



West London Dyke Master Repair Plan

Public Information Centre #2
Thursday, February 23, 2012 6-9PM

Its purpose is to inform the public and to receive input with regards to the West London Dyke Master Repair Plan. The following panels describe the *history*, *recent work* and the *purposes* of this project.

Please feel free to take a handout, along with a comment sheet, which you can fill out at your convenience. Questions relating to a panel or in regards to the project in general can be answered by either City of London, Upper Thames River Conservation Authority or Stantec staff.

INTRODUCTION

The West London Dyke is 2374 m long, comprises of both a concrete and earthen revetment, and runs along the west bank of the North Branch of the Thames River from Oxford Street to the forks of the Thames River and then along the west bank of the main branch to the west side of the Wharncliffe Road Bridge. The City of London owns the dyke and through an agreement, the Upper Thames River Conservation Authority (UTRCA) undertakes major maintenance activities.

PROBLEM OPPORTUNITY STATEMENT

The UTRCA and the City of London are undertaking a Master Repair Plan covering the next 20-year period to address aging infrastructure, flood protection, public use, and integration of other City initiatives. This study is being conducted in accordance with requirements of Phases 1 and 2 of the Municipal Class Environment Assessment (Class EA) which is an approved process under the Environmental Assessment Act.

The intent of the Master Repair Plan is to develop the required strategic plan to allow the UTRCA and the City to have a method for determining when a trigger point for repair and/or replacement of a portion of the dyke is required.

West London Dyke - Study Area



Old North



St. Patrick's



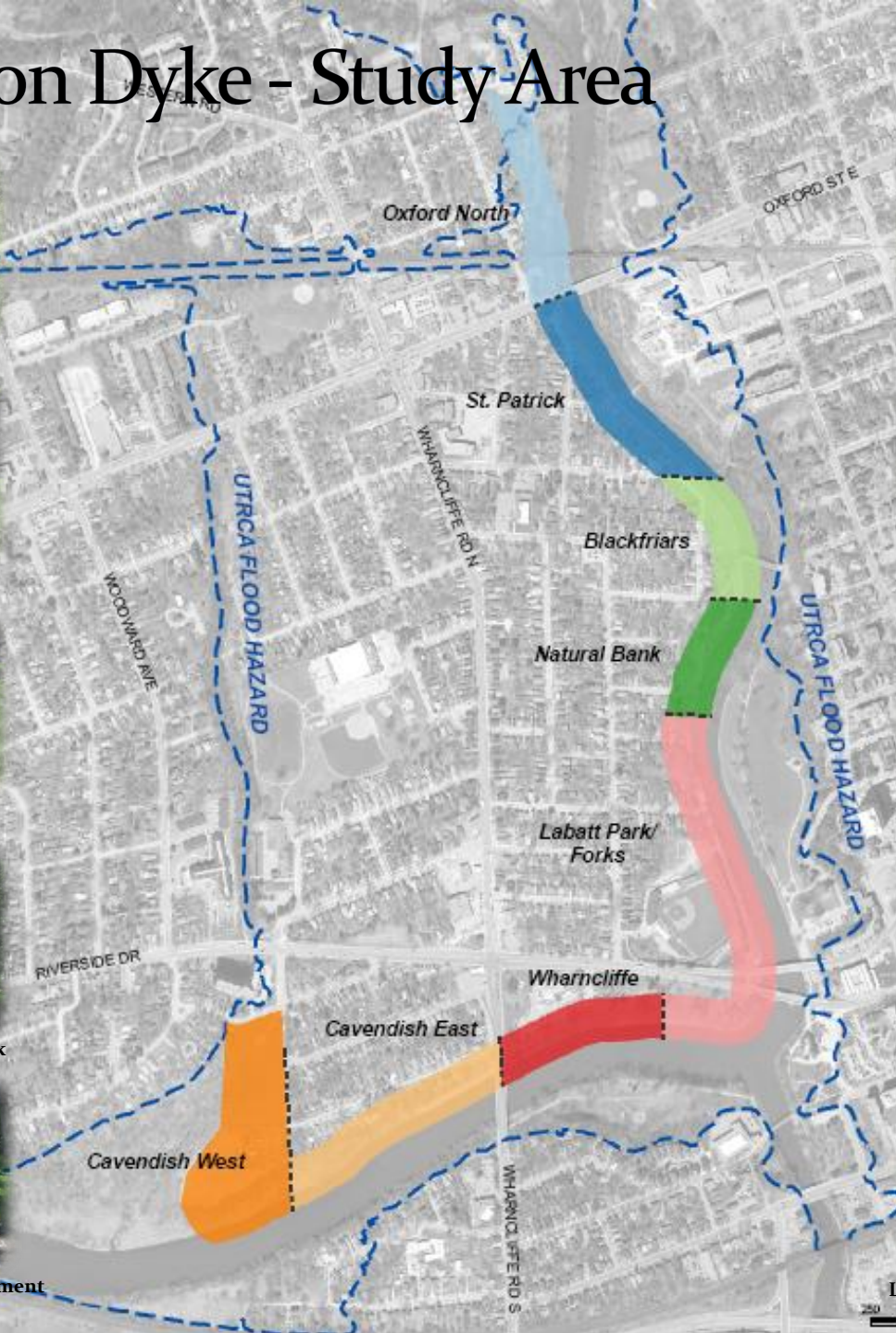
Blackfriars Bridge



Blackfriars / Approaching Natural Bank



Harris Park / Approaching Phase I Replacement



Cavendish West



Cavendish East



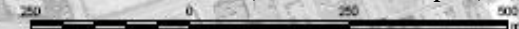
Wharncliffe



Forks (Blackburn Memorial Fountain)



Labatt Park / Forks (Pedestrian Underpass)



Historical Information

- When London was settled in the early 1800s, the Thames River offered water, a means of transportation and a power source for mills. Both natives and early settlers had used the low riverside land to the west of the Forks for farming.
- By the late 1800s, the small settlements of London West and Kensington were growing on the banks of the Thames River from their beginnings surrounding water-powered mills. The communities experienced several floods, such as the catastrophic July 1883 flood that killed 17 people. Rather than resettling away from the hazardous areas, the response was to build a formalized dyke system.
- Construction of the West London Dyke, the first of the City's seven dykes to be built, began in the late 1880s. By the early 1900s, the dyke had been reinforced, extended and raised at least twice. The flood of April 1937 overtopped the reinforcements, though, and flooded the communities behind the dyke. Additional raising of the dyke occurred after the 1937 flood on the main branch section and before the 1947 flood. In 1947 some overtopping of the dyke on the North Branch section required evacuations, although flooding was not as deep as in 1937.
- The UTRCA was formed following the 1947 Flood and resulted in a watershed management partnership between the Province of Ontario and watershed member municipalities (including the City of London) to carry out a comprehensive watershed flood control program. Besides the London Dyke system that had existed for some time, additional flood control dams, flood plain management, and land stewardship programs were implemented to further ease the flood pressure on the dykes.

West London Dyke, April 1947 Flood



Forks of the Thames, July 2000 Flood



Source: UTRCA



Forks of the Thames, July 2000 Flood

Previous Work/Rehabilitation

- 1980's Investigations & Repairs

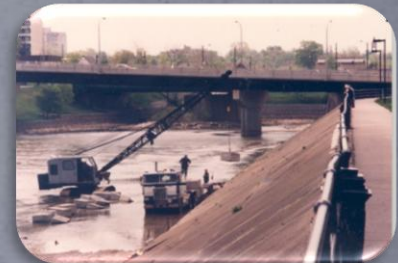
- Geotechnical Investigation undertaken in October 1982 revealed sections of revetment (dyke) in poor condition with noticeable shifting and tilting. Abrupt changes in slope of facing noted with cracking along concrete surface.
- Based on investigations undertaken, repair of select sections of dyke including grouting behind panels and improvements to toe structure were completed between 1983 and 1985.



