

WELCOME

Tuck Creek Erosion Control Environmental Assessment

PUBLIC INFORMATION CENTRE

December 15, 2020

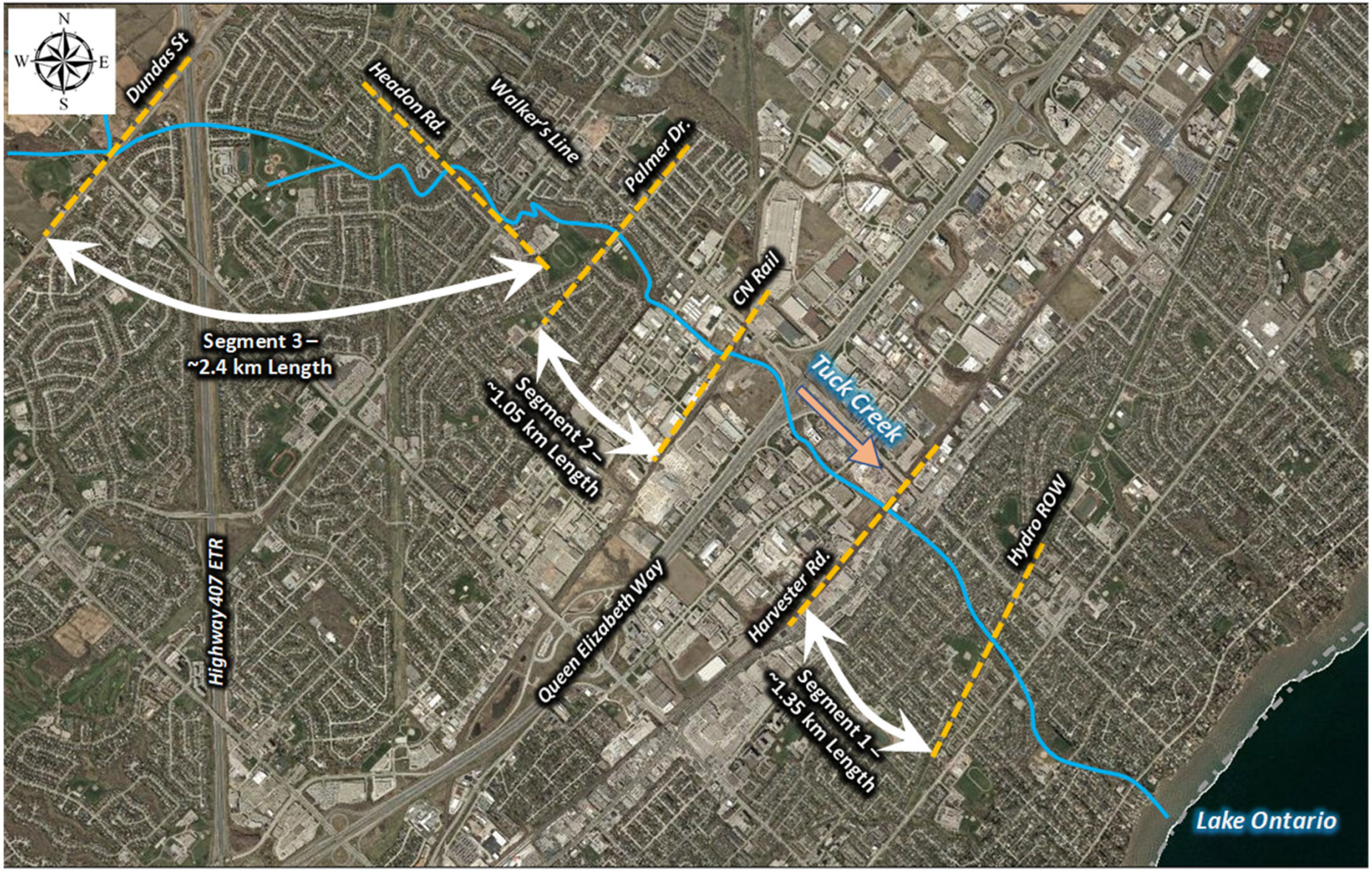
Your comments are encouraged and appreciated, as this will provide us an opportunity to address project issues and concerns.

Aquafor Beech Limited

City of Burlington

STUDY AREA

The study area along Tuck Creek is between Dundas St. to Headon Rd., Palmer Dr. to CN Rail & Harvester Rd. to Hydro ROW



STUDY PURPOSE / PROBLEM DEFINITION



The study is being carried out to study the risk of erosion related to Tuck Creek within the study area, and provide recommendations to reduce erosion and protect the natural heritage in the area.

PUBLIC INFORMATION CENTRE PURPOSE



This Public Information Centre (PIC) is Designed to:

- Present information on existing conditions
- Present alternative approaches to erosion protection
- Present study process and timelines



To gain community input on:

- Existing conditions information
- Identification of opportunities and mitigation preferences
- Prioritization of erosion sites
- Alternative evaluation criteria and scoring
- Selection of preferred solutions

MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT PROCESS

CLASS EA PROCESS - SCHEDULE B

Many projects related to municipal systems are similar in nature, are carried out routinely, and have predictable and mitigatable environmental effects which are investigated according to the Municipal Engineers Association "Municipal Class Environmental Assessment" (October 2000, as amended in 2007 & 2011).

This study is being undertaken as a Schedule B project under the Municipal Class Environmental Assessment process. The flow chart illustrates the key steps to be undertaken as part of the EA process.

Phase 1 – Identify Problems

- ✓ Identify Problem or Opportunity
- ✓ Public Consultation



We Are Here →

Phase 2 – Alternate Solutions

- ✓ Identify Alternative Solutions
- ✓ Inventory Natural, Social, Economic Environment
- ✓ Environmental Impacts and Mitigation
- ✓ Alternatives Evaluation
- Review Agency and Public Consultation
- Select Preferred Solution
- Review and Confirm Choice of Schedule
- Notice of Completion to Review Agency & Public
- Implementation

NATURAL HERITAGE ASSESSMENT

To assess the existing natural environment within the study area, the following studies were undertaken:

1. Tree inventory and assessment;
2. Vegetation community classification (Ecological Land Classification (ELC) protocol);
3. Vascular plant survey (includes vascular plant Species at Risk (SAR) survey);
4. Breeding Bird Surveys (BBS);
5. Candidate bat maternity roost surveys;
6. Snake surveys (no snakes recorded during surveys);
7. Frog and toad call surveys;
8. Fish community and aquatic habitat assessment;
9. SAR screening and habitat assessment; and,
10. Significant Wildlife Habitat (SWH) screening and assessment.



Eastern Cottontail (*Sylvilagus floridanus*) – a common urban resident



Fragile Forktail (*Ischnura posita*) – Rare in Halton Region



Forested Tuck Creek Corridor

VEGETATION COMMUNITY CLASSIFICATION

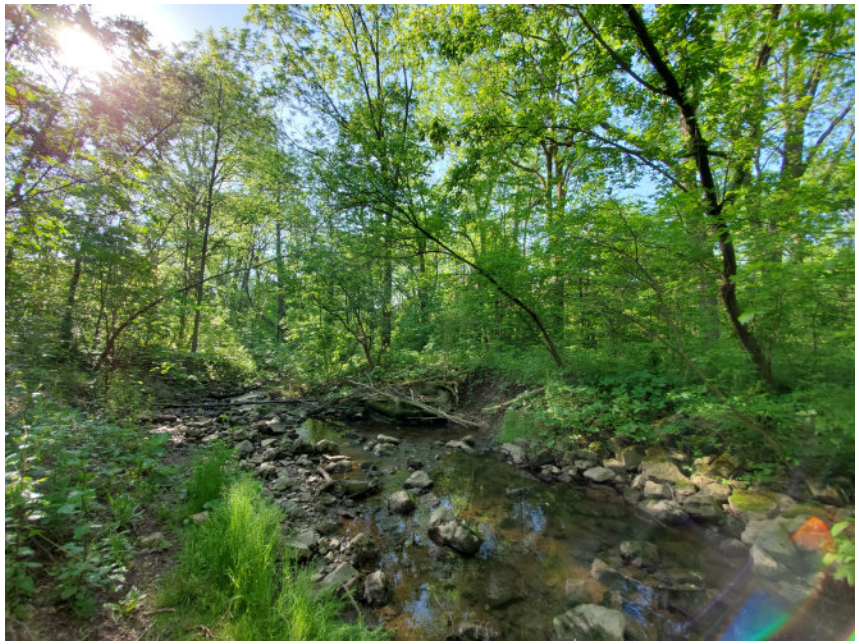
Vegetation communities within the study area were identified during field surveys completed in accordance with the *Ecological Land Classification (ELC) System for Southern Ontario: First Approximation and its Application* (Lee et al., 1998) protocol in 2020.

Determining the vegetation communities within the study area aids in identifying the presence of significant vegetation communities, Significant Wildlife Habitat (SWH), and the habitats of potential Species at Risk.

In total, 15 vegetation communities are within the study area (see Board 7). Community types ranged from disturbed woodlands and open meadows, to deciduous forest habitats containing mature species and moderate to high quality habitat. One community is considered provincially rare – FOD7-4 (S2S3), although found to be severely degraded by disturbance.



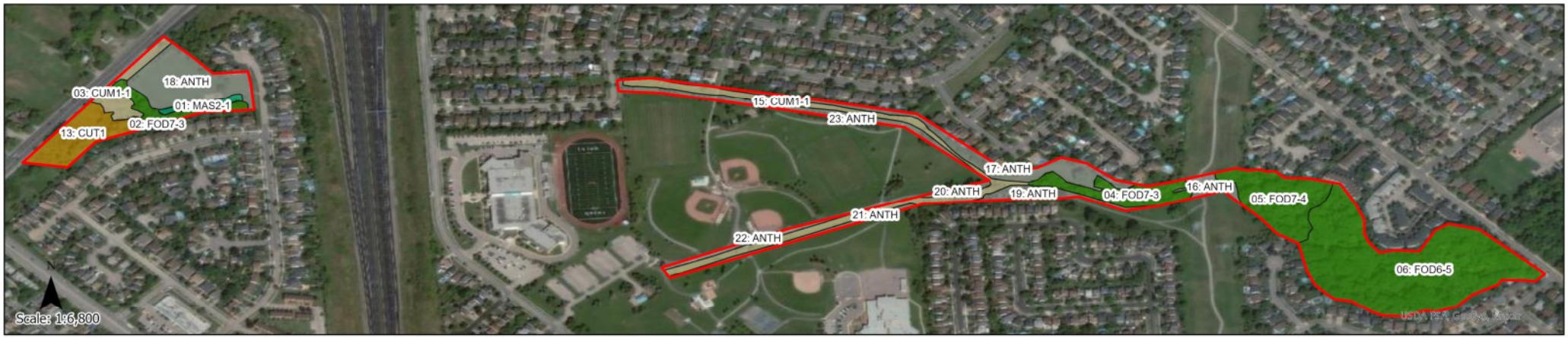
FOD7-4: Fresh – Moist Black Walnut Lowland Deciduous Forest Type (S2S3)

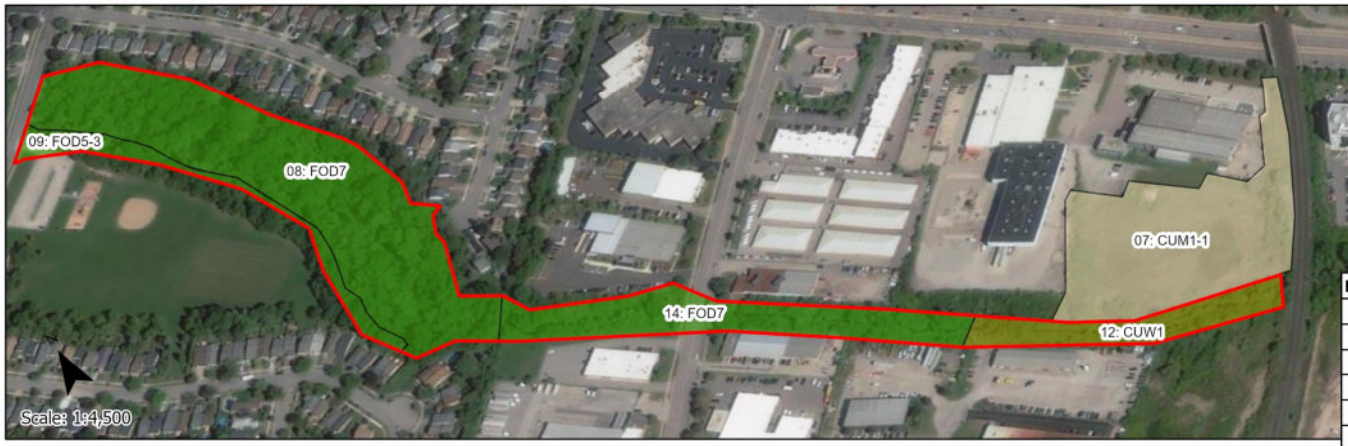


Mature Deciduous Forest adjacent to Tuck Creek

VEGETATION COMMUNITY CLASSIFICATION

Tuck Creek Erosion Control Environmental Assessment







Polygon	ELC Code	Community Name
01	MAS2-1	Cattail Mineral Shallow Marsh
02	FOD7-3	Fresh - Moist Willow Lowland Deciduous Forest
03	CUM1-1	Dry -Moist Old Field Meadow
04	FOD7-3	Fresh - Moist Willow Lowland Deciduous Forest
05	FOD7-4	Fresh - Moist Black Walnut Lowland Deciduous Forest
06	FOD6-5	Fresh - Moist Sugar Maple - Hardwood Deciduous Forest
07	CUM1-1	Dry -Moist Old Field Meadow
08	FOD7	Fresh - Moist Lowland Deciduous Forest
09	FOD5-3	Dry - Fresh Sugar Maple - Oak Deciduous Forest
10	CUT1/CUM1-1	Mineral Cultural Thicket / Dry - Moist Old Field Meadow Complex
11	FOD7	Fresh - Moist Lowland Deciduous Forest
12	CUW1	Mineral Cultural Woodland
13	CUT1	Mineral Cultural Thicket
14	FOD7	Fresh - Moist Lowland Deciduous Forest
15	CUM1-1	Dry -Moist Old Field Meadow
16	ANTH	Anthropogenic
17	ANTH	Anthropogenic
18	ANTH	Anthropogenic
19	ANTH	Anthropogenic
20	ANTH	Anthropogenic
21	ANTH	Anthropogenic
22	ANTH	Anthropogenic
23	ANTH	Anthropogenic

VASCULAR PLANTS

Vascular plants were identified in concert with vegetation community surveys in 2020. To date, 201 species have been identified.

Attributes of the vascular plant species recorded within the study area are as follows:

- Introduced Species: 78
- Native Species: 86
- Regionally Rare Species: 22
- Provincially Rare Species (S1-S3): 1 (Pignut Hickory, *Carya glabra*)
- Species at Risk: 0



Cut-leaved Toothwort (*Cardamine concatenata*) – Uncommon in Halton Region



Yellow Trout Lily (*Erythronium americanum*)



Pignut Hickory (*Carya glabra*) – S3; Rare in Halton Region

BREEDING BIRDS

Two Breeding Bird Surveys (BBS) were conducted in 2020 by a qualified avian biologist. A total of 32 species were recorded during surveys. BBS results are as follows:

- Confirmed breeding: 3
- Probable breeding: 9
- Possible breeding: 14
- No breeding evidence: 6

Significant Species are as follows:

- Provincially rare species: 1 (Black-crowned Night-heron (*Nycticorax nycticorax*))
- Species at Risk: 2 (Barn Swallow (*Hirundo rustica*), Eastern Wood-pewee (*Contopus virens*))
- Woodland Raptors: 1 (Cooper's Hawk (*Accipiter cooperii*))



Cooper's Hawk (*Accipiter cooperii*) – Uncommon in Halton Region

One breeding pair of Cooper's Hawk were observed in April by Aquafor staff. Nest location was confirmed by local residents.

Due to a lack of breeding evidence (i.e. no nests were observed in trees or on suitable structures), it is believed the Black-crowned Night-heron and Barn Swallow are using the Tuck Creek corridor for foraging.

OTHER WILDLIFE

Species specific surveys (Snake and calling Frogs and Toads) were conducted in 2020 by qualified terrestrial ecologists, along with incidental wildlife observations recorded throughout the duration of all site visits. A total of 17 additional wildlife species were recorded during surveys, as follows:

- Mammals: 5
- Amphibians: 2
- Insects: 11

Provincially rare species: 1 (River Bluet (*Enallagma anna*))

Regionally rare species: 1 (Fragile Forktail (*Ischnura posita*)



River Bluet (*Enallagma anna*) – S3, found along the grassy margins of Tuck Creek near Lansdown Park

Frog and Toad surveys only recorded two calling individuals throughout the study area (Green Frog and Spring Peeper). Their preferred habitat – wetland – was not abundantly present throughout the Tuck Creek corridor.

No snakes were observed directly by Aquafor staff, likely due to cool, overcast weather conditions and a tendency for these species to avoid detection.

SPECIES AT RISK

For the purpose of this study, Species At Risk (SAR) are defined as species listed as Endangered (END), Threatened (THR), or Special Concern (SC) under the provincial Endangered Species Act (ESA) and/or the federal Species at Risk Act (SARA). Other Species of Conservation Concern (SOCC) are those with Global ranks of G1-G3 and/or Subnational/Provincial ranks of S1-S3.

Species included in the screening assessment include those provided by secondary sources and those documented via direct observations by Aquafor Beech Limited. **A total of 18 SAR and SOCC are included in the screening assessment**. Of these, 10 are either confirmed present or have the potential to occur within the study area. These are as follows:

Species Name		Ranking					Assessment of Species Occurrence at or Near the Study Area
Scientific Name	Common Name	SARA*	ESA*	G-Rank	S-Rank	Halton Region	
Myotis leibii	Eastern Small-footed Myotis	END	END	G4	S2S3	-	Potentially Present
Myotis lucifugus	Little Brown Myotis	END	END	G3	S4	Common	Likely Present
Myotis septentrionalis	Northern Myotis	END	END	G1G2	S3	Common	Likely Present
Perimyotis subflavus	Tri-coloured Bat	END	END	G2G3	S3?	-	Likely Present
Nycticorax nycticorax	Black-crowned Night-heron	-	-	G5	S3B, SZN	Uncommon	Confirmed Present
Contopus virens	Eastern Wood-Pewee	SC	SC	G5	S4B	Common	Confirmed Present
Hirundo rustica	Barn Swallow	THR	THR	G5	S4B	Common	Confirmed Present
Carya glabra	Pignut Hickory	-	-	G5	S3	Rare	Confirmed Present
Enallagma anna	River Bluet	-	-	G5	S2	Rare	Confirmed Present
Danaus plexippus	Monarch	SC	SC	G4	S2N,S4B	Common	Confirmed Present

*Species ranking for SARA and ESA are as follows: EXT – Extinct, EXP – Extirpated, END – Endangered, THR – Threatened, SC – Special Concern, NAR – Not-at-Risk, and DD – Data Deficient

SIGNIFICANT WILDLIFE HABITAT

The province has provided guidance for the identification and assessment of Significant Wildlife Habitat (SWH). In Burlington, the primary document to use to identify SWH is the Technical Guide for Ecoregion 7E (Government of Ontario, 2015).

Candidate or Confirmed SWH types within the study area are as follows:

- **Bat Maternity Colonies – Candidate**
- **Landbird Migratory Stopover Areas – Candidate**
- **Woodland Raptor Nesting Habitat – Confirmed**
- **Seeps and Springs - Candidate**
- **Special Concern and Rare Wildlife Species – Confirmed**
  - Eastern Wood-pewee (SC, S4B), Confirmed
  - River Bluet (S2), Confirmed
  - Pignut Hickory (S3), Confirmed



Cooper's Hawk (*Accipiter cooperii*)

SWH is a *Key Feature* of Halton Region's Natural Heritage System (RNHS) and is protected under the Region's Official Plan.

FISHERIES & AQUATIC HABITAT

To assess the existing fisheries and aquatic habitat within the study the following studies were undertaken:

- Aquatic habitat assessments at six (6) locations throughout the study area, from Ryerson Park upstream to Ireland Park;
- Aquatic community assessments of historic data; and,
- SAR screening and potential habitat identification.

Summary of Fish Community Sampling

Scientific Name	Common Name
Rhinichthys atratulus	Blacknose dace
Culaea inconstans	Brook stickleback
Cyprinidae	Carps and minnows
Luxilus cornutus	Common shiner
Semotilus atromaculatus	Creek chub
Pimephales promelas	Fathead minnow
Rhinichthys cataractae	Longnose dace
Oncorhynchus mykiss	Rainbow trout
Gasterosteus aculeatus	Threespine stickleback
Catostomus commersoni	White sucker

Key Findings:

- No aquatic SAR were identified within the study area;
- The thermal classification of Tuck Creek within the study area is that of a Cool-Warm thermal regime and is dominated by warmwater and coolwater species, with the exception of Rainbow trout (coldwater);
- Coldwater species limited in distribution to downstream extent of the creek (migratory species);
- Very little evidence of groundwater (coldwater) contributions;
- Habitat quality and quantity varier throughout the study area and was largely dependent on surrounding landuse;
- A number of **fish barrier(s)** were observed throughout the study area, such as the perched culvert at Palmer Drive; and,
- There are opportunities to improve fish habitat.

