TATHAM ENGINEERING

Enhancing our communities

Edward/George Street Residential Development

FLOODPLAIN HAZARD STUDY

2408969 Ontario Inc.

File 418426 | May 17, 2019

Document Control

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Date:		
May 17, 2019		

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Issue	Date	Description
1	May 17, 2019	Final report

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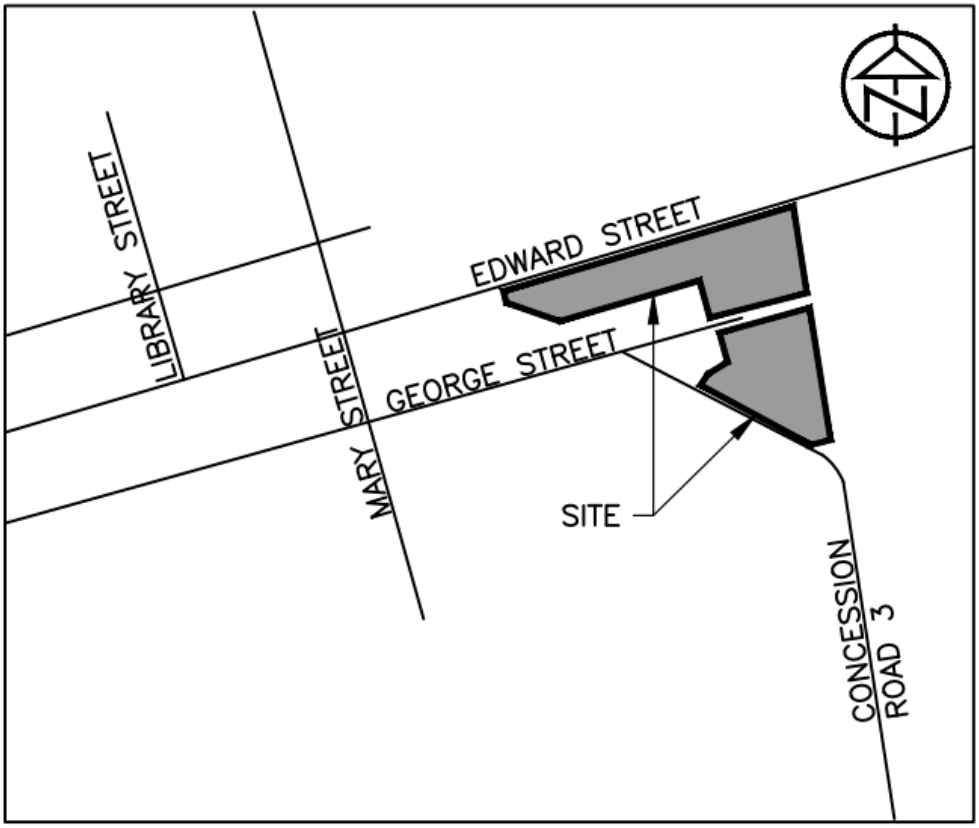
1 Introduction

Tatham Engineering Limited (Tatham) has been retained by 2408969 Ontario Inc. to complete a floodplain hazard study in support of a proposed residential development at 101 Edward Street and 111 George Street, located in the village of Creemore, within the Township of Clearview. The purpose of this study is to confirm the limits of the existing 100-year and regional floodplain in the vicinity of the site in order to establish the limit of developable area on the site in support of a Zoning By-law Amendment (ZBA) and Draft Plan of Subdivision application for the property.

1.1 SITE DESCRIPTION

The site is bounded by Edward Street East to the north, existing residential land to the west, undeveloped land to the east, and Concession Road 3 to the south. The site consists of two properties. The north parcel (101 Edward Street) is legally described as Part Lots 35 & 36 S/S of Edward Street, Plan 315 Township of Clearview, County of Simcoe. The south parcel (111 George Street) is legally described as Part Lot 43 S/S of George Street, Plan 138 & 315 Nottawasaga, Part 22 S/S of George Street Plan 138 & 315 Nottawasaga Township of Clearview, County of Simcoe. The location of the site is illustrated on the Site Location Plan (Figure 1) below.

Figure 1: Site Location Plan



The site consists of approximately 4.71 ha of mainly undeveloped land. The majority of the land cover is meadows with small pockets of woodland. The site slopes from northwest to southeast at an approximate slope of 1%. Detailed topographic survey of both properties have been completed by Martin W. Knisley, Ontario Land Surveyor

The site is located within the Nottawasaga Valley Conservation Authority (NVCA) watershed. Mad River, which is located approximately 475 m southwest of the subject property, flows eastward towards the Minesing wetlands where it ultimately discharges into the Nottawasaga River. Due to the site's proximity to Mad River and its associated floodplain, a significant portion of the site is located within NVCA's regulated area.

1.2 OBJECTIVES

The primary objective of this study is to determine the existing condition 100-year and regional floodplain limits in the vicinity of the site. The floodplain limits will be used to establish the limit of developable area on the site and determine flood-proofing elevations for future dwellings.

1.3 GUIDELINES & BACKGROUND DOCUMENTS

This analysis was completed recognizing applicable provincial and Conservation Authority guidelines on hydrologic and hydraulic analysis and floodplain design standards for watercourses as follows:

- Ministry of Natural Resources and Forestry (MNRF) Technical Guide - River and Stream Systems: Flooding Hazard Limit (2002);
- MacLaren Plansearch Watershed Hydrology Study for Nottawasaga, Pretty and Batteaux Rivers Black Ash, Silver and Sturgeon Creeks (1988);
- The Nottawasaga Valley Conservation Authority (NVCA) Stormwater Technical Guide (2013);
- NVCA Natural Hazards Technical Guide (December 2013);
- NVCA Mad River Flood Risk Maps; and
- The Ministry of the Environment, Conservation & Parks (MECP) Stormwater Management Planning and Design Manual (2003).

This study is subject to the review of the NVCA and the Township of Clearview.

1.4 PROPOSED DEVELOPMENT

The proposed development plan includes single family residential dwellings, medium density townhouse blocks, a stormwater management (SWM) block and various servicing blocks. Access to the development will be provided from Edward Street East and George Street, respectively.

Four residential lots are also proposed on Concession Road 3. The current development concept is shown on Figure 2, appended.

2 Existing Conditions

2.1 HYDROLOGY

This study relies on peak flows as described in the MacLaren Plansearch Watershed Hydrology Study (May 1988), which is the NVCA approved watershed hydrology model for the area. The flows documented in MacLaren Study for the nodes upstream and downstream of the site are consistent with the 100-year and regional flows referenced in the Mad River Flood Risk Maps, which are provided in Appendix A. Based on the MNRF Ontario Flow Assessment Tool (OFAT), a total drainage area of 242 km^2 contributes to the Mad River at the 6/7 Sideroad and Concession Road 3 intersection. This is generally consistent with the drainage area documented in the MacLaren Study, as the closest upstream node to the site (confluence of Noisy River and Mad River) has a drainage area of 214.4 km^2. The flow rates provided in the MacLaren Study and Flood Risk Map peak flows are also consistent with the flow file in the base HEC-RAS model used for this assessment, which is further described below. The applied peak flows are summarized in Table 1, below.

Table 1: Peak Flow Summary

RETURN PERIOD	PEAK FLOW (m^3/s)		
	CROSS SECTION 44525	CROSS SECTION 44462	CROSS SECTION 42690
100-year[1]	140.30	140.30	140.30
Regional	375.80	373.60	371.10

[1] 100-year flows are conservative based on total 100-year flow from MacLaren Study (node 1307)

It is noted the flows decrease throughout this reach of Mad River. This is consistent with the MacLaren study and is assumed to account for spill flows leaving the system.

2.2 EXISTING CONDITION HYDRAULIC ANALYSIS

The Mad River floodplain is governed by the Flood Risk Maps prepared as part of the Flood Damage Reduction Program (FDRP) model. As such, the FDRP HEC-RAS model has been used as a starting point for the hydraulic analysis. In order to confirm the FDRP model is an appropriate starting point, we compared the cross-section geometry and elevations for cross sections located immediately upstream, bisecting, and downstream of the subject property (cross sections 43550, 43450, 43280, 43200, and 43050) against the Tatham existing conditions surface. The Tatham surface has been constructed using a combination of detailed topographic survey information for the subject property and adjacent area, with the remainder of the mapping constructed using 2012 NVCA DTM. Figure 1, appended, depicts the limits of the various

surfaces used to create the combined Tatham surface. The NVCA DTM elevations and the detailed topographic information were generally consistent at the boundary of the surveyed area, and, therefore, no vertical adjustments to the NVCA DTM have been made. It is noted the locations of the FDRP cross sections are approximated based on the available Flood Risk Maps (Maps 4, 5, and 11) which are included in Appendix A), as the FDRP HEC-RAS model is not georeferenced. Recognizing the locations of the cross sections are not exact, the Tatham surface was generally consistent with the FDRP surface. A comparison of the four cross sections is provided in Appendix B. In order to increase the accuracy of the hydraulic model, and better model the existing road elevations on George Street and Concession Road 3, cross sections 43450, 43280, 43200 and 43050 have been updated to reflect the Tatham surface. Five additional cross sections have been added to the model (cross sections 43400, 43375, 43350, 43325, and 43300) using geometry data from the Tatham surface.

The additional cross sections have been used to create a lateral weir, which is modelled to represent the existing top of berm located on the north side of Concession Road 3. As documented below, and as shown on Drawings FLD-1A and FLD-1B, this berm generally contains the regional floodplain within the Concession Road 3 ditch. However, there is a 40 m length of the berm located between cross sections 43400 and 43325 which is overtopped during the regional event. The overtopping of the berm in this location is considered to be a spill, as floodwater exits the main Mad River floodplain and spills through the subject property eventually rejoining the Mad River further downstream. The lateral weir has been accurately modelled based on detailed topographic information, and results in a regional spill flow of 0.47 m^3/s which overtops the existing berm. This is further discussed in Section 2.2.1.

All cross sections corresponding to the existing conditions HEC-RAS model are depicted on the Pre-Development Floodplain Mapping (Drawing FM-1A). It should be noted that we have added levee stations to the appropriate cross sections within HECRAS model to increase the accuracy of the model. We have also maintained the manning's 'n' values as per the original FDRP model, however, we have reviewed the values and find them consistent with existing land cover.

The updated HEC-RAS model results in slightly lower regional floodplain elevations in the vicinity of the site. A summary of the floodplain elevations are provided in Table 2. Detailed model results are provided in Appendix C.