1980's Repair Work

- 2004 Inspection

- In 2004, the UTRCA undertook a condition assessment of the Thames River dykes within the City, including the West London Dyke. Approximately 350 m of the dyke north from the Queens Avenue Bridge were identified as being the highest priority for repair. This portion was originally built in the 19th century in order to minimize flooding in the West London area.



1980's Repair Work

- 2005 Concrete Repair Program

- In 2005, while undertaking the initial stages of a concrete repair program on the 350 m segment identified in the 2004 study, it was concluded that a significant portion of this section had come to the end of its useful life and needed to be replaced rather than repaired.



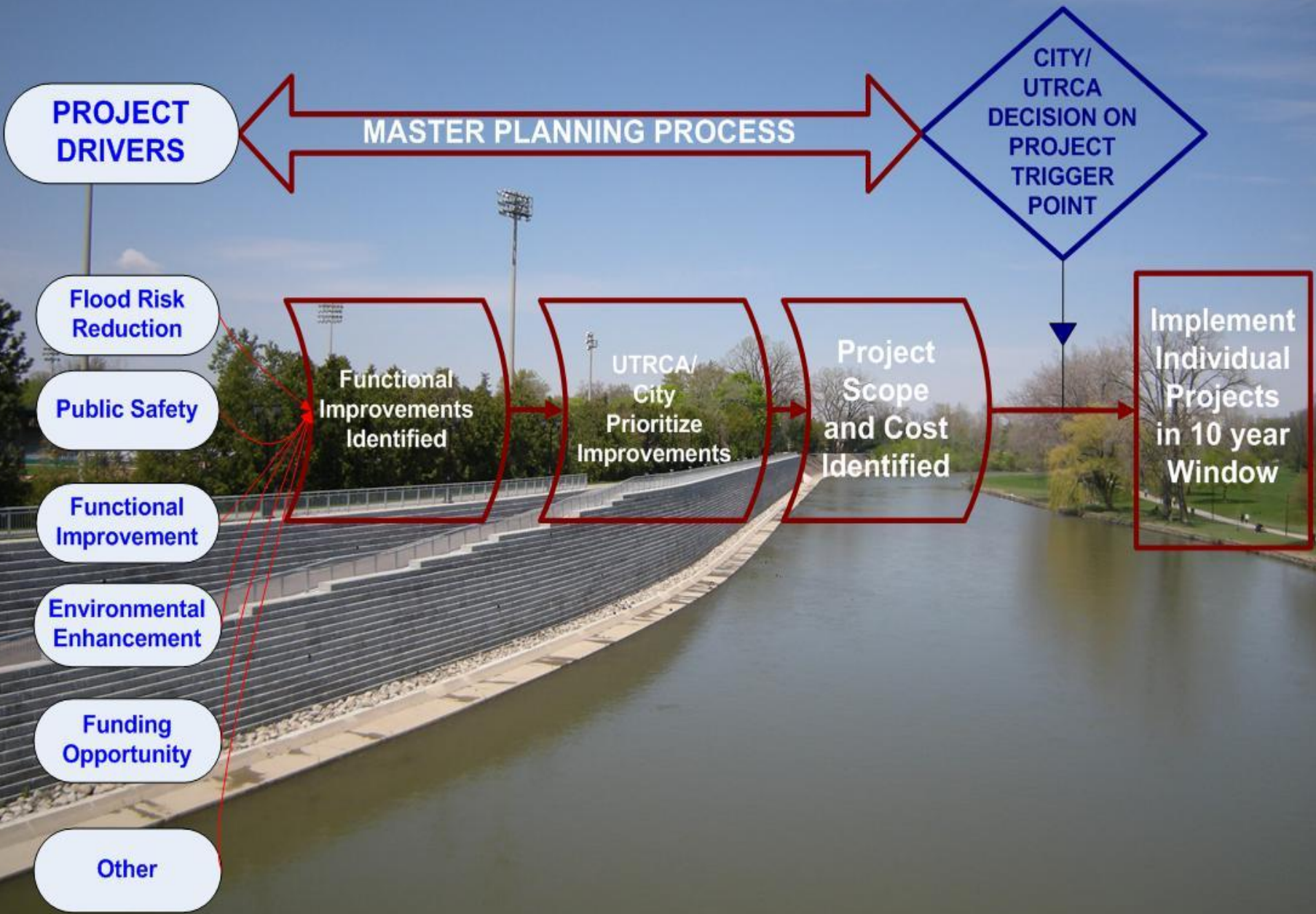
2005 Concrete Repair Program

- 2007 Phase I Dyke Replacement

- The first phase of the project (July to December, 2007) replaced a 300 metre section of the dyke north from Queens Avenue, adjacent to Labatt Park. The new dyke structure is located entirely within the footprint of the previous dyke and provided some improvement to flood height protection.
- Phase 1 was funded by the MNR Water and Erosion Control Infrastructure Program and the City of London. The total cost of the Phase 1 construction project was \$3,600,000.



2007 Phase I Dyke Replacement



EA Process / Public & Agency Input*

- The purpose of the Ontario Environmental Assessment Act (EA Act) is “the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management in Ontario of the environment”. Environment is applied broadly and includes the natural, social, cultural, built and economic components.
- Environmental Assessment (EA) is a decision making process to promote good environmental assessment planning. The key features are:
 - Early consultation
 - Consideration of reasonable range of alternatives
 - Assessment of environmental effects
 - Systematic evaluation of alternatives
 - Clear documentation and traceable decision making
- **Public Involvement**
 - The role of those members of the public with an interest in a study is to provide background information to advise the proponent (City of London / UTRCA) of their support and concerns, and to review and provide comments and input about the study findings (as the project progresses – Public Information Centre (PIC) 1 and PIC 2).
 - Members of the public with an interest in the study can ask to be placed on the mailing list to receive notification of the consultation opportunities for the project.
- **Municipal Class EA**
 - This study is being conducted in accordance with the requirements of Phases 1 and 2 of the Municipal Class EA which is an approved process under the EA Act.
 - It is anticipated to be a Schedule B Class EA.

EXHIBIT A.2

MUNICIPAL CLASS EA PLANNING AND DESIGN PROCESS

NOTE: This flow chart is to be read in conjunction with Part A of the Municipal Class EA