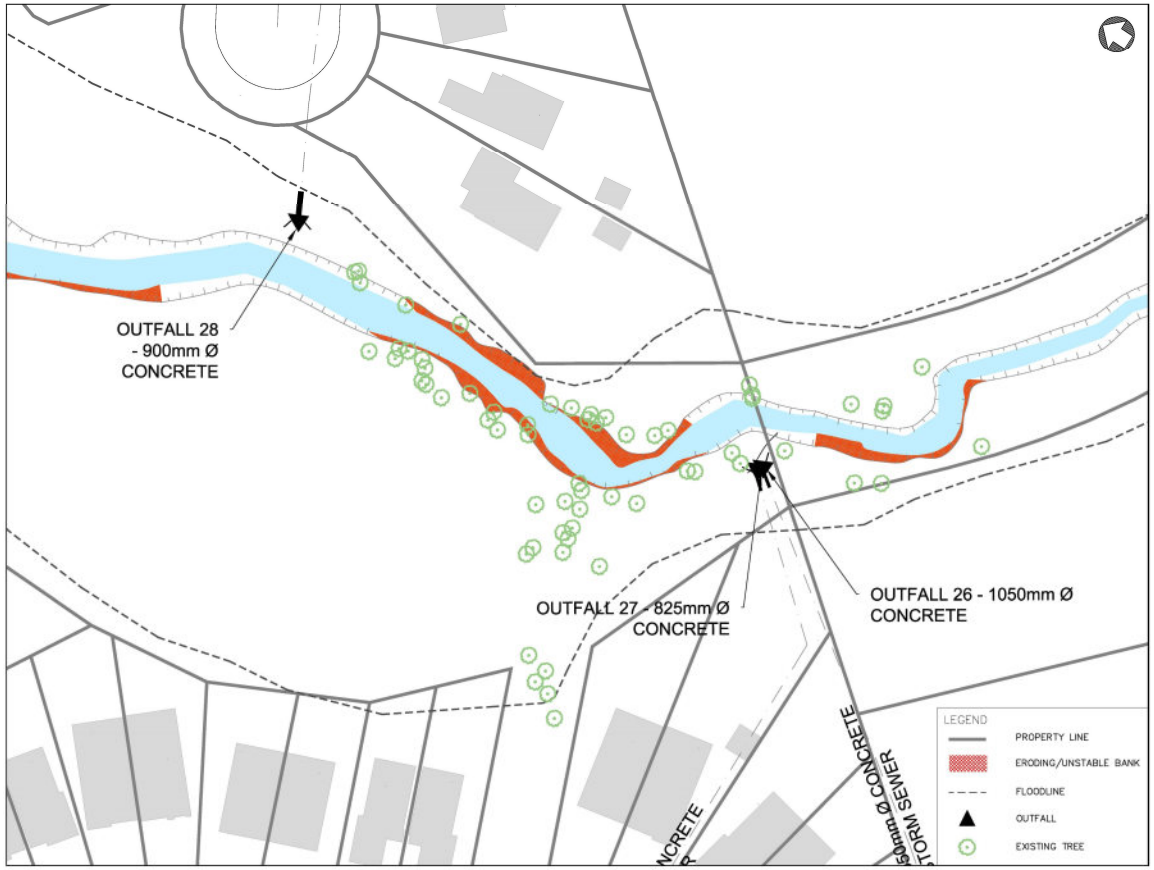


Fathead Minnow, *Pimephales promelas*
Photo Credit: Konrad P. Schmidt & Donals Biemborn

Next Steps:

- Data analysis and final reporting

TREE INVENTORY



Species Common Name	Species Botanical Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Apple	*Malus spp.*		1					
Balsam Poplar	*Populus balsamifera*							1
Basswood	*Tilia americana*		1		1			
Black Cherry	*Prunus serotina*			1	1			
Black Locust	*Robinia pseudoacacia*	1						
Black Walnut	*Juglans nigra*	1	4	19	5	5		2
Common Buckthorn	*Rhamnus cathartica*		1					
Eastern Cottonwood	*Populus deltoides*						2	1
Fireberry Hawthorn	*Crataegus chrysocarpa*					1		
Golden Willow	*Salix alba var. vitellina*	1	1		3	5		1
Honey Locust	*Gleditsia triacanthos var. inermis*	1						
Hybrid Crack Willow	*Salix x rubens*				6	4	1	3
Manitoba Maple	*Acer negundo*	1		3	33	10		17
Silver Maple	*Acer saccharinum*				1		1	
Small-leaved Linden	*Tilia cordata*		1					1
Sugar Maple	*Acer saccharum*				4			1
Trembling Aspen	*Populus tremuloides*				3			
White Ash	*Fraxinus americana*	1	6	6	7	6		1
White Elm	*Ulmus americana*							1
White Pine	*Pinus strobus*							1
White Spruce	*Picea glauca*						3	
Wild Cherry	*Prunus avium*		5	3				1

- Trees greater than 10cm diameter were inventoried in proximity to erosion sites within the study area, and a total of 22 species were identified.

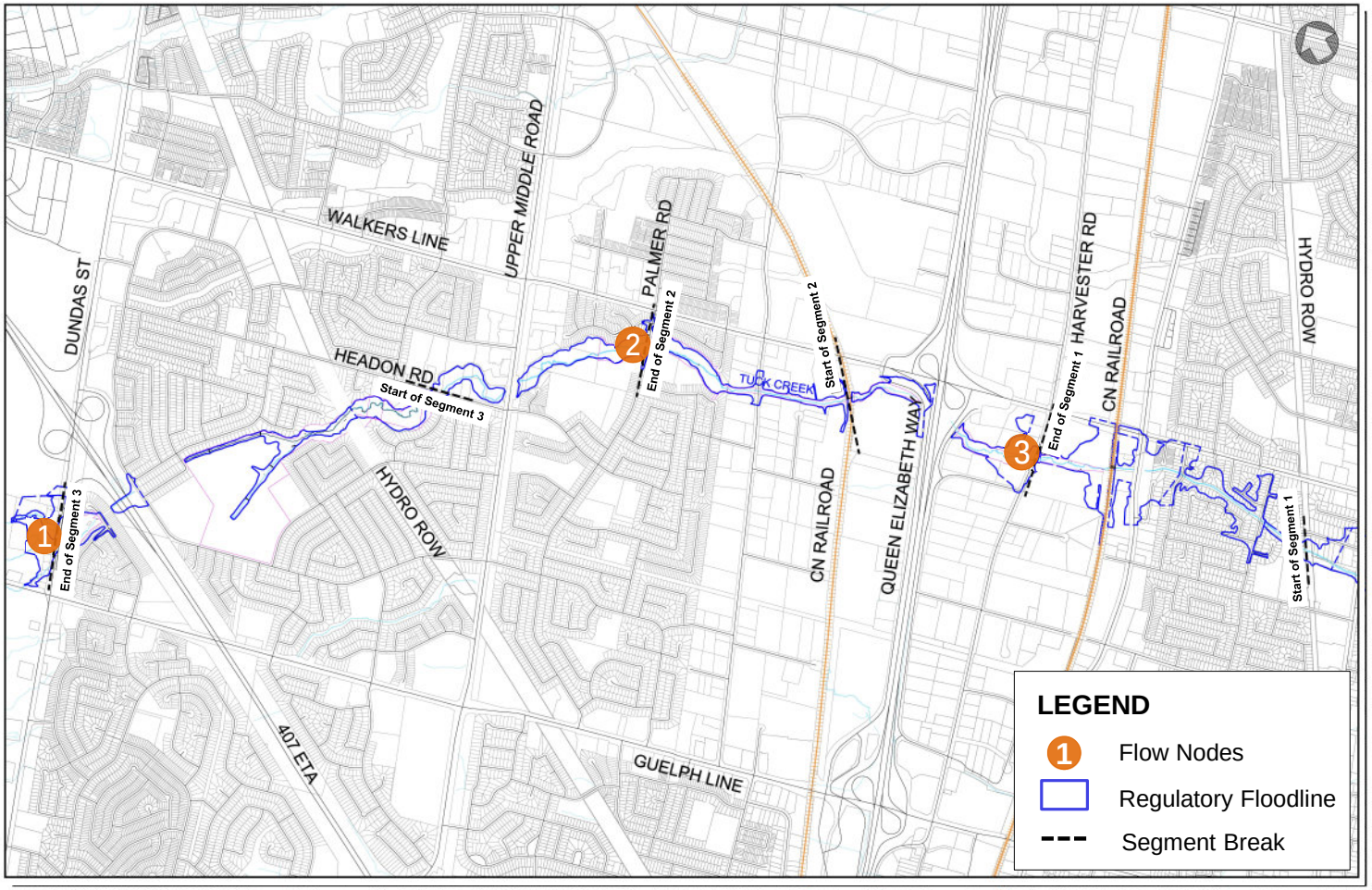
- Removal of trees may be required to accommodate channel works. However, the removed trees will be compensated with as per City of Burlington and Conversation Halton standards during restoration stage.



HYDROLOGY & EXISTING FLOODING PROFILE

Flows at different locations under various rainfall events are presented in the table, and the flooding profile under regional storm is shown in the figure.

Event	Flow (m^3/s)		
	Node 1	Node 2	Node 3
Regional	28.6	81	108.1
100 Year	13.8	38.9	51.2
50 Year	11.7	33.5	45.9
25 Year	9.7	29.2	40.1
10 Year	7.1	23.4	33.8
5 Year	5.3	19.9	28.1
2 Year	3.1	13.6	20.4

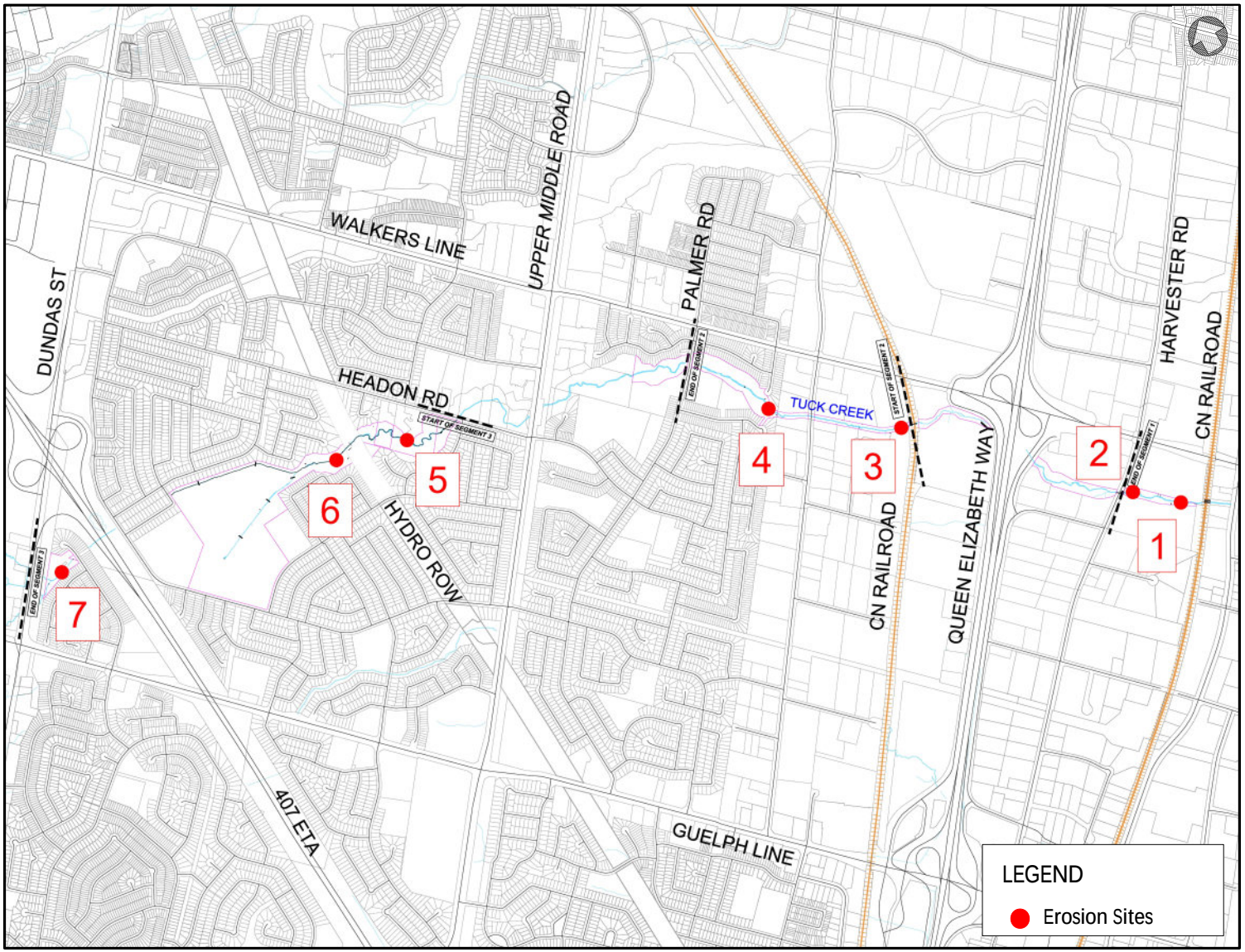


EROSION INVENTORY

Seven erosion sites were identified within the study area.

Risks observed at the erosion sites include:

- Risks to private properties;
- Risks to municipal infrastructure;
- Negative impacts on water quality;
- Fish barrier;
- Woody debris and fallen trees within the creek – negative impact on flow conveyance;
- Deteriorating engineered structures requires restoration / rehabilitation.



EVALUATION CRITERIA

The following criteria are used to evaluate each alternative. It will help determine which alternative should be selected as the preliminary preferred alternative.

Comment sheets are provided to collect public feedback on the evaluation criteria and preliminary evaluation.

Physical / Natural Environment

Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks to public
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher
Potential to Improve Terrestrial Habitat	Greater improvements to terrestrial habitat scores higher, including loss and replacement of vegetation and natural corridor connectivity
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher

Social / Cultural Environment

Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties scores higher
Community Disruption	Less disruption the surrounding community and residents scores higher
Public Health and Safety	Greater protection of public health and safety for a longer time scores higher

Technical and Engineering Considerations

Ease of Implementation	Ease of Implementation Greater ease of implementing scores higher
Potential to Reduce Flooding Risks	Greater reduction of flooding risks to public and/or private lands for longer time scores higher
City Acceptance	City Acceptance Greater compliance with existing City plans, policies, and bylaw requirements scores higher
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher

Economic Environment

Construction Costs	Lower construction cost relative to other alternatives scores higher
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher

EVALUATION APPROACH

Each erosion sites will be specifically evaluated to determine the preferred method for rehabilitation.

The evaluation uses a ranking scheme which accounts for Physical and Natural Environment, Technical Criteria, Social and Cultural Conditions, and Economics Considerations.

A preliminary ranking has been applied to each alternative for each reach. The alternative with the highest score will define which method of alternative is preferred for each erosion sites.

The ranking score has been normalized to provide equal weighting for each category of evaluation criteria.

Comment Sheets are provided to gain public input on the preliminary ranking. The ranking will be finalized once public input has been incorporated.

An Example is illustrated in the adjacent table:

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Local Restoration Works	Alternative 3 - Reach Scale Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	0	4	5
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	2	4
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	4	3	2
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	2	4
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	4	3	2
	Physical / Natural Environment Criteria Subtotal	**10**	**14**	**17**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**8**	**11**	**14**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	4	3	3
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	2	2	4
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	2	3	4
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	2	3	5
	Technical and Engineering Criteria Subtotal	**10**	**11**	**16**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**15**	**17**	**24**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	2	3	4
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	2	4	4
Community Disruption	Less disruption the surrounding community and residents scores higher	4	3	2
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	4	3	3
	Social / Cultural Environment Criteria Subtotal	**12**	**13**	**13**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**12**	**13**	**13**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	4	3	2
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	3	4
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	1	3	4
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	4	4
	Economic Criteria Subtotal	**7**	**13**	**14**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**11**	**20**	**21**
Total		46	60	72

Highest Score = Preferred Alternative

Ranking Scale							
No / Negative Impact	0	1	2	3	4	5	**Ideal / Most Positive Impact**

PRELIMINARY ALTERNATIVE SOLUTIONS

1. Do Nothing

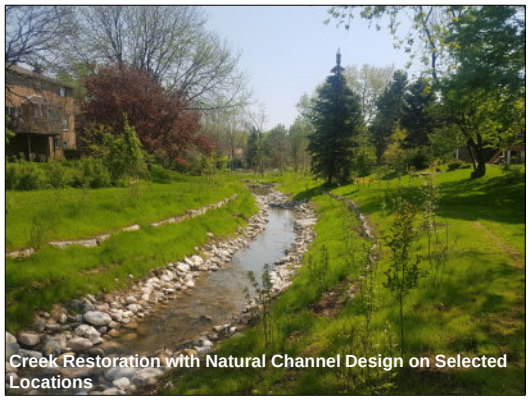
- Leave the site as it is and allow erosional processes to continue within the watercourse corridor;
- Ongoing monitoring of erosion areas to address increased risks;
- Maintenance or possible emergency works may be required in the future.



Active Bank Erosion along the outer bend of the channel, Risk to Private Property

2. Local Restoration Works

- Localized channel bank and/or bed work to address erosion issues at the site;
- May require ongoing maintenance, occasional repairs, or eventual replacement;
- Often preferred to limit the economic cost and the environmental damage of large-scale channel engineering and stream restoration works.



Creek Restoration with Natural Channel Design on Selected Locations

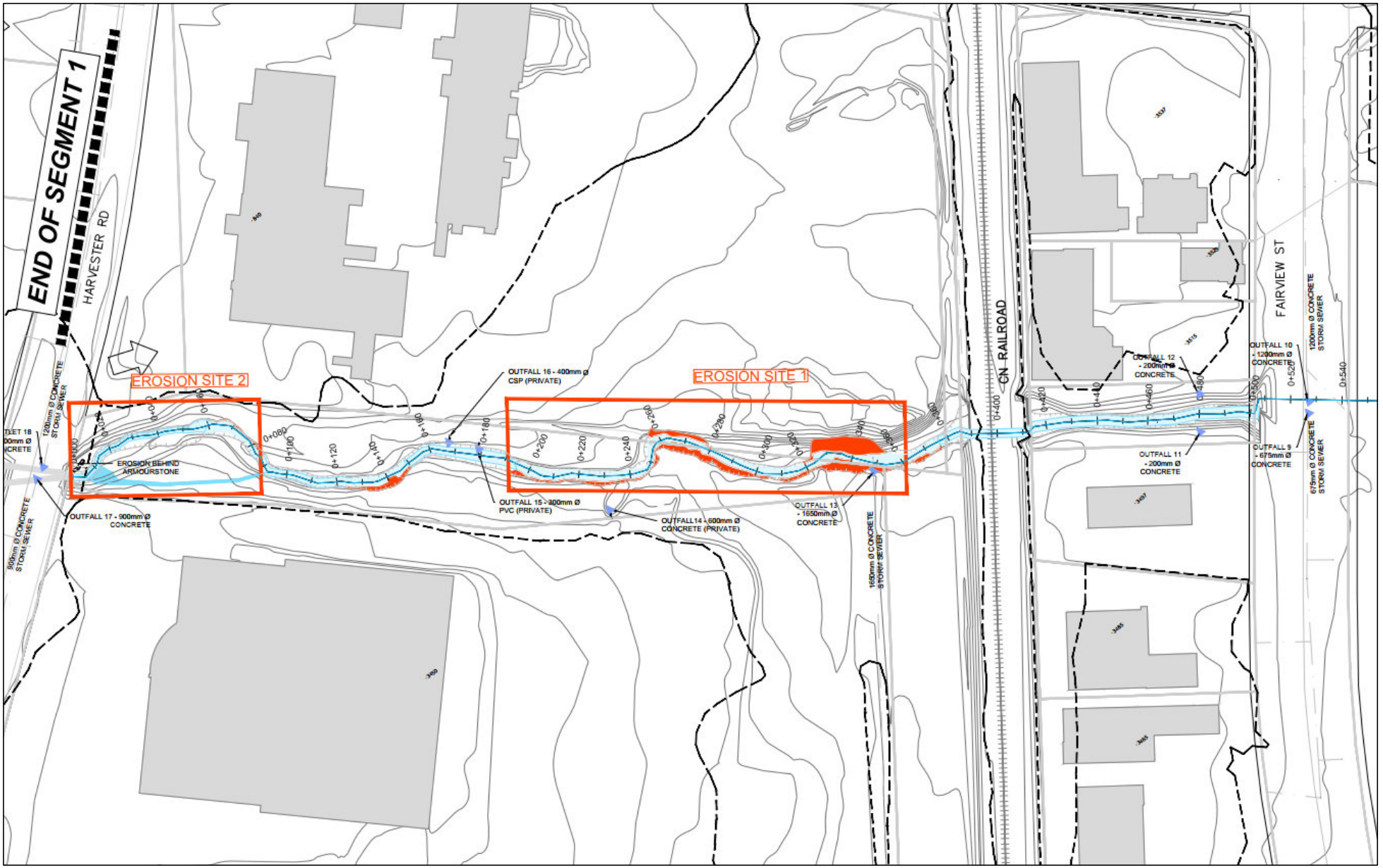
3. Reach Scale Work

- A reach-based approach to address erosion issues at the site;
- Typically applied in highly constrained urban watercourses;
- Utilizes both “natural channel design” and “hard” channel engineering approaches;
- Higher capital cost, but require minimal maintenance.



