Appendix A CONTACT LIST

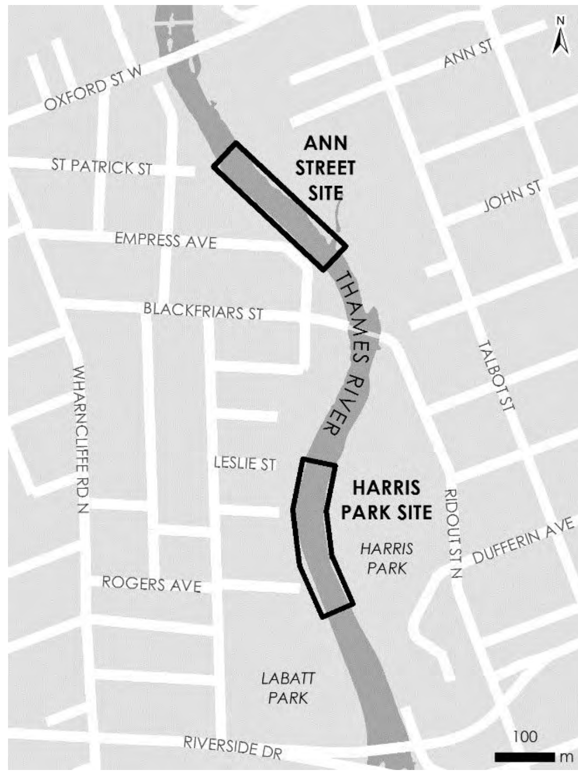
West London Dyke Erosion Control
Municipal Class Environmental Assessment
Stakeholder Contact List

Interest	Agency	Title	First Name	Last Name	Department	Title	Address	City	Pr	Postal	Phone	Email	
Provincial Contacts													
Federal	Fisheries and Oceans Canada	Mr.	Rob	Dobos	Environmental Protection	Manager	867 Lakeshore Road, 5th Fl Office L509	Burlington	ON	L7S 1A1		rob.dobos@canada.ca	
Provincial	Infrastructure Ontario	Mr.	Peter	Reed	Planning		1 Dundas St.W. Suite 2000	Toronto	ON	M5G 2L5			
Provincial	Ministry of Natural Resources and Forestry	Ms.	Kathryn	Markham	Aylmer District	District Planner	615 John Street North	Aylmer	ON	N5H 2S8		kmarkham@ontario.ca	
Provincial	Ministry of the Environment and Climate Change	Mr.	Craig	Newton	Southwestern Region	Regional Environmental Assessment Coordinator	733 Exeter Road	London	ON	N6E 1L3			
Provincial	Ministry of the Environment and Climate Change				Environmental Assessment & Approvals Branch	Director	135 St. Clair Avenue West, 1st Floor	Toronto	ON	M4V 1P5			Email only completion notice
Provincial	Ministry of Tourism, Culture and Sport	Mr.	Joseph	Muller	Culture Services Unit	Heritage Planner	401 Bay Street, Suite 1700	Toronto	ON	M7A 0A7			
Local Government													
Local	City of London	Ms.	Cathy	Saunders	City Clerk's Office	City Clerk	300 Dufferin Avenue, 3rd Floor	London	ON	N6A 4L9			
Local	City of London	Mr.	Scott	Mathers	Environmental and Engineering Services	Director, Water and Wastewater	300 Dufferin Avenue, 3rd Floor	London	ON	N6A 4L9		smathers@london.ca	
Local	City of London	Mr.	Jeff	Bruin	Environmental and Parks Planning	Manager, Parks and Open Space Design	267 Dundas Street, 3rd Floor	London	ON	N6A 1H2			
Local	City of London	Mr.	Andrew	MacPherson	Environmental and Parks Planning	Manager	267 Dundas Street, 3rd Floor	London	ON	N6A 1H2			
Local	City of London	Mr.	Chris	McIntosh	Environmental and Engineering Services	Environmental Services Engineer, Manager of Industrial Land Developme	300 Dufferin Avenue, 3rd Floor	London	ON	N6A 4L9		mcintosh@london.ca	
Local	City of London	Ms.	Anna	Hopkins	Ellected Officials/Councillor's Office	Ward 9 Councillor	300 Dufferin Avenue, 3rd Floor	London	ON	N6A 4L9			
Local	City of London	Ms.	Tanya	Park	Elected Officials/Councillor's Office	Ward 13 Councillor	300 Dufferin Avenue, 3rd Floor	London	ON	N6A 4L9		tpark@london.ca	
Local Contacts													
Local	Thames River Anglers Association						2202 Coronation Drive	London	ON	N6G 0B9			
UTRCA	Upper Thames River Conservation Authority	Ms.	Sandy	Levin		UTRCA Board Member	1424 Clarke Road	London	ON	N5V 5B9			
Middlesex	Middlesex-London Health Unit		Fatih	Sekercioglu	Manager, Safe Water, Rabies and Vector Borne Disease		50 King Street	London	ON	N6A 5L7	T:519.663.5317 ext.2	fatih.sekercioglu@mlhu.on.ca	
London	London Police Services	Sgt.	Ryan	Scrivens			601 Dundas Street	London	ON	N6B 1X1	T:519.661.5670	0	
London	London Hydro	Mr.	Rod	Doyle		Distribution Engineer	P.O. Box 2700	London	ON	N6A 4H6	519-661-5800 ext. 45	doyler@londonhydro.com	
Rogers/London	Rogers Cablesystems Utilities Coordinating Committee	Mr.	Ted	Feeney			800 York St.	London	ON	N5W 2S9	T:519.660.7527F:519.672.0199		
Bell/London	Bell Canada	Mr.	Jeff	Holmes	Access Network Facilities		100 Dundas Street, 4th Floor	London	ON	N6A 4L6	T:519.663.6105F:519	0	
London	Union Gas	Mr.	Taylor	Jones		Construction Project Manager	108 Commissioners Road West	London	ON	N6A 4P1	T:519.667.4142F:519	TLJones3@uniongas.com	
Local	Thames Region Ecological AssociationC/O Grosvenor Lodge	Mr.	Paul	Bolaga			1017 Western Road	London	ON	N6G 1G5			
Local	Advisory Committee on the Environment, City of London	Ms.	Jerry	Bunn		Committee Secretary	300 Dufferin Avenue	London	ON	N6A 4L9	T:519.661.2500 ex 54	jbunn@london.ca	
Local	London Canoe Club						P.O. Box 24010 Westown RPO	London	ON	N6H 5C4		information@londoncanoeclub.ca	
Local	Nature London	Ms.	S.	Levin								s.levin@sympatico.ca	
Local	McIlwraith Field Naturalists		Gail	McNeil	Nature London		Box 24008	London	ON	N6H 5C4		gcmcneil@ody.ca; info@naturelondon.ca	
Local	Middlesex Western Rowing Club						4212 Hamilton Road	Dorcheste	ON	N0L1G3	T:519.453.1288		
Local	Natural Outdoor Activity Heritage Conservation Club	Mr.	Todd	Sleeper							T:519.452.5485C:519	todd.sleeper@emdiesels.com	
Local	Ontario Federation of Anglers and Hunters, Zone J						1758 Gainsborough Road	London	ON	N6H 5L2	T:519.641.8540	ofah@ofah.org	
Local	Thames Valley Trail Association	Mr.	Kirk	Johnson								kjsm.johnson@gmail.com	
Local	Urban League of London	Mr.	Stephen	Turner			1017 Western Road	London	ON	N6G 1G5	T:519.645.2845	stephenturner@sympatico.ca	
Local	London Cycling Advisory Committee	Ms.	Jackie	Martin		Committee Secretary	300 Dufferin Avenue	London	ON	N6A 4L9		jmartin@london.ca	
Local	Western Ontario Fish and Game Protective Association	Mr.	Stan	Gibbs			790 Southdale Rd. East	London	ON	N6E 1A8	T:519.681.2370		
Local	Blackfriars Neighbourhood Association	Ms.	Susan	Jory-Spindler								susan@susanjoryinteriors.com	
Aboriginal Contacts													
Local	Chippewas of the Thames	Chief	Henry	Myeengun		Chief	320 Chippewa Road RR1	Muncey	ON	N0L 1Y0	519-289-5241	myeegun@cottfn.com	
Local	Chippewas of the Thames	Ms.	Rochelle	Smith	Lands and Resources	Consultation Coordinator	320 Chippewa Road RR1	Muncey	ON	N0L 1Y1	T:519.289.2662 ext 2	rsmith@cottfn.com	
Local	Oneida Nation of the Thames	Chief	Randall	Phillips			2212 Elm Avenue	Southwold	ON	N0L 2G0	T: 519-652-6161	randall.phillips@oneida.on.ca	
Local	Oneida Nation of the Thames	Ms.	Catherine	Cornelius		Political Chief Assistant	2212 Elm Avenue	Southwold	ON	N0L 2G0	T: 519-652-6161	Catherine.cornelius@oneida.on.ca	
Local	Munsee-Delaware Nation	Chief	Roger	Thomas		-	289 Jubilee Road	Muncey	ON	N0L 1Y0	T:519-289-5396 Ext.	chief.thomas@munsee-delaware.org	
Local	Munsee-Delaware Nation	Mr.	Glenn	Forrest		Band Manager	289 Jubilee Road	Muncey	ON	N0L 1Y0	T:519-289-5396 Ext.	glenn@munsee.ca	
Local	Delaware Nation	Chief	Denise	Stonefish		-	14760 School House Line RR #3	Thamesvill	ON	N0P 2K0	T: 519.692.3936 F: 5	denise.stonefish@delawarenation.on.ca	
Local	Bkejwanong Territory (Walpole Island)	Chief	Dan	Miskokomon		-	117 Tahgahoning Road RR #3	Wallacebu	ON	N8A 4K9	T.(519) 627-1481	drskoke@wifn.org	
Local	Bkejwanong Territory (Walpole Island)	Ms.	Janet	Macbeth		Project Review Coordinator	117 Tahgahoning Road RR #3	Wallacebu	ON	N8A 4K9	T: 519.627.1475 Ext	janet.macbeth@wifn.org	
Local	Bkejwanong Territory (Walpole Island)	Dr.	Dean	Jacobs		Consultation Manager	117 Tahgahoning Road RR #3	Wallacebu	ON	N8A 4K9	T: 519.627.1475 Ext	dean.jacobs@wifn.org	
Local	Caldwell First Nation	Mr.	Allen	Deleary		Director of Operations	P.O.Box 388	Leamingto	ON	N8H 3W3	T: 519.322-1766	allen.deleary@caldwellfirstnation.ca	
Local	Chippewas of Kettle and Stony Point First Nation	Chief	Tom	Bressette			6247 Indian Lane	Forest	ON	N0N 1J0	T: 519-786-2125	Thomas.bressette@kettlepoint.org	
Local	Chippewas of Kettle and Stony Point First Nation	Ms.	Valerie	George		Consultation Coordinator	6247 Indian LaneRR#2	Forest	ON	N0N 1J0	T: 519.786.2125 F: 5	valerie.george@kettlepoint.org	
Local	Aamjiwnaang First Nation	Chief	Joanne	Rogers		-	978 Tashmoo Avenue	Sarnia	ON	N7T 7H5	T: 519.336.8410 F: 5	chief@aamjiwnaang.ca	
Local	Aamjiwnaang First Nation	Ms.	Sharilyn	Johnston		Environment Coordinator	978 Tashmoo Avenue	Sarnia	ON	N7T 7H5	T: 519.336.8410 ext.	sjohnston@aamjiwnaang.ca	

Appendix B PUBLIC CONSUTLATION AND PUBLIC INFORMATION CENTRE MATERIALS

West London Dyke Erosion Control
Municipal Class Environmental Assessment
Notice of Study Commencement

The Upper Thames River Conservation Authority, in coordination with the City of London, are undertaking a Municipal Class Environmental Assessment (Class EA) to identify preferred solutions for addressing erosion and scour conditions in two areas along the West London Dyke: the Anne Street Site, and the Harris Park Site. The study is being undertaken in accordance with the Municipal Engineers Association Municipal Class EA process (2000, as amended in 2007, 2011, and 2015).



Why are we undertaking the study?

Both structures, the Ann Street Weir at the Ann Street Site and the rock vanes at the Harris Park Site, direct the flow of the Thames River in a manner that could compromise the foundation of the West London Dyke. The Class EA is being undertaken to identify and evaluate alternative solutions that mitigate future erosion at these sites. Alternatives to be considered include structure and/or shoreline modifications, partial or complete removal of structures, added dyke toe protection, or a combination thereof.

How can I participate in the study?

The study team encourages you to provide input for consideration in the study. To be added to the study contact list, or provide information on existing conditions within these two areas of the Thames River, please contact a member of the study team listed below. A Public Information Centre (PIC) will be held early in 2018 to present more information on the study and alternatives considered.

Cameron Gorrie, P.Eng.
Project Manager, Stantec Consulting Ltd.
(519) 675-6650
cameron.gorrie@stantec.com

Stephanie Bergman, MA, ENV SP
Planner, Stantec Consulting Ltd.
(519) 675-6614
stephanie.bergman@stantec.com

All correspondence received with respect to this study will be kept on file for use during the decision making process, and will become part of the public record. Under the Municipal Freedom of Information and Protection of Privacy Act, and the Environmental Assessment Act, unless otherwise stated in the submission, personal information such as name, address, telephone number, and property location included in a submission may become part of the public record, and will be released, if requested, to any person.

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West London Dyke Erosion Control
Municipal Class Environmental Assessment
Notice of Public Information Centre

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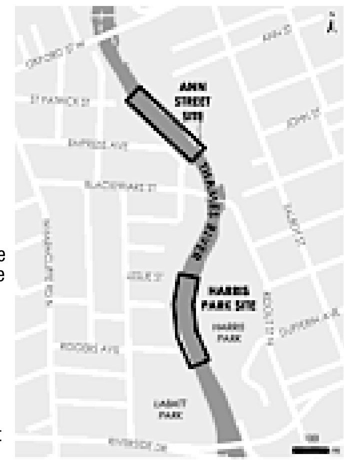

How can I participate in the study?
A Public Information Centre (PIC) is being held to provide background information on the study, an overview of the existing conditions, alternative solutions considered, preliminary recommendations, and environmental mitigation. We encourage you to attend the PIC and provide comments on the study. Presentation materials will be made available online following the PIC (www.thamesriver.on.ca). Alternatively, contact a member of the study team to request a copy of the presentation materials, to be added to the study contact list, or provide comment on the study.

Date **Tuesday, February 13th, 2018**
Time **4:30pm-6:30pm (open-house)**
Location **Kinsman Recreation Centre**
20 Granville Street, London, ON

Cameron Gorrie, P.Eng.
Project Manager, Stantec Consulting Ltd.
(519) 675-6650
cameron.gorrie@stantec.com

Stephanie Bergman, MA, ENV SP
Planner, Stantec Consulting Ltd.
(519) 675-6614
stephanie.bergman@stantec.com

All correspondence received with respect to this study will be kept on file for use during the decision making process, and will become part of the public record. Under the Municipal Freedom of Information and Protection of Privacy Act, and the Environmental Assessment Act, unless otherwise stated in the submission, personal information such as name, address, telephone number, and property location included in a submission may become part of the public record, and will be released, if requested, to any person.

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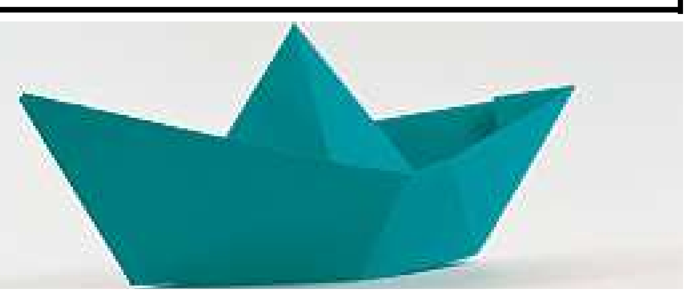


Welcome!

Public Information Centre (PIC)
West London Dyke Erosion Control
Municipal Class Environmental Assessment

Members of the study team are available to answer any questions you may have.

We encourage you to tell us your thoughts on the information presented!

Fraser Brandon-Sutherland, EIT
UTRCA

Cameron Gorrie, P. Eng.
Stantec

Brad Fairley, MES
Stantec

Stephanie Bergman, Planner
Stantec

Chris McIntosh, P. Eng.
City of London

Purpose of Tonight's PIC

We are here tonight to:

- Provide an overview of the Municipal Class EA process
- Provide a description of the problems being addressed
- Provide an overview of the existing environmental conditions
- Present the list of alternative solutions
- Provide an overview of the evaluation and ***preliminary*** recommendations for public review and comment
- Answer questions and get your feedback

We want ***your*** input!
Ask questions and share your input with the team.

Please fill out a comment sheet and leave it in the box provided, or submit comments directly to the study team.

UPPER THAMES RIVER CONSERVATION AUTHORITY

Stantec

Definitions and Acronyms

- **WLD**: West London Dyke flood control structure
- **TVP**: Thames Valley Parkway trail system
- **Scour**: The process of wearing away river bed or bank material caused by the flow of water. Another term for 'erosion' when referring to river processes
- **Weir**: a structure that modifies flow characteristics of a river
- **Vanes:** structures within a riverbed used to slow and direct flow.
- **Fluvial Geomorphology:** the study of the way flowing water shapes the land
- **Riffle:** a rocky, shallow part of a stream – riffles positively contribute to aquatic habitats by providing diversity in the river bed, and improve water quality through oxygenation
- **EA**: Environmental Assessment – a holistic process of evaluating a project's impact on the social, cultural, natural, economic and technical environments
- **Toe**: base or foundation of the WLD flood control structure

What is a Municipal Class Environmental Assessment (Class EA)?

- A process approved under the *Environmental Assessment Act* which municipalities follow for the planning and design of municipal infrastructure projects
- This study is being undertaken as a **Schedule B project**, which follows Phases 1 and 2 of the planning process:

PHASE 1 Project Initiation

PHASE 2 Alternative Solutions

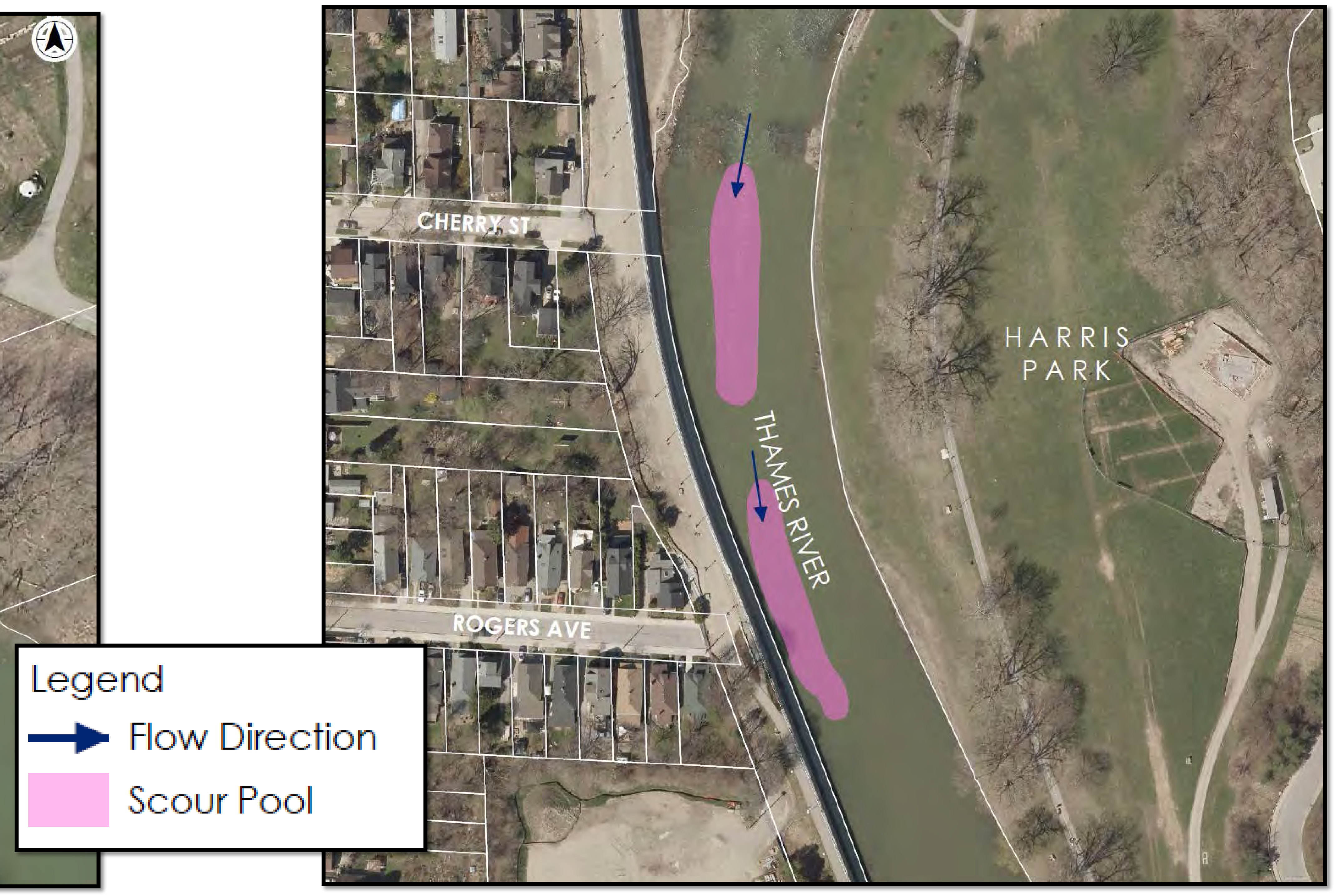
The planning and decision making process is documented in a **Project File** and placed on **public record for a minimum 30-day public review** period. If there are outstanding concerns that cannot be addressed through discussions with the project team, any member of the public has the right to send a request to the Minister of the Environment and Climate Change to issue an order to comply with Part II of the EA Act (a 'Part II Order', or 'Bump Up' request). See the project team for more information.

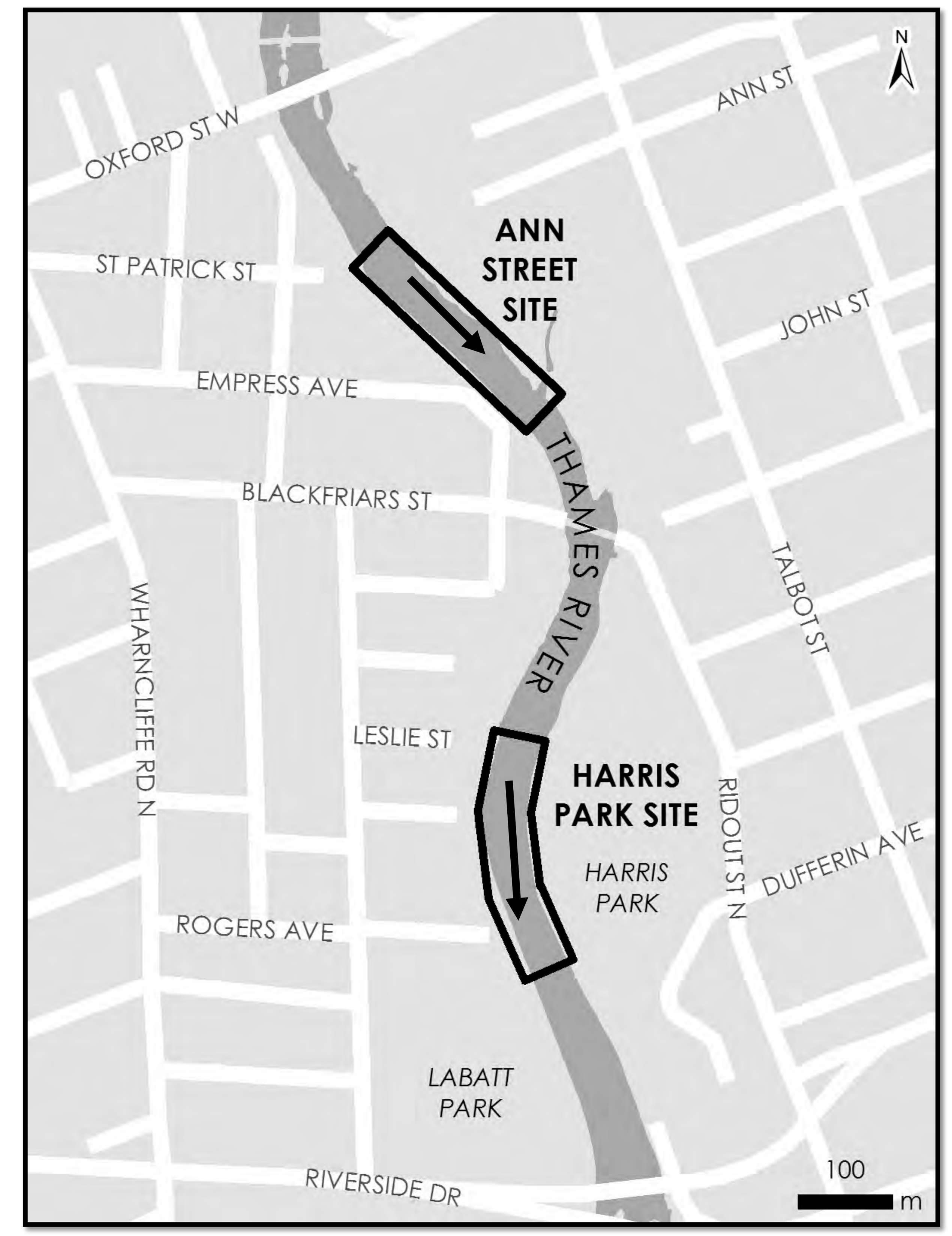
Why are we doing this study?
Problems and Opportunities

While undertaking the West London Dyke (WLD) Master Repair Plan, two locations of erosion (or scour) were identified. Existing structures within the river in each location are directing flows towards the west bank, causing erosion at the toe of the WLD:

Ann Street Site

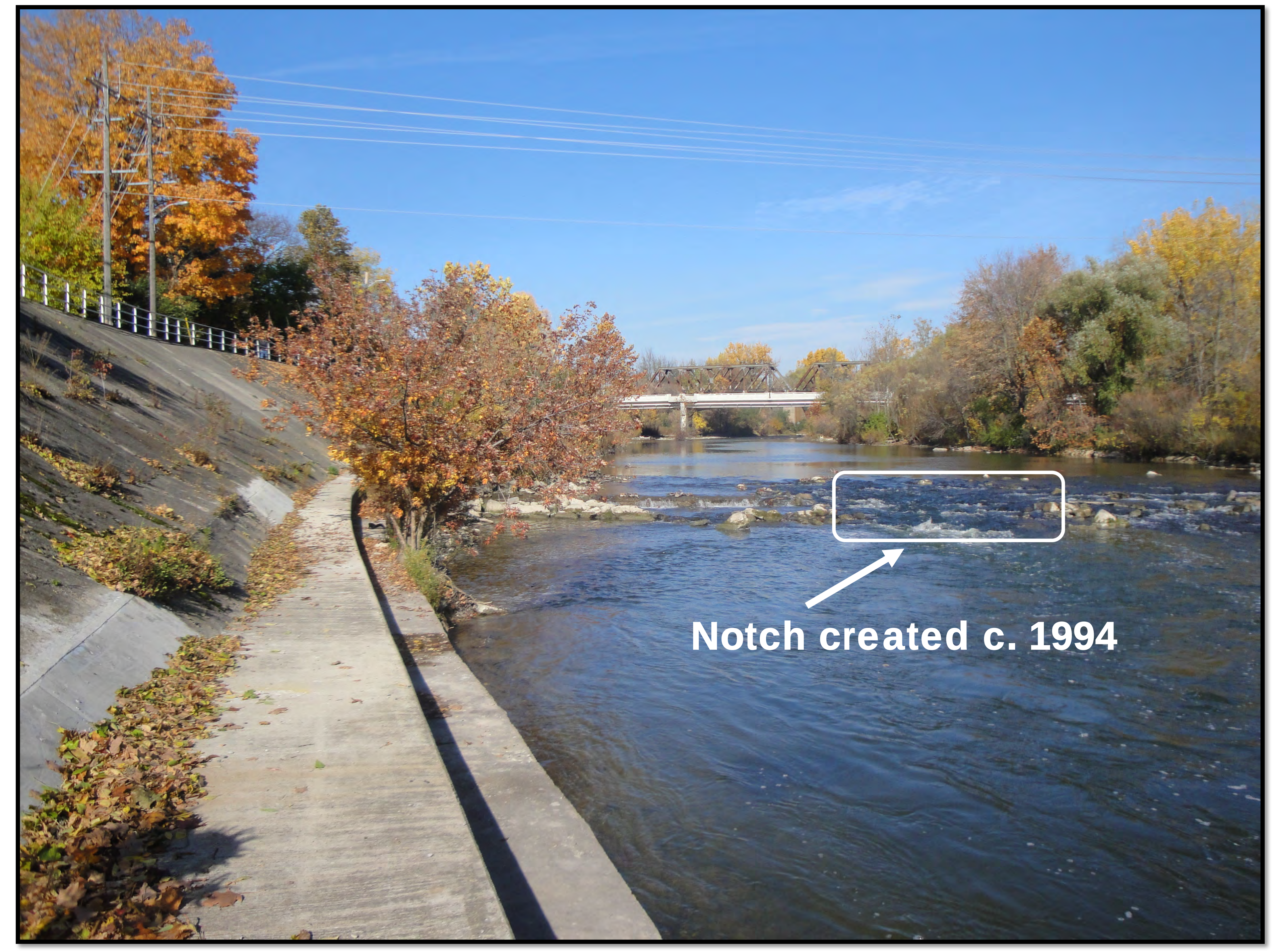
Harris Park Site

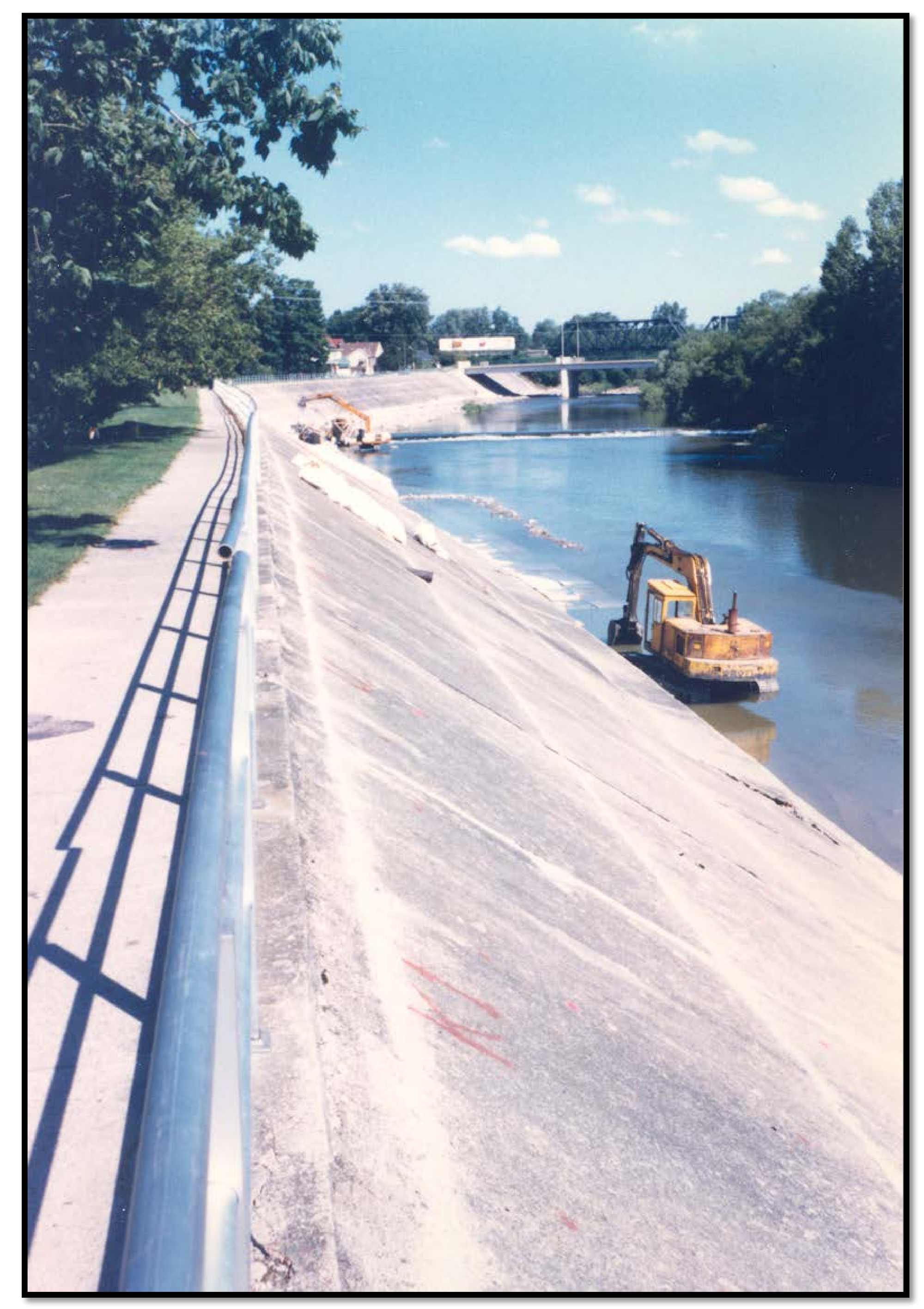




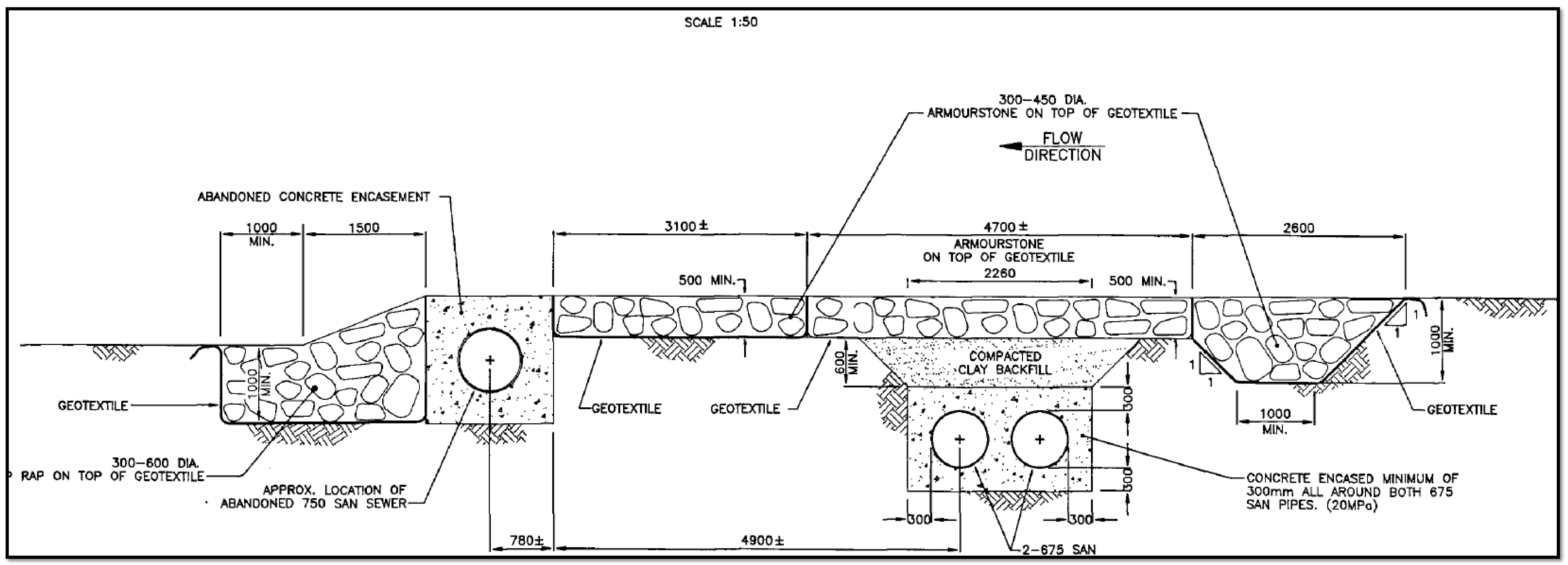
Existing Conditions
Ann Street

- An abandoned concrete-encased sanitary sewer crosses the Thames River between Ann Street and St. Patrick Street, forming a weir (a portion of pipe was removed, and the rest filled with concrete c. 1994).
- This sewer was replaced in 1994 with a deeper, twinned sewer. The new sewer crossing is located just upstream of the abandoned crossing.
- Riffles exist both upstream and downstream of the weir crossing.
- This is a popular spot for fishing, and the existing notch provides boaters a place to practice traversing a mini-rapid.