Table 2: Flood Elevation Summary

FDRP HEC-RAS CROSS SECTION ID (TATHAM HEC-RAS CROSS SECTION ID)	100-YEAR FLOOD ELEVATION (m)		REGIONAL FLOOD ELEVATION (m)	
	FDRP	TATHAM	FDRP	TATHAM
43550 (71)	254.75	254.76	255.25	255.25
43450 (68)	253.87	253.63	254.35	253.96
Start of Lateral Weir				
43400 (67.4025)[1]	N/A	253.33	N/A	253.69
43375 (66.953)[1]	N/A	253.26	N/A	253.58
43350 (66.314)[1]	N/A	253.09	N/A	253.37
43325 (66.082)[1]	N/A	253.02	N/A	253.23
43300 (65.812)[1]	N/A	252.87	N/A	253.20
43280 (65)	252.68	252.58	253.07	252.88
End of Lateral Weir				
43260 (63.52)	N/A	252.14	N/A	252.50
43200 (63)	252.04	251.89	252.38	252.24
43050 (60)	251.00	250.57	251.28	251.01
42920 (59)	250.46	250.47	250.86	250.86

[1] Additional Tatham cross sections, not included in the original FDRP model

2.2.1 Interpretation of Results

The results of the hydraulic analysis demonstrate the subject property is not located within the limits of the 100-year or regional floodplain, as depicted on Drawings FLD-1A and FLD-1B. As mentioned, there is a minor spill of 0.47 m^3/s under the regional event, which overtops an existing berm and is conveyed southeast through the subject property, likely connecting back into the Mad River system further downstream. It is noted the spill flow of 0.47 m^3/s is relatively minor in comparison to the regional flows experienced by Mad River. As the subject site is not located within the floodplain, considerations for maintaining floodplain storage is not required. Under the proposed scenario, the spill flows will continue to be routed through the subject property. Additional information regarding the proposed development scenario is provided below.

3 Proposed Development

As mentioned above, the proposed development is not located within the limits of the 100-year or regional floodplain. However, the development must continue to safely convey the regional spill flow through the site. Under proposed conditions the spill flow will be routed through the SWM block (behind the proposed lots fronting on Concession Road 3) and will either discharge back into the Concession Road 3 ditch. It should be noted that under existing conditions Concession Road 3 and the associated roadside ditch (which contains the majority of the floodplain in this area) is not centered within the rights-of-way (ROW) and encroaches on the subject property. It is assumed that in support of the proposed development, Concession Road 3 will be reconstructed within the ROW, and the existing bank elevations will be maintained to ensure there is no additional spill into the subject lands. The detailed design of these works will be completed at a future date. It is assumed the detailed design of these works will maintain existing flood elevations and storage volumes. It is also noted that during the detailed design of these works, it may be possible to eliminate the spill through the subject property (provided there are no negative impacts to upstream or downstream landowners), and therefore the requirement of routing spill flow through the development will be eliminated.

The proposed development concept is shown on Figure 1, appended. Tatham is currently advancing a Functional Servicing and Preliminary Stormwater Management report for the proposed development in support of the ZBA and Draft Plan of Subdivision application for the site. This report will be provided to NVCA for review and approval and will provide additional detail regarding the proposed grading and SWM plan, including additional design information demonstrating the conveyance of the spill flows through the property. Floodproofing elevations for the lots along Concession Road 3 will also be provided, as well as confirmation that the SWM pond can be designed to function adequately with respect to the flood elevations.

4 Conclusion

This study has established existing conditions floodplain elevations in the vicinity of the subject site, resulting in detailed floodplain mapping for the subject area. The hydraulic model and floodplain mapping demonstrate the subject properties (101 Edward Street and 111 George Street) are located outside of the existing regional floodplain. The 111 George Street property does convey a minor spill through the site under existing conditions, which will be accommodated under the proposed conditions. As such, the limit of developable area on the site is not restricted by the Mad River floodplain.

We trust this study provides sufficient information to support the proposed development at 101 Edward Street and 111 George Street.

If you have any questions or concerns, please do not hesitate to contact us.

Appendix A: Background Information

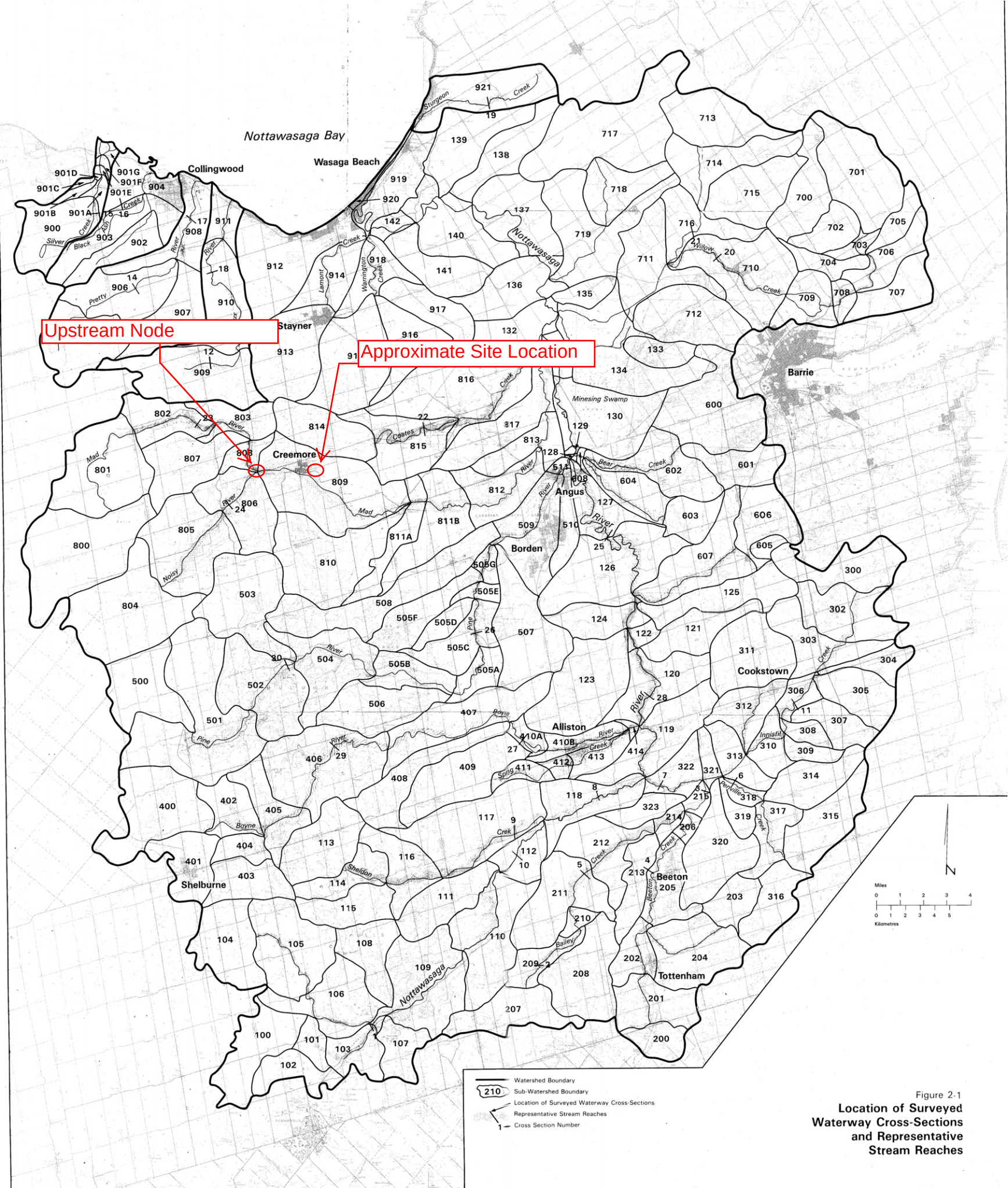


Figure 2-1
Location of Surveyed Waterway Cross-Sections and Representative Stream Reaches

APPENDIX G

DESIGN FLOWS: NOTTAWASAGA BASIN

REF. NO.	DESCRIPTION	TRIBUTARY AREA (KM2)	DEVELOPMENT CONDITION	DISCHARGE (M3/S) 5-YR	10-YR	20-YR	50-YR	100-YR	REGIONAL STORM
MAD RIVER									
800	Outlet of catchment 800	42.8	Present	7.01	8.60	10.2	12.2	13.9	47.6
			Future	7.01	8.60	10.2	12.2	13.9	47.6
670	Outlet of catchment 801	74.5	Present	15.6	19.2	22.7	27.3	31.1	92.6
			Future	15.6	19.2	22.7	27.3	31.1	92.6
680	Outlet of catchment 802	88.7	Present	20.4	25.0	29.6	35.6	40.4	116.3
			Future	20.4	25.0	29.6	35.6	40.4	116.3
690	Outlet of catchment 803	99.7	Present	25.1	30.8	36.5	43.9	49.9	135.5
			Future	25.1	30.8	36.5	43.9	49.9	135.5
807	Outlet of catchment 807	19.9	Present	14.3	17.6	20.8	25.0	28.5	86.2
			Future	14.3	17.6	20.8	25.0	28.5	86.2
1303	Confluence of catchments 803 and 807	119.6	Present	35.6	43.7	51.8	62.2	70.8	186.4
			Future	35.6	43.7	51.8	62.2	70.8	186.4
700	Outlet of catchment 808	124.3	Present	38.7	47.5	56.2	67.6	76.9	199.5
			Future	38.7	47.5	56.2	67.6	76.9	199.5
804	Outlet of catchment 804	38.61	Present	14.1	17.3	20.4	24.6	27.9	96.5
			Future	14.1	17.3	20.4	24.6	27.9	96.5
710	Outlet of catchment 805	70.0	Present	22.8	28.0	33.2	39.9	45.4	158.0
			Future	22.8	28.0	33.2	39.9	45.4	158.0
720	Outlet of catchment 806	90.1	Present	31.9	39.2	46.4	55.8	63.4	202.5
			Future	31.9	39.2	46.4	55.8	63.4	202.5
1307	Confluence of catchments 806 and 808	214.4	Present	70.6	86.6	102.7	123.4	140.3	378.7
			Future	70.6	86.6	102.7	123.4	140.3	378.7
730	Outlet of catchment 809	256.1	Present	62.7	76.9	91.1	109.5	124.6	365.6
			Future	62.7	76.9	91.1	109.5	124.6	365.6
810	Outlet of catchment 810	35.3	Present	17.1	21.0	24.8	29.9	33.9	116.3
			Future	17.1	21.0	24.8	29.9	33.9	116.3
1309	Confluence of catchments 810 and 809	291.4	Present	72.5	88.9	105.3	126.6	144.0	425.2
			Future	72.5	88.9	105.3	126.6	144.0	425.2
740	Outlet of catchment 811A WSC gauge	303.0	Present	75.0	92.0	109.0	131.0	149.0	440.9
			Future	75.0	92.0	109.0	131.0	149.0	440.9

Environment Canada — Inland Waters Directorate

Environnement Canada — Direction Générales des Eaux Intérieures

Ministry of Natural Resources
Ministère des richesses naturelles
Ontario

Sheet

02 17 5710 49080

SCALE 1:2000 ÉCHELLE

METRES 40 0 100 200 MÈTRES

FEET 100 0 100 200 300 400 500 600 700 800 PIEDS

CONTOUR INTERVAL 1.0 METRE WITH A 0.5 METRE AUXILIARY. NORTH AMERICAN DATUM 1927.