Armourstone Bank Treatment within Confined Channel

EROSION SITE 1 – UPSTREAM METROLINX / CN RAILWAY



EROSION SITE 1 – EXISTING CONDITIONS

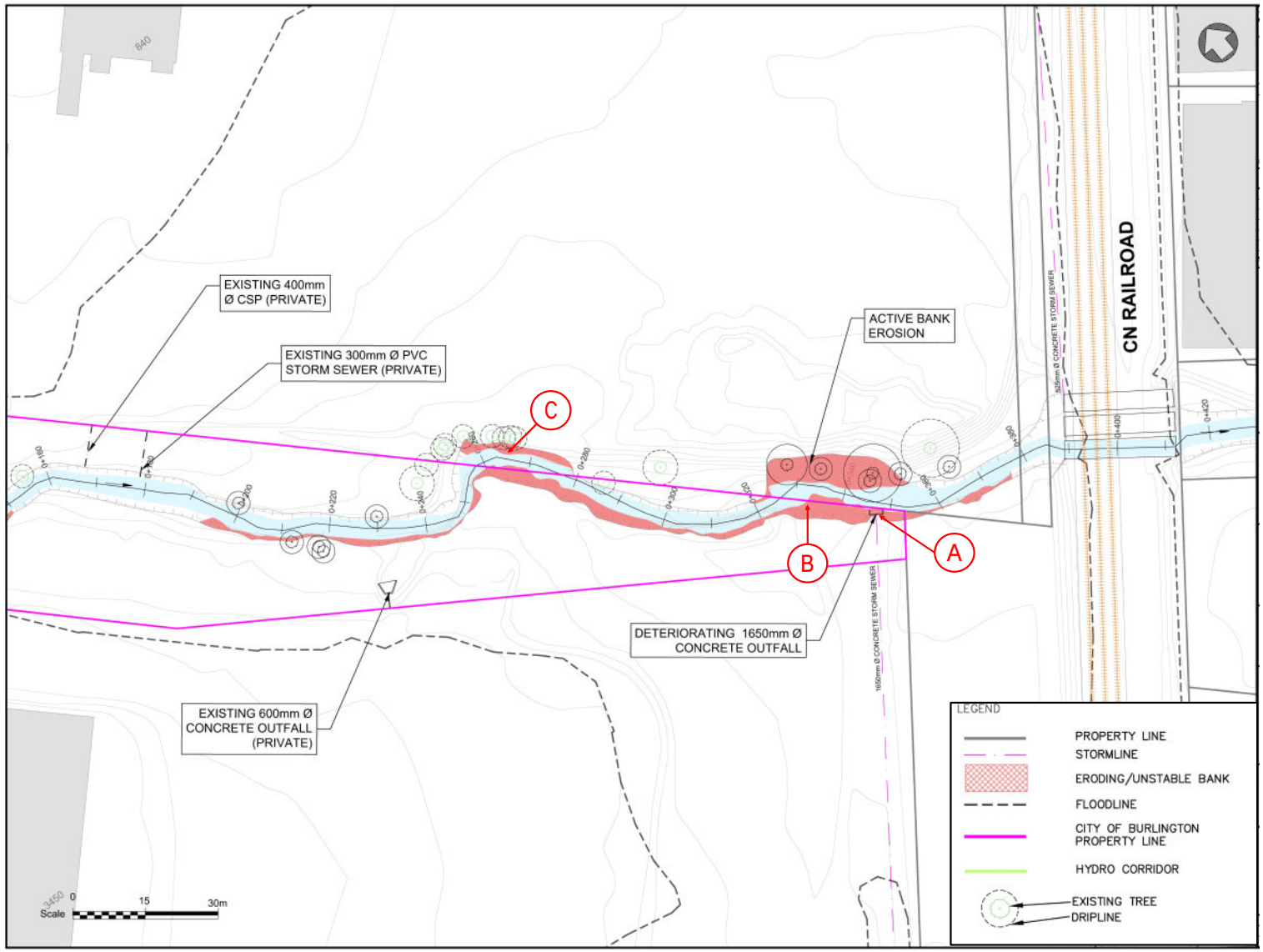



Photo A – Deteriorating Outfall Headwall due to Erosion


Photo B – Active Bank Erosion and Over-Steepened Banks

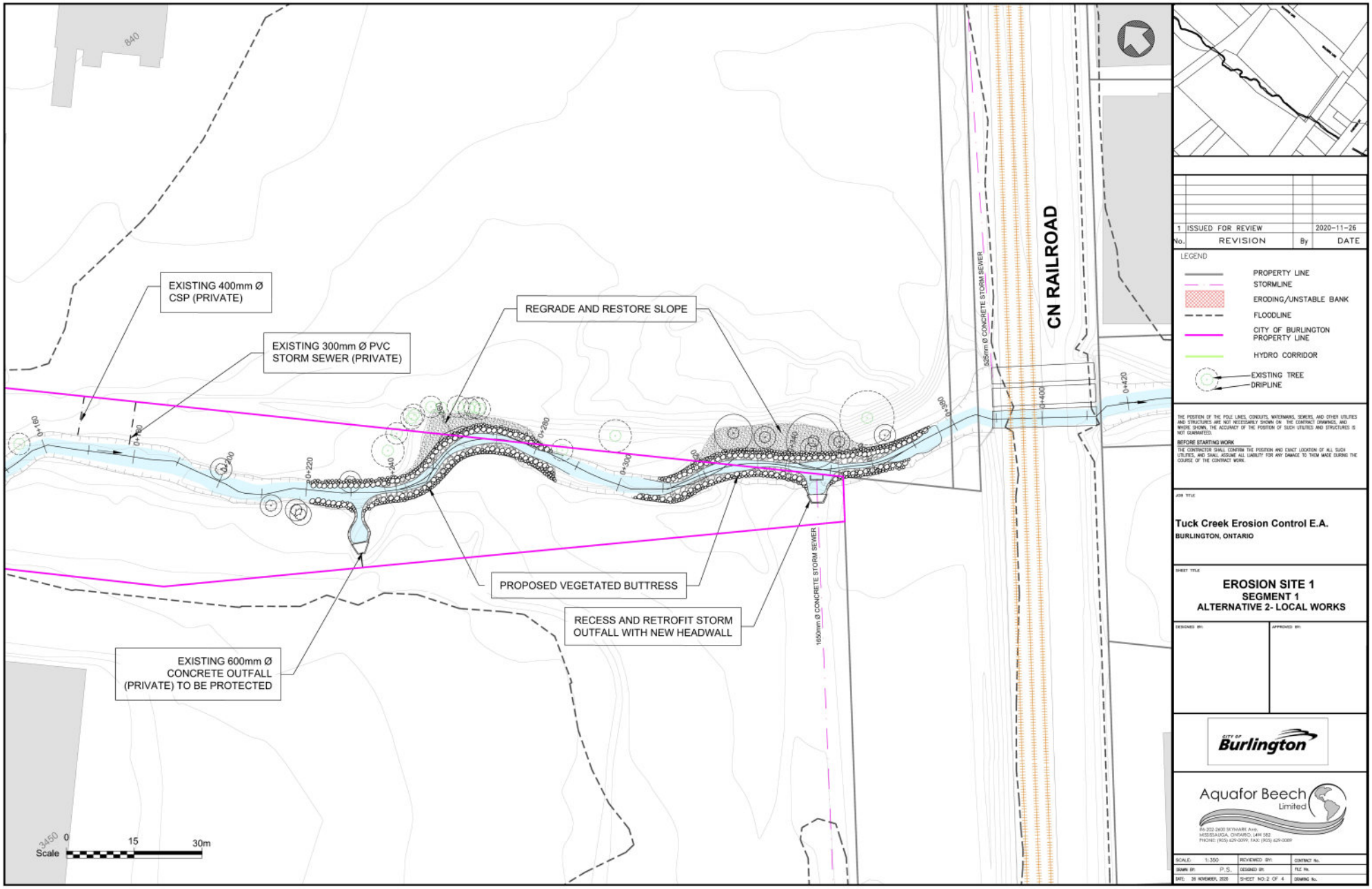

Photo C – Failed Bank Protection Using Concrete Debris placed by Local Landowners.

Risks to private property, municipal infrastructure and aquatic habitat due to:

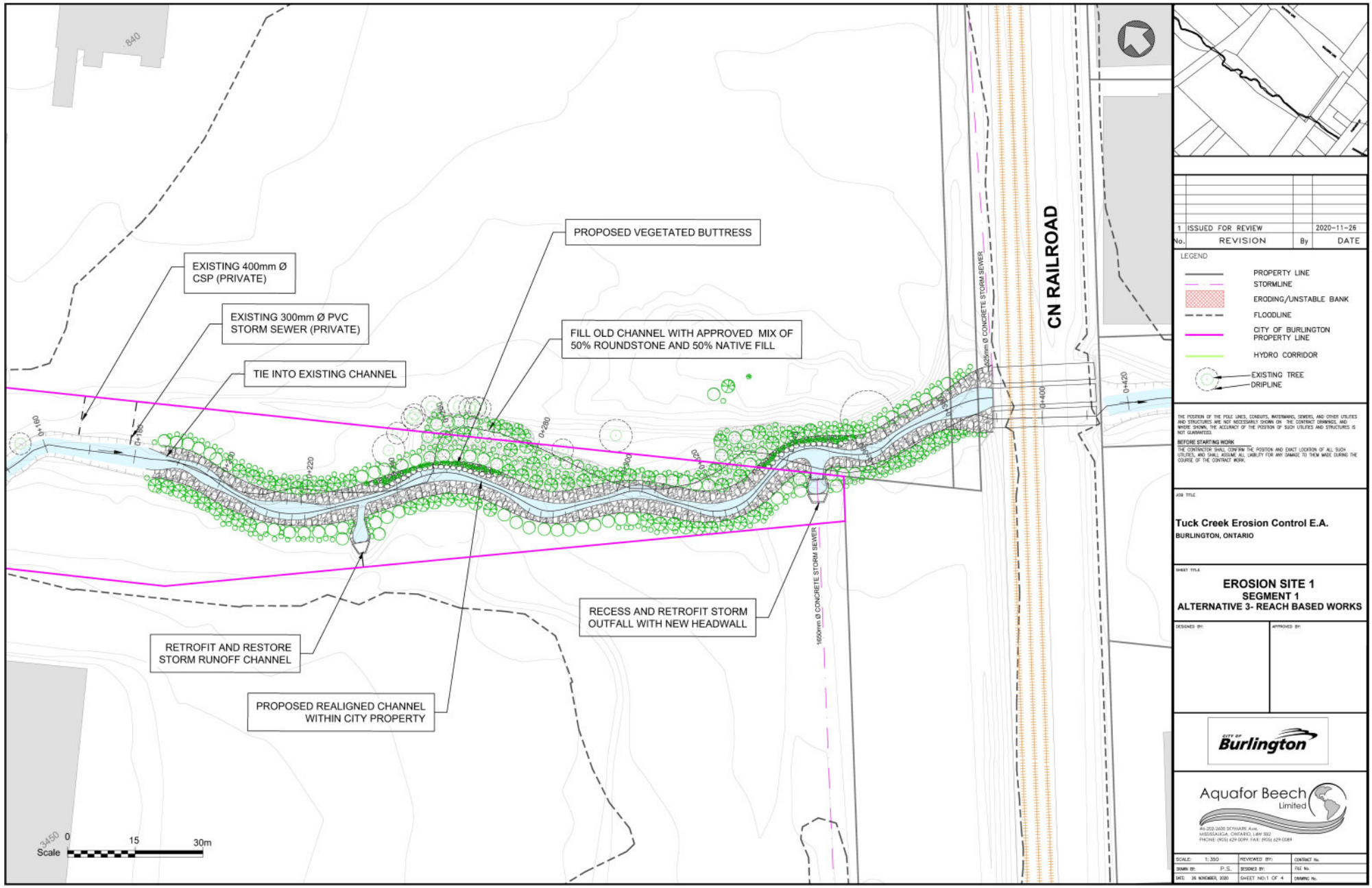
- Active bank erosion
- Deteriorating storm outfall headwall
- Creek encroaching private property

Level of Risk: High

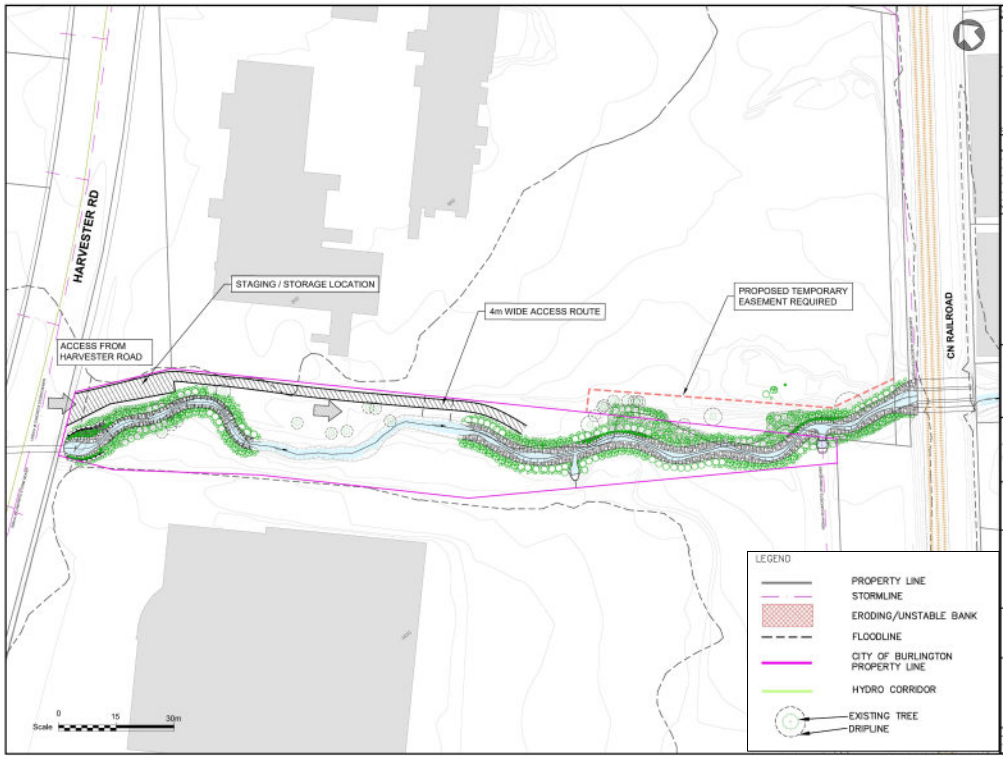
EROSION SITE 1 – LOCAL RESTORATION WORKS



EROSION SITE 1 – REACH SCALE WORKS



EROSION SITE 1 – POTENTIAL PREFERRED ALTERNATIVE





An Example of Natural Channel Design with Riffle-Pool



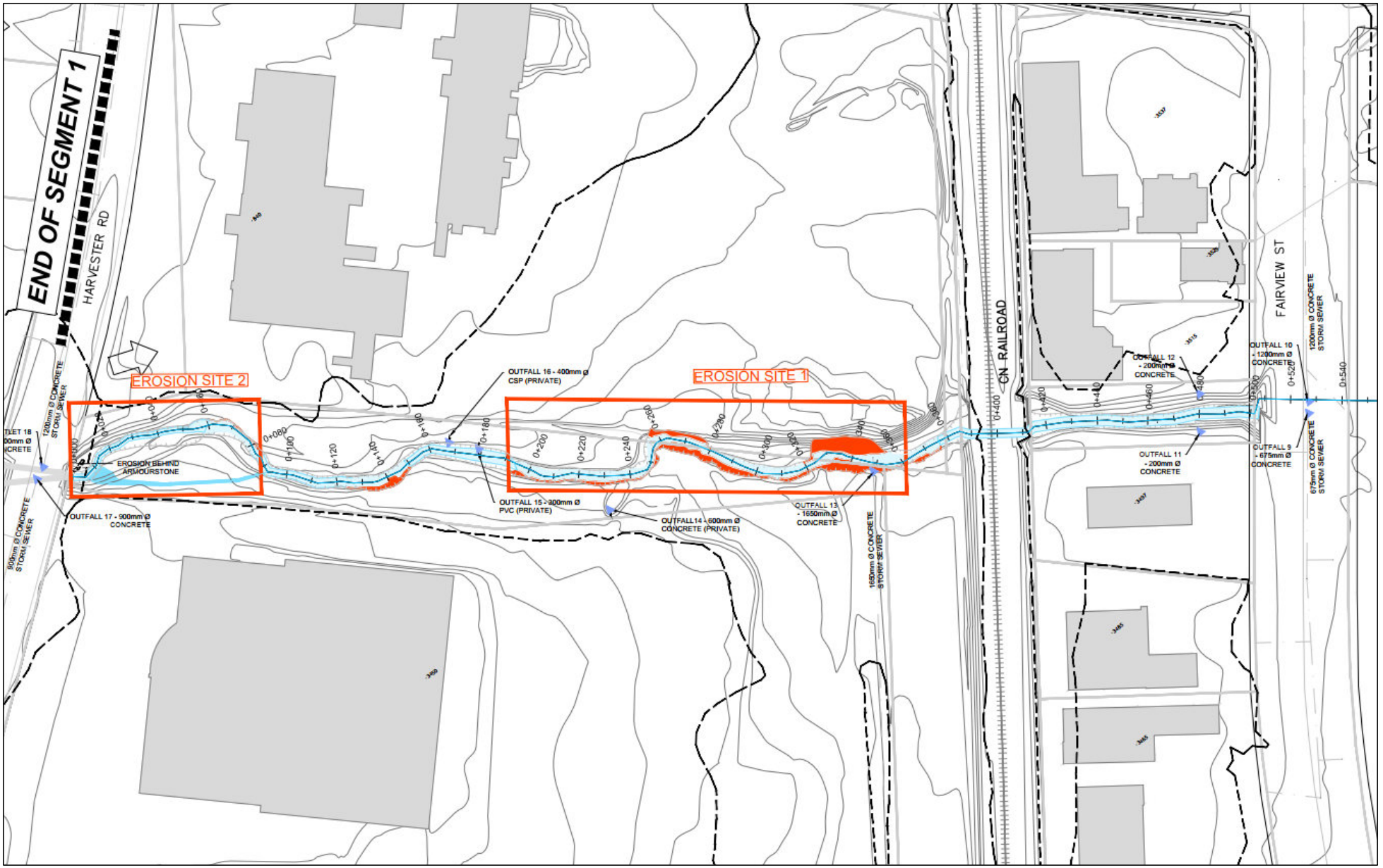
An Example of Natural Channel Design Enhanced with Vegetated Buttress

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Local Restoration Works	Alternative 3 - Reach Scale Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	0	4	5
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	2	4
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	4	3	2
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	2	4
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	4	3	2
	Physical / Natural Environment Criteria Subtotal	**10**	**14**	**17**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**8**	**11**	**14**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	4	3	3
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	2	2	4
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	2	3	4
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	2	3	5
	Technical and Engineering Criteria Subtotal	**10**	**11**	**16**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**15**	**17**	**24**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	2	3	4
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	2	4	4
Community Disruption	Less disruption the surrounding community and residents scores higher	4	3	2
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	4	3	3
	Social / Cultural Environment Criteria Subtotal	**12**	**13**	**13**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**12**	**13**	**13**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	4	3	2
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	3	4
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	1	3	4
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	4	4
	Economic Criteria Subtotal	**7**	**13**	**14**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**11**	**20**	**21**
Total		46	60	72

Preliminary Preferred Alternative - Reach Scale Works

- Realign channel planform within City Property to protect private property
- Recess and Retrofit Storm Outfall with New Headwall
- Natural channel design to enhance creek riparian while providing protection to aquatic habitats
- Installation of a vegetated buttress to prevent lateral migration
- Preferred alternative requires temporary easement

EROSION SITE 2 – DOWNSTREAM HARVESTER ROAD



EROSION SITE 2 – EXISTING CONDITIONS

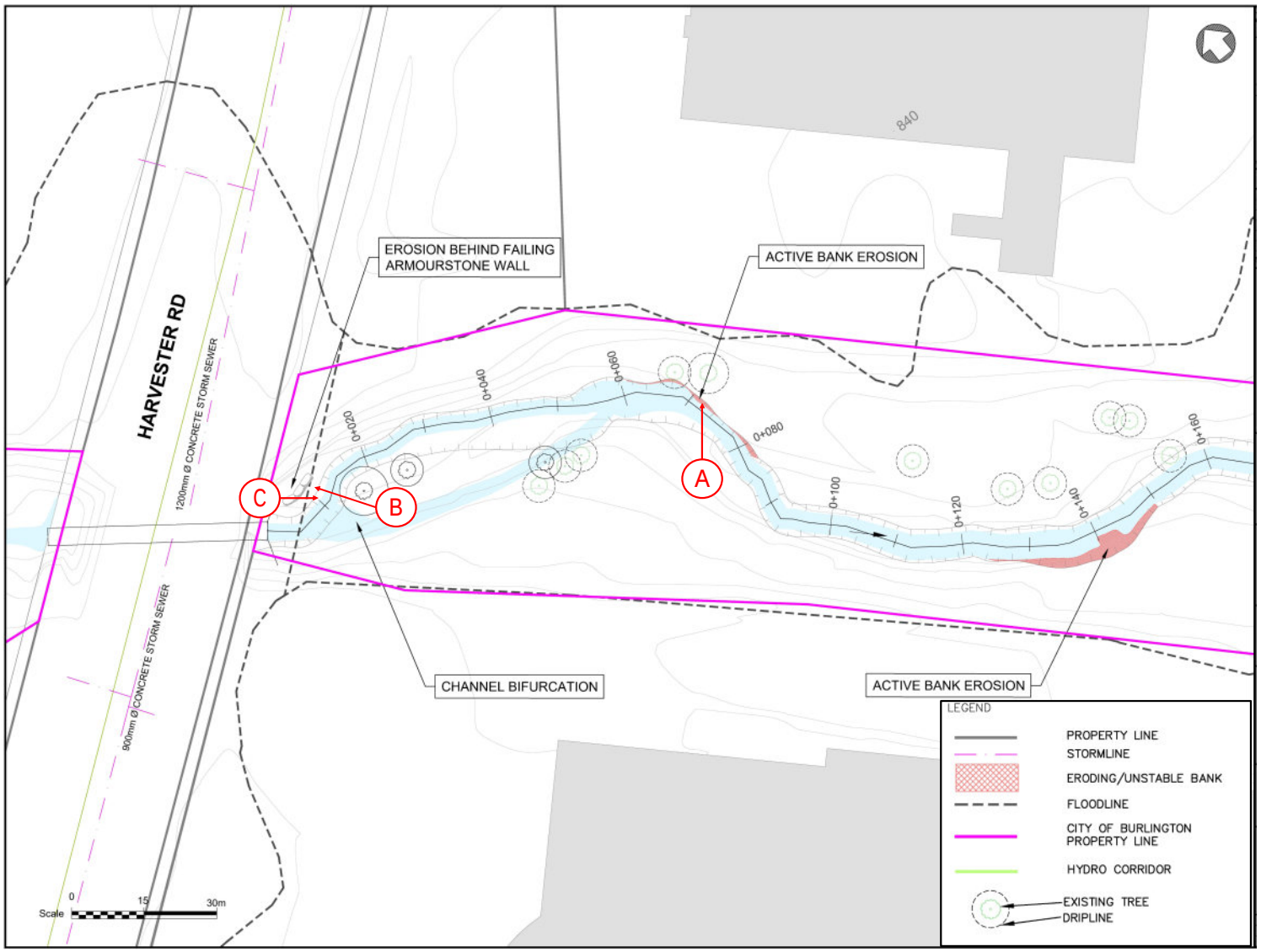



Photo A – Active Bank Erosion along the Eastern Bank


Photo B – Erosion Behind Failing Armourstone Wall

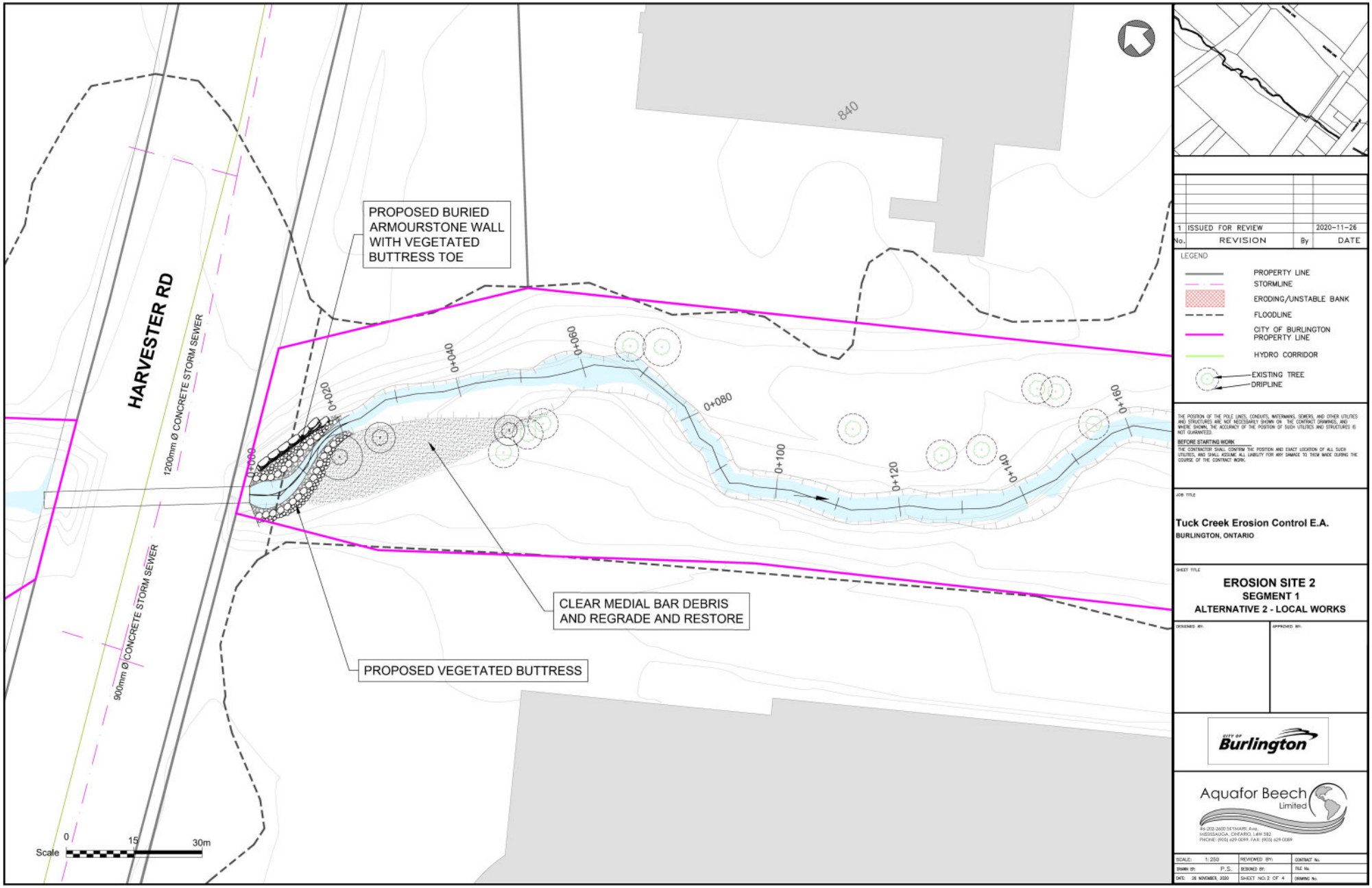

Photo C – Bifurcated Channel and Evidence of Channel Planform Adjustment

Risks to private property, municipal infrastructure and aquatic habitat due to:

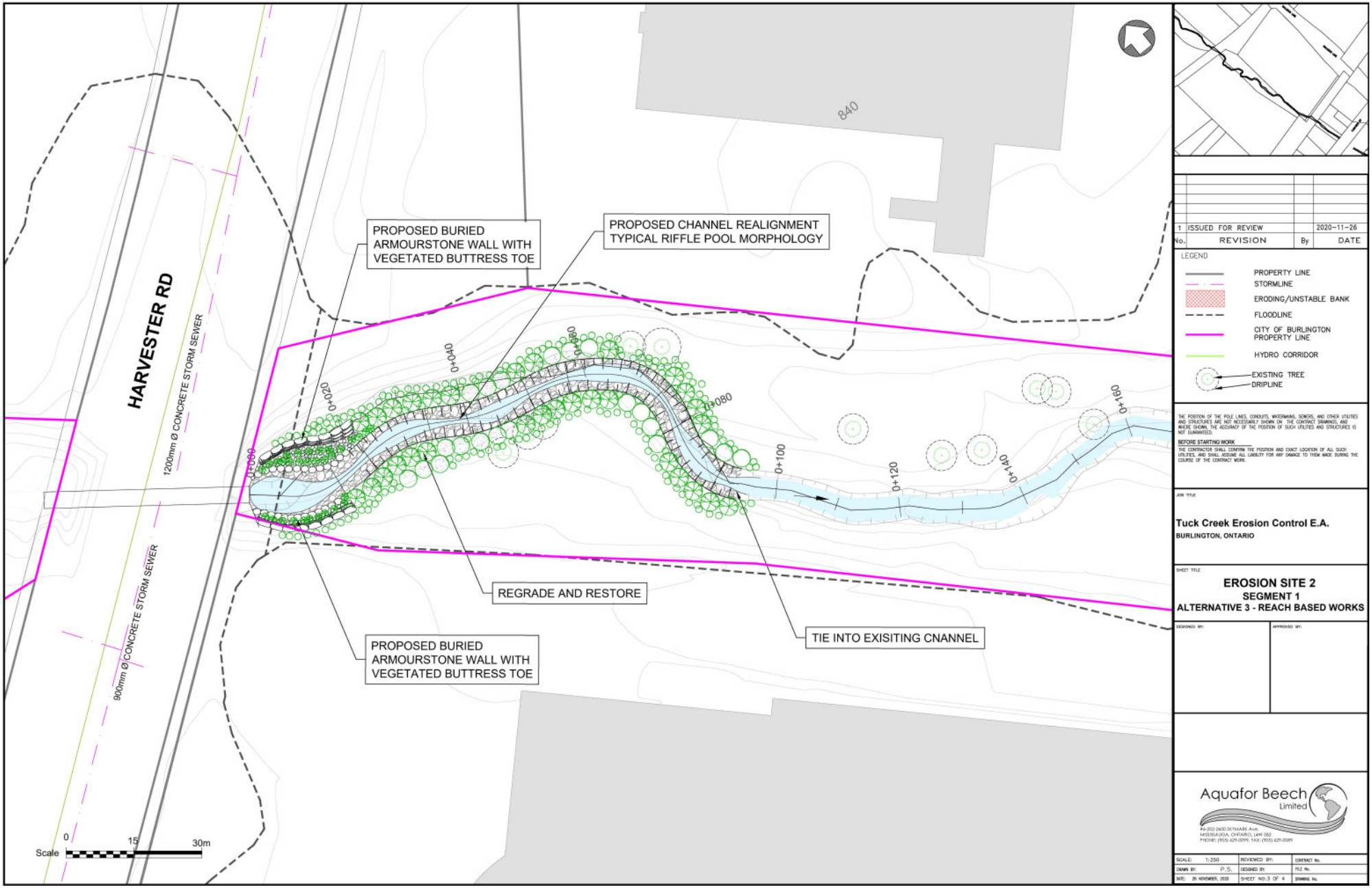
- Active bank erosion
- Erosion behind failing armourstone wall
- Channel bifurcation

Level of Risk: Low

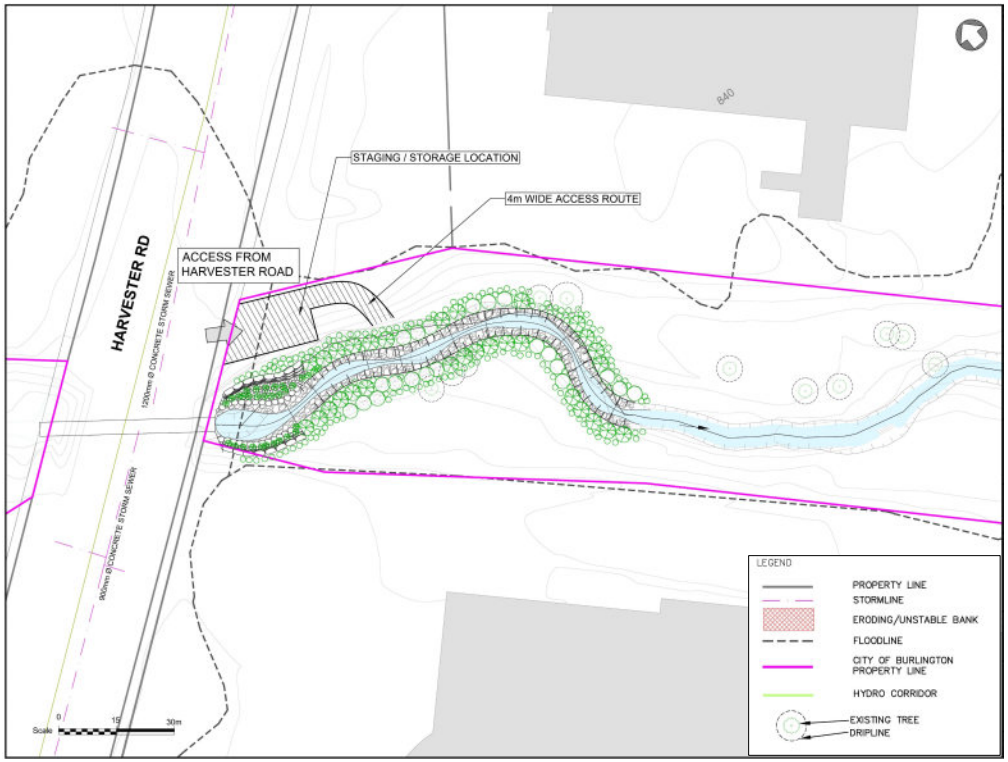
EROSION SITE 2 – LOCAL RESTORATION WORKS



EROSION SITE 2 – REACH SCALE WORKS



EROSION SITE 2 – POTENTIAL PREFERRED ALTERNATIVE





An Example of Natural Channel Design with Riffle-Pool



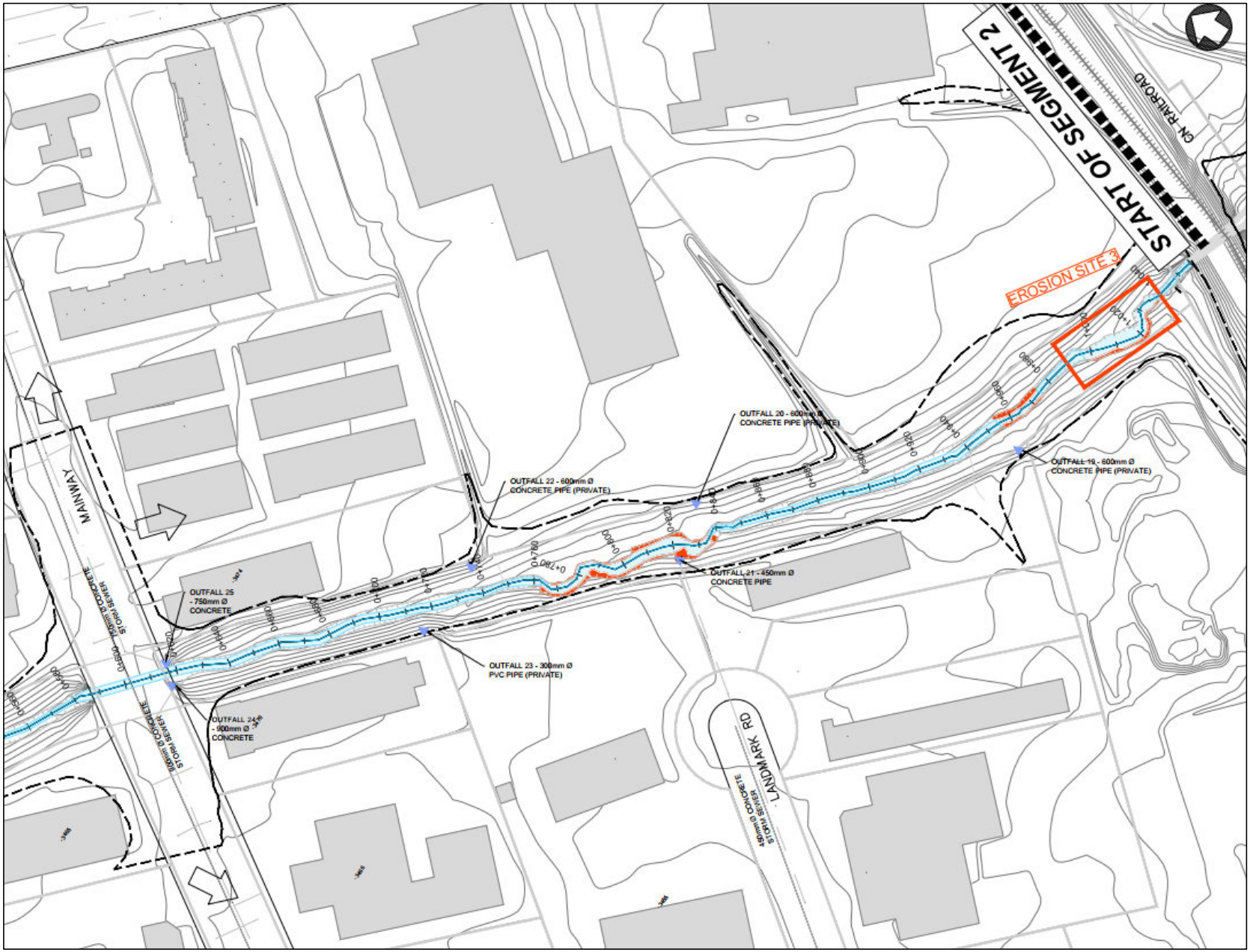
An Example of Natural Channel Design Enhanced with Vegetation Buffer

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Local Restoration Works	Alternative 3 - Reach Scale Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	0	2	4
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	2	4
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	5	3	2
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	3	4
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	5	3	3
	Physical / Natural Environment Criteria Subtotal	**12**	**13**	**17**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**10**	**10**	**14**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	5	3	3
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	1	2	4
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	1	3	4
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	5	4	3
	Technical and Engineering Criteria Subtotal	**12**	**12**	**14**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**18**	**18**	**21**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	1	3	4
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	1	3	4
Community Disruption	Less disruption the surrounding community and residents scores higher	5	3	3
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	5	3	2
	Social / Cultural Environment Criteria Subtotal	**12**	**12**	**13**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**12**	**12**	**13**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	5	2	1
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	3	4
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	1	3	4
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	3	4
	Economic Criteria Subtotal	**8**	**11**	**13**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**12**	**17**	**20**
Total		52	57	67

Preliminary Preferred Alternative - Reach Scale Works

- Realign channel planform within City Property to protect private property
- Natural channel design with typical riffle-pool morphology to enhance creek riparian while providing protection to aquatic habitats
- Proposed buried armourstone wall with vegetated buttress to prevent toe erosion
- Regrade and restore banks

EROSION SITE 3 – UPSTREAM OF CN RAILROAD



EROSION SITE 3 – EXISTING CONDITIONS

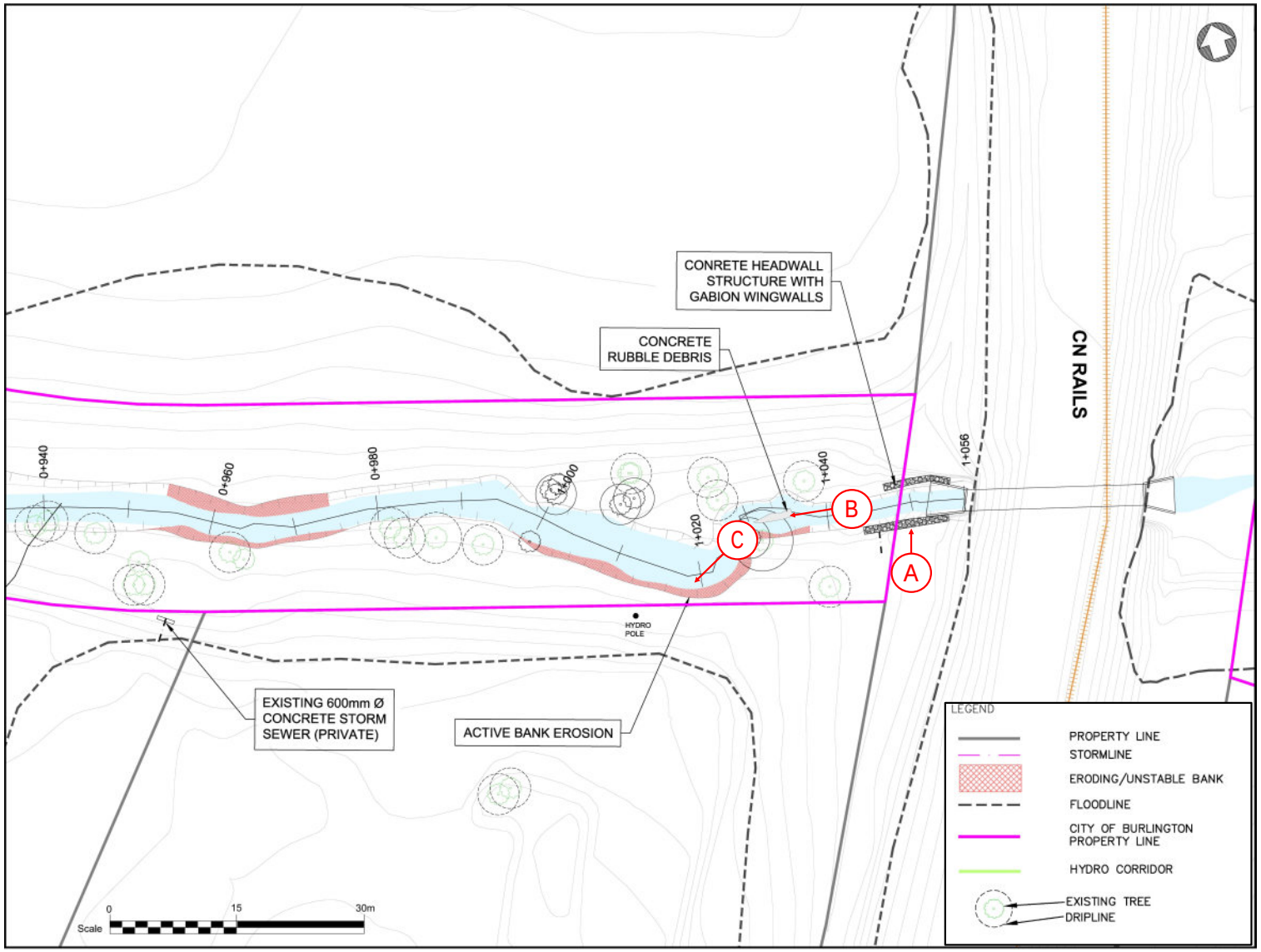




Photo A – Deteriorating Gabion Basket Wingwall and Emptying at Higher Level

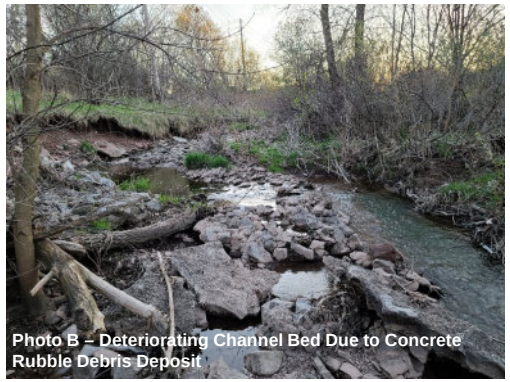


Photo B – Deteriorating Channel Bed Due to Concrete Rubble Debris Deposit



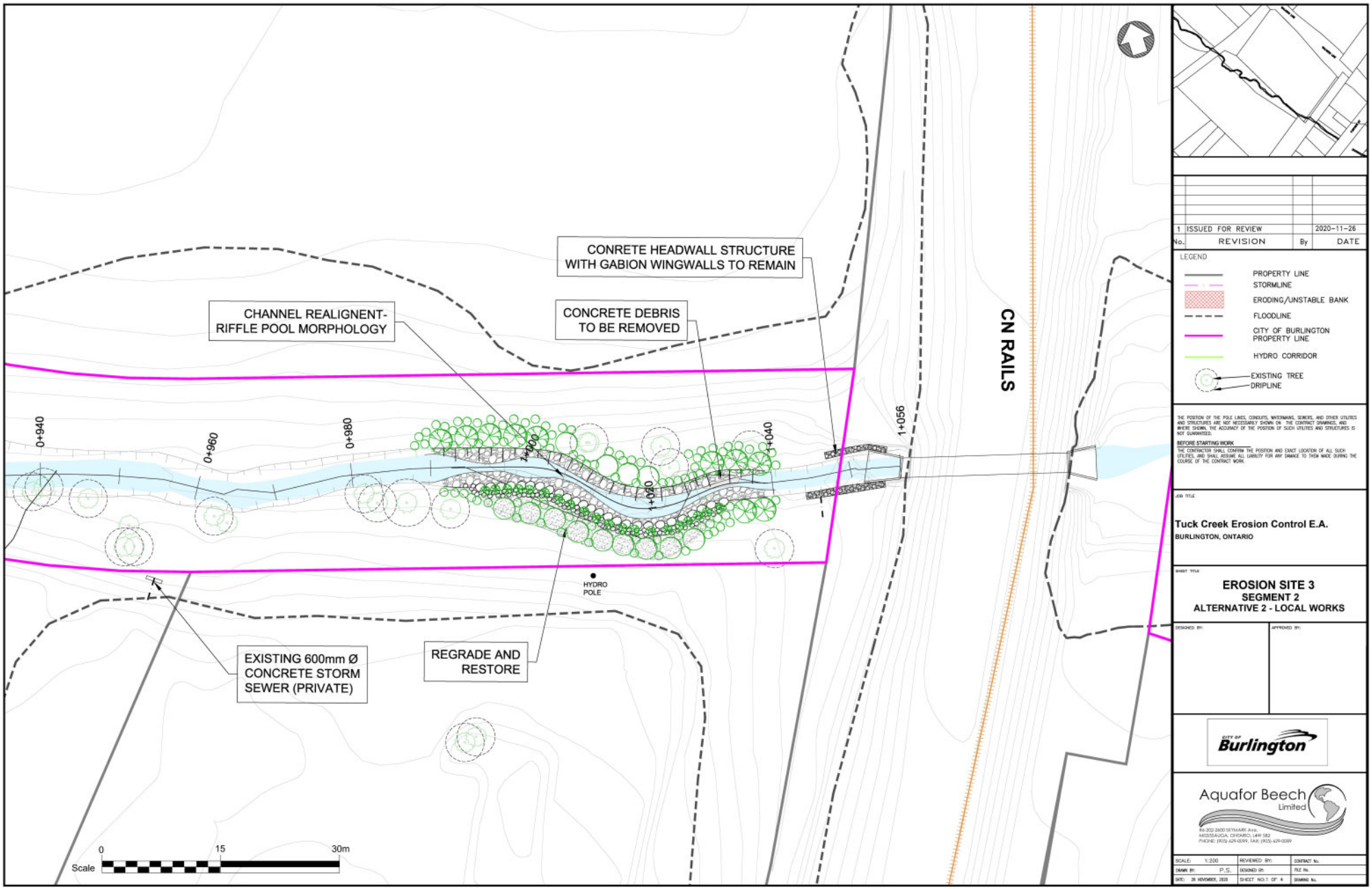
Photo C – Bank Erosion with Evidence of Planform Adjustment posing Hydro Pole at Risk

Risks to private property, municipal infrastructure and aquatic habitat due to:

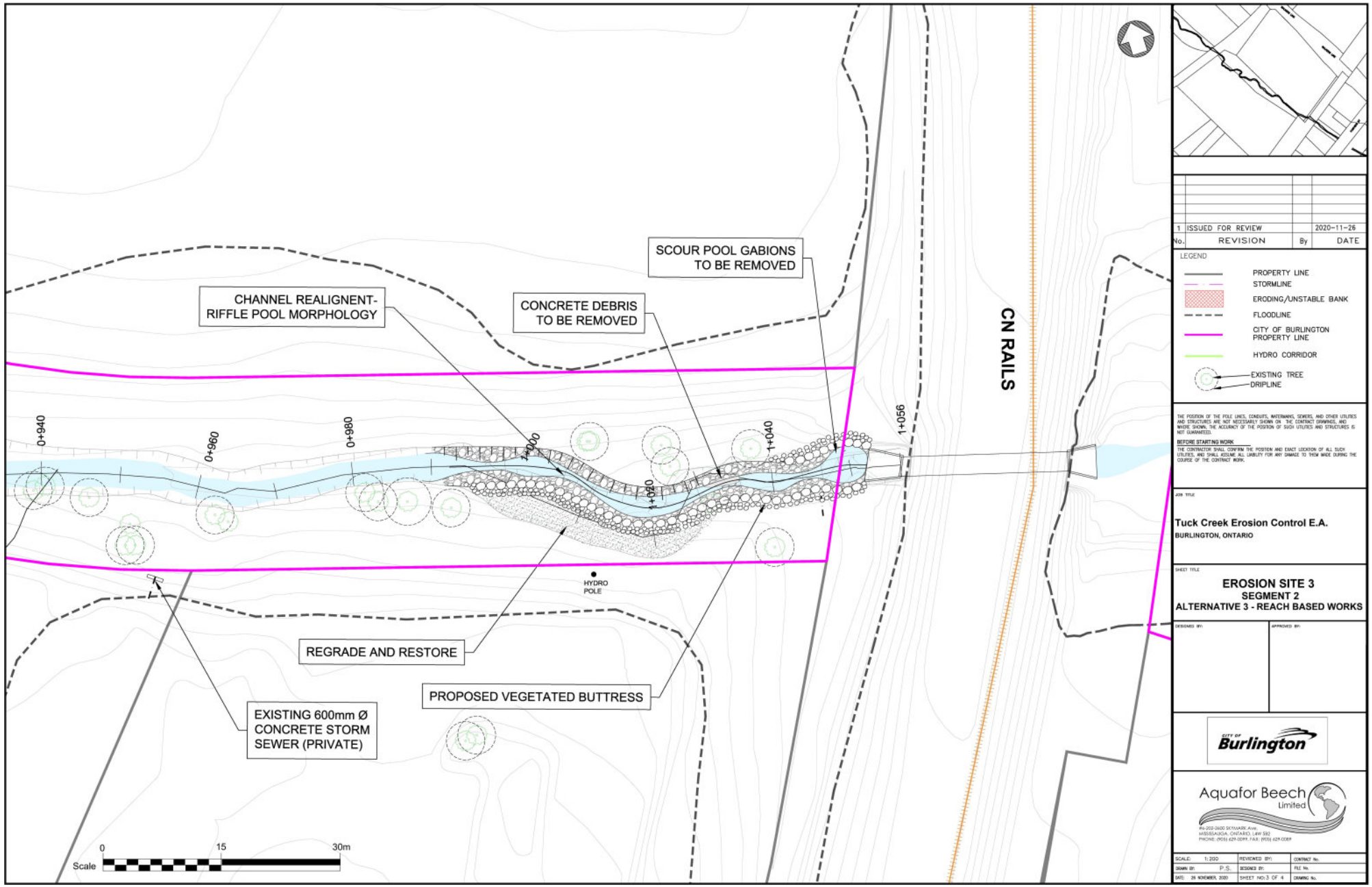
- Active bank erosion
- Deteriorating channel bed due to channel rubble debris deposit

Level of Risk: Medium

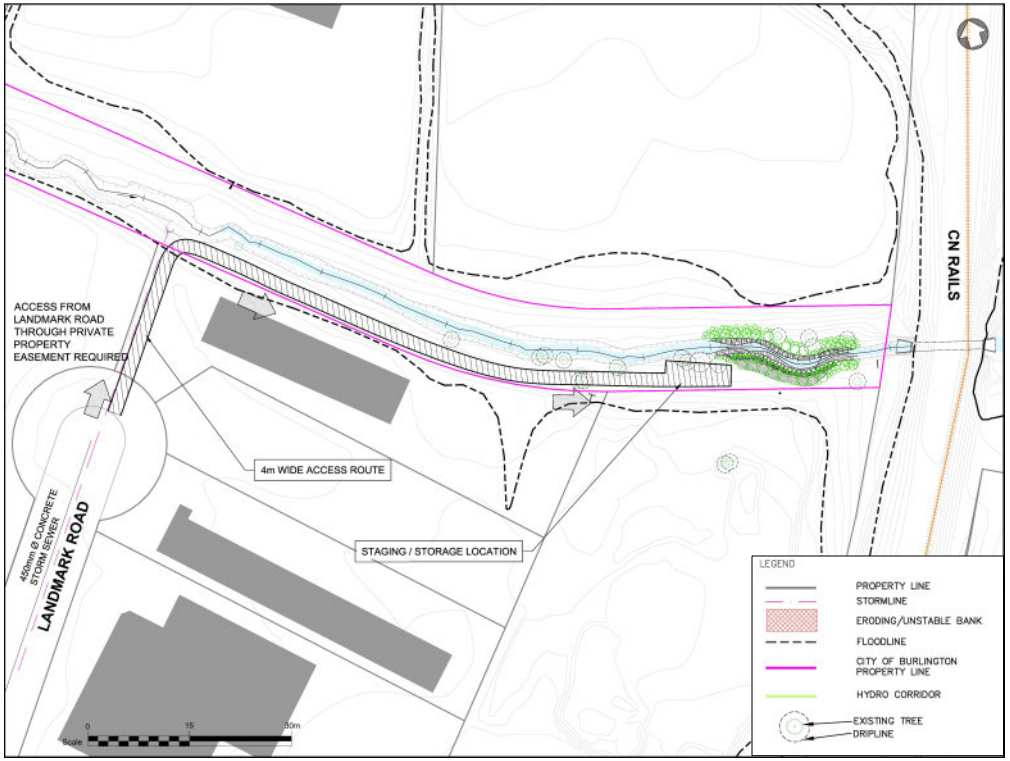
EROSION SITE 3 – LOCAL RESTORATION WORKS



EROSION SITE 3 – REACH SCALE WORKS

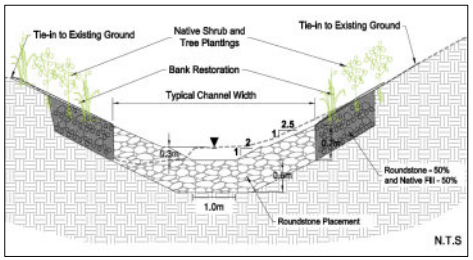


EROSION SITE 3 – POTENTIAL PREFERRED ALTERNATIVE





An Example of Natural Channel Design with Riffle-Pool



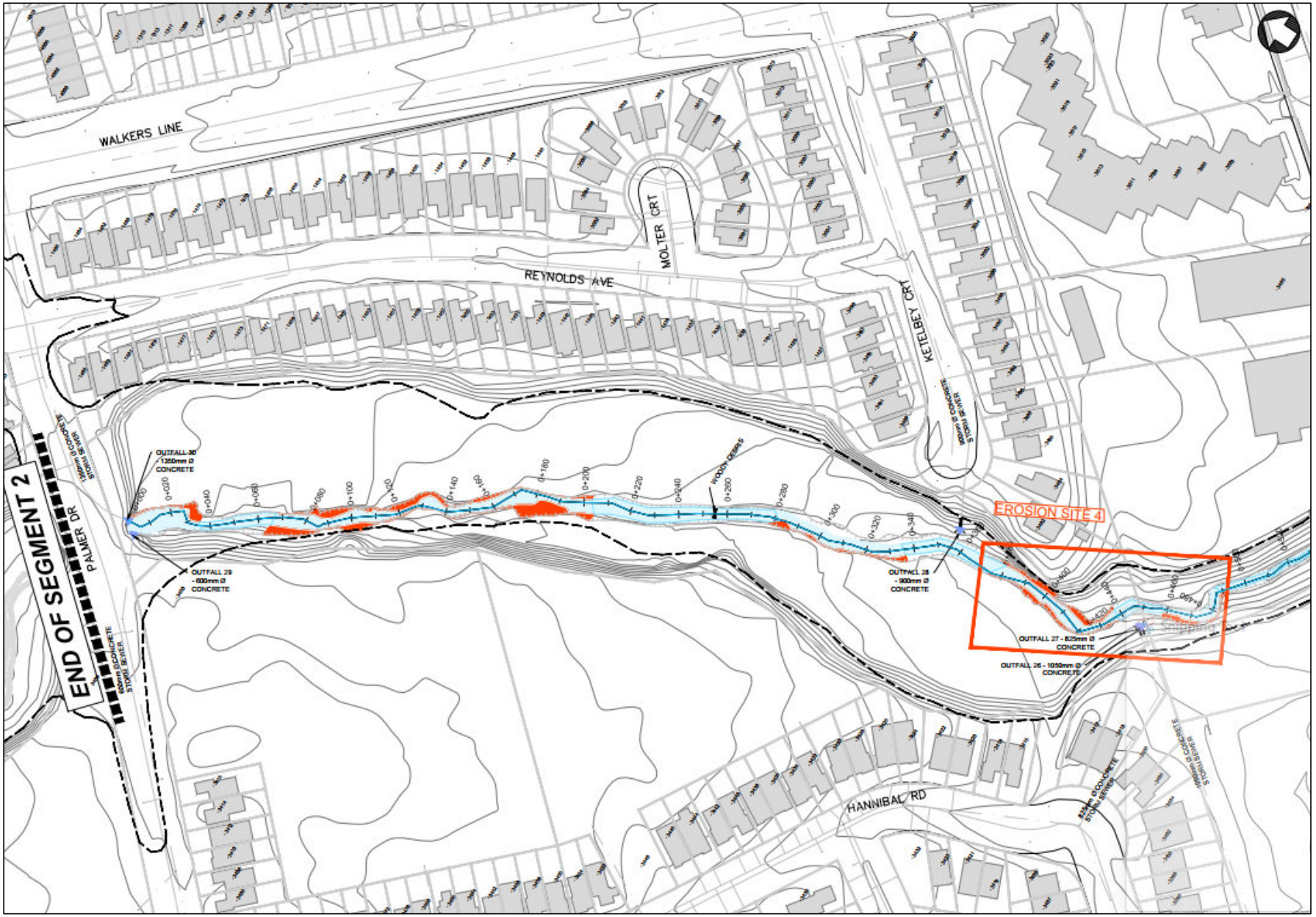
An Example of Typical Roundstone Riffle – Local Gravel Placement

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Local Restoration Works	Alternative 3 - Reach Scale Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	1	3	4
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	3	3
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	5	4	3
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	3	3
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	5	3	3
	Physical / Natural Environment Criteria Subtotal	**13**	**16**	**16**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**10**	**13**	**13**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	5	3	3
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	2	3	4
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	1	4	3
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	1	4	3
	Technical and Engineering Criteria Subtotal	**9**	**14**	**13**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**14**	**21**	**20**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	1	3	3
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	2	3	3
Community Disruption	Less disruption the surrounding community and residents scores higher	2	4	3
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	4	4	4
	Social / Cultural Environment Criteria Subtotal	**9**	**14**	**13**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**9**	**14**	**13**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	5	4	3
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	3	3
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	1	5	3
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	4	4
	Economic Criteria Subtotal	**8**	**16**	**13**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**12**	**24**	**20**
Total		45	72	65

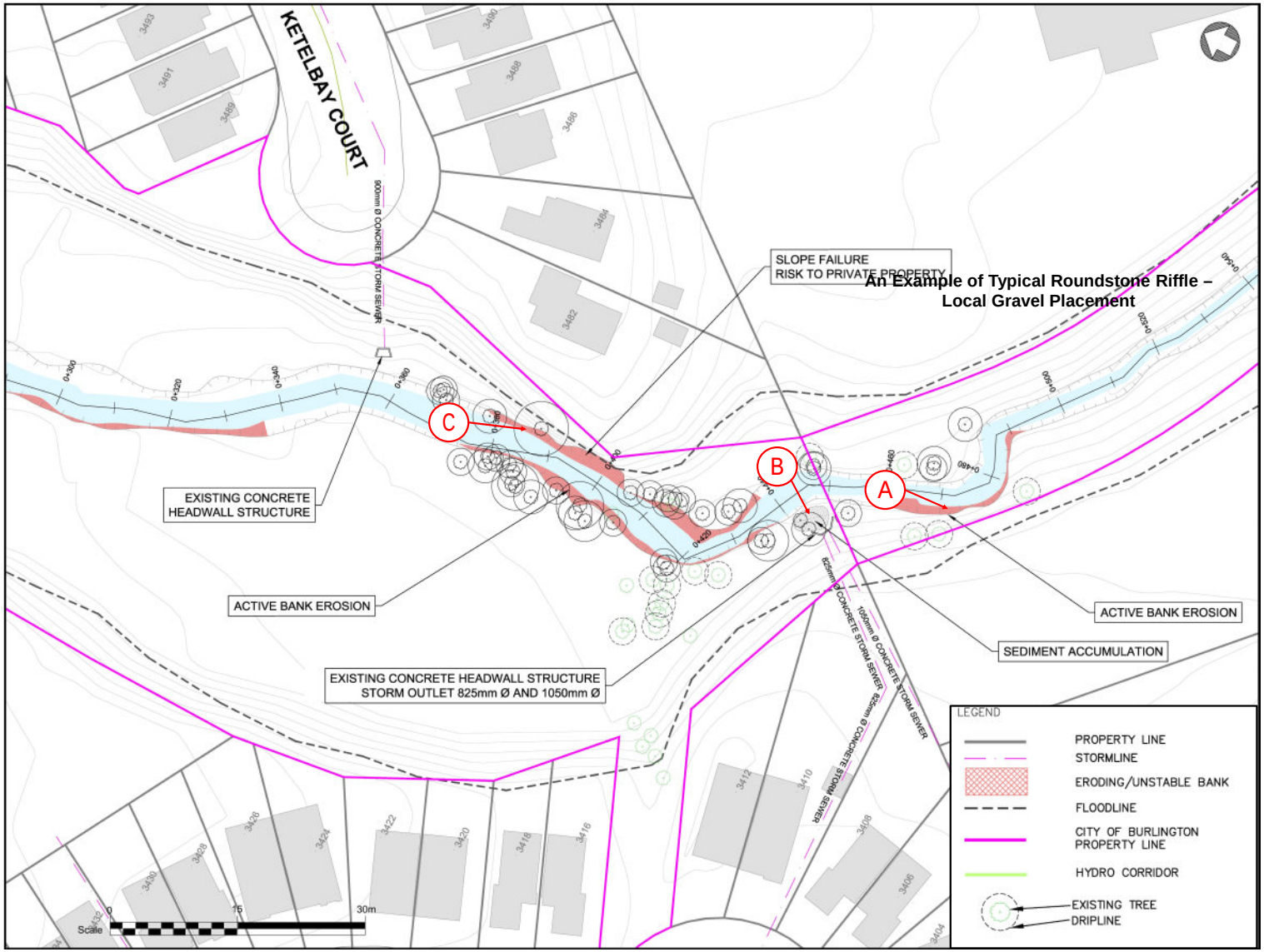
Preliminary Preferred Alternative - Local Restoration Works

- Minor channel realignment with riffle-pool morphology to enhance creek riparian while providing protection to aquatic habitats
- Removal of concrete debris from channel bed
- Regrade and restore banks

EROSION SITE 4 – LANSDOWN PARK & KETTLEBY ROAD



EROSION SITE 4 – EXISTING CONDITIONS



An Example of Typical Roundstone Riffle – Local Gravel Placement



Photo A – Eroded Outer Bank with Near Vertical Slope



Photo B – Accumulated Sediment Infront of Twin Storm Outfall



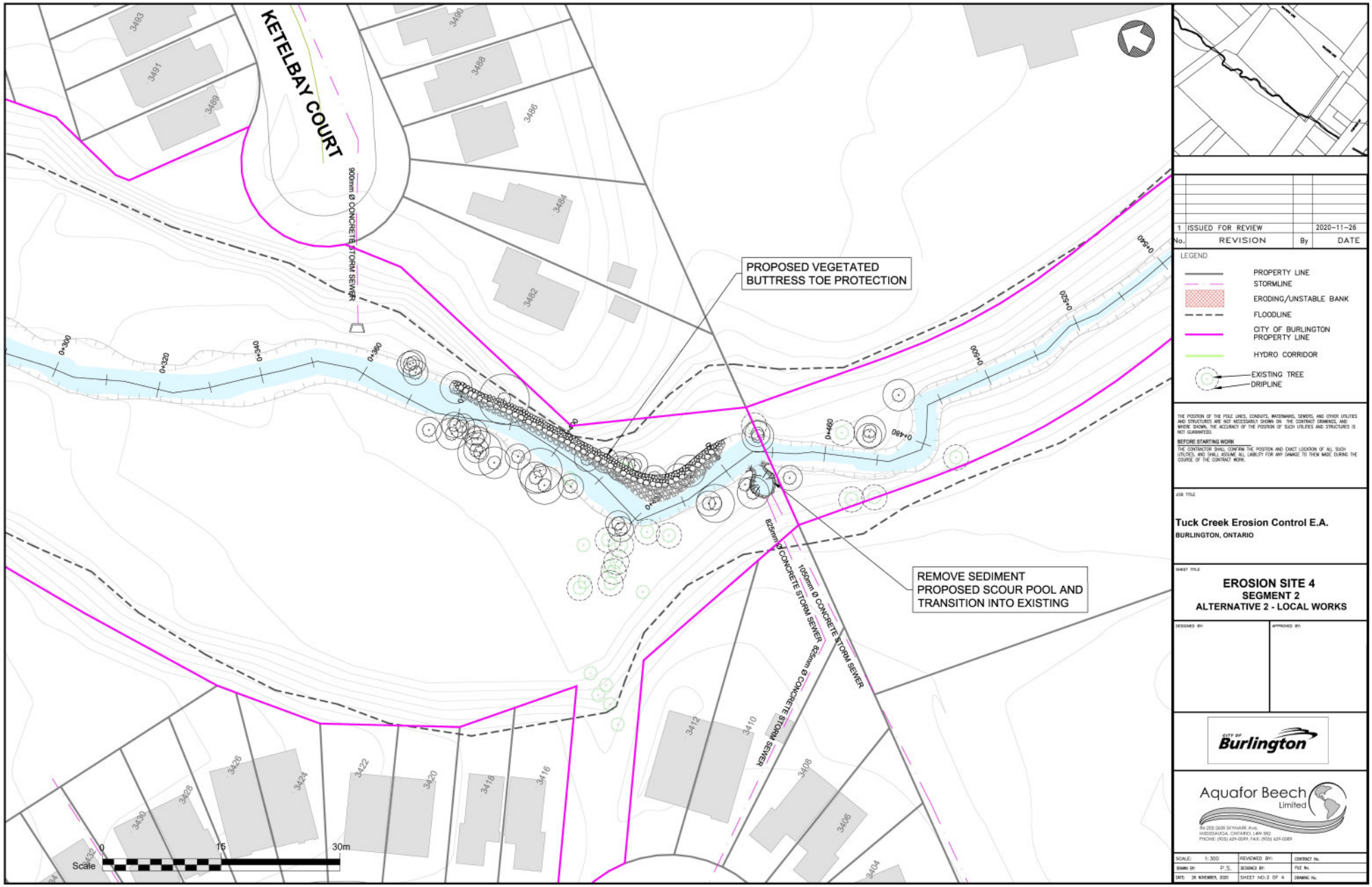
Photo C – Over-steepened Slope Due to Erosion, Adjacent to Private Property, Undermined Trees

Risks to private property, municipal infrastructure and aquatic habitat due to:

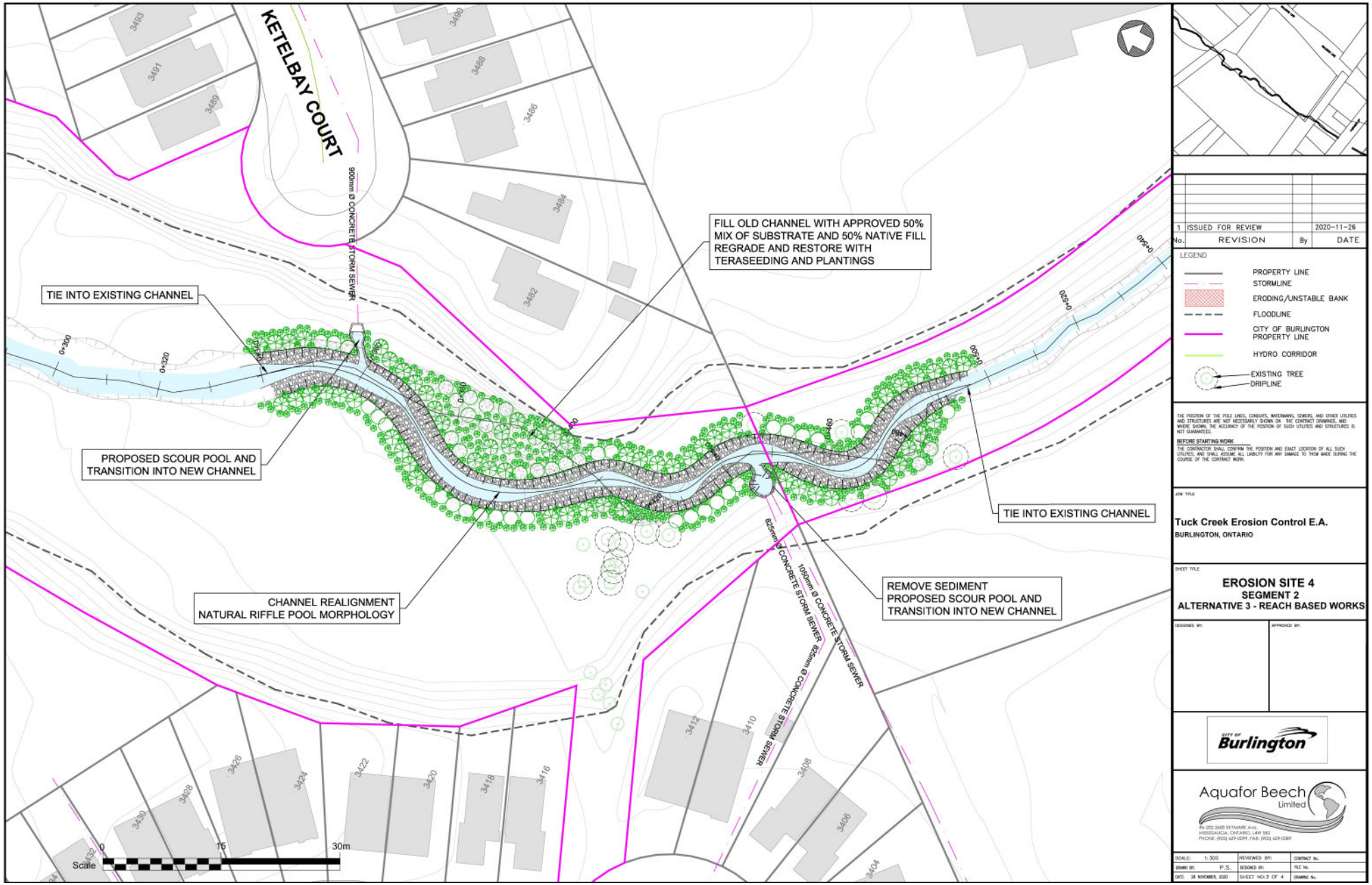
- Active bank erosion, undermined trees, slope failure posing risk to private property adjacent to Kettleby Court properties
- Sediment accumulated in front of storm sewer

