Appendix 'A' - Broughdale Dyke EA Executive Summary

Executive Summary

1. Introduction

In response to major floods in 1937, the UTRCA and City of London has developed and maintains a system of flood protection dykes along the Thames River. The dykes have done a good job of protecting people and properties in areas that would otherwise be at significant risk of flooding. Broughdale dyke is an integral part of this larger flood control network that includes other dykes, flood control dams, and a flood forecasting and warning system. In recent years slope stability concerns have been identified at the dyke and the dyke fails to provide the necessary flood protection (250 year event) mandated by the provincial government. The relevant studies are outlined below.

The Broughdale dyke, located on the south side of the Thames River between Richmond Street and Meadowdown Drive, is 710m long (**See Figure ES1**). Construction of the western section of the dyke, from Raymond Avenue to Meadowdown Drive, was completed after the 1937 flood with the eastern section, in Ross Park, completed in 1990. The Broughdale dyke hazard classification is Moderate/High based on potential impacts to life and property within the Broughdale area if the dyke were to fail. The minimum Design Flood for a Moderate/High classification is the Regulatory Flood (250 year event). The dyke currently provides protection up to the 100 year event, putting residents of 191 properties within the 250 year regulatory flood limit at risk of flooding.

In 2011, stability and condition assessments of the Broughdale dyke identified sections of the dyke to be in poor condition with severe stability issues which require, at a minimum, reconstruction of the unstable sections to ensure public safety. The 2013 London Earth Dykes Stability Review (AECOM) assessed the stability of the Thames River Dykes and developed Preliminary Dyke Standards in the absence of Provincial standards. The long-term management of the Broughdale dyke should take these standards into account while also considering climate change adaptation. The Broughdale Dyke Flood Characterization 2D Model Report was completed in 2016 and identified very high flood hazard for the people and structures within the Broughdale Area during the 250 year event due to fast flowing and deep water. These studies indicate a need to consider repairing and raising the Broughdale dyke to provide critical flood protection for the Broughdale community.

This Class EA was carried out as a Schedule 'B' project in accordance with the Ontario Municipal Engineers Association (MEA) Municipal Class EA document (October 2000 as recently amended in 2015), which is approved under the Ontario *Environmental Assessment Act (EAA)*. This report documents the need and justification for the project, the planning process undertaken to select the preferred solution, and measures to mitigate impacts.

2. Preferred Solution Project Description

Based on the evaluation of alternative solutions, the preferred alternative is:

Alternative 7 – Raise and extend the dyke to the 250 year event plus 0.9m freeboard and relocate the dyke between Bernard Avenue and Meadowdown Drive towards the flood plain