ÉQUIDISTANCE DES COURBES DE NIVEAU 1.0 MÈTRE AVEC COURBE AUXILIAIRE DE 0.5 MÈTRE. SYSTÈME DE RÉFÉRENCE GÉODÉSIQUE NORD-AMÉRICAIN 1927.

NOTTAWASAGA VALLEY CONSERVATION AUTHORITY

TOWNSHIP OF NOTTAWASAGA

VILLAGE OF CREEMORE

FLOOD RISK MAP

MAD RIVER

CARTE DU RISQUE D'INONDATION

LEGEND LÉGENDE

Aerial Cableway	Téléphérique
Boundary	Frontière
International	Internationale
Interprovincial	de province
District Township Indian Reserve	Limite de district, de canton, de reserve indienne
Approximate	Approximatif
Lot, Concession	Lot, Concession
Approximate	Approximatif
Annotation	Annotation
Park Boundary	Limite de parc
Bridge	Pont
Road, Railroad	de route, de chemain de fer
Foot Bridge	Passerelle
Building	Bâtiment
Chimney	Cheminée
Cliff, Pit, Pile	Falaise, Gravière ou Sablière, Pile
Contours	
Intermediate	Courbes de niveau intermédiaires
Index	Maîtresses
Auxiliary	Auxiliaires
Indefinite	Approximatives
Depression	Courbes de cuvettes
Control Points	Points de contrôle
Horizontal	Horizontal
Vertical	Vertical
Culvert	Ponceau
Dam	Barrage
Ditch	Fossé
Dyke	Digue
Falls Double line river	Chutes Rivière à ligne double
Fence, Hedge, Wall	Clôture, Haie, Mur
Feature Outline (construction features, etc.)	Limites (en construction, etc.)
Flooded Land	Région Inondée
Lake, Pond	Lac, Bassin
Lock	Écluses
Marsh or Swamp	Marais ou Marécage
Mast	Mât
Pipeline (above ground)	Pipe-line (au dessus de la terre)
Railroad	Chemin de fer
Single Track	Voie Unique
Abandoned	Désaffecté
Turnable	Plaque Tournante
Rapids	Rapides
Double line river with multiple rapids	Rivière à ligne double avec plusieurs chutes
Double line river with multiple rapids	Rivière à ligne double avec plusieurs chutes
Reservoir	Réservoir
River, Stream, Canal	Fleuve, Rivière, Canal
Approximate Seasonal	Approximatif Saisonnier
Direction of Flow	Direction du courant
Road	Route
Hwy, County, Township	Chemin de Comté Canton
Access (road of doubtful maintenance or significant driveway)	Chemin d'acces (condition inconnu ou entrée privée)
Trail, Bush Road (portage, alley)	Sentier, Chemin de Bois (portage, ruelle)
Rock Significant	Roche Significatif
Shoal	Banc
Spot Elevation (lake elevations)	Point Coté (élévation du plan d'eau)
Tower	Tour
Transmission Line	Ligne de transport d'énergie
Poles	Pôteau
Pylon	Pylône
Tunnel	Tunnel
Utility Pole	Pôteau
Wharf, Dock, Pier	Quai, Bassin, Jetée
Wooded Area	Région Boisée
Line of trees	Ligne d'arbres
Fill Line	Limite de remplissage
Regulatory Floodline	La Crue Régulatrice
100 Year Floodline	100 Années Limit de la crue des eaux
Cross section number	Le numéro de la coupe tranversale
Regulatory flood elevation	Niveau de la crue régulatrice
100 Year flood elevation	Niveau de la crue de 100 ans

SHEET INDEX TABLEAU D'ASSEMBLAGE

GENERAL INFORMATION

Vertical datum:	mean sea level
Horizontal datum:	North American (1927)
Map projection:	Transverse Mercator
Central Meridian	81° W
Grid spacing	100 metres
Aerial Photography:	May, 1987

RENSEIGNEMENTS GENERAUX

Niveau de reference:	niveau moyen de la mer
Systeme geodesique:	Nord Americain unifie (1927)
Projection:	transverse de Mercator
Meridien central	81° W
Quadrillage de:	100 metres
Photographies aeriennes:	Mai, 1987

J.D. BARNES LIMITED, Surveyors
Cadastral · Geodetic · Photogrammetric · Engineering Surveys
435 McNicoll Avenue, Willowdale (Toronto) Ontario M2H 3M7
Date: Jan 1/89

REGISTERED PROFESSIONAL ENGINEER
D. M. LEVER
PROVINCE OF ONTARIO

Cumming Cockburn Limited
Consulting Engineers and Planners
Hull, Ottawa, Brockville, Kingston, Toronto, Waterloo, London

Date: _____

REGISTERED PROFESSIONAL ENGINEER
B.R. PLAZEK
PROVINCE OF ONTARIO

Date	Amendment/Revision

COMPILATION NOTE

Production techniques used in the preparation of this map are designed for Class "A" standards.

This map was prepared under the auspices of the Canada-Ontario Flood Damage Reduction Agreement signed MARCH 31, 1978 and amended NOVEMBER 14, 1985.

PHOTOGRAMMETRIE

Les normes de production de cette carte se conforment aux standards de premiere classe.

Cette carte a ete preparee dans le cadre de l'accord Canada - Ontario de la reduction des dommages dus inondations conclu le 31 MARS, 1978 et modifiée le 14 NOVEMBRE 1985.

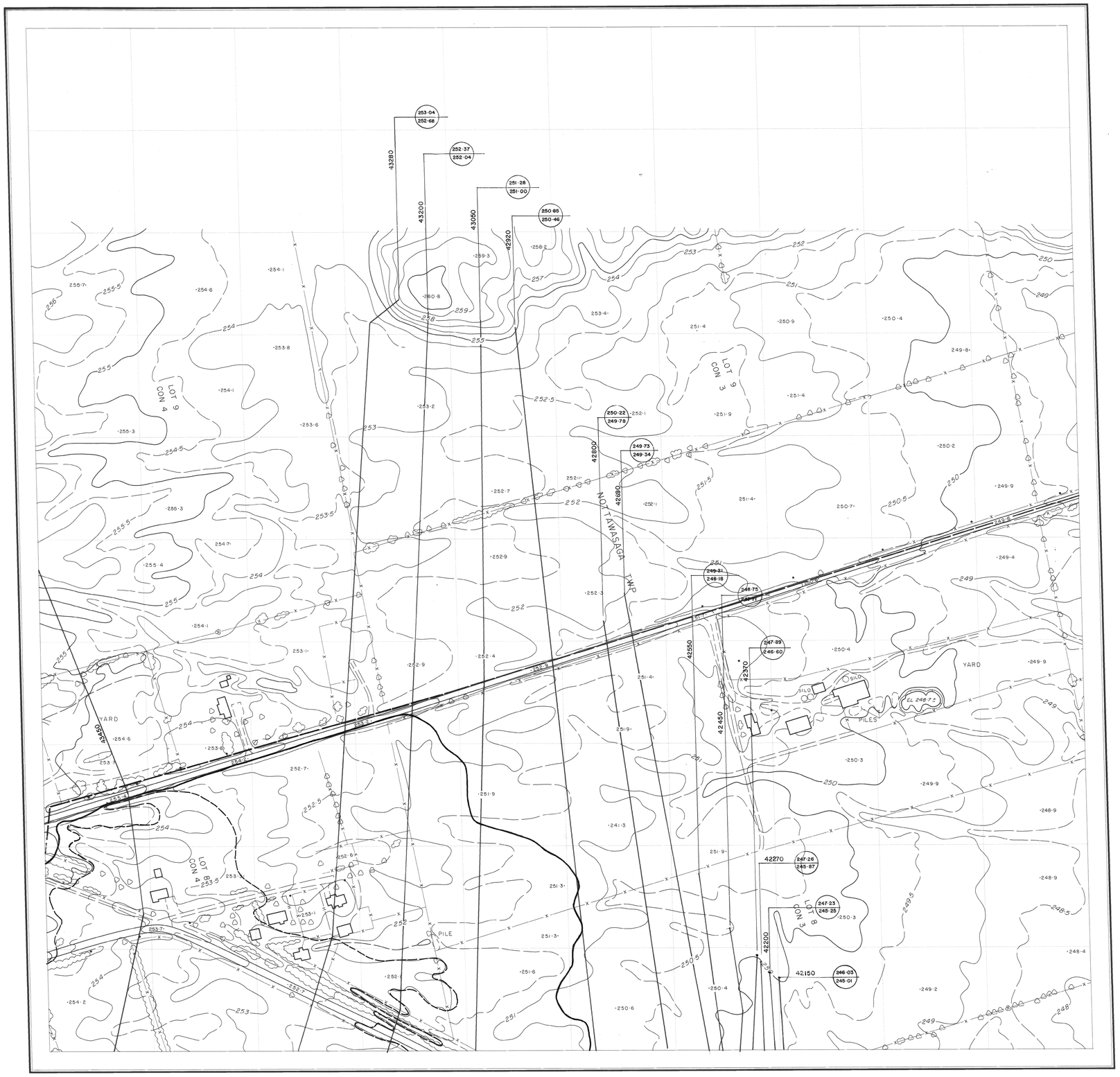
ONTARIO REGULATION NO. _____
NO. DU RÉGLEMENT DE L'ONTARIO

SCHEDULE No _____
CÉDULE No

MAP NO. _____
CARTE NO.

DATE _____

SHEET NO. 4 **of** 18



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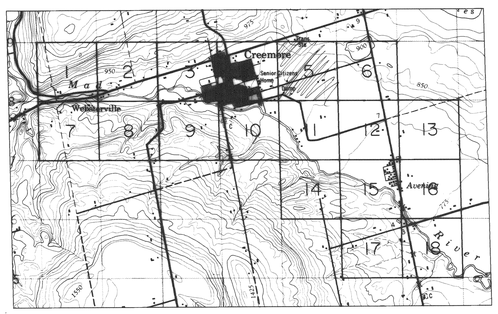
Cross section number 123	Le numéro de la coupe tranversale
Regulatory flood elevation 114·72	Niveau de la crue régulatrice
100 Year flood elevation 112·91	Niveau de la crue de 100 ans

SHEET INDEX TABLEAU D'ASSEMBLAGE



GENERAL INFORMATION

Vertical datum:	mean sea level
Horizontal datum:	North American (1927)
Map projection:	Transverse Mercator
Central Meridian	81° W
Grid spacing	100 metres
Aerial Photography:	May, 1987

RENSEIGNEMENTS GENERAUX

Niveau de reference:	niveau moyen de la mer
Systeme geodesique:	Nord Americain unifie (1927)
Projection:	transverse de Mercator
Meridien central	81° W
Quadrillage de:	100 metres
Photographies aeriennes:	Mai, 1987

J.D. BARNES LIMITED, Surveyors
Cadastral · Geodetic · Photogrammetric · Engineering Surveys
435 McNicoll Avenue, Willowdale (Toronto) Ontario M2H 3M7
Date: Jan 5/89

REGISTERED PROFESSIONAL ENGINEER
D. M. LEVER
PROVINCE OF ONTARIO

Cumming Cockburn Limited
Consulting Engineers and Planners
Hull, Ottawa, Brockville, Kingston, Toronto, Waterloo, London
Date: _____

REGISTERED PROFESSIONAL ENGINEER
B.P. PLAZEK
PROVINCE OF ONTARIO

COMPILATION NOTE

Production techniques used in the preparation of this map are designed for Class "A" standards.