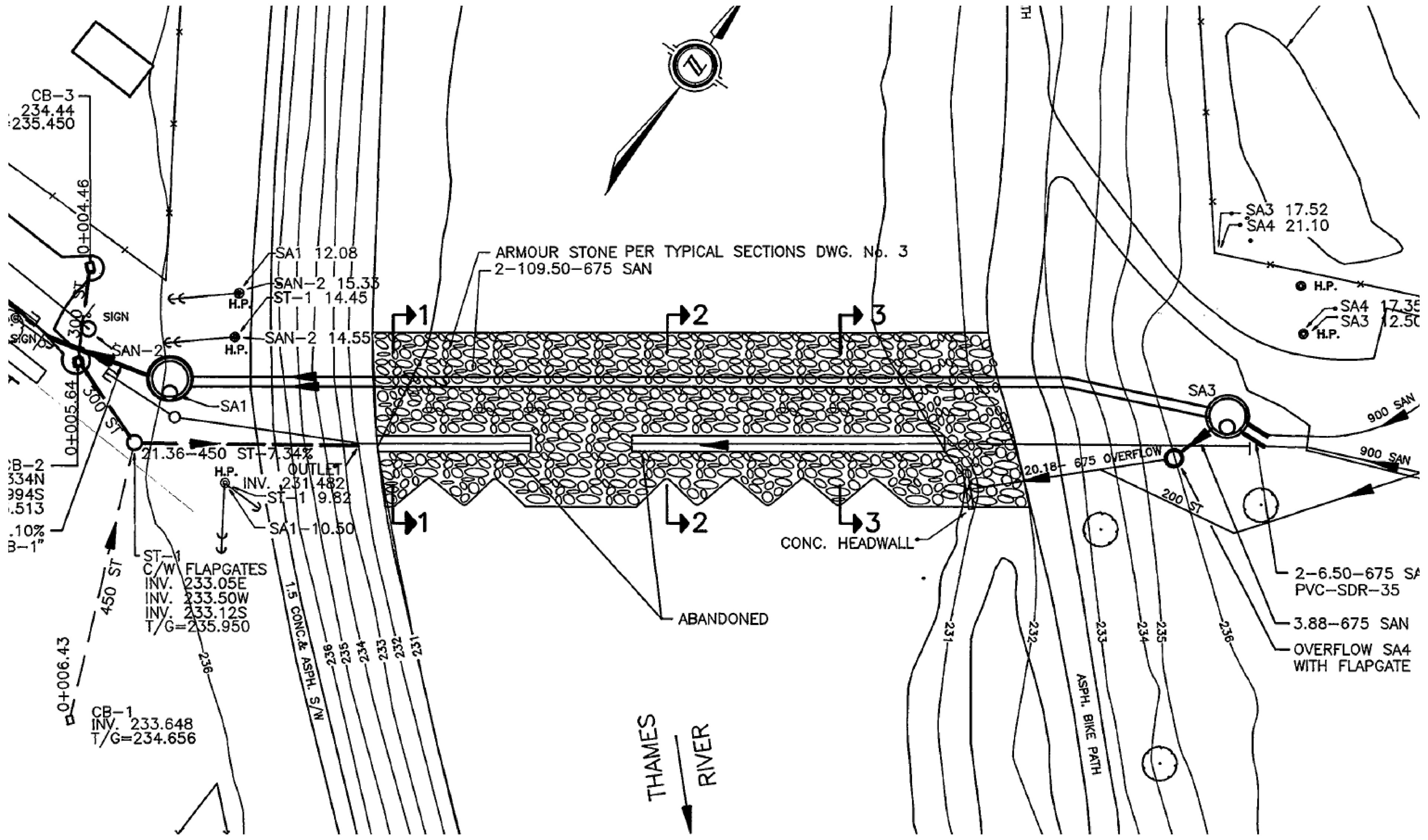


Installation of concrete ballast block along dyke toe c. 1982

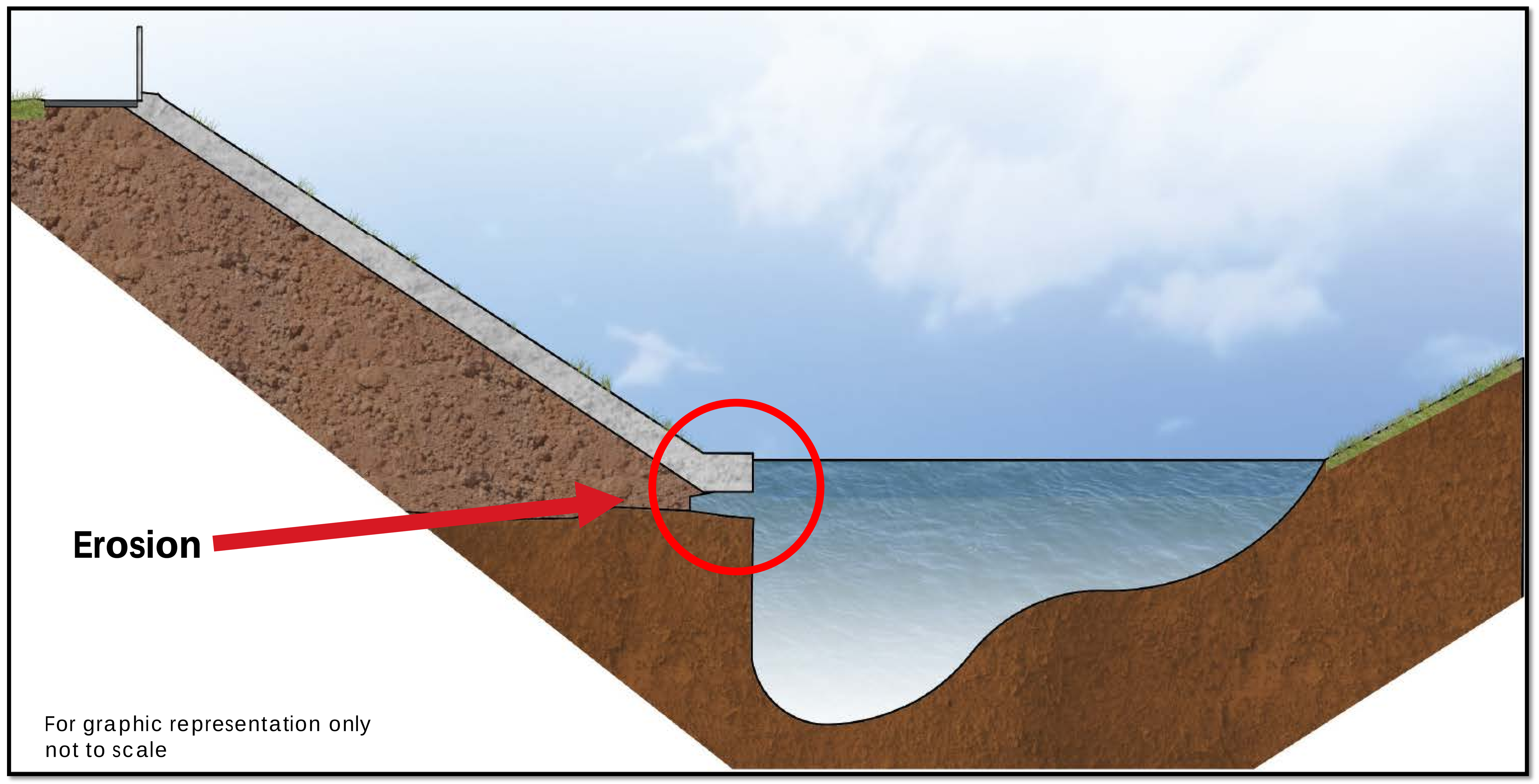


As-Built drawing of sewer crossing - 1994

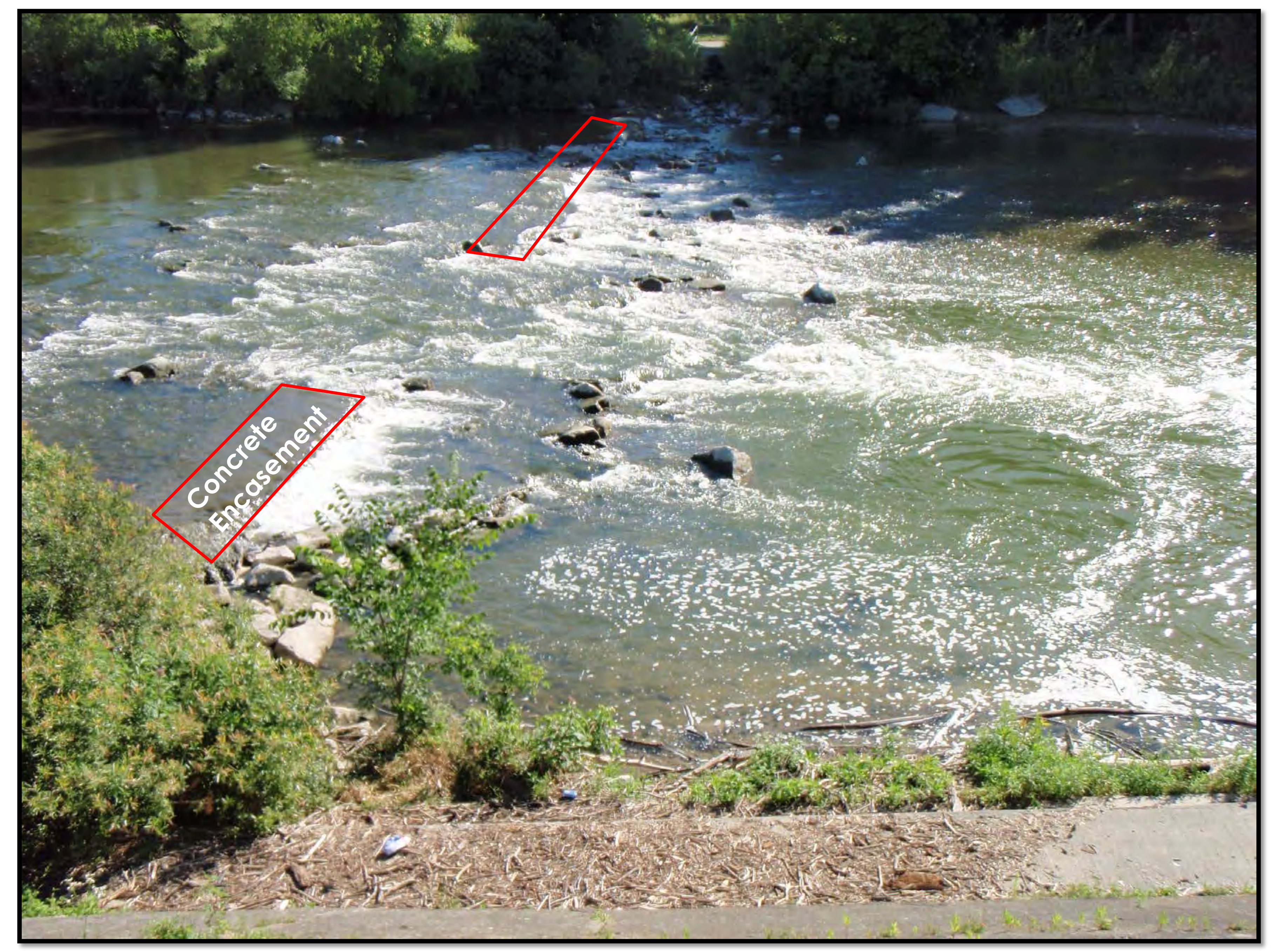
What does the erosion look like?
Ann Street



As-Built drawing from the Ann Street Crossing, 1994



Ann Street Site – Conceptual Cross Section



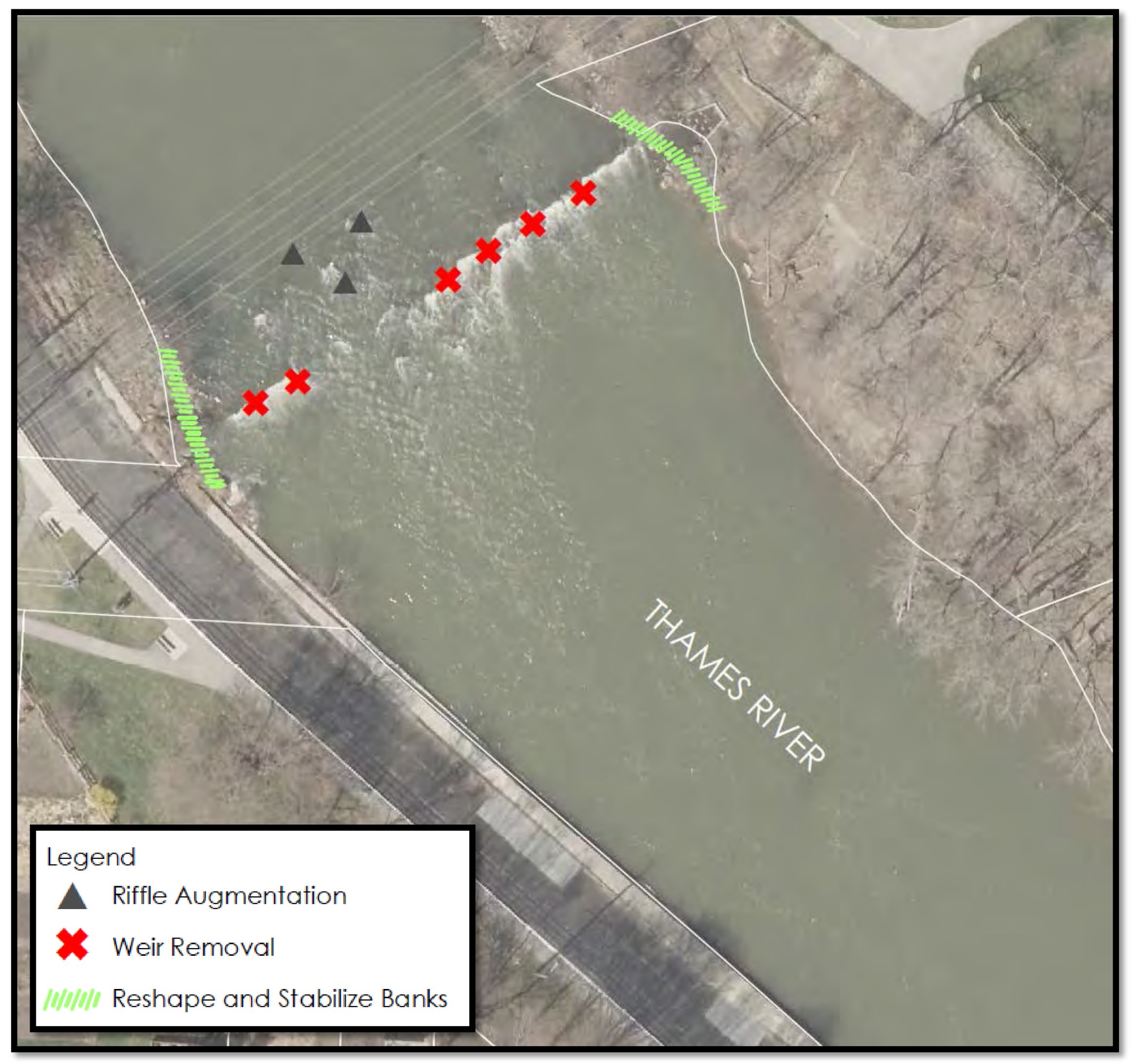
Alternative Solutions – Ann Street Site

Alternative solutions being considered include both flow modification (addressing the source of the erosion), and WLD toe protection (to protect the toe from further erosion). The Do Nothing alternative is being considered as a baseline against which to evaluate the impacts of improvements.

- Construction access for all alternatives will be off Ann Street and the Thames Valley Parkway (TVP)
- Construction will occur in the River under low flow conditions, during approved periods, and with appropriate mitigation measures to avoid adverse affects on aquatic life

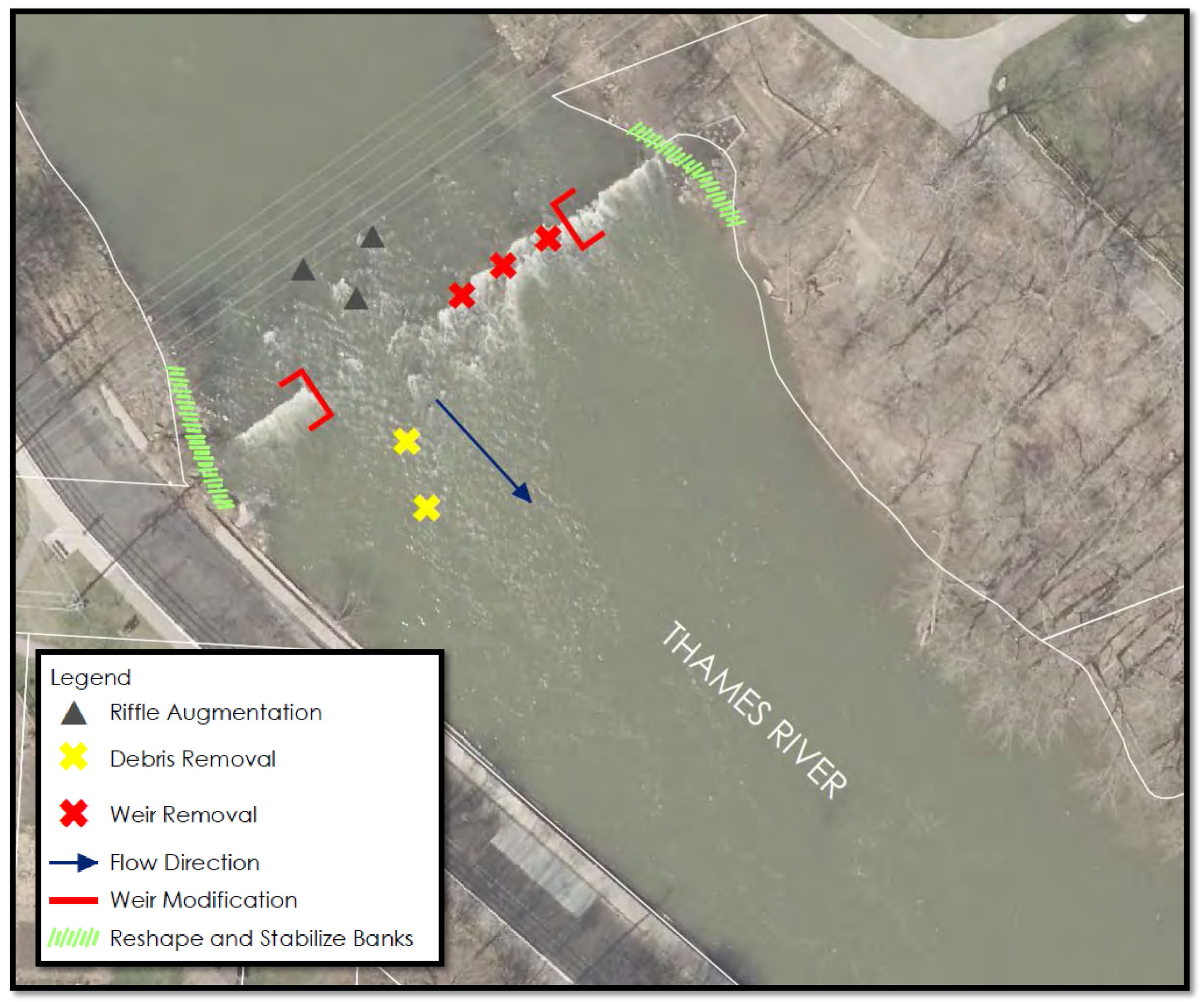
Flow Modification

Alternative 1 – Remove Weir



The existing concrete weir would be removed, eliminating the effect of the weir notch that is directing flow toward the west bank. Shaping or regrading of the banks may be required where the weir may have exacerbated erosion.

Alternative 2 – Modify Weir



Portions of the existing concrete weir would be removed to eliminate the effect of the existing weir notch. Shaping or regrading of the banks may be required where the weir may have exacerbated erosion.

Toe Protection

Alternative 3 – Boulder Toe Protection

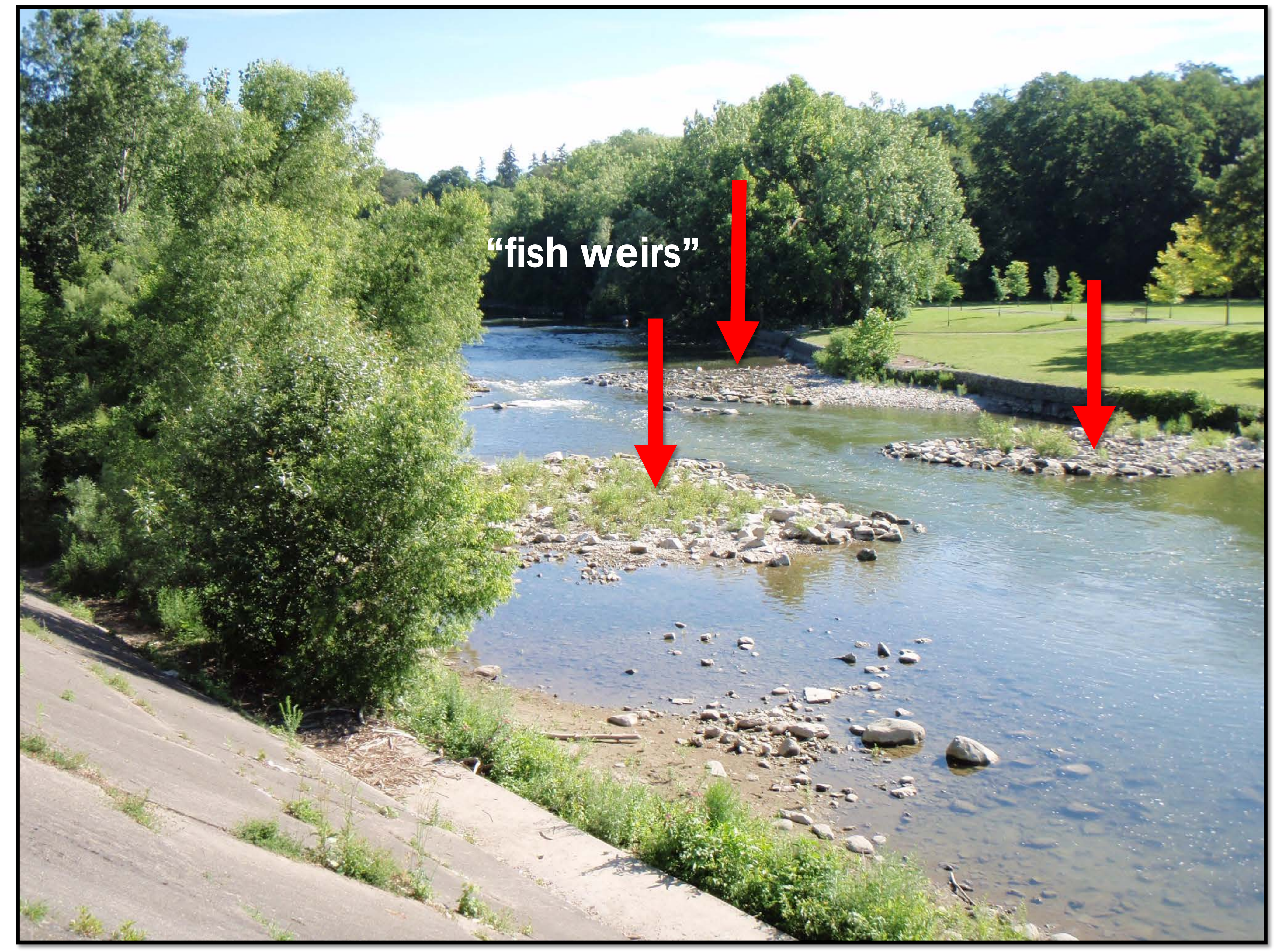
Boulders would be installed along the toe of the dyke, for a stretch of approximately 60 m. Treatment would be approximately 5 m wide. Under this alternative, grading and reshaping the east bank is recommended to compensate for the reduction in river cross section from the installation of boulders.

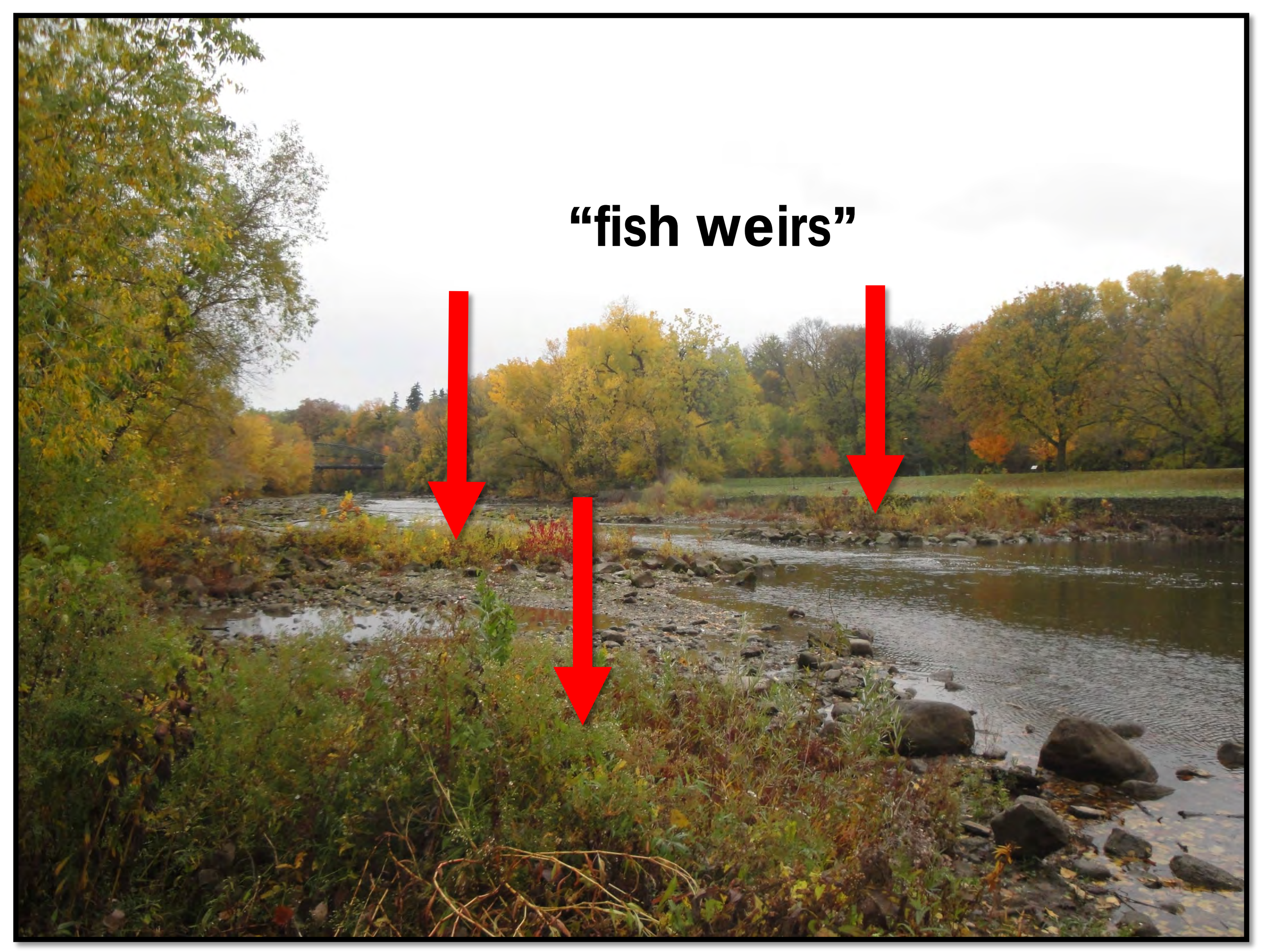
Alternative 4 – Bench and Vanes

A bankfull bench composed of engineered fill (boulders, concrete, granular material) would be installed and planted with deeply rooting vegetation. Vanes 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.

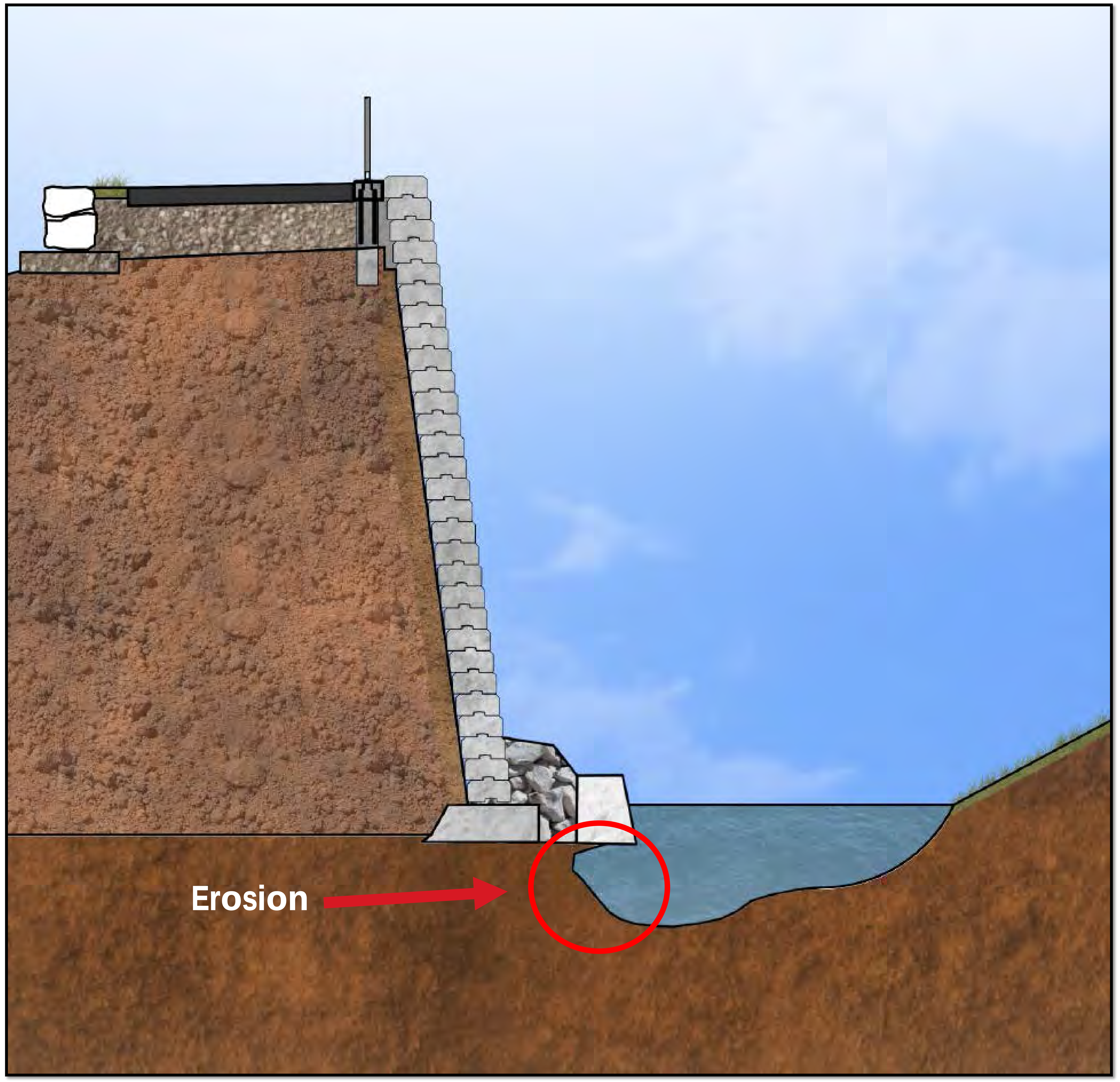
Existing Conditions
Harris Park

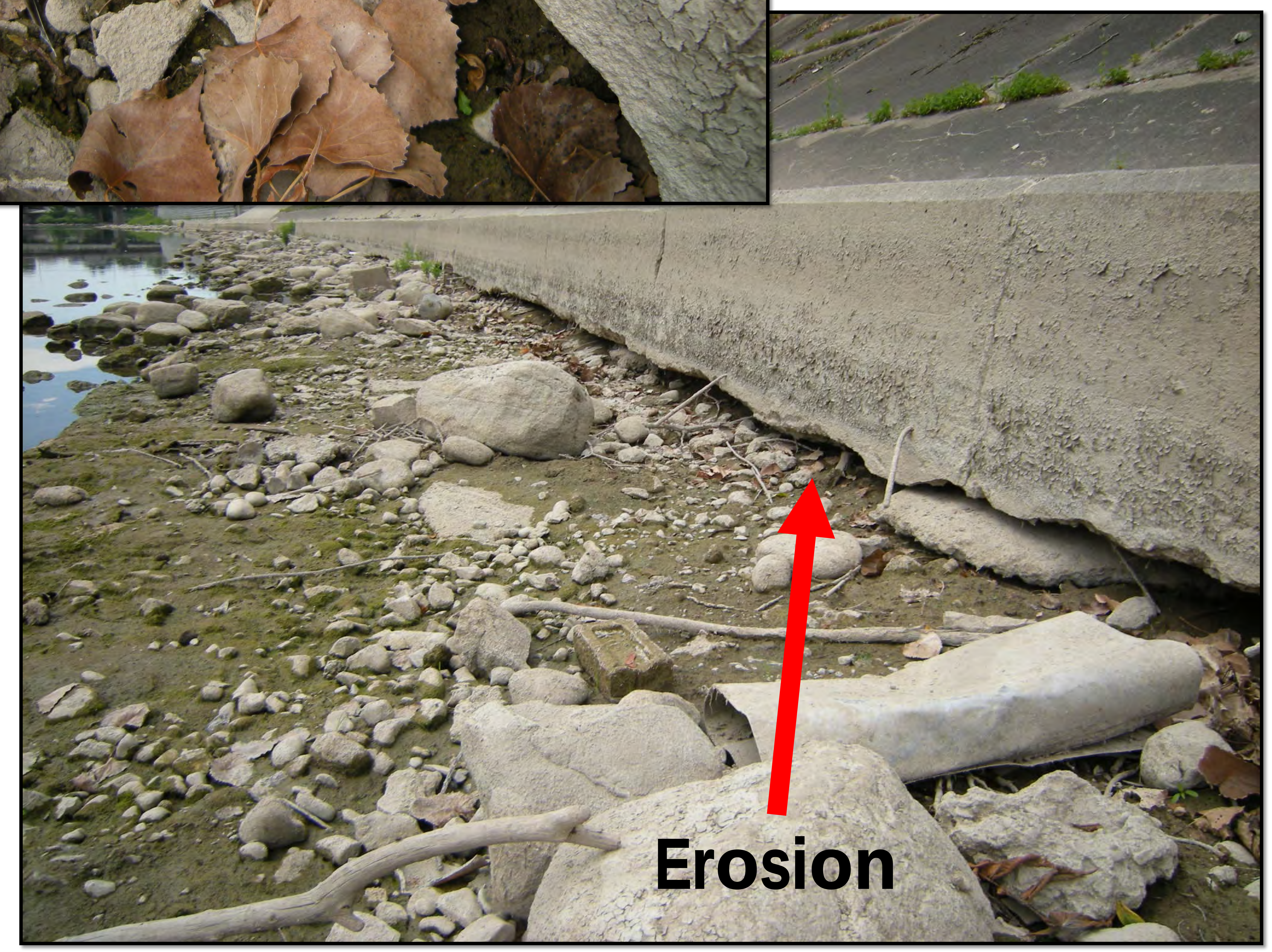
- The Ministry of Natural Resources and Forestry (MNRF) installed rocks features (referred to as fish weirs) c. 1980's to improve fish habitat and passage in the area.
- This is a popular spot for fishing (and boating).
- The potential exists for species at risk, and species of special concern turtles in this area of the river.
- This area is just upstream of the Forks of the Thames – an area of focus for the One River Master Plan Environmental Assessment and Back to the River. Any recommendations for shoreline improvements will need to be coordinated with those projects.





What does the erosion look like?
Harris Park Site





Alternative Solutions – Harris Park Site

Alternative solutions being considered include both flow modification (addressing the source of the erosion), and WLD toe protection (to protect the toe from further erosion). The Do Nothing alternative is also being considered as a baseline against which to evaluate the impacts of the other alternatives.

Toe Protection

Alternative 1 – Boulder Toe Protection

Boulders would be installed along the toe of the dyke for a stretch of approximately 240 m. The treatment would be approximately 5 m wide.

Flow Modification

Alternative 2 – Remove Gabions and Reshape Point Bar

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.

Alternative 3 – Modify MNRF 'Fish Weirs'

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.

Evaluation Process

A qualitative evaluation is used to assess the impacts of each alternative in relation to each other and to the Do Nothing alternative.

