West London Dyke Erosion Control Schedule B Municipal Class EA Project File

DRAFT October 2018

Prepared for:
Upper Thames River Conservation Authority
Prepared by:
Stantec Consulting Ltd.

Stantec

UPPER THAMES RIVER
CONSERVATION AUTHORITY

West London Dyke Erosion Control
Municipal Class Environmental Assessment

Schedule B Project File

May 29, 2018 Updated October 17, 2018

Prepared for:

Upper Thames River Conservation Authority

Prepared by:

Stantec Consulting Ltd.

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600-171 Queens Avenue, London ON N6A 5J7

January 3, 2019
File: 165630129

FILE
West London Dyke Erosion Control
Schedule B Municipal Class Environmental Assessment Attachment

Reference: West London Dyke Erosion Control Municipal Class Environmental Assessment

This letter has been prepared as a supplement to the West London Dyke Erosion Control Municipal Class Environmental Assessment Project File (Stantec, 2018) to address the requirement to consider Source Water Protection as part of the Municipal Class EA process, as identified within the 2015 Amendments to the Municipal Engineer's Association Municipal Class EA process.

Protecting surface and underground sources of drinking water from becoming contaminated or overused will ensure a sufficient supply of clean, safe drinking water. The Clean Water Act 2006 (CWA) is intended to protect existing and future sources of drinking water as part of the government's overall commitment to protecting human health and the environment. The CWA sets out a framework for source protection planning on a watershed basis, with Source Protection Regions and Areas established based on the watershed boundaries of Ontario's 36 Conservation Authorities.

The West London Dyke Erosion Control Study Area is located within the Upper Thames River Source Protection Area (SPA), part of the Thames-Sydenham Source Protection Region, and is subject to the policies of the Upper Thames River Source Protection Plan (SPP) approved in 2015 under the CWA. The SPP contains legally binding policies applicable to 'Significant Threat' policies, and other groups of policies (Moderate and Low Threat policies, Monitoring, and Other Permitted Policies) intended to be implemented by various bodies (conservation authorities, municipalities, and provincial ministries).

Based on the mapping provided by the Thames-Sydenham Source Protection Region (http://maps.thamesriver.on.ca) and the Upper Thames River SPA Approved Assessment Report (2015), portions of the study area are located within areas designated as Highly Vulnerable Aquifer (HVA) (see Figure 1), and Significant Groundwater Recharge Area (SGRA) with a vulnerability score of 6 (see Figure 2).

Reference: West London Dyke Erosion Control Municipal Class Environmental Assessment

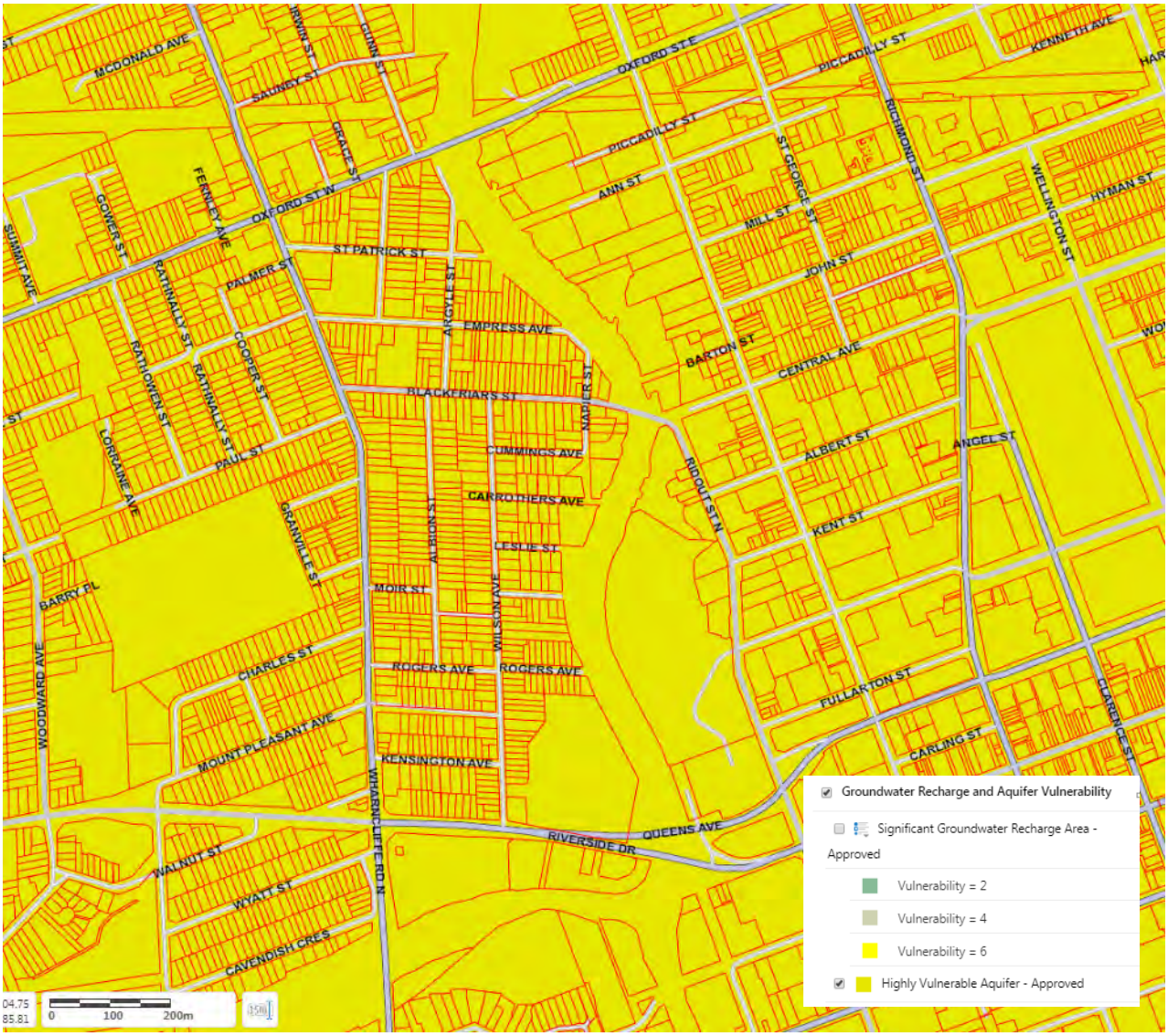

FIGURE 1 Upper Thames Source Protection Area – Highly Vulnerable Aquifer (Thames-Sydenham & Region Interactive Mapping, accessed via https://maps.thamesriver.on.ca/gvh/?viewer=tsrassessmentreport)

Reference: West London Dyke Erosion Control Municipal Class Environmental Assessment

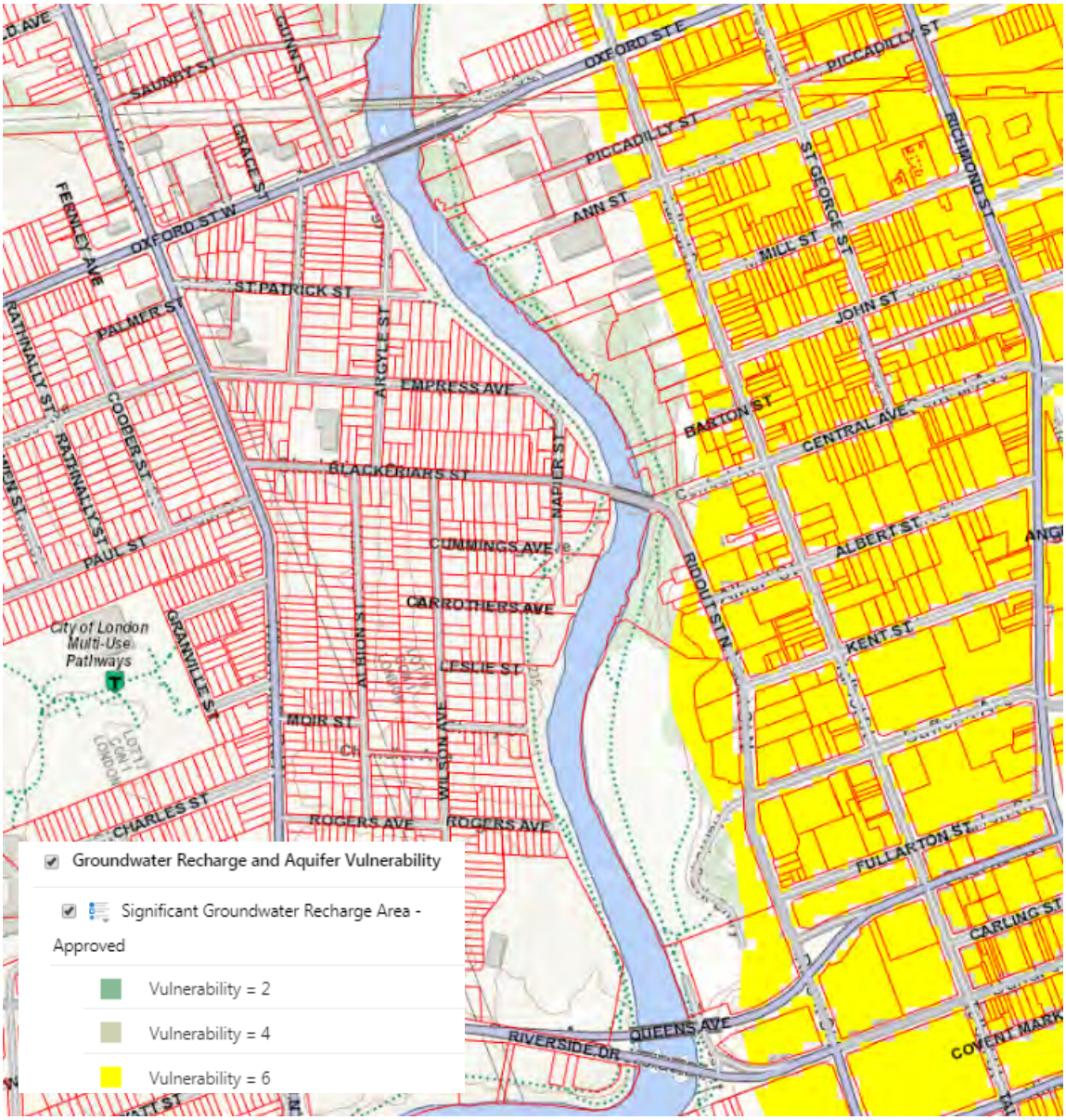

Figure 2 Upper Thames Source Protection Area – Significant Groundwater Recharge Area (Thames-Sydenham & Region Interactive Mapping, accessed via https://maps.thamesriver.on.ca/gvh/?viewer=tsrassessmentreport)

Reference: West London Dyke Erosion Control Municipal Class Environmental Assessment

The available mapping and vulnerability scores indicate that certain activities that corresponded to the MECP Table of Drinking Water Threats within these vulnerable areas may be considered Moderate and Low threats. With regard to improvements identified within the West London Dyke Erosion Control Class EA, no threats have been identified. Therefore, there are no anticipated impacts to the existing approved Source Protection Plan or approved Assessment Report as a result of the proposed improvements within the West London Dyke Erosion Control Class EA.

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Sign-off Sheet

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Prepared by _____

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Stephanie Bergman, MA, Planner

Reviewed by _____

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Approved by _____

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Executive Summary

Introduction

The Upper Thames River Conservation Authority (UTRCA) has retained Stantec Consulting Ltd. to undertake a Schedule B Municipal Class Environmental Assessment (Class EA) to identify preferred solutions for addressing erosion and scour conditions in two areas along the West London Dyke flood control structure: the Ann Street Site, and the Harris Park Site.

Problem Statement

The West London Dyke Erosion Control Class EA is being undertaken to identify environmentally sensitive and sustainable solutions to address existing erosion and scour processes of the Thames River at the Ann Street and Harris Park Sites that, if not addressed, have the potential to undermine the foundation of the West London Dyke flood control structure. The Class EA's recommendations should be integrated with future river improvement or development projects in order to ensure the long-term protection of this vital piece of infrastructure.

Existing Environmental Conditions

The existing socio-economic cultural, and natural environments within the two study areas were reviewed to identify potential impacts of the alternative solutions, and recommendations for mitigation.

Fluvial Geomorphology

The West London Dyke River Morphology and Scour Remediation Study (Stantec, April 2016) was undertaken to determine the degree of undermining of the dyke toe through scour surveys in the two study area locations. This information was used in the development and evaluation of alternative solutions for the current Municipal Class EA.

Alternative Solutions and Evaluation

Alternative solutions for each of the study areas included flow modification alternatives, which address the existing source of the erosion and scour processes, as well as toe protection alternatives, intended to protect the toe from further erosion processes. A qualitative evaluation was undertaken using criteria identified to address the socio-economic/cultural, natural, technical, and economic environmental components within the study areas.

Recommendations

Ann Street: The recommendations for the Ann Street Site include the installation of boulder toe protection along the west bank and modification to the existing weir structure to divert flows towards the centre of the channel as shown in Figure E.1. Sizing of boulders would be determined during detailed design, but they are expected to be larger than 600 mm. The treatment would be 5 m wide and extend along the toe of the dyke between the existing weir and approximately 60 m downstream. The 5m width is required to achieve a slope of 2.5:1. Construction costs for these recommendations are estimated at $92,000. This estimate represents construction costs based on per unit costs for

similar projects, and does not include engineering, permitting/approvals, contract administration, or contingency. Detailed cost estimates will be updated at the time of detailed design.

Figure E.1 Ann Street Recommendations

Harris Park: The recommendations for the Harris Park Site include modification to the downstream MNRF Fish Weir and the addition of boulder toe protection along the west bank, shown on Figure E.2. The treatment would be 5 m wide and extend along the toe of the dyke between the existing MNRF weir and approximately 240 m downstream. Removing the gabions along the east bank would improve floodplain access and flow conveyance through this site and reduce scour potential; however, this has greater implications for the adjacent parkland area, and should be explored through the more rigorous public consultation and design studies currently being undertaken by the City.

Figure E.2 Harris Park Recommendations

Construction costs are estimated at $337,000. This cost estimate represents construction costs based on per unit costs for similar projects, and does not include engineering, permitting/approvals, contract administration, or contingency. Detailed cost estimates will be updated at the time of detailed design. Allowing this area to be a 'soft' depositional area is recommended to allow natural river processes to occur. It is not anticipated that the cut-fill balance will be achieved at this site with respect to the implementation of the boulder toe protection on its own. It should be noted that subsequent work related to the point bar should be undertaken which will involve only cut activities resulting in a net export of material. It is likely that, under final design conditions, that the cut material from the point bar would be able to be balanced (or nearly balanced) with the fill material from the implementation of the boulder toe protection.

This information should be considered in more detail within the Back to the River/One River Master Plan study currently underway.

Environmental Impacts and Mitigation

The project is located within an area that contains several sensitive natural heritage features, including species at risk, fish, and fish habitat. A number of specific mitigation, best management practices, and agency consultation have been identified to mitigate potential environmental impacts. Provided these measures are implemented, no significant impacts to environmental features are anticipated as a result of the recommended solutions.

Consultation and Class EA Filing Process

The following table documents the mandatory points of contact with the public, agency, and Indigenous Community stakeholders throughout the project. Additional stakeholder consultation is included in Appendix B.

Table E.1 Points of Contact

Point of Contact	Method of Communication and Date
Notice of Commencement including a project introduction, study area map, and project team contact information.	Mailed to study contact list (December 18, 2018)
Public Information Centre – Open house to present overview of environmental conditions, problems and opportunities, alternative solutions, and preliminary recommendations, for public review and comment. **February 13, 2018, 4:30-6:30pm – Kinsman Recreation Centre, 20 Granville Street, London ON**	Notice mailed to all stakeholders (January 29, 2018) Notice published in the Londoner newspaper (February 1 and 8, 2018) PIC display material posted to the UTRCA's website (http://thamesriver.on.ca/water-management/london-dyke-system/west-london-dyke/west-london-dyke-erosion-control-ea/)

Notice of Completion to provide an overview of study recommendations, public review period, and Part II Order process. **30-day review period – December 6, 2018 -Feb 8th, 2019 (revised)**	Notice mailed to all stakeholders (November 28, 2018) Published in the Londoner (December 6th, 2018 and December 13, 2018) Report made available at the UTRCA website and UTRCA Watershed Conservation Centre

Closing

This Project File has been prepared to document the Municipal Class EA planning process for Schedule B projects. It outlines the process which the Upper Thames River Conservation Authority has undertaken to address the problems identified, and the potential solutions to be implemented. This process has involved mandatory contact with the public, Indigenous communities and review agencies to ensure that they are aware of the project and that their concerns have been addressed, along with an evaluation of a range of alternatives leading to the project recommendations. The Notice of Completion has been posted for 30-day review, and all correspondence received during this period will be appended to the final report in Appendix F.

1.0 INTRODUCTION AND BACKGROUND

The Upper Thames River Conservation Authority (UTRCA) has retained Stantec Consulting Ltd. to undertake a Schedule B Municipal Class Environmental Assessment (Class EA) to identify preferred solutions for addressing erosion and scour conditions in two areas along the West London Dyke flood control structure.

While completing technical assessments as part of the West London Dyke Master Repair Plan (Stantec 2016), scour (or erosion) conditions were identified in two locations along the West London Dyke, which have the potential to undermine the toe of the dyke structure. River scour surveys were then undertaken in these two locations to determine the degree of undermining of the dyke toe (West London Dyke River Morphology and Scour Remediation Report, Stantec 2015). The data collected as part of the West London Dyke River Morphology and Scour Remediation Report 2015 provides the technical basis for this Municipal Class EA (see Appendix C).

1.1 STUDY AREA

The study area consists of two locations along the West London Dyke: the Ann Street Site and the Harris Park Site.

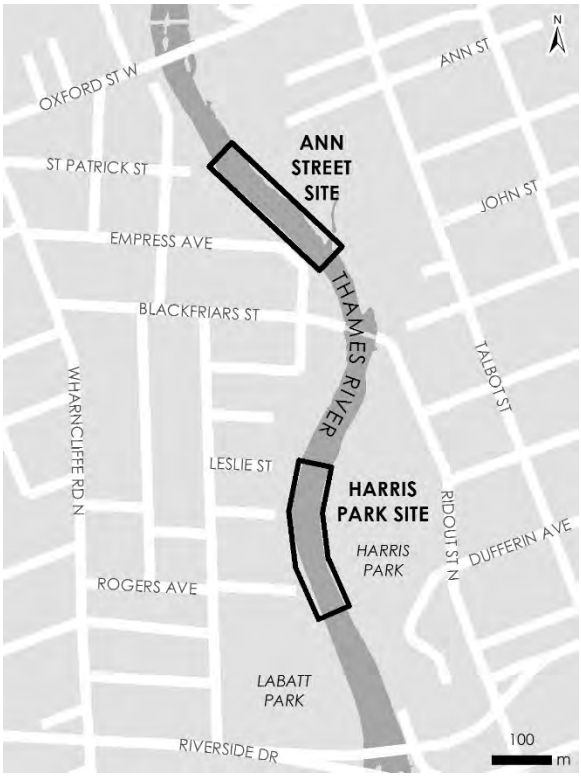


Figure 1.1 Study Area

1.1.1 The Ann Street Site

An abandoned concrete-encased sanitary sewer crosses the Thames River between Ann Street and St. Patrick Street, forming a weir across the river. The weir structure has been a fixture of the river landscape at this location for decades, being visible on 1955 aerial imagery.

Based on City of London as-built drawings, a new sanitary sewer crossing was installed in 1994, just upstream of the old sewer crossing, and located deeper within the riverbed than the old sewer. At this time, a notch was created in the weir by removing a portion of the old concrete encased sewer, which created a low flow channel. The notch currently directs flow towards the west bank, creating a scour pool downstream that has the potential to undermine the toe of the West London Dyke flood control structure.

Figure 1.2 Ann Street Site

1.1.2 The Harris Park Site

The Harris Park Site consists of a number of rock features (referred to as “fish weirs”) installed by the Ministry of Natural Resources and Forestry circa 1980 to improve fish habitat in the area. The fish weirs provide habitat variety, and improve fish passage during low flow periods by creating low flow channels. The location of the downstream fish weir currently directs flow towards the west bank, creating scour pools that have the potential to undermine the toe of the West London Dyke flood control structure.

Figure 1.3 Harris Park Site

1.2 CONSULTATION PLAN

Consultation is a vital part of the Class EA process. At the beginning of the project, a stakeholder list was developed which included Federal and Provincial ministries, local government and municipal staff contacts, local interest groups, neighbourhood associations, and First Nations communities, and was updated throughout the study to include anyone who expressed interest in the study. The study contact list is included in Appendix A.