This map was prepared under the auspices of the Canada-Ontario Flood Damage Reduction Agreement signed MARCH 31, 1978 and amended NOVEMBER 14, 1985.

PHOTOGRAMMETRIE

Les normes de production de cette carte se conforment aux standards de premiere classe.

Cette carte a ete preparee dans le cadre de l'accord Canada - Ontario de la reduction des dommages dus inondations conclu le 31 MARS, 1978 et modifiée le 14 NOVEMBRE 1985.

ONTARIO REGULATION NO. _____
NO. DU RÉGLEMENT DE L'ONTARIO

SCHEDULE No _____
CÉDULE No

MAP NO. _____
CARTE NO.

DATE _____

SHEET NO. 5 **of** 18

Environment Canada — Inland Waters Directorate
Environnement Canada — Direction Générales des Eaux Intérieures

Ontario — Ministry of Natural Resources
Ministère des richesses naturelles

Sheet

02 17 5720 49080

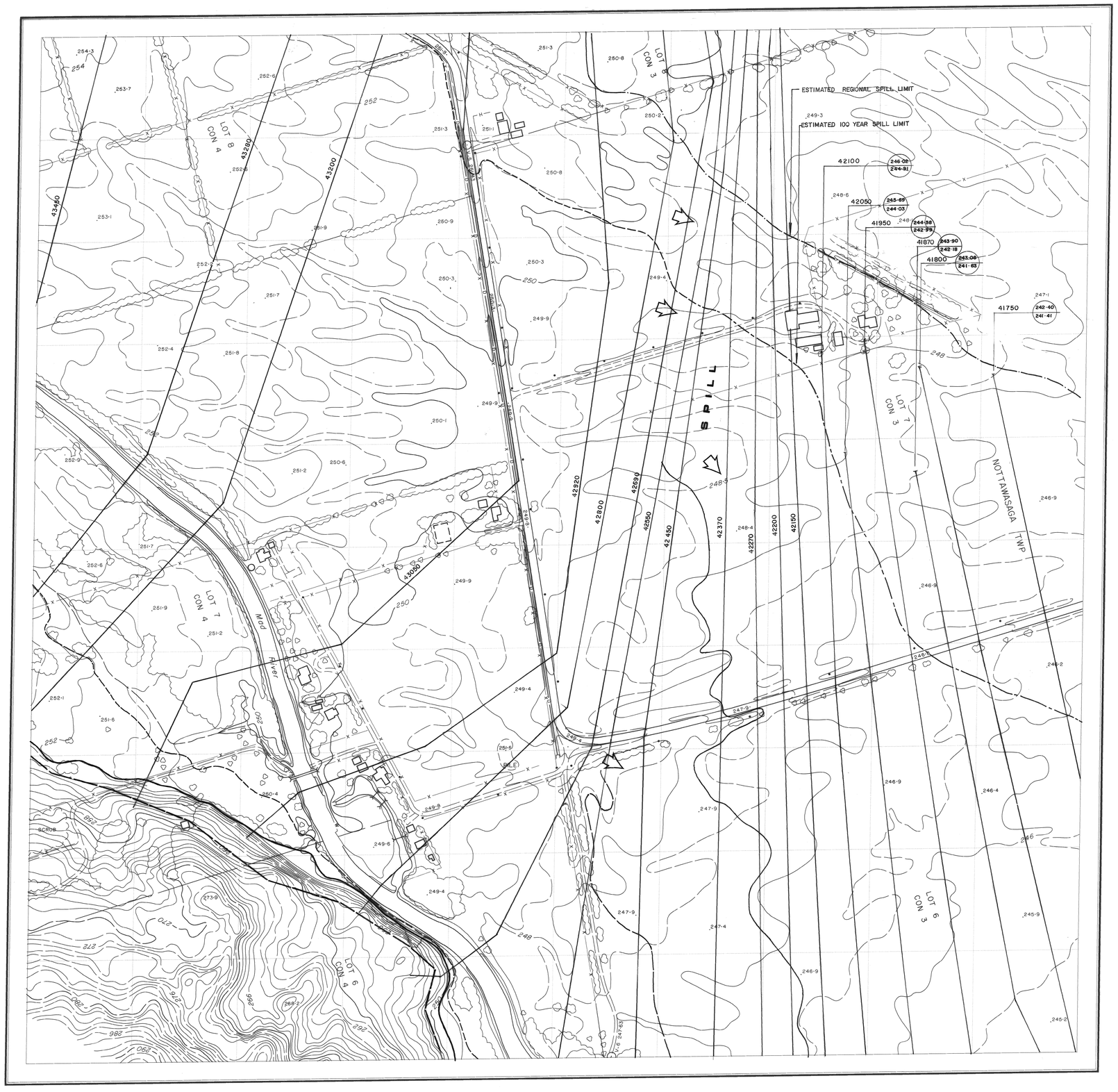
SCALE 1:2000 ÉCHELLE

METRES 40 0 100 200 METRES
FEET 100 0 100 200 300 400 500 600 700 800 PIEDS

CONTOUR INTERVAL 1.0 METRE WITH A 0.5 METRE AUXILIARY. NORTH AMERICAN DATUM 1927.

ÉQUIDISTANCE DES COURBES DE NIVEAU 1.0 MÈTRE AVEC COURBE AUXILIAIRE DE 0.5 MÈTRE. SYSTÈME DE RÉFÉRENCE GÉODÉSIQUE NORD-AMÉRICAIN 1927.

Date	Amendment/Revision



NOTTAWASAGA VALLEY CONSERVATION AUTHORITY

TOWNSHIP OF NOTTAWASAGA

VILLAGE OF CREEMORE

FLOOD RISK MAP

MAD RIVER

CARTE DU RISQUE D'INONDATION

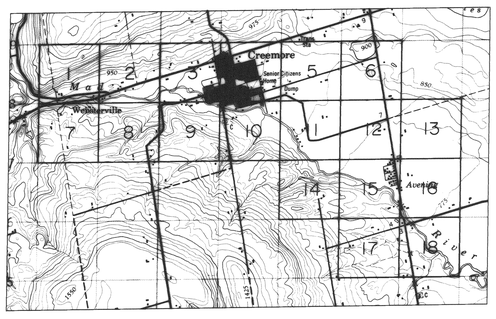
LEGEND LÉGENDE

Aerial Cableway	Téléphérique
Boundary	Frontière
International	Internationale
Interprovincial	de province
District Township Indian Reserve	Limite de district, de canton, de reserve indienne
Approximate	Approximatif
Lot, Concession	Lot, Concession
Approximate	Approximatif
Annotation (LOT CON)	Annotation
Park Boundary	Limite de parc
Bridge	Pont
Road, Railroad	de route, de chemain de fer
Foot Bridge	Passerelle
Building	Bâtiment
Chimney	Cheminée
Cliff, Pit, Pile	Falaise, Gravière ou Sablière, Pile
Contours	Courbes de niveau
Intermediate (69)	Intermédiaires
Index (70)	Maîtresses
Auxiliary	Auxiliaires
Indefinite	Approximatives
Depression	Courbes de cuvettes
Control Points	Points de contrôle
Horizontal (010774051)	Horizontal
Vertical (100·02)	Vertical
Culvert	Ponceau

Dam	Barrage
Ditch	Fossé
Dyke	Digue
Falls Double line river	Chutes Rivière à signe double
Fence, Hedge, Wall	Clôture, Haie, Mur
Feature Outline (construction features, etc.)	Limites (en construction, etc.)
Flooded Land	Région inondée
Lake, Pond	Lac, Bassin
Lock	Écluses
Marsh or Swamp	Marais ou Marécage
Mast	Mât
Pipeline (above ground)	Pipe-line (au-dessus de la terre)
Railroad	Chemin de fer
Single Track	Voie Unique
Abandoned	Désaffecté
Turnable	Plaque Tournante
Rapids	Rapides
Double line river with multiple rapids	Rivière à ligne double avec plusieurs chutes
Double line river with multiple rapids	Rivière à ligne double avec plusieurs chutes
Reservoir	Réservoir
River, Stream, Canal	Fleuve, Rivière, Canal
Approximate Seasonal	Approximatif Saisonnier
Direction of Flow	Direction du courant

Road	Route
Hwy, County, Township	Chemin de Comté Canton
Access (road of doubtful maintenance or significant driveway)	Chemin d'acces (condition inconnu ou entrée privée)
Trail, Bush Road (portage, ruelle)	Sentier, Chemin de Bois (portage, ruelle)
Rock Significant	Roche Significatif
Shoal	Banc
Spot Élévation (lake elevations) (104·7)	Point Coté (élévation du plan d'eau)
Tower	Tour
Transmission Line	Ligne de transport d'énergie
Poles	Pôteau
Pylon	Pylône
Tunnel	Tunnel
Utility Pole	Pôteau
Wharf, Dock, Pier	Quai, Bassin, Jetée
Wooded Area	Région Boisée
Line of trees	Ligne d'arbres
Fill Line	Limite de remplissage
Regulatory Floodline	La Crue Régulatrice
100 Year Floodline	100 Années Limit de la crue des eaux
Cross section number (123)	Le numéro de la coupe tranversale
Regulatory flood elevation (114·72)	Niveau de la crue régulatrice
100 Year flood elevation (112·91)	Niveau de la crue de 100 ans

SHEET INDEX TABLEAU D'ASSEMBLAGE



GENERAL INFORMATION

Vertical datum:	mean sea level
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J.D. BARNES LIMITED, Surveyors
Cadastral - Geodetic - Photogrammetric - Engineering Surveys
435 McNicoll Avenue, Willowdale (Toronto) Ontario M2H 3M7
Date: Jan 5/89

REGISTERED PROFESSIONAL ENGINEER D. M. LEVER PROVINCE OF ONTARIO

Cumming Cockburn Limited
Consulting Engineers and Planners
Hull, Ottawa, Brockville, Kingston, Toronto, Waterloo, London
Date: _____

REGISTERED PROFESSIONAL ENGINEER B.R. PLAZEK PROVINCE OF ONTARIO

COMPILATION NOTE

Production techniques used in the preparation of this map are designed for Class "A" standards.

This map was prepared under the auspices of the Canada-Ontario Flood Damage Reduction Agreement signed MARCH 31, 1978 and amended NOVEMBER 14, 1985.

