Appendix H FLUVIAL GEOMORPHOLOGICAL ASSESSMENT

Black Creek at Bass Pro Mills Drive, From Highway 400 to Weston Road, Vaughan, Ontario, Fluvial Geomorphological Assessment

May 10, 2022

Prepared for:

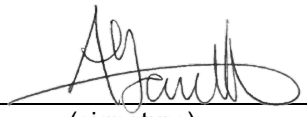
City of Vaughan
2141 Major Mackenzie Drive
Vaughan, ON L6A 1T1

Prepared by:

Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo, ON N2L 0A4
Tel.: (519) 579-4410

160540006

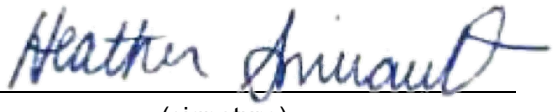
This document entitled Black Creek at Bass Pro Mills Drive, From Highway 400 to Weston Road, Vaughan, Ontario, Fluvial Geomorphological Assessment was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of The City of Vaughan (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by 
(signature)

Amber Garrett, P.Eng.
Water Resources Engineer

Reviewed by 
(signature)

Scott Cowan, P.Geo., C.Tech.
Fluvial Geomorphologist

Approved by 
(signature)

Heather Amirault, P. Eng.
Stream Restoration Engineer

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. was retained by the City of Vaughan to provide a fluvial geomorphological assessment for Black Creek as part of a Municipal Class Environment Assessment (EA) for the proposed extension of Bass Pro Mills Drive, from Highway 400 to Weston Road. The results of the assessment will support the project by delineating the limits of Black Creek's meander belt, confirming the required width of the proposed channel corridor at the extension of Bass Pro Mills Drive, calculating the 100-year erosion rate to support the design of any proposed crossing structures, and analyzing potential crossing location alternatives.

The Study Area is generally bounded by Rutherford Road to the north, Weston Road to the west, Highway 400 to the east, and Valeria Boulevard to the south. Black Creek enters the Study Area through a culvert at the intersection of Rutherford Road and Weston Road flowing south as a roadside ditch along Weston Road to a point opposite Astona Boulevard, after which it flows southeast to the southern limit of the Study Area. South of the Study Area, Black Creek has been realigned and restored. The Study Area for this assessment is larger than the EA Project Site. The location of the Study Area and the Project Site is presented in Figure 1, Appendix A.

The following background studies were reviewed in support of the fluvial geomorphological assessment:

Stormwater Management Facility Design Brief – Block 14 Draft Plan 19T-97014 Part of Lot 14, Concession 5 Hwy. 400 and Bass Pro Mills Drive (Stantec, 2004) – This report presents the proposed Stormwater Management (SWM) facility design of the future Rutherford Business Park subdivision west of Highway 400 and south of Rutherford Road.

Stormwater Management Brief – Vaughan Mills Centre Secondary Plan Stormwater Management Conceptual Strategy (MMM Group, 2013) – This report reviews the relevant policies and regulations related to SWM in the Vaughan Mills Secondary Plan area and examines the realignment of Black Creek as part of the future development.

Functional Stormwater Management Plans – Future Secondary Plan Areas (Cole Engineering, 2013) – This report outlines the servicing strategies for multiple Secondary Plans throughout the City of Vaughan including Block 27, Block 41, Vaughan Mills, Highway 7 and Weston Road, Concord Centre, Vaughan Health Campus of Care, Dufferin Street and Centre Street, and Promenade Mall.

The City of Vaughan and the Toronto and Region Conservation Authority (TRCA) have confirmed that there is no background fluvial geomorphological information available for the section of Black Creek that was realigned as part of the development of the Weston/400 North Industrial Subdivision.