The Consultation Plan for the study generally included project notifications and a Public Information Centre (PIC) to solicit input on the study. Study notifications, PIC materials, and input received are included in Appendix B.

The table below provides an overview of the main points of contact with the public and stakeholders throughout the study.

Point of Contact	Method of Communication and Date
Notice of Commencement including a project introduction, study area map, and project team contact information.	Mailed to study contact list (December 18, 2018)
Public Information Centre – Open house to present overview of environmental conditions, problems and opportunities, alternative solutions, and preliminary recommendations, for public review and comment. **February 13, 2018, 4:30-6:30pm – Kinsman Recreation Centre, 20 Granville Street, London ON**	Notice mailed to all stakeholders (January 29, 2018) Notice published in the Londoner newspaper (February 1 and 8, 2018) PIC display material posted to the UTRCA's website (http://thamesriver.on.ca/water-management/london-dyke-system/west-london-dyke/west-london-dyke-erosion-control-ea/)
Notice of Completion to provide an overview of study recommendations, public review period, and Part II Order process. **30-day review period – (DATE-DATE)**	Notice mailed to all stakeholders (DATE) Published in the Londoner (DATE) Report made available at the UTRCA website and UTRCA Watershed Conservation Centre

1.2.1 Indigenous Community Consultation

Indigenous communities throughout Southern Ontario were contacted throughout the study based on correspondence received from the Ministry of the Environment and Climate Change, location of traditional territory, and known interests. Project Notices were mailed to communities and follow up calls were made to discuss the project components and to provide additional opportunities to identify concerns or comments. The following Indigenous Communities were included on the study's contact list:

- Chippewas of the Thames First Nation;
- Oneida Nation of the Thames First Nation;
- Munsee-Delaware Nation;
- Delaware-Moravian First Nation;
- Bkejwanong Territory (Walpole Island) First Nation;
- Chippewas of Kettle and Stony Point First Nation; and
- Aamjwnaang First Nation.

All correspondence with First Nations communities has been documented in a TRACER – Team Response and Commitment to Environmental Requirements table in Appendix B.

2.0 PHASE 1 – PROBLEMS AND OPPORTUNITIES

Phase 1 of the Class EA process involves identification of the need and justification for undertaking this study, leading to a clear statement of the problems and opportunities being addressed as part of the study. This section contains an overview of relevant studies and documents that provide the need, justification, and overall context for undertaking the study, followed by the Problem and Opportunity Statement which highlights the objectives of the Class EA.

2.1 WEST LONDON DYKE MASTER REPAIR PLAN

The Upper Thames River Conservation Authority, in conjunction with the City of London, undertook the West London Dyke Master Repair Plan (Stantec 2016) to develop a framework for future improvements to the West London Dyke Flood Control Structure (WLD) and adjacent Thames Valley Parkway trail system. The study spanned several years, incorporated updated flood mapping, and included an extensive community engagement program.

As part of the WLD Master repair work inspections, two sites were determined to be at risk of undermining, and have experienced some undermining caused by erosion: downstream of the Ann Street weir (sewer crossing), and just downstream of the fish weir structures at Harris Park.

2.2 WEST LONDON DYKE RIVER MORPHOLOGY AND SCOUR REMEDIATION REPORT

The WLD River Morphology and Scour Remediation Report (Stantec 2015) was undertaken as part of the overall Master Repair Plan to determine the degree of scour at the Ann Street and Harris Park locations. The report also identified a number of design concepts and opinions of probable cost for restorative treatment to address the scour and protect the WLD from further undermining. Scour surveys of the river were undertaken in these two locations, and the river bed material was characterized to evaluate its capacity to resist scour.

The report identified a number of restorative treatments at each of the two locations, which included both bed/bank protection to reinforce and protect the channel bed or banks with material that resists erosion, and flow vector modification to reduce the river's capacity to cause erosion by decreasing shear stress, or by directing erosive forces away from sensitive areas.

The data collected as part of the report will be used as the technical basis for this Class EA.

2.3 ONE RIVER MASTER PLAN AND OTHER CITY INITIATIVES

The City of London is concurrently undertaking the One River Master Plan Class EA to develop an integrated vision for the Thames River corridor from the Boler Road Bridge to the Forks of the Thames and Harris Park. The Master Plan integrates a number of City initiatives including Back to the River, the Pollution Prevention and Control Plan, the Thames River Clear Water Revival, the London Plan (London's new Official Plan), and the Thames Valley Corridor Action Plan to find integrated solutions to the broad social, economic, and environmental issues facing the City.

Stage 1 of the Master Plan included a number of background studies, public consultation, and an assessment of alternatives for the future of the Springbank Dam. The Stage 1 Report identified that the recommended option for the Springbank Dam, taking into account public, stakeholder, Indigenous Communities, and agency input involved a Free-Flowing River, and decommissioning of the dam. The Stage 1 Report was presented at a Public Participation meeting before the Civic Works Committee on January 9, 2018. Stage 2 of the Master Plan will consist of the assessment of river management strategies, including a number of different infrastructure and river improvement projects. The Forks of the Thames and Harris Park will be included in the focus of Stage 2 of the Master Plan, and the recommendations of the current Class EA with respect to river morphology should be considered and incorporated into the overall Master Plan's considerations.

2.4 PROBLEM STATEMENT

The West London Dyke Erosion Control Class EA is being undertaken to identify environmentally sensitive and sustainable solutions to address existing erosion and scour processes of the Thames River at the Ann Street and Harris Park Sites that, if not addressed, have the potential to undermine the foundation of the West London Dyke flood control structure. The Class EA's recommendations should be integrated with future river improvement or development projects in order to ensure the long-term protection of this vital piece of infrastructure.

3.0 EXISTING CONDITIONS

As part of Phase 2 of the Municipal Class EA process, an inventory of the social, cultural, and natural environments is compiled to characterize the study area, form the basis of the evaluation of alternative solutions, and the identification of impacts and mitigation measures.

3.1 SOCIO-ECONOMIC ENVIRONMENT

Land uses surrounding the Ann Street site include well established residential areas, including high density residential along the east bank, and low density residential (Blackfriars Neighbourhood) along the west bank. There is an existing industrial operation (Mobile Mix Concrete) located on Ann Street also directly adjacent to the Thames River on the east bank.

The Thames Valley Parkway trail system runs along both the west and east banks of the Thames River. As part of the recent improvements to the West London Dyke Phase 1-3, improvements were made to the trail system along the west bank.

Figure 3.1 Thames Valley Parkway/West London Dyke West Bank

Ann Street Park is located along the east bank just south of the Ann Street weir, which includes a community garden. Harris Park is also located on the east bank, which hosts a number of events and festivals throughout the year (Rock the Park, Blues Fest, etc.).

3.2 CULTURAL HERITAGE RESOURCES

The legislative framework for the consideration of cultural heritage as part of the EA process is identified within the *EA Act*, the MEA Municipal Class EA process, and within the Provincial Policy Statement, issued under Section 3 of the *Planning Act*. Cultural Heritage Resources (including Build Cultural Heritage, Cultural Heritage Landscapes, and Archaeological resources) should be identified early in the process and avoided where possible.

The study area is located adjacent to the Blackfriars/Petersville Heritage Conservation District (west bank), as well as the Downtown Heritage Conservation District (east bank). In addition, a Cultural Heritage Evaluation Report (CHER) was also completed as part of the WLD Master Repair Plan Class EA (Stantec 2016). These resources form the basis of the cultural heritage review for the current WLD Erosion Control Class EA.

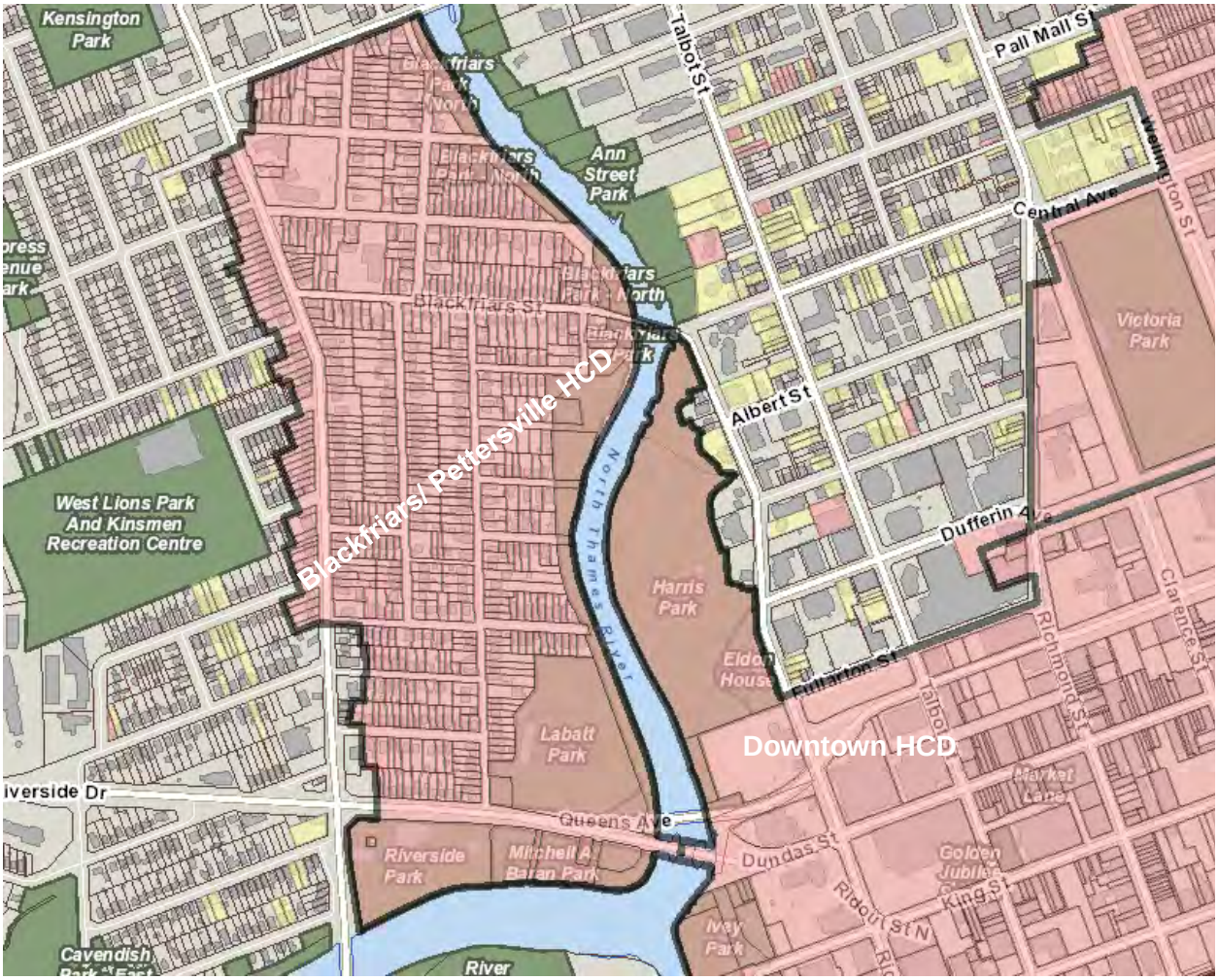
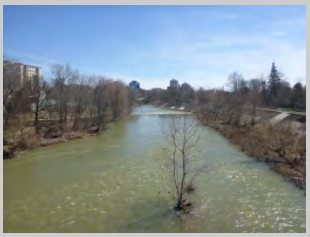


Figure 3.2 Heritage Conservation Districts

The CHER (Stantec 2016) was completed as part of the West London Dyke Master Repair Plan Municipal Class EA to identify heritage resources, including built heritage and cultural heritage landscapes, present within the greater WLD study area. Where potential heritage resources were identified, an evaluation of the cultural heritage value or interest (CHVI) was undertaken in accordance with Ontario Regulation 9/06 – Criteria for Determining Cultural Heritage Value or Interest. The table below provides a summary of the evaluation of resources specific to the Ann Street and Harris Park Sites.

This inventory of Built Cultural Heritage Resources/Cultural Heritage Landscapes will be used during the development and evaluation of alternative solutions. Potential impacts of alternative solutions will be identified, and recommendations will be included to ensure that heritage attributes are protected.

Table 3.1 Overview of Cultural Heritage Resources[1]

Description/Address	CHVI	Resource Number	Heritage Attributes	Photo
Thames River from Oxford Street to Approximately Blackfriars Street	Yes	CH-2	Designated as a Canadian Heritage River. Associated with the historical development of London and historically linked to its surroundings.	
St. Patrick Street Viewshed	Yes	CH-4	Clear, unobstructed view of the Thames River pedestrian pathway and east side of the Thames River in the distance.	
Carrothers Avenue Viewshed	Yes	CH-30	View of dead-end street overlooking the Thames River pedestrian pathway (TVP)	
Leslie Street Viewshed	Yes	CH-33	View of dead-end street overlooking Thames River embankment and Thames River pedestrian pathway (TVP)	
Cherry Street Viewshed	YES	CH-36	View of dead-end street overlooking Thames River embankment and Thames River pedestrian pathway (TVP)	

Description/Address	CHVI	Resource Number	Heritage Attributes	Photo
Rogers Ave Viewshed	Yes	CHR-40	Clear unobstructed view of the Thames River pedestrian pathway (TVP) and east side of Thames River with the Downtown visible in the distance.	

[1] Evaluation of Cultural Heritage Value of Interest from Cultural Heritage Evaluation Report; West London Dyke Master Repair Plan (Stantec 2016)

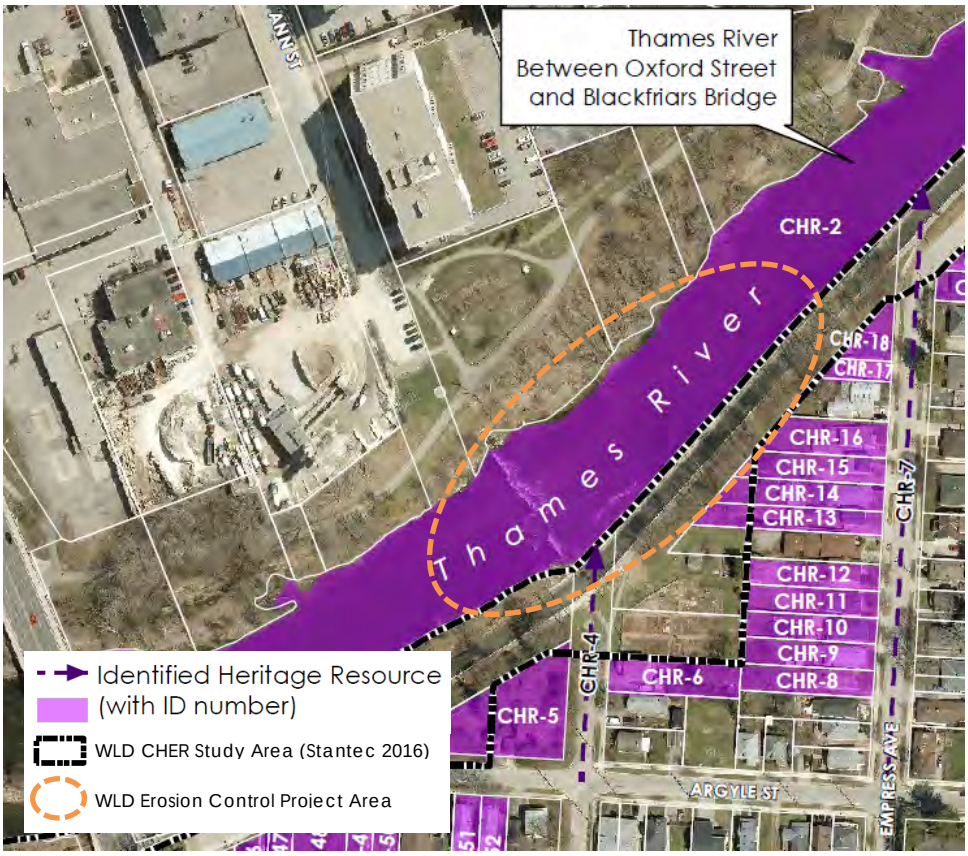


Figure 3.3 Cultural Heritage Resources - Ann Street Site (Stantec 2016)

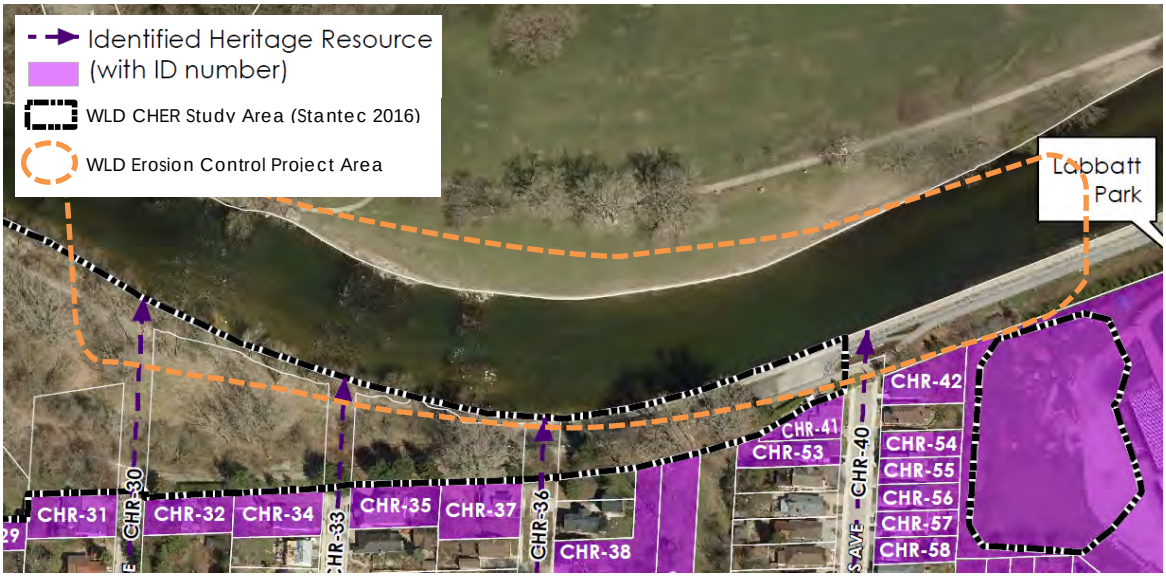


Figure 3.4 Cultural Heritage Resources - Harris Park Site (Stantec 2016)

3.2.1 Archaeological Resources

The weir located at the Ann Street Site was created by a concrete encased sanitary sewer crossing. In 1994, this sewer was abandoned, partially excavated, and replaced by a deeper sewer, located approximately 3m upstream (north) of the abandoned crossing in conjunction with construction/upgrades to the St. Patrick Street/Ann Street Sanitary Syphon. As identified in the as-built drawings included in Appendix D, the sewer crossing and siphon upgrades were constructed via open-cut excavation. Based on the recent and extensive disturbance undertaken during construction of the sewer crossing and siphon upgrades, impacts to archaeological resources are not anticipated.

With respect to the Harris Park Site, based on information contained in the City's draft Archaeological Management Plan (ASI, LHC, and D.R. Poulton and Associates Inc. 2017) and through consultation with City staff, there are known archaeological sites within Harris Park. The evaluation of alternative solutions will consider the potential impact to archaeological resources, and recommendations will be identified for further study to confirm/eliminate the potential for archaeological resources.

3.3 EXISTING CONDITIONS NATURAL ENVIRONMENT

The following sections provide an overview of the significance and sensitivity of the natural features documented within the Ann Street and Harris Park study areas. Data within this report has been retrieved from the West London Dyke Environmental Impact Study (EIS) Report completed by Stantec in 2016, supplemented by field investigations and consultation with the Upper Thames River Conservation Authority (UTRCA).

3.3.1 Study Area Context

The study areas are located within Rowe's (1972) Deciduous Forest Region, specifically, the Niagara section. This area is also commonly referred to as the Carolinian Forest. Vegetation cover in this forest region is dominated by broadleaved trees and shrubs. Hardwood forests frequently include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), white elm (*Ulmus americana*), American basswood (*Tilia americana*), various oaks (*Quercus* sp.) and hickories (*Carya* sp.), with numerous other species found where substrates are well developed on upland sites. Lowlands, including rich floodplain forests, typically contain green ash (*Fraxinus pennsylvanica*), silver maple (*Acer saccharinum*), red maple (Acer rubrum), and black ash (*Fraxinus nigra*). Some species that are representative of the Deciduous Forest Region that are not found elsewhere in Ontario include the tulip-tree (*Liriodendron tulipifera*), sycamore (*Platanus occidentalis*), black gum (Nyssa sylvatica) and pawpaw (*Asimina triloba*) (Crins 2009).