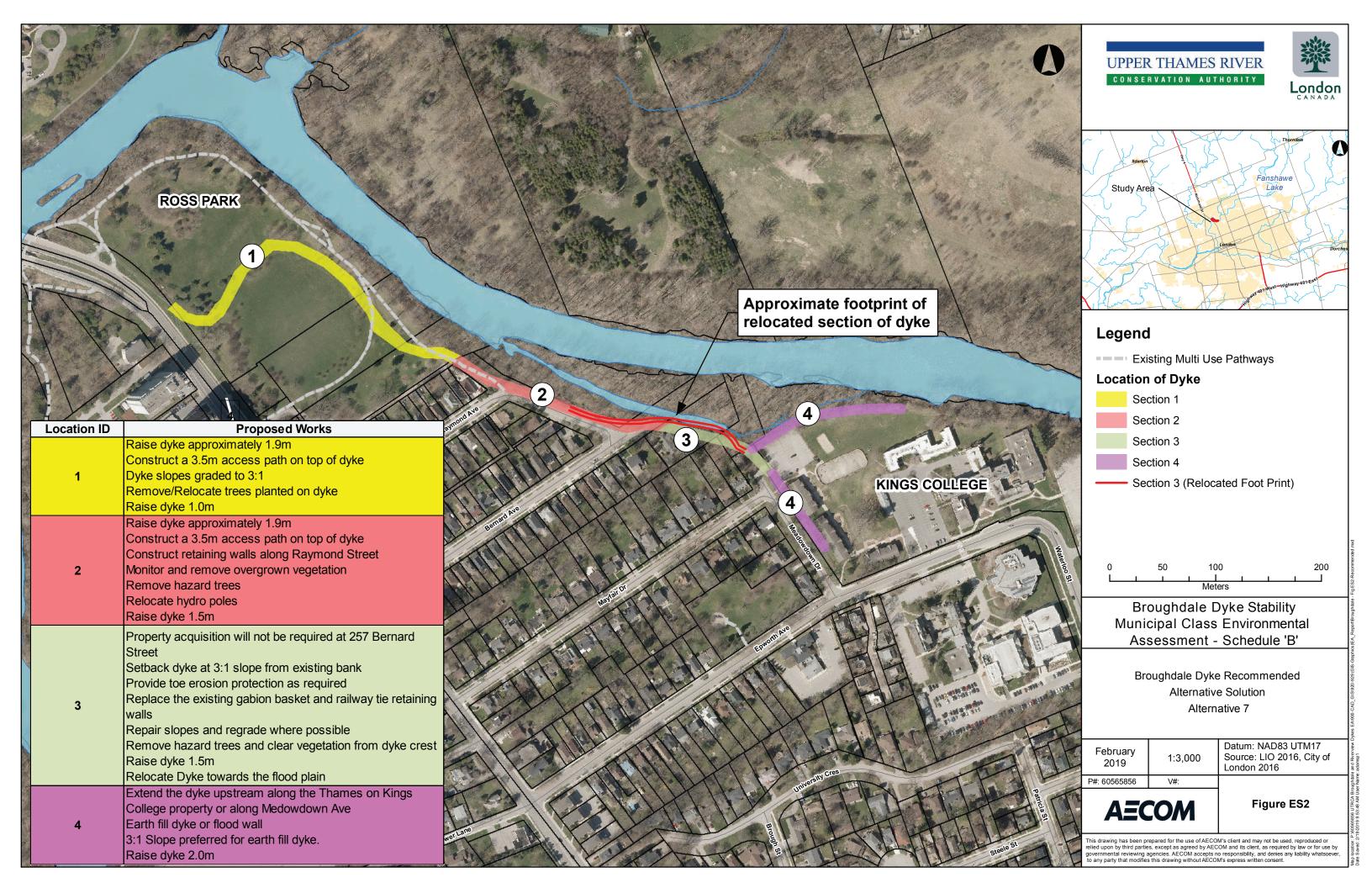
The preferred alternative provides flood protection for the 250 year flood event plus a 0.9m freeboard allowing for climate change resiliency. By shifting the footprint of the dyke towards the flood plain the need to acquire 257 Bernard Avenue is removed. **See Figure ES2.**

Ross Park

This section of the dyke will be raised approximately 1.0m at a 3:1 graded slope. Trees located on top of the dyke would be removed and relocated. This section is easily accessed and won't require a maintenance path.

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Broughdale Dyke Stability
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Raymond Avenue from Ross Park to Bernard Avenue

This section of the dyke will remain in place and a sheet pile flood wall be driven down vertically through the existing structure to provide the additional 2m height above the current top of dyke. Hydro poles currently located on the dyke will need to be relocated and any hazard trees removed. An architectural façade would be placed on the exposed sheet pile to improve the aesthetics of the flood wall.

Bernard Avenue to Meadowdown Drive

This section of dyke will have the existing fill removed. The dyke alignment will be shifted towards the floodplain and reconstructed using retaining walls, engineered fill and a flood wall to raise the dyke and restrict encroachment into the flood plain. **See Figure 11** for a conceptual drawing of the alignment. A 3.5 m paved maintenance path will be constructed on the dyke to facilitate future inspections and maintenance works. The path will also form part of the Thames Valley Parkway (TVP) to connect the Broughdale Area and North London community to the Ross Park portion of the TVP.