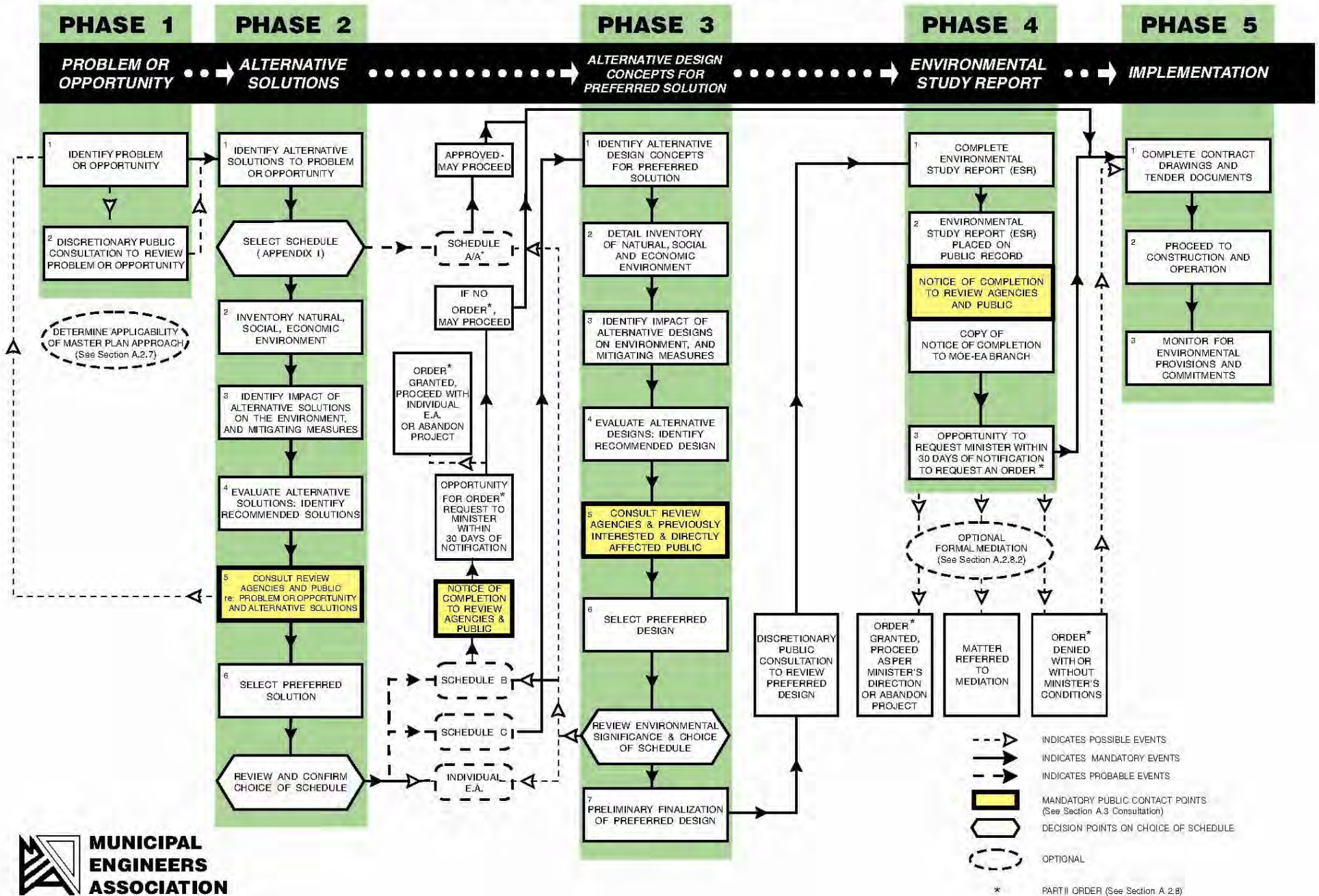


Table 10.1

Segment	Approximate Length (m)	Condition Rating	Type	Flood Elevation		Lowest Elevation (mASL)	Approx. # of Properties within Hazard Area	Est. Current Flood Damage 100yr/250yr (in \$2012)	Alternatives	Compliance with Guiding Principles		Natural Environment	Social Cultural	Economic/Financial		Future Class EA Requirements	Technical Issues / Requirements	Preferred Alternative
				100 yr (mASL)	250 yr (mASL)					Flood Protection	Amenity/Functional Improvements			Estimated Capital Costs	Estimated Maintenance Costs			
				236.30	237.37	-237.4	20	\$121,000 / \$2,145,000	Alternative 1: Do Nothing	Does not provide protection to Regulatory Flood Level	Does not provide for amenity / functional improvement opportunities including potential future pathway extension	None identified as no work is proposed	None identified as no work is proposed	None identified	Highest maintenance costs over the planning period due to concrete dike	Not applicable	Existing dike may require replacement within 20 year period due to condition.	○ Not preferred as it does not meet the guiding principles for the dike. Also, it is anticipated that structure may need replacement within 20 year horizon.
									Alternative 2: Replace w Similar Dyke (existing footprint)	Does not provide protection to Regulatory Flood Level.	Does not provide for amenity / functional improvement opportunities including potential future pathway extension	Least impact compared to Alternatives 3 and 4	Least impact compared to Alternatives 3 and 4 relating to construction activities	\$480,000	No significant maintenance costs anticipated	Schedule B	Work within vicinity of Oxford Street Bridge. No construction issues noted.	○ This option is preferred as the cost/benefit is anticipated to be significantly less than Alternative 4.
									Alternative 3: Replace w 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined	Allows opportunities for improvements including pathway upgrades (per 2007 Master Plan Concept)	Potential requirement to conduct work in river due to existing constraints and potential need to construct future pathway beneath Oxford St. Bridge, however impacts can be mitigated through best management practices.	Moderate increased impact compared to Alternative 2, but can be mitigated using best management practices.	\$650,000	No significant maintenance costs anticipated.	Schedule B	Work within vicinity of Oxford Street Bridge. In order to accommodate amenity/functional improvements, slope of dike may be increased	● Viable solution, however it does not provide protection to Regulatory Level. Opportunity to incorporate active flood protection measures due to proximity to nearby road for access.
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined	Allows opportunities for improvements including pathway upgrades (per 2007 Master Plan Concept)	Potential requirement to conduct work in river due to existing constraints and potential need to construct future pathway beneath Oxford St. Bridge, however impacts can be mitigated through best management practices.	Moderate increased impact compared to Alternative 2, but can be mitigated using best management practices.	\$685,000	No significant maintenance costs anticipated.	Schedule B	Due to limited footprint, slope of dike would need to increase to accommodate height increase. Would need to consider impact on flood storage due to reduction in cross section area.	● Preferred solution as it best meets the guiding principles. Impacts through construction can be mitigated through best management practices. Costs for enhancement are comparable to 100 year structure.
St. Patrick	350	2	Concrete Revetment with Toe	236.27-236.24	237.36-237.33	236.9	200	\$575,000 / \$6,267,000	Alternative 1: Do Nothing	Currently provides up to 100 year flood protection with ~ 0.6m freeboard. Does not meet Regulatory Flood Level requirements.	Does not provide for amenity / functional improvement opportunities	None identified as no work is proposed	None identified as no work is proposed	None identified	Highest Maintenance Costs over the planning period	Not applicable	Existing dike likely to require replacement within 20 year period due to current condition.	○ Not preferred as it does not meet the guiding principles for the dike. Existing condition of dike would indicate that replacement versus repair is likely required within the 20 year planning period.
									Alternative 2: Replace w Similar Dyke (existing footprint)	Provides up to 100 year flood protection with ~ 0.3-0.4m freeboard. Does not meet Regulatory Flood Level requirements.	Current pathway does not meet City standards. Presence of City owned land would permit potential Butterfly/Bird Watching garden	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners)	Minimal impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$4,100,000	No significant maintenance costs anticipated	Schedule B	Construction/staging constraints	○ This option is not preferred as the cost/benefit is anticipated to be significantly less than Alternative 4.
