeted neighborhoods. Include an educational section on the dyke that includes the ecological sensitivity of the dyke, the associated natural heritage framework, and direction for those seeking additional information. Handbook should discourage dumping and littering, and seek community cooperation as stewards. It could also provide suggestions as to what plants would be most beneficial in the area.

3.2.5. Community Meetings / Stakeholder Consultations

Community meetings can be used as a forum to speak about emerging concerns, with the goal of keeping people involved by making them aware of the issues surrounding the dyke and how they are being managed. The goal is to resolve potential conflicts before they arise. It is also an

opportunity to educate the public about the risks and options and then engage participants and stakeholders in a design charrette to elicit feedback and recommendations.

3.3. Improve the Floodplain Corridor (Landscape Connectivity)

The floodplain habitat in this area is narrow due to the placement of the dyke and the surrounding residential/industrial developments. This reduction in habitat can lead to impairments to habitat connectivity, an increase in dispersal distance of floodplain vegetation and animals, and a reduction of exposure to natural hydrological cycles. These in turn can shift wildlife and vegetation community composition.

Given that residential properties are very close to the dyke, it is not possible to move the location of the dyke. Rather, the floodplain habitat surrounding the dyke can be enhanced by reintroducing native species, improving connectivity by expanding the existing natural habitat west of the dyke, and buffering existing and restored habitats from the surrounding land uses and urban disturbances. Depending on the outcome of the regrading of the slope, there may be an opportunity to create new riparian habitat.

In the long term, property acquisition should be considered in this area.

3.4. Mimic Natural Disturbance Processes (Restore Hydrology)

Floods and droughts are, and have always been, the main hydrologic hazards in the Upper Thames River Basin (Wianecki and Gazendam 2004a, ICLR 2007). The predicted shift in climate and the increasing development on the floodplain are expected to exacerbate the hazards by increasing the frequency, magnitude, location and duration of hydrological extremes (Shrubsole *et al.* 2003). Changed hydrological extremes will have important implications on the design of future hydraulic structures, flood-plain development, and water resource management.

Disturbance processes also have a strong influence over vegetation communities. Species in floodplain communities are adapted to the naturally occurring disturbance processes of the hydrologic regime of a river. The system of dykes and dams has disconnected the river from its floodplain, changing the hydrology by reducing the frequency and duration of inundation in the floodplain. Natural storage areas, such as wetlands and floodplain communities, also change (or disappear) completely when these hydrologic processes have been altered by human activity. The rapid increases and decreases in flow resulting from the loss of natural storage opportunities alter the plant species composition, reduce the biodiversity of the area (creating monocultures) and increase the prevalence of invasive exotic species. These changes contribute to the recruitment of undesirable species on the dykes.

To restore the area to a more typical hydro-period, the river and the floodplain should be reconnected. This can include the physical alteration of the local topography (creating swales and seasonal pools by grading within the disturbed floodplain) to improve hydrological conditions, the connection of the river to floodplain pools, and the establishment of new wetlands (e.g., wooded lowlands) in the floodplain.

3.5. Improve Soil Conditions

Soils influence siltation and erosion processes and therefore affect the composition of the plant community. When soils have been disturbed by construction and / or fill, they favor aggressive weedy species. After repair to the dyke, the soil should be stabilized as soon as possible to prevent sediments from reaching the river and to maintain the shape of the dyke. To prevent the re-introduction of non-native species and to decrease erosion and sedimentation, limit further disturbance to the soil. Also encourage the establishment of deep fibrously rooted native shrubs to hold the soil in place.

Slopes on the dyke running through forested areas may have to be seeded since they are steep. They may also have to be seeded if considerable height has been added. Those areas where there is little threat of erosion can regenerate naturally.

3.6. Control Non-Native Plants

Vegetation communities on and adjacent to Riverview dyke are in a disturbed state that favors the growth of invasive, non-native species leading to a decline in natural diversity and ecological function. The plant species growing on and adjacent to the dyke are dominated by species tolerant of these habitats (e.g., ornamentals and invasive non-native species). Non-native species tend to be aggressive because they are often fast-growing and shallow-rooted. They will displace conservative, native species, and can weaken the structure and stability of the dykes. These species are present because of a number of reasons:

- the disruption of the natural hydrologic conditions have influenced the species composition on the adjacent floodplains,
- Seed rain is dominated by the non-native species, making them the only sources of seed available on the dyke. There is minimal regeneration of native species.
- Riverview dyke is adjacent to urban parks and residential backyards, so grass clippings and other sources of non-native material are dumped on the dyke.

To improve the abundance and diversity of native plants, the following steps should be undertaken:

3.6.1. Identify and prioritize non-native species

It would be very difficult to control or eradicate the vast number of plants that have the potential to be invasive. As well, the less aggressive species can be beneficial, helping to control bank erosion. Therefore, focus should be on controlling highly aggressive, non-native species.

On the Riverview dyke, seven non-native plants that may become a concern are garlic mustard (*Alliaria petiolata*), goutweed (*Aegopodium podagraria*), periwinkle (*Vinca minor*), buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera tatarica*), Norway maple (*Acer platanoides*), and Manitoba maple (*Acer negundo*).

3.6.2. Remove / control non-native species

Regular removal of non-native species should be done when they are easily identified and prior to the release of seed. Qualified staff should identify and mark the species for removal, as well as ensure they are properly removed and disposed of. On the Riverview dyke, the removal of these species may increase erosion and slumping of the highly erodible slope. Therefore, removal may have to occur over a several years to help stabilize the slope and control erosion.

Table 1 shows the preferred method for the removal / control of the seven species of concern. Most of the methods for controlling each species are manual cutting with a follow up herbicide treatment to reduce the amount of disruption to the soil. Continuous removal on a regular basis will be necessary for a few years to get the species under control. Although it is sometimes important to thin a wooded area to encourage growth, this technique is not recommended for the Riverview dyke given the basal area, steep slopes, and the composition of size classes on the floodplain and on the dyke.

Table 1. Preferred method for removal or control of the 7 non-native species of concern

SPECIES	METHOD	NOTES
Alliaria petiolata (garlic mustard)	Remove first year plants and roots and cut mature plants annually in late June.	Must prevent seed production until plant absent for 3 years.
Aegopodium podagraria (goutweed)	Manually pull all underground stems once plants leaf out and then cover the ground with plastic for a year.	Forms dense patches. Seed bank short-lived and no establishment in the shade
Vinca minor (periwinkle)	Manually dig out or cut stumps to ground and paint on glyphosate.	Spreads along the ground but does not climb. Forms dense carpet.
Rhamnus cathartica (buckthorn)	Increase water levels or cut in fall and apply Garlon 4 or glyphosate.	Fire is most effective control.
Lonicera tatarica (honeysuckle)	Pull out shallow roots in spring when soil moist and then trample soil. Repeat for 3-5 years and underplant with native species	Tolerates herbivory, drought, heat and humidity. Forms dense thickets and spread by animals carrying seed
Acer platanoides (Norway maple)	Remove mid to late fall by cutting and applying Garlon 4 or glyphosate.	Creates dense shade and hold leaves longer.
Acer negundo (Manitoba maple)	Chainsaw large trees and and apply Garlon 4 or glyphosate. Hand-pull seedlings.	Fast growth, short-lived species that produce seed or reproduce vegetatively.

Individual landowners should be educated about the non-native species and why they are a problem. These landowners should be allowed to pull or cut the invasive plants in their backyard to reduce the number of seeds they produce. As well, the dumping of garbage, fill, compost and garden waste is a main contributing factor to the spread of invasive plants. Preventing these activities will improve the success of native plant introduction.

3.6.3. Reintroduce native plants

Once the non-native plants have been removed, the reintroduction of native species in the vicinity of Riverview dyke will help improve the abundance and diversity of native plants in the area, as well as restore and conserve the remnant natural plant populations. The lowland deciduous forest community 1 (FOD 7) is more naturalized, and can be built upon to conserve and restore the broader natural heritage system. Species selection should be based on historical plant communities, on species that complement other management strategies of the plan, and also on an understanding of the processes driving the community (e.g., soils, topographic position, climate, hydrology, etc.). **Appendix F** provides a list of appropriate species compositions for restoration plantings in the vicinity of Riverview dyke.

The cultural meadow community 2 (CUM) west of the dyke can be re-vegetated with shrub species planted by community groups or by the local neighbours to increase the amount of natural cover along the river, improve connectivity and act as a seed source for the nearby dyke.

On Riverview dyke, do not replant with trees as they may cause problems in the future. Rather rehabilitate the dyke vegetation (vegetation communities 3 and 4) by planting native shrubs with fibrous root systems (**Appendix G**) to stabilize and enhance the structural integrity of the dyke slope. It may be difficult to reestablish native species on the dyke, since the vegetation communities there are highly impacted by human disturbance (e.g., soil compaction). As well, floodplain communities have minimal regeneration, sandy soils and ephemeral pools. Therefore, re-seed the dyke yearly with native species (**Appendix F**) to compete with the undesirable herbaceous species on the dyke, with the goal of greatly reducing or eventually removing the non-native seed source.

3.6.4 Establish a monitoring / maintenance program

Development of a non-native species monitoring program is necessary to ensure that removal and re-vegetation efforts achieve manageable levels. Given that the hydrologic regime of the Thames River has been altered by human activity, including rapid increases and decreases in flow resulting from the loss of natural storage opportunities caused by dams, the composition of plant species able to grow within this environment has changed, favoring invasive exotic species. As a result, it is important to schedule regular removal of young non-native plants as part of a maintenance routine to reduce recruitment of hazardous species. Removal efforts of non-native species will have to persist for several years to maintain manageable levels of control.

Since the condition of the existing embankments can change very quickly during flooding, the banks should be inspected after each major flood event. Based on these inspections, repairs should be scheduled as required.

3.7. Remove Hazard Trees

Direct hazards, such as trees growing directly on the dyke, affect the structural integrity of the dyke and therefore have the highest priority for management action. Removing fallen, leaning, and dying trees from the dyke will be necessary if they are tearing out portions of the dyke. Hazard tree removal will necessitate the removal of both the exposed root systems and the hazard trees. It is a four step process:

3.7.1. Identify and prioritize hazard vegetation

Trees deemed as a potential problem were rated as to how hazardous they were. Hazard tree criteria described in **Appendix C** was used to rank trees according to three classes **(Appendix D)**: 1) trees that have to be removed immediately (total hazard score between 24 - 30), 2) trees that have to be monitored closely (total hazard score between 18 - 23), and 3) trees that pose little threat to the dyke (total hazard score between 10 - 17).

Each hazard tree was assigned a GPS coordinate and mapped for future assistance in locating these trees. **Figures 6a and 6b** show the location of the hazard trees on Riverview dyke. Based on these scores, approximately 18 trees have been identified for immediate removal, while 26 trees appear to pose little threat to the dyke. The remaining 130 trees have to be monitored closely.

3.7.2. Remove high priority trees

The public may have certain perceptions that will need to be addressed regarding the destruction and removal of mature trees. Public perception and concern over the removal of large trees can be reduced by supplementing removal activities with an informative brochure and public meetings.

Trees will be removed manually (cut down) or, if possible, pruned to remove the defective parts. Girdling the trees is not an option because this will only create a new hazard in the future. Root systems will be chemically treated by applying triclopyr (e.g., Garlon) on the stumps or foliage to reduce suckering. Roots will not be pulled out in order to keep soil disturbance to a minimum. However, removal of fallen, dying or leaning trees from the dyke may be necessary if they are tearing out part of the dyke. Depending on the extent of the damage, large equipment may need to be brought in. Disturbance to the dyke should be kept to a minimum to retain as much vegetation cover as possible. However, in some areas, the need to remove the hazard tree may require the removal of vegetation to gain access.