Level of Risk: High

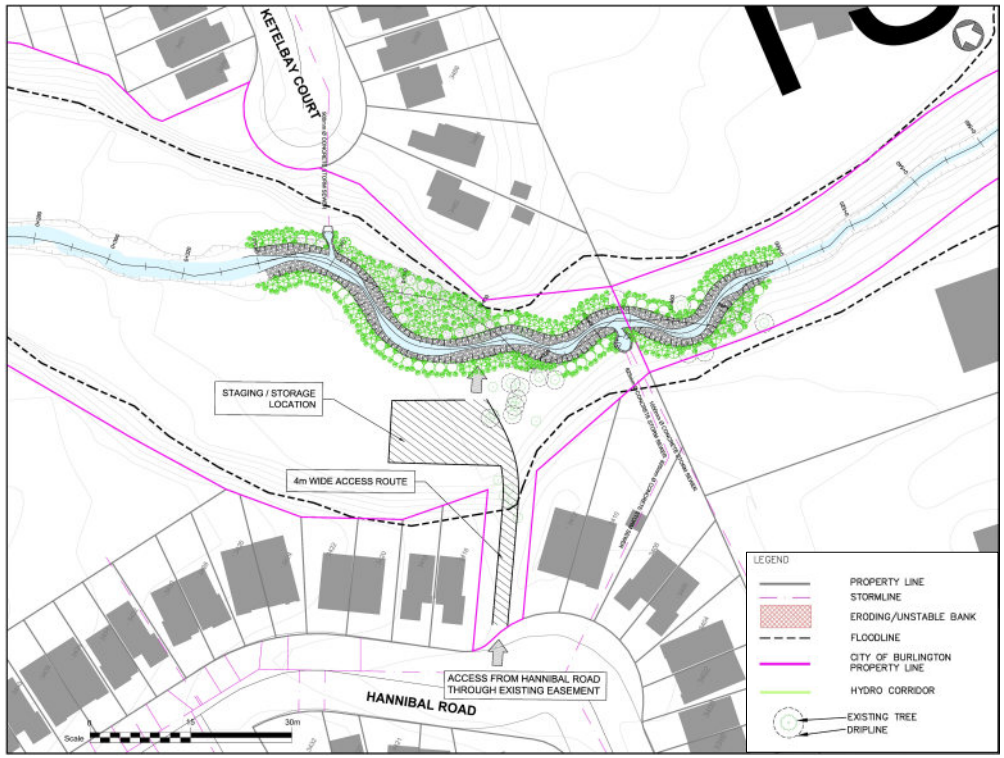
EROSION SITE 4 – LOCAL RESTORATION WORKS



EROSION SITE 4 – REACH SCALE WORKS

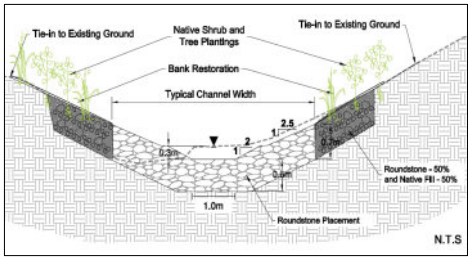


EROSION SITE 4 – POTENTIAL PREFERRED ALTERNATIVE





An Example of Natural Channel Design with Riffle-Pool



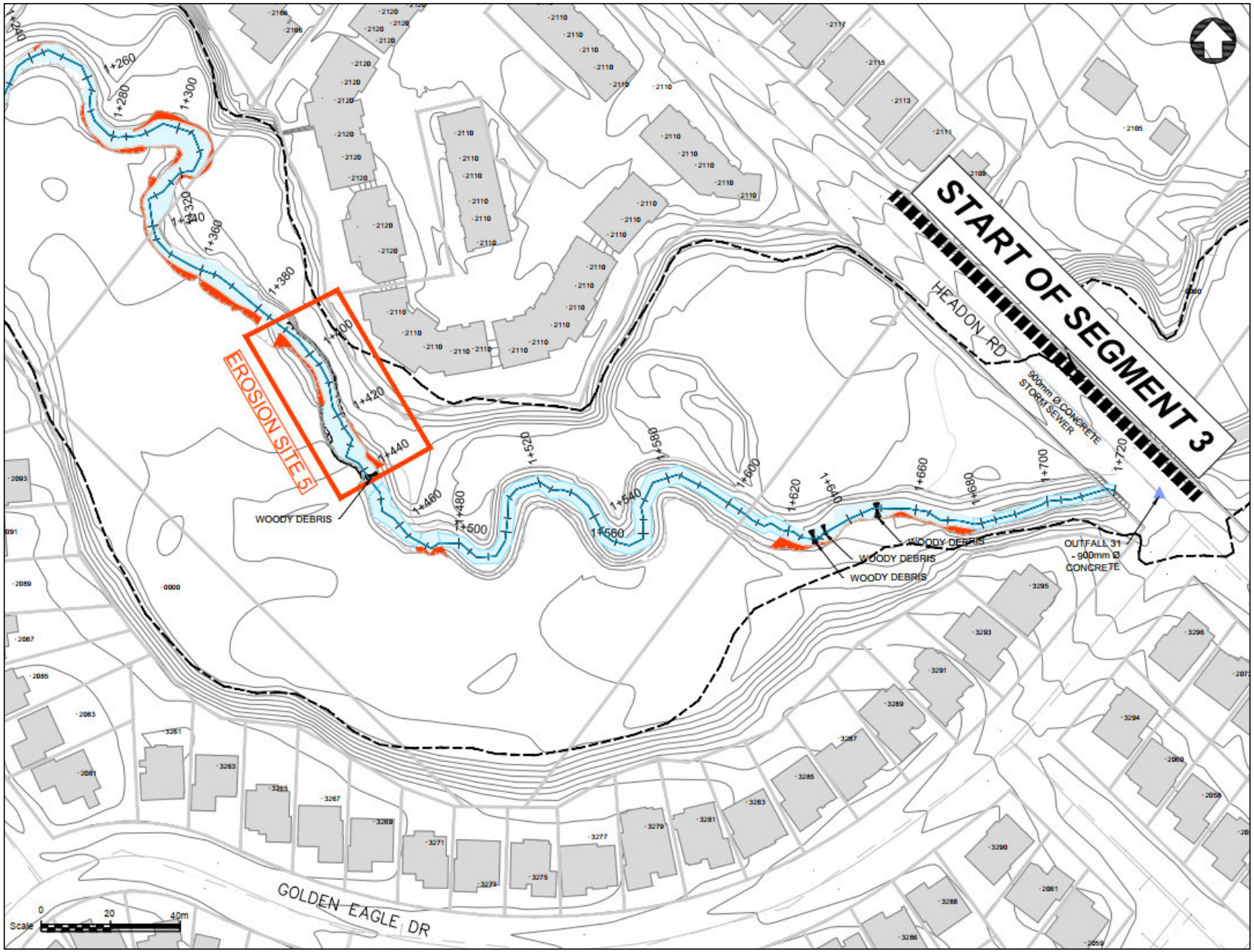
An Example of Typical Roundstone Riffle – Local Gravel Placement

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Local Restoration Works	Alternative 3 - Reach Scale Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	1	3	5
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	3	4
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	5	4	2
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	3	4
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	5	3	1
	Physical / Natural Environment Criteria Subtotal	**13**	**16**	**16**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**10**	**13**	**13**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	5	4	4
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	2	3	3
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	1	2	4
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	1	3	4
	Technical and Engineering Criteria Subtotal	**9**	**12**	**15**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**14**	**18**	**23**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	1	3	4
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	1	4	5
Community Disruption	Less disruption the surrounding community and residents scores higher	5	3	2
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	5	3	2
	Social / Cultural Environment Criteria Subtotal	**12**	**13**	**13**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**12**	**13**	**13**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	5	3	2
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	3	4
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	2	3	4
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	4	4
	Economic Criteria Subtotal	**9**	**13**	**14**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**14**	**20**	**21**
Total		49	63	69

Preliminary Preferred Alternative – Reach Scale Works

- Realign channel planform with riffle-pool morphology to enhance creek riparian and protect private properties while providing protection to aquatic habitats
- Recess and Retrofit Storm Outfall with New Headwall
- Scour pool for storm sewer outlet and transition into new channel

EROSION SITE 5 – UPSTREAM HEADON ROAD



EROSION SITE 5 – EXISTING CONDITIONS

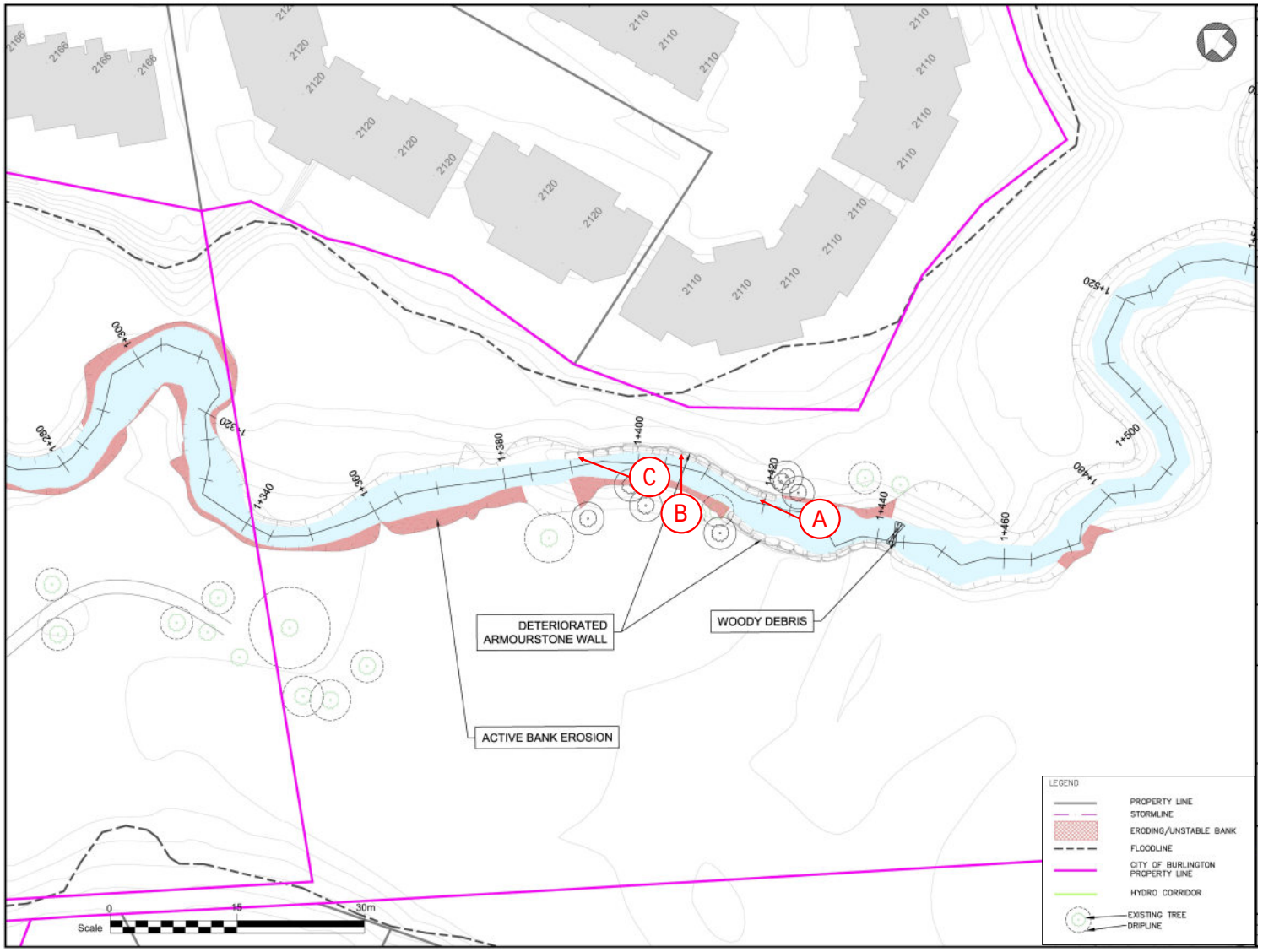



Photo A – Deteriorating Armourstone Wall


Photo B – Installation of Armourstone without Proper Drainage

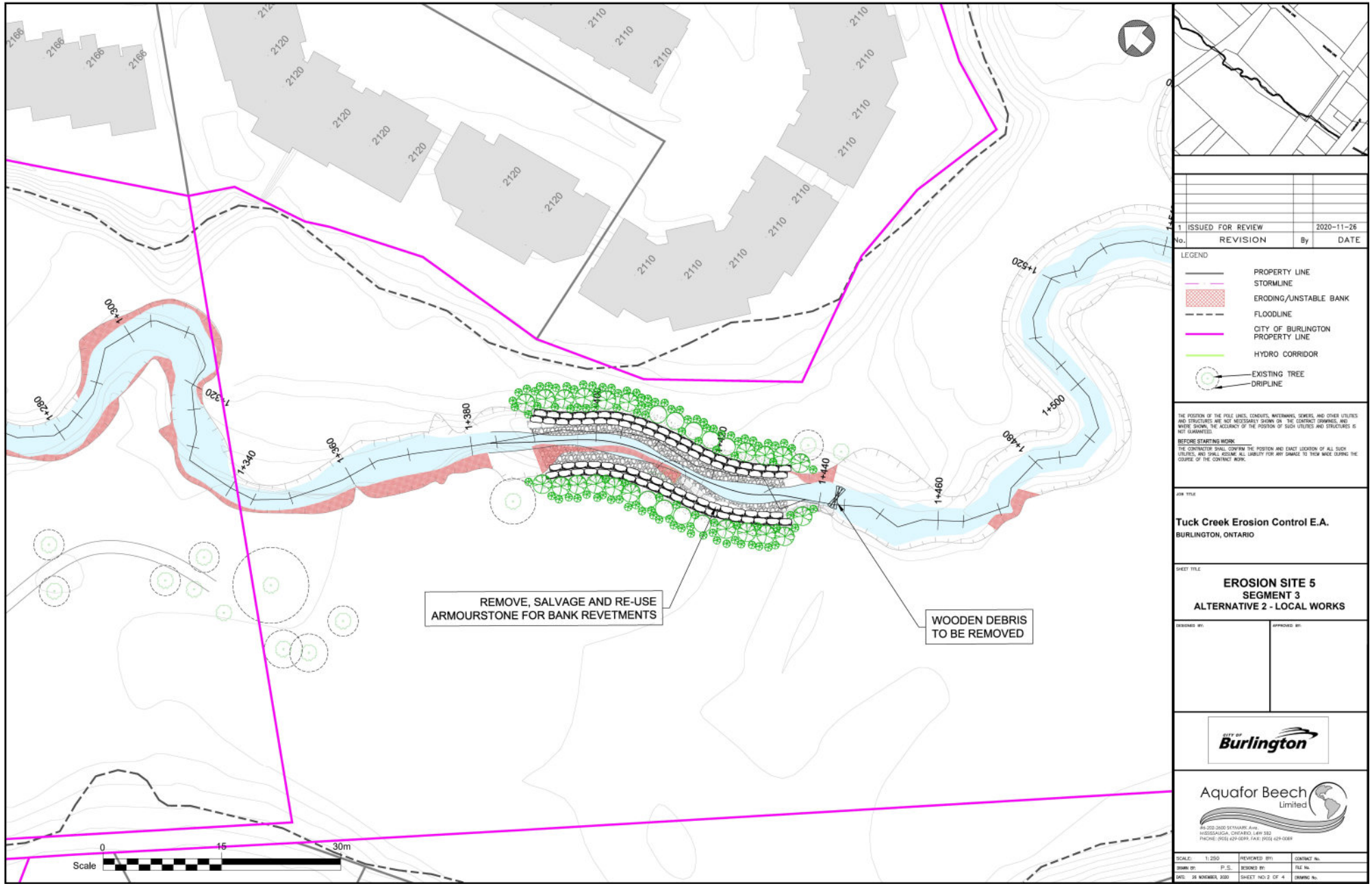

Photo C – Failing Armourstone falling towards the Creek

Risks to private property, municipal infrastructure and aquatic habitat due to:

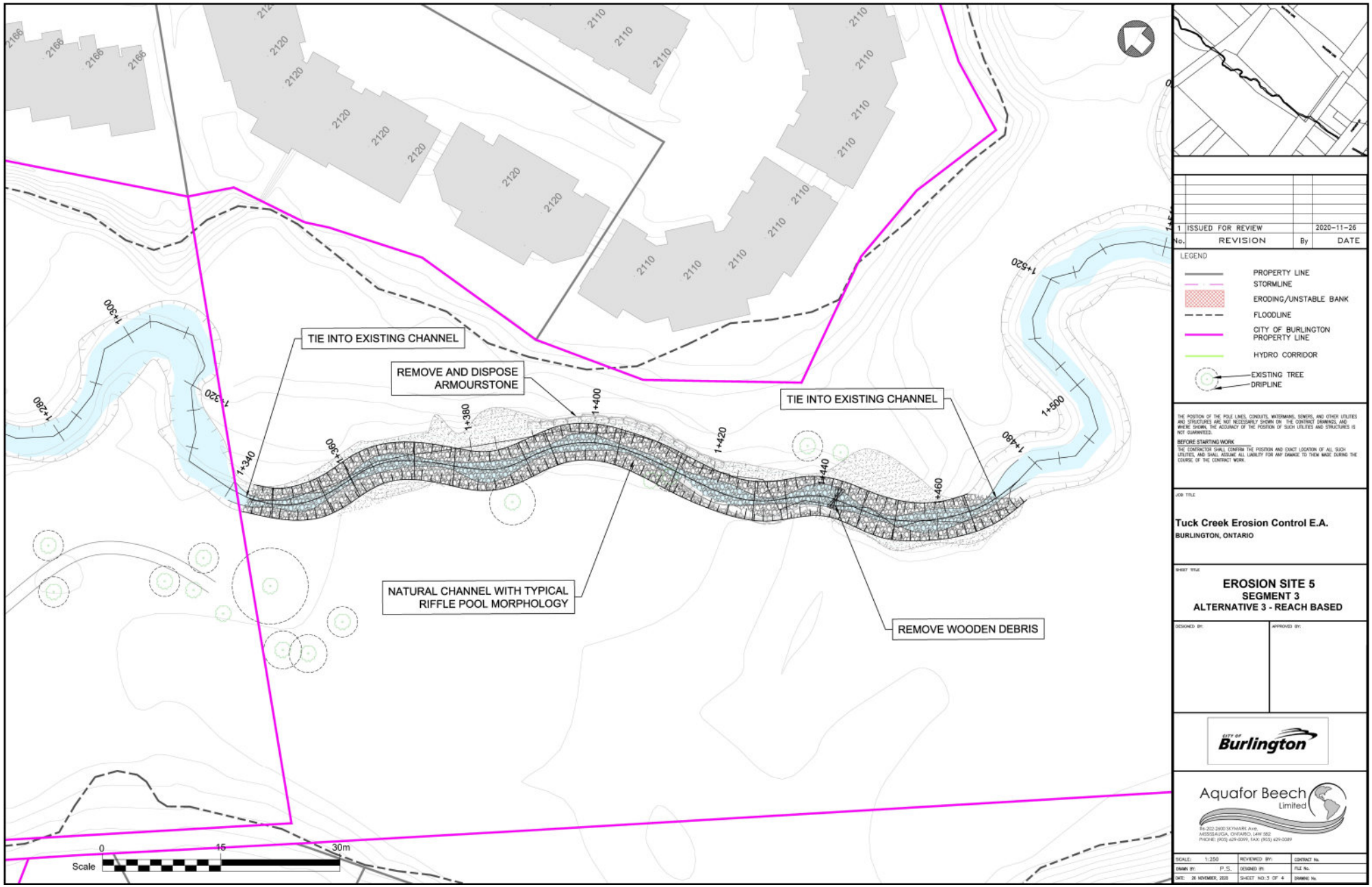
- Active bank erosion
- Woody debris jam in the channel
- Deteriorated armourstone wall

Level of Risk: Low

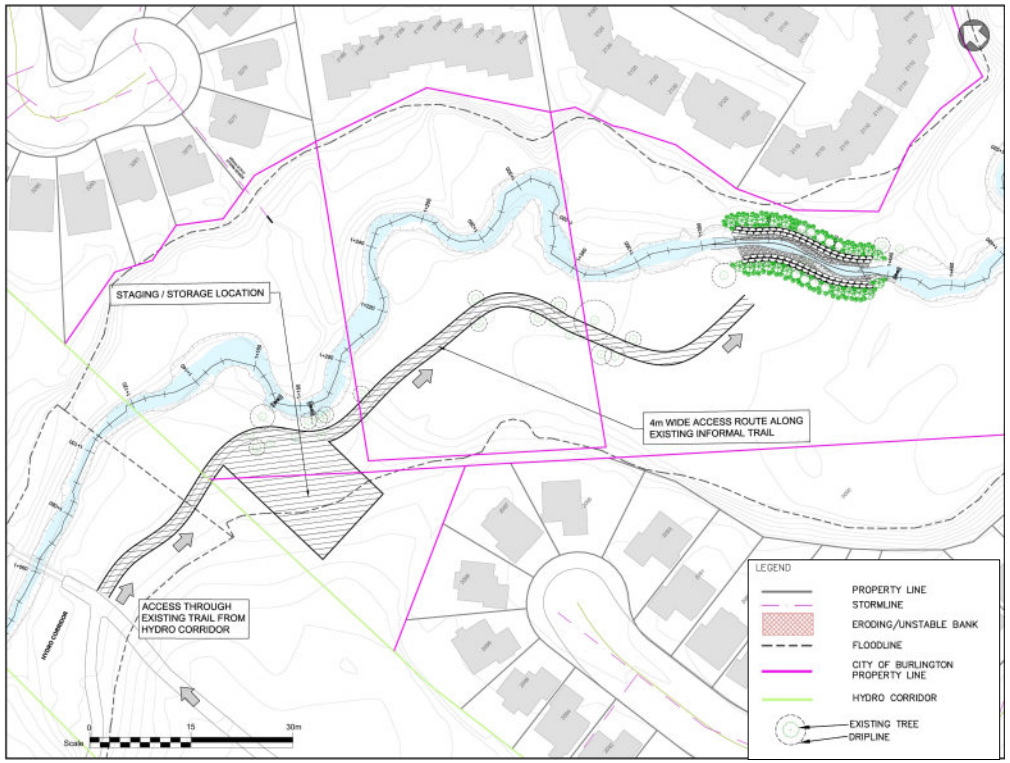
EROSION SITE 5 – LOCAL RESTORATION WORKS