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Date	Amendment/Revision

ONTARIO REGULATION NO. _____
NO. DU RÉGLEMENT DE L'ONTARIO

SCHEDULE No _____
CÉDULE No

MAP NO. _____
CARTE NO.

DATE _____

SHEET NO. 11 **of** 18

Environment Canada — Inland Waters Directorate
Environnement Canada — Direction Générales des Eaux Intérieures

Ontario — Ministry of Natural Resources
Ministère des richesses naturelles

Sheet

02 17 5720 49070

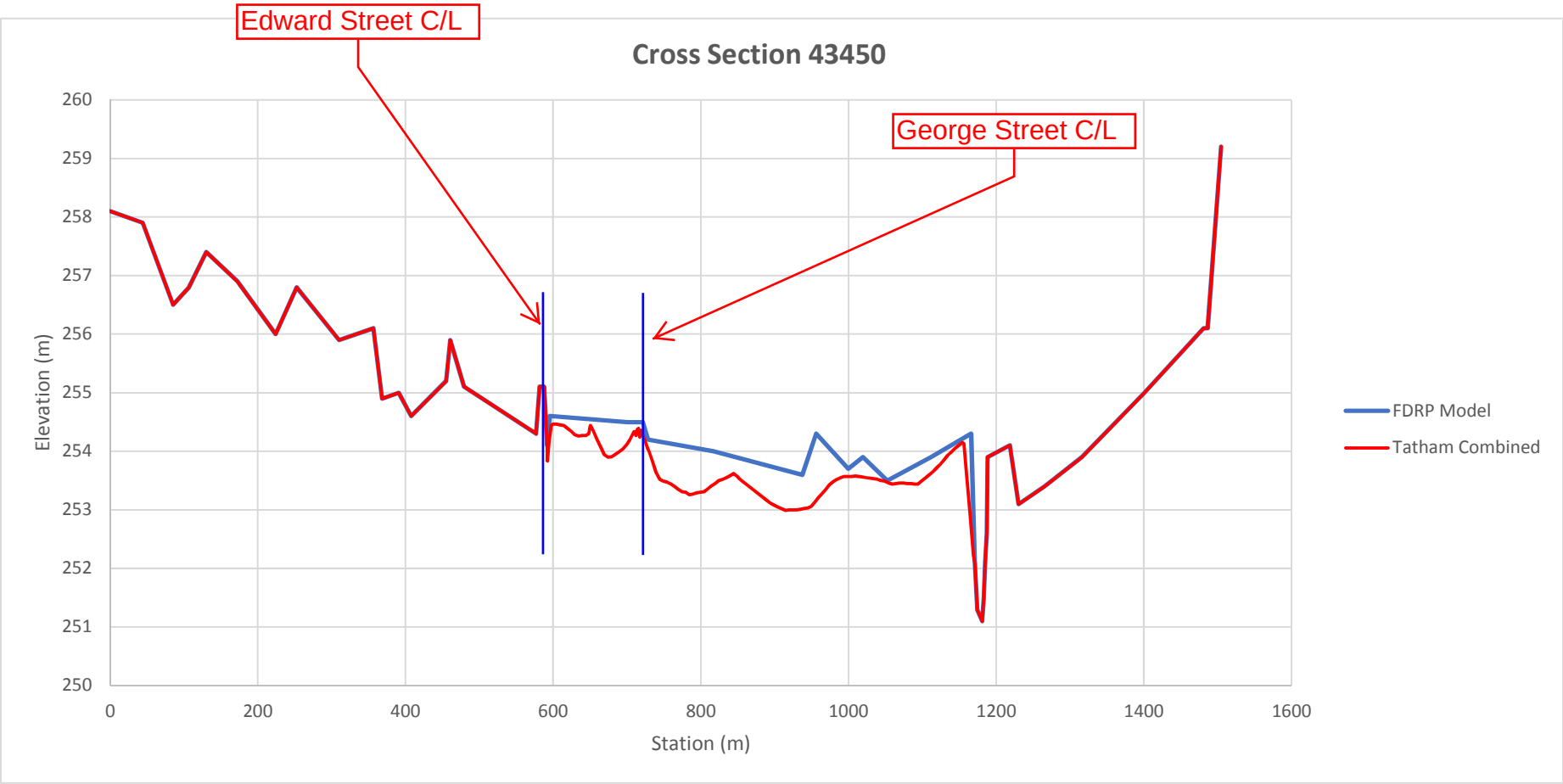
SCALE 1:2000 ÉCHELLE

METRES 40 0 100 200 METRES
FEET 100 0 100 200 300 400 500 600 700 800 PIEDS

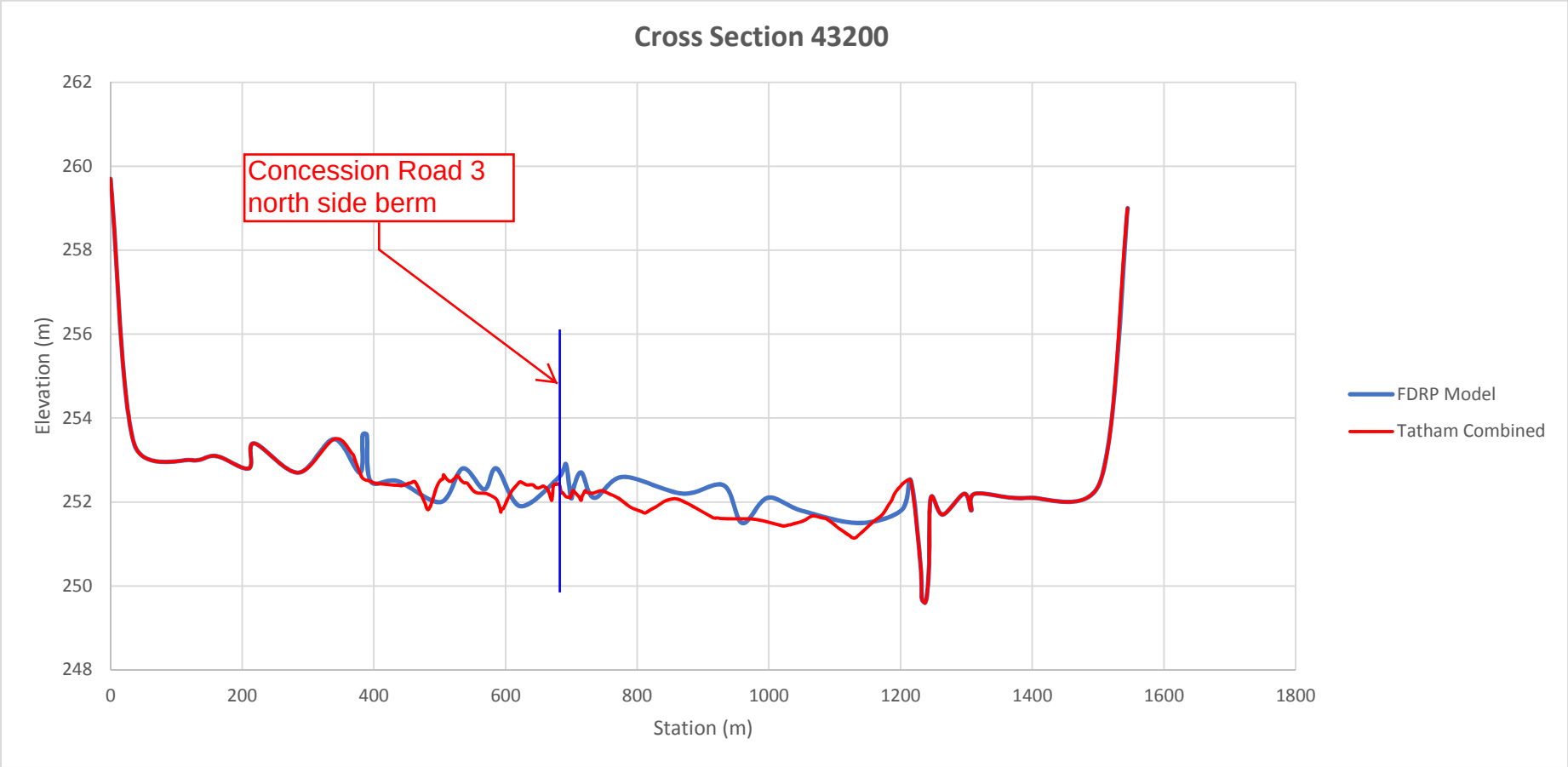
CONTOUR INTERVAL 1.0 METRE WITH A 0.5 METRE AUXILIARY. NORTH AMERICAN DATUM 1927.

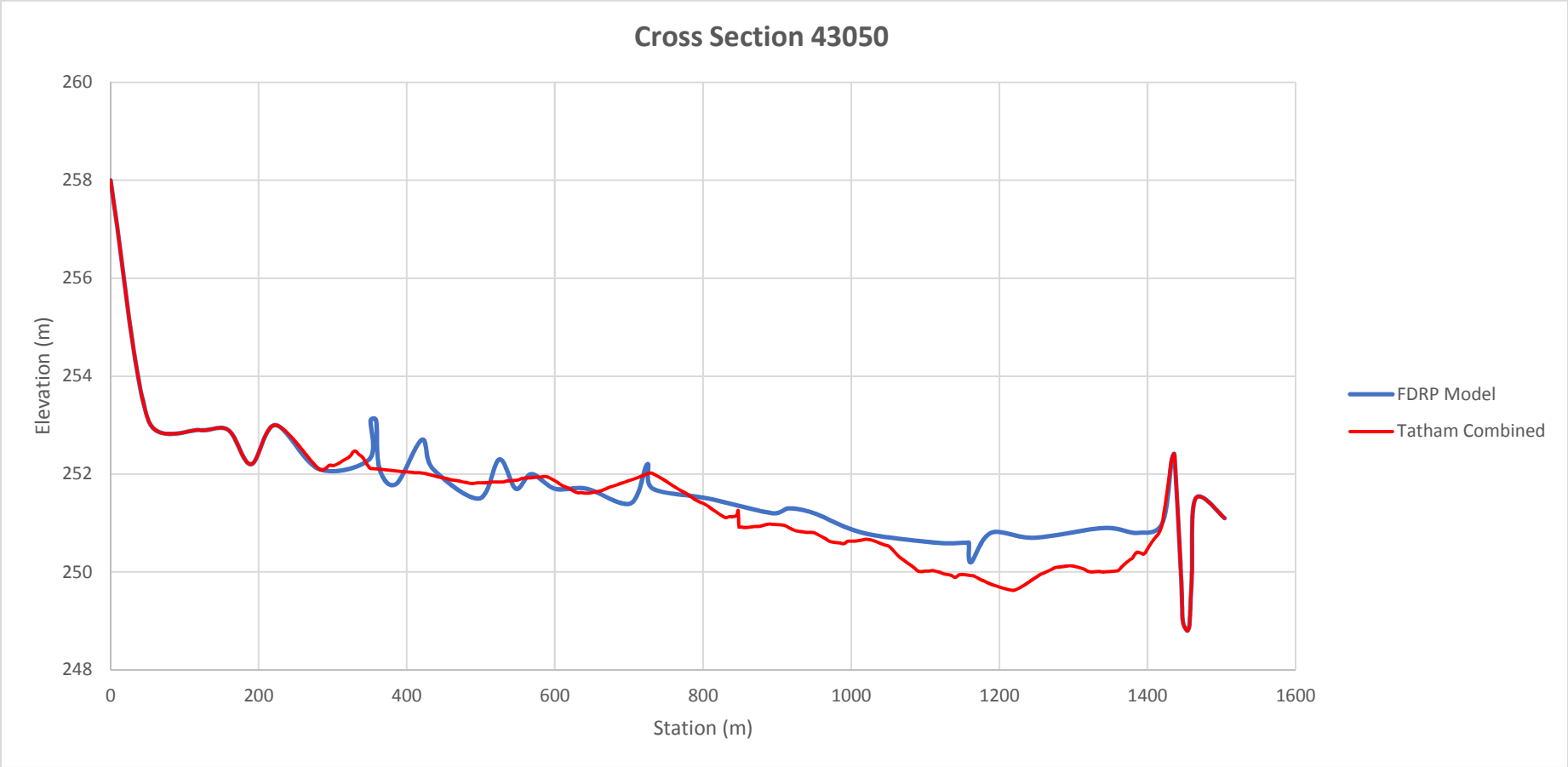
ÉQUIDISTANCE DES COURBES DE NIVEAU 1.0 MÈTRE AVEC COURBE AUXILIAIRE DE 0.5 MÈTRE. SYSTÈME DE RÉFÉRENCE GÉODÉSIQUE NORD-AMÉRICAIN 1927.