The study areas are situated upstream of the Forks of the Thames, within The Forks Watershed portion of the Upper Thames River basin. Much of the surrounding lands are comprised of residential and natural areas.

3.3.2 Background Data Collection

A desk-top review was conducted to identify potential impacts of the proposed alternatives in addition to identifying mitigation measures and providing recommendations. The information contained in the following sections is based primarily on data collected from various background documents and sources of information as listed below:

- City of London Official Plan (1989), the London Plan (2018) and Zoning By-Law (2013);
- Fisheries and Oceans Canada (DFO). 2017. Upper Thames River Conservation Authority Aquatic Species at Risk Digital Mapping. Distributed by Conservation Ontario;
- Government of Canada. Species at Risk Public Registry (2012). Accessed June 11, 2018;
- Ministry of Natural Resources and Forestry (MNRF, 2018). 2012-2018. Species at Risk Ontario List;
- Natural Heritage Information Centre (NHIC) database. MNRF, 2018. Natural Areas and Species records search;
- Biodiversity explorer (NHIC, 2018). https://www.ontario.ca/environment-andenergy/natural-heritage-information-centre.com. Accessed June 2018;
- West London Dykes Subject Lands Status Report (UTRCA, 2015);
- Atlas of the Mammals of Ontario (Dobbyn, 1994);
- Reptiles and Amphibians of Ontario (Ontario Nature, 2018);
- Ontario Breeding Bird Atlas (Cadman et al., 2007);
- Important Bird Areas database (Bird Studies Canada and Bird Life International);
- Ontbirds Archives (various years);
- The Physiography of Southern Ontario (Chapman and Putnam, 1984); and
- Aerial Photographs (City of London, 2017)

3.3.3 Field Investigations

Information from field investigations from the Stantec 2016 West London Dyke EIS and a supplementary field visit to confirm conditions in 2017 were used as the basis for this report. Fieldwork and targeted species surveys completed for the 2016 EIS WLD study area included:

- Vegetation community mapping using the Ecological Land Classification (ELC) system;
- Three season botanical inventories;
- Two rounds of call count surveys for breeding amphibians;
- Three rounds of breeding bird surveys;
- Snake emergent surveys;
- Basking and nesting turtle surveys;
- Bat habitat assessments;
- Winter raptor surveys; and
- Wildlife habitat assessment.

3.3.4 Existing Vegetation Communities

Field surveys were conducted as part of the West London Dyke EIS by Stantec ecologists in 2015, and conditions were confirmed in 2017. Mapping of vegetation communities included Ecological Land Classification (ELC) using the ELC system for Southern Ontario (Lee et al. 1998) and, where appropriate, the updated ELC Catalogue (2008). ELC mapping was completed to the finest level of resolution (vegetation type) where possible. Vegetation communities were first identified on aerial imagery and then checked in the field. Provincial significance of vegetation communities was based on the rankings assigned by the Natural Heritage Information Centre (MNRF, 2015). Botanical surveys were conducted in spring (May), summer (July) and fall (September). Botanical nomenclature was recorded using the updated list of Ontario vascular plants produced by the Natural Heritage Information Centre (2015a) and Michigan Flora Online (2011).

As the study areas are located in the downtown core of London, many of the ELC communities are heavily influenced by anthropogenic disturbances such as constructed and industrial communities. Large portions of the study areas are dominated by the Thames River, classified as Open Water (OAW) under ELC guidelines, in addition to recreational

(CGL_4), parkland (CGL_2), and single family residential (CVR_3) areas adjacent to the study areas. The Ann Street study area and Harris Park study area are shown on Figure 3.5.Vegetation communities identified in both the study areas were primarily comprised of treed shoreline (SHTM1-1), deciduous woodland (WODM5), swamp thicket (SWTM3) and mixed meadow (MEMM4) communities, as identified below in **Tables 3.2 and 3.3.**

Table 3.2 Vegetation Communities - Ann Street Site

ELC Type	Community Description
SWAMP (SW)	
Swamp Thicket (SWT)	
SWTM3 Willow Mineral Deciduous Thicket Swamp Type	This community was a narrow swath of thicket swamp along the banks of the Thames River. Willows such as sandbar willow and Missouri willow were dominant. Black willow and peach-leaved willow were less abundant in this community type. Occasional saplings of sycamore were present throughout. Herbaceous flora such as spotted Joe-pye-weed, spotted touch-me-not, giant goldenrod, great angelica, reed canary grass, narrow-leaved cattail, purple loosestrife and Pennsylvania smartweed were abundant.
CULTURAL	
Naturalized Hedgerow	
FODM11 Naturalized Deciduous Hedgerow Ecosite	This community was a narrow deciduous hedgerow along the western side of the Thames River.
Shoreline (SH)	
Treed Shoreline (SHT)	
SHTM1-1 Cottonwood Mineral Treed Shoreline	This community lined the banks and narrow floodplains of the Thames River. Large cottonwoods in the canopy layers were abundant and characteristic of this narrow community. The understory and ground layers were disturbed and contained a variable mixture of exotic and native species such as common buckthorn, Norway maple, goutweed, garlic mustard, Canada anemone, wooly blue violet, giant goldenrod and white snakeroot.

Table 3.3 Vegetation Communities - Harris Park Site

ELC Type	Community Description
WOODLAND (WO)	
Deciduous Woodland (WOD)	

ELC Type	Community Description
WODM5* Fresh-Moist Deciduous Woodland Ecosite	This community type occurred mostly along the banks and narrow floodplains as disturbed woodland communities dominated by Manitoba maple, cottonwood, black locust, Norway maple, and white mulberry, and to a lesser extent, hackberry and crack willow. An abundance of common buckthorn was observed throughout.
MEADOW (ME)	
Forb Meadow (MEM)	
MEMM4 Fresh-Moist Mixed Meadow Ecosite	This moist meadow community type occurring in a narrow portion along the riverbanks was dominated by typical old field species such as goldenrods (giant and tall), New England aster, smooth brome and orchard grasses. Stinging nettle and woodland chervil were common in areas.
SHORELINE (SH)	
Treed Shoreline (SHT)	
SHTM1-1 Cottonwood Mineral Treed Shoreline	This community lined the banks and narrow floodplains of the Thames River. Large cottonwoods in the canopy layers were abundant, and characteristic of this narrow community. The understory and ground layers were disturbed and contained a variable mixture of exotic and native species such as common buckthorn, Norway maple, goutweed, garlic mustard, Canada anemone, wooly blue violet, giant goldenrod and white snakeroot.

* Denotes modified community extent from 2016 WLD EIS due to recent Phase 3 dyke reconstruction

None of the vegetation communities identified in the study areas are considered rare in the province. No provincially rare or at-risk species (listed on the Species at Risk Ontario List) were identified in the study areas; however, two regionally rare species to the Middlesex County region were identified. Virginia Stickseed was observed during site investigations within the treed floodplain area (WODM5*) of the Harris Park Site. Sweet Ox-eye was identified along the edge of the Thames River within the Harris Park study area.

Stantec

Legend

- Erosion Control Study Area
- 2016 Investigation Area
- ELC Boundary (Stantec 2016)

ELC Key

BLO	Open Bluff
CGL_2	Parkland
CGL_4	Recreational
CV	Constructed (Dyke Structure)
CVC_3	Heavy Industrial
CVI_1	Transportation
CVR_2	High Density Residential
CVR_3	Single Family Residential
FODM11	Naturalized Deciduous Hedgerow
MEMM4	Fresh - Moist Mixed Meadow
OAW	Open Water
SHTM1-1	Cottonwood Mineral Treed Shoreline
SWTM3	Willow Mineral Deciduous Thicket Swamp
WODM5	Fresh - Moist Deciduous Woodland

* Denotes modified community extent from 2016 WLD EIS due to recent Phase 3 dyke reconstruction.

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
3.5

Title

Ecological Land Classification (ELC)

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Revised: 2018-06-19 By: kbuchanan

3.3.5 Amphibians

Amphibian surveys were conducted during site visits in 2015 as part of the 2016 EIS. Both the Ann Street and Harris Park study areas did not support suitable breeding amphibian habitat. As such, breeding amphibian surveys did not overlap in these study areas.

One breeding amphibian survey station was located approximately 100m north of the Harris Park study area and 200m south of the Ann study area in the WODM5* community, as shown on Figure 3.6. The survey was conducted in accordance with Environment Canada's Marsh Monitoring Program (MPP) and Environment Canada's Amphibian Road Call Count program (Environment Canada, 2008). Pooling and potential breeding amphibian habitat was identified during the April survey; however, the following survey in May documented minimal pooling. A third survey was not conducted in June due to the absence of any pooling of water. No amphibians were heard calling during the April and May surveys at this survey station.

3.3.6 Reptiles

3.3.6.1 Snakes

Emergent surveys were conducted for snakes in early spring, 2015 to capture any potential basking snake species emerging from overwintering locations. Areas targeted were specific to potential hibernacula features and habitat. Hibernacula features were not identified in the Ann Street or Harris Park study areas. No snakes were observed during 2015 field investigations.

3.3.6.2 Turtles

Turtle basking surveys were conducted along the Thames River from April to September in 2015 for the West London Dyke EIS study area. Turtle basking habitat was assessed along the Thames River. A turtle basking survey station was established where suitable basking features were present and could be viewed from along the shore of the Thames River. One Turtle basking station was established slightly outside the Ann Street study area. No basking stations were established in the Harris Park study area. No turtles were documented in either the Ann Street or Harris Park study areas; however, Eastern Spiny Softshell, Northern Map Turtle, and Red-eared Slider were documented in other areas of the Thames River during 2015 field investigations. Snapping Turtle is also a known resident of the Thames River, and is considered to be continuous within the extent of the Thames River.

Turtle nesting habitat was also assessed for the full extent of the West London Dyke study area in 2015. One area was identified to potentially support turtle nesting and overlaps with a portion of the Harris Park study area. The WODM5* and disturbed area had areas of sandy banks that may have been suitable for turtle nesting. Follow-up surveys were conducted in June 2015 to identify evidence of turtle nesting; however, no nesting evidence was observed. This area has since recently been cleared as part of the Phase 3 and Phase 4 West London Dyke Replacement Project. To mitigate impacts to Eastern Spiny Softshell, a Letter of Advice (LOA) was issued by MNRF on August 8, 2016. Further information on SAR and SAR habitat in the study areas are discussed in Section 3.3.10.

3.3.7 Breeding Birds

Three rounds of breeding bird surveys were conducted within the WLD EIS study area in 2015. Birds commonly observed and showing breeding evidence in the Ann study area included: Mourning Dove, Rock Pigeon, Great-crested Flycatcher, Warbling Vireo, European Starling, Gray Catbird, American Robin, Northern Cardinal, Red-winged Blackbird, House Finch, American Goldfinch and House Sparrow. Birds commonly observed and showing breeding evidence in the Harris Park study area included: Gray Catbird, American Robin, Yellow Warbler, Common Grackle, Red-winged Blackbird, American Goldfinch, House Sparrow and Song Sparrow. Two bird SAR, Chimney Swift and Barn Swallow were observed during the 2015 breeding bird surveys. Chimney Swift were observed in the Ann Street and Harris Park study areas. Barn Swallow were observed in the Harris Park study area. Further information regarding SAR birds is discussed in Section 3.3.10**.**

3.3.8 Bats

MNRF's Bat and Bat Habitat Guidelines (MNR, 2011) were used to assess bat habitat within the full extent of the West London Dyke Replacement Project study area in 2015. Suitable roosting habitat was not identified in either the Ann Street or Harris Park study areas. Lowland forest communities located directly adjacent to the Thames River provides open water foraging habitat for Little Brown Myotis and Northern Myotis, in particular. No potential hibernacula were identified during the background review or during field investigations conducted in 2015.

Stantec

Legend

- Erosion Control Study Area
- 2016 Investigation Area
- Amphibian Monitoring Station
- Turtle Basking Station
- Bat Habitat Assessment
- Turtle Nesting Survey

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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Figure No.
3.6

Title

Survey Station Locations
(2016 WLD EIS)

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Revised: 2018-07-11 By: kbuchanan

3.3.9 Winter Wildlife and Winter Raptor Surveys

A winter wildlife survey was completed concurrently with a winter raptor survey in March 2015 for the West London Dyke Replacement Project study area. The full extent of the study area was walked systematically along both sides of the Thames River. Two raptor species, Bald Eagle and Red-tailed Hawk, were observed flying over the Thames River. Although neither species were identified to be nesting within the study area, the Thames River does have the potential to support foraging habitat for both species. Nesting areas for these two species are considered absent in the Ann Street and Harris Park study areas. Other winter wildlife recorded in the general area during the winter survey included Grey Squirrel, Eastern Cottontail and Mink.

3.3.10 Species at Risk and Species of Conservation Concern

Species at risk are those species given status rankings by the Federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and/or the provincial Committee on the Status of Species at Risk in Ontario (COSSARO), as threatened or endangered according to federal or provincial legislation. Endangered and threatened species in Ontario receive general habitat protection under the ESA 2007. Special concern species are not afforded habitat protection and have been summarized as species of conservation concern (SOCC). On federal lands (e.g. Indigenous reserves), endangered and threatened species as well as their residence and critical habitat are protected under the federal Species at Risk Act (SARA 2002).

Based on background information obtained for the study areas through NHIC records and information provided in various wildlife atlases (Section 3.3.2), 16 SOCC and 18 SAR have ranges that overlap with the study areas. Only recent records (less than 30 years old) of SOCC and SAR were considered. For protection purposes, exact locations of species are not provided (only within a 1 km grid), and presence of the species in the study areas are not definite. As such, the potential for species to be present is limited by habitat suitability and availability in the study areas. SAR and SOCC potentially occurring the study areas based on NHIC and atlas records, referenced in Section 3.3.2. Species presence in the study areas were determined through consideration of the 2015 West London Dyke field results.

Based on the 2015 field results and the locations of Ann Street and Harris Park study areas, 6 SAR and 2 SOCC either have the potential to occur or have been confirmed in the study areas:

- Three (3) turtle species: Eastern Spiny Softshell, Northern Map Turtle, Snapping Turtle
- Two (2) bird species: Barn Swallow, Chimney Swift
- Two (2) fish species: Silver Shiner and Spotted Sucker
- One (3) mussel species: Rayed Bean, Round Pigtoe and Wavy-Rayed Lampmussel

Barn Swallow was observed in the Ann Street study area, and Chimney Swift was observed in both the Ann Street and Harris Park study areas. No other SAR or SOCC were documented in these two study areas; however, SAR and SOCC associated with the Thames River (Eastern Spiny Softshell, Northern Map Turtle, Snapping Turtle) are anticipated to occur in both study areas.

According to the DFO Species at Risk Mapping for Ontario South West (Map 21 of 34), critical habitat for one or more Extirpated, Endangered, or Threatened fish and/or mussel species (Eastern Sand Darter, Rainbow mussel, Rayed Bean mussel, and Round Pigtoe) is mapped within the Thames River, beyond the study area downstream of the Forks of the Thames. Records for Special Concern species of fish and mussels are also mapped in the Thames River upstream of the study area (Northern Brook Lamprey, Spotted Sucker, and Wavy-Rayed Lampmussel).

3.3.10.1 Field Observations

Barn Swallow

The Barn Swallow has a provincial rank of S4B (apparently secure breeding status) in Ontario and is designated a provincially and federally threatened species. This species is afforded general habitat protection under the *ESA* (2007). Barn Swallows nest on walls or ledges of barns as well as on other human-made structures, such as bridges, culverts or buildings (Cadman et al., 2007; COSEWIC, 2011). Barn Swallow was observed during 2015 field investigations flying over the Thames River within the Harris Park study area. It was suspected to be nesting under the bridge structures crossing over the Thames River (including the Queens Avenue Bridge and Blackfriars Bridge – subsequently removed for rehabilitation as part of a separate project). As there are no bridge structures proposed for alteration or removal for this project, no impacts to Barn Swallow are anticipated.

Chimney Swift

The Chimney Swift has a provincial rank of S4B (apparently secure breeding status) in Ontario and is designated a provincially and federally threatened species. This species is afforded general habitat protection under the *ESA* (2007). Chimney Swift uses both man-made and natural structures for roosting and breeding (Cadman et al., 2007; COSEWIC, 2007). This species was observed flying over the Thames River in both the Ann Street and Harris Park study areas during 2015 field investigations. Nesting features and habitat for Chimney Swift were not identified during 2015 field investigations and is considered absent within the study areas. It is likely the species is nesting in industrial buildings in downtown London. No impacts to Chimney Swift are anticipated as a result of project activities.

Eastern Spiny Softshell

The Eastern Spiny Softshell is ranked as S3 (vulnerable) in Ontario and is designated as a provincially and federally threatened species. This species is afforded general habitat protection under the *ESA* (2007). This species requires sandy beaches and riverbanks for nesting, and shallow soft-bottomed water bodies to function as nurseries and refugia (COSEWIC, 2002b). This species was observed in the Thames River during 2015 field investigations. Although no observations were made directly in the Ann Street or Harris Park study areas, this species is considered present in the Thames River for both study areas. No nesting habitat was identified in either of the study areas. As part of the West London Dyke Replacement Project, a LOA was issued for Eastern Spiny Softshell.

Follow-up discussions are recommended with MNRF in regard to the Ann St and Harris Park study areas to address SAR and SAR habitat for Eastern Spiny Softshell.

Silver Shiner

Silver Shiner is listed Federally as Special Concern and Provincially as Threatened. They prefer to inhabit moderate to large, deep, relatively clear streams with swift currents, and moderate to high gradients that include substrates consisting of gravel, pebble, cobble, boulder, sand, mud, and clay.

Spotted Sucker

The Spotted Sucker is listed Federally and Provincially as Special Concern that generally inhabits clear creeks and small to moderate sized rivers with sand, gravel or hard-clay bottoms, usually free of silt. It has been found in turbid waters as well.

Mussels

Rayed Bean mussel (Endangered Federally and Provincially), Round Pigtoe (Endangered Federally and Provincially) and Wavy-Rayed Lampmussel (Special Concern Federally; Threatened Provincially) are all bivalve mussels that occupy a variety of habitat types.

No specific surveys were completed to determine the presence of fish or mussel species in the study area, and their potential presence was based on the review of species at risk mapping and information requests.

Follow-up discussions are recommended with MNRF in regard to the Ann Street and Harris Park study areas to review SAR and SAR habitat for all aquatic species.

3.3.11 Species of Conservation Concern

Northern Map Turtle

The Northern Map Turtle is ranked as S3 (vulnerable) in Ontario and is considered a provincial and federal species of special concern. This species is highly aquatic and inhabits slow moving large rivers and lakes with soft bottoms with abundant aquatic vegetation (COSEWIC, 2002a). This species was not observed in the Ann Street or Harris Park study areas; however, this species is considered present in the Thames River for both study areas. No nesting habitat was identified in either of the study areas. Mitigation measures outlined in the LOA issued by MNRF on August 8, 2016 for Eastern Spiny Softshell is considered to provide adequate mitigation for all turtle species in the West London Dyke Replacement Project study area, which overlaps with both the Ann Street and Harris Park study areas.

Snapping Turtle

The Snapping Turtle is ranked as S3 (vulnerable) in Ontario and is considered a provincial and federal species of special concern. This species inhabit ponds, sloughs, streams, rivers and shallow bays that are characterized by slow moving water, aquatic vegetation and soft bottoms (COSEWIC, 2008). This species was not observed during 2015 field investigations; however, this species is considered present in the Thames River for both study areas. No nesting habitat was identified in either of the study areas. Mitigation measures outlined in the LOA issued by MNRF on August 8, 2016 for Eastern Spiny Softshell is considered to provide adequate mitigation for all turtle species in the

West London Dyke Replacement Project study area, which overlaps with both the Ann Street and Harris Park study areas.

3.3.12 Significant Natural Features

3.3.12.1 Significant Wetlands

There were no provincially or locally significant wetlands, or areas of unevaluated wetlands identified in the study areas.

One wetland community type was identified during 2015 site investigations; willow swamp thicket (SWTM3). This wetland community was identified in the Ann Street study area. This community will be temporarily disturbed during construction activities. To address the temporary construction and disturbance in these areas, development of a habitat restoration plan is recommended.

3.3.12.2 Habitat for Endangered or Threatened Species

Eastern Spiny Softshell is considered present in the study areas. This species is restricted to the Thames River. The species is known to use the Thames River for nesting and overwintering; however, the study areas do not support suitable nesting habitat for Eastern Spiny Softshell. In-water work is proposed for the completion of this project. As such, this species and its habitat has the potential to be impacted during project activities. Follow-up discussions with MNRF to determine permitting requirements prior to the start of project activities is recommended to avoid contravention of the ESA (2007).