									Alternative 3: Replace w 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including potential Butterfly/Bird Watching garden near existing park (per 2007 Master Plan Concept)	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners)	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$5,500,000	No significant maintenance costs anticipated	Schedule B	In order to accommodate amenity/functional improvements, slope of dike may be increased. Construction staging and access may be difficult.	● Viable solution, however it does not provide protection to Regulatory Level. Opportunity exists to incorporate active flood protection measures due to proximity to nearby roads for access. However, significant measures would be necessary to accommodate length of entire section.
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including potential Butterfly/Bird Watching garden near existing park (per 2007 Master Plan Concept)	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners). Increase in elevation may require placement of structure closer to toe.	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$5,800,000	No significant maintenance costs anticipated	Schedule B	In order to accommodate increased height to 250 year level (+ freeboard), and amenity/functional improvements, increase dike slope may be required. Would need to consider impact on flood storage due to reduction in cross section area.	● Preferred solution as it best meets the guiding principles. Significant number of properties protected by dike in this area, therefore passive protection to 250 year level (+ freeboard) is preferable. Cost/benefit advantage over Alternative 3 is significant.
Blackfriars	260	2	Concrete Revetment with Toe	235.81-235.79	236.81-236.77	236.3	210	\$0 / \$9,005,400	Alternative 1: Do Nothing	Currently provides up to 100 year flood protection with ~ 0.5m freeboard. Does not meet Regulatory Flood Level requirements.	Does not provide for amenity / functional improvement opportunities. Difficulties along pathway noted that would require action.	None identified as no work is proposed	None identified as no work is proposed	None identified	Highest Maintenance Costs over the planning period	Not applicable	Existing dike likely to require replacement within 20 year period due to current condition.	○ Not preferred as it does not meet the guiding principles for the dike
									Alternative 2: Replace w Similar Dyke (existing footprint)	Provides up to 100 year flood protection with ~ 0.5m freeboard. Does not meet Regulatory Flood Level requirements.	Current pathway does not meet City standards. This option would not allow additional amenity/functional improvements including lookout area and pathway beneath bridge due to proximity to adjacent lands	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners)	Moderate impact based on construction activities, but can be mitigated using best management practices. No impact to Blackfriars Bridge anticipated.	\$3,100,000	No significant maintenance costs anticipated	Schedule B	Construction/staging constraints	○ This option is not preferred as the cost/benefit is anticipated to be significantly less than Alternative 4
									Alternative 3: Replace w 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including pathway beneath Blackfriars Bridge and Lookout Area (per 2007 Master Plan Concept)	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners). Staging requirements may call for removal of vegetation along south boundary.	Moderate impact based on construction activities, but can be mitigated using best management practices. No impact to Blackfriars Bridge anticipated.	\$4,400,000	No significant maintenance costs anticipated. Maintenance costs associated with pathway may be higher (impact of high water level)	Potential for Schedule C EA requirement due to presence of Blackfriars Bridge and potential transportation impacts.	In order to accommodate amenity/functional improvements, slope of dike may be increased	● Viable solution, however it does not provide protection to Regulatory Level. Opportunity to incorporate active flood protection measures due to proximity to nearby roads for access.
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including pathway beneath Blackfriars Bridge and Lookout Area (per 2007 Master Plan Concept)	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners). Staging requirements may call for removal of vegetation along south boundary.	Moderate impact based on construction activities, but can be mitigated using best management practices. No impact to Blackfriars Bridge anticipated, but likely subject to final dike elevation.	\$4,600,000	No significant maintenance costs anticipated. Maintenance costs associated with pathway may be higher (impact of high water level)	Potential for Schedule C EA requirement due to presence of Blackfriars Bridge and potential transportation impacts.	In order to accommodate amenity/functional improvements and increase in dike height, slope of dike may be increased	● Preferred solution as it best meets the guiding principles. It is anticipated that additional increase in height of ~1m (subject to review of freeboard needs) would be sufficient to provide 250 yr + protection. Significant number of properties protected by dike in this area, therefore passive protection to 250 year level (+ freeboard) is preferable. Cost/benefit advantage over Alternative 3