Common elements among alternatives:

- Potential release of sediment during construction; sediment control measures and monitoring to be undertaken during construction
- Temporary disruption to habitats during construction
- Ann Street: construction access off of Ann Street and TVP (east bank)
- Harris Park: construction access on west bank (same construction access used for recent WLD construction)

Social/Cultural Environment

- Recreational Boating
- Recreational Fishing
- Public Safety
- Cultural Heritage and Archaeology
- Aesthetics
- Parks and Open Space
- First Nations

Natural Environment

- Water Quality
- Aquatic Habitat and Fish Passage
- Terrestrial Habitats
- Species at Risk
- Climate Change

Technical/Economic

- Fluvial Geomorphology
- Long Term Operations and Maintenance
- Approvals/Permitting
- Constructability
- Construction Access
- Coordination with Existing and Planned
- Thames Valley Corridor Projects

Summary of Preliminary Evaluation

Ann Street Site

	Flow Modification		Toe Protection	
Environmental Component	Alternative 1 – Remove Weir	Alternative 2 – Modify Weir	Alternative 3 – Boulder Toe Protection	Alternative 4 – Bench and Vanes
Social / Cultural	• Greatest impact to existing boating over all other alternatives	• Potential to maintain some of the existing recreational boating uses	• Potential for positive impacts to recreational fishing with additional fish habitat	• Potential for positive impacts to recreational fishing with additional fish habitat
Natural	• No significant impacts to habitat (upstream riffles to be maintained) • Potential improvement to wildlife movement based on slower velocities (turtles)	• No significant impacts to habitat (upstream riffles to be maintained) • Potential improvement to wildlife movement based on slower velocities, but less potential than Alternative 1 (turtles)	• Additional fish habitat provided	• Greatest potential for improved aquatic and terrestrial habitats
Technical / Economic	• Effective in redirecting flows and addressing source of scour • Should be implemented in conjunction with toe protection • In-water work required • $	• Effective in redirecting flows and addressing source of scour • Should be implemented in conjunction with toe protection • In-water work required • $$	• Does not address source of erosion; should be implemented in conjunction with flow modification for best results • $$	• Most robust treatment of existing erosion, should be implemented in conjunction with flow modification for best results • $$$$
Overview	Less preferred over modification to weir structure	***Recommended*** in conjunction with Flow Modification	***Recommended*** in conjunction with Flow Modification	Less preferred over Boulder Toe Protection

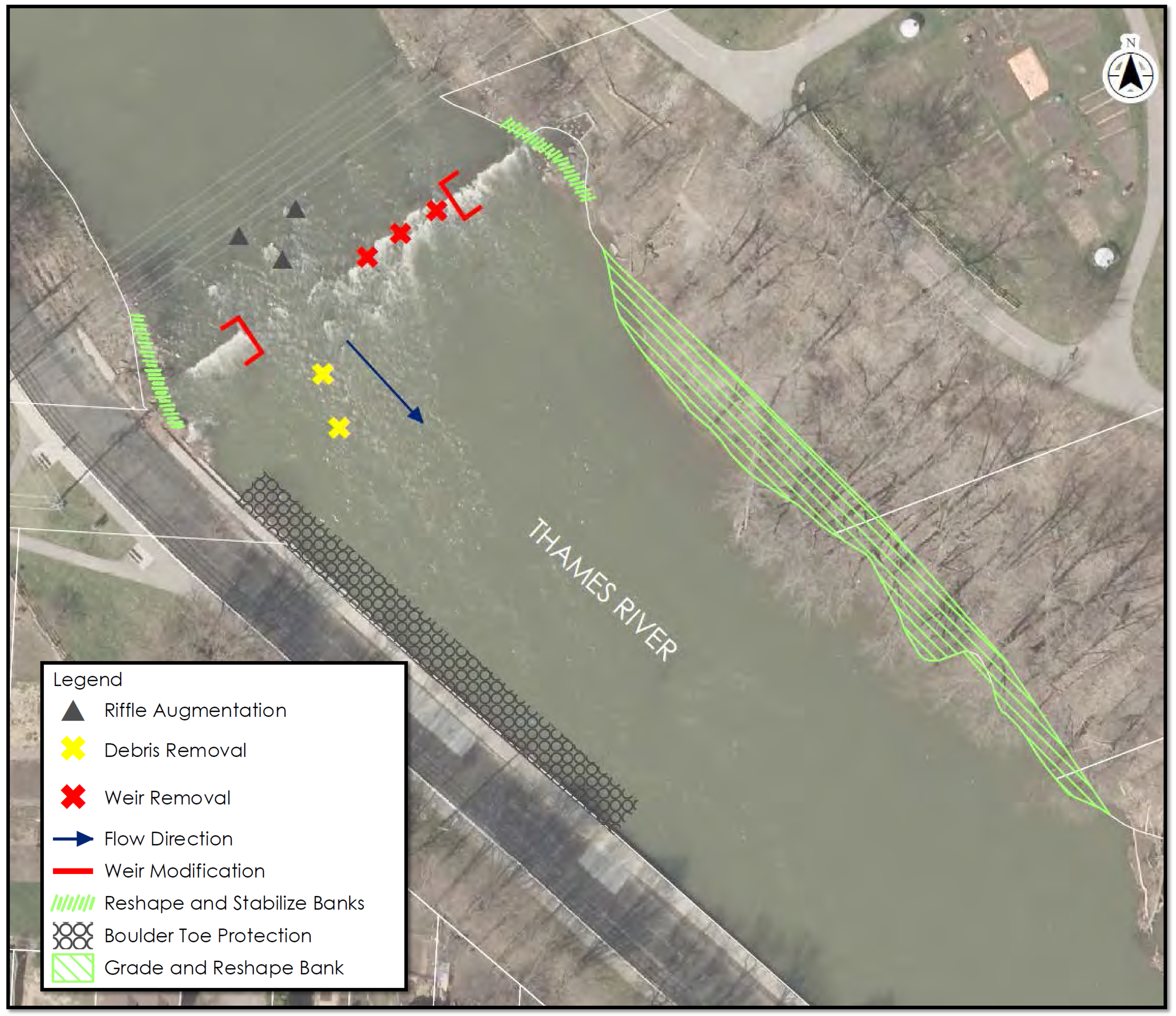
Harris Park Site

	Toe Protection	Flow Modification	
Environmental Component	Alternative 1 – Boulder Toe Protection	Alternative 2 – Remove Gabion Baskets and Reshape Point Bar	Alternative 3 – Modify MNRF Weirs
Social / Cultural	• Potential for positive impacts to recreational fishing with additional fish habitat	• Impacts to parkland and TVP; coordination required with One River Master Plan considerations	• Least overall impact
Natural	• Additional fish habitat provided	• Improves floodplain access and floodplain habitats	• Least overall impact
Technical / Economic	• Does not address source of erosion; should be implemented in conjunction with flow modification for best results • $$$	• Effective in reducing flow velocities and further erosion, should be implemented in conjunction with toe protection • $$	• Effective in directing flow away from the WLD, should be implemented in conjunction with toe protection • $$
Overview	***Recommended*** in conjunction with Modification to MNRF Fish Weirs	Less preferred over Alternative 1	Most efficient for addressing source of erosion, least overall impact ***Recommended*** in conjunction with Boulder Toe Protection

Preliminary Recommendations

The preliminary recommendations at each site include a combination of toe protection to address the existing areas of erosion and flow modification to address the source and mitigate further erosion.

Ann Street Site
Modification to Weir Structure and Boulder Toe Protection



Harris Park Site
Modification to MNRF Fish Weirs and Boulder Toe Protection

Next Steps

Additional Environmental Review

- Additional environmental reviews will be conducted to determine mitigation measures and permitting requirements

Stakeholder Consultation

- Meet with stakeholder and First Nations groups
- Review and address input received from public, agencies, and First Nations communities

Project File

- Confirm study recommendations
- Planning and decision-making process is documented in a Project File

Public Review

- Notice of Completion is published
- The Project File is made available for a minimum 30-day public review period
- Address concerns expressed during the review period

Please share your thoughts and opinions on the information presented tonight. Comment sheets are available, or you can submit comments directly to members of the project team.

Stephanie Bergman, Planner
Stantec Consulting Ltd.
519-675-6614
stephanie.bergman@stantec.com

Cameron Gorrie, P. Eng.
Stantec Consulting Ltd.
519-675-6650
cameron.gorrie@stantec.com

UPPER THAMES RIVER
CONSERVATION AUTHORITY

West London Dyke Erosion Control Municipal Class Environmental Assessment

Public Information Centre

Tuesday February 13, 2018 4:30pm-6:30pm

Kinsman Recreation Centre
20 Granville Street, London ON

St

PLEASE SIGN IN TO STAY UPDATED ON STUDY PROGRESS

NAME	ADDRESS	POSTAL CODE	PHONE NUMBER
DANA			
KIRK			
Jason			

West London Dyke Erosion Control
Municipal Class Environmental Assessment

Public Information Centre No. 1
Tuesday, February 13, 2018 4:30-6:30pm
Kinsman Recreation Centre
COMMENT SHEET (Please Print Clearly – more space is available on the back)

Name: Jason Jordan
Mailing Address: 970 Willow Dr
Email Address: jason.jordan.jd@gmail.com
Interest (i.e. property owner, agency): Enjoy going along the river
Comment: Looks very good.

- Like the extended Boulder Toe Protection along Labatt's section. Would allow vegetation to grow along that section of the river.

- Would like Harris Park's Bank to be modified to be softer. Can be done in a later design work done in Harris Park

Please place comments in the box provided, or return to the following
BY February 27, 2018:
Stephanie Bergman
Planner
Stantec Consulting Ltd.
600-171 Queens Ave., London
ON, N6A 5J7
Phone: (519) 675-6614
Fax: (519) 645-6575
Stephanie.bergman@stantec.com

UPPER THAMES RIVER CONSERVATION AUTHORITY

Stantec

All correspondence will be kept on file and documented within the Project File. Under the Municipal Freedom of Information and Protection of Privacy Act and the Environmental Assessment Act, unless otherwise stated in the submission, any personal information contained within the submission (name, address, etc.) will become part of the public record and will be released, if requested, to any person.

From:	Gorrie, Cameron
To:	Bergman, Stephanie
Subject:	FW: West London Dyke erosion control study
Date:	Monday, January 08, 2018 9:56:06 AM

FYI. I called Christine on Thursday evening and went through her comments and concerns.

-----Original Message-----
From:
Sent: Thursday, January 04, 2018 5:58 PM
To: Gorrie, Cameron <Cameron.Gorrie@stantec.com>
Cc: johnbroeze@gmail.com
Subject: West London Dyke erosion control study

Hello Cameron,

We live in the Blackfriars area, the last house at the east end of St. Patrick Street. We are very familiar with the Anne Street Weir, which is very close to our house. It has a few uses that you might not be aware of:

The weir is a significant part of the river. Fish and other river life are particularly abundant just above and downstream of the weir. Many people fish in that stretch of the river, including fly fishing. There is a heron that stands patiently waiting on the weir for a meal most days. Ducks and geese are of course often there. Eagles, hawks, and osprey frequently fly over and dive into the water immediately upstream from the weir. A semicircle of stones was placed just downstream from the weir many years ago, I believe by a fishing conservation group. This also helps with the abundant river life.

That stretch of the river is very close to Oxford Street. When the river is in flood and the waterfall is quiet, we can hear the traffic. At other times, the sound of water on the weir drowns out all the traffic noise.

The third advantage of the weir is that it is a place for people to learn to kayak up a small rapid. Even the geese bring their goslings to teach them to swim upstream!

Finally, being on the same level as the river is a completely different experience from standing on top of the dyke. Partly because of the good fishing opportunities, many people scramble down the slope of the dyke at the weir to be at river level on the west side of the river. The Blackfriars neighbourhood has a long history of being connected to the river. One of the heritage attributes of the Blackfriars area that was identified in the Blackfriars-Petersville Heritage Conservation District Pan and Guidelines of April, 2014, is “Proximity and historical relationship with the Thames River”.
The proposed design of the new dyke does not allow any access to the river. This cuts the neighbourhood off from its most precious asset. A set of stairs (or some other access solution) at the weir would allow the residents to continue to have access to the river at the beloved weir.

We would be pleased to discuss any of these thoughts further, as well as to share other insights about the weir with you or team members.

And please add us to the study contact list.

Thank you,

INDIGENOUS CONSULTATION

West London Dyke Erosion Control
Municipal Class Environmental Assessment
First Nations Consultation Log

Contact Information	Date/Method of Communication	Comment/Concern	Response/Commitment to Carry Forward
Aamjiwnaang First Nation Chief Joanne Rogers 978 Tashmoo Avenue, Sarnia, ON N7T 7H5 519-336-8410 chief@aamjiwnaang.ca	Notice of Commencement Sent via Canada Post December 21, 2017		
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email February 15, 2018 Follow-up phone call May 24, 2018	Received email response on March 21, 2018. Information on the study was discussed at the Aamjiwnaang First Nation's Environment Committee meeting. Identified the following interest in the study: • Road wildlife mortalities and plans for mitigation; • Restoration of disturbed areas/habitats/corridors following construction; • Softened erosion control using riparian buffers; • Interested in archaeological studies, and requests that an archaeological monitor be present on site during assessments and construction; • Also requests that native species be used in re-planting – Aamjiwnaang runs the Maajiigin Gumig greenhouse project which provides a local source of native vegetation.	Follow-up phone call on May 24, 2018. Discussed status of the project, and noted that environmental mitigation/restoration has been incorporated into the study recommendations to carry forward into detailed design. Aamjiwnaang and UTRCA to coordinate archaeological monitors for any subsequent archaeological studies. Request included in Project File. No further concerns identified.
	Notice of Completion Canada Post DATE		
Caldwell First Nation Allen Delery, Director of Operations P.O.Box 388 Leamington, ON N8H 3W3 Allen.deleary@caldwellfirstnation.ca	Notice of Commencement Sent via Canada Post December 21, 2017		
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email February 15, 2018 Follow-up phone call May 24, 2018 (Spoke with Shirley Johnson – no concerns identified)		
	Notice of Completion Canada Post DATE		
Chippewas of Kettle and Stony Point First Nation Chief Tom Bressette 6247 Indian Lane Forest ON N0N 1J0 Thomas.bressette@kettlepoint.org **Valerie George,Consultation Coordinator** **Valerie.george@kettlepoint.org**	Notice of Commencement Sent via Canada Post December 21, 2017		
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email February 15, 2018 Follow-up phone call May 24, 2018/June 1 (left 2 messages with Sherilyn Johnston and Valerie George)		
	Notice of Completion Canada Post DATE		
Chippewa of the Thames First Nation Chief Henry Myeegun Lands & Environment 320 Chippewa Road, Muncey, ON N0L 1Y0 519-289-2662 Ext. 213 Rochelle Smith, Consultation Coordinator rsmith@cottfn.com	Notice of Commencement Sent via Canada Post December 21, 2017	Response sent January 31, 2018. Identified that study area includes lands subject to the London Township Treaty, and within the Big Bear Creek Additions to Reserve (ATR) land selection area. Identified that COTTFN has identified moderate concern with the project.	Stantec staff followed up to schedule a meeting for Monday February 26th, 2018. PIC materials were sent prior to meeting.
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email February 15, 2018 Meeting held Feb 6, 2018 at COTTFN offices, with Rochelle Smith,	See meeting notes included in project file. Requested archaeological monitors be present during archaeological assessments.	See meeting overview included in project file (email dated Feb 26, 2018). Noted request for archaeological monitors.

Contact Information	Date/Method of Communication	Comment/Concern	Response/Commitment to Carry Forward
	Notice of Completion Canada Post DATE		
Delaware Nation Chief Denise Stonefish Denise.stonefish@delawarenation.on.ca 14760 School House Line RR3 Thamesville ON N0P 2K0 gpeters@mnsi.net loganju@xplornet.ca	Notice of Commencement Sent via Canada Post December 21, 2017		
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email Feb 15 2018		
	Notice of Completion Canada Post DATE		
Munsee-Delaware Nation Chief Roger Thomas, Glenn Forrest 279 Jubilee Road Muncey ON N0L 1Y0 Chief.thomas@munsee-delaware.org	Notice of Commencement Sent via Canada Post December 21, 2017		
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email February 15, 2018 Follow-up phone call May 24, 2018 – Left message with Glenn Forest.		
	Notice of Completion Canada Post DATE		
Oneida of the Thames First Nation Chief Sheri Doxtator Holly Elijah 2212 Elm Ave Southwold, ON N0L 2G0 sheri.doxtator@oneida.on.ca	Notice of Commencement Sent via Canada Post December 21, 2017		
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email February 15, 2018 Follow-up phone call May 24, 2018/June 1 left message with reception.		
	Notice of Completion Canada Post DATE		
Bkejwanong Territory (Walpole Island) Chief Dan Miskokomon Janet Macbeth Dr. Dean Jacobs Janet.macbeth@wifn.org Wallaceburg, ON N8A 4K9	Notice of Commencement Sent via Canada Post December 21, 2017		
	Notice of PIC sent via Canada Post January 29, 2018 PIC materials sent via email February 15, 2018 Follow-up phone call May 24, 2018 – left message with Janet Macbeth.		
	Notice of Completion Canada Post DATE		

Stantec Consulting Ltd.
600-171 Queens Ave. London, ON N6A 5J7

January 29, 2018
File: 165630129

Attention: Attention

SAMPLE INDIGNOUS COMMUNITY LETTER

Dear Recipient's Name,

Reference: West London Dyke Erosion Control Municipal Class Environmental Assessment – Notice of Public Information Centre

The Upper Thames River Conservation Authority, in coordination with the City of London, has initiated a Municipal Class Environmental Assessment (Class EA) to investigate erosion and scour conditions at two locations along the Thames River (refer to the study area figure and Notice attached). The Ann Street Weir at the Ann Street Site, and the rock vanes at the Harris Park Site, currently direct the flow of the Thames River in a manner that could compromise the foundation of the West London Dyke. This Class EA is investigating alternative solutions that mitigate future erosion at these sites, while taking into consideration the social, cultural, natural, and economic environments. See the attached Notice of Public Information Centre (PIC) for more information.

You would have received a Notice of Study Commencement in December 2017. This letter is intended to notify you of the upcoming PIC, and provide the opportunity to identify any initial questions or concerns with respect to the project. If you are unable to attend the PIC, we will be happy to follow-up with either an electronic or paper copy of the presentation materials for you to review. We would also be happy to walk through the information with you following the PIC.

The PIC will be held in open-house format on T**uesday, February 13th, 2018 from 4:30-6:30pm** at the **Kinsman Recreation Centre (20 Granville Street, London, ON).**

If you would like to discuss the project further, please do not hesitate to reach via the phone or email below.

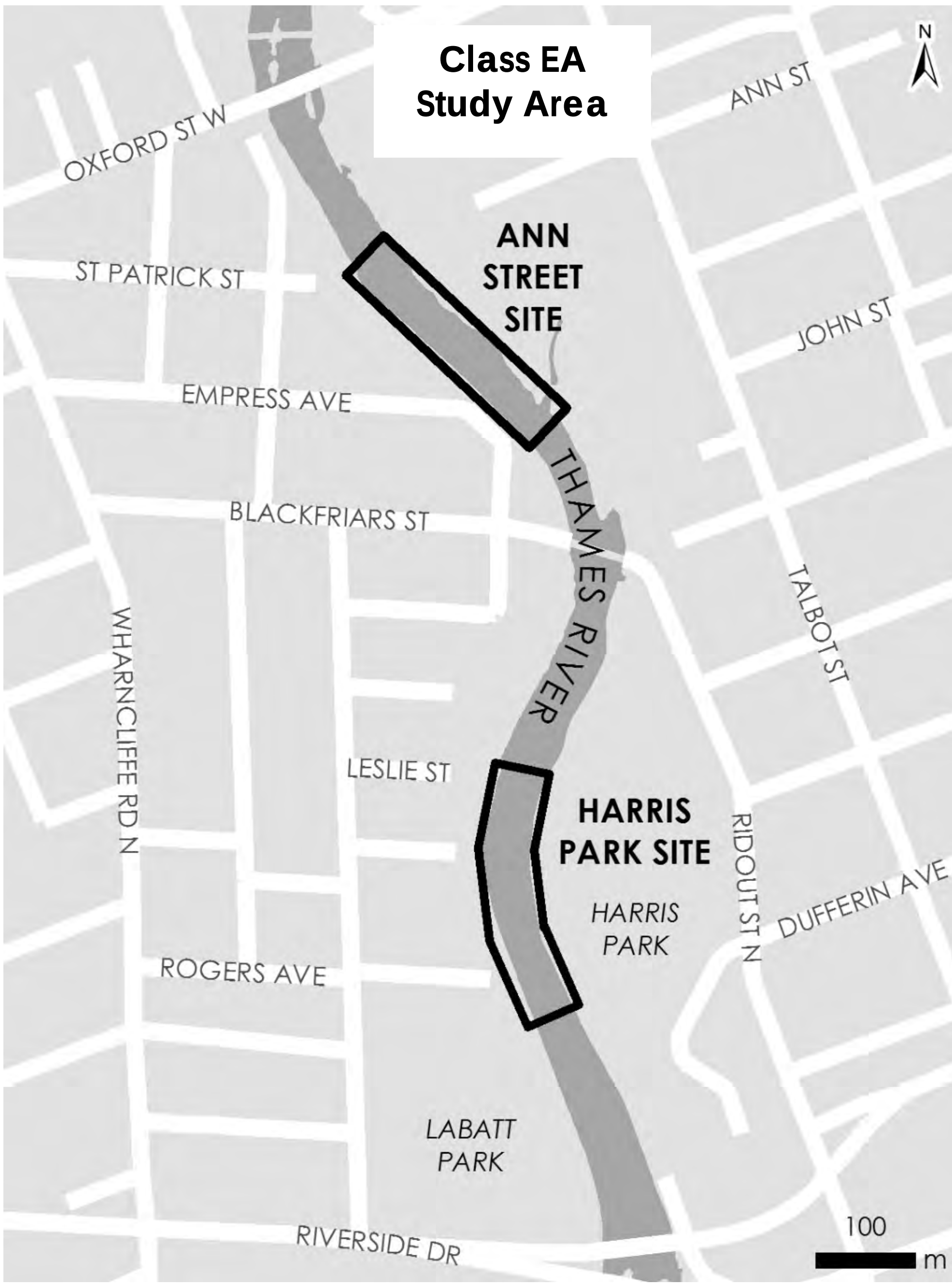
Regards,

Stantec Consulting Ltd.

Stephanie Bergman, MA, ENV SP
Planner
Phone: 519-675-6614
Fax: 519-6456575
Stephanie.bergman@stantec.com

Attachment: Notice of Study Commencement
c. Fraser Brandon-Sutherland, UTRCA; Cameron Gorrie, Stantec Consulting Ltd.; Chris McIntosh, City of London

Reference: West London Dyke Erosion Control Municipal Class Environmental Assessment – Notice of Public Information Centre



From:	Bergman, Stephanie
To:	"denise.stonefish@delawarenation.on.ca"
Cc:	Gorrie, Cameron
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 2:36:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Chief Stonefish,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class Environmental Assessment being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.

Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From:	Bergman, Stephanie
To:	"tammy.jolicoeur@caldwellfirstnation.ca"
Cc:	Gorrie, Cameron
Subject:	FW: No longer Valid Re: West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:58:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Ms. Jolicoeur,

I received the bounce-back below, so I am forwarding this information:

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class Environmental Assessment being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.

Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From: Allen Deleary [mailto:allen.deleary@caldwellfirstnation.ca]
Sent: Thursday, February 15, 2018 1:54 PM
To: Bergman, Stephanie <Stephanie.Bergman@stantec.com>
Subject: No longer Valid Re: West London Dyke Erosion Control Class EA

Please forward all communication to tammy.jolicoeur@caldwellfirstnation.ca

--
W. Allen Deleary
14 Orange Street
Leamington, ON
N8H 1P3
519.322.1766

From:	Bergman, Stephanie
To:	"chief@aamjiwnaang.ca"; "sjohnston@aamjiwnaang.ca"
Cc:	Gorrie, Cameron
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:55:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Chief Rogers and Ms. Johnston,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class Environmental Assessment being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.

Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From:	Bergman, Stephanie
To:	"valerie.george@kettlepoint.org"; "Thomas.bressette@kettlepoint.org"
Cc:	Gorrie, Cameron
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:54:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Chief Bressette and Ms. George,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class Environmental Assessment being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.

Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From:	Bergman, Stephanie
To:	"allen.deleary@caldwellfirstnation.ca"
Cc:	Gorrie, Cameron
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:52:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Mr. Deleary,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class Environmental Assessment being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.

Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From:	Bergman, Stephanie
To:	"janet.macbeth@wifn.org"
Cc:	Gorrie, Cameron; "drskoke@wifn.org"
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:51:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Janet,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class Environmental Assessment being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.
Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From:	Bergman, Stephanie
To:	"denise.stonefish@delawarenation.on.ca"
Cc:	Gorrie, Cameron
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:48:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Chief Stonefish,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class Environmental Assessment being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.
Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From:	Bergman, Stephanie
To:	"chief.thomas@munsee-delaware.org"
Cc:	Gorrie, Cameron; "glenn@munsee.ca"
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:46:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Chief Thomas,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class EA being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provide an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns. We'd be happy to discuss the project further.
Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

From:	Bergman, Stephanie
To:	"randall.phillips@oneida.on.ca"
Cc:	Gorrie, Cameron; "Catherine.cornelius@oneida.on.ca"
Subject:	West London Dyke Erosion Control Class EA
Date:	Thursday, February 15, 2018 1:44:00 PM
Attachments:	WLD_Erosion_EA_PIC_Feb_13_2018.pdf

Good afternoon Chief Phillips,

A Public Information Centre (PIC) was held on Tuesday, February 13th , 2018 for the West London Dyke Erosion Control Municipal Class EA being undertaken by the Upper Thames River Conservation Authority. I've attached the materials that were presented at the PIC, which provides an overview of the project, alternatives being considered, and preliminary recommendations. Please don't hesitate to contact me if you have any questions or concerns.

Have a great day,

Stephanie L. Bergman
MA, ENV SP
Planner

Direct: 519-675-6614
Fax: 519-645-6575

January 31, 2018

Cameron Gorrie, P.Eng.
Project Manager
Stantec Consulting
600-171 Queens Avenue
London ON N6A 5J7

RE: Class EA for West London Dyke Erosion

Mr. Gorrie,

On January 10, 2018, we have received information concerning the abovementioned project. The proposed work will be conducted within the London Township Treaty (1796) area to which Chippewas of the Thames First Nation (COTTFN) is a signatory. The proposed work is also located within the Big Bear Creek Additions to Reserve (ATR) land selection area, as well as COTTFN Traditional territory.

After screening this project, we have identified it to be of moderate concern. At this time, I would like to invite you to meet with us to discuss your project in more detail. Please contact myself at 519-289-2662 ext. 213 or email at rsmith@cottfn.com.

We look forward to continuing this open line of communication. To implement meaningful consultation, COTTFN has developed its own protocols — a document and a process that will guide positive working relationships. We would be happy to meet with you to review COTTFN's Consultation Protocols.

Please do not hesitate to contact me if you need further clarification of this letter.

Sincerely,

Rochelle Smith
A/Consultation Coordinator
Chippewa of the Thames First Nation
(519) 289-2662 Ext. 213
rsmith@cottfn.com

From:	Gorrie, Cameron
To:	Fraser Brandon- Sutherland
Cc:	Bergman, Stephanie
Subject:	RE: West London Dyke Erosion Control Class EA
Date:	Monday, February 26, 2018 7:17:25 PM
Attachments:	image001.png

Fraser / Steph,

The meeting with Rochelle and Emma went well this afternoon. The original letter which indicated that the project was of moderate concern was written prior to Rochelle and Emma having the opportunity to review the presentation materials which we provided prior to today's meeting. A few key points that were discussed are below:

- Is the decommissioned sanitary sewer at Ann Street still empty – clarified that it was abandoned and grouted
- What type of grading will be necessary along the east bank at Ann Street – indicated that grading will be minor and will only account for compensation to the west bank
- Timelines – Class EA to be completed in March 2018 followed by 30-day review period, preferred alternative will be identified within the Project File
- Design and Construction – dependent on funding, may occur as early as 2019
- Relevance to Back to the River – mentioned that the "natural bank" area may be subject to future design elements through that Class EA, however through this Class EA we've left the area as a relatively blank slate (as well as through the dyke reconstruction work)

Rochelle has also requested if we can provide them with a copy of the EIS that was completed as part of the WLD Phase 3 work as well as the geomorphology report. Steph – could you please provide a digital copy of these?

Based on our meeting today, COTTFN has now identified that there are no concerns with this project going forward and will issue a letter likely next week which will summarize this.
Thanks,

Cam

From: Fraser Brandon- Sutherland [mailto:sutherlandfb@thamesriver.on.ca]
Sent: Monday, February 26, 2018 9:27 AM
To: Emma Young <eyoung@cottfn.com>; Rochelle Smith <rsmith@cottfn.com>
Cc: Gorrie, Cameron <Cameron.Gorrie@stantec.com>; Bergman, Stephanie <Stephanie.Bergman@stantec.com>
Subject: RE: West London Dyke Erosion Control Class EA

Hello Rochelle and Emma,

My apologies, I will not be able to attend the meeting this afternoon. I was out of the province visiting family last week and today at 2:45 PM was the earliest appointment that my family doctor had available.

Cameron can still attend and I'm confident that he would be able to relay all of the project details and considerations, and receive & discuss your input and feedback on this project. I can also be reached be email or phone as well up till 2 pm today. Or if you prefer we can also reschedule for a later date.

Thank-you and sorry again that I had to cancel last minute.

Fraser Brandon-Sutherland
UTRCA, Project E.I.T.
1424 Clarke Road, London, ON, N5V 5B9
(519) 451-2800 ext. 422

>>> "Gorrie, Cameron" <Cameron.Gorrie@stantec.com> 2/24/2018 3:50 PM >>>
Thanks for the update Rochelle. Looking forward to meeting with you on Monday.

From: Rochelle Smith [mailto:rsmith@cottfn.com]
Sent: Friday, February 23, 2018 3:33 PM
To: Gorrie, Cameron <Cameron.Gorrie@stantec.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>; Fraser Brandon- Sutherland (SutherlandFB@thamesriver.on.ca) <SutherlandFB@thamesriver.on.ca>
Subject: RE: West London Dyke Erosion Control Class EA

As you may be aware, while travelling to our offices if you come off of the 401: Iona Station exit the road is closed at the bridge due to the flooding. I know there will need to be some road work done to get it back up and running. With that being said, I recommend coming off of Hwy 2/Longwoods Rd. on to Melbourne Rd. then to Switzer/Anishinaabeg Rd.

There is also a road closure sign at Hwy 2 and Melbourne rd., please disregard it and by pass the sign as the road is fine from there to our offices

Rochelle Smith
A/ Consultation Coordinator
Chippewas of the Thames First Nation
320 Chippewa Road, Muncey, ON N0L 1Y0
519-289-2662 ext. 213

From: Rochelle Smith
Sent: February 23, 2018 3:24 PM
To: 'Gorrie, Cameron' <Cameron.Gorrie@stantec.com>
Cc: 'Bergman, Stephanie' <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>; 'Fraser Brandon- Sutherland (SutherlandFB@thamesriver.on.ca)' <SutherlandFB@thamesriver.on.ca>
Subject: RE: West London Dyke Erosion Control Class EA

Cameron,

We are still not fully moved over to the new location yet.
With that being said, we would like to have the meeting at our old offices.

77 Anishinaabeg Rd. Muncey ON N0L 1Y0

Google link address:
https://www.google.ca/maps/place/6609+Switzer+Dr,+Melbourne,+ON+N0L+1T0/@42.8084996,-81.5391575,690m/data=!3m1!1e3!4m5!3m4!1s0x882fab246afb55b5:0x43156f2ad4b129e1!8m2!3d42.8097102!4d-81.5385411

Again, my apologies in the change in location. We look forward to meeting with you Monday at 2pm.

Kind regards,
Rochelle Smith

Rochelle Smith
A/ Consultation Coordinator
Chippewas of the Thames First Nation
320 Chippewa Road, Muncey, ON N0L 1Y0
519-289-2662 ext. 213

From: Rochelle Smith
Sent: February 14, 2018 10:03 AM
To: 'Gorrie, Cameron' <Cameron.Gorrie@stantec.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>; Fraser Brandon- Sutherland (SutherlandFB@thamesriver.on.ca) <SutherlandFB@thamesriver.on.ca>
Subject: RE: West London Dyke Erosion Control Class EA

Miigwech, I will review it prior to our meeting.

Rochelle Smith
A/ Consultation Coordinator
Chippewas of the Thames First Nation
320 Chippewa Road, Muncey, ON N0L 1Y0
519-289-2662 ext. 213

From: Gorrie, Cameron [mailto:Cameron.Gorrie@stantec.com]
Sent: February 13, 2018 10:33 PM
To: Rochelle Smith <rsmith@cottfn.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>; Fraser Brandon- Sutherland (SutherlandFB@thamesriver.on.ca) <SutherlandFB@thamesriver.on.ca>
Subject: RE: West London Dyke Erosion Control Class EA

Rochelle,

Please find attached a digital copy of the display boards for this project. We'll bring a hard copy as well for our meeting on the 26th.

Thanks,

Cam

From: Rochelle Smith [mailto:rsmith@cottfn.com]
Sent: Friday, February 09, 2018 11:45 AM
To: Gorrie, Cameron <Cameron.Gorrie@stantec.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>
Subject: RE: West London Dyke Erosion Control Class EA

No problem, we are currently still at the SOAHAC site but are moving the week of Feb 12th to the Administration Office at 320 Chippewa rd.
By the time we have our meeting we would like to be fully moved over.

Rochelle Smith
A/ Consultation Coordinator
Chippewas of the Thames First Nation
320 Chippewa Road, Muncey, ON N0L 1Y0
519-289-2662 ext. 213

From: Gorrie, Cameron [mailto:Cameron.Gorrie@stantec.com]
Sent: February 9, 2018 11:42 AM
To: Rochelle Smith <rsmith@cottfn.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>
Subject: RE: West London Dyke Erosion Control Class EA

Thanks for clarifying the location – previous meetings I've been at have been held at the SOAHAC off of Anishnaabeg Road/Switzer Road.

From: Rochelle Smith [mailto:rsmith@cottfn.com]
Sent: Friday, February 09, 2018 11:20 AM
To: Gorrie, Cameron <Cameron.Gorrie@stantec.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>
Subject: RE: West London Dyke Erosion Control Class EA

Perfect, thank you for the speedy response. I will schedule you in for **February 26th at 2pm**.
Our office is located at **320 Chippewa Rd. Muncey, Ontario N0L 1Y0**

Kind regards,
Rochelle Smith

Rochelle Smith
A/ Consultation Coordinator
Chippewas of the Thames First Nation
320 Chippewa Road, Muncey, ON N0L 1Y0
519-289-2662 ext. 213

From: Gorrie, Cameron [mailto:Cameron.Gorrie@stantec.com]
Sent: February 9, 2018 11:11 AM
To: Rochelle Smith <rsmith@cottfn.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>
Subject: RE: West London Dyke Erosion Control Class EA

Rochelle,

February 26th at 2pm would work best. We can send you a copy of the presentation materials ahead of time and will bring a copy to review as well.

Thanks,

Cam

From: Rochelle Smith [mailto:rsmith@cottfn.com]
Sent: Friday, February 09, 2018 11:09 AM
To: Gorrie, Cameron <Cameron.Gorrie@stantec.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>; Emma Young <eyoung@cottfn.com>
Subject: RE: West London Dyke Erosion Control Class EA

Cameron,

Thank you for accepting our invitation to discuss the West London Dyke project further.

Our available dates to meet are, February 26th at 2 pm or March 5th at 10 am.

Please let me know which date works best.

Kind regards,
Rochelle Smith

Rochelle Smith
A/ Consultation Coordinator
Chippewas of the Thames First Nation
320 Chippewa Road, Muncey, ON N0L 1Y0
519-289-2662 ext. 213

From: Gorrie, Cameron [mailto:Cameron.Gorrie@stantec.com]
Sent: February 8, 2018 4:56 PM
To: Rochelle Smith <rsmith@cottfn.com>
Cc: Bergman, Stephanie <Stephanie.Bergman@stantec.com>
Subject: West London Dyke Erosion Control Class EA

Rochelle,

Thank you for expressing your interest with the West London Dyke Erosion Control Class EA. I'd be more than happy to meet with you to discuss the proposed planning alternatives in further detail. Please let me know what date works best for you.

Thanks,

Cameron Gorrie
P.Eng.
Project Manager, Water

Direct: (519) 675-6650
Mobile: (519) 933-5918
Fax: (519) 645-6675

Stantec Consulting Ltd.
600-171 Queens Avenue
London ON N6A 5J7 CA

AAMJIWNAANG FIRST NATION

978 Tashmoo Ave.
Sarnia, Ontario N7T 7H5
Ph.: 519-336-8410
Fax: 519-336-0382

March 21, 2018

Our File # 2015-0044

Attn: Cameron Gorrie, P. Eng.
Project Manager, Stantec Consulting Ltd.
Cameron.gorrie@stantec.com

Re: West London Dyke Erosion Control
Municipal Class Environmental Assessment
Notice of Study Commencement

Dear Cameron Gorrie:

We are writing to follow-up with the information that you recently provided regarding the above noted project dated January 17, 2018 The information was recorded into our consultation log and recently discussed at the Aamjiwnaang First Nation's Environment Committee on March 6, 2018 for their review and consideration.

After review of information provided, Aamjiwnaang First Nation (AFN) has concerns with road mortalities during construction and would like to know your plans to reduce/mitigate impacts on wildlife? AFN requests that any habitat areas that have been disturbed or removed as a result of the project be restored, where possible. Softened erosion control by using riparian buffers. Any wildlife corridors that are disturbed due to the project, be restored after completion of the project. Also, AFN is interested in any archeological studies in the project area. AFN request that we have our Archeological and Species at Risk Monitors on site during assessments studies and construction. In addition, as part of the rebuilding after improvements, AFN would like to have native plant species re-planted or planted in another significant area near the project area. We are enclosing a copy of our greenhouse "Maajiigin Gumig" brochure. Our greenhouse provides a local source of native vegetation. The greenhouse technician can be reached at 519-336-8410. Or kwilliams@aamjiwnaang.ca

As the First Peoples of this territory, we are intimately connected to our lands, water and resources. We have an inherent and sacred responsibility to manage and protect our lands and resources. Our existing Aboriginal and treaty rights, our perspectives, interests and obligations of stewardship must inform the development of any proposed project, which may potentially impact these rights. Our First Nation must be involved in the decision-making processes at an early stage in the project and be fully informed throughout.

978 Tashmoo Ave.
Sarnia, Ontario N7T 7H5
Ph.: 519-336-8410
Fax: 519-336-0382

To promote consistency and timely responses, please forward any and all relevant information pertaining to this project to:

Chief Joanne Rogers
Aamjiwnaang First Nation
978 Tashmoo Avenue
Sarnia, Ontario, N7T 7H5
Office: (519) 336-8410

Sharilyn Johnston
Environmental Coordinator
Aamjiwnaang First Nation
978 Tashmoo Avenue
Sarnia, Ontario, N7T 7H5
Office: (519) 336-8410
Email: sjohnston@aamjiwnaang.ca

Information sharing between the proponent and our community is critical to making informed decisions. However, this review process must not in any way be interpreted as satisfying the Crown's constitutional duty to consult and accommodate Aamjiwnaang First Nation. As the Supreme Court set out in *Haida Nation*, the Crown may delegate procedural elements of its duty to consult, however, "the ultimate legal responsibility for consultation and accommodation rests with the Crown and the Crown alone."

Aamjiwnaang First Nation is committed to facilitating a flexible, clear, and reasonable process for reviewing information in relation to the proposed project and will participate fully in responding to the information provided. This letter does not abrogate or derogate Aamjiwnaang First Nation's continuing ability to assert and exercise its Aboriginal Rights and Title to all parts for its Reserve and Traditional Territory.