1.1 SCOPE OF WORK

The scope of this assessment involved various desktop and field components. The goal of these components was to determine a meander belt and 100-year erosion limit for Black Creek within the Study Area and to analyze crossing location alternatives. The tasks completed for this study included:

i. review background information including topographic mapping, geologic mapping, and aerial photographs;
ii. complete reach delineation and field observations from publicly accessible rights-of-way;
iii. meander belt width delineation;
iv. 100-year erosion limit delineation; and
v. assessment of crossing location alternatives.

During this assessment, as noted in the Introduction, permission to enter the Study Area was not available. All observations were completed from publicly accessible rights-of-way. A geomorphic site investigation to support any channel realignment works will be required during detailed design phase as access to property becomes available.

2.0 BACKGROUND REVIEW

2.1 GEOLOGY

Surficial and bedrock geology maps published by the Ontario Geological Survey (OGS) indicated the predominant surficial geology type within the Study Area is fine textured glaciolacustrine deposits composed of interbedded silt and clay (OGS, 2003). The Precambrian bedrock geology within the Study Area is the shale-dominant Georgian Bay Formation of the Ordovician period composed of shale, limestone, dolostone, and siltstone (OGS, 2011).

2.2 THE BLACK CREEK SUBWATERSHED

The Black Creek subwatershed drains an area of approximately 65 km^2 and is located within the greater Humber River watershed within the City of Vaughan. Black Creek flows north to south from its headwaters in Vellore, contained in a retention basin, to the Humber River in Toronto. The Black Creek subwatershed has been almost entirely developed. Many of the older residential and industrial areas were developed prior to the adoption of stormwater quantity and quality control measures (TRCA, 2008). As a result, runoff within the subwatershed tends to be flashy with relatively high peak flows which has caused flooding to become a significant hazard. Large reaches of Black Creek have been transformed to concrete channels to increase the conveyance capacity.

Within the Study Area, Black Creek is a straightened channel adjacent to Weston Road from Rutherford Road south to the future location of the Bass Pro Mills Drive extension where it continues southeast connecting with a realigned and restored reach of Black Creek just downstream of the Study Area. The drainage area contributing to the extension of Bass Pro Mills Drive is approximately 2.7 km^2 (Cole Engineering, 2013).

2.3 HISTORICAL ANALYSIS

A sequence of historic aerial photographs (1954, 1978, 1999, 2005, and 2020) and topographic mapping (1 m contours available from York Region Open Data) were reviewed to gain insight into channel form, surrounding land use/cover, and to identify any changes that have occurred during the period of record. The historical aerial photographs that were reviewed are included in Appendix B. The current predominant land use within the watershed is industrial/commercial with a growing proportion of residential in more recent years. Prior to 1999 the predominant land use within the watershed was agricultural. Within the Study Area Black Creek was straightened along Weston Road prior to 1954 and has remained in a similar orientation throughout the period of record with the channel being realigned eastward downstream of Astona Boulevard to accommodate development between 1978 and 1999. This type of channel modification is common within urban areas in the Greater Toronto Area. Culvert crossings were added at the entrances to businesses along Weston Road between 1978 and 1999. The current and historical riparian corridor consists of mostly grasses and other herbaceous vegetation.

3.0 REACH DELINEATION AND FIELD OBSERVATIONS

3.1 REACH DELINEATION

Reaches are lengths of channel that have physical constraints (e.g. geology, slope, discharge, vegetation, sediment input) that remain nearly constant along their length and subsequently exhibit similar physical geomorphic characteristics (e.g. channel form, sinuosity, physical dimensions). As a result, the controlling and modifying influences of channel form in a reach are similar (TRCA, 2004). This partitioning of a channel into reaches guides the desktop and field analyses, in that it considers the influence of localized channel patterns and processes. Based on the information available, Black Creek within the Study Area is one reach (Reach BC1). Reach BC1 begins at the outlet of the culvert under Rutherford Road and extends 1,240 m to the restored and realigned reach downstream of the Study Area. Reach breaks are outlined on Figure 1.