3.7.3. Re-vegetate with native material

To avoid further colonization of undesirable tree species following the removal of the hazard trees, a rehabilitation plan should be in place. The excavated material should be replaced and the area re-vegetated with native material before undesirable plants establish themselves to replace the lost vegetation cover on earthen dykes. Avoid planting tree species, especially shallow rooted species, since they can become top heavy and lean over, gradually heaving portions of the dyke structure. Also avoid planting species that cause dense shading of the understory, leaving the soil bare and favoring the undesirable invasive species. Rather, plant dense, fibrously rooted native shrub and native herbaceous species (**Appendix F**) to reinforce soil stability, provide enhanced structural integrity for the dyke, and promote diversification of native species that will compete with the undesirable species that now exist in the area.

3.7.4. Conduct annual systematic evaluation of trees

Simply identifying and treating hazard trees is a short-term solution to the problem. Careful and wise vegetation management is the long-term key to ensuring that the dyke remains structurally sound in the future. Ongoing monitoring must be conducted to identify new hazard trees and the re-growth of problem species in critical condition areas of the dyke to avoid the potential for future damage. A maintenance routine must be established for the long-term management of the dyke that leads to a sustainable and less risk-prone vegetation cover.

3.8. Repair Dyke Damage

A preliminary investigation to evaluate the ability of the dyke to function in the event of a flood (i.e., the structural integrity) was conducted by Dougan & Associates and UTRCA staff on January 6, 2006 to identify risks to all seven dykes in the City of London and then prioritize sections of the dykes by condition (risk category). An additional study was conducted by Stantec in 2008 from sections 0+190 to 0+ 300. In summary, these studies found that:

1. The physical integrity of the dyke is about to be compromised or contains problem species that may lead to hazardous conditions in section 0+000 to 0+275, which is the section that is immediately adjacent to the private homes on Riverview Avenue (**Figure 9 - critical**). This area of the dyke requires immediate action. At this location the dyke is fairly narrow

and there is a steep drop-off to the river. Care should be exercised that fill does not reach the watercourse.

2. Localized erosion and numerous hazard trees occur throughout section 0+190 to 0+300. To assess the full extent of erosion problems, additional investigation should occur. Hazard trees should be removed. Additionally, steep slopes are found throughout, with emphasis in the vicinity of sections 0+210 and 0+260. At station 0+210, the concrete at the bottom of the headwall is deteriorating and the railing is not fastened de to damage. Remedial work is likely required for the steep slopes, headwall and railing.
3. There is no short term threat to the integrity of the dyke in section 0+275 to 0+425, the western portion of the dyke that curves south away from the river (**Figure 9 - threshold**). The floodplain does a good job of protecting this small portion of the dyke, acting as an extensive toe and protecting it through the reduction in floodplain velocities. However, this area of the dyke may require action within 1 – 3 years.

A report, map, and field review by Golder and Stantec in 2008 compared erosion progress to previous years and provided specific erosion measurements. Golder provided preliminary considerations for future efforts that may be required to ensure future flood protection for the Riverview flood plain area. As future vegetation management and dyke stability is investigated, it may become apparent that efforts are required that may necessitate complete removal of vegetation on the banks and the dyke in order to access the areas required for protection efforts to be undertaken. Re-establishment of native vegetation species complementing such efforts would then be then be the focus of a vegetation maintenance program to restore natural plant populations. At this time, and for the next few years, it is anticipated that vegetation management will complement any future monitoring and necessary efforts to ensure flood protection.

3.9. Phasing Schedule for Implementation

3.9.1. Phase I. Repair degraded section of Riverview Dyke (2010 – 2012)

Step 1. Obtain appropriate permits

- Obtain a UTRCA permit through Section 28 for work in the floodplain.

Step 2. Inform public about repair

- inform residents backing onto the dyke about the proposed construction in informative brochure and public meetings
- erect appropriate barriers

Step 3. Remove trees and non-native species

- manually remove all trees on the dyke as well as down slope of dyke repair area and chemically treat roots
- remove non-native species in spring prior to seed with manual cutting followed up with a herbicide

Step 4. Repair degraded section of dyke

- repair after June to minimize effects on significant fish species.

Step 5. Stabilize slopes
- revegetate slopes on the dyke using deep fibrously rooted native shrubs and herbaceous plants

Step 6. Revegetate dyke slope with native species
- improve the diversity on the dyke by planting additional native shrub and herbaceous upland species listed in **Appendices F and G** amongst the deep fibrously rooted species

Step 7. Improve floodplain meadow west of the dyke
- revegetate using native emergent and lowland / wetland species listed in **Appendix F**
- reconnect river and floodplain by creating swales, seasonal pools and wooded lowlands / wetlands

3.9.2. Phase II. Remove remainder of hazard trees (2011 – 2012)

Step 1. Inform and educate public about hazard trees
- address destruction of mature hazard trees in informative brochure delivered to residents within and along Riverview Avenue
- hold public meeting for entire neighborhood to discuss process

Step 2. Remove high hazard trees
- Manually remove all trees that have a hazard score between 24 – 30 (**Appendix D**) and chemically treat roots

Step 3. Stabilize slopes
- revegetate slopes on the dyke using deep fibrously rooted native shrubs and herbaceous plants

Step 4. Revegetate
- improve the diversity on the dyke by planting additional native shrub and herbaceous upland species listed in **Appendices F and G** that are appropriate to the type of vegetation community amongst the deep fibrously rooted species
- for areas where there is little treat of erosion, allow it to naturally regenerate once the tree has been removed.

3.9.3. Phase III. Improve corridor (2012 – 2013)

Step 1. Improve floodplain
- revegetate using native emergent and lowland / wetland species listed in **Appendix F**
- reconnect river and floodplain by creating swales, seasonal pools and wooded lowlands / wetlands
- expand natural habitat to the west

Step 2. Remove non-native species
- remove non-native species in spring prior to seed with manual cutting followed up with a herbicide
- Areas that need rehabilitation include the dyke and the anthropogenic floodplain meadow to the west of the dyke (**Figure 5**).

Step 3. Revegetate
- revegetate using native shrub and herbaceous species listed in **Appendices F and G** that are appropriate to the type of vegetation community
- improve buffer plantings between public and private lands
- erect and maintain fence between back yard of properties along Riverview Avenue and the public lands surrounding the dyke

Step 4. Formalize trail
- GPS formal trail and submit to City of London as part of pedestrian / bike trail in this area
- Identify unique features along the trail
- Close informal trails with signs stating regeneration / rehabilitation

Step 5. Educate the public
- develop a community handbook that discusses naturalization verses non-native plantings
- enforce bylaws for dumping garbage on public lands

3.9.4. Phase IV. Monitor progress annually (2012 - ongoing)

Step 1. Examine dyke structure after each major flood
- schedule repairs to portions of the dyke annually

Step 2. Examine hazard trees
- rescore all trees on the dyke annually

Step 3. Examine non-native species and new vegetation annually
- identify locations of new infestations of non-natives
- monitor success of re-vegetation

Step 4. Remove non-native species and high hazard trees
- revegetate using native shrub and herbaceous species listed in **Appendices F and G** that are appropriate to the type of vegetation community
- Manually remove all trees that have a hazard score between 24 – 30 and chemically treat roots

Step 5. Report findings to stakeholders and develop new project phases depending on monitoring results
- hold public meeting for entire neighborhood to discuss process

Step 6. Inform public
- hold public meeting for entire neighborhood to discuss process
- educate public about problems facing the dyke and developing solutions to those problems
- develop community handbook that discusses good stewardship and the purpose of the dyke

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Glossary

Basal Area
The area occupied by trees near the ground surface. Usually measured in m^2/ha.

CC (Appendix A)
Coefficient of Conservatism that is based on the Floristic Quality Assessment System for Southern Ontario (Oldham *et al.* 1995) and on analysis of native plant distribution in the London sub watershed area (Bowles *et al.* 1994). Describes the probability of finding a native species in a particular and, therefore, aids in measuring the overall quality of the site. Values range from 0 (widespread) to 10 (found only in very specialized habitats).

COSEWIC (Appendix A)
A status rank assigned by the Committee on the Status of Endangered Wildlife in Canada.

Cultural Community
A vegetation community originating from, or maintained by, people (e.g., meadows growing on disturbed soils, pine plantations). Non-native species are often abundant.

CW (Appendix A)
The Coefficient of Wetness was assigned to plant species by Oldham et al. (1995) where 5 refers to obligate upland species and -5 to obligate wetland species.

Diameter at Breast Height (DBH)
The point at which a tree trunk diameter is usually measured (i.e., 1.3 m) above the ground.

Geographic Information Systems (GIS)
Describes any information system that captures, integrates, stores, edits, analyzes, manages, shares, and displays information or data that is linked to location. GIS applications are tools that allow users to create interactive queries (user created searches), analyze spatial information, edit data, maps, and present the results of all these operations.

I_N (Appendix A)
Invasive or native classification of the plant

Native Species
Native species are those that occur in the region in which they have evolved prior to European settlement (around 1600 AD). Native species evolve over time in response to climate and interactions with other species inhabiting the community. Thus, native plants possess certain traits that make them uniquely adapted to local conditions.

Natural Community
Vegetation community resulting from natural dynamics of vegetation development, not maintained as a result of anthropogenic disturbance regimes. The anthropogenic influences are either not of sufficient intensity or were long enough ago that the community has recovered some of its original composition and structure.

Non-Native Species
Species that have been introduced to a new area, usually a new continent. They tend to grow at high population densities and can have a negative impact on other plants.

SRANK (Appendix A)
Provincial (or Sub national) ranks are used by the Natural Heritage Information Centre to set protection priorities for rare species and natural communities. These ranks are not legal designations. Provincial ranks are assigned by a consensus of the network of CDCs, scientific experts, and The Nature Conservancy to designate a rarity rank based on the range-wide status of a species, subspecies or variety. The most important factors are the total number of known, and extant, sites province-wide, and the degree to which they are potentially or actively threatened with destruction. Other criteria include the number of known populations considered to be securely protected, the size of the various populations, and the ability of the taxon to persist at its known sites. The taxonomic distinctness of each taxon has also been considered. Hybrids, introduced species, and taxonomically dubious species, subspecies and varieties have not been included. By comparing provincial ranks, the status, rarity, and urgency of conservation needs can be ascertained. The NHIC evaluates provincial ranks on a continual basis and produces updated lists at least annually:

SX - extirpated

SH – possible extirpated

S1 – critically impaired

S2 – imperiled

S3 – vulnerable

S4 – apparently secure

S5 – secure

SNR – not ranked

SU – unrankable

SNA – not applicable

Weed (Appendix A)
Weediness scoring system from -1 to -3 developed by Oldham *et al.* (1995). The most aggressive or invasive non-native species are more negative (i.e., -3).

Woody Debris
Includes fallen trees, limbs, branches, stumps and logs.

Appendix A. UTRCA Vegetation Inventory of the Riverview Dyke

1.0 Purpose

The purpose of the vegetation inventory is to identify invasive species that may pose a threat to the structure of Riverview dyke and to the natural succession of the native species found on the dyke.

2.0 Methodology

2.1 Aerial Photos

Spring 2006 air photography illustrating the dyke location, plant community and the Thames River floodplain; as well as 1:2000 and 1:10,000 Ontario Base Mapping (OBM) and AutoCAD Base Map files showing property lines, permanent and built structures, Thames River, Thames River Floodplain and surrounding communities, were reviewed (**Figure 5**).

2.2 Landowner Contact

A large portion of the Riverview Dyke is only accessible through private property. Consent forms requesting permission to access the dyke were sent to each landowner that lived along the dyke (**Appendix B**). Follow up phone calls were also made to let landowners know when UTRCA staff would be on their property. 12 of the 14 landowners gave either written or verbal permission to access the dyke through their property. Field staff carried the signed forms while doing inventories.

2.3 Inventory Methodology

A three-season qualitative inventory of the vegetation was conducted in the spring, summer and fall of 2006 and 2007 by the UTRCA. This ensured that a complete list of plants and wildlife species were recorded. Ontario's Ecological Land Classification (ELC) scheme (Lee *et al.* 1998) was used to classify the vegetation communities to the ecosite level (i.e., green level of the ELC) where possible. The ELC scheme is designed to help standardize the categorization of natural areas throughout the province by assigning sites to specific ecological community types depending upon the composition of their dominant tree species, soil types, hydrology, and understory vegetation.