Construction of the dyke will primarily occur from the top of the dyke to reduce the construction footprint and mitigate impacts to riparian vegetation. Any private property impacted during construction will be restored. A landscaping plan will be developed in close consultation with property owners and could include a wooden privacy fence and targeted plantings to improve privacy and aesthetics for neighbouring properties. **Figure 12** presents a conceptual cross section of the proposed realigned and reconstructed dyke through this section.

Upstream Extension to Kings College Property

Three options are being considered to extend the dyke upstream:

- Construct an earth dyke or floodwall along the top of the existing slope beside the Thames River on Kings College property and tying into high ground near the Alumni Court Residence.
- Construct a floodwall along the west boulevard of Meadowdown Drive from the Kings College entrance to Epworth Avenue.
- Raise the Kings College parking lot and soccer field to the 250-year event plus 0.9 m freeboard using clean, imported fill and restore the parking lot and soccer field.

A maintenance path along this section of the dyke is not anticipated because access can be achieved through the Kings College parking lot and soccer field or from Meadowdown Drive. The preferred option will be determined during detailed design in consultation with Kings College. Recent discussions with Kings College indicated that raising the sports field and parking lot would likely have the least long-term impacts on Kings College students and facilities.

3. Implementation Schedule

Before implementation of the preferred alternative, an appropriate source of funding for the project must be acquired. This will be a major factor dictating the implementation schedule of the proposed works. If a source of funding for the project is acquired immediately after filing this report for completion, detailed design on the slope stability works could start as early as 2020 with tender and construction starting in the spring/summer of 2022.

Staged construction could be utilized to address the more immediate stability concerns.

Detailed design will include the following items:

Completion of an Environmental Impact Statement (EIS) for the preferred alternative presented in this
report;

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Broughdale Dyke Stability
Municipal Class Environmental Assessment

- Species at Risk permitting which could include a net benefit permit;
- Ongoing consultation with neighbouring property owners to determine their preference for restoration, landscaping and privacy fencing;
- Ongoing consultation with Kings College to determine the preferred option for extending the dyke upstream and to develop a design that addresses their concerns while achieving the necessary flood protection; and,
- Ongoing consultation with Oneida of the Thames and Chippewa of the Thames including a site walk with Elders and Traditional Knowledge Holders.

4. Property Requirements

The implementation of Alternative 7 will not require the acquisition of any properties. Property agreements and/or temporary easements will be required to facilitate construction. A permanent property agreement or easement with Kings College may also be required to allow for future inspections and maintenance of the dyke.

5. Consultation

As part of the Municipal Class EA planning process, several steps were undertaken to inform stakeholders, study area residents, review agencies and Indigenous communities about the project, and to solicit comments at key stages of the study process. Consultation methods included:

- Publication of newspaper notices for all project milestones, including Notices of Study Commencement,
 Public Information Centre (PIC), and Study Completion.
- Placement of notices and other materials on the City's website.
- Direct mailing of project notices to stakeholders, study area residents, businesses, review agencies and Indigenous communities.
- One Community Site Walk to engage local residents early in the EA process, with an additional site walk to accommodate EEPAC members who had a scheduling conflict.
- One PIC to engage and obtain input from the public, review agencies, and stakeholders.
- Individual meetings with residents/stakeholders as required or as opportunities arose.

6. Conclusion and Recommendation

The preferred solution includes the reconstruction of the earthen berm dyke, construction of retaining walls and flood walls and a maintenance path that will meet the preliminary design standards provided by the 2013 Earth Dyke Stability Review.