Sincerely,

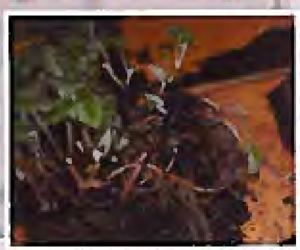
Christine James

Christine James
Aamjiwnaang Consultation Worker
Aamjiwnaang First Nation


Growing a Large Selection of Native Plant Species for Small & Large Scale Ecological Restoration Projects
Maajiigin Gumig
Maajiigin Gumig,
native plant greenhouse, is an ecology based social enterprise focusing on growing native plants for the Aamjiwnaang community & the Sarnia-Lambton area.
Shell
uniongas
A Spectra Energy Company
For more information:
Aamjiwnaang
ENVIRONMENT DEPARTMENT
978 Tashmoo Avenue,
Sarnia, Ontario N7T 7H5
Tel: 519-336-8410
kyle.williams@aamjiwnaang.onmicrosoft.com
Maajiigin Gumig
Native Plant Greenhouse
"Place where plants start to grow"

Plant Rescue

Seed Collecting & Cleaning



Native Plant Propagation

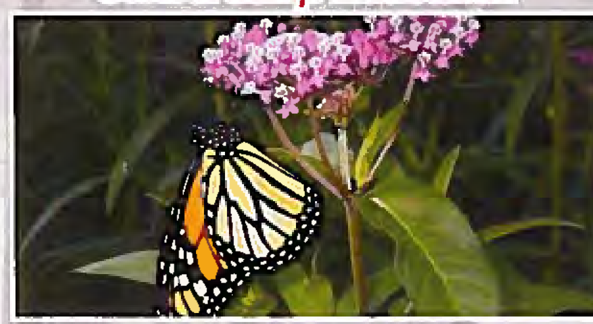
Residential
Commercial / Industrial

- Ecological Restoration
- Consultation
- Post Construction Remediation
- Native Plants, Seed Mixes

Sustainable Economic Development
Program Offering Employment, Training
& Volunteer Opportunities

Multi-generation
Teaching & Learning

Ecological
Stewardship Education



Reconnecting With The Earth

Appendix C FLUVIAL GEOMORPHOLOGY REPORT (STANTEC 2015)

West London Dyke River Morphology and Scour Remediation Report

Stantec

Prepared for:
Upper Thames River Conservation Authority

Prepared by:
Stantec Consulting Ltd.
49 Frederick Street
Kitchener, ON N2H 6M7
Tel: (519) 579-4410
Fax: (519) 579-6733

1656-30035
December 2015

WEST LONDON DYKE RIVER MORPHOLOGY AND SCOUR REMEDIATION REPORT

This document entitled West London Dyke river morphology and scour remediation report was prepared by Stantec Consulting Ltd. for the Upper Thames River Conservation Authority. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation.

Prepared by ______________________________
(signature)

Trevor Chandler, M.Sc.
Fluvial Geomorphologist

Reviewed by ______________________________
(signature)

Heather Amirault, P.Eng.
Water Resources Engineer

Reviewed by ______________________________
(signature)

Brad Fairley, MES
Stream Restoration Services Leader

Stantec

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1.0 Introduction

As part of the West London Dyke (WLD) North Branch Thames River, Project 14-10, river scour surveys were undertaken at two locations along the WLD: downstream of the Ann Street Weir and downstream of Leslie Street. The sites are located between Fanshawe Dam and the confluence of the North Branch with the South branch of the Thames River, locally referred to as the Forks, as illustrated in Figure 1. The purpose of the river scour surveys is to determine the degree of undermining of the dyke toe or other bank protection structures as this is the primary mechanism for dyke failure. In order to provide adequate bank protection for the dyke, estimates of scour depth are required. The ultimate depth of scour should consider channel degradation and natural scour and fill processes.

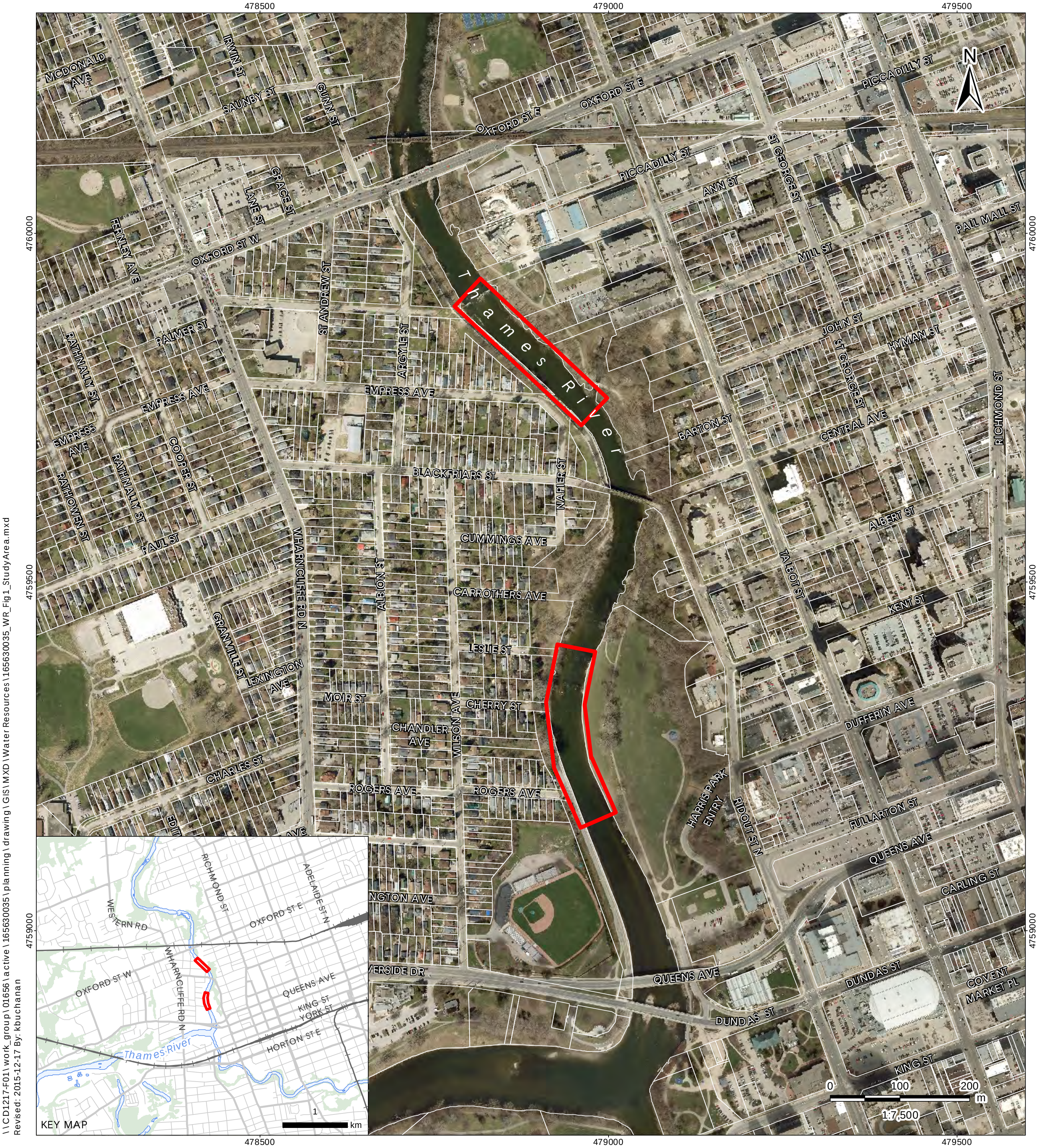
1.1 SCOPE

The purpose of this work was twofold, as outlined below.

1. To undertake a scour survey at the two identified sites and,
2. To apply the information from the scour surveys to design concepts and opinions of probable cost for restorative treatments, which address scour and erosion and protect the dyke and other infrastructure.

The specific tasks for this work entailed:

- Background review of available information, including but not limited to historical planform assessments, geomorphic survey reports, topographic and cross-section surveys, sewer crossing plans and plans of existing river bed and bank treatments. This information was used to develop the field survey methodology for this investigation.
- Conduct two field surveys at both sites to characterize the study sites and to determine where scour processes are affecting the dyke, including measurements of scour depth. One survey was to be in winter 2015 (pre spring high flow) and the second in late fall 2015. The purpose of the two surveys was to determine if there is an observable change in the bed profile and scour depths and locations between the two periods.
- Directly observe and photograph the river to document flow dynamics and interaction of the flow with the banks. These observations occurred for a range of low and high flows.
- Characterize the river bed material and evaluate its capacity to resist scour.
- Prepare concept plans and opinions of probable cost for restorative bed and/or bank treatments that address scour and erosion at the site and protect the dyke and related infrastructure.



December 2015
165630035

\\CD1217-F01\work_group\01656\active\165630035\planning\drawing\GIS\MXD\Water Resources\165630035_WR_Fig1_StudyArea.mxd
Revised: 2015-12-17 By: kbuchanan

Stantec

Legend

- Study Site
- Parcel

Client/Project

Upper Thames River Conservation Authority - West London Dyke River Scour Survey

Figure No.

1

Title

Project Location

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2015.
3. Imagery and base features used under license with the City of London, © 2014.

2.0 Background

As part of this study Stantec reviewed the background data that was provided to Stantec by the Upper Thames River Conservation Authority (UTRCA). These data include topographic and cross-sectional surveys conducted by UTRCA and sewer crossing plans as well as plans of the weir structure at Leslie Street. Stantec also reviewed the historical data on planform adjustment available within a 2007 report prepared for the City of London by Stantec as it provides some interesting insights into the history of the river. Previous cross-section surveys by UTRCA in 2014 were used as well.

The following background studies and investigations were reviewed in support of this scour report:

- **Central Thames Subwatershed Study (Parish Geomorphic, 2014)** – this study characterizes the Central Thames subwatershed as part of the Phase II Climate Change Adaptability Strategy. The study evaluates the existing geomorphic condition of the watershed commenting on slope stability, erosion and sediment movement. Detailed geomorphic data were collected from the North Branch two kilometres upstream of the WLD study area, including longitudinal profile, cross-section geometry and substrate characteristics.

- **London Dykes Stability Review (AECOM, LVM, 2012)** this report provides detailed descriptions of local surficial geology, bank material composition and parent material in which the Thames River flows.

- **Thames River Fluvial and Slope Stability Scoping Study and Final Report (Water's Edge, 2013)** – The Thames River within the City of London was partitioned into 17 representative reaches and channel stability was assessed using a variety of techniques, including the rapid geomorphic assessments (RGA). Geomorphic surveys were conducted in the North Thames River, which provide information on channel slope and bankfull dimensions in the vicinity of the study area.

- **Thames River Reach Study and Fluvial Geomorphological Assessment (Water's Edge, 2014)** – this report concentrates largely on the South Thames River and the mainstem downstream of the confluence with the North Branch.

Other information was reviewed as well to more fully evaluate the available relevant background information for the North branch of the Thames River at the two sites investigated. This information included:

- **Fluvial Characteristics of the Thames River, London, Ontario (1970)**. This is a graduate thesis (University of Western Ontario) by Robert Jay McCalla containing longitudinal profiles and cross-section data for the North Branch of the Thames River, including the Leslie Street site. These data were used to evaluate changes to the river bed elevation at this site since 1970.

- **Kilally Gabion Wall Failure and Preliminary Restoration Replacement Options (Stantec, 2007)** – The report included a historical assessment of planform changes along the North Branch between Highbury Avenue and Richmond Street. Although this is upstream of the study area of this investigation, the report included information pertaining to long term changes to channel planform (meander migration) and longitudinal profile (incision).

- **Back to the River (Stantec, 2015)** – A historical planform map was prepared for the Thames River within city boundaries, including the North Branch. River planform was mapped for five periods between 1863 and 2010, using a combination of archival maps and aerial photographs. The map provides an indication of long term river planform stability and includes both current study sites.

2.1 GEOLOGY

Geology and climate represent the primary aspects of the physical environment that control channel form and process. Climate, and specifically runoff from precipitation, provides the energy for the system and directly influences basin hydrology. Geology, physiography and vegetation act as constraints to the level of fluvial activity and, in part, determine the nature and quantity of sediment supplied to the watercourse.

The City of London occupies a physiographic feature known as the London Basin. This region of relatively uniform terrain is composed of silt, sand and gravel deposited by Lake London at the end of the last glaciation (Chapman and Putnam, 1984). Surficial deposits along both banks of the North Branch through the study area consist of modern alluvium, which is made up of sand, gravel, and silt (Dreimanis, 1964). The alluvium is of varying thickness and is on top of glacial till from the Lake Huron or Erie lobes, formed from consolidated clayey silt. Within the study site, a previous study by AECOM (2012) investigated in detail the surficial geology along the dyke on the west side of the river. The strata consist of sandy fill (3-4 m) over sand or sand and gravel (1-2 m) over dense silt till. The top of the till stratum occurs at an elevation of approximately 231 m at both sites. There are no exposures of bedrock reported in this area (AECOM, 2012).

2.2 HYDROLOGY

The North Branch of the Thames River within the study area drains an area of approximately 1,700 km^2. Hydrological data for the North branch are collected at Water Survey of Canada (WSC) gauging station 02GD003 at Fanshawe Dam. The gauge is located 12 km upstream of the study sites and regulates flows at the study sites. The two year return period flow for the North Branch is 342 m^3/s, based on an analysis of WSC gauge data. A bankfull discharge of 191 m^3/s was determined from measurements of bankfull morphology at a site two kilometres upstream of the study area. Water surface slope throughout the river between the Fanshawe Dam and the Forks is relatively uniform, ranging between 0.1% and 0.2%, with locally higher slopes over obstructions (Parish, 2014).

2.3 HISTORICAL ASSESSMENT

The North Branch of the Thames River between the Fanshawe Dam and the Forks has shifted its planform considerably at some locations. The dominant change has been due to gradual bank erosion and chute cutoffs (Stantec, 2007). Within the study area, the river planform has been relatively stable with no substantive shifts over the period of record from 1863-2012, (Stantec, 2015). Throughout much of this time, the West London Dyke has been a fixture of the river landscape, and is visible on 1922 aerial photography. The main change in river planform was the deposition of a large point bar between the two study sites, immediately downstream of Blackfriar's Bridge. This bar was visible on the 1922 aerial imagery as a mainly non-vegetated feature and which gradually became well-established and forested over the period of record.

2.4 RIVER SCOUR IN THE THAMES RIVER

Several occurrences of scour holes have been observed along the North Branch of the Thames River (Stantec, 2007; Parish, 2014). These holes are often 3 m deep or more and have cut into the underlying till parent material. Scour was observed where the channel narrowed and where flows accelerated through a local constriction. The constrictions were caused by variations in local geology but more frequently by human activities, such as bridges, dykes, and river bank protection that limited the channel width. One example is an artificial narrowing of the channel upstream of Adelaide Street. The bank was extended into the river and secured with a sheet pile wall. The structure contributed to bed and bank scour and the undermining of an upstream gabion wall along the outside of a meander bend (Stantec, 2007). The resulting bed scour cut into underlying till that is highly resistant to scour when first exposed but less so over time. As the till becomes hydrated from prolonged (months) exposure to river water the intergranular bonds near the fluid-sediment interface are weakened (Khan, 2006). In a few months, a shear stress of approximately 15 N/m^2 is capable of eroding the weathered surface layer (Ashmore, 2007). A shear stress of 15 N/m^2 is capable of mobilizing material as large as 2 cm. As such, the scour of till is a cyclical process of repeated scour and weathering. The scour observed in the North branch was regarded as a potential risk to nearby riparian infrastructure (Parish, 2014).

3.0 Methods

In natural rivers, scour processes are governed by a number of inter-related controls including depth of flow, water surface slope, substrate size, flow cross-sectional area, and river entrenchment and access to its floodplain (Knighton, 1994). Using the information from the review of background documents, Stantec developed a plan for surveying the two key areas: Ann Street and Leslie Street. The surveys extended a minimum of 100 m above and below scour areas. The surveys were conducted by accessing the river by wading or canoe. Given the importance of bed material in determining likely scour potential, Stantec characterized the sediment by Wolman pebble count to determine the sediment gradation, including median size (D_{50}) of the bed material. Using standard shear stress calculations, Stantec determined the ability of the material to prevent/limit scour. The surveys were carried out using Topcon GR-5 Survey Equipment (sub-centimetre accuracy). The new data was integrated with the dyke base plans provided by UTRCA to help determine the severity of the scour.

3.1 GEOMORPHIC SURVEYS

The river longitudinal profile was surveyed in order to map thalweg, water surface slope, and bankfull. Several cross-sections were also surveyed at each site to depict changes in cross-sectional geometry along the channel. At least two cross-sections for each site were located in the scour pool. Bankfull stage was marked on the cross-sections wherever it could be determined with confidence. Identifying bankfull enables shear stress and scour potential to be determined for bankfull conditions.

Historic cross-section locations provided by UTRCA were loaded into the Stantec survey equipment such that precise resurvey of the cross-sections was undertaken in the field. The UTRCA cross-sections were originally surveyed in 2014 and were resurveyed in 2015 in order to show changes in the cross-section geometry related to scour. All survey data were brought into AutoCAD and then imported into Stantec's RiverMorph software. The RiverMorph program was used to determine a variety of morphological parameters, such as bankfull cross-sectional area and hydraulic radius, and to generate longitudinal profiles and cross-section graphics.

3.2 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 Wolman Pebble Count. If the channel bed consisted of consolidated material (e.g. glacial till), this observation was noted. In this case, 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.

3.3 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.

3.4 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 bed 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 flows are actually capable of producing during bankfull, and was calculated using a standard relation as 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 bed material mobilized. Critical shear is defined as the shear stress at which the motion of a sediment particle is initiated; the larger the particle, the greater the shear stress required to initiate motion. Input data to calculate critical shear stress include measurements of channel slope and hydraulic radius, as measured during the longitudinal profile and cross-section surveys at each site. 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; and
- Leopold, Wolman, and Miller, 1964

The model output is a measure of the largest grain size, in mm that bankfull conditions are able to mobilize. However, the predictions are for average conditions and local burst and sweeps (turbulence) in the river are capable, albeit less frequently, of mobilizing larger material. The results of the shear analysis were compared to measurements of substrate gradation as well as local site conditions as observed during the field survey.

4.0 Results

A combination of poor weather, high flows, and otherwise unsafe field conditions in spring 2015 resulted in the first survey being postponed until June 26, 2015. Both study sites were surveyed at this time. The second channel survey has not been completed. During the June survey, UTRCA reduced flow in the river at the Fanshawe Dam to facilitate the fieldwork as below:

- Before 10:30: 7.7 m^3/s
- 10:30 to 15:30: 1.8 m^3/s
- After 15:30: 12 m^3/s

In spite of the flow reduction, water levels were relatively high but could be readily surveyed by wading or from the canoe.

During the June survey, the geographical extent of the river survey was expanded considerably to increase the length of river surveyed from 30 m to more than 100 m upstream and downstream of the scour locations. This was done to fully include the large scour pools and the distance that separated scour locations from the river features that were suspected of contributing to scour. The locations of the surveyed longitudinal profiles and cross-sections are shown in Figures 2 and 3, and details of the survey results are provided below.

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2015/12/17 10:42 AM By: Chandler, Trevor

Legend

CROSS-SECTION

THALWEG

0 15 45 75m

1:1500

Stantec

49 Frederick Street
Kitchener, ON, N2H 6M7
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UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE, THAMES RIVER
NORTH BRANCH RIVER SCOUR SURVEY

Figure No.

2

Title

ANN STREET
CROSS-SECTION LOCATIONS

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2015/12/17 10:40 AM By: Chandler, Trevor

Legend

CROSS-SECTIONS

THALWEG

0 15 45 75m

1:1500

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WEST LONDON DYKE, THAMES RIVER
NORTH BRANCH RIVER SCOUR SURVEY

Figure No.

3

Title

LESLIE STREET
CROSS-SECTION LOCATIONS

4.1 ANN STREET SITE

The Ann Street Site is located along the outside of a slight bend in the channel, along river right (west bank). Meander radius of curvature is 360 m and the site is located at the downstream end of the meander. The dyke has been at this location for many years, appearing on 1922 imagery. There is a large concrete weir on the channel bed at this location. The weir is located approximately 200 m downstream (south) of Oxford Street and extends across the entire length of the channel and into both banks. The structure is believed to be a concrete encasement for a now abandoned sanitary sewer. The sanitary sewer was lowered at this crossing location and is presently located underneath the existing crossing. The “weir” structure has been a fixture of the river landscape at this location for decades, being visible on 1955 aerial imagery; it does not appear on imagery dating from 1950 or earlier. The presence of the weir, which was no doubt originally installed below the river bed, indicates that considerable incision has occurred at this site in the past. Within the past decade, a notch was cut in the structure, which created a low flow “channel”. The notch is located toward the right (west) bank and the notch invert is approximately 0.5 m lower than the rest of the structure. Photographs of the site are included in Appendix B.

4.1.1 Longitudinal profile

The longitudinal profile at the Ann Street site extended a distance of 270 m from just downstream of Oxford Street to 130 m downstream of the weir crossing (Figure 4). There is a deep pool located downstream of Oxford Street and the channel bed gradually rises toward the weir at station 0+140 (XS3 WEIR cross-section). The channel bed upstream of the weir consists of gravel and small cobble in a sandy matrix. Water depths along the thalweg vary by as much as 2 m, between the maximum depth of the pools and crest of the weir structure. The water surface slope through this area is 0.003 m/m with a total drop of 0.6 m over the weir during low flows.

The scour pool is located downstream of the weir along the right bank. Depths were variable through the scour pool with substrate material consisting of large rubble/stone or firm glacial till. Flow velocities were in excess of 1 m/s immediately below the weir due to the concentrated flow through the weir notch. The scour pool extended from station 0+150 to station 0+190 for a total distance of 40 m. Downstream of the scour pool, the toe of the dyke was protected by deposits of gravel and rubble.

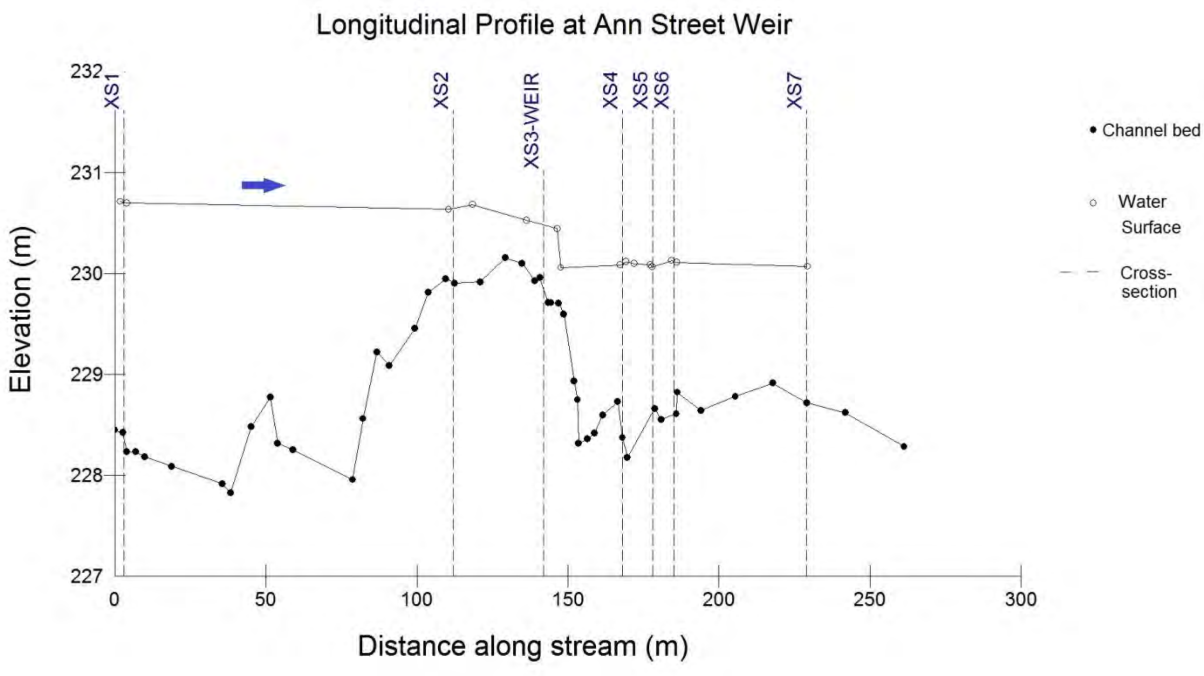

Figure 4: Longitudinal Profile at Ann Street Site

4.1.2 Cross-Section Geometry

A total of 7 cross-sections were surveyed at the Ann Street site: 2 upstream of the weir, 1 at the weir, 3 in the scour pool, and 1 additional downstream section. Cross-sections 3 and 7 coincide with 2014 UTRCA cross-section surveys. Cross-sections 3, 4 and 7 are presented in Figures 5, 6, and 7; the other cross-sections are located in Appendix A. All cross-sections are viewed in the downstream direction.

The weir notch is visible at cross-section 3 (Figure 5) along the right side of the section. The weir was exposed (no flowing water) along the left and far right banks with a maximum water depth of 0.5 m through the notch on June 26, 2015. The 2014 UTRCA cross-section is depicted in Figure 5 as the dashed line. Cross-section 4 was located in the central portion of the scour pool (Figure 6). Locally, the scour extended laterally under the toe of the concrete dyke by up to 0.4 m. The material eroded consisted of dense silty till that was friable and easily broken. At cross-section 7 (Figure 7), the channel has not changed appreciably.

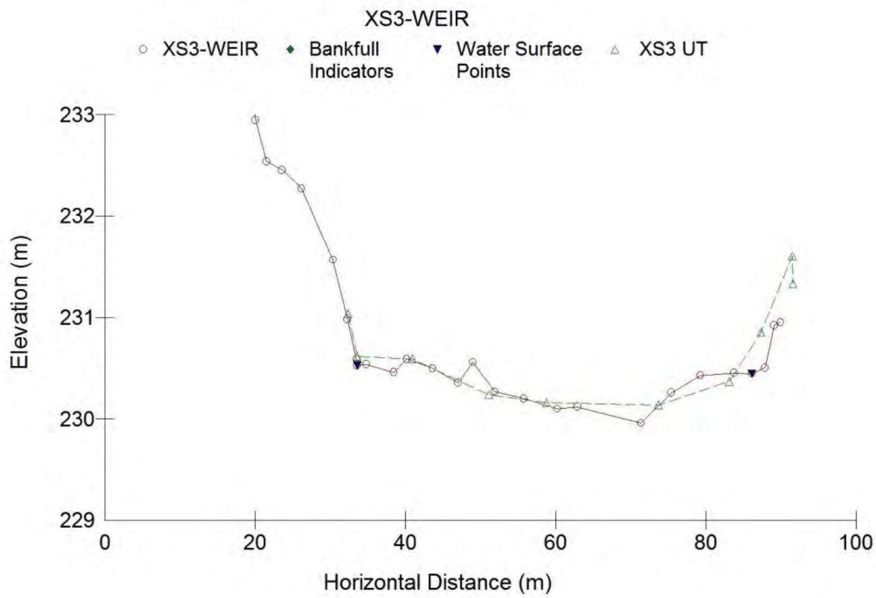

Figure 5: Cross-Section 3 at Ann Street Weir

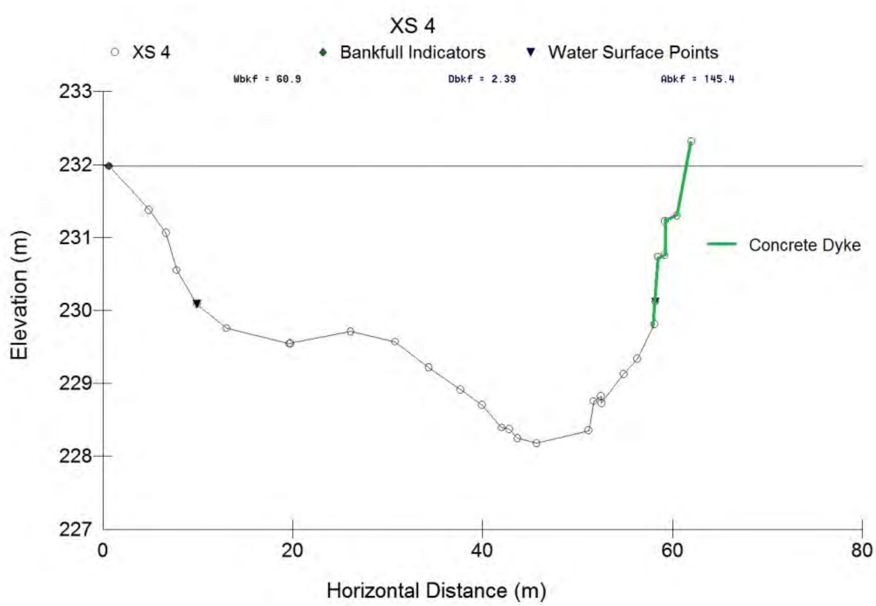

Figure 6: Cross-Section 4, 30 m Downstream of Ann Street Weir

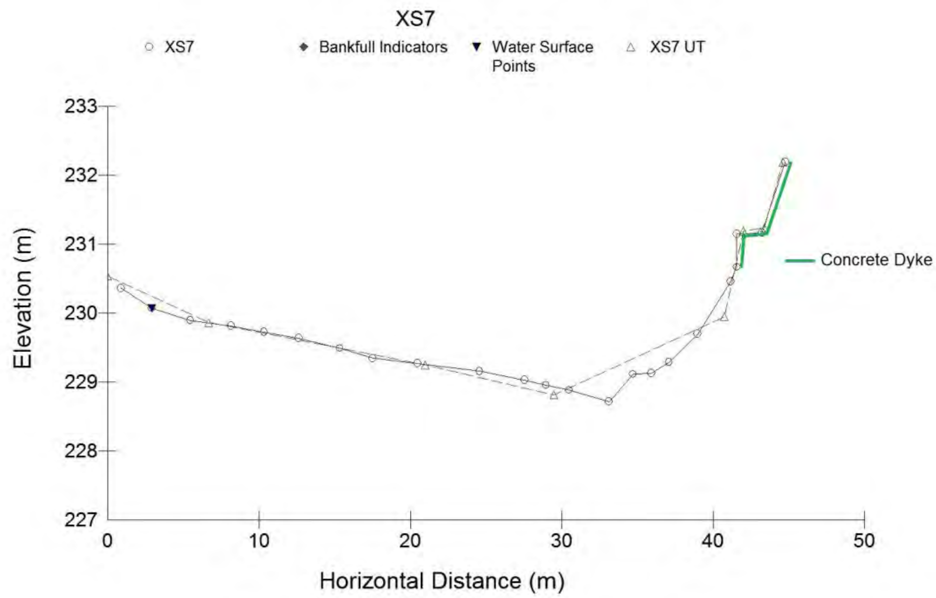

Figure 7: Cross-Section 7 Downstream of Scour Hole

Channel morphology and morphometry at the Ann Street site are presented for pools and riffles in Table 1, below.

Table 1: Channel Dimensions at Ann Street Site

Channel	Scour Pool	Riffle
Bankfull width (m)	60.9	56.4
Mean bankfull depth (m)	2.39	1.44
Bankfull width-depth ratio	25.5	39.2
Bankfull cross-sectional area (m^2)	145.2	81.4
Bankfull hydraulic radius (m)	2.30	1.43
Water surface slope (m/m)	0.003	

4.1.3 Substrate Characteristics

There was no unconsolidated substrate on the channel bed within the scour pool and the channel bed consisted of exposed silt till. The till was observed at an elevation of approximately 230 m and lower, which coincides with the borehole data results from AECOM (2012). The till material on the channel bed was firm but along the bank (at water's edge) the top 1-2 cm of the till could be removed by hand with relative ease. The till collected in this way was friable (crumbly) and not considered to be resistant to erosion. Immediately upstream and downstream of the scour hole, on river right, there was deposition of gravel and cobble-sized material. This material consisted of 71% gravel and 29% cobble, with the following gradation:

Size Fraction	Particle Size (mm)
D_{16}	23.32
D_{35}	35.6
D_{50}	46.65
D_{84}	84.13
D_{95}	128
D_{100}	256

4.1.4 River Flow Dynamics and Scour

The Ann Street site is located along the outside of a meander and some degree of scour is to be expected. However, observations of flows at the site indicate that the weir is intensifying scour potential. The Ann Street site was inspected and photographed a total of 7 times throughout the winter, spring and summer of 2015 to inspect flows and their interaction with the banks. During these surveys it became clear that flow vectors were coming from the weir and targeting the area of increased scour immediately downstream of the weir on river right. The configuration (bathymetry and structure) of the weir, and more precisely the weir notch, is considered to contribute to the intensified scour observed on site. A large recirculation zone was present at the upstream and of the scour hole during lower flows (7.2 m^3/s) during the geomorphic survey of June 26, 2015. The scour was most prevalent immediately downstream of the weir (5-10 m) and decreased in intensity in the downstream direction. Photographs of the channel and flows are presented in Appendix C.

Shear stress during bankfull conditions is 54.11 N/m^2, with calculations presented in Appendix D. The critical shear stress analysis indicated that bankfull discharge was capable of mobilizing material 90-100 mm in diameter (cobble), which is larger than D_{84} (84.13 mm). Based on the gradation of sediments at this site, the majority of consolidated sediments are mobilized during bankfull conditions. This condition is supported by the lack of consolidated substrate in the deepest part of the scour hole.

Due to the highly variable resistance of till over time, the erosion of till does not lend itself to rapid changes in channel geometry. The scour of unconsolidated sediments can occur very quickly, but the river has already scoured these sediments from this site and they are not able to settle in the scour pool and offer bank protection. The slow erosion of till compared to unconsolidated sediments means that there is more time to head off the erosion of the underlying till.

4.1.5 Recommendations

Erosion is a natural and necessary process in alluvial channels and provides sediment that is vital for the continued replenishment of riffles and other river forms. Erosion becomes a problem when rates exceed what is expected or if it occurs in places where it normally does not occur in a stable system, such as in straight sections of channel through riffles or along the inside of meanders. Controlling excessive erosion may be done at this site by two basic methods:

1. **Bed/bank protection**: to re-enforce and protect the channel bed or banks with materials that resist erosion, or
2. **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 scour prevention treatments proposed at the Ann Street site involve protection of the bank toe, modification to flows or a combination of the two scour control methods. Three bed/bank treatments option have been developed in order to deal with the scour occurring at this site. The concept plan for each option include a planview and cross-section schematic, as outlined below. This option will reduce the rate of scour at this location. Bank protection may still be required at a later date to protect the dyke at this location. The options proposed below for this site may be used separately or the options may be used in combination with each other.

Ann Street Option 1 - Weir Removal

The weir is deflecting flow vectors directly toward the right bank downstream of the weir and scour processes are being intensified as a result. Removal of the weir would eliminate the effect of the weir notch that is presently directing flows toward the scour location (Drawing 1-1, Appendix E). The riffle located immediately upstream of the weir may need to be augmented and re-built in order to maintain the grade control that has established at this location. Augmentation of this riffle is not included in the opinion of probable cost.

Option 1 Opinion of Probable Cost: $30,000

Ann Street Option 2 - Boulder Toe Protection

A boulder toe could be used to protect the dyke toe from scour. The treatment would extend along the toe of the dyke between the existing weir and approximately 50 m downstream, as depicted in Drawing 1-2, Appendix E. The available options for toe protection are somewhat limited since the treatment used must adequately interface with the concrete dyke toe. This option is to be combined with weir removal. Long term maintenance of this option would include monitoring at the scour location. Bank protection may still be required at a later date to protect the dyke at this location. Option 1 is included as a part of Option 2.

Option 2 Opinion of Probable Cost: $100,000

Ann Street Option 3 - Bench and Vanes

This option is a combination of bank protection and flow modification, and requires removal of the concrete weir structure (Option 1). Flows are modified by vanes, which are linear structures anchored into the bank and which point upstream at approximately 25 degrees toward the channel (Drawing 1-3, Appendix E). Vanes function by slowing flow and turning it away from the bank and toward the center of the channel. Scour process will continue but in the center of the channel where they pose less of a risk to the dyke. The vanes would consist of large material (armourstone or boulder) and be anchored into the streambed.

Additional bank protection is provided by a bankfull bench. The bench, composed of granular fill and aggressively planted with deeply rooting vegetation, would extend along the dyke through the scour hole. The top of the bench would be at the bankfull elevation, which is approximately 231.5 m and the same elevation as the existing concrete bench along the toe of the dyke. The fill in the bench would consist of materials that would be stable in this location due to the protective influence of the vanes and the roots of the plantings. Once established, this option with strengthen over time and require minimal maintenance.

Option 3 Opinion of Probable Cost: $250,000

The opinions of probable cost presented above assume the following:

- No water management or erosion/sediment control
- No mobilization / demobilization
- No contingency
- No site access
- No traffic staging
- No permits
- No Contract Administration

4.2 LESLIE STREET SITE

The Leslie Street site is located approximately 300 m upstream of the Queen Street Bridge and 400 m downstream of Blackfriar's Bridge. The scour site is located along the outside of a gradual bend on river right. The meander radius of curvature is 320 m and the site is located along the downstream end of the meander. The dyke was constructed before 1922 as indicated by archival aerial imagery. Substantial repairs to the dyke were undertaken in the 1980s at which time armourstone toe protection was installed at this site. The armourstone consists of 1 or 2 rows that are stacked 2-3 stones high. A gabion wall has been installed along river left (east bank) along the inside of the meander bend, which likely results in a local flow constriction. Channel width through the constriction is 40 m compared to 55 m immediately upstream and downstream of the constriction.

At the upstream section of this site, a Newbury weir was constructed with armourstone. The structure was constructed in partnership with the Ministry of Natural Resources and herein is referred to as the MNR Weir. The downstream end of the weir is located 300 m downstream of Blackfriar's Bridge and immediately upstream of the scour site. The severest scour observed at this location is approximately 150 m downstream of the downstream end of the MNR Weir. Photographs of the site are presented in Appendix B.

