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TECHNICAL MEMO

DATE June 8, 2018 **PROJECT NO.** 1476-4787
RE Floodplain Analysis
100/108/114 Emma Street, Town of Grand Valley, Dufferin County

TO Nathan Garland, Resources Officer (Grand River Conservation Authority)
FROM Abraham Barrios, P.Eng.
CC Mohsin Samdany (Golden Canadian Homes Inc.)
Loghman Azar (Line Architect)

Introduction

C.F. Crozier and Associates Inc. (Crozier) was retained by Golden Canadian Homes Inc. (the Owner) to complete a floodplain analysis to support the Site Plan Application for a proposed development at 100/108/114 Emma Street in the Town of Grand Valley. The purpose of this memo is to document the methodology and results of the floodplain analysis and demonstrate that the proposed site grading design meets the criteria of the Grand River Conservation Authority (GRCA) for the lands in the vicinity of the Site.

Background

The subject property is approximately 0.3 ha and is currently vegetated undeveloped land. The property is located in a mixed residential area, bounded by Emma Street to the east and William Street to the north, residential properties to the west, and a carwash facility to the south. It is understood that the proposed development includes the construction of a 22 to 24-unit apartment building and associated parking area.

The Grand River is located approximately 75 m to the east of the property and the eastern third of the property is contained within the Regulatory Floodplain of Grand River. As a result of this, a floodplain analysis is required to satisfy GRCA requirements prior to proceeding with a Site Plan Application. The GRCA regulates this reach of the Grand River as a two-zone floodplain and the site is contained within the flood fringe of the floodplain.

The material in this memo reflects best judgment in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. C.F. Crozier & Associates Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Terms of Reference

Terms of Reference were developed for the location of the proposed development with respect to the floodplain were developed development through correspondence with GRCA.

The following terms were agreed upon through pre-consultation with GRCA in December 2007 and February 2018:

- The Regional flood level at the site is 455.33 m and the 100-Year flood level at the site is 453.74 m.
- A cut and fill balance analysis is not required for developments located within the flood fringe of a two-zone floodplain.
- The fixed floor elevation (FFE) of a building located within the flood fringe of a two-zone floodplain should be situated at least 1 cm above the Regional floodplain.

Methodology

The floodplain assessment included the following tasks:

- Reviewing the Grand River hydraulic (HEC-RAS) model provided by the GRCA.
- Confirming that the Regional and 100-Year flood levels provided by the GRCA model were 455.33 masl and 453.74 masl, respectively, by interpolating the water level of HEC-RAS stations 442.3 (upstream of the site) and 437.3 (downstream of the site).
- Interpolating the existing Regional and 100-Year floodplains onto the topographic survey (Cullen & Associates, November 2013) of the site.
- Completing conceptual grading of the site based on raising the fixed floor elevation of the proposed building above the Regional floodplain (to 455.34 m). The site was raised above the Regional floodplain through the addition of fill, no cut and fill balance is required because the site is located within the flood fringe of the two-zone floodplain.

Existing Conditions

As discussed in the Terms of Reference, the high-water elevation corresponding to the Regional and 100-year event for the subject reach of the Grand River is 455.33 m and 453.74 m, respectively. The topographic survey provided by Cullen & Associates indicates that the property is sloping downwards from west to east. The Regional floodplain extends onto approximately one third of the property, including part of the proposed construction area. The section of the property located within the Regional floodplain is situated between the Regional food level and the 100-Year flood level, an area classified as the flood fringe of the two-zone floodplain.

The 100-Year flood line is mostly confined to the western edge of Emma Street, apart from a small area at the south east corner of the property that is located within the 100-Year flood line. The area that is located below the 100-Year flood level is classified as the flood way of the two-zone floodplain.

Proposed Conditions

A conceptual grading plan of the site was completed to show that the proposed building can be elevated above the Regional floodplain elevation, as shown in Figure 1. Under proposed conditions, the area of the proposed building will be earth filled to bring the fixed floor elevation of the proposed building to 455.34m. As can be seen in Figure 1, the proposed Regional floodplain is pushed east of existing Regional floodplain location approximately 6 m. The proposed parking area is to be located within the flood fringe of the floodplain.