Considering the above, it is recommended that:

- 1. Following EA documentation filing and clearance, and securing appropriate funding, the recommended works proceed to the design phase including permitting/approvals; and
- EA commitment and mitigation measures identified in Section 8 are expanded upon during design and implementation as part of construction.

Key commitments to be implemented during detailed design include:

- Completion of an Environmental Impact Study (EIS) for the preferred alternative presented in this
 report;
- Species at Risk permitting which could include a net benefit permit;

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Broughdale Dyke Stability Municipal Class Environmental Assessment

- The dyke is currently located on and/or abuts neighbouring properties that will be highly sensitive to
 construction impacts. Ongoing and open dialogue with neighbouring properties during the design,
 construction and post construction phases will be critical in ensuring optimal design while managing and
 mitigating impacts during and after construction. This includes working with property owners to determine
 their preference for restoration, landscaping and privacy fencing;
- Ongoing consultation with Kings College to determine the preferred option for extending the dyke upstream and to develop a design that addresses their concerns while achieving the necessary flood protection; and,
- Ongoing consultation with Oneida of the Thames and Chippewa of the Thames including a site walk with Elders and Traditional Knowledge Holders.

Appendix 'B' -Riverview Evergreen Dyke EA Executive Summary

Executive Summary

1. Introduction

In response to major floods in 1937, the UTRCA and City of London has developed and maintains a system of flood protection dykes along the Thames River. The dykes have done a good job of protecting people and properties in areas that would otherwise be at significant risk of flooding. Riverview Evergreen Dyke is an integral part of this larger flood control network that includes other dykes, flood control dams, and a flood forecasting and warning system. In recent years slope stability concerns have been identified at the dyke and the dyke fails to provide the necessary flood protection (250 year event) mandated by the provincial government. The relevant studies are outlined below.

The Riverview Evergreen Dyke, located in the central part of London on the south side of the Thames River bounded by the CP Rail line to the south, Wharncliffe Road to the east and the Thames River to the north and west (**See Figure ES1**) is approximately 250m long. The Riverview Evergreen Dyke hazard classification is Low/Moderate based on potential impacts to life and property within the Riverview area if the dyke were to fail. The minimum Design Flood for a Moderate/High classification is the Regulatory Flood (250 year event). The dyke currently provides protection up to the 80 year event, putting residents of 19 properties within the 250 year regulatory flood limit at risk of flooding.

In 2011, stability and condition assessments of the Riverview Evergreen Dyke identified sections of the dyke to be in poor condition with severe stability issues which require, at a minimum, reconstruction of the unstable sections to ensure public safety. The 2013 London Earth Dykes Stability Review (AECOM) assessed the stability of the Thames River Dykes and developed Preliminary Dyke Standards in the absence of Provincial standards. The long-term management of the Riverview Evergreen Dyke should take these standards into account while also considering climate change adaptation.

This Class EA was carried out as a Schedule 'B' project in accordance with the Ontario Municipal Engineers Association (MEA) Municipal Class EA document (October 2000 as recently amended in 2015), which is approved under the Ontario *Environmental Assessment Act (EAA)*. This report documents the need and justification for the project, the planning process undertaken to select the preferred solution, and measures to mitigate impacts.