The ecosite is one scale smaller than the community series level, which is the scale that vegetation work by Dougan and Associates was conducted. Detailed ELC site inventories are required to advance the ELC designation from the Community Series level to the Ecosite level. The vegetation communities were surveyed on foot and a description of the top four species by presence for each vegetation layer (canopy, sub-canopy, and understory) was recorded. No formal quantitative analysis of the vegetation was performed during this survey (i.e., no sampling quadrants or measured transects were taken) but general observations regarding abundance were noted. Vegetation community boundaries were verified and mapped.

For vegetation communities dominated by trees, prism sweeps were used to determine basal area by tree species and size. Basal area measures the area that is taken up by standing trees and is used to determine productivity and growth rate. Prism sweeps were recorded at least once for

each vegetation community. Descriptions of the physiography and estimates of disturbance were also recorded.

2.4 Date of Field Visits

Field visits were conducted on four dates (1 x spring, 2 x summer and 1 x fall):
July 14, 2006
August 28, 2006
September 7, 2006
May 22, 2007

3.0 Vegetation Description

3.1 Plant Communities

Four plant communities were identified and mapped for the Riverview Dyke **(Figure 5)**. Community 1 (FOD 7) was a fresh-moist lowland deciduous forest ecosite, with an open canopy cover of 10-25% **(Table A1)**. The canopy was made up of black walnut (*Juglans nigra*), Manitoba maple (*Acer negundo*) and cottonwood (*Populus deltoides*), with a subcanopy of Manitoba maple. The under story was honeysuckle (*Lonicera tatarica* and *L. morrowii*), buckthorn (*Rhamnus cathartica*) and green ash (*Fraxinus pennsylvanica*). The inclusion of green ash trees had been planted by a community group.

Table A1. Top 4 Species in Community 1 (FOD 7) for Each Vegetation Layer

	Height	Cover	Species 1		Species 2		Species 3		Species 4
Canopy	>25m	10-25%	Black Walnut	=	Manitoba Maple	=	Cottonwood		
Subcanopy	10-25m	25-60%	Manitoba Maple						
Understory	2-10m	10-25%	Green Ash	>	Tartarian Honeysuckle	=	European Buckthorn		

The basal area for Community 1 is 21.5 m^2/ha (**Table A2**), which is close to the ideal basal area of 20 m^2/ha for optimal growth and productivity. However, polewood is over-represented while trees 38 – 60 cm in diameter are under-represented on the dyke, when compared to the ideal basal area tree size distribution.

Table A2. Basal Area of Community 1 (FOD 7)

TREE TALLY BY SPECIES: Prism Factor (BAF) 2

Stations	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
4	Total # of Stations

DIAMETER CLASSES (**A** = **A**cceptable **G**rowing **S**tock, **U** = **U**nacceptable **G**rowing **S**tock)

SPECIES	Polewood (10 - 24cm) A	U	Small (26 - 36cm) A	U	Medium (38 - 48cm) A	U	Large (50 - 60cm) A	U	X- Large (>62cm) A	U	Total All A	U
Manitoba Maple	12	2	7	3	1	2	0	1	0	0	20	8
White Elm	1	0	0	0	0	1	0	0	0	0	1	1
Horse Chestnut	1	0	0	0	0	0	0	0	0	0	1	0
European Buckthorn	0	1	0	0	0	0	0	0	0	0	0	1
Black Walnut	1	0	0	0	1	0	0	0	0	0	2	0
Norway Maple	1	0	1	0	0	0	0	0	0	0	2	0
White Willow	0	0	0	0	0	0	1	0	0	1	1	1
Hackberry	3	0	0	0	0	0	0	0	0	0	3	0
Hybrid Willow	0	0	0	0	0	0	0	0	1	1	1	1
DEAD (snags)												
Total	19	3	8	3	2	3	1	1	1	2	31	12
Ideal Basal Area	4		5		5		4		2		20	
*Actual Basal Area (m^2/ha)	11		5.5		2.5		1		1.5		21.5	

*Actual BA/ha = (Total Trees **x** BAF) / (Total # of stations) = (43 * 2)/4 = **21.5**

Community 2 (CUM) was an open cultural meadow with a few scattered black walnut, silver maple (*Acer saccharinum*) and Manitoba maple (**Table A3**). There was a sumac (*Rhus typhina*) thicket along the railway tracks that runs along the south side of the community. Another small group of green ash had been planted in the northeast corner by a community group.

Table A3. Top 4 Species in Community 2 (CUM) for Each Vegetation Layer

	Height	Cover	Species 1		Species 2		Species 3		Species 4
Canopy	>25m	0-10%	Silver Maple						
Subcanopy	10-25m	0-10%	Black Walnut	=	Manitoba Maple				
Understory	2-10m	0-10%	Staghorn Sumac	>	Green Ash				

The dyke itself is beside a very steep slope that leads into the river. Communities 3 (FOD 4) and 4 (FOD 4) were identified on the steep bank and on top of the dyke. Community 3 includes the dyke and the slope on the city property from Evergreen Avenue up to the houses. Community 4 incorporates the dyke area and slope behind the houses along Riverview Avenue and O'Brien Street.

The slope was a dry-fresh deciduous forest and the tree canopy was open with 25-60 % cover (**Tables A4 and A5**). It consisted of Manitoba maple, black walnut, Norway maple (*Acer platanoides*), sugar maple (*Acer saccharum*), willows (*Salix sp.*) and a few scattered elms (*Ulmus americana*). The subcanopy was made up of Manitoba maple, hackberry (*Celtis*

occidentalis), Norway maple and basswood (*Tilia americana*). Buckthorn, Norway maple, Manitoba maple and choke cherry (*Prunus virginiana*) were found in the understory.

Table A4. Top 4 Species in Community 3 for Each Vegetation Layer

	Height	Cover	Species 1		Species 2		Species 3		Species 4
Canopy	10-25m	25-60%	Manitoba Maple	>>	Hybrid Poplar	>	Black Walnut	=	White Elm
Subcanopy	10-25m	10-25%	Manitoba Maple	>>	Hackberry	=	Norway Maple		
Understory	2-10m	10-25%	European Buckthorn	=	Norway Maple	=	Manitoba Maple	>	Choke Cherry

Table A5. Top 4 Species in Community 4 for Each Vegetation Layer

	Height	Cover	Species 1		Species 2		Species 3		Species 4
Canopy	10-25m	25-60%	Manitoba Maple	=	Norway Maple	=	Sugar Maple	=	Black Walnut
Subcanopy	10-25m	10-25%	Manitoba Maple	=	Hackberry	>>	Basswood		
Understory	2-10m	10-25%	European Buckthorn						

The basal area on the slope was 22 m^2/ha (**Table A6**), which is close to the ideal basal area of 20 m^2/ha for optimal growth and productivity. However, trees < 36 cm in diameter are over-represented while trees >36 cm in diameter are under-represented on the dyke, when compared to the ideal basal area tree size distribution.

Table A6. **Basal Area of Communities 3 and 4**

TREE TALLY BY SPECIES: Prism Factor (BAF) 2

Stations	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
2	Total # of Stations

DIAMETER CLASSES (**A** = **A**cceptable **G**rowing **S**tock, **U** = **U**nacceptable **G**rowing **S**tock)

SPECIES	Polewood (10 - 24cm)		Small (26 - 36cm)		Medium (38 - 48cm)		Large (50 - 60cm)		X- Large (>62cm)		Total All	
	A	U	A	U	A	U	A	U	A	U	A	U
Norway Maple	0	0	2	0	1	0	0	0	0	0	3	0
Hackberry	5	0	0	0	0	0	0	0	0	0	5	0
Basswood	1	0	0	0	0	0	0	0	0	0	1	0
Manitoba Maple	3	0	2	0	0	1	0	0	0	0	5	1
Sugar Maple	0	0	1	0	0	0	0	0	0	1	1	1
European Buckthorn	1	0	0	0	0	0	0	0	0	0	1	0
White Elm	0	0	0	1	0	1	0	0	0	0	0	2
Black Walnut	0	0	1	0	1	0	0	0	0	0	2	0
DEAD (snags)												
Total	10	0	6	1	2	2	0	0	0	1	18	4
Ideal Basal Area	4		5		5		4		2		20	
*Actual Basal Area (m^2/ha)	10		7		4		0		1		22	

***Actual BA/ha = (Total Trees x BAF) / (Total # of stations) = (22*2)/2 = 22**

3.2 Plant Species Description

A total of 167 species were found at the Riverview Dyke, of which 67 species were native and 100 were non-native (**Table A7**). The non-native species represented 60% of the plants in Community 1; 66% in Community 2; and approximately 50% in each of Communities 3 and 4.

The Riverview Dyke is adjacent to residential backyards, floodplains and open meadows, which are dominated by invasive species tolerant to these habitats. With the dyke being located along a disturbed floodplain, many invasive plants have come down the river both by way of seeds and vegetative pieces. As well, many aggressive plants observed on the dyke and surrounding areas have escaped from backyard gardens and landscape plantings. In the floodplain, 63% of the plants were non-native; on the dyke, 53% were non-native.

On this site, some plants that may pose a problem to the function of the habitat are garlic mustard (*Alliaria petiolata*), goutweed (*Aegopodium podagraria*), periwinkle (*Vinca minor*), buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera tatarica*), Norway maple (*Acer platanoides*) and Manitoba maple (*Acer negundo*).

Table A7. Plant Species List for Each Community

SCI_NAME	COM_NAME	CC	CW	WEED	I_N	SRANK
Community 1	**FOD 7**					
Acer negundo	Manitoba Maple	0	-2		N	
Acer saccharinum	Silver Maple	5	-3		N	
Acer saccharum	Sugar Maple	4	3		N	
Aegopodium podagraria	Goutweed		0	-3	I	
Alliaria petiolata	Garlic Mustard		0	-3	I	
Anthriscus sylvestris	Wild Chervil		5	-2	I	
Arctium minus	Common Burdock		5	-2	I	
Asclepias syriaca	Common Milkweed	0	5		N	
Aster cordifolius	Heart-leaved Aster	5	5		N	
Aster lateriflorus	Calico Aster	3	-2		N	
Aster novae-angliae	New England Aster	2	-3		N	
Aster pilosus	Hairy Aster	4	2		N	
Aster urophyllus	Arrow-leaved Aster	6	5		N	
Bromus inermis	Smooth Brome		5	-3	I	
Campanula rapunculoides	Creeping Bellflower		5	-2	I	
Celtis occidentalis	Common Hackberry	8	1		N	
Chelidonium majus	Celandine		5	-3	I	
Cichorium intybus	Chicory		5	-1	I	
Cirsium vulgare	Bull Thistle		4	-1	I	
Dactylis glomerata	Orchard Grass		3	-1	I	
Daucus carota	Wild Carrot		5	-2	I	
Elymus repens	Quack Grass		3	-3	I	
Festuca arundinacea	Tall Fescue		2	-1	I	
Fraxinus pennsylvanica	Red/Green Ash	3	-3		N	
Galium mollugo	Wild Madder		5	-2	I	
Geum aleppicum	Yellow Avens	2	-1		N	
Geum canadense	White Avens	3	0		N	
Glechoma hederacea	Gill-over-the-ground		3	-2	I	
Hemerocallis fulva	Orange Day Lily		5	-3	I	
Hesperis matronalis	Dame's Rocket		5	-3	I	
Impatiens pallida	Pale Touch-me-not	7	-3		N	
Juglans nigra	Black Walnut	5	3		N/I	S4
Lapsana communis	Nipplewort		5	-2	I	
Leonurus cardiaca	Motherwort		5	-2	I	
Ligustrum vulgare	Privet		1	-2	I	
Linaria vulgaris	Butter-and-eggs		5	-1	I	
Lonicera morrowii	Morrow's Honeysuckle		5	-1	I	
Lonicera tatarica	Tartarian Honeysuckle		3	-3	I	
Lysimachia nummularia	Moneywort		-4	-3	I	
Malus pumila	Apple		5	-1	I	
Malva neglecta	Common Mallow		5	-1	I	
Melissa officinalis	Lemon Balm		1	-2	I	
Morus alba	White Mulberry		0	-3	I	
Origanum vulgare	Wild Marjoram		5	-2	I	
Ornithogalum umbellatum	Star-of-Bethlehem		1	-1	I	
Oxalis stricta	European Wood-sorrel	0	3		N	
Parthenocissus quinquefolia	Virginia Creeper	6	1		N	