Appendix B:
Cross Section Comparisons


Edward Street C/L
Cross Section 43450
George Street C/L
260
259
258
257
256
255
254
253
252
251
250
Elevation (m)
0
200
400
600
800
1000
1200
1400
1600
Station (m)
FDRP Model
Tatham Combined

Cross Section 43280
Concession Road 3
north side berm
Elevation (m)
262
260
258
256
254
252
250
248
0
200
400
600
800
1000
1200
1400
1600
Station (m)
FDRP Model
Tatham Combined


Cross Section 43200
Concession Road 3
north side berm
Elevation (m)
262
260
258
256
254
252
250
248
0
200
400
600
800
1000
1200
1400
1600
1800
Station (m)
FDRP Model
Tatham Combined


Cross Section 43050
Elevation (m)
260
258
256
254
252
250
248
0
200
400
600
800
1000
1200
1400
1600
Station (m)
FDRP Model
Tatham Combined

Appendix C:
Hydraulic Analysis Results

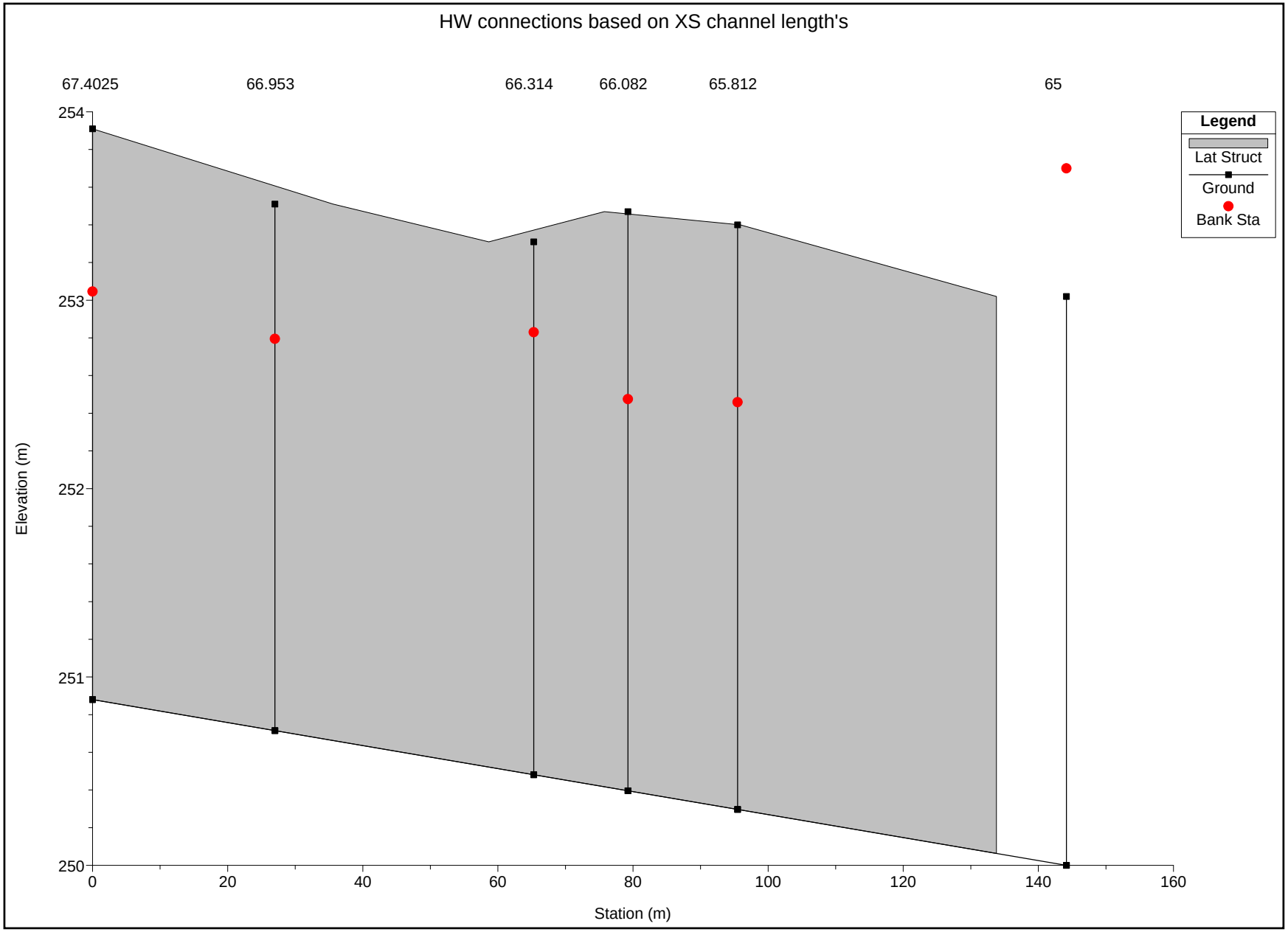
HEC-RAS Plan: Tatham Ex. Locations: User Defined

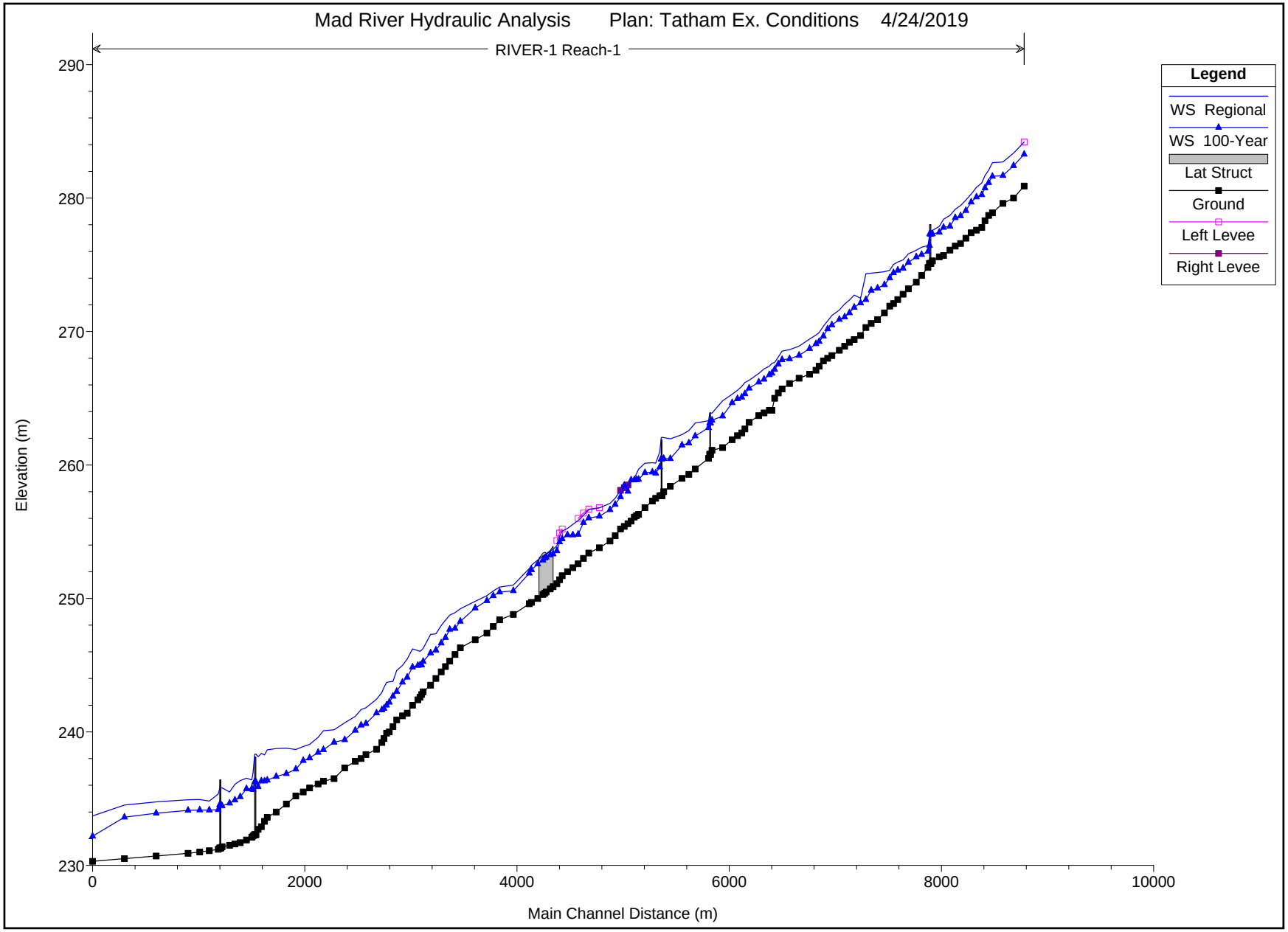
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
RIVER-1	Reach-1	71	Regional	373.60	252.00	255.25	255.25	255.61	0.003610	3.45	331.04	498.02	0.64
RIVER-1	Reach-1	71	100-Year	140.40	252.00	254.76		254.94	0.001680	2.09	137.13	268.73	0.42
RIVER-1	Reach-1	70	Regional	373.60	251.70	255.05	255.05	255.32	0.004006	3.28	413.99	636.10	0.66
RIVER-1	Reach-1	70	100-Year	140.40	251.70	254.46	254.46	254.80	0.003942	2.82	105.66	307.75	0.63
RIVER-1	Reach-1	69	Regional	373.60	251.40	254.67	254.67	254.88	0.003571	3.02	360.91	627.71	0.62
RIVER-1	Reach-1	69	100-Year	140.40	251.40	254.23	254.23	254.47	0.002924	2.47	128.68	363.67	0.55
RIVER-1	Reach-1	68	Regional	373.60	251.10	253.95	253.95	254.18	0.004305	3.16	318.55	543.83	0.68
RIVER-1	Reach-1	68	100-Year	140.40	251.10	253.56	253.56	253.79	0.003529	2.52	127.21	410.83	0.59
RIVER-1	Reach-1	67.4025	Regional	373.60	250.88	253.69		253.86	0.004551	2.89	324.27	561.49	0.67
RIVER-1	Reach-1	67.4025	100-Year	140.40	250.88	253.33	253.27	253.49	0.003696	2.27	146.31	420.00	0.58
RIVER-1	Reach-1	66.953	Regional	373.60	250.72	253.58		253.74	0.004124	2.76	342.86	598.95	0.64
RIVER-1	Reach-1	66.953	100-Year	140.40	250.72	253.26	253.23	253.39	0.003164	2.13	166.80	487.42	0.55
RIVER-1	Reach-1	66.314	Regional	373.13	250.48	253.37	253.37	253.55	0.005559	2.95	330.27	672.31	0.73
RIVER-1	Reach-1	66.314	100-Year	140.40	250.48	253.09	253.09	253.25	0.004139	2.26	156.85	533.48	0.61
RIVER-1	Reach-1	66.082	Regional	373.13	250.40	253.23	253.23	253.44	0.005794	3.06	320.42	676.85	0.75
RIVER-1	Reach-1	66.082	100-Year	140.40	250.40	253.02	253.02	253.14	0.003051	2.03	180.13	595.74	0.53
RIVER-1	Reach-1	65.812	Regional	373.13	250.30	253.20		253.33	0.003844	2.52	377.05	689.78	0.61
RIVER-1	Reach-1	65.812	100-Year	140.40	250.30	252.87	252.87	253.01	0.003756	2.16	162.70	574.61	0.58
RIVER-1	Reach-1	65	Regional	373.13	250.00	252.88	252.88	253.10	0.005489	3.14	326.71	690.92	0.73
RIVER-1	Reach-1	65	100-Year	140.40	250.00	252.58	252.58	252.78	0.003706	2.39	140.23	453.90	0.59
RIVER-1	Reach-1	63.52	Regional	373.13	249.70	252.50	252.50	252.69	0.005651	2.96	350.91	883.57	0.73
RIVER-1	Reach-1	63.52	100-Year	140.40	249.70	252.14	252.14	252.33	0.004989	2.38	124.85	386.03	0.66
RIVER-1	Reach-1	63	Regional	373.13	249.60	252.24	252.24	252.43	0.004938	3.25	337.05	790.19	0.71
RIVER-1	Reach-1	63	100-Year	140.40	249.60	251.89	251.89	252.06	0.003621	2.52	144.38	397.09	0.59
RIVER-1	Reach-1	60	Regional	373.13	248.80	251.01		251.06	0.002457	1.78	434.94	593.98	0.47
RIVER-1	Reach-1	60	100-Year	140.40	248.80	250.57		250.60	0.001725	1.32	221.12	381.51	0.38
RIVER-1	Reach-1	59	Regional	373.13	248.40	250.86		250.88	0.000801	1.33	675.95	785.22	0.29
RIVER-1	Reach-1	59	100-Year	140.40	248.40	250.47		250.49	0.000521	0.94	389.23	699.68	0.23
RIVER-1	Reach-1	58	Regional	373.13	247.90	250.56	250.56	250.76	0.004965	3.21	324.24	607.86	0.72
RIVER-1	Reach-1	58	100-Year	140.40	247.90	250.20	250.20	250.40	0.003975	2.52	136.90	390.51	0.62