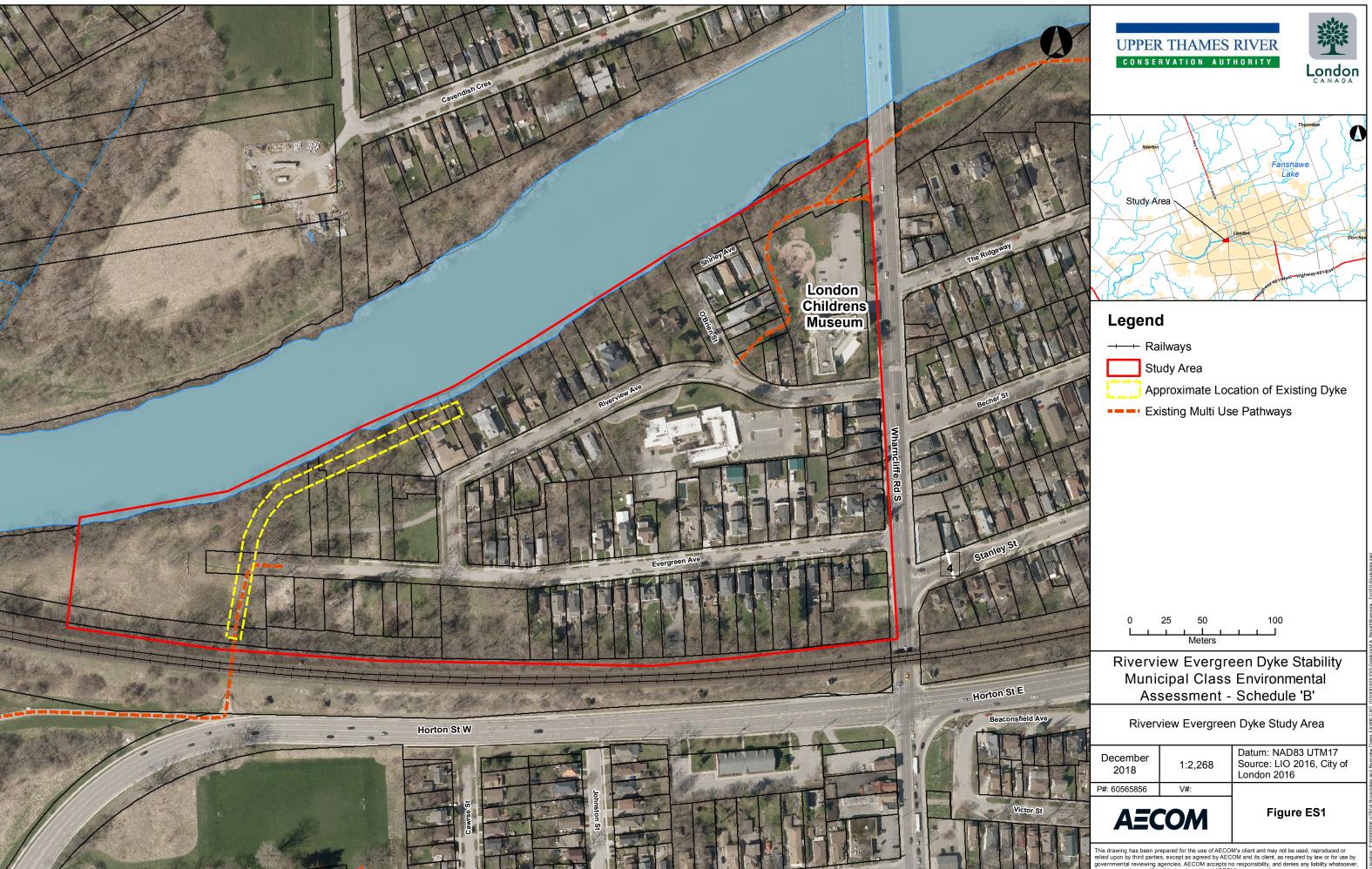
2. Preferred Solution Project Description

Based on the evaluation of alternative solutions, the preferred alternative is:

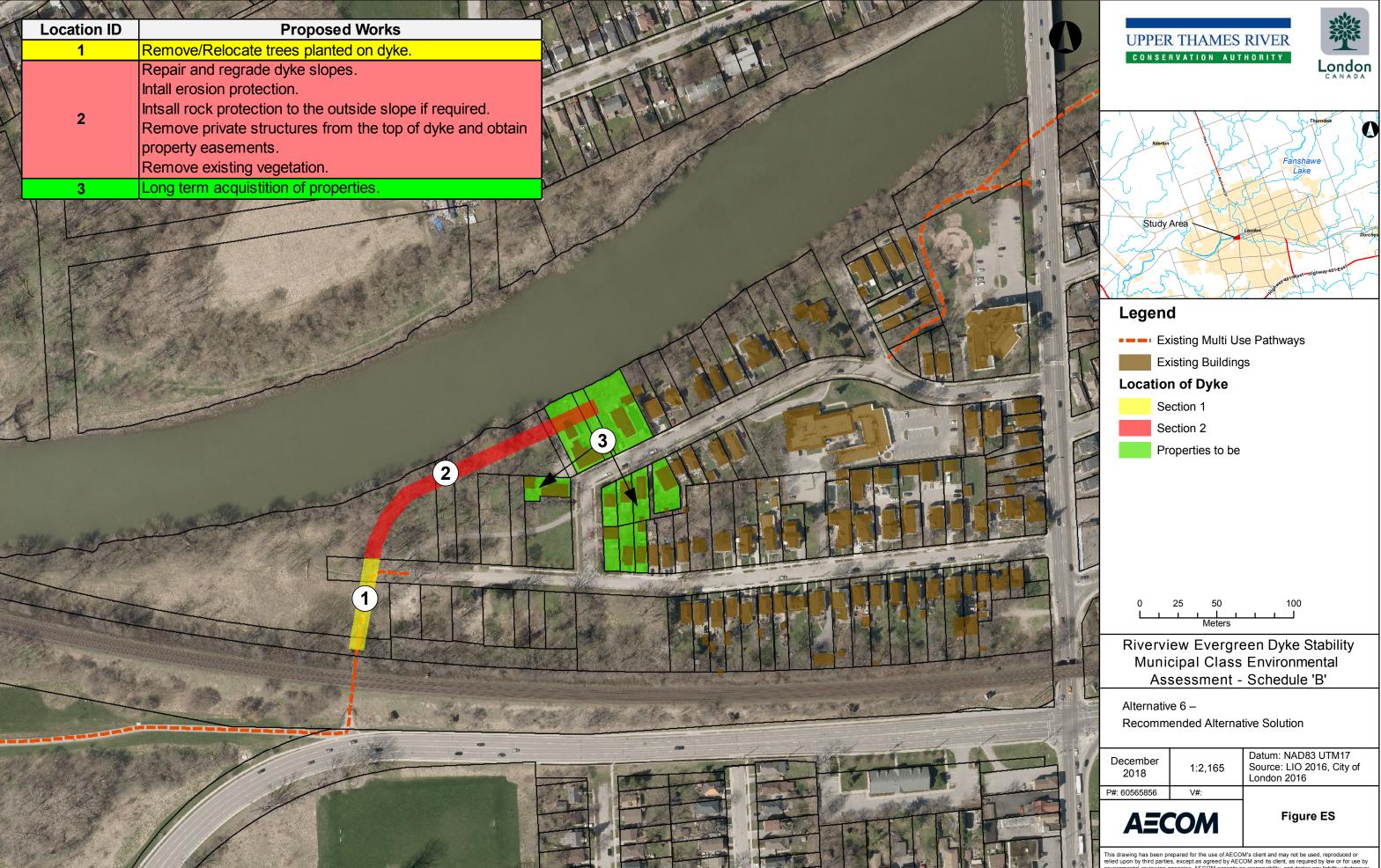
Alternative 6 – Repair and Maintain Dyke with Future Decommissioning

The preferred alternative maintains the current level of flood protection for the 80 year flood event until the properties that are protected by it can be purchased. During the interim period the deficiencies outlined in the 2013 Earth Dyke Stability Review would be repaired. Repairs would include the removal and relocation of trees planted on top of the dyke, removing hazard trees and overgrown vegetation, and regrading to a more stable slope where possible. **See Figure ES2.**

By maintaining the current level of flood protection (80 year event) this option would not protect to Regulatory Flood event, however it would maintain the current level of protection until the 11 properties that are protected by the dyke can be purchased. Once all of the properties are purchased the flood risk would be removed.