Physalis heterophylla	Clammy Ground-cherry	3	5		N
Plantago major	Common Plantain		-1	-1	I
Populus deltoides	Cottonwood	4	-1		N/I
Prunus avium	Sweet Cherry		5	-2	I
Prunus serotina	Wild Black Cherry	3	3		N
Prunus virginiana	Choke Cherry	2	1		N
Ranunculus acris	Common Buttercup		-2	-2	I
Rhamnus cathartica	Common Buckthorn		3	-3	I
Rhamnus frangula	Glossy Buckthorn		-1	-3	I
Rubus idaeus	Wild Red Raspberry	0	-2		N
Rubus occidentalis	Black Raspberry	2	5		N
Rumex crispus	Curly Dock		-1	-2	I
Saponaria officinalis	Bouncing Bet		3	-3	I
Setaria viridis	Green Foxtail		5	-1	I
Silene latifolia	White Cockle		5	-2	I
Solanum dulcamara	Climbing Nightshade		0	-2	I
Solidago altissima	Late Goldenrod	1	3		N
Solidago canadensis	Canada Goldenrod	1	3		N
Solidago gigantea	Tall Goldenrod	4	-3		N
Syringa vulgaris	Common Lilac		5	-2	I
Taraxacum officinale	Common Dandelion		3	-2	I
Taxus baccata	English Yew		3	-1	I
Tilia americana	Basswood	4	3		N
Tussilago farfara	Coltsfoot		3	-2	I
Verbena urticifolia	White Vervain	4	-1		N
Viola odorata	Sweet Violet		5	-1	I
Viola sororia	Common Blue Violet	4	1		N
Vitis riparia	Riverbank Grape	0	-2		N

Community 2 CUM

SCI_NAME	COM_NAME	CC	CW	WEED	I_N	SRANK
Acer negundo	Manitoba Maple	0	-2		N	
Acer saccharinum	Silver Maple	5	-3		N	
Alliaria petiolata	Garlic Mustard		0	-3	I	
Ambrosia artemisiifolia	Common Ragweed	0	3		N	
Anthriscus sylvestris	Wild Chervil		5	-2	I	
Arctium minus	Common Burdock		5	-2	I	
Asclepias syriaca	Common Milkweed	0	5		N	
Asparagus officinalis	Garden Asparagus		3	-1	I	
Aster lanceolatus	Panicled Aster	3	-3		N	
Barbarea vulgaris	Winter Cress		0	-1	I	
Bromus inermis	Smooth Brome		5	-3	I	
Calystegia sepium	Hedge Bindweed	2	0		N	
Celtis occidentalis	Common Hackberry	8	1		N	
Cerastium fontanum	Mouse-eared Chickweed		3	-1	I	
Chelidonium majus	Celandine		5	-3	I	
Chenopodium album	Lamb's-quarters		1	-1	I	
Cichorium intybus	Chicory		5	-1	I	
Cirsium arvense	Canada Thistle		3	-1	I	
Cirsium vulgare	Bull Thistle		4	-1	I	
Convolvulus arvensis	Field Bindweed		5	-1	I	
Dactylis glomerata	Orchard Grass		3	-1	I	
Daucus carota	Wild Carrot		5	-2	I	
Dipsacus fullonum	Teasel		5	-1	I	
Echinocystis lobata	Wild Cucumber	3	-2		N	
Elymus repens	Quack Grass		3	-3	I	
Equisetum arvense	Field Horsetail	0	0		N	
Festuca arundinacea	Tall Fescue		2	-1	I	
Fraxinus pennsylvanica	Red/Green Ash	3	-3		N	
Galium mollugo	Wild Madder		5	-2	I	
Geum canadense	White Avens	3	0		N	
Glechoma hederacea	Gill-over-the-ground		3	-2	I	
Helianthus tuberosus	Jerusalem Artichoke		0	-2	I	
Hemerocallis fulva	Orange Day Lily		5	-3	I	
Hesperis matronalis	Dame's Rocket		5	-3	I	
Hypericum perforatum	Common St. John's-wort		5	-3	I	
Juglans nigra	Black Walnut	5	3		N/I	S4
Lactuca serriola	Prickly Lettuce		0	-1	I	
Lapsana communis	Nipplewort		5	-2	I	
Leonurus cardiaca	Motherwort		5	-2	I	
Linaria vulgaris	Butter-and-eggs		5	-1	I	
Malva neglecta	Common Mallow		5	-1	I	
Medicago lupulina	Black Medick		1	-1	I	
Melilotus alba	White Sweet-clover		3	-3	I	
Morus alba	White Mulberry		0	-3	I	
Nepeta cataria	Catnip		1	-2	I	
Oenothera biennis	Hairy Yellow Evening-primrose	0	3		N	
Oxalis stricta	European Wood-sorrel	0	3		N	
Parthenocissus quinquefolia	Virginia Creeper	6	1		N	

Plantago lanceolata	English Plantain		0	-1	I	
Plantago major	Common Plantain		-1	-1	I	
Polygonum aviculare	Prostrate Knotweed		1	-1	I	
Polygonum convolvulus	Wild Buckwheat		1	-1	I	
Polygonum persicaria	Lady's-thumb		-3	-1	I	
Populus deltoides	Cottonwood	4	-1		N/I	
Potentilla recta	Rough-fruited Cinquefoil		5	-2	I	
Prunus virginiana	Choke Cherry	2	1		N	
Rhamnus cathartica	Common Buckthorn		3	-3	I	
Rhus typhina	Staghorn Sumac	1	5		N	
Rubus occidentalis	Black Raspberry	2	5		N	
Rumex crispus	Curly Dock		-1	-2	I	
Saponaria officinalis	Bouncing Bet		3	-3	I	
Scrophularia marilandica	Carpenter's-square	7	4		N	S4
Sisymbrium altissimum	Tumble Mustard		3	-1	I	
Solanum dulcamara	Climbing Nightshade		0	-2	I	
Solidago altissima	Late Goldenrod	1	3		N	
Sonchus arvensis	Perennial Sow-thistle		1	-1	I	
Taraxacum officinale	Common Dandelion		3	-2	I	
Tilia americana	Basswood	4	3		N	
Tragopogon pratensis	Yellow Goat's-beard		5	-1	I	
Ulmus pumila	Siberian Elm		5	-1	I	
Verbascum thapsus	Common Mullein		5	-2	I	
Verbena urticifolia	White Vervain	4	-1		N	
Veronica officinalis	Common Speedwell		5	-2	I	
Vicia cracca	Cow Vetch		5	-1	I	
Viola blanda	Sweet White Violet	6	-2		N	
Viola sororia	Common Blue Violet	4	1		N	
Vitis riparia	Riverbank Grape	0	-2		N	

SCI_NAME	COM_NAME	CC	CW	WEED	I_N	SRANK
Community 3 FOD 4						
Acer negundo	Manitoba Maple	0	-2		N	
Acer platanoides	Norway Maple		5	-3	I	
Acer saccharinum	Silver Maple	5	-3		N	
Acer saccharum	Black Maple	7	3		N	
Acer saccharum	Sugar Maple	4	3		N	
Aegopodium podagraria	Goutweed		0	-3	I	
Aesculus hippocastanum	Horse-chestnut		5	-1	I	
Ajuga reptans	Bugle, Bugleweed		0	-2	I	
Alliaria petiolata	Garlic Mustard		0	-3	I	
Anthriscus sylvestris	Wild Chervil		5	-2	I	
Arctium minus	Common Burdock		5	-2	I	
Aster lateriflorus	Calico Aster	3	-2		N	
Aster pilosus	Hairy Aster	4	2		N	
Aster urophyllus	Arrow-leaved Aster	6	5		N	
Bromus inermis	Smooth Brome		5	-3	I	
Celtis occidentalis	Common Hackberry	8	1		N	
Chelidonium majus	Celandine		5	-3	I	
Circaea lutetiana	Enchanter's-nightshade	3	3		N	
Dactylis glomerata	Orchard Grass		3	-1	I	
Daucus carota	Wild Carrot		5	-2	I	
Echinocystis lobata	Wild Cucumber	3	-2		N	
Festuca arundinacea	Tall Fescue		2	-1	I	
Fraxinus pennsylvanica	Red/Green Ash	3	-3		N	
Galium odoratum	Sweet Woodruff		2	-1	I	
Geum aleppicum	Yellow Avens	2	-1		N	
Geum canadense	White Avens	3	0		N	
Glechoma hederacea	Gill-over-the-ground		3	-2	I	
Hemerocallis fulva	Orange Day Lily		5	-3	I	
Hesperis matronalis	Dame's Rocket		5	-3	I	
Hypericum perforatum	Common St. John's-wort		5	-3	I	
Impatiens pallida	Pale Touch-me-not	7	-3		N	
Juglans nigra	Black Walnut	5	3		N/I	S4
Lamium purpureum	Purple Dead-nettle		5	-2	I	
Lapsana communis	Nipplewort		5	-2	I	
Leonurus cardiaca	Motherwort		5	-2	I	
Ligustrum vulgare	Privet		1	-2	I	
Lonicera maackii	Amur Honeysuckle		5	-2	I	
Lonicera tatarica	Tartarian Honeysuckle		3	-3	I	
Lysimachia nummularia	Moneywort		-4	-3	I	
Malus pumila	Apple		5	-1	I	
Morus alba	White Mulberry		0	-3	I	
Narcissus sp.	Daffodil species			-1	I	
Oxalis stricta	European Wood-sorrel	0	3		N	
Parthenocissus inserta	Virginia Creeper	3	3		N	
Plantago major	Common Plantain		-1	-1	I	
Polygonum cuspidatum	Japanese Knotweed		3	-1	I	
Populus deltoides	Cottonwood	4	-1		N/I	
Prunus avium	Sweet Cherry		5	-2	I	
Prunus virginiana	Choke Cherry	2	1		N	

Rhamnus cathartica	Common Buckthorn		3	-3	I
Rubus occidentalis	Black Raspberry	2	5		N
Rudbeckia laciniata	Cut-leaved Coneflower	7	-4		N
Rumex obtusifolius	Bitter Dock		-3	-1	I
Salix fragilis	Crack Willow		-1	-3	I
Salix x rubens	(S. alba X S. fragilis)		-4	-3	I
Saponaria officinalis	Bouncing Bet		3	-3	I
Solanum dulcamara	Climbing Nightshade		0	-2	I
Solidago altissima	Late Goldenrod	1	3		N
Solidago flexicaulis	Zig-zag Goldenrod	6	3		N
Solidago gigantea	Tall Goldenrod	4	-3		N
Taraxacum officinale	Common Dandelion		3	-2	I
Tilia americana	Basswood	4	3		N
Ulmus americana	American Elm	3	-2		N
Ulmus pumila	Siberian Elm		5	-1	I
Urtica dioica	Stinging Nettle	2	-1		N
Verbena urticifolia	White Vervain	4	-1		N
Viburnum opulus	European Highbush-cranberry		0	-1	I
Viburnum trilobum	Highbush-cranberry	5	-3		N
Vinca minor	Common Periwinkle		5	-2	I
Viola cucullata	Marsh Violet	5	-5		N
Viola sororia	Common Blue Violet	4	1		N
Vitis riparia	Riverbank Grape	0	-2		N