3.2 REACH DESCRIPTION

Existing site conditions were observed during a site visit completed by Stantec on March 23, 2021. As site access was not permitted at the time of the field investigation, the site observations were made from the public right-of-way. Reach BC1 exhibited a straightened planform within an unconfined valley. The channel cross-section was trapezoidal with a small low flow channel present within cattails and phragmites. The bank slopes in this reach were moderate, and bank material was soft and cohesive. The bed morphology was homogeneous and featureless, and bed material in the accessible areas was mostly silt/clay with some sand and gravel which may have washed in from the roadway. The bank and riparian vegetation on the left bank consisted of herbaceous and flood tolerant vegetation. The right bank was vegetated with herbaceous and non-woody plants, and the right riparian area was mostly a roadway or other development. The bankfull width was estimated to be 4.0 m based on the measurements of a single cross-section accessible alongside Weston Road. Additional cross-sections should be evaluated during a detailed field assessment to confirm bankfull dimensions. The channel was generally stable with no significant aggradation, degradation, or areas of bank erosion. The physical attributes of Reach BC1 and the results of a Rapid Geomorphic Assessment (RGA) are summarized in Table 1 below. A photographic inventory of Reach BC1 is included as Appendix C and RGA included as Appendix D.

Table 1 - Summary of Existing Conditions Along Black Creek

Parameter	Reach BC1
Length (m)	1240
Valley Form	Unconfined
Channel Slope (m/m)	0.00376*
Approximate Bankfull Width (m)	4.0
Substrate	Silt/Clay with some sand and small gravel
Bank Material	Loam
Sinuosity	Low (Straightened)
RGA Stability Index	0.10 - Stable
Riparian Vegetation	Densely vegetated with grasses, cattails, and phragmites

*Channel slope was extracted from existing conditions HEC-RAS model. See Section 4.1

4.0 MEANDER BELT WIDTH DETERMINATION

The meander belt is a term used to quantify the lateral extent of a river's occupation of its floodplain (TRCA, 2004). Meander belts are inherently variable, and their extent is dependent on several controlling factors. These include, among other things, hydrology, stormwater flows, bank erosion rates, channel slope, and the degree of channel confinement by the valley walls.

Black Creek within the Study Area was straightened prior to the available historic air photo record and modified during the period of record. As a result, channel mapping procedures could not be implemented to delineate the meander belt width. In such situations, a surrogate approach can sometimes be used wherein the meander pattern of a similar system is measured and the results are applied to the straightened channel. However, no such suitable surrogate reach could be located for this study as most of the watercourses of this size and slope within this region have also been straightened or altered.

Since there is no available evidence of this channel's historical meander pattern and no suitable surrogate reach available, the specific meander belt delineation methodology applied to the study area was the Empirical Approach. Procedure 5 from TRCA (2004). The empirical approach is based on a variety of physical variables within the watershed and is considered appropriate for estimating the meander belt width for Black Creek within the Study Area.

4.1 TRCA PROCEDURE 5 – EMPIRICAL APPROACH

The empirical relationship developed for this method requires calculating stream power during a 2-year flow event, defined as the product of the specific weight of water, discharge, and channel slope, as follows:

$$SP = \gamma Qs, \text{ where:}$$

SP = Stream power (watts/m^2)

γ = Specific weight of water (9806 kg/m^2 s^2)

Q = 2-year flow, (m^3/s)

s = Channel slope (m/m)

The empirical relationship used is as follows:

$$W_b = -14.827 + 8.319 \ln (SP * DA) + S, \text{ where:}$$

W_b = Meander belt width (m)

DA = Drainage area (km^2)

S = Standard Error of Equation (8.63)

Meander Belt Width Determination

A one-dimensional HEC-RAS model of Black Creek was obtained from the TRCA (2019_11_15 – Updated Humber River Submission 6) which was updated to ensure accurate existing conditions within the Study Area. The 2-year flow of 2.22 m^3/s and channel slope of 0.376% were extracted from the existing conditions HEC-RAS model. The drainage area included the contributing external drainage area north of the Study Area of 1.93 km^2 (Stantec, 2004), as well as 0.73 km^2 which was the portion of the Study Area draining to Bass Pro Mills Drive (Cole Engineering, 2013) for a total drainage area of approximately 2.7 km^2. The resulting meander belt width for BC1 using the TRCA empirical relationship is 39 m. This meander belt width is illustrated on Figure 1 in Appendix A.