4.2.1 Longitudinal Profile

The longitudinal profile at the Leslie Street site extended from the downstream end of the MNR Weir for a total distance of 280 m (Figure 8). The profile indicated the presence of a compound pool at this location with a maximum depth observed at stations 0+072 (near XS102) and 0+160 at XS107. Water surface slope through the site was 0.001 m/m, which is consistent with water surface slopes measure throughout the North branch of the Thames River. River bed elevations surveyed by McCalla (1970) are also shown in Figure 8 for reference. There appears to be a pool at this location over the long term (decades) but it has deepened by as much as 1 m since 1970. The downstream riffle at XS 107 and XS 108 appears to be a permanent fixture of the river.

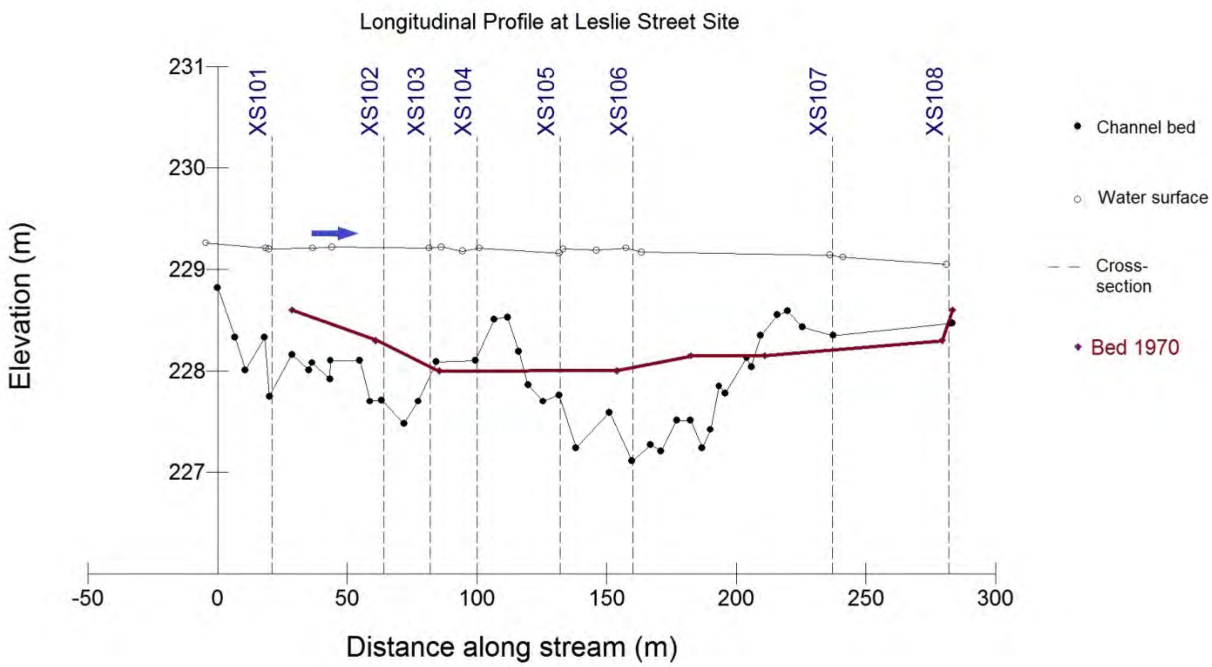

Figure 8: Longitudinal Profile at Leslie Street Site

4.2.2 River Cross-Section Geometry

A total of eight cross-sections were surveyed at this site and included one section (XS 101) at the downstream end of the MNR weir, two sections along the downstream riffle (XS 107 and XS108) and five sections through a compound pool. The upstream section of the pool extended from station 0+000 to 0+110 with a short run between 0+110 and 1+120 and the downstream section of the pool extended from station 0+120 to 1+220.

In the upstream section of pool, cross-section XS103 shows that the cross-section geometry has not changed substantially between 2014 and 2015 (Figure 9). On the right bank, the concrete dyke extends down to the water surface. Below this elevation, a broad area of sediment extends 10-15 meters into the channel. The thalweg is located 15 m away from the right bank and appears to be migrating toward the right bank. The sediment along the right bank consists mainly of gravel with some cobble. There is a gabion wall along the left bank.

Within the downstream section of pool, the maximum depth is located at Cross-section XS106 (Figure 10). At this location, there is armourstone along the toe of the dyke. Sections of the armourstone toe are missing and appear to have fallen into the pool. It was noted that the bankfull width decreases from 52.7 m at XS103 to 40.6 m at XS106, a reduction of 23%, resulting in a local constriction. The constriction, as well as the location of the thalweg within 10 m of the right bank, would result in greater shear along this section of bank.

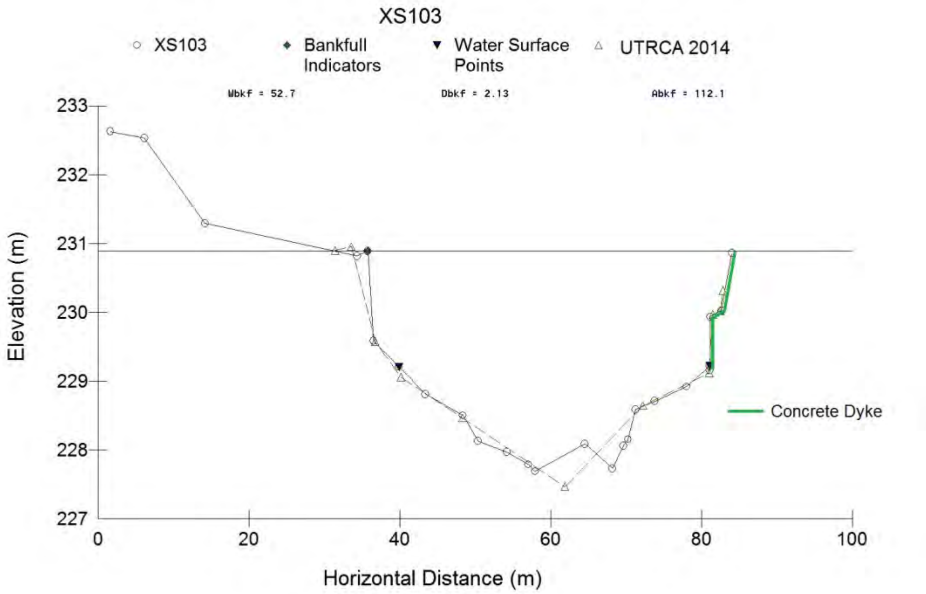

Figure 9: Cross-Section XS103, in Upstream Section of Pool

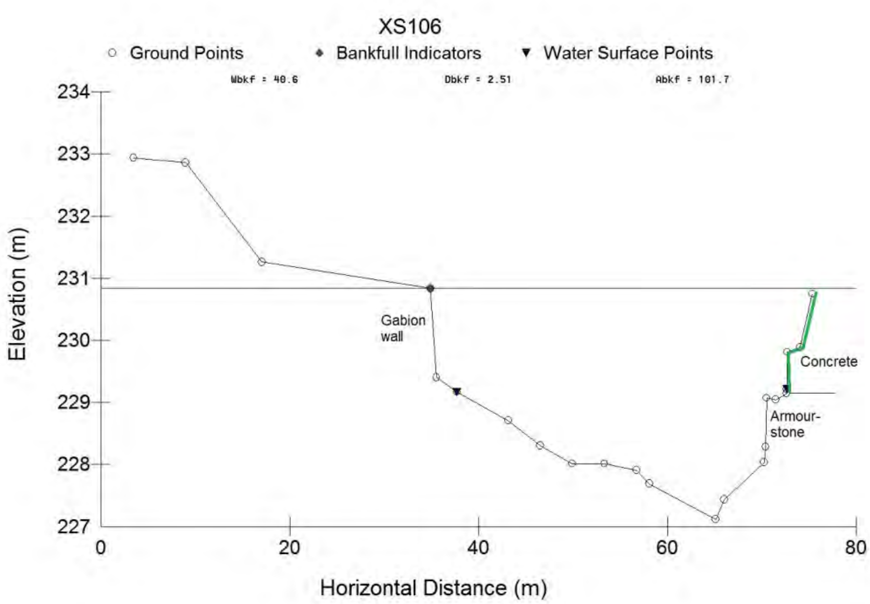

Figure 10: Cross-Section XS106, in Downstream Section of Pool

Farther downstream, at cross-section XS107, the channel bed is relatively stable as the thalweg is located in the middle of the channel (Figure 11). There has been little change in cross-section XS107 geometry between 2014 and 2015. All cross-section plots are presented in Appendix A.

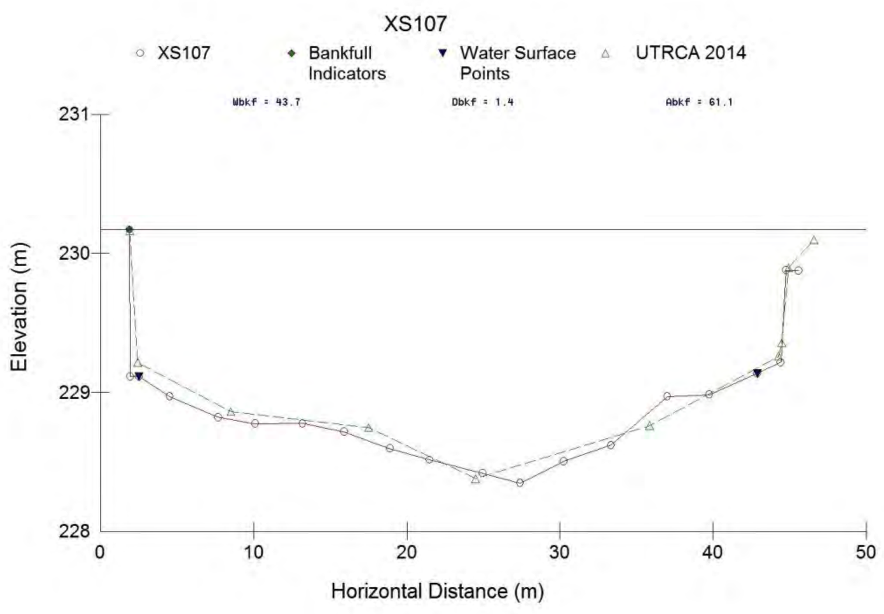

Figure 11: Cross-Section XS107, at Riffle Crest Downstream of Scour Pool

Channel morphology and morphometry at the Leslie Street site is presented for the two sections of the pool and the downstream riffle (Table 2). The mean bankfull width in the downstream section of the pool illustrates the presence of a constriction.

Table 2: Channel Dimensions at Ann Street Site

Channel	Pool -Upstream Cross Sections	Pool - Downstream Cross-Sections	Riffle Cross-Sections
Bankfull width (m)	52.7	40.6	49.3
Mean bankfull depth (m)	2.13	2.51	1.44
Maximum bankfull depth (m)	3.20	3.73	1.86
Bankfull width-depth ratio	24.76	16.17	34.25
Bankfull cross-sectional area (m^2)	112.1	101.7	71.04
Bankfull hydraulic radius (m)	2.05	2.34	1.39
Water surface slope (m/m)	0.001		

4.2.3 Substrate Characteristics

Substrate was collected along the right bank next to the upstream section of the pool. This material consisted of 3% sand, 69% gravel, 26% cobble, and 2% boulder, with the following gradation:

Size Fraction	Particle Size (mm)
D_{16}	21.66
D_{35}	31.06
D_{50}	41.94
D_{84}	81.33
D_{95}	121.7
D_{100}	512.0

There was no unconsolidated substrate on the channel bed within the downstream pool and the channel bed consisted of exposed silt till that was firm. The till was observed at an elevation of approximately 229 m and lower, which coincides with the 2012 borehole data collected by AECOM (2012).

4.2.4 River Flow Dynamics and Scour

Evidence of scour at this site was observed along a 220 m section of channel extending from the downstream end of the MNR weir and just downstream of Rogers Avenue. This length is consistent with the length of the compound pool survey at this site. A combination of factors appears to be resulting in the scour that is occurring at this site. First, the site is located along the outside of a meander bend where scour is commonly observed. Second, the scour process is likely accelerated by flows coming off the MNR weir. Flows observed over a variety of stages intercepted the bank in the downstream section of the pool, where scour was most pronounced. Third, there is a notable constriction within the downstream section of the pool which limits flow capacity and accelerates flow, resulting in scour. Scour was observed along the entire pool along the right bank but was particularly severe along the downstream section of the pool, between station 0+120 and 0+220 of the longitudinal profile. Scour in this downstream section of the pool has undermined sections of the armourstone toe at the base of the dyke.

Shear stress during bankfull conditions is highest in the downstream section of the pool and is 22.9 N/m^2. The shear stress is capable of moving material approximately 50 mm in diameter. As such, more than 50% of the channel bed could be mobile during bankfull conditions. The lack of consolidated sediment in the downstream section of pool indicates that the bed material is easily mobilized and does not provide adequate erosion protection.

4.2.5 Recommendations

The scour prevention treatments proposed at the Leslie Street site involve protection of the bank toe, modification to flows or a combination of the two. Three bed/bank treatments options have been developed in order to deal with the scour occurring at this site. The options proposed for this site may be used separately or the options may be used in combination with each other. The concept plan for each option includes a planview and cross-section schematic, as outlined below.

Leslie Street Option 1 - Toe Protection

A boulder toe is recommended to protect the dyke toe from scour. The treatment would extend along the toe of the dyke between the existing MNR weir and approximately 220 m downstream, as depicted in Drawing 2-1, Appendix E. The available options for toe protection are somewhat limited since the treatment used must adequately interface with the concrete dyke toe. Long term maintenance of this option would include monitoring at the scour location.

Option 1 Opinion of Probable Cost: $325,000

Leslie Street Option 2 – Remove Gabions and Reshape Point Bar

This option would occur in combination with option 1. Removing the gabions along river left would improve floodplain access and flow conveyance through this site and reduce scour potential, as depicted in Drawing 2-2, Appendix E. The bankfull width should be at least 50 m through this section instead of the existing 40 m. The left bank would be sloped toward the river and create a depositional environment. The sediment gradation expected at this location is expected to be fine-textured due to the lower shear stress at the inside of a bend. The technique would need to be combined with toe protection along the dyke to repair the scour and undermining.

Option 2 Opinion of Probable Cost: $475,000

Leslie Street Option 3 – Modify MNR Weir

This option would occur in combination with option 1 and involve reconfiguring the downstream vane in the MNR weir in order to redirect the flow vector away from the downstream right bank (Drawing 2-3, Appendix E). The existing armourstone in the vane would be re-used and configured to deflect flows toward the center of the channel. The option would need to be combined with toe protection along the dyke to repair the scour and undermining.

Option 3 Opinion of Probable Cost: $350,000

The opinions of probable cost presented above assume the following:

- No water management or erosion/sediment control
- No mobilization / demobilization
- No contingency
- No site access
- No traffic staging
- No permits
- No Contract Administration

5.0 Summary

An investigation of river morphology and scour was conducted at two sites along the North Branch of the Thames River where the West London Dyke is being undermined by river scour. The sites investigated are located at Ann Street and Leslie Street. A geomorphic survey was undertaken at both sites in June 2015 in order to collect the river data required to evaluate scour potential. The river was visited seven times throughout 2015 to observe a variety flow conditions and the interaction of flow with the banks. The purpose of the investigations was to determine the location of scour along the bank to determine a cause(s) or contributing factor(s) for the scour, and to develop restorative treatments that protect the dyke and/or reduce the potential for future scour.

One geomorphic field survey was completed in June 2015 and the second survey was not conducted. During the June survey the location of the scour was determined with confidence. The scour is cutting into glacial till which is eroding in a cyclical manner but at a very slow rate. Another geomorphic survey in 2015 was considered to not add value to this investigation. The gradual rate of the scour of till is likely at the limit of resolution of annual surveys given that we are unlike to resurvey every point at the precise location as before. Surveys 2-3 years apart will likely show differences and are recommended until a solution is designed and implemented.

At Ann Street, scour was observed along a 40 m section of the toe of the dyke. The scour at this location accelerated by a concrete weir structure located immediately upstream. Flows through a notch in the weir are directed toward the bank at the toe of the dyke, resulting in scour. Proposed treatments include the following options:

Ann Street Site Options

Option 1 Removal of the concrete weir structure to modify and re-direct flows away from the bank and may require re-building of the riffle to maintain grade control.

Opinion of Probable Cost: $30,000

Option 2 Boulder toe protection along the base of the dyke. This option includes the removal of the weir (Option 1-1).

Opinion of Probable Cost: $100,000

Option 3 Bankfull bench and vanes along the toe of the dyke; the vanes modify and re-direct flows away from the bank. Removal of the weir (Option 1-1) is mandatory with this option.

Opinion of Probable Cost: $250,000

The Leslie Street site is located along the outside of a broad meander. Bed morphology was dominated by a large compound pool that was 220 m in length and located immediately downstream of the MNR weir. Scour was observed along the entire pool along the right bank but was particularly severe along the downstream section of the pool. The section of pool is located 120 to 220 m downstream of the weir where scour has undermined the armourstone toe. The causes of the scour are related to the location of the site along a channel bend, constriction effects from an artificial narrowing of the channel and flows coming off the MNR weir that directed against the bank toe. Restorative treatments that protect the bank from scour include:

Leslie Street Site Options

Option 1: Boulder toe protection along the base of the dyke.

Opinion of Probable Cost: $325,000

Option 2 Removal of gabions and shaping of the point bar on river left to improve floodplain connection and reduce scour along the outside of the bend. Option 2-1 is included as part of this option.

Opinion of Probable Cost: $475,000

Option 3 Modify the tail of the MNR weir in order to redirect flows away from the right bank and into the center of the channel. Options 2-1 and 2-2 are included as part of this option.

Opinion of Probable Cost: $350,000

6.0 References

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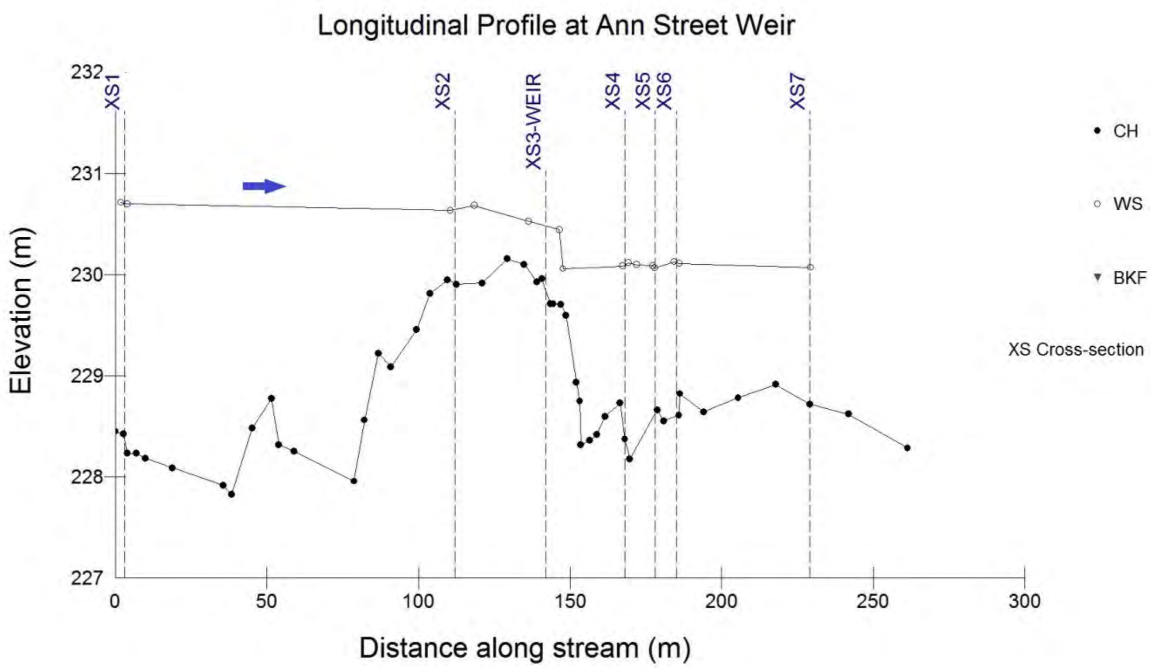
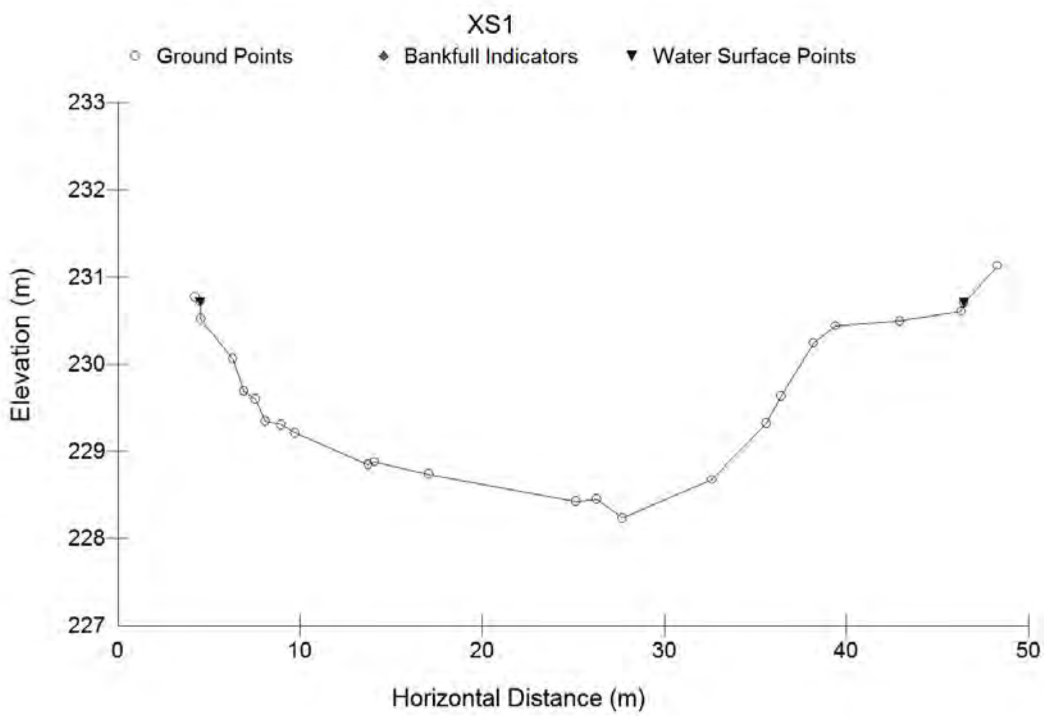
APPENDIX A

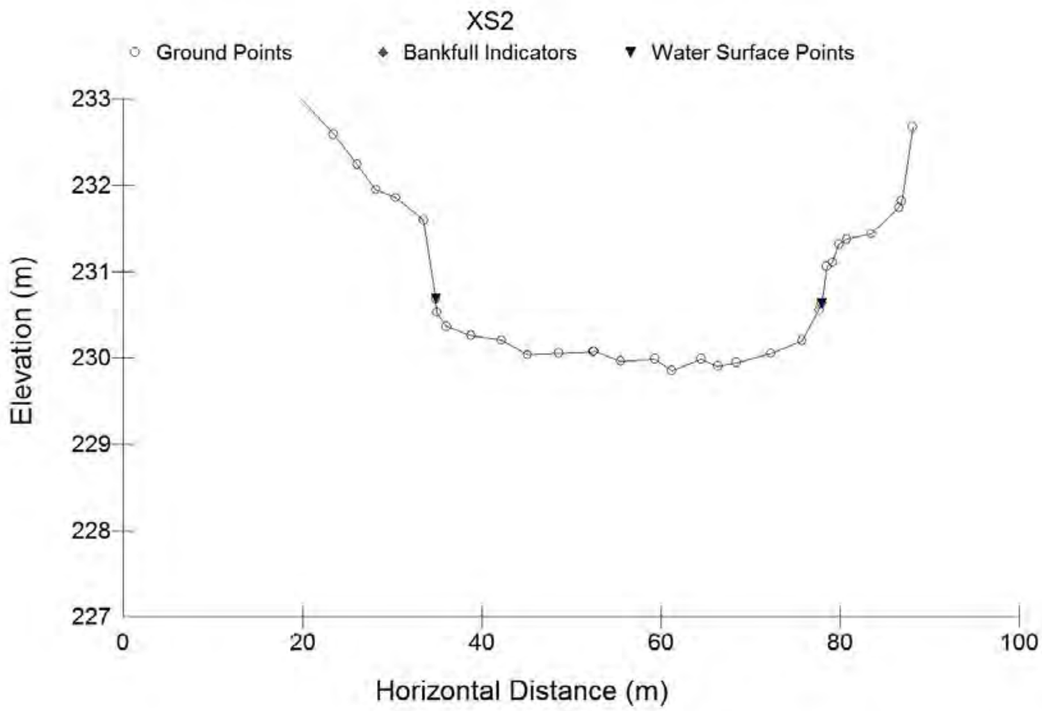
Longitudinal Profiles and Cross-Sections

ANN STREET SITE; CROSS-SECTION LOCATIONS. CROSS-SECTIONS VIEWED FACING DOWNSTREAM

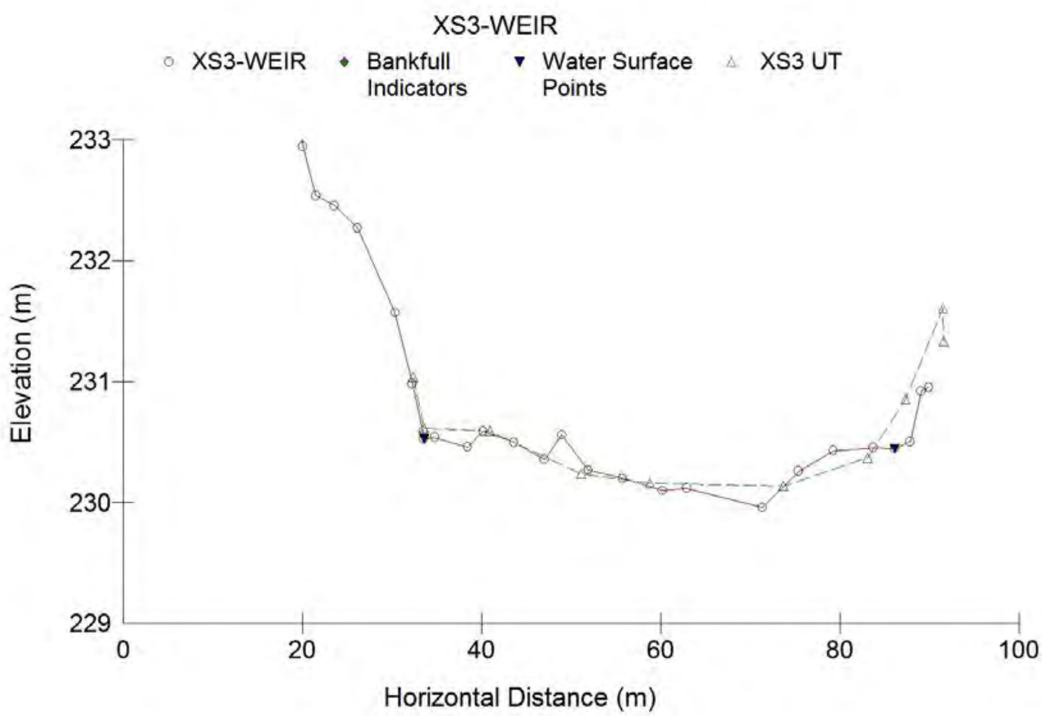




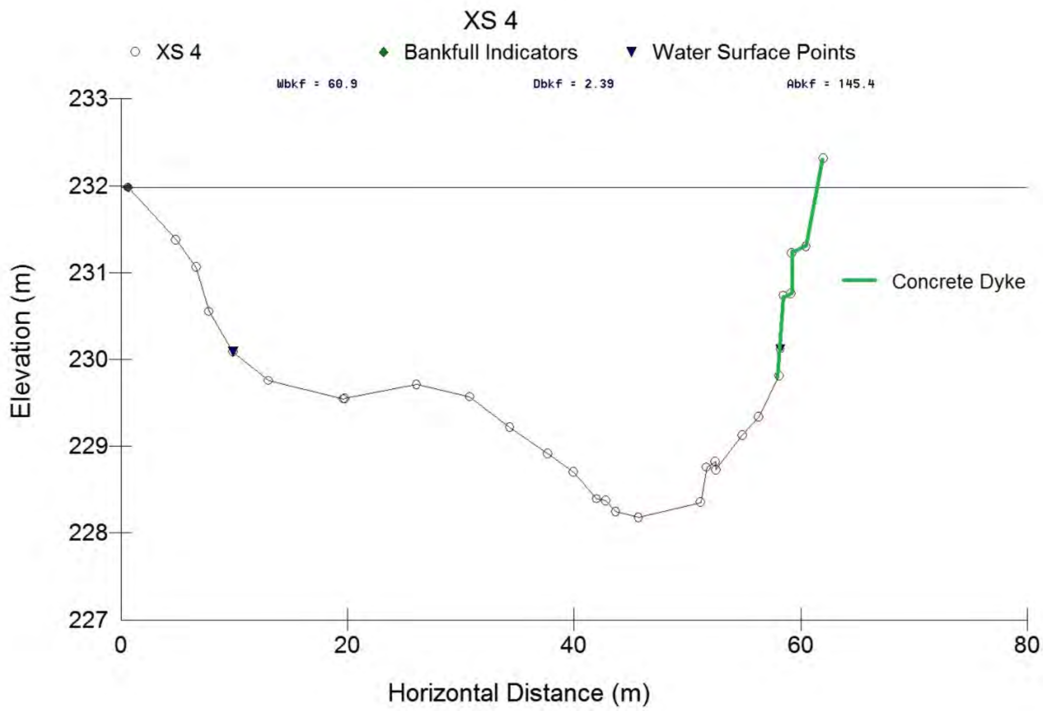
CROSS-SECTION 1 (POOL), LOCATED 50 M DOWNSTREAM OF OXFORD STREET



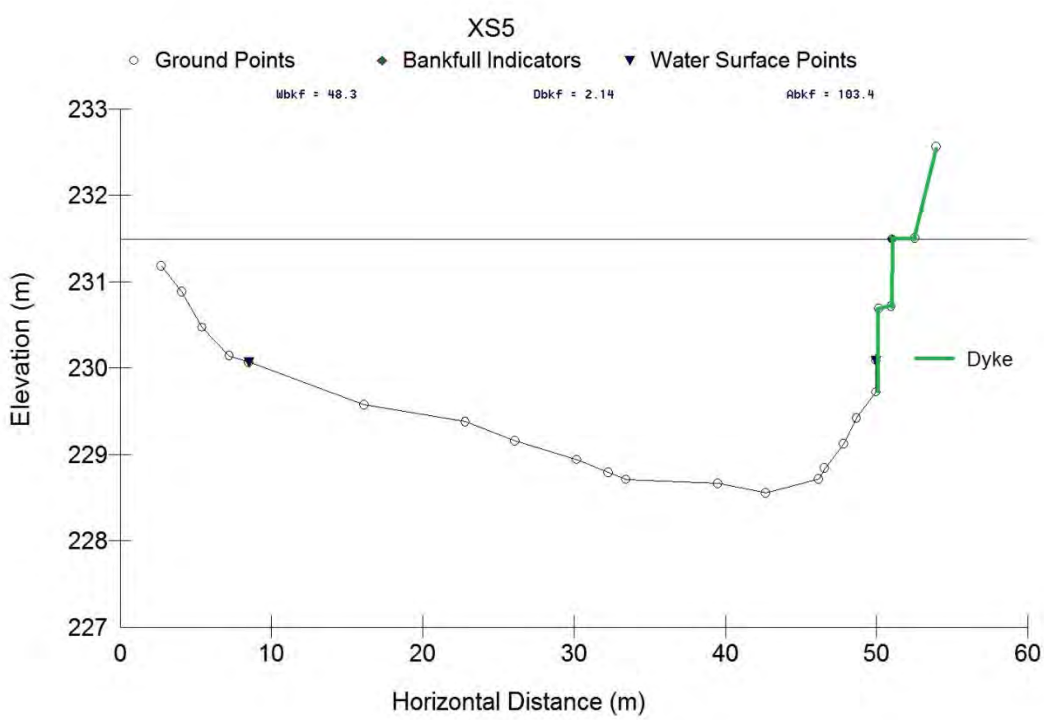
CROSS-SECTION 2 (RIFFLE)



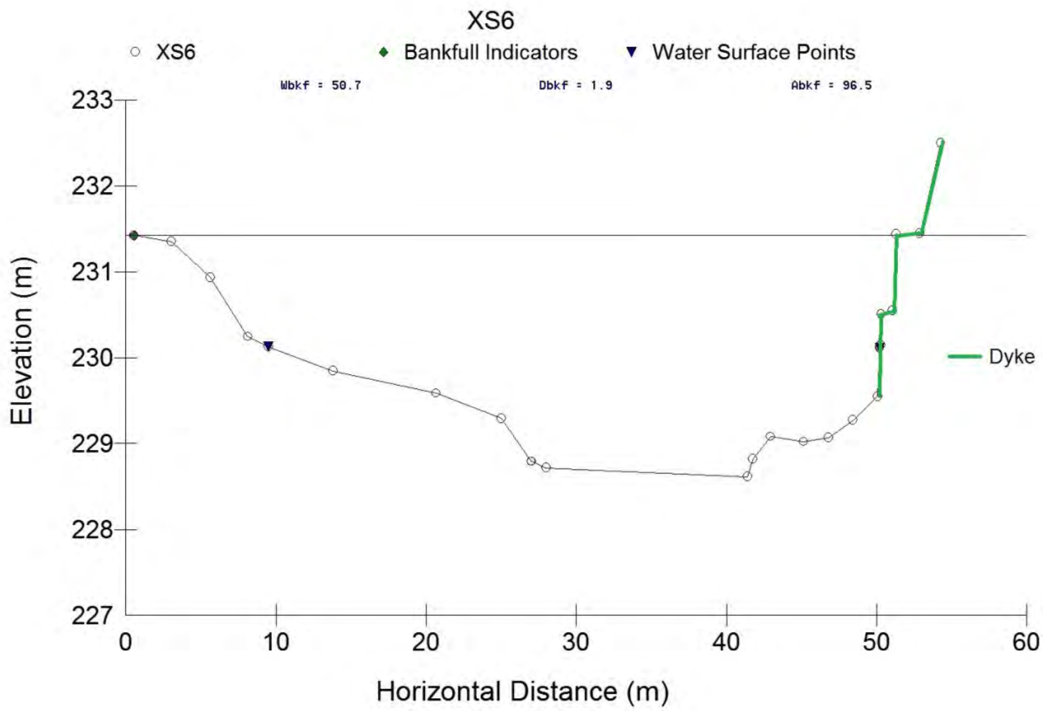
CROSS-SECTION 3 ACROSS TOP OF CONCRETE WEIR STRUCTURE. DASHED LINE IS 2014 UTRCA SECTION



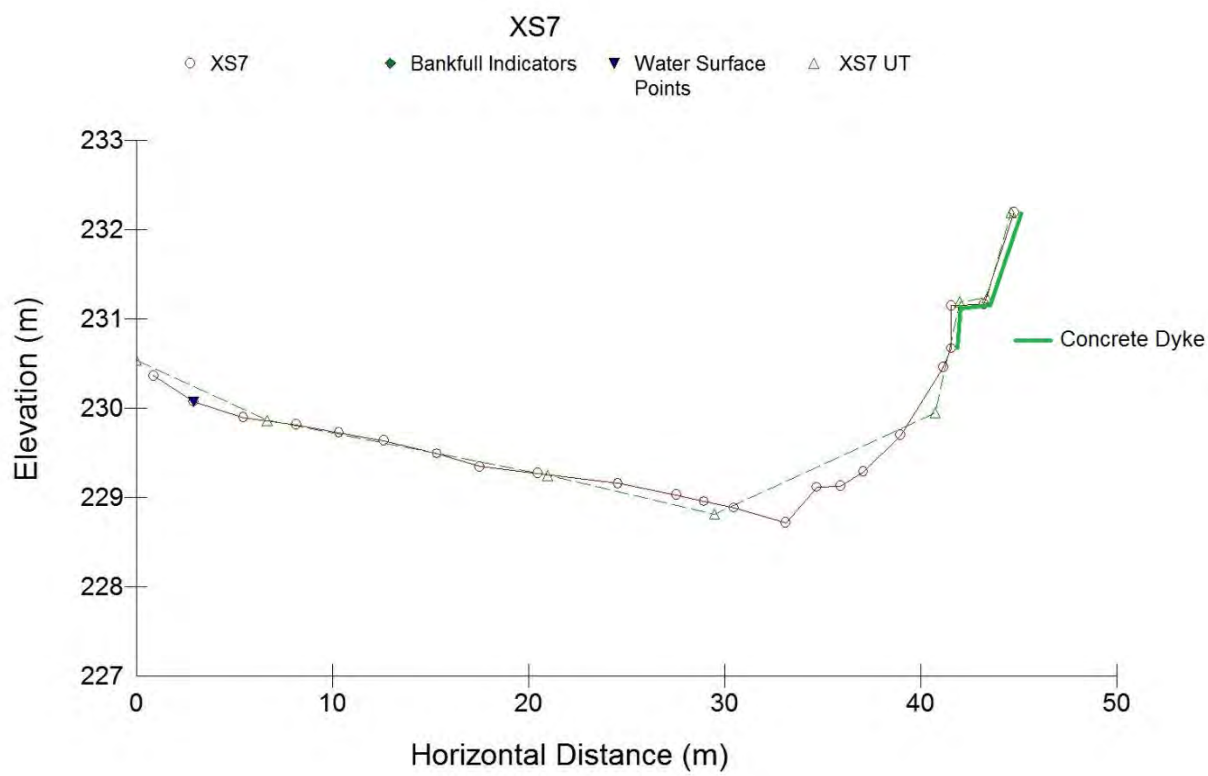
CROSS-SECTION 4; MIDDLE OF SCOUR POOL



CROSS-SECTION 5 (POOL)