Table 10.1

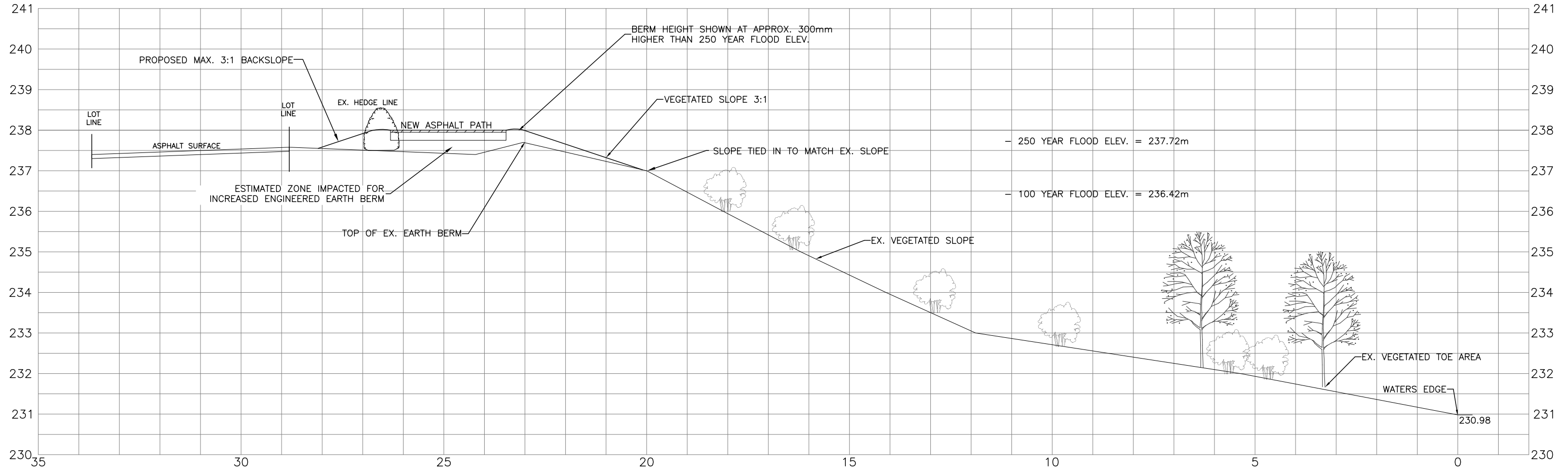
Segment	Approximate Length (m)	Condition Rating	Type	Flood Elevation		Lowest Elevation (mASL)	Approx. # of Properties within Hazard Area	Est. Current Flood Damage 100yr/250yr (in \$2012)	Alternatives	Compliance with Guiding Principles			Economic/Financial		Future Class EA Requirements	Technical Issues / Requirements	Preferred Alternative			
				100 yr (mASL)	250 yr (mASL)					Flood Protection	Amenity/Functional Improvements	Natural Environment	Social Cultural	Estimated Capital Costs				Estimated Maintenance Costs		
Natural Bank	230	4	Concrete Revestment with Naturalized Toe	235.74	236.77	236	160	\$0 / \$8,069,300	Alternative 1: Do Nothing	Currently provides up to 100 year flood protection with ~0.6m freeboard. Does not meet Regulatory Flood Level requirements.	Does not provide for amenity / functional improvement opportunities	None identified as no work is proposed.	None identified as no work is proposed.	None identified	Highest Maintenance Costs over the planning period	Not applicable	None identified.	○	Not preferred as it does not meet the guiding principles for the dyke. Invasive species in area could result in further damage to the dyke.	
				235.79	236.78					Alternative 2: Replace w Similar Dyke (existing footprint)	Provides up to 100 year flood protection with ~0.6m freeboard. Does not meet Regulatory Flood Level requirements.	Current pathway does not meet City standards. This option could still allow additional amenity/functional improvements including enhanced playground area and river access as per 2007 Master Plan Concept behind dyke	Potential significant impact to existing vegetated area. Could require substantial clearing and grubbing, however mostly invasive species noted. Marginal impact to river. Work in river not anticipated.	Moderate impact based on construction activities, but can be mitigated using best management practices. Work in river not anticipated.	\$2,500,000	No significant maintenance costs anticipated, however, if segment is to remain vegetated, minor vegetation control costs should be budgeted	Schedule B	Need to determine extent of dyke (as it is partially buried by deposition), could require significant earthworks	●	This option is not preferred as the cost/benefit is anticipated to be significantly less than Alternative 3 or 4
										Alternative 3: Replace w 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including enhanced playground area and river access (per 2007 Master Plan Concept)	Potential significant impact to existing vegetated area. Could require substantial clearing and grubbing, however mostly invasive species noted. Marginal impact to river. Work in river not anticipated.	Moderate impact based on construction activities, but can be mitigated using best management practices. Work in river not anticipated.	\$2,950,000	No significant maintenance costs anticipated, however, if segment is to remain vegetated, minor vegetation control costs should be budgeted	Schedule B	Need to determine extent of dyke (as it is partially buried by deposition), could require significant earthworks	●	Viable solution, however it does not provide protection to Regulatory Level. Would negatively impact mature vegetation along the dyke face, but could be mitigated using proper planning and best management practices.
										Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including enhanced playground area and river access (per 2007 Master Plan Concept)	Potential significant impact to existing vegetated area. Could require substantial clearing and grubbing, however mostly invasive species noted. Marginal impact to river. Work in river not anticipated.	Moderate impact based on construction activities, but can be mitigated using best management practices. Work in river not anticipated.	\$3,100,000	No significant maintenance costs anticipated, however, if segment is to remain vegetated, minor vegetation control costs should be budgeted	Schedule B	Need to determine extent of dyke (as it is partially buried by deposition), could require significant earthworks. Should not increase height significantly.	●	Preferred solution as it best meets the guiding principles. Significant number of properties protected by dyke in this area, therefore passive protection to 250 year level (+ freeboard) is probable. Cost/benefit advantage over Alternative 3 is significant.
Labatt Park/Forks	135	3	Concrete Revestment with Toe	235.74	236.78	236	340	\$0 / \$18,591,300	Alternative 1: Do Nothing	Currently provides up to 100 year flood protection with ~0.6m freeboard. Does not meet Regulatory Flood Level requirements.	Does not provide for amenity / functional improvement opportunities	None identified as no work is proposed	None identified as no work is proposed	None identified	Highest Maintenance Costs over the planning period	Not applicable	Existing dyke likely to require replacement within 20 year period due to current condition.	○	Not preferred as it does not meet the guiding principles for the dyke	
									Alternative 2: Replace w Similar Dyke (existing footprint)	Provides up to 100 year flood protection with ~0.6m freeboard. Does not meet Regulatory Flood Level requirements.	Current pathway does not meet City standards. This option could not allow additional amenity/functional improvements including look out area to Harris Park as per 2007 Master Plan Concept behind dyke	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners). Large trees located near property line likely impacted based on existing footprint.	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$1,600,000	No significant maintenance costs anticipated	Schedule B	Construction/grading constraints	●	This option is not preferred as the cost/benefit is anticipated to be significantly less than Alternative 4	
									Alternative 3: Replace w 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including pathway widening and ability to incorporate look out area depending on alignment of wall	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners). Impact to large trees located near property line may be minimized depending on placement of wall.	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$1,775,000	No significant maintenance costs anticipated	Schedule B	In order to accommodate amenity/functional improvements, slope of dyke may be increased	●	Viable solution, however it does not provide protection to Regulatory Level. Opportunity to incorporate active flood protection measures due to proximity to nearby roads for access.	
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including pathway widening and ability to incorporate look out area depending on alignment of wall	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners). Impact to large trees located near property line may be minimized depending on placement of wall.	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$1,900,000	No significant maintenance costs anticipated	Schedule B	Consider same type of dyke structure as Phase 1 for continuity connection at Rogers Ave	●	Preferred solution as it best meets the guiding principles. It is anticipated that additional increase in height of ~1m (subject to review of freeboard needs) would be sufficient to provide 250 yr + protection. Cost/benefit advantage over Alternative 3 is significant.	
	300	4	Concrete Modular Block Wall with Geogrid (2007 - 2009 Replacement Project)	235.64	236.64	236.8			Alternative 1: Do Nothing	Current structure provides up to Regulatory Flood Level + 0.3m Freeboard	Amenity/functional improvements identified in 2007 construction	None identified as no work is proposed	None identified as no work is proposed	Not applicable	Minor maintenance required, primarily along lower pathway.	Not applicable	Not applicable	●	Preferred solution. No additional work required based on current Regulatory Flood Level and amenity/functional requirements.	
				235.74	236.78				Alternative 2: Replace w Similar Dyke (existing footprint)										○	Not applicable. Structure constructed in 2007 and not anticipated to require replacement within 20 year planning period
									Alternative 3: Replace w 100 yr + Freeboard										○	Not applicable. Structure constructed in 2007 and not anticipated to require replacement within 20 year planning period
									Alternative 4: Replace with 250 yr + Freeboard										○	Not applicable. Structure constructed in 2007 and not anticipated to require replacement within 20 year planning period
	75	4	Natural Bank with Gabion Toe	235.64	236.64	236.2	0		Alternative 1: Do Nothing	Currently provides up to 100 year flood protection with ~0.1-0.4m freeboard. Does not meet Regulatory Flood Level requirements.	Does not provide for amenity / functional improvement opportunities	None identified as no work is proposed	None identified.	Not applicable.	Maintenance costs associated with vegetation control.	Not applicable.	Not applicable.	○	Viable alternative as amenity improvements can be integrated without dyke upgrades. Does not meet the Regulatory Flood Level, however less impacted properties in this area, therefore cost benefit of raising the structure is less.	
				235.49	236.42				Alternative 2: Replace w Similar Dyke (existing footprint)										○	This option not applicable to earth dyke segments as it is generally no different than the "Do Nothing" option or Alternative 3.
									Alternative 3: Replace w 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined.	Forks of the Thames Phase 4 completed. Not known whether additional amenity/functional improvements are required.	No significant impact anticipated due to working area present. Return to prior natural/vegetated conditions.	None identified.	\$240,000	Depends on type of dyke selected and amenity requirements. Not anticipated to be significantly higher costs than existing dyke maintenance	Schedule A (no work anticipated in river)	None identified	●	Viable solution, however it does not provide protection to the Regulatory Flood Limit. Adequate land behind dyke would make Alternative 4 more preferable.	
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined.	Forks of the Thames Phase 4 completed. Not known whether additional amenity/functional improvements are required.	No significant impact anticipated due to working area present. Return to prior natural/vegetated conditions.	None identified.	\$280,000	Depends on type of dyke selected and amenity requirements. Not anticipated to be significantly higher costs than existing dyke maintenance	Schedule A (no work anticipated in river)	None identified	●	Preferred solution as it best meets the guiding principles and assuming additional flood protection accomplished by means of berm enhancements. It is anticipated that additional increase in height of ~0.5m (subject to review of freeboard needs) would be sufficient to provide 250 yr + protection. Cost/benefit advantage is marginal, however, due to smaller impacted area.	