5.0 100-YEAR EROSION LIMIT ANALYSIS

The 100-year erosion limit at the crossing was calculated using the methodology outlined in the TRCA Crossings Guideline for Valley and Stream Corridors (Crossings Guideline) (TRCA, 2015).

Since Black Creek has a bankfull width of less than 5 m at the proposed crossing location, and there is no available evidence of this channels' historical meander pattern and no suitable surrogate reach available, the 100-year erosion limit was delineated as per Table 4 in Figure 14 of the Crossings Guideline (TRCA, 2015). This table provides minimum 100-year erosion limit recommendations based on field observations of channel stability, dimensions, and soil structure.

As mentioned in section 3.2, the channel banks were well vegetated, the substrate was mostly silt/clay, and the channel was generally stable with no significant aggradation, degradation, or areas of bank erosion. Although no evidence of erosion was noted, the Crossings Guideline states that the majority of watercourses with defined bed and banks will display evidence of active erosion or will have bankfull flow competence in excess of the erosion threshold. As a conservative approach, an approximate 100-year erosion limit of 5.0 m will be applied to each side of the bankfull channel.

Within the Crossings Guideline, it is noted that if spanning the meander belt is not feasible, spanning the 100-year erosion limit should be considered to minimize the risk associated with channel migration over time. For future crossing structures this would correspond with a minimum span of 14.0 m. This 100-year erosion limit is outlined on Figure 1 in Appendix A. Additional analysis should be undertaken during detailed design to confirm assumptions with site specific information.

6.0 CROSSING LOCATION ALTERNATIVES

It is understood that the Project Site is situated within the Vaughan Mills Centre Secondary Plan area, and that growth and development is planned within this area. However, the future configuration of land uses, including the future location of Black Creek to the north and south of the proposed extension of Bass Pro Mills Drive, is not currently known. As such, in support of this Class EA, the impact of four different crossing locations on the geomorphological function of Black Creek were evaluated:

- Alternative A kept Black Creek in its current location with only a minor realignment at the upstream end; and
- Alternatives B, C, and D would involve moving the crossing location progressively further east requiring a more extensive realignment and potentially a reduced channel slope.

Crossing location alternatives are shown in Figure 2, Appendix A.

The realignment and restoration of Black Creek will be developed as part of future stages of land use planning, and no conceptual design of these realigned corridors is included as part of this roadway Class EA.

6.1 RECOMMENDED ALTERNATIVE

From a feasibility perspective, the channel could be realigned to connect with any of the proposed crossing location alternatives. The existing channel has been straightened and contains few bedforms and habitat features. A realigned channel of similar slope and dimension could provide equivalent or better habitat.

Although all four options are feasible, Alternative A was considered the preferred alternative as it minimizes the impact to the existing creek and its floodplain by requiring the least extensive realignment. Additionally, by reducing the length of required realignment, Alternative A has the lowest potential for impacting the existing sediment transport regime at the proposed culvert crossing location. As a result, Alternative A has the least potential to impact the current geomorphological function of Black Creek in the Study Area.

The preferred proposed realignment and road profile are included as Appendix E. The culvert is oriented perpendicular to the road stationing which will require a minor realignment of Black Creek. This orientation minimizes channel length within the culvert, which in turn minimizes habitat loss. It also allows Black Creek to tie into the existing watercourse downstream of the crossing without impacting the property to the south and allows for the incorporation of flows from the existing tributary east of Black Creek upstream of the crossing.