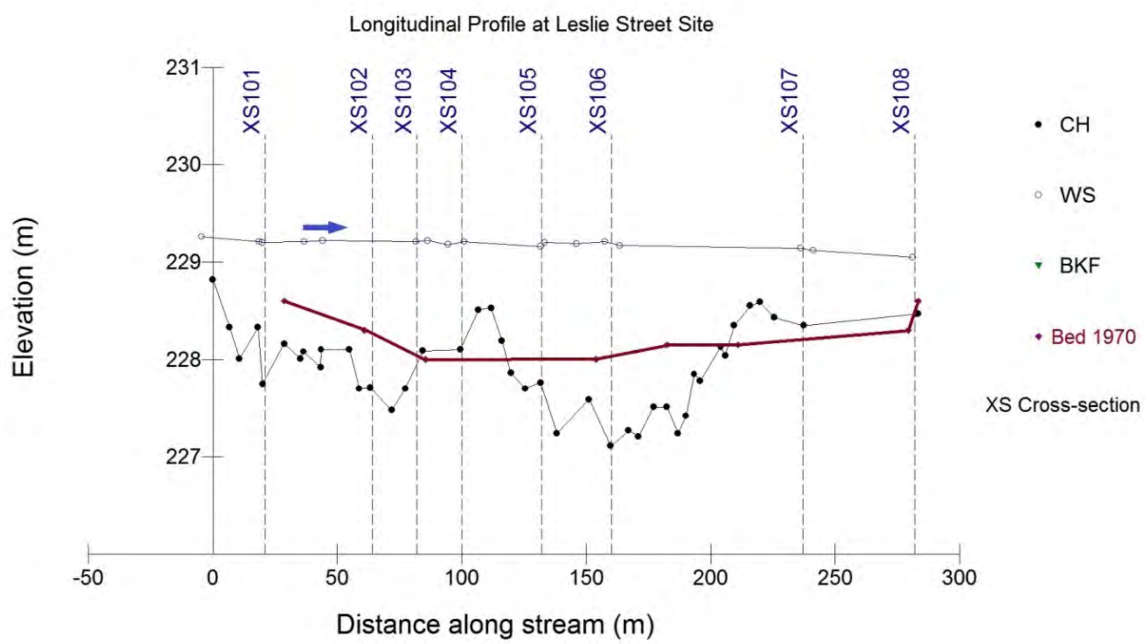


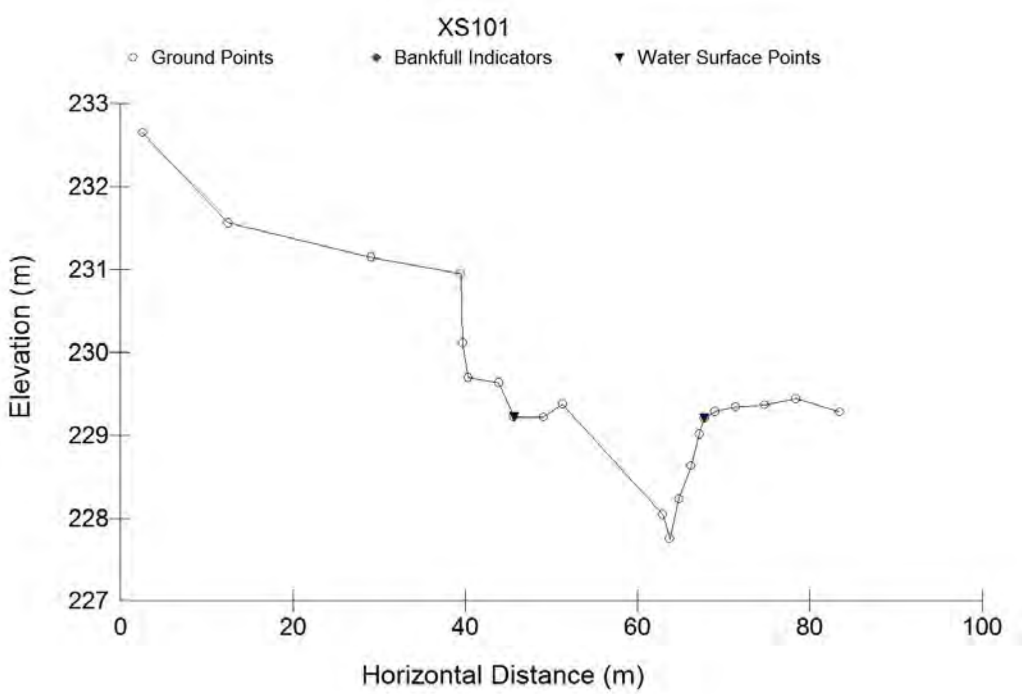
CROSS-SECTION 6 (POOL)



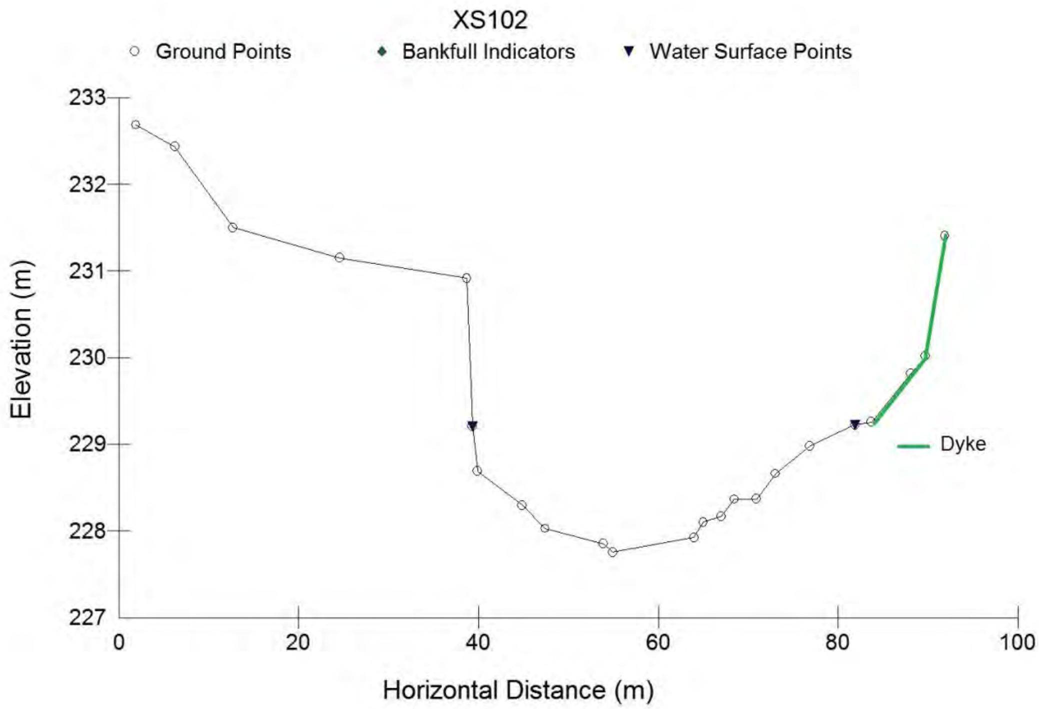
CROSS-SECTION 7 (RIFFLE); DASHED LINE IS UTRCA 2014 SECTION

LESLIE STREET SITE AND COMPOUND POOL; SECTION XS101 IS LOCATED AT DOWNSTREAM VANE OF MNR WEIR, 300 M DOWNSTREAM OF BLACKFRIARS BRIDGE

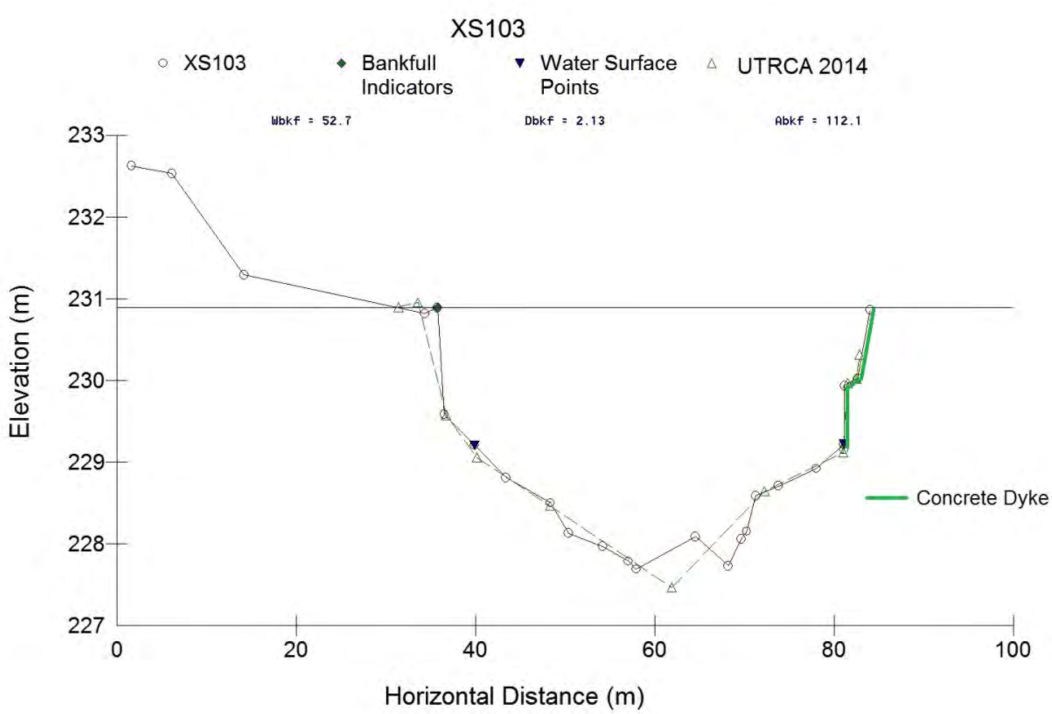




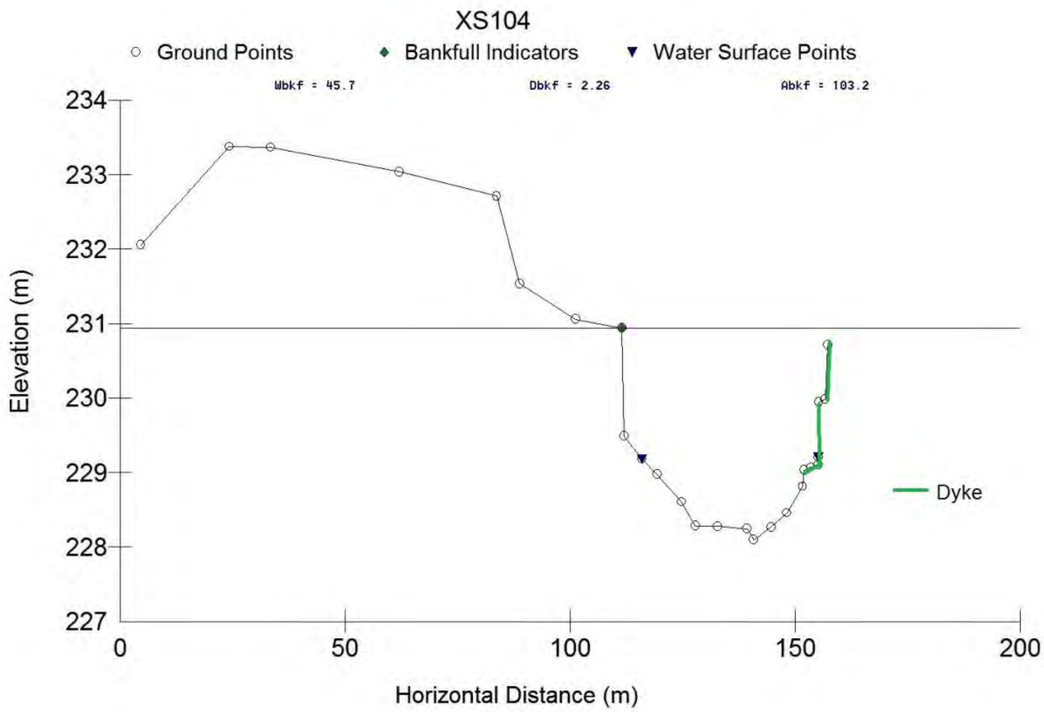
CROSS-SECTION 101 (VANE AT MNT WEIR); Points between stations 0+050 and 0+062 were not surveys due to high (unsafe) water velocities.



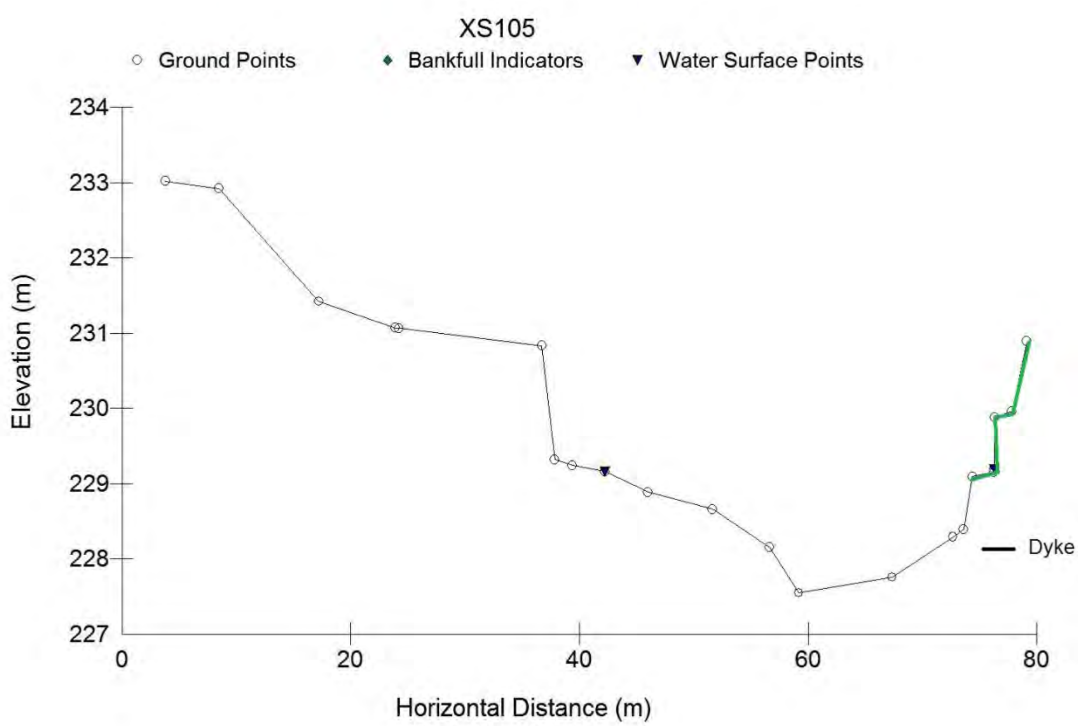
CROSS-SECTION 102 U/S SECTION OF COMPOUND POOL



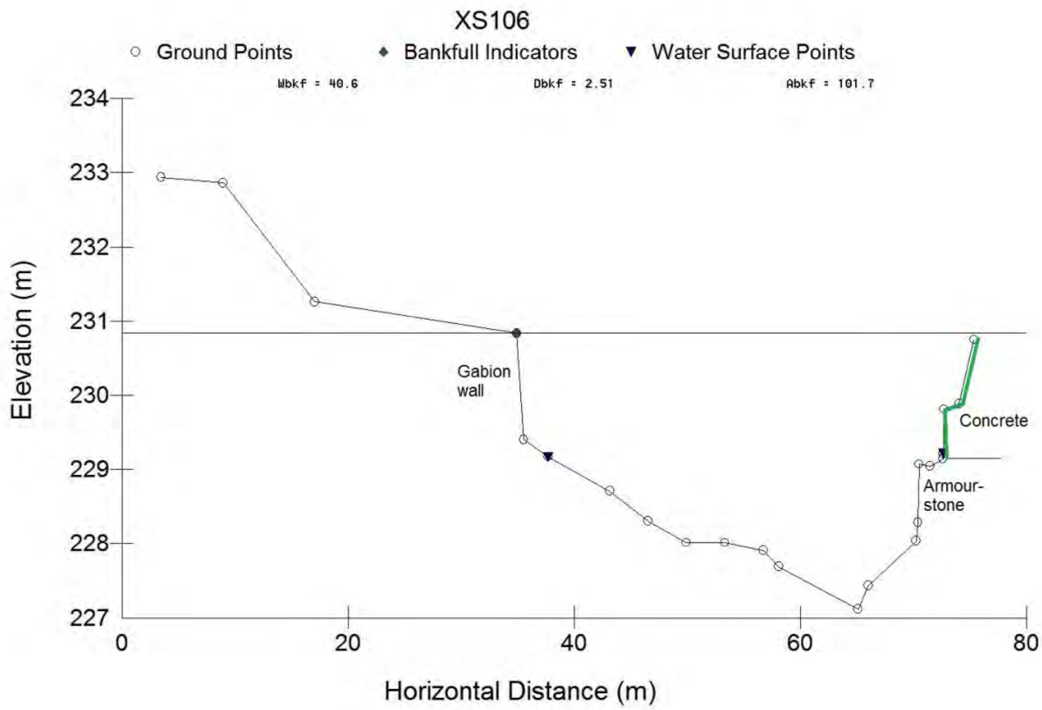
CROSS-SECTION 103 – U/S SECTION OF COMPOUND POOL; DASHED LINE IS UTRCA 2014 SECTION



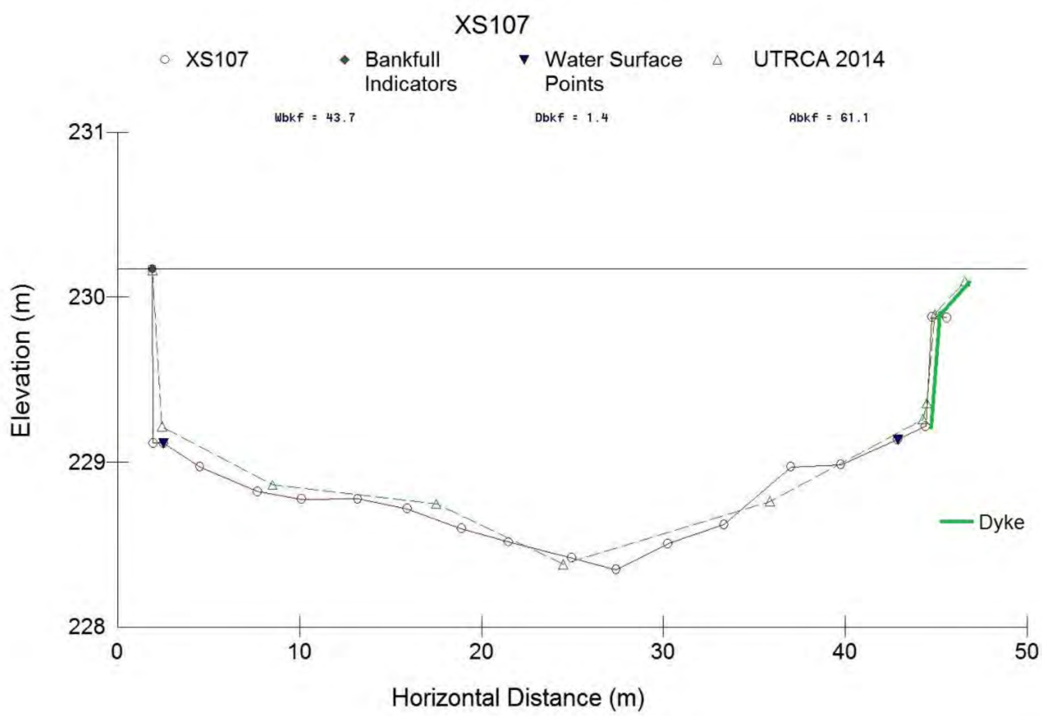
CROSS-SECTION 104; TRANSITION BETWEEN U/S AND D/S SECTIONS OF COMPOUND POOL



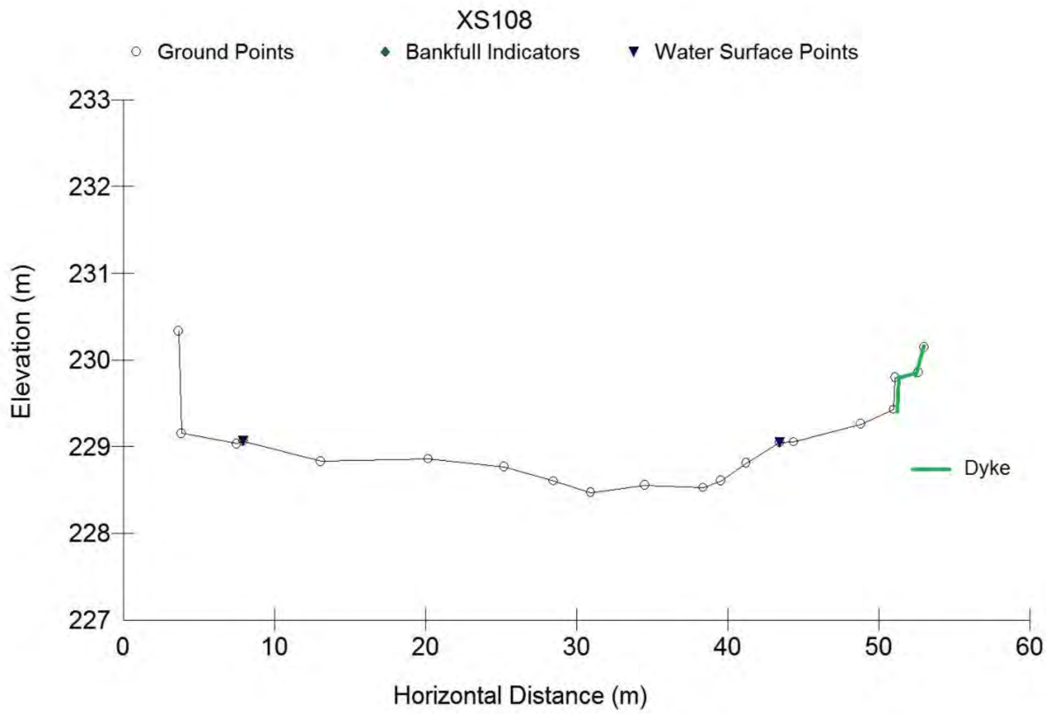
CROSS-SECTION 105; DOWNSTREAM SECTION OF COMPOUND POOL



CROSS-SECTION 106; DOWNSTREAM SECTION OF COMPOUND POOL



CROSS-SECTION 107 RIFFLE CREST DOWNSTREAM OF POOL; DASHED LINE IS UTRCA 2014 SECTION



CROSS-SECTION 108 RIFFLE DOWNSTREAM OF SCOUR POOL

APPENDIX B

Site Photographs

Photo 1-1 – Ann Street Site, view from weir looking downstream in the direction of flow toward bank at dyke toe.

Photo 1-2 – Ann Street Site. Dyke toe 25 m downstream of weir showing 0.4 m undercut. The substrate (submerged) is silt till. View downstream.

Photo 1-3 – Ann Street Site. Sample of weathered silt till collected from site. The material is friable and easily eroded. Freshly exposed till is resistant to fluvial erosion.

Photo 1-4 – On top of Ann Street Weir looking eastward from right bank to left bank.Flow to right.

Photo 1-5 – On top of Ann Street Weir looking concrete structure and riprap. View toward right bank, flow to left.

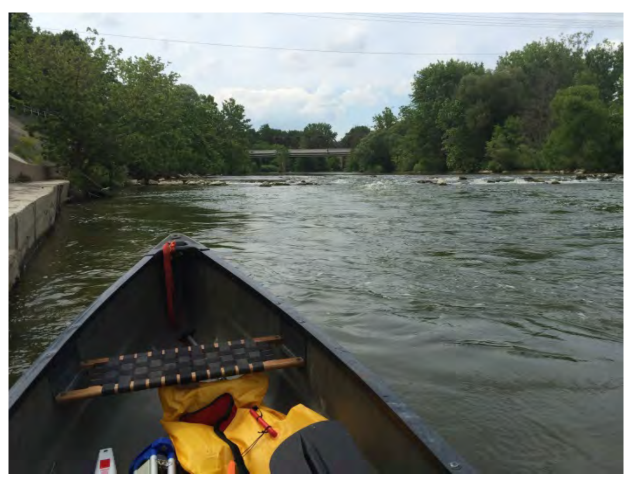


Photo 1-6 – Downstream of Ann Street Weir looking upstream at right bank scour pool. Note eddying effect at location of scour pool.

Photo 2-1 – Upstream end of the Leslie Street Site looking downstream.The narrowing of the channel in the foreground is the downstream vane of the MNR weir.

Photo 2-2 – Leslie Street. Base of dyke and armourstone toe along the upstream section of the compound pool. Sections of the concrete toe of the dyke have been undermined (arrow). View downstream.

Photo 2-3 – Upstream of the Leslie Street Site looking downstream. Upstream limit of the scour pool. Note sandy point bar forming on left bank (arrow).

Photo 2-4 – Leslie Street Site looking downstream. The deepest part of the scour pool is located at the transition from sloped to vertical dyke wall at the foot of rogers Avenue (arrow).

Photo 2-5 – Leslie Street Site looking upstream at right bank and deepest area of scour pool. The first row of armorstone (submerged) is in good condition. Some of the blocks from the second row (at right, not visible) have fallen into the pool. View upstream.

Photo 2-6 – Leslie Street Site looking at downstream riffle. Gabion baskets alogn left bank were failing.

APPENDIX C

Site Photographs for Different River Discharges

Photo 1-1 – Ann Street Weir showing flows coming off weir toward the dyke (foreground). March 12, 2015. River discharge: 3.9 m^3/s.

Photo 1-2 – Ann Street Weir, April 8, 2015. River discharge 38.0 m^3/s.

Photo 1-3 – Ann Street Weir, April 10, 2015. River Discharge 157.7 m^3/s. Frequent boils visible on the water surface at the toe of the dyke indicate turbulence (kolks) and high shear.

Photo 1-4 – Ann Street Weir, May 20, 2015. River discharge 3.1 m^3/s. Turbulence evident along dyke toe despite low flows.

Photo 1-5 – Ann Street Weir, June 13, 2015. River discharge 26.8 m^3/s. Vantage is approximatley 100 m downstream of vantage of photos 1-1 to 1-4.

Photo 1-6 – Ann Street Weir, August 22, 2015. River discharge 5.4 m^3/s. Flow vector intecepts bank approximately 40 m downstream of weir (arrow).

Photo 2-1 – Leslie Street Site (Vantage 1 - upstream): Flow coming off MNR Weir located upstream of the scour area, March 12, 2015. River discharge 3.9 m^3/s. Flows calm.

Photo 2-2 – Leslie Street Site (Vantage 1), April 8, 2015. River discharge 38.0 m^3/s.Some turbulence evident along dyke toe.

Photo 2-3 – Leslie Street Site (Vantage 1), April 10, 2015. River discharge 157.7 m^3/s. Flows near to toe of the dyke are relatively calm, with no indication of excessive turbulence or scour.

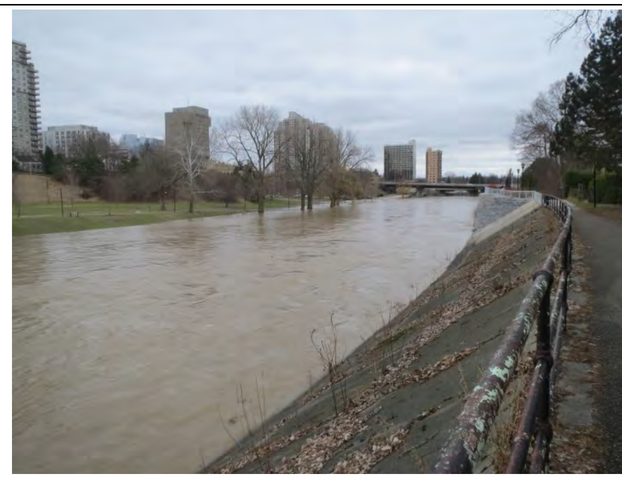


Photo 2-4 – Leslie Street Site (Vantage 2 - downstream), April 10, 2015. View of downstream section of compound pool. Boils on water surface near the dyke toe indicate turbulence (kolks) and high shear.

Photo 2-5 – Leslie Street Site (Vantage 1), May 20, 2015. River discharge 3.7 m^3/s. Flows calm.

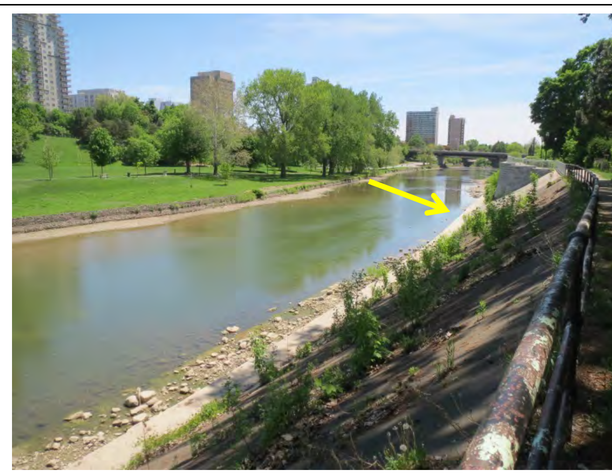


Photo 2-6 – Leslie Street Site (Vantage 2), May 20, 2015. The arrow indicates where the armourstone toe is failing, at the foot of Rogers Avenue. Flows calm.

	
Photo 2-7 – Leslie Street Site (Vantage 1), June 13, 2015. River discharge 26.8 m^3/s. Note calm conditions at toe of dyke (foreground).	Photo 2-8 – Leslie Street Site (Vantage 2), June 13, 2015. Some turbulence evident through the thalweg but flows along dyke toe are relatively calm.
	
Photo 2-9 – Leslie Street Site (Vantage 1), August 22, 2015. River discharge 5.3 m^3/s. Flows calm/no turbulence.	Photo 2-10 – Leslie Street Site (Vantage 2) August 22, 2015. Flows calm / no turbulence

APPENDIX D

Shear Stress Calculations

165630035 - WEST LONDON DYKE Thames North Branch Scour

Shear Stress/Particle Size Calculation

ANN STREET AT CROSS-SECTION 6 (SCOUR POOL)

SECTION 1: OBSERVED SHEAR STRESS, τ_0

Method 1: Chow (1959)

Calculate Observed Shear Stress, τ_0:

$$\tau_o = \gamma R_h S$$

Specific Weight of Water, γ (N/m^3)	9790
Hydraulic Radius, R_h (m)	2.1
Bed Slope, S (m/m)	0.003
Observed Shear Stress, τ_0 (N/m^2)	61.677

Method 2: HEC-RAS Output

a) Channel Shear Stress, $\tau_{0,channel}$ (N/m^2)	170.31
b) Total Shear Stress, $\tau_{0,total}$ (N/m^2)	54.11

Shear Stress Selection for Analysis:

Method selected for analysis	Method 2a)
Observed Shear Stress, τ_0 (N/m^2)	54.11
Safety Factor	1
Observed Shear Stress, τ_0, considered in analysis	**60**

SECTION 2: CRITICAL SHEAR STRESS, τ_c

Method 1: Shields/Julien (1995)

Step 1: Calculate Dimensionless Particle Diameter, d_*, for particle d_i:

$$d_* = d_i \left[\frac{(G-1)g}{{v_m}^2}\right]^{1/3}$$ Julien (1995)

Particle Diameter, d_i (mm)	68.75
Specific Gravity of Particulate, G	2.65
Gravitational Acceleration, g (m/s^2)	9.81
Kinematic Viscosity of Water, v_m (m^2/s)	1.00E-06
Dimensionless Particle Diameter, d_*	1739.19

Step 2: Calculate Critical Shields Parameter, τ_{*c}, for particle d_i:

If $d_* < 0.3$, $\tau_{*c} = 0.5 tan\phi$

If $0.3 \le d_* < 19$, $\tau_{*c} = 0.25 d_*^{-0.6} tan\phi$

If $19 \le d_* < 50$, $\tau_{*c} = 0.013 d_*^{0.4} tan\phi$

If $d_* \ge 50$, $\tau_{*c} = 0.06 tan\phi$

Julien (1995)

Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.733038286	
Critical Shields Parameter, τ_{*c}	0.054024243	

Step 3: Calculate Critical Shear Stress, τ_c, for particle d_i:

$$\tau_c = \tau_{*c}[(G-1)\gamma d_i]$$ Julien (1995)

Specific Gravity of Particulate, G	(as in Step 1)
Specific Weight of Water, γ (N/m^3)	9790
Particle Diameter, d_i (mm)	(as in Step 1)
Critical Shields Parameter, τ_{*c}	(as in Step 2)
Critical Shear Stress, τ_c (N/m^2)	60

Setting τ_0 (Section 1) = τ_c (Section 2, Method 1) yields a particle size, d_i, of: **70** mm

165630035 - WEST LONDON DYKE Thames North Branch Scour
Shear Stress/Particle Size Calculation
ANN STREET AT CROSS-SECTION 6 (SCOUR POOL)

Method 2: MTO DMM (1997) - Shear Stress on Bed

Step 1: Calculate Critical Shear Stress of Bed Material, $\tau_{c,bed}$

$$\tau_{cb} = 0.0642 g\, d_i$$

Equation 5.31, MTO DMM (1997)

Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	95.27	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	60	
Setting τ_0 (Section 1) = $\tau_{c,bed}$ (Section 2, Method 2) yields a particle size, d_i, of:	**100**	mm

Method 3: MTO DMM (1997) - Shear Stress on Side Slopes

Step 1: Calculate Observed Shear Stress of Side Slopes, $\tau_{0,ss}$

$$\tau_{os} = 0.75\gamma R_h S = 0.75\tau_o$$

Chow (1959)

Observed Shear Stress, τ_0 (N/m^2)	(as in Section 1)
Observed Shear Stress of Side Slopes, $\tau_{0,ss}$ (N/m2)	45

Step 2: Calculate Bank Tractive Force Coefficient, K_{sb}

$$K_{sb} = \left(\frac{1-\sin^2\theta}{\sin^2\phi}\right)^{0.5}$$

Design Chart 2.11, MTO DMM (1997)

Side Slopes, H:1V (e.g., 3:1)	3	
Angle of Side Slopes, θ (radians)	0.34	
Angle of Side Slopes, θ (degrees)	19.5	
Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.73	
Bank Tractive Force Coefficient, K_{sb}	0.87	

Step 3: Calculate Critical Shear Stress of Side Slopes, $\tau_{0,ss}$

$$\tau_{c,ss} = K_{sb}\tau_{c,bed}$$

Equation 5.32, MTO DMM (1997)

Bank Tractive Force Coefficient, K_{sb}	(as in Step 2)	
Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	82.40	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	51.90	
Critical Shear Stress of Side Slopes, $\tau_{C,ss}$ (N/m^2)	45	

Setting $\tau_{0,ss}$ (Section 2, Method 3) = $\tau_{c,ss}$ (Section 2, Method 3) yields a particle size, d_i, of:

90 mm

Method 4: Smith (1978)

Step 1: Calculate Particle Diameter, di:

$$d_i = 10yS$$

Smith (1978)

Normal Flow Depth, y (m)	2.81	
Bed Slope, S (m/m)	0.003	
Particle Diameter, di (m)	0.0843	
Particle Diameter, di (mm)	84.3	
Method 4 yields a particle size, d_i, of:	**90**	mm

165630035 - WEST LONDON DYKE Thames North Branch Scour
Shear Stress/Particle Size Calculation
ANN STREET AT CROSS-SECTION 6 (SCOUR POOL)

Method 5: WARSSS Colorado Trendline (Rosgen, 2006)

$$d_i = 152.02\tau_c^{0.7355}$$

Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	1.25

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	1.25376
Particle Size, d_i (mm)	179.5301636

Method 5 yields a particle size, d_i, of: **180** mm

Method 6: Leopold, Wolman, and Miller (1964) Trendline

$$d_i = 77.966\tau_c^{1.042}$$

Leopold et al. (1964); Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	1.25

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	1.25
Particle Size, d_i (mm)	98.68

Method 5 yields a particle size, d_i, of: **100** mm

SECTION 3: SUMMARY OF RESULTS

Method	Particle Size (mm)
Shields/Julien (1995)	70
MTO DMM (1997) - Shear Stress on Bed	100
MTO DMM (1997) - Shear Stress on Side Slopes	90
Smith (1978)	90
WARSSS Colorado Trendline (Rosgen, 2006)	180
Leopold, Wolman, and Miller (1964) Trendline	100

165630035 - WEST LONDON DYKE Thames North Branch Scour

Shear Stress/Particle Size Calculation

LESLIE STREET AT CROSS-SECTION 6 (SCOUR POOL)

SECTION 1: OBSERVED SHEAR STRESS, τ_0

Method 1: Chow (1959)

Calculate Observed Shear Stress, τ_0:

$$\tau_o = \gamma R_h S$$

Specific Weight of Water, γ (N/m^3)	9790
Hydraulic Radius, R_h (m)	2.34
Bed Slope, S (m/m)	0.001
Observed Shear Stress, τ_0 (N/m^2)	22.9086

Method 2: HEC-RAS Output

a) Channel Shear Stress, $\tau_{0,channel}$ (N/m^2)	170.31
b) Total Shear Stress, $\tau_{0,total}$ (N/m^2)	54.11

Shear Stress Selection for Analysis:

Method selected for analysis	Method 2a)
Observed Shear Stress, τ_0 (N/m^2)	22.9086
Safety Factor	1
Observed Shear Stress, τ_0, considered in analysis	**30**