Table 10.1

Segment	Approximate Length (m)	Condition Rating	Type	Flood Elevation		Lowest Elevation (mASL)	Approx. # of Properties within Hazard Area	Est. Current Flood Damage 100yr/250yr (in \$000)	Alternatives	Compliance with Guiding Principles		Natural Environment	Social Cultural	Economic/Financial		Future Class EA Requirements	Technical Issues / Requirements	Preferred Alternative				
				100 yr (mASL)	250 yr (mASL)					Flood Protection	Amenity/Functional Improvements			Estimated Capital Costs	Estimated Maintenance Costs							
										Potential impacts to the natural environment due to siting requirements	Short-term construction related impacts including traffic, noise, access	Initial cost to undertake the alternative	Estimated maintenance and/or operational requirements	Anticipated Class EA requirements to implement project		Ability to implement alternative						
															Consideration for constructability of proposed solution, timing, potential for disruptions							
															Ability of the solution to suit potential regulatory requirements							
Warracloffe	380	4	Natural Bank with Gabion Toe	235.50-235.53	236.45-236.26	235.5	1	\$1,118,000 / \$1,162,000	Alternative 1: Do Nothing	Currently provides up to 100 year flood protection with little to no freeboard. Does not meet Regulatory Flood Level requirements.	Capable of implementing amenity or functional improvements separately within the area due to its size.	None identified as no work is proposed	None identified as no work is proposed.	Not applicable	Maintenance costs associated with vegetation control.	Not applicable.	Not applicable.	○	Not preferred as it does not meet the guiding principles for the dyke			
									Alternative 2: Replace with Similar Dyke (existing footprint)												X	This option not applicable to earth dyke segments as it is generally no different than the "Do Nothing" option or Alternative 3.
									Alternative 3: Replace with 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined.	Capable of implementing amenity or functional improvements separately within the area due to its size.	No significant impacts expected as construction could proceed out of river. Minor repairs to existing gabions may be required at rivers edge.	None identified	\$1,200,000	Maintenance costs associated with vegetation control.	Schedule A (no work anticipated in river), Schedule B (if work in river is required).	May need to relocate pathway.	●	Viable solution, however it does not provide protection to the Regulatory Limit. Adequate land behind dyke would make Alternative 4 more preferable without a significant increase in cost.			
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined.	Capable of implementing amenity or functional improvements separately within the area due to its size.	No significant impacts expected as construction could proceed out of river. Minor repairs to existing gabions may be required at rivers edge.	None identified	\$1,400,000	Maintenance costs associated with vegetation control.	Schedule A (no work anticipated in river), Schedule B (if work in river is required).	May need to relocate pathway.	●	Preferred solution as it best meets the guiding principles and assuming additional flood protection accomplished by means of berm enhancements. It is anticipated that additional increase in height of ~0.5m (subject to review of freeboard needs) would be sufficient to provide 250 yr + protection. Cost/benefit advantage is marginal, however, due to smaller impacted area.			
Cavendish East	160	3	Concrete Revetment with Toe	235.26	236.17	233.5	70	\$3,465,500 / \$5,109,300	Alternative 1: Do Nothing	Does not provide protection to Regulatory Flood Level	Does not provide for amenity / functional improvement opportunities including potential future pathway extension	None identified as no work is proposed	None identified as no work is proposed	Not applicable	Highest maintenance costs compared to other alternatives over the planning period	Not applicable	Existing dyke likely to require replacement within 20 year period due to current condition.	○	Not preferred as it does not meet the guiding principles for the dyke			
									Alternative 2: Replace with Similar Dyke (existing footprint)	Does not provide protection to Regulatory Flood Level	Does not provide for amenity / functional improvement opportunities including potential future pathway extension or construction of pathway at top of dyke.	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners)	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$1,950,000	No significant maintenance costs anticipated	Schedule B (work in river anticipated)	Construction/staging constraints	○	This option is not preferred as the cost/benefit is anticipated to be significantly less than Alternative 3 or 4			
									Alternative 3: Replace with 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level. Additional freeboard to be determined	Allows opportunities for improvements including pathway construction depending on alignment of wall.	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners)	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$3,150,000	No significant maintenance costs anticipated. Maintenance costs associated with pathway may be higher (impact of high water level)	Schedule B (work in river anticipated)	In order to accommodate amenity/functional improvements, slope of dyke may be increased	●	Viable solution, however it does not provide protection to the Regulatory Limit. Could potentially implement active flood control measures.			
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level. Additional freeboard to be determined.	Allows opportunities for improvements including pathway construction depending on alignment of wall.	Potential requirement to conduct work in river due to existing constraints (proximity to adjacent landowners)	Moderate impact based on construction activities, but can be mitigated using best management practices. May require work in river.	\$3,300,000	No significant maintenance costs anticipated. Maintenance costs associated with pathway may be higher (impact of high water level)	Schedule B (work in river anticipated)	In order to replace dyke to 250 yr, area available for construction may result in increased slope of dyke, similar to Phase I structure (also to minimize benefit)	●	Preferred solution as it best meets the guiding principles.			
Cavendish West	220	4	Natural Bank with Berms	235.24-235.04	236.16-235.97	~236	0	\$385,100 / \$667,700	Alternative 1: Do Nothing	Does not provide protection to Regulatory Flood Level	Does not provide for amenity / functional improvement opportunities	None identified as no work is proposed	None identified as no work is proposed	Not applicable	Maintenance costs associated with vegetation control	Not applicable	Not applicable	○	Not preferred as it does not meet the guiding principles for the dyke			
									Alternative 2: Replace with Similar Dyke (existing footprint)											X	This option not applicable to earth dyke segments as it is generally no different than the "Do Nothing" option or Alternative 3.	
									Alternative 3: Replace with 100 yr + Freeboard	Does not provide protection to Regulatory Flood Level.	Capable of implementing amenity or functional improvements (signage) within the area due to its size.	Mature trees along this section, could impose constraints on construction.	None identified	\$1,000,000	Maintenance costs associated with vegetation control	Schedule A (no work anticipated in river)	Significant mature vegetation to address during construction	●	Viable solution, however it does not provide protection to the Regulatory Limit.			
									Alternative 4: Replace with 250 yr + Freeboard	Provides protection to Regulatory Flood Level	Capable of implementing amenity or functional improvements (signage) within the area due to its size.	Mature trees along this section, could impose constraints on construction.	None identified	\$1,200,000	Maintenance costs associated with vegetation control	Schedule A (no work anticipated in river)	Significant mature vegetation to address during construction	●	Preferred solution as it meets the guiding principles. Would negatively impact mature vegetation along the dyke face, but could be mitigated using proper planning and best management practices.			

Note:
 1) Estimated capital cost includes construction cost, engineering costs at 12.5%, architectural costs at 2%, and geotechnical/environmental costs at 1.5%.
 2) Denotes total estimated cost in 2012 dollars. Refer to Table 10.2 for potential costs associated with segmenting of work.
 3) X - Denotes non-applicable action.

APPROXIMATE STATION -0+015



MARCH 2011



Stantec

Stantec Consulting Ltd.

800-171 Queens Avenue
 London ON Canada
 N6A 5J7
 Tel. 519.645.2007
 Fax. 519.645.6575
 www.stantec.com

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Client/Project

UTRCA
 WEST LONDON DYKE
 MASTER REPAIR PLAN

Figure No.