The Ontario Ministry of Natural Resources and Forestry (MNR) Technical Guide: River and Stream Systems: Flooding Hazard Limit (2002) provides recommendations relating to the safe ingress/egress of the site. In Appendix 6 of the MNR Technical Guide, the MNR presents guidelines for the velocity and flooding depth to allow for safe ingress/egress. The MNR's "3x3" rule indicates that vehicles are stable with velocity x depth product of approximately 3 m²/s and advises a maximum flooding depth of 0.9 m -1.2 m for diesel fire trucks before the vehicle would have issues with ingress/egress from the site. In conversation with the GRCA, it was stated that "by virtue of locating in the two zone it has safe access".

The northern site entrance at the property line has a low point elevation of 454.42 m at the property line. This corresponds to a Regional flood depth of 0.91 m. The bank velocity (0.82 m/s) of the Regional storm at the property is determined by taking the average of the HEC-RAS overbank velocities of River Stations 442.3 and 437.3 on the right bank, see Table 1. With a flood depth of 0.91 m and a velocity of 0.82 m/s, the velocity x depth in this specific location is 0.75 m²/s. The Regional depth of flooding and depth x velocity product at the property line of the northern property access ramp satisfy the MNR requirements for diesel fire truck ingress/egress to the site. The northern entrance to the site is located within the flood fringe and would thereby provide safe access under the GRCA two-zone policy. It should be noted that the elevation of Emma Street at the southern site access is located within the floodway.

Table 1: HEC-RAS Overbank Velocity and Water Surface Elevation for the Regional Storm Event

HEC-RAS River Station	Right Overbank Velocity (m/s)	Regional Water Surface Elevation (m)
442.3	0.61	455.39
437.3	1.03	455.27
Average	0.82	455.33

A conceptual Site Grading and Drainage Plan (Figure 1) illustrates that drainage from the site will not be impeded by the proposed development. During frequent precipitation events, stormwater from the site will continue to drain to the roadside ditch along Emma Street. Two culverts will be required within the Emma Street roadside ditch to convey flow under the site entrance ramps at the east and west side of the site.

Conclusions and Recommendations

We conclude that the floodplain analysis for this property is in general conformance with the GRCA standards for a two-zone floodplain. The proposed building is situated at a fixed floor elevation 455.34 m, which is above the Regional floodplain elevation of 455.33m as required by the GRCA for developments within the flood fringe. The Regional flood depth and velocity at the northern site entrance ramp allow for safe ingress/egress of emergency vehicles.

We trust that this analysis meets the GRCA requirements to support the proposed development of the site and recommend that the floodplain analysis contained in this memo is accepted such that the owner can proceed with the Site Plan Application for the proposed works.

Please contact the undersigned if you have any questions.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.