3.3.12.3 Significant Woodlands

Site investigations completed as part of the West London Dyke Replacement Project in 2015 identified one woodland community type (WODM5) associated with significant woodlands located within the Harris Park Site, as designated by The City of London's *Guideline Documents for the Evaluation of Ecologically Significant Woodlands* (City of London, 2006a). Additional areas of significant woodlands as designated by the City of London Official Plan (1989) and London Plan (2018) were found within the Harris Park Site at the SHTM1-1 community type east of the Thames River. To address the temporary construction and disturbance in these areas, development of a habitat restoration plan is recommended.

3.3.12.4 Significant Valleylands

According to the MNRF and LIO data, no significant valleylands were documented within the study areas. However, the Subject Lands Status Report (UTRCA, 2015) identifies the Thames River as a Significant River; the City of London Official Plan (1989) identifies the stream and ravine corridor as a significant corridor, and the London Plan (2018) identifies the Thames River corridor as Valleylands. Based on the above designations, the Thames River corridor in the study areas are expected to qualify as Significant Valleyland. To address the temporary construction and disturbance in these areas, development of a habitat restoration plan is recommended.

3.3.12.5 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) is defined as an area where plants, animals and other organisms live. Wildlife habitat is crucial to species during vulnerable life stages and migration, though non-migratory species use this habitat as well. Significance of wildlife habitat is divided into four broad categories, as outlined in the Significant Wildlife Habitat Ecoregion 7E Criterion Schedule (MNRF, 2015b), and include:

- Habitats of seasonal concentrations of animals
- Rare vegetation communities or specialized habitats for wildlife
- Habitats of species of conservation concern (excluding endangered and threatened species)
- Animal movement corridors

Habitat of Seasonal Concentrations of Animals

Seasonal concentration areas are those where several species congregate, large numbers of one species gather at a certain time of year, areas that support a SAR, or areas where a large percentage of the population may be lost if habitat is destroyed. The Ann Street and Harris Park study areas are considered to support turtle wintering areas, as shown on Figure 3.7**.**

Rare Vegetation Communities or Specialized Habitats

No rare habitats or rare vegetation communities were identified during the background review or 2015 field investigations.

Specialized habitats are defined as microhabitats critical to wildlife species such as turtle nesting habitat. No specialized habitats were identified within the study areas during 2015 field investigations.

Habitats of Species of Conservation Concern (excluding Endangered and Threatened Species)

Species of Conservation Concern are identified as species listed provincially or federally as special concern, and/or have a ranking of S1-S3 in the province. Two species of conservation concern were identified in the study areas during 2015 field investigations: Northern Map Turtle and Snapping Turtle. Habitat for these two species are associated with the Thames River, and overlaps with SWH for turtle overwintering habitat.

Animal Movement Corridors

Animal movement corridors provide access for animals to move from one habitat to another using lengthened, naturally vegetated landscapes, general for migratory or breeding purposes, or different habitat and/or food requirements. No animal movement corridors were identified within the study areas through the background review or 2015 field investigations.

3.3.12.6 Fish and Fish Habitat

The Thames River provides both fish and fish habitat in The Ann Street and Harris Park study areas.

3.3.12.7 Significant Corridors

Schedule B-1 of the City of London Official Plan (1989) identified significant corridors along the Thames River within the study areas. Significant corridors include several metres along the riverbank to encompass the floodplain areas. To address the temporary construction and disturbance in the areas designated as “significant corridors” along the Thames River, development of a habitat restoration plan is recommended.

3.3.13 Existing Natural Environment – Summary

Based on the 2015 field results from the West London Dyke Replacement Project in relation to the Ann Street and Harris Park study areas, the following natural heritage features have been identified within the study area and must be considered during the design of the erosion control to identify and mitigate any potential negative impacts:

- Wetlands:
    - One wetland community is present in Ann Street study area. To address the temporary construction and disturbance in these areas, development of a habitat restoration plan is recommended.
- Habitat for Endangered or Threatened species:
    - The study areas provide habitat for Eastern Spiny Softshell. Follow-up discussions with MNRF are recommended to determine permitting requirements under the ESA (2007).
- Significant Woodlands:
    - Presence of significant woodlands for both the Ann Street and Harris Park study areas were identified through The London Plan (2018) and through The City of London’s *Guideline Documents for the Evaluation of Ecologically Significant Woodlands* (City of London, 2006a). To address the temporary construction and disturbance in these areas, development of a habitat restoration plan is recommended.
- Significant Valleylands:
    - The Thames River corridor is considered to qualify as a significant valleyland. To address the temporary construction and disturbance in this corridor, development of a habitat restoration plan is recommended.
- Significant Wildlife Habitat:
    - Presence of Seasonal Concentration of Animals: Turtle Overwintering for Eastern Spiny Softshell, Northern Map Turtle, Snapping Turtle and Red-eared Slider.
    - Habitat of species of Conservation Concern: Northern Map Turtle and Snapping Turtle.

  - To mitigate impacts to these species during construction activities (including in-water works), mitigation measures developed through consultation with MNRF in regards to Eastern Spiny Softshell will also be developed to consider other turtle species present in the study areas.

- Fish and Fish Habitat:
  - Fish and fish habitat is present throughout the Thames River and in both of the Study Areas. Several species at risk are potentially present in both study areas. MNRF should be consulted to determine appropriate mitigation approaches and management of construction activities to reduce potential impacts to species at risk and aquatic life in the Thames River.
- Significant Corridors:
  - Considered present along the banks of the Thames River. To address the temporary construction and disturbance in in these areas, development of a habitat restoration plan is recommended.

Discussion on potential impacts on the Natural Environment, including vegetation, wildlife, wildlife habitat and existing natural features along with recommended mitigation measures are discussed in Section 7.1.2.

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Stantec

Legend

- Erosion Control Study Area
- 2016 Investigation Area
- ELC Boundary

Natural Features

- Significant Woodland (MNHSS 2014)

Significant Wildlife Habitat

Seasonal Concentration Area

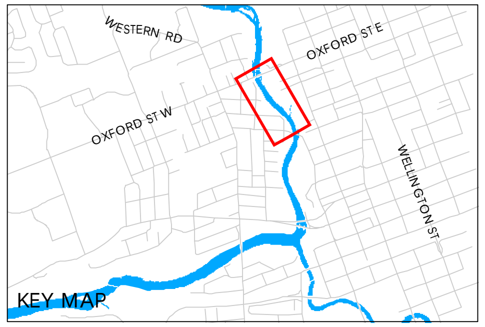
- Turtle Overwintering Area

Habitat for Species of Conservation Concern

- SOCC Habitat

ELC Key

BLO	Open Bluff
CGL_4	Recreational
OAW	Open Water
SHTM1-1	Cottonwood Mineral Treed Shoreline
SWTM3	Willow Mineral Deciduous Thicket Swamp
WODM5	Fresh - Moist Deciduous Woodland



Notes

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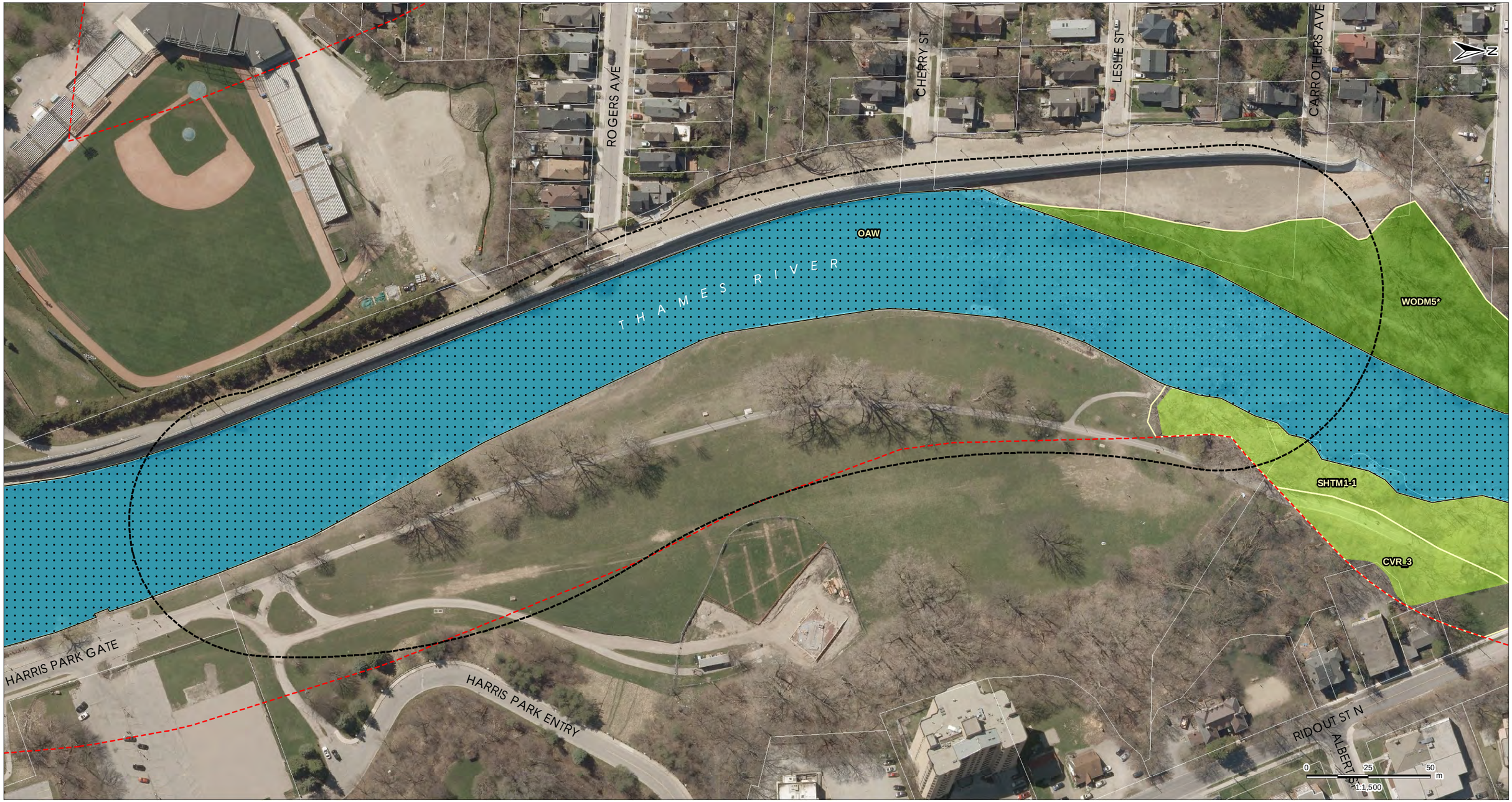
Figure No.

3.7a

Title

Designated Natural Features and Significant Wildlife Habitat Ann Street Study Area



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Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
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Legend
- Erosion Control Study Area
- 2016 Investigation Area
- ELC Boundary

Natural Features
- Significant Woodland (Stantec)
- Significant Woodland (MNHSS 2014)

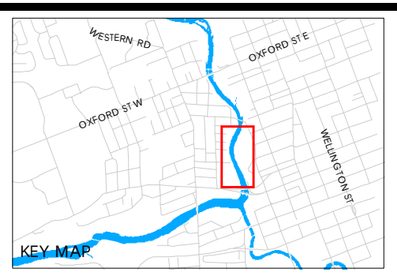
Significant Wildlife Habitat
Seasonal Concentration Area
- Turtle Overwintering Area

Habitat for Species of Conservation Concern
- SOCC Habitat

ELC Key

CVR_3	Single Family Residential
OAW	Open Water
SHTM1-1	Cottonwood Mineral Treed Shoreline
WODM5	Fresh - Moist Deciduous Woodland

* Denotes modified community extent from 2016 WLD EIS due to recent Phase 3 dyke reconstruction.



Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
3.7b

Title
Designated Natural Features and Significant Wildlife Habitat
Harris Park Study Area

4.0 EXISTING CONDITIONS FLUVIAL GEOMORPHOLOGY

As part of the West London Dyke Master Repair Plan, two sites along the West London Dyke, downstream of the Ann Street Weir and within Harris Park, were determined to be undermined by scour and erosion.

The West London Dyke River Morphology and Scour Remediation Study (Stantec, April 2016) was undertaken to determine the degree of undermining of the dyke toe through scour surveys in the two locations. The study also included the development of restorative options to address the scour and erosion processes to provide adequate bank protection for the dyke. This information was used in the development and evaluation of alternative solutions for the current Municipal Class EA.

4.1 METHODOLOGY

4.1.1 Geomorphic Surveys

The river longitudinal profile was surveyed to map the thalweg, water surface slope, and bankfull elevations. Several cross-sections were also surveyed to determine changes in cross-sectional geometry along the channel. At least two cross-sections for each site were located in the scour pool. Identifying the bankfull elevation enables shear stress and scour potential to be determined. Bankfull elevation is identified where shear stress within the channel is the greatest.

4.1.2 Substrate Characterization

The size of the river substrate was quantified at each site where bed scour was observed. Unconsolidated substrate (e.g. sand, gravel) was characterized by use of a Wolman Pebble Count. If the channel bed consisted of consolidated material (e.g. glacial till), this observation was noted. In these cases the pebble counts were performed on substrate that was as close as possible to the scour location in order to estimate the size of unconsolidated material in the immediate vicinity of the scour. A total of 100 particles were measured at each site from river bed on the same side of the river as the scour.

4.1.3 River Flow Dynamics

River flows and their interaction with the banks were assessed at both sites through direct field observation. Photographs of the river were taken from a variety of vantages that illustrated how and where the flow was impacting the bank and scour locations along the dyke. Photographs were taken of the river at various stages (low to high) to determine the effect of flow stage on river flow patterns. Streamflow data from the Fanshawe Dam gauge were used to determine river discharge for each field observation to verify that a wide range of flows was observed.

4.1.4 Analysis of Scour

The purpose of the scour analysis was to determine if the existing river substrate at each of the two sites was capable of resisting scour during bankfull discharge. Bankfull discharge was selected as it is the critical river flow condition that largely controls channel morphology. Observed shear stress and critical shear stress were calculated for each

site. Observed shear is the shear stress that the observed flows can produce, and was calculated using the following equation presented in Chow (1959):

$\tau_o = \gamma R_h S$, where

τ_o = Shear Stress, (N/m^2)
γ = Specific gravity of water, 9806 kg/m^2s^2
R_h = Hydraulic radius, m
S = water surface slope, m/m

A variety of critical shear stress equations were applied to determine the size of material mobilized. Critical shear is defined as the shear stress at which the motion of a sediment particle is initiated. Input data to calculate critical shear stress include measurements of channel slope and hydraulic radius. The analysis was performed using the representative cross-sections measured at the two scour sites. The critical shear stress equations used for this study included:

- Shields, as modified by Julien, 1995
- MTO DMM, 1997 – Shear stress on channel bed
- MTO DMM, 1997 – Shear stress on side slopes
- Smith, 1978
- Rosgen, 2006 – WARSSS Colorado
- Leopold, Wolman, and Miller, 1964

The results of the shear analysis were compared to the measurements of substrate as well as local site conditions observed during the field survey. Please see the Fluvial Geomorphology Report (Stantec 2015) included in Appendix C for full calculations.

4.2 ANN STREET SITE

At this location (approximately 200 m downstream of Oxford Street) there is a large concrete weir across the channel bed created by a concrete-encased, abandoned sanitary sewer. The weir extends across the entire length of the channel and into both banks. Within the past decade, a notch was cut in the structure, creating a low flow channel. The notch is approximately 0.5 m lower than the rest of the structure and has the effect of directing flows toward the west bank.

The longitudinal profile of the Thames River downstream of the weir contains a double scour pool. The upstream scour pool is largely attributed to weir scour and the downstream scour is attributed to a combination of natural river processes and weir impacts. The Ann Street site is located along an outer meander bend and some degree of scour is to be expected in this location due to normal river processes which result in scour along outer bends (pools). A Scour depth of 2.8 m is predicted at this location, which is well under the maximum observed scour depth within the Ann Street site of 3.3 m (approximately 30 m downstream of the weir in the second scour pool). However, observations of flows at the site indicate that the weir is intensifying scour at this location, both through the ‘drop’ over the weir and through the configuration of the weir (the notch and the angle across the river) which angles the flow of the river towards the dyke. The combination of these effects has resulted in an observed scour depth that is deeper than predicted. Given the localized scour conditions at the weir, an additional method was applied to evaluate maximum potential scour depth related to the weir structure. The U.S. Bureau of Reclamation Drop/Weir Equation

(USBR, 1995) predicted a vertical scour depth of 3.5 m downstream of the weir. The maximum scour depth immediately downstream of the weir (~10m downstream) was 3.2 m. The existing scour depth of 3.2 m downstream of the weir indicates that the drop/weir scour may not have yet reached its maximum depth and is ongoing, which would correspond with the erosion conditions (e.g., exposed glacial till on bed) that were observed at this site.

Calculations determining longitudinal scour location were not completed as actual surveyed scour location data was available. Based on the surveys of the longitudinal profile completed in 2012 and 2015, the scour pool began directly downstream of the weir but was not at its deepest until 15-30 m downstream. The longitudinal profiles are shown in the Fluvial Geomorphology Report included in Appendix C.

The erosion and scour conditions are presented on Figure 4.1 and Figure 4.2.