Lateral Structure

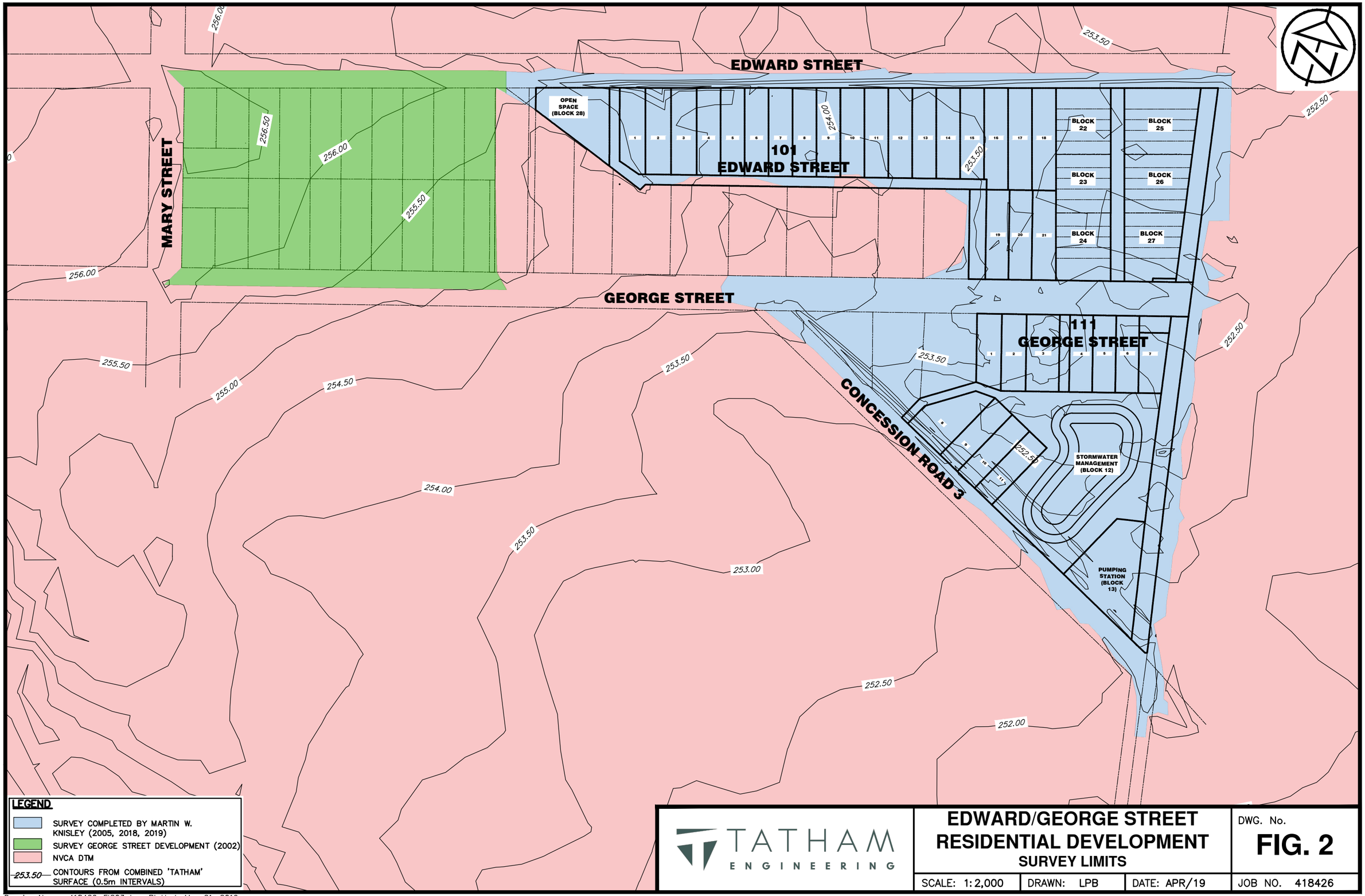
HEC-RAS Plan: Tatham Ex. River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
			(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
Reach-1	67	Regional	373.60	0.47	373.13	0.47		33.58	0.10	0.05	253.02	253.86	253.69	253.15	252.95
Reach-1	67	100-Year	140.40	0.00	140.40	0.00					253.02	253.49	253.33	252.83	252.64


HW connections based on XS channel length's
67.4025
66.953
66.314
66.082
65.812
65
Legend
Lat Struct
Ground
Bank Sta
Elevation (m)
254
253
252
251
250
0
20
40
60
80
100
120
140
160
Station (m)


Mad River Hydraulic Analysis Plan: Tatham Ex. Conditions 4/24/2019
RIVER-1 Reach-1
Legend
WS Regional
WS 100-Year
Lat Struct
Ground
Left Levee
Right Levee
Elevation (m)
290
280
270
260
250
240
230
0
2000
4000
6000
8000
10000
Main Channel Distance (m)

Appendix D: Drawings



TATHAM ENGINEERING

EDWARD/GEORGE STREET RESIDENTIAL DEVELOPMENT
SURVEY LIMITS

DWG. No. **FIG. 2**

SCALE: 1:2,000	DRAWN: LPB	DATE: APR/19	JOB NO. 418426

Drawing Name: 418426–FIG03.dwg, Plotted: May 21, 2019

EDWARD STREET

GEORGE STREET

MARY STREET

CONCESSION ROAD 3

OPEN SPACE (BLOCK 28)

101 EDWARD STREET

111 GEORGE STREET

BLOCK 22

BLOCK 23

BLOCK 24

BLOCK 25

BLOCK 26

BLOCK 27

STORMWATER MANAGEMENT (BLOCK 12)

PUMPING STATION (BLOCK 13)

REGIONAL SPILL FLOW
0.47m³/s
(TO BE ROUTED THROUGH SWM BLOCK)

SANITARY PUMPING STATION

256.00 256.50 255.50 255.00 254.50 254.00 253.50 253.00 252.50 252.00

LEGEND

- PROPOSED LOT LINES
- EXISTING LOT LINES
- REGIONAL SPILL FLOW DIRECTION
- TOWNHOUSE/CONDO BLOCKS
- SINGLE FAMILY RESIDENTIAL LOTS
- SERVICING BLOCKS
- SWM BLOCK
- OPEN SPACE BLOCK