The existing tributary east of Black Creek shown in Appendix E was not observed during this assessment as site access was not permitted during the field investigation. The tributary appears small in dimension,

and it is expected that a realignment of the tributary could be designed to provide equivalent or better habitat and conveyance capacity than exist at present.

It is recommended that future channel realignments employ Natural Channel Design (NCD) methods with the objective of improving aquatic and riparian habitat, providing appropriate flood conveyance, and including considerations for erosion thresholds and sediment transport. Future channel realignments should also follow the TRCA's Channel Modification Design and Submission Requirements (TRCA, 2007). Additionally, site specific geomorphic and topographic data for Black Creek and the east tributary should be obtained through a detailed field assessment prior to detailed design, once full site access is available. This information will support the detailed design of the minor realignment of Black Creek at the proposed culvert crossing and the design of the east tributary realignment.

7.0 SUMMARY

The purpose of this fluvial geomorphological assessment was to define a meander belt width, 100-year erosion limit, and to evaluate potential crossing location alternatives for Black Creek within the Study Area. The results of this assessment define a meander belt of 39 m, a 100-year erosion limit of 14 m, and identify Alternative A as the preferred crossing location of Black Creek at Bass Pro Mills Drive. The meander belt width and 100-year erosion limits have been developed based on information gathered during the site visit from the publicly accessible right-of-way. It is recommended that a detailed site investigation and additional analysis are undertaken during detailed design.

8.0 REFERENCES

Cole Engineering, 2013. Functional Stormwater Management Plans – Future Secondary Plan Areas

Dialog and MMM Group, 2014. Vaughan Mills Centre Secondary Plan

MMM Group, 2013. Stormwater Management Brief – Vaughan Mills Centre Secondary Plan Stormwater Management Conceptual Strategy

Ontario Geological Survey (OGS), 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release–Data 126 - Revision 1

Ontario Geological Survey (OGS), 2003. Surficial Geology of Southern Ontario.

Stantec, 2004. Stormwater Management Facility Design Brief – Block 14 Draft Plan 19T-97014 Part of Lot 14, Concession 5 Hwy. 400 and Bass Pro Mills Drive

Toronto and Region Conservation Authority (TRCA), 2004. Belt Width Delineation Procedures

Toronto and Region Conservation Authority (TRCA), 2007. Channel Modification Design and Submission Requirements.

Toronto and Region Conservation Authority (TRCA). 2015. Crossings Guideline for Valley and Stream Corridors.

Toronto and Region Conservation Authority (TRCA), 2008. Humber River State of the Watershed Report – Surface Water Quantity.

APPENDIX A

Figures

Stantec

Legend

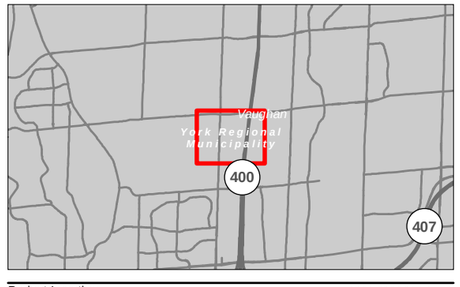
- Flow Direction
- Reach Break
- Black Creek 2020
- Meander Belt
- Contour (1 m interval, MASL)
- 100-Year Erosion Limit
- Study Area
- Project Site

0 100 200 Metres

1:6,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. 3. Orthoimagery © First Base Solutions, 2021. Imagery Date, 2020.
4. Contour data interpolated from the Ontario Lidar Digital Terrain Model (DTM) Land Information Onatario (LIO) dataset, 2021-05-07.