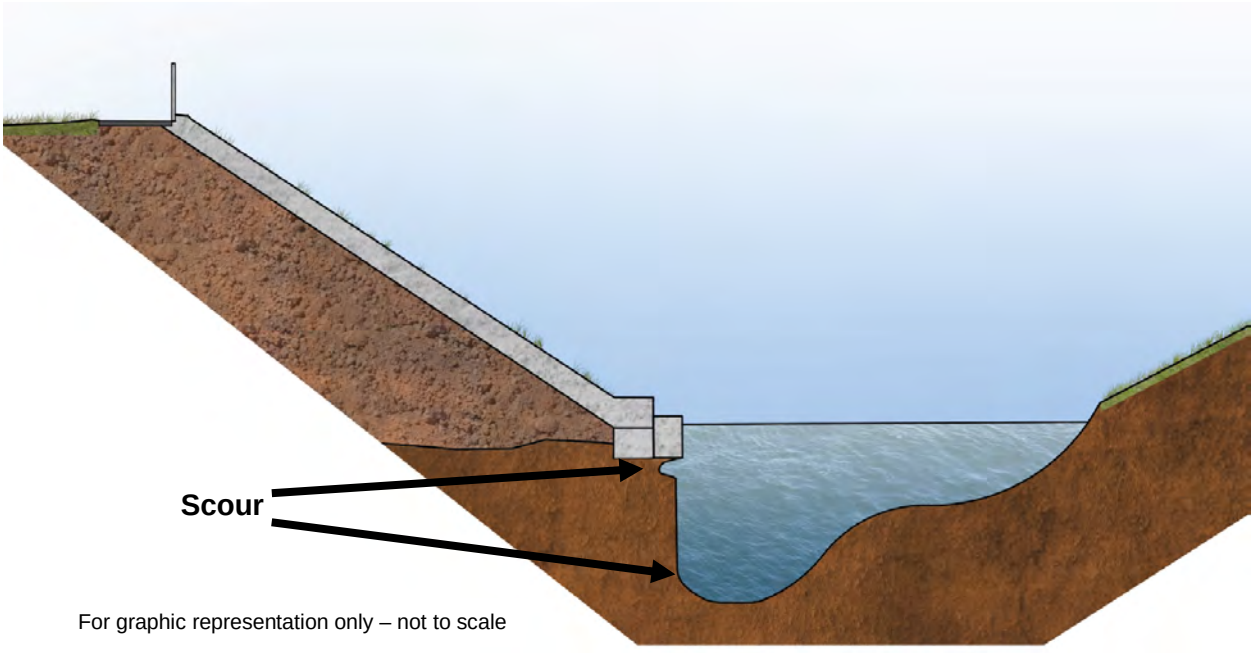


Figure 4.1 Ann Street Site Existing Conditions – Cross-Section

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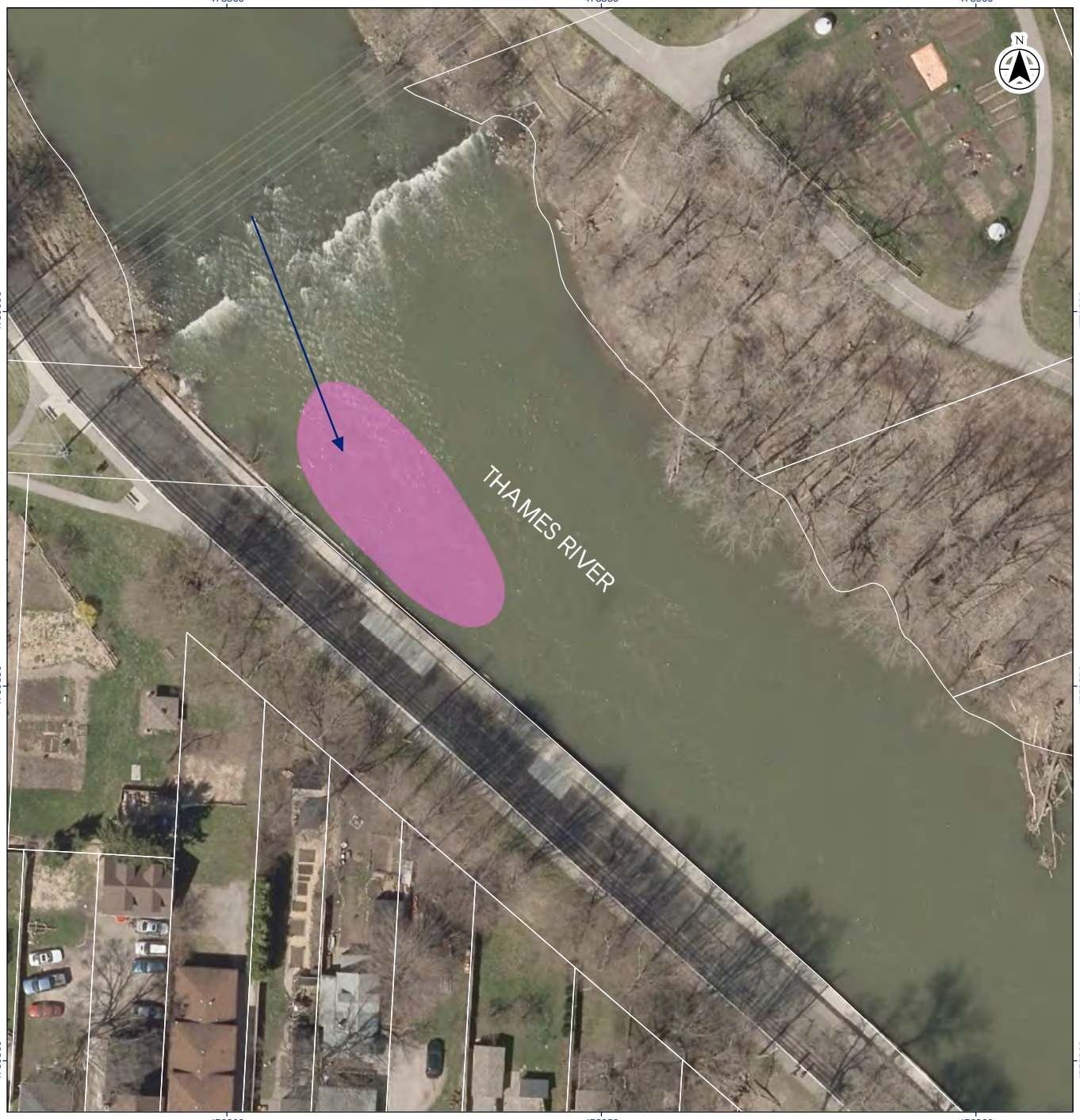

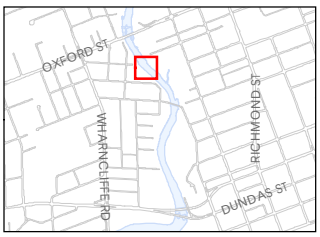

Legend

- Flow Direction
- Scour Pool

0 8 16 metres

1:800 (at original document size of 8.5x11)

Stantec

Project Location
City of London

165630129 REVA
Prepared by KDB on 2018-01-30

Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
4.2

Title
Ann Street
Existing Conditions

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

4.3 HARRIS PARK SITE

The Harris Park site consists of a series of structures created in partnership with the Ministry of Natural Resources and Forestry circa 1980 to improve fish habitat and passage, likely in coordination with a local angling group (herein referred to as MNRF fish weirs). The weirs were created by the introduction of boulder stones constructed where there was already a broad, shallow riffle. The structures divert flows away from the channel banks through a relatively deep channel that provides swift flow, even during low flow conditions, which is desired by kayakers and other recreational users. The downstream end of the weir is located 300 m downstream of Blackfriars Bridge and immediately upstream of the scour site. The worst scour observed at this location is approximately 150 m downstream of the downstream southern-most weir structure.

Scour at the Harris Park site occurs in several forms: bend scour, constriction scour and possibly jet scour. Observed scour depths within the compound pool downstream of the MNRF weir were measured at 3.2 m and 3.7 m at approximately 60 m and 150 m downstream of the MNRF weir respectively. The erosion and scour conditions are presented on Figure 4.3 and Figure 4.4.

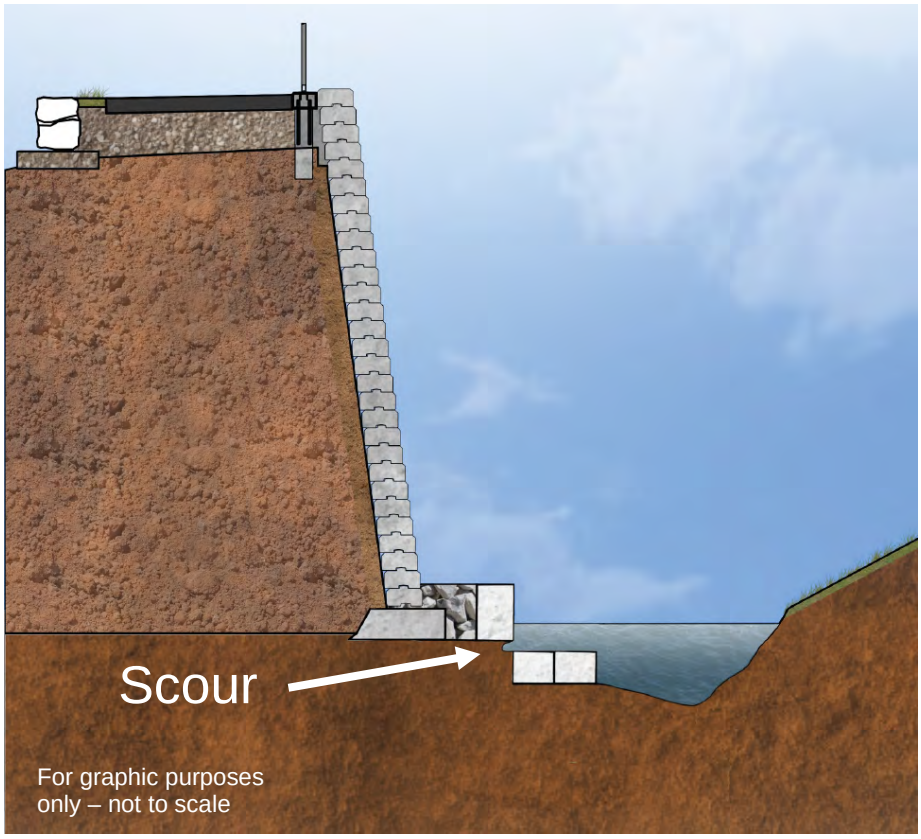

Figure 4.3 Harris Park Existing Conditions – Cross-Section

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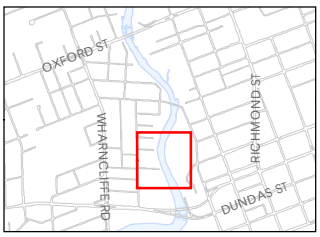

Legend

- Flow Direction
- Scour Pool

0 20 40 metres

1:2,000 (at original document size of 8.5x11)

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City of London

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MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
4.4

Title
Harris Park
Existing Conditions

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

5.0 PHASE 2 ALTERNATIVE SOLUTIONS

Alternative solutions being considered at each site include both **flow modification** (addressing the source of the erosion), and WLD **toe protection** (to protect the toe from further erosion).

5.1 ANN STREET ALTERNATIVE SOLUTIONS

There are a number of elements that are common to all alternatives (with the exception of Do Nothing):

- In-water work will be required. Based on the nature of the work proposed, it is preferable to undertake construction during low-flow periods without diverting flows. This will allow the team to visually observe the impacts to flow vectors. Appropriate mitigation can be incorporated to reduce impacts of sedimentation.
- Construction access will be provided from Ann Street, and will temporarily impact portions of the Thames Valley Parkway (TVP). A Traffic Management Plan will be prepared to ensure the safety of pedestrians and cyclists along the TVP.

Do Nothing

No physical improvements will be made. River flows would continue to be directed towards the toe of the WLD Dyke structure and continue to undermine its foundation. This option carries no capital costs.

Flow Modification Alternatives

Alternative AS1 – Remove Weir (Figure 5.1)

This alternative involves the complete removal of the weir created by the concrete encased abandoned sewer, eliminating the effect of the weir notch that is directing flow toward the west bank. Shaping or regrading of the river banks may also be required where the weir may have exacerbated erosion. Total cost for this alternative is approximately $147,000 (see Appendix E for a breakdown of cost estimates).

Alternative AS2 – Modify Weir (Figure 5.2)

This alternative involves the partial removal of the weir created by the concrete encased abandoned sewer, to modify the flow vector away from the toe of the WLD Dyke. Total cost for this alternative is approximately $159,000 (see Appendix E for a breakdown of cost estimates).

Toe Protection Alternatives

Alternative AS3 – Boulder Toe Protection (Figure 5.3)

Boulders would be installed along the toe of the Dyke for a stretch of approximately 60m. The treatment would be approximately 5 m wide. The 5m width is required to achieve a slope of 2.5:1. Boulders will be sized for bankfull shear stresses to ensure they will not wash away. The current scour depth is approximately equivalent to the predicted scour depth, therefore no keying in of the toe has been identified, but may be considered during detailed design. Under this alternative, grading and reshaping the east bank would be recommended under this option to

compensate for the reduction in river cross section from the installation of boulders. It is anticipated that the design of the boulder toe protection would accommodate some or all of the existing concrete blocks, which would remain in place.

Total cost for this alternative is approximately $238,000 (see Appendix E for a breakdown of cost estimates).

Alternative AS4 – Bench and Vanes (Figure 5.4)

A bankfull bench composed of engineered fill (boulders, concrete, granular material) would be installed and planted with deeply rooting vegetation. Vanes would be installed, which consist of boulders or armourstone anchored into the stream bank pointing upstream to slow flow and turn it towards the centre of the river channel. Total cost for this alternative is approximately $416,500 (see Appendix E for a breakdown of cost estimates).

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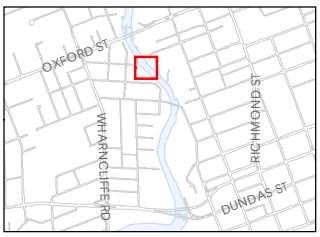

Legend

- Riffle Augmentation
- Weir Removal
- Reshape and Stabilize Banks

0 8 16 metres

1:800 (at original document size of 8.5x11)

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MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
5.1

Title
Ann Street
Design Option #1

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

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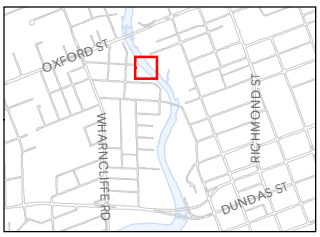

Legend

- Riffle Augmentation
- Debris Removal
- Weir Removal
- Flow Direction
- Weir Modification
- Reshape and Stabilize Banks

0 8 16 metres

1:800 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

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Figure No.
5.2

Title
Ann Street
Design Option #2

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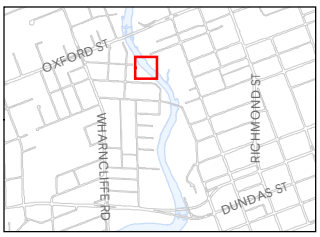

Legend

- Boulder Toe Protection
- Grade and Reshape Bank

0 8 16 metres

1:800 (at original document size of 8.5x11)

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City of London

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Client/Project
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WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
5.3

Title
Ann Street
Design Option #3

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

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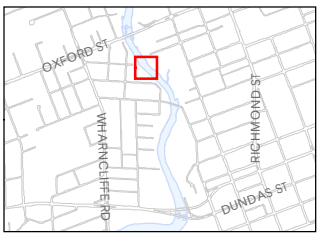

Legend

- Bankfull Bench
- Rock Spur

0 8 16 metres

1:800 (at original document size of 8.5x11)

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Project Location
City of London

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Prepared by KDB on 2018-01-30

Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
5.4

Title
Ann Street
Design Option #4

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

5.2 HARRIS PARK ALTERNATIVE SOLUTIONS

There are a number of elements that are common to all alternatives (with the exception of Do Nothing):

- Access to the river will be provided via the west bank, utilizing the access route created during construction of the WLD Phase 3 and upcoming Phase 4 construction work.
- Similar to the proposed activities at Ann Street, based on the nature of work it is recommended that construction take place during low-flow periods without redirecting flows. This will allow the team to visually observe the changes in flow vectors that result from modification to the river structures.

Do Nothing

No physical improvements will be made. River flows would continue to be directed towards the toe of the WLD Dyke structure and continue to undermine its foundation. This option caries no initial capital costs.

Toe Protection

Alternative HP1 – Boulder Toe Protection (Figure 5.5)

Boulders would be installed along the toe of the dyke for a stretch of approximately 240 m to protect the dyke toe from scour/erosion. The length of the boulder treatment will protect the entire outer meander bend from approximately Leslie Street to just downstream of Rogers Avenue. This area is within a confined section of the river and is more prone to erosion. The length of the treatment should be confirmed during detailed design. The treatment would be approximately 5 m wide, required in order to achieve a slope of 2.5:1. It is anticipated that the design of the boulder toe protection would accommodate some or all of the existing concrete blocks, which would remain in place. Boulders will be sized for bankfull shear stresses to ensure they will not wash away.

Total cost for this alternative is approximately $531,000 (see Appendix E for a breakdown of cost estimates).

Flow Modification

Alternative HP2 – Remove Gabions and Reshape Point Bar (Figure 5.6)

The existing gabion baskets would be removed, and the point bar would be reshaped and graded to create a depositional environment typical of a point bar on the inside of a meander belt. This alternative increases the river's cross section and reduces flow velocities which lowers scour and erosion potential. This alternative has the potential to impact the existing Thames Valley Parkway within Harris Park, would require additional coordination with designs proposed for the Harris Park/Forks of the Thames as part of the One River/Back to the River projects.

Total cost for this alternative is approximately $395,600 (see Appendix E for a breakdown of cost estimates).

Alternative HP3 – Modify MNRF 'Fish Weirs' (Figure 5.7)

This alternative involves modification to the most downstream MNRF fish weir structure to divert flows towards the centre of the river bed, away from the toe of the dyke. The function of the weir structures, i.e. to improve fish habitat would be maintained, and the structures only modified to divert flows.

Total cost for this alternative is approximately $207,000 (see Appendix E for a breakdown of cost estimates).

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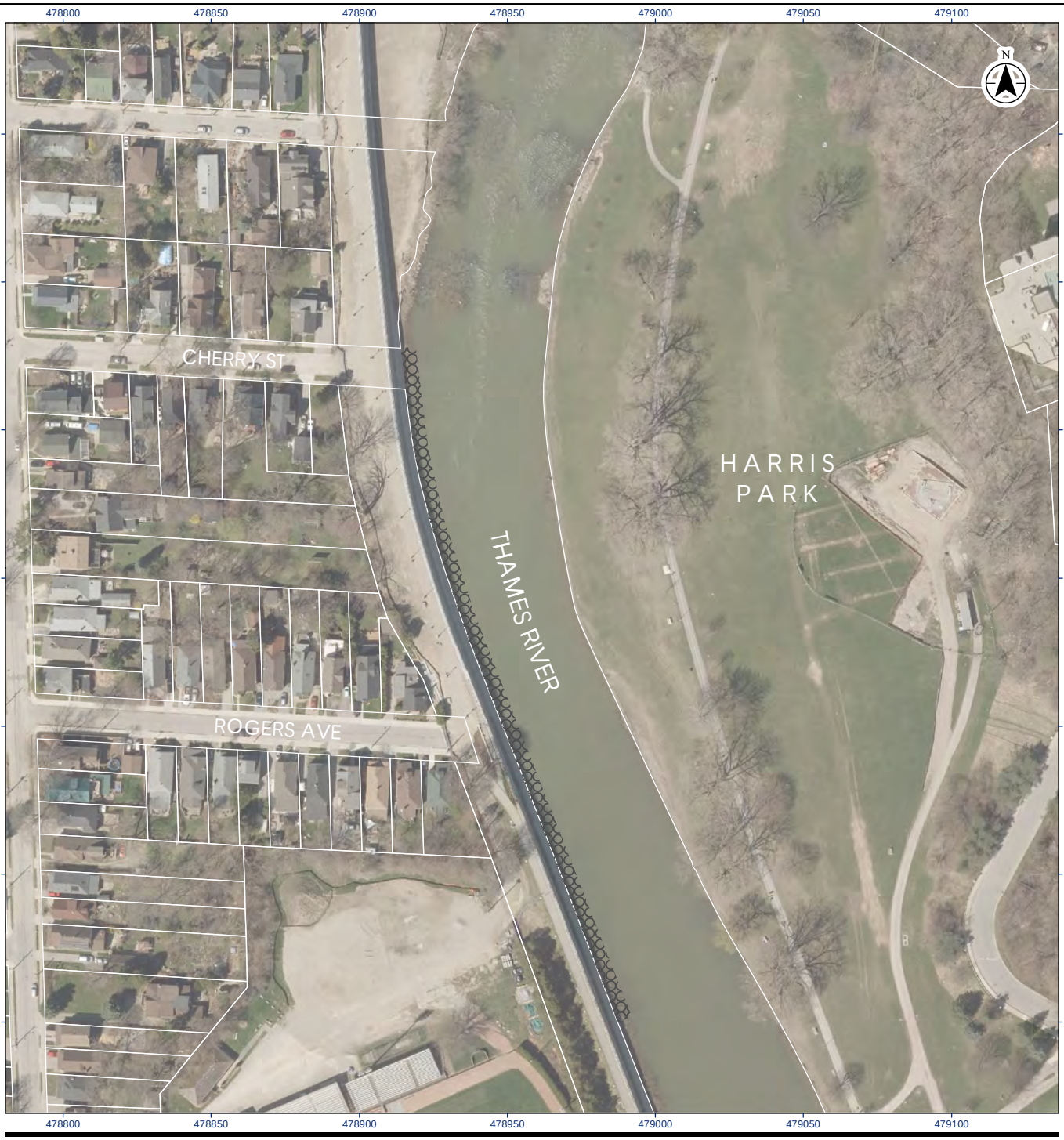

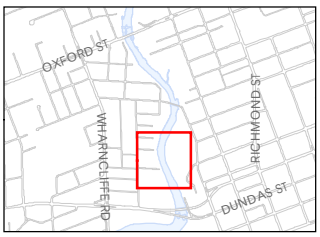

Legend

Boulder Toe Protection

0 20 40 metres

1:2,000 (at original document size of 8.5x11)

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Project Location
City of London

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Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
5.5