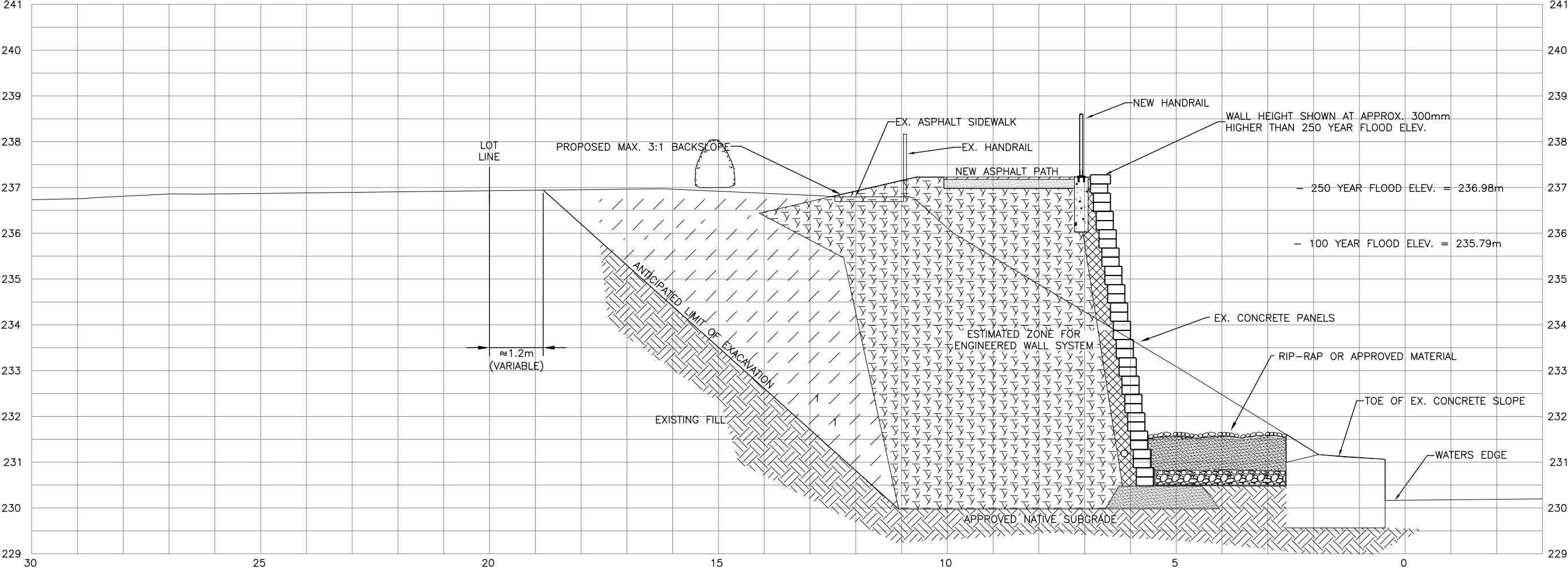
3

Title

SECTION 1 - OXFORD NORTH

APPROXIMATE STATION 0+565

CONCEPTUAL WALL PLACED IN APPROX. CENTER OF EXISTING STRUCTURE. LOCATION SUBJECT TO CHANGE.



ORIGINAL SHEET - ANSI B



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 London ON Canada
 N6A 5J7
 Tel. 519.645.2007
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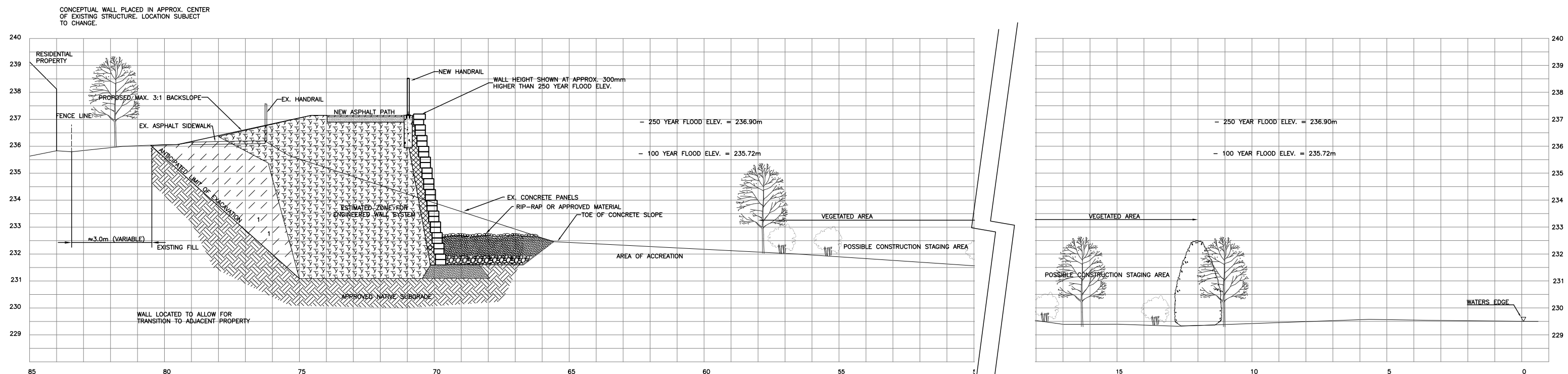
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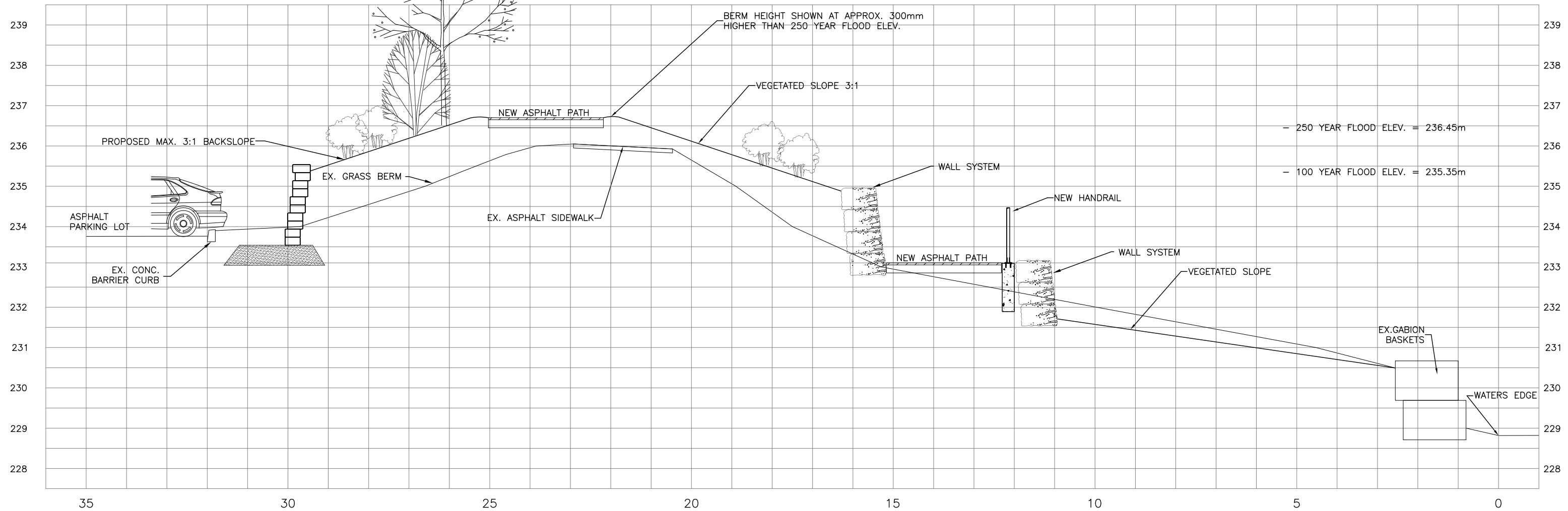
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 UTRCA
 WEST LONDON DYKE
 MASTER REPAIR PLAN
 Figure No.
 5
 Title
 SECTION 3 - BLACKFRIARS