SECTION 2: CRITICAL SHEAR STRESS, τ_c

Method 1: Shields/Julien (1995)

Step 1: Calculate Dimensionless Particle Diameter, d_*, for particle d_i:

$$d_* = d_i \left[\frac{(G-1)g}{v_m^{\,2}}\right]^{1/3}$$

Julien (1995)

Particle Diameter, d_i (mm)	34.38
Specific Gravity of Particulate, G	2.65
Gravitational Acceleration, g (m/s^2)	9.81
Kinematic Viscosity of Water, v_m (m^2/s)	1.00E-06
Dimensionless Particle Diameter, d_*	869.59

Step 2: Calculate Critical Shields Parameter, τ_{*c}, for particle d_i:

If $d_* < 0.3$,	$\tau_{*c} = 0.5\tan\phi$	Julien (1995)
If $0.3 \le d_* < 19$,	$\tau_{*c} = 0.25 d_*^{-0.6}\tan\phi$	
If $19 \le d_* < 50$,	$\tau_{*c} = 0.013 d_*^{0.4}\tan\phi$	
If $d_* \ge 50$,	$\tau_{*c} = 0.06\tan\phi$	

Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.733038286	
Critical Shields Parameter, τ_{*c}	0.054024243	

Step 3: Calculate Critical Shear Stress, τ_c, for particle d_i:

$$\tau_c = \tau_{*c}[(G-1)\gamma d_i]$$

Julien (1995)

Specific Gravity of Particulate, G	(as in Step 1)
Specific Weight of Water, γ (N/m^3)	9790
Particle Diameter, d_i (mm)	(as in Step 1)
Critical Shields Parameter, τ_{*c}	(as in Step 2)
Critical Shear Stress, τ_c (N/m^2)	30

Setting τ_0 (Section 1) = τ_c (Section 2, Method 1) yields a particle size, d_i, of: **40** mm

Shear Stress/Particle Size Calculation
LESLIE STREET AT CROSS-SECTION 6 (SCOUR POOL)

Method 2: MTO DMM (1997) - Shear Stress on Bed

Step 1: Calculate Critical Shear Stress of Bed Material, $\tau_{c,bed}$

$$\tau_{cb} = 0.0642g\, d_i$$

Equation 5.31, MTO DMM (1997)

Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	47.63	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	30	
Setting τ_0 (Section 1) = $\tau_{c,bed}$ (Section 2, Method 2) yields a particle size, d_i, of:	**50**	mm

Method 3: MTO DMM (1997) - Shear Stress on Side Slopes

Step 1: Calculate Observed Shear Stress of Side Slopes, $\tau_{0,ss}$

$$\tau_{os} = 0.75\gamma R_h S = 0.75\tau_o$$

Chow (1959)

Observed Shear Stress, τ_0 (N/m^2)	(as in Section 1)
Observed Shear Stress of Side Slopes, $\tau_{0,ss}$ (N/m2)	22.5

Step 2: Calculate Bank Tractive Force Coefficient, K_{sb}

$$K_{sb} = \left(\frac{1 - sin^2\theta}{sin^2\phi}\right)^{0.5}$$

Design Chart 2.11, MTO DMM (1997)

Side Slopes, H:1V (e.g., 3:1)	3	
Angle of Side Slopes, θ (radians)	0.34	
Angle of Side Slopes, θ (degrees)	19.5	
Particulate Angularity	Very Angular	
Particulate Angle of Repose, ϕ (degrees)	42	(see reference figure)
Particulate Angle of Repose, ϕ (radians)	0.73	
Bank Tractive Force Coefficient, K_{sb}	0.87	

Step 3: Calculate Critical Shear Stress of Side Slopes, $\tau_{0,ss}$

$$\tau_{c,ss} = K_{sb}\tau_{c,bed}$$

Equation 5.32, MTO DMM (1997)

Bank Tractive Force Coefficient, K_{sb}	(as in Step 2)	
Gravitational Acceleration, g (m/s^2)	9.81	
Particle Diameter, d_i (mm)	41.20	
Critical Shear Stress of Bed Material, $\tau_{c,bed}$ (N/m^2)	25.95	
Critical Shear Stress of Side Slopes, $\tau_{C,ss}$ (N/m^2)	23	
Setting $\tau_{0,ss}$ (Section 2, Method 3) = $\tau_{c,ss}$ (Section 2, Method 3) yields a particle size, d_i, of:	**50**	mm

Method 4: Smith (1978)

Step 1: Calculate Particle Diameter, di:

$$d_i = 10yS$$

Smith (1978)

Normal Flow Depth, y (m)	3.7	
Bed Slope, S (m/m)	0.001	
Particle Diameter, di (m)	0.037	
Particle Diameter, di (mm)	37	
Method 4 yields a particle size, d_i, of:	**40**	mm

165630035 - WEST LONDON DYKE Thames North Branch Scour
Shear Stress/Particle Size Calculation
LESLIE STREET AT CROSS-SECTION 6 (SCOUR POOL)

Method 5: WARSSS Colorado Trendline (Rosgen, 2006)

$$d_i = 152.02\tau_c^{\,0.7355}$$

Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	0.63

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	0.62688
Particle Size, d_i (mm)	107.8275816

Method 5 yields a particle size, d_i, of: **110** mm

Method 6: Leopold, Wolman, and Miller (1964) Trendline

$$d_i = 77.966\tau_c^{\,1.042}$$

Leopold et al. (1964); Rosgen (2006) (see reference figure)

Step 1: Convert Observed Shear Stress, τ_0, to lbs/ft^2 (equation uses τ in lbs/ft^2, d_i in mm)

Conversion Factor for N/m^2 to lbs/ft^2	0.020896
Observed Shear Stress, τ_0 (lbs/ft^2)	0.63

Step 2: Set Observed Shear Stress, τ_0 (lbs/ft^2) equal to Critical Shear Stress, τ_c (lbs/ft^2), calculate d_i:

Critical Shear Stress, τ_c (lbs/ft^2)	0.63
Particle Size, d_i (mm)	47.93

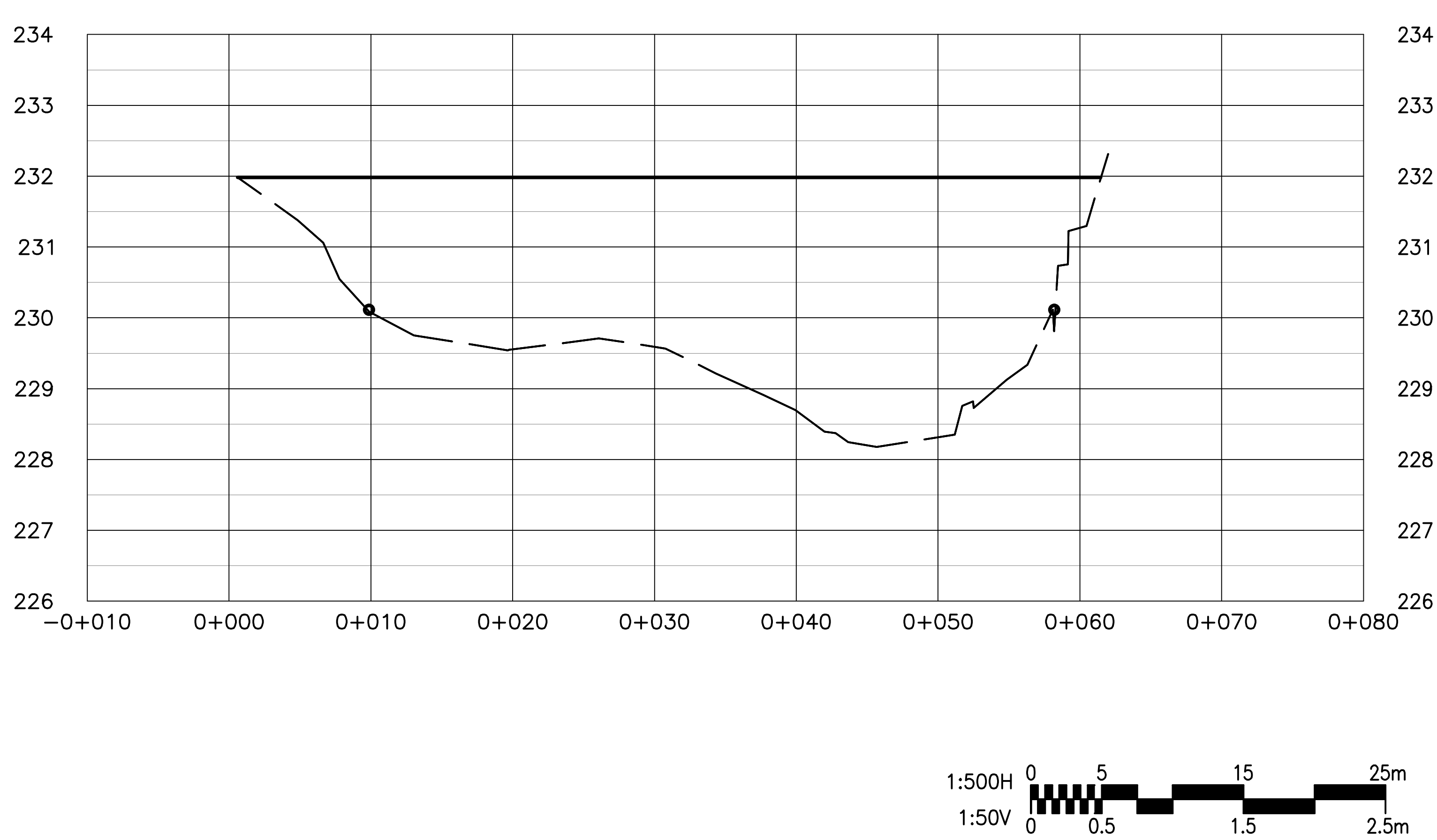
Method 5 yields a particle size, d_i, of: **50** mm

SECTION 3: SUMMARY OF RESULTS

Method	Particle Size (mm)
Shields/Julien (1995)	40
MTO DMM (1997) - Shear Stress on Bed	50
MTO DMM (1997) - Shear Stress on Side Slopes	50
Smith (1978)	40
WARSSS Colorado Trendline (Rosgen, 2006)	110
Leopold, Wolman, and Miller (1964) Trendline	50

APPENDIX E

Proposed Restoration Concepts and Opinion of Probable Cost



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2015/12/17 5:02 PM By: Tweedle, Shannon

ORIGINAL SHEET - ANSI B

DECEMBER 2015
165630035

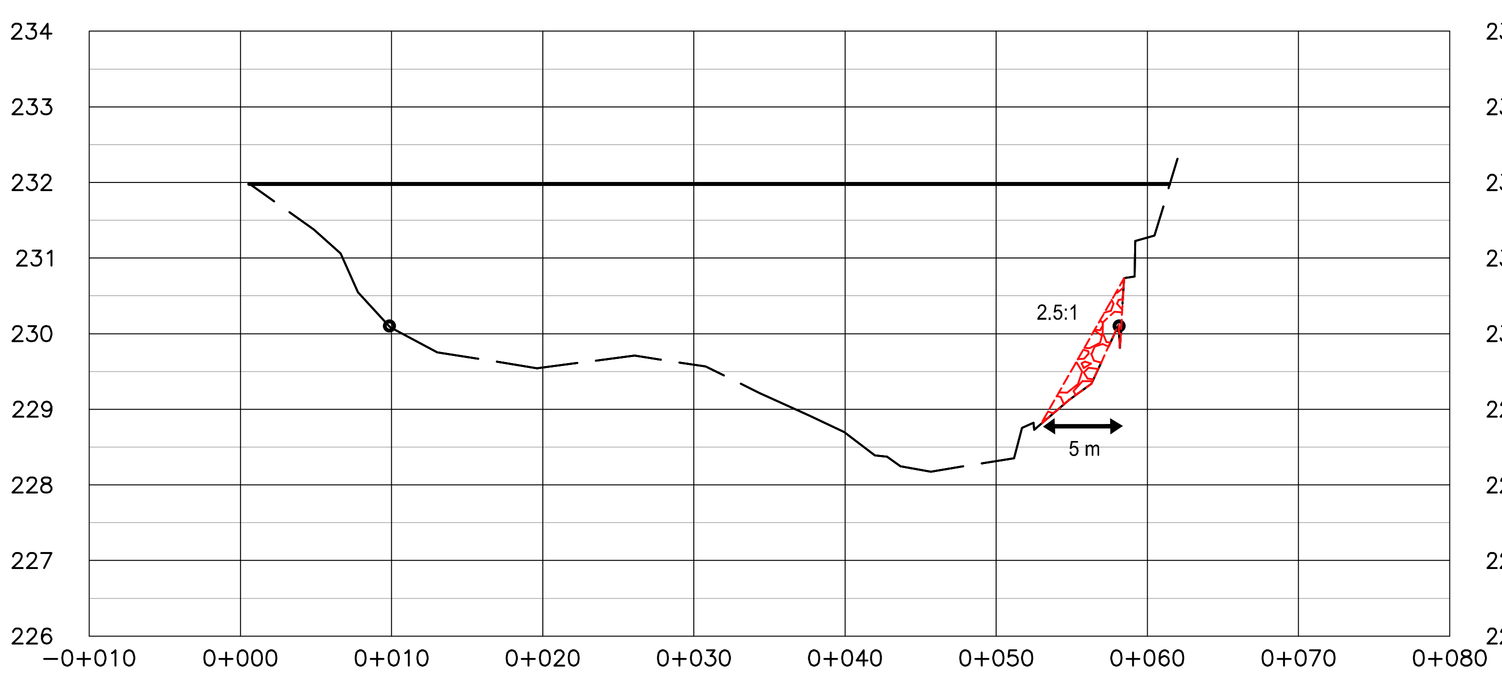
Stantec
49 Frederick Street
Kitchener, ON, N2H 6M7
Tel. 519.579.4410
www.stantec.com

WEIR REMOVAL
RESHAPE AND STABILIZE BANKS
BANKFULL STAGE
LOW−FLOW STAGE

Client/Project
UPPER THAMES RIVER CONSERATION AUTHORITY
WEST LONDON DYKE NOTRH BRANCH
THAMES RIVER SCOUR REPORT

Figure No.
1.1

Title
ANN STREET
DESIGN OPTION #1



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2015/12/17 5:02 PM By: Tweedle, Shannon

ORIGINAL SHEET - ANSI B

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ROCK TOE PROTECTION

BANKFULL STAGE

LOW–FLOW STAGE

Client/Project

UPPER THAMES RIVER CONSERATION AUTHORITY

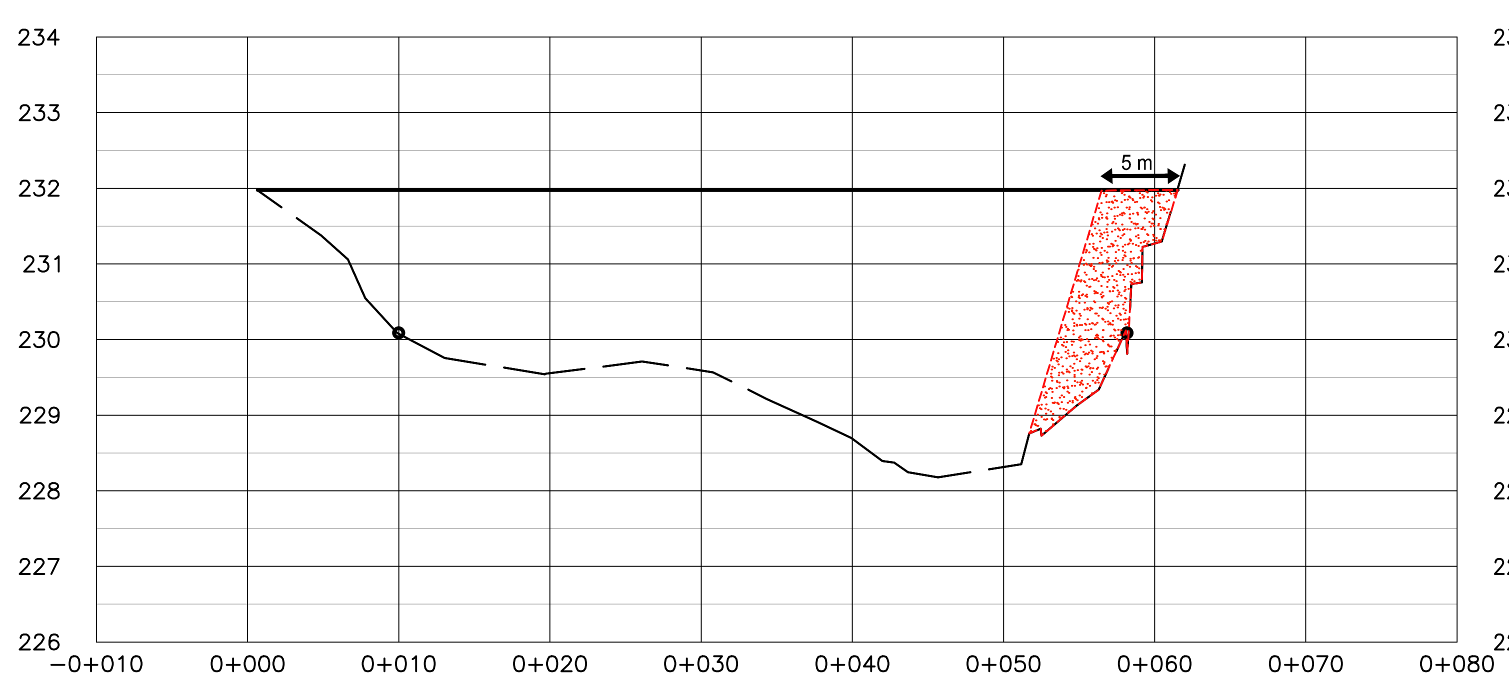
WEST LONDON DYKE NOTRH BRANCH
THAMES RIVER SCOUR REPORT

Figure No.

1.2

Title

ANN STREET
DESIGN OPTION #2



1:500H 0 5 15 25m
1:50V 0 0.5 1.5 2.5m

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2015/12/17 5:02 PM By: Tweedle, Shannon

ORIGINAL SHEET - ANSI B

DECEMBER 2015
165630035

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BANKFULL BENCH

ROCK SPUR

BANKFULL STAGE

LOW–FLOW STAGE

WEIR REMOVAL

RESHAPE AND STABILIZE BANKS

Client/Project

UPPER THAMES RIVER CONSERATION AUTHORITY

WEST LONDON DYKE NOTRH BRANCH

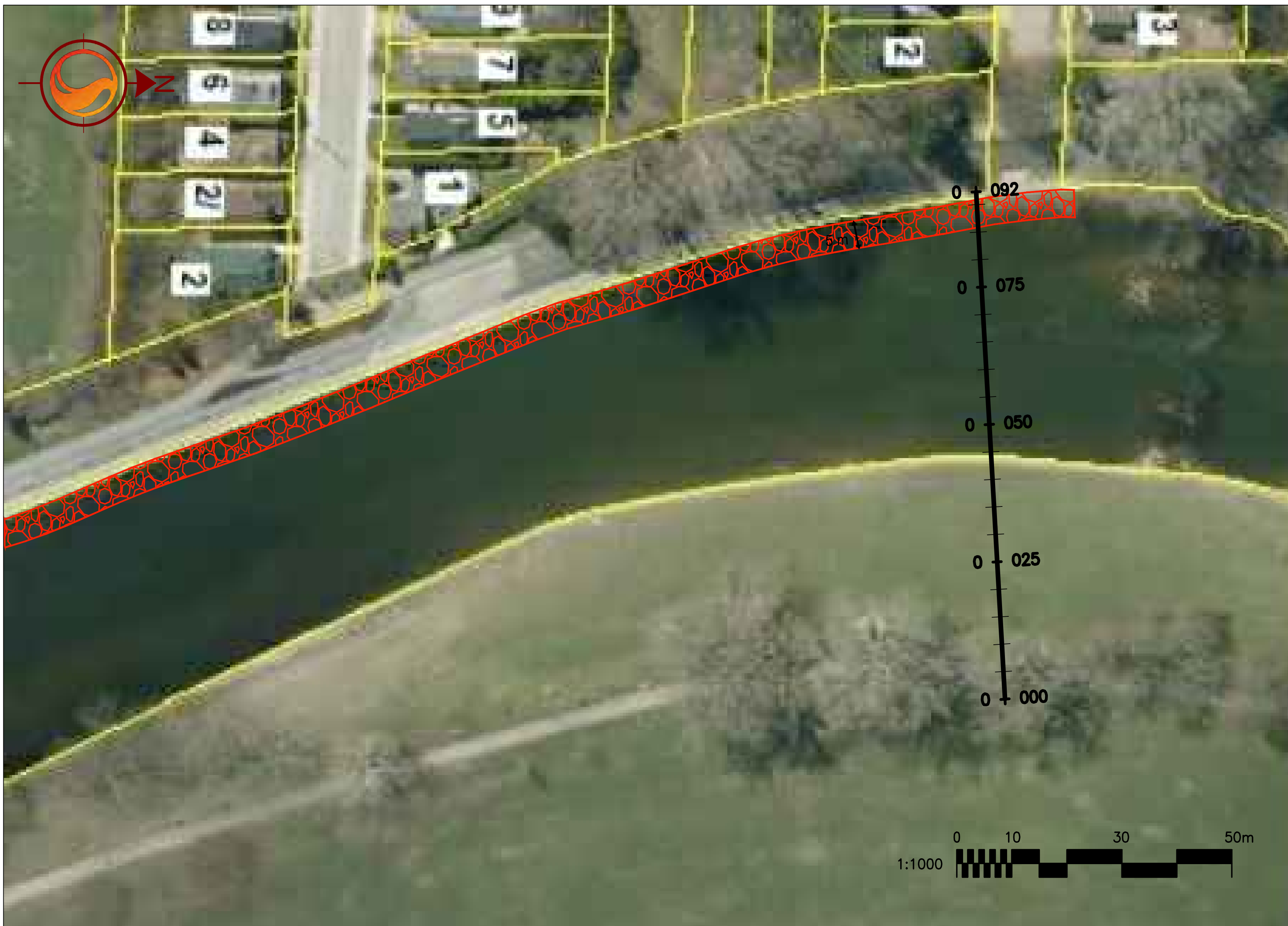
THAMES RIVER SCOUR REPORT

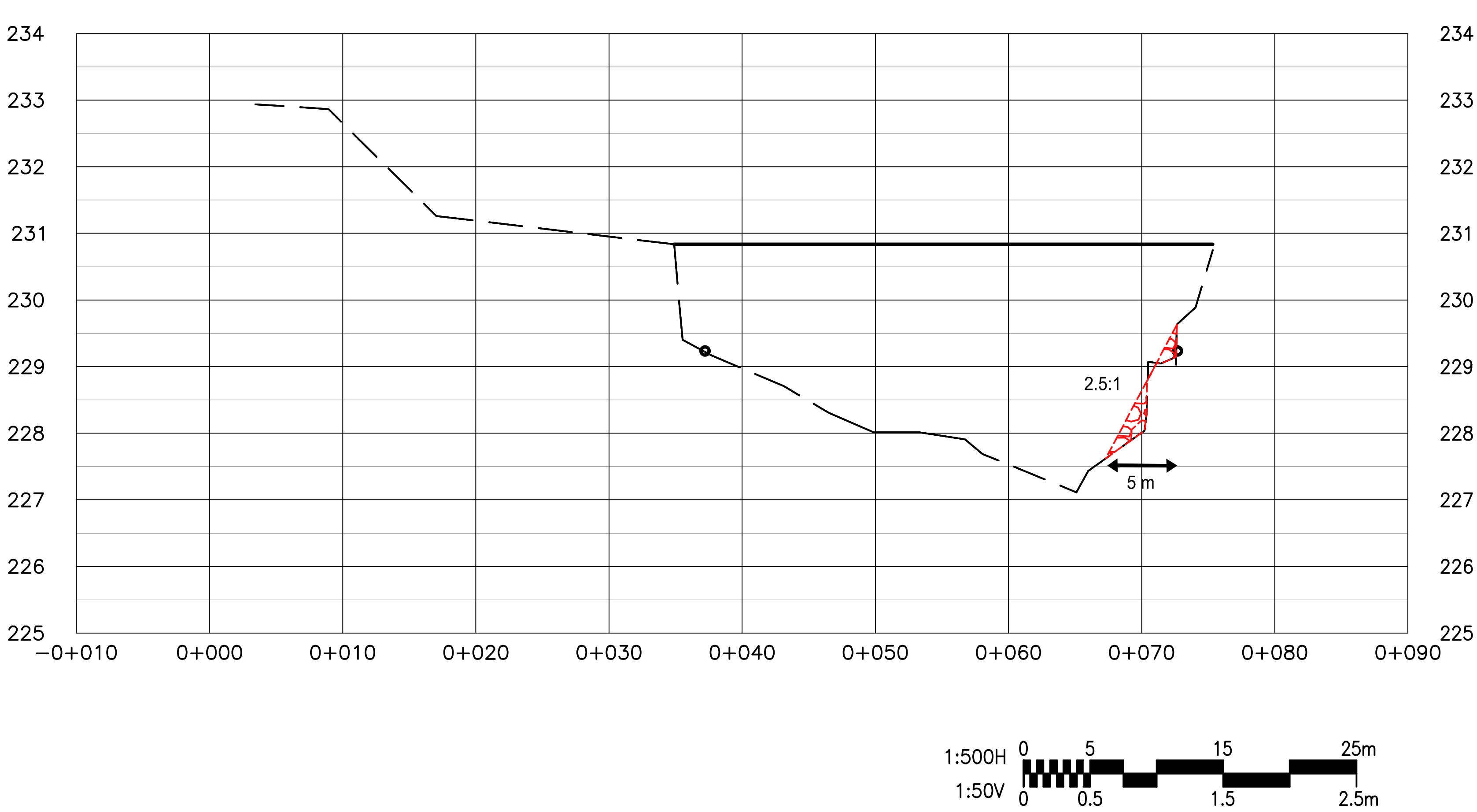
Figure No.

1.3

Title

ANN STREET
DESIGN OPTION #3





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2015/12/17 5:13 PM By: Tweedle, Shannon

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DECEMBER 2015
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ROCK TOE PROTECTION

BANKFULL STAGE

LOW–FLOW STAGE

Client/Project

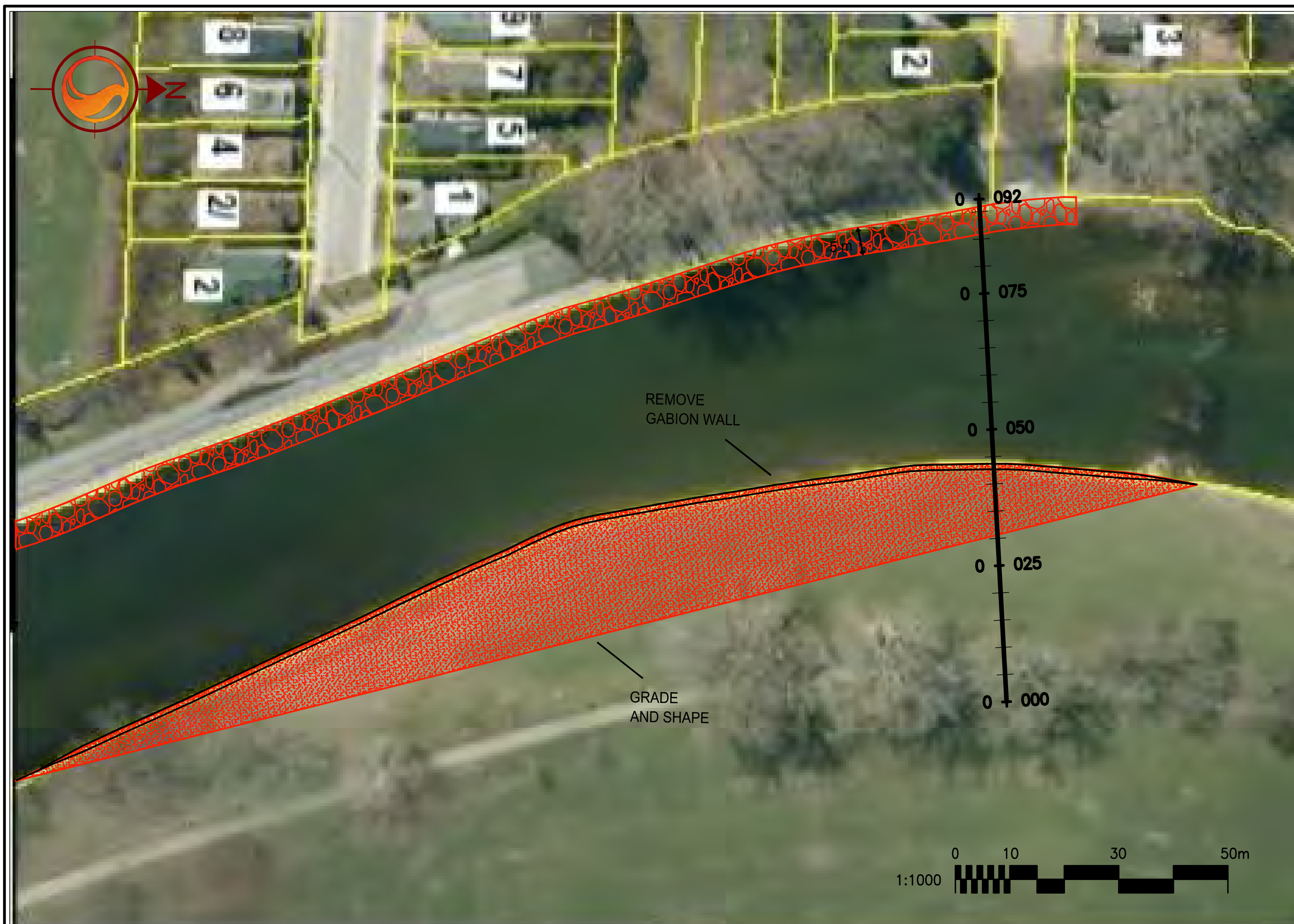
UPPER THAMES RIVER CONSERATION AUTHORITY
WEST LONDON DYKE NOTRH BRANCH
THAMES RIVER SCOUR REPORT

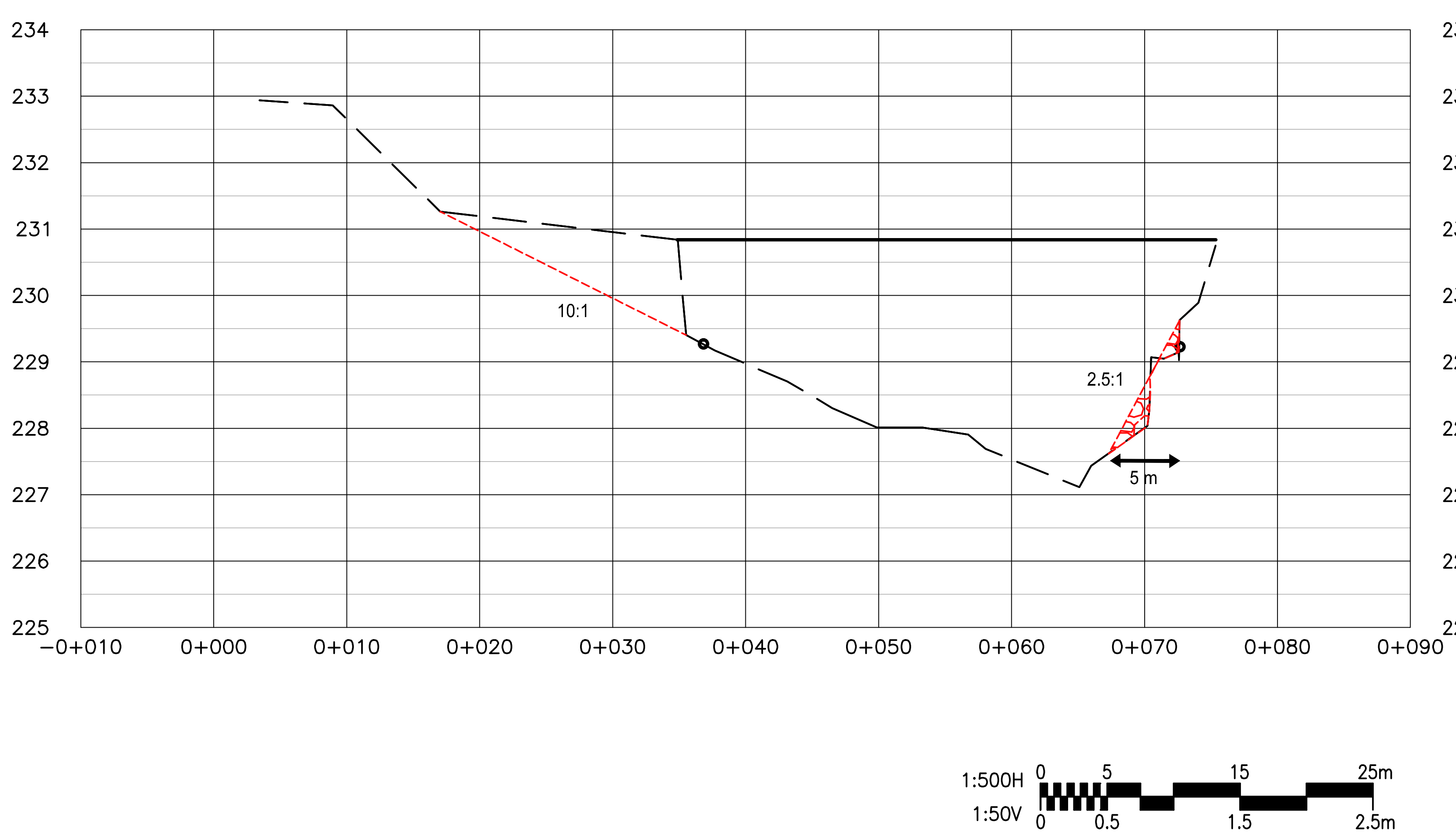
Figure No.

2.1

Title

LESLIE STREET
DESIGN OPTION #1





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ROCK TOE PROTECTION

POINT BAR GRADING

BANKFULL STAGE

LOW−FLOW STAGE

Client/Project

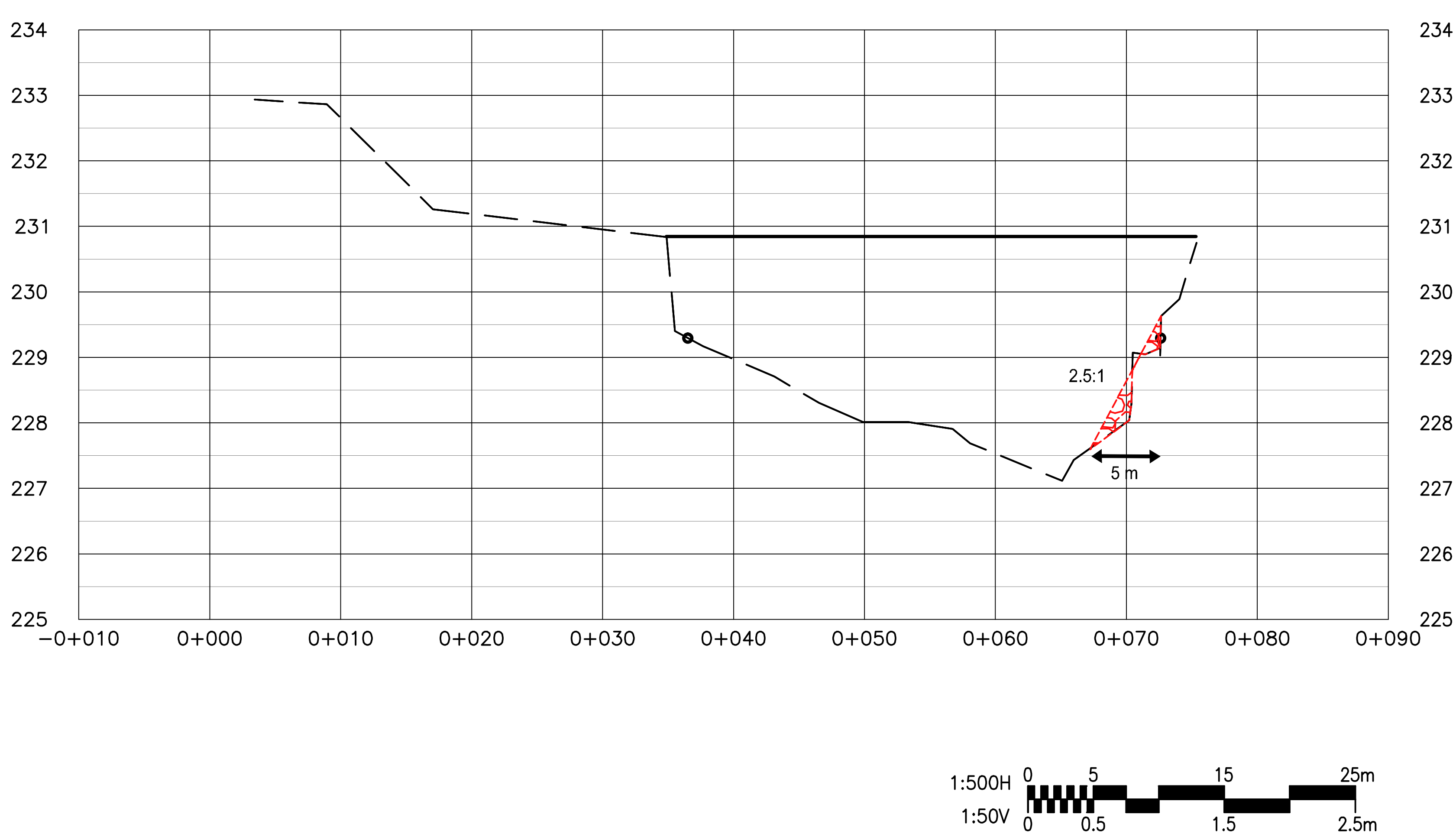
UPPER THAMES RIVER CONSERVATION AUTHORITY
WEST LONDON DYKE NOTRH BRANCH
THAMES RIVER SCOUR REPORT

Figure No.