Title
Harris Park
Design Option #1

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

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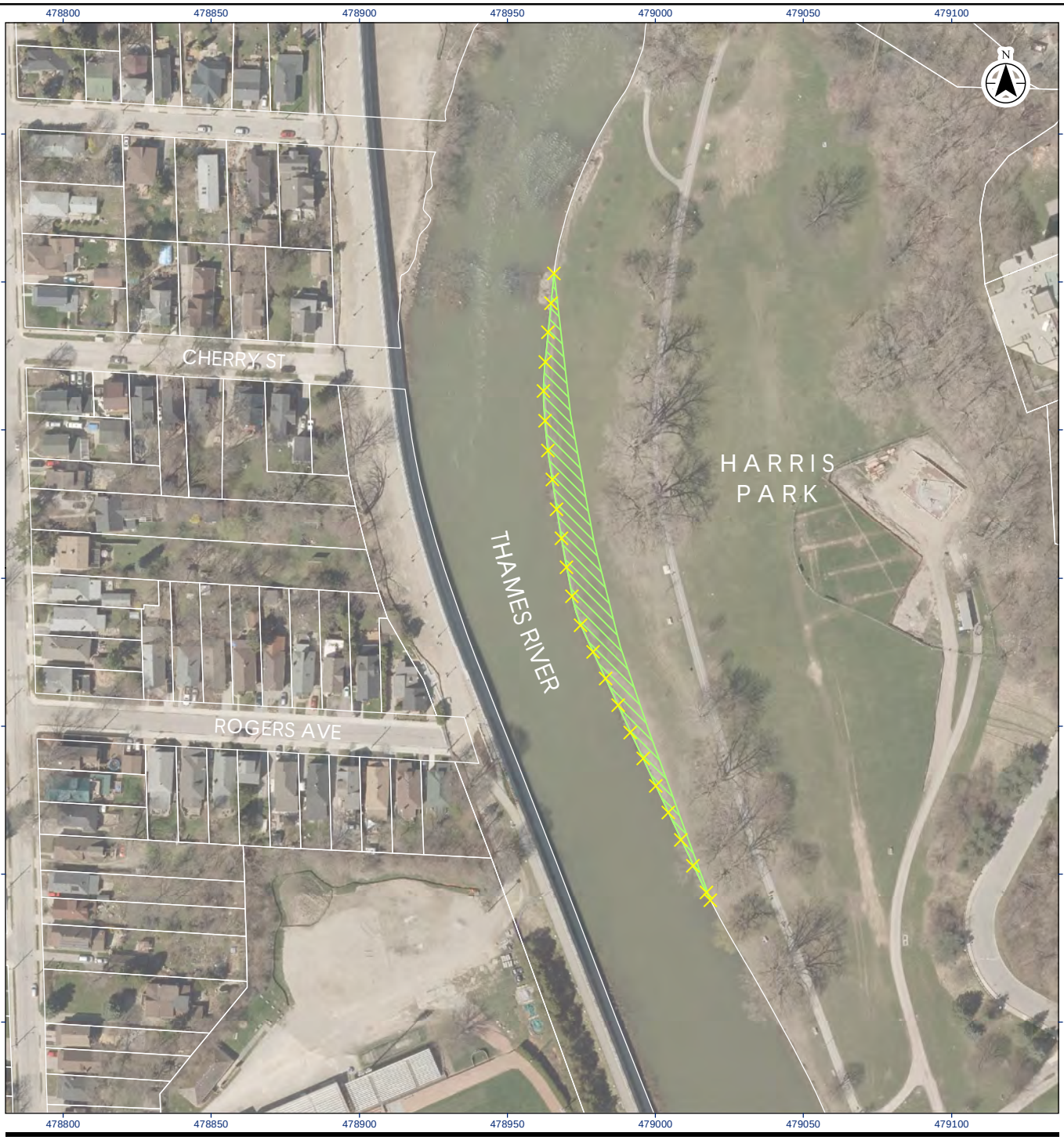

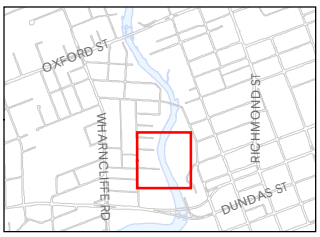

Legend

- Remove Gabion Wall
- Point Bar Grading

0 20 40 metres

1:2,000 (at original document size of 8.5x11)

Stantec

Project Location
City of London

165630129 REVA
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Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
5.6

Title
Harris Park
Design Option #2

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

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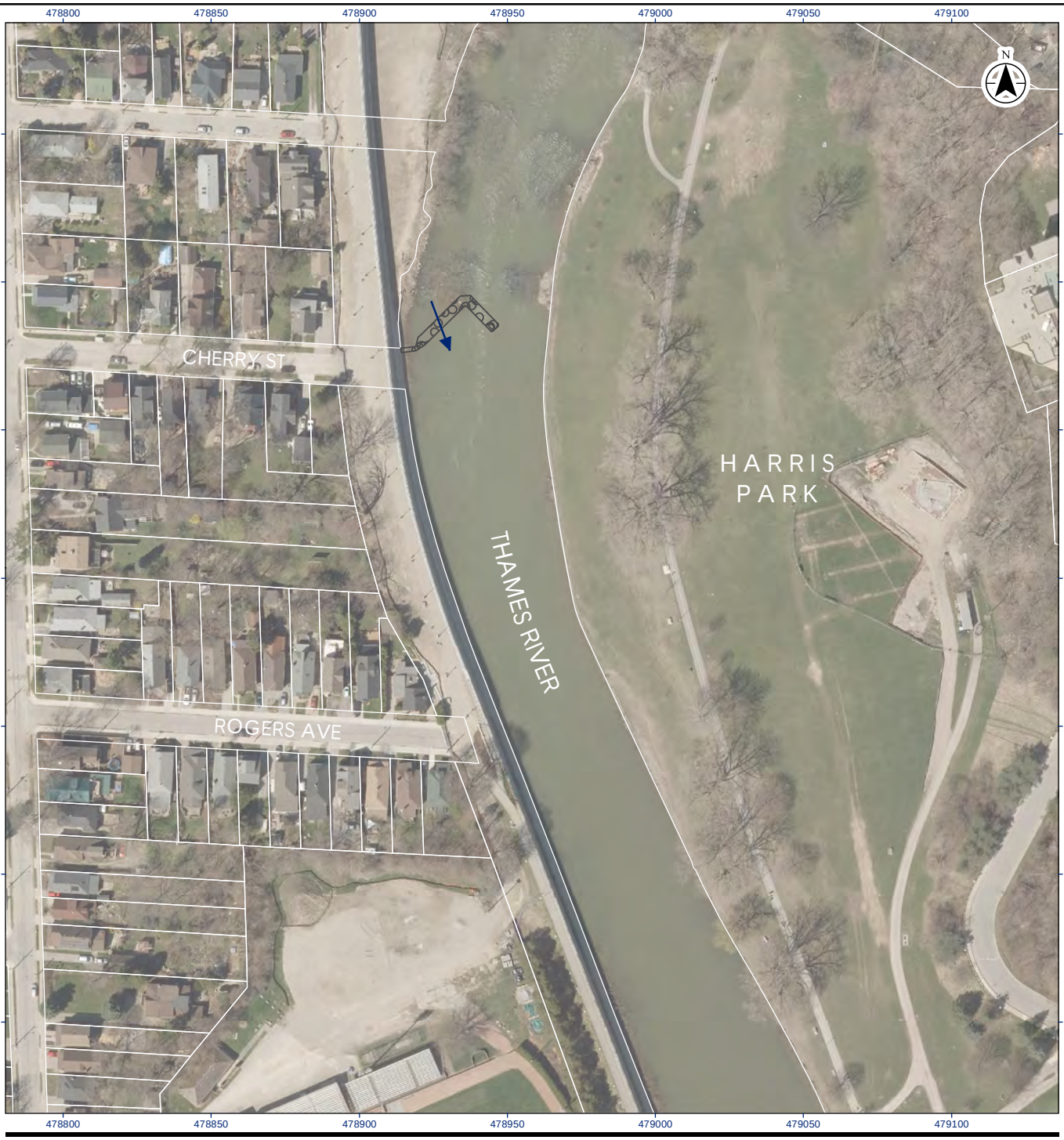

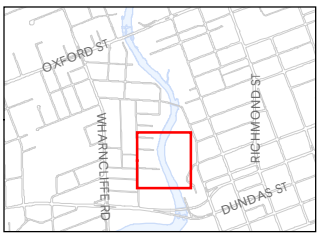

Legend

- Flow Direction
- Modified Weir/ Fish Vane

0 20 40 metres

1:2,000 (at original document size of 8.5x11)

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Project Location
City of London

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Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
5.7

Title
Harris Park
Design Option #3

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

5.3 EVALUATION

As part of Phase 2 of the Class EA process, the framework and criteria for assessing the alternatives are established. The criteria for evaluating the alternatives were chosen to identify the significant advantages and disadvantages of each in terms of the Social/Cultural, Natural, Technical, and Economic components of the project. A decision matrix was developed to document the qualitative evaluation including potential impacts associated with each option and to assist in the selection of the preferred alternative(s). Evaluation criteria are identified in Table 5.1 and the qualitative evaluation is provided in Table 5.2 and Table 5.3.

Table 5.1 Evaluation Criteria

Environmental Component	***Criteria***	***Description***
Socio-Economic/ Cultural Environment	Recreational Boating	Impacts to existing recreational boating activities identified at the two sites.
	Recreational Fishing	Impacts to existing recreational fishing activities identified at the two sites.
	Public Safety	Potential impacts to public safety, risks of property damage, etc.
	Cultural Heritage	Impacts to identified built cultural heritage, cultural heritage landscapes, and archaeological resources.
	Aesthetics	Visual changes to the visual character of the river.
	Impacts to Parks/Open Space and Coordination with other Thames River Initiatives	The potential for the alternative to impact ongoing initiatives such as the One River Master Plan, and overall urban regeneration efforts.
	Indigenous Community Interests	Impacts to known interests of First Nations communities.
Natural Environment	Water Quality	Potential impacts to water quality, including opportunities for water quality improvement.
	Aquatic Habitat and Fish Passage	Potential changes to existing fish habitat or passage.
	Terrestrial Habitats	Impacts to existing terrestrial habitats, including temporary construction impacts and permanent impacts.
	Species at Risk including ESA Permitting Requirements	Impacts to known species at risk, including temporary construction impacts and habitat modification.
	Climate Change	How the alternative may be impacted by climate change.
Technical and Economic	River Geomorphology	How the alternatives address/impact existing scour and erosion processes.
	Floodplain Impacts	Impacts on the existing floodplain/river carrying capacity caused by changes in river cross section.
	Long Term Operations and Maintenance Requirements	Potential operations and maintenance requirements.
	Constructability Challenges	Potential challenges with respect to design/construction.
	Construction Access	Access for construction, including temporary trail detours, etc.

Environmental Component	***Criteria***	***Description***
	Coordination with Existing and Planned TVC Projects	Opportunities/requirements for coordination with other TVC projects including the One River Master Plan.
	Capital Costs – including engineering, construction, contract administration and contingency	Costs including engineering, construction, contract administration, and contingency.

Ann Street Site – Evaluation of Alternatives
West London Dyke Erosion Control Class EA

Table 5.2 Ann Street Evaluation

✗ Overall negative impact – Does not address the project's Problem and Opportunity Statement.

▬ Neutral – Potential for some impacts, but can be adequately addressed through subsequent project stages and appropriate mitigation.

✓ Positive – Can address the project's Problem and Opportunity Statement, with no significant impacts.

			Flow Modification		WLD Toe Protection	
	Criteria	**Do Nothing**	**Alternative AS 1 – Remove Weir**	**Alternative AS 2 – Modify Weir**	**Alternative AS 3 – Boulder Toe Protection**	**Alternative AS 4 – Bench and Vanes Toe Protection**
Social/ Cultural	Recreational Boating	Existing notch in concrete weir provides opportunities for boaters to practice traversing a small rapid (see input received from local resident).	Impacts existing boating opportunities.	Potential to maintain some of the existing boating activities at the site.	No impact to boating recreation.	No impact to boating recreation.
	Recreational Fishing	Existing weir provides habitat diversity within the riverbed, and this area is often used for recreational fishing.	May result in a change to existing recreational fishing in the immediate area with removal of weir, but no negative impact.	Less impact on existing recreational fishing compared to Alternative 1.	Boulder toe protection provides additional fish habitat, which may positively impact recreational fishing – Boulders provide more hiding places and different water velocities, over the existing uniform concrete wall.	Greatest potential for additional fish habitat, which may positively impact recreational fishing.
	Public Safety	With continued erosion and scour, the flood control structure (WLD) will be compromised with greater risk to public safety during flooding events (property damage, etc.).	Mitigates long term public safety concerns by protecting WLD from continued erosion; however, implemented on its own, does not fully address the source of erosion and presents potential long term risks during flooding events.	Mitigates long term public safety concerns by addressing source of WLD toe erosion. On its own, does not address existing scour conditions, and presents potential long term risks during flooding events.	Mitigates long term public safety concerns; however, implemented on its own, does not fully address source of erosion and presents potential long term risks during flooding events.	Most effectively mitigates long term public safety concerns associated with further erosion of the dyke by dissipating energy above bankfull stage, versus just at waterline as with boulder toe protection; however, implemented on its own, does not fully address the source of erosion and presents potential long term risks during flooding events.
	Cultural Heritage	Blackfriars/Petersville Heritage Conservation District located west of study area, increased long term risk with undermining of WLD. Low potential for archaeological resources based on previous construction of sanitary crossings – consistent with all alternatives.	Mitigates long term risk to heritage properties by addressing source of WLD toe erosion. Low potential for archaeological resources based on previous construction of sanitary crossings – consistent with all alternatives.	Mitigates long term risk to heritage properties by addressing source of WLD toe erosion. Low potential for archaeological resources based on previous construction of sanitary crossings – consistent with all alternatives.	Mitigates long term risk to heritage properties by protecting WLD toe erosion. Low potential for archaeological resources based on previous construction of sanitary crossings – consistent with all alternatives.	Mitigates long term risk to heritage properties by protecting WLD toe erosion. Low potential for archaeological resources based on previous construction of sanitary crossings – consistent with all alternatives.
	Aesthetics	No change to river aesthetics.	No significant impacts to the character of the River. By taking out the weir, bed material may be moved to address grade drop, which may create additional water surface variability (i.e. riffles).	No significant impacts to the character of the River.	Boulders can contribute to a more varied shoreline when compared to existing concrete dyke toe.	Rocks and vegetation will create a more naturalized shoreline over boulder toe protection.

Table 5.2 Ann Street Evaluation

			Flow Modification		WLD Toe Protection	
	Criteria	**Do Nothing**	**Alternative AS 1 – Remove Weir**	**Alternative AS 2 – Modify Weir**	**Alternative AS 3 – Boulder Toe Protection**	**Alternative AS 4 – Bench and Vanes Toe Protection**
	Impacts to Parks/Open Space and coordination with other Thames River Initiatives	Potential long term impacts to Thames Valley Parkway (TVP) system along the west bank with continued erosion and undermining of the WLD if no improvements undertaken.	Temporary impacts to TVP east bank during construction. Traffic Management Plan to be developed to ensure safe pedestrian access during construction (all alternatives). No impacts to One River Master Plan considerations.	Temporary impacts to TVP east bank during construction (can be coordinated with WLD repairs). Traffic Management Plan to be developed to ensure safe pedestrian access during construction (all alternatives). No impacts to One River Master Plan considerations.	Temporary impacts to TVP east bank during construction. Traffic Management Plan to be developed to ensure safe pedestrian access during construction (all alternatives). Grading and reshaping of east river bank recommended to compensate for the reduction in river cross section caused by introduction of boulders. No direct impact to TVP on the east.	Temporary impacts to TVP east bank during construction. Traffic Management Plan to be developed to ensure safe pedestrian access during construction (all alternatives) No permanent impacts to TVP on east. No impacts to One River Master Plan considerations.
	First Nations Interests	No concerns identified from First Nations communities.	Environmental mitigation and restoration to be undertaken to address interests identified by First Nations communities (wildlife protection, habitat restoration).	Environmental mitigation and restoration to be undertaken to address interests identified by First Nations communities (wildlife protection, habitat restoration).	Environmental mitigation and restoration to be undertaken to address interests identified by First Nations communities (wildlife protection, habitat restoration).	Environmental mitigation and restoration to be undertaken to address interests identified by First Nations communities (wildlife protection, habitat restoration).
Social/Cultural Overview		**✗ Does not address the Problem and Opportunity Statement. Long term risks to WLD flood control structure by not addressing erosion concerns.**	**– Greatest impact to existing recreational boating use at the site as noted by local residents.**	**✓ Addresses Problem and Opportunity with minimal impacts to social/cultural elements.**	**✓ Addresses Problem and Opportunity with minimal impacts to social/cultural elements.**	**✓ Addresses Problem and Opportunity with minimal impacts to social/cultural elements.**
Natural	Water Quality	No direct impacts to water quality.	No long-term impacts to water quality. Potential for release of sediment during weir removal. Sediment protection and monitoring to be undertaken during construction.	No long-term impacts to water quality. Potential for release of sediment during weir modification. Sediment protection and monitoring to be undertaken during construction.	No long-term impacts to water quality. Potential for release of sediment during construction. Sediment protection and monitoring to be undertaken during construction.	Potential for release of sediment during construction. Sediment protection and monitoring to be undertaken during construction.
	Aquatic Habitat and Fish Passage	Existing area of the River provides habitat for a range of aquatic species. Weir currently adds variety to the river bed, contributing to fish habitat.	Temporary disruption of aquatic habitat during construction. No significant impact to fish passage. Potential improvement to passage for turtles by slowing flow velocity.	Temporary disruption of aquatic habitat during construction. No significant impact to fish passage. Less potential than Alternative 1 for improving passage for turtles.	Boulders can provide some improvement to fish habitat over existing habitat. Boulders provide more hiding places and different water velocities, over the existing uniform concrete wall.	Greatest potential for improved fish habitat.

Table 5.2 Ann Street Evaluation

			Flow Modification		WLD Toe Protection	
	Criteria	**Do Nothing**	**Alternative AS 1 – Remove Weir**	**Alternative AS 2 – Modify Weir**	**Alternative AS 3 – Boulder Toe Protection**	**Alternative AS 4 – Bench and Vanes Toe Protection**
	Terrestrial Habitats	No direct impacts to terrestrial habitats. Adjacent vegetation communities on east bank include Cottonwood Mineral Treed Shoreline/Willow Mineral Deciduous Thicket Swamp.	Temporary disruption/vegetation removal required for construction access from TVP/Ann Street (consistent with all alternatives). Mitigation and restoration to be employed for impacts associated with construction access.	Temporary disruption/vegetation removal required for construction access from TVP/Ann Street (consistent with all alternatives). Mitigation and restoration to be employed for impacts associated with construction access.	Temporary disruption/vegetation removal required for construction access from TVP/Ann Street (consistent with all alternatives). Mitigation and restoration to be employed for impacts associated with construction access. Permanent vegetation removal also required along east bank for regrading/shoreline modifications. Restoration to include appropriate bankfull vegetation to improve habitat opportunities.	Temporary disruption/vegetation removal required for construction access from TVP/Ann Street (consistent with all alternatives). Mitigation and restoration to be employed for impacts associated with construction access. Introduction of shoreline bench to introduce new habitats.
	Species at Risk	Existing species at risk with the potential to occur in the area include Threatened, Endangered, and Special Concern turtles, and aquatic species.	Temporary construction impacts to potential habitat for Threatened, Endangered, and Special Concern turtles and aquatic species within the Thames River. Mitigation can be identified.	Temporary construction impacts to potential habitat for Threatened, Endangered, and Special Concern turtles and aquatic species within the Thames River. Mitigation can be identified.	Temporary construction impacts to potential habitat for Threatened, Endangered, and Special Concern turtles and aquatic species within the Thames River. Mitigation can be identified.	Temporary construction impacts to potential habitat for Threatened, Endangered, and Special Concern turtles and aquatic species within the Thames River. Mitigation can be identified.
	Climate Change	With changes in flood flows and stream velocities due to climate change, greater risk of negative impacts to the WLD if no improvements are undertaken.	Less risk of negative impacts to the WLD from changes in flood flows/stream velocities due to climate change by directing river flows away from WLD.	Less risk of negative impacts to the WLD from changes in flood flows/stream velocities due to climate change by directing river flows away from WLD.	Somewhat effective on its own for addressing changes in flood flows/stream velocities due to climate change. More effective in conjunction with flow modification.	Somewhat effective for addressing changes in flood flows/stream velocities due to climate change. More effective in conjunction with flow modification.
Natural Environment Overview		✗ **Does not address Problem and Opportunity Statement. Long term risks associated with WLD flood control structure by not addressing erosion concerns.**	**Temporary construction impacts associated with removal of weir. Can be addressed through appropriate mitigation.**	**Temporary construction impacts associated with modification to weir. Can be addressed through appropriate mitigation.**	**Temporary construction impacts associated with modification to weir. Can be addressed through appropriate mitigation.**	✓ **Construction impacts associated with construction of bench and vanes, but long term opportunity to improve existing habitats.**
Technical/ Economic	River Geomorphology	Existing notch in concrete structure creates a low flow channel that directs flow to the west bank and the toe of the WLD.	Effective in reducing velocity of flow that is directed towards the west bank and the toe of the WLD. Toe protection should be implemented to address existing scour and further protect against future erosion.	Effective in reducing velocity of flow that is directed towards the west bank and the toe of the WLD. Toe protection should be implemented to address existing scour and further protect against future erosion.	Does not address source of erosion. Somewhat effective in addressing existing erosion of the WLD in combination with flow modification.	Most effective in addressing existing erosion of the WLD, in combination with flow modification.