Project Location
City of Vaughan

160540006 REV4
Prepared by JW on 2021-09-24

Client/Project
CITY OF VAUGHAN
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
BASS PRO MILLS DRIVE,
FROM HIGHWAY 400 TO WESTON ROAD

Figure No.
1

Title
Study Area, Meander Belt Width and 100-Year Erosion Limit for Black Creek at Bass Pro Mills Drive

Legend

- Flow Direction
- Existing Watercourse
- Alternative Black Creek Culvert Crossing Location
- Proposed Bass Pro Mills Drive Extension
- Project Site

0 100 200 Metres

1:6,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. 3. Orthoimagery © First Base Solutions, 2021. Imagery Date, 2020..

Project Location
City of Vaughan

160540006 REV4
Prepared by JW on 2021-09-24

Client/Project
CITY OF VAUGHAN
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
BASS PRO MILLS DRIVE,
FROM HIGHWAY 400 TO WESTON ROAD

Figure No.
2

Title
Black Creek Culvert Crossing Location Alternatives

APPENDIX B

Historic Aerial Photographs

Stantec

0 100 200 metres

1:5,000 (At original document size of 11x17)

1954 Aerial Photo
Source: Ontario Department of Lands and Forests (Air Photos of Southern Ontario)

Stantec

0 100 200 metres

1:5,000 (At original document size of 11x17)

1978 Aerial Photo
Source: York Region Open Data

Stantec

0 100 200 metres

1:5,000 (At original document size of 11x17)

1999 Aerial Photo
Source: York Region Open Data

Stantec

0 100 200 metres

1:5,000 (At original document size of 11x17)

2005 Aerial Photo
Source: York Region Open Data

Stantec

0 100 200 metres

1:5,000 (At original document size of 11x17)

2020 Aerial Photo
Source: York Region Open Data

APPENDIX C

Photographic Inventory

Stantec

BLACK CREEK – REACH BC1

Figure 1: Looking downstream at BC1 from culvert at corner of Rutherford Road and Weston Road

Figure 2: Looking upstream within BC1 at entrance of Black Creek from intersection of Rutherford Road and Weston Road

Figure 3: Looking downstream within BC1 where Black Creek moves southeast away from Weston Road.

Figure 4: Looking upstream within BC1 where Black Creek moves southeast away from Weston Road.

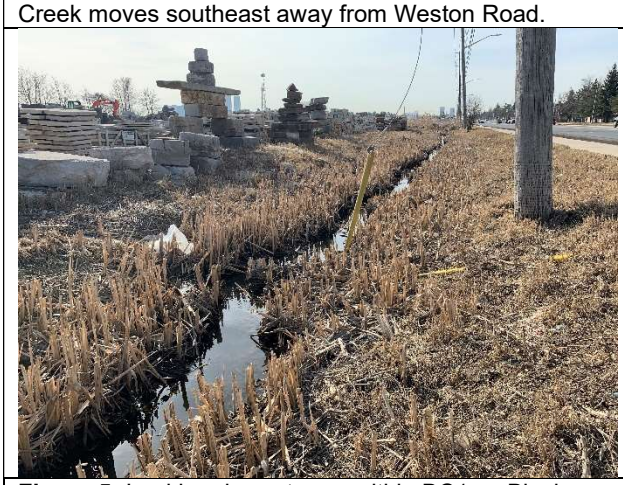


Figure 5: Looking downstream within BC1 as Black Creek travels parallel to Weston Road.

Figure 6: Looking downstream within BC1. Note heavy cattails on banks with small low flow channel.