EROSION SITE 5 – REACH SCALE WORKS

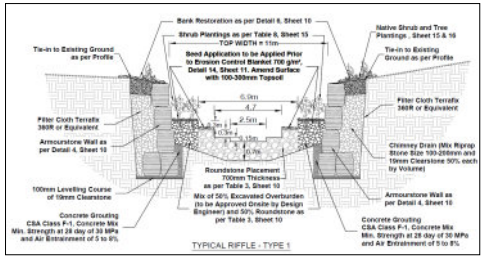


EROSION SITE 5 – POTENTIAL PREFERRED ALTERNATIVE





An Example of Armourstone for Bank Revetments



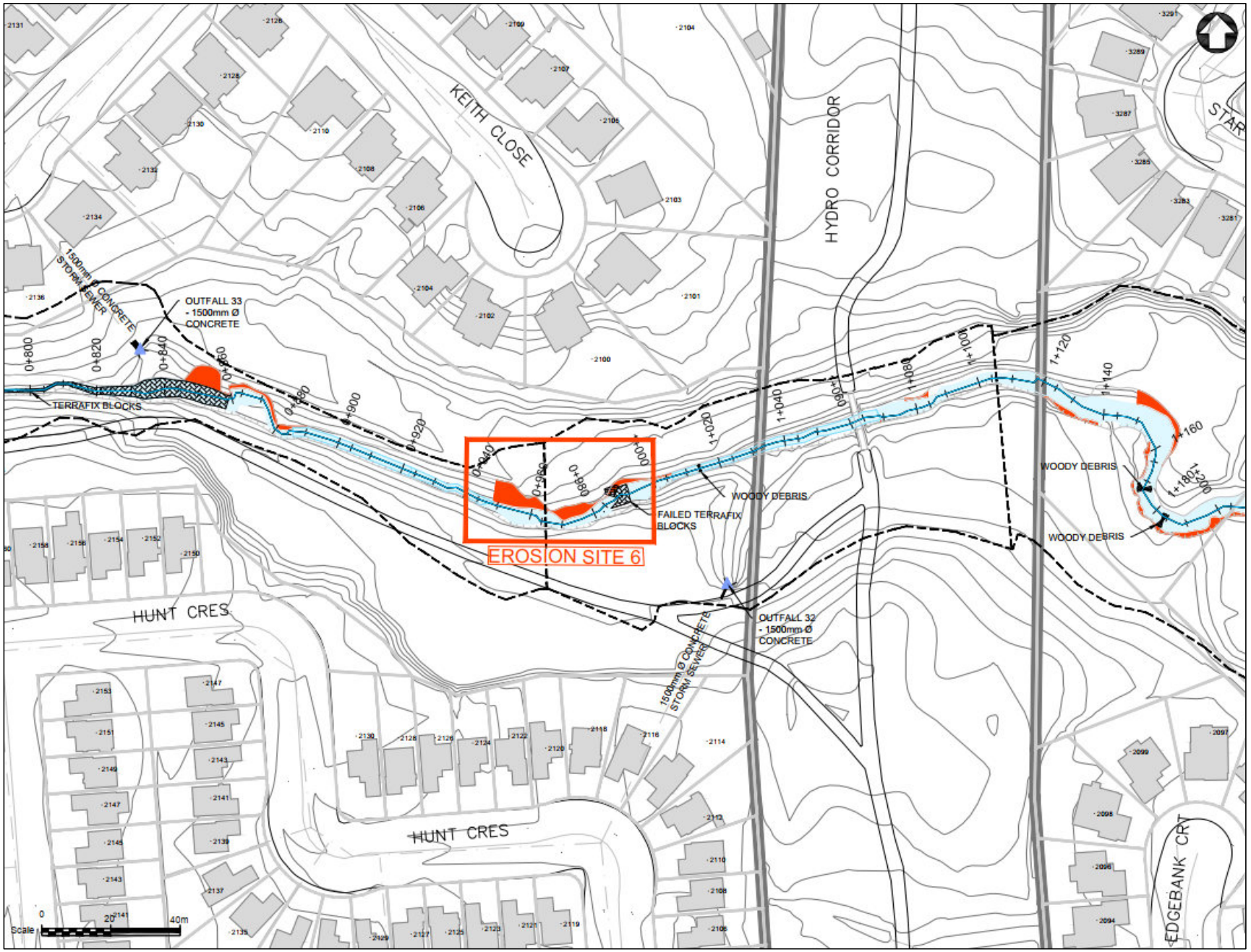
An Example of Armourstone Wall Detail for Bank Revetment

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Local Restoration Works	Alternative 3 - Reach Scale Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	1	2	4
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	4	3
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	5	3	1
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	3	4
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	5	2	1
	Physical / Natural Environment Criteria Subtotal	**13**	**14**	**13**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**10**	**11**	**10**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	5	4	2
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	2	3	3
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	1	4	3
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	2	4	4
	Technical and Engineering Criteria Subtotal	**10**	**15**	**12**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**15**	**23**	**18**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	1	3	5
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	1	3	5
Community Disruption	Less disruption the surrounding community and residents scores higher	3	3	1
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	5	3	1
	Social / Cultural Environment Criteria Subtotal	**10**	**12**	**12**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**10**	**12**	**12**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	5	3	1
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	3	4
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	1	4	4
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	4	4
	Economic Criteria Subtotal	**8**	**14**	**13**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**12**	**21**	**20**
Total		47	67	60

Preliminary Preferred Alternative – Local Restoration Works

- Remove, salvage, and re-use armourstone for bank revetments
- Removal of woody debris

EROSION SITE 6 – DOWNSTREAM IRELAND PARK



EROSION SITE 6 – EXISTING CONDITIONS

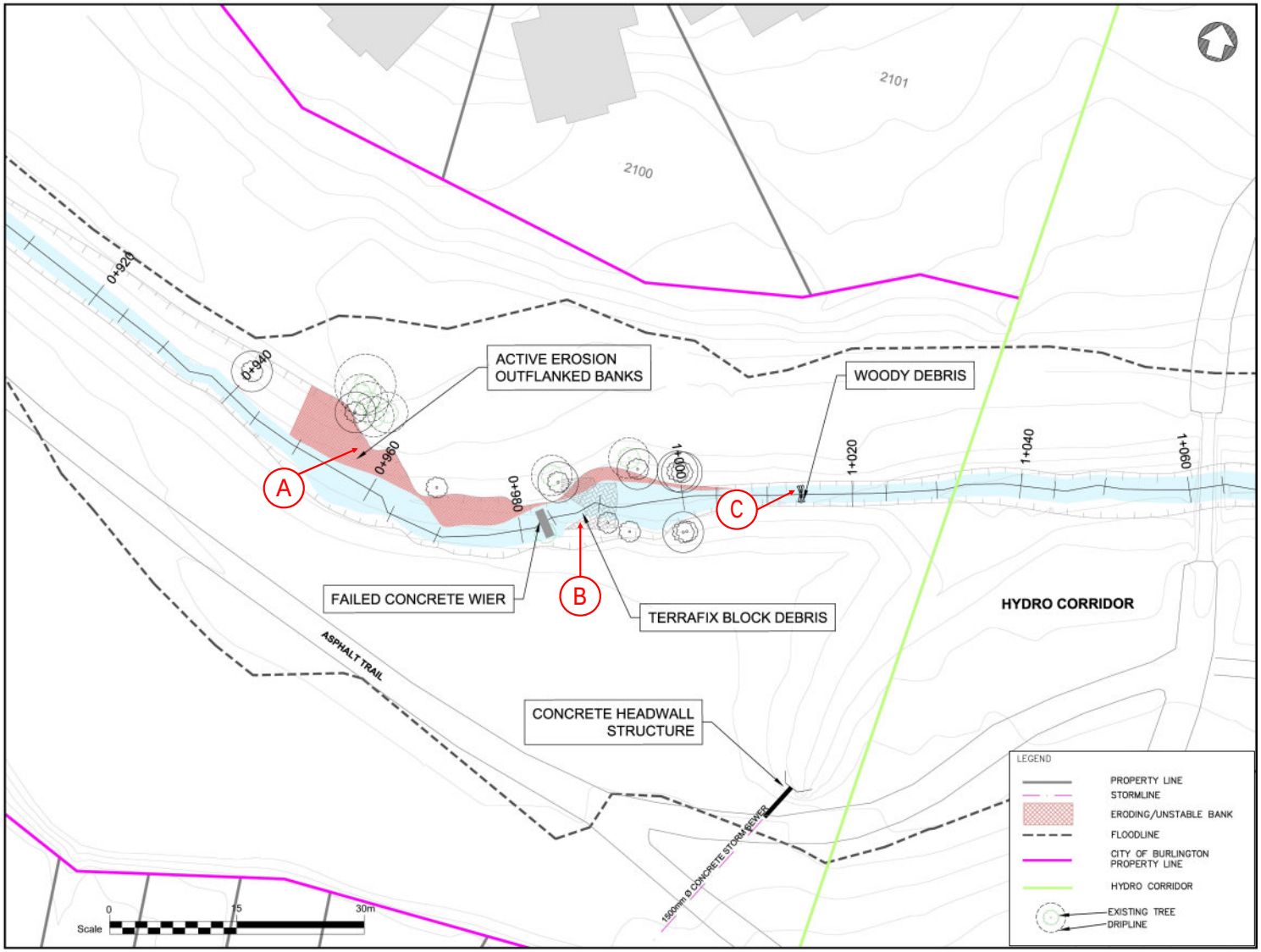



Photo A – Active Erosion and Outflanked Banks with Evidence of Planform Adjustment


Photo B – Failed Terrafix Block & Concrete Weir

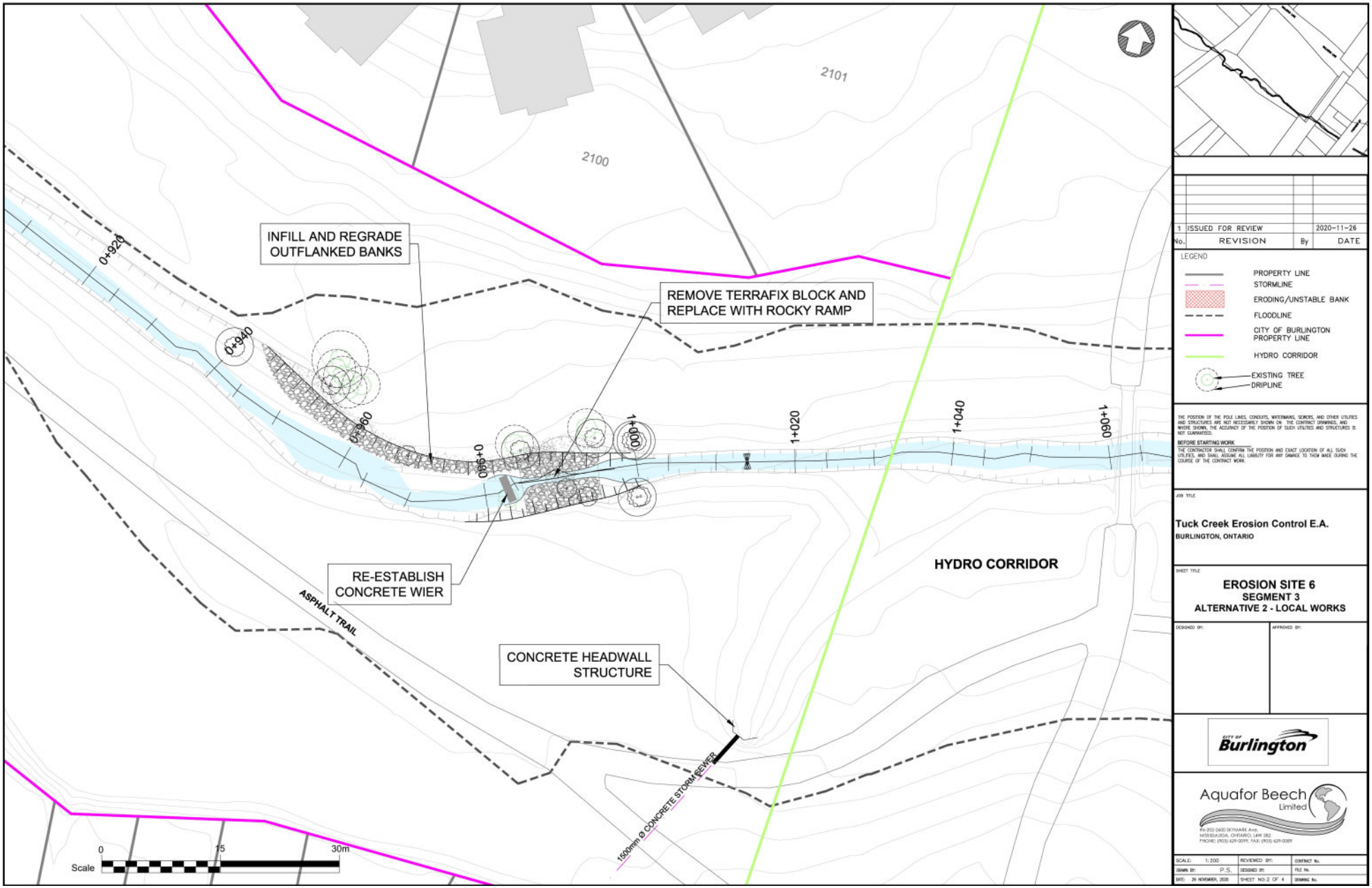

Photo C – Woody Debris Jam in the Channel

Risks to private property, municipal infrastructure and aquatic habitat due to:

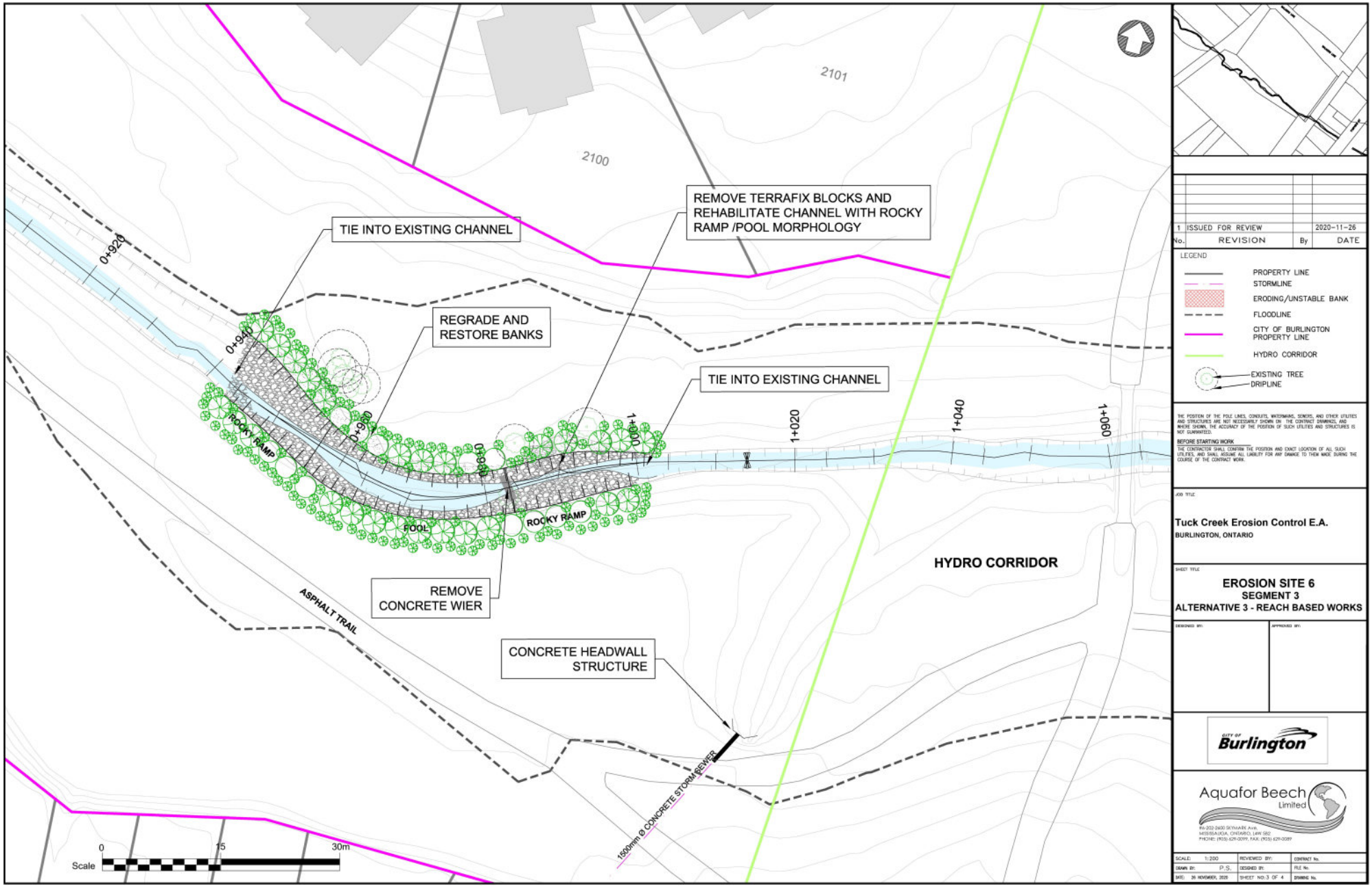
- Active bank erosion and outflanked banks
- Failed concrete weir and terrafix block debris
- Woody debris jam in the channel

Level of Risk: High

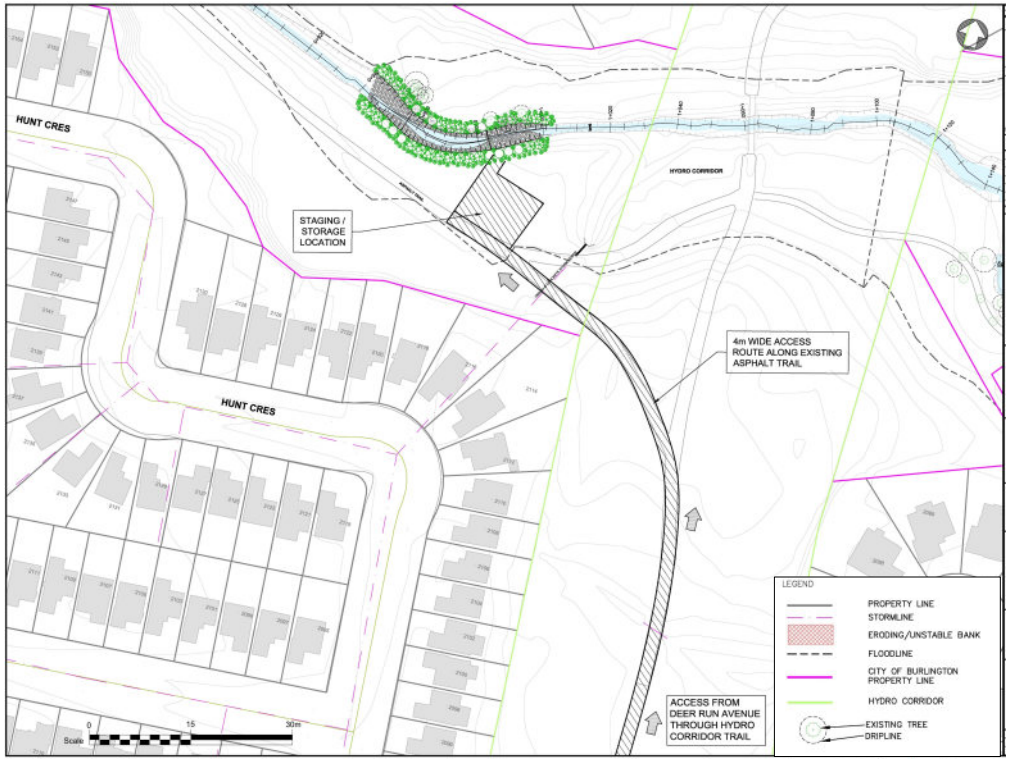
EROSION SITE 6 – LOCAL RESTORATION WORKS