Table 5.2 Ann Street Evaluation

			Flow Modification		WLD Toe Protection	
	Criteria	**Do Nothing**	**Alternative AS 1 – Remove Weir**	**Alternative AS 2 – Modify Weir**	**Alternative AS 3 – Boulder Toe Protection**	**Alternative AS 4 – Bench and Vanes Toe Protection**
	Floodplain Impacts	No impact to existing floodplain.	No impact to existing floodplain.	No impact to existing floodplain.	Minimal impact to existing floodplain – grading of point bar on east shore should be undertaken to compensate for loss of river capacity caused by the addition of boulders.	Minimal impact to existing floodplain – grading of point bar on east shore should be undertaken to compensate for loss of river capacity caused by the addition of the bench and vanes.
	Long Term Operations and Maintenance Requirements	Potential for increased maintenance costs required to address continued erosion of the WLD.	On its own, would require additional long term maintenance to address toe undermining.	On its own, would require additional long term maintenance to address toe undermining.	Minimal long term maintenance required.	Minimal long term maintenance required. Bench is planted with deeply rooting vegetation, which would strengthen bench over time.
	Approvals/ Permitting Requirements	N/A	Potential ESA requirements to address potential for impacts to SAR turtles. To be confirmed with MNRF.	Potential ESA requirements to address potential for impacts to SAR turtles. To be confirmed with MNRF.	Potential ESA requirements to address potential for impacts to SAR turtles. To be confirmed with MNRF.	Potential ESA requirements to address potential for impacts to SAR turtles. To be confirmed with MNRF.
	Constructability	N/A	Machinery needed in water to remove concrete weir.	Machinery needed in water to remove concrete weir.	Machinery needed to remove concrete weir. Less complex design/construction over Alternative AS 4.	Machinery needed in water to construct bench and vanes. Most involved and complex construction in order to interface bench and vanes with existing concrete dyke.
	Construction Access	N/A	Construction equipment to enter from Ann Street/TVP – Consistent with all alternatives.	Construction equipment to enter from Ann Street/TVP – Consistent with all alternatives.	Construction equipment to enter from Ann Street/TVP – Consistent with all alternatives.	Construction equipment to enter from Ann Street/TVP – Consistent with all alternatives.
	Coordination with Existing and Planned TVC Projects	N/A	No significant implications on One River Master Plan considerations.	No significant implications on One River Master Plan considerations.	No significant implications on One River Master Plan considerations.	No significant implications on One River Master Plan considerations.
	Capital Cost (includes design, construction and contract admin)	N/A	$147,000	$159,000	$238,000	$416,500
Technical/Economic Overview		✗ **Does not address Problem and Opportunity Statement. Long term risks to WLD flood control structure, including increased maintenance costs by not addressing erosion concerns, causing increased maintenance and financial considerations.**	**Addresses Problem and Opportunity statement, with greater cost (including removal and disposal of concrete debris) over Alternative AS 2.**	✓ **Addresses Problem and Opportunity, at less cost than Alternative AS 1.**	✓ **Addresses Problem and Opportunity Statement, at significantly lower cost and lower design/construction complexity over Alternative AS 4.**	✗ **Addresses Problem and Opportunity Statement, but at significantly higher construction cost and complexity over Alternative AS 3.**

Ann Street Site – Evaluation of Alternatives

West London Dyke Erosion Control Class EA

Table 5.2 Ann Street Evaluation

			Flow Modification		WLD Toe Protection	
	Criteria	**Do Nothing**	**Alternative AS 1 – Remove Weir**	**Alternative AS 2 – Modify Weir**	**Alternative AS 3 – Boulder Toe Protection**	**Alternative AS 4 – Bench and Vanes Toe Protection**
	Overall	Not recommended – used as a baseline for comparison of alternatives.	Less preferred – greater net social impacts and overall impact to habitat.	Recommended in conjunction with toe protection – less social impact, less net impact to habitats.	Recommended in conjunction with flow modification – adequate toe protection, additional fish habitat, and significantly less cost than Option 4.	Less preferred – greater benefit to habitats, but provides same general level of protection when compared to Alternative 3, for significantly higher cost.

Harris Park Site – Evaluation of Alternatives
West London Dyke Erosion Control Class EA

Table 5.3 Harris Park Evaluation

✗ Overall negative impact – Does not address the project's Problem and Opportunity Statement.

Neutral – Potential for some impacts, but can be adequately addressed through subsequent project stages and appropriate mitigation.

✓ Positive – Can address the project's Problem and Opportunity Statement, with no significant impacts.

			Toe Protection	Flow Modification	
	Criteria	**Do Nothing**	**Alternative HP 1 Boulder Toe Protection**	**Alternative HP 2 Remove Gabions and Reshape Point Bar**	**Alternative HP 3 Modify Fish Weirs**
Social/ Cultural	Recreational Boating	Currently limited boating recreation in this area due to low water levels.	No significant impact on existing boating recreation opportunities in the area.	No significant impact on existing boating recreation opportunities in the area.	No significant impact on existing boating recreation opportunities in the area.
	Recreational Fishing	Site often used for recreational fishing.	Potential to improve recreational fishing with increased habitat.	No significant impact on recreational fishing.	No significant impact on recreational fishing.
	Public Safety	With continued erosion and scour, the flood control structure (WLD) may be compromised with greater risk to public safety during flooding events (property damage, etc.)	Mitigates public safety concerns by protecting WLD from continued erosion; however, implemented on its own, does not fully address the source of erosion and presents potential risks during flooding events.	Mitigates public safety concerns by protecting WLD from continued erosion; however, implemented on its own, does not fully address the existing erosion concerns, and presents potential risks during flooding events.	Mitigates public safety concerns by redirecting flows from the WLD; however, implemented on its own, does not fully address the existing erosion concerns, and presents potential risks during flooding events.
	Cultural Heritage	Blackfriars/Petersville Heritage Conservation District located west of study area, increased risk with undermining of WLD. Low potential for archaeological resources based on previous installation of fish weirs by MNRF.	Blackfriars/Petersville Heritage Conservation District located west of study area. No impacts to heritage properties or viewscapes. Low potential for archaeological resources based on previous installation of fish weirs by MNRF.	Blackfriars/Petersville Heritage Conservation District located west of study area. No impacts to heritage properties or viewscapes. Potential for archaeological resources based on known archaeological resources within the Harris Park area. Archaeological assessment to be undertaken prior to design.	Blackfriars/Petersville Heritage Conservation District located west of study area. No impacts to heritage properties or viewscapes. Low potential for archaeological resources based on previous installation of fish weirs by MNRF within the last 20 years.
	Aesthetics	No change to river aesthetics.	Boulders would add variety to the shoreline along the WLD.	Reshaping would contribute to a more naturalized shoreline.	Minimal impact to the aesthetic character of the river in this area.
	Impacts to Parks/Open Space	Potential long term impacts to Thames Valley Parkway (TVP) system along the west bank with continued erosion and undermining of the WLD if no improvements undertaken.	Minor and temporary disruption to TVP on west bank for construction access. No significant implications for One River Master Plan considerations or Back to the River designs.	Encroachment into Harris Park and the TVP (coordination required with One River Master Plan and Back to the River designs for the Forks of the Thames area). Temporary disruption to TVP/Harris Park during construction. Traffic Management Plan to be developed to ensure safe pedestrian access during construction.	Minor and temporary disruption to TVP on west bank for construction access. No significant implications for One River Master Plan considerations or Back to the River designs.
	First Nations Interests	No concerns identified from First Nations communities.	Environmental mitigation and restoration to be undertaken within any disturbed areas to address interests identified by First Nations communities (wildlife protection, habitat restoration).	Environmental mitigation and restoration to be undertaken within any disturbed areas to address interests identified by First Nations communities (wildlife protection, habitat restoration). Chippewas of the Thames First Nation also requested an archaeological monitor be present for any archaeological field work conducted.	Environmental mitigation and restoration to be undertaken within any disturbed areas to address interests identified by First Nations communities (wildlife protection, habitat restoration).
Social/Cultural Overview		**✗ Does not address Problem and Opportunity Statement. Long term risks associated with WLD flood control structure by not addressing erosion concerns.**	**✓ No overall impact to social/cultural environmental considerations.**	**Potential for impacts to Harris Park and TVP. To be considered as part of the on going One River Master Plan and Back to the River designs.**	**✓ No overall impact to social/cultural environmental considerations.**

Harris Park Site – Evaluation of Alternatives

West London Dyke Erosion Control Class EA

Table 5.3 Harris Park Evaluation

			Toe Protection	Flow Modification	
	Criteria	**Do Nothing**	**Alternative HP 1 Boulder Toe Protection**	**Alternative HP 2 Remove Gabions and Reshape Point Bar**	**Alternative HP 3 Modify Fish Weirs**
Natural	Water Quality	No significant impact to water quality.	No significant impact to water quality. Potential for release of sediment during construction. Sediment protection measures and monitoring to be undertaken during construction.	No significant impact to water quality. Potential for release of sediment during construction. Sediment protection measures and monitoring to be undertaken during construction.	No significant impact to water quality. Potential for release of sediment during construction. Sediment protection measures and monitoring to be undertaken during construction.
	Aquatic Habitat and Fish Passage	Existing area of the River provides habitat for a range of aquatic species.	Boulders provide more hiding places and different water velocities, over the existing uniform concrete wall.	No significant impact to fish habitat.	No significant/long term impact to fish habitat.
	Terrestrial Habitats	Existing vegetation communities adjacent to site include parkland.	Temporary disruption/vegetation removal required for construction access along west bank (area previously disturbed for WLD staging area).	Large mature trees located along east bank, but impacts may be avoided through design. Softening of shoreline has ecological benefits over gabion baskets by providing more shoreline habitat opportunities.	Temporary disruption/vegetation removal required for construction access along west bank (area previously disturbed for WLD staging area).
	Species at Risk	Existing species at risk/habitat in the area include Threatened, Endangered, and Special Concern turtles.	Potential temporary impacts to Threatened, Endangered, and Special Concern turtles during construction, but after implementation boulders could provide habitat enhancement .	Potential temporary impacts to Threatened, Endangered, and Special Concern turtles during construction, but after implementation, new bankfull area may create new habitat.	Potential temporary impacts to Threatened, Endangered, and Special Concern turtles during construction. No long term impacts to habitat.
	Climate Change	With changes in flood flows and stream velocities due to climate change, greater risk of negative impacts to the WLD if no improvements are undertaken.	Less effective than Alternatives 2 and 3 on its own for addressing changes in flood flows/stream velocities due to climate change.	Somewhat effective on its own in addressing changes in flood flows/stream velocities due to climate change, by allowing more natural river processes to occur. Most effective in coordination with toe protection.	Somewhat effective on its own in addressing changes in flood flows/stream velocities due to climate change. Most effective in coordination with toe protection.
Natural Environment Overview		**Does not address Problem and Opportunity Statement. Long term risks to WLD flood control structure by not addressing erosion concerns.**	**No overall impacts. All temporary construction impacts can be mitigated through proper environmental controls.**	**Potential impacts to mature trees within Harris Park. All temporary construction impacts can be mitigated through proper environmental controls.**	**No overall impacts. All temporary construction impacts can be mitigated through proper environmental controls.**
Technical/ Economic	River Geomorphology	Several scour processes are currently occurring within this section: bend scour, constriction scour, and potentially jet scour. Erosion and scour to continue if no improvements are undertaken.	Does not address source of existing scour, but addresses existing undermining of the WLD.	Reshaping point bar increases river cross section and reduces flow velocities, which reduces scour. Softening of the bank at the point bar will allow for natural river processes to occur. Effective in addressing existing scour along the WLD.	Modification to the downstream section of the MNRF weirs would redirect flows away from the west bank and the toe of the WLD. Effective in addressing existing scour along the WLD.
	Floodplain Impacts	No impact to existing floodplain.	Minimal impact to existing floodplain – removal of gabion baskets and grading of point bar on east bank should be undertaken to compensate for loss of river capacity caused by the addition of the boulders along the west bank.	Removal of gabion baskets and grading of point bar would improve floodplain access and allow more natural river processes to occur.	No impact to existing floodplain.
	Long term operations and maintenance requirements	Potential for increased maintenance costs to address continued erosion of the WLD.	No long-term maintenance.	No long-term maintenance required.	No long-term maintenance required.
	Approvals/ permitting	N/A	Potential ESA requirements to address potential for impacts to SAR turtles. To be confirmed with MNRF.	Potential ESA requirements to address potential for impacts to SAR turtles. To be confirmed with MNRF.	Potential ESA requirements to address potential for impacts to SAR turtles. To be confirmed with MNRF.

Harris Park Site – Evaluation of Alternatives

West London Dyke Erosion Control Class EA

Table 5.3 Harris Park Evaluation

			Toe Protection	Flow Modification	
	Criteria	**Do Nothing**	**Alternative HP 1 Boulder Toe Protection**	**Alternative HP 2 Remove Gabions and Reshape Point Bar**	**Alternative HP 3 Modify Fish Weirs**
	Constructability	N/A	Machinery required in-water to install boulder toe protection. Relatively simple design and short-term construction period.	Machinery required to remove gabions and reshape bank. Simple construction in relation to Alternative 1, consisting of mainly earthworks/grading.	Simplest construction in relation to Alternatives 1 and 2. Requires machinery in water to modify the location of existing rocks making up the weir.
	Construction Access	N/A	Construction access provided via the west bank (same construction access used for WLD construction).	Construction access provided via Harris Park/TVP.	Construction access provided via the west bank (same construction access used for WLD construction).
	Coordination with existing and planned TVC projects	N/A	No significant implications on One River Master Plan considerations.	One River Master Plan currently considering options for Harris Park shoreline – One River Master Plan should consider floodplain impacts from the addition of boulder toe protection (i.e. grading and reshaping of east river bank.	No significant implications for One River Master Plan considerations or Back to the River designs.
	Capital Cost (includes design, construction and contract admin)	N/A	$531,000	$395,600	$207,000
	Technical/Economic Overview	✗ **Does not address Problem and Opportunity Statement. Long term risks to WLD flood control structure by not addressing erosion concerns, causing increased maintenance and financial considerations.**	✓ **Addresses Problem an Opportunity Statement, relatively simple design and construction.**	**Addresses Problem and Opportunity Statement, but requires additional considerations for overall design within Harris Park and TVP.**	✓ **Addresses Problem and Opportunity Statement, relatively simple construction and effectively addresses source of erosion.**
	Overall	Not recommended – used as a baseline for comparison.	Recommended in conjunction with flow modification. ✓	Less preferred over the short term than modification to the weir structure, but could be undertaken in conjunction with other recommendations. Integration with ongoing One River Master Plan/Back to the River designs should be undertaken, and more consultation should be undertaken to determine long term design plans for Harris Park.	Recommended in conjunction with boulder toe protection ✓

5.4 PREFERRED ALTERNATIVES

In order to fully address the existing scour and erosion processes at each site, recommendations include a combination of toe protection to address existing areas of erosion and flow modification to address the source and mitigate future erosion.

Ann Street Site

Based on the qualitative evaluation provided in Table 5.2, the recommended alternatives at the Ann Street Site include modification to the weir structure (i.e. partial removal), and the installation of boulder toe protection along the west bank. Recommendations are discussed further in Section 7.0.

Harris Park Site

Based on the qualitative evaluation provided in Table 5.3.the recommended alternatives at the Harris Park Site include modification to the downstream MNRF fish weir and the addition of boulder toe protection along the west bank. Recommendations are discussed further in Section 7.0.

Removing the gabions along the left bank would improve floodplain access and flow conveyance through this site and reduce scour potential; however, this has greater implications for the adjacent parkland area, and should be explored through the more rigorous public consultation and design studies currently being undertaken by the City. Allowing this area to be a 'soft' depositional area is recommended to allow natural river processes to occur. It is not anticipated that the cut-fill balance will be achieved at this site with respect to the implementation of the boulder toe protection on its own. It should be noted that subsequent work related to the point bar should be undertaken which will involve only cut activities resulting in a net export of material. It is likely that, under final design conditions, that the cut material from the point bar would be able to be balanced (or nearly balanced) with the fill material from the implementation of the boulder toe protection.

6.0 PHASE 2 PUBLIC CONSULTATION

Existing conditions, alternative solutions, evaluation methodology and preliminary recommendations were presented to the public and stakeholders at a Public Information Centre (PIC) held on Tuesday February 13th, 2018. The PIC was held in open house format at the Kinsman Recreation Centre, 20 Granville Street, London. Notification of the PIC was mailed directly to the study's stakeholder list, and advertised in the local Londoner newspaper on February 1st, and February 8th, 2018. Staff from the Upper Thames River Conservation Authority, City of London, and Stantec Consulting were on hand to answer questions.

Three individuals signed in at the PIC, including a representative from the Thames Valley Trail Association. One comment form was submitted at the PIC, which noted they were in favour of the boulder toe protection along the WLD, and also noted that the Harris Park shoreline should be softened (i.e. gabion baskets removed) but should be done in coordination with other Harris Park/Thames River design projects. General discussions with PIC participants were positive, and issues were discussed such as impacts to the TVP during construction.

6.1 INDIGENOUS CONSULTATION

Identified Indigenous Communities were invited to attend the PIC and the presentation materials were provided via email on Thursday February 15, 2018. Correspondence was received from the Chippewas of the Thames First Nation (COTTFN), identifying that the project area is located within the London Township Treaty area (1796), the Big Bear Creek Additions to Reserve (ATR) land selection area, as well as COTTFN Traditional Territory. The initial letter indicated a moderate level of concern for the project and invited the project team to meet to discuss the project further. A meeting was held between the project team and COTTFN representatives Rochelle Smith (Consultation Coordinator) and Emma Young (Environment Officer) on February 26, 2018. A few key points in the discussion included:

- Questions regarding the contents of the decommissioned sanitary sewer at Ann Street – Stantec clarified that the sewer was abandoned and grouted;
- Questions regarding the grading necessary along the east bank at Ann Street – Stantec indicated that grading will be minor and will only account for compensation for the river cross section reduced by the boulder toe protection along the west bank;
- Timelines – the Class EA to be completed in the Spring 2018 followed by a 30-day review period;
- Design and construction – implementation of the recommendations dependent on available funding, may occur as early as 2019;
- Relevance to Back to the River – mentioned that the 'natural bank' area will be subject to future design elements through the One River Master Plan; current Class EA to make recommendations for further consideration within the One River Master Plan and subsequent design processes (as well as through further dyke reconstruction work); and

- COTTFN requested a copy of the Environmental Impact Study that was completed as part of the WLD Phase 3 work as well as the geomorphology report (subsequently provided to COTTFN on February 27, 2018).

Based on discussions at the meeting, COTTFN identified that there were no concerns with this project moving forward.

Correspondence was also received from Aamjiwnaang First Nation (AFN) on March 21, 2018. Information on the project was discussed at the AFN's Environment Committee on March 6, 2018 for their review and consideration. Based on their review, they noted a number of considerations including:

- Wildlife mortality during construction, and wildlife mitigation;
- Restoration of disturbed areas where possible, including wildlife corridors;
- Softened erosion control by using riparian buffers;
- AFN requests that archaeological and species at risk monitors be on site during assessment studies and construction; and
- Requests that native plant species be used for restoration and included information on their Maajiigin Gumig greenhouse which provides a local source of native vegetation.

UTRCA is committed to maintaining open relationships with Indigenous partners and shares the concerns regarding wildlife and habitat protection. The project and alternatives have been designed to minimize impacts to the natural environment, and best management and other mitigation measures will be identified to further protect the natural heritage system within the surrounding area.

7.0 RECOMMENDATIONS AND COST ESTIMATES

Based on the investigation of river morphology and scour at the Ann Street and Harris Park sites and an assessment of impacts to the social, cultural, natural, technical, and economic environments, a combination of solutions are recommended to address existing areas of erosion and protect against future erosion.

Ann Street Site

The recommendations for the Ann Street Site include the installation of boulder toe protection along the west bank and modification to the existing weir structure to divert flows towards the centre of the channel as shown in Figure 7.1. Sizing of boulders would be determined during detailed design, but they are expected to be larger than 600 mm. The treatment would be 5 m wide and extend along the toe of the dyke between the existing weir and approximately 60 m downstream. The 5m width is required to achieve a slope of 2.5:1. Boulders will be sized for bankfull shear stresses to ensure they will not wash away. The current scour depth is approximately equivalent to the predicted scour depth, therefore no keying in of the toe has been identified, but may be considered during detailed design The reduction of cross-sectional area on the west (right) bank due to the placement of boulders should compensated by the creation of an equal area on the east (left) bank. This would be achieved through grading.

Construction costs for these recommendations are estimated at $92,000. This estimate represents construction costs based on per unit costs for similar projects, and does not include engineering, permitting/approvals, contract administration, or contingency. Detailed cost estimates will be updated at the time of detailed design.