2.2

Title

LESLIE STREET
DESIGN OPTION #2



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2015/12/17 5:14 PM By: Tweedie, Shannon

ORIGINAL SHEET - ANSI B

DECEMBER 2015
165630035

Stantec

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Kitchener, ON, N2H 6M7
Tel. 519.579.4410
www.stantec.com

ROCK TOE PROTECTION

MODIFIED RIFFLE

FLOW DIRECTION

BANKFULL STAGE

LOW–FLOW STAGE

Client/Project

UPPER THAMES RIVER CONSERATION AUTHORITY
WEST LONDON DYKE NOTRH BRANCH
THAMES RIVER SCOUR REPORT

Figure No.

2.3

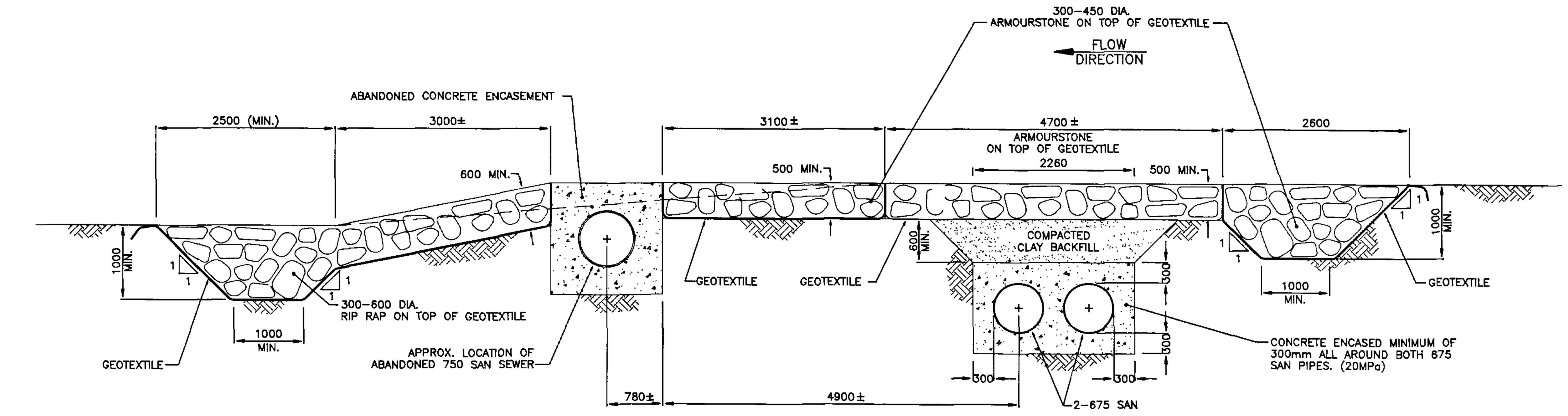
Title

LESLIE STREET
DESIGN OPTION #3

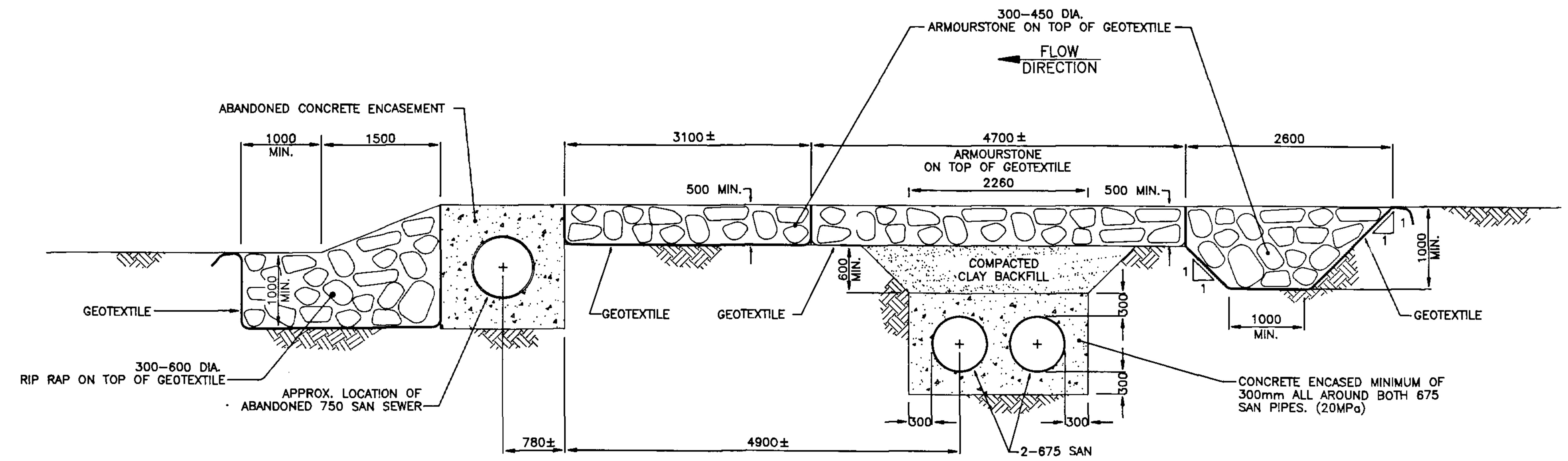
Appendix D AS-BUILTS

Send to Plotter

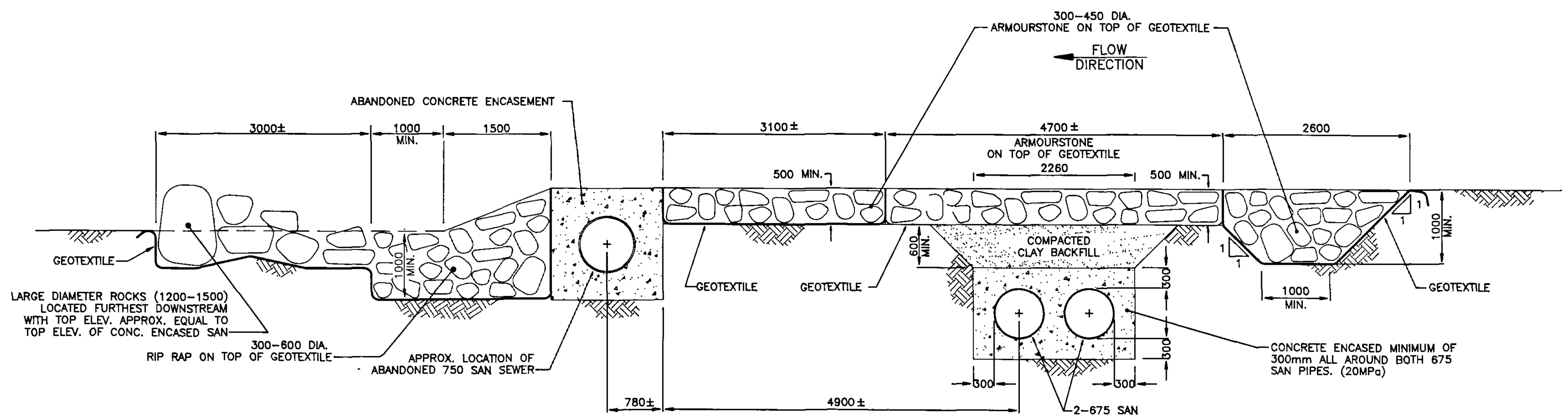
13,586



CROSS–SECTION 1–1
OF SYPHON AT RIVER CROSSING
SCALE 1:50



CROSS–SECTION 2–2
OF SYPHON AT RIVER CROSSING
SCALE 1:50



CROSS–SECTION 3–3
OF SYPHON AT RIVER CROSSING
SCALE 1:50

AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION		No.	REVISIONS	DATE	BY
BENCHMARK: C.P.36 –238.707m BRASS TABLET SET IN THE SOUTHWEST CORNER OF OXFORD ST. BRIDGE (WEST) (NEAR EXPANSION JOINT) SOUTH SIDE OF BRIDGE.			DESIGN S.H.	1	AS CONSTRUCTED	DEC/94	S.A.H
			DRAWN S.E.				
			CHECKED R.P.				
			APPROVED S.A.S.				
			DATE JUNE/93				
			DELCAN PROJECT No. 07–1917				

CADD FILE: ANNCLOWS 04/07/95

CONSULTANT OR DIVISION
DELCAN
ENGINEERS PLANNERS ARCHITECTS
1069 WELLINGTON ROAD SOUTH, SUITE 214, LONDON, ONTARIO, N6E 2H6

ENGINEER'S STAMP
REGISTERED PROFESSIONAL ENGINEER
S.A. HAYMAN
PROVINCE OF ONTARIO

CORPORATION OF THE CITY OF LONDON
DIVISION HEAD
CITY ENGINEER

SCALE
SCALE – 1 : 50
0.5 0 1m

TITLE
CITY OF LONDON
SAINT PATRICK ST./ANN ST.
SANITARY SYPHON
RIP RAP CROSS SECTIONS

PROJECT No. 610/A/23
SHEET No. 3
PLAN FILE No. 13,586

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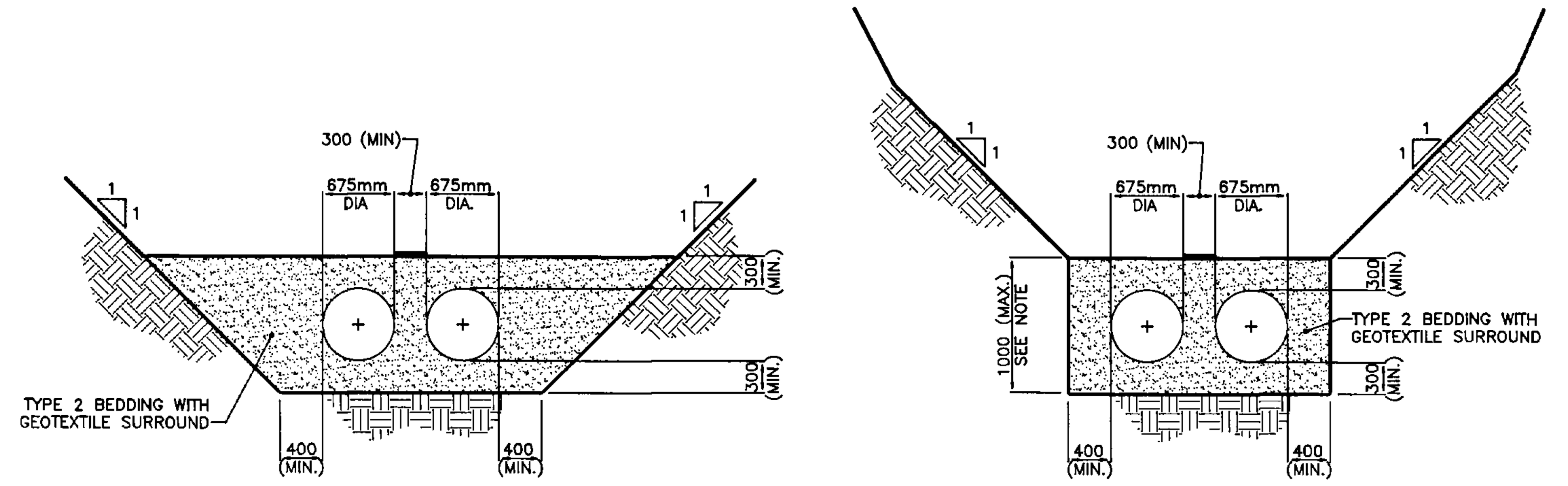


NOTE;

Excavation through the granular materials and upper portions of the clayey silt till shall be cut with side slopes inclined no steeper than 1:1. A trench support system shall be used in areas such that the existing hydro poles are not disturbed on the west bank.

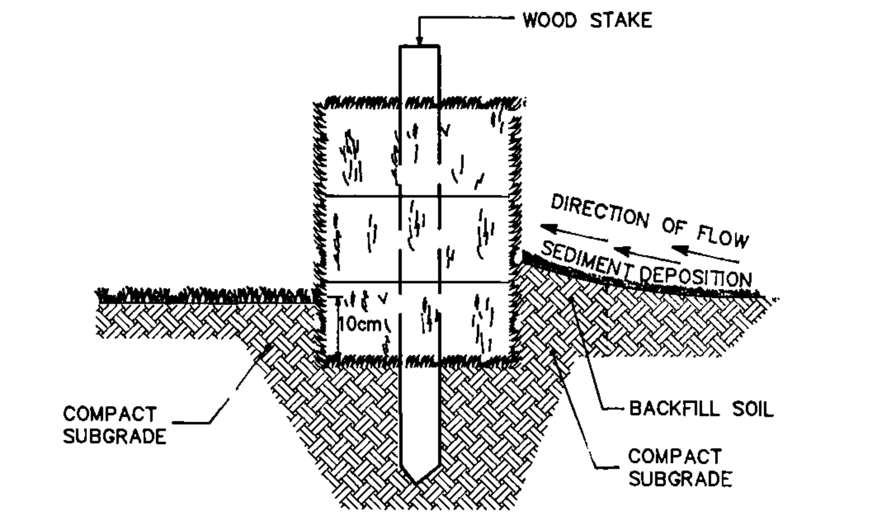
NOTE:

Where the lower 1.0m of the excavation is entirely within the clayey silt till, vertical side walls may be cut.

BEDDING DETAIL

(FOR 2–675 SAN PIPES IN REVETMENT AREA)

SCALE 1:50



TYPICAL SECTION OF STRAW BALE USED TO FILTER OVERLAND FLOW

SEDIMENT CONTROL MEASURES:

1. PROTECT ALL EXPOSED SURFACES AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
2. ALL EROSION CONTROL MEASURES TO BE IN PLACE BEFORE STARTING CONSTRUCTION AND REMAIN IN PLACE UNTIL RESTORATION COMPLETE.
3. MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION.
4. ALL COLLECTED SEDIMENT TO BE DISPOSED OF AT AN APPROVED LOCATION.
5. MINIMIZE AREA DISTURBED DURING CONSTRUCTION.
6. ALL DEWATERING TO BE DISPOSED OF IN AN APPROVED SEDIMENTATION BASIN.
7. PROTECT ALL CATCHBASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION.
8. KEEP ALL SUMPS CLEAN DURING CONSTRUCTION.
9. PREVENT WIND-BLOWN DUST.
10. STRAW BALES TO BE USED IN LOCALIZED AREAS AS SHOWN AND AS DIRECTED BY THE ENGINEER DURING CONSTRUCTION.

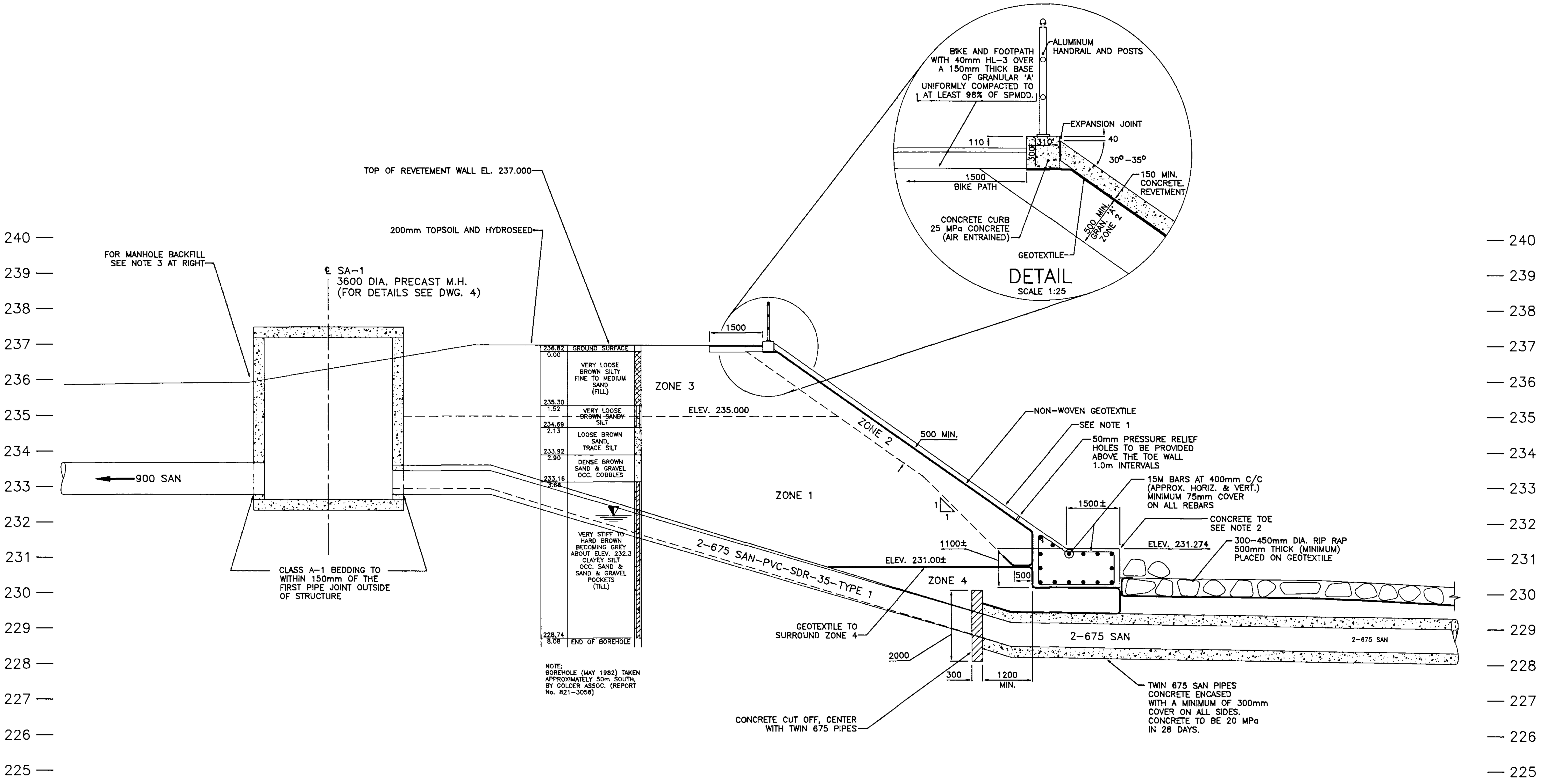
NOTES:

1. ENDS OF ROWS OF STRAW BALES SHALL BE ROUNDED UP TO PREVENT POTENTIAL SILT RUNOFF AROUND ROWS.
2. AREAS DISTURBED BY CONSTRUCTION TO BE RESTORED TO SATISFACTION OF LANDSCAPE ARCHITECT.
3. STRAW BALES TO BE MAINTAINED DURING CONSTRUCTION.
4. TEMPORARY STRAW BALES, AS DIRECTED BY ENGINEER, TO BE USED IN LOCALIZED AREAS ADJACENT TO CONSTRUCTION.

STRAW BALE FILTER

N.T.S.

13,585



NOTES RE: BACKFILL IN REVETMENT

ZONE 1: Areas above the river water level shall consist of the native clayey silt till and granular materials uniformly compacted to at least 95 percent of standard Proctor maximum dry density in maximum loose lifts of 300 millimetres in thickness.

ZONE 2: The backfill extending from 0.5 metres below the revetment slab or toe wall base to the underside of the revetment or toe wall shall consist of Granular 'A' material uniformly compacted to at least 98 percent of standard Proctor maximum dry density in maximum 300 millimetre thick loose lifts.

ZONE 3: The backfill comprising the revetment wall above elevation 235 metres shall consist of Granular 'A' or City of London Select Granular 'B' compacted to 98 percent of standard Proctor maximum dry density.

ZONE 4: Below the river water level where problems in achieving the specified degree of compaction may occur due to wet conditions, the backfill shall consist of crushed stone provided with a geotextile surround.

NOTES:

1. Prior to any excavation, the existing concrete revetment panels shall be sawcut a minimum of one metre beyond the limits of excavation or removed to the next joint. Care is to be taken in order to minimize disturbance to the adjacent concrete revetment panels and sections of toe wall.

   Concrete revetment facing to be restored with a minimum thickness of 150 mm of 25 MPa air entrained concrete. If the existing revetment is found to be thicker, then the concrete depth is to be increased to match the existing. The new concrete facing shall have contraction joints, or expansion joints, at approximately 3 m x 3 m spacing in order to match as closely as possible the configuration of the existing concrete face to the north and south of the excavation.

   The new concrete revetment panels shall be dowelled into the existing works by drilling 50 mm diameter holes a minimum of 300 mm deep and grouting in place (using an epoxy grout), 1050 mm long, 20 m epoxy-coated rebar spaced at 500 mm c/c.

2. Concrete toe dimensions shall match existing toe dimensions (concrete to be 25 MPa air entrained). New concrete toe to be dowelled into the existing toe by drilling 50 mm diameter holes, a minimum of 300 mm deep and grouting in place (using an epoxy grout) – a total of 16 (eight each end) 20 m epoxy-coated rebar, 1050 mm in length at 500 mm c/c.

3. Backfill around new manholes shall consist of the native sand or sand and gravel and/or Granular "B" uniformly compacted to at least 95 percent of Standard Proctor maximum dry density.

4. River Crossing

   It is anticipated that the excavation for the installation of the new syphon below river water level will require the construction of temporary cofferdams. The excavations will likely encounter thin granular riverbed deposits overlying very stiff to hard clayey silt till. It is likely that groundwater and river seepage within the excavations can be controlled using a system of properly filtered sumps.

CROSS SECTION THROUGH REVETMENT WALL (WEST BANK)

SCALE 1:75

AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION
BENCHMARK: C.P.36 –238.707m BRASS TABLET SET IN THE SOUTHWEST CORNER OF OXFORD ST. BRIDGE (WEST) (NEAR EXPANSION JOINT) SOUTH SIDE OF BRIDGE.		

DESIGN	S.H.
DRAWN	S.E.
CHECKED	R.P.
APPROVED	S.A.S.
DATE	JUNE/93
DELCAN PROJECT No.	07-1917

No.	REVISIONS	DATE	BY
1	AS CONSTRUCTED	DEC/94	S.A.H

CONSULTANT OR DIVISION: DELCAN ENGINEERS PLANNERS ARCHITECTS, 1069 WELLINGTON ROAD SOUTH, SUITE 214, LONDON, ONTARIO, N6E 2H6

ENGINEER'S STAMP: REGISTERED PROFESSIONAL ENGINEER S.A. HAYMAN PROVINCE OF ONTARIO

CORPORATION OF THE CITY OF LONDON

DIVISION HEAD

CITY ENGINEER

SCALE: AS SHOWN

TITLE: CITY OF LONDON

SAINT PATRICK ST./ANN ST. SANITARY SYPHON

REVETMENT WALL AND MISCELLANEOUS DETAILS

PROJECT No. 610/A/23

SHEET No. 2

PLAN FILE No. 13,585

CADD FILE: ANN2.DWG 6/25/95

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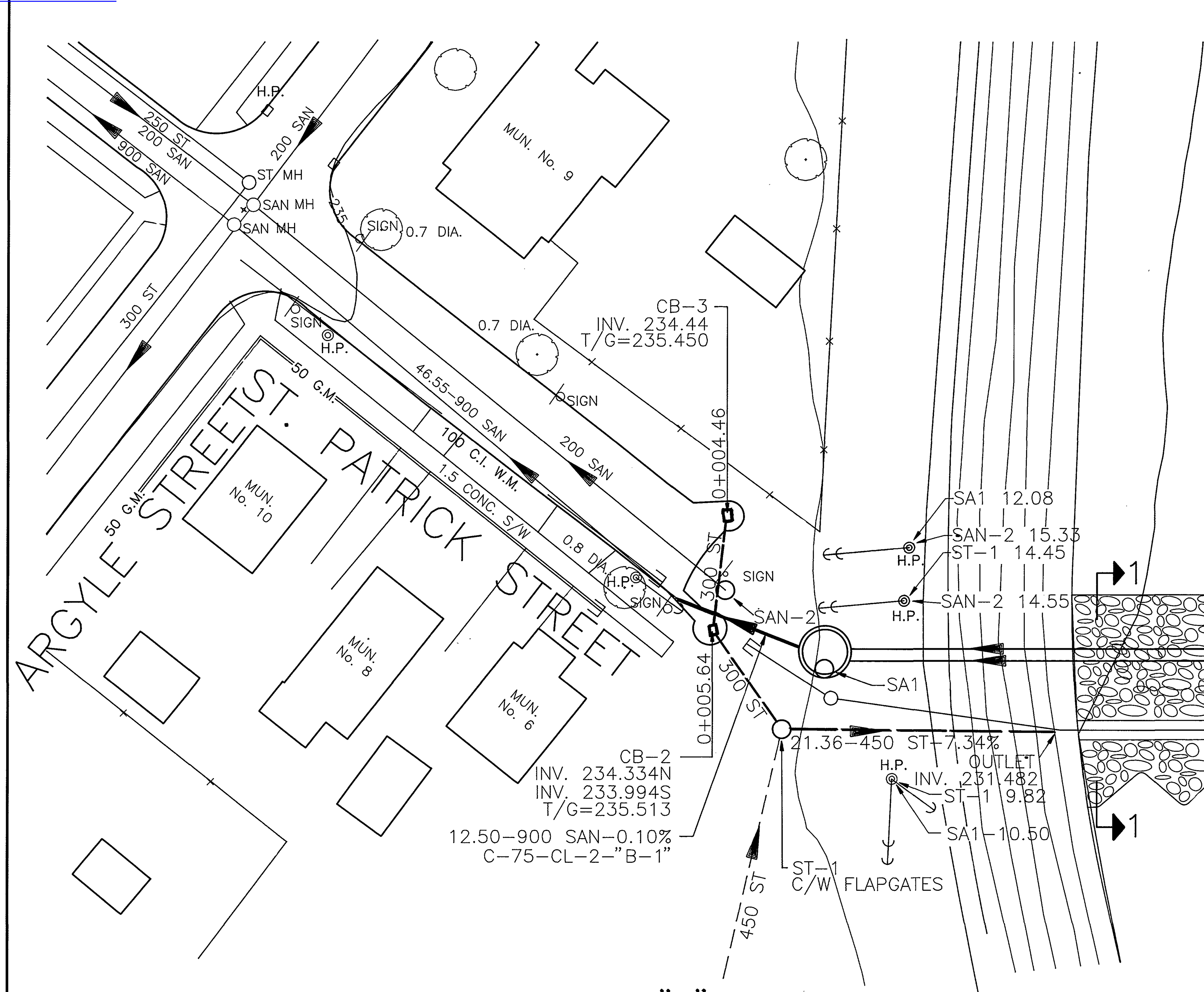
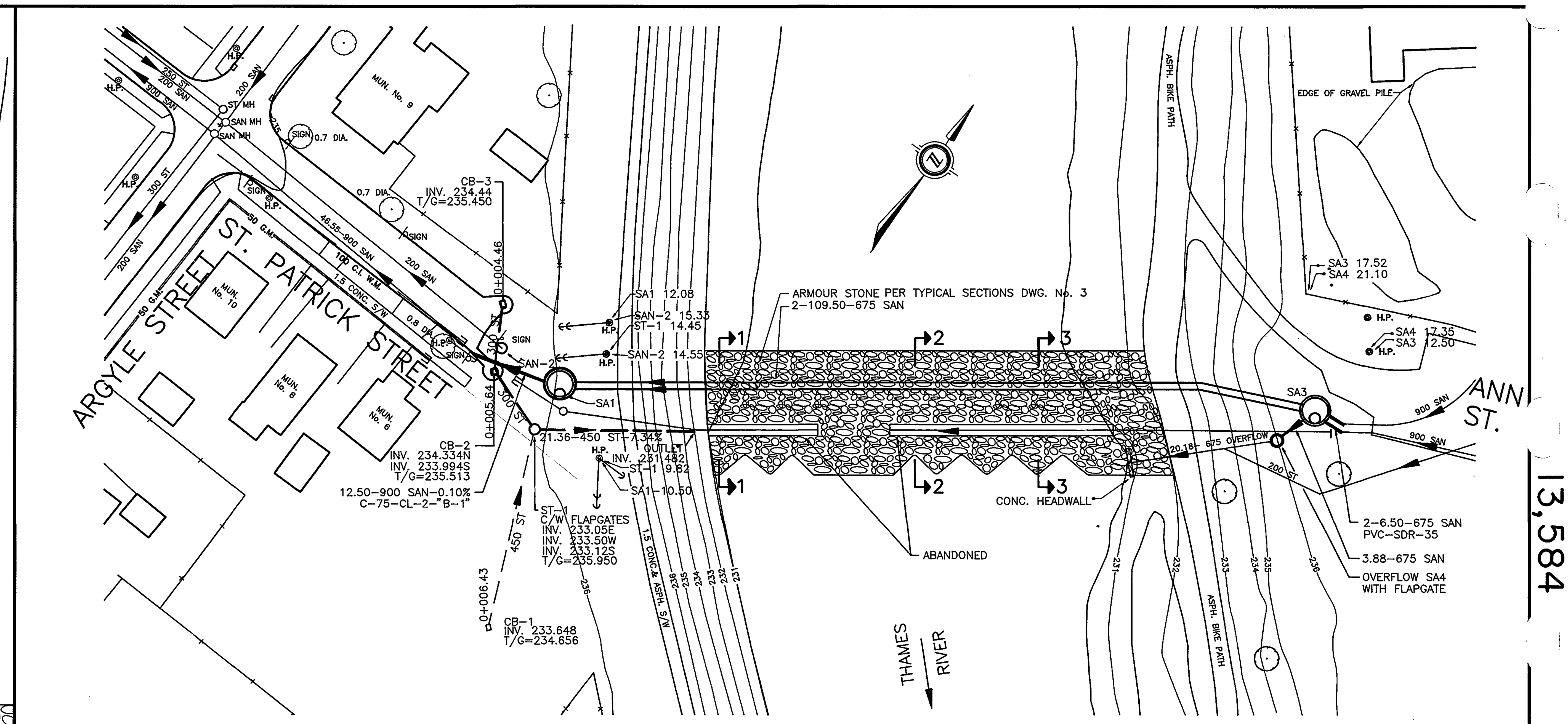
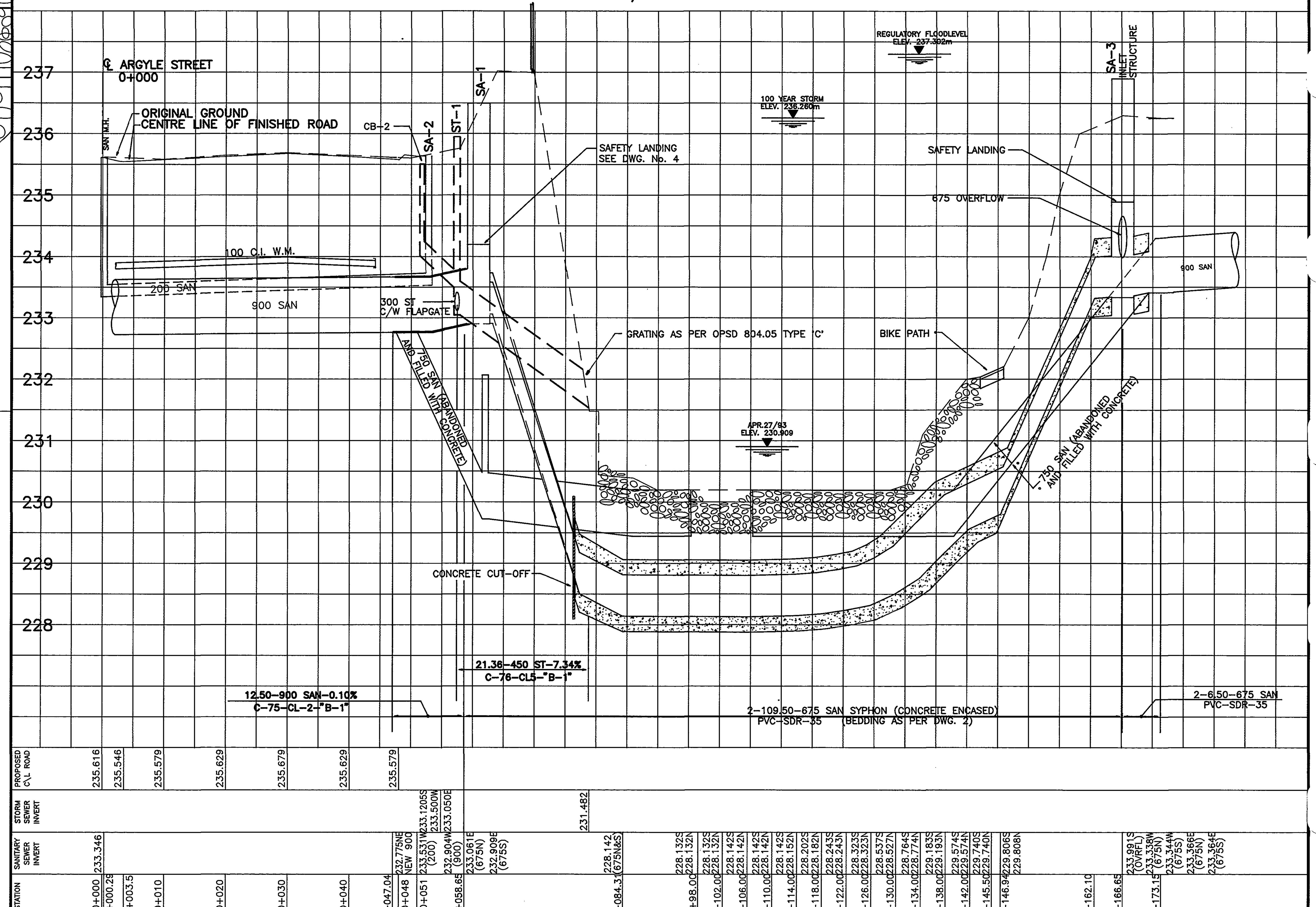


DETAIL "A"
SCALE 1:250



ST. PATRICK STREET / ANN STREET SANITARY SYPHON



AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION		No.	REVISIONS	DATE	BY
BENCHMARK:	SAN SEWER & MH'S	SEPT '94	DESIGN S.H.	1	REVISED WATERMAIN NOTES	07/26/93	S.H.
C.P.36 –238.707m BRASS TABLET SET IN THE SOUTHWEST CORNER OF OXFORD ST. BRIDGE (WEST) (NEAR EXPANSION JOINT) SOUTH SIDE OF BRIDGE.	ST SEWER, CB'S & MH'S	SEPT '94	DRAWN S.E.	2	ST. PATRICKS ROADWORKS DELETED	03/94	S.H.
			CHECKED R.P.	3	AS CONSTRUCTED	DEC 1994	S.H.
			APPROVED S.A.S.				
			DATE JUNE/93				
			DELCAN PROJECT No. 07–1917				

CADD FILE: ANN1.DWG 09/22/95

CONSULTANT OR DIVISION

DELCAN ENGINEERS PLANNERS ARCHITECTS

1069 WELLINGTON ROAD SOUTH, SUITE 214, LONDON, ONTARIO, N6E 2H6

ENGINEER'S STAMP: REGISTERED PROFESSIONAL ENGINEER S.A. HAYMAN PROVINCE OF ONTARIO

CORPORATION OF THE CITY OF LONDON

DIVISION HEAD

CITY ENGINEER

SCALE
HORZ SCALE – 1 : 500 (5 0 10m)
VERT SCALE – 1 : 50 (0.5 0 1m)
OR AS SHOWN

TITLE

CITY OF LONDON

SANITARY SYPHON

ST. PATRICK SREET TO ANN STREET

PROJECT No. 610/A/23

SHEET No. 1

PLAN FILE No. 13,584

Appendix E COST ESTIMATES

Opinion of Probable Cost for Each Alternative

			DESIGN		CONSTRUCTION							TOTALS		
SITE		ALTERNATIVE	ENGINEERING SERVICES	PERMITS	MOB / DEMOB	WATER / EROSION CONTROL	SITE ACCESS	TRAFFIC CONTROL	CONSTRUCTION COST	CONTRACT ADMIN	CONTINGENCY	TOTAL ENGINEERING	TOTAL CONSTRUCTION	TOTAL PROJECT COST
ANN STREET	AS1	Remove Weir	$ 21,000	$ 16,000	$ 11,000	$ 21,000	$ 11,000	$ 3,000	$ 20,000	$ 32,000	$ 12,000	$ 37,000	$ 110,000	$ 147,000
	AS2	Modify Weir	$ 32,000	$ 16,000	$ 11,000	$ 32,000	$ 11,000	$ 3,000	$ 10,000	$ 32,000	$ 12,000	$ 48,000	$ 111,000	$ 159,000
	AS3	Dyke Toe Protection	$ 32,000	$ 16,000	$ 11,000	$ 32,000	$ 11,000	$ 3,000	$ 78,000	$ 32,000	$ 23,000	$ 48,000	$ 190,000	$ 238,000
	AS4	Bench and Vanes	$ 42,000	$ 16,000	$ 21,000	$ 42,000	$ 11,000	$ 3,000	$ 200,500	$ 37,000	$ 44,000	$ 58,000	$ 358,500	$ 416,500
HARRIS PARK	HP1	Boulder Toe Protection	$ 32,000	$ 16,000	$ 32,000	$ 32,000	$ 11,000	$ 3,000	$ 312,000	$ 32,000	$ 61,000	$ 48,000	$ 483,000	$ 531,000
	HP2	Remove Gabions & Reshape Point Bar	$ 42,000	$ 16,000	$ 42,000	$ 47,000	$ 11,000	$ 4,000	$ 150,600	$ 42,000	$ 41,000	$ 58,000	$ 337,600	$ 395,600
	HP3	Modify Fish Weirs	$ 32,000	$ 16,000	$ 32,000	$ 37,000	$ 11,000	$ 4,000	$ 20,000	$ 37,000	$ 18,000	$ 48,000	$ 159,000	$ 207,000

Appendix F NOTICE OF COMPLETION