EROSION SITE 6 – REACH SCALE WORKS

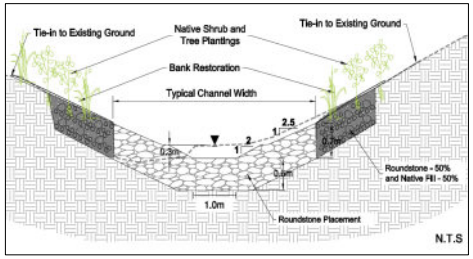


EROSION SITE 6 – POTENTIAL PREFERRED ALTERNATIVE





An Example of Rocky Ramp / Pool Morphology



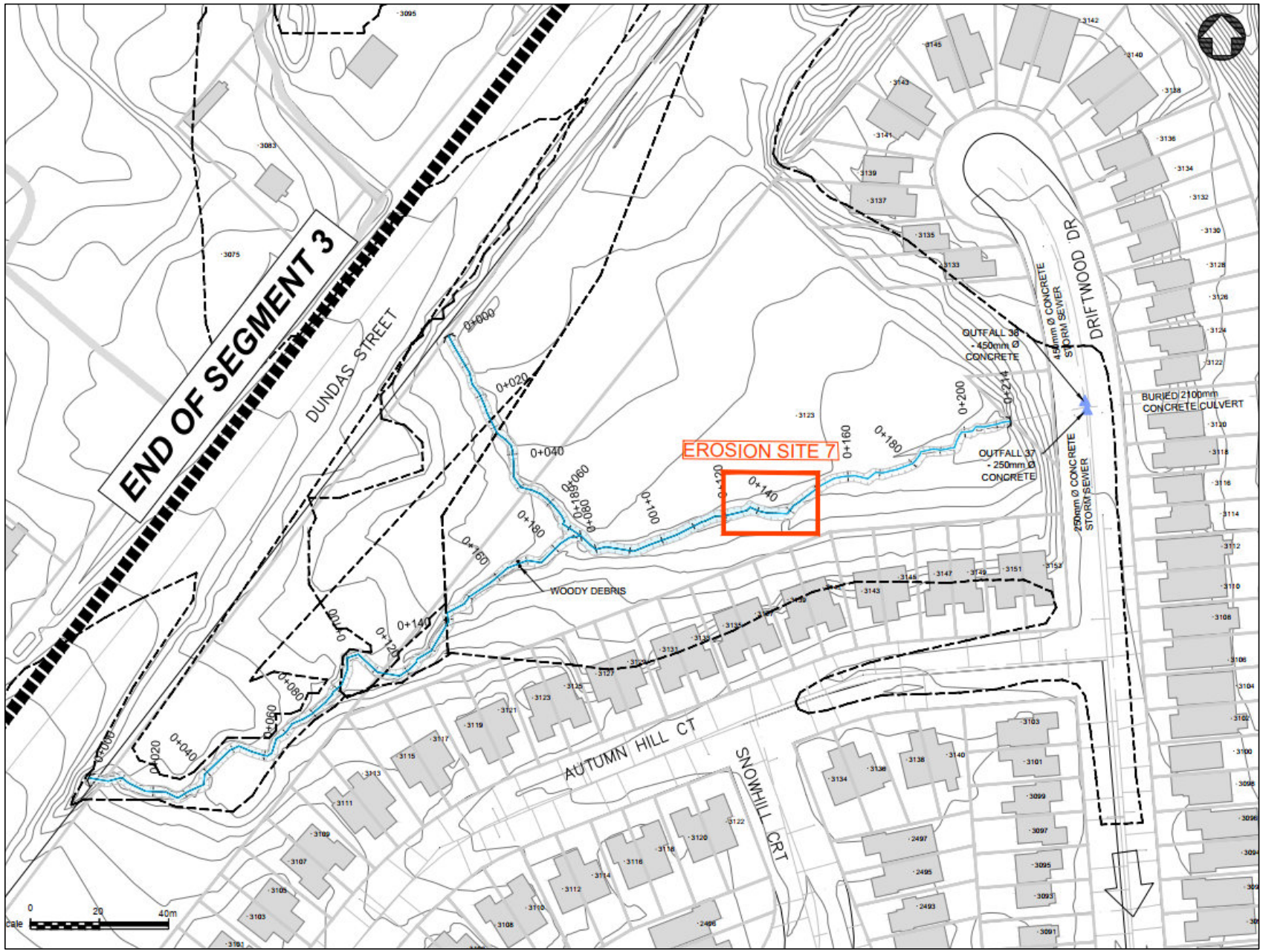
An Example of Typical Roundstone Riffle – Local Gravel Placement

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Local Restoration Works	Alternative 3 - Reach Scale Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	1	2	4
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	2	4
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	5	3	1
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	3	4
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	5	3	2
	Physical / Natural Environment Criteria Subtotal	**13**	**13**	**15**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**10**	**10**	**12**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	5	3	3
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	2	3	3
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	1	3	4
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	2	3	4
	Technical and Engineering Criteria Subtotal	**10**	**12**	**14**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**15**	**18**	**21**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	1	3	5
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	0	2	5
Community Disruption	Less disruption the surrounding community and residents scores higher	2	3	2
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	5	3	2
	Social / Cultural Environment Criteria Subtotal	**8**	**11**	**14**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**8**	**11**	**14**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	5	3	2
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	4	5
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	1	3	4
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	4	5
	Economic Criteria Subtotal	**8**	**14**	**16**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**12**	**21**	**24**
Total		45	60	71

Preliminary Preferred Alternative – Reach Scale Works

- Removal of concrete weir and terrafix blocks
- Rehabilitate channel bed with rocky ramp / pool morphology
- Regrade and restore banks

EROSION SITE 7 – DRIFTWOOD PARK



EROSION SITE 7 – EXISTING CONDITIONS

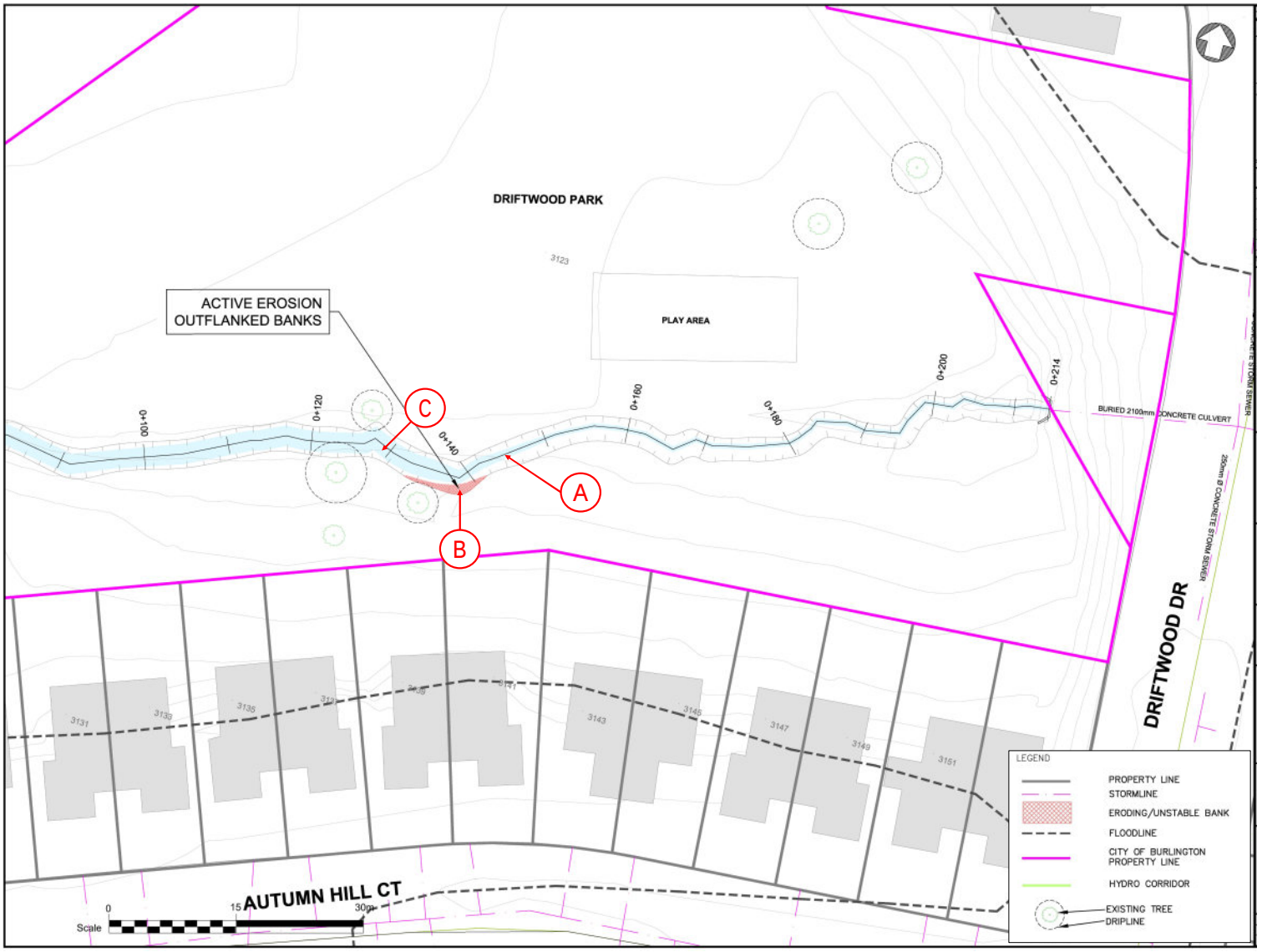




Photo A – Downstream of the Erosion Site



Photo B – Active Bank Erosion and Outflanked Banks with Evidence of Planform Adjustment



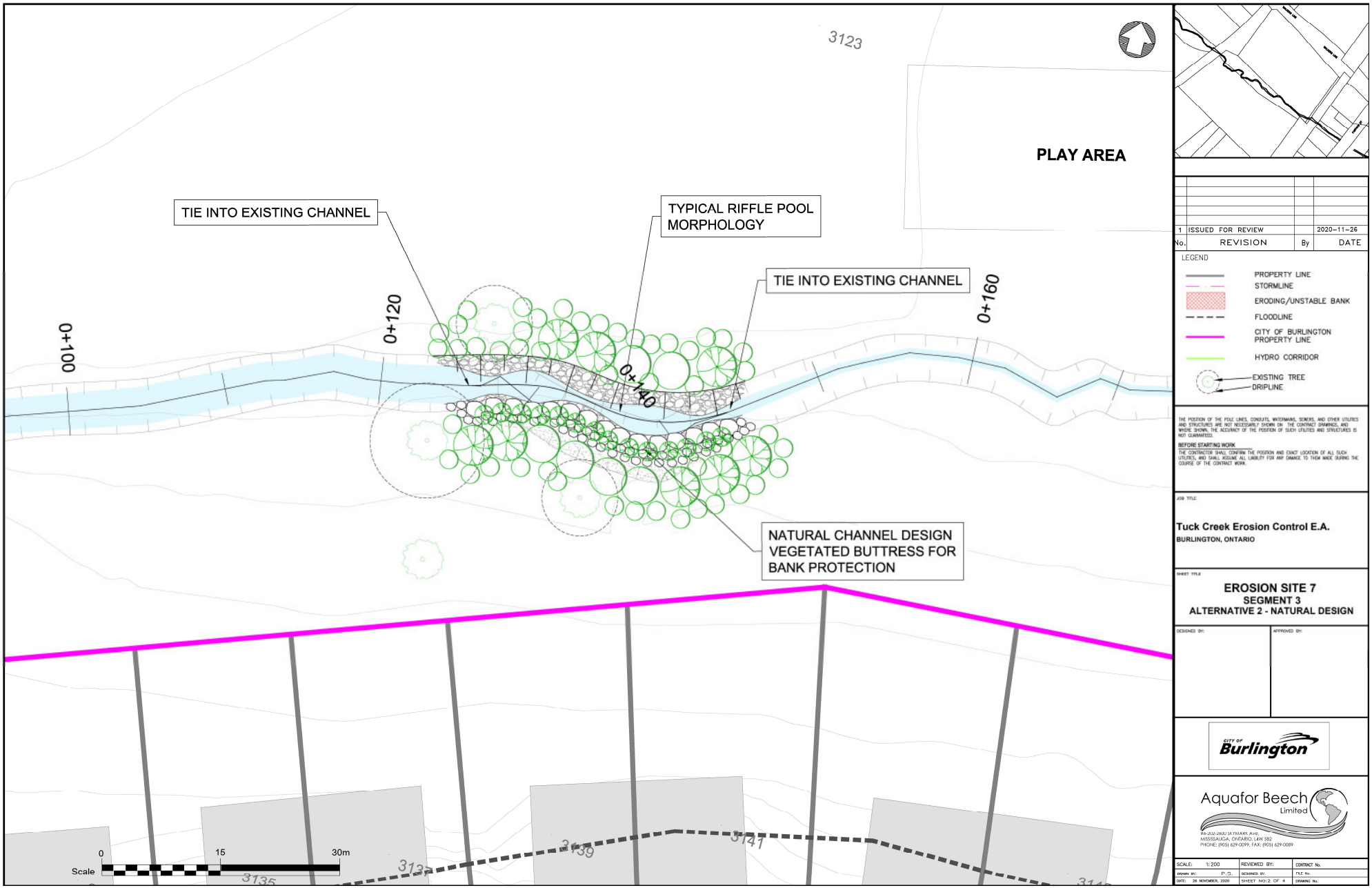
Photo C – Upstream of the Erosion Site

Risks to private property, municipal infrastructure and aquatic habitat due to:

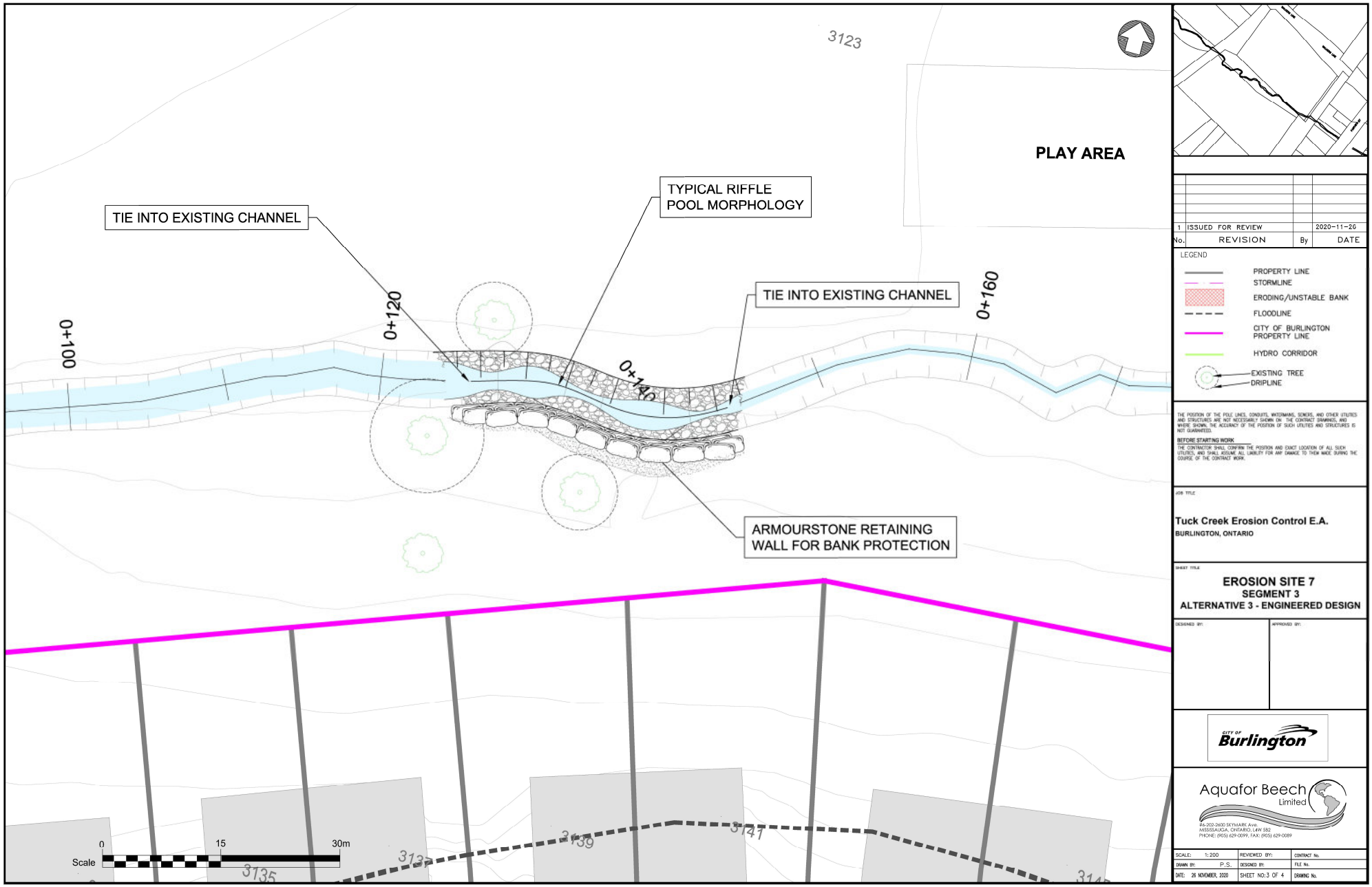
- Active bank erosion and outflanked banks
- Creek encroaching private property

Level of Risk: Medium

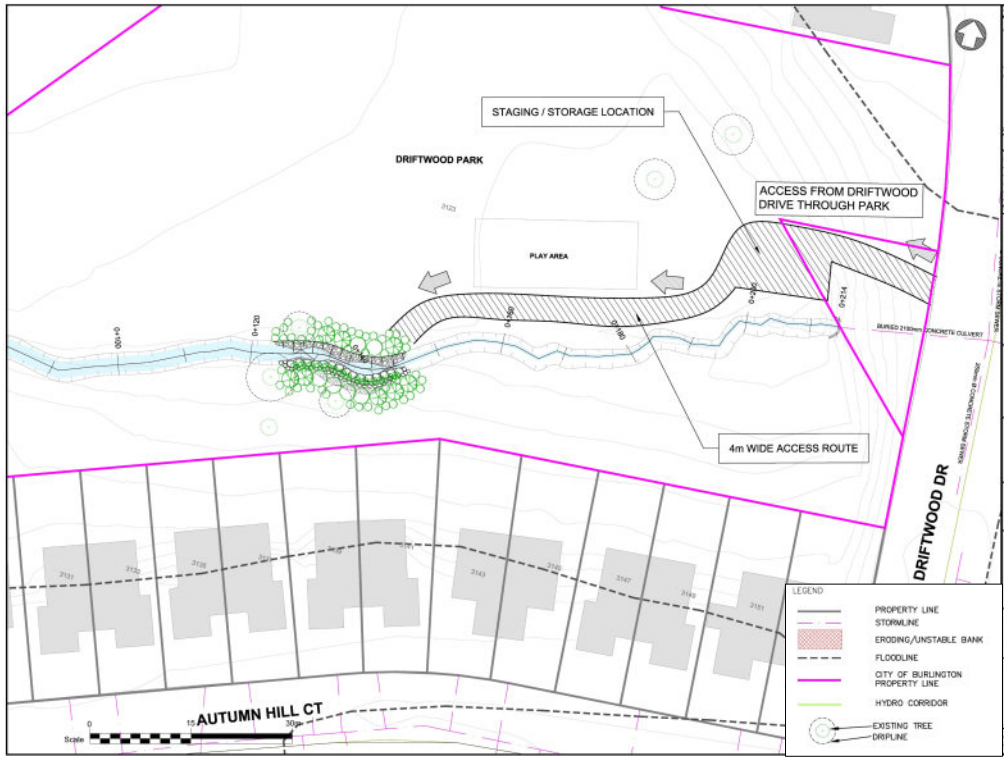
EROSION SITE 7 – NATURAL DESIGN



EROSION SITE 7 – ENGINEERED DESIGN

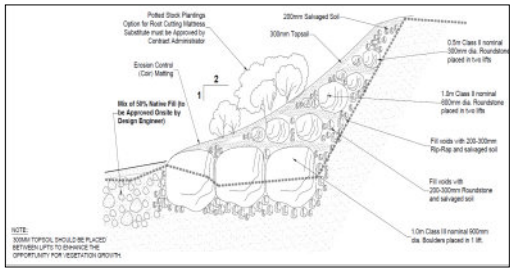


EROSION SITE 7 – POTENTIAL PREFERRED ALTERNATIVE





An Example of Natural Channel Design Enhanced with Vegetated Buttress



An Example of Vegetated Buttress Detail

EVALUATION CRITERIA		Alternative 1 - Do Nothing	Alternative 2 - Natural Design	Alternative 3 - Engineered Works
		Score	Score	Score
Physical / Natural Environment Criteria				
Potential to Reduce Stream Bank and Stream Bed Erosion	Greater reduction of erosion risks, slope failures, and loss of public and private properties/parklands	1	4	4
Potential to Improve Aquatic Habitat	Greater improvements to fish and aquatic habitat scores higher, including substrate, overhanging vegetation, turbidity, and passage/connectivity	1	4	3
Potential Impacts to Aquatic Habitat During Construction	Less disruption to fish and aquatic habitat during construction scores higher	5	3	3
Potential to Improve Terrestrial Habitat	Greater improvements to the existing terrestrial condition score higher, including factors such as management/removal of invasive species, creation of new habitat types/features, or increasing the area/functionality of natural corridors	1	3	4
Potential Impacts to Terrestrial Habitat During Construction	Less disruption to the terrestrial habitat during construction scores higher	5	3	3
	Physical / Natural Environment Criteria Subtotal	**13**	**17**	**17**
	Weighted Score for Physical / Natural Environment Criteria (maximum of 25 pts)	**10**	**14**	**14**
Technical and Engineering Criteria				
Ease of Implementation	Less impact to the surrounding infrastructure (e.g., sewers, watermains, gas, roads) during and after constructions scores higher	5	3	3
Flooding Impacts	Greater reduction of flooding risks to public and/or private lands for longer time scores higher	2	3	3
City Acceptance	Greater compliance with existing City plans, policies, and bylaw requirements scores higher	1	4	3
Technical Feasibility	Greater technical feasibility relative to other alternatives scores higher	2	4	4
	Technical and Engineering Criteria Subtotal	**10**	**14**	**13**
	Weighted Score for Technical and Engineering Criteria (maximum of 25 pts)	**15**	**21**	**20**
Social / Cultural Environment Criteria				
Aesthetics / Recreation	Greater improvements to the aesthetics of the creek corridor and how the alternative impacts recreational use of the corridor score higher	1	4	2
Compatibility with Adjacent Land Use	Greater compatibility with the land use of adjacent properties (e.g. softer approach will be preferred in the residential and parklands compared to hard-engineered structure) scores higher	3	5	2
Community Disruption	Less disruption the surrounding community and residents scores higher	2	3	3
Archaeological Impacts	Less disturbance of areas with archaeological potential and cultural heritage resources scores higher	5	5	5
	Social / Cultural Environment Criteria Subtotal	**11**	**17**	**12**
	Weighted Score for Social / Cultural Environment Criteria (maximum of 25 pts)	**11**	**17**	**12**
Economic Environment Criteria				
Construction Costs	Lower construction cost relative to other alternatives scores higher	5	3	2
Operation and Maintenance Costs	Lower operations and maintenance costs relative to other alternatives scores higher	1	4	3
Life Cycle Costs	Lower life cycle costs relative to the other alternatives scores higher	1	4	3
Infrastructure Protection	Greater protection of existing infrastructure for a longer time scores higher	1	4	4
	Economic Criteria Subtotal	**8**	**15**	**12**
	Weighted Score for Economic Criteria (maximum of 25 pts)	**12**	**23**	**18**
Total		48	74	63

Preliminary Preferred Alternative – Natural Design

- Natural design to enhance creek riparian while providing protection to aquatic habitats
- Installation of a vegetated buttress to prevent lateral migration
- Restore channel with typical riffle-pool morphology

NEXT STEPS

PUBLIC CONSULTATION – DECEMBER, 2020

- Receive PIC feedback, incorporate input and update results
- Compile and review feedback. Confirm or adapt preliminary preferred alternatives.



SUBMIT EA PROJECT FILE AND OBTAIN AGENCY APPROVALS – SUMMER 2021

- EA Project file posted for 30 day review period.

DETAILED DESIGN & IMPLEMENTATION

- Construction timing dependant on City of Burlington Capital Planning.

TO PROVIDE COMMENT, OR TO BE ADDED TO THE STUDY STAKEHOLDER LIST, PLEASE CONTACT:

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THANK YOU

FOR PARTICIPATING IN THE TUCK CREEK EROSION CONTROL ENVIRONMENTAL ASSESSMENT STUDY