Jordan Atherton, M.Sc., E.I.T.
Water Resources E.I.T.
/ko

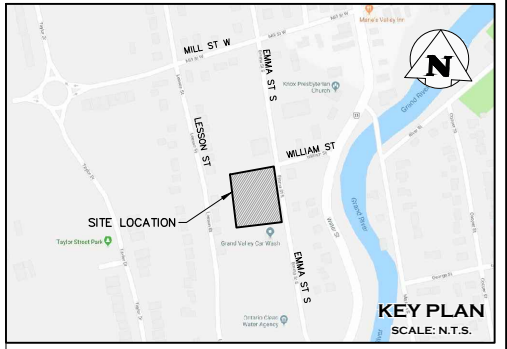
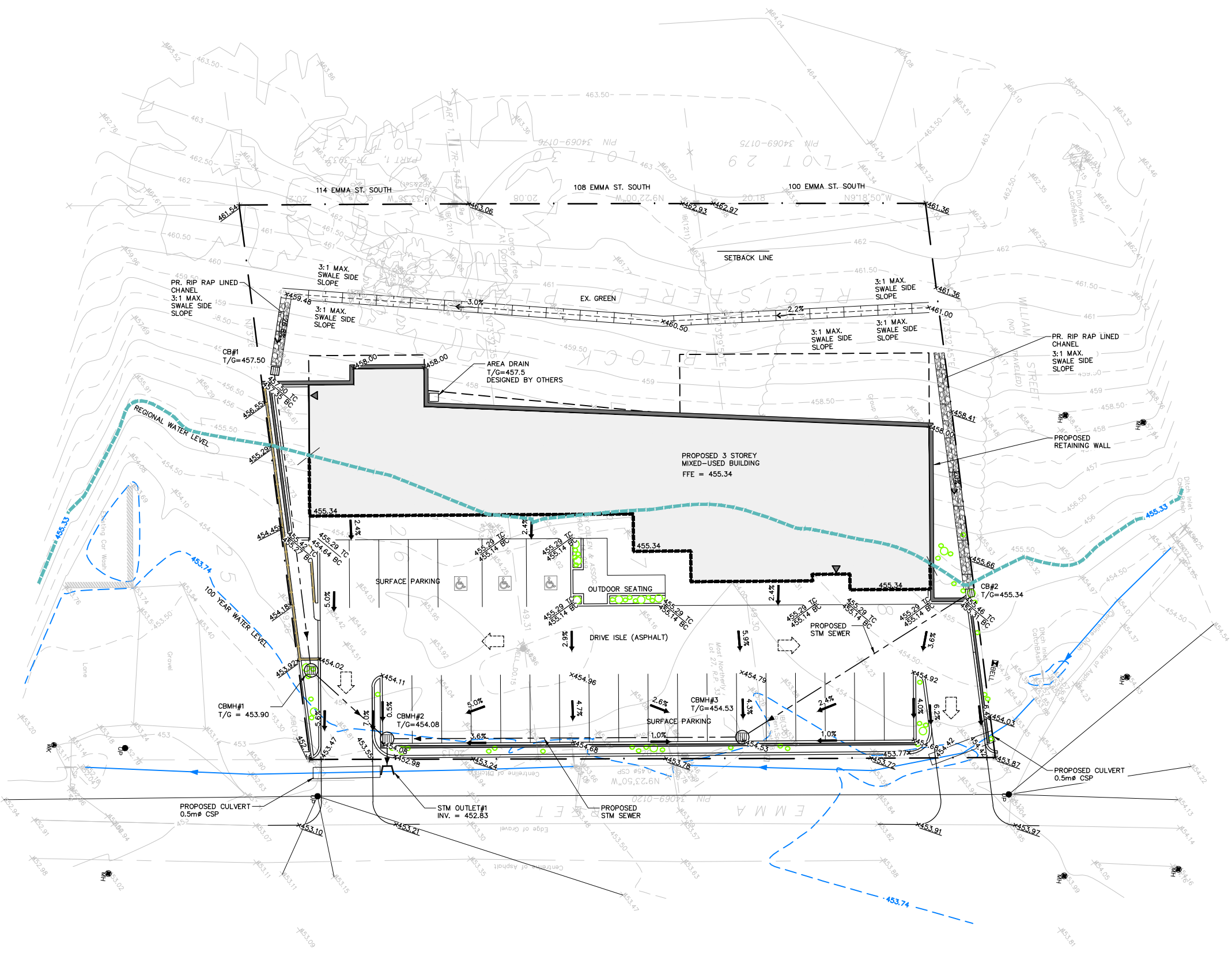
C.F. CROZIER & ASSOCIATES INC.



Abraham Barrios, P.Eng.
Senior Water Resources Engineer

Encl. Figure 1: Conceptual Grading and Drainage Figure
 Correspondence with GRCA
 HEC-RAS Output for River Stations 442.3 and 437.3

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LEGEND

	PROPERTY LINE
	EX. CONTOUR (0.5m)
	EX. CONTOUR (1.0m)
	EXISTING DITCH
	EXISTING FENCE
	EXISTING GRADE
	PROPOSED GRADE
	PROPOSED GRADE (TO MATCH EXISTING)
	PROPOSED MINOR FLOW DIRECTION
	PROPOSED GRASSED SWALE
	PROPOSED SLOPE (3:1 MAX.)
	PROPOSED MAJOR OVERLAND FLOW DIRECTION
	PROPOSED BUILDING EXIT
	PROPOSED TREES
	PROPOSED CURB
	PROPOSED RETAINING WALL
	PROPOSED STORM SEWER
	PROPOSED CATCHBASIN
	PROPOSED CATCHBASIN MANHOLE
	PROPOSED RIPRAP LINED CHANNEL
	EXISTING REGIONAL FLOODPLAIN; ELEV = 455.33
	PROPOSED REGIONAL FLOODPLAIN