SCI_NAME	COM_NAME	CC	CW	WEED	I_N	
Community 4 FOD 4						
Abies balsamea	Balsam Fir	5	-3		N/I	
Acer negundo	Manitoba Maple	0	-2		N	
Acer platanoides	Norway Maple		5	-3	I	
Acer saccharinum	Silver Maple	5	-3		N	
Acer saccharum	Black Maple	7	3		N	
Acer saccharum	Sugar Maple	4	3		N	
Aegopodium podagraria	Goutweed		0	-3	I	
Aesculus hippocastanum	Horse-chestnut		5	-1	I	
Alliaria petiolata	Garlic Mustard		0	-3	I	
Ambrosia artemisiifolia	Common Ragweed	0	3		N	
Angelica atropurpurea	Angelica	6	-5		N	
Anthriscus sylvestris	Wild Chervil		5	-2	I	
Arctium minus	Common Burdock		5	-2	I	
Aster cordifolius	Heart-leaved Aster	5	5		N	
Aster lateriflorus	Calico Aster	3	-2		N	
Aster urophyllus	Arrow-leaved Aster	6	5		N	
Barbarea vulgaris	Winter Cress		0	-1	I	
Bidens frondosa	Devil's Beggarticks	3	-3		N	
Bromus inermis	Smooth Brome		5	-3	I	
Calystegia sepium	Hedge Bindweed	2	0		N	
Celtis occidentalis	Common Hackberry	8	1		N	
Cercis canadensis	Redbud	8	3		N/I	
Chelidonium majus	Celandine		5	-3	I	
Circaea lutetiana	Enchanter's-nightshade	3	3		N	
Cirsium arvense	Canada Thistle		3	-1	I	
Cirsium vulgare	Bull Thistle		4	-1	I	
Convallaria majalis	Lily-of-the-valley		5	-2	I	
Daucus carota	Wild Carrot		5	-2	I	
Echinocystis lobata	Wild Cucumber	3	-2		N	
Elaeagnus angustifolia	Oleaster, Russian Olive		4	-1	I	
Epipactis helleborine	Helleborine		5	-2	I	
Erechtites hieracifolia	Pilewort	2	3		N	
Erigeron annuus	Daisy Fleabane	0	1		N	
Euonymus europaea	Spindle-tree		5	-1	I	
Euonymus fortunei	Wintercreeper		5	-1	I	
Euonymus obovata	Running Strawberry-bush	6	5		N	
Eupatorium rugosum	White Snakeroot	5	3		N	
Forsythia viridissima	Forsythia		0	-1	I	
Fraxinus pennsylvanica	Red/Green Ash	3	-3		N	
Geum aleppicum	Yellow Avens	2	-1		N	
Hedera helix	English Ivy		2	-2	I	
Hemerocallis fulva	Orange Day Lily		5	-3	I	
Hesperis matronalis	Dame's Rocket		5	-3	I	
Humulus lupulus	Common Hop		3	-1	I	
Hypericum perforatum	Common St. John's-wort		5	-3	I	
Impatiens capensis	Spotted Touch-me-not	4	-3		N	
Impatiens glandulifera	Purple Touch-me-not		-3	-2	I	
Impatiens pallida	Pale Touch-me-not	7	-3		N	
Juglans nigra	Black Walnut	5	3		N/I	S4

Lactuca sp.		3	2			
Lapsana communis	Nipplewort		5	-2	I	
Leonurus cardiaca	Motherwort		5	-2	I	
Lonicera maackii	Amur Honeysuckle		5	-2	I	
Lonicera morrowii	Morrow's Honeysuckle		5	-1	I	
Lonicera tatarica	Tartarian Honeysuckle		3	-3	I	
Lysimachia nummularia	Moneywort		-4	-3	I	
Lythrum salicaria	Purple Loosestrife		-5	-3	I	
Maianthemum racemosum	False Solomon's-seal	4	3		N	
Maianthemum stellatum	Starry False Solomon's-seal	6	1		N	
Melissa officinalis	Lemon Balm		1	-2	I	
Myosotis sp.	Forget me not		0	-1		
Oenothera biennis	Hairy Yellow Evening-primrose	0	3		N	
Oxalis sp.	Wood-sorrel species	0	3			
Parthenocissus inserta	Virginia Creeper	3	3		N	
Parthenocissus quinquefolia	Virginia Creeper	6	1		N	
Picea abies	Norway Spruce		5	-1	I	
Pilea pumila	Clearweed	5	-3		N	
Polygonum cuspidatum	Japanese Knotweed		3	-1	I	
Polygonum hydropiper	Water-pepper	4	-5		I?	
Polygonum hydropiperoides	Mild Water-pepper	4	-5		N	
Polygonum persicaria	Lady's-thumb		-3	-1	I	
Populus deltoides	Cottonwood	4	-1		N/I	
Prunella vulgaris	Heal-all		0	-1	N	
Prunus avium	Sweet Cherry		5	-2	I	
Prunus virginiana	Choke Cherry	2	1		N	
Ranunculus hispidus	Hispid Buttercup	8	0		N	SW
Rhamnus cathartica	Common Buckthorn		3	-3	I	
Ribes americanum	Wild Black Currant	4	-3		N	
Robinia pseudo-acacia	Black Locust		4	-3	I	
Rosa multiflora	Multiflora Rose		3	-3	I	
Rosa rubiginosa	Sweetbrier		5	-1	I	
Rubus idaeus	Wild Red Raspberry	0	-2		N	
Rubus occidentalis	Black Raspberry	2	5		N	
Rumex obtusifolius	Bitter Dock	-3	-1		I	
Salix x rubens	(S. alba X S. fragilis)		-4	-3	I	
Scrophularia marilandica	Carpenter's-square	7	4		N	S4
Sicyos angulatus	Bur Cucumber	5	-2		N	
Solanum dulcamara	Climbing Nightshade		0	-2	I	
Solidago altissima	Late Goldenrod	1	3		N	
Solidago canadensis	Canada Goldenrod	1	3		N	
Syringa vulgaris	Common Lilac		5	-2	I	
Tanacetum vulgare	Tansy		5	-1	I	
Taraxacum officinale	Common Dandelion		3	-2	I	
Taxus baccata	English Yew		3	-1	I	
Tilia americana	Basswood	4	3		N	
Ulmus americana	American Elm	3	-2		N	
Ulmus pumila	Siberian Elm		5	-1	I	
Urtica dioica	Stinging Nettle	2	-1		N	
Verbena urticifolia	White Vervain	4	-1		N	
Viburnum trilobum	Highbush-cranberry	5	-3		N	

Vinca minor	Common Periwinkle	5	-2	I
Vitis riparia	Riverbank Grape	0	-2	N

Appendix B. Landowner Contact Letter

July 10, 2006

Dear Property Owner:

Subject: Request for Access to Property for Vegetation and Wildlife Inventory for the Purposes of Dyke Maintenance Planning.

The Upper Thames River Conservation Authority is planning a multi - year program to maintain the London Dyke system under agreement with the City of London. Your property has been identified as possibly having a flood reduction dyke on it or it is sufficiently close to a dyke that you may be affected by any planned future maintenance activities. Studies over the last two years by consultants for the Conservation Authority have identified characteristics and maintenance concerns for the various dykes in the City. Typical of concerns with many of the earthen dykes is the effect that vegetation present on the dykes has on dyke soil stability.

Each specific dyke requires attention to different matters. First and foremost the Conservation Authority and the City recognize the continued importance of the dykes to local residents as a flood reduction structure. Further as maintenance has not been undertaken regularly and for some time, we assume that landowners may have strong views on any maintenance activities. A recent field visit with some residents along the "Riverview" Dyke in your area brought forward their own concerns with stability of the Thames River bank and the dyke on the top of the bank. Concerns with overhanging and breakage of trees were discussed. Resident's comments are consistent with our studies of the dykes.

The Conservation Authority will be making a funding application to the Ministry of Natural Resources Water and Erosion Control Infrastructure program to assist the Authority in sharing costs with the City for the work that is being planned as noted below. The city must also approve its share of costs. Most of the work will be contingent on receiving funding. The Authority has set aside funds to undertake activity 1) noted below over the short term. Activities that are being considered for the Riverview Dyke in your area are described as follows:

1) Undertaking of seasonal inventories of vegetation and wildlife. These would typically be summer, fall, and spring surveys. The inventories provide more complete information on species and may direct maintenance activities to consider environmental sensitivities. The Conservation Authority wishes to initiate a summer survey soon.
2) Inventory and locating of hazard trees that may affect bank and dyke stability. Possibly to take place in fall 2006.
3) Establish bank erosion stations to monitor the progress of erosion of the Thames River bank. Undertake a further inspection and a preliminary geotechnical assessment of the bank and dyke. This work is proposed to be done in fall 2006.

Page 2
Subject: Request for Access to Property for Vegetation and Wildlife Inventory for the Purposes of Dyke Maintenance Planning.

4) Undertake a topographic survey of the bank and dyke and locate the dyke relative to property boundaries. This survey is proposed to be done in fall 2006.
5) Develop a hazard vegetation cutting plan and schedule. Develop bank and vegetation restoration plans for cutting areas. This work is proposed for fall 2006 and winter 2007.

6) Develop information and education materials and communicate and consult on issues and progress of inventories and plans. This work will take place in fall 2006, and will be ongoing.
7) Undertake a trial or demonstration of vegetation management measures, including hazard tree removal. The time frame for this work will be dependent on the foregoing activities.

Future work is anticipated for all dyke areas in the City and further work on the Riverview Dyke will be planned based on priorities and funding. A dyke on the Thames River South Branch near Adelaide St South in London will undergo similar activities at the same time as for the Riverview Dyke.

The Conservation Authority with this letter is requesting your consent for access to your property to undertake the activities 1) through 4). Each activity is quick and unobtrusive. Access to dyke areas will be planned to occur from public lands wherever possible. All persons undertaking the surveys are experienced professionals. This letter is being delivered by hand. We would appreciate receiving your consent for access to your property during surveys by filling out the attached form and returning it in the addressed and stamped envelope. We understand you may be fairly busy but would appreciate your reply on the attached consent form, whether agreeing or not by the week of July 17 to 21, 2006.

As well we would be pleased to answer any questions you may have. I will be unavailable until August 14 but please feel free to contact Matt Wood, Project Engineer at 519-451-2800-X 239. Matt is also involved with the projects we are undertaking on the London Dykes.

Yours truly,
UPPER THAMES RIVER CONSERVATION AUTHORITY

Rick Goldt, C.E.T.
Supervisor, Water Control Structures
Attachment

C.c. Mr. S. Mathers, P .Eng., City of London, Engineering and Environmental Services Dept.

Landowner Consent Form for Access to Property

for 2006 Riverview Dyke survey activities 1) to 4)

Please complete this form and return it in the enclosed stamped, self-addressed envelope in the week of July17 to 21, 2006. Thank you very much fro your assistance.

Permission is granted for qualified personnel, employed or contracted by the Upper Thames River Conservation Authority, to be on lands described

as_____ (**Property Address**) owned by

_____ (**Owner Name**) from the period of July 17 to December 15, 2006.

☐ YES

☐ NO (please explain):

Please also fill in the following:

Contact Person:

Telephone:

Signed by: _____ Print Name:_____

NOTICE OF COLLECTION

Personal information contained on this form is collected under the authority of the Conservation Authorities Act, Section 18(1) and will be used by the Authority in making decisions on this project. Questions regarding the collection of this information may be made to: General Manager, Upper Thames River Conservation Authority, 1424Clarke Road, London, Ontario N5V 5B9, 519-451-2800.

Appendix C. UTRCA Hazard Tree Criteria

1.0 Methodology

1.1 Aerial Photos

Spring 2006 air photography illustrating the dyke location, plant community and the Thames River floodplain; as well as 1:2000 and 1:10,000 Ontario Base Mapping (OBM) and AutoCAD Base Map files showing grading contours, property lines, permanent and built structures, Thames River, Thames River Floodplain and surrounding communities, were reviewed. The locations of all hazard trees were mapped (**Figures 6a & 6b**).

1.2 Landowner Contact

A large portion of the Riverview Dyke is only accessible through private property. Consent forms requesting permission to access the dyke were sent to each landowner that lived along the dyke (**Appendix B**). Follow up phone calls were also made to let landowners know when UTRCA staff would be on their property. 12 of the 14 landowners gave either written or verbal permission to access the dyke through their property. Field staff carried the signed forms while doing inventories.