Harris Park Site

The recommendations for the Harris Park Site include modification to the downstream MNRF Fish Weir and the addition of boulder toe protection along the west bank, shown on Figure 7.2. The existing boulders in the weir would be re-used and configured to deflect flows toward the center of the channel. Sizing of boulders for the toe protection treatment would be determined in detailed design, but are expected to be larger than 600 mm. The treatment would be 5 m wide and extend along the toe of the dyke between the existing MNRF weir and approximately 240 m downstream. The length of the boulder treatment has been identified to protect the entire outer meander bend from approximately Leslie Street to just downstream of Rogers Avenue. This area is within a confined section of the river and is more prone to erosion. The length of the treatment should be confirmed during detailed design.

Removing the gabions along the east bank would improve floodplain access and flow conveyance through this site and reduce scour potential; however, this has greater implications for the adjacent parkland area, and should be explored through the more rigorous public consultation and design studies currently being undertaken by the City. Allowing this area to be a ‘soft’ depositional area is recommended to allow natural river processes to occur. It is not anticipated that the cut-fill balance will be achieved at this site with respect to the implementation of the boulder toe protection on its own. It should be noted that subsequent work related to the point bar should be undertaken which will involve only cut activities resulting in a net export of material. It is likely that, under final design conditions, that the cut material from the point bar would be able to be balanced (or nearly balanced) with the fill material from the

implementation of the boulder toe protection. This information should be considered in more detail within the Back to the River/One River Master Plan study currently underway.

Construction costs are estimated at $337,000. This cost estimate represents construction costs based on per unit costs for similar projects, and does not include engineering, permitting/approvals, contract administration, or contingency. Detailed cost estimates will be updated at the time of detailed design.

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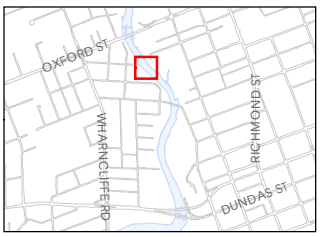

Legend

- Riffle Augmentation
- Debris Removal
- Weir Removal
- Flow Direction
- Weir Modification
- Reshape and Stabilize Banks
- Boulder Toe Protection
- Grade and Reshape Bank

0 8 16 metres

1:800 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

Stantec

Project Location
City of London

165630129 REVA
Prepared by KDB on 2018-01-30

Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
7.1

Title
Ann Street Preferred Alternative Design Options #2 & #3

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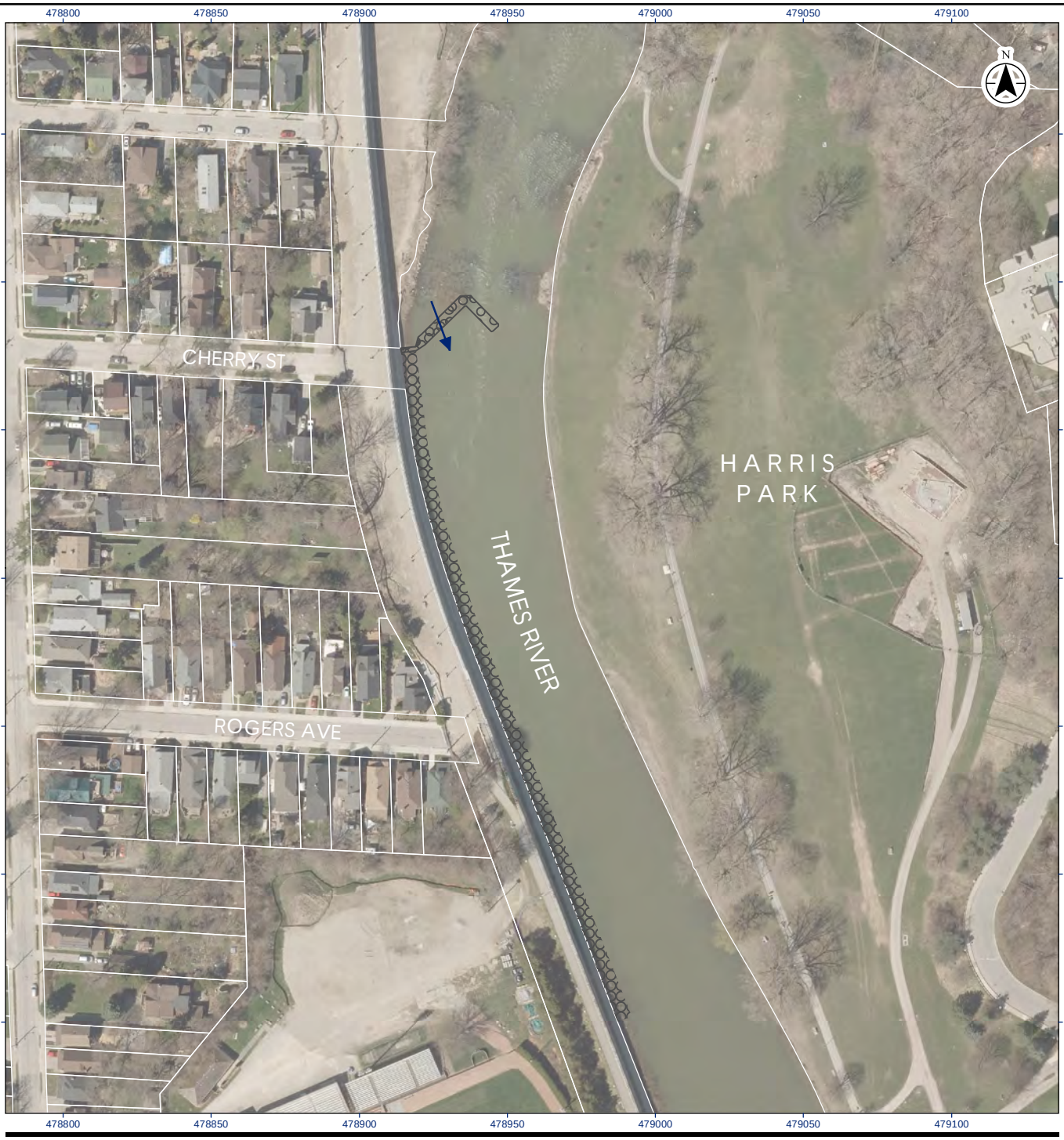

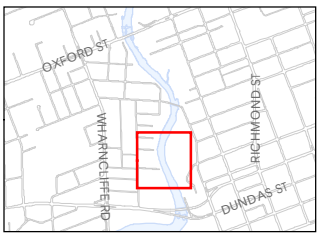

Legend

- Flow Direction
- Boulder Toe Protection
- Modified Riffle

0 20 40 metres

1:2,000 (at original document size of 8.5x11)

Stantec

Project Location
City of London

165630129 REVA
Prepared by KDB on 2018-01-30

Client/Project
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE EROSION CONTROL
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
7.2

Title
Harris Park Preferred Alternative
Design Options #1 & #3

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features and imagery used under City of London Open Data License. Imagery date Spring 2016.

7.1 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Through design and the use of best management practices, construction of the identified improvements is not expected to result in significant environmental impacts. Recommended protection and mitigation measures are identified below and should be consulted during detailed design and construction.

7.1.1 Social/Cultural Impacts

Impacts to Pedestrian Circulation

Construction of the recommended solutions at both sites may result in temporary disruptions to the Thames Valley Parkway trail system. A Traffic Management Plan shall be prepared to minimize disruptions to the trail network, identify detours, and ensure the safety of trail and park users during construction.

Build Cultural Heritage and Cultural Heritage Landscapes

Based on a review of existing conditions, including identified cultural heritage resources and previous studies, no impacts to built cultural heritage or cultural heritage landscapes are anticipated at either the Ann Street or Harris Park Sites.

Archaeological Resources

The Ann Street Site has been subject to recent, extensive disturbance during the construction of the new sanitary sewer crossing, and therefore has limited archaeological potential.

There are known archaeological sites in proximity to the Harris Park Site. Archaeological investigations will be required prior to implementing the recommended solutions. The requirement for archaeological investigations will be confirmed during detailed design and overall project footprint.

It should also be noted that Chippewas of the Thames First Nation, and Aamjiwnaang First Nation have requested that an archaeological monitor be present during archaeological field investigations.

7.1.2 Natural Environment Impacts

The project is located within an area that contains several sensitive natural heritage features. The following measures shall be incorporated to minimize or mitigate potential adverse impacts on natural features and functions during detailed design and construction.

7.1.3 Species at Risk

Based on field investigations undertaken in 2015, communications with UTRCA staff, and other SAR records, there are known occurrences of SAR turtles within the study areas. Eastern Spiny Softshell is a resident of the Thames River, and is restricted to the river and riverbanks. Mitigation measures recommended to reduce impacts to Eastern Spiny Softshell during construction is to avoid the peak active season, from approximately the end of March to November. If construction proceeds during the peak active season, silt fencing or other barrier fencing should be used to inhibit the movement of turtles and other wildlife into working areas. Specification of exclusion fencing will be

consistent with the OMNR's (2013) *Reptile and Amphibian Exclusion Fencing: Best Practices, Version 1.0*. As in-water works are proposed as part of the project activities, discussions with MNRF will be required to discuss permitting requirements, and address appropriate mitigation measures to avoid contravention of the ESA (2007). Anticipated mitigation measures are discussed below, and will be confirmed through discussions with MNRF.

Installation of barrier fencing is recommended occur before June 1 or after September 1 (i.e., outside of turtle nesting season) to define work areas and restrict the movement of turtles into the working area. If construction must be initiated during the turtle nesting season, a qualified biologist will visually inspect the site for turtle nests and adult turtles and direct installation of construction barrier fencing to avoid nests. If it is not possible to isolate a nest from construction, work will be delayed until it is determined that the nest no longer includes viable eggs (hatchlings have emerged, or eggs were predated), or collected in accordance with existing UTRCA permissions.

Factsheets will be provided to all construction staff to assist with identification of Eastern Spiny Softshell. If turtles are encountered during construction, work at that location will stop until they are no longer present. Qualified professions may be permitted to move individuals to suitable and safe locations with prior authorization form MNRF. Any observations of Eastern Spiny Softshell or other species at risk will be reported to MNRF within 48 hours.

7.1.4 Fish and Fish Habitat/Aquatic Species at Risk

As in-water work is required within the study area for the completion of this project, there is potential for aquatic organisms and their habitats to be impacted by the introduction of silt and sediment during construction. There will be a requirement to provide measures to avoid, mitigate, and offset any harm to fish and fish habitat, in accordance with the DFO's Fisheries Protection Policy Statement (DFO 2013).

The *Fisheries Act* requires that projects avoid causing serious harm to fish unless authorized by the Minister of Fisheries and Oceans Canada (DFO). This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery. Effective November 25, 2013, proponents must ensure their projects meet the DFO requirements under the Self-Assessment process or contact DFO for a formal review or approval under the *Fisheries Act*.

In-water work will be required for the construction of the recommended solutions, including the installation of boulder toe protection and modifications to existing structures within the river.

In addition to the erosion and sediment controls listed in Section 7.1.6 below, the following measures are recommended to protect aquatic SAR at the proposed scour protection areas:

- Conduct a mussel survey according to the Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario-Great Lakes Area (OGLA) (Mackie et al 2008) prior to any in-water works to confirm presence of freshwater mussels in the two locations.
- If freshwater mussels are present in the area, prepare a plan to relocate the mussels according to the Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario-Great Lakes Area (OGLA) (Mackie et al 2008) prior to conducting in-water works.
- Time construction to occur within the appropriate in-water construction window of July 1 to August 15 to protect freshwater mussels present within the Thames River.
- Design scour protection to increase riffle habitat with gravel substrates within the river to create additional spawning habitat for Spotted Sucker and preferred habitat for freshwater mussel species.

7.1.5 Protection of Natural Areas

It is anticipated that construction access for the Harris Park Site will be provided via the existing access along the west bank used during previous WLD Phase 3 repair projects, or may be incorporated into future WLD repair phases. At the Ann Street Site, construction access shall be provided off of Ann Street and the TVP, which will require temporary disruption to the SHTM1-1 community (Cottonwood Mineral Treed Shoreline). Activities related to construction including grading, cut-and-fill, and presence of heavy machinery can cause soil erosion and compaction, and mobilize silt and sediment into adjacent watercourses. Potential for machinery to destroy over-hanging vegetation may occur while working in natural areas. Encroachment into the natural areas can also occur by machinery, foot traffic, and discarding or storage of construction materials outside the construction envelope. The following strategies are recommended to mitigate impacts watercourses and areas of natural vegetation that will be retained through the proposed plan:

- Clearly delineate/demarcate work areas to avoid encroachment and incidental damage to native trees and areas of natural vegetation, particularly along the woodlands located adjacent to the Project Footprint;
- Educate workers on the requirements for and importance of avoiding entrance to the demarcated area;
- Inspectors shall commit to maintaining construction vehicles and personnel to stay within the construction envelope, thereby limiting the disturbance of natural vegetation;
- All maintenance activities, vehicle refueling or washing, as well as the storage of chemical and construction equipment shall be located >30 m from the Thames River wetlands and floodplain, and >10m from Significant Woodland and other natural areas where possible;
- In the event of an accidental spill, the MOE Spills Action Centre shall be contacted and emergency spill procedures implemented immediately; and
- Accidental damage to trees, or unexpected vegetation removal, shall be replaced/ restored with native species.

7.1.5.1 Habitat Restoration Plan

Where possible, construction should be directed away from the natural features present within the study area. In addition to the proposed protection and mitigation measures, a habitat restoration plan for the wetland community within the Ann Street study area, and the significant woodlands, Thames River valleyland and corridor within the Ann Street and Harris Street study area, should be implemented upon the completion of the proposed works. The habitat restoration plan will consider naturalization work to promote natural regeneration of these areas:

- Wetland plantings to buffer the wetland community;
- Meadow plantings, and the use of native seed mixes to create pollinator habitat;
- Spot removal of invasive plans, where feasible;
- Planting of native shrubs and wetland plants in accordance with the Guide to Plant Selection for Natural Heritage Areas and Buffers (City of London, 1994); and
- Qualitative vegetation monitoring of the above mentioned restoration measures to ensure the survival of any planted species and the establishment of native plans.

7.1.6 Erosion and Sediment Control

- Minimize the access and temporary work space to the extent possible to limit destabilization of soils near the work area.

- Timing of the work to minimize impacts to fish in the Thames River using the warm water timing windows provided by LTCA that allow work to occur from July 1 to March 31 (no work from April 1 to June 30) of any given year.
- Silt fencing and/or barriers such as sediment logs (i.e., SiltSoxx™) could be used along all work zones where there is potential for sedimentation of watercourses or wetlands, or inadvertent encroachment of construction vehicles into trees or natural areas.
- Dust could be controlled by using water and not chemical suppressants in dust-sensitive areas such as the mapped natural heritage features.
- No equipment should be permitted to enter any natural areas beyond the barrier fencing.
- All exposed soil areas should be stabilized (native seed mixes; sourced locally if possible) and re-vegetated, through the placement of seed and mulching or seed and an erosion control blanket, promptly upon completion of construction activities.
- Equipment should be re-fueled 30 m away from sensitive natural features (e.g. watercourses) to avoid potential impacts if an accidental spill occurs.
- In addition to any specified requirements, additional silt fence and/or silt logs should be available on site, prior to grading operations, to provide a contingency supply in the event of an emergency.
- Sediment and erosion controls should be monitored regularly and properly maintained as required. Controls are to be removed only after the soils of the construction area have been stabilized and adequately protected or until cover is re-established.
- The limits of construction adjacent to natural features to be retained will be fenced prior to construction and monitored during construction (along with sediment and erosion control measures) to make sure that the limits are maintained with respect to vehicular traffic and soil or equipment stockpiling.
- The Contractor is required to restore any disturbed natural areas to pre-construction conditions.
- In-water work requirements should be reviewed with the Proponent to determine if in-water sediment controls (silt curtains, work area isolation, etc.) should be implemented. The requirement for turbidity monitoring during in-water works will also be determined in conjunction with a review of the methods of construction. Silt resuspension during inwater works often mimics suspended sediment levels experienced following runoff events, and the expected duration of inwater disturbance can assist with determining the degree of controls and monitoring that would be required.

8.0 CLASS EA FILING PROCEDURE AND CLOSING

The Project File is being placed on public record for the statutory 30-day review period, and all previously identified stakeholders will be provided notification in accordance with the consultation plan followed throughout the project. The Notice of completion is included in Appendix F and details the 30-day review period (December 6th, 2018 to February 8th, 2019), the locations at which the Project File is available, where comments should be directed during the review period, and outlines the Part II Order procedure discussed below. The Notice of Completion was published in the Londoner newspaper (December 6th, 2018 and December 13th, 2018), mailed to all stakeholders and Indigenous communities (November 28, 2018), and posted to the UTRCA and City of London websites starting January 7th, 2019. Please note that the Public Review Period was extended to account for postage delays and to ensure all agencies and the public had ample time to review project documentation.

8.1 FORMAL APPEAL PROCESS – PART II ORDER PROCESS

The Class EA planning process encourages the identification and resolution of concerns early and throughout the project, and it is the obligation of the proponent to adequately address concerns raised by the public, Indigenous communities, and review agencies. If an interested part feels as though their concerns have not been adequately addressed, and that the proposed undertaking needs to be subject to a more in-depth planning process, a request for a Part II Order may be submitted to the Ministry of the Environment and Climate Change. Under the provisions of Section 16 of the EA Act, the Minister or delegate may require a proponent to comply with Part II of the EA Act by completing an individual Environmental Assessment before proceeding to implementation.

The Minister may deny the request, impose conditions on the proposed undertaking, or for Schedule B projects, the Minister may elevate the status of the project to a Schedule C project, requiring the completion of the full planning process prior to implementation. As per Section A.2.8 of the MEA Municipal Class EA document, the process for requesting a Part II Order involves the following:

- Persons with a concern bring it to the attention of the proponent during the planning process;
- If the concern is not resolved through consultation with the proponent, the person may request that the proponent voluntarily elevate the status of the project to a Schedule C project, or an Individual Environmental Assessment; and
- If the proponent refuses to elevate the status of the project, the person with the concern may send a written request to the Minister of the Environment and Climate Change during the 30-day review period to issue an order to comply with Part II of the EA Act, with a copy to the proponent. A Part II Order request form (Form number 012-2206E) is available online at: http://www.forms.ssb.gov.on.ca/mbs/ssb/forms/ssbforms.nsf/FormDetail?OpenForm&ACT=RDR&TAB=PROFILE&SRCH=&ENV=WWE&TIT=2206&NO=012-2206E

Some additional considerations for the Part II Order process are noted below:

- The request must be made upon the completion of the planning process (i.e. after a Notice of Completion is issued and all project documentation has been made available) so that all potential environmental impacts and impact management measures are understood;

- Must not be made for the sole purpose of delaying stopping frustrating the planning and implementation of a project;
- Must focus on potential environmental effects (including the social, cultural, and natural environments) of a project, and not on decisions made outside of the Class EA process (for example, land use planning decisions made under the Planning Act, or issues related to municipal funding of projects);
- Must not raise issues that are not related to the projects; and
- Should be withdrawn promptly by the request if the proponent has satisfied the concerns of the requester.

It is the proponent's responsibility to provide several opportunities for public, Indigenous communities, and agency review and input, as well as that of the public, Indigenous Communities and Agencies to bring their concern to the attention of the proponent early in the planning process. Every reasonable effort must be made by the proponent to address concerns brought forward. If concerns have not been addressed upon the issuance of the Notice of Completion, any member of the public may submit a request to the Minister of the Environment and Climate Change within the 30 day review period. The Part II Order request form can be found at: http://www.forms.ssb.gov.on.ca/mbs/ssb/forms/ssbforms.nsf/FormDetail?OpenForm&ACT=RDR&TAB=PROFILE&SRCH=&ENV=WWE&TIT=2206&NO=012-2206E, or by searching Part II Order or 012-2206E on the Forms Repository main website: http://www.forms.ssb.gov.on.ca/.

8.2 CLOSING

This Project File has been prepared to document the Municipal Class EA planning process for Schedule B projects. It outlines the process which the Upper Thames River Conservation Authority has undertaken to address the problems identified, and the potential solutions to be implemented. This process has involved mandatory contact with the public, Indigenous communities and review agencies to ensure that they are aware of the project and that their concerns have been addressed, along with an evaluation of a range of alternatives leading to the project recommendations. The Notice of Completion has been posted for 30-day review, and all correspondence received during this period will be appended to the final report in Appendix F.

9.0 REFERENCES

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APPENDICES

Appendix A CONTACT LIST

Appendix B PUBLIC CONSUTLATION AND PUBLIC INFORMATION CENTRE MATERIALS

Appendix C FLUVIAL GEOMORPHOLOGY REPORT (STANTEC 2015)

Appendix D AS-BUILTS

Appendix E COST ESTIMATES

Appendix F NOTICE OF COMPLETION