A	ISSUED WITH FLOODPLAIN ANALYSIS	2018/JUN/07
No.	ISSUE / REVISION	YYYY/MM/DD

ELEVATION NOTE:
 ALL ELEVATIONS SHOWN HERON ARE DERIVED FROM VERTICAL CONTROL MONUMENT No. 00819798442
 ELEVATION = 472.478m

SURVEY NOTES:
 SURVEY COMPLETED BY CULLEN & ASSOCIATES (2017/NOV/13)
 REFERENCE No.: 17-186

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SITE PLAN NOTES:
 DESIGN ELEMENTS ARE BASED ON SITE PLAN BY LINE ARCHITECT
 DRAWING No.: A101, REV.1 (2017/APR/11)
 PROJECT No.: 1731

DRAWING NOTES:
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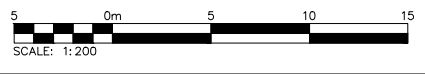
Project
MOHSIN SAMDANY
100,108 & 114 EMMA ST SOUTH
GRAND VALLEY

Drawing
CONCEPTUAL
SITE GRADING AND DRAINAGE PLAN

NOT FOR CONSTRUCTION

Stamp

CROZIER & ASSOCIATES Consulting Engineers	2800 HIGH POINT DRIVE SUITE 100 MILTON, ON L9T 6P4 905 875-0026 T 905 875-4915 F WWW.CFCROZIER.CA		
	Drawn I.K.A.	Design J.A.	Project No. 1476-4787
Check S.C.S.	Check A.J.B.	Scale 1:200	Dwg. FIG1



HEC-RAS Plan: 2015 Locations: User Defined

River	Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl	Vel Left (m/s)	Vel Right (m/s)	Vel Total (m/s)
Grand	Upper	442.3	Regional	780.00	449.88	455.39		455.58	0.000700	2.25	576.62	235.02	0.33	0.70	0.61	1.35
Grand	Upper	442.3	100-yr	296.00	449.88	453.81		453.92	0.000600	1.59	250.94	171.59	0.28	0.35	0.29	1.18
Grand	Upper	442.3	50-yr	279.00	449.88	453.73		453.84	0.000591	1.55	238.02	166.54	0.28	0.33	0.27	1.17
Grand	Upper	442.3	20-yr	250.00	449.88	453.59		453.70	0.000576	1.49	215.19	161.69	0.28	0.28	0.24	1.16
Grand	Upper	442.3	10-yr	222.00	449.88	453.44		453.54	0.000562	1.42	191.53	155.13	0.27	0.23	0.20	1.16
Grand	Upper	442.3	5-yr	192.00	449.88	453.26		453.35	0.000546	1.34	164.76	136.38	0.26	0.17	0.18	1.17
Grand	Upper	442.3	2-yr	132.00	449.88	452.81		452.87	0.000493	1.13	116.93	58.38	0.24		0.10	1.13
Grand	Upper	437.3	Regional	780.00	449.76	455.27		455.46	0.000867	2.34	495.46	171.28	0.36		1.03	1.57
Grand	Upper	437.3	100-yr	296.00	449.76	453.68		453.82	0.000809	1.77	234.34	142.51	0.33		0.58	1.26
Grand	Upper	437.3	50-yr	279.00	449.76	453.61		453.74	0.000806	1.74	223.43	141.33	0.32		0.56	1.25
Grand	Upper	437.3	20-yr	250.00	449.76	453.47		453.59	0.000802	1.69	203.75	139.18	0.32		0.50	1.23
Grand	Upper	437.3	10-yr	222.00	449.76	453.32		453.44	0.000807	1.64	182.78	137.34	0.32		0.44	1.21
Grand	Upper	437.3	5-yr	192.00	449.76	453.13		453.25	0.000799	1.57	158.43	123.44	0.31		0.41	1.21
Grand	Upper	437.3	2-yr	132.00	449.76	452.68		452.77	0.000805	1.40	105.90	84.77	0.31		0.37	1.25

Jordan Atherton

From: Nathan Garland <ngarland@grandriver.ca>
Sent: Wednesday, February 14, 2018 10:25 AM
To: Jordan Atherton
Subject: RE: 105/108/114 Emma Street Grand River (1476-4787)

Response below in red.