1.3 Inventory Methodology

Not all species or individuals of a particular tree species growing on the London Dykes present the same level of risk to the integrity of the dyke. An evaluation process to recognize hazardous defects in trees and objectively assess their threat to the dyke was developed by Dougan and Associates (2006 Table 1), and modified by the UTRCA. Individual trees were identified, measured, and examined for the presence of 11 hazard criteria.

For each criterion, the tree was given a score as follows:

High = 3
Medium = 2
Low = 1

Hazard trees were then prioritized based on their cumulative hazard score (**Appendix D**).

PHYSICAL TREE HAZARDS

Criterion 1 Species

Rationale:

- Certain tree species are prone to forming weak branch unions or breaking at a young age Hardwoods (deciduous trees) tend to live longer than softwoods (conifers). As well, there are several species prone to disease/infestation.
- Other species are a threat to most habitats as they tend to disperse widely and aggressively colonize newly disturbed sites
- Some species are fast growing, shallow rooted weedy species that tend to have weak limbs that can become top heavy and lean over, gradually heaving portions of the dyke structure
- Some species can cause dense shading of the understory, leaving soil relatively bare and favoring establishment of undesirable invasive groundcovers with coarse shallow root systems that leave soil susceptible to erosion.

Description:

High = trees prone to structural defects, softwoods, or species prone to disease/infestation (Crack Willow, Manitoba Maple, Norway Maple, Ash, Hickory, Beech, Elm, Butternut
Medium = invasive hardwoods or dense shading species (Common Buckthorn, Tartarian Honey Suckle, Black Locust, Basswood, Silver Maple)
Low = other hardwoods (Hackberry, Walnut, Sugar Maple, Cherry)

Criterion 2. Diameter

Rationale:

- Large trees provide the greatest risk in terms of hazard because they are more likely to contain significant amounts of internal wood decay and other defects.
- Large trees can cause more damage when they fall because they can strike objects at considerable distances.
- Growth and expansion of large tree trunks and roots can separate and break hard structures such as concrete and stone
- Larger trees donate larger logs to flows which could batter or block downstream flow management structures
- Large trunks can experience greater scour from high water events

Description:

High = >25cm DBH
Medium = 10 – 25cm DBH
Low = < 10cm DBH

Criterion 3. Lean

Rationale:

- Trees with a lean have a higher potential for falling. The steep slopes on the dyke can cause many trees to have a severe lean with evidence of mounding (soil heaving) within the root zone.

Description:

High = 10°, soil heaving, or high height to basal diameter ratio (tall and thin boles)
Medium = 5°- 10°
Low = < 5°

Criterion 4. Root Exposure

Rationale:

- A tree's root system anchors the tree into the ground. Trees with exposed roots have a higher potential for falling since exposed roots can be wounded in the same manner as tree boles and lead to the same problems of invasion by wood decay. Roots can also lift and pull out portions of the dyke

Description:

High = exposed OR undercut roots AND signs of erosion (i.e., portions of the dyke have been lifted, opened or removed due to upheaval of root systems from leaning and fallen trees)
Medium = exposed OR undercut roots
Low = no exposed roots

Criterion 5. Insect / Disease

Rationale:

- Infestations weaken trees

Description:

High = confirmation of presence of insect or disease (e.g., root disease fungi, bark beetle, ash borer, etc.)

Medium = suspected presence of insect or disease including conks, mushrooms, brackets, soil mounding

Low = no signs of presence of insect or disease

Criterion 6. Decay

Rationale:

- Decay is a condition of the wood rather than the bark. Indicators of decay include missing wood, rotting wood, fungal growths, bulges and/or cavities in the trunk. Decay signals which trees are among the most likely to fail due to heart rot or weakness.

Description:

High = 100% dead, > 25% dead branches, or has signs of decay on > 40% of the trunk or major branches

Medium = any signs of decay including crown damage, broken branches, loose/peeling/missing bark, exposed wounds, deep cracks, scars around circumference, weak branch unions, soft and crumbly wood, absence of wood in cavities

Low = no signs of disease

Criterion 7. Damage to Private / Public Property

Rationale:

- Trees that can reach private / public property targets (trails, homes) are a threat.
- Determined by measuring the height of the tree and the distance from the base of the tree to any potential target.

Description:

High = lean towards private / public property AND any part of tree can reach the property

Medium = lean away from private / public property AND any part of tree can reach the property

Low = tree cannot reach private / public property

HAZARD TREE MANAGEMENT CONCERNS

Criterion 8. Position on Dyke

Rationale:

- Trees can present greater or lesser hazards depending on their location on the dyke as certain areas of the dyke are more sensitive to uprooting than other areas. During high water events, the toe of the bank is scoured, which weakens the structure and stability of the dyke.

Description:

High = located on toe of the dyke

Medium = located mid bank

Low = located top of bank

Criterion 9. Effort

Rationale:

- Some large trees will require more effort and may cause more damage to the structure to remove than they would if they were to fall down naturally. This criterion attempts to capture the amount of effort required to remove the trees, compared to leaving them.

Description:

High = Damage to property target will be severe, failure of the tree involves medium to large trees or entire trees and impacts will be direct.

Medium = Damage to property target will be moderate, failure of the tree involves small to medium sized trees, and impacts will be direct.

Low = Very little to no damage to property target, failure of the tree will involve small parts or small trees.

Criterion 10. Presence of Wildlife

Rationale:

- Certain hazard trees are beneficial to wildlife. A tree with a high wildlife score would have a lower hazard priority and timing and/or compensation for its removal would have to be considered.
- Cavities in trees that are otherwise healthy are significant wildlife shelters
- Given that hazard tree management frequently targets removal of trees or parts of trees that attract wildlife, it must account for this type of diversity. With some planning, hazard tree management can be sensitive to wildlife. Some examples include:
    - Place nesting boxes on nearby secure sites when cavities are lost through removal.
    - Do not remove tree during the most critical (breeding) time to the species using the tree

Description:

High = no evidence of wildlife AND no evidence of wildlife habitat

Medium = potential wildlife habitat (e.g., hollow trunks, dens, >45cm DBH, decaying trees)

Low = presence of wildlife OR evidence of current and active use (e.g., fur, claw marks, gnawing, stick nests, woodpecker holes, fresh scat around a tree)

HAZARD TREE EVALUATION

Once all the trees have been scored for each criterion, the next step is to evaluate the final tree rating scores to prioritize which trees need treatment and in which order (when resources are not available for treating all the higher risk trees). The recognition of multiple defects in a tree is critical when prioritizing trees for removal. Table B1 provides an example of how a tree may be ranked based on its characteristics

Table B1.Example of Hazard Rating per Tree for Each Criterion

Tree #	Species	DBH	Lean	Root Exposure	Insects / Disease	Decay / Death	Property Risk	Dyke Position	Effort	Wildlife Presence	Hazard Score*
0000	N.Maple (2)	15cm (2)	13° (3)	Exposed, no erosion (2)	Brackets, conks (2)	Loose bark (2)	Cannot reach (1)	Toe (3)	Medium tree near property (2)	Potential (2)	24

*Using this ranking system, each tree was given a final hazard score and removal priority (**Appendix D**) according to the following:

Total Hazard Score	Removal Priority
10-17	LOW
18-23	MEDIUM
24-30	HIGH

Appendix D. UTRCA Hazard Tree Inventory Scores for Riverview Dyke

Table C1. Breakdown of criteria scores for each tree on Riverview dyke

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
78	1 bl wal	3	1	1	1	2	3	2	3	2	19	**M**
79	3 man mpl	3	2	2	1	2	2	2	1	1	19	**M**
80	3 man mpl	2	2	2	1	3	2	2	1	1	19	**M**
81	1 bl wal	2	1	1	1	2	3	2	2	2	17	**L**
82	3 man mpl	2	2	2	1	2	3	1	1	1	18	**M**
83	3 nor mpl	3	2	2	1	1	3	1	2	1	19	**M**
84	1 hack	2	2	2	1	1	2	2	1	2	16	**L**
85	3 man mpl	3	3	3	1	2	2	3	1	1	22	**M**
86	2 bass	2	2	2	1	2	2	3	1	2	19	**M**
87	2 buck	2	3	1	2	2	2	3	1	2	20	**M**
88	3 nor mpl	3	1	2	1	1	2	1	2	1	17	**L**
89	1 sug mpl	3	1	2	1	2	3	1	3	3	20	**M**
90	1 hack	2	3	2	1	1	3	2	1	2	18	**M**
91	3 nor mpl	3	1	2	1	1	2	2	2	3	20	**M**
92	3 nor mpl	3	1	2	1	2	2	3	2	3	22	**M**
93	2 buck	2	2	2	1	2	1	3	1	3	19	**M**
94	1 hack	2	3	3	1	1	1	3	1	2	18	**M**
95	3 man mpl	2	1	3	1	2	1	2	1	3	19	**M**
96	3 nor mpl	2	1	2	1	2	3	1	2	3	20	**M**
97	3 wh elm	3	2	2	2	2	3	2	3	3	25	**H**

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
98	1 bl wal	3	1	2	1	2	3	2	3	2	20	**M**
99	3 man mpl	3	3	3	1	2	1	3	1	3	23	**M**
100	3 man mpl	3	3	2	1	2	1	3	1	3	22	**M**
101	3 man mpl	3	3	1	1	2	1	3	1	3	21	**M**
102	3 man mpl	3	3	1	1	2	1	3	2	3	22	**M**
103	3 man mpl	3	3	2	1	2	1	3	3	3	24	**H**
104	3 man mpl	2	3	2	1	2	1	3	1	3	21	**M**
105	1 hack	2	1	2	1	1	2	3	2	2	17	**L**
106	3 nor mpl	2	1	1	1	2	3	1	3	3	20	**M**
107	1 sug mpl	2	1	2	1	2	2	1	2	3	17	**L**
108	3 nor mpl	3	2	2	1	2	2	1	2	3	21	**M**
109	3 willow	3	3	2	1	2	3	1	3	3	24	**H**
110	2 bass	2	2	1	2	2	2	2	2	2	19	**M**
111	3 nor mpl	2	2	2	1	2	2	2	1	3	20	**M**
112	1 hack	2	1	2	1	1	2	2	1	3	16	**L**
113	2 buck	2	1	1	1	1	1	2	1	3	15	**L**
114	3 man mpl	3	3	3	1	2	1	3	2	3	24	**H**
115	3 man mpl	2	3	2	1	2	1	3	1	3	21	**M**
116	1 bl wal	3	2	1	1	1	2	3	2	2	18	**M**
117	1 hack	3	2	2	1	1	2	3	2	2	19	**M**
118	3 nor mpl	3	1	1	1	2	3	1	3	1	19	**M**
119	3 wh elm	3	1	2	2	3	2	1	3	3	23	**M**
120	1 bl wal	3	1	2	1	1	3	1	3	2	18	**M**

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
121	1 other	2	1	1	1	3	2	2	1	3	17	**L**
122	3 wh elm	3	1	2	1	3	2	2	2	3	22	**M**
123	3 man mpl	3	3	3	1	2	1	3	3	3	25	**H**
124	3 man mpl	3	3	2	1	2	1	3	3	3	24	**H**
125	1 other	3	1	3	1	1	2	3	2	3	20	**M**
126	2 buck	2	3	3	1	2	1	3	1	3	21	**M**
127	3 man mpl	2	1	2	1	2	1	2	2	3	19	**M**
128	3 nor mpl	3	2	2	1	1	2	1	3	3	21	**M**
129	3 man mpl	3	3	3	1	2	1	3	2	3	24	**H**
130	1 sil mpl	3	1	2	1	2	3	1	3	1	18	**M**
131	1 sug mpl	3	1	1	1	2	2	2	3	3	19	**M**
132	3 nor mpl	2	2	3	1	1	1	2	1	3	19	**M**
133	1 hack	3	1	1	1	1	2	2	3	2	17	**L**
134	3 man mpl	2	3	3	1	3	1	3	2	3	24	**H**
135	3 man mpl	2	3	1	1	1	1	3	2	3	20	**M**
136	1 hack	3	2	2	1	1	2	2	2	2	18	**M**
137	1 sw cher	3	3	1	2	3	2	3	1	3	22	**M**
138	3 wh elm	3	3	2	2	2	2	3	2	3	25	**H**
139	1 bl wal	3	1	1	1	2	3	2	2	2	18	**M**
140	3 man mpl	2	3	3	1	2	2	2	1	3	22	**M**
141	1 other	3	1	1	1	1	3	1	2	3	17	**L**
142	1 hack	2	1	1	1	1	2	1	2	2	14	**L**
143	1 other	3	1	1	1	1	2	1	2	3	16	**L**