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3. Implementation Schedule

Before implementation of the preferred alternative, an appropriate source of funding for the project must be acquired. This will be a major factor dictating the implementation schedule of the proposed works. If a source of funding for the project is acquired immediately after filing this report for completion, detailed design on the slope stability works could start as early as 2020 with tender and construction starting in the spring/summer of 2022.

Staged construction could be utilized to address the more immediate stability concerns.

Detailed design will include the following items:

- Completion of an Environmental Impact Statement (EIS) for the preferred alternative presented in this
 report;
- Species at Risk permitting which could include a net benefit permit;
- Ongoing consultation with neighbouring property owners to determine their preference for restoration, landscaping and privacy fencing; and
- Ongoing consultation with Oneida of the Thames and Chippewa of the Thames including a site walk with Elders and Traditional Knowledge Holders.

4. Property Requirements

Prior to decommissioning the Riverview Evergreen dyke acquisition of 11 properties is required. These properties would be purchased as they become available. Properties requiring acquisition are identified in **Table ES1**.

Properties Requiring Acquisition under Alternative 6	
15 Riverview Avenue	2 Riverview Avenue
19 Riverview Avenue	4 Riverview Avenue
17 Riverview Avenue	6 Riverview Avenue
21 Riverview Avenue	10 Riverview Avenue
23 Riverview Avenue	55 Evergreen Avenue
53 Evergreen Avenue	57 Evergreen Avenue

Table ES1: Property Acquisition Requirement

5. Consultation

As part of the Municipal Class EA planning process, several steps were undertaken to inform stakeholders, study area residents, review agencies and Indigenous communities about the project, and to solicit comments at key stages of the study process. Consultation methods included:

- Publication of newspaper notices for all project milestones, including Notices of Study Commencement,
 Public Information Centre (PIC), and Study Completion.
- Placement of notices and other materials on the City's website.
- Direct mailing of project notices to stakeholders, study area residents, businesses, review agencies and Indigenous communities.
- One Community Site Walk to engage local residents early in the EA process.
- One PIC to engage and obtain input from the public, review agencies, and stakeholders.
- Individual meetings with residents/stakeholders as required or as opportunities arose.

6. Conclusion and Recommendation

The preferred solution includes the repair and maintenance of the earthen berm dyke, until the properties within the 80 year return period boundary can be purchased.

Considering the above, it is recommended that:

- 1. Following EA documentation filing and clearance, and securing appropriate funding, the recommended works proceed to the design phase including permitting/approvals; and
- 2. EA commitment and mitigation measures identified in **Section 8** are expanded upon during design and implementation as part of construction.

The above future permitting-approvals, mitigation measures and monitoring requirements form EA commitments that will be subject to the design and construction phases.

Key commitments to be implemented during detailed design include:

- Completion of an Environmental Impact Study (EIS) for the preferred alternative presented in this
 report;
- Species at Risk permitting which could include a net benefit permit;
- The dyke is located on and/or abuts neighbouring properties that will be highly sensitive to construction impacts. Ongoing and open dialogue with neighbouring properties during the design, construction and post construction phases will be critical in ensuring optimal design while managing and mitigating impacts during and after construction. This includes working with property owners to determine their preference for restoration and landscaping; and
- Ongoing consultation with Oneida of the Thames and Chippewa of the Thames including a site walk with Elders and Traditional Knowledge Holders.

Appendix 'C' – West London Dyke Erosion Control EA Executive Summary

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

EROSION CONTROL SCHEDULE B CLASS ENVIRONMENTAL ASSESSMENT PROJECT FILE

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

Point of Contact

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.

Method of Communication and Date

Table E.1 Points of Contact

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

EROSION CONTROL SCHEDULE B CLASS ENVIRONMENTAL ASSESSMENT PROJECT FILE

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.