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APPROXIMATE STATION 1+750



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800-171 Queens Avenue
 London ON Canada
 N6A 5J7
 Tel. 519.645.2007
 Fax. 519.645.6575
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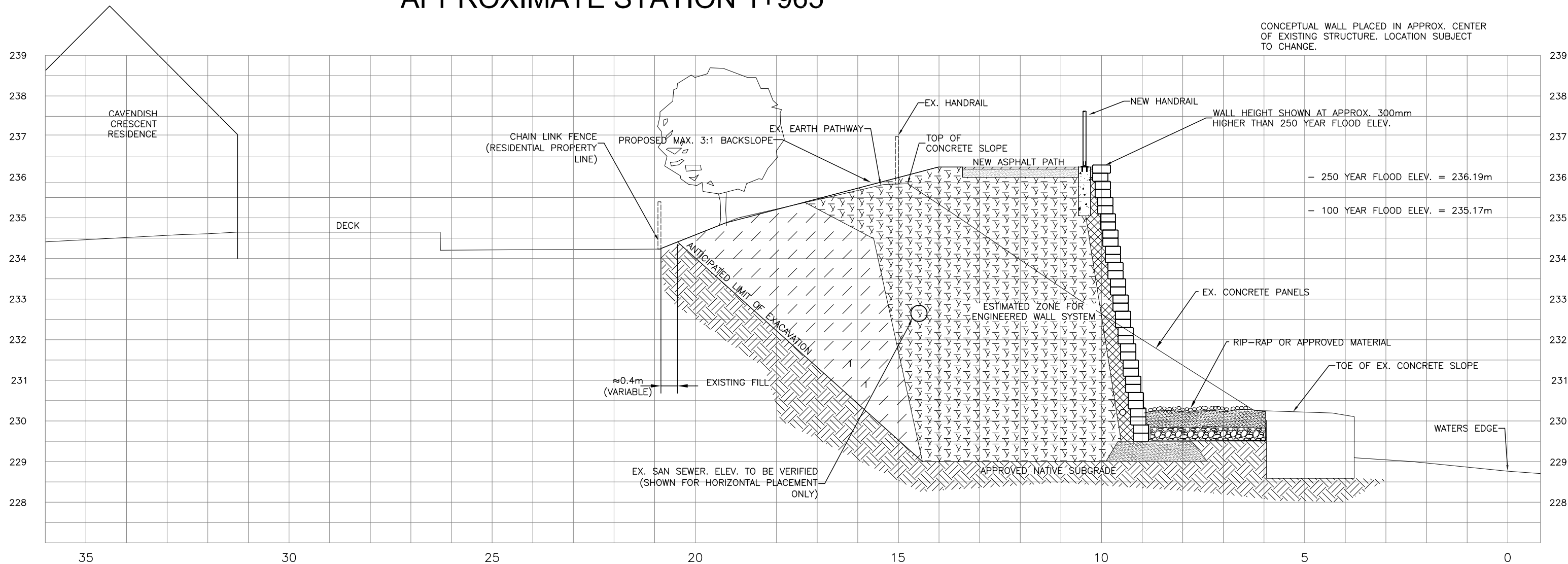
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8

Title

SECTION 6 - WHARNCLIFFE

APPROXIMATE STATION 1+965



EST. CROSS SECTION REFLECTS MAX. HEIGHT OF WALL AT PROPOSED PLACEMENT WITHOUT IMPACT TO ADJACENT PROPERTIES. INCREASE IN HEIGHT BEYOND 250YEAR + 0.3m FREEBOARD WOULD LIKELY REQUIRE FURTHER ENCROACHMENT TOWARDS THE RIVER OR ALTERNATE BACKSLOPE.

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ORIGINAL SHEET - ANSI B



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800-171 Queens Avenue
 London ON Canada
 N6A 5J7
 Tel. 519.645.2007
 Fax. 519.645.6575
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Figure No.

9

Title

SECTION 7 - CAVENDISH EAST



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800-171 Queens Avenue
 London ON Canada
 N6A 5J7
 Tel. 519.645.2007
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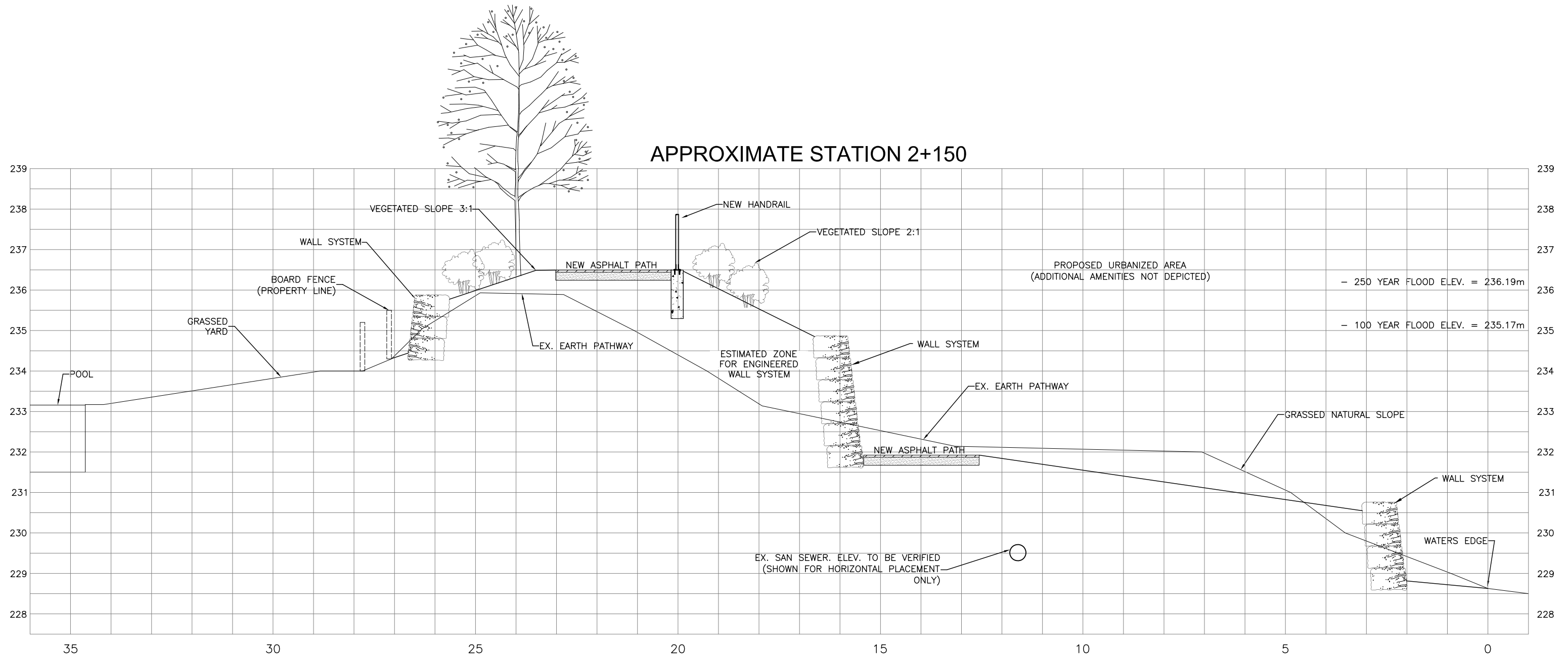
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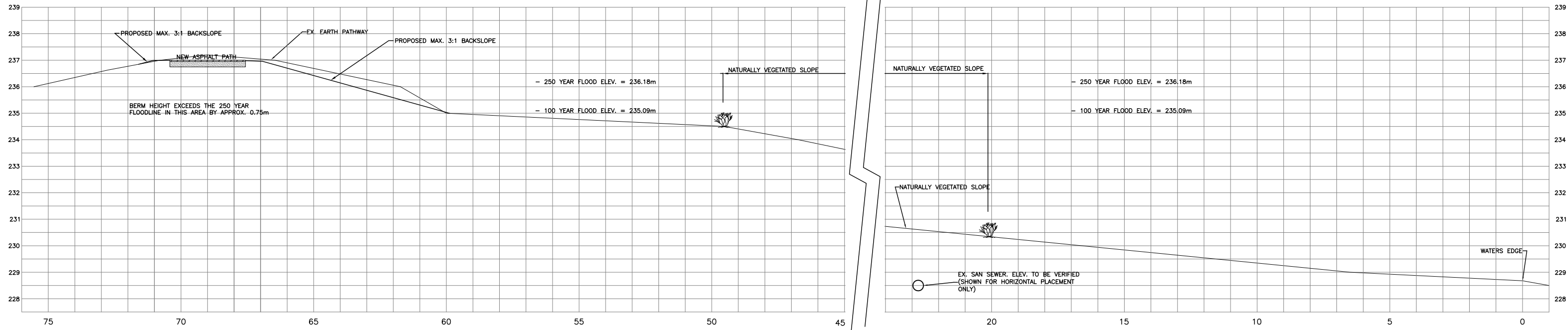
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SECTION 8 - CAVENDISH EAST

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APPROXIMATE STATION 2+385



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 Fax. 519.645.6575
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Figure No.

11

Title

SECTION 9 - CAVENDISH WEST