TATHAM ENGINEERING

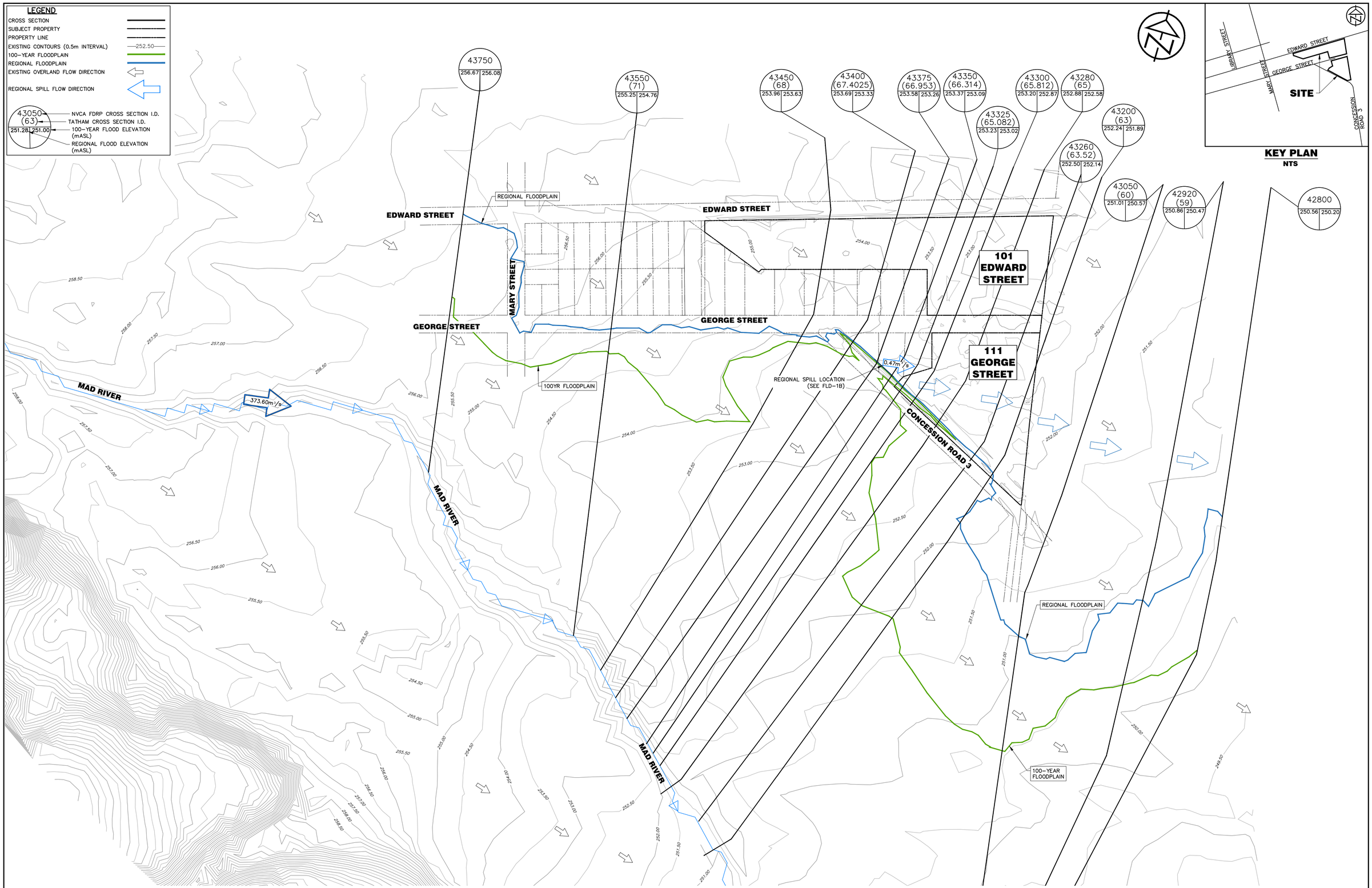
EDWARD/GEORGE STREET RESIDENTIAL DEVELOPMENT

PROPOSED DEVELOPMENT PLAN

DWG. No. **FIG. 3**

SCALE: 1:2,000	DRAWN: LPB	DATE: APR/19	JOB NO. 418426

Drawing Name: 418426–FIG05.dwg, Plotted: May 21, 2019



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BENCHMARKS

TBM1 – ELEVATION 254.32m
TOP OF FIRE HYDRANT ON GEORGE STREET EAST OF CONCESSION ROAD 3.

TBM2 – ELEVATION 259.17
WEST FOUNDATION WALL OF HOUSE#24 ON THE NORTH SIDE OF CAROLINE STREET 90cm FROM THE SW CORNER OF THE BUILDING, 36cm BELOW THE BLOCKS.

NOTES

LEGAL SURVEY INFORMATION SOUTH OF GEORGE ST. SHOWN ON THIS PLAN PREPARED BY MARTIN W. KNISLEY SEPTEMBER 4, 2018. RECEIVED SEPTEMBER 18, 2018.

LEGAL SURVEY INFORMATION NORTH OF GEORGE ST. SHOWN ON THIS PLAN PREPARED BY MARTIN W. KNISLEY SEPTEMBER 3, 2005. RECEIVED APRIL 28, 2017.

TOPOGRAPHIC INFORMATION SHOWN ON THIS PLAN PREPARED BY MARTIN W. KNISLEY AUGUST 2005 AND 2018.

No.	REVISION DESCRIPTION	DATE
1.	ISSUED FOR DRAFT PLAN APPROVAL	MAY 17/19

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
N.A. MILLINGTON
100190121
May 17/2019
PROVINCE OF ONTARIO

EDWARD/GEORGE STREET RESIDENTIAL DEVELOPMENT

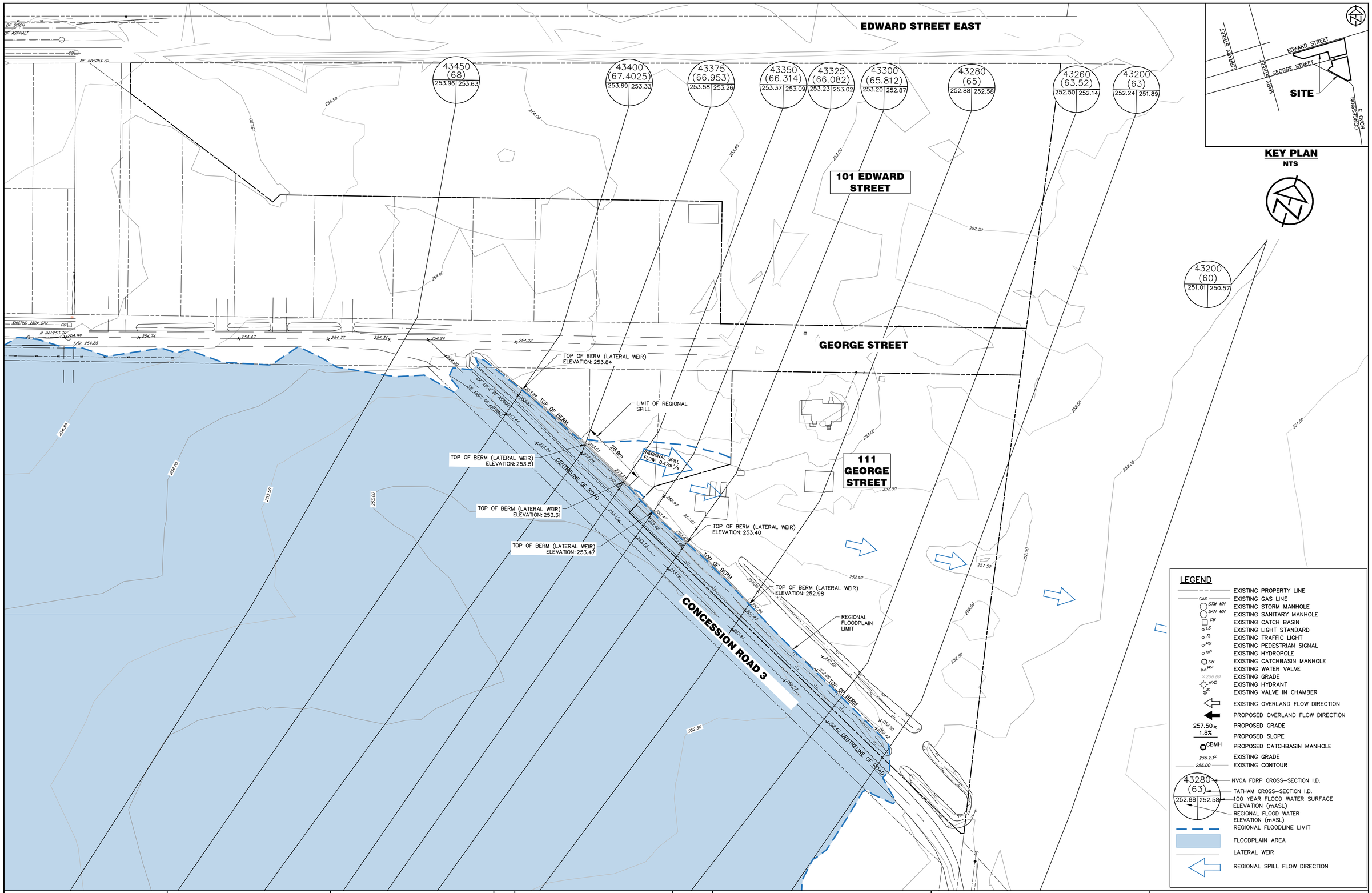
TOWNSHIP OF CLEARVIEW

TATHAM ENGINEERING

EXISTING CONDITIONS FLOODPLAIN MAPPING

DESIGN: NM	FILE: 418426	DWG:
DRAWN: LPB	DATE: MAY 2019	FLD-1A
CHECK: ALK	SCALE: 1:2,000	

Drawing Name: 418426-FPL01.dwg, Plotted: May 17, 2019



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WEST FOUNDATION WALL OF HOUSE#24 ON THE NORTH SIDE OF CAROLINE STREET 90cm FROM THE SW CORNER OF THE BUILDING, 36cm BELOW THE BLOCKS.

NOTES

LEGAL SURVEY INFORMATION SOUTH OF GEORGE ST. SHOWN ON THIS PLAN PREPARED BY MARTIN W. KNISLEY SEPTEMBER 4, 2018. RECEIVED SEPTEMBER 18, 2018.

LEGAL SURVEY INFORMATION NORTH OF GEORGE ST. SHOWN ON THIS PLAN PREPARED BY MARTIN W. KNISLEY SEPTEMBER 3, 2005. RECEIVED APRIL 28, 2017.

TOPOGRAPHIC INFORMATION SHOWN ON THIS PLAN PREPARED BY MARTIN W. KNISLEY AUGUST 2005 AND 2018.

No.	REVISION DESCRIPTION	DATE
1.	ISSUED FOR DRAFT PLAN APPROVAL	MAY 17/19

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
N.A. MILLINGTON
100190121
May 17/2019
PROVINCE OF ONTARIO

EDWARD/GEORGE STREET RESIDENTIAL DEVELOPMENT

TOWNSHIP OF CLEARVIEW

EXISTING CONDITIONS FLOODPLAIN MAPPING: REGIONAL SPILL

TATHAM ENGINEERING

DESIGN: NM	FILE: 418426	DWG:
DRAWN: LPB	DATE: MAY 2019	FLD-1B
CHECK: ALK	SCALE: 1:750	

Drawing Name: 418426-FM01.dwg, Plotted: May 17, 2019