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
144	3 man mpl	3	3	1	1	1	2	1	1	3	19	**M**
145	1 hack	3	2	2	2	1	2	2	2	2	19	**M**
146	1 sw cher	2	2	3	2	3	1	3	1	3	21	**M**
147	1 hack	2	2	3	2	1	1	3	1	2	18	**M**
148	3 man mpl	2	3	3	1	2	1	3	2	3	23	**M**
149	3 nor mpl	2	2	3	1	2	1	2	1	3	20	**M**
150	1 bl wal	3	2	2	1	1	2	2	3	2	19	**M**
151	3 man mpl	2	3	2	1	2	3	1	1	3	21	**M**
152	1 bl wal	3	2	2	2	2	3	1	3	1	20	**M**
153	3 wh elm	3	2	2	2	3	1	2	2	3	23	**M**
154	1 other	3	2	2	1	2	1	3	2	2	19	**M**
155	3 man mpl	3	3	3	1	2	1	2	3	3	24	**H**
156	3 nor mpl	3	2	3	1	2	2	1	3	1	21	**M**
157	3 nor mpl	3	3	3	1	1	2	1	3	3	23	**M**
158	3 wh elm	3	2	2	2	3	2	2	2	3	24	**H**
159	3 wh elm	2	3	1	2	3	1	2	2	3	22	**M**
160	1 sug mpl	3	2	1	2	3	2	1	3	1	19	**M**
161	3 nor mpl	3	2	2	1	1	2	2	3	3	22	**M**
162	3 wh elm	3	3	1	3	2	1	2	2	3	23	**M**
163	3 nor mpl	2	2	1	1	1	2	1	2	3	18	**M**
164	3 nor mpl	3	2	2	1	1	3	1	3	1	20	**M**
165	3 nor mpl	2	2	2	1	1	3	1	2	3	20	**M**
166	3 nor mpl	2	3	2	1	1	1	2	1	3	19	**M**

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
167	1 sil mpl	3	3	2	2	2	3	2	3	1	22	**M**
168	3 nor mpl	2	3	2	1	1	1	3	2	3	21	**M**
169	3 wh elm	3	3	2	2	3	3	2	2	3	26	**H**
170	1 bl wal	3	2	1	1	1	3	1	3	2	18	**M**
171	3 man mpl	3	3	2	1	2	1	2	3	3	23	**M**
172	1 bl wal	3	1	1	2	1	2	1	3	2	17	**L**
173	3 wh elm	2	2	1	2	3	2	1	2	3	21	**M**
174	3 man mpl	3	3	2	2	2	2	1	3	1	22	**M**
175	3 man mpl	3	3	2	2	2	2	1	3	1	22	**M**
176	3 man mpl	3	3	2	1	2	1	2	1	3	21	**M**
177	3 man mpl	2	3	2	1	2	1	3	1	3	21	**M**
178	3 man mpl	2	3	2	1	1	1	2	1	3	19	**M**
179	3 man mpl	3	1	2	1	2	2	1	2	1	18	**M**
180	3 man mpl	2	3	1	1	1	1	1	1	3	17	**L**
181	3 man mpl	2	1	1	1	2	3	1	1	3	18	**M**
182	3 man mpl	2	1	1	1	2	1	1	1	3	16	**L**
183	3 man mpl	2	3	2	1	2	1	1	1	3	19	**M**
184	3 man mpl	2	3	2	2	2	1	2	1	3	21	**M**
185	3 man mpl	2	3	2	1	1	1	3	1	3	20	**M**
186	3 wh elm	2	3	3	2	2	1	3	1	3	23	**M**
187	3 man mpl	3	3	2	2	2	1	3	3	3	25	**H**
188	3 man mpl	3	2	2	2	3	1	1	1	1	19	**M**
189	3 man mpl	3	3	2	2	2	1	1	1	3	21	**M**

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
190	3 man mpl	3	3	1	2	2	1	1	1	3	20	**M**
191	3 man mpl	2	3	2	2	2	3	1	1	2	22	**M**
192	3 man mpl	3	3	1	2	2	2	1	2	1	20	**M**
193	3 man mpl	2	3	1	2	2	1	1	1	3	19	**M**
194	1 pop	3	2	3	1	1	1	3	2	3	20	**M**
195	1 other	2	2	3	2	2	1	3	1	3	20	**M**
196	3 man mpl	2	3	2	1	2	1	2	1	3	20	**M**
197	3 wh elm	3	3	2	2	2	2	2	3	3	25	**H**
198	3 man mpl	3	3	2	2	3	1	2	1	3	23	**M**
199	3 willow	3	2	1	2	2	3	1	2	3	22	**M**
200	3 willow	3	1	1	2	2	3	1	3	1	20	**M**
201	3 nor mpl	3	2	1	1	1	1	1	1	3	17	**L**
202	3 man mpl	2	3	2	2	2	1	2	1	3	21	**M**
203	3 man mpl	3	3	2	2	2	1	2	2	3	23	**M**
204	3 man mpl	3	3	1	2	2	1	1	2	3	21	**M**
205	3 man mpl	2	3	2	2	2	1	2	1	3	21	**M**
206	1 other	2	3	2	1	2	1	2	1	3	18	**M**
207	1 pop	3	2	3	1	1	1	3	2	3	20	**M**
208	3 man mpl	3	3	1	2	2	1	1	2	3	21	**M**
209	3 man mpl	2	3	1	2	2	1	1	1	3	19	**M**
210	3 man mpl	3	3	2	2	3	1	1	2	3	23	**M**
211	3 man mpl	3	3	3	2	2	1	2	2	3	24	**H**
212	3 man mpl	3	1	1	2	2	1	1	2	1	17	**L**

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
213	3 man mpl	3	3	2	2	2	1	1	2	3	22	**M**
214	1 bl wal	3	2	3	1	1	1	3	2	2	19	**M**
215	3 man mpl	2	3	2	1	1	1	3	1	3	20	**M**
216	3 man mpl	3	3	2	2	2	1	2	2	3	23	**M**
217	3 man mpl	2	3	3	2	2	1	3	1	3	23	**M**
218	3 willow	3	3	2	2	2	1	2	3	1	22	**M**
219	3 willow	3	2	1	2	1	1	1	3	1	18	**M**
220	3 man mpl	3	3	2	2	2	1	1	2	1	20	**M**
221	3 man mpl	3	2	1	2	2	1	1	2	1	18	**M**
222	3 man mpl	3	1	1	2	2	1	1	2	3	19	**M**
223	3 man mpl	3	2	1	2	2	1	1	2	1	18	**M**
224	3 man mpl	3	2	1	2	2	1	1	2	3	20	**M**
225	3 willow	3	3	2	2	2	1	1	2	3	22	**M**
226	3 willow	3	3	2	2	2	1	1	2	3	22	**M**
227	3 man mpl	3	3	2	2	2	1	3	2	3	24	**H**
228	1 bl wal	2	1	3	1	1	1	3	1	2	16	**L**
229	1 bl wal	2	1	2	1	1	1	3	1	2	15	**L**
230	2 bass	3	2	2	3	2	1	2	2	1	20	**M**
231	2 bass	3	3	2	3	3	1	2	3	1	23	**M**
232	3 man mpl	3	3	1	1	1	1	2	2	3	20	**M**
233	3 man mpl	3	2	1	1	1	1	2	2	3	19	**M**
234	3 man mpl	3	3	1	1	1	1	1	2	3	19	**M**
235	3 man mpl	3	3	2	2	2	1	1	1	3	21	**M**

Tree No.	Species	DBH	Lean	Root Exposure	Insect / Disease	Decay / Death	Public Risk	Dyke Position	Effort	Wildlife	Final Hazard Score	Removal Priority
236	3 man mpl	3	3	2	2	2	1	2	3	3	24	**H**
237	3 man mpl	3	3	2	2	2	1	2	3	3	24	**H**
238	1 bl wal	3	1	1	1	1	1	1	1	2	13	**L**
239	1 bl wal	2	1	1	1	1	1	1	1	2	12	**L**
240	1 bl wal	3	1	1	1	1	1	1	1	2	13	**L**
241	1 pop	3	2	1	2	2	1	1	3	1	17	**L**
242	1 bl wal	3	2	1	1	1	1	1	1	2	14	**L**
243	1 bl wal	3	1	1	1	1	1	1	1	2	13	**L**
244	1 pop	3	2	1	2	2	3	1	3	3	21	**M**
245	1 pop	3	2	1	2	2	2	1	3	3	20	**M**
246	3 man mpl	3	3	1	2	2	3	1	3	1	22	**M**
247	3 man mpl	3	3	1	2	2	1	1	2	3	21	**M**
248	3 man mpl	3	3	2	2	2	1	1	2	3	22	**M**
249	3 man mpl	3	3	2	2	2	1	1	2	3	22	**M**
250	3 man mpl	3	3	2	2	2	1	1	3	3	23	**M**
251	1 sil mpl	3	1	1	2	2	1	1	3	1	16	**L**

Bass = basswood
Bl wal = black walnut
Buck = buckthorn
Hack = hackberry
Man mpl = Manitoba maple
Nor mpl = Norway maple
Other = Unknown species
Pop = poplar
Sil mpl = silver maple
Sug mpl = sugar maple
Sw cher = sweet cherry
Wh elm = white elm
Willow = willow

Appendix E. Wildlife Description of Riverview Dyke

Date of field visits:
July 14, 2006
August 28, 2006
September 7, 2006
May 22, 2007

Habitat features recorded:
Cavity trees
Mast trees/fruit shrubs
Fallen logs
Feeding trees
Dens/burrows
Watercourse

Wildlife sightings:
American Crow
American Goldfinch
American Robin
Black-capped Chickadee
Blue Jay
Cabbage White
Common Grackle
Common Yellowthroat
Downy Woodpecker
European Starling
Gray Catbird
Gray Squirrel (black phase)
Gray Squirrel (gray phase)
House Sparrow
House Wren
Mallard
Monarch
Northern Cardinal
Raccoon
Red-tailed Hawk
Red-winged Blackbird
Song Sparrow
White-breasted Nuthatch
White-tail Deer
Woodchuck
Yellow Warbler

Appendix F. Recommended Native Plants for Reintroduction in the Vicinity of Riverview Dyke

Table E1. Recommended native plants for reintroduction in the vicinity of Riverview dyke and associated shade tolerance (s = shade, P = part shade, F = full sun)

Scientific Name	Common Name	Light			Habitat		
HERBACEOUS PLANTS		**S**	**P**	**F**	**Emergent**	**Low / wet**	**Upland**
Arisaema triphyllum	Jack-in-the-pulpit	X				X	X
Asarum canadense	wild ginger	X					X
Asclepias incarnata	swamp milkweed		X	X	X	X	
Aster novae-angliae	New England aster		X	X			X
Bidens cernua	nodding beggar-ticks		X	X	X	X	
Caltha palustris	marsh marigold		X	X		X	
Chelone glabra	white turtlehead	X	X			X	
Dicentra cucullaria	Dutchman's breeches	X					X
Equisetum hyemale	horsetail, scouring rush	X	X	X		X	X
Eupatorium maculatum	Joe pye weed		X	X	X	X	
Eupatorium perfoliatum	common boneset		X	X	X	X	
Helianthus decapetalus	ten-petaled sunflower		X	X		X	X
Heliopsis helianthoides	oxeye sunflower		X	X			X
Iris virginica	Virginia blue flag		X	X	X	X	
Lobelia cardinalis	cardinal flower		X	X	X	X	
Lobelia siphilitica	great blue lobelia		X	X		X	X
Maianthemum racemosa	false Solomon's seal	X	X			X	X
Mimulus ringens	monkeyflower		X	X	X	X	
Monarda didyma	bee balm		X	X		X	X
Nymphaea odorata	American water lily			X	X		
Phlox divaricata	woodland phlox	X	X				X
Podophyllum peltatum	mayapple	X	X				X
Rudbeckia laciniata	cut-leaved coneflower		X	X		X	X
Sagittaria latifolia	broadleaf arrowhead			X	X	X	
Senecio aureus	golden ragwort	X	X			X	X
Solidago rugosa	rough-stemmed goldenrod		X	X		X	X
Verbena hastata	blue vervain		X	X		X	
Viola pubescens	yellow violet	X	X				X