I'm going to stress this pretty strongly and you can relay this along to your client, but we have not been in touch with any geotechnical engineer or seen any geotechnical consideration and this is going to be a major consideration for the site. Right now this is looking like it is going to be near the end of the project and we are going to red flag the geotechnical if it comes back as a concern.

Regards,

Nathan Garland
Resource Planner
Grand River Conservation Authority

ngarland@grandriver.ca
Direct Line: 519.621.2763 x 2236
Office: 1.866.900.4722
Fax: 519.621.4945

From: Jordan Atherton [mailto:jatherton@cfcrozier.ca]
Sent: February 14, 2018 9:48 AM
To: Nathan Garland
Subject: RE: 105/108/114 Emma Street Grand River (1476-4787)

Hi Nathan,

I have some questions regarding the requirements for developing within the flood fringe for the Emma Street property.

- What are the cut/fill requirements, is a balance required? **No cut and fill requirement because it is two zone.**
- Do we require a freeboard above the regional flood level? **Just higher than the regulatory line. 1 cm if you wanted a number.**

Thanks,

| **JORDAN ATHERTON** | E.I.T. | C.F. CROZIER & ASSOCIATES
| 2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
| cfcrozier.ca | jatherton@cfcrozier.ca | tel 905 875 0026



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From: Nathan Garland [<mailto:ngarland@grandriver.ca>]
Sent: Tuesday, December 05, 2017 2:03 PM
To: Jordan Atherton <jatherton@cfcrozier.ca>
Subject: RE: 105/108/114 Emma Street Grand River (1476-4787)

Hi Jordan,

The criteria for two zone is safe access therefore by virtue of locating in the two zone it has safe access. However, one of the reasons we have been so firm on the requirement that it not be assisted living or institutional is that the access will may be safe, but not dry and therefore would not support the use. So if we review a zone change application and there is reference to assisted living, seniors, home care or any type of supported living we will likely raise a concern. Once again I have not seen any plans or proposals so I can give you generals and reference policy, but there are details and facts left out we will raise a concern.

Regards,

Nathan Garland
Resource Planner
Grand River Conservation Authority

ngarland@grandriver.ca
Direct Line: 519.621.2763 x 2236
Office: 1.866.900.4722
Fax: 519.621.4945

From: Jordan Atherton [<mailto:jatherton@cfcrozier.ca>]
Sent: December 5, 2017 1:57 PM
To: Nathan Garland
Subject: RE: 105/108/114 Emma Street Grand River (1476-4787)

Hi Nathan,

I have a question about ingress/egress within the flood fringe for the Emma Street property.

Section 8.1.31 of the GRCA Policies state that building may be permitted within the flood fringe provided that "e) ingress and egress to the building or structure is 'dry' where this standard can be practically achieved, or floodproofed to an elevation which is practical and feasible, but no less than 'safe'."

Are there any more specific GRCA guidelines or requirements on ingress/egress for properties within the flood fringe area? Is this an issue with this property. I have not seen this topic raised in previous correspondence with Mohsin.

Thanks,

Jordan

From: Nathan Garland [<mailto:ngarland@grandriver.ca>]
Sent: Monday, December 04, 2017 11:48 AM
To: Jordan Atherton <jatherton@cfcrozier.ca>

Cc: Gabriela Skibinski <gskibinski@cfcrozier.ca>
Subject: RE: 105/108/114 Emma Street Grand River (1476-4787)

Hi Jordan,

Probably sometime after 3pm would be fine.

Nathan Garland
Resource Planner
Grand River Conservation Authority

ngarland@grandriver.ca
Direct Line: 519.621.2763 x 2236
Office: 1.866.900.4722
Fax: 519.621.4945

From: Jordan Atherton [<mailto:jatherton@cfcrozier.ca>]
Sent: December 4, 2017 11:46 AM
To: Nathan Garland
Cc: Gabriela Skibinski
Subject: 105/108/114 Emma Street Grand River (1476-4787)

Hi Nathan,
We would like to have a quick chat with you regarding our clients proposed development at 105/108/114 Emma Street in Grand Valley. Would we be able to give you a call sometime this afternoon?
Thanks,
Jordan

| **JORDAN ATHERTON** | E.I.T. | C.F. CROZIER & ASSOCIATES
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