APPENDIX D

Rapid Geomorphic Assessment

STANTEC CONSULTING LIMITED			RAPID GEOMORPHIC ASSESSMENT		
Watercourse:	Black Creek		Date:	March 23, 2021	
Location:	Rutherford Weston – Vaughan		Reach:	Upstream – BC1	
FORM/ PROCESS	GEOMORPHIC INDICATOR		PRESENT		FACTOR
	NO (2)	DESCRIPTION (3)	NO (4)	YES (5)	VALUE (6)
Evidence of Aggradation (AI)	1	Lobate bar	/		
	2	Coarse material in riffles embedded	/		
	3	Siltation in pools		/	
	4	Medial bars	/		
	5	Accretion on point bars	N/A		
	6	Poor longitudinal sorting of bed materials	/		
	7	Deposition in overbank zone	/		
		SUM OF INDICES			
Evidence of Degradation (DI)	1	Exposed bridge footings	N/A		
	2	Exposed sanitary/storm sewer/pipeline/etc.	/		
	3	Elevated stormsewer outfall(s)	/		
	4	Undermined gabion baskets/concrete aprons/etc.	/		
	5	Scour pools d/s of culverts/stormwater outlets	/		
	6	Cut face on bar forms	/		
	7	Head cutting due to knick point migration		/	
	8	Terrace cut through older bar material	/		
	9	Suspended armour layer visible in bank	/		
	10	Channel worn into undisturbed overburden/bedrock	/		
		SUM OF INDICES			
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/ect.	/		
	2	Occurrence of large organic debris	/		
	3	Exposed tree roots	/		
	4	Basal scour on inside meander bends	/		
	5	Basal scour on both sides of channel through riffle	/		
	6	Gabion baskets/concrete walls/ect. out flanked	/		
	7	Length of basal scour > 50% through subject reach	/		
	8	Exposed length of previously buried pipeline/cable/ect.	/		
	9	Fracture lines along top of bank	/		
	10	Exposed building foundation	/		
		SUM OF INDICES			
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chutes	/		
	2	Single thread to multiple channel	/		
	3	Evolution of pool-riffle form to low bed relief form		/	
	4	Cutoff channel(s)	/		
	5	Formation of island(s)	/		
	6	Thalweg alignment out of phase with meander form	/		
	7	Bar forms poorly formed/reworked/removed	/		
		SUM OF INDICES			
STABILITY INDEX (SI) = (AI + DI + WI + PI) / m					

1/6 = 0.16

1/9 = 0.11

0

1/7 = 0.14

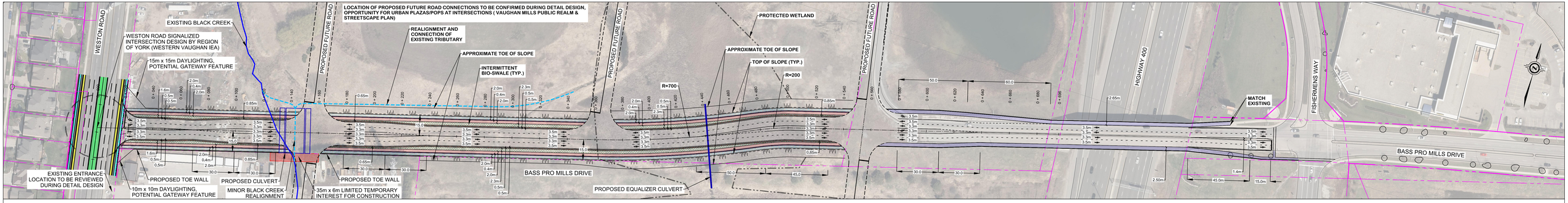
Source: MOE 2003

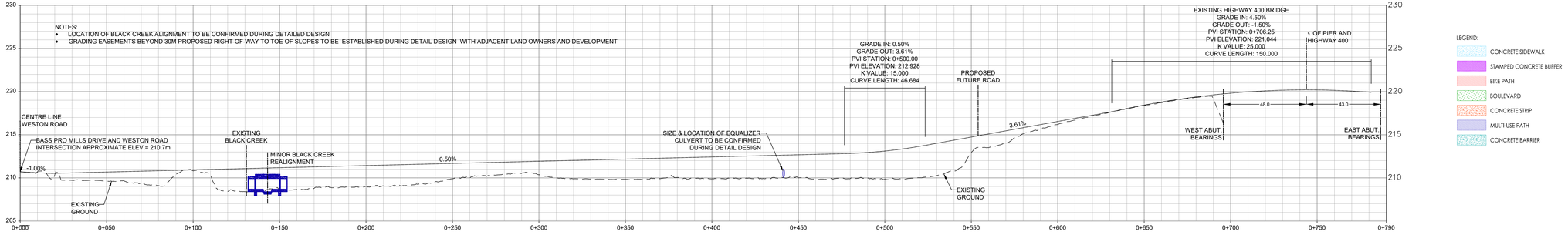
NOTES

SI = 0.10 [Stable]

APPENDIX E

Bass Pro Mills Drive Extension Plan and Profile


LOCATION OF PROPOSED FUTURE ROAD CONNECTIONS TO BE CONFIRMED DURING DETAIL DESIGN, OPPORTUNITY FOR URBAN PLAZAS/POPS AT INTERSECTIONS (VAUGHAN MILLS PUBLIC REALM & STREETSCAPE PLAN)
WESTON ROAD
EXISTING BLACK CREEK
WESTON ROAD SIGNALIZED INTERSECTION DESIGN BY REGION OF YORK (WESTERN VAUGHAN IEA)
15m x 15m DAYLIGHTING, POTENTIAL GATEWAY FEATURE
PROPOSED FUTURE ROAD
REALIGNMENT AND CONNECTION OF EXISTING TRIBUTARY
APPROXIMATE TOE OF SLOPE
INTERMITTENT BIO-SWALE (TYP.)
PROTECTED WETLAND
APPROXIMATE TOE OF SLOPE
TOP OF SLOPE (TYP.)
R=700
R=200
HIGHWAY 400
MATCH EXISTING
FISHERMENS WAY
BASS PRO MILLS DRIVE
EXISTING ENTRANCE LOCATION TO BE REVIEWED DURING DETAIL DESIGN
10m x 10m DAYLIGHTING, POTENTIAL GATEWAY FEATURE
PROPOSED TOE WALL
PROPOSED CULVERT
MINOR BLACK CREEK REALIGNMENT
PROPOSED TOE WALL
35m x 6m LIMITED TEMPORARY INTEREST FOR CONSTRUCTION
BASS PRO MILLS DRIVE
PROPOSED EQUALIZER CULVERT


NOTES:
• LOCATION OF BLACK CREEK ALIGNMENT TO BE CONFIRMED DURING DETAILED DESIGN
• GRADING EASEMENTS BEYOND 30M PROPOSED RIGHT-OF-WAY TO TOE OF SLOPES TO BE ESTABLISHED DURING DETAIL DESIGN WITH ADJACENT LAND OWNERS AND DEVELOPMENT
CENTRE LINE WESTON ROAD
BASS PRO MILLS DRIVE AND WESTON ROAD INTERSECTION APPROXIMATE ELEV.= 210.7m
-1.00%
EXISTING BLACK CREEK
MINOR BLACK CREEK REALIGNMENT
EXISTING GROUND
0.50%
SIZE & LOCATION OF EQUALIZER CULVERT TO BE CONFIRMED DURING DETAIL DESIGN
GRADE IN: 0.50%
GRADE OUT: 3.61%
PVI STATION: 0+500.00
PVI ELEVATION: 212.928
K VALUE: 15.000
CURVE LENGTH: 46.684
PROPOSED FUTURE ROAD
3.61%
EXISTING GROUND
EXISTING HIGHWAY 400 BRIDGE
GRADE IN: 4.50%
GRADE OUT: -1.50%
PVI STATION: 0+706.25
PVI ELEVATION: 221.044
K VALUE: 25.000
CURVE LENGTH: 150.000
℄ OF PIER AND HIGHWAY 400
WEST ABUT. BEARINGS
EAST ABUT. BEARINGS
48.0
43.0
LEGEND:
CONCRETE SIDEWALK
STAMPED CONCRETE BUFFER
BIKE PATH
BOULEVARD
CONCRETE STRIP
MULTI-USE PATH
CONCRETE BARRIER