Scientific Name	Common Name	Light			Habitat		
FERNS AND FERN ALLIES		**S**	**P**	**F**	**Emergent**	**Low / wet**	**Upland**
Botrychium virginianum	rattlesnake fern	X	X			X	X
Matteucia stuthiopteris	fiddlehead / ostrich fern	X	X			X	
Onoclea sensibilis	sensitive fern	X	X			X	X
Osmunda cinnamomea	cinnamon fern	X	X			X	
Polystichium acrostichoides	Christmas fern	X					X
GRASSES, SEDGES, REEDS		**S**	**P**	**F**	**Emergent**	**Low / wet**	**Upland**
Andropogon gerardii	big bluestem		X	X			X
Carex crinita var. crinita	long hair sedge	X	X		X	X	
Carex stricta	tussock sedge		X	X	X	X	
Elymus hystrix	bottlebrush grass	X	X	X			X
Elymus virginicus	Virginia wild rye	X	X	X		X	
Juncus effusus	soft rush		X	X	X	X	
Leersia oryzoides	rice cutgrass		X	X	X	X	
Panicum virgatum	switch grass		X	X	X	X	
Scirpus cyperinus	woolgrass bulrush		X	X	X	X	
Typha latifolia	broad-leaved cattail			X	X		
VINES		**S**	**P**	**F**	**Emergent**	**Low / wet**	**Upland**
Clematis virginiana	virgin's bower		X	X		X	X
Parthenocissus quinquefolia	Virginia creeper		X	X		X	X
SHRUBS		**S**	**P**	**F**	**Emergent**	**Low / wet**	**Upland**
Aronia melanocarpa	black chokeberry		X	X		X	X
Cornus amomum	silky dogwood	X	X	X		X	
Lindera benzoin	spicebush	X	X			X	X
Rubus allegheniensis	alleghany blackberry		X	X		X	X
Sambucus canadensis	common elderberry		X	X		X	X
Spiraea alba	narrow-leaved meadowsweet			X		X	

Scientific Name	Common Name	Light			Habitat		
SMALL TREES		**S**	**P**	**F**	**Emergent**	**Low / wet**	**Upland**
Amelanchier arborea	downy serviceberry		X	X			X
Amelanchier laevis	smooth serviceberry		X	X			X
Cornus alternifolia	alternate-leaf dogwood	X	X				X
Crataegus sp.	hawthorn		X	X			X
Ostrya virginiana	Eastern hop-hornbeam	X	X				X
Prunus pensylvanica	pincherry			X	X		
Ptelea trifoliata	hop tree		X	X			X
Rhus glabra	smooth sumac		X			X	X
Rhus typhina	staghorn sumac		X	X			X
Salix nigra	black willow			X	X	X	
Salix amygdaloides	peach-leaved willow			X	X	X	
MEDIUM TO LARGE TREES		**S**	**P**	**F**	**Emergent**	**Low / wet**	**Upland**
Acer nigrum / saccharum	black / sugar maple	X	X	X			X
Acer rubrum	red maple		X	X	X	X	X
Acer saccharinum	silver maple		X	X	X	X	X
Carpinus caroliniana	blue beech	X					X
Castanea dentata	American chestnut	X	X	X			X
Celtis occidentalis	hackberry		X	X		X	X
Fagus grandifolia	American beech	X	X				X
Fraxinus americana	white ash		X	X		X	X
Fraxinus pensylvanica	green ash		X	X		X	
Juglans nigra	black walnut		X	X		X	X
Liriodendron tulipifera	tulip-tree			X		X	X
Platanus occidentalis	sycamore		X	X		X	X
Quercus alba	white oak		X	X		X	X
Quercus bicolor	swamp white oak		X	X		X	
Quercus macrocarpa	bur oak		X	X		X	X
Quercus muhlenbergii	chinquapin oak			X			X
Quercus palustris	pin oak	X	X			X	
Quercus rubra	red oak		X	X			X
Quercus velutina	black oak		X	X			X
Sassafras albidum	sassafras	X	X			X	X
Tilia americana	American basswood		X	X			X
Ulmus americana	American / white elm	X	X	X	X	X	
Ulmus rubra	red / slippery elm	X	X			X	X

Appendix G. Recommended Native Shrubs for Rehabilitation of Riverview Dyke

Table F1. Recommended native shrubs for rehabilitation of Riverview dyke and associated shade tolerance (s = shade, P = part shade, F = full sun)

Scientific Name	Common Name	Light		
HERBACEOUS PLANTS		**S**	**P**	**F**
Arisaema triphyllum	Jack-in-the-pulpit	X		
Asarum canadense	wild ginger	X		
Aster novae-angliae	New England aster		X	X
Equisetum hyemale	horsetail, scouring rush	X	X	X
Maianthemum racemosa	false Solomon's seal	X	X	
Phlox divaricata	woodland phlox	X	X	
Podophyllum peltatum	mayapple	X	X	
Solidago rugosa	rough-stemmed goldenrod		X	X
Viola pubescens	yellow violet	X	X	
FERNS AND FERN ALLIES		**S**	**P**	**F**
Botrychium virginianum	rattlesnake fern	X	X	
Onoclea sensibilis	sensitive fern	X	X	
Polystichium acrostichoides	Christmas fern	X		
GRASSES, SEDGES, REEDS		**S**	**P**	**F**
Andropogon gerardii	big bluestem		X	X
Elymus hystrix	bottlebrush grass	X	X	X
SHRUBS		**S**	**P**	**F**
Celastrus scandens	bittersweet		X	X
Cornus alternifolia	alternate leaved dogwood	X	X	
Cornus racemosa	grey dogwood			X
Physocarpus opulifolius	ninebark		X	X
Prunus virginiana	choke cherry	X	X	X
Rhus aromatica	fragrant sumac		X	X
Rhus typhina	staghorn sumac		X	X
Rosa carolina	pasture rose			X
Rubus idaeus	wild red raspberry			X
Rubus odoratus	purple-flowering raspberry		X	
Sambucus canadensis	common elderberry		X	X
Sambucus racemosa	red-berried elderberry	X	X	

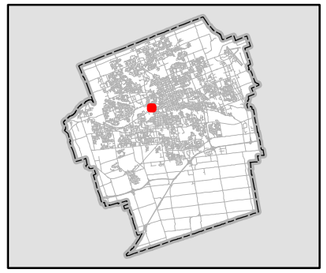
Scientific Name	Common Name	Light		
VINES		**S**	**P**	**F**
Clematis virginiana	virgin's bower		X	X
Menispermum canadense	Canada moonseed		X	X
Parthenocissus inserta	thicket creeper		X	X

Figure 8
Location of Flooddplain

Legend

- Riverview Dyke
- Dyke System
- Floodplain
- Public Property
- Private Property

Location Map

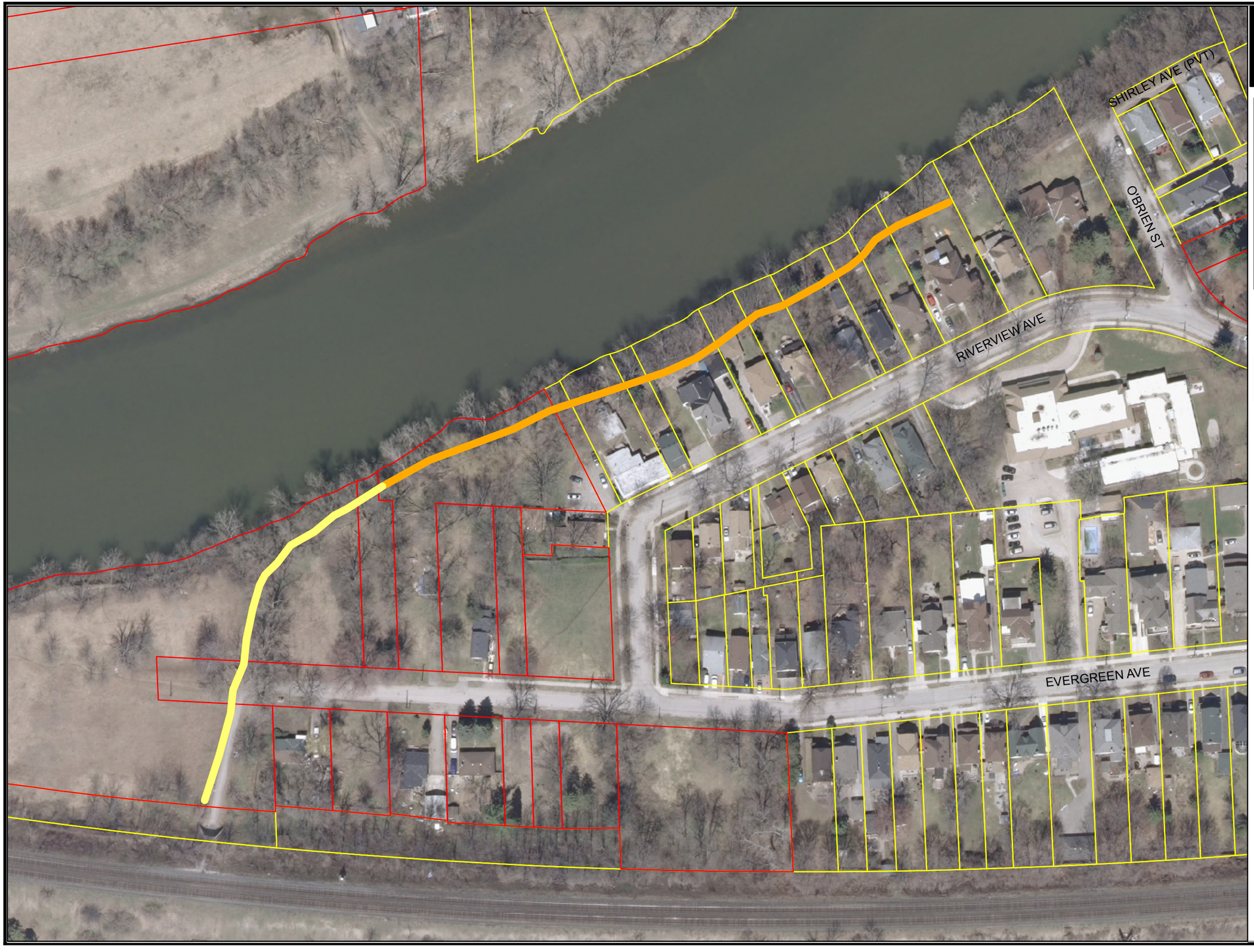


N

0 10 20 30 40 50
metres

UPPER THAMES RIVER
CONSERVATION AUTHORITY

Figure 9
Location of Structural Damage



Legend

Dyke Location/Priority

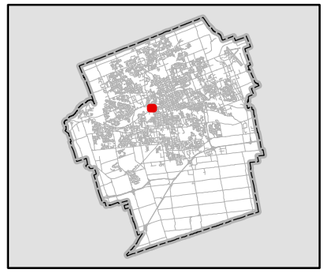
- Degraded
- Critical
- Threshold
- No Action Required

- Public Property
- Private Property

From Figure: DA06 in the City of London Dyke System by Dougan & Associates, February 2006.

Dyke Locations provided by the 2004 Inspection for the UTRCA.

Location Map



N

0 10 20 30 